AP64100QSP-EVM

40V, 1A, Low IQ, SYNCHRONOUS DC-DC BUCK CONVERTER WITH PROGRAMMABLE FREQUENCY

DESCRIPTION

AP64100Q is an automotive-compliant, 1A, synchronous buck converter with a wide input voltage range of 3.8V to 40V. The device fully integrates a 150mΩ high-side power MOSFET and an 80mΩ low-side power MOSFET to provide high-efficiency step-down DC-DC conversion.

The AP64100Q device is easily used by minimizing the external component count due to its adoption of peak current mode control.

The AP64100Q design is optimized for Electromagnetic Interference (EMI) reduction. The device 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 AP64100Q also features Frequency Spread Spectrum (FSS) with a switching frequency jitter of ±6%, which reduces EMI by not allowing emitted energy to stay in any one frequency for a significant period of time.

The device is available in a SO-8EP package.

FEATURES

- AEC-Q100 Qualified for Automotive Applications
  - Device Temperature Grade 1: -40°C to +125°C TA Range
- VIN: 3.8V to 40V
- Output Voltage (VOUT): 0.8V to VIN
- 1A Continuous Output Current
- 0.8V ±1% Reference Voltage
- 22µA Ultralow Quiescent Current (Pulse Frequency Modulation)
- Adjustable Switching Frequency: 100kHz to 2.2MHz
- External Clock Synchronization: 100kHz to 2.2MHz
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- Up to 88% Efficiency at 5mA Light Load
- Proprietary Gate Driver Design for Best EMI Reduction
- Frequency Spread Spectrum (FSS) to Reduce EMI
- Low-Dropout (LDO) Mode
- 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

- Automotive Power Systems
- Automotive Infotainment
- Automotive Instrument Clusters
- Automotive Telematics
- Automotive Lighting Control
- Advanced Driver Assistance Systems

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	39	V
T_A	Operating Ambient Temperature Range	-40	+125	°C
T_J	Operating Junction Temperature Range	-40	+150	°C

EVALUATION BOARD

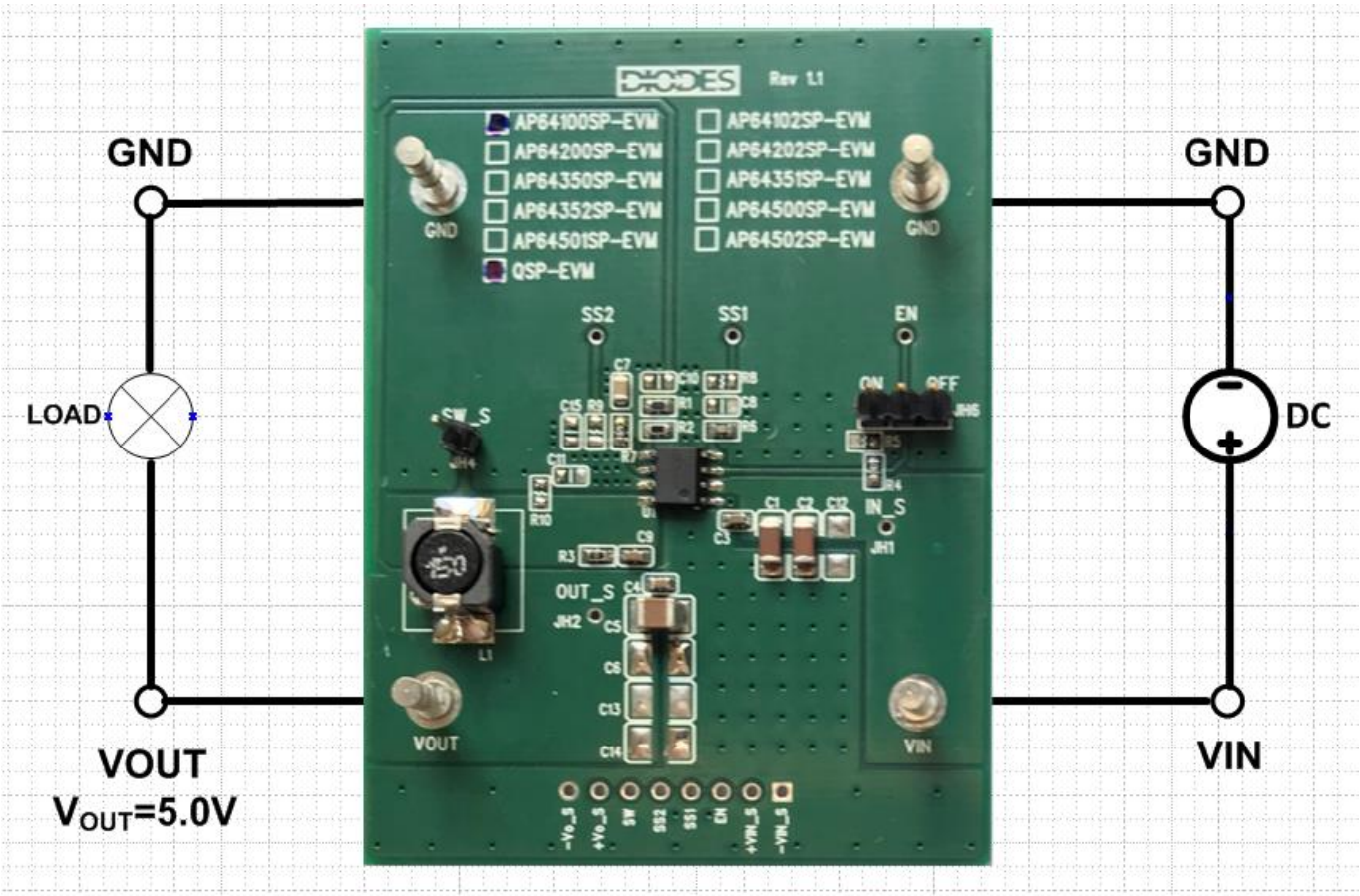


Figure 1. AP64100SP-EVM

QUICK START GUIDE

The AP64100QSP-EVM has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP64100QSP, follow the procedure below:

1. Connect a power supply to the input terminals VIN and GND. Set VIN to 12V.
2. Connect the positive terminal of the electronic load to VOUT and negative terminal to GND.
3. For Enable, to enable IC, place a jumper at JH6 to “ON” position to connect EN pin to VIN through 100KΩ resistor or leave it OPEN. Jump to “OFF” 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 VOUT and GND. Measurement can also be done with a multimeter with the positive and negative leads between VOUT and GND.
6. Set the load to 1A 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	R7	C7	C1, C2	C5	C10
1.2V	4.99KΩ	10KΩ	6.8µH	1.69KΩ	10nF	2x10µF	22µF	OPEN
1.5V	8.66KΩ	10KΩ	8.2µH	2.10KΩ	10nF	2x10µF	22µF	OPEN
1.8V	12.4KΩ	10KΩ	10µH	2.55KΩ	10nF	2x10µF	22µF	OPEN
2.5V	21.5KΩ	10KΩ	10µH	3.48KΩ	10nF	2x10µF	22µF	OPEN
3.3V	31.6KΩ	10KΩ	15µH	4.64KΩ	10nF	2x10µF	22µF	OPEN
5.0V	52.3KΩ	10KΩ	15µH	6.98KΩ	10nF	2x10µF	22µF	OPEN
12V	140KΩ	10KΩ	33µH	11.3KΩ	10nF	2x10µF	22µF	OPEN

Table 1. Common Output Voltages

EVALUATION BOARD SCHEMATIC

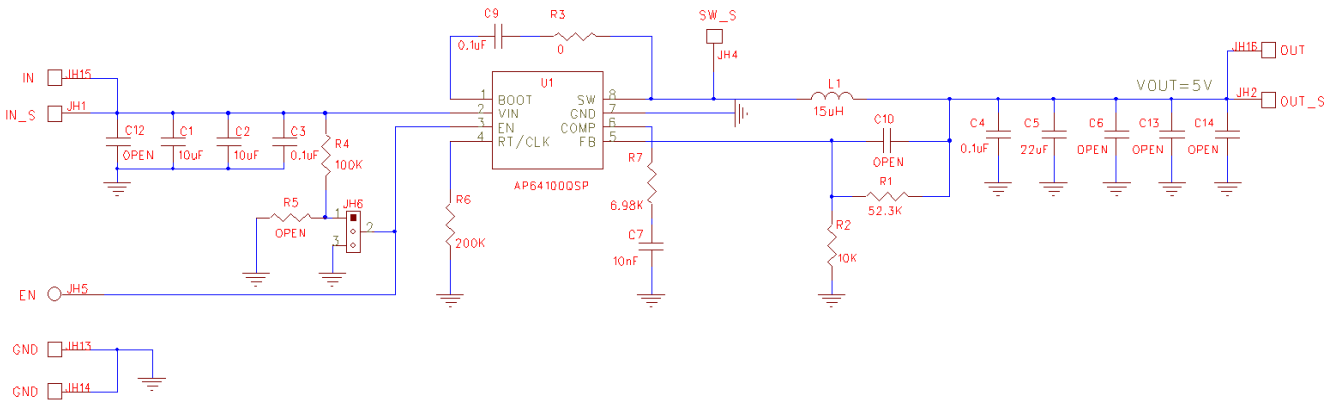


Figure 2. AP64100QSP-EVM Schematic

PCB TOP LAYOUT

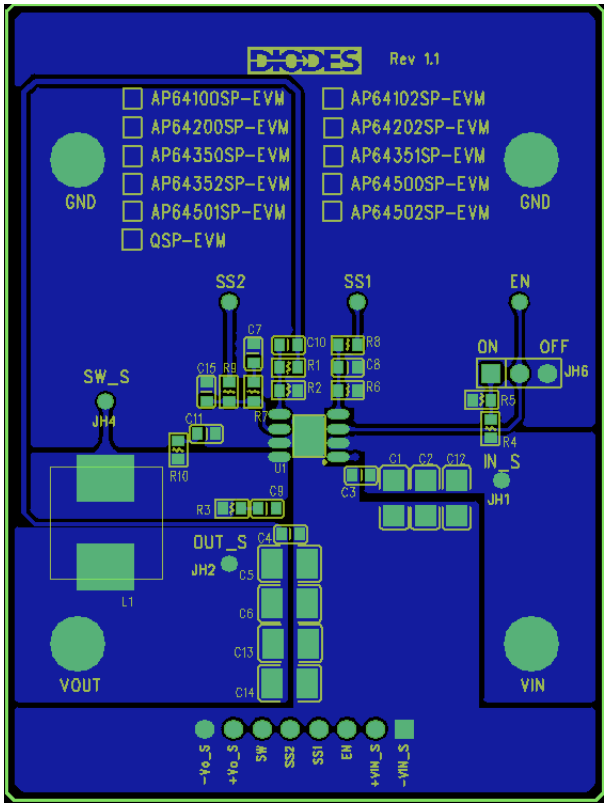


Figure 3. AP64100QSP-EVM – Top Layer

PCB BOTTOM LAYOUT

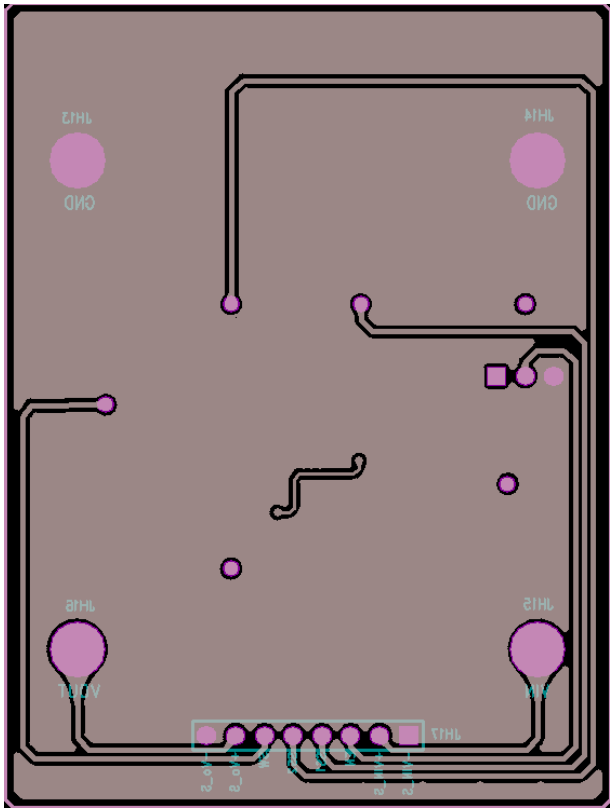


Figure 4. AP64100QSP-EVM – Bottom Layer

BILL OF MATERIALS for AP64100QSP-EVM for V_{OUT}=5V

Ref	Value	Description	Qty	Size	Vendor Name	Manufacturer PN
C1, C2	10µF	Ceramic Capacitor, 50V	2	1206	TDK	CGA5L1X7R1H106K160AC
C3, C4, C9	0.1µF	Ceramic Capacitor, 50V	3	0603	TDK	CGA3E3X8R1H104K080AB
C5	22µF	Ceramic Capacitor, 16V	1	1210	TDK	CGA6P1X8L1C226M250AC
C7	10nF	Ceramic Capacitor, 50V	1	0603	TDK	C1608NP01H103J080AA
R1	52.3KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3EKF5232V
R2	10KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3EKF1002V
R3	0Ω	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3GEY0R00V
R4	100KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3EKF1003V
R6	200KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-S03F2003V
R7	6.98KΩ	RES SMD 1% 1/10W	1	0603	Panasonic	ERJ-3EKF6981V
L1	15µH	DCR=69.5mΩ, Ir=2.2A	1	7.4x 7.3x 4.5mm	Wurth Electronics	7447773150
JH6		PCB Header, 36 POS	1	1X3	Amphenol	78511-136HLF
VIN, VOUT, GNDx2	1598	Terminal Turret Triple 0.094" L (Test Points)	4	Thu-Hole	Keystone Electronics	1598-2
U1	AP64100Q	Sync DC-DC Converter	1	SO-8EP	Diodes Incorporated (Diodes)	AP64100QSP

TYPICAL PERFORMANCE CHARACTERISTICS

Figure 5. Efficiency vs Output Current

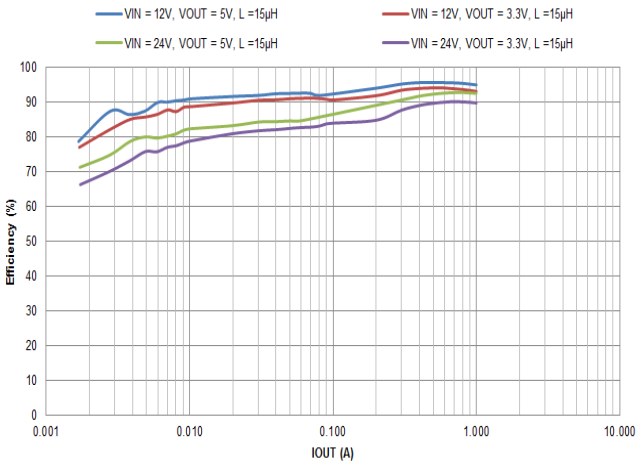


Figure 6. Load Transient 0.5A to 1A

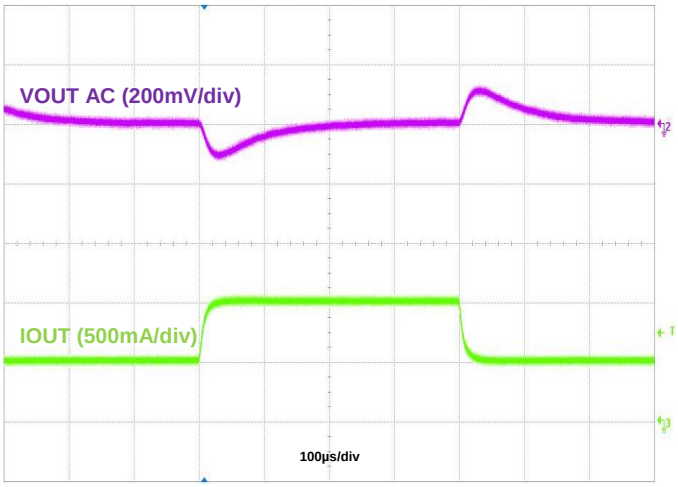


Figure 7. Output Voltage Ripple, IOUT=1A

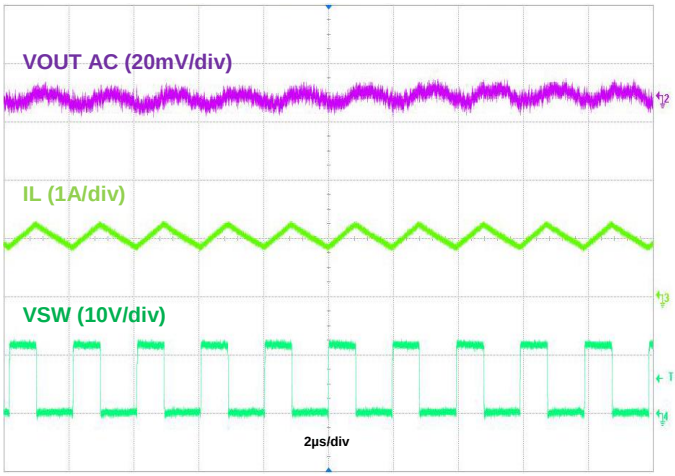
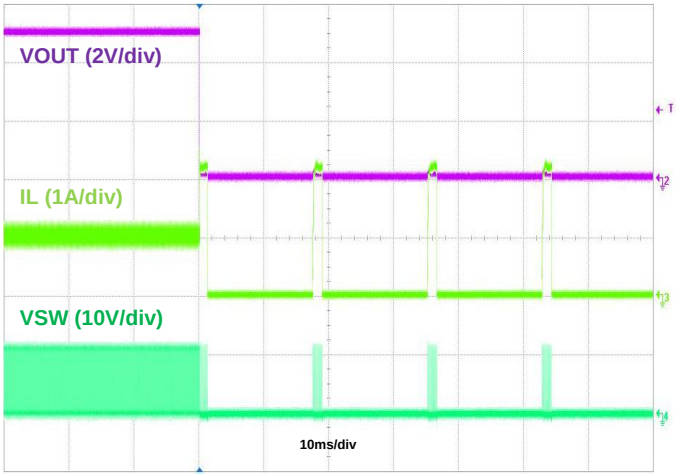


Figure 8. Output Short Protection, IOUT=1A



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