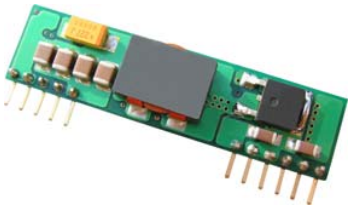
NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input **0.75 Vdc - 3.63 Vdc/10 A Output**

VRBC-10E2Ax **RoHS Compliant** **Rev.A**

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Flexible Output Voltage Sequencing (Option)
- Remote Sense
- Wide Input
- Wide Trim
- OCP/SCP
- Remote On/Off
- Active Low/High (Option)
- Over Temperature Protection
- Under-voltage Lockout (UVLO)
- Industrial Temperature Range



Description

The Bel VRBC-10E2Ax is part of the non-isolate dc/dc power 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-10E2Ax has a sequencing feature that enables designers to implement various types of output voltage sequencing when powering. The efficiency is typically 94.3% at 3.3 V output at 5.0 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	10 A	36.3 W	94.3%	VRBC-10E2AL	VRBC-10E2A0

Notes: 1. Add “G” suffix at the end of the model number to indicate 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	-	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-10E2Ax 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 V Vo,set ≥ 3.0 V	 4.5 V Vo,set+1.5 V	 - -	 14 V 14 V	
Input Current (full load)	-	-	8.6 A	An input line fuse must always be used.
Input Current (no load)	-	40 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 4 × 47 uF/16 V Tantalum 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	-	4.0 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=5 V & 12 V, full load
Load Regulation	-	0.1% Vo,set	-	
Line Regulation	-	0.1% Vo,set	-	
Regulation Over Temperature (-40°C to +85°C)	-	0.3Vo,set	-	Tref=Tamin to Tamax
Output Current	0 A	-	10 A	
Current Limit Threshold	-	200% Iout	-	
Short Circuit Surge Transient	-	1 A^2s	3 A^2s	
Ripple and Noise (pk-pk)	-	30 mV	80 mV	Tested with 0-20 MHz, with 10 uF tantalum capacitor & 1 uF ceramic capacitor at the output
Ripple and Noise (rms)	-	12 mV	35 mV	
Turn on Time	-	8 mS	20 mS	
Overshoot at Turn on	-	0%	1%	
Output Capacitance	0 uF	-	5600 uF	
Transient Response				
50% ~ 100% Max Load	Vo = 0.75 V - 3.63 V	-	160 mV	-	di/dt=2.5 A/uS; Vin=5 V & 12 V; and with 470 uF Tantalum capacitor at the output
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	160 mV	-	
Settling Time		-	50 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	-	94.3%	-	Measured at Vin=5 V, full load
Vo=2.5 V	-	93%	-	
Vo=1.8 V	-	91.5%	-	
Vo=1.5 V	-	90.8%	-	
Vo=1.2 V	-	89.3%	-	
Vo=0.75 V	-	83%	-	
Efficiency				
Vo=3.3 V	-	93%	-	Measured at Vin=12 V, full load
Vo=2.5 V	-	92%	-	
Vo=1.8 V	-	90%	-	
Vo=1.5 V	-	89%	-	
Vo=1.2 V	-	87.5%	-	
Vo=0.75 V	-	81%	-	
Switching Frequency	265 kHz	300 kHz	335 kHz	
Over Temperature Shutdown	-	130°C	-	
Output Voltage Trim Range	0.7525 V	-	3.63 V	
Remote Sense Compensation	-	-	0.5 V	
MTBF	5,114,191 hours			Calculated Per Bell Core TR-332 (Io = 80%Iomax; Vo=3.3 V; Vin=12 V; Ta = 25 °C)
Dimensions				
Inches (L × W × H)	2.0 x 0.5 x 0.32			
Millimeters (L × W × H)	50.8 x 12.7 x 8.13			
Weight	-	7.1 g	-	

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

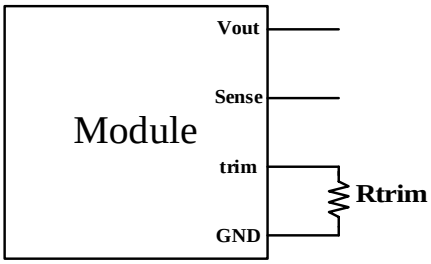
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.2 V	-	0.3 V	VRBC-10E2A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	-	-	Vin, max	
Signal Low (Unit On)	-0.2 V	-	0.3 V	VRBC-10E2AL; 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	-	100 mV	200 mV	
Power-Down	-	300 mV	500 mV	

Output Trim Equations

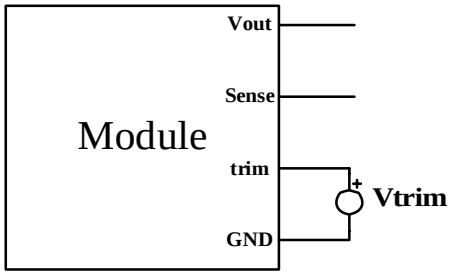
Equation for calculating the trim resistor (in Ω) given the desired output voltage (Vo) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

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

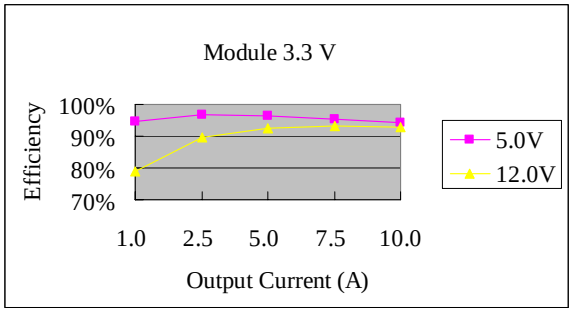


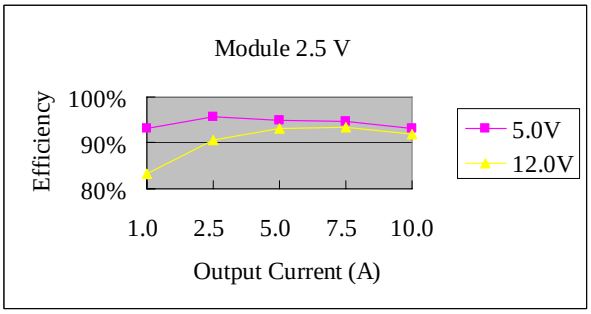
Equation for calculating the trim voltage (in V) given the desired output voltage (Vo) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

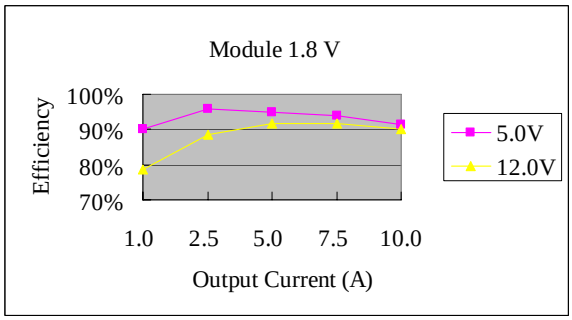
$$V_{trim} = 0.7 - 0.0667 \times (Vo - 0.7525)$$

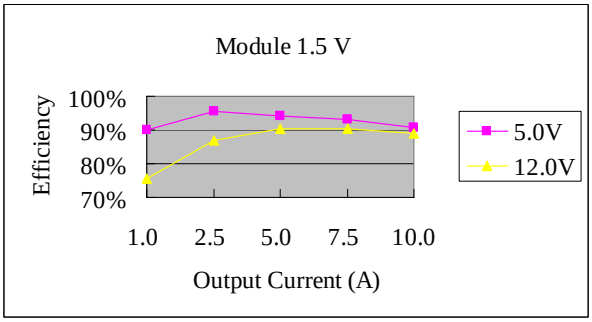


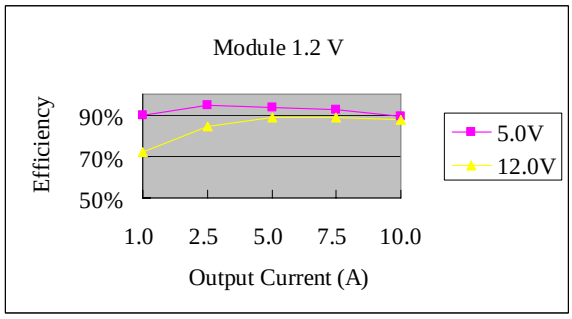
Efficiency Data

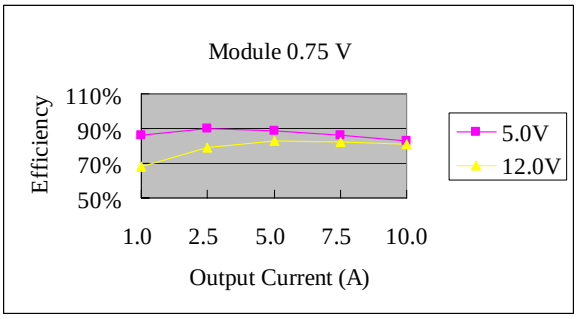




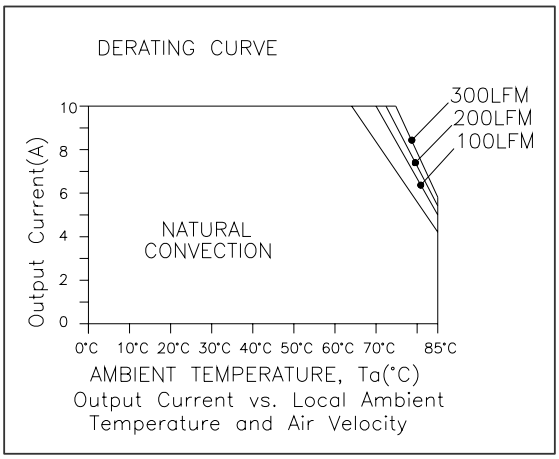




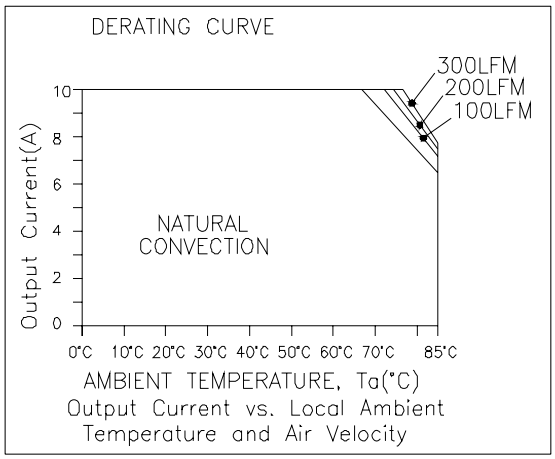




Thermal Derating Curves

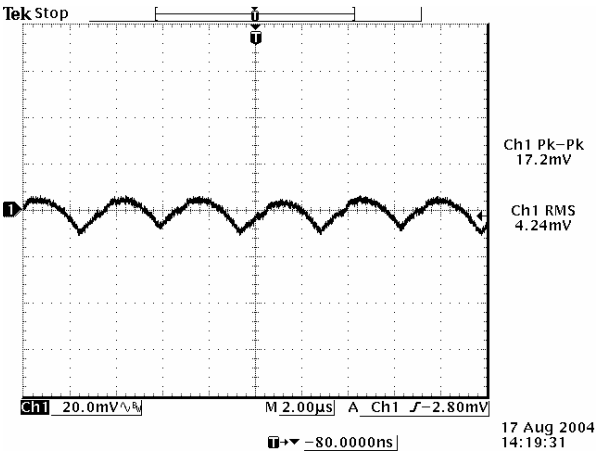


Vin=12 V, Vo = 3.3 V

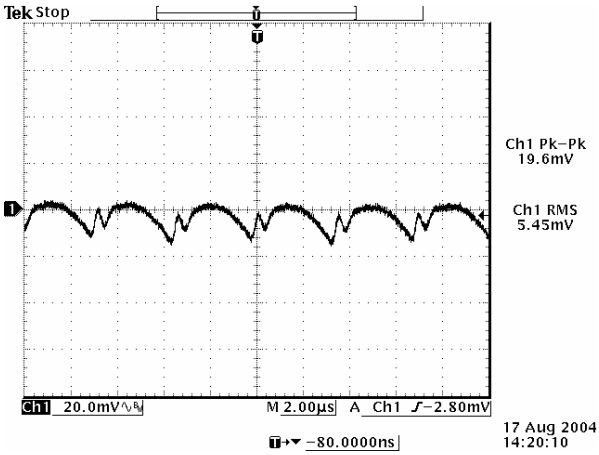


Vin=5 V, Vo = 3.3 V

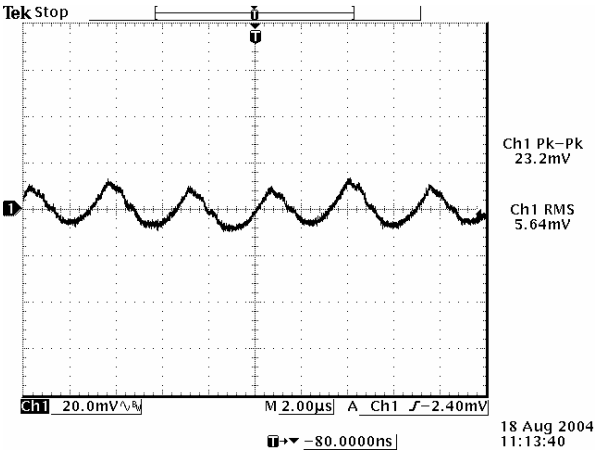
Ripple and Noise Waveforms



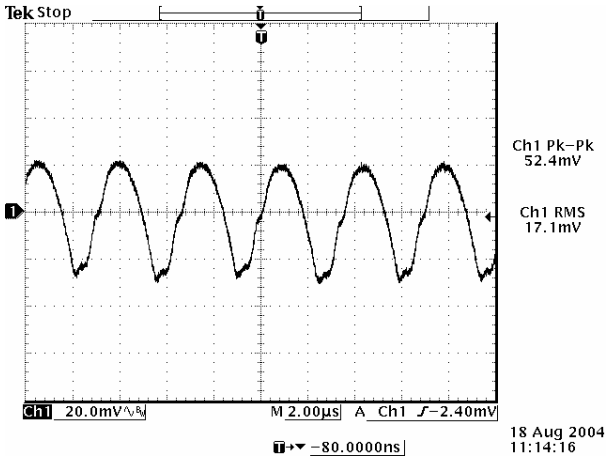
Vin=5 V, Vo=0.75 V



Vin=12 V, Vo=0.75 V



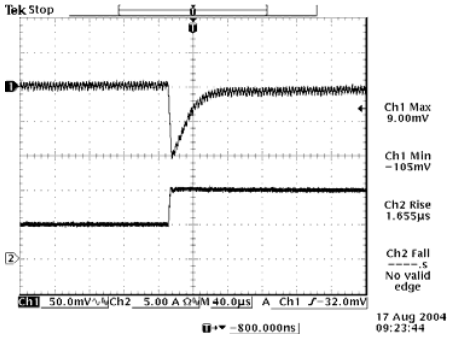
Vin=5 V, Vo=3.3 V



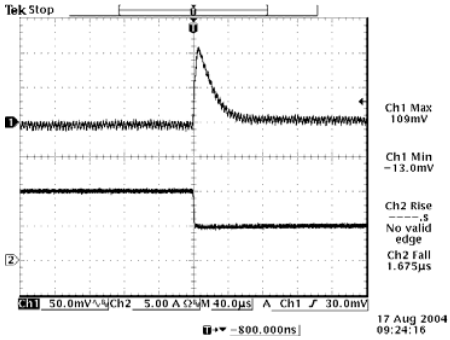
Vin=12 V, Vo=3.3 V

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

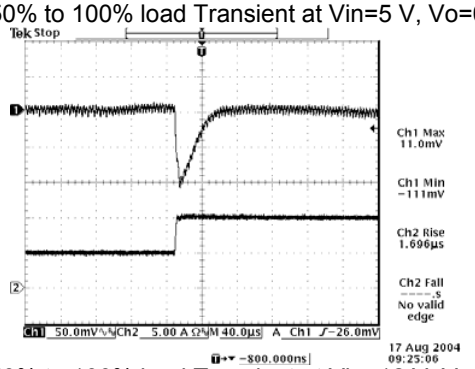
Transient Response Waveforms



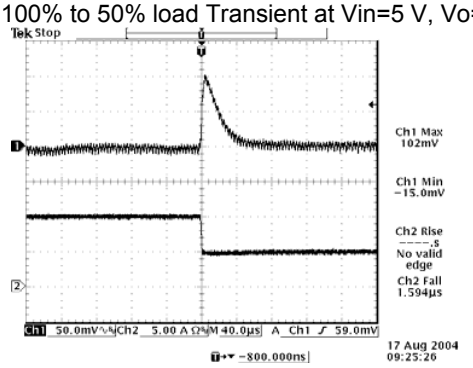
50% to 100% load Transient at Vin=5 V, Vo=0.75 V



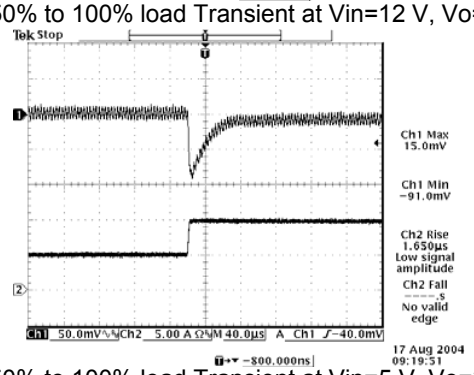
100% to 50% load Transient at Vin=5 V, Vo=0.75 V



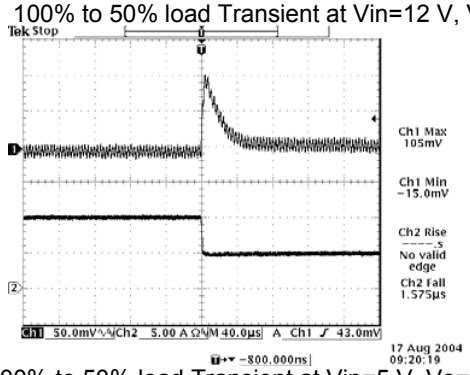
50% to 100% load Transient at Vin=12 V, Vo=0.75 V



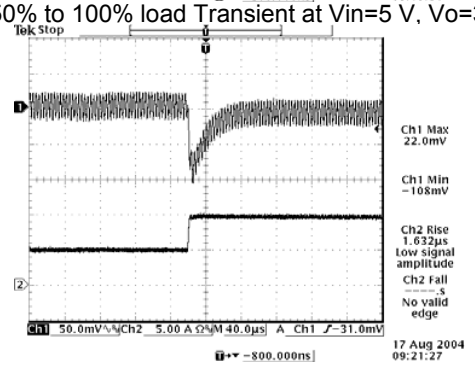
100% to 50% load Transient at Vin=12 V, Vo=0.75 V



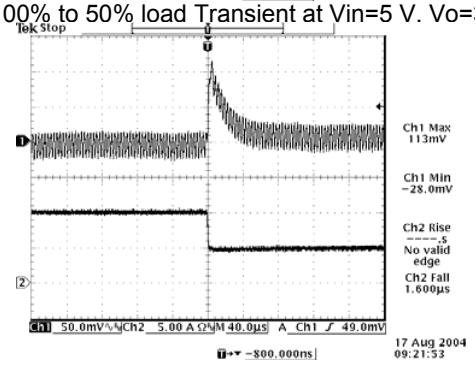
50% to 100% load Transient at Vin=5 V, Vo=3.3 V



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



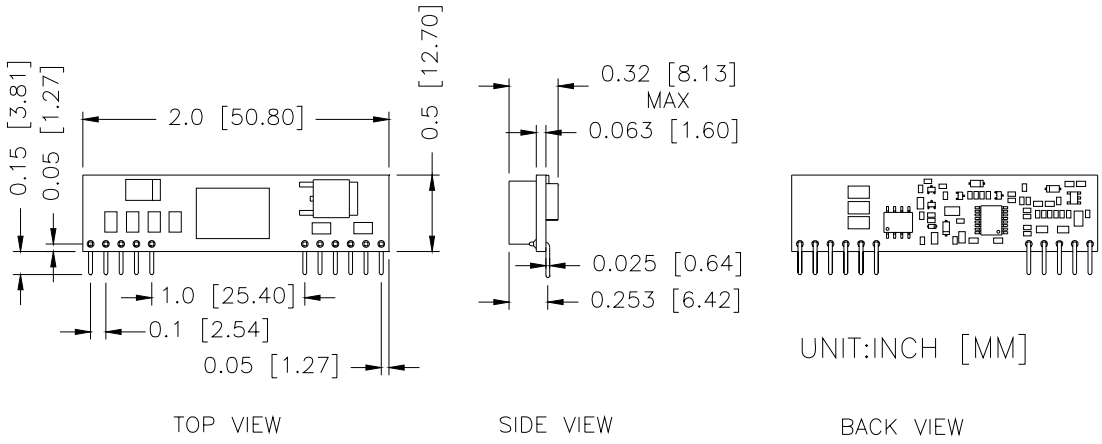
100% to 50% load Transient at Vin=12 V, Vo=3.3 V

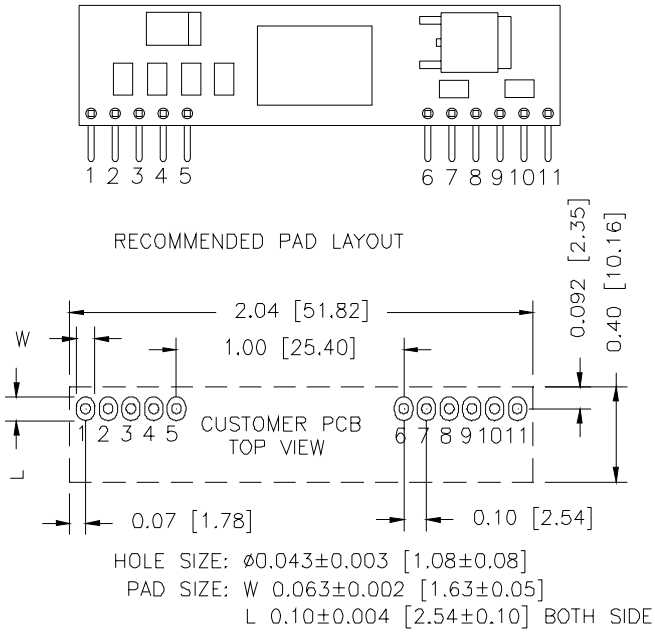
Note: Transient response at di/dt=2.5 A/uS, external load with 470 uF tantalum capacitor at the output.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input **0.75 Vdc - 3.63 Vdc/10 A Output**

Mechanical Outline





Pin Connections

Pin	Function
1	Vout
2	Vout
3	Remote Sense
4	Vout
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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