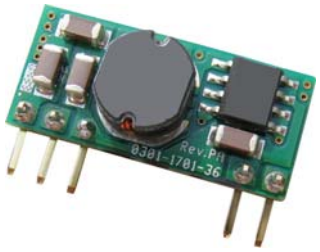
NON-ISOLATED DC/DC CONVERTERS

8.3 V-14 V Input 0.75 V-5.0 V/3 A Output

VRBA-03A1Ax Series RoHS Compliant

- Non-Isolated
- Fixed Frequency
- High Efficiency
- High Power Density
- Active Low/High (option)
- Under-Voltage Lockout (UVLO)
- OCP/SCP
- Remote On/Off
- Wide Trim Range
- Wide Input Range



Description

The Bel VRBA-03A1Ax modules are a series of non-isolated dc/dc converters that deliver up to 3 A of output current with full load efficiency of 93% at 5.0 V output. These modules provide precisely regulated voltage programmable via external resistor from 0.75 V to 5.5 V over a wide range of input voltage. 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, over-temperature protection, over current protection, short circuit protection, and under-voltage lockout.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency at 5.0V	Model Number Active High	Model Number Active Low
0.75 V - 5.0 V	8.3 V - 14 V	3 A	15 W	93%	VRBA-03A1A0	VRBA-03A1AL

Note: Add “G” suffix at the end of the model number to indicate Tray Packaging.

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	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

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

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	8.3 V	12 V	14 V	
Input Current (full load)				
Vo=5.0 V	-	1.35 A	2.00 A	
Vo=3.3 V	-	0.90 A	1.37 A	
Vo=0.75 V	-	0.24 A	0.37 A	
Input Current (no load)				
Vo=5.0 V	-	55 mA	65 mA	
Vo=3.3 V	-	40 mA	50 mA	
Vo=0.75 V	-	15 mA	20 mA	

Input Specifications (continued)

Parameter	Min	Typ	Max	Notes
Remote Off Input Current	-	3 mA	6 mA	
Input Reflected Ripple Current (pk-pk) Vo=5.0 V Vo=3.3 V Vo=0.75 V	 - - -	 70 mA 60 mA 25 mA	 100 mA 90 mA 40 mA	Tested with two 100 uF/25 V tantalum input capacitors & simulated source impedance of 1uH, 5 Hz to 20 MHz.
Input Reflected Ripple Current (rms) Vo=5.0 V Vo=3.3 V Vo=0.75 V	 - - -	 20 mA 15 mA 6 mA	 60 mA 30 mA 15 mA	
I^2t Inrush Current Transient	-	0.01 A^2s	0.02 A^2s	
Turn-on Voltage Threshold	7.6 V	7.9 V	8.2 V	
Turn-off Voltage Threshold	7.0 V	7.8 V	8.1 V	

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point	-2%Vo,set	-	2%Vo,set	Vin=12 V, Io=Iomax, full load
Output Voltage Set Point	-2.5%Vo,set	-	3.5%Vo,set	Over all operating input voltages, resistive loads and temperature conditions
Load Regulation	0.5%Vo,set	0.4%Vo,set	0.5%Vo,set	Io=Io, min to Io, max
Line Regulation	0.4%Vo,set	0.3%Vo,set	0.4%Vo,set	Vin=Vin, min to Vin, max
Regulation Over Temperature (-40 °C to +85 °C)	-	0.5%Vo,set	0.8%Vo,set	
Output Current	0 A	-	3 A	
Current Limit Threshold	4.2 A	-	11 A	
Short Circuit Surge Transient	-	0.1 A^2s	-	
Ripple and Noise (pk-pk) Vo=5.0 V Vo=3.3 V Vo=0.75 V	 - - -	 80 mV 55 mV 25 mV	 120 mV 80 mV 45 mV	Tested with 0-20 MHz, with 10 uF/10 V tantalum capacitor and 1uF/10 V ceramic capacitor at the output
Ripple and Noise (rms) Vo=5.0 V Vo=3.3 V Vo=0.75 V	 - - -	 25 mV 15 mV 5 mV	 45 mV 25 mV 10 mV	
Turn on Time	-	5 mS	8 mS	
Overshoot at Turn on	-	0%	3%	
Output Capacitance	0 uF	-	1200 uF	
Transient Response				
50% ~ 100% Max Load	-	200 mV	300 mV	di/dt=2.5 A/uS; Vin=12 V; and with 10 uF/10 V tantalum capacitor and 1uF/10 V ceramic capacitor at the output
Settling Time	-	50 uS	80 uS	
100% ~ 50% Max Load	-	200 mV	300 mV	
Settling Time	-	50 uS	80 uS	

(All)

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency Vo=5.0 V Vo=3.3 V Vo=0.75 V	 89% 86% 73%	 93% 90% 77%	 - - -	Measured at Vin=12 V, full load (Current Source)
Switching Frequency	-	300 kHz	-	
Over Temperature Shutdown	-	135 °C	-	
MTBF	8,791,825 hours			Calculated Per Bell Core SR-332 (Io = Nominal; Ta = 25 °C)
Dimensions (Vertical Mount) Inches (L × W × H) Millimeters (L × W × H)	 0.9 x 0.4 x 0.243 22.9 x 10.2 x 6.16			
Weight	-	2.5 g	-	

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

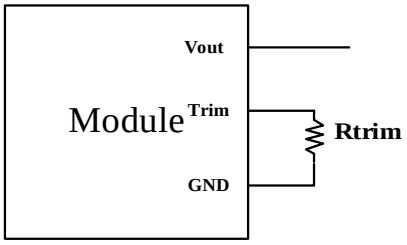
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.3 V	-	0.4 V	VRBA-03A1A0; 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	VRBA-03A1AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5 V	-	14 V	
Output Voltage Trim Range (Wide Trim)	0.7525 V	-	5.0 V	

Output Trim Equations

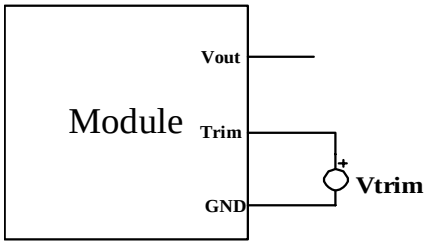
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

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

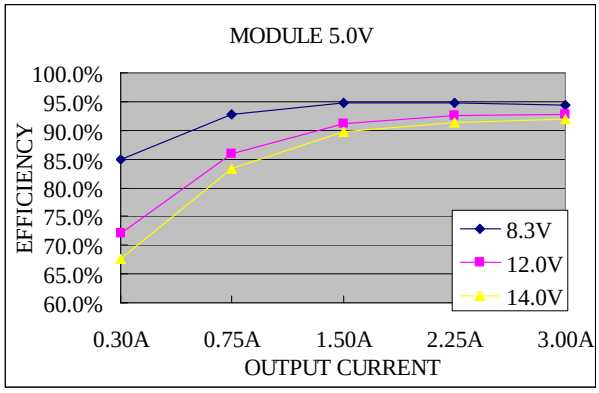


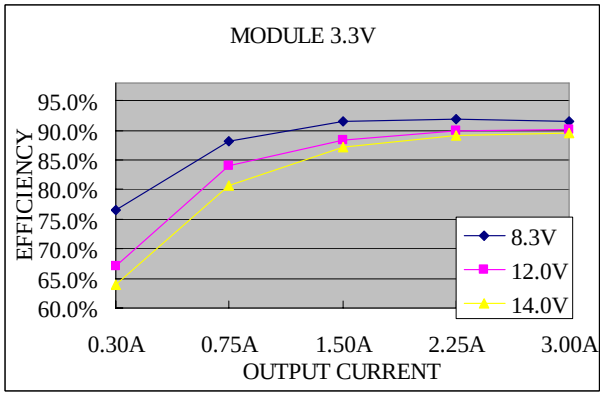
Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

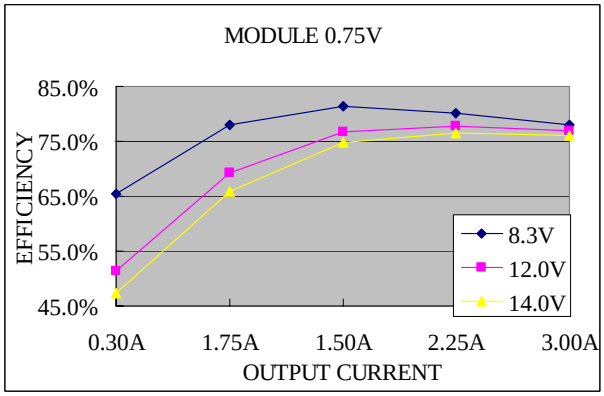
$$V_{trim} = 0.7 - 0.0667 \times (V_{adj} - 0.7525)$$



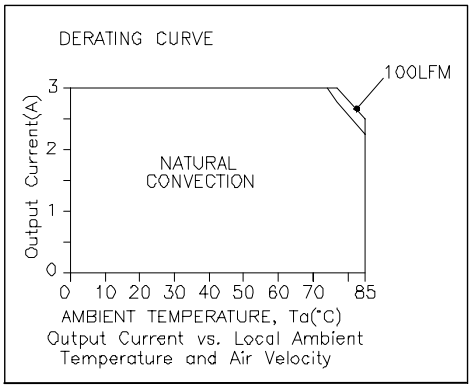
Efficiency Data



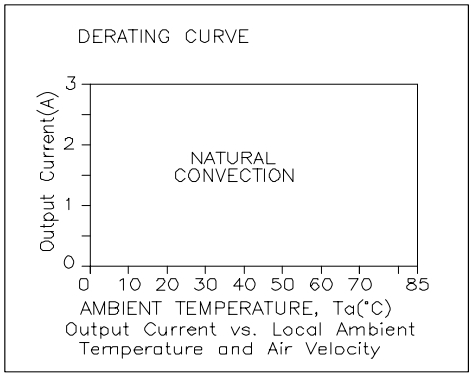




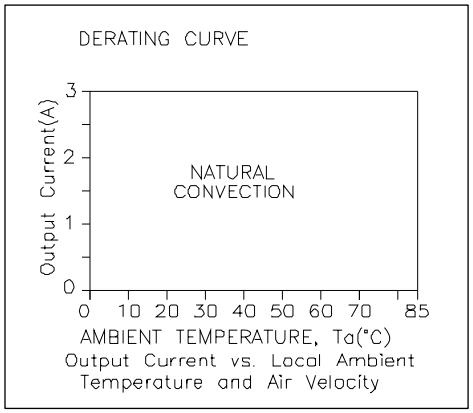
Thermal Derating Curves



Vin=12 V, Vo=5.0 V



Vin=12 V, Vo=3.3 V



Vin=12 V, Vo=0.75 V

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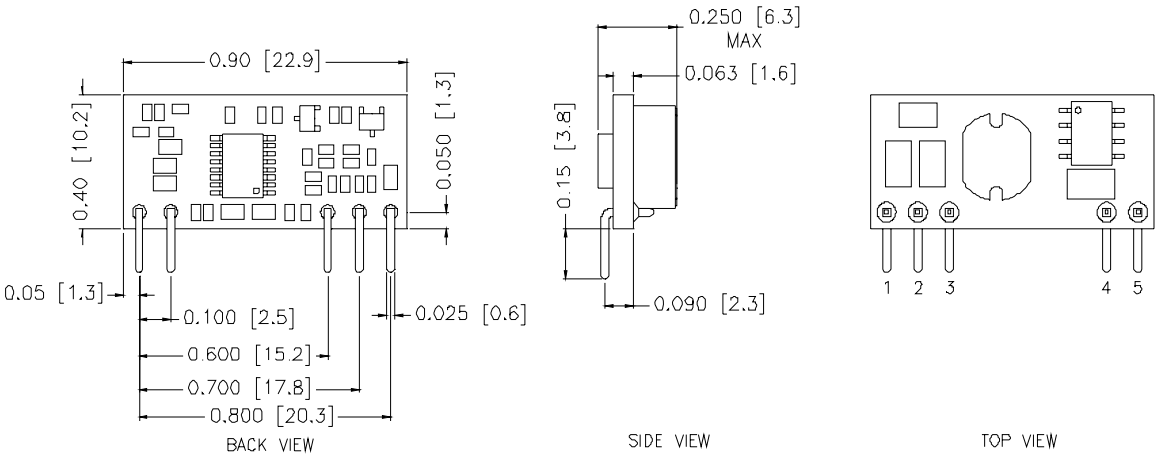
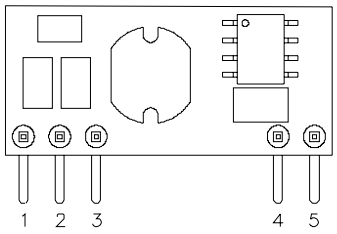
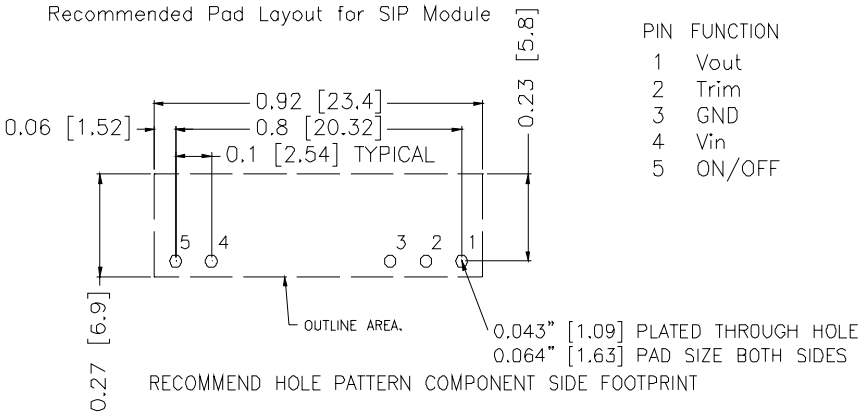
Mechanical Outline







PIN	FUNCTION
1	Vout
2	Trim
3	GND
4	Vin
5	ON/OFF

Pin Connections

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

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