

# 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

BP02S7DB-12C

### 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>	-40		85	°C
Storage Temperature	T <sub>stor</sub>	-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	V <sub>in</sub>	3	3.3	3.6	V
Input Current	2.5V 1.8V 1.5V 1.2V	I <sub>in</sub>			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 <sup>1</sup>	All			25	50	mA <sub>rms</sub>
Input Reflected Ripple Current (P-P) <sup>1</sup>	All			80	160	mApk
I <sup>2</sup> t Inrush Current Transient	All			0.1	0.2	A <sup>2</sup> s
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.

# NON-ISOLATED DC/DC CONVERTERS

## 3.3V Input / 1.2V – 2.5V Output / 12A



BP02S7DB-12C

### Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Output Voltage Set Point <sup>1</sup>	2.5V	Vout	2.450	2.500	2.550	V
	1.8V		1.764	1.800	1.836	
	1.5V		1.470	1.500	1.530	
	1.2V		1.176	1.200	1.224	
Load Regulation	All		3.0	10	mV	
Line Regulation	All		2.0	5	mV	
Regulation Over Temperature	2.5V			19	38	mV
	1.8V			13	27	
	1.5V			11	23	
	1.2V			9	18	
Total Output Voltage Regulation	2.5V				53	mV
	1.8V				42	
	1.5V				38	
	1.2V				33	
Output Ripple and Noise <sup>2</sup>	2.5V			55	100	mVp-p
	1.8V			50	100	
	1.5V			40	100	
	1.2V			40	100	
Output Ripple and Noise <sup>2</sup>	2.5V			15	30	mVrms
	1.8V			10	25	
	1.5V			10	25	
	1.2V			10	25	
Output Current Range	All	Iout	0		12	A
Output DC Current Limit	All	Ioutlim	15.6		30	A
Short Circuit Surge	2.5V	Ioutsurge		0.1	0.2	A <sup>2</sup> s
	1.8V			0.2	0.4	
	1.5V			0.5	1	
	1.2V			0.6	1.2	
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.

BP02S7DB-12C

### 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			110	150	mV
Settling Time		Ts		50	100	$\mu s$
$\Delta V$ 100% to 50% of Max Load				110	150	mV
Settling Time		Ts		50	100	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.8V			100	150	mV
Settling Time		Ts		50	100	$\mu s$
$\Delta V$ 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		50	100	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.5V			100	150	mV
Settling Time		Ts		50	100	$\mu s$
$\Delta V$ 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		50	100	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.2V			90	125	mV
Settling Time		Ts		50	100	$\mu s$
$\Delta V$ 100% to 50% of Max Load				90	125	mV
Settling Time		Ts		50	100	$\mu s$

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.  
 $3. di/dt = 0.5A/\mu S$ ,  $V_{in}=3.3V_{dc}$ ,  $T_a = 25^\circ C$ , and with a  $470\mu F$  (ESR=0.90 ohm) tantalum cap at output.

# NON-ISOLATED DC/DC CONVERTERS

## 3.3V Input / 1.2V – 2.5V Output / 12A



BP02S7DB-12C

### General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency <sup>1</sup>	2.5V	$\eta$	88	91		%
	1.8V		84	87		
	1.5V		81	84		
	1.2V		79	82		
Switching Frequency	All	Fsw	250	300	340	kHz
Output Voltage Trim Range <sup>2</sup>	2.5V		90		105	%
	1.8V		90		110	
	1.5V		90		110	
	1.2V		90		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 <sup>3</sup>	All	Vouten				V
Signal Low (Unit Off)	All		-0.3		0.8	V
Signal High (Unit On)	All		2.8		4	V

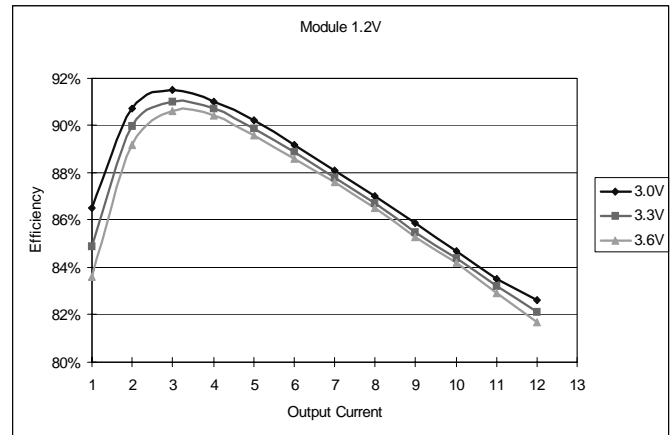
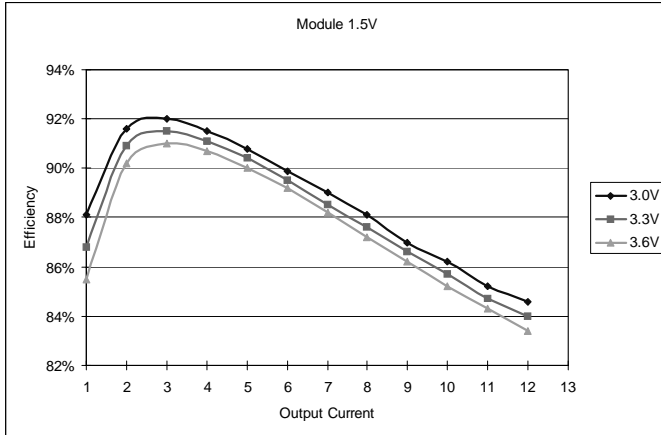
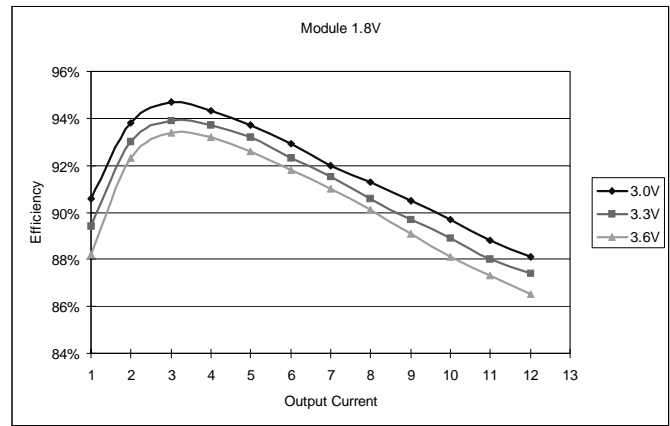
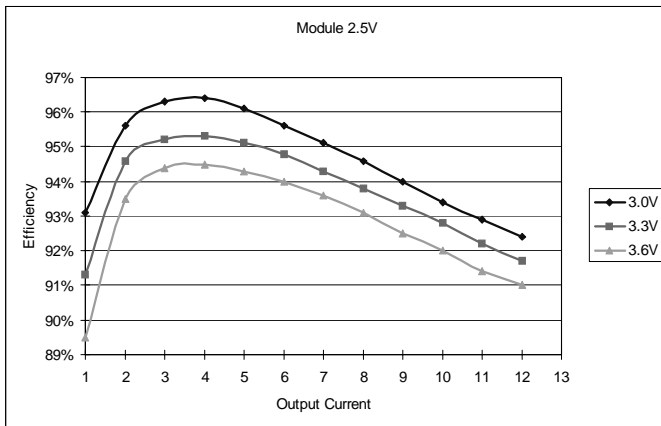
3. With remote on/off pin 8 open, the module is on.

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

©2002 Bel Fuse Inc. Specifications subject to change without notice. 10.02

BP02S7DB-12C

### Efficiency Data



# NON-ISOLATED DC/DC CONVERTERS

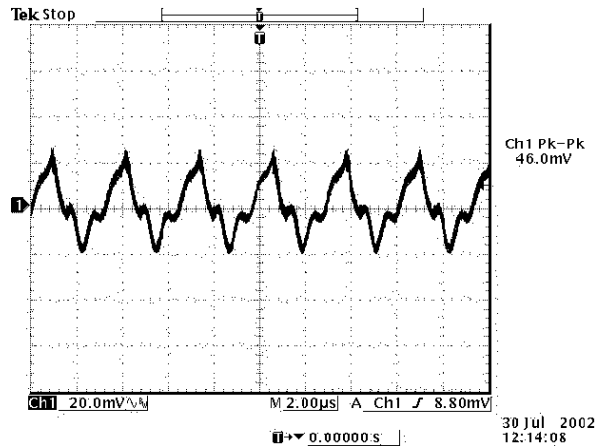
## 3.3V Input / 1.2V – 2.5V Output / 12A



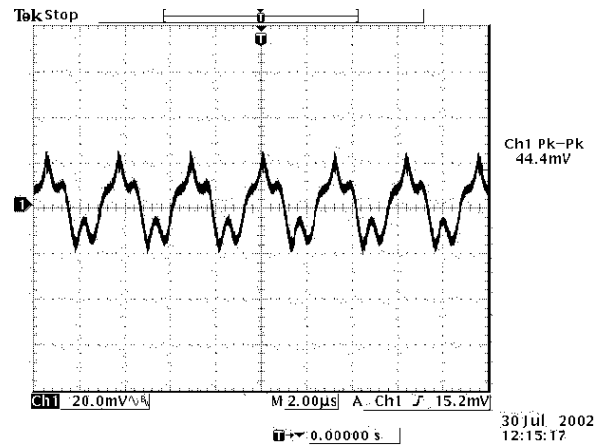
BP02S7DB-12C

### Ripple and Noise

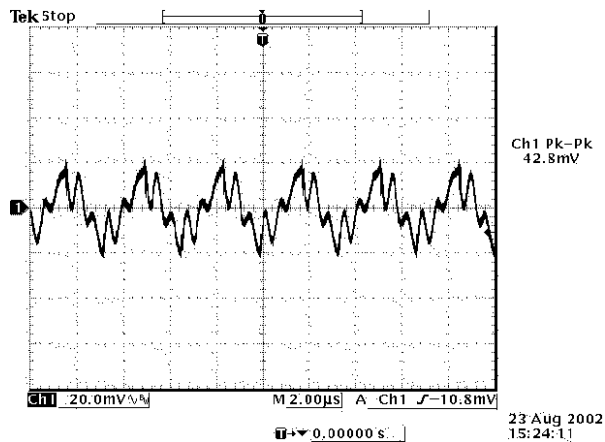
1 $\mu$ F ceramic cap and 10 $\mu$ F aluminum electrolytic cap added at the output.



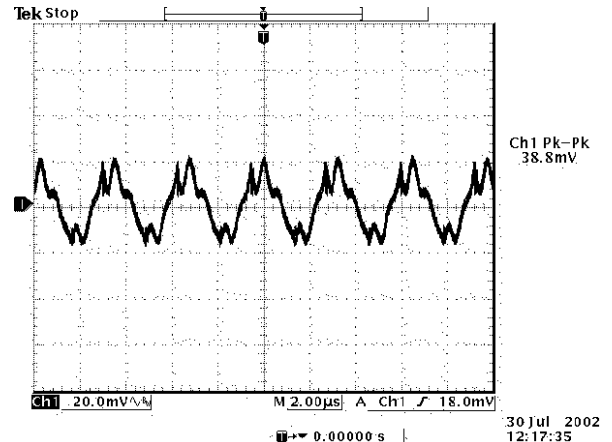
Ripple and noise at full load and 3.3Vdc input, 2.5Vdc output and Ta=25° C



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

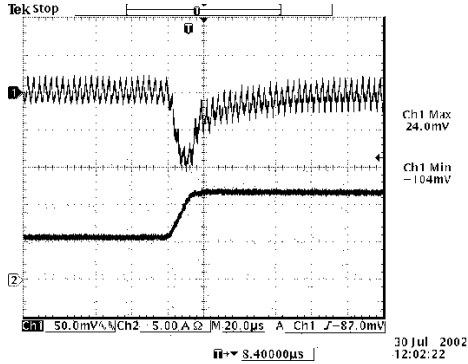


Ripple and noise at full load and 3.3Vdc input, 1.2Vdc output and Ta=25° C

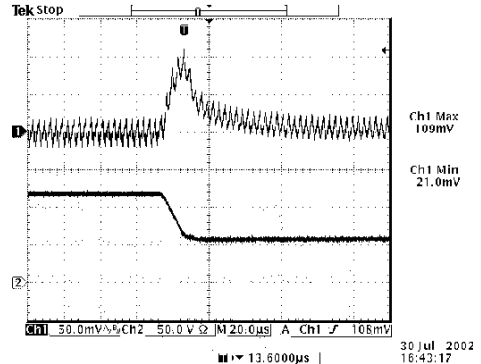
BP02S7DB-12C

### Transient Response

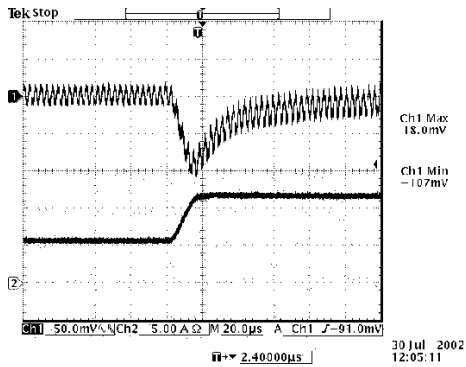
Transient response:  $di/dt = 0.5A/\mu S$ , external load capacitance  $C_o=470\mu F$  (tantalum capacitor ESR=0.9 ohm)



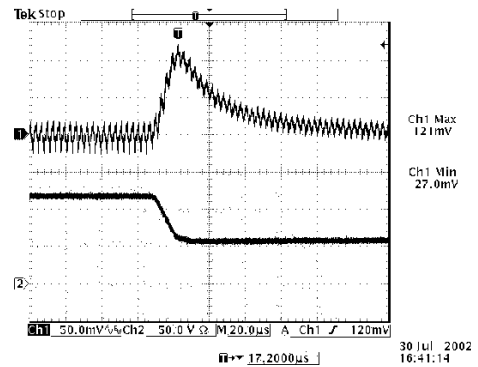
Vout=2.5V  
50% to 100% load transients at 3.3V input and Ta=25° C



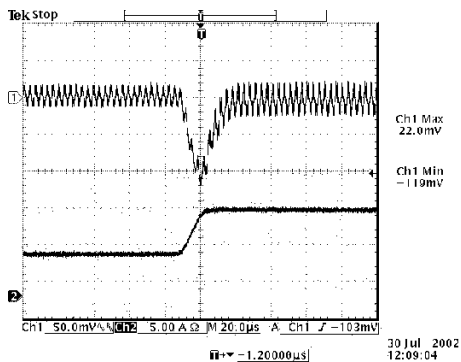
Vout=2.5V  
100% to 50% load transients at 3.3V input and Ta=25° C



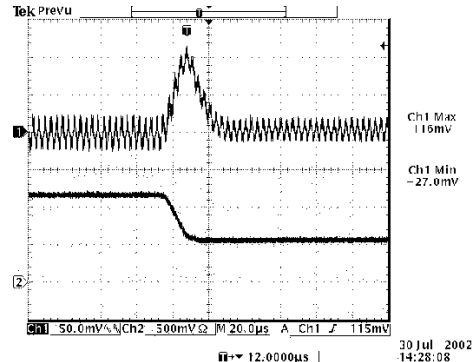
Vout=1.8V  
50% to 100% load transients at 3.3V input and Ta=25° C



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



# NON-ISOLATED DC/DC CONVERTERS

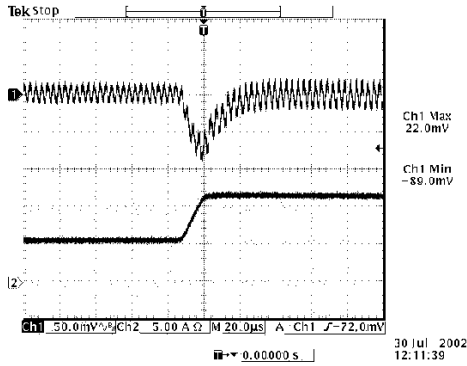
## 3.3V Input / 1.2V – 2.5V Output / 12A



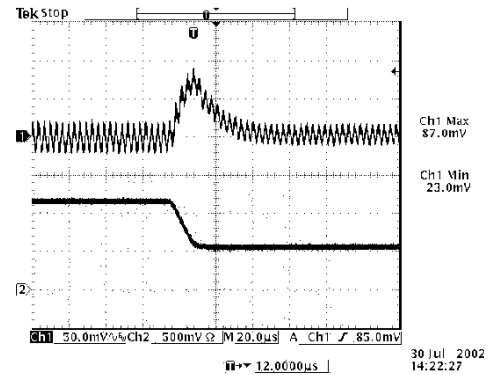
BP02S7DB-12C

### Transient Response

Transient response:  $di/dt = 0.5A/\mu S$ , external load capacitance  $C_o=470\mu F$  (tantalum capacitor  $ESR=0.9\text{ ohm}$ )

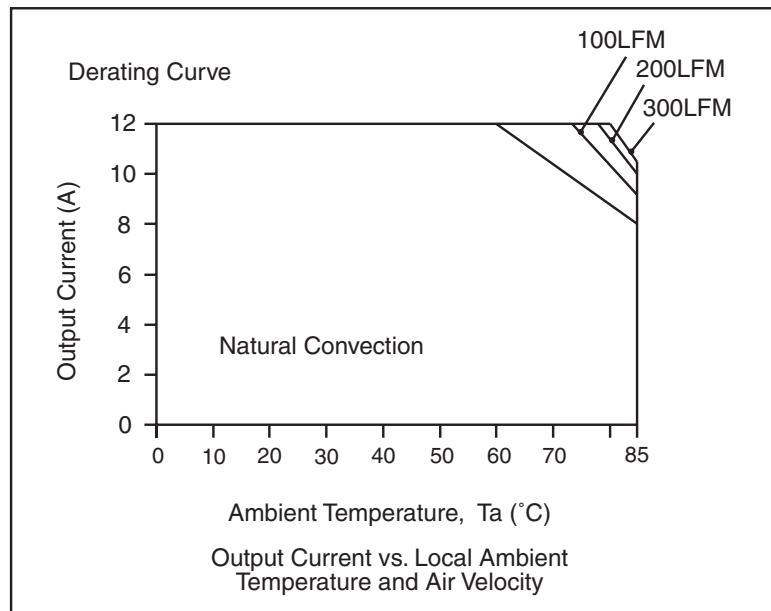


$V_{out}=1.2V$   
50% to 100% load transients at 3.3V input and  $T_a=25^\circ C$



$V_{out}=1.2V$   
100% to 50% load transients at 3.3V input and  $T_a=25^\circ C$

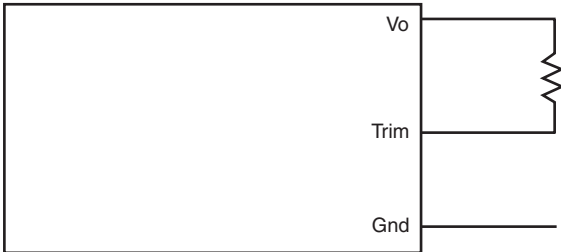
### Thermal Considerations



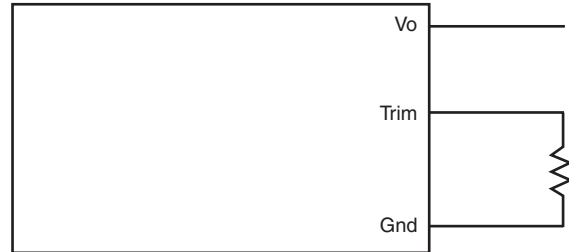
BP02S7DB-12C

### Output Voltage Set-Point Adjustment

Trim Down Test Circuit



Trim Up Test Circuit

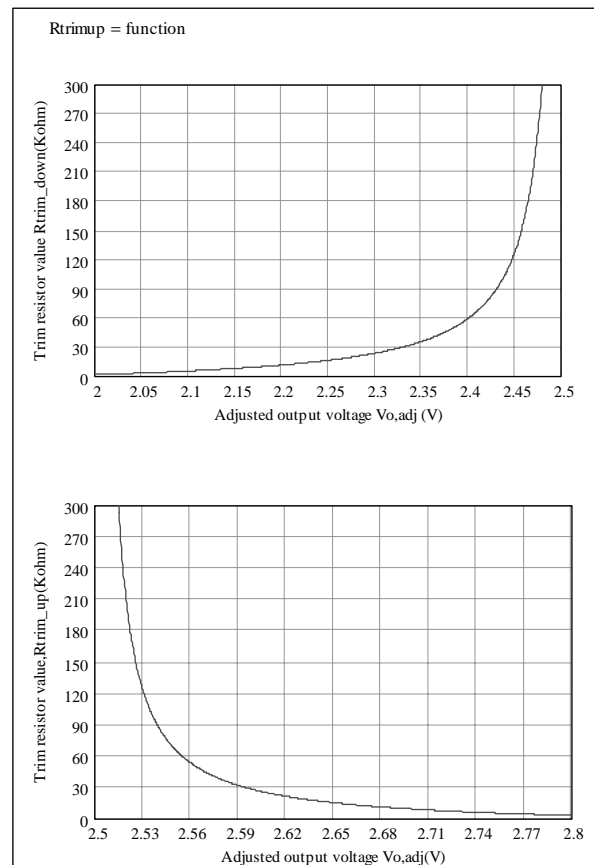


### Output Voltage Set-Point Adjustment

#### S7DB-12C250 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{7.544}{V_o - V_{o, \text{adj}}} - 13.52 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.544}{V_{o, \text{adj}} - V_o} - 9.09 \right) \text{ Kohm}$$



# NON-ISOLATED DC/DC CONVERTERS

## 3.3V Input / 1.2V – 2.5V Output / 12A



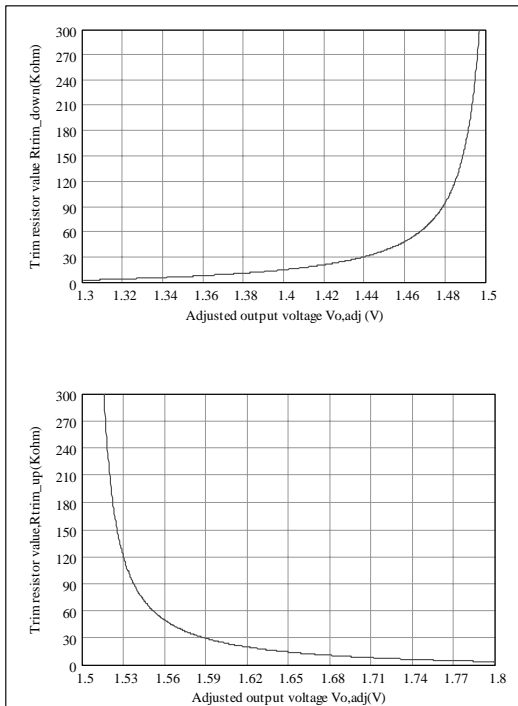
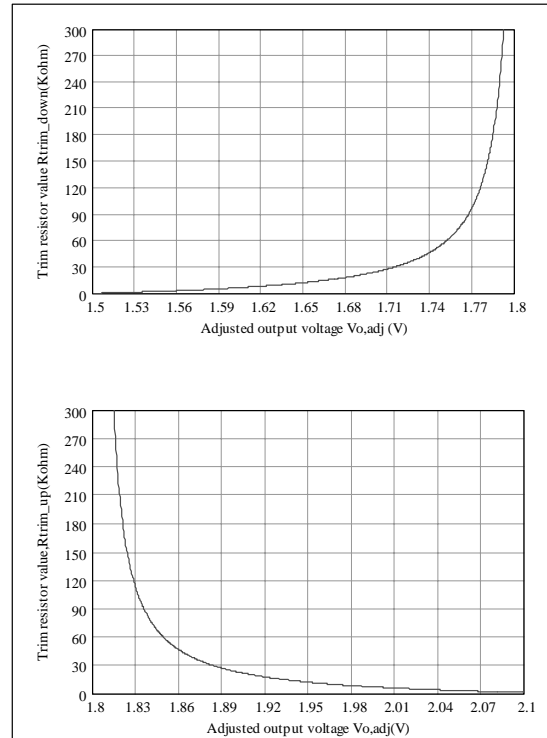
BP02S7DB-12C

### Output Voltage Set-Point Adjustment

#### S7DB-12C180 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{3.857}{V_o - V_{o, \text{adj}}} - 12.93 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.072}{V_{o, \text{adj}} - V_o} - 9.09 \right) \text{ Kohm}$$



#### S7DB-12C150 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{2.708}{V_o - V_{o, \text{adj}}} - 10.99 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.072}{V_{o, \text{adj}} - V_o} - 7.15 \right) \text{ Kohm}$$

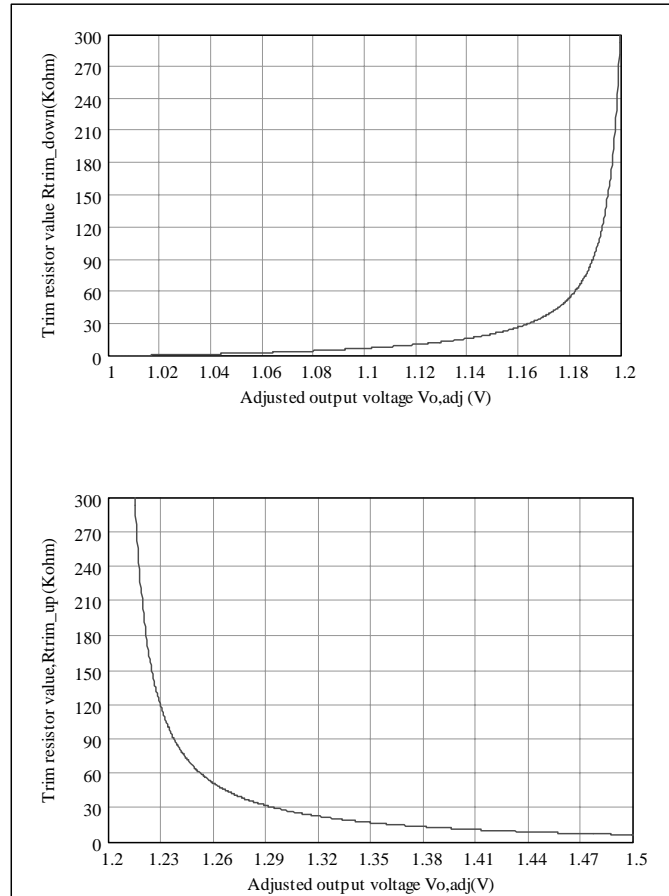
BP02S7DB-12C

## Output Voltage Set-Point Adjustment

### S7DB-12C120 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{1.553}{V_o - V_{o, \text{adj}}} - 8.26 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.072}{V_{o, \text{adj}} - V_o} - 4.42 \right) \text{ Kohm}$$



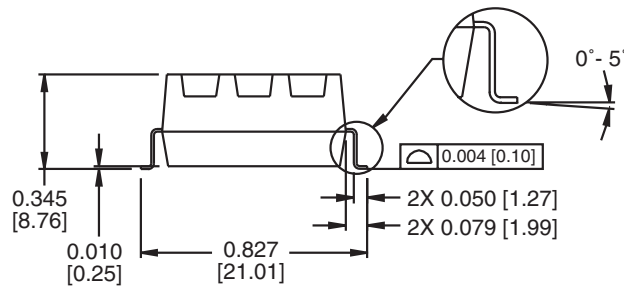
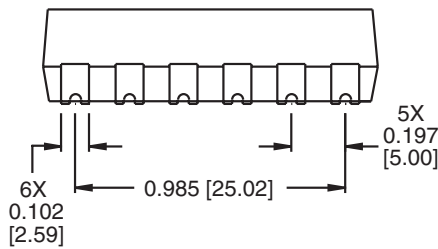
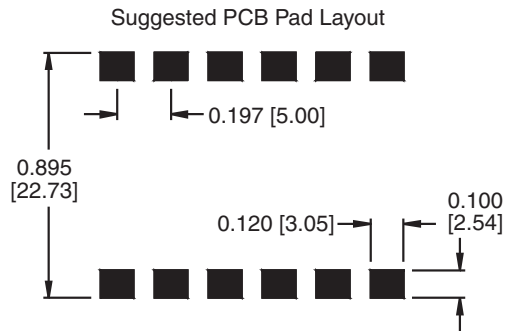
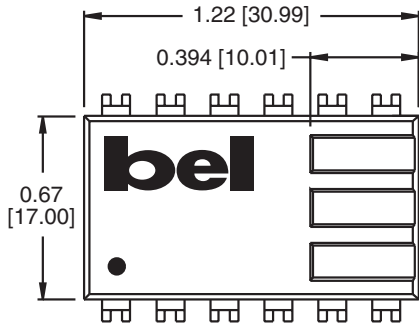
# NON-ISOLATED DC/DC CONVERTERS

3.3V Input / 1.2V – 2.5V Output / 12A



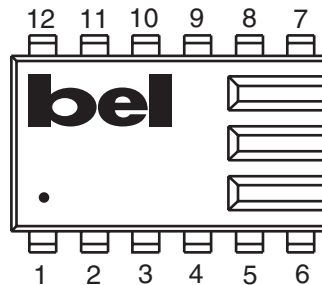
BP02S7DB-12C

## Mechanical



Dimensions are in inches [millimeters].  
Standard dimension tolerance is  $\pm 0.005$  [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



©2002 Bel Fuse Inc. Specifications subject to change without notice. 10.02

### 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