# EVQ2179-LE-00A

## 5.5V, 3A, 2.4MHz, Synchronous Step-Down Converter with PG and SS, AEC-Q100 Qualified Evaluation Board

## DESCRIPTION

The EVQ2179-LE-00A is is an evaluation board designed to demonstrate the capabilities of the MPQ2179, a monolithic, step-down switch-mode converter with built-in internal power MOSFETs.

The EVQ2179-LE-00A achieves 3A of output current from a 2.5V to 5.5V input voltage range, with excellent load and line regulation. The output voltage ($V_{OUT}$) can be regulated to as low as 0.6V.

Fault protections include cycle-by-cycle current limiting and thermal shutdown.

The EVQ2179-LE-00A is a fully assembled and tested evaluation board. It generates a 1.2V $V_{OUT}$ at load currents up to 3A from a 2.5V to 5.5V input range.

The MPQ2179 is available in a compact QFN-8 (1.5mmx2mm) package, and is AEC-Q100 qualified.

## ELECTRICAL SPECIFICATIONS

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input voltage | $V_{IN}$ | 2.5 to 5.5 | V |
| Output voltage | $V_{OUT}$ | 1.2 | V |
| Output current | $I_{OUT}$ | 3 | A |

## FEATURES

**Designed for Automotive Applications**

- Wide 2.5V to 5.5V Operating Input Range
- Up to 3A Output Current
- 1% FB Accuracy

**High Performance for Improved Thermals**

- 65mΩ and 35mΩ Internal Power MOSFET Switches

**Optimized for EMC/EMI**

- 2.4MHz Switching Frequency
- Forced Continuous Conduction Mode (CCM) across the Full Load Range

**Additional Features**

- Power Good (PG)
- External Soft Start (SS) Control
- Output Discharge
- Output Over-Voltage Protection ($V_{OUT}$ OVP)
- Short-Circuit Protection (SCP) with Hiccup Mode

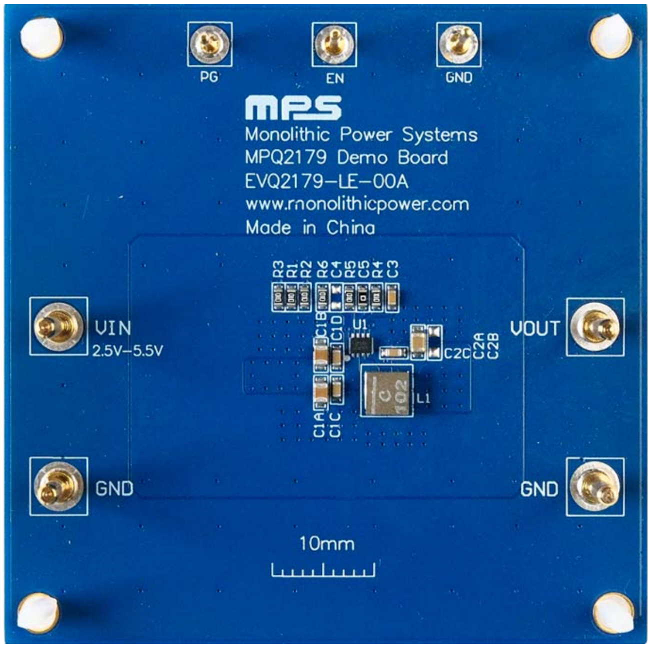
**Optimized for Board Size and BOM**

- Integrated Compensation Network
- Available in a Compact QFN-8 (1.5mmx2mm) Package
- Available in AEC-Q100 Grade 1

## APPLICATIONS

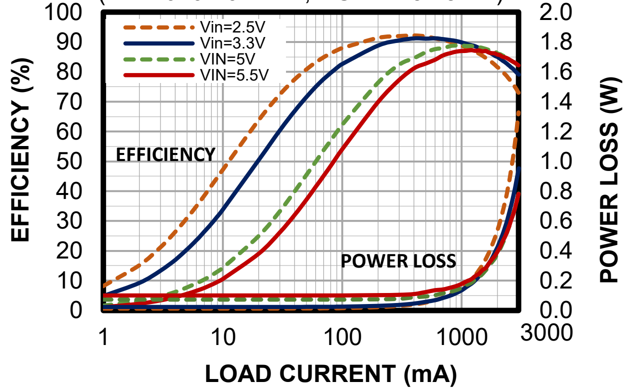
- Automotive Infotainment
- Camera Modules
- Key Fobs
- Automotive Clusters
- Automotive Telematics
- Industrial Supplies
- Battery-Powered Devices

## EVQ2179-LE-00A EVALUTION BOARD




**(LxWxH) 6.3cmx6.3cmx0.3cm**

| Board Number | MPS IC Number |
|---|---|
| EVQ2179-LE-00A | MPQ2179GQHE-AEC1 |



## QUICK START GUIDE

1. Preset the power supply to $2.5V \leq V_{IN} \leq 5.5V$.
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 connections, turn on the power supply.
5. To use the enable function, apply a digital input to the EN pin. Drive EN above 0.9V to turn the regulator on; drive EN below 0.65V to turn it off.
6. The external resistor divider sets the output voltage ($V_{OUT}$). To adjust the MPQ2179's output, set feedback resistor R5 to be between 10kΩ and 100kΩ. R6 can then be calculated with Equation (1):

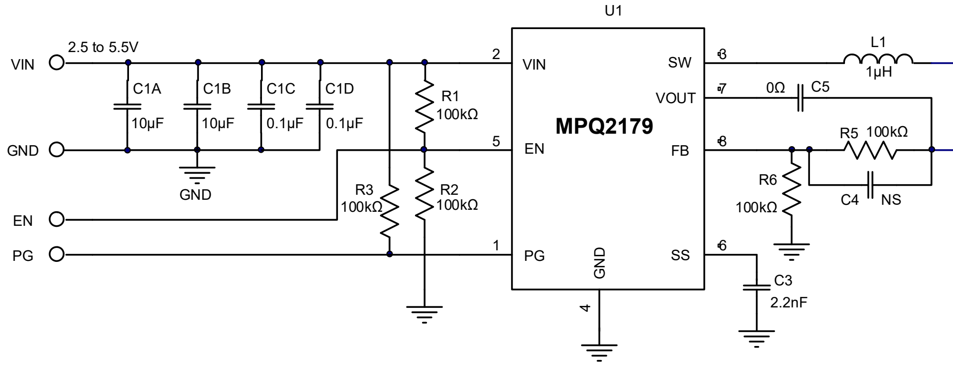
$$R6 = \frac{R5}{\frac{V_{OUT}}{0.6} - 1} \quad (1)$$

Table 1 lists the recommended resistor values for common output voltages.

**Table 1: Resistor Values for Common Output Voltages**

| $V_{OUT}$ (V) | R1 (kΩ) | R2 (kΩ) |
|---|---|---|
| 1.0 | 30.9 (1%) | 47 (1%) |
| 1.2 | 100 (1%) | 100 (1%) |
| 1.8 | 36 (1%) | 18 (1%) |
| 2.5 | 51 (1%) | 16 (1%) |
| 3.3 | 68 (1%) | 15 (1%) |

# EVALUATION BOARD SCHEMATIC




| $V_{OUT}$ (V) | R5 (kΩ) | R6 (kΩ) |
|---|---|---|
| 1.2 | 100 (1%) | 100 (1%) |
| 1.8 | 36 (1%) | 18 (1%) |
| 3.3 | 68 (1%) | 15 (1%) |

**Figure 1: Evaluation Board Schematic**

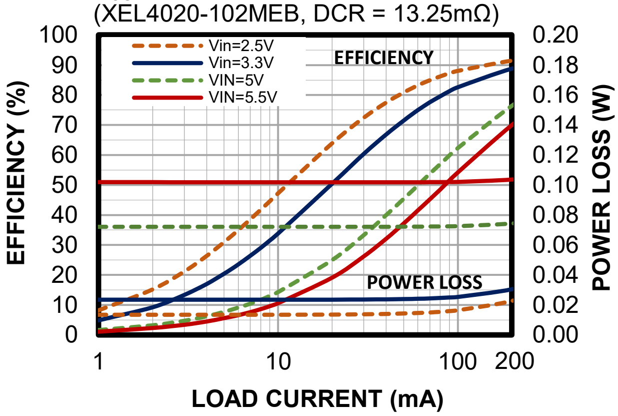
## EVQ2179-LE-00A BILL OF MATERIALS

| Qty | Designator | Value | Description | Package | Manufacturer | Manufacturer PN |
|---|---|---|---|---|---|---|
| 1 | CIN1 | 22μF | Electrical capacitor, 63V | SMD | Jianghai | VTD-63V22 |
| 2 | C1A, C1B | 4.7μF | Ceramic capacitor, 16V, X7R | 0805 | Murata | GCM21BR71C475KA73L |
| 3 | C1C, C1D, C2C | 0.1μF | Ceramic capacitor, 16V, X7R | 0603 | TDK | C1608X7R1C104K |
| 1 | C2A | 22μF | Ceramic capacitor, 6.3V, X5R | 0805 | Murata | GRM21BR60J226ME39L |
| 1 | C5 | 0Ω | Film resistor, 1% | 0603 | Yageo | RC0603FR-070RL |
| 0 | C4 | NS | | | | |
| 1 | C3 | 2.2nF | Ceramic capacitor, 50V, X7R | 0603 | TDK | C1608X7R1H222K |
| 5 | R1, R2, R3, R5, R6 | 100kΩ | Film resistor, 1% | 0603 | Yageo | RC0603FR-07100KL |
| 1 | R4 | 10Ω | Film resistor, 1% | 0603 | Yageo | RC0603FR-0710RL |
| 1 | L1 | 1μH | Inductor, 14.6mΩ, 9.6A | SMD | Coilcraft | XEL4020-102MEB |
| 4 | VIN, GND, VOUT, GND | Test point | 2.0 golden pin | DIP | Custom | |
| 3 | EN, PG, GND | Test point | 1.0 golden pin | DIP | Custom | |
| 1 | U1 | MPQ2179-AEC1 | 5.5V, 3A, step-down converter, AEC-Q100 qualified | QFN-8 (1.5mmx 2mm) | MPS | MPQ2179GQHE-AEC1 |

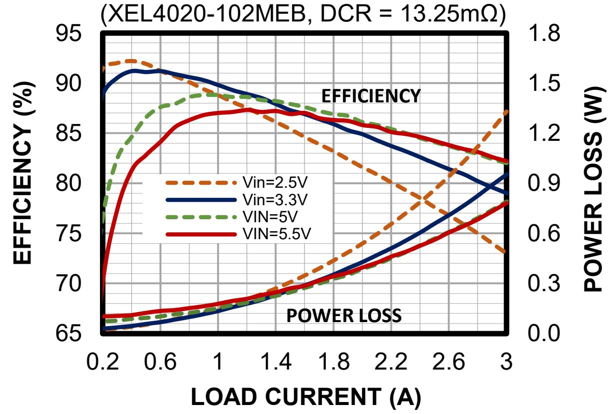
# EVB TEST RESULTS

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 3.6V, $V_{OUT}$ = 1.2V, L = 1µH, $C_{OUT}$ = 22µF, $T_A$ = 25°C, unless otherwise noted.**

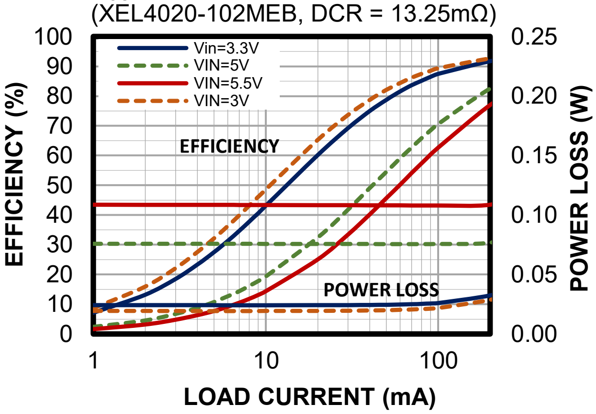
**Efficiency vs. Load Current vs. Power Loss (Light Loads)**
$V_{OUT}$ = 1.2V, L = 1µH
(XEL4020-102MEB, DCR = 13.25mΩ)



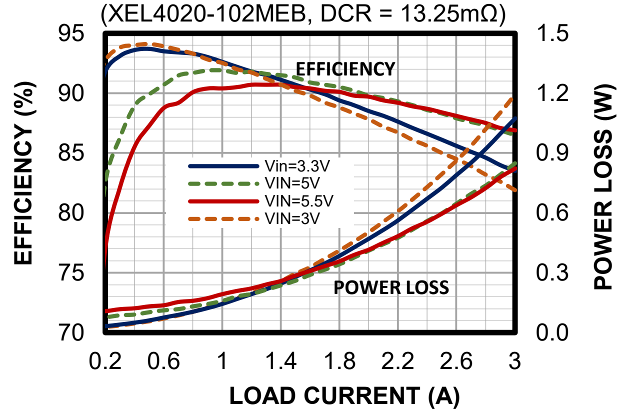

**Efficiency vs. Load Current vs. Power Loss**
$V_{OUT}$ = 1.2V, L = 1µH
(XEL4020-102MEB, DCR = 13.25mΩ)



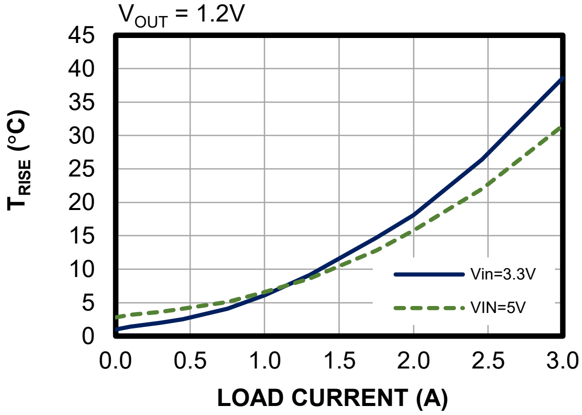

**Efficiency vs. Load Current vs. Power Loss (Light Loads)**
$V_{OUT}$ = 1.8V, L = 1µH
(XEL4020-102MEB, DCR = 13.25mΩ)



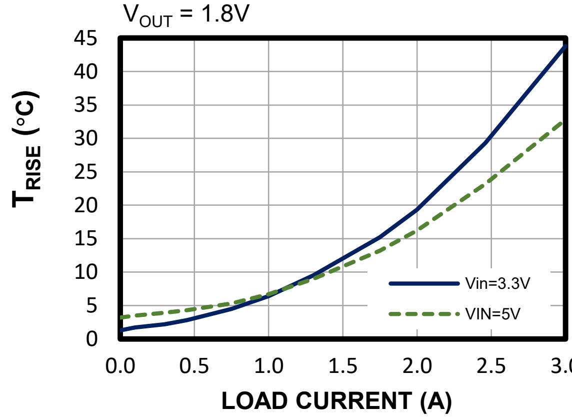

**Efficiency vs. Load Current vs. Power Loss**
$V_{OUT}$ = 1.8V, L = 1µH
(XEL4020-102MEB, DCR = 13.25mΩ)




**Case Temperature Rise**
$V_{OUT}$ = 1.2V

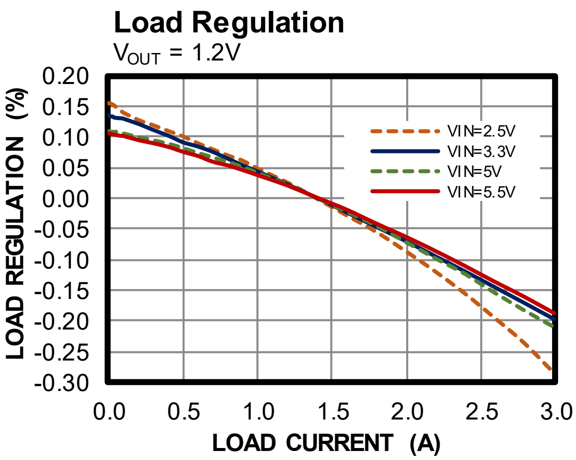


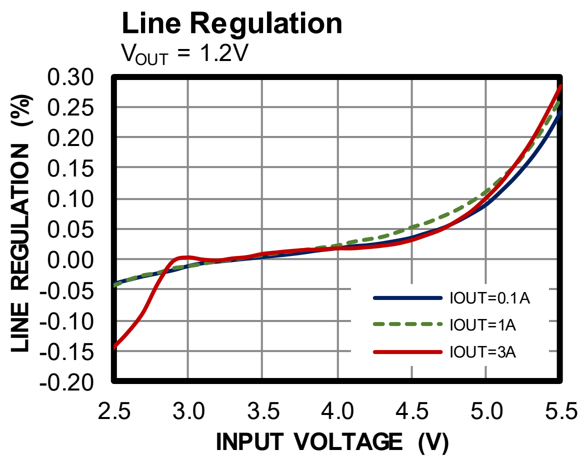

**Case Temperature Rise**
$V_{OUT}$ = 1.8V



## EVB TEST RESULTS *(continued)*

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 3.6V, $V_{OUT}$ = 1.2V, L = 1µH, $C_{OUT}$ = 22µF, $T_A$ = 25°C, unless otherwise noted.**



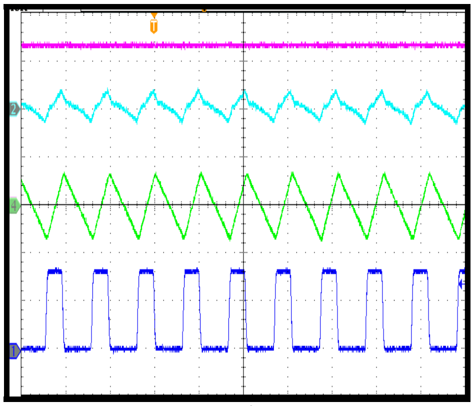



## EVB TEST RESULTS *(continued)*

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 3.6V, $V_{OUT}$ = 1.2V, L = 1µH, $C_{OUT}$ = 22µF, $T_A$ = 25°C, unless otherwise noted.**

**Steady State**

$I_{OUT}$ = 0A

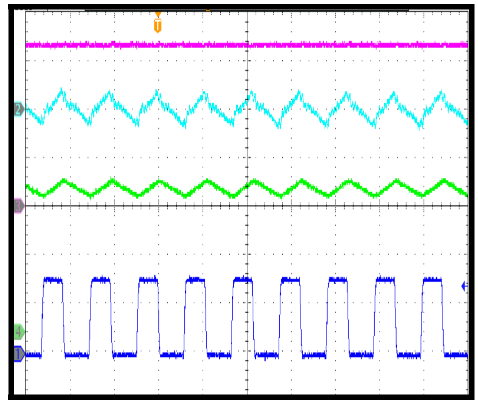


CH3: $V_{IN}$ 1V/div.
CH2: $V_{OUT}$/AC 5mV/div.
CH4: $I_L$ 200mA/div.
CH1: SW 2V/div.

400ns/div.

**Steady State**

$I_{OUT}$ = 3A

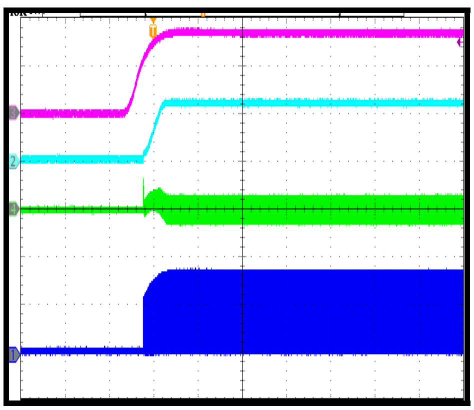


CH2: $V_{OUT}$/AC 5mV/div.
CH3: $V_{IN}$ 1V/div.
CH4: $I_L$ 1A/div.
CH1: SW 2V/div.

400ns/div.

**Start-Up through VIN**

$I_{OUT}$ = 0A

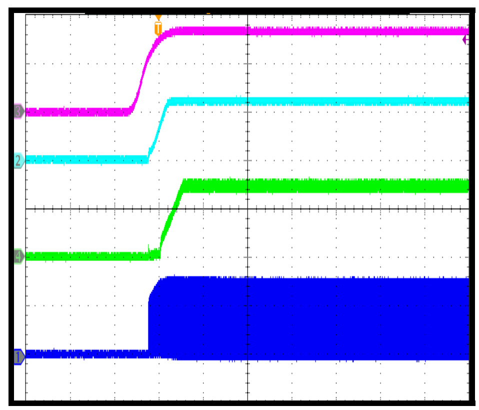


CH3: $V_{IN}$ 2V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 500mA/div.
CH1: SW 2V/div.

1ms/div.

**Start-Up through VIN**

$I_{OUT}$ = 3A

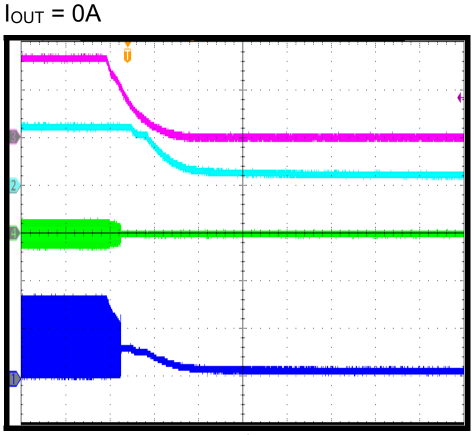


CH3: $V_{IN}$ 2V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 2A/div.
CH1: SW 2V/div.

1ms/div.

**Shutdown through VIN**

$I_{OUT}$ = 0A

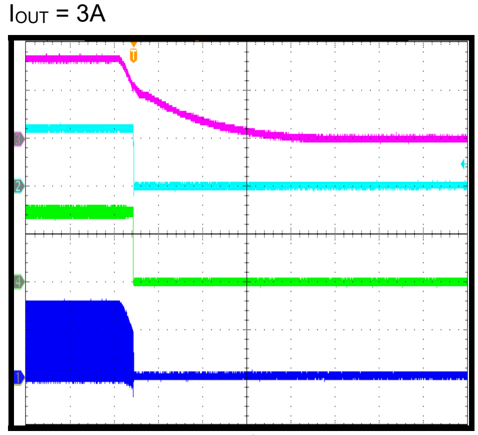


CH3: $V_{IN}$ 2V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 500mA/div.
CH1: SW 2V/div.

10ms/div.

**Shutdown through VIN**

$I_{OUT}$ = 3A



CH3: $V_{IN}$ 2V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 2A/div.
CH1: SW 2V/div.

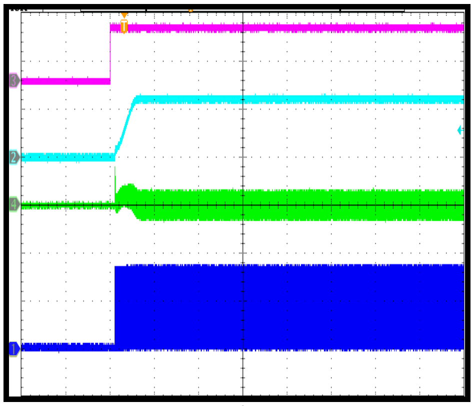
4ms/div.

## EVB TEST RESULTS *(continued)*

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 3.6V, $V_{OUT}$ = 1.2V, L = 1µH, $C_{OUT}$ = 22µF, $T_A$ = 25°C, unless otherwise noted.**

**Start-Up through EN**
$I_{OUT}$ = 0A

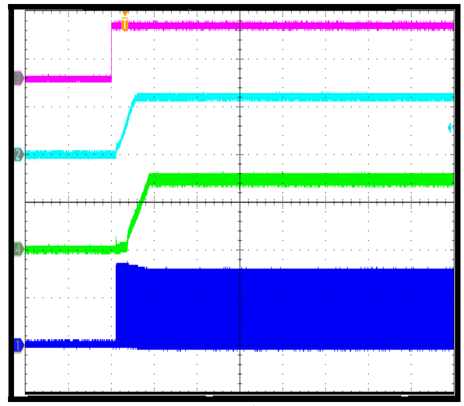
CH3: EN 3V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 500mA/div.
CH1: SW 2V/div.



1ms/div.

**Start-Up through EN**
$I_{OUT}$ = 3A

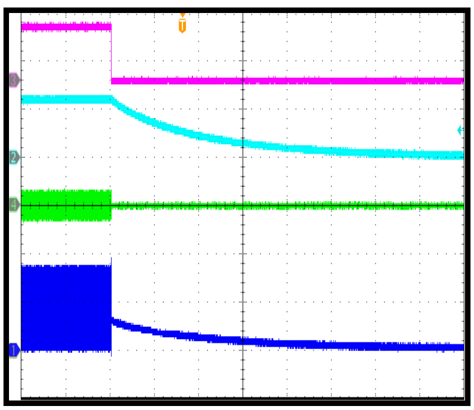
CH3: EN 3V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 2A/div.
CH1: SW 2V/div.



1ms/div.

**Shutdown through EN**
$I_{OUT}$ = 0A

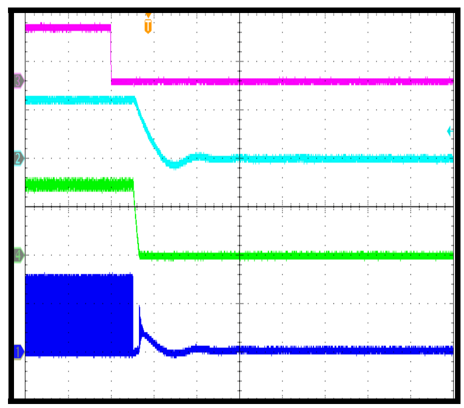
CH3: EN 3V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 500mA/div.
CH1: SW 2V/div.



2ms/div.

**Shutdown through EN**
$I_{OUT}$ = 3A

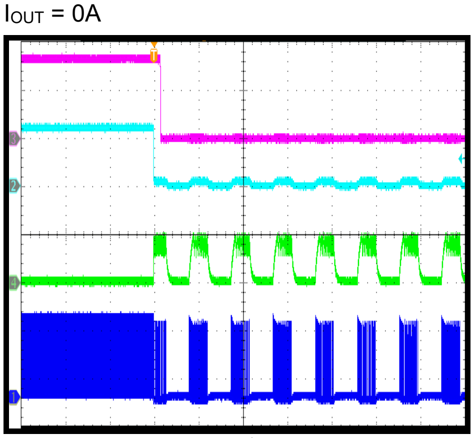
CH3: EN 3V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 2A/div.
CH1: SW 2V/div.



20µs/div.

**SCP Entry**
$I_{OUT}$ = 0A

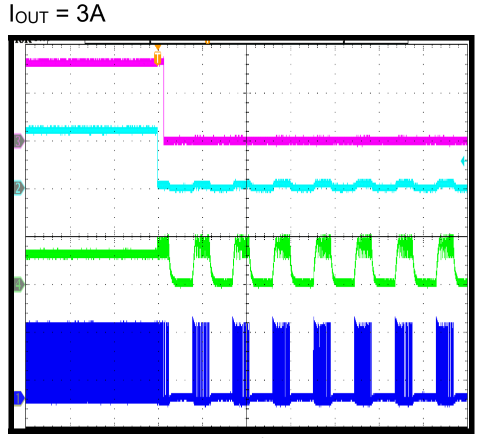
CH3: PG 2V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 5A/div.
CH1: SW 2V/div.



400µs/div.

**SCP Entry**
$I_{OUT}$ = 3A

CH3: PG 2V/div.
CH2: $V_{OUT}$ 1V/div.
CH4: $I_L$ 5A/div.
CH1: SW 2V/div.

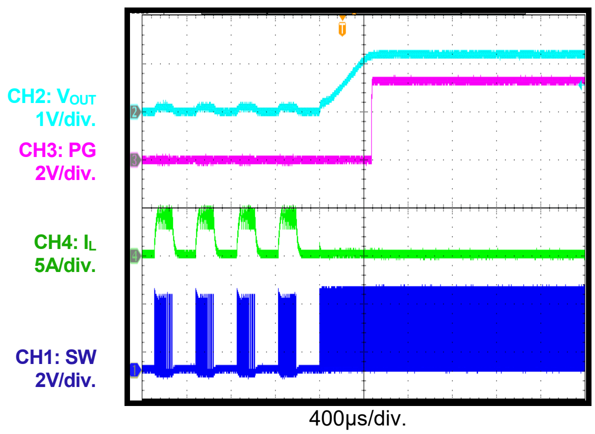


400µs/div.

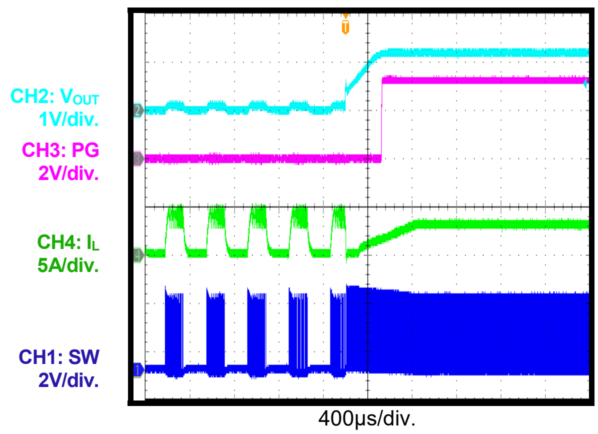
## EVB TEST RESULTS *(continued)*

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 3.6V, $V_{OUT}$ = 1.2V, L = 1µH, $C_{OUT}$ = 22µF, $T_A$ = 25°C, unless otherwise noted.**

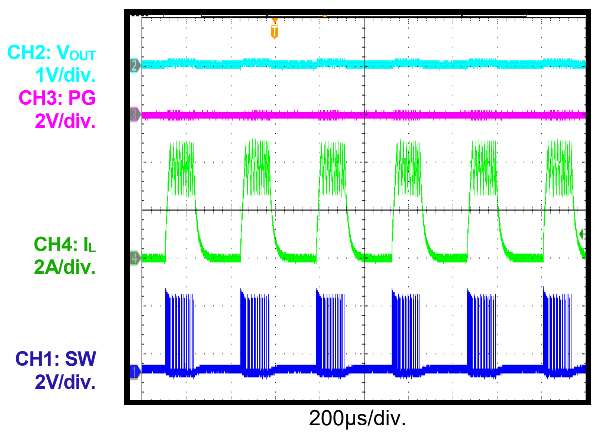
**SCP Recovery**
$I_{OUT}$ = 0A



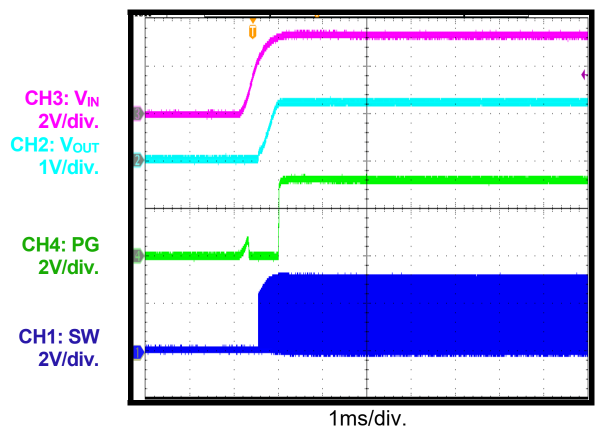

**SCP Recovery**
$I_{OUT}$ = 3A



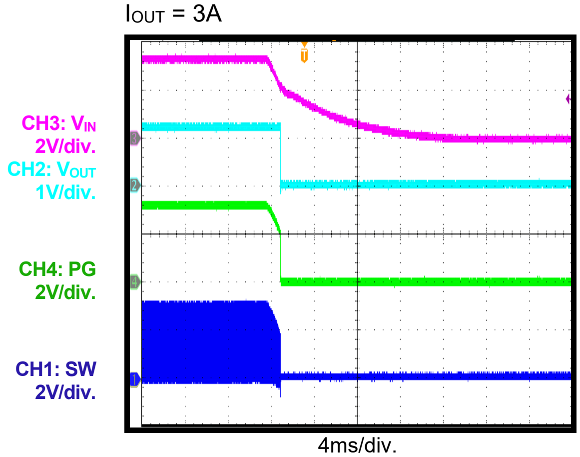

**Short Circuit**



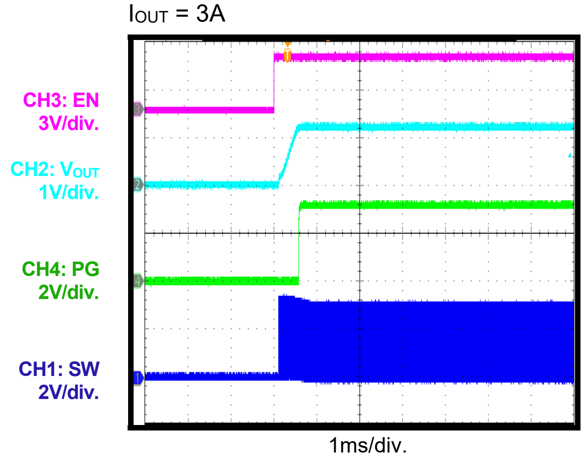

**PG Start-Up through VIN**
$I_{OUT}$ = 3A




**PG Shutdown through VIN**
$I_{OUT}$ = 3A




**PG Start-Up through EN**
$I_{OUT}$ = 3A

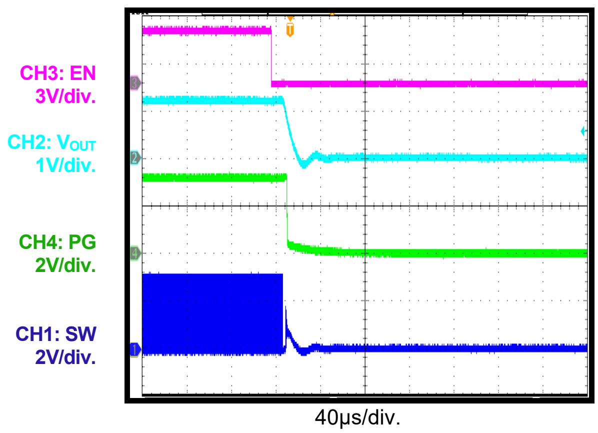


## EVB TEST RESULTS *(continued)*

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 3.6V, $V_{OUT}$ = 1.2V, L = 1µH, $C_{OUT}$ = 22µF, $T_A$ = 25°C, unless otherwise noted.**

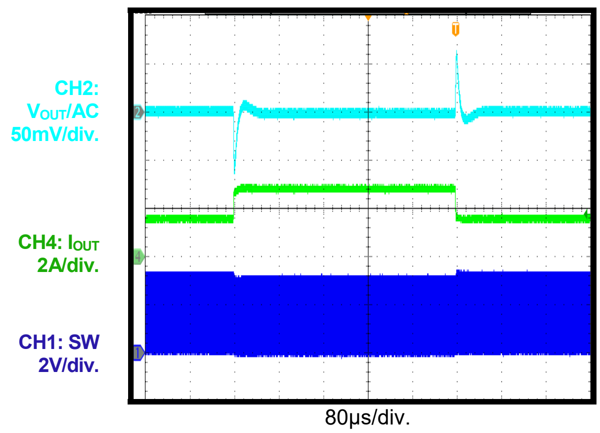
**PG Shutdown through EN**

$I_{OUT}$ = 3A




**Load Transient**

$I_{OUT}$ = 1.5A to 3A, 1A/µs



## PCB LAYOUT

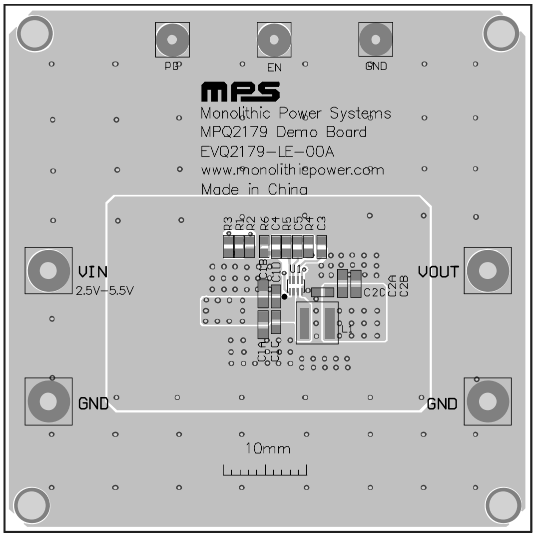



Figure 2: Top Silk and Top Layer

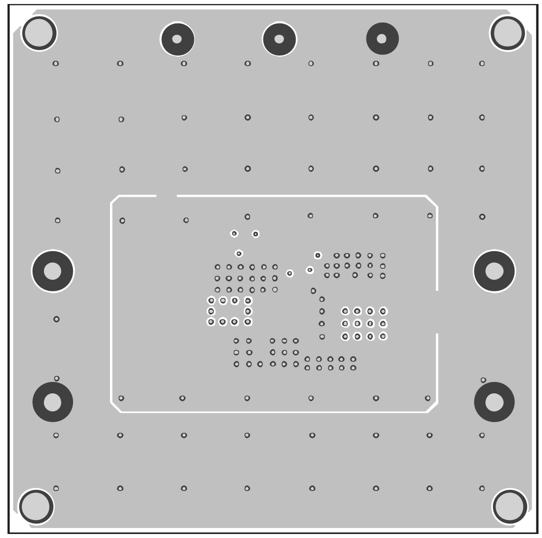


Figure 3: Mid-Layer 1

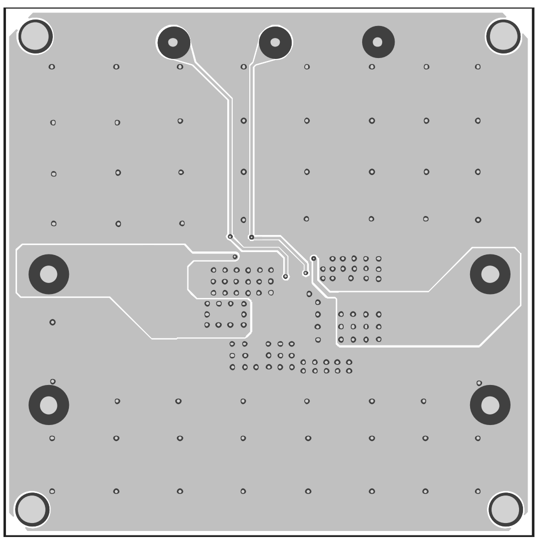


Figure 4: Mid-Layer 1

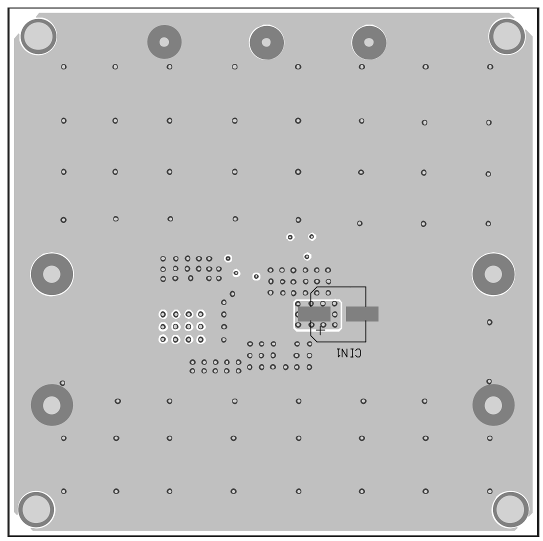


Figure 5: Bottom Layer and Bottom Silk

# REVISION HISTORY

| Revision # | Revision Date | Description | Pages Updated |
|---|---|---|---|
| 1.0 | 06/18/2021 | Initial Release | - |