# EV2497DN-00A

**3A, 50V, 100kHz Step-Down Converter with Programmable Output Current Limit Evaluation Board**

The Future of Analog IC Technology

## DESCRIPTION

The EV2497DN-00A is an evaluation board for the MP2497. The MP2497 is a monolithic step-down switch mode converter with a programmable output current limit. It achieves 3A continuous output current over a wide input supply range with excellent load and line regulation. An internal 2~4ms soft start prevents inrush current at turning on. And it is capable of providing output line drop compensation.

MP2497 achieves low EMI signature with well controlled switching edges.

Fault condition protection includes hiccup current limit and short circuit protection, programmable output over voltage protection and thermal shutdown.

The MP2497 requires a minimum number of readily available standard external components.

## FEATURES

- Wide 8V to 50V Operating Input Range
- Programmable up to 3A Output Current
- Programmable Output Over Voltage Protection
- Internal 4ms Soft Start
- Stable with Low ESR Output Ceramic Capacitors
- Fixed 100kHz Frequency
- Low EMI Signature
- Thermal Shutdown
- Output Line Drop Compensation
- Hiccup Circuit Limit and Short Circuit Protection

## APPLICATIONS

- USB Power Supplies
- Automotive Cigarette Lighter Adapters
- Power Supply for Linear Chargers

## ELECTRICAL SPECIFICATIONS

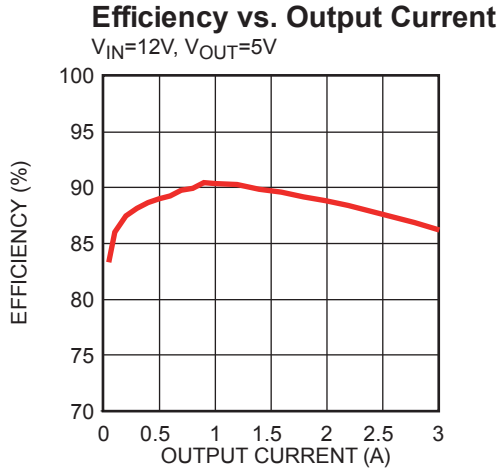
| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 8 - 50 | V |
| Output Voltage | $V_{OUT}$ | 5 | V |
| Output Current Limit | $I_{OUT-L}$ | 3 | A |
| Output OVP | $V_{OVP}$ | 6 | V |



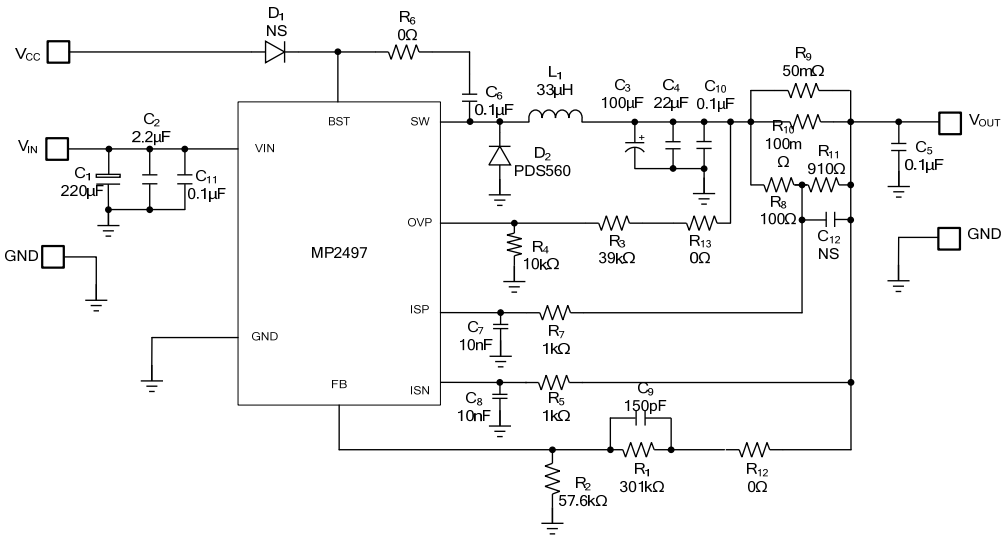
## EV2497DN-00A EVALUATION BOARD


**(L x W x H) 2.5" x 2.5" x 0.4"**
**(6.35cm x 6.35cm x 1cm)**

| Board Number | MPS IC Number |
|---|---|
| EV2497DN-00A | MP2497 |



## EVALUATION BOARD SCHEMATIC




## EV2497DN-00A BILL OF MATERIALS

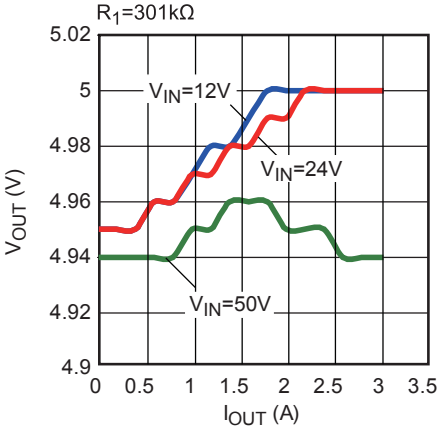
| Qty | RefDes | Value | Description | Package | Manufacturer | Manufacturer P/N |
|---|---|---|---|---|---|---|
| 1 | C1 | 220µF | Electronic Cap., 63V | DIP | Rubycon | 220uF/63V |
| 1 | C2 | 2.2µF | Ceramic Cap., 100V, X7R | 1210 | muRata | GRM32ER72A225KA35L |
| 1 | C3 | 100µF | Electronic Cap., 16V | SMD | Sanyo | 16SVPC100MV |
| 1 | C4 | 22µF | Ceramic Cap., 16V, X7R | 1210 | muRata | GRM32ER71C226KE18L |
| 3 | C5, C6, C10 | 100nF | Ceramic Cap., 50V, X7R | 0603 | muRata | GRM188R71H104KA93D |
| 2 | C7,C8 | 10nF | Ceramic Cap., 50V, X7R | 0603 | TDK | C1608X7R1H103K |
| 1 | C9 | 150pF | Ceramic Cap., 50V, X7R | 0603 | TDK | C1608C0G1H151J |
| 1 | C11 | 0.1µF | Ceramic Cap., 100V, X7R | 0603 | muRata | GRM188R72A104KA35D |
| 0 | C12 | NS | Do Not Stuff | | | |
| 0 | D1 | NS | Do Not Stuff | | | |
| 1 | D2 | 5A,60V | Diode | PowerDI TM5 | Diodes | PDS560 |
| 1 | L1 | 33µH | Inductor, 5.5A/45mΩ | SMD | SMD | 7447709330 |
| 1 | R1 | 301kΩ | Film Res., 1% | 0603 | Yageo | RC0603FR-07301KL |
| 1 | R2 | 57.6kΩ | Film Res., 1% | 0603 | Yageo | RC0603FR-0757K6L |
| 1 | R3 | 39kΩ | Film Res., 1% | 0603 | Yageo | RC0603FR-0739KL |
| 1 | R4 | 10kΩ | Film Res., 1% | 0603 | Yageo | RC0603FR-0710KL |
| 2 | R5,R7 | 1kΩ | Film Res., 1% | 0603 | Royalohm | 0603F1001T5E |
| 1 | R8 | 100Ω | Film Res., 1% | 0603 | Yageo | RC0603FR-07100RL |
| 1 | R11 | 910Ω | Film Res., 1% | 0603 | Yageo | RC0603FR-07910RL |
| 3 | R6, R12,R13 | 0Ω | Film Res., 5% | 0603 | Royalohm | 0603J0000T5E |
| 1 | R9 | 50mΩ | Sense Res., 1% | 2512 | CYNTEC | RL3264-6-R050-FN |
| 1 | R10 | 100mΩ | Sense Res., 1% | 2512 | CYNTEC | RL3264-6-R0100-FN |
| 1 | U1 | | DC-DC Converter | SOIC8E | MPS | MP2497DN |

# EVB TEST RESULTS

**C1=220µF, C2=2.2µF, C3=100µF, C4=22µF, L=33µH, $R_{SENSE}$=R9//R10=33mΩ, R8=100Ω, R11=910Ω, $T_A$=25ºC，unless otherwise noted.**

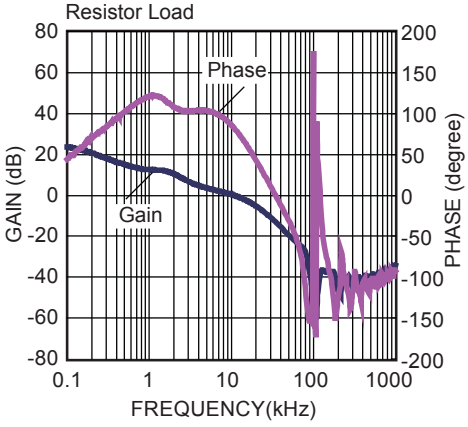
### Output Line Drop Compensation

$R_{SENSE}$=25mΩ, $R_{TRACE}$=120mΩ
$R_1$=301kΩ



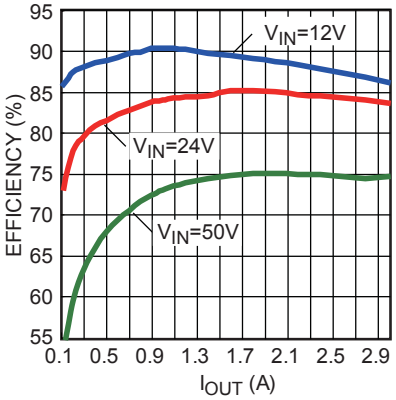

### Loop Gain with Phase Margin

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=3A
Resistor Load



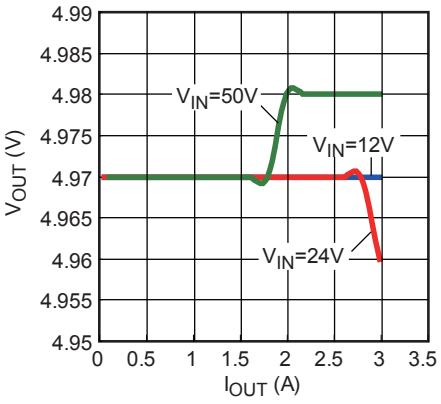

### Efficiency vs. Output Current

$V_{OUT}$=5V



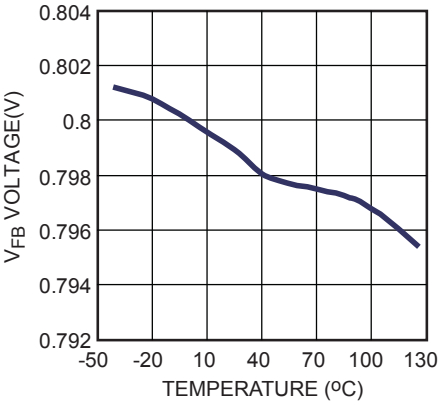

### Load Regulation

Connect ISP, ISN to GND



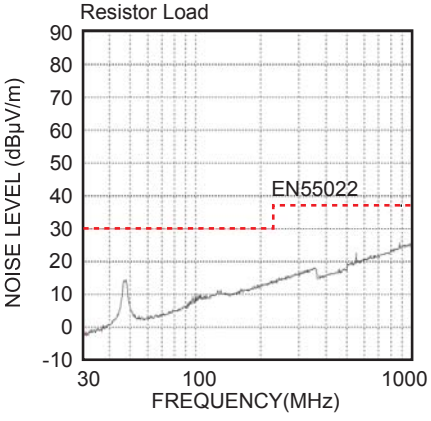

### $V_{FB}$ vs. Temperature

$V_{IN}$=12V




### EMI Radiation

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=3A
Resistor Load

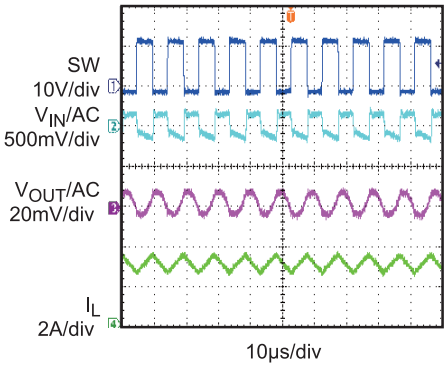


## EVB TEST RESULTS *(Continued)*

**C1=220µF, C2=2.2µF, C3=100µF, C4=22µF, L=33µH, $R_{SENSE}$=R9//R10=33mΩ, R8=100Ω, R11=910Ω, $T_A$=25ºC，unless otherwise noted.**

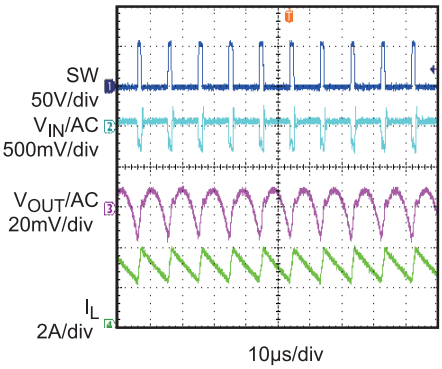
### Steady State

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=3A
E-Load



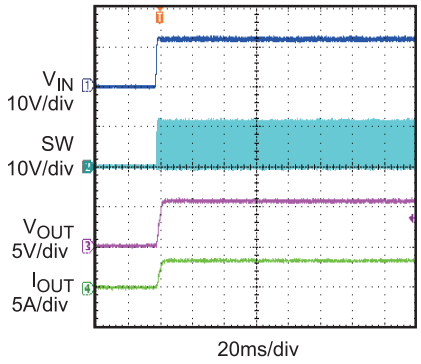

### Steady State

$V_{IN}$=50V, $V_{OUT}$=5V, $I_{OUT}$=3A
E-Load



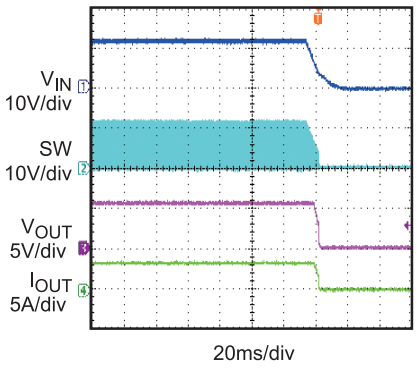

### Power Ramp Up

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=3A
Resistor Load



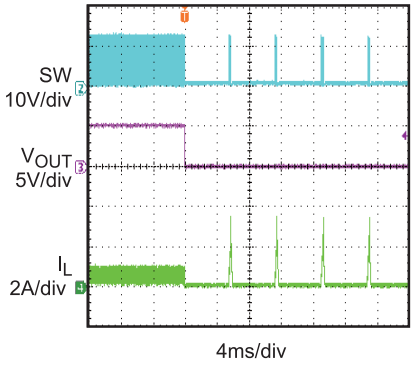

### Power Ramp Down

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=3A
Resistor Load



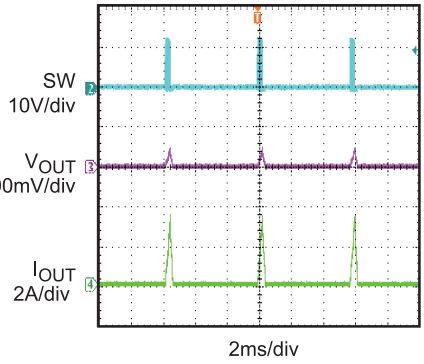

### Short Circuit Enter

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=0.5A
E-Load



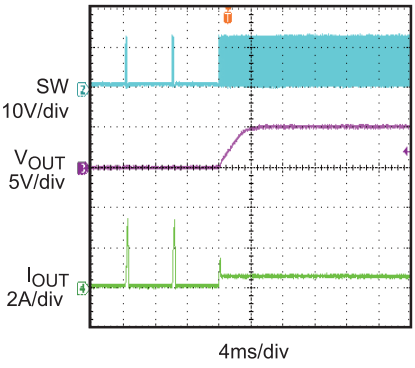

### Short Circuit Steady

$V_{IN}$=12V, $V_{OUT}$=5V
E-Load



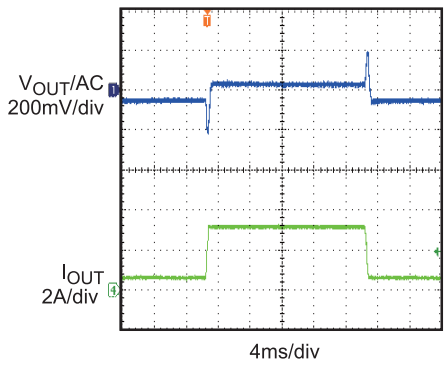

### Short Circuit Recovery

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=0.5A
E-Load



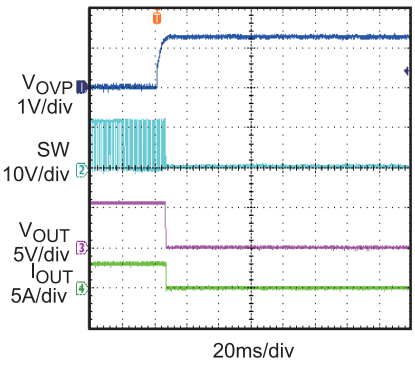

### Load Transient Response

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=0.3A-3A
Slew Rate=6.4mA/µs




### Over Voltage Protection

$V_{IN}$=12V, $V_{OUT}$=5V, $I_{OUT}$=3A
Add an External Power to OVP



## PRINTED CIRCUIT BOARD LAYOUT

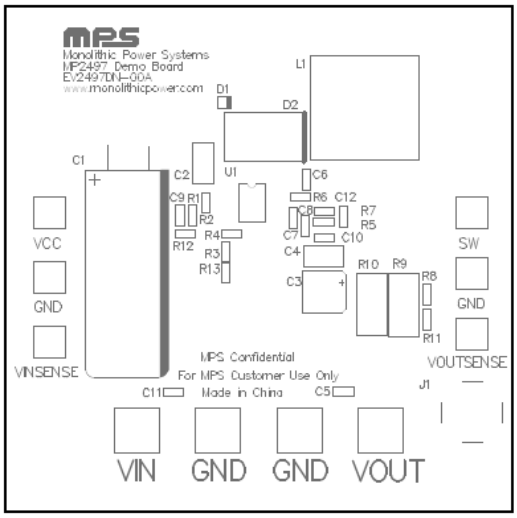



**Figure 1—Top Silk Layer**

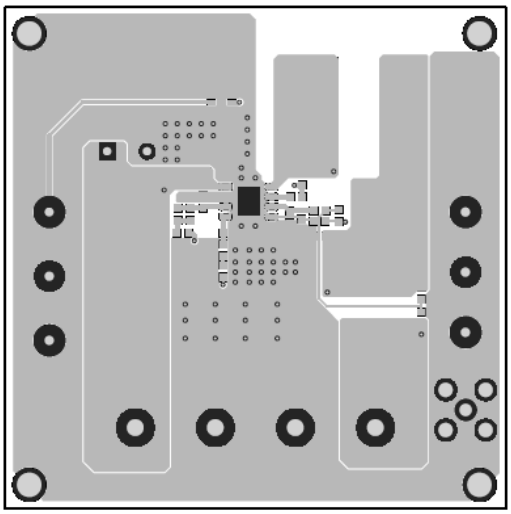


**Figure 2—Top Layer**

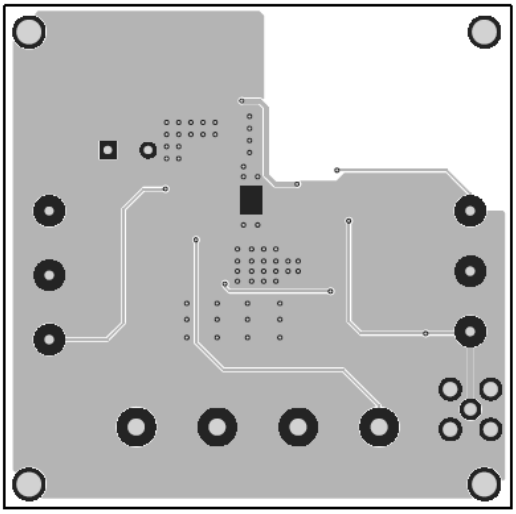


**Figure 3—Bottom Layer**

## QUICK START GUIDE

1. The output voltage of this board is set to 5V. The board layout accommodates most commonly used inductors and output capacitors.
2. Attach the positive and negative ends of the load to the VOUT and GND pins, respectively.
3. Attach the input voltage (8V ≤ $V_{IN}$ ≤ 50V) and input ground to the VIN and GND pins, respectively.
4. The output current limit is set as:

$$I_{OUT\_L} = \frac{100mV}{R_{SENSE}} \times \frac{R8 + R11}{R11} \qquad (R_{SENSE} = R9 // R10)$$

5. The output line compensation is set via R1

$$R1 = \frac{R_{TRACE} \times 400k\Omega}{6 \times R_{SENSE}} \times \frac{R8 + R11}{R11}$$

   Where, the $R_{TRACE}$ is the resistance of the output line.

6. The output voltage $V_{OUT}$ can be set by R2. The formula is:

$$R2 = R1 \times \frac{V_{FB}}{V_{OUT} - V_{FB}}$$

   Where $V_{FB}$ = 0.8V

   For example, for $V_{OUT}$ = 5V, R1=301kΩ:

$$R2 = R1 \times \frac{V_{FB}}{V_{OUT} - V_{FB}} = 301k\Omega \times \frac{0.8V}{5V - 0.8V} = 57.6k\Omega$$

   For the closest standard 1% value.

7. The short circuit current limit is set as:

$$I_{OUT\_SL} = \frac{100mV - 6.2uA \times R7}{R_{SENSE}} \times \frac{R8 + R11}{R11}$$

8. RC filter connected to ISN and ISP pin is better to be set as RC$\geqslant 10^{-5}$s, and it should meet

$$R7 + \frac{R8 \times R11}{R8 + R11} = R5,\ C7 = C8$$

9. When the OVP pin voltage is higher than 1.23V, the part will shutdown. The R3 is set as:

$$R3 = \frac{(V_{OUT} - 1.23V) \times R4}{1.23V}$$