NON-ISOLATED DC/DC CONVERTERS

12 Vdc Input 0.9 Vdc - 3.3 Vdc/7 A Output

xRAH-07A1A0 RoHS Compliant Rev.A

- Non-Isolated
- Fixed Frequency
- High Efficiency
- High Power Density
- Low Cost
- Remote On/Off
- Input Under Voltage Lockout
- OCP/SCP
- Wide Range Trim
- UL60950-1 Recognized (UL/cUL)

Description

The Bel xRAH-07A1A0 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 a range of output voltages from 0.9 Vdc to 3.3 Vdc. It is packaged in a compact, overmolded package rated at 7 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 is typically 88% for 3.3 Vdc output at full load. 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
0.9 Vdc - 3.3 Vdc	12 Vdc	7 A	23.1 W	88%	SRAH-07A1A0	VRAH-07A1A0

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	-	15 V	
Output Enable Terminal Voltage	-0.3 V	-	14 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	10 V	-	14 V	
Input Current (no load)	-	-	100 mA	
Input Current (full load)				
V_O=3.3 V	-	-	3.0 A	
V_O=2.5 V	-	-	2.6 A	
V_O=1.8 V	-	-	1.9 A	
V_O=1.5 V	-	-	1.6 A	
V_O=1.2 V	-	-	1.3 A	
V_O=0.9 V	-	-	1.0 A	
Remote Off Input Current	-	3 mA	10 mA	

Input Specifications (continued)

Parameter	Min	Typ	Max	Notes
Input Reflected Ripple Current (pk-pk)	-	180 mA	-	Tested with simulated source impedance of 500 nH, 5 Hz to 20 MHz and two 270 uF/16 V Oscon capacitors with ESR=0.018 ohm max. at 100 kHz
Input Reflected Ripple Current (rms)	-	50 mA	-	
I^2t Inrush Current Transient	-	0.01 A^2s	0.02 A^2s	
Turn on Voltage Threshold	-	9.5 V	-	
Turn off Voltage Threshold	-	9.0 V	9.5 V	

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point				
Vo=3.3 V	3.247 V	3.3 V	3.353 V	Test conditions: Vin=12 V, Io=50% full load
Vo=2.5 V	2.460 V	2.5 V	2.540 V	
Vo=1.8 V	1.771 V	1.8V	1.829 V	
Vo=1.5 V	1.476 V	1.5 V	1.524 V	
Vo=1.2 V	1.181 V	1.2 V	1.219 V	
Vo=0.9 V	0.886 V	0.9 V	0.914 V	
Line Regulation	-	±3mV	±6mV	
Load Regulation				
Vo=3.3 V	-	±5 mV	±10 mV	
Vo=2.5 V	-	±5 mV	±10 mV	
Vo=1.8 V	-	±5 mV	±10 mV	
Vo=1.5 V	-	±3 mV	±6 mV	
Vo=1.2 V	-	±3 mV	±6 mV	
Vo=0.9 V	-	±3 mV	±6 mV	
Regulation Over Temperature (-40 °C to +85 °C)	-	30 mV	50 mV	
Output Current	0 A	-	7 A	
Current Limit Threshold	10 A	-	20 A	
Short Circuit Surge Transient	-	0.02 A^2s	0.04 A^2s	
Ripple and Noise (rms)				Test condition: 0-20 MHz BW, with a 330 uF/10 V Tantalum capacitor at the output.
Vo=3.3 V	-	20 mV	50 mV	
Vo=2.5 V	-	20 mV	50 mV	
Vo=1.8 V	-	15 mV	40 mV	
Vo=1.5 V	-	15 mV	40 mV	
Vo=1.2 V	-	15 mV	30 mV	
Vo=0.9 V	-	10 mV	30 mV	
Ripple and Noise (pk-pk)				
Vo=3.3 V	-	70 mV	100 mV	
Vo=2.5 V	-	70 mV	100 mV	
Vo=1.8 V	-	60 mV	100 mV	
Vo=1.5 V	-	60 mV	80 mV	
Vo=1.2 V	-	60 mV	80 mV	
Vo=0.9 V	-	50 mV	70 mV	
Turn on Time	-	8 mS	20 mS	
Overshoot at Turn on	-	0%	3%	
Output Capacitance	330 uF	-	2800 uF	
Transient Response				
50% ~ 100% Max Load — Overshoot	-	120 mV	180 mV	Test conditions: di/dt = 0.5 A/uS; Vin = 12 V; with a 330 uF/10 V Tantalum capacitor at the output.
50% ~ 100% Max Load — Settling Time	-	50 uS	80 uS	
100% ~ 50% Max Load — Overshoot	-	120 mV	180 mV	
100% ~ 50% Max Load — Settling Time	-	50 uS	80 uS	

All

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%	-	Measured at Vin=12 V, full load and Ta=25 °C
Vo=2.5 V	83%	86%	-	
Vo=1.8 V	80%	83%	-	
Vo=1.5 V	78%	81%	-	
Vo=1.2 V	75%	78%	-	
Vo=0.9 V	71%	74%	-	
Switching Frequency	250 kHz	300 kHz	350 kHz	
Output Trim Range (wide trim)	-	-	403% Vo	Vo=0.9 V
Output Trim Range (narrow trim)				
Vo=1.2 V-3.3 V	90% Vo	-	110% Vo	
Vo=0.9 V	-	-	110% Vo	
MTBF	8,202,646 hours			Calculated Per Bell Core SR-332 (Vin=12 V; Vo=3.3 V; Io = 5.6 A; Ta = 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 g	-	

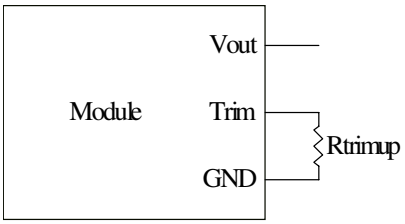
Control Specifications

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)	3.5 V	-	14 V	

Output Trim Equations

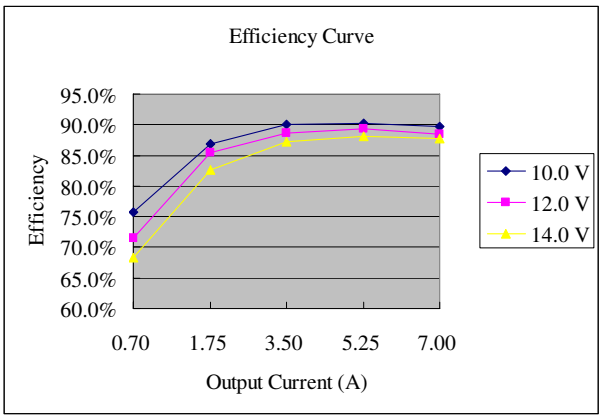
Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom) are shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trimup} = \frac{6.06}{V_{adj} - V_{nom}} - 1.05$$

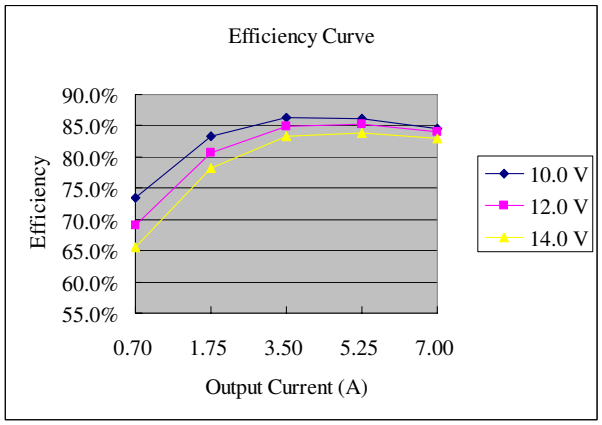


Note: Output voltage Vo=0.9 V when Rtrimup is not connected.

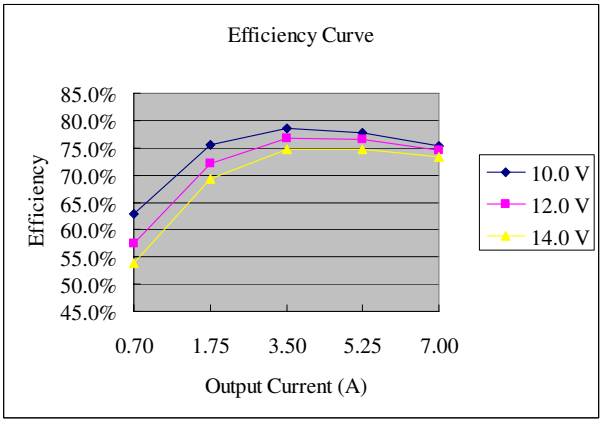
Efficiency Data



Vo=3.3 V

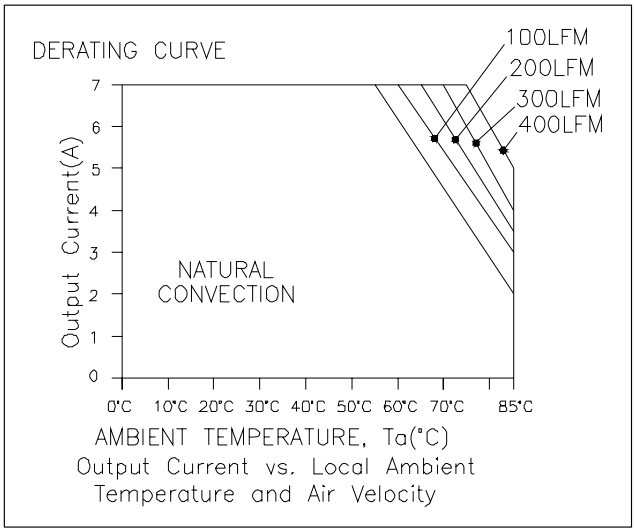


Vo=1.8 V

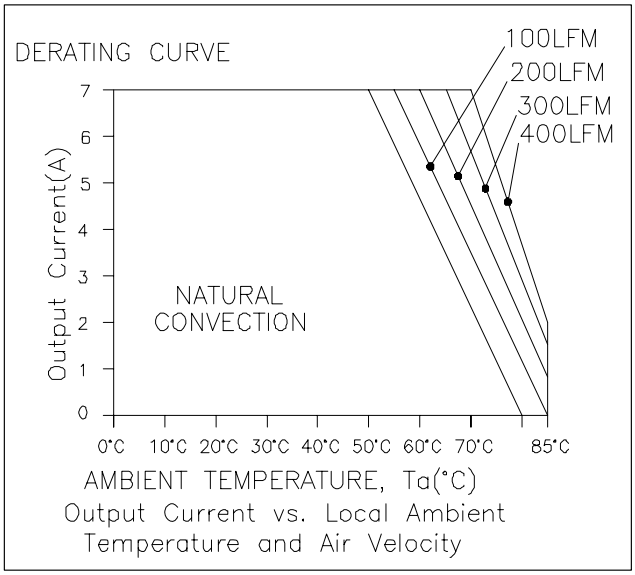


Vo=0.9 V

Thermal Derating Curves

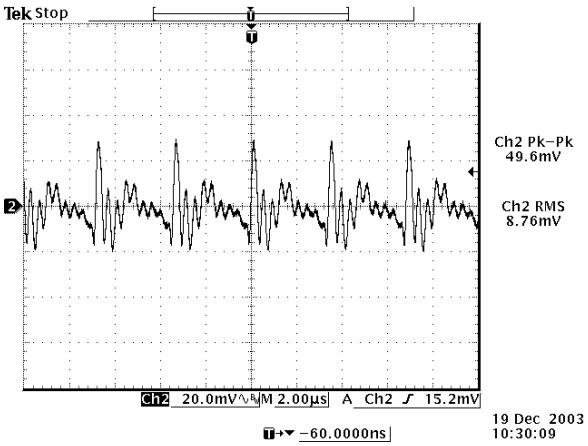


Vo=0.9 V - 2.5 V

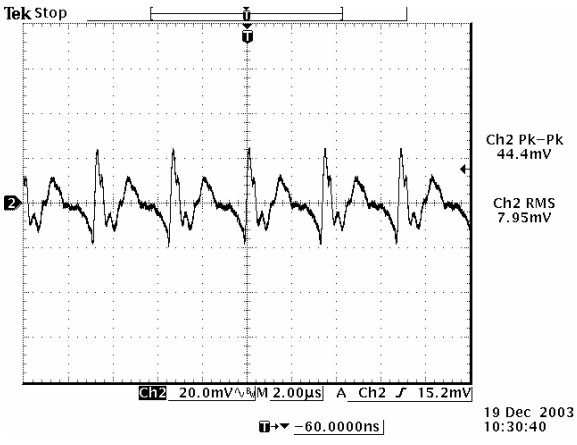


Vo=3.3 V

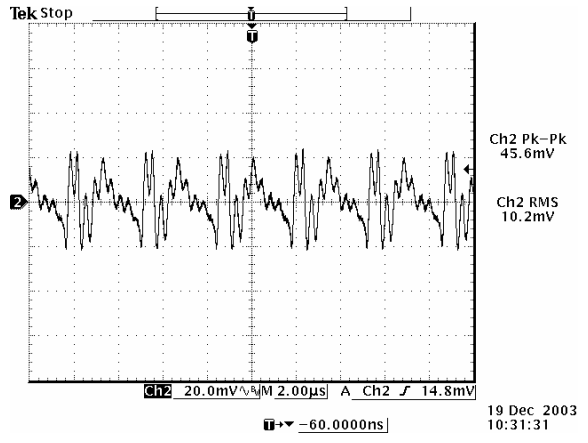
Ripple and Noise Waveforms



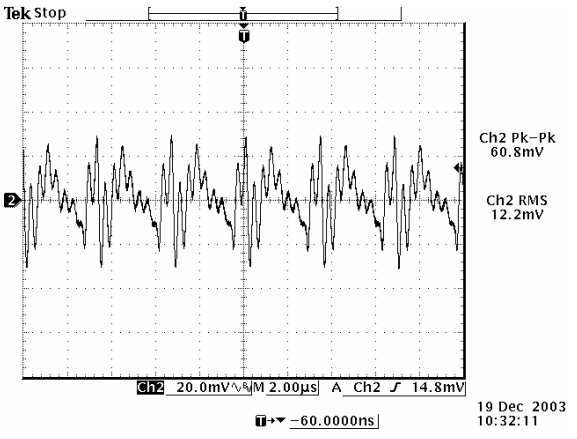
Ripple and noise at full load 0.9 Vdc output



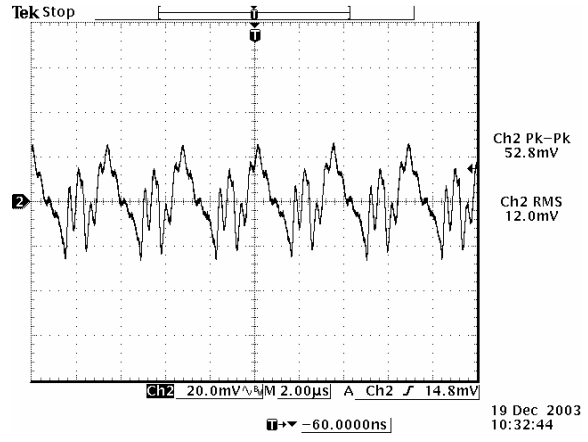
Ripple and noise at full load 1.2 Vdc output



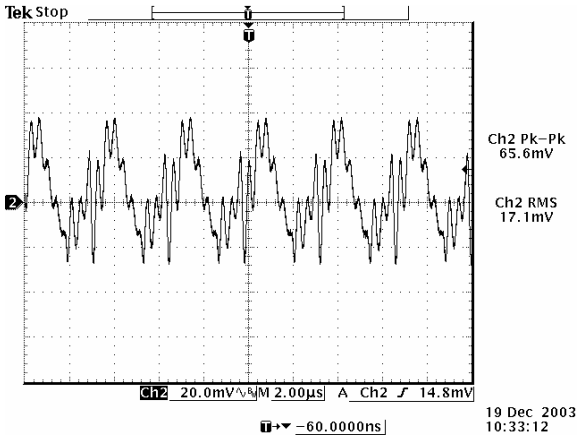
Ripple and noise at full load 1.5 Vdc output



Ripple and noise at full load 1.8 Vdc output



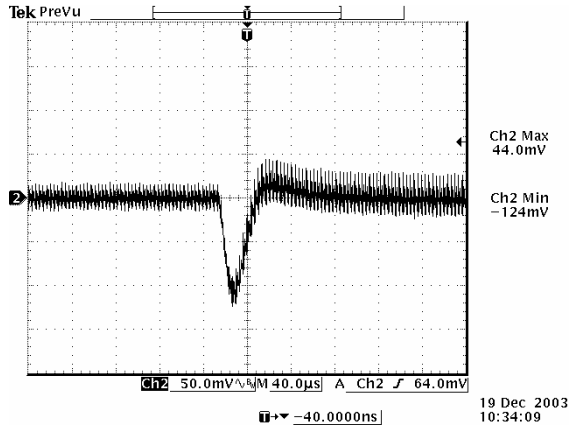
Ripple and noise at full load 2.5 Vdc output



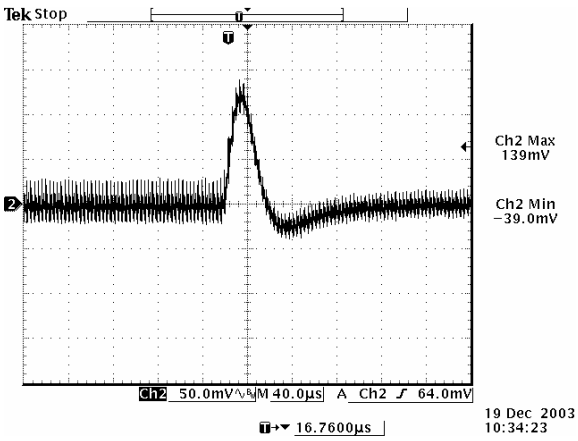
Ripple and noise at full load 3.3 Vdc output

Note: Ripple and Noise at 12 Vdc input, with a 330 uF/10 V tantalum cap at the output, Ta=25 deg C.

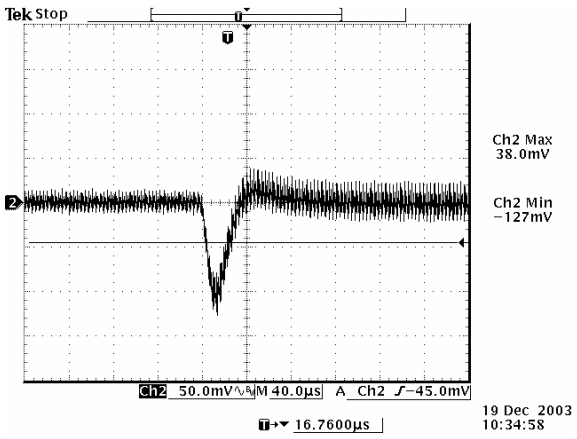
Transient Response Waveforms



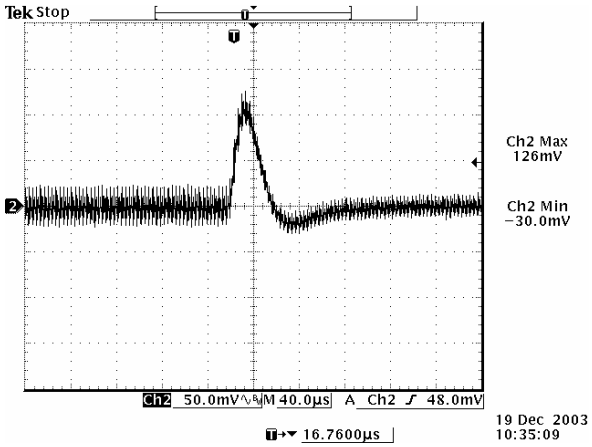
Transients 50% to 100% load 0.9 Vdc output



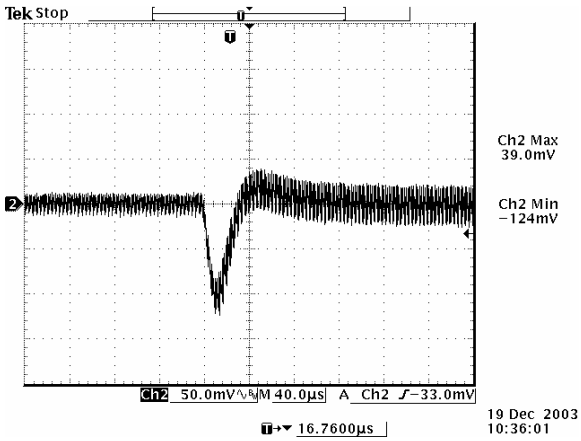
Transients 100% to 50% load 0.9 Vdc output



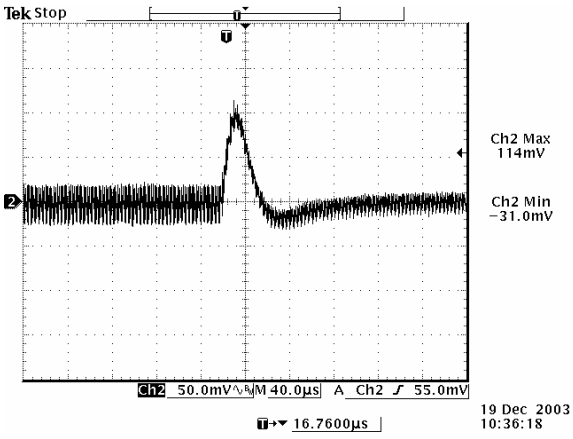
Transients 50% to 100% load 1.2 Vdc output



Transients 100% to 50% load 1.2 Vdc output

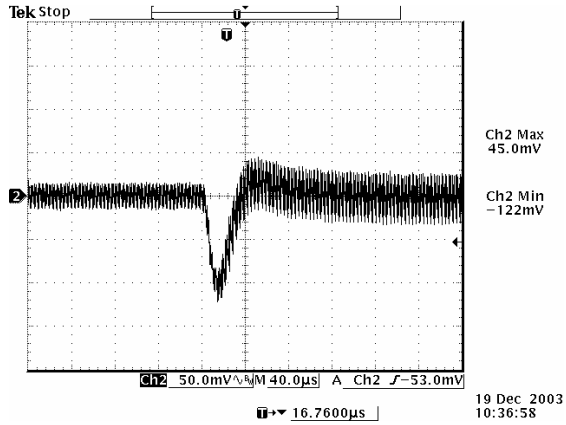


Transients 50% to 100% load 1.5 Vdc output

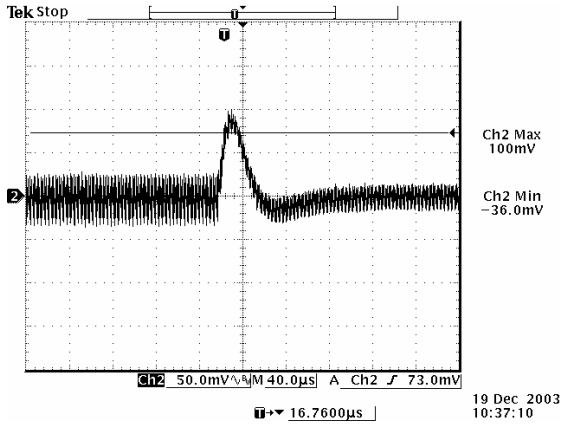


Transients 100% to 50% load 1.5 Vdc output

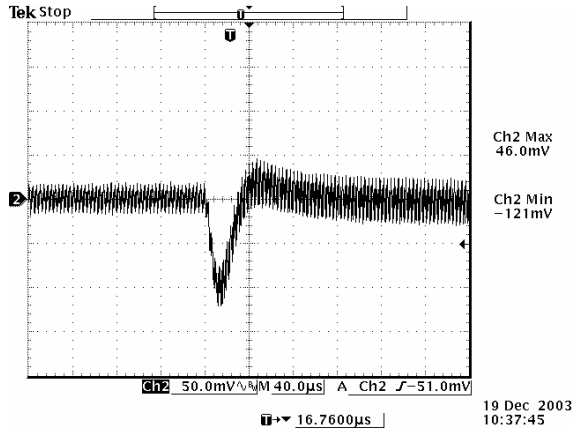
Transient Response Waveforms (continued)



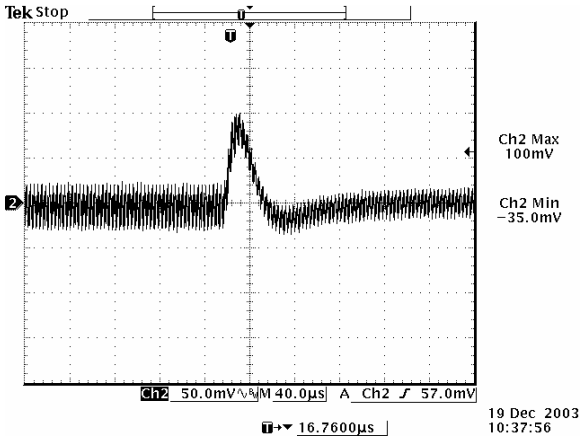
Transients 50% to 100% load 1.8 Vdc output



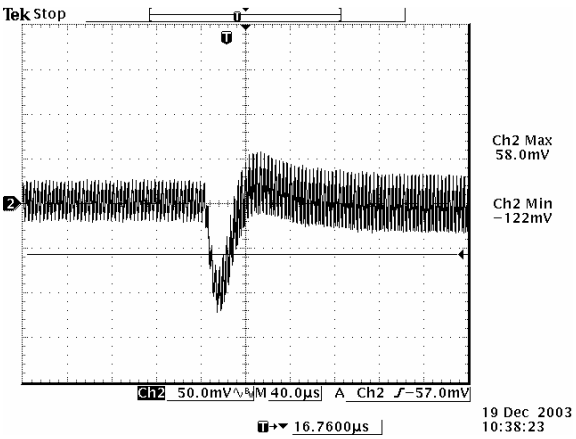
Transients 100% to 50% load 1.8 Vdc output



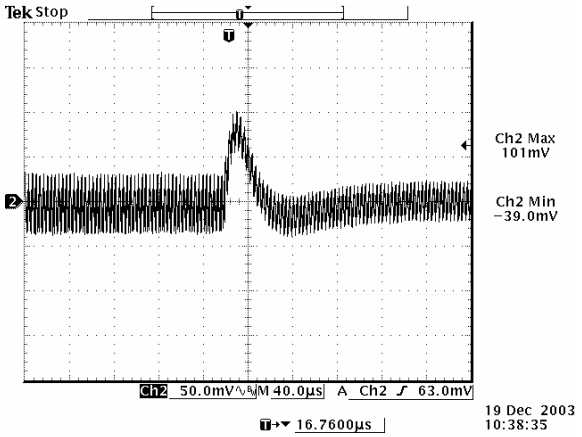
Transients 50% to 100% load 2.5 Vdc output



Transients 100% to 50% load 2.5 Vdc output



Transients 50% to 100% load 3.3 Vdc output



Transients 100% to 50% load 3.3 Vdc output

Note: Transient Response at 12 V input, di/dt=0.5 A/uS, with 330 uF/10 V tantalum cap at the output, Ta=25 deg C.

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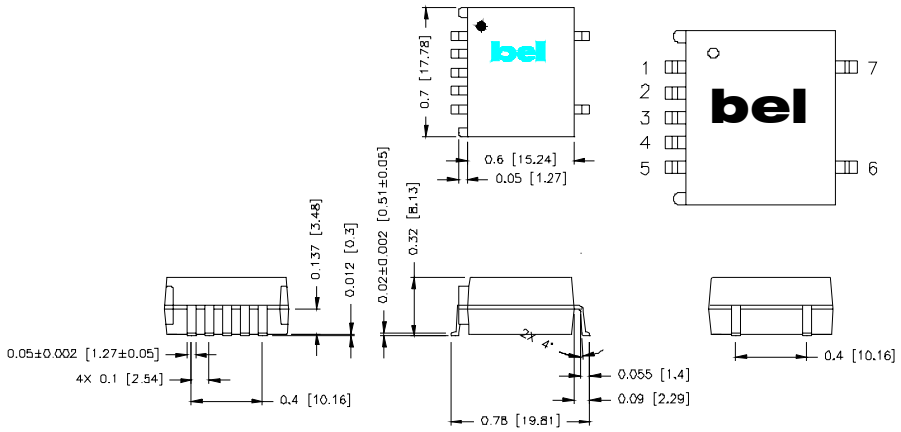
12 Vdc Input 0.9 Vdc - 3.3 Vdc/7 A Output

Mechanical Outline

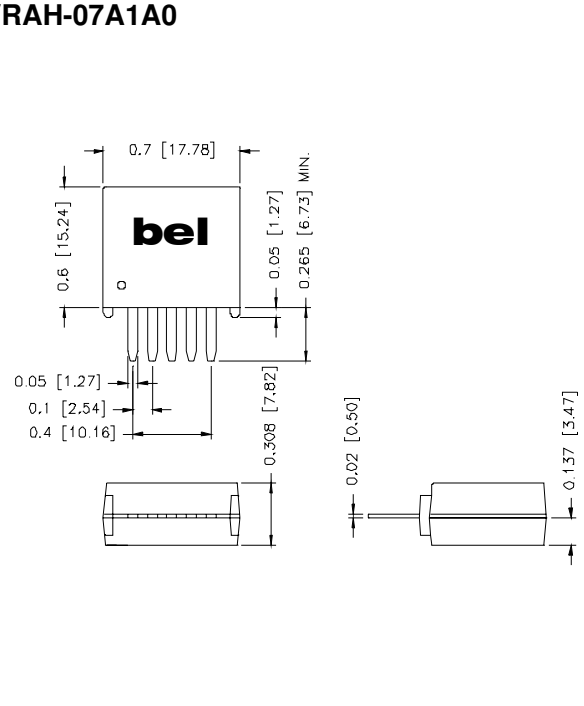
SRAH-07A1A0



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-07A1A0



Pin Connections

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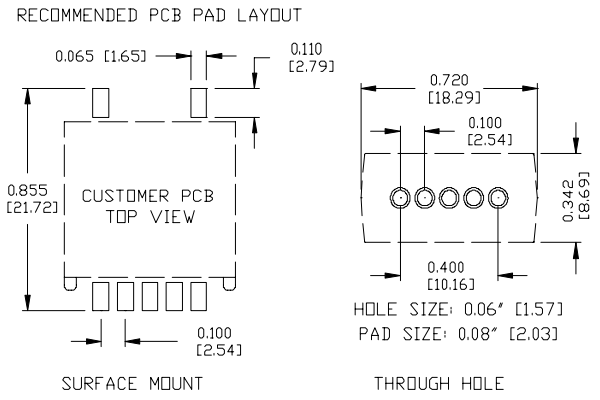

RoHS Compliance

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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