EVL2491N-QB-00A

32V, 6A, High-Efficiency, Synchronous Step-Down Converter Evaluation Board

DESCRIPTION

The EVL2491N-QB-00A evaluation board is designed to demonstrate the capabilities of the MP2491N, a fully integrated, high-voltage step-down converter. The MP2491N can achieve 6A of continuous output current (I_{OUT}), with excellent load and line regulation across a wide input supply range.

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

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

The MP2491N requires a minimal number of readily available, standard external components, and is available in a QFN-13 (2.5mmx3mm) package.

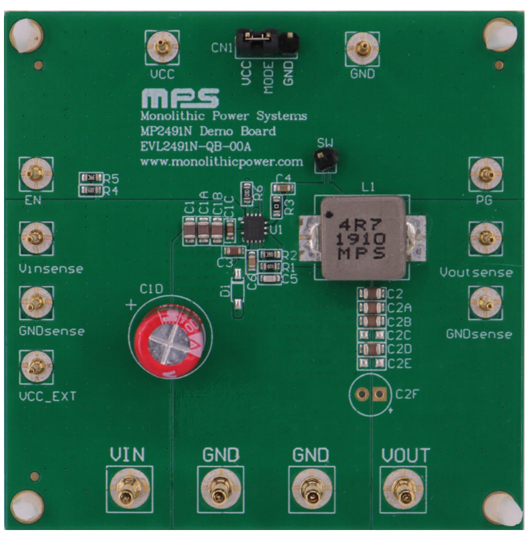
PERFORMANCE SUMMARY (1)

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

Parameters	Conditions	Value
Input voltage (V_{IN}) range		16V to 32V
Output voltage (V_{OUT})	V_{IN} = 16V to 32V, I_{OUT} = 0A to 6A	V_{OUT} = 5V
Maximum output current (I_{OUT})	V_{IN} = 16V to 32V	6A
Typical efficiency	V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 6A	91.9%
Peak efficiency	V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 2A	94.7%
Switching frequency (f_{SW})		540kHz

MPL Optimized Performance with MPS Inductor MPL-AY1050 Series

EVL2491N-QB-00A EVALUATION BOARD



LxWxH (6.35cmx6.35cmx1.3cm)

Board Number	MPS IC Number
EVL2491N-QB-00A	MP2491NGQB

QUICK START GUIDE

The EVL2491N-QB-00A evaluation board is easy to set up and use to evaluate the performance of the MP2491N. For proper measurement equipment set-up, refer to Figure 1 and follow the steps below:

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 automatically start up.
5. Check for the proper output voltage (V_{OUT}) between the VOUTSENSE and GNDSEN terminals.
6. The converter's default mode is set to automatic pulse-frequency modulation (PFM) and pulse-width modulation (PWM) mode. Select a different mode by adjusting the MODE pin (see Table 1).

Table 1: Mode Selection

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

7. Once the proper V_{OUT} is established, adjust the load within the operating range and measure the efficiency, output ripple voltage, and other parameters.

Note:

1) Ensure that V_{IN} does not exceed 32V.

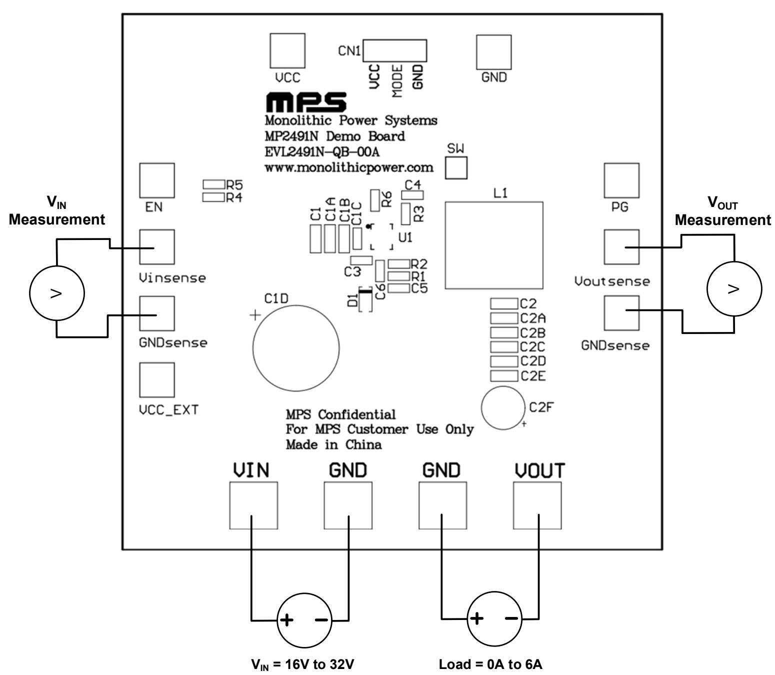


Figure 1: Proper Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

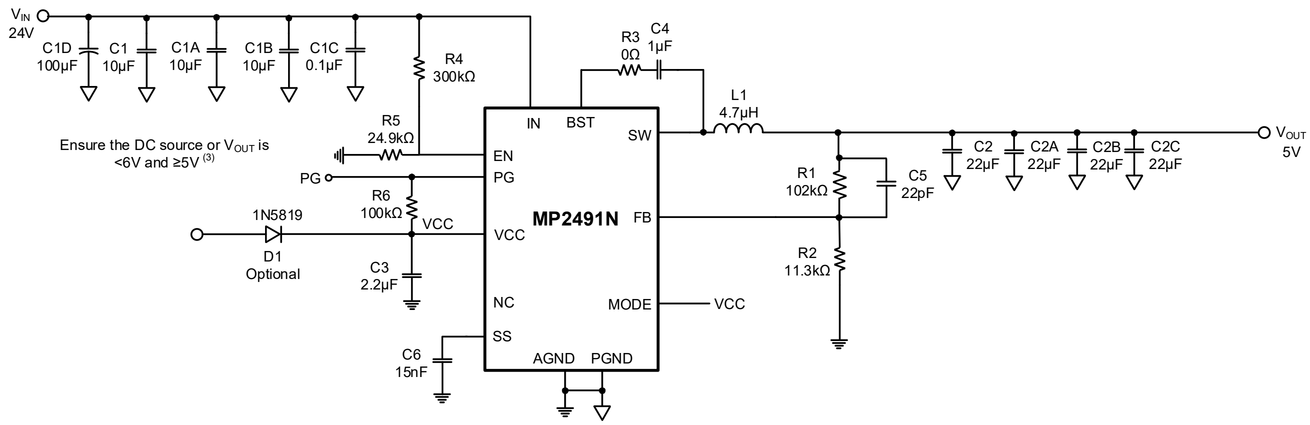


Figure 2: Evaluation Board Schematic

Notes:

2) The EN resistor divider sets the V_{IN} rising threshold to 16V. For low V_{IN} applications, change R5.
3) D1 is an optional diode that can be used to achieve high efficiency under light loads.

EVL2491N-QB-00A BILL OF MATERIALS

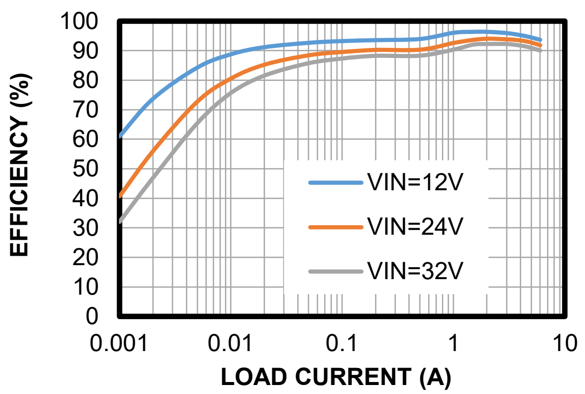
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
3	C1, C1A, C1B	10µF	Ceramic capacitor, 35V, X5R	0805	Murata	GRM21BR61E106KA43L
1	C1C	100nF	Ceramic capacitor, 50V, X7R	0603	Samsung	CL05B104KB5NNNC
1	C1D	100µF	Electrolytic capacitor, 50V	DIP	Wurth	860010674014
4	C2, C2A, C2B, C2C	22µF	Ceramic capacitor, 25V, X5R	0805	Murata	GRM31CR61E226KE15L
1	C3	2.2µF	Ceramic capacitor, 16V, X7S	0603	Murata	GRM188C71C225KE11D
1	C4	1µF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71A105KA61D
1	C5	22pF	Ceramic capacitor, 50V, C0G	0603	Murata	GRM1885C1H220JA01D
1	C6	15nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H153KA01D
1	R1	102kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07102KL
1	R6	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R2	11.3kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0711K3L
1	R3	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	R4	300kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07300KL
1	R5	24.9kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0724K9L
1	D1	NS				
1	L1	MPL-AY1050-4R7	Inductor, 4.7µH, D_{CR} = 9.5mΩ, I_{SAT} = 15A	11mmx 10mmx 4.8mm	MPS	MPL-AY1050-4R7
1	U1	MP2491 N	32V, 6A, synchronous step-down converter	QFN-13 (2.5mmx 3mm)	MPS	MP2491NGQB

EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT} = 5V, T_A = 25°C, unless otherwise noted.

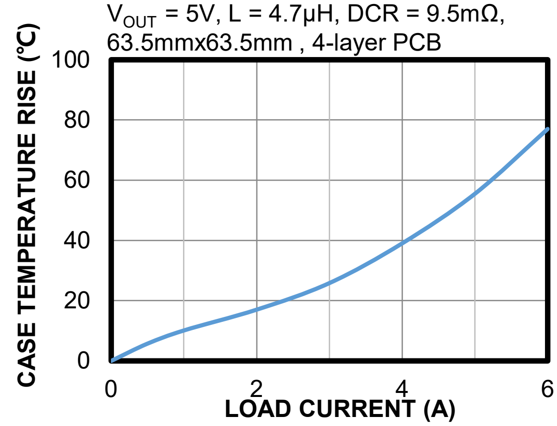
Efficiency vs. Load Current

V_{OUT} = 5V, L = 4.7µH, DCR = 9.5mΩ



Case Temperature Rise vs. Load Current

V_{OUT} = 5V, L = 4.7µH, DCR = 9.5mΩ, 63.5mmx63.5mm , 4-layer PCB

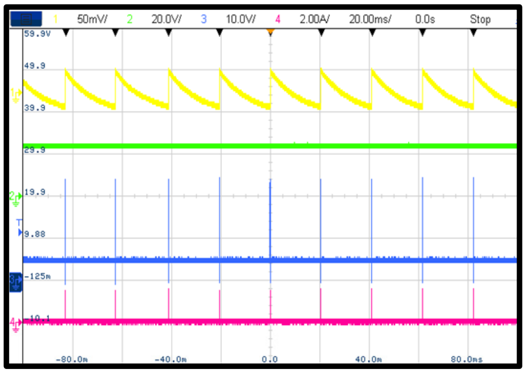


EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{OUT} = 5V, T_A = 25°C, unless otherwise noted.

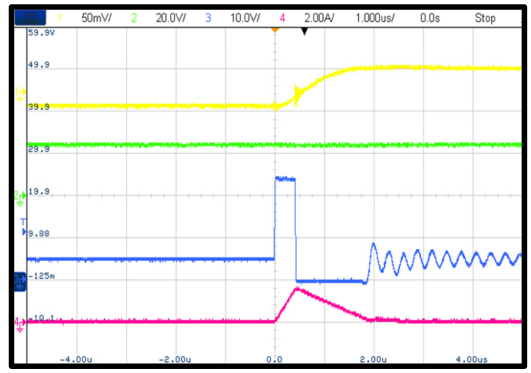
Output Voltage Ripple

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



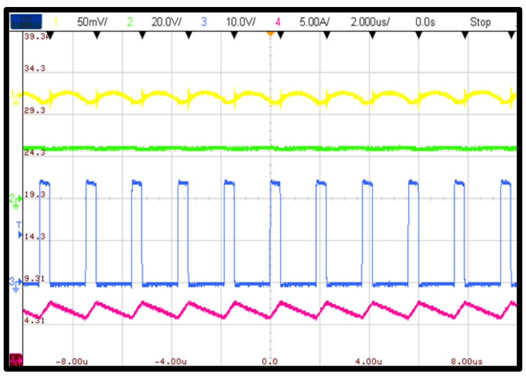
Output Voltage Ripple

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



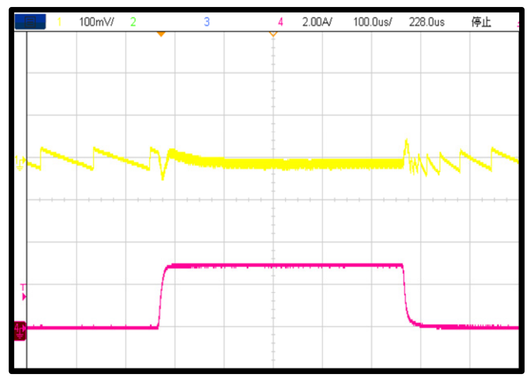
Output Voltage Ripple

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



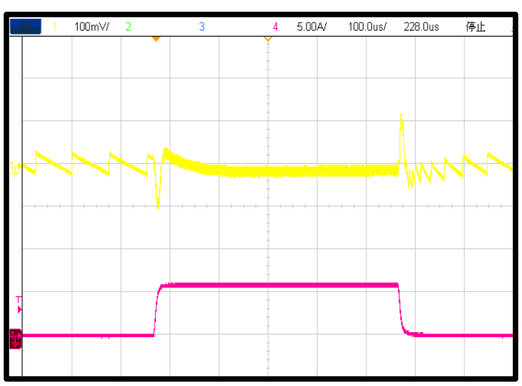
Load Transient Response

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A to 3A, 2.5A/μs with e-load



Load Transient Response

V_{IN} = 24V, V_{OUT} = 5V, I_{OUT} = 0A to 6A, 2.5A/μs with e-load



PCB LAYOUT

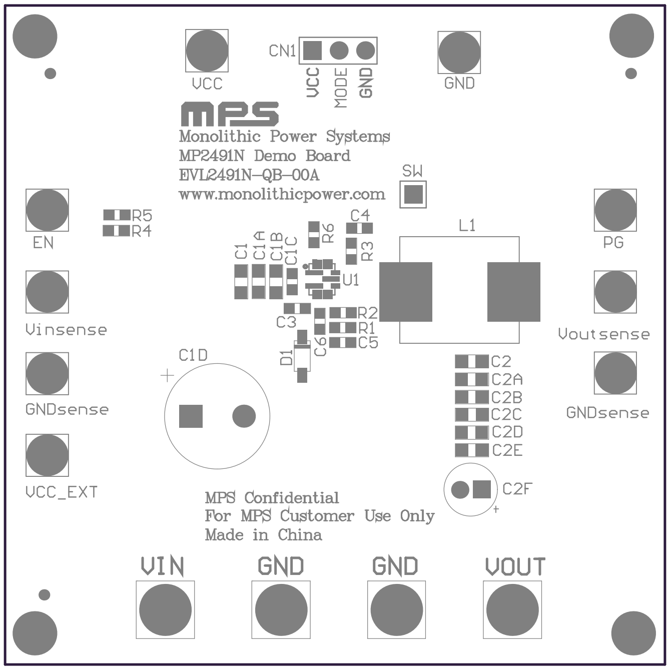


Figure 3: Top Silk

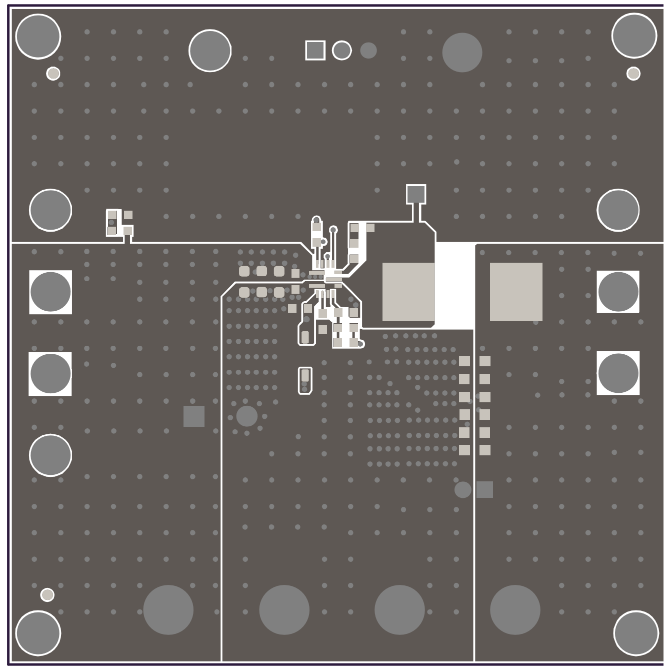


Figure 4: Top Layer

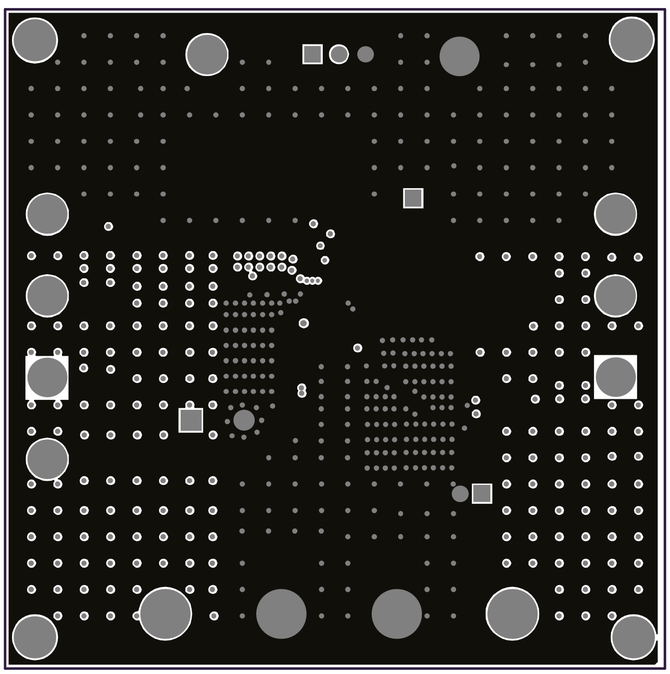


Figure 5: Mid-Layer 1

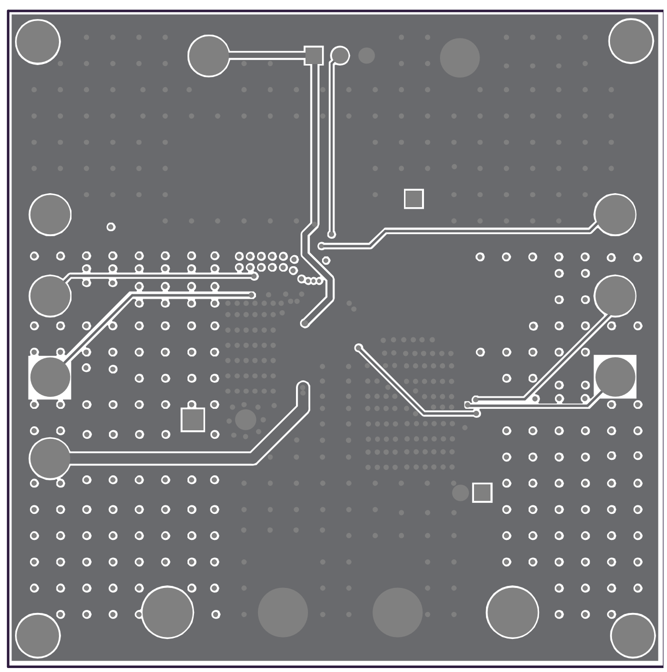


Figure 6: Mid-Layer 2

PCB LAYOUT *(continued)*

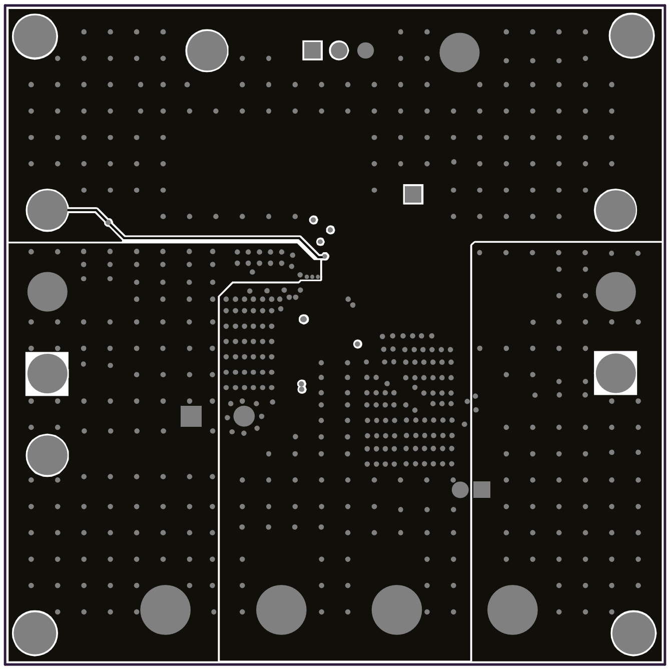


Figure 7: Bottom Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	9/8/2022	Initial Release	-