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

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

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.

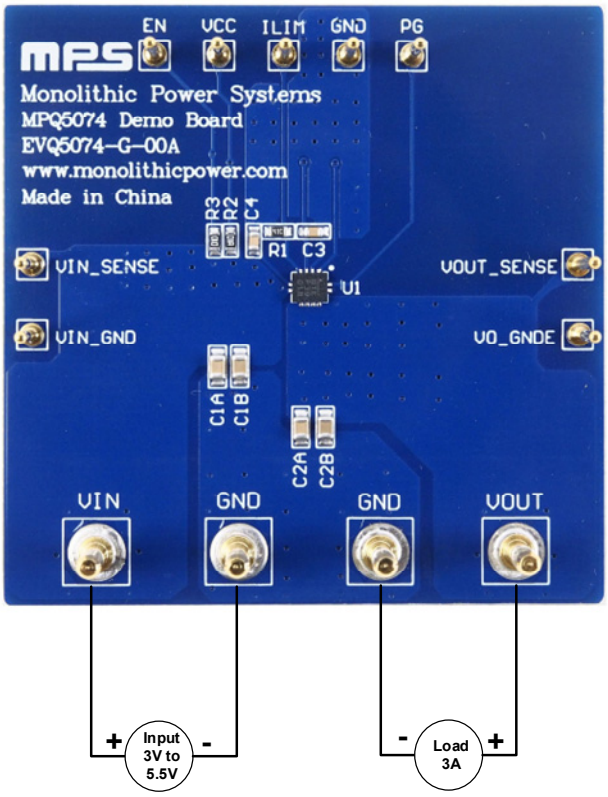


Figure 1: Measurement Equipment Set-Up

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

EVALUATION BOARD SCHEMATIC

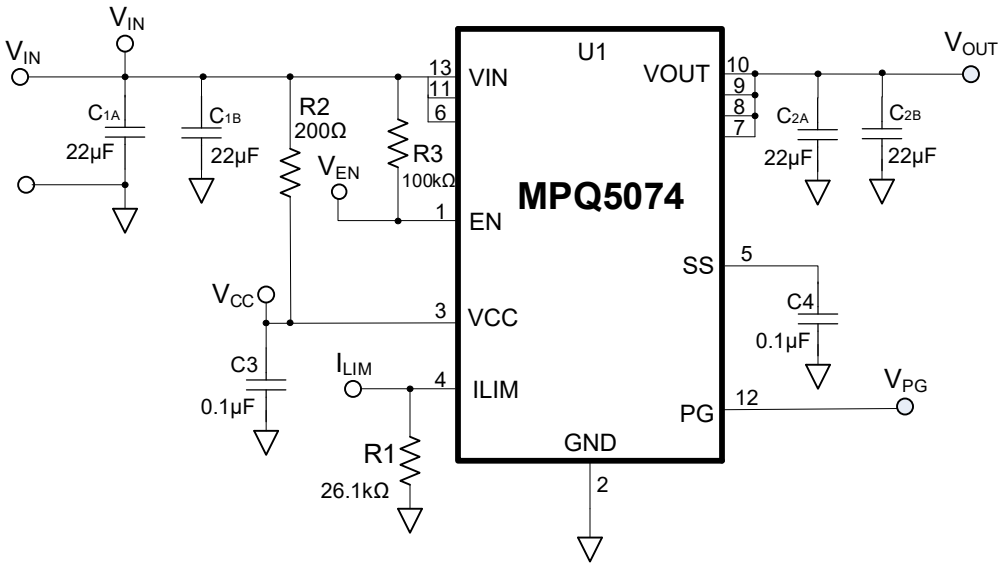


Figure 2: Evaluation Board Schematic

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

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

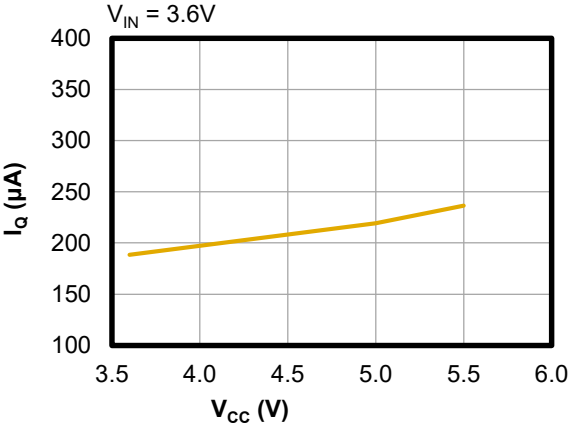
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

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.

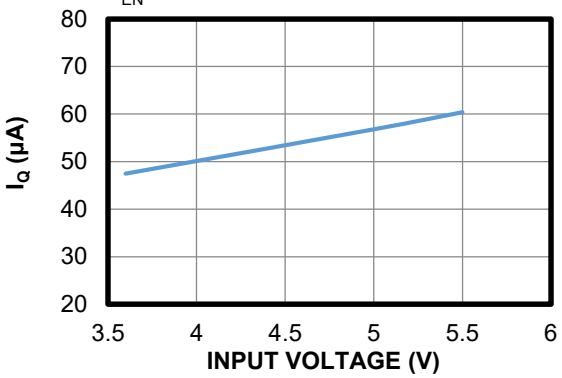
Quiescent Current vs. VCC Voltage

V_{IN} = 3.6V

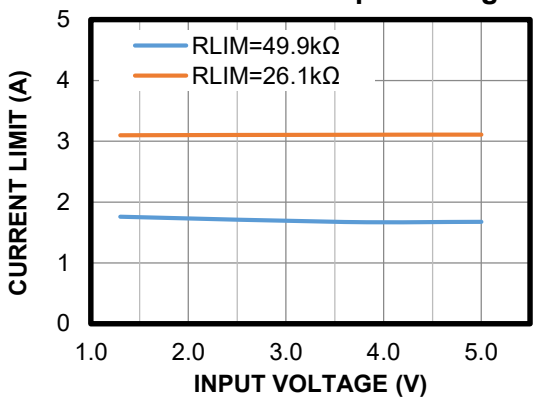


Quiescent Current vs. Input Voltage

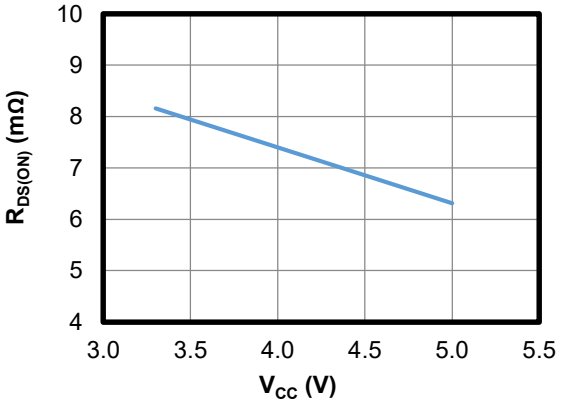
V_{EN} = 0V



Current Limit vs. Input Voltage

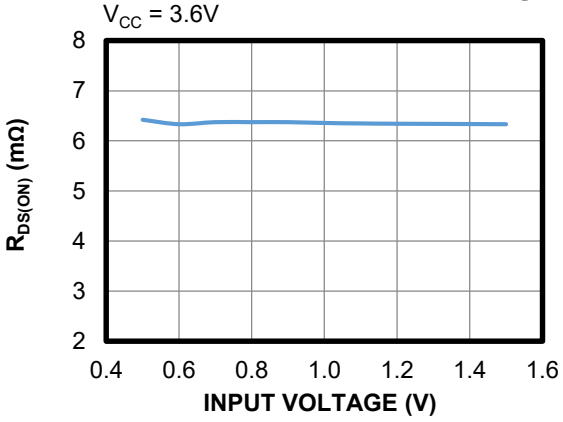


On Resistance vs. VCC Voltage



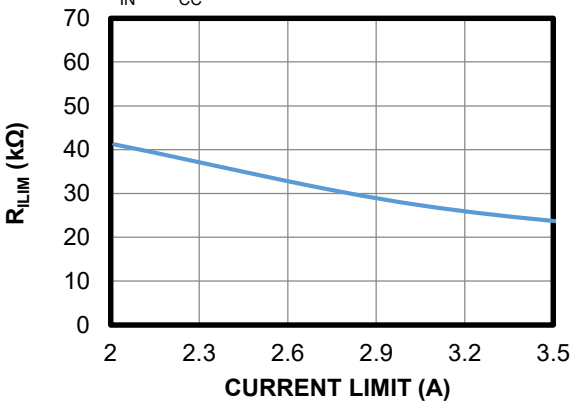
On Resistance vs. Input Voltage

V_{CC} = 3.6V



ILIM Resistance vs. Current Limit

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



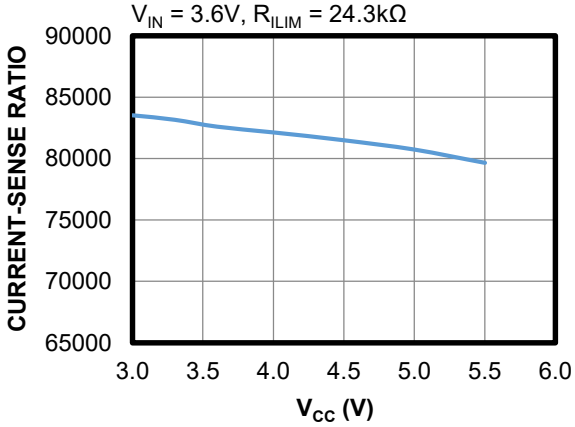
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

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.

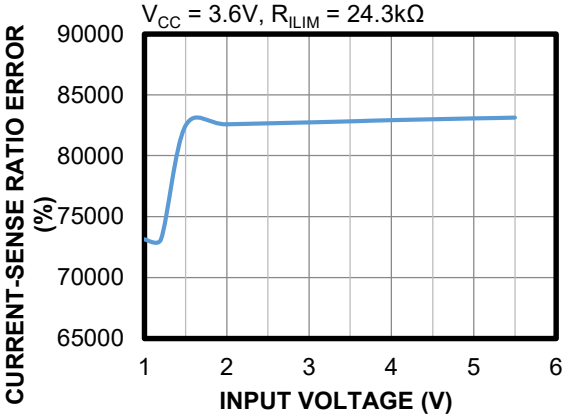
Current-Sense Ratio vs. VCC Voltage

V_{IN} = 3.6V, R_{ILIM} = 24.3kΩ



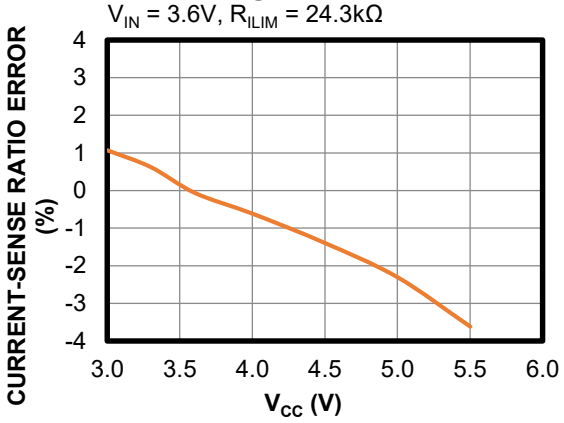
Current-Sense Ratio vs. Input Voltage

V_{CC} = 3.6V, R_{ILIM} = 24.3kΩ



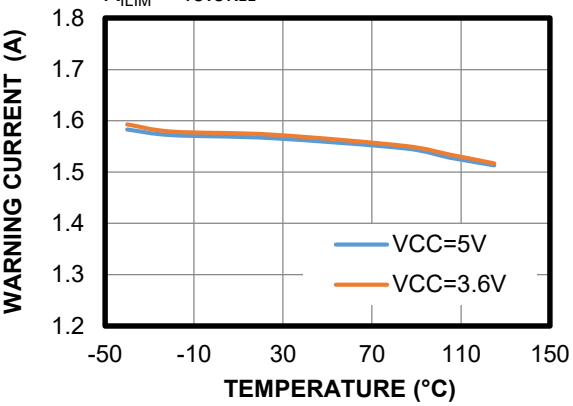
Current-Sense Ratio Error vs. VCC Voltage

V_{IN} = 3.6V, R_{ILIM} = 24.3kΩ



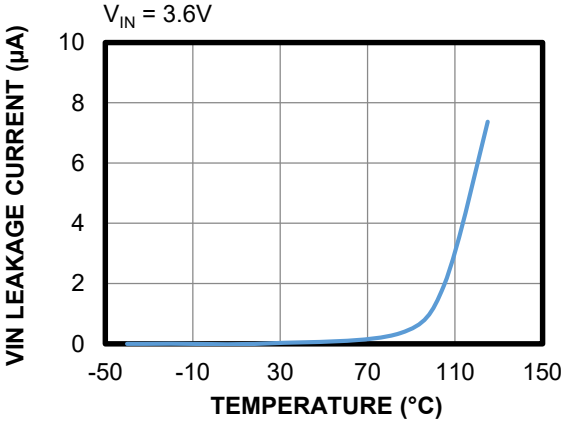
Warning Current vs. Temperature

R_{ILIM} = 49.9kΩ



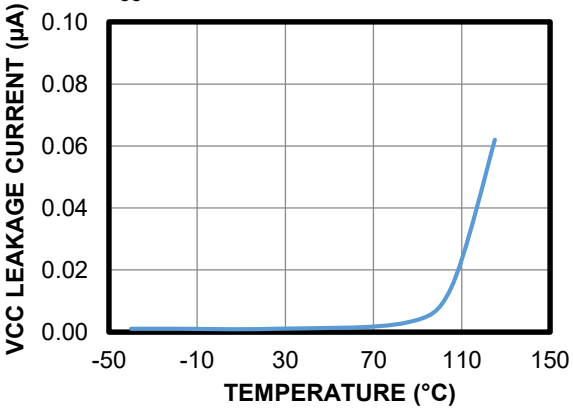
VIN Leakage Current vs. Temperature

V_{IN} = 3.6V



VCC Leakage Current vs. Temperature

V_{CC} = 3.6V

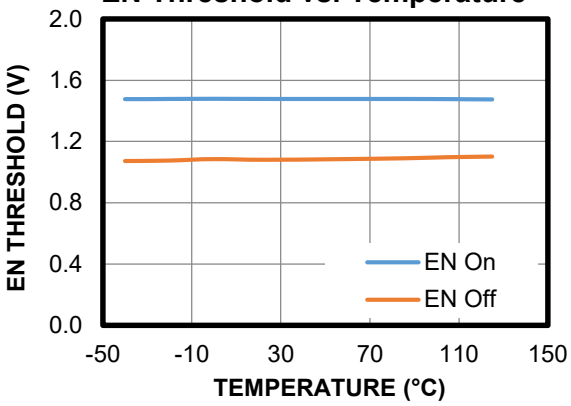


MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

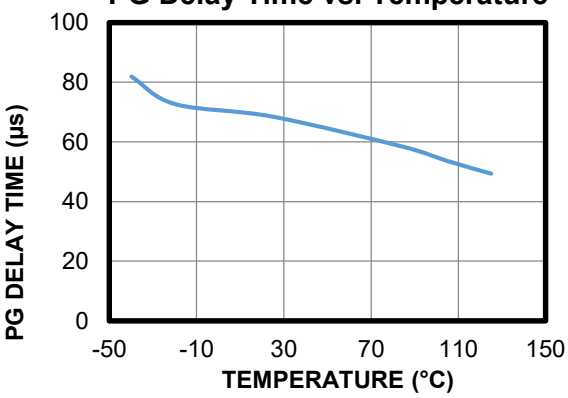
EVB TEST RESULTS *(continued)*

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.

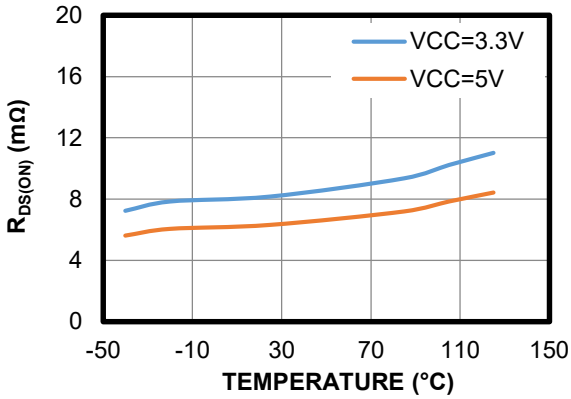
EN Threshold vs. Temperature



PG Delay Time vs. Temperature

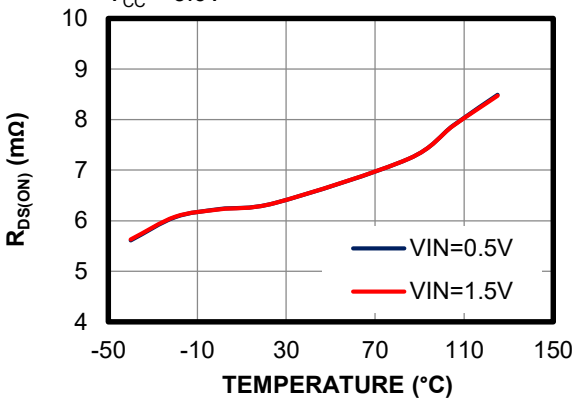


On Resistance vs. Temperature

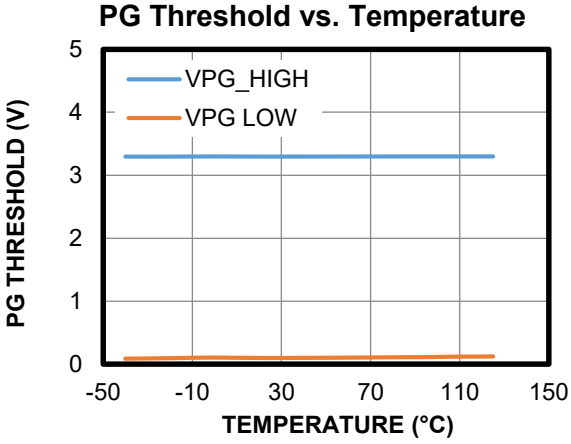


On Resistance vs. Temperature

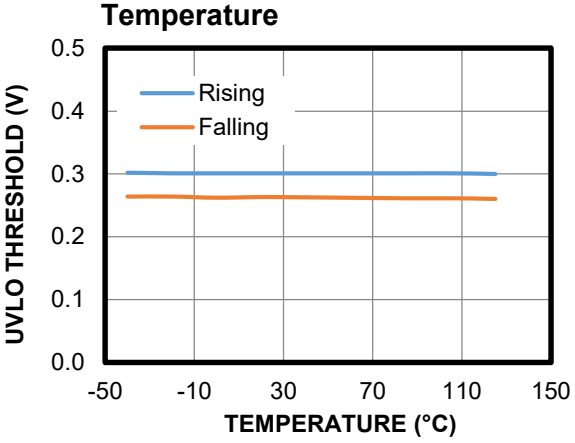
V_{CC} = 3.6V



PG Threshold vs. Temperature



UVLO Threshold vs. Temperature

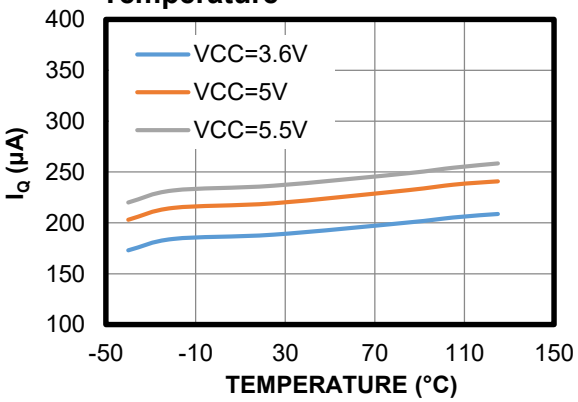


MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

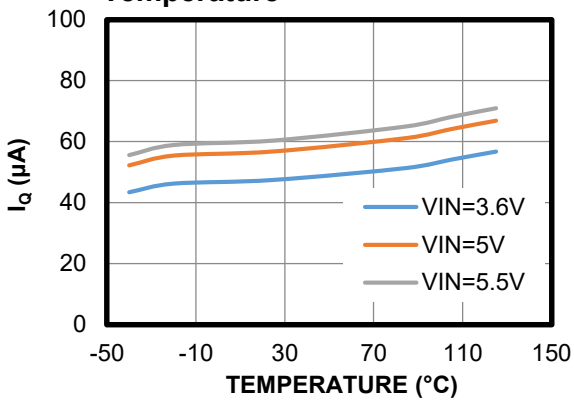
EVB TEST RESULTS *(continued)*

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



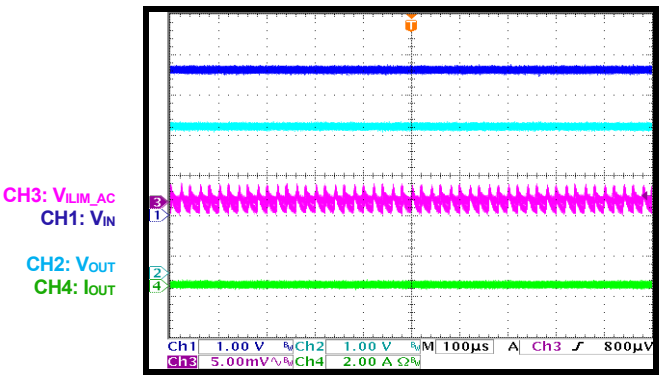
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

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.

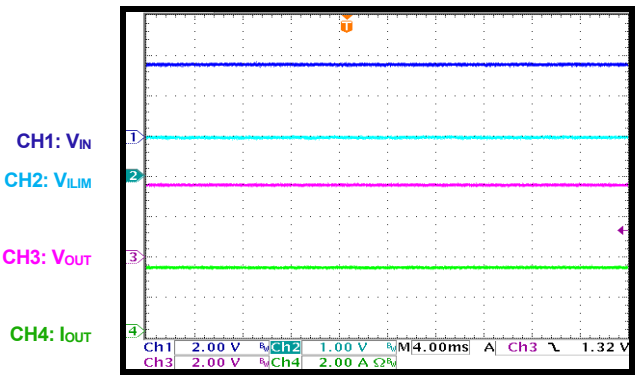
Steady State

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



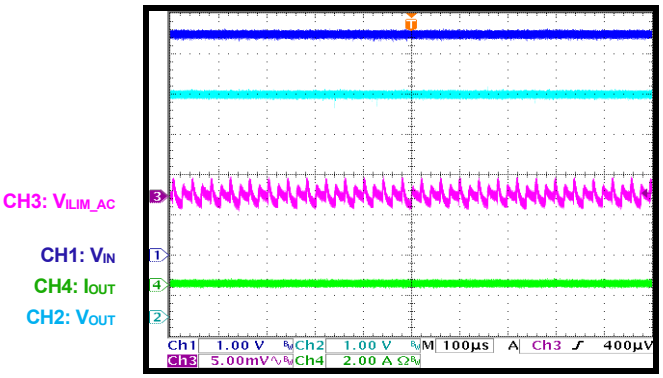
Steady State

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



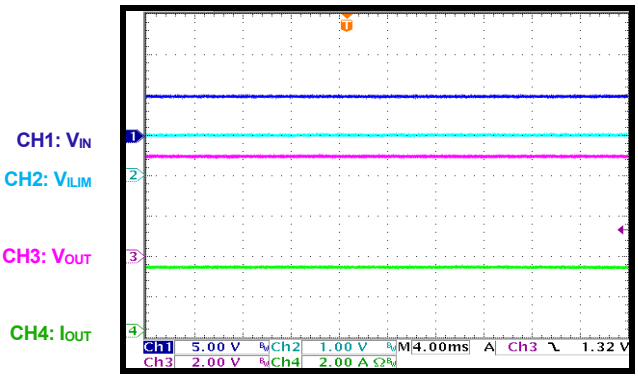
Steady State

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



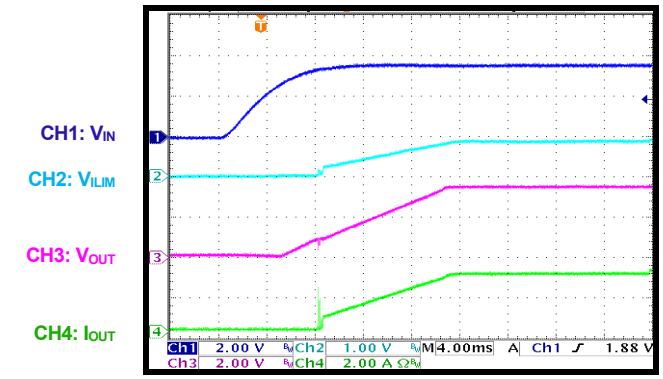
Steady State

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



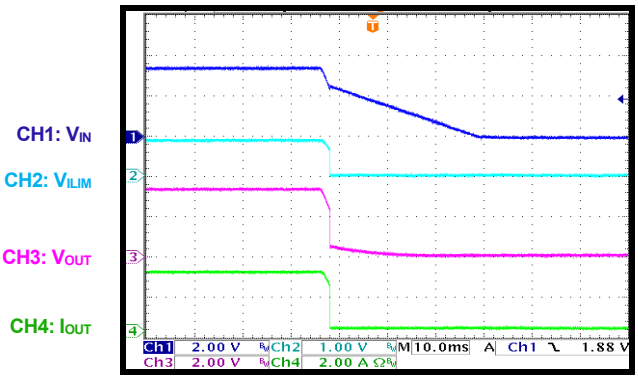
Start-Up

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



Shutdown

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



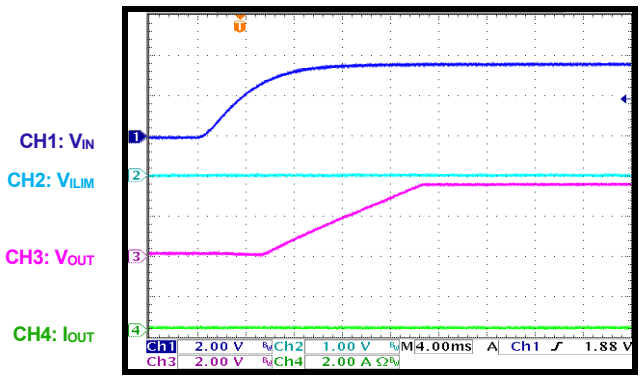
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

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.

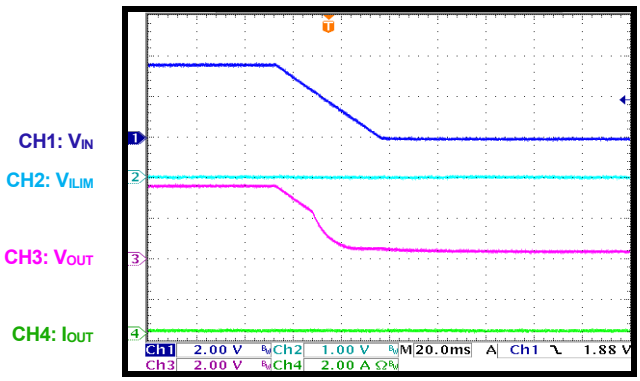
Start-Up

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



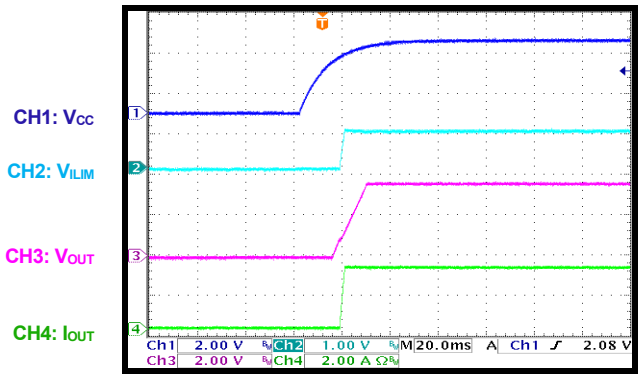
Shutdown

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



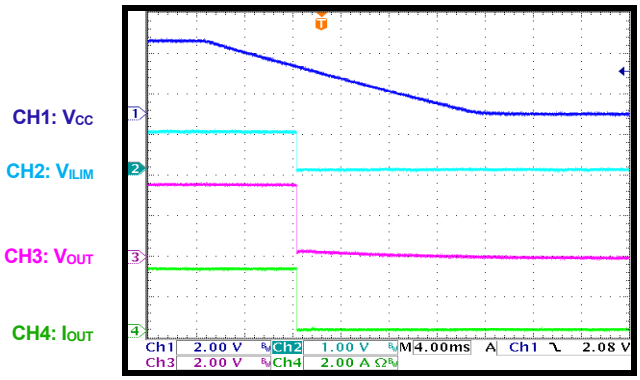
VCC On

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



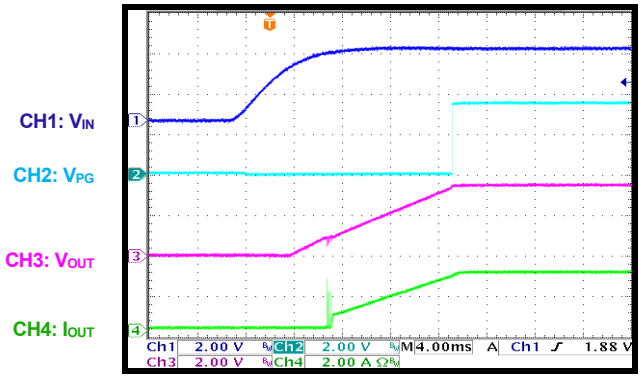
VCC Off

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



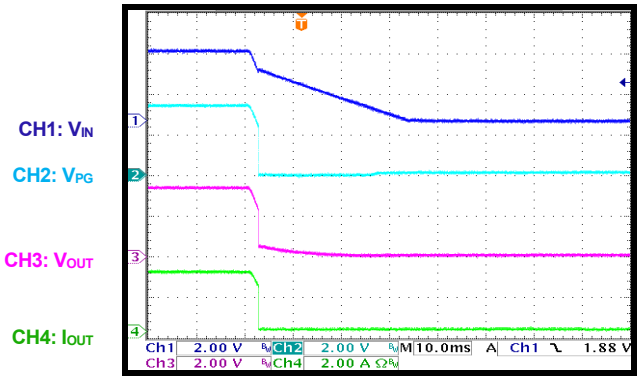
Start-Up with PG

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



Shutdown with PG

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



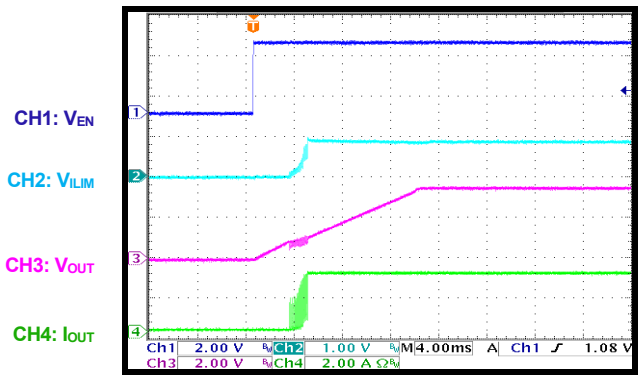
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

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.

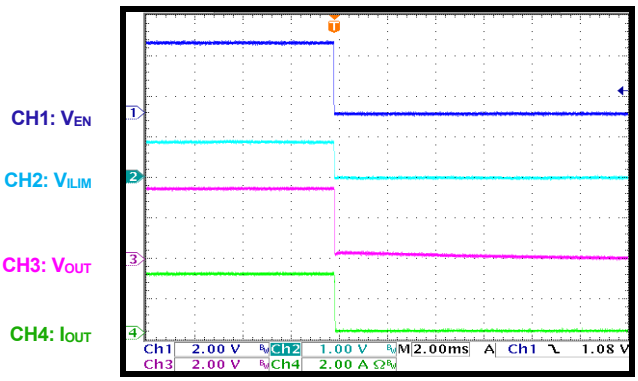
Start-Up through EN

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



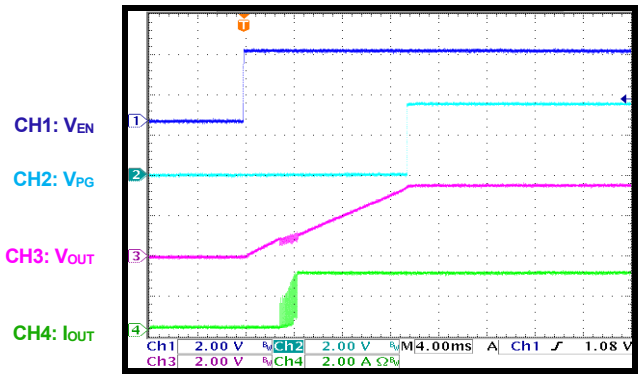
Shutdown through EN

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



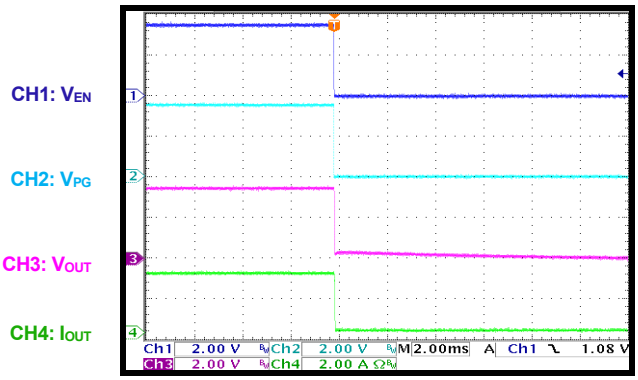
Start-Up through EN with PG

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



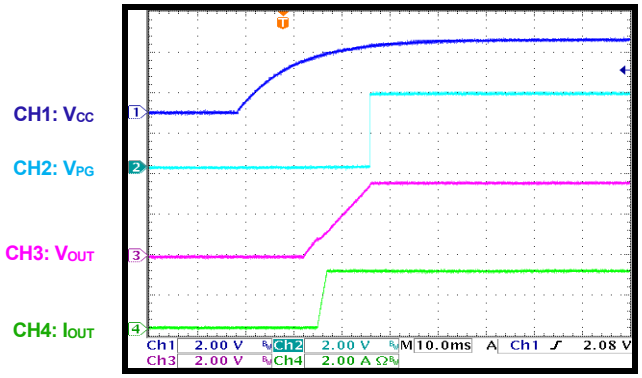
Shutdown through EN with PG

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



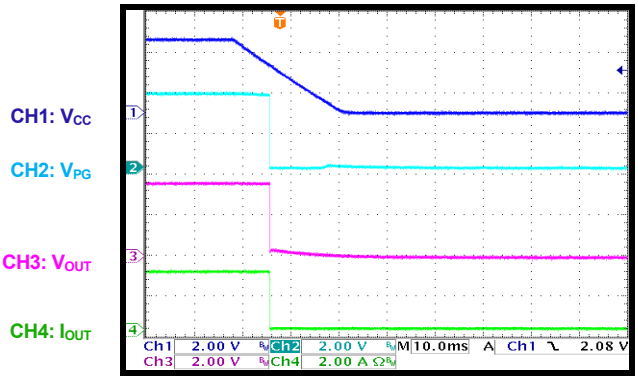
Start-Up through VCC with PG

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



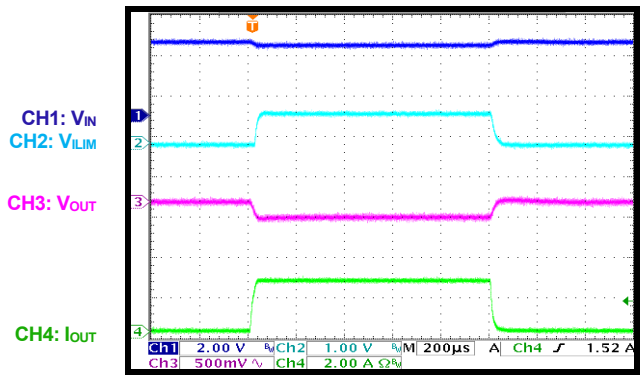
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

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.

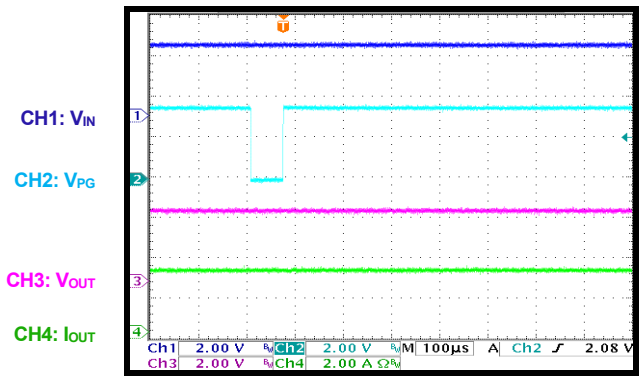
Load Transient

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



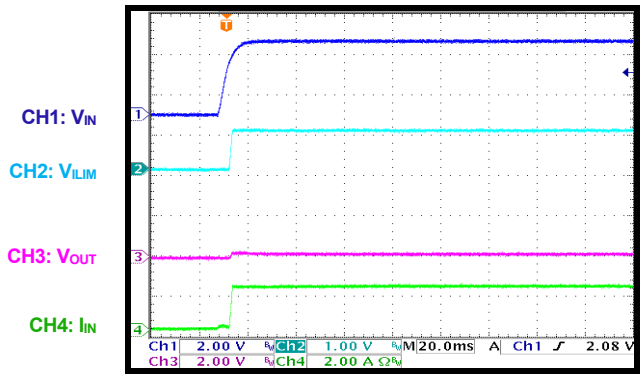
Current Limit Warning

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



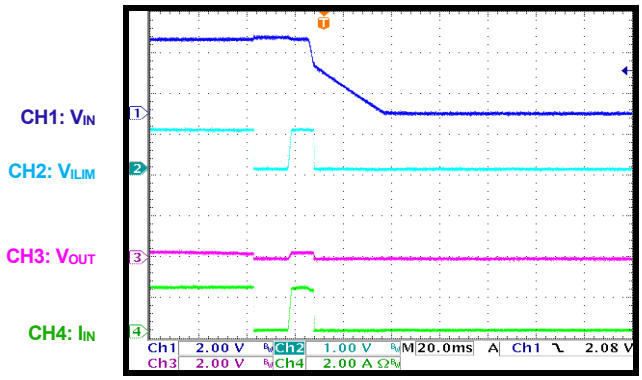
SCP Start-Up

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



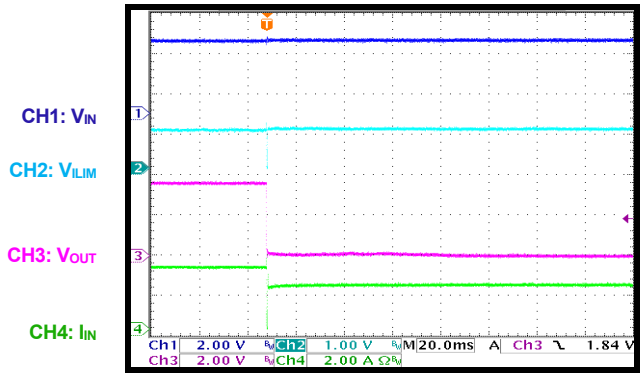
SCP Shutdown

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



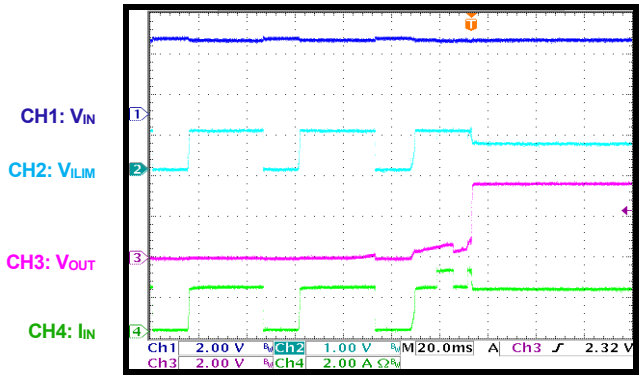
SCP

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



SCP Recovery

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



MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

PCB LAYOUT

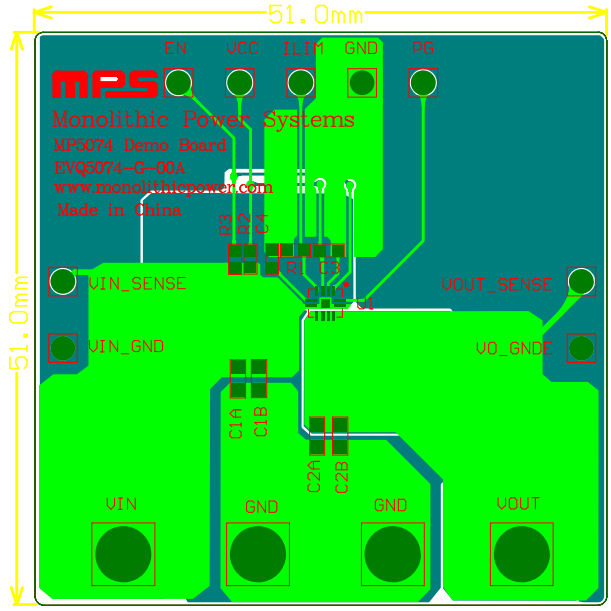


Figure 3: Top Silk

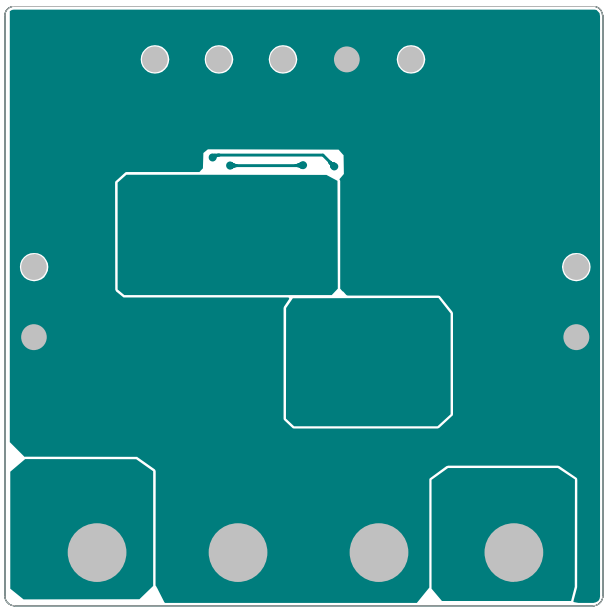


Figure 4: Bottom Layer

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

REVISION HISTORY

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

Notice: The information in this document is subject to change without notice. Please contact MPS for current specifications. Users should warrant and guarantee that third-party Intellectual Property rights are not infringed upon when integrating MPS products into any application. MPS will not assume any legal responsibility for any said applications.

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.