EVQ5074-G-00A

5.5V, 3A, Programmable Current, Low-$R_{DS(ON)}$ Load Switch, AEC-Q100 Qualified Evaluation Board

DESCRIPTION

The EVQ5074-G-00A is an evaluation board for the MPQ5074, a low-$R_{DS(ON)}$ load switch with current limiting. The MPQ5074 provides up to 3A of load protection, covering a 1.2V to 5.5V voltage range. With very low $R_{DS(ON)}$ in a tiny package, the MPQ5074 provides a space-saving solution for automotive infotainment, clusters, and advanced driver-assistance system (ADAS) applications.

The max load at the output (source) is current-limited. This is accomplished by utilizing a sense FET topology. The magnitude of the current limit is controlled by an external resistor from the ILIM pin to ground.

The EVQ5074-G-00A board can deliver up to 3A of continuous load current across a 1.2V to 5.5V operating input voltage (V_{IN}) range. The MPQ5074 is available in a compact QFN-13 (2.5mmx3mm) package, and is AEC-Q100 qualified.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C, unless otherwise noted.

Parameters	Conditions	Value
Input voltage (V_{IN}) range		3V to 5.5V
Output voltage (V_{OUT})	V_{IN} = 3V to 5.5V, I_{OUT} = 0A to 3A	V_{OUT} = 3V to 5.5V
Maximum output current (I_{OUT})	V_{IN} = 3V to 5.5V	3A
Typical efficiency		
Peak efficiency		
Switching frequency (f_{SW})		

EVQ5074-G-00A EVALUATION BOARD

LxWxH (6.4cmx6.4cmx1.3cm)

Board Number	MPS IC Number
EVQ5074-G-00A	MPQ5074GQBE-AEC1

QUICK START GUIDE

The EVQ5074-G-00A evaluation board is easy to set up and use to evaluate the MPQ5074's performance. For proper measurement equipment set-up, refer to Figure 1 and follow the steps below:

1. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
2. Preset the power supply output between 3V to 5.5V, then turn off the power supply.
3. Connect the power supply output terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
4. Turn the power supply on. The board should automatically start up.
5. To use the enable function, apply a digital input to the EN pin. Drive EN above 2.6V to turn the MPQ5074 on; drive it below 0.4V to turn the device off.
6. Use R1 to set the output current (I_{OUT}) limit. Use C4 to set the soft-start time (t_{SS}). (1)
7. If the input voltage (V_{IN}) drops below 3V, then VCC requires a 3.6V power supply.
8. If using two input supplies, remove R2.

Note:

1) To select appropriate values for R1 and C4, refer to the Application Information section of the MPQ5074 datasheet.

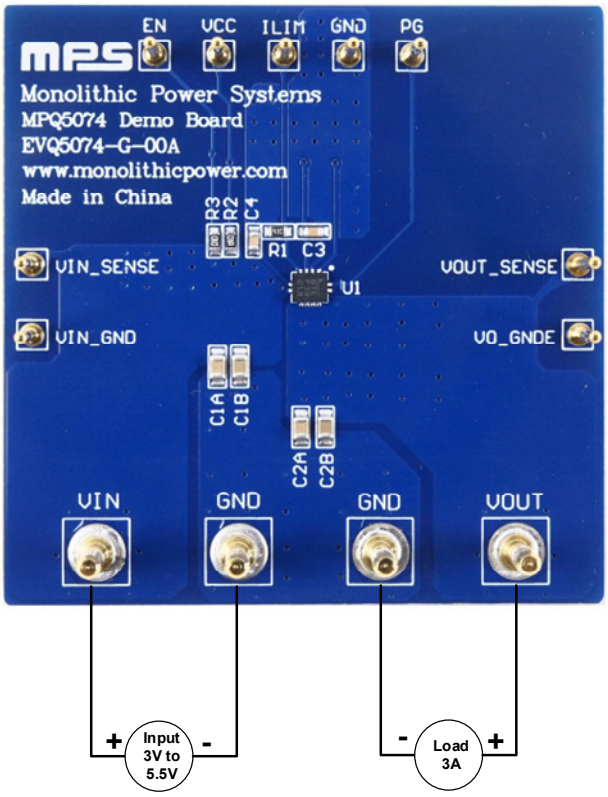


Figure 1: Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

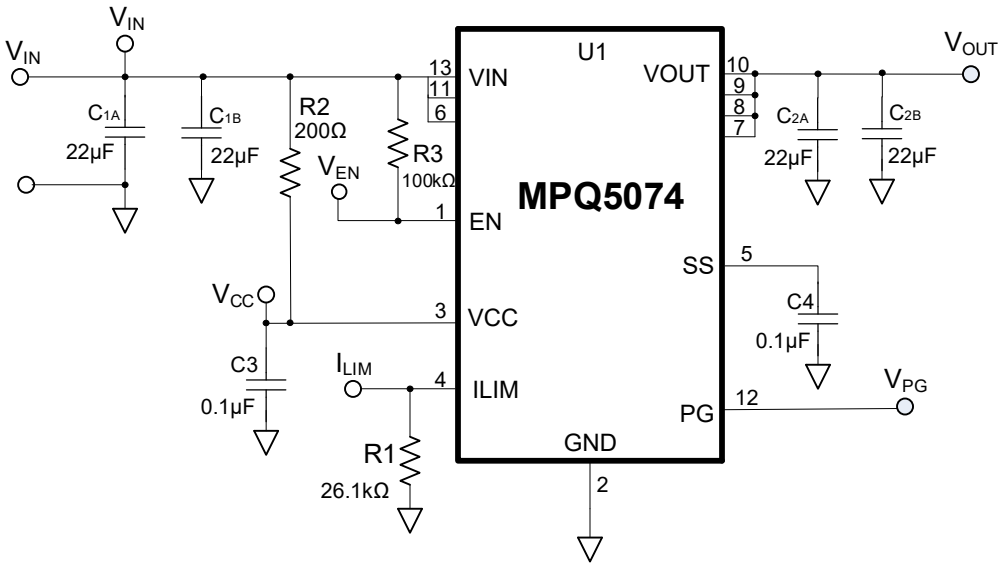


Figure 2: Evaluation Board Schematic

EVQ5074-G-00A BILL OF MATERIALS

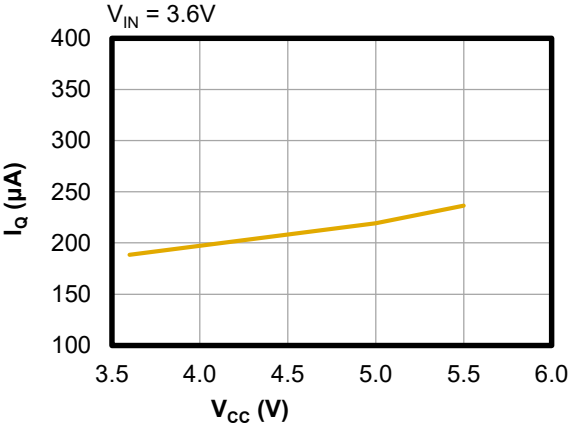
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
4	C1A, C1B, C2A, C2B	22µF	Ceramic capacitor, 10V, X5R	0805	Murata	GRM21BR61A226ME44L
2	C3, C4	100nF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E104KA01D
2	R2	200Ω	Resistor, 5%	0603	Yageo	AA0603JR-07200L
1	R1	26.1kΩ	Resistor, 1%	0603	Yageo	RC0603FR-0726K1L
1	R3	100kΩ	Resistor, 5%	0603	Yageo	RC0603JR-07100KL
9	PG, EN, V_{CC}, I_{LIM}, GND VIN_SENSE, VIN_GND, VOUT_SENSE, VOUT_GND	1mm	Test point	1mm	Any	
4	V_{IN}, GND, GND, V_{OUT}	2mm	Test point	2mm	Any	
1	U1	MPQ5074	5.5V, 3A load switch, AEC-Q100 qualified	QFN-13 (2.5mm x3mm)	MPS	MPQ5074GQBE-AEC1

EVB TEST RESULTS

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{ILIM} = 26.1kΩ, I_{OUT} = 3A, T_A = 25°C, unless otherwise noted.

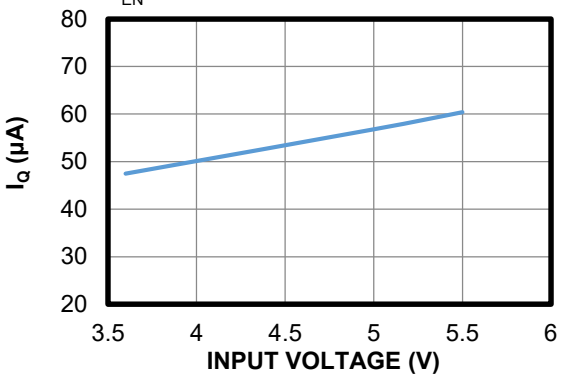
Quiescent Current vs. VCC Voltage

V_{IN} = 3.6V

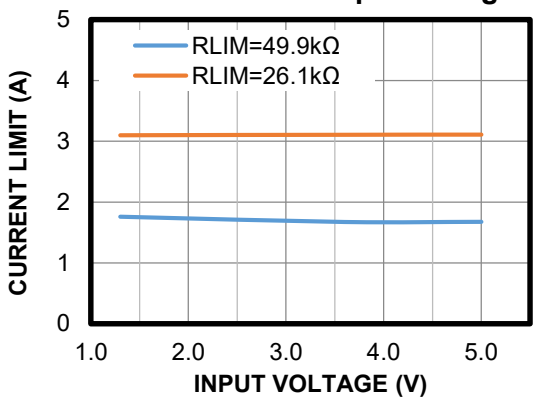


Quiescent Current vs. Input Voltage

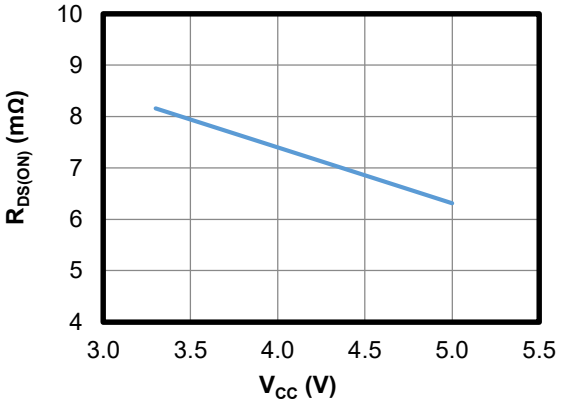
V_{EN} = 0V



Current Limit vs. Input Voltage

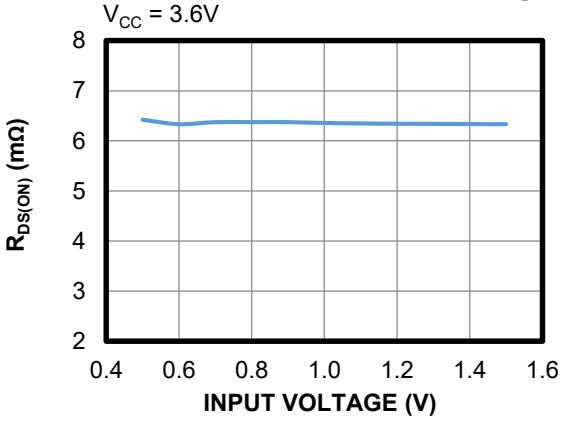


On Resistance vs. VCC Voltage



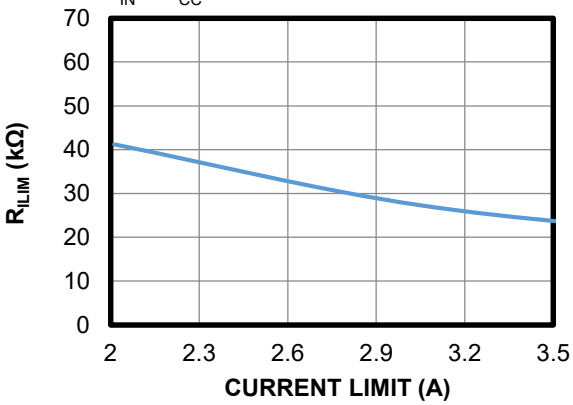
On Resistance vs. Input Voltage

V_{CC} = 3.6V



ILIM Resistance vs. Current Limit

V_{IN} = V_{CC} = 3.6V

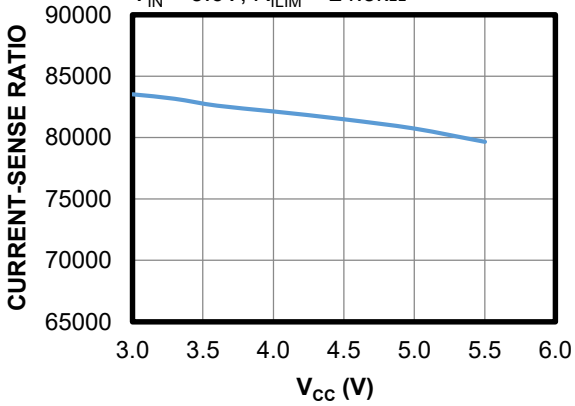


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{ILIM} = 26.1kΩ, I_{OUT} = 3A, T_A = 25°C, unless otherwise noted.

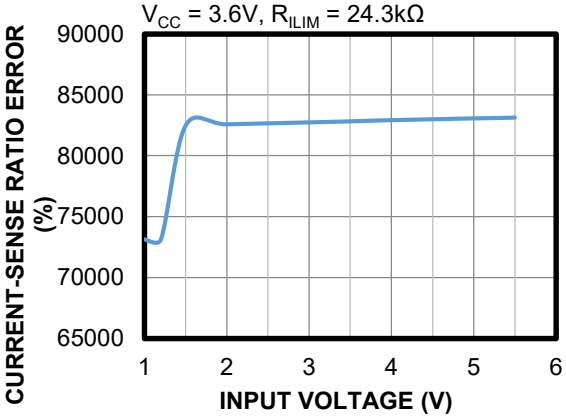
Current-Sense Ratio vs. VCC Voltage

V_{IN} = 3.6V, R_{ILIM} = 24.3kΩ



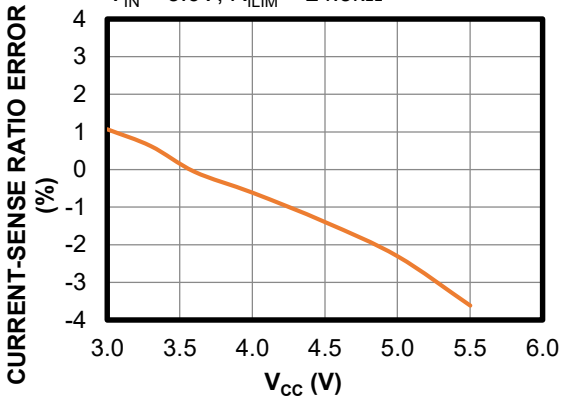
Current-Sense Ratio vs. Input Voltage

V_{CC} = 3.6V, R_{ILIM} = 24.3kΩ



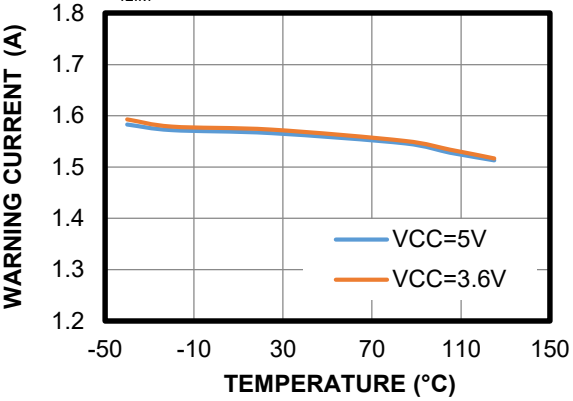
Current-Sense Ratio Error vs. VCC Voltage

V_{IN} = 3.6V, R_{ILIM} = 24.3kΩ



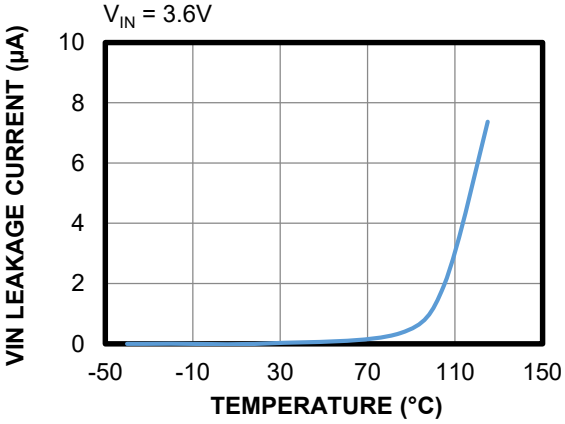
Warning Current vs. Temperature

R_{ILIM} = 49.9kΩ



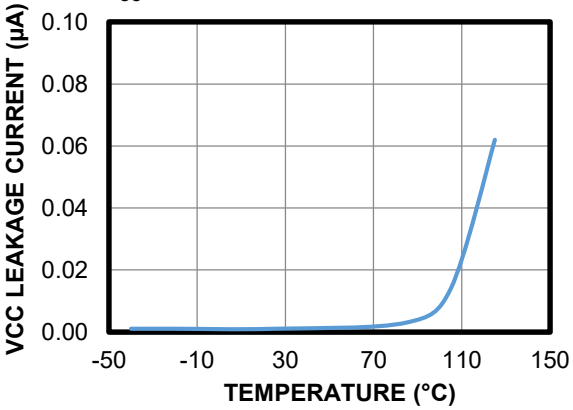
VIN Leakage Current vs. Temperature

V_{IN} = 3.6V



VCC Leakage Current vs. Temperature

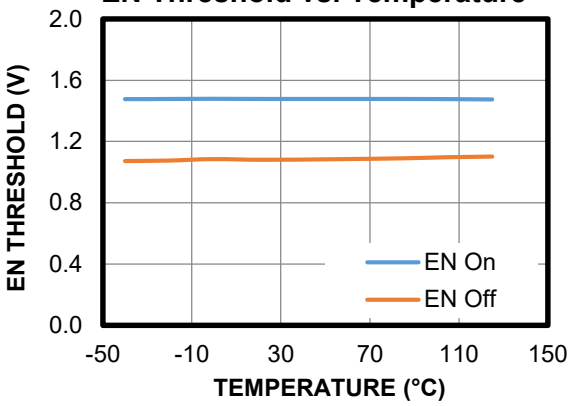
V_{CC} = 3.6V



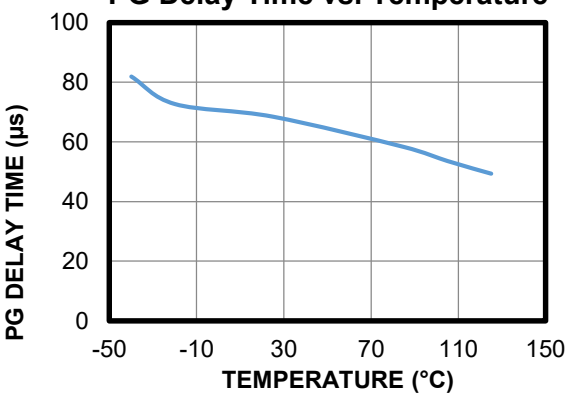
EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{ILIM} = 26.1kΩ, I_{OUT} = 3A, T_A = 25°C, unless otherwise noted.

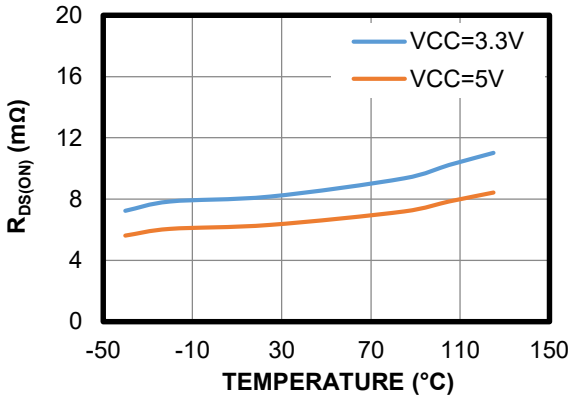
EN Threshold vs. Temperature



PG Delay Time vs. Temperature

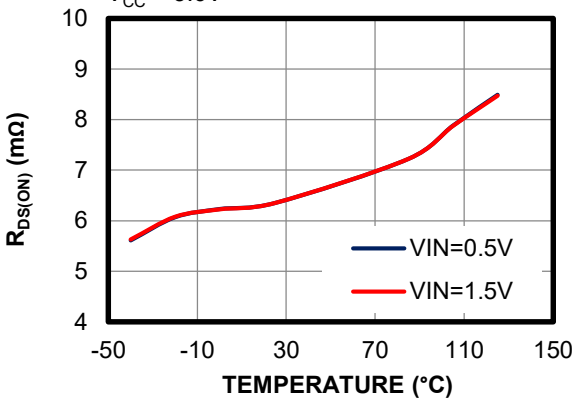


On Resistance vs. Temperature

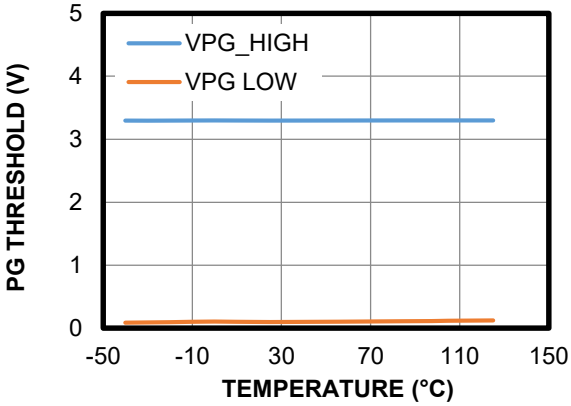


On Resistance vs. Temperature

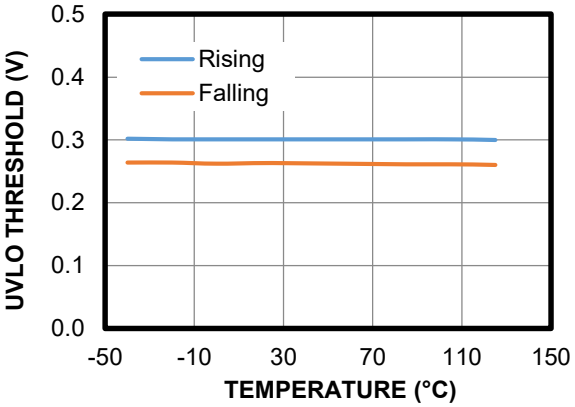
V_{CC} = 3.6V



PG Threshold vs. Temperature



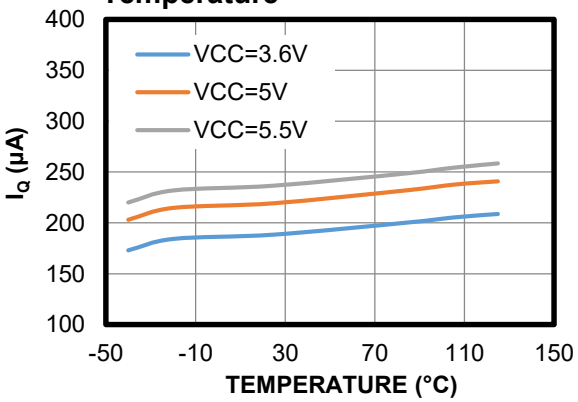
UVLO Threshold vs. Temperature



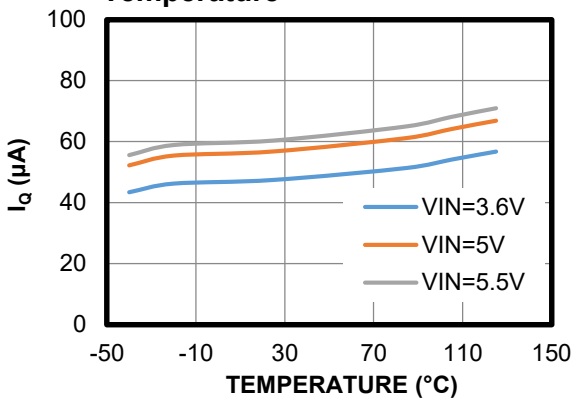
EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{ILIM} = 26.1kΩ, I_{OUT} = 3A, T_A = 25°C, unless otherwise noted.

Quiescent Current vs. Temperature



Quiescent Current vs. Temperature

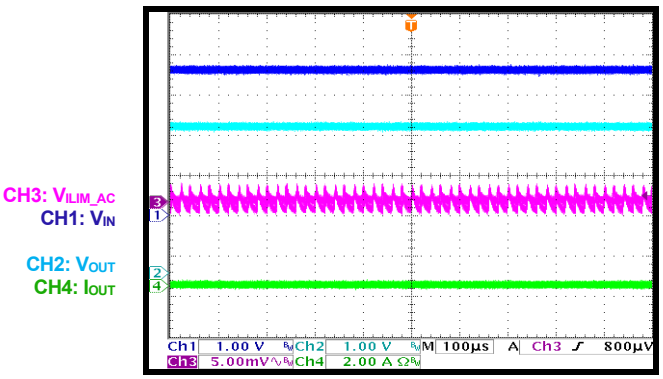


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{ILIM} = 26.1kΩ, I_{OUT} = 3A, T_A = 25°C, unless otherwise noted.

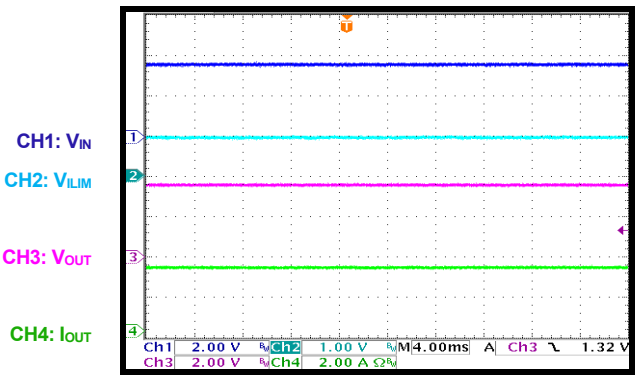
Steady State

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 0A



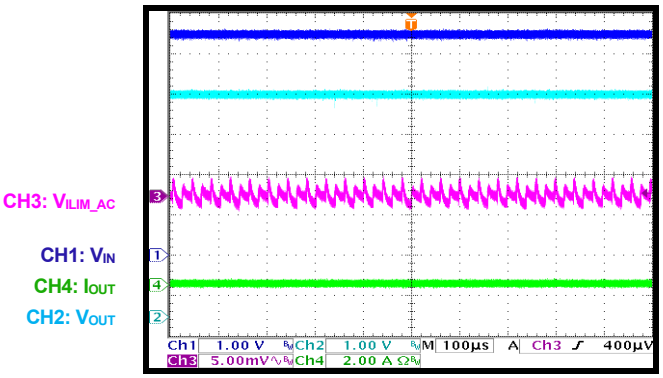
Steady State

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 3A



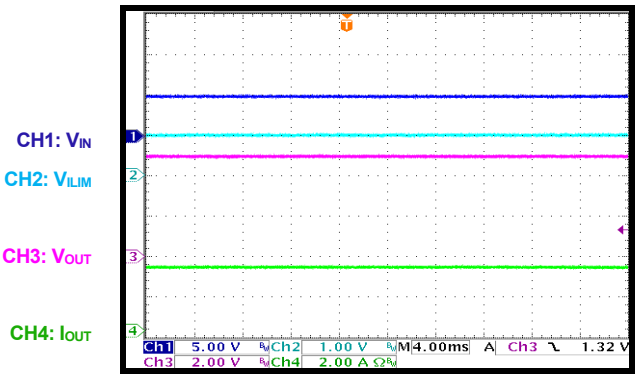
Steady State

V_{IN} = 5.5V, V_{CC} = 3.6V, I_{OUT} = 0A



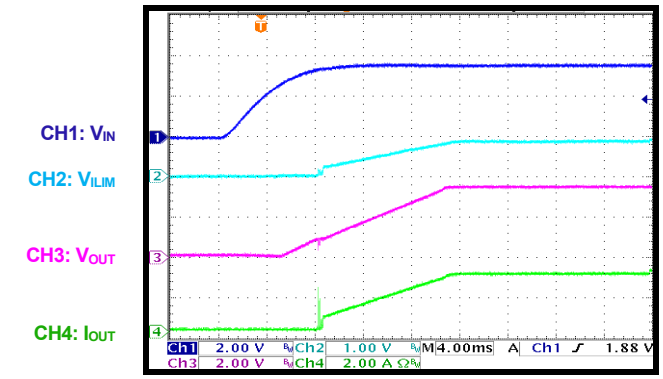
Steady State

V_{IN} = 5V, V_{CC} = 5V, I_{OUT} = 3A



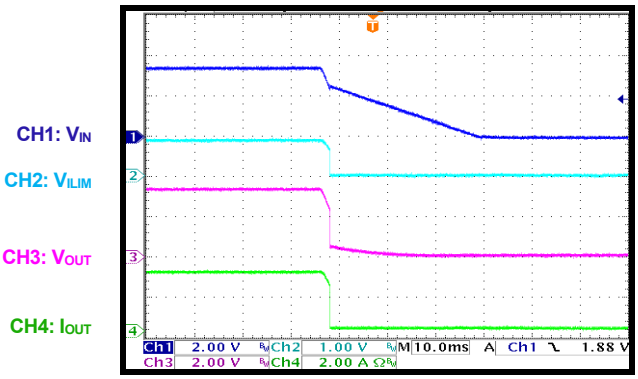
Start-Up

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 3A



Shutdown

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 3A

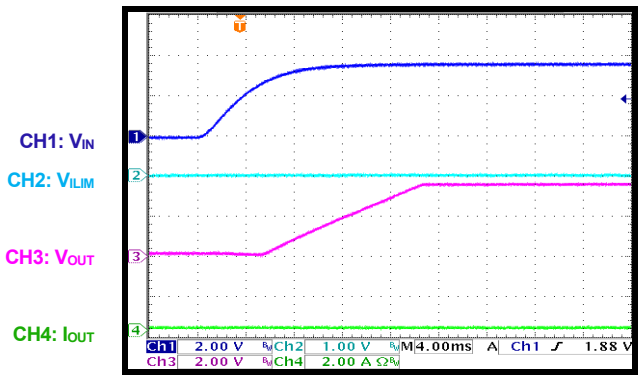


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{ILIM} = 26.1kΩ, I_{OUT} = 3A, T_A = 25°C, unless otherwise noted.

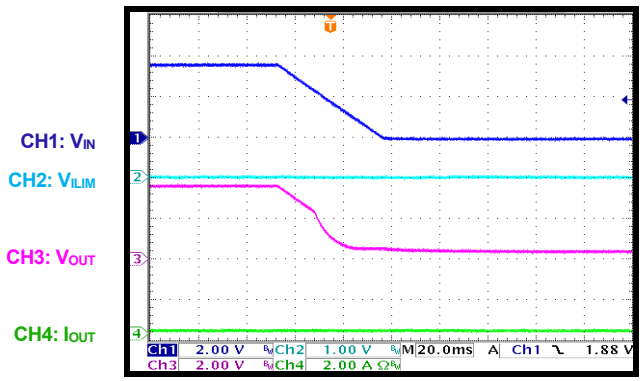
Start-Up

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 0A



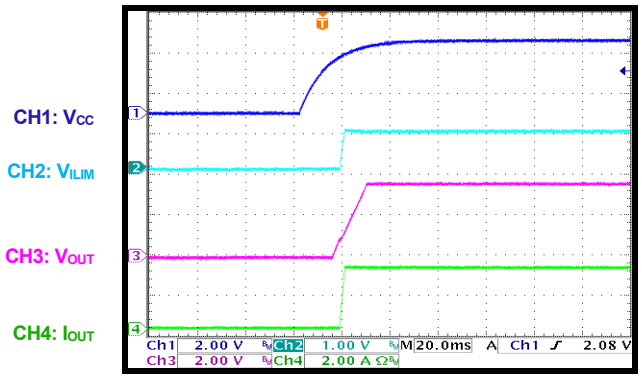
Shutdown

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 0A



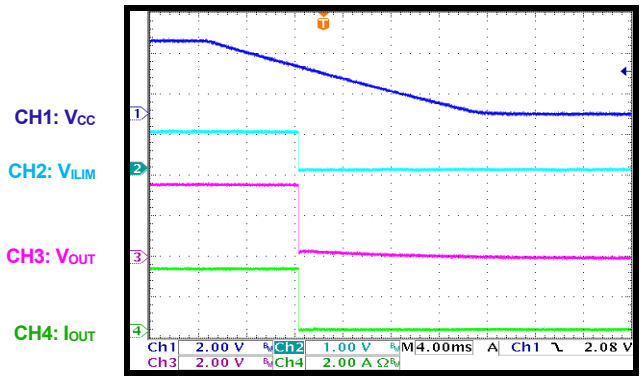
VCC On

V_{IN} = V_{EN} = 3.6V, V_{CC} = 3.6V, I_{OUT} = 3A



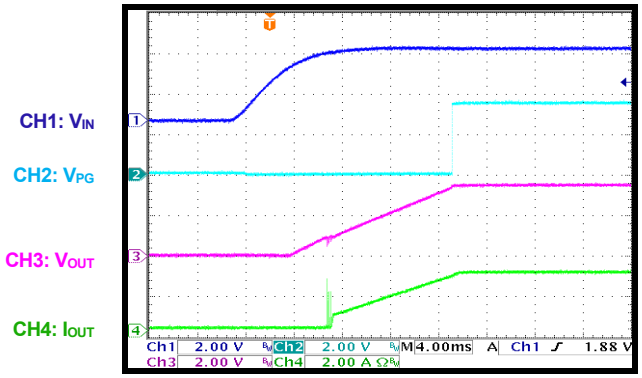
VCC Off

V_{IN} = V_{EN} = 3.6V, V_{CC} = 3.6V, I_{OUT} = 3A



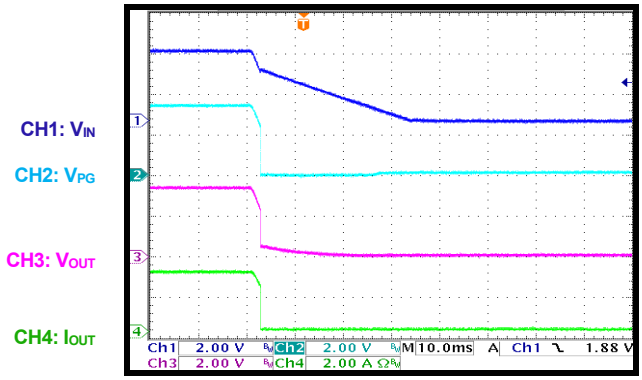
Start-Up with PG

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 2.9A



Shutdown with PG

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 2.9A

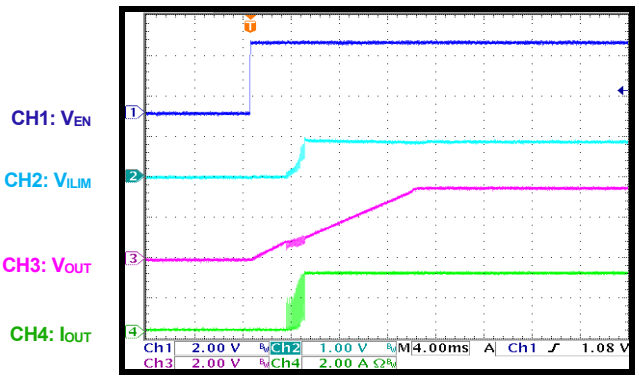


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{ILIM} = 26.1kΩ, I_{OUT} = 3A, T_A = 25°C, unless otherwise noted.

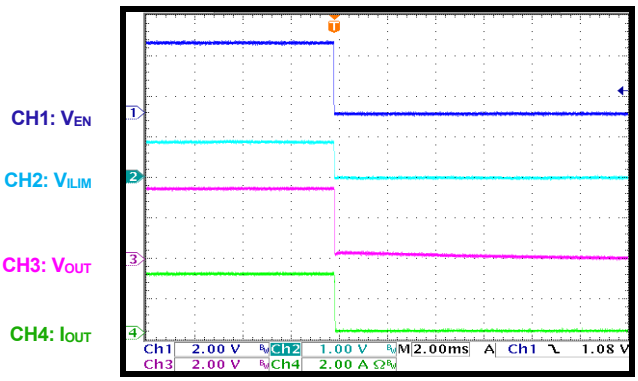
Start-Up through EN

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 2.9A



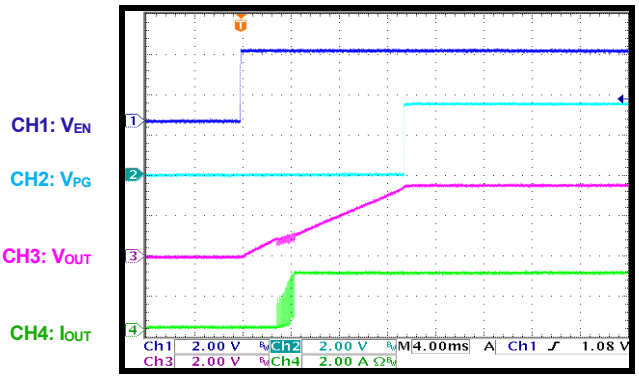
Shutdown through EN

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 2.9A



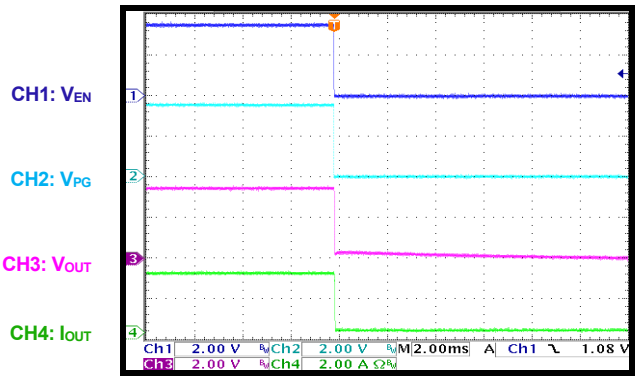
Start-Up through EN with PG

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 2.9A



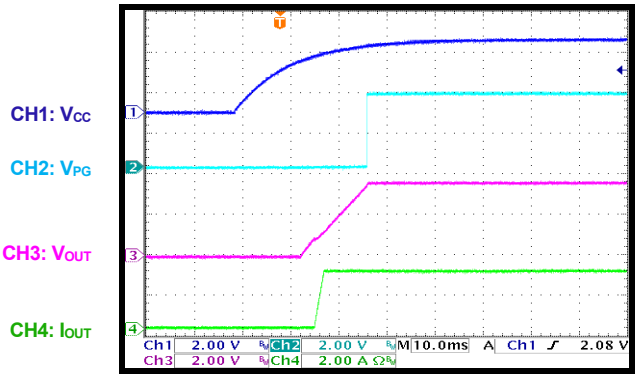
Shutdown through EN with PG

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 2.9A



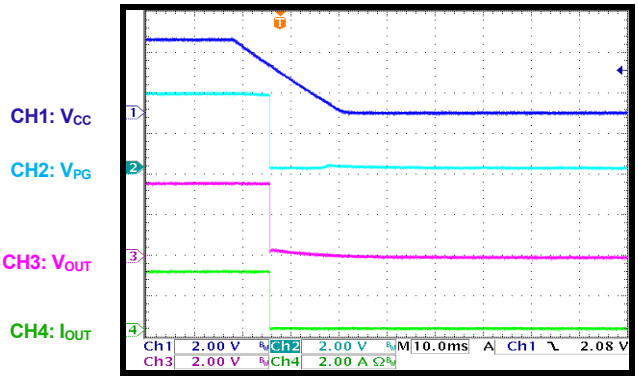
Start-Up through VCC with PG

V_{IN} = V_{EN} = 3.6V, I_{OUT} = 2.9A



Shutdown through VCC with PG

V_{IN} = V_{EN} = 3.6V, I_{OUT} = 2.9A

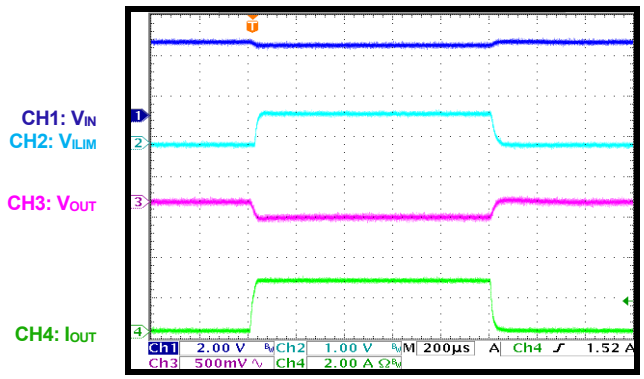


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{ILIM} = 26.1kΩ, I_{OUT} = 3A, T_A = 25°C, unless otherwise noted.

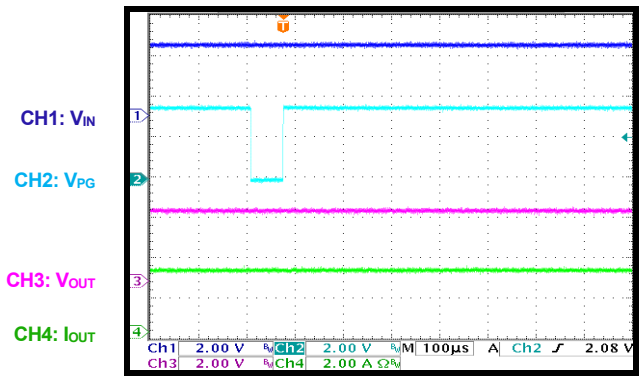
Load Transient

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 0A to 2.5A



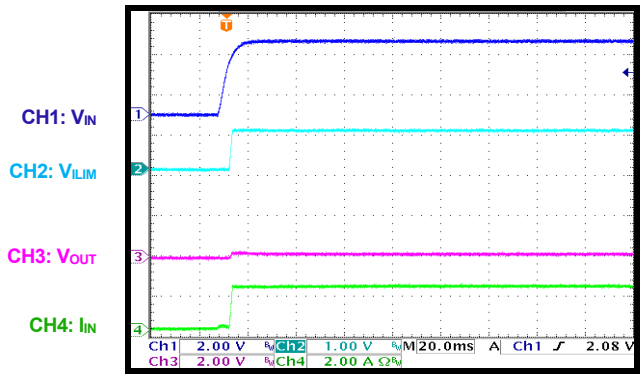
Current Limit Warning

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 2.97A



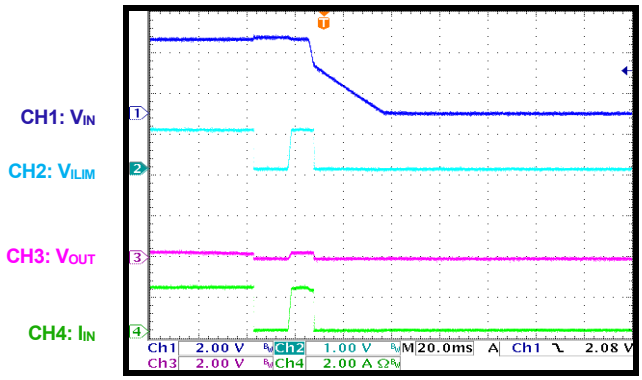
SCP Start-Up

V_{IN} = V_{CC} = V_{EN} = 3.6V



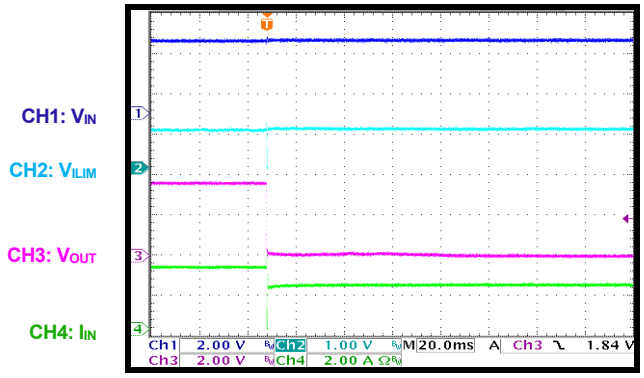
SCP Shutdown

V_{IN} = V_{CC} = V_{EN} = 3.6V



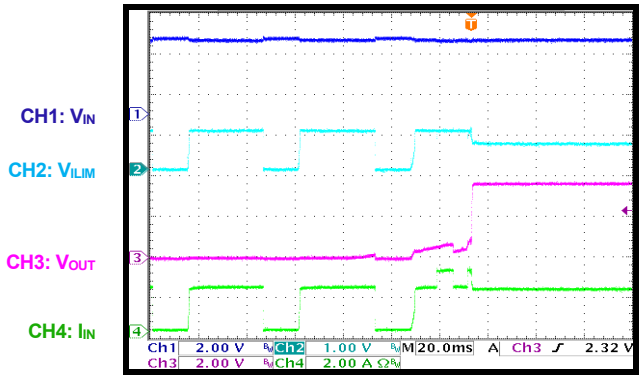
SCP

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 3A



SCP Recovery

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 2A



PCB LAYOUT

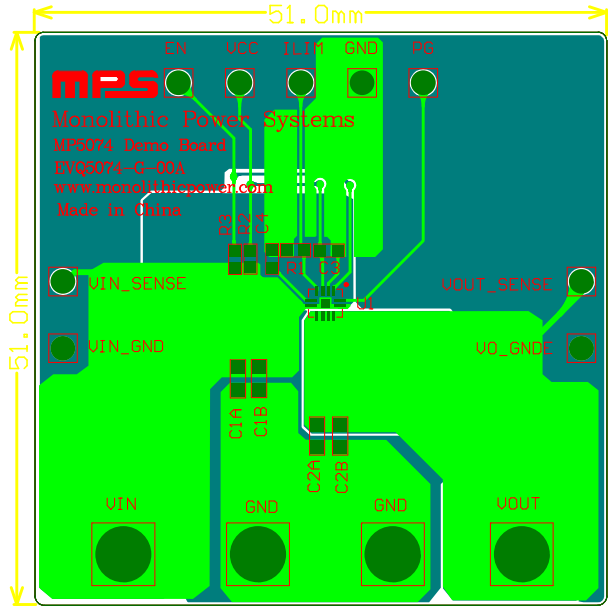


Figure 3: Top Silk

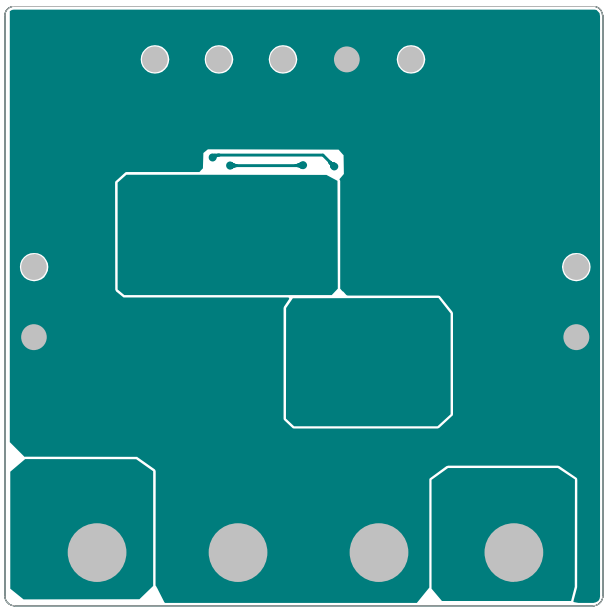


Figure 4: Bottom Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	5/19/2023	Initial Release	-