AP64200SP-EVM

40V, 2A, Low IQ, Synchronous DC-DC Buck Converter with Programmable Frequency

DESCRIPTION

The AP64200 is 2A, synchronous buck converter with a wide input voltage range of 3.8V to 40V. The device fully integrates a 160mΩ high-side power MOSFET and a 80mΩ low-side power MOSFET to provide high-efficiency step-down DC-DC conversion.

The AP64200 device is easily used by minimizing the external component count due to its adoption of peak current mode control.

The AP64200 design is optimized for Electromagnetic Interference (EMI) reduction. The converter 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. It also 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 device is available in a SO-8EP (Standard) package.

FEATURES

- Wide Input Range: 3.8V-40V
- 2A 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
- 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

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

TYPICAL APPLICATIONS CIRCUIT

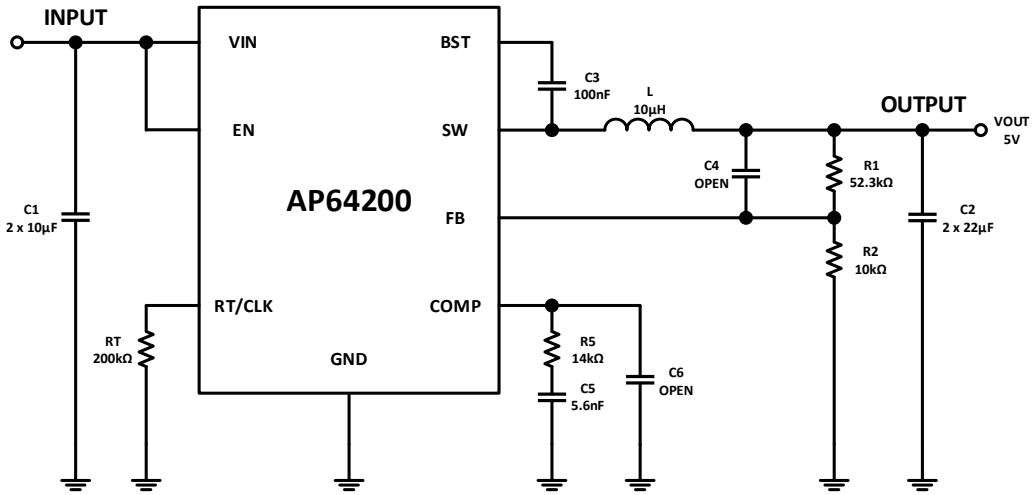


Figure 1. Typical Application Circuit

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
VIN	Supply Pin Voltage	-0.3 to +42.0 (DC)	V
		-0.3 to +45.0 (400ms)	
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	+85	°C
T_J	Operating Junction Temperature Range	-40	+125	°C

EVALUATION BOARD

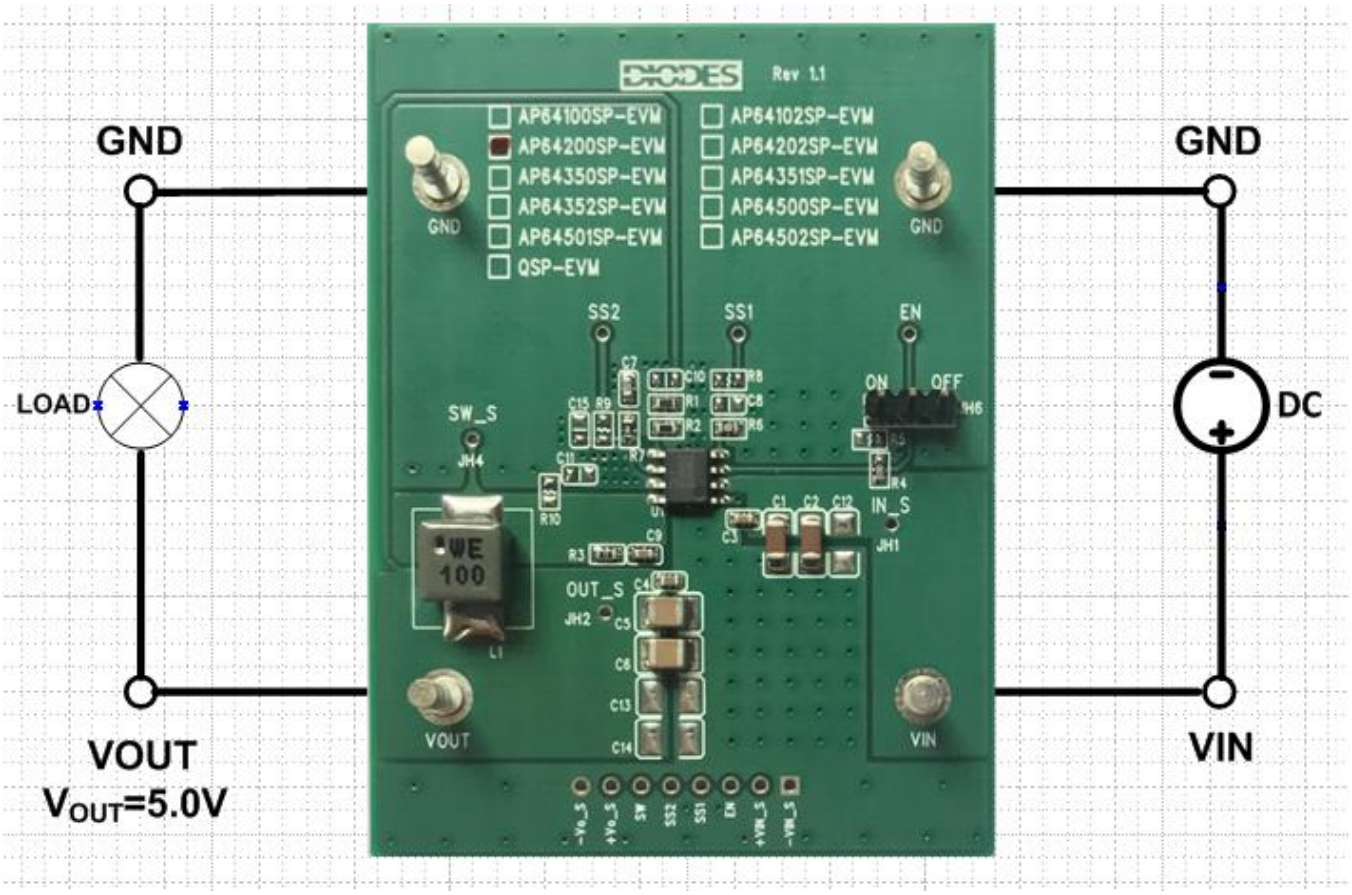


Figure 2. AP64200SP-EVM

QUICK START GUIDE

The AP64200SP-EVM has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the AP64200SP, 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 2A 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, C6	C10
1.2V	4.99KΩ	10KΩ	3.3μH	3.32 KΩ	5.6nF	2x10μF	2x22μF	OPEN
1.5V	8.66KΩ	10KΩ	4.7μH	4.22KΩ	5.6nF	2x10μF	2x22μF	OPEN
1.8V	12.4KΩ	10KΩ	4.7μH	4.99KΩ	5.6nF	2x10μF	2x22μF	OPEN
2.5V	21.5KΩ	10KΩ	6.8μH	6.98KΩ	5.6nF	2x10μF	2x22μF	OPEN
3.3V	31.6KΩ	10KΩ	6.8μH	9.31KΩ	5.6nF	2x10μF	2x22μF	OPEN
5.0V	52.3KΩ	10KΩ	10μH	14KΩ	5.6nF	2x10μF	2x22μF	OPEN
12V	140KΩ	10KΩ	22μH	22.1KΩ	5.6nF	2x10μF	2x22μF	OPEN

Table 1. Common Output Voltages

EVALUATION BOARD SCHEMATIC

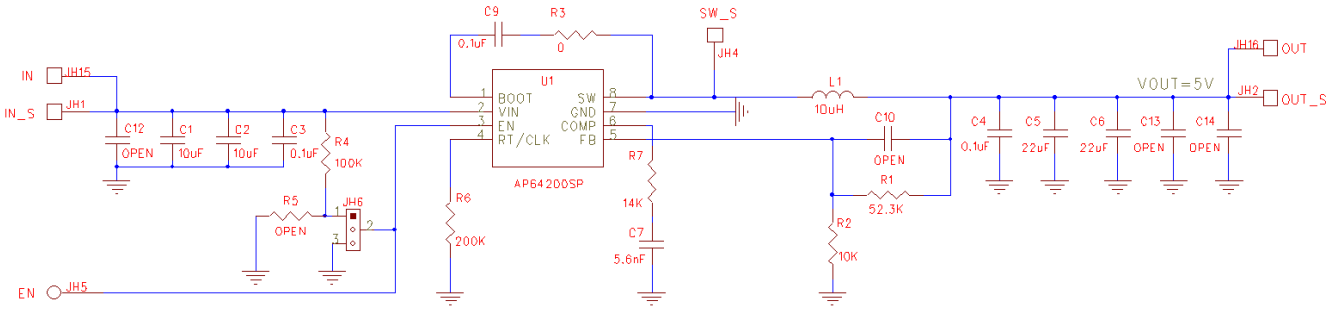


Figure 3. AP64200SP-EVM Schematic

PCB TOP LAYOUT

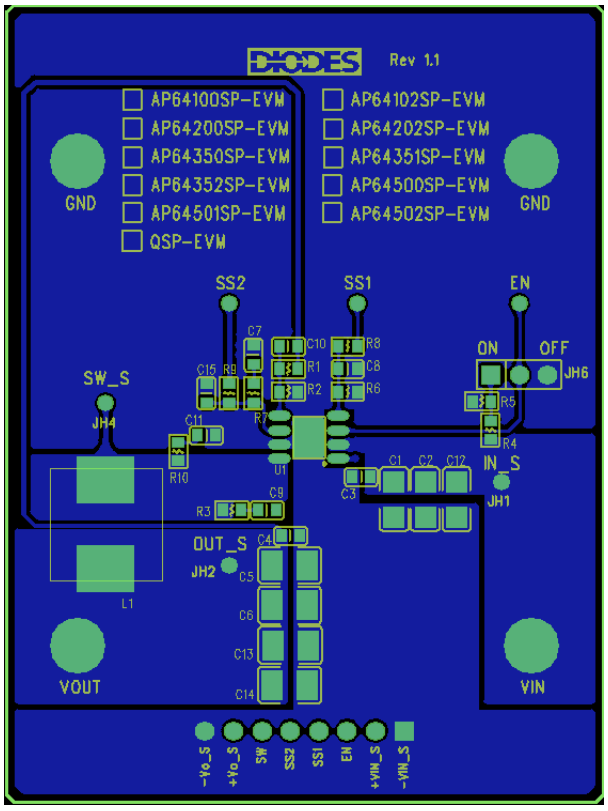


Figure 4. AP64200SP-EVM – Top Layer

PCB BOTTOM LAYOUT

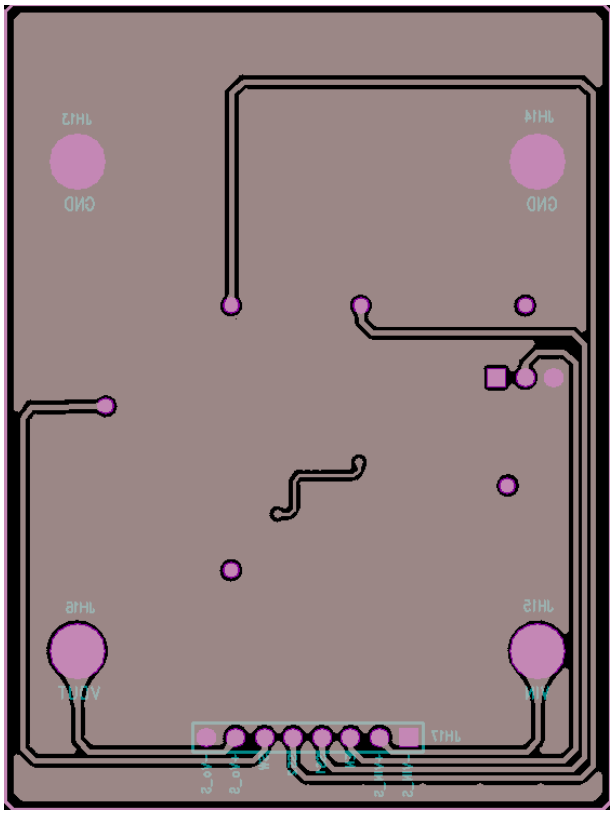


Figure 5. AP64200SP-EVM – Bottom Layer

BILL OF MATERIALS for AP64200SP-EVM for V_{OUT}=5V

Ref	Value	Description	Qty	Size	Vendor Name	Manufacturer PN	PCB Layer
C1, C2	10µF	Ceramic Capacitor, 50V, X7R, 10%	2	1206	Samsung	CL31B106KBHNNNE	Top
C3, C4, C9	0.1µF	Ceramic Capacitor, 50V, X7R, 10%	3	0603	Wurth Electronics	885012206095	Top
C5, C6	22µF	Ceramic Capacitor, 16V, X7R	2	1210	Samsung	CL32B226KOJNNNE	Top
C7	5.6nF	Ceramic Capacitor, 50V	1	0603	TDK	CGA3E2NP01H562J080AA	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	Yageo	RC0603FR-07100KL	Top
R6	200KΩ	RES SMD 1% 1/10W	1	0603	Yageo	RC0603FR-07200KL	Top
R7	14KΩ	RES SMD 1% 1/10W	1	0603	Panasonic	ERJ-3EKF1402V	Top
L1	10µH	DCR=26.5mΩ, Ir=5A	1	6.65x 6.45x 6.1mm	Wurth Electronics	74439346100	Top
JH6		PCB Header, 40 POS	1	1X3	3M	2340-6111TG	Top
VIN, VOUT, GNDx2	1598	Terminal Turret Triple 0.094" L (Test Points)	4	Through-Hole	Keystone Electronics	1598-2	Top
U1	AP64200	Sync DC/DC Converter	1	SO-8EP	Diodes Incorporated (Diodes)	AP64200SP	Top

TYPICAL PERFORMANCE CHARACTERISTICS

Figure 6. Efficiency vs Output Current

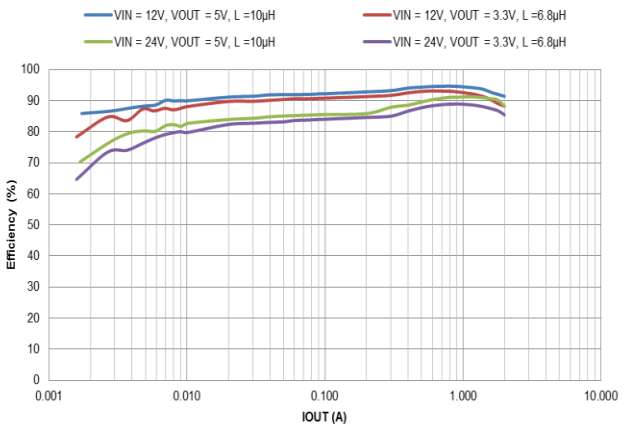


Figure 7. Load Transient 1A to 2A

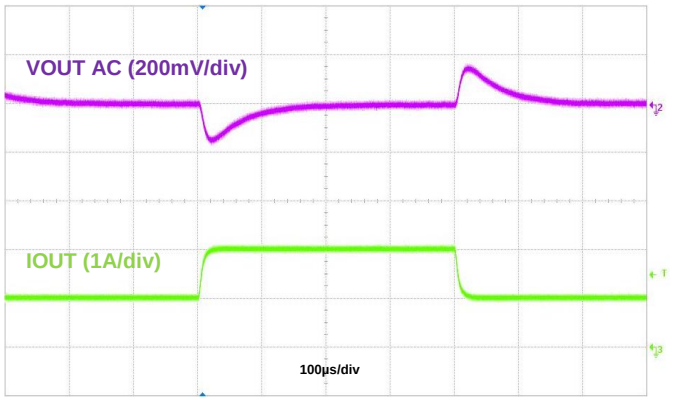


Figure 8. Output Voltage Ripple, IOUT=2A

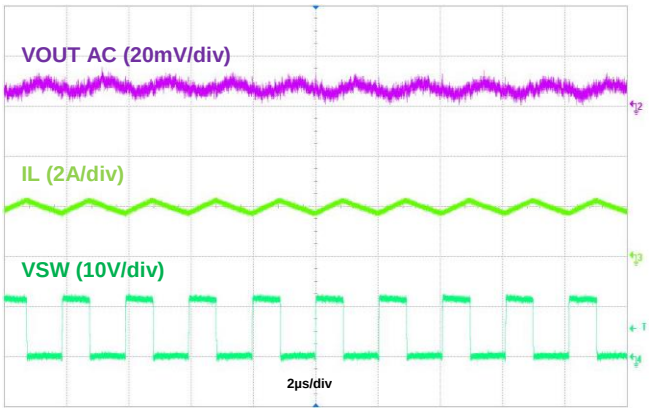
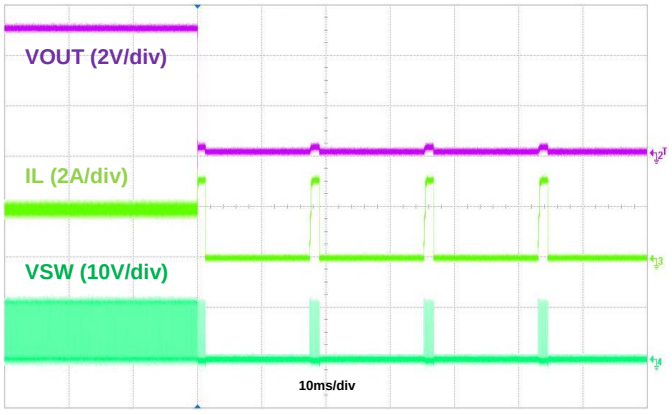


Figure 9. Output Short Protection, IOUT=2A



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