

ISOLATED DC/DC CONVERTERS

48 Vdc Input 3.3 Vdc - 24 Vdc/7 A - 1.25 A Output



Nov. 29, 2010

Bel Power, Inc. , a subsidiary of Bel Fuse, Inc.

0RLC-25T Series RoHS Compliant Rev.B

Features

- Isolated
- High Efficiency
- High Power Density
- Fixed Frequency (230 KHz)
- Low Cost
- Input Under Voltage Lockout
- Class 1, Category 2, Isolated DC/DC Converter (refer to IPC-9592)
- Output Over Voltage Shutdown
- Output Voltage Trim
- OCP/SCP
- Over Temperature Protection
- Remote On/Off
- Remote On/Off Logic (Optional)



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The 0RLC-25T series are isolated dc/dc converters that operate from a nominal 48 Vdc source. These units will provide up to 30 W of output power. These units are designed to be high efficient and very low cost. Features include remote on/off, over current protection, and under voltage lockout. These converters are provided in an industry standard package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active High	Model Number Active Low
3.3 Vdc	36 Vdc - 75 Vdc	7 A	23 W	88%	0RLC-25T033	0RLC-25T03L
5.0 Vdc	36 Vdc - 75 Vdc	5 A	25 W	90%	0RLC-25T050	0RLC-25T05L
12.0 Vdc	36 Vdc - 75 Vdc	2.5 A	30 W	90%	0RLC-25T120	0RLC-25T12L
15.0 Vdc	36 Vdc - 75 Vdc	2.0 A	30 W	90%	0RLC-25T150	0RLC-25T15L
24.0 Vdc	36 Vdc - 75 Vdc	1.25 A	30 W	89%	0RLC-25T240	0RLC-25T24L

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

Part Number Explanation

$\frac{0}{1} \frac{R}{2} \frac{LC}{3} - \frac{25}{4} \frac{T}{5} \frac{xx}{6} \frac{x}{7}$

1---Through hole mount

2---RoHS 6, change "R" to "7" means RoHS 5

3---Series name

4---Series code

5---Input range (36-75V)

6---Output voltage

7---Enable, "0" or "3" mean active high, and "L" means active low

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage (continuous)	-0.3	-	80	V	
Remote On/Off	-0.3	-	12	V	
Ambient Temperature	-40	-	85	°C	
Storage Temperature	-55	-	125	°C	

Note: Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

Input Specifications

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage	36	-	75	V	
Input Current (full load)	-	-	1.1	A	
Input Current (no load)	-	25	40	mA	
Remote Off Input Current	-	3	10	mA	
Input Reflected Ripple Current (rms)	-	10	20	mA	With simulated source impedance of 10 μ H, 5 Hz to 20 MHz. And use a 100 μ F/ 100 V electrolytic capacitor with ESR=1 ohm max, at 200 kHz.
Input Reflected Ripple Current (pk-pk)	-	40	60	mA	
I^2t Inrush Current Transient	-	0.1	0.5	A ² s	
Turn-on Voltage Threshold	31	34	36	V	
Turn-off Voltage Threshold	30	33	35	V	

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

Output Specifications

Parameter	Min	Typ	Max	Unit	Notes
Output Voltage Set Point					Test condition: $V_{in}=48$ V, $I_o=50\%$ load at the output.
Vo=3.3 V	3.234	3.3	3.366	V	
Vo=5.0 V	4.900	5.0	5.100	V	
Vo=12.0 V	11.76	12.0	12.240	V	
Vo=15.0 V	14.70	15.0	15.300	V	
Vo=24.0 V	23.52	24.0	24.480	V	
Line Regulation					
Vo=3.3 V	-	± 1	± 3	mV	
Vo=5.0 V	-	± 2	± 5	mV	
Vo=12.0 V	-	± 5	± 10	mV	
Vo=15.0 V	-	± 8	± 15	mV	
Vo=24.0 V	-	± 10	± 20	mV	
Load Regulation					
Vo=3.3 V	-	± 2	± 5	mV	
Vo=5.0 V	-	± 4	± 8	mV	
Vo=12.0 V	-	± 9	± 18	mV	
Vo=15.0 V	-	± 10	± 20	mV	
Vo=24.0 V	-	± 15	± 30	mV	

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Output Specifications (continued)

Parameter	Min	Typ	Max	Unit	Notes
Regulation Over Temperature (-40 °C to +85 °C)					
Vo=3.3 V	-	30	50	mV	
Vo=5.0 V	-	40	70	mV	
Vo=12.0 V	-	100	170	mV	
Vo=15.0 V	-	120	200	mV	
Vo=24.0 V	-	150	240	mV	
Total Regulation					
Vo=3.3 V	-	33	58	mV	
Vo=5.0 V	-	46	83	mV	
Vo=12.0 V	-	114	198	mV	
Vo=15.0 V	-	140	250	mV	
Vo=24.0 V	-	150	330	mV	
Ripple and Noise (pk-pk)					
Vo=3.3 V	-	40	75	mV	Test condition of the output ripple and noise: 0-20 MHz BW, with a 1 μ F ceramic capacitor and a 10 μ F/35 V electrolytic capacitor at the output.
Vo=5.0 V	-	40	75	mV	
Vo=12.0 V	-	40	75	mV	
Vo=15.0 V	-	80	120	mV	
Vo=24.0 V	-	85	150	mV	
Ripple and Noise (rms)					
Vo=3.3 V	-	10	20	mV	
Vo=5.0 V	-	10	20	mV	
Vo=12.0 V	-	10	20	mV	
Vo=15.0 V	-	15	30	mV	
Vo=24.0 V	-	20	40	mV	
Output Current Range					
Vo=3.3 V	0	-	7.0	A	
Vo=5.0 V	0	-	5.0	A	
Vo=12.0 V	0	-	2.5	A	
Vo=15.0 V	0	-	2.0	A	
Vo=24.0 V	0	-	1.25	A	
Output DC Current Limit					
Vo=3.3 V	7.7	-	12.0	A	
Vo=5.0 V	5.5	-	8.0	A	
Vo=12.0 V	3.0	-	4.2	A	
Vo=15.0 V	2.2	-	3.4	A	
Vo=24.0 V	1.5	-	2.2	A	
Short Circuit Surge Transient	-	0.5	1	A ² s	
Turn on Time	-	10	25	mS	
Overshoot at Turn on	-	0	5	%	
Output Capacitance					
Vo=3.3 V	0	-	3300	μ F	
Vo=5.0 V	0	-	2200		
Vo=12.0 V	0	-	330		
Vo=15.0 V	0	-	330		
Vo=24.0 V	0	-	330		

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Output Specifications (continued)

Parameter		Min	Typ	Max	Unit	Notes
Transient Response						
50% ~ 75% Max Load	Overshoot	Vo= 3.3 V	-	75	100	mV
	Settling Time		-	150	200	uS
25% ~ 50% Max Load	Overshoot		-	75	100	mV
	Settling Time		-	150	200	uS
50% ~ 75% Max Load	Overshoot	Vo= 5.0 V	-	100	150	mV
	Settling Time		-	150	200	uS
25% ~ 50% Max Load	Overshoot		-	100	150	mV
	Settling Time		-	150	200	uS
50% ~ 75% Max Load	Overshoot	Vo= 12.0 V	-	150	200	mV
	Settling Time		-	150	200	uS
25% ~ 50% Max Load	Overshoot		-	150	200	mV
	Settling Time		-	150	200	uS
50% ~ 75% Max Load	Overshoot	Vo= 15.0 V	-	100	200	mV
	Settling Time		-	200	300	uS
25% ~ 50% Max Load	Overshoot		-	100	200	mV
	Settling Time		-	200	300	uS
50% ~ 75% Max Load	Overshoot	Vo= 24.0 V	-	150	300	mV
	Settling Time		-	300	500	uS
25% ~ 50% Max Load	Overshoot		-	150	300	mV
	Settling Time		-	300	500	uS

Test condition of the transient response: di/dt=0.1 A/us, Vin=48 V, with a 220 uF/35 V electrolytic capacitor at the output.

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

General Specifications

Parameter	Min	Typ	Max	Unit	Notes
Efficiency					
Vo=3.3 V	85	88	-	%	Measured at Vin=48 V, Io=Io, max
Vo=5.0 V	87	90	-	%	
Vo=12.0 V	87	90	-	%	
Vo=15.0 V	87	90	-	%	
Vo=24.0 V	86	89	-	%	
Switching Frequency	200	230	260	kHz	
I/O Isolation Voltage	1500	-	-	V	
Isolation Capacitance	-	1500	-	pF	
Output Voltage Trim Range	90	-	110	%	
Over Temperature Protection	-	110	-	°C	
Over Voltage Protection					
Vo=3.3 V	3.90	-	5.0	V	Test condition of Over Voltage Protection: Vin=48 V, Io=100% load at 25 °C ambient.
Vo=5.0 V	5.70	-	7.0	V	
Vo=12.0 V	13.60	-	14.2	V	
Vo=15.0 V	17.25	-	22.5	V	
Vo=24.0 V	27.60	-	36.0	V	
Weight	-	20	-	g	
MTBF	2,602,427			hours	Calculated Per Bell Core SR-332 (Io = 80% load; Vin=48 V; Vo=3.3 V, Ta = 25 °C)
Dimensions					
Inches (L x W x H)	2.0 x 1.0 x 0.438			-	
Millimeters (L x W x H)	50.8 x 25.4 x 11.14			-	

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

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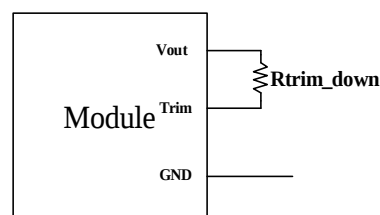
Remote On/Off

Parameter		Min	Typ	Max	Unit	Notes
Signal Low (Unit On)	Active Low	-0.3	-	0.8	V	The remote on/off pin open, Unit off
Signal High (Unit Off)		3.5	-	12	V	
Signal Low (Unit Off)	Active High	-0.3	-	0.8	V	The remote on/off pin open, Unit on
Signal High (Unit On)		3.5	-	12	V	
Current Sink		0.3	-	0.75	mA	

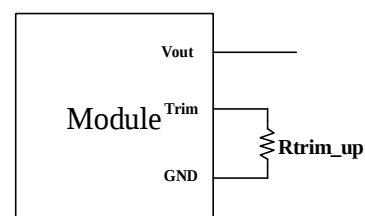
Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (V_{adj}) and the nominal output voltage of the converter (V_{nom}) are shown below. The Trim Down resistor should be connected between the Trim pin and V_{out} . The Trim Up resistor should be connected between the Trim pin and Ground. Only one of the resistors should be used for any given application.

$$R_{trim_down} = \frac{A}{V_{nom} - V_{adj}} - B$$



$$R_{trim_up} = \frac{C}{V_{adj} - V_{nom}} - D$$



Vnom	A	B	C	D
24.0	272.305	15.664	31.634	3.010
15.0	92.125	9.360	18.400	2.000
12.0	53.320	9.260	14.025	3.650
5.0	19.300	15.120	6.350	10.000
3.3	21.711	40.610	13.032	30.100

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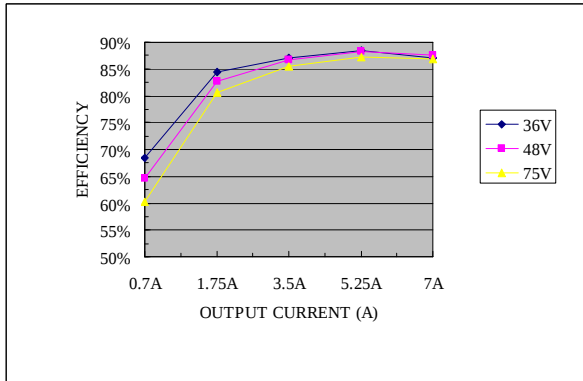
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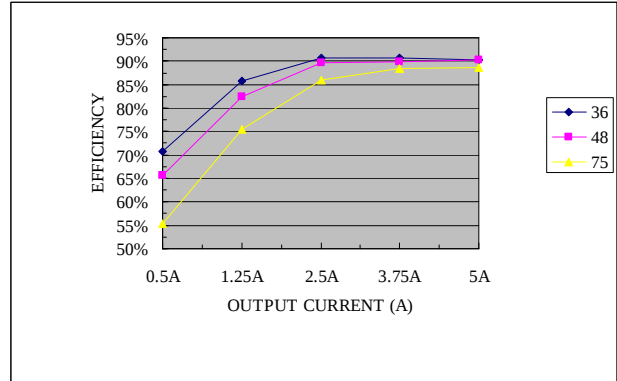
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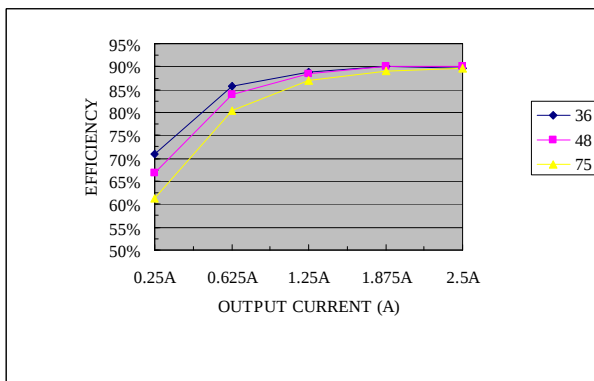
Efficiency Data



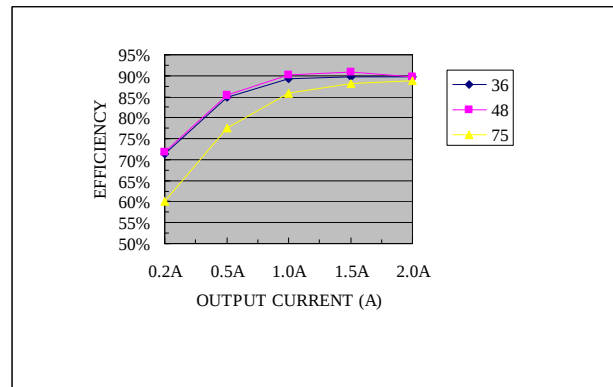
ORLC-25T033



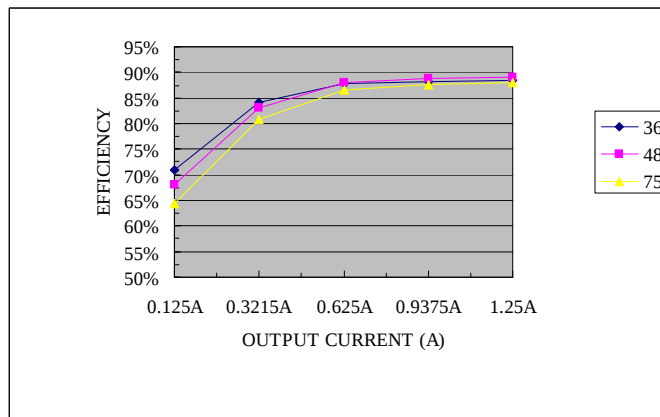
ORLC-25T050



ORLC-25T120



ORLC-25T150



ORLC-25T240

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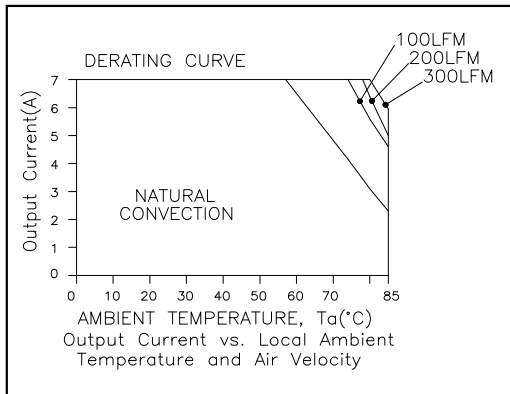
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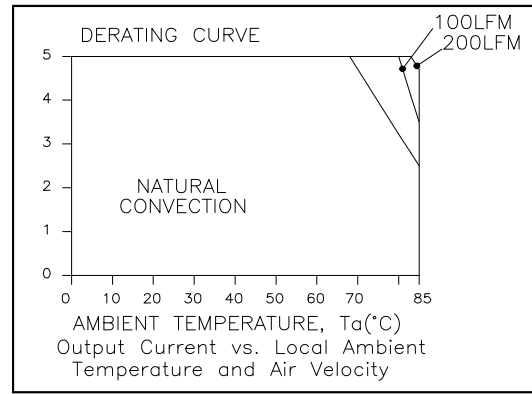
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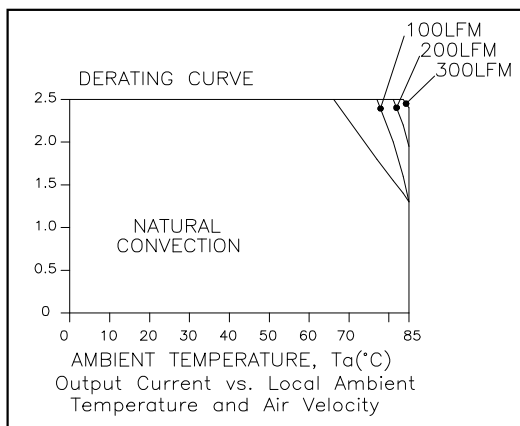
Thermal Derating Curves



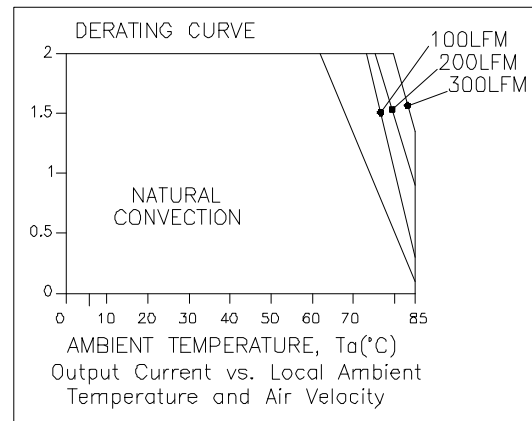
ORLC-25T033



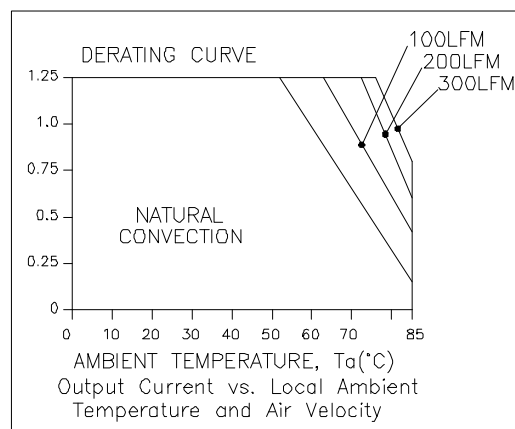
ORLC-25T050



ORLC-25T120



ORLC-25T150



ORLC-25T240

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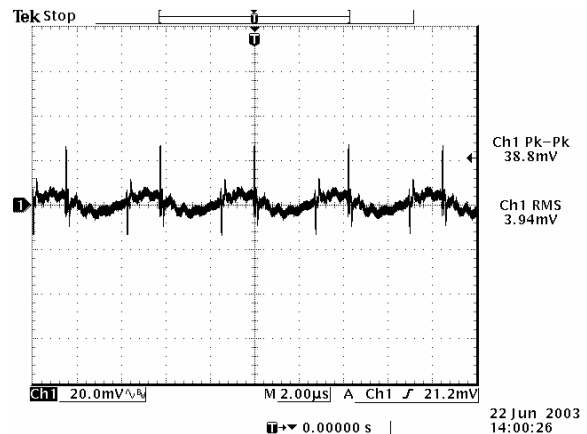
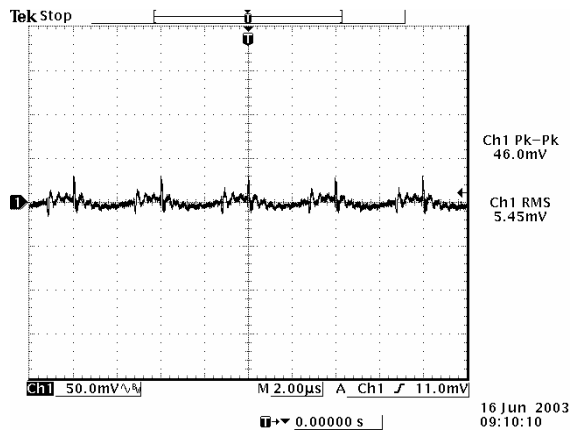
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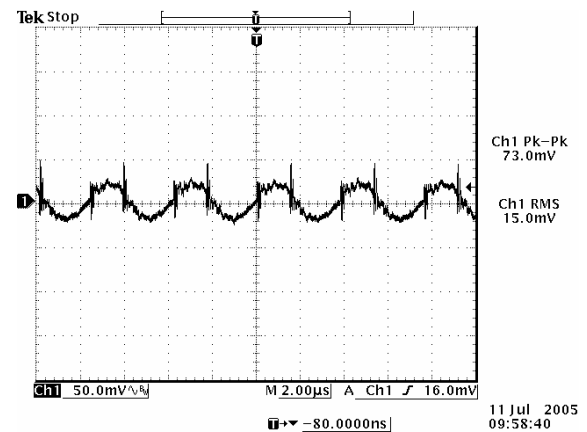
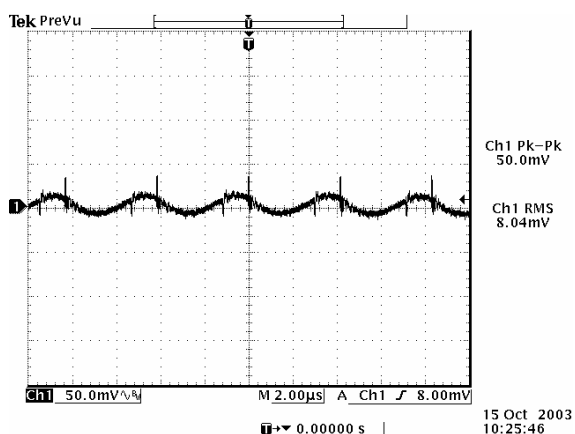
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Ripple and Noise Waveforms



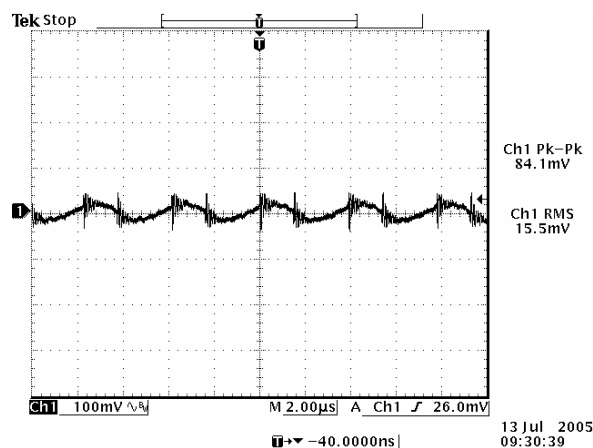
Ripple and noise at full load, 3.3 Vdc/7 A output

Ripple and noise at full load, 5.0 Vdc/5 A output



Ripple and noise at full load, 12 Vdc/2.5 A output

Ripple and noise at full load, 15 Vdc/2 A output



Ripple and noise at full load, 24 Vdc/1.25 A output

Note: Ripple and noise at 48 Vdc input, with a 0.47 μ F ceramic cap at the output, $T_a=25$ deg C.

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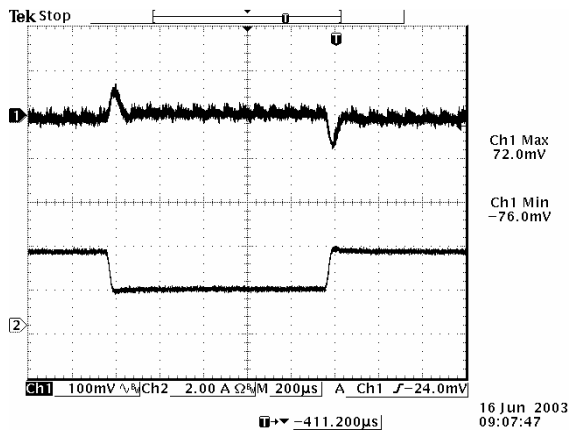
48 Vdc Input 3.3 Vdc - 24 Vdc/7 A - 1.25 A Output



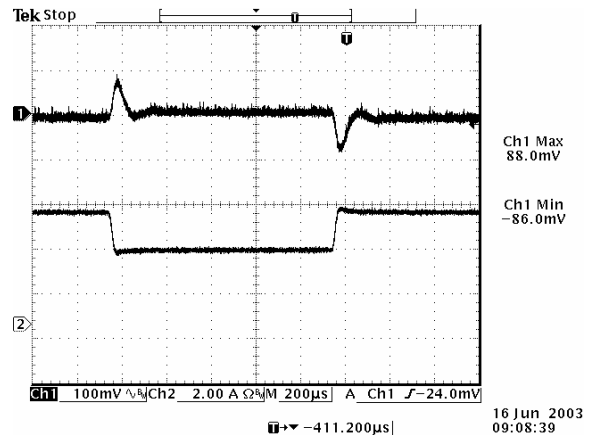
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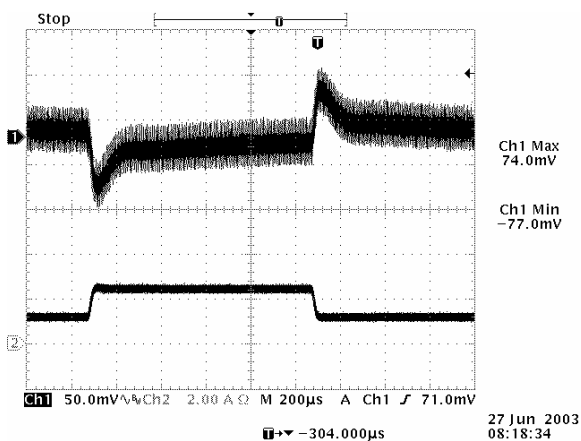
Transient Response Waveforms



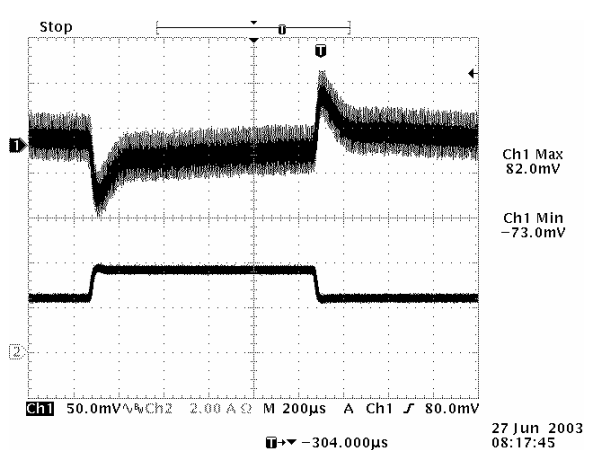
Transients 25% to 50% load 3.3 Vdc output



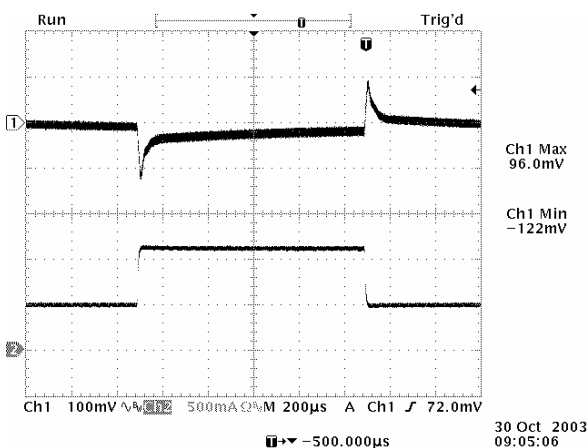
Transients 50% to 75% load 3.3 Vdc output



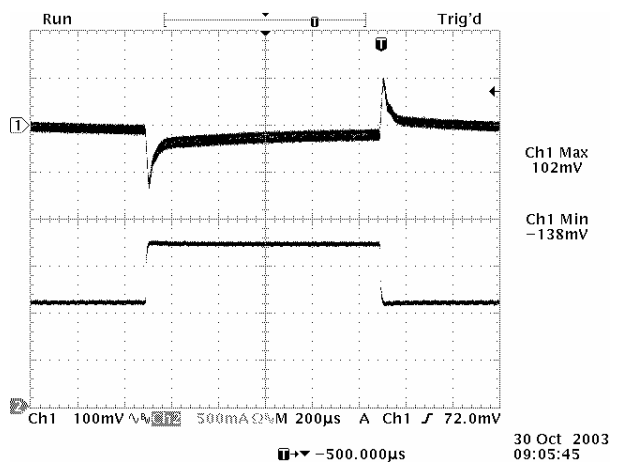
Transients 25% to 50% load 5.0 Vdc output



Transients 50% to 75% load 5.0 Vdc output



Transients 25% to 50% load 12 Vdc output



Transients 50% to 75% load 12 Vdc output

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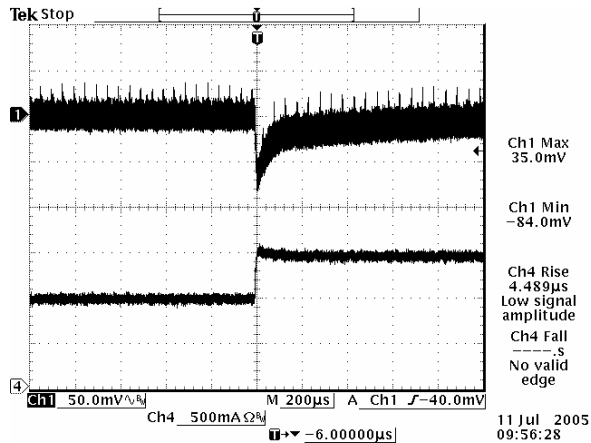
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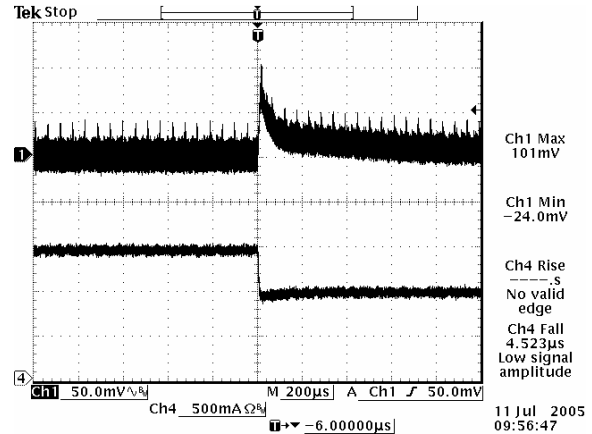
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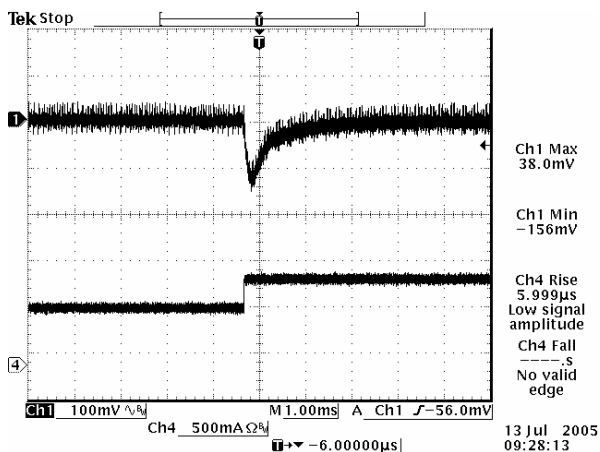
Transient Response Waveforms (continued)



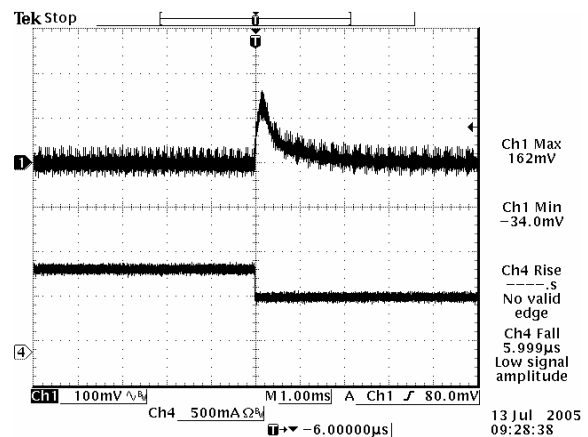
Transients 25% to 50% load 15 Vdc output



Transients 50% to 75% load 15 Vdc output



Transients 25% to 50% load 24 Vdc output



Transients 50% to 75% load 24 Vdc output

Note: Transient response at 48 Vdc input, $di/dt=0.1$ A/µS, with external 220 µF electrolytic cap and 0.47 µF ceramic cap at the output, and $T_a=25$ deg C.

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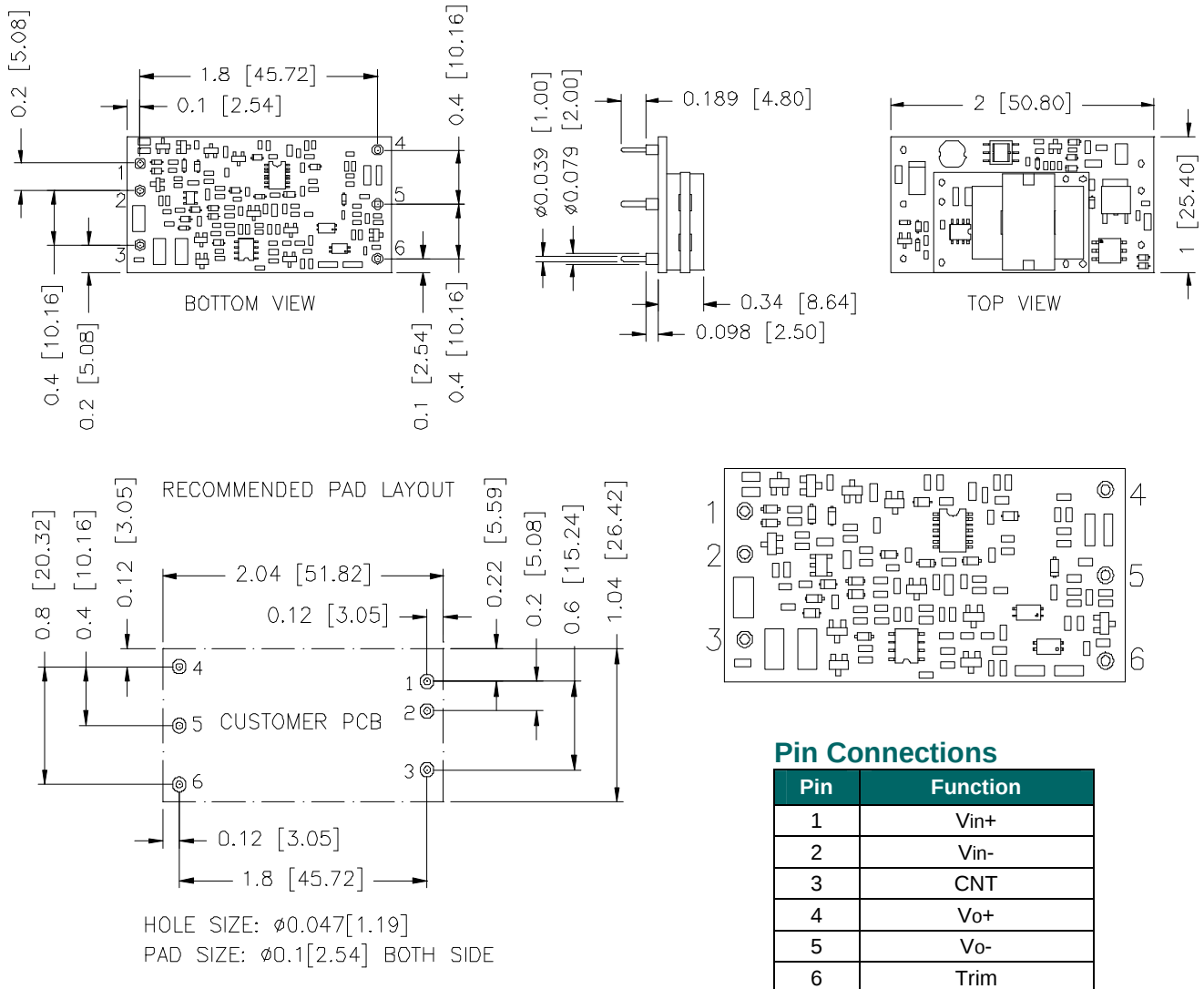
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Mechanical Outline



Note: This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 °C for less than 5 seconds.

Note:

- 1) All Pins: Material - Copper Alloy;
Finish – 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate.
- 2) Undimensioned components are shown for visual reference only.
- 3) All dimensions in inches (mm); Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm).

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Revision History

Date	Revision	Changes Detail	Approval
2007-03-02	A	First Release.	XF Jiang
2010-11-29	B	Update the notes in Remote On/Off.	XF Jiang

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

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