

User Guide
MP-HW80EVAL-01
Analog DC-DC
Evaluation Board

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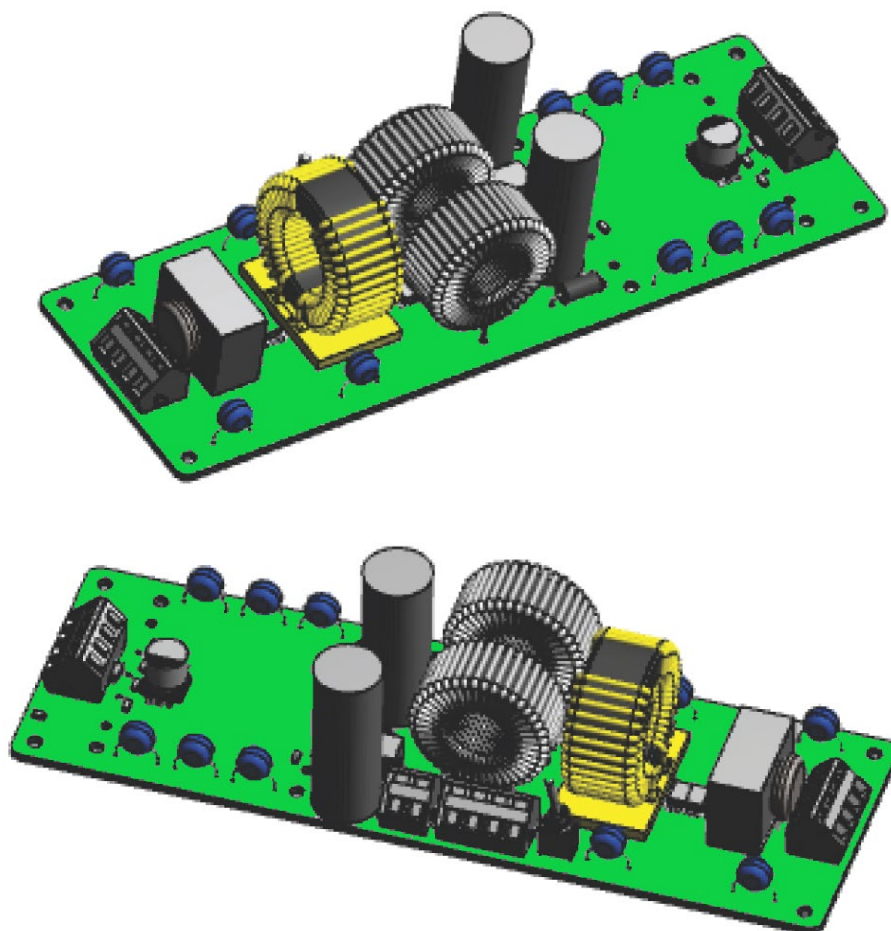
1. Introduction

MP-HW80EVAL-01 Evaluation Board User Guide

The MP-HW80EVAL-01 Evaluation Board is designed to assist with the evaluation of the IRH-W80, 250W, 10:1 input range DC/DC converter module from Murata Power Solutions. The IRH-W80 series of isolated regulated converter modules, deliver an impressive 250W single output from a wide input range of 16V – 160Vdc, complying with the input battery voltage transient range of EN50155.

The half brick module offers high efficiency levels up to 90%, with an input – output isolation voltage of 4242Vdc. The module features Overvoltage, Overcurrent, Short Circuit, Adjustable output voltage, Adjustable Current Limit, Positive or Negative Logic enable, Pulse output signal and Hold up function for an external capacitor. See Page 10 for full schematic.

Figure 1 – Evaluation Board

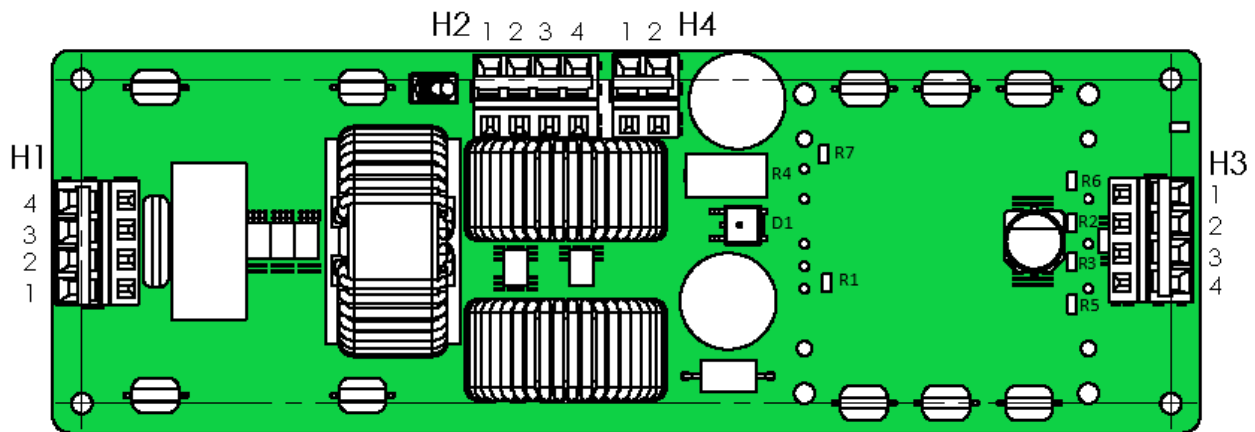


2. Setup

2.1 Connections

This section describes the connector locations/pinouts on the evaluation board, to enable correct set up.

Figure 2 - Connectors Position / Resistor Functions (Top View)



| H1 Input Voltage Connector | |
|----------------------------|------|
| Pin 1 | VIN- |
| Pin 2 | VIN- |
| Pin 3 | VIN+ |
| Pin 4 | VIN+ |

| H2 Signal Connector | |
|---------------------|--------|
| Pin 1 | PULSE |
| Pin 2 | VIN- |
| Pin 3 | ON/OFF |
| Pin 4 | PE |

| Resistor / Function | |
|---------------------|-----------|
| R1 | UVLO |
| R2 | TRIM DOWN |
| R3 | TRIM UP |
| R4 | CHARGE |
| R5 | SENSE (+) |
| R6 | SENSE (-) |
| R7 | OCF |

| H3 Output Voltage Connector | |
|-----------------------------|-------|
| Pin 1 | VOUT- |
| Pin 2 | VOUT- |
| Pin 3 | VOUT+ |
| Pin 4 | VOUT+ |

| H4 External Hold Up Connector | |
|-------------------------------|--------|
| Pin 1 | VIN- |
| Pin 2 | CHOLD+ |

R1, R2, R3, R5, R6, R7 = SMD0805

2.2 On Board Component Values

2.2.3 OCP Resistor Value

R7 = OCP – Overcurrent Protection.

By adding a resistor SMD0805 to position R7 on the PCB, it is possible to set the overcurrent threshold point. Leave unconnected if not used.

Figure 3 - OCP Resistor Selection

| R7 OCP Value | 562Ω | 665Ω | 845Ω | 1.13kΩ | 1.69kΩ | 3.32kΩ | 6.65kΩ | 10kΩ | Open |
|--------------|-------|-------|-------|--------|--------|--------|--------|-------|-------|
| 24Vin | 14.5A | 16.2A | 18.2A | 20.2A | 22.4A | 24.3A | 25A | 25.5A | 26A |
| 48Vin | 15.5A | 17.4A | 19.4A | 21.1A | 23A | 24.5A | 25.4A | 25.9A | 26.5A |
| 72Vin | 15.5A | 17.4A | 19.4A | 21.1A | 23A | 24.5A | 25.4A | 25.9A | 26.5A |
| 110Vin | 11.6A | 14A | 17.1A | 19.8A | 22.1A | 24.5A | 25.4A | 25.8A | 27A |

2.2.4 Under Voltage Lockout. (UVLO)

By adding a SMD0805 resistor to R1 position as per the table below, the converter will shut down if the input voltage drops below the threshold. The converter will automatically restart when the input voltages rises above the UVLO threshold. Leave unconnected if not used.

Figure 4 - UVLO Resistor Value Table

| Vin | 24V | 36V | 48V | 72V | 96V | 110V |
|----------------|---------|-------------|---------|---------|---------|---------|
| Turn Off | 10V-12V | 17.5V-19.5V | 26V-28V | 40V-43V | 56V-60V | 65V-70V |
| Turn On | 13V-15V | 22V-24V | 31V-34V | 48V-51V | 68V-72V | 80V-84V |
| Resistor Value | Open | 27.4kΩ | 13kΩ | 6.8kΩ | 4.3kΩ | 3.57kΩ |

2.2.5 Output Voltage Trim Resistors

R3 and R2 – Trimming the Output Voltage.

The trim pin of the converter allows the user to adjust the output either +10% or -20% by using SMD0805 fixed value resistors.

Figure 5 - Output Trim Resistor Values

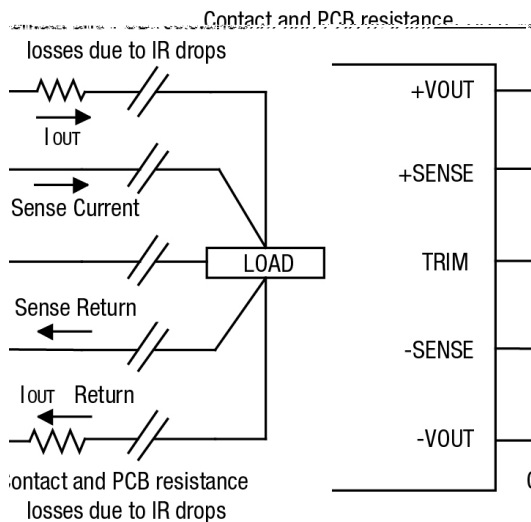
12V Output

| Output Voltage | 9.6V | 10.8V | 11.4V | 12.6V | 13.2V |
|----------------|------|-------|--------|-------|-------|
| R3 - Trim Up | NA | NA | NA | 188kΩ | 97kΩ |
| R2 - Trim Down | 4kΩ | 8.9kΩ | 18.7kΩ | NA | NA |

2.2.6 Sense Connections

If intended to utilize the output sense feature, please ensure that you short out, or add a zero ohm link in positions R5, Sense (+) and R6, Sense (-). If it is proposed to use the sense function, then please leave R5 and R6 open circuit, and connect output sense lines to the load. The sense connections can compensate up to 0.5V voltage drop of output leads.

Figure 6 - Remote Sense Connection



2.2.7 Hold Up Circuit

The BUS pin of the IRH250W80 module, is a voltage source output of 80Vdc to allow external capacitors to be connected in order to provide hold up power of the converter. The eval board houses a resistor (R4) to slowly charge the capacitors up, and a feed forward diode (D1) for rapid discharge into the module during hold up mode. The capacitor value can be as per the below table to provide 10msec or 20msec of hold up. Connect the capacitor to H4 Pin 1 = VIN-, Pin 2 = CHOLD+. As per Figure 2.

Figure 7 - Hold-Up Capacitor Values

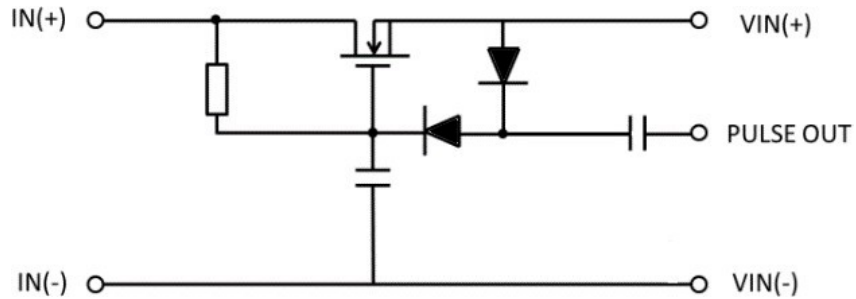
| Hold-up time | 24Vin | 36Vin | 48Vin | 72Vin | 96Vin | 110Vin |
|--------------|--------|--------|--------|--------|--------|--------|
| 10ms | 2200uF | 2200uF | 2200uF | 2200uF | 1100uF | 700uF |
| 20ms | 4400uF | 4400uF | 4400uF | 4400uF | 2200uF | 1400uF |

2.2.8 External Fusing

The evaluation board does not have any fusing protection, the user must provide external fusing, circuit breaker protection as required.

2.2.9 Pulse Out

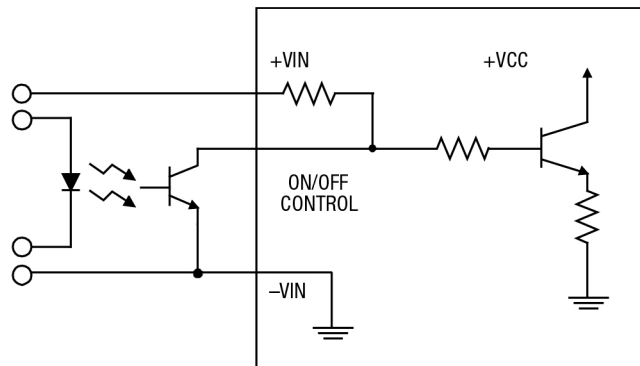
This pin outputs a 1kHz 50% duty cycle pulse voltage with 12V amplitude. It is designed to provide a bootstrap signal for the input inrush current limit circuit and could also indicate operating status with a LED connected. Leave unconnected if not used.



2.2.10 On/Off Control

Connect the On/Off pin (Pin 3, H2) to -VIN (Pin 2, H2) connection if “Negative” logic level is used in the part number of the IRH-W80. Leave the On/Off pin open if “Positive” logic level is used.

Note: A mechanical On/Off switch is also provided on the top side of the evaluation board.



3. EMI Circuit

The following schematic below meets EN55011 Class A.

Figure 8 - EMI Schematic

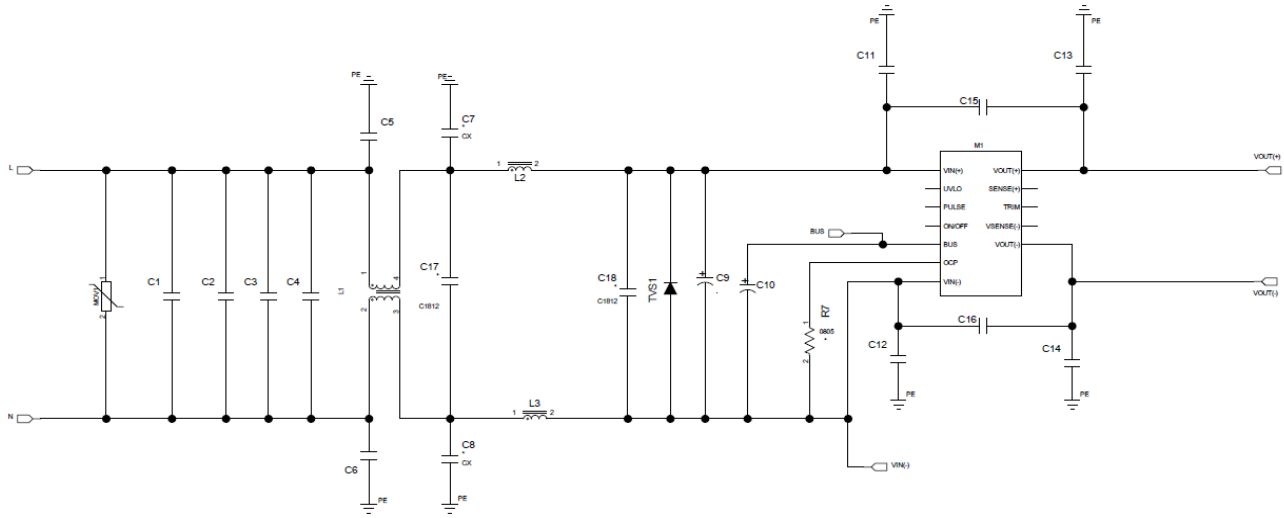


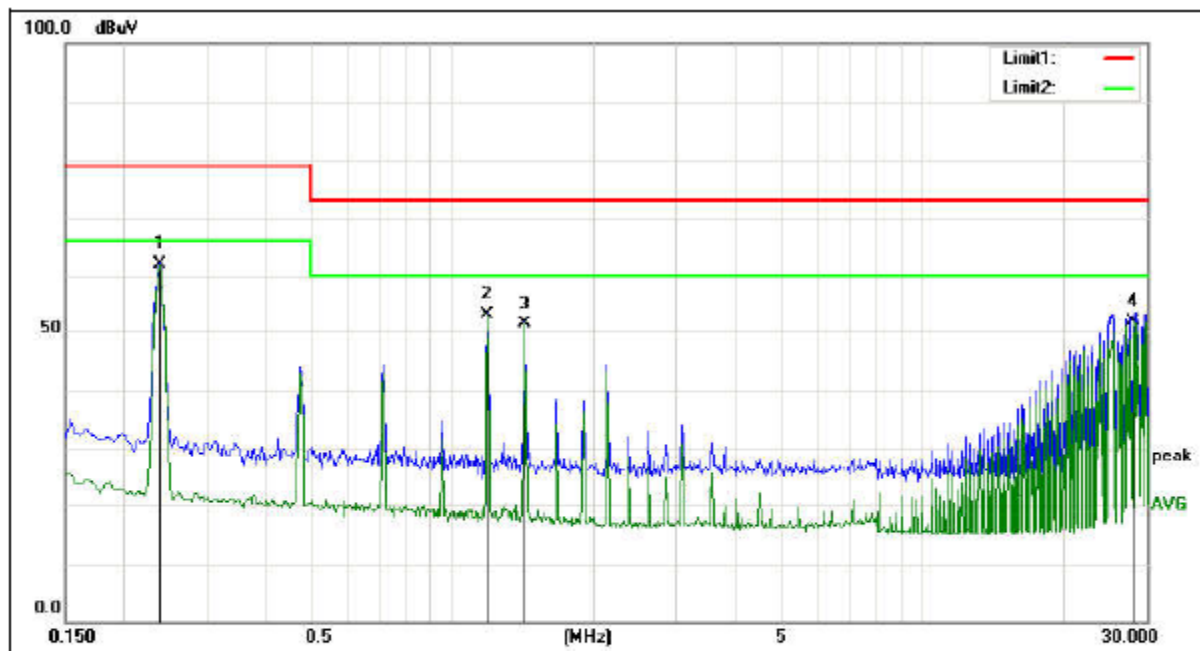
Figure 9 - EMI BOM

| Reference | Manufacturer | MPN | Type | Specifications | Qty |
|----------------------------|--------------|---------------------|---------------------|----------------|-----|
| MOV1 | Epcos | B72214S0141K101 | Varistor | 180V, 36J | 1 |
| TVS1 | Littel Fuse | 1.5KE220A | TVS diode | 185V, 1.5KW | 1 |
| C1 | Faratronc | C212E475K9AC000 | Polyester capacitor | 250V, 4.7uF | 1 |
| C2, C3, C4 | Murata | GRM43DR72E474KW01L | Capacitor MLCC | 250V, 0.47uF | 3 |
| C5, C6, C11, C12, C13, C14 | Murata | DE1E3RA102MA4BQ01F | Safety ceramic cap | 500V, 1000pF | 6 |
| C9, C10 | NCC | EKXJ251EXX271ML40S | E-cap | 250V, 270uF | 2 |
| C15, C16 | Murata | DE1E3RA472MA4BQ01F | Safety ceramic cap | 500V, 4700pF | 2 |
| L1 | Würth | 7448262013 | CM choke | 1.3mH, 20A | 1 |
| L2, L3 | Bourns | 2300HT-220-V-RC1951 | DM choke | 22uH, 19A | 2 |
| C7, C8 | NA | NOT USED | NA | NA | 0 |
| C17, C18 | NA | NOT USED | NA | NA | 0 |

Figure 10 - EMI Results

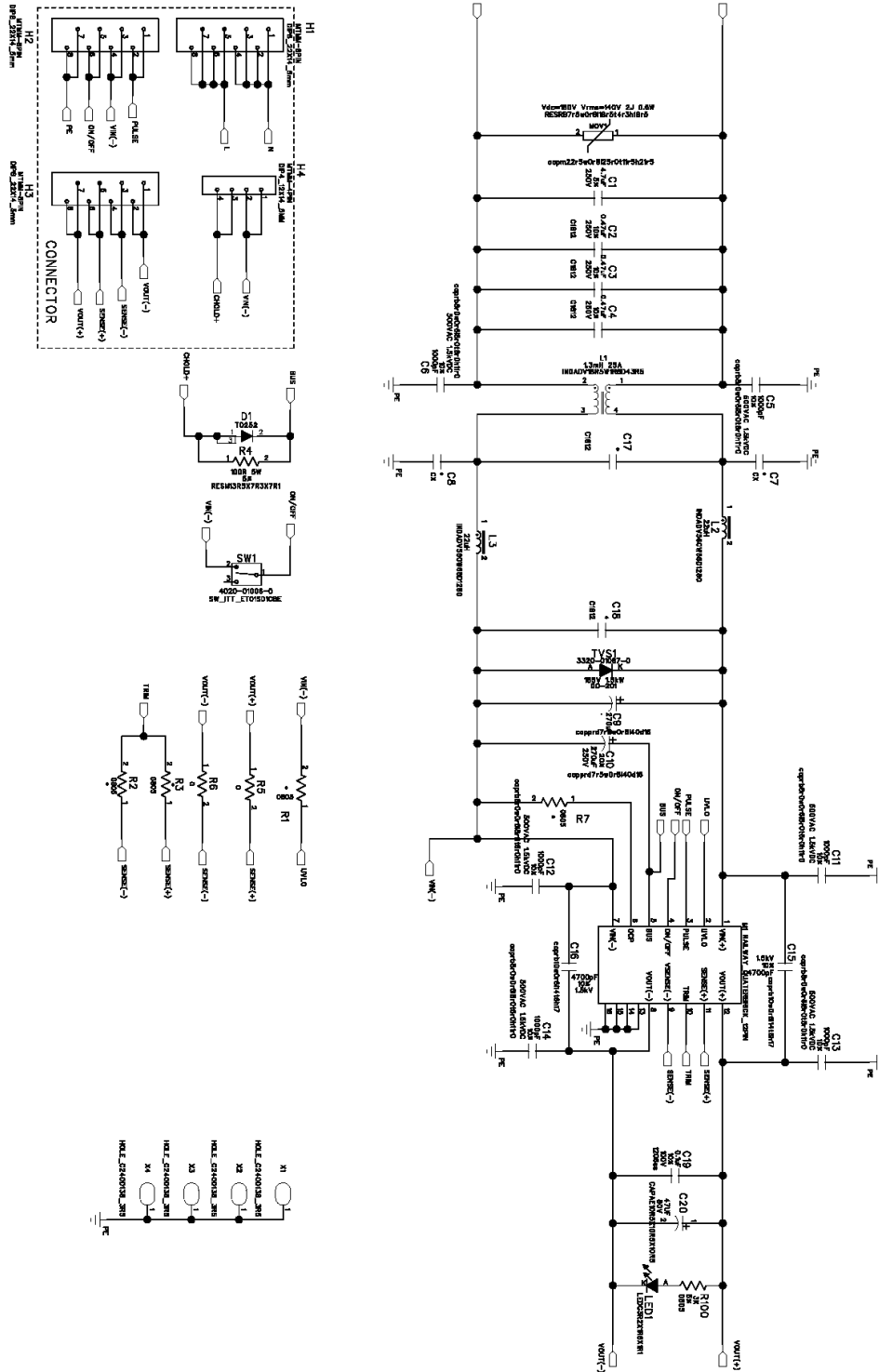
Limit Line as per EN55011 level A

Vin = 110V, Line L

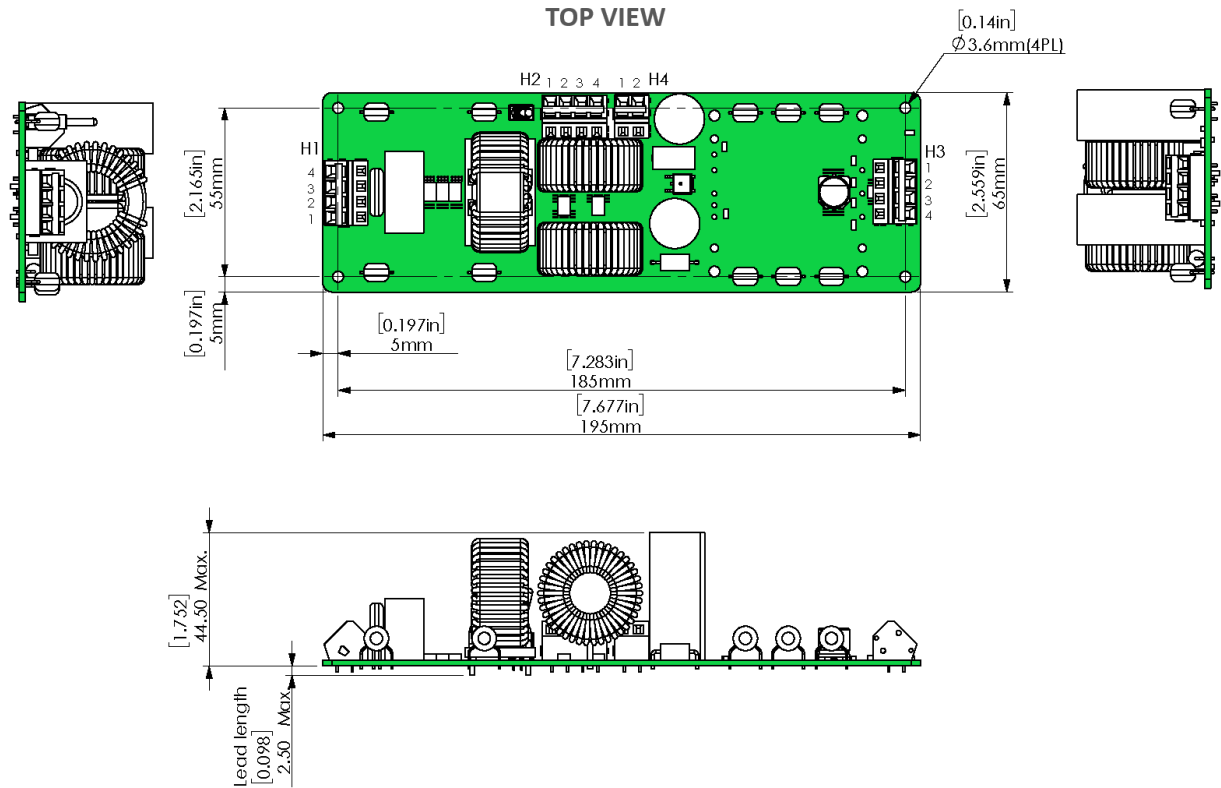


| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 1 | 0.2380 | 42.32 | 19.57 | 61.89 | 66.00 | -4.11 | AVG |
| 2 | 1.1900 | 33.46 | 19.64 | 53.10 | 60.00 | -6.90 | AVG |
| 3 | 1.4260 | 31.80 | 19.65 | 51.45 | 60.00 | -8.55 | AVG |
| 4 | 28.0420 | 31.96 | 19.97 | 51.93 | 60.00 | -8.07 | AVG |

4. Circuit Schematic



5. Mechanical Drawings / Dimensions

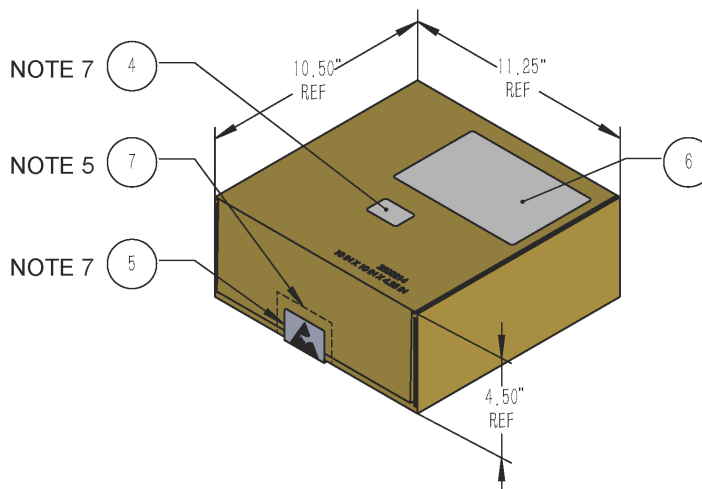
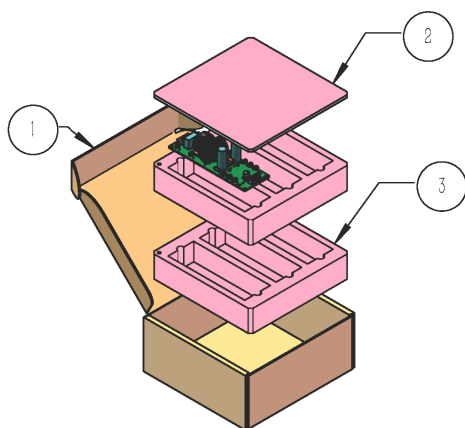


| Connector | Pin number | Function |
|-----------|------------|----------|
| H1 | 1 | VIN- |
| | 2 | |
| | 3 | VIN+ |
| | 4 | |
| H2 | 1 | PULSE |
| | 2 | VIN- |
| | 3 | ON/OFF |
| | 4 | PE |
| H3 | 1 | VOUT- |
| | 2 | |
| | 3 | VOUT+ |
| | 4 | |
| H4 | 1 | VIN- |
| | 2 | CHOLD+ |

NOTES:
 UNLESS OTHERWISE SPECIFIED:
 1: ALL DIMENSIONS ARE IN INCHES [MILIMETER].
 2: ALL TOLERANCES:
 x.xx in, ±0.02 in (x.x mm, ±0.5 mm),
 x.xxx in, ±0.01 in (x.xx mm, ±0.25 mm).
 3: UNIT WEIGHT = 690 grams

6. Packaging Information

| Item No. | Part Number | Description | Qty |
|----------|--------------|-----------------------------------|------------|
| 1 | 2300214 | Carton, 10"x 10"x4.45" | 1 |
| 2 | 2300216 | Pad, ESD Foam, 9.92" SQ, 1/4" Thk | 1 (NOTE 8) |
| 3 | 6256-01639-0 | PACKING FOAM | 2 |
| 4 | 2300159 | Label, Paper, 1.0" x 1.5" | 1 |
| 5 | 5600-01098-0 | Label, ESD Warning | 1 |
| 6 | 5652-01166-0 | Label, Paper, Shipping 2" x 4" | 1 (NOTE 6) |
| 7 | 6200-01211-0 | ESD Tape, 3/4" Wide | .33' |



NOTES:

- THIS DOCUMENT DEFINES THE GENERAL PACKING RULES FOR THE APPLICABLE SHIPPING KIT. INFORMATION FOR SEALING AND MARKING IS NOT PART OF THIS DOCUMENT.
- REFER TO SHIPPING KIT BOM DETAILS.
- INSERT UNITS INTO FOAM POCKETS UB TRAYS APPROX AS SHOWN.
- EACH FOAM TRAY (6256-01639-0) CONTAINS 3 UNITS. IN FULL MPQ QUANTITIES, 2 TRAYS EQUAL TO A TOTAL OF 6 (2x3) UNITS PER BOX.
- FRONT FLAP SHALL BE SEALED WITH ESD TAPE SPECIFIED OR EQUIVALENT AFTER THE BOX IS CLOSED.
- LABEL (ITEM 6) USED FOR MFR OVERPACK CARTON.
- APPLY ESD LABEL (ITEM 5) OVER TAPE USED TO SEAL BOX AND APPLY IDENTIFICATION LABEL (ITEM 4) APPROX AS SHOWN.
- PAD (ITEM 2) MAY, AT MFR'S OPTION, BE EXCHANGED FOR THINNER PAD IF FOAM STACKUP EXCEEDS CARTON HEIGHT BY >1/8" OR ADDITIONAL PAD MAY BE ADDED IF STACKUP IS BELOW INSIDE CARTON HEIGHT BY > 1/8" ALTERNATE PADS: 1/4" THK=2300216, 3/8" THK=2300218, 1/2" THK=2300219, 3/4" THK=2300221.

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 ISO 9001 and 14001 REGISTERED



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