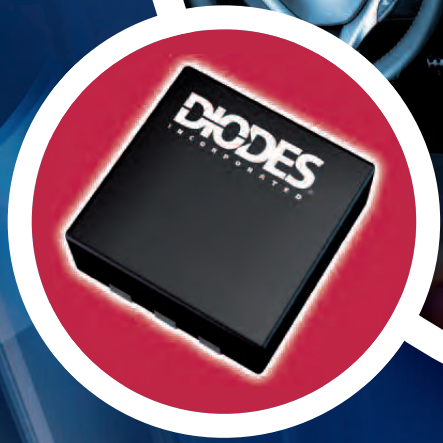
DIODES
INCORPORATED

AUTOMOTIVE PRODUCTS



diodes.com

DIODES INCORPORATED'S PRODUCTS ARE DESIGNED FOR HIGH PERFORMANCE, ACROSS A WIDE RANGE OF EXISTING AND EMERGING APPLICATIONS

COMPANY OVERVIEW

Diodes Incorporated is a leading global provider of Discrete, Analog, and Logic semiconductors.

Its global footprint includes sales offices in 5 countries and manufacturing locations in China, Europe and the USA.

A focus on product innovation, cost reduction, acquisitions and customer service has made Diodes Incorporated an industry leader.

Combining leading silicon and packaging technologies, Diodes provides a broad portfolio of discrete semiconductors comprising Bipolar Transistors, MOSFETs, Schottky diodes, SBR®, switching diodes and functional specific arrays to enable our customers' next generation designs.

The Diodes' Analog IC portfolio consists of 6 main areas: Power Management ICs, Standard Linear, Lighting, Sensors, Direct Broadcast by Satellite and Application-Specific Standard Products. Diodes IC portfolio also includes Standard Logic products.

DIODES INCORPORATED MEANS AUTOMOTIVE BUSINESS

Diodes Incorporated offers a broad portfolio of analog and discrete devices, qualified to AEC-Q100 and AEC-Q101 respectively, that meet the requirements of the Automotive segment.

However, many Automotive OEM's require products to be traceable and supported by a Production Part Approval Process warrant (PPAP).

To meet this requirement Diodes Incorporated has introduced an Automotive product line.

Identified by the letter 'Q' at the end of the part numbering nomenclature, these 'Q' parts are qualified to AEC-Q101 or AEC-Q100, supported by a PPAP and manufactured in TS16949-compliant facilities.

Furthermore, many of the products have additional performance features.
For example, the Super Barrier Rectifier Portfolio is 100% Avalanche tested.

DIODES PRODUCT QUALIFICATION STANDARDS

Automotive 'Q' Product	Product with a Q suffix has passed the rigorous AECQ reliability standard AND is fully supported for Automotive customers with PPAP, and TS16949–approved manufacturing sites.
AEC-Q100/101 Qualified Product	Product has met the rigorous AECQ reliability standard, and is capable of meeting automotive reliability requirements.
Commercial Grade Product	Product fit for commercial applications made and supplied within Diodes standard quality control envelope.

Powertrain
- MOSFETs
- Hall Sensors
- SBRs
- Bipolar Transistors

Daytime Running Lights
- LED Drivers
- Schottky Diodes
- MOSFETs
- Bipolar Transistors

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Body Control Module
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- Shunt Regulator
- Voltage Reference
- IntelliFETs
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Interior Light
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- MOSFETs
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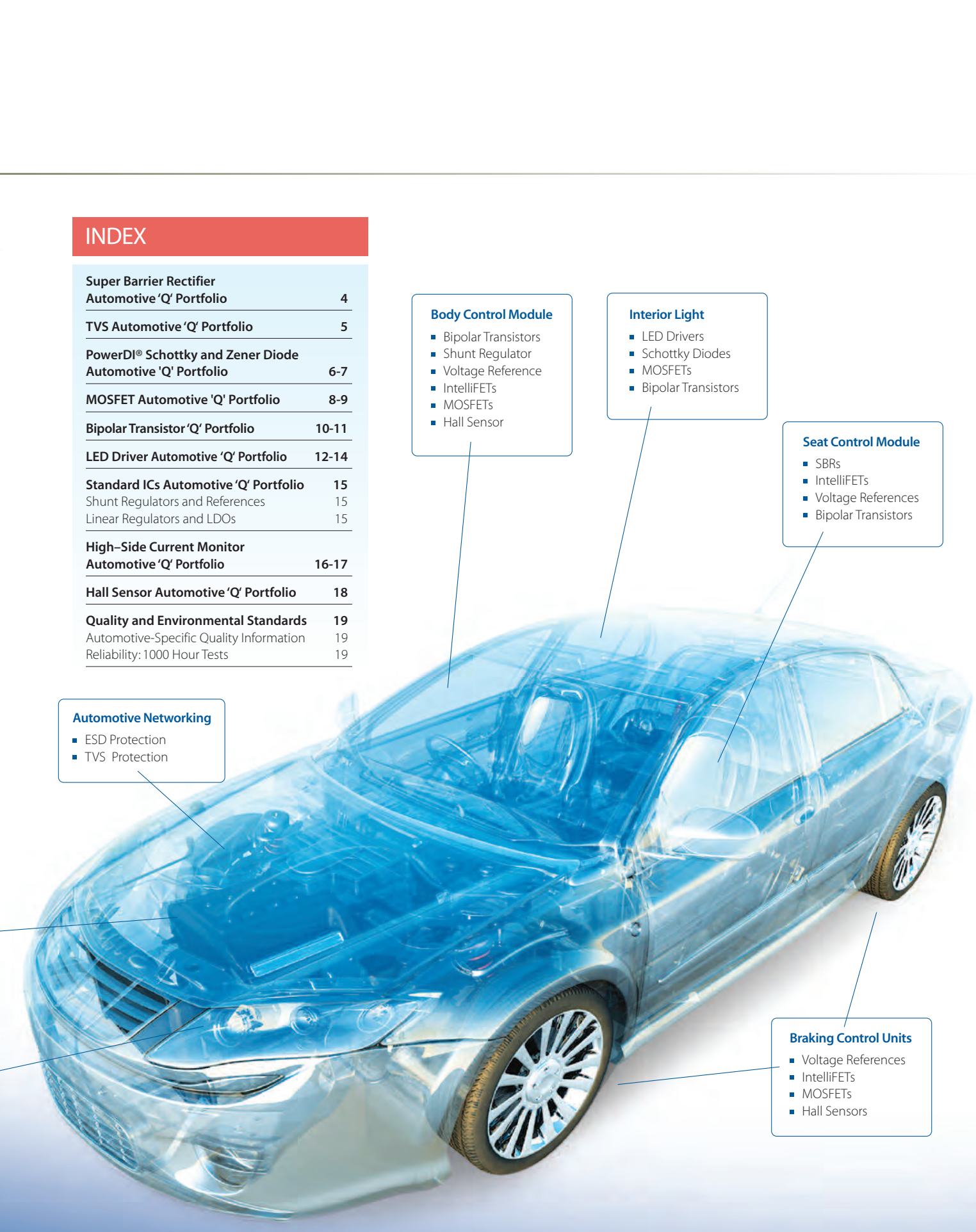
Seat Control Module
- SBRs
- IntelliFETs
- Voltage References
- Bipolar Transistors

Automotive Networking
- ESD Protection
- TVS Protection

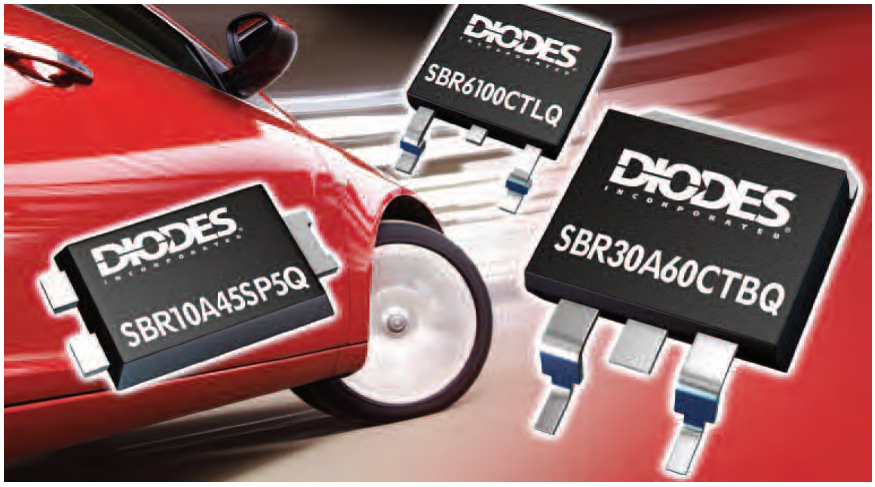


Braking Control Units
- Voltage References
- IntelliFETs
- MOSFETs
- Hall Sensors

Super Barrier Rectifier Automotive 'Q' Portfolio

Super Barrier Rectifier (SBR) is a Diodes Incorporated proprietary rectifier technology that combines the low reverse leakage (I_R) and fast switching characteristics (T_{RR}) of ultrafast rectifiers, with the low forward voltage drop (V_F) of Schottky diodes.

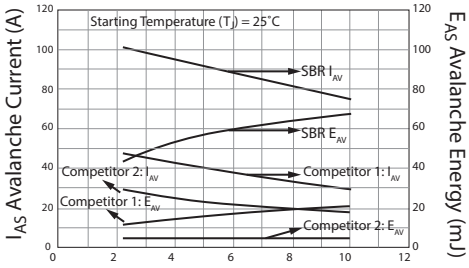
Furthermore, SBR has a proven, best-in-class repetitive avalanche rating, high temperature stability and wide safe operating area (SOA) that improves the reliability of the end application. These characteristics make it ideal for use as a reverse battery, blocking or freewheel diode in Automotive applications.



THE **DIODES** ADVANTAGE

Product Features and Benefits

- **Avalanche Rated**
  Reverse Avalanche capabily that is up to 10 times greater than competing solutions. 100% Avalanche tested, ensuring more rugged and reliable end applications.
- **Low Reverse Leakage Current (I_R)**
  Low reverse leakage (I_R) at high temperatures provides increased reliability against thermal runaway.
- **Low Forward Voltage (V_F)**
  The lower forward voltage drop of the SBR ensures power dissipation is minimized.
- **AEC-Q101**
  High-reliability qualification in association with AEC-Q101.
- **PPAP Supported**
  Production Part Approval Process documents provided.



Comparison of SBR I_{AS} and E_{AS} performance versus equivalent schottky diodes.

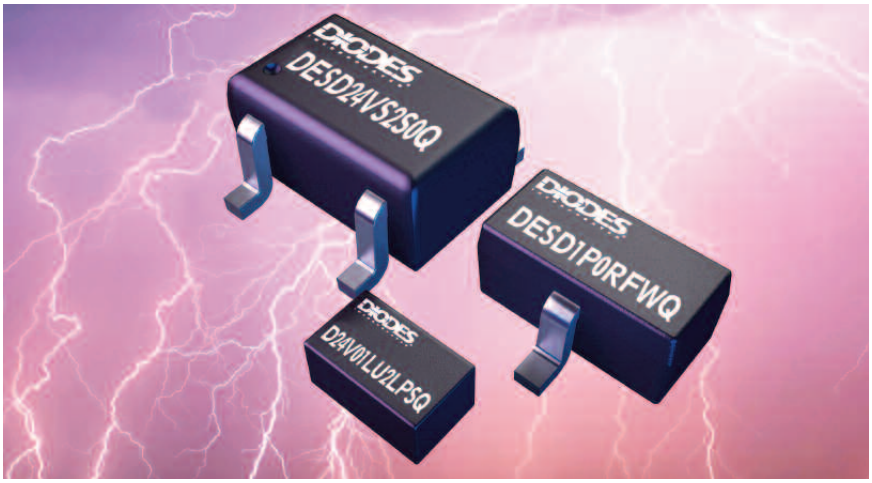
SBR 'Q' Portfolio for Automotive Applications

Part	Package	V_R (V)	I_o (A)	V_F Max (V) I_{rated} @25C	I_R Max (mA) $V_{B,rated}$ @25C	I_R Max (mA) $V_{B,rated}$ @125C	E_{AS} (mJ)	AEC-Q101	Availability
SBR2A40P1Q	PowerD123	40	2	0.5	1	10	N/S	Yes	Released
SBR3U40P1Q	PowerDI123	40	3	0.47	0.4	40	N/S	Yes	Released
SBR3A40SAQ	SMA	40	3	0.5	0.4	40	N/S	Yes	Released
SBR660CTLQ	TO-252	60	6	0.57	0.3	5	190	Yes	Released
SBR6100CTLQ	TO-252	60	6	0.74	0.1	6	120	Yes	Released
SBR1045D1Q	TO-252	45	10	0.5	0.3	50	200	Yes	Released
SBR10U45D1Q	TO-252	45	10	0.57	0.3	13	620	Yes	Released
SBR1045CTLQ	TO-252	45	10	0.55	0.3	13	200	Yes	Released
SBR15U100CTLQ	TO-252	100	15	0.8	0.1	1.5	192	Yes	Released
SBR20A60CTBQ	TO-263	60	20	0.47	0.5	20	500	Yes	Released
SBR30A60CTBQ	TO-263	60	30	0.6	0.33	30	800	Yes	Released
SBR30A45CTBQ	TO-263	45	30	0.55	0.5	20	240	Yes	Released
SBR3045CTBQ	TO-263	45	30	0.63	0.5	80	180	Yes	Q1 2014
SBR40U60CTBQ	TO-263	60	40	0.6	0.4	15	2050	Yes	Q1 2014
SBR60A60CTBQ	TO-263	60	60	0.62	0.2	15	2050	Yes	Q1 2014
SBR8U60P5Q	PowerDI5	60	8	0.53	0.33	60	790	Yes	Q1 2014
SBR10U45SP5Q	PowerDI5	45	10	0.47	0.3	TBC	TBC	Yes	Q1 2014
SBR8U20SP5Q	PowerDI5	20	8	0.52	0.3	16	146	Yes	Q1 2014
SBR12U100SP5Q	PowerDI5	100	12	0.55	0.25	11	592	Yes	Q1 2014
SBR12U120SP5Q	PowerDI5	100	12	0.55	0.25	11	592	Yes	Q1 2014
SBR15U30SP5Q	PowerDI5	30	15	0.49	0.3	10	1074	Yes	Q1 2014

TVS Automotive 'Q' Portfolio

Diodes range of Automotive TVS and ESD clamping diodes series protects sensitive automotive circuits such as electronic control units and infotainment systems against surges and ESD discharges.

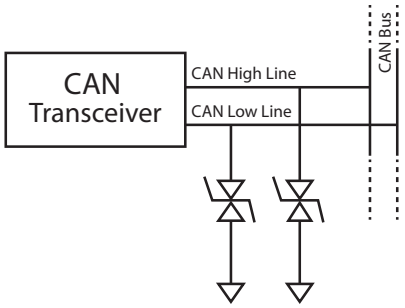
They are used in applications for smart junction boxes, relay protection and power-line protection.



THE **DIODES** ADVANTAGE

Product Features and Benefits

- **AEC-Q101**
  High-reliability qualification in association with AEC-Q101.
- **PPAP Supported**
  Production Part Approval Process documents provided.
- **IEC Compliant**
  IEC61000-4-2 and 6100-4-5 compliant against electrostatic discharge.
- **Small Form Factor Package**

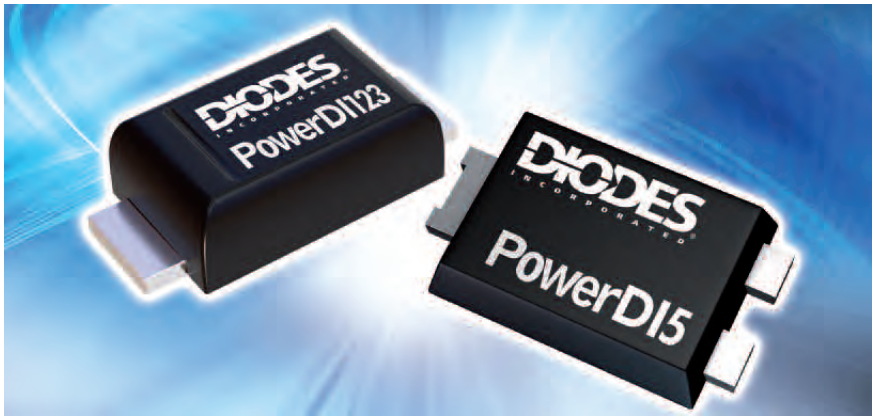


TVS 'Q' Portfolio for Automotive Applications

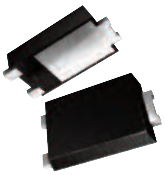
Part	Package	Configuration	Channel Input Capacitance C_T Typ (pF)	Reverse Standoff Voltage V_{RWM} (V)	Breakdown Voltage V_{BR} Min (V)	Typ Reverse Leakage Current I_R @ V_{RWM} Max (nA)	Max Peak Pulse Current I_{PP} @ 8x20µs Max (A)	Max Clamping Voltage @ Max Peak Pulse Current V_{CL} (V)	VESD IEC61000-4-2 Contact Discharge (±kV)	Availability
DESD24VS2S0Q	SOT23	Dual	42	24	26	10	5	41	30	Q2 2014
DESD5V0S1BAQ	SOD323	1 ch bi-directional	35	5	5.5	5	12	14	30	Q2 2014
DESD5V0S1BBQ	SOT523	1 ch bi-directional	35	5	5.5	5	12	14	30	Q2 2014
DESD1P0RFWQ	SOT323	2 ch uni-directional	1	70	TBC	15	15	6	30	Q2 2014
D5V0L1U2LPLPQ	DFN1006	1 ch uni-directional	1	5.2	6	10	3	13	20	Q2 2014
D24V01LU2LPSQ	DFN1006	1 ch bi-directional	25	24	26	10	TBC	TBC	15	Q2 2014
DUP1105LSOQ	SOT23	1 ch bi-directional	25	24	26.2	100	8	44	30	Q2 2014

PowerDI Schottky and Zener Diode Automotive 'Q' Portfolio

The PowerDI123 and PowerDI5 packages feature a proprietary clip die attach that improves I_{FSM} and reliability. Furthermore, both the PowerDI5 and PowerDI123 feature off board profiles of just 1.1mm and 1mm respectively, providing designers with a high-density, low-profile Schottky portfolio.



PowerDI123



PowerDI5

Package Cross Sections

Diodes Incorporated's patent-pending flat lead frame heat-sink solder pad results in higher power dissipation and surge capabilities in a compact, low-profile package.

THE **DIODES** ADVANTAGE

Product Features and Benefits

- **AEC-Q101**
  High-reliability qualification in association with AEC-Q101.
- **PPAP Supported**
  Production Part Approval Process documents provided.
- **Low Profile Package**
  PDI123 off board profile is 1mm, 62% thinner than SMA enabling thinner applications.
  PDI5 has package profile of just 1.1mm, 62% thinner than the industry-standard DPAK.
- **Small Form Factor Package**
  PowerDI5 occupies just 26mm^2, 55% smaller than DPAK.
  PD123 PCB footprint is just is 7.5mm^2, 60% smaller than SMA package.

PowerDI123 Zener Diode 'Q' Portfolio for Automotive Applications

Part	Package	Configuration	P_D (W)	V_Z (nom) (V)@25C	@ I_{ZT} @25C	V, Tolerance (%) Typ	$I_{R, Max}$ (µA)	AEC-Q101	Availability
DFLZ10Q	PowerDI123	Single	1	10	50	5	5	Yes	Q4 2013
DFLZ11Q	PowerDI123	Single	1	11	50	5	4	Yes	Q4 2013
DFLZ12Q	PowerDI123	Single	1	12	50	5	3	Yes	Q4 2013
DFLZ13Q	PowerDI123	Single	1	13	50	5	2	Yes	Q4 2013
DFLZ15Q	PowerDI123	Single	1	15	50	5	1	Yes	Q4 2013
DFLZ16Q	PowerDI123	Single	1	16	25	5	1	Yes	Q4 2013
DFLZ18Q	PowerDI123	Single	1	18	25	5	1	Yes	Q4 2013
DFLZ20Q	PowerDI123	Single	1	20	25	5	1	Yes	Q4 2013
DFLZ22Q	PowerDI123	Single	1	22	25	5	1	Yes	Q4 2013
DFLZ24Q	PowerDI123	Single	1	24	25	5	1	Yes	Q4 2013
DFLZ27Q	PowerDI123	Single	1	27	25	5	1	Yes	Q4 2013
DFLZ30Q	PowerDI123	Single	1	30	25	5	1	Yes	Q4 2013
DFLZ33Q	PowerDI123	Single	1	33	25	5	1	Yes	Q4 2013
DFLZ36Q	PowerDI123	Single	1	36	10	5	1	Yes	Q4 2013
DFLZ39Q	PowerDI123	Single	1	39	10	5	1	Yes	Q4 2013
DFLZ5V1Q	PowerDI123	Single	1	5.1	100	5	2.5	Yes	Q4 2013
DFLZ5V6Q	PowerDI123	Single	1	5.6	100	5	10	Yes	Q4 2013
DFLZ6V2Q	PowerDI123	Single	1	6.2	100	5	5	Yes	Q4 2013
DFLZ68Q	PowerDI123	Single	1	6.8	100	5	5	Yes	Q4 2013
DFLZ7V5Q	PowerDI123	Single	1	7.5	100	5	5	Yes	Q4 2013
DFLZ8V2Q	PowerDI123	Single	1	8.2	100	5	5	Yes	Q4 2013

PowerDI323 Schottky 'Q' Portfolio for Automotive Applications

Part	Package	V_R (V)	I_o (A)	V_F Max (V)	I_R Max (mA)	I_R Max (mA)	AEC-Q101	Availability
				I_{rated} @25C	$V_{B, rated}$ @25C	$V_{B, rated}$ @125C		
PD3S120LQ	PowerDI323	20	1	0.42	0.16	30	Yes	Q4 2013
PD3S130HQ	PowerDI323	30	1	0.55	0.1	-	Yes	Q4 2013
PD3S130LQ	PowerDI323	30	1	0.42	0.25	-	Yes	Q4 2013
PDS3140Q	PowerDI323	40	1	0.55	1.5	100	Yes	Q4 2013
PDS3160Q	PowerDI323	60	1	0.64	0.1	2	Yes	Q4 2013
PD3S220LQ	PowerDI323	20	2	0.49	0.16	30	Yes	Q4 2013
PD3S230HQ	PowerDI323	30	2	0.6	1.5	-	Yes	Q4 2013
PD3S230LQ	PowerDI323	30	2	0.45	1.4	-	Yes	Q4 2013

PowerDI5 Schottky 'Q' Portfolio for Automotive Applications

Part	Package	V_R (V)	I_o (A)	V_F Max (V)	I_R Max (mA)	I_R Max (mA)	AEC-Q101	Availability
				I_{rated} @25C	$V_{B, rated}$ @25C	$V_{B, rated}$ @125C		
PDS340Q	PowerDI5	40	3	0.49	0.5	25	Yes	Q1 2014
PDS360Q	PowerDI5	60	3	0.62	0.15	15	Yes	Q1 2014
PDS3100Q	PowerDI5	100	3	0.72	0.1	20	Yes	Q1 2014
PDS3200Q	PowerDI5	200	3	0.78	0.1	25	Yes	Now
PDS4150Q	PowerDI5	150	4	0.76	0.01	4.5	Yes	Now
PDS540Q	PowerDI5	40	5	0.52	0.25	40	Yes	Q1 2014
PDS560Q	PowerDI5	60	5	0.67	0.15	30	Yes	Now
PDS5100Q	PowerDI5	100	5	0.78	0.2	20	Yes	Q1 2014
PDS760Q	PowerDI5	60	7	0.62	0.1	20	Yes	Now

PowerDI123 Schottky 'Q' Portfolio for Automotive Applications

Part	Package	V_R (V)	I_o (A)	V_F Max (V)	I_R Max (mA)	AEC-Q101	Availability
				I_{rated} @25C	$V_{B, rated}$ @25C		
DFLS1200Q	PowerDI123	200	1	0.85	2	Yes	Q1 2014
DFLS120LQ	PowerDI123	20	1	0.36	1	Yes	Q1 2014
DFLS130LQ	PowerDI123	30	1	0.36	1	Yes	Q1 2014
DFLS140Q	PowerDI123	40	1	0.55	0.01	Yes	Q1 2014
DFLS140LQ	PowerDI123	40	1	0.51	0.1	Yes	Q1 2014
DFLS160Q	PowerDI123	60	1	0.5	0.1	Yes	Q1 2014
DFLS1100Q	PowerDI123	100	1	0.77	2	Yes	Q1 2014
DFLS230Q	PowerDI123	30	2	0.49	1	Yes	Q1 2014
DFLS230LQ	PowerDI123	30	2	0.42	1	Yes	Q1 2014
DFLS240LQ	PowerDI123	40	2	0.5	1	Yes	Q1 2014
DFLS260Q	PowerDI123	60	2	0.62	1	Yes	Q1 2014
DFLS2100Q	PowerDI123	100	2	0.86	1	Yes	Q1 2014

MOSFET Automotive 'Q' Portfolio

Embracing both industry-standard and differentiated products, such as the industry's smallest self-protected MOSFET –the ZXMS6004FFQ–the Diodes MOSFET portfolio encompasses N-channel, P-channel and Complementary devices qualified to AEC-Q101.

The Automotive Q portfolio also features devices that are qualified to +175°C, 100% avalanche rated and fully PPAP compliant.

THE **DIODES** ADVANTAGE

Product Features and Benefits

- **AEC-Q101**
  Hi-reliability qualification in association with AEC-Q101.
- **PPAP Supported**
  Production Part Approval Process documents provided.
- **Broad Portfolio**
  N-channel MOSFET's, P-channel MOSFETs, Complementary Duals and Quads, self-protected MOSFETs.

MOSFET 'Q' Portfolio

Part	Package	Polarity	V_{DS} (V)	V_{gss} (V)	I_D (A)	$R_{DSON\ MAX}$ (mOhm)		Qg typ @10V (nc)	Typ.Ciss (pf) @0.5V_{DSS}	E_{AS} (mJ)	Availability
						@10V	@4.5V				
DMP4015SK3Q	T0252-3	P	-40	20		11	13	47*	4234	242	Released
DMP4015SP5Q	PowerDI5060	P	-40	20	-17	11	13	47*	4234	242	Released
DMP4015SSSQ	SO8	P	-40	20		11	13	47*	4234	242	Released
DMP3010LPSQ	PowerDI5060	P	-30	20	-36	7.5	10	59	6324	153	Released
ZXMP6A13FQ	SOT23	P	-60	20	-2.3	400	600	5.9	219	N/S	Released
ZXMP6A17E6Q	SOT23-6	P	-60	20	-4.1	125	190	17.7	637	N/S	Released
ZXMP6A17GQ	SOT223	P	-60	20	-3	125	190	17.7	637	N/S	Released
ZXMP6A16DN8Q	SO8	P	-60	20	-3	125	190	17.7	637	N/S	Released
ZXMP7A17GQ	SOT223	P	-70	20	-3.7	160	250	18	635	N/S	Released
ZXMP10A17E6Q	SOT223	P	-100	20	-1.6	350	450	10.7	424	N/S	Released
ZXMN6A08E6Q	SOT223	N	60	20	3.5	80	150	5.8	459	N/S	Released
ZXMN6A08GQ	SOT223	N	60	20	5.3	80	150	5.8	459	N/S	Released

MOSFET 'Q' Portfolio

Part	Package	Polarity	V_{DS} (V)	V_{gss} (V)	I_D (A)	V_{gsth} (V)	$R_{DSON\ MAX}$ (mOhm)		Qg typ @10V (nc)	Typ.Ciss (pf) @0.5V_{DSS}	E_{AS} (mJ)	Availability
							@10V	@4.5V				
DMN4003CTBQ	TO263-3L	N	40	20	100	2-4	2.2	-	70	5500	320	Q2 2014
DMN4004LK3Q	T0252-3L	N	40	20	95	2-4	3.3	5.5	46	3610	95	Q2 2014
DMN4005LK3Q	TO252-3L	N	40	20	80	2-4	5	-	50	2300	77	Q2 2014
DMN4007LK3Q	TO252-3L	N	40	20	50	1.2- 2.2	7.5	10.5	25	1800	55	Q2 2014
DMN4010LK3Q	TO252-3L	N	40	40	20	2-4	10	-	14	1100	42	Q2 2014

AECQ101, PPAP Available, Auditable to VDA6.3, Avalanche Rugged

Self-Protected MOSFET for Automotive Applications

Part	Configuration	TAB	BV_{DSS}	I_D (A)	PD	$R_{DS(on)}$ max (mΩ) @ V_{IN}			V_{DS} (S/C)	E_{AS} (mJ)	Package Outlines	Availability
			(V)	V_{IN} =	(W)	3V	5V	10V	V_{IN} = 5V			
BSP75GQ	Single	Drain	60	1.4	2.5	-	0.675	0.55	36	550	SOT223	Q1 2014
BSP75NQ	Single	Source	60	1.2	1.5	-	0.675	0.55	36	550	SOT223	Q1 2014
ZXMS6001N3Q	Single	Source	60	1.1	1.5	2	0.675	-	36	550	SOT223	Q1 2014
ZXMS6002GQ	Single	Drain	60	1.4	2.5	-	0.675	0.55	36	550	SOT223	Q1 2014
ZXMS6003GQ	Single	Drain	60	1.4	2.5	-	0.675	0.55	36	550	SOT223	Q1 2014
ZXMS6004DGQ	Single	Drain	60	1.3	3	0.6	0.5	-	36	490	SOT223	Q1 2014
ZXMS6004FFQ	Single	N/A	60	1.3	1.5	0.6	0.5	-	36	90	SOT23F	Q1 2014
ZXMS6004SGQ	Single	Source	60	1.3	1.6	0.6	0.5	-	36	480	SOT223	Q1 2014
ZXMS6004DT8Q	Dual	N/A	60	1.2	2.3	0.6	0.5	-	36	210	SM8	Q1 2014
ZXMS6005DGQ	Single	Drain	60	2	1.6	0.25	0.2	-	36	490	SOT223	Q1 2014
ZXMS6005SGQ	Single	Source	60	2	1.6	0.25	0.2	-	36	490	SOT223	Q1 2014
ZXMS6005DT8Q	Dual	N/A	60	1.8	1.6	0.25	0.2	-	36	210	SM8	Q1 2014
ZXMS6006DGQ	Single	Drain	60	2.8	3	0.1	0.125	-	36	490	SOT223	Q1 2014
ZXMS6006SGQ	Single	Source	60	2.8	3	0.1	0.125	-	36	490	SOT223	Q1 2014
ZXMS6006DT8Q	Dual	N/A	60	-	2.1	0.1	0.125	-	36	210	SM8	Q1 2014

Automotive Applications: Reverse Battery Protection

Application Requirements

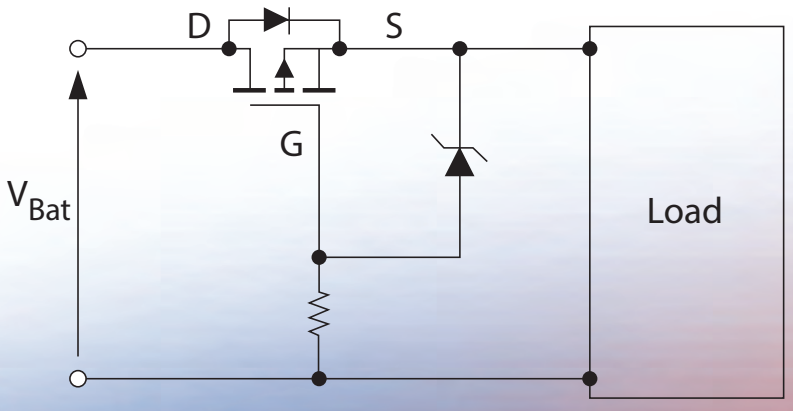
- Protect against user reverse polarity connection of the battery
- Low cost
- Minimal power losses
- Simple solution
- AEC-Q101 AND PPAP required

Diodes Advantage

- Provides designers with a choice of diode, N-channel MOSFET or P-channel MOSFET.

Key Products

- DMP4015SP5
- DMP4015LK3



Bipolar Transistor Automotive 'Q' Portfolio

Diodes Incorporated is the market leader when it comes to bipolar transistors. The company has enhanced its cost-competitive, small signal transistor portfolio with best-in-class transistor technology from Zetex.
By utilizing its wide array of in-house packaging and superior silicon technology, Diodes is ideally positioned to meet your application needs for bipolar transistors.

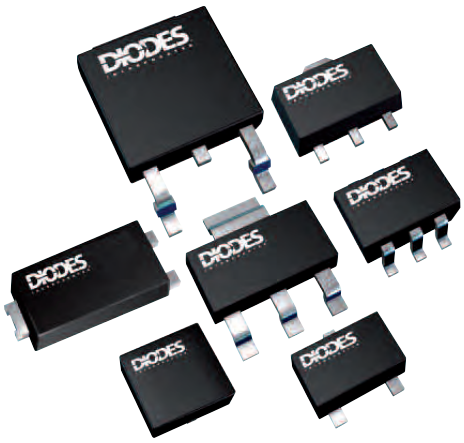
Continued Innovation

The bipolar transistor automotive portfolio is built on successive generations of our innovative matrix emitter process. Years of know-how, leading-edge designs and process innovation have extended our leadership in building ultra-low saturation, fast switching transistors.

Best-in-Class Performance

With focus on optimizing processes for the lowest saturation voltage, reduced die area and subsequently improved switching performance, the consequent reduction in power dissipation allows ever smaller surface-mount packages, which still meet the rigorous requirements of automotive applications.

Our bipolar products meet the market demands for improved electronic systems solutions, whether in terms of improved efficiency, increased power density, or just cost reduction.



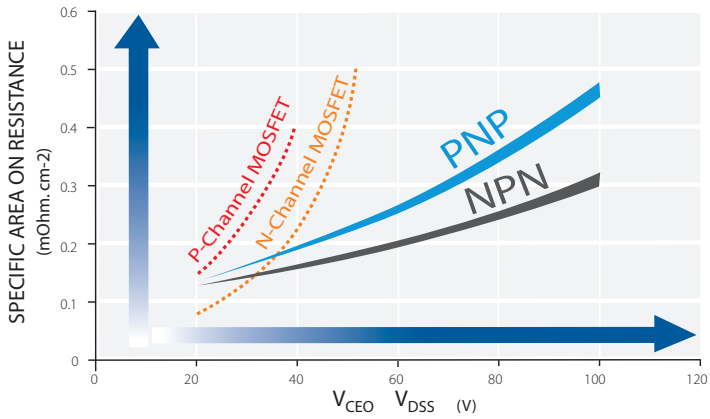
THE **DIODES** ADVANTAGE

Product Features and Benefits

- **Broad Portfolio**
  NPN, PNP, Darlingtons, Matched Pairs, Pre-Biased Transistors, Gate Drivers to meet the majority of customer needs.
- **Low Vce(sat)**
  Leading-edge silicon technology gives best-in-class saturation voltage performance with respect to footprint.
- **High Peak Current**
  For gate driving, the high peak current handling allows the capacitive load of MOSFET and IGBT gates to be switched quickly.
- **High Gain**
  High minimum gains help to reduce the base current requirements and assist in switching faster.
- **AEC-Q101**
  Hi-reliability qualification to meet the demands of the automotive industry.
- **PPAP Supported**
  Production Part Approval Process documents provided.

Part	Product Type	V_{CEO} (V)	I_C (A)	I_{CM} (A)	P_D (W)	h_{FE}				$V_{CE(sat)}$				Package	Availability
						Min.	@I_C (A)	Min.	@I_C2 (A)	Max. (mV)	@ I_C/I_B (A/mA)	Max.2 (mV)	@ I_C/I_B2 (A/mA)		
FZT651Q	NPN	60	3	6	2	100	0.5	40	2	300	1/100	600	3/300	SOT223	Released
FZT751Q	PNP	60	3	6	2	100	0.5	40	2	300	1/100	600	3/300	SOT223	Released
BCP5616Q	NPN	80	1	2	2	100	0.15	25	0.5	500	0.5/50	-	-	SOT223	Q1 2014
BCP5316Q	PNP	80	1	2	2	100	0.15	25	0.5	500	0.5/50	-	-	SOT223	Q1 2014
FMMT491Q	NPN	60	1	2	0.5	100	0.5	80	1	150	0.5/50	250	1/100	SOT23	Released
FMMT591Q	PNP	60	1	2	0.5	100	0.5	80	1	180	0.5/50	350	1/100	SOT23	Released
FMMT459Q	NPN	450	0.15	0.5	0.625	50	0.03	-	-	75	0.02/2	90	0.05/6	SOT23	Released
FMMT560Q	PNP	500	0.15	0.5	0.625	100	0.001	80	0.05	200	0.02/2	500	0.05/10	SOT23	Released
BCX5616Q	NPN	80	1	1.5	1	100	0.15	25	0.5	500	0.5/50	-	-	SOT89	Q1 2014
BCX5316Q	PNP	80	1	1.5	1	100	0.15	25	0.5	500	0.5/50	-	-	SOT89	Q1 2014
MJD31CQ	NPN	100	3	5	15	25	1	10	3	1200	3/375	-	-	TO252	Released
MJD32CQ	PNP	100	3	5	15	25	1	10	3	1200	3/375	-	-	TO252	Released
FMMT634Q	NPN	100	0.9	5	0.625	15,000	1	-	-	960	1/5	-	-	SOT23	Released

Latest generation Bipolars offer lower specific on-resistance than MOSFETs



World-leading Bipolar processing and designs

- Inventor of the Matrix emitter transistor structure.
- Industry-leading, low saturation voltage.
- Highest current handling capability for given package outlines.
- Reduced switching losses due to smaller die sizes.
- High minimum gains to reduce base drive requirements.
- Reverse blocking capability.

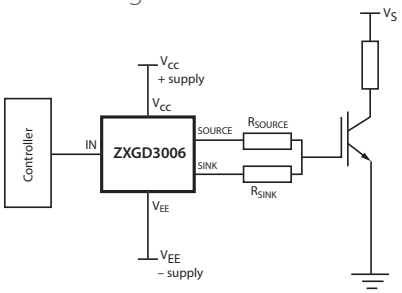
Gate Drivers

THE **DIODES** ADVANTAGE

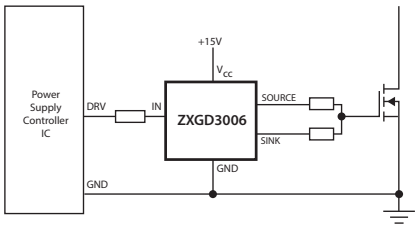
Product Features and Benefits

- **4A output from 1mA input**
  High-gain buffer stage for driving the capacitive load of MOSFET and IGBT gates.
- **40V wide operating voltage**
  Full enhancement to minimise on-state losses.
- **Resistant to latch-up and shoot-through**
  Bipolar Emitter-follower configuration is inherently resistant to latch-up and shoot-through issues.
- **Short Propagation Delay**
  Less than 10ns propagation delay can rapidly track input.

IGBT Driving



MOSFET Driving



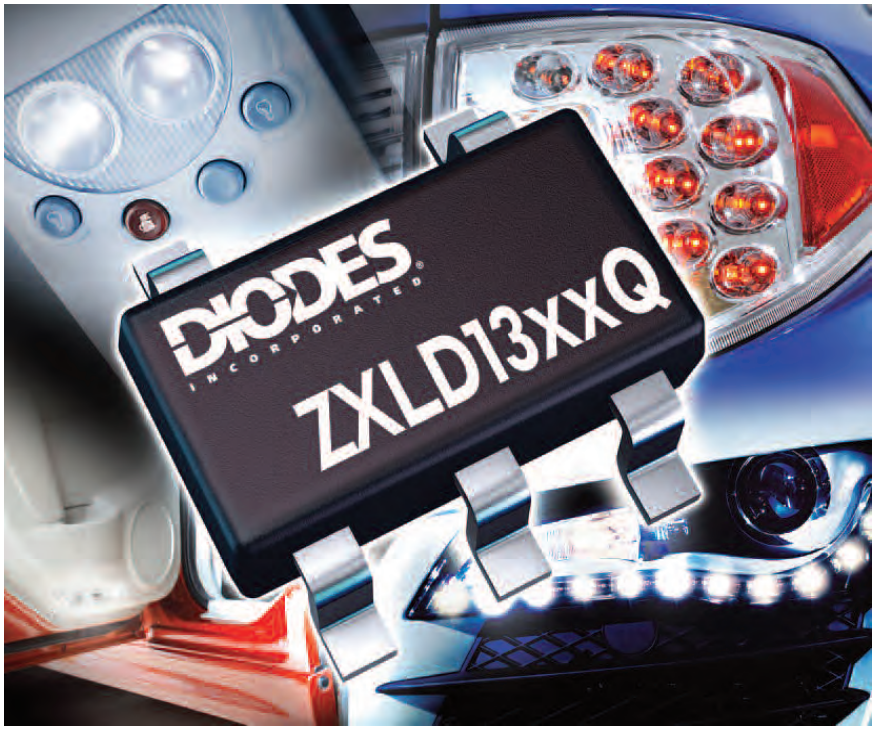
Part	V_{IN} & V_{CC} Max V	I_{source} @ I_{IN} = 1mA A	I_{sink} @ I_{IN} = 1mA A	I_{pk} A	I_{IN} A	Gate Driver Switching Times (typ) td(rise) ns	tr ns	td(fall) ns	tf ns	@ Condition	Package	Availability
ZXGD3006E6Q	40	4	3.8	10	0.1	9.5	14.5	6	14	C_L=1nF; R_L=0.18Ω; V_{CC}=15V; V_{IN}=15V; R_{IN}=200Ω	SOT26	Released

LED Driver Automotive 'Q' Portfolio

THE **DIODES** ADVANTAGE

The best Analog ICs provide circuit designers with the most advantageous combination of efficiency, functionality and package size.

Diodes Incorporated's automotive LED lighting solutions are not only recognized for their high efficiency and simplicity, but also for their flexibility and versatility, making them well suited for Automotive applications.



Product Features and Benefits

- **Reduced Switching Noise and Ringing**
  Solves EMI issues.
- **Open LED, Short LED and Overtemperature Protection**
  Open LED - automatically stops switching.
  Short LED - duty cycle reduction.
- **5% Initial LED Average Current Accuracy**
  Meets the accuracy requirements of Automotive lighting.
- **AEC-Q100**
  High-reliability qualification in association with AEC-Q100.
- **PPAP Supported**
  Production Part Approval Process documents provided.

Part	AEC-Q100/1 Grade	Buck	Boost	Buck-boost	Linear	Input Voltage		Max Output Voltage	Current Sense Voltage	Typ Peak LED Current	LED Current Accuracy	Max Switching Frequency	Efficiency	Temp Range	Quiescent Current	Package	Availability
						Min	Max										
						V	V	V	mV	A	%	kHz	%	°C	mA		
AL5801W6Q	-	-	-	-	Y	5	100	100	560	0.35	-	-	-	-40~+125	-	SOT26	Released
AL5802QW6	-	-	-	-	Y	4.5	30	30	650	120	-	-	-	-40~+125	-	SOT26	Released
AL8400QSE	1	Y	-	-	Y	2	18	-	200	Ext	3	-	-	-40~+125	0.48	SOT353	Released
AL8807QMP	1	Y	-	-	-	6	30	30	100	1.3	5	1000	95	-40~+125	1.8	MSOP-8EP	Q1 2014
ZXLD1350QET5	2	Y	-	-	-	7	30	30	100	0.35	5	1000	95	-40~+105	0.25	TSOT25	Released
ZXLD1356QET5	1	Y	-	-	-	6	60	60	200	0.55	3	1000	97	-40~+125	1.6	TSOT25	Released
ZXLD1360QET5	1	Y	-	-	-	7	30	30	100	1	5	1000	95	-40~+125	1.8	TSOT25	Released
ZXLD1362QET5	1	Y	-	-	-	6	60	60	100	1	5	1000	95	-40~+125	1.8	TSOT25	Released
ZXLD1366QEN8	1	Y	-	-	-	6	60	60	200	1	2.5	500	95	-40~+125	1.6	SO-8EP	Released
ZXLD1366QET5	1	Y	-	-	-	6	60	60	200	1	2.5	500	95	-40~+125	1.6	TSOT25	Released
ZXLD1370QEST	1	Y	Y	Y	-	6.5	60	Ext.	218	Ext. MOS	2	1000	95	-40~+125	1.65	TSSOP-16EP	Released
ZXLD1371QEST	1	Y	Y	Y	-	5	60	Ext.	218	Ext. MOS	2	1000	95	-40~+125	1.65	TSSOP-16EP	Released
ZXLD1374QEST	1	Y	Y	Y	-	6.5	60	60	218	1.5	2	1000	95	-40~+125	1.65	TSSOP-20EP	Released

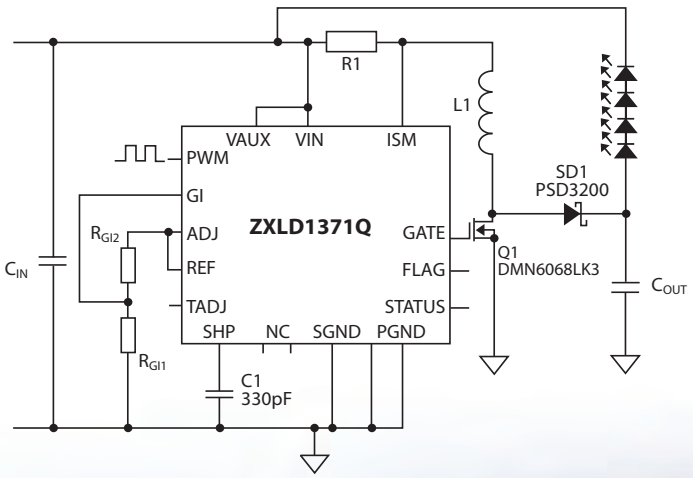
Automotive Applications 1. Daytime Running Lights

Application Requirements

- Operate over whole battery (9~16V) voltage range
- High efficiency drive of LEDs
- Wide temperature range >+85°C
- Withstand load dump
- Meet AEC-Q100 automotive quality requirements and PPAP Production Part Approval Process documents provided

The Diodes Advantage

- Multitopology LED drivers → Buck-boost mode works over V_{BATT} range driving LED chain used in DRL.
- 2% accuracy → better matching between DRL pair.
- Qualified to AEC-Q100 grade 1.
- Ambient temperature range up to +125°C.
- LED Thermal protection loop.



Key Products

- ZXLD1371Q
- ZXLD1374Q
- DMN6068LK3 MOSFET
- PD3S200Q SD1

Automotive Applications 2. Door Lighting

Application Requirements

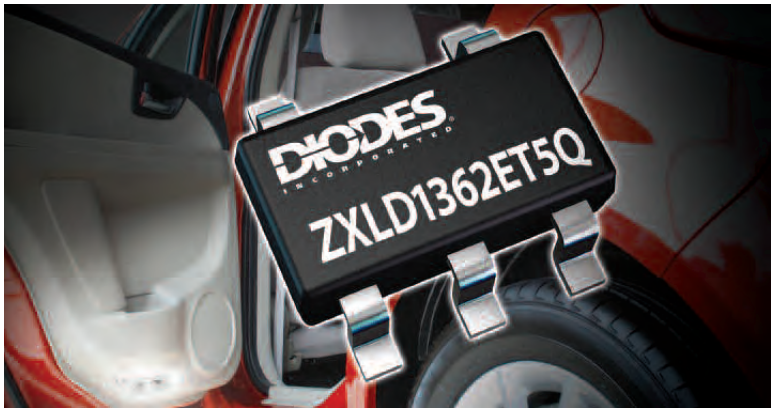
- 9~16V typical input voltage range
- High efficiency drive of 1 LED in series
- Wide temperature range >+85°C
- Withstand load dump
- Meet AEC-Q100 automotive quality requirements

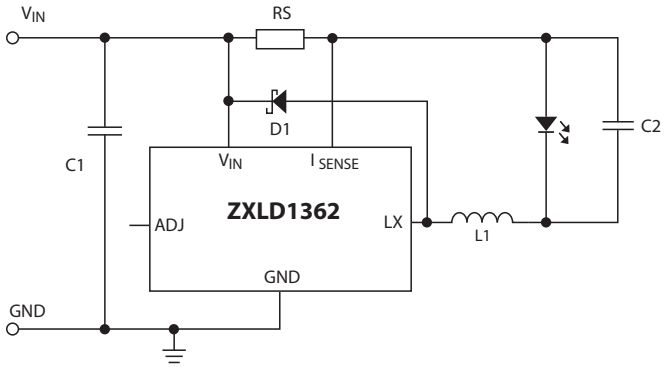
The Diodes Advantage

- 7~60V input range → supports normal battery range and load dumps
- 1A switch → Drives 0.5,1 and 3W LEDs
- Qualified to AEC-Q100 grade 1
- +125°C Ambient temperature range
- High accuracy: ZXLD1356/66Q: 2.5%
ZXLD1362Q: 5%

Key Products

- ZXLD1362Q
- ZXLD1356Q
- ZXLD1366Q
- PD3S140Q D1





Automotive Applications 3. Interior Light

Application Requirements

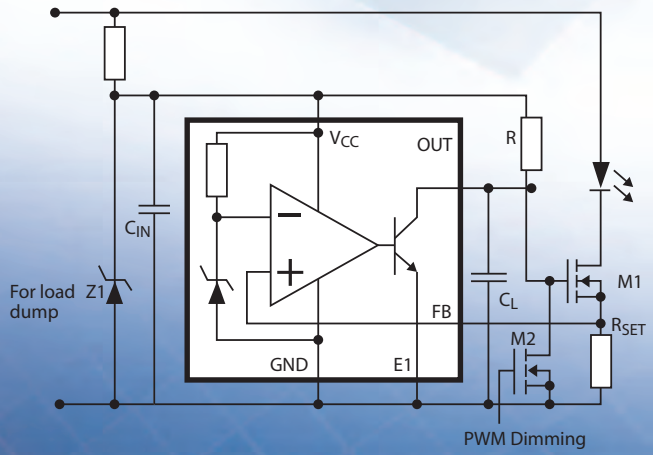
- Operate over whole battery (9~16V) voltage range
- Wide temperature range >+85°C
- Simple cost-effective solution for driving 50~150mA LEDs
- Meet AEC-Q100 automotive quality requirements

The Diodes Advantage

- Qualified to AEC-Q100 grade 1 and AEC-Q101 with PPAP support
- Ambient temperature range up to +125°C
- Drives external transistor → determines LED current and P_{DIS} capability
- Simple cost-effective solution

Key Products

- AL8400Q
- ZXMN4A06GQ, DMN6068SEQ M1
- BZT52C12Q Z1
- 2N7002Q M2



Standard ICs Automotive 'Q' Portfolio

Shunt Regulators and References

THE **DIODES** ADVANTAGE

Product Features and Benefits

- AEC-Q100 Qualification
  Meets requirements of automotive needs.
- PPAP Supported
  Production Part Approval Process documents provided.
- Extended -40°C to +125°C Ambient Temperature Range
  Meets requirements for automotive applications.
- Industry-Standard Pin Out and Packages

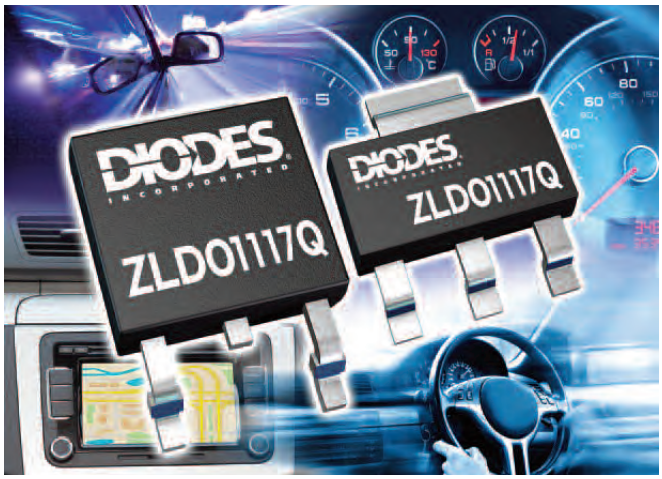
Part	Reference Voltage (V)	Accuracy (%)	Max V_K (V)	Sink Current (mA)	Minimum I_K for Regulation Typ (µA)	Ambient Temperature Range (°C)	AEC-Q100 Grade	Package	Availability
Shunt Regulators									
ZTL431Q	2.5	0.5, 1	20	100	400	-40 to +125	1	SOT23, SOT25	Q1 2014
ZTL432Q	2.5	0.5, 1	20	100	400	-40 to +125	1	SOT23	Q1 2014
TLV431Q	1.24	0.2, 0.5, 1	18	15	55	-40 to +125	1	SOT23, SOT25	Released
Shunt Reference									
LM4040-xxQ	2.5, 3.0, 5.0	0.2, 0.5, 1	-	15	60	-40 to +85	1	SOT23	Q1 2014
LM4041Q	1.225	0.5, 1	-	12	30	-40 to +125	1	SOT23	Released
LM4041_ADJQ	1.233	0.5, 1	10	12	30	-40 to +125	1	SOT23	Q1 2014

Linear Regulators and LDOs

THE **DIODES** ADVANTAGE

Product Features and Benefits

- AEC-Q100 Qualification
  Meets requirements of automotive needs.
- PPAP Supported
  Production Part Approval Process documents provided.
- ZLDO1117Q with Extended -40°C to +125°C Ambient Temperature Range
  Meets requirements for automotive applications.
- Industry-Standard Pin Out and Packages



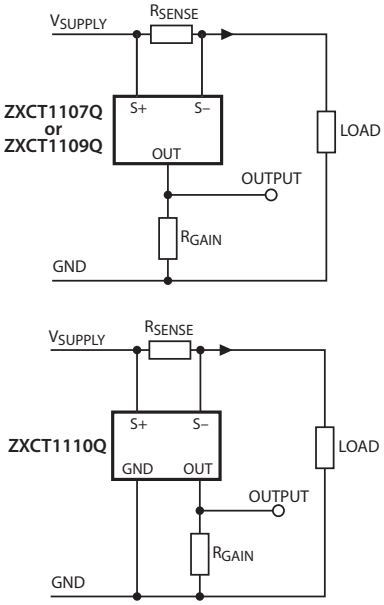
Part	Output Voltage (V)	Accuracy (%)	Max Input Voltage (V)	Output Current (mA)	Ambient Temperature Range (°C)	AEC-Q100 Grade	Package
Quasi-LDO Regulators							
ZLDO1117Q	Adj, 1.2, 1.5, 1.8, 2.5, 3.3, 5.0	1	20	1000	-40 to +125	1	SOT223, TO252
Linear Voltage Regulators							
ZMR250Q	2.5	2.5	22.5	50	-40 to +85	3	SOT23
ZMR330Q	3.3		24				
ZMR500Q	5.0		25				

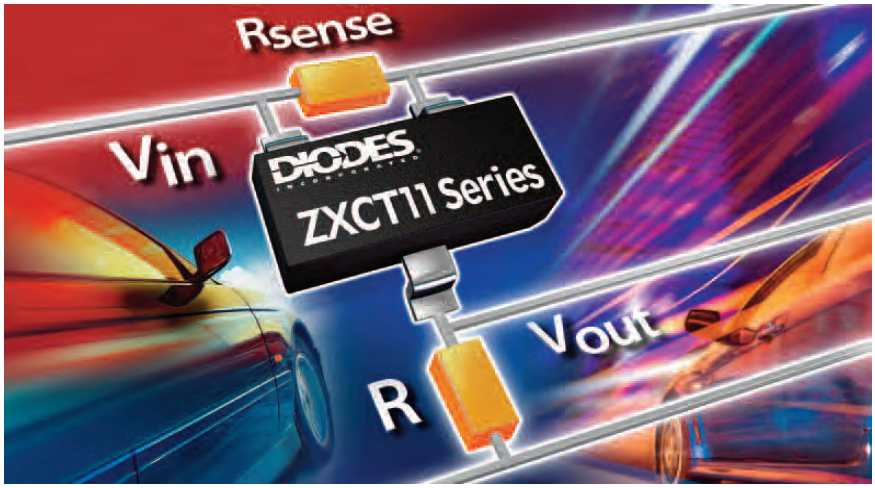
High-Side Current Monitor Automotive 'Q' Portfolio

Diodes' current monitors offer simple, cost-effective solutions to high-sided current measurement.

The current-output versions provide a variable gain, while the voltage-output versions provide fixed gain and require only one external resistor.

All versions have AEC-Q100 qualification.





Product Features and Benefits

- **High-side current sensing**
  Doesn't disturb the ground plane.
- **Up to 2.5V sense voltage**
  Measures larger transient currents while keeping accuracy at lower currents.
- **Up to 60V common-mode sensing**
  Withstands Load dump conditions.
- **1% typical accuracy**
  Meets accuracy requirements of applications.
- **AEC-Q100 Qualification**
  Meets requirements of automotive needs.
- **PPAP Supported**
  Production Part Approval Process documents provided.

Automotive Current Monitors

Current Output

Part	Description	V_{IN} (V)	V_{CC} (V)	Accuracy @ 100mV	Quiescent Current	Gain $\left(\frac{V_{OUT}}{V_{SENSE}}\right)$	Bandwidth (MHz)	Package	Ambient Temperature Range (°C)	Availability
ZXCT1008/9Q	Cost-effective current monitor	2.5 to 20	N/A	±2.5%	4µA	10mA/V	2	SOT23	-40 to +85	Q1 2014
ZXCT1082Q	60V improved accuracy	2.7 to 60	2.5 ~ 60	2%	25µA	Prog	0.5	SOT25	-40 to +125	Q1 2014
ZXCT1083Q	40V improved accuracy	2.7 to 40	2.5 ~ 40	2%	25µA	Prog	0.5	SOT25	-40 to +125	Q1 2014
ZXCT1107/9Q	High-accuracy and cost-effective	2.5 to 36	N/A	±3.4%	3µA	4mA/V	0.3	SOT23	-40 to +125	Q1 2014
ZXCT1110Q	Improved offset over ZXCT1107/9	2.5 to 36	N/A	±1.8%	3µA	4mA/V	0.3	SOT25	-40 to +125	Q1 2014

Voltage Output

Part	Description	V_{IN} (V)	V_{CC} (V)	Accuracy @ 100mV	Quiescent Current	Gain $\left(\frac{V_{OUT}}{V_{SENSE}}\right)$	Bandwidth (MHz)	Package	Ambient Temperature Range (°C)	Availability
ZXCT1080Q	60V common-mode range	3 to 60	4.5 ~ 12	±3%	30µA	10	0.5	SOT25	-40 to +125	Q1 2014
ZXCT1081Q	40V common-mode range	3 to 40	4.5 ~ 12	±3%	30µA	10	0.5	SOT25	-40 to +125	Q1 2014
ZXCT1084/5Q	60V/40V common-mode enhanced performance	2.7 to 60/40	2.5 ~60/40	2%	25µA	25	0.5	SOT25	-40 to +125	Q1 2014
ZXCT1086/7Q						50	0.2	SOT25	-40 to +125	Q1 2014

Current Monitor Automotive Applications: Window Lift

Application Requirements

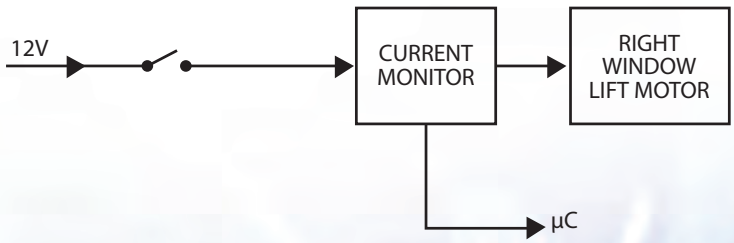
- High-side current measurement so that ground reference point isn't disturbed
- Wide operating temperature range
- AEC-Q100 qualified
- PPAP provided

The Diodes Advantage

- ZXCT1109 qualified to AEC-Q100 grade 1 (up to +125°C ambient)
- Up to 36V common-mode voltage.
- Up to 800mV sense voltage (can be extended by couple of resistors)
- Only two resistors required to measure current and set gain

Key Products

- ZXCT1008Q
- ZXCT11Q Series



Hall Sensor Automotive 'Q' Portfolio

Diodes' Hall Effect Sensors provide simple and reliable solutions to contactless switching.

They are used in many application areas from open and close detection to rotation and flow monitoring. Diodes provides three automotive Hall Effect single channel switch product families:

Omnipolar	Responds to any magnetic field polarity
Unipolar	Responds to either a N or S field dependent on package
Bipolar Latch	Latches and changes state only when opposite field is applied

Product Features and Benefits

- Extended -40°C to +150°C Ambient Temperature Range
  Meets requirements for automotive applications.
- Chopper Stabilized and High ESD (8kV)
  High accuracy and robustness.
- AEC-Q100 Qualification
  Meets requirements of automotive needs.
- PPAP Supported
  Production Part Approval Process documents provided.
- High Sensitivity
  Accurate and responds to smaller magnetic fields.

Part	Function Type	Output Type	Operating Voltage (V)	Supply Current (mA)	Reverse Supply Voltage Protection	Operating Point Bop (Gauss)			Release Point Brp (Gauss)			Temp Range	Package	Sample Availability
						Min	Typ	Max	Min	Typ	Max	°C		
AH3762Q	Latch	Open-Drain	3 to 28	2.7	Yes	10	25	40	-40	-25	-10	-40 to +150	SOT23, SIP-3	Q2 2014
AH3764Q	Latch	Open-Drain	3 to 28	2.7	Yes	20	40	60	-60	-40	-20	-40 to +150	SOT23, SIP-3	Q2 2014
AH3765Q	Latch	Open-Drain	3 to 28	2.7	Yes	50	70	90	-90	-50	-70	-40 to +150	SOT23, SIP-3	Q2 2014
AH3362Q	Unipolar	Open-Drain	3 to 28	2.7	Yes	15	30	45	5	20	35	-40 to +150	SOT23, SIP-3	Q2 2014
AH3366Q	Unipolar	Open-Drain	3 to 28	2.7	Yes	60	100	135	50	85	120	-40 to +150	SOT23, SIP-3	Q2 2014
AH3562Q	Omnipolar	Open-Drain	3 to 28	2.7	Yes	±10	±20	±30	±5	±10	±20	-40 to +150	SOT23, SIP-3	Q2 2014

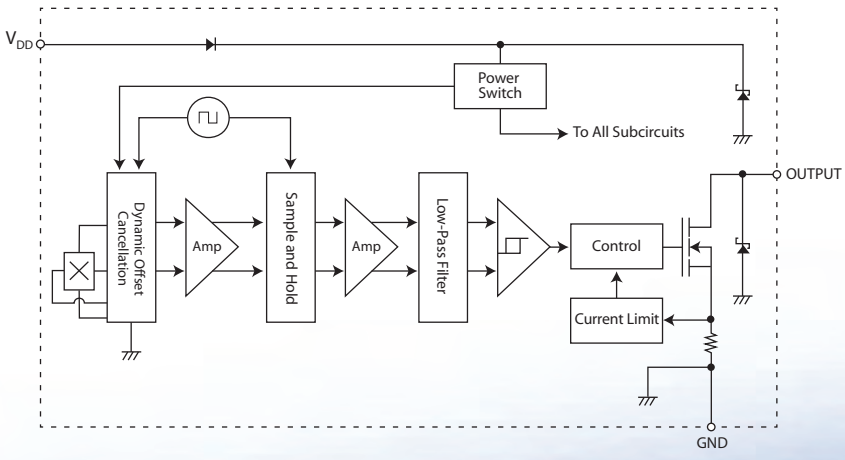
Automotive Hall Sensor Application

Requirements

- Operate over whole battery (9~16V) voltage range
- Wide temperature range >+125°C
- Simple cost-effective solution for sensing
- Meet AEC-Q100 automotive quality requirements and supports PPAP documents
- ESD > 4kV

The Diodes Advantage

- Qualified to AEC-Q100 grade 0 and PPAP supported
- 8kV HBM ESD
- Ambient temperature range up to +150°C
- Open drain output → easily interfaces to 3.3V and 5V µC
- Simple cost-effective solution



Quality and Environmental Standards

- ISO/TS 16949:2009 Quality Management System
  - Process-Based / Customer-Focused
- ISO14001 Environmental Management System
- VDA6.3 Compliant Wafer and Assembly Facilities
- RoHS-Compliant

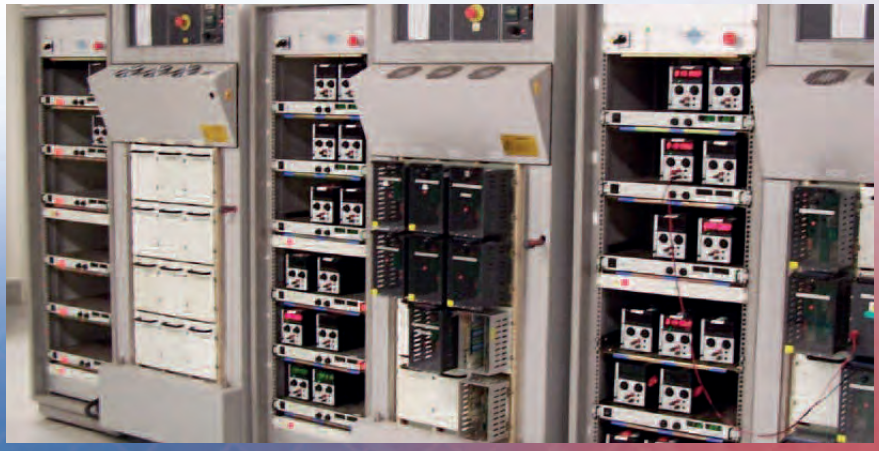
All Reliability and Environmental Information Available at www.diodes.com

Automotive-Specific Quality Information

- Production Part Approval Process (PPAP)
  - Process-Based / Customer-Focused
- Product Change Notification (PCN)
  - Diodes Aligns its PCN Process with JEDEC Standard JESD46C
- Reliability Testing Completed in Accordance with AEC Q100 and Q101 Standards

Reliability: 1000 Hour Tests

- Basic Device Reliability Tests
  - High Temperature Reverse Bias (HTRB)
  - High Temperature Gate Bias (HTGB)
  - High Temperature Operating Life (HTOL)
- Package-Related Reliability Tests
  - Temperature Humidity with Bias (THB or 85/85)
  - PCT
  - Temperature Cycle
  - Resistance to Soldering Heat
  - High Temperature Storage



Reliability Test Equipment

DIODES
INCORPORATED

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