EVL2491C-QB-00A

32V, 6A, Step-Down Converter with a Configurable Current Limit and V_{OUT} Scaling Evaluation Board

DESCRIPTION

The EVL2491C-QB-00A is an evaluation board designed to demonstrate the capabilities of the MP2491C, a high-voltage, step-down converter with a configurable current limit and output voltage (V_{OUT}) scaling. The MP2491C can achieve up to 6A of continuous output current (I_{OUT}) across a wide input voltage (V_{IN}) range, with excellent load and line regulation.

Constant-on-time (COT) control provides fast transient response and easy loop design, as well as very tight output regulation.

Full protection features include over-current protection (OCP), output over-voltage protection (OVP), current limiting with hiccup mode, and thermal shutdown.

The MP2491C requires a minimal number of readily available, standard external components, and is available in a QFN-13 (2.5mmx3mm) package.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	24	V
Output voltage	V_{OUT}	5	V
Output current	I_{OUT}	6	A

FEATURES

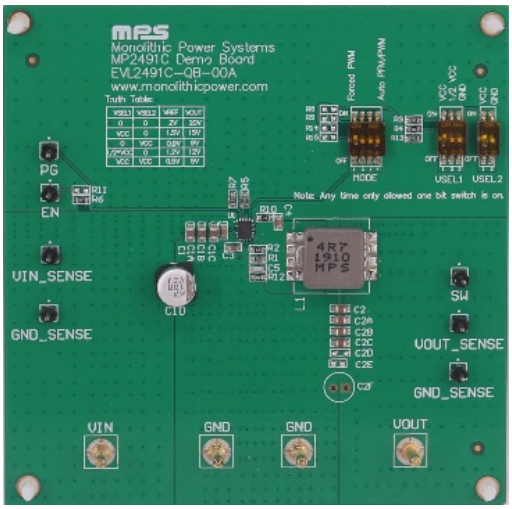
- Wide 4V to 32V Operating Input Voltage (V_{IN}) Range
- 0.5V to 30V Output Voltage (V_{OUT}) Range
- 6A Continuous Output Current (I_{OUT})
- 33mΩ/22mΩ Internal MOSFETs
- 450μA Quiescent Current (I_Q)
- 490kHz Fixed Switching Frequency (f_{SW})
- Constant-On-Time (COT) Control
- Two Dedicated Voltage Scaling (DVS) Control Pins
- Slew Rate Control for DVS
- Low-Dropout Mode
- Output Line Drop Compensation
- Adjustable Automatic Pulse-Frequency Modulation (PFM)/Pulse-Width Modulation PWM Mode or Forced PWM (FPWN) Mode
- Output Over-Voltage Protection (OVP)
- Adjustable Current Limit
- Enable (EN) Shutdown Discharge
- Power Good (PG) Indication
- Available in a QFN-13 (2.5mmx3mm) Package

MPL Optimized Performance with MPS Inductor MPL-AL6050 Series

APPLICATIONS

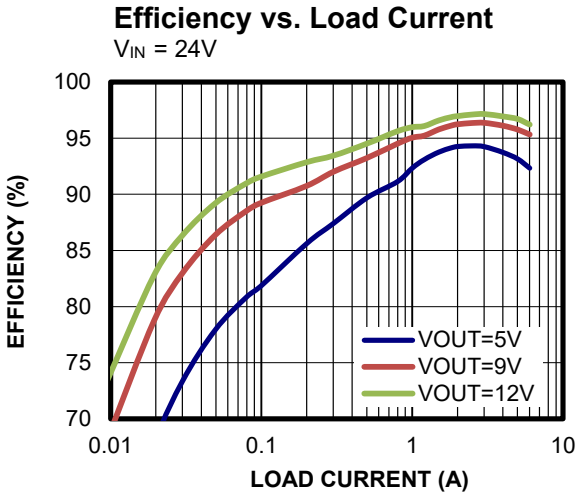
- Televisions and Monitors
- Multi-Functional Peripheral (MFP) Power Supplies
- Universal Serial Bus (USB) Power Supplies with Power Delivery (PD)
- Automotive Cigarette Lighter Adapters

EVL2491C-QB-00A EVALUATION BOARD



LxW (8.5cmx8.5cm)

Board Number	MPS IC Number	MPS Inductor
EVL2491C-QB-00A	MP2491CGQB	MPL-AY1050-4R7



QUICK START GUIDE

1. Preset the power supply to 24V, then turn off the power supply.
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. The board should start up automatically.
5. The default output voltage (V_{OUT}) is 5V. Select a different V_{OUT} by adjusting VSEL1 and VSEL2 (see Table 1).

Table 1: V_{OUT} Selection

VSEL1	VSEL2	V_{REF}	V_{OUT}
0	0	2V	20V
V_{CC}	0	1.5V	15V
0	V_{CC}	0.9V	9V
0.5 x V_{CC}	0	1.2V	12V
V_{CC}	V_{CC}	0.5V	5V

6. The converter's default mode is set to forced pulse-frequency modulation (FPFM) mode. Select a different mode by adjusting the MODE pin (see Table 2).

Table 2: Mode Selection

Pin Voltage	Mode
0V	Forced PWM
V_{CC}	Auto-PFM/PWM

EVALUATION BOARD SCHEMATIC

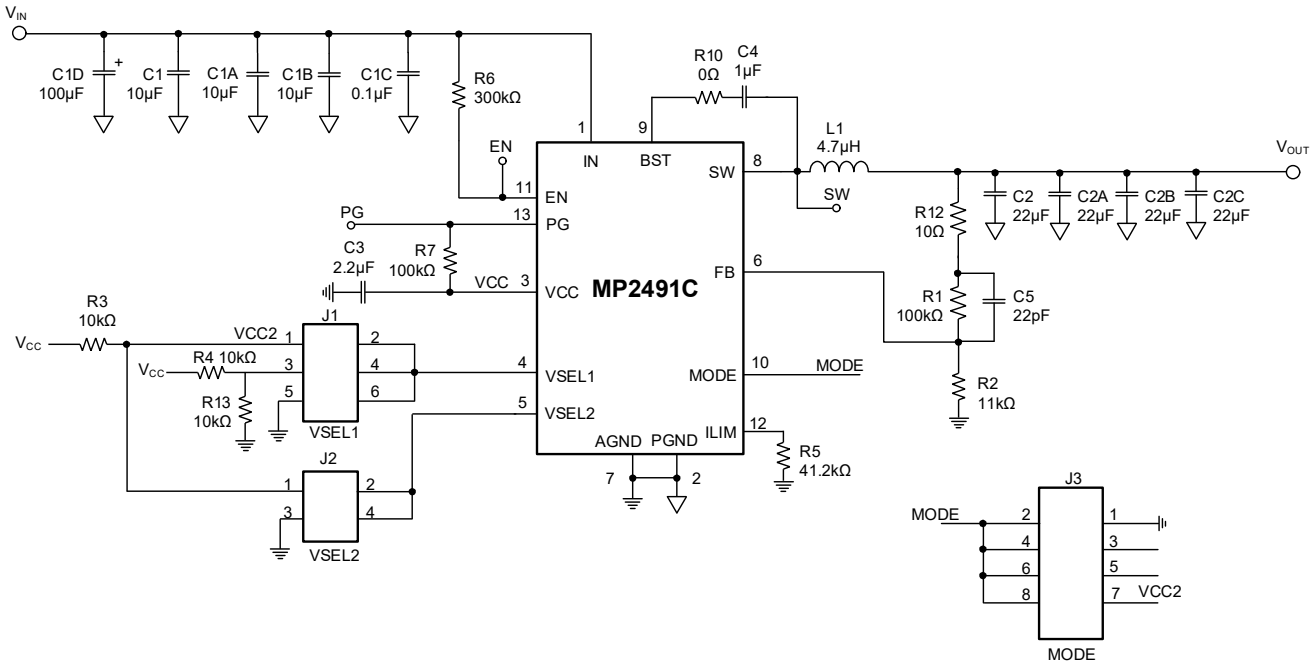


Figure 1: Evaluation Board Schematic

EVL2491C-QB-00A BILL OF MATERIALS

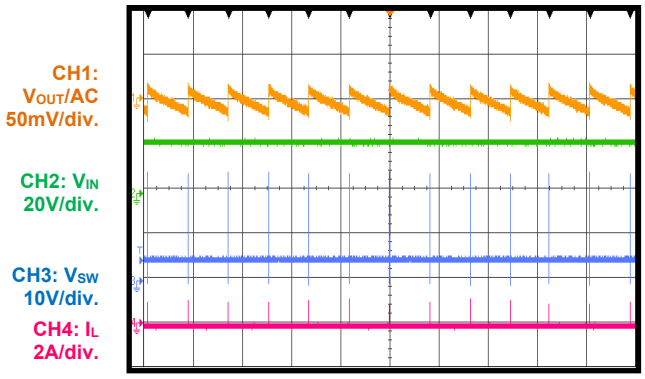
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
3	C1, C1A, C1B	10µF	Ceramic capacitor, 35V, X5R	0805	Murata	GRM21BR61E106KA43L
1	C1C	0.1µF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H104KA93D
1	C1D	100µF	Electrolytic capacitor, 35V	DIP	Chemi-Con	EMZJ35ADA101MF80G
4	C2, C2A, C2B, C2C	22µF	Ceramic capacitor, 25V, X5R	0805	Murata	GRM21BR61E226ME44L
1	C3	2.2µF	Ceramic capacitor, 10V, X7R	0603	Murata	GRM188R71A225KE15D
1	C4	1µF	Ceramic capacitor, 10V, X7R	0603	Murata	GRM188R71A105KA61D
1	C5	22pF	Ceramic capacitor, 50V, C0G	0603	Murata	GRM1885C1H220JA01D
2	R1, R7	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R2	11kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0711KL
3	R3, R4, R13	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
1	R5	41.2kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0741K2L
1	R6	300kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07300KL
1	R10	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	R12	10Ω	Film resistor, 1%	0603	Yageo	RC0603JR-0710RL
1	L1	MPL-AY1050-4R7	Inductor, 4.7µH, I_{SAT} = 15A, R_{DC} = 9.5mΩ,	SMT	MPS	MPL-AY1050-4R7
1	U1	MP2491C	Step-down converter, 32V, 6A	QFN-13 (2.5mmx 3mm)	MPS	MP2491CGQB

EVB TEST RESULTS

V_{IN} = 24V, V_{OUT} = 5V, f_{SW} = 490kHz, L = 4.7µH, PFM mode, T_A = 25°C, unless otherwise noted.

Output Voltage Ripple

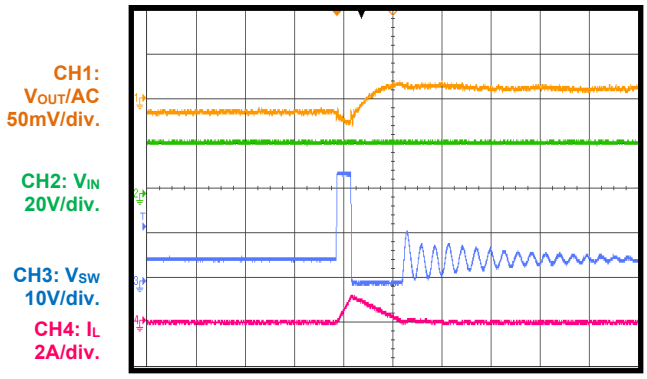
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A



20ms/div.

Output Voltage Ripple

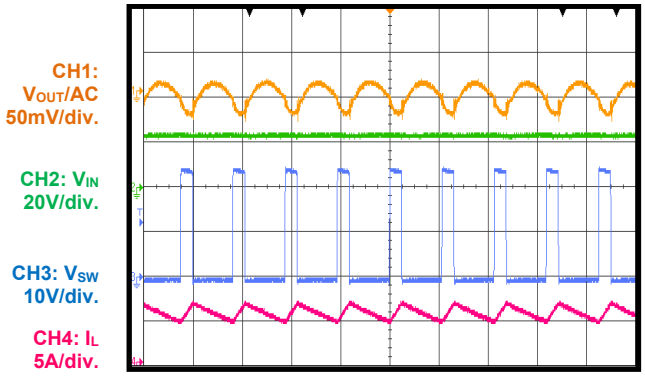
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A



1µs/div.

Output Voltage Ripple

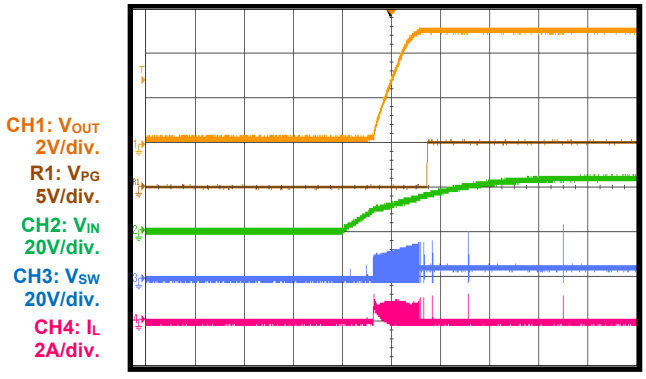
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 6A



2µs/div.

Start-Up

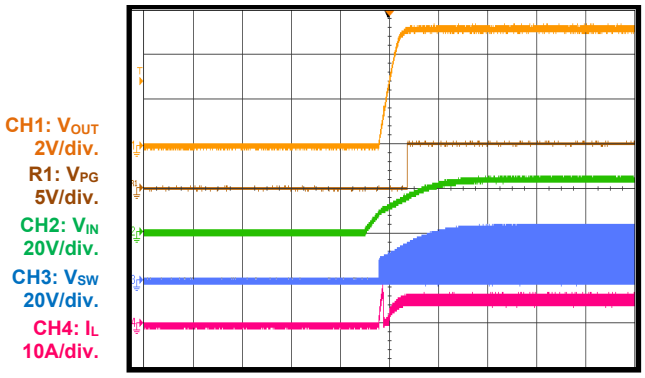
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A



1ms/div.

Start-Up

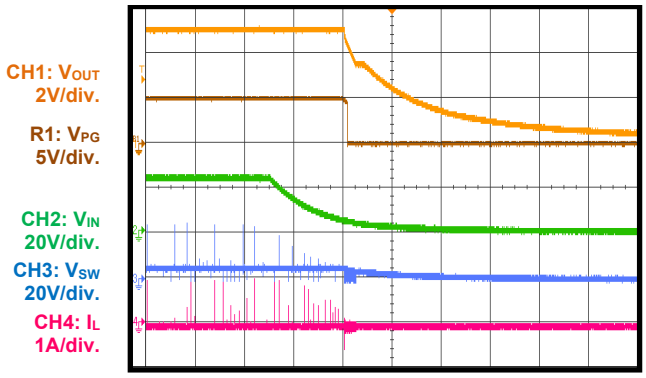
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 6A



2ms/div.

Shutdown

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A



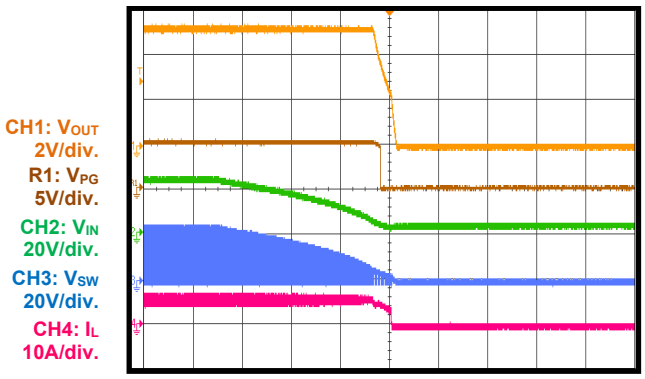
200ms/div.

EVB TEST RESULTS *(continued)*

V_{IN} = 24V, V_{OUT} = 5V, f_{SW} = 490kHz, L = 4.7µH, PFM mode, T_A = 25°C, unless otherwise noted.

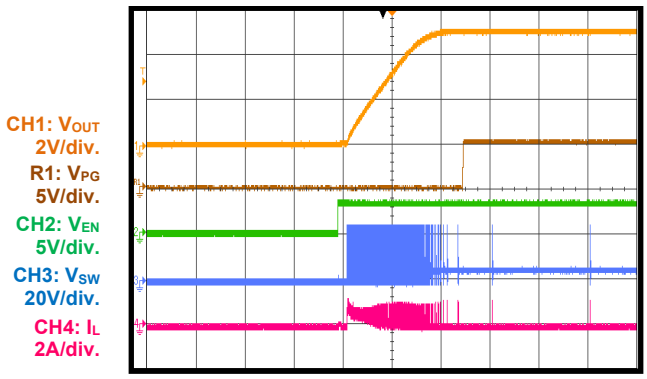
Shutdown

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 6A



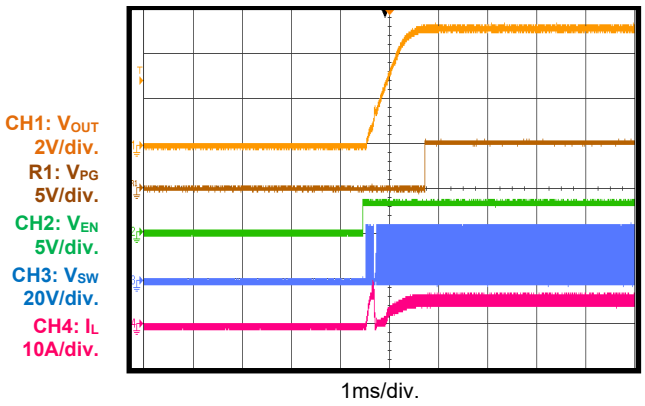
Start-Up through EN

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A



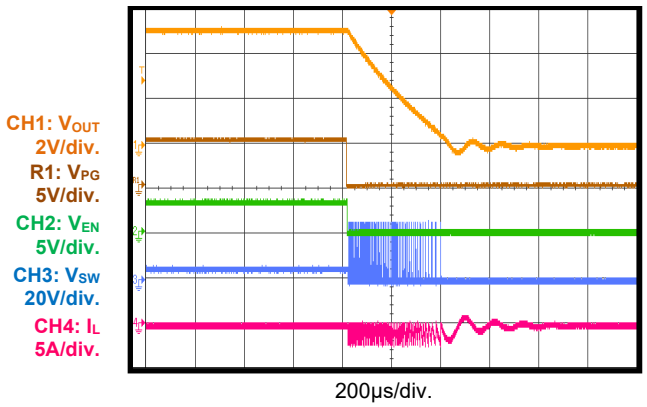
Start-Up through EN

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 6A



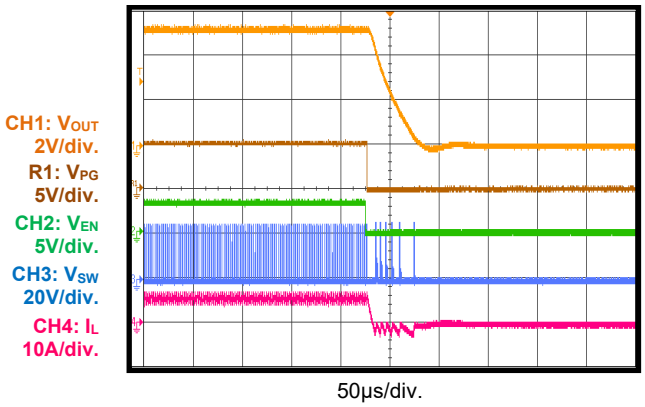
Shutdown through EN

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A



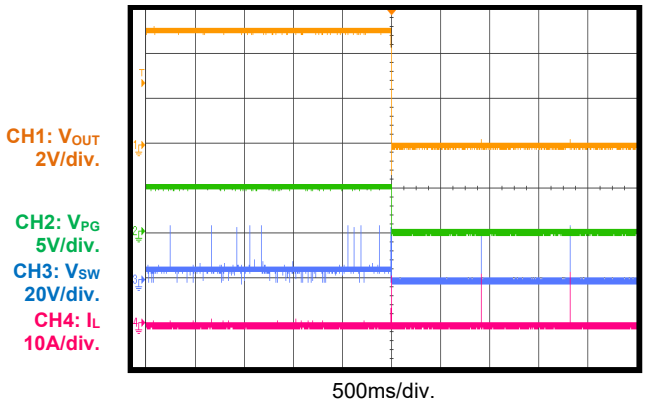
Shutdown through EN

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 6A



SCP Entry

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A

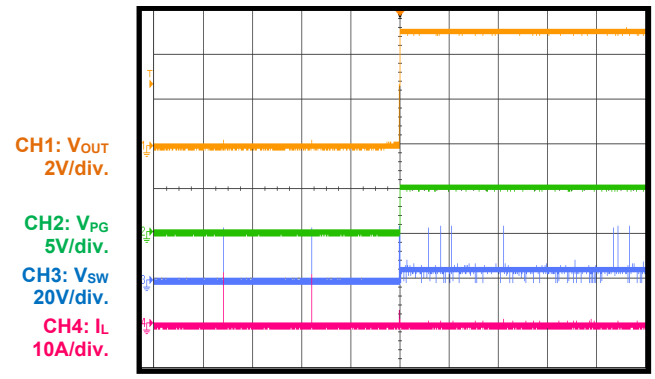


EVB TEST RESULTS *(continued)*

V_{IN} = 24V, V_{OUT} = 5V, f_{SW} = 490kHz, L = 4.7µH, PFM mode, T_A = 25°C, unless otherwise noted.

SCP Recovery

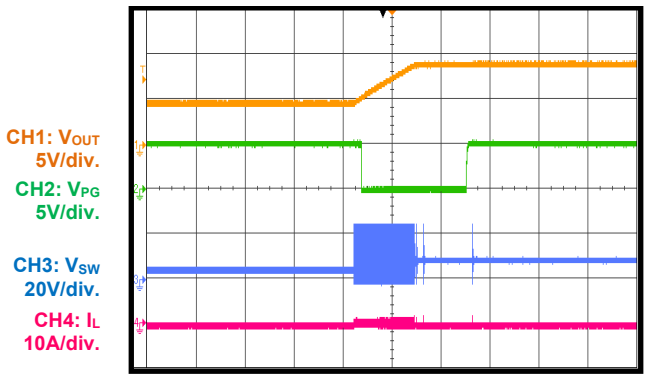
V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A



500ms/div.

V_{OUT} Scaling Up

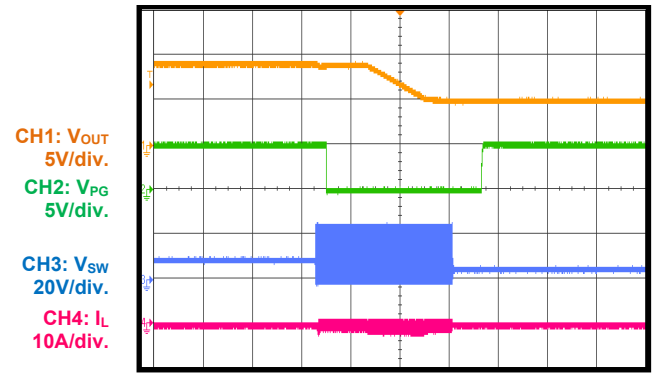
V_{IN} = 24V, I_{OUT} = 0A, V_{OUT} = 5V to 9V



200µs/div.

V_{OUT} Scaling Down

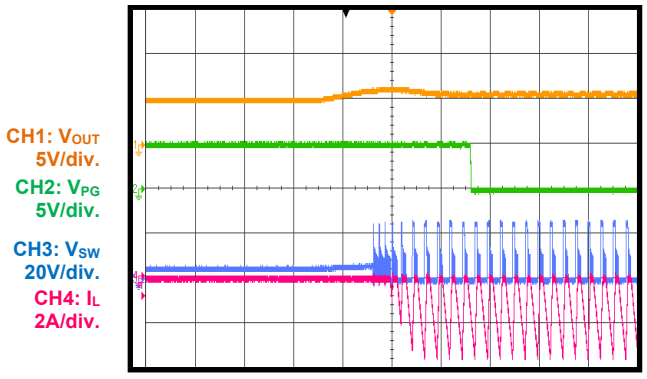
V_{IN} = 24V, I_{OUT} = 0A, V_{OUT} = 9V to 5V



200µs/div.

Output OVP

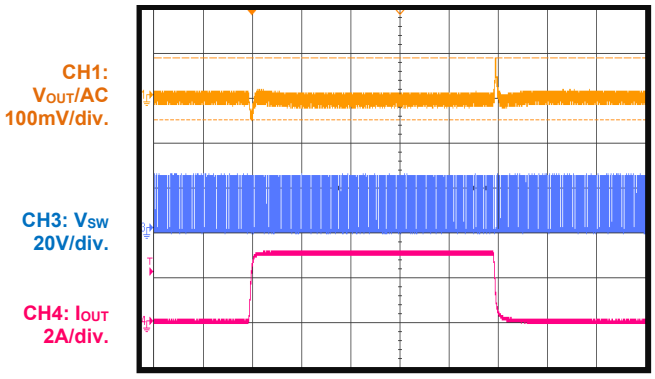
V_{IN} = 24V, I_{OUT} = 0A, external DC voltage added to the output



20µs/div.

Load Transient

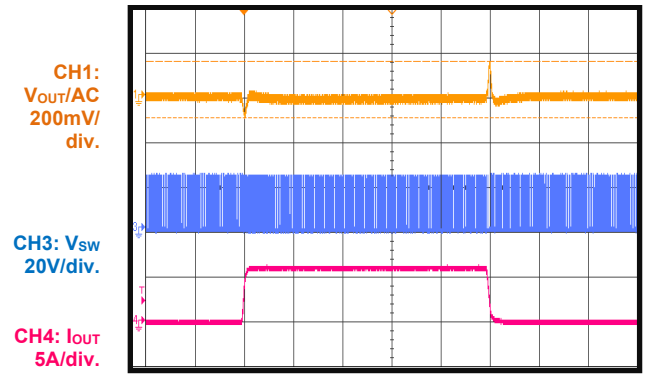
800mA/µs, V_{IN} = 24V, V_{FB} = 1.2V, V_{OUT} = 5V, I_{OUT} = 0A to 3A



100µs/div.

Load Transient

800mA/µs, V_{IN} = 24V, V_{FB} = 1.2V, V_{OUT} = 5V, I_{OUT} = 0A to 6A



100µs/div.

PCB LAYOUT

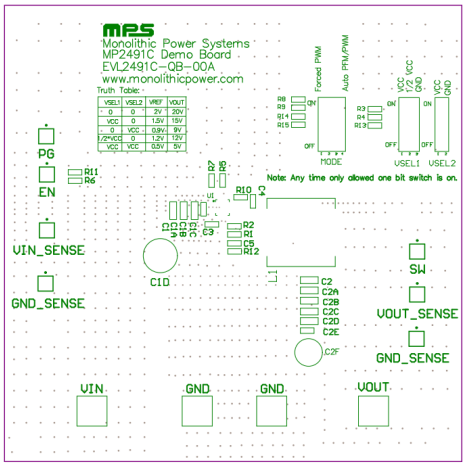


Figure 2: Top Silk

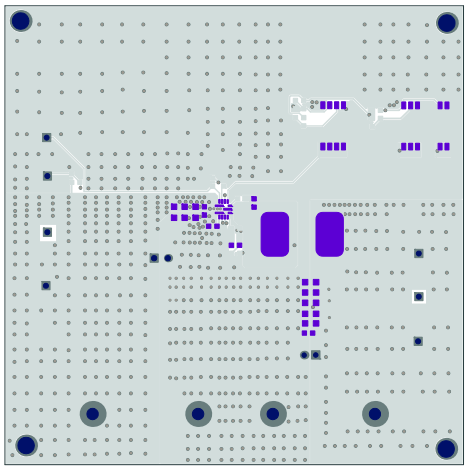


Figure 3: Top Layer

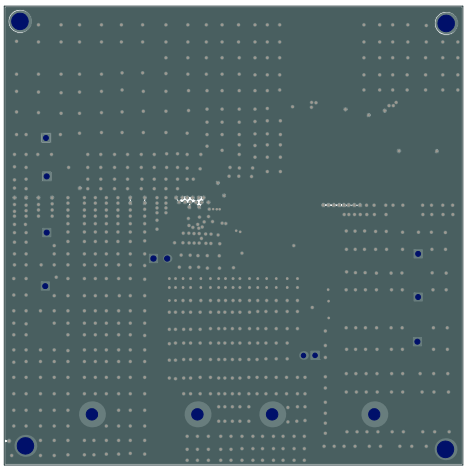


Figure 4: Mid-Layer 1

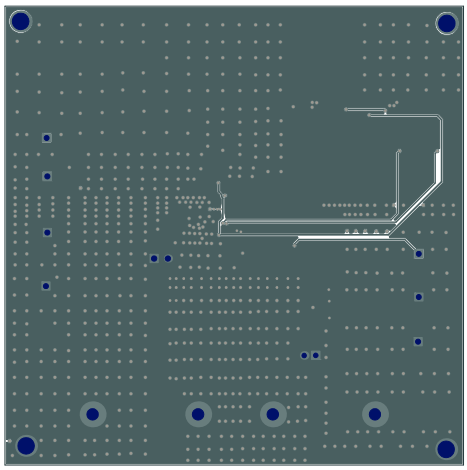


Figure 5: Mid-Layer 2

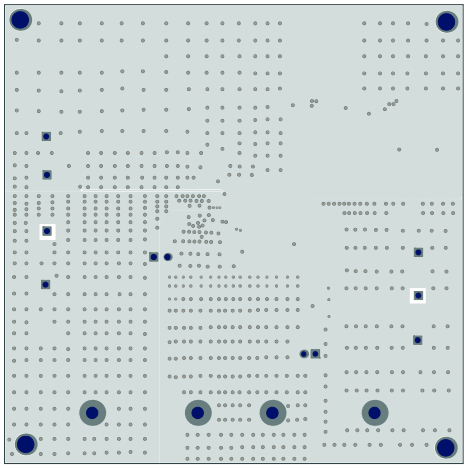


Figure 6: Bottom Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	08/24/2021	Initial Release	-