ISOLATED DC/DC CONVERTERS

48 V Input 1.2 V - 3.3 V/15 A, 5 V/12 A, 12 V/5 A Output, 1/8 Brick

bel POWER PRODUCTS

0RCY-60T Series RoHS Compliant

- Isolated
- High Efficiency
- High Power Density
- Fix Frequency (300 kHz)
- Low Cost
- Input Under Voltage Lockout
- UL60950 Recognized (UL/cUL)
- Output Over Voltage Shutdown
- OCP/SCP
- Over Temperature Protection
- Remote On/Off Logic (Option)
- Output Voltage Trim
- Positive/Negative Remote Sense
- Basic Isolation

Description

The 0RCY-60T Series are isolated dc/dc converters that operate from a nominal 48 V source. These units provide up to 60 W of output power from a nominal 48 V input. These units are designed to be highly efficient and low cost. Features include remote on/off, short circuit protection, over current protection, over temperature protection, input under voltage lockout, and output over voltage protection. These converters are provided in an industry standard eighth brick package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active High	Model Number Active Low
12.0 V	36 V - 75 V	5 A	60.0 W	91%	0RCY-60T120	0RCY-60T12L
5.0 V	36 V - 75 V	12 A	60.0 W	91%	0RCY-60T050	0RCY-60T05L
3.3 V	36 V - 75 V	15 A	50.0 W	89%	0RCY-60T033	0RCY-60T03L
2.5 V	36 V - 75 V	15 A	37.5 W	87%	0RCY-60T025	0RCY-60T02L
1.8 V	36 V - 75 V	15 A	27 W	85%	0RCY-60TV80	0RCY-60TV8L
1.5 V	36 V - 75 V	15 A	22.5 W	84%	0RCY-60TV50	0RCY-60TV5L
1.2 V	36 V - 75 V	15 A	18 W	82%	0RCY-60TV20	0RCY-60TV2L

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	-2 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	36 V	48 V	75 V	
Input Current (full load)				
Vo=12.0 V	-	-	3.0 A	
Vo=5.0 V	-	-	2.8 A	
Vo=3.3 V	-	-	2.6 A	
Vo=2.5 V	-	-	2.0 A	
Vo=1.8 V	-	-	1.4 A	
Vo=1.5 V	-	-	1.2 A	
Vo=1.2 V	-	-	0.9A	
Input Current (no load)				
Vo=12.0 V	-	90 mA	130 mA	
Vo=5.0 V	-	55 mA	75 mA	
Vo=3.3 V	-	45 mA	70 mA	
Vo=2.5 V	-	40 mA	70 mA	
Vo=1.2 V - 1.8 V	-	30 mA	60 mA	
Remote Off Input Current	-	2 mA	10 mA	
Input Reflected Ripple Current(rms)	-	4 mA	10 mA	with simulated source impedance of 10 uH; a 100uF/100V electrolytic capacitor with ESR = 1 ohm max. 5 Hz to 20 MHz
Input Reflected Ripple Current(Pk-Pk)	-	20 mA	40 mA	
I^2t Inrush Current Transient	-	0.01 A^2s	0.02 A^2s	
Turn on Voltage Threshold	32 V	34 V	35 V	
Turn off Voltage Threshold	30 V	32 V	33 V	

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point				
Vo=12.0 V	11.760 V	12.0 V	12.240 V	Vin=48 V, Io=50% full load, Ta=25 °C.
Vo=5.0 V	4.925 V	5.0 V	5.075 V	
Vo=3.3 V	3.250 V	3.3 V	3.350 V	
Vo=2.5 V	2.463 V	2.5 V	2.538 V	
Vo=1.8 V	1.773 V	1.8 V	1.827 V	
Vo=1.5 V	1.478 V	1.5 V	1.523 V	
Vo=1.2 V	1.182 V	1.2 V	1.218 V	
Line Regulation				
Vo=12.0 V	-	±30 mV	±60 mV	
Vo=5.0 V	-	±10 mV	±20 mV	
Vo=3.3 V	-	±7 mV	±15 mV	
Vo=2.5 V	-	±6 mV	±12 mV	
Vo=1.8 V	-	±5 mV	±10 mV	
Vo=1.5 V	-	±5 mV	±10 mV	
Vo=1.2 V	-	±5mV	±10 mV	
Load Regulation				
Vo=12.0 V	-	±12 mV	±24 mV	
Vo=5.0 V	-	±5 mV	±10 mV	
Vo=3.3 V	-	±3 mV	±7 mV	
Vo=2.5 V	-	±3 mV	±7 mV	
Vo=1.8 V	-	±3 mV	±7 mV	
Vo=1.5 V	-	±3 mV	±7 mV	
Vo=1.2 V	-	±3 mV	±7 mV	

Output Specifications (continued)

Parameter	Min	Typ	Max	Notes
Regulation Over Temperature (-40 °C to +85 °C)				
Vo=12.0 V	-	±60 mV	±100 mV	
Vo=5.0 V	-	±45 mV	±75 mV	
Vo=3.3 V	-	±30 mV	±50 mV	
Vo=2.5 V	-	±25 mV	±40 mV	
Vo=1.8 V	-	±20 mV	±30 mV	
Vo=1.5 V	-	±15 mV	±25 mV	
Vo=1.2 V	-	±12 mV	±20mV	
Output Current				
Vo=12.0 V	0 A	-	5 A	
Vo=5.0 V	0 A	-	12 A	
Vo=3.3 V	0 A	-	15 A	
Vo=2.5 V	0 A	-	15 A	
Vo=1.8 V	0 A	-	15 A	
Vo=1.5 V	0 A	-	15 A	
Vo=1.2 V	0 A	-	15 A	
Current Limit Threshold				
Vo=12.0 V	5.5 A	6.5 A	8 A	
Vo=5.0 V	13.5 A	16 A	19 A	
Vo=3.3 V	16 A	18 A	20 A	
Vo=2.5 V	16 A	18 A	20 A	
Vo=1.8 V	16 A	18 A	20 A	
Vo=1.5 V	16 A	18 A	20 A	
Vo=1.2 V	16 A	18 A	20 A	
Short Circuit Surge Transient	-	3 A^2s	5 A^2s	
Ripple and Noise (rms)				Test conditions: Vin=48 V, Ta=25 °C, with a 1uF ceramic capacitor and a 10 uF Tantalum capacitor at the output.
Vo=12.0 V	-	25 mV	50 mV	
Vo=5.0 V	-	25 mV	50 mV	
Vo=3.3 V	-	15 mV	30 mV	
Vo=2.5 V	-	12 mV	25 mV	
Vo=1.8 V	-	10 mV	20 mV	
Vo=1.5 V	-	10 mV	20 mV	
Vo=1.2 V	-	10 mV	20 mV	
Ripple and Noise (pk-pk)				
Vo=12.0 V	-	100 mV	130 mV	
Vo=5.0 V	-	95 mV	120 mV	
Vo=3.3 V	-	55 mV	80 mV	
Vo=2.5 V	-	55 mV	80 mV	
Vo=1.8 V	-	45 mV	70 mV	
Vo=1.5 V	-	45 mV	70 mV	
Vo=1.2 V	-	45 mV	70 mV	
Turn on Time	-	15 mS	30 mS	
Overshoot at Turn on	-	0%	5%	
Output Capacitance				
Vo=12.0 V	0 uF	-	1000 uF	
Vo=5.0 V	0 uF	-	10000 uF	
Vo=3.3 V	0 uF	-	18000 uF	
Vo=2.5 V	0 uF	-	18000 uF	
Vo=1.8 V	0 uF	-	18000 uF	
Vo=1.5 V	0 uF	-	18000 uF	
Vo=1.2V	0 uF	-	18000 uF	

Output Specifications (continued)

Parameter			Min	Typ	Max	Notes
Transient Response						
25% ~ 50% Max Load	Overshoot	Vo=12.0 V	-	300 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		-	400 uS	500 uS	
50% ~ 25% Max Load	Overshoot		-	300 mV	400 mV	
	Settling Time		-	400 uS	500 uS	
25% ~ 50% Max Load	Overshoot	Vo=5.0 V	-	200 mV	230 mV	
	Settling Time		-	300 uS	400 uS	
50% ~ 25% Max Load	Overshoot		-	200 mV	230 mV	
	Settling Time		-	300 uS	400 uS	
25% ~ 50% Max Load	Overshoot	Vo=3.3 V	-	130 mV	160 mV	
	Settling Time		-	150 uS	200 uS	
50% ~ 25% Max Load	Overshoot		-	130 mV	160 mV	
	Settling Time		-	150 uS	200 uS	
25% ~ 50% Max Load	Overshoot	Vo=2.5 V	-	130 mV	160 mV	
	Settling Time		-	150 uS	200 uS	
50% ~ 25% Max Load	Overshoot		-	130 mV	160 mV	
	Settling Time		-	150 uS	200 uS	
25% ~ 50% Max Load	Overshoot	Vo=1.8 V - 1.2 V	-	120 mV	150 mV	
	Settling Time			150 uS	200 uS	
50% ~ 25% Max Load	Overshoot		-	120 mV	150 mV	
	Settling Time		-	150 uS	200 uS	

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
Vo=12.0 V	88%	91%	-	Vin=48 V, full load
Vo=5.0 V	88%	91%	-	
Vo=3.3 V	87%	89%	-	
Vo=2.5 V	85%	87%	-	
Vo=1.8 V	83%	85%	-	
Vo=1.5 V	82%	84%	-	
Vo=1.2 V	80%	82%	-	
Switching Frequency	270 kHz	300 kHz	330 kHz	
Isolation capacitance	-	1500 pF	-	
Output Voltage Trim Range	80%Vo	-	110%Vo	The total voltage increased by trim and remote sense should not exceed 10%Vo
Remote Sense Compesation	-	-	10%Vo	
Over Temperature Protection	-	125 °C	-	
Over Voltage Protection	-	130%Vo	-	Vin=48V, full load, in hiccup mode
MTBF	2,410,000 hours			Calculated Per Bell Core SR-332 (Io = 12 A, Vin=48 V, Vo=3.3 V, Ta = 25 °C, No forced air)
Dimensions				
Inches (L × W × H)	2.30 x 0.896 x 0.411			
Millimeters (L × W × H)	58.42 x 22.86 x 10.45			
Weight	-	20 g	-	

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

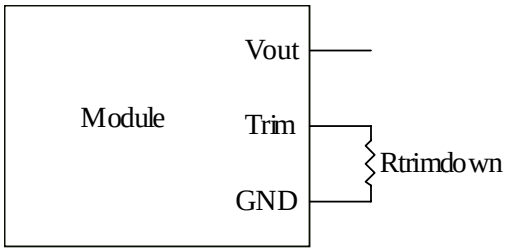
Control Specifications

Parameter		Min	Typ	Max	Notes
Remote On/Off					
Signal Low (Unit On)	Active Low	-0.3 V	-	0.8 V	0RCY-60TxxL. 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	0RCY-60Txx0. 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 (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.

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

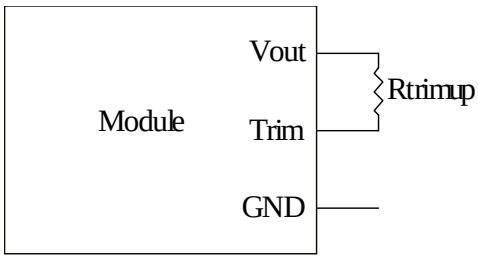


1.Vo =12 V-1.5 V

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

2. Vo =1.2 V

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

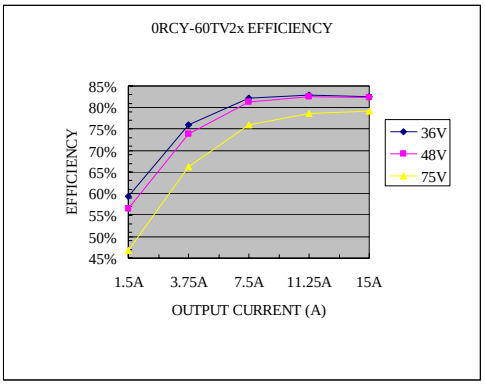


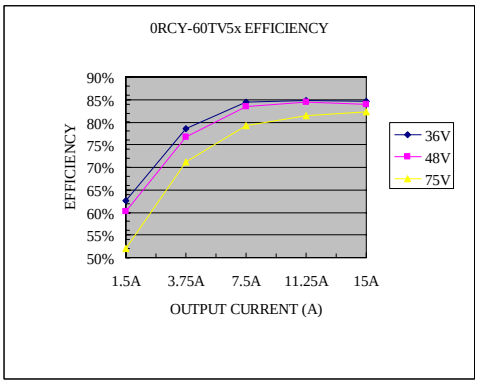
Notes:

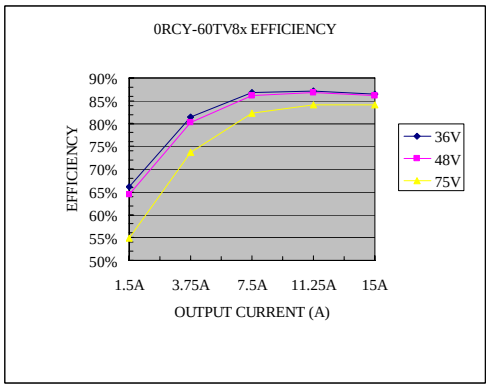
$$delta = \frac{(Vo\_req - Vo)}{Vo} \times 100[\%]$$

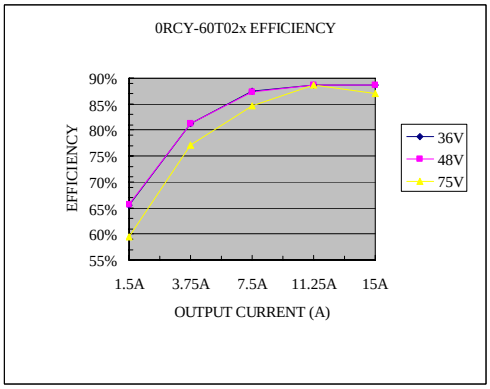
Vo_req=Desired (trimmed) output voltage [V]

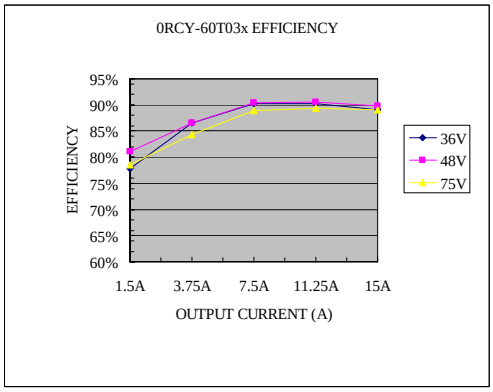
Efficiency Data

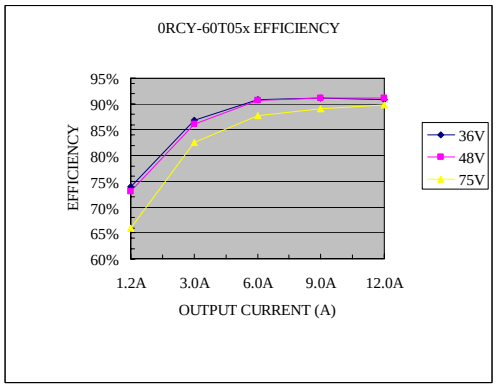


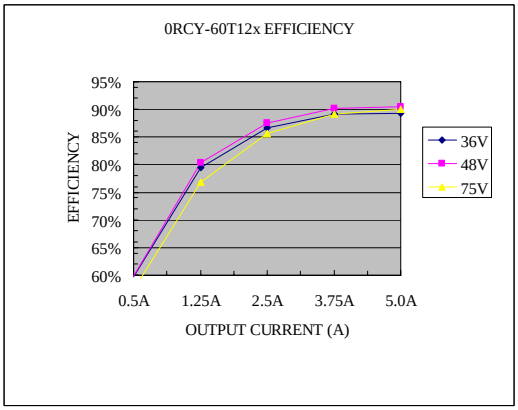






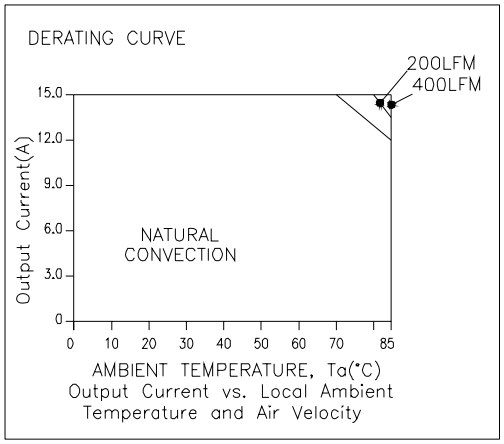




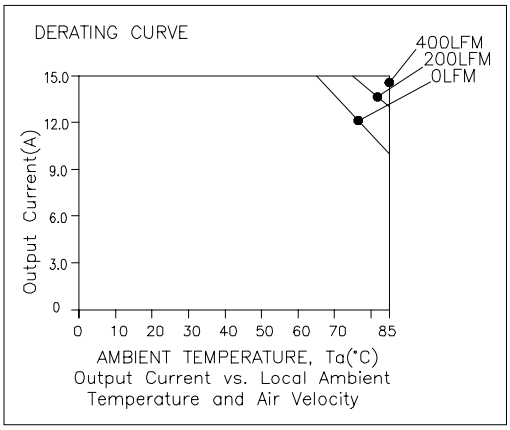


Thermal Derating Curves

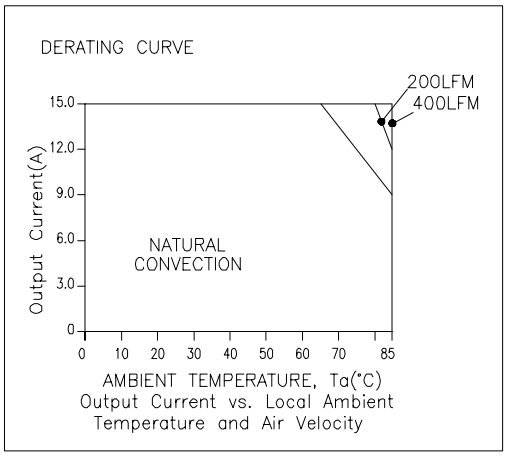
Vin=48V, with maximum junction temperature of semiconductors derated to 120 degree C.



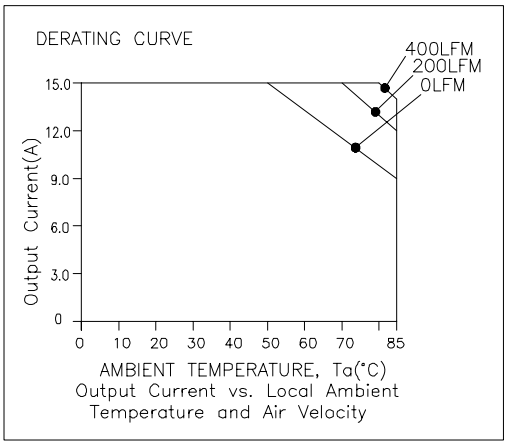
Vo=1.2 V



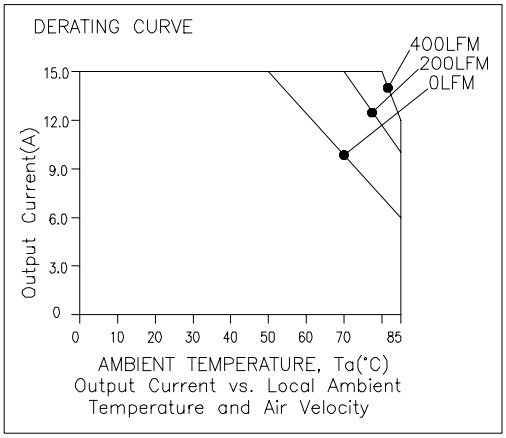
Vo=1.5 V



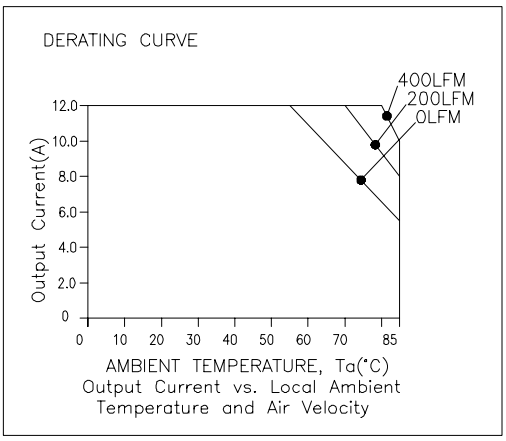
Vo=1.8 V



Vo=2.5 V

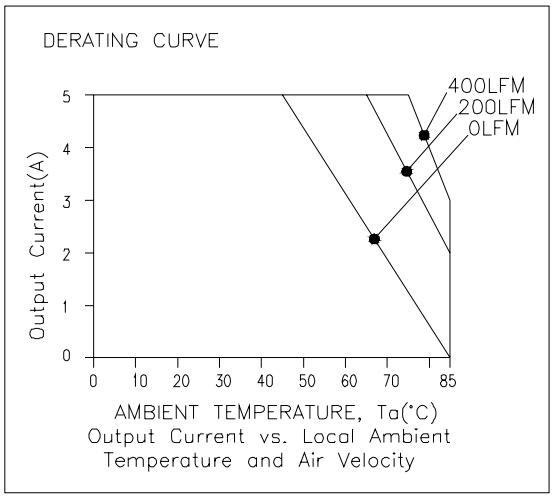


Vo=3.3 V



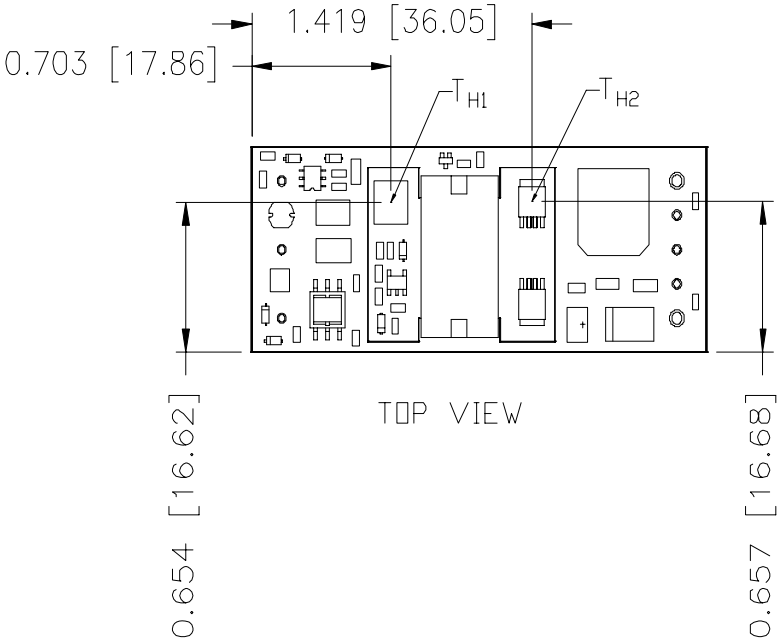
Vo=5 V

Thermal Derating Curves (continued)



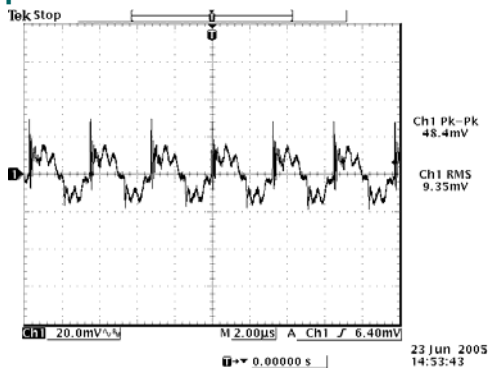
Vo=12 V

Thermal Reference

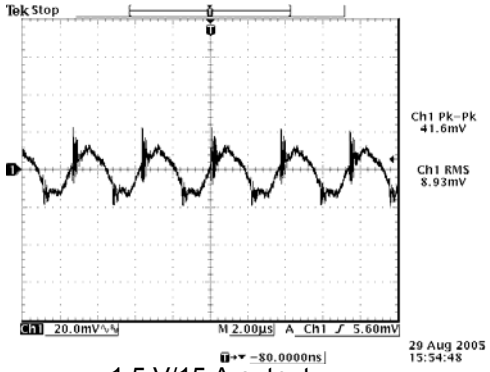


Note: T_{H1} and T_{H2} are hot spots which should not exceed 118 degree C.

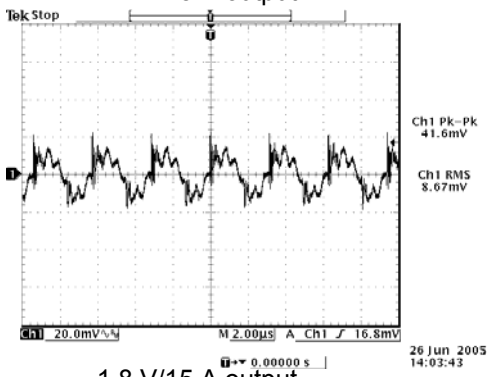
Ripple and Noise Waveforms



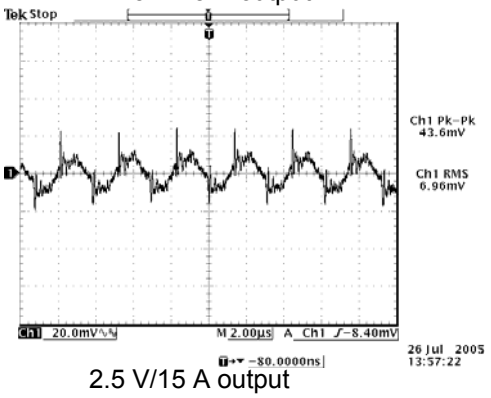
1.2 V/15 A output.



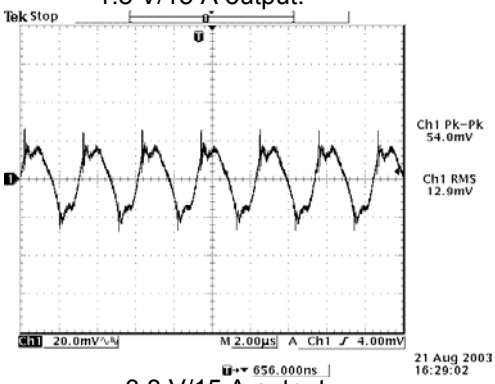
1.5 V/15 A output



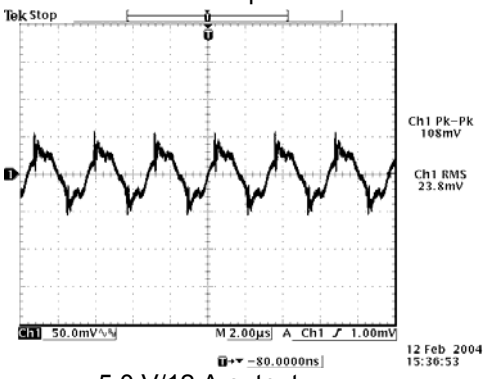
1.8 V/15 A output.



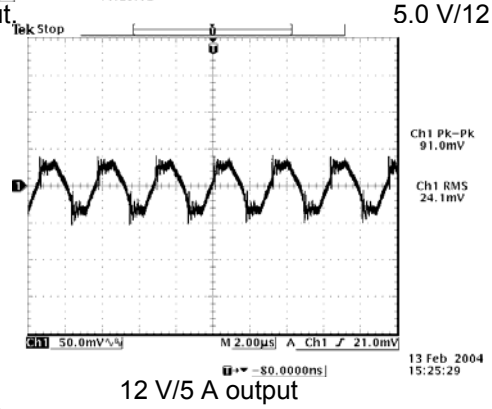
2.5 V/15 A output



3.3 V/15 A output.



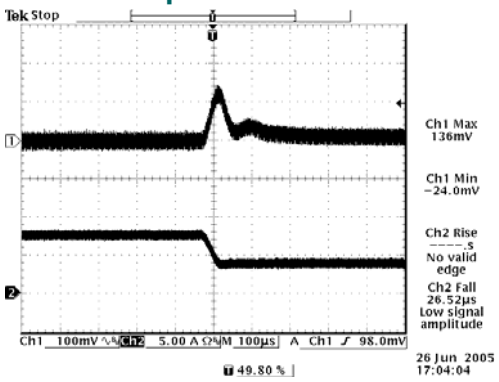
5.0 V/12 A output



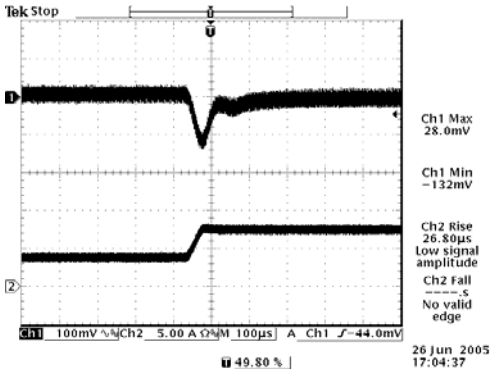
12 V/5 A output

Note: Ripple and noise at full load, 48 V input, and with a 1 uF ceramic cap and a 10 uF tantalum cap at the output, Ta=25 deg C.

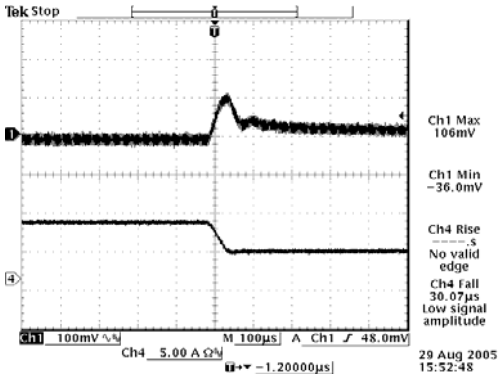
Transient Response Waveforms



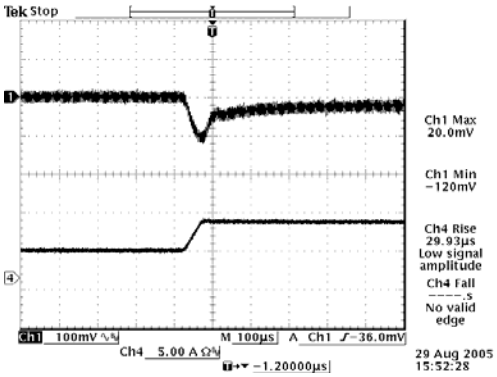
Vout=1.2 V 50% to 25% Load Transients



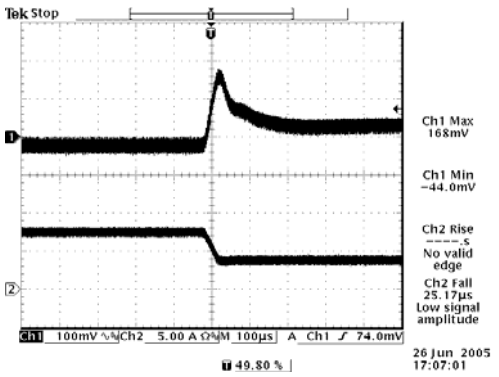
Vout=1.2 V 25% to 50% Load Transients



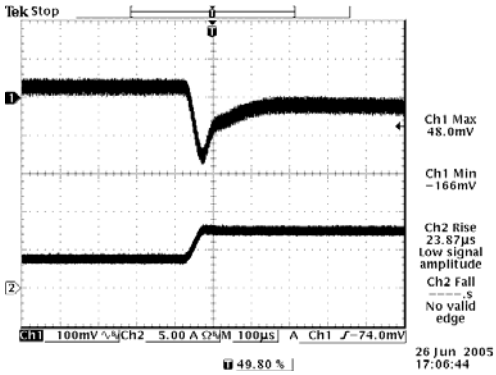
Vout=1.5 V 50% to 25% Load Transients



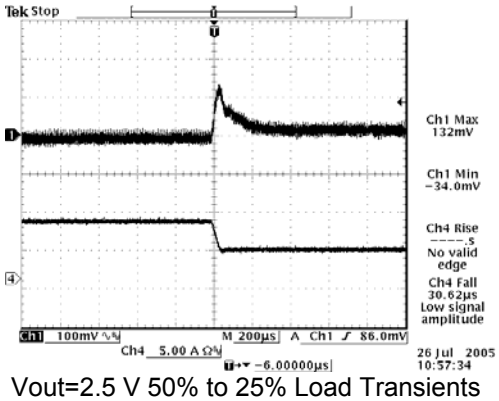
Vout=1.5 V 25% to 50% Load Transients



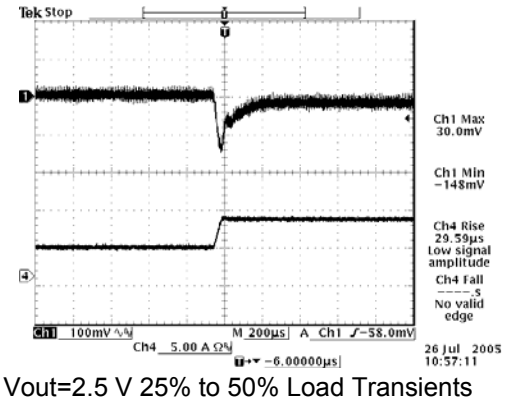
Vout=1.8 V 50% to 25% Load Transients



Vout=1.8 V 25% to 50% Load Transients

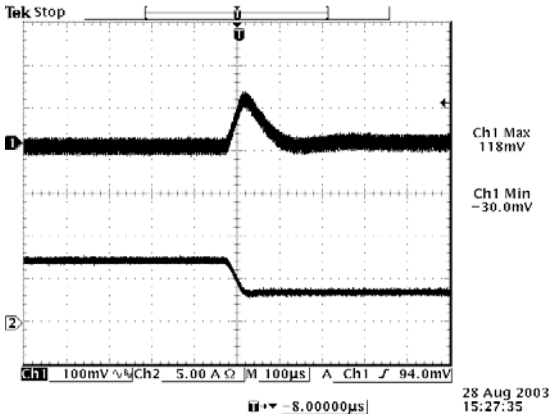


Vout=2.5 V 50% to 25% Load Transients

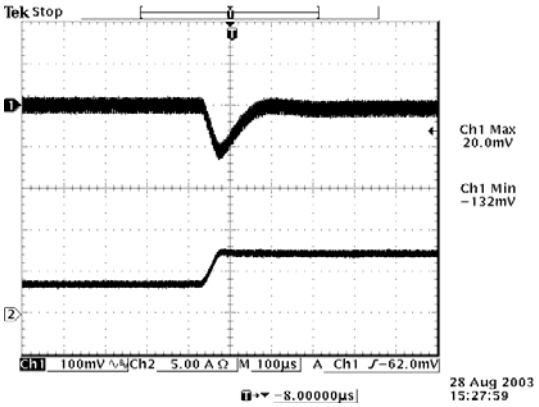


Vout=2.5 V 25% to 50% Load Transients

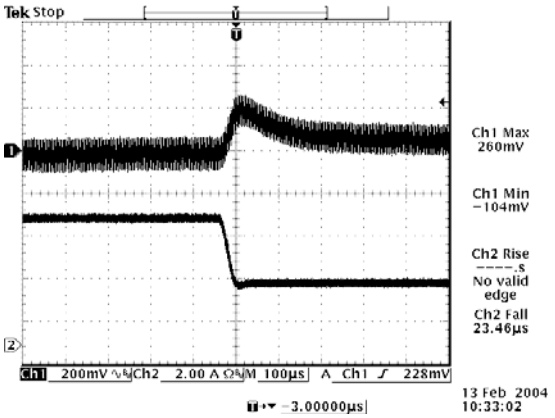
Transient Response Waveforms (continued)



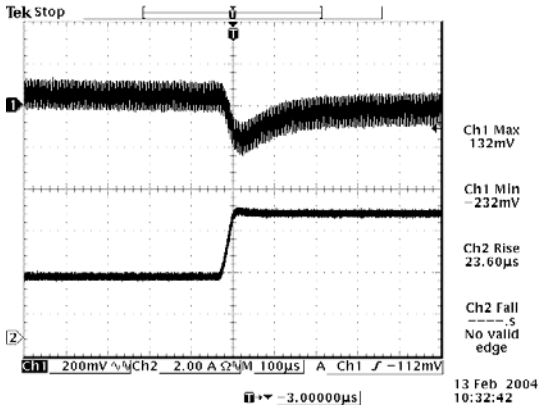
Vout=3.3 V 50% to 25% Load Transients



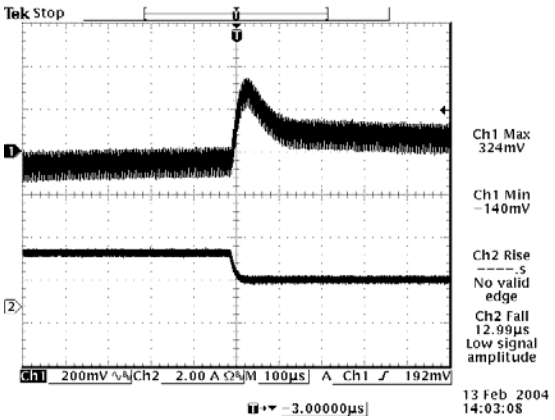
Vout=3.3 V 25% to 50% Load Transients



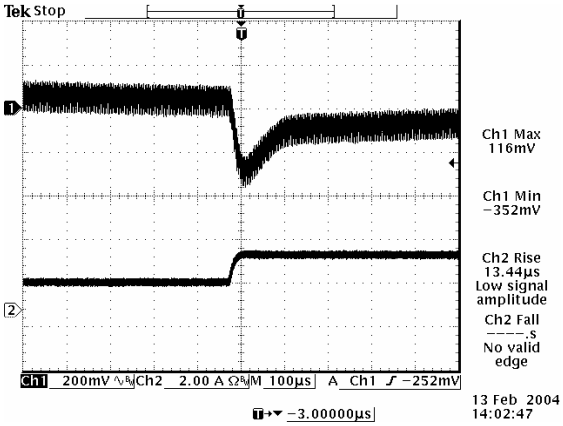
Vout=5.0 V 50% to 25% Load Transients



Vout=5.0 V 25% to 50% Load Transients



Vout=12 V 50% to 25% Load Transients



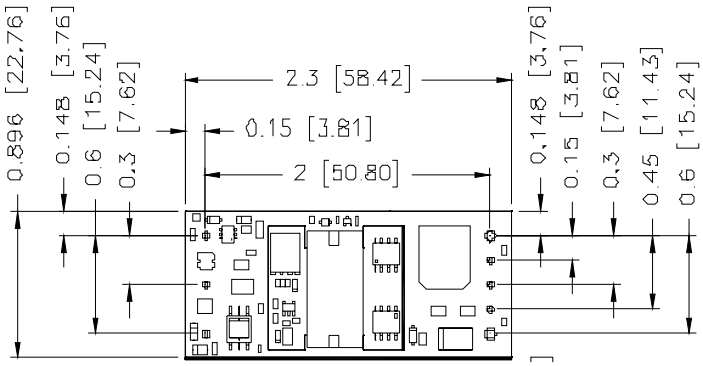
Vout=12 V 25% to 50% Load Transients

Note: Transient response is tested at di/dt=0.1 A/uS, external 10 uF tantalum capacitor and 1 uF ceramic capacitor, Vin=48 V, Ta=25 deg C.

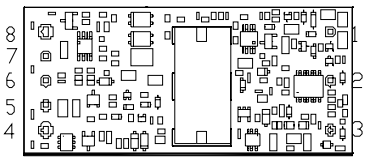
ISOLATED DC/DC CONVERTERS

48 V Input 1.2 V - 3.3 V/15 A, 5 V/12 A, 12 V/5 A Output, 1/8 Brick

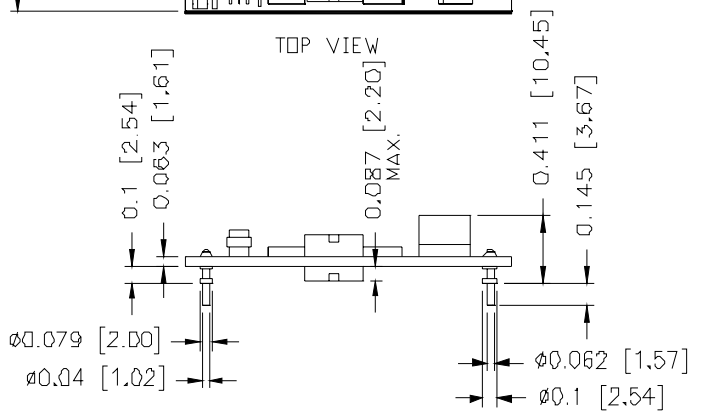
Mechanical Outline

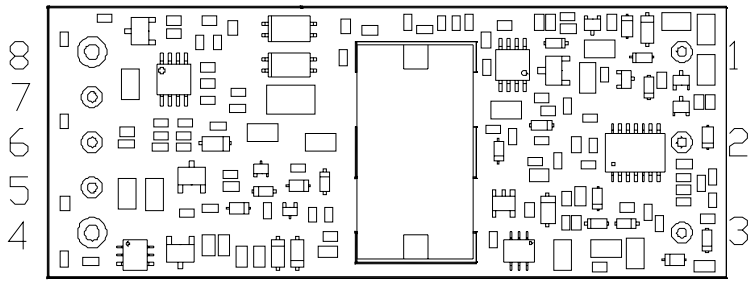


TOP VIEW



BOTTOM VIEW





BOTTOM VIEW

Pin Connections

Pin	Function
1	Vin+
2	Remote On/Off
3	Vin-
4	Vout-
5	Sense-
6	Trim
7	Sense+
8	Vout+

RoHS Compliance

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

CORPORATE

Bel Fuse Inc.
206 Van Vorst Street
Jersey City, NJ 07302
Tel 201-432-0463
Fax 201-432-9542
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
www.belfuse.com

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