

ISOLATED DC/DC CONVERTERS

48 Vdc Input 28 Vdc / 7 A Output

bel
POWER PRODUCTS

0RQB-D0T28x

RoHS Compliant

Rev.B

- Fixed Frequency (300 kHz)
- Isolated
- High Efficiency
- High Power Density
- Input Under Voltage Lockout
- Basic Insulation
- Wide Output Trim Range
- Output Over Voltage Latch Off
- Over Temperature Protection
- Short Circuit Latch Off
- Low Cost
- Remote On/Off
- Droop Load Share with 0.125V/A
- Voltage Fold-back Constant Current Limit



Description

The 0RQB-D0T28x is isolated dc/dc converter that operates from a nominal 48 Vdc source. This unit will provide up to 196 W of output power from a nominal 48 Vdc input. The unit is designed to be highly efficient and low cost. Features include remote on/off, output current limit protection, input under-voltage lockout and output over-voltage latch off. This converter is provided in an industry standard quarter brick package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active High	Model Number Active Low
28 Vdc	36 Vdc - 75 Vdc	7 A	196 W	92%	0RQB-D0T280	0RQB-D0T28L

Notes: 1. Add "G" suffix at the end of the model number to indicate Tray Packaging.
2. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Continuous Input Voltage	-0.3 V	-	80 V	
Transient Input Voltage	-	-	100 V	100 mS Max
Remote On/Off	-0.3 V	-	18 V	
I/O Isolation Voltage	-	-	1500 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

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

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	36 V	48 V	75 V	
Input Current (no load)	-	40 mA	60 mA	
Input Current (full load)	-	-	7 A	
Remote Off Input Current	-	14 mA	20 mA	
Input Reflected Ripple Current (pk-pk)	-	20 mA	30 mA	With simulated source impedance of 12 uH, 5 Hz to 20 MHz; use a 220uF/100 V electrolytic capacitor with ESR = 1 ohm max. at 200 kHz
Input Reflected Ripple Current (rms)	-	5 mA	10 mA	

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Input Specifications (continued)

Parameter	Min	Typ	Max	Notes
I ² t Inrush Current Transient	-	-	0.1 A ² s	
Turn-on Voltage Threshold	33 V	34 V	35 V	
Turn-off Voltage Threshold	31 V	33 V	34 V	

Notes: 1. Should place at least 100uF/100V electrolytic capacitor directly adjacent to the input pin of the module.
2. All specifications are typical at nominal input, full load at 25 °C unless otherwise stated.

Output Specifications

Parameter	Min	Typ	Max	Notes		
Output Voltage Set Point	27.44 V	28.0 V	28.56 V	V _{in} =48 V, I _o =No Load		
Droop Rate	-	125 mV/A	-			
Line Regulation	-	28 mV	56 mV			
Regulation Over Temperature (-40 °C to 85 °C)	-	0.02%Vo/°C	-			
Output Current	0 A	-	7 A			
Current Limit Threshold	7.5 A	8.2 A	9.5 A			
Ripple and Noise (rms)	-	20 mV	50 mV	0 - 20 MHz BW, with 1 uF ceramic load capacitor and a 100uF Al capacitor at the output		
Ripple and Noise (pk-pk)	-	100 mV	180 mV			
Turn on Time	-	65 mS	100 mS			
Overshoot at Turn on	-	0%	5%			
Output Capacitance	68 uF	-	4700 uF			
Transient Response						
50% ~ 75% Max Load	Overshoot	Vo=28 V	-	375 mV	600 mV	di/dt=0.1A/us, Vin=48Vdc, Ta=25 °C, with 1 uF ceramic capacitor and a 100uF Al capacitor at the output.
	Settling Time		-	800 uS	1000 uS	
75% ~ 50% Max Load	Overshoot		-	375 mV	600 mV	
	Settling Time		-	800 uS	1000 uS	

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency	89%	92%	-	V _{in} =48 V, full load
Switching Frequency	270 kHz	300 kHz	330 kHz	
Isolation characteristics				
Input to Output	-	-	1500 V	
Input to Case	-	-	1500 V	
Output to Case	-	-	500 V	
Isolation Resistance	10M Ohm	-	-	
Isolation Capacitance	-	1000 pF	-	

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General Specifications (continued)

Parameter	Min	Typ	Max	Notes
Remote Sense Compensation	0 V	-	1.5 V	The voltage increased by trim and sense should not exceed 110%Vout.
Output Voltage Trim Range	60%	-	110%	
Over Temperature Protection	-	125 °C	130 °C	
Over Voltage Protection	32 V	-	34 V	V _{in} =48 V, I _o =full load, Latch mode
MTBF	TBD			Calculated Per Bell Core SR-332 (V _{in} =48 V, V _o =28 V, I _o =5.6 A, 400LFM forced air flow, T _a = 25 °C)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	2.28 x 1.45 x 0.50 57.91 x 36.83 x 12.7			
Weight	-	60 g	-	

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

Control Specifications

Parameter		Min	Typ	Max	Notes
Remote On/Off					
Signal Low (Unit On)	Active Low	-0.3 V	-	0.8 V	The Remote On/Off pin is open, Unit off.
Signal High (Unit Off)		2.4 V	-	18 V	
Signal Low (Unit Off)	Active High	-0.3 V	-	0.8 V	The Remote On/Off pin is open, Unit on
Signal High (Unit On)		2.4 V	-	18 V	

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Output Trim Equations

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

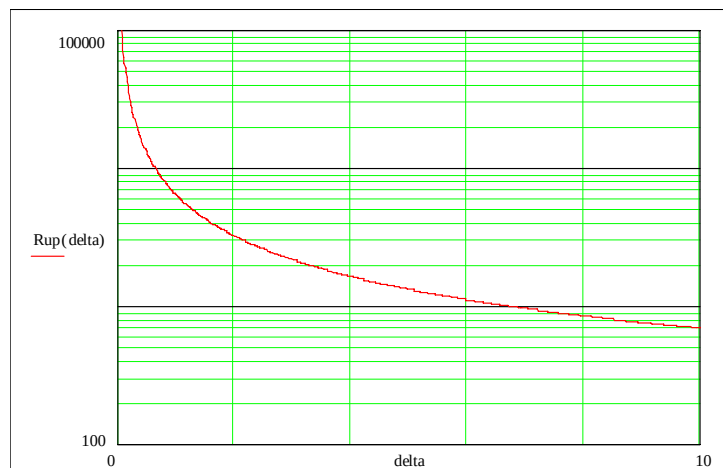
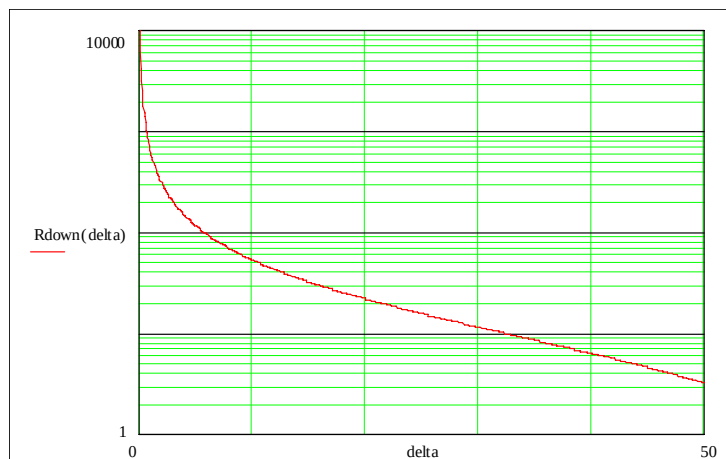
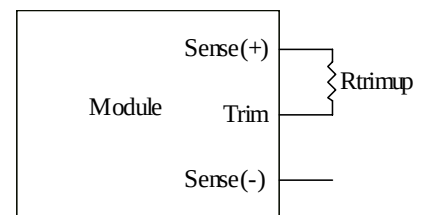
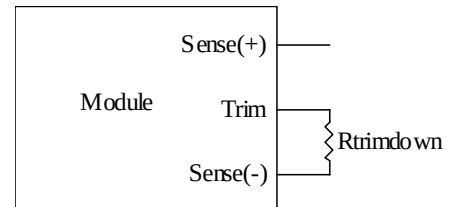
$$R_{trimdown} = 6.19 \times \left(\frac{100}{|\delta|} - 1 \right) - 3.01 [k\Omega]$$

$$R_{trimup} = 6.19 \times \left(\frac{V_o \times (100 + \delta)}{V_{ref} \times \Delta} - \frac{100}{\delta} \right) - 9.2 [k\Omega]$$

Note:

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

Output voltage $V_o = 28$ V

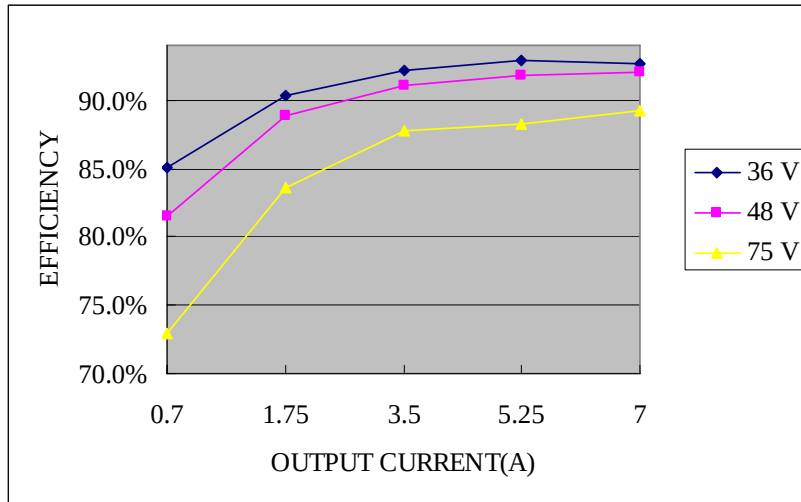


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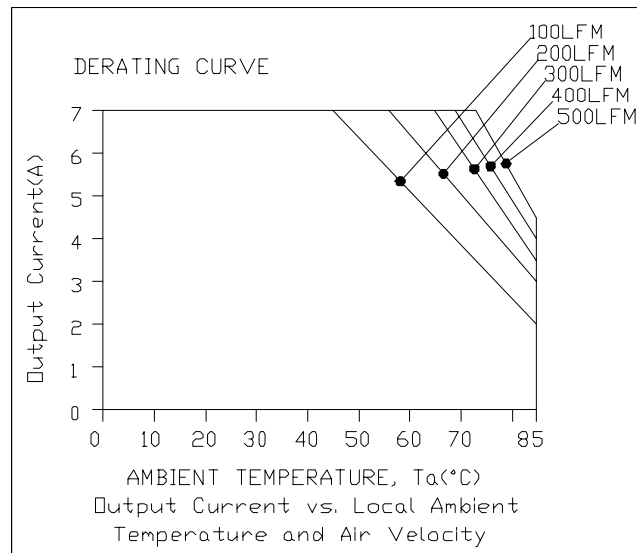


Efficiency Data



Thermal Derating Curve

$V_{in}=48V$, with maximum junction temperature of semiconductors derated to $120^{\circ}C$.

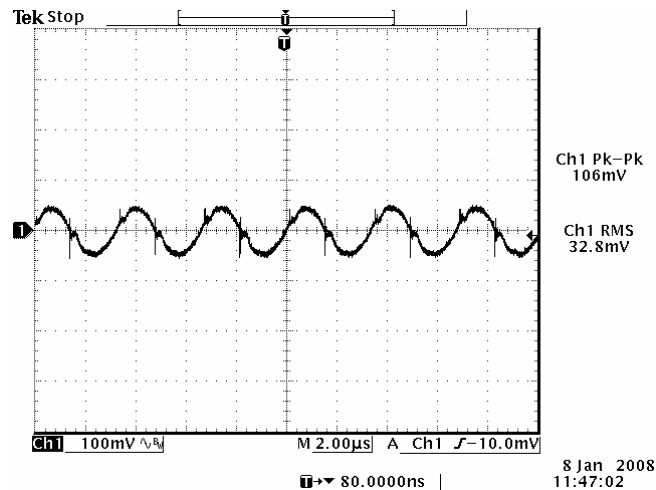


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48 Vdc Input 28 Vdc / 7 A Output

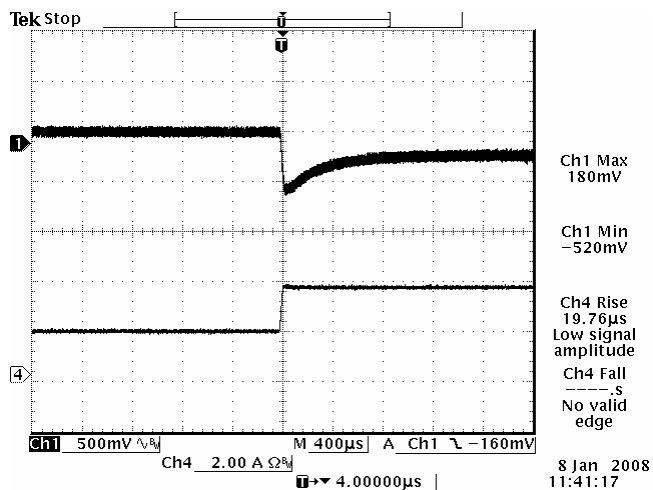
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Ripple and Noise Waveform

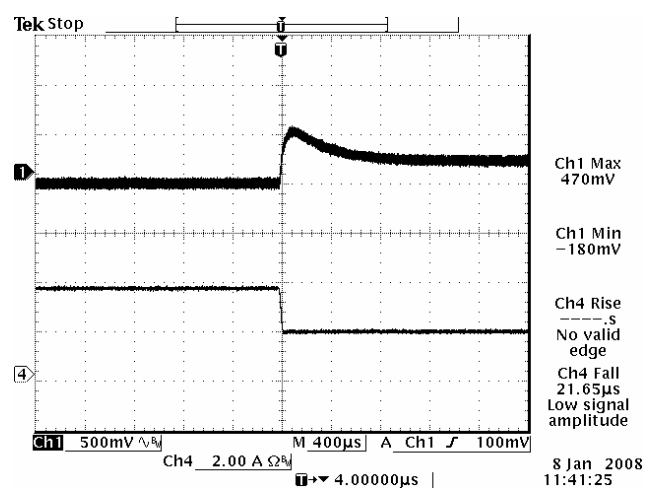


Note: Ripple and noise at full load, 48 Vdc input, 28 Vdc/7 A output, and with a 1 μ F ceramic cap and a 100 μ F aluminum cap at the output, $T_a=25$ deg C.

Transient Response Waveforms



25%-50% Load Transients at $V_{in}=48$



50%-25% Load Transients at $V_{in}=48$ V

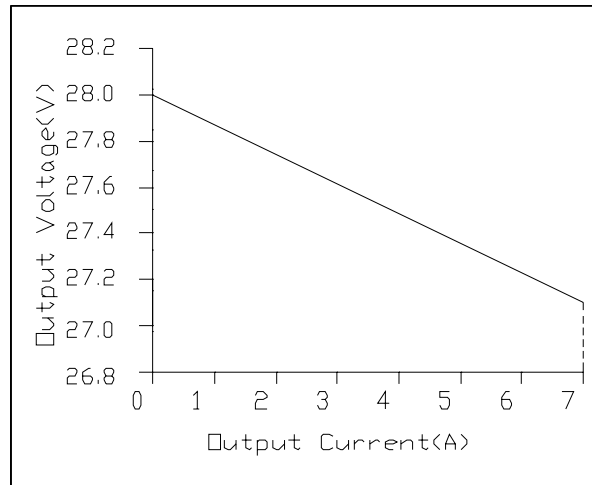
Note: Transients response at $di/dt=0.1$ A/ μ s, $V_{in}=48$ Vdc, $T_a=25$ $^{\circ}$ C, with 1 μ F ceramic capacitor and a 100 μ F aluminum cap at the output.

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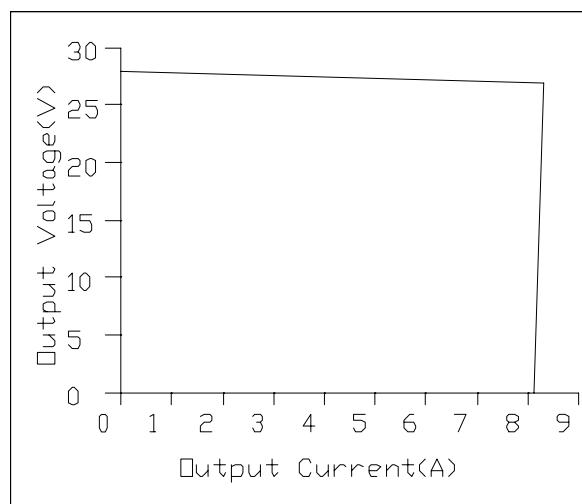


Droop Rate



Typical Output Voltage vs. Load Current at $T_a=25^{\circ}\text{C}$.

Current Limit



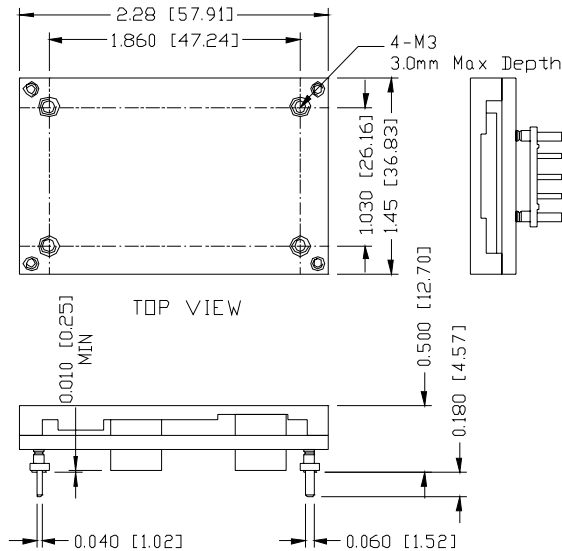
Output Current Limit Characteristics vs. Output Voltage at $T_a=25^{\circ}\text{C}$.

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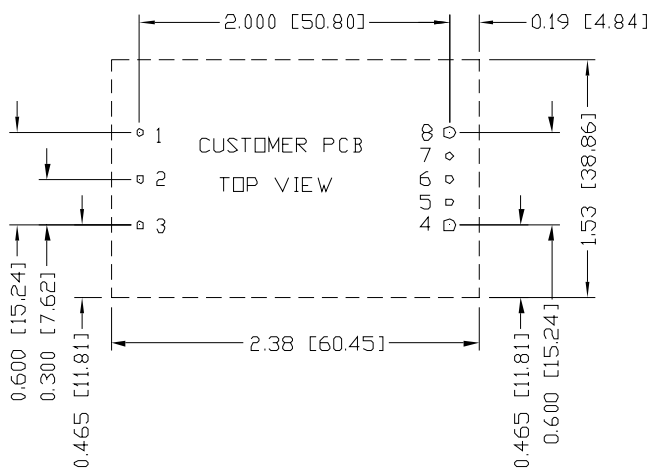
48 Vdc Input 28 Vdc /7 A Output



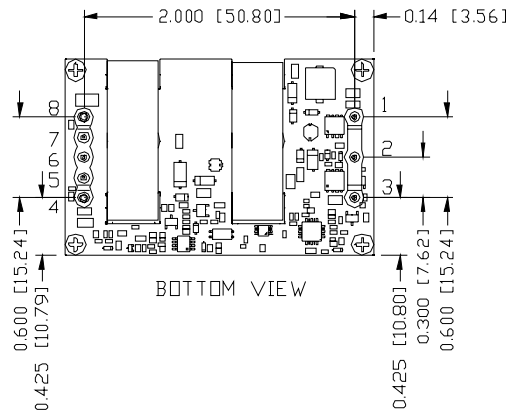
Mechanical Outline



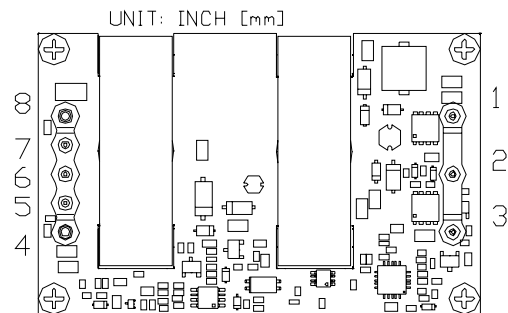
RECOMMENDED PAD LAYOUT



1,2,3,5,6,7 Ø0.047 HOLE SIZE, Ø0.08 min PAD SIZE
4,8 Ø0.07 HOLE SIZE, Ø0.10 min PAD SIZE



BOTTOM VIEW



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Pin Connections

Pin	Function	Pin Size
1	Vin(+)	0.040"
2	On/Off	0.040"
3	Vin(-)	0.040"
4	Vo(-)	0.062"
5	Sense(-)	0.040"
6	Trim	0.040"
7	Sense(+)	0.040"
8	Vo(+)	0.062"

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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