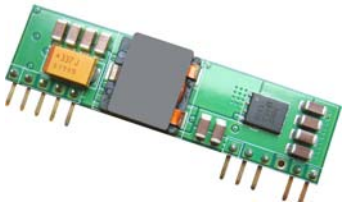
NON-ISOLATED DC/DC CONVERTERS

2.4 Vdc - 5.5 Vdc Input 0.75 Vdc - 3.63 Vdc/16A Output

VRBC-16F1Ax Series RoHS Compliant Rev.A

- Non-Isolated
- High Efficiency
- High Power Density
- OCP/SCP
- Fixed Frequency (300 kHz)
- Converter can Sink and Source Current
- Under-Voltage Lockout (UVLO)
- Over Temperature Protection
- Remote Sense
- Wide Input
- Wide Trim Range
- Remote On/Off
- Active Low/High (Option)



Description

The Bel VRBC-16F1Ax modules are a series of non-isolated dc/dc converters that can deliver up to 16 A of output current with full load efficiency of 94% at 3.3 Vdc output. These modules provide precisely regulated voltage programmable via external resistor from 0.75 Vdc to 3.63 Vdc over a wide range of input voltage (2.4 Vdc - 5.5 Vdc). 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 Active Low	Model Number Active High	Model Number Active Low
0.75 V-3.63 V[1]	2.4 V-5.5 V	16 A	58.1 W	94%	VRBC-16F1AL	VRBC-16F1A0	VRBC-16F1AW[2]

Notes: 1. These modules use a buck topology, so the output voltages must be 0.8 V less than the input voltage.
2. Change the last character “L” to “C” to indicate 0.20’’ pin length.
3. “W” indicates special coating.
4. Add “G” to the end of the Model Number to indicate Tray Packaging.
5. 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	-	5.8 V	
Output Enable Terminal Voltage	-0.3 V	-	5.8 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				
Vo≤1.5 V	2.4 V	-	5.5 V	
Vo=1.8 - 2.5 V	3.0 V	-	5.5 V	
Vo=3.3 V	4.5 V	-	5.5 V	
Input Current (full load)				
Vo=3.3 V	-	11.23 A	12.89 A	
Vo=1.8 V	-	6.47 A	13.55 A	
Vo=0.75 V	-	3.08 A	6.67 A	

Input Specifications (continued)

Parameter	Min	Typ	Max	Notes
Input Current (no load)	-	80 mA	-	
Remote Off Input Current	-	10 mA	22 mA	
Input Reflected Ripple Current (pk-pk)	-	100 mA	-	Tested with two 100 uF / 10 V tantalum input capacitors (P/N: TPSC107K010R0075 AVX) & simulated source impedance of 1 uH, 5 Hz to 20 MHz.
Input Reflected Ripple Current (rms)	-	40 mA	-	
I^2t Inrush Current Transient	-	0.15 A^2s	0.3 A^2s	
Turn-on Voltage Threshold	-	2.2 V	-	
Turn-off Voltage Threshold	-	2.0 V	-	

Note: All specifications are typical 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, Io=Iomax full load
Output Voltage Set Point		-3% Vo,set	-	3% Vo,set	Over all operating input voltages, resistive loads and temperature conditions
Load Regulation		-	0.4% Vo,set	-	Io=Io, min to Io, max
Line Regulation		-	0.3% 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	-	16 A	
Current Limit Threshold		19 A	-	35 A	
Short Circuit Surge Transient		-	1.6 A^2s	2 A^2s	
Ripple and Noise (pk-pk)		-	25 mV	50 mV	Tested with 0-20 MHz, 10 uF / 16 V tantalum capacitor & 1 uF / 10 V TDK ceramic capacitor at the output
Ripple and Noise (rms)		-	8 mV	15 mV	
Turn on Time		-	4 mS	8 mS	
Overshoot at Turn on		-	0% Vo,set	3% Vo,set	
Output Capacitance ESR ≥ 1 mohm ESR ≥ 10 mohm		 0 uF 0 uF	 - -	 1000 uF 5000 uF	
Transient Response					
50% ~ 100% Max Load	Vo=0.75 V - 3.3 V	-	300 mV	-	di/dt=2.5 A/uS; Vin=5 V; and with 10 uF / 16 V tantalum capacitor & 1 uF / 10 V ceramic capacitor at the output
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	300 mV	-	
Settling Time		-	50 uS	-	
Transient Response					
50% ~ 100% Max Load	Vo=0.75 V - 3.3 V	-	150 mV	-	di/dt=2.5 A/uS; Vin=5 V; and with two 150 uF / 10 V tantalum capacitors & 1 uF / 10 V ceramic capacitor at the output
Settling Time		-	100 uS	-	
100% ~ 50% Max Load		-	150 mV	-	
Settling Time		-	100 uS	-	

Note: All specifications are typical at nominal input (Vin = 5 V), full load at 25 °C unless otherwise stated.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency Vo=3.3 V Vo=1.8 V Vo=0.75 V	 91% 86% 75%	 94% 89% 78%	 - - -	Measured at Vin=5 V, full load
Switching Frequency	250 KHz	300 KHz	350 KHz	
Over Temperature Shutdown	-	125°C	-	
Output Trim Range (Wide Trim)	0.7525 V	-	3.63 V	Total adjustment of trim, setpoint and remote sense combined should not exceed 3.63 V. Vo=0.7525 V when trim pin open
Remote Sense Compensation	-	-	5%	
MTBF	5,500,000 hours			Calculated Per Bell Core SR-332 (Io = Nominal; Ta = 25 °C)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 2.0 x 0.5 x 0.363 50.80 x 12.7 x 9.23			
Weight	-	8.3 g	-	

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

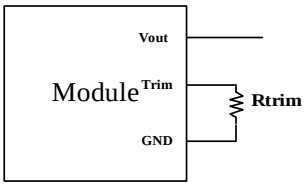
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.3 V	-	0.3 V	VRBC-16F1A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	1.5 V	-	5.8 V	
Signal Low (Unit On)	-0.3 V	-	0.3 V	VRBC-16F1AL & VRBC-16F1AW; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	1.5 V	-	5.8 V	

Output Trim Equations

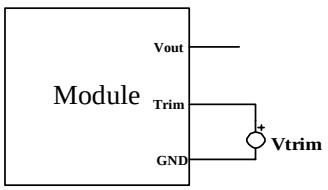
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trim} = \frac{21.07}{V_{adj} - 0.7525} - 5.11$$

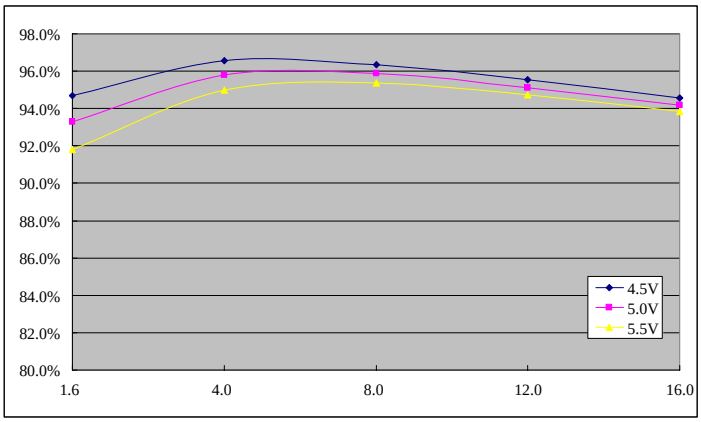


Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

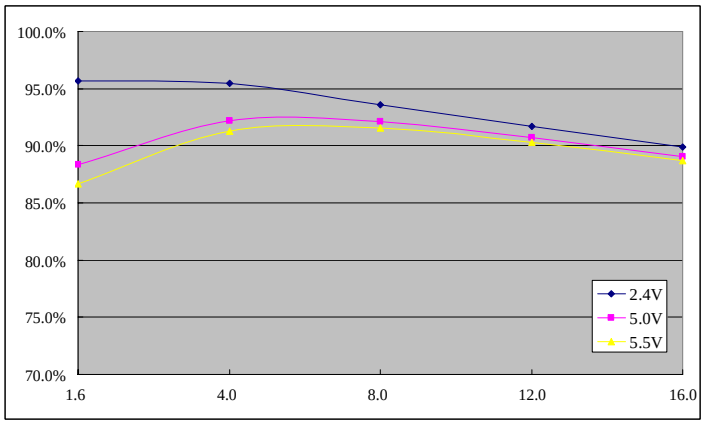
$$V_{trim} = 0.7 - 0.1698 \times (V_{adj} - 0.7525)$$



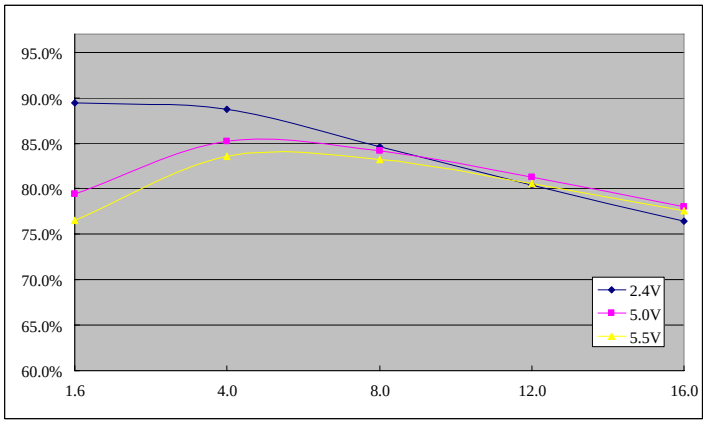
Efficiency Data



Vo=3.3 V

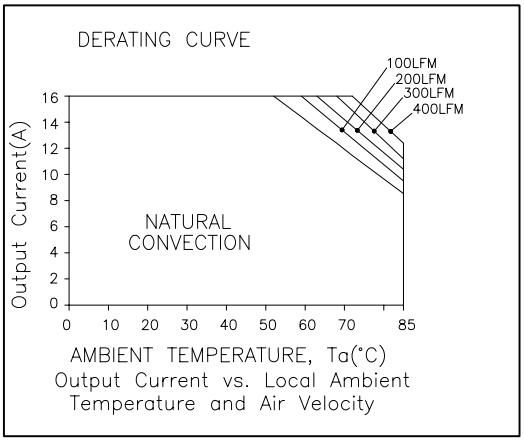


Vo=1.8 V

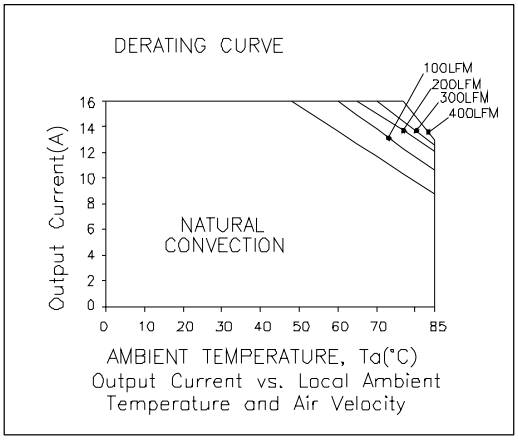


Vo=0.75 V

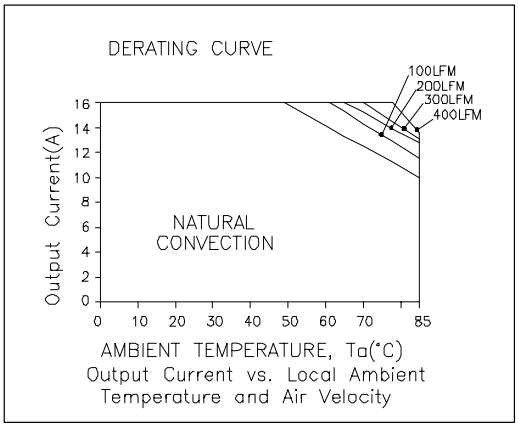
Thermal Derating Curves



Vo=3.3 V

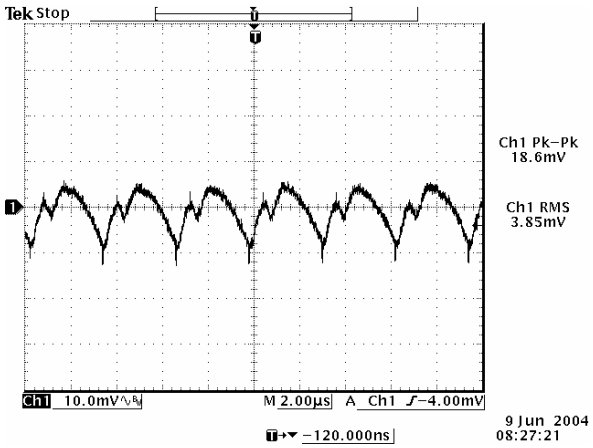


Vo=1.8 V

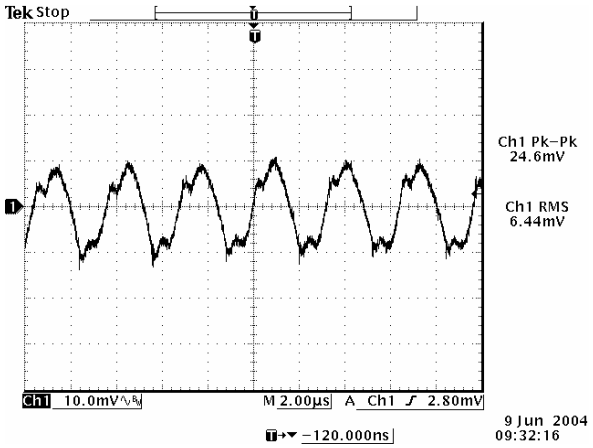


Vo=0.7525 V

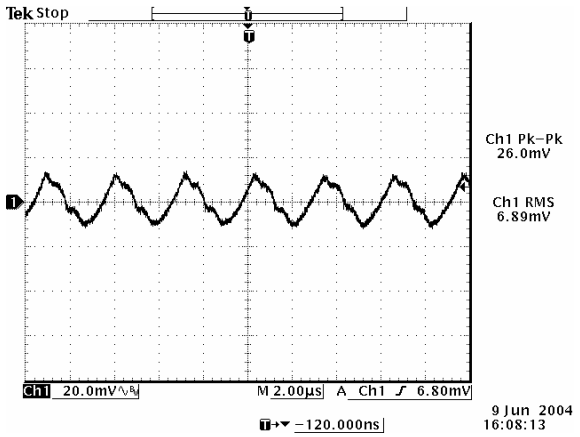
Ripple and Noise Waveforms



Vin=5.0 V, Vo=0.75 V



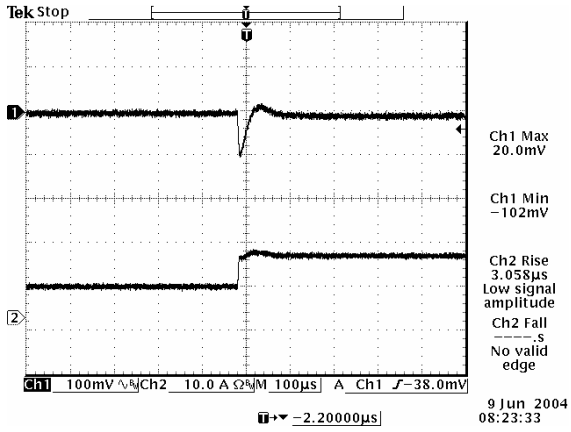
Vin=5.0 V, Vo=1.8 V



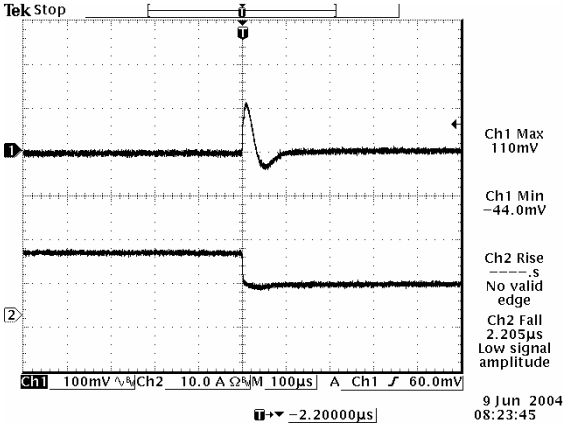
Vin=5.0 V, Vo=3.3 V

Note: Ripple and noise is tested at 0-20 MHz BW, 10 uF/16 V tantalum capacitor and 1uF/10 V ceramic capacitor, Ta=25 deg C.

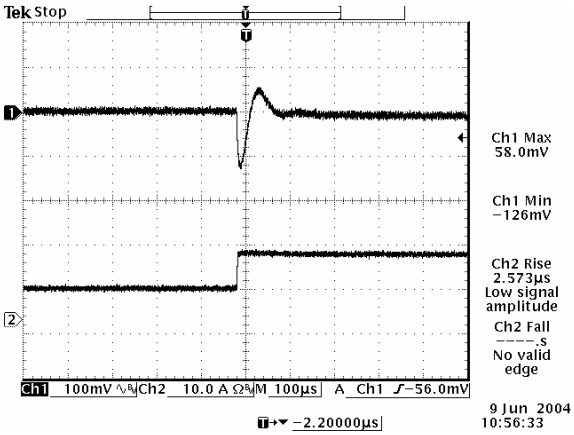
Transient Response Waveforms



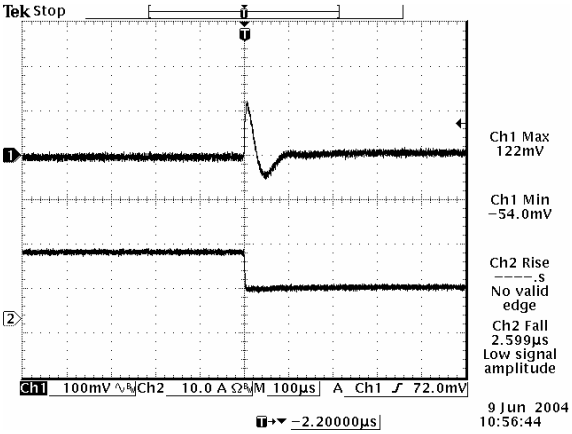
50% to 100% load step at Vin=5.0 V, Vo=0.75 V



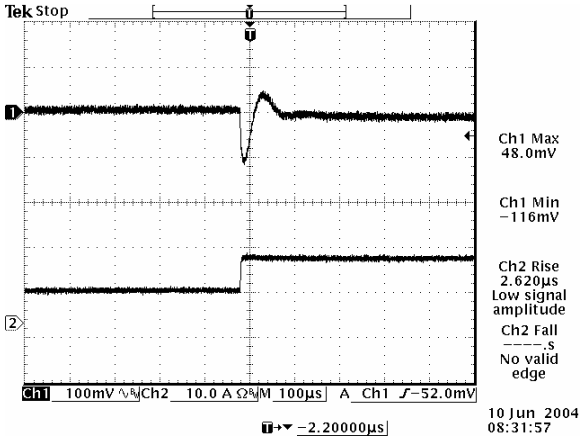
100% to 50% load step at Vin=5.0 V, Vo=0.75 V



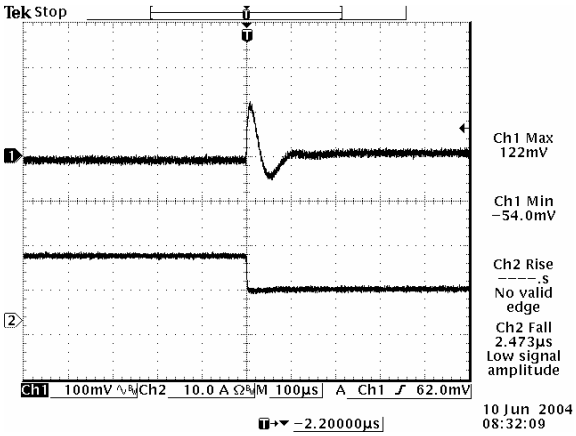
50% to 100% load step at Vin=5.0 V, Vo=1.8 V



100% to 50% load step at Vin=5.0 V, Vo=1.8 V



50% to 100% load step at Vin=5.0 V, Vo=3.3 V



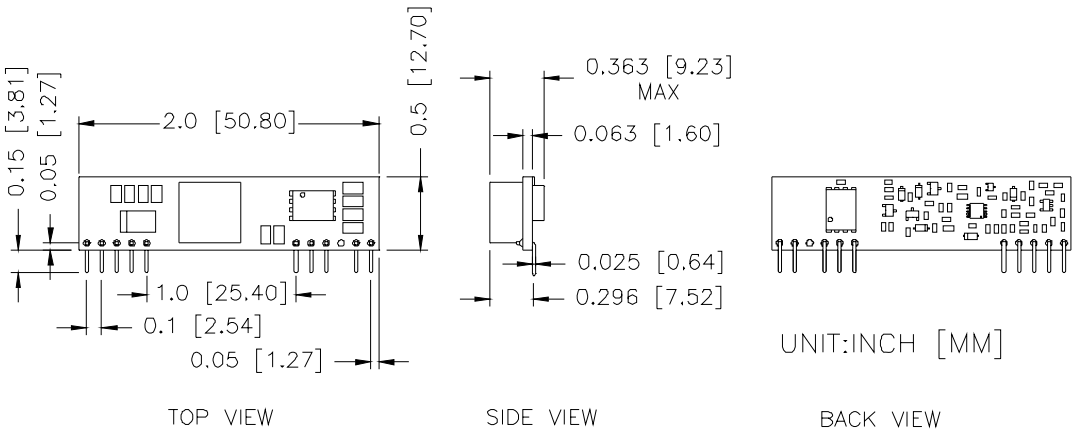
100% to 50% load step at Vin=5.0 V, Vo=3.3 V

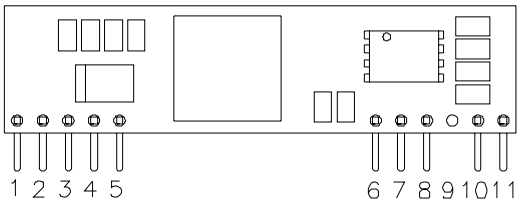
Note: Transient response is tested at di/dt=2.5 A/uS, with two 150 uF/10 V tantalum capacitor and 1 uF/10 V ceramic capacitor, Ta=25 deg C.

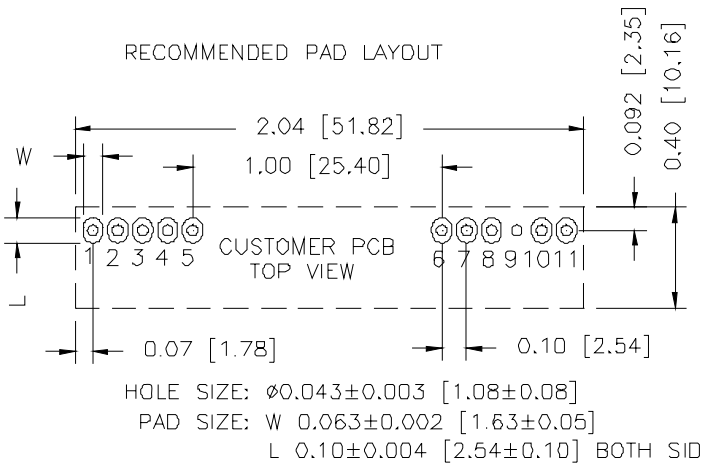
NON-ISOLATED DC/DC CONVERTERS

2.4 Vdc - 5.5 Vdc Input 0.75 Vdc - 3.63 Vdc/16A Output

Mechanical Outline







Pin Connections

Pin	Function
1	Vout
2	Vout
3	Vo,sense
4	Vout
5	Ground
6	Ground
7	Vin
8	Vin
9	N/A
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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