EVQ5077A-G-01A

5.5V, 7A, Configurable-Current, Low-$R_{DS(ON)}$, Load Switch Evaluation Board, AEC-Q100 Qualified

DESCRIPTION

The EVQ5077A-G-01A is an evaluation board designed for the MPQ5077A, a low on resistance ($R_{DS(ON)}$) load switch with current limiting. The MPQ5077A provides 7A of load protection across a 1.2V to 5.5V input voltage (V_{IN}) range. With a very low $R_{DS(ON)}$ in a tiny package, the MPQ5077A provides a space-saving solution for automotive infotainment, clusters, and advanced driver-assistance system (ADAS) applications.

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

The EVQ5077A-G-01A board can deliver a continuous 7A load current across a 1.2V to 5.5V operating V_{IN} range.

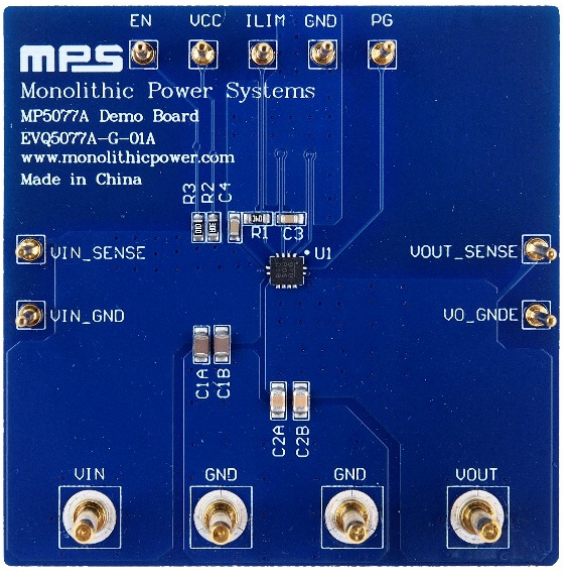
The MPQ5077A is available in a compact QFN-13 (2.5mmx3mm) package, and it is available in AEC-Q100 Grade 1.

PERFORMANCE SUMMARY

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

Parameters	Conditions	Value
Input voltage (V_{IN}) range	V_{IN} = 3V to 5.5V, I_{OUT} = 0A to 7A	3V to 5.5V
Extended V_{IN} range	V_{IN} = 1.2V to 5.5V, I_{OUT} = 0A to 7A, V_{CC} = 3V to 5.5V	1.2V to 5.5V
Output voltage (V_{OUT})	V_{IN} = 1.2V to 5.5V, I_{OUT} = 0A to 7A	1.2V to 5.5V
Maximum output current (I_{OUT})	V_{IN} = 1.2V to 5.5V	7A

EVQ5077A-G-01A EVALUATION BOARD



LxWxH (6.4cmx6.4cmx1.3cm)

Board Number	MPS IC Number
EVQ5077A-G-01A	MPQ5077AGQBE-AEC1

QUICK START GUIDE

1. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
2. Preset the power supply output to be 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 (EN) function, apply a digital input to the EN pin. Drive EN above 2.6V to turn the regulator on; drive EN below 0.4V to turn the regulator 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 V_{IN} is between 3V and 5.5V, one input supply is needed. Figure 1 shows this configuration.
8. If V_{IN} is below 3V, use two input supplies and remove R2. Figure 2 on page 3 shows this configuration.

Note:

1) To select the appropriate values for R1 and C4, refer to the Application Information section of the MPQ5077A's datasheet.

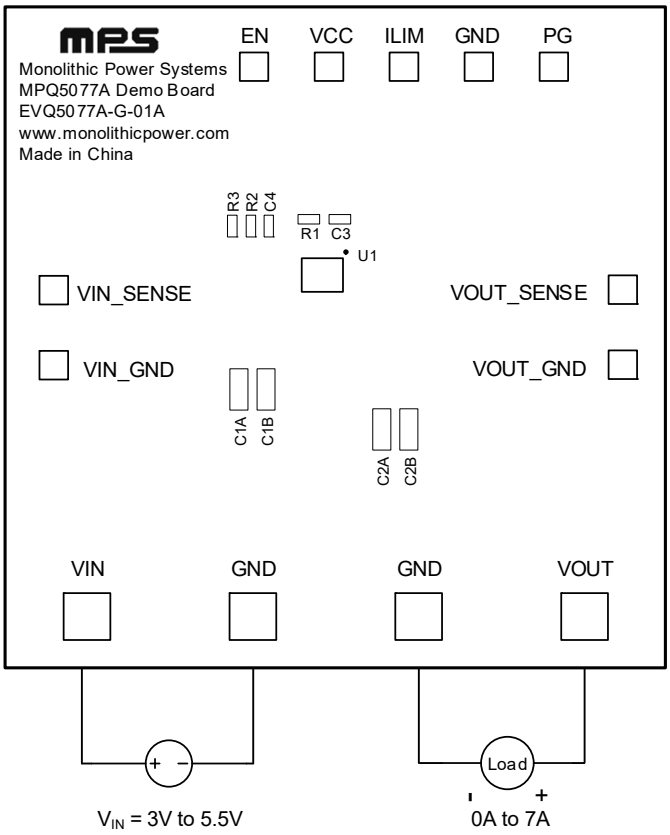


Figure 1: Measurement Equipment Set-Up (V_{IN} = 3V to 5.5V)

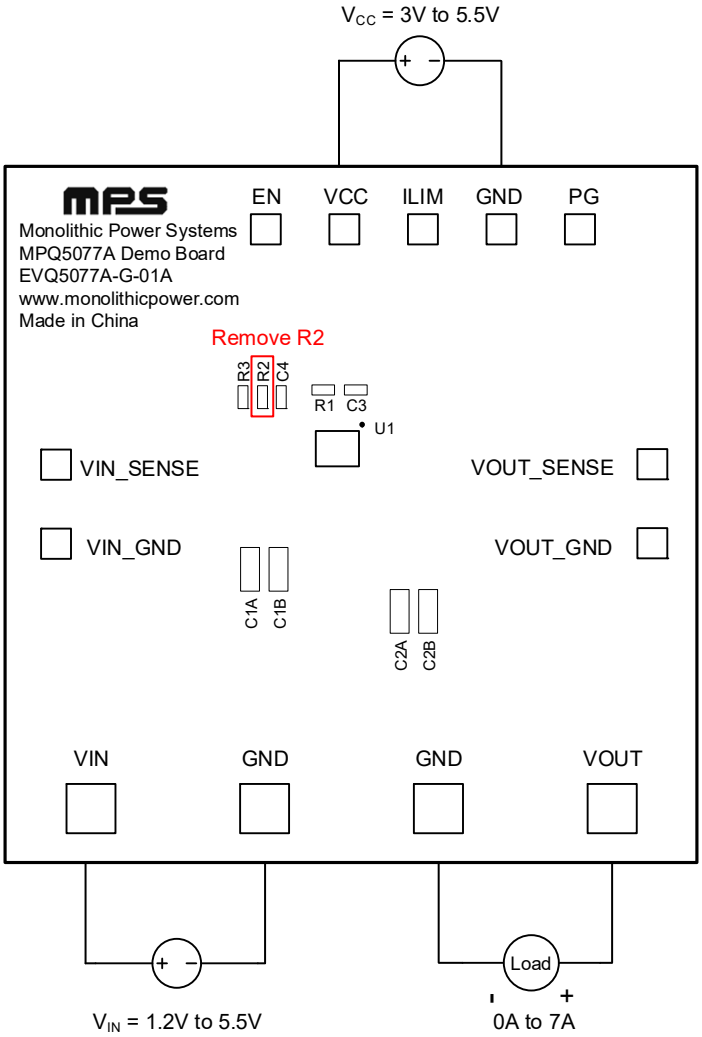


Figure 2: Measurement Equipment Set-Up (V_{IN} = 1.2V to 5.5V)

EVALUATION BOARD SCHEMATIC

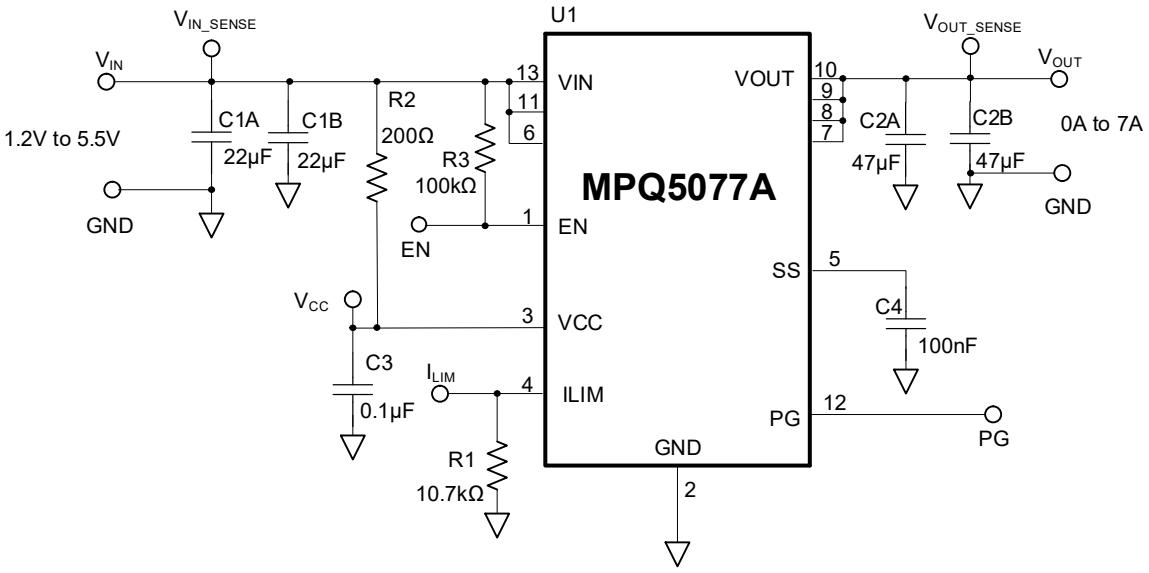


Figure 3: Evaluation Board Schematic

EVQ5077A-G-01A BILL OF MATERIALS

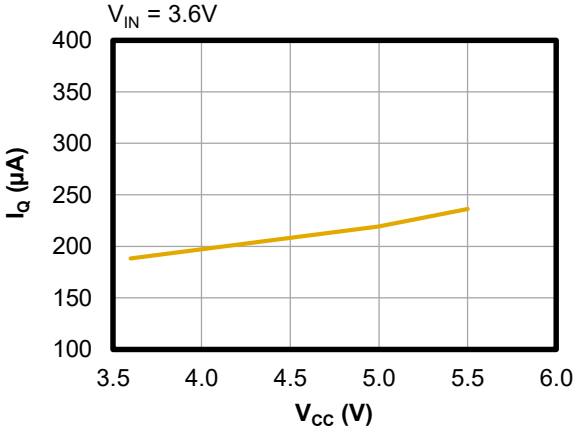
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	C1A, C1B	22µF	Ceramic capacitor,10V, X7R	0805	Murata	GRM21BZ71A226ME15L
2	C2A, C2B	47µF	Ceramic capacitor,10V, X5R	0805	Murata	GRM21BR61A476ME15L
2	C3, C4	100nF	Ceramic capacitor,16V, X7R	0603	Murata	GRM188R71C104KA01D
1	R2	200Ω	Resistor, 1%	0603	Yageo	RC0603FR-07200RL
1	R1	10.7kΩ	Resistor, 1%	0603	Yageo	RC0603FR-0710K7L
1	R3	100kΩ	Resistor, 1%	0603	Yageo	RC0603JR-07100KL
9	PG, EN, VCC, ILIM, GND, VIN_SENSE, VIN_GND, VO_SENSE, VO_GND	1mm	Signal connection	Generic	Any	
4	VIN, GND, GND, VOUT	2mm	Power connection	Generic	Any	
1	U1	MPQ5077A-AEC1	5.5V, 7A current load switch, AEC-Q100 qualified	QFN-13 (2.5mmx 3mm)	MPS	MPQ5077AGQBE-AEC1

EVB TEST RESULTS

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

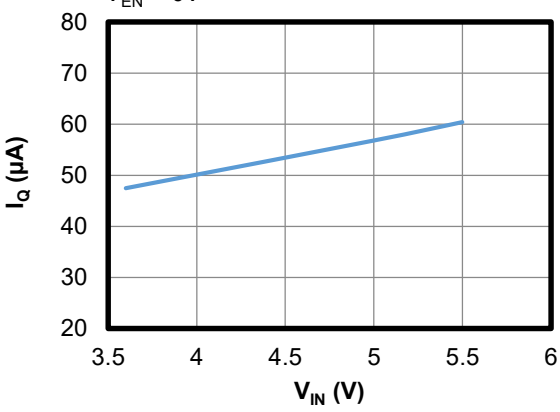
Quiescent Current vs. V_{CC}

V_{IN} = 3.6V

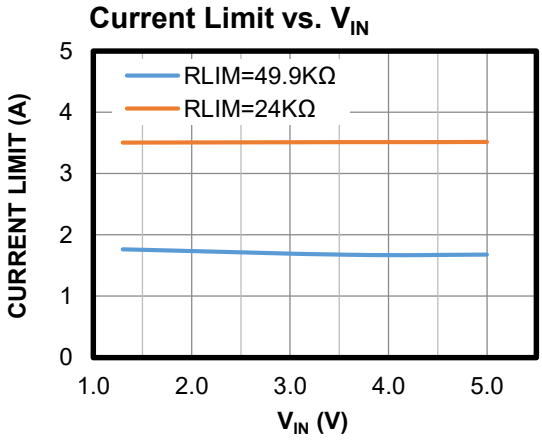


Quiescent Current vs. V_{IN}

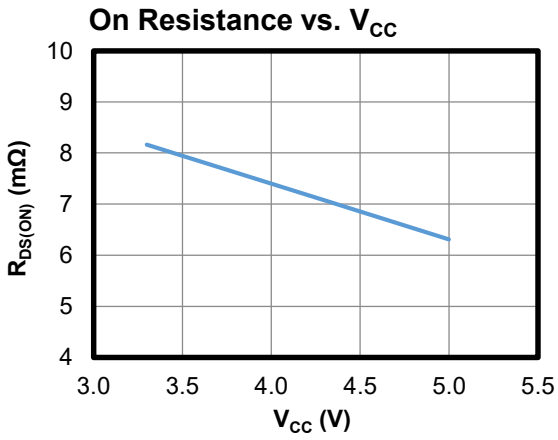
V_{EN} = 0V



Current Limit vs. V_{IN}

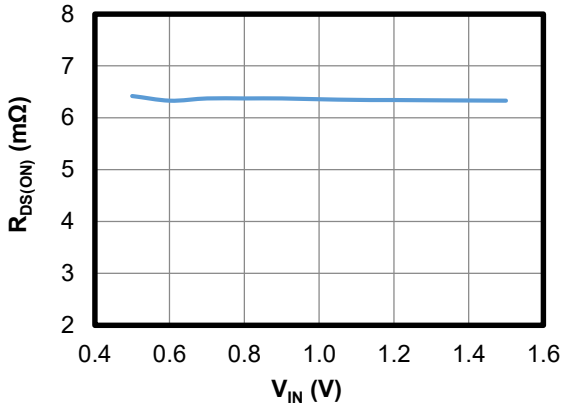


On Resistance vs. V_{CC}



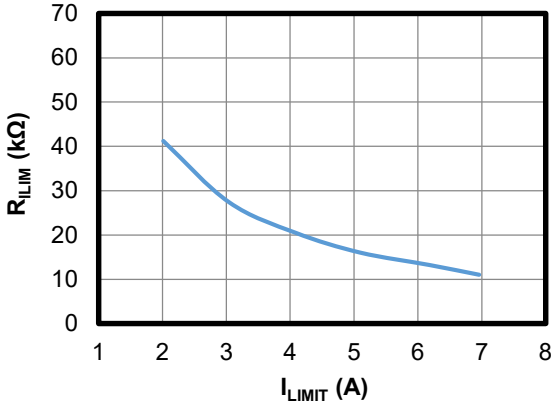
On Resistance vs. V_{IN}

V_{CC} = 3.6V



ILIM Resistance vs. I_{LIMIT}

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

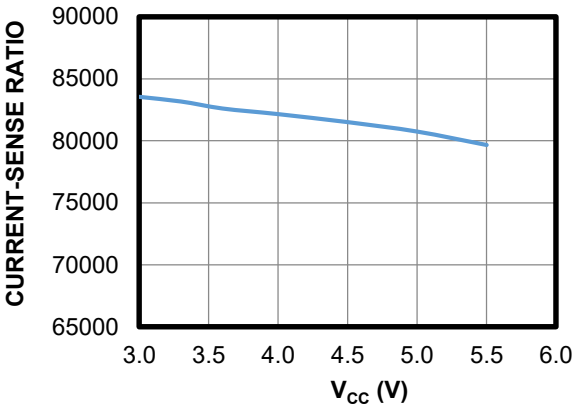


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

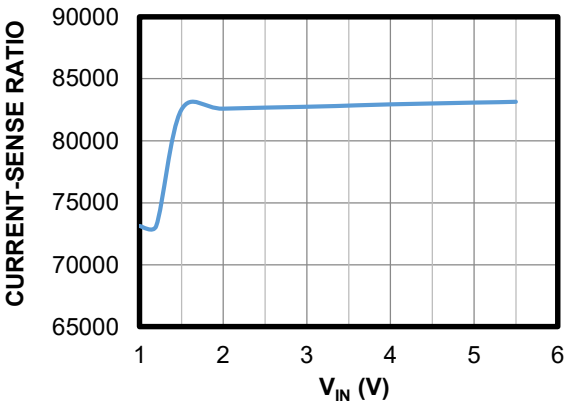
Current-Sense Ratio vs. V_{CC}

V_{IN} = 3.6V, R_{ILIM} = 24.3kΩ



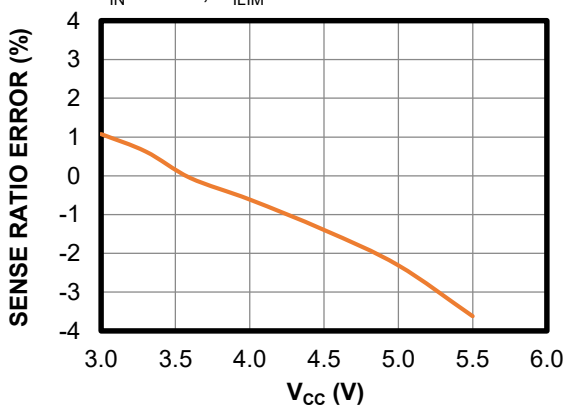
Current-Sense Ratio vs. V_{IN}

V_{IN} = 3.6V, R_{ILIM} = 24.3kΩ



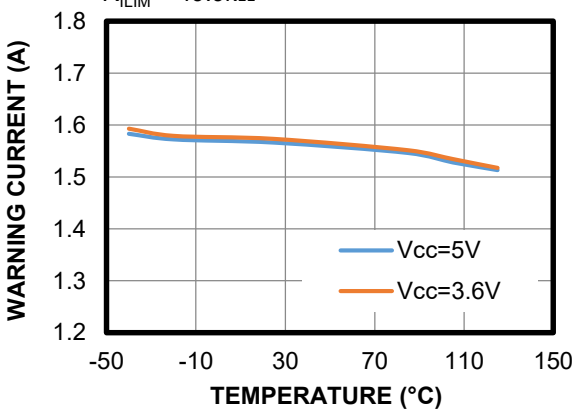
Sense Ratio Error vs. V_{CC}

V_{IN} = 3.6V, R_{ILIM} = 24.3kΩ



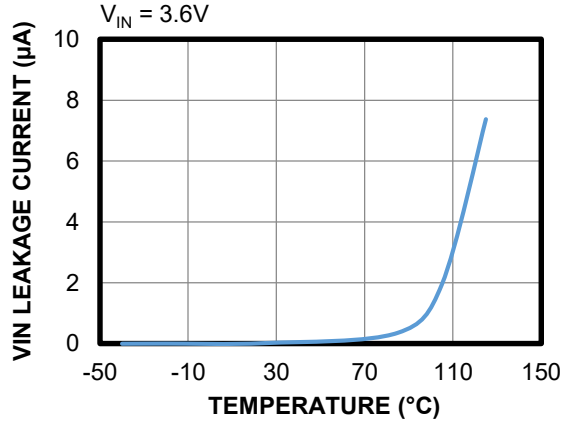
Warning Current vs. Temperature

R_{ILIM} = 49.9kΩ



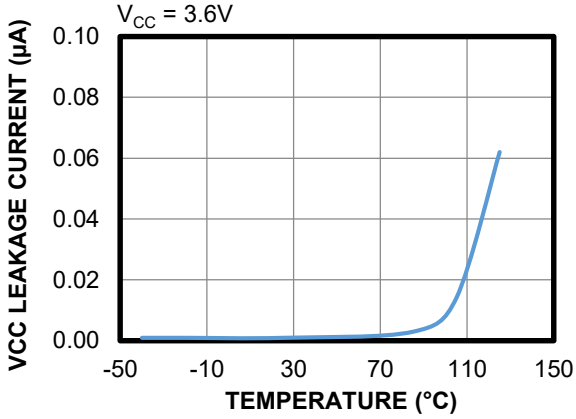
VIN Leakage Current vs. Temperature

V_{IN} = 3.6V



VCC Leakage Current vs. Temperature

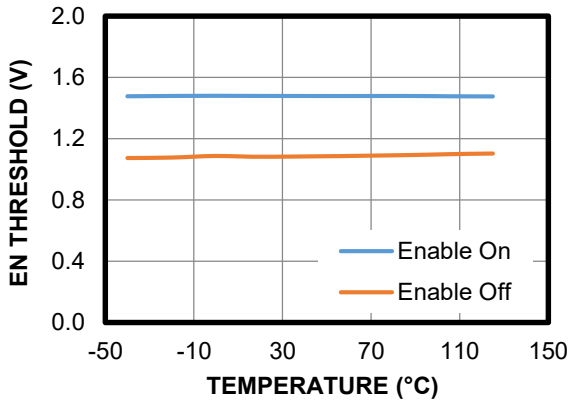
V_{CC} = 3.6V



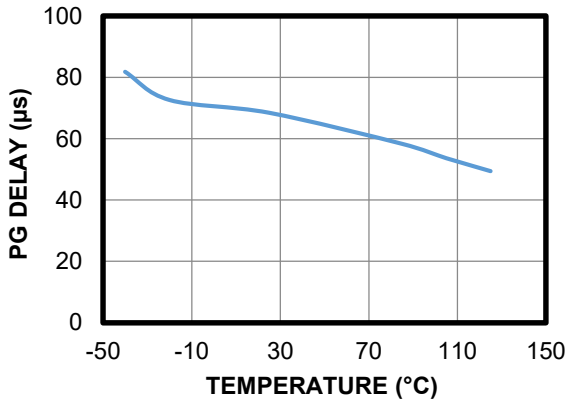
EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

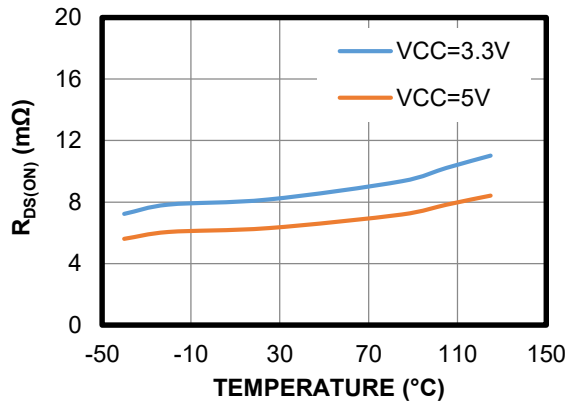
EN Threshold vs. Temperature



PG Delay vs. Temperature

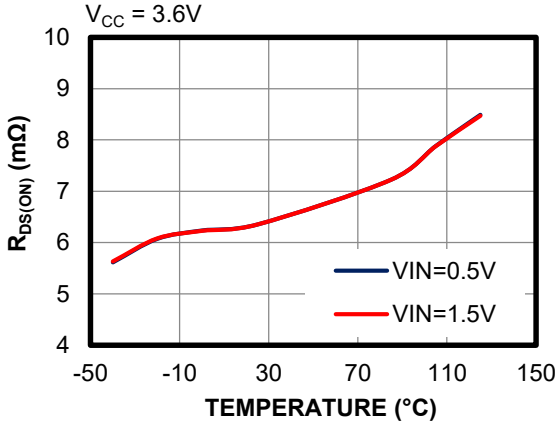


On Resistance vs. Temperature

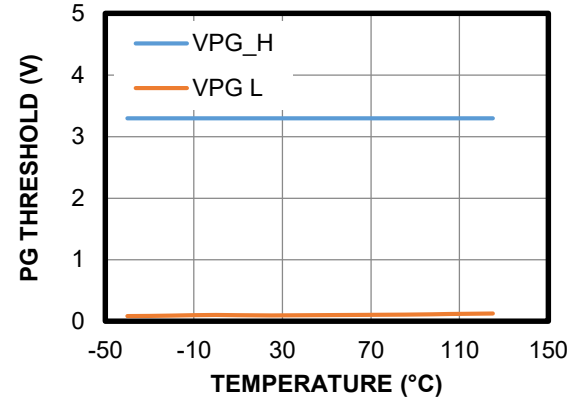


On Resistance vs. Temperature

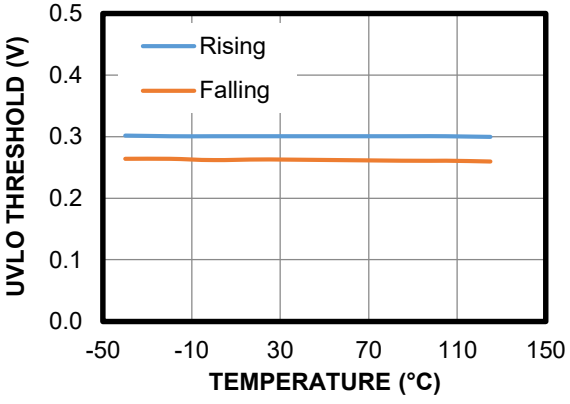
V_{CC} = 3.6V



PG Threshold vs. Temperature



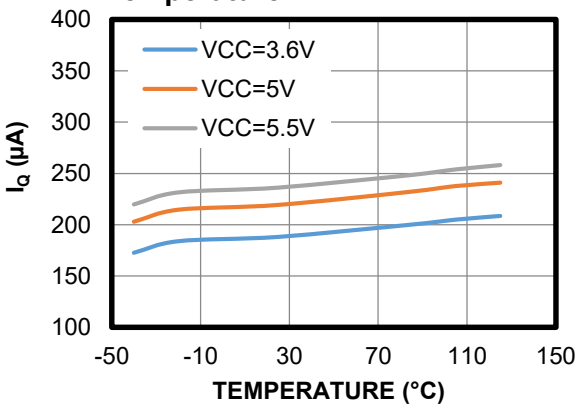
UVLO Threshold vs. Temperature



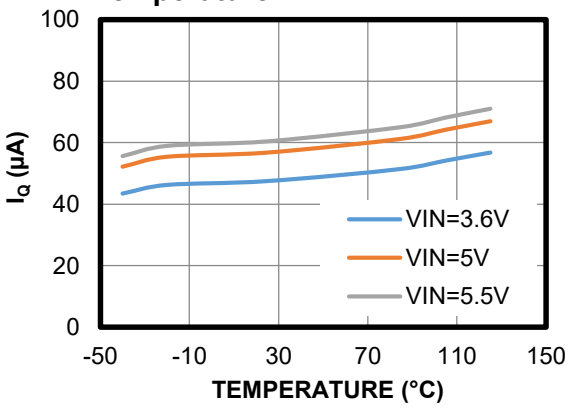
EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

Quiescent Current vs. Temperature



Quiescent Current vs. Temperature

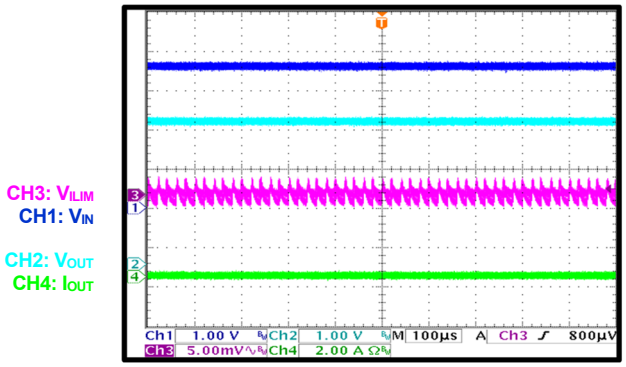


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

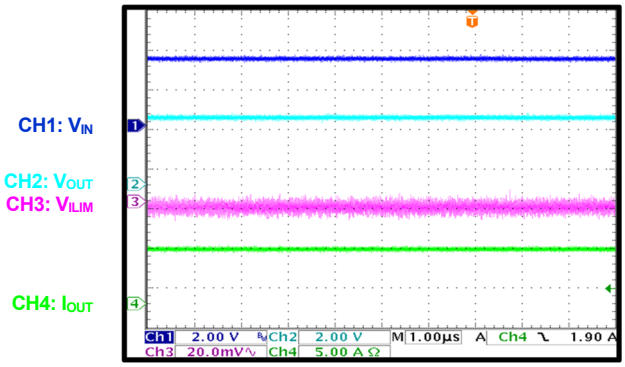
Steady State

V_{IN} = V_{CC} = 3.6V, V_{EN} = 4V, I_{OUT} = 0A



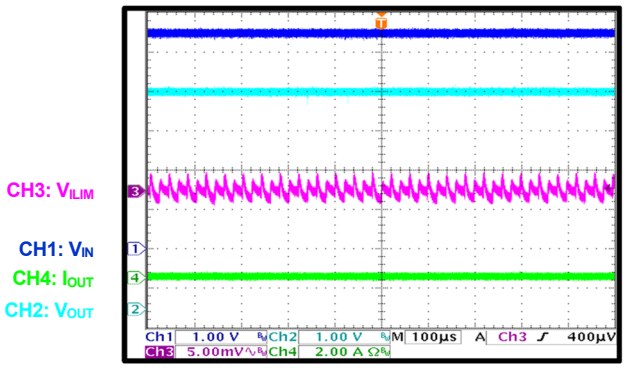
Steady State

V_{IN} = V_{CC} = V_{EN} = 3.6V, I_{OUT} = 7A



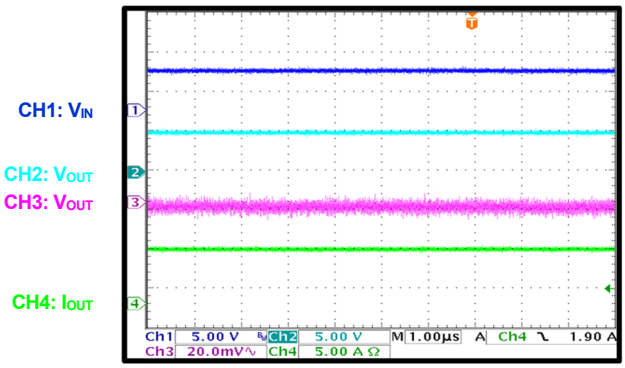
Steady State

V_{IN} = 5.5V, V_{CC} = 3.6V, V_{EN} = 4V, I_{OUT} = 0A



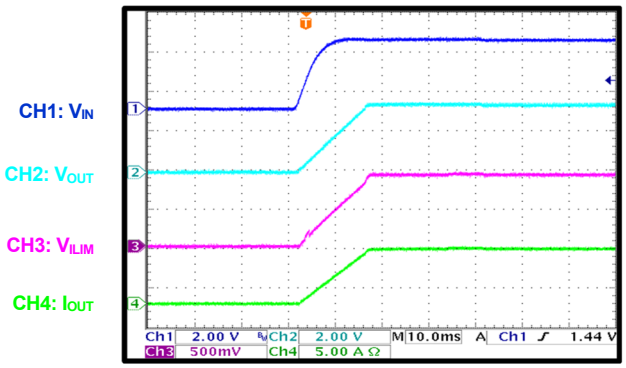
Steady State

V_{IN} = 5.5V, V_{CC} = V_{EN} = 3.6V, I_{OUT} = 7A



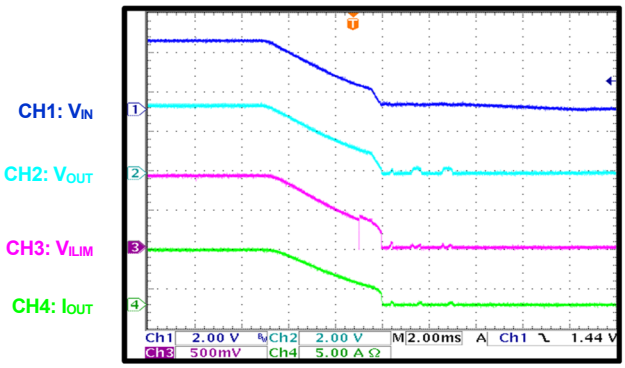
Start-Up

V_{IN} = V_{CC} = V_{EN} = 3.6V, I_{OUT} = 7A



Shutdown

V_{IN} = V_{CC} = V_{EN} = 3.6V, I_{OUT} = 7A

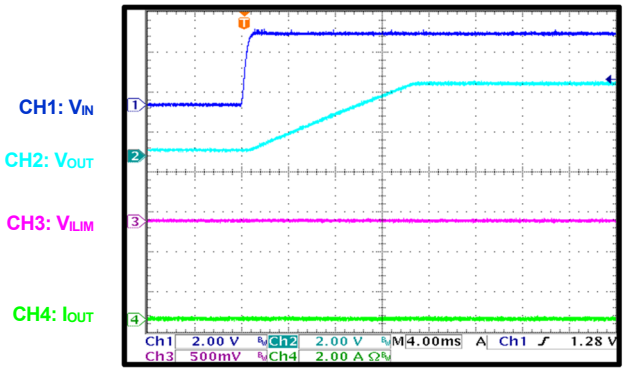


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

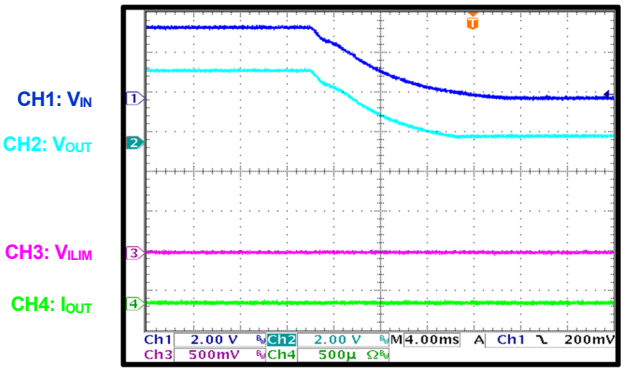
Start-Up

V_{IN} = V_{CC} = 3.6V, V_{EN} = 4V, I_{OUT} = 0A



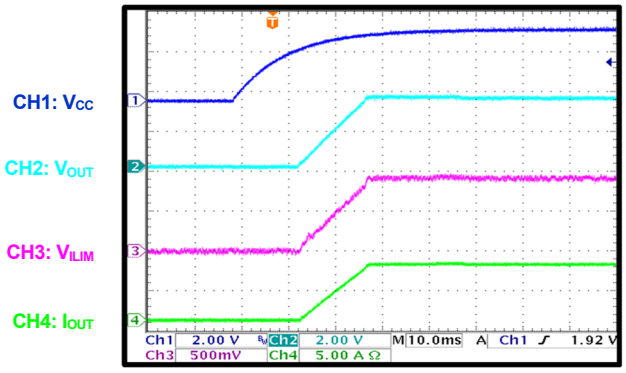
Shutdown

V_{IN} = V_{CC} = 3.6V, V_{EN} = 4V, I_{OUT} = 0A



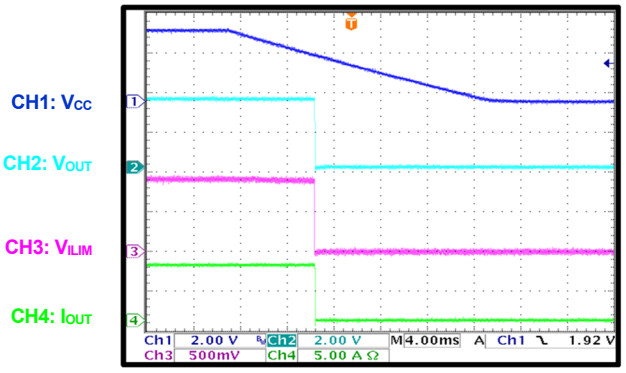
Start-Up through VCC

V_{IN} = V_{EN} = 3.6V, V_{CC} = 3.6V, I_{OUT} = 7A



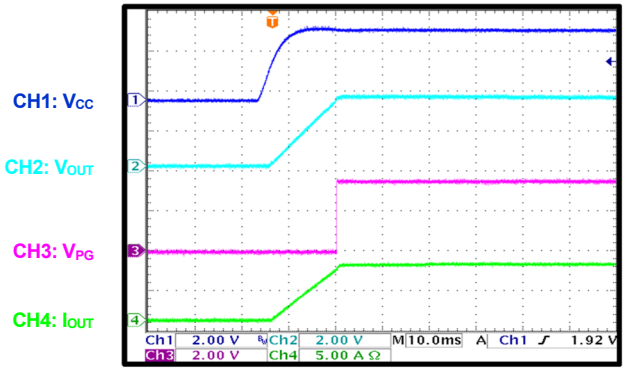
Shutdown through VCC

V_{IN} = V_{EN} = 3.6V, V_{CC} = 3.6V, I_{OUT} = 7A



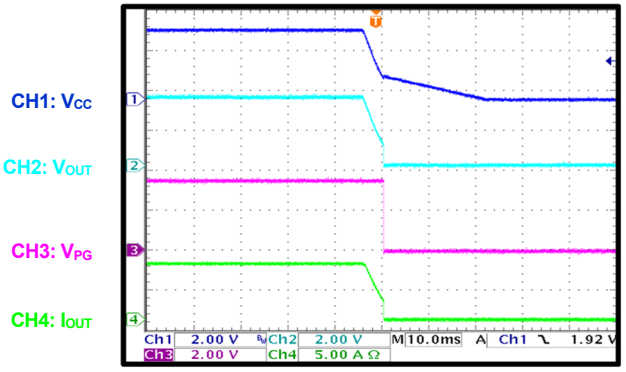
Start-Up through PG

V_{IN} = 3.6V, V_{CC} = V_{EN} = 3.6V, I_{OUT} = 7A



Shutdown through PG

V_{IN} = 3.6V, V_{CC} = V_{EN} = 3.6V, I_{OUT} = 7A

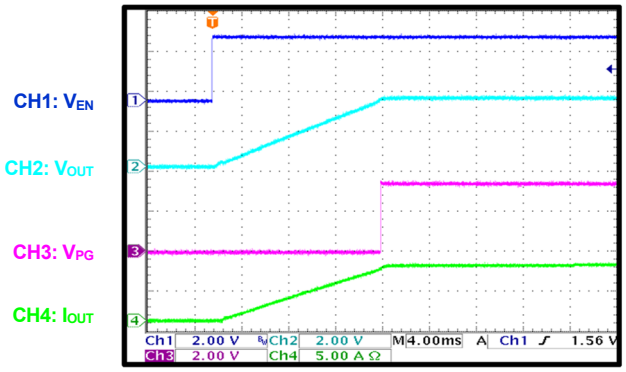


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

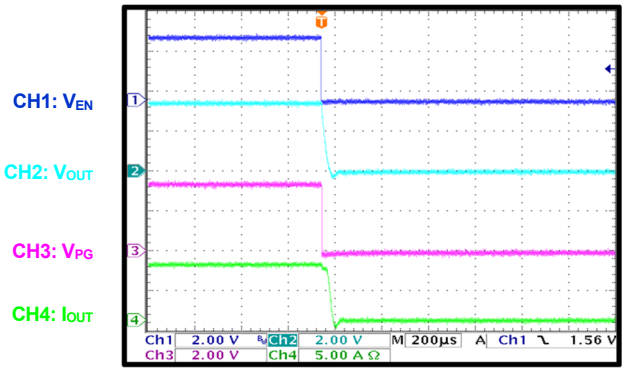
Start-Up through EN

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 7A



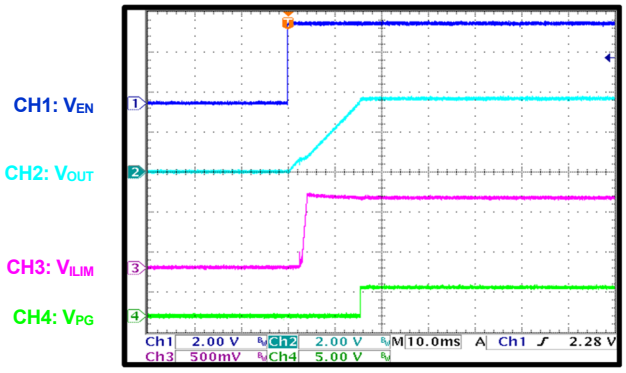
Shutdown through EN

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 7A



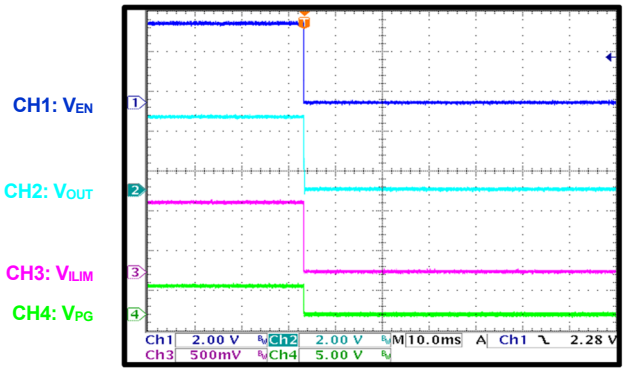
Start-Up through EN with PG

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 5A



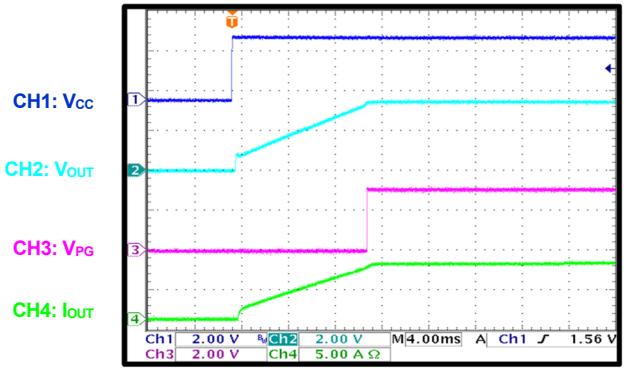
Shutdown through EN with PG

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 5A



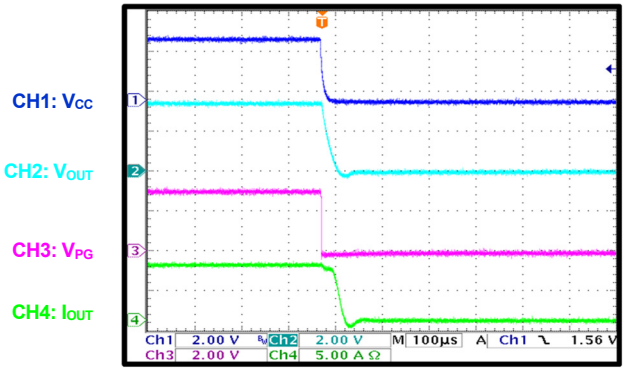
Start-Up through VCC with PG

V_{IN} = V_{EN} = 3.6V, V_{CC} = 3.6V, I_{OUT} = 7A



Shutdown through VCC with PG

V_{IN} = V_{EN} = 3.6V, V_{CC} = 3.6V, I_{OUT} = 7A

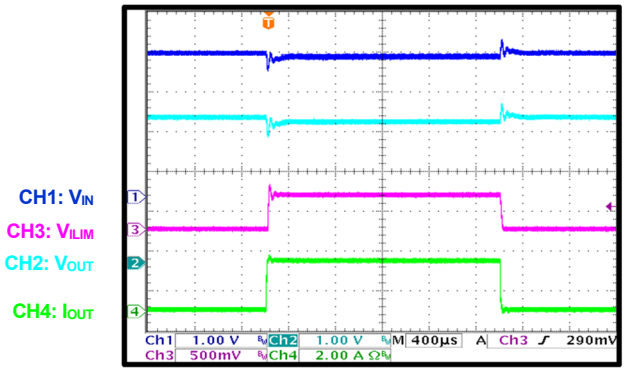


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

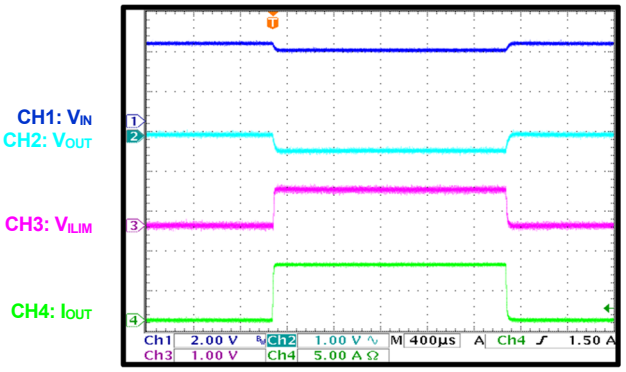
Load Transient Response

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



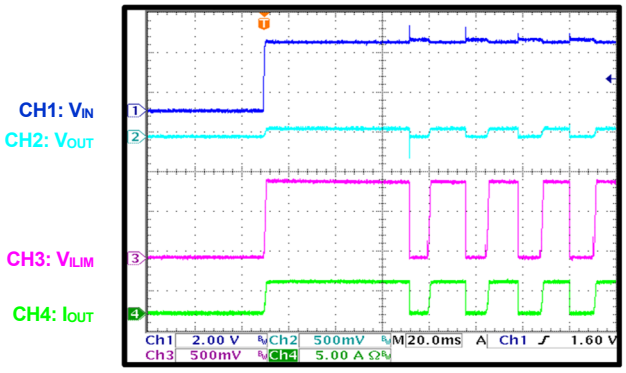
Load Transient Response

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 0A to 7A



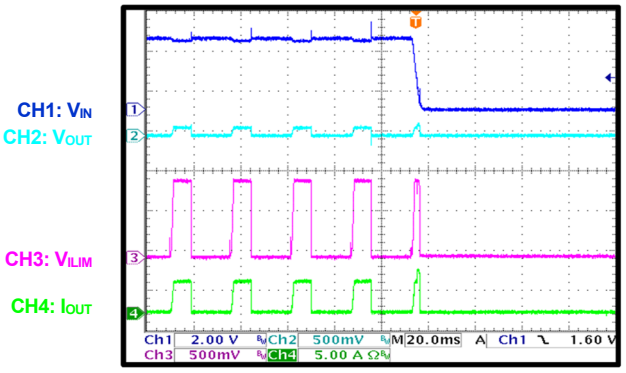
SCP Start-Up

V_{IN} = V_{CC} = 3.6V, V_{EN} = 4V



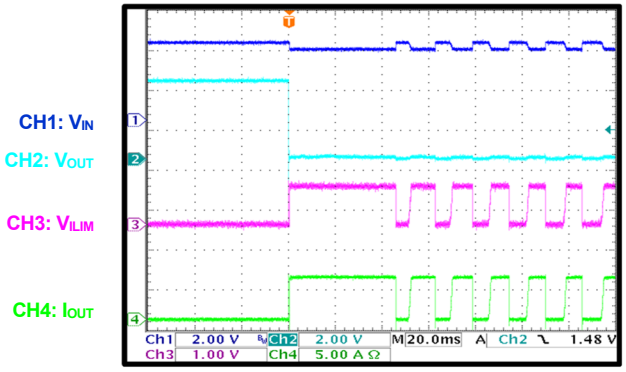
SCP Shutdown

V_{IN} = V_{CC} = 3.6V, V_{EN} = 4V



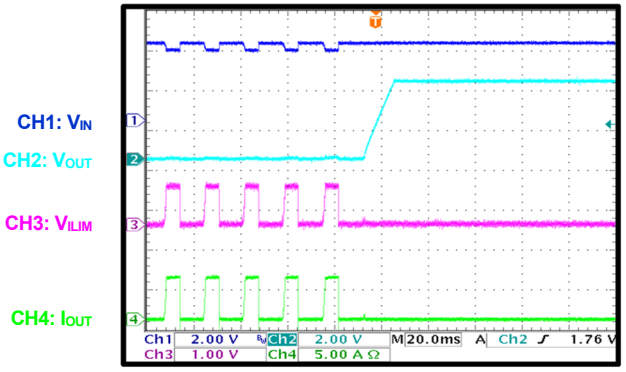
SCP

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



SCP Recovery

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

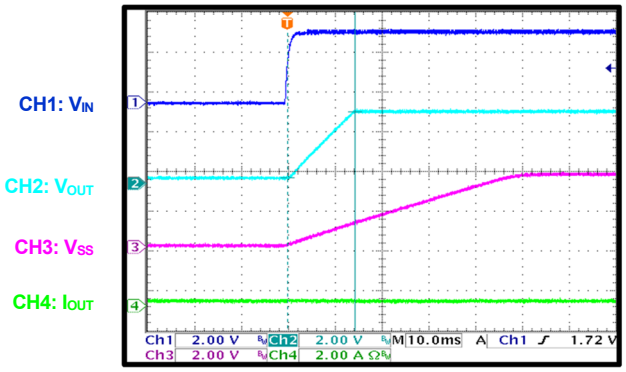


EVB TEST RESULTS *(continued)*

V_{IN} = 3.6V, V_{CC} = 3.6V, V_{EN} = 2.5V, R_{LIMIT} = 10.7kΩ, I_{OUT} = 7A, T_A = 25°C, unless otherwise noted.

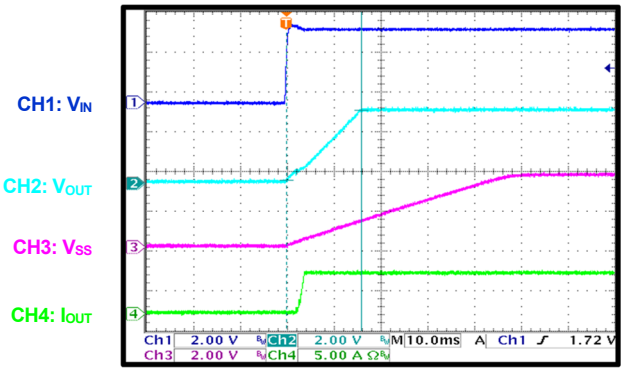
Soft Start

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 5mA



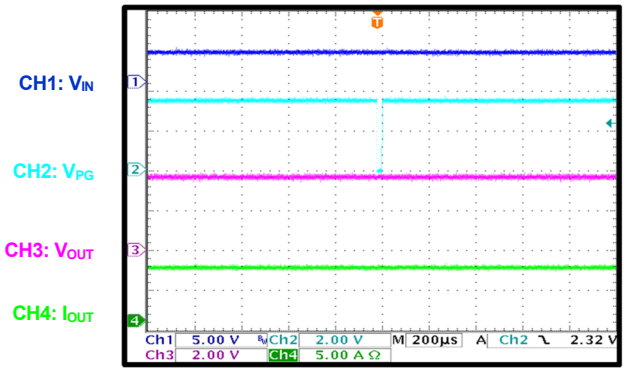
Soft Start

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 5A



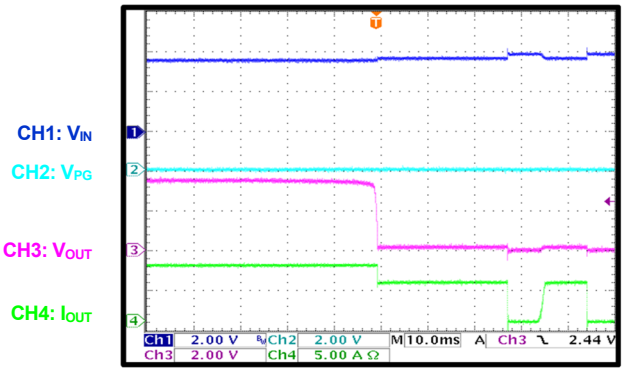
Current Limit Warning

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 6.7A



Current Limit

V_{IN} = V_{CC} = 3.6V, I_{OUT} = 7.1A



PCB LAYOUT

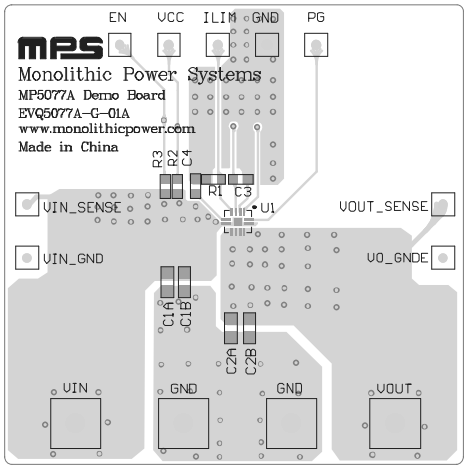


Figure 4: Top Silk

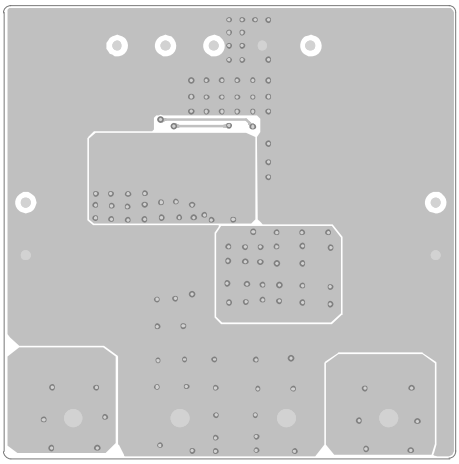


Figure 5: Bottom Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	9/6/2024	Initial Release	-