

## ISOLATED DC/DC CONVERTERS

48 Vdc Input 1.0 - 1.8 Vdc/13 - 10 A, 3.3 - 3.4 Vdc/8 - 10 A Dual Outputs

**bel**  
POWER PRODUCTS

### 0RXW-45TDx0 Series RoHS Compliant Rev.C

- Isolated
- Fixed Frequency (270 kHz)
- High Efficiency
- High Power Density
- Low Cost
- Input Under-voltage Lockout (UVLO)
- Output Over-voltage shut down
- Over Temperature Protection
- SCP/OCP
- Remote On/Off
- Output Voltage Trim
- Safety Approval to UL60950-1 (UL/cUL)



### Description

The 0RXW-45TDx0 series converters are isolated dc/dc converters that operate from a nominal 48 Vdc source. These converters provide up to 45 W of output power with two output voltages. These units are designed to be highly efficient and cost-effective. Typical features include remote on/off, over current protection, short circuit protection, over temperature protection and input under voltage lockout. These converters are provided in a compact, through-hole industrial standard package that is easy to use and provides good thermal performance.

### Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number
3.3 V/1.2 V	36 V - 75 V	8 A/13 A	45 W	84%	0RXW-45TD10
3.3 V/1.5 V	36 V - 75 V	8 A/12 A	45 W	85%	0RXW-45TD20
3.3 V/1.8 V	36 V - 75 V	10 A/10 A	45 W	85%	0RXW-45TD30
3.4 V/1.6 V	36 V - 75 V	8 A/12 A	45 W	85%	0RXW-45TD40
3.3 V/1.0 V	36 V - 75 V	8 A/13 A	45 W	84%	0RXW-45TD50

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

### Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Continuous Input Voltage	-0.3 V	-	80 V	
Remote On/Off	-0.3 V	-	12 V	Active Low
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

### Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	36 V	-	75 V	
Input Current (no load)	-	60 mA	110 mA	
Input Current (full load)	-	-	2 A	
Remoted Off Input Current	-	6 mA	20 mA	
Input Reflected Ripple Current (rms)	-	20 mA	40 mA	With simulated source impedance of 10 uH, 5 Hz to 20 MHz. Input filter for noise, not for EMI. C1-L-C2 filter, C1=100uF/100V, L=12uH, C2=100uF/100V.
Input Reflected Ripple Current (pk-pk)	-	60 mA	100 mA	
$I^2t$ Inrush Current Transient	-	0.002 A <sup>2</sup> s	-	
Turn On Voltage Threshold	31 V	34 V	36 V	
Turn Off Voltage Threshold	30 V	33 V	35 V	

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## Output Specifications

Parameter		Min	Typ	Max	Notes
Output Voltage Set Point	V <sub>O1</sub> =1.0 V	0.96 V	1.0 V	1.04 V	Test conditions: V <sub>in</sub> =48 V, 50% load
	V <sub>O1</sub> =1.2 V	1.20 V	1.24 V	1.28 V	
	V <sub>O1</sub> =1.5 V	1.50 V	1.54 V	1.58 V	
	V <sub>O1</sub> =1.6 V	1.58 V	1.63 V	1.68 V	
	V <sub>O1</sub> =1.8 V	1.80 V	1.84 V	1.88 V	
	V <sub>O2</sub> =3.3 V	3.30 V	3.34 V	3.38 V	
	V <sub>O2</sub> =3.4 V	3.38 V	3.35 V	3.52 V	
Regulation	Line Regulation	-	-	0.5% V <sub>O</sub>	(V <sub>in</sub> = 36~75 V I <sub>omax</sub> for V <sub>O2</sub> ) (V <sub>in</sub> = 48 V, I <sub>o</sub> = 0-I <sub>omax</sub> for V <sub>O2</sub> )
	Load Regulation	-	-	1.5% V <sub>O</sub>	
	Cross Regulation	-	-	1.5% V <sub>O</sub>	
Regulation Over Temperature		-	-	0.02% V <sub>O</sub> /°C	(-40°C to +70°C)
Output Current	V <sub>O1</sub> =1.2 V V <sub>O2</sub> =3.3 V	0 A 0 A	- -	13 A 8 A	0RXW-45TD10
	V <sub>O1</sub> =1.5 V V <sub>O2</sub> =3.3 V	0 A 0 A	- -	12 A 8 A	0RXW-45TD20
	V <sub>O1</sub> =1.8 V V <sub>O2</sub> =3.3 V	0 A 0 A	- -	10 A 10 A	0RXW45TD30
	V <sub>O1</sub> =1.6 V V <sub>O2</sub> =3.4 V	0 A 0 A	- -	12 A 8 A	0RXW45TD40
	V <sub>O1</sub> =1.0 V V <sub>O2</sub> =3.3 V	0 A 0 A	- -	13 A 8 A	0RXW45TD50
Output Current Limit	V <sub>O1</sub> =1.2 V V <sub>O2</sub> =3.3 V	15 A 9 A	- -	- -	Hiccup Mode
	V <sub>O1</sub> =1.5 V V <sub>O2</sub> =3.3 V	15 A 9 A	- -	- -	
	V <sub>O1</sub> =1.8 V V <sub>O2</sub> =3.3 V	13 A 12 A	- -	- -	
	V <sub>O1</sub> =1.6 V V <sub>O2</sub> =3.4 V	13 A 9 A	- -	- -	
	V <sub>O1</sub> =1.0 V V <sub>O2</sub> =3.3 V	15 A 9 A	- -	- -	
Short Circuit Protection		-	-	-	Hiccup Mode
Ripple and Noise (rms) V <sub>O1</sub> =1.0V/1.2V/1.5V/1.6V V <sub>O1</sub> =1.8V V <sub>O2</sub> =3.3 V/3.4V		- - -	5 mV 6 mV 6 mV	10 mV 10 mV 10 mV	0-20MHz BW, with a 1uf ceramic capacitor and a 10µF tantalum capacitor at output, V <sub>in</sub> =48V, With all load and at 25C ambient.
Ripple and Noise (pk-pk) V <sub>O1</sub> =1.0V/1.2V/1.5V/1.6V V <sub>O1</sub> =1.8V V <sub>O2</sub> =3.3 V/3.4V		- - -	15 mV 25 mV 25 mV	25 mV 35 mV 35 mV	
Ripple and Noise (rms) V <sub>O1</sub> =1.0V/1.2V/1.5V/1.6V/1.8V V <sub>O2</sub> =3.3 V/3.4V		- -	15 mV 15 mV	30 mV 30 mV	0-20MHz BW, over all load, line and temperature conditions with a 1µF tantalum capacitor and a 10µF tantalum capacitor at output
Ripple and Noise (pk-pk) V <sub>O1</sub> =1.0V/1.2V/1.5V/1.6V/1.8V V <sub>O2</sub> =3.3 V/3.4V		- -	30 mV 30 mV	50 mV 50 mV	
Turn on Delay Time V <sub>O1</sub> =1.0 V/1.2 V/1.5 V/1.6V/1.8 V V <sub>O2</sub> =3.3 V/3.4 V		- -	- -	- -	V <sub>O1</sub> turns on no later than V <sub>O2</sub>

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### Output Specifications (continued)

Parameter		Min	Typ	Max	Notes	
Turn on Time		-	10 mS	20 mS		
Overshoot at Turn On		-	0%	5%		
Output Capacitance						
	Vo1=1.0 V	0 uF	-	5,600 uF		
	Vo1=1.2 V	0 uF	-	5,600 uF		
	Vo1=1.5 V	0 uF	-	5,600 uF		
	Vo1=1.6 V	0 uF	-	5,600 uF		
	Vo1=1.8 V	0 uF	-	5,600 uF		
	Vo2=3.3 V	0 uF	-	4,700 uF		
	Vo2=3.4 V	0 uF	-	4,700 uF		
<b>Transient Response</b>						
25% ~ 75% Max Load	Overshoot	Vo2=3.4 V	-	150 mV	200 mV	Test conditions: di/dt=1 A/us, Vin=48 V, with a 470 uF/6.3 V Tantalum capacitor at the output.
	Settling Time		-	100 uS	200 uS	
75% ~ 25% Max Load	Overshoot	Vo2=3.4 V	-	150 mV	200 mV	
	Settling Time		-	100 uS	200 uS	
25% ~ 75% Max Load	Overshoot	Vo2=3.3 V	-	100 mV	150 mV	
	Settling Time		-	100 uS	200 uS	
75% ~ 25% Max Load	Overshoot	Vo2=3.3 V	-	100 mV	150 mV	
	Settling Time		-	100 uS	200 uS	
25% ~ 75% Max Load	Overshoot	Vo1=1.8 V	-	100 mV	150 mV	
	Settling Time		Vo1=1.5 V	-	100 uS	
75% ~ 25% Max Load	Overshoot	Vo1=1.2 V	-	100 mV	150 mV	
	Settling Time		Vo1=1.0 V	-	150 uS	
25% ~ 75% Max Load	Overshoot	Vo1=1.6 V	-	150 mV	200 mV	
	Settling Time		-	100 uS	200 uS	
75% ~ 25% Max Load	Overshoot	Vo1=1.6 V	-	100 mV	200 mV	
	Settling Time		-	150 uS	200 uS	
	Settling Time			100 uS	200 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	83%	85%	-	Vin=48V; full load, Vo1=1.5V/1.6V/1.8 V
	82%	84%	-	Vin=48V; full load, Vo1=1.0V/1.2V
Switching Frequency	240 kHz	270 kHz	300 kHz	
I/O Isolation Voltage	-	1500 V	-	
Isolation Capacitance	-	1500 pF	-	
Output Trim Range	80%	-	110%	
Over Voltage Protection (Static)				Latch
Vo1=1.0 V	1.20 V	-	1.50 V	
Vo1=1.2 V	1.45 V	-	1.8 V	
Vo1=1.5 V	1.77 V	-	2.26 V	
Vo1=1.6 V	1.77 V	-	2.26 V	
Vo1=1.8 V	2.16 V	-	2.70 V	
Vo2=3.3 V	3.90 V	-	5.00 V	
Vo2=3.4 V	3.90 V	-	5.00 V	

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## General Specifications

Parameter	Min	Typ	Max	Notes
Over Voltage Protection(Dynamic)				Latch. The transient over voltage must be measured by shorting feedback opto-coupler.
Vo1=1.0 V	1.20 V	-	1.80 V	
Vo1=1.2 V	1.45 V	-	2.1 V	
Vo1=1.5 V	1.77 V	-	2.50 V	
Vo1=1.6 V	1.77 V	-	2.50 V	
Vo1=1.8 V	2.16 V	-	3.00 V	
Vo2=3.3 V	3.90 V	-	5.30 V	
Vo2=3.4 V	3.90 V	-	5.30 V	
Over-temperature	-	115 °C	-	
MTBF	1,590,652 hours			Calculated Per Bell Core SR-332 (Io = Normal; TA = 25 °C)
Dimensions				
Inches (L x W x H)	2.3 x 1.45 x 0.45			
Millimeters (L x W x H)	58.4 x 36.8 x 11.4			
Weight	-	26 g	-	

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

## Control Specifications

Parameter	Min	Typ	Max	Notes
<b>Remote On/Off</b>				
Signal High (Unit Off)	3.5 V	-	12 V	Active Low; Remote On/Off pin open, Unit on.
Signal Low (Unit On)	-0.3 V	-	1 V	

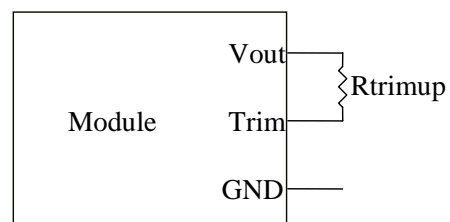
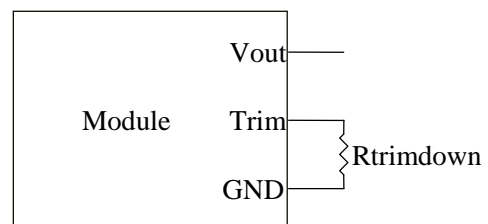
## Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom) are shown below. The Trim Down resistor should be connected between the Trim pin and GND. The Trim Up resistor should be connected between the Trim pin and Vout. Only one of the resistors should be used for any given application.

$$R_{trimdown} = \frac{2.81 \cdot V_{adj}}{V_{nom} - V_{adj}} - 2.37$$

$$R_{trimup} = \frac{(4.532 \cdot V_{nom} - 2.81) \cdot V_{adj}}{V_{adj} - V_{nom}} - 2.37$$

- Notes:**
- 0RXW-45TD50 Vnom=1.00 V
  - 0RXW-45TD40 Vnom=1.63 V
  - 0RXW-45TD30 Vnom=1.84 V
  - 0RXW-45TD20 Vnom=1.54 V
  - 0RXW-45TD10 Vnom=1.24 V

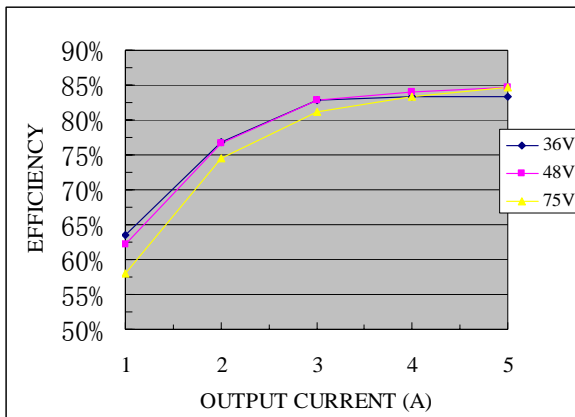


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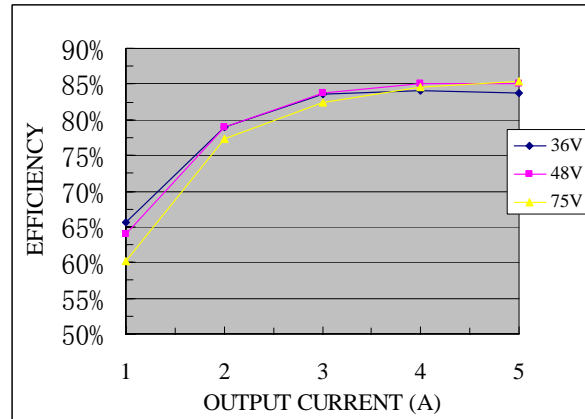
48 Vdc Input 1.0 - 1.8 Vdc/13 - 10 A, 3.3 - 3.4 Vdc/8 - 10 A Dual Outputs



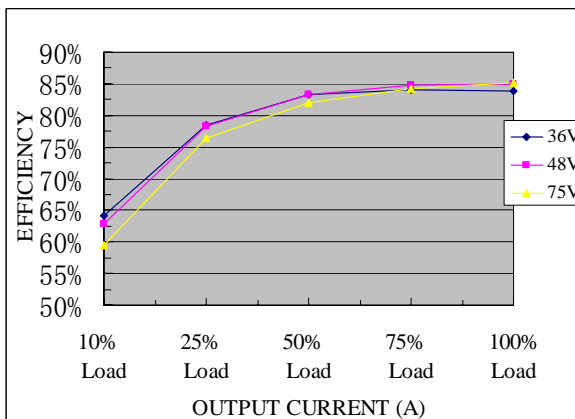
## Efficiency Data



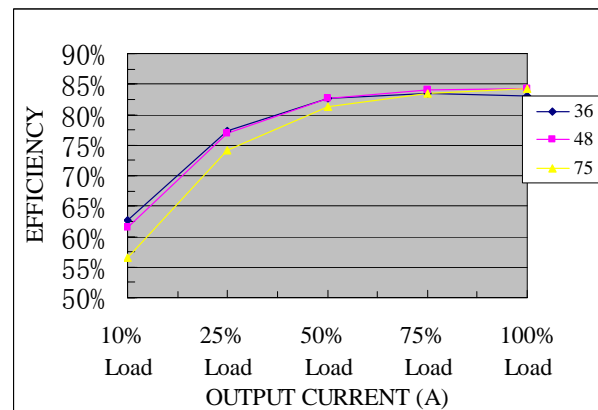
0RXW-45TD40



0RXW-45TD30

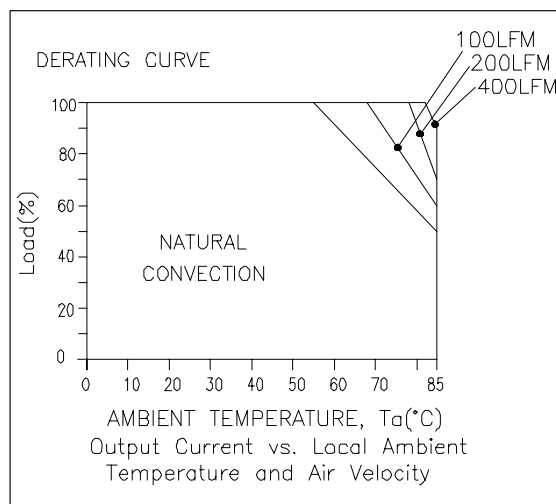


0RXW-45TD20



0RXW-45TD10

## Thermal Derating Curve



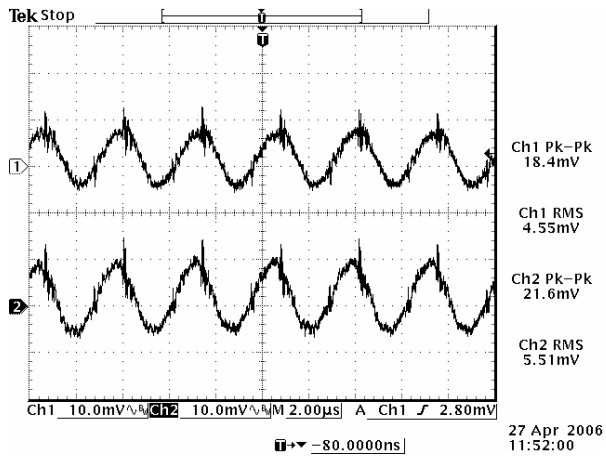
Derating curve for 3.3V/8A, 1.5V/12A output module

# ISOLATED DC/DC CONVERTERS

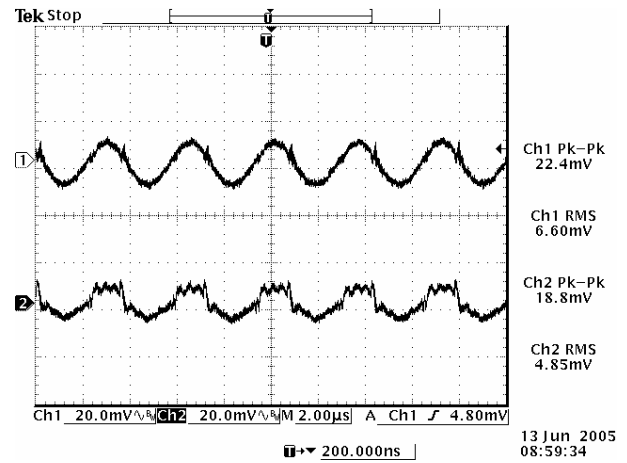
48 Vdc Input 1.0 - 1.8 Vdc/13 - 10 A, 3.3 - 3.4 Vdc/8 - 10 A Dual Outputs



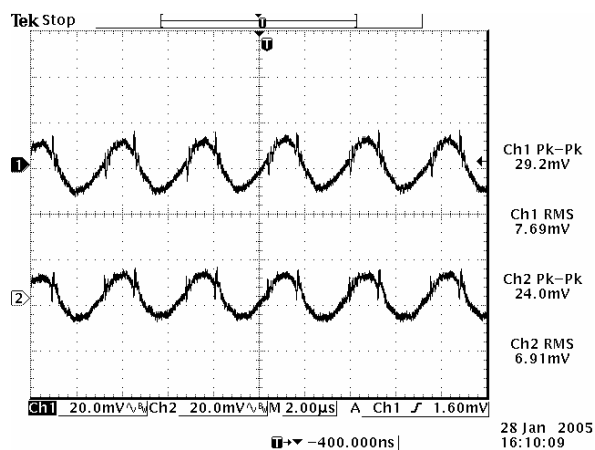
## Ripple and Noise Waveforms



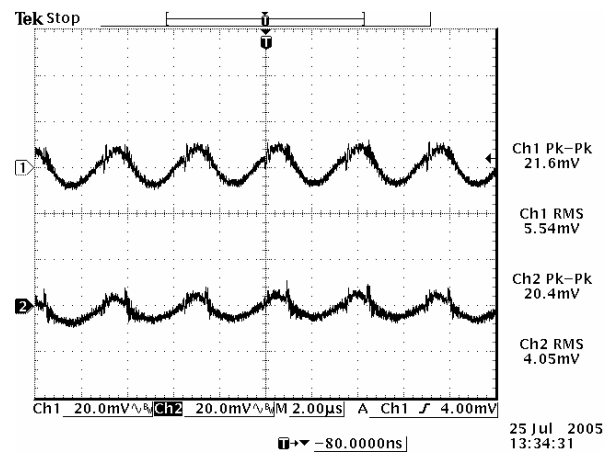
ch1 3.4 Vdc/8 A, ch2 1.6 Vdc/12 A



ch1 3.3 Vdc/10 A, ch2 1.8 Vdc/10 A



ch1 3.3 Vdc/8 A, ch2 1.5 Vdc/12 A



ch1 3.3 Vdc/8 A, ch2 1.2 Vdc/13 A

**Note:** Ripple and noise at full load, 48 Vdc input, with a 10µF Tan cap and 0.1µF ceramic cap at output.

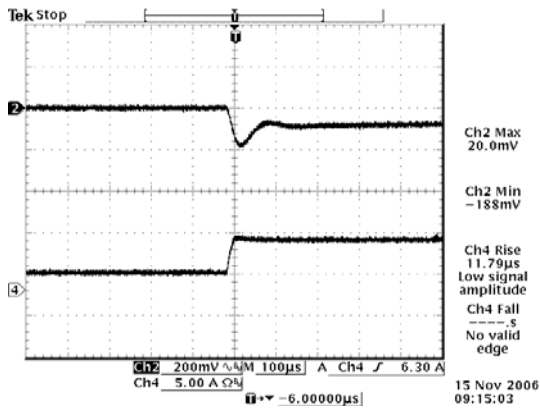
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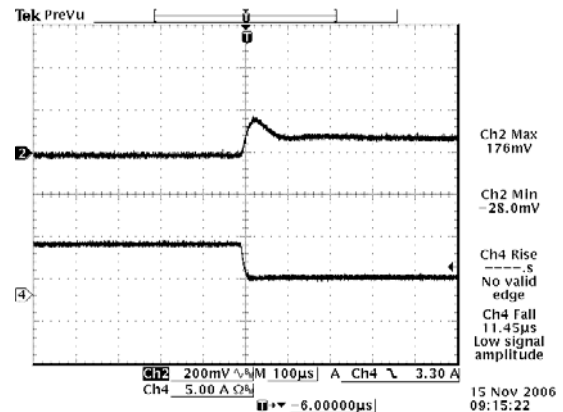


## Transient Response Waveforms

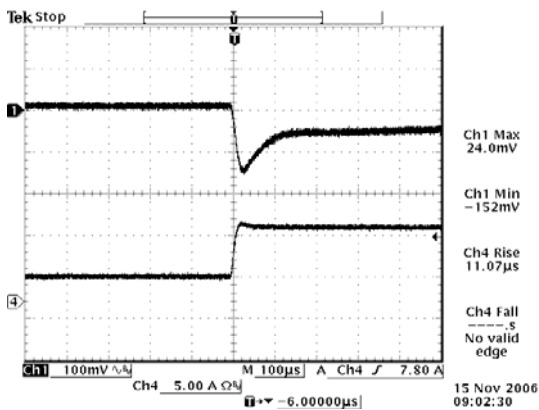
### 0RXW-45TD40



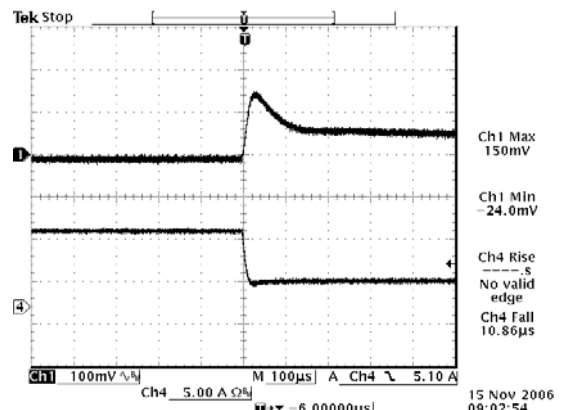
Vout=3.4 V 25%-75% Load Transients



Vout=3.4 V 75%-25% Load Transients

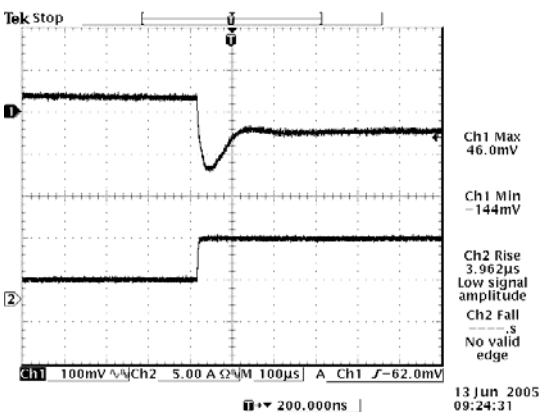


Vout=1.6 V 25%-75% Load Transients

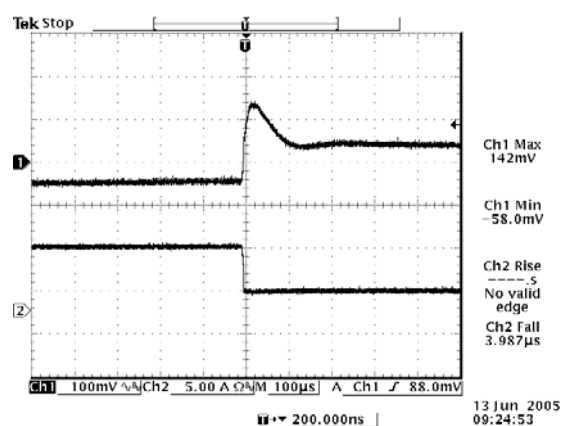


Vout=1.6 V 75%-25% Load Transients

### 0RXW-45TD30



Vout=3.3 V 25%-75% Load Transients



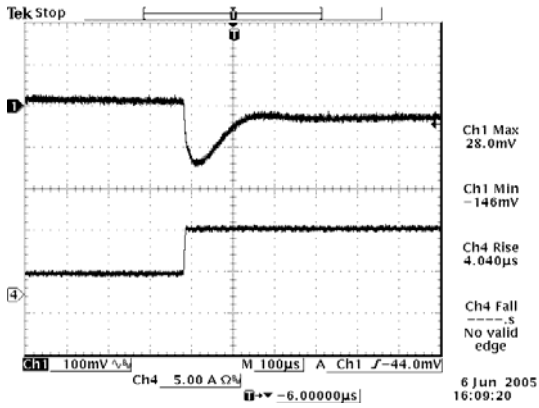
Vout=3.3 V 75%-25% Load Transients

# ISOLATED DC/DC CONVERTERS

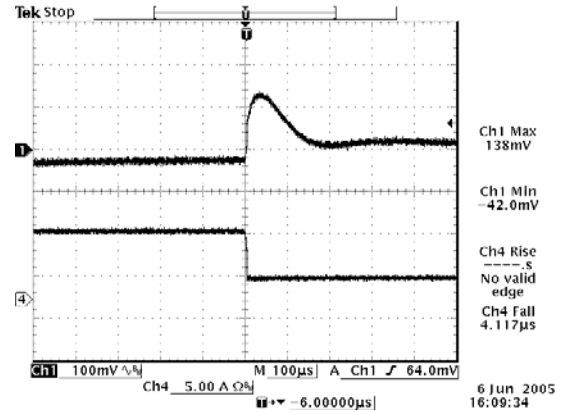
48 Vdc Input 1.0 - 1.8 Vdc/13 - 10 A, 3.3 - 3.4 Vdc/8 - 10 A Dual Outputs



## Transient Response Waveforms (continued)

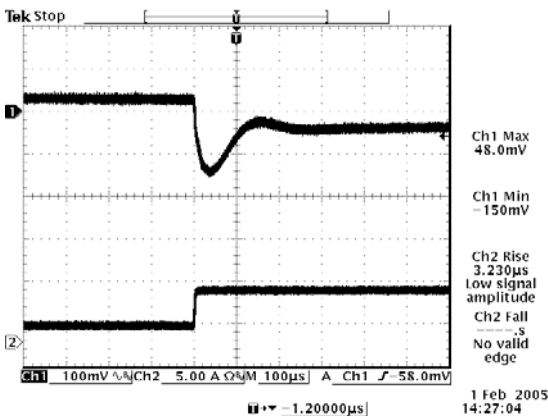


Vout=1.8 V 25%-75% Load Transients

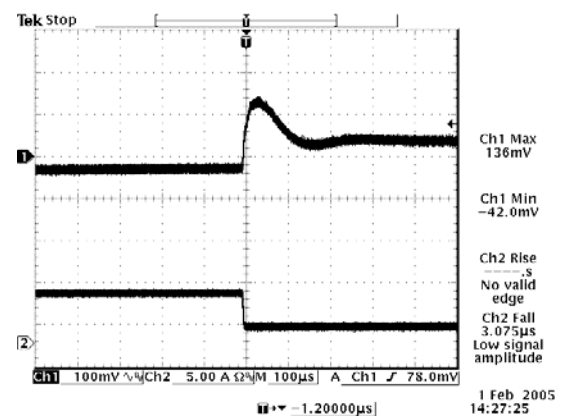


Vout=1.8 V 75%-25% Load Transients

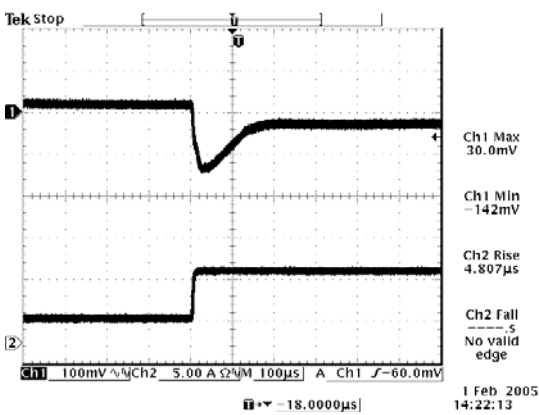
## 0RXW-45TD20



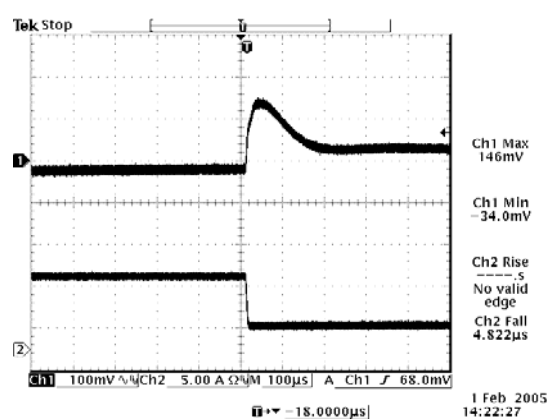
Vout=3.3 V 25%-75% Load Transients



Vout=3.3 V 75%-25% Load Transients



Vout=1.5 V 25% - 75% Load Transients



Vout=1.5 V 75% - 25% Load Transients

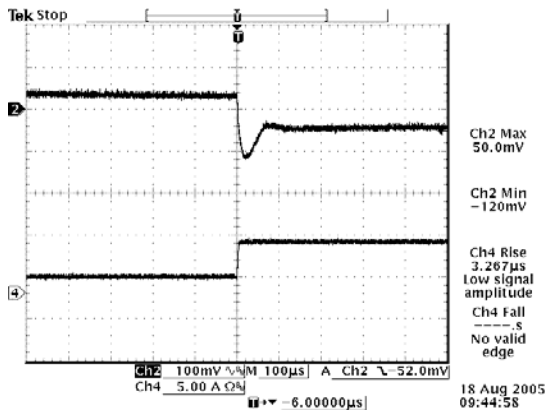
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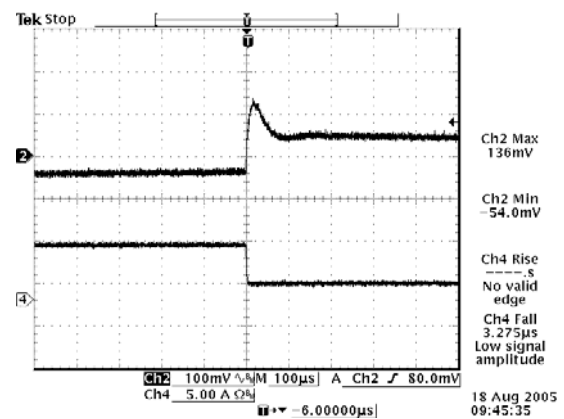


## Transient Response Waveforms (continued)

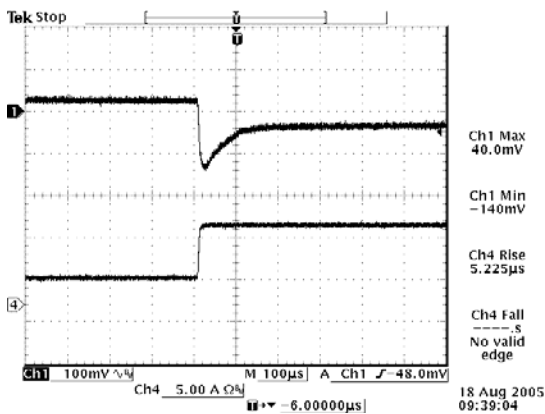
### ORXW-45TD10



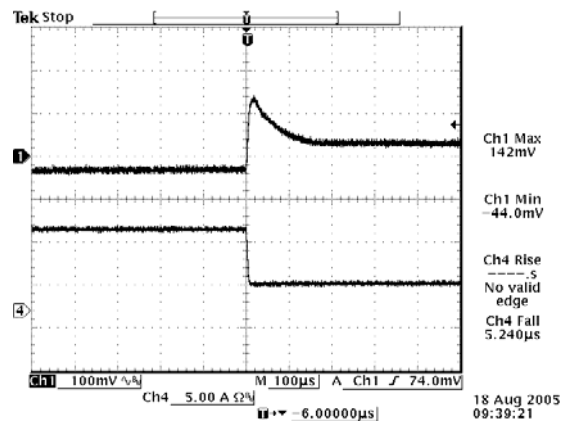
Vout=3.3 V 25%-75% Load Transients



Vout=3.3 V 75%-25% Load Transients



Vout=1.2 V 25% - 75% Load Transients



Vout=1.2 V 75% - 25% Load Transients

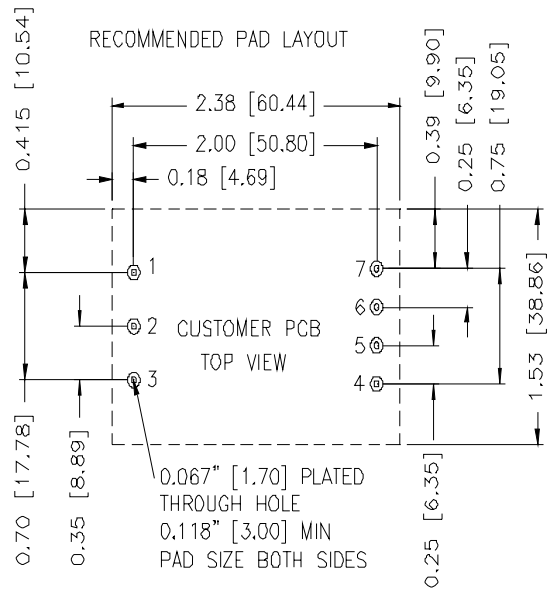
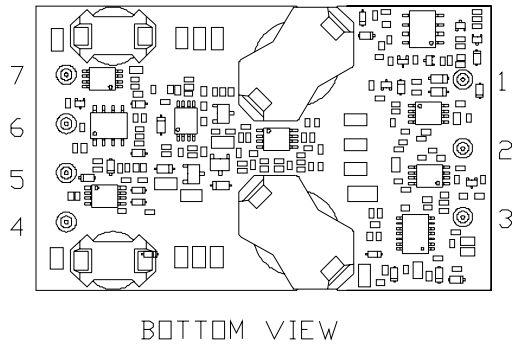
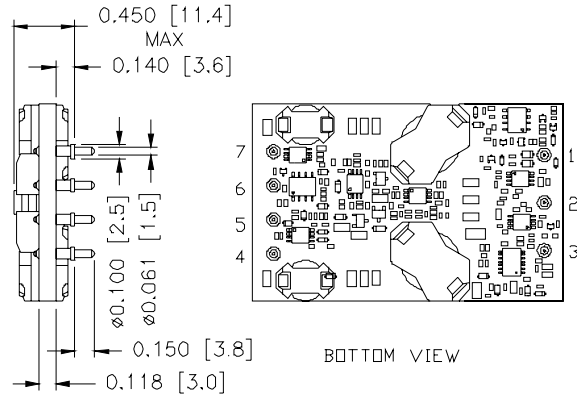
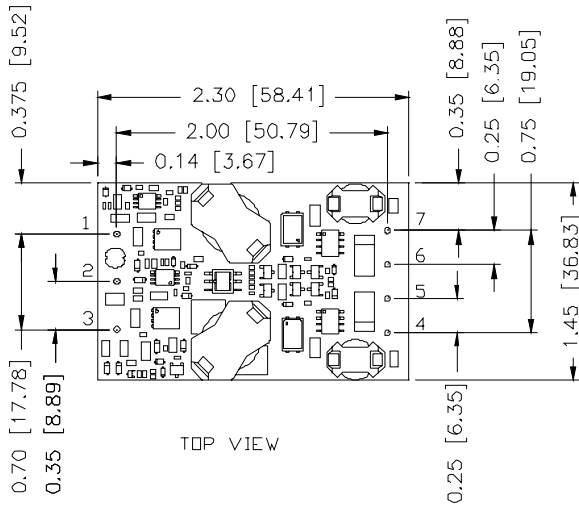
**Note:** Transient response at  $di/dt=1$  A/uS, external 470 uF Tantalum Cap and 0.1 uF Ceramic Cap at the output.

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## Mechanical Outline



## Pin Connections

Pin	Function
1	V <sub>in</sub> (+)
2	On/Off
3	V <sub>in</sub> (-)
4	V <sub>o1</sub> (+)
5	RTN[V <sub>o1</sub> (-) and V <sub>o2</sub> (-)]
6	Trim
7	V <sub>o2</sub> (+)

## 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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### CORPORATE

Bel Fuse Inc.  
206 Van Vorst Street  
Jersey City, NJ 07302  
Tel 201-432-0463  
Fax 201-432-9542  
[www.belfuse.com](http://www.belfuse.com)

### FAR EAST

Bel Fuse Ltd.  
8F/ 8 Luk Hop Street  
San Po Kong  
Kowloon, Hong Kong  
Tel 852-2328-5515  
Fax 852-2352-3706  
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### EUROPE

Bel Fuse Europe Ltd.  
Preston Technology Management Centre  
Marsh Lane, Suite G7, Preston  
Lancashire, PR1 8UD, U.K.  
Tel 44-1772-556601  
Fax 44-1772-888366  
[www.belfuse.com](http://www.belfuse.com)