NON-ISOLATED DC/DC CONVERTERS

5.0 Vdc Input 1.2 Vdc - 3.3 Vdc/15 A Output

VRPF-15B1AC RoHS Compliant Rev.A

- Non-Isolated
- Fixed Frequency (300 kHz)
- Remote On/Off
- Low Cost
- Power Good Output Signal (open collector)
- Wide Trim Range
- Under-voltage Lockout (UVLO)
- OCP/SCP
- Converter Can Sink and Source Current

Description

The Bel VRPF-15B1AC is part of the low cost non-isolated dc/dc converter series. The modules use a SIP package for ease of layout and space savings. The output is closely regulated and can be trimmed from 1.2 Vdc to 3.3 Vdc. The efficiency is typically 93% at 3.3 Vdc output at full load. Typical features include remote on/off, under-voltage lockout, over-current protection and short circuit protection.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number
1.2 Vdc - 3.3 Vdc	5 Vdc	15 A	49.5 W	93%	VRPF-15B1AC

Notes: 1. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.
2. Add “0” suffix at the end of the model number to indicate “Tube Packaging”, and “G” for “Tray Packaging”.

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	7 V	
Output Enable Terminal Voltage	-0.3 V	-	7 V	
Ambient Temperature	0 °C	-	80 °C	
Storage Temperature	-40 °C	-	125 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	4.5 V	5 V	5.5 V	
Input Current (Source)				
Vo=3.3 V	-	11.7 A	12.5 A	
Vo=1.8 V	-	6.8 A	7.4 A	
Vo=1.2 V	-	4.8 A	5.2 A	
Input Current (Sink)				
Vo=3.3 V	-	-10 A	-7.8 A	
Vo=1.8 V	-	-5 A	-3.8 A	
Vo=1.2 V	-	-3 A	-2.3 A	
No Load Input Current	-	35 mA	-	
Remote Off Input Current	-	10 mA	22 mA	
Input Reflected Ripple Current (pk-pk)	-	90 mA	150 mA	Tested with simulated source impedance of 500 nH, 5 Hz to 20 mHz and five 10 uF/10 V capacitors (P/N: C3216X5R1A106K, TDK) at the input
Input Reflected Ripple Current (rms)	-	20 mA	40 mA	
I^2t Inrush Current Transient	-	0.02 A^2s	0.05 A^2s	
Turn-on Voltage Threshold	-	4.25 V	-	
Turn-off Voltage Threshold	-	4 V	-	

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point				
Vo=3.3 V	3.234 V	3.3 V	3.366 V	Test condition: Vin=5 V, Iout=50% full load
Vo=1.8 V	1.764 V	1.8 V	1.836 V	
Vo=1.2 V	1.176 V	1.2 V	1.224 V	
Load Regulation				Line/Load regulation is the deviation from nominal to minimum and maximum line/load.
Vo=3.3 V	-	5 mV	8 mV	
Vo=1.8 V	-	3 mV	5 mV	
Vo=1.2 V	-	2 mV	4 mV	
Line Regulation				
Vo=3.3 V	-	2 mV	5 mV	
Vo=1.8 V	-	1 mV	3 mV	
Vo=1.2 V	-	1 mV	2 mV	
Regulation Over Temperature (0°C to +80 °C)				
Vo=3.3 V	-	13 mV	28 mV	
Vo=1.8 V	-	9 mV	18 mV	
Vo=1.2 V	-	8 mV	15 mV	
Output Ripple and Noise (pk-pk)	-	30 mV	50 mV	Tested at 0-20 MHz BW with 1000 uF electrolytic capacitor & five 10 uF/10 V TDK C3216X5R1A106K capacitors and 0.1 uF ceramic capacitor at the output
Output Ripple and Noise (rms)	-	5 mV	15 mV	
Output Current	-15 A	-	15 A	
Current Limit Threshold	19 A	-	35 A	
Short Circuit Surge Transient	-	0.5 A^2s	1 A^2s	
Turn on Time	-	10 mS	20 mS	
Overshoot at Turn on	-	0%	3%	
Output Capacitance				
Vo=3.3 V	-	-	13200 uF	
Vo=1.8 V	-	-	16400 uF	
Vo=1.2 V	-	-	17600 uF	
Transient Response				
50% ~ 100% Max Load	Vo=1.2 V-3.3 V	-	35 mV	50 mV	Test conditions: di/dt = 0.1 A/uS; Vin = 5 V; with 1000 uF electrolytic capacitor and five 10 uF/10 V TDK C3216X5R1A106K ceramic capacitors at the output
Settling Time		-	50 uS	100 uS	
100% ~ 50% Max Load		-	35 mV	50 mV	
Settling Time		-	50 uS	100 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 (Current Source)				Measured at Vin=5 V, full load.
V_O=3.3 V	89%	93%	-	
V_O=1.8 V	83%	87%	-	
V_O=1.2 V	80%	82%	-	
Efficiency (Current Sink)				
V_O=3.3 V	86%	90%	-	
V_O=1.8 V	79%	83%	-	
V_O=1.2 V	72%	75%	-	
Switching Frequency	275 kHz	300 kHz	325 kHz	
Output Voltage Trim Range	1.2 V	-	3.3 V	
MTBF	4,573,743 hours			Calculated Per Bell Core SR-332 (V_{in}=5.0 V, I_O=12 A; T_a = 25 °C)
Dimensions				
Inches (L × W × H)	1.2 x 1.0 x 0.457			
Millimeters (L × W × H)	30.48 x 25.4 x 11.6			
Weight	-	13 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	-	0.8 V	
Signal High (Unit On)	2.4 V	-	7 V	
Power Good Delay [1]	-	-	10 mS	
Signal Low [2]	-	0.3 V	-	
Current Sink	-	5 mA	-	

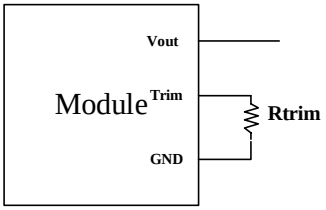
Notes: All specifications are typical at 25 °C unless otherwise stated.

1. Power good delay time is the time from output voltage in full regulation to power good asserted.
2. The power good signal is an open collector output. When the output of the module is higher than 90% of the nominal set point, the power good pin is high.

Output Trim Equation

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

$$Vadj = \left(\frac{0.992}{5.62K} + \frac{0.992}{Rtrim} \right) \cdot 1.18K + 0.992$$

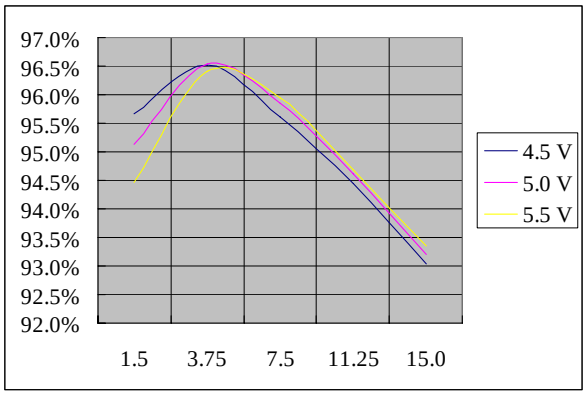


Power Good Signal Level Set

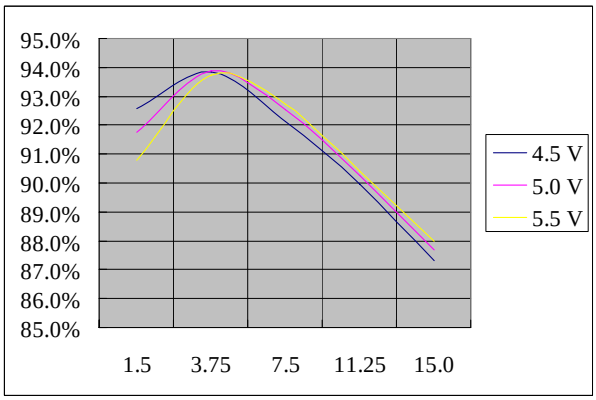
Equation for calculating the power good threshold (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Rset resistor should be connected between the PG_set pin (Pin 9) and Ground.

$$PG\_Threshold = 6.19K \left(\frac{1.24}{2.21K + Rset} - 18.86 \cdot 10^{-6} \right) + 1.24$$

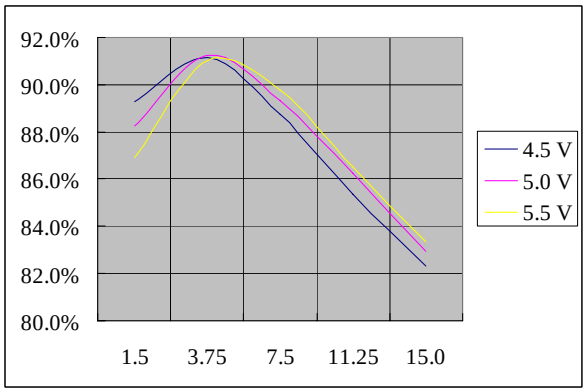
Efficiency Data



Vo=3.3 V

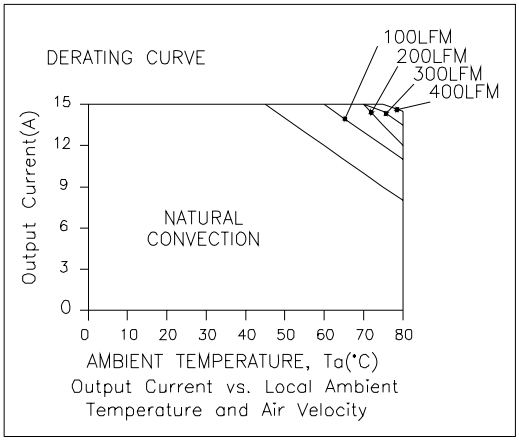


Vo=1.8 V

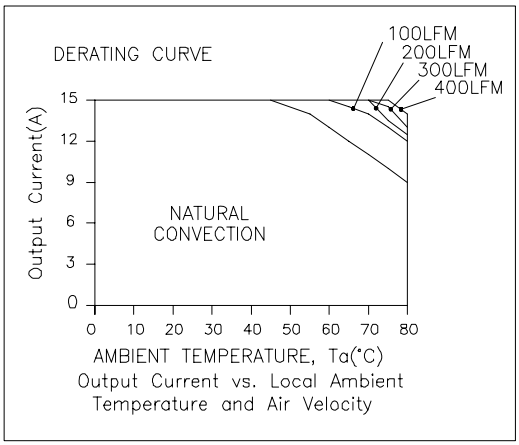


Vo=1.2 V

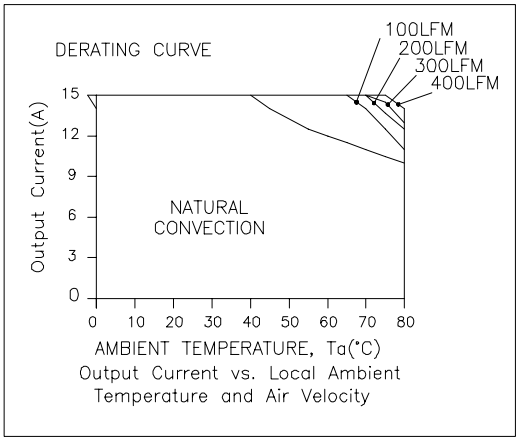
Thermal Derating Curves



Vo=3.3 V

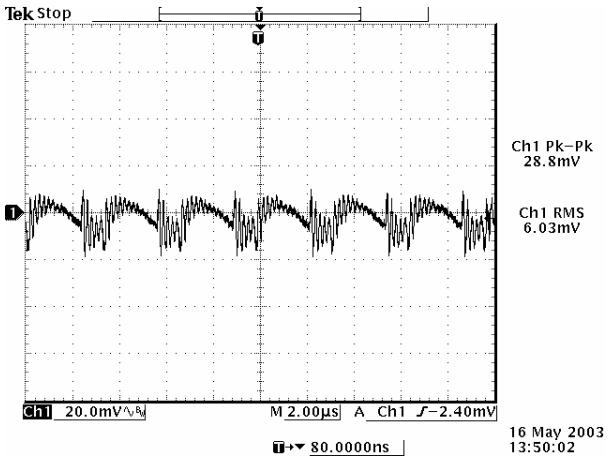


Vo=1.8 V

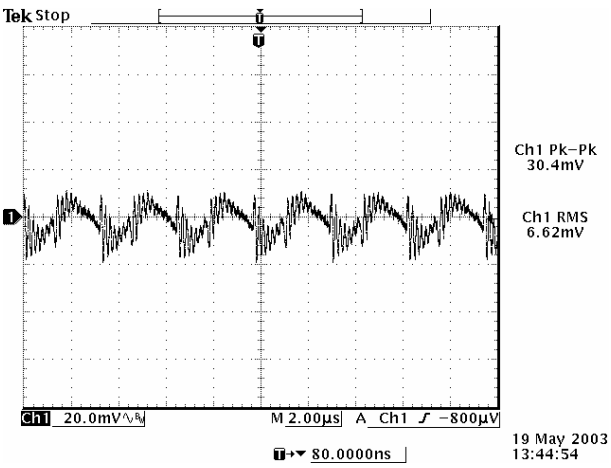


Vo=1.2 V

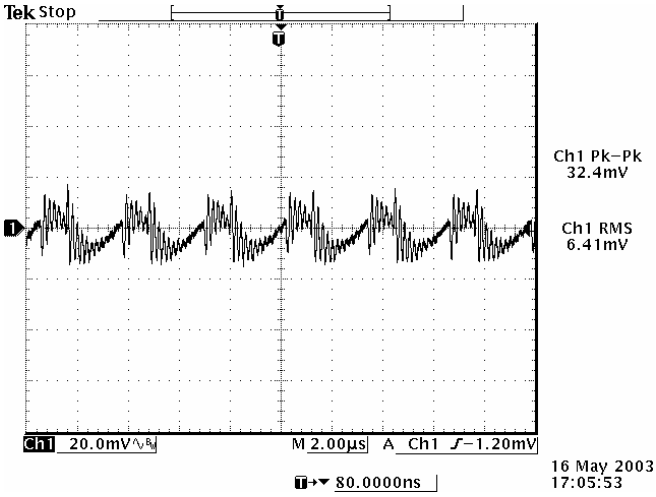
Ripple and Noise Waveforms



Vout=1.2 V



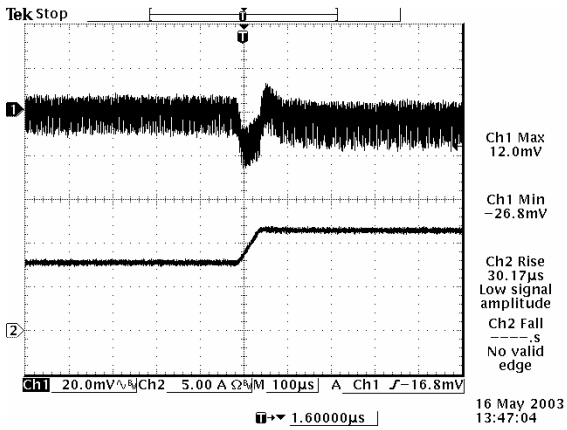
Vout=1.8 V



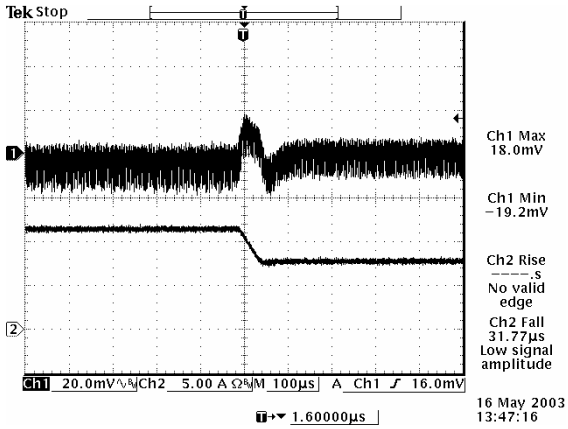
Vout=3.3 V

Note: Ripple and noise at max load input=5.0 V, 0-20 MHz BW, with external 5x10 uF/10 V and 0.1 uF/25 V ceramic capacitor, 1000uF electrolytic capacitor at the output, and Ta=25 deg C.

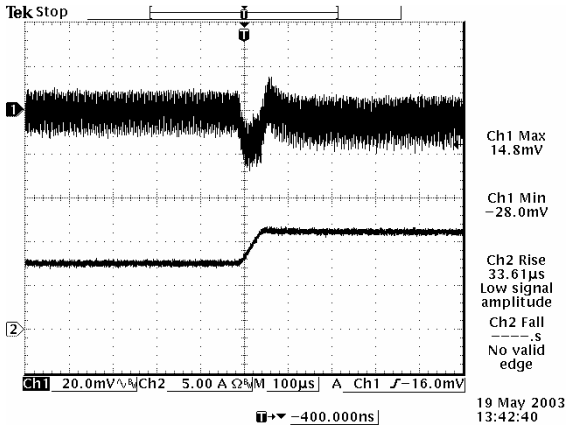
Transient Response Waveforms



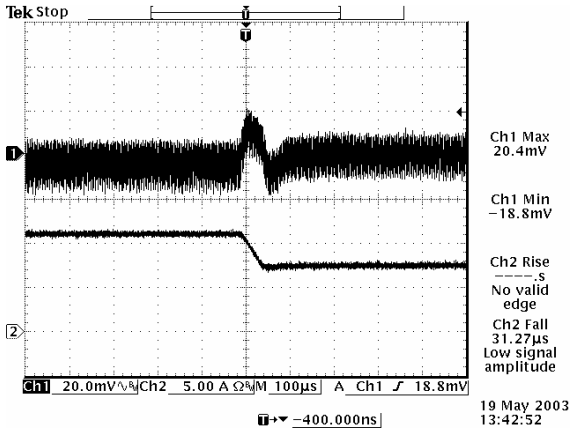
Transients 50% to 75% load, 1.2 Vdc Output



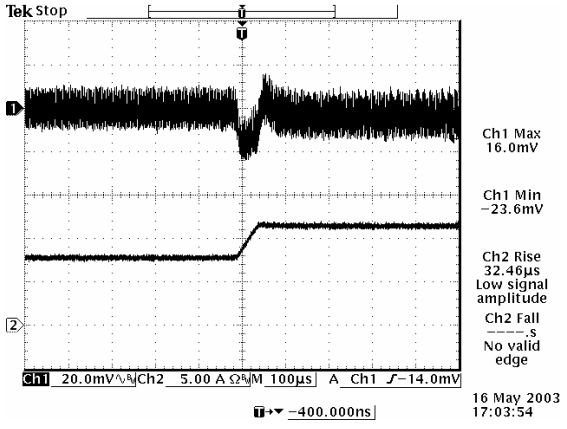
Transients 75% to 50% load, 1.2 Vdc Output



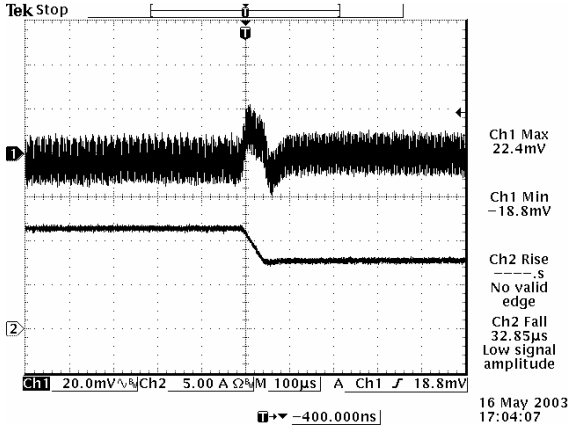
Transients 50% to 75% load, 1.8 Vdc Output



Transients 75% to 50% load, 1.8 Vdc Output



Transients 50% to 75% load, 3.3 Vdc Output



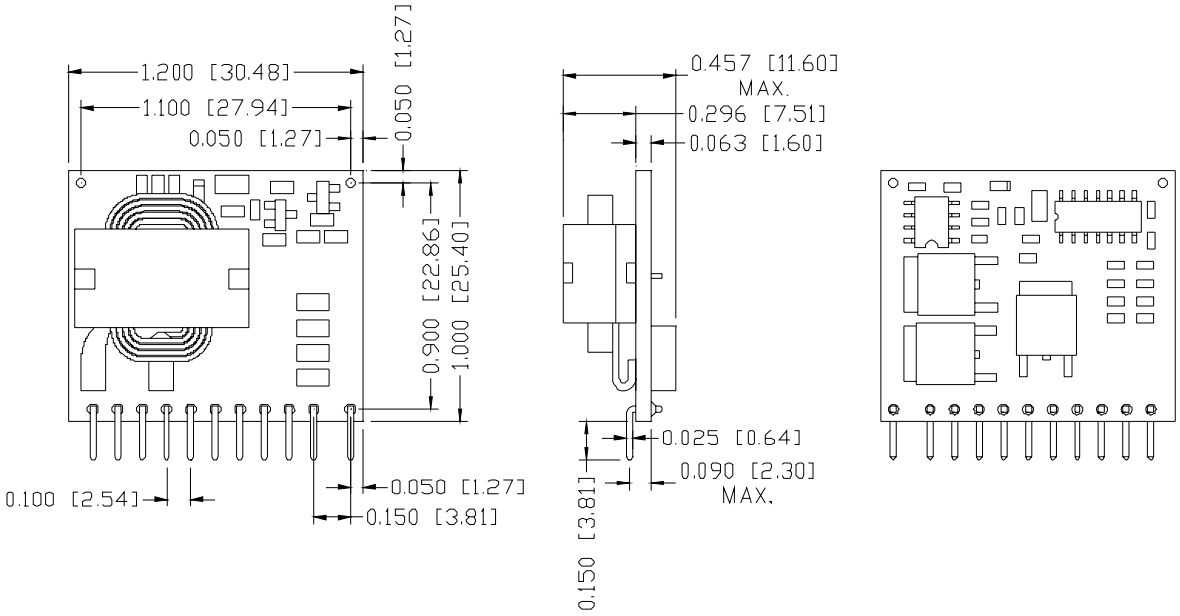
Transients 75% to 50% load, 3.3 Vdc Output

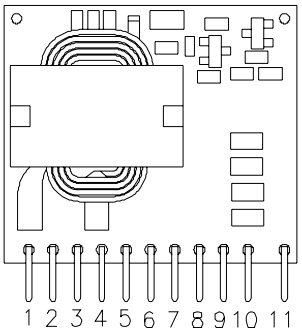
Note: Transient Response at Vin=5 Vdc, with external load capacitor 5 x10 uF/10 V and 0.1 uF/25 V ceramic capacitor and an 1000 uF electrolytic capacitor at the output, and Ta=25 deg C.

NON-ISOLATED DC/DC CONVERTERS

5.0 Vdc Input 1.2 Vdc - 3.3 Vdc/15 A Output

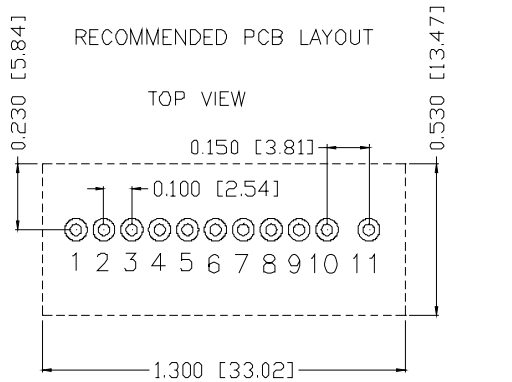
Mechanical Outline





Pin Connections

Pin	Function
1	Vo+
2	Vo+
3	Vo+
4	Trim
5	Remote On/Off
6	Power Good
7	Ground
8	Ground
9	PG_Set
10	Vin+
11	Vin+



HOLE SIZE: ø0.040±0.003 [1.02±0.08]
PAD SIZE: ø0.079±0.002 [2.00±0.05]

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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