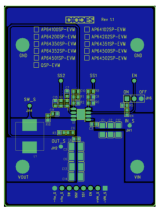

DIODES AP64500SP-EVM Low IQ Synchronous Buck With Programmable Frequency User Guide

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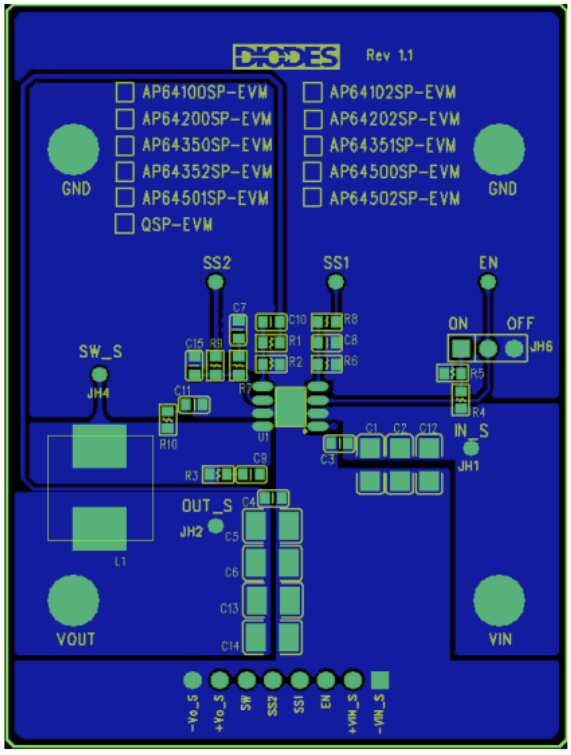


Contents

DESCRIPTION

The AP64500 is 5A, synchronous buck converter with a wide input voltage range of 3.8V to 40V. The device fully integrates a 45mΩ high-side power MOSFET and a 20mΩ low-side power MOSFET to provide high-efficiency stepdown DC-DC conversion.

The AP64500 device is easily used by minimizing the external component count due to its adoption of peak current mode control.

The AP64500 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. AP64500 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.

- 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

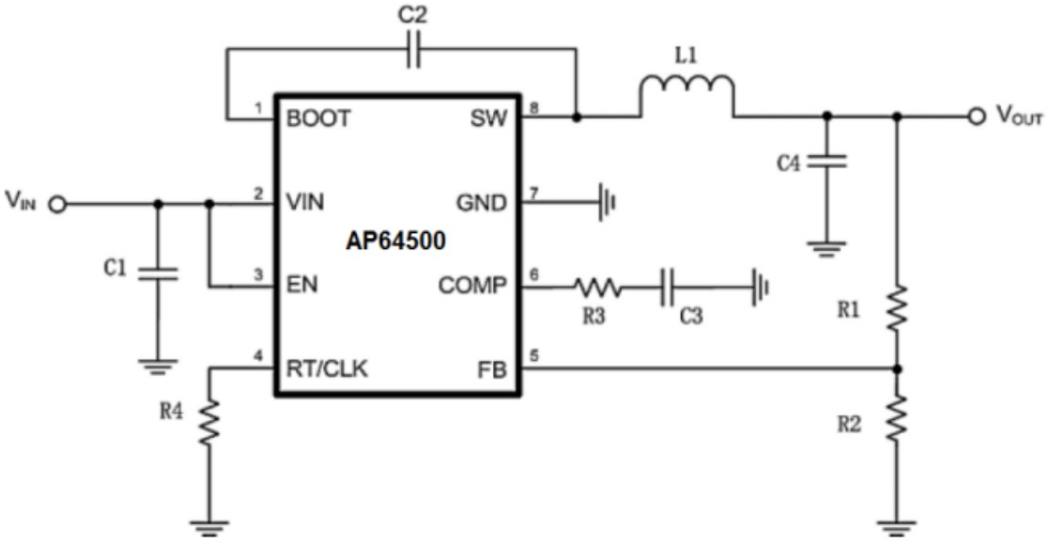
APPLICATIONS

- 5V, 12V, and 24V 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

TYPICAL APPLICATIONS CIRCUIT

Figure 1. Typical Application Circuit



ABSOLUTE MAXIMUM RATINGS

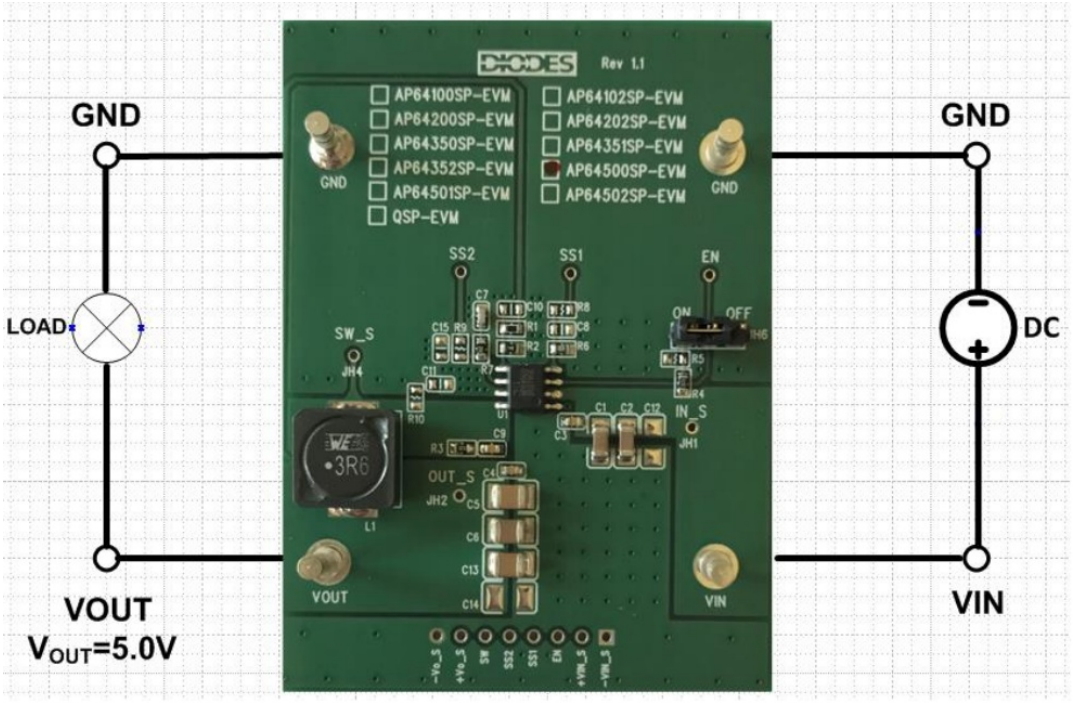
Symbol	Parameter	Rating	Unit
VIN	Supply Pin Voltage	-0.3 to +42.0 (DC)	V
		-0.3 to +45.0 (400ms)	
VBST	Bootstrap Pin Voltage	V_{SW} – 0.3 to V_{SW} + 6.0	V
VEN	Enable/UVLO Pin Voltage	-0.3 to +42.0	V
VRT/CLK	RT/CLK Pin Voltage	-0.3 to +6.0	V
VFB	Feedback Voltage	-0.3V to +6.0	V
VCOMP	Compensation Pin Voltage	-0.3 to +6.0	V
VSW	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 2. AP64500SP-EVM



QUICK START GUIDE

The AP64500SP-EVM has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP64500SP, 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 5A 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:

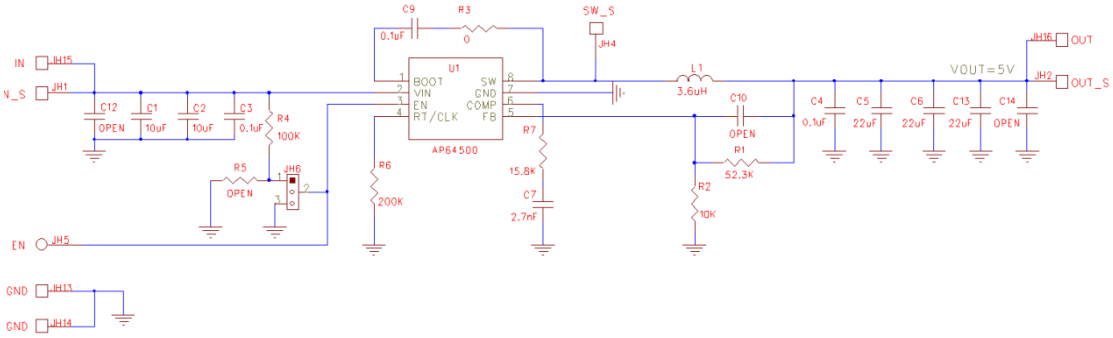
Table 1 shows a list of recommended component selections for common output voltages.

Table 1. Common Output Voltages

VOUT	R1	R2	L1	R7	C7	C1, C2	C5, C6, C13
1.2V	4.99KΩ	10KΩ	1.5μH	3.74KΩ	2.7nF	2×10μF	3×22μF
1.5V	8.66KΩ	10KΩ	2.2μH	4.75KΩ	2.7nF	2×10μF	3×22μF
1.8V	12.4KΩ	10KΩ	2.2μH	5.62KΩ	2.7nF	2×10μF	3×22μF
2.5V	21.5KΩ	10KΩ	3.3μH	7.87KΩ	2.7nF	2×10μF	3×22μF
3.3V	31.6KΩ	10KΩ	3.3μH	10.5KΩ	2.7nF	2×10μF	3×22μF
5.0V	52.3KΩ	10KΩ	3.6μH	15.8KΩ	2.7nF	2×10μF	3×22μF
12V	140KΩ	10KΩ	10μH	37.4KΩ	2.7nF	2×10μF	3×22μF

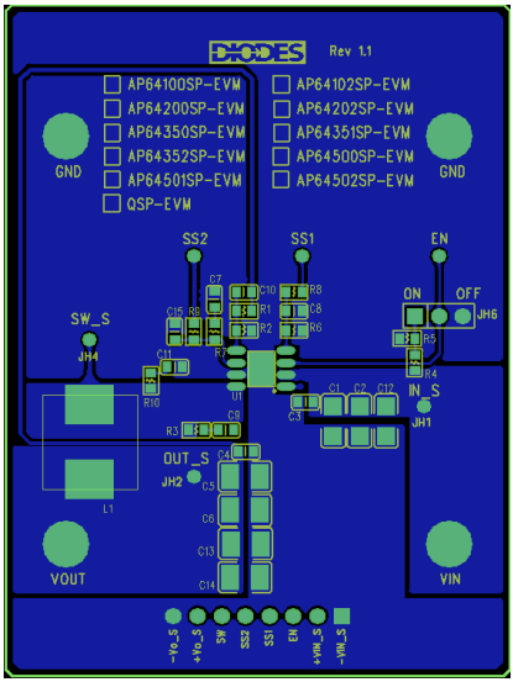
EVALUATION BOARD SCHEMATIC

Figure 3. AP64500SP-EVM Schematic



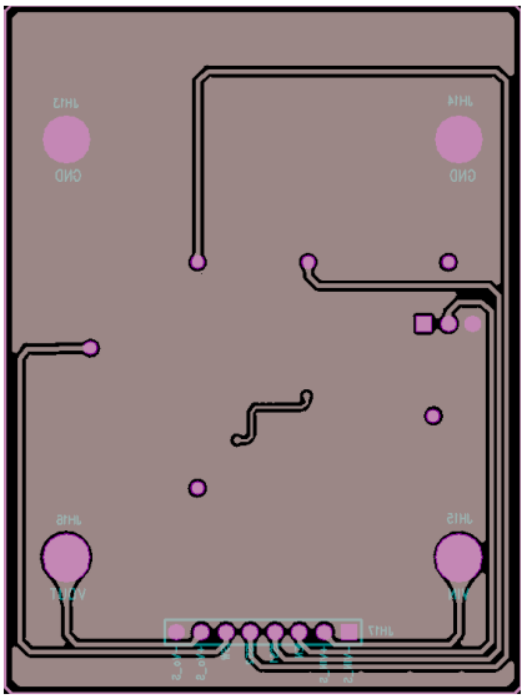
PCB TOP LAYOUT

Figure 4. AP64500SP-EVM – Top Layer



PCB BOTTOM LAYOUT

Figure 5. AP64500SP-EVM – Bottom Layer



BILL OF MATERIALS for AP64500SP-EVM for VOUT=5V

Ref	Value	Description	Qty	Size	Vendor Name	Manufacturer PN	PCBLayer
C1, C2	10μF	Ceramic Capacitor,50V, X7R, 10%	2	1206	Samsung	CL31B106KBHNNNE	Top
C3, C4, C9	0.1μF	Ceramic Capacitor,50V, X7R, 10%	2	0603	WurthElectronics	885012206095	Top
C5, C6, C13	22μF	Ceramic Capacitor,16V, X7R	3	1210	Samsung	CL32B226KOJNNNE	Top
C7	2.7nF	Ceramic Capacitor, 50V, X7R	1	0603	Murata	GRM1885C1H272JA01D	Top
R1	52.3KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3EKF5232V	Top
R2	10KΩ	SMD Resistor, 1%	1	0603	Panasonic	ERJ-3EKF1002V	Top
R3	0Ω	RES SMD 1% 1/10W	1	0603	Vishay	CRCW06030000Z0EAC	Top
R4	100KΩ	RES SMD 1% 1/10W	1	0603	Vishay	CRCW0603100KFKEA	Top
R6	200KΩ	RES SMD 1% 1/10W	1	0603	Yageo	RC0603FR-07200KL	Top
R7	15.8KΩ	RES SMD 1% 1/10W	1	0603	Bourns Inc	CR0603-FX-1582ELF	Top
L1	3.6μH	DCR=12.2mΩ, Ir=8.2A	1	10.2×10.2×4.5mm	Wurth Electronics	7447797360	Top
JH6		PCB Header, 40 POS	1	1X3	3M	2340-6111TG	Top
VIN,VOUT, GNDx2	1598	Terminal TurretTriple 0.094″ L (Test Points)	4	Through-Hole	Keystone Electronics	1598-2	Top
U1	AP64500	Sync DC-DC Converter	1	SO-8EP	Diodes Incorporated (Diodes)	AP64500SP	Top

TYPICAL PERFORMANCE CHARACTERISTICS

Figure 6. Efficiency vs. Output Current

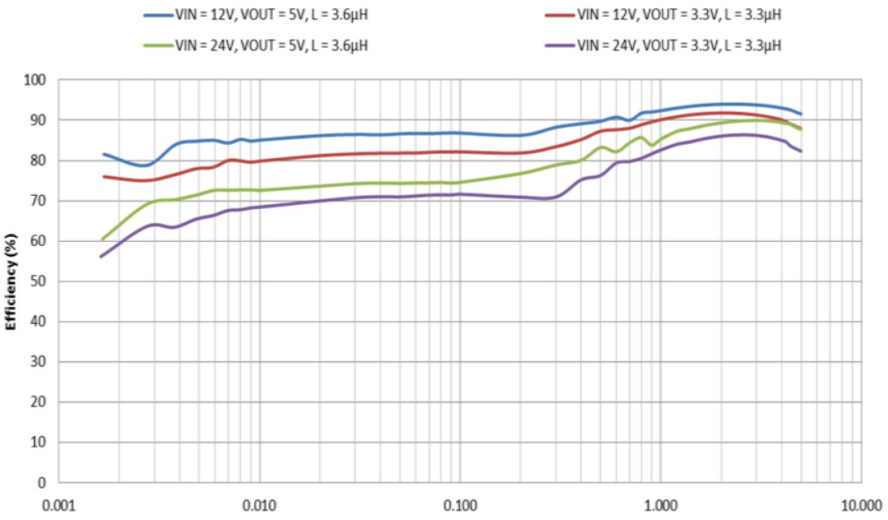


Figure 7. Load Transient 3A to 5A

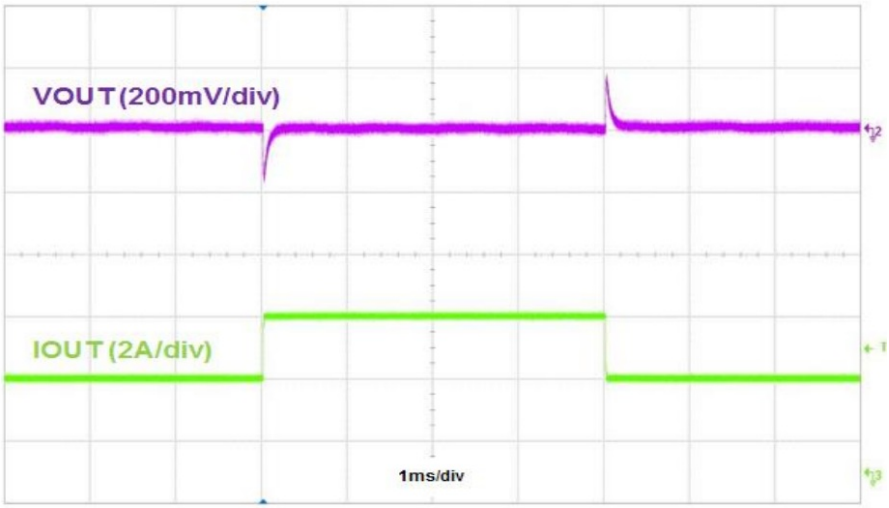


Figure 8. Output Voltage Ripple, IOUT=5A

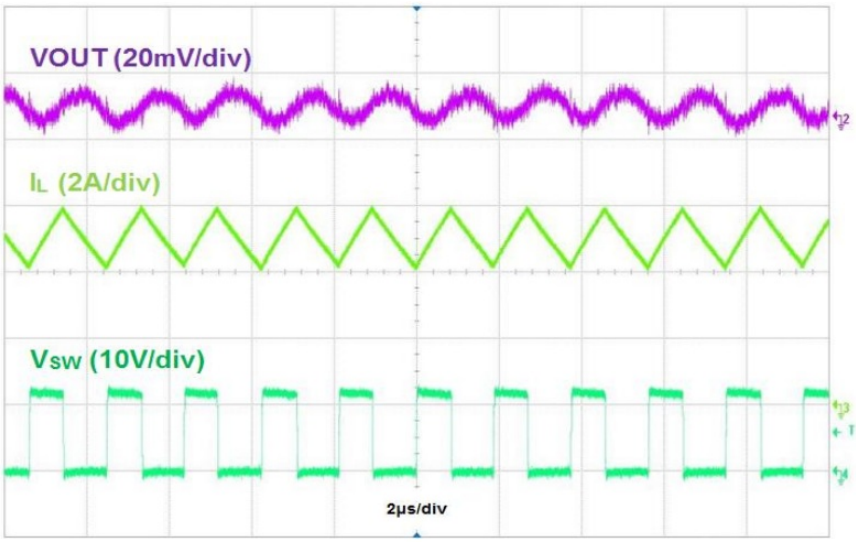
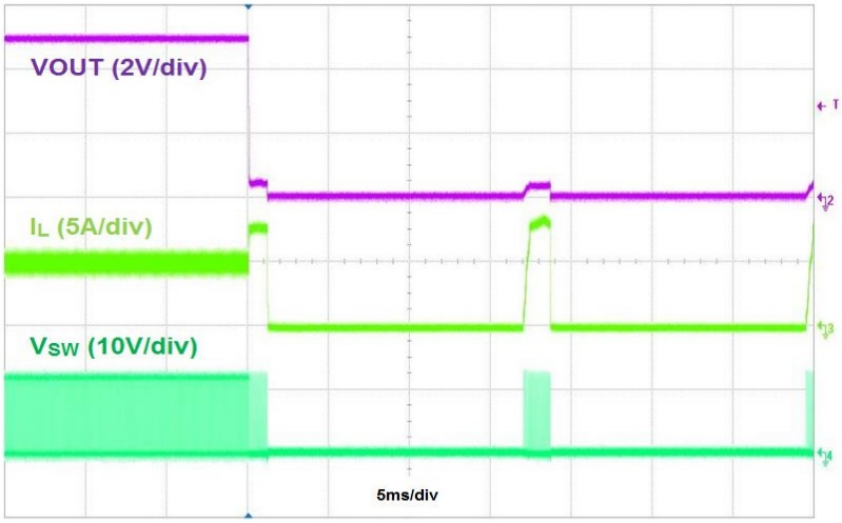


Figure 9. Output Short Protection, IOUT=5A



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