NON-ISOLATED DC/DC CONVERTER

4.5 Vdc - 32 Vdc Input 1.2 Vdc - 3.3 Vdc/1 A Output

xRAH-01H1A0 RoHS Compliant Rev.A

- Non-Isolated
- Trim Function
- Low Profile Package (7.82 mm)
- UL60950-1 Recognized (UL/cUL)
- Remote On/Off
- OCP/SCP
- Under-Voltage Lockout (UVLO)

Description

The Bel xRAH-01H1A0 is part of the low cost non-isolated dc/dc converter series. The modules use a SMD or vertical mount package for ease of layout and space savings. The output is widely trimmed from 1.2 Vdc to 3.3 Vdc. Typical features include remote on/off, input under voltage lockout, 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
1.2 V - 3.3 V	4.5 V - 32 V	1 A	3.3 W	86%	SRAH-01H1A0	VRAH-01H1A0

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	-	34 V	
Output Enable Terminal Voltage	-0.3 V	-	12 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-40 °C	-	125 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	4.5 V	20 V	32 V	
Input Current (no load)	-	5 mA	8 mA	
Input Current (full load) VO=3.3 V VO=2.5 V VO=1.8 V VO=1.5 V VO=1.2 V	 - - - - -	 - - - - -	 0.20 A 0.16 A 0.12 A 0.11 A 0.09 A	
Remote Off Input Current	-	2 mA	5 mA	
Input Reflected Ripple Current (pk-pk)	-	300 mA	420 mA	Tested with simulated source impedance of 500 nH, 5 Hz to 20 MHz and one 100 F/50 V electrolytic capacitor and a 3.3 uF/50 V ceramic capacitor at the input
Input Reflected Ripple Current (RMS)	-	100 mA	160 mA	
I^2t Inrush Current Transient	-	0.02 A^2s	0.1 A^2s	
Turn on Voltage Threshold	-	4.1 V	4.5 V	
Turn off Voltage Threshold	-	3.3 V	4.0 V	

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

Output Specifications

Parameter			Min	Typ	Max	Notes
Output Voltage Set Point						
	Vo=3.3 V		3.234 V	3.3 V	3.366 V	Test conditions: Vin=20 V, Io=50% full load
	Vo=2.5 V		2.450 V	2.5 V	2.550 V	
	Vo=1.8 V		1.764 V	1.8 V	1.836 V	
	Vo=1.5 V		1.470 V	1.5 V	1.530 V	
	Vo=1.2 V		1.176 V	1.2 V	1.224 V	
Line Regulation						
	Vo=3.3 V		-	±3 mV	±6 mV	
	Vo=2.5 V		-	±2 mV	±5 mV	
	Vo=1.8 V		-	±2 mV	±4 mV	
	Vo=1.5 V		-	±1 mV	±3 mV	
	Vo=1.2 V		-	±1 mV	±2 mV	
Load Regulation						
	Vo=3.3 V		-	±3 mV	±6 mV	
	Vo=2.5 V		-	±2 mV	±5 mV	
	Vo=1.8 V		-	±2 mV	±4 mV	
	Vo=1.5 V		-	±1 mV	±3 mV	
	Vo=1.2 V		-	±1 mV	±2 mV	
Regulation Over Temperature (-40 °C to +85 °C)			-	±10 mV	±20 mV	
Output Current			0 A	-	1 A	
Current Limit Threshold			2 A	-	3 A	
Short Circuit Surge Transient			-	0.02 A^2s	0.1 A^2s	
Ripple and Noise (rms)			-	6 mV	10 mV	Test condition: 0-20 MHz BW
Ripple and Noise (pk-pk)			-	60 mV	100 mV	
Turn on Time			-	6 mS	30 mS	
Overshoot at Turn on			-	2%	5%	
Output Capacitance			0 uF	-	400uF	
Transient Response						
50% ~ 100% Max Load	Overshoot	Vo=3.3 V	-	80 mV	120 mV	Test conditions: di/dt = 0.5 A/uS; Vin = 20 V
	Settling Time		-	150 uS	200 uS	
100% ~ 50% Max Load	Overshoot		-	80 mV	120 mV	
	Settling Time		-	150 uS	200 uS	
50% ~ 100% Max Load	Overshoot	Vo=2.5 V	-	70 mV	110 mV	
	Settling Time		-	120 uS	160 uS	
100% ~ 50% Max Load	Overshoot		-	70 mV	110 mV	
	Settling Time		-	120 uS	160 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.8 V	-	60 mV	100 mV	
	Settling Time		-	100 uS	130 uS	
100% ~ 50% Max Load	Overshoot		-	60 mV	100 mV	
	Settling Time		-	100 uS	130 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.5 V	-	60 mV	100 mV	
	Settling Time		-	100 uS	130 uS	
100% ~ 50% Max Load	Overshoot		-	60 mV	100 mV	
	Settling Time		-	100 uS	130 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.2 V	-	60 mV	100 mV	
	Settling Time		-	100 uS	130 uS	
100% ~ 50% Max Load	Overshoot		-	60 mV	100 mV	
	Settling Time		-	100 uS	130 uS	

Note: All specifications are typical at 20 V input, full load at 25 °C unless otherwise stated.

NON-ISOLATED DC/DC CONVERTER

4.5 Vdc - 32 Vdc Input 1.2 Vdc - 3.3 Vdc/1 A Output

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
Vo=3.3 V	83%	86%	-	Measured at Vin=20 V, full load.
Vo=2.5 V	80%	83%	-	
Vo=1.8 V	76%	79%	-	
Vo=1.5 V	73%	76%	-	
Vo=1.2 V	70%	73%	-	
Switching Frequency				
Vo=3.3 V	270 kHz	290 kHz	310 kHz	
Vo=2.5 V	190 kHz	220 kHz	250 kHz	
Vo=1.8 V	150 kHz	170 kHz	190 kHz	
Vo=1.5 V	130 kHz	150 kHz	170 kHz	
Vo=1.2 V	100 kHz	120 kHz	140 kHz	
Output Trim Range	1.2 V	-	3.3 V	Vo=1.2 V when trim pin open.
MTBF	8,040,762 hours			Calculated Per Bell Core SR-332 (I_O =0.8 A, Vin=20 V; T_a = 25 °C)
Dimensions (surface mount)				
Inches (L × W × H)	0.78 x 0.70 x 0.32			
Millimeters (L × W × H)	19.81 x 17.78 x 8.13			
Dimensions (vertical)				
Inches (L × W × H)	0.70 x 0.308 x 0.65			
Millimeters (L × W × H)	17.78 x 7.82 x 16.51			
Weight	-	5.1 g	-	

Note: All specifications are typical at 20V input, full load at 25 °C unless otherwise stated.

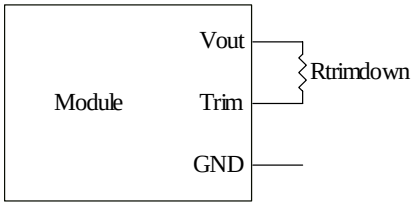
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit On)	-0.3 V	-	1 V	Remote on/off pin open, unit on.
Signal High (Unit Off)	2.8 V	-	12 V	

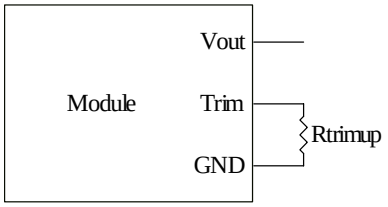
Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vo) are shown below. The Trim Down resistor should be connected between the Trim pin and Vout. 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.

$$R_{TrimDown} = \frac{8.7}{V_o - V_{adj}} - 21.5$$

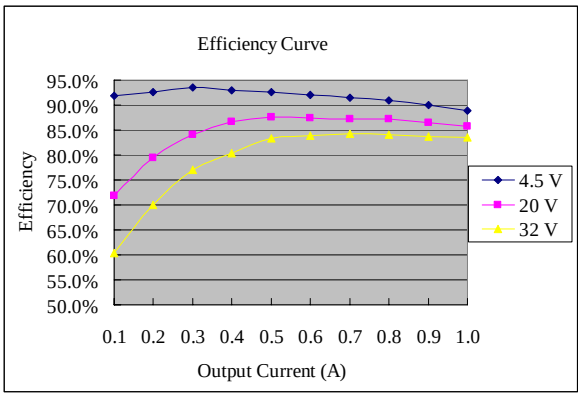


$$R_{TrimUp} = \frac{17.2}{V_{adj} - V_o}$$

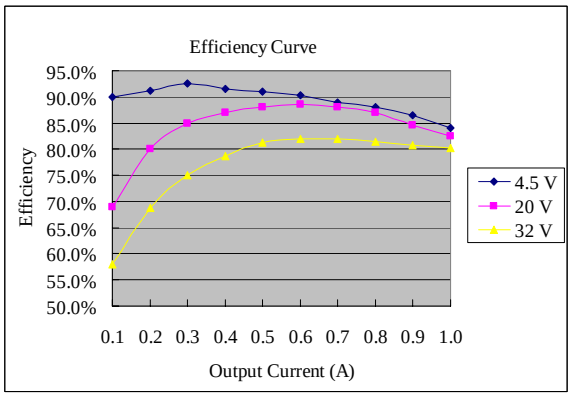


Note: Output voltage Vo=1.205 V

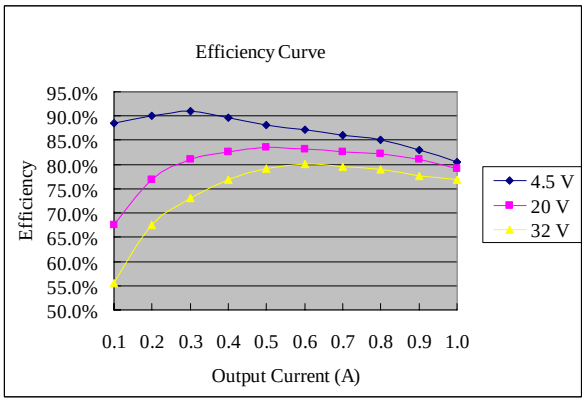
Efficiency Data



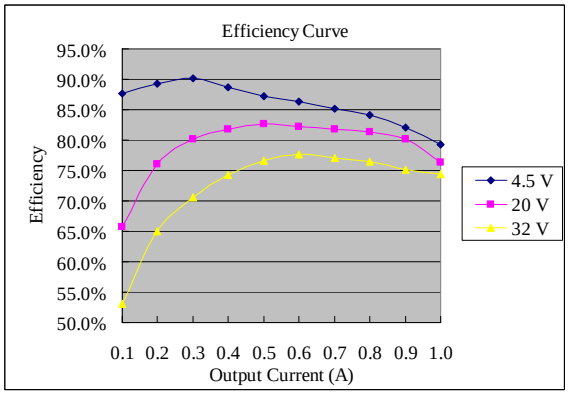
Vo = 3.3 V



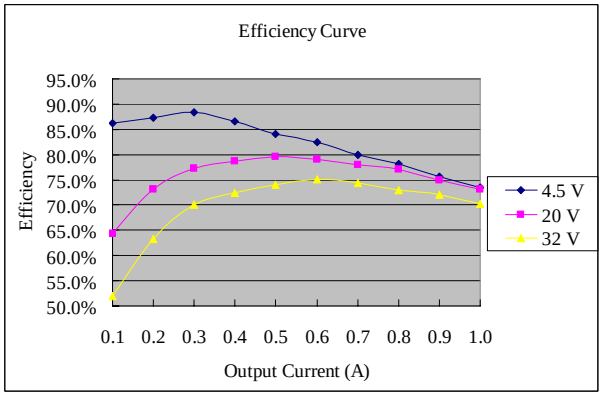
Vo = 2.5 V



Vo = 1.8 V

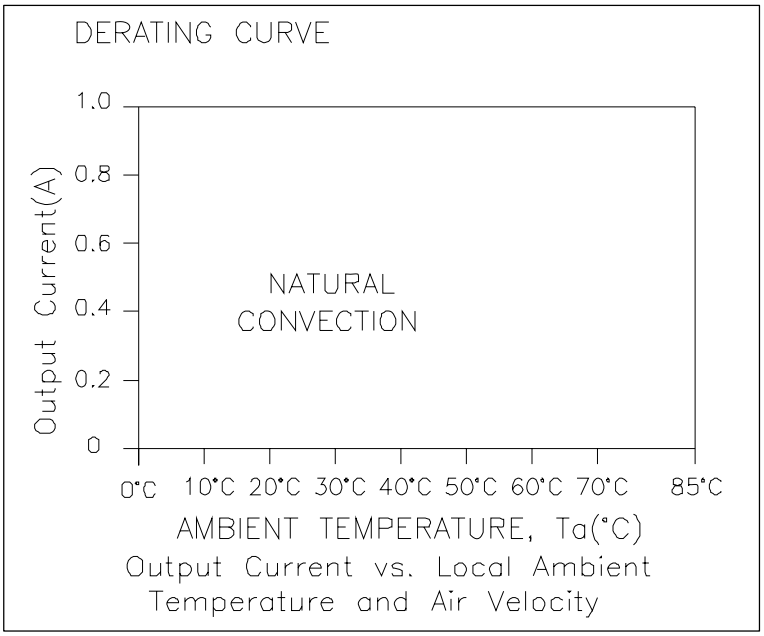


Vo = 1.5 V



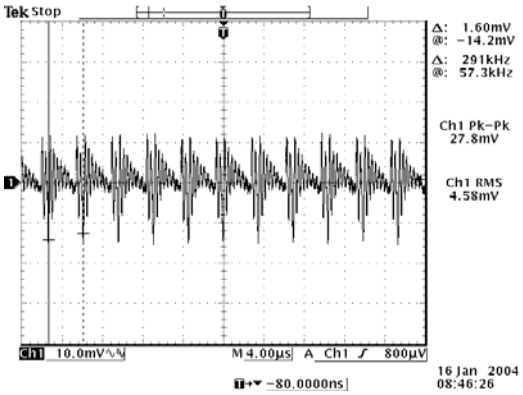
Vo = 1.2 V

Thermal Derating Curve

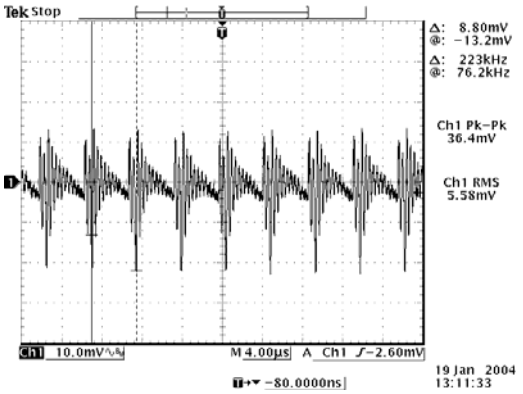


Test Condition: Derating curve is tested at nominal input voltage.

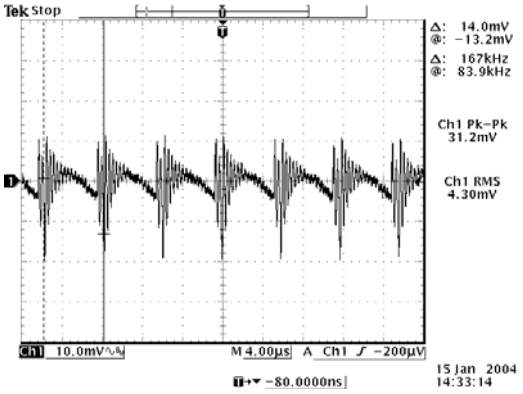
Ripple and Noise Waveforms



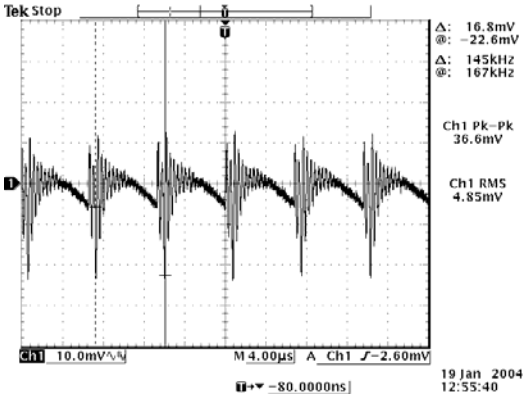
20 Vdc input, 3.3 Vdc output



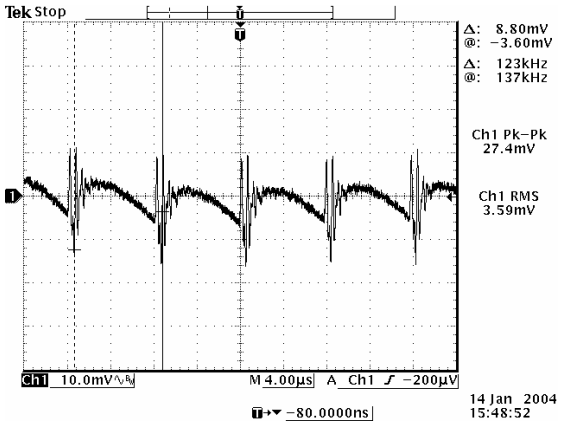
20 Vdc input, 2.5 Vdc output



20 Vdc input, 1.8 Vdc output



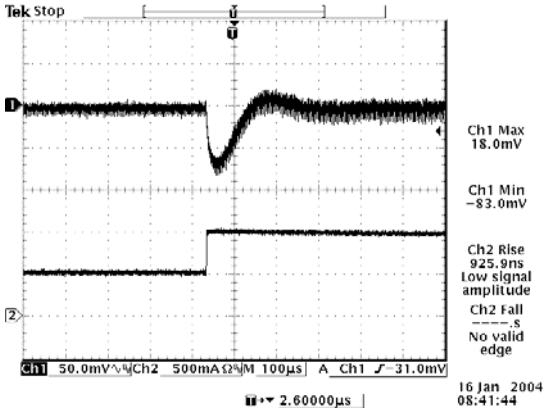
20 Vdc input, 1.5 Vdc output



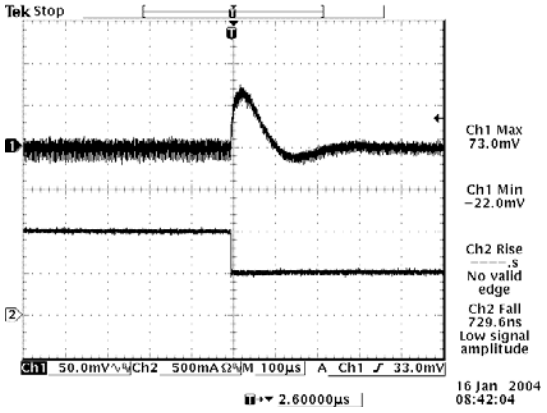
20 Vdc input, 1.2 Vdc output

Note: Ripple and noise at max load, 0-20MHz BW, Ta=25 deg C.

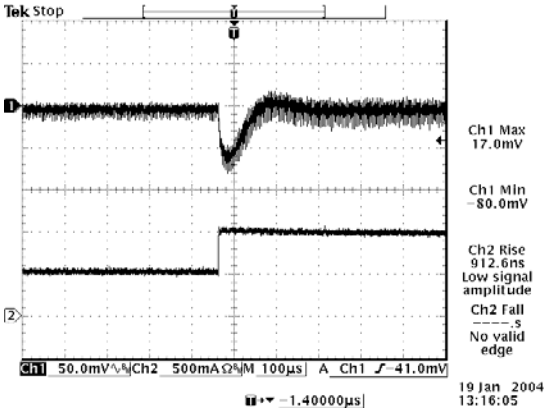
Transient Response Waveforms



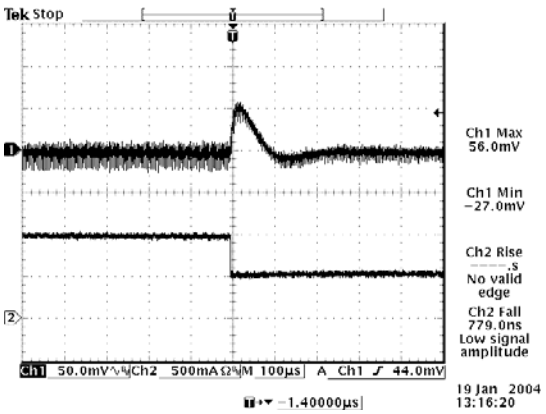
50% to 100% load, 3.3 Vdc output



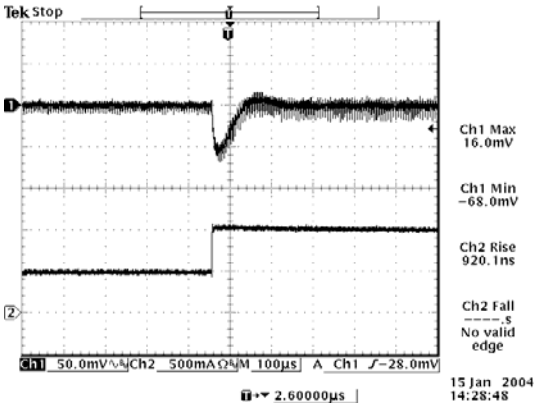
100% to 50% load, 3.3 Vdc output



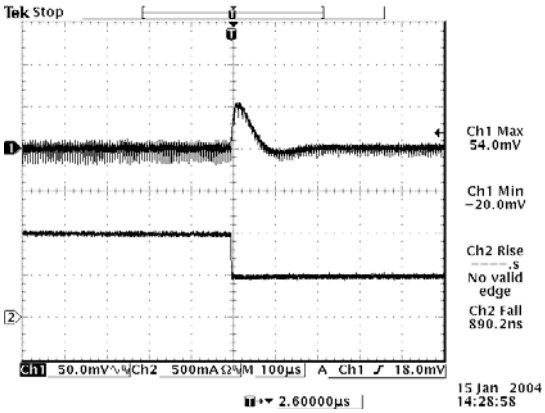
50% to 100% load, 2.5 Vdc output



100% to 50% load, 2.5 Vdc output

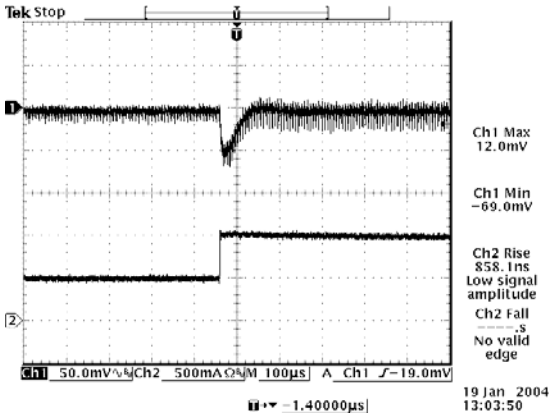


50% to 100% load, 1.8 Vdc output

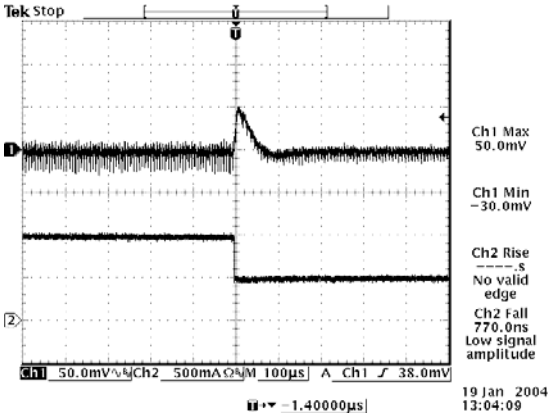


100% to 50% load, 1.8 Vdc output

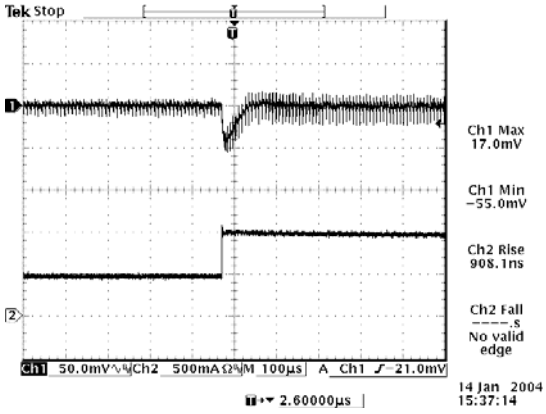
Transient Response Waveforms (continued)



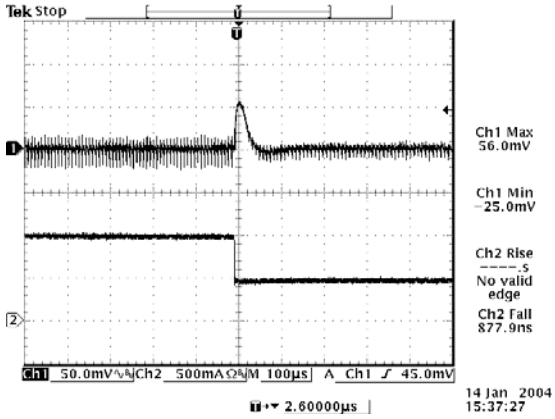
50% to 100% load, 1.5 Vdc output



100% to 50% load, 1.5 Vdc output



50% to 100% load, 1.2 Vdc output



100% to 50% load, 1.2 Vdc output

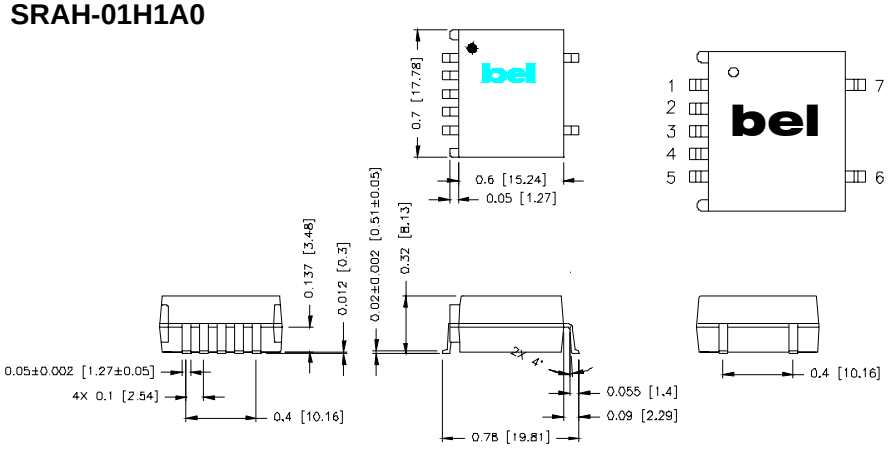
Note: Transient Response at 20 Vdc input, di/dt=0.5 A/uS, Ta=25 deg C.

NON-ISOLATED DC/DC CONVERTER

4.5 Vdc - 32 Vdc Input **1.2 Vdc - 3.3 Vdc/1 A Output**

Mechanical Outline

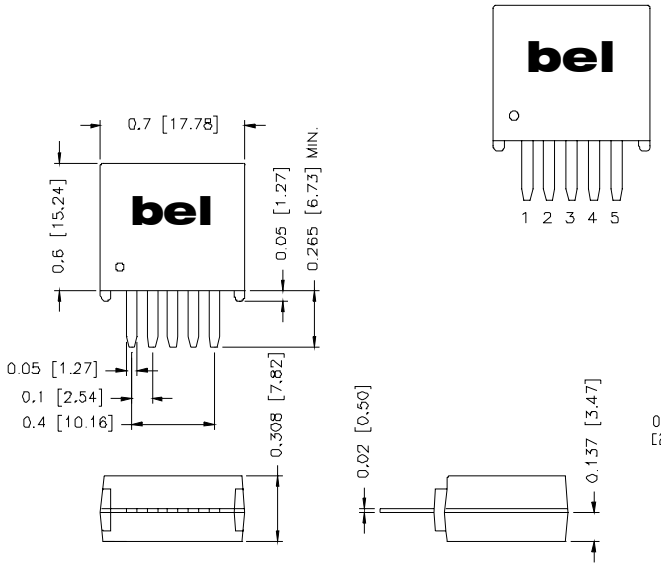
SRAH-01H1A0



Pin Connections

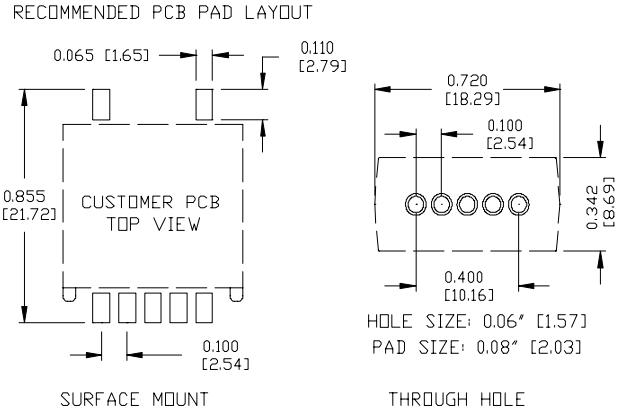
Pin	Function
1	Remote On/Off (option)
2	Vin
3	Ground
4	Vout
5	Trim (option)
6	N/A
7	N/A

VRAH-01H1A0



Pin Connections

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



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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