NON-ISOLATED DC/DC CONVERTERS
12V Input / 1.2V – 5.0V Output / 7A

bel POWER PRODUCTS

BP06SRDB-07A

SRDB-07A Series **RoHS Compliant**

- 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 SRDB-07A modules are a series of non-isolated, step down DC/DC power converters that operate from a nominal 12V source. These converters are available in a range of output voltages from 1.2V to 5.0V. They are packaged in a compact, low profile, surface mount DIP package for ease of layout and space savings. 7A maximum output is also provided. Standard features include remote on/off, 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 12V 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
5.0V	12V	7A	35.0W	92%	SRDB-07A500
3.3V	12V	7A	23.1W	90%	SRDB-07A330
2.5V	12V	7A	17.5W	88%	SRDB-07A250
1.8V	12V	7A	12.6W	83%	SRDB-07A180
1.5V	12V	7A	10.5W	82%	SRDB-07A150
1.2V	12V	7A	8.4W	81%	SRDB-07A120

Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
Continuous Input Voltage	Vin	-0.3		15	V
Output Enable Terminal Voltage	Vouten	-0.3		15.3	V
Ambient Temperature	Tamb	0		70	°C
Storage Temperature	Tstor	-40		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	10.8	12	13.2	V
Input Current	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V	Iin			4.0 2.6 2.0 1.7 1.4 1.3	A
No Load Input Current	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V			50 45 35 30 30 30	65 60 50 45 45 45	mA
Remote Off Input Current				1	4	mA
Input Reflected Ripple Current[1]	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V			20 15 12 12 12 12	30 25 25 20 20 20	mA_{rms}
Input Reflected Ripple Current (P-P)[1]	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V			70 50 45 35 35 35	120 100 100 60 60 60	mApk
I^2t Inrush Current Transient				0.08	0.16	A^2s
Turn On Voltage Threshold					10.4	V
Turn Off Voltage Threshold			8.2			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.

Output Specifications

BP06SRDB-07A

Parameter	Module	Symbol	Min	Typical	Max	Units
Output Voltage Set Point [1]	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V	Vout	4.900 3.247 2.460 1.771 1.476 1.181	5.00 3.30 2.50 1.80 1.50 1.20	5.100 3.353 2.540 1.829 1.524 1.219	V
Load Regulation	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V			15 10 9 9 9 9	30 16.5 15 15 15 15	mV
Line Regulation	All			3	10	mV
Regulation Over Temperature	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V				50 33 25 18 15 12	mV
Total Output Voltage Regulation	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V				90 59.5 50 43 40 37	mV
Output Ripple and Noise [2]	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V			75 60 60 60 60 60	125 100 100 100 100 100	mVp-p
Output Ripple and Noise [2]	All			15	30	mVrms
Output Current Range	All	Iout	0		7	A
Output DC Current Limit	All	Ioutlim	9.1	12	16	A
Short Circuit Surge	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V	Ioutsurge		1.2 1.0 0.9 0.7 0.7 0.6	1.7 1.5 1.4 1.2 1.2 1.1	A^2s
Turn on Time	5.0V 3.3V 2.5V 1.8V 1.5V 1.2V	Ton		45 30 30 30 30 30	75 50 50 50 50 50	ms
Overshoot at Turn On	All				3	%
Output Capacitance	All	Cout	0		3500	µF

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.
1. Vin = 12V, Iout = full load, Ta = 25° C.
2. 0 - 20MHz, 0.1µF ceramic cap and 10µF aluminum cap on output.

BP06SRDB-07A

Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Transient Response [3]						
ΔV 50% to 100% of Max Load	5.0V			125	250	mV
Settling Time		Ts		25	50	µs
ΔV 100% to 50% of Max Load				125	250	mV
Settling Time		Ts		25	50	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	3.3V			100	165	mV
Settling Time		Ts		25	50	µs
ΔV 100% to 50% of Max Load				100	165	mV
Settling Time		Ts		25	50	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	2.5V			100	150	mV
Settling Time		Ts		25	50	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		25	50	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.8V			100	150	mV
Settling Time		Ts		30	70	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		30	70	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.5V			100	150	mV
Settling Time		Ts		30	70	µs
ΔV 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		30	70	µs
Transient Response [3]						
ΔV 50% to 100% of Max Load	1.2V			110	150	mV
Settling Time		Ts		30	70	µs
ΔV 100% to 50% of Max Load				110	150	mV
Settling Time		Ts		30	70	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 220µF Tantalum cap at output.

General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency[1]		η				%
	5.0V		89	92		
	3.3V		87	90		
	2.5V		85	88		
	1.8V		80	83		
	1.5V		79	82		
	1.2V		78	81		
Switching Frequency		Fsw				kHz
	5.0V		285	355	425	
	3.3V		280	330	380	
	2.5V		238	280	322	
	1.8V		180	210	240	
	1.5V		180	210	240	
	1.2V		180	210	240	
Output Voltage Trim Range[2]						%
	5.0V		90		110	
	3.3V		70		110	
	2.5V		70		110	
	1.8V		90		120	
	1.5V		90		120	
	1.2V		90		110	
Remote Sense Compensation	All				10	%
Weight	All			10.8		g

1. Vin=12V, full load and Ta=25° C.
2. See graphs on pages 10-13.

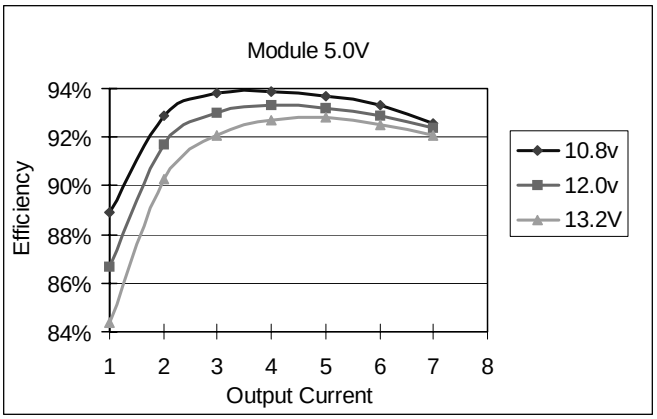
Control Specifications

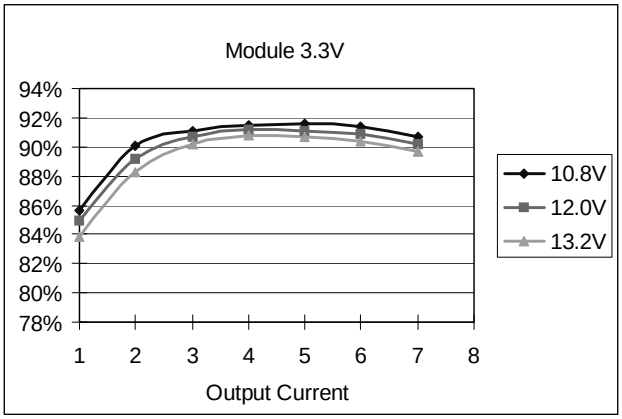
Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off [3]	All	Vouten				V
Signal Low (Unit Off)	All		0		1	V
Signal High (Unit On)	All		2.5		13.2	V

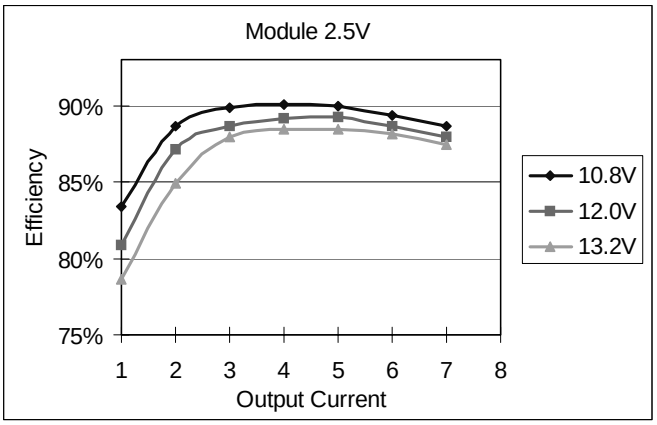
3. With remote on/off pin 8 open, the module is on.

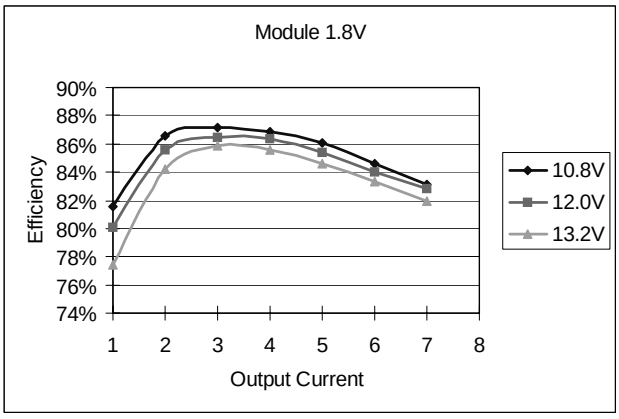
Note: On/off pin designed to work with an open collector/drain switch.

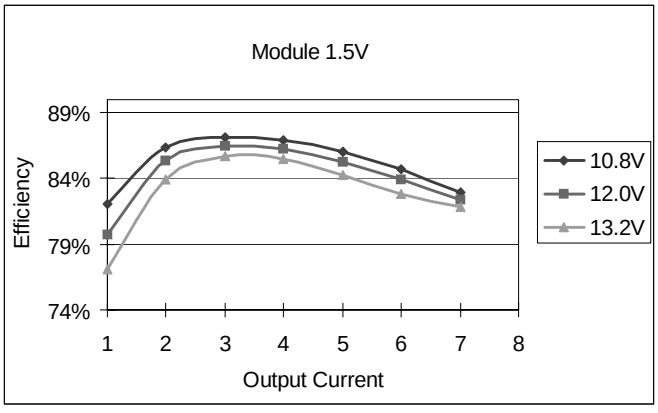
Efficiency Data

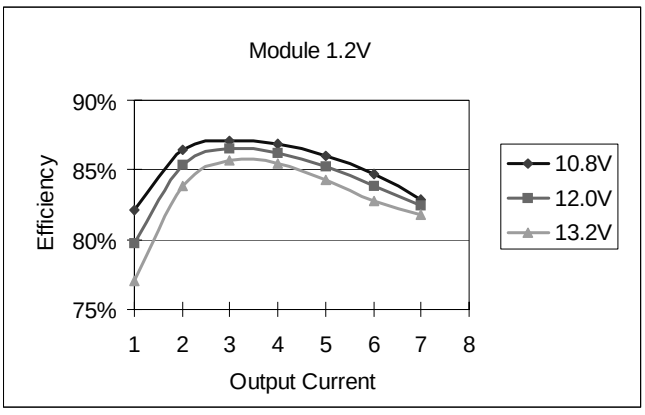






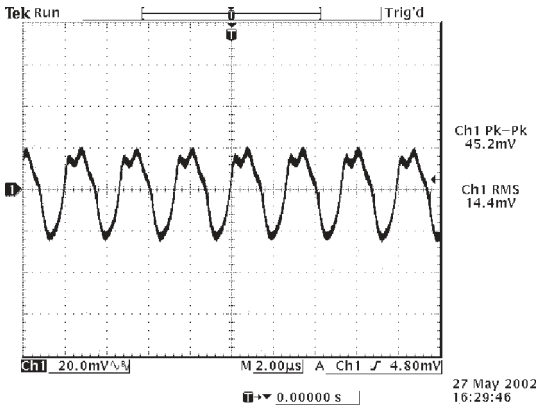




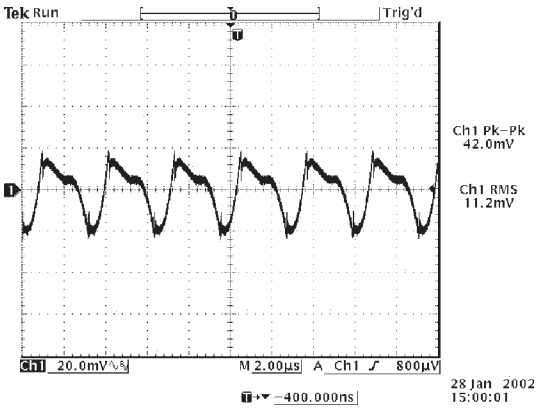


Ripple and Noise

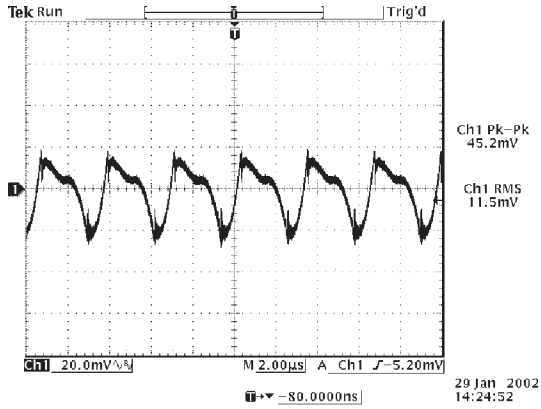
0.1µF ceramic cap and 10µF aluminum electrolytic cap added at the output.



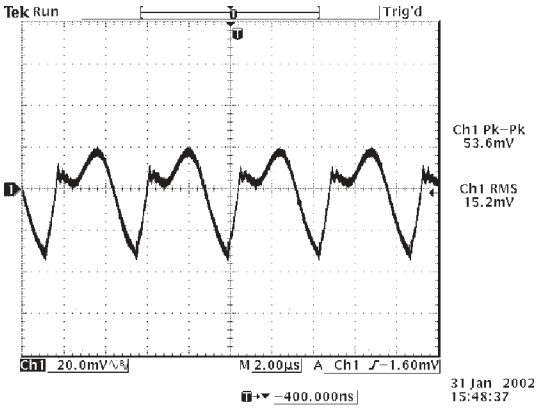
Ripple and noise at full load and 12Vdc input, 5.0Vdc output and Ta=25° C



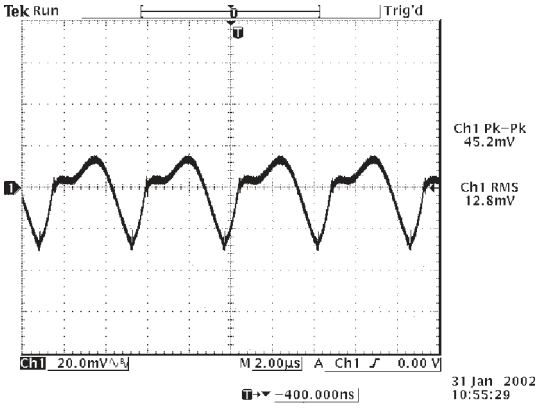
Ripple and noise at full load and 12Vdc input, 3.3Vdc output and Ta=25° C



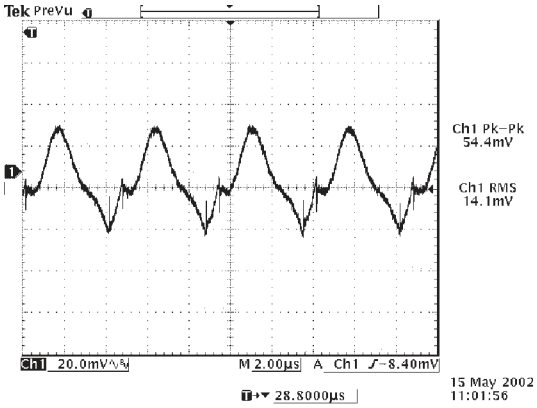
Ripple and noise at full load and 12Vdc input, 2.5Vdc output and Ta=25° C



Ripple and noise at full load and 12Vdc input, 1.8Vdc output and Ta=25° C



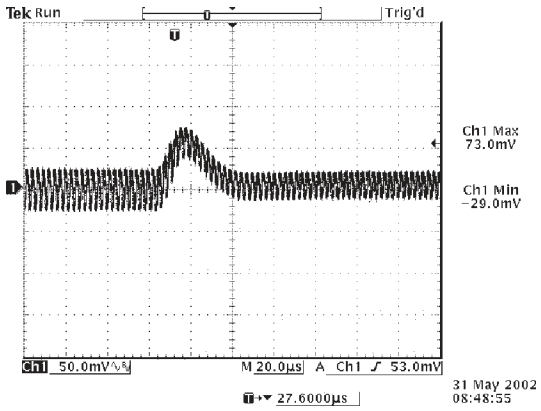
Ripple and noise at full load and 12Vdc input, 1.5Vdc output and Ta=25° C



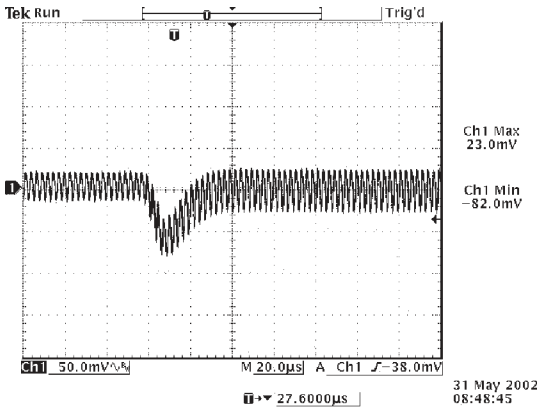
Ripple and noise at full load and 12Vdc input, 1.2Vdc output and Ta=25° C

Transient Response

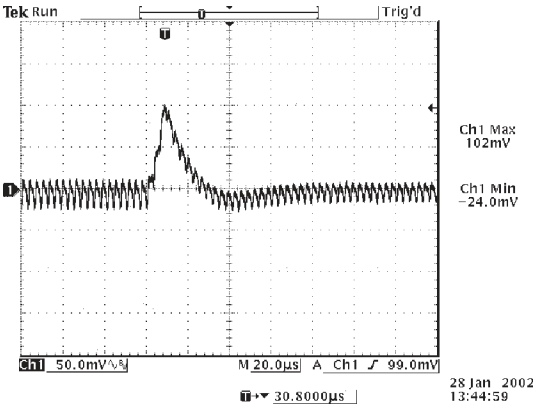
Transient response: di/dt = 0.5A/µS, external load capacitance Co=220µF aluminum cap at output



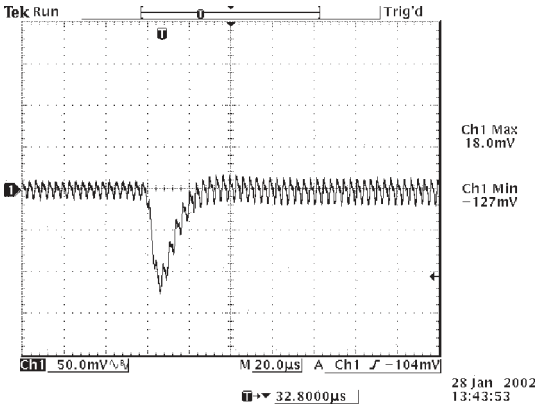
Vout=5.0V
50% to 100% load transients at 12V input and Ta=25° C



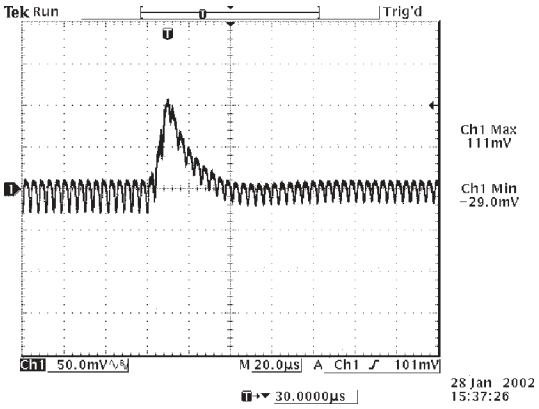
Vout=5.0V
100% to 50% load transients at 12V input and Ta=25° C



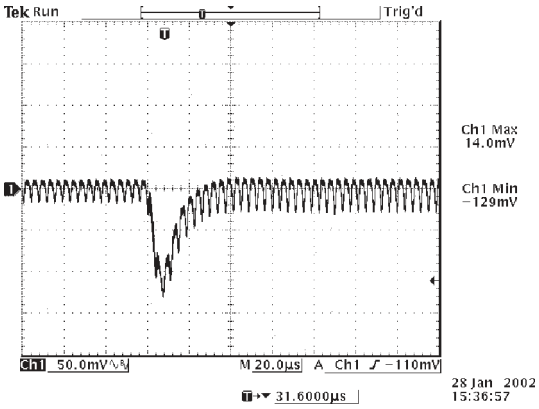
Vout=3.3V
50% to 100% load transients at 12V input and Ta=25° C



Vout=3.3V
100% to 50% load transients at 12V input and Ta=25° C



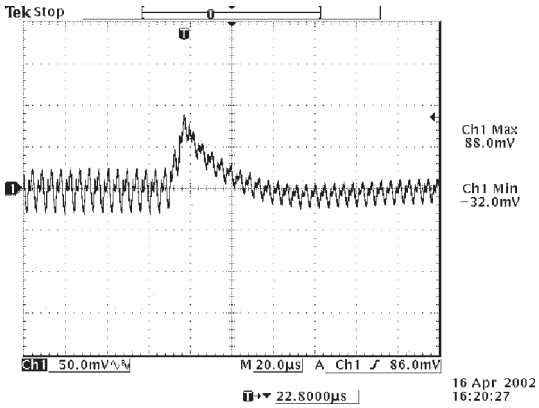
Vout=2.5V
50% to 100% load transients at 12V input and Ta=25° C



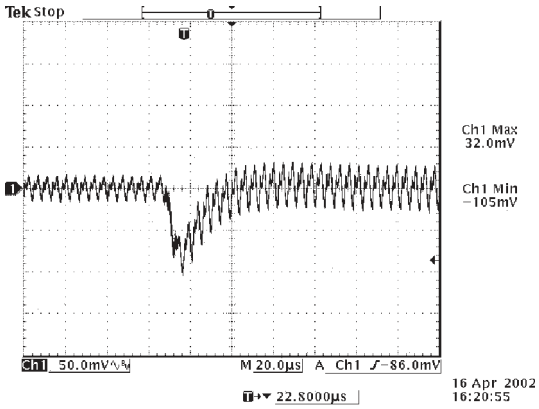
Vout=2.5V
100% to 50% load transients at 12V input and Ta=25° C

Transient Response

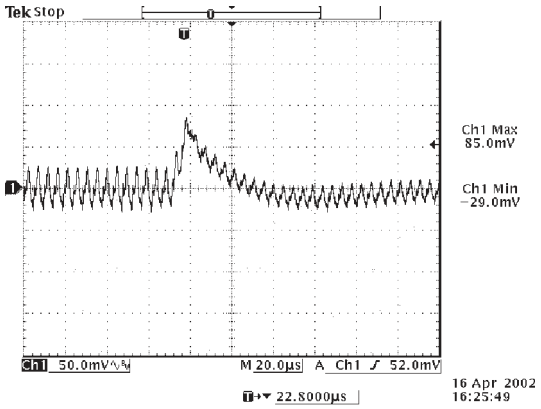
Transient response: di/dt = 0.5A/µS, external load capacitance Co=470µF (Tantalum capacitor)



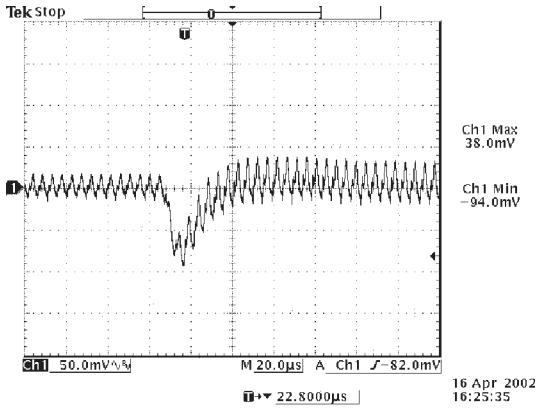
Vout=1.8V
50% to 100% load transients at 12V input and Ta=25° C



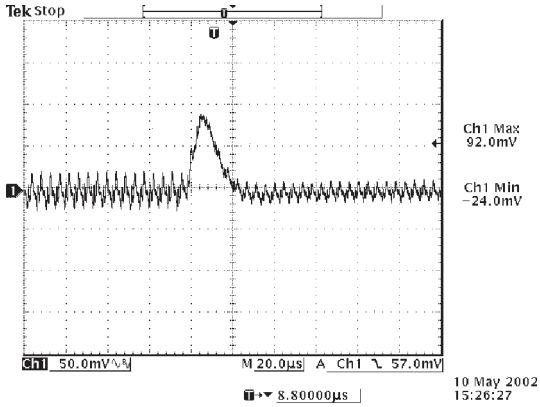
Vout=1.8V
100% to 50% load transients at 12V input and Ta=25° C



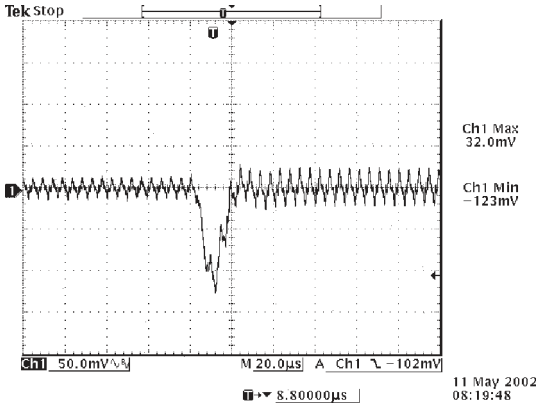
Vout=1.5V
50% to 100% load transients at 12V input and Ta=25° C



Vout=1.5V
100% to 50% load transients at 12V input and Ta=25° C

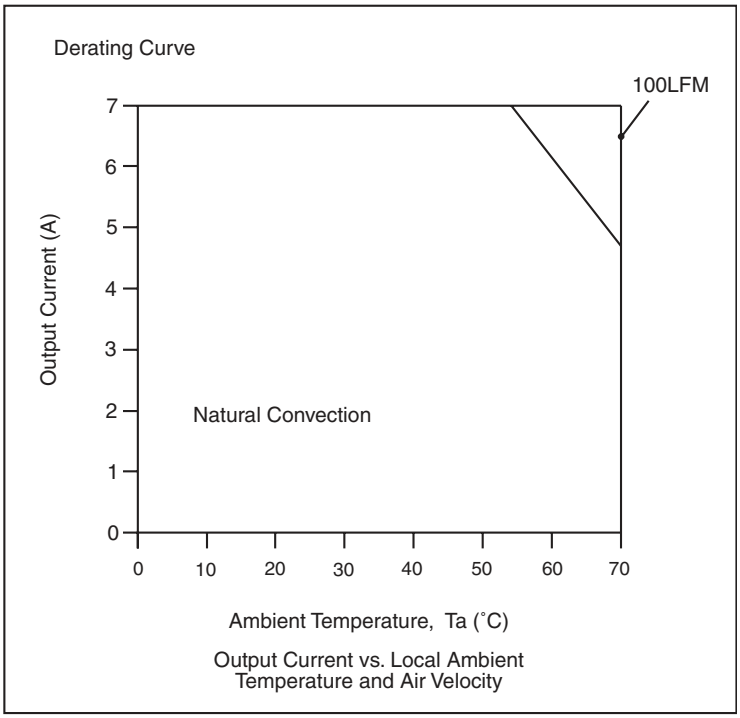


Vout=1.2V
50% to 100% load transients at 12V input and Ta=25° C



Vout=1.2V
100% to 50% load transients at 12V input and Ta=25° C

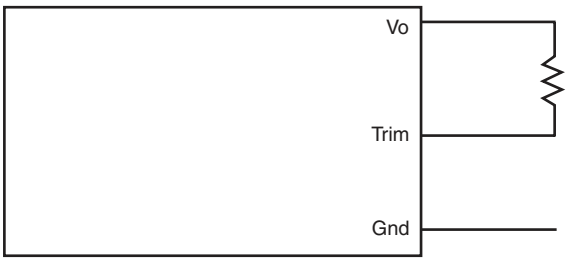
Thermal Considerations



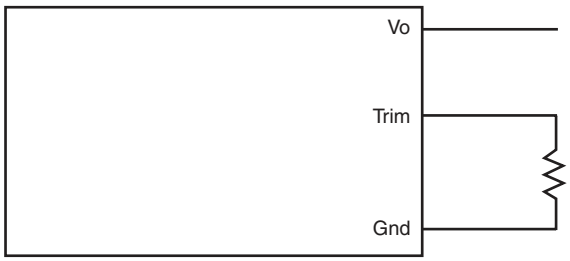
Output Current vs. Local Ambient Temperature and Air Velocity

Output Voltage Set-Point Adjustment

Trim Down Test Circuit



Trim Up Test Circuit

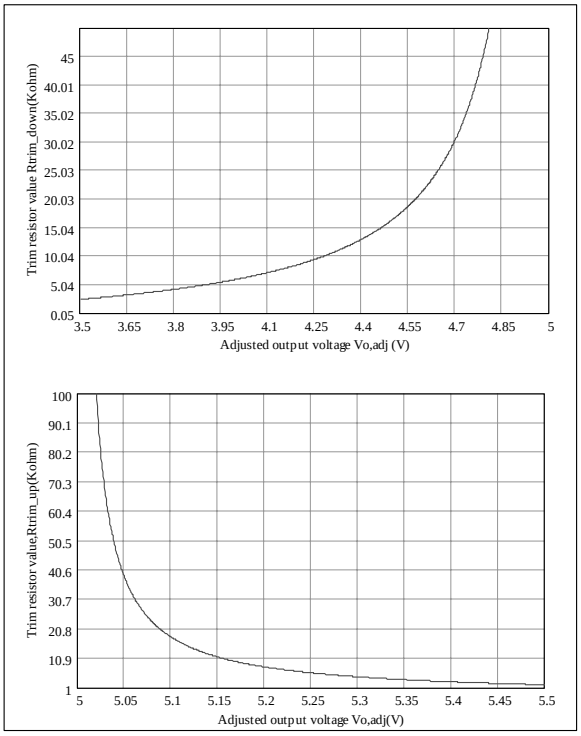


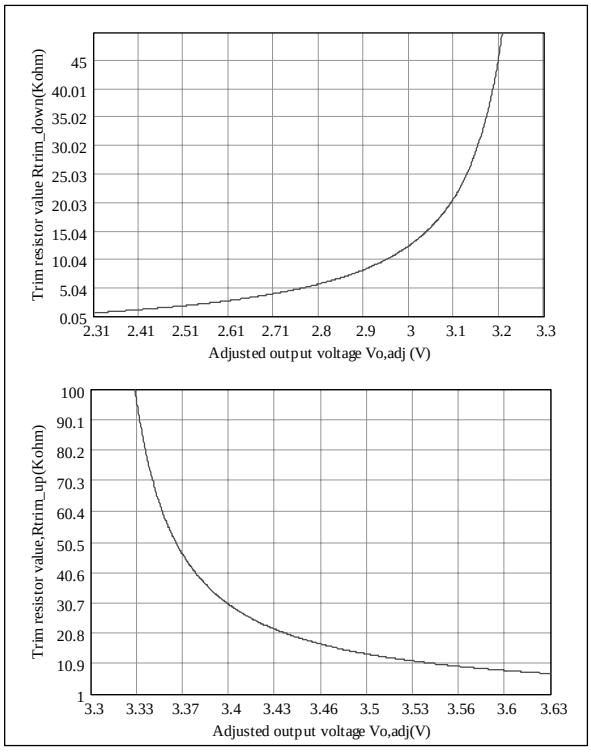
Output Voltage Set-Point Adjustment

SRDB-07A500 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{10.52}{Vo - Vo,\ adj} - 4.55\right) \text{Kohm}$$

$$\text{Rtrim up} = \left(\frac{2}{Vo,\ adj - Vo} - 2.05\right) \text{Kohm}$$





SRDB-07A330 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{5.08}{Vo - Vo,\ adj} - 4.55\right) \text{Kohm}$$

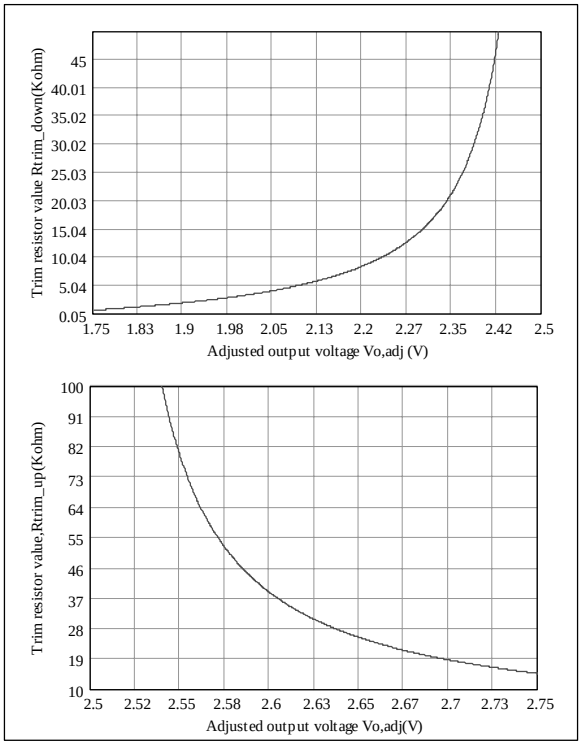
$$\text{Rtrim up} = \left(\frac{3.175}{Vo,\ adj - Vo} - 2.05\right) \text{Kohm}$$

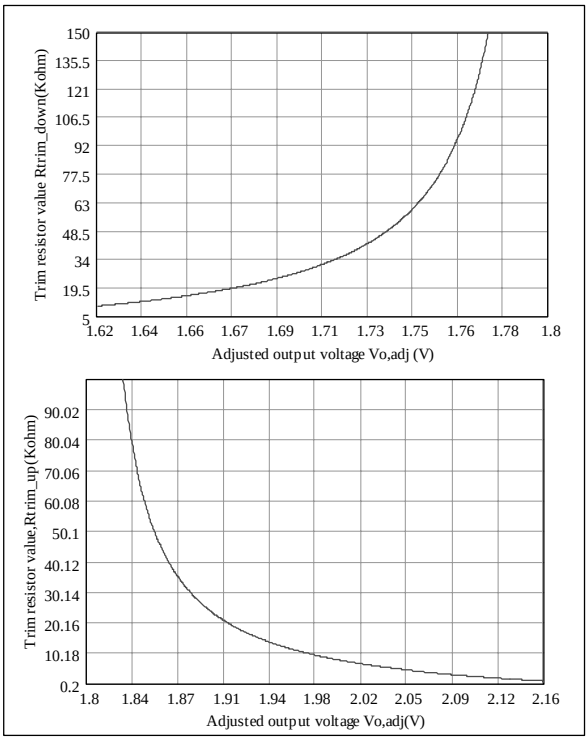
Output Voltage Set-Point Adjustment

SRDB-07A250 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{3.926}{Vo - Vo,\ adj} - 4.64\right) \text{ Kohm}$$

$$\text{Rtrim up} = \left(\frac{4.02}{Vo,\ adj - Vo} - 1.47\right) \text{ Kohm}$$





SRDB-07A180 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{3.869}{Vo - Vo,\ adj} - 11.34\right) \text{ Kohm}$$

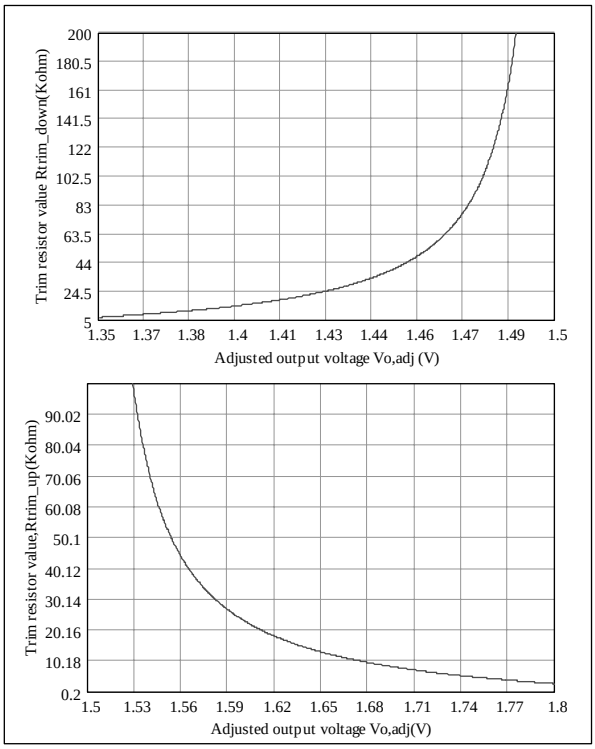
$$\text{Rtrim up} = \left(\frac{3.072}{Vo,\ adj - Vo} - 7.5\right) \text{ Kohm}$$

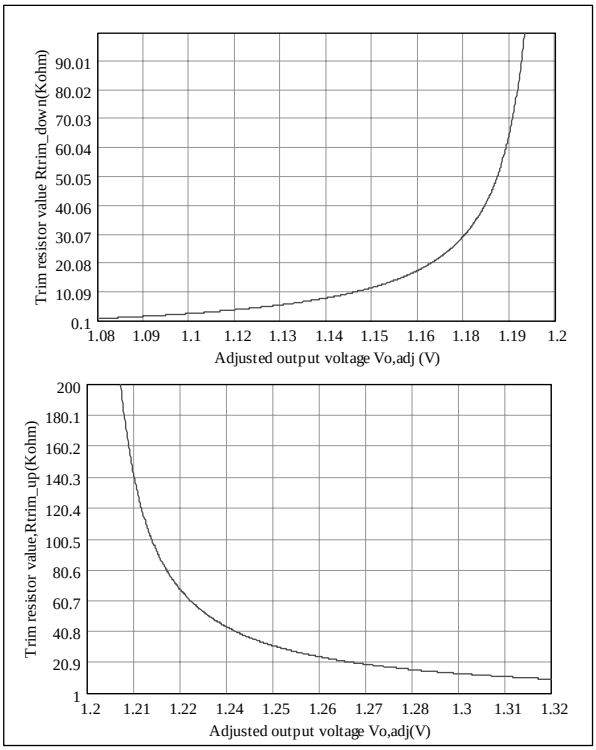
Output Voltage Set-Point Adjustment

SRDB-07A150 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{2.704}{Vo - Vo,\ adj} - 11.34\right) \text{Kohm}$$

$$\text{Rtrim up} = \left(\frac{3.072}{Vo,\ adj - Vo} - 7.5\right) \text{Kohm}$$





SRDB-07A120 Trim Resistor Calculation

$$\text{Rtrim down} = \left(\frac{0.874}{Vo - Vo,\ adj} - 6.58\right) \text{Kohm}$$

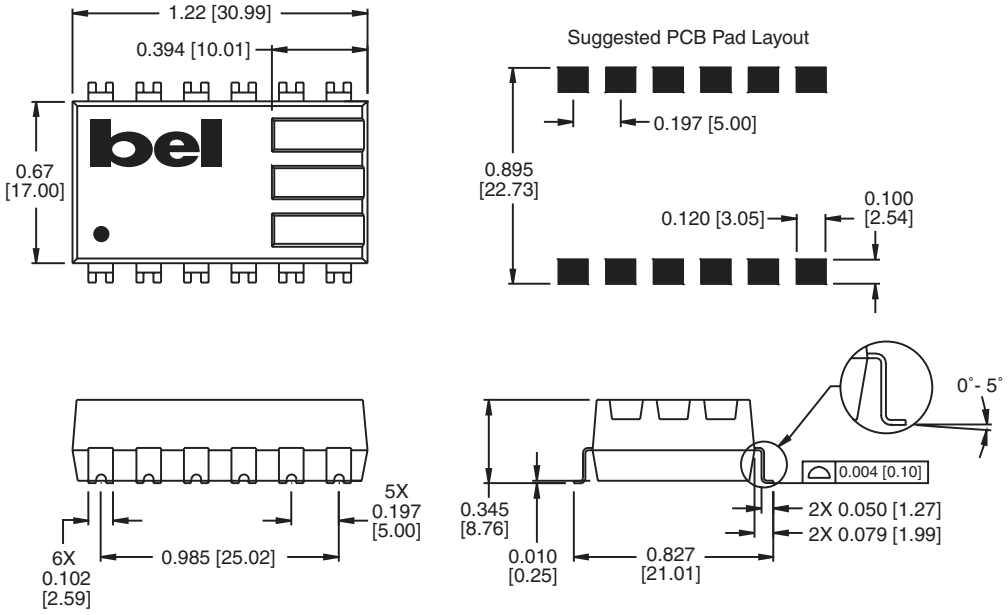
$$\text{Rtrim up} = \left(\frac{1.728}{Vo,\ adj - Vo} - 4.42\right) \text{Kohm}$$

NON-ISOLATED DC/DC CONVERTERS

12V Input / 1.2V – 5.0V Output / 7A

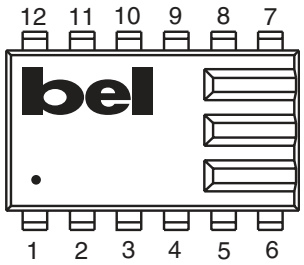
BP06SRDB-07A

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



RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products. These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 240ºC.

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