Power Management Guide

Texas Instruments

Power Management Guide 2014

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2014

Power Management Guide
Introduction and Contents

Texas Instruments (TI) offers complete power solutions with a full line of high-performance products. These products, which range from standard linear regulators to highly efficient DC/DC converters and battery management, are tailored to meet your design challenges. And, TI makes designing easier with leading-edge support tools such as the WEBENCH® Design Center, a broad selection of evaluation modules (EVMs), application notes, comprehensive technical documentation and more. TI also offers samples and small orders (shipped within 24 hours via authorized distributors) to help accelerate your time-to-market.

Included in this selection guide are design factors, featured products, graphic representations of portfolios and parametric tables.

For information about HiRel and military versions of Power Management products, please visit:

www.ti.com/hirel

For information about automotive-qualified Power Management products, please visit:

www.ti.com/automotive

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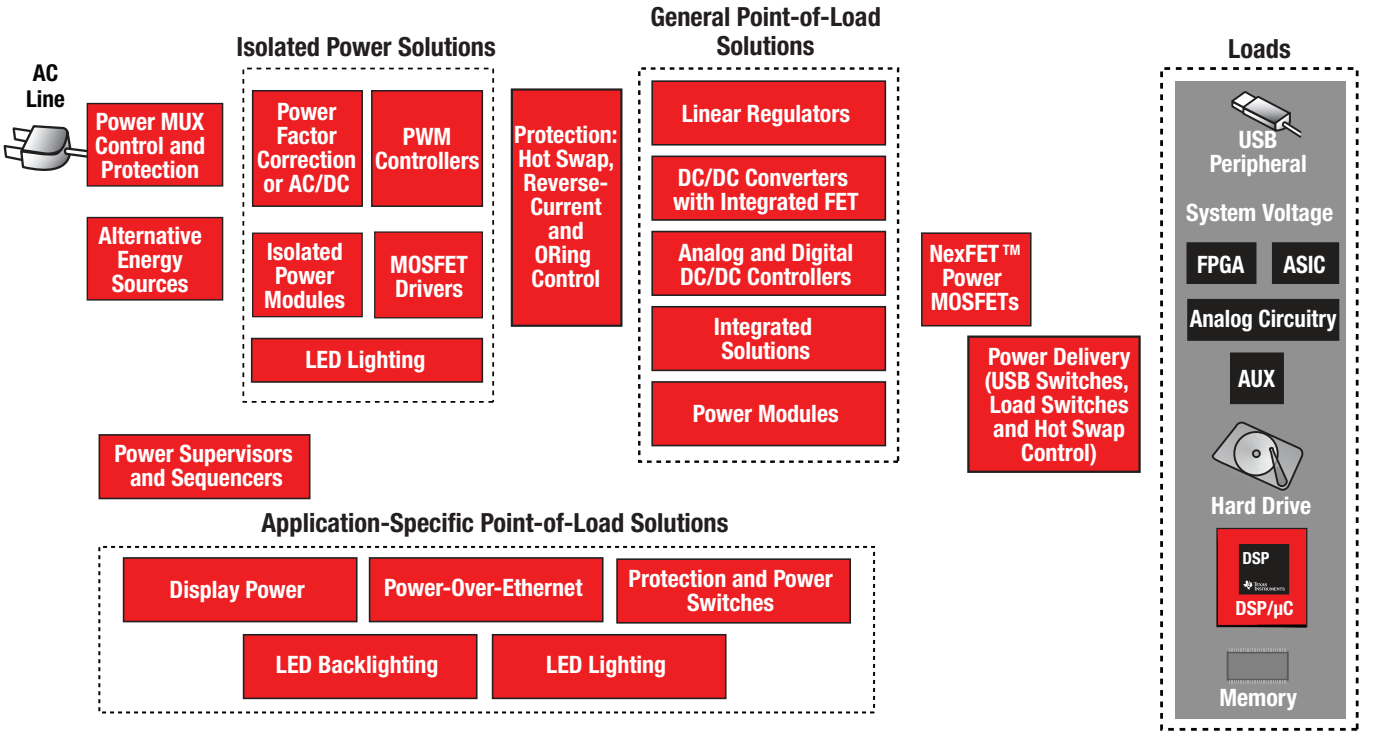
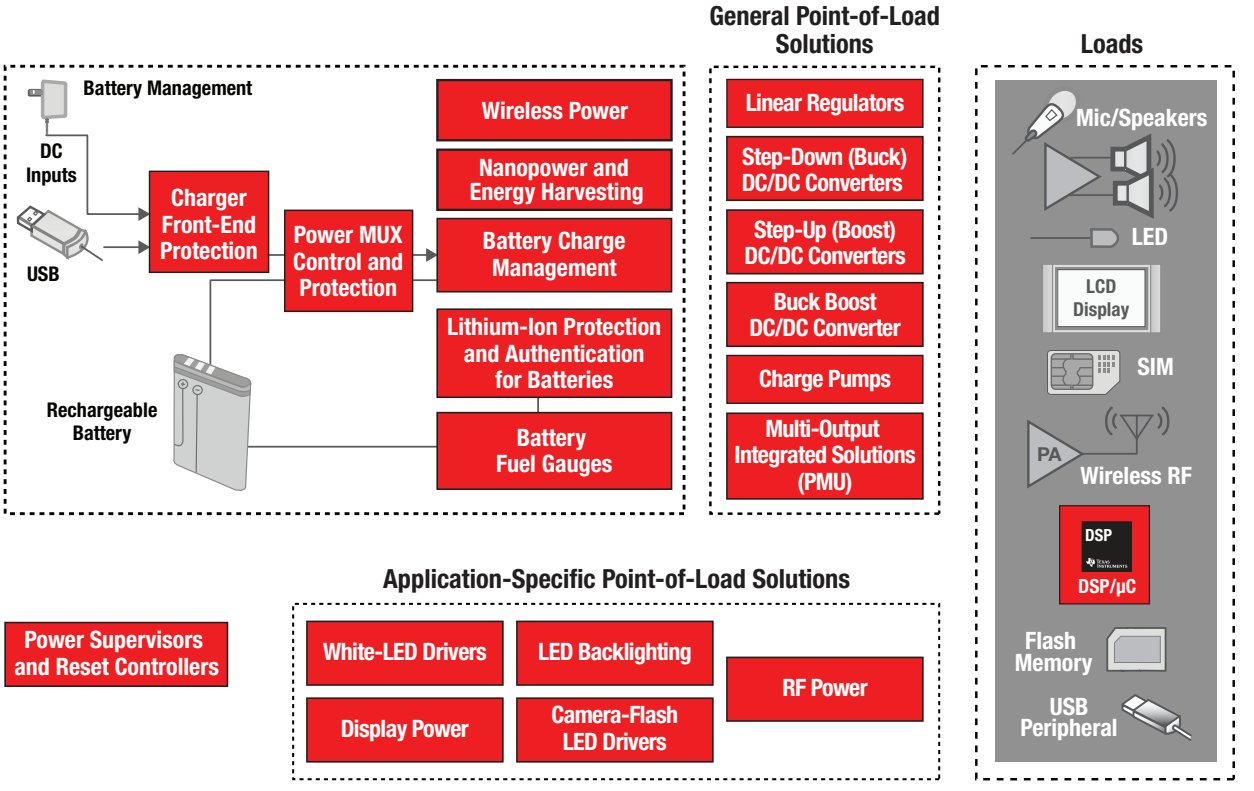
Portable and Line Power Solutions

Line Power Solutions



Portable Power Solutions



AC/DC and Isolated DC/DC Power Supplies
Overview

The TI portfolio of isolated power-conversion solutions covers the complete end-to-end power-supply building blocks from front-end PFC controllers to PWM controllers. These solutions support the most popular isolated-power topologies, including the advanced phase-shifted full-bridge. The portfolio also includes a variety of MOSFET gate drivers that support both primary and secondary MOSFET-driver applications, including synchronous-rectifier driver topologies and many other power-supply support products.

Power-Supply Solutions

- PFC controllers:
  - Transition mode
  - Continuous-current mode
  - Interleaved
  - Bridgeless
- PWM controllers:
  - Single-ended: Flyback, forward, active-clamp
  - Double-ended: Half-bridge, phase-shifted full-bridge, push-pull, LLC half-bridge
  - UCD3K digital control solutions
- Gate drivers:
  - GaN FET driver
  - Synchronous-rectifier driver
  - Single low-side
  - Dual low-side
  - 110-V high-side/low-side
  - Synchronous-buck

Design Factors

Control Method

Average-Current Mode (ACM) — Optimum control method to achieve PFC and low harmonic distortion.

Transition Mode (TM) — Simpler, inexpensive control with high peak currents and filtering requirements.

Interleaved — TM- and ACM-compatible multiphase, high-power, high-density topology. Delivers better EMI, smaller magnetics and reduced ripple currents.

Zero-Voltage-Transition (ZVT) Mode — A type of soft-switching technique, which reduces EMI and allows for higher frequency operations.

Protection

- Overvoltage protection (OVP) prevents output capacitor, switches and load from overcharge condition
- Soft-start (programmable) provides controlled start-up
- Overcurrent protection (OCP) provides protection during overload conditions

Performance

- Voltage feed-forward for linearized performance and faster transient response over wide line voltage range
- Multiplier linearity and zero power detect functions improve light load operation
- Onboard high output current drive capability without external MOSFET drivers

Flexibility

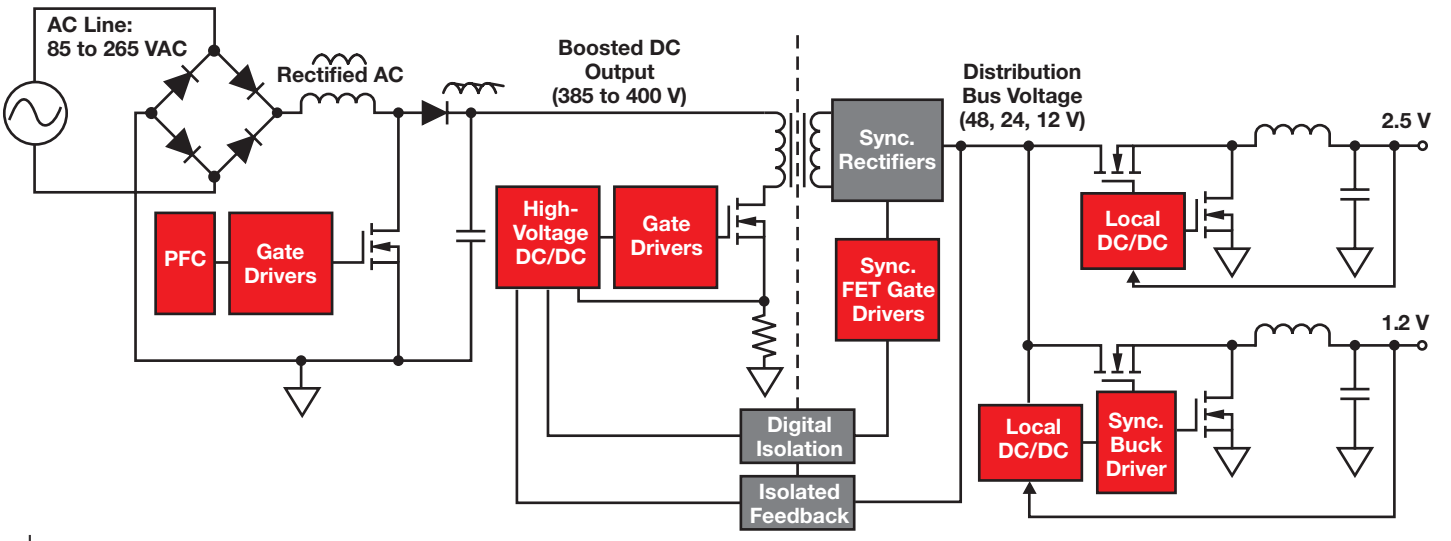
- Versatile advanced PWM controllers and bias supply converters for high-performance secondary-side control
- Ability to work with a wide line voltage range
- Different levels of undervoltage lockout thresholds for self bias and auxiliary bias applications
- Ability to synchronize controllers to eliminate noise issues

Power Level

- IEC requirements are applicable to all power supplies above 75 W
- Higher power converters may require zero-current-switching (ZCS) and ZVT-switching techniques to achieve high efficiencies
- Some of the simpler control techniques not usable at high power levels

Features

- From 50 W to 5 kW, TI PFC controllers deliver EN61000-3-2 compliance
- Industry standard architecture
- Deliver PF > 0.993
- Integrated controllers with on-chip start-up circuit and MOSFET drivers for high-density primary-side control
- Integrated synchronous rectifier control with pre-bias operation for monotonic start-up
- Superior applications support



AC/DC and Isolated DC/DC Power Supplies

Power Factor Correction (PFC)

Interleaved PFC

Interleaved PFC is gaining popularity in external and embedded-type power-supply architectures. It is exceptionally flexible and provides many cost-saving features such as passive-component size reductions, smaller EMI filtering components and higher efficiencies. TI offers both transition mode (UCC28063) and continuous conduction mode (CCM) (UCC28070) control methods.

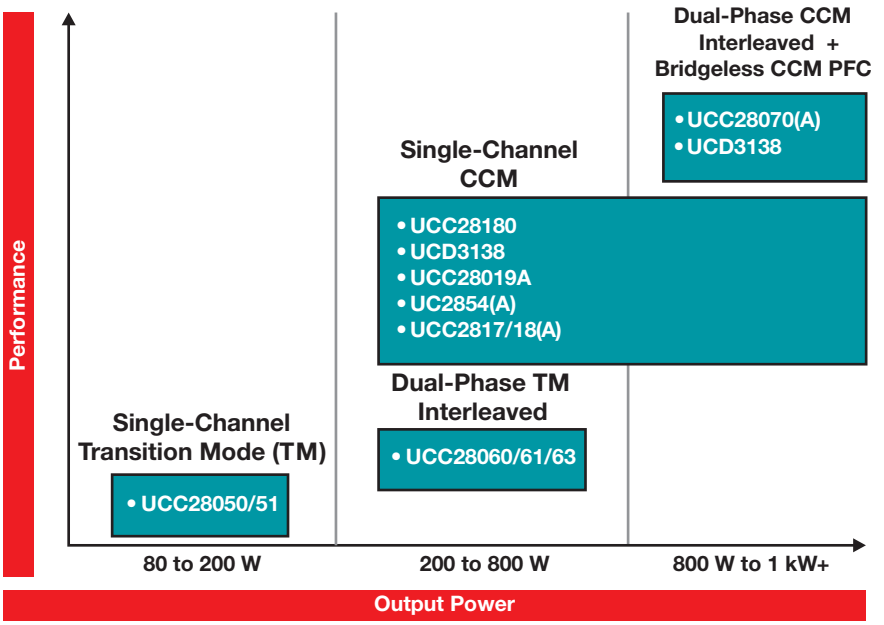
Other benefits of interleaving include scalability and ultrathin designs. Scalability allows for addressing many different power levels and applications.

Why Interleave?

- Lower system cost from ripple-current cancellation
- Enables ultraslim and high-density designs
- Lower total inductor volume
- Smaller or lower-cost EMI filter and output capacitors
- Facilitates higher efficiency

Applications

- Digital TV
- Telecom power supplies and rectifiers
- Professional and consumer audio
- Merchant power supplies
- Air conditioning and refrigeration compressors
- Variable-speed motors
- Low-profile power-supply applications

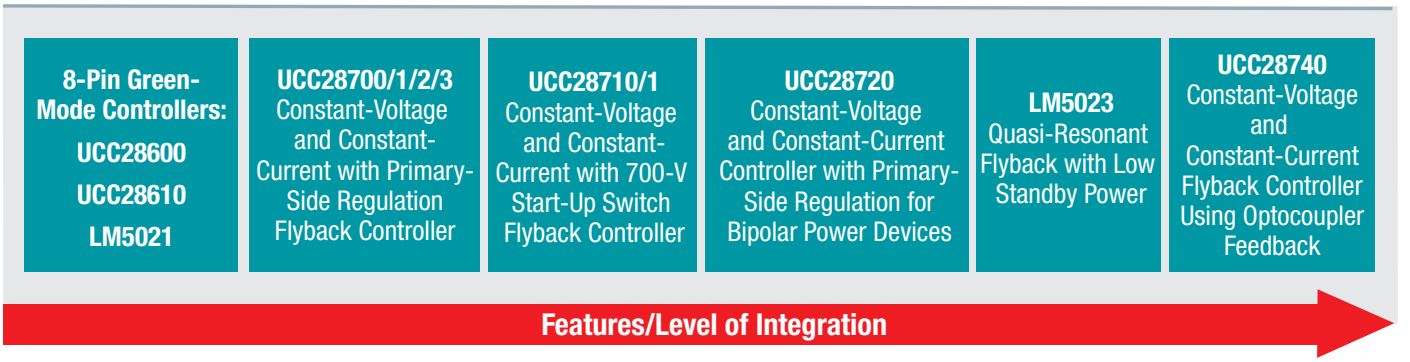


Get more information: **www.ti.com/power**
or **www.ti.com/product/UCC28180**

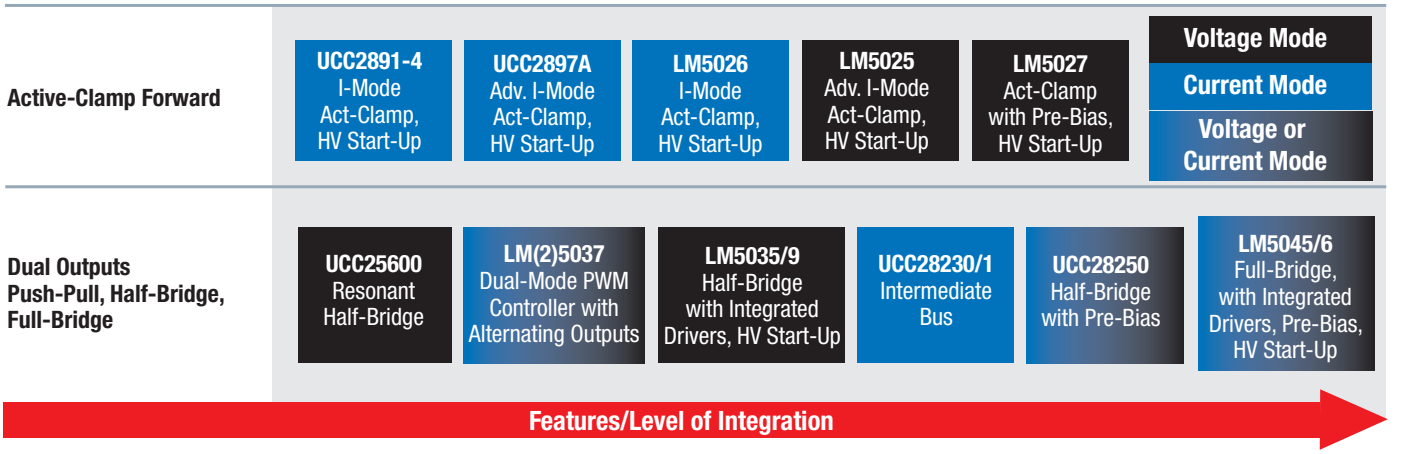
AC/DC and Isolated DC/DC Power Supplies

PWM and Resonant Controllers

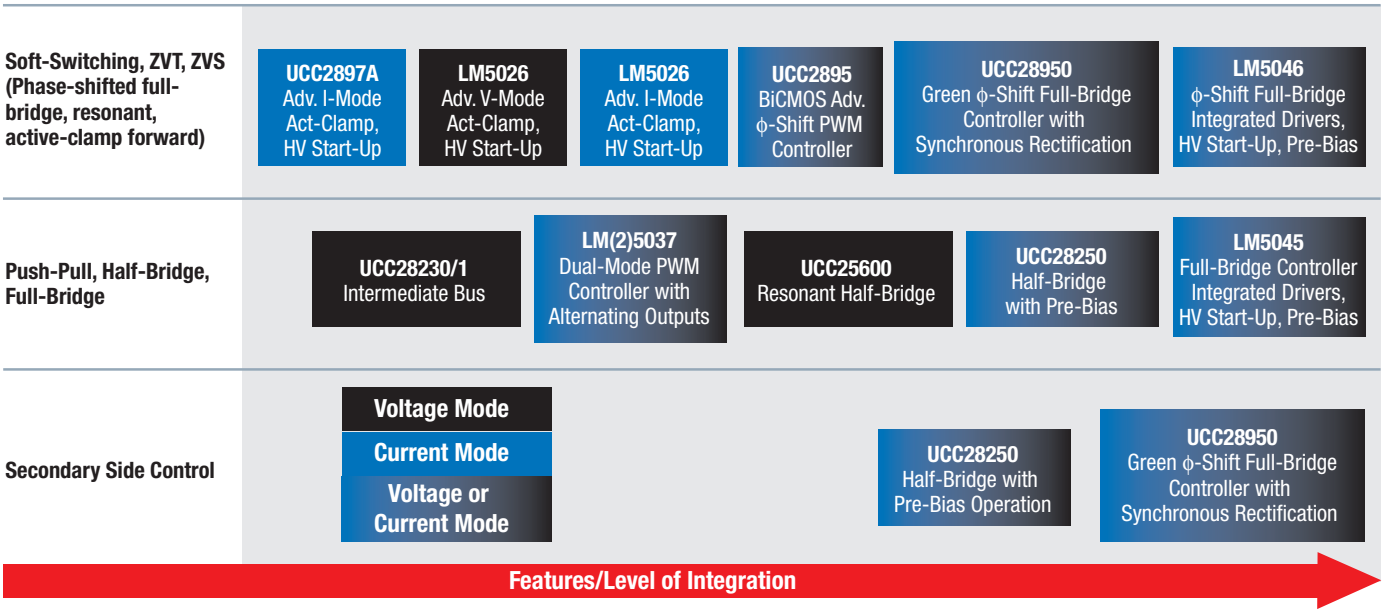
Green-Mode Controllers (Up to 150 W)



Low- to Medium-Power PWM Controllers (25 W to 350 W)



Medium- to High-Power PWM Controllers (>300 W)



AC/DC and Isolated DC/DC Power Supplies

PWM and Resonant Controllers

Green Advanced Phase-Shifted Full-Bridge and Synchronous Rectifier Controller

UCC28950

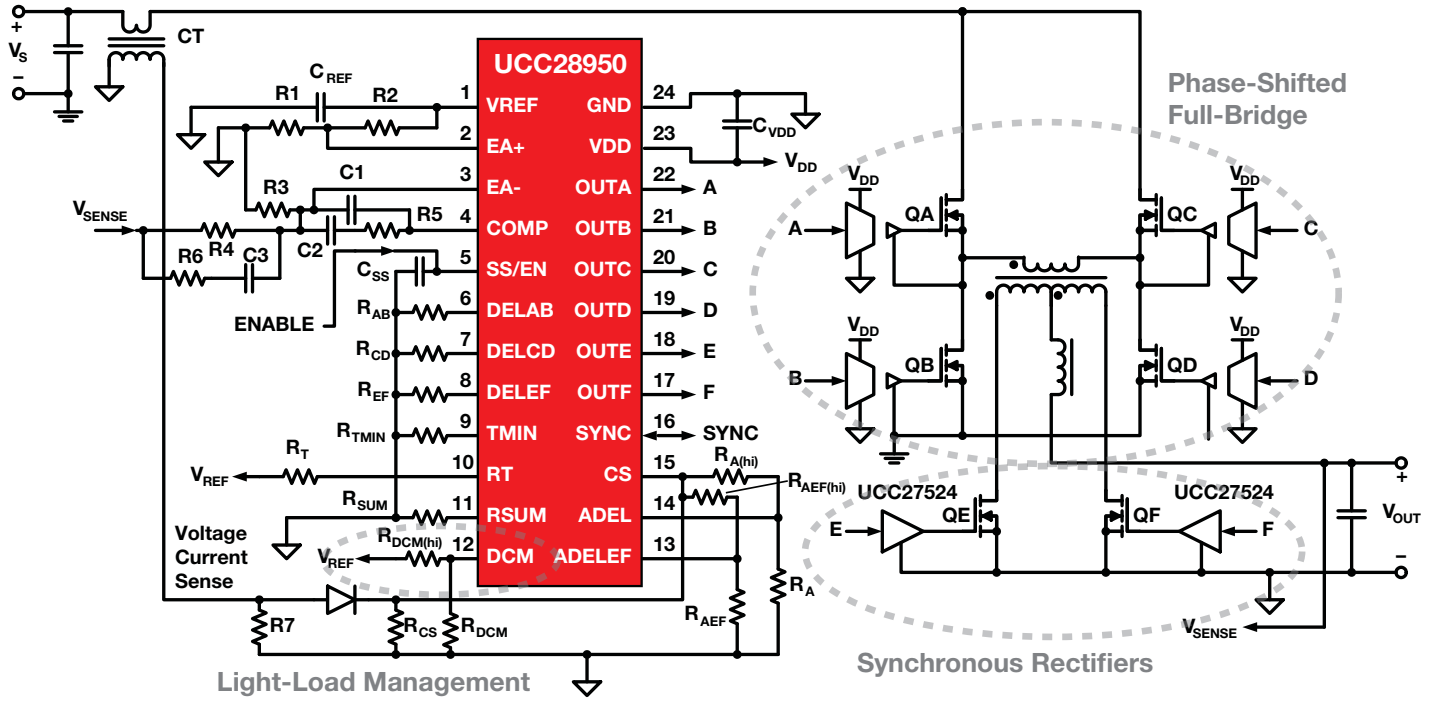
The UCC28950 phase-shifted full-bridge controller offers best-in-class efficiency in today's high-performance power systems. The UCC28950 implements advanced full-bridge control along with active control of the synchronous rectifier's output stage. The primary-side signals allow programmable delays to ensure ZVS operation over wide load current and input voltage range, while the load current naturally tunes the secondary-side synchronous rectifier's switching delays, maximizing overall system efficiency.

Key Features

- Optimized for 90+ efficiency standards
- User-programmable operation in DCM mode with lowered frequency at light load (burst)
- Programmable ramp compensation allows current- or voltage-mode control
- Adaptive ZVS switching over wide input/output range
- Optimal timing outputs for synchronous-rectifier drivers
- Sync in and sync out with 90% phase shift for master/slave interleaved operation of two modules

Applications

- Phase-shifted full-bridge converters
- Server, telecom power supplies
- Industrial power systems
- High-density power architectures
- Solar inverters
- Electric vehicles
- DC motor drives



Get more information: **www.ti.com/product/UCC28950**

AC/DC and Isolated DC/DC Power Supplies

PWM and Resonant Controllers

Selection Guide

Device[1]	Typical Power Level (W)	Control Method: Voltage Mode	Control Method: Current Mode	Control Method: Avg. Current Mode	Topologies	Maximum Practical Frequency	Supply Voltage (V)	700-V Start-Up Circuit	110-V Start-Up Circuit	Soft Start	Output Drive (Sink/ Source) (A)	Package(s)	Price*
Green Mode PWM Controllers													
UCC28710/1	Up to 25		✔		Flyback	130 kHz	9 to 35		✔	✔	0.025/7	7-SOIC, 6-SOT-23	0.42
UCC28700/1/2/3	Up to 30		✔		Flyback	130 kHz	9 to 35			✔	0.025/7	6-SOT-26	0.35
UCC28720	Up to 30		✔		Flyback	80 kHz	9 to 35	✔		✔	0.37/1	8-SOIC	0.40
UCC28740	Up to 30		✔		Flyback	100 kHz	9 to 35	✔		✔	0.25/7	8-SOIC	0.42
UCC28610	10 to 40		✔		Buck, Flyback (SEPIC, Cuk)	140 kHz	9 to 20				—	8-SOIC	0.60
LM5023	5 to 100		✔		Quasi-Resonant Mode Flyback	130 kHz	8 to 15			✔	0.3/0.7	8-MSOP	0.38
UCC28600	50 to 150		✔		Flyback (SEPIC, Cuk)	130 kHz	30			✔	1/0.75	8-SOIC	0.49
General-Purpose Single-Ended Controllers													
UCC3889	<10	✔			Flyback (SEPIC, Cuk)	250 kHz	9			✔	0.2/0.15	8-SOIC-W/DIL (PDIP)	0.59
LM5020	10 to 100		✔		Buck, Boost, Flyback (SEPIC, Cuk)	1 MHz	13 to 100		✔	✔	1	10-MSOP/QFN	0.90
LM5021	10 to 100		✔		Flyback (SEPIC, Cuk), Forward (D > 50%)	1 MHz	8 to 30			✔	0.7	8-MSOP	0.66
LM5022	25 to 100		✔		Buck, Boost, Flyback (SEPIC, Cuk)	2 MHz	6 to 60			✔	1	10-MSOP	1.13
UCC3800/1/2/3/4/5	10 to 200	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd), Forward (D > 50%)	1 MHz	4.1 to 15			✔	1/1	8-TSSOP/SOIC/DIL (PDIP)	1.35
UCC3807-1-2-3	10 to 200	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Forward (D > 50%)	1 MHz	6.9 to 15			✔	1/1	8-SOIC/DIL (PDIP)	1.50
UCC3809-1-2	10 to 200	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Forward (D > 50%)	1 MHz	8 to 19			✔	0.8/0.4	8-MSOP/TSSOP/SOIC/ DIL (PDIP)	0.85
UCC3813-0/1/2/3/4/5	10 to 200	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd)[2], Forward (D > 50%)[2]	1 MHz	7.2 to 15[2]			✔	1/1	8-TSSOP/SOIC/DIL (PDIP)	0.80
UCC3884	50 to 250	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Forward (D > 50%)	1 MHz	8.9 to 15			✔	1/0.5	16-SOIC/DIL (PDIP)	1.60
UCC38C40/1/2/3/4/5	10 to 250	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Forward (D > 50%)	1 MHz	5 Options				1/1	8-MSOP/SOIC/DIL (PDIP)	0.95
TL3842B/3B/4B/5B	30 to 350	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Forward (D > 50%)	500 kHz	10 to 30				1/1	8/14-SOIC, 8-DIL (PDIP)	0.54
UC3842A/3A/4A/5A	30 to 350	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Forward (D > 50%)	500 kHz	10 to 30				1/1	8/14-SOIC, 8-DIL (PDIP)	0.80
UC28023	50 to 750	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Forward (D > 50%)	1 MHz	9 to 30			✔	1.5/1.5	16-SOIC-W/DIL (PDIP)	1.35
UC3823A/B	50 to 750	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Forward (D > 50%)	1 MHz	9 to 22			✔	2/2	16-SOIC-W/DIL (PDIP), 20-PLCC	4.90
Dual Output Controllers													
LM5015	30 to 250		✔		Fwd (Including 2-Switch Fwd)	750 kHz	4.25 to 75			✔	1	14-TSSOP	2.05
LM5032	30 to 250		✔		Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd)	1 MHz	13 to 100		✔	✔	2.5/2.5	16-TSSOP	1.55
LM5034	30 to 250		✔		Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd)	1 MHz	8 to 100		✔	✔	2.5/2.5	20-TSSOP	1.90
UC3824	50 to 250	✔	✔		Push-Pull, Half-Bridge, Full-Bridge	1 MHz	9 to 30			✔	1.5/1.5	16-SOIC-W/DIL (PDIP)	4.55
UCC28089	25 to 250				Interleaved Fwd/Flyback/Boost, Push-Pull, Half-Bridge, Full-Bridge	500 kHz	8 to 15			✔	0.5/1.0	8-SOIC	0.65
LM5035/A/B/C	50 to 300	✔			Half-Bridge	2 MHz	8 to 100		✔	✔	2/2	28-TSSOP, 20-HTSSOP, 24-QFN	1.90
LM(2)5037	30 to 300	✔	✔		Push-Pull, Half-Bridge, Full-Bridge	2 MHz	13 to 75/100		✔	✔	1.2/1.2	16-TSSOP	1.35/1.62
LM5039	50 to 300	✔			Half-Bridge	2 MHz	8 to 100		✔	✔	2/2	20-HTSSOP, 24-QFN	1.90
LM5045	50 to 400	✔	✔		Full-Bridge	2 MHz	14 to 100		✔	✔	1.5/2	28-HTSSOP/QFN	2.25
TL494 or TL594	50 to 500	✔			Buck, Boost, Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd), Forward (D > 50%), Interleaved Fwd/ Flyback/Boost, Push-Pull, Half-Bridge, Full-Bridge	300 kHz	7 to 40				0.2/0.2	16-TSSOP/SOIC/DIL (PDIP)	0.23
TL598	50 to 500	✔			Buck, Boost, Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd), Forward (D > 50%), Interleaved Fwd/ Flyback/Boost, Push-Pull, Half-Bridge, Full-Bridge	300 kHz	7 to 40				0.2/0.2	16-SOIC/DIL (PDIP)	0.81
UC3524A	50 to 500	✔			Push-Pull, Half-Bridge, Full-Bridge	250 kHz	8 to 40			✔	0.2/0.2	16-SOIC/DIL (PDIP)	1.70
UC3525B - UC3526A	50 to 500	✔			Push-Pull, Half-Bridge, Full-Bridge	250 kHz	8 to 40			✔	0.2/0.2	16-SOIC/DIL (PDIP), 20-PLCC	1.05
UC3827-1/-2	50 to 500		✔		I-Fed/V-Fed Push-Pull	450 kHz	8.4 to 20			✔	1/0.8	24-SOIC-W/DIL (PDIP), 28-PLCC	3.50
UCC3808-1/-2/A-1/A-2	50 to 500		✔		Push-Pull, Half-Bridge, Full-Bridge	1 MHz	4.3 to 15			✔	1.0/0.5	8-TSSOP/SOIC/DIL (PDIP)	1.30
UCC38083/4/5/6	50 to 500		✔		Push-Pull, Half-Bridge, Full-Bridge	1 MHz	8.3 to 15			✔	1.0/0.5	8-TSSOP/SOIC/DIL (PDIP)	1.10
UCC3810	50 to 500	✔	✔		Buck, Boost, Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd), Interleaved Fwd/Flyback/Boost	1 MHz	8.3 to 11				1/1	16-SOIC/DIL (PDIP)	1.85

[1] *UC2xxx and UCC2xxx devices are extended temperature-range versions of the UC3xxx and UCC3xxx devices.*

[2] *Value varies by part number suffix. Please check datasheet.*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

AC/DC and Isolated DC/DC Power Supplies
PWM and Resonant Controllers

Selection Guide (Continued)

Device[1]	Typical Power Level (W)	Control Method: Voltage Mode	Control Method: Current Mode	Control Method: Avg. Current Mode	Topologies	Maximum Practical Frequency	Supply Voltage (V)	700-V Start-Up Circuit	110-V Start-Up Circuit	Soft Start	Output Drive (Sink/ Source) (A)	Package(s)	Price*
Dual Output Controllers (Continued)													
LM5030	50 to 600		✔		Act-Clamp Fwd/Flyback, Half-Bridge, Full-Bridge	1 MHz	14 to 100		✔	✔	1.5/1.5	20-TSSOP	1.10
LM5033	50 to 600	✔			Push-Pull, Half-Bridge, Full-Bridge	1 MHz	15 to 100		✔	✔	1.5/1.5	10-MSOP/QFN	1.00
UC28025	50 to 750	✔	✔		Push-Pull, Half-Bridge, Full-Bridge	1 MHz	9 to 30			✔	1.5/1.5	16-SOIC-W/DIL (PDIP)	1.35
UC3825	50 to 750	✔	✔		Push-Pull, Half-Bridge, Full-Bridge	1 MHz	9 to 30			✔	1.5/1.5	16-SOIC-W/DIL (PDIP), 20-PLCC	1.60
UC3825A/B	50 to 750	✔	✔		Push-Pull, Half-Bridge, Full-Bridge	1 MHz	9 to 22			✔	2/2	16-SOIC-W/DIL (PDIP), 20-PLCC	2.65
UC3846/56	50 to 750	✔	✔		Push-Pull, Half-Bridge, Full-Bridge	1 MHz	8 to 40			✔	0.5/0.5	16-SOIC-W/DIL (PDIP), 20-PLCC	1.60
UCC3806	50 to 750	✔	✔		Push-Pull, Half-Bridge, Full-Bridge	350 kHz	7 to 15			✔	0.5/0.5	16-SSOP/TSSOP/SOIC/ SOIC-W/DIL (PDIP), 20-PLCC	4.10
LM5041/A/B	50 to 800		✔		I-Fed/V-Fed Push-Pull	1 MHz	15 to 100		✔	✔	1/5/1.5	16-TSSOP/QFN	2.15
UCC28250/1	100 to 800	✔	✔		Fwd (Including 2-Switch Fwd), Interleaved Fwd/Flyback/ Boost, Act-Clamp Fwd/Flyback, Push-Pull, Half-Bridge	1 MHz	4.7 to 17			✔	—	20-TSSOP/QFN	1.70
UCC28220/1	50 to 800		✔		Interleaved Fwd/Flyback/Boost	1 MHz/ch.	8 to 14.5		✔	✔	0.01/0.01	16-TSSOP/SOIC	1.60
Soft-Switching, ZVT and ZVS Controllers													
LM5025/A/B/C	50 to 250	✔			Act-Clamp Fwd/Flyback	1 MHz	8 to 100		✔	✔	3/3	16-TSSOP/QFN	1.25
LM5026	50 to 250		✔		Act-Clamp Fwd/Flyback	1 MHz	8 to 100		✔	✔	3/3	16-TSSOP/QFN	1.30
LM5027/A	50 to 250	✔			Act-Clamp Fwd/Flyback	1 MHz	8 to 105		✔	✔	2/2	24-TSSOP, 20-QFN	1.75
LM5046	50 to 400	✔	✔		Φ-Shifted FB	2 MHz	14 to 100		✔	✔	2/2	28-HTSSOP/QFN	2.45
UCC2897A	75 to 600		✔		Forward (D > 50%), Act-Clamp Fwd/Flyback	1 MHz	8.5 to 14.5		✔	✔	2/2, 2/2	20-TSSOP, 16-SOIC	1.50
UCC25600	200 W to 1 kW				Half-Bridge	350 kHz	11.5 to 18			✔	0.4/0.8	8-SOIC	0.80
UCC28950	200 W to 2 kW	✔	✔	✔	Φ-Shifted FB	1 MHz	8 to 17			✔	—	24-TSSOP	4.25
UCC3895	200 W to 2 kW	✔	✔	✔	Φ-Shifted FB	1 MHz	11 to 17			✔	Four at 0.1/0.1	20-SOIC-W/DIL (PDIP)/ PLCC	4.35
Wide-Input Range Voltage Mode Controllers													
UCC35701/2	25 to 250	✔			Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd), Forward (D > 50%)	700 kHz	8.8 to 15			✔	1.2/1.2	14-TSSOP/SOIC/DIL (PDIP)	2.95
UCC35705/6	25 to 250	✔			Boost, Flyback (SEPIC, Cuk), Fwd (Including 2-Switch Fwd), Forward (D > 50%)	4 MHz	8.0 to 15				0.1/0.1	8-MSOP/SOIC/DIL (PDIP)	0.75
Auxiliary Bias Supplies													
TPS55010	<2		✔		Fly-Buck™ (Forward Flyback)	2 MHz	2.95 to 6			✔	—	16-QFN	0.99
UCC25230	1 to 2				Buck, Fly-Buck (Forward Flyback)	445 kHz	12 to 75			✔	—	8-SON	1.35
LM34927/6/5	3 to 7	Note 2			Buck, Isolated Buck	1 MHz	9 to 100				0.6/0.3/0.15	8-LLP/PSOP	1.65
LM5017	3 to 7	Note 2			Buck, Isolated/Non-Isolated Flyback	1 MHz	9 to 100				0.6	8-LLP/PSOP	1.65
Intermediate Bus Controllers													
UCC28230/1	150 to 500				Half-Bridge, Full-Bridge	2 MHz	–0.3 to 20			✔	0.2/0.2	12-SON, 14-TSSOP	1.20
Secondary-Side, Post Regulation													
LM(2)5115/A	—		✔		Synchronous Secondary-Side Post Regulator	1 MHz	4.5 to 42/75			✔	2/2.5	16-TSSOP/QFN	1.35/1.80

[1]UC2xxx and UCC2xxx devices are extended temperature-range versions of the UC3xxx and UCC3xxx devices.
[2]Value varies by part number suffix. Please check datasheet.

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

AC/DC and Isolated DC/DC Power Supplies
Gate Drivers

Design Factors

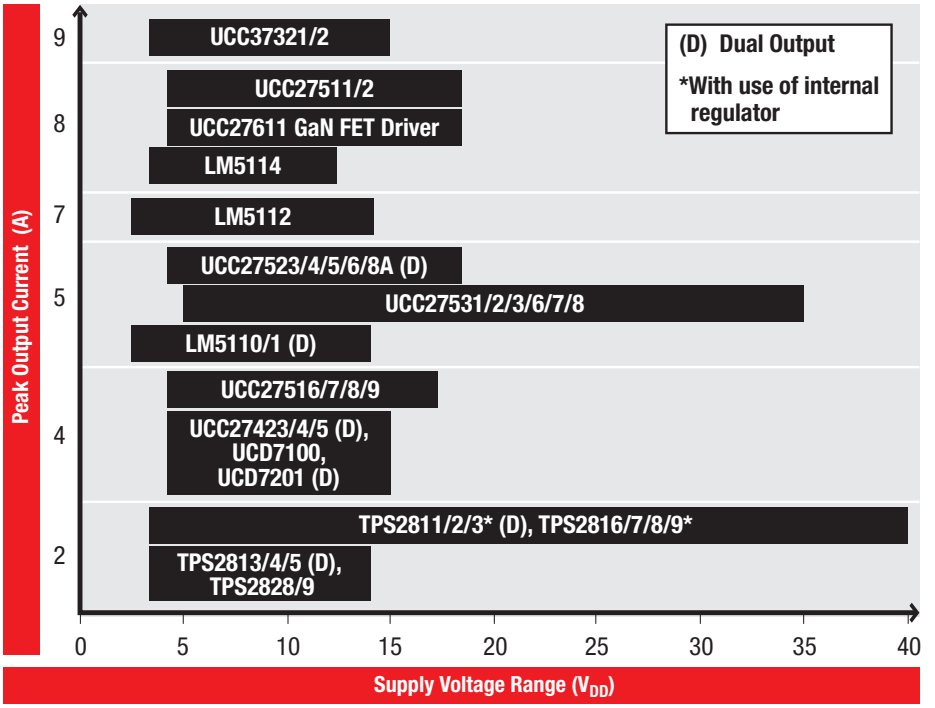
Supply Voltage Range — With internal voltage regulators, MOSFET drivers can operate over a wide input voltage range, making them flexible for many applications.

Number of Outputs — Single and dual drivers are available to complement DC/DC switching and motor control applications.

Output Configuration — Inverting, non-inverting, AND and NAND configurations are available.

New single-channel low-side drivers offer split outputs (for independent source and sink to allow optimization of switch timing) and asymmetrical drive (higher sink than source current) for faster transition through Miller Plateau.

Low-Side Gate Driver Portfolio



Product Highlights

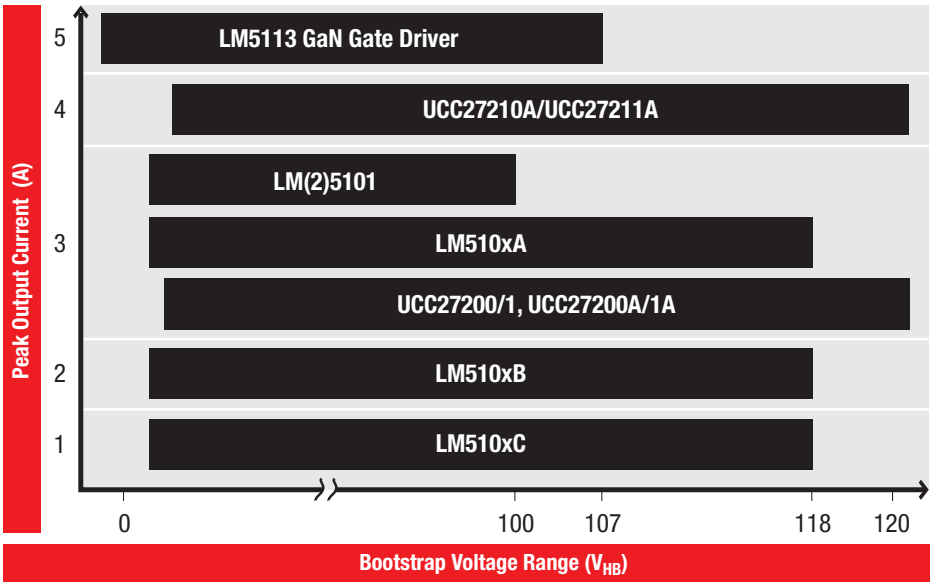
UCC2751x and UCC2752xA
- Asymmetrical drive and split output options available on select single-channel drivers
- Best-in-class propagation delay and higher V_{DD} compatibility with IGBT power switches
- UCC27528 features CMOS input thresholds

UCC27531
- FET and IGBT single-gate drivers
- 2.5 A and 5 A, 35-V maximum V_{DD}

LM5114
- Next-generation 7.6-A, 12-ns single-channel MOS and GaN FET-compatible driver

UCC27611
- High-speed 5-V GaN FET driver

High-Side/Low-Side Bridge Driver Portfolio



Product Highlights

UCC2721xA
- 4-A next generation of popular UCC2720x has 120-V boot voltage, –10-V input-voltage capability and ESD enhancements

LM510xx Family
- Drive capability scales with power-converter requirements

LM5113
- Industry's only 100-V driver for enhancement-mode GaN FETs

AC/DC and Isolated DC/DC Power Supplies

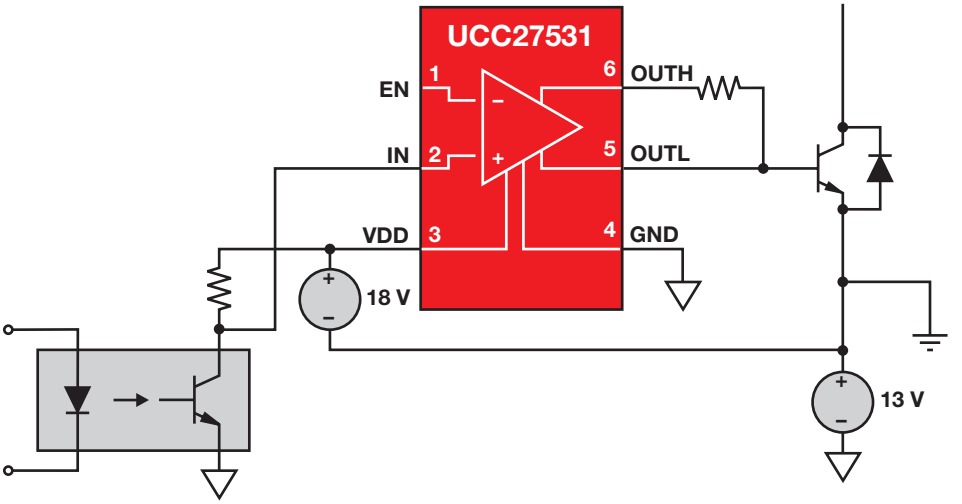
Gate Drivers

2.5-A/5-A, 35-V Max Single-Gate Driver for FETs, IGBTs and SiC FETs

UCC27531

Advantages over Discrete Design

- Built-in level shifting
- Flexibility: Inverting and non-inverting configurations
- Matches parasitic and improves layout
- Reduced number of devices (three needed for discrete design)
- Reduced overall cost—transistor/FET and PC board space

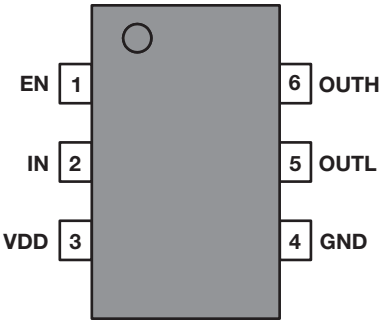


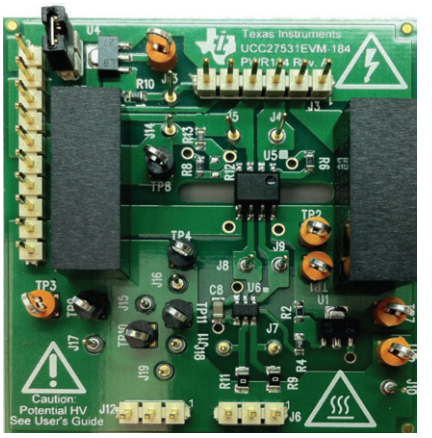
Key Features

- High V_{DD}: 35 V allows significant margin
- Strong output-drive capability: 2.5-A source/5-A sink allows fast charging
- Fastest propagation time: 17-ns typical delay
- High reliability: UVLO setting and rail-to-rail output voltage provide system protection
- Negative-input-voltage handling allows driver to support “noisy” industrial designs
- Can be used for low side and high side
- Used with TI’s UCD3138 digital power controller or C2000™ microcontrollers

Applications

- Solar inverters
- Motor control
- UPS
- HEV/EV chargers
- Switch-mode power
- Intelligent power modules





UCC27531EVM-184 evaluation module.

Get more information: **www.ti.com/product/UCC27531**

www.ti.com/lit/slua669

www.ti.com/tool/UCC27531EVM-184

AC/DC and Isolated DC/DC Power Supplies
Gate Drivers

Selection Guide

Device	No. of Channels	Output Configuration	Output Type[1]	Peak I_{OUT} Source/Sink (A)	Rise/Fall Time (ns)	V_{CC} Range (V)	Prop Delay (ns)	Input Threshold	Enable	Dead Time Control	Protection Features[2]	Internal Regulator	Price*
General-Purpose Low-Side Drivers													
UCC37321	1	Inverting	TrueDrive™	9/9	20/20	4 to 15	30	TTL/CMOS	✔	—	—	—	0.99
UCC37322	1	Non-inverting	TrueDrive	9/9	20/20	4 to 15	30	TTL/CMOS	✔	—	—	—	0.99
LM5112	2	Non-inverting	Split	7/3	14/12	3.5 to 15	25	CMOS	—	—	✔	—	0.50
UCC27523	2	Inverting	—	5/5	9/7	4.5 to 18	14	TTL	✔	—	—	—	0.75
UCC27524A	2	Non-inverting	—	5/5	9/7	4.5 to 18	14	TTL	✔	—	—	—	0.75
UCC27525A	2	See Note 3	—	5/5	9/7	4.5 to 18	14	TTL	✔	—	—	—	0.75
UCC27526A	2	See Note 3	—	5/5	9/7	4.5 to 18	14	TTL	✔	—	—	—	0.75
LM5111	2	Non-inverting	Split	5/3	14/12	3.5 to 15	25	TTL	—	—	✔	—	0.65
LM5110	2	Non-inverting	Split	5/2	14/12	3.5 to 15	25	TTL	—	—	✔	—	0.65
LM5134	2	Non-inverting with Pilot output	Split	4.5/7.6 0.66/0.82	5.3/4.7	4 to 12.6	12	TTL/CMOS	—	—	—	—	0.60
UCC27511	1	Non-inverting	Split	4/8	9/9	4.5 to 18	14	Dual input TTL	—	—	—	—	0.60
UCC27512	1	Non-inverting	—	4/8	9/7	4.5 to 18	14	Dual input TTL	—	—	—	—	0.60
UCC27516	1	See Note 3	—	4/4	9/7	4.5 to 18	14	TTL	—	—	—	—	0.49
UCC27517A	1	See Note 3	—	4/4	9/7	4.5 to 18	14	TTL	—	—	—	—	0.49
UCC27518	1	Inverting	—	4/4	9/7	4.5 to 18	14	CMOS	—	—	—	—	0.49
UCC27519	1	Non-inverting	—	4/4	9/7	4.5 to 18	14	CMOS	—	—	—	—	0.49
UCD7100PWP	1	Uncommitted/ Non-inverting	TrueDrive	4/4	10/10	4.5 to 16	20	CMOS/TTL	—	Adaptive	—	—	0.99
UCD7201PWP	2	Uncommitted/ Non-inverting	TrueDrive	4/4	10/10	4.5 to 16	20	CMOS/TTL	—	Adaptive	—	—	1.20
TPS2812	2	Non-inverting	TrueDrive	2/2	25/25	4 to 40	40	CMOS	—	—	—	✔	0.90
TPS2814	2	Dual 2-input AND; one inverting	TrueDrive	2/2	25/25	4 to 14	40	CMOS	—	—	—	—	0.90
TPS2828	1	Inverting	TrueDrive	2/2	25/25	4 to 14	40	CMOS	—	—	—	—	0.60
TPS2829	1	Non-inverting	TrueDrive	2/2	25/25	4 to 14	40	CMOS	—	—	—	—	0.60
LM5114A/B	1	Non-inverting	Split	1.3/7.6	8/3.2	4 to 12.6	—	TTL/CMOS	—	—	—	—	0.60
UCC27611	1	See Note 3	—	–4/8	5/5	—	14	TTL	—	—	—	—	0.85
UCC27531	1	Non-inverting	—	–2.5/5	15/7	—	17	TTL	—	—	—	—	0.75
UCC27532	1	Non-inverting	—	–2.5/5	15/7	—	17	CMOS	—	—	—	—	0.75
UCC27533	1	See Note 3	—	–2.5/5	15/8	—	15	TTL	—	—	—	—	0.75
UCC27536	1	Inverting	—	–2.5/5	15/8	—	15	TTL	—	—	—	—	0.75
UCC27537	1	Non-inverting	—	–2.5/5	15/8	—	15	TTL	—	—	—	—	0.75
UCC27538	2	Non-inverting	—	–2.5/5	15/8	—	15	TTL	—	—	—	—	0.75
Synchronous-Rectifier Drivers													
UCC24610		Non-inverting	—	3/3	30/25	4.5 to 5.5	44	CMOS/TTL	✔	Adaptive	✔	—	0.75
Synchronous Buck Drivers													
TPS2838	2	Non-inverting	TrueDrive	4/4	120	10 to 15	40	TTL	✔	Adaptive	—	✔	1.30
TPS2839	2	Inverting	TrueDrive	4/4	120	10 to 15	40	TTL	✔	Adaptive	—	✔	1.30
TPS2848	2	Non-inverting	TrueDrive	4/4	120	10 to 15	20	TTL	✔	Adaptive	—	✔	1.25
TPS2849	2	Inverting	TrueDrive	4/4	120	10 to 15	20	TTL	✔	Adaptive	—	✔	1.25
UCD7230	2	Non-inverting	CMOS	4/4	10/10	4.5 to 15.5	25	CMOS/TTL	—	Adaptive	Adjustable	—	0.80
UCC27221	2	Inverting	TrueDrive	3.3/3.3	20/20	3.7 to 20	82/103	TTL	—	PGD[4]	—	✔	1.70
UCC27222	2	Non-inverting	TrueDrive	3.3/3.3	20/20	3.7 to 20	82/103	TTL	—	PGD[4]	—	✔	1.70
UCC27223	2	Non-inverting	TrueDrive	3.3/3.3	25/35	4.15 to 20	82/103	TTL	✔	PGD[4]	—	✔	1.70
TPS2830	2	Non-inverting	TrueDrive	2.4/2.4	50/50	4.5 to 15	75	CMOS	✔	Adaptive	OVPC	—	1.05
TPS2831	2	Inverting	TrueDrive	2.4/2.4	50/50	4.5 to 15	75	CMOS	✔	Adaptive	OVPC	—	1.05
TPS2832	2	Non-inverting	TrueDrive	2.4/2.4	50/50	4.5 to 15	75	CMOS	—	Adaptive	—	—	1.00

[1] Output type: TrueDrive is the hybrid bipolar/CMOS output architecture for improved current drive capability at low voltages (at Miller threshold).
[2] OVPC = overvoltage protection crowbar, UVLO = undervoltage lockout.
[3] One inverting, one non-inverting.
[4] Predictive Gate Drive™.
[5] Maximum boot voltage at HS pin.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Selection Guide (Continued)

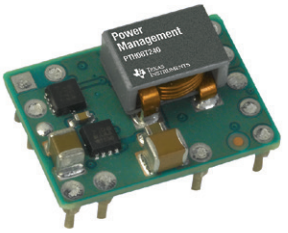
Device	No. of Channels	Output Configuration	Output Type[1]	Peak I_{OUT} Source/Sink (A)	Rise/Fall Time (ns)	V_{CC} Range (V)	Prop Delay (ns)	Input Threshold	Enable	Dead Time Control	Protection Features[2]	Internal Regulator	Price*
Synchronous Buck Drivers (Continued)													
TPS2833	2	Inverting	TrueDrive	2.4/2.4	50/50	4.5 to 15	75	CMOS	—	Adaptive	—	—	1.00
TPS2834	2	Non-inverting	TrueDrive	2.4/2.4	30/30	4.5 to 15	70	TTL	✔	Adaptive	OVPC	—	1.05
TPS2835	2	Inverting	TrueDrive	2.4/2.4	30/30	4.5 to 15	70	TTL	✔	Adaptive	OVPC	—	1.05
TPS2836	2	Non-inverting	TrueDrive	2.4/2.4	30/30	4.5 to 15	70	TTL	—	Adaptive	—	—	1.25
TPS2837	2	Inverting	TrueDrive	2.4/2.4	30/30	4.5 to 15	70	TTL	—	Adaptive	—	—	1.25
TPS28225	2	Non-inverting	CMOS	2/4	10/10	4.5 to 8.8	14	TTL/CMOS	✔	Adaptive	UVLO	—	0.60
TPS28226	2	Non-inverting	CMOS	2/4	10/10	4.5 to 8.8	14	TTL/CMOS	✔	Adaptive	UVLO	—	0.60
High-Side Low-Side Drivers—Half Bridge, Full Bridge													
UCC27210	2	Non-inverting	—	4/4	12/9	to 115[5]	20	CMOS	—	—	UVLO	—	1.40
UCC27211	2	Non-inverting	—	4/4	12/9	to 115[5]	20	TTL	—	—	UVLO	—	1.40
LM25101A/B/C	2	Non-inverting	CMOS	3/3	8/8	to 80	25	TTL	—	—	UVLO	—	0.49
LM5100A/B/C	2	Non-inverting	CMOS	3/3	8/8	to 118	25	CMOS	—	—	UVLO	—	1.25
LM5101A/B/C	2	Non-inverting	CMOS	3/3	8/8	to 118	25	TTL	—	—	UVLO	—	1.25
UCC27200/A	2	Non-inverting	TrueDrive	3/3	8/7	to 110[5]	20	CMOS	—	—	UVLO	—	1.30
UCC27201/A	2	Non-inverting	TrueDrive	3/3	8/7	to 110[5]	20	TTL	—	—	UVLO	—	1.30
LM5113	2	Non-inverting	GaN FET	1.2/5	4/4	to 100[5]	30	TTL	—	—	UVLO	—	1.65

[1] Output type: TrueDrive is the hybrid bipolar/CMOS output architecture for improved current drive capability at low voltages (at Miller threshold).
[2] OVPC = overvoltage protection crowbar, UVLO = undervoltage lockout.
[3] One inverting, one non-inverting.
[4] Predictive Gate Drive™.
[5] Maximum boot voltage at HS pin.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Power Modules (Non-Isolated)
Overview

Design with TI's comprehensive power module portfolio for wide input-voltage and output-current ranges, flexible packaging options and easy-to-use integrated solutions for a variety of non-isolated, industrial, medical, and communications applications.



PTH08T2xx "T2" Power Modules

High-current modules for applications that require up to 50 A.

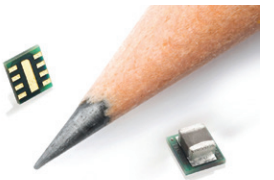
- High output current of up to 50 A
- TurboTrans™ feature for tunable transient response
- Current sharing (50-A version)

SIMPLE SWITCHER® Power Modules

QFN Package: LMZ3 Series

Easy-to-use high-power-density modules for applications requiring a small footprint.

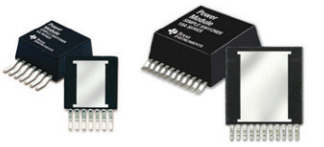
- Input-voltage range: 2.95 to 50 V
- Output current up to 30 A
- Feature-rich and flexible
- Only three external components required



QFN Package: Nano Series

Tiny modules for point-of-load applications that require up to 1 A.

- Input-voltage range: 2.7 to 5.5 V
- Tiny 2.6 x 3 x 1.5-mm packaging
- High efficiency up to 96%
- Low output ripple



Leaded Package

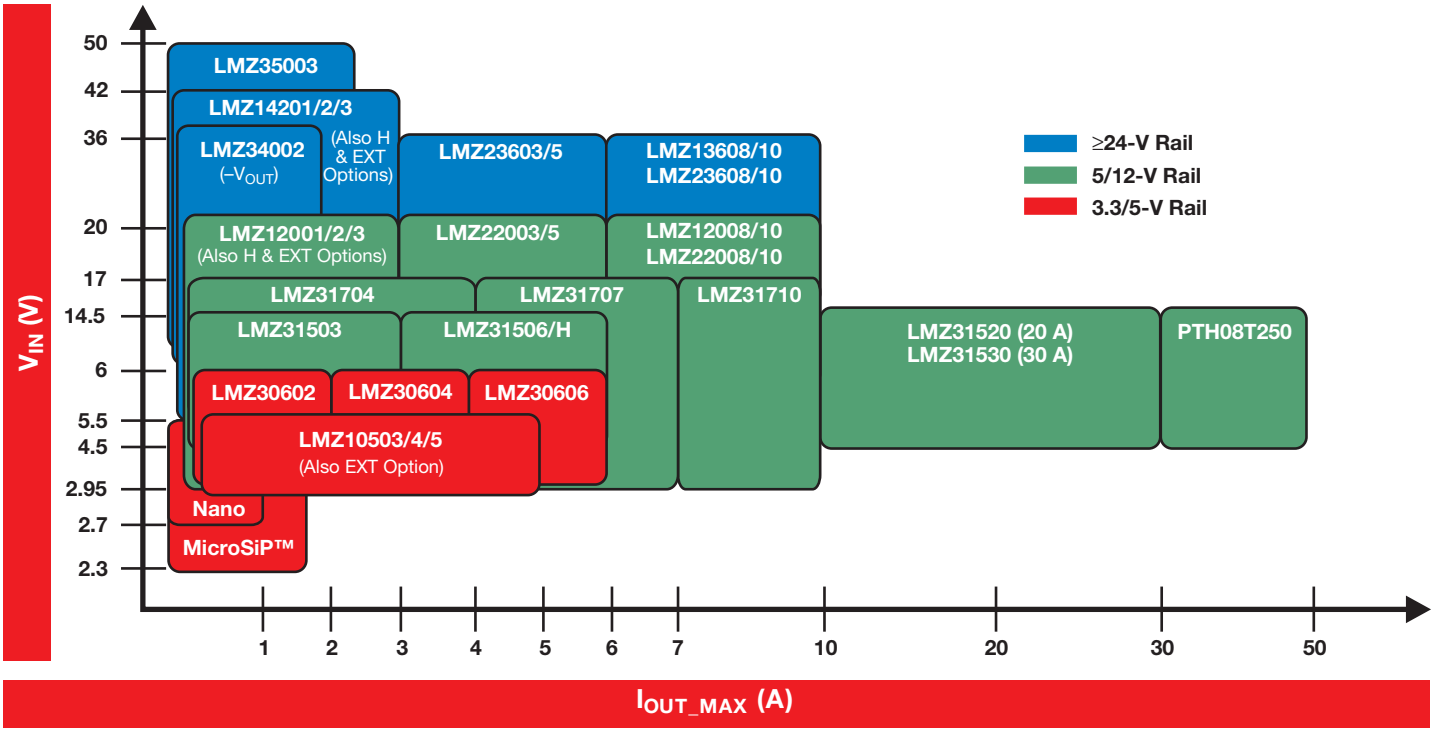
Easy-to-use modules for applications requiring high input voltages of up to 42 V.

- Single exposed bottom
- Supports 5-V, 12-V and 24-V rails
- Output current up to 10 A

MicroSiP™ Modules: TPS81k (Boost) Family and TPS82k (Step-Down) Family

Smallest total-solution footprint.

- Integrates all required components
- Achieves 90 mA/mm^2
- High efficiency over entire load range
- Supports noise-critical applications through spread-spectrum modulation



Power Modules (Non-Isolated)

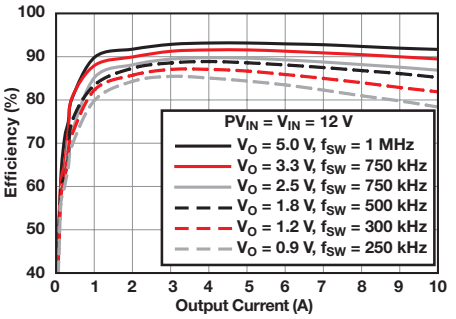
Step-Down (Buck) Modules

SIMPLE SWITCHER® QFN Power Modules

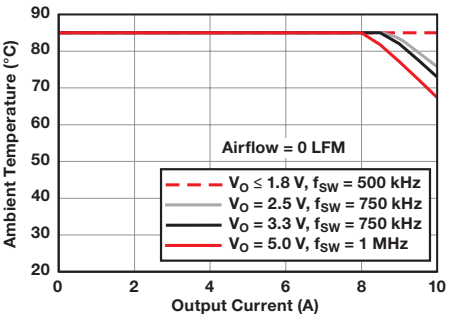
LMZ31710

Key Features

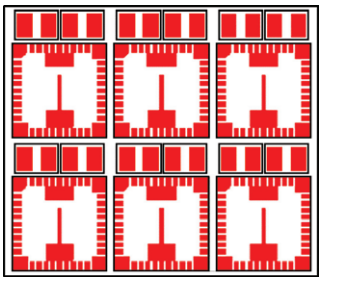
- World's smallest 10-A power solution in a tiny 10 x 10 x 4.3-mm QFN package
- 2.95- to 17-V input
- 0.6- to 5.5-V output up to 10 A
- Pin-compatible with LMZ31707 (7 A) and LMZ31704 (4 A)
- Current sharing up to 60 A
- Low noise: Meets EN55022 Class B emissions
- Wide operating temperature: Up to 125°C T_J



High-power efficiency from 5 V and 12 V.



Great thermal efficiency even without forced air.



Capable of current sharing up to six devices for 60 A.

Get more information: **www.ti.com/LMZ3**

www.ti.com/product/LMZ31710 (10 A) or **LMZ31707** (7 A) or **LMZ31704** (4 A)

SIMPLE SWITCHER® QFN Power Modules Selection Guide

Device	I_{OUT} (A)	V_{IN} (V)	V_{OUT} (V)	Package θ_{JA} (°C/W)	Switching Frequency (kHz)	Features						EVM	Package(s)	Price*
						Power Good Pin	Sync Pin	Adj. Soft Start	180° Out of Phase	Sequencing/ Tracking	Current Sharing			
Low Input Voltage														
LMZ30602	2	2.95 to 6.0	0.8 to 3.6	12	500 to 2000	✔	✔	✔		✔		✔	39 QFN (9x11x2.8 mm)	2.95
LMZ30604	4	2.95 to 6.0	0.8 to 3.6	12	500 to 2000	✔	✔	✔		✔		✔	39 QFN (9x11x2.8 mm)	3.80
LMZ30606	6	2.95 to 6.0	0.8 to 3.6	12	500 to 2000	✔	✔	✔		✔	✔	✔	39 QFN (9x11x2.8 mm)	4.50
Mid Input Voltage														
LMZ31503	3	4.5 to 14.5	0.8 to 5.5	13	330 to 780	✔	✔	✔		✔		✔	47 QFN (9x15x2.8 mm)	4.25
LMZ31704	4	2.95 to 17	0.6 to 5.5	13	200 to 1200	✔	✔	✔	✔	✔	✔	✔	44 QFN (10x10x4.3 mm)	5.25
LMZ31506	6	4.5 to 14.5	0.6 to 5.5	13	250 to 780	✔	✔	✔		✔	✔	✔	47 QFN (9x15x2.8 mm)	5.45
LMZ31707	7	2.95 to 17	0.6 to 5.5	13	200 to 1200	✔	✔	✔	✔	✔	✔	✔	44 QFN (10x10x4.3 mm)	6.50
LMZ31710	10	2.95 to 17	0.6 to 5.5	13	200 to 1200	✔	✔	✔	✔	✔	✔	✔	44 QFN (10x10x4.3 mm)	8.95
LMZ31520	20	4.5 to 14.5	0.6 to 2.8	8.6	500/900	✔		✔		✔		✔	68 QFN (15x16x5.8 mm)	14.00
LMZ31530	30	4.5 to 14.5	0.6 to 2.8	8.6	500/900	✔		✔		✔		✔	68 QFN (15x16x5.8 mm)	17.00
Wide Input Voltage														
LMZ35003	2.5	7 to 50	2.5 to 15	12	400 to 1000	✔	✔	✔		✔		✔	41 QFN (9x11x2.8 mm)	7.95
LMZ34002	2	4.5 to 40	–3 to –17	14	700 to 900		✔	✔				✔	41 QFN (9x11x2.8 mm)	6.75

All of the above devices have undervoltage lockout and thermal protection built in.

*New devices are listed in **bold red**.*

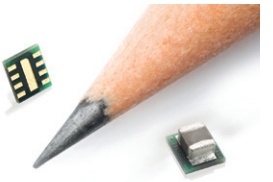
**Suggested resale price in U.S. dollars in quantities of 1,000.*

WEBENCH® models available for all SIMPLE SWITCHER® QFN devices: **www.ti.com/webench**

Power Modules (Non-Isolated)
Step-Down (Buck) Modules

SIMPLE SWITCHER® Nano Modules

The new SIMPLE SWITCHER nano modules combine ease of use and high performance in a tiny solution size. Nano modules provide enhanced system performance and can be used to reduce board area in applications with space and height limitations.



Easy-to-Use Package

- 2.6 x 3 x 1.5-mm footprint
- Eight pins and a thermal pad
- 50°C/W θ_{JA}
- MSL3
- 260°C peak reflow temperature
- No exposed die

SIMPLE SWITCHER® Nano Modules

Device	Output Current (max) (A)	Input Voltage (V)	Adjustable Output Voltage (V)	Operating Junction Temperature (°C)	Features	Frequency (kHz)	Eco-mode™	Power Good	CISPR22 Class B EMI	Package Size (mm)	Price*
LMZ10500/01	0.65/1	2.7 to 5.5	0.6 to 3.6	–40 to 125	EN, SS	2000			✔	2.6 x 3 x 1.5	1.30/1.50

**Suggested resale price in U.S. dollars in quantities of 1,000.*

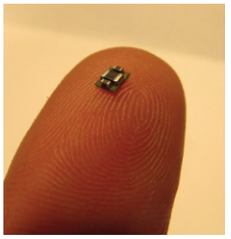
MicroSiP™ Modules

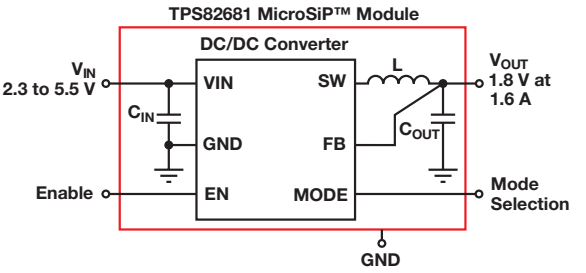
PREVIEW

1.6-A DC-DC Converter Module Achieves Less Than 9-mm² Footprint

TPS82681

The TPS8268x series of MicroSiP™ modules are step-down (buck) converters with integrated inductor and input/output capacitors. They can achieve greater than 5-W output power at a total solution size of less than 9 mm² and 1 mm high, simplifying design and saving up to 50% more board space than complete solutions. The 6-MHz, 1.6-A TPS82681 module supports an output power density of 580 mW/mm³. With an input voltage range of 2.3 to 5.5 V, the TPS8268x series also achieves a power efficiency of up to 92%, which enables it to efficiently manage 5 W in a module format of less than 9 mm³. The modules are suited for noise-critical applications through their PWM frequency dithering.





Get more information: **www.ti.com/microsip**

Key Features

- Smallest solution size: Achieves a solution less than 9 mm² and 1 mm high, providing a power density of 580 mW/mm³
- Simplifies design: High integration, including passives and capacitors, significantly reduces the effort required for hardware design and layout
- High performance: Up to 92% peak efficiency and high efficiency over a wide load range

Applications

- Cell phones, smartphones, tablet PCs
- Surveillance cameras
- Fiber optics
- Portable medical equipment
- USB powered applications

MicroSiP™ Power Modules Selection Guide

Device	Base Function	I_{OUT} (mA)	V_{IN} (V)	Fixed V_{OUT} (V)	Peak Efficiency (%)	Switching Frequency (typ) (kHz)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Active Output Capacitor Discharge	Total Solution Size (mm²)	MicroSiP™ Package	EVM	Features and Differentiators	Price*
Fully Integrated Solutions (Inductor plus input/output capacitors on device)														
TPS82740	Step-Down	300	2.2 to 5.5	1.8 to 3.3	95	3000	0.36	0.07	✔	9	9	✔	Load switch; 4-pin V-Select	1.50
TPS82695	Step-Down	500	2.3 to 4.35	2.5 to 2.85	95	4000	24	0.5	✔	6.7	8	✔		1.15
TPS82671	Step-Down	600	2.3 to 4.8	1.0 to 1.9	90	5500	17	0.5	✔	6.7	8	✔	Spread spectrum	1.15
TPS82693	Step-Down	800	2.3 to 4.8	2.2 to 3.2	95	3000	21	0.5	✔	6.7	8	✔	Spread spectrum	1.25
TPS82681	Step-Down	1600	2.3 to 5.5	0.8 to 3.3	92	6000	20	0.5	✔	6.7	9	✔	Spread spectrum	1.60

All of the above devices have undervoltage lockout and thermal protection built in.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

*Preview devices are listed in **bold teal**.*

Power Modules (Non-Isolated)

Step-Down (Buck) Modules

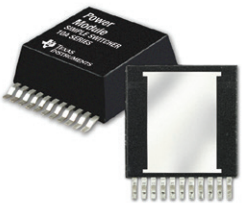
SIMPLE SWITCHER® Leaded Power Modules

The SIMPLE SWITCHER leaded power modules allow you to design and optimize robust power supplies with a minimum set of external components. All SIMPLE SWITCHER power modules provide you with low EMI, excellent thermal performance and pin-to-pin compatibility for added design flexibility. Plus, SIMPLE SWITCHER power modules utilize WEBENCH® Power Designer online design tools, feature evaluation boards and reference designs, and include application notes and videos to make design easy.

Easy-to-Use Packaging

Up to 5 A

Up to10 A



Key Features

- Integrated shielded inductor
- Precision enable, external soft-start, and tracking for sequencing
- Best-in-class thermal performance
- Low output voltage ripple
- Standard junction temperature grade: –40 to +125°C
- Easy-to-use package with single exposed copper bottom
- Passes EN55022 (CISPR22) Class B Radiated and Conducted EMI Standard

SIMPLE SWITCHER® LMZ1-Series Power Modules

Device	Output Current (max) (A)	Input Voltage (V)	Adjustable Output Voltage (V)	Peak Efficiency (%)	Operating Junction Temperature (°C)	Features	EMI EN55022/CISPR22 Class B Certification		Package(s)	Price*
							Radiated	Conducted[1]		
LMZ10503/04/05	3/4/5	2.95 to 5.5	0.8 to 5	96	–40 to 125	EN, SS	✔	✔	TO-PMOD-7	3.95/4.50/4.95
LMZ12001/02/03	1/2/3	4.5 to 20	0.8 to 6	92	–40 to 125	EN, SS	✔	✔	TO-PMOD-7	4.46/5.10/5.95
LMZ14201/02/03	1/2/3	6 to 42	0.8 to 6	90	–40 to 125	EN, SS	✔	✔	TO-PMOD-7	6.18/7.13/8.95
LMZ12008/10	8/10	6 to 20	0.8 to 6	92	–40 to 125	EN, SS	✔	✔	TO-PMOD-11	10.93/13.30
LMZ13608/10	8/10	6 to 36	0.8 to 6	92	–40 to 125	EN, SS	✔	✔	TO-PMOD-11	15.68/17.10

[1] *Additional input filter required.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

High Output Voltage Power Modules

The LMZ1420xH SIMPLE SWITCHER power modules have an output voltage range from 5 to 30 V. These power modules are a good choice for intermediate rail conversions, powering fans or other types of non-traditional points of load, and for sensing applications requiring voltages below –6 V.

Extended Temperature (EXT) Family of Power Modules

The SIMPLE SWITCHER EXT power modules provide excellent performance in the most extreme conditions, with extended ambient temperatures guaranteed down to –55°C and shock and vibration compliant to meet military MIL-STD-883 standards.

High Output Voltage and Extended Temperature Power Modules

Device	Output Current (max) (A)	Input Voltage (V)	Adjustable Output Voltage (V)	Peak Efficiency (%)	Operating Junction Temperature (°C)	Features	EMI EN55022/CISPR22 Class B Certification		Shock and Vibration Compliant	Package(s)	Price*
							Radiated	Conducted[1]			
LMZ10503/04/05EXT	3/4/5	2.95 to 5.5	0.8 to 5	96	–55 to 125	EN, SS	✔	✔	✔	TO-PMOD-7	12.60/13.50/14.40
LMZ12001/02/03EXT	1/2/3	4.5 to 20	0.8 to 6	92	–55 to 125	EN, SS	✔	✔	✔	TO-PMOD-7	9.50/11.40/13.80
LMZ14201/02/03EXT	1/2/3	6 to 42	0.8 to 6	94	–55 to 125	EN, SS	✔	✔	✔	TO-PMOD-7	12.40/14.30/17.20
LMZ14201H/02H/03H	1/2/3	6 to 42	5 to 24	97	–40 to 125	EN, SS	✔	✔		TO-PMOD-7	6.18/7.13/8.95

[1] *Additional input filter required.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

SIMPLE SWITCHER® LMZ2-Series Power Modules

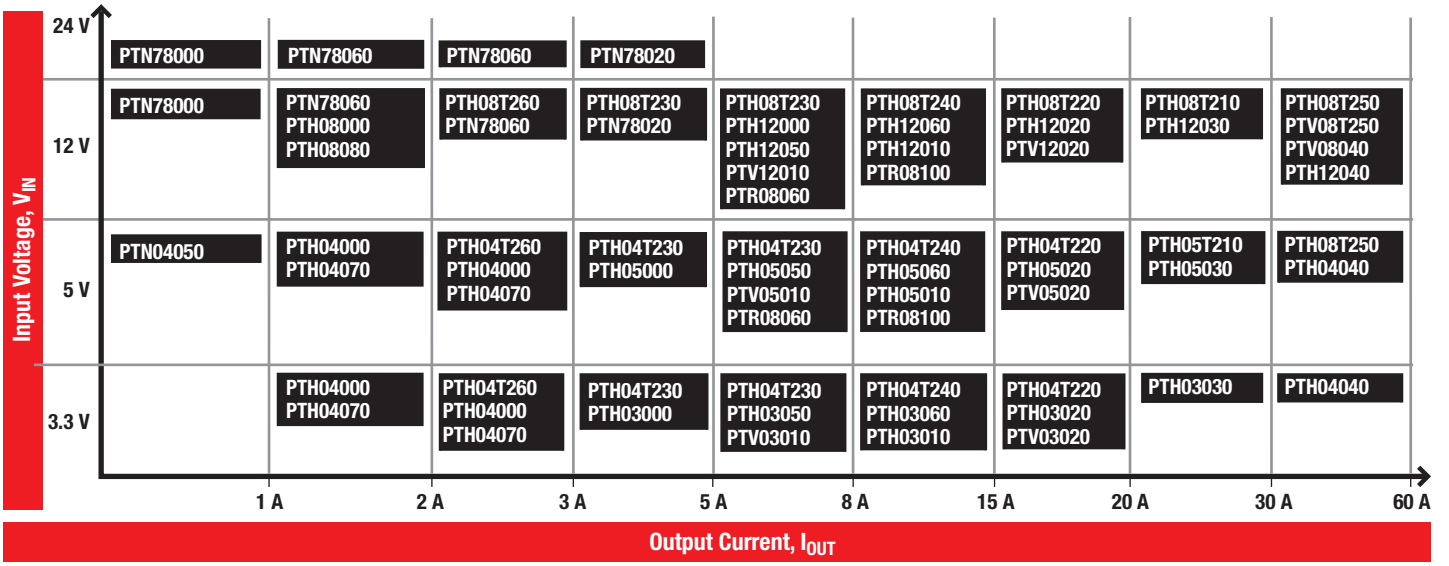
Device	Output Current (max) (A)	Input Voltage (V)	Adjustable Output Voltage (V)	Operating Junction Temperature (°C)	Features	EMI EN55022/CISPR22 Class B Certification		Package(s)	Price*
						Radiated	Conducted[1]		
LMZ22003/5	3/5	6 to 20	0.8 to 5	–40 to 125	EN, SS, Freq Sync	✔	✔	TO-PMOD-7	5.50/6.25
LMZ23603/5	3/5	6 to 36	0.8 to 6	–40 to 125	EN, SS, Freq Sync	✔	✔	TO-PMOD-7	9.85/12.50
LMZ22008/10	8/10	6 to 20	0.8 to 6	–40 to 125	EN, SS, Freq Sync, Current Share	✔	✔	TO-PMOD-11	11.50/14.00
LMZ23608/10	8/10	6 to 36	0.8 to 6	–40 to 125	EN, SS, Freq Sync, Current Share	✔	✔	TO-PMOD-11	16.50/18.00

[1] *Additional input filter required.* **Suggested resale price in U.S. dollars in quantities of 1,000.*

Power Modules (Non-Isolated)

Step-Down (Buck) Modules

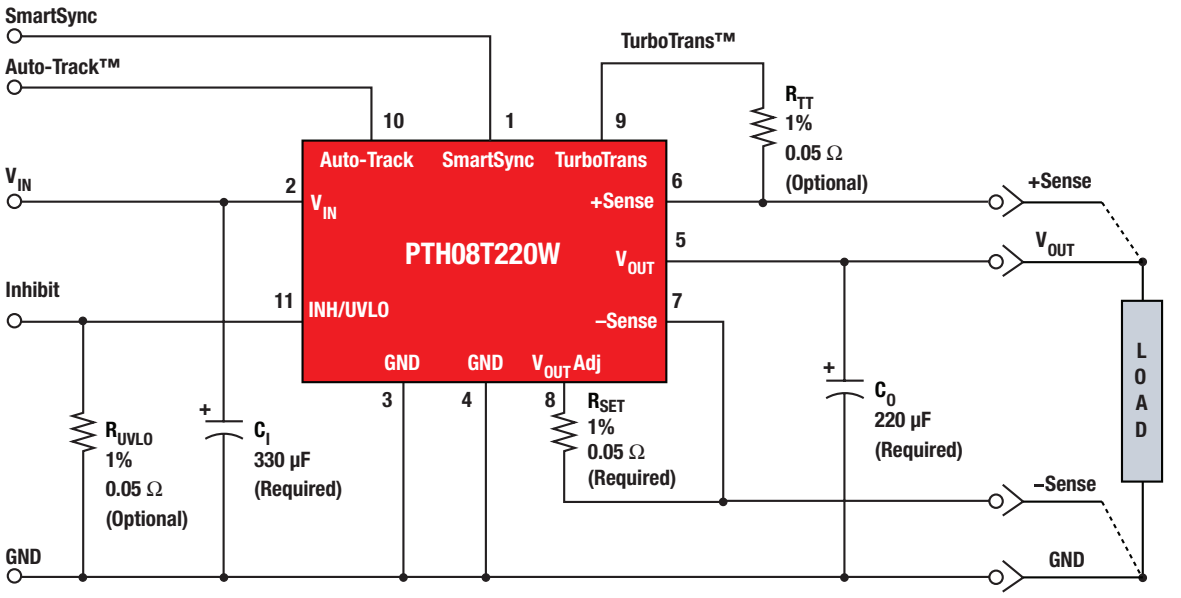
Non-Isolated Plug-In Power Modules (POLA™ and Others) Family of Products



16-A, 4.5-V to 14-V Input, POL Module with TurboTrans™ Technology

PTH08T220W

The PTH08T220W is a high-performance, 16-A-rated, T2 point-of-load (POL) power module. Operating from an input voltage range of 4.5 V to 14 V, the PTH08T220W requires a single resistor to set the output voltage to any value over the range of 0.7 V to 5.5 V. The PTH08T220W incorporates TurboTrans technology, SmartSync and Auto-Track™ sequencing.



Get more information: **www.ti.com/product/PTH08T220W**

Power Modules (Non-Isolated)

Step-Down (Buck) Modules

Selection Guide

Device[1]	Input Bus Voltage	Description	P_{OUT} or I_{OUT}	V_O Range (V)	V_O Adj.	Auto-Track™ Sequencing	POLA™	DDR-QDR	Price*
Non-Isolated Single Positive Output									
PTH03000W	3.3 V	3.3-V Input 6-A POL	6 A	0.8 to 2.5	✔				6.90
PTH03010W	3.3 V	3.3-V Input 15-A POL with Auto-Track™ Sequencing	15 A	0.8 to 2.5	✔	✔	✔		11.60
PTH03020W	3.3 V	3.3-V Input 22-A POL with Auto-Track Sequencing	22 A	0.8 to 2.5	✔	✔	✔		18.15
PTH03030W	3.3 V	3.3-V Input 30-A POL with Auto-Track Sequencing	30 A	0.8 to 2.5	✔	✔	✔		25.00
PTH03050W	3.3 V	3.3-V Input 6-A POL with Auto-Track Sequencing	6 A	0.8 to 2.5	✔	✔	✔		6.90
PTH03060W	3.3 V	3.3-V Input 10-A POL with Auto-Track Sequencing	10 A	0.7 to 2.5	✔	✔	✔		9.80
PTH04000W	3.3 V/5 V	3-V to 5.5-V Input 3-A POL with Auto-Track Sequencing	3 A	0.9 to 3.6	✔	✔	✔		4.50
PTH04070W	3.3 V/5 V	3-V to 5.5-V Input 3-A POL	3 A	0.9 to 3.6	✔				4.28
PTH04040W	3.3 V/5 V	3-V to 5.5-V Input 60-A POL with Auto-Track Sequencing	60 A	0.8 to 3.6	✔	✔	✔		35.00
PTH04T220/221W	3.3 V/5 V	2.2- to 5.5-V Input, 16-A T2 2nd Gen PTH POL with TurboTrans™	16 A	0.7 to 3.6	✔	✔	✔		12.60
PTH04T230/231W	3.3 V/5 V	2.2- to 5.5-V Input, 6-A T2 2nd Gen PTH POL with TurboTrans	6 A	0.7 to 3.6	✔	✔			7.90
PTH04T240/241W	3.3 V/5 V	2.2- to 5.5-V Input, 10-A T2 2nd Gen PTH POL with TurboTrans	10 A	0.7 to 3.6	✔	✔			10.80
PTH04T260/261W	3.3 V/5 V	2.2- to 5.5-V Input, 6-A T2 2nd Gen PTH POL with TurboTrans	3 A	0.7 to 3.6	✔	✔			6.25
PTH05000W	5 V	5-V Input 6-A POL	6 A	0.8 to 3.6	✔				6.90
PTH05010W	5 V	5-V Input 15-A POL with Auto-Track Sequencing	15 A	0.8 to 3.6	✔	✔	✔		11.60
PTH05020W	5 V	5-V Input 22-A POL with Auto-Track Sequencing	22 A	0.8 to 3.6	✔	✔	✔		18.15
PTH05030W	5 V	5-V Input 30-A POL with Auto-Track Sequencing	30 A	0.8 to 3.6	✔	✔	✔		25.00
PTH05050W	5 V	5-V Input 6-A POL with Auto-Track Sequencing	6 A	0.8 to 3.6	✔	✔	✔		6.90
PTH05060W	5 V	5-V Input 10-A POL with Auto-Track Sequencing	10 A	0.8 to 3.6	✔	✔	✔		9.80
PTH05T210W	5 V	5-V Input, 30-A T2 2nd Gen PTH POL with TurboTrans	30 A	0.7 to 3.6	✔	✔	✔		18.00
PTH08000W	5 V/12 V	4.5-V to 18-V Input, 2.25-A POL with Auto-Track Sequencing	2.25 A	0.9 to 5.5	✔	✔	✔		4.50
PTH08080W	5 V/12 V	4.5-V to 18-V Input, 2.25-A POL	2.25 A	0.9 to 5.5	✔				4.28
PTH08T210W	12 V	5.5- to 14-V Input, 30-A T2 2nd Gen PTH POL with TurboTrans	30 A	0.7 to 3.6	✔	✔	✔		18.00
PTH08T220/221W	5 V/12 V	4.5- to 14-V Input, 16-A T2 2nd Gen PTH POL with TurboTrans	16 A	0.7 to 5.5	✔	✔	✔		12.60
PTH08T230/231W	5 V/12 V	4.5- to 14-V Input, 6-A T2 2nd Gen PTH POL with TurboTrans	6 A	0.7 to 5.5	✔	✔			7.90
PTH08T240/241W	5 V/12 V	4.5- to 14-V Input, 10-A T2 2nd Gen PTH POL with TurboTrans	10 A	0.7 to 5.5	✔	✔			10.80
PTH08T240F	5 V/12 V	4.5- to 14-V Input, 10-A T2 2nd Gen PTH POL for 3-GHz DSP Systems	10 A	0.7 to 2.0	✔	✔			10.80
PTH08T250/255W	5 V/12 V	4.5- to 14-V Input, 50-A T2 2nd Gen PTH POL with TurboTrans	50 A	0.7 to 5.5	✔	✔			36.00
PTH08T260/261W	5 V/12 V	4.5- to 14-V Input, 3-A T2 2nd Gen PTH POL with TurboTrans	3 A	0.7 to 5.5	✔	✔			6.25
PTH12000L/W	12 V	12-V Input 6-A POL	6 A	0.8 to 1.8/1.2 to 5.5	✔				6.90
PTH12010L/W	12 V	12-V Input 12-A POL with Auto-Track Sequencing	12 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		11.60
PTH12020L/W	12 V	12-V Input 18-A POL with Auto-Track Sequencing	18 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		18.15
PTH12030L/W	12 V	12-V Input 26-A POL with Auto-Track Sequencing	26 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		25.00
PTH12040W	12 V	12-V Input 50-A POL with Auto-Track Sequencing	50 A	0.8 to 5.5	✔	✔	✔		35.00
PTH12050L/W	12 V	12-V Input 6-A POL with Auto-Track Sequencing	6 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		6.90
PTH12060L/W	12 V	12-V Input 10-A POL with Auto-Track Sequencing	10 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		9.80
PTH03010Y	3.3 V	3.3-V Input 15-A DDR Terminating Module	15 A	Follows V_{REF}	✔		✔	✔	11.60
PTH03050Y	3.3 V	3.3-V Input 6-A DDR Terminating Module	6 A	Follows V_{REF}	✔		✔	✔	6.90
PTH03060Y	3.3 V	3.3-V Input 10-A DDR Terminating Module	10 A	Follows V_{REF}	✔		✔	✔	9.80
PTH05010Y	5 V	5-V Input 15-A DDR Terminating Module	15 A	Follows V_{REF}	✔		✔	✔	11.60
PTH05050Y	5 V	5-V Input 6-A DDR Terminating Module	6 A	Follows V_{REF}	✔		✔	✔	6.90
PTH05060Y	5 V	5-V Input 10-A DDR Terminating Module	10 A	Follows V_{REF}	✔		✔	✔	9.80
PTH12010Y	12 V	12-V Input 12-A DDR Terminating Module	12 A	Follows V_{REF}	✔		✔	✔	11.60
PTH12050Y	12 V	12-V Input 6-A DDR Terminating Module	6 A	Follows V_{REF}	✔		✔	✔	6.90
PTH12060Y	12 V	12-V Input 8-A DDR Terminating Module	8 A	Follows V_{REF}	✔		✔	✔	9.80
PTN04050C	3.3 V/5 V	3-V/5-V Input, 12-W Output Step-Up (Boost) ISR	12 W	5 to 15	✔				8.00
PTN78000W/H	V_O + 2 to 36 V	Wide-Input, Wide-Output 1.5-A Positive Step-Down ISR	1.5 A	2.5 to 12/12 to 22	✔				8.00
PTN78060W/H	V_O + 2 to 36 V	Wide-Input, Wide-Output 3-A Positive Step-Down ISR	3 A	2.5 to 12/12 to 22	✔				11.00
PTN78020W/H	V_O + 2 to 36 V	Wide-Input, Wide-Output 6-A Positive Step-Down ISR	6 A	2.5 to 12/12 to 22	✔				15.00
PTR08060W	5 V/12 V	4.5- to 14-V Input, 6-A POL	6 A	0.6 to 5.5	✔				6.00
PTR08100W	5 V/12 V	4.5- to 14-V Input, 10-A POL	10 A	0.6 to 5.5	✔				8.00
PTV03010W	3.3 V	5-V Input 8-A Vertical SIP with Auto-Track Sequencing	8 A	0.8 to 2.5	✔	✔	✔		6.90
PTV03020W	3.3 V	5-V Input 18-A Vertical SIP with Auto-Track Sequencing	18 A	0.8 to 2.5	✔	✔	✔		11.60
PTV05010W	5 V	5-V Input 8-A Vertical SIP with Auto-Track Sequencing	8 A	0.8 to 3.6	✔	✔	✔		6.90
PTV05020W	5 V	5-V Input 18-A Vertical SIP with Auto-Track Sequencing	18 A	0.8 to 3.6	✔	✔	✔		11.60
PTV08T250W	12 V	8-V to 14-V Input, 50-A T2 2nd Gen PTH POL with TurboTrans	50 A	0.8 to 3.6	✔	✔			36.00
PTV12010L/W	12 V	12-V Input 8-A Vertical SIP with Auto-Track Sequencing	8 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		6.90
PTV12020L/W	12 V	12-V Input 18-A Vertical SIP with Auto-Track Sequencing	16 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		11.60

[1] *See **www.ti.com/power** for a complete product offering.*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

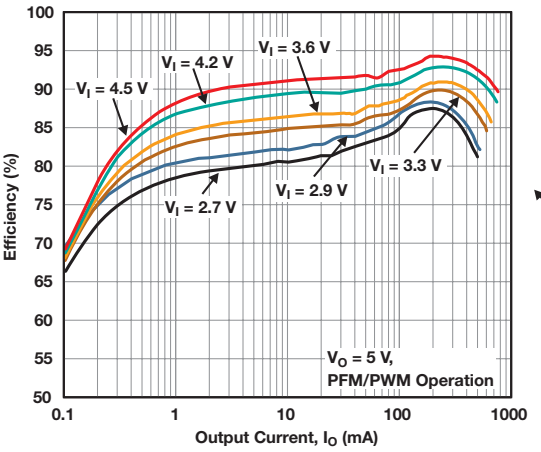
Power Modules (Non-Isolated)

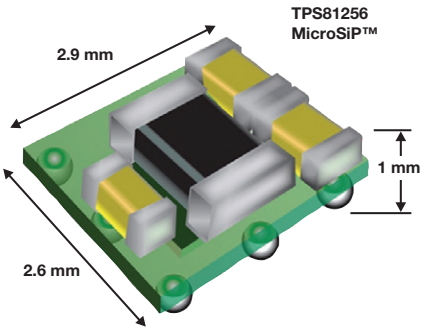
Step-Up (Boost) and Negative Output Modules

3-W, High-Efficiency Step-Up Converter

TPS81256

The TPS81256 MicroSiP™ converter is a 3-W boost converter that integrates the inductor and input/output capacitors to achieve a solution less than 9 mm^2 and sub-1 mm high, simplifying design and saving up to 50% more board space than competing solutions. The 4-MHz, 600-mA TPS81256 module supports a 5-V output with a power density of 400 mW/mm^3. The device extends battery life by reducing the supply current to 43 µA during light-load operation. Over a Li-Ion battery's full voltage range of 2.5 to 5.5 V, the TPS81256 also achieves a power efficiency of up to 91% that enables it to efficiently manage 3 W in a module format of less than 9 cubic millimeters.





3-W boost converter integrated solution.

Key Features

- Smallest solution size: Achieves a solution less than 9 mm^2 and sub-1 mm high, providing a power density of 400 mW/mm^3
- Simplifies design: High integration, including passives and capacitors, significantly reduces the effort required for hardware design and layout
- High performance: Up to 91% peak efficiency, and high efficiency over a wide load range

Applications

- Cell phones, smartphones, tablet PCs
- Powering mono and stereo APA
- Powering USB-OTG, HDMI
- USB charging port (5 V)

Get more information: **www.ti.com/product/TPS81256**

MicroSiP™ Boost Power Module

Device	Base Function	I_{OUT} (mA)	V_{IN} (V)	Fixed V_{OUT} (V)	Peak Efficiency (%)	Switching Frequency (typ) (kHz)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Synchronous Rectifier	Active Output Capacitor Discharge	Total Solution Size (mm^2)	MicroSiP™ Package	EVM	Features and Differentiators	Price*
Fully Integrated Solutions (Inductor plus input/output capacitors on device)															
TPS81256	Boost	600	2.5 to 5.5	5	95	4000	37	0.85	✔		9	9	✔	True load disconnect	1.70

All of the above devices have undervoltage lockout and thermal protection built in.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Negative Output Modules

Device	Input Bus Voltage	Description	P_{OUT} or I_{OUT}	V_O Range (V)	V_O Adj.	Price*
PTN04050A	3.3 V/5 V	3-V to 5-V Input, 6-W Positive to Negative (Buck-Boost) ISR	6 W	–3.3 to –15	✔	8.00
PTN78000A	7 to 29 V	Wide-Input, Wide-Output 1.5-A Positive to Negative (Buck-Boost) ISR	1.5 A	–3 to –15	✔	8.00
PTN78060A	9 to 29 V	Wide-Input, Wide-Output 15-W Positive to Negative (Buck-Boost) ISR	15 W	–3 to –15	✔	11.00
PTN78020A	9 to 29 V	Wide-Input, Wide-Output 25-W Positive to Negative (Buck-Boost) ISR	25 W	–3 to –15	✔	15.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Device	I_{OUT} (A)	V_{IN} (V)	V_{OUT} (V)	Package Theta J_A (°C/W)	Switching Frequency (kHz)	Features		EVM	Package(s)	Price*
						Sync Pin	Adj. Soft Start			
SWIFT™ Wide Input Power Module										
TPS84259	2[1]	4.5 to 40	–3 to –17	12	500/800	✔	✔	✔	41 QFN (9x11x2.8 mm)	6.00

All of the above devices have undervoltage lockout and thermal protection built in.
[1]*Maximum current depends on input and output voltages.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

DC/DC Switching Regulators
Overview

TI's large portfolio of non-isolated DC/DC point-of-load solutions address size, efficiency, performance or cost constraints. Our solutions range from discrete devices to integrated power solutions that contain magnetics within the IC package.

The DC/DC converter portfolio provides the industry's most comprehensive wide-input voltage range with rich feature sets to meet the demanding requirements of high-performance systems. With operating voltages of up to 100 V, TI's wide-V_{IN} portfolio eliminates input protection components to reduce cost and solution size.

Visit **www.ti.com/power** to find the latest point-of-load solutions by simply providing the voltages and output current of your system.

Step-Down DC/DC Converters — Integrated MOSFET technology has reached high levels of density over the past few years to provide higher efficiency in smaller packages. TI's DC/DC converters offer many compelling solutions up to 30 A.

Power-Management Units (PMUs) — Multiple DC/DC converters in one package simplify the power design by reducing component count. TI's PMUs integrate several inductive step-down converters with linear regulators, charge pumps or other analog circuits such as battery chargers and an I^2C interface to save space.

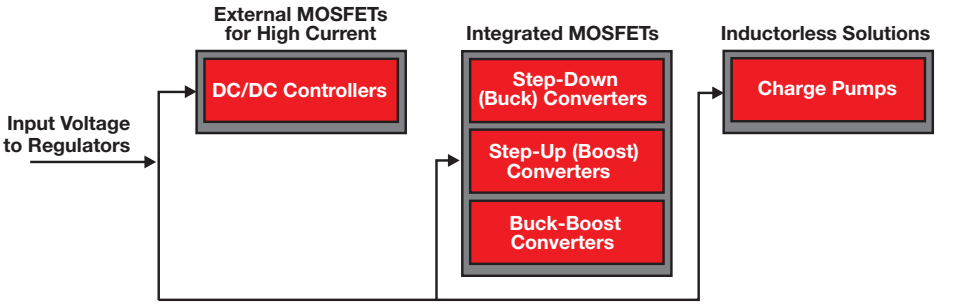
Step-Up Boost Converters — The datasheet specifies the current limit of the integrated power MOSFET switches. A rough estimate for the actual output current achievable is a function of the duty cycle and can be estimated with the following formula:

$$I_{OUT} = 0.65 \times I_{Switch(min)} \times (V_{IN}/V_{OUT})$$

Buck-Boost Converters — A DC/DC converter must be able to regulate the output voltage at all possible input-voltage conditions, whether V_{IN} is higher or lower than V_{OUT}. TI's single-inductor buck-boost converters integrate four power MOSFETs on-chip to save space and to seamlessly transition in between the modes of operation.

Charge Pumps — TI's family of low-voltage charge pumps provides a low-noise solution to boost the voltage without an inductor. Charge pumps achieve 90% peak efficiency and are useful for output currents under 300 mA.

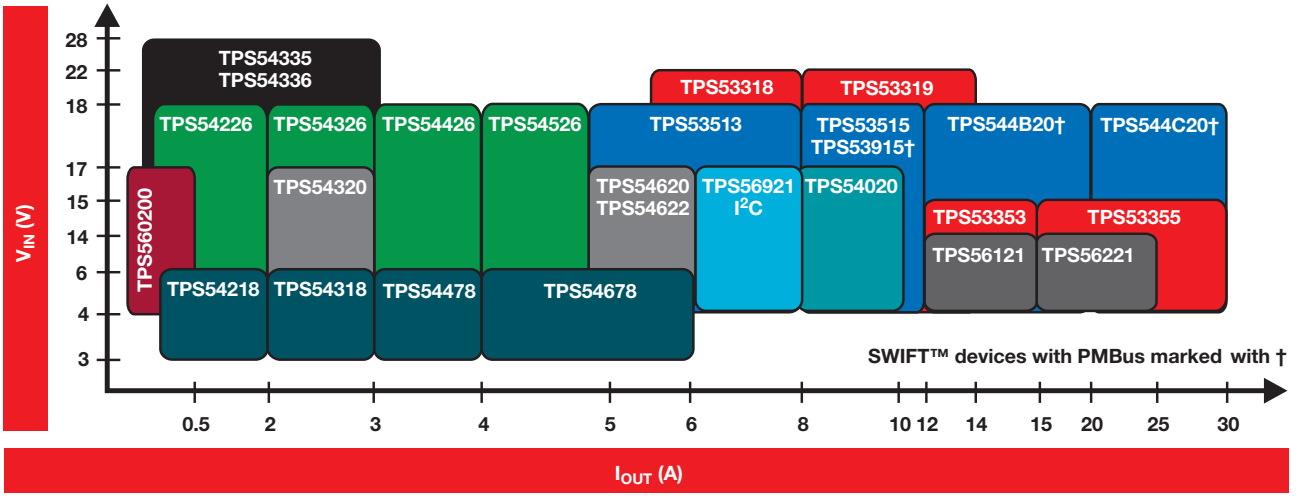
DC/DC Controllers — The output current is set by external MOSFETs, which allows the designer to optimize the efficiency and performance. Strong MOSFET drivers in TI's controllers can drive more external MOSFETs.



Step-Down Converters (Line and Portable Power)

SWIFT™ Featured DC/DC Converters

TI's SWIFT DC/DC converters are switchers with integrated FETs that deliver a high power density, high efficient and high-performance point-of-load power supply. Learn more at **www.ti.com/swift**



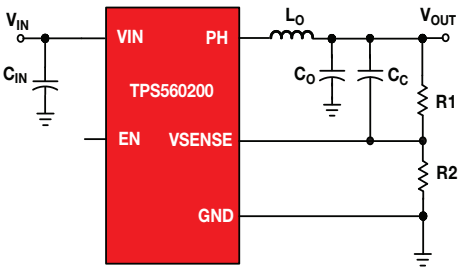
DC/DC Switching Regulators

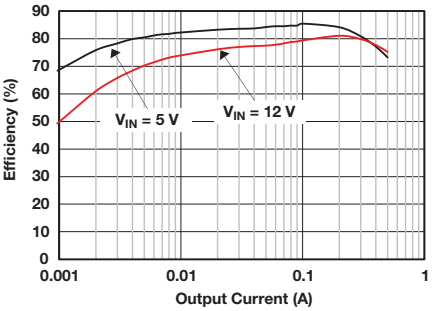
Step-Down Converters (Line and Portable Power)

0.5-A SWIFT™ Converter in SOT-23: High-Efficiency Solution for Standby/Always-On Rails

TPS560200

The TPS560200 is TI's latest offering for a low-cost, 500-mA, step-down converter with advanced Eco-mode™ (light-load efficiency) in a SOT-23 package. It is ideal for a set-top box, digital metering, smart appliances and any other application where improving standby power is a necessity.





Key Features

- Peak efficiency of 85% in small SOT-23 package provides alternative to linear regulator
- D-CAP2™ control with 650-kHz switching provides good transient response with small coil
- Internal 2-ms soft start and Enable pin support power sequencing
- 0.8-V reference and 1% accuracy over temperature provide best accuracy in >10-V_{IN} and sub-1-A class
- –40°C to 125°C operating junction temperature supports industrial applications

Get more information: **www.ti.com/product/TPS560200**

SWIFT™ Converters Selection Guide

Device	V_{IN} (V)	V_{OUT} (V)	I_{OUT} (A)	Frequency (kHz)	Control Mode	Package(s)	Features	Price*
Low Input (3.3/5 V)								
TPS54218	2.95 to 6	0.8 to 4.5	2	200 to 2000	CM	3x3 mm, 16 QFN	PG, EN, Sync Fsw, Pre-Biased and Adj. Soft Start, Ext. Comp.	1.40
TPS54318	2.95 to 6	0.8 to 4.5	3	200 to 2000	CM	3x3 mm, 16 QFN	PG, EN, Sync Fsw, Pre-Biased and Adj. Soft Start, Ext. Comp.	1.90
TPS54478	2.95 to 6	0.6 to 4.5	4	200 to 2000	CM	3x3 mm, 16 QFN	PG, EN, Sync Fsw, Track, Pre-Biased and Adj. Soft Start, Ext. Comp.	2.30
TPS54678	2.95 to 6	0.6 to 4.5	6	200 to 2000	CM	3x3 mm, 16 QFN	PG, EN, Sync Fsw, Track, Pre-Biased and Adj. Soft Start, Ext. Comp.	2.85
TPS53317	1 to 6	0.6 to 1.25	6	600/1000	D-CAP+™	3.5x4 mm, 20 QFN	VTT for DDR Memory, 4.5- to 5.5-V Bias Required	2.60
TPS54917	3 to 4	0.9 to 2.5	9	280 to 1600	VM	3.5x7 mm, 34 QFN	PG, EN, Sync Fsw, Adj. Soft Start, Ext. Comp.	3.30
Medium Input (5/12 V)								
TPS560200	4.5 to 17	0.8 to 6.5	0.5	600	D-CAP2™	SOT2-3	EN, Pre-Biased Soft Start, Advanced Eco-mode™	0.50
TPS54226	4.5 to 18	0.76 to 5.5	2	700	D-CAP2	3x3 mm, 16 QFN[1]	PG, EN, Pre-Biased and Adj. Soft Start, Eco-mode	0.75
TPS54320	4.5 to 17	0.8 to 16	3	200 to 1200	CM	3.5x3.5 mm, 14 QFN	PG, EN, Sync Fsw, Track, Pre-Biased and Adj. Soft Start, Ext. Comp.	1.60
TPS54326	4.5 to 18	0.76 to 5.5	3	700	D-CAP2	3x3 mm, 16 QFN[1]	PG, EN, Pre-Biased and Adj. Soft Start, Eco-mode	0.87
TPS54335/6	4.5 to 28	0.8 to 25	3	340	CM	3x3 mm, 10 SON	EN, Adj. Soft Start, Light Load Efficiency, Ext. Comp.	0.90
TPS54426	4.5 to 18	0.76 to 5.5	4	700	D-CAP2	3x3 mm, 16 QFN[1]	PG, EN, Pre-Biased and Adj. Soft Start, Eco-mode	0.97
TPS54526	4.5 to 18	0.76 to 5.5	5	700	D-CAP2	3x3 mm, 16 QFN[1]	PG, EN, Pre-Biased and Adj. Soft Start, Eco-mode	1.12
TPS54622	4.5 to 17	0.6 to 16	6	200 to 1600	CM	3.5x3.5 mm, 14 QFN	PG, EN, Sync Fsw, Track, Pre-Biased and Adj. Soft Start, Ext. Comp.	2.50
TPS53513	4.5 to 18	0.6 to 5.5	8	250 to 1000	D-CAP3™	3.5x4.5 mm, 28 QFN	PG, EN, Pre-Biased and Selectable Soft Start, ILIM, Eco-mode	2.55
TPS54020	4.5 to 17	0.6 to 5.0	10	200 to 1200	CM	3.5x3.5 mm, 15 QFN	PG, EN, Sync Fsw, Track, Pre-Biased and Adj. Soft Start, Eco-mode, 180° Out of Phase, ILIM, Ext. Comp.	3.45
TPS53515	4.5 to 18	0.6 to 5.5	12	250 to 1000	D-CAP3	3.5x4.5 mm, 28 QFN	PG, EN, Pre-Biased and Selectable Soft Start, ILIM, Eco-mode	2.70
TPS53319	4.5 to 18	0.6 to 5.5	14	250 to 1000	D-CAP™	5x6 mm, 22 QFN	PG, EN, Pre-Biased and Selectable Soft Start, ILIM, Eco-mode	3.25
TPS56121	4.5 to 14	0.6 to 12	15	300/500/1000	VM	5x6 mm, 22 QFN	PG, EN, Pre-Biased and Adj. Soft Start, ILIM, Ext. Comp.	3.50
TPS53353	4.5 to 15	0.6 to 5.5	20	250 to 1000	D-CAP	5x6 mm, 22 QFN	PG, EN, Pre-Biased and Selectable Soft Start, ILIM, Eco-mode	3.50
TPS56221	4.5 to 14	0.6 to 12	25	300/500/1000	VM	5x6 mm, 22 QFN	PG, EN, Pre-Biased and Adj. Soft Start, ILIM, Ext. Comp.	3.75
TPS53355	4.5 to 15	0.6 to 5.5	30	250 to 1000	D-CAP	5x6 mm, 22 QFN	PG, EN, Pre-Biased and Selectable Soft Start, ILIM, Eco-mode	3.75
SWIFT™ with PMBus								
TPS53915	4.5 to 18	0.6 to 5.5	12	250 to 1000	D-CAP3	3.5x4.5 mm, 28 QFN	PG, EN, Eco-mode Efficiency, PMBus Programmable	3.05
TPS544B20	4.5 to 18	0.6 to 5.5	20	250 to 1000	D-CAP, D-CAP2	5x7 mm, 40 QFN	PG, EN, Remote Sense, PMBus Programmable with Telemetry	3.70
TPS544C20	4.5 to 18	0.6 to 5.5	30	250 to 1000	D-CAP, D-CAP2	5x7 mm, 40 QFN	PG, EN, Remote Sense, PMBus Programmable with Telemetry	3.90

[1] *Also available in 14-HTSSOP.*

*New devices are listed in **bold red**. Preview devices are listed in **bold teal**.*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

DC/DC Switching Regulators

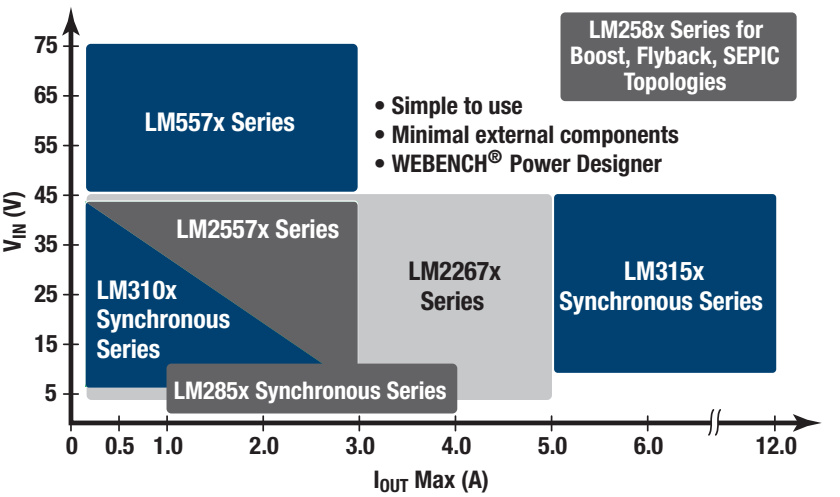
Step-Down Converters (Line and Portable Power)

SIMPLE SWITCHER® Converters

National's award-winning SIMPLE SWITCHER products allow you to design and optimize robust power supplies with a minimum set of external components. Supporting input voltage ranges of 3 to 75 V, each SIMPLE SWITCHER series provides you with multiple products with pin-to-pin compatibility for added design flexibility. Plus, all SIMPLE SWITCHER products utilize the WEBENCH® Power Designer end-to-end design and prototyping tools.

For more information, please visit:
www.ti.com/switcher

SIMPLE SWITCHER® Step-Down (Buck) Family



LM2267x and LM22680 SIMPLE SWITCHER® Non-Synchronous Regulators

Device	Output Current (mA)	V_{IN} (max) (V)	V_{IN} (min) (V)	V_{OUT} (min) (V)	Frequency Range (kHz)	f_{sync}	PWM Mode	Package(s)	Price*
LM22671/74	500	42	4.5	1.285	200 to 1000 Adj	✔/–	Voltage	PSOP-8	1.38/1.32
LM22672/75	1000	42	4.5	1.285	200 to 1000 Adj	✔/–	Voltage	PSOP-8	1.78/1.68
LM22680	2000	42	4.5	1.285	200 to 1000 Adj	✔	Voltage	PSOP-8	1.85
LM22670/73/76	3000	42	4.5	1.285	200 to 1000 Adj	✔/–/–	Voltage	TO263-7 Thin, PSOP-8	1.98/1.98/1.92
LM22677/78/79	5000	42	4.5	1.285	200 to 1000 Adj	✔/–/–	Voltage	TO263-7 Thin	3.38/3.25/3.38

**Suggested resale price in U.S. dollars in quantities of 1,000.*

LM2557x and LM557x SIMPLE SWITCHER® Non-Synchronous Regulators

Device	Output Current (mA)	V_{IN} (max) (V)	V_{IN} (min) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Frequency Range (kHz)	f_{sync}	On/Off Pin	PWM Mode	Package(s)	Price*
LM25574	500	42	6	1.23	40	50 to 1000	✔	✔	Current	TSSOP-16	1.48
LM5574	500	75	6	1.23	70	50	✔	✔	Current	TSSOP-16	1.75
LM25575	1500	42	6	1.23	40	50 to 1000	✔	✔	Current	eTSSOP-16	1.76
LM5575	1500	75	6	1.23	70	50	✔	✔	Current	eTSSOP-16	2.20
LM25576	3000	42	6	1.23	40	50 to 1000	✔	✔	Current	eTSSOP-20	2.40
LM5576	3000	75	6	1.23	70	50	✔	✔	Current	eTSSOP-20	3.05

**Suggested resale price in U.S. dollars in quantities of 1,000.*

SIMPLE SWITCHER® Synchronous Regulators

Device	Output Current (mA)	V_{IN} (max) (V)	V_{IN} (min) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Frequency Range (kHz)	PWM Mode	Package(s)	Price*
LM3103	750	42	4.5	0.6	38	1000	COT[1]	eTSSOP-16	1.80
LM3100	1500	36	4.5	0.8	7	1000	COT	eTSSOP-20	2.35
LM3102	2500	42	4.5	0.8	7	1000	COT	eTSSOP-20	1.90
LM2852	2000	5.5	2.85	0.8	3.3	500, 1500	Voltage	eTSSOP-14	2.59
LM2853	3000	5.5	3	0.8	3.3	550	Voltage	eTSSOP-14	2.00
LM2854	4000	5.5	2.95	0.8	5	500, 1000	Voltage	eTSSOP-16	2.40

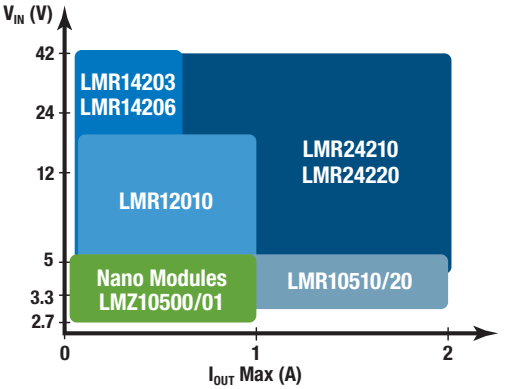
[1] *COT = Constant ON-time control.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

DC/DC Switching Regulators

Step-Down Converters (Line and Portable Power)

SIMPLE SWITCHER® Step-Down (Buck) Nano Regulators

The new SIMPLE SWITCHER nano regulators feature tiny packaging, 1-MHz or greater switching frequency for extremely small surface mount inductors and chip capacitors, and a minimal BOM to reduce board space. All nano regulators are offered in either LLP, SOT-23, or micro SMD packaging for added design flexibility.



SIMPLE SWITCHER® Step-Down (Buck) Nano Regulators

Device	Output Current (max) (A)	Input Voltage (V)	Adjustable Output Voltage (V)	Frequency (kHz)	Features	Package(s)	Price*
Nano Step-Down (Buck)							
LMR10510	1	3 to 5.5	0.6 to 4.5	1600, 3000	EN, SS	LLP-6, SOT-23	0.30
LMR10515	1.5	3 to 5.5	0.6 to 4.5	1600, 3000	EN, SS	LLP-6, SOT-23	0.85
LMR10520	2	3 to 5.5	0.6 to 4.5	1600, 3000	EN, SS	LLP-6	0.38
LMR12010	1	3 to 20	0.8 to 16	1600, 3000	EN, SS	TSOT-23	0.79
LMR14203	0.3	4.5 to 42	0.765 to 34	1250	EN, SS	TSOT-23	0.90
LMR14206	0.6	4.5 to 42	0.765 to 34	1250	EN, SS	TSOT-23	1.01
LMR24210	1	4.5 to 42	0.8 to 24	1000 max	EN, SS	micro SMD-28	1.50
LMR24220	2	4.5 to 42	0.8 to 24	1000 max	EN, SS	micro SMD-28	2.00
LMR22007	0.75	2.7 to 20	0.9 to 5.5	500, 1100, 2100	EN, PG, SS, Low I_q	micro SMD-9	0.89
LMR12007	0.75	3 to 18	1.25 to 16	550, 1600	EN, SS	TSOT23	0.80
LMR14006	0.6	4 to 40	0.765 to 36	1100, 2100	EN, Low I_q	TSOT	1.10

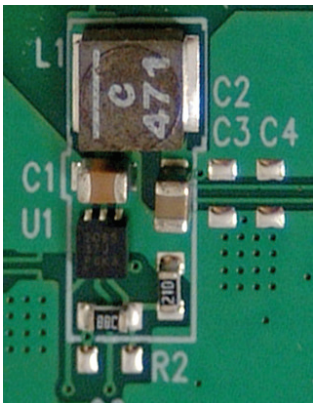
**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

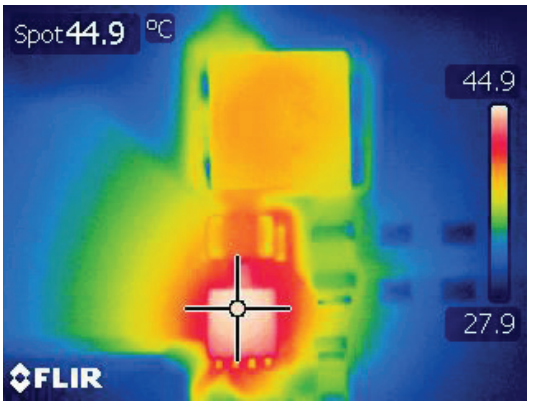
3-A Step-Down Converter with HotRod™ Leadframe Allows <65-mm^2 Solution Size

TPS62085

The TPS62085 is a high-frequency, synchronous step-down converter optimized for small solution size and high efficiency over a wide output-current range. The converter operates in PWM mode at medium to heavy loads and automatically enters power-save mode at light loads to maintain high efficiency. The switch current limit prevents the device from drawing high inductor current or excessive current from the battery or input-voltage rail. A demand for excessive current might occur with a shorted/saturated inductor, a heavy load or a shorted output circuit. Once the internal current limit is triggered 32 times, the device stops switching, resets the soft start, enables the output discharge and then automatically starts up again after a typical delay of 66 µs. This is called hiccup short-circuit protection. The device repeats this mode until the high current disappears.



Evaluation module layout.



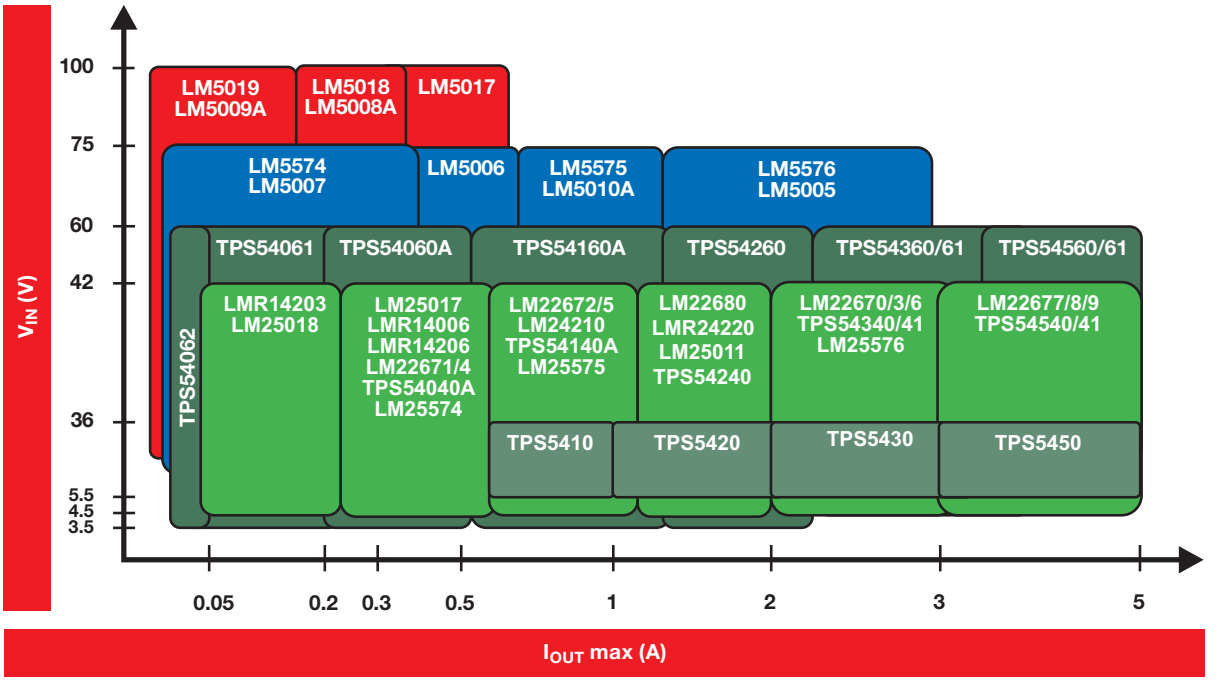
Only about 25°C rise at 6-V input and 1.2-V output at 3 A.

Get more information: **www.ti.com/product/TPS62085** or **www.ti.com/dcs-control**

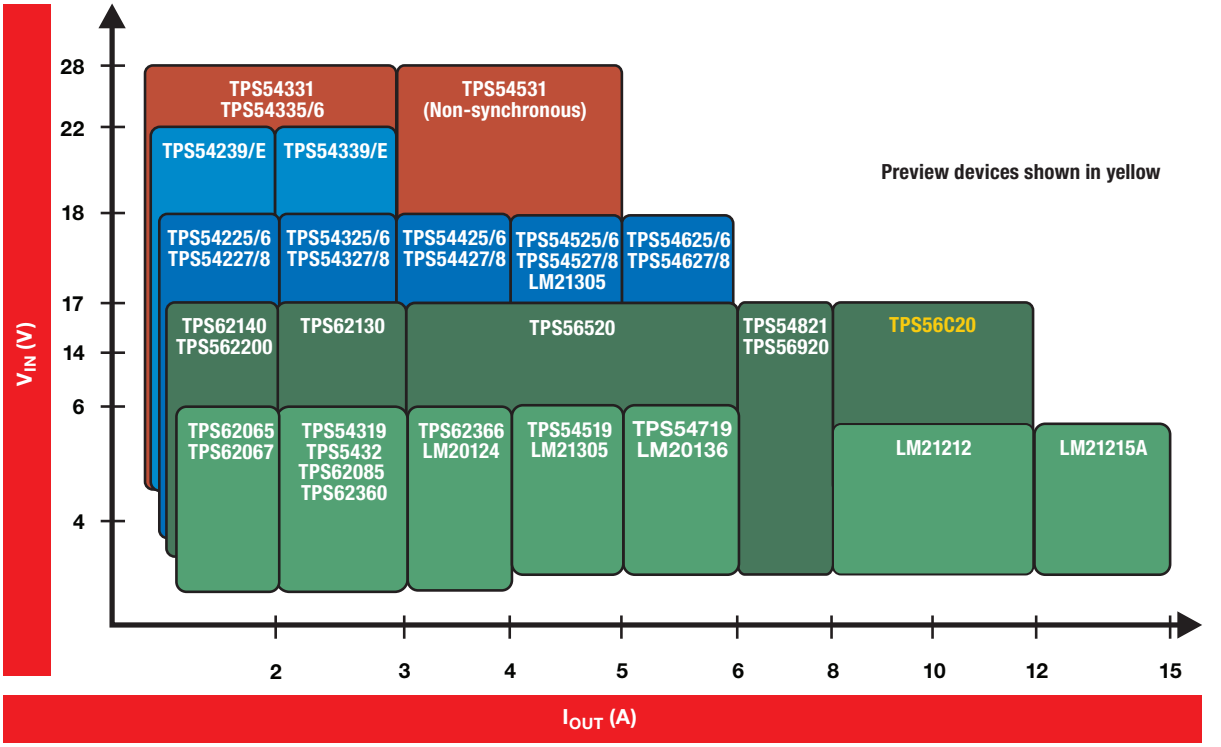
DC/DC Switching Regulators

Step-Down Converters (Line and Portable Power)

Wide-V_{IN} Step-Down Converters with Integrated FETs



Low- and Mid-V_{IN} Synchronous Step-Down Converters with Integrated FETs



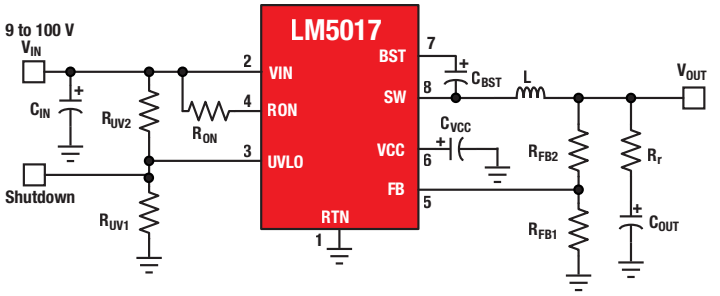
DC/DC Switching Regulators

Step-Down Converters (Line and Portable Power)

100-V Buck Regulator Enhances Reliability for High-Voltage Applications

LM5017

TI's family of high-voltage converters is characterized by a constant-on-time (COT) architecture that reduces the number of required external components to keep solution sizes small and simplify designs. The new LM5017 100-V, 600-mA synchronous buck regulator is the first in a family of the industry's first 100-V converters with integrated high-side and low-side FETs. Continuous conduction mode operation allows for use as a small, isolated bias supply.



Get more information: **www.ti.com/product/LM5017**

Key Features

- Wide 9- to 100-V input-voltage range
- Integrated, 100-V high- and low-side switches
- Fast transient response
- Frequency adjustable to 1 MHz
- Constant-on-time architecture requires no loop compensation

Applications

- Telecommunication systems
- Automotive electronics
- Isolated bias supply
- Smart power meters

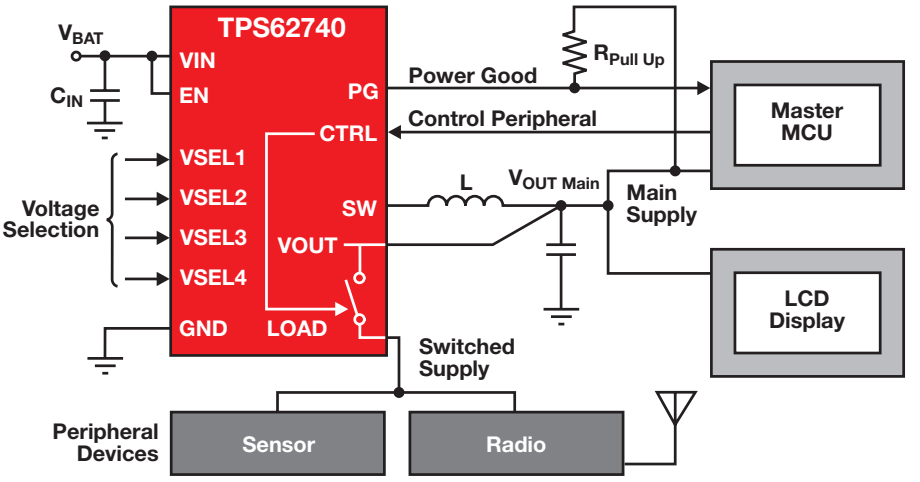
Reference designs available at **www.ti.com/tool/pmp7315** and **www.ti.com/tool/pmp7316**

Step-Down Converter with 360-nA I_Q, Voltage Select and Load Switch

TPS62740

The TPS62740 consumes only 360 nA of quiescent current. The output voltage is set with four VSEL pins. The TPS62740 features dynamic voltage scaling. Once the battery voltage comes close to the output voltage, the device enters a no-ripple 100% mode to prevent RF interference. The device then stops switching and connects the output to the input voltage. The integrated, slew-rate-controlled load switch connects the LOAD pin to the output voltage and can be used to power up and shut down other system components that are used temporarily, such as sensors. The device operates from rechargeable Li-Ion batteries, Li-primary battery chemistries, two-cell alkaline batteries, a USB port or thinfilm solar modules.

Also see TPS62730 for additional low-power RF solutions like BLE and ZigBee®.



Get more information: **www.ti.com/lit/SLYT531**
www.ti.com/product/TPS62740 or **TPS62730**
www.ti.com/dcs-control

DC/DC Switching Regulators

Step-Down Converters (Line and Portable Power)

Selection Guide for Line Power

Device	I_{OUT} (mA)	V_{IN} (V)	Min V_{OUT} (V)	Max Duty Cycle (%)	Switching Frequency (kHz)	Features								EVM	Package(s)	Price*
						Synchronous Rectifier	Power Good Pin	Sync Pin	180° Out-of-Phase Switching	Adj. Soft Start	Light-Load Efficiency	External Compensation	Sequencing/ Tracking			
Low Input Voltage Step-Down Converters (<7 V_{IN} Max)																
TPS62085	3000	2.5 to 6.0	0.8	100	2400	✔	✔				✔			✔	7 QFN (2x2 mm)	1.15
LM20123/33/43	3000	2.95 to 5.5	0.8	—	250 to 1500	✔	✔	✔		✔		✔	✔	✔	16 eTSSOP	1.36
TPS54319	3000	2.95 to 6.0	0.8	98	300 to 2000	✔	✔	✔		✔		✔	✔	✔	16 QFN (3x3 mm)	0.80
TPS53311	3000	2.9 to 6.0[1]	0.6	85	1000	✔		✔			✔	✔		✔	16 QFN (3x3 mm)	2.15
LM20124/34/44/54	4000	2.95 to 5.5	0.8	—	250 to 1500	✔	✔	✔		✔		✔	✔	✔	16 eTSSOP	1.50
LM20125/45	5000	2.95 to 5.5	0.8	—	250 to 1500	✔	✔			✔		✔	✔	✔	16 eTSSOP	1.56
TPS53316	5000	2.95 to 6	0.6	80	750/1100/2000	✔	✔				✔	✔		✔	16 QFN (3x3 mm)	2.55
LM20136/46	6000	2.95 to 5.5	0.8	—	250 to 1500	✔	✔	✔		✔		✔	✔	✔	16 eTSSOP	1.68
LM21212-1	12000	2.95 to 5.5	0.6	100	300 to 1500	✔	✔	✔		✔		✔	✔	✔	20 eTSSOP	3.30
LM21212-2	12000	2.95 to 5.5	0.6	100	300 to 1500	✔	✔			✔		✔	✔	✔	20 eTSSOP	3.30
LM21215	Up to 15000	2.95 to 5.5	0.6	100	500	✔	✔			✔		✔	✔	✔	20 eTSSOP	3.55
LM21215A	15000	2.95 to 5.5	0.6	100	300 to 1500	✔	✔	✔		✔		✔	✔	✔	20 eTSSOP	3.55
Mid Input Voltage Step-Down Converters (7 to 30 V_{IN} Max)																
LM2717-ADJ	2200/3200	4 to 20	0.6	90	300, 600					✔				✔	24 TSSOP	2.65
LM2717	2200/3200	4 to 20	0.6	90	300, 600					✔				✔	24 TSSOP	2.65
TPS62175	500	4.75 to 28	1.0	100	1000		✔				✔			✔	10 QFN (2x3 mm)	0.90
TPS62160	1000	3.0 to 17	0.9	100	2500	✔	✔				✔			✔	8 QFN (2x2 mm)	0.95
TPS62140	2000	3.0 to 17	0.9	100	2500	✔	✔			✔	✔		✔	✔	16 QFN (3x3 mm)	1.13
TPS54227/8	2000	4.5 to 18	0.76	90[2]	700	✔				✔	–/✔			✔	8 HSOIC, 10 SON	0.61/0.63
TPS54231/2/3	2000	3.5 to 28	0.8	93	570/1000/300					✔	✔	✔		✔	8 SOIC	0.55
TPS54239/239E	2000	4.5 to 23	0.76	90	600	✔				✔	–/✔			✔	8 HSOIC	0.73/0.75
TPS54320	3000	4.5 to 17	0.8	98	200 to 1200	✔	✔	✔		✔		✔	✔	✔	14 QFN	1.70
TPS54327/8	3000	4.5 to 18	0.76	90[2]	700	✔				✔	–/✔			✔	8 HSOIC, 10 SON	0.73/0.75
TPS54331	3000	3.5 to 28	0.8	93	570					✔	✔	✔		✔	8 SOIC	0.60
TPS54339/339E	3000	4.5 to 23	0.76	90	600	✔				✔	–/✔			✔	8 HSOIC	0.85/0.87
TPS54332	3500	3.5 to 28	0.8	93	1000					✔	✔	✔		✔	8 HSOIC	0.73
TPS54427/8	4000	4.5 to 18	0.76	90[2]	700	✔				✔	–/✔			✔	8 HSOIC, 10 SON	0.83/0.85
TPS56428	4000	4.5 to 18	0.76	85	650	✔	✔				✔			✔	8 HSOIC	1.15
TPS56528	4000	4.5 to 18	0.76	85	650	✔	✔				✔			✔	8 HSOIC	1.20
LM21305	5000	3 to 18	0.6	100	250 to 1500		✔	✔		✔	✔	✔	✔	✔	28 LLP	2.50
TPS54527/8	5000	4.5 to 18	0.76	90[2]	700	✔				✔	–/✔			✔	8 HSOIC	0.98/1.00
TPS54531	5000	3.5 to 28	0.8	90	570					✔	✔	✔		✔	8 SOIC	0.80
TPS54627/8	6000	4.5 to 18	0.76	85	650	✔				✔	–/✔			✔	8 HSOIC	1.30/1.35
TPS56628	6000	4.5 to 18	0.76	85	700	✔	✔				✔			✔	8 HSOIC	1.40
TPS53313	6000	4.5 to 16	0.6	70	250 to 1500		✔	✔		✔		✔		✔	16 QFN (4x4 mm)	2.60
TPS54821	8000	4.5 to 17	0.6	98	200 to 1600	✔	✔	✔		✔		✔	✔	✔	QFN (3.5x3.5 mm)	1.70
TPS56921	9000	4.5 to 17	0.72	98	200 to 1600	✔	✔	✔		✔		✔	✔	✔	20 HTSSOP	2.00
TPS51315	10000	3 to 14[3]	0.76	100[4]	100 to 1000	✔	✔				✔			✔	QFN (5x7 mm)	2.65
TPS51362	10,000	3.0 to 22	0.6	87	800	✔	✔			✔	✔			✔	28 QFN	1.25
TPS51367	12,000	3.0 to 22	0.6	87	800	✔	✔			✔	✔			✔	28 QFN	1.30
Wide Input Voltage Step-Down Converters (>30 V_{IN} Max)																
TPS54062	50	4.7 to 60	0.8	98	100 to 400	✔		✔				✔		✔	8 MSOP	1.10
LM(2)5019	100	9 to 48/100	1.23	—	250 to 1000	✔								✔	8 LLP, 8 PSOP	1.25
LM5009/A	150	8/6 to 95	—	—	50 to 600									✔	8 LLP, 8 MSOP	1.00/1.25
TPS54061	200	4.7 to 60	0.8	98	50 to 1100	✔		✔		✔	✔	✔		✔	8 SON (3x3 mm)	1.30
LM(2)5018	300	9 to 48/100	1.23	—	250 to 1000	✔								✔	8 LLP, 8 PSOP	1.12/1.40

[1] *Requires 2.9- to 3.5-V bias input.*
[2] *Maximum V_{OUT} is 5.5 V.*
[3] *Maximum V_{OUT} is 5.5 V.*
[4] *Maximum V_{OUT} is 5.5 V.*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

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DC/DC Switching Regulators

Step-Down Converters (Line and Portable Power)

Selection Guide for Line Power (Continued)

Device	I_{OUT} (mA)	V_{IN} (V)	Min V_{OUT} (V)	Max Duty Cycle (%)	Switching Frequency (kHz)	Features								EVM	Package(s)	Price*
						Synchronous Rectifier	Power Good Pin	Sync Pin	180° Out-of-Phase Switching	Adj. Soft Start	Light-Load Efficiency	External Compensation	Sequencing/ Tracking			
Wide Input Voltage Step-Down Converters (>30 V_{IN} Max) (Continued)																
LM5008/A	350	8/6 to 95	—	—	50 to 600									✔	8 LLP, 8 MSOP	1.18/1.20
LM(2)5007	500	9 to 42/75	2.5	—	50 to 800									✔	8 LLP, 8 MSOP	1.05/1.30
TPS54040A/60A	500	3.5 to 42/60	0.8	98	100 to 2500		✔	✔		✔	✔	✔	✔	✔	10 MSOP, 10 SON (3x3mm)	1.15/1.45
LM(2)5017	600	9 to 48/100	1.23	—	250 to 1000	✔								✔	8 LLP, 8 PSOP	1.25/1.65
LM34919/B/C	600	6/4.5 to 40/50	2.5	—	Up to 2600		✔			✔				✔	10 micro SMD, 12 WSON, DSBGA	1.20/1.25
LM5006	650	6 to 75	2.5		50 to 600									✔	10 MSOP	1.50
LM(2)5010/A	1000	8/6 to 42/75	2.5	—	50 to 1000					✔				✔	10 LLP, 14 eTSSOP	1.15/1.53
TPS5410	1000	5.5 to 36	1.23	87	500									✔	8 SOIC	1.60
LM34917A	1250	8 to 33	2.5	—	2000					✔					12 micro SMD	1.35
LM34910/C	1250	8 to 36/50	2.5	—	1000					✔					10 LLP	1.32
LM26001	1500	3 to 38	1.25	—	150 to 500		✔	✔	✔		✔	✔		✔	16 TSSOP	2.85
TPS54140A/60A	1500	3.5 to 42/60	0.8	98	100 to 2500		✔	✔		✔	✔	✔	✔	✔	10 MSOP, 10 SON (3x3mm)	1.40/1.75
LM25011/A	Up to 2000	6 to 42	2.5	—	Up to 2000		✔			✔				✔	10 MSOP	1.30
LM20242	2000	4.5 to 36	0.8	—	1000		✔			✔		✔	✔	✔	16 eTSSOP	1.46
TPS5420	2000	5.5 to 36	1.23	87	500									✔	8 SOIC	1.70
LM(2)5005	2500	7 to 42/75	1.23	—	50 to 500			✔		✔		✔		✔	20 eTSSOP	1.95
TPS54240/60	2500	3.5 to 42/60	0.8	98	100 to 2500		✔	✔		✔	✔	✔	✔	✔	10 MSOP, 10 SON (3x3mm)	1.55/1.95
LM26003	3000	3 to 38	1.25	—	150 to 500		✔	✔	✔		✔	✔		✔	20 eTSSOP	3.52
LM20323/33/43	3000	4.5 to 36	0.8	—	250 to 1500		✔	✔		✔		✔	✔	✔	20 eTSSOP	1.50
TPS5430	3000	5.5 to 36	1.23	87	500									✔	8 HSOIC	1.85
TPS54341/61	3000	4.5 to 42/60	0.8	98	100 to 2500		✔	✔		✔	✔	✔	✔	✔	10 SON	2.00/2.60
TPS54340/60	3500	4.5 to 42/60	0.8	98	100 to 2500					✔	✔	✔		✔	8 HSOIC	1.75/2.10
TPS5450	5000	5.5 to 36	1.23	87	500									✔	8 HSOIC	2.25
TPS54540/60	5000	4.5 to 42/60	0.8	98	100 to 2500					✔	✔	✔		✔	8 HSOIC	1.95/2.30
TPS54541/61	5000	4.5 to 42/60	0.8	98	100 to 2500		✔	✔		✔	✔	✔	✔	✔	10 SON	2.30/3.00
Dual-Channel Step-Down Converters																
TPS54290/1/2	1500/2500	4.5 to 18	0.8	90	300/600/1200	✔			✔				✔	✔	16 HTSSOP	2.95
TPS54294/5	2000 each	4.5 to 18	0.76	85	700	✔	✔/–			–/✔				✔	16 HTSSOP, 16 QFN	2.40
TPS54283/6	2000 each	4.5 to 28	0.8	90/85	300/600				✔				✔		14 HTSSOP	2.40
TPS55383/6	3000 each	4.5 to 28	0.8	90/85	300/600				✔			✔	✔	✔	16 HTSSOP	2.65
TPS54494/5	4000/2000	4.5 to 18	0.76	85	700	✔	✔/–			–/✔				✔	16 HTSSOP, 16 QFN	2.90

[1] *Requires 2.9- to 3.5-V bias input.*
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DC/DC Switching Regulators

Step-Down Converters (Line and Portable Power)

Selection Guide for Portable Power

Device	I_{OUT} (mA)	V_{IN} (V)	V_{OUT} Adjustable/Fixed (V)	Peak Efficiency (%)	Switching Frequency (typ) (kHz)	Recommended Inductor Size (µH)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Power Good	Synch. to Ext. CLK (Opt.)	DCS-Control™ Topology	Package(s)	EVM	Features and Differentiators	Price*
General Purpose, Step-Down (Buck) Regulators — Small, Efficient, Low I_q															
TPS62240	300	2.0 to 6.0	Adj. (0.6 to V_{IN})/1.2/1.8	95	2250	2.2	15	0.1				SOT-23, QFN	✔		0.50
LM3670	350	2.5 to 5.5	0.7 to 3.3	—	1000	10	15	0.1				SOT-23	✔		0.57
LM3671	600	2.7 to 5.5	1.1 to 3.3	—	2000	2.2	16	0.01				SOT-23, QFN	✔		0.70
TPS62260	600	2.0 to 6.0	Adj. (0.6 to V_{IN})/1.2/1.8	95	2250	2.2	15	0.1				SOT-23, QFN	✔		0.65
TPS62250	700	2.0 to 6.0	Adj. (0.6 to V_{IN})	95	2250	2.2	15	0.1				QFN		USB applications	0.80
TPS62290	1000	2.3 to 6.0	Adj. (0.6 to V_{IN})/1.8/3.3	95	2250	2.2	15	0.1				QFN	✔		0.80
TPS62080	1200	2.3 to 6.0	Adj. (0.5 to 4.0)/1.8/3.3	94	2000	1	5	6.5	✔		✔	QFN, MSOP	✔	Snooze mode, active discharge	0.83
TPS62510	1500	1.8 to 3.8	Adj. (0.6 to V_{IN})	97	1500	2.2	18	0.1				QFN	✔	Output-voltage tracking	1.00
TPS62060	1600	2.3 to 6.0	Adj. (0.6 to V_{IN})/1.8/3.3	94	3000	1.0	18	0.1				2x2 QFN	✔		0.85
TPS62065	2000	2.3 to 6.0	Adj. (0.6 to V_{IN})	94	3000	1.0	18	0.1				2x2 QFN	✔		0.90
TPS62067	2000	2.9 to 6.0	Adj. (0.6 to V_{IN})	97	3000	1.0	18	0.1	✔			2x2 QFN	✔		0.93
TPS62085	3000	2.5 to 6.0	Adj. (0.8 to V_{IN})/1.8/3.3	95	2400	0.47	17	0.7	✔		✔	2x2 QFN	✔	HotRod™ leadframe	1.05
TPS62090	3000	2.0 to 5.5	Adj. (0.8 to V_{IN})/1.8/2.5/3.3	96	2800/1400	0.47	20	0.6	✔		✔	3x3 QFN	✔	Adj. soft start, frequency select	1.05
TPS62095	4000	2.5 to 5.5	Adj. (0.8 to V_{IN})	95	1400	1	20	0.6	✔		✔	3x3 QFN	✔	Adj. soft start	1.35
General Purpose, Step-Down (Buck) Regulators — Value Line, Relaxed Specification															
TPS62560	600	2.5 to 5.5	Adj. (0.6 to V_{IN})/1.8	95	2250	2.2	15	0.1				SOT-23, QFN	✔	3% V_{OUT} tolerance	0.50
TLV62080	1200	2.5 to 5.5	Adj. (0.5 to 4.0)	94	2000	1	30	0.6	✔		✔	QFN	✔		0.65
TLV62565	1500	2.7 to 5.5	Adj. (0.6 to V_{IN})	94	1500	2.2	50	0.1	✔			SOT-23	✔		0.67
TLV62084	2000	2.7 to 5.5	Adj. (0.5 to 4.0)	94	2000	1	30	0.6	✔		✔	SON	✔	HotRod leadframe	0.73
TLV62090	3000	2.5 to 5.5	Adj. (0.8 to V_{IN})	96	1400	0.47	20	0.6	✔		✔	QFN	✔	Adj. soft start	0.82
TLV62150	1000	4.0 to 17	Adj. (0.9 to 5.0)	96	2250	2.2	19	1.5	✔		✔	QFN	✔	Adj. soft start (opt.)	0.75
TLV62130	3000	4.0 to 17	Adj. (0.9 to 5.0)	96	2250	2.2	19	1.5	✔		✔	QFN	✔	Adj. soft start (opt.)	0.90
Special-Function Step-Down (Buck) Regulators															
TPS62730	100	1.9 to 3.9	1.9/2.1/2.3	95	3000	2.2	25	0.03			✔	QFN	✔	Bypass switch; for BLE and RF4CE	0.65
TPS62736	50	2.0 to 5.5	Adj. (1.3 to 5.0)	96	2000 (max)	10	0.35	0.02				QFN	✔	Ultra-low I_Q, low-battery indicator	0.80
TPS62737	500	2.0 to 5.5	Adj. (1.3 to 5.0)	96	2000 (max)	10	0.35	0.02				QFN	✔	Ultra-low I_Q, low-battery indicator	1.00
TPS62740	300	2.2 to 5.5	1.3 to 3.3	95	3000	2.2	0.36	0.03	✔		✔	SON	✔	Load switch; 4-pin V_{select}	1.15
TPS62750	1300	2.9 to 6.0	Adj. (0.8 to 0.85 × V_{IN})	94	2250	2.2	745	0.3				QFN	✔	Powered by USB; progr. input-current limit	0.95
TPS62120	75	2.0 to 15	Adj. (1.2 to 5.5)	96	800	22	11	0.3	✔		✔	SOT-23, QFN	✔	Ext. UVLO hysteresis	0.65
TPS62125	300	3.0 to 17	Adj. (1.2 to 10)	93	1000	10	5	0.3	✔		✔	QFN	✔	Program. EN threshold and hysteresis	0.70
Extended Input-Voltage Range															
TPS62170	500	3.0 to 17	Adj. (0.9 to 6)/1.8/3.3/5.0	92	2500	2.2	17	1.5	✔		✔	QFN	✔		0.65
TPS62175	500	4.75 to 28	Adj. (1 to 6)/3.3/5.0	90	1000	10	4.8	1.5	✔		✔	QFN	✔	Snooze mode	0.75
TPS62050	800	2.7 to 10.0	Adj. (0.7 to 6)/1.5/1.8/3.3	95	850	10	12	1.5	✔	✔		MSOP	✔	Low-battery indicator	1.05
TPS62150	1000	3.0 to 17	Adj. (0.9 to 6)/1.8/3.3/5.0	96	2500/1250	2.2	17	1.5	✔		✔	QFN	✔	Soft start (opt.), tracking, voltage and frequency select pin	0.90
TPS62160	1000	3.0 to 17	Adj. (0.9 to 6)/1.8/3.3/5.0	92	2500	2.2	17	1.5	✔		✔	QFN, VSSOP	✔		0.85
TPS62110	1500	3.1 to 17	Adj. (1.2 to 16)/3.3/5	95	1000	6.8	18	1.5	✔	✔		QFN	✔	Low-battery indicator	1.30
TPS62140	2000	3.0 to 17	Adj. (0.9 to 6)/1.8/3.3/5.0	96	2500/1250	2.2	17	1.5	✔		✔	QFN	✔	Soft start (opt.), tracking, voltage and frequency select pin	1.00
TPS62130	3000	3.0 to 17	Adj. (0.9 to 6)/1.8/3.3/5.0	96	2500/1250	2.2	17	1.5	✔		✔	QFN	✔	Soft start (opt.), tracking, voltage and frequency select pin	1.10
Dual Output, 180° Out-of-Phase															
TPS62400	400 + 600	2.5 to 6.0	Adj. (0.6 to V_{IN})/1.1 to 1.9/3.3	95	2250	3.3	30	0.1				QFN	✔	EasyScale™ interface	0.85
TPS62410	800 + 800	2.6 to 6.0	Adj. (0.6 to V_{IN})	95	2250	3.3	30	0.1				QFN		EasyScale interface	1.00
TPS62420	600 + 1000	2.6 to 6.0	Adj. (0.6 to V_{IN})	95	2250	3.3	30	0.1				QFN	✔	EasyScale interface	1.00

All of the above devices have an on-chip soft start, undervoltage lockout and thermal protection built in.

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DC/DC Switching Regulators

Step-Down Converters (Line and Portable Power)

Selection Guide for Portable Power (Continued)

Device	I_{OUT} (mA)	V_{IN} (V)	V_{OUT} Adjustable/Fixed (V)	Peak Efficiency (%)	Switching Frequency (typ) (kHz)	Recommended Inductor Size (µH)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Power Good	Synch. to Ext. CLK (Opt.)	DCS-Control™ Topology	Package(s)	EVM	Features and Differentiators	Price*
Smallest Solution Size, High Switching Frequency															
TPS62619	350	2.3 to 5.5	1.2/1.5/1.8/2.15	90	6000	0.47	31	0.2				CSP		0.4-mm solution height	0.50
TPS62690	500	2.3 to 4.8	2.85	95	4000	1.0	19	0.2				CSP	✔	Spread spectrum	0.65
TPS62230	500	2.05 to 6.0	1.0 to 3.3	94	3000	1	22	0.1			✔	QFN	✔	Up to 90-dB PSRR	0.50
TPS62674	500	2.3 to 4.8	1.2/1.26/1.5/1.8	92	5500	0.47	17	0.2				CSP	✔	Spread spectrum	0.65
LM8801	600	2.3 to 5.5	1.0 to 2.9	—	6000	—	—	—				CSP	✔		0.80
TPS62620	600	2.3 to 5.5	1.82/1.8/1.5/1.2	90	6000	0.47	31	0.2				CSP	✔		0.65
LM3691	1000	2.3 to 5.5	0.75 to 3.3	—	4000	—	—	—				CSP	✔		0.80
TPS62660	1000	2.3 to 5.5	1.2/1.8	91	6000	0.47	31	0.2				CSP	✔	Active cap discharge	0.85
LM3678	1500	2.5 to 5.5	0.8 to 3.3	—	3300	—	—	—				QFN	✔		1.15
Processor Power, Dynamic Voltage Scaling															
TPS62270	400	2.0 to 6.0	1.15/0.9, 3.3/2.1, 3.3/2.5	95	2250	2.2	15	0.1				QFN	✔	V_{select} pin	0.60
TPS62650	800	2.3 to 5.5	Adj. (0.75 to 1.44)	86	6000	0.47	38	0.5				CSP		I^2C Interface	0.87
TPS62360	3000	2.5 to 5.5	Adj. (0.5 to 1.77)	91	2500	1	56	0.5			✔	CSP	✔	I^2C interface, different. sense	1.26
TPS62366	4000	2.5 to 5.5	Adj. (0.5 to 1.77)	91	2500	1	56	0.5			✔	CSP	✔	I^2C interface, different. sense	1.39

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DC/DC Switching Regulators

Step-Up (Boost)/Flyback/SEPIC and Inverting Converters

Battery-Front-End, Synchronous Boost Converter with Bypass for Single-Cell Li-Ion, Ni-Rich, Si-Anode Battery Applications

TPS61280

The TPS6128x family of devices has been developed to solve challenges that designers have been facing in battery-powered systems. Challenge 1: New battery chemistries allow new cutoff-voltage values that are lower than the needed system voltage. Challenge 2: Large current surges caused by power amplifiers or highly loaded application processors result in a voltage droop at the battery, which forces the system into shutdown. In both situations, high-voltage LDOs fall out of regulation.

TPS6128x is a highly-efficient, battery front end power-management IC. It allows utilizing the maximum capacity of the new chemistry batteries because the minimum voltage value is lower than the required system voltage. Also, high current pulses that may force the system into shutdown are buffered by the device with a seamless back-and-forth transition between boost and bypass modes. These features can provide either longer use time and better user experience with the same battery capacity or reduced battery costs with similar use times.

During shutdown, the TPS6128x device operates in a true pass-through mode, consuming only 2 µA of quiescent current for a longer battery shelf life. During operation, when the battery is at a good state of charge, a low-resistance, highly efficient integrated pass-through path connects the battery to the powered system. Efficiency of almost 99% is reached.

If the battery's state of charge and voltage become lower than the required minimum system voltage, the device seamlessly transitions into boost mode.

The TPS6128x family offers a very small, total-solution footprint of less than 20 mm^2 with a 16-pin chipscale package. The TPS61280 provides a high level of flexibility to the customer through an I^2C (2-wire) interface. The parameters that can be programmed are:

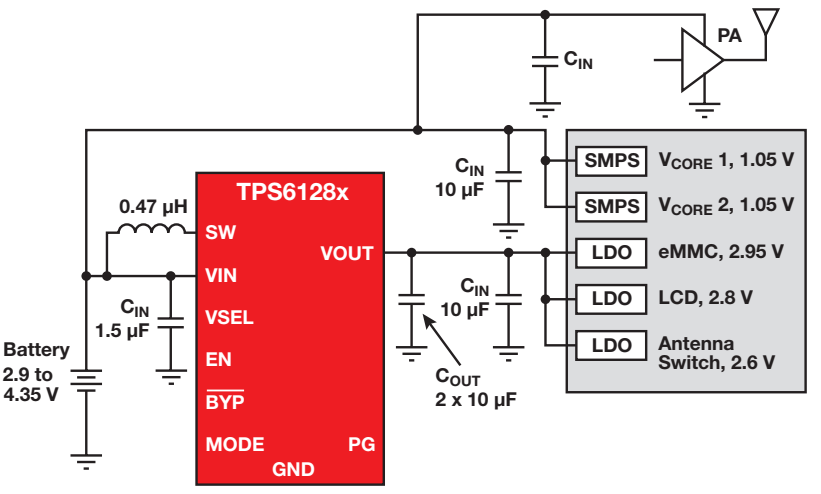
- Valley inductor current limit
- DC/DC boost/bypass threshold voltage
- Spread-spectrum modulation activation

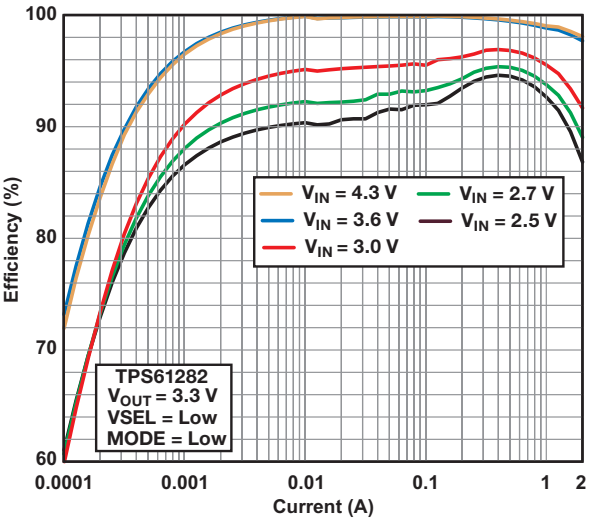
Key Features

- $I_{OUT} \geq 4$ A (peak) at $V_{OUT} = 3.35$ V, $V_{IN} \geq 2.65$ V
- Integrated pass-through mode (35 mΩ)
- Programmable valley-inductor current limit and output voltage system
- True pass-through mode during shutdown
- Best-in-class line and load transient
- Low-ripple, light-load PFM mode

Applications:

- Single-cell powered, (Ni-Rich, Si-Anode, Li-Ion and $LiFePO_4$) personal electronics like smartphones or tablet PCs
- 2.5G/3G/4G mini-module data cards
- Current limited applications featuring high-peak-power loads



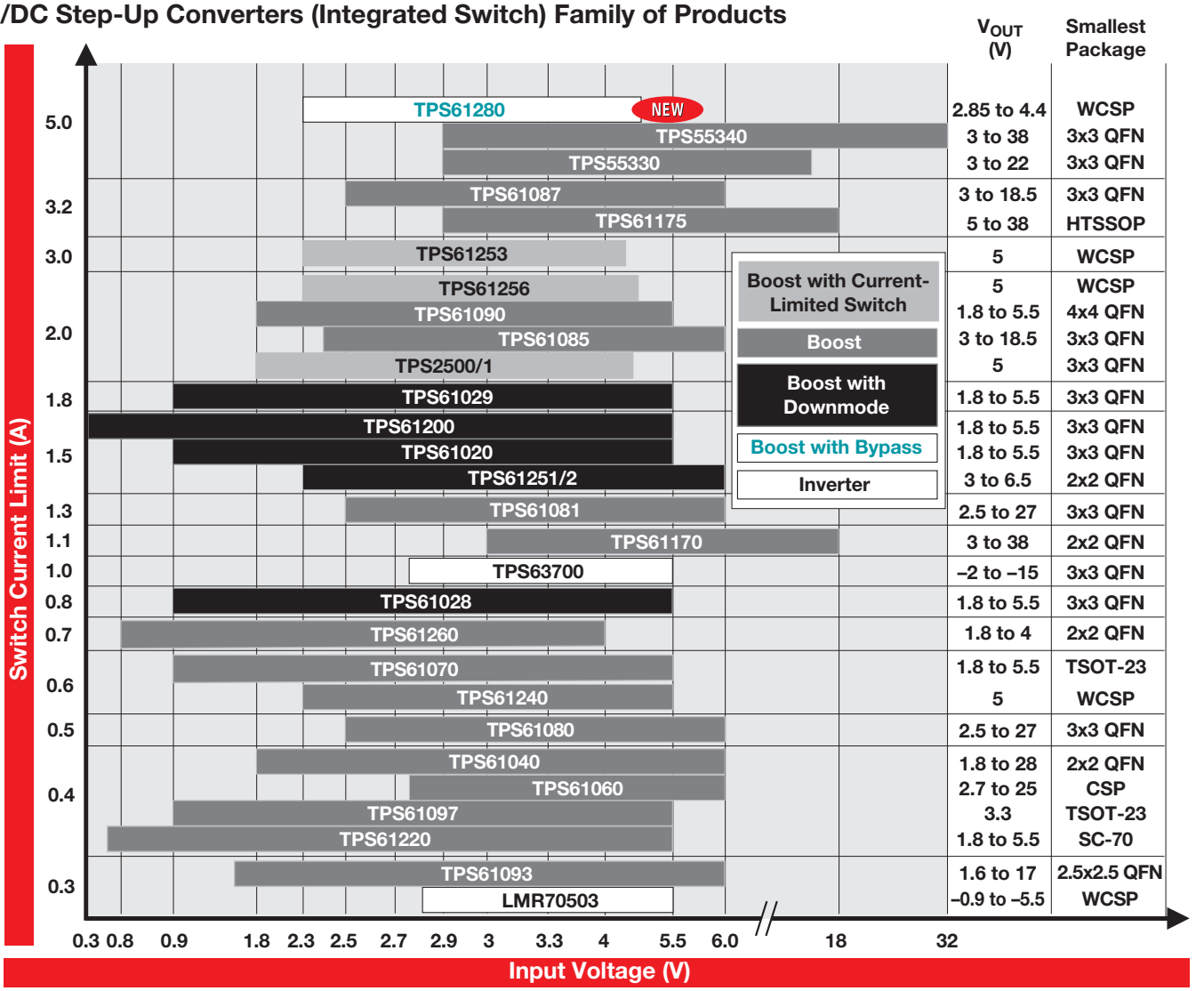


Get more information: **www.ti.com/product/TPS61280**

DC/DC Switching Regulators

Step-Up (Boost)/Flyback/SEPIC and Inverting Converters

DC/DC Step-Up Converters (Integrated Switch) Family of Products



Selection Guide for Step-Up (Boost) Converters

Device[1]	Switch Current Limit (typ) (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Peak Efficiency (%)	Switching Frequency (typ) (kHz)	Recommended Inductor Size (µH)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Synchronous Rectification	Features[2]	Package(s)	EVM	Price*
Step-Up Regulators — Up to 6-A Switch Limit														
TPS61041	250	1.8 to 6.0	V_{IN} to 28	—	87	1000	10	28	0.1		UVLO	5 SOT-23	✔	0.65
TPS61097-33	350	0.9 to 5.5	—	3.3	90	—	10	4	0.005	✔	UVLO	5 SOT23		0.75
TPS61040	400	1.8 to 6.0	V_{IN} to 28	—	87	1000	10	28	0.1		UVLO	5 SOT-23	✔	0.70
TPS61220/21/22	400	0.7 to 5.5	1.8 to 5.5	3.3/5	95	—	4.7	5.5	0.2	✔	UVLO	6 SOIC	✔	0.43
LM5002	500	3.1 to 75	1.26 and up	—	95	1500	330	3100	95		UVLO	8 SOIC, (4x4 mm) SON		1.70
TL497A	500	4.5 to 12	(V_{IN} + 2) to 30	—	85	—	—	11 mA	6000			14 TSSOP, 14 SOIC		0.90
TPS61080	500	2.5 to 6.0	V_{IN} to 27	—	87	1200	4.7	—	—			(3x3 mm) QFN	✔	1.35
TPS61240/41	600/700	2.3 to 5.5	—	5	90	3500	1	30	1.5	✔	UVLO	(2x2) SON, (1.2x0.86) 6 CSP	✔	0.55
TPS61070/1/2/3	700	0.9 to 5.5	1.8 to 5.5	—	90	1200	4.7	19	1	✔	UVLO	6 SOT-23		0.45
TPS61260/61	700	0.8 to 4.0	1.8 to 4.0	3.3	95	2.3	4.7	29	0.1	✔	UVLO	(2x2 mm) SON	✔	0.50

[1] *All devices listed have thermal and/or short-circuit protection except TL499A and TL497A.*
[2] *UVLO = undervoltage lockout; LBI = low-battery indicator; PG = Power Good; VSEL= ability to select different output voltages.*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*
*Preview devices are listed in **bold teal**.*

DC/DC Switching Regulators

Step-Up (Boost)/Flyback/SEPIC and Inverting Converters

Selection Guide for Step-Up (Boost) Converters (Continued)

Device[1]	Switch Current Limit (typ) (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Peak Efficiency (%)	Switching Frequency (typ) (kHz)	Recommended Inductor Size (µH)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Synchronous Rectification	Features[2]	Package(s)	EVM	Price*
Step-Up Regulators — Up to 6-A Switch Limit (Continued)														
TPS61028	800	0.9 to 5.5	1.8 to 5.5	—	96	720	6.8	25	0.1	✔	LBI, UVLO	(3x3 mm) QFN	✔	0.75
LM2621	1000	1.2 to 1.4	1.24 to 14	—	90	2000	6.8	80	2.5			8 TSSOP	✔	0.65
LM5001	1000	3.1 to 75	1.26 and up	—	96	1500	100	3100	95		UVLO	8 SOIC, (4x4 mm) SON	✔	1.85
TPS61291	1000	0.9 to 5.0	—	2.5 to 3.3	95	TBD	3.3	5	0.03	✔	UVLO, boost + bypass	(2x2 mm) QFN	✔	0.70
TPS61014/5/6	1000/1100/ 1130	0.8 to 3.3	—	2.8/3/3.3	95	500	10	36	1	✔	LBI, UVLO	10 MSOP, (3x3 mm) QFN		1.10
TPS61093	1100	1.6 to 6	V_{IN} to 17	—	88	1200	10	0.9 mA	1		UVLO	(2.5x2.5 mm) SON	✔	1.20
TPS61010	1130	0.8 to 3.3	1.5 to 3.3	—	95	500	10	36	1	✔	LBI, UVLO	10 MSOP, (3x3 mm) QFN	✔	1.10
LM4510	1200	2.7 to 5.5	V_{IN} to 18	—	85	1000	4.7	1700	—		UVLO	(3x3 mm) SON	✔	1.80
TPS61081	1200	2.5 to 6.0	V_{IN} to 27	—	87	1200	4.7	—	—			(3x3 mm) QFN	✔	1.25
TPS61170	1200	3.0 to 18	V_{IN} to 38	—	93	1200	10	—	1		UVLO	(2x2) QFN		1.20
LM27313	1250	2.7 to 14	V_{IN} to 28	—	90	1600	10	2100	—			5 SOT-23		0.61
LM2731	1400	2.7 to 14	V_{IN} to 22	—	90	1600	10	2000	—			5 SOT-23	✔	1.08
MC34063A	1500	3 to 40	3 to 39.5	—	—	100	—	—	1		UVLO	(4x4 mm) QFN, 8 SOIC	✔	0.21
TPS61020	1500	0.9 to 5.5	1.8 to 5.5	—	96	720	6.8	25	0.1	✔	LBI, UVLO	(3x3 mm) QFN	✔	0.80
TPS61024/5/7	1500	0.9 to 5.5	1.8 to 5.5	3/3.3/5	96	720	6.8	25	0.1	✔	LBI, UVLO	(3x3 mm) QFN		0.80
TPS61200/1/2	1500	0.3 to 5.5	0 to V_{IN}	3.3/5	90	1250	2.2	50	1	✔	UVLO	(3x3 mm) QFN	✔	1.00
TPS61251	1500	2.3 to 6	3 to 6	—	92	3500	1	30	0.85	✔	PG, UVLO	(2x2 mm) QFN	✔	0.75
TPS61252	1500	2.3 to 6	3 to 6	—	92	3500	1	30	0.85	✔	PG, UVLO	(2x2 mm) QFN	✔	0.75
LM2733	1550	2.7 to 14	V_{IN} to 40	—	90	1600	10	2100	—			5 SOT-23	✔	1.04
LM2622	1650	2 to 12	V_{IN} to 18	—	90	1300	10	1300	—			8 MSOP		0.91
TPS61026/9	1800	0.9 to 5.5	1.8 to 5.5	—	96	720	6.8	25	0.1	✔	LBI, UVLO	(3x3 mm) QFN	✔	0.85
LM2698	1900	2.7 to 12	V_{IN} to 17	—	94	1250	10	1300	—			8 MSOP	✔	1.83
LM5000	2000	3.1 to 40	1.26 and up	—	90	1300	33	2000	18		UVLO	16 TSSOP, (4x4 mm) SON	✔	2.00
TPS61091/2	2000	1.8 to 5.5	—	3.3/5	96	600	6.8	20	0.1	✔	LBI, UVLO	(4x4 mm) QFN		0.95
TPS61254/6	2150	2.5 to 4.85	—	4.5/5	93	3500	1	22	0.85	✔	UVLO	(1.2x1.3 mm) 9 CSP	✔	0.75
LM2623	2200	0.8 to 14	1.24 to 14	—	90	2000	4.7	80	—			8 MSOP, (4x4 mm) SON	✔	1.09
TPS61090	2200	1.8 to 5.5	1.8 to 5.5	—	96	600	6.8	20	0.1	✔	LBI, UVLO	(4x4 mm) QFN	✔	0.95
LM3224	2450	2.7 to 7	V_{IN} to 20	—	90	1250	10	1300	—			8 MSOP	✔	1.10
LM3310	2600	2.5 to 7	V_{IN} to 20	—	93	1280	10	3100	—		UVLO	(4x4 mm) QFN		1.38
LM3311	2600	2.5 to 7	V_{IN} to 20	—	93	1280	10	3100	—		UVLO	(4x4 mm) QFN		1.38
TPS61085	2600	2.3 to 6	(V_{IN} + 0.5) to 18.5	—	91	1200	3.3	70	1		UVLO, adj SS, sel. fsw	8 TSSOP, 8 MSOP	✔	0.95
TPS61086	2600	2.3 to 6	(V_{IN} + 0.5) to 18.5	—	91	1200	3.3	70	1		UVLO, adj SS, sel. forced PWM	(3x3 mm) QFN	✔	0.95
LM2735	3000	2.7 to 5.5	V_{IN} to 24	—	90	1600	15	3400	—			5 SOT-23, 8 MSOP, (3x3) QFN	✔	1.25
TPS61281	3000	2.3 to 4.85	—	3.15/3.35	95	2300	0.47	15	2.6		UVLO, PG, bypass switch (35 mΩ), VSEL	(1.6x1.6 mm) 16 WCSP	✔	0.65
TPS61253/58/59	3150	2.5 to 4.5	—	4.5/5/5.1	94	3500	1	22	0.85	✔	UVLO	(1.2x1.3 mm) 9 CSP	✔	0.80
LM2700	3600	2.2 to 12	1.26 to 17.5	—	92	1250	4.7	1300	—			14 TSSOP, (4x4) QFN	✔	1.71
TPS61175	3800	2.9 to 18	V_{IN} to 38	—	95	2200	10	—	<1.5		UVLO	14 TSSOP	✔	1.30
TPS61087	4000	2.5 to 6.0	(V_{IN} + 0.5) to 18.5	—	91	1200	3.3	75	1		UVLO, adj SS, sel. fsw	(3x3 mm) QFN	✔	1.20
TPS61282	4000	2.3 to 4.85	—	3.3/3.5	95	2300	0.47	15	2.6		UVLO, PG, bypass switch (35 mΩ), VSEL	(1.6x1.6 mm) 16 WCSP	✔	0.80
TPS61030/1/2	4500	1.8 to 5.5	1.8 to 5.5	3.3/5	96	600	6.8	20	0.1	✔	LBI, UVLO	(4x4 mm) QFN, 16 TSSOP	✔	1.25
TPS61280	5000	2.3 to 4.85	2.85 to 4.4	—	95	2300	0.47	15	2.6		UVLO, bypass switch (35 mΩ), I^2C programmable current limit and V_{OUT}	(1.6x1.6 mm) 16 WCSP	✔	0.99
TPS61230	5500	2.3 to 5.5	2.4 to 5.25	3.3/5	96	2000	1	35	1	✔	UVLO	(3x3 mm) QFN	✔	1.25
TPS55330	6600	2.9 to 16	3 to 22	—	92	1200	2.2	500	2.7		PG, UVLO	(3x3) QFN	✔	1.75
TPS55340	6600	2.9 to 32	3 to 38	—	95	1200	10	500	2.7		PG, UVLO	14 TSOP, (3x3) QFN	✔	1.85

[1] *All devices listed have thermal and/or short-circuit protection except TL499A and TL497A.*
[2] *UVLO = undervoltage lockout; LBI = low-battery indicator; PG = Power Good; VSEL= ability to select different output voltages.*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*
*Preview devices are listed in **bold teal**.*

DC/DC Switching Regulators

Step-Up (Boost)/Flyback/SEPIC and Inverting Converters

Selection Guide for Step-Up (Boost) Converters (Continued)

Device[1]	Switch Current Limit (typ) (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Peak Efficiency (%)	Switching Frequency (typ) (kHz)	Recommended Inductor Size (µH)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Integrated LDO I_{OUT} (mA)/V_{OUT} (V)	Synchronous Rectification	Features[2]	Package(s)	EVM	Price*
Step-Up (Boost) Regulators with Integrated LDO (Dual Output)															
TL499A	—	1.1 to 10	2.9 to 30	—	85	—	—	—	15	100/Adj.			8 SOIC		1.20
TPS61120	1300	1.8 to 5.5	2.5 to 5.5	—	95	500	10	40	0.2	200/Adj.	✔	PG, LBI, UVLO	16 TSSOP, (4x4) QFN	✔	1.65
TPS61121/2	1300	1.8 to 5.5	—	3.3/3.6	95	500	10	40	0.2	200/1.5, 3.3	✔	PG, LBI, UVLO	16 TSSOP, (4x4) QFN		1.65
Inverting Regulators															
LMR70503	300	2.8 to 5.5	–0.9 to –5.5	—	79	500	—	0.245 mA	0.01	—		UVLO	(1.64x0.86) CSP	✔	1.15
TL497A	500	4.5 to 12	–1.2 to –25	—	85	—	—	11 mA	6000	—			14 TSSOP, 14 SOIC		0.90
TPS63700	1000	2.7 to 5.5	–2 to –15	—	84	1400	4.7	—	0.014	—		UVLO	(3x3) SON	✔	0.90
MC34063A	1500	3 to 38	–1.25 to –36.3	—	—	100	—	0.330 mA	—	—		UVLO	8 SOIC, (4x4 mm) QFN	✔	0.21

[1]All devices listed have thermal and/or short-circuit protection except TL499A and TL497A.
[2]UVLO = undervoltage lockout; LBI = low-battery indicator; PG = Power Good; VSEL= ability to select different output voltages.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

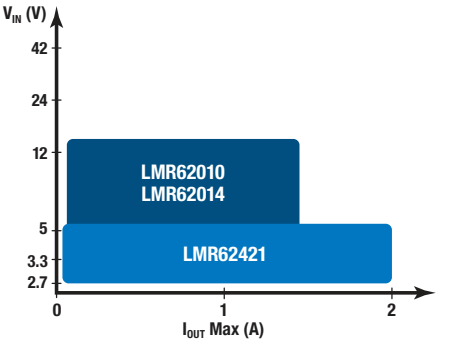
SIMPLE SWITCHER® Boost/Flyback/SEPIC

Device	I_{OUT} (A)	V_{IN} (max) (V)	V_{IN} (min) (V)	V_{OUT} (min) (V)	Frequency Range (kHz)	Package(s)	Price*
LM2585	3	40	4	1.23	100	TO-220, TO-263	3.17
LM2586	3	40	4	1.23	100 to 200	TO-220, TO-263	3.27
LM2587	5	40	4	1.23	100	TO-220, TO-263	4.17
LM2588	5	40	4	1.23	100 to 200	TO-220, TO-263	4.50

**Suggested resale price in U.S. dollars in quantities of 1,000.*

SIMPLE SWITCHER® Step-Up (Boost) Nano Regulators

The new SIMPLE SWITCHER nano regulators feature tiny packaging, 1-MHz or greater switching frequency for extremely small surface mount inductors and chip capacitors, and a minimal BOM to reduce board space. All nano regulators are offered in either LLP, SOT-23, or micro SMD packaging for added design flexibility.



SIMPLE SWITCHER® Step-Up (Boost) Nano Regulators

Device	Output Current (max) (A)	Input Voltage (V)	Adjustable Output Voltage (V)	Frequency (kHz)	Features	Package(s)	Price*
LMR62421	2.1	2.7 to 5.5	3 to 24	1600	EN, SS	SOT-23, LLP-6	0.74
LMR62014	1.4	2.7 to 14	3 to 20	1600	EN	SOT-23	0.54
LMR64010	1	2.7 to 14	3 to 40	1600	EN	SOT-23	0.59

**Suggested resale price in U.S. dollars in quantities of 1,000.*

DC/DC Switching Regulators
Buck-Boost Converters

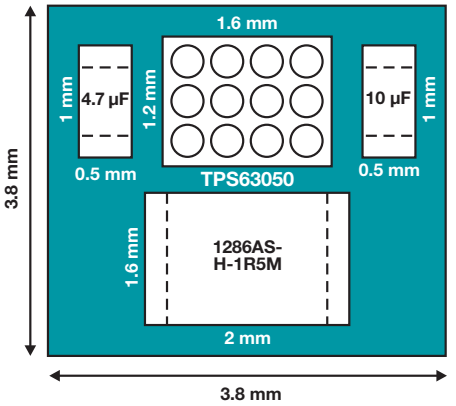
New-Generation Single-Inductor Buck-Boost Converter

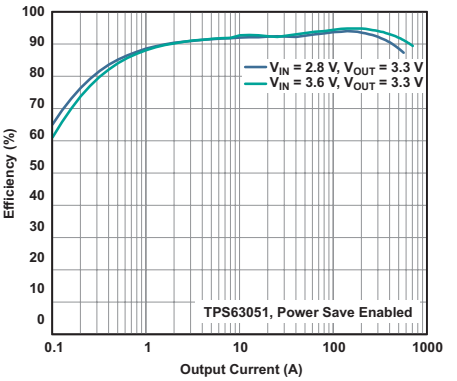
TPS63050

The TPS63050 is the first of TI's new-generation buck-boost converters with improved electrical performance and a 45% solution-size reduction.

The device delivers 500-mA continuous output current from an input voltage as low as 2.5 V, with more than 90% efficiency in boost mode and 95% in buck mode. The TPS63050 transitions seamlessly from buck to boost mode and vice versa, with an output-voltage ripple as low as 25 mV. The device features an adjustable input-current limit and soft start to control inrush current from limited power sources.

The improved control method of the TPS63050 allows the use of very small input and output capacitors, achieving a total solution footprint of less than 15 mm^2.





Key Features

- Input-voltage range: 2.5 to 5.5 V
- 0.5-A continuous output current with $V_{IN} \geq 2.5$ and $V_{OUT} = 3.3$ V
- Real buck or boost operation
- Efficiency of up to 95% in buck mode and higher than 90% in boost mode
- Adjustable average-input-current limit
- Adjustable soft start
- Power Save mode with quiescent current of less than 0.45 µA (typical) for improved efficiency at low output power
- Load disconnect during shutdown
- Available in small 1.6 x 1.2-mm WCSP-12 package with 0.4-mm pitch

Applications

- Single-cell lithium-battery-powered equipment
- Smartphones
- Tablet PCs
- Phone accessories
- USB-powered applications
- Industrial metering equipment

Get more information: **www.ti.com/product/TPS63050**

Selection Guide

Device	I_{OUT}[1] (mA)	Switch-Current Limit (typ) (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Peak Efficiency (%)	Switching Frequency (typ) (kHz)	Recommended Inductor Size (µH)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Adj. Input-Current Limit	Load Disconnect During Shutdown	Synch. to Ext. CLK Pin	Power Good Pin	Undervoltage Lockout	Package(s)	EVM	Price*
TPS61130/31/32	300	1300	1.8 to 5.5	2.5 to 5.5	3.3/3.3	90	500	10	40	0.2		✔		✔		QFN, TSSOP	✔	1.55
TPS63030/31/36	500	1000	1.8 to 5.5	1.2 to 5.5	3.3	96	2400	1.5	25	0.1		✔	✔		✔	10 QFN, 8 WCSP	✔	0.95
TPS63050[2]	500	1000	2.5 to 5.5	2.5 to 5.5	3.3	96	2500	1.5	25	0.1	✔	✔		✔	✔	12 WCSP	✔	1.00
TPS63000/1/2	800	1800	1.8 to 5.5	1.2 to 5.5	3.3/5.0	90	1400	2.2	30	0.1		✔	✔		✔	10 QFN	✔	1.35
TPS63010/11/12	800	2200	2 to 5.5	1.2 to 5.5	3.3/3.4/ 2.8/2.9	96	2400	1.5	30	0.1		✔	✔		✔	20 WCSP	✔	1.35
LM3668	1000	1850	2.8 to 5.5	2.8 to 5.0	2.8/3.3	96	2200	2.2	45	0.01			✔		✔	12 QFN	✔	2.25
TPS63060/1	1300	1800	2.5 to 8	2.5 to 12	5	93	2400	2.2	30	—		✔	✔	✔	✔	10 QFN	✔	1.50
TPS63020	2000	4000	1.8 to 5.5	1.2 to 5.5	3.3	96	2400	1.5	30	0.1		✔	✔	✔	✔	14 QFN	✔	1.90
TPS63025	2000	4000	2.3 to 5.5	2.5 to 3.6	—	97	2500	1	35	0.1		✔				10 WCSP	✔	2.30

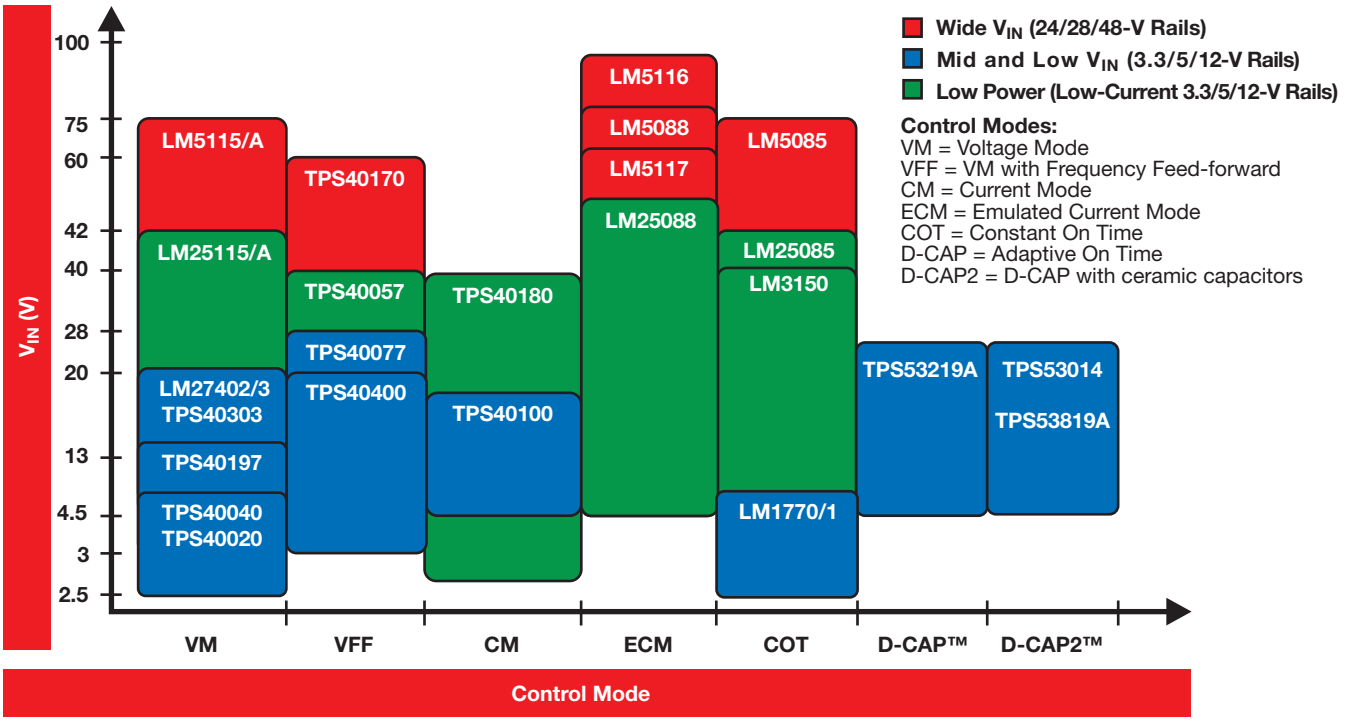
[1] V_{OUT} = 3.3 V, boost mode
[2] Adjustable average input-current limit and soft start.
*Suggested resale price in U.S. dollars in quantities of 1,000.

*New devices are listed in **bold red**.*
*Preview devices are listed in **bold teal.***

DC/DC Switching Regulators

Controllers (External Switch)

Single-Channel, Step-Down DC/DC Controllers



SIMPLE SWITCHER® Synchronous Controllers

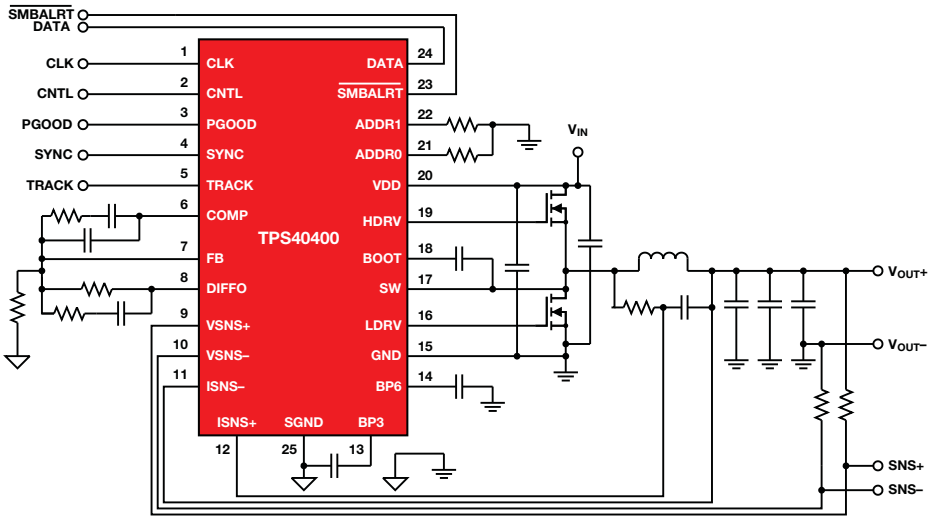
Device	V_{IN} (max) (V)	V_{IN} (min) (V)	V_{OUT} (min) (V)	V_{OUT} (max) (V)	Feedback Tolerance (%)	Frequency Range (kHz)	Package(s)	Price*
LM3150	42	6	0.6	Adj	1.50	Adj to 1 MHz	eTSSOP-14	2.30
LM3151	42	6	3.3	3.3	1.50	250 kHz	eTSSOP-14	2.30
LM3152	33	6	3.3	3.3	1.50	500 kHz	eTSSOP-14	2.30
LM3153	18	6	3.3	3.3	1.50	750 kHz	eTSSOP-14	2.30

**Suggested resale price in U.S. dollars in quantities of 1,000.*

DC/DC Switching Regulators
Controllers (External Switch)

3- to 20-V PMBus Synchronous Buck Controller
TPS40400

The TPS40400 is a cost-optimized flexible synchronous buck controller that operates from a nominal 3- to 20-V supply. This controller is an analog PWM controller that allows programming and monitoring via the PMBus interface. Flexible features found on this device include programmable soft-start time, programmable short circuit limit and programmable undervoltage lockout (UVLO).



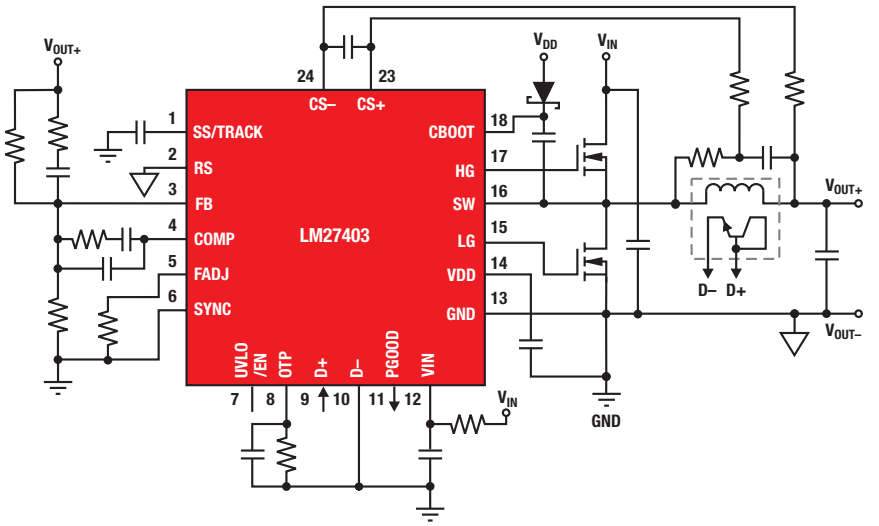
Get more information: **www.ti.com/product/TPS40400**

Key Features
- Input operating voltage: 3 to 20 V
- PMBus enabled analog controller
- Reference 600 mV ± 1%
- Remote voltage sense amplifier
- Internal 6-V regulator and 6-V gate drive
- Programmable overcurrent protection
- Inductor resistance or series resistance used for current sensing
- Programmable switching frequency: 200 kHz to 2 MHz
- Powergood indicator
- Thermal shutdown
- Programmable soft-start
- Internal bootstrap diode
- Pre-bias output safe
- 24-pin QFN package

Applications
- Smart power systems
- Power supply modules
- Communications equipment
- Computing equipment

Synchronous Buck Controller with Temperature-Compensated DCR Current Sensing
LM27403

The LM27403 synchronous buck controller delivers better than 95% efficiency from 12 V at 25 A to shrink PCB size and deliver fast transient response in communications infrastructures and industrial applications. This high-performance PWM controller provides higher switching frequency at low V_{OUT} and temperature-compensated DCR sensing to reduce inductor size for high-power PoL conversion.



Get more information: **www.ti.com/product/LM27403**

Key Features
- Wide 3- to 20-V input-voltage range
- Remote sensing for DCR temperature compensation and thermal protection
- 15-ns adaptive dead-time control
- 1%, 0.6-V reference (–40°C to 125°C)
- Clock synchronization (200 kHz to 1.2 MHz)
- 30-ns minimum ON time
- 6-MHz-bandwidth error amplifier improves load transient response
- 4 x 4-mm WQFN-24 package

Applications
- High-current DC/DC converters powering FPGAs/ASICs
- Telecom, datacom and networking equipment
- Distributed-power buck converters
- High-power-density non-isolated POL modules

DC/DC Switching Regulators

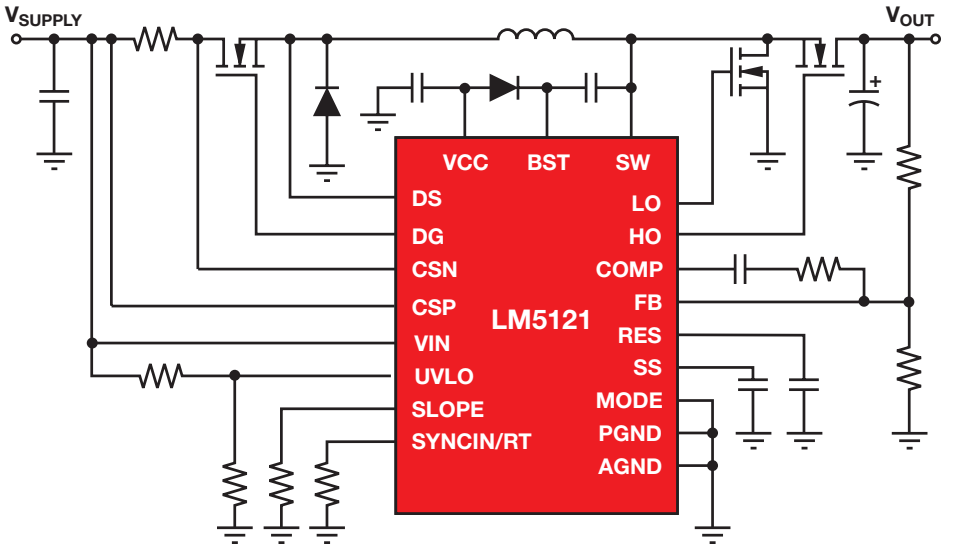
Controllers (External Switch)

Stackable, Wide-V_{IN}, Synchronous Boost Controllers

LM5121, LM5122

The LM5121 and LM5122 synchronous boost controllers are intended for high-efficiency, high-power, boost-regulator applications. The control method is based upon peak-current-mode control which provides inherent line feed-forward, cycle-by-cycle current limiting and simplifies loop compensation. Switching frequency is programmable up to 1 MHz.

The LM5121 provides disconnection switch control which completely disconnects the output from the input during an output short or a shutdown condition. The LM5122 is a multiphase-capable controller. Both devices are available in AEC-Q100 versions for automotive applications.



Get more information: **www.ti.com/product/LM5121** or **LM5122**

Key Features

- AECQ-100 Grade 1 qualified
- Wide-input/output range accommodates automotive cold crank and load dump
- 3- to 65-V V_{IN} and up to 100 V_{OUT}
- Bypass (V_{OUT} = V_{IN}) operation
- 1.2-V reference with ±1.0% accuracy
- Free-run/synchronizable up to 1 MHz
- Peak-current-mode control
- Robust integrated 3-A gate drivers
- LM5122: Multiple-phase capability for high-power industrial, automotive, and telecom requirements
- LM5121: Disconnection switch enables fault protection and complete load disconnect

DC/DC Switching Regulators

Controllers (External Switch)

Selection Guide

All parts have soft start, short-circuit protection, and undervoltage lockout functions.

Device	Mode of Control[1]	V_{IN} (min/max) (V)	V_O (min/max) (V)	Driver Current (A)	Output Current (A)[2]	Frequency (kHz)	V_{REF} Tol (%)	Internal Bootstrap	Package(s)	Pwr Good	Source and Sink[3]	Pre-biased Operation	Ext Synch Pin	Predictive Gate Drive™	DDR[4]	Remote Sense	Price*
General-Purpose DC/DC Step-Down Controllers																	
TPS40000/2	V	2.25 to 5.5	0.7 to 4	1	15	300/600	1	Yes	10 MSOP			Yes		Yes			0.99
TPS40007/9	V	2.25 to 5.5	0.7 to 4	1	15	300/600	1	Yes	10 MSOP		Yes[5]	Yes		Yes			1.20
TPS40040	V	2.25 to 5.5	0.6 to 4.95	1	15	300	1	Yes	8 SON		Yes[5]	Yes					0.90
TPS40041	V	2.25 to 5.5	0.6 to 4.88	1	15	600	1	Yes	8 SON		Yes[5]	Yes					0.90
TPS40042	V	3 to 5.5	0.7 to 4.95	1.2	15	600	Ext	Yes	10 SON		Yes[5]	Yes			Yes		0.90
TPS40020/21	V	2.25 to 5.5	0.7 to 4	2	25	Adj. to 1000	1	Yes[6]	16 HTSSOP	Yes	21[5]	20	Yes	Yes			1.45
LM3743	V	3 to 5.5	0.8 to 4.6	3.1	10	300 to 1000	1.75		10 MSOP				Yes				1.10
LM2745	V	1 to 17	0.6	1.9	20	50 to 1000	1.5		14 TSSOP	Yes		Yes	Yes				1.15
LM3475	Hysteretic	2.7 to 10	0.8 to V_{IN}	0.5	5	0 to 2000	1.5		5 SOT23								0.52
TPS40190	V	4.5 to 15	0.59 to 12.75	1.2	20	300	1	Yes	10 SON		Yes[5]	Yes					1.00
LM2742	V	1 to 16	0.6	1.6	20	50 to 2000	1.5		14 TSSOP	Yes							1.25
LM2743	V	1 to 16	0.6	1.6	20	50 to 1000	2		14 TSSOP	Yes							1.15
LM2744	V	1 to 16	0.6	1.6	20	50 to 1000	1.5		14 TSSOP	Yes							1.15
LM2748	V	1 to 16	0.6	1.9	20	50 to 1000	1.5		14 TSSOP	Yes		Yes	Yes				1.15
LM2747	V	1 to 17	0.6	1.9	20	50 to 1000	1		14 TSSOP	Yes		Yes	Yes				1.45
TPS40100[7]	C	4.5 to 18	0.7 to 5.5	1.3	20	600	1		24 QFN	Yes	Yes[5]	Yes	Yes			Yes	1.95
TPS40101[7]	V	4.5 to 18	0.7 to 5.5	1.3	20	1000	1		24 QFN	Yes	Yes[5]	Yes	Yes			Yes	1.95
LM3753/54	V	4.5 to 18	0.6 to 3.6	1.9	50	200 to 1000	1		32 LLP	Yes		Yes	Yes			Yes	2.95
TPS40192/3	V	4.5 to 18	0.59 to 14.4	1.2	15/20	600/300	0.5	Yes	10 SON	Yes	Yes[5]	Yes					1.05
TPS40195[8]	V	4.5 to 20	0.59 to 17	1.2	20	Adj. to 600	0.5	Yes	16 TSSOP, 16 QFN	Yes	Yes[5]	Yes	Yes[9]				1.50
TPS40400	VFF, PMBus	3 to 20	0.6 to 12	2	25	Adj. to 2000	1	Yes	24 QFN	Yes	Yes	Yes	Yes			Yes	2.15
TPS40303/4/5	V	3 to 20	0.6 to 18	2	25	300/600/1200	1	Yes	10 SON	Yes	Yes[5]	Yes					1.50
LM27402	V	3 to 20	0.6 to 19	2.6	30	200 to 1200	1		LLP-16, 16 TSSOP	Yes		Yes	Yes				1.10
LM27403	V	3 to 20	0.6 to 19	2.6	30	200 to 1200	1		24 WQFN	Yes		Yes	Yes				1.20
TPS53125/26/27 (dual output)	D-CAP2™ Mode	4.5 to 26	0.76 to 5.5	1.5	15	350/700	1	Yes	24 QFN, 24 TSSOP		Yes	Yes					1.60
TPS53014/15	D-CAP2 Mode	4.5 to 28	0.76 to 7	1.5	25	500	1	Yes	10 MSOP	No/ Yes	Yes	Yes					0.90
TPS40075	VFF	4.5 to 28	0.7 to 23	1	20	Adj. to 1000	1	Yes	20 QFN	Yes	Yes[5]	Yes	Yes	Yes		Yes	1.80
TPS40077	VFF	4.5 to 28	0.7 to 23	1	20	Adj. to 1000	1	Yes	16 PowerPAD™	Yes	Yes[5]	Yes		Yes			1.60
LM3485	Hysteretic	4.5 to 35	1.242 to V_{IN}	0.4	4	0 to 1400	2		8 MSOP								0.55
LM3489	Hysteretic	4.5 to 35	1.239 to V_{IN}	0.4	4	0 to 1400	2		8 MSOP								0.62
LM3477	C	2.97 to 35	1.265 to 30.8	1.0	6	500	1.5		8 MSOP								0.92
TPS40054/55/57	VFF	8 to 40	0.7 to 35	1	20	Adj. to 1000	1	Yes	16 PowerPAD		55, 57[5]	57	Yes				1.65
TPS40056	V	10 to 40	0.7 to 35	1	20	Adj. to 1000	Ext	Yes	16 PowerPAD		Yes		Yes		Yes		1.65
TPS40200[9]	VFF	4.5 to 52	0.7 to 46	0.2	3	Adj. to 500	1	Note 10	8 SOIC				Yes				0.75
TPS40170	VFF	4.5 to 60	0.6 to 58	1.2	15	Adj. to 600	1	Yes	20 QFN	Yes	Yes[5]	Yes	Yes				2.25
LM(2)5117	ECM	4.5 to 65	0.8 to 60	2.2	20	50 to 750	1.5		20 TSSOP, 24 LLP				Yes				1.75/2.04
LM(2)5085/A	COT	4.5 to 42/75	1.25/0.9 to V_{IN}	1.5	10	1000	2		8 MSOP, 8 LLP								0.79/0.85/ 1.00
LM(2)5088	ECM	4.5 to 42/75	1.2 to 40/70	1.5	10	50 to 1000	1.5		e16 TSSOP				Yes				1.40/1.84
LM(2)5115/A	V	4.5 to 42/75	0.75 to 13.5	2.5	20	100 to 1000	1.7		16 TSSOP				Yes				1.40/1.85
LM(2)5116	ECM	6 to 100	1.2 to 80	3.5	20	50 to 1000	1.5		20 eTSSOP				Yes				1.85/2.42

[1] V = Voltage-mode control, C = Current-feedback control, VFF = Voltage mode with voltage feed-forward compensation, ECM = Emulated current mode and COT = Constant ON-time control.
[2] Current levels of this magnitude can be supported with commonly available commercial FETs.
[3] The controller of choice for most applications will be the source/sink version, which has two-quadrant operation and will source or sink output current.
[4] DDR = Supports DDR memory.
[5] During soft start: source only.
[6] Integrated voltage-doubler charge pump for higher drive voltage.
[7] Provides advanced start-up sequencing and output voltage margining.
[8] Bidirectional 180° out-of-phase synchronization.
[9] Non-synchronous, drives P-FETs.
[10] Drives high-side P-FET.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

DC/DC Switching Regulators
Controllers (External Switch)

Selection Guide (Continued)

All parts have soft start, short-circuit protection, and undervoltage lockout functions.

Device	Mode Control[1]	Switched Outputs	Phases	V_{IN} (min/max) (V)	V_O (min/max) (V)	Driver Current (A)	Output Current (A)[2]	Frequency (kHz)	V_{REF} Tol (%)	Package(s)	Pwr Good	Overvoltage Protection	Source and Sink[3]	Pre-biased Operation	Ext Synch Pin	Remote Sense	Price*
Multiphase Synchronous DC/DC Buck Controllers																	
LM2642	C	1 or 2	1 or 2	4.5/30	1.3/96% x V_{IN}	1.1	25/phase	300	1.8	28L TSSOP	Yes	Yes	—	—	No	—	1.48
LM2647	VFF	1 or 2	1 or 2	5.5/28	0.6/7.8	2	25/phase	Adj. 200 to 500	1.5	28L TSSOP	Yes	Yes	—	—	No	—	1.80
LM2657	VFF	1 or 2	1 or 2	4.5/28	0.6/7.4	2	25/phase	Adj. 200 to 500	1.5	28L TSSOP	Yes	Yes	—	—	No	—	1.80
LM3000	ECM	1 or 2	1 or 2	3.3/18.5	0.6/80% x V_{IN}	—	25/phase	Adj. 200 to 1500	1.5	32L LLP	Yes	Yes	—	Yes	No	—	2.75
LM3753	VFF	1 or 2	1 or 2	4.5/18	0.6/3.6	4	25/phase	Adj. 200 to 1000	1	32L LLP	Yes	Yes	—	Yes	Yes	—	2.75
LM3754	VFF	1 or 2	1 or 2	4.5/18	0.6/3.6	4	25/phase	Adj. 200 to 1000	1	32L LLP	Yes	Yes	—	Yes	Yes	—	2.75
LM(2)5119	ECM	1	2	4.5/5.5 to 42/65	0.8 to 38/59	2.2	50	50 to 750	1.5	32 LLP	—	—	—	—	Yes	—	2.60/3.25
LM5642	C	1 or 2	1 or 2	4.5/36	1.3/90% x V_{IN}	1.1	25/phase	200	1.7	28L TSSOP	No	Yes	—	—	Yes	—	1.75
LM5642x	C	1 or 2	1 or 2	4.5/36	1.3/90% x V_{IN}	1.1	25/phase	375	1.7	28L TSSOP	No	Yes	—	—	Yes	—	1.75
TPS40132	C	1	2	1/40	0.6/5.8	1	50	Adj. to 1000	0.8	32 QFN	Yes	Yes	Yes	Yes	Yes	Yes	2.95
TPS40140[4]	C	1 or 2	1 or 2	2/40	0.7/5.8	1.2	25/phase	Adj. to 1000	0.5	36 QFN	Yes	Yes	Yes	Yes	Yes	Yes	3.05
TPS40180[5]	C	1	1	2/40	0.7/5.8	1.2	25	Adj. to 1000	0.75	24 QFN	Yes	Yes	Yes	Yes	Yes	Yes	2.05
TPS40322	VFF	1 or 2	1 or 2	3/20	0.6/5.6	2	25/phase	Adj. to 1000	1	32 QFN	Yes	Yes	Yes	Yes	Yes	Yes	2.40
TPS40422	VFF/PMBus	1 or 2	1 or 2	4.5/20	0.6/5.6	2	25/phase	Adj. to 1000	1	40 QFN	Yes	Yes	Yes	Yes	Yes	Yes	3.10
TPS51631	D-CAP+™	1	3	4.5/28	0.5/2.3	—	30	Adj. 400 to 1000	0.5	32 QFN	Yes	Yes	Yes	—	No	Yes	1.65
TPS59621	D-CAP+	1	2	3/28	0.3/1.5	8	30	Adj. 200 to 500	0.5	40 QFN	Yes	Yes	Yes	—	No	Yes	1.80
TPS59640	D-CAP+	2	4	3/28	0.25/1.52	6	30	Adj. 250 to 500	0.5	48 QFN	Yes	Yes	Yes	—	No	Yes	2.25
TPS59641	D-CAP+	2	4	3/28	0.25/1.52	6	30	Adj. 250 to 500	0.5	48 QFN	Yes	Yes	Yes	—	No	Yes	2.25
TPS59650	D-CAP+	2	5	3/28	0.25/1.52	6	30	Adj. 250 to 600	0.5	48 QFN	Yes	Yes	Yes	—	No	Yes	2.65

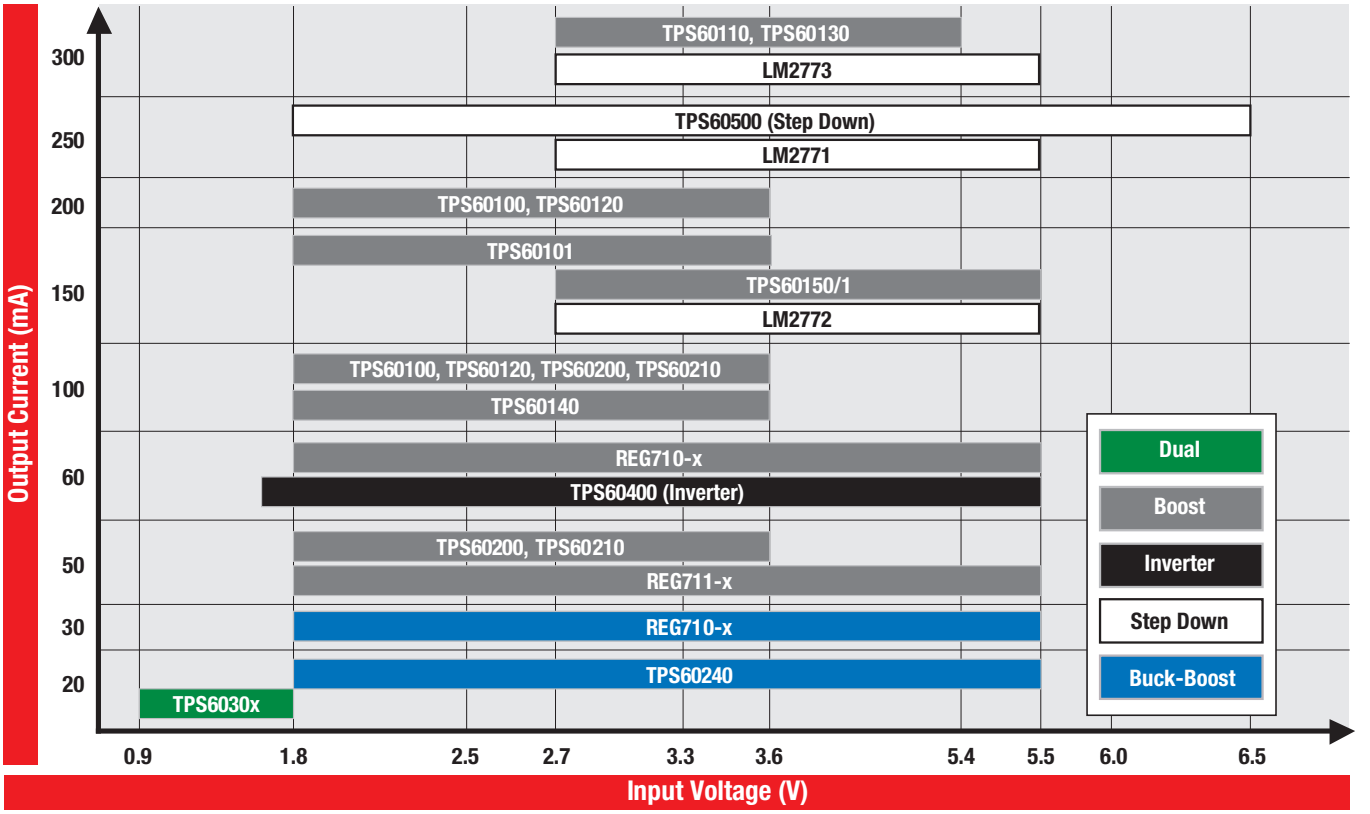
Device	Switched Outputs	LDO Outputs	Phases	V_{IN} (min/max) (V)	V_O (min/max) (V)	Driver Current (A)	Output Current (A)[2]	Frequency (kHz)	V_{REF} Tol (%)	Control Method	Internal Bootstrap	Package(s)	Overvoltage Protection	Power Good	ULQ™[6]	Price*
DC/DC Synchronous Buck Controllers with Light-Load Efficiency																
TPS53128/29	2	0	1	4.5/24	0.76/24	1.5	15	350/700	1	D-CAP2™ Mode	Yes	24 QFN, 28 TSSOP	Yes	No	No	1.70
TPS51220A	2	2	1	4.5/32	1.0/12.0	2	20	200 to 1000	1	Current or D-CAP™ Mode	Yes	32 QFN	Yes	Yes	No	2.25
TPS51225/B/C	2	2	1	5.5/24	3.3/5.0[7]	1.7	10	300 to 335	1	D-CAP Mode	Yes	20 QFN	Yes	Yes	No	1.05
TPS51275/B/C	2	2	1	5.0/24	3.3/5.0[7]	1.7	20	330 to 335	1	D-CAP Mode	Yes	20 QFN	Yes	Yes	No	1.05
TPS51285A/B	2	2	1	5.0/24	3.3/5.0[7]	1.7	20	400 to 475	1	D-CAP Mode	Yes	20 QFN	Yes	Yes	Yes	1.05
TPS53211	1	0	1	4.5/15	0.8/0.7 x V_{IN}	2	25	200 to 600	0.5	Voltage	Yes	16 QFN	Yes	Yes	No	2.00
TPS53219	1	0	1	4.5/28	0.6/5.5	2	25	Select up to 1000	0.5	D-CAP Mode	Yes	16 QFN	Yes	Yes	No	1.35
TPS59124	2	0	1	3/28	0.76/5.5	3	10	300, 360, 420	1	D-CAP Mode	No	24 QFN	Yes	Yes	No	1.90
TPS59610/11	1	0	1	3/30	0.3/1.5	8	27	200 to 500	0.5	D-CAP+	Yes	32 QFN	Yes	Yes	No	1.40
TPS59621	1	0	2	3/30	0.3/1.5	8	54	250 to 500	0.5	D-CAP+	Yes	40 QFN	Yes	Yes	No	1.80

Device	V_{IN} (min/max) (V)	V_O (min/max) (V)	Frequency Range (kHz)	f_{sync}	On/Off Pin	Topology	Package(s)	Price*
Boost and Buck-Boost Controllers								
LM3430	6.0/40	1.25/—	50 to 2000	✔	—	Boost	12 LLP	1.00
LM3478	2.95/40	1.26/—	100 to 1000	✔	✔	Boost, SEPIC, flyback	8 MSOP	0.93
LM3481	2.97/48	1.275/—	100 to 1000	✔	✔	Boost, SEPIC, flyback	10 MSOP	0.95
LM3488	2.95/40	1.26/—	100 to 1000	✔	✔	Boost, SEPIC, flyback	8 MSOP	0.99
LM5020	13/100	Set by external feedback network	50 to 1000	✔	✔	Flyback, inverting, buck, boost, forward	10 MSOP, 10 LLP	0.99
LM5022/C	6.0/60	1.25/—	50 to 2000	✔	✔	Boost, SEPIC	10 MSOP	1.13
LM(2)5118	3.0/(42/75)	1.23/38 or 70	50 to 500	✔	✔	Buck-boost	20 eTSSOP	2.00/2.38
LM5121/2[8]	3.0/65	3.0/100	50 to 1000	✔	✔	Boost	20 HTSSOP	2.05/1.80
TPS40210/1[9]	4.5/52	5/26	Adj. to 1000	✔	✔	Boost, SEPIC, flyback	10 MSSOP/SON	1.10
TPS43000[10]	1.8/9	0.8/8	Adj. to 2000	✔	✔	Boost, SEPIC, flyback	16 TSSOP	2.25
TPS43060/61[10]	4.5/38	4.5/60	50 to 1000	✔	✔	Synchronous boost (60 V)	16 QFN	1.40

[1] C = Current-feedback control and VFF = voltage mode with voltage feed-forward compensation.
[2] Current levels of this magnitude can be supported with commonly available commercial FETs.
[3] The controller of choice for most applications will be the source/sink version, which has two-quadrant operation and will source or sink output current.
[4] Stackable to 16 phases.
[5] Stackable to 8 phases, reference is trimmable.
[6] ULQ = Ultralow quiescent-current mode.
[7] Fixed range: OUT1 = 5.0 V ±10% and OUT2 = 3.3 V ±10%.
[8] Input current limiting and disconnect switch (LM5121).
[9] Overvoltage protection, source only.
[10] External synch pin.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

DC/DC Switching Regulators
Charge Pumps

Inductorless DC/DC Regulators (Charge Pumps) Family of Products



Selection Guide

Device	I_{OUT} (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Efficiency (%)	Switching Frequency (max) (kHz)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Features						Package(s)	EVM	Price*
									Shutdown	Low Battery	Power Good	Undervoltage Lockout	Current Limit	Thermal Limit			
Step-Down (Buck) Regulators																	
LM2772	150	2.7 to 5.5	—	1.2	—	1100	45	—	✔					✔	QFN-10	✔	0.75
TPS60500	250	1.8 to 6.5	0.8 to 3.3	1.5, 1.8, 3.3	90	1200	40	0.05	✔		✔	✔	✔	✔	MSOP-10	✔	0.55
LM2771	250	2.7 to 5.5	—	1.5	—	1100	45	—	✔						QFN-10		0.85
LM2773	300	2.5 to 5.5	1.6 to 1.8	—	—	1150	48	—	✔						micro SMD-9	✔	0.90
Boost Regulators																	
TL7660	20	1.5 to 10	—	< 2 V_{IN}	99	10.35	80	—							SOT-23, MSOP-8		0.80
TPS60202	50	1.8 to 3.6	—	3.3	90	400	40	0.05	✔	✔[1]	✔[1]	✔			MSOP-10		0.65
TPS60212	50	1.8 to 3.6	—	3.3	90	400	35	2	Snooze	✔[1]	✔[1]	✔			MSOP-10		0.65
TPS60101	100	1.8 to 3.6	—	3.3	90	300	50	0.05	✔			✔	✔		TSSOP-20		0.65
TPS60120	100, 200[1]	1.8 to 3.6	—	3.0, 3.3[1]	85	450	55	0.05	✔	✔[1]	✔[1]	✔	✔		TSSOP-20		0.65, 0.80[1]
TPS60140	100	1.8 to 3.6	—	5.0	70	450	65	0.05	✔	✔[1]	✔[1]	✔	✔		TSSOP-20	✔	0.65
TPS60200	100	1.8 to 3.6	—	3.3	90	400	35	0.05	✔	✔[1]	✔[1]	✔			MSOP-10	✔	0.65
TPS60210	100	1.8 to 3.6	—	3.3	90	400	35	2	Snooze	✔[1]	✔[1]	✔			MSOP-10	✔	0.65
TPS60150	140	2.7 to 5.5	—	5.0	90	1500	4.7	0.01	✔					✔	QFN-6	✔	0.50
TPS60111	150	2.7 to 5.4	—	5.0	90	300	60	0.05	✔			✔	✔		TSSOP-20		0.70
TPS60130	150, 300[1]	2.7 to 5.4	—	5.0	90	450	60	0.05	✔	✔[1]	✔[1]	✔			TSSOP-20		0.70, 0.80[1]
TPS60100	200	1.8 to 3.6	—	3.3	90	300	50	0.05	✔			✔	✔		TSSOP-20	✔	0.80
TPS60110	300	2.7 to 5.4	—	5.0	90	300	60	0.05	✔			✔	✔		TSSOP-20	✔	0.80

[1] *Device parameter, feature and/or price may vary with each device number in family.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

DC/DC Switching Regulators
Charge Pumps

Selection Guide (Continued)

Device	I_{OUT} (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Efficiency (%)	Switching Frequency (max) (kHz)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Features						Package(s)	EVM	Price*
									Shutdown	Low Battery	Power Good	Undervoltage Lockout	Current Limit	Thermal Limit			
Dual-Output Regulators																	
TPS60300	20, 40	0.9 to 1.8	—	3.0, 3.3, 2 V_{IN}[1]	90	900	35	1	✔		✔	✔			MSOP-10	✔	0.70
TPS60310	20, 40	0.9 to 1.8	—	3.0, 3.3, 2 V_{IN}[1]	90	900	35	2	Snooze		✔	✔			MSOP-10		0.65
Buck-Boost Regulators																	
REG710	30	1.8 to 5.5	—	2.5 to 5.0	90	1000	65	0.01	✔				✔	✔	SOT-23		0.45
REG71050	60	2.7 to 5.5	—	5.0	90	1000	65	0.01	✔				✔	✔	SOT-23	✔	0.50
REG711	50	1.8 to 5.5	—	2.5 to 5.0	90	1000	60	0.01	✔				✔	✔	MSOP-8		0.48
TPS60240	12	1.8 to 5.5	—	3.3	90	160	25	0.1					✔	✔	MSOP-8		0.55
Inverting Regulators																	
TPS60400	60	1.6 to 5.5	–16.6 to –5.25	—	99	50 to 250	125	—							SOT-23	✔	0.33
TPS60401	60	1.6 to 5.5	–16.6 to –5.25	—	99	20	70	—							SOT-23		0.33
TPS60402	60	1.6 to 5.5	–16.6 to –5.25	—	99	50	275	—							SOT-23		0.33
TPS60403	60	1.6 to 5.5	–16.6 to –5.25	—	99	250	400	—							SOT-23		0.33

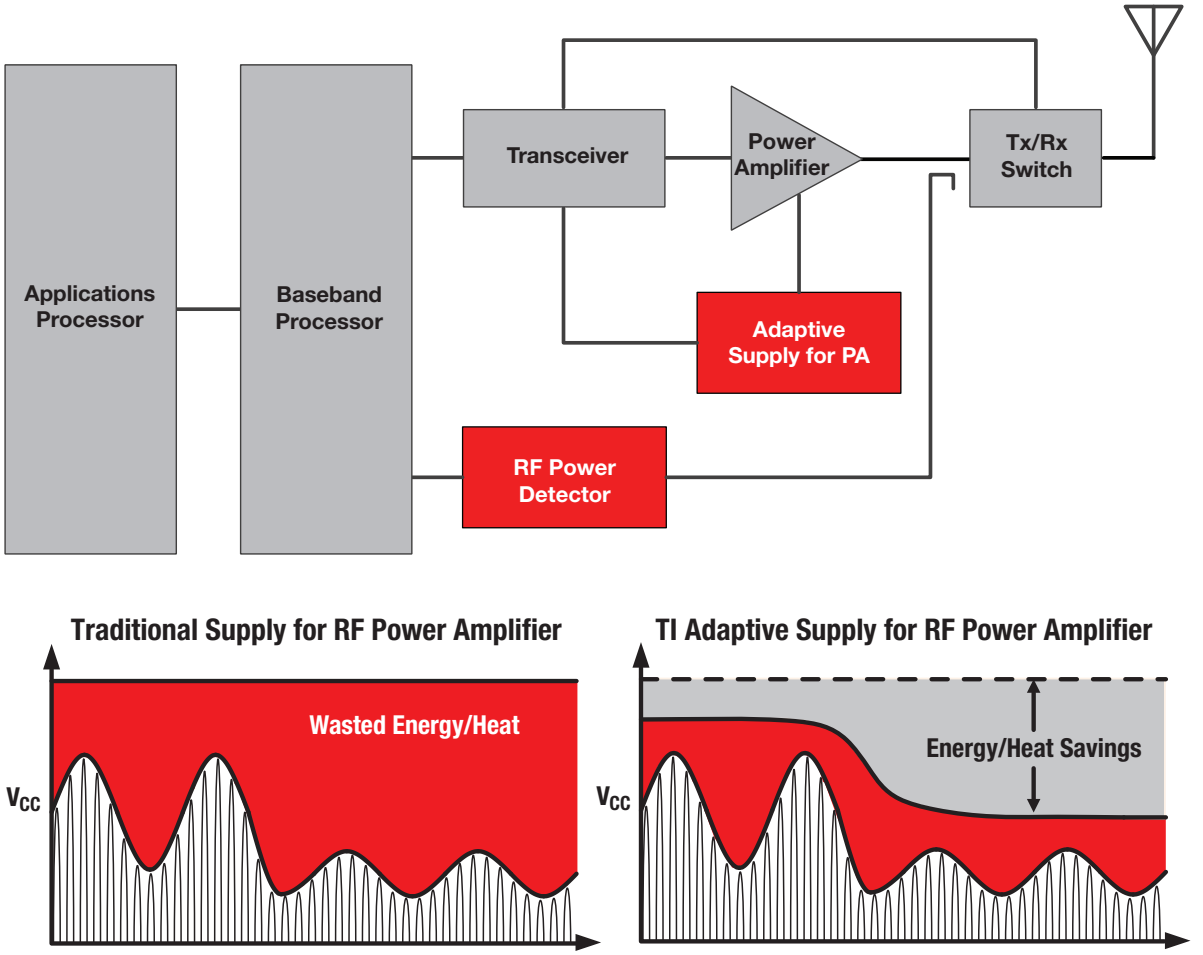
[1] *Device parameter, feature and/or price may vary with each device number in family.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

RF Power Solutions
Overview

RF Front End Power Solutions for 2G, 3G and 4G Portable Devices

Operation of the radio circuitry in a portable device accounts for a significant amount of the total power consumption—leading to less battery life and more heat. Traditionally, the RF power amplifier (PA), which is used to drive the antenna, is connected directly to the battery. However, this approach wastes a significant amount of energy as the PA is supplied with maximum power when often only a fraction is required to reliably ensure wireless voice and data connection. TI's portfolio of RF power management products delivers energy and heat saving solutions that enable higher performing RFFE systems. Supply for Power Amplifier products are dynamically adjustable power supplies for RF power amplifiers that optimize power usage—especially when maximum PA power is not needed—to extend battery life and reduce heat dissipation. TI's family of RF detectors provides transmit power control so that only the necessary amount of power is used, saving power and increasing transmission range. These RF detectors feature high linearity and accuracy over temperature to reduce PA power guard-band requirements for more coverage range, battery power savings, and increased channel quality.

Get more information: **www.ti.com/rfpower**

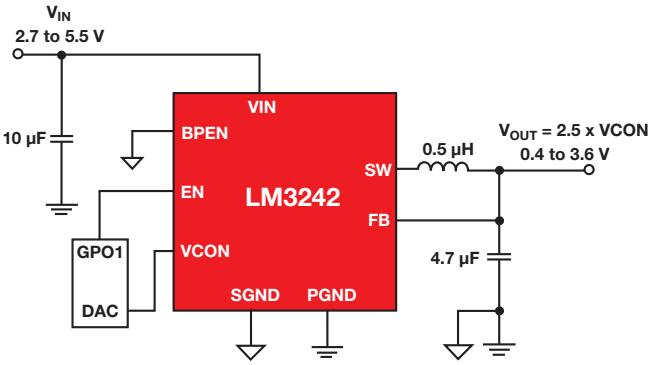


RF power solutions from TI enable efficient RF front-end designs.

RF Power Solutions
RF DC/DC Converters

6-MHz, 750-mA Miniature, Adjustable, Step-Down Converter for 3G/4G RF Power Amplifiers
LM3242

TI's Supply for Power Amplifier products are dynamic power supplies for RF power amplifiers. Converters like the LM3242 enable active adjustment of the power delivered to the RF power amplifier in order to optimize the power usage—especially when maximum power is not required—to drastically increase efficiency. These energy savings extend battery life for more talk and data usage time and reduce heat dissipation by up to 30°C for a more reliable, easier-to-design system.



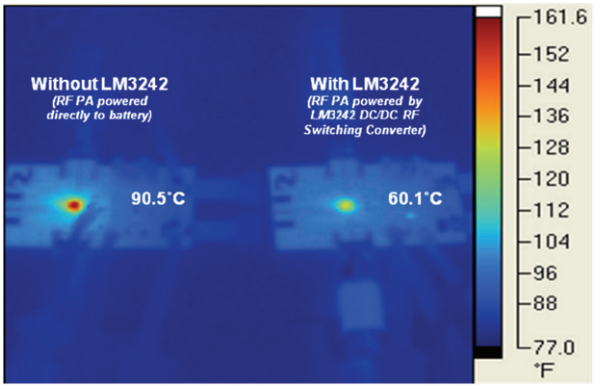
LM3242 application circuit with just three tiny surface-mount components.

Key Features

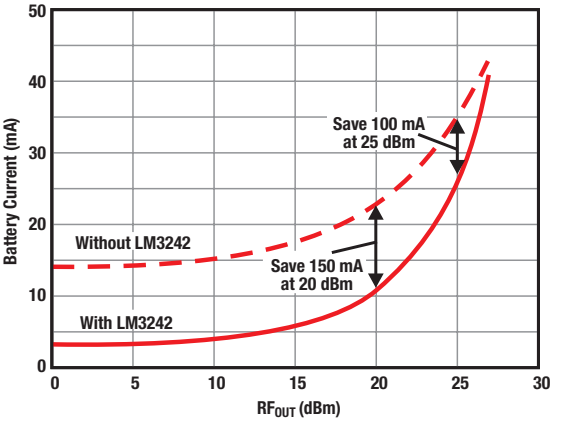
- Operates from a single Li-Ion cell (2.7 to 5.5 V)
- Adjustable output voltage (0.4 to 3.6 V) maximizes RF PA power savings
- 750-mA maximum load capability (up to 1 A in bypass) increases performance reliability during transients
- 6-MHz (typ) PWM switching frequency minimizes inductor footprint
- Automatic ECO/PWM/BP mode change for optimal operation during all load requirements and battery conditions
- Current and thermal overload protection
- Small solution size

Get more information:
www.ti.com/product/LM3242

Thermal Imaging—RF Power Amplifier



LM3242 reduces PA heat by 30°C at maximum RF power (28 dBm).



LM3242 extends battery life with dramatically reduced current consumption.

RF DC/DC Switching Converters with Adjustable Output Power for RF Power Amplifiers

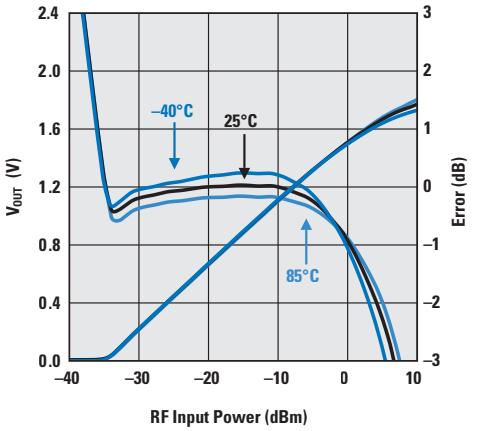
Device	Topology	V_{IN} (V)	V_{OUT} (V)	I_{OUT} (max) (mA)	Bypass Modes	Soft Start	Switching Frequency (MHz)	Package(s)	Description/Features	Price*
LM3209-G3	Buck-boost	2.7 to 5.5	0.6 to 4.2	1000	None	No	2.4	12-bump micro SMD		0.90
LM3269	Buck-boost	2.7 to 5.5	0.6 to 3.8	1000	None	No	2.4	12-bump micro SMD		0.75
LM3212	Buck	2.7 to 5.5	0.5 to 3.4	2500	Forced and active	No	1.6	16-bump micro SMD		1.10
TPS62730	Buck	1.9 to 3.9	1.9/2.1/2.3	100	Active	Yes	3	6-QFN (1x1.5 mm)	BLE, RF4CE, status pin	0.75
TPS62740	Buck	2.2 to 5.5	1.3 to 3.3	300	None	Yes	3	12-SON (2x3mm)	Load switch, 4-pin V_{select}	1.15
LM3241	Buck	2.7 to 5.5	0.6 to 3.4	750	None	Yes	6	6-bump micro SMD		0.40
LM3242	Buck	2.7 to 5.5	0.4 to 3.6	750	Forced and auto	Yes	6	9-bump micro SMD		0.37
LM3262	Buck	2.5 to 5.5	0.4 to 3.6	800	Forced and auto	Yes	6	9-bump micro SMD		0.40
LM3243	Buck	2.7 to 5.5	0.4 to 3.6	2500	Forced and active	No	2.7	16-bump micro SMD		0.45
LM3263	Buck	2.7 to 5.5	0.4 to 3.6	2500	Forced and active	No	2.7	16-bump micro SMD		0.48
LM3290/91	Envelope tracking power supply	2.7 to 5.0	0.6 to 4.5	1300	None	No	2.7	30-bump/12-bump micro SMD		0.80/ 0.70
LM3248	Boost-buck	2.7 to 5.5	0.4 to 4.0	2500	None	No	2.7	30-bump micro SMD		0.85
LM3279	Buck-boost	2.7 to 5.5	0.4 to 4.2	1000	None	No	2.5	16-bump micro SMD		0.75

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

RF Power Solutions
RF Power Detectors

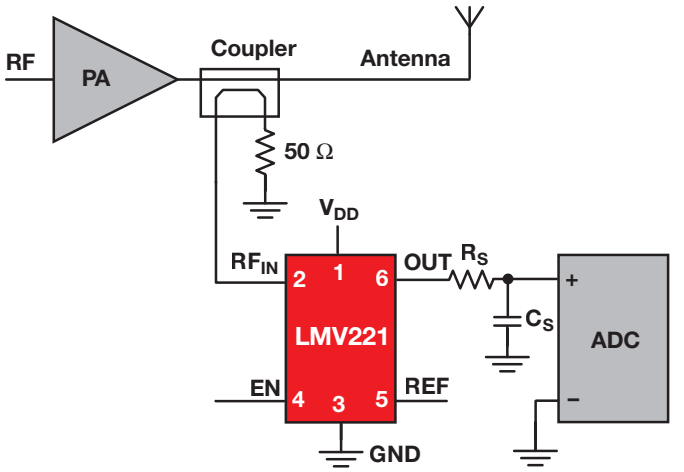
8-GHz LOG/LIN RMS RF Power Detector
LMH2110, LMH2120



Key Features
- LMH2110: 40-dB linear-in-dB power detection range
- LMH2120: 40-dB linear-in-V power detection range
- > 30-dB dynamic range, 1900 MHz, n = 50
  - ±0.3-dB log conformance error
  - ±0.3-dB variation over temperature
  - 0.05-dB (typ) output variation due to modulation, WCDMA
- Shutdown pin
- Multi-band operation from 50 MHz up to 8 GHz
- Available in micro SMD-6 packaging (0.84 x 1.24 mm)

Get more information: **www.ti.com/product/LMH2110** or **LMH2120**

50-MHz to 4-GHz 40-dB Logarithmic Power Detector for CDMA and WCDMA
LMV221, LMH2100



Typical application circuit.

Key Features
- 40-dB linear-in-dB power detection range
- 0.3-V to 2-V output voltage range
- Shutdown pin
- Multi-band operation from 50 MHz to 3.5 GHz
- 0.5-dB accurate temperature compensation
- External configurable output filter bandwidth
- Available in LLP-6 packaging, 2.2 x 2.5 x 0.8 mm (LMV221)
- Available in micro SMD-6 packaging, 0.85 x 1.25 x 0.6 mm (LMH2100)

Get more information: **www.ti.com/product/LMV221** or **LMH2100**

RF Power Detectors

Device	Application	Channels	Supply Voltage Range (V)	Dynamic Range (dB)	Frequency Range (MHz)	Type	Package(s)	EVM	Price*
LMV221	CDMA, WCDMA, GSM, GPRS	1	2.7 to 3.3	40	50 to 3500	LOG Amp	LLP-6	✔	0.90
LMV225	CDMA, WCDMA, GSM, EDGE, GPRS, TDMA	1	2.7 to 5.5	>30	450 to 2000	LOG Amp	micro SMD-4, LLP-6	✔	0.32
LMV226	CDMA, WCDMA, GSM, EDGE, GPRS, TDMA	1	2.7 to 5.5	>30	450 to 2000	LOG Amp	micro SMD-4	✔	0.42
LMV228	CDMA, WCDMA, GSM, EDGE, GPRS, TDMA	1	2.7 to 5.5	>30	450 to 2000	LOG Amp	micro SMD-4	✔	0.36
LMV232	3G, UMTS, WCDMA, CDMA2000, LAN, GPS	2	2.5 to 3.3	20	50 to 2000	LIN MS Amp	micro SMD-8	✔	0.85
LMV242	GSM, GPRS, TDMA, LAN	2	2.6 to 5.5	50	450 to 2000	LOG Amp	LLP-10	✔	0.55
LMH2100	CDMA, WCDMA, GSM, GPRS	1	2.7 to 3.3	40	50 to 4000	LOG Amp	micro SMD-6	✔	0.95
LMH2110	LTE, UMTS, WCDMA, CDMA2000, GSM/EDGE	1	2.7 to 5	45	50 to 8000	LOG RMS	micro SMD-6	✔	0.80
LMH2120	LTE, UMTS, WCDMA, CDMA2000, GSM/EDGE	1	2.7 to 5	40	50 to 6000	LIN RMS	micro SMD-6	✔	0.80
LMH2121	LTE, UMTS, WCDMA	1	2.7 to 5	40	100 to 3000	Fast LIN Amp	micro SMD-4		0.60

**Suggested resale price in U.S. dollars in quantities of 1,000.*

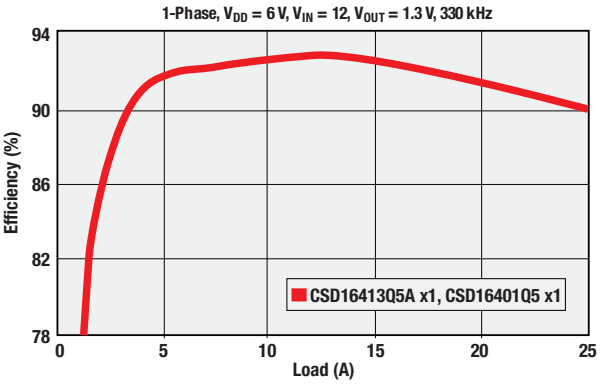
NexFET™ Power MOSFETs

TI's premier power management innovation called NexFET™ technology combines vertical current flow with a lateral power MOSFET. It provides a low on resistance and requires an extremely low gate charge with industry-standard package outlines—a combination not previously possible with existing silicon platforms.

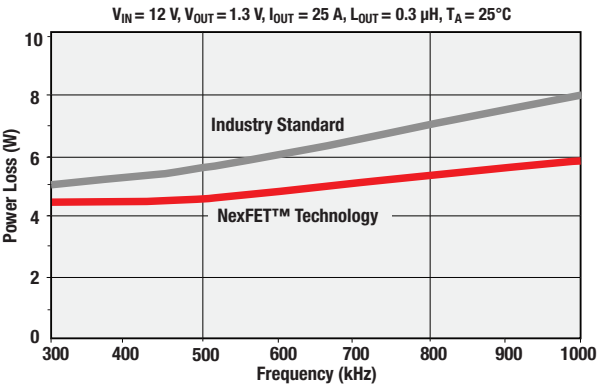
NexFET technology delivers high performance for both N- and P-channel power MOSFET devices. Designers are able to achieve 90% power supply efficiencies from light to full loads with high output currents and low duty cycles, representing a breakthrough in discrete designs.

	NexFET™ Technology	Industry Standard
Control FET	$R_{DS(on)}$ = 5.8 mΩ	$R_{DS(on)}$ = 6.6 mΩ
	Q_G = 6.5 nC	Q_G = 12.3 nC
Sync FET	$R_{DS(on)}$ = 2.5 mΩ	$R_{DS(on)}$ = 2.3 mΩ
	Q_G = 13.2 nC	Q_G = 39.8 nC

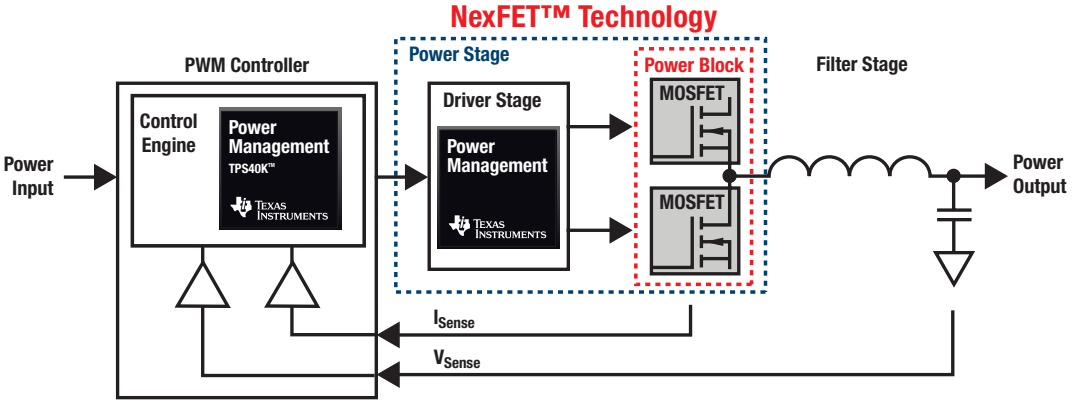
90% Efficiency from Light to Full Load



Same Power Loss, Double the Frequency



System Block Diagram of TI Electronics in a Power System Design



NexFET™ Power MOSFETs

N-Channel MOSFETs Selection Guide

Device	V_{DS} (V)	V_{GS} (V)	Typical $V_{GS(th)}$ (V)	Typical $R_{DS(on)}$ (mΩ) at 10 V	Typical $R_{DS(on)}$ (mΩ) at 4.5 V	Typical $R_{DS(on)}$ (mΩ) at 2.5 V	Maximum $R_{DS(on)}$ (mΩ) at 10 V	Maximum $R_{DS(on)}$ (mΩ) at 4.5 V	Maximum I_D Continuous (A)	Maximum I_D at T_C = 25°C (A)	I_D/I_{PEAK} (max) (A)	Typical Q_G (nC)	Typical Q_{GS} (nC)	Typical Q_{GD} (nC)	Price*
WLP 1x1															
Single															
CSD13201W10	12	8	0.8	—	26	29	—	34	—	1.6	20.2	2.3	0.5	0.3	0.20
WLP 1x1.5															
Single															
CSD13303W1015	12	8	0.85	—	16	18	—	20	—	7	7	3.9	1	0.4	0.25
WLP 1.7x2.3															
Dual Common Source															
CSD86311W1723	25	10	1	—	31	—	—	42	4.5	5	5	3.1	0.85	0.33	0.43
LGA 1x0.6															
Single															
CSD13381F4	12	8	0.85	—	140	170	—	180	2.1	—	7	1.06	0.23	0.14	0.06
CSD17381F4	30	12	0.85	—	90	110	—	117	3.1	—	10	1.04	0.226	0.133	0.10
CSD17483F4	30	12	0.85	—	200	240	—	260	1.5	—	5	1.01	0.22	0.13	0.06
SO-8															
Dual															
CSD88537ND	60	20	2	12.5	—	—	15	—	15	16	62	14	4.6	2.3	0.25
CSD88539ND	60	20	2	23	—	—	28	—	15	11.7	46	7.2	2.7	1.1	0.19
SON 2x2															
Single															
CSD15571Q2	20	20	1.45	12	16	—	15	19.2	10	21	136	2.5	0.93	0.66	0.14
CSD16301Q2	25	10	1.1	—	23	—	—	29	5	21	136	2	0.6	0.4	0.15
CSD17313Q2	30	10	1.3	—	26	—	—	32	5	21	112	2.1	0.7	0.4	0.15
CSD17313Q2Q1	30	10	1.3	24	26	—	30	32	5	21	112	2.1	0.7	0.4	0.18
SON 3x3															
Single															
CSD16323Q3	25	10	1.1	—	4.4	—	—	5.5	60	33	200	6.2	1.8	1.1	0.39
CSD16327Q3	25	—	1.2	—	4	—	—	4.8	60	21	112	6.2	—	1.1	0.39
CSD16340Q3	25	10	0.85	—	4.3	6.1	—	5.5	60	21	115	6.5	2.1	1.2	0.39
CSD16406Q3	25	16	1.7	4.2	5.9	—	5.3	7.4	60	21	131	5.8	2.5	1.5	0.39
CSD16409Q3	25	16	2	6.2	9.5	—	8.2	12.4	60	38	240	4	2.1	1	0.33
CSD16411Q3	25	16	2	8	12	—	10	15	56	28	184	2.9	1.5	0.7	0.30
CSD17304Q3	30	10	1.3	—	6.9	—	—	8.8	56	21	135	5.1	1.8	1.1	0.32
CSD17308Q3	30	10	1.3	—	9.4	—	—	11.8	47	19	114	3.9	1.3	0.8	0.30
CSD17309Q3	30	10	1.2	—	4.9	—	—	6.3	60	31	200	7.5	2.5	1.7	0.39
CSD17551Q3A	30	20	1.6	7.8	9.6	—	9	11.8	12	31	200	6	2.3	1.5	0.17
CSD17552Q3A	30	20	1.5	5.5	6.5	—	6	8.1	15	22	141	9	3.6	2.3	0.20
Dual Common Source															
CSD87312Q3E	30	10	1	—	31	—	—	38	27	33	200	6.3	1.9	0.7	0.35
DualCool™ SON 3x3															
Single															
CSD16323Q3C	25	10	1.1	—	4.4	—	—	5.5	60	22	141	6.2	1.8	1.1	0.43
SON 5x6															
Single															
CSD16321Q5	25	10	1.1	—	2.1	—	—	2.6	100	15	90	14	4	2.5	0.65
CSD16322Q5	25	10	1.1	—	4.6	—	—	5.8	97	16	158	6.8	2.4	1.3	0.41
CSD16325Q5	25	10	1.1	—	1.7	—	—	2.2	100	14	138	18	6.6	3.5	0.95
CSD16342Q5A	25	10	—	—	4.3	6.1	—	5.5	100	14	91	6.5	2.1	1.2	0.42
CSD16401Q5	25	16	1.5	1.3	1.8	—	1.6	2.3	100	24	156	21	8.3	5.2	0.95
CSD16403Q5A	25	16	1.6	2.2	2.9	—	2.8	3.7	184	34	213	13.3	5.5	3.5	0.60

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

N-Channel MOSFETs Selection Guide (Continued)

Device	V_{DS} (V)	V_{GS} (V)	Typical $V_{GS(th)}$ (V)	Typical $R_{DS(on)}$ (mΩ) at 10 V	Typical $R_{DS(on)}$ (mΩ) at 4.5 V	Typical $R_{DS(on)}$ (mΩ) at 2.5 V	Maximum $R_{DS(on)}$ (mΩ) at 10 V	Maximum $R_{DS(on)}$ (mΩ) at 4.5 V	Maximum I_D Continuous (A)	Maximum I_D at T_C = 25°C (A)	I_D/I_{PEAK} (max) (A)	Typical Q_G (nC)	Typical Q_{GS} (nC)	Typical Q_{GD} (nC)	Price*
SON 5x6 (Continued)															
Single (Continued)															
CSD16404Q5A	25	16	1.8	4.1	5.7	—	5.1	7.2	81	38	200	6.5	3	1.7	0.39
CSD16407Q5	25	16	1.6	1.8	2.5	—	2.4	3.3	100	40	249	13.3	5.3	3.5	0.65
CSD16408Q5	25	16	1.8	3.6	5.4	—	4.5	6.8	113	28	181	6.7	3.1	1.9	0.45
CSD16410Q5A	25	16	1.9	6.8	9.6	—	8.5	12	59	16	104	3.9	1.8	1.1	0.32
CSD16412Q5A	25	16	2	—	13	—	11	16	52	32	200	2.9	1.4	0.7	0.30
CSD16413Q5A	25	16	1.6	—	4.1	—	3.9	5.6	100	15	88	9	3.5	2.5	0.44
CSD16414Q5	25	16	1.6	—	2.1	—	1.9	2.6	100	29	181	16.6	7.3	4.4	0.75
CSD16415Q5	25	16	1.5	0.99	1.5	—	1.15	1.8	100	24	155	21	8.3	5.2	1.05
CSD16556Q5B	25	20	1.4	0.9	1.2	—	1.07	1.5	100	14	92	37	12	13	0.58
CSD17301Q5A	30	10	1.1	—	2.3	—	—	3	100	13	78	19	5.7	4.3	0.60
CSD17302Q5A	30	10	1.2	—	7.3	—	—	9	87	20	112	5.4	1.7	1.2	0.32
CSD17303Q5	30	10	1.1	—	2	—	—	2.6	100	21	134	18	5.6	4	0.65
CSD17305Q5A	30	10	1.1	—	2.8	—	—	2.8	100	32	200	14.1	4.5	3	0.49
CSD17306Q5A	30	10	1.1	—	3.3	—	—	4.2	100	38	200	11.8	3.5	2.4	0.44
CSD17307Q5A	30	10	1.3	—	9.7	—	—	12.1	73	5	20	4	1.3	1	0.30
CSD17310Q5A	30	10	1.3	—	4.5	—	—	5.9	100	5	20	8.9	2.7	2.1	0.39
CSD17311Q5	30	10	1.2	—	1.8	—	—	2.3	100	16	104	24	6.3	5.2	0.75
CSD17312Q5	30	10	1.1	—	1.4	—	—	1.7	100	13	85	28	8.4	6	0.95
CSD17322Q5A	30	10	1.6	—	10	—	—	12.4	87	10	10	3.6	1.6	1.1	0.32
CSD17327Q5A	30	10	1.6	—	12.5	—	—	15.5	65	—	—	2.8	1.2	0.8	0.30
CSD17501Q5A	30	20	1.3	—	3	—	2.9	3.7	100	28	187	13.2	5.4	3.5	0.60
CSD17505Q5A	30	20	1.3	2.9	3.7	—	3.5	4.6	100	24	153	10	3.5	2.7	0.49
CSD17506Q5A	30	20	1.3	—	4.2	—	4	5.3	100	23	150	8.3	3.1	2.3	0.44
CSD17507Q5A	30	20	1.6	—	11.8	—	10.8	16.1	65	13	85	2.8	1.3	0.7	0.30
CSD17510Q5A	30	20	1.5	—	5.4	—	5.2	7.3	55	20	129	6.4	2.7	1.9	0.39
CSD17522Q5A	30	20	1.6	6.7	10	—	8.1	12.4	87	16	104	3.6	1.6	1.1	0.32
CSD17527Q5A	30	20	1.6	9.3	12.5	—	10.8	15.5	65	13	85	2.8	1.2	0.8	0.30
CSD17551Q5A	30	20	1.7	8.8	9	—	8.8	11	13.5	48	71	6	2.8	1.4	0.19
CSD17552Q5A	30	20	1.5	5.1	6.1	—	6.2	7.5	17	48	85	9	3.6	2	0.27
CSD17553Q5A	30	20	1.5	3.1	4	—	2.7	3.5	100	60	84	17.5	5.8	4.7	0.30
CSD17555Q5A	30	20	1.5	2.3	2.8	—	2.7	3.4	100	24	153	23	7.5	5	0.36
CSD17556Q5B	30	20	1.4	1.2	1.5	—	1.4	1.8	34	23.5	151	28.5	10.7	6.9	0.57
CSD17559Q5	30	20	1.4	0.95	1.15	—	1.15	1.5	40	—	—	39	14.4	9.3	0.64
CSD18501Q5A	40	20	1.8	2.5	3.3	—	3.2	4.3	100	142	155	42	8.1	5.9	0.80
CSD18502Q5B	40	20	1.8	1.8	2.5	—	2.3	3.3	100	204	167	52	10.3	8.4	1.01
CSD18503Q5A	40	20	1.8	3.4	4.7	—	4.3	6.2	100	145	124	27	4.5	4.3	0.65
CSD18504Q5A	40	20	1.9	5.3	7.5	—	6.6	9.8	50	75	95	16	3.2	2.4	0.50
CSD18531Q5A	60	20	1.8	3.5	4.4	—	4.6	5.8	100	134	122	36	6.9	5.9	0.80
CSD18532NQ5B	60	20	2.8	2.7	—	—	3.4		100	163	135	49	16	7.9	1.01
CSD18532Q5B	60	20	1.8	2.5	3.3	—	3.2	4.3	100	172	143	44	10	6.9	1.01
CSD18533Q5A	60	20	1.9	4.7	6.5	—	5.9	8.5	100	103	107	29	6.6	5.4	0.63
CSD18534Q5A	60	20	1.9	7.8	9.9	—	9.8	12.4	50	69	81	17	3.2	3.5	0.50
CSD18537NQ5A	60	20	3	10	—	—	13	—	50	62	72	14	4.7	2.3	0.41
CSD18563Q5A	60	20	2	8.6	5.7	—	10.8	6.8	100	169	179	15	3.3	2.9	0.60
CSD19502Q5B	80	20	2.7	3.4	—	—	4.1	—	100	138	200	48	14	8.6	1.02
CSD19531Q5A	100	20	2.7	5.3	—	—	6.4	—	100	172	143	37	10.5	6.6	0.90

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

NexFET™ Power MOSFETs

N-Channel MOSFETs Selection Guide (Continued)

Device	V_{DS} (V)	V_{GS} (V)	Typical $V_{GS(th)}$ (V)	Typical $R_{DS(on)}$ (mΩ) at 10 V	Typical $R_{DS(on)}$ (mΩ) at 4.5 V	Typical $R_{DS(on)}$ (mΩ) at 2.5 V	Maximum $R_{DS(on)}$ (mΩ) at 10 V	Maximum $R_{DS(on)}$ (mΩ) at 4.5 V	Maximum I_D Continuous (A)	Maximum I_D at T_C = 25°C (A)	I_D/I_{PEAK} (max) (A)	Typical Q_G (nC)	Typical Q_{GS} (nC)	Typical Q_{GD} (nC)	Price*
SON 5x6 (Continued)															
Single (Continued)															
CSD19532Q5B	100	20	2.6	4	—	—	4.9	—	100	124	200	48	13	8.7	1.22
CSD19533Q5A	100	20	2.8	7.8	—	—	9.4	—	100	75	80	27	7.9	4.9	0.76
DualCool SON 5x6															
Single															
CSD16321Q5C	25	10	1.1	—	2.1	—	—	2.6	100	69	81	14	4	2.5	0.75
CSD16322Q5C	25	10	1.1	—	4.6	—	—	5.8	97	54	91	6.8	2.4	1.3	0.45
CSD16325Q5C	25	10	1.1	—	1.7	—	—	2.2	100	62	72	18	6.6	3.5	1.05
CSD16407Q5C	25	16	1.6	1.8	2.5	—	2.4	3.3	100	91	96	13.3	5.3	3.5	0.75
CSD16408Q5C	25	16	1.8	3.6	5.4	—	4.5	6.8	113	—	—	6.7	3.1	1.9	0.49
TO-220															
Single															
CSD18502KCS	40	20	1.8	2.4	3.3	—	2.9	4.3	100	200	211	52	10.3	8.4	0.97
CSD18503KCS	40	20	1.9	3.6	5.4	—	4.5	6.8	100	130	155	30	7.7	4.6	0.71
CSD18504KCS	40	20	1.9	5.5	8	—	7	10	100	85	133	19	4.4	3.5	0.58
CSD18532KCS	60	20	1.8	3.3	4.2	—	4.2	5.3	100	169	179	44	10	6.9	0.97
CSD18533KCS	60	20	1.9	5	6.9	—	6.3	9	100	114	135	28	9.4	3.9	0.71
CSD18534KCS	60	20	1.9	7.6	10.2	—	9.5	13.3	100	71	108	19	4.8	3.1	0.58
CSD18537NKCS	60	20	3	11	—	—	14	—	50	54	91	14	5.2	2.3	0.49
CSD19501KCS	80	29	2.7	5.5	—	—	6.6	—	100	129	146	38	12.4	5.8	1.02
CSD19503KCS	80	20	2.8	7.6	—	—	9.2	—	100	94	113	28	9.8	5.4	0.88
CSD19505KCS	80	20	2.6	2.6	—	—	3.1	—	150	208	400	76	25	11	1.55
CSD19506KCS	80	20	2.6	2	—	—	2.3	—	150	273	400	120	37	25	2.29
CSD19531KCS	100	20	2.7	6.4	—	—	7.7	—	100	105	122	37	11.9	7.5	1.02
CSD19533KCS	100	20	2.8	8.7	—	—	10.5	—	100	86	104	27	9	5.4	0.88
CSD19535KCS	100	20	2.7	3.1	—	—	3.6	—	150	187	400	78	25	13	1.55
CSD19536KCS	100	20	2.5	2.3	—	—	2.7	—	150	259	400	118	37	17	2.29

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

P-Channel MOSFETs Selection Guide

Device	V_{DS} (V)	V_{GS} (V)	Typical $V_{GS(th)}$ (V)	Typical $R_{DS(on)}$ (mΩ) at 4.5 V	Typical $R_{DS(on)}$ (mΩ) at 2.5 V	Maximum $R_{DS(on)}$ (mΩ) at 4.5 V	Maximum $R_{DS(on)}$ (mΩ) at 2.5 V	Maximum I_D Continuous (A)	Maximum I_D at T_C = 25°C (A)	I_D/I_{PEAK} (max) (A)	Typical Q_G (nC)	Typical Q_{GS} (nC)	Typical Q_{GD} (nC)	Price*
LGA 1x0.6														
Single														
CSD23381F4	–12	–8	–0.95	150	250	175	300	–2.3	—	–9	1.14	0.3	0.19	0.06
CSD25481F4	–20	–12	–0.95	90	145	105	174	–2.5	—	–10	0.913	0.24	0.153	0.10
CSD25483F4	–20	–12	–0.95	210	338	245	390	–1.6	—	–6.5	0.959	0.252	0.16	0.06
WLP 1x1														
Single														
CSD25213W10	–20	–6	–0.85	39	54	47	67	—	–1.6	–16	2.2	0.74	0.14	0.22
CSD23201W10	–12	–6	0.6	66	—	82	96	–2.2	–2.2	–8.8	1.8	0.28	0.4	0.20
WLP 1x1.5														
Single														
CSD25211W1015	–20	–6	–0.8	27	36	33	44	–3.2	–3.2	–9.5	3.4	1.1	0.2	0.25
CSD25301W1015	–20	–8	0.75	62	—	75	100	–2.2	–2.2	–8.8	2	0.35	0.32	0.25
CSD25303W1015	–20	–8	–0.65	46	56	58	71	–3	–3	–9	3.3	0.6	0.6	0.25

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

P-Channel MOSFETs Selection Guide (Continued)

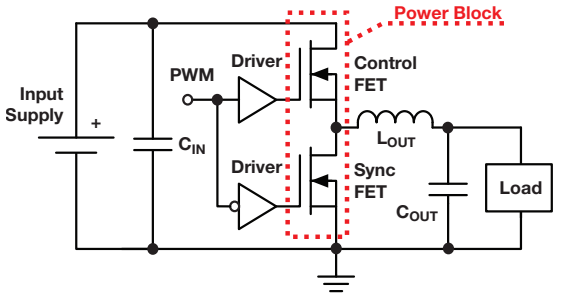
Device	V_{DS} (V)	V_{GS} (V)	Typical $V_{GS(th)}$ (V)	Typical $R_{DS(on)}$ (mΩ) at 4.5 V	Typical $R_{DS(on)}$ (mΩ) at 2.5 V	Maximum $R_{DS(on)}$ (mΩ) at 4.5 V	Maximum $R_{DS(on)}$ (mΩ) at 2.5 V	Maximum I_D Continuous (A)	Maximum I_D at T_C = 25°C (A)	I_D/I_{PEAK} (max) (A)	Typical Q_G (nC)	Typical Q_{GS} (nC)	Typical Q_{GD} (nC)	Price*
WLP 1x1.5 (Continued)														
Dual Common Source														
CSD75205W1015	–20	–6	0.65	95	—	120	145	–1.2	–1.2	–9.6	1.6	—	0.4	0.26
CSD75301W1015	–20	–8	0.7	80	—	100	135	–1.2	–1.2	–17.5	1.5	0.28	0.3	0.26
WLP 1.5x1.5														
Single														
CSD25201W15	–20	–6	–0.7	33	—	40	50	–4	–4	–4	4.3	1	0.7	0.28
Dual Common Source														
CSD22202W15	–8	–6	–0.8	10.2	14.5	12.2	17.4	—	–5	–48	6.5	1.6	1	0.32
CSD75204W15	–20	–6	0.7	80	—	100	130	–3	–3	–28	2.8	0.5	0.6	0.30
CSD75207W15	–20	–6	–0.8	22	32	27	39	—	–2.4	–24	2.9	0.7	0.4	0.35
WLP 1.7x2.3														
Dual Common Source														
CSD75211W1723	–20	–8	–0.7	32	—	40	50	–4.5	–4.5	–4.5	4.5	0.9	0.9	0.43
SON 2x2														
Single														
CSD25310Q2	–20	–8	–0.8	19.9	27	23.9	32.5	–9.6	–9.6	–20	3.6	1.1	0.5	0.18
SON 3x3														
Single														
CSD25402Q3A	–20	–12	–0.9	7.7	13.3	8.9	15.9	–15	–15	–72	7.5	2.4	1.1	0.31

**Suggested resale price in U.S. dollars in quantities of 1,000.*

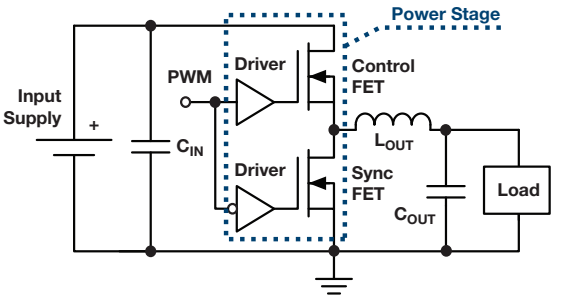
*New devices are listed in **bold red**.*

NexFET™ Power MOSFETs

CSD8xxx NexFET™ Power Block and Power Block II families contain an optimized MOSFET pair in innovative packages



CSD9xxx NexFET Power Stage integrates enhanced gate drivers with two MOSFETs in TI's PowerStack™ package



Power MOSFET Modules Selection Guide

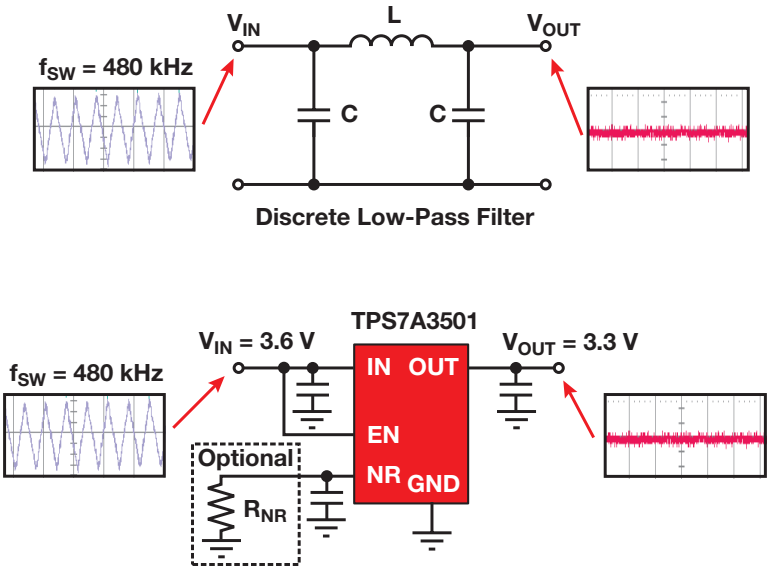
Device	Attributes	Integrated Driver	V_{DS} (V)	V_{GS} (V)	Power Loss (W)	P_{loss} Current (A)	Maximum Current (A)	Price*
LGA Power Block II								
CSD87381P	N-Channel	No	30	10	1	8	15	0.32
CSD87588N	N-Channel	No	30	20	2.1	15	25	0.48
CSD87384M	N-Channel	No	30	10	3.7	25	30	0.67
SON 3x3 Power Block								
CSD86330Q3D	N-Channel	No	25	10	1.9	15	20	0.75
CSD87330Q3D	N-Channel	No	30	10	2.0	15	20	0.56
CSD87331Q3D	N-Channel	No	30	10	1.3	10	15	0.43
CSD87333Q3D	N-Channel	No	30	10	1.5	8	15	0.51
SON 3.5x4.5 Power Stage								
CSD95375Q4M	N-Channel	Yes	20	—	2.2	15	25	0.87
CSD97374Q4M	N-Channel	Yes	30	—	2.3	15	25	0.94
CSD97376Q4M	N-Channel	Yes	30	—	2.2	12	20	0.82
SON 5x6 Power Block and Power Stage								
CSD86350Q5D	N-Channel	No	25	10	2.8	25	40	0.85
CSD86360Q5D	N-Channel	No	25	10	2.6	25	50	0.94
CSD87350Q5D	N-Channel	No	30	10	3	25	40	0.85
CSD87351Q5D	N-Channel	No	30	10	2.5	20	32	0.75
CSD87351ZQ5D	N-Channel	No	30	10	2.5	20	32	0.75
CSD87352Q5D	N-Channel	No	30	10	1.8	15	25	0.63
CSD87353Q5D	N-Channel	No	30	10	3.3	25	40	0.94
CSD95372AQ5M	N-Channel	Yes	25	—	3.3	30	60	1.85
CSD95372BQ5M	N-Channel	Yes	20	—	2.8	30	60	2.19
CSD95373AQ5M	N-Channel	Yes	20	—	2.6	25	45	1.39
CSD96370Q5M	N-Channel	Yes	25	—	2.6	25	40	1.16
CSD96371Q5M	N-Channel	Yes	25	—	2.4	25	50	1.26
CSD97370AQ5M	N-Channel	Yes	30	—	2.8	25	40	1.16
CSD97370Q5M	N-Channel	Yes	30	—	2.8	25	40	1.16

**Suggested resale price in U.S. dollars in quantities of 1,000.*

TI's First Power Filter Removes Switching Noise

TPS7A3501

The TPS7A3501 is a positive-voltage, low-noise power filter that is capable of sourcing up to 1 A in quiet supply fashion. Rather than regulate output voltage like a traditional LDO, the TPS7A3501 regulates the voltage drop across the input and output. The power filter maintains a fixed efficiency while still cleaning up the switching noise from DC/DC converters upstream. In addition, the device comes in a small 2x2-mm package, which makes it a great alternative solution to many passive filters and large LDOs being used in space-constrained applications.



TPS7A3501 typical application and waveforms.

Get more information: **www.ti.com/product/TPS7A3501**

Key Features

- Regulates input-to-output voltage
- High PSRR: >32 dB (360 kHz to 3.9 MHz)
- Low Noise Output: 4 μV_{RMS}
- Output voltage range: 1.21 to 4.5 V
- 2x2-mm SON-6 package

Key Benefits

- Maintains high efficiency
- Eliminates switching noise
- Provides clean rail
- Post-DC/DC regulation
- Small size for space-constrained solutions

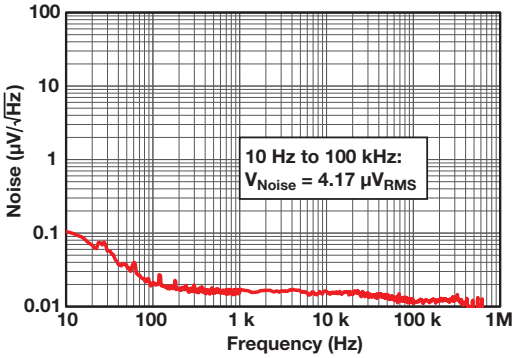
The reference design is available at: **www.ti.com/tool/pmp5863.1**

Industry's Cleanest, Ultra-Low-Noise LDO

TPS7A4700, TPS7A4701

The TPS7A4700/1 devices are positive-voltage (+36 V), ultra-low-noise (4.17 μV_{RMS}) linear regulators capable of sourcing a 1-A load. In addition, the LDO output voltage is fully user adjustable via a PCB layout without the need of external resistors or feed-forward capacitors, reducing overall component count.

The TPS7A4701 retains the same functionality of the TPS7A4700 and provides the option to set the output voltage via external resistors.



TPS7A4700/1 spectral noise plot

Get more information: **www.ti.com/product/TPS7A4700 or TPS7A4701**

Key Features

- Extremely low noise/high PSRR
- Robust for high-line voltage transients
- Higher precision for VCO/PLL/ADC
- Improved size/cost
- No external resistors required to set V_{OUT}

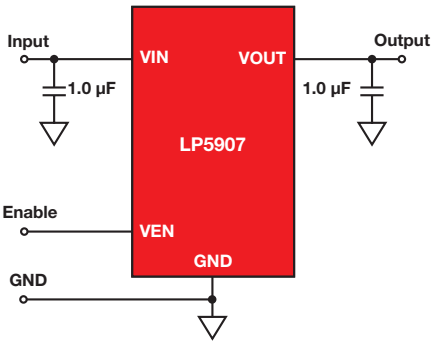
Linear Regulators

Ultra-Low Noise, 250-mA Linear Regulator for RF/Analog Circuits

LP5907

The LP5907 is a linear regulator capable of supplying 250-mA output current. Designed to meet the requirements of RF and analog circuits, the LP5907 device provides low noise, high PSRR, low quiescent current, and low line or load transient-response figures. Using new innovative design techniques, the LP5907 offers class-leading noise performance without a noise bypass capacitor and the ability for remote output capacitor placement.

The device is designed to work with a 1-µF input and a 1-µF output ceramic capacitor (no bypass capacitor is required). It is available in 4-bump, ultra-thin DSBGA, 5-pin SOT-23, and 4-pin X2SON packages.



Output voltages are available between 1.2 V and 4.5 V in 25-mV steps. Contact Texas Instruments Sales for specific voltage option needs.

Key Features

- Stable with 1-µF ceramic input and output capacitors
- No noise bypass capacitor required
- Remote output capacitor placement
- Thermal-overload and short-circuit protection
- –40°C to +125°C junction temperature range for operation

Applications

- Cellular phones
- PDA handsets
- Wireless LAN devices

Get more information: **www.ti.com/product/LP5907**

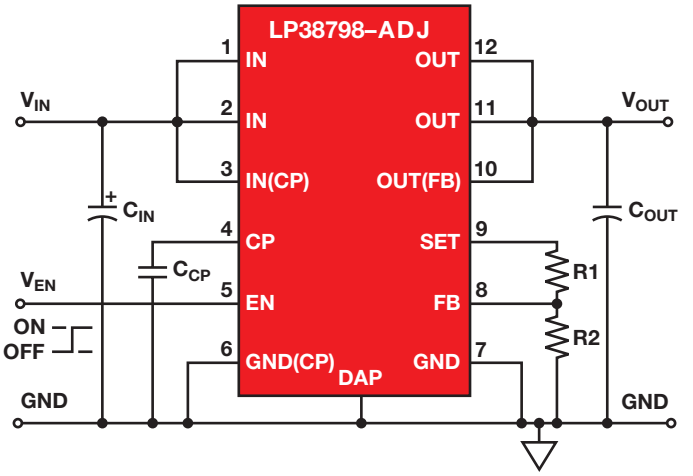
Ultra-Low Noise, 800-mA Linear Regulator for RF/Analog Circuits

LP38798

The LP38798-ADJ is a high-performance linear regulator capable of supplying 800-mA output current. Designed to meet the requirements of sensitive RF/analog circuitry, the regulator implements a novel linear topology on an advanced CMOS process to deliver ultra-low output noise and high PSRR at power supply switching frequencies. The LP38798SD-ADJ is stable with both ceramic and tantalum output capacitors and requires a minimum output capacitance of only 1 µF for stability.

The LP38798-ADJ can operate over a wide input voltage range (3.0 V to 20 V) that makes it well suited for many post-regulation applications.

The LP38798-ADJ is available in a 12-lead WSON package (4x4x0.8 mm) with a thermal pad.



Key Features

- Ultra-low output noise: 5 μV_{RMS} (10 Hz to 100 kHz)
- High PSRR: 90 dB at 10 kHz, 60 dB at 100 kHz
- Wide operating input voltage range: 3.0 V to 20 V
- ±1.0% output voltage initial accuracy (T_J = 25°C)
- Very low dropout: 200 mV (typical) at 800 mA
- Stable with ceramic or tantalum output capacitors
- Excellent line and load transient response
- Current-limit and over-temperature protection

Applications

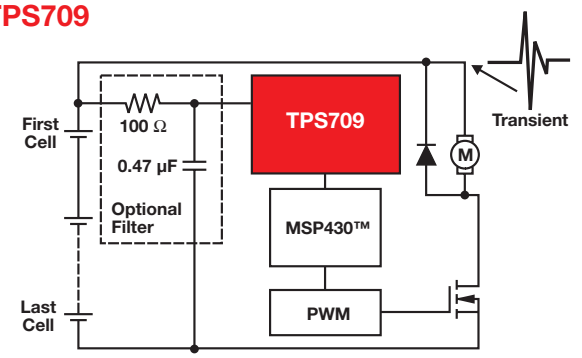
- RF and VCO power
- Wireless LAN devices
- Wireless cable modems
- Low-noise post-regulation

Get more information: **www.ti.com/product/LP38798**

Linear Regulators

High-Voltage, Low-I_Q Linear Voltage Regulator for Battery Packs

TPS709



Key Features

- V_{IN}: 2.7 to 30 V
- I_{OUT}: 150 mA
- V_{DO}: 245 mV at 50 mA
- I_Q of 1 µA
- Accuracy: 2% over temperature
- 2x2-mm SON, SOT23-5 and SOT223-5 packages

Applications

- E-metering
- Remote controllers
- Portable electronics powered from 9- to 12-V battery
- Smoke detectors/security
- Automotive
- High-cell-count battery packs for power tools

Get more information: **www.ti.com/product/TPS70912**

Low Dropout (LDO) Regulators Selection Guide

Device	V_{IN} Range (V)	I_{OUT} (mA)	Price*
Wide V_{IN}			
TPS7A40xx	7 to 100	50	1.05
LM9076	5.35 to 70	150	0.78
TPS7A16xx	3 to 60	100	1.39
LM2936HV	5.5 to 60	50	0.62
TPS709xx	2.7 to 30	150	0.39
TPS715Axx	2.5 to 24	80	0.40
LM1084	5 to 27	5000	1.00

Device	Dropout (mV)	V_{IN} Range (V)	I_{OUT} (A)	Price*
Low Dropout Voltage (With Bias Control Input)				
TPS747xx	50	0.8 to 5.5	0.5	0.75
TPS74(2/3/8)xx	55/55/60	0.8 to 5.5	1.5	1.00
TPS74(4/9)xx	115/120	0.8 to 5.5	3	2.00
LP38851	115	0.95 to 5.5	0.8	0.71
TPS720xx	130	1.1 to 4.5	0.32	0.37
LP3885(2/5/8)	130	1.15 to 5.5	1.5	0.85
LP3885(3/6/9)	240	1.15 to 5.5	3	1.60
TPS7A8300	125	1.1 to 6.5	2	2.45

Device	Dropout (mV)	V_{IN} Range (V)	I_{OUT} (A)	Price*
Low Dropout Voltage (Without Bias Control Input)				
TPS73(1/2/6)xx	30/40/75	1.7 to 5.5	0.15/0.25/0.40	0.33/0.45/0.75
TPS799xx	100	2.7 to 6.5	0.2	0.30
TPS7A7(1/2/3)xx	200	1.5 to 7.0	1/2/3	1.05/1.20/1.35
LP388(1/2/3)	75/110/210	1.5 to 5.5	0.8/1.5/3	1.95
TPS73(5/7)xx	280/130	2.2 to 5.5	0.5/1	0.49/0.58
LP3851(1/2/3)	135/250/425	2.25 to 5.5	0.8/1.5/3	0.75
TPS7A37xx	130	2.2 to 5.5	1	0.66

Suggested resale price in U.S. dollars in quantities of 1,000.

Device	Load Transient (mV)	V_{IN} Range (V)	I_{OUT} (A)	Price*
Fast Transient Response				
LP5907	±20	2.2 to 5.5	0.25	0.23
TPS7A37xx	±25	2.2 to 5.5	1	0.66
TPS7A8101	±50	2.2 to 6.5	1	1.00
TPS727xx	±50	2 to 5.5	0.25	0.48
TPS74(2/3/4)xx	±50	0.8 to 5.5	1.5/3	2.00/2.00/2.75
LP3851x	±50	2.25 to 5.5	0.8/1.5/3	0.60
TPS717xx	±65	2.5 to 5.5	0.15	0.36

Device	Noise (μV_{rms})	PSRR at 100 kHz (dB)	V_{IN} Range (V)	I_{OUT} (A)	Price*
Ultralow Noise/High PSRR					
TPS7A3501	3.8	40	1.7 to 5	1	0.75
TPS7A470(0/1)	4	68	3 to 36	1	2.10
LP38798-ADJ	5	100	3 to 20	0.8	1.3
TPS7A8300	6	47	1.1 to 6.5	2	2.45
LP590(0/7)	6.5	49	2.2 to 5.5	0.15/0.25	0.20/0.23
TPS7A4901	15	54	3 to 36	0.15	1.10
TPS7A3001	15	55	–3 to –36	0.2	1.50
TPS7A3301	16	64	–3 to –36	1	2.70
LP2989/LV	18	30	2.1 to 16	0.5	0.89
TPS7A8101	23.5	60	2.2 to 6.5	1	1.00

Device	I_Q (no load) (µA)	V_{IN} Range (V)	I_{OUT} (mA)	Price*
Low I_Q				
TPS78(0/2)xx	0.5	2.2 to 5.5	150	0.35
TPS709xx	1	2.7 to 30	150	0.39
TPS797xx	1	1.8 to 5.5	50	0.34
TPS715Axx	3	2.5 to 24	80	0.40
TPS7A16xx	5	3 to 60	100	1.40
LP8340	19	2.7 to 10	1000	0.53

Linear Regulators

Low Dropout (LDO) Regulators Selection Guide (Continued)

Device	Package	V_{IN} Range (V)	I_{OUT} (A)	Price*
Small Package				
TLV713xx	1x1-mm SON	1.4 to 5.5	150	0.12
TLV717xx	1x1-mm SON	1.7 to 5.5	0.15	0.12
TLV707xx	1x1-mm SON	2 to 5.5	0.2	0.12
TLV705xx	0.8x0.8-mm DSBGA	2.2 to 5.6	0.2	0.18
LP5907	1x1-mm SON	2.2 to 5.5	0.25	0.23

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Dual Output LDOs Selection Guide

Device	I_{O1} (mA)	I_{O2} (mA)	V_{DO1} at I_{O1} (mV)	V_{DO2} at I_{O2} (mV)	I_Q (µA)	Output Options: Fixed Voltage (V)	Accuracy (%)	Package(s)	V_O (min) (V)	V_O (max) (V)	Enable	V_{IN} (min) (V)	V_{IN} (max) (V)	Comments	Price*
TLV716	150	150	210	210	50	1.2/2.75, 2.8/1.8, 2.8/2.8, 3.0/3.0, 3.3/1.8	1.5	SON 6	1.8	3.3	EN	1.4	5.5	Capacitor-free functionality allows for smallest 150-mA dual-LDO solution	0.18
LP2966	150	150	135	135	300	1.8/3.3, 2.5/1.8, 2.5/2.5, 2.8/2.8, 3.3/2.5, 5.0/5.0	3	Mini-SO8	1.8	5	EN	1.8	5	Independent shutdown of each LDO regulator	0.70
LP3996	150	300	110	210	35	0.8/3.3, 1.0/1.8, 1.5/2.5, 1.8/3.3, 2.8/2.8, 3.0/3.0, 3.0/3.3, 3.3/0.8, 3.3/3.3	1.5	LLP10	0.8	3.3	EN	2	6	Power Good	0.30
LP5996	150	300	110	210	35	0.8/3.3, 1.0/1.8, 1.5/2.5, 2.5/3.3, 2.8/2.8, 3.0/3.0, 3.0/3.3, 3.3/0.8, 3.3/3.3	1.5	LLP10	0.8	3.3	EN	2	6		0.30
LP8900	200	200	110	110	85	2.8/2.8, 2.7/2.7, 2.8/2.7, 2.8/1.2	1	WCSP	1.2	3.6	EN	1.8	5.5	Ultralow noise, high accuracy	0.30
TLV710	200	200	175	175	70	1.8/2.8, 3.3/1.8	2	SON 6	1.2	4.8	EN	2.0	5.5	Value dual LDO	0.19
TLV711	200	200	175	175	70	1.2/2.5, 1.2/3.3, 1.3/2.3, 1.3/3.3, 1.5/1.8, 1.5/3.3, 1.8/1.2, 1.8/3.3, 1.9/3.0, 2.5/1.25, 2.5/2.5, 2.85/1.8, 2.85/2.85, 3.0/2.5, 3.0/3.0, 3.3/1.8, 3.3/2.85, 3.3/3.0, 3.3/3.3	2	SON 6	1.2	4.8	EN	2.0	5.5	TLV710xx w/active output pulldown	0.19
TPS718	200	200	230	230	90	1.2/3.3, 1.8/2.7, 1.8/3.3, 2.5/1.2, 2.8/2.8, 2.8/3.0	3	QFN/WCSP	0.9	3.6	EN	2.5	6.5	High PSRR, low noise	0.55
TPS719	200	200	230	230	90	1.3/2.8, 1.8/1.2, 1.8/1.3, 2.1/2.2, 2.6/1.5, 2.8/2.8, 2.85/2.85, 3.3/2.8, 3.3/3.3, 3.6/3.15	3	QFN/WCSP	0.9	3.6	EN	2.5	6.5	TPS718xx w/active output pulldown	0.55
LP2967	200	200	240	240	200	1.8/25, 1.8/3.3, 2.5/2.8, 2.5/3.3, 2.6/2.6, 2.8/2.8	3	Mini-SO8, micro SMD	1.8	3.3	EN	1.6	16	Smallest possible size (micro SMD package)	0.99
TPS712	250	250	125	125	300	1.8/2.85, 1.8/Adj., 2.8/2.8, 2.8/Adj., 2.85/2.85, Adj./Adj.	3	SON 6	1.2	5.3	EN	2.7	5.5	High PSRR, low noise	0.80

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Battery Management Products
Overview

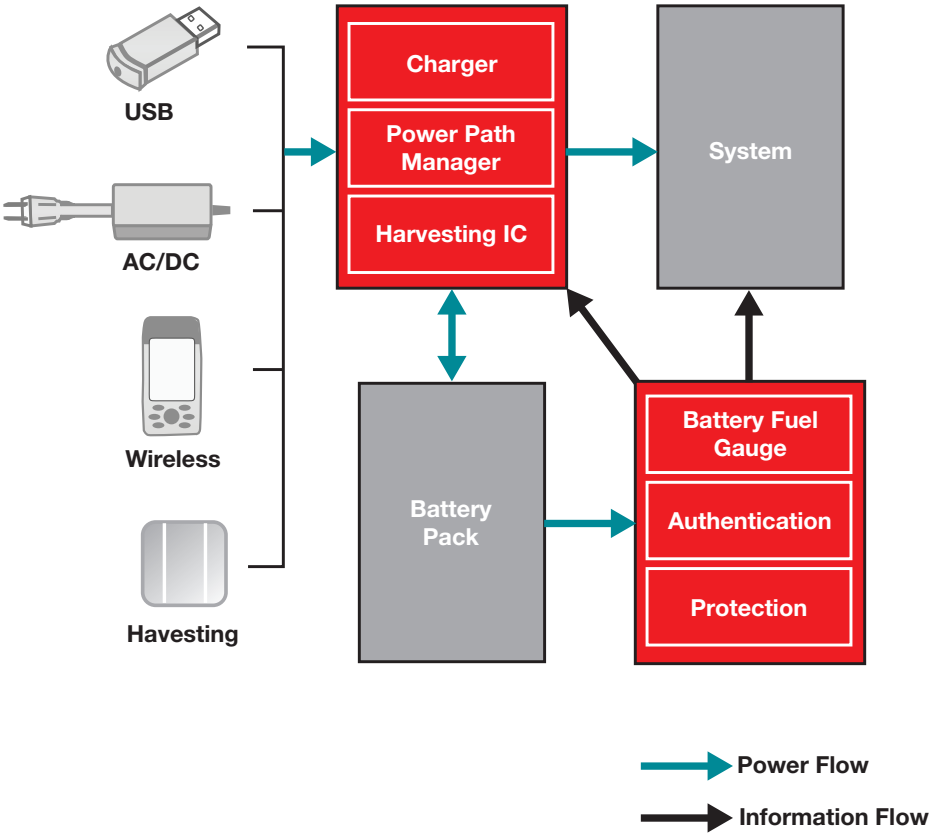
End applications in wireless, computing, consumer, industrial and medical markets continue to expand into the portable space. TI's battery management solutions help address system protection, cost-effective linear and highly-efficient switch-mode battery charging. New advances in switch-mode charging increase efficiency and decrease power dissipation, promoting a green environment by wasting less energy. With battery-powered systems demanding increased reliability, TI ensures maximum product safety with chargers that protect batteries from overvoltage and overcurrent conditions.

Battery Chemistry

Lithium Ion (Li-Ion) is the most widely used chemistry family for rechargeable batteries. There are different chemistries in the Li-Ion family with different operating characteristics such as discharge profiles and self-discharge rate. TI battery management ICs are developed by chemistry to account for these differences to charge the battery more efficiently and report the remaining energy in the battery more accurately.

Fundamentals

TI products support applications such as mobile phones, smartphones, tablets, portable consumer devices, portable navigation devices, notebook computers and many industrial and medical applications. TI has a battery-management IC to match your design specifications. We also offer the evaluation modules, application notes, samples and data sheets needed to get your design to market faster.



Battery Management Products

Battery Charger Solutions

Selection Guide

Device	Number of Cells	V_{IN} Absolute Max (V)	V_{IN} OVP (V)	Charge Current (A)	Charge Voltage (V)	Control Interface	Topology	Integrated Power FET	Temperature Monitor	Packaging		EVM	Comments	Price*
										WCSP	QFN/MLP			
Multi-Chemistry (Li-Ion and NiCd/NiMH)														
bq24030/31/35	1	18	6.4	2	4.2/4.1/4.2	Stand Alone	Linear	Yes	Yes		20	✔	Regulated 4.4-V output for AC input condition	1.80
bq24032A/38	1	18	6.4	2	4.2/ (4.24/4.36)	Stand Alone	Linear	Yes	Yes		20	✔	Regulated 4.4-V output for AC input condition	1.80
bq24040/41	1	30	6.6/7.1	1	4.2	Stand Alone	Linear	Yes	Yes		10	✔		0.45
bq24045	1	30	6.6/7.1	1	4.35	Stand Alone	Linear	Yes	Yes		10	✔		0.45
bq24050/52	1	30	6.6	0.8	4.2	Stand Alone	Linear	Yes	Yes		10	✔	JEITA Charging (100K NTC — bq24052)	0.50
bq24055	1	30	6.6	0.8	4.2	Stand Alone	Linear	Yes	Yes		12	✔	JEITA, PG Pin	0.60
bq24072/72T	1	28	6.6	1.5	4.3 / 4.2	Stand Alone	Linear	Yes	Yes		16	✔	V_{OUT} tracks V_{BAT}, V_{IN_DPPM}	1.00
bq24073	1	28	6.6	1.5	4.2	Stand Alone	Linear	Yes	Yes		16	✔	V_{IN_DPPM}	1.00
bq24074	1	28	10.5	1.5	4.2	Stand Alone	Linear	Yes	Yes		16	✔	V_{IN_DPPM}	1.00
bq24075T/79T	1	28	6.6	1.5	4.2/4.1	Stand Alone	Linear	Yes	Yes		16	✔	SYSOFF pin disconnects battery, V_{IN_DPPM}, powers system and charges battery	1.00
bq24090/91	1	12	6.6	1	4.2	Stand Alone	Linear	Yes	Yes		10	✔	10K NTC (100K NTC — bq24091)	0.40
bq24092/93	1	12	6.6	1	4.2	Stand Alone	Linear	Yes	Yes		10	✔	JEITA, 10K NTC (JEITA, 100K NTC — bq24093)	0.40
bq24095	1	12	6.6	1	4.35	Stand Alone	Linear	Yes	Yes		10	✔	10K NTC	0.40
bq24140	1	20	9.8	1.5	Adj	I^2C	Switching	Yes	No	30		✔	Simultaneous charge and USB OTG output	1.60
bq24153A/58	1	20	6.5	1.25	3.5 to 4.4	I^2C	Switching	Yes	No	20		✔	USB OTG supported with boost, no battery detect on power up (bq24158)	0.95
bq24156A/59	1	20	9.8	1.5	3.5 to 4.4	I^2C	Switching	Yes	No	20		✔	No battery detect on power up (bq24159)	0.95
bq24157	1	20	6.5	1.25	3.5 to 4.4	I^2C	Switching	Yes	No	20		✔	USB OTG supported with boost, no battery detect on power up, safety timer disabled	0.90
bq24160/A	1	20	10.5/6.5(USB)	2.5/1.5	3.5 to 4.4	I^2C	Switching	Yes	Yes	49	24	✔	D+/D– detect, JEITA, 3-V V_{BAT_SHORT}	1.95
bq24161/B	1	20	10.5/6.5(USB)	2.5/1.5	3.5 to 4.4	I^2C	Switching	Yes	Yes	49		✔	USB selection pin, std temp	1.95
bq24163	1	20	10.5/6.5(USB)	2.5/1.5	3.5 to 4.4	I^2C	Switching	Yes	No	49	24	✔	D+/D– detect, JEITA	1.95
bq24165	1	20	10.5/6.5(USB)	2.5/1.5	4.2	Stand Alone	Switching	Yes	No	49		✔	I_{USB}1/2/3 USB select, no temp monitor, JEITA	1.95
bq24166	1	20	10.5/6.5(USB)	2.5/1.5	4.2	Stand Alone	Switching	Yes	Yes	49		✔	I_{USB}1/2/3 USB select, temp monitor, std temp	1.95
bq24167	1	20	10.5/6.5(USB)	2.5/1.5	4.2	Stand Alone	Switching	Yes	Yes	49	24	✔	I_{USB}1/2/3 USB select, temp monitor, JEITA	1.95
bq24168	1	20	6.5/6.5(USB)	2.5/1.5	3.5 to 4.4	Stand Alone	Switching	Yes	Yes	49	24	✔	USB select pins, JEITA, no timers	1.95
bq24180	1	20	16.5	1.5	3.5 to 4.4	I^2C	Switching	Yes	Yes	25		✔	Accessory power output	1.00
bq24185	1	20	16.5	1.5	3.5 to 4.4	I^2C	Switching	Yes	Yes	25		✔	USB OTG supported with boost	1.00
bq24187	1	30	6.5	2.0	3.5 to 4.4	I^2C	Switching	Yes	Yes	36	24	✔	PSEL detect, JEITA, Power Path, OTG	TBD
bq24190	1	20	18	4.5	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes		24	✔	D+/D–, 1.3-A OTG, standard temp., 12-mΩ battery FET	2.90
bq24192	1	20	18	4.5	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes		24	✔	PSEL, 1.3-A OTG, standard temp., 12-mΩ battery FET	2.90
bq24192I	1	20	18	4.5	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes		24	✔	PSEL, 1.3-A OTG, standard temp., 1-A default charging	2.90
bq24193	1	20	18	4.5	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes		24	✔	PSEL, 1.3-A OTG, JEITA, 12-mΩ battery FET	2.90
bq24196	1	20	18	2.5	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes		24	✔	PSEL, 1.3-A OTG, standard temp., 12-mΩ battery FET	1.95
bq24195L	1	20	18	2.5	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes		24	✔	D+/D–, 1.0-A synchronous boost for power bank	2.90
bq24195	1	20	18	4.5	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes		24	✔	D+/D–, 2.1-A synchronous boost for power bank	3.25
bq24232	1	28	10.5	0.5	4.2	Stand Alone	Linear	Yes	Yes		16	✔	SYSOFF pin disconnects battery, VIN_DPPM, powers system and charges battery	1.00
bq24232H	1	28	10.5	0.5	4.35	Stand Alone	Footnote 1	Yes	Yes		16	✔	Higher voltage battery pack flexibility (4.35 V), USB friendly, powers system and charges battery	1.15
bq24250/51	1	20	10.5	2.0	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes	30	24	✔	EN1-2 or D+/D– detection, JEITA, Power Path	1.15
bq24253	1	20	10.5	2.0	4.2	Stand Alone	Switching	Yes	Yes	30	24	✔	D+/D– detection, JEITA, Power Path	1.15
bq24257	1	20	6.5	2.0	3.5 to 4.4	I^2C/Stand Alone	Switching	Yes	Yes	30	24	✔	D+/D– detection, JEITA	1.15
bq24260	1	30	10.5	3.0	3.5 to 4.4	I^2C	Switching	Yes	Yes	36	24	✔	D+/D– detect, JEITA, Power Path, OTG	1.75
bq24261	1	30	14	3.0	3.5 to 4.4	I^2C	Switching	Yes	Yes	36	24	✔	PSEL detect, JEITA, Power Path, OTG	1.75
bq24262	1	30	6.5	3.0	3.5 to 4.4	I^2C	Switching	Yes	Yes	36	24	✔	PSEL detect, JEITA, Power Path, OTG	1.75
bq24270/71	1	20	6.5	1.5	3.5 to 4.4	I^2C	Switching	Yes	Yes	49	24	✔	D+/D- detect or PSEL, JEITA, Power Path	1.25
bq24272	1	20	10.5	2.5	3.5 to 4.4	I^2C	Switching	Yes	Yes	49	24	✔	Power Path	1.25
bq24273	1	20	10.5	2.5	3.5 to 4.4	I^2C	Switching	Yes	Yes	49		✔	non-Power Path	1.25
bq24278	1	20	10.5	2.5	4.2	Stand Alone	Switching	Yes	Yes	49	24	✔	Input current limit programming input	1.25
bq25040	1	30	6.9	1.1	4.2	Stand Alone	Linear	Yes	Yes		10	✔	USB compliant w/50-mA integrated LDO	0.55
bq25050	1	30	6.5	1	4.2	Single Wire	Linear	Yes	Yes		10	✔	Single-wire inerface	0.60
bq25060	1	30	10.5	1	4.2	Stand Alone	Linear	Yes	Yes		10	✔	USB compliant w/50-mA integrated LDO	0.65
bq24130	1 to 3	20	Adj	4	Adj	I^2C	Switching	Yes	Yes		20	✔	Host control, supports Li-Ion and Super Cap	1.95
bq24133	1 to 3	20	Adj	2.5	4.2/Cell	Stand Alone	Switching	Yes	Yes		24	✔	Power Path	1.75

[1] *Linear/Switch-Mode/CC/CV*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*
*Preview devices are listed in **bold teal**.*

Battery Management Products

Battery Charger Solutions

Selection Guide (Continued)

Device	Number of Cells	V_{IN} Absolute Max (V)	V_{IN} OVP (V)	Charge Current (A)	Charge Voltage (V)	Control Interface	Topology	Integrated Power FET	Temperature Monitor	Packaging		EVM	Comments	Price*
										WCSP	QFN/MLP			
Multi-Chemistry (Li-Ion and NiCd/NiMH) (Continued)														
bq24170	1 to 3	20	Adj	4	4.2/Cell	Stand Alone	Switching	Yes	Yes		24	✔	Power Path	1.80
bq24171	1 to 3	20	Adj	4	Adj	Stand Alone	Switching	Yes	Yes		24	✔	JEITA, Power Path	1.80
bq24172	1 to 3	20	Adj	4	Adj	Stand Alone	Switching	Yes	Yes		24	✔	Adjustable charge voltage, Power Path	1.80
bq24707A	1 to 4	30	Adj	8	Adj	SMBus	Switching	No	No		20	✔	Programmable switching frequency	2.90
bq24735	1 to 4	30	Adj	8	Adj	SMBus	Switching	No	No		20	✔	Intel™ CPU Turbo Mode support	3.00
bq24617	1 to 5	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes		24	✔	600 kHz	2.90
bq24600	1 to 6	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes		16	✔	1200 kHz	2.50
bq24610	1 to 6	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes		24	✔	600 kHz	2.90
bq24616	1 to 6	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes		24	✔	JEITA	2.90
bq24618	1 to 6	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes		24	✔	USB V_{IN} and adapter	2.90
bq24715	2 to 3	30	26	8	Adj	SMBus	Switching	No	No		20	✔	NVDC charger	2.25
bq24725A	2 to 4	30	Adj	8	Adj	SMBus	Switching	No	No		20	✔	Programmable switching frequency, enhanced safety, battery learn	2.90

Device	Number of Cells	V_{IN} Absolute Max (V)	V_{IN} OVP (V)	Charge Current (A)	Charge Voltage (V)	Control Interface	Topology	Integrated Power FET	Temperature Monitor	Packaging				EVM	Comments	Price*
										QFN/MLP	TSSOP	SOIC	DIP			
Solar/Energy Harvesting (Li-Ion)																
bq24210	1	20	7.7	0.800	4.2	Stand Alone	Linear	Yes	Yes	10				✔	Solar panel V_{IN}	1.10
bq25504	1	5.5	Adj	0.1	2.5 to 5.25	Stand Alone	Boost	Yes	Yes	16				✔	Energy harvester, ultra-low power and quiescent current, high efficiency, dynamic MPPT	2.10
bq25505	1	5.5	Adj	0.1	2.5 to 5.25	Stand Alone	Boost	Yes	Yes	16				✔	Energy harvester, 330-nA ultra-low power and quiescent current, high efficiency, dynamic MPPT, autonomous power-path multiplexing	2.40
bq25570	1	5.5	Adj	0.1	2.5 to 5.25	Stand Alone	Boost-Buck	Yes	Yes	16				✔	Energy harvester, <488-nA ultra-low power and quiescent current, high efficiency, dynamic MPPT	2.90
bq24650	1 to 6	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes	16				✔	Max power point tracking	2.85
$LiFePO_4$																
bq25070	1	30	10.5	1	3.5	Stand Alone	Linear	Yes	Yes	10				✔	$LiFePO_4$, 50-mA LDO	0.75
bq24620	1 to 7	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes	16				✔	$LiFePO_4$, 300 kHz	2.90
bq24630	1 to 7	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes	24				✔	$LiFePO_4$, 300 kHz, power selector	2.90
Super Cap																
bq24640	1 to 9	33	32	10 (Ext)	Adj	Stand Alone	Switching	No	Yes	16				✔	SuperCap	2.90
NiCd/NiMH Chemistry																
bq2002/C/E/F	Multiple	7	—	>2	6	Stand Alone	Current-limited	No	Yes			8	8		Trickle charge	0.85
bq2004/E/H	Multiple	7	—	>2	5.5	Stand Alone	Switching	No	Yes			16	16		Selectable timers and pulse-trickle rates	2.15
bq2005	Multiple	7	—	>2	5.5	Stand Alone	Switching	No	Yes			20	20		Sequential fast charge of two battery packs	2.15
bq24400/1	Multiple	7	—	>2	5.5	Stand Alone	Switching	No	Yes		8	8				1.55
Lead-Acid Chemistry																
bq24450	Multiple	40	—	>2	—	Stand Alone	Linear	No	No			16	16		Temp-compensated internal reference	2.75
UC3909	Multiple	40	—	>2	—	Stand Alone	Switching	No	Yes			20	20		Differential current sense input	3.05
bq2031	Multiple	7	—	>2	—	Stand Alone	Switching	No	Yes			16	16	✔	Three user-selectable charge algorithms to accommodate cyclic and standby applications	2.80
Multi-Chemistry (Li-Ion and NiCd/NiMH)																
bq2000/T	Multiple	7	—	—	—	Stand Alone	Switching	Yes	Yes		8	8	8	✔	Charges NiCd, NiMH, and Li-Ion	1.50
bq24650	1 to 6	33	32	10 A (Ext)	Adj	Stand Alone	Switching	No	Yes	16				✔	Max power point tracking	2.85
bq24765	2 to 4	30	—	—	—	Stand Alone	Switching	Yes	No	34				✔	SMBus charger with integrated power FETs	3.95

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Battery Management Products

Battery Charger Solutions

Selection Guide (Continued)

Device	Standard	Charge Current (A)	Output Voltage (V)	Topology	V_{IN} Absolute Max (V)	Control Interface	Integrated FET	Temperature Monitor	QFN/ MLP	Chip Scale	EVM	Comments	Price*
Wireless Power Receivers													
bq51003	WPC1.1	0.5	5	Linear	20	Stand Alone	Yes	Yes	Yes	3x2x0.5	Yes	2.5-W WPC1.1 receiver solution for wearable appllications	1.30
bq51013B	WPC1.1	1	5	Linear	20	Stand Alone	Yes	Yes	Yes	3x2x0.5	Yes	~4-W WPC1.1 receiver solution	1.50
bq51050B/51B	WPC1.1	1	4.2/4.35	Battery Charger	20	Stand Alone	Yes	Yes	Yes	3x2x0.5	Yes	~4-W direct battery charger, WPC1.1 receiver solution	1.90
bq51010B	WPC1.1	1	7	Linear	20	Stand Alone	Yes	Yes	Yes	3x2x0.5	Yes	~4-W WPC1.1 receiver solution with 7-V outputs for reduced power loss	1.70
bq51020	WPC1.1	1.5	Adj (4-8)	Linear	20	I^2C	Yes	Yes	—	3.6x2.9x0.5	Yes	High-efficiency, >5-W WPC1.1 receiver solution with adj output voltage	2.50
bq51021	WPC1.1	1.5	Adj (4-8)	Linear	20	I^2C	Yes	Yes	—	3.6x2.9x0.5	Yes	High-efficiency, >5-W WPC1.1 receiver solution with adj output voltage and I^2C control	2.60
bq51221	WPC1.1/ PMA	1.5	Adj (4-8)	Linear	20	I^2C	Yes	Yes	—	3.6x2.9x0.5	Yes	Dual-mode, high-efficiency, >5-W WPC1.1 and PMA receiver solution	3.00

Device	Standard	Transmitter Type	Number of Coils Supported	V_{IN} (V)	Power (W)	Dynamic Power Limit	Magnet	Automotive Qualified	Comments	Price*
Wireless Power Transmitters										
bq500210	WPC1.0	A1/A10	1	19	5	No	No	No	WPC1.0 transmitter solution for 19-V_{IN} systems	1.90
bq500211	WPC1.1	A5/A11	1	5	5	Yes	No	No	WPC1.0 transmitter for low-cost, 5-V, non-WPC transmitters	1.90
bq500212A	WPC1.1	A5/A11	1	5	5	Yes	No	No	Latest WPC1.1, 5-V transmitter with reduced BOM and improved, simplified FOD	2.00
bq500412A	WPC1.1	A6/A19	1,2,3	12	5	Yes	No	No	Latest WPC1.1, A6 transmitter with reduced BOM and improved, simplified FOD	2.10
bq500414Q	WPC1.1	A6/A19/A21	1,2,3	12	5	No	No	Yes	Q100-qualified A6 transmitter for automotive applications	3.40

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

For a complete list of Resources, visit: **www.ti.com/chargers**

Battery Charger Protection

Selection Guide

Device	V_{IN} Max (V)	OVP (V)	OCP	Battery OVP (V)	LDO Output (V)	Max Operating Current (µA)	Package(s)	EVM	Comments	Price*
bq24300/4/5	30	10.5	Fixed 300 mA	4.35	5.5/4.5/5.0	400/500/500	8-QFN/SON	✔	Reverse polarity protection	0.30
bq24308	30	6.3	Fixed 700 mA or Prog. <1.5 A	4.35	5	500	8-QFN/SON	✔	Reverse polarity protection	0.30
bq24312	30	5.85	Prog. <1.5 A	4.35	—	500	8/12-QFN/SON		Fault indication	0.35
bq24313	11	10.5	Prog. <1.5 A	4.35	—	500	8/12-QFN/SON		Fault indication	0.35
bq24314/A	30	5.85	Prog. <1.5 A	4.35	—	600	8/12-QFN/SON	✔	Fault indication	0.35
bq24314C	30	5.85	Prog. <1.5 A	4.45	—	600	8/12-QFN/SON	✔	Fault indication	0.35
bq24315	30	5.85	Prog. <1.5 A	4.35	5.5	600	8-QFN/SON	✔	Fault indication	0.35
bq24316	30	6.8	Prog. <1.5 A	4.35	—	600	8/12-QFN/SON	✔	Fault indication	0.35
bq24380	30	6.3	No OCP	4.35	5.5	250	8-QFN/SON	✔	Fault indication	0.25
bq24381	30	7.1	No OCP	4.35	5	300	8-QFN/SON	✔	Fault indication	0.25
bq24382	30	10.5	No OCP	4.35	5	300	8-QFN/SON		Fault indication	0.25
bq24350	30	6.17	Fixed 1.2 A	4.35	5.5	500	8-QFN/SON	✔	Integrated charge FET	0.40
bq24351	30	10.5	Fixed 1.2 A	4.35	6.38	500	8-QFN/SON	✔	Integrated charge FET	0.40
bq24352	30	7.1	Fixed 1.2 A	4.35	5.5	500	8-QFN/SON	✔	Integrated charge FET	0.40

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Battery Management Products

Battery Fuel Gauges

Single-Cell Fuel Gauges Selection Guide

Device	Min Max Series Cell	SHA-1 Authentication	System or Pack	Communication Protocol	Other Features	Package	Price*
Lithium-Ion, Lithium-Polymer Chemistry							
bq27510	1	—	System	I^2C	System-side fuel gauge with Impedance Track™ technology with integrated LDO	12-pin QFN	1.45
bq27541	1	Yes	Pack	I^2C/HDQ	Pack-side fuel gauge with Impedance Track technology	12-pin QFN	1.45
bq27520	1	—	System	I^2C	System-side fuel gauge with Impedance Track technology with integrated LDO	15-ball CSP	1.50
bq27425	1	—	System	I^2C	System-side fuel gauge with Impedance Track Lite technology with integrated sense resistor	15-ball CSP	1.40
bq27421	1	—	System	I^2C	System-side fuel gauge with Impedance Track technology with integrated sense resistor	9-pin CSP	1.40
bq2753x	1	—	System	I^2C	Impedance Track technology fuel gauge with charger control	15-pin CSP	1.80
bq28z560	1	Yes	Pack	SMBus/HDQ	Pack-side fuel gauge with Impedance Track technology	12-pin QFN	3.15
bq28550	1	Yes	Pack	SMBus	Pack-side fuel gauge with CEDV technology with integrated LDO	12-pin QFN	2.90

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Multi-Cell Fuel Gauges Selection Guide

Device	Approx. Battery Capacity (mAh)	Min Max Series Cell	Number of LEDs	Communication Protocol	Other Features	Package	Price*
Lithium-Ion, Lithium-Polymer, $LiFePO_4$ Chemistry							
bq28400	500 to 16000	2	—	SMBus	CEDV+ gas gauge with integrated protector	20-pin TSSOP	3.20
bq3050	500 to 32000	2 to 4	3, 4 or 5	SMBus	CEDV+ gas gauge with integrated protector	38-pin TSSOP	3.55
bq3055	500 to 32000	2 to 4	—	SMBus	CEDV+ gas gauge with integrated protector	30-pin TSSOP	3.90
bq3060	500 to 32000	2 to 4	—	SMBus	CEDV+ gas gauge with integrated protector	24-pin TSSOP	3.55
bq20z655-R1	800 to 32000	2 to 4	3, 4, 5 or LCD	SMBus	Impedance Track fuel gauge with LED or LCD and integrated protector	44-pin TSSOP	5.20
bq34z100	65000 and above	1 to 16	4	I^2C or HDQ	Wide-range fuel gauge with Impedance Track™ technology	14-pin TSSOP	2.50
bq34z651	800 to 32000	2 to 4	3, 4 or 5	SMBus	Gas gauge and protection enabled with Impedance Track and external battery heater control	44-pin TSSOP	5.20
bq34z950	800 to 32000	2 to 4	3, 4 or 5	SMBus or HDQ	Gas gauge and protection with Impedance Track technology	44-pin TSSOP	2.30
Lead Acid Chemistry							
bq34z110	Up to 650 Ah	1 to 16	4	I^2C or HDQ	Wide-range fuel gauge with Impedance Track technology	14-pin TSSOP	3.90
Super Cap							
bq33100	—	2 to 5	—	SMBus	Fully integrated 2, 3, 4 and 5 series super capacitor manager	24-pin TSSOP	4.20
Battery Monitors							
bq2019	>20000	—	—	Single wire (HDQ)	64-bit ID ROM and 1 program output non-volatile memory	8-pin TSSOP	1.95
bq2023	>20000	—	—	Single wire (SDQ)	64-bit ID ROM and 1 program output automatic offset error calibration	8-pin TSSOP	2.00
bq26200	>20000	—	—	Single wire (HDQ)	High-performance battery, coulomb counter	8-pin TSSOP	2.00
bq26220	>20000	—	—	Single wire (HDQ)	64-bit ID ROM and 1 program output on-chip voltage measurement	8-pin TSSOP	2.05
bq76PL536A	—	3 to 192	—	SPI	3- to 6-cell EV and UPS stackable monitor and cell-balancing AFE	64-pin HTQFP	6.09

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Battery Management Products

Battery (Li-Ion) Protection

Selection Guide

Device	Number of Series Cells	Charge/Discharge Current (A)	Shutdown Current (µA)	Other Features	Package(s)	Price*
bq2920x	2	—	3	Overvoltage safety with cell balancing	8-pin SON	0.30
bq2944x	2 to 4	—	3	Overvoltage safety for chemical fuse activation	8-pin SON	0.45
bq2945xy	2 or 3	—	4	Overvoltage safety for chemical fuse activation	6-pin SON	0.40
bq2946xy	1	—	4	Overvoltage safety for chemical fuse activation	6-pin SON	0.38
bq76925	3 to 6	—	1	Host-controlled protector with cell balancing	20-pin TSSOP, 24-pin QFN	1.50
bq76PL536A	3 to 192	External NFET	12	3- to 6-cell EV and UPS stackable monitor and cell-balancing AFE	64-pin HTQFP	6.09
bq76PL536A-Q1	3 to 192	External NFET	12	3- to 6-cell automotive-qualified EV and UPS stackable monitor and cell-balancing AFE	64-pin HTQFP	7.73
bq77PL900	5 to 10	External PFET	—	Stand-alone or host-controlled protector with cell balancing	48-pin SSOP	2.95
bq7716xy	2 to 4	—	1	Overvoltage protection with external delay capacitor	8-pin QFN	0.51
bq7718xy	2 to 5	—	1	Overvoltage protection with internal delay timer	8-pin QFN	0.79
bq77908A	4 to 8	External NFET	5	Stand-alone protector with cell balancing	38-pin TSSOP	2.70
bq77910A	4 to 10	External NFET	5	Stand-alone protector with cell balancing	38-pin TSSOP	2.70
bq77PL157A4225	3 to 6	External NFET	3	Stackable overvoltage protector; stack 3 for 18 series cells	16-pin TSSOP	0.65

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Wireless Power

Selection Guide

Device	Standard	Charge Current (A)	Output Voltage (V)	Topology	V_{IN} Absolute Max (V)	Control Interface	Integrated FET	Temperature Monitor	QFN/ MLP	Chip Scale	EVM	Comments	Price*
Wireless Power Receivers													
bq51003	WPC1.1	0.5	5	Linear	20	Stand Alone	Yes	Yes	Yes	3x2x0.5	Yes	2.5-W WPC1.1 receiver solution for wearable appllications	1.30
bq51013B	WPC1.1	1	5	Linear	20	Stand Alone	Yes	Yes	Yes	3x2x0.5	Yes	~4-W WPC1.1 receiver solution	1.50
bq51050B/51B	WPC1.1	1	4.2/4.35	Battery Charger	20	Stand Alone	Yes	Yes	Yes	3x2x0.5	Yes	~4-W direct battery charger, WPC1.1 receiver solution	1.90
bq51010B	WPC1.1	1	7	Linear	20	Stand Alone	Yes	Yes	Yes	3x2x0.5	Yes	~4-W WPC1.1 receiver solution with 7-V outputs for reduced power loss	1.70
bq51020	WPC1.1	1.5	Adj (4-8)	Linear	20	I^2C	Yes	Yes	—	3.6x2.9x0.5	Yes	High-efficiency, >5-W WPC1.1 receiver solution with adj output voltage	2.50
bq51021	WPC1.1	1.5	Adj (4-8)	Linear	20	I^2C	Yes	Yes	—	3.6x2.9x0.5	Yes	High-efficiency, >5-W WPC1.1 receiver solution with adj output voltage and I^2C control	2.60
bq51221	WPC1.1/ PMA	1.5	Adj (4-8)	Linear	20	I^2C	Yes	Yes	—	3.6x2.9x0.5	Yes	Dual-mode, high-efficiency, >5-W WPC1.1 and PMA receiver solution	3.00

Device	Standard	Transmitter Type	Number of Coils Supported	V_{IN} (V)	Power (W)	Dynamic Power Limit	Magnet	Automotive Qualified	Comments	Price*
Wireless Power Transmitters										
bq500210	WPC1.0	A1/A10	1	19	5	No	No	No	WPC1.0 transmitter solution for 19-V_{IN} systems	1.90
bq500211	WPC1.1	A5/A11	1	5	5	Yes	No	No	WPC1.0 transmitter for low-cost, 5-V, non-WPC transmitters	1.90
bq500212A	WPC1.1	A5/A11	1	5	5	Yes	No	No	Latest WPC1.1, 5-V transmitter with reduced BOM and improved, simplified FOD	2.00
bq500412A	WPC1.1	A6/A19	1,2,3	12	5	Yes	No	No	Latest WPC1.1, A6 transmitter with reduced BOM and improved, simplified FOD	2.10
bq500414Q	WPC1.1	A6/A19/A21	1,2,3	12	5	No	No	Yes	Q100-qualified A6 transmitter for automotive applications	3.40

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*New devices are listed in **bold red**.*

LED Lighting
General Illumination

LED efficacy improvements and driver-IC integration are evolving at a fast pace, which drives down system costs for solid-state lighting (SSL). The result is that LEDs are becoming a standard for lighting applications that require:

- High efficiency
- Long lifetime
- Excellent dynamic range
- High controllability

Solid-state LED-based lighting is commonly found in:

- Indoor and outdoor area lighting
- Automotive interior and exterior lighting
- Retrofit replacement lamps

To address the demanding power requirements of solid-state lighting, Texas Instruments presents an extensive IC portfolio to support power conversion for a wide variety of LED products.

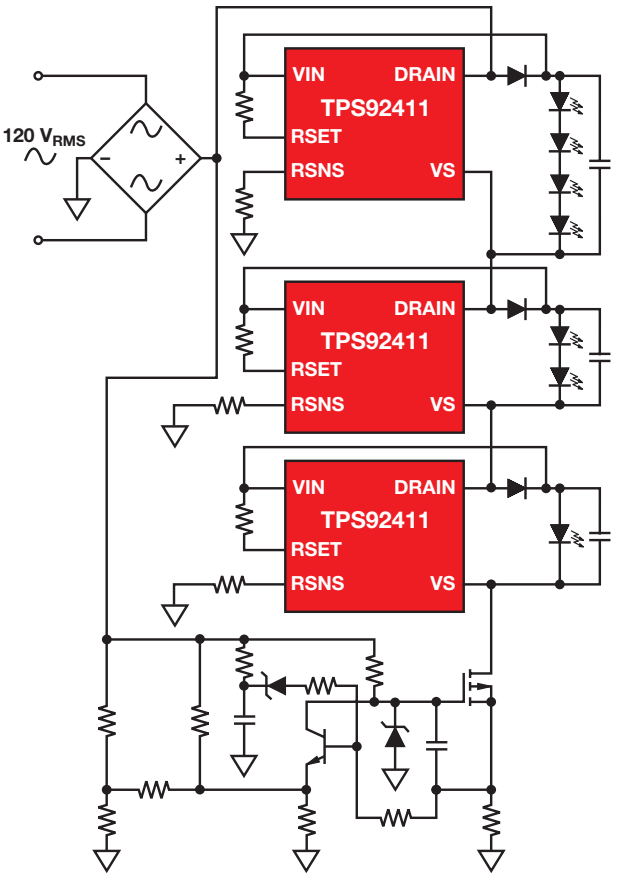
AC/DC LED drivers — TI offers AC/DC, LED-lighting-driver solutions that are dimmable, isolated and non-isolated, highly efficient and power-factor corrected. The also support long-life and compact form-factors while maintaining compatibility with installed fixtures and dimmers. Other features like overvoltage, overcurrent and overtemperature protection ensure that LED lighting products are safer than the traditional bulbs they replace.

DC/DC LED Drivers — TI offers DC/DC lighting-driver solutions with wide input/output operating ranges that can be used in buck, boost, SEPIC and flyback architectures. Small solution sizes facilitate automotive exterior lighting, indoor and outdoor area lighting, and 12- to 24-V retrofit lamps such as MR16 and AR111.

Get more information: **www.ti.com/led**

Floating Switch for Offline AC Linear Direct Drive of LEDs with Low Ripple Current (inductor and transformer free)

TPS92411



The TPS92411 is an AC linear direct-drive solution capable of replacing a switch-mode power supply in LED lamps and downlights. It greatly reduces design complexity by eliminating magnetic components, yet delivers low-ripple and constant LED current by using a novel energy-storage technique. The resistive impedance of this solution yields near unity power factor, low total harmonic distortion, and nearly perfect compatibility with TRIAC and reverse-phase dimmers.

Applications

- LED lamp and light bulbs
- LED luminaires and downlights
- Indoor/outdoor area lighting

Evaluation Modules

Part Number	Description
TPS92411EVM-001	TPS92411 120-VAC, 12-W evaluation module
TPS92411EVM-002	TPS92411 230-VAC, 16-W evaluation module

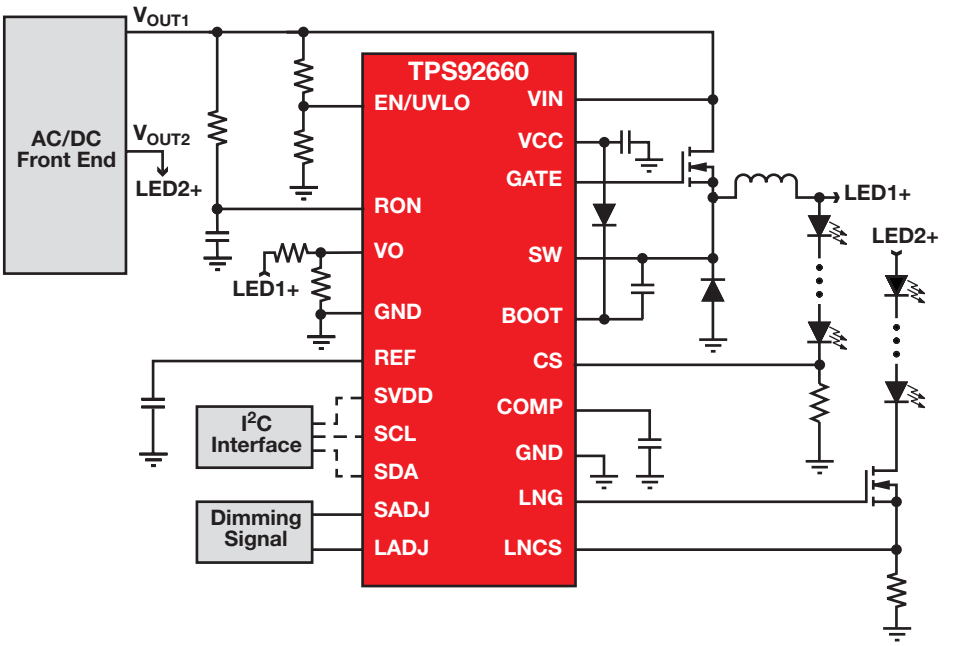
Get more information: **www.ti.com/product/TPS92411**

LED Lighting
General Illumination

Two-String LED Driver with I²C One-Time-Programmable ROM Current Trim

TPS92660

The TPS92660 is a dual-channel current controller for LED lighting applications that require precise color-temperature control and lumen output. It consists of a high-voltage, non-synchronous buck controller and a linear controller capable of driving an N-MOSFET for high dimming resolution. The one-time-programmable ROM and I²C interface allow a lighting manufacturer to factory-trim LED string currents during lamp production for very uniform lamp-to-lamp performance.



Get more information: **www.ti.com/product/TPS92660**

Applications

- Professional lighting
- Industrial and commercial lighting
- General illumination

Evaluation Module

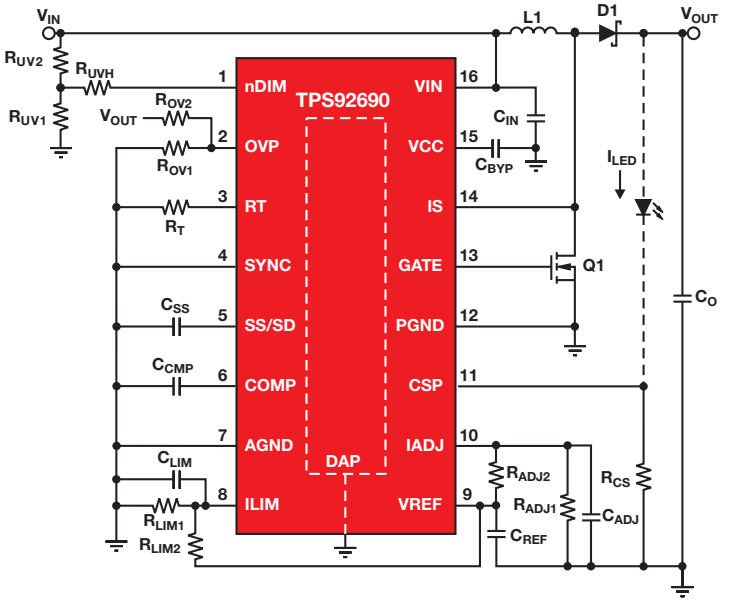
Part Number	Description
TPS92660EVM	TPS92660 20- to 80-VDC input, 31-W evaluation module

LED Lighting
General Illumination

N-Channel Controller for Dimmable LED Driver with Low-Side Current Sense

TPS92690-Q1

The TPS92690-Q1 is a 75-V-input, LED current controller suitable for boost, SEPIC, flyback and Cuk topologies. Switching frequency is adjustable up to 2 MHz via an internal oscillator or can be synchronized to an external clock. It is dimmable via analog, PWM or combination methods. Low-side current sensing facilitates lower EMI topologies such as Cuk.



The TPS92690-Q1 is AEC-Q100 grade 1 qualified.

Applications

- Automotive forward lighting
- Indoor/outdoor area lighting
- Constant-current regulator

Evaluation Module

Part Number	Description
TPS92690EVM	TPS92690 8- to 19-VDC input, 35-W evaluation module

Get more information:
www.ti.com/product/TPS92690

Selection Guide

Device	V_{IN} (min) (V)	V_{IN} (max) (V)	LED Voltage (max) (V)	Switching Frequency	DC/DC or AC/DC Control	Isolated Applications	Non-Isolated Applications	Topology	LED Configuration	Dimming	PFC	EVM	Package(s)	Price*
AC/DC High-Brightness LED Drivers														
TPS92001	9	19	Configurable	Prog: 30 kHz to 1 MHz	AC/DC	✔	✔	Flyback/Buck	Series/Parallel	External	✔	✔	8 MSOP, 8 SOIC	0.45
TPS92023	11.5	18	Configurable	Adj: 40 to 380 kHz	DC/DC	✔	✔	Half-Bridge	Multi-String Series/Parallel	PWM		✔	8 SOIC	0.65
TPS92210	9	20	Configurable	Adj: 30 to 140 kHz	AC/DC	✔	✔	Flyback	Series/Parallel	External	✔	✔	8 SOIC	0.60
TPS92074	11	18.5	Configurable	Adj: 50 to 300 kHz	AC/DC		✔	Buck/Buck-Boost	Series/Parallel	External	✔		6 TSOT, 8 SOIC	0.45
TPS92075	11	18.5	Configurable	Adj: 50 to 300 kHz	AC/DC		✔	Buck/Buck-Boost	Series/Parallel	TRIAC, TE	✔	✔	6 TSOT, 8 SOIC	0.65
TPS92310	13	36	Configurable	Adj: 60 to 150 kHz	AC/DC	✔	✔	Flyback/Buck	Series/Parallel	External	✔	✔	10 MSOP/16 SOIC	0.50
TPS92311	13	36	Configurable	Adj: 60 to 150 kHz	AC/DC	✔	✔	Flyback/Buck	Series/Parallel	External	✔	✔	16 SOIC	0.65
TPS92314/14A	13	35	Configurable	Adj: 60 to 150 kHz	AC/DC	✔	✔	Flyback/Buck	Series/Parallel	External	✔	✔	8 SOIC	0.50
TPS92315	9	35	Configurable	Adj: 44 to 130 kHz	AC/DC	✔	✔	Flyback/Buck	Series/Parallel	External		✔	6 SOT23	0.35
LM3444	8	13	Configurable	Adj: 30 kHz to 1 MHz	AC/DC	✔	✔	Flyback/Buck	Series/Parallel	External	✔	✔	10 MSOP	0.55
LM3445	8	12	Configurable	Adj: 30 kHz to 1 MHz	AC/DC	✔	✔	Flyback/Buck	Series/Parallel	TRIAC, TE	✔	✔	10 MSOP, 14 SOIC	0.60
LM3447	7.5	17.5	Configurable	Adj: 60 to 120 kHz	AC/DC	✔	✔	Flyback	Series/Parallel	TRIAC, TE	✔	✔	14 TSSOP	0.65
LM3448	8	12	Configurable	Adj: 30 kHz to 1 MHz	AC/DC	✔	✔	Flyback/Buck	Series/Parallel	TRIAC, TE	✔	✔	16 SOIC	0.75
LM3450/50A	8.5	20	Configurable	Adj: 60 to 120 kHz	AC/DC	✔	✔	Flyback	Series/Parallel	TRIAC, TE	✔	✔	16 TSSOP	1.00
UCC28810	15.4	18	Configurable	Adj: 5 to 250 kHz	AC/DC	✔	✔	Flyback/Boost	Series/Parallel	External	✔	✔	8 SOIC	0.32
UCC28811	12	18	Configurable	Adj: 5 to 250 kHz	AC/DC	✔	✔	Flyback/Boost	Series/Parallel	PWM/Analog	✔	✔	8 SOIC	0.32
TPS92561	6.5	42	Configurable	Adj: 50 kHz to 1.5 MHz	AC/DC		✔	Boost	Series/Parallel	TRIAC, TE	✔	✔	8 eMSOP	0.65
TPS92411	7.5	100	Configurable	—	AC/DC		✔	Linear	Series	TRIAC, TE	✔	✔	5 SOT23, 8 PSOP	0.23

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

LED Lighting
General Illumination

Selection Guide (Continued)

Device	Max LED Current (A)	Input Voltage Range (V)	Maximum Output Voltage (V)	Maximum Number of LEDs in Series	Switching Frequency	Topology	Q100 Automotive Qualified	Features	Packaging	Price*
DC/DC High-Brightness LED Drivers										
LM3402/02HV	0.5	6.0 to 42/75	40/73	12/20	Adj: 20 kHz to 1 MHz	Buck		Fast PWM dimming, no control loop compensation, supports ceramic capacitor and capacitor-less outputs	8 SSOP/PSOP	0.80/0.85
LM3404/04HV	1	6.0 to 42/75	40/73	12/20	Adj: 20 kHz to 1 MHz	Buck		Fast PWM dimming, no control loop compensation, supports ceramic capacitor and capacitor-less outputs	8 SOIC/PSOP	0.85/0.90
LM3406/06HV	1.5	6.0 to 42/75	40/73	12/20	Adj: 20 kHz to 1 MHz	Buck	✔	Fast PWM dimming. no control loop compensation, supports ceramic capacitor and capacitor-less outputs	14 eTSSOP	0.95/1.00
TPS92510	1.5	3.5 to 60	57	15	Prog: 100 kHz to 2.5 MHz	Buck		Thermal foldback, analog and PWM dimming, frequency sync	10 eMSOP	1.05
TPS92511	0.5	4.5 to 65	60	17	Prog: 100 to 500 kHz	Floating Buck		Pulse level modulation method, thermal foldback, no current sense resistor	8 HSOIC	0.60
LM3414/14HV	1	4.5 to 45/65	42/63	16	Prog: 250 kHz to 1 MHz	Floating Buck		Thermal foldback , analog and PWM dimming, no external current sense resistor	8 ePSOP/WSON	0.70/0.80
LM3409/09HV	5	6.0 to 42/75	42/73	13/20	Adj: 50 kHz to 2 MHz	Buck	✔	PWM and analog dimming, high-side current sense, 100% duty cycle achievable	10 VSSOP/ 14 PDIP	0.70/0.75
TPS92550	0.45	4.5 to 36	34	10	400 kHz	Buck		Integrated micro-module	7 TO-PMOD	3.00
TPS92551	0.45	4.5 to 60	57	16	800 kHz	Buck		Integrated micro-module	7 TO-PMOD	3.25
TPS92690	>2	4.5 to 75	72	20	Prog: 200 kHz to 2 MHz	Boost, SEPIC, Buck, Cuk	✔	Fast PWM dimming, LED ready, broken open check overvoltage protection, FLT, cycle-by-cycle current limit	16 eTSSOP	1.45
LM3421/23/29	>2	4.5 to 75	75	20	Adj: 100 kHz to 2 MHz	Boost, SEPIC, Buck	✔	Fast PWM dimming, LED ready, broken open check overvoltage protection, FLT, cycle-by-cycle current limit, HS sense resistor	14/16/20 eTSSOP	1.15/1.25/1.00
LM3424	>3	4.5 to 75	72	18	Prog: 25 kHz to 2 MHz	Boost, SEPIC	✔	Temperature foldback, synchronizable 50-kHz max PWM dimming, HS sense resistor	20 HTSSOP	1.30
LM3463	1.2	12 to 95	95	25	—	Linear		Dynamic headroom control, 6 output channels	48 WQFN	2.35
LM3464/64A	1.4	12 to 80/95	80/95	25	—	Linear		Dynamic headroom control, 4 output channels	28 eTSSOP	2.00/2.10
LM3466	1.5	6 to 70	70	20	—	Linear		LED string current equalization	8 ePSOP	0.75
LM3410X/Y	1	2.7 to 5.5	24	6	525 kHz/ 1.6 MHz	Boost, SEPIC	✔	PWM dimming, small footprint, low external component count	5 SOT23, 6 WSON, 8 MSOP	1.00
LM3431	0.6	5.0 to 36	40	11	Prog: 200 kHz to 1 MHz	Boost	✔	3-output channels, linear current controller	28 TSSOP/LLP	1.20
LM3492/92HC	0.2/0.25	4.5 to 65	65	17	Prog: 200 kHz to 1 MHz	Boost	✔	2 output channels, dynamic headroom control, 10000:1 dimming contrast ratio	20 eTSSOP	1.00/1.30
TPS40211	>3	4.5 to 52	50	15	Prog: 35 kHz to 1 MHz	Boost, SEPIC, Flyback	✔	Programmable soft start, overcurrent protection with auto retry, external synchronization frequency	10 MSOP, 10 SON	0.80
TPS92560	>1	6.5 to 42	42	11	Adj: 50 kHz to 1.5 MHz	Buck, SEPIC		Integrated active low-side input rectifiers	10 SOIC	0.72
TPS92640/41	5	7 to 85	83	23	Adj: 50 kHz to 1 MHz	Buck		Wide dimming range: Up to 20000:1 with shunt FET PWM	14/16 TSSOP	1.20/1.40
TPS92660	>2	10 to 80	75	21	Adj: 50 kHz to 1 MHz	Buck + Linear		2-string LED driver with I^2C/EEPROM current trim for high CRI lighting	20 eTSSOP	1.30
LM3433/34	>6	–9.0 to –14/–30	–11/–27	1	Adj: 200 kHz to 1 MHz	Buck		Drives common-anode LEDs tied to the ground referenced chassis, no output capacitor, analog and fast PWM dimming	24 LLP/WQFN	1.25/1.29

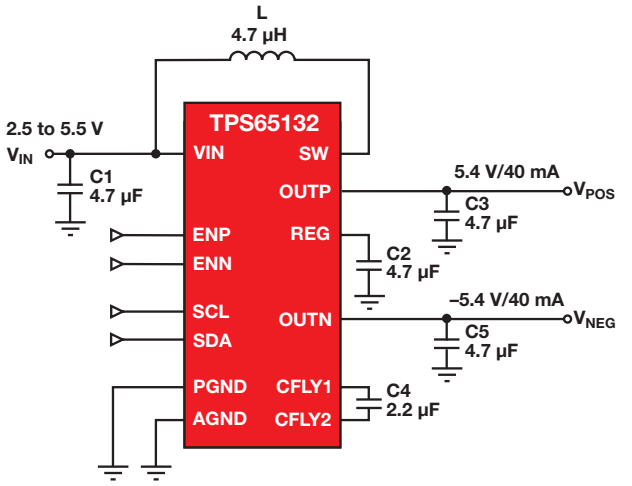
**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Dual-Output LCD Bias for Smartphones, Tablets and General-Purpose, Dual-Power-Supply Applications

TPS65132

The TPS65132 is designed to support positive/negative-driven TFT-LCD panels up to at least 10 inches. It is well suited for small- to media-form-factor applications like smartphones and tablets, or general-purpose, dual-power-supply applications. The two output rails are usually connected to the source-driver IC. The device uses a single inductor scheme for the smallest solution size possible as well as high efficiency.



Get more information: **www.ti.com/product/TPS65132**

Key Features

- >85% efficiency
- Dual output with only one inductor
- 15-bump CSP package
- Maximum output current: 80 mA
- Internal memory (EEPROM type 1000x programmable)
- Programmable sequencing
- Enable pin function—no hard reset (values stay in memory)
- 2.5- to 5.5-V input-voltage range
- Positive output voltage: 4.5 to 6 V (0.1-V steps)
- Negative output voltage: –4.5 to –6 V (0.1-V steps)
- Excellent line-transient regulation
- Programmable active discharge
- UVLO rising/falling

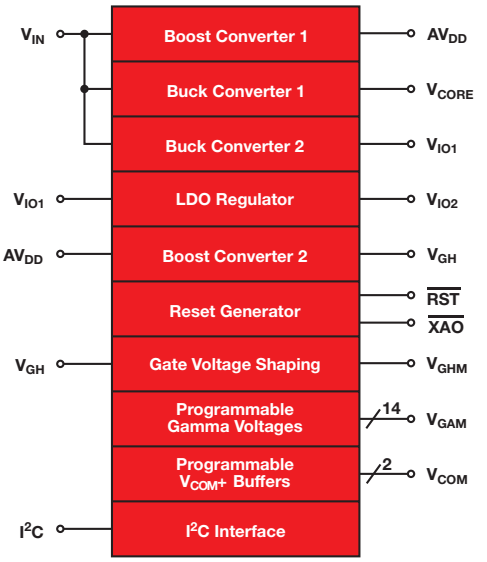
Applications

- Smartphone and tablet
- Dual-power-supply applications

LCD Bias with Integrated Gamma Reference for Notebook PCs, Tablets and Monitors

TPS65642

The TPS65642 is a compact LCD bias solution primarily intended for use in notebook PCs and tablets. The device comprises two boost converters to supply the LCD panel's source driver and gate driver/level shifter; two buck converters and an LDO linear regulator to supply the system's logic voltages; a programmable V_{COM} generator with two high-speed amplifiers; 14-channel gamma-voltage correction; and a gate-voltage shaping function.



Get more information: **www.ti.com/product/TPS65642**

Key Features

- Supports GIP and non-GIP displays
- I^2C interface
- 56-ball, 3.16 × 3.45-mm WCSP package with 0.4-mm pitch
- 2.6- to 6.0-V input-voltage range
- Programmable synchronous boost converter (AV_{DD})
- Nonsynchronous boost converter with optional temperature compensation
- Programmable synchronous buck converters (V_{CORE} and V_{IO1})
- Programmable low-dropout regulator
- Programmable V_{COM} calibrator with two integrated buffer amplifiers
- 14-channel, 10-bit programmable gamma-voltage reference
- Gate-voltage shaping
- /XAO panel and T-CON reset signals
- E2PROM with write protect
- Thermal shutdown

Applications

- Notebook PCs
- Tablets

Display Power
LCD Bias and AMOLED Bias Solutions

Selection Guide

Device	V_{IN} (V)	Boost I_{Limit} (min) (A)	Buck I_{Limit} (min) (A)	Features[1]						Price*
				Isolation Switch	V_{GH}	V_{GL}	GVS	V_{Com}	Other	
Solutions for Large LCDs (TVs)										
TPS65160/A	12	2.8	2	External	Driver	Driver	—	—		2.14
TPS65161	12	2.8	2.3	External	Driver	Driver	—	—		2.78
TPS65161A	12	3.7	2.3	External	Driver	Driver	—	—		2.78
TPS65161B	12	3.7	2.5	External	Driver	Driver	—	—		2.78
TPS65162	12	2.8	2.8	Integrated	Driver	Driver	Yes	2 op amps		2.45
TPS65163	12	2.8	1.5	External	Controller	Controller	In level shifter	—	9-ch level shifter, LCD discharge, reset generator	2.32
TPS65168	12	3.5	2.8	Integrated	Controller	Controller	—	—	I^2C programmable, 2 buck, temp. compensation, reset	2.10
TPS65170	12	2.8	1.5	External	Controller	Controller	—	—	Reset	1.40
TPS65176	12	3.5	2.5	External	Controller	Controller	—	—	Max AVDD 18.5 V, Vlogic 3.3 V	1.00
TPS65178	12	3.5	2.6	Integrated	Controller	Controller	—	—	Integrated 6-ch gamma buffer, I^2C, V_{Com}, bucks for HVDD, VCC, VCORE, VEPI, boost for VDD	1.90
TPS65177	12	4.25	3	Integrated	Controller	Controller	Yes	—	Temp compensation, I^2C, 1 boost, 3 bucks	1.90
TPS65175/B	12	3.5	2.6	Integrated	Controller	Controller	Yes	1 op amp	Integrated 6-ch gamma buffer, I^2C, V_{Com}, bucks for HVDD, VCC, VCORE, VEPI, boost for VDD, 12-ch level shifter	2.00

Device	V_{IN} (V)	Boost I_{Limit} (min) (A)	Features[1]							Price*
			Overvoltage Protection	Isolation Switch	V_{Logic}	V_{GH}	V_{GL}	GVS	V_{Com}	Other	
Solutions for Medium and Small LCDs (Monitors and Notebooks)											
TPS61085	5	2	Yes	—	—	External	External	—	—		0.95
TPS61087	5	3.2	Yes	—	—	External	External	—	—		1.60
TPS65100/Q1	5	1.6	Yes	—	LDO controller	Integrated	Driver	—	1 buffer		1.87
TPS65105	5	0.96	Yes	—	LDO controller	Integrated	Driver	—	1 buffer		1.87
TPS65140/Q1	5	1.6	Yes	—	LDO controller	Integrated	Driver	—	—		1.71
TPS65142	5	1.8	Yes	—	LDO	Driver	External	Yes	1 buffer	Integrated 6-ch WLED backlight driver, with integrated MOSFET	1.35
TPS65145/Q1	5	0.96	Yes	—	LDO controller	Integrated	Driver	—	—		1.71
TPS65146	2.5 to 6	2	Yes	—	LDO	Integrated	External	Yes	1 buffer		1.40
TPS65148	2.5 to 6	4	Yes	External	LDO	External	External	Yes	1 buffer	LDO for gamma, reset (/XAO), LCD discharge	2.10
TPS65149	3 to 6	4.0	Yes	External	—	Controller	Controller	—	Programmable, no buffer	Level shifters, reset	1.90
TPS65150/Q1	5	2	Yes	External	—	Driver	Driver	Yes	1 buffer		1.92
TPS65165	5	4.4	Yes	—	—	Integrated	Driver	Yes	2 op amps, 1 buffer		1.80
TPS65642/A	5	2.5	Yes	—	LDO	Integrated	External	Yes	2 buffers	I^2C, 14-ch gamma buffer	1.70
TPS65154	5	2.4	Yes	—	LDO	Integrated	Integrated	Yes	1 buffer	6-ch WLED backlight driver, I^2C	1.35

[1] *V_{GH} = Positive LCD rail voltage, V_{GL} = Negative LCD rail voltage, GVS = Gate-voltage shaping for V_{GH}, V_{Com} = LCD V_{Com} voltage source, and HVS = High-voltage stress-test control.*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Device	Description	Number of Channels			V_{GH1} (max) (V)	V_{GH2} (max) (V)	V_{GL} (max) (V)	V_{Com}	GVS/GPM	Charge Sharing	Other	Package	Price*
		Clock	Discharge	Additional									
LCD Support IC Solutions (Scan Drivers/Level Shifters)													
TPS65192	10-channel level shifter for LCD displays w/GPM	7	1	2	38	38	–15	—	Yes	—	LCD discharge	QFN-28	1.40
TPS65194	13-channel level shifter for LCD displays w/V_{Com} op amp	6	1	6	38	38	–15	Op amp 200 mA	—	—	State machine	QFN-24	0.80
TPS65193	5-channel level shifter for LCD displays (dual channel scan driver)	5	—	—	35	—	–28	—	—	Yes		QFN-24	0.80
TPS65196	15-channel level shifter for LCD displays	8	1	6	38	38	–23	—	Yes	—	Soft-start	QFN-28	0.80
TPS65198	13-channel level shifter for LCD displays w/VCom op amp	6	1	6	38	38	–23	Op amp 200 mA	Yes	—	4x4 package	QFN-24	1.00
TPS65197	8-channel level shifter supporting different charge-sharing methods and panel discharge	6	2	—	45	—	–20	—	—	Selectable: Disable, Method 1, Method 2	4x4 package	QFN-28	1.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Display Power
LCD Bias and AMOLED Bias Solutions

Selection Guide (Continued)

Device[1]	V_{IN} (V)	LDO 1	LDO 2	Charge Pump 1	Charge Pump 2	Application	Communication Interface	V_{Com} Adjust	Active Discharge	P2P with TPS65181/2	Package	Price*
Solutions for E-Readers												
TPS65185	3 to 6	15 V, 120 mA	–15 V, 120 mA	22 V, 10 mA	–20 V, 12 mA	Power supply for Active Matrix E Ink® Vizplex® panels	I^2C	User programmable (internal)	Yes	No	QFN-48 (0.5 mm 7x7 or 0.4 mm 6x6)	1.75
TPS65186	3 to 6	15 V, 120 mA	–15 V, 120 mA	22 V, 10 mA	–20 V, 12 mA	Power Supply for Active Matrix E Ink Vizplex panels	I^2C	User programmable (internal)	No	Yes	QFN-48 (0.5 mm 7x7)	1.75

[1] *See datasheets for more specifications.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Device	Description	Features	V_{IN} (min) (V)	V_{IN} (max) (V)	Frequency	AV_{DD} I_{Limit} (min) (mA)	AV_{DD} (max) (V)	Isolation Switch	V_{Logic1} I_{Limit} (min) (A)	V_{Logic1} (min) (V)	V_{GH} (I_{GH})	V_{GL} (I_{GL})	Other	Package	Price*
LCD SFF/MFF — IPS and OLED Solutions (<5 V)															
TPS65120	4-ch single inductor multiple outputs (SIMO) bias IC w/fixed 3.3-V V_{Logic}	Small form factor	2.5	5.5	4 MHz	7.5/25	5.6	Internal	LDO controller	Fixed 3.3	Integrated 20 V max. (6 mA)	Inverter –18 V max. (6 mA)	—	QFN-16	0.95
TPS65121	4-ch single inductor multiple outputs (SIMO) bias IC w/fixed 1.8-V V_{Logic}	Small form factor	2.5	5.5	4 MHz	7.5/25	5.6	Internal	LDO controller	Fixed 1.8	Integrated 20 V max. (6 mA)	Inverter –18 V max. (6 mA)	—	QFN-16	0.95
TPS65124	3-ch single inductor multiple outputs (SIMO) bias IC w/ adjustable sequencing	Small form factor	2.5	5.5	4 MHz	7.5/25	5.6	Internal	—	—	Integrated 20 V max. (6 mA)	Inverter –18 V max. (6 mA)	Adjustable sequencing	QFN-16	0.95
TPS65130	Dual positive and negative outputs (700 mA)	OLED, CCD sensor	2.7	5.5	1.4 MHz	—	—	External	—	—	Boost 15 V max. (0.7 A I_{Limit})	Inverter –15 V max. (0.7 A I_{Limit})	—	QFN-24	1.70
TPS65131/Q1	Dual positive and negative outputs (1800 mA)	OLED, CCD sensor	2.7	5.5	1.4 MHz	—	—	External	—	—	Boost 15 V max. (1.8 A I_{Limit})	Inverter –15 V max. (1.8 A I_{Limit})	—	QFN-24	2.20
TPS65136	Single inductor multiple outputs (SIMO) for positive and negative output	AMOLED	2.3	5.5	40 kHz to 1 MHz	—	—	Internal	—	—	Boost fixed 4.6 V (80 mA)	Inverter –6 V max. (80 mA)	—	QFN-16	1.20
TPS65137	Dual positive and negative output w/digital Vneg adjustment	AMOLED	2.3	5.5	1.6 MHz	—	—	Internal	—	—	Boost fixed 4.6 V (200 mA)	Inverter –5.2 V max. (200 mA)	Digital adjust for V_{GL}	QFN-10	0.85
TPS65138	Dual positive and negative output w/digital Vneg adjustment	AMOLED	2.9	4.5	1.6 MHz	—	—	Internal	—	—	Boost fixed 4.62 V (300 mA)	Inverter –2.2 down to –5.2 V max. (300 mA)	0.8% Vpos accuracy	QFN-10	0.95
TPS65631	Dual-output AMOLED display power supply	AMOLED	2.9	4.5	1.7 MHz	—	—	Internal	—	—	Boost fixed 4.6 V (300 mA)	Inverter –1.4 down to –4.4 V max. (300 mA)	0.5% Vpos accuracy	QFN-12	1.20
TPS65632A	Triple-output AMOLED display power supply	AMOLED	2.9	4.5	1.7 MHz	—	—	Internal	—	—	Boost fixed 4.6 V (300 mA)	Inverter –1.4 down to –4.4 V max. (300 mA)	0.5% Vpos accuracy, fixed AVDD of 7.7 V	QFN-16	1.50
TPS65135	Single inductor multiple outputs (SIMO) for positive and negative output	SFF/MFF IPS panel	2.5	5.5	1 MHz	—	—	Internal	—	—	Boost up to 6 V	Inverter down to –7 V	80-mA output current, 50% current mismatch	QFN-16	1.20
TPS65132	Dual-output LCD bias for smartphones and tablets	SFF/MFF IPS panel	2.5	5.5	1.8 MHz	—	—	Internal	—	—	Boost up to 6 V	Inverter down to –6 V	80-mA output current, 100% current mismatch, single inductor	CSP-15	1.00
TPS65133	Dual-output LCD bias for smartphones and tablets	SFF/MFF IPS panel	2.9	5	1.7 MHz	—	—	Internal	—	—	Boost fixed at 5 V	Buck-boost fixed at –5 V	250-mA output current, 100% current mismatch, dual inductor	QFN-12	1.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Gamma Buffers

Channels	0-V_{Com} Channels	1-V_{Com} Channels	2-V_{Com} Channels
22 (+2 static)			BUF22821
18		LM8207	BUF18830, BUF20800, BUF20820
16			BUF16821
14			BUF16820
12	BUF12800, BUF12840		
10		BUF11702/4/5	

Channels	0-V_{Com} Channels	1-V_{Com} Channels	2-V_{Com} Channels
8		BUF08821, BUF08832, BUF08630	
7		BUF08800	
6	BUF06703, BUF06704	BUF07702/3/4	
4	BUF04701	BUF05703, BUF05704	
0		BUF01900, BUF01901	

Display Power
LED Drivers—Backlighting

Design Factors

Dot Correction — Creates uniform LED brightness. Gives the ability to dynamically control the output current.

Grayscaling — Provides an enhanced color spectrum per LED equivalent with the number of grayscale steps available.

Output Voltage Monitor — Monitors voltages at constant current output terminals to detect LED failure and short circuit.

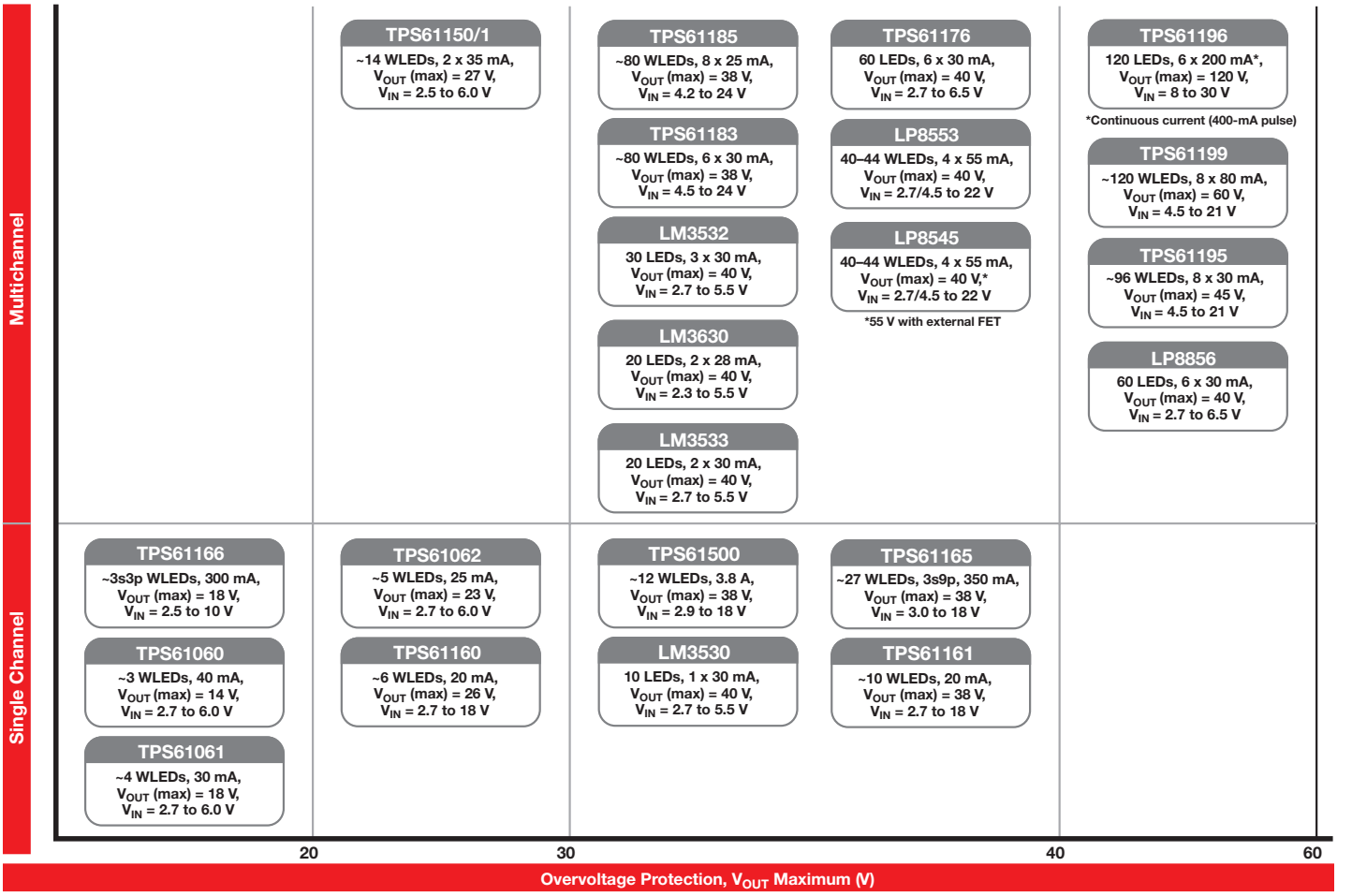
LED Open Detection — Indicates a broken or disconnected LED at an output terminal.

Thermal Error Flag — Indicates an overtemperature condition.

Watchdog Timer — Turns output off when scan signal is stopped.

Thermal Shutdown — Turns output off when junction temperature exceeds its limit.

LED Drivers Function Guide

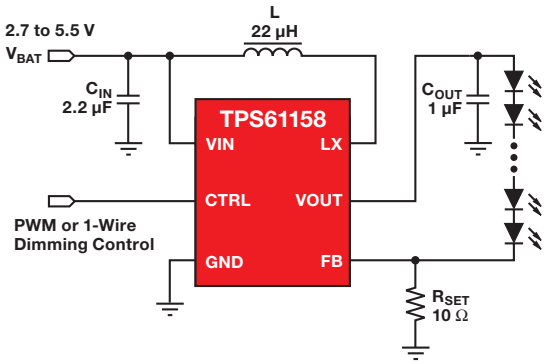


Display Power
LED Drivers—Backlighting

30-V WLED Driver with Integrated Power Diode

TPS61158

With a 30-V-rated integrated switch FET and power diode, the TPS61158 is a boost converter that drives LEDs in series. The boost converter runs at a 750-kHz fixed switching frequency to reduce output ripple, improve conversion efficiency and allow for the use of small external components.



Applications

- Feature phones
- Smartphones
- Portable media players
- Ultra mobile devices
- GPS receivers
- Backlight for small- and media-form-factor LCD display

Key Features

- Integrated 0.6-A, 30-V internal switch FET and power diode
- 2 x 2 x 0.8-mm, 6-pin QFN package with thermal pad
- Flexible digital and PWM brightness control (analog dimming implemented)
- PWM dimming-control interface (20 kHz up to 100 kHz)
- 2.7- to 5.5-V input-voltage range
- 28-V open LED protection (up to 8 LEDs)
- 750-kHz switching frequency
- 1-wire control interface (EasyScale™)
- Up to 100:1 PWM dimming ratio
- Integrated loop compensation
- Built-in soft start
- Built-in WLED open protection
- Thermal shutdown

Get more information: **www.ti.com/product/TPS61158**

6-Channel, High-Efficiency WLED Drivers Supporting Single-Cell-Battery Inputs

LP8557, TPS61176

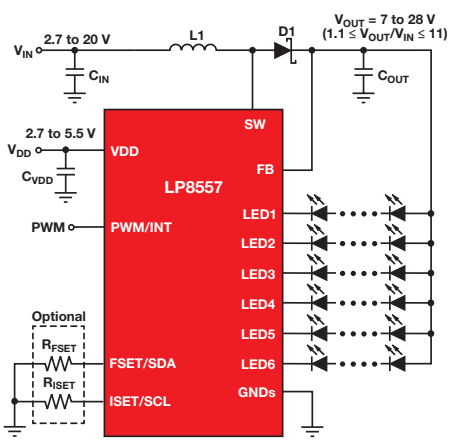
The LP8557 and TPS61176 provide highly integrated solutions for tablet PC backlighting and support an input voltage as low as 2.7 V (suitable for a single-cell battery). Both devices support 6 channels of LEDs and mixed-mode dimming for high efficiency.

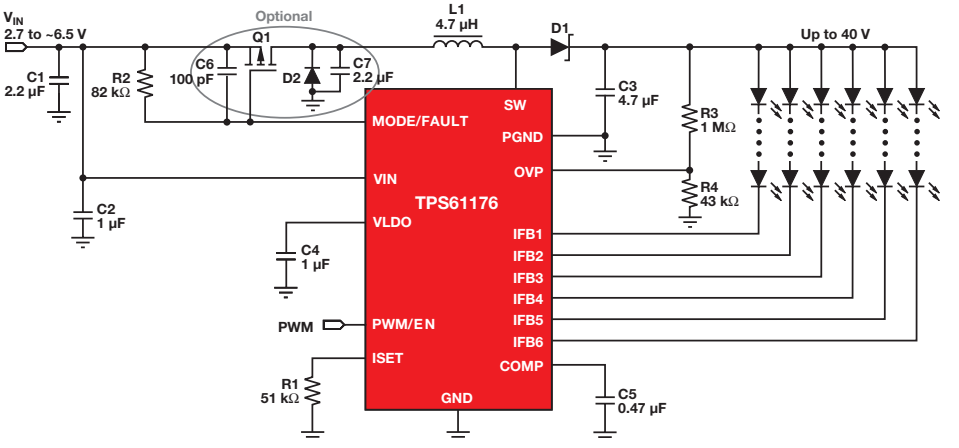
Key Features (LP8557/TPS61176)

- Maximum LED current per channel: 25 mA/30 mA
- Dimming methods: PWM, adaptive, pure analog
- Programmability: Resistor
- Package: 16 SMD/16 QFN
- Content adjusted backlight (LP8557)

Applications

- Tablet backlight powered by single-cell battery
- Backlight for small and medium form-factor LCD display with input from single-cell or multicell battery





Get more information: **www.ti.com/product/LP8557** or **TPS61176**

Display Power
LED Drivers—Backlighting

Selection Guide

Device	V_{IN} (V)	Synchronous	Type	Number of LEDs[1]	OLED Capable	LED Configuration	Switch Current Limit (typ) (mA)	Current Regulation	Overvoltage Protection (min) (V)	Output Capacitor	Load-Disconnect During Shutdown	Dimming[2]	Peak Efficiency[3] (%)	Quiescent Current (typ) (mA)	Shutdown Current (typ) (µA)	Package(s)	Price*
WLED Drivers																	
TPS61041	1.8 to 6.0		Inductive	4		Series	250		No	1 µF		Yes	85	0.028	0.1	SOT-23	0.65
TPS61040	1.8 to 6.0		Inductive	6		Series	400		No	1 µF		Yes	86	0.028	0.1	SOT-23	0.65
TPS61043	1.8 to 6.0		Inductive	4		Series	400	✔	17	100 nF	✔	Yes	85	0.038	0.1	QFN-8	0.71
TPS61042	1.8 to 6.0		Inductive	6		Series	500	✔	28	100 nF	✔	Yes	85	0.038	0.1	QFN-8	0.75
TPS61045	1.8 to 6.0		Inductive	6	✔	Series	500	✔	28	100 nF	✔	Yes	85	0.038	0.1	QFN-8	0.90
TPS61140	2.5 to 6.0	✔	Inductive	4 + 1 OLED	✔	2 Series	2 x 550	✔	28	—		1-pin	82	2	1.5	QFN-10	1.00
TPS61150A	2.5 to 6.0	✔	Inductive	Up to 2 x 6		2 Series	2 x 550	✔	28	—		1-pin	83	2	1.9	QFN-10	1.00
TPS61166	2.5 to 6.0	✔	Inductive	5		Series	1100[4]	✔	19	4.7 µF	✔	Yes		1.5	1	QFN-10	1.35
TPS61160	2.7 to 18		Inductive	6		Series	700	✔	26	1 µF		1-pin	90	1.8	1	QFN-6	0.72
TPS61161	2.7 to 18		Inductive	10		Series	700	✔	38	1 µF		1-pin	90	1.8	1	QFN-6	0.76
TPS61165	3.0 to 18		Inductive	10 to 40		Series	1200	✔	38	1 µF		1-pin	90	2.3	1	QFN-6	1.10
TPS61060	2.7 to 6.0	✔	Inductive	3		Series	400	✔	14	220 nF		Yes	83	—	1	QFN-8/WCSP-8	0.85
TPS61061	2.7 to 6.0	✔	Inductive	4		Series	400	✔	18	220 nF		Yes	82	—	1	QFN-8/WCSP-8	0.90
TPS61062	2.7 to 6.0	✔	Inductive	5		Series	400	✔	22	220 nF		Yes	81	—	1	QFN-8/WCSP-8	0.97
REG71050	3.2 to 5.5		Charge pump	3		Parallel	—		—	2.2 µF		No	92	0.065	0.01	SOT-23	0.55
TPS60230/1	2.7 to 6.5		Charge pump	5, 3		Parallel	—	✔	—	1 µF		Yes	85	0.200	0.1	QFN-16	0.48
TPS60250/5	2.7 to 6.0		Charge pump	7		Parallel	—	✔	—	4.7 µF		I^2C	—	6.7	1.3	QFN-16	0.85
TPS60251	2.7 to 6.0		Charge pump	7 + Aux		Parallel	—	✔	—	4.7 µF		I^2C	—	6.7	1.3	QFN-24	0.85
TPS75103/5	2.7 to 5.5		LDO	2 or 4		Parallel	—	✔	—	—		Yes	—	0.18	0.1	WCSP-9	0.65
TCA6507	1.65 to 3.6		Parallel	7		Parallel	—	—	—	—		—	—	—	—	WCSP-12/QFN-12	0.80
TPS61183/87	4.5 to 24		Inductive	10 x 6		6 Channels	2000	✔	38	10 µF		Yes	95	4	11	QFN-20	1.85
TPS61185	4.2 to 24		Inductive	10 x 8		8 Channels	2000	✔	38	10 µF		Yes	94	<3	<10	QFN-24	1.80
TPS61195	4.5 to 21		Inductive	8 x 10		10 Channels	3500	✔	50	10 µF		Yes	95	<3	<10	QFN-28	1.95
TPS61176	2.7 to 6.5		Inductive	6 x 10/11		6 Channels	1000	✔	38	4.7 µF		Mixed-Mode	90	<3	<4	QFN-16	1.10
TPS61199[5]	8 to 30		Inductive	15 x 8		8 Channels	5000	✔	30	3 x 33 µF		Yes	93	<1.5	<10	SOP-20/HTSSOP-20	1.85
LP8543	4.5 to 22		Inductive	7 x 10		7P10S	2500	✔	V_{BOOST} + 1.6 V	4.7, 10 µF		PWM, I^2C, ALS	92	<3.5, Boost ON	—	QFN-24	2.30
TPS61196	8 to 30		Inductive	20 x 6		6 Channels	—	✔	38	100 µF		PWM	96	<1.5	<15	HTSSOP-28	1.85
LP8545	4.5 to 22		Inductive	6 x 10		6P10S	2500	✔	V_{BOOST} + 1.6 V	4.7, 10 µF		PWM, I^2C	95	<4, Boost ON	—	QFN-24	0.99
LP8550	4.5 to 22		Inductive	6 x 10		6P10S	2500	✔	V_{BOOST} + 1.6 V	4.7, 10 µF		PWM, I^2C	95	<3, Boost ON	—	micro SMD-25	0.82
LP8553	4.5 to 22		Inductive	4 x 10		4P10S	2500	✔	V_{BOOST} + 1.6 V	4.7, 10 µF		PWM, I^2C	95	<3, Boost ON	—	micro SMD-25	0.82
LP8556	2.7 to 20		Inductive	6 x 10		6P10S	2600	✔	V_{BOOST} + 1.6 V	4.7, 10 µF		PWM, I^2C	95	2.2	—	micro SMD-25/ QFN-24	0.95
LP8557	2.7 to 5.5		Inductive	6 x 10		6P7S	1800	✔	V_{BOOST} + 1.6 V	4.7, 10 µF		PWM, I^2C	95	2.2	—	WCSP-16	0.82
LM3528	2.5 to 5.5		Inductive	12	✔	2P6S	770	✔	19.25	1 µF	✔	I^2C	85	0.25	1.8	WCSP-12	1.00
LM3530	2.7 to 5.5		Inductive	11		10 Series	839	✔	40	1 µF	✔	I^2C	88	1.35	1	WCSP-12	0.47
LM3532	2.7 to 5.5		Inductive	30		3P10S	1000	✔	40	1 µF	✔	I^2C	87	1.35	1	WCSP-16	0.45
LM3533	2.7 to 5.5		Inductive	22		2P10S	1000	✔	40	1 µF	✔	I^2C	87	—	—	WCSP-20	0.70
LM3535	2.7 to 5.5		Charge pump	8		8P	—	✔	—	1 µF	✔	I^2C	92	1.1	1.7	WCSP-20	0.65
LM3537	2.7 to 5.5		Charge pump	8		8P	—	✔	—	1 µF	✔	I^2C	92	1.1	0.2	WCSP-30	0.85
LM3538	2.7 to 5.5		Charge pump	8		8P	—	✔	—	1 µF	✔	I^2C	92	1.1	0.2	WCSP-30	0.80
LM3630	2.7 to 5.5		Inductive	20		2P10S	1200	✔	40	1 µF	✔	I^2C	90	—	1.8	WCSP-12	0.36
LM3697	2.7 to 5.5		Inductive	21		3P7S	1000	✔	40	1 µF	✔	I^2C	90	—	1.8	WCSP-12	0.40

[1]More LEDs can be driven in parallel string configuration.
[2]May be via ENABLE pin, CONTROL pin or analog feedback network.
[3]Depends on LED current, input voltage, number of LEDs, ILED pin.
[4]Output current is limited to 300 mA.
[5]External FET needed.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Display Power
LED Drivers—Backlighting

Selection Guide (Continued)

Device	V_{IN} (V)	Synchronous	Type	Number of LEDs[1]	OLED Capable	LED Configuration	Switch Current Limit (typ) (mA)	Current Regulation	Overvoltage Protection (min) (V)	Output Capacitor	Load-Disconnect During Shutdown	Dimming[2]	Peak Efficiency[3] (%)	Quiescent Current (typ) (mA)	Shutdown Current (typ) (µA)	Package(s)	Price*
WLED Drivers (Continued)																	
LM2756	2.7 to 5.5		Charge pump	8		8P	—	✔	—	1 µF	✔	I^2C	92	2.1	3.7	WCSP-20	1.40
LP5521	2.7 to 5.6		Charge pump	3		3P	—	✔	—	1 µF	✔	I^2C	—	—	—	WCSP-20	0.40
LP5522	2.7 to 5.7		Charge pump	1		—	—	✔	—	—	✔	1 Pin	—	—	—	WCSP-06	0.40
LP5523	2.7 to 5.8		Charge pump	9		9P	—	✔	—	1 µF	✔	I^2C	—	—	—	WCSP-25	0.85
LP5524	2.7 to 5.9		Charge pump	4		4P	—	✔	—	—	✔	—	—	—	—	WCSP-09	0.60
LM8502	2.7 to 5.10	✔	Inductive	10		10P	—	✔	—	10 µF	✔	I^2C	—	—	—	WCSP-30	1.50

[1]More LEDs can be driven in parallel string configuration.
[2]May be via ENABLE pin, CONTROL pin or analog feedback network.
[3]Depends on LED current, input voltage, number of LEDs, ILED pin.
[4]Output current is limited to 300 mA.
[5]External FET needed.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Device	No. of Chan.	V_{IN} Min (V)	V_{IN} Max (V)	Output Current I_{LED} (mA)	Channel-to-Channel Accuracy (%)	Dev.-to-Dev. Accuracy (%)	Short Detection	Open Detection	Overtemperature Detection	Comments	Price*
LED Drivers											
TLC5960	8	10	28	350[1]	0.3	±1	✔	✔	✔	4 iHVM™ outputs, 4 PWM controls, external FET	1.10

[1]TLC5960 output current is limited by external FET.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Device	Typical Power Level	Topology	Maximum Practical Frequency (kHz)	Start-Up Current (µA)	Operating Current (mA)	Supply Voltage (V)	UVLO: On/Off (V)	Max Duty Cycle (%)	Soft Start	Output Drive (Sink/Source) (A)	Package(s)	Price*
LLC Controllers												
UCC25600	200 W to 1 kW	Half-bridge	350	100	7.5	11.5 to 18	11.1/8.9	Variable	✔	0.4/0.8	8-SOIC	0.80
UCC25710	80 W to 500 W	Half-bridge	300	—	—	12 to 18	10/8.5	—	✔	0.4/0.8	20-SOIC	1.50

Note: UCC2xxx devices are extended temperature-range versions of the UCC3xxx devices.
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Display Power
LED Drivers—Camera Flash

Design Factors

Series or Parallel LED Configuration — Drives the driver topology. Inductive boost converters provide the necessary high voltage to a series LED string. This requires only one current regulation loop and two connection points for the LED string.

Charge pumps typically drive parallel LEDs; but unless each LED is current-regulated, each leg requires a current-set resistor.

Current Regulation — Avoids brightness variations in LED strings or legs that consist of LEDs with different forward voltages (V_f).

Overvoltage Protection (OVP) — Protects the inductive driver from destruction in case faulty LEDs open the LED string.

Dimming — LED drivers typically feature analog and/or digital dimming to adjust the LED brightness.

Selection Guide

Device[1]	V_{IN} (V)	Max. Number of LEDs	Privacy LED	I_{OUT} (max) (mA)	Typical Switch Current (mA)	Super-Capacitor Support	Down Mode when $V_{IN} > V_{OUT}$	Control Interface	LED Temperature Monitoring	Power Save Mode	Battery Voltage-Droop Monitoring	Package(s)	Features and Differentiators	Total Solution Size (mm^2)	Price*
Camera Flash LED Drivers															
TPS61050/2	2.5 to 5.5	1	✔	1200	2000			I^2C				QFN-10, WCSP-12	Voltage-mode selection pin	25	1.00
TPS61054/5	2.5 to 5.5	1		700/500	1500/1000			Simple logic signal				QFN-10, WCSP-12		25	0.85
TPS61310/1	2.5 to 5.5	3	✔	1500	—		✔	I^2C	✔	✔	✔	WCSP-20	HW-reset input, dual-wire camera-module interface, Power Good	25	1.00
TPS61325	2.5 to 5.5	3	✔	4100	—	✔	✔	I^2C	✔	✔		WCSP-20	Dual-wire camera-module interface, super-capacitor balancing, flash ready output	25	1.50
TPS61300/1/5	2.5 to 5.5	3	✔	4100	1850	✔	✔	I^2C	✔	✔		WCSP-20	Voltage-mode selection pin (TPS61300/1) DC light-mode selection pin (TPS61300) Flash ready output, HW-reset input (TPS61301/5)	25	1.50
LM3561	2.5 to 5.5	1		600	1000/1500		✔	I^2C	✔			WCSP-12	600-mA compact solution with integrated protection features	15	0.55
LM3554	2.5 to 5.5	2		1200	1000/1500/2000/2500		✔	I^2C	✔		✔	WCSP-16	1.2-A inductive driver with protection features and voltage mode	23	0.46
LM3555	2.5 to 5.5	2		500	1250/1500/1750/2000			I^2C	✔			WCSP- 12	Series driver with 90% efficiency and indicator LED	31	0.35
LM3556	2.5 to 5.5	1		1500	1700/1900/2500/3100		✔	I^2C	✔		✔	WCSP-16	4-MHz LED driver with tiny solution size and integrated protection features	18	0.50
LM3559	2.5 to 5.5	2		1800	1400/2100/2700/3200		✔	I^2C	✔		✔	WCSP-16	1.8-A inductive flash LED driver with programmable indicator blinking	26	0.55
LM3560	2.5 to 5.5	2		2000	1600/2300/3000/3600		✔	I^2C	✔			WCSP-16	1.8-A inductive flash LED driver with programmable indicator blinking	26	0.80
LM3550	2.5 to 5.5	4		5000	—	✔		I^2C				LLP	Super-cap flash LED driver with optimal mode to limit power dissipation	—	0.70
LM3642	2.5 to 5.5	1		1500	1700/1900		✔	I^2C	✔		✔	WCSP-9	4-MHz LED driver with tiny solution size and integrated protection features	18	0.35
LM3646	2.5 to 5.5	1		1500	1000/3100		✔	I^2C	✔		✔	WCSP-20	4-MHz LED driver with tiny solution size and integrated protection features	22	0.45
LM3565	2.5 to 5.5	1		930	2300/2600/2900/3300		✔	I^2C	✔		✔	WCSP-16	4-MHz dual series LED driver with tiny solution size and integrated protection features	26	0.44

[1] *All of these devices have TX-Mask and safety timer DC/Flash.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

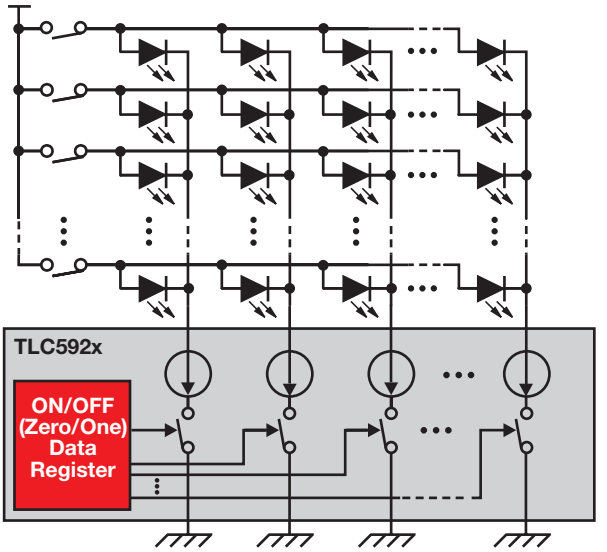
Display Power
LED Drivers—Signage/Linear

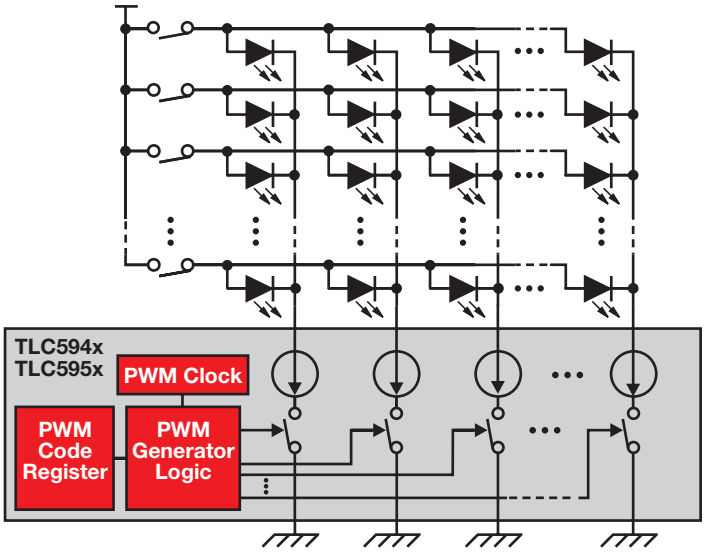
TI's signage and linear LED drivers offer constant-current-sink, RGB and/or white LED lamp drivers for applications requiring multichannel drives.

LED Dot-Matrix Display Drivers for Signage

As shown in the simplified diagram below, the TLC592x/4x/5x series drives LED dot-matrix displays in LED signage applications such as stadium video/score screens, roadside advertisements and station/airport information boards. The TLC592x series uses simple on/off control for flexible system design with high-power image processors. The TLC594x/5x series uses an integrated PWM generator for reduced controller power.

LED drivers from Texas Instruments are used in video displays throughout the world.





RGB and White LED Architectural/Illumination Linear Drivers

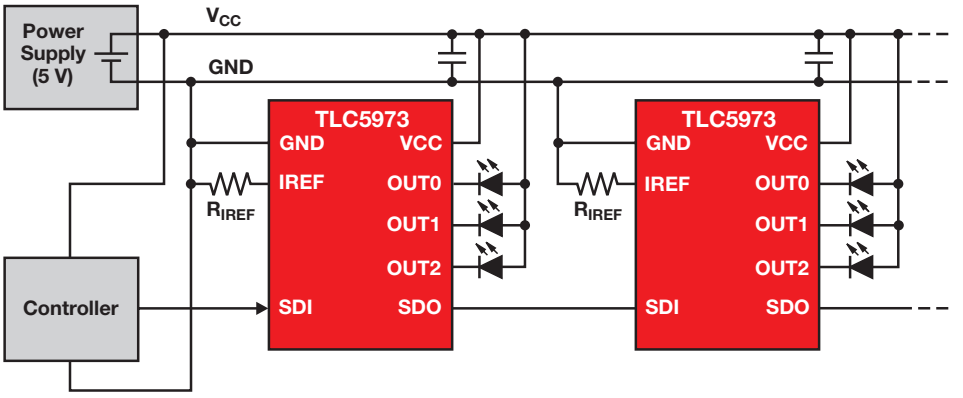
The TLC597x series on the following page supports nontypical LED dot-matrix display applications such as rainbow-colored wall lightings/decorations for buildings; LED "mesh" displays; and RGB LED illuminations.

Get more information: **www.ti.com/signage**

Display Power
LED Drivers—Signage/Linear

3-Channel, 12-Bit, PWM Constant-Current LED Driver with Single-Wire Interface (EasySet™)

TLC5973



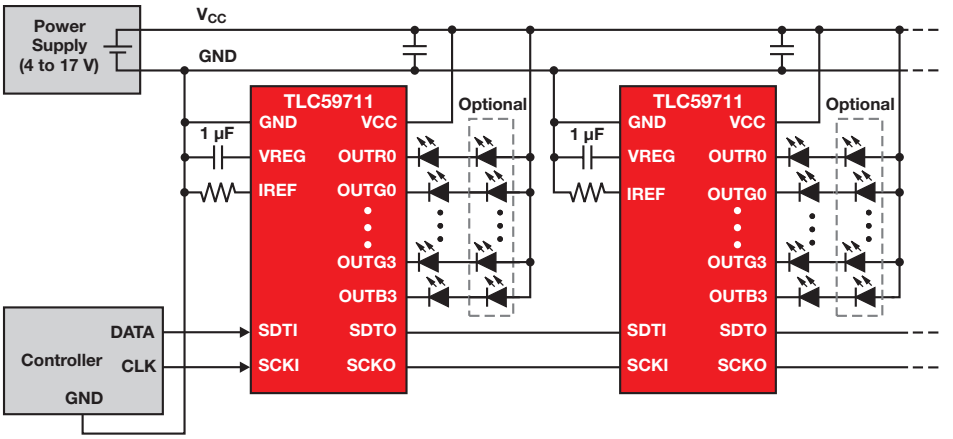
Get more information: **www.ti.com/product/TLC5973**

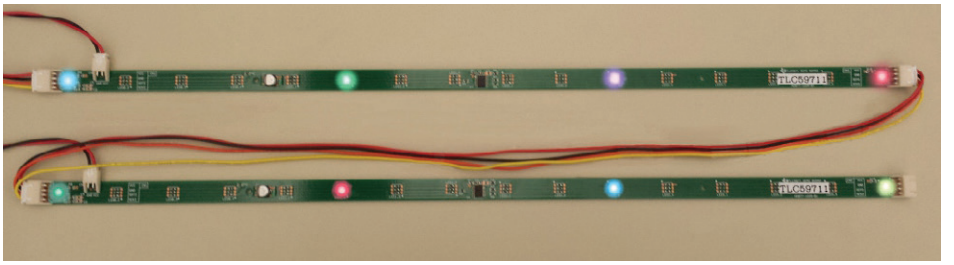
Key Features

- Three constant-current-sink channels with 4096-step PWM each
- Only three wires (VCC, GND and data) for cascading
- Built-in shunt regulator to self-bias the IC from a higher LED voltage rail

12-Channel, 16-Bit, Enhanced-Spectrum PWM, RGB LED Driver with 3.3-V Linear Regulator and Watchdog Timer

TLC59711





Get more information: **www.ti.com/product/TLC59711**

Key Features

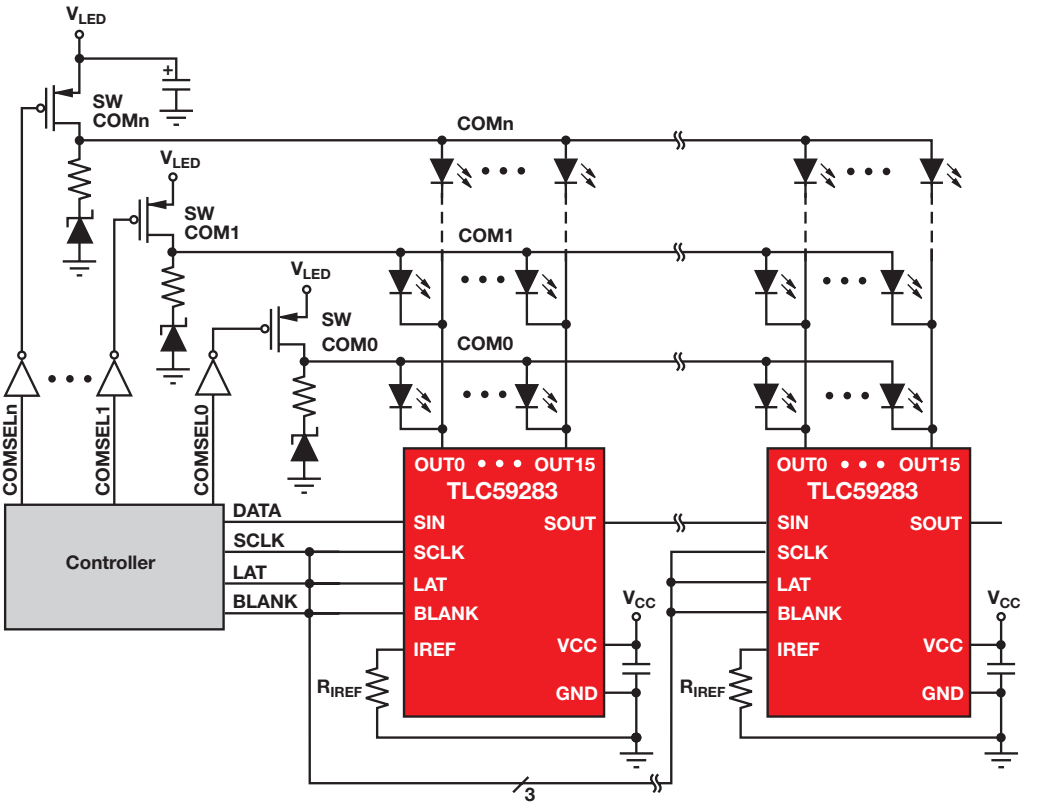
- 12 constant-current-sink channels (four RGB lamps) with 16-bit PWM each
- Only four wires (VCC, GND, data and clock) for cascading
- Built-in LDO regulator to self-bias the IC from a higher LED voltage rail

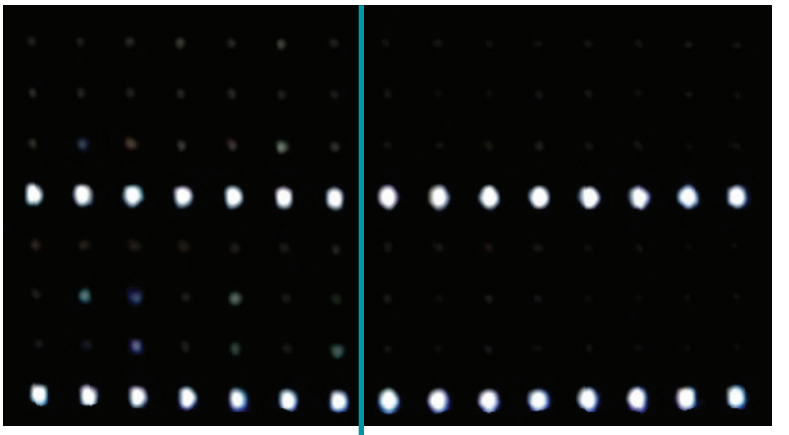
Display Power
LED Drivers—Signage/Linear

16-Channel, Constant-Current LED Driver with Precharged FETs

TLC59283

Precharged FETs deliver an anti-ghost noise function in LED matrix display systems. The TLC59283 eliminates unwanted lighting of LED lamps. For the example shown below, only two white lines were programmed. The traditional solution on the left shows unwanted lamps turned on, whereas the solution using the TLC59283 shows them turned off.





Device without anti-ghost function | TLC59283 with anti-ghost function

Get more information: **www.ti.com/product/TLC59283**

Display Power
LED Drivers—Signage/Linear

Selection Guide

Device	No. of Chan.	V_{IN} Min (V)	V_{IN} Max (V)	Output Current I_{LED} (mA)	Channel-to-Channel Accuracy (%)	Dev.-to-Dev. Accuracy (%)	Recharged FET	Short Detection	Open Detection	Overtemperature Detection	Brightness Control (Bits)	Dot Correction (Bits)	PWM Grayscale Control (Bits)	Interface	Comments	Price*
TL4242	1	4.5	42	500	—	—		✔	✔	✔				—		0.35
TLC5916	8	3.3	5.5	120	±3 (Max)	±6 (Max)			✔	✔	8			SPI		0.47
TLC5917	8	3.3	5.5	120	±3 (Max)	±6 (Max)		✔	✔	✔	8			SPI		0.60
TLC59108	8	3	5.5	100	±3 (Max)	—			✔	✔	8		8	I^2C	Constant-current output	0.80
TLC59108F	8	3	5.5	100	±3 (Max)	—			✔	✔	8		8	I^2C	Open-drain output	0.80
TLC59208F	8	3	5.5	50	±3 (Max)	—			✔	✔	8		8	I^2C	Open-drain output, programmable I^2C address	0.65
TLC59116	16	3	5.5	100	±6 (Max)	—			✔	✔	8		8	I^2C	Constant-current output	1.45
TLC59116F	16	3	5.5	100	±6 (Max)	—			✔	✔	8		8	I^2C	Open-drain output	1.45
TLC59210	8	3	5.5	200	—	—								Parallel	Clear function and clock pin for data latch	0.60
TLC59211	8	3	5.5	200	—	—								Parallel	No clear function and clock pin for data latch	0.55
TLC59212	8	3	5.5	40	—	—								Parallel		0.48
TLC59213/A	8	3	5.5	–500	—	—								Parallel	"A" version has 15 ns (non-"A" is 25 ns)	0.70
TLC5921	16	4.5	5.5	80	±1	±4 (Max)			✔	✔				SPI		1.25
TLC5922	16	3	5.5	80	±1	±4						7		SPI		1.35
TLC5923	16	3	5.5	80	±1	±4			✔	✔		7		SPI		1.40
TLC5924	16	3	5.5	80	±1	±4	✔		✔	✔		7		SPI		1.50
TLC5925	16	3	5	45	±4 (Max)	±6 (Max)				✔				SPI		0.50
TLC59025	16	3	5	45	±4 (Max)	±6 (Max)				✔				SPI		0.55
TLC5926	16	3	5.5	120	±6 (Max)	±6 (Max)			✔	✔	8			SPI		0.60
TLC5927	16	3	5.5	120	±6 (Max)	±6 (Max)		✔	✔	✔	8			SPI		0.65
TLC5928	16	3	5.5	35	±1	±1			✔	✔				SPI		0.50
TLC59281	16	3	5.5	35	±1	±1								SPI		0.43
TLC59283	16	3	5.5	45	±1.4	±2	✔							SPI	4-channel grouped delay	0.55
TLC59284	16	3	5.5	45	±1.4	±2								SPI	4-channel grouped delay	0.45
TLC5929	16	3	5.5	50	±1	±2		✔	✔	✔	7			SPI	Full protection/monitor for remote-controlled systems	0.85
TLC5940	16	3	5.5	120[1]/60[2]	±1	±2/–2.7			✔	✔		6	12	SPI		1.20
TLC59401	16	3	5.5	120[1]/80[2]	±1	+2/–2.7			✔	✔		6	12	SPI		1.20
TLC5941	16	3	5.5	80	±1	+2/–2.7			✔	✔		6	12	SPI		0.95
TLC5942	16	3	5.5	50	±1.5	±3			✔	✔		7	12	SPI		1.00
TLC5943	16	3	5.5	50	±1.5	±3			✔	✔	7		16E[3]	SPI	4-channel grouped delay, LED open auto-off	1.20
TLC5944	16	3	5.5	60	±1	±3	✔		✔	✔		6	12	SPI	4-channel grouped delay, LED open auto-off	1.05
TLC5945	16	3	5.5	80	±1	+2/–2.7			✔	✔		6	12	SPI		1.00
TLC5946	16	3	5.5	40	±1	±2			✔	✔		6	12	SPI	4-channel grouped delay, LED open auto-off	0.95
TLC59461	16	3	5.5	40	±1	±2			✔	✔		6	12	SPI	4-channel grouped delay	0.95
TLC5947	24	3	5.5	30	±2	±2				✔			12	SPI	30-V V_{LED}, internal oscillator	1.95
TLC5948A	16	3	5.5	60[1]/45[2]	±0.6	±1		✔	✔	✔	7	7	16E/C[3]	SPI	Full protection/monitor for remote-controlled systems	1.30
TLC59482	16	3	5.5	45[1]/35[2]	±1	±2					6		16E[3]	SPI	4-channel grouped delay	1.15
TLC5949	16	3	3.6	45	±0.6	±1		✔	✔	✔	7		12E/C[3]	SPI	Full protection/monitor for remote-controlled systems	1.25
TLC5951	24	3	5.5	40	±1.5	±3		✔	✔	✔	8	7	12, 10, 8	SPI	For 8 RGB LED lamps	1.55
TLC5952	24	3	5.5	35	±1	±3		✔	✔	✔	7			SPI	For 8 RGB LED lamps	1.35
TLC5970	3	10	36	150	±0.5	±3		✔	✔	✔	7	7	12	Differential SPI	Buck DC/DC for local LED voltage generation	1.70
TLC5971	12	3	17	60	±1	±1				✔	7		16E[3]	SPI	Integrated LDO and oscillator for PWM	1.20
TLC59711	12	3	17	60	±1	±1				✔	7		16E[3]	SPI	Integrated LDO and oscillator for PWM, WDT	1.30
TLC5973	3	3	6	50	±0.5	±0.5							12	Single-wire	Shunt regulator, internal PWM clock	0.45
TLC59731	3	3	6	50	—	—							8	Single-wire	Open-drain output, shunt regulator, internal PWM clock	0.28

[1] *Output current with V_{CC} > 3.6 V.*
[2] *Output current with V_{CC} ≤ 3.6 V.*
[3] *16E = 16-bit enhanced-spectrum PWM. 16E/C or 12E/C = 16-bit or 12-bit enhanced-spectrum or conventional PWM selectable.*

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Multi-Output Power Management Units (PMUs)
Overview

Our world is continuing to shrink around us. The golden age of the Internet has linked people around the world, enabling faster communication in the fields of finance, research and social media. All around us the world is getting smaller, and this is no more noticeable than in our electronic devices. Cell phones and computers have transformed into high-performance, portable, multipurpose tools that can fit into your pocket or briefcase.

The key to these devices becoming more powerful and portable are the advances in semiconductor technology. In keeping with Moore's law, the number of transistors in a given space has increased a millionfold over the last 40 years, allowing for higher performance in smaller packages. But to further reduce these package sizes, integration of functions needs to occur. With several different operations being performed in a single integrated circuit (IC) instead of individual discrete ICs, end products can be made smaller and often more efficient.

The integration in the digital realm has been mirrored in the analog realm, and that is where TI's portfolio of multichannel power management units (PMUs) enters the playing field. TI has a diverse selection of products that combine a high level of integration with high-efficiency outputs. Whether your product requires multiple rails for automotive solutions, processor power management or just a multi-output solution with a communication interface, TI has a wide range of options to choose from to match your power-design needs. TI's power solutions come in very small packages, such as QFN and DSBGA bump packaging; and the high-frequency operation of TI's PMU products also reduces the size of passive elements such as inductors and capacitors. All of these factors ultimately result in a drastically reduced PCB footprint and eliminate the need for multiple single-function components.

Whatever your power-management needs, TI will be there to help you through the effort. With a vast portfolio of evaluation modules, accessible reference designs and available technical support, TI supplies you with the tools you need for a successful power design.

Automotive PMUs

An ever expanding product portfolio in Q100-qualified automotive parts makes TI one of the leaders in power solutions for infotainment, telematics, advanced driver assistant systems (ADASs) and automotive safety. TI provides a multitude of analog and embedded processing products for rich, dedicated human/machine-interface environments complementing multimodal applications. These applications include:

- Voice, gesture and face recognition
- Consumer multimedia systems such as video games, audio, digital radio and portable electronics
- Telematics applications such as emergency call (E-Call) and rear-seat entertainment

TI's ADAS power solutions complement the embedded processing and analog components required for these systems. ADAS functions such as collision warning, surround-view cameras and ultrasonic park assist require processors with DSP and/or integrated SoCs. TI also has high-voltage devices with a wide V_{IN} range in addition to low-voltage devices qualified for automotive applications.

Special Function PMUs

Integration does not have to be a benefit for processor-based end equipment alone. TI has a broad portfolio of PMUs that couple DC/DC converters and LDOs with other features such as linear or switching battery chargers, load switches, charge pumps or WLED boost drivers to fit the needs of a wide range of applications. TI PMUs support lower-power products like *Bluetooth*® headsets and 3D glasses, as well as higher-power products like embedded and digital cameras. And flexibility designed into the devices opens up a vast space beyond their original target applications. Examples of such devices are our TPS65090, a front-end PMU for charging two to three Li-Ion batteries in series, and the TPS657120, a PMU designed for supplying baseband and RF-PA power. Each of these devices has associated application guides, reference designs and evaluation modules available at the TI.com Web site.

Processor Attachment PMUs

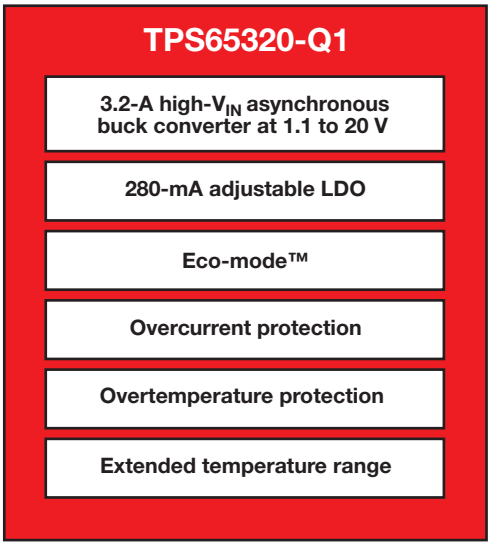
TI offers several highly efficient PMU solutions aligned with today's major processors and provides comprehensive technical support for them. Evaluation modules and reference designs are available for PMU/enhanced-product solutions, as well as application guides and extensive online support via E2E™ forums. TI not only supports the latest OMAP™ and Sitara™-based processors but also offers solutions for a variety of processors from other manufacturers. We also offer automotive-qualified power solutions for automotive-specific processors. Refer to the "Embedded Processors Supported by TI PMUs" table at the end of this section to find the power solution right for you.

Multi-Output Power Management Units (PMUs)

Automotive PMUs—High-Voltage

40-V Step-Down Converter wih Eco-mode™ and LDO

TPS65320-Q1



Key Features

- High-V_{IN} (3.6- to 40-V) asynchronous buck converter:
  - 1.1 to 20 V at 3.2 A
  - Supports high-duty-cycle operation
  - 100-kHz to 2.5-MHz adjustable-frequency PWM control
  - Less than 140-µA standby current in low-power mode
- 280-mA adjustable LDO:
  - 1.1- to 5.5-V output voltage
  - Input-supply auto-source to balance efficiency and low standby current
  - Power Good output
- Extended temperature range: –40 to 125°C
- Available in 14-pin HTSSOP package with PowerPAD™

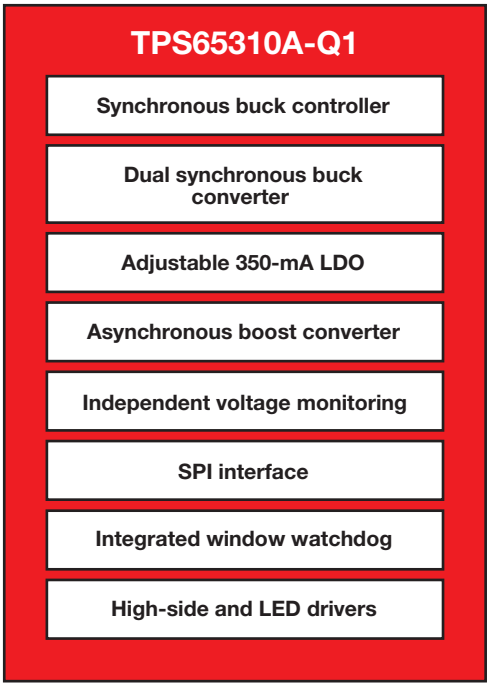
Applications

- Infotainment, telematics
- TFT cluster
- Advanced driver assistant system (ADAS)

Get more information: **www.ti.com/product/TPS65320-Q1**

High-Voltage PMU for Automotive Safety Applications

TPS65310A-Q1



Key Features

- High V_{IN} range (4 to 40 V) with transients up to 60 V
- Synchronous buck controller:
  - Peak gate-drive current: 0.6 A
  - 490-kHz fixed switching frequency
- 2-A dual synchronous buck converter:
  - Out-of-phase switching
  - 0.98-MHz switching frequency
- Adjustable 350-mA LDO
- 1-A asynchronous boost converter
- Soft-start feature on all outputs
- Independent voltage monitoring
- UV/OV protection
- SPI interface
- High-side driver for external FETs
- LED driver
- 56-pin QFN enhanced PowerPAD™ package

Applications

- Camera- or radar-based vision systems (ADAS)
- Multirail DC power-distribution systems
- Safety-critical automotive applications

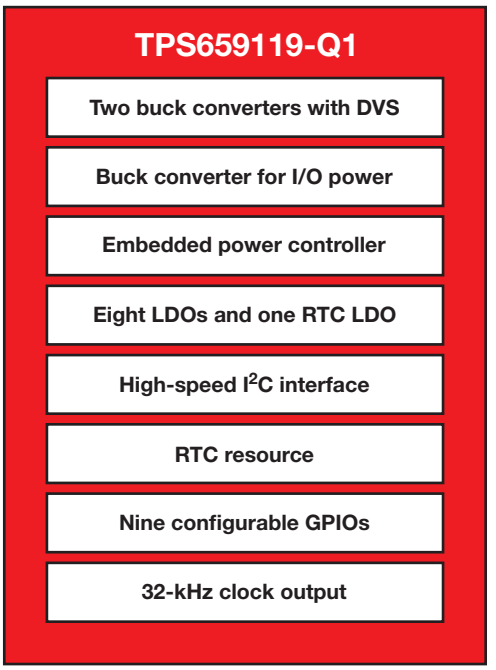
Get more information: **www.ti.com/product/TPS65310A-Q1**

Multi-Output Power Management Units (PMUs)

Automotive PMUs—Low-Voltage

Integrated PMU with Three DC/DC Converters and Eight LDOs

TPS659119-Q1



Key Features

- V_{IN} range from 2.7 to 5.5 V
- Four adjustable step-down converters:
  - Two 0.8- to 1.65-V at 1.8 A for DVFS
  - One 0.9- to 3.4-V at 1 A for I/O
  - One 1.2- to 3.4-V at 1.8 A for DDRx memory
- Two microprocessor DC/DC converters for RTC supply
- 200-mA LDO at 0.9- to 3.3-V adjustable output
- Three load switches support:
  - DDR3 self-refresh mode
  - USB port
  - 9-V auxiliary power port
- Precision output-voltage monitoring for compatibility with SA335x
- Automatic power-up/down sequencing
- Extended temperature range of –40 to 125°C
- I^2C interface
- 6 x 6-mm QFN or 9 x 9-mm HTQFP package

Applications

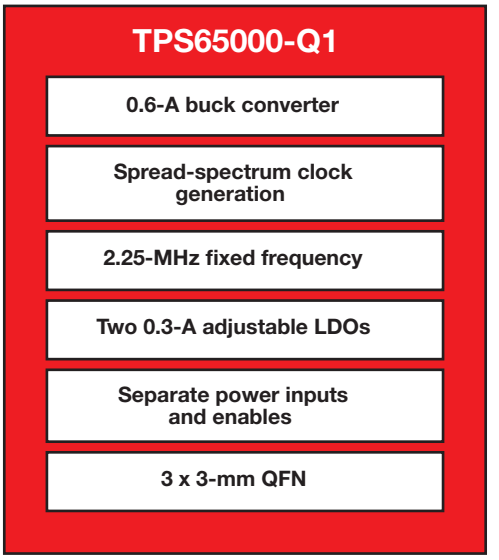
- Infotainment
- Advanced driver assistant system (ADAS)
- Instrument cluster

Get more information: **www.ti.com/product/TPS659119-Q1**

2.25-MHz Step-Down Converter with Dual LDOs and SVS

TPS65000-Q1

The TPS65000 was introduced several years ago as a general-purpose LDO for consumer products. It has been requalified to enable the same flexibility in automotive products.



Key Features

- 0.6-A step-down converter:
  - V_{IN} range from 2.3 to 6 V
  - Spread-spectrum clock (SSC) generation for reduced EMI
  - 2.25-MHz fixed-frequency operation
- Two 0.3-A adjustable LDOs:
  - V_{IN} range from 1.6 to 6 V
  - Separate power inputs and enables
- AEC-Q100 qualified:
  - Device temperature grade 2: –40 to 105°C
  - Device HBM ESD classification level H2
  - Device CDM ESD classification level C4B
- 3 x 3-mm 16-pin QFN package

Applications

- Point of load
- Embedded processor power
- Portable media

Get more information: **www.ti.com/product/TPS65000-Q1**

Multi-Output Power Management Units (PMUs)

Automotive PMUs

Selection Guide

Device	V_{IN} (V)	No. of Regulator Outputs	WLED Boost	DC/DC Step-Down Converter	DC/DC Step-Down Controller	LDO	Communication Interface	Description	Package(s)	Price*
LM5119	5.5 to 65	2	—	—	2	—	—	General purpose with current sharing between channels	QFN-32	3.25
LM25119	4.5 to 42	2	—	—	2	—	—	General purpose with current sharing between channels	QFN-32	2.60
LM26420	3 to 5.5	2	—	2	—	—	—	Dual 2.0-A buck	WQFN-16, HTSSOP-20	2.05
LM26480	3 to 5.5	2	—	4	—	2	—	Dual buck, dual LDO	LLP-24	1.10
LP3907	2.8 to 5.5	4	—	2	—	2	I^2C	General purpose	SMD-25, LLP-24	1.10
LP8728	4.5 to 5.5	4	—	4	—	—	—	General purpose	QFN-28	1.60
TPS43331	5 to 30	4	—	—	2	—	I^2C	Two programmable linear regulators for MPUs and DSPs	HTSSOP-38	4.00
TPS4333x	4 to 40	3	—	—	2	—	—	Infotainment, navigation instruments	HTSSOP-38	3.00
TPS65000	2 to 6	3	—	1	—	2	—	General purpose	QFN-16	1.64
TPS65023	2.5 to 6.0	6	—	3	—	3	I^2C	Flexible 6-channel PMU, also WCSP package	QFN-40	3.45
TPS650241/3/4	2.5 to 6	6	—	3	—	3	I^2C	Flexible 6-channel PMU	VQFN-32	3.04
TPS650250	2.5 to 6	6	—	3	—	3	—	Flexible 6-channel PMU	VQFN-32	2.57
TPS65051	2.5 to 6	6	—	2	—	4	—	6-channel PMU, digital voltage selection for LDOs	QFN-32	2.05
TPS65053	2.5 to 6.0	5	—	2	—	3	—	Low-cost 5-channel PMU, optimized for DM355x	QFN-24	1.95
TPS650732	2.8 to 6.3	5	Yes	3	—	2	I^2C	Versatile 5-channel PMU w/charger	QFN-48	4.25
TPS652510	4.5 to 18	3	—	3	—	—	—	General purpose w/soft start	QFN-40	3.05
TPS65300	5.6 to 40	4	—	1	—	3	—	PMU w/soft start and voltage supervisor	HTSSOP-24, QFN-24	1.98
TPS65301	5.6 to 40	4	—	1	—	3	—	High-voltage PMU for automotive safety applications	HTSSOP-24, QFN-24	2.15
TPS65310A/11	4 to 40	5	—	2	1	1	SPI	Optimized for automotive safety	QFN-56	4.99
TPS65320	3.6 to 40	2	—	1	—	1	—	General purpose w/soft start and Eco-mode™	HTSSOP-14	1.45
TPS65381	5.8 to 36	5	—	1	—	4	SPI	PMU w/MCU interface for automotive safety	HTSSOP-32	2.57
TPS658629	2.9 to 5.5	14	Yes	3	—	11	I^2C	Advanced PMU	nFBGA-169	7.00
TPS659038	3.135 to 5.5	18	—	7	—	11	SPI, 2x I^2C	Advanced PMU for processor	nFBGA-169	8.00
TPS659039	3.135 to 5.5	13	—	7	—	6	SPI, 2x I^2C	Advanced PMU for processors J6, Vision 28 and OMAP57xx	nFBGA-169	7.60
TPS659119	2.7 to 5.5	11	—	3	—	8	I^2C, GPIOs	Advanced PMU w/embedded processor controller	HTQFP-80	4.49

**Suggested resale price in U.S. dollars in quantities of 1,000.*

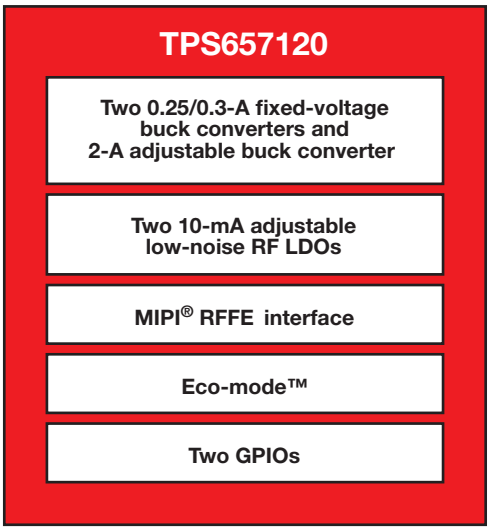
*New devices are listed in **bold red**. Preview devices are listed in **bold teal**.*

Multi-Output Power Management Units (PMUs)

Special Function PMUs

PMU for Baseband and RF-PA Power

TPS657120



Key Features

- V_{IN} range from 2.8 to 5.5 V
- Three step-down converters for RF transceiver power
- Dynamic voltage scaling
- Two low-noise RF LDOs with 1.2- to 3.4-V output-voltage range
- 16- to 26-µA quiescent current for converters, 32-µA for LDOs
- Bypass switch for powering RF-PA
- Eco-mode™
- Two GPIOs with 1-mA sink capability
- 26-MHz MIPI® RFFE interface
- Flexible power-up/down sequencing

Applications

- Data cards
- Smartphones

Get more information: **www.ti.com/product/TPS657120**

Selection Guide

Device	V_{IN} (V)	No. of Regulator Outputs	Charger	WLED Boost	DC/DC Step-Down Converter	LDO	DC/DC Step-Up Converter	Communication Interface	Description	Package(s)	Price*
LM10502	2.5 to 5.5	3	—	—	2	1	—	SPI	PMU for SSD memory	Micro SMD-34	0.90
LP3910	2.5 to 6	5	Linear	—	2	2	1	I²C	PMU for HDD-based media player	WQFN-48	2.11
LP3913	2.5 to 6	5	Linear	—	3	2	—	I²C	PMU for flash-based media player	WQFN-48	2.11
LP3918	3 to 5.5	7	Linear	—	—	7	—	I²C	Battery charge management PMU	DSBGA-25	0.53
LP3921	3 to 5.5	7	Linear	—	—	7	—	I²C	Battery management PMU for audio amp	WQFN-32	0.90
LP3923	3 to 5.5	8	Linear	—	—	8	—	I²C	Cell phone PMU	DSBGA-30	0.60
LP3925	2.5 to 4.5	18	Linear	—	3	15	—	I²C	High-performance PMU for handsets w/USB 2.0	DSBGA-30	1.40
LP3927	3 to 5.5	5	—	—	—	5	—	—	PMU for cellular/handsets	WQFN-28	2.16
TPS40490	6 to 60	1	Switch	—	1	—	—	—	Buck controller configured for GaN/Si FETs	QFN-28	6.00
TPS65030	2.5 to 6	1	—	—	—	1	—	—	Three charge pumps for USB OTG	25-ball chip scale	2.75
TPS65090	5.0 to 17.0	5	Switch	—	3	2	—	I²C	Front-end PMU for two to three Li-Ion in series	QFN-100	4.95
TPS65200	2.5 to 6.5	0	Switch	Yes	—	—	—	I²C	Front-end PMU with charger+WLED	WCSP, QFN	2.45
TPS65233	4.5 to 20	2	—	—	—	1	1	I²C	LNB voltage regulator for satellites	QFN-16	0.90
TPS65290	2.5 to 5.5	2	—	—	1	1	—	I²C	Meters, energy harvesting, +10-year battery	QFN-24	1.75
TPS65471	2.7 to 5.75	5	Linear	Yes	—	4	1	—	PMU for handheld devices	QFN-40	2.25
TPS65510	2.7 to 5.5	5	—	—	—	4	1	—	Battery-backup IC	QFN-16	1.50
TPS65530/30A	1.5 to 5.5	9	—	—	7	1	1	—	PMU for digital still cameras	QFN-48	3.90
TPS657120	2.8 to 5.5	—	—	—	3	2	—	MIPI® RFFE, 2x GPIO	PMU for baseband and RF-PA power	WCSP-30	1.95
TPS65735/x835	2.5 to 6.4	2	Linear	—	—	1	—	—	3D glasses, x835 with MSP430™	QFN-40	1.25
TPS658310	3.0 to 6.0	0	Switch	Yes	—	—	—	I²C	Front-end PMU with charger+flash+WLED	WCSP-49	3.45

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Multi-Output Power Management Units (PMUs)

Processor Attachment PMUs

Selection Guide

Device	V_{IN} (V)	No. of Regulator Outputs	Charger	Audio Codec	USB 2.0 OTG Transceiver	WLED Boost	DC/DC Step-Down Converter	DC/DC Step-Down Controller	LDO	Communication Interface	Description	Package(s)	Price*
ARM® Cortex™-R4													
TPS65381-Q1	5.8 to 36	5	—	—	—	—	1	—	4	SPI	Safety-critical applications	HTSSOP-32	2.57
ARM Cortex A8 PMUs													
LP3925	4.5 to 6.5	18	Linear	—	—	Yes	3	—	15	I^2C	Smartphone PMU	Micro SMD-81	1.40
LP3974	4.5 to 6.5	20	Linear	—	—	—	4	—	16	I^2C	Smartphone PMU	Micro SMD-100	2.46
TPS65023x	2.5 to 6.0	6	—	—	—	—	3	—	3	I^2C	Flexible 6-channel PMU, also WCSP package	QFN-40	2.95
TPS65024x	2.5 to 6	6	—	—	—	—	3	—	3	I^2C	Flexible 6-channel PMU	VQFN-32	2.60
TPS650250	2.5 to 6.0	6	—	—	—	—	3	—	3	—	Flexible PMU with adjustable V_{OUT}, optimized for AM335x	QFN-32	2.20
TPS65053	2.5 to 6.0	5	—	—	—	—	2	—	3	—	Low-cost 5-channel PMU, optimized for DM355x	QFN-24	1.95
TPS65070/2/3x	2.8 to 6.3	5	Linear	—	—	Yes	3	—	2	I^2C	With and without touch-screen controller, Jacinto 3	QFN-48	3.60
TPS65217x	2.7 to 6.5	7	Linear	—	—	Yes	3	—	4	—	Optimized for AM335x processors	QFN-48	3.45
TPS65910x	2.7 to 5.5	13	—	—	—	—	3	—	9	2x I^2C	Flexible PMU with 5-V boost	QFN-48	3.30
TPS65921	2.7 to 4.5	7	—	—	Yes	—	3	—	4	2x I^2C	Optimized for OMAP™35x processors	BGA-139	3.20
TPS65930	2.7 to 4.5	7	—	Yes	Yes	—	3	—	4	2x I^2C	Optimized for OMAP35x processors	BGA-139	3.80
TPS65950	2.7 to 4.5	13	Linear	Yes	Yes	—	3	—	10	2x I^2C	Optimized for OMAP35x processors	BGA-209	4.40
TPS65951	2.7 to 4.5	13	—	Yes	Yes	—	3	—	10	2x I^2C	Optimized for OMAP35x, 0.8-mm pitch	BGA-169	4.40
ARM Cortex A9 PMUs													
TPS65862x/4x	4.3 to 6.5	14	Linear	—	—	Yes	3	—	11	I^2C	Optimized for Tegra® 2	BGA-121	5.95
TPS659110/2/3/9	2.7 to 5.5	13	—	—	—	—	3	1	9	2x I^2C	With DC/DC controller up to 10 A, TPS659119 optimized for Jacinto 4/5 and Tegra 3	BGA-98	3.75
TPS65912x	2.3 to 5.5	14	—	—	—	—	4	—	10	I^2C/SPI	Flexible PMU with four DC/DC converters	WCSP-81	4.95
TWL6030/32/40/41	2.3 to 5.5	18	Switch	Yes	—	—	7	—	11	2x I^2C	OMAP 4 power and audio	FBGA + PBGA	4.30
ARM Cortex A15 PMUs													
TPS659038EP-Q1	3.15 to 5.5	12	—	—	—	—	7	—	5	2x I^2C	Cortex A15 processors, OMAP54xx	nFBGA, mrQFN-st	8.00
TPS659039-Q1	3.135 to 5.5	13	—	—	—	—	7	—	6	SPI, 2x I^2C	Advanced PMU for processors J6, Vision 28 and OMAP57xx	nFBGA-169	7.60
TPS65913	2.3 to 5.5	18	—	—	—	1	6	—	11	2x I^2C	Cortex A15 processors	WCSP, mrQFN	TBD
TWL6040/41	2.3 to 5.5	18	—	—	—	1	6	—	11	2x I^2C	OMAP 5 power and audio	WCSP, mrQFN	1.70/1.50

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*New devices are listed in **bold red**. Preview devices are listed in **bold teal**.*

Multi-Output Power Management Units (PMUs)

General Purpose PMUs

Selection Guide

Device	V_{IN} (V)	No. of Regulator Outputs	Charger	WLED Boost	DC/DC Step-Down Converter	LDO	Load Switches	Communication Interface	Description	Package(s)	Price*
LM10503	3 to 5.5	3	—	—	3	—	—	PWI™	Ideal for ASIC and SOC designs	WQFN-36	3.75
LM10504/6	3 to 5.5	4	—	—	3	1	—	SPI	Ideal for flash and SSDs	DSBGA-34	1.20
LM10524	3 to 5.5	3	—	—	3	—	—	SPI	Ideal for flash and SSDs	SMD-46	2.15
LM26400Y	3.0 to 20.0	2	—	—	2	—	—	—	Dual buck	LLP-16	2.10
LM26420	3 to 5.5	2	—	—	2	—	—	—	Dual 2.0-A buck	WQFN-16, HTSSOP-20	2.05
LM26480	2.8 to 5.5	4	—	—	2	2	—	—	General purpose	LLP-24	0.95
LM26484	3 to 5.5	3	—	—	2	1	—	—	General purpose	WQFN-24	0.70
LM3280	2.7 to 5.5	4	—	—	1	3	—	—	Battery-powered RF	SMD-16	0.65
LM3686	2.7 to 5.5	3	—	—	1	2	—	—	Low-power PMU	DSBGA-12	0.40
LM3687	2.7 to 5.5	3	—	—	1	1	—	—	Low-power PMU	DSBGA-9	0.40
LP3905	3 to 5.5	4	—	—	2	2	—	—	General purpose	WSON-14	1.17
LP3906	2.7 to 5.5	4	—	—	2	2	—	I^2C	General purpose	WQFN-24	1.17
LP3907	2.8 to 5.5	4	—	—	2	2	—	I^2C	General purpose	DSBGA-25, WQFN-24	0.95
LP3910	2.7 to 5.5	5	Linear	—	3	2	—	I^2C	Portable with buck-boost	LLP-48	2.11
LP3971/2	2.7 to 5.5	9	Backup	—	3	6	—	I^2C	PMU for advanced applications processors	WQFN-40	3.25
LP3974	2.7 to 5.5	15	Linear	—	4	11	—	I^2C	PMU for advanced applications processors	Micro SMD-100	2.46
LP8720	2.7 to 4.5	6	—	—	1	5	—	I^2C	General purpose	DSBGA-20	0.70
LP8725	2.6 to 4.5	9	—	—	2	7	—	I^2C	General purpose	DSBGA-30	1.29
TPS6500x	1.8 to 6.0	3	—	—	1	2	—	—	General purpose	QFN-16	1.40
TPS6501x	4.5 to 5.5	4	Linear		2	2	—	I^2C	General purpose	QFN-48	2.55
TPS65050/1/2/4/6	2.5 to 6.0	6	—	—	2	4	—	Logic H/L	Low-cost 6-channel PMU	QFN-32	1.75
TPS65053/8	2.5 to 6.0	5	—	—	2	3	—	—	Low-cost 5-channel PMU	QFN-24	1.65
TPS65250/1	4.5 to 18.0	3	—	—	3	—	—	—	General purpose	QFN-40	3.05
TPS65252	4.5 to 16.0	2	—	—	2	—	1	—	General purpose w/USB switch	QFN-28	1.95
TPS65253	4.5 to 16.0	2	—	—	2	—	—	—	General purpose w/integrated FETs	QFN-28	2.95
TPS65257/8	4.5 to 16	3	—	—	3	—	2	—	With 1/2 USB switches	QFN-40	3.25
TPS65261	4.5 to 18	3	—	—	—	3	—	—	General purpose triple buck converter	QFN-32	1.90
TPS65262	4.5 to 18	5	—	—	3	2	—	—	Triple buck converters with dual LDO	QFN	2.20
TPS65270	4.5 to 16.0	2	—	—	2	—	—	—	General purpose (3 A, 2 A), ideal for two layers	QFN-28	1.25
TPS65273V/6V/9V	4.5 to 18	2	—	—	2	—	—	I^2C	General purpose w/diff. current ratings	HTSSOP-32, QFN-36	2.95
TPS65280/1/2	4.5 to 18.0	1	—	—	1	—	2	—	With one to two power switches	QFN-24	1.95
TPS65287	4.4 to 18	4	—	—	3	—	1	—	Triple output buck with integrated USB high-power switch	QFN-40	2.45
TPS65288	4.5 to 18	5	—	—	3	—	2	—	Triple buck converters with two high-power switches	QFN-40	2.45
TPS65580/1	4.5 to 18	3	—	—	3	—	—	—	Advanced D-CAP2™	HTSSOP-20	0.65
TPS657051/2	3.3 to 6	3	—	—	2	1	—	—	PMU for embedded cameras	WCSP-16	1.20
TPS65708	3.6 to 6	4	—	—	2	2	—	—	PMU for embedded cameras	WCSP-16	1.65
TPS65720/1	4.3 to 28.0	2	Linear	—	1	1	—	I^2C	Smallest single-Li-Ion applications	WCSP-25, QFN	1.65
TPS65800/10/11/20	4.3 to 16	11	Linear	Yes	2	7	—	I^2C, three GPIOs	Advanced PMU w/ LED drivers	QFN-56	5.75

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Multi-Output Power Management Units (PMUs)

Embedded Processor Support

Embedded Processors Supported by TI Power Management Units (PMUs)

Processor	Part Number	PMU
TI	C2834x	TPS65000, TPS650061, TPS65300/301-Q1
TI	C55x	TPS65000x
TI	C6742/6/8	TPS65910, TPS65070, TPS65023-Q1
TI	C6745/7	TPS65910, TPS65023
TI	C6A814x	TPS659113
TI	C6A816x	TPS659112
TI	DM335, DM355, DM365, DM367	TPS65053, TPS65070/73
TI	DM368	TPS650532, TPS65023
TI	DM385	TPS659113
TI	DM37x 800MHz	TPS6595x/30/2x/10, TPS65023, TPS650731
TI	DM37x 1GHz	TPS65950A3/x51/x21B1/x10, TPS65023, TPS650731
TI	DM643x, DM644x	TPS65023-Q1, TPS659105
TI	DM812x/ DM814x	TPS659113
TI	DM816x	TPS659112
TI	AM17x	TPS65910, TPS65000x, TPS650061, TPS65023-Q1
TI	AM18x	TPS65910, TPS65000x, TPS650061, TPS65070/73
TI	AM335x	TPS65910A/A3, TPS65217/8, TPS650250-Q1
TI	AM35x	TPS65910, TPS650732-Q1, TPS65023-Q1
TI	AM37x 800MHz	TPS6595x/30/2x/10, TPS65023-Q1, TPS650731
TI	AM37x 1GHz	TPS65950A3/x51/x21B1/x10, TPS65023, TPS650731
TI	AM387x	TPS659113
TI	AM389x	TPS659112
TI	RM4x, TMS570	TPS65300/301-Q1, TPS6531x-Q1, TPS65381-Q1
TI	OMAP™3503/15/25/30	TPS6595x/30/2x/10, TPS65073x, TPS65023-Q1
TI	OMAP3611/21/30	TPS6595x/30/2x/10, TPS65023
TI	OMAP-L132, L137, L138	TPS65910, TPS65023, TPS650061, TPS65070
TI	OMAP4430/60/70	TWL6030/32, TWL6040/41 TPS659119-Q1
TI	OMAP543x	TWL6040/41, TPS659038-Q1
TI	Jacinto 3 (DRA5xx)	TPS650732-Q1
TI	Jacinto 4 (DRA64x)	TPS659119-Q1
TI	Jacinto 5 (DRA62x/65x)	TPS659119-Q1
TI	Jacinto 6 (DRA72x/74x)	TPS659038-Q1

Processor	Part Number	PMU
Altair	3100/6200	TPS659122
Ambarella	iOne	Please ask TI
Freescale	IMX25	TPS65051/2
Freescale	IMX27	TPS65053-Q1, TPS659107
Freescale	IMX35/37	TPS650250-Q1, TPS659107
Freescale	IMX508	TPS659108
Freescale	IMX51	TPS659109
Freescale	IMX53	TPS659106
Freescale	IMX6x	Please ask TI
Freescale[1]	Qorivva (57xx)	TPS65381-Q1
Freescale[1]	Qorivva (576x)	TPS65381-Q1
Infineon[1]	Aurix (TC27x)	TPS65381-Q1
Marvell	PXA270	TPS65021/2
Marvell	Armada	Please ask TI
Nvidia	Tegra 2	TPS658621/2/3, TPS658640/3, TPS658629-Q1
Nvidia	Tegra 3	TPS659110/9, TPS659119-Q1
Nvidia	Tegra 4	TPS65913
Nvidia	Tegra 4 (SP30)	TPS65712x, LP8755
Nvidia	i450, i500	TPS659121
Renesas[1]	RH850/V850	TPS65381-Q1
Rockchip	RK29	TPS659102
Rockchip	RK30	TPS659102
Samsung	S5PV210, S5PC110	TPS659101
Samsung	S5PC100	TPS659103, LP3974
Samsung	S5P6440	TPS659104
Samsung	S5PV310	Please ask TI
Samsung	Exynos 4210	Please ask TI
STM	SPEAr 300	TPS650532
STM	SPEAr 1310	Please ask TI

[1] *Automotive-only processor.*

Reference designs for these TI processor families are available online. Bookmark these pages to find new designs for the latest DSP and microprocessor generations.

PMU solutions with and without battery charger:
www.ti.com/pmu

TI power-management reference designs:
www.ti.com/processorpower

Power Protection, Distribution and Monitoring
Overview

Distributing and controlling power—even after the correct voltage is derived—is becoming more complex. Because increasing numbers of voltage rails are required in today's advanced processing or embedded systems, distributing and managing these rails is a constant challenge.

Load switches, MUXes, or inrush-protection devices are routinely required to safely route power where it is needed and deliver it properly. When power needs to be moved from system to system, issues like hot-swap control, safety certification, and monitoring quickly become top priorities.

Digital control takes all of these concerns and capabilities to yet another level. Microprocessor control and monitoring in system health and power blocks gives designers even more options to improve the robustness of their system. Using digital interfaces to various functional blocks and sensors, it is possible to monitor the power or current consumption, system temperature, or other variables, and then take action.

eFuses, Hot-Swap Control, Protection and Monitoring

Power management has become a focus area in applications demanding higher efficiency, accurate monitoring, and lower costs. The traditional function of hot-swap controllers (allowing the plugging in and unplugging of loads in live systems) has expanded to include programmable protection from all types of misbehaving loads and supplies. This might include protection from short circuits, overvoltage, undervoltage, lightning surges or a failed load. Different systems have different power-management requirements, and TI has solutions for all types of applications ranging from automotive to zero-downtime systems.

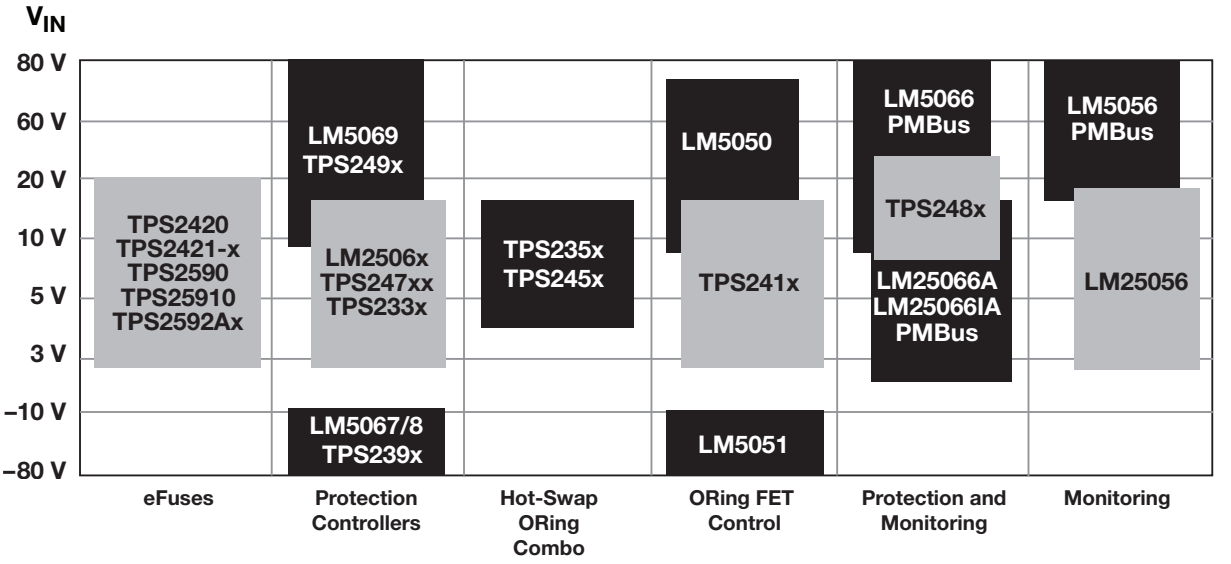
The single-rail system has become quite rare as today's electronics rely on multiple voltages to power processors, interfaces, fans and displays. More often than not, there are specific requirements regarding ramp rates, turn-on/off sequencing and fault reporting. TI solutions support these systems at all popular voltages and currents.

As power densities continue to climb, so does the demand for detailed real-time knowledge about system behavior. In these applications, TI's monitoring and protection devices can deliver current monitoring with up to ½% accuracy.

Monitors are available with and without protection functions.

To satisfy the demand for small, easy-to-use protection devices, TI has developed a family of UL-recognized eFuses well suited to applications under 20 V and 12 A. TI eFuses have internal FETs with built-in thermal protection and, in some cases, active FET SOA protection. This rapidly growing family is finding homes in many applications such as HDDs, SSDs, NIC cards, fan control and server AUX power.

Protection Power Portfolio



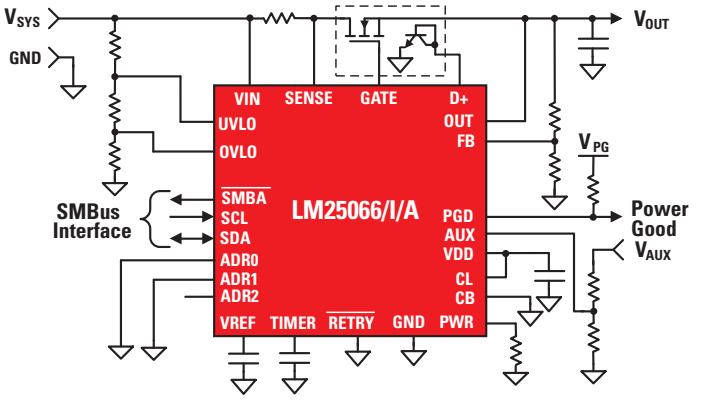
Power Protection, Distribution and Monitoring

eFuses, Hot-Swap Control, Protection and Monitoring

System Power Management and Protection IC with PMBus

LM25066, LM25066I, LM25066A

TI's PMBus-enabled system protection and management products combine hot swap control with embedded telemetry measurement, intelligence, and digital communications which enable them to deliver accurate power usage data back to the system to optimize power consumption, reduce operating expenses, and increase reliability



Typical application circuit.

Get more information: **www.ti.com/product/LM25066**

Key Features

- Intel Node Manager 2.0 compliant
- Hot swap with current and power limiting
- Adjustable current limit, circuit breaker thresholds
- Measure voltage, current, power and temperature
- Simultaneous sampling of current and voltage for true power measurement
- Peak and programmable average power capture
- Dynamic configuration of fault and warning levels
- I^2C/SMBus interface with PMBus compliance

Applications

- Server backplane systems
- Base station power distribution systems
- Solid-state circuit breakers

eFuse (Integrated FET) Selection Guide

Device	Description	Channels	V_{IN} (min) (V)	V_{absmax_cont} (V)	Current-Limit Threshold (typ) (A)	Fault Response	R_{ON} (mΩ)	ON_OFF Control Input(s)	Status Output	Package(s)	Price*
TPS2420	3- to 20-V, 2- to 5-A eFuse with load current monitoring	1	2.9 to 20	25	1 to 5	Prog	30	EN\	FLT, IMON, PG	16 QFN	1.38
TPS2421-1/2	3- to 20-V, 2- to 5-A eFuse	1	2.9 to 20	25	1 to 5	Latch/Retry	33	EN\	FLT, PG	8SO PowerPAD™	1.06
TPS24750/1	2.5- to 18-V, 12-A eFuse, current limit at startup only	1	2.5 to 18	30	Adjustable	Latch/Retry	3	ENUV	FLT, IMON, PG\	36 VQFN	1.80
TPS2590	3- to 20-V, 0- to 6.5-A eFuse	1	2.9 to 20	25	1 to 5	Prog	30	EN\	FLT	16 QFN	0.90
TPS25910	3- to 20-V, 2- to 6.5-A eFuse with dV/dt control	1	2.9 to 20	22	0.8 to 6.5	Auto Retry	30	EN\	FLT	16 QFN	0.90
TPS2592AL/AA	12-V, 2- to 5-A eFuse/surge clamp with block FET driver	1	4.5 to 13.8	20	2 to 5	Latch/Retry	28	ENUV	—	10 SON	0.55
TPS2592BA/BL	5-V, 2- to 5-A eFuse/surge clamp with block FET driver	1	4.5 to 5.5	20	2 to 5	Latch/Retry	28	ENUV	—	10 SON	0.55
TPS2592ZA	19-V, 2- to 5-A eFuse with block FET driver	1	4.5 to 19	20	2 to 5	Auto Retry	28	ENUV	—	10 SON	0.55
UCC2912	3- to 8-V , 0- to 3-A single hot-swap IC high-side MOSFET	1	3 to 8	8	IFAULT +1 or 4 A	Auto Retry	150	SHTDWN\	FLT\	16 SOIC, 24 TSSOP	3.25
UCC2915	7- to 15-V, 0- to 3-A high-side MOSFET, 100-µA I_Q	1	7 to 15	15.5	IFAULT +1 or 4 A	Auto Retry	150	SHTDWN\	FLT\	16 SOIC	5.00
UCC3912	3- to 8-V, 0- to 3-A single hot-swap IC high-side MOSFET	1	3 to 8	8	IFAULT +1 or 4 A	Auto Retry	150	SHTDWN\	FLT\	16 SOIC, 24 TSSOP	2.30
UCC3915	0- to 3-A, 7- to 15-V high-side MOSFET, 100-µA I_Q	1	7 to 15	15.5	IFAULT +1 or 4 A	Auto Retry	150	SHTDWN\	FLT\	16 SOIC, 24 TSSOP	2.55
UCC3916	4- to 6-V, 1.65-A high-side MOSFET for SCSI	1	4 to 6	6	2	Auto Retry	220	SHTDWN\	FLT	8 SOIC	2.55
UCC3918	3- to 6-V, 0- to 4-A low R_{ON} high-side protection	1	3 to 6	8	0.5 to 5	Auto Retry	75	SHTDWN\	FLT\	16 SOIC	2.35
TPS2556/7	2.5- to 6.5-V, 0.5- to 5-A precision limit eFuse	1	2.5 to 6.5	7	0.5 to 5	Auto Retry	22	1L/1H	FLT\	8 QFN	0.90
TPS2560/A	2.5- to 6.5-V, 0.25- to 2.8-A dual precision limit eFuse	2	2.5 to 6.6	7	0.25 to 2.8	Auto Retry	44	2L	FLT\	10 QFN	0.90
TPS2561/A	2.5- to 6.5-V, 0.25- to 2.8-A dual precision limit eFuse	2	2.5 to 6.7	7	0.25 to 2.8	Auto Retry	44	2H	FLT\	10 QFN	0.90

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Power Protection, Distribution and Monitoring

eFuses, Hot-Swap Control, Protection and Monitoring

Hot Swap Controllers (External FET) Selection Guide

Device	Target Applications	Channels	V_{IN} Range (V)	Features[1]							Ramp	Power Limiting	Package(s)	Price*
				Enable/ Shutdown	UV	OV	Fault	PG	Latch	Auto Retry				
TPS2300/01	CompactPCI®, general	2	3 to 13/3 to 5.5	1L/1H	✔		✔	✔	✔		Voltage	No	20-pin TSSOP	1.60
TPS2310/11	CompactPCI, general	2	3 to 13/3 to 5.5	1L/1H	✔		✔	✔	✔		Voltage	No	20-pin TSSOP	1.60
TPS2320/21	CompactPCI, general	2	3 to 13/3 to 5.5	1L/1H	✔		✔	✔	✔		Voltage	No	16-pin SOIC/TSSOP	1.35
TPS2330/31	CompactPCI, general	1	3 to 13	1L/1H	✔		✔	✔	✔		Voltage	No	14-pin SOIC/TSSOP	1.25
TPS2342	CompactPCI, PCI-X®, PC-X2.0	12	3.3, V_{aux}, V_{IO}, 5, +12, –12	1L	✔			✔	✔		Voltage	No	80-pin HTQFP	7.00
TPS2350	Full featured –48-V telecom, LS active ORing	2	–12 to –80	1H	✔	✔	✔	✔		✔	Current	No	14-pin SOIC/TSSOP	1.90
TPS2358	xTCA mezzanine cards, general 12 V	2	8.5 to 17	2L	✔		✔	✔	✔		Current	No	48-pin QFN	4.00
TPS2359	xTCA mezzanine cards, general 12 V	2	8.5 to 17	1H/1L	✔	✔	✔	✔	S[2]	S[2]	Current	No	36-pin QFN	5.00
TPS2363	PCI Express®	6	3.3 V_{aux}, 3.3, +12	1L	✔		✔	✔	✔		Voltage	No	48-pin QFP	2.50
TPS2390	Simple –48-V telecom	1	–36 to –80	1H			✔		✔		Current	No	8-pin MSOP	1.00
TPS2391	Simple –48-V telecom	1	–36 to –80	1H			✔			✔	Current	No	8-pin MSOP	1.00
TPS2392	Full featured –48-V telecom	1	–20 to –80	1H	✔	✔	✔	✔	✔		Current	No	14-pin TSSOP	1.35
TPS2393	Full featured –48-V telecom	1	–20 to –80	1H	✔	✔	✔	✔		✔	Current	No	14/44-pin TSSOP	1.35
TPS2393A	Full featured –48-V telecom (Fast retry)	1	–20 to –80	1H	✔	✔	✔	✔		✔	Current	No	14-pin TSSOP	1.35
TPS2394	Full featured, ESD ruggedized –48-V hotswap	1	–12 to –80	1H	✔	✔	✔	✔		✔	Current	No	14-pin TSSOP	1.35
TPS2398	Simple –48-V telecom with PG	1	–36 to –80	1H				✔	✔		Current	No	8-pin MSOP	1.35
TPS2399	Simple –48-V telecom with PG	1	–36 to –80	1H				✔		✔	Current	No	8-pin MSOP	1.35
TPS2400	Overvoltage/undervoltage protection IC	1	2 to 100	1H	✔	✔			✔		—	No	5-pin SOT-23	0.80
TPS2456/A	Inrush controller with reverse current control	2	8.5 to 15	2H	✔		✔	✔	✔		Current	No	36-pin QFN	3.75
TPS2458	xTCA mezzanine cards, general 12 V	1	8.5 to 15	1L	✔		✔	✔	✔		Current	No	32-pin QFN	2.00
TPS2459	xTCA mezzanine cards, general 12 V	1	8.5 to 15	1H/1L	✔	✔	✔	✔	S[2]	S[2]	Current	No	32-pin QFN	2.50
TPS24700	Industrial, mass storage, servers, telecom	1	2.5 to 18	1H	✔			✔	✔		Current	No	8-pin MSOP	1.10
TPS24701	Industrial, mass storage, servers, telecom	1	2.5 to 18	1H	✔			✔		✔	Current	No	8-pin MSOP	1.10
TPS24710	Industrial, mass storage, servers, telecom	1	2.5 to 18	1H	✔		L	L	✔		Current	Yes	10-pin MSOP	1.25
TPS24711	Industrial, mass storage, servers, telecom	1	2.5 to 18	1H	✔		L	L		✔	Current	Yes	10-pin MSOP	1.25
TPS24712	Industrial, mass storage, servers, telecom	1	2.5 to 18	1H	✔		H	H	✔		Current	Yes	10-pin MSOP	1.25
TPS24713	Industrial, mass storage, servers, telecom	1	2.5 to 18	1H	✔		H	H		✔	Current	Yes	10-pin MSOP	1.25
TPS24720	Industrial, mass storage, servers, telecom	1	2.5 to 18	1H	✔	✔	✔	✔	S[2]	S[2]	Current	Yes	16-pin SON	1.40
TPS2490	Servers, basestations, +48 V, +12 V	1	9 to 80	1H	✔			✔	✔		Current	Yes	10-pin MSOP	1.40
TPS2491	Servers, basestations, +48 V, +12 V	1	9 to 80	1H	✔			✔		✔	Current	Yes	10-pin MSOP	1.40
TPS2492	Servers, basestations, industrial, +48 V, +12 V	1	9 to 80	1H	✔	✔	✔	✔	✔		Current	Yes	14-pin TSSOP	1.45
TPS2493	Servers, basestations, industrial, +48 V, +12 V	1	9 to 80	1H	✔	✔	✔	✔		✔	Current	Yes	14-pin TSSOP	1.45
LM25069	12-V hotswap controller with power limiting	1	2.9 to 17	1H	✔	✔	✔	H	-1	-2	Current	Yes	10-pin MSOP	1.19
LM25061	12-V hotswap controller with power limiting	1	2.9 to 17	1H	✔		✔	H	-1	-2	Current	Yes	10-pin MSOP	1.33
LM5060/Q	Low Iq high-side protection controller	1	5.5 to 65	1H	✔	✔	✔	L	✔		Voltage	No	10-pin MSOP	1.28/1.40
LM5069	+48-V hotswap controller with power limiting	1	9 to 80	1H	✔	✔	✔	H	-1	-2	Current	Yes	10-pin MSOP	1.35
LM5068	Simple –48-V hotswap controller family	1	–10 to –90	1H	✔	✔	✔	H/H/L/L	-1/-3	-2/-4	Current	No	8-pin MSOP	1.35
LM5067	–48-V hotswap controller with power limiting	1	–9 to –80	1H	✔	✔	✔	H	-1	-2	Current	Yes	10-pin MSOP/14-pin SOIC	1.50

[1] *Pin function: L = active low, H = active high.*
[2] *S = Selectable.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Power Protection, Distribution and Monitoring

eFuses, Hot-Swap Control, Protection and Monitoring

Protection and Monitoring with PMBus/I²C Selection Guide

Device	V_{IN} Range (V)	Enable/ Shutdown	UV	OV	Fault	PG	Latch	Auto Retry	Interface	FET SOA Protection	Package(s)	Price*
LM25066/A	2.9 to 17	1H	✔	✔	✔	✔	Prog	Prog	I²C, SMBus, PMBus	Yes	24-pin LLP	2.33/2.80
LM25066I/A	2.9 to 17	1H	✔	✔	✔	✔	Prog	Prog	I²C, SMBus, PMBus	Yes	24-pin LLP	2.33/2.80
TPS2480/1	9 to 24	1H	✔			✔	Prog	Prog	I²C	Yes	20-pin TSSOP	2.50
TPS2482/3	9 to 36	1H	✔			✔	Prog	Prog	I²C	Yes	20-pin TSSOP	3.00
LM5066	10 to 80	1H	✔	✔	✔	✔	Prog	Prog	I²C, SMBus, PMBus	Yes	28-pin eTSSOP	3.95
LM5064	–10 to –80	1H	✔	✔	✔	✔	Prog	Prog	I²C, SMBus, PMBus	Yes	28-pin eTSSOP	3.45

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Monitoring with PMBus/I²C Selection Guide

Device	V_{IN} Range (V)	Enable/ Shutdown	Fault	Telemetry Data				Interface	Package(s)	Price*
				V_{IN}	I_{IN}	P_{IN}	Temp			
LM25056/A	3 to 17	1H	✔	✔	✔	✔	✔	I²C, SMBus, PMBus	24-pin LLP	1.50/1.70
LM5056	10 to 80	1H	✔	✔	✔	✔	✔	I²C, SMBus, PMBus	28-pin TSSOP	2.49

**Suggested resale price in U.S. dollars in quantities of 1,000.*

ORing Controllers Selection Guide

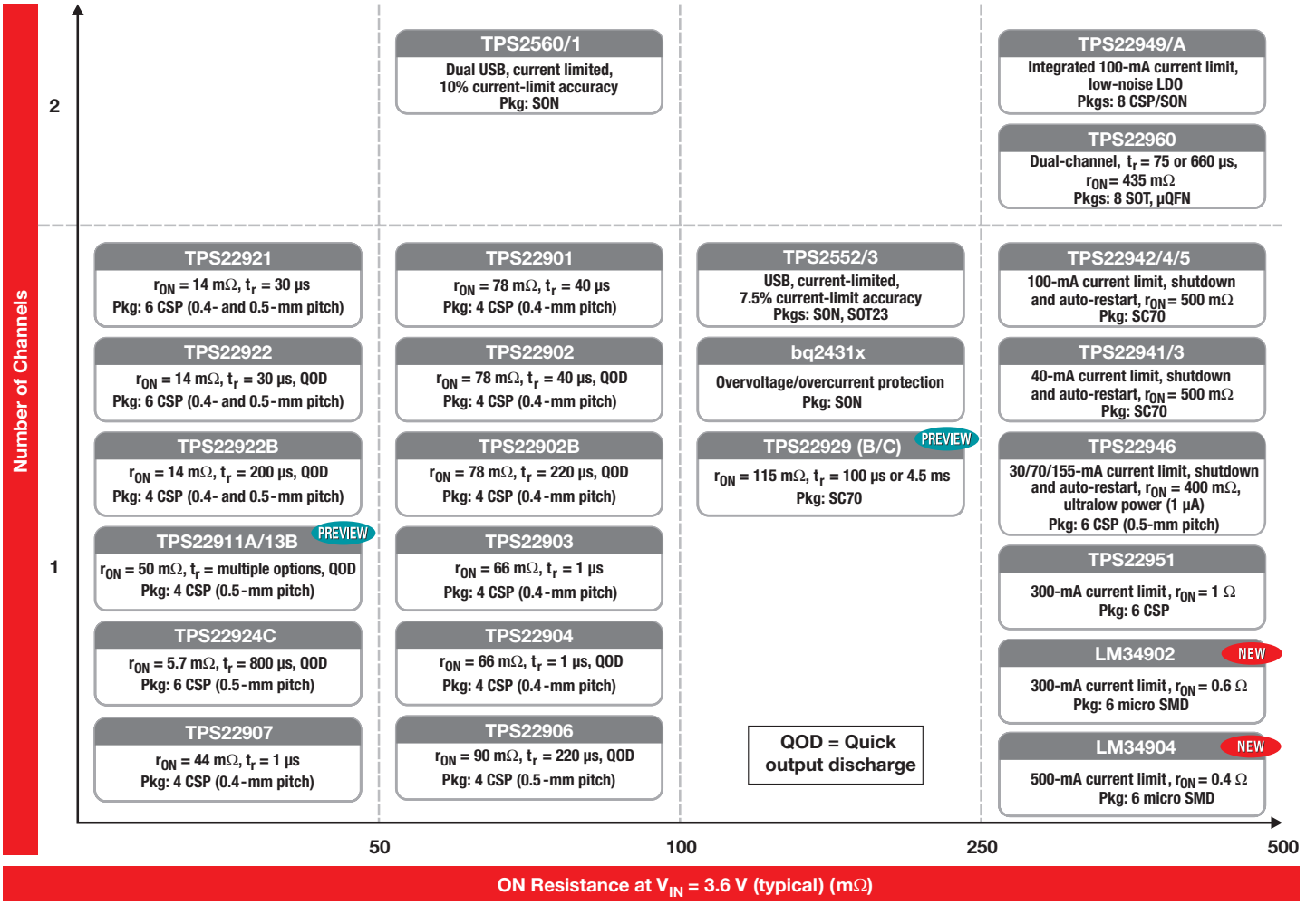
Device	Description	Channels	V_{IN} Range (V)	Enable/ Shutdown	UV	OV	Fault	PG	ORing Linear Gate Drive	On/Off ORing Function	Package(s)	Price*
TPS2410	ORing FET controller/MUX controller	1	0.8 to 16.5	1H	✔	✔	✔	✔	✔		14-pin TSSOP	1.70
TPS2411	ORing FET controller/MUX controller	1	0.8 to 16.5	1H						✔	14-pin TSSOP	1.70
TPS2412	ORing FET controller	1	0.8 to 16.5						✔		8-pin SOIC, 8-pin TSSOP	1.20
TPS2413	ORing FET controller	1	0.8 to 16.5							✔	8-pin SOIC, 8-pin TSSOP	1.20
TPS2419	ORing FET controller with OV/enable	1	3 to 16.5	1H		✔				✔	8-pin SOIC	1.20
LM5050-1	Positive HV ORing controller with AUX input	1	5 to 80	L					✔	✔	6-pin TSOT	1.25
LM5050-2	Positive HV ORing controller with FET test	1	6 to 80	L			✔		✔	✔	6-pin TSOT	1.25
LM5051	Negative HV ORing controller with FET test	1	–6 to –100	L			✔		✔	✔	8-pin SOIC	1.25
TPS2456/A	Inrush/reverse current controller for dual sources	2	8.5 to 15	2H	✔		✔	✔	✔		36-pin QFN	3.45
TPS2358	Dual 12-V/3.3-V hotswap/ORing controller	2	8.5 to 15	2L							48-pin QFN	4.00
TPS2359	Dual 12-V/3.3-V hotswap/ORing controller	2	8.5 to 15	Via I²C							36-pin QFN	5.00

**Suggested resale price in U.S. dollars in quantities of 1,000.*

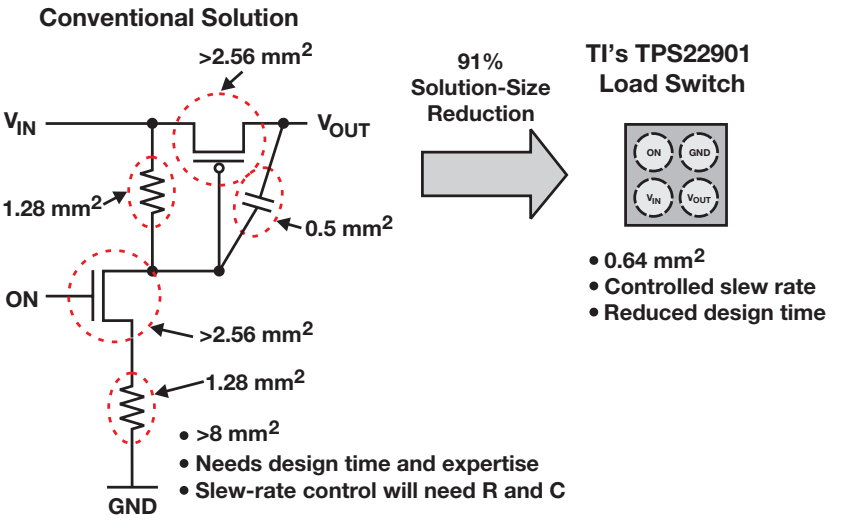
Power Protection, Distribution and Monitoring

Current-Limited and Non-Current-Limited Load Switches

Portable Electronics Integrated Load Switches Product Portfolio



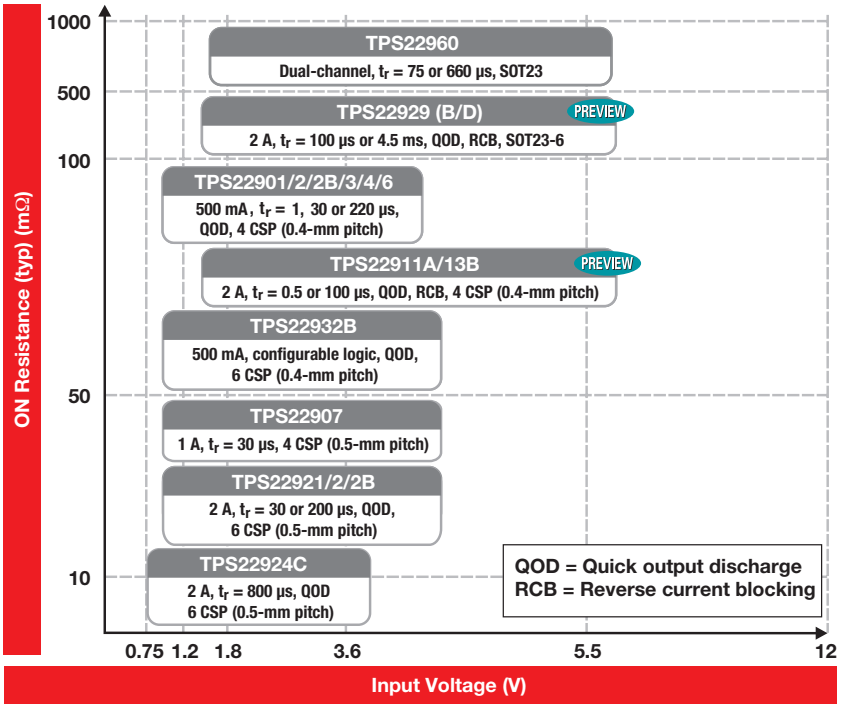
The Integration/Size Advantage of Load Switches



Power Protection, Distribution and Monitoring

Current-Limited and Non-Current-Limited Load Switches

Non-Current-Limited Load Switches Product Portfolio



Selection Guide

Device	Input Voltage Range (V)	Number of Channels	r_{ON} at 3.6 V (mΩ)	Output Rise Time (µs)	Quick Output Discharge	Max Output Current	Enable	Package(s)	Price*
Non-Current-Limiting Load Switches									
TPS22901	1.0 to 3.6	1	78	40	No	500 mA	Active high	CSP (0.8x0.8 mm)	0.32
TPS22902/B	1.0 to 3.6	1	78	40/220	Yes	500 mA	Active high	CSP (0.8x0.8 mm)	0.32
TPS22903	1.1 to 3.6	1	66	1	No	500 mA	Active high	CSP (0.8x0.8 mm)	0.32
TPS22906	1.0 to 3.6	1	90	220	Yes	500 mA	Active high	CSP (0.9x0.9 mm)	0.32
TPS22907	1.1 to 3.6	1	44	36	No	1 A	Active high	CSP (0.9x0.9 mm)	0.38
TPS22921	0.9 to 3.6	1	14	30	No	2 A	Active high	CSP (0.8x1.2 mm or 0.9x1.4 mm)	0.43
TPS22922/B	0.9 to 3.6	1	14	30/200	Yes	2 A	Active high	CSP (0.8x1.2 mm or 0.9x1.4 mm)	0.43
TPS22924B/C	0.75 to 3.6	1	18.3	100/800	Yes	2 A	Active high	CSP (0.9x1.4x0.4/0.5 mm)	0.28
TPS22920	0.75 to 3.6	1	5.3	800	Yes	4 A	Active high	CSP, 0.9x1.9 mm	0.34
TPS22966	0.8 to 5.5	2	15	Adj.	Yes	6 A	Active high	SON-14, 3x2 mm	0.44
Non-Current-Limiting Load Switches with Reverse Current Protection									
TPS22910A	1.4 to 5.5	1	61	1	No	2 A	Active low	CSP (0.9x0.9x0.5 mm)	0.24
TPS22913B	1.4 to 5.5	1	61	100	Yes	2 A	Active high	CSP (0.9x0.9x0.5 mm)	0.24
TPS22913C	1.4 to 5.5	1	61	1000	Yes	2 A	Active high	CSP (0.9x0.9x0.5 mm)	0.24
TPS22912C	1.4 to 5.5	1	61	1000	No	2 A	Active high	CSP (0.9x0.9x0.5 mm)	0.24
TPS22929D	1.4 to 5.5	1	115	4000	Yes	2 A	Active high	SOT23-6 (3x3 mm)	0.24

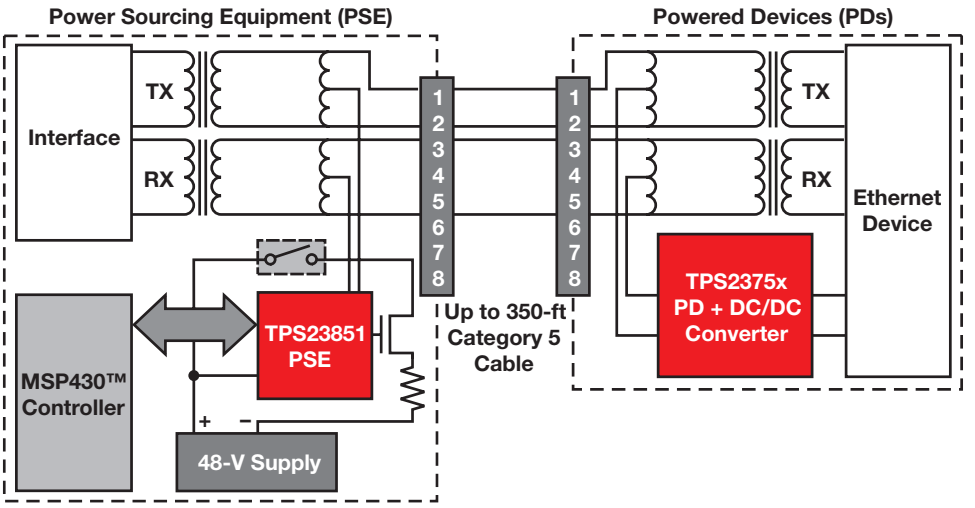
Device	Input Voltage Range (V)	r_{ON} at 1.8 V (Ω)	Current Limit (mA)	Current-Limit Blanking Time (ms)	Auto-Restart Time (ms)	Active	Package(s)	Price*
Current-Limiting Load Switches								
TPS22941	1.62 to 5.5	1.1	40	10	80	Low	5 SC70	0.42
TPS22942	1.62 to 5.5	1.1	100	10	80	Low	5 SC70	0.42
TPS22943	1.62 to 5.5	1.1	40	0	—	High	5 SC70	0.42
TPS22944	1.62 to 5.5	1.1	100	0	—	High	5 SC70	0.42
TPS22945	1.62 to 5.5	1.1	100	10	80	High	5 SC70	0.42
TPS22946	1.62 to 5.5	0.6	155/70/30	10	70	High	6 CSP	0.55
TPS22949/A	1.62 to 4.5	1	100	12	70	High	8 CSP/SON	0.70
TPS22951	2.8 to 5.3	1	600	—	—	High	6 CSP	0.45
LM34902/4	2.8 to 5.3	0.6/0.4	300/500	—	—	High	micro SMD-6	0.29/0.33

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Power Protection, Distribution and Monitoring

Power-over-Ethernet (PoE)

The concept of providing power along with data is as old as basic telephone service, but the formal standard for providing power along Ethernet lines is much more recent. Though the original Power-over-Ethernet (PoE) specification was approved in 2005, the IEEE ratified a superseding standard in summer 2009—the IEEE 802.3at. Both standards specify behavior for devices receiving power across Ethernet lines, known as powered devices (PDs), and methods for injecting power onto the line, used in equipment known as power sourcing equipment (PSE).



TPS23851 and TPS23752 maximize light-load efficiency using programmable synchronous rectifier shutoff and variable-frequency operation.

Original PoE . . . Only Better!

The vast majority of PoE applications need less than 12.95 W. For this growing market area, TI has a large portfolio of options to consider.

TPS23753A

- Simplest, most elegant, lowest-cost solution for a standard PoE PD
- Incorporates rugged tolerance for extended ESD exposure
- Auxiliary power supplies are fully supported—down to 12 V

TPS23750

- TI's original PD front end plus DC/DC converter
- Supports simple, low-cost, non-isolated buck-converter topologies with no transformer required

TI has a family of IEEE 802.3at compliant PoE solutions for all power levels, including those above 13 W.

Get more information: **www.ti.com/poe**

IEEE 802.3at PoE High-Power PD Interface

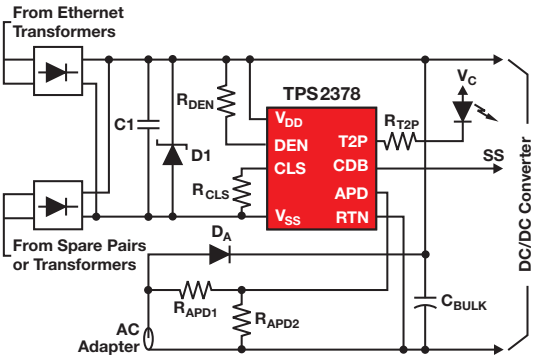
TPS2378, TPS2379

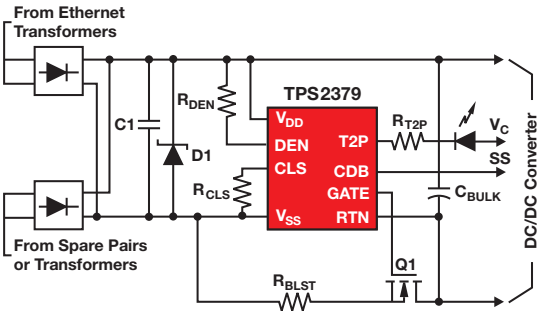
The TPS2378 and TPS2379 are IEEE 802.3at compliant, type 2 PoE PDCs targeted specifically for high-power PDs such as surveillance-system cameras and wireless access points.

The TPS2378 and TPS2379 enable nonstandard, 51-W (four-pair) PDs such as Cisco UPOE™ in either forced (TPS2378) or LLDP-based (TPS2379) modes.

Key Features

- TPS2378: Supports high-power auxiliary adapters (APD pin)
- TPS2378: Forced UPOE (SLVA625)
- TPS2379: Gate drive for external booster NFET allowing high-power expansion (GATE pin)
- TPS2379: LLDP UPOE (SLVA498)
- Start-up control for the DC/DC converter (CDB pin)
- IEEE 802.3at compliant
- 100-V monolithic process





Get more information: **www.ti.com/product/TPS2378** or **TPS2379**

Power Protection, Distribution and Monitoring

Power-over-Ethernet (PoE)

Selection Guide

Device	Description	Abs Max V_{IN} (V)	Operating Temp (°C)	Full Inrush Current Limiting	Current Limit (mA)	Second Gate Driver for Maximum Efficiency	Package(s)	Price*
Power-over-Ethernet (PoE) Powered Device (PD) Controllers with Integrated DC/DC Controllers								
TPS23750/70	Integrated PD with PWM controller	100	–40 to 85	Fixed	405	No	TSSOP-20	1.50
TPS23753A	PD+controller with AUX ORing	100	–40 to 85	Fixed	405	No	TSSOP-14	1.45
TPS23754/6	High-power PD + high-efficiency controller	100	–40 to 125	Fixed	850	Yes	TSSOP-20 PowerPAD™	1.90
TPS23757	PD + high-efficiency controller	100	–40 to 125	Fixed	405	Yes	TSSOP-20	1.65
TPS23751/2	PD with Green Mode PWM	100	–40 to 85	Fixed	800	No - VF	TSSOP-20	1.50
LM5070	Integrated PD with PWM controller	80	–40 to 125	Prog	500	No	TSSOP-16	1.45
LM5071	Integrated PD with PWM controller and AUX interface	80	–40 to 125	Fixed	390	No	TSSOP-16	1.45
LM5072	Integrated PD with PWM controller and AUX control	100	–40 to 125	Prog	800	No	TSSOP16	1.85

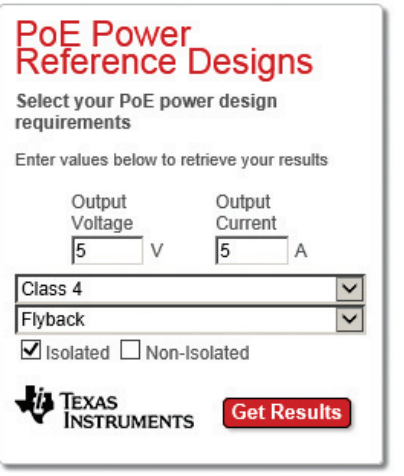
Device	Description	Detection	Classification	Abs Max V_{IN} (V)	Operating Temp (°C)	Full Inrush Current Limiting	Current Limit (mA)	Auto Retry or Latch Off in Fault	UVLO	DC/DC Interface	Package(s)	Price*
Power-over-Ethernet (PoE) Powered Device (PD) Interface Front-End Controllers												
TPS2375/-1	Powered device controller	4	Yes, Class 0-4	100	–40 to 85	Programmable	450	Latch Off/Retry	802.3af (30.6/39.4 V)	PG	SOIC-8, TSSOP-8/TSSOP-8	1.00
TPS2376	Powered device controller	4	Yes, Class 0-4	100	–40 to 85	Programmable	450	Latch Off	Adjustable	PG	SOIC-8, TSSOP-8	1.00
TPS2376-H	High-power PD controller	4	Yes, Class 0-4	100	–40 to 85	Programmable	600	Auto Retry	Adjustable	PG	SOIC-8	1.25
TPS2377	Powered device controller	4	Yes, Class 0-4	100	–40 to 85	Programmable	450	Latch Off	Legacy (30.5/35.0 V)	PG	SOIC-8, TSSOP-8	1.00
TPS2377-1	Powered device controller	4	Yes, Class 0-4	100	–40 to 85	Programmable	450	Auto Retry	Legacy (30.5/35.0 V)	PG	SOIC-8	1.00
TPS2378	PD with AUX control	4	Yes, Class 0-4	100	–40 to 85	Fixed	800	Auto Retry	30.5/35	PG	SOIC-8	1.00
TPS2379	PD with high power	4	Yes, Class 0-4	100	–40 to 85	Fixed	800	Auto Retry	30.5/35	PG	SOIC-8	1.00
LM5073	PD controller w/AUX control	4	Yes, Class 0-4	100	–40 to 85	Programmable	800	Auto Retry	Adjustable	PG	TSSOP-14	1.30

Device	Applications	Channels	Abs Max V_{IN} (V)	Operating Temp (°C)	IEEE Compliant	Interface	Disconnect	Measurements	Power FET	Package	Price*
Power-over-Ethernet (PoE) Power Sourcing Equipment (PSE) Controllers											
TPS2384	Routers, switches, SOHO hubs, midspans	4	80	–40 to 125	802.3af	I^2C	Both AC and DC	Current, voltage, capacitance and temperature	Internal	64-pin LQFP	4.75
TPS23841	Proprietary, higher-power 24-V/48-V PoE switches, hubs, midspans	4	80	–40 to 125	802.3af	I^2C	Both AC and DC	Current, voltage, capacitance and temperature	Internal	64-pin LQFP	7.50
TPS23851	High power PoE for switches, hubs, midspans and industrial applications	4	70	–20 to 125	802.3at Type 1 & 2	I^2C	Both AC and DC	Current, voltage and temperature	External	36-pin SSOP	4.50

Reference Design	Description	Device	V_{IN} (VAC)	V_{OUT} (V) at I_{OUT} (A)	Class	Topology	Efficiency (%)
Power-over-Ethernet (PoE) Reference Designs							
PMP5592	Positive-referenced PoE buck	**TPS23750**	36 to 57	3.3 V at 0.6 A	1	Non-isolated buck, upside down	74
PMP8752	Multiple-output, high-efficiency flyback converter	**TPS23785B, TLV431A, CSD17507Q5A**	36 to 57	3.3 V at 0.7 A, 5 V at 0.145 A	1	Isolated synchronous flyback	89

**Suggested resale price in U.S. dollars in quantities of 1,000.*

Check for reference designs similar to your application: **www.ti.com/poe**



Power Protection, Distribution and Monitoring
Power-over-Ethernet (PoE)

Power-over-Ethernet (PoE) Evaluation Modules

EVM Name[1]	Topology Description	Input-Voltage Source(s)	Output Power	Class	Efficiency at Full Load: DC/DC Converter at V_{IN} PoE End-to-End
TPS23753AEVM-001 (HPA304)	CCM/DCM flyback diode rectifier	PoE, 24/48-V adapters. 12-V adapter at reduced output power.	7 W (5 V, 1.4 A)	3	82% at 48 V, 80% at PoE 48 V
TPS23750EVM-107 (HPA107)	Low-side buck	PoE, 48-V adapters	10 W (5 V, 2 A)	3	84% at 44 V, 80% at PoE 48 V
TPS23750EVM-107 (HPA107)	Low-side buck	PoE, 48-V adapters	10 W (3.3 V, 2.5 A)	3	79% at 44 V, 75% at PoE 48 V
TPS23750EVM-108 (HPA108)	CCM flyback synchronous rectifier (self-driven)	PoE, 48-V adapters	10 W (3.3 V, 3 A)	3	84% at 44 V, 81% at PoE 48 V
TPS23750EVM-108 (HPA108)	CCM flyback synchronous rectifier (self-driven)	PoE, 48-V adapters	10 W (5 V, 2 A)	3	84% at 44 V, 80% at PoE 48 V
TPS23753AEVM-004 (HPA305)	CCM flyback synchronous rectifier (self-driven)	PoE, 24/48-V adapters. 12-V adapter at reduced output power.	10 W (3.3 V, 3.0 A)	3	87% at 48 V, 83% at PoE 48 V
TPS23757EVM (HPA480)	CCM flyback synchronous rectifier (driven)	PoE, 24/48-V adapters	11 W (5 V, 2.2 A)	3	91% at 48 V, 89% at PoE 48 V
TPS23757EVM (HPA480)	CCM flyback synchronous rectifier (driven)	PoE, 24/48-V adapters	11 W (3.3 V, 3.3 A)	3	88% at 48 V, 85% at PoE 48 V
TPS2375EVM (HPA028)	PD controller only (no DC/DC)	PoE	13 W	3	NA, 95% at PoE 48 V
TPS2378EVM-105 (PWR105)	Type 2 PD controller only (no DC/DC)	PoE, 48-V adapters	25 W	4	NA, 97.4% (2-pair) at PoE 48 V
TPS23751EVM-104 (PWR104)	Efficient CCM flyback synchronous rectifier (self-driven)	PoE, 24/48-V adapters	25 W (5 V, 4.5 A)	4	90% at 48 V, 87.5% at PoE 48 V
TPS23752EVM-145 (PWR145)	High-efficiency CCM flyback synchronous rectifier (driven)	PoE, 24/48-V adapters	25 W (5 V, 5.0 A)	4	93% at 48 V, 90% at PoE 48 V
TPS23754EVM-383 (HPA383)	Active-clamp forward synchronous rectifiers (self-driven)	PoE, 48-V adapters	25 W (12 V, 2.0 A)	4	89% at PoE 48 V
TPS23754EVM-420 (HPA420)	CCM flyback synchronous rectifier (driven)	PoE, 24/48-V adapters	25 W (5 V, 5.0 A)	4	88% at 48 V, 85% at PoE 48 V
TPS23754EVM-420 (PMP6672)	CCM flyback synchronous rectifier (driven)	PoE, 24/48-V adapters	25 W (5 V, 5.0 A)	4	92% at 48 V, 89% at PoE 48 V
TPS23756EVM (HPA479)	Active-clamp forward synchronous rectifier (self-driven)	PoE, 12/24/48-V adapters	25 W (5 V, 5.0 A)	4	91% at 12 V, 92% at 24 V, 88% at 48 V, 86% at PoE 48 V
TPS2376HEVM (HPA244)	CCM flyback synchronous rectifier	PoE, 48-V adapters	25 W (5 V, 5 A)	4	87% at 48 V, 82% at PoE 48 V
TPS2379EVM-106 (PWR106)	Type 2 PD controller only, with external boost FET (no DC/DC)	PoE and extended PoE	60 W	4+	NA, 97.5% (4-pair) at PoE 48 V

[1] *Bold indicates a fully orderable (as is) device. Otherwise PD is configurable via BOM changes.*

Power Protection, Distribution and Monitoring
USB and Power Switches

1 & 2 Channels, 4.5- to 5.5-V USB Switches

Channels	Rated Current Amps	Enable Polarity	Output Discharge	SOIC	MSOP DGN PowerPAD™	MSOP DGK	SOT-23	SON DRC
1	0.5	L	Y				**TPS2041CDBV**	
		H	Y				**TPS2051CDBV**	
	1	L	Y		**TPS2061CDGN**		**TPS2061CDBV**	
		H	Y		**TPS2065CDGN**		**TPS2065CDBV**	
			N		**TPS2065CDGN-2**		**TPS2065CDBV-2**	
	1.5	L	Y		**TPS2068CDGN**			
		H	Y		**TPS2069CDGN**		**TPS2069CDBV**	
			N		**TPS2069CDGN-2**			
	2	L	Y		**TPS2000CDGN**	**TPS2000CDGK**		
		H	Y		**TPS2001CDGN**	**TPS2001CDGK**		
2	0.5	H	Y		**TPS2052CDGN**			
	1	L	Y	**TPS2062CD**	**TPS2062CDGN**			
			N					**TPS2062CDRB-2**
		H	Y	**TPS2066CD**	**TPS2066CDGN**			
			N		**TPS2066CDGN-2**			
	1.5	L	Y		**TPS2060CDGN**			
		H	Y		**TPS2064CDGN**			
			N		**TPS2064CDGN-2**			
	2	L	Y					**TPS2002CDRC**
		H	Y					**TPS2003CDRC**

*Value devices are listed in **bold red**.*

Fixed I_{LIMIT}
Single Channel, 2.7- to 5.5-V USB Switches

Rated Current Amps	Enable Polarity	Output Discharge	SOIC D	MSOP DGN PowerPAD™	SOT-23 DBV	P
0.1	L	N	**TPS2049D**			
0.2	L	N	**TPS2020D, TPS2020IDRQ1**			
	H	N	**TPS2030D, TPS2030DRQ1**			**TPS2030P**
0.25	L	N	**TPS2045AD**			
	H	N	**TPS2055AD**			
0.5	L	N	**TPS2041BD, LM3525M-L**	**TPS2041BDGN**	**TPS2530BV, TPS2041BDBV, TPS2041BMDBVTEP, TPS2041BQDBVRQ1**	
	H	N	**TPS2051BD, TPS2051BD, LM3525M-H**	**TPS2051BDGN**	**TPS2051BDBV**	
0.6	L	N	**TPS2021D, TPS2021DRQ1**			**TPS2021P**
	H	N	**TPS2031D**			**TPS2031P**
1	L	N	**TPS2022D, TPS2022DRQ1, TPS2061D**	**TPS2061DGN**	**TPS2061DBV**	
	H	Y		**TPS2065DGN-1**		
		N	**TPS2065D, TPS2032D, TPS2032DRQ1**	**TPS2065DGN, TPS2065DGNRQ1**	**TPS2065DBV**	
1.5	L	N	**TPS2023D, TPS2068D, TPS2068IDGNRQ1**	**TPS2068DGN**		**TPS2023P**
	H	N	**TPS2033D**	**TPS2069DGN**		
2	L	N	**TPS2024D, TPS2024IDRQ1**			**TPS2024P**
	H	N	**TPS2034D**			**TPS2034P**

*Value devices are listed in **bold red**.*

Most TI USB switches are recognized by UL under UL2367. Please consult datasheet for latest status.

Power Protection, Distribution and Monitoring
USB and Power Switches

Fixed I_{LIMIT}
Dual Channels, 2.7- to 5.5-V USB Switches

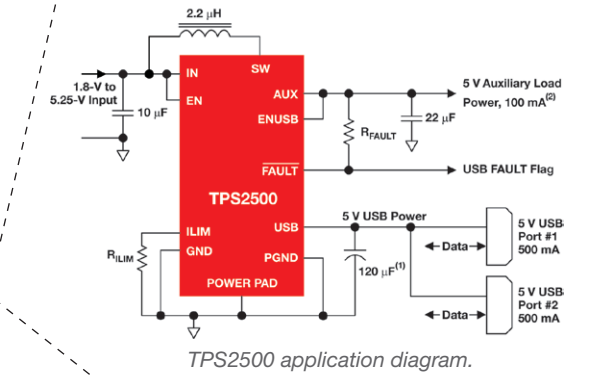
Rated Current Amps	Enable Polarity	Output Discharge	SOIC D	MSOP DGN PowerPAD™	SON DRC
0.25	L	N	TPS2046BD		
	H	N	TPS2056AD		
0.5	L	N	TPS2042BD, TPS2042BQDRQ1, LM3526M-L	TPS2042BDGN	TPS2042BDRB
	H	N	TPS2052BD, LM3526M-H	TPS2052BDGN	TPS2052BDRB
1	L	Y	TPS2062D-1		
		N	TPS2062AD, TPS2062D	TPS2062QDGNRQ1, TPS2062DGN	TPS2062ADBR
	H	Y		TPS2066DGN-1	
		N	TPS2066AD, TPS2066D	TPS2066DGN, TPS2066DGNRQ1	TPS2066ADBR
1.5	L	N		TPS2060DGN	TPS2060DBR
	H	N		TPS2064DGN	TPS2064DBR

Fixed I_{LIMIT}
3 & 4 Channels, 2.7- to 5.5-V USB Switches

V Operating	Channels	Rated Current Amps	Enable Polarity	SOIC D16
2.7 to 5.5	3	0.25	L	TPS2047BD
			H	TPS2057AD
		0.5	L	TPS2043BD
			H	TPS2053BD
		1	L	TPS2063D
			H	TPS2067D
	4	0.25	L	TPS2048AD
			H	TPS2058AD
		0.5	L	TPS2044BD, LM3544M-L
			H	TPS2054BD, LM3544M-H

Fixed I_{LIMIT}
with Boost Converter USB Switches

V Operating	USB Channels	I_{LIMIT} Adj. Range (Amps/Channel)	3.3-V LDO	Enable Polarity	$F_{VARIABLE}$ Eco-mode™	QFN20	SON10 DRC
1.8 to 5.5	1	0.13 to 1.4	N	H	Y		TPS2500
					N		TPS2501
	2	0.1 to 1.1	Y		Y	TPS2505	



TPS2500 application diagram.

Precision Adjustable I_{LIMIT} USB Switches

Channels	$I_{CONT.}$ Adj. Range (Amps/Channel)	V Operating	V_{ABSMAX}	Number of Programmable Thresholds	Latch Off Retry	Output Discharge	Active Reverse Current Blocking Threshold (mV)	R_{ON} (mΩ)	Packages	Device
1	0.1 to 1.0	2.5 to 6.5	7	1	Retry	N	135	85	SOT 23-6	TPS2551QDBVRQ1
	0.075 to 1.5							85	SOT 23-6	TPS2552DBV
								100	SON6 2x2 mm	TPS2552DRV
					Latch Off			85	SOT 23-6	TPS2552DBV-1
								100	SON6 2x2 mm	TPS2552DRV-1
					Retry			85	SOT 23-6	TPS2553DBV TPS2553QDBVRQ1
								100	SON6 2x2 mm	TPS2553DRV
					Latch Off			85	SOT 23-6	TPS2553DBV-1
								100	SON6 2x2 mm	TPS2553DRV-1
	0.075 to 2.5	2.5 to 6.5	20	1	Latch Off	N	na	60	SOT 23-6	TPS25200DRV
	0.5 to 2.5 Dual Adjustable, Selectable	4.5 to 5.5	7	2	Retry	Y	na	73	SON10 3x3 mm	TPS2555DRC
									SON10 3x3 mm	TPS2554DRC
	0.5 to 5.0	2.5 to 6.5	7	1	Retry	N	na	22	SON8 3x3 mm	TPS2556DRB TPS2556QDRBRQ1
									SON8 3x3 mm	TPS2557DRB TPS2557QDRBRQ1
2	0.25 to 2.8	2.5 to 6.5	7	1	Retry	N	na	45	SON10 3x3 mm	TPS2560DRC
									SON10 3x3 mm	TPS2561DRC TPS2561QDRCRQ1
	0.25 to 2.8 (Tuned for I_{LIMIT} = 2.3 ± 0.2 A)								SON10 3x3 mm	TPS2560ADRC
									SON10 3x3 mm	TPS2561ADRC TPS2561AQDRCRQ1

*New devices are listed in **bold red**.*

Most TI USB switches are recognized by UL under UL2367. Please consult datasheet for latest status.

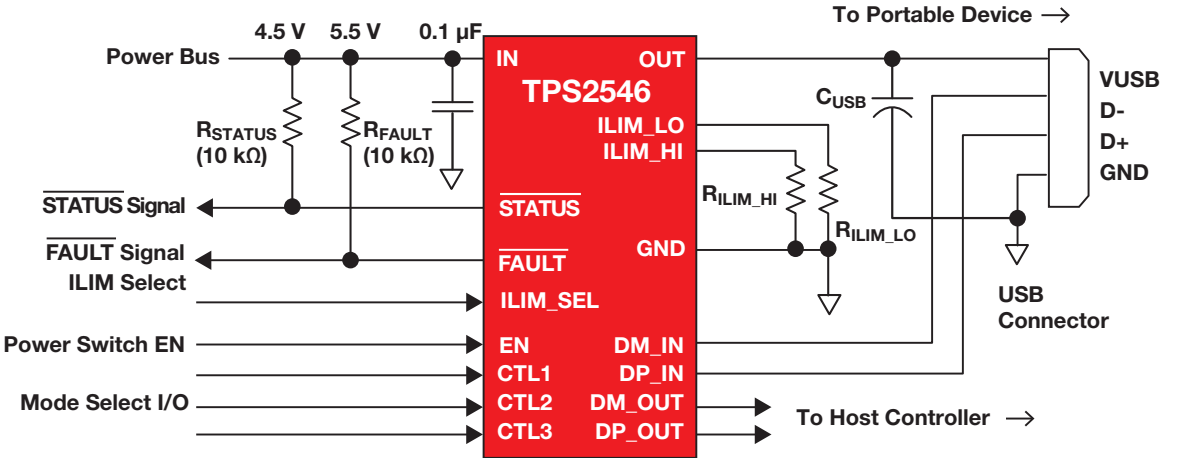
Power Protection, Distribution and Monitoring
USB and Power Switches

USB Charging Port Controllers (USB-CPC)

Device	Internal Power Switch	CDP	SDP	DCP/Auto					S3 Mouse HID Wake	Load Detect	UL Listed	Package(s)
				BC1.2 Mode	Divide Mode 1 2.0/2.7 V	Divide Mode 2 2.7/2.0 V	1.2/1.2 V	Divide Mode 3 2.7/2.7 V				
TPS2513A/3AQ100/4A	No	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	SOT-23
TPS2513/14	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	SOT-23
TPS2511/Q100	Yes	No	No	Yes	Yes	Yes	Yes	No	No	50% of I_{LIMIT}	Yes	MSOP 8
TPS2546	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	LS/FS	50 mA	Yes	QFN 16
TPS2544	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	LS/FS	No	Yes	QFN 16
TPS2543/Q100	Yes	Yes	Yes	Yes	Yes	Yes	No	No	LS	50 mA	Yes	QFN 16

*New devices are listed in **bold red**.*

- All switch devices are UL recognized.
- SDP = BC1.2 standard downstream port, supports USB 2.0 (500 mA) and USB 3.0 (900 mA).
- CDP = BC1.2 charging downstream port, supports charging to 1.5 A.
- DCP = BC1.2 dedicated charging port, a stand-alone charger with no data path (wall charger).
- Divider mode 2 allows charging to 2.1 A.
- TPS2546 pin/function compatible to TPS2543; TPS2544 pin/function compatible to TPS2543/6.
- TPS2513/A = 2 channels; TPS2514/A =1 channel; TPS2513A/14A support 2.7/2.7-V divider mode.



TPS2546 application schematic.

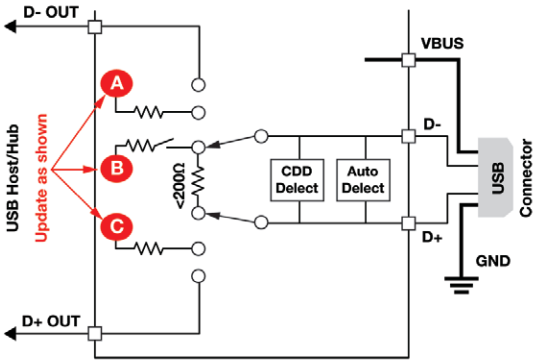
Most TI USB switches are recognized by UL under UL2367. Please consult datasheet for latest status.

A Brief Explanation of USB Charging Handshakes

TI USB charging controllers support, to varying degrees, four of the most common USB charging schemes found in popular handheld media and cellular devices:

- USB Battery Charging Specification BC1.2
- Chinese Telecommunications Industry Standard YD/T 1591-2009
- Divider Mode 1 and Divider Mode 2
- 1.2-V mode

YD/T 1591-2009 is a subset of the BC1.2 specification which supports the vast majority of devices that implement USB charging. Divider Modes 1 and 2 and 1.2-V charging schemes support popular devices from specific manufacturers. BC1.2 lists three different port types as listed below.



USB charging controller handshake interface.

Handshaking Schemes Supported by TI USB Charging Controllers

Mode	Switch		Node (V)		
	D–	D+	A	B	C
BC1.2	200 Ω to D+	200 Ω to D–	—	—	—
Divider 1	2.7 V	2.0 V	2.7	—	2.0
Divider 2	2.0 V	2.7 V	2.0	—	2.7
1.2 V	1.2 V	1.2 V	—	1.2	—

DCP BC1.2 and YD/T 1591-2009

Both standards define that the D+ and D– data lines should be shorted together at the host with a maximum series impedance of 200 Ω as shown here in the table and figure.

DCP Divider Charging Scheme

Some charging controllers support Divider Modes 1 and 2. The DCP interface configurations for Divider 1 and Divider 2 are shown in the table and figure. Divider 1 charging applies 2.0 V and 2.7 V to D+ and D– data lines, respectively. This is reversed in Divider Mode 2.

DCP 1.2-V Charging Scheme

1.2-V charging scheme is used by some handheld devices to enable fast charging at 2.0 A. Certain devices (as shown) support this scheme in the DCP-Auto mode before the device enters BC1.2 shorted mode. To simulate this charging scheme, D+/D– lines are shorted and pulled up to 1.2 V for a fixed duration; then the device moves to DCP shorted mode as defined in BC1.2 specification.

Most TI USB switches are recognized by UL under UL2367. Please consult datasheet for latest status.

Digital Power Control Solutions
Complete Isolated Telecom DC/DC PMBus Power Solution

Digital Power Means Smart Power

For many years, digital communication and processing have been making their way into the power supply. Power-hungry data systems like mobile phone base stations, servers and disk arrays need to increase efficiency and quality of service in smaller form factors while integrating some form of digital capability into the power supply. This digital integration allows designers to make smarter systems where the data traffic and power supply can work together. Below is a typical application example of just such a "smart" power system.

Digital power products range from analog controllers with digital blocks for configuration and telemetry and a digital port for communication, to complex microcontrollers with multiple processors, digital control blocks and multiple communication ports. All of these power solutions perform the required power management but with various degrees of digital integration. The more digital integration there is, the more you can do with your power supply—in the same or a smaller space.

Digital Controllers

TI's digital power controllers include the hardware-optimized, fully programmable UCD3K family of digital controllers for isolated power supplies; the configurable UCD9K family of digital non-isolated point-of-load controllers; and the UCD7K digital-compatible drivers with a programmable current limit. In addition to power-management digital controllers, TI's fully programmable TMS320F28x MCUs support many power- and energy-related applications, offering versatility and performance.

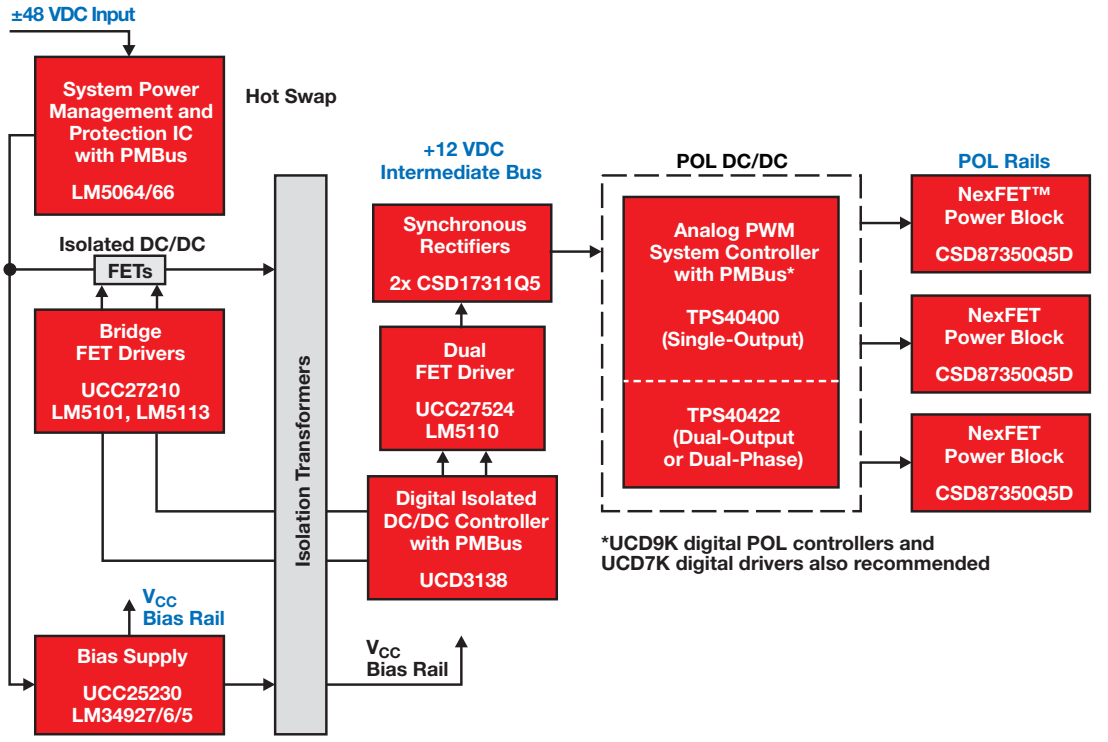
Analog Control with PMBus

Power-supply designers who prefer the benefits and familiarity of analog solutions now have the functionality of digital configuration and communication that won't impact the analog performance. TI offers the TPS404xx family of 20-V step-down voltage regulators with a PMBus-compatible digital interface and an adaptive voltage-scaling capability for non-isolated point-of-load designs. Together with the high-voltage LM(2)50xx hot-swap system protection and power-management products, TI provides complete single-, dual- and multi-rail, multi-phase PMBus solutions—allowing telecom and server designers to intelligently monitor, protect and manage their power systems.

Fusion Digital Power™ Designer

The UCD3K and UCD9K families of digital controllers, the LM5066 and LM5064 hot-swap controllers and the TPS40400 and TPS40422 analog PWM controllers are supported by TI's Fusion Digital Power designer GUI tool. This GUI allows power-supply designers to select compensation networks; configure device parameters such as output voltage and fault-limit values; read back a variety of real-time parameters such as voltage, current, power and temperature; and perform PMBus command, fault and data logging.

Get more information: **www.ti.com/digitalpower**



Digital Power Control Solutions

Isolated and Non-Isolated Digital Power Controllers

TI focuses on non-isolated (UCD9K) and isolated (UCD3K) PWM digital power controllers, complementary Power Stage solutions (UCD7K), and PTD-series modules. These products are power-management specific and are well-suited for applications that benefit from configurability, communications, diagnostics and adaptive control solutions. They include both isolated and non-isolated solutions from AC line to point-of-load, covering uninterruptible power supplies (UPS), server, telecom and datacom applications. The digital power ICs provide cost-effective solutions with greater levels of performance, reliability and flexibility than today's pure analog designs. For the most up-to-date information on digital power technology and product availability, go to: **www.ti.com/digitalpower**

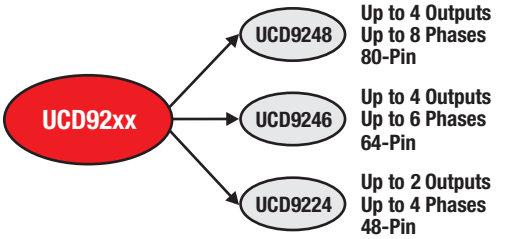
Key Benefits

- High levels of integration:
  - Multiple outputs and phases with a single controller
  - Integrated supply-voltage sequencing, monitoring and margining
  - Improved reliability with fewer parts
- Advanced functionality:
  - Real-time power monitoring, data logging and failure prediction
  - Flexible control for varying operation modes and load characteristics
  - Calibration in manufacturing
- System optimization:
  - Easily set fault limits, start characteristics after system is assembled
  - Enhanced phase management
- Full programmability (UCD3K)

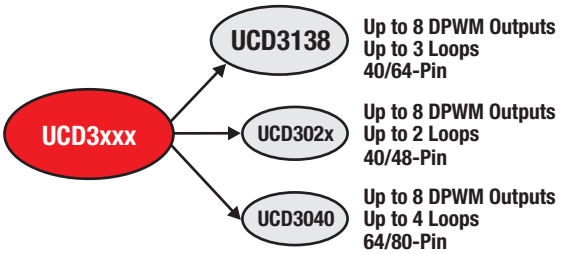
Digital Solution Features

- PMBus Version 1.1
- Power + Designer Graphical User Interface tool
- Programmable soft-start/stop configuration
- Voltage sequencing and tracking
- Voltage margining and monitoring
- Pre-biased, monotonic start-up
- Multiple levels of fault protection with selectable response
- Hardware-accelerated digital compensator
- Load sharing on multiphase power stages
- Frequency synchronization
- Digital monitoring of power-supply parameters

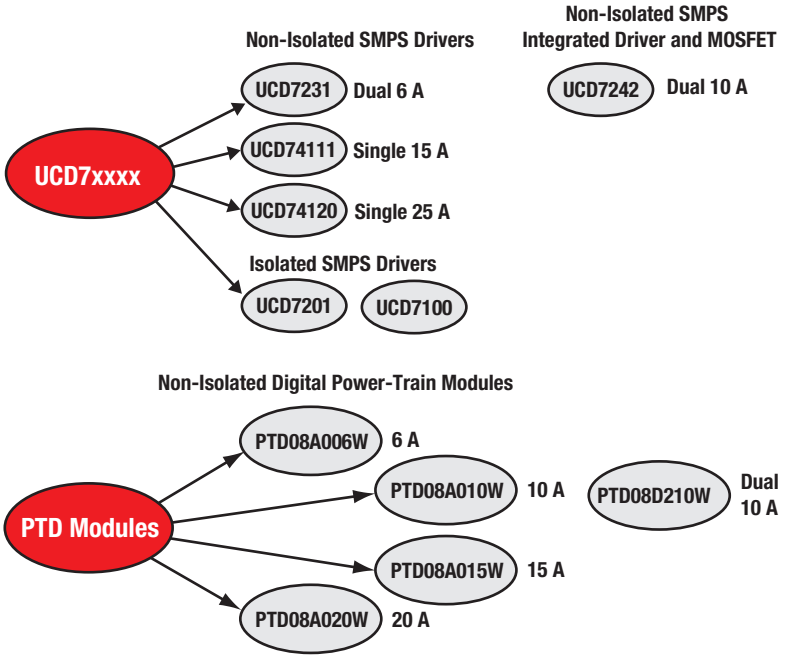
UCD9K Buck Controllers



UCD3K Isolated Power Controllers



Digital Power Stage Solutions

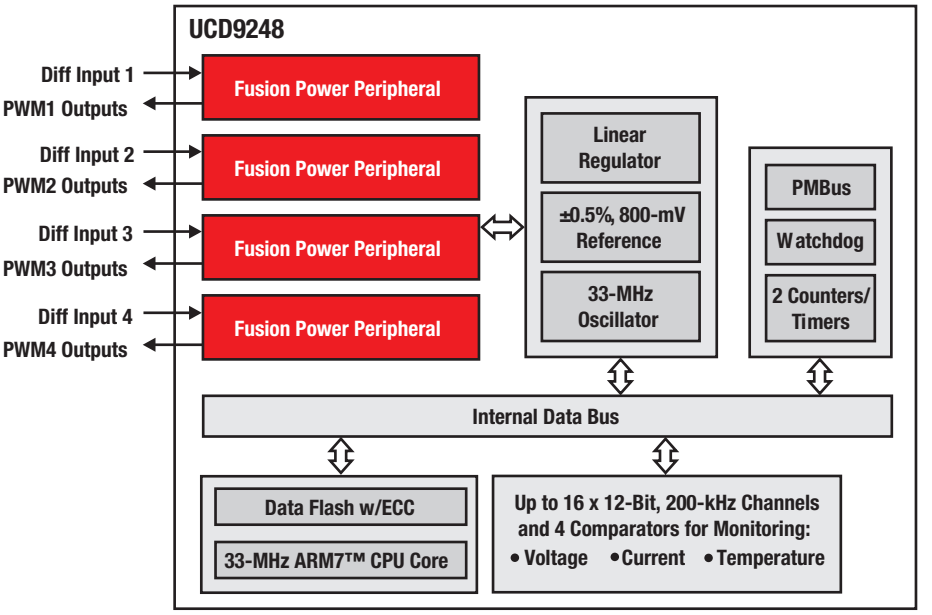


Digital Power Control Solutions

Isolated and Non-Isolated Digital Power Controllers

Digital Point-of-Load Controller

UCD9248

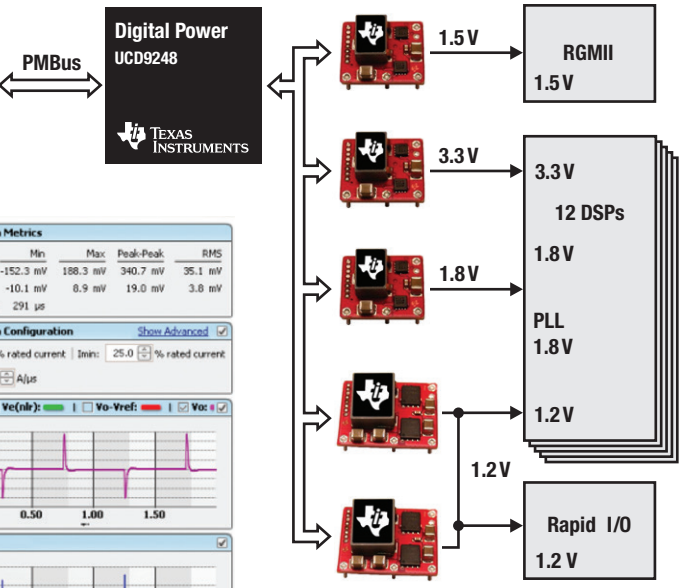


UCD9248 controller overview.

Key Features

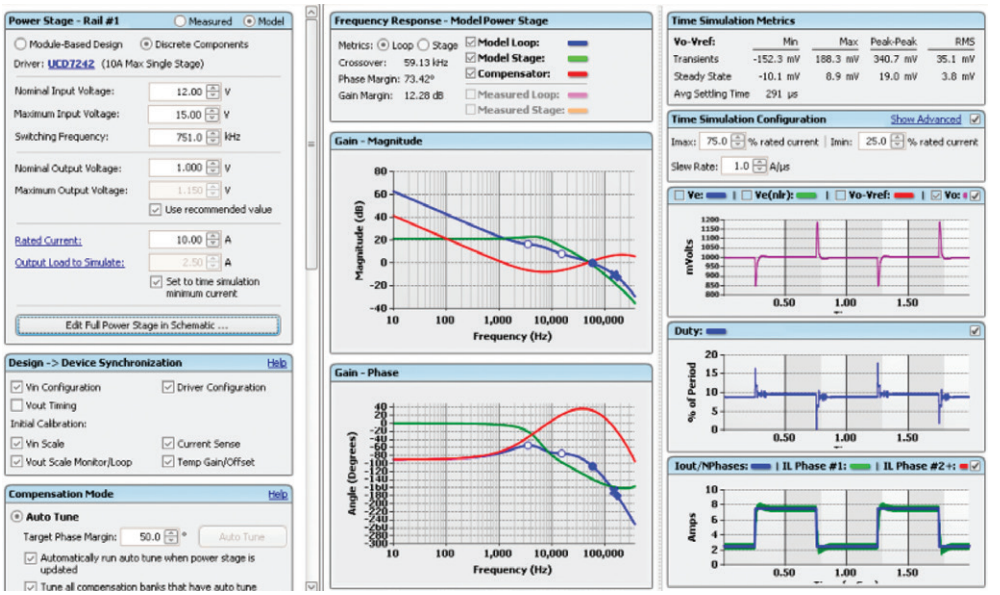
- Controls up to 8 power stages and up to 4 voltage-feedback control loops
- Output voltage is configurable from 0.4 to 4.0 V
- Flexible configuration to control:
  - Four single or two dual power stages,
  - Two 4-phase power stages, or
  - One 2-, 4-, 6- or 8-phase power stage
- Switching frequencies of up to 2 MHz
- Supports conversion ratio of 12:1 at 2 MHz with 250-ps duty-cycle resolution
- ±1-mV feedback resolution
- Hardware-accelerated, digital 3-pole/ 3-zero compensator
- Can synchronize PWM clocks between multiple UCD9248 devices

Get more information: **www.ti.com/product/UCD9248**



Multiprocessor, multiple-supply-rail systems (three single-phase outputs and one dual-phase output) featuring UCD9248 and first-generation PTD modules.

Fusion Digital Power™ Designer



Graphical user interface (GUI) Digital Power developer tool simplifies the design process.

Digital Power Control Solutions

Isolated and Non-Isolated Digital Power Controllers

Isolated Digital Power-Control Solutions

UCD3138

The UCD3138 is a highly integrated and configurable digital-power-management controller that is optimized for AC/DC and isolated DC/DC power-supply applications. The device offers an innovative path to increase power density and reliability in a broad range of power-supply topologies used in servers, telecom rectifiers and high-power DC/DC modules. Digital control capabilities allow designers to do more with their power systems, including reuse of hardware designs across multiple platforms. Designers also have the versatility to fine-tune the performance and control parameters for each application, thus allowing faster time to market. The UCD3138 combines a powerful 32-bit microprocessor, high-speed precision data converters, multiple programmable hardware control loops and various communication engines in a small 6x6-mm package.

Key Features

- Digital control—Three voltage or current feedback loops with up to six high-resolution digital pulse-width-modulated (DPWM) outputs.
- Boosted peak- and light-load efficiency—Includes sync-FET soft on-off control, dynamic phase shedding, dynamic frequency adjustment and dynamic mode switching.
- Supports all isolated power-supply topologies—Controller support for single-phase, two-phase interleaved, or bridgeless power factor correction; hard-switching full bridge, phase-shifted full bridge, resonant LLC and other topologies.
- Integrates all essential protection features—Included functions are peak current-mode control, cycle-by-cycle peak-current limiting, high-speed input voltage feed-forward, overvoltage, overcurrent and overtemperature protection.

Easy-to-Use GUI and Development Tools

Designers will have easy access to several digital-power development tools such as full-voltage and feature-rich evaluation modules, development kits, reference designs, application firmware source code, programmerís manuals and the Code Composer Studio™ software development environment. TI's Fusion Digital Power™ Designer graphical user interface (GUI) software tool provides flexible configuration of key power parameters, as well as telemetry, logging and communication functions. A broad range of hardware design tools, such as control-card and open-loop evaluation modules, are available to select customers. In addition, TI offers easy-to-use development kits and reference designs.

Evaluation Modules

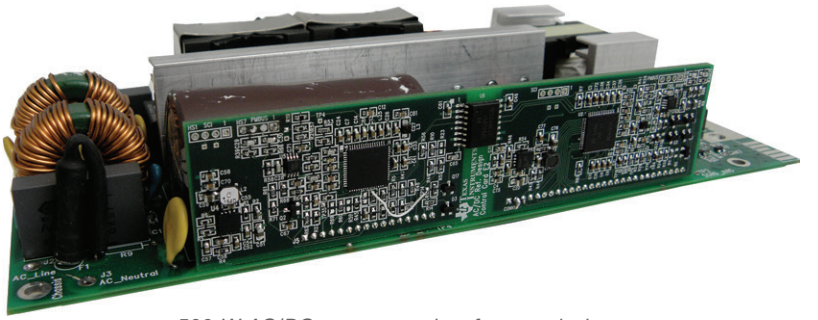
- UCD3138CC64EVM-030 control card
- UCD3138OL64EVM-031—UCD3138 64-pin, open-loop board with socket
- UCD3138OL40EVM-032—UCD3138 40-pin, open-loop board with socket
- UCD3138064EVM-166—Control card in digitally controlled off-line isolated power converters

Development Kits

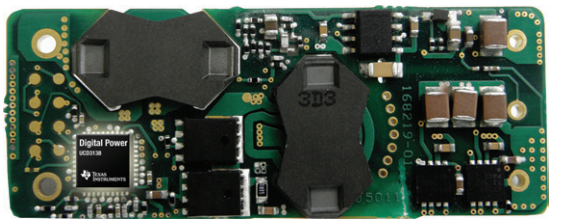
- UCD3138PFCEVM-026—Universal-input, 400-V_{OUT}, AC/DC PFC development kit that is configurable into single- or two-phase interleaved and bridgeless topologies
- UCD3138PSFBEVM-027—400-V_{IN}/12-V_{OUT} DC/DC phase-shifted full bridge
- UCD3138LLCEVM-028—400-V_{IN}/12-V_{OUT} DC/DC half-bridge resonant LLC
- UCD3138HSFBEVM-029—48-V_{IN}/12-V_{OUT} DC/DC hard-switching full bridge

Reference Designs

- 48-V_{IN}/12-V_{OUT} 1/8-brick DC/DC reference design (hard-switching full bridge)



500-W AC/DC power supply reference design.



250-W 1/8th brick module reference design.

Get more information: **www.ti.com/product/UCD3138**

Digital Power Control Solutions

Isolated and Non-Isolated Digital Power Controllers

Selection Guide

Device	Pin Count	Number of Outputs	Number of Phases	Maximum F_{SW} (MHz)	PWM Resolution (ps)	Compensator	Nonvolatile Memory	Price*
Digital Point-of-Load Controllers								
UCD9222/44[1]	48/64	2/4	1	2	250	3-pole/3-zero	3-pole/3-zero	3.15/5.85
UCD9224	48	2	4	2	250	3-pole/3-zero	3-pole/3-zero	2.65
UCD9248/6	80/64	4	8/6	2	250	3-pole/3-zero	Yes w/ECC	4.85/4.50

[1] *UCD9222 and UCD9244 digital PWM controllers with support for TMS320C6670 and TMS320C6678 DSPs VID interface.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Device	Number of Outputs	Output Configuration	Output Type[1]	Peak I_{OUT} Source/Sink (A)	Rise/Fall Time (ns)	V_{CC} Range (V)	Propagation Delay (ns)	Input Threshold	Dead-Time Control	Protection Features	Price*
Digital Power MOSFET Drivers											
UCD7231	2	Non-inverting	CMOS	6/6	10/10	4.5 to 15.5	25	CMOS/TTL	Adaptive	Adjustable	0.60
UCD7232	2	Non-inverting	CMOS	6/6	10/10	4.5 to 15.5	25	CMOS/TTL	Adaptive	Adjustable	0.60
UCD7100	1	Uncommitted/Non-inverting	TrueDrive™	4/4	10/10	4.5 to 16	20	CMOS/TTL	Adaptive	Adjustable	0.99
UCD7201	2	Uncommitted/Non-inverting	TrueDrive	4/4	10/10	4.5 to 16	20	CMOS/TTL	Adaptive	Adjustable	1.20

[1] *Output type: TrueDrive is the hybrid bipolar/CMOS output architecture for improved current drive capability at low voltages (at Miller threshold).*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Device	Pin Count	Number of DPWM Outputs	Number of Independent Control Loops	DPWM Resolution (ps)	DPWM Maximum Frequency (MHz)	Program Flash Memory Size (KB)	Number of 12-Bit ADC Channels	Compensator	Price*
Digital Isolated Power Controllers									
UCD3020	48	6	2	250	2	32	9	3-pole/3-zero	2.45
UCD3028	40	8	2	250	2	32	9	3-pole/3-zero	2.35
UCD3040	64/80	8	4	250	2	32	11/15	3-pole/3-zero	3.75/4.05
UCD3138	40/64	8	3	250	2	32	7/14	2-pole/2-zero	2.70/4.10
UCD3138064	64	8	3	250	2	64	9	2-pole/2-zero	4.89

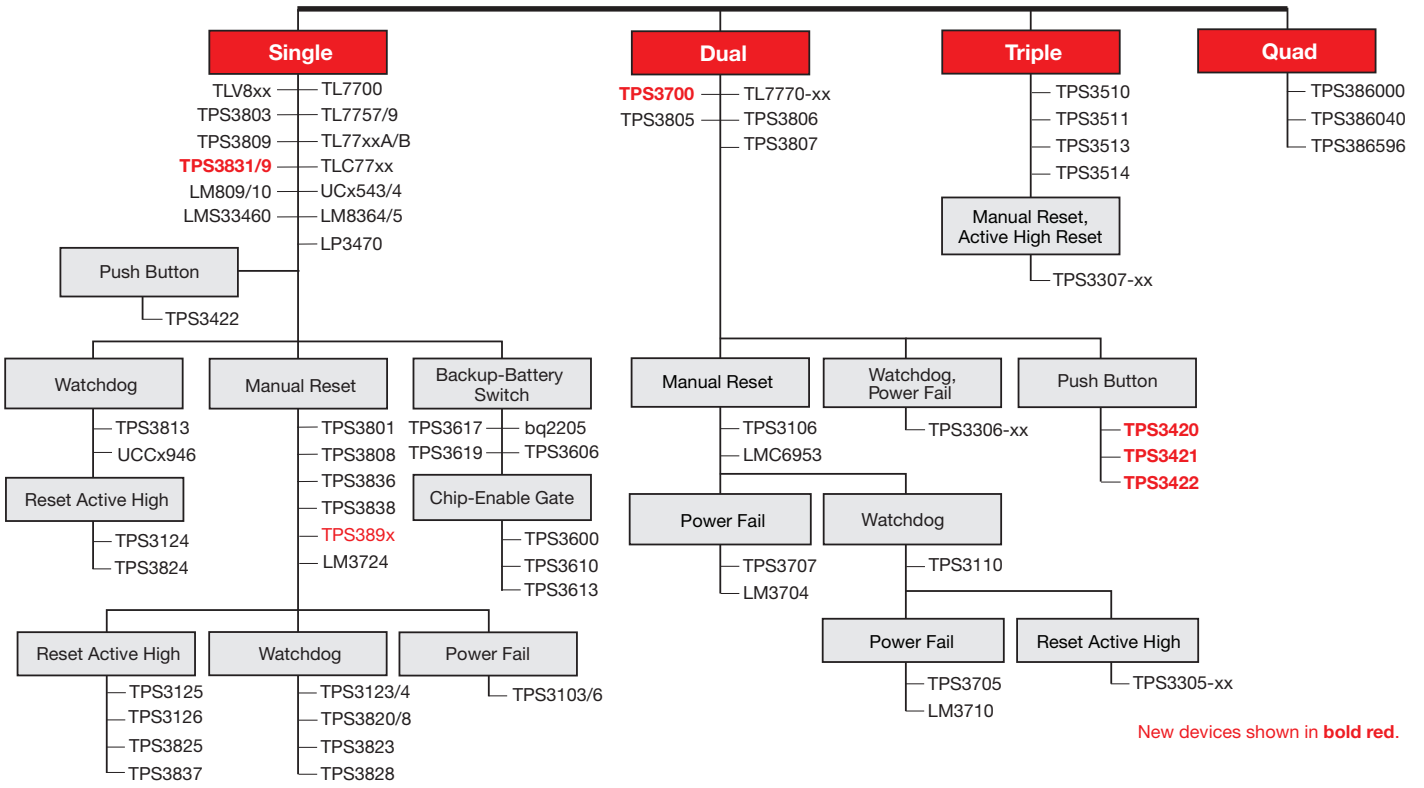
Device	Input Voltage (V)	Output Configuration	Current Rating (A)	Price*
Digital Power Stages				
UCD7242	4.5 to 18	Dual	10/10	2.65
UCD74106	4.5 to 14	Single	6	1.00
UCD74111	4.5 to 14	Single	15	2.95
UCD74120	4.5 to 14	Single	25	3.95

Device	Input Voltage (V)	Output Configuration	Current Rating (A)	Price*
Digital Power-Train Modules				
PTD08A006W	4.75 to 14	Single	6	6.90
PTD08A010W	4.75 to 14	Single	10	8.50
PTD08A015W	4.75 to 14	Single	15	9.80
PTD08A020W	4.75 to 14	Single	20	12.90
PTD08D210W	4.75 to 14	Dual	10/10	9.25
PTD08A210W	4.75 to 14	Single	10	7.50

**Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Supervisory Circuits, Reset ICs and Sequencers Family of Products

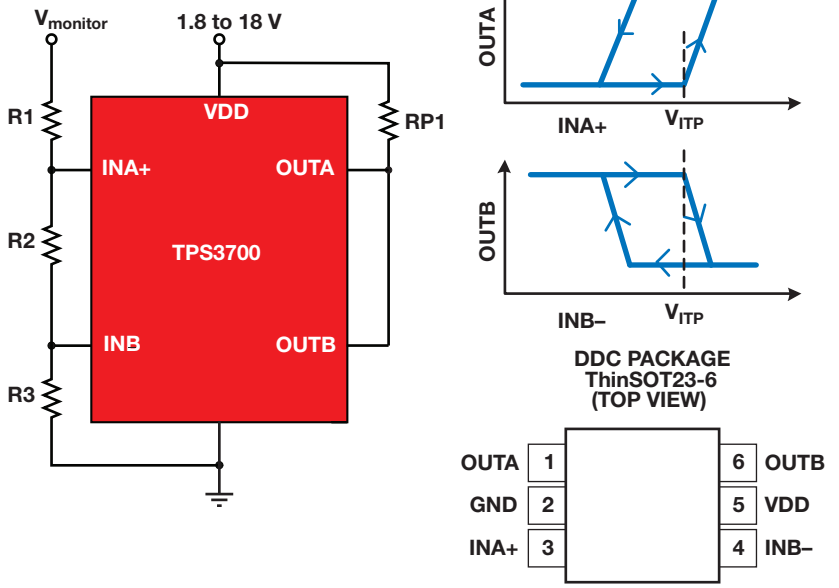


New devices shown in **bold red**.

For more information, please visit: **www.ti.com/supervisors**

Window Comparator for Over- and Under-Voltage Detection

TPS3700



Features

- Wide supply range: 1.8 to 18 V
- High accuracy threshold: 1% (over temperature range)
- Open drain OV and UV output
- Available in TSOT23-6 package

Get more information: **www.ti.com/product/TPS3700**

Supervisors and Reset ICs

Selection Guide

Device	Number of Supervisors	Supervised Voltages	Package(s)	V_{DD} Range (V)	I_{DD} (typ) (µA)	Time Delay (ms)	Watchdog Timer WDI (sec)	Reset Threshold Accuracy (%)	Manual Reset/Enable Reset	Active-Low Reset/Output	Active-High Reset/Output	Reset Output Topology[1]	Power-Fail PFI/PFO	Overvoltage Detection	Overcurrent Detection	Chip-Enabled Gating	Comments	Price*
General Purpose Supply Supervisors																		
LM3724	1	2.32, 3.08, 4.63	SOT23-5, D, W	1 to 6	6	0.02		±2.5	✔	✔		OD	✔					0.95/0.80
LP3470	1	2.63, 2.75, 2.83, 2.93, 3.08, 3.65, 4.0, 4.38, 4.63, 4.8	SOT23-5	0.5 to 5	16	0.3		±1		✔		OD						0.595/0.562
LM3704	2	2.32, 3.08, 3.6	micro SMD-9, MSOP-10	1 to 5.5	28	0.02		±2	✔	✔		CMOS, OD	✔					0.77
LM3710	2	2.32, 3.08, 4.63	MINI SOIC	1 to 5.5	28	0.02	0.0062 to 25.6	±2	✔	✔		CMOS, OD	✔					1.10
LM8364	1	2.0	SOT23-5	1 to 6	0.65	0.3		±2.5		✔		CMOS, OD						0.24
LM8365	1	2.75, 4.5	SOT23-5	1 to 6	0.65	0.1		±2.5		✔		CMOS, OD						0.25
LM809	1	2.63, 2.93, 3.08, 4.38, 4.63	SOT23-3, LLP-6, D, W	1 to 6	15	0.02		±1.5		✔		CMOS						0.23
LM810	1	4.63	SOT23-3, D, W	1 to 6	15	0.02		±1.5			✔	CMOS						0.23
LMS33460	1	3	SC-70	1 to 7	1	0.2		±5		✔		OD						0.17
LMC6953	2	3.3, 3.5	SOIC-8	1.5 to 6	800	0.0005		±3	✔	✔		OD						1.44
TPS3895	1	Adj.	SON-6	1.7 to 6.5	6	0.04, Prog	—	0.25	✔		✔	PP					Ultra small	0.60
TPS3896	1	Adj.	SON-6	1.7 to 6.5	6	0.04, Prog	—	0.25	✔	✔		PP					Ultra small	0.60
TPS3897	1	Adj.	SON-6	1.7 to 6.5	6	0.04, Prog	—	0.25	✔		✔	OD					Ultra small	0.60
TPS3898	1	Adj.	SON-6	1.7 to 6.5	6	0.04, Prog	—	0.25	✔	✔		OD					Ultra small	0.60
TLV803	1	2.5/3/3.3/5	3SOT-23	1.1 to 6	9	200	—	2.00		✔		OD						0.20
TLV810	1	2.5/3/3.3/5	3SOT-23	1.1 to 6	9	200	—	2.00			✔	PP						0.20
TPS3808	1	Adj./0.9/1.2/1.5/1.8/2.5/ 3.0/3.3/5.0/EEPROM	SOT-23, SON-6	1.8 to 6.5	2.4	Prog	—	0.5	✔	✔		OD						0.70
TPS3103	1	1.2/1.5/2.0/3.3	SOT-23	0.4 to 3.3	1.2	130	—	0.75	✔	✔		OD	✔					0.90
TPS3123	1	1.2/1.5/1.8	SOT-23	0.75 to 3.3	14	180	1.4	3.6	✔	✔		PP						0.85
TPS3124	1	1.2/1.5/1.8	SOT-23	0.75 to 3.3	14	180	1.4	3.6		✔	✔	PP						0.85
TPS3125	1	1.2/1.5/1.8/3.0	SOT-23	0.75 to 3.3	14	180	—	3.6	✔	✔	✔	PP						0.80
TPS3126	1	1.2/1.5/1.8	SOT-23	0.75 to 3.3	14	180	—	3.5	✔	✔	✔	OD						0.80
TPS3128	1	1.2/1.5/1.8	SOT-23	0.75 to 3.3	14	180	1.4	3.5	✔	✔		OD						0.85
TPS3800	1	2.7	SC-70	1.6 to 6.0	9	100	—	2	✔	✔		PP						0.40
TPS3801	1	Adj./1.8/2.5/3.0/3.3/5.0	SC-70	1.6 to 6.0	9	200	—	2	✔	✔		PP						0.40
TPS3802	1	3.0/3.3	SC-70	1.6 to 6.0	9	400	—	2	✔	✔		PP						0.40
TPS3803	1	Adj./1.5	SC-70	1.3 to 6.0	3	—	—	1.5		✔		OD					Voltage detector	0.25
TLV809	1	2.5/3.0/3.3/5.0	SOT-23	2.0 to 6.0	9	200	—	2.2		✔		PP						0.25
TPS3813	1	2.5/3.0/3.3/5.0	SOT-23	2.0 to 6.0	9	25	Window	2.2		✔		OD					Window watchdog	0.90
TPS3820/8-xx	1	3.3/5.0	SOT-23	1.1 to 5.5	15	25/200	0.2/1.6	2.4	✔	✔		PP/OD						0.65
TPS3823	1	2.5/3.0/3.3/5.0	SOT-23	1.1 to 5.5	15	200	1.6	2.4	✔	✔		PP						0.65
TPS3824-xx	1	2.5/3.0/3.3/5.0	SOT-23	1.1 to 5.5	15	200	1.6	2.2		✔	✔	PP						0.65
TPS3825-xx	1	3.3/5.0	SOT-23	1.1 to 5.5	15	200	—	2.2	✔	✔	✔	PP						0.55
TPS3831	1	—	SON-4	0.6 to 6.5	0.15	200	—	1.5	✔	✔		PP					Ultra small	0.30
TPS3839	1	—	SON-4, SOT-23	0.6 to 6.5	0.15	200	—	1.5		✔		PP					Ultra small	0.21
TPS3836/8	1	1.8/2.5/3.0/3.3	SOT-23	1.6 to 6.0	0.22	10/200	—	2.5	✔	✔		PP/OD						0.85
TPS3837	1	1.8/2.5/3.0/3.3	SOT-23	1.6 to 6.0	0.22	10/200	—	2.4	✔		✔	PP						0.85
TLC77xx	1	Adj./2.5/3.3/3.0/5.0	SO-8, DIP-8, TSSOP-8	2.0 to 6.0	9	Prog	—	5.5		✔	✔	PP						0.65
TPS3807	2	3/3.5	SC-70	1.8 to 6.5	3.5	20	—	1		✔		OD						0.95
TPS3106	2	Adj./0.9/1.6/3.3	SOT-23	0.4 to 3.3	1.2	130	—	0.75	✔	✔		OD						0.90
TPS3110	2	Adj./0.9/1.2/1.5/3.3	SOT-23	0.4 to 3.3	1.2	130	1.1	0.75	✔	✔		PP						0.99
TPS3305-xx	2	1.8/2.5/3.3/5.0	SO-8, MSOP-8	2.7 to 6.0	15	200	1.6	2.7	✔	✔	✔	PP						1.00
TPS3306-xx	2	1.5/1.8/2.0/2.5/3.3/5.0	SO-8, MSOP-8	2.7 to 6.0	15	100	0.8	2.7		✔		OD	✔					1.05
TPS3700	2	Adj.	ThinSOT23-6, SON-6	1.8 to 18	5.5	—	—	0.25		✔	✔	OD					Window comparator	0.70
TPS3705-xx	2	3.0/3.3/5.0	SO-8, MSOP-8	2.0 to 6.0	30	200	1.6	2.1	✔	✔		PP	✔					0.80
TPS3707-xx	2	2.5/3.0/3.3/5.0	SO-8, MSOP-8	2.0 to 6.0	20	200	—	2.2	✔	✔	✔	PP	✔					0.75

[1] *PP = push-pull, OD = open drain, OC = open collector.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Note: Custom voltages can be provided. Minimum order quantities may apply. Contact TI for details and availability.

*New devices are listed in **bold red**.*

Supervisors and Reset ICs

Selection Guide (Continued)

Device	Number of Supervisors	Supervised Voltages	Package(s)	V_{DD} Range (V)	I_{DD} (typ) (µA)	Time Delay (ms)	Watchdog Timer WDI (sec)	Reset Threshold Accuracy (%)	Manual Reset/Enable Reset	Active-Low Reset/Output	Active-High Reset/Output	Reset Output Topology[1]	Power-Fail PFI/PFO	Overvoltage Detection	Overcurrent Detection	Chip-Enabled Gating	Comments	Price*
General Purpose Supply Supervisors (Continued)																		
TPS3805	2	Adj./3.3	SC-70	1.3 to 6.0	3	—	—	1.5		✔		PP					Voltage detector	0.34
TPS3806	2	Adj./2.0/3.3	SOT-23	1.3 to 6.0	3	—	—	2		✔		OD					Voltage detector	0.45
TPS3307-xx	3	Adj./1.8/2.5/3.3/5.0	SO-8, MSOP-8	2.0 to 6.0	15	200	—	2.7	✔	✔	✔	PP						1.05
TPS386596	4	Adj./3.0	MSOP-8	1.8 to 6.5	7.5	Prog	—	0.25	✔	✔		OD		✔				1.25
TPS3860x0	4	Adj. (includes negative rail)	QFN	1.8 to 6.5	9	Prog	0.6	0.25	✔	✔	✔	PP/OD		✔				1.95
Battery Backup Switchover Supply Supervisors																		
TPS3600	1	2.0/2.5/3.3/5.0	TSSOP-14	1.6 to 5.5	20	100	0.8	2.3	✔	✔		PP	✔			✔		2.15
TPS3606-33	1	3.3	MSOP-10	1.6 to 5.5	20	100	0.8	2	✔	✔		PP	✔					1.45
TPS3610	1	1.8/5.0	TSSOP-14	1.6 to 5.5	20	100	0.8	2		✔		PP	✔			✔		1.80
TPS3613-01	1	Adjustable	MSOP-10	1.6 to 5.5	20	100	—	1.7	✔	✔	✔	PP				✔		1.50
TPS3619	1	3.3/5.0	MSOP-8	1.6 to 5.5	15	100	—	2	✔	✔		PP	✔					1.10
Special Function Supply Supervisors																		
TPS3510/1	3	3.3/5.0/12.0	SO-8, DIP-8	4 to 15	1 mA	300	—	9.1		✔		OD	✔	✔			PC power supplies	0.45
TPS3513/4	3	3.3/5.0/12.0	SO-14, DIP-14	4.5 to 15	1 mA	300	—	9.1		✔		OD	✔	✔	✔		PC power supplies	0.70

[1] *PP = push-pull, OD = open drain, OC = open collector.*
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Note: Custom voltages can be provided. Minimum order quantities may apply. Contact TI for details and availability.

*New devices are listed in **bold red**.*

Sequencers

Selection Guide

Device	Number of Supervisors	Supervised Voltages	Number of Sequenced Outputs	Package(s)	V_{DD} Range (V)	I_{DD} (typ) (µA)	Time Delay (ms)	Comments	Price*
LM3880	—	—	3	SOT23-6	2.7 to 5.5	25	Fixed		0.50
LM3881	—	—	3	MSOP-8	2.7 to 5.5	80	Prog		0.50
UCD9090	10	Prog. by software GUI	—	QFN-64	3.3 to 12	50 mA	Prog		3.60
UCD90120A	13	Prog. by software GUI	—	QFN-64	3.3 to 12	50 mA	Prog		4.95
UCD90124A	13	Prog. by software GUI	—	QFN-64	3.3 to 12	50 mA	Prog	With fan control	6.45
UCD90160	16	Prog. by software GUI	—	QFN-64	3.3 to 12	50 mA	Prog		5.65
UCD90910	10	Prog. by software GUI	—	QFN-64	3.3 to 12	50 mA	Prog	With fan control	5.90

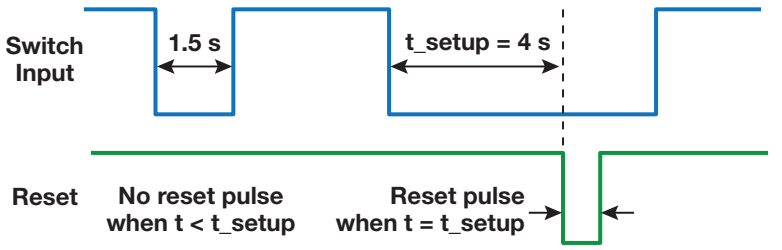
**Suggested resale price in U.S. dollars in quantities of 1,000.*

Push-Button Controllers

Single and Dual Push-Button Controllers

TPS3420, TPS3421, TPS3422

TPS342x family of devices provide the ability to perform a hardware system reset during a software crash. It also eliminates the need to remove batteries to activate a reset. These controllers are used in designs with an embedded battery to ensure a hard- and full-system reset when needed. They include a fail-safe option when the system/microprocessor freezes and a system reset is required. Holding one or two external button switches for x amount of seconds generates a reset. To improve system stability, short-period switch closures are rejected by the setup delay time (t_setup), as shown in the timing diagram.



Key Features

- Very small, 1.45x1-mm SON package
- Low supply current: 250 nA
- User-selectable input delay using two-state logic
- Fixed-pulse or input-dependent reset behavior

Applications

- Smart phones
- Tablets
- Ultrabooks
- Notebooks
- Routers
- Consumer medical

Get more information: **www.ti.com/product/TPS3420D**, **TPS3421EC** or **TPS3422EG**

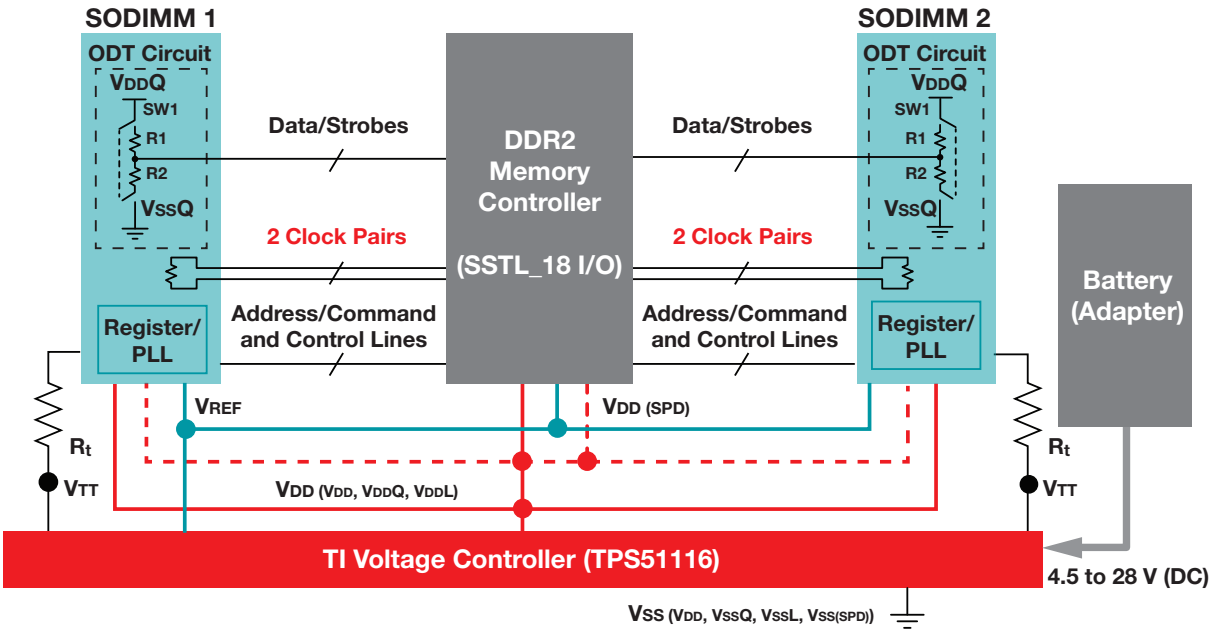
Current Power Monitors

Selection Guide

Device	Description	Common-Mode Range (min) (V)	Common-Mode Range (max) (V)	Gain (V/V)	Output Type	Input Offset (+/-)(max) (µV)	CMRR (min) (dB)	Quiescent Current (+/-)(typ) (mA)	V_S (min) (V)	V_S (max) (V)	Package(s)	Price*
INA226	High-side measurement, bi-directional current power monitor with I^2C interface	0	36	1	I^2C	10	126	0.33	2.7	5.5	MSOP-10	1.30
INA210	Voltage output, high/low-side measurement, bi-directional zero-drift series current power monitor	–0.3	26	200	Voltage	35	105	0.065	2.7	26	µQFN-10, SC70-6	0.65
INA219	Zero-drift, bi-directional current power monitor	0	26	Programmable	I^2C	50	100	0.7	3	5.5	SOIC-8, SOT-23-8	0.80
INA230	Precision digital/current/voltage/power monitor	0	28	1	I^2C	50	100	330	2.7	5.5	QFN-16	1.15
INA282	Wide common mode range, bidirectional, high accuracy current power monitor	–14	80	50	Voltage	70	120	0.6	2.7	18	SOIC-8	1.25
LMP8640	Precision high-voltage current sense amplifier	–2	76	20, 50, 100	Voltage	900	60	0.72	2.7	12	SOT-6	0.89
LMP8645	Precision high-voltage current sense amplifier	–2	76	Programmable	Voltage	1000	60	0.61	2.7	12	SOT-6	0.89
LMP8646	Precision current limiter	–2	76	Programmable	Voltage	1000	95	0.38	2.7	12	SOT-6	1.20

**Suggested resale price in U.S. dollars in quantities of 1,000.*

TI DDR Power Application



Selection Guide

Device	V_{IN} (V)	I_{OUT} (A)	Provides	DDR Type
Plug-in Modules				
PTH03010/50/60W	2.95 to 3.65	6/10/15	VTT	1, 2, 3
PTH05010/50/60W	4.5 to 5.5	6/10/15	VTT	1, 2, 3
PTH12010/50/60L	10.8 to 13.2	6/10/12	VTT	1, 2, 3
Controllers				
TPS40042	2.25 to 5.5	Up to 15	VTT	1, 2, 3
TPS40057	8 to 40	Up to 20	VTT	1, 2, 3
Controller + LDO				
TPS51116, TPS51216/716/916	3 to 28[1]	Up to 25 A for VDDQ, 3 (2-A VTT for TPS51216/916)	VTT, VDDQ, VREF	1, 2, 3, LV3, LP3
Dual Controller				
TPS51020	4.5 to 28	Up to 15	VTT, VDDQ, VREF	1, 2
Termination Voltage (Source and Sink) LDOs				
TPS51100	1.2 to 3.6[2]	Up to 3	VTT, VREF	1, 2, 3, LV3, LP3
TPS51200	1.1 to 3.5[3]	Up to 3	VTT, VREF	1, 2, 3, LV3, LP3
TPS51206	VTT+0.4 V to 3.5 V	Up to 2	VTT, VREF	1, 2, 3, LV3, LP4
LP2995	2.2 to 5.5	1.5	VTT, VREF	1
LP2996	1.8 to 5.5	1.5	VTT, VREF	1, 2
LP2996A	1.5 to 5.5	1.5	VTT, VREF	1, 2, 3
LP2997	1.8 to 5.5	0.5	VTT, VREF	1, 2
LP2998	1.35 to 5.5	1.5	VTT, VREF	1, 2, 3
Switchers with Integrated FETs				
TPS54372	3 to 6	3	VTT	1, 2, 3
TPS53317, TPS54672	3 to 6	6	VTT	1, 2, 3 , LV3, LP3
TPS54972	3 to 4	9	VTT	1, 2, 3
TPS51362/7	3 to 22[1]	10/12	VDDQ	1, 2, 3, LV3, LP3
TPS560200	4.5 to 17	0.5	VPP	4

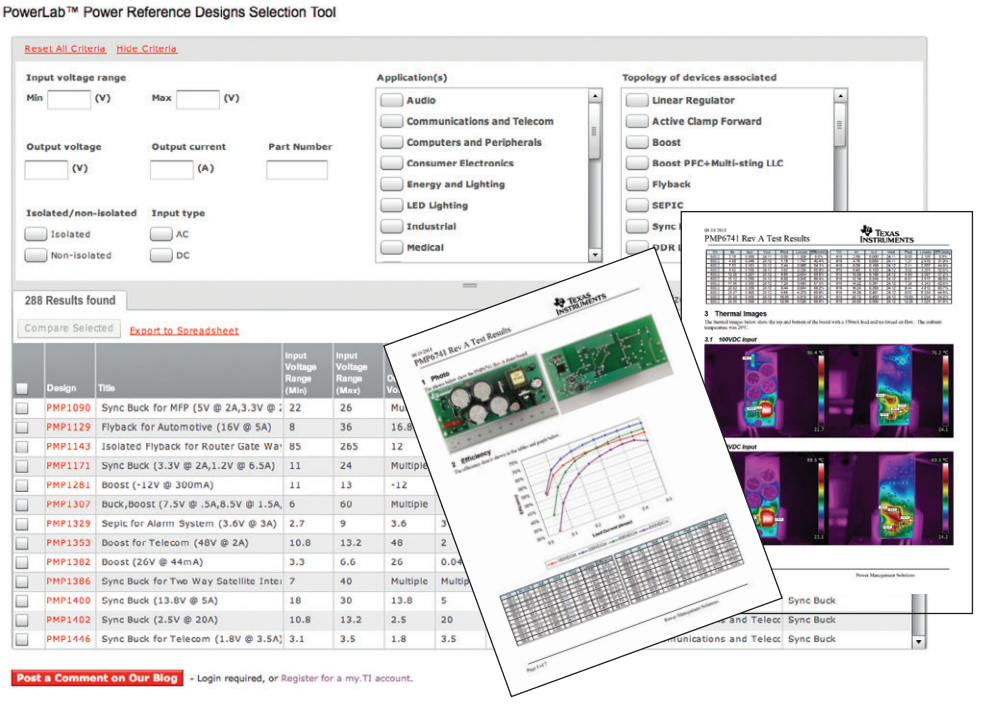
[1] *Needs 4.5- to 5.5-V bias.*
[2] *Needs 4.75- to 5.25-V bias.*
[3] *Needs 2.4- to 3.5-V bias.*

PowerLab™ Power Reference Design Library

The PowerLab library includes an interactive and powerful search engine for design engineers looking for a proven and tested solution to their power-supply requirements. This interactive search tool allows engineers to find designs by application, topology, input type, input voltage or output voltage.

Features

- Extensive collection of tested power-management reference designs
- Hundreds of power-management designs for a wide range of applications and power-conversion topologies
- Reference designs include both isolated and non-isolated designs for lighting, telecommunication, computing, consumer electronics and more



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- Simulate electrical characteristics, choose probe points and examine waveforms to determine performance
- Simulate thermal behavior and your circuit on a PCB in your defined environment and view color heat maps
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- Request samples and purchase parts or demo boards
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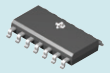
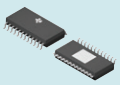
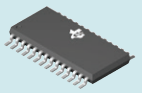
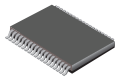
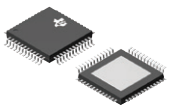
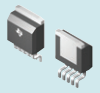
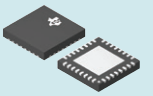
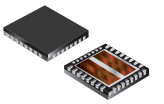
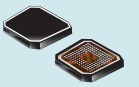
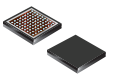
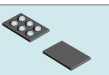
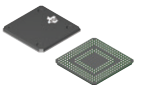
Resources
Packaging

Surface Mount Packages

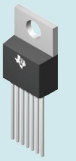
	Package Type	Package Designator	Key Characteristics
Small Outline Packages			
	Small Outline Integrated Circuit (SOIC)	D, DW, DWU, DTH, DTC, DDA, DVB, DWP	High MSL rating* (MSL1/ MSL2), variable size availability
	Mini Small Outline Package (MSOP)	DGK, DGS	Small form factor, thin package
	Heat Sink Small Outline Package (HSOP)	DWP, DWD	Thermally enhanced SOP (low to mid power)
	Small Shrink Outline Package (SSOP)	DL, DB, DF, DBQ, DCE, DCT	High MSL rating* (MSL1/ MSL2), higher stand-off height
	Thin Shrink Small Outline Package (TSSOP)	DA, PW, DBT	Variable pin count options available, high MSL rating* (MSL1/ MSL2), small form factor
	Exposed Pad Thin Shrink Small Outline Package (HTSSOP)	PWP, DAP, DAD, DCA	Thermally enhanced TSSOP (low to high power); various pin count options available
	Power Small Outline Package (PSOP3)	DKP (slug down), DKD (slug up)	Very high power handling capability, mechanically robust package
Quad Leaded Packages			
	Thin Quad Flat Pack (TQFP)	PFB, PAG, PJT, PBS, PAG	High pin count, leadframe based package
	Exposed Pad Thin Quad Flat Pack (HTQFP)	PAP, PJD, PZP, PHP, PNP, PHD	Thermally enhanced TQFP (mid to high power)
Small Outline Transistors			
	Small Outline Transistor (SC-70)	DCK	Mini form factor
	Small Outline Transistor Package (SOT23)	DBV, DCN, DDC, thin SOT	Small form factor, high MSL rating* (MSL1/ MSL2)
	Small Outline Transistor (SOT223)	DCY, DCQ	High MSL rating* (MSL1/ MSL2)
	Transistor Outline (TO236)	DBZ	Small form factor
Leaded Packages			
	Plastic Flange Mount Package (DDPak/TO-263)	KTT, KTW	Very high power handling capability
Leadless Packages			
	Small Outline No Leads (SON)	DRB, DRC, DRD, DRK, DRM, DRN, DRT, DSE, DSG, DSJ	Small footprint, thermal package (low to mid power)

**MSL rating should be checked for individual device.*

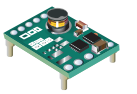
Surface Mount Packages (Continued)

	Package Type	Package Designator	Key Characteristics
Leadless Packages (Continued)			
	Quad Flatpack No Leads (QFN)	RGC, RGE, RGF, RGP, RGT, RGW, RGY, RGZ, RHA, RHB, RHD, RHF, RHH, RHL, RSA, RSB, RSH, RSJ, RSL, RSM, RTE, RTH, RTQ, RTT, RUK, RUV, RVA	Compact footprint, thermal package (mid to high power), available in variable thicknesses
	Flip-Chip Power Packages	RSJ	High power handling capability
Ball Grid Arrays (BGAs)			
	Wafer Chip Scale Package (WCSP)/ Die Sized Ball Grid Array (DSBGA)	YEG, YEK, YEJ, YEA, YZA, YED	Die size package, very small form factor, finer pitch
	MicroStar BGA™	ZGU	Controllable count density, variable thickness option availability
	MicroStar Junior™ BGA	ZQE, ZQZ	Smaller sized MicroStar BGA, controllable pin count density
	PicoStar™	YFM	Extremely small sized package, ultra-thin, board embeddable
	BGA	ZVD	Very high pin count density

Through-Hole Packages

	Package Type	Package Designator	Key Characteristics
	Plastic Dual Inline Package (PDIP)	P, N, NT, NTD	Recommended for wave soldering, excellent board-level reliability
	Transistor Outline (TO220)	KC	Very high power handling capability, recommended for wave soldering, mechanically robust

Package Modules

	Package Type	Package Designator	Key Characteristics
	Power Modules	—	Integrated passives, enhanced functionality

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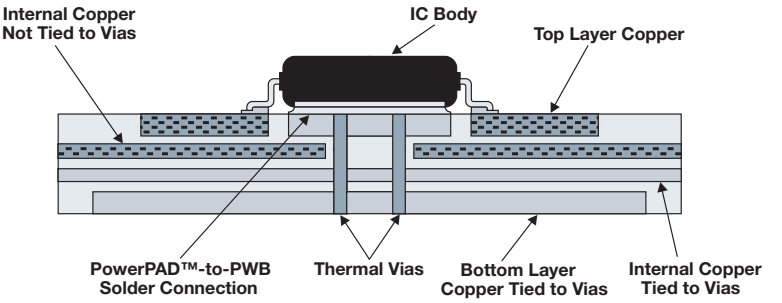
Connecting the PowerPAD™

The PowerPAD package should be connected to the appropriate internal signal plane as specified in the product datasheet. Depending on the electrical properties of the thermally conductive epoxy used to connect the Integrated Circuit (IC) to the lead frame, the PowerPAD may have a low impedance connection to the internal signal plane as specified in the product datasheet.

You can find additional information in the following resources. Technical literature can be accessed online with **www.ti.com/lit/litnumber** by replacing **litnumber** with one of the following literature numbers shown in parentheses.

- Remember to check the CAD format for your package under "Symbols/ Footprints," available in all TI Product Folders
- Download the "PowerPAD Made Easy" application brief (SLMA004) in conjunction with the "PowerPAD Thermally Enhanced Package" technical brief (SLMA002)
- Specific information on QFN/SON packages is available in application reports (SLUA271 and SCBA017)
- Visit TI's Analog & Mixed-Signal KnowledgeBase at: **support.ti.com/sc/knowledgebase**
- Ask our experts your specific design questions via email by selecting Analog & Mixed-Signal email support in the Contact Tech Support frame at: **support.ti.com**



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