NON-ISOLATED DC/DC CONVERTERS
5V Input / 0.9V – 3.3V Output / 10A

bel POWER PRODUCTS

BP03V7PB-10B

V7PB-10B Series

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



Description

The Bel V7PB-10B 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 0.9V to 3.3V. They are packaged in a compact, SIP package rated at 10A. Standard features include remote on/off, over current and short circuit protection, output voltage adjust and industrial temperature range (-40° to +85° C). The output is closely regulated and the efficiency is typically 95.5% @ 3.3V output at full load. 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

Part Number Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number Remote Sense Active Low	Part Number Remote Sense Active High
3.3V	5V	10A	33W	95.5%	V7PB-10B33L	V7PB-10B33S
2.5V	5V	10A	25W	94%	V7PB-10B25L	V7PB-10B25S
1.8V	5V	10A	18W	92%	V7PB-10B18L	V7PB-10B18S
1.5V	5V	10A	15W	91%	V7PB-10B15L	V7PB-10B15S
1.2V	5V	10A	12W	90%	V7PB-10B12L	V7PB-10B12S
0.9V	5V	10A	9W	87%	V7PB-10B09L	V7PB-10B09S

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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	-40		85	°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 0.9V	Iin			8.7 6.7 4.9 4.2 3.4 2.6	A
No Load Input Current	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			85 130 130 140 100 140	120 180 180 180 140 180	mA
Remote Off Input Current	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			5 5 8 4 4 4	10 10 10 10 10 10	mA
Input Reflected Ripple Current[1]	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			35 40 30 30 30 20	50 50 50 50 50 50	mArms
Input Reflected Ripple Current [1]	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			120 120 100 90 90 70	180 180 180 180 180 180	mApk
I^2t Inrush Current Transient	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			0.0093 0.0089 0.0050 0.0022 0.0015 0.0018		A^2s
Turn On Voltage Threshold	All			4.25		V
Turn Off Voltage Threshold	All			3.85		V

Note:
Input capacitance two 270µF/16V, ESR = 0.018 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]	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V	Vout	3.234 2.450 1.764 1.470 1.176 0.882	3.3 2.5 1.8 1.5 1.2 0.9	3.366 2.550 1.836 1.530 1.224 0.918	V
Load Regulation	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			8 6 5 4 4 4	16.5 12.5 9.0 7.5 7.5 7.5	mV
Line Regulation	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			5 4 3 3 3 3	10 7.5 5.5 4.5 4.5 4.5	mV
Regulation Over Temperature	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			30 40 30 20 15 10	40 50 40 30 25 20	mV
Total Output Voltage Regulation	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			43 50 38 27 22 17	66.5 70 54.5 42 37 32	mV
Output Ripple and Noise [2]	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			30 35 30 30 25 20	45 50 45 45 35 30	mVpk
Output Ripple and Noise [2]	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V			10 10 10 10 6 5	15 15 15 15 10 10	mVrms
Output Current Range	All	Iout	0		10	A
Output DC Current Limit	All	Ioutlim	13		25	A
Short Circuit Surge	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V	Ioutsurge		0.194 0.215 0.193 0.170 0.160 0.197		A^2s
Turn on Time	All	Ton		6	10	ms
Overshoot at Turn On	All			0	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 = 5V, 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	3.3V			120	160	mV
Settling Time		Ts		30	60	µs
ΔV 100% to 50% of Max Load				130	160	mV
Settling Time		Ts		30	60	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	2.5V			80	120	mV
Settling Time		Ts		30	60	µs
ΔV 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		30	60	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.8V			90	120	mV
Settling Time		Ts		30	60	µs
ΔV 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		30	60	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.5V			90	120	mV
Settling Time		Ts		30	60	µs
ΔV 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		30	60	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.2V			80	110	mV
Settling Time		Ts		30	60	µs
ΔV 100% to 50% of Max Load				80	110	mV
Settling Time		Ts		30	60	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	0.9V			80	100	mV
Settling Time		Ts		30	60	µs
ΔV 100% to 50% of Max Load				80	100	mV
Settling Time		Ts		30	60	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 without external load capacitance.

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General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency[1]	3.3V 2.5V 1.8V 1.5V 1.2V 0.9V	η	92.5 91 89 88 87 84	95.5 94 92 91 90 87		%
Switching Frequency	All	Fsw	250	300	340	kHz
Output Voltage Trim Range[2]	All		90		110	%
Remote Sense Compensation					10	%
Weight	All			9.2		g

1. Vin=5V, full load and Ta=25° C.
2. See graphs on pages 12 - 17.

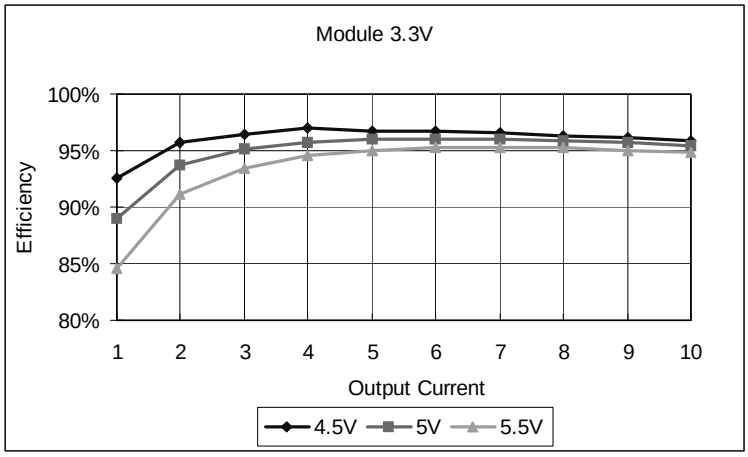
Control Specifications

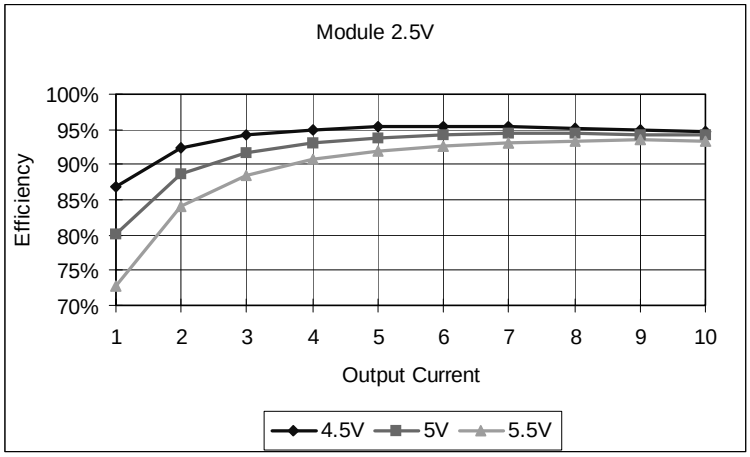
Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off [3]	All	Vouten				V
Signal Low (Unit Off)	V7PB-10BxxS		-0.3		0.8	V
Signal High (Unit On)			2.5		5.5	V
Signal Low (Unit On)	V7PB-10BxxL		-0.3		0.8	V
Signal High (Unit Off)			2.5		5.5	V

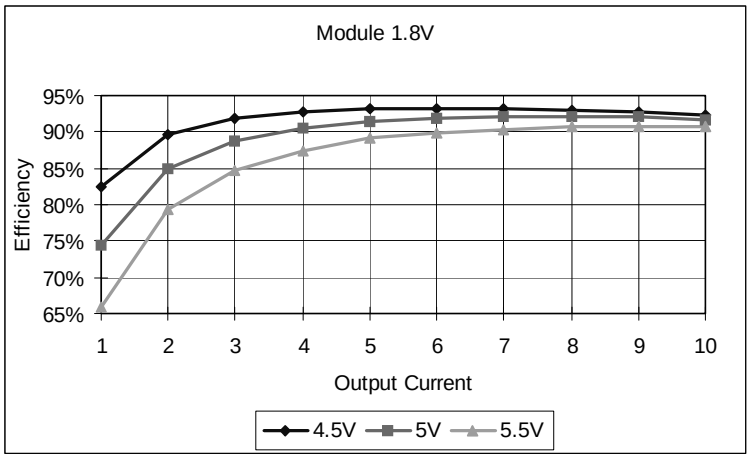
3. With remote on/off pin 11 open, the module is on.
Note: On/off pin designed to work with an open collector/drain switch.

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Efficiency Data

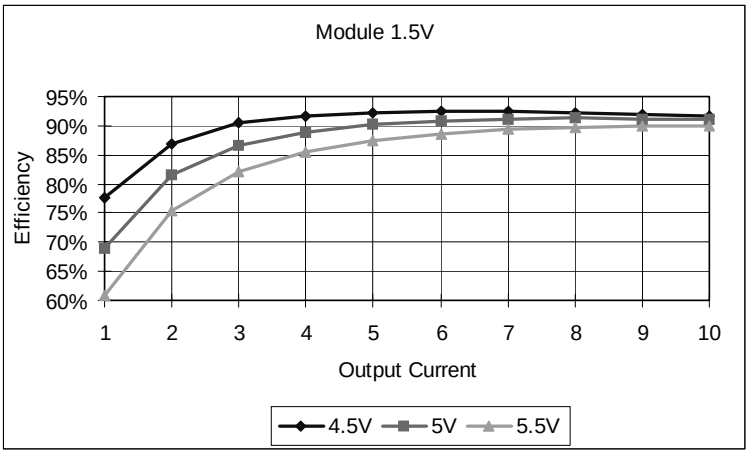


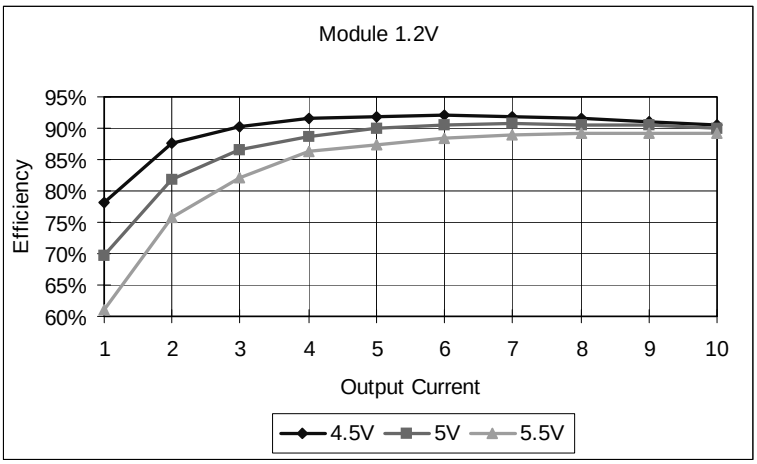


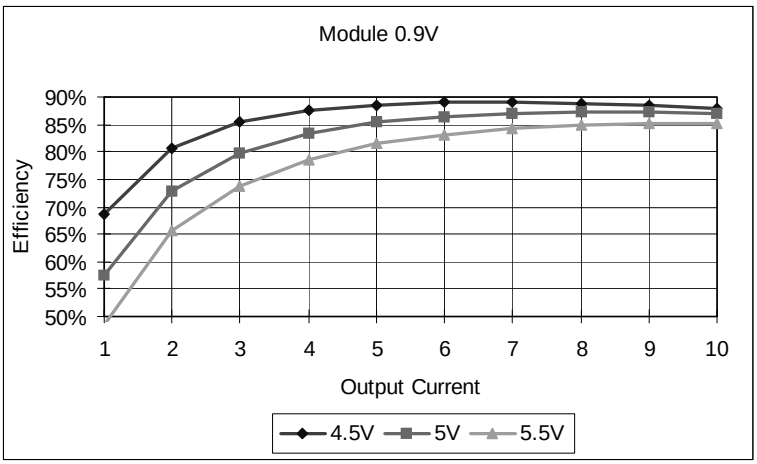


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Efficiency Data





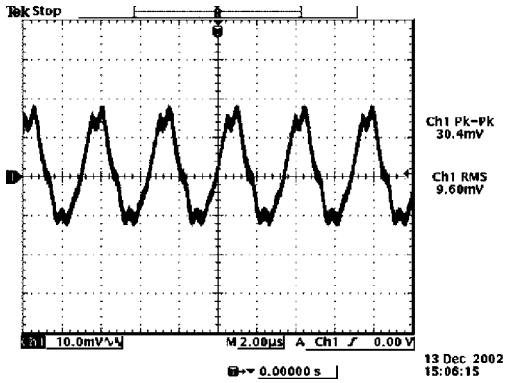


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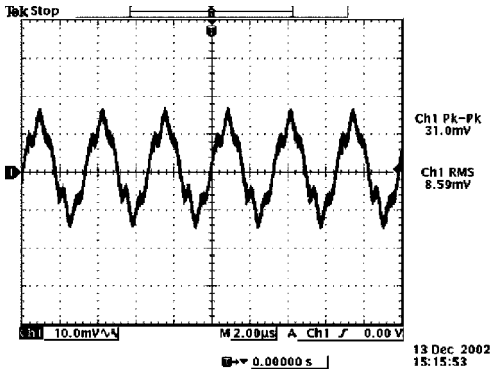
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Ripple and Noise

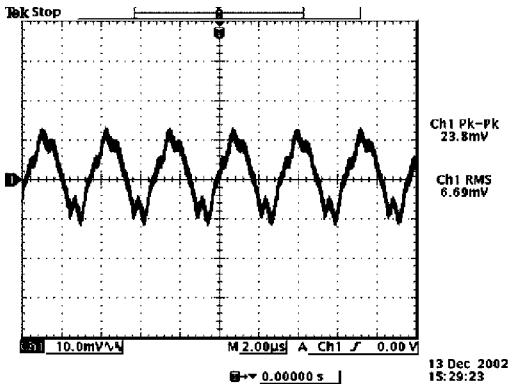
1µF ceramic cap added at the output.



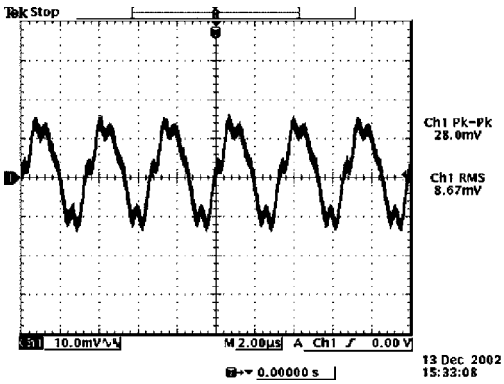
Ripple and noise at full load and 5Vdc input, 3.3Vdc output and Ta=25° C



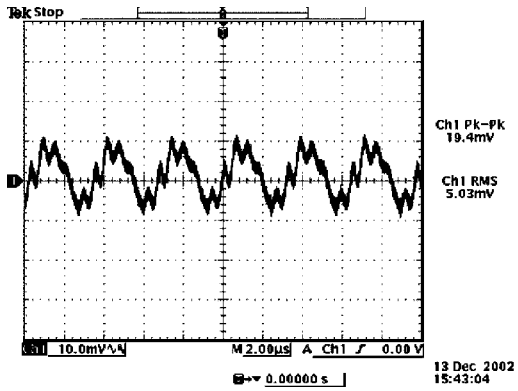
Ripple and noise at full load and 5Vdc input, 2.5Vdc output and Ta=25° C



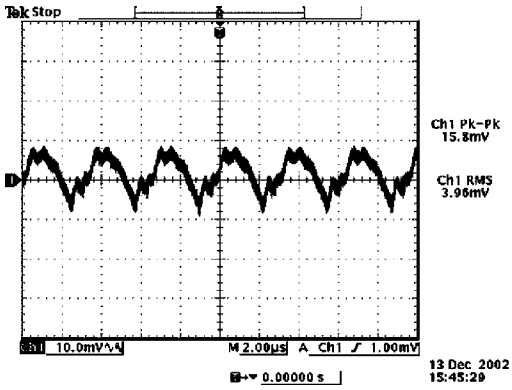
Ripple and noise at full load and 5Vdc input, 1.8Vdc output and Ta=25° C



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

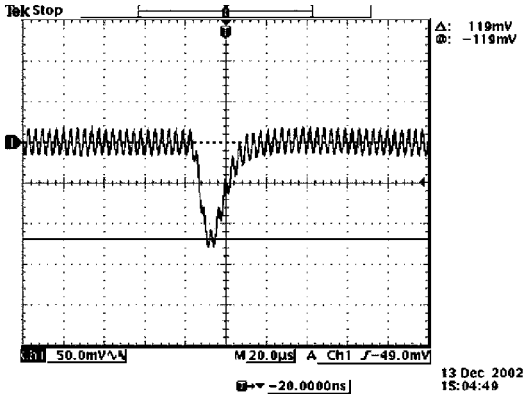


Ripple and noise at full load and 5Vdc input, 0.9Vdc output and Ta=25° C

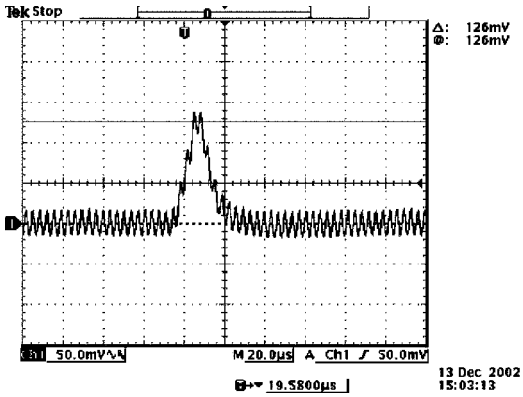
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Transient Response

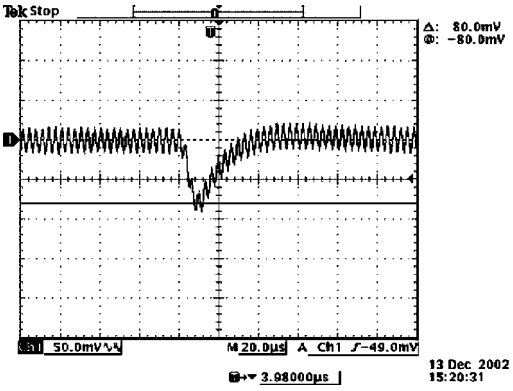
Transient response: di/dt = 0.5A/µS, no external load capacitance



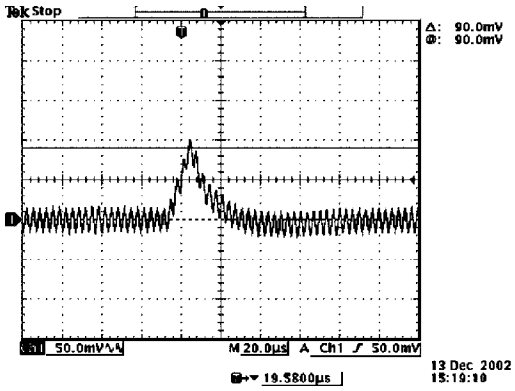
Vout=3.3V
50% to 100% load transients at 5V input and Ta=25° C



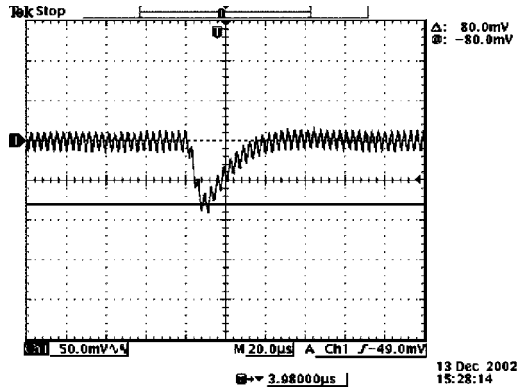
Vout=3.3V
100% to 50% load transients at 5V input and Ta=25° C



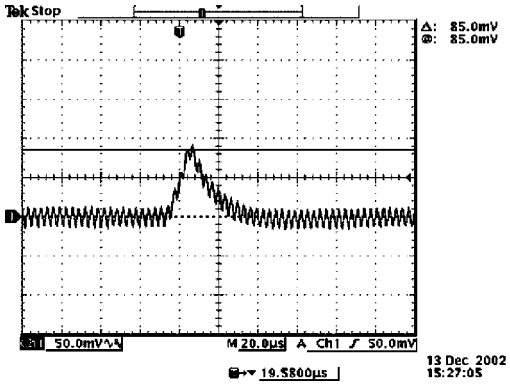
Vout=2.5V
50% to 100% load transients at 5V input and Ta=25° C



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



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

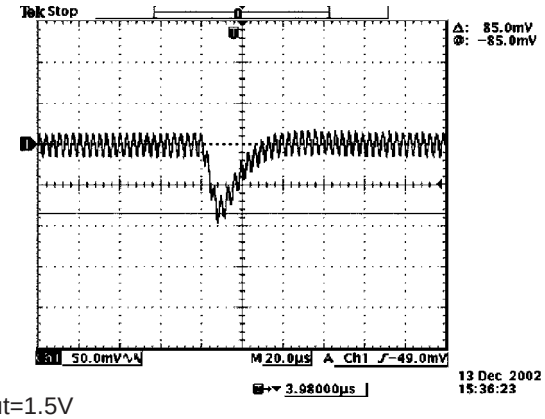


Vout=1.8V
100% to 50% load transients at 5V input and Ta=25° C

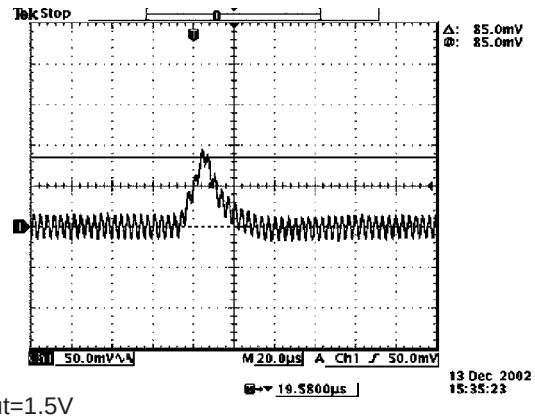
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Transient Response

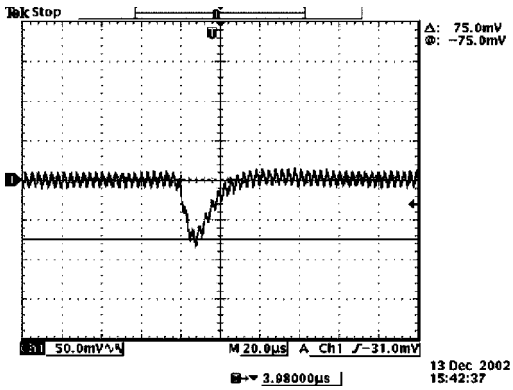
Transient response: di/dt = 0.5A/µS, no external load capacitance



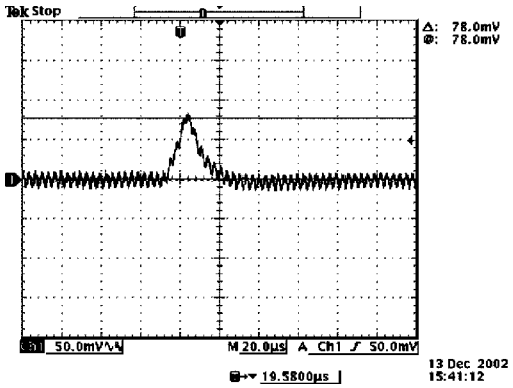
Vout=1.5V
50% to 100% load transients at 5V input and Ta=25° C



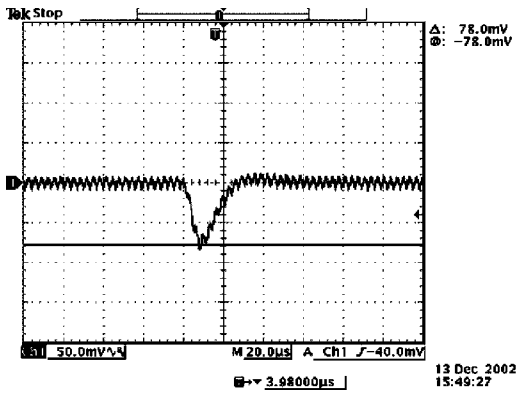
Vout=1.5V
100% to 50% load transients at 5V input and Ta=25° C



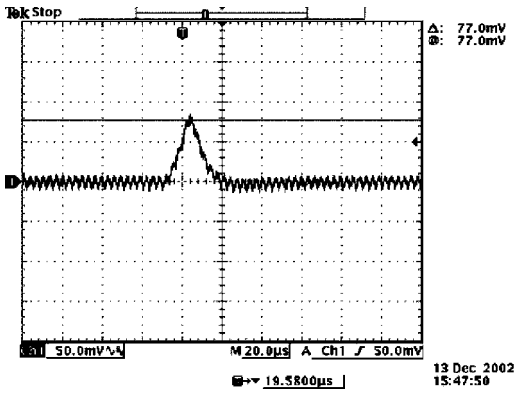
Vout=1.2V
50% to 100% load transients at 5V input and Ta=25° C



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



Vout=0.9V
50% to 100% load transients at 5V input and Ta=25° C

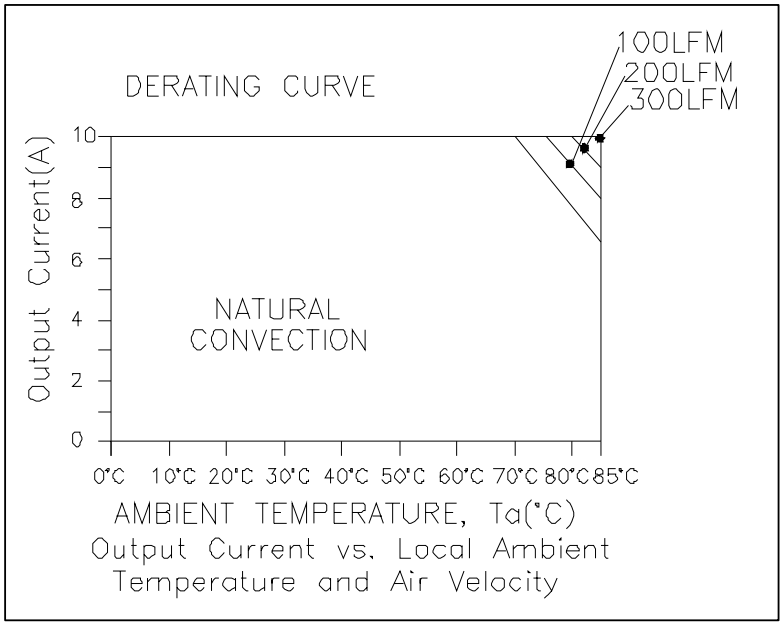


Vout=0.9V
100% to 50% load transients at 5V input and Ta=25° C

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Thermal Considerations

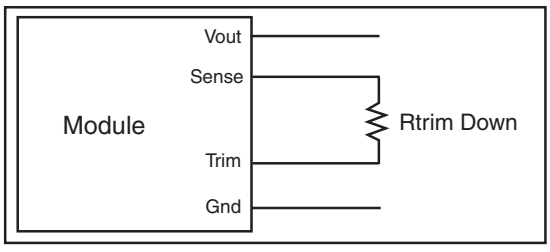
V7PB-10B



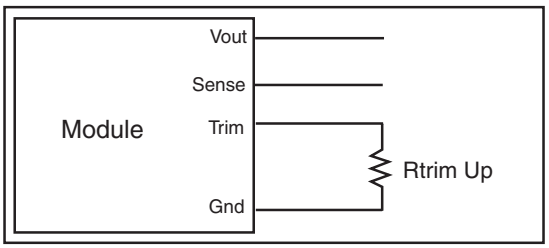
Output Current vs. Local Ambient Temperature and Air Velocity

Output Voltage Set-Point Adjustment

Trim Down Circuit



Trim Up Circuit



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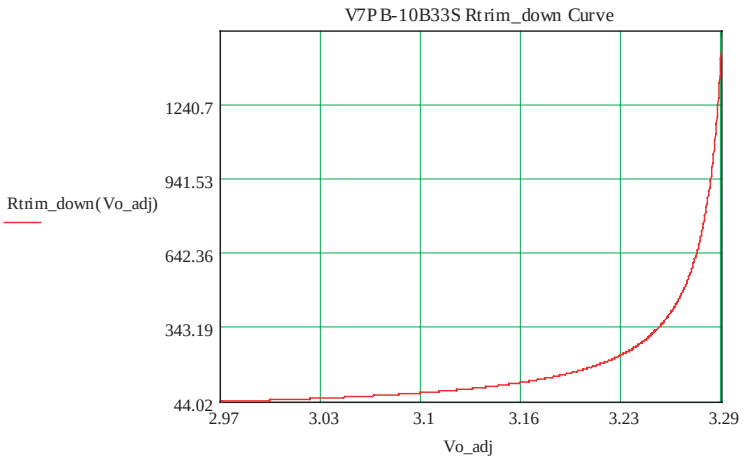
Output Voltage Set-Point Adjustment

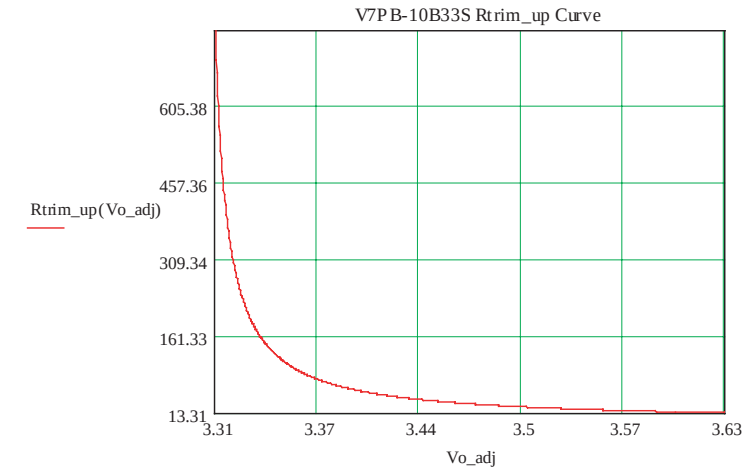
V7PB-10B33S Trim Resistor Calculation

$Vo_nom = 3.302$ Unit:Volt

$$Rtrim_down(Vo_adj) := \frac{7.5(Vo_adj - 0.8)}{Vo_nom - Vo_adj} - 4.99$$ Unit:Kohm

$$Rtrim_up(Vo_adj) := \frac{6}{Vo_adj - Vo_nom} - 4.99$$ Unit:Kohm





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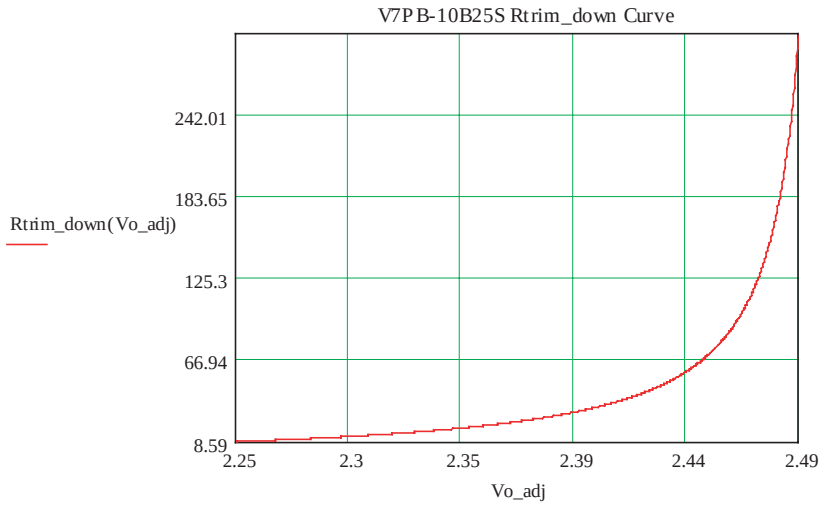
Output Voltage Set-Point Adjustment

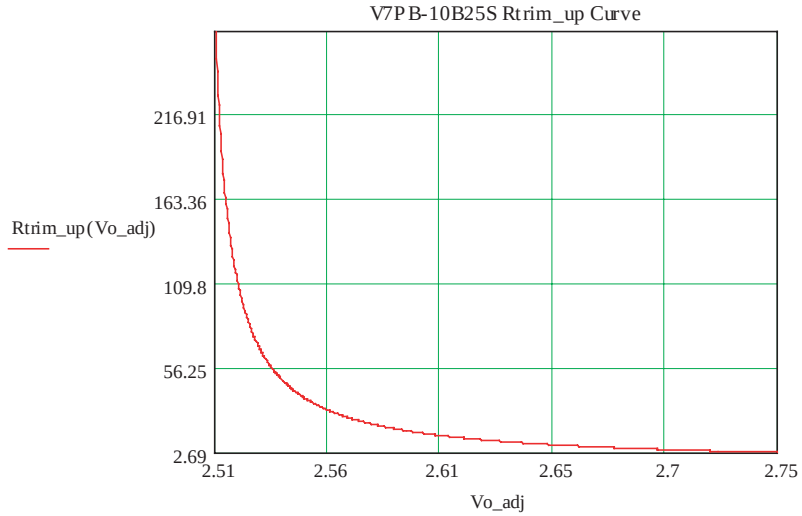
V7PB-10B25S Trim Resistor Calculation

$Vo_nom = 2.503$ Unit: Volt

$$Rtrim_down(Vo_adj) := \frac{2.37(Vo_adj - 0.8)}{Vo_nom - Vo_adj} - 4.99$$ Unit: Kohm

$$Rtrim_up(Vo_adj) := \frac{1.896}{Vo_adj - Vo_nom} - 4.99$$ Unit: Kohm





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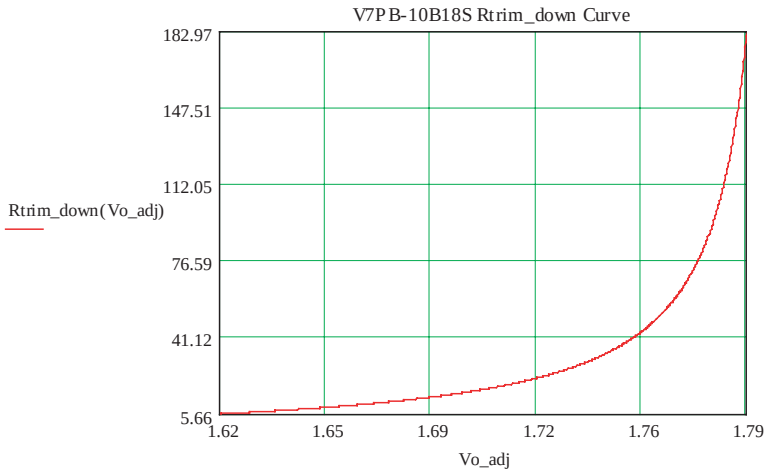
Output Voltage Set-Point Adjustment

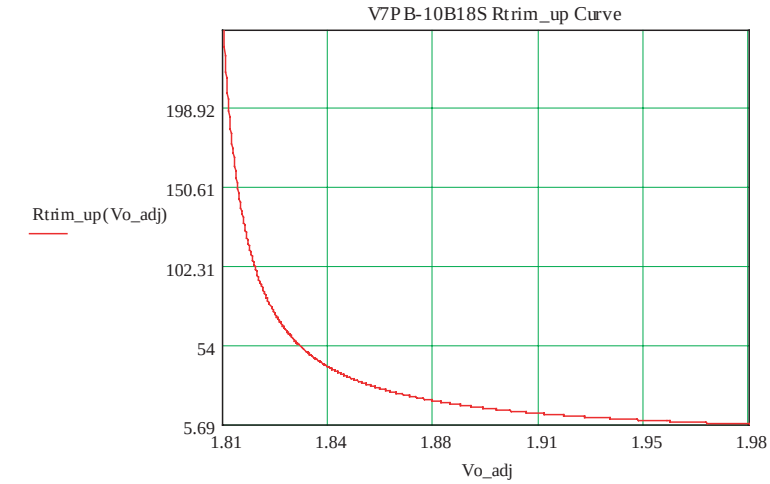
V7PB-10B18S Trim Resistor Calculation

$Vo_nom = 1.802$ Unit: Volt

$$Rtrim_down(Vo_adj) := \frac{2.37(Vo_adj - 0.8)}{Vo_nom - Vo_adj} - 4.99$$ Unit: Kohm

$$Rtrim_up(Vo_adj) := \frac{1.896}{Vo_adj - Vo_nom} - 4.99$$ Unit: Kohm





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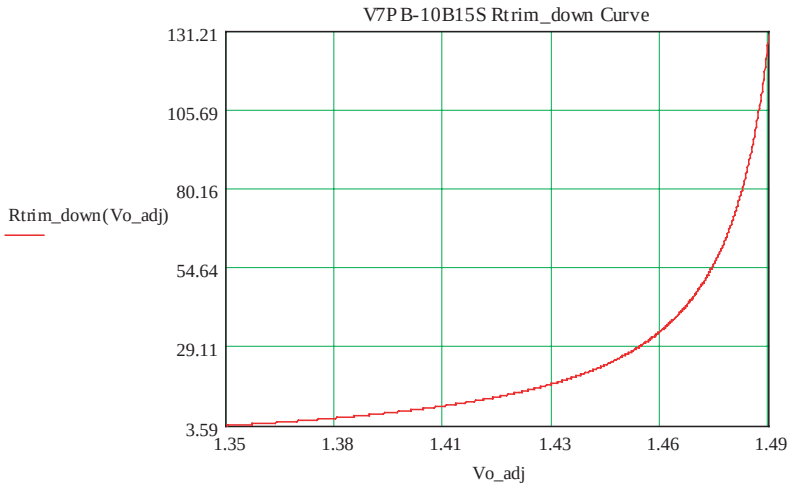
Output Voltage Set-Point Adjustment

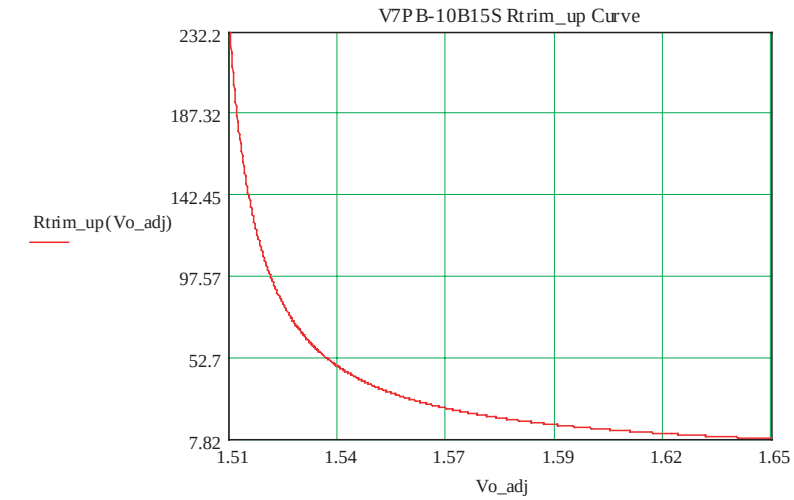
V7PB-10B15S Trim Resistor Calculation

$Vo_nom = 1.502$ Unit: Volt

$$Rtrim_down(Vo_adj) := \frac{2.37(Vo_adj - 0.8)}{Vo_nom - Vo_adj} - 4.99$$ Unit: Kohm

$$Rtrim_up(Vo_adj) := \frac{1.896}{Vo_adj - Vo_nom} - 4.99$$ Unit: Kohm





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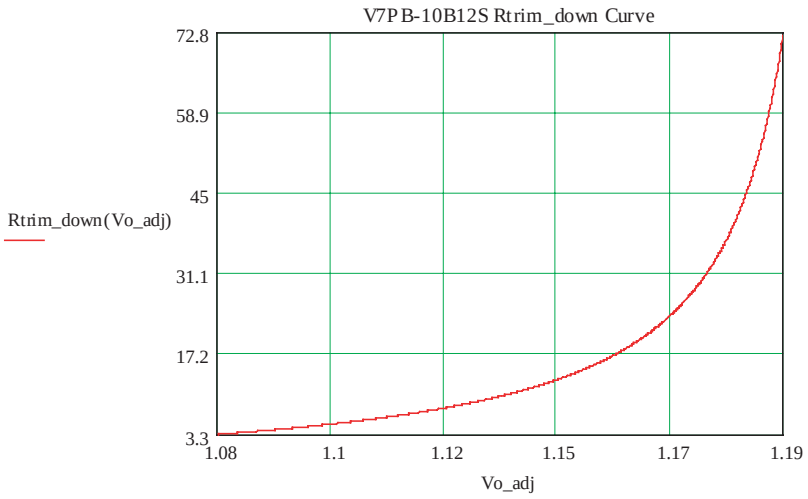
Output Voltage Set-Point Adjustment

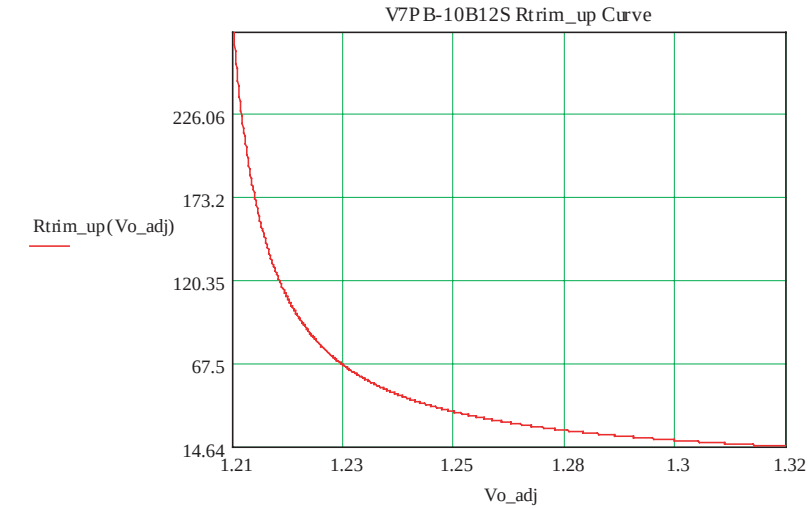
V7PB-10B12S Trim Resistor Calculation

$Vo_nom = 1.203$ Unit: Volt

$$Rtrim_down(Vo_adj) := \frac{2.49(Vo_adj - 0.8)}{Vo_nom - Vo_adj} - 2.37$$ Unit: Kohm

$$Rtrim_up(Vo_adj) := \frac{1.992}{Vo_adj - Vo_nom} - 2.37$$ Unit: Kohm





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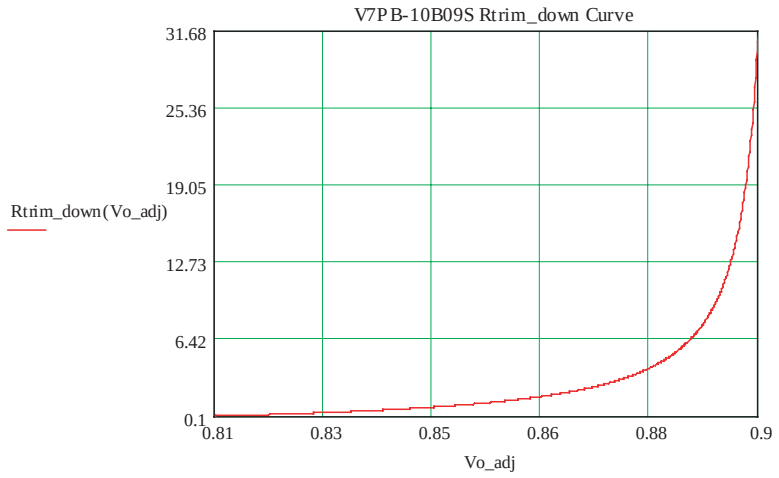
Output Voltage Set-Point Adjustment

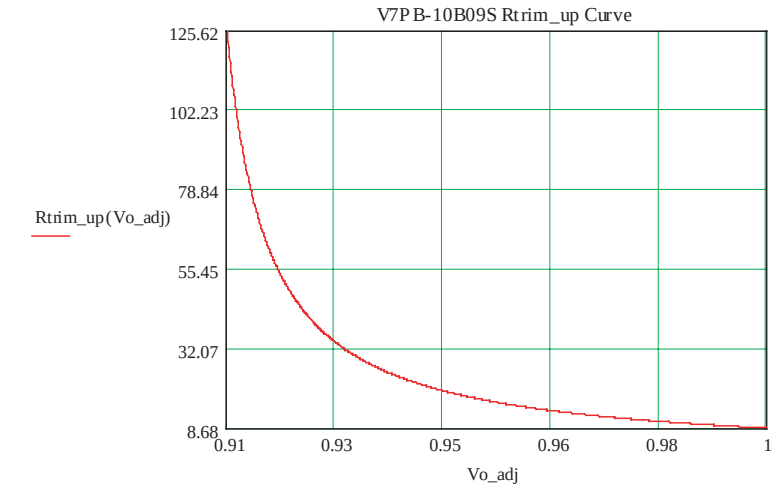
V7PB-10B09S Trim Resistor Calculation

$Vo_nom = 0.903$ Unit:Volt

$$Rtrim_down(Vo_adj) := \frac{1.05(Vo_adj - 0.8)}{Vo_nom - Vo_adj} - 0.01$$ Unit:Kohm

$$Rtrim_up(Vo_adj) := \frac{0.84}{Vo_adj - Vo_nom} - 0.01$$ Unit:Kohm



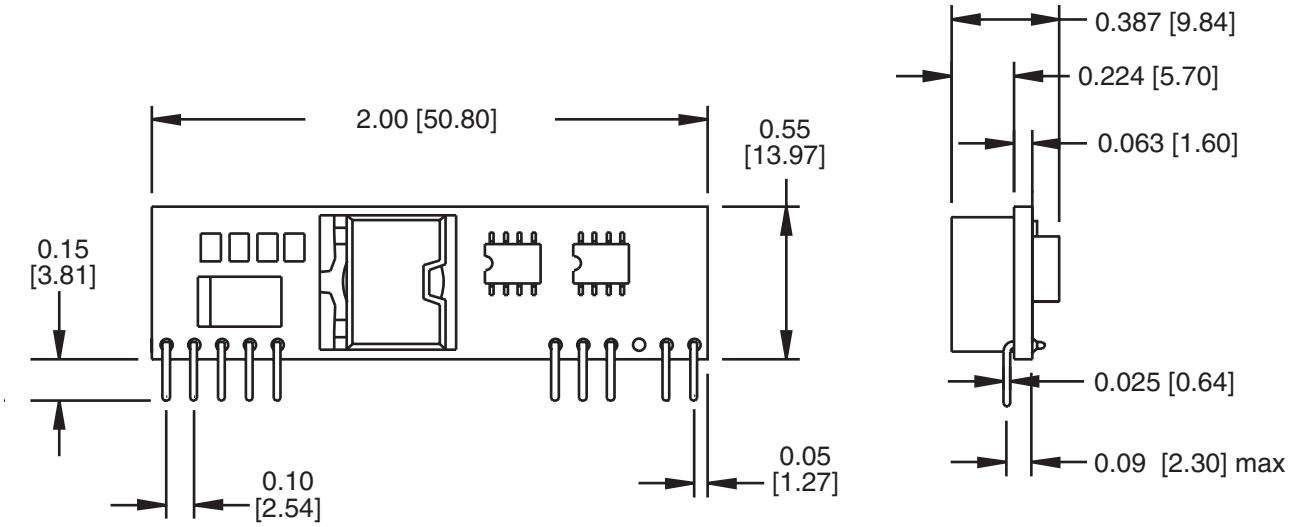


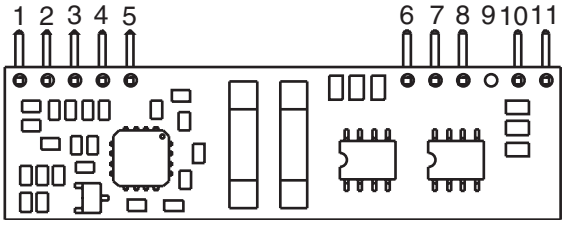
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BP03V7PB-10B

Mechanical

V7PB-10B





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

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