

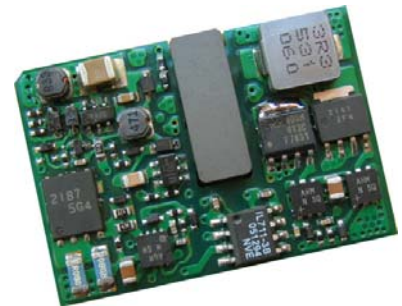
ISOLATED DC/DC CONVERTERS

24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick

bel
POWER PRODUCTS

xRSB-40U Series RoHS Compliant Rev.A

- Isolated
- Fixed Frequency
- High Efficiency
- High Power Density
- Low Cost
- Output Voltage Trim
- Basic Insulation
- Remote On/Off Logic (Option)
- Input Under Voltage Lockout
- Output Over Voltage Shutdown
- OCP/SCP
- Over Temperature Protection
- Wide Input Voltage
- Positive/Negative Remote Sense
- Through Hole and SMT(Option)
- Input Over Voltage Protection



Description

The xRSB-40U series are isolated dc/dc converters that operate from a nominal 24 Vdc or 48 Vdc source. These units will provide up to 40 W of output power from an 18 Vdc - 75 Vdc wide input range. 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
1.2 Vdc	18 Vdc - 75 Vdc	18 A	22 W	82%	xRSB-40UV2L	xRSB-40UV20
1.5 Vdc	18 Vdc - 75 Vdc	16 A	24 W	84%	xRSB-40UV5L	xRSB-40UV50
1.8 Vdc	18 Vdc - 75 Vdc	14 A	25 W	85%	xRSB-40UV8L	xRSB-40UV80
2.5 Vdc	18 Vdc - 75 Vdc	12 A	30 W	86%	xRSB-40U02L	xRSB-40U025
3.3 Vdc	18 Vdc - 75 Vdc	10 A	33 W	87.5%	xRSB-40U03L	xRSB-40U033
5.0 Vdc	18 Vdc - 75 Vdc	8 A	40 W	87%	xRSB-40U05L	xRSB-40U050
12 Vdc	18 Vdc - 75 Vdc	3.5 A	42 W	85%	xRSB-40U12L	xRSB-40U120

- 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	
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	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	18 V	48 V	75 V	
Input Current (full load)				
Vo=1.2 V - 1.8 V	-	-	2.5 A	
Vo=2.5 V - 3.3 V	-	-	3.0 A	
Vo=5.0 V - 12 V	-	-	3.5 A	

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Input Specifications (continued)

Parameter	Min	Typ	Max	Notes
Input Current (no load)	-	60 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 ² t Inrush Current Transient	-	0.01 A ² s	0.02 A ² s	
Turn On Voltage Threshold	16.6 V	17.2 V	17.8 V	
Turn Off Voltage Threshold	16.2 V	16.8 V	17.4 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=1.2 V Vo=1.5 V Vo=1.8 V Vo=2.5 V Vo=3.3 V Vo=5.0 V Vo=12 V	1.182 V 1.478 V 1.773 V 2.463 V 3.250 V 4.925 V 11.750 V	1.2 V 1.5 V 1.8 V 2.5 V 3.3 V 5.0 V 12 V	1.218 V 1.523 V 1.827 V 2.538 V 3.350 V 5.075 V 12.250 V	Test conditions: Vin=48 V; Io=50% load
Line Regulation	Vo=1.2 V - 1.8 V Vo=2.5 V Vo=3.3 V Vo=5.0 V Vo=12 V	- - - - -	±0.5 mV ±1.0 mV ±3.0 mV ±4.0 mV ±6.0 mV	±3 mV ±4 mV ±8 mV ±9 mV ±15 mV	
Load Regulation	Vo=1.2 - 2.5 V Vo=3.3 - 5.0 V Vo=12 V	- - -	±3 mV ±4 mV ±9 mV	±5 mV ±9 mV ±18 mV	
Regulation Over Temperature(-40 °C to +85 °C)	Vo=1.2 V Vo=1.5 - 1.8 V Vo=2.5 - 3.3 V Vo=5.0 V Vo=12 V	- - - - -	±4 mV ±6 mV ±9 mV ±15 mV ±20 mV	±9 mV ±14 mV ±16 mV ±30 mV ±35 mV	
Output Current	Vo=1.2 V Vo=1.5 V Vo=1.8 V Vo=2.5 V Vo=3.3 V Vo=5.0 V Vo=12 V	0 A 0 A 0 A 0 A 0 A 0 A 0 A	- - - - - - -	18 A 16 A 14 A 12 A 10 A 8 A 3.5 A	
Short Circuit Surge Transient		-	0.5 A ² s	1 A ² s	

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24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



Output Specifications (continued)

Parameter		Min	Typ	Max	Notes	
Current Limit Threshold	Vo=1.2 V	21 A	25 A	29 A		
	Vo=1.5 V	19 A	22 A	26 A		
	Vo=1.8 V	17 A	20 A	23 A		
	Vo=2.5 V	14 A	17 A	20 A		
	Vo=3.3 V	11 A	14 A	16 A		
	Vo=5.0 V	8.8 A	10 A	12.5 A		
	Vo=12 V	4.2 A	5 A	6 A		
Ripple and Noise (rms)	Vo=1.2 V - 1.8 V	-	6 mV	12 mV	Tested at 0-20 MHz BW, with a 1 uF ceramic capacitor and a 10 uF Tantalum capacitor at the output.	
	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=1.2 V - 1.8 V	-	40 mV	70 mV	Tested at 0-20 MHz BW, with a 1 uF ceramic capacitor and a 10 uF Tantalum capacitor at the output.	
	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		-	25 mS	50 mS		
Overshoot at Turn on		-	0%	5%		
Output Capacitance	Vo=1.2 V	470 uF	-	15000 uF	Recommend to use AVX TPS series Tantalum capacitor as min capacitor.	
	Vo=1.5 V	470 uF	-	10000 uF		
	Vo=1.8 V	470 uF	-	10000 uF		
	Vo=2.5 V	470 uF	-	5600 uF		
	Vo=3.3 V	330 uF	-	4700 uF		
	Vo=5.0 V	150 uF	-	2200 uF		
	Vo=12 V	10 uF	-	220 uF		
Transient Response						
25% ~ 50% Max Load	Overshoot	Vo=1.2 V	-	60 mV	110 mV	Test conditions: di/dt = 0.1 A/uS, Vin=48 V, with a 1 uF ceramic capacitor and a Min Capacitance of Tantalum capacitor at the output
	Settling Time		-	80 uS	150 uS	
50% ~ 25% Max Load	Overshoot	Vo=1.2 V	-	60 mV	110 mV	
	Settling Time		-	80 uS	150 uS	
25% ~ 50% Max Load	Overshoot	Vo=1.5 -1.8 V	-	60 mV	110 mV	
	Settling Time		-	80 uS	150 uS	
50% ~ 25% Max Load	Overshoot	Vo=1.5 -1.8 V	-	60 mV	110 mV	
	Settling Time		-	80 uS	150 uS	
25% ~ 50% Max Load	Overshoot	Vo=2.5 -3.3 V	-	180 mV	250 mV	
	Settling Time		-	80 uS	150 uS	
50% ~ 25% Max Load	Overshoot	Vo=2.5 -3.3 V	-	180 mV	250 mV	
	Settling Time		-	80 uS	150 uS	
25% ~ 50% Max Load	Overshoot	Vo=5.0 V	-	250 mV	350 mV	
	Settling Time		-	100 uS	200 uS	
50% ~ 25% Max Load	Overshoot	Vo=5.0 V	-	250 mV	350 mV	
	Settling Time		-	100 uS	200 uS	
25% ~ 50% Max Load	Overshoot	Vo=12 V	-	400 mV	650 mV	
	Settling Time		-	150 uS	300 uS	
50% ~ 25% Max Load	Overshoot	Vo=12 V	-	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.

ISOLATED DC/DC CONVERTERS

24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				Vin=48 V, full load
Vo=1.2 V	78%	82%	-	
Vo=1.5 V	79%	84%	-	
Vo=1.8 V	81%	85%	-	
Vo=2.5 V	83%	86%	-	
Vo=3.3 V	85%	87.5%	-	
Vo=5.0 V	85%	87%	-	
Vo=12 V	83%	85%	-	
Switching Frequency				
Vo=1.2 V -12 V	450 kHz	500 kHz	550 kHz	
Vo=1.8 V	500 kHz	550 kHz	600 kHz	
Isolation Capacitance	-	3900 pF	-	
Over Temperature Protection	-	125 °C	-	
Output Voltage Trim Range	90% Vo	-	110% Vo	
Over Voltage Protection	-	130% Vo	160% Vo	Test conditions: Vin=48 V, full load and short the feedback optocoupler.
MTBF	TBD			Calculated Per Bell Core SR-332 (Io = Nominal; Ta = 25 °C)
Dimensions	1.3 x 0.9 x 0.446 33.0 x 22.9 x 11.34			SRSB-40Uxxx
Inches (L x W x H)	1.3 x 0.9 x 0.460 33.0 x 22.9 x 11.39			0RSB-40Uxxx
Millimeters (L x W x H)				
Weight	-	14 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	-	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)		2.4 V	-		18 V
Signal Low (Unit Off)	Active High	-0.3 V	-		0.8 V
Signal High (Unit On)		2.4 V	-		18 V
Current Sink	-	0 mA	-	1 mA	

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POWER PRODUCTS

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.

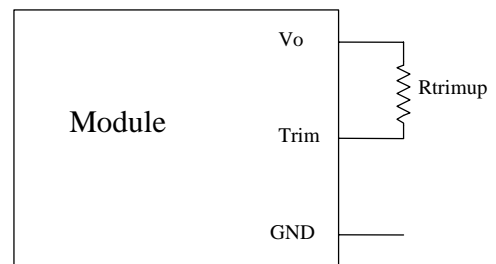
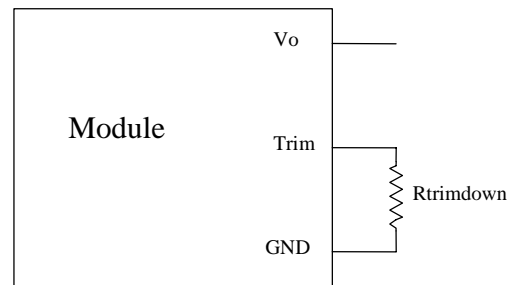
1) Trim Equations for Vo=1.2 V

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

$$R_{trimup} = \frac{(100 + \delta) \cdot V_o \cdot 5.11 - 313}{0.6125 \cdot \delta} - 10.22$$

Note:
$$\delta = \frac{(V_o_{req} - V_o)}{V_o} \times 100[\%]$$

V_{o_req}=Desired (trimmed) output voltage [V] V_o=1.202 V



2) Trim Equations for Vo=1.5 V - 12 V

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

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

Note:
$$\delta = \frac{(V_o_{req} - V_o)}{V_o} \times 100[\%]$$

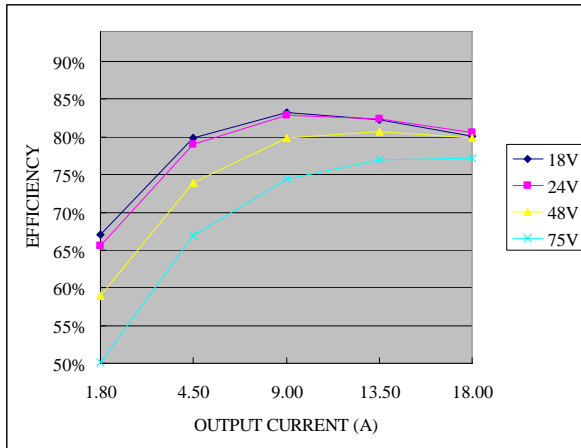
V_{o_req}=Desired (trimmed) output voltage [V]

ISOLATED DC/DC CONVERTERS

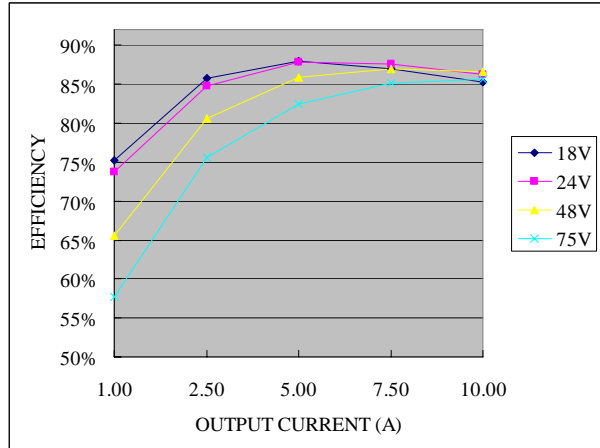
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



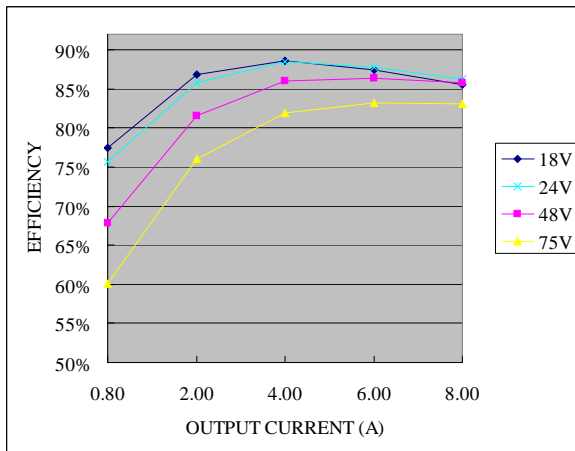
Efficiency Data



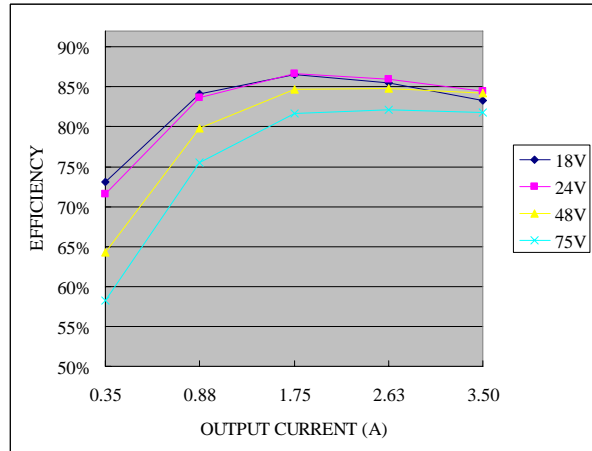
xRSB-40UV2x



xRSB-40U03x



xRSB-40U05x



xRSB-40U12x

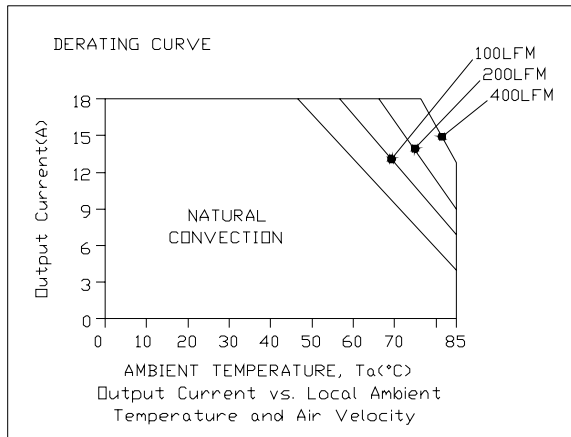
ISOLATED DC/DC CONVERTERS

24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick

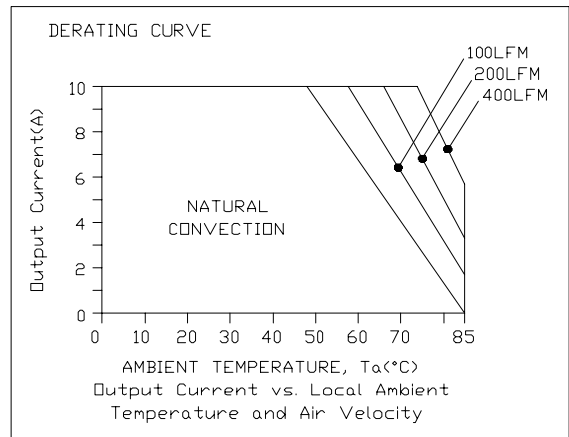


Thermal Derating Curves

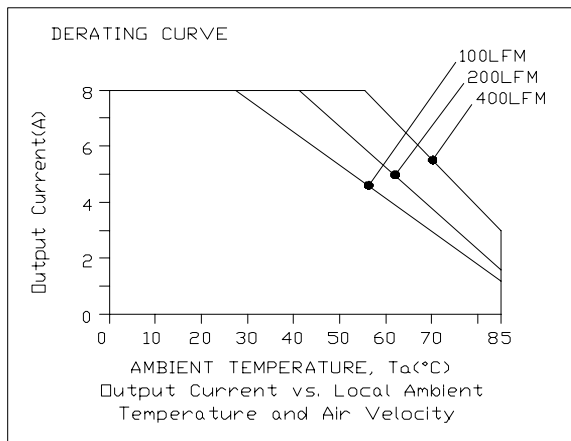
Vin=48 Vdc



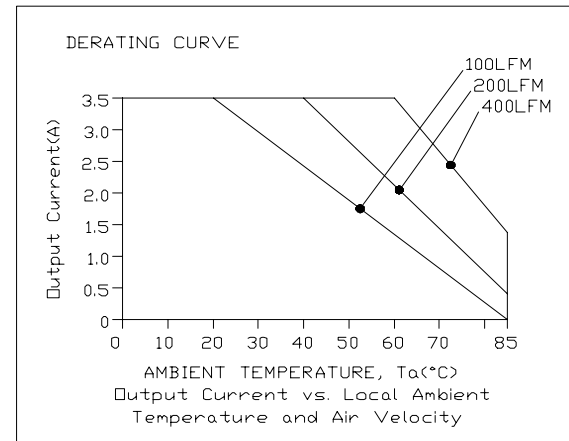
xRSB-40UV2x



xRSB-40U03x



xRSB-40U05x



xRSB-40U12x

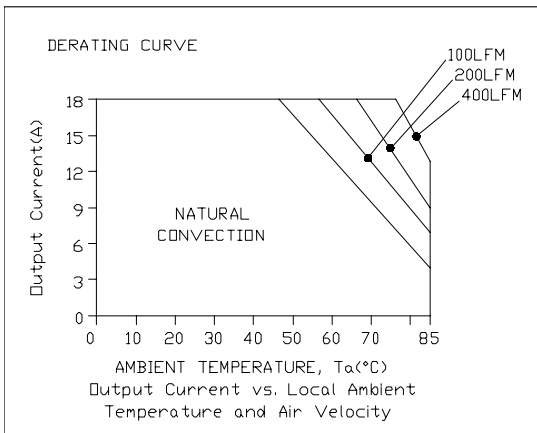
ISOLATED DC/DC CONVERTERS

24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick

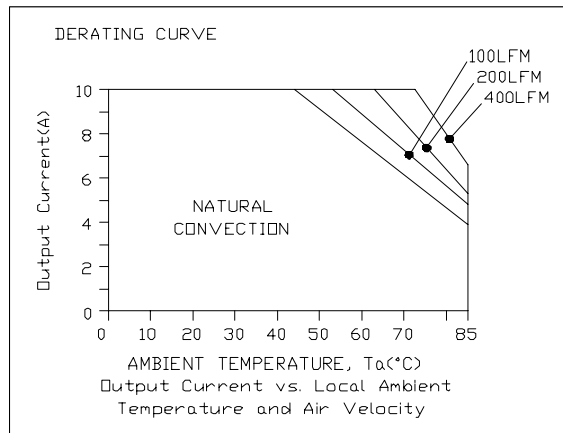


Thermal Derating Curves (continued)

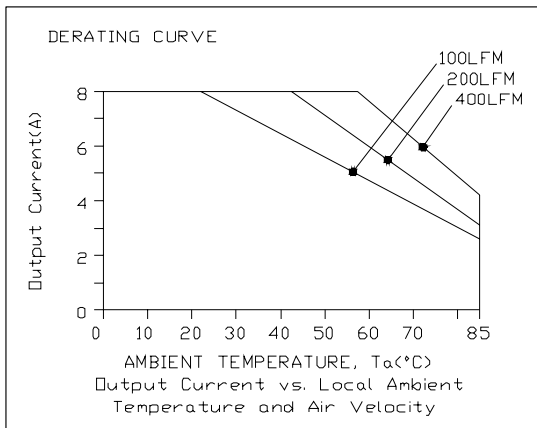
$V_{in}=24\text{ Vdc}$



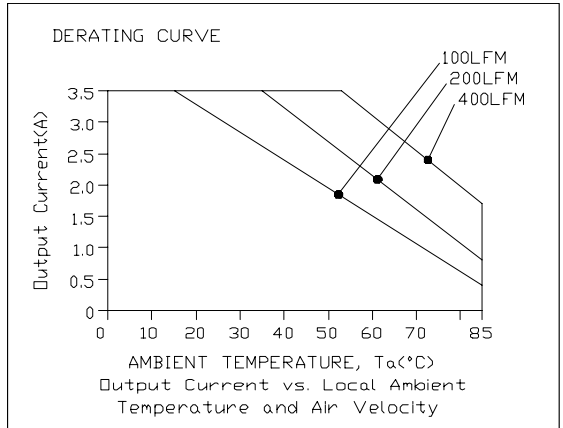
xRSB-40UV2x



xRSB-40U03x



xRSB-40U05x



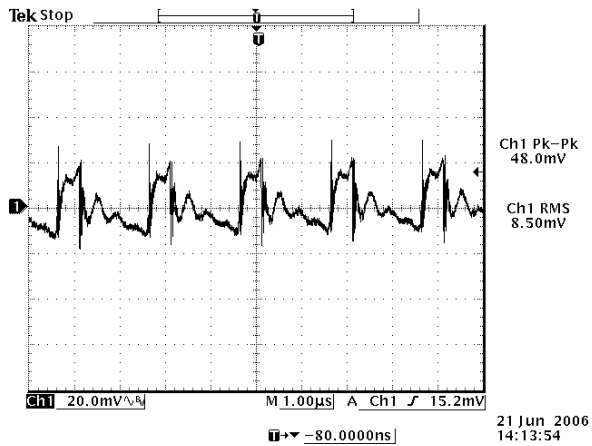
xRSB-40U12x

ISOLATED DC/DC CONVERTERS

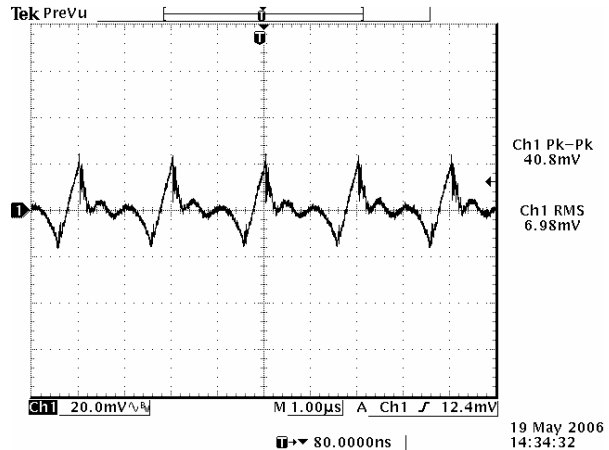
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



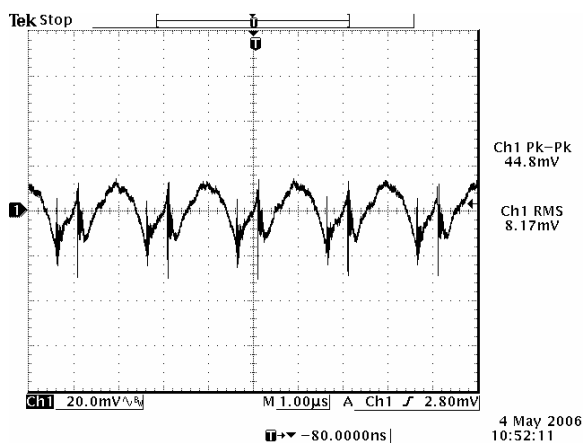
Ripple and Noise Waveforms



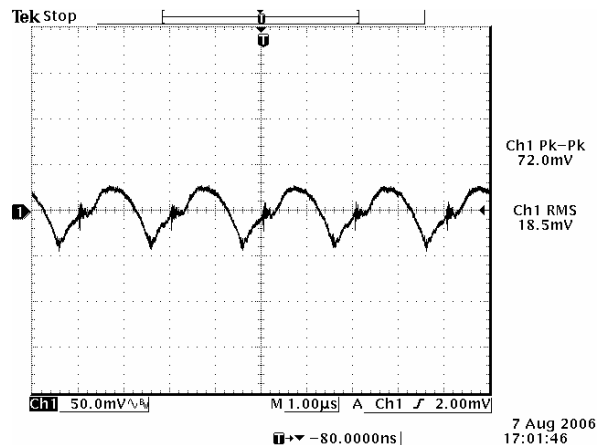
48 Vdc input, 1.2 Vdc output



48 Vdc input, 3.3 Vdc output



48 Vdc input, 5.0 Vdc output



48 Vdc input, 12 Vdc output

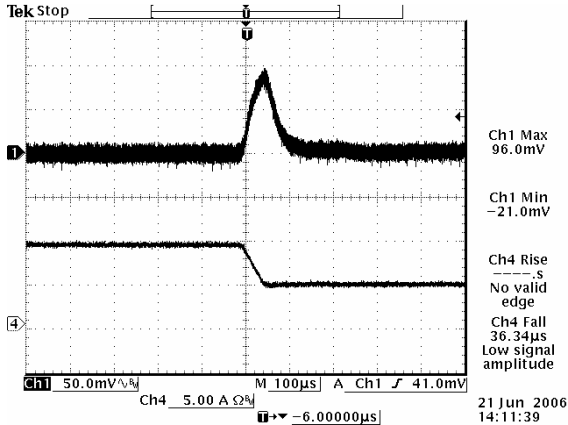
Note: Ripple and noise at full load, with a 1 μ F ceramic capacitor and a Min Capacitance of Tantalum capacitor at the output, $T_a=25$ deg C.

ISOLATED DC/DC CONVERTERS

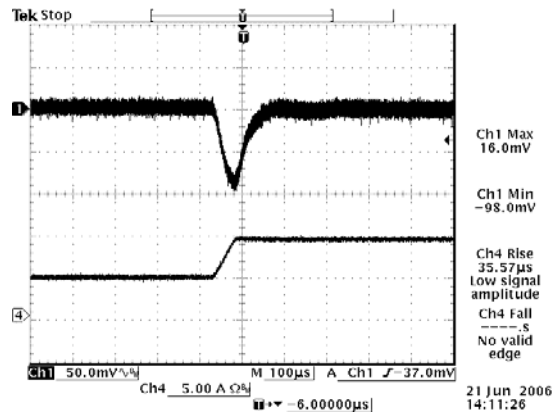
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



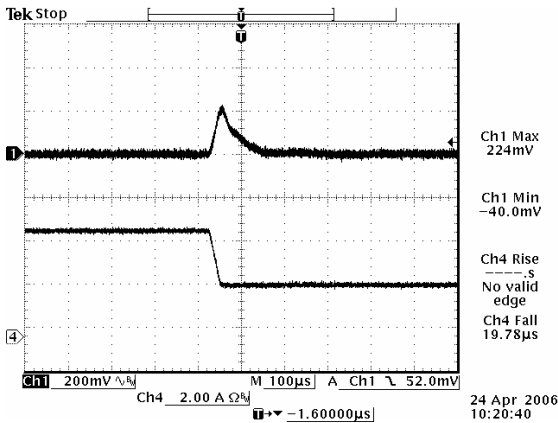
Transient Response Waveforms



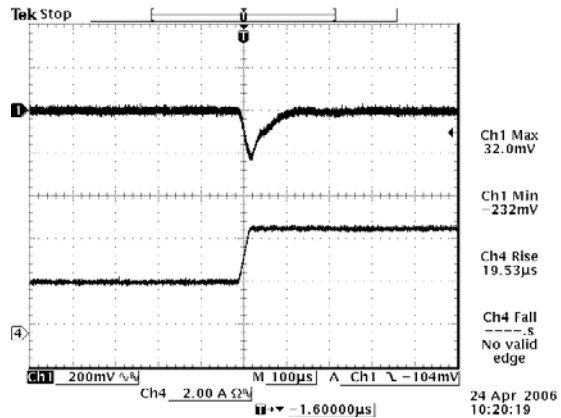
Vout=1.2 V 50% to 25% Load Transients



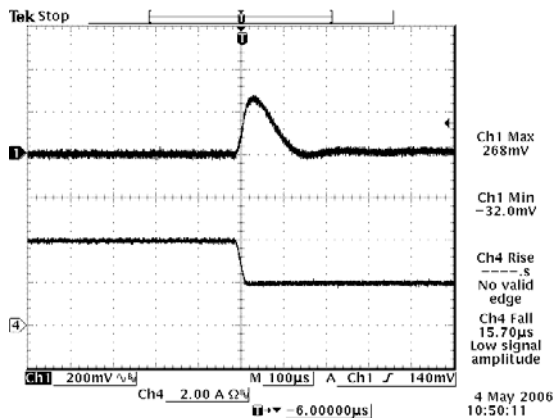
Vout=1.2 V 25% to 50% Load Transients



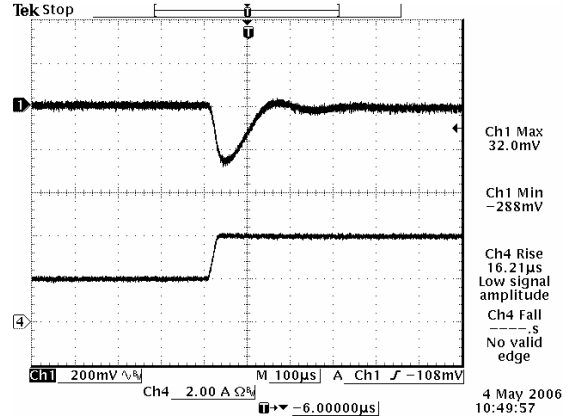
Vout=3.3 V 50% to 25% Load Transients



Vout=3.3 V 25% to 50% Load Transients



Vout=5.0 V 50% to 25% Load Transients



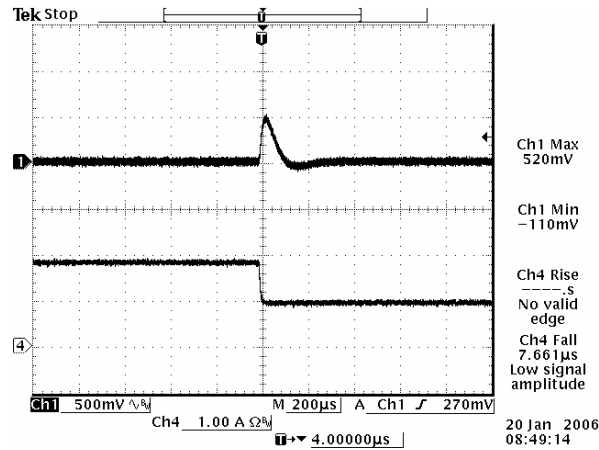
Vout=5.0 V 25% to 50% Load Transients

ISOLATED DC/DC CONVERTERS

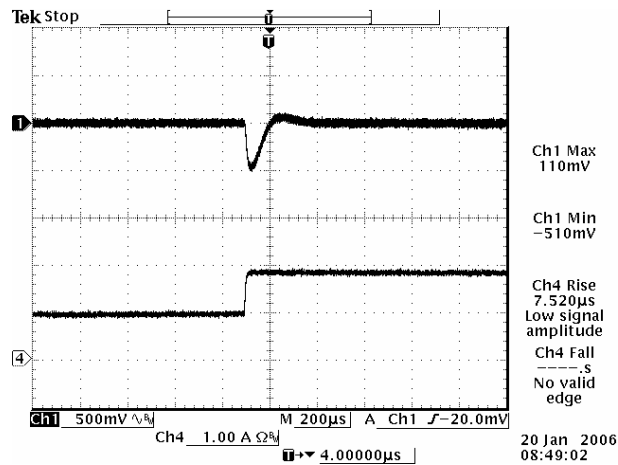
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



Transient Response Waveforms (continued)



Vout=12 V 50% to 25% Load Transients



Vout=12 V 25% to 50% Load Transients

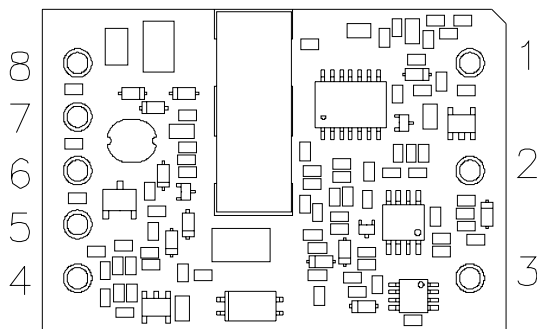
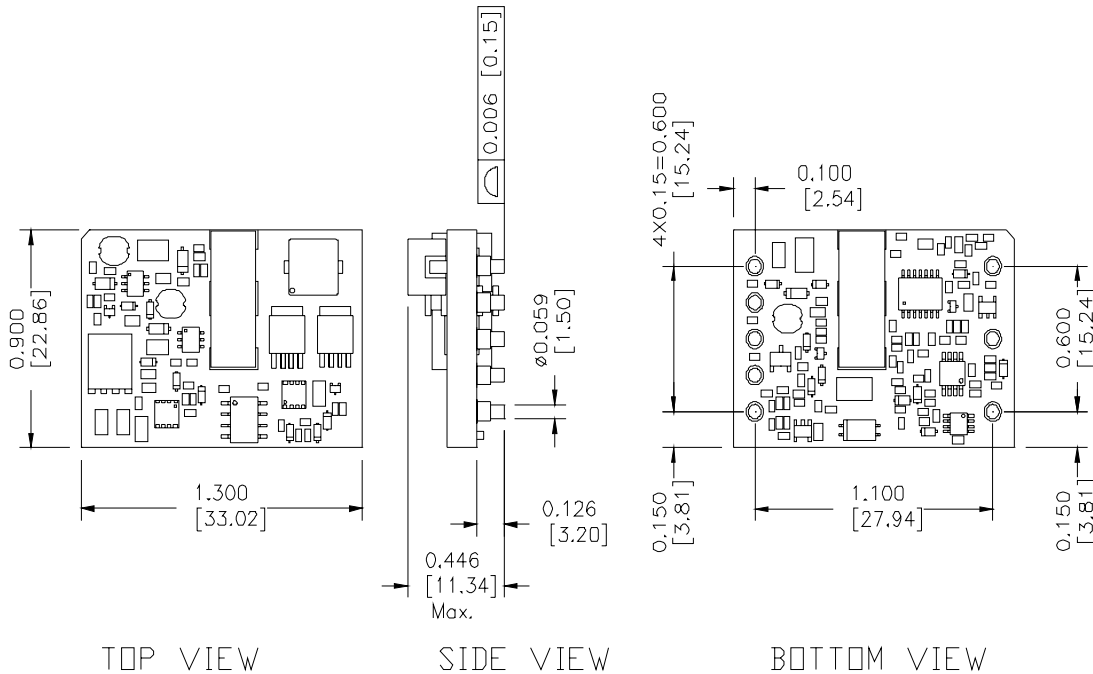
Note: Transient Response at Vin=48 V, di/dt=0.1 A/uS, with a 1 uF ceramic capacitor and a Min Capacitance of Tantalum capacitor at the output, Ta=25 deg C.

ISOLATED DC/DC CONVERTERS

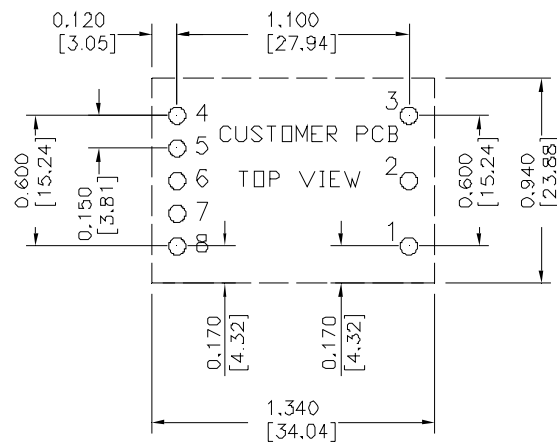
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



SMT Package (SRSB-40Uxxx)



RECOMMENDED PCB PAD LAYOUT



Pin Connections

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

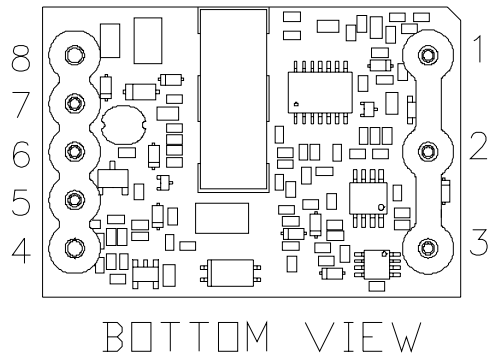
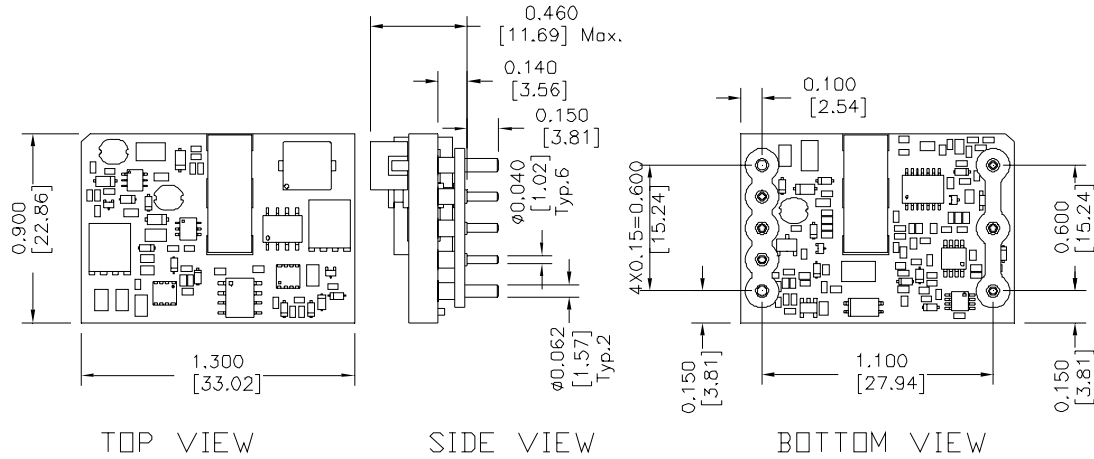
Recommended Surface Mount Pads
 Min. $\phi 0.080''$ [2.03]
 Max. $\phi 0.092''$ [2.34]

ISOLATED DC/DC CONVERTERS

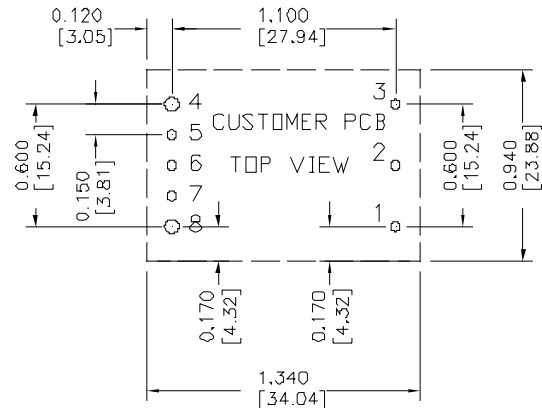
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



Through Hole Package (0RSB-40Uxxx)



RECOMMENDED PCB PAD LAYOUT



HOLE SIZE: 1-3, 5-7 $\phi 0.047$ [1.19],
4,8 $\phi 0.07$ [1.78]
PAD SIZE: 1-3, 5-7 $\phi 0.08$ [2.03]
4,8 $\phi 0.10$ [2.54]

Pin Connections

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



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