ISOLATED DC/DC CONVERTERS

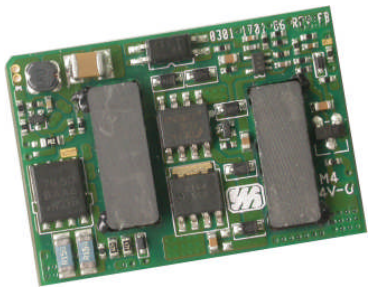
48 Vdc Input 1.5 Vdc - 12 Vdc / 22 A - 5 A Outputs, 1/16 Brick

Nov. 17, 2010

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

xRSB-50T Series RoHS Compliant Rev.G

- Isolated
- Fixed Frequency (600 kHz)
- High Efficiency
- High Power Density
- Low Cost
- Output Voltage Trim
- Basic Insulation
- UL60950-1 Recognized (UL/cUL)
- Input Under Voltage Lockout
- Output Over Voltage Shutdown
- OCP/SCP
- Over Temperature Protection
- Remote On/Off (option)
- Positive/Negative Remote Sense
- Through Hole and SMT (option)



Description

The xRSB-50T series are isolated dc/dc converters that operate from a nominal 48 Vdc source. These units will provide up to 60 W of output power from a nominal 48 Vdc input. These units are designed to be highly efficient and low cost. Features include remote on/off, over current protection and under voltage lockout. These converters are provided in an industry standard sixteenth brick package.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active Low	Model Number Active High
1.5 V	36 V - 75 V	22 A	33 W	85%	xRSB-50TV5L	xRSB-50TV50
1.8 V	36 V - 75 V	20 A	36 W	87%	xRSB-50TV8L	xRSB-50TV80
2.5 V	36 V - 75 V	18 A	45 W	87%	xRSB-50T02L	xRSB-50T025
3.3 V	36 V - 75 V	15 A	50 W	89%	xRSB-50T03L	xRSB-50T033
5.0 V	36 V - 75 V	12 A	60 W	90%	xRSB-50T05L	xRSB-50T050
12 V	36 V - 75 V	5 A	60 W	89%	xRSB-50T12L	xRSB-50T120

Notes: 1. Add “G” suffix at the end of the model number to indicate Tray Packaging. Replace”x” with “S” to indicate SMT package, or “0” to indicate through hole package.
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
Input Voltage (continuous)	-0.3 V	-	80 V	
Input Voltage Transient (100 ms)	-0.3 V		100 V	
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	

Downloaded from Arrow.com.

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	36 V	48 V	75 V	
Input Current (full load)	-	-	2.4 A	
Input Current (no load)	-	70 mA	120 mA	
Remote Off Input Current	-	1 mA	3 mA	
Input Reflected Ripple Current (pk-pk)	-	20 mA	50 mA	Tested with simulated source impedance of 15 uH, 5 Hz to 20 MHz; use a 100 uF/100 V electrolytic capacitor with ESR=1 ohm max at 200 kHz at the input.
Input Reflected Ripple Current (rms)	-	3 mA	7 mA	
I^2t Inrush Current Transient	-	0.01 A^2s	0.02 A^2s	
Turn On Voltage Threshold	31 V	32 V	35 V	
Turn Off Voltage Threshold	30 V	31 V	34 V	

Note: 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				
Vo=1.5 V	1.478 V	1.5 V	1.523 V	
Vo=1.8 V	1.773 V	1.8 V	1.827 V	Test conditions:
Vo=2.5 V	2.463 V	2.5 V	2.538 V	Vin=48 V; Io=50%
Vo=3.3 V	3.250 V	3.3 V	3.350 V	load
Vo=5.0 V	4.925 V	5.0 V	5.075 V	
Vo=12 V	11.750 V	12.0 V	12.250 V	
Line Regulation				
Vo=1.5 - 1.8 V	-	±0.5 mV	±3 mV	
Vo=2.5 V	-	±1 mV	±6 mV	
Vo=3.3 V	-	±3 mV	±8 mV	
Vo=5.0 V	-	±4 mV	±9 mV	
Vo=12 V	-	±10 mV	±25 mV	
Load Regulation				
Vo=1.5 - 2.5 V	-	±3 mV	±5 mV	
Vo=3.3 - 5.0 V	-	±4 mV	±9 mV	
Vo=12 V	-	±9 mV	±18 mV	
Regulation Over Temperature(-40 °C to +85 °C)				
Vo=1.5 - 1.8 V	-	±6 mV	±14 mV	
Vo=2.5 - 3.3 V	-	±9 mV	±16 mV	
Vo=5.0 V	-	±15 mV	±30 mV	
Vo=12 V	-	±20 mV	±35 mV	
Output Current				
Vo=1.5 V	0 A	-	22 A	
Vo=1.8 V	0 A	-	20 A	
Vo=2.5 V	0 A	-	18 A	
Vo=3.3 V	0 A	-	15 A	
Vo=5.0 V	0 A	-	12 A	
Vo=12 V	0 A	-	5 A	

Downloaded from Arrow.com.

Output Specifications (continued)

Parameter			Min	Typ	Max	Notes
Current Limit Threshold						
	Vo=1.5 V		28 A	34 A	40 A	
	Vo=1.8 V		24 A	28 A	34 A	
	Vo=2.5 V		22 A	26 A	30 A	
	Vo=3.3 V		19 A	22 A	26 A	
	Vo=5.0 V		14 A	19 A	24 A	
	Vo=12 V		5.2 A	6.5 A	8.5 A	
Short Circuit Surge Transient			-	0.5 A^2s	1 A^2s	
Ripple and Noise (rms)						Tested at 0-20 MHz BW, with a 1 uF ceramic capacitor and a Tantalum capacitor (refer to the min. output capacitance below for each output) at the output.
	Vo=1.5 - 1.8 V		-	6 mV	12 mV	
	Vo=2.5 V		-	10 mV	20 mV	
	Vo=3.3 V		-	12 mV	25 mV	
	Vo=5.0 V		-	25 mV	50 mV	
	Vo=12 V		-	30 mV	55 mV	
Ripple and Noise (pk-pk)						
	Vo=1.5 - 1.8 V		-	40 mV	70 mV	
	Vo=2.5 V		-	45 mV	80 mV	
	Vo=3.3 V		-	55 mV	90 mV	
	Vo=5.0 V		-	70 mV	120 mV	
	Vo=12 V		-	90 mV	180 mV	
Turn on Time			-	35 mS	70 mS	
Overshoot at Turn on			-	0%	5%	
Output Capacitance						Recommend to use AVX TPS series Tantalum capacitor as the min capacitor
	Vo=1.5 V		470 uF	-	15000 uF	
	Vo=1.8 - 2.5 V		470 uF	-	10000 uF	
	Vo=3.3 V		220 uF	-	5600 uF	
	Vo=5.0 V		100 uF	-	4700 uF	
	Vo=12 V		22 uF	-	470 uF	
Transient Response						
25% ~ 50% Max Load	Overshoot	Vo=1.5 - 1.8 V	-	110 mV	150 mV	Test conditions: di/dt = 0.1 A/uS, Vin=48 V, with a 1uF ceramic capacitor and a Tantalum capacitor (refer to the min. output capacitance above for each output) at the output.
	Settling Time		-	110 uS	180 uS	
50% ~ 25% Max Load	Overshoot		-	110 mV	150 mV	
	Settling Time		-	110 uS	180 uS	
25% ~ 50% Max Load	Overshoot	Vo=2.5 - 3.3 V	-	150 mV	250 mV	
	Settling Time		-	120 uS	200 uS	
50% ~ 25% Max Load	Overshoot		-	150 mV	250 mV	
	Settling Time		-	120 uS	200 uS	
25% ~ 50% Max Load	Overshoot	Vo=5.0 V	-	220 mV	350 mV	
	Settling Time		-	120 uS	250 uS	
50% ~ 25% Max Load	Overshoot		-	220 mV	350 mV	
	Settling Time		-	120 uS	250 uS	
25% ~ 50% Max Load	Overshoot	Vo=12 V	-	400 mV	650 mV	
	Settling Time		-	150 uS	300 uS	
50% ~ 25% Max Load	Overshoot		-	400 mV	650 mV	
	Settling Time		-	150 uS	300 uS	

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

Downloaded from Arrow.com.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency Vo=1.5 V Vo=1.8 - 2.5 V Vo=3.3 V Vo=5.0 V Vo=12 V	 82% 84% 86% 87% 86%	 85% 87% 89% 90% 89%	 - - - - -	Vin=48 V, full load
Switching Frequency	540 kHz	600 kHz	660 kHz	
Isolation Capacitance	-	3900 pF	-	
Output Voltage Trim Range Vo=1.5 - 5.0 V Vo=12 V	 90% Vo 80% Vo	 - -	 110% Vo 110% Vo	
Over Temperature Protection	120 °C	-	140 °C	
Over Voltage Protection	-	130% Vo	160% Vo	Test conditions: Vin=48 V, full load and short the feedback optocoupler.
MTBF	2,770,832 hours			Calculated Per Bell Core SR-332 (I_O =80% load, Vin=48 V, Vo=5 V; T_a = 25 °C)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 1.3 x 0.9 x 0.364 33.02 x 22.86 x 9.24			SMT Package
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 1.3 x 0.9 x 0.388 33.02 x 22.86 x 9.85			Through Hole Package
Weight	-	13 g	-	

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

Control Specifications

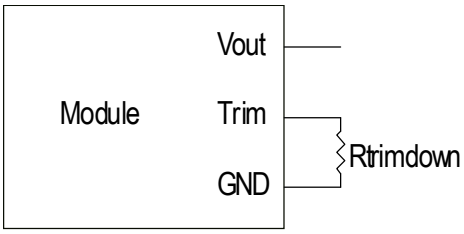
Parameter		Min	Typ	Max	Notes
Remote On/Off					
Signal Low (Unit On)	Active Low	-0.3 V	-	0.8 V	When Remote On/Off pin is open, for active low option, unit is off; for active high option, unit is on
Signal High (Unit Off)		2.95 V	-	18 V	
Signal Low (Unit Off)	Active High	-0.3 V	-	0.8 V	
Signal High (Unit On)		2.95 V	-	18 V	
Current Sink	-	0 mA	-	1 mA	

Downloaded from Arrow.com.

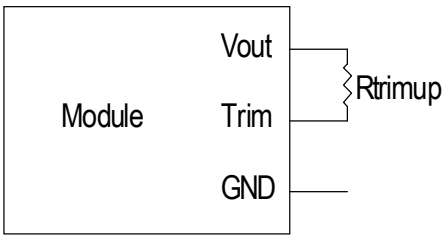
Output Trim Equations

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.

$$R_{trimdown} = \frac{511}{|delta|} - 10.22$$



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



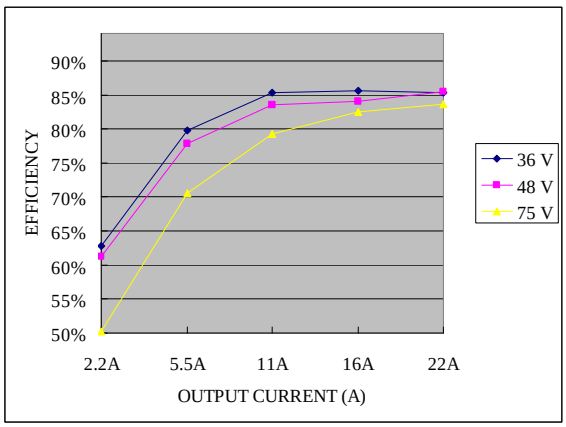
Note:

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

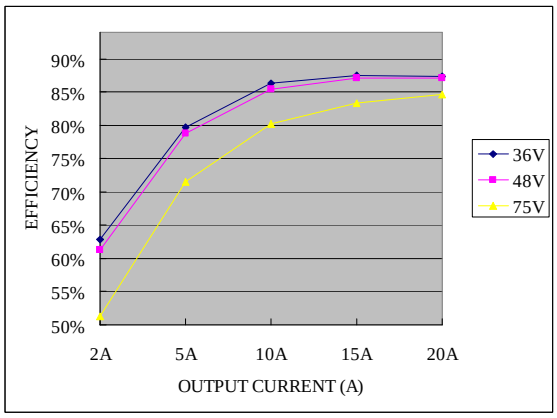
Vo_req=Desired (trimmed) output voltage [V]

Vo=1.503 V for 1.5 V output; Vo=1.804 V for 1.8 V output; Vo=2.505 V for 2.5 V output; Vo=3.308 V for 3.3 V output; Vo=5.002 V for 5 V output; Vo=12.007 V for 12 V output.

Efficiency Data



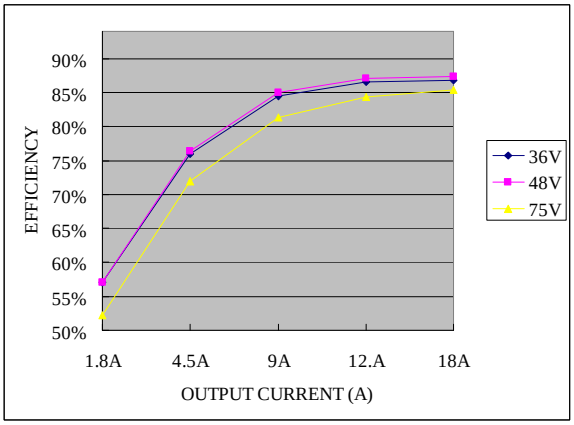
Vo=1.5 V



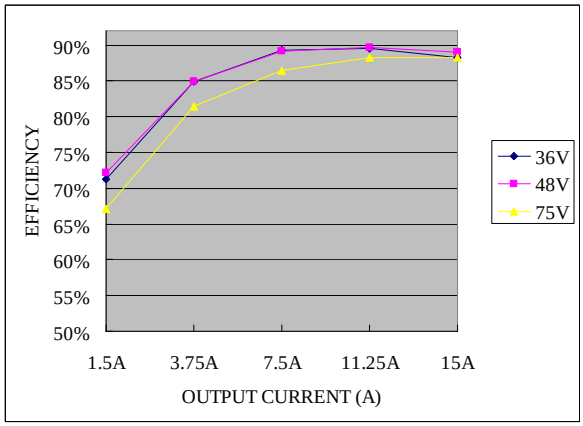
Vo=1.8 V

Downloaded from Arrow.com.

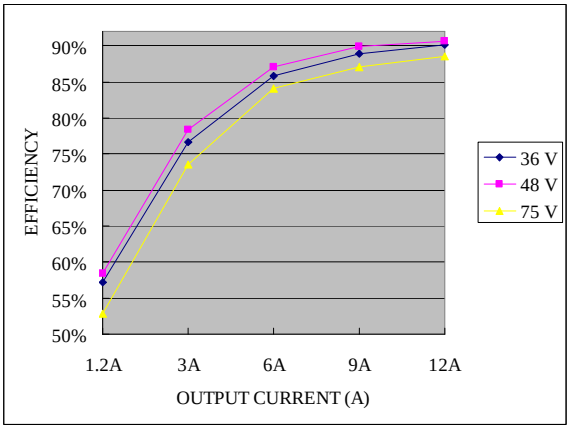
Efficiency Data (continued)



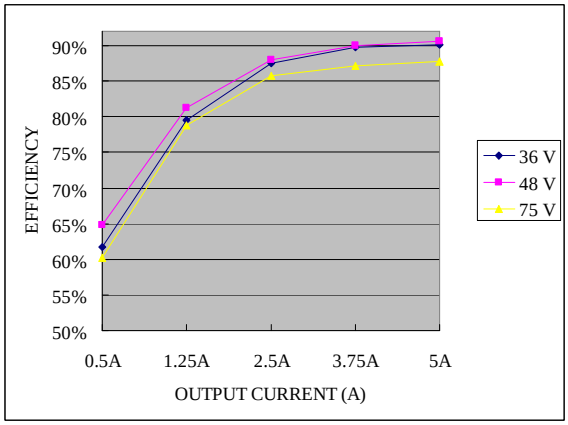
Vo=2.5 V



Vo=3.3 V

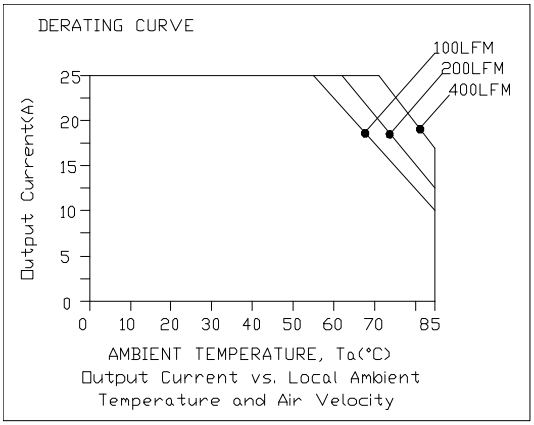


Vo=5.0 V

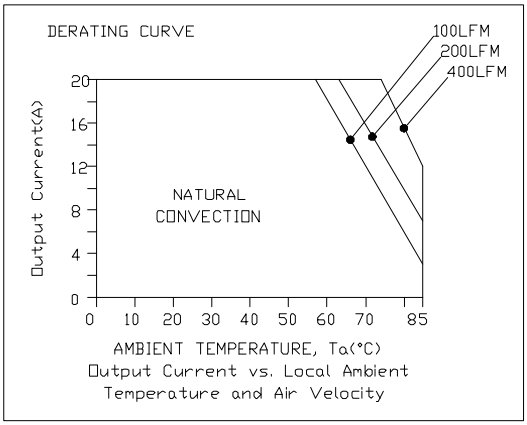


Vo=12 V

Thermal Derating Curves



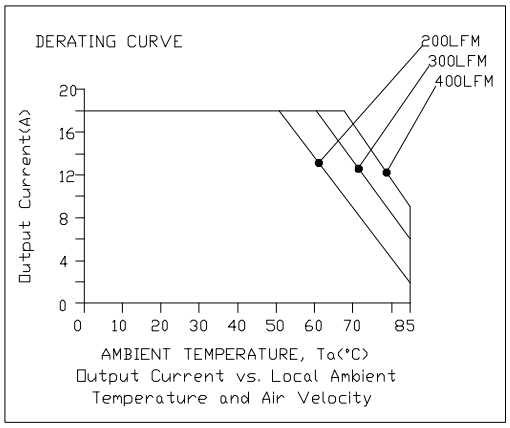
Vin=48 V, Vo=1.2 V



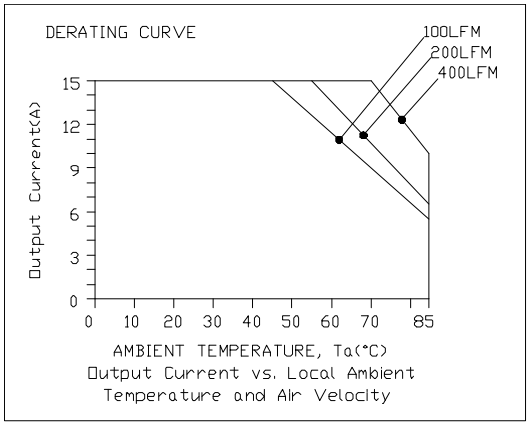
Vin=48 V, Vo=1.8 V

Downloaded from Arrow.com.

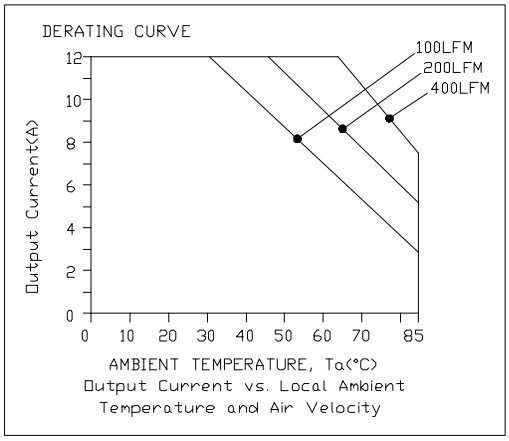
Thermal Derating Curves (continued)



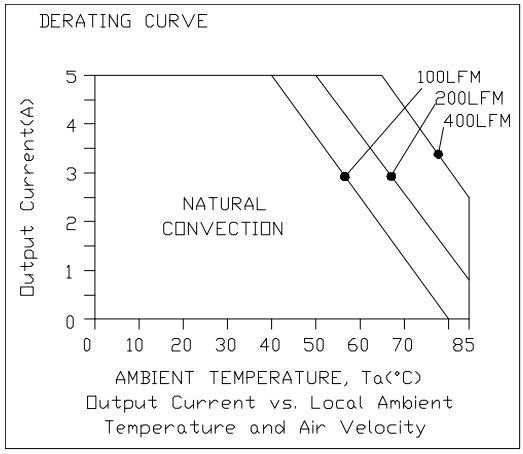
Vin=48 V, Vo=2.5 V



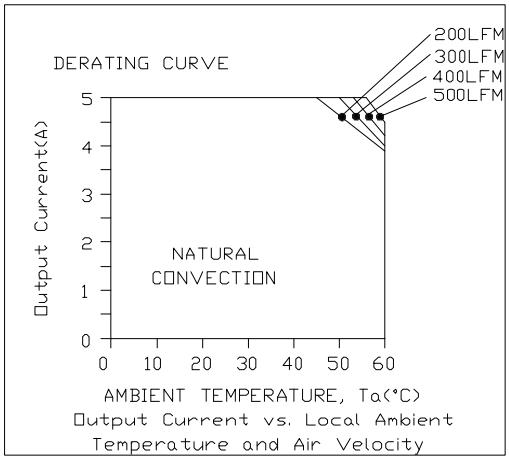
Vin=48 V, Vo=3.3 V



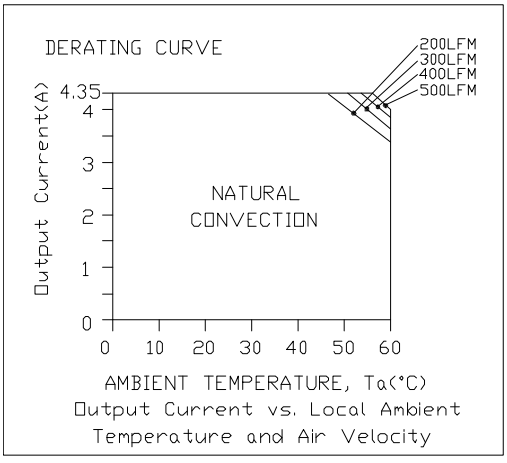
Vin=48 V, Vo=5.0 V



Vin=48 V, Vo=12 V



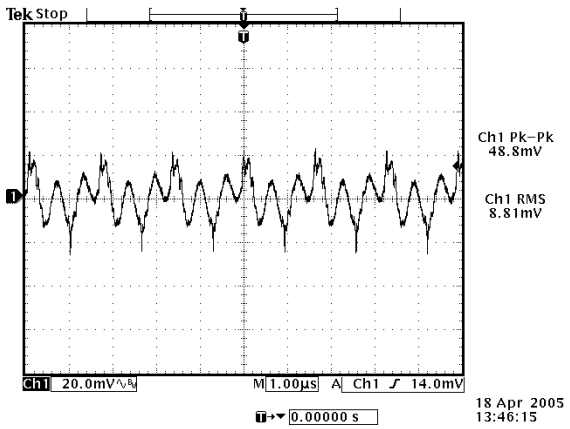
Vin=36 V, Vo=12 V



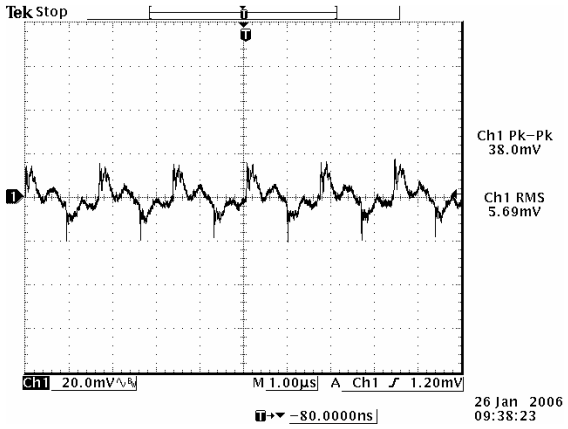
Vin=75 V, Vo=12 V

Downloaded from Arrow.com.

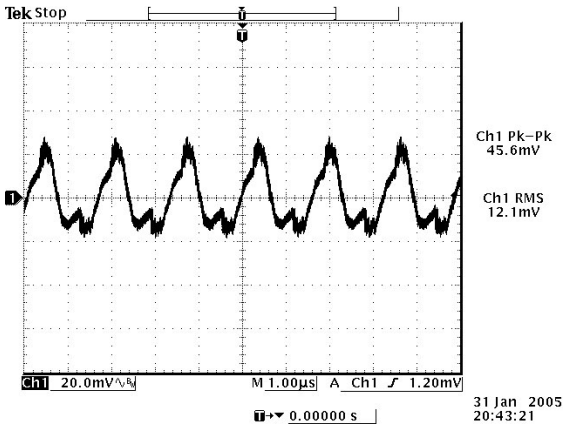
Ripple and Noise Waveforms



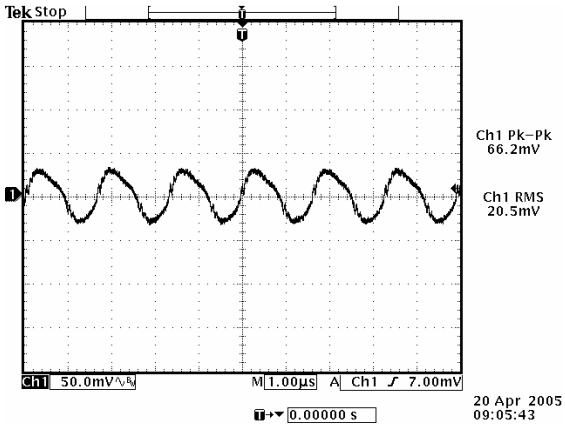
Vo=1.8 V



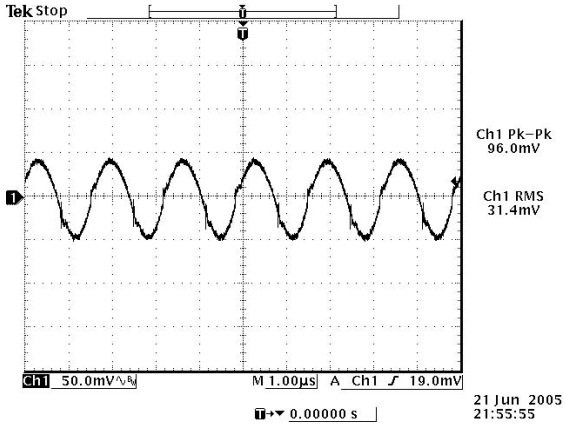
Vo=2.5 V



Vo=3.3 V



Vo=5.0 V



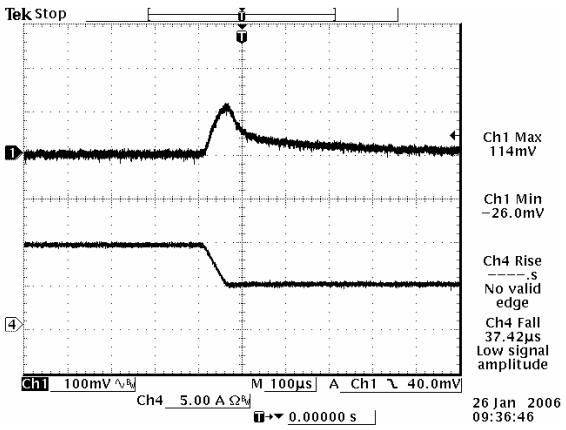
Vo=12 V

Note: Ripple and Noise at full load, 48 V input, Ta=25 deg C.

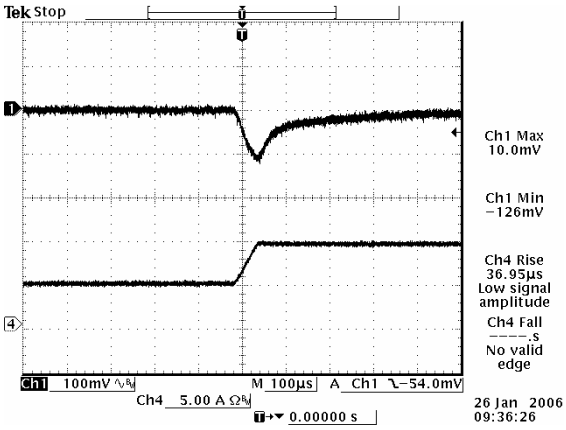
1) For Vo=1.8 V -2.5 V, with a 1 uF ceramic capacitor and a 470 uF tantalum cap at the output;
2) For Vo=3.3 V, with a 1 uF ceramic capacitor and a 220 uF tantalum cap at the output;
3) For Vo=5.0 V, with a 1 uF ceramic capacitor and a 100 uF tantalum cap at the output;
4) For Vo=12 V, with a 1 uF ceramic capacitor and a 22 uF tantalum cap at the output.

Downloaded from Arrow.com.

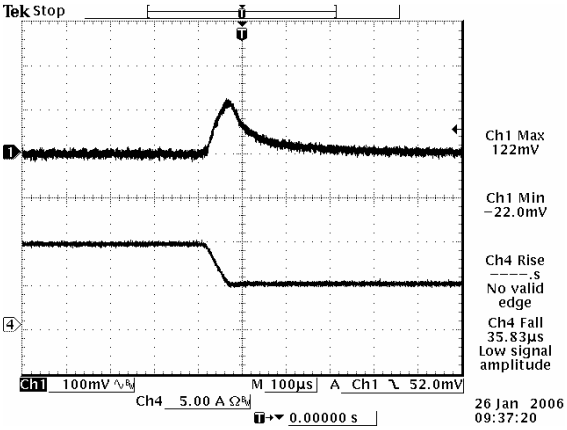
Transient Response Waveforms



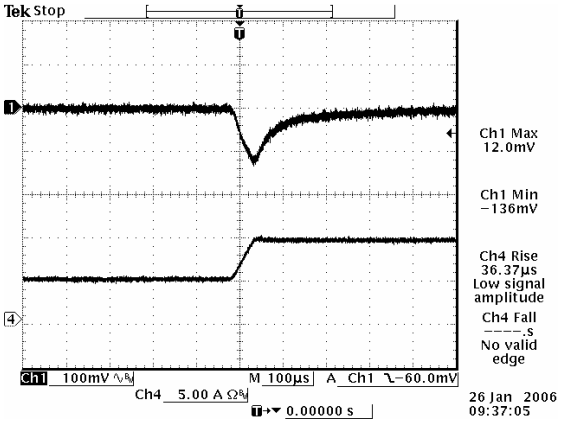
Vo=1.8 V 50% to 25% Load Transients



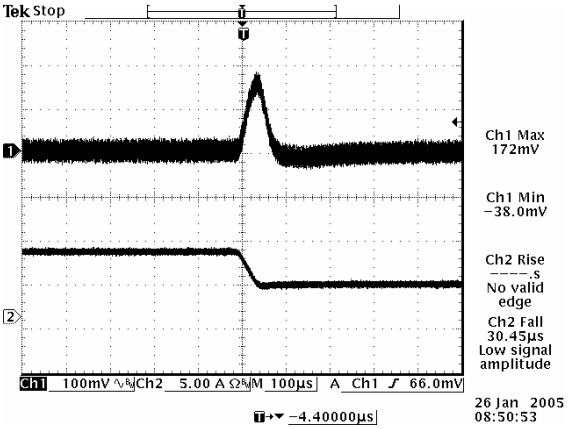
Vo=1.8 V 25% to 50% Load Transients



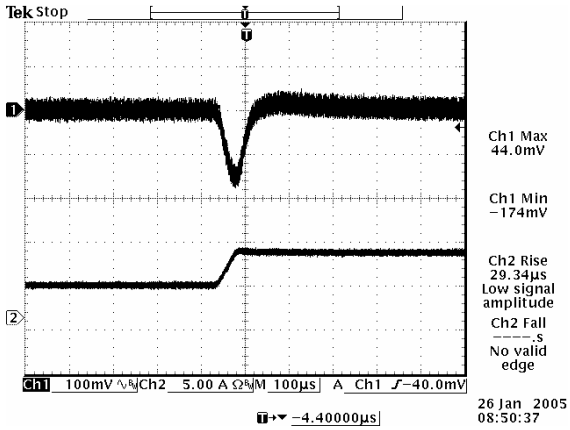
Vo=2.5 V 50% to 25% Load Transients



Vo=2.5 V 25% to 50% Load Transients



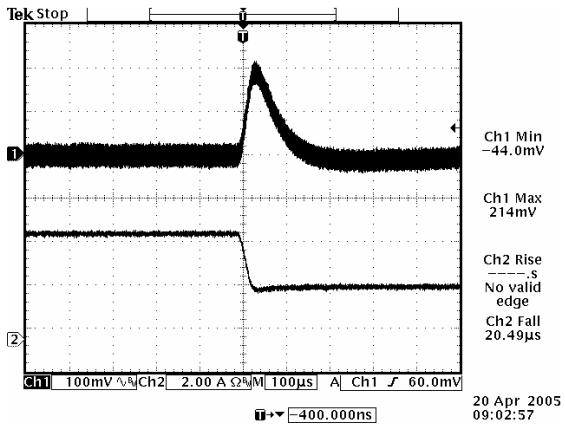
Vo=3.3 V 50% to 25% Load Transients



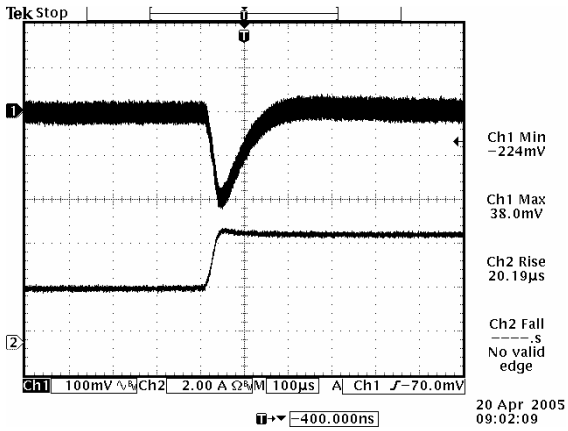
Vo=3.3 V 25% to 50% Load Transients

Downloaded from Arrow.com.

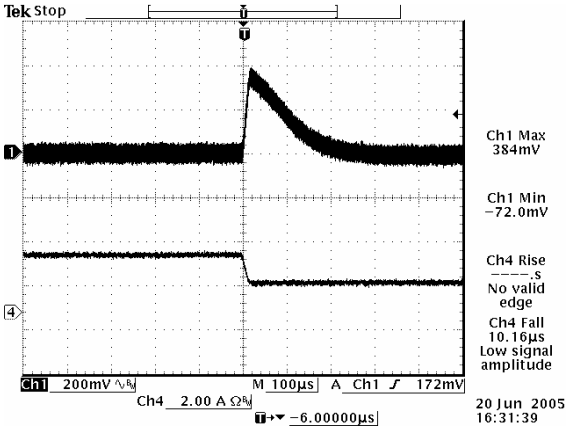
Transient Response Waveforms (continued)



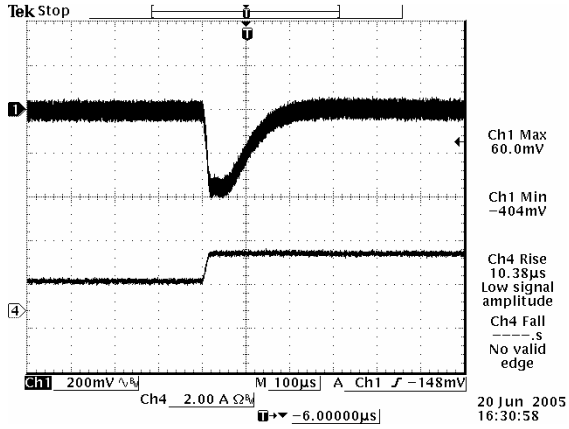
Vo=5 V 50% to 25% Load Transients



Vo=5 V 25% to 50% Load Transients



Vo=12 V 50% to 25% Load Transients



Vo=12 V 25% to 50% Load Transients

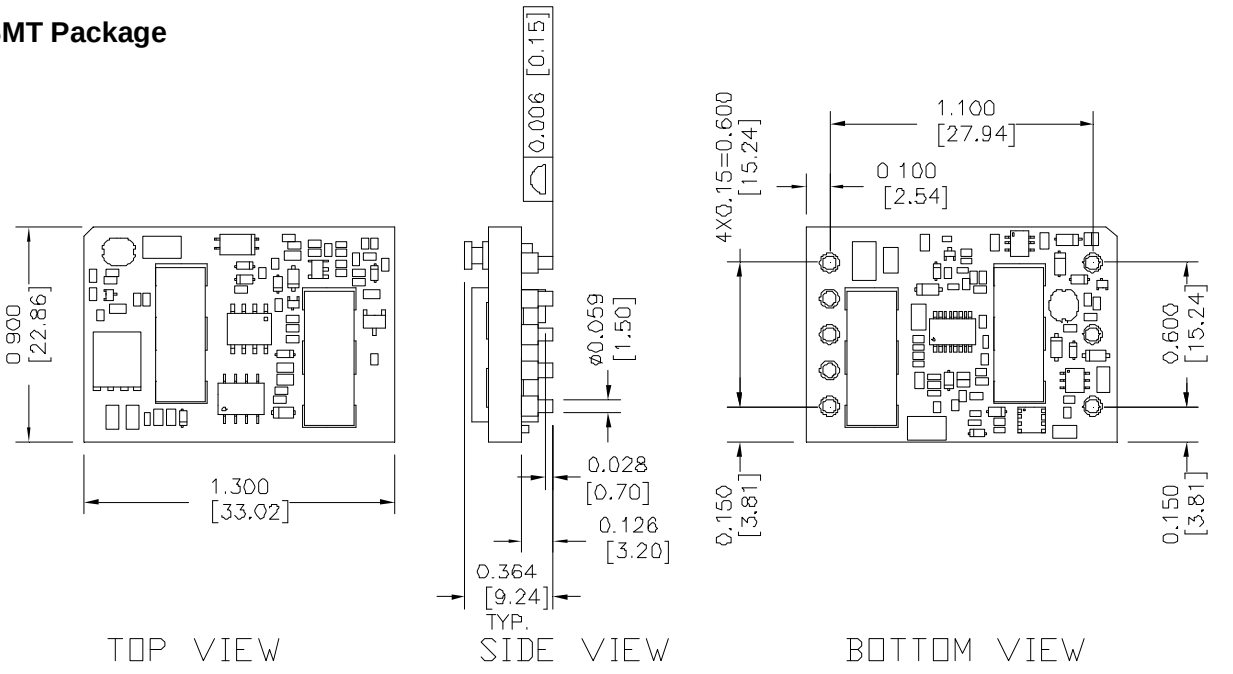
Note: Transients Response at Vin=48 V, di/dt=0.1A/uS, Ta=25 deg C.

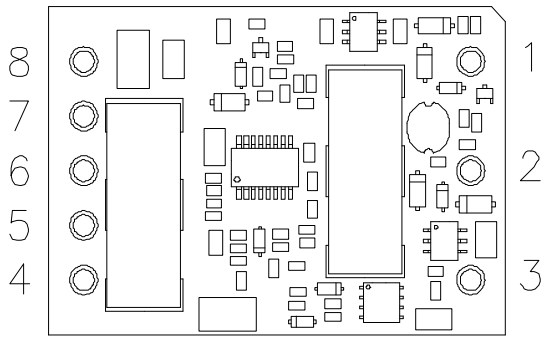
1) For Vo=1.8 V -2.5 V, with a 1 uF ceramic capacitor and a 470 uF tantalum cap at the output;
2) For Vo=3.3 V, with a 1 uF ceramic capacitor and a 220 uF tantalum cap at the output;
3) For Vo=5.0 V, with a 1 uF ceramic capacitor and a 100 uF tantalum cap at the output;
4) For Vo=12 V, with a 1 uF ceramic capacitor and a 22 uF tantalum cap at the output.

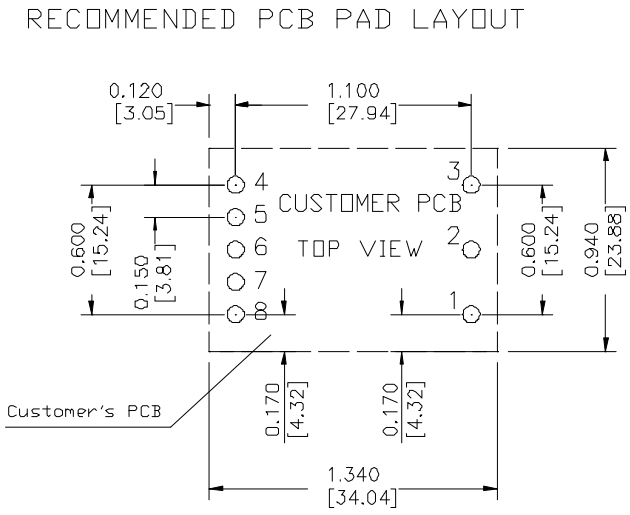
Downloaded from Arrow.com.

Mechanical Outline

SMT Package







Recommended Surface Mount Pads
Min. ø0.080" [2.03]
Max. ø0.092" [2.34]

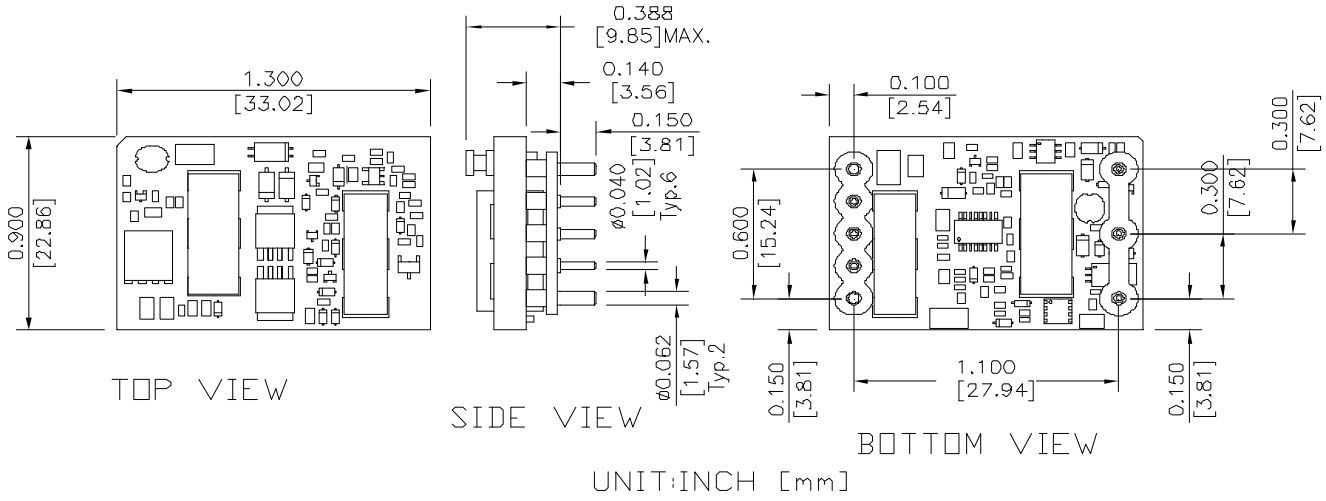
Pin Connections

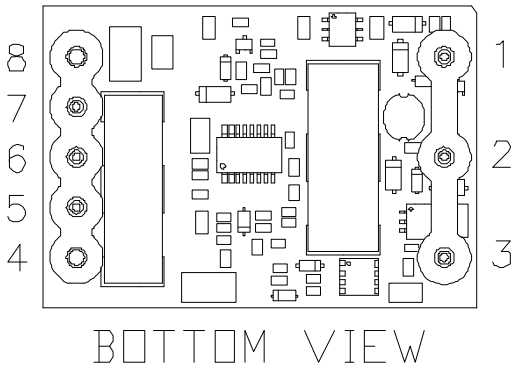
Pin	Function
1	Vin (+)
2	Remote On/Off
3	Vin (-)
4	Vout-
5	Remote Sense (-)
6	Trim
7	Remote Sense (+)
8	Vout (+)

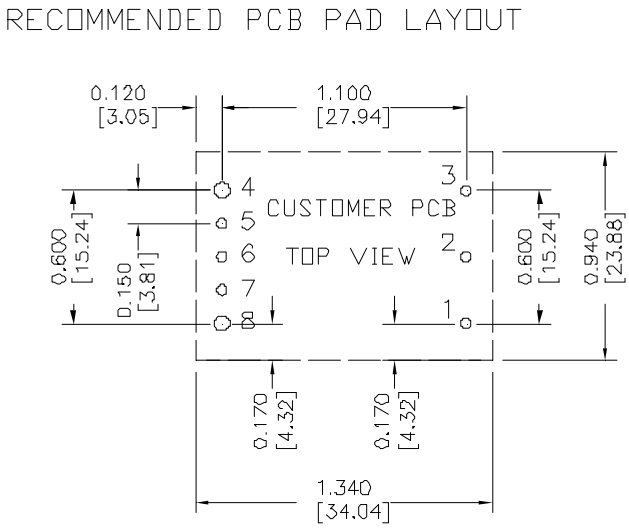
Downloaded from Arrow.com.

Mechanical Outline (continued)

Through Hole Package







Pin Connections

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

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; Tolerances: x.xx +/-0.02 in. x.xxx +/-0.010 in. unless otherwise stated.

Downloaded from Arrow.com.

Revision History

Date	Revision	Changes Detail	Approval
2010-04-12	F	Update the 0RSB-50T series product height from 0.378'' to 0.388''.	Jack Fan
2010-11-17	G	Add Derating Curve under 36Vin, 75Vin at 12V output.	JZ Wang

RoHS Compliance

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

©2010 Bel Fuse Inc. Specifications subject to change without notice. 111710

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

Downloaded from Arrow.com.