AP64102SP
EVB User Guide

DESCRIPTION

AP64102 is a 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 a 80mΩ low-side power MOSFET to provide high-efficiency step-down DC-DC conversion.

The AP64102 device is easily used by minimizing the external component count due to its adoption of peak current mode control along with its integrated loop compensation network.

The AP64102 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 AP64102 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 an SO-8EP package.

FEATURES

- Wide Input Range: 3.8V to 40V
- 1A Continuous Output Current
- 0.8V ±1% Reference Voltage
- 25µA Ultralow Quiescent Current (Pulse Frequency Modulation)
- Adjustable Switching Frequency: 100kHz to 2.2MHz
- External Clock Synchronization: 100kHz to 2.2MHz
- Adjustable Soft-Start Time
- 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

- Distributed Power Bus Supplies
- Power Tools and Laser Printers
- White Goods and Small Home Appliances
- Home Audio
- Network Systems
- Consumer Electronics
- General Purpose Point of Load

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_{SS}	Soft-Start 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	+85	°C
T_J	Operating Junction Temperature Range	-40	+125	°C

EVALUATION BOARD

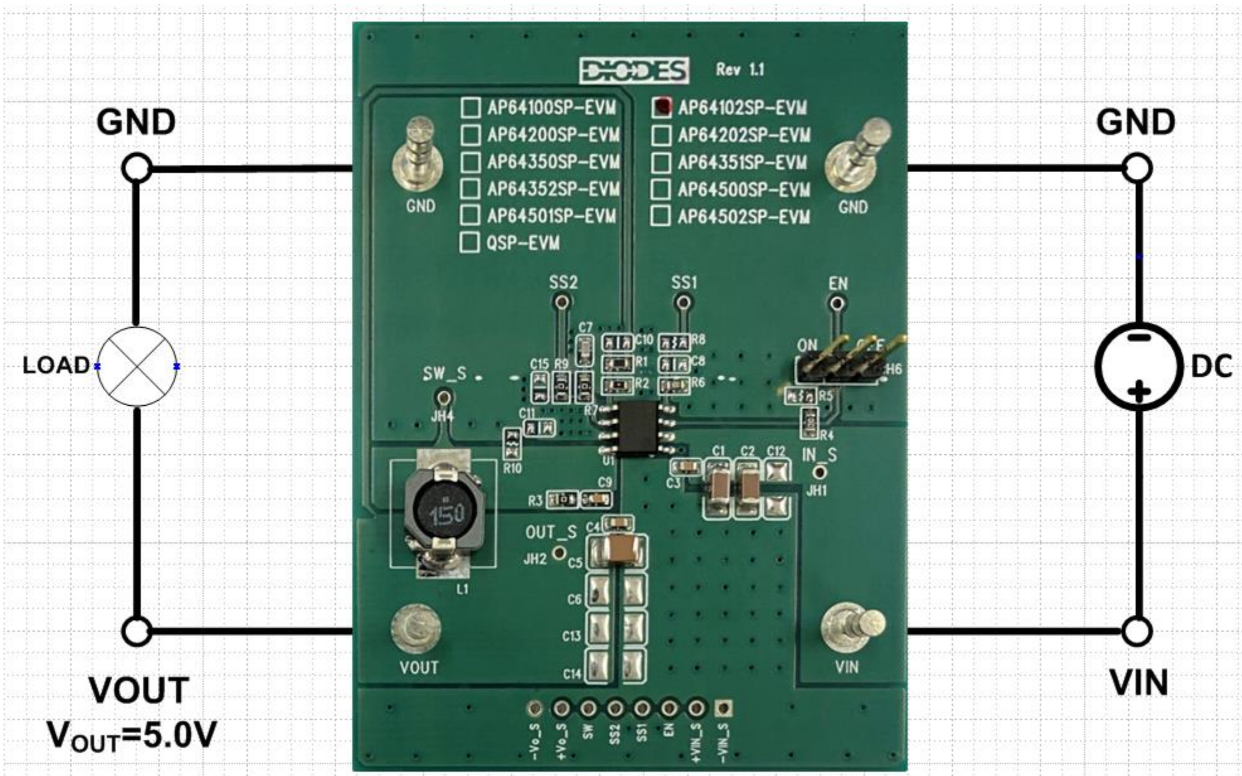


Figure 1. AP64102SP-EVM

QUICK START GUIDE

The AP64102SP-EVM has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP64102SP, 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, to enable IC, place a jumper at JH6 to “ON” position to connect EN pin to V_{IN} 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 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 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	C1, C2	C5
1.2V	4.99KΩ	10KΩ	6.8µH	2x10µF	22µF
1.5V	8.66KΩ	10KΩ	8.2µH	2x10µF	22µF
1.8V	12.4KΩ	10KΩ	10µH	2x10µF	22µF
2.5V	21.5KΩ	10KΩ	10µH	2x10µF	22µF
3.3V	31.6KΩ	10KΩ	15µH	2x10µF	22µF
5.0V	52.3KΩ	10KΩ	15µH	2x10µF	22µF
12V	140KΩ	10KΩ	33µH	2x10µF	22µF

Table 1. Common Output Voltages

EVALUATION BOARD SCHEMATIC

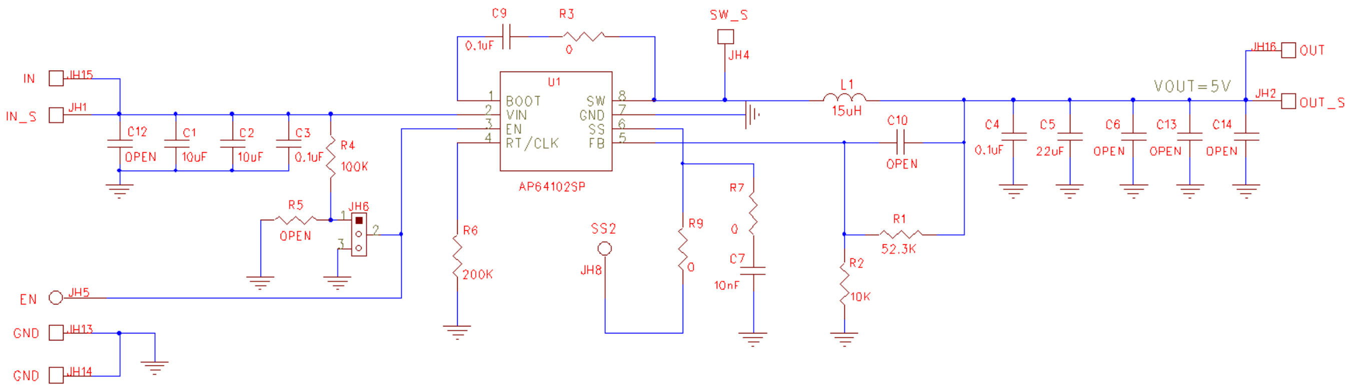


Figure 2. AP64102SP-EVM Schematic

PCB TOP LAYOUT

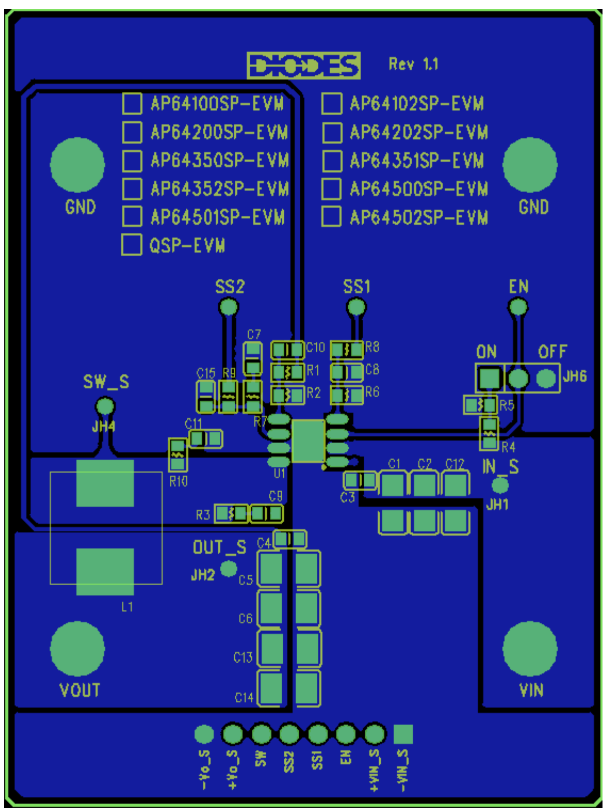


Figure 3. AP64102SP-EVM – Top Layer

PCB BOTTOM LAYOUT

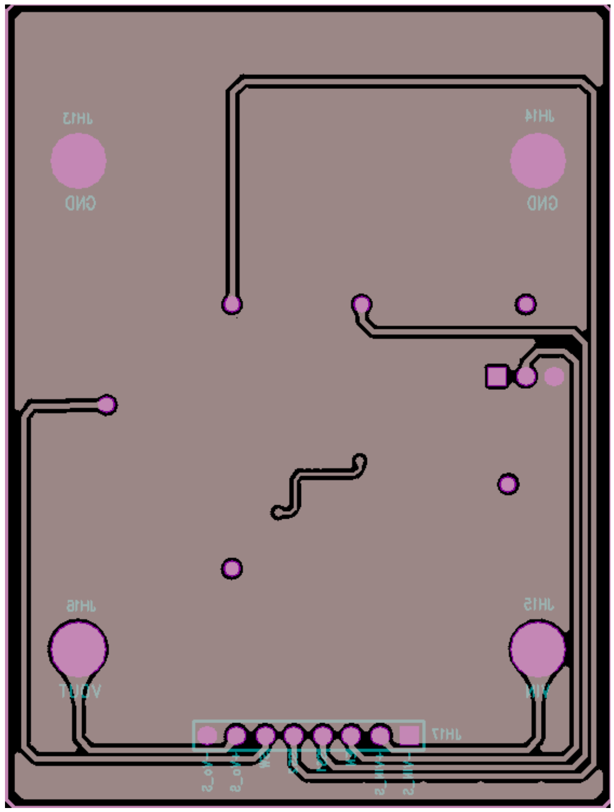


Figure 4. AP64102SP-EVM – Bottom Layer

BILL OF MATERIALS for AP64102SP-EVM for V_{OUT}=5V

Ref	Value	Description	Qty	Size	Vendor Name	Manufacturer PN
C1, C2	10µF	Ceramic Capacitor, 50V, X7R, 10%	2	1206	Samsung	CL31B106KBHNNNE
C3, C4, C9	0.1µF	Ceramic Capacitor, 50V, X7R, 10%	3	0603	Wurth Electronics	885012206095
C5	22µF	Ceramic Capacitor, 16V, X7R	1	1210	Samsung	CL32B226KOJNNNE
C7	10nF	Ceramic Capacitor, 50V, X7R	1	0603	Wurth Electronics	885382206002
R1	52.3KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3EKF5232V
R2	10KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3EKF1002V
R3, R7, R9	0Ω	SMD Resistor, 1%	3	0603	Panasonic	ERJ-3GEY0R00V
R4	100KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3EKF1003V
R6	200KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-S03F2003V
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
JH13, JH14, JH15, JH16	1598	Terminal Turret Triple 0.094" L (Test Points)	4	Through -Hole	Keystone Electronics	1598-2
U1	AP64102	Sync DC-DC Converter	1	SO-8EP	Diodes Incorporated (Diodess0	AP64102SP

TYPICAL PERFORMANCE CHARACTERISTICS

Figure 5. Efficiency vs Output Current

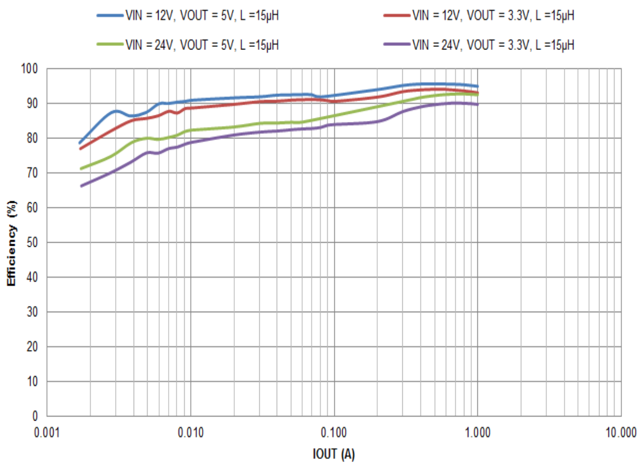


Figure 6. Load Transient 0.5A to 1A

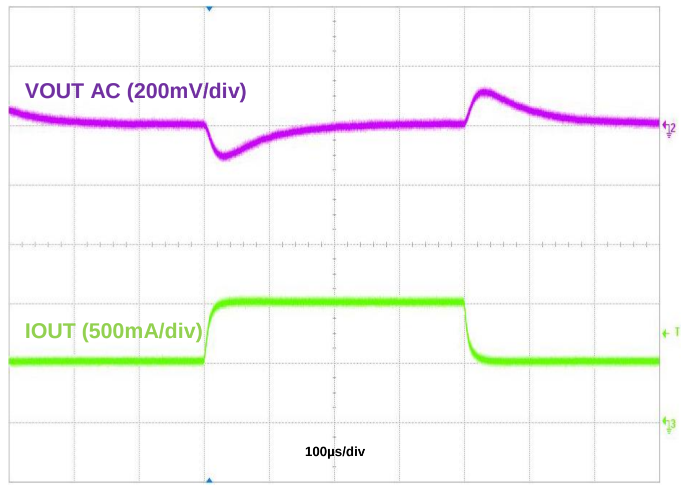


Figure 7. Output Voltage Ripple, IOUT=1A

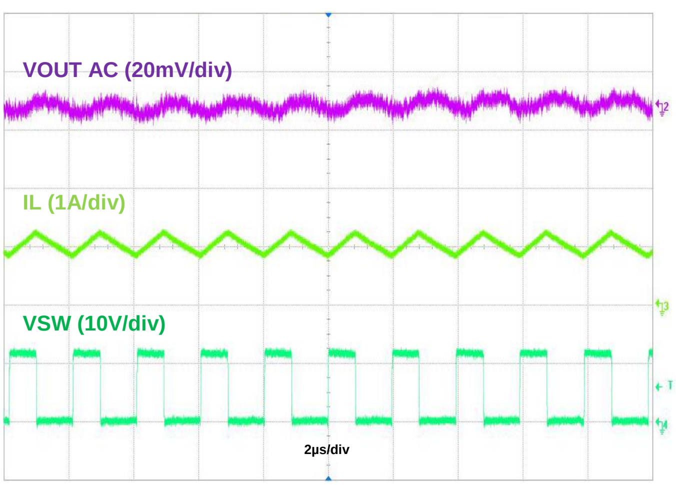
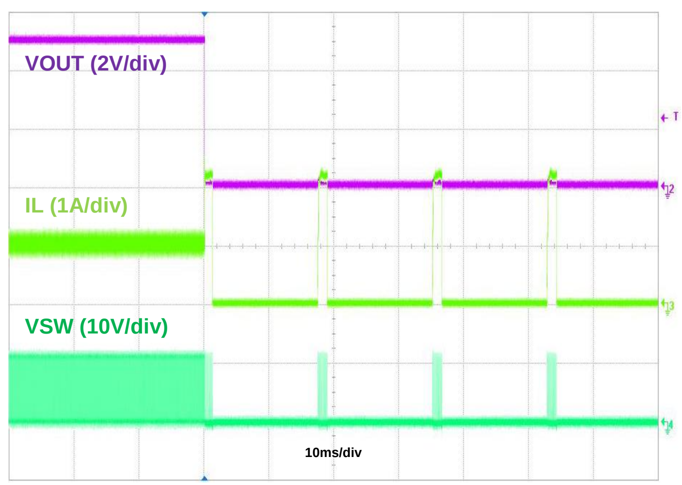


Figure 8. Output Short Protection, IOUT=1A



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