

ISOLATED DC/DC CONVERTERS

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



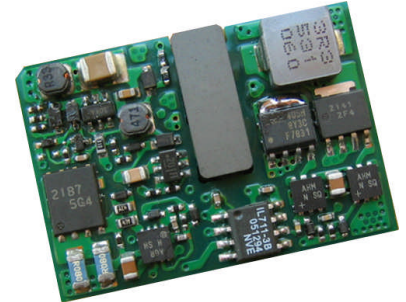
Apr. 07, 2011

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

xRSB-40U Series RoHS Compliant Rev.C

Features

- Isolated
- Fixed Frequency
- High Efficiency
- High Power Density
- Low Cost
- Output Voltage Trim
- Basic Insulation
- Remote On/Off Logic (Option)
- Class 1, Category 2, Isolated DC/DC Converter (refer to IPC-9592)
- UL60950-1 Recognized (UL/cUL) (Pending)
- 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



Applications

- Networking
- Computers and peripherals
- Telecommunications

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

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Part Number Explanation

$\frac{x}{1} \frac{R}{2} \frac{SB}{3} - \frac{40}{4} \frac{U}{5} \frac{xx}{6} \frac{x}{7}$

1---Replace "x" with "S" to indicate SMT package, or "0" to indicate through hole package

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

3---Series name, 1/16 Brick

4---Series code

5---Input range (18-75V)

6---Output voltage, V2=1.2Vout, V5=1.5Vout, V8=1.8Vout, O2=2.5Vout, O3=3.3Vout, O5=5.0Vout, 12=12Vout

7---Option, "x" of the model part number to be 0-9, A-Z, which will represent the special request of customer.

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage (continuous)	-0.3	-	80	V	
Input Transient Voltage	-	-	100	V	100mS maximum
Remote On/Off	-0.3	-	18	V	
I/O Isolation Voltage	-	-	1500	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	18	48	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	
Input Current (no load)	-	60	120	mA	
Remote Off Input Current	-	1	3	mA	
Input Reflected Ripple Current (pk-pk)	-	20	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	7	mA	
Input Over Voltage Lockout	78	-	82	V	
I ² t Inrush Current Transient	-	0.01	0.02	A ² s	
Turn-on Voltage Threshold	16.6	17.2	17.8	V	
Turn-off Voltage Threshold	16.2	16.8	17.4	V	

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

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Output Specifications

Parameter	Min	Typ	Max	Unit	Notes
Output Voltage Set Point					Test conditions: Vin=48 V; Io=50% load
Vo=1.2 V	1.182	1.2	1.218	V	
Vo=1.5 V	1.478	1.5	1.523	V	
Vo=1.8 V	1.773	1.8	1.827	V	
Vo=2.5 V	2.463	2.5	2.538	V	
Vo=3.3 V	3.250	3.3	3.350	V	
Vo=5.0 V	4.925	5.0	5.075	V	
Vo=12 V	11.750	12	12.250	V	
Line Regulation					
Vo=1.2 V - 1.8 V	-	±0.5	±3	mV	
Vo=2.5 V	-	±1.0	±4	mV	
Vo=3.3 V	-	±3.0	±8	mV	
Vo=5.0 V	-	±4.0	±9	mV	
Vo=12 V	-	±6.0	±15	mV	
Load Regulation					
Vo=1.2 - 2.5 V	-	±3	±5	mV	
Vo=3.3 - 5.0 V	-	±4	±9	mV	
Vo=12 V	-	±9	±18	mV	
Regulation Over Temperature(-40 °C to +85 °C)					
Vo=1.2 V	-	±4	±9	mV	
Vo=1.5 - 1.8 V	-	±6	±14	mV	
Vo=2.5 - 3.3 V	-	±9	±16	mV	
Vo=5.0 V	-	±15	±30	mV	
Vo=12 V	-	±20	±35	mV	
Output Current					
Vo=1.2 V	0	-	18	A	
Vo=1.5 V	0	-	16	A	
Vo=1.8 V	0	-	14	A	
Vo=2.5 V	0	-	12	A	
Vo=3.3 V	0	-	10	A	
Vo=5.0 V	0	-	8	A	
Vo=12 V	0	-	3.5	A	
Short Circuit Surge Transient	-	0.5	1	A ² s	Hiccup mode, auto recovery
Current Limit Threshold					
Vo=1.2 V	21	25	33	A	
Vo=1.5 V	19	22	26	A	
Vo=1.8 V	17	20	23	A	
Vo=2.5 V	14	17	20	A	
Vo=3.3 V	11	14	16	A	
Vo=5.0 V	8.8	10	12.5	A	
Vo=12 V	3.7	5	6	A	
Ripple and Noise (rms)					Tested at 0-20 MHz BW, with a 1 uF ceramic capacitor and a 10 uF Tantalum capacitor at the output.
Vo=1.2 V - 1.8 V	-	6	12	mV	
Vo=2.5 V	-	10	20	mV	
Vo=3.3 V	-	12	25	mV	
Vo=5.0 V	-	25	50	mV	
Vo=12 V	-	30	55	mV	
Ripple and Noise (pk-pk)					
Vo=1.2 V - 1.8 V	-	40	70	mV	
Vo=2.5 V	-	45	80	mV	
Vo=3.3 V	-	55	90	mV	
Vo=5.0 V	-	70	120	mV	
Vo=12 V	-	90	180	mV	

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Output Specifications (continued)

Parameter		Min	Typ	Max	Unit	Notes	
Turn on Time		-	25	50	mS		
Overshoot at Turn on		-	0	5	%		
Output Capacitance	Vo=1.2 V	470	-	15000	uF	Recommend to use AVX TPS series Tantalum capacitor as min capacitor.	
	Vo=1.5 V	470	-	10000	uF		
	Vo=1.8 V	470	-	10000	uF		
	Vo=2.5 V	470	-	5600	uF		
	Vo=3.3 V	330	-	4700	uF		
	Vo=5.0 V	150	-	2200	uF		
	Vo=12 V	10	-	220	uF		
Transient Response							
25% ~ 50% Max Load	Overshoot	Vo=1.2 V	-	60	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	150	uS	
50% ~ 25% Max Load	Overshoot	Vo=1.2 V	-	60	110	mV	
	Settling Time		-	80	150	uS	
25% ~ 50% Max Load	Overshoot	Vo=1.5 -1.8 V	-	90	180	mV	
	Settling Time		-	80	150	uS	
50% ~ 25% Max Load	Overshoot	Vo=1.5 -1.8 V	-	90	180	mV	
	Settling Time		-	80	150	uS	
25% ~ 50% Max Load	Overshoot	Vo=2.5 -3.3 V	-	180	250	mV	
	Settling Time		-	80	150	uS	
50% ~ 25% Max Load	Overshoot	Vo=2.5 -3.3 V	-	180	250	mV	
	Settling Time		-	80	150	uS	
25% ~ 50% Max Load	Overshoot	Vo=5.0 V	-	250	350	mV	
	Settling Time		-	100	200	uS	
50% ~ 25% Max Load	Overshoot	Vo=5.0 V	-	250	350	mV	
	Settling Time		-	100	200	uS	
25% ~ 50% Max Load	Overshoot	Vo=12 V	-	400	650	mV	
	Settling Time		-	150	300	mS	
50% ~ 25% Max Load	Overshoot	Vo=12 V	-	400	650	mV	
	Settling Time		-	150	300	mS	

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

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General Specifications

Parameter	Min	Typ	Max	Unit	Notes
Efficiency					
Vo=1.2 V	78	82	-	%	Vin=48 V, full load
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	500	550	KHz	
Vo=1.8 V	500	550	600	KHz	
Isolation Capacitance	-	3900	-	pF	
Over Temperature Protection	-	125	-	°C	The OTP threshold is set at 125°C in non-latch mode, and the module will restart automatically when temperature falls down to 115°C.
Output Voltage Trim Range	90	-	110	% Vo	
Over Voltage Protection	-	130	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	1.30 x 0.90 x 0.493 33.02 x 22.86 x 12.53			-	SRSB-40Uxxx
Inches (L x W x H)	1.30 x 0.90 x 0.507 33.02 x 22.86 x 12.89			-	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	Unit	Notes	
Remote On/Off						
Signal Low (Unit On)	Active Low	-0.3	-	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)		2.4	-	18	V	
Signal Low (Unit Off)	Active High	-0.3	-	0.8	V	
Signal High (Unit On)		2.4	-	18	V	
Current Sink	-	0	-	1	mA	

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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.

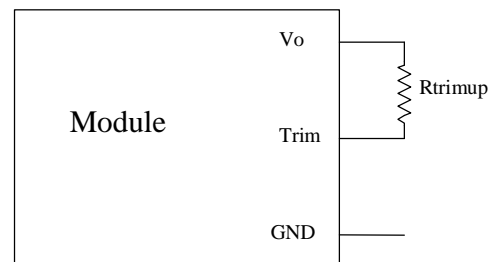
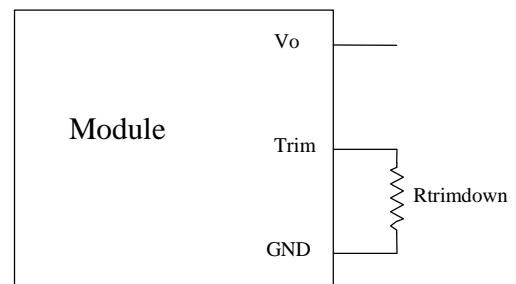
1) Trim Equations for Vo=1.2 V

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

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

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

Vo_req=Desired (trimmed) output voltage [V] Vo=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:
$$\delta = \frac{(V_o_{req} - V_o)}{V_o} \times 100[\%]$$

Vo_req=Desired (trimmed) output voltage [V]

Vo=1.503V, Vo=1.800V, Vo=2.505V, Vo=3.308V, Vo=5.002V, Vo=12.007V

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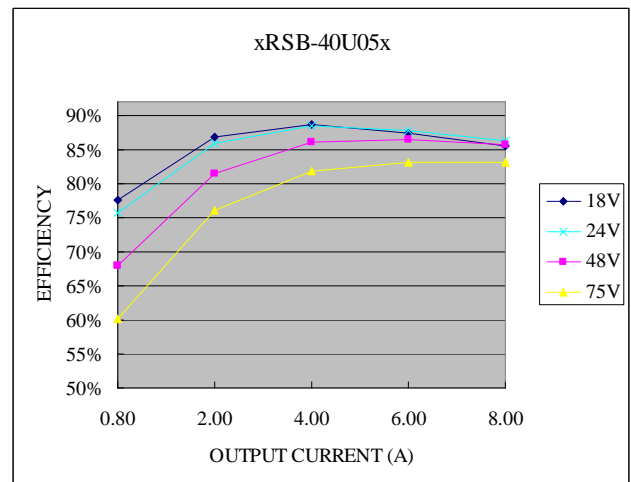
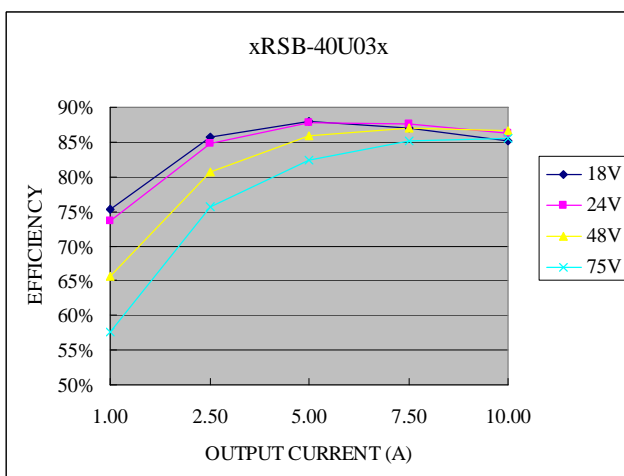
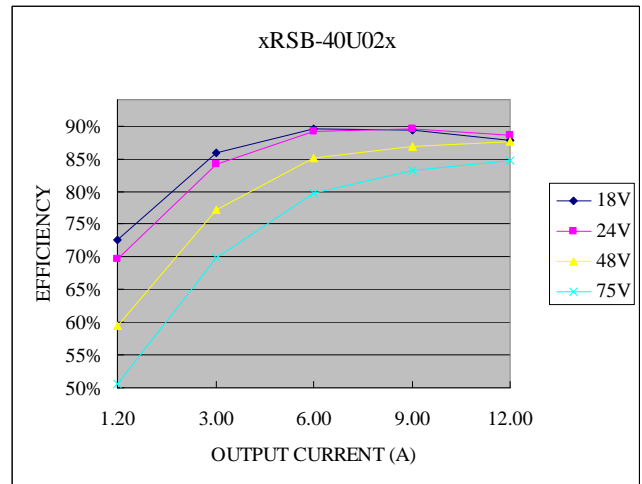
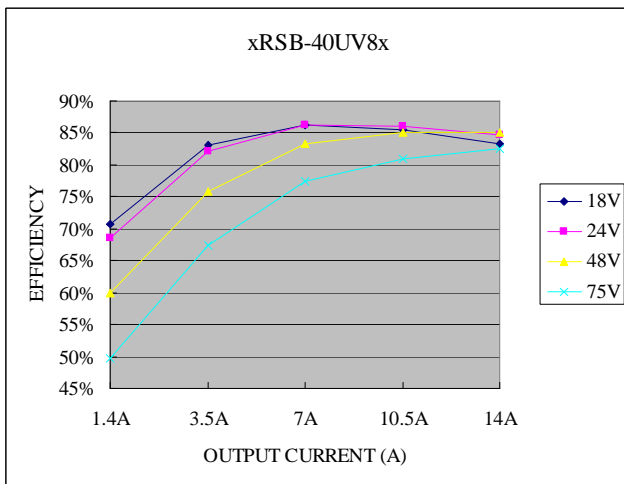
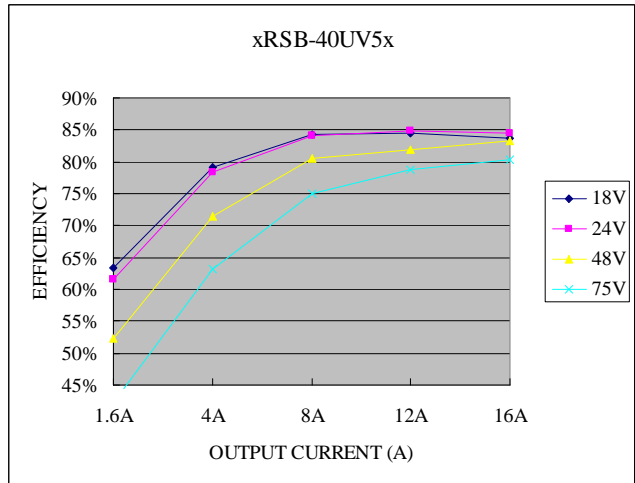
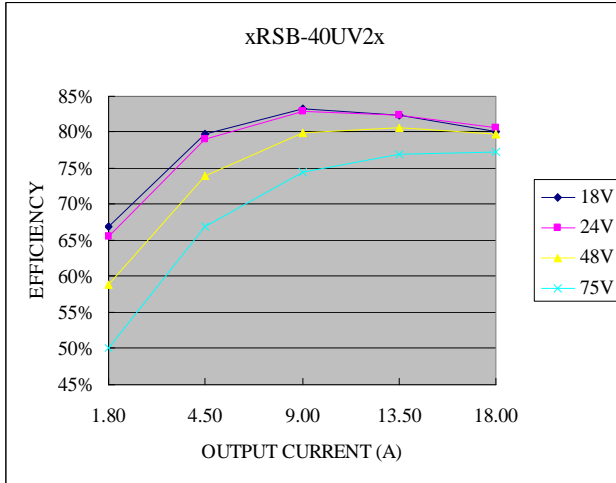
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Efficiency Data



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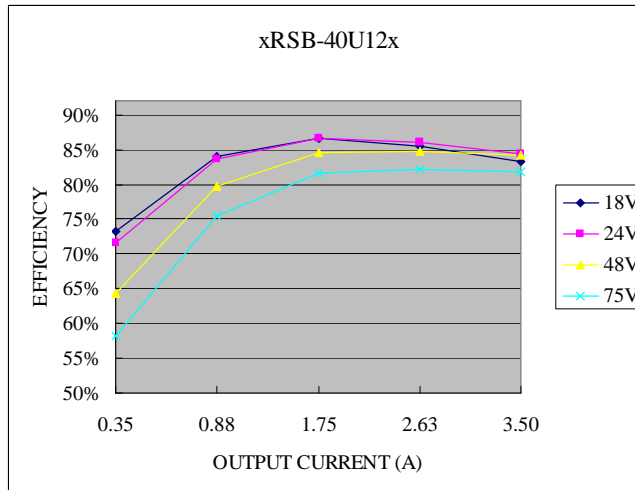
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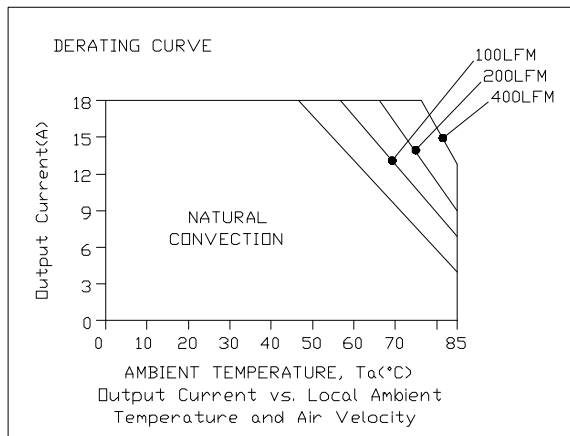
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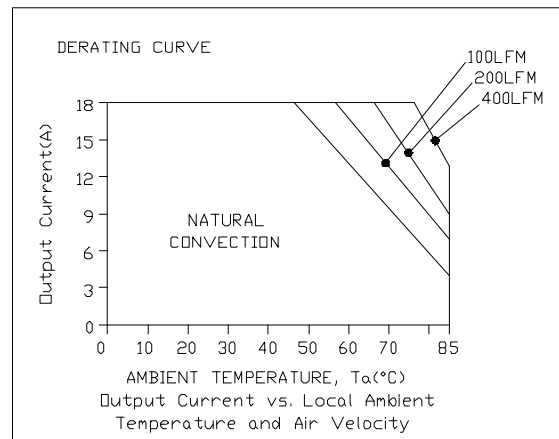
Efficiency Data (continued)



Thermal Derating Curves



xRSB-40UV2x, Vin=48V



xRSB-40UV2x, Vin=24V

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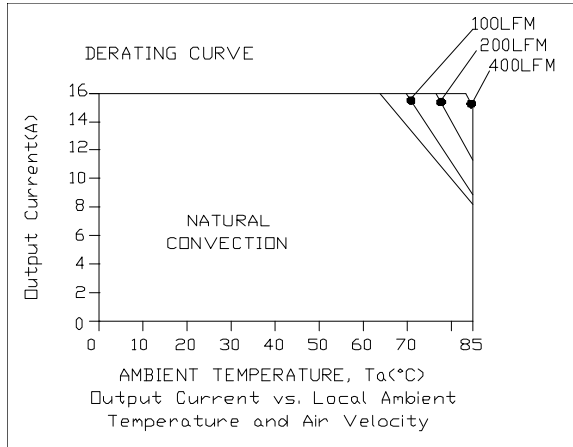
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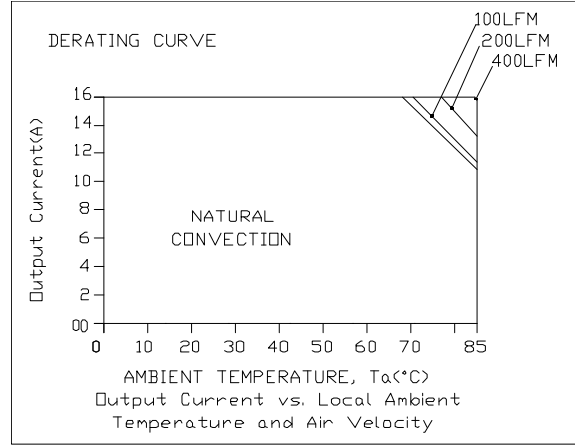
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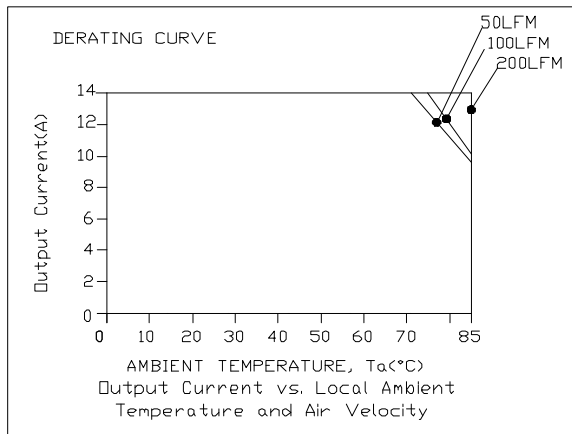
Thermal Derating Curves (continued)



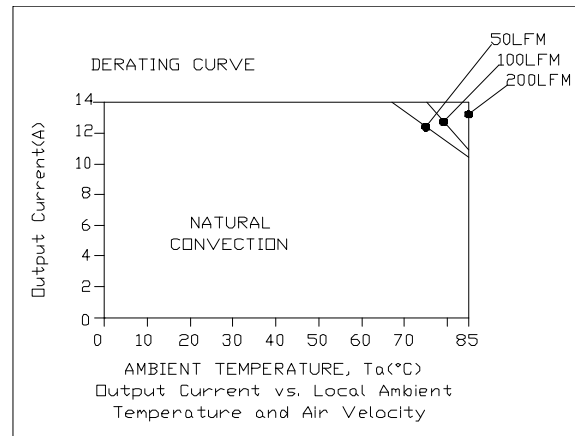
xRSB-40UV5x, Vin=48V



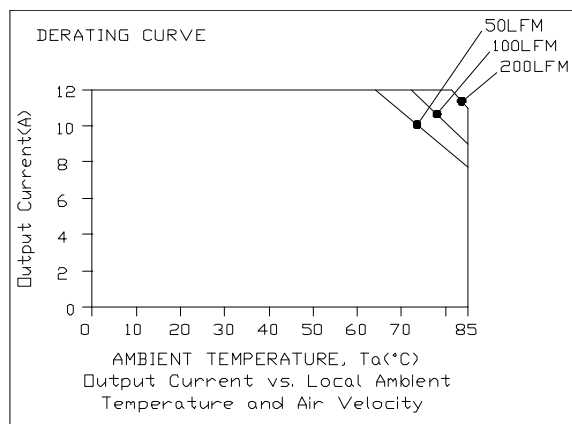
xRSB-40UV5x, Vin=24V



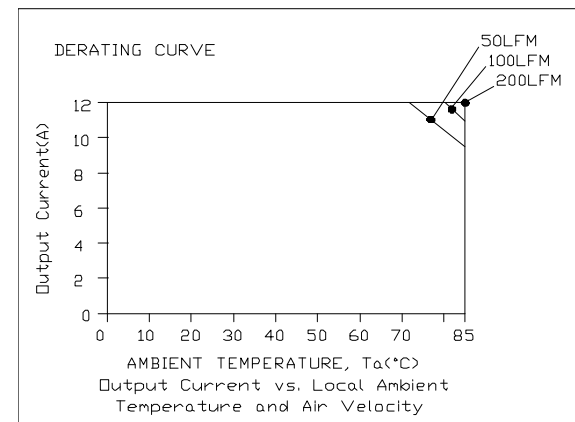
xRSB-40UV8x, Vin=48V



xRSB-40UV8x, Vin=24V



xRSB-40U02x, Vin=48V



xRSB-40U02x, Vin=24V

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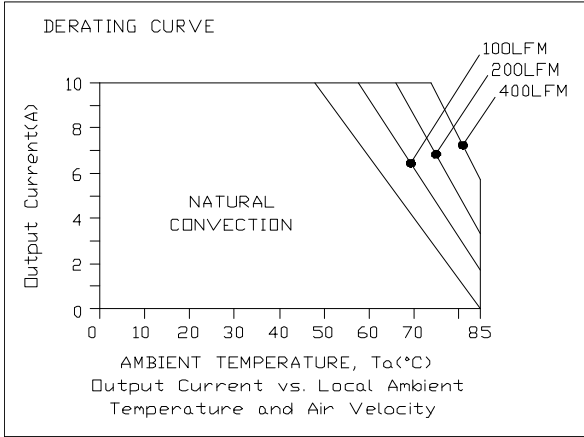
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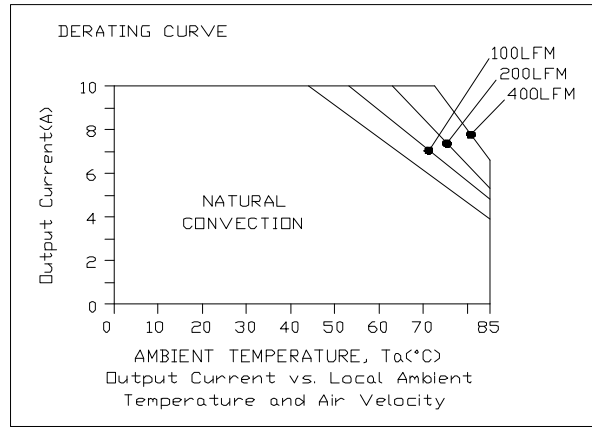
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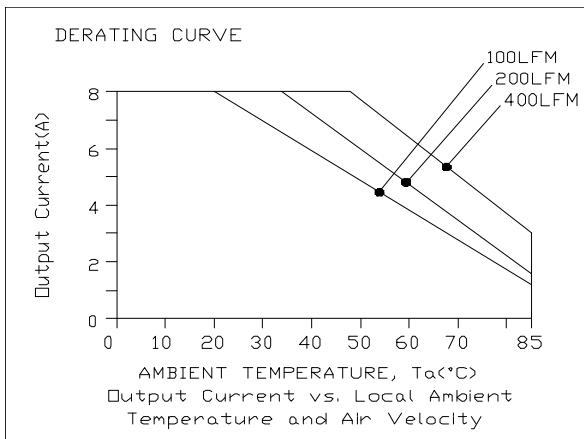
Thermal Derating Curves (continued)



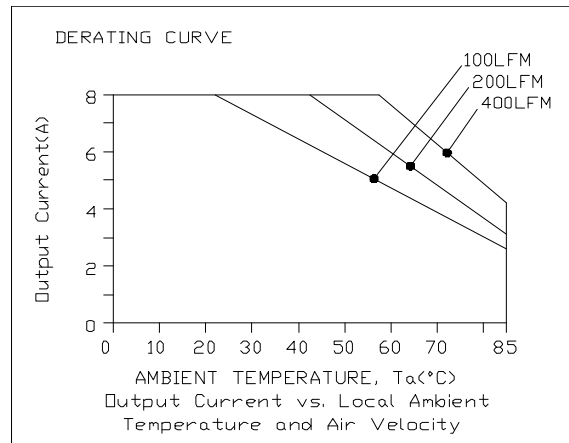
xRSB-40U03x, Vin=48V



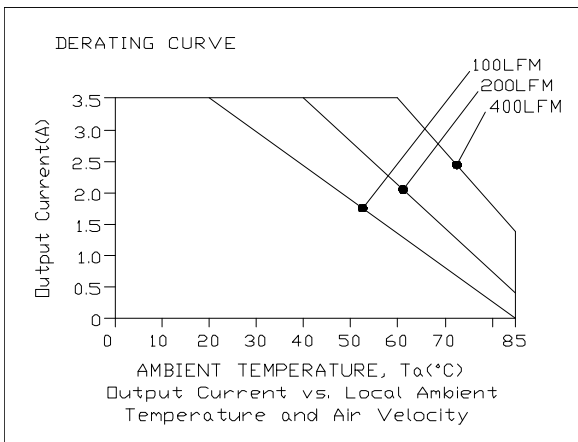
xRSB-40U03x, Vin=24V



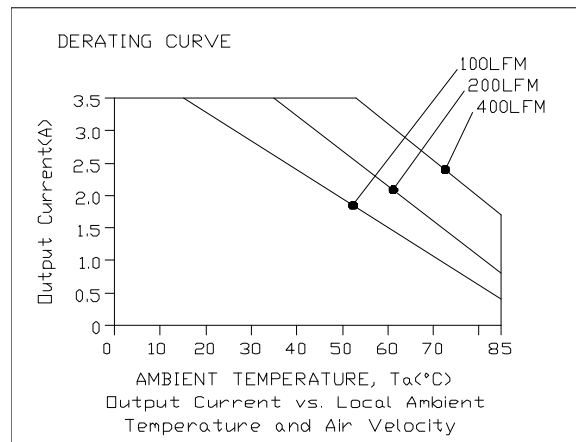
xRSB-40U05x, Vin=48V



xRSB-40U05x, Vin=24V



xRSB-40U12x, Vin=48V



xRSB-40U12x, Vin=24V

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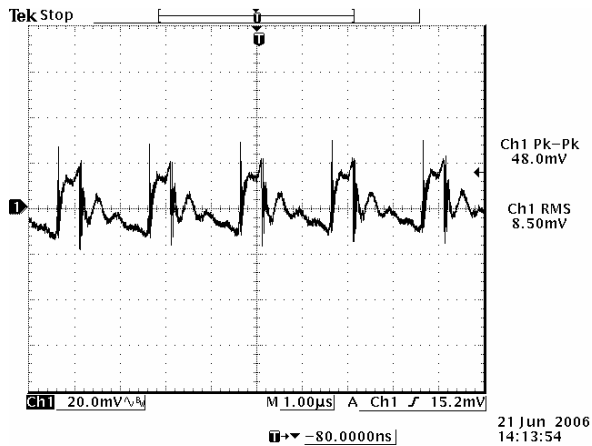
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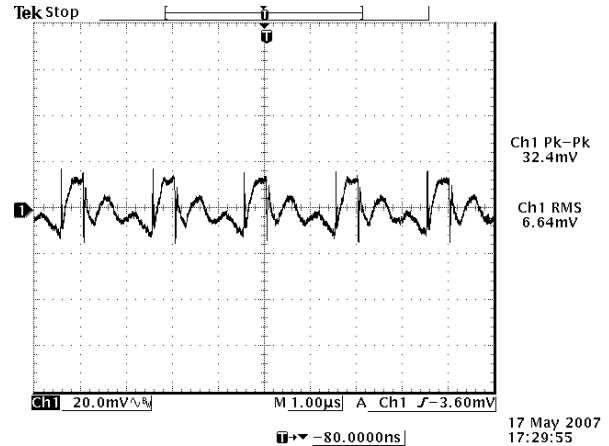
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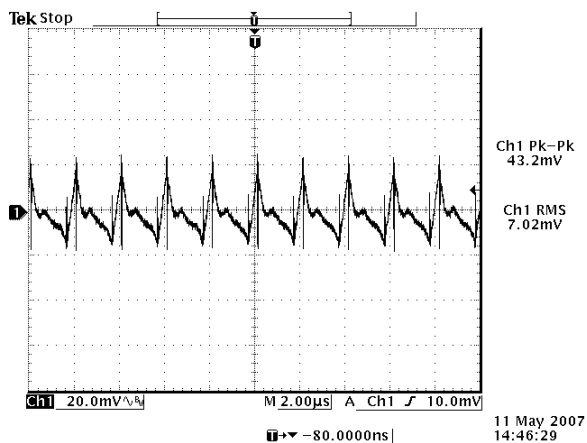
Ripple and Noise Waveforms



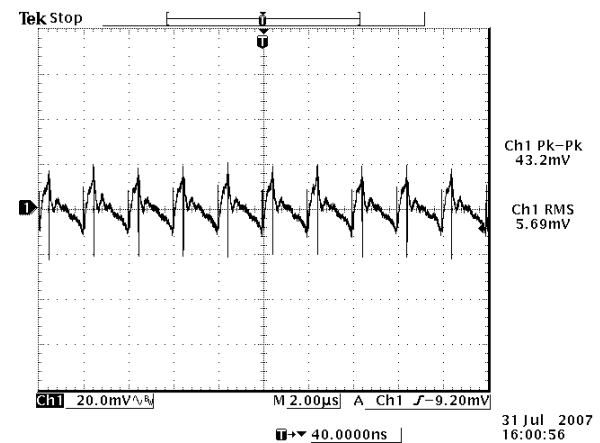
48 Vdc input, 1.2 Vdc output



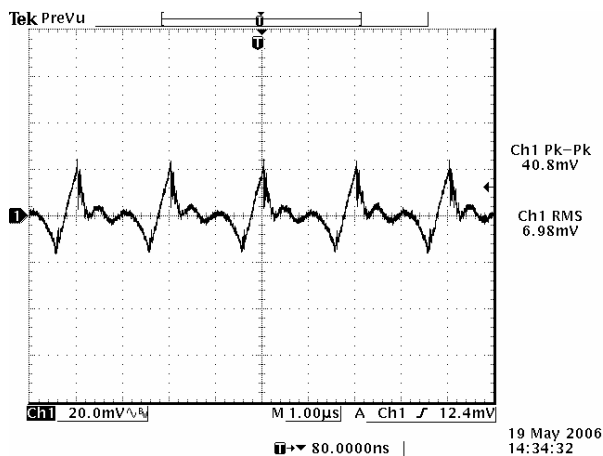
48 Vdc input, 1.5 Vdc output



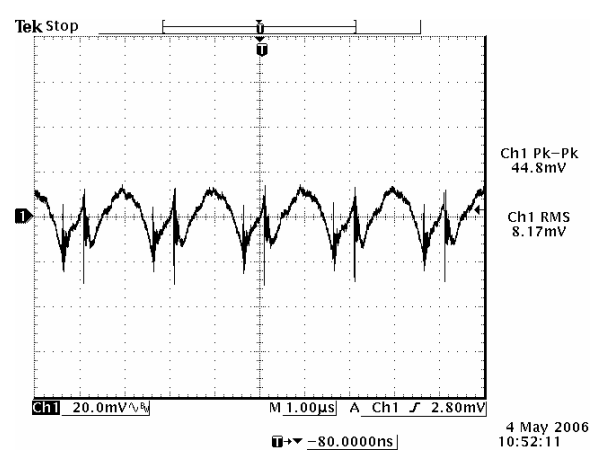
48 Vdc input, 1.8 Vdc output



48 Vdc input, 2.5 Vdc output



48 Vdc input, 3.3 Vdc output



48 Vdc input, 5.0 Vdc output

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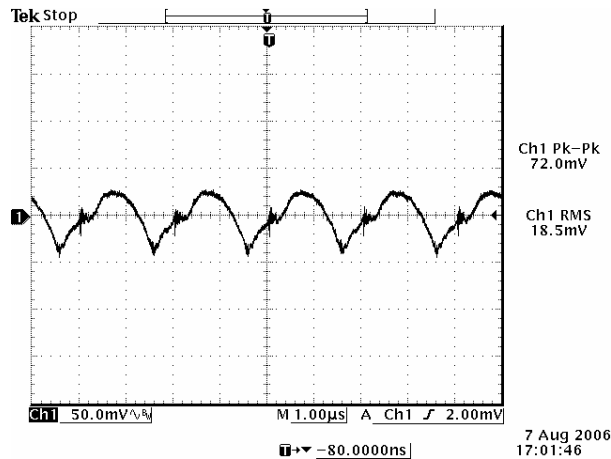
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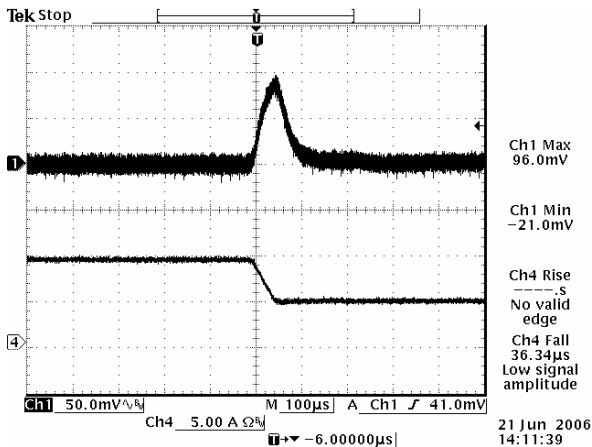
Ripple and Noise Waveforms (continued)



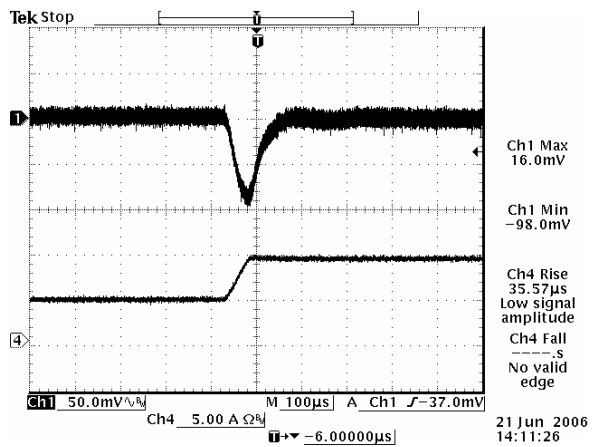
48 Vdc input, 12 Vdc output

Note: Ripple and noise at full load, with external a 1 μ F ceramic cap and a 470 μ F Tantalum cap for 1.2-1.8V output, with external a 1 μ F ceramic cap and a 10 μ F Tantalum cap for 2.5V and 12V output, with external a 1 μ F ceramic cap and a 220 μ F Tantalum cap for 3.3V output, with external a 1 μ F ceramic cap and a 100 μ F Tantalum cap for 5V output, $T_a=25$ deg C.

Transient Response Waveforms



Vout=1.2 V 50% to 25% Load Transients



Vout=1.2 V 25% to 50% Load Transients

ISOLATED DC/DC CONVERTERS

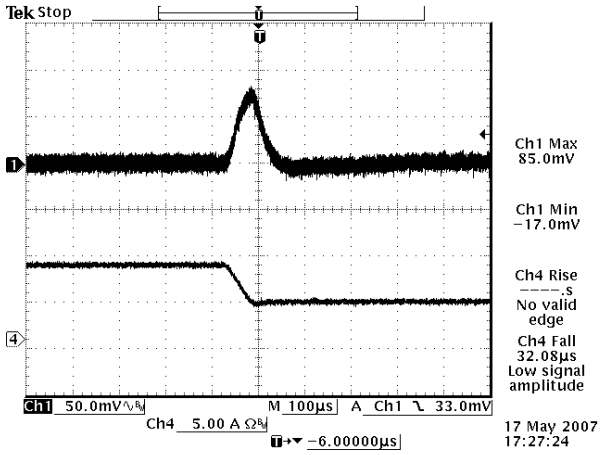
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



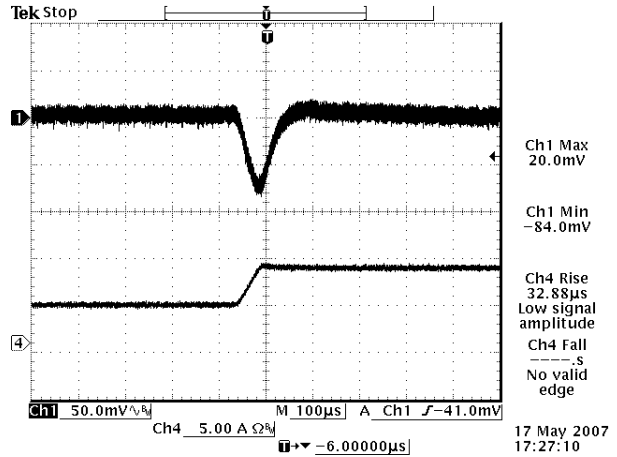
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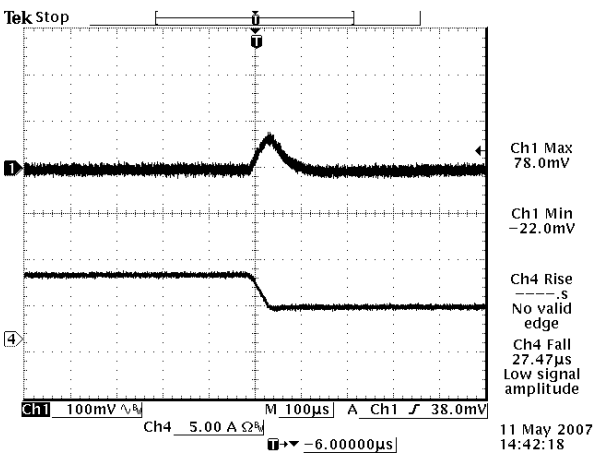
Transient Response Waveforms (continued)



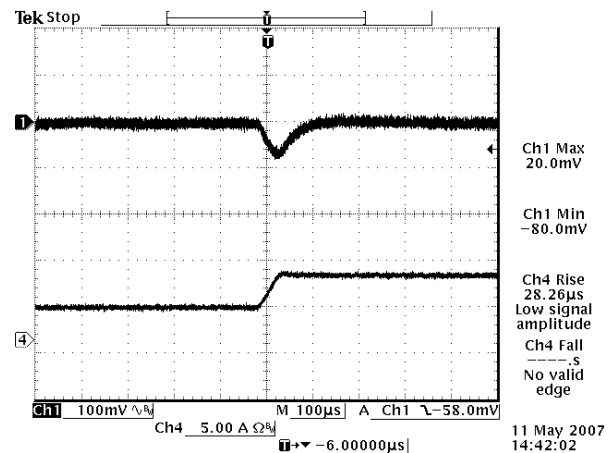
Vout=1.5 V 50% to 25% Load Transients



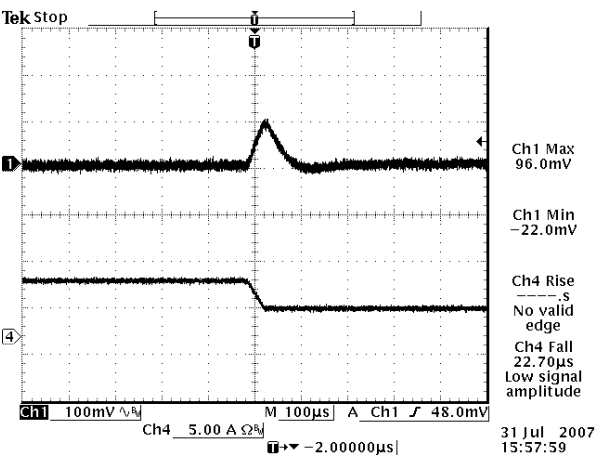
Vout=1.5 V 25% to 50% Load Transients



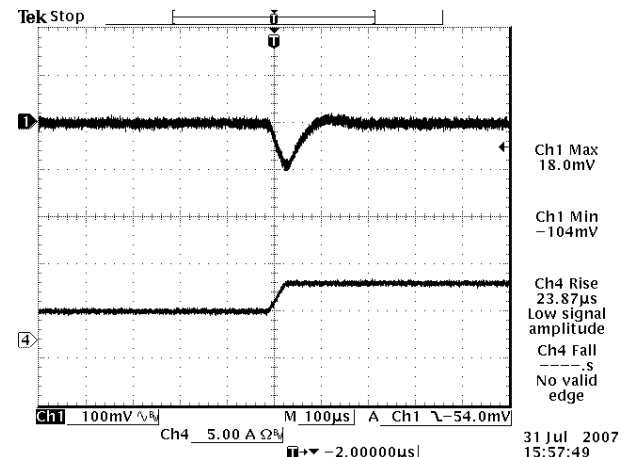
Vout=1.8 V 50% to 25% Load Transients



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

ISOLATED DC/DC CONVERTERS

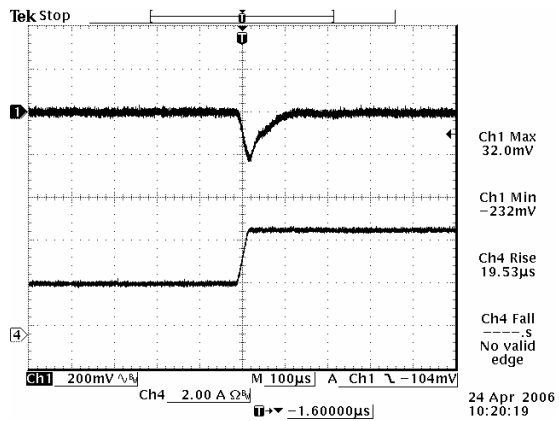
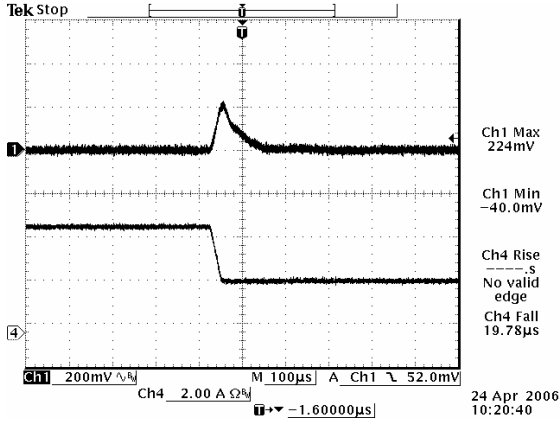
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



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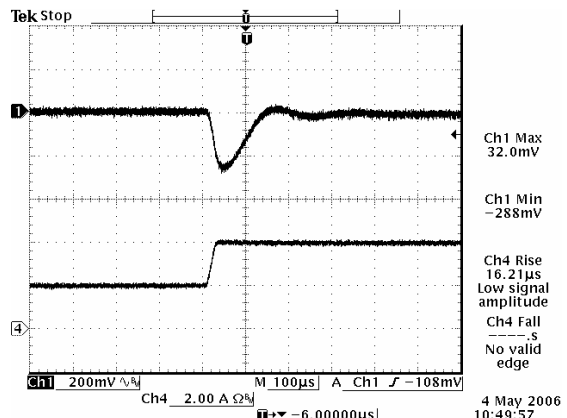
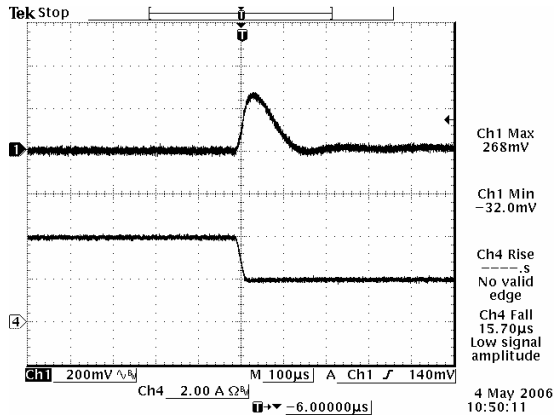
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Transient Response Waveforms (continued)



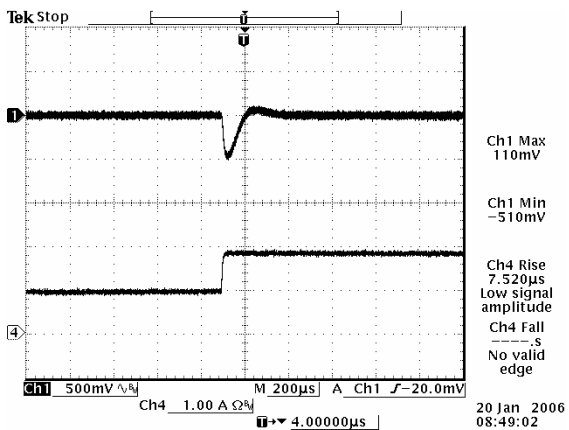
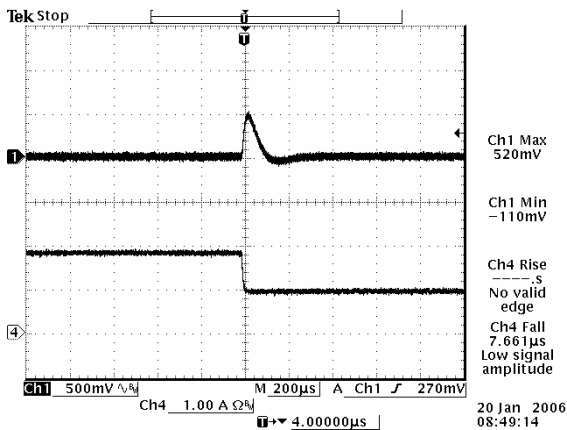
Vout=3.3 V 50% to 25% Load Transients

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 at Vin=48 V, di/dt=0.1 A/uS, with external a 1 uF ceramic cap and a 470 uF Tantalum cap for 1.2-1.8V output, with external a 1 uF ceramic cap and a 10 uF Tantalum cap for 2.5V and 12V output, with external a 1 uF ceramic cap and a 220 uF Tantalum cap for 3.3V output, with external a 1 uF ceramic cap and a 100 uF Tantalum cap for 5V 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

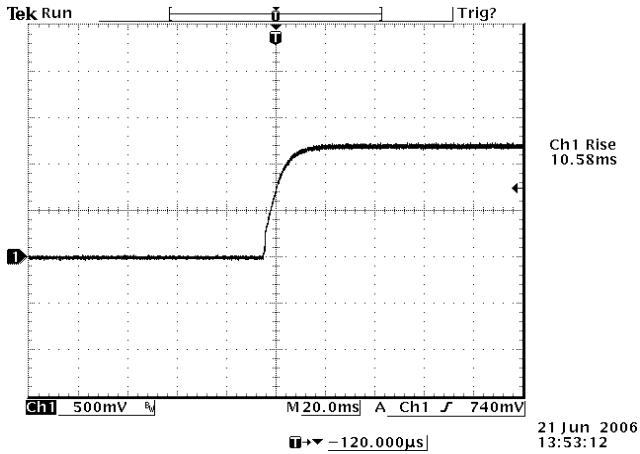


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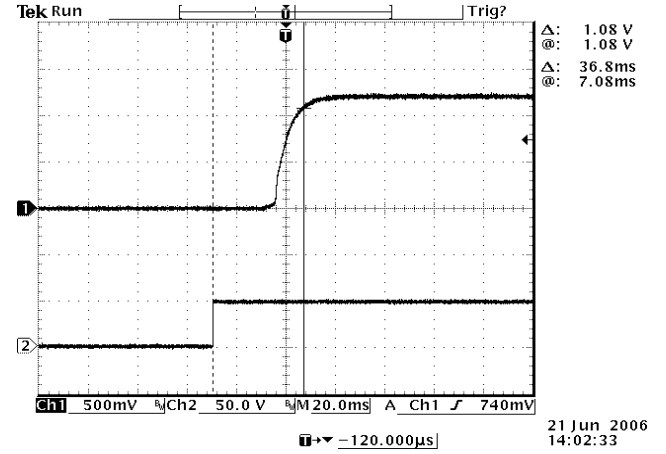
Startup

Rise Time



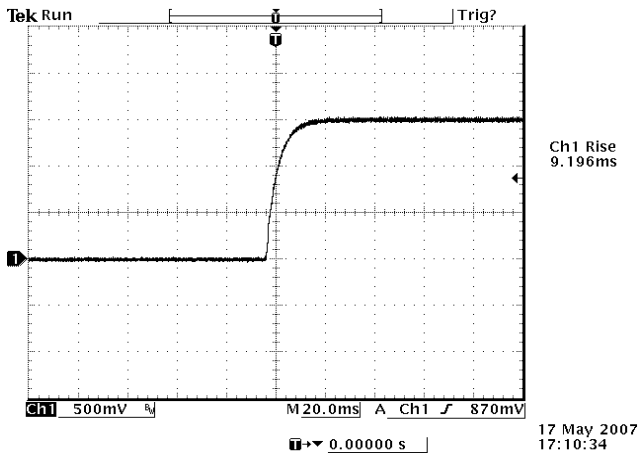
Vout=1.2V 100% Load at Vin=48V

Startup time



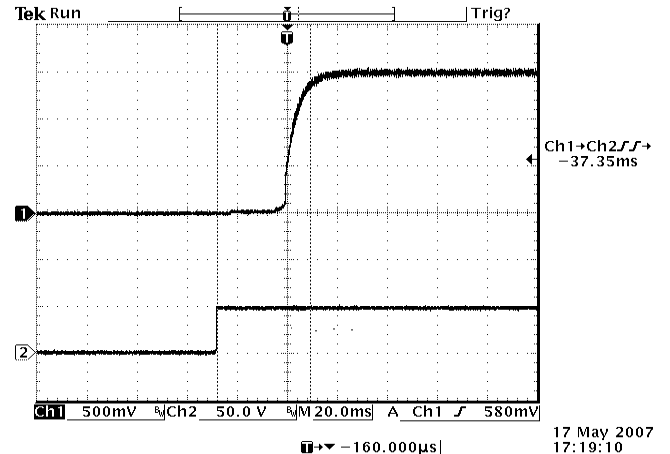
CH1: Vout
CH2: Vin
Vout=1.2V 100% Load at Vin=48V

Rise Time



Vout=1.5V 100% Load at Vin=48V

Startup time



CH1: Vout
CH2: Vin
Vout=1.5V 100% Load at Vin=48V

ISOLATED DC/DC CONVERTERS

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

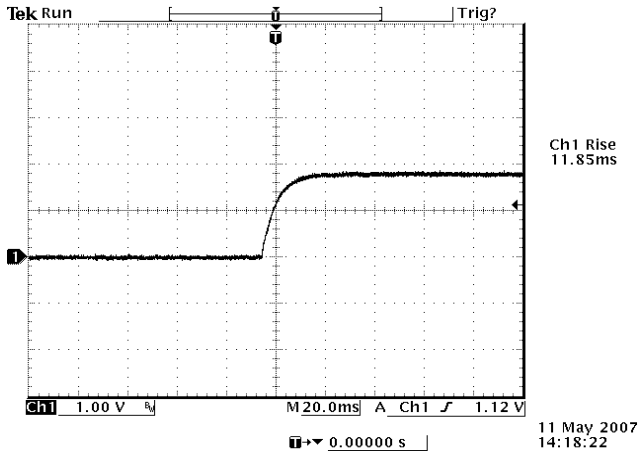


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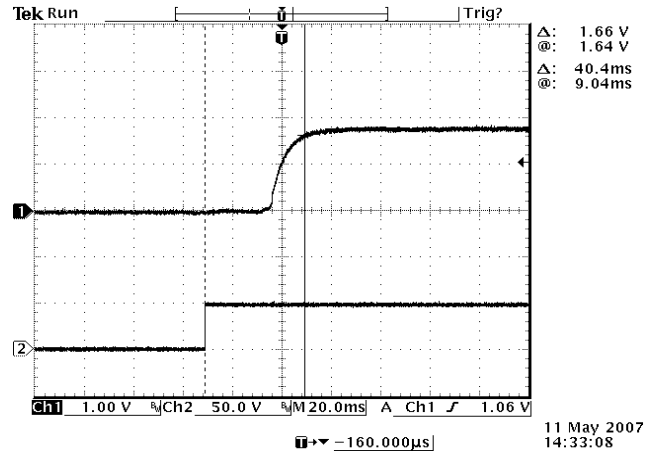
Startup (continued)

Rise Time



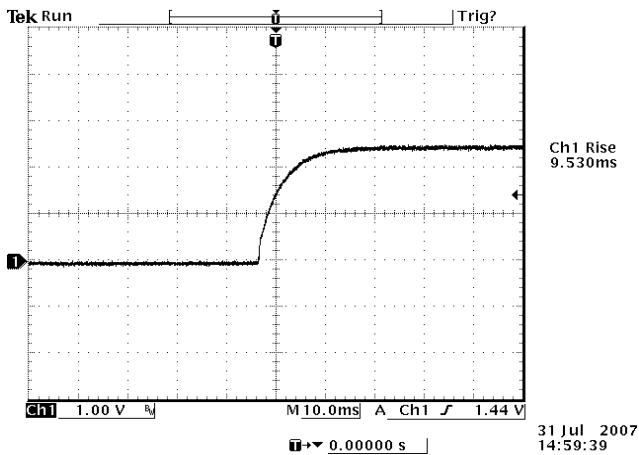
Vout=1.8V 100% Load at Vin=48V

Startup time



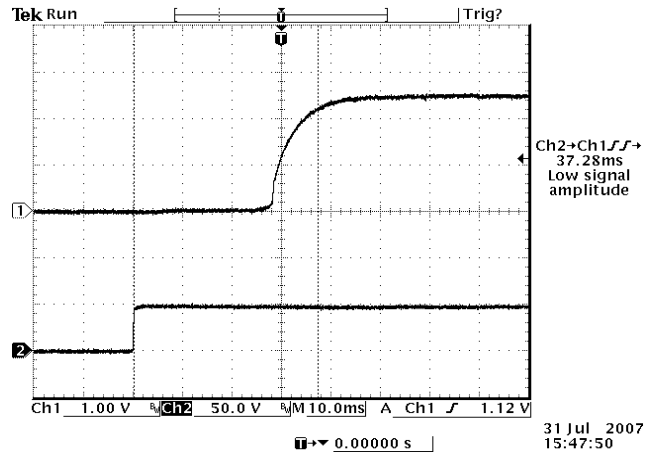
CH1: Vout
CH2: Vin
Vout=1.8V 100% Load at Vin=48V

Rise Time



Vout=2.5V 100% Load at Vin=48V

Startup time



CH1: Vout
CH2: Vin
Vout=2.5V 100% Load at Vin=48V

ISOLATED DC/DC CONVERTERS

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

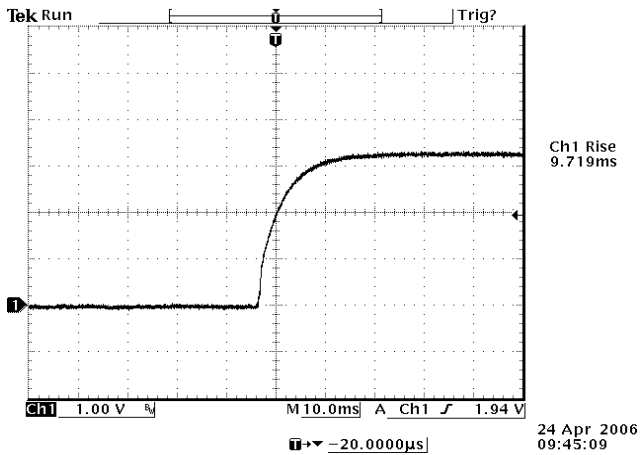


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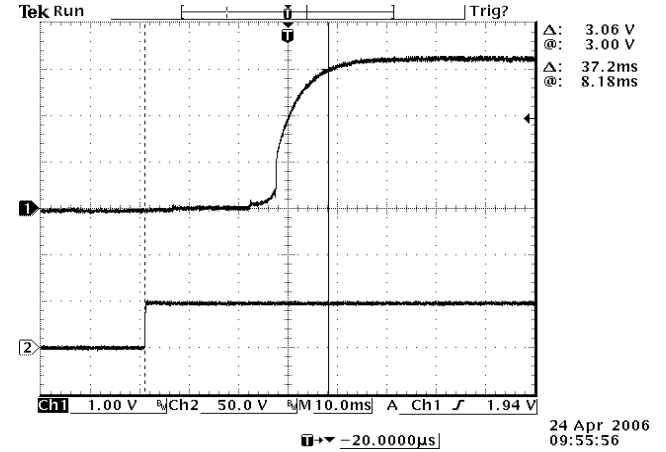
Startup (continued)

Rise Time



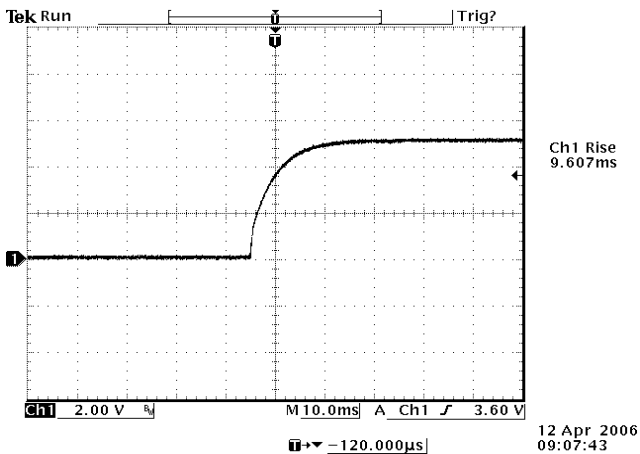
Vout=3.3V 100% Load at Vin=48V

Startup time



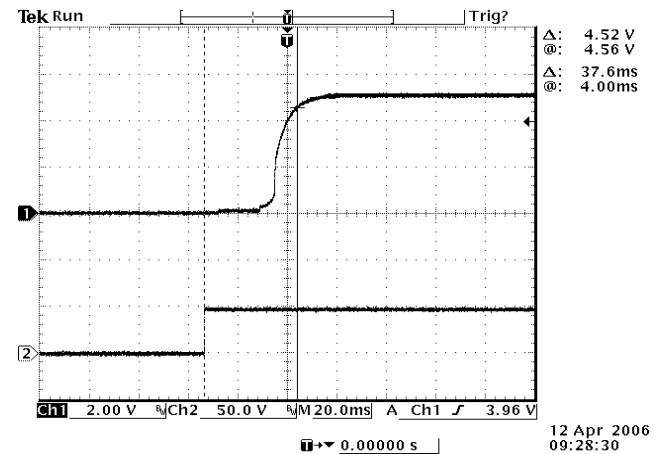
CH1: Vout
CH2: Vin
Vout=3.3V 100% Load at Vin=48V

Rise Time



Vout=5V 100% Load at Vin=48V

Startup time



CH1: Vout
CH2: Vin
Vout=5V 100% Load at Vin=48V

ISOLATED DC/DC CONVERTERS

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

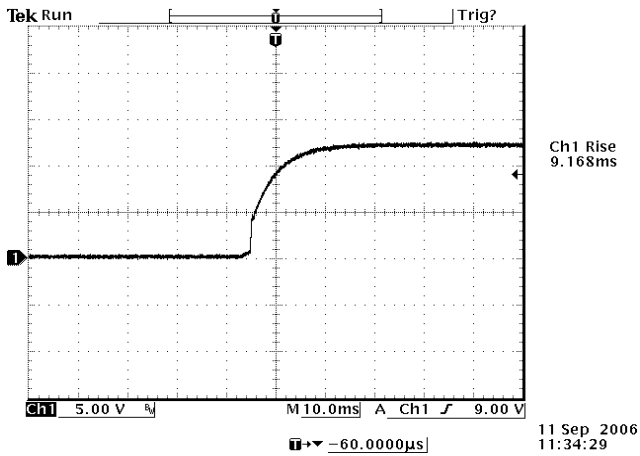


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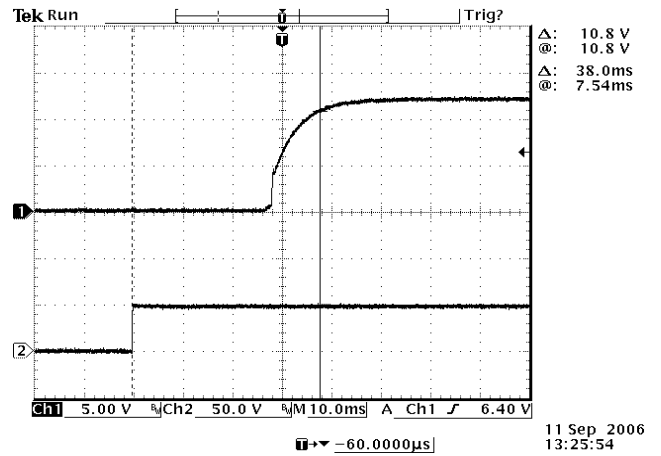
Startup (continued)

Rise Time



Vout=12V 100% Load at Vin=48V

Startup time



CH1: Vout
CH2: Vin
Vout=12V 100% Load at Vin=48V

Note: Start up waveform, External 220uF Tantalum Cap and 1uF Ceramic Cap, Ta=25 deg C.

ISOLATED DC/DC CONVERTERS

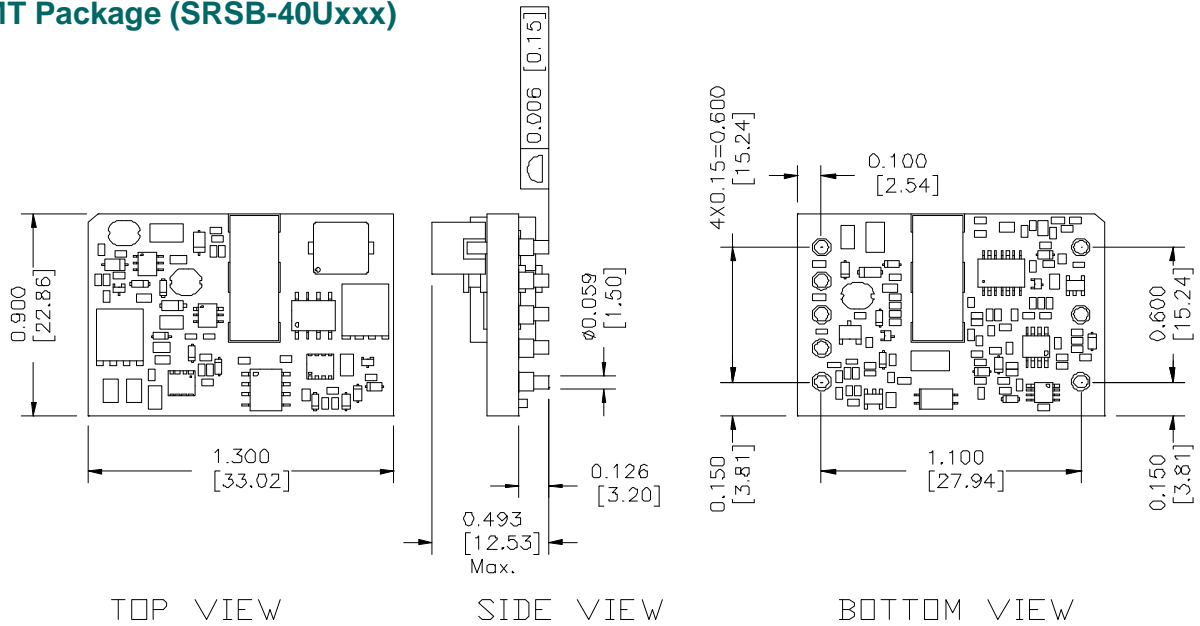
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



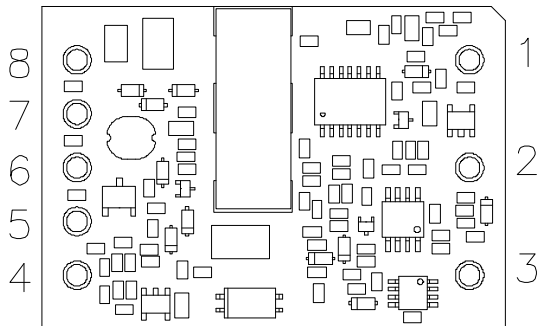
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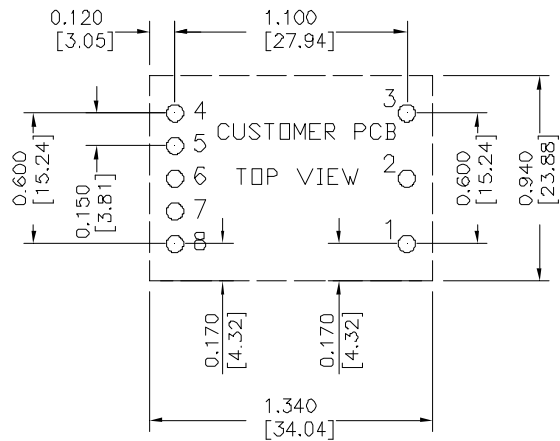
SMT Package (SRSB-40Uxxx)



UNIT: INCH [mm]



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

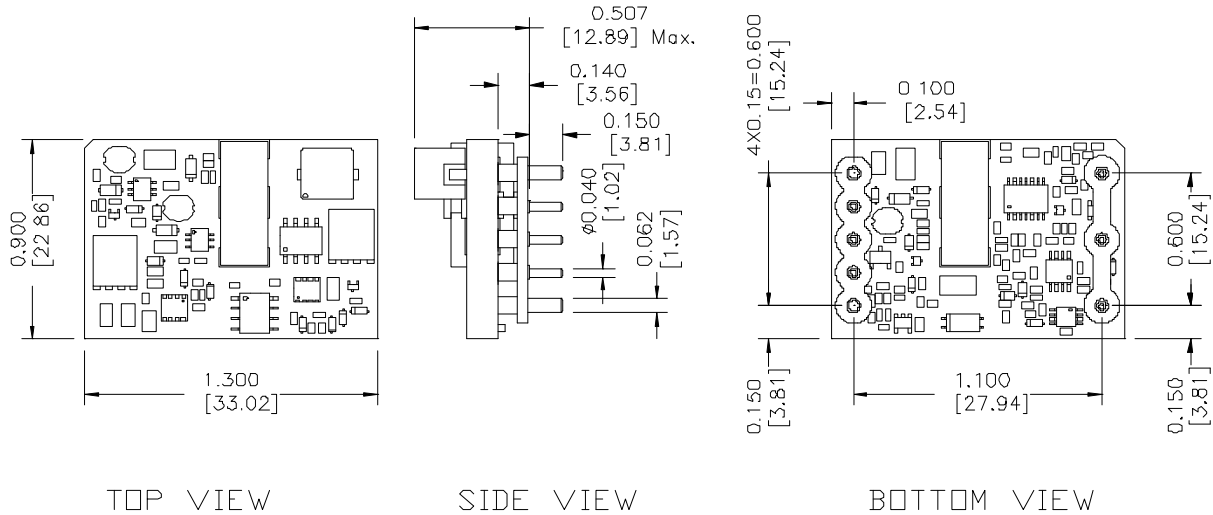
24 Vdc/48 Vdc Input 1.2 Vdc - 12 Vdc / 18 A - 3.5 A Outputs, 1/16 Brick



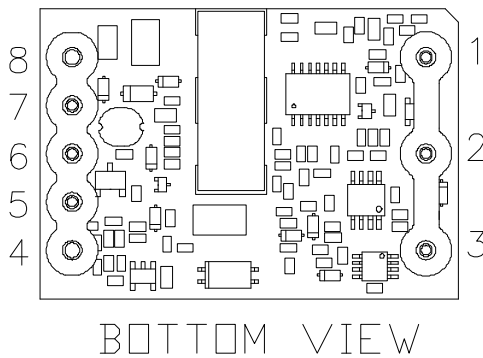
Apr. 07, 2011

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

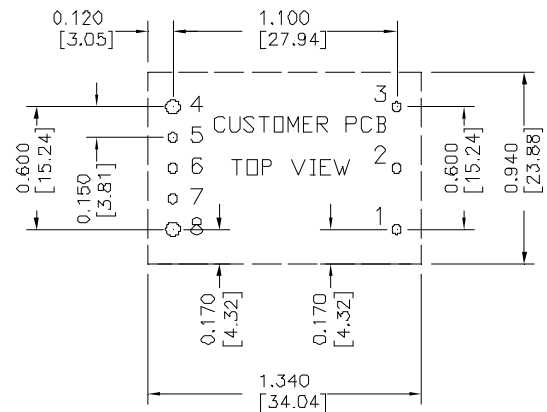
Through Hole Package (0RSB-40Uxxx)



UNIT: INCH [mm]



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 (+)

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).

ISOLATED DC/DC CONVERTERS

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



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Revision History

Date	Revision	Changes Detail	Approval
2011-04-07	C	<ol style="list-style-type: none">1. Add input transient voltage in absolute maximum ratings.2. Add input over voltage lockout in input specifications.3. Add startup waveform.	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.



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