ISOLATED DC/DC CONVERTERS

48 V Input 12 V/12 A, 3.3 V/46 A, 5 V/30 A, 1.2 V - 2.5 V/50 A

bel POWER PRODUCTS

0RQB-C5T Series RoHS Compliant PRELIMINARY

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

Description

The 0RQB-C5T Series are isolated dc/dc converters that operate from a nominal 48 V source. These units will provide up to 150 W of output power from a nominal 48 V input. These units are designed to be highly efficient and low cost. Typical efficiency of 12 V output at 48 V input at full load is 93%. Features include remote on/off, over current protection and under-voltage lockout. These converters are 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
12 V	36 V - 75 V	12 A	144 W	93.0%	0RQB-C5T120	0RQB-C5T12L
5.0 V	36 V - 75 V	30 A	150 W	92.5%	0RQB-C5T050	0RQB-C5T05L
3.3 V	36 V - 75 V	46 A	152 W	91.0%	0RQB-C5T033	0RQB-C5T03L
2.5 V	36 V - 75 V	50 A	125 W	90.5%	0RQB-C5T025	0RQB-C5T02L
1.8 V	36 V - 75 V	50 A	90 W	88.0%	0RQB-C5TV80	0RQB-C5TV8L
1.5 V	36 V - 75 V	50 A	75 W	85.0%	0RQB-C5TV50	0RQB-C5TV5L
1.2 V	36 V - 75 V	50 A	60 W	83.0%	0RQB-C5TV20	0RQB-C5TV2L

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	

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

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	36 V	48 V	75 V	
Input Current (full load)				
Vo=12 V	-	-	4.5 A	
Vo=5.0 V	-	-	4.9 A	
Vo=3.3 V	-	-	4.9 A	
Vo=2.5 V	-	-	4.1 A	
Vo=1.8 V	-	-	3.0 A	
Vo=1.5 V	-	-	2.6 A	
Vo=1.2 V	-	-	2.1 A	
Input Current (no load)	-	120 mA	180 mA	
Remote Off Input Current		10 mA	15 mA	
Input Reflected Ripple Current (pk-pk)	-	10 mA	15 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)	-	1.5 mA	3 mA	
I^2t Inrush Current Transient	-	0.05 A^2s	0.1 A^2s	
Turn-on Voltage Threshold	32 V	34 V	35 V	
Turn-off Voltage Threshold	30 V	32 V	34 V	
Input over voltage Lockout	76 V	78 V	80 V	

Output Specifications

Parameter		Min	Typ	Max	Notes
Output Voltage Set Point					
	Vo=12 V	11.790 V	12.030 V	12.270 V	
	Vo=5.0 V	4.925 V	5.004 V	5.075 V	
	Vo=3.3 V	3.260 V	3.308 V	3.360 V	
	Vo=2.5 V	2.450 V	2.503 V	2.550 V	Vin=48 V, Io=50% full load
	Vo=1.8 V	1.770 V	1.808 V	1.844 V	
	Vo=1.5 V	1.477 V	1.500 V	1.523 V	
	Vo=1.2 V	1.176 V	1.200 V	1.224 V	
Line Regulation					
	Vo=12 V	-	±8 mV	±15 mV	
	Vo=5.0 V	-	±5 mV	±15 mV	
	Vo=1.2 V-3.3 V	-	±3 mV	±6 mV	
Load Regulation					
	Vo=5.0 V-12 V	-	±10 mV	±20 mV	
	Vo=2.5 V-3.3 V	-	±5 mV	±10 mV	
	Vo=1.2 V-1.8 V	-	±2 mV	±5 mV	
Regulation Over Temperature					
(-40 °C to +85 °C)	Vo=12 V	-	±60 mV	±100 mV	
	Vo=5.0 V	-	±40 mV	±65 mV	
	Vo=3.3 V	-	±30 mV	±50 mV	
	Vo=2.5 V	-	±20 mV	±40 mV	
	Vo=1.8 V-1.2 V	-	±15 mV	±30 mV	
Output Current					
	Vo=12 V	0 A	-	12 A	
	Vo=5.0 V	0 A	-	30 A	
	Vo=3.3 V	0 A	-	46 A	
	Vo=1.2 V-2.5 V	0 A	-	50 A	

Output Specifications (continued)

Parameter			Min	Typ	Max	Notes
Current Limit Threshold						
		Vo=12 V	14 A	15.5 A	18 A	
		Vo=5.0 V	35 A	40 A	45 A	
		Vo=3.3 V	50 A	60 A	65 A	
		Vo=1.2 V-2.5 V	55 A	60 A	65 A	
Short Circuit Surge Transient			-	3 A^2s	5 A^2s	
Ripple and Noise (rms)						
		Vo=12 V	-	25 mV	30 mV	
		Vo=5.0 V	-	20 mV	25 mV	
		Vo=3.3 V	-	20 mV	20 mV	
		Vo=1.2 V-2.5 V	-	15 mV	20 mV	Test conditions: 0-20 MHz BW, with a 1 uF ceramic capacitor and a 10 uF Tantalum capacitor at the output.
Ripple and Noise (pk-pk)						
		Vo=12 V	-	70 mV	90 mV	
		Vo=5.0 V	-	60 mV	80 mV	
		Vo=3.3 V	-	50 mV	70 mV	
		Vo=1.8 V	-	45 mV	60 mV	
		Vo=2.5 V	-	40 mV	60 mV	
		Vo=1.5 V	-	55 mV	70 mV	
		Vo=1.2 V	-	40 mV	60 mV	
Turn on Time			10 mS	-	100 mS	
Overshoot at Turn on			-	0%	5%	
Output Capacitance						
		Vo=12.0 V	0 uF	-	2200 uF	
		Vo=5.0 V	0 uF	-	10000 uF	
		Vo=1.2 V-3.3 V	0 uF	-	20000 uF	
Transient Response						
50% ~ 75% Max Load	Overshoot	Vo=12.0 V	-	600 mV	800 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		-	200 uS	300 uS	
75% ~ 50% Max Load	Overshoot		-	600 mV	800 mV	
	Settling Time		-	200 uS	300 uS	
50% ~ 75% Max Load	Overshoot	Vo=5.0 V	-	250 mV	375 mV	
	Settling Time		-	100 uS	200 uS	
75% ~ 50% Max Load	Overshoot		-	250 mV	375 mV	
	Settling Time		-	100 uS	200 uS	
50% ~ 75% Max Load	Overshoot	Vo=3.3 V	-	100 mV	200 mV	
	Settling Time		-	200 uS	300 uS	
75% ~ 50% Max Load	Overshoot		-	100 mV	200 mV	
	Settling Time		-	200 uS	300 uS	
50% ~ 75% Max Load	Overshoot	Vo=2.5 V	-	100 mV	200 mV	
	Settling Time		-	300 uS	400 uS	
75% ~ 50% Max Load	Overshoot		-	100 mV	200 mV	
	Settling Time		-	300 uS	400 uS	
50% ~ 75% Max Load	Overshoot	Vo=1.8 V Vo=1.5 V	-	100 mV	140 mV	
	Settling Time		-	200 uS	300 uS	
75% ~ 50% Max Load	Overshoot		-	100 mV	140 mV	
	Settling Time		-	200 uS	300 uS	
50% ~ 75% Max Load	Overshoot	Vo=1.2 V	-	100 mV	120 mV	
	Settling Time		-	200 uS	300 uS	
75% ~ 50% Max Load	Overshoot		-	100 mV	120 mV	
	Settling Time		-	200 uS	300 uS	

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
V_O=12 V	90%	93%	-	Vin=48 V, full load , Ta=25 °C
V_O=5.0 V	89%	92.5%	-	
V_O=3.3 V	88%	91%	-	
V_O=2.5 V	87%	90.5%	-	
V_O=1.8 V	85%	88%	-	
V_O=1.5 V	82%	85%	-	
V_O=1.2 V	80%	83%	-	
Switching Frequency	280 kHz	330 kHz	380 kHz	
Isolation capacitance	-	1500 pF	-	
Input to Output Isolation Voltage	-	-	2000 V	
Remote Sense Compesation	-	-	10% Vo	The total voltage increased by trim and remote sense should not exceed 10%Vo.
Output Voltage Trim Range	80% Vo	-	110% Vo	
Over Temperature Protection	-	125 °C	-	
Over Voltage Protection	-	130% Vo	-	Vin=48V, full load, Hiccup mode
MTBF	TBD			Calculated Per Bell Core SR-332 (I_O = Nominal; T_a = 25 °C)
Dimensions				
Inches	2.30 x 1.45 x 0.395			
millimeters	58.42 x 36.83 x 10.03			
Weight	-	41 g	-	

Control Specifications

Parameter		Min	Typ	Max	Notes
Remote On/Off					
Signal Low (Unit On)	Active Low	-0.3 V	-	0.8 V	0RQB-C5TxxL. The remote on/off pin open, Unit off.
Signal High (Unit Off)		2.4 V	-	18 V	
Signal Low (Unit Off)	Active High	-0.3 V	-	0.8 V	0RQB-C5Txx0. The remote on/off pin open, Unit on.
Signal High (Unit On)		2.4 V	-	18 V	
Current Sink		0 mA	-	0.75 mA	

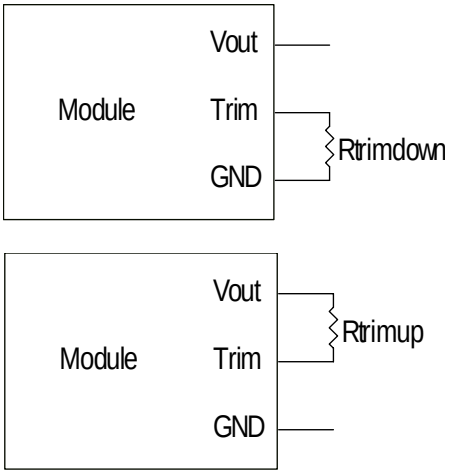
Output Trim Equations

Equations for calculating the trim resistor are shown below (Unit: kΩ). 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.

1) For Vo=1.5 V – 12 V:

$$Rtrimdown = \frac{511}{|delta|} - 10.22$$

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



Note:

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

Vo_req=Desired (trimmed) output voltage [V]; Vo=output voltage
Vo=12.004 V for 12 V output; Vo=5 V for 5.004 V output; Vo=3.308 V for 3.3 V output; Vo=2.503 V for 2.5 V output; Vo=1.808 V for 1.8 V output; Vo=1.503 V for 1.5 V output

2) For Vo=1.2 V:

$$Rtrimdown = \frac{511}{|delta|} - 10.22$$

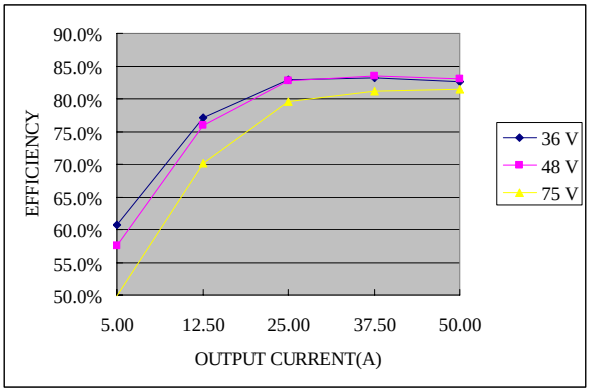
$$Rtrimup = \frac{(100 + delta) \cdot Vo \cdot 5.11 - 313}{0.6125 \cdot delta} - 10.22$$

Note:

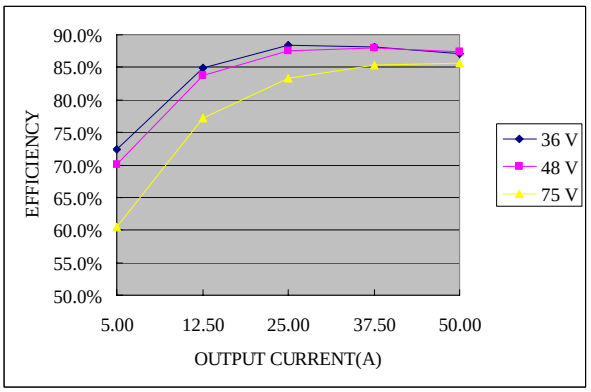
$$delta = \frac{(Vo\_req - Vo)}{Vo} \times 100[\%]$$

Vo_req=Desired (trimmed) output voltage [V]; Vo=output voltage
Vo=1.202 V for 1.2 V output

Efficiency Data



0RQB-C5TV2x



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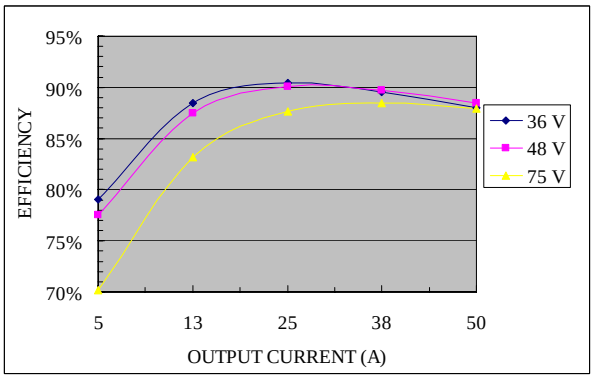

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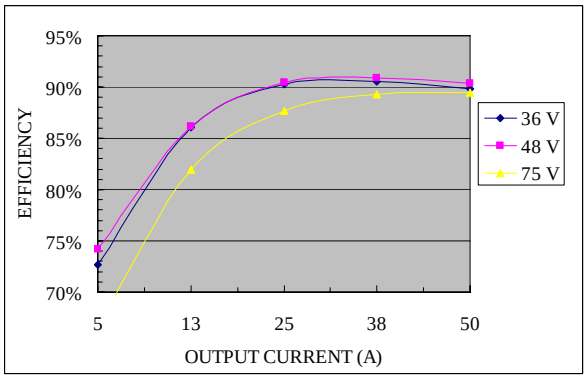

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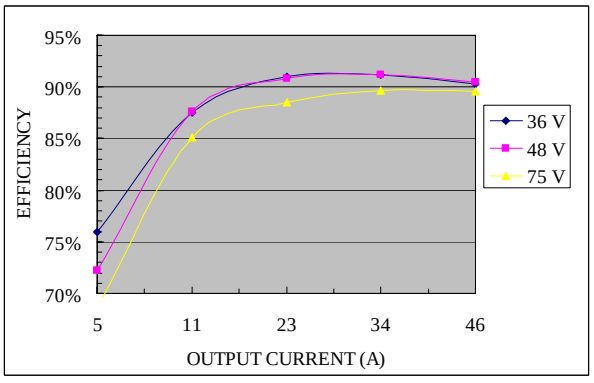

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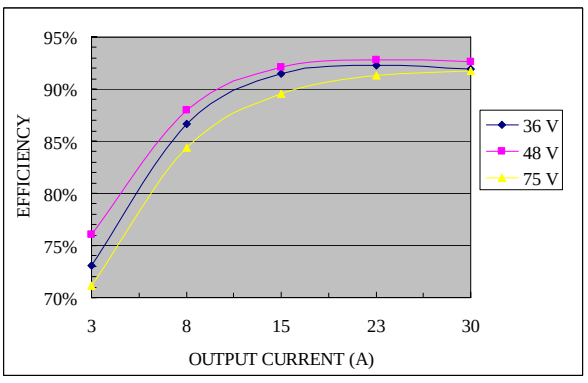
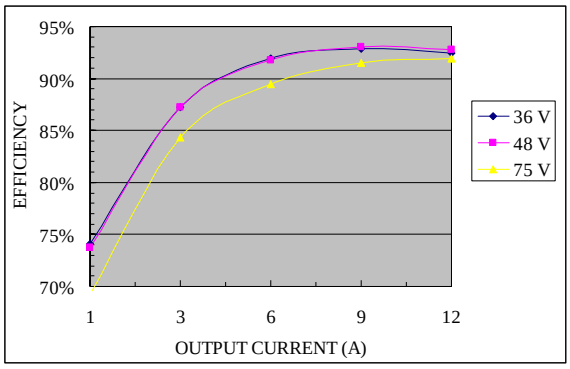


0RQB-C5T05x

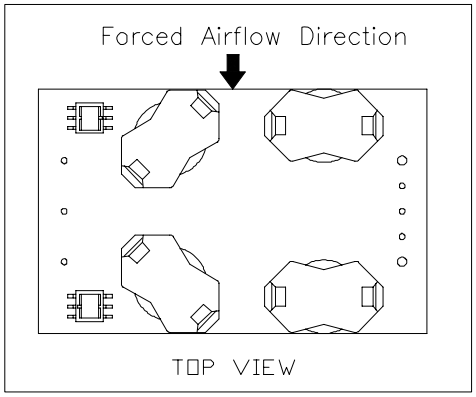
Efficiency Data (continued)



0RQB-C5T12x

Thermal Derating Curves

Vin=48V, with maximum junction temperature of semiconductors derated to 120 degree C.



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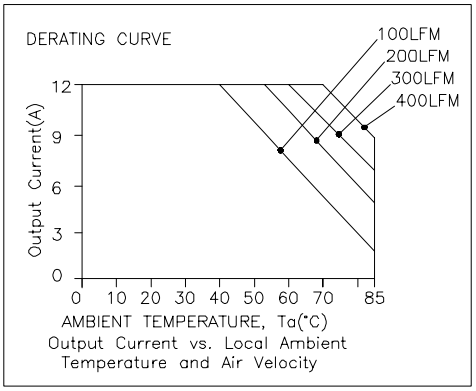

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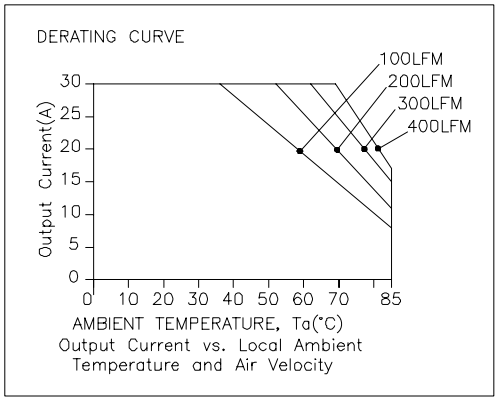

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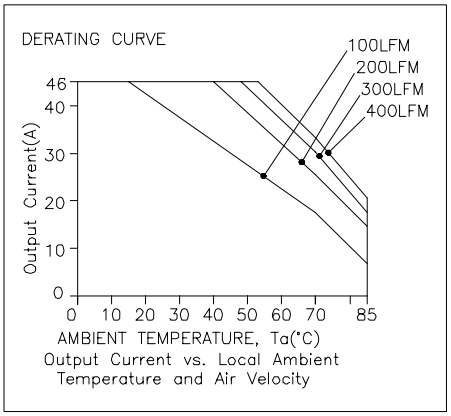

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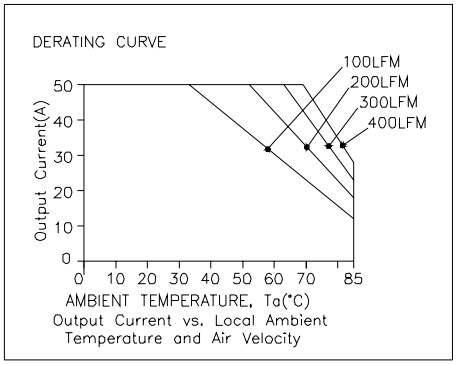
Thermal Derating Curves (continued)



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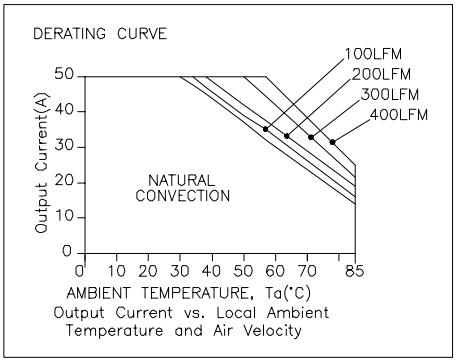

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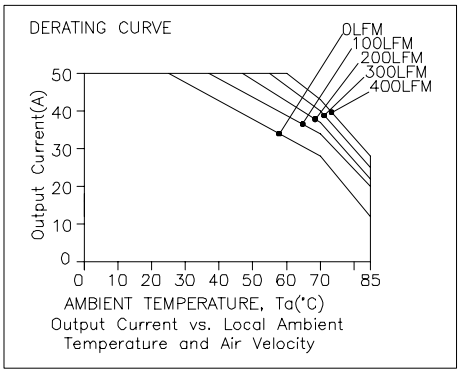

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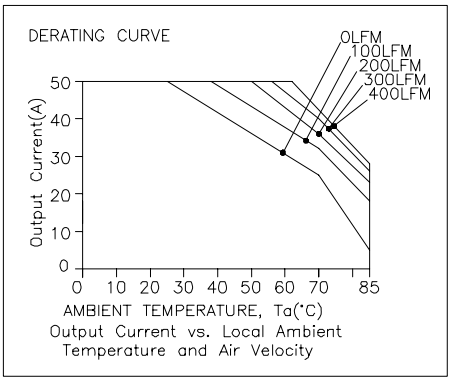
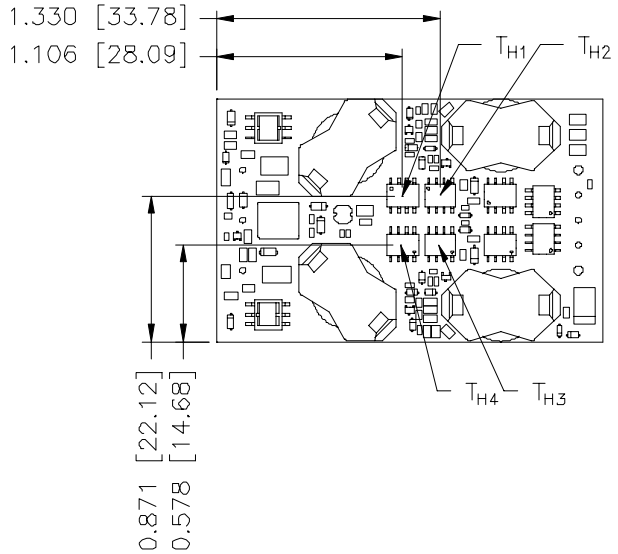


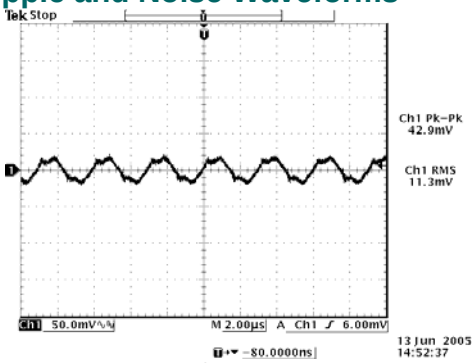
0RQB-C5TV2x

Thermal Reference

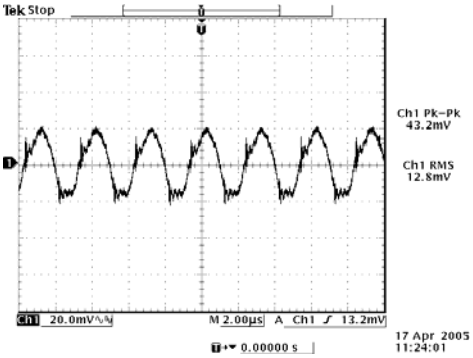


Note: T_{H1}, T_{H2}, T_{H3} and T_{H4} are hot spots which should not exceed 115 degree C.

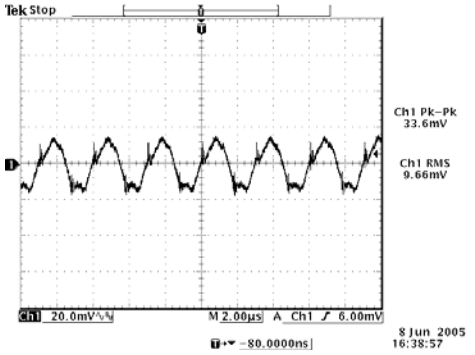
Ripple and Noise Waveforms



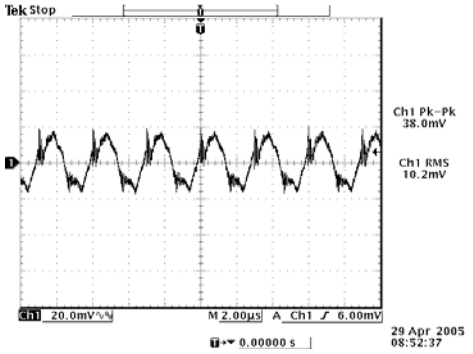
Ripple and noise at full load, 1.2 V/50 A output



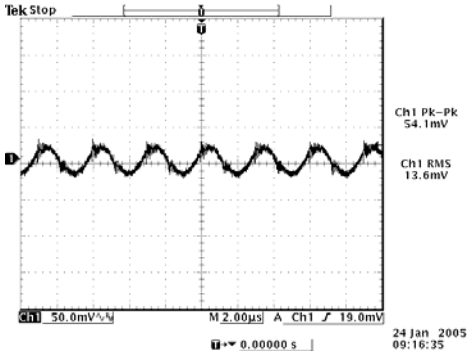
Ripple and noise at full load, 1.5 V/50 A output



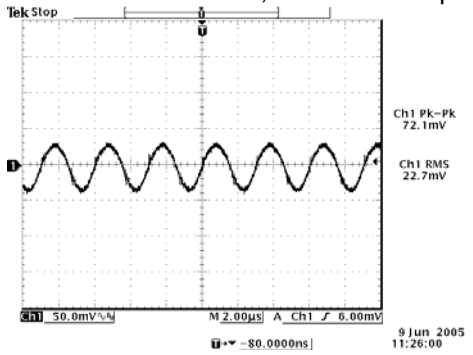
Ripple and noise at full load, 1.8 V/50 A output



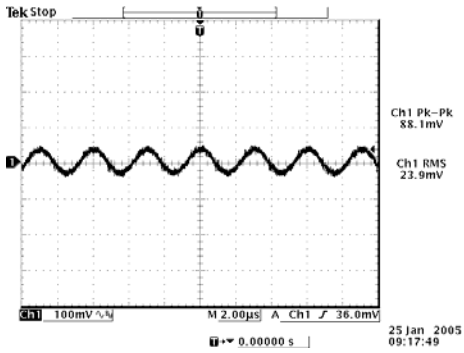
Ripple and noise at full load, 2.5 V/45 A output



Ripple and noise at full load, 3.3 V/46 A output



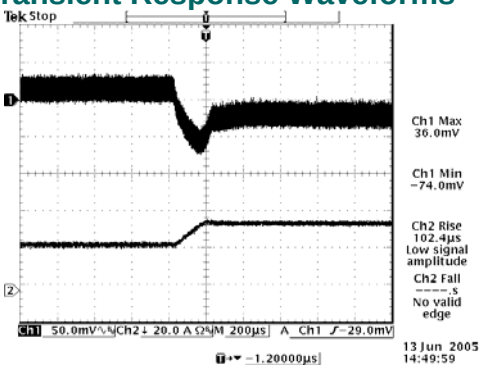
Ripple and noise at full load, 5.0 V/30 A output



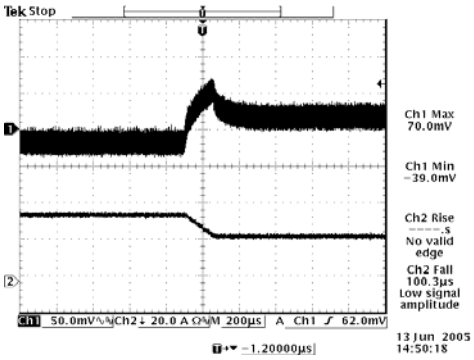
Ripple and noise at full load, 12 V/12 A output

Note: Ripple and noise is tested with a 1 uF ceramic cap and a 10 uF tantalum capat output, Ta=25 deg C.

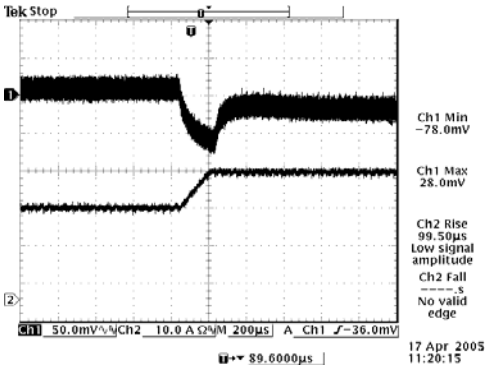
Transient Response Waveforms



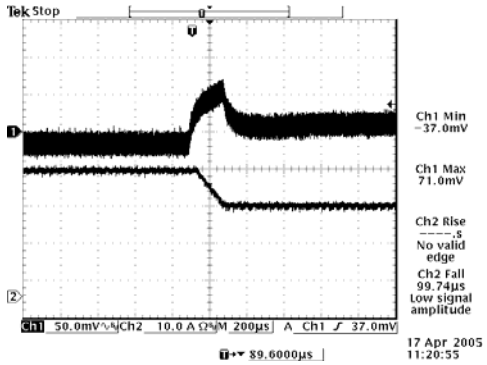
Vout= 1.2 V 50%-75% Load Transients



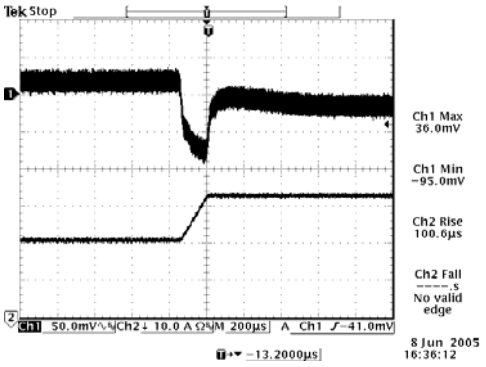
Vout= 1.2 V 75%-50% Load Transients



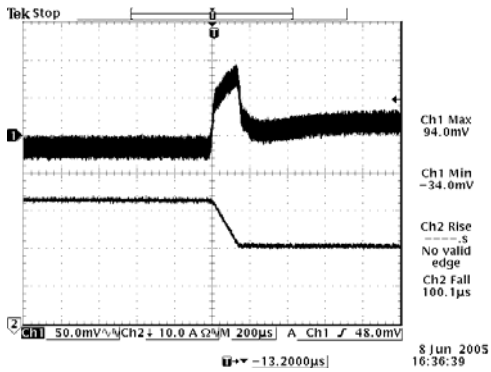
Vout= 1.5 V 50%-75% Load Transients



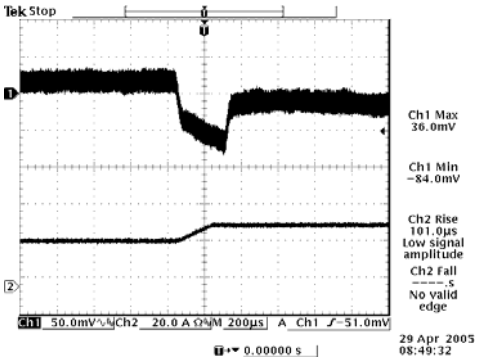
Vout= 1.5 V 75%-50% Load Transients



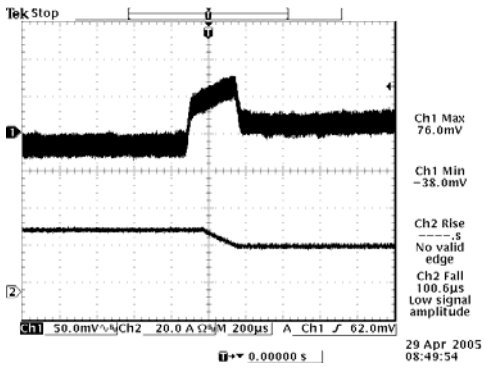
Vout= 1.8 V 50%-75% Load Transients



Vout= 1.8 V 75%-50% Load Transients

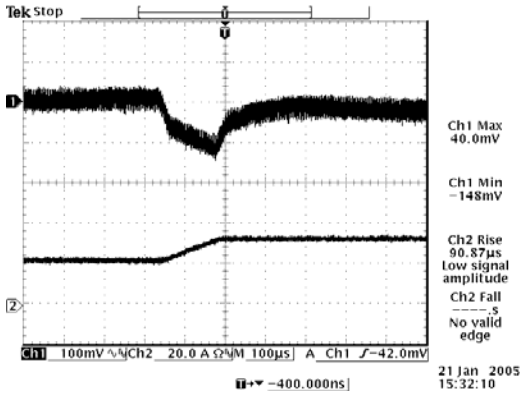


Vout= 2.5 V 50%-75% Load Transients

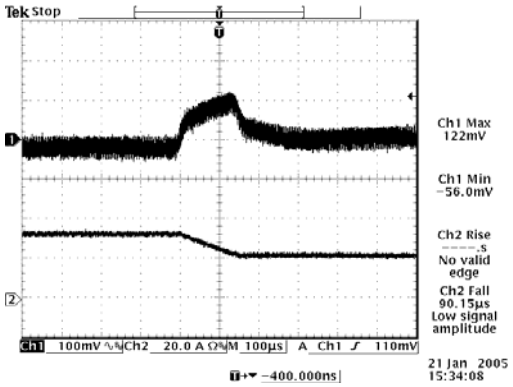


Vout= 2.5 V 75%-50% Load Transients

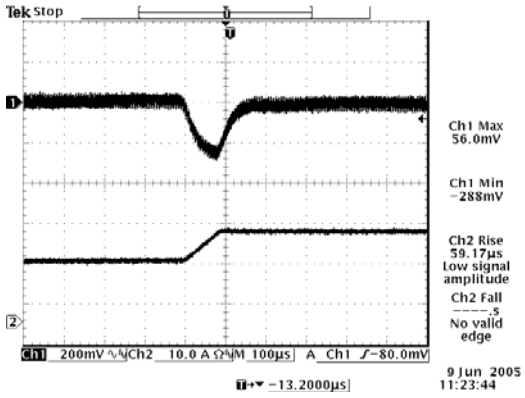
Transient Response Waveforms (continued)



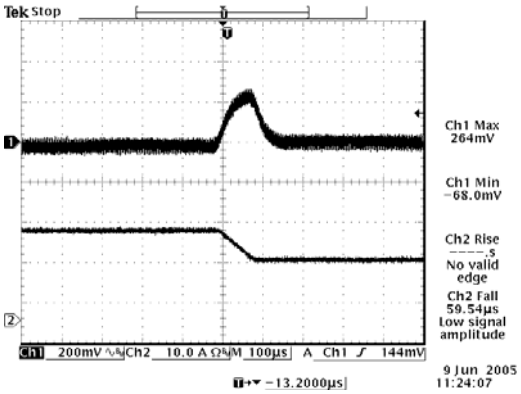
Vout= 3.3 V 50%-75% Load Transients



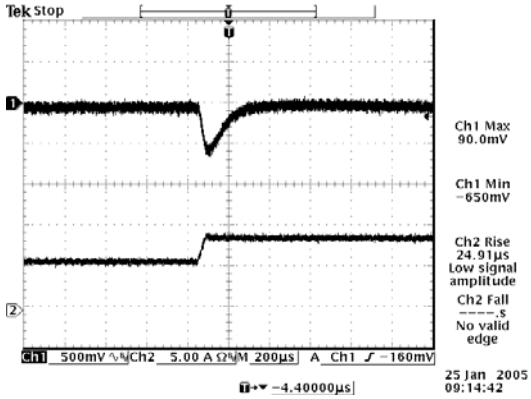
Vout= 3.3 V 75%-50% Load Transients



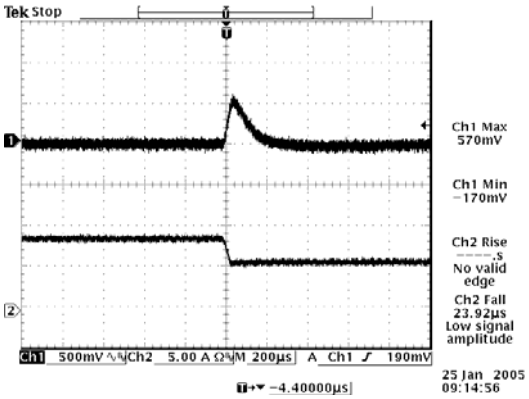
Vout= 5.0 V 50%-75% Load Transients



Vout= 5.0 V 75%-50% Load Transients



Vout= 12 V 50%-75% Load Transients

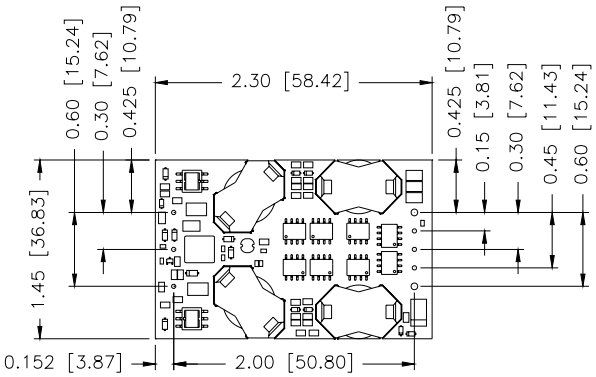


Vout= 12 V 75%-50% Load Transients

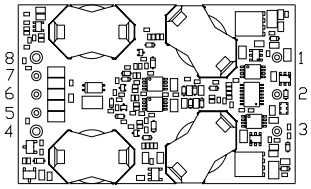
ISOLATED DC/DC CONVERTERS

48 V Input 12 V/12 A, 3.3 V/46 A, 5 V/30 A, 1.2 V - 2.5 V/50 A

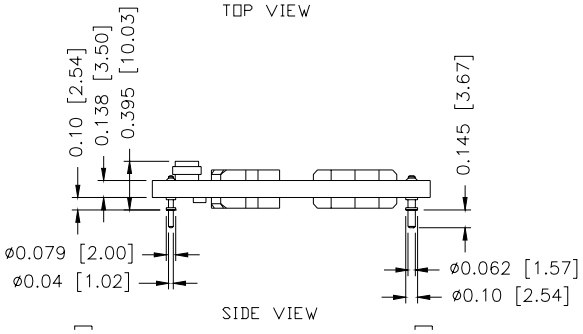
Mechanical Outline



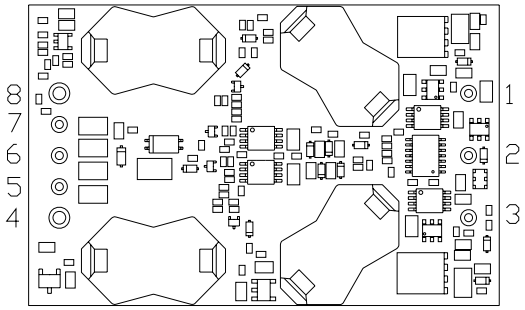
TOP VIEW



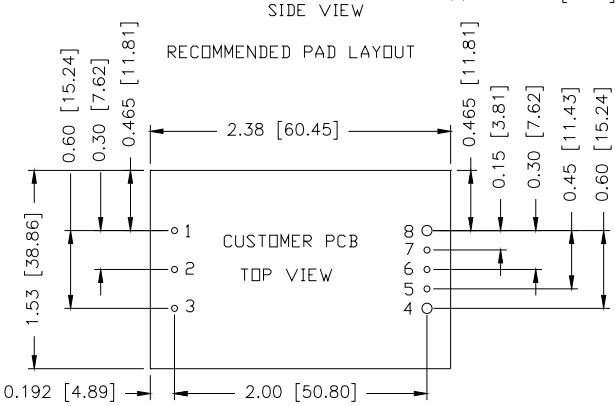
BOTTOM VIEW



SIDE VIEW



BOTTOM VIEW



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

Pin Connections

Pin	Function	Pin Size
1	Vin (+)	0.04"
2	Remote On/Off	0.04"
3	Vin (-)	0.04"
4	Vout (-)	0.062"
5	Remote Sense (-)	0.04"
6	Trim	0.04"
7	Remote Sense (+)	0.04"
8	Vout (+)	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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