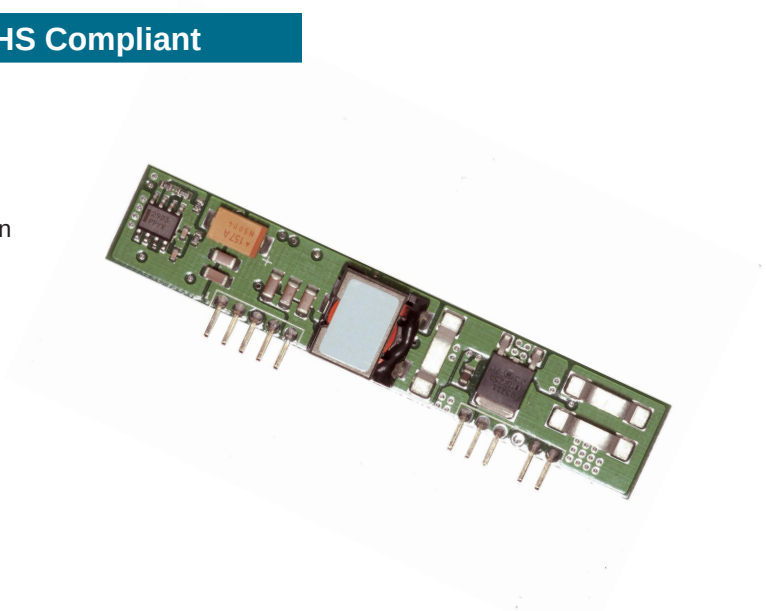
NON-ISOLATED DC/DC CONVERTERS
3.3V Input / 1.2V – 2.5V Output / 15A

bel POWER PRODUCTS

BP06VRPD-15C

VRPD-15C Series **RoHS Compliant**

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



Description

The Bel VRPD-15C modules are a series of non-isolated, step down DC/DC power converters that operate from a nominal 3.3V source. These converters are available in a range of output voltages from 1.2V to 2.5V. They are packaged in an industry standard, single-in-line footprint and provide a maximum 15A output. Standard features include remote on/off, over current and short circuit protection, output voltage adjust and remote sense. 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

- Distributed power architectures
- Data networking equipment
- Telecommunications
- Computers and peripherals

Options

- Reverse remote on/off logic

Part Number Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number Active Low	Part Number Active High
2.5V	3.3V	15A	37.5W	92%	VRPD-15C250	VRPD-15C25H
1.8V	3.3V	15A	27.0W	87%	VRPD-15C180	VRPD-15C18H
1.5V	3.3V	15A	22.5W	85%	VRPD-15C150	VRPD-15C15H
1.2V	3.3V	15A	18.0W	81%	VRPD-15C120	VRPD-15C12H

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Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
Continuous Input Voltage	Vin	-0.3		7	V
Output Enable Terminal Voltage	Vouten	-0.3		7	V
Ambient Temperature	Tamb	-40		85	°C
Storage Temperature	Tstor	-55		125	°C

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

Input Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Operating Input Voltage	All	Vin	3	3.3	3.6	V
Input Current	2.5V 1.8V 1.5V 1.2V	Iin			15 12 11 10	A
No Load Input Current	All				150	mA
Remote Off Input Current				15	30	mA
Input Reflected Ripple Current[1]	All			25	60	mA_{rms}
Input Reflected Ripple Current (P-P)[1]	All			60	100	mApk
I^2t Inrush Current Transient	All			0.05	0.1	A^2s
Turn On Voltage Threshold	All			2.85		V
Turn Off Voltage Threshold	All			2.5		V

Note: Input capacitance two 470µF/6.3V with 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 [1]	2.5V 1.8V 1.5V 1.2V	Vout	2.450 1.764 1.470 1.176	2.500 1.800 1.500 1.200	2.550 1.836 1.530 1.224	V
Load Regulation	2.5V 1.8V 1.5V 1.2V			7.5 5 4.5 3.6	12.5 10 7.5 6.0	mV
Line Regulation	2.5V 1.8V 1.5V 1.2V			5 4 4 3	7.5 5.4 4.5 3.6	mV
Regulation Over Temperature	2.5V 1.8V 1.5V 1.2V			12 10 10 10	30 20 20 20	mV
Total Output Voltage Regulation	2.5V 1.8V 1.5V 1.2V				50 35.4 32 29.6	mV
Output Ripple and Noise [2]	All			70	100	mVp-p
Output Ripple and Noise [2]	All			14	35	mVrms
Output Current Range	All	Iout	0		15	A
Output DC Current Limit	All	Ioutlim	18		37	A
Short Circuit Surge	2.5V 1.8V 1.5V 1.2V	Ioutsurge		0.15 0.2 0.3 0.4	0.2 0.4 0.5 0.7	A^2s
Turn on Time	All	Ton		7	20	ms
Overshoot at Turn On	All				3	%
Output Capacitance	All	Cout	0		5600	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, 1µF ceramic cap on output.

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Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Transient Response [3]						
ΔV 50% to 100% of Max Load	2.5V			100	150	mV
Settling Time		Ts		35	50	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		35	50	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.8V			100	150	mV
Settling Time		Ts		35	50	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		35	50	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.5V			100	150	mV
Settling Time		Ts		35	50	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		35	50	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.2V			100	150	mV
Settling Time		Ts		35	50	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		35	50	µs

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.
3. di/dt = 0.5A/1µS, Ta = 25° C with a 470µF aluminum cap on the output.

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General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency[1]	2.5V 1.8V 1.5V 1.2V	η	88 83 81 77	92 87 85 81		%
Switching Frequency	All	Fsw	250	300	340	kHz
Over Temperature Shutdown	All	Tc		120		°C
Output Voltage Trim Range[2]	2.5V 1.8V 1.5V 1.2V		90 90 90 90		105 110 110 110	%
Remote Sense Compensation	2.5V 1.8V 1.5V 1.2V				5 10 10 10	%
Weight	All			13.9		g

1. Vin=3.3V, full load and Ta=25° C.
2. See graphs on pages 11-13.

Control Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off [3]		Vouten				V
Signal Low (Unit On)	V7PD-15Cxx0		-0.3		1	V
Signal High (Unit Off)			2.8		7	V
Signal Low (Unit Off)	V7PD-15CxxH		-0.3		0.8	V
Signal High (Unit On)			2.8		7	V

3. With remote on/off pin 11 open, the module is on.

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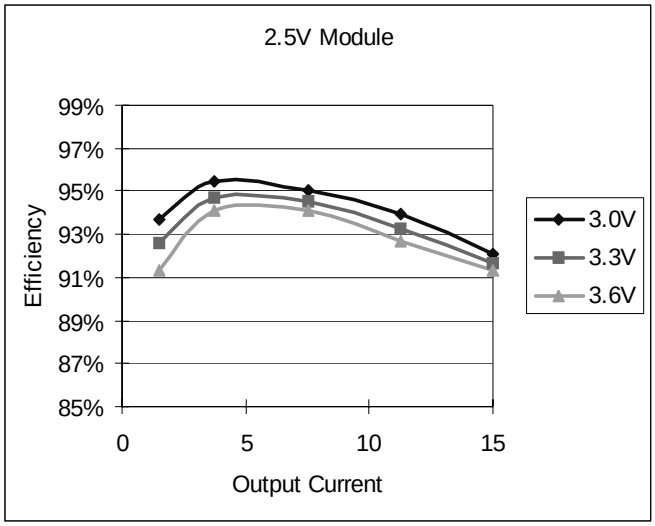
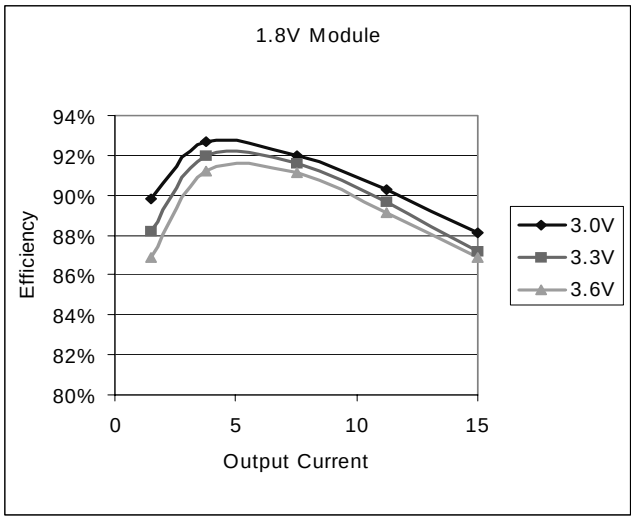
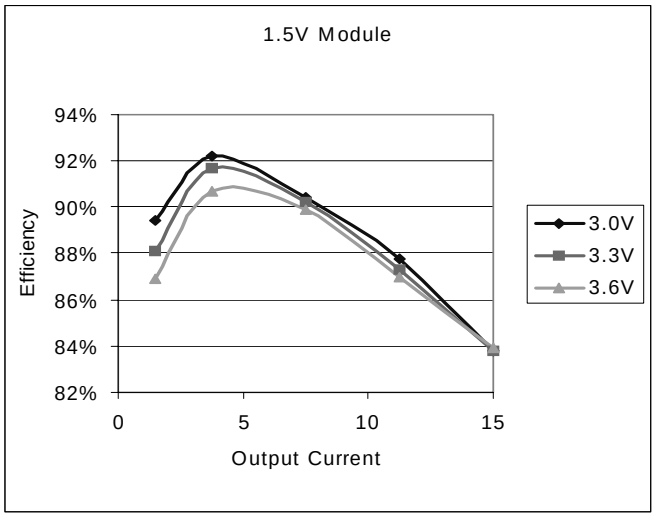
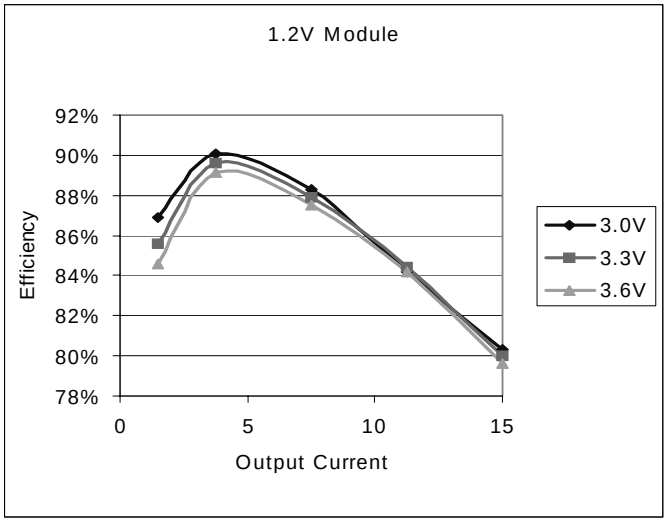
Efficiency Data









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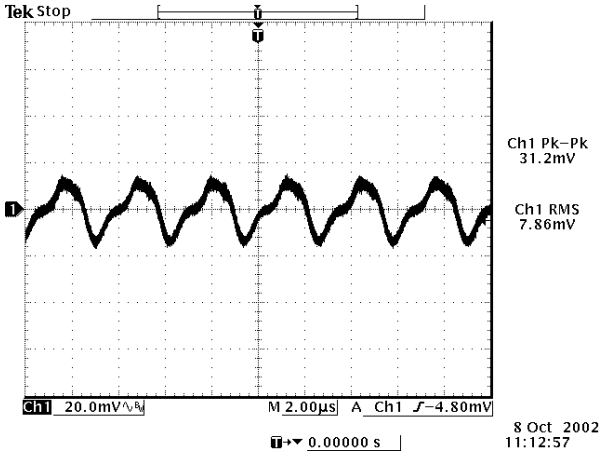
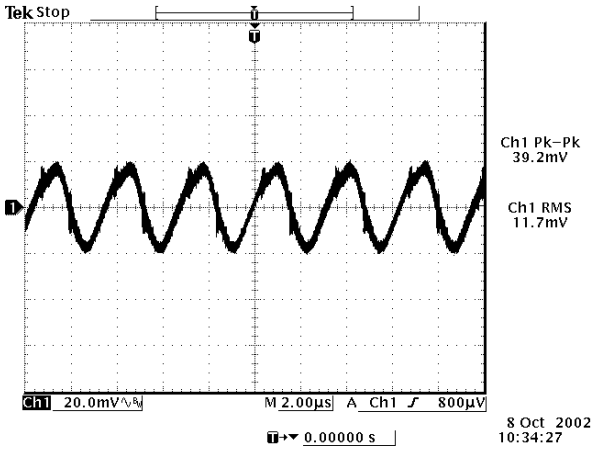
Ripple and Noise

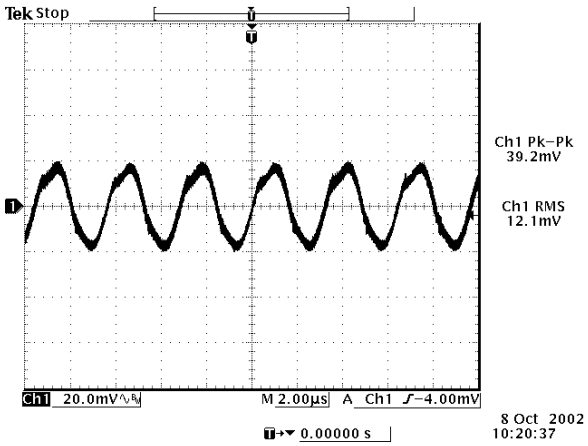
1µF ceramic cap added at the output.



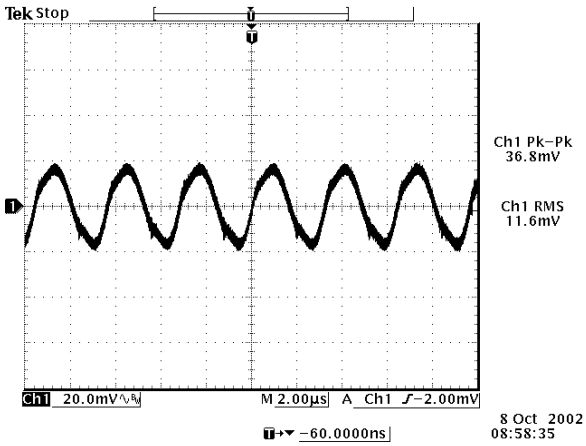
Ripple and noise at full load and 3.3Vdc input, 2.5Vdc output and Ta=25° C



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



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



Ripple and noise at full load and 3.3Vdc input, 1.2Vdc output and Ta=25° C

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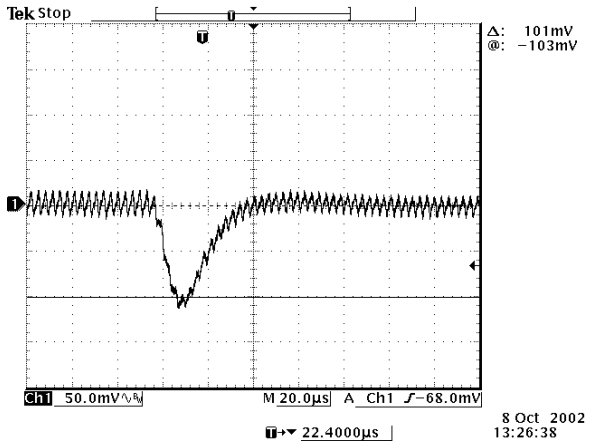
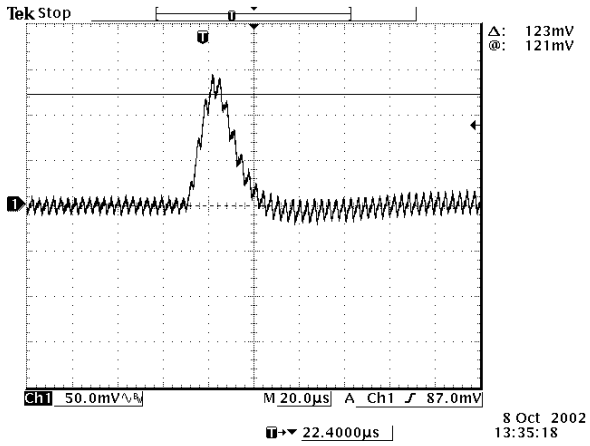
Transient Response

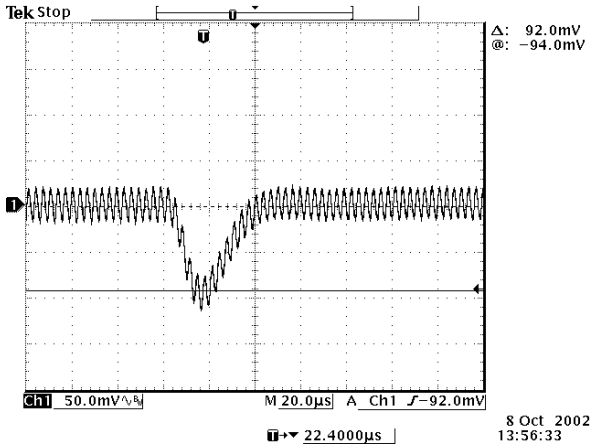
Transient response: di/dt = 0.5A/µS, with a 470µF aluminum cap on the output



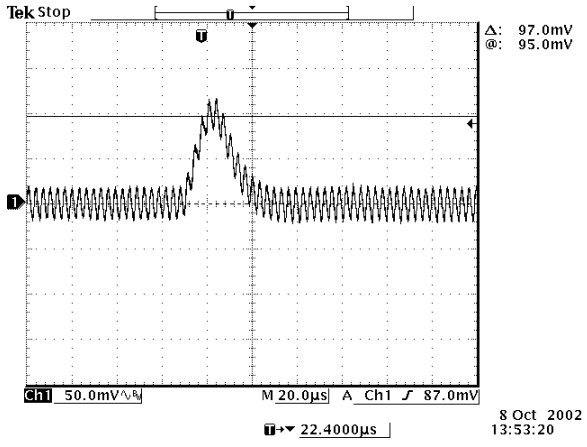
Vout=2.5V
50% to 100% load transients at 3.3V input and Ta=25° C



Vout=2.5V
100% to 50% load transients at 3.3V input and Ta=25° C



Vout=1.8V
50% to 100% load transients at 3.3V input and Ta=25° C



Vout=1.8V
100% to 50% load transients at 3.3V input and Ta=25° C

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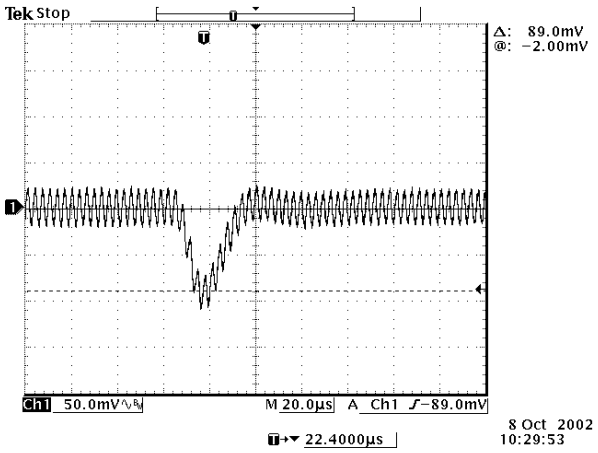
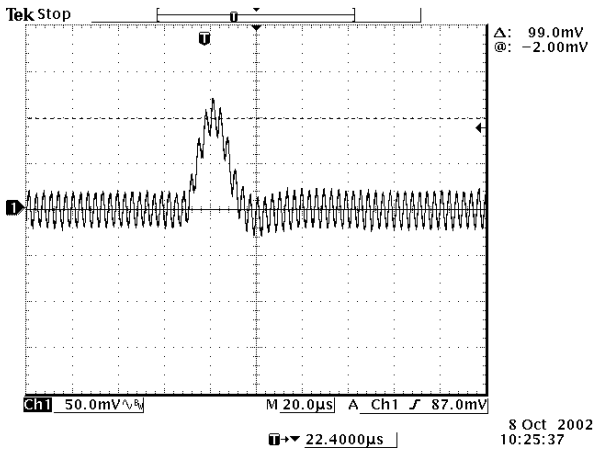
Transient Response

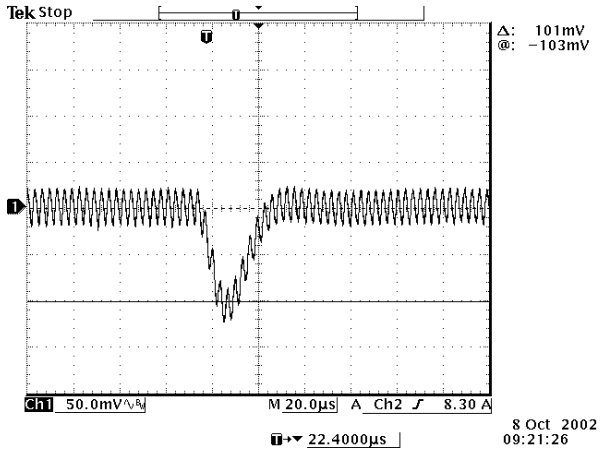
Transient response: di/dt = 0.5A/µS, with a 470µF aluminum cap on the output



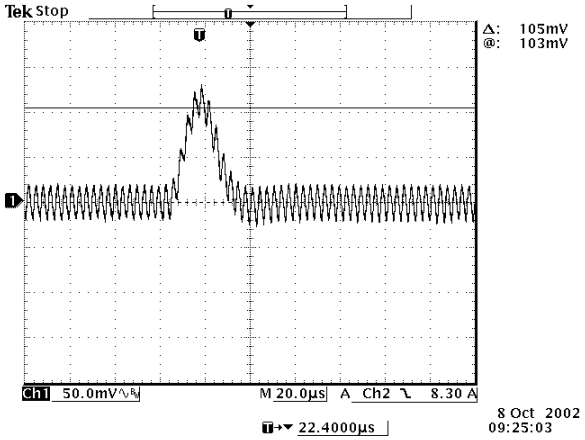
Vout=1.5V
50% to 100% load transients at 3.3V input and Ta=25° C



Vout=1.5V
100% to 50% load transients at 3.3V input and Ta=25° C



Vout=1.2V
50% to 100% load transients at 3.3V input and Ta=25° C



Vout=1.2V
100% to 50% load transients at 3.3V input and Ta=25° C

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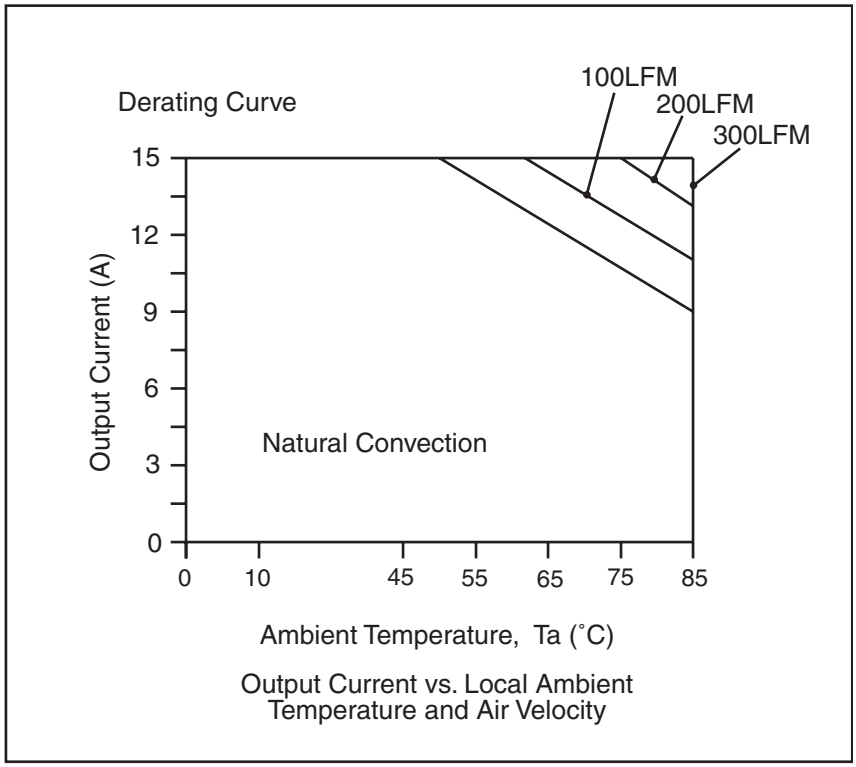
Thermal Considerations

VRPD-15C



Output Current vs. Local Ambient Temperature and Air Velocity

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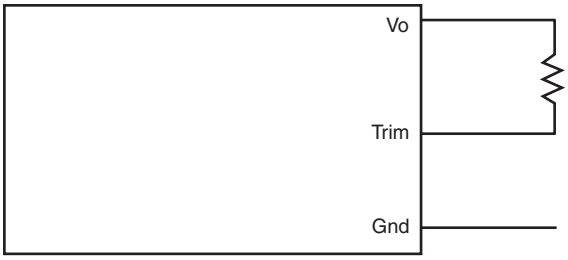
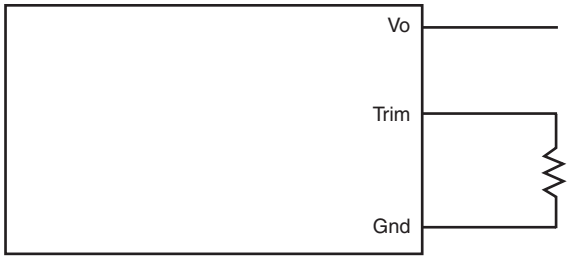
Output Voltage Set-Point Adjustment

Trim Down Test Circuit



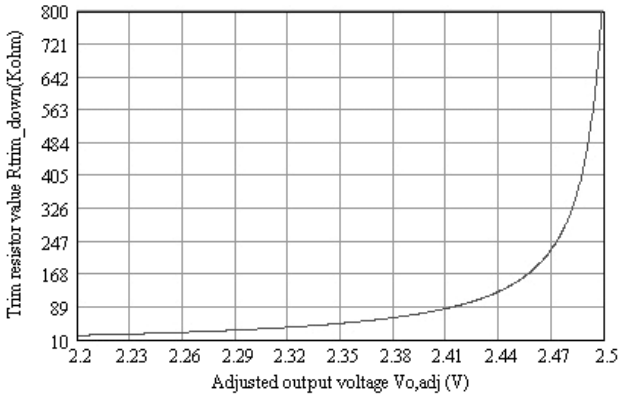
Trim Up Test Circuit



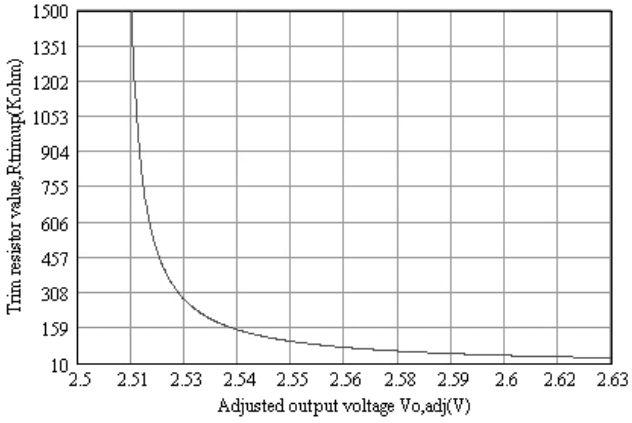
Output Voltage Set-Point Adjustment

VRPD-15C25xTrim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{9.631}{Vo - Vo,\ adj} - 10.740\right) \text{Kohm}$$



$$\text{Rtrim up} = \left(\frac{4.504}{Vo,\ adj - Vo} - 5.110\right) \text{Kohm}$$



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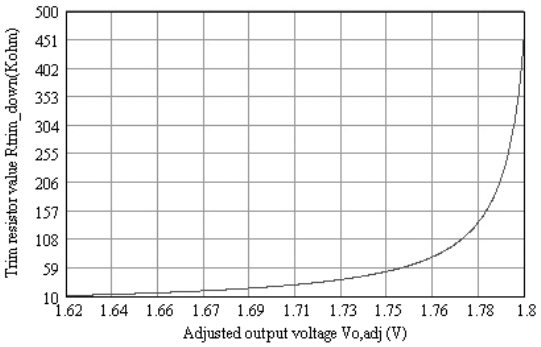
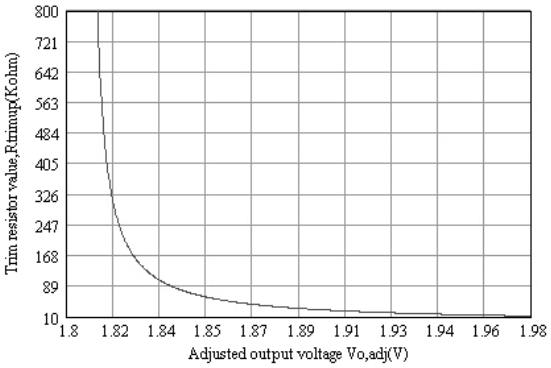
Output Voltage Set-Point Adjustment

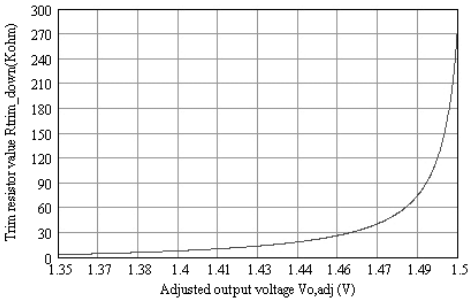
VRPD-15C18x Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{3.869}{Vo - Vo,\ adj} - 9.460\right) \text{Kohm}$$



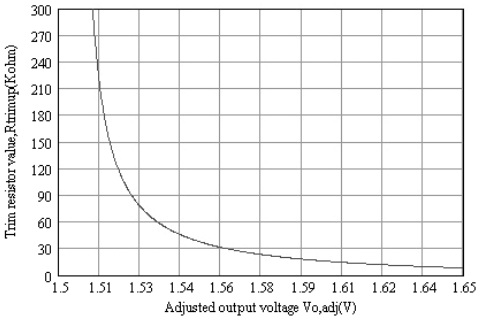
$$\text{Rtrim up} = \left(\frac{3.072}{Vo,\ adj - Vo} - 5.620\right) \text{Kohm}$$





VRPD-15C15x Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{1.765}{Vo - Vo,\ adj} - 8.120\right) \text{Kohm}$$



$$\text{Rtrim up} = \left(\frac{2.000}{Vo,\ adj - Vo} - 5.620\right) \text{Kohm}$$

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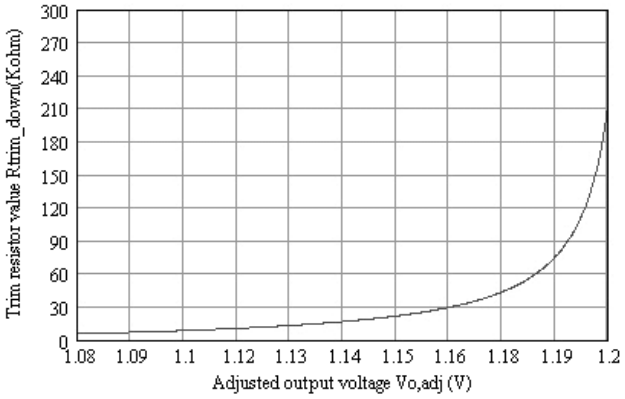
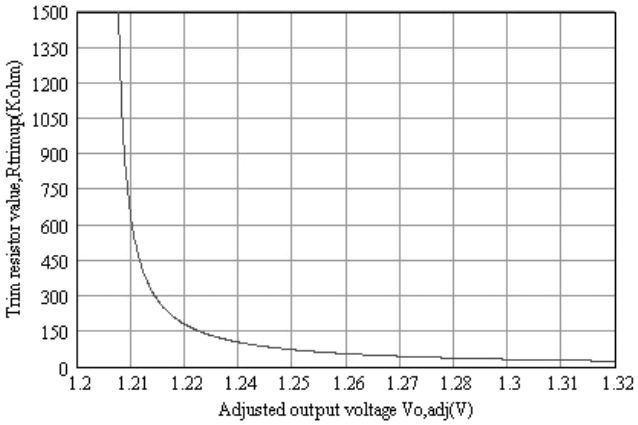
Output Voltage Set-Point Adjustment

VRPD-15C12x Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{1.562}{Vo - Vo,\ adj} - 6.580\right) \text{ Kohm}$$



$$\text{Rtrim up} = \left(\frac{3.072}{Vo,\ adj - Vo} - 2.740\right) \text{ Kohm}$$



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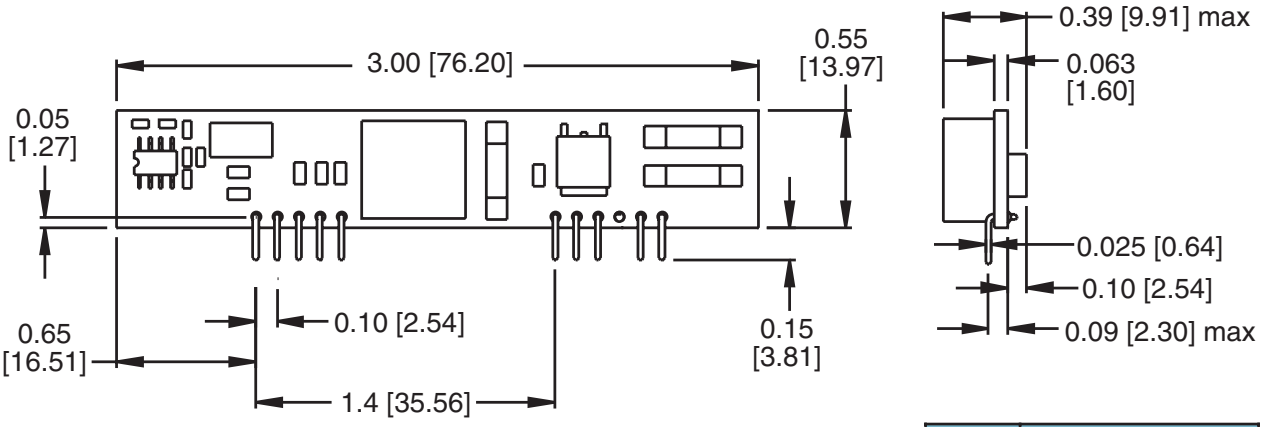
Mechanical

VRPD-15C



Dimensions are in inches [millimeters].
Standard dimension tolerance is ±0.005 [0.13] unless otherwise noted.

Pin	Function
1	+Vo
2	+Vo
3	Remote Sense
4	+Vo
5	Ground
6	Ground
7	+Vin
8	+Vin
9	Not Used
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.

RoHS 2002/95/EC

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