

NON-ISOLATED DC/DC CONVERTERS

5V Input / 1.2V – 3.3V Output / 15A

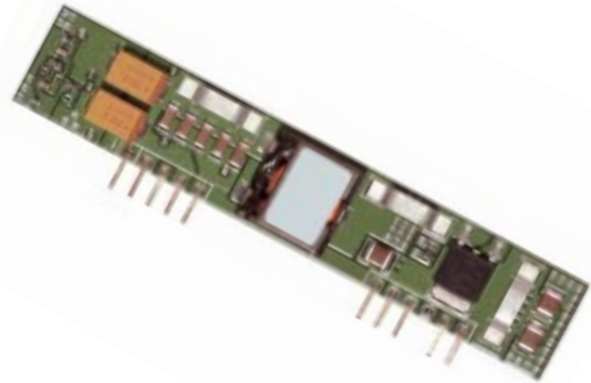


BP06VRPD-15B

VRPD-15B 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-15B modules are a series of non-isolated, step down DC/DC power converters that operate from a nominal 5V source. These converters are available in a range of output voltages from 1.2V to 3.3V. 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 5V 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 High	Part Number Active Low
3.3V	5V	15A	49.5W	93%	VRPD-15B330	VRPD-15B33L
2.5V	5V	15A	37.5W	91%	VRPD-15B250	VRPD-15B25L
1.8V	5V	15A	27.0W	89%	VRPD-15B180	VRPD-15B18L
1.5V	5V	15A	22.5W	86%	VRPD-15B150	VRPD-15B15L
1.2V	5V	15A	18.0W	83%	VRPD-15B120	VRPD-15B12L

Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
Continuous Input Voltage	Vin	-0.3		6	V
Output Enable Terminal Voltage	Vouten	-0.3		6	V
Ambient Temperature	Tamb	0		70	°C
Storage Temperature	Tstor	-55		105	°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	4.5	5	5.5	V
Input Current	3.3V 2.5V 1.8V 1.5V 1.2V	Iin			13.5 10.5 7.6 6.5 5.3	A
No Load Input Current	All			70	100	mA
Remote Off Input Current	All			6	10	mA
Input Reflected Ripple Current ¹	All			50	80	mA _{rms}
Input Reflected Ripple Current (P-P) ¹	All			135	160	mApk
I ² t Inrush Current Transient	All			0.18		A ² s
Turn On Voltage Threshold	All			4.25		V
Turn Off Voltage Threshold	All			3.85		V

Note: Input capacitance a 680µF/6.3V and a 270µF/16V Oscon caps

1. With simulated source impedance of 500nH, 5Hz to 20MHz.

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Output Specifications

BP06VRPD-15B

Parameter	Module	Symbol	Min	Typical	Max	Units
Output Voltage Set Point ¹	3.3V 2.5V 1.8V 1.5V 1.2V	Vout	3.234 2.450 1.764 1.470 1.176	3.3 2.5 1.8 1.5 1.2	3.366 2.550 1.836 1.530 1.224	V
Load Regulation	3.3V 2.5V 1.8V 1.5V 1.2V			8 6 6 5 5	16.5 12.5 11.0 10.5 10.5	mV
Line Regulation	3.3V 2.5V 1.8V 1.5V 1.2V			5 3 3 2 2	10 7.5 6.0 4.5 4.5	mV
Regulation Over Temperature	3.3V 2.5V 1.8V 1.5V 1.2V			15 10 7 5 5	35 25 20 15 15	mV
Total Output Voltage Regulation	3.3V 2.5V 1.8V 1.5V 1.2V			28 19 16 12 12	61.5 45 37 30 30	mV
Output Ripple and Noise ²	3.3V 2.5V 1.8V 1.5V 1.2V			50 50 48 45 38	100 100 90 80 70	mVp-p
Output Ripple and Noise ²	3.3V 2.5V 1.8V 1.5V 1.2V			25 20 18 15 12	30 25 23 20 17	mVrms
Output Current Range	All	Iout	0		15	A
Output DC Current Limit	All	Ioutlim	19.5		37.5	A
Short Circuit Surge	3.3V 2.5V 1.8V 1.5V 1.2V	Ioutsurge		0.041 0.048 0.070 0.081 0.095		A²s
Turn on Time	All	Ton		11	20	ms
Overshoot at Turn On	All			0	3	%
Output Capacitance	All	Cout	0		6800	µF

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

1. Vin = 5V, Iout = full load, Ta = 25° C.

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

Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Transient Response ³						
ΔV 50% to 100% of Max Load	3.3V			88	150	mV
Settling Time		Ts		20	50	μs
ΔV 100% to 50% of Max Load				85	150	mV
Settling Time		Ts		20	50	μs
Transient Response ³						
ΔV 50% to 100% of Max Load	2.5V			95	150	mV
Settling Time		Ts		20	50	μs
ΔV 100% to 50% of Max Load				95	150	mV
Settling Time		Ts		20	50	μs
Transient Response ³						
ΔV 50% to 100% of Max Load	1.8V			94	150	mV
Settling Time		Ts		20	50	μs
ΔV 100% to 50% of Max Load				92	150	mV
Settling Time		Ts		20	50	μs
Transient Response ³						
ΔV 50% to 100% of Max Load	1.5V			95	150	mV
Settling Time		Ts		20	50	μs
ΔV 100% to 50% of Max Load				95	150	mV
Settling Time		Ts		20	50	μs
Transient Response ³						
ΔV 50% to 100% of Max Load	1.2V			80	150	mV
Settling Time		Ts		20	50	μs
ΔV 100% to 50% of Max Load				75	150	mV
Settling Time		Ts		20	50	μs

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.
 3. di/dt = 0.5A/1 μ S, Ta = 25° C without external load capacitance.

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5V Input / 1.2V – 3.3V Output / 15A



BP06VRPD-15B

General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency ¹	3.3V 2.5V 1.8V 1.5V 1.2V	η	91 89 87 84 81	93 91 89 86 83		%
Switching Frequency	All	Fsw	230	300	340	kHz
Overtemperature Shutdown	All	Tc		120		°C
Output Voltage Trim Range ²	All		90		110	%
Weight	All			15		g

1. Vin=5V, full load and Ta=25° C.

2. See graphs on pages 11-13.

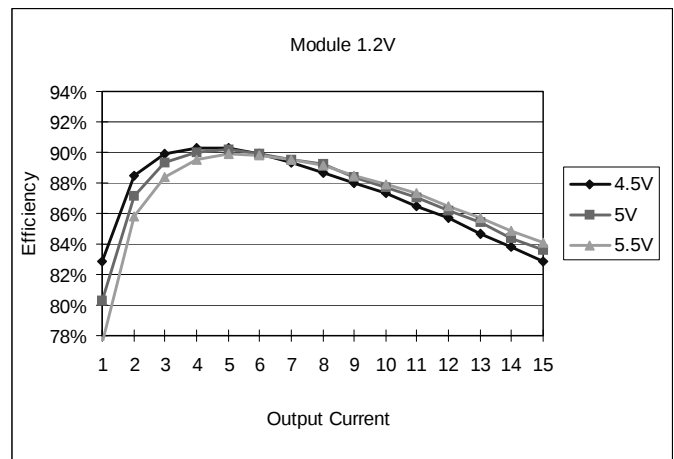
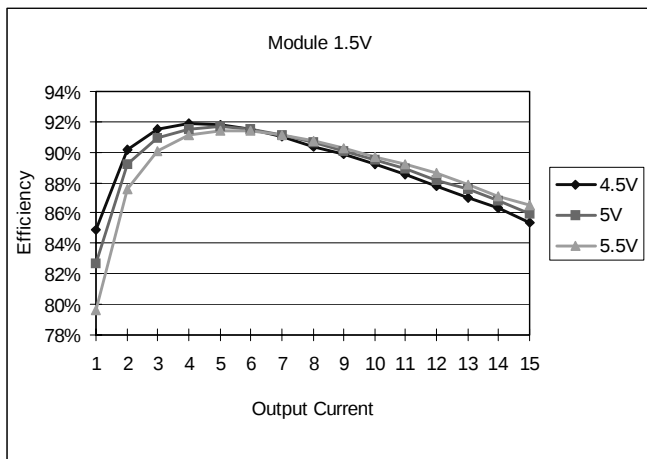
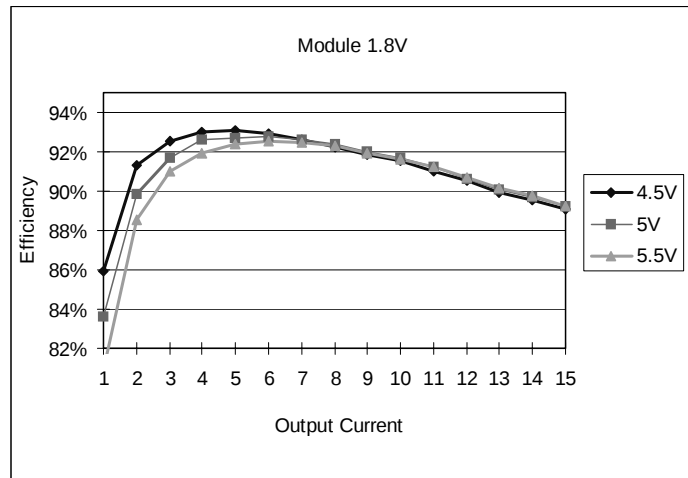
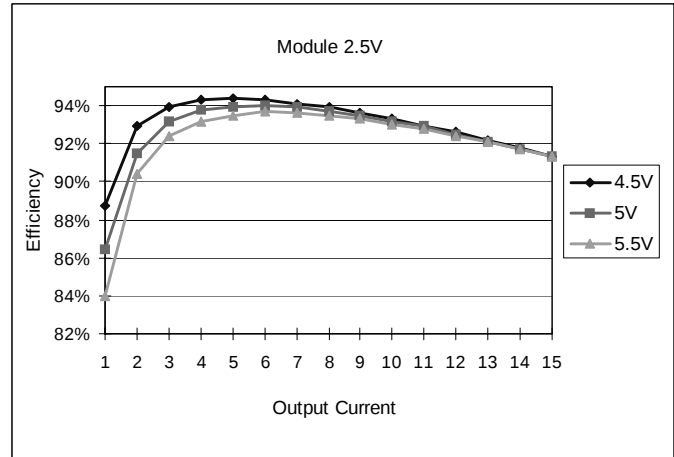
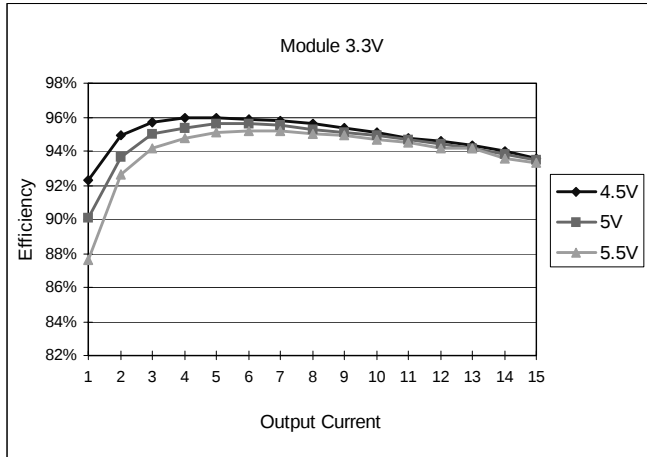
Control Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off ³		Vouten				V
Signal Low (Unit Off)	V7PD-15Bxx0		-0.3		0.8	V
Signal High (Unit On)			2.5		5.5	V
Signal Low (Unit On)	V7PD-15BxxL		-0.3		0.8	V
Signal High (Unit Off)			2.5		5.5	V

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

BP02V7PD-15B

Efficiency Data



NON-ISOLATED DC/DC CONVERTERS

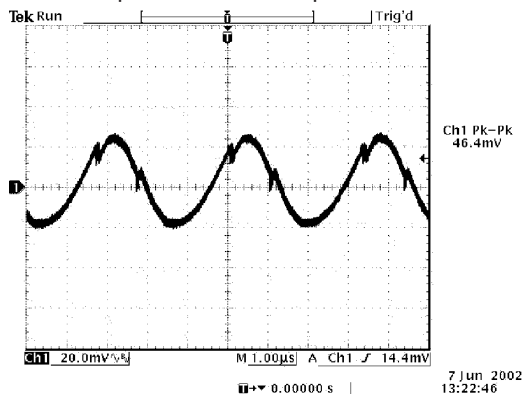
5V Input / 1.2V – 3.3V Output / 15A



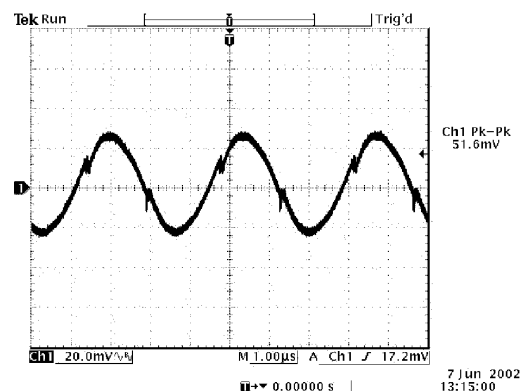
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Ripple and Noise

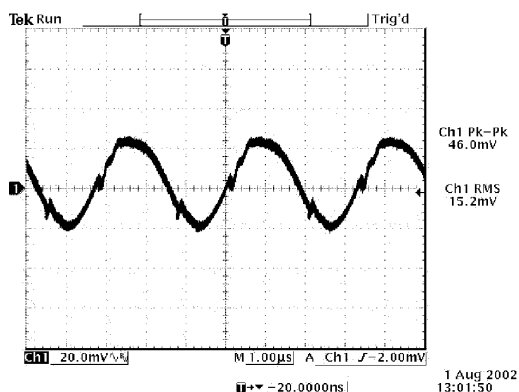
0.1 μ F ceramic cap added at the output.



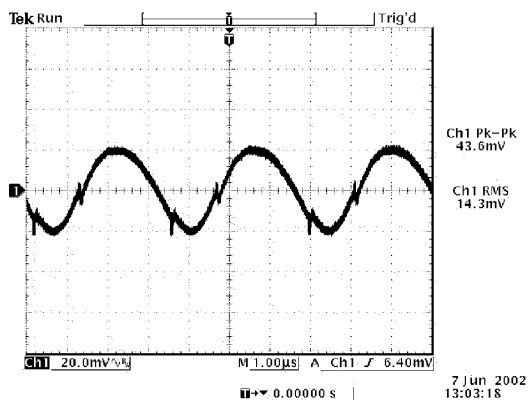
Ripple and noise at full load and 5Vdc input, 3.3Vdc output and Ta=25° C



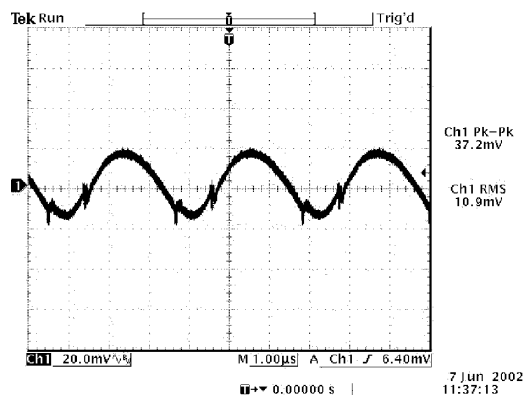
Ripple and noise at full load and 5Vdc input, 2.5Vdc output and Ta=25° C



Ripple and noise at full load and 5Vdc input, 1.8Vdc output and Ta=25° C



Ripple and noise at full load and 5Vdc input, 1.5Vdc output and Ta=25° C

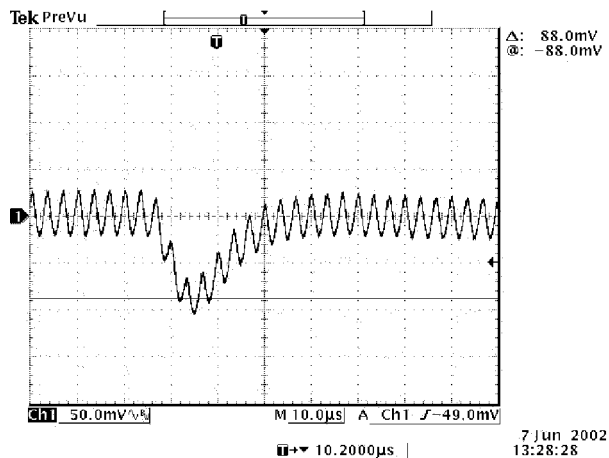


Ripple and noise at full load and 5Vdc input, 1.2Vdc output and Ta=25° C

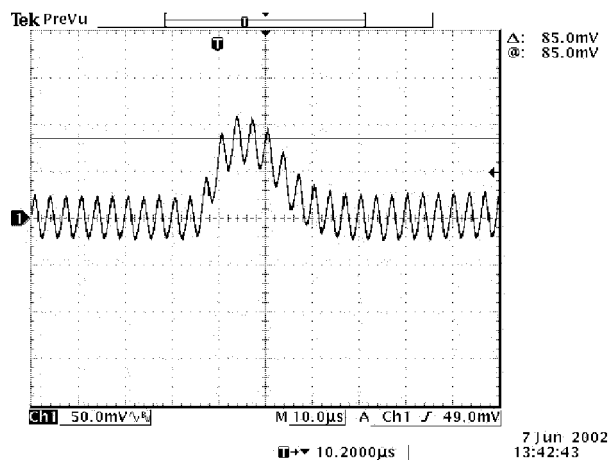
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Transient Response

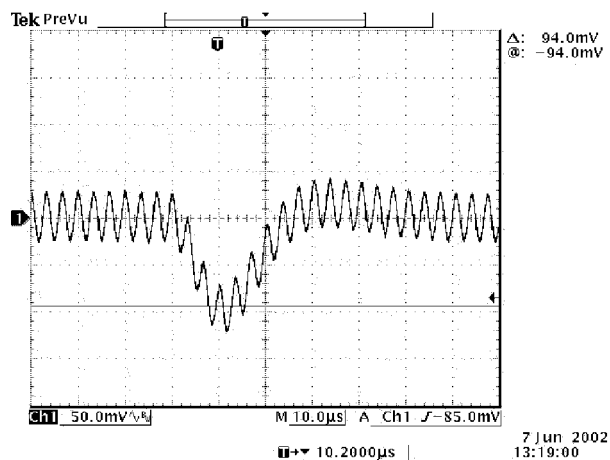
Transient response: $di/dt = 0.5A/\mu S$, no external load capacitance



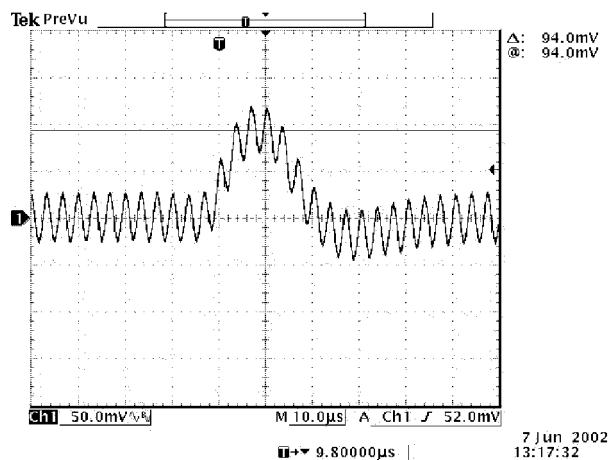
Vout=3.3V
50% to 100% load transients at 5V input and Ta=25° C



Vout=3.3V
100% to 50% load transients at 5V input and Ta=25° C



Vout=2.5V
50% to 100% load transients at 5V input and Ta=25° C



Vout=2.5V
100% to 50% load transients at 5V input and Ta=25° C

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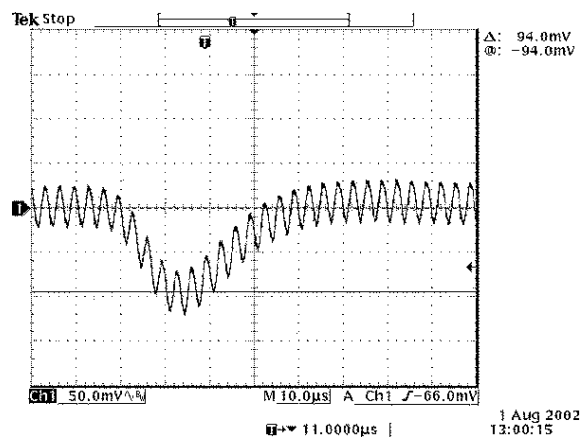
5V Input / 1.2V – 3.3V Output / 15A



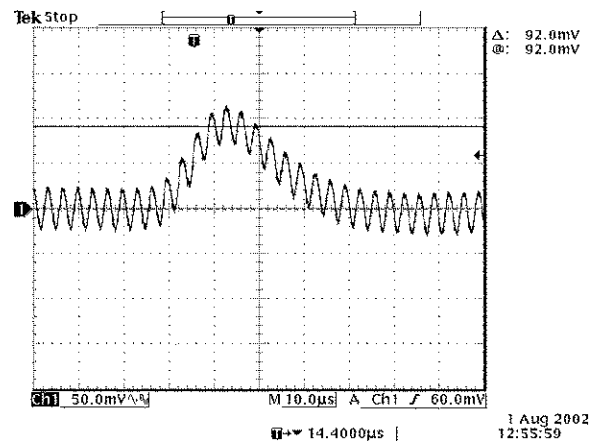
BP06VRPD-15B

Transient Response

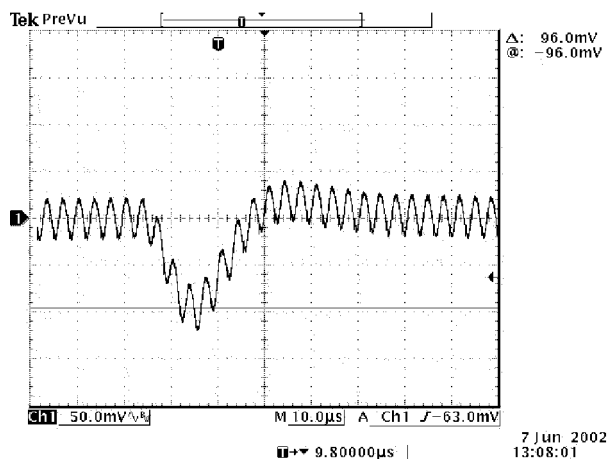
Transient response: $di/dt = 0.5A/\mu S$, no external load capacitance



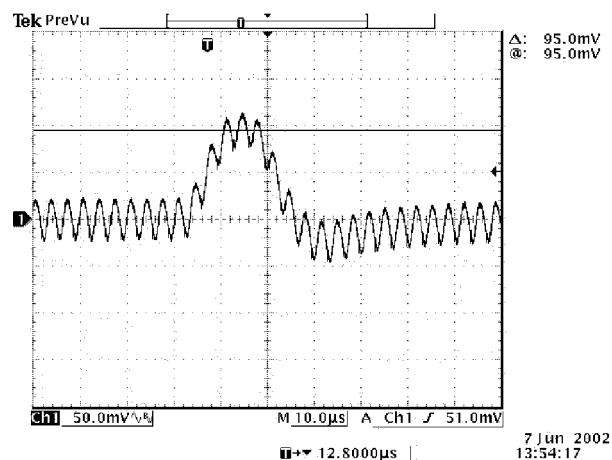
Vout=1.8V
50% to 100% load transients at 5V input and Ta=25° C



Vout=1.8V
100% to 50% load transients at 5V input and Ta=25° C



Vout=1.5V
50% to 100% load transients at 5V input and Ta=25° C

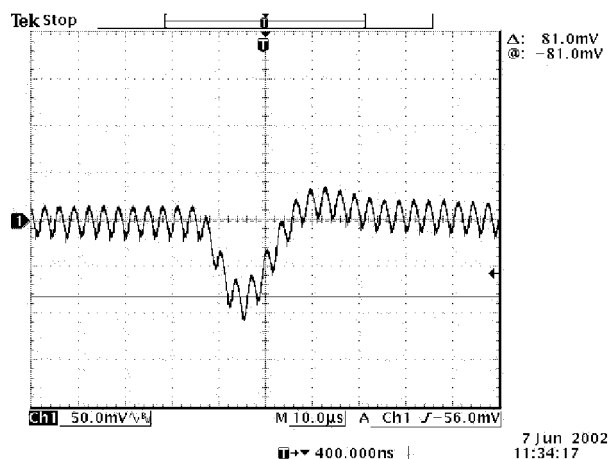


Vout=1.5V
100% to 50% load transients at 5V input and Ta=25° C

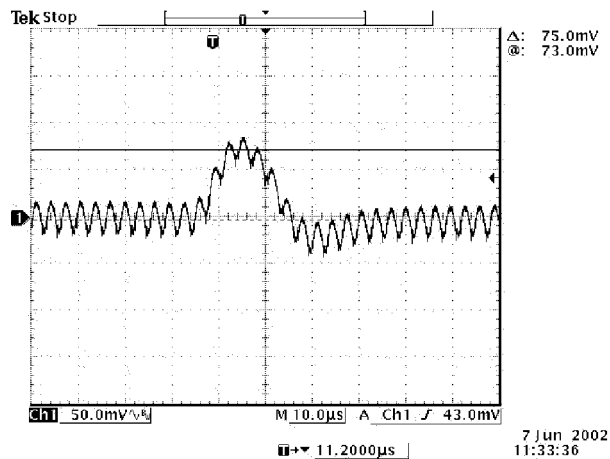
BP02V7PD-15B

Transient Response

Transient response: $di/dt = 0.5A/\mu S$, no external load capacitance



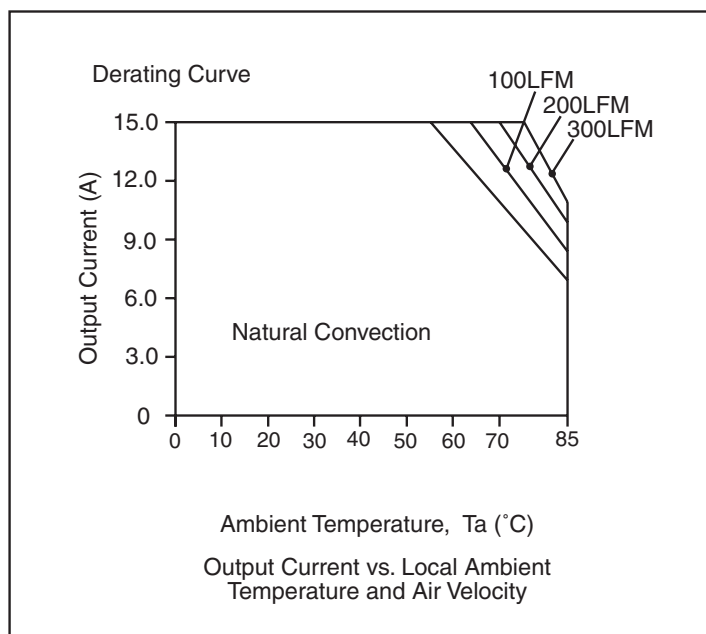
Vout=1.2V
50% to 100% load transients at 5V input and Ta=25° C



Vout=1.2V
100% to 50% load transients at 5V input and Ta=25° C

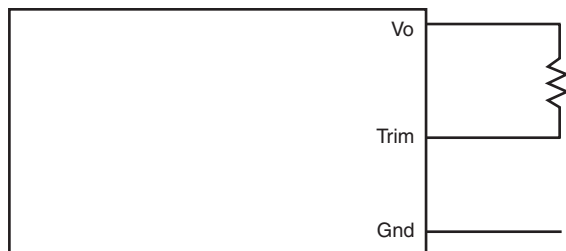
Thermal Considerations

V7PD-15B

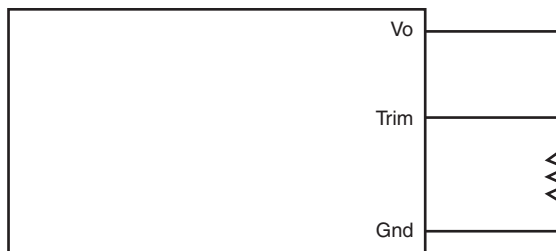


Output Voltage Set-Point Adjustment

Trim Down Test Circuit



Trim Up Test Circuit

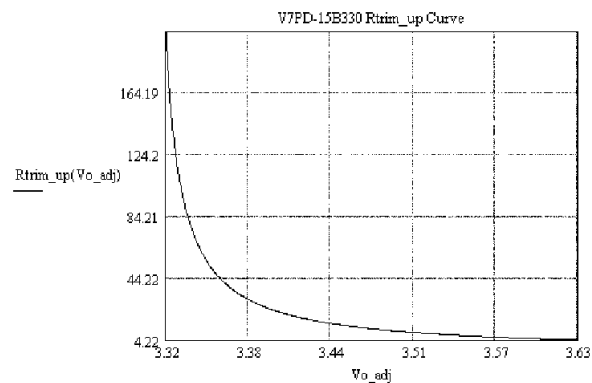
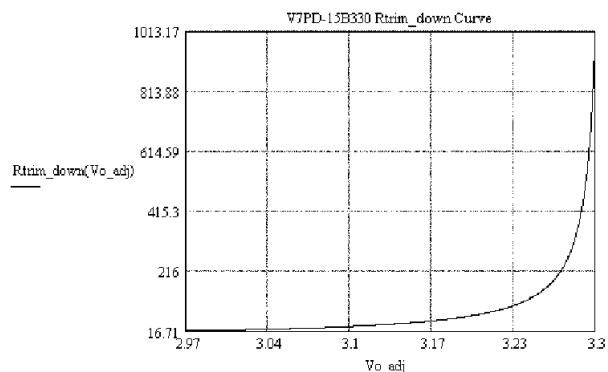


Output Voltage Set-Point Adjustment

VRPD-15B33x Trim Resistor Calculation

$$R_{\text{trim down}} = \left(\frac{3.17 V_{o \text{ adj}} - 0.767 V_{o \text{ nom}}}{V_{o \text{ nom}} - V_{o \text{ adj}}} - 3.65 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left(\frac{0.767 V_{o \text{ nom}}}{V_{o \text{ adj}} - V_{o \text{ nom}}} - 3.65 \right) \text{ Kohm}$$



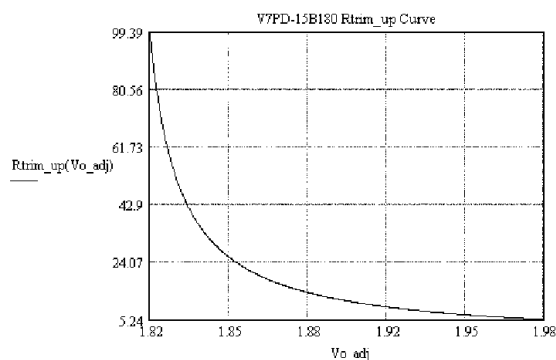
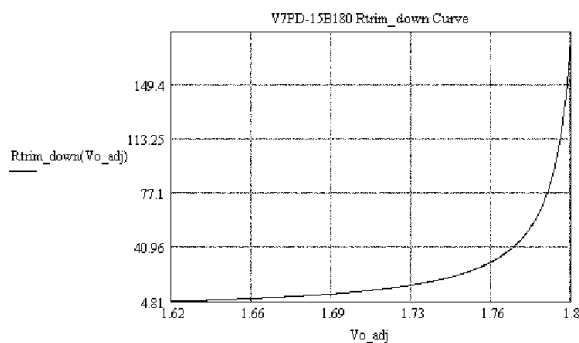
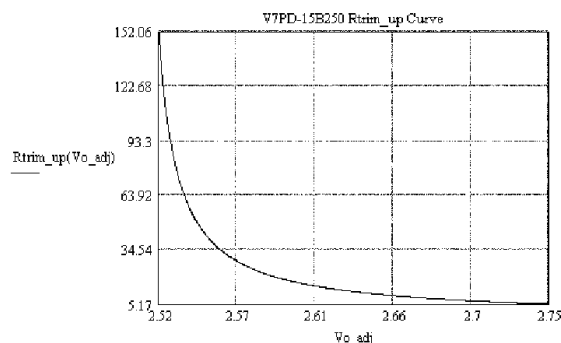
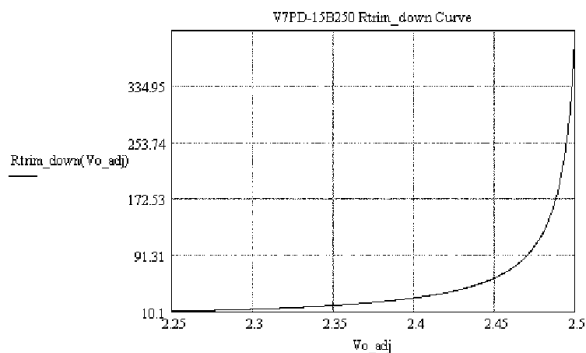
BP02V7PD-15B

Output Voltage Set-Point Adjustment

VRPD-15B25x Trim Resistor Calculation

$$R_{\text{trim down}} = \left(\frac{2.16 V_o \text{ adj} - 0.689 V_o \text{ nom}}{V_o \text{ nom} - V_o \text{ adj}} - 2 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left(\frac{0.689 V_o \text{ nom}}{V_o \text{ adj} - V_o \text{ nom}} - 2 \right) \text{ Kohm}$$



VRPD-15B18x Trim Resistor Calculation

$$R_{\text{trim down}} = \left(\frac{1.51 V_o \text{ adj} - 0.668 V_o \text{ nom}}{V_o \text{ nom} - V_o \text{ adj}} - 1.78 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left(\frac{0.668 V_o \text{ nom}}{V_o \text{ adj} - V_o \text{ nom}} - 1.78 \right) \text{ Kohm}$$

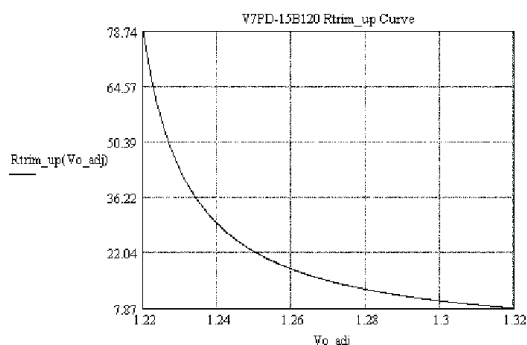
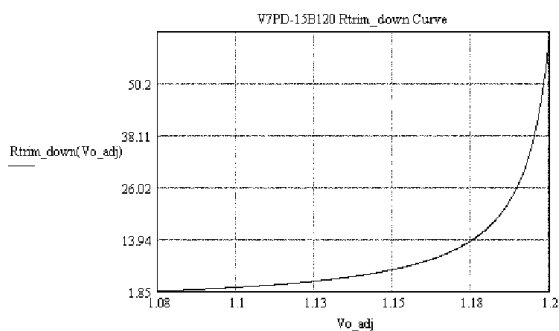
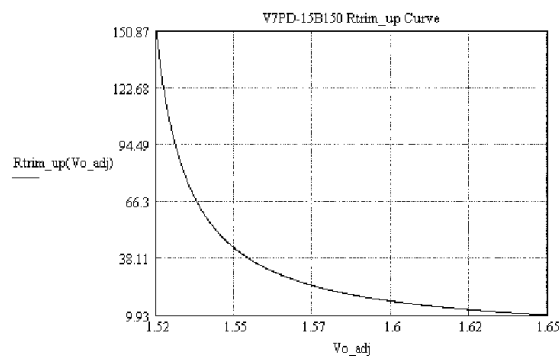
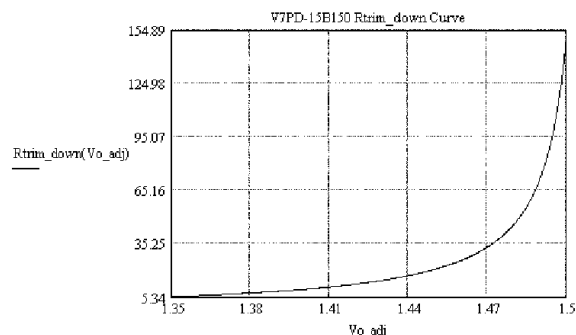
BP02V7PD-15B

Output Voltage Set-Point Adjustment

VRPD-15B15x Trim Resistor Calculation

$$R_{\text{trim down}} = \left(\frac{2.06 V_{o, \text{adj}} - 1.092 V_{o, \text{nom}}}{V_{o, \text{nom}} - V_{o, \text{adj}}} - 1.78 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left(\frac{1.092 V_{o, \text{nom}}}{V_{o, \text{adj}} - V_{o, \text{nom}}} - 1.78 \right) \text{ Kohm}$$



VRPD-15B12x Trim Resistor Calculation

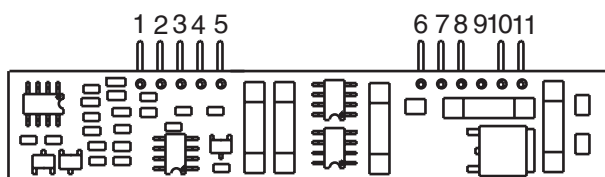
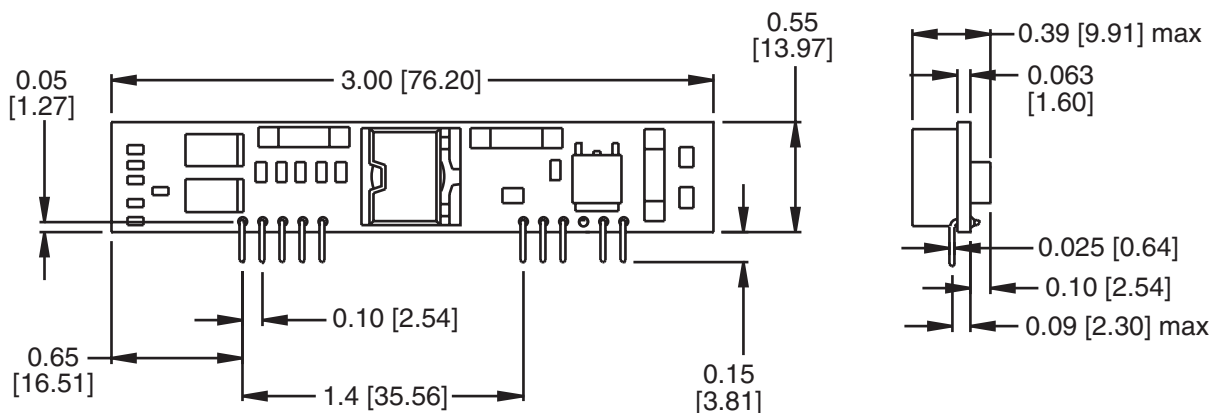
$$R_{\text{trim down}} = \left(\frac{1.22 V_{o, \text{adj}} - 0.808 V_{o, \text{nom}}}{V_{o, \text{nom}} - V_{o, \text{adj}}} - 0.825 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left(\frac{0.808 V_{o, \text{nom}}}{V_{o, \text{adj}} - V_{o, \text{nom}}} - 0.825 \right) \text{ Kohm}$$

BP06VRPD-15B

Mechanical

VRPD-15B



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

Dimensions are in inches [millimeters].

Standard dimension tolerance is ± 0.005 [0.13] unless otherwise noted.

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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