

# NON-ISOLATED DC/DC CONVERTERS

## 3.3V Input / 1.5 – 2.5V Output / 10A

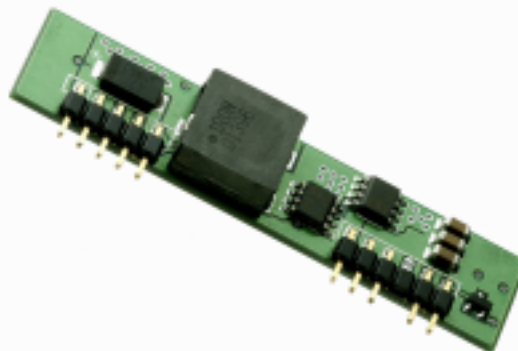
**bel**  
POWER PRODUCTS

BP06VRPC-10C

### VRPC-10C Series

### RoHS Compliant

- Nonisolated
- Industry standard pinout
- Fixed frequency
- High efficiency means less power dissipation
- High power density
- Optimized for cost
- Remote on/off
- Undervoltage lockout
- Over current and short circuit protection



## Description

The Bel VRPC-10C series modules are non-isolated, DC/DC power converters that operate from a nominal 3.3V source. These converters are available in a range of output voltages from 1.5V to 2.5V. They are packaged in an industry standard single-in-line footprint with 10A maximum output. Standard features include remote on/off, over current and short circuit protection and output voltage adjust. Remote sense is an optional feature. These products may be used almost anywhere low voltage silicon is employed and a 3.3V source is available. Typical applications include file servers, routers, line cards and other computing and communications equipment.

## Applications

- Telecommunications
- Networking
- Computers and peripherals

## Options

- Remote Sense

## Part Number Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number	Part Number Remote Sense Option
2.5V	3.3V	10A	25W	92%	VRPC-10C250	VRPC-10C25S
1.8V	3.3V	10A	18W	87%	VRPC-10C180	VRPC-10C18S
1.5V	3.3V	10A	15W	86%	VRPC-10C150	VRPC-10C15S

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## Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
Continuous Input Voltage	V <sub>in</sub>	-0.3		4	V
Output Enable Terminal Voltage	V <sub>outen</sub>	-0.3		4	V
Ambient Temperature	T <sub>amb</sub>	0		70	°C
Storage Temperature	T <sub>stor</sub>	-40		125	°C

Note: Use beyond the maximum ratings may cause a reliability degradation of the DC/DC converter or may permanently damage the device.

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## Input Specifications

Parameter	Symbol	Min	Typical	Max	Units
Operating Input Voltage	V <sub>in</sub>	3	3.3	3.6	V
Input Current	I <sub>in</sub>			9.2	A
No Load Input Current				100	mA
Remote Off Input Current			10	22	mA
Input Reflected Ripple Current <sup>1</sup>			20	40	mA <sub>rms</sub>
Input Reflected Ripple Current (P-P) <sup>1</sup>			90	150	mApk
I <sup>2</sup> t Inrush Current Transient			0.02	0.05	A <sup>2</sup> s
Turn On Voltage Threshold			2.85		V
Turn Off Voltage Threshold			2.3		V

Note: Input capacitance 2 x 270µF/16V, ESR = 0.03 Ω max at 100kHz @ 25° C.  
 1. With simulated source impedance of 500nH, 5Hz to 20MHz.

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### Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Output Voltage Set Point <sup>1</sup>	2.5V	Vout	2.45 1.76 1.47	2.5 1.8 1.5	2.55 1.84 1.53	V
	1.8V					
	1.5V					
Load Regulation	2.5V			7.5 5.4 4.5	12.5 9.0 7.5	mV
	1.8V					
	1.5V					
Line Regulation	2.5V			3 2.5 2	7.5 5.4 4.5	mV
	1.8V					
	1.5V					
Regulation Over Temperature 0° - 70° C	2.5V			12 10 7	30 20 15	mV
	1.8V					
	1.5V					
Total Output Voltage Regulation	2.5V				50 34.4 27	mV
	1.8V					
	1.5V					
Output Ripple and Noise <sup>2</sup>	All			70	100	mVp-p
Output Ripple and Noise <sup>2</sup>	All			18	25	mVrms
Output Current Range	All	Iout	0		10	A
Output DC Current Limit	All	Ioutlim	13		25	A
Short Circuit Surge	2.5V	Ioutsurge		0.15 0.27 0.27	0.2 0.5 0.5	A <sup>2</sup> s
	1.8V					
	1.5V					
Turn on Time	All	Ton		10	20	ms
Overshoot at Turn On	All				3	%
Output Capacitance	All	Cout	0		4000	μF

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

1. Vin = 3.3V, Iout = full load, Ta = 25° C.

2. 0 - 20MHz BW, 0.1μF ceramic cap on output.

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## Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	2.5V			100	150	mV
Settling Time		Ts		35	50	$\mu s$
$\Delta V$ 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		35	50	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.8V			100	150	mV
Settling Time		Ts		35	50	$\mu s$
$\Delta V$ 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		35	50	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.5V			100	150	mV
Settling Time		Ts		35	50	$\mu s$
$\Delta V$ 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		35	50	$\mu s$

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.  
 $3. di/dt = 0.5A/\mu s$ ,  $V_{in} = 3.3VDC$ ,  $T_a = 25^\circ C$ , and with a 470 $\mu F$  aluminum cap on output.

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### General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency <sup>1</sup>	2.5V	$\eta$	88	92		%
	1.8V		84	87		
	1.5V		82	86		
Switching Frequency	All	F <sub>sw</sub>	250	300	340	kHz
Output Voltage Trim Range <sup>2</sup>	2.5V		90		105	%
	1.8V		90		110	
	1.5V		90		110	
Remote Sense Compensation	2.5V				5	%
	1.8V				10	
	1.5V				10	
Weight	All			8.3		g

1. Vin=3.3V, full load and Ta=25° C.

2. Total adjustment of trim, setpoint and remote sense combined should not exceed 5% @nominal Vin, 25° C ambient for the 2.5V output module.

### Control Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off	All	Vouten				V
Signal Low (Unit Off)	All		-0.3		0.3	V
Signal High (Unit On)	All		2.8		4	V

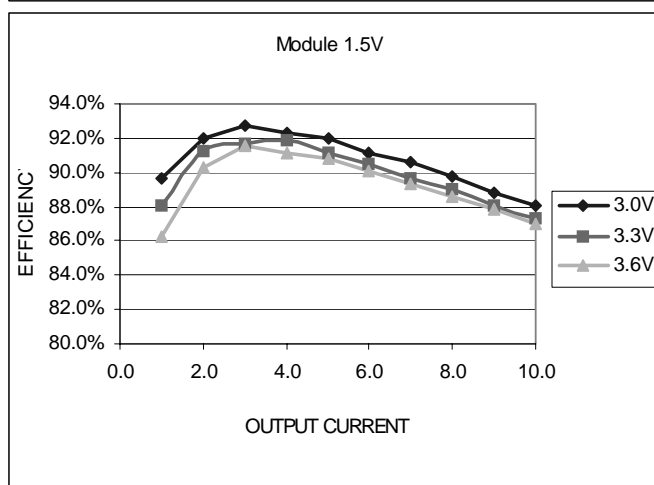
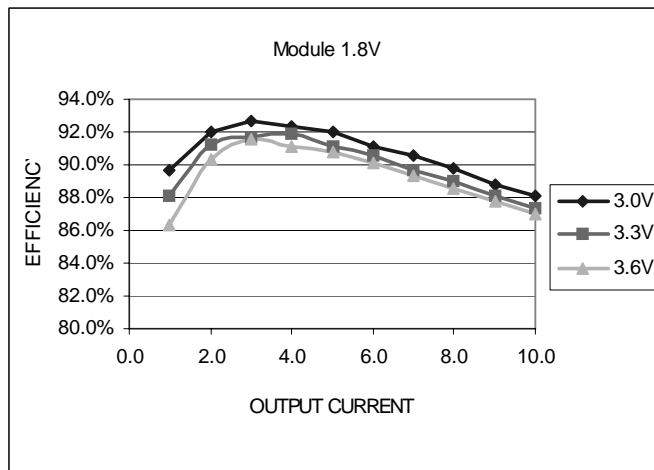
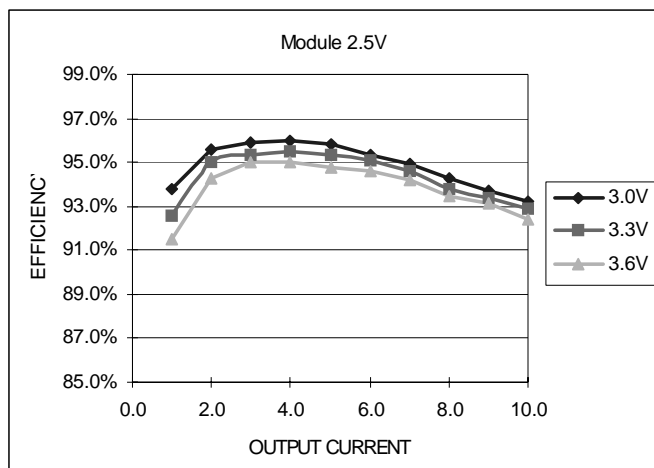


# NON-ISOLATED DC/DC CONVERTERS

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### Efficiency Data



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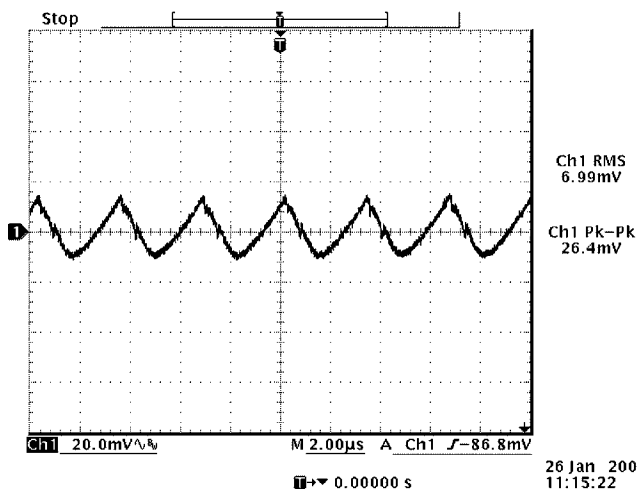
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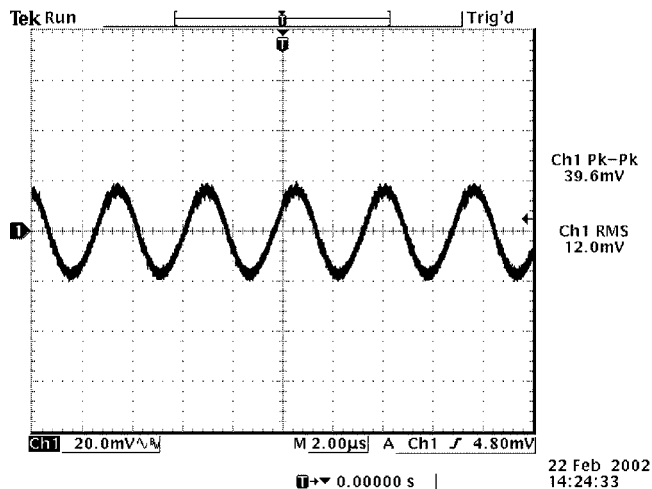
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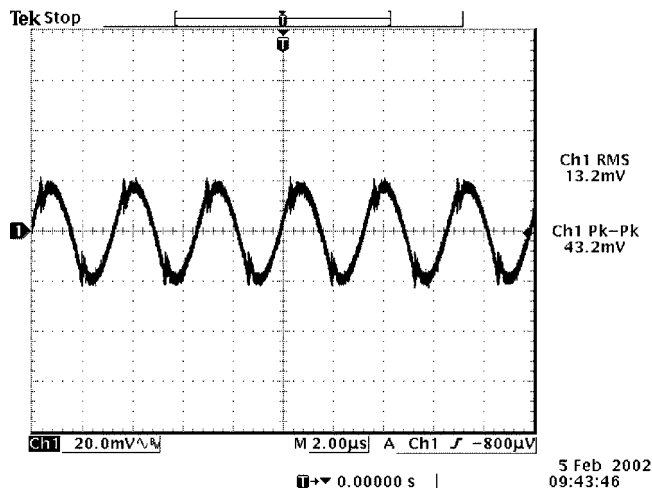
## Ripple and Noise



Ripple and noise at full load and 3.3Vdc input, 2.5V output and Ta=25° C



Ripple and noise at full load and 3.3Vdc input, 1.8V output and Ta=25° C



Ripple and noise at full load and 3.3Vdc input, 1.5V output and Ta=25° C

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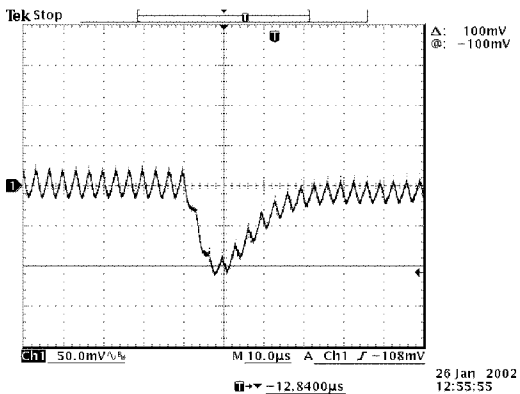
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## 3.3V Input / 1.5 – 2.5V Output / 10A

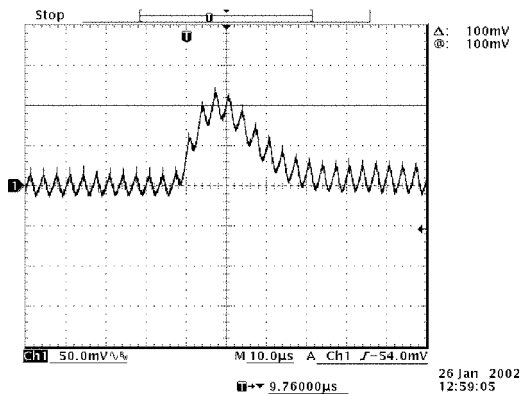
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### Transient Response

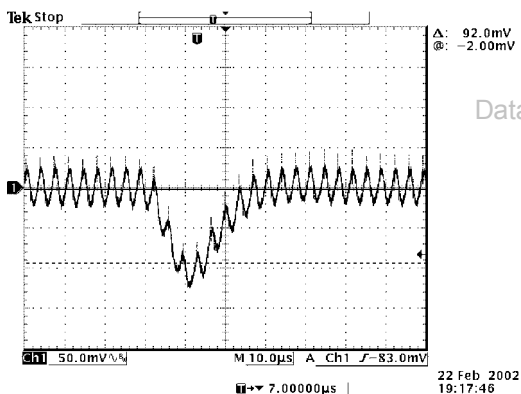
Transient response:  $di/dt = 0.5A/\mu S$ , external load capacitance  $C_o = 470\mu F$  (electrolytic)



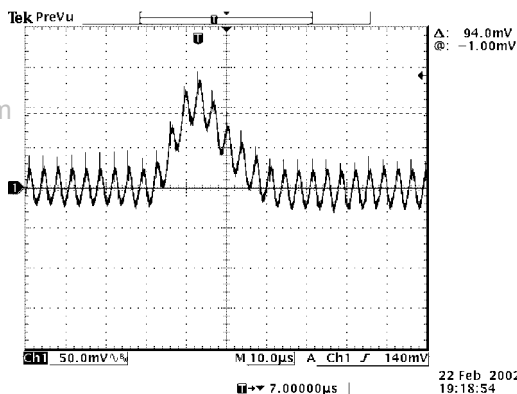
Vout=2.5V  
50% to 100% load transients at 3.3V input and  $T_a=25^\circ C$



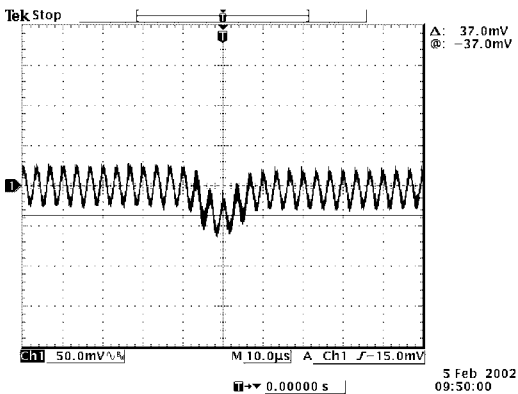
Vout=2.5V  
100% to 50% load transients at 3.3V input and  $T_a=25^\circ C$



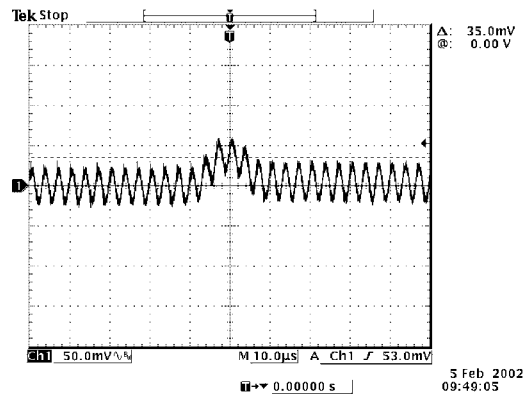
Vout=1.8V  
50% to 100% load transients at 3.3V input and  $T_a=25^\circ C$



Vout=1.8V  
100% to 50% load transients at 3.3V input and  $T_a=25^\circ C$



Vout=1.5V  
50% to 100% load transients at 3.3V input and  $T_a=25^\circ C$

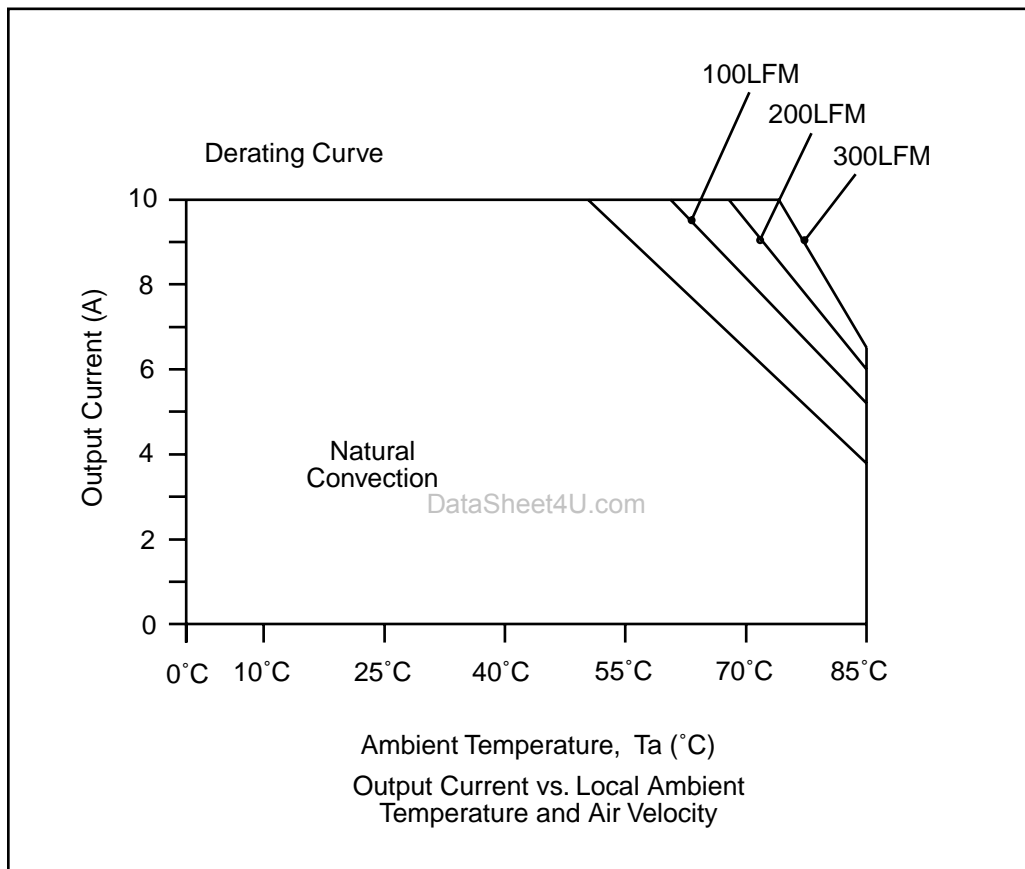


Vout=1.5V  
100% to 50% load transients at 3.3V input and  $T_a=25^\circ C$



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### Thermal Considerations

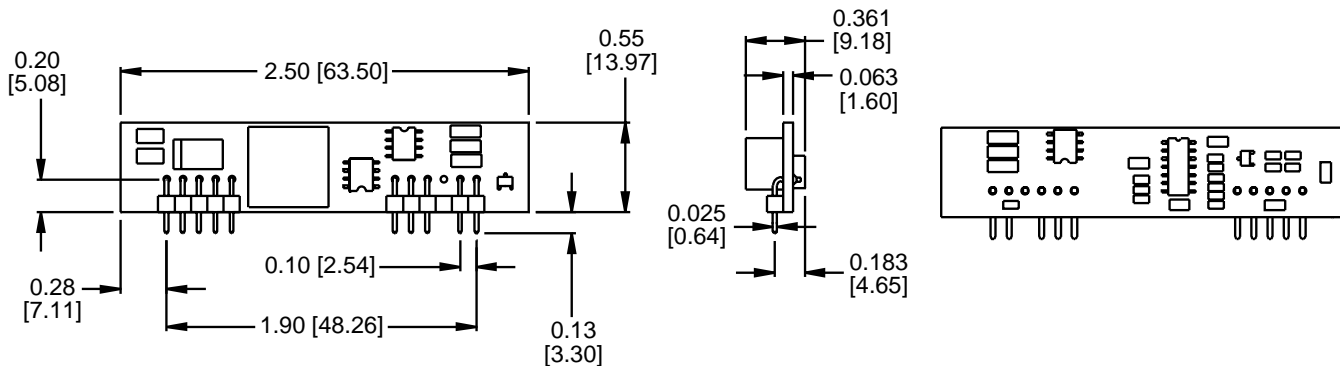


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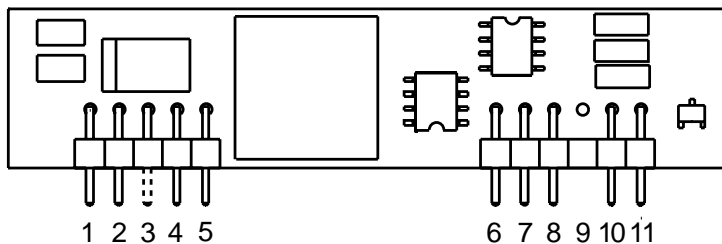
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### Mechanical



Pin	Function
1	+Vo
2	+Vo
3*	No Pin
4	+Vo
5	Ground
6	Ground
7	+Vin
8	+Vin
9	No Pin
10	Trim
11	Remote On/Off

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\*Pin 3 used for remote sense option.

### RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products.



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