AP64060QWU
EVB User Guide

DESCRIPTION

The AP64060Q is a 600mA, synchronous buck converter with a wide input voltage range of 4.5V to 40V. The device fully integrates a 600mΩ high-side power MOSFET and a 300mΩ low-side power MOSFET to provide high-efficiency step-down DC-DC conversion.

The AP64060Q device is easily used by minimizing the external component count due to its adoption of peak current mode control.

The AP64060Q design has a proprietary gate driver scheme to resist switching node ringing without sacrificing MOSFET turn-on and turn-off times, which reduces high-frequency radiated EMI noise caused by MOSFET switching.

The device is available in a TSOT26 package.

FEATURES

- AEC-Q100 Qualified with the Following Results
  - Device Temperature Grade 1: -40°C to +125°C T_A Range
  - Device HBM ESD Classification Level H2
  - Device CDM ESD Classification Level C5
- VIN 4.5V to 40V
- Wide Input Range: 4.5V to 40V
- 600mA Continuous Output Current
- 0.8V ±1% Reference Voltage
- 90µA Low Quiescent Current (Pulse Frequency Modulation)
- 2.2MHz Switching Frequency
- Supports Pulse Frequency modulation (PFM)
- Precision Enable Threshold to adjust UVLO
- Protection Circuitry
  - Undervoltage Lockout (UVLO)
  - Output Overvoltage Protection (OVP)
  - Cycle-by-Cycle Peak Current Limit
  - Thermal Shutdown
- **Totally Lead-Free & Fully RoHS Compliant**
- **Halogen and Antimony Free. "Green" Device**

APPLICATIONS

- 5V, 12V, and 24V Distributed Power Bus Supplies
- eMeter
- Automotive
- White Goods and Small Home Appliances
- FPGA, DSP, and ASIC supplies
- General Purpose Point of Load (POL) devices

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
VIN	Supply Pin Voltage	-0.3 to +42.0 (DC)	V
		-0.3 to +45.0 (400ms)	
V_{BST}	Bootstrap Pin Voltage	V_{SW} - 0.3 to V_{SW} + 6.0	V
V_{EN}	Enable/UVLO Pin Voltage	-0.3 to +42.0	V
$V_{RT/CLK}$	RT/CLK Pin Voltage	-0.3 to +6.0	V
V_{FB}	Feedback Voltage	-0.3V to +6.0	V
V_{COMP}	Compensation Pin Voltage	-0.3 to +6.0	V
V_{SW}	Switch Node Voltage	-0.3 to VIN + 0.3 (DC)	V
		-2.5 to VIN + 2.0 (20ns)	
T_J	Junction Temperature	+160	°C
T_L	Lead Temperature	+260	°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
VIN	Supply Voltage	3.8	40	V
VOUT	Output Voltage	0.8	26	V
T_A	Ambient Temperature Range (Commercial)	-40	+85	°C
	Ambient Temperature Range (Automotive)	-40	+125	°C
T_J	Junction Temperature Range (Commercial)	-40	+125	°C
	Junction Temperature Range (Automobile)	-40	+150	°C

EVALUATION BOARD

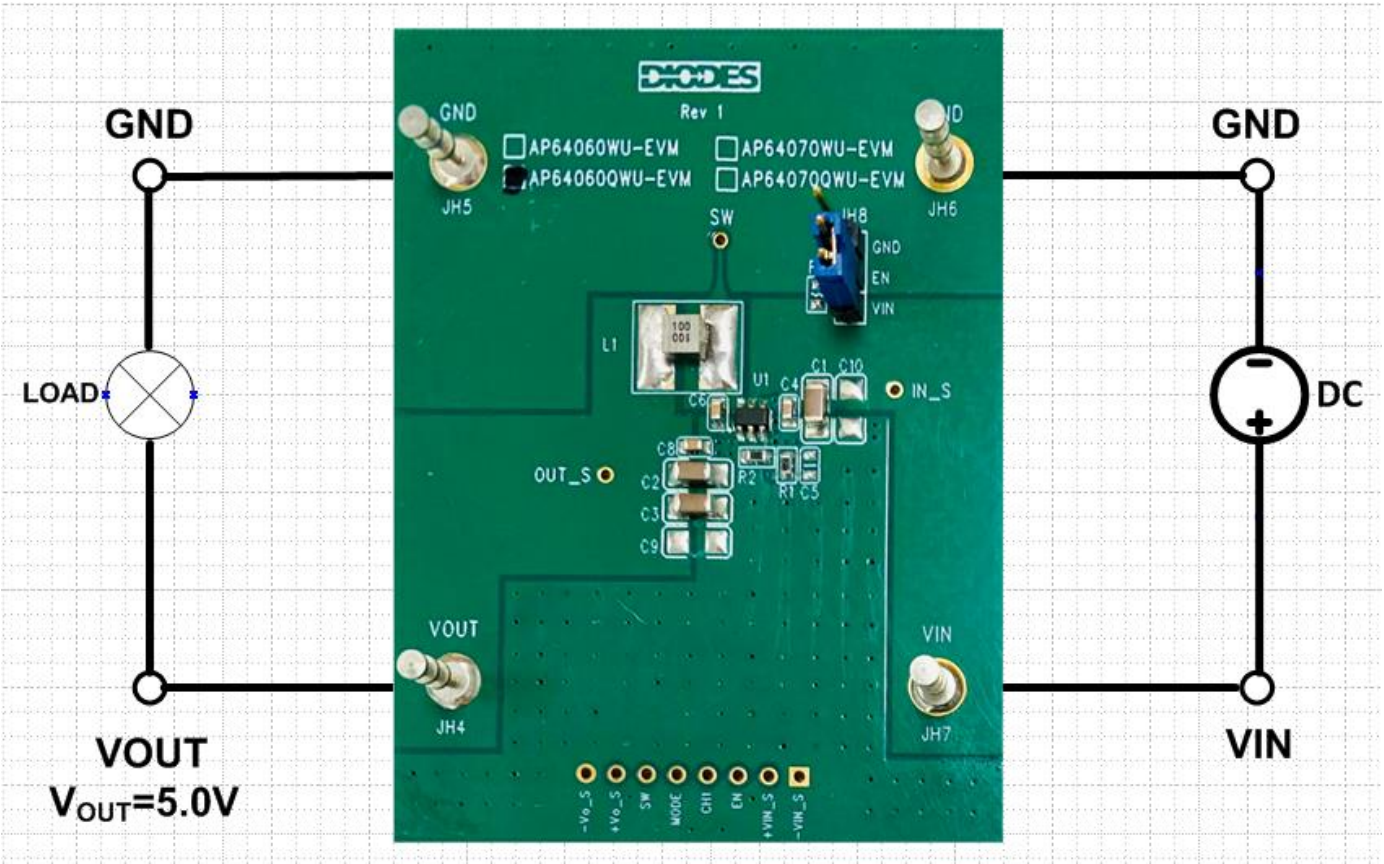


Figure 1. AP64060QWU-EVM

QUICK START GUIDE

The AP64060QWU-EVM has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP64060QWU, follow the procedure below:

1. Connect a power supply to the input terminals V_{IN} and GND. Set V_{IN} to 12V.
2. Connect the positive terminal of the electronic load to V_{OUT} and negative terminal to GND.
3. For Enable, at JH8, place a jumper to “VIN” position to connect EN pin directly to V_{IN}. Jump to “GND” position to disable IC.
4. The evaluation board should now power up with a 5.0V output voltage.
5. Check for the proper output voltage of 5.0V (±1%) at the output terminals V_{OUT} and GND. Measurement can also be done with a multimeter with the positive and negative leads between V_{OUT} and GND.

6. Set the load to 600mA through the electronic load. Check for the stable operation of the SW signal on the oscilloscope. Measure the switching frequency.

MEASUREMENT/PERFORMANCE GUIDELINES:

1) When measuring the output voltage ripple, maintain the shortest possible ground lengths on the oscilloscope probe. Long ground leads can erroneously inject high frequency noise into the measured ripple.

2) For efficiency measurements, connect an ammeter in series with the input supply to measure the input current. Connect an electronic load to the output for output current.

SETTING OUTPUT VOLTAGE:

Table 1 shows a list of recommended component selections for common output voltages.

VOUT	R1	R2	L1	C1	C2, C3 (C9)
1.8V	27.4KΩ	22.1KΩ	4.7µH	2.2µF	10µFx2
2.5V	47.5KΩ	22.1KΩ	6.8µH	2.2µF	10µFx2
3.3V	69.8KΩ	22.1KΩ	8.2µH	2.2µF	10µFx2
5.0V	115KΩ	22.1KΩ	10µH	2.2µF	10µFx2
12V	309KΩ	22.1KΩ	22µH	2.2µF	10µFx3

Table 1. Common Output Voltages (AP64060Q)

EVALUATION BOARD SCHEMATIC

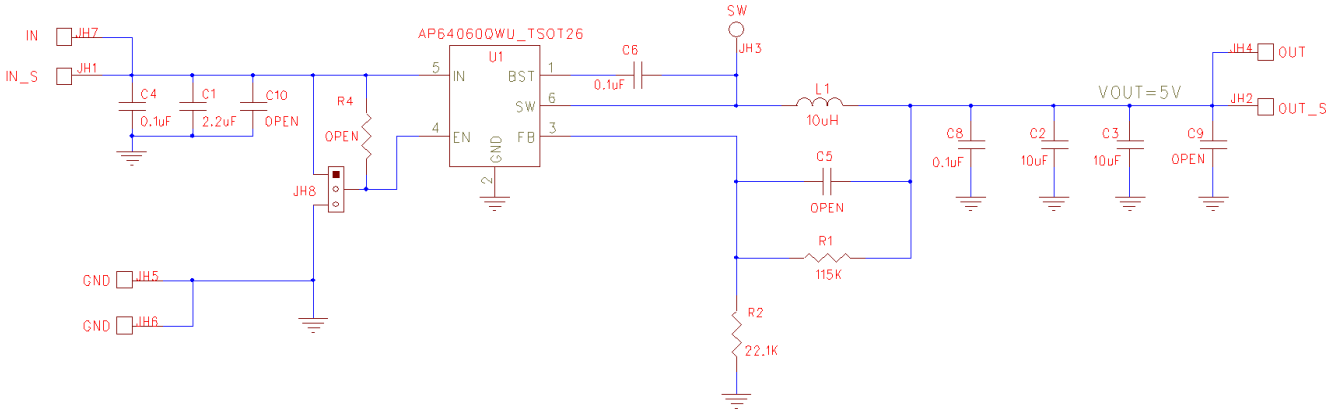


Figure 2. AP64060QWU-EVM Schematic (Automotive)

PCB TOP & BOTTOM LAYOUTS

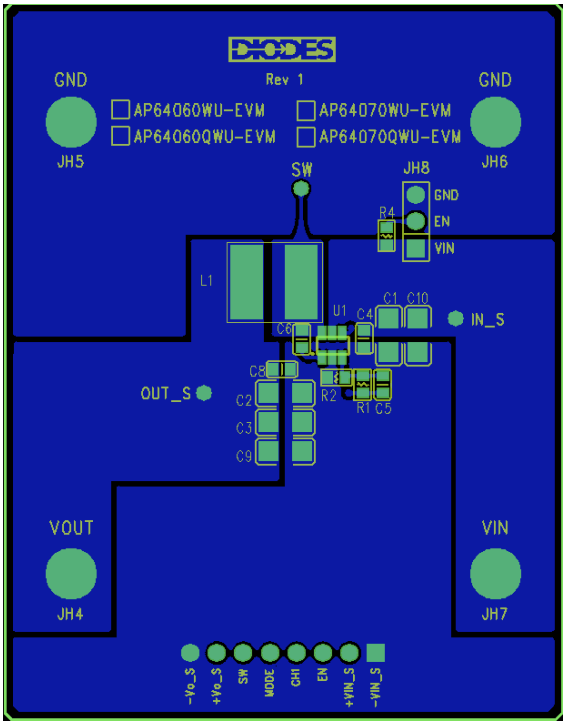


Figure 3. AP64060QWU-EVM – Top Layer

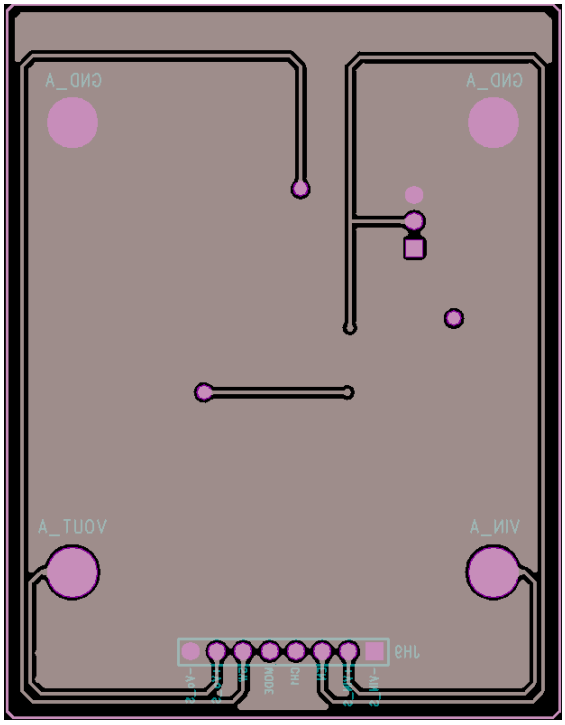


Figure 4. AP64060QWU-EVM – Bottom Layer

BILL OF MATERIALS for AP64060QWU-EVM (Automotive) for V_{OUT}=5V

Ref	Value	Description	Qty	Size	Vendor Name	Manufacturer PN
C1	2.2µF	Ceramic Capacitor, 50V	1	1206	TDK	CGA5L1X8L1H225K160AC
C4, C6, C8	0.1µF	Ceramic Capacitor, 50V	3	0603	TDK	CGA3E3X8R1H104K080AB
C2	10µF	Ceramic Capacitor, 16V	2	1206	TDK	CGA5L1X7R1C106K160AC
R1	115KΩ	RES SMD	1	0603	Panasonic	ERJ-3RED1153V
R2	22.1KΩ	RES SMD	1	0603	Panasonic	ERJ-3RBD2212V
L1	10µH	DCR=322mΩ, Ir=1.2A	1	3.0x3.0 x 2.0mm	Wurth	78438336100
JH8		PCB Header, 36 POS	1	1X3	Amphenol	78511-136HLF
JH4, JH5, JH6, JH7	1598	Terminal Turret Triple 0.094" L (Test Points)	4	Through-Hole	Keystone Electronics	1598-2
U1	AP64060Q	Sync DC-DC Buck Converter	1	SO-8EP	Diodes Incorporated (Diodes)	AP64060QWU

TYPICAL PERFORMANCE CHARACTERISTICS

Figure 5. Efficiency vs Output Current

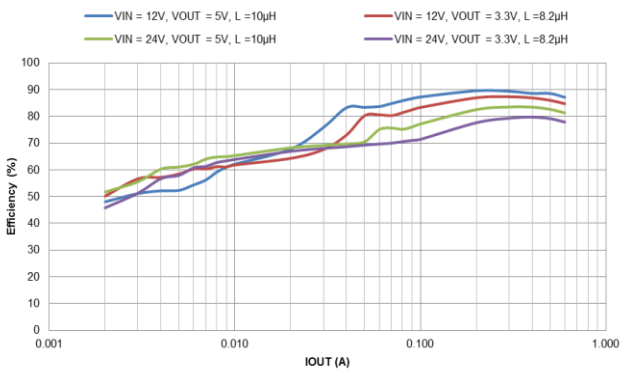


Figure 6. Load Transient, VIN=12V, 0.05 to 0.6A

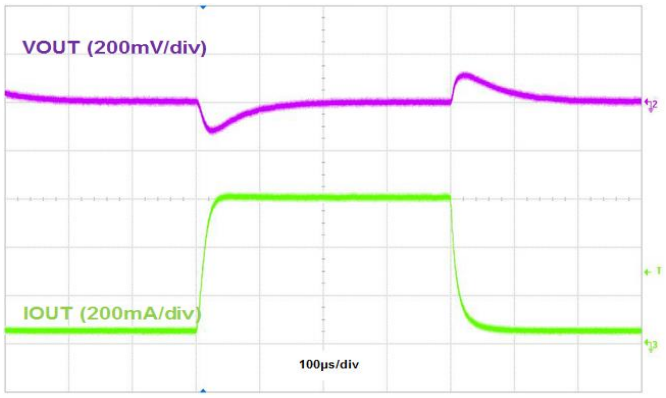


Figure 7. Output Voltage Ripple, IOUT=0.6A

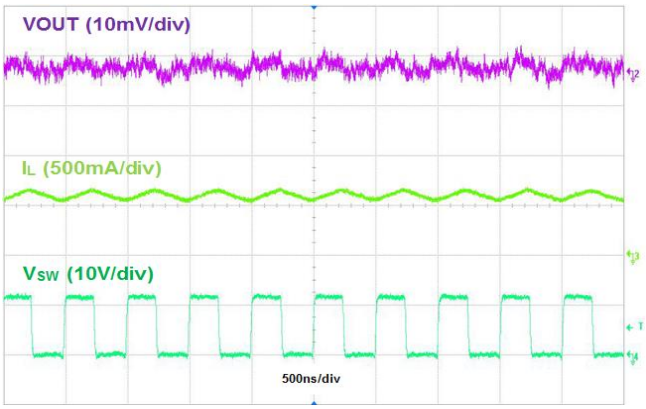
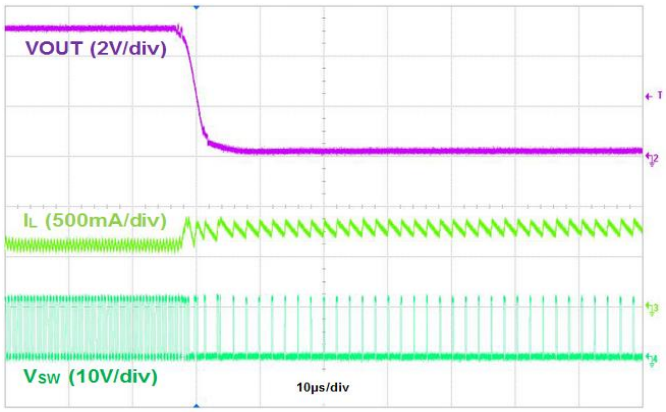


Figure 8. Output Short Protection, IOUT=0.6A



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