

ISOLATED DC/DC CONVERTERS

48 V Input 3.3 V/50 A, 5.0 V/30 A Output

bel
POWER PRODUCTS

0RHB-C5T Series RoHS Compliant PRELIMINARY

- Isolated
- High Efficiency
- High Power Density
- Low Cost
- Fixed Frequency (330 kHz)
- Input Under/Over Voltage Lockout
- UL60950 Recognized (UL/cUL)
- Output Over Voltage Shutdown
- OCP/SCP
- Over Temperature Protection
- Remote On/Off
- Output Voltage Trim
- Positive/Negative Remote Sense



Description

The 0RHB-C5T Series are isolated dc/dc converters that operate from a nominal 48 V source. This unit will provide up to 165 W of output power from a nominal 48 V input. This unit is designed to be highly efficient and low cost. It is provided in an industry standard half-brick package.

Part Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Model Number Active High | Model Number Active Low |
|----------------|---------------|---------------------|-------------------|--------------------|--------------------------|-------------------------|
| 5.0 V | 48 V | 30 A | 150 W | 93.0% | 0RHB-C5T050 | 0RHB-C5T05L |
| 3.3 V | 48 V | 50 A | 165 W | 92.5% | 0RHB-C5T033 | 0RHB-C5T03L |

Note: Add "G" suffix at the end of the model number to indicate Tray Packaging.

Absolute Maximum Ratings

| Parameter | Min | Typ | Max | Notes |
|----------------------------|--------|-----|--------|-------|
| Input Voltage (continuous) | -0.3 V | - | 80 V | |
| Remote On/Off | -0.3 V | - | 18 V | |
| I/O Isolation Voltage | - | - | 2000 V | |
| Ambient Temperature | -40 °C | - | 85 °C | |
| Storage Temperature | -55 °C | - | 125 °C | |

Input Specifications

| Parameter | Min | Typ | Max | Notes |
|---|------|-----------------------|----------------------|--|
| Input Voltage | 36V | 48 V | 75 V | |
| Input Current (full load) | | | | |
| Vo=5.0 V | - | - | 5.0 A | |
| Vo=3.3 V | - | - | 5.2 A | |
| Input Current (no load) | - | 120 mA | 180 mA | |
| Remote Off Input Current | | 5 mA | 20 mA | |
| Input Reflected Ripple Current (pk-pk) | - | 20 mA | 40 mA | Tested with simulated source impedance of 10 uH, 5 Hz to 20 MHz; use a 100 uF /100 V electrolytic capacitor with ESR = 1 ohm max. at 200 kHz at 25 °C. |
| Input Reflected Ripple Current (rms) | - | 5 mA | 10 mA | |
| I ² t Inrush Current Transient | - | 0.05 A ² s | 0.1 A ² s | |
| Turn-on Voltage Threshold | 31 V | - | 35 V | |
| Turn-off Voltage Threshold | 29 V | - | 33 V | |
| Input Over Voltage Threshold | 76 V | - | 80 V | |

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

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Output Specifications

| Parameter | | Min | Typ | Max | Notes | |
|---|---------------|----------|--------------------|--------------------|--|--|
| Output Voltage Set Point | Vo=5.0 V | 4.925 V | 5.000 V | 5.075 V | Vin=48 V, Io=50% load | |
| | Vo=3.3 V | 3.250 V | 3.300 V | 3.350 V | | |
| Line Regulation | Vo=5.0 V | - | ±5 mV | ±10 mV | | |
| | Vo=3.3 V | - | ±3 mV | ±7 mV | | |
| Load Regulation | Vo=5.0 V | - | ±10 mV | ±20 mV | | |
| | Vo=3.3 V | - | ±7 mV | ±15 mV | | |
| Regulation Over Temperature (-40 °C to +85 °C) | Vo=5.0 V | - | ±45 mV | ±75 mV | | |
| | Vo=3.3 V | - | ±30 mV | ±50 mV | | |
| Output Current | Vo=5.0 V | 0 A | - | 30 A | | |
| | Vo=3.3 V | 0 A | - | 50 A | | |
| Current Limit Threshold | Vo=5.0 V | 32 A | 38 A | 45 A | | |
| | Vo=3.3 V | 55 A | 65 A | 75 A | | |
| Short Circuit Surge Transient | | - | 3 A ² s | 5 A ² s | | |
| Ripple and Noise (rms) | Vo=5.0 V | - | 25 mV | 50 mV | Test conditions: 0-20MHz BW, with a 1uF ceramic capacitor and a 10uF Tantalum capacitor at the output. | |
| | Vo=3.3 V | - | 15 mV | 30 mV | | |
| Ripple and Noise (pk-pk) | Vo=5.0 V | - | 70 mV | 140 mV | | |
| | Vo=3.3 V | - | 55 mV | 100 mV | | |
| Turn on Time | | - | 15 mS | 20 mS | | |
| Overshoot at Turn on | | - | 0% | 5% | | |
| Output Capacitance | Vo=5.0 V | 0 uF | - | 10000 uF | | |
| | Vo=3.3 V | 0 uF | - | 20000 uF | | |
| Transient Response | | | | | | |
| 75% ~ 50% Max Load | Overshoot | Vo=5.0 V | - | 250 mV | 400 mV | Test conditions: di/dt = 0.1 A/uS, Vin=48 V with a 1 uF ceramic capacitor and a 10 uF Tantalum capacitor at the output. |
| | Settling Time | | - | 250 uS | 400 uS | |
| 50% ~ 75% Max Load | Overshoot | | - | 250 mV | 400 mV | |
| | Settling Time | | - | 250 uS | 400 uS | |
| 75% ~ 50% Max Load | Overshoot | Vo=3.3 V | - | 100 mV | 200 mV | |
| | Settling Time | | - | 200 uS | 300 uS | |
| 50% ~ 75% Max Load | Overshoot | | - | 100 mV | 200 mV | |
| | Settling Time | | - | 200 uS | 300 uS | |

Note: All specifications are typical at nominal input, full load at 25 °C unless noted.

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General Specifications

| Parameter | Min | Typ | Max | Notes |
|--|--|----------------|---------|--|
| Efficiency Vo=5.0 V Vo=3.3 V | 90% 90% | 93.0% 92.5% | - - | Vin=48V, full load, Ta=25°C |
| Switching Frequency | 300 kHz | 330 kHz | 360 kHz | |
| Isolation capacitance | - | 1500 pF | - | |
| Output Voltage Trim Range | 80% Vo | - | 110% Vo | |
| Over Temperature Protection | - | 120 °C | - | |
| Over Voltage Protection ¹ | - | 130% Vo | - | |
| Input to Output Isolation Voltage ² | - | - | 2000 V | |
| MTBF | TBD | | | Calculated Per Bell Core SR-332 (Io = Nominal; Ta = 25 °C) |
| Dimensions Inches millimeters | 2.28 x 2.4 x 0.42 57.51 x 60.98 x 10.67 | | | |
| Weight | - | 76 g | - | |

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

- OVP is tested under 48 Vin and full load with photo coupler short. The output will be latched off if the output voltage exceeds over voltage specification. To turn the converter on requires either cycling the ON/OFF pin or power to the converter.
- Isolation between input and output is basic isolation, test duration is 60 seconds.

Control Specifications

| Parameter | Min | Typ | Max | Notes |
|------------------------|-------------|--------|-----|---------------------------------------|
| Remote On/Off | | | | |
| Signal Low (Unit On) | Active Low | -0.3 V | - | The remote on/off pin open, Unit off. |
| Signal High (Unit Off) | | 2.4 V | - | |
| Signal Low (Unit Off) | Active High | -0.3 V | - | The remote on/off pin open, Unit on. |
| Signal High (Unit On) | | 2.4 V | - | |

Output Trim Equations

Equations for calculating the trim resistor (in kΩ) are shown below. The Trim Down resistor should be connected between the Trim pin and Ground 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.

$$R_{trimdown} = \frac{100}{|\delta|} - 2 [k\Omega]$$

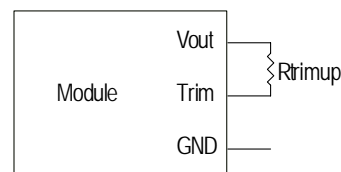
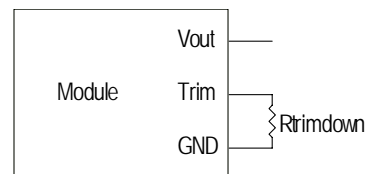
$$R_{trimup} = \frac{(100 + \delta) \cdot V_o - 122.5}{1.225 \cdot \delta} - 2 [k\Omega]$$

Notes:

$$\delta = \frac{(V_o_{req} - V_o)}{V_o} \times 100 [\%]$$

V_{o_req}=Desired(trimmed) output voltage[V]

Output voltage V_o=3.304 V for 3.3 V; V_o=5.008 V for 5 V.

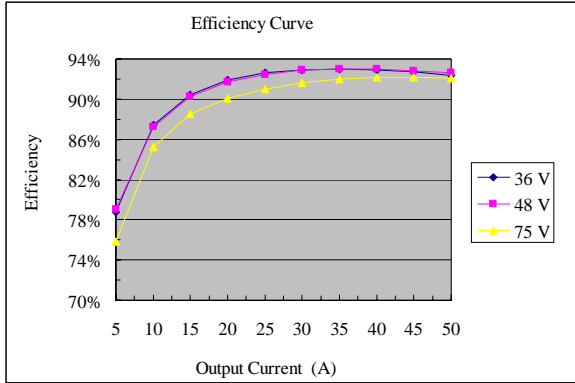


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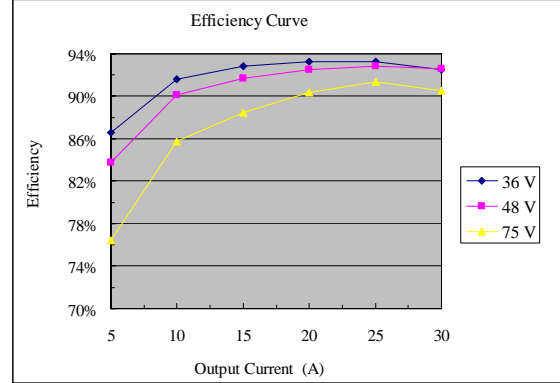
48 V Input 3.3 V/50 A, 5.0 V/30 A Output



Efficiency Data

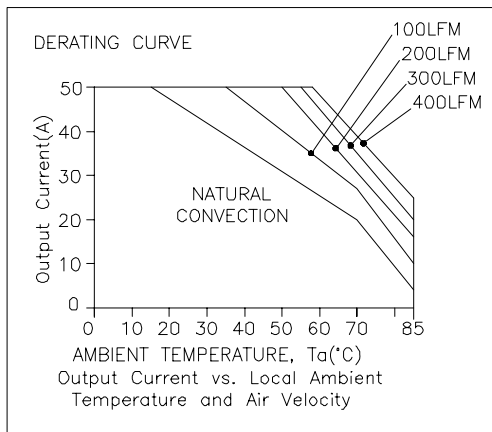


ORHB-C5T03x

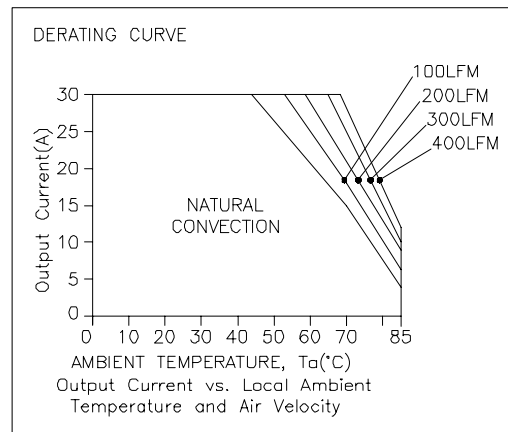


ORHB-C5T05x

Thermal Derating Curves

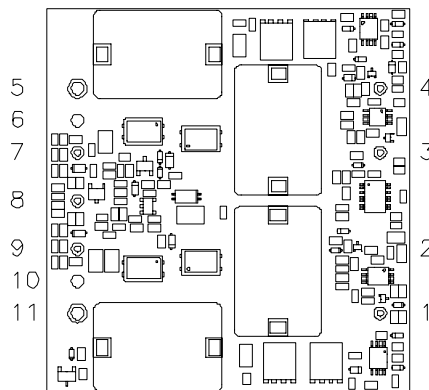


ORHB-C5T03x



ORHB-C5T05x

FORCED AIRFLOW DIRECTION

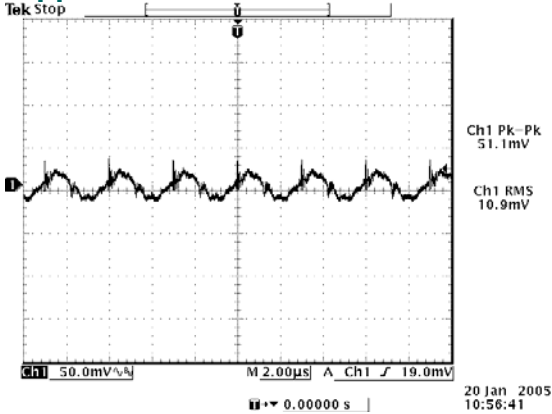


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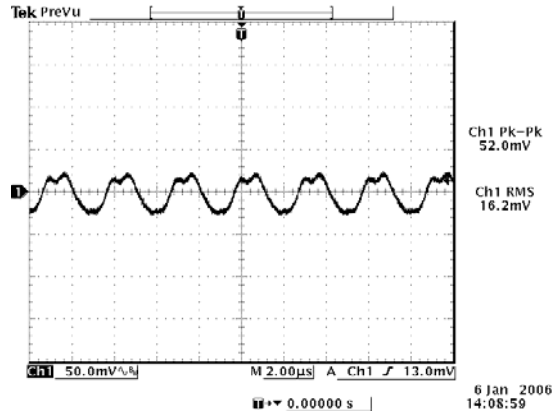
48 V Input 3.3 V/50 A, 5.0 V/30 A Output



Ripple and Noise Waveforms



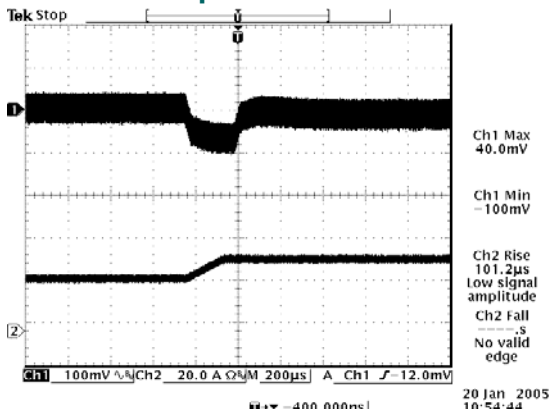
Ripple and noise at full load 3.3 V/50 A output



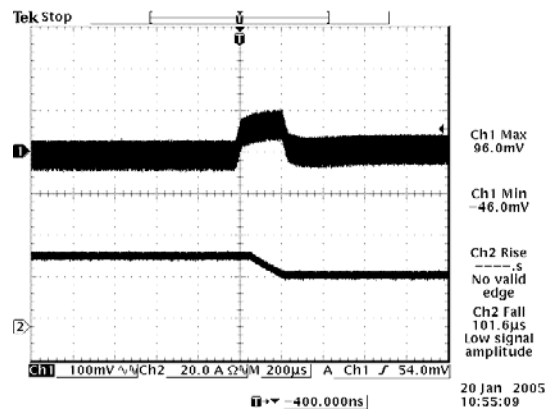
Ripple and noise at full load 5.0 V/30 A output

Note: Ripple and noise at 48 V input, with a 1 μ F ceramic capacitor and a 10 μ F tantalum capacitor at the output and $T_a=25$ deg C.

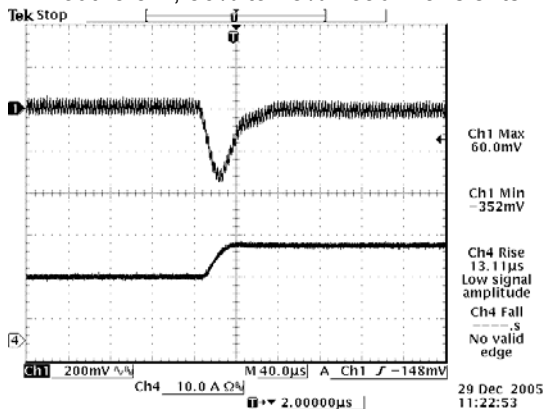
Transient Response Waveforms



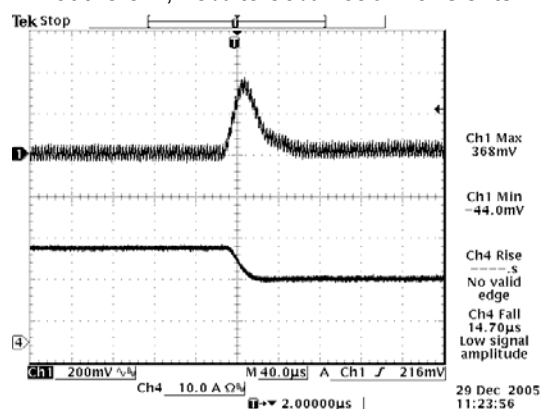
Vout=3.3 V, 50% to 75% Load Transients



Vout=3.3 V, 75% to 50% Load Transients



Vout=5.0 V, 50% to 75% Load Transients



Vout=5.0 V, 75% to 50% Load Transients

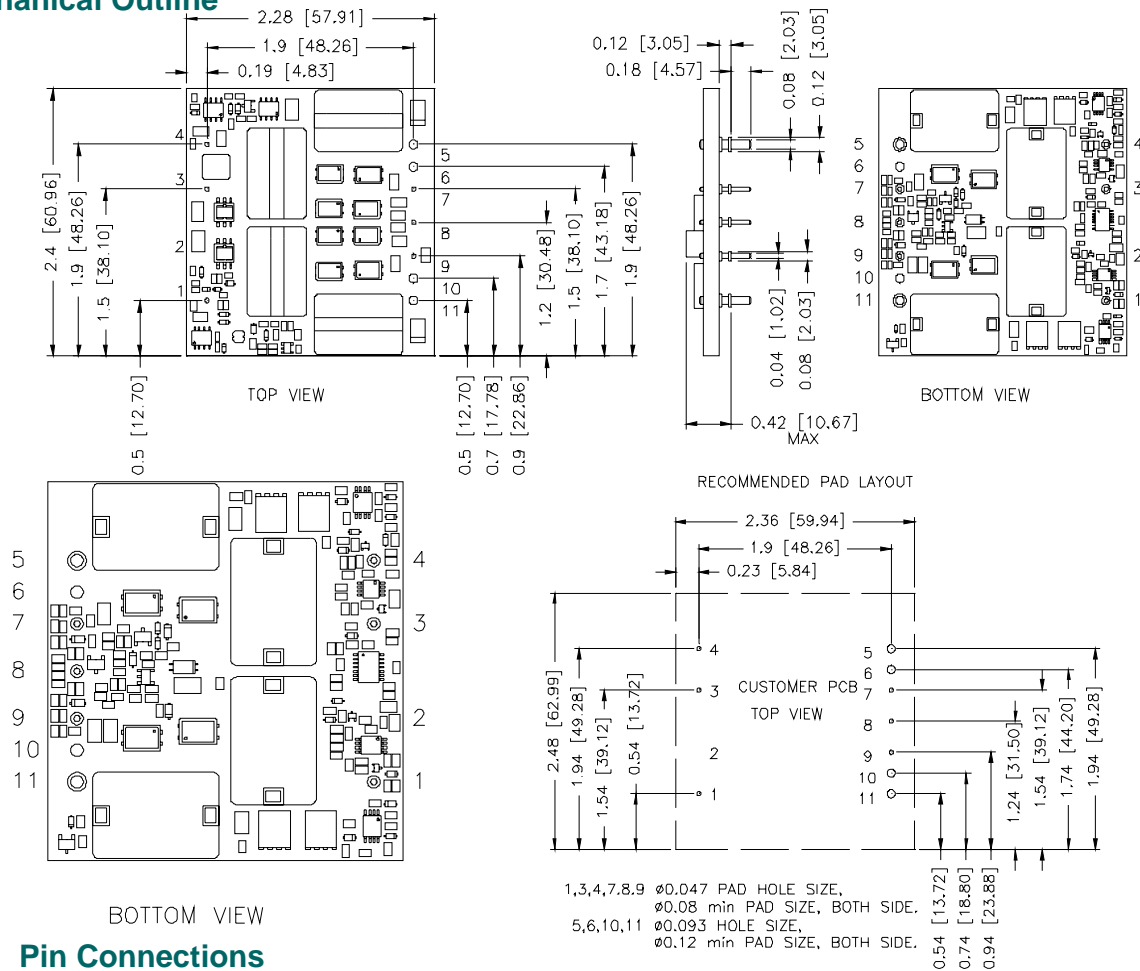
Note: Transient Response is tested at $di/dt=0.1$ A/ μ s ($V_o=3.3$ V), $di/dt=0.5$ A/ μ s ($V_o=5.0$ V), $V_{in}=48$ V, $T_a=25^\circ$ C, with a 1 μ F ceramic capacitor and a 10 μ F tantalum capacitor at the output.

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Mechanical Outline



Pin Connections

| pin# | function | pin size | pin# | function | pin size |
|------|----------|----------|------|----------|----------|
| 1 | -Input | 0.04" | 6 | N/A | |
| 2 | N/A | | 7 | +Sense | 0.04" |
| 3 | On/Off | 0.04" | 8 | Trim | 0.04" |
| 4 | +Input | 0.04" | 9 | -Sense | 0.04" |
| 5 | +Output | 0.08" | 10 | N/A | |
| | | | 11 | -Output | 0.08" |

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products.



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