# 0RCY-C4T03x

## Isolated DC-DC Converter

The 0RCY-C4T03x is isolated DC-DC converter that operates from a nominal 48 VDC source. This unit will provide up to 132 W of output power from a nominal 48 VDC input. This unit is designed to be highly efficient and low cost.

Features include remote on/off, over current protection and under-voltage lockout. This converter is provided in an industry standard eighth brick package.

RoHS Compliant

### Key Features & Benefits

- 36-75 VDC Input
- 3.3 VDC @ 40 A Output
- 1/8th Brick Converter
- Isolated
- Fixed Frequency (300kHz)
- High Efficiency
- High Power Density
- Input Under Voltage Lockout
- Output Voltage Trim
- Basic Insulation
- Output Over Voltage Protection with Auto-Recovery
- OCP/SCP
- Over Temperature Protection
- Remote On/Off
- Positive/Negative Remote Sense
- Low Cost
- Approved to IEC/EN 62368-1
- Approved to UL/CSA 62368-1
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

### Applications

- Industrial
- Computers and peripherals
- Telecommunications

## 1. MODEL SELECTION

| MODEL NUMBER | OUTPUT VOLTAGE | INPUT VOLTAGE | MAX. OUTPUT CURRENT | MAX. OUTPUT POWER | TYPICAL EFFICIENCY |
|---|---|---|---|---|---|
| 0RCY-C4T03L | 3.3 VDC | 48 VDC | 40 A | 132 W | 92% |
| 0RCY-C4T033 | 3.3 VDC | 48 VDC | 40 A | 132 W | 92% |

**NOTE**: Add "G" suffix at the end of the model number to indicate packaging.

### PART NUMBER EXPLANATION

| 0 | R | CY | - | C4 | T | 03 | x | G |
|---|---|---|---|---|---|---|---|---|
| Mounting Type | RoHS Status | Series Name | | Output Power | Input Range | Output Voltage | Logic and Optional Features | Package Type |
| Through hole mount | RoHS | 1/8th Brick | | 132 W | 36 - 75 V | 3.3 V | L - Active low, open frame<br>3 - Active high, open frame | Tray package |

## 2. ABSOLUTE MAXIMUM RATINGS

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Input Voltage | Continuous | -0.3 | - | 80 | V |
| Remote On/Off | | -0.3 | - | 18 | V |
| I/O Isolation Voltage | | - | - | 1500 | V |
| Ambient Temperature ($T_A$) | | -40 | - | 85 | °C |
| Component Temperature ($T_C$) | Detail information refer to Thermal Derating Curves. | -40 | - | 120 | °C |
| Storage Temperature | | -55 | - | 125 | °C |
| Altitude | | - | - | 5000 | 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 | | 36 | 48 | 75 | V |
| Input Current (full load) | | - | - | 5 | A |
| Input Current (no load) | | - | 70 | 120 | mA |
| Remote Off Input Current | | - | 10 | 15 | mA |
| Input Reflected Ripple Current is (rms) | With simulated source impedance of 10 µH, 5 Hz to 20 MHz. Use a 100 µF/100 V electrolytic cap with ESR = 1 ohm max, at 200 kHz @ 25°C. | - | 5 | 10 | mA |
| Input Reflected Ripple Current is (pk-pk) | | - | – | 30 | mA |
| $I^2t$ Inrush Current Transient | | - | – | 0.1 | $A^2s$ |
| Under-voltage Turn on Threshold | | 33 | – | 35.5 | V |
| Under-voltage Turn off Threshold | | 32 | – | 34.5 | V |

**CAUTION: This converter is not internally fused. An input line fuse must be used in application.** Recommended input fast-acting fuse on system board.

## 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 | Vin = 48 V, Io = 50% load | 3.234 | 3.300 | 3.366 | V |
| Load Regulation | Io = 0~100% load | - | ±4 | ±9 | mV |
| Line Regulation | | - | ±8 | ±16.5 | mV |
| Regulation Over Temperature (-40°C - 85°C) | | - | ±30 | ±50 | mV |
| Total Regulation | | - | ±36 | ±65.6 | mV |
| Output Ripple and Noise (pk-pk) | Vin = 48 V, 0 – 20 MHz BW, with a 10 µF Tantalum cap at output. | - | 55 | 90 | mV |
| Output Ripple and Noise (rms) | | - | 10 | 20 | mV |
| Output Current Range | | 0 | - | 40 | A |
| Output DC Current Limit | | 44 | - | 56 | A |
| Short Circuit Surge Transient | | - | 2 | 4 | $A^2s$ |
| Turn-On Time | | - | - | 25 | ms |
| Overshoot at Turn on | | - | - | 3 | % |
| Output Capacitance | | 330 | - | 5600 | µF |
| ***Transient Response*** | | | | | |
| △V 25%~50% of Max Load | di/dt = 0.1 A/µs, Vin = 48 VDC, Ta = 25°C, with a 330 µF Tantalum cap at output. | - | 100 | 200 | mV |
| Settling Time | | - | 150 | 250 | µs |
| △V 50%~25% of Max Load | | - | 100 | 200 | mV |
| Settling Time | | - | 150 | 250 | µs |

## 5. GENERAL SPECIFICATIONS

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Efficiency (full load) | Measured at Vin = 48 V | 90 | 92 | - | % |
| Switching Frequency | | 270 | 300 | 330 | kHz |
| FIT | Calculated Per Bell Core SR-332 (Vin = 48 V, Io = 80% load, Ta = 25 °C, FIT = $10^9$/MTBF) | | TBC | | |
| Over Temperature Protection | | - | 125 | - | °C |
| Output Voltage Trim Range | The total voltage increased by trim and remote sense should not exceed 10%Vo | 80 | - | 110 | % |
| Remote Sense Compensation | | - | - | 10 | % |
| Over Voltage Protection | Vin = 48 V, full load, in hiccup mode. | 3.8 | - | 4.5 | V |
| Weight | | - | 28 | - | g |
| Dimensions (L × W × H) | | | 2.30 x 0.9 x 0.40 | | inch |
| | | | 58.42 x 22.86 x 10.26 | | mm |
| ***Isolation Characteristics*** | | | | | |
| Isolation Capacitance | | - | 2200 | - | pF |



 

## 6. EFFICIENCY DATA

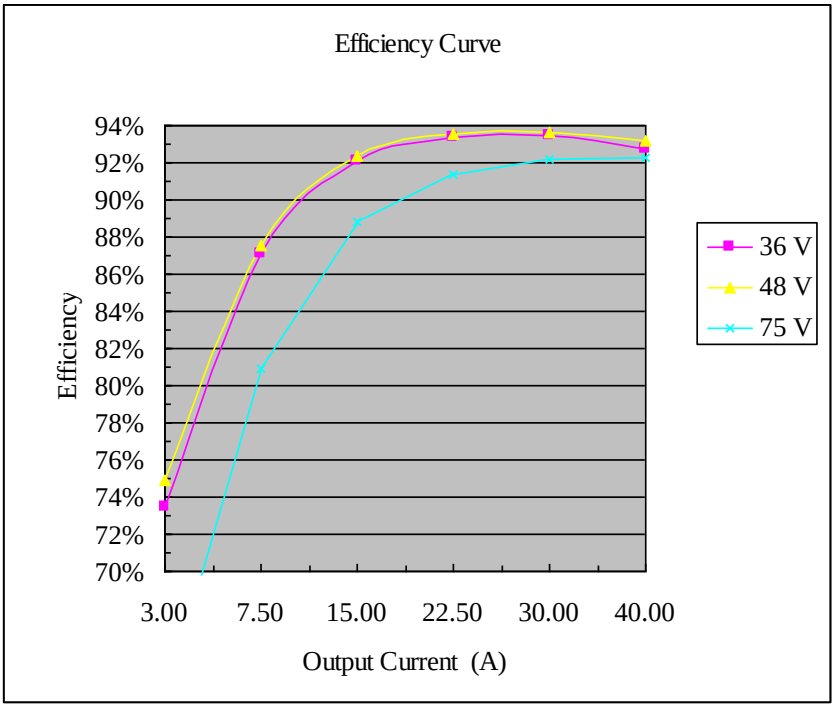


*Figure 1. Efficiency data*

## 7. REMOTE ON/OFF

| PARAMETER | | DESCRIPTION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Signal Low (Unit On) | Active Low | 0RCY-C4T03L<br>The remote on/off pin open, Unit off. | -0.7 | - | 0.8 | V |
| Signal High (Unit Off) | | | 2.4 | - | 18 | V |
| Signal Low (Unit Off) | Active High | 0RCY-C4T033<br>The remote on/off pin open, Unit on. | -0.7 | - | 0.8 | V |
| Signal High (Unit On) | | | 2.4 | - | 18 | V |
| Current Sink | | | 0 | - | 1 | mA |

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

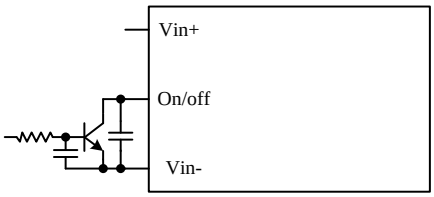


*Figure 2. Control with open collector/drain circuit*

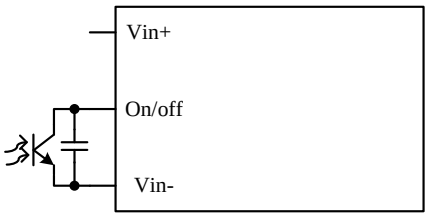


*Figure 3. Control with photocoupler circuit*

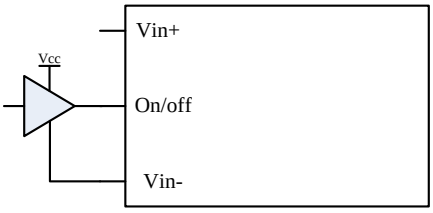


*Figure 4. Control with logic circuit*

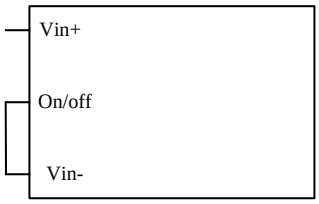


*Figure 5. Permanently on*

**Recommended remote on/off circuit for active high**

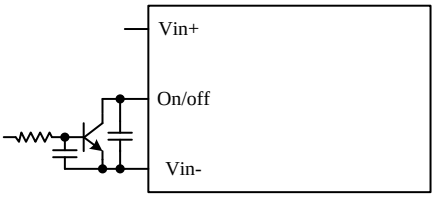


*Figure 6. Control with open collector/drain circuit*

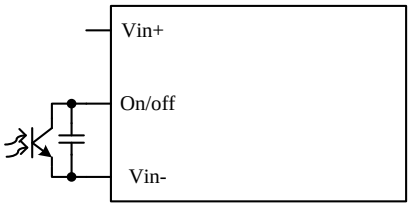


*Figure 7. Control with photocoupler circuit*

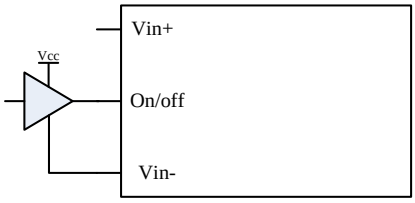


*Figure 8. Control with logic circuit*

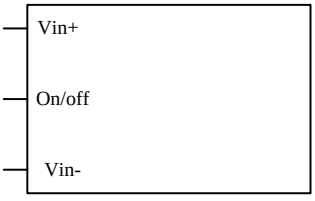


*Figure 9. Permanently on*



 

## 8. RIPPLE AND NOISE WAVEFORM

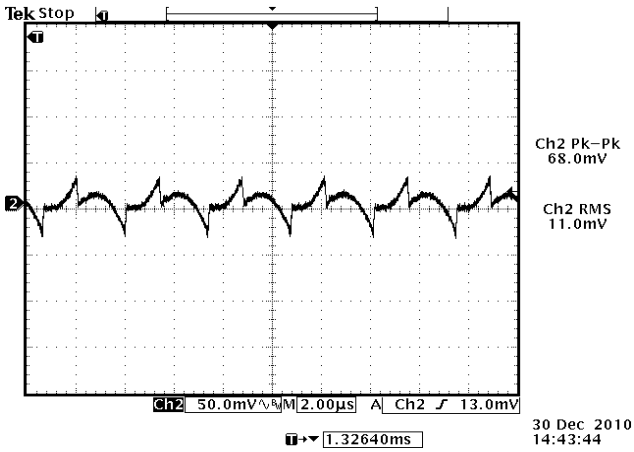


*Figure 10. Lo = 0A, Vin = 48V*

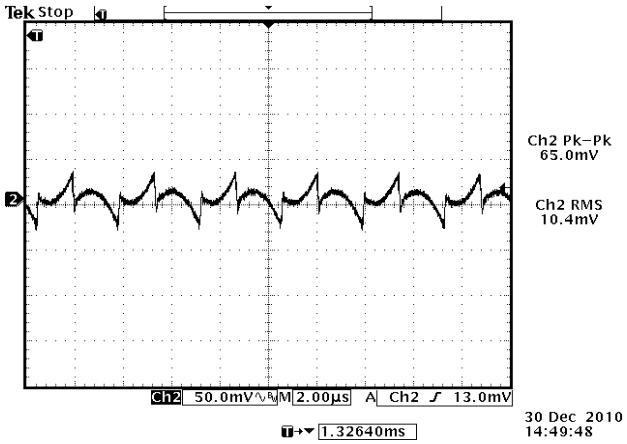


*Figure 11. Lo = 40A, Vin = 48V*

**Note:** Ripple and noise at full load, 48 VDC input, 3.3 VDC/30 A output with a 1 µF ceramic cap and a 10 µF Tantalum cap at output, and Ta = 25 °C.

## 9. TRANSIENT RESPONSE WAVEFORMS

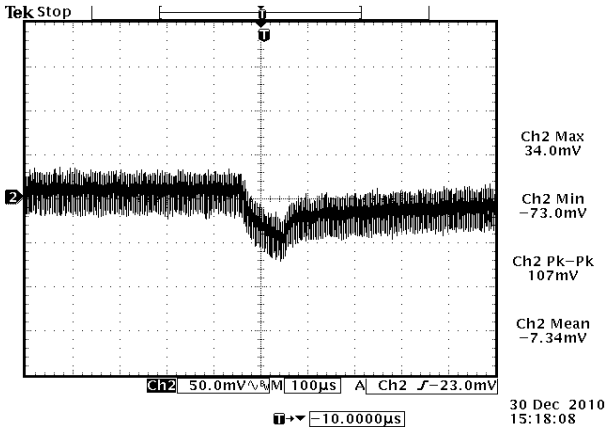


*Figure 12. Vout = 3.3V, 75% to 50% Load Transients*

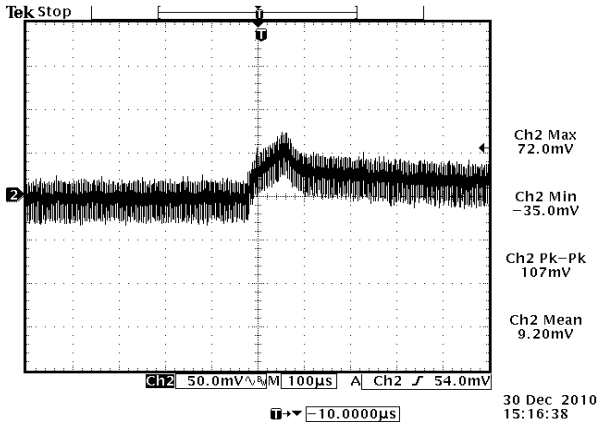


*Figure 13. Vout = 3.3V, 50% to 75% Load Transients*

**Note:** Transient response at di/dt = 0.1 A/µs, Vin = 48 VDC, Ta = 25°C, external 330 µF Tantalum Cap.

## 10. OUTPUT TIRM EQUATIONS

Equations for calculating the trim resistor are shown below. The Trim Down resistor should be connected between the Trim pin and GND pin. The Trim Up resistor should be connected between the Trim pin and the Vout. Only one of the resistors should be used for any given application.

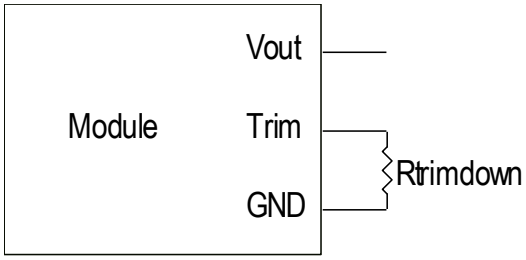


*Figure 14. Trim down test circuit*

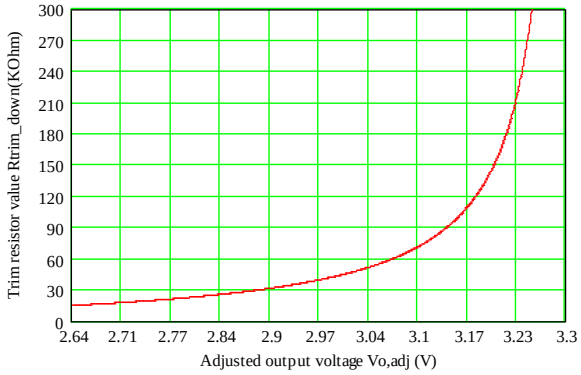


*Figure 15. Trim down curve*

$$Rtrimdown = \frac{511}{|delta|} - 10.22[k\Omega]$$

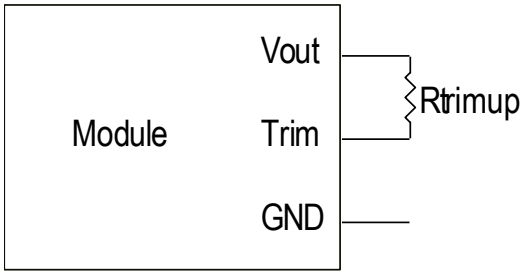


*Figure 16. Trim up test circuit*

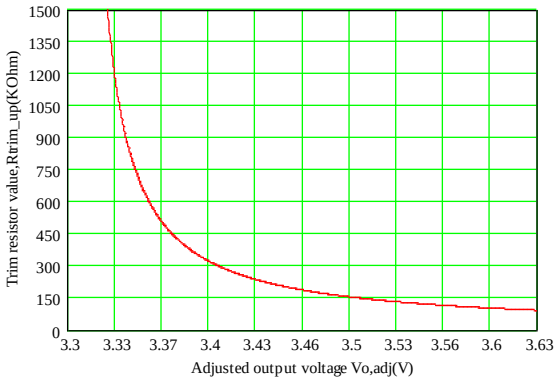


*Figure 17. Trim up curve*

$$Rtrimup = \frac{(100 + delta) \cdot Vo \cdot 5.11 - 626}{1.225 \cdot delta} - 10.22[k\Omega]$$

$$delta = \frac{(Vo\_req - Vo)}{Vo} \times 100[\%]$$

**Note:**
Vo_req = Desired (trimmed) output voltage [V]
Output voltage Vo = 3.3 V.



 

## 11. THERMAL DERATING CURVES

Maximum Tcase (TC1 & TC2) temperature of semiconductors derated to 120 °C.

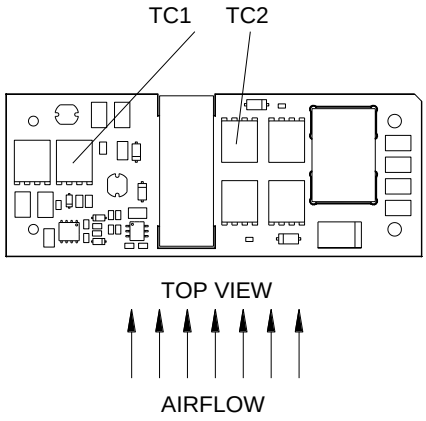


*Figure 18. Airflow direction*

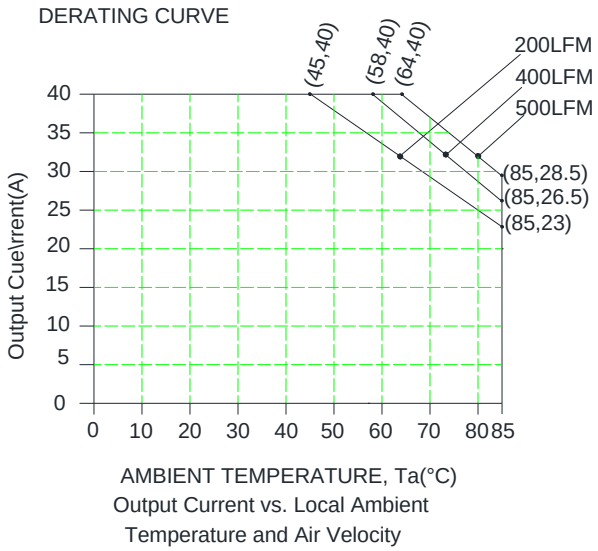


*Figure 19. Thermal derating curve @ Vin = 48 V,*
*with maximum junction temperature of semiconductors derated to 120°C, airflow from Vo to Vin.*

## 12. MECHANICAL DIMENSIONS

### OUTLINE

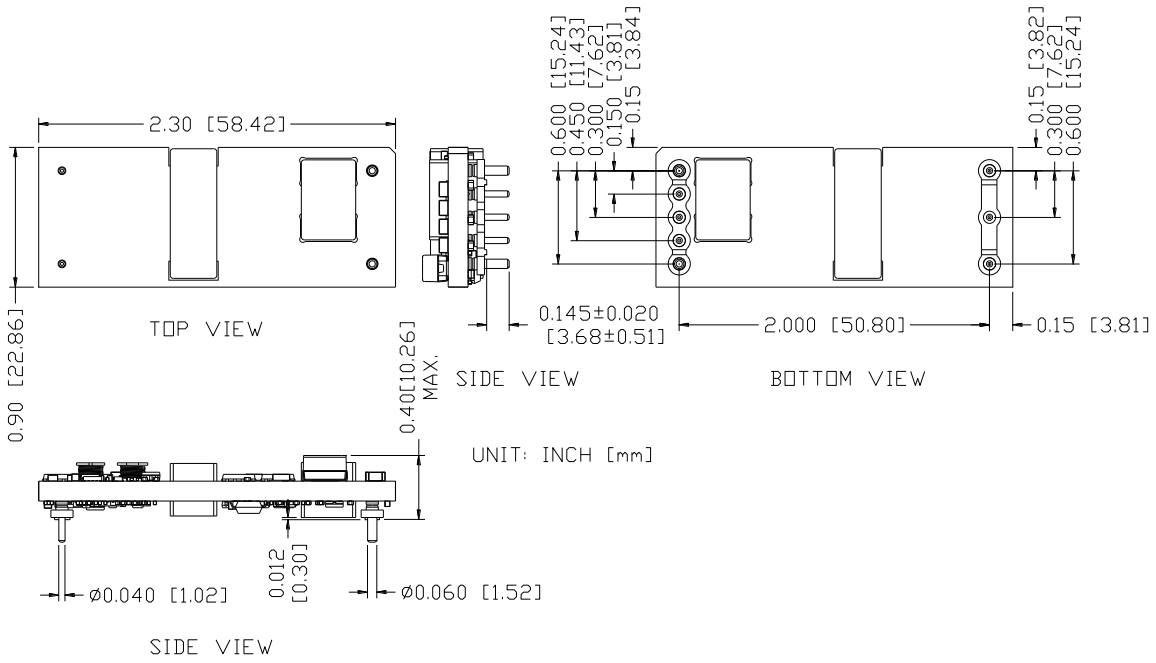


*Figure 20. Outline*

**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 - Gold plated.
2) Un-dimensioned components are shown for visual reference only.
3) All dimensions in inches; Tolerances: x.xx +/-0.02 in [0.5 mm]. x.xxx +/-0.010 in [0.25 mm]. Unless otherwise stated.

## PIN DEFINITIONS

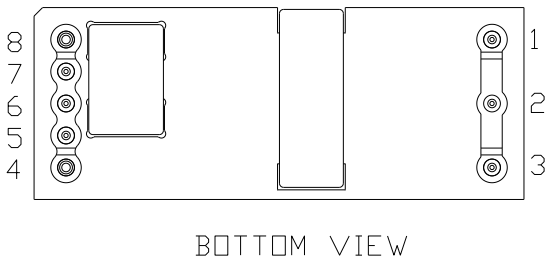


*Figure 21. Pins*

| PIN | FUNCTION | PIN SIZE |
|---|---|---|
| 1 | Vin+ | 0.040'' |
| 2 | On/Off | 0.040'' |
| 3 | Vin- | 0.040'' |
| 4 | Vout- | 0.062'' |
| 5 | Sense- | 0.040'' |
| 6 | Trim | 0.040'' |
| 7 | Sense+ | 0.040'' |
| 8 | Vout+ | 0.062'' |

## RECOMMENDED PAD LAYOUT

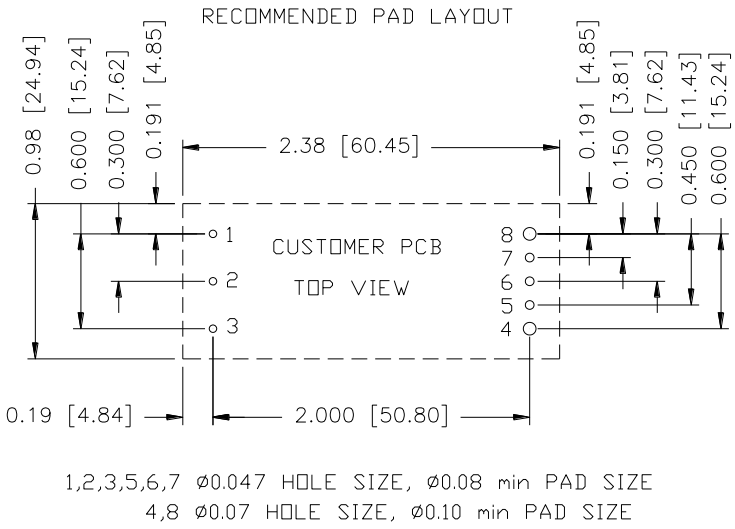


*Figure 22. Recommended pad layout*

## 13. REVISION HISTORY

| DATE | REVISION | CHANGES DETAIL | APPROVAL |
|---|---|---|---|
| 2011-01-04 | PA | First release | JZ.Wang |
| 2011-01-12 | PB | Change max input current (full load) from 4.5A to 5A in input specifications. Change typical efficiency from 91% to 92% in general specifications. | JZ.Wang |
| 2012-06-29 | PC | Update MD. | JZ.Wang |
| 2018-08-08 | AD | Update the form and TD. | XF.Jiang |
| 2018-11-14 | AE | Update TD | XF.Jiang |
| 2021-04-27 | AF | Add object ID and safety certificate. Update mechanical outline. | XF.Jiang |

**For more information on these products consult: tech.support@psbel.com**

**NUCLEAR AND MEDICAL APPLICATIONS -** Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.
**TECHNICAL REVISIONS -** The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manµFactured. Specifications are subject to change without notice.

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