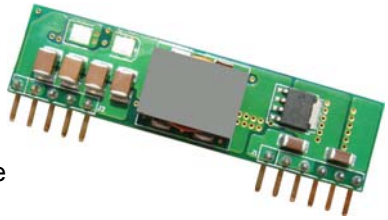
NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input 0.75 Vdc - 3.63 Vdc/16 A Output

VRBC-16E2Ax RoHS Compliant Rev.A

- Non-Isolated
- High Efficiency
- Fixed Frequency
- Low Cost
- Wide Trim
- Flexible Output Voltage Sequencing (option)
- Wide Input
- Under-Voltage Lockout (UVLO)
- Over Temperature ShutDown
- OCP/SCP
- Remote Sense
- Remote On/Off
- Industrial Temperature Range (option)
- Active Low/High (Option)



Description

The Bel VRBC-16E2Ax is part of the non-isolated dc/dc converter series. The modules use a SIP package. These converters are available in a range of output voltages from 0.75 Vdc to 3.63 Vdc over a wide range of input voltage (Vin = 4.5 Vdc -14 Vdc). The Bel VRBC-16E2Ax has a sequencing feature that enables designers to implement various types of output voltage sequencing when powering. The efficiency is typically 93.5% at 3.3 Vdc output and 5 Vdc input at full load.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active Low	Model Number Active High
0.75 V - 3.63 V	4.5 V - 14 V	16 A	58 W	93.5%	VRBC-16E2AL	VRBC-16E2A0

Notes: 1. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.
2. 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	
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. VRBC-16E2Ax 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 not using the sequencing feature, either, tie the SEQ pin to Vin or leave it unconnected.

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage Vo,set < 3.0 Vo,set ≥ 3.0	 4.5 V Vo,set+1.5 V	 - -	 14 V 14 V	
Input Current (full load)	-	-	15 A	
Input Current (no load)	-	100 mA	-	
Remote Off Input Current	-	2 mA	-	
Input Reflected Ripple Current (pk-pk)	-	-	400 mA	Tested with one 1000 uF/25 V AL input capacitor with ESR=0.03 ohm max and 6 × 47uF/16 V tan capacitors with ESR=0.013 ohm max at 100 kHz, & simulated source impedance of 1000 nH, 5 Hz to 20 MHz.
Input Reflected Ripple Current (rms)	-	-	150 mA	
I^2t Inrush Current Transient	-	0.2 A^2s	0.4 A^2s	
Turn-on Voltage Threshold	-	4.3 V	-	
Turn-off Voltage Threshold	3.7 V	-	4.2 V	

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point	-2% Vo,set	-	2% Vo,set	Vin=12 V, full load
Load Regulation	-	0.2% Vo,set	-	Io=Iomin to Iomax
Line Regulation	-	0.3% Vo,set	-	Vin=Vinmin to Vinmax
Regulation Over Temperature (-40°C to +85°C)	-	0.3% Vo,set	-	Tref=Tamin to Tamax
Output Current	0 A	-	16 A	
Current Limit Threshold	-	180% Io,out	-	
Short Circuit Surge Transient	-	1 A^2s	3 A^2s	
Ripple and Noise (pk-pk)	-	30 mV	80 mV	Tested with 0-20 MHz, 10 uF Tantalum capacitor &1 uF TDK ceramic capacitor at the output
Ripple and Noise (rms)	-	12 mV	35 mV	
Turn on Time	-	8 mS	20 mS	
Overshoot at Turn on	-	-	1% Vo,set	
Output Capacitance	0 uF	-	5600 uF	
Transient Response				
50% ~ 100% Max Load	All	-	100 mV	-	di/dt=2.5 A/uS; Vin=12 V; and Cext=0 uF.
Settling Time	All	-	80 uS	-	
100% ~ 50% Max Load	All	-	100 mV	-	
Settling Time	All	-	80 uS	-	

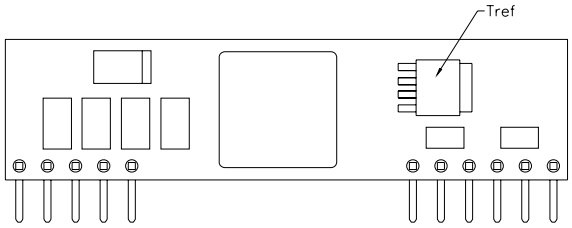
Note: All specifications are typical at nominal input, full load at 25 °C unless otherwise stated.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency Vo=3.3 V Vo=2.5 V Vo=1.8 V Vo=1.5 V Vo=1.2 V Vo=0.75 V	 - - - - - -	 91.7% 90.4% 87.5% 86% 85% 79%	 - - - - - -	Measured at Vin=12 V, full load
Efficiency Vo=3.3 V Vo=2.5 V Vo=1.8 V Vo=1.5 V Vo=1.2 V Vo=0.75 V	 - - - - - -	 93.5% 91.5% 88.4% 87% 86% 80%	 - - - - - -	Measured at Vin=5 V, full load
Switching Frequency	250 kHz	280 kHz	310 kHz	
Over Temperature Shutdown[1]	-	130 °C	-	
Output Trim Range (Wide Trim)	0.7525 V	-	3.63 V	
Remote Sense Compensation	-	-	0.5 V	
MTBF	4,619,490 hours			Calculated Per Bell Core SR-332 (I_O = 80% Io,max; Vin=12 V; Vo=3.3 V; T_a = 25 °C)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 2.0x 0.5 x 0.32 50.8 x 12.7 x 8.13			
Weight	-	7.1 g	-	

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

1. The Tref temperature measurement location:



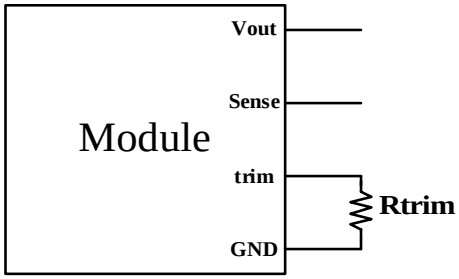
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.2 V	-	0.3 V	VRBC-16E2A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	-	-	Vin, max	
Signal Low (Unit On)	-0.2 V	-	0.3 V	VRBC-16E2AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5 V	-	Vin, max	
Voltage Sequencing				
Sequencing Delay Time	25 mS	-	-	Delay from Vinmin to application of voltage on SEQ pin
Sequencing Slew Rate Capability	-	-	2 V/mS	Vinmin to Vinmax; Iomin to Iomax; Vseq<Vo
Tracking Accuracy Power-Up Power-Down	 - -	 100 mV 200 mV	 200 mV 400 mV	

Output Trim Equations

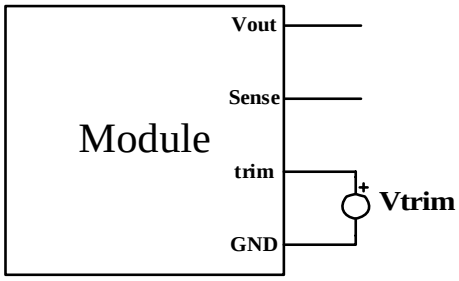
Equation for calculating the trim resistor (in Ω) given the desired output voltage (Vo) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trim} = \frac{10500}{Vo - 0.7525} - 1000$$

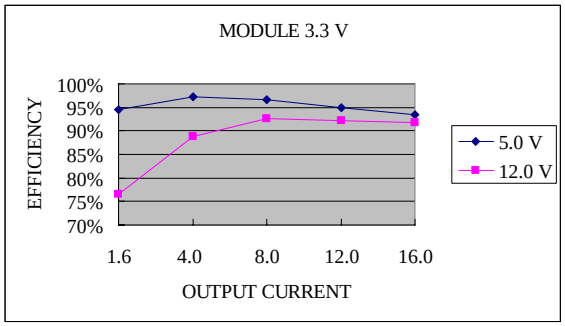


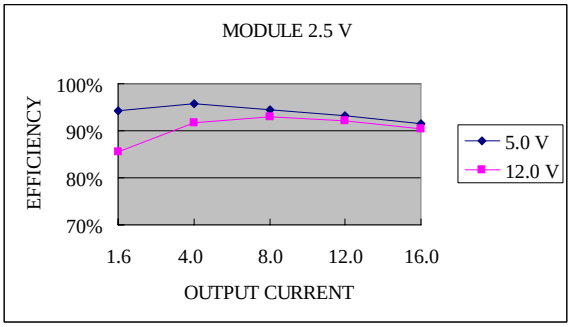
Equation for calculating the trim voltage (in V) given the desired output voltage (Vo) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

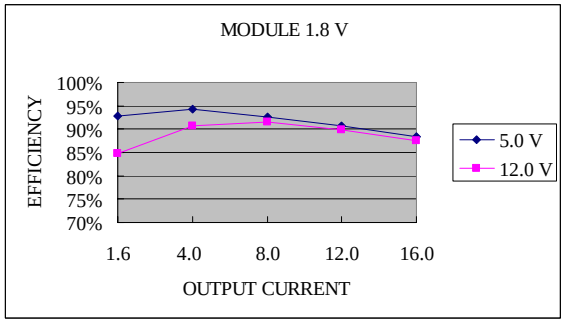
$$V_{trim} = 0.7 - 0.0667 \times (Vo - 0.7525)$$

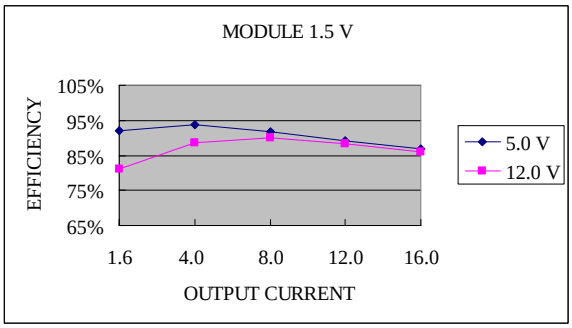


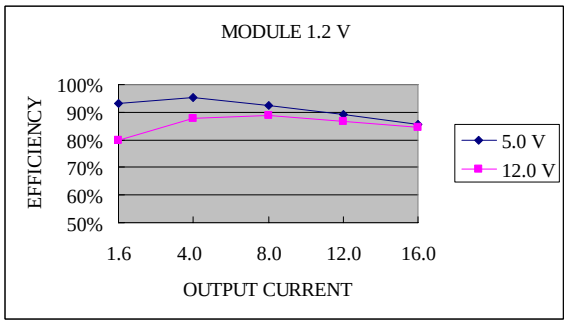
Efficiency Data

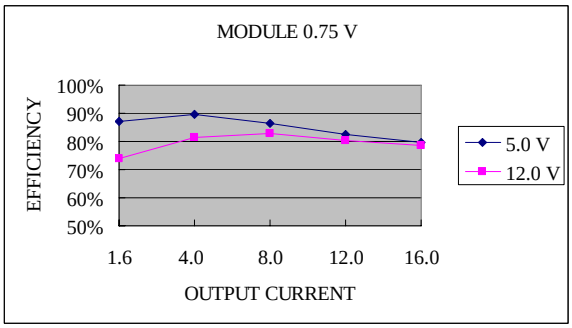




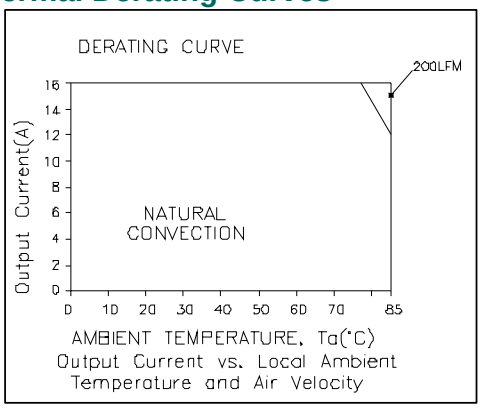




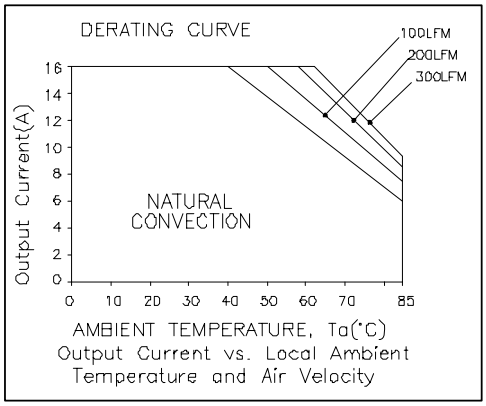




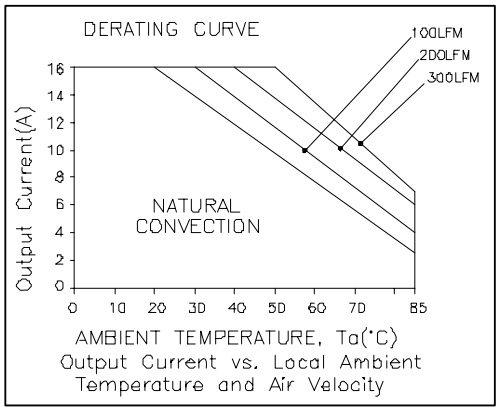
Thermal Derating Curves



Vo=0.75 V; Vin=12.0 V

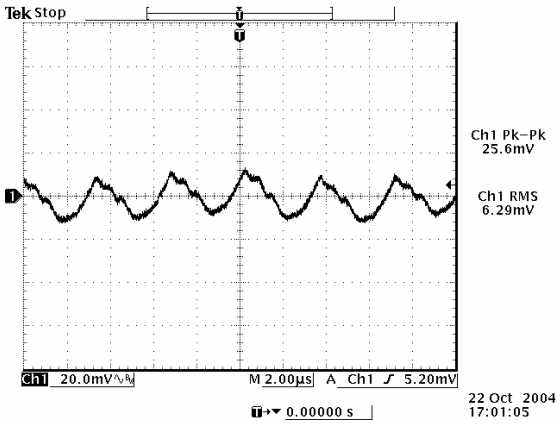


Vo=1.8 V; Vin=12.0 V

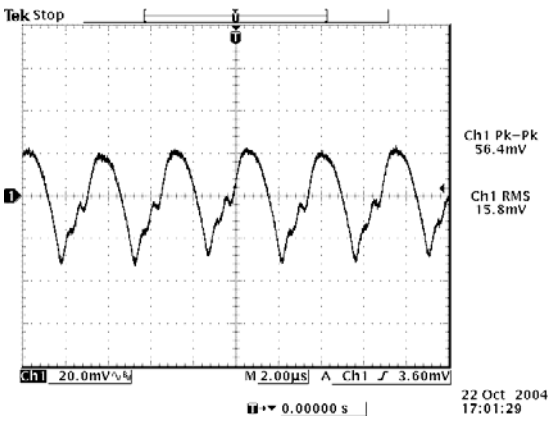


Vo=3.3 V; Vin=12.0 V

Ripple and Noise Waveforms



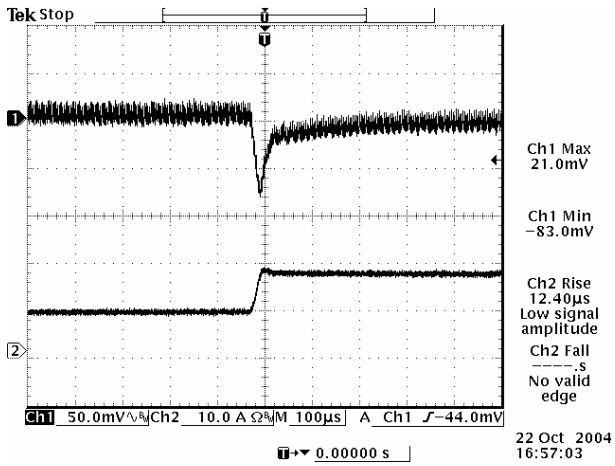
Vin=5.0 V, Vo=3.3 V



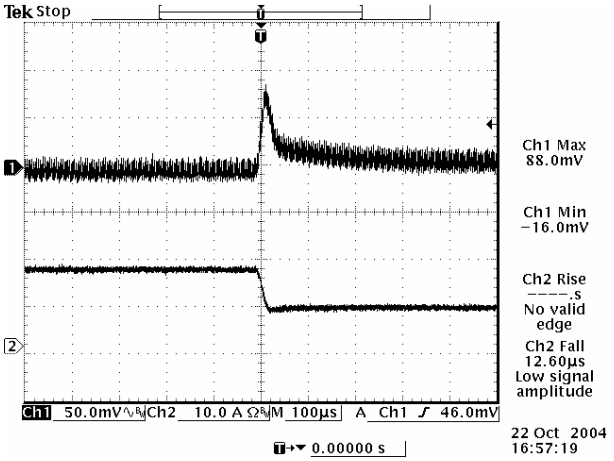
Vin=12 V, Vo=3.3 V

Note: External load with 10 uF tantalum capacitor and 1 uF ceramic at the output, full load, Ta=25 deg C.

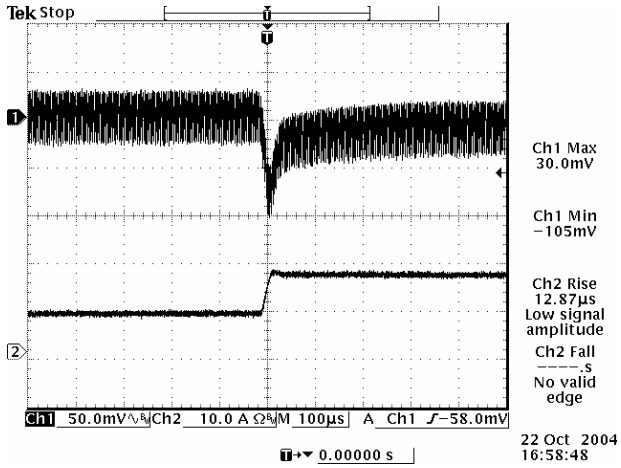
Transient Response Waveforms



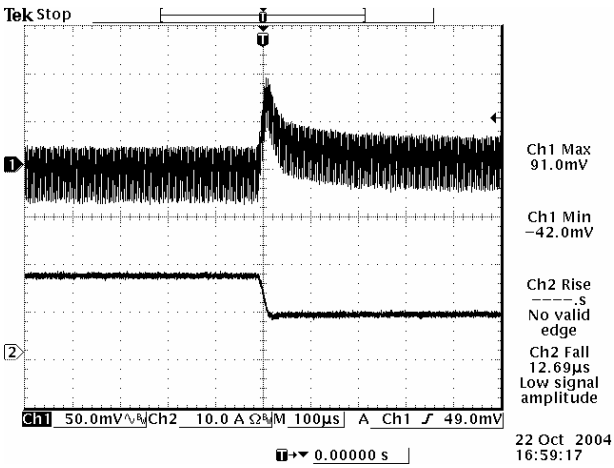
50% to 100% load Transient at Vin=5 V, Vo=3.3 V



100% to 50% load Transient at Vin=5 V, Vo=3.3 V



50% to 100% load Transient at Vin=12 V, Vo=3.3 V



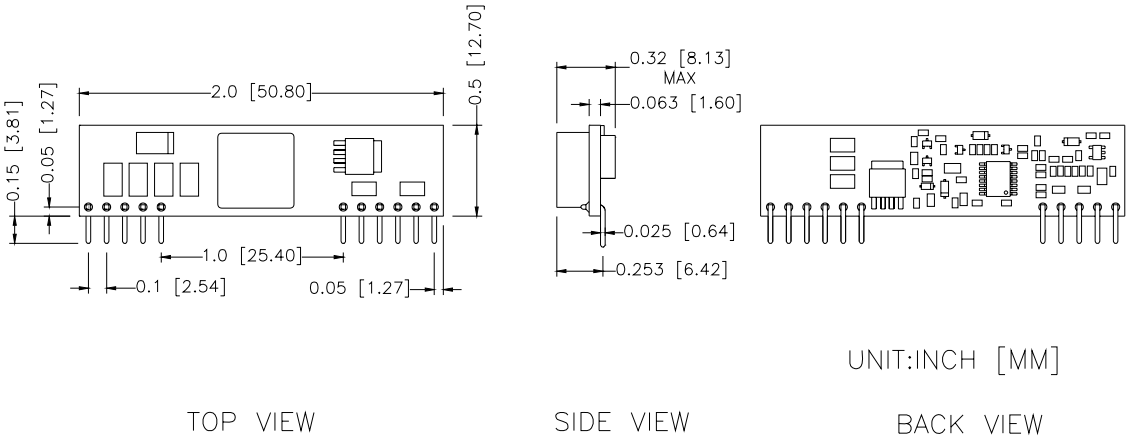
100% to 50% load Transient at Vin=12 V, Vo=3.3 V

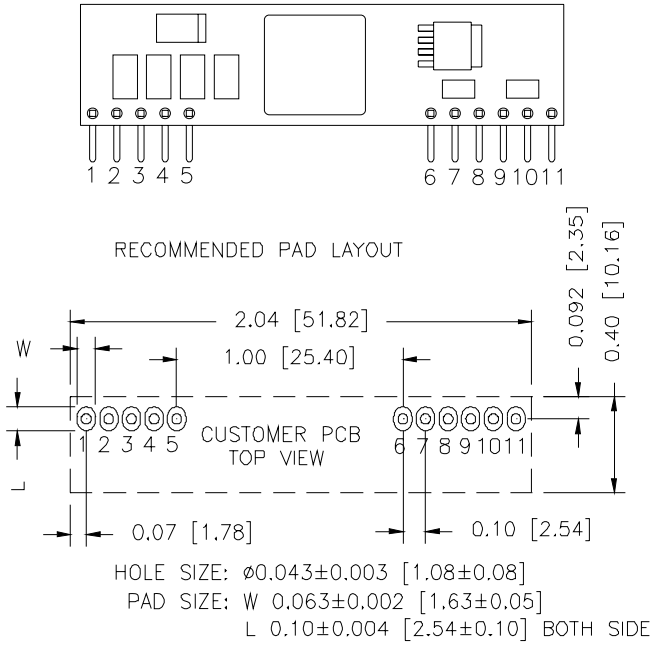
Note: External load capacitor Cext=0 uF, and Ta=25 deg C.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input 0.75 Vdc - 3.63 Vdc/16 A Output

Mechanical Outline





Pin Connections

Pin	Function
1	Vo
2	Vo
3	Remote Sense
4	Vo
5	Ground
6	Ground
7	Vin
8	Vin
9	SEQ
10	Trim
11	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

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