AP62400WU-EVM

18V, 4A, LOW IQ, COT SYNCHRONOUS DC/DC BUCK CONVERTER

DESCRIPTION

The AP62400 is a 4A, synchronous buck converter with a wide input voltage range of 4.2V to 18V. The device fully integrates a 50mΩ high-side power MOSFET and a 22mΩ low-side power MOSFET to provide high-efficiency step-down DC-DC conversion.

The AP62400 is easily used by minimizing external component count due to its adoption of Constant On-Time (COT) control to achieve fast transient response, easy loop stabilization, and low output voltage ripple.

The AP62400 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 AP62400 is available in the TSOT26 package.

FEATURES

- VIN: 4.2V to 18V
- Output Voltage (VOUT): 0.8V to 7V
- 4A Continuous Output Current
- 0.8V ± 1% Reference Voltage (T_A = +25°C)
- 190μA Low Quiescent Current (Pulse Frequency Modulation)
- 800kHz Switching Frequency (VIN = 12V, VOUT = 5V)
- Up to 83% Efficiency at 5mA Light Load
- Proprietary Gate Driver Design for Best EMI Reduction
- Protection Circuitry:
  - Undervoltage Lockout (UVLO)
  - Cycle-by-Cycle Valley Current Limit
  - Thermal Shutdown
- Totally Lead-Free & Fully RoHS Compliant

APPLICATIONS

- 5V and 12V distributed power bus supplies
- Flat screen TV sets and monitors
- White goods and small home appliances
- FPGA, DSP, and ASIC supplies
- Home audio
- Network systems
- Gaming consoles
- Consumer electronics
- General-purpose point of loads

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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
VIN	Supply Pin Voltage	-0.3 to +20.0 (DC)	V
		-0.3 to 22.0 (400ms)	
V_{SW}	Switch Pin Voltage	-1.0 to VIN + 0.3 (DC)	V
		-2.5 to VIN + 2.0 (20ns)	
V_{BST}	Bootstrap Pin Voltage	V_{SW} - 0.3 to V_{SW} + 6.0	V
V_{EN}	Enable/UVLO Pin Voltage	-0.3 to +6.0	V
V_{FB}	Feedback Pin Voltage	-0.3 to +6.0	V
T_{ST}	Storage Temperature	-65 to +150	°C
T_J	Junction Temperature	+150	°C
T_L	Lead Temperature	+260	°C
ESD Susceptibility			
HBM	Human Body Mode	2000	V
CDM	Charge Device Model	500	V

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Rating	Unit
V_{IN}	Supply Voltage	4.2 to 18	V
V_{OUT}	Output Voltage Range	0.8 to 7	V
T_A	Operating Ambient Temperature	-40 to +85	°C
T_J	Operating Junction Temperature	-40 to +125	°C

SETTING OUTPUT VOLTAGE:

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

VOUT	C1	C2, C3	R1	R2	L1	C6
1.2V	10µF	2 x 22µF	4.99KΩ	10KΩ	1.0µH	100nF
1.5V	10µF	2 x 22µF	8.66KΩ	10KΩ	1.0µH	100nF
1.8V	10µF	2 x 22µF	12.4KΩ	10KΩ	1.5µH	100nF
2.5V	10µF	2 x 22µF	21.5KΩ	10KΩ	1.5µH	100nF – 220nF
3.3V	10µF	2 x 22µF	31.6KΩ	10KΩ	2.2µH	100nF – 330nF
5.0V	10µF	2 x 22µF	52.3KΩ	10KΩ	2.2µH	100nF – 330nF

Table 1. Common Output Voltages (AP62400)

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EVALUATION BOARD

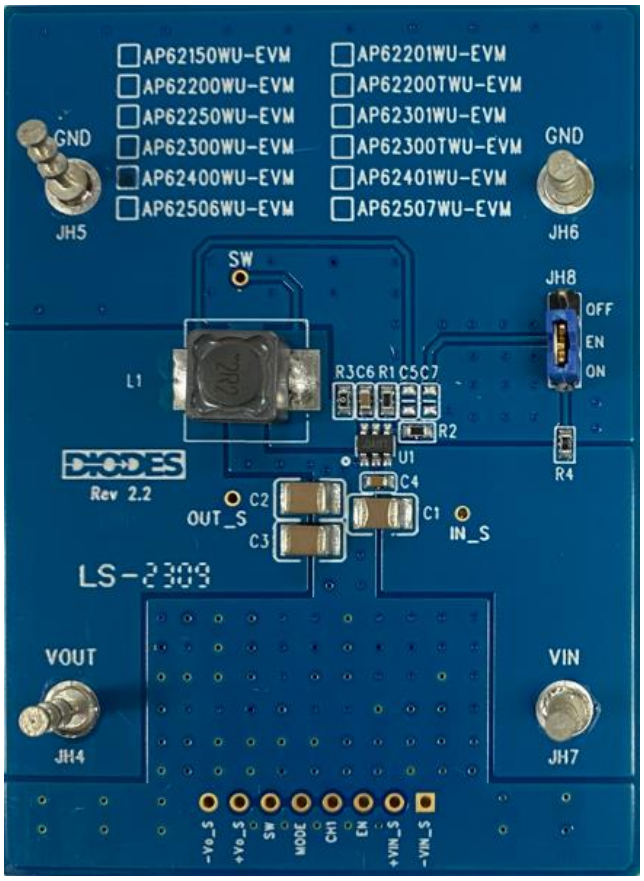

Figure 1. AP62400WU-EVM

QUICK START GUIDE

The AP62400WU-EVM has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP62400, follow the procedure below:

1. Connect the 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, place a jumper at JH8 to “ON” position to connect EN pin to VIN through 100KΩ resistor to enable IC or leave it OPEN. Jump to “OFF” position to disable IC.
   The evaluation board should now power up with a 5.0V output voltage.
4. 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.
5. Set the load to 4A for AP62400 through the electronic load. Check for the stable operation of the SW signal on the oscilloscope. Measure the switching frequency.

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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.

BOOTSTRAP CAPACITOR GUIDELINES:

To ensure proper operation, a ceramic capacitor must be connected between the BST and SW pins to supply the drive voltage for the high-side power MOSFET. A 100nF ceramic capacitor is sufficient for most applications. In the cases where output voltage is higher than 2.5V, a higher capacitance is recommended to help maintain stable voltage from BST to SW. Please refer to Tables 1 for details.

EVALUATION BOARD SCHEMATIC

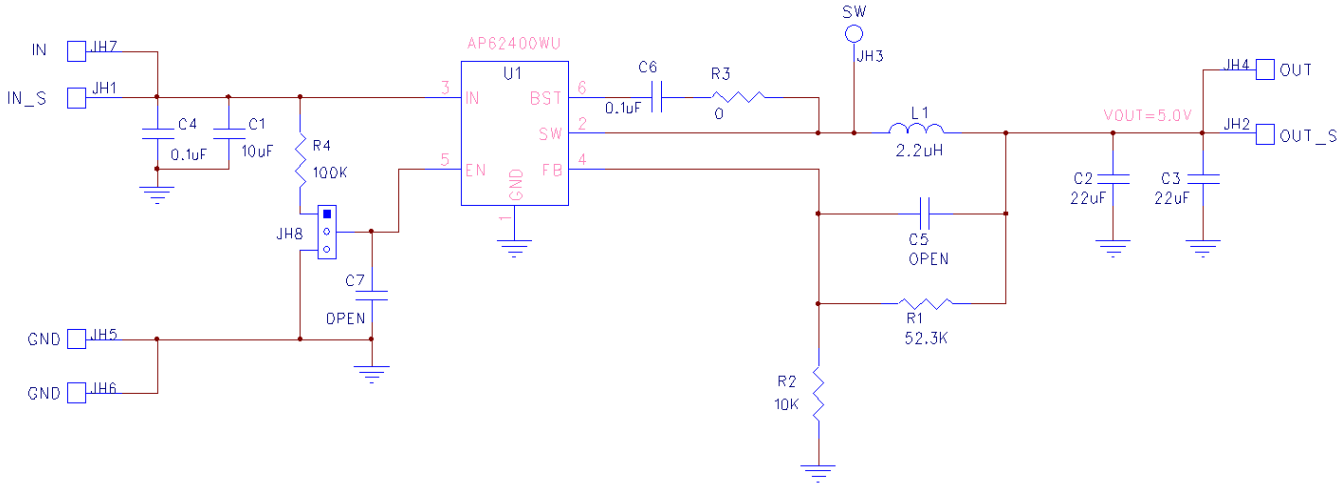

Figure 2. AP62400WU-EVM Schematic

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PCB TOP LAYOUT

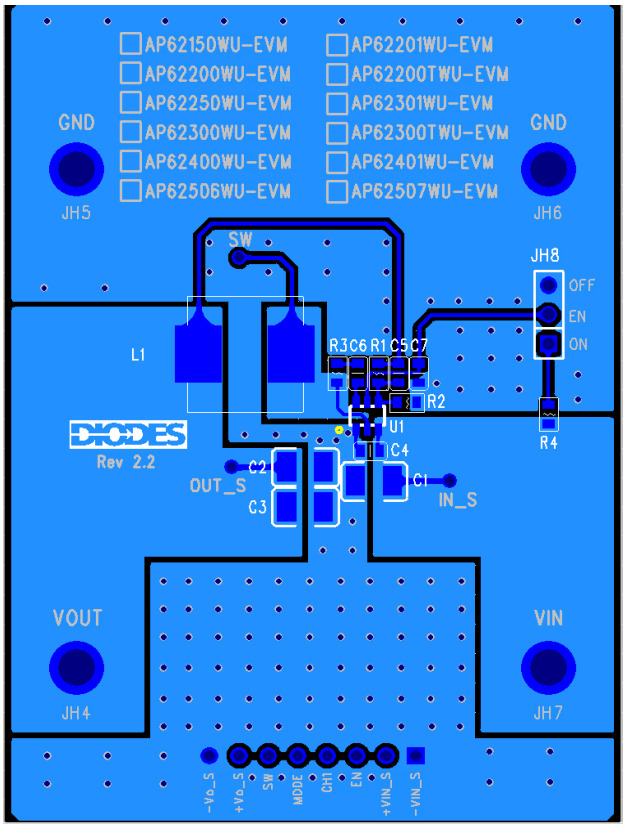

Figure 3. AP62400WU-EVM – Top Layer

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PCB BOTTOM LAYOUT

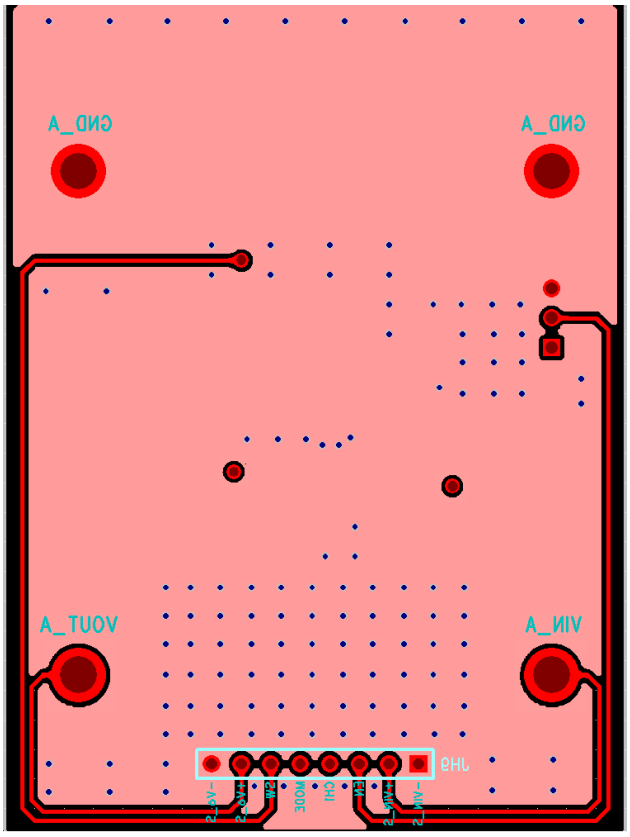

Figure 4. AP62400WU-EVM – Bottom Layer

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BILL OF MATERIALS for AP62400WU-EVM for V_{OUT}=5V

Ref	Value	Description	Qty	Size	Vendor Name	Manufacturer PN
C1	10µF	Ceramic Capacitor, 25V, X7R, 10%	1	1210	KEMET	C1210C106K3RACTU
C2, C3	22µF	Ceramic Capacitor, 25V, X7R, 10%	2	1210	KEMET	C1210C226K3RAC7800
C4	0.1µF	Ceramic Capacitor, 50V, X7R, 10%	1	0603	KEMET	C0603C104K5RACTU
C6	0.33µF	Ceramic Capacitor, 16V, X7R, 10%	1	0603	Samsung	CL10B334KO8NNNC
L1	2.2µH	DCR=20mΩ, Ir=4.2A	1	7.3x7.3x 4.5mm	Wurth Electronics	7447779002
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
JH4, JH5, JH6, JH7	1598	Terminal Turret Triple 0.094" L (Test Points)	4	Through-Hole	Keystone Circuit	1598-2
JH8	-	PCB Header, 40 POS	1	1X3	Wurth Electronics	61304011121
U1	AP62400	Sync Buck DC/DC converter	1	TSOT26	Diodes Inc	AP62400WU-7

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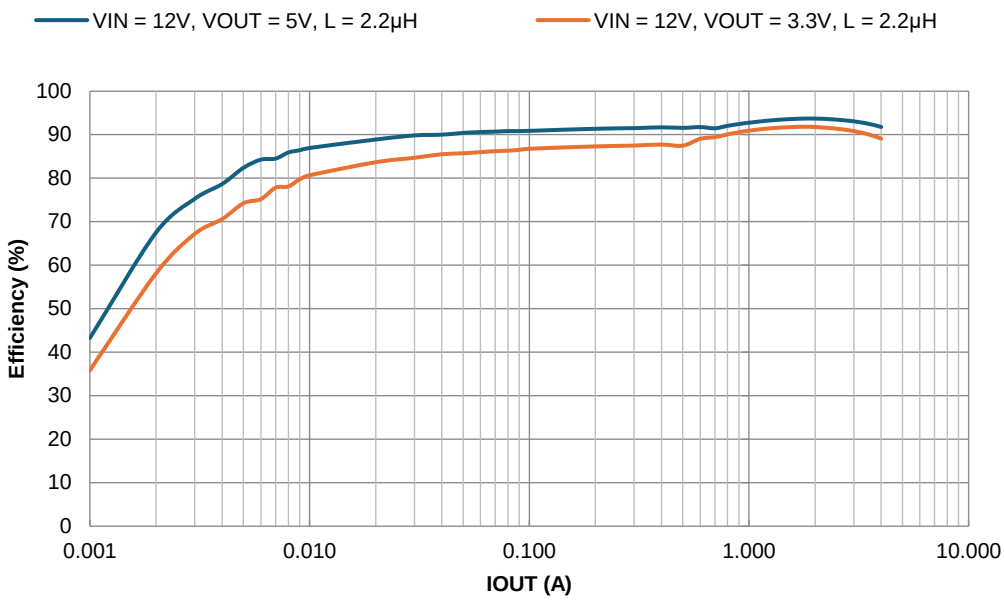
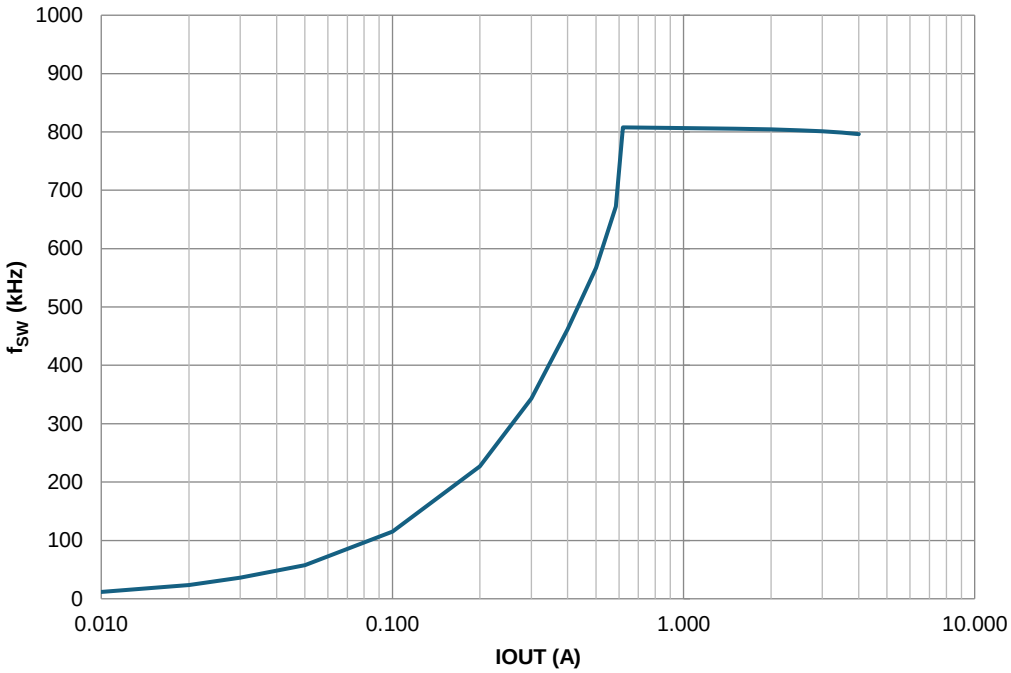
TYPICAL PERFORMANCE CHARACTERISTICS





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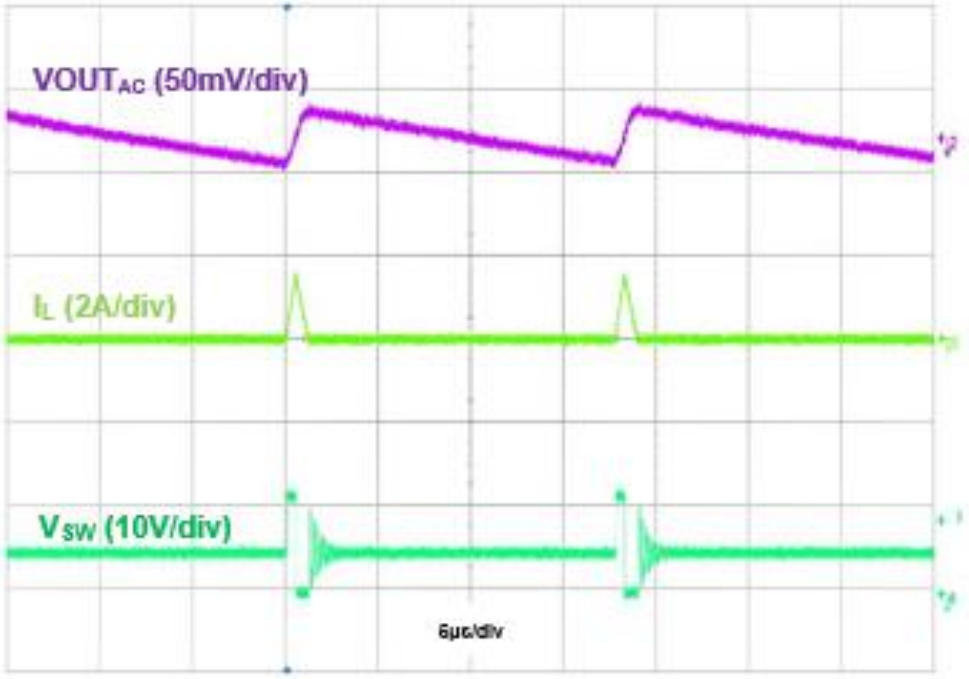
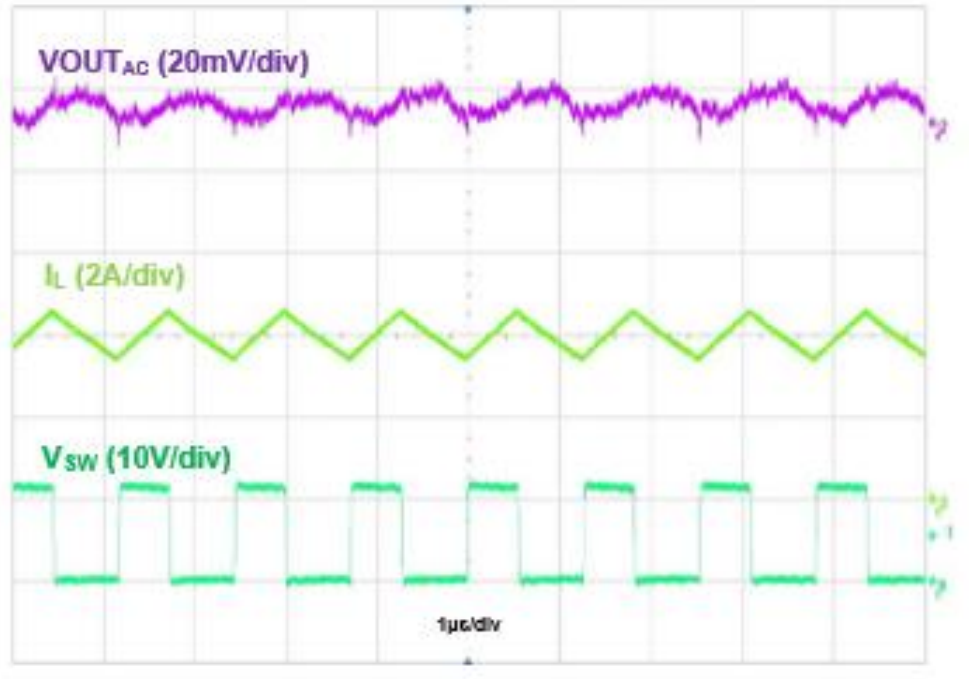
TYPICAL PERFORMANCE CHARACTERISTICS (continued)



Output Voltage Ripple, VOUT = 5V, IOUT = 50mA



Output Voltage Ripple, VOUT = 5V, IOUT = 4A

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