NON-ISOLATED DC/DC CONVERTERS

3.3V Input / 1.2V – 2.5V Output / 12A

BP02S7DB-12C

S7DB-12C Series

- Nonisolated
- Compact, low profile surface mount package
- Fixed frequency
- High efficiency means less power dissipation
- Excellent thermal performance
- Optimized for cost
- Remote on/off
- Undervoltage lockout (UVLO)
- Over current and short circuit protection
- Remote sense

Description

The Bel S7DB-12C 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 a compact, low profile, surface mount DIP package for ease of layout and space savings. 12A maximum output is also provided. Standard features include remote on/off, remote sense, over current and short circuit protection, UVLO and output voltage adjust. 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

Part Number Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number
2.5V	3.3V	12A	30W	91%	S7DB-12C250
1.8V	3.3V	12A	21.6W	87%	S7DB-12C180
1.5V	3.3V	12A	18.0W	84%	S7DB-12C150
1.2V	3.3V	12A	14.4W	82%	S7DB-12C120

Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
Continuous Input Voltage	Vin	-0.3		4	V
Output Enable Terminal Voltage	Vouten	-0.3		4	V
Ambient Temperature	Tamb	-40		85	°C
Storage Temperature	Tstor	-55		100	°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			12 9.5 8.2 6.7	A
No Load Input Current	All				100	mA
Remote Off Input Current				10	20	mA
Input Reflected Ripple Current[1]	All			25	50	mA_{rms}
Input Reflected Ripple Current (P-P)[1]	All			80	160	mApk
I^2t Inrush Current Transient	All			0.1	0.2	A^2s
Turn On Voltage Threshold	All			2.85		V
Turn Off Voltage Threshold	All			2.3		V

Note: Input capacitance two 270µF/10V, ESR = 0.018 Ω max at 100kHz @ 25° C.
1. With simulated source impedance of 500nH, 5Hz to 20MHz.

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	All			3.0	10	mV
Line Regulation	All			2.0	5	mV
Regulation Over Temperature	2.5V 1.8V 1.5V 1.2V			19 13 11 9	38 27 23 18	mV
Total Output Voltage Regulation	2.5V 1.8V 1.5V 1.2V				53 42 38 33	mV
Output Ripple and Noise [2]	2.5V 1.8V 1.5V 1.2V			55 50 40 40	100 100 100 100	mVp-p
Output Ripple and Noise [2]	2.5V 1.8V 1.5V 1.2V			15 10 10 10	30 25 25 25	mVrms
Output Current Range	All	Iout	0		12	A
Output DC Current Limit	All	Ioutlim	15.6		30	A
Short Circuit Surge	2.5V 1.8V 1.5V 1.2V	Ioutsurge		0.1 0.2 0.5 0.6	0.2 0.4 1 1.2	A^2s
Turn on Time	All	Ton		10	20	ms
Overshoot at Turn On	All			0	3	%
Output Capacitance	All	Cout	0		4800	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 and 10µF aluminum cap on output.

Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Transient Response [3]						
ΔV 50% to 100% of Max Load	2.5V			110	150	mV
Settling Time		Ts		50	100	µs
ΔV 100% to 50% of Max Load				110	150	mV
Settling Time		Ts		50	100	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.8V			100	150	mV
Settling Time		Ts		50	100	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		50	100	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.5V			100	150	mV
Settling Time		Ts		50	100	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		50	100	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.2V			90	125	mV
Settling Time		Ts		50	100	µs
ΔV 100% to 50% of Max Load				90	125	mV
Settling Time		Ts		50	100	µs

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.
3. di/dt = 0.5A/µS, Vin=3.3Vdc, Ta = 25° C, and with a 470µF (ESR=0.90 ohm) tantalum cap at output.

General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency[1]	2.5V 1.8V 1.5V 1.2V	η	88 84 81 79	91 87 84 82		%
Switching Frequency	All	Fsw	250	300	340	kHz
Output Voltage Trim Range[2]	2.5V 1.8V 1.5V 1.2V		90 90 90 90		105 110 110 110	%
Remote Sense Compensation	All				10	%
Weight	All			10.5		g

1. Vin=3.3V, full load and Ta=25° C.
2. See graphs on pages 10-12. Total adjustment of trim, setpoint and remote sense combined should not exceed 5% at nominal Vin, 25°C ambient for the 2.5V output module.

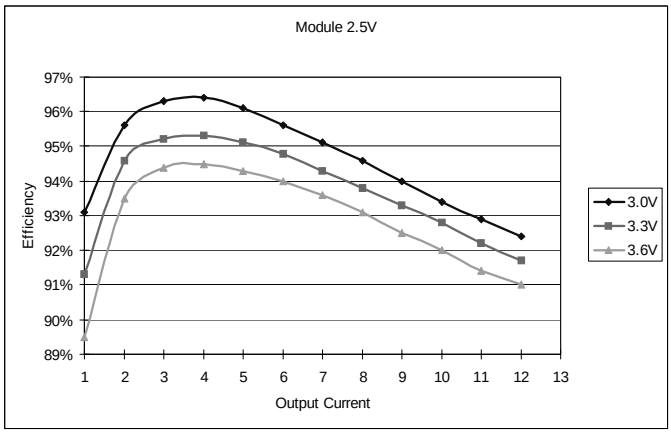
Control Specifications

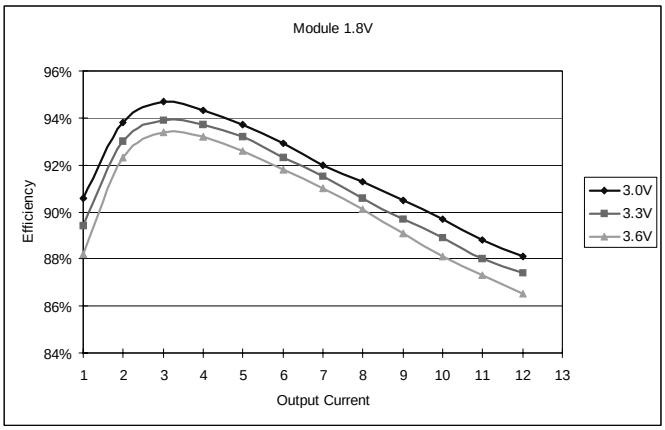
Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off [3]	All	Vouten				V
Signal Low (Unit Off)	All		-0.3		0.8	V
Signal High (Unit On)	All		2.8		4	V

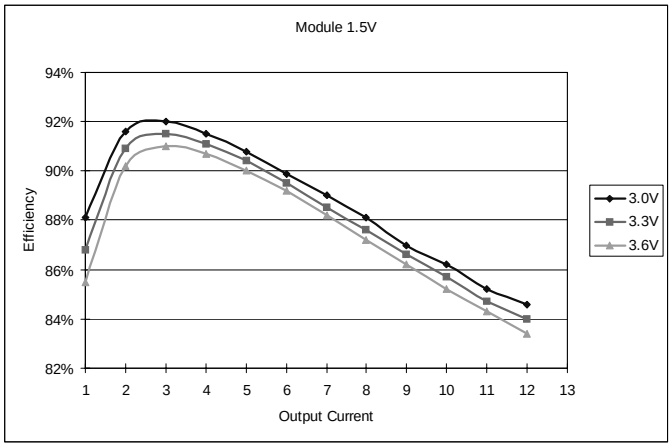
3. With remote on/off pin 8 open, the module is on.

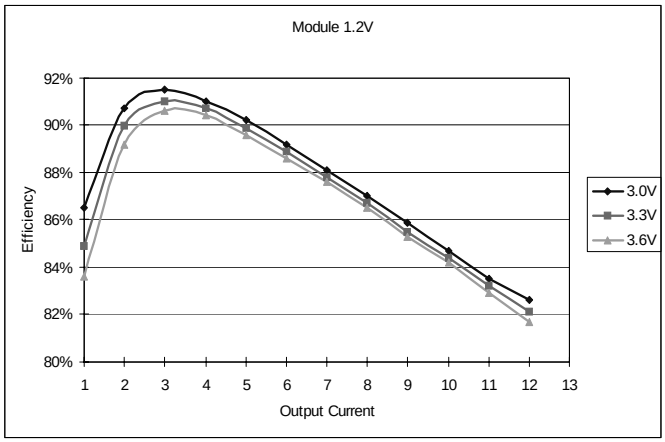
Note: On/off pin designed to work with an open collector/drain switch.

Efficiency Data



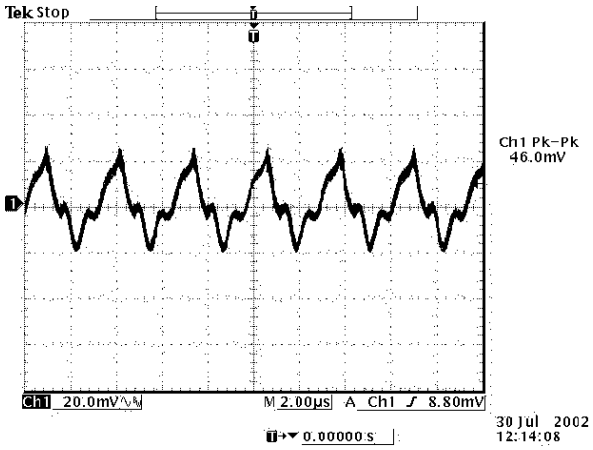




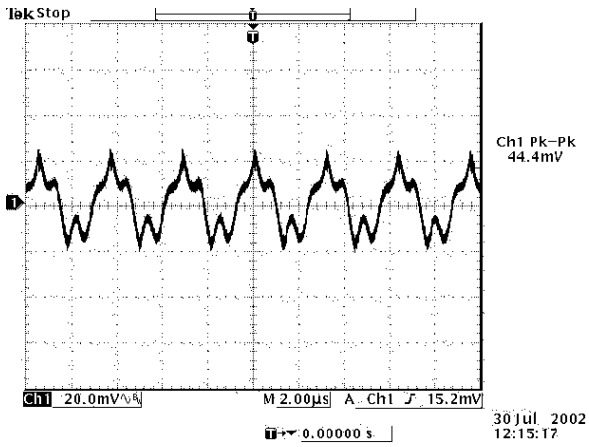


Ripple and Noise

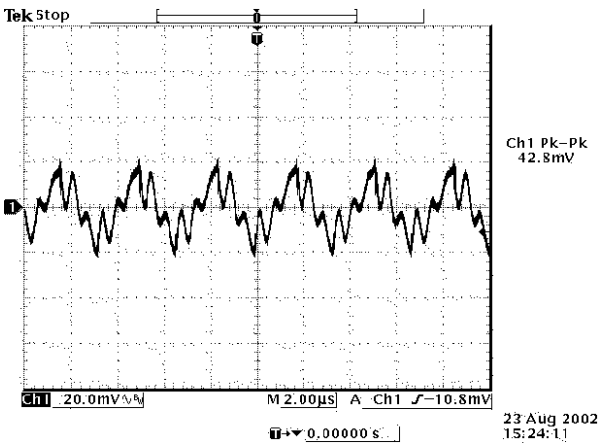
1µF ceramic cap and 10µF aluminum electrolytic cap added at the output.



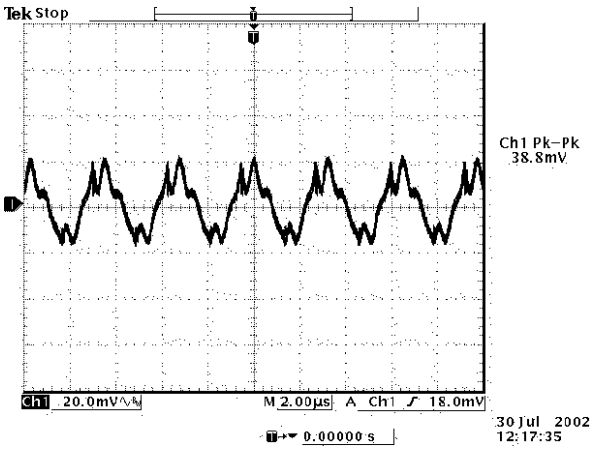
Ripple and noise at full load and 3.3Vdc input, 2.5Vdc output and Ta=25° C



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

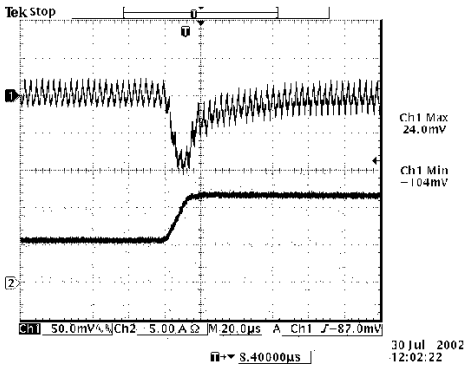


Ripple and noise at full load and 3.3Vdc input, 1.2Vdc output and Ta=25° C

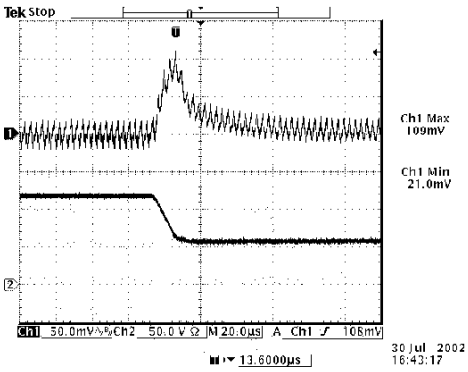
BP02S7DB-12C

Transient Response

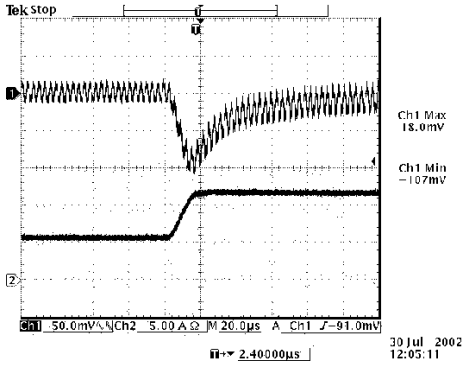
Transient response: di/dt = 0.5A/µS,external load capacitance Co=470µF (tantalum capacitor ESR=0.9 ohm)



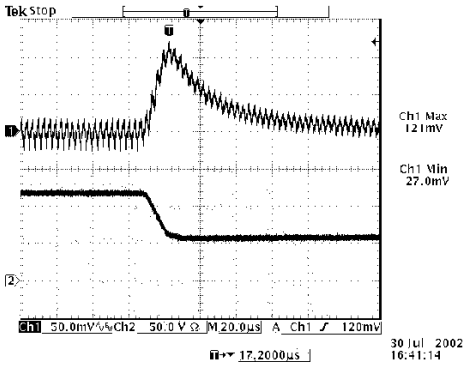
Vout=2.5V
50% to 100% load transients at 3.3V input and Ta=25° C



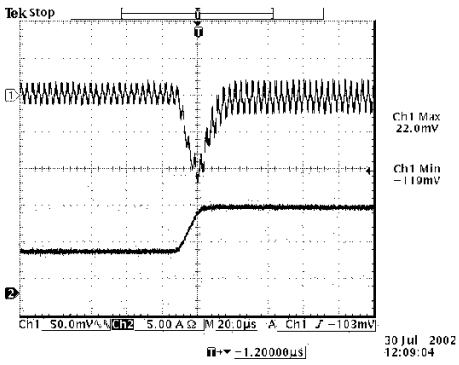
Vout=2.5V
100% to 50% load transients at 3.3V input and Ta=25° C



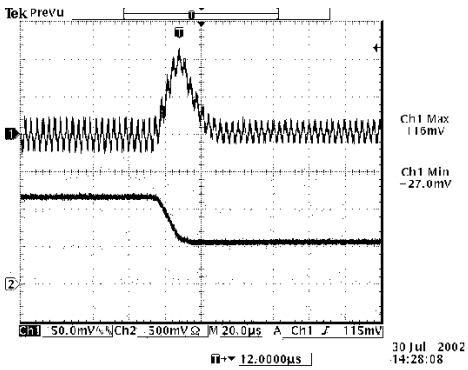
Vout=1.8V
50% to 100% load transients at 3.3V input and Ta=25° C



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



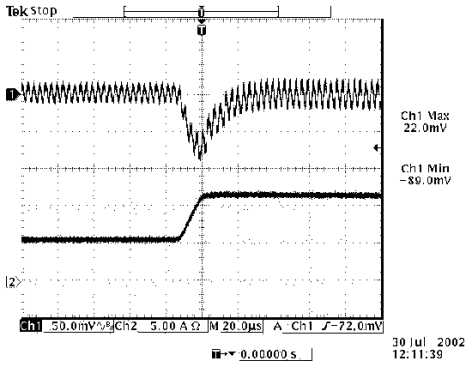
Vout=1.5V
50% to 100% load transients at 3.3V input and Ta=25° C



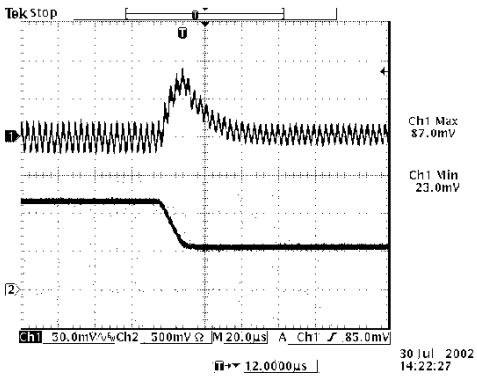
Vout=1.5V
100% to 50% load transients at 3.3V input and Ta=25° C

Transient Response

Transient response: di/dt = 0.5A/µS,external load capacitance Co=470µF (tantalum capacitor ESR=0.9 ohm)

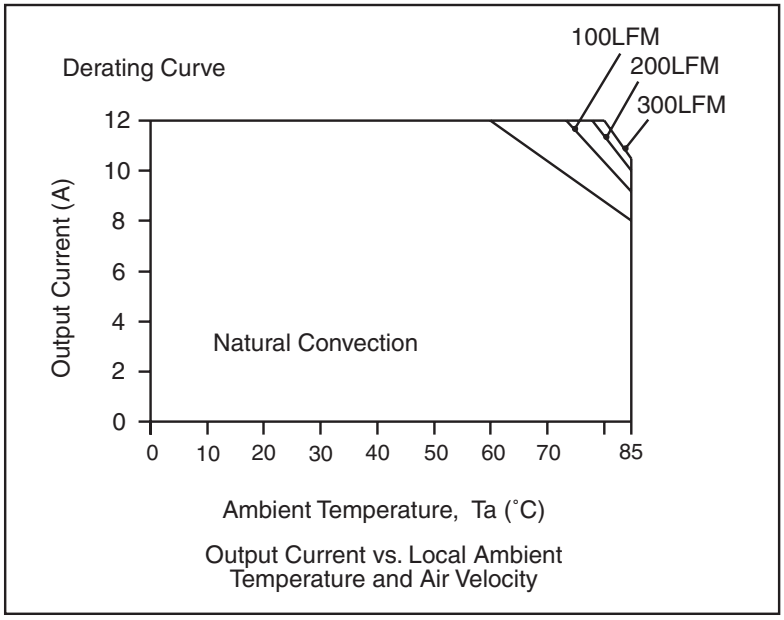


Vout=1.2V
50% to 100% load transients at 3.3V input and Ta=25° C



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

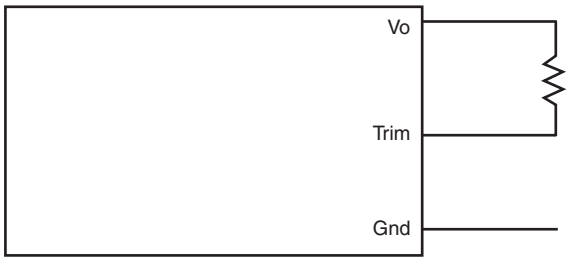
Thermal Considerations



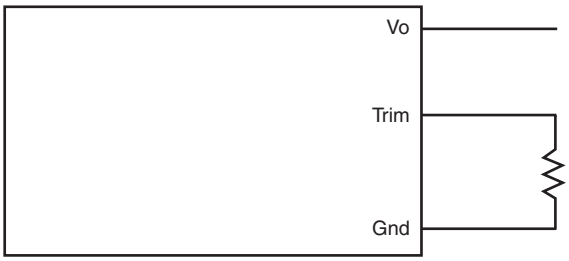
Output Current vs. Local Ambient Temperature and Air Velocity

Output Voltage Set-Point Adjustment

Trim Down Test Circuit



Trim Up Test Circuit



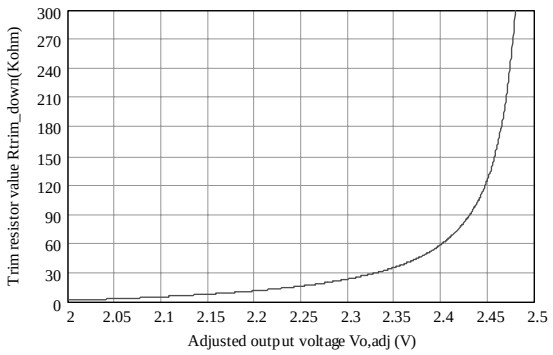
Output Voltage Set-Point Adjustment

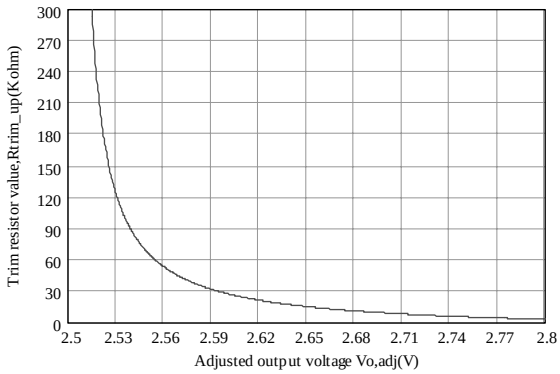
S7DB-12C250 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{7.544}{Vo - Vo,\ adj} - 13.52\right) \text{Kohm}$$

$$\text{Rtrim up} = \left(\frac{3.544}{Vo,\ adj - Vo} - 9.09\right) \text{Kohm}$$

Rtrimup = function



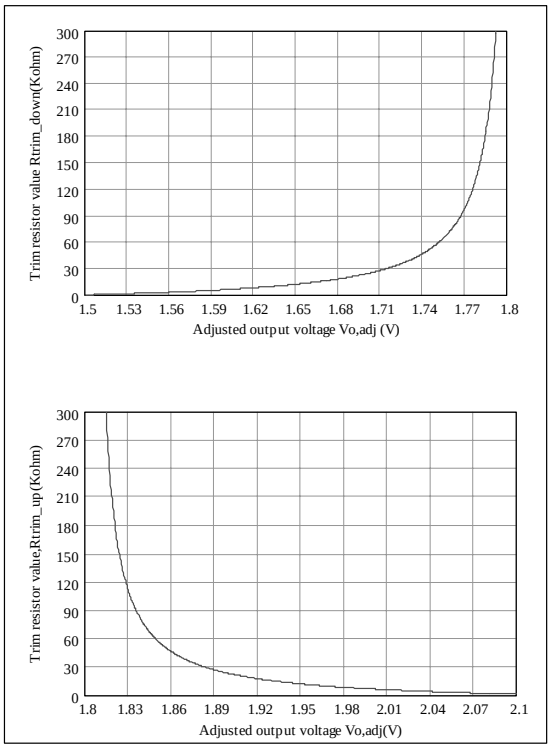


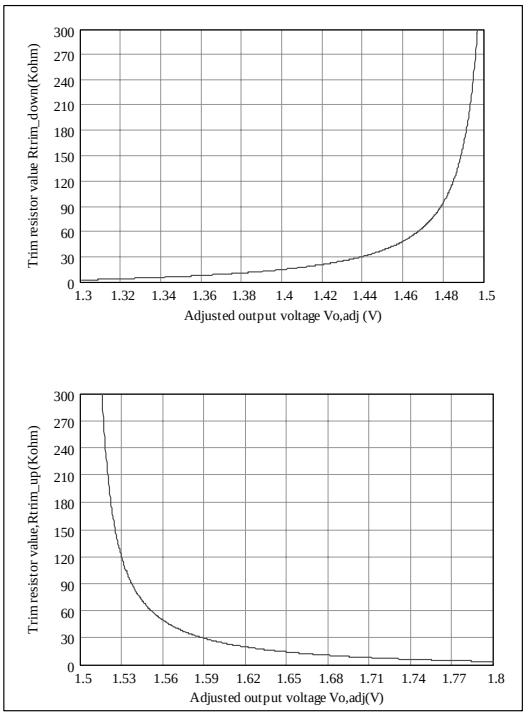
Output Voltage Set-Point Adjustment

S7DB-12C180 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{3.857}{Vo - Vo,\ adj} - 12.93\right)\ \text{Kohm}$$

$$\text{Rtrim up} = \left(\frac{3.072}{Vo,\ adj - Vo} - 9.09\right)\ \text{Kohm}$$





S7DB-12C150 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{2.708}{Vo - Vo,\ adj} - 10.99\right)\ \text{Kohm}$$

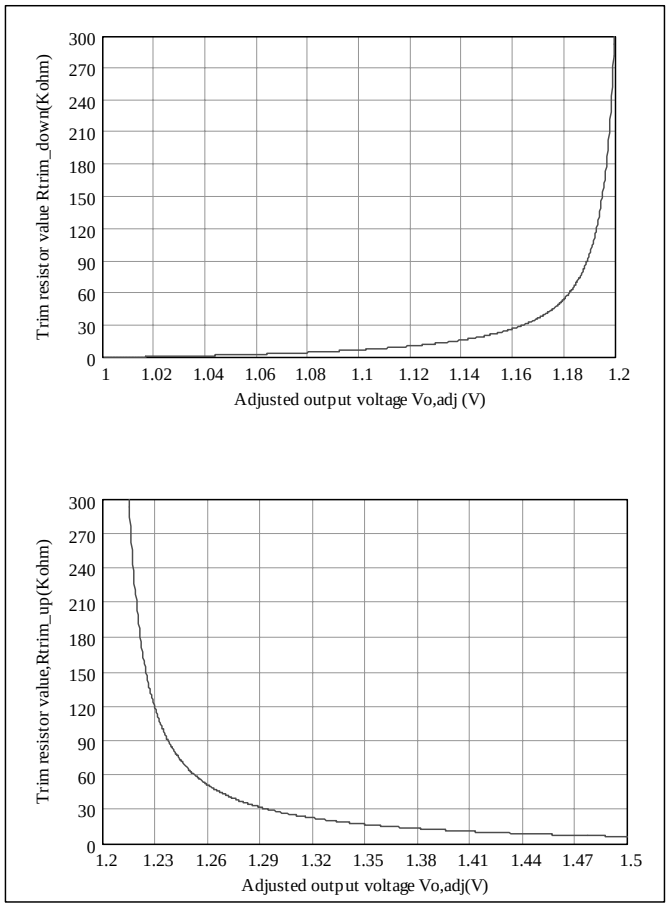
$$\text{Rtrim up} = \left(\frac{3.072}{Vo,\ adj - Vo} - 7.15\right)\ \text{Kohm}$$

Output Voltage Set-Point Adjustment

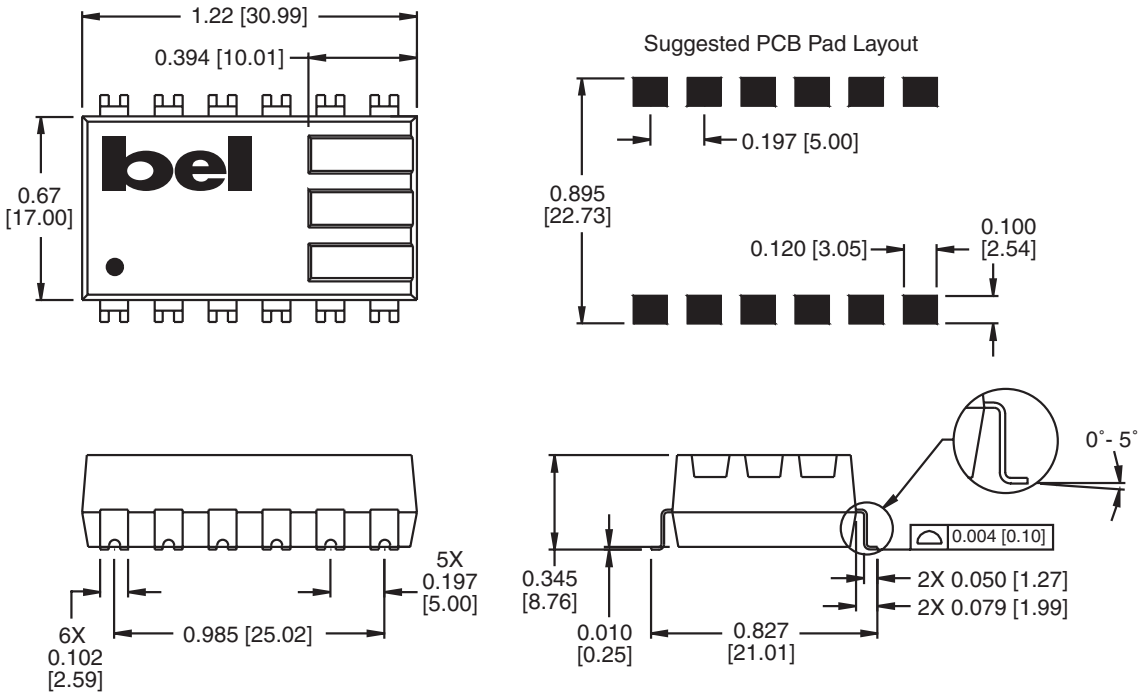
S7DB-12C120 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{1.553}{Vo - Vo,\ adj} - 8.26\right) \text{Kohm}$$

$$\text{Rtrim up} = \left(\frac{3.072}{Vo,\ adj - Vo} - 4.42\right) \text{Kohm}$$

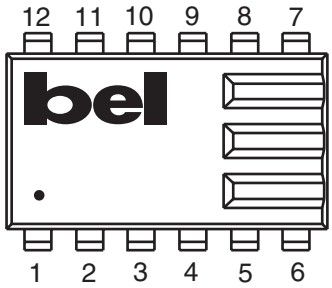


Mechanical



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

Pin	Function
1	Ground
2	Ground
3	Ground
4	Ground
5	+Vin
6	+Vin
7	Trim
8	Remote On/Off
9	Remote Sense (+)
10	+Vo
11	+Vo
12	+Vo



CORPORATE

Bel Fuse Inc.
206 Van Vorst Street
Jersey City, NJ 07302
Tel 201-432-0463
Fax 201-432-9542
www.belfuse.com

FAR EAST

Bel Fuse Ltd.
8F / 8 Luk Hop Street
San Po Kong
Kowloon, Hong Kong
Tel 852-2328-5515
Fax 852-2352-3706
www.belfuse.com

EUROPE

Bel Fuse Europe Ltd.
Preston Technology Management Centre
Marsh Lane, Suite G7, Preston
Lancashire, PR1 8UD, U.K.
Tel 44-1772-556601
Fax 44-1772-888366
www.belfuse.com