

# 0RQB-D0W12L

## Isolated DC-DC Converter

The 0RQB-D0W12L is an isolated DC/DC converter that provides up to 200 W of output power from a wide input range (72 V, 96 V and 110 V typical).

The unit is designed to be highly efficient. Standard features include remote on/off, input under-voltage lockout, over current protection, short circuit protection and over voltage protection. Conformal coated PCB is used for environmental ruggedness.

### Key Features & Benefits

- 72 / 96 / 110 VDC Input
- 12 VDC @ 16.7 A Output
- 1/4<sup>th</sup> Brick Converter
- Isolated
- Fixed Frequency
- High Efficiency
- Input Under-Voltage Lockout
- Input Over-Voltage Lockout
- OCP / SCP
- Output Over-Voltage Protection
- Over Temperature Protection
- Approved to IEC/EN 62368-1 (TBC)
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)



### Applications

- Industrial
- Railways
- Telecommunications

## 1. MODEL SELECTION

| MODEL NUMBER | OUTPUT VOLTAGE | INPUT VOLTAGE     | MAX. OUTPUT CURRENT | MAX. OUTPUT POWER | TYPICAL EFFICIENCY |
|--------------|----------------|-------------------|---------------------|-------------------|--------------------|
| ORQB-D0W12LG | 12 VDC         | 72 / 96 / 110 VDC | 16.7 A              | 200 W             | 93%                |

### PART NUMBER EXPLANATION

| 0                  | R           | QB                 | - | D0           | W               | 12             | L                          | G            |
|--------------------|-------------|--------------------|---|--------------|-----------------|----------------|----------------------------|--------------|
| Mounting Type      | RoHS Status | Series Name        |   | Output Power | Input Range     | Output Voltage | Active Logic               | Package Type |
| Through Hole Mount | RoHS        | DOSA Quarter Brick |   | 200 W        | 72 / 96 / 110 V | 12 V           | Active Low, with Baseplate | Tray Package |

## 2. ABSOLUTE MAXIMUM RATINGS

| PARAMETER                              | DESCRIPTION  | MIN  | TYP | MAX  | UNITS |
|--|--|------|-----|------|-------|
| Continuous non-operating Input Voltage |  | -0.5 | -   | 164  | V     |
| Remote On/Off                          |  | -0.3 | -   | 15   | V     |
| Current Sink                           |  | 0    | -   | 10   | mA    |
| Isolation Voltage                      | Input to output  | -    | -   | 2250 | V     |
| Operating Temperature                  | Temperature measured at the center of the baseplate, full load | -40  | -   | 95   | °C    |
| Thermal Resistance                     |  | -    | 0.3 | -    | °C/W  |
| Storage Temperature                    |  | -55  | -   | 125  | °C    |
| Altitude                               |  | -    | -   | 2000 | m     |

**NOTE:** Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

## 3. INPUT SPECIFICATIONS

All specifications are typical at 25°C unless otherwise stated.

| PARAMETER                              | DESCRIPTION  | MIN   | TYP | MAX   | UNIT |
|--|--|-------|-----|-------|------|
| Operating Input Voltage 1              | Fully functioning for long term operation.   | 50    | -   | 137.5 | V    |
| Operating Input Voltage 2              | Fully functioning for 100 ms operation.  | 43    | -   | 50    | V    |
| Operating Input Voltage 3              | Fully functioning for 100 ms operation. Full function is not guaranteed but undamaged for 1 s operation. | 137.5 | -   | 156   | V    |
| Input Current (full load)              |  | -     | -   | 5.7   | A    |
| Input Current (no load)                |  | -     | 50  | -     | mA   |
| Remoted Off Input Current              |  | -     | 2   | 5     | mA   |
| Input Reflected Ripple Current (rms)   |  | -     | 20  | -     | mA   |
| Input Reflected Ripple Current (pk-pk) |  | -     | 50  | -     | mA   |
| Under-voltage Turn on Threshold        | Turn on Threshold  | 46    | 47  | 49    | V    |
| Under-voltage Turn off Threshold       | Turn off Threshold, non-latching   | 40    | 41  | 42.5  | V    |
| Over-voltage Shutdown Threshold        | Auto-recovery and non-latching.  | 161   | 163 | 165   | V    |
| Over-voltage Recovery Threshold        |  | 154   | 155 | 156   | V    |

## 4. OUTPUT SPECIFICATIONS

All specifications are typical at nominal input, full load at 25°C unless otherwise stated.

| PARAMETER                   | DESCRIPTION   | MIN   | TYP | MAX   | UNIT |
|-----------------------------|---|-------|-----|-------|------|
| Output Voltage Set Point    | Test condition of the output setpoint:<br>Vin = 110 V, Io = 100% load at 25 °C ambient.       | 11.76 | 12  | 12.24 | V    |
| Load Regulation             |   | -     | -   | ±30   | mV   |
| Line Regulation             |   | -     | -   | ±30   | mV   |
| Regulation Over Temperature |   | -     | ±60 | ±200  | mV   |
| Ripple and Noise (pk-pk)    | 40 kHz – 100 MHz BW, with 1 µF ceramic capacitor and 220 µF bulk electrolytic at output.      | -     | -   | 250   | mV   |
| Ripple and Noise (rms)      |   | -     | -   | 50    | mV   |
| Output Current Range        |   | 0     | -   | 16.7  | A    |
| Output DC Current Limit     | Enter a hiccup mode, non-latching.  | 18    | 20  | 22    | A    |
| Rise Time                   | Vin = 110 V, Io = 16.7 A, with 1 µF ceramic capacitor and 220 µF bulk electrolytic at output. | -     | -   | 200   | ms   |
| Start-up Time               |   | -     | 300 | 500   | ms   |
| Overshoot at Turn on        |   | -     | 0   | 3     | %    |
| Undershoot at Turn off      |   | -     | 0   | 3     | %    |
| Output Capacitance          |   | 220   | -   | 5000  | µF   |
| <b>Transient Response</b>   |   |       |     |       |      |
| ΔV 50%~75% Load             |   | -     | -   | 600   | mV   |
| Settling Time               | di/dt = 0.1 A/us, with 1 µF ceramic capacitor and 220 µF bulk electrolytic at output.         | -     | -   | 2     | ms   |
| ΔV 75%~50% Load             |   | -     | -   | 600   | mV   |
| Settling Time               |   | -     | -   | 2     | ms   |

## 5. GENERAL SPECIFICATIONS

| PARAMETER                        | DESCRIPTION   | MIN                 | TYP    | MAX  | UNIT |
|----------------------------------|---|---------------------|--------|------|------|
| Efficiency                       | Io = 60% – 100% Irate   | 92                  | 93     | -    | %    |
|                                  | Io = 40% - 60% Irate  | 90                  | 92     | -    |      |
| Switching Frequency              |   | -                   | 250    | -    | kHz  |
| Output Voltage Trim Range        |   | 10.8                | -      | 13.2 | V    |
| Over Temperature Protection      | Temperature measured at the center of the baseplate, full load  | -                   | 110    | -    | °C   |
| Output Over Voltage Protection   | Enter a latching, non-hiccup mode   | -                   | -      | 15   | V    |
| Weight                           |   | -                   | 69     | -    | g    |
| FIT                              | Calculated Per Bell Core SR-332<br>(Vin = 110 V, Vo = 12 V, Io = 13 A,<br>Ta = 25°C, FIT = 10 <sup>9</sup> /MTBF) | -                   | 190.48 | -    | -    |
| MTBF                             |   | -                   | 5.25   | -    | Mhrs |
| Dimensions (L x W x H)           |   | 2.45 x 1.45 x 0.59  |        |      | inch |
|                                  |   | 62.23 x 36.83 x15.0 |        |      | mm   |
| <b>Isolation Characteristics</b> |   |                     |        |      |      |
| Input to Output                  |   | -                   | -      | 2250 | VDC  |
| Input to Heatsink                |   | -                   | -      | 2250 | VDC  |
| Output to Heatsink               |   | -                   | -      | 2250 | VDC  |
| Isolation Resistance             |   | 10M                 | -      | -    | Ohm  |
| Isolation Capacitance            |   | -                   | 2200   | -    | pF   |



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## 6. EFFICIENCY DATA

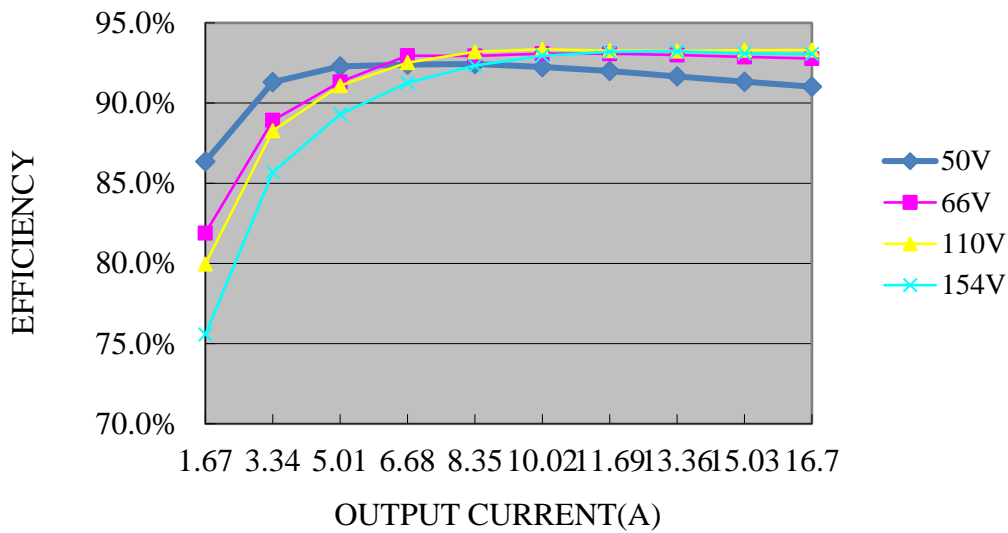


Figure 1. Efficiency data

## 7. REMOVE ON/OFF

| PARAMETER              | DESCRIPTION                                  | MIN  | TYP | MAX | UNIT |
|------------------------|--|------|-----|-----|------|
| Signal Low (Unit On)   | Active Low                                   | -0.3 | -   | 0.8 | V    |
| Signal High (Unit Off) | Remote On/Off pin is open, the module is off | 2.4  | -   | 18  | V    |
| Current Sink           |  | 0    | -   | 1   | mA   |

### Recommended remote on/off circuit for active low

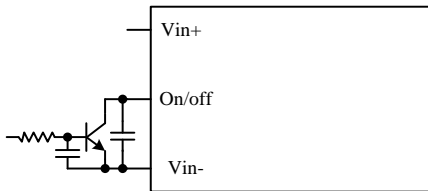


Figure 2. Control with open collector/drain circuit

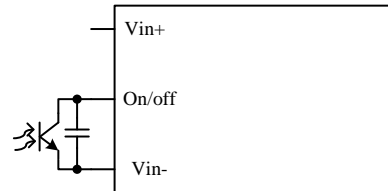


Figure 3. Control with photocoupler circuit

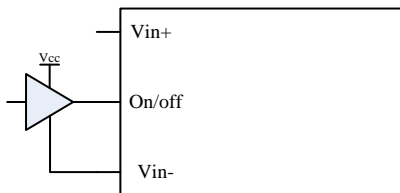


Figure 4. Control with logic circuit

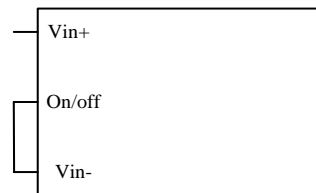


Figure 5. Permanently on



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## 8. REMOTE SENSE

This module has remote sense compensation feature. It can minimize the effects of resistance between output and load in system layout and facilitate accurate voltage regulation at load terminals or other selected point.

1. The remote sense lines carry very little current and hence do not require a large cross-sectional area.
2. This module compensates for a maximum drop of 4% of the nominal output voltage.
3. If the unit is already trimmed up, the available remote sense compensation range should be correspondingly reduced. The total voltage increased by trim and remote sense should not exceed 4% of the nominal output voltage.
4. When using remote sense compensation, all the resistance, parasitic inductance and capacitance of the system are incorporated within the feedback loop of this module which can make an effect on the module's compensation, affecting the stability and dynamic response. A 0.1  $\mu$ F ceramic capacitor can be connected at the point of load to de-couple noise on the sense wires.
5. Recommend the connection of remote sense compensation as below figure. There are a resistor RS+ (100 ohm) from Vo+ to Sense+ and a resistor RS- (100 ohm) from Vo- to Sense- inside of this module.

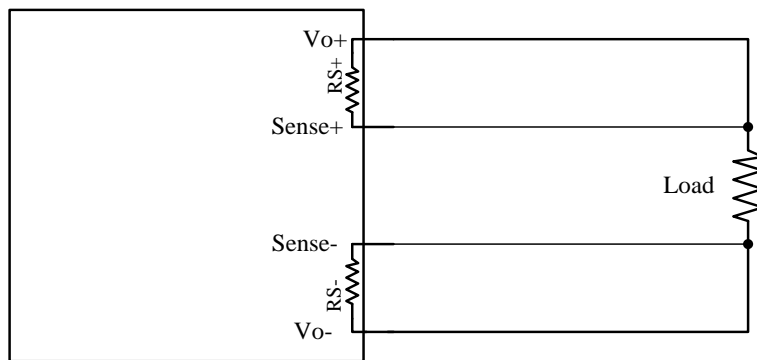


Figure 6.

6. If not using remote sense compensation, please connect sense directly to output at module's pin, that is, connect sense+ to Vo+ and sense- to Vo- at module's pin, the shorter the better. see below figure.

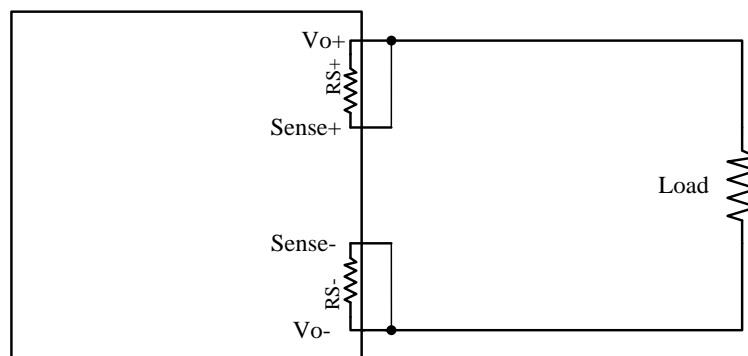


Figure 7.

9. RIPPLE AND NOISE WAVEFORM

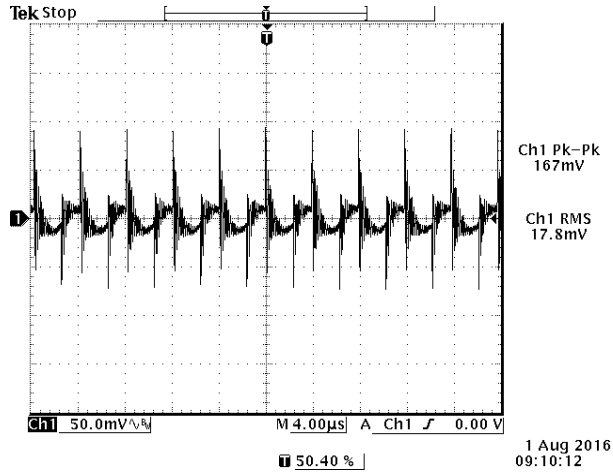


Figure 8.

**Note:** Ripple and noise 110 VDC input, 12 VDC / 16.7 A output and  $T_a = 25^\circ\text{C}$ , and with a  $1\ \mu\text{F}$  ceramic cap and  $220\ \mu\text{F}$  electrolytic cap at output.

10. TRANSIENT RESPONSE WAVEFORMS

Transient Response:  $di/dt=0.1\ \text{A}/\mu\text{s}$ ,  $1\ \mu\text{F}$  ceramic cap and  $220\ \mu\text{F}$  electrolytic cap at output.

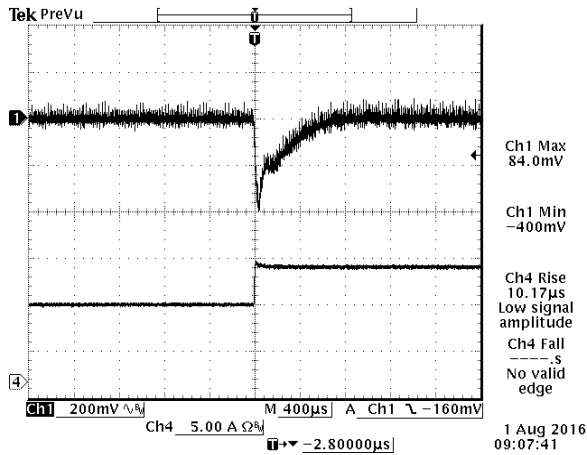


Figure 9.  $V_{out} = 12\ \text{V}$ , 50%-75% Load Transients at  $V_{in} = 110\ \text{V}$ ,  $T_a = 25^\circ\text{C}$

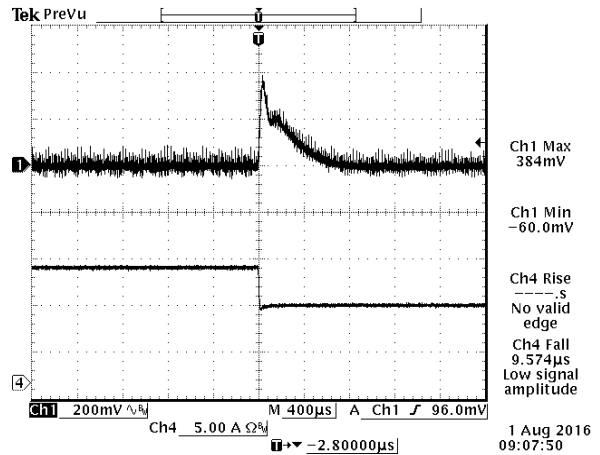


Figure 10.  $V_{out} = 12\ \text{V}$ , 75%-50% Load Transients at  $V_{in} = 110\ \text{V}$ ,  $T_a = 25^\circ\text{C}$

## 11. OVER CURRENT PROTECTION

To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry which can endure current limiting for a few milliseconds. If the over current condition persists beyond a few milliseconds, the module will shut down into hiccup mode and restart once every 800 ms. The module operates normally when the output current goes into specified range. The typical average output current is 0.51 A during hiccup.

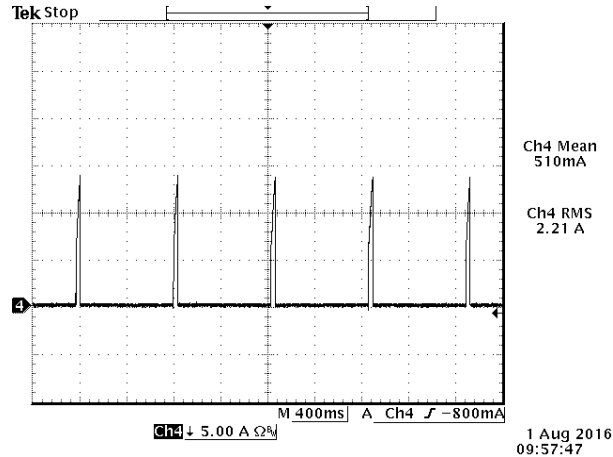


Figure 11. Over current protection

## 12. OVER TEMPERATURE PROTECTION

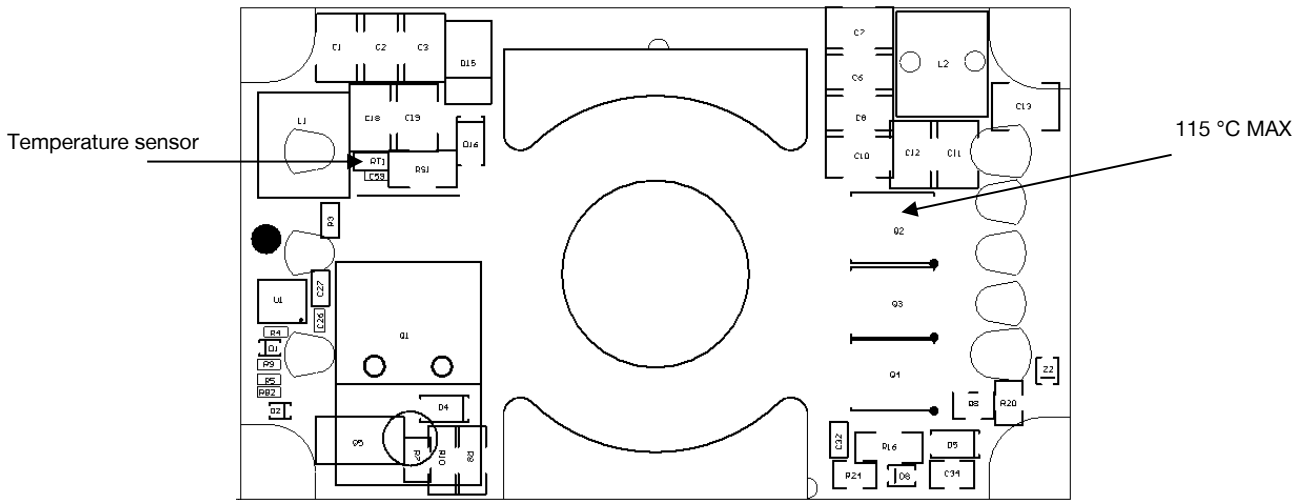


Figure 12. Over temperature protection



13. INPUT UNDER-VOLTAGE LOCKOUT

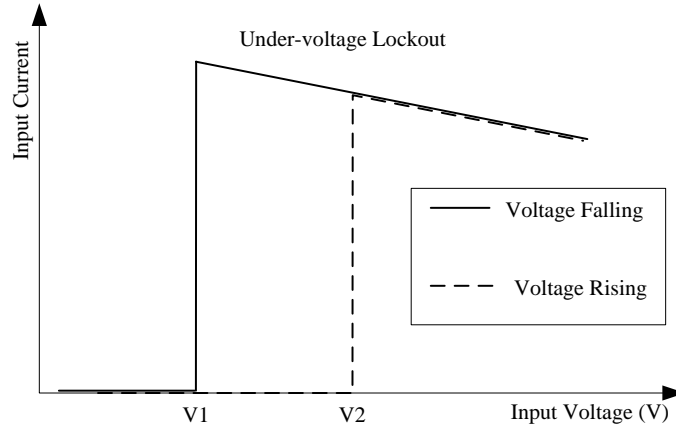
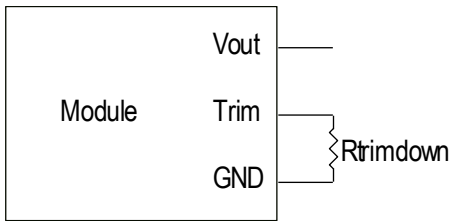


Figure 13. Input under-voltage lockout  
 V1 = 38 V  
 V2 = 40 V

14. TRIM

ORQB-D0W12L Trim Resistor Calculate

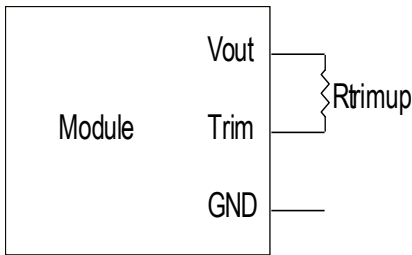
Trim down test circuit



$$R_{trimdown} = \frac{Vo\_req}{12 - Vo\_req} - 1 [k\Omega]$$

Figure 14. Trim down test circuit

Trim up test circuit



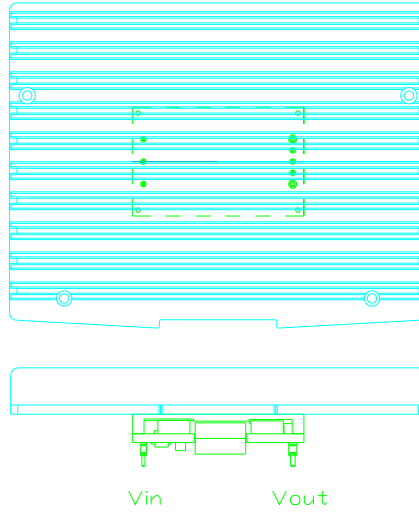
$$R_{trimup} = \frac{1 - 0.10332}{0.10332 - 1.24 / Vo\_req} - 1 [k\Omega]$$

Figure 15. Trim up test circuit

Note: Vo\_req=Desired(trimmed) output voltage[V]

**15. THERMAL DERATING CURVES**

Maximum junction temperature of semiconductors derated to 115 °C.



HSK Dimension:142x110x16mm (16 includes baseplate and ribs)

Figure 16. Thermal test setup

TA is the temperature on the large heatsink rib.

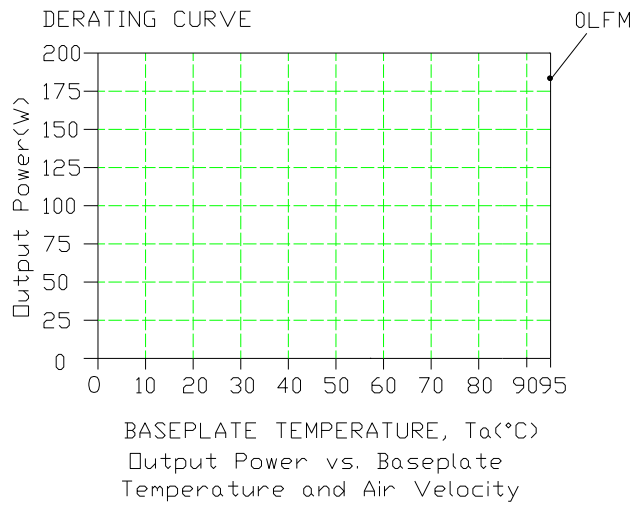


Figure 17. Thermal derating curve

**16. SAFETY & EMC**

**Safety:**

TBC

**EMC:**

Compliance to EN 55032 class A (both peak and average) with the following inductive and capacitive filter.

Test Setup:

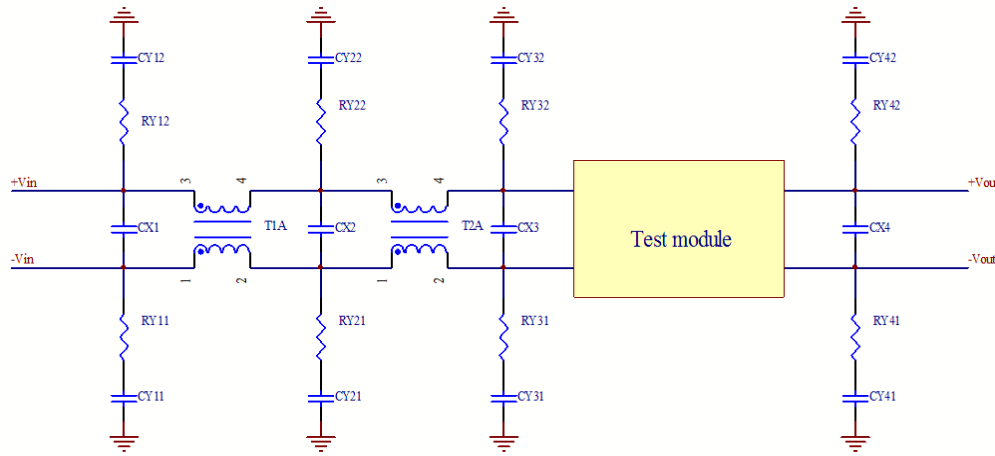


Figure 18.

| T1A | CX1      | RY11 | RY12 | CY11  | CY12  |
|-----|----------|------|------|-------|-------|
| -   | 330µF AL | -    | -    | -     | -     |
| T2A | CX2      | RY21 | RY22 | CY21  | CY22  |
| 1mH | 1µF      | 0R   | 0R   | 2.2µF | 2.2µF |
|     | CX3      | RY31 | RY32 | CY31  | CY32  |
|     | 1µF      | -    | -    | -     | --    |
|     | CX4      | RY41 | RY42 | CY41  | CY42  |
|     | 220µF AL | -    | -    | -     | -     |

Positive

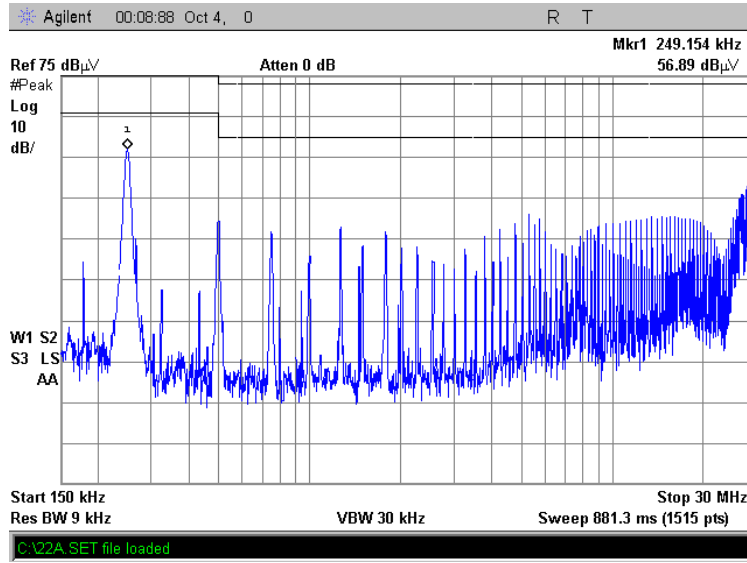


Figure 19.

Negative

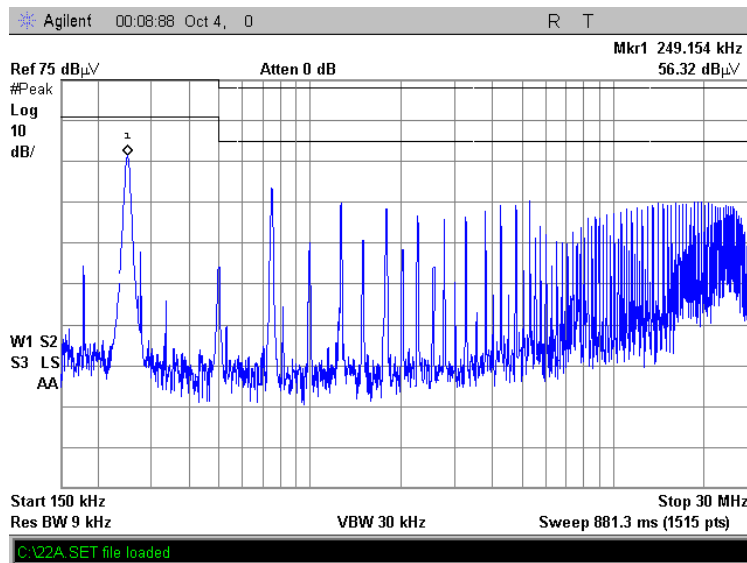


Figure 20.

## 17. MECHANICAL DIMENSIONS

### OUTLINE

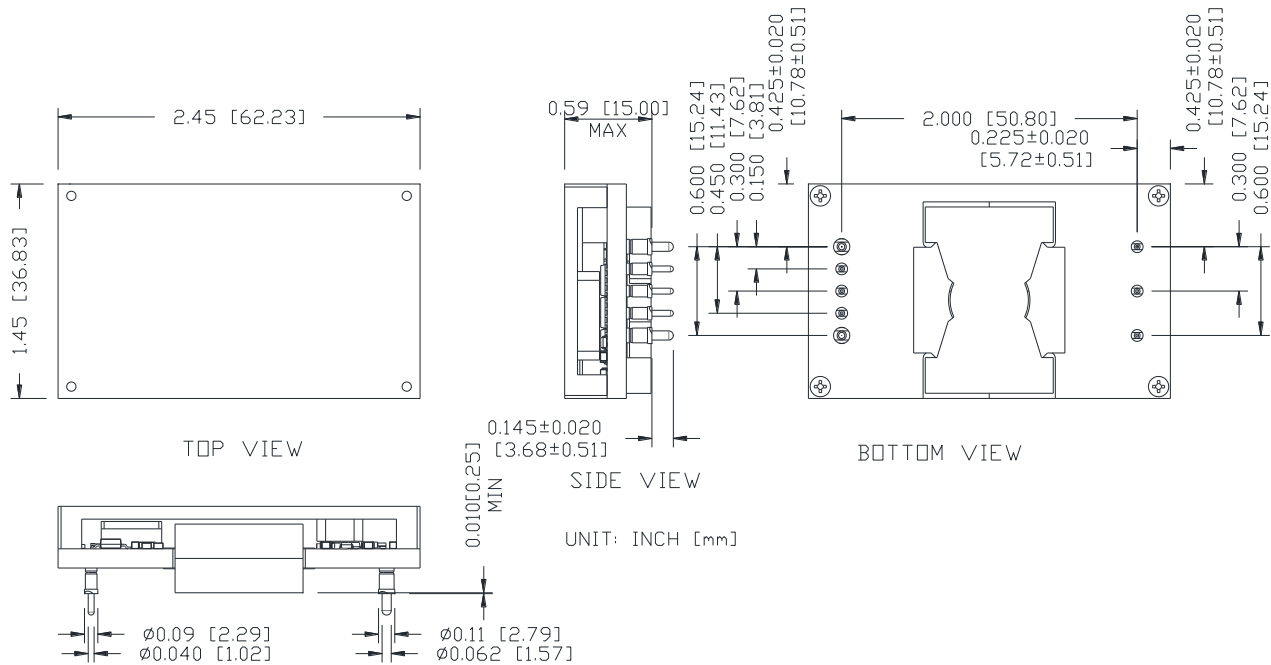


Figure 21. Outline

**Note:** This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 °C for less than 5 seconds.

#### NOTES:

- 1) All Pins: Material - Copper Alloy;  
Finish - Tin plated
- 2) Un-dimensioned components are shown for visual reference only.
- 3) All dimensions in inch [mm]; Tolerances: x.xx +/-0.02 inch [0.51 mm]. x.xxx +/-0.010 inch [0.25 mm].

**PIN DEFINITIONS**

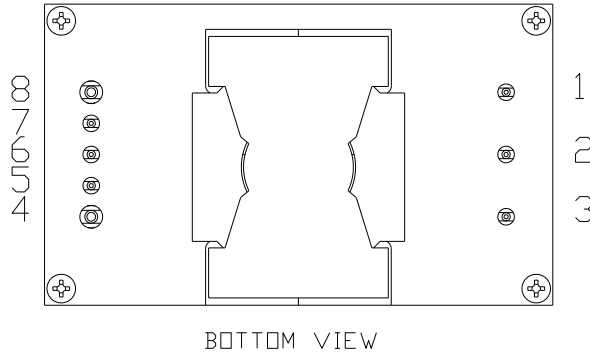


Figure 22. Pins

| PIN | FUNCTION | PIN SIZE | PIN LENGTH |
|-----|----------|----------|------------|
| 1   | Vin(+)   | 0.040"   | 0.145"     |
| 2   | On/off   | 0.040"   | 0.145"     |
| 3   | Vin(-)   | 0.040"   | 0.145"     |
| 4   | Vout(-)  | 0.062"   | 0.145"     |
| 5   | Sense(-) | 0.040"   | 0.145"     |
| 6   | Trim     | 0.040"   | 0.145"     |
| 7   | Sense(+) | 0.040"   | 0.145"     |
| 8   | Vout(+)  | 0.062"   | 0.145"     |

**RECOMMENDED PAD LAYOUT**

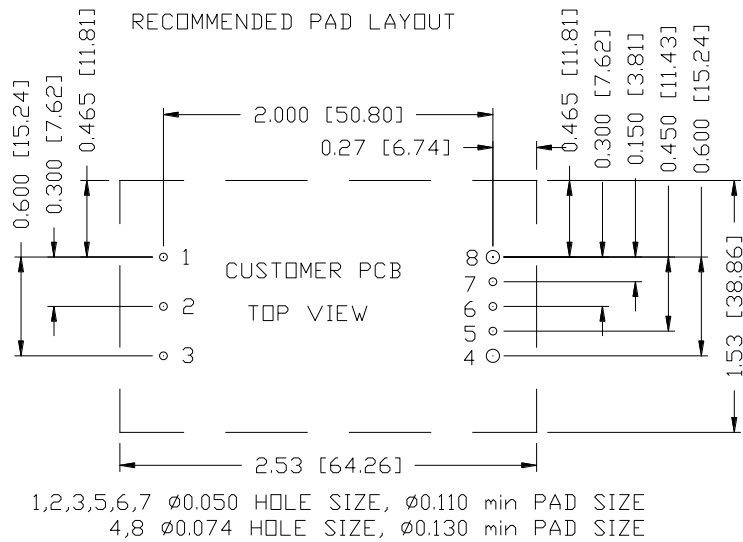


Figure 23. Recommended pad layout

## 18. REVISION HISTORY

| DATE       | REVISION | CHANGES DETAIL  | APPROVAL |
|------------|----------|---|----------|
| 2016-09-09 | AA       | First release   | Z.Tang   |
| 2017-04-13 | AB       | Update Input Voltage                                  | J.Yan    |
| 2017-06-07 | AC       | Update Input Specs                                    | J.Yan    |
| 2017-08-04 | AD       | Update Efficiency Data                                | S.Wang   |
| 2017-08-22 | AE       | Update Operating Input Voltage                        | S.Wang   |
| 2018-03-07 | AF       | Update MTBF   | S.Wang   |
| 2019-04-25 | AG       | Update Input Specifications and Mechanical Dimensions | S.Wang   |
| 2021-05-18 | AH       | Add object ID. Update recommended pad layout.         | XF.Jiang |

For more information on these products consult: [tech.support@psbel.com](mailto:tech.support@psbel.com)

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**TECHNICAL REVISIONS** - The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.



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