NON-ISOLATED DC/DC CONVERTERS

5 Vdc - 24 Vdc Input 0.9 Vdc - 3.3 Vdc/3 A Output

xRAH-03L1A0 RoHS Compliant Rev.A

- Non-Isolated
- High Efficiency
- High Power Density
- Low Cost
- Remote On/Off
- Fixed Frequency
- OCP/SCP
- UL60950-1 Recognized (UL/cUL

Description

The Bel xRAH-03L1A0 modules are a series of non-isolated, step down dc/dc converters that operate from a nominal 12 Vdc source. These converters are available in an output voltage range from 0.9 Vdc to 3.3 Vdc. It is packaged in a compact, overmolded package rated at 3 A. Optional lead forming provides a vertical mount product for minimal footprint or a surface mount option for a very low profile. The output is closely regulated and the efficiency for 3.3 Vdc output is typically 88% at full load. Typical features include remote on/off, over current protection and short circuit protection.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number Surface Mount	Part Number Vertical Mount
0.9 V - 3.3 V	5.0 V - 24 V	3 A	10 W	88%	SRAH-03L1A0	VRAH-03L1A0

Notes: 1. Add “0” suffix at the end of the model number to indicate “Tube Packaging”, and “R” for “Reel Packaging”, and “G” for “Tray Packaging”.
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	-	25 V	
Output Enable Terminal Voltage	-0.3 V	-	24 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-40 °C	-	125 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage				
Vo=3.3 V	5 V	-	24 V	
Vo=2.5 V	5 V	-	24 V	
Vo=1.8 V	5 V	-	18 V	
Vo=1.5 V	5 V	-	15 V	
Vo=1.2 V	5 V	-	12 V	
Vo=0.9 V	5 V	-	9 V	
Input Current (no load)	-	-	100 mA	
Input Current (full load)	-	-	3 A	
Remote Off Input Current	-	3 mA	10 mA	
Input Reflected Ripple Current (pk-pk)	-	200 mA	-	With simulated source impedance of 500 nH, 5 Hz to 20 MHz. Use one 100 uF/ 35 V Tantalum capacitor and one 3.3 uF/ 50 V ceramic capacitor at the input
Input Reflected Ripple Current (rms)	-	50 mA	-	
I^2t Inrush Current Transient	-	0.05 A^2s	0.1 A^2s	
Turn on Voltage Threshold	-	4.0 V	-	
Turn off Voltage Threshold	3.5 V	-	4.9 V	

Output Specifications

Parameter			Min	Typ	Max	Notes
Output Voltage Set Point						
	Vo=3.3 V		3.200 V	3.3 V	3.400 V	Test conditions: Io=50% full load.
	Vo=2.5 V		2.425 V	2.5 V	2.575 V	
	Vo=1.8 V		1.746 V	1.8 V	1.854 V	
	Vo=1.5 V		1.470 V	1.5V	1.530 V	
	Vo=1.2 V		1.176 V	1.2 V	1.224 V	
	Vo=0.9 V		0.882 V	0.9 V	0.918 V	
Line Regulation						
	Vo=3.3 V		-	±10 mV	±20 mV	
	Vo=2.5 V		-	±10 mV	±15 mV	
	Vo=1.8 V		-	±5 mV	±10 mV	
	Vo=1.5 V		-	±5 mV	±10 mV	
	Vo=1.2 V		-	±5 mV	±10 mV	
	Vo=0.9 V		-	±3 mV	±7.5 mV	
Load Regulation						
	Vo=3.3 V		-	±25 mV	±45 mV	
	Vo=2.5 V		-	±15 mV	±35 mV	
	Vo=1.8 V		-	±10 mV	±25 mV	
	Vo=1.5 V		-	±10 mV	±20 mV	
	Vo=1.2 V		-	±8 mV	±15 mV	
	Vo=0.9 V		-	±5 mV	±13 mV	
Regulation Over Temperature (-40 °C to +85 °C)						
	Vo=3.3 V		-	±30 mV	±60 mV	
	Vo=2.5 V		-	±25 mV	±45 mV	
	Vo=1.8 V		-	±20 mV	±33 mV	
	Vo=1.5 V		-	±15 mV	±27 mV	
	Vo=1.2 V		-	±10 mV	±22 mV	
	Vo=0.9 V		-	±8 mV	±16 mV	
Output Current Range			0 A	-	3 A	
Output DC Current Limit			4 A	-	8 A	
Short Circuit Surge Transient			-	0.8 A^2s	1.5 A^2s	
Ripple and Noise (rms)			-	30 mV	50 mV	Test conditions: 0-20 MHz BW, with 1 uF /16 V ceramic capacitor at the output.
Ripple and Noise (pk-pk)						
	Vo=3.3 V		-	70 mV	130 mV	
	Vo=2.5 V		-	70 mV	100 mV	
	Vo=1.8 V		-	60 mV	100 mV	
	Vo=1.5 V		-	60 mV	100 mV	
	Vo=1.2 V		-	50 mV	100 mV	
	Vo=0.9 V		-	50 mV	100 mV	
Turn on Time			-	7 mS	10 mS	
Overshoot at Turn on			-	0%	3%	
Output Capacitance			0 uF	-	1200 uF	
Transient Response						
50% ~ 100% Max Load	Overshoot	3.3 V	-	150 mV	200 mV	Test conditions: di/dt = 0.5 A/us, with 220 uF external capacitor at the output.
	Settling Time		-	50 uS	100 uS	
100% ~ 50% Max Load	Overshoot		-	150 mV	200 mV	
	Settling Time		-	50 uS	100 uS	
50% ~ 100% Max Load	Overshoot	0.9 V-2.5 V	-	100 mV	150 mV	
	Settling Time		-	50 uS	100 uS	
100% ~ 50% Max Load	Overshoot		-	100 mV	150 mV	
	Settling Time		-	50 uS	100 uS	

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
Vo=3.3 V	85%	88%	-	Vin=12.0V; Io=Io, max
Vo=2.5 V	82%	85%	-	
Vo=1.8 V	79%	82%	-	
Vo=1.5 V	77%	80%	-	
Vo=1.2 V	74%	77%	-	
Vo=0.9 V	72%	75%	-	
Switching Frequency	250 kHz	300 kHz	360 kHz	
MTBF	9,900,543 hours			Calculated Per Bell Core SR-332 (Vin=12 V; Vo=3.3 V; Io =2.4 A; Ta = 25 °C)
Dimensions (surface mount)				
Inches (L × W × H)	0.78 x 0.7 x 0.32			
Millimeters (L × W × H)	19.81 x 17.78 x 8.13			
Dimensions (vertical)				
Inches (L × W × H)	0.7 x 0.308 x 0.65			
Millimeters (L × W × H)	17.78 x 7.82 x 16.51			
Weight	-	4.9 g	-	

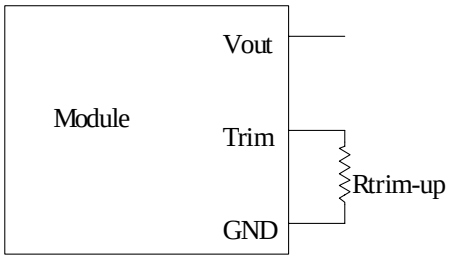
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.3 V	-	1 V	Remote on/off pin open, Unit On
Signal High (Unit On)	2.8 V	-	24 V	

Output Trim Equations

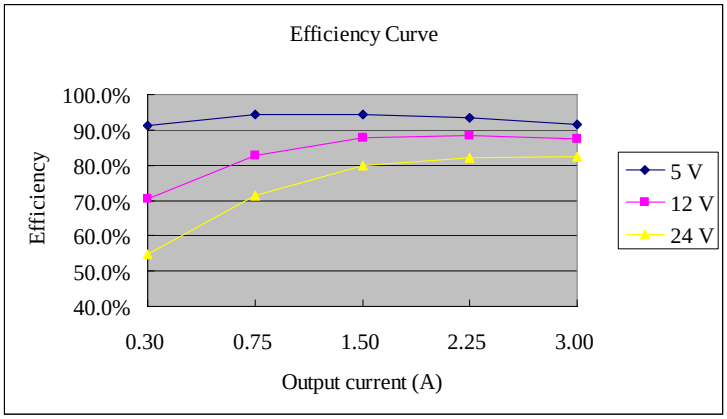
Equations for calculating the trim resistor given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vo) are shown below. The Trim Up resistor should be connected between the Trim pin and Ground. Only one of the resistors should be used for any given application.

$$Rtrim\_up = \left(\frac{6.928}{Vadj\_up - Vo} - 1 \right) Kohm$$

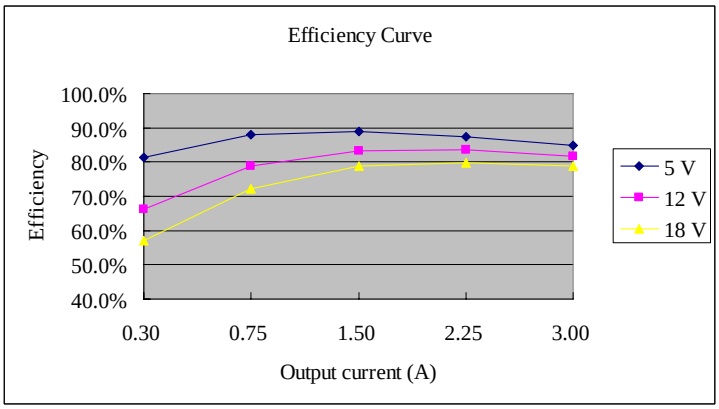


Note: Output voltage Vo=0.902 V when Rtrim_up is not connected.

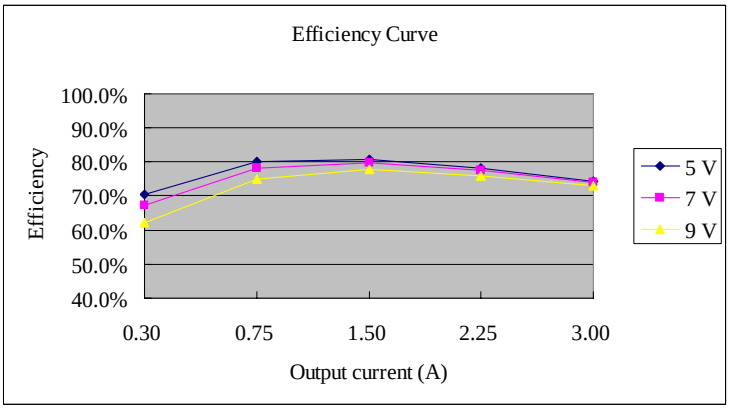
Efficiency Data



Vo=3.3 V

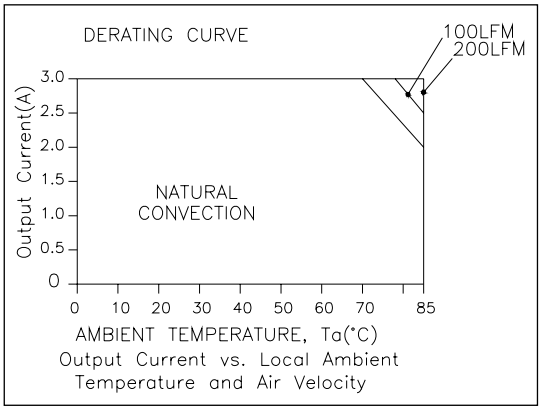


Vo=1.8 V



Vo=0.9 V

Thermal Derating Curve



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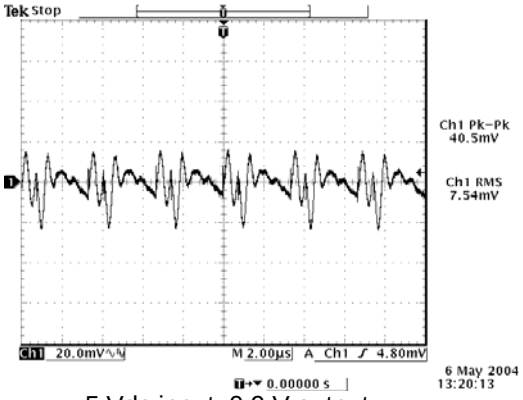
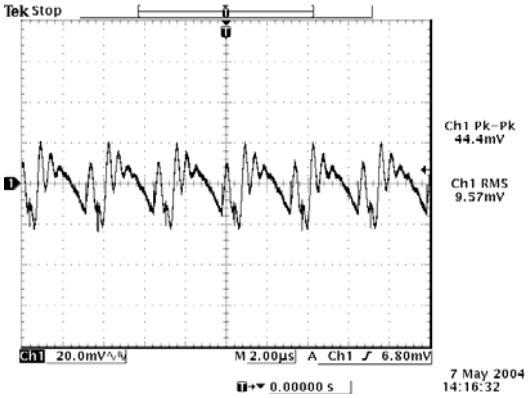
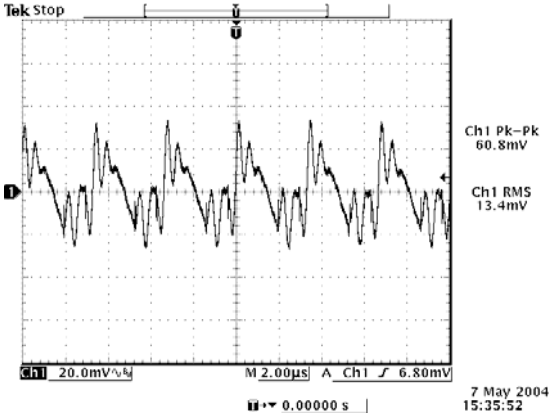
Ripple and Noise Waveforms



5 Vdc input, 0.9 V output



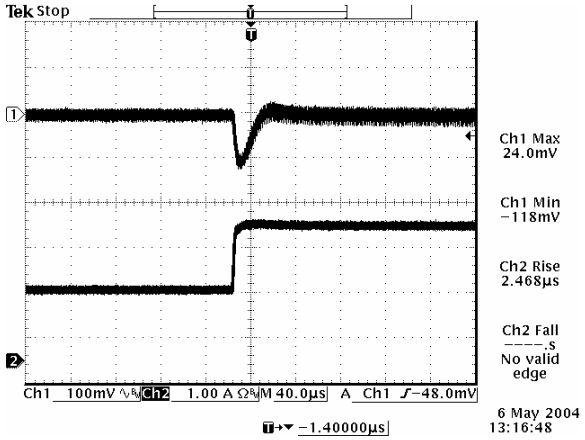
12 Vdc input, 1.8 V output



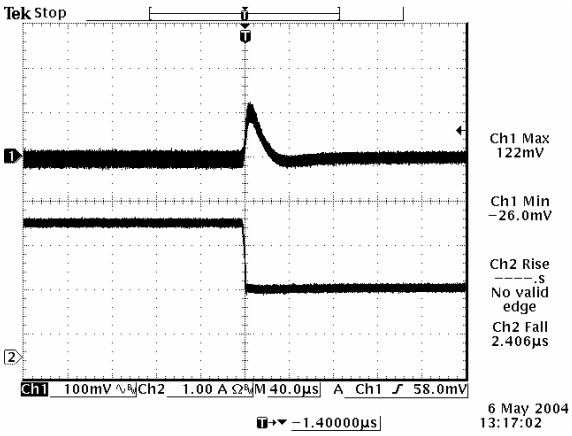
12 Vdc input, 3.3 V output

Note: Ripple and noise at full load, with 1uF/16V ceramic cap at the output, Ta=25 deg C.

Transient Response Waveforms



50% to 100% load 5 V input, 0.9 V output



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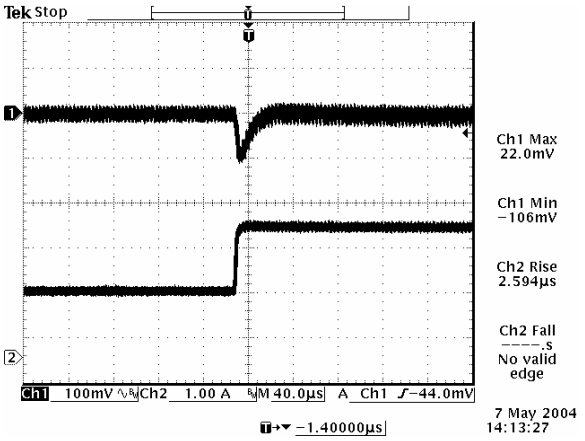
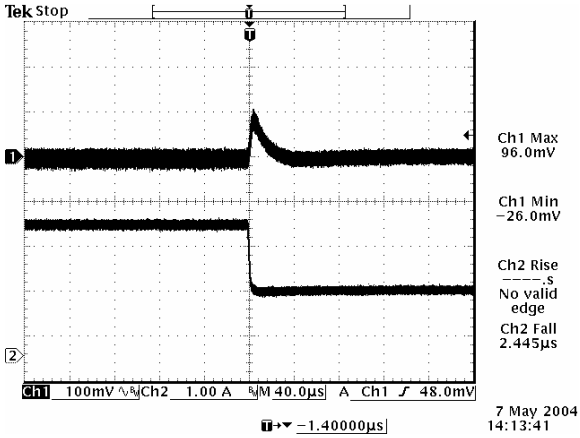


50% to 100% load 12 V input, 1.8 V output



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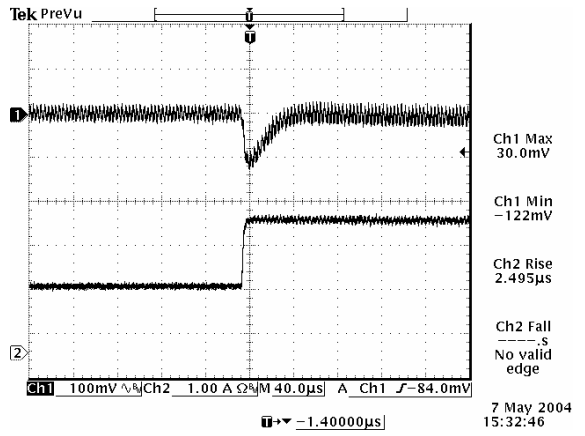
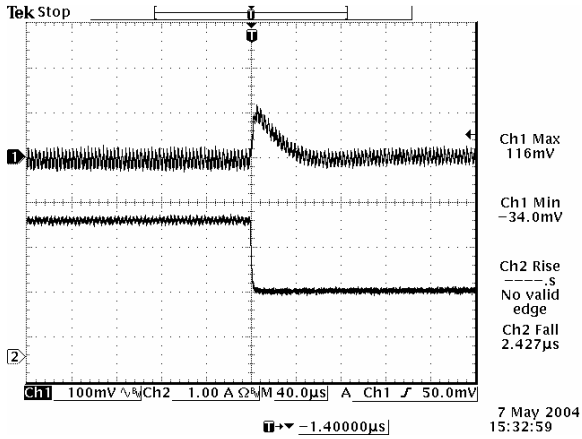


50% to 100% load 12 V input, 3.3 V output



50% to 100% load 12 V input, 3.3 V output

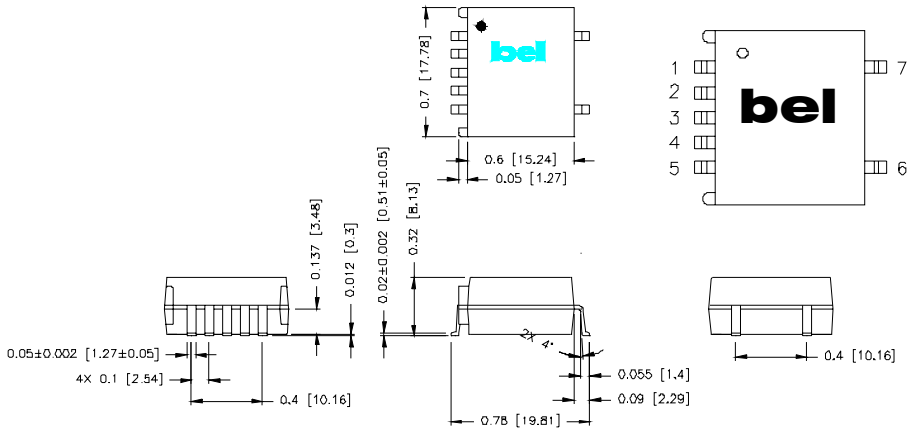
Note: Transient Response at di/dt=0.5 A/uS, with 220 uF/10 V external cap, Ta=25 deg C.

NON-ISOLATED DC/DC CONVERTERS

5 Vdc - 24 Vdc Input 0.9 Vdc - 3.3 Vdc/3 A Output

Mechanical Outline

SRAH-03L1A0



Pin Connections

Pin	Function
1	Remote On/Off (option)
2	Vin
3	Ground
4	Vout
5	Trim (option)
6	N/A
7	N/A

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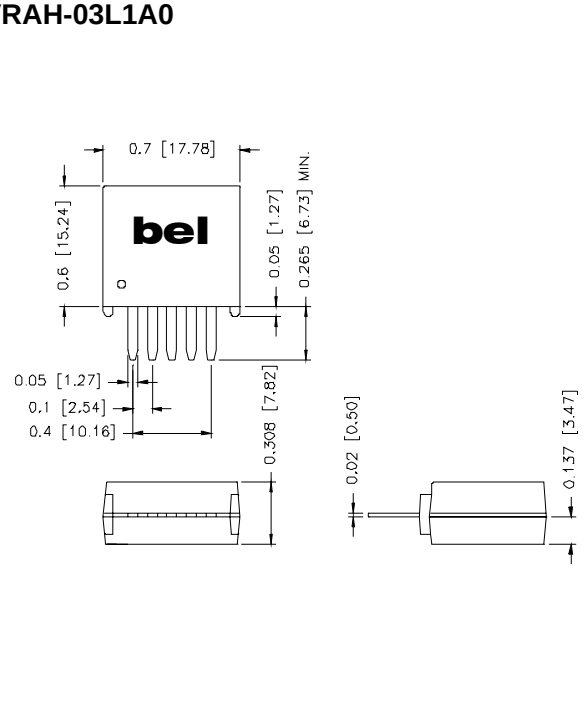

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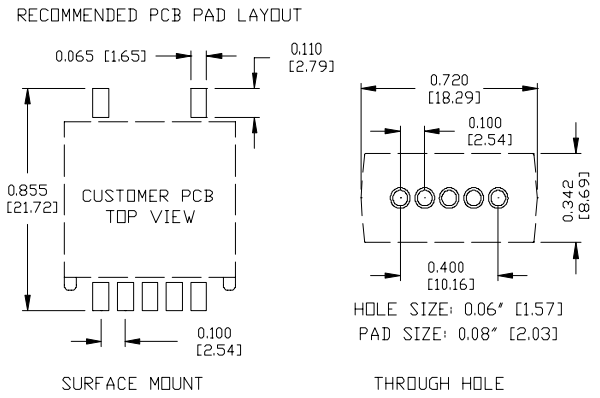

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products. These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 240 ºC.

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