EV2188-QA-00A

Dual 3A, 5.5V, 1.2MHz Synchronous Step-Down Swithers With Auto Output Discharge Evaluation Board

The Future of Analog IC Technology®

DESCRIPTION

The EV2188-QA-00A evaluation Board is designed to demonstrate the capabilities of MP2188, an internally compensated 1.2MHz dual COT synchronous step-down regulator. The output voltages of the two channels are 1.1V and 1.8V respectively.

The constant-on-time control scheme provides fast transient response and eases loop stabilization. Fault condition protections include cycle-by-cycle current limiting and thermal shutdown.

The MP2188 is available in small 2.2mmx2.6mm QFN16 package and requires only a minimal number of readily available standard external components.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage Range	V_{IN}	3.6-5.5	V
Output Voltages	V_{OUT1}	1.1	V
	V_{OUT2}	1.8	V
Load Current	I_{OUT1}	3	A
	I_{OUT2}	3	A

Note: Low Vin application may need more input capacitors.

FEATURES

- 2.5V to 5.5V Input Voltage Range
- Fixed Output Voltages: 1.1V, 1.8V
- 100% Duty Cycle in Dropout
- Up to 3A Output Current
- Low IQ: 80μA
- 60mΩ and 30mΩ Internal Power MOSFET Switches
- Default 1.2MHz Switching Frequency
- EN and Power-Good for Power Sequencing
- Cycle-by-Cycle Over-Current Protection
- Auto Discharge at Power-Off
- Short-Circuit Protect with Hiccup Mode
- Stable with Low-ESR Output Ceramic Capacitors
- Available in a 2.2mm x 2.6mm QFN16 Package

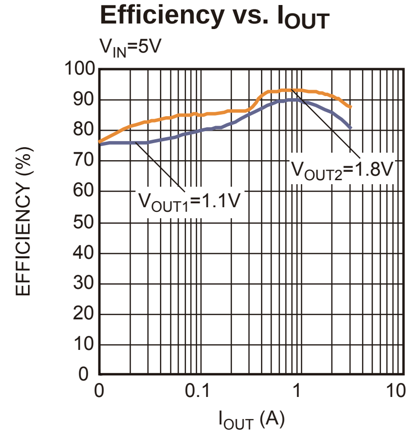
APPLICATIONS

- Solid State Drives(SSD)
- Low Voltage I/O System Power
- Handheld/Battery-powered Systems
- Wireless/Networking Cards

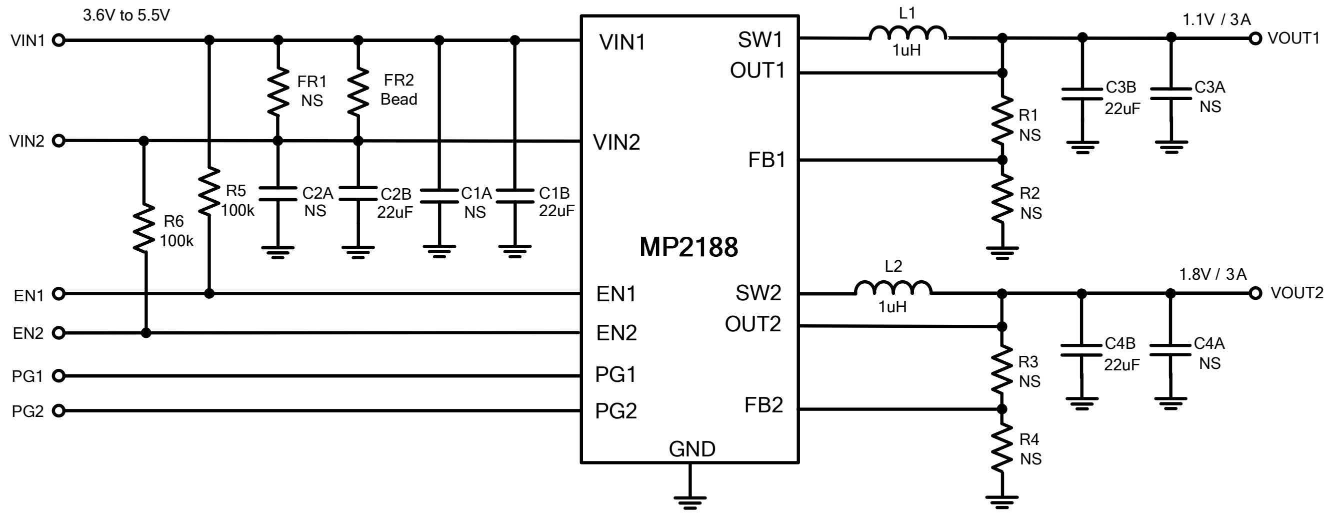
EV2188-QA-00A EVALUATION BOARD

Board Number	MPS IC Number
EV2188-QA-00A	MP2188GQA

Efficiency vs. I_{OUT}



EVALUATION BOARD SCHEMATIC



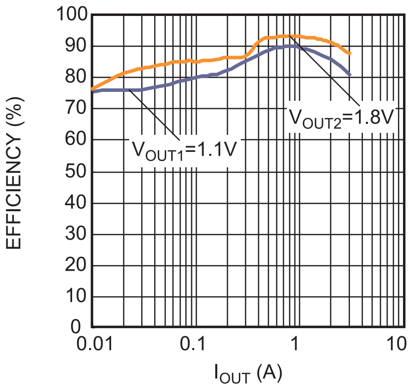
EV2188-QA-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer P/N
2	C1B, C2B	22µF	Ceramic Cap., 10V, X5R	1206	muRata	GRM31CR61A226ME19L
2	C3B, C4B	22µF	Ceramic Cap, 6.3V,X5R	1206	muRata	GRM31CR60J226KE19L
0	C1A, C2A, C3A, C4A, FR1	NS	NS	NS	NS	NS
1	FR2	Bead	390mΩ@100MHz, Ir=2A	1206	muRata	BLM31PG601SN1L
0	R1, R2, R3, R4	NS	NS	NS	NS	NS
2	R5, R6	100k	Film Res.,5%	0603	ROYAL	RL0603FR-07100KL
2	L1, L2	1µH	Inductor Isat=10.2A		Wurth	744777001
1	U1	MP2188	Step Down Switcher	QFN	MPS	MP2188

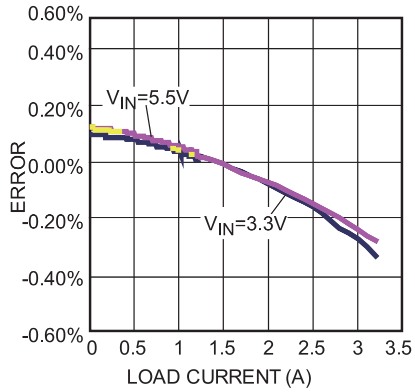
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.
V_{IN} = 5V, V_{OUT1} = 1.1V, V_{OUT2} = 1.8V, L1=L2 = 1μH, C_{OUT1}=C_{OUT2}=22μF, T_A = 25°C, unless otherwise noted.

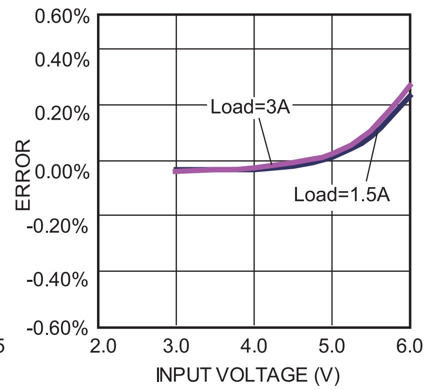
Efficiency vs. I_{OUT}



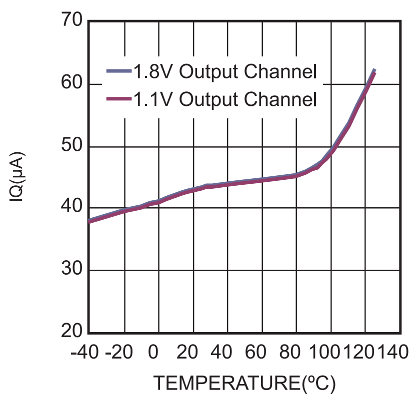
Load Regulation



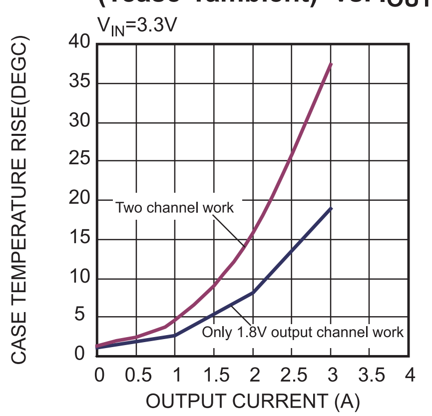
Line Regulation



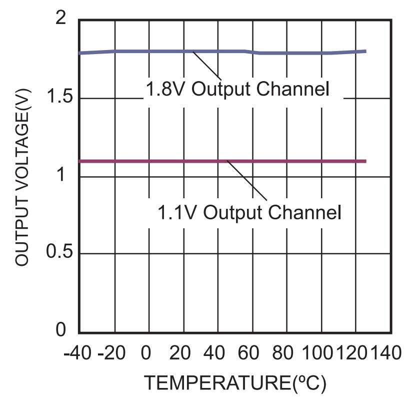
Quiescent Current vs. Temperature



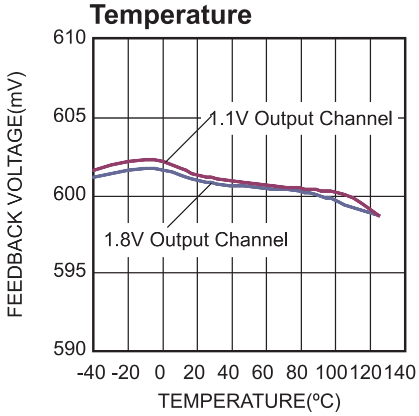
Case Temperature Rise (Tcase-Tambient) vs. I_{OUT}



Output Voltage vs. Temperature



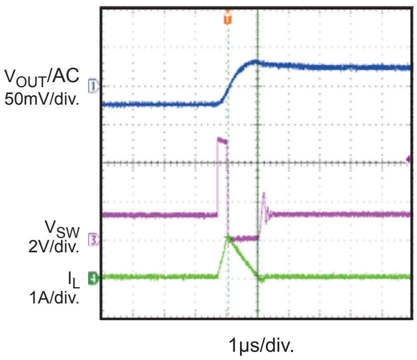
Feedback Voltage vs. Temperature



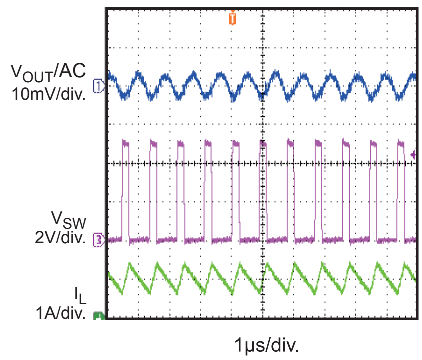
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 5V, V_{OUT1} = 1.1V, V_{OUT2} = 1.8V, L1=L2 = 1μH, C_{OUT1}=C_{OUT2}=22μF, T_A = 25°C, unless otherwise noted.

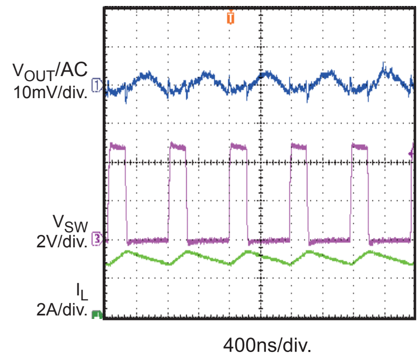
Output Ripple
I_{OUT}=0A



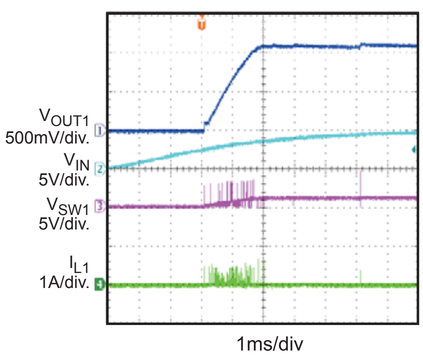
Output Ripple
I_{OUT}=1A



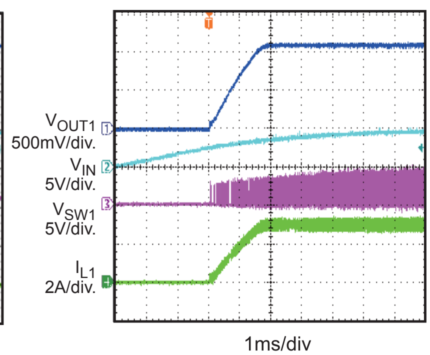
Output Ripple
I_{OUT}=3A



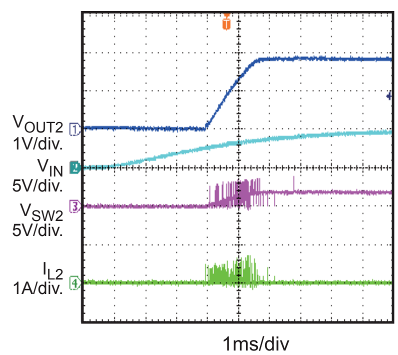
VIN Power On
V_{OUT1}=1.1V, I_{OUT1}=0A



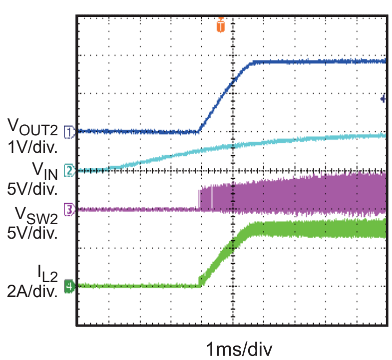
VIN Power On
V_{OUT1}=1.1V, I_{OUT1}=3A



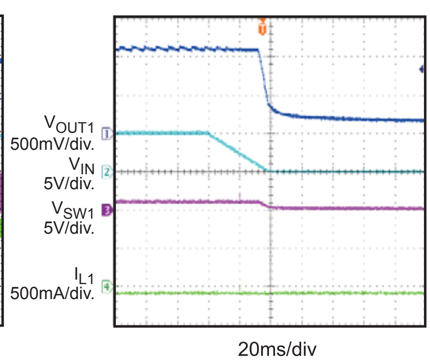
VIN Power On
V_{OUT2}=1.8V, I_{OUT2}=0A



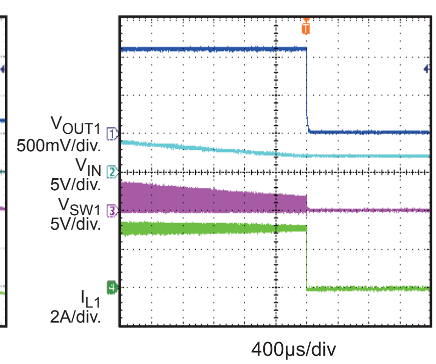
VIN Power On
V_{OUT2}=1.8V, I_{OUT2}=3A



VIN Power Off
V_{OUT1}=1.1V, I_{OUT1}=0A



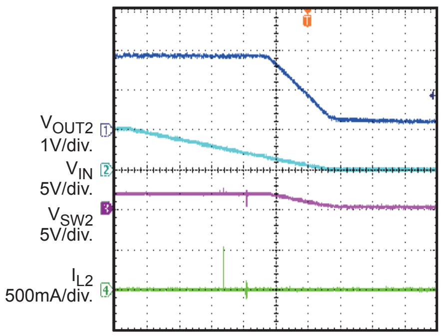
VIN Power Off
V_{OUT1}=1.1V, I_{OUT1}=3A



EVB TEST RESULTS *(continued)*

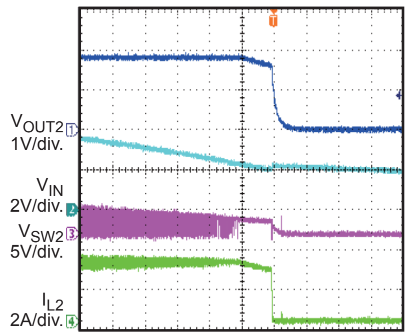
Performance waveforms are tested on the evaluation board.
V_{IN} = 5V, V_{OUT1} = 1.1V, V_{OUT2} = 1.8V, L1=L2 = 1µH, C_{OUT1}=C_{OUT2}=22µF, T_A = 25°C, unless otherwise noted.

VIN Power Off
V_{OUT2}=1.8V, I_{OUT2}=0A



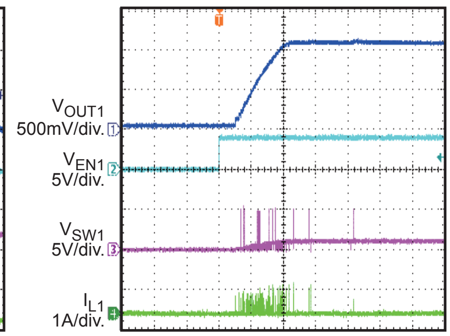
20ms/div.

VIN Power Off
V_{OUT2}=1.8V, I_{OUT2}=3A



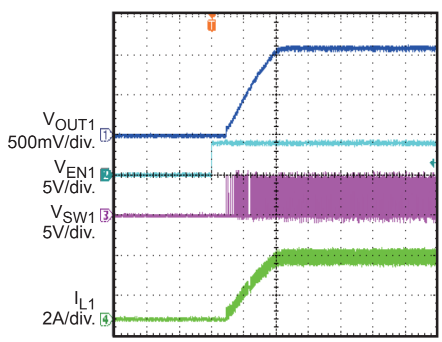
100µs/div.

EN ON
V_{OUT1}=1.1V, I_{OUT1}=0A



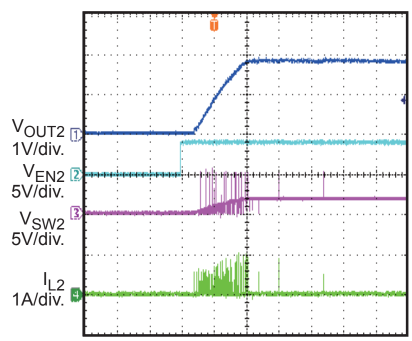
1ms/div.

EN ON
V_{OUT1}=1.1V, I_{OUT1}=3A



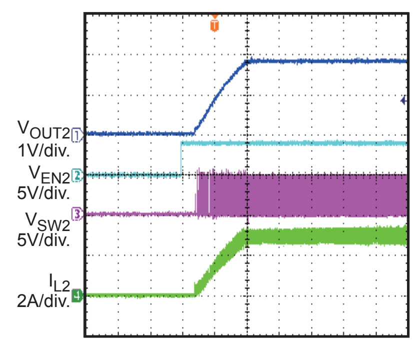
1ms/div

EN ON
V_{OUT2}=1.8V, I_{OUT2}=0A



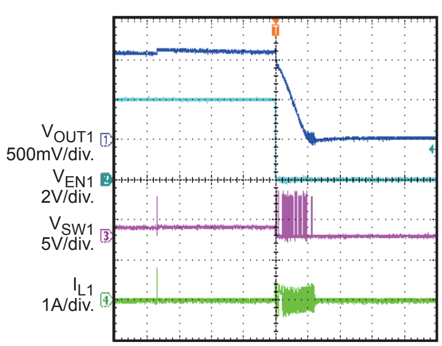
1ms/div

EN ON
V_{OUT2}=1.8V, I_{OUT2}=3A



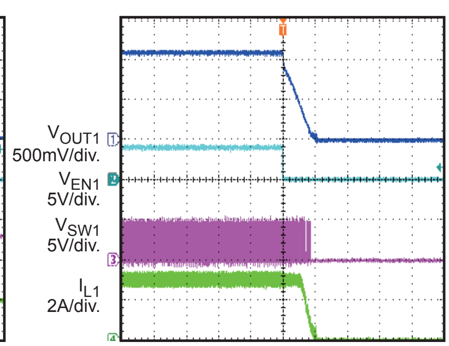
1ms/div

EN OFF
V_{OUT1}=1.1V, I_{OUT1}=0A



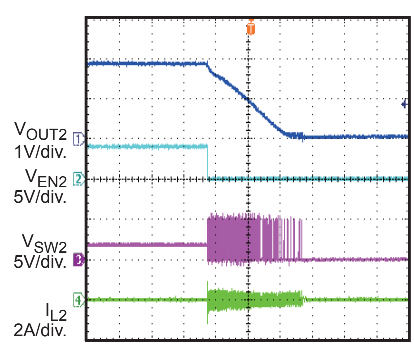
1ms/div

EN OFF
V_{OUT1}=1.1V, I_{OUT1}=3A



1ms/div

EN OFF
V_{OUT2}=1.8V, I_{OUT2}=0A



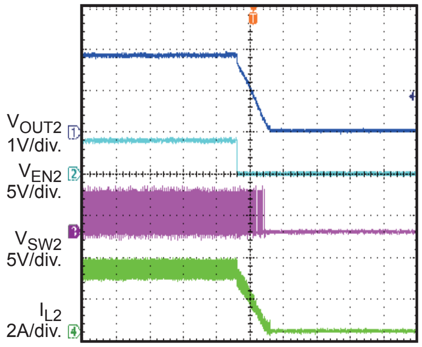
400µs/div

EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.
V_{IN} = 5V, V_{OUT1} = 1.1V, V_{OUT2} = 1.8V, L1=L2 = 1µH, C_{OUT1}=C_{OUT2}=22µF, T_A = 25°C, unless otherwise noted.

EN OFF

V_{OUT2}=1.8V, I_{OUT2}=3A



PRINTED CIRCUIT BOARD LAYOUT

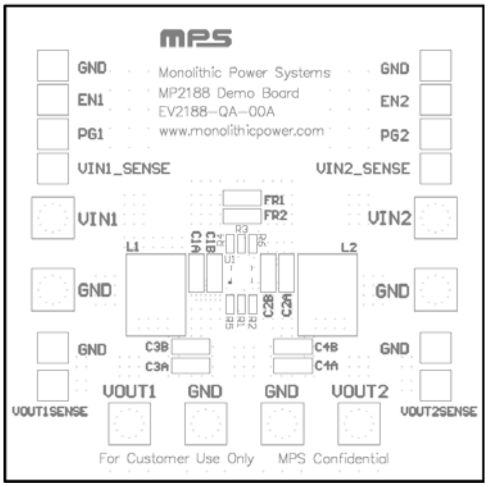


Figure 1—Top Silk Layer

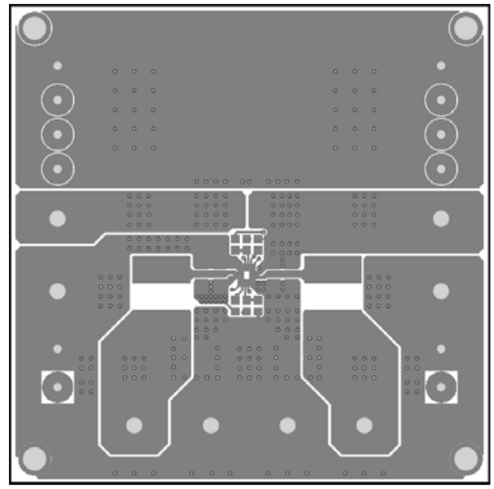


Figure 2—Top Layer

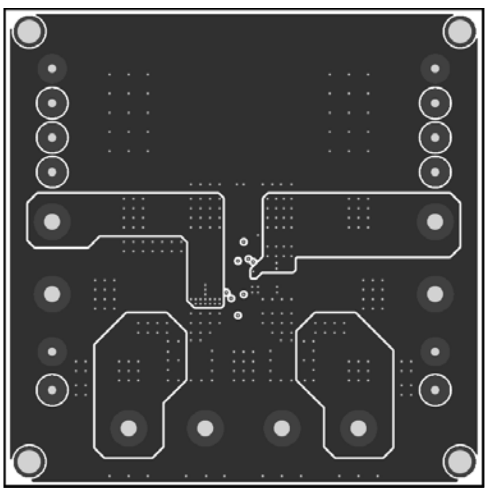


Figure 3—Inner 1 Layer

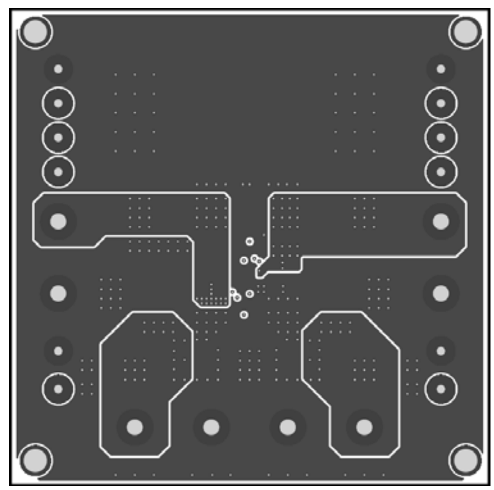


Figure 4—Inner 2 Layer

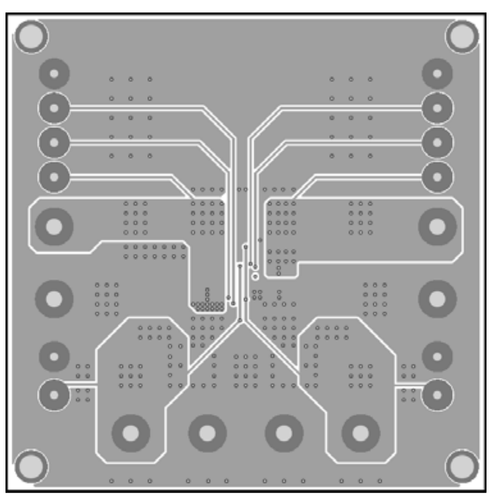


Figure 5—Bottom Layer

QUICK START GUIDE

1. Connect the positive and negative terminals of the load to the VOUT and GND pins, respectively.
2. Preset the power supply output between 3.6V and 5.5V, and then turn off the power supply.
3. Connect the positive and negative terminals of the power supply output to the VIN and GND pins, respectively.
4. Turn the power supply on. The board will automatically start up. And the output voltages are the pre-set fixed 1.1V and 1.8V.
5. To use the Enable function, apply a digital input to the EN pin. Drive EN higher than 1.2V to turn on the regulator or less than 0.4V to turn it off.
6. The output voltage of the two channels can be programmed by external FB divider resistors. Figure 6 shows the MP2188 feedback network.

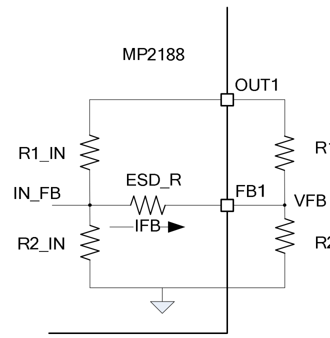


Figure 6 — Feedback network

Considering the internal divider resistors, choose external FB divider resistors <20kΩ. Using below formulas to set the new output voltages:

$$I_{FB} = \frac{V_{OUT} - V_{CH}}{R1\_IN}$$

$$V_{FB} = 0.6 - I_{FB} \times ESD\_R$$

$$R_1 = \frac{V_{OUT} - V_{FB}}{V_{FB} - I_{FB} \times R_2} \times R_2$$

Where, V_{CH} is the pre-set fixed output voltage of each channel.

For channel 1: V_{CH}=1.1V, $R_{1\_internal}$ =214.58kOhm, ESD_R=3.59kOhm.

For channel 2: V_{CH}=1.8V, $R_{1\_internal}$ =227.61kOhm, ESD_R=4.28kOhm.