



EV28310-C-00A

Ultra-Low I_Q Step-Down Regulator with LDO Step-Down Switcher Evaluation Board

DESCRIPTION

The EV28310-C-00A is an evaluation board designed to demonstrate the capabilities of the MP28310, a monolithic power management unit containing a 300mA, high-efficiency, step-down switching converter and a 100mA LDO regulator. The sub-mA quiescent current provides extremely high efficiency when the load current is low (down to a μA range). With a maximum 5.5V input range, the MP28310 is ideal for use in battery-powered devices.

Constant-on-time (COT) control provides fast transient response, high light-load efficiency, and allows for minimal capacitors.

Another 100mA LDO regulator provides easy system configuration with a low LDO output voltage ripple.

The MP28310 is available in a small CSP-12 (1.2mmx1.6mm) package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN1} , V_{IN2}	2.0 to 5.5	V
Output voltage	V_{OUT1} , V_{OUT2}	Table 1	
Output current	I_{OUT1}	0.3	A
	I_{OUT2}	0.1	A

Note:

- 1) If V_{IN} is below 3.3V, an additional input capacitor may be required.

FEATURES

300mA Buck Switcher:

- Ultra-Low 500nA I_Q
- Wide 2.0V to 5.5V Operating Input Range
- 7 Selectable Output Voltages
- Up to 300mA Output Current
- 1.5MHz Switching Frequency during CCM
- 100% Duty Cycle in Dropout Mode
- 0.25 Ω and 0.25 Ω Internal Power MOSFET Switches
- Cycle-by-Cycle Over-Current Protection
- Short-Circuit Protection with Hiccup Mode

100mA LDO:

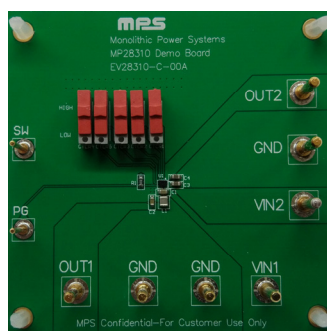
- Ultra-Low 300nA I_Q
- 2.0V to 5.5V Operation Input Range
- 3 Selectable Output Voltages
- Over-Temperature Protection
- Available in a CSP-12 (1.2mmx1.6mm) Package

APPLICATIONS

- Wearables
- Internet-of-Things (IoT)
- Portable Instruments
- Battery-Powered Devices

All MPS parts are lead-free, halogen-free, and adhere to the RoHS directive. For MPS green status, please visit the MPS website under Quality Assurance. "MPS", the MPS logo, and "Simple, Easy Solutions" are trademarks of Monolithic Power Systems, Inc. or its subsidiaries.

EV28310-C-00A EVALUATION BOARD

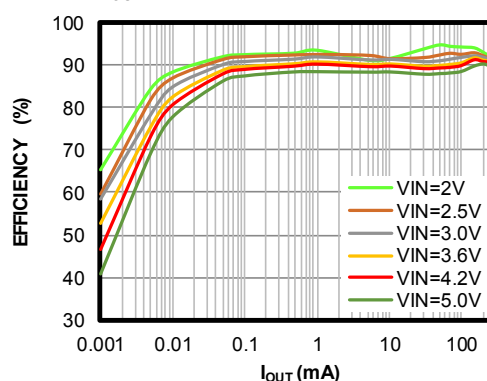


(LxW) 6.3cmx6.3cm

Board Number	MPS IC Number
EV28310-C-00A	MP28310GC

Efficiency vs. Load Current

$V_{OUT} = 1.8V$



QUICK START GUIDE

The output voltage of this board is set using the CTRL pins (see Table 1). If the switcher pulls high, the relative CTRL pin connects to VIN. If the switcher pulls low, the CTRL pin connects to GND.

Table 1: CTRL vs. Output Voltages ⁽²⁾

For Step-Down Switcher			
CTRL3	CTRL2	CTRL1	OUT1
0	0	0	Disabled
0	0	1	1.2V
0	1	0	1.5V
0	1	1	1.8V
1	0	0	2.5V
1	0	1	2.8V
1	1	0	3.0V
1	1	1	3.3V
For LDO			
CTRL5	CTRL4	N/A	OUT2
0	0	N/A	Disabled
0	1	N/A	1.8V
1	0	N/A	2.8V
1	1	N/A	3.0V

- Connect the load terminals to:
 - Positive (+): VOUT
 - Negative (-): GND
- Preset the power supply output between 2.0V and 5.5V, then turn the power supply off.
- Connect the power supply output to:
 - Positive (+): VIN
 - Negative (-): GND
- Turn the power supply on.
- Turn the relative switchers (CTRL) on to test the voltage (see Table 1). The board should automatically start up.
- If switching to a different output voltage, directly flip the tact switch.

Note:

- 2) If only using the LDO, VIN1 should exceed 2V.

EVALUATION BOARD SCHEMATICS

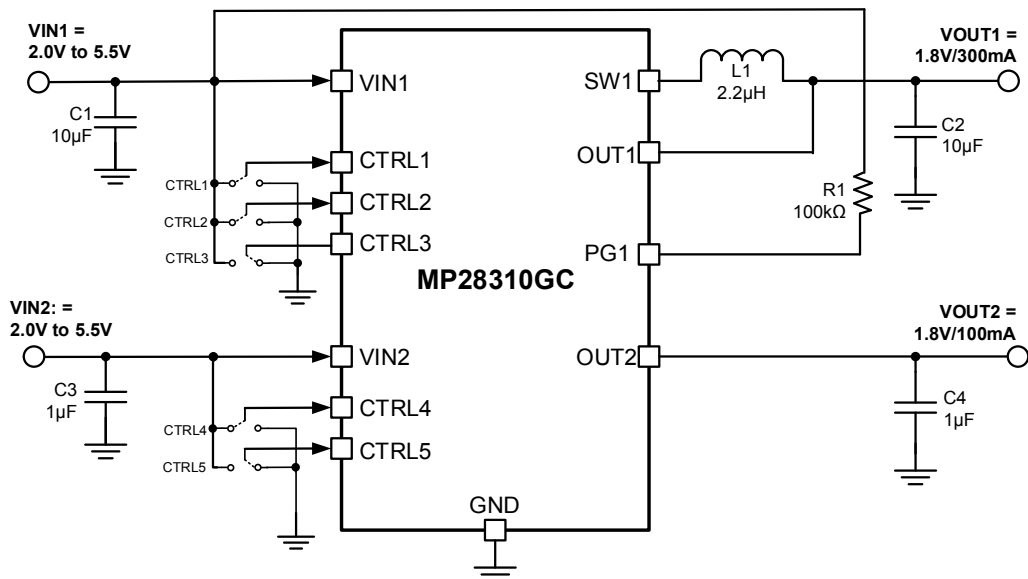


Figure 1: Typical Application Circuit for the MP28310GC ⁽³⁾

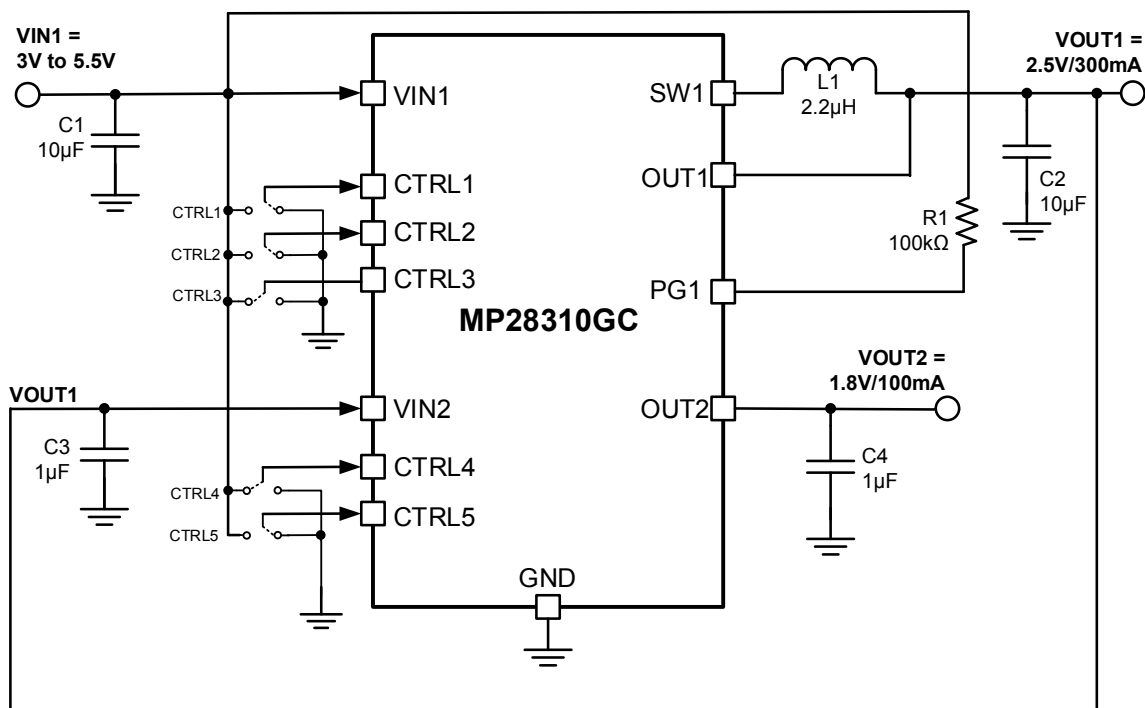


Figure 2: Typical Application Circuit for Buck Converter and LDO in Sequence ^{(3) (4)}

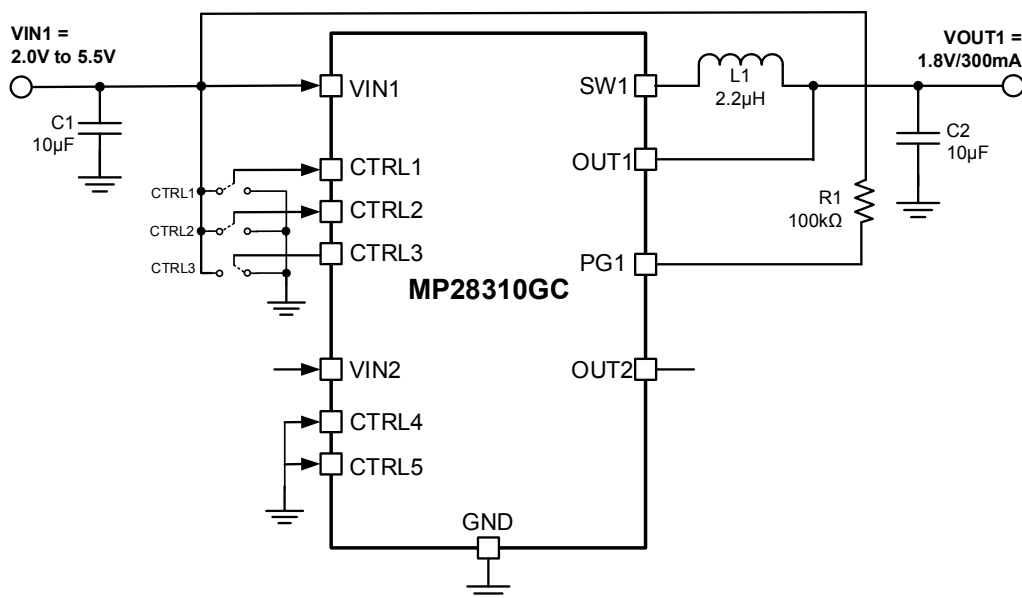


Figure 3: Typical Application Circuit for Buck Converter ⁽³⁾

Note:

- 3) If V_{IN} is below 3.3V, an additional input capacitor may be required.
- 4) For this application, V_{IN} should exceed V_{OUT} .

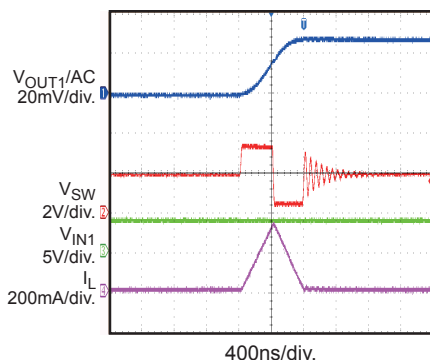
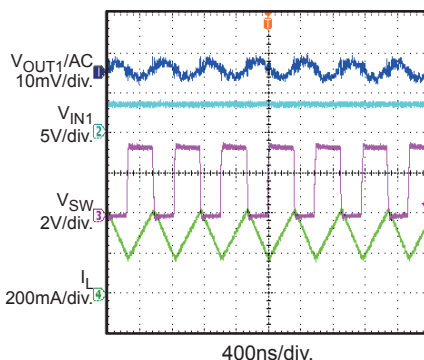
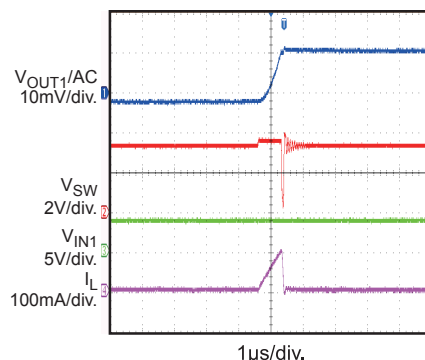
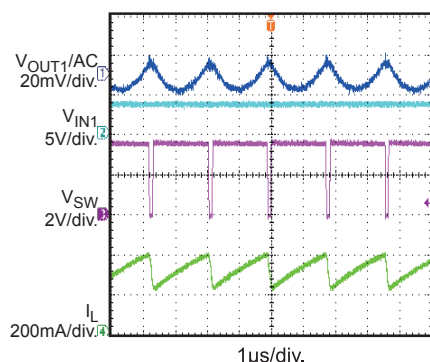
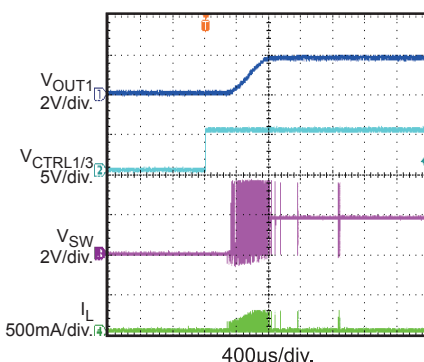
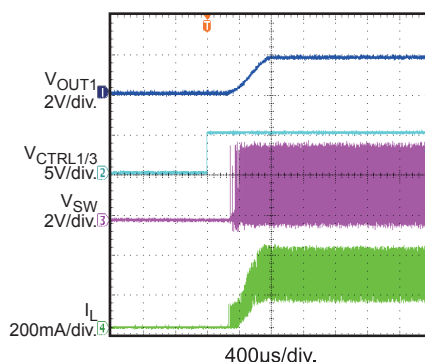
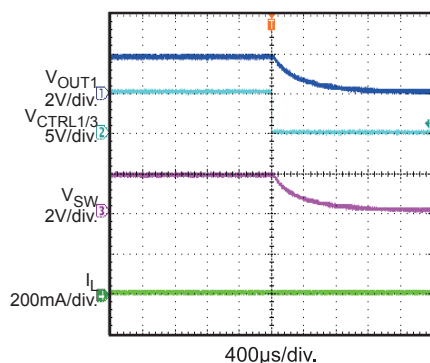
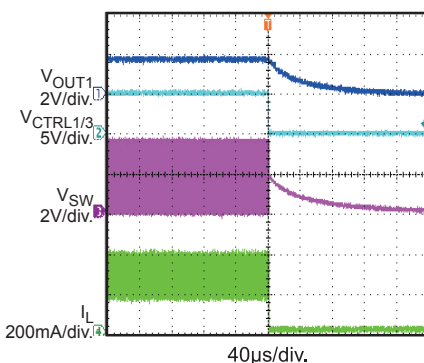
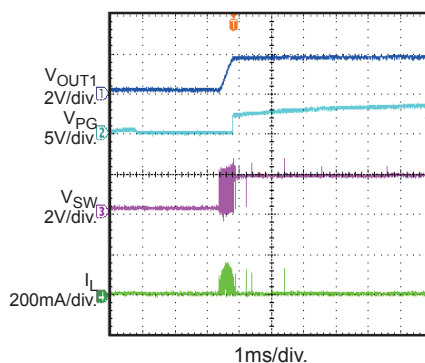


EV28310GC-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer P/N
2	C1, C2	10 μ F	Ceramic capacitor, 6.3V, X5R	0603	Murata	GRM188R60J106ME47D
2	C3, C4	1 μ F	Ceramic capacitor, 6.3V, X5R	0603	Murata	GRM188R60J105KA01D
1	R1	100k Ω	Film resistor, 1%	0603	Royal	F1003T5E
1	L1	2.2 μ H	Inductor, $I_{SAT} = 2.1A$, $R_{DC} = 144m\Omega$	2016	Murata	DFE201612P-2R2M
1	U1	MP28310	Step-down switcher	CSP-12 (1.2mmx 1.6mm)	MPS	MP28310GC
5	CTRL1, CTRL2, CTRL3, CTRL4, CTRL5		Tact switch	DIP (3.5mmx 2.9mmx 1.35mm)	Wurth	450301014042

EVB TEST RESULTS

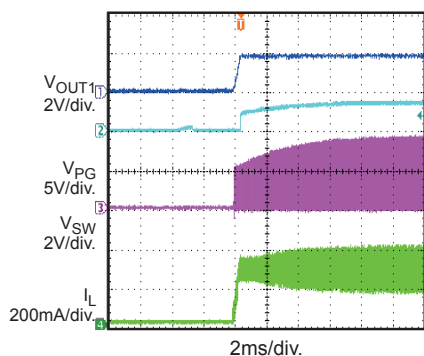
Performance waveforms are tested on the evaluation board. $V_{IN1} = 3.6V$, $V_{OUT1} = 1.8V$, $L_1 = 2.2\mu H$, $C_{IN1} = 10\mu F$, $C_{OUT1} = 10\mu F$, $V_{IN2} = 3.6V$, $V_{OUT2} = 1.8V$, $C_{IN2} = 1\mu F$, $C_{OUT2} = 1\mu F$, $T_A = 25^\circ C$, unless otherwise noted.

Steady State
 $I_{OUT1} = 0A$

Steady State
 $I_{OUT1} = 0.3A$

Steady State
 $V_{OUT1} = 3.3V$, $I_{OUT1} = 0A$

Steady State
 $V_{OUT1} = 3.3V$, $I_{OUT1} = 0.3A$

CTRL On
 $I_{OUT1} = 0A$

CTRL On
 $I_{OUT1} = 0.3A$

CTRL Off
 $I_{OUT1} = 0A$

CTRL Off
 $I_{OUT1} = 0.3A$

PG On
 $I_{OUT1} = 0A$


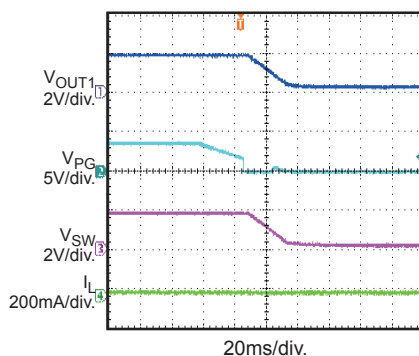
EVB TEST RESULTS (continued)

Performance waveforms are tested on the evaluation board. $V_{IN1} = 3.6V$, $V_{OUT1} = 1.8V$, $L_1 = 2.2\mu H$, $C_{IN1} = 10\mu F$, $C_{OUT1} = 10\mu F$, $V_{IN2} = 3.6V$, $V_{OUT2} = 1.8V$, $C_{IN2} = 1\mu F$, $C_{OUT2} = 1\mu F$, $T_A = 25^\circ C$, unless otherwise noted.

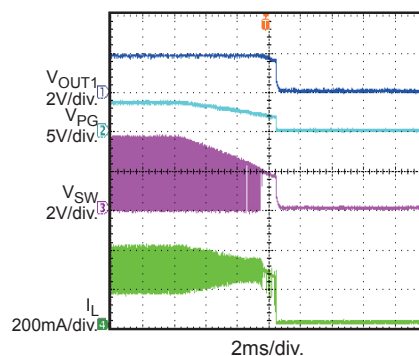
PG On
 $I_{OUT1} = 0.3A$



PG Off
 $I_{OUT1} = 0A$

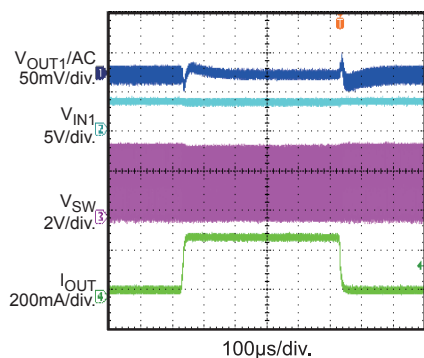


PG Off
 $I_{OUT1} = 0.3A$



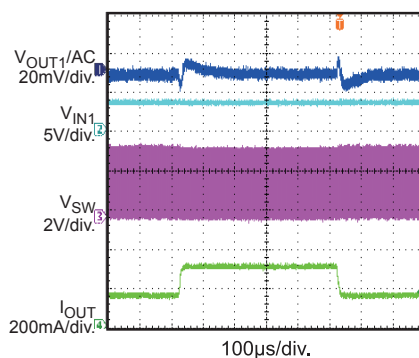
Load Transient

$I_{OUT1} = 30mA$ to $300mA$, $0.25A/\mu s$

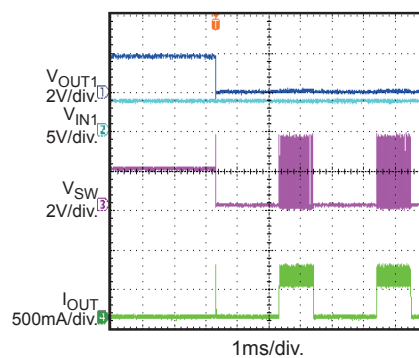


Load Transient

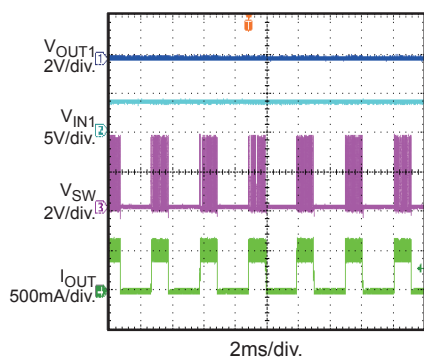
$I_{OUT1} = 150mA$ to $300mA$, $0.25A/\mu s$



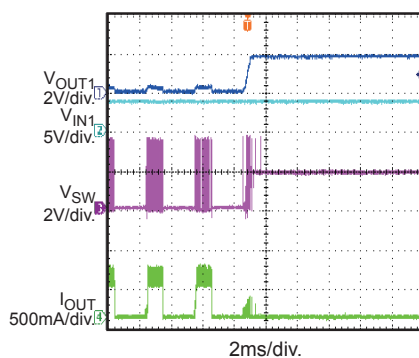
Short-Circuit Entry



Short-Circuit Steady

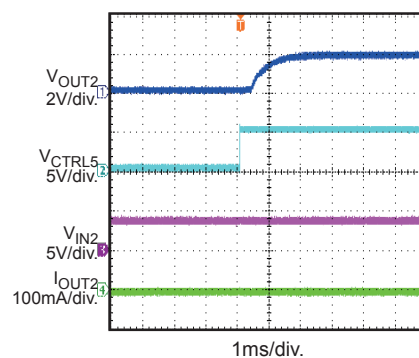


Short-Circuit Recovery



CTRL On

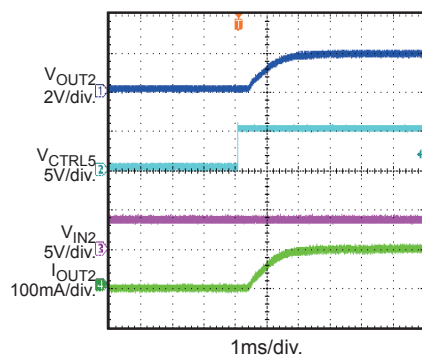
$I_{OUT2} = 0A$



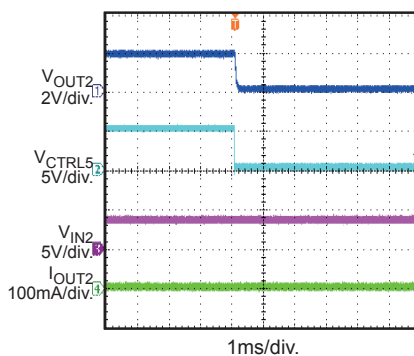
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. $V_{IN1} = 3.6V$, $V_{OUT1} = 1.8V$, $L_1 = 2.2\mu H$, $C_{IN1} = 10\mu F$, $C_{OUT1} = 10\mu F$, $V_{IN2} = 3.6V$, $V_{OUT2} = 1.8V$, $C_{IN2} = 1\mu F$, $C_{OUT2} = 1\mu F$, $T_A = 25^\circ C$, unless otherwise noted.

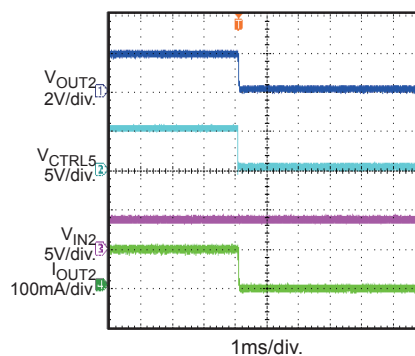
CTRL On
 $I_{OUT2} = 0.1A$



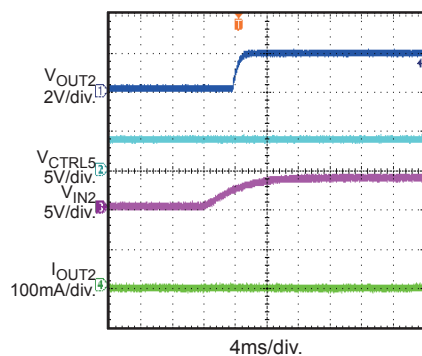
CTRL Off
 $I_{OUT2} = 0A$



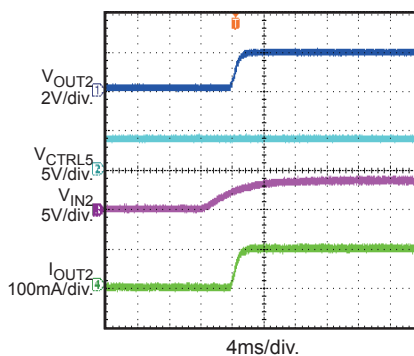
CTRL Off
 $I_{OUT2} = 0.1A$



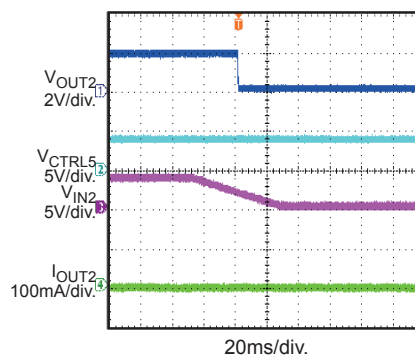
VIN On
 $I_{OUT2} = 0A$



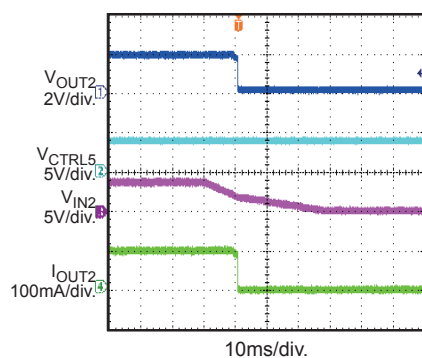
VIN On
 $I_{OUT2} = 0.1A$



VIN Off
 $I_{OUT2} = 0A$

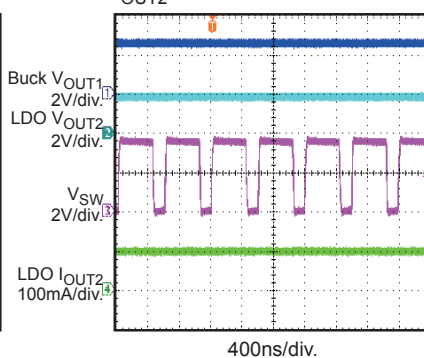


VIN Off
 $I_{OUT2} = 0.1A$



Buck and LDO

$V_{IN1} = 3.6V$, $V_{OUT1} = 2.5V$, $V_{IN2} = V_{OUT1}$,
 $V_{OUT2} = 1.8V$, $I_{OUT1} = 200mA$,
 $I_{OUT2} = 100mA$



PCB LAYOUT

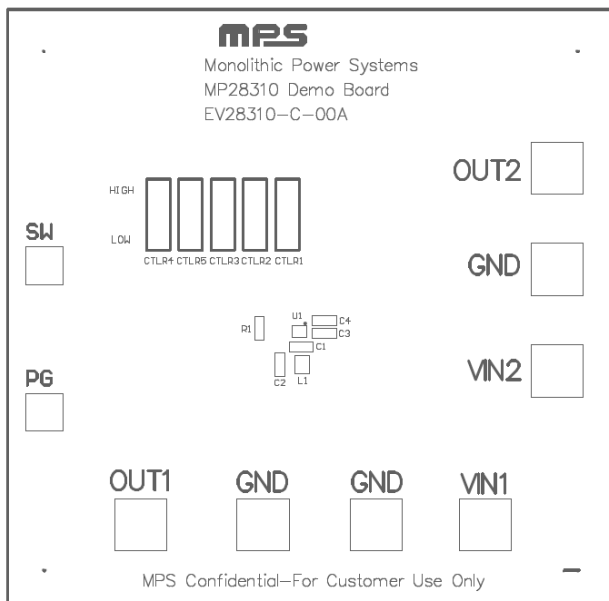


Figure 4: Top Silk Layer

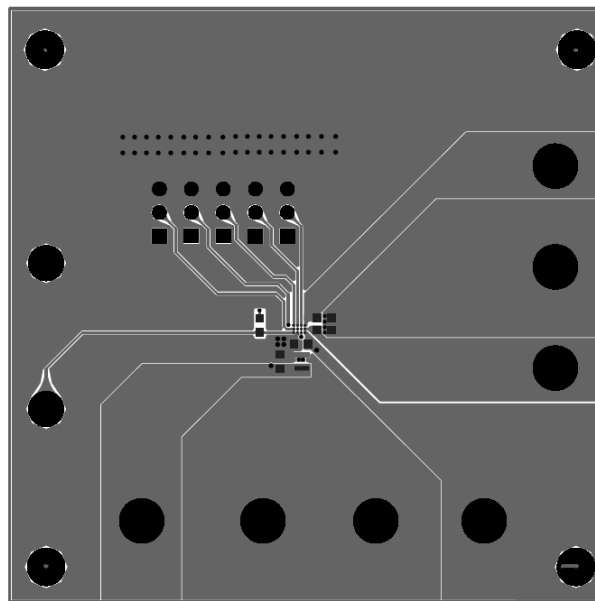


Figure 5: Top Layer

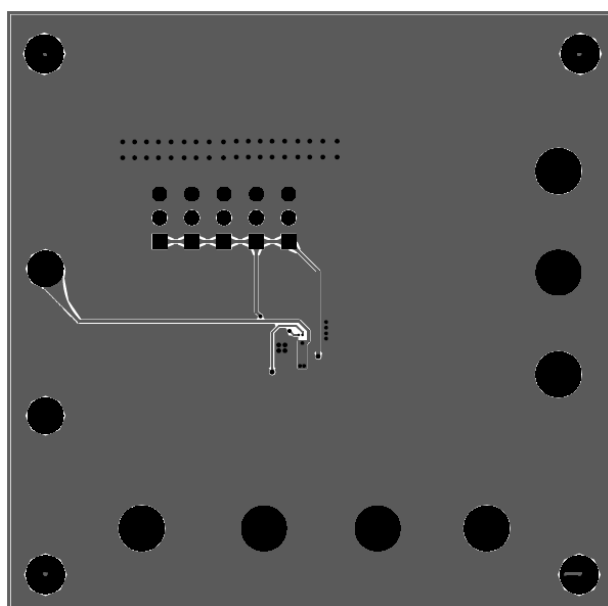


Figure 6: Bottom Layer



Revision History

Revision #	Revision Date	Description	Pages Updated
1.0	12/6/2016	Initial Release	-
1.1	07/30/2020	Technical Review	All
		Bill of Materials Updated	Page 5
		EVB test results updated. Replaced two waveforms ("Steady State with $I_{OUT1} = 0A$ " and "Steady State with $V_{OUT1} = 3.3V$, $I_{OUT1} = 0A$ ") with new waveforms.	Page 6

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.