EVQ5850-J-00A

36V, Smart Diode Controller with Reverse Protection Evaluation Board, AEC-Q100 Qualified

DESCRIPTION

The EVQ5850-J-00A is an evaluation board designed to demonstrate the capabilities of the MPQ5850, a 36V, smart diode controller with reverse protection.

The MPQ5850 is a smart diode controller that can drive an external N-channel MOSFET to replace a Schottky diode for reverse input protection. The device's 20mV ultra-low dropout minimizes power loss and enables a low minimum input voltage (V_{IN}), which makes the MPQ5850 well-suited for cold-crank conditions in automotive applications. The 4µA shutdown current also makes the device ideal for battery-powered applications. The ultra-fast transient response meets stringent ISO16750 requirements.

The MPQ5850 integrates an internal boost to provide a boost voltage that turns on the external N-channel MOSFET, even at low input voltages. An open-drain, power good (PG) signal indicates when the external N-channel MOSFET is fully on.

The EVQ5850-J-00A is fully assembled and tested. The MPQ5850 is available in a TSOT23-8 (2mmx3mm) package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	3.3 to 36	V
Output current	I_{OUT}	5	A

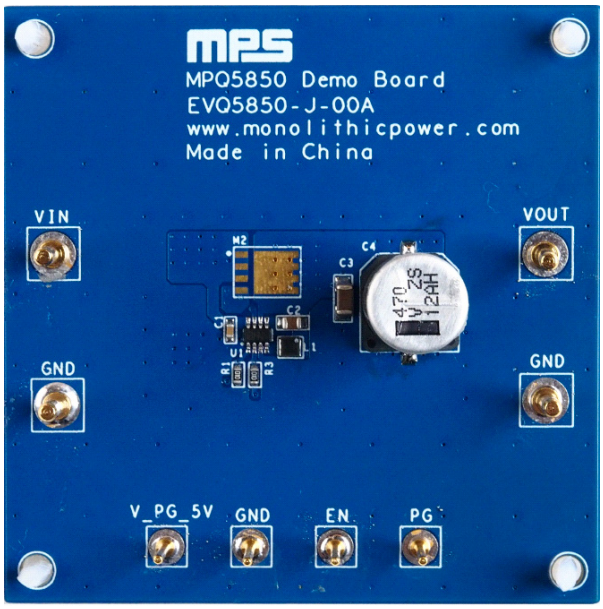
FEATURES

- **Built to Handle Tough Automotive Transients:**
  - -36V Blocking Voltage
  - Load Dump Up to 42V
  - Cold Crank Down to 3V
  - Rectifies AC Frequency Up to 100kHz
  - Strong Gate Drive Ability: 170mA Pull-Up and 430mA Pull-Down
- **Extended Vehicle Battery Life:**
  - Low Quiescent Current in Standby Mode (4µA)
  - Low Quiescent Current in Steady State (30µA)
- **Reduced Board Size:**
  - Available in a TSOT23-8 (2mmx3mm) Package
- **Additional Features:**
  - 20mV Ultra-Low Dropout
  - Integrates a Boost Converter
  - Power Good (PG) Indication for RES Out of Regulation, Fast Pull-Up, and Part Disabling
  - Available in AEC-Q100 Grade 1

APPLICATIONS

- Automotive System Protection
- Automotive ADAS Systems (Cameras)
- Automotive Infotainment Systems, Including Digital Clusters and Head Units
- Battery-Powered Systems

EVQ5850-J-00A EVALUATION BOARD

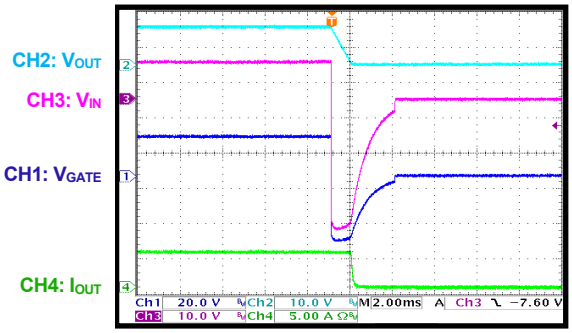


LxWxH (6.35cmx6.35cmx1.8cm)

Board Number	MPS IC Number
EVQ5850-J-00A	MPQ5850GJ-AEC1

Negative Pulse

I_{OUT} = 5A



QUICK START GUIDE

1. Preset the power supply between 3.3V and 36V, then turn off the power supply. Electronic loads represent a negative impedance to the regulator, so set the load current between 0A and 5A.
2. Connect the power supply terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
3. Connect the load terminals to:
   a. Positive (+): VOUT
   b. Negative (-): GND
4. After making the connections, turn on the power supply.
5. To use the enable function, apply a digital input to the EN pin. Drive EN above 1.2V to turn the regulator on; drive EN below 1V to turn it off . If the enable function is not being used, connect EN directly to VIN.
6. To use the PG function, add a 5V external supply to V_PG_5V to drive the PG signal.

EVALUATION BOARD SCHEMATIC

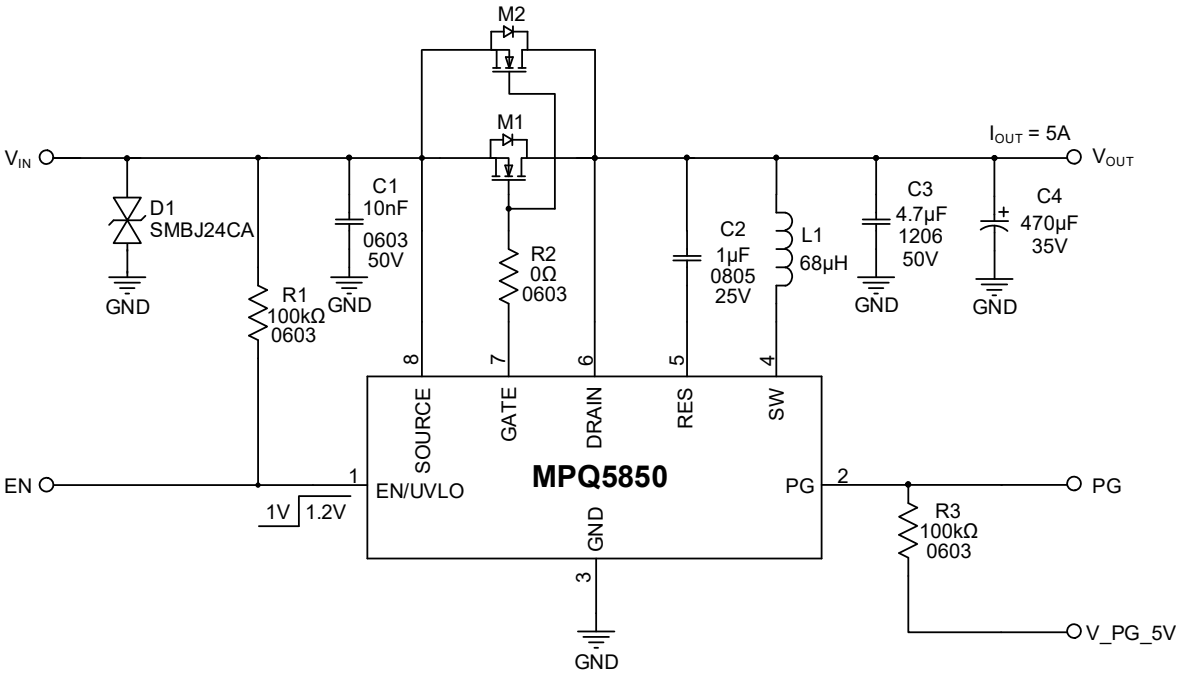


Figure 1: Evaluation Board Schematic

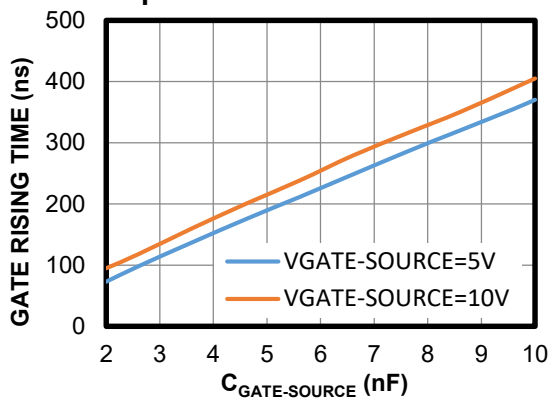
EVQ5850-J-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
4	PG, EN, GND, V_PG_5V	1mm male	Connector	DIP	Any	
1	C1	10nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H103KA01D
1	C2	1μF	Ceramic capacitor, 25V, X7R	0805	Murata	GCM21BR71E105KA56L
1	C3	4.7μF	Ceramic capacitor, 50V, X7R	1206	Murata	GRM31CR71H475KA12L
1	C4	470μF	Electrolytic capacitor, 35V	SMD	Panasonic	EEHZS1V471P
1	D1	24V	TVS diode	DO-214AA-2	Vishay	SMBJ24CA-E3/52
4	VOUT, VIN, GND, GND	2mm male	Connector	DIP	Any	
1	L1	68μH	Inductor, DCR = 6.14Ω, I_{SAT} = 0.2A	SMD	Coilcraft	XPL2010-683MLB
1	M1	60V	N-channel MOSFET, 4.8mΩ, 83A	TO-252	Analog Power	AM90N06-04D-T1-PF
0	M2	NC				
2	R1, R3	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R2	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	U1	MPQ5850	Smart diode controller, 36V	TSOT23-8 (2mmx 3mm)	MPS	MPQ5850GJ-AEC1

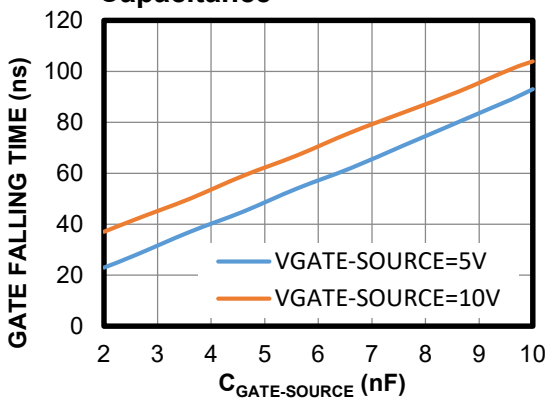
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

Gate Rising Time vs. Gate Capacitance



Gate Falling Time vs. Gate Capacitance

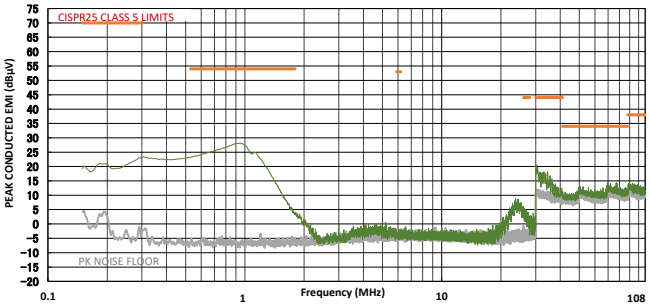


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

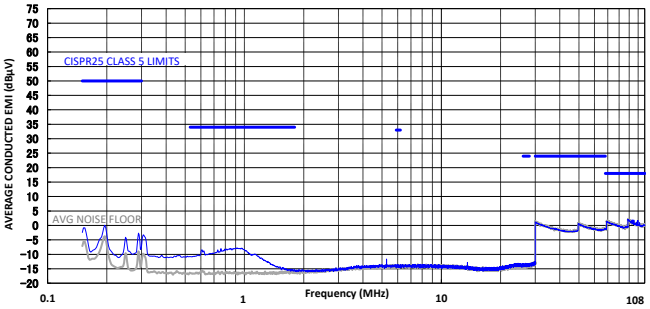
CISPR25 Class 5 Peak Conducted Emissions

150kHz to 108MHz



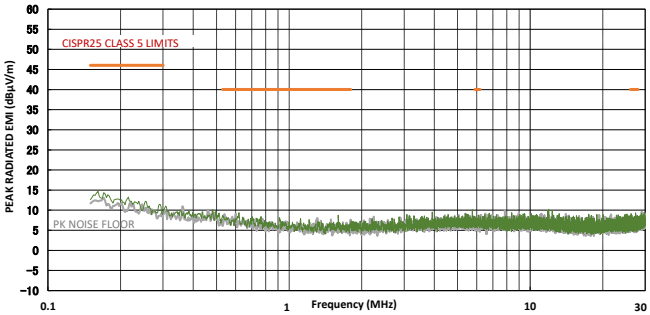
CISPR25 Class 5 Average Conducted Emissions

150kHz to 108MHz



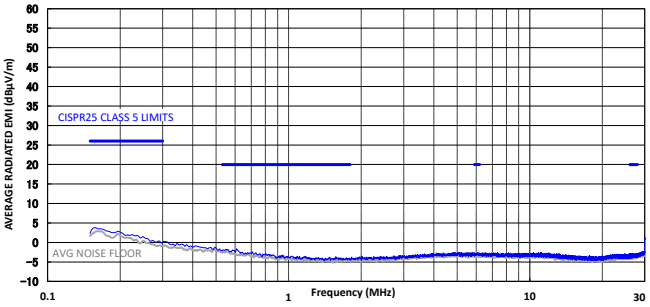
CISPR25 Class 5 Peak Radiated Emissions

150kHz to 30MHz



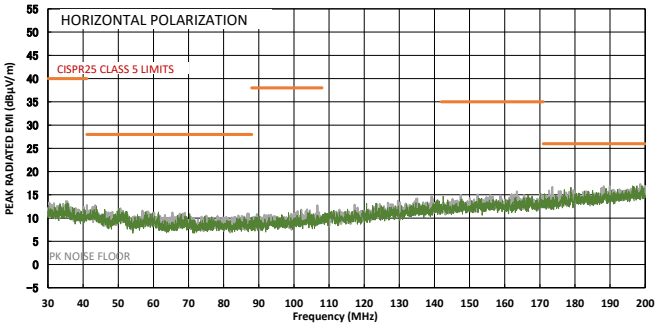
CISPR25 Class 5 Average Radiated Emissions

150kHz to 30MHz



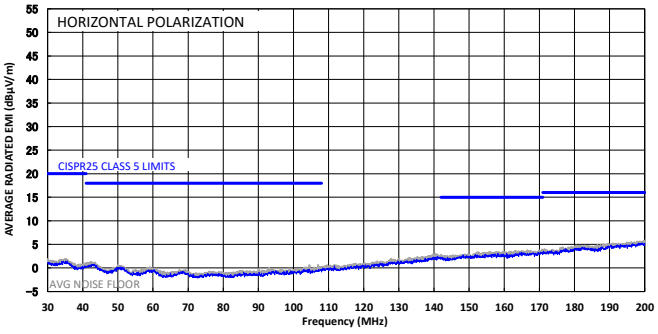
CISPR25 Class 5 Peak Radiated Emissions

Horizontal, 30MHz to 200MHz



CISPR25 Class 5 Average Radiated Emissions

Horizontal, 30MHz to 200MHz

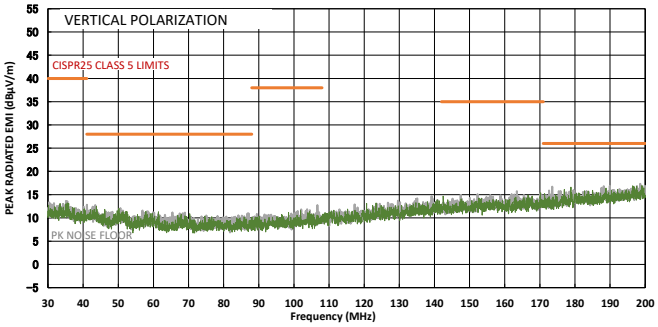


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

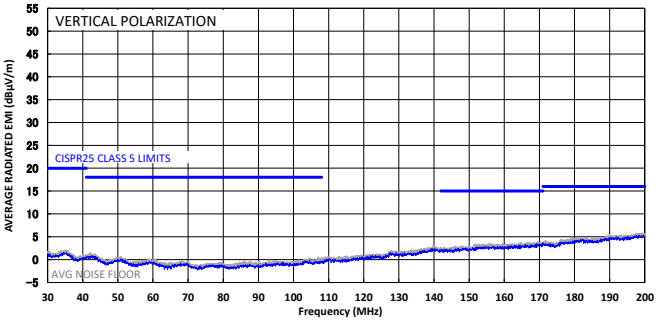
CISPR25 Class 5 Peak Radiated Emissions

Vertical, 30MHz to 200MHz



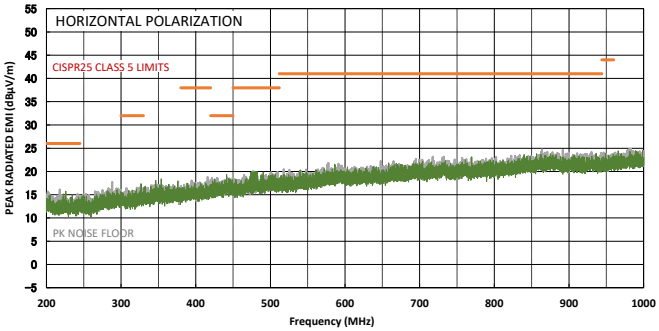
CISPR25 Class 5 Average Radiated Emissions

Vertical, 30MHz to 200MHz



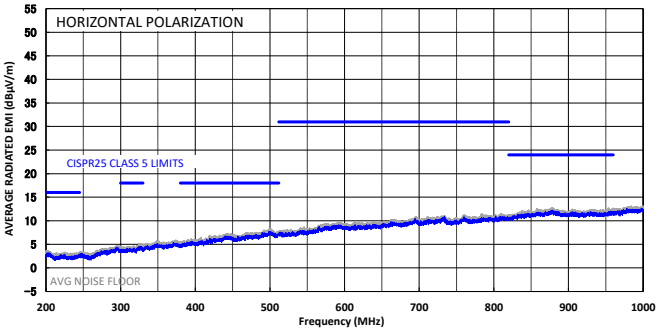
CISPR25 Class 5 Peak Radiated Emissions

Horizontal, 200MHz to 1GHz



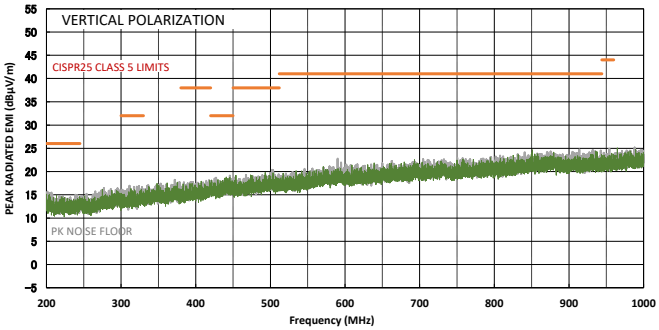
CISPR25 Class 5 Average Radiated Emissions

Horizontal, 200MHz to 1GHz



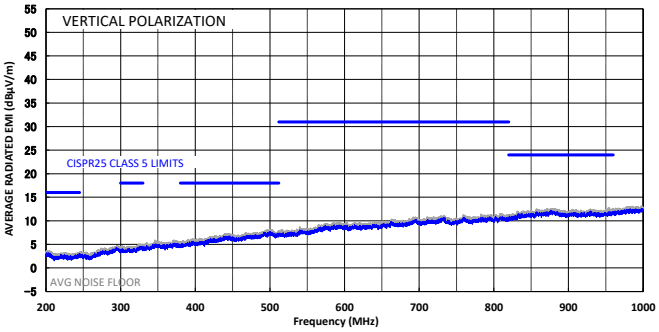
CISPR25 Class 5 Peak Radiated Emissions

Vertical, 200MHz to 1GHz



CISPR25 Class 5 Average Radiated Emissions

Vertical, 200MHz to 1GHz

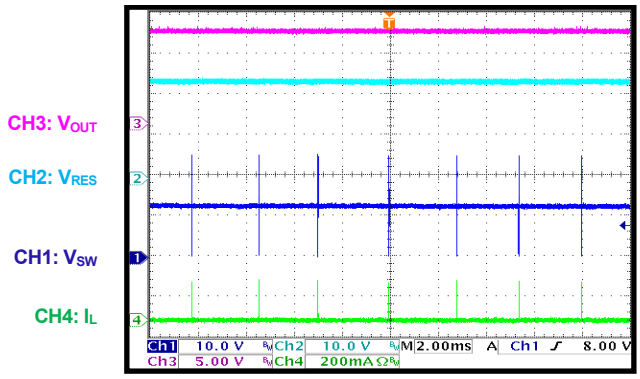


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

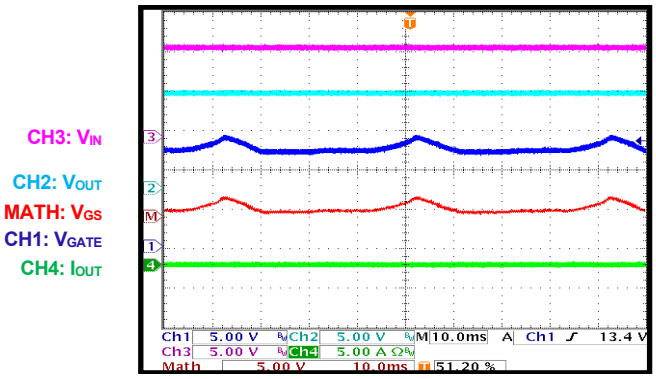
Steady State (for Internal Boost)

I_{OUT} = 0A



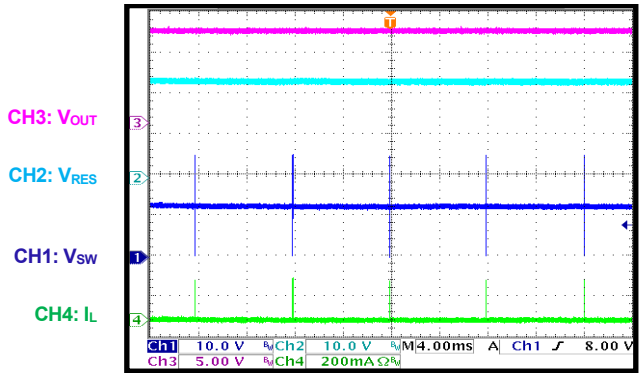
Steady State (for Smart Diode)

I_{OUT} = 0A



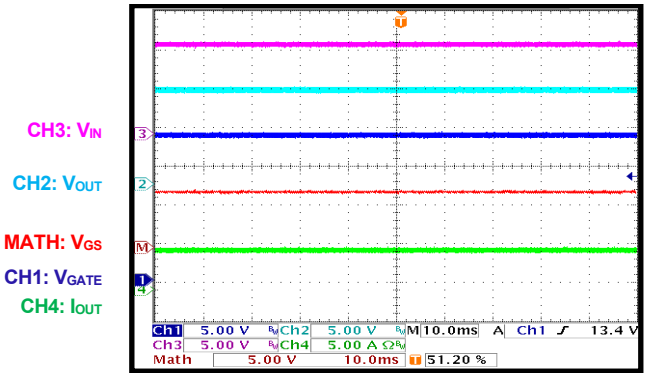
Steady State (for Internal Boost)

I_{OUT} = 5A



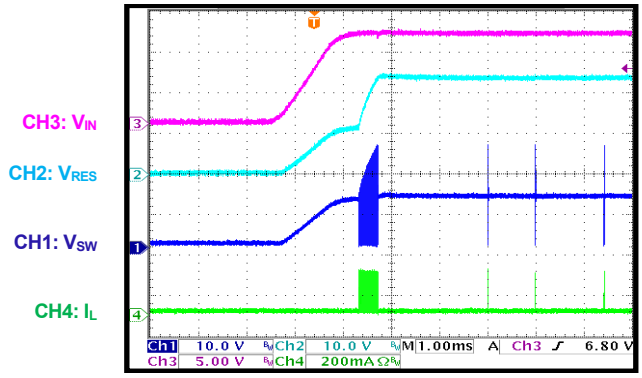
Steady State (for Smart Diode)

I_{OUT} = 5A



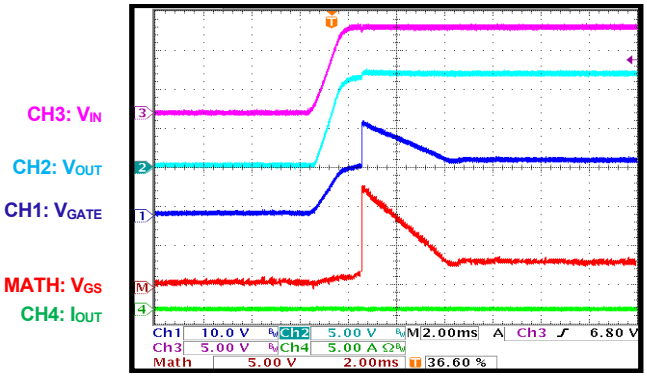
Start-Up through VIN (for Internal Boost)

I_{OUT} = 0A



Start-Up through VIN (for Smart Diode)

I_{OUT} = 0A

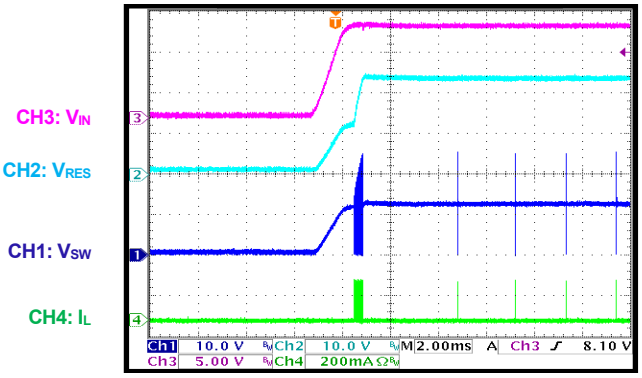


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

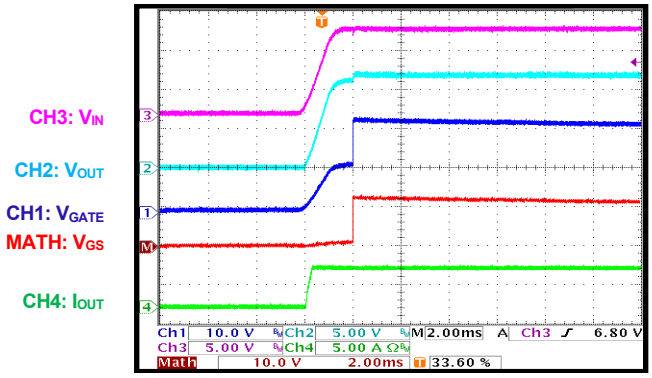
Start-Up through VIN (for Internal Boost)

I_{OUT} = 5A



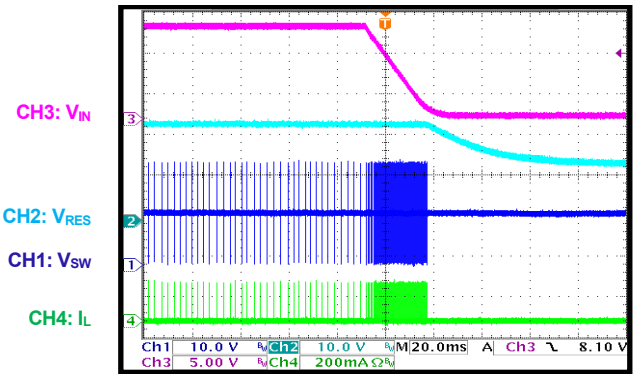
Start-Up through VIN (for Smart Diode)

I_{OUT} = 5A



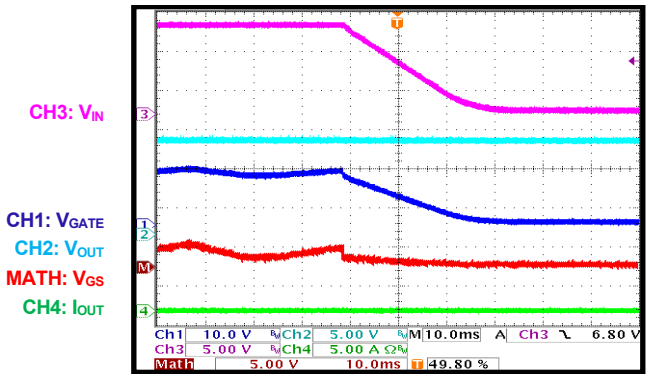
Shutdown through VIN (for Internal Boost)

I_{OUT} = 0A



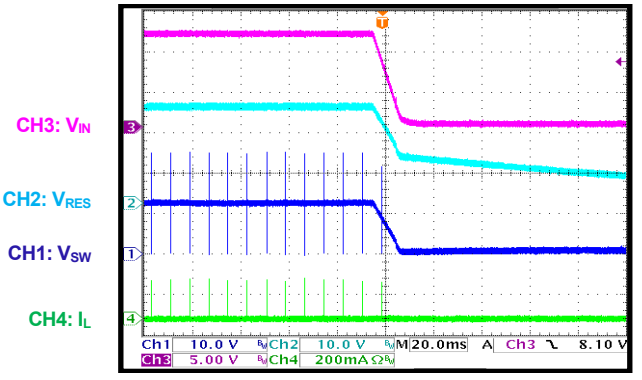
Shutdown through VIN (for Smart Diode)

I_{OUT} = 0A



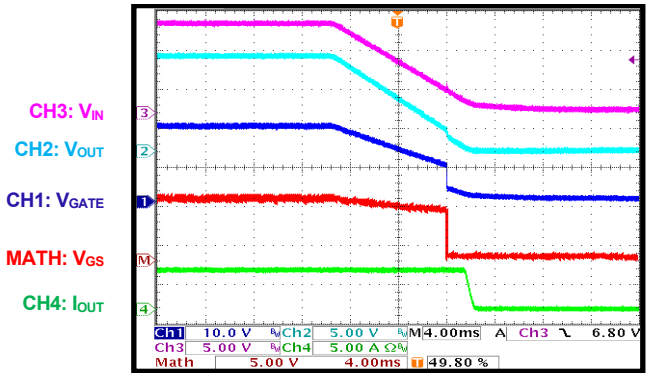
Shutdown through VIN (for Internal Boost)

I_{OUT} = 5A



Shutdown through VIN (for Smart Diode)

I_{OUT} = 5A

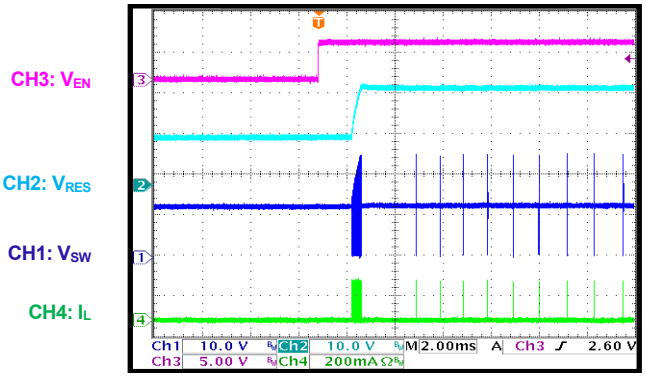


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

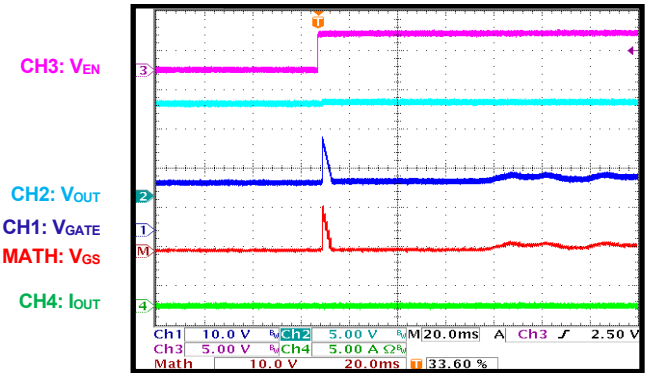
Start-Up through EN (for Internal Boost)

I_{OUT} = 0A



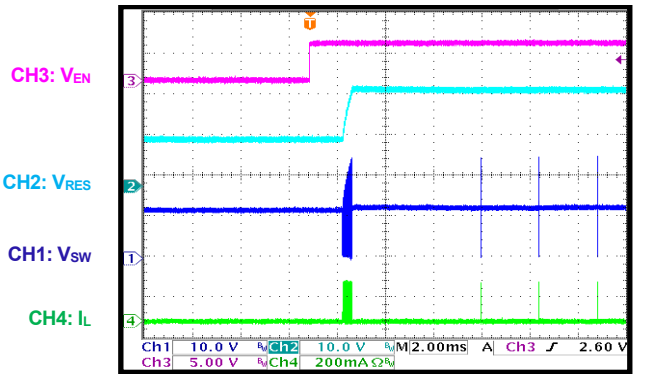
Start-Up through EN (for Smart Diode)

I_{OUT} = 0A



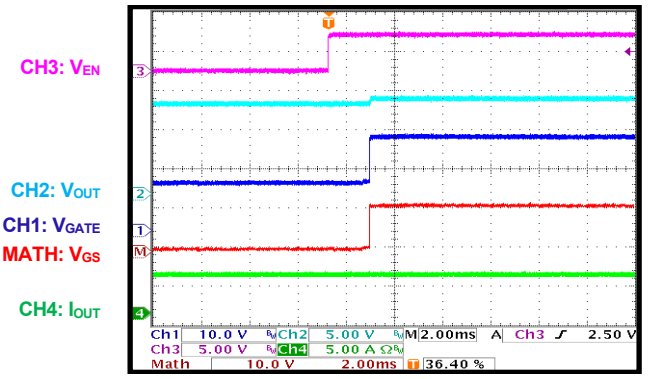
Start-Up through EN (for Internal Boost)

I_{OUT} = 5A



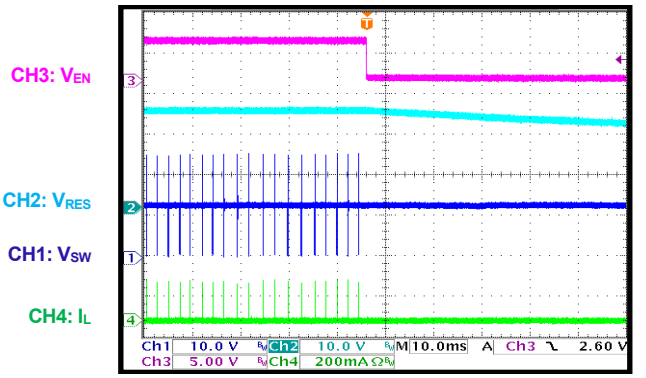
Start-Up through EN (for Smart Diode)

I_{OUT} = 5A



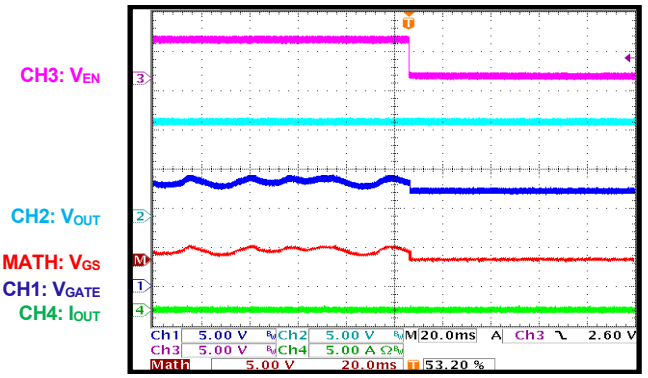
Shutdown through EN (for Internal Boost)

I_{OUT} = 0A



Shutdown through EN (for Smart Diode)

I_{OUT} = 0A

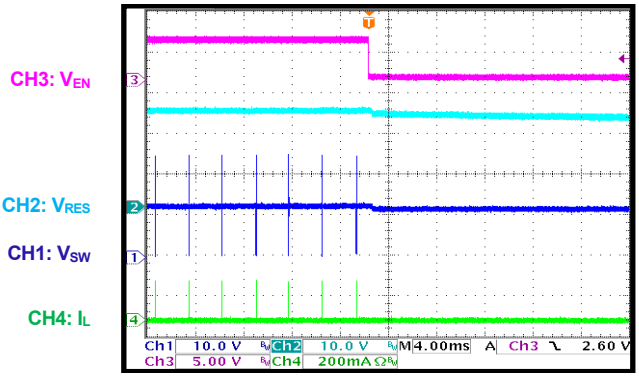


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

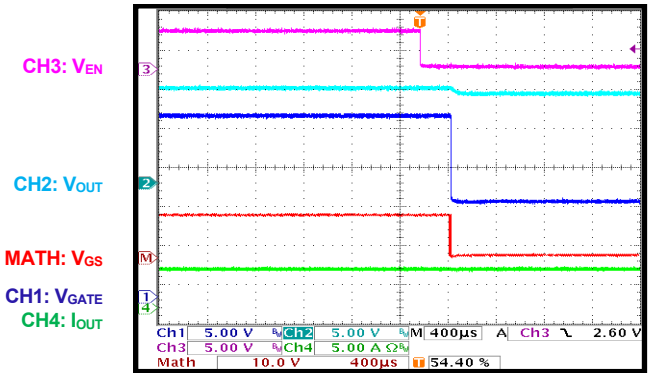
Shutdown through EN (for Internal Boost)

I_{OUT} = 5A



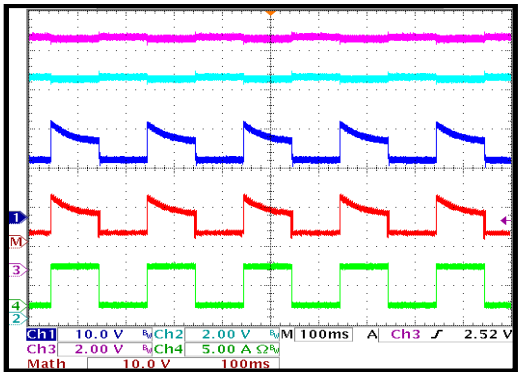
Shutdown through EN (for Smart Diode)

I_{OUT} = 5A



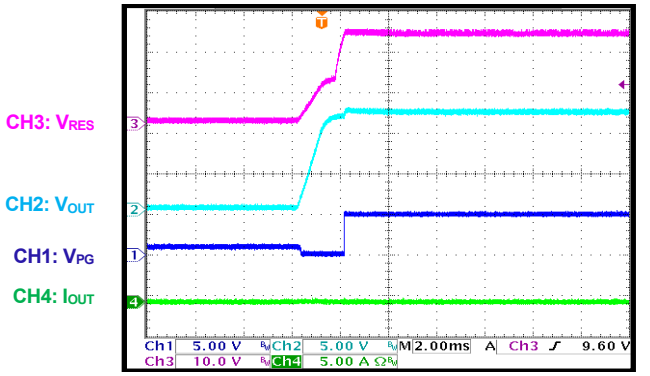
Load Transient

I_{OUT} = 0A to 5A, 6A/µs



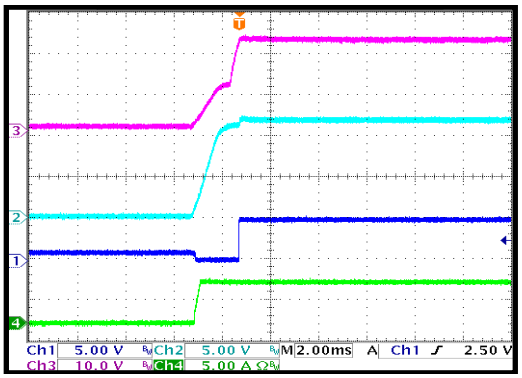
PG in Start-Up Through VIN

I_{OUT} = 0A



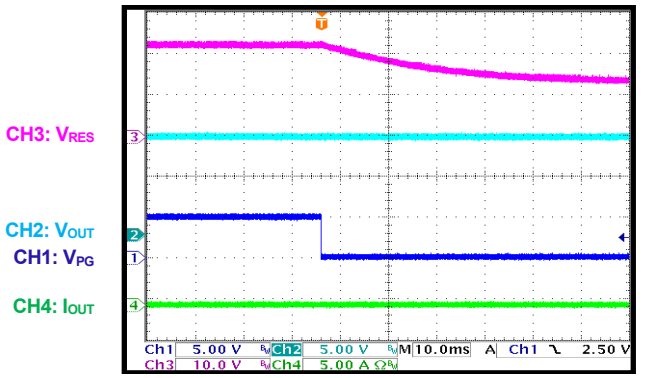
PG in Start-Up through VIN

I_{OUT} = 5A



PG in Shutdown through VIN

I_{OUT} = 0A

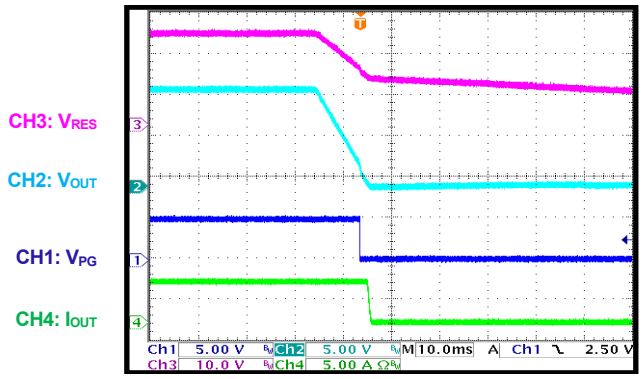


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

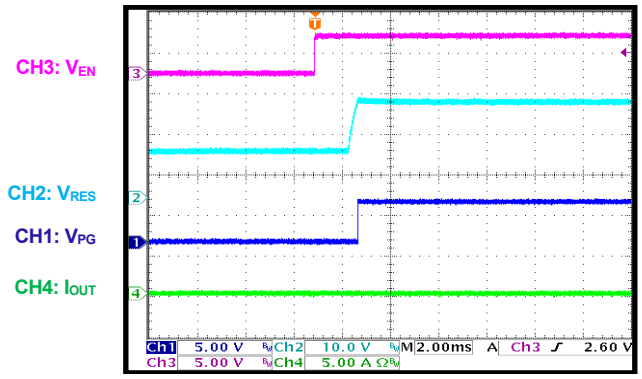
PG in Shutdown through VIN

I_{OUT} = 5A



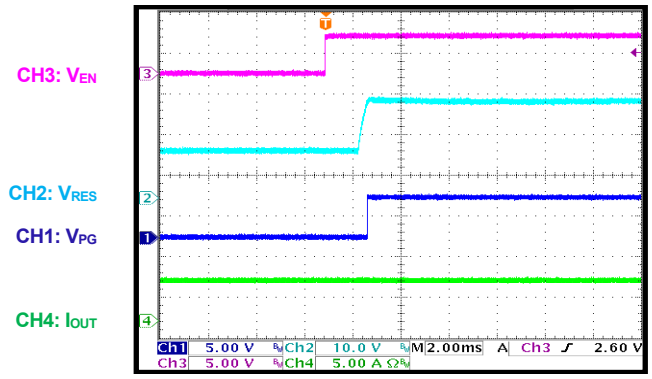
PG in Start-Up through EN

I_{OUT} = 0A



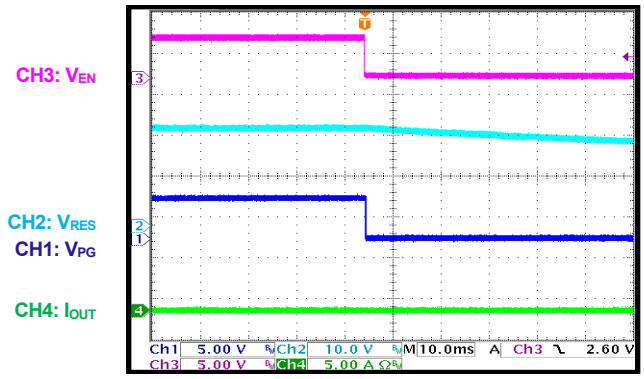
PG in Start-Up through EN

I_{OUT} = 5A



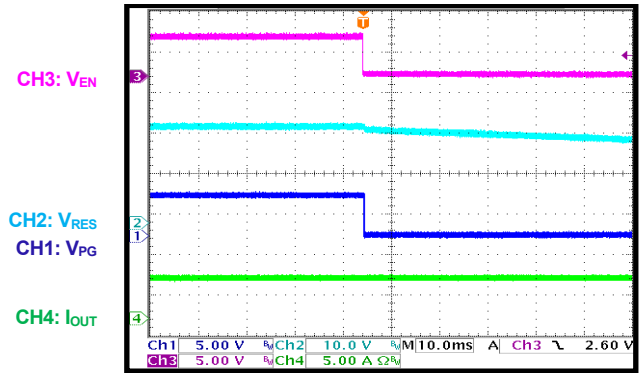
PG in Shutdown through EN

I_{OUT} = 0A



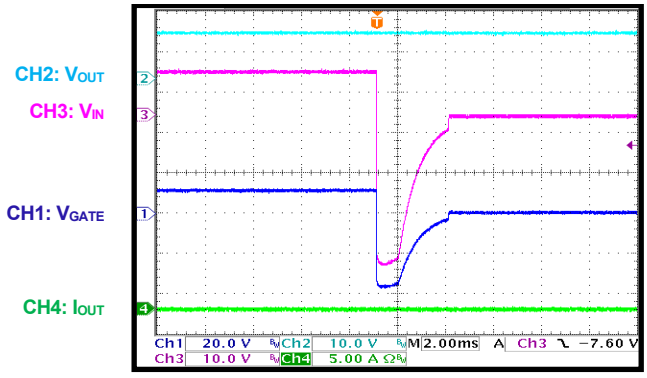
PG in Shutdown through EN

I_{OUT} = 5A



Negative Pulse

I_{OUT} = 0A

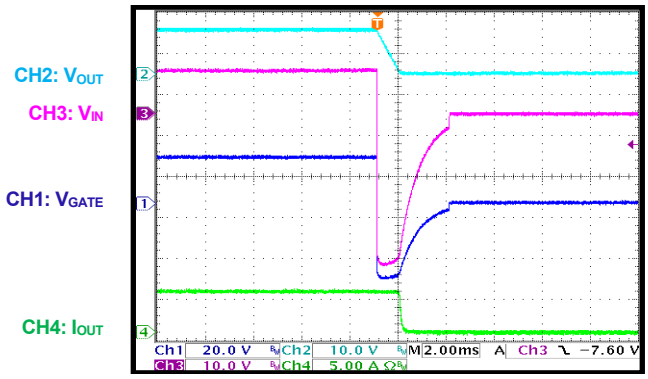


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

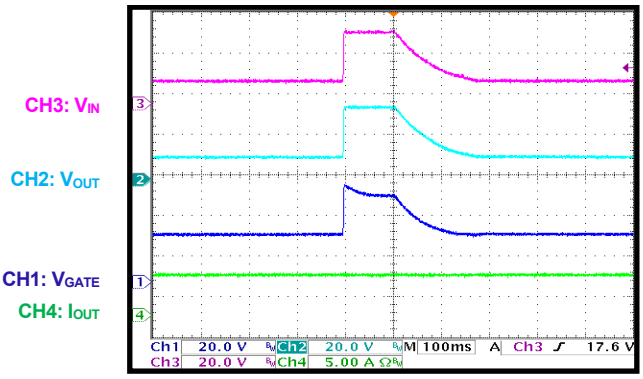
Negative Pulse

I_{OUT} = 5A



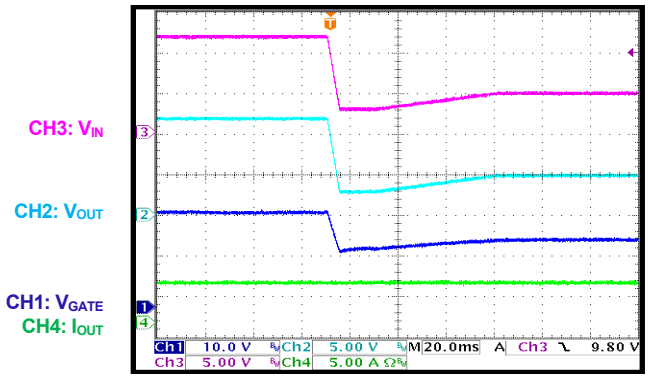
Load Dump

I_{OUT} = 5A



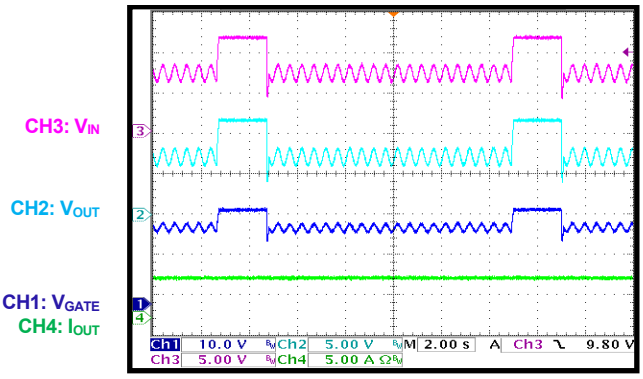
Cold Crank

I_{OUT} = 5A



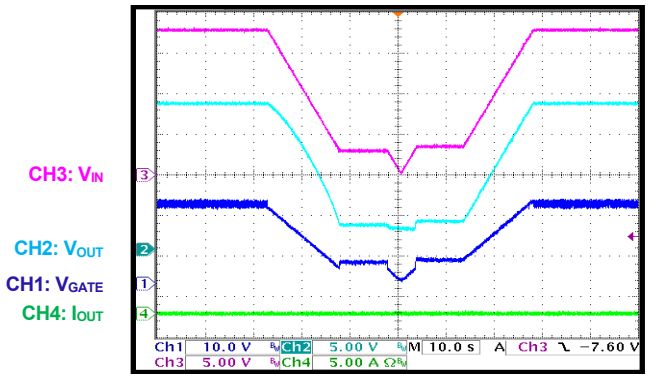
Start Pulses

I_{OUT} = 5A



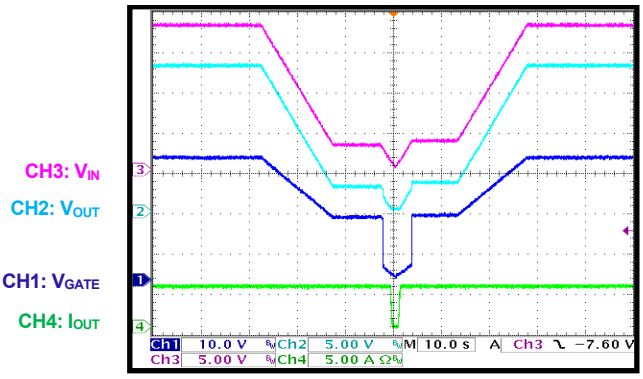
Slow Decrease and Increase of the Supply Voltage

I_{OUT} = 0A



Slow Decrease and Increase of the Supply Voltage

I_{OUT} = 5A

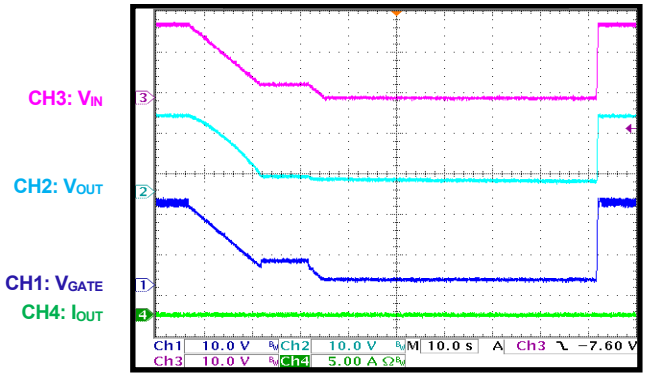


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, I_{OUT} = 5A, L = 68µH, T_A = 25°C, unless otherwise noted.

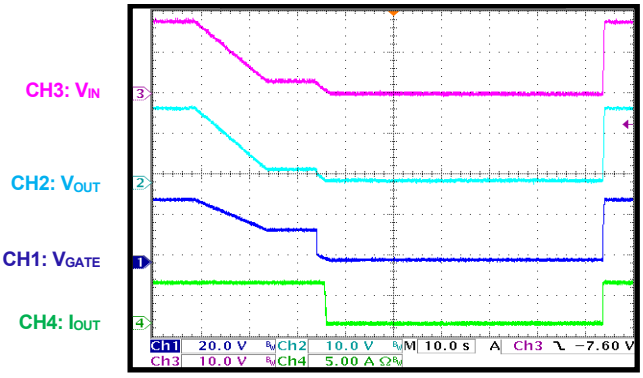
Slow Decrease and Quick Increase of the Supply Voltage

I_{OUT} = 0A



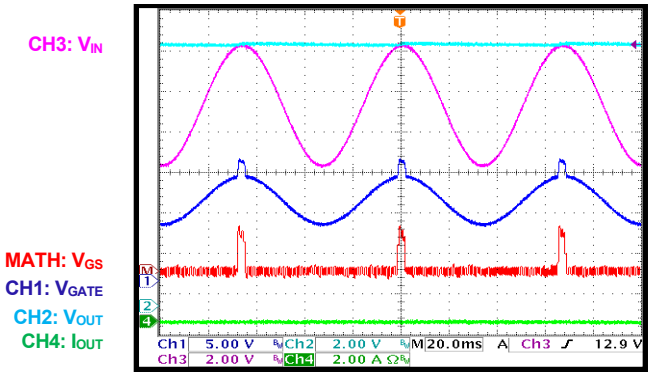
Slow Decrease and Quick Increase of the Supply Voltage

I_{OUT} = 5A



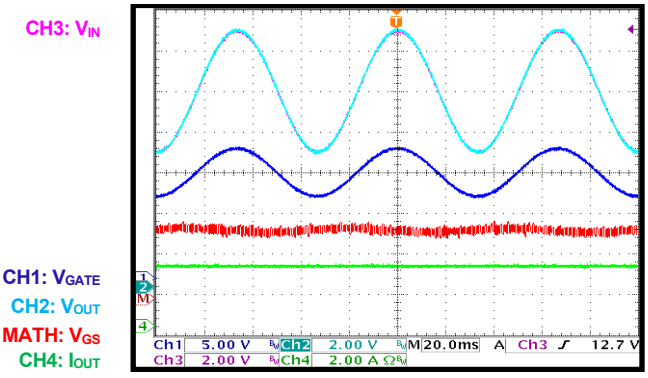
Simultaneous Input

V_{PP} = 6V, f = 15Hz, I_{OUT} = 0A



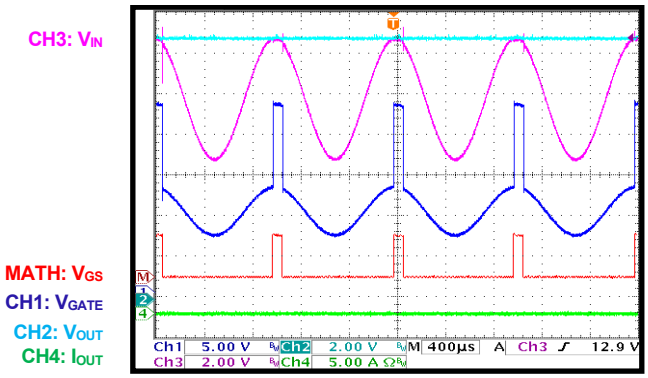
Simultaneous Input

V_{PP} = 6V, f = 15Hz, I_{OUT} = 3A



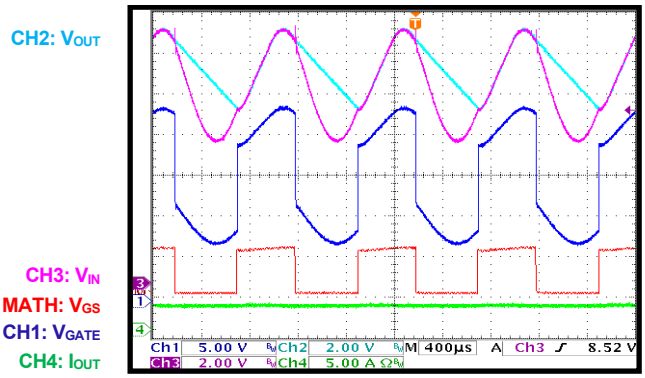
Simultaneous Input

V_{PP} = 6V, f = 1kHz, I_{OUT} = 0A



Simultaneous Input

V_{PP} = 6V, f = 1kHz, I_{OUT} = 3A



PCB LAYOUT

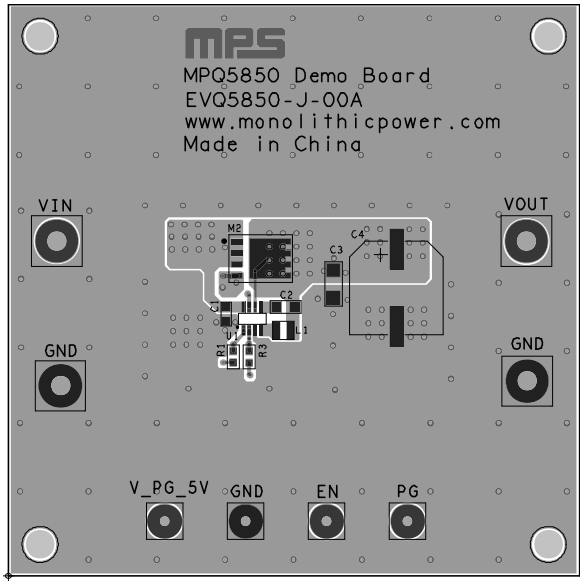


Figure 2: Top Silk and Top Layer

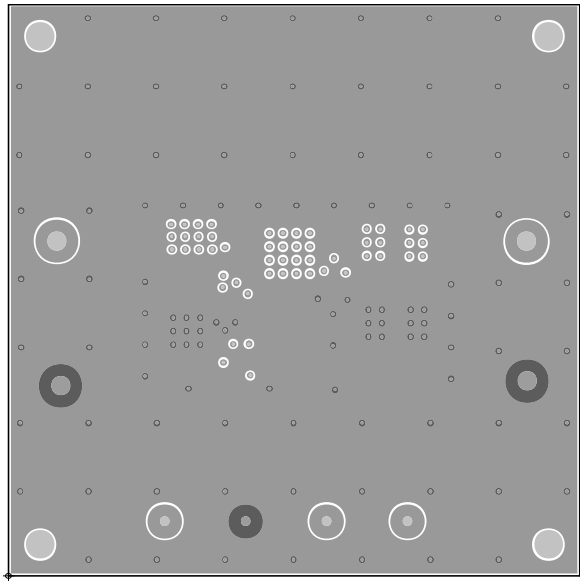


Figure 3: Mid-Layer 1

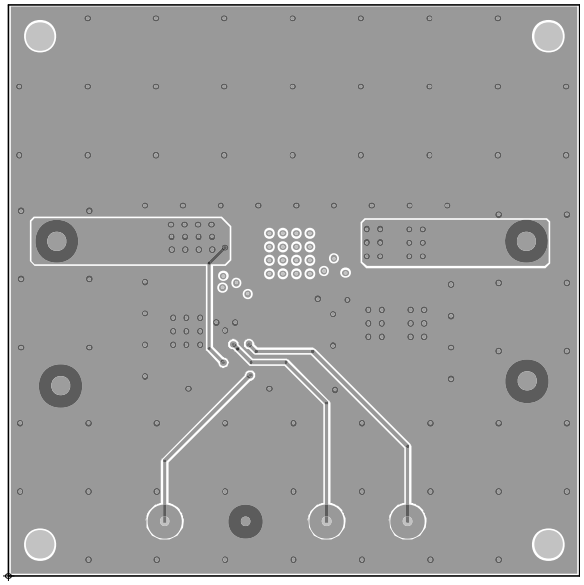


Figure 4: Mid-Layer 2

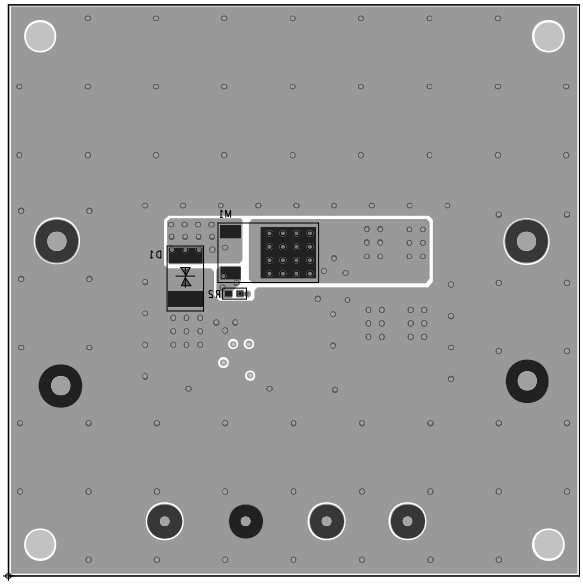


Figure 5: Bottom Layer and Bottom Silk

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	10/27/2021	Initial Release	-