AP64500SP-EVM

40V, 5A, Synchronous DC/DC Buck Converter with Programmable Frequency

DESCRIPTION

The AP64500 is 5A synchronous buck converters with wide input voltage, ranging from 3.8V to 40V, which integrates a 45mΩ high-side MOSFET and a 20mΩ low-side MOSFET. The AP64500, ad40Vopting the peak current mode control, supports the Pulse Skipping Modulation (PSM) with typical 25uA low quiescent current which assists the converter on achieving high efficiency at light load or standby condition.

The AP64500 features programmable switching frequency from 100kHz to 2.2MHz with an external resistor, which provides the flexibility to optimize either efficiency or external component size. The converter supports external clock synchronization with a frequency band from 100kHz to 2.2MHz. The AP64500 allows power conversion from high input voltage to low output voltage with a minimum 100ns on-time of high-side MOSFET.

The AP64500 is an Electromagnetic Interference (EMI) friendly buck converter with implementing optimized design for EMI reduction. The AP64500 features Frequency Spread Spectrum FSS with ±6% jittering span of the 500kHz switching frequency and modulation rate 1/512 of switching frequency to reduce the conducted EMI.

The AP64500 offers cycle-by-cycle current limit and hiccup over current protection, thermal shutdown protection, output over-voltage protection and input voltage under-voltage protection. The device is available in an 8-pin thermally enhanced SOP-8 package.

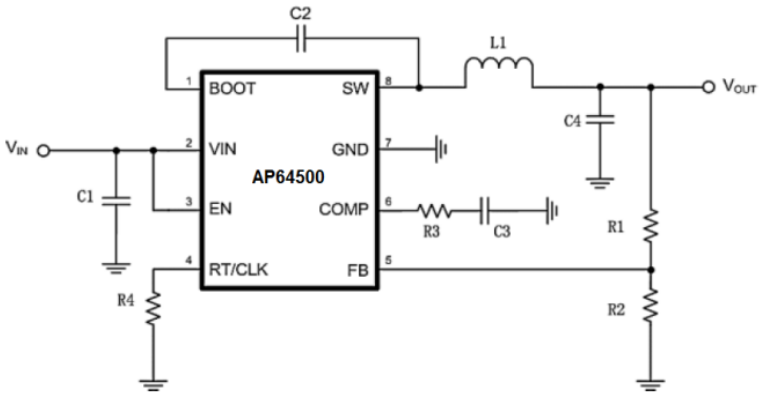
FEATURES

- Wide Input Range: 3.8V-40V
- Up to 5A Continuous Output Current
- 0.8V ±1% Feedback Reference Voltage
- Integrated 45mΩ High-Side and 20mΩ Low-Side Power MOSFETs
- Pulse Skipping Mode (PSM) with 25uA Quiescent Current in Sleep Mode
- 100ns Minimum On-time
- 4ms Internal Soft-start Time
- Adjustable Frequency 100kHz to 2.2MHz
- External Clock Synchronization
- Frequency Spread Spectrum (FSS) Modulation for EMI Reduction
- Precision Enable Threshold for Programmable Input Voltage Under-voltage Lock Out Protection (UVLO) Threshold and Hysteresis
- Low Dropout Mode Operation
- Derivable Inverting Voltage Regulator
- Overvoltage and Over-temperature Protection
- Available in an ESOP-8 Package
- Totally Lead-Free & Fully RoHS Compliant
- Halogen and Antimony Free. “Green” Device

APPLICATIONS

- Battery Pack Powered System - Cordless Power Tools, Cordless Home Appliance, Drone, Aero Modelling, GPS Tracker etc.
- Cigarette Lighter Adapters, Chargers
- LCD Display
- USB Type-C Power Delivery, USB Charging
- Industrial and Medical Distributed Power Supplies
- Optical Communication and Networking System
- Automotive Systems

TYPICAL APPLICATIONS CIRCUIT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
V_{VIN}	Supply Voltage	-0.3 to +42.0	V
V_{EN}	Enable Voltage	-0.3 to +42.0	V
V_{BOOT}	Bootstrap Voltage	-0.3 to +42.0	V
V_{SW}	Switch Node Voltage	-1.0 to +42.0	V
$V_{BOOT-SW}$	BOOT to SW Pin Voltage	-0.3 to +6.0	V
All other pins		-0.3 to +6.0	V
T_J	Junction Temperature	+150	°C
T_L	Lead Temperature	+260	°C
HBM	Human Body Mode	2000	V
CDM	Charged Device Model	500	V

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{IN}	Supply Voltage	3.8	40	V
T_A	Operating Junction Temperature	-40	+125	°C

EVALUATION BOARD

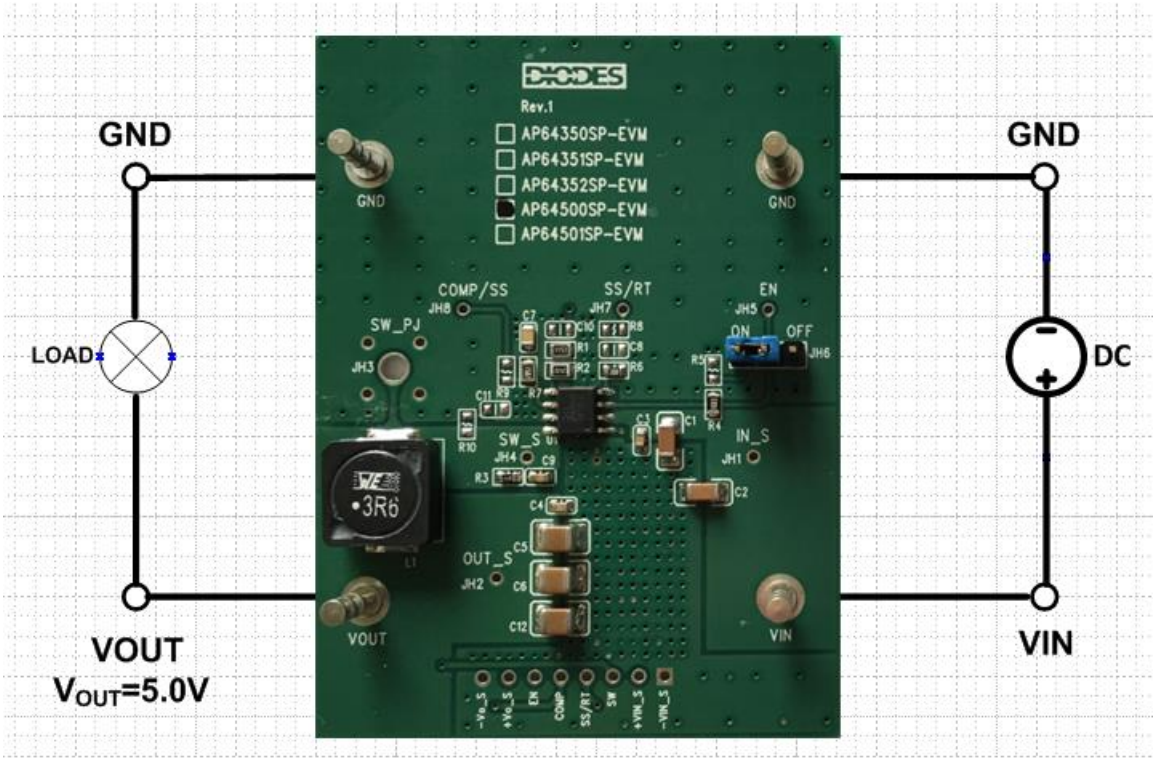


Figure 1. AP64500SP-EVM

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 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, place a jumper at JH6 to "ON" position to connect EN pin to V_{IN} through 100KΩ resistor to enable IC. 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 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.

V_{OUT}	R1	R2	L1	R7	C7
1.2V	11KΩ	22.1KΩ	1.5μH	3.74KΩ	2.7nF
1.5V	19.6KΩ	22.1KΩ	2.2μH	4.75KΩ	2.7nF
1.8V	27.4KΩ	22.1KΩ	2.2μH	5.62KΩ	2.7nF
2.5V	47.5KΩ	22.1KΩ	3.3μH	7.87KΩ	2.7nF
3.3V	69.8KΩ	22.1KΩ	3.3μH	10.5KΩ	2.7nF
5.0V	115KΩ	22.1KΩ	3.6μH	15.8KΩ	2.7nF
12V	309KΩ	22.1KΩ	10μH	37.4KΩ	2.7nF

Table 1. Common Output Voltages

EVALUATION BOARD SCHEMATIC

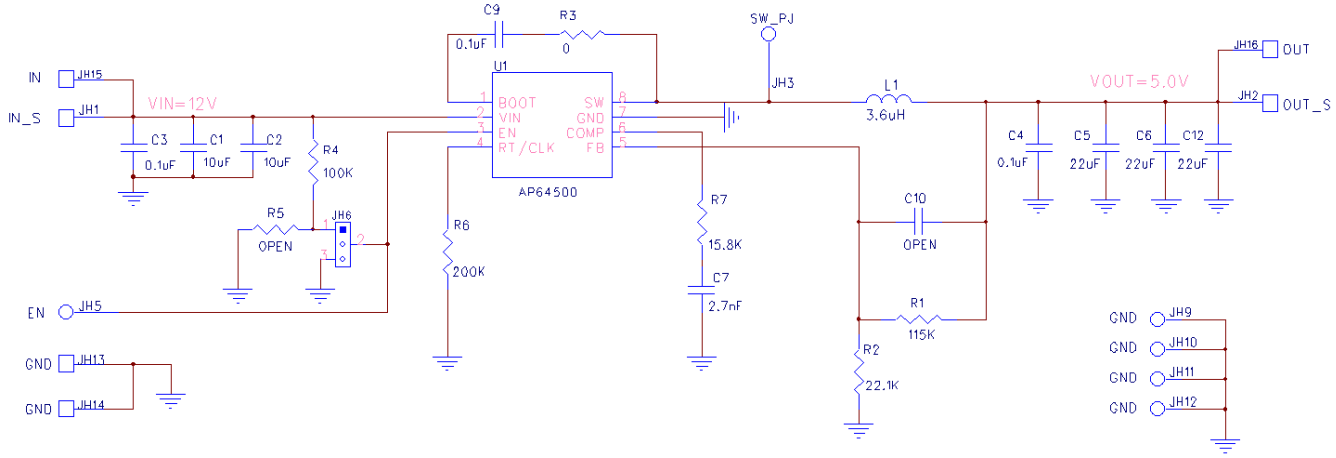


Figure 2. AP64500SP-EVM Schematic

PCB TOP LAYOUT

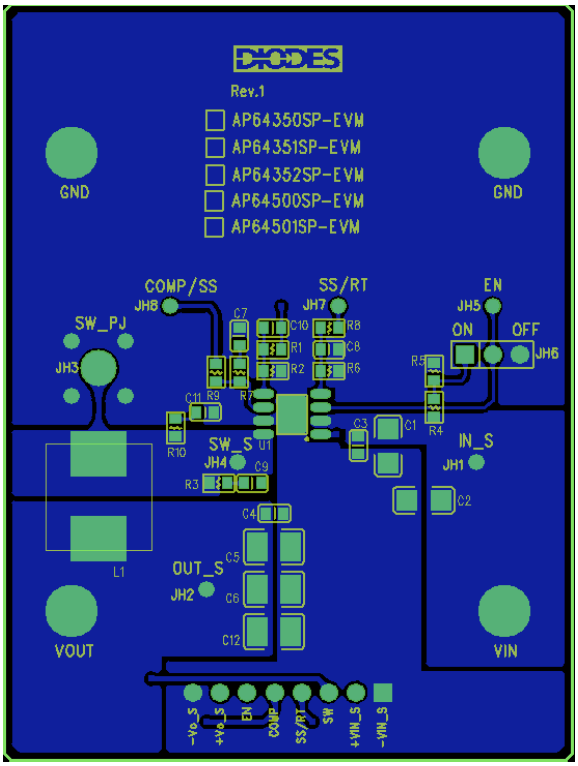


Figure 3. AP64500SP-EVM – Top Layer

PCB BOTTOM LAYOUT

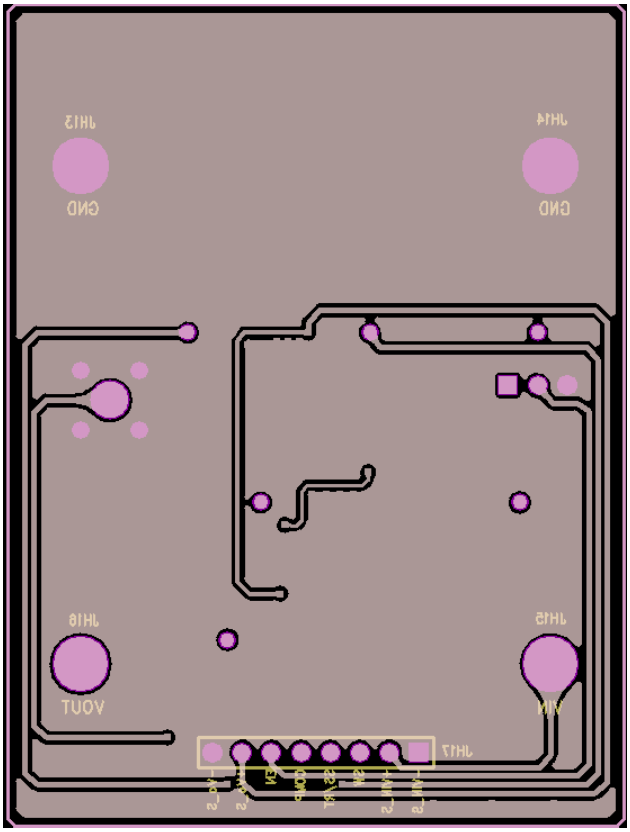
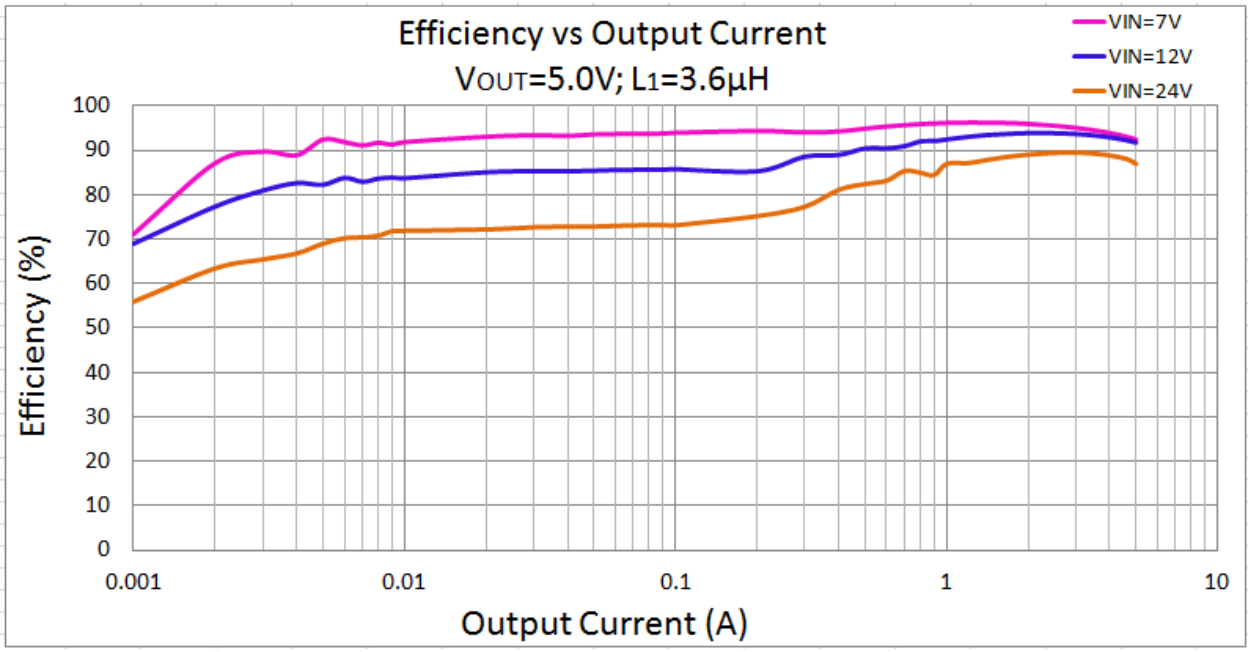


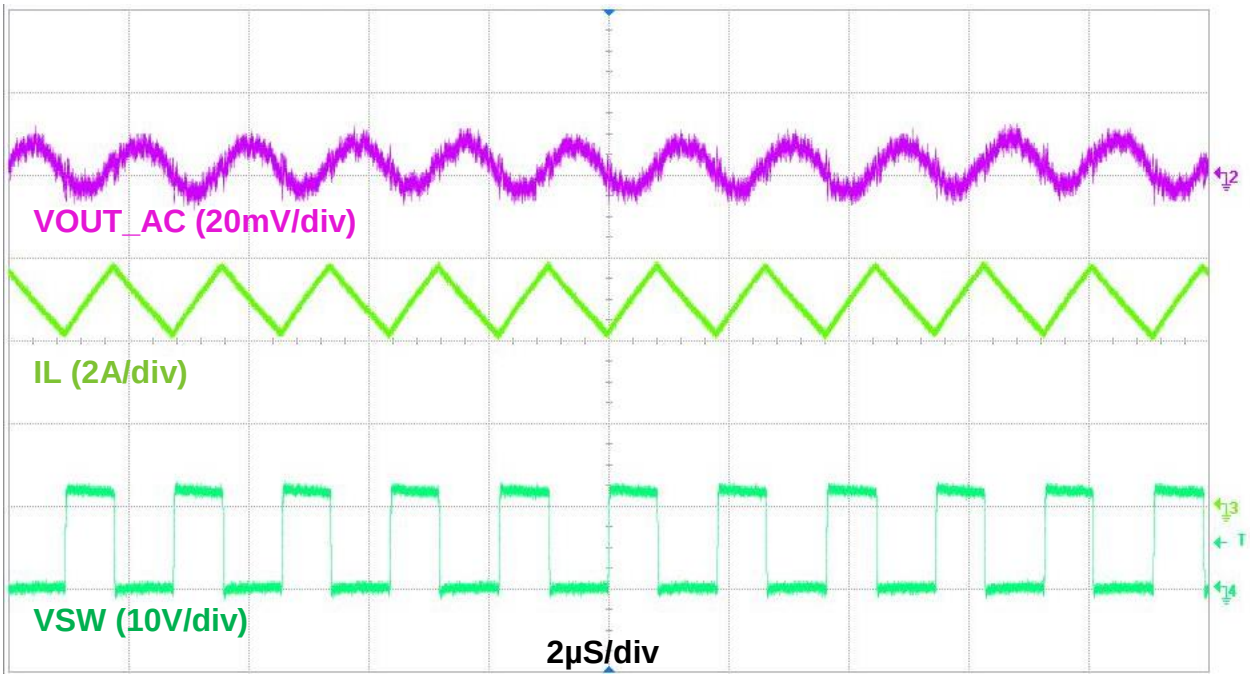
Figure 4. AP64500SP-EVM – Bottom Layer

BILL OF MATERIALS for AP64500SP-EVM

Ref	Value	Description	Qty	Size	Vendor Name	Manufacturer PN
C1, C2	10µF	Ceramic Capacitor, 50V, X7R, 10%	2	1206	Samsung	CL31B106KBHNNNE
C3, C4	0.1µF	Ceramic Capacitor, 50V, X7R, 10%	2	0603	Wurth Electronics	885012206095
C5, C6, C12	22µF	Ceramic Capacitor, 16V, X7R	3	1210	Samsung	CL32B226KOJNNNE
C7	2.7nF	Ceramic Capacitor, 50V, X7R	1	0603	Murata	GRM1885C1H272JA01D
C9	0.1µF	Ceramic Capacitor, 25V, X7R	1	0603	Wurth Electronics	885012206071
R1	115KΩ	RES SMD 1% 1/8W	1	0603	Panasonic	ERJ-3EKF1153V
R2	22.1KΩ	RES SMD 1% 1/8W	1	0603	Stackpole	RNCP0603FTD22K1
R3	0Ω	RES SMD 1% 1/10W	1	0603	Vishay	CRCW06030000Z0EAC
R4	100KΩ	RES SMD 1% 1/10W	1	0603	Vishay	CRCW0603100KFKEA
R6	200KΩ	RES SMD 1% 1/10W	1	0603	Yageo	RC0603FR-07200KL
R7	15.8KΩ	RES SMD 1% 1/10W	1	0603	Bourns Inc	CR0603-FX-1582ELF
L1	3.6µH	DCR=12.2mΩ, Ir=8.2A	1	10.2x10.2x 4.5mm	Wurth Electronics	7447797360
JH6		PCB Header, 40 POS	1	1X3	3M	2340-611TG
JH13, JH14, JH15, JH16	1598	Terminal Turret Triple 0.094" L (Test Points)	4	Through-Hole	Keystone Electronics	1598-2
U1	AP64500	Sync DC/DC Converter	1	SO-8EP	Diodes Inc	AP64500SP

TYPICAL PERFORMANCE CHARACTERISTICS





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