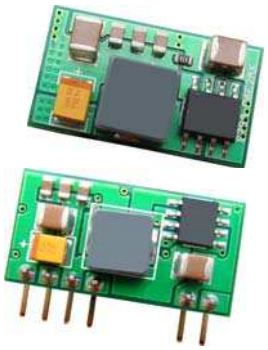
NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc -14 Vdc Input 0.75 Vdc - 5.0 Vdc/6 A Output

xRBA-06E2Ax Series RoHS Compliant Rev.A

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



Description

The Bel xRBA-06E2Ax modules are a series of non-isolated dc/dc converters that can deliver up to 6 A of output current with full load efficiency of 92% at 5.0 Vdc output. These modules provide precisely regulated voltage programmable via external resistor from 0.75 Vdc to 5.0 Vdc over a wide range of input voltage. These modules have a sequencing feature that enables designers to implement various types of output voltage sequencing when powering multiple voltages on a board. Their open-frame construction and small footprint enable designers to develop cost and space-efficient solutions. Standard features include remote On/Off, programmable output voltage and over current protection.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Surface Mount	Model Number Vertical Mount
5.0 V	7.0 V - 14 V	6 A	30.0 W	92%	SRBA-06E2Ax	VRBA-06E2Ax
0.75 V - 3.3 V[1]	4.5 V - 14 V	6 A	19.8 W	88%	SRBA-06E2Ax	VRBA-06E2Ax

Notes: 1. These modules use a buck topology, so the output voltages must be 0.5 V less than the input voltage.
2. Use “0” to replace “x” for remote on/off active high logic and use “L” for active low logic. Change the last character “L” to “C” to indicate 0.20’’ pin length. Add “G” suffix at the end of the model numbers to indicate Tray Packaging.
3. 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	-	15 V	
Sequencing Voltage [1]	-0.3 V	-	Vin	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

Notes: All specifications are typical at 25 °C unless otherwise stated.
1. xRBA-06E2Ax series of modules include a sequencing feature that enables users to implement various types of output voltage sequencing in their applications. This is accomplished via an additional sequencing pin. When the sequencing feature is not used, tie the SEQ pin to Vin.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc -14 Vdc Input 0.75 Vdc - 5.0 Vdc/6 A Output

bel POWER PRODUCTS

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage				
Vo, set≤3.3 V	4.5 V	12 V	14 V	
Vo, set=5.0 V	7.0 V	12 V	14 V	
Input Current (full load)				
Vo=5.0 V	-	2.75 A	4.8 A	
Vo=3.3 V	-	1.85 A	4.8 A	
Vo=1.8 V	-	1.05 A	3.2 A	
Vo=0.75 V	-	0.55 A	1.8 A	
Input Current (no load)				
Vo=5.0 V	-	-	100 mA	
Vo=0.75 V	-	-	20 mA	
Remote Off Input Current	-	3 mA	5 mA	
Input Reflected Ripple Current (pk-pk)	-	120 mA	200 mA	With simulated source impedance of 1 uH, 5 Hz to 20 MHz and two 100 uF/25 V external input tantalum capacitors.
Input Reflected Ripple Current (rms)	-	60 mA	100 mA	
I^2t Inrush Current Transient	-	0.002 A^2s	0.02 A^2s	
Turn-on Voltage Threshold				
Vo, set≤3.3 V	-	4.3 V	4.5 V	
Vo, set=5.0 V	-	6.0 V	6.5 V	
Turn-off Voltage Threshold				
Vo, set≤3.3 V	-	4.0 V	4.3 V	Shut down or below 90% set point.
Vo, set=5.0 V	-	5.5 V	6.0 V	

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point	-2%Vo,set	-	2%Vo,set	Vin=12 V, full load
Output Voltage Set Point [1]	-2.5%Vo,set	-	3.5%Vo,set	
Load Regulation	-0.7%Vo,set	0.4%Vo,set	0.7%Vo,set	Io=Io, min to Io, max
Line Regulation	-0.7%Vo,set	0.3%Vo,set	0.7%Vo,set	Vin=Vin, min to Vin, max
Regulation Over Temperature (-40 °C to +85 °C)	-	0.5%Vo,set	-	Tref=Ta, min to Ta, max
Output Current	0 A	-	6 A	
Current Limit Threshold	6.8 A	-	15 A	
Short Circuit Surge Transient	-	0.25 A^2s	-	
Ripple and Noise (pk-pk)				Tested with 0-20 MHz, with 10 uF/10 V tantalum capacitor & 1 uF/10 V ceramic capacitor at the output
Vo=5.0 V	-	100 mV	140 mV	
Vo=3.3 V	-	80 mV	120 mV	
Vo=0.75 V	-	35 mV	7 0 mV	
Ripple and Noise (rms)				
Vo=5.0 V	-	35 mV	50 mV	
Vo=3.3 V	-	25 mV	40 mV	
Vo=0.75 V	-	10 mV	15 mV	
Turn on Time	-	6 mS	12 mS	
Overshoot at Turn on	-	0%	3%	
Output Capacitance				
ESR ≥ 1mohm	0 uF	-	1000 uF	
ESR ≥ 10mohm	0 uF	-	2200 uF	

Transient Response					
50% ~ 100% Max Load	All outputs	-	200 mV	350 mV	di/dt=2.5 A/uS; Vin=12 V; and with 10 uF/10 V tantalum capacitor & 1uF/10 V ceramic capacitor at the output.
Settling Time		-	25 uS	50 uS	
100% ~ 50% Max Load		-	200 mV	350 mV	
Settling Time		-	25 uS	50 uS	

Notes: All specifications are typical at nominal input (Vin=12 V), full load at 25 °C unless otherwise stated.

1. Over all operating input voltages, resistive loads and temperature conditions.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency Vo=5.0 V Vo=3.3 V Vo=1.8 V Vo=0.75 V	 88% 85% 80% 68%	 92% 88% 84% 73%	 - - - -	Measured at Vin=12 V, full load
Switching Frequency	220 kHz	250 kHz	280 kHz	
Output Voltage Trim Range (wide trim)	0.7525 V	-	5 V	
MTBF	3,079,469 hours			Calculated Per Bell Core SR-332 (Vin=12 V; Vo=3.3 V, Io=4.8 V; Ta = 25 °C)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 0.8 x 0.45 x 0.251 20.32 x 11.42 x 6.38			Surface Mount
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 1.0 x 0.5 x 0.243 25.4 x 12.7 x 6.16			Vertical Mount
Weight	-	5 g	-	

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

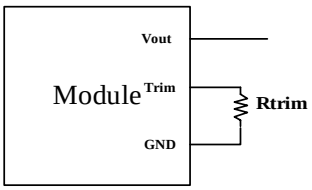
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.3 V	-	0.4 V	xRBA-06E2A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	2.5 V	-	14 V	
Signal Low (Unit On)	-0.3 V	-	0.4 V	xRBA-06E2AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5 V	-	14 V	
Voltage Sequencing				
Sequencing Voltage	0.05 V	-	Vin	Sequencing Voltage should be higher than output voltage.
Sequencing Slew Rate Capability	-	-	2 V/mS	
Sequencing Delay Time	10 mS	-	-	Delay from Vin, min to application of voltage on SEQ pin
Tracking Accuracy Power-Up Power-Down	 - -	 100 mV 200 mV	 200 mV 400 mV	

Output Trim Equations

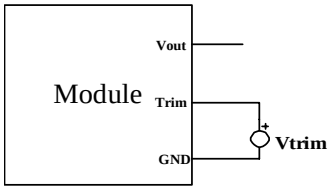
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trim} = \frac{10.507}{V_{adj} - 0.7525} - 1$$

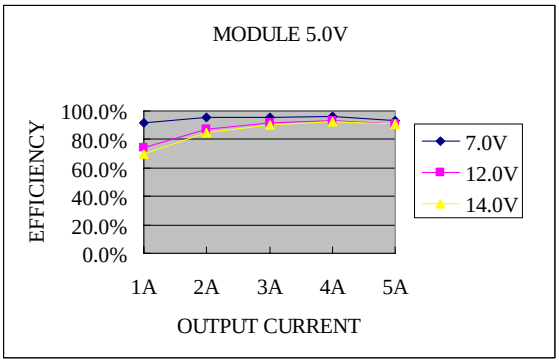


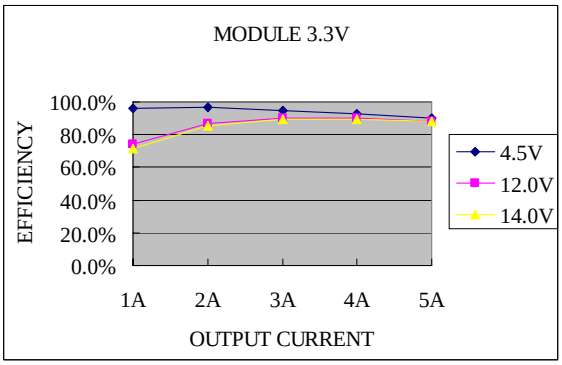
Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

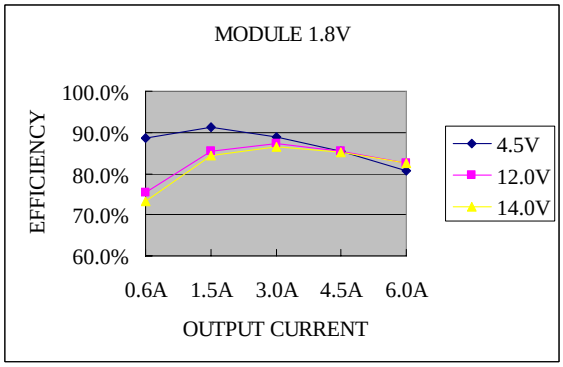
$$V_{trim} = 0.7 - 0.0667 \times (V_{adj} - 0.7525)$$

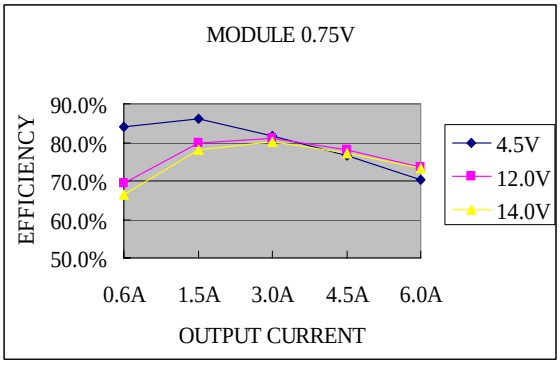


Efficiency Data

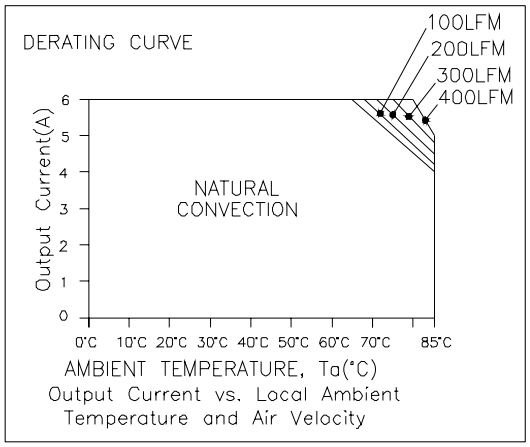




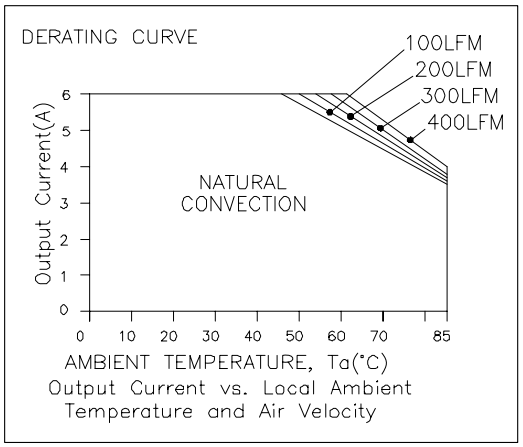




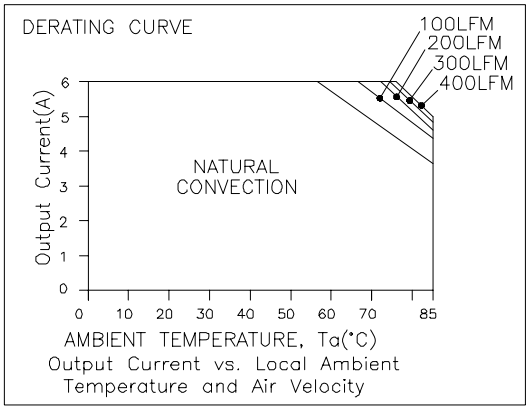
Thermal Derating Curves



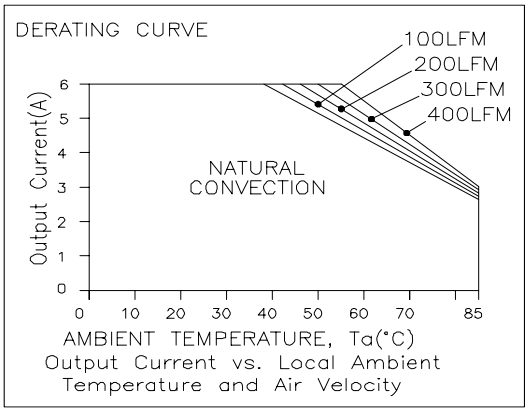
SRBA-06E2Ax, Vo=0.75 V



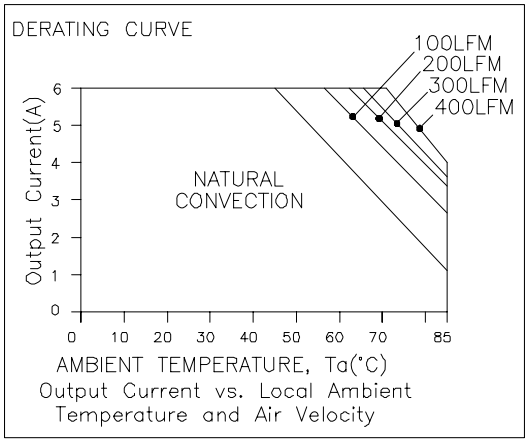
VRBA-06E2Ax, Vo=0.75 V



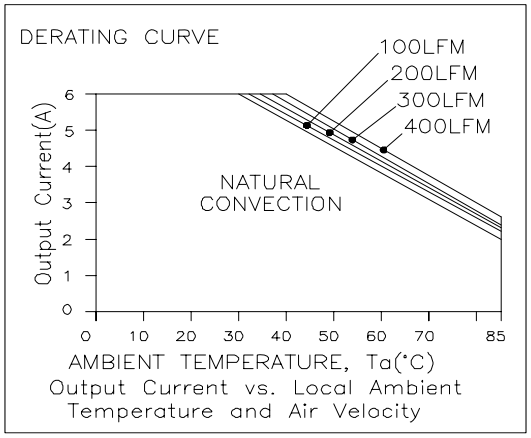
SRBA-06E2Ax, Vo=2.5 V



VRBA-06E2Ax, Vo=2.5 V

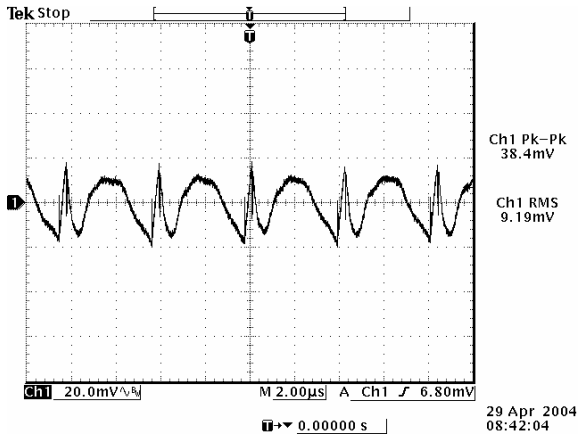


SRBA-06E2Ax, Vo=5.0 V

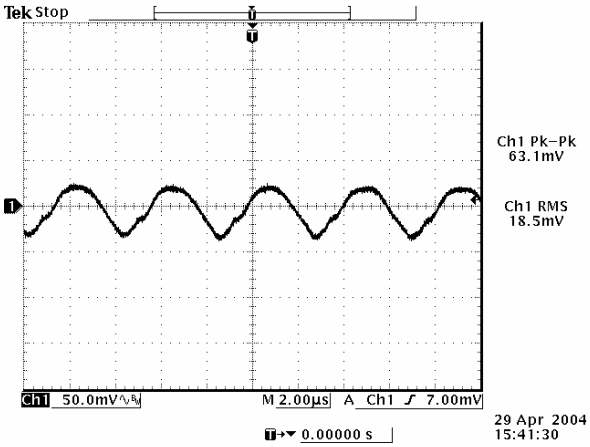


VRBA-06E2Ax, Vo=5.0 V

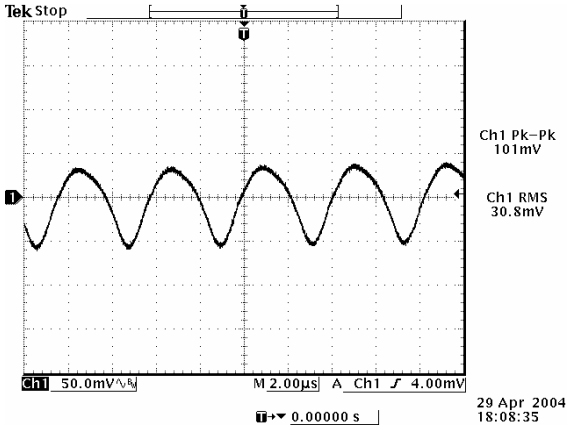
Ripple and Noise Waveforms



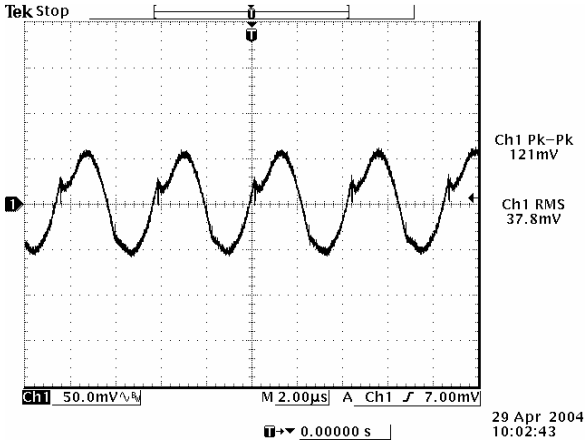
Ripple and noise at full load, Vo=0.75 V



Ripple and noise at full load, Vo=1.8 V



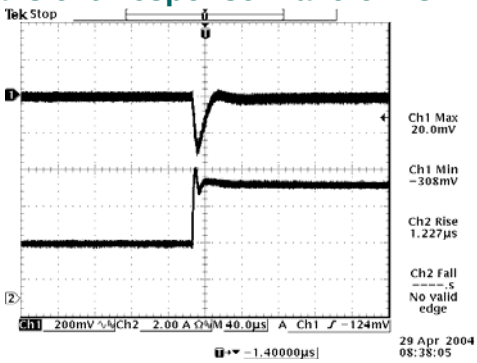
Ripple and noise at full load, Vo=3.3 V



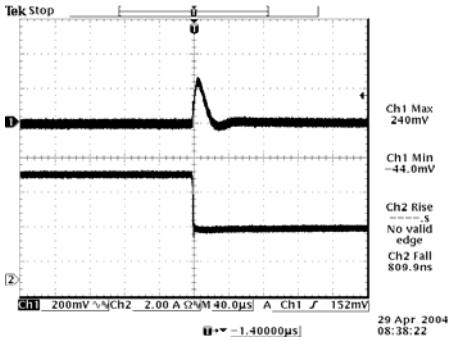
Ripple and noise at full load, Vo=5.0 V

Note: Ripple and noise at 12 V input, 0-20 MHz BW, 10 uF/10 V tantalum capacitor and 1 uF/10 V ceramic capacitor, Ta=25 deg C.

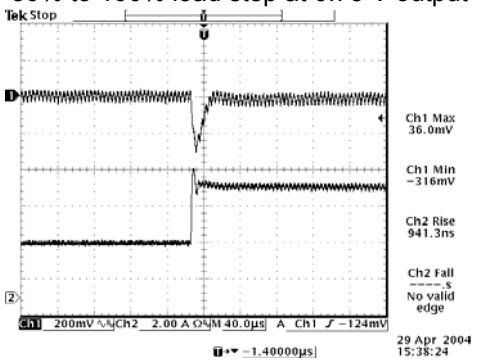
Transient Response Waveforms



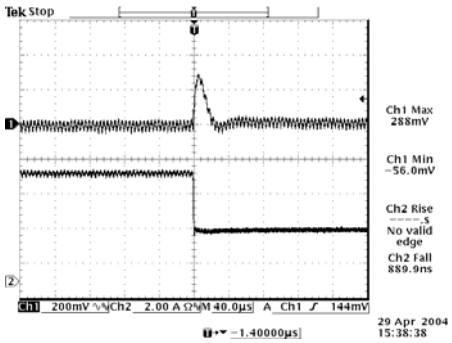
50% to 100% load step at 0.75 V output



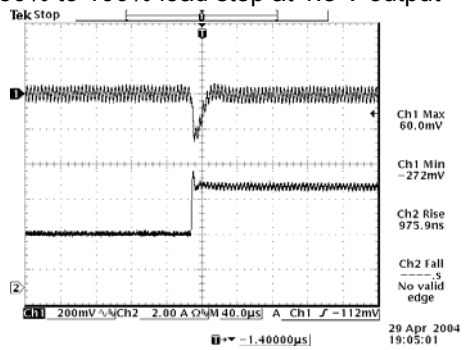
100% to 50% load step at 0.75 V output



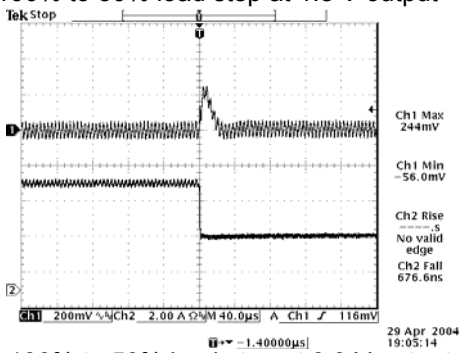
50% to 100% load step at 1.8 V output



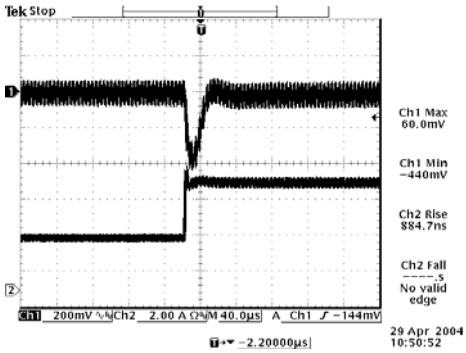
100% to 50% load step at 1.8 V output



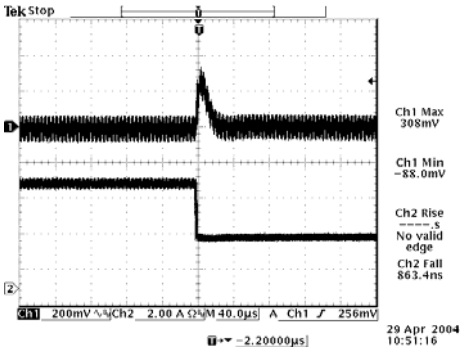
50% to 100% load step at 3.3 V output



100% to 50% load step at 3.3 V output



50% to 100% load step at 5.0 V output

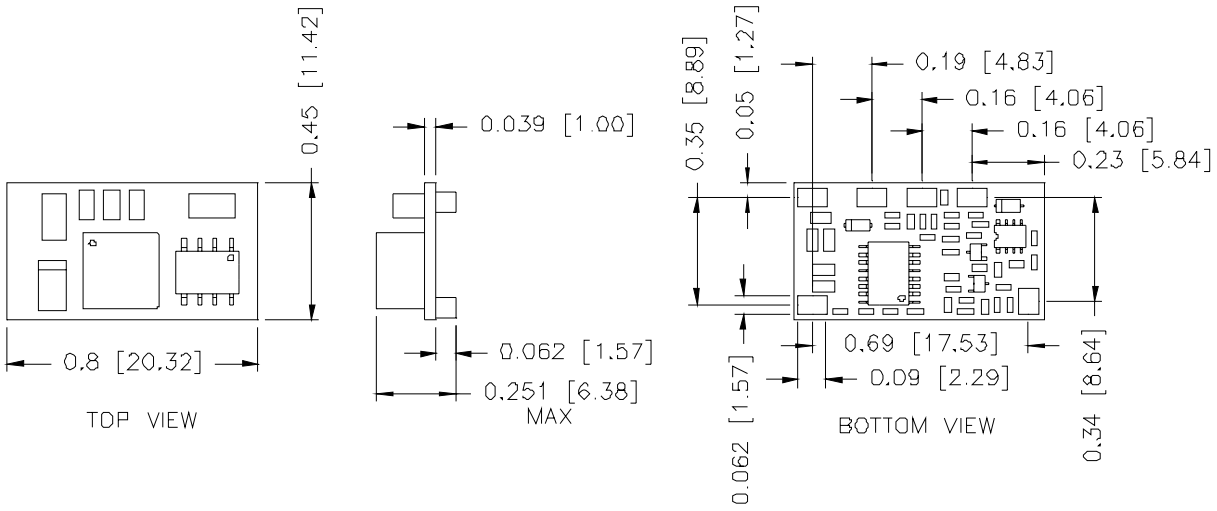


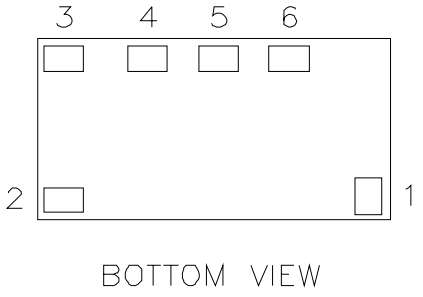
100% to 50% load step at 5.0 V output

Note: Transient response at 12 V input, di/dt=2.5 A/uS, with 10 uF/10 V tantalum capacitor and 1uF/10 V ceramic capacitor, and Ta=25 deg C.

Mechanical Outline

SRBA-06E2Ax

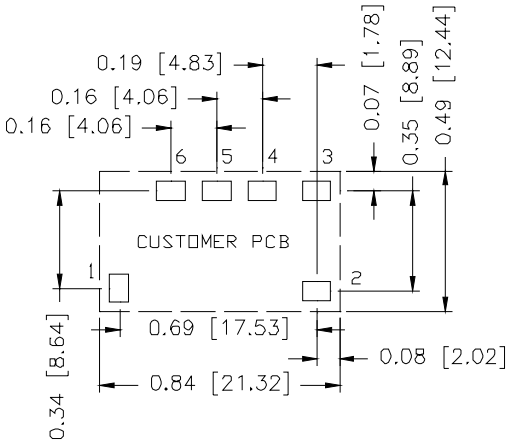




Pin Connections

Pin	Function
1	Remote On/Off
2	Vin+
3	SEQ
4	Ground
5	Trim
6	Vout+

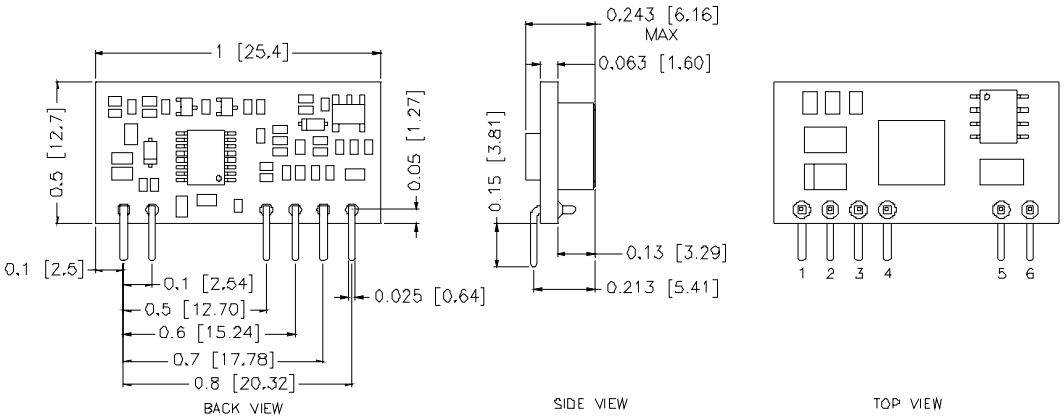
RECOMMENDED PAD LAYOUT

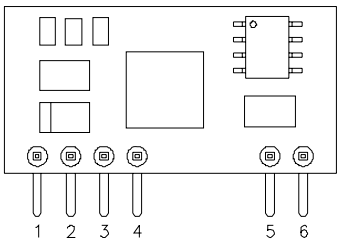


PAD SIZE:
MIN: 0.12"* 0.095" (3.05mm * 2.41mm)
MAX: 0.135"* 0.11" (3.43mm * 2.79mm)

Mechanical Outline (continued)

VRBA-06E2Ax





Pin Connections

Pin	Function
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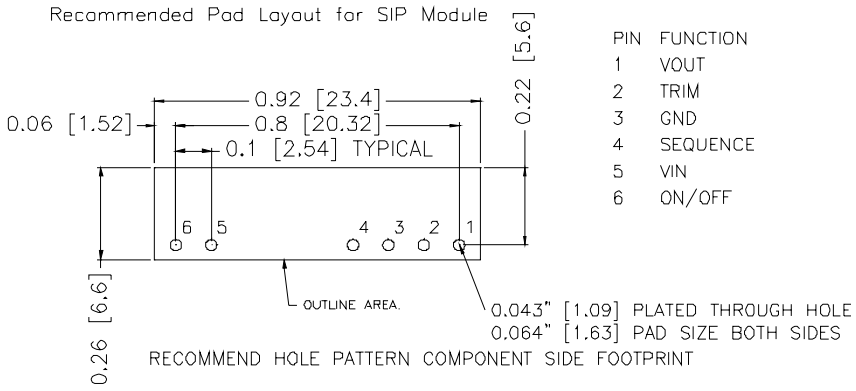

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products.

CORPORATE

Bel Fuse Inc.
206 Van Vorst Street
Jersey City, NJ 07302
Tel 201-432-0463
Fax 201-432-9542
www.belfuse.com

FAR EAST

Bel Fuse Ltd.
8F/ 8 Luk Hop Street
San Po Kong
Kowloon, Hong Kong
Tel 852-2328-5515
Fax 852-2352-3706
www.belfuse.com

EUROPE

Bel Fuse Europe Ltd.
Preston Technology Management Centre
Marsh Lane, Suite G7, Preston
Lancashire, PR1 8UD, U.K.
Tel 44-1772-556601
Fax 44-1772-888366
www.belfuse.com