

NON-ISOLATED DC/DC CONVERTERS

5V Input / 1.2V – 3.3V Output / 12A



BP02S7DB-12B

S7DB-12B 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-12B 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 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 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
3.3V	5V	12A	39.6W	92%	S7DB-12B330
2.5V	5V	12A	30.0W	90%	S7DB-12B250
1.8V	5V	12A	21.6W	86%	S7DB-12B180
1.5V	5V	12A	18.0W	84%	S7DB-12B150
1.2V	5V	12A	14.4W	82%	S7DB-12B120

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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		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	4.5	5	5.5	V
Input Current	3.3V 2.5V 1.8V 1.5V 1.2V	Iin			11.2 8.7 6.6 5.5 4.5	A
No Load Input Current	All			50		mA
Remote Off Input Current				10	20	mA
Input Reflected Ripple Current ¹	All			40	80	mA _{rms}
Input Reflected Ripple Current (P-P) ¹	All			140	280	mApk
I ² t Inrush Current Transient	All			0.1	0.2	A ² s
Turn On Voltage Threshold	All			4.3	4.5	V
Turn Off Voltage Threshold	All			3.85	4.49	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.

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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	Vout	3.234 2.45 1.764 1.47 1.176	3.3 2.5 1.8 1.5 1.2	3.366 2.55 1.836 1.53 1.224	V
Load Regulation	3.3V 2.5V 1.8V 1.5V 1.2V			6.0 6.0 6.0 6.0 6.0	12 12 10 10 10	mV
Line Regulation	All			2.0	5	mV
Regulation Over Temperature	3.3V 2.5V 1.8V 1.5V 1.2V			22 17 12 10 8	45 34 25 20 17	mV
Total Output Voltage Regulation	3.3V 2.5V 1.8V 1.5V 1.2V				62 51 40 35 32	mV
Output Ripple and Noise ²	All			30	60	mVp-p
Output Ripple and Noise ²	All			10	25	mVrms
Output Current Range	All	Iout	0		12	A
Output DC Current Limit	All	Ioutlim	15.6		30	A
Short Circuit Surge	3.3V 2.5V 1.8V 1.5V 1.2V	Ioutsurge		0.25 0.3 0.35 0.45 0.5	0.5 0.6 0.7 0.9 1	A ² s
Turn on Time	All	Ton		12	20	ms
Overshoot at Turn On	All			0	3%	V
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 = 5V, Iout = full load, Ta = 25° C.

2. 0 - 20MHz, 1μF ceramic cap and 10μF aluminum 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			90	120	mV
Settling Time		Ts		35	70	μs
ΔV 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		35	70	μs
Transient Response ³						
ΔV 50% to 100% of Max Load	2.5V			90	120	mV
Settling Time		Ts		35	70	μs
ΔV 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		35	70	μs
Transient Response ³						
ΔV 50% to 100% of Max Load	1.8V			90	120	mV
Settling Time		Ts		35	70	μs
ΔV 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		35	70	μs
Transient Response ³						
ΔV 50% to 100% of Max Load	1.5V			90	120	mV
Settling Time		Ts		35	70	μs
ΔV 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		35	70	μs
Transient Response ³						
ΔV 50% to 100% of Max Load	1.2V			90	120	mV
Settling Time		Ts		35	70	μs
ΔV 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		35	70	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.

NON-ISOLATED DC/DC CONVERTERS

5V Input / 1.2V – 3.3V Output / 12A



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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	η	89 87 83 81 89	92 90 86 84 82		%
Switching Frequency	All	Fsw	260	300	340	kHz
Output Voltage Trim Range ²	All		90		110	%
Remote Sense Compensation	All				10	%
Weight	All			10.5		g

1. Vin=5V, full load and Ta=25° C.

2. See graphs on pages 10-12.

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Control Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off ³	All	Vouten				V
Signal Low (Unit On)	All		0		1	V
Signal High (Unit Off)	All		2.5		5.5	V

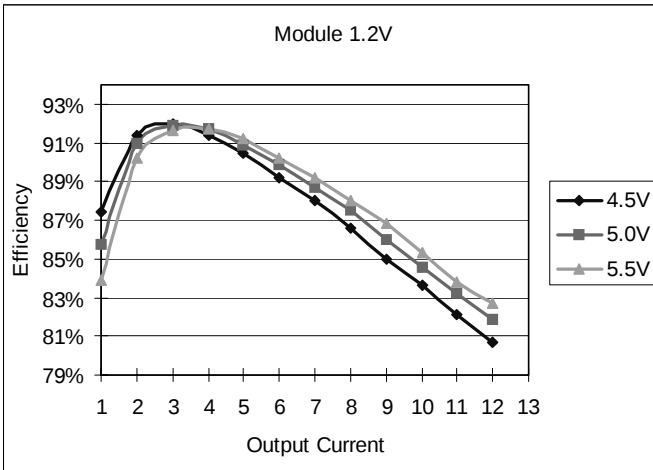
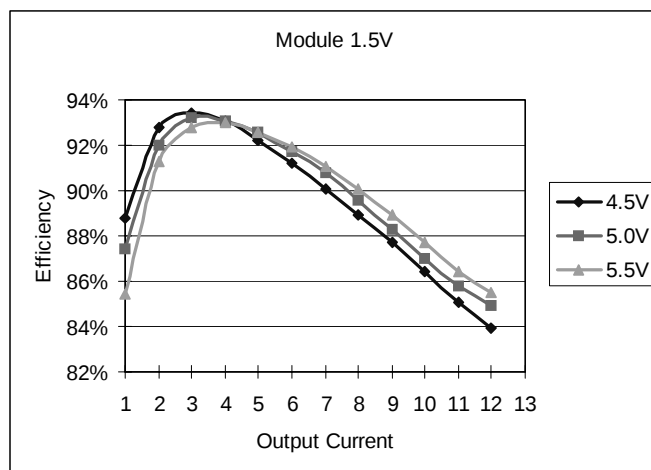
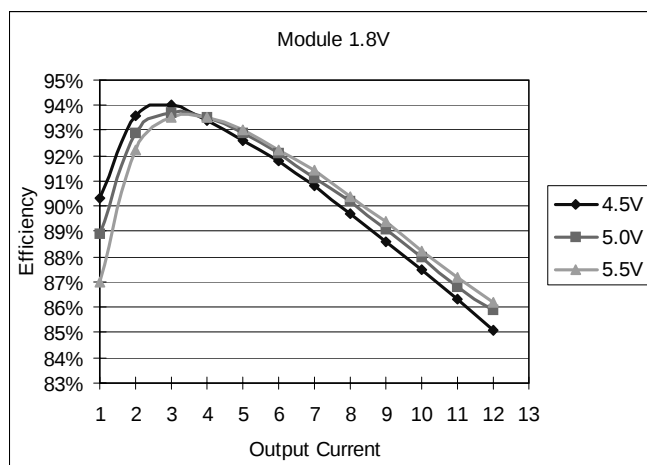
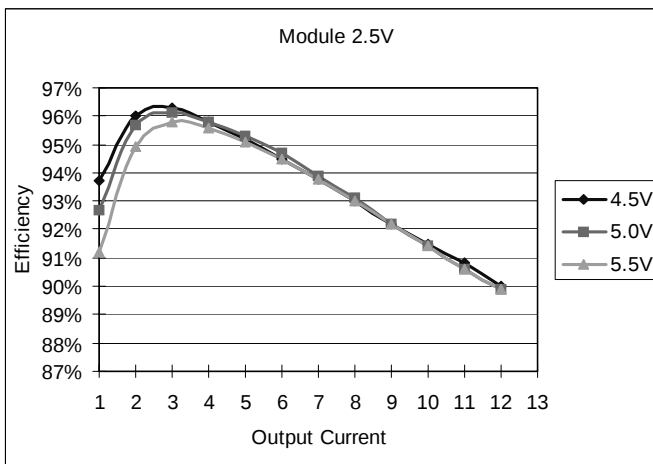
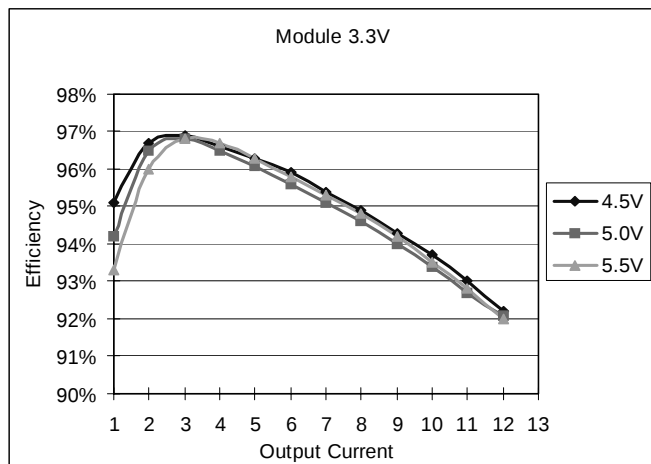
3. With remote on/off pin 8 open, the module is on.

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Efficiency Data



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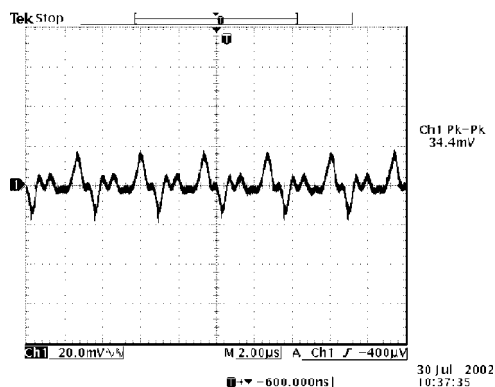
5V Input / 1.2V – 3.3V Output / 12A



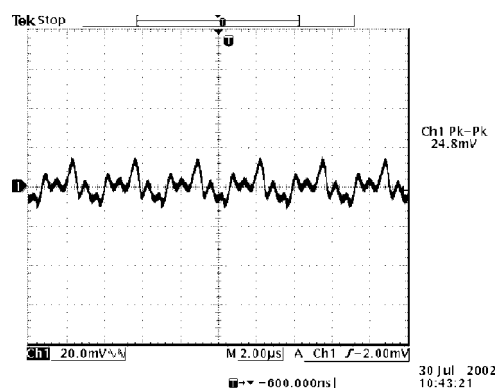
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Ripple and Noise

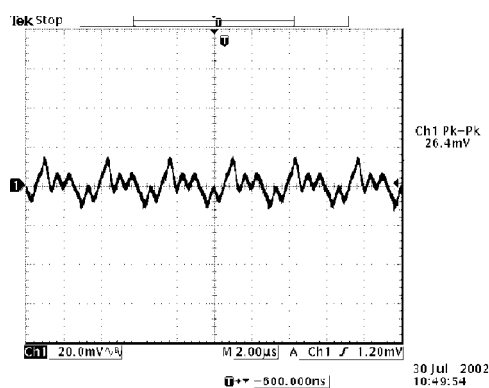
1 μ F ceramic cap and 10 μ F aluminum electrolytic cap added at the output.



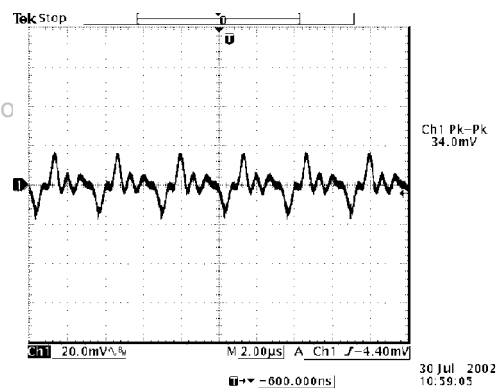
Ripple and noise at full load and 5Vdc input, 3.3Vdc output and Ta=25° C



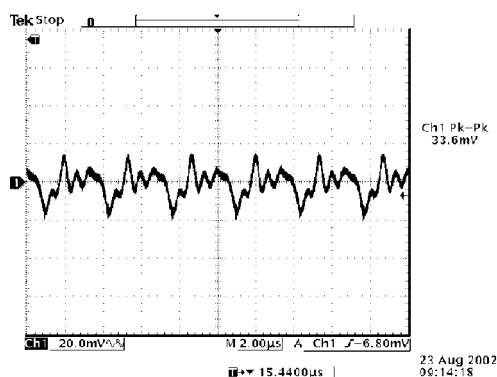
Ripple and noise at full load and 5Vdc input, 2.5Vdc output and Ta=25° C



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



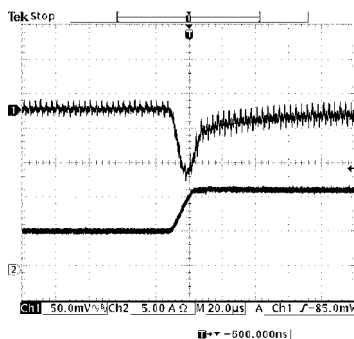
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5V Input / 1.2V – 3.3V Output / 12A

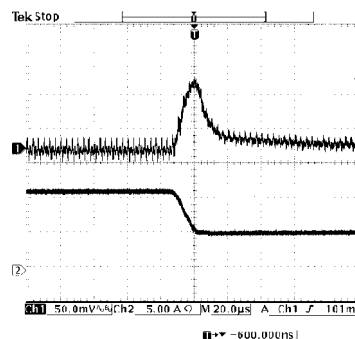
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Transient Response

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



30 Jul 2002
10:41:26



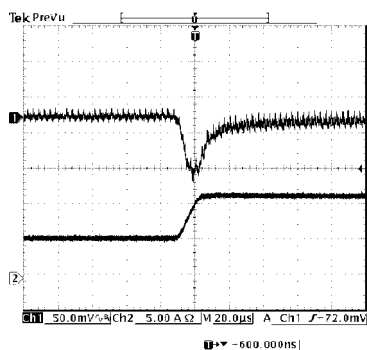
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Vout=3.3V

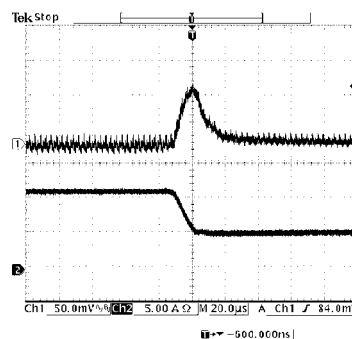
50% to 100% load transients at 5V input and Ta=25° C

Vout=3.3V

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



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10:46:32



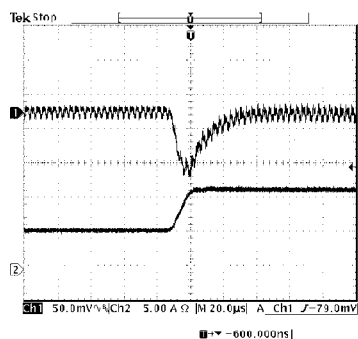
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Vout=2.5V

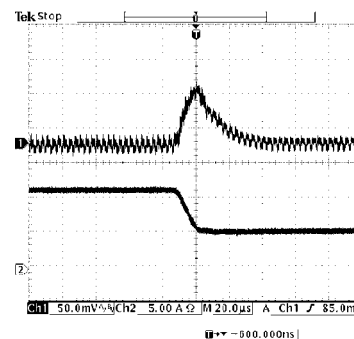
50% to 100% load transients at 5V input and Ta=25° C

Vout=2.5V

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



30 Jul 2002
10:53:24



30 Jul 2002
10:51:35

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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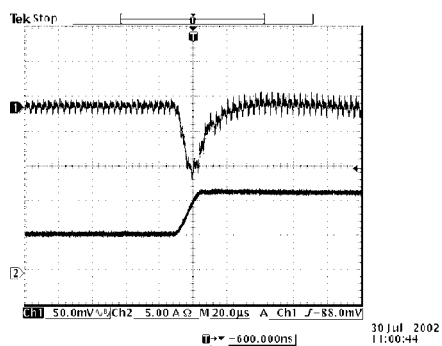
5V Input / 1.2V – 3.3V Output / 12A



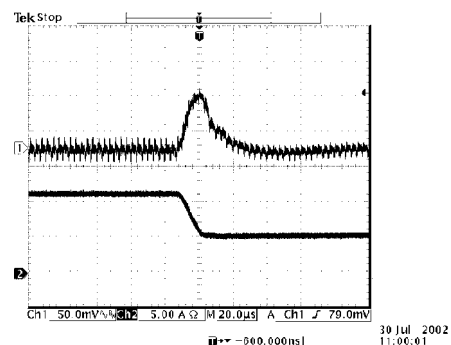
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Transient Response

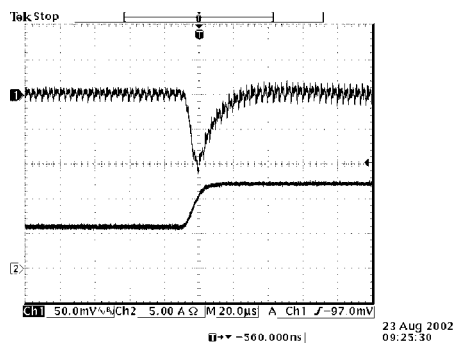
Transient response: $di/dt = 0.5A/\mu S$, no external load capacitance



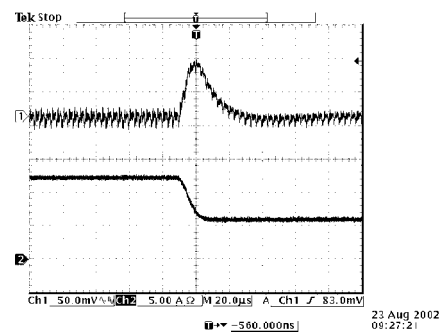
Vout=1.5V
50% to 100% load transients at 5V input and Ta=25° C



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

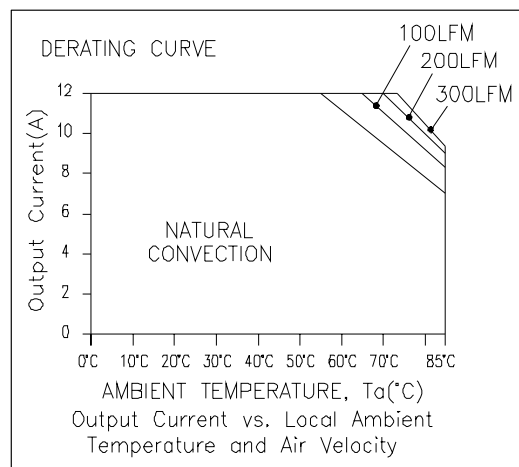


Vout=1.2V
50% to 100% load transients at 5V input and Ta=25° C



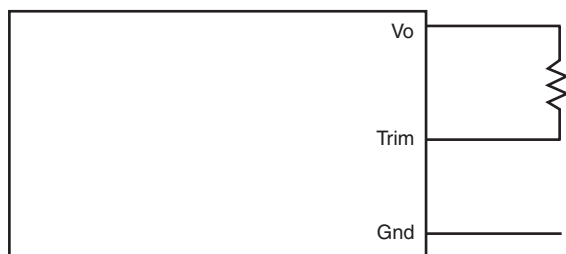
Vout=1.2V
100% to 50% load transients at 5V input and Ta=25° C

Thermal Considerations

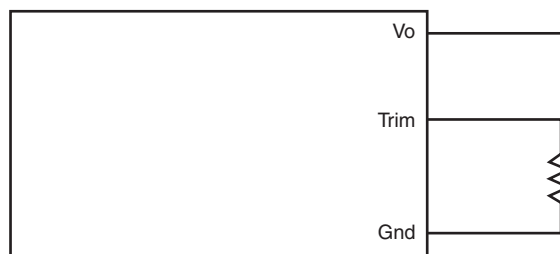


Output Voltage Set-Point Adjustment

Trim Down Test Circuit



Trim Up Test Circuit



Output Voltage Set-Point Adjustment

S7DB-12B330 Trim Resistor Calculation

$$R_{trim_down} = \left(\frac{7.964}{V_o - V_{o,adj}} - 6.82 \right) \text{Kohm}$$

where,

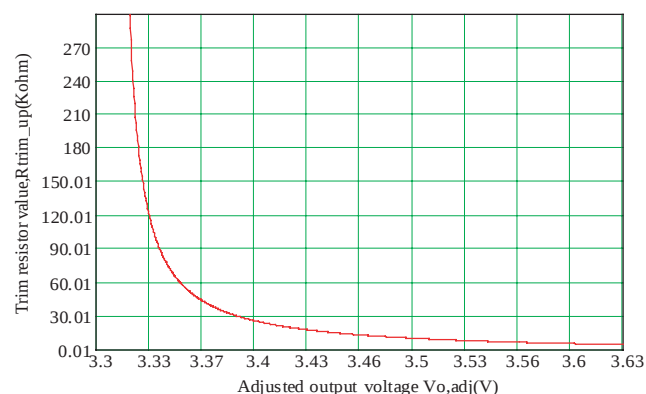
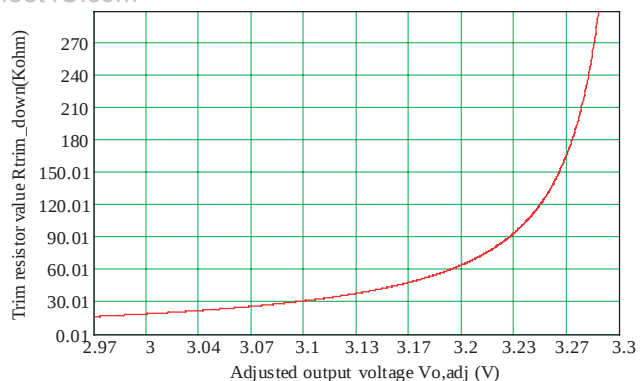
V_o is the nominal output voltage setpoint when trim pin is open, $V_o=3.312\text{V}$
 $V_{o,adj}$ is the adjusted output voltage.
 $R_{trim-down}$ is the resistance required between TRIM and V_o .

$$R_{trim_up} = \left(\frac{2.536}{V_{o,adj} - V_o} - 3.65 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=3.312\text{V}$
 $V_{o,adj}$ is the adjusted output voltage.
 $R_{trim-up}$ is the resistance required between TRIM and GND.

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Output Voltage Set-Point Adjustment

S7DB-12B250 Trim Resistor Calculation

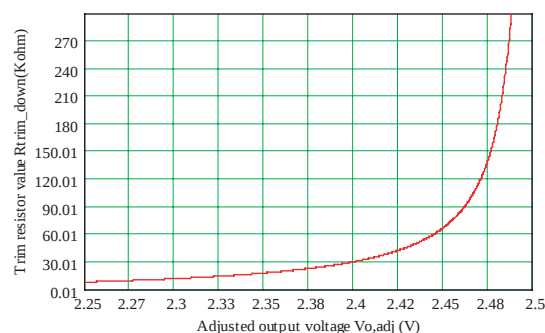
$$R_{trim_down} = \left(\frac{3.691}{V_o - V_{o,adj}} - 6.8 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=2.509\text{V}$

$V_{o,adj}$ is the adjusted output voltage.

R_{trim_down} is the resistance required between TRIM and V_o .



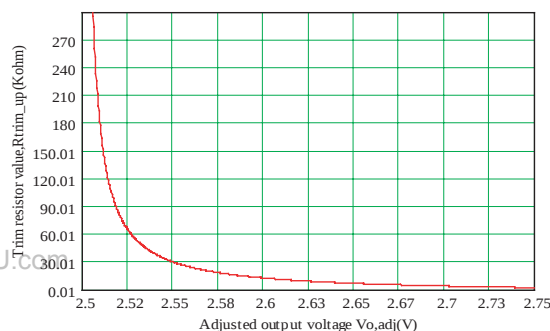
$$R_{trim_up} = \left(\frac{1.728}{V_{o,adj} - V_o} - 4.64 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=2.509\text{V}$

$V_{o,adj}$ is the adjusted output voltage.

R_{trim_up} is the resistance required between TRIM and GND.



S7DB-12B180 Trim Resistor Calculation

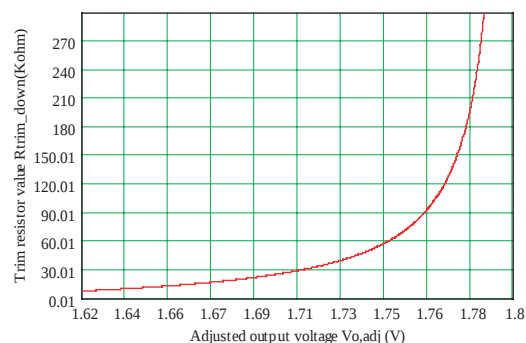
$$R_{trim_down} = \left(\frac{3.869}{V_o - V_{o,adj}} - 13.84 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=1.808\text{V}$

$V_{o,adj}$ is the adjusted output voltage.

R_{trim_down} is the resistance required between TRIM and V_o .



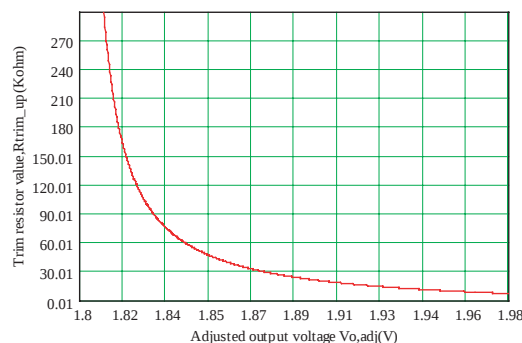
$$R_{trim_up} = \left(\frac{3.072}{V_{o,adj} - V_o} - 10 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=1.808\text{V}$

$V_{o,adj}$ is the adjusted output voltage.

R_{trim_up} is the resistance required between TRIM and GND.



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Output Voltage Set-Point Adjustment

S7DB-12B150 Trim Resistor Calculation

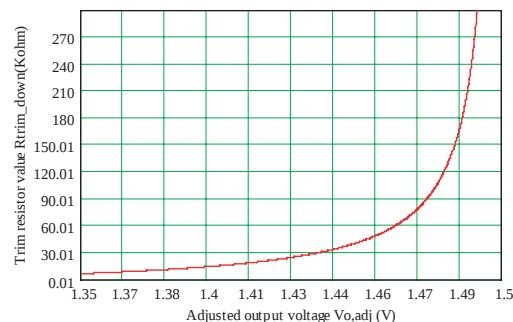
$$R_{trim_down} = \left(\frac{2.716}{V_o - V_{o,adj}} - 11.71 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=1.507\text{V}$

$V_{o,adj}$ is the adjusted output voltage.

$R_{trim-down}$ is the resistance required between TRIM and V_o .



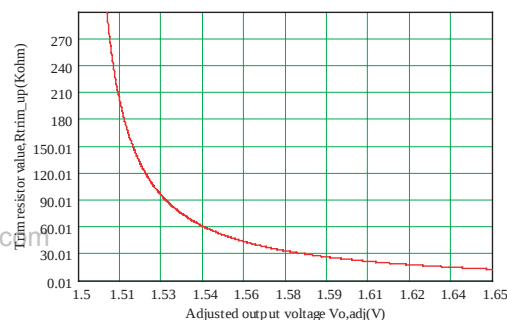
$$R_{trim_up} = \left(\frac{3.072}{V_{o,adj} - V_o} - 7.87 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=1.507\text{V}$

$V_{o,adj}$ is the adjusted output voltage.

$R_{trim-up}$ is the resistance required between TRIM and GND.



S7DB-12B120 Trim Resistor Calculation

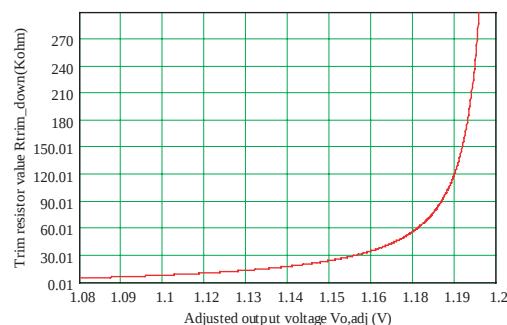
$$R_{trim_down} = \left(\frac{1.562}{V_o - V_{o,adj}} - 8.48 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=1.207\text{V}$

$V_{o,adj}$ is the adjusted output voltage.

$R_{trim-down}$ is the resistance required between TRIM and V_o .



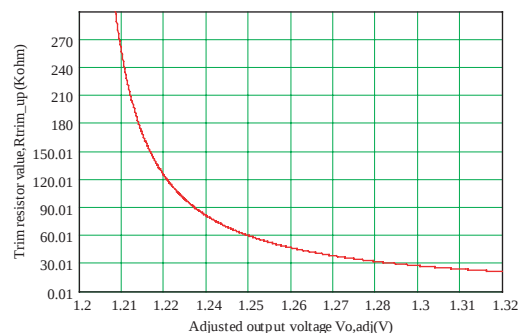
$$R_{trim_up} = \left(\frac{3.072}{V_{o,adj} - V_o} - 4.64 \right) \text{Kohm}$$

where,

V_o is the nominal output voltage setpoint when trim pin is open, $V_o=1.207\text{V}$

$V_{o,adj}$ is the adjusted output voltage.

$R_{trim-up}$ is the resistance required between TRIM and GND.



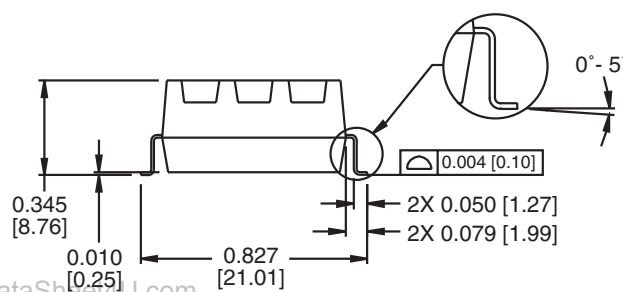
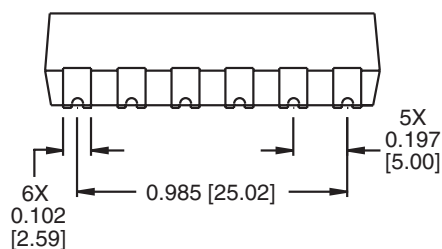
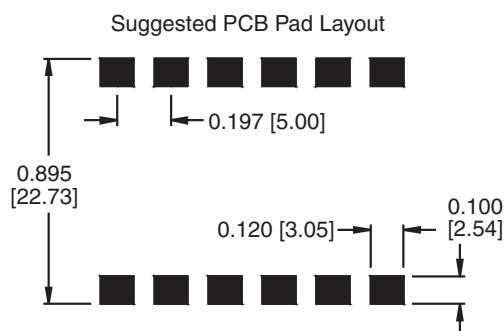
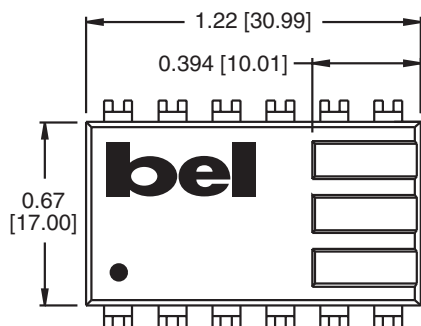
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POWER PRODUCTS

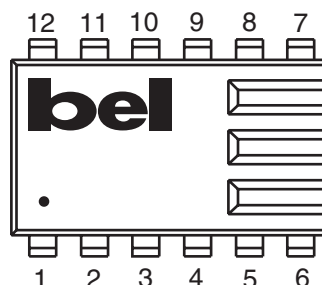
BP02S7DB-12B

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



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CORPORATE

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