NON-ISOLATED DC/DC CONVERTERS
5V Input / 1.2V – 3.3V Output / 12A

bel POWER PRODUCTS

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

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^2t Inrush Current Transient	All			0.1	0.2	A^2s
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.

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^2s
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.

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/1µS, Ta = 25° C without external load capacitance.

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

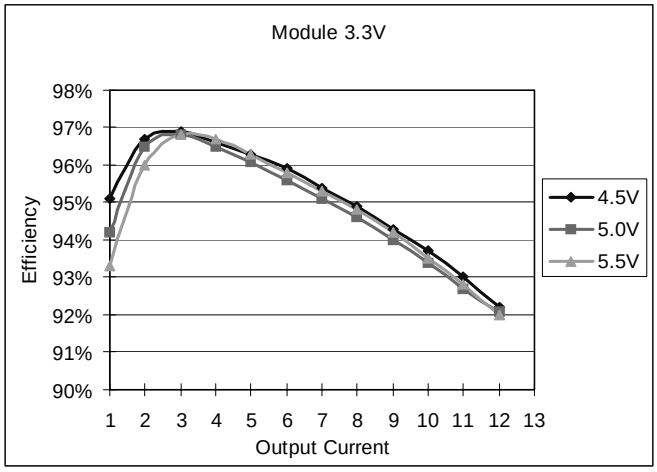
1. Vin=5V, full load and Ta=25° C.
2. See graphs on pages 10-12.

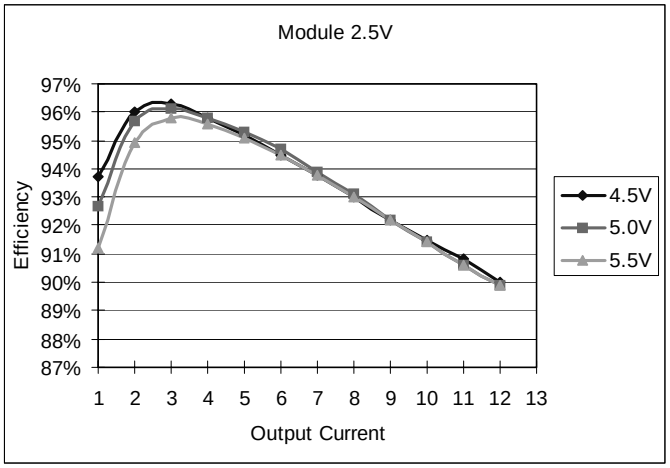
Control Specifications

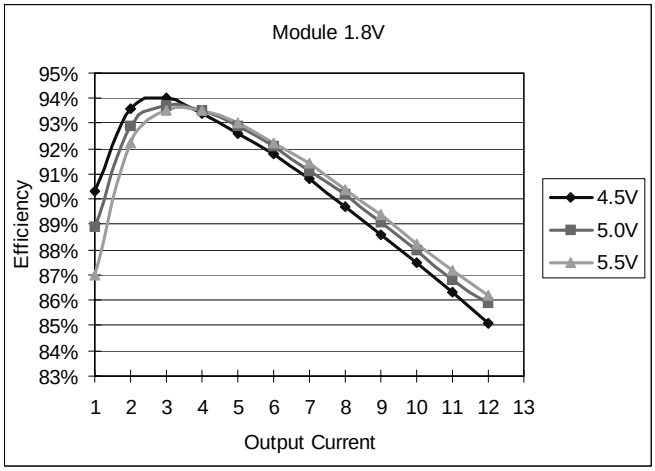
Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off [3]	All	Vouten				V
Signal Low (Unit On)	All		0		1	V
Signal High (Unit Off)	All		2.5		5.5	V

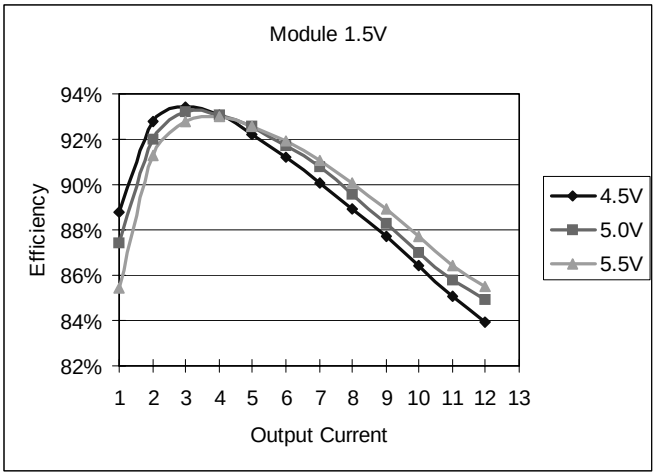
3. With remote on/off pin 8 open, the module is on.

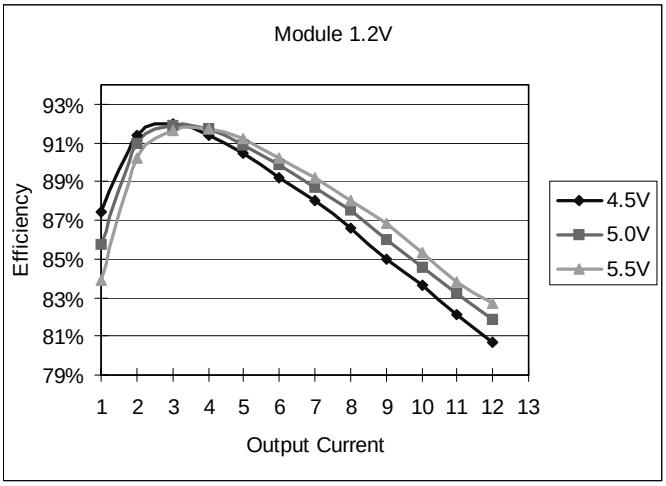
Efficiency Data





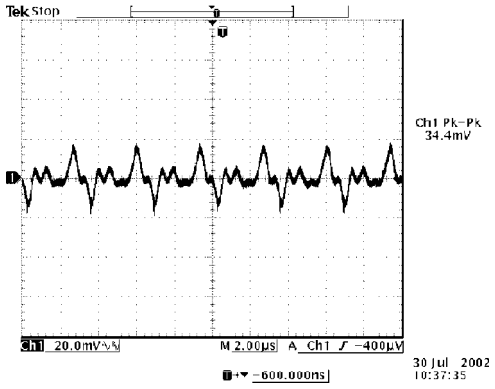




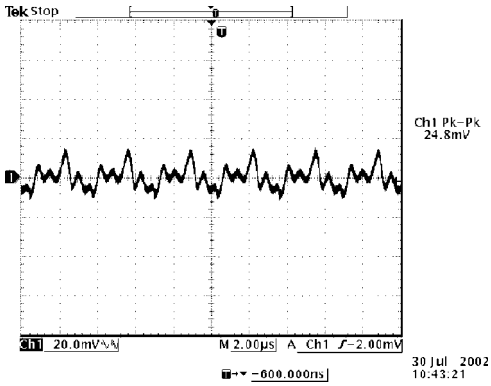


Ripple and Noise

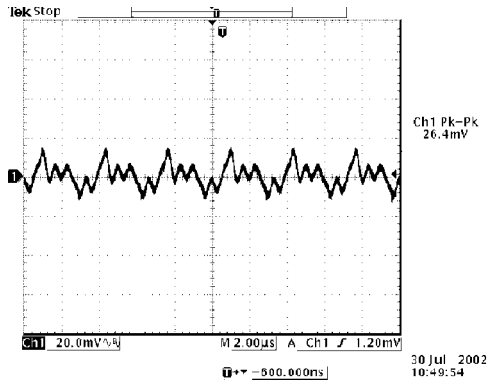
1µF ceramic cap and 10µF aluminum electrolytic cap added at the output.



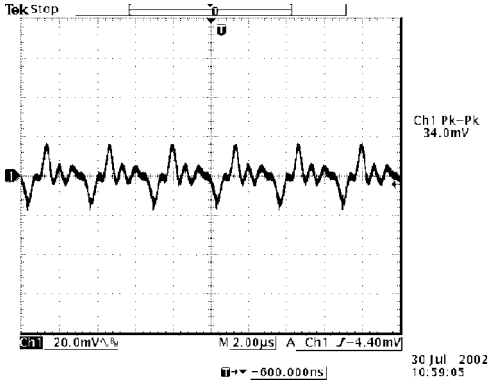
Ripple and noise at full load and 5Vdc input, 3.3Vdc output and Ta=25° C



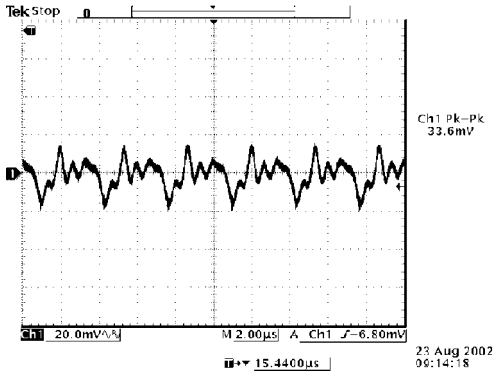
Ripple and noise at full load and 5Vdc input, 2.5Vdc output and Ta=25° C



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



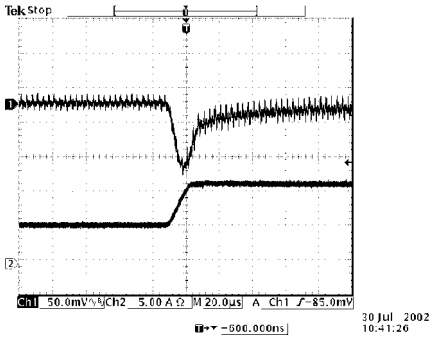
Ripple and noise at full load and 5Vdc input, 1.5Vdc output and Ta=25° C



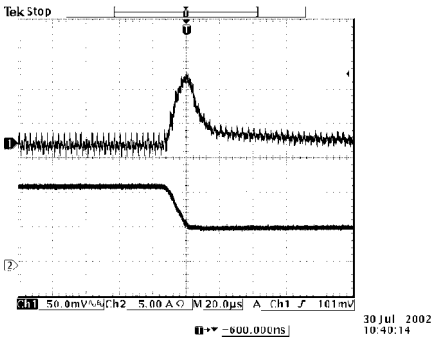
Ripple and noise at full load and 5Vdc input, 1.2Vdc output and Ta=25° C

Transient Response

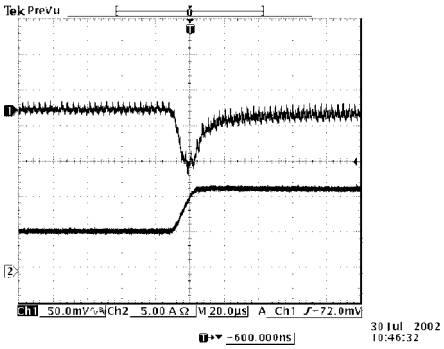
Transient response: di/dt = 0.5A/µS, no external load capacitance



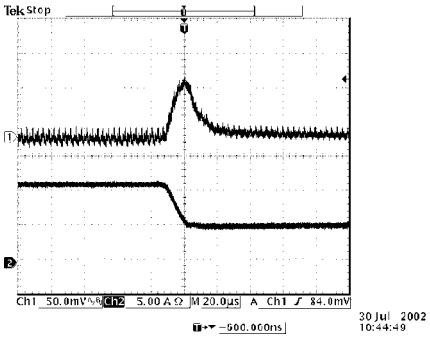
Vout=3.3V
50% to 100% load transients at 5V input and Ta=25° C



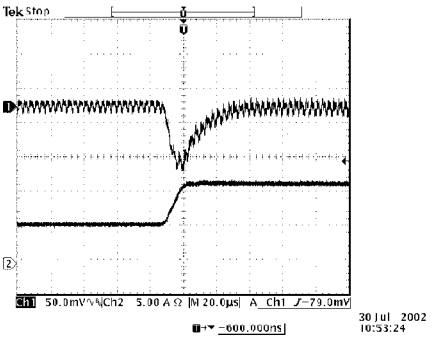
Vout=3.3V
100% to 50% load transients at 5V input and Ta=25° C



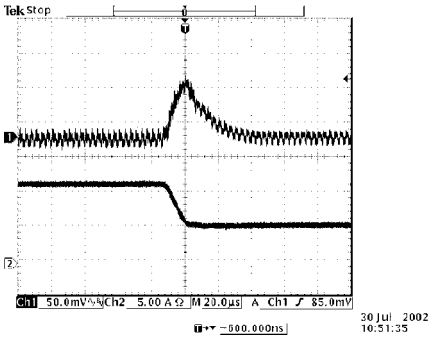
Vout=2.5V
50% to 100% load transients at 5V input and Ta=25° C



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



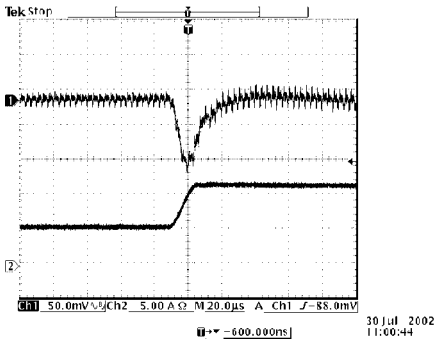
Vout=1.8V
50% to 100% load transients at 5V input and Ta=25° C



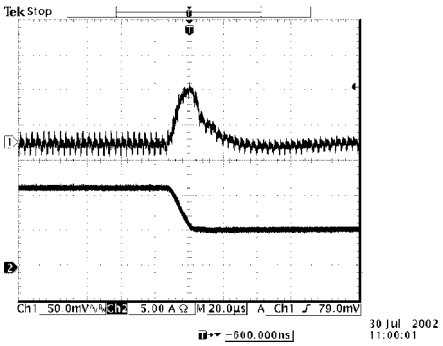
Vout=1.8V
100% to 50% load transients at 5V input and Ta=25° C

Transient Response

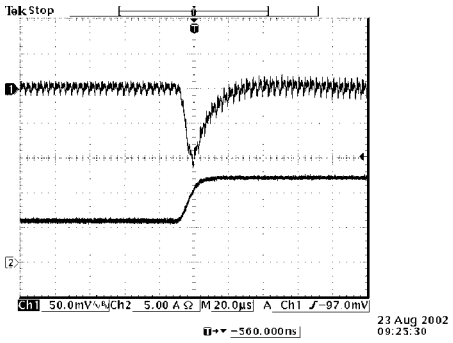
Transient response: di/dt = 0.5A/µS, no external load capacitance



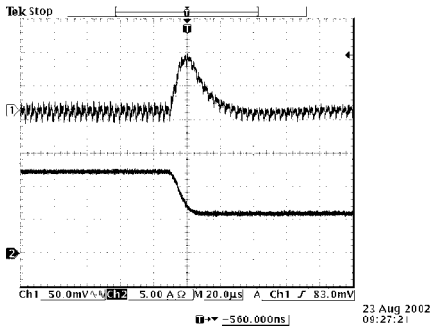
Vout=1.5V
50% to 100% load transients at 5V input and Ta=25° C



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

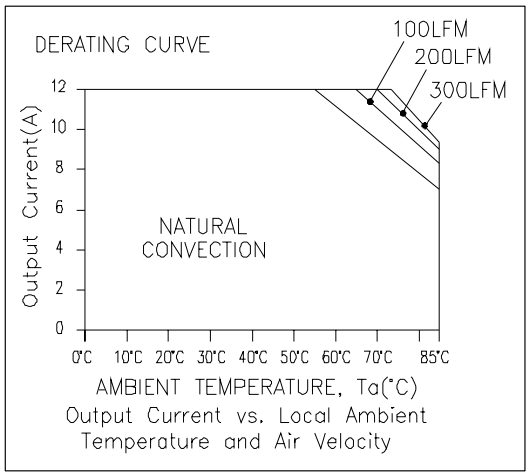


Vout=1.2V
50% to 100% load transients at 5V input and Ta=25° C



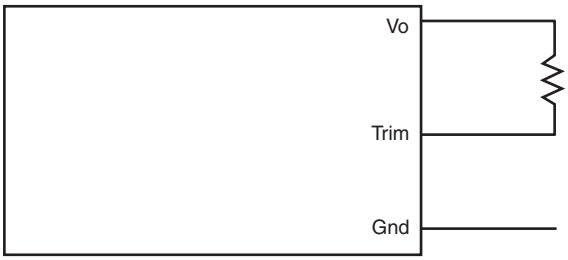
Vout=1.2V
100% to 50% load transients at 5V input and Ta=25° C

Thermal Considerations

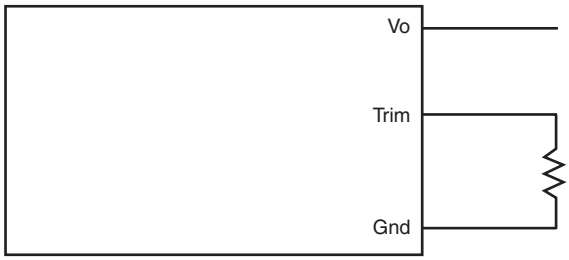


Output Voltage Set-Point Adjustment

Trim Down Test Circuit



Trim Up Test Circuit



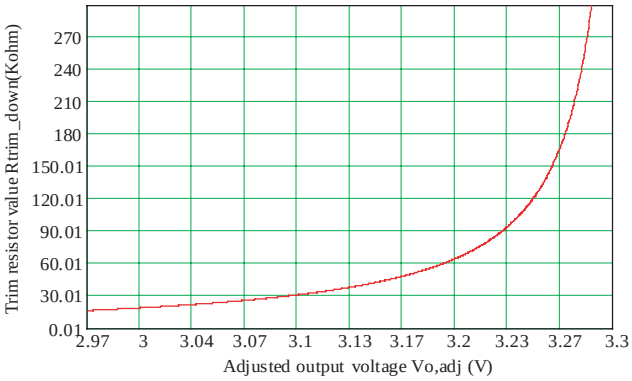
Output Voltage Set-Point Adjustment

S7DB-12B330 Trim Resistor Calculation

$$Rtrim\_down = \left(\frac{7.964}{Vo - Vo,adj} - 6.82\right)Kohm$$

where,

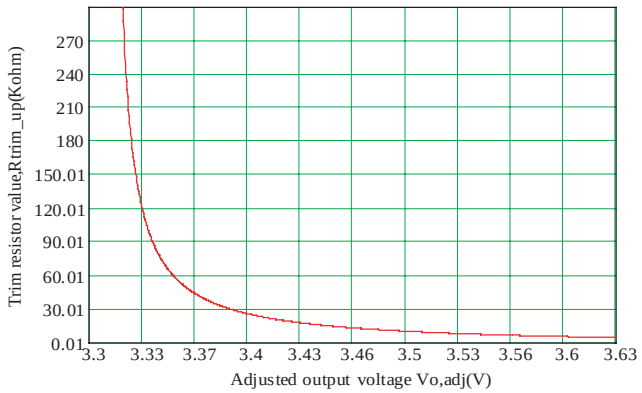
Vo is the nominal output voltage setpoint when trim pin is open ,Vo=3.312V
Vo,adj is the adjusted output voltage.
Rtrim-down is the resistance required between TRIM and Vo.



$$Rtrim\_up = \left(\frac{2.536}{Vo,adj - Vo} - 3.65\right)Kohm$$

where,

Vo is the nominal output voltage setpoint when trim pin is open ,Vo=3.312V
Vo,adj is the adjusted output voltage.
Rtrim-up is the resistance required between TRIM and GND.



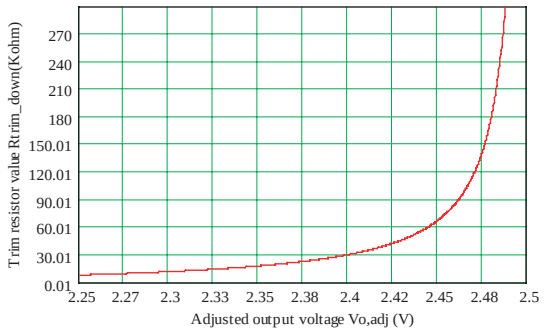
Output Voltage Set-Point Adjustment

S7DB-12B250 Trim Resistor Calculation

$$Rtrim\_down = \left(\frac{3.691}{Vo - Vo,adj} - 6.8\right)Kohm$$

where,

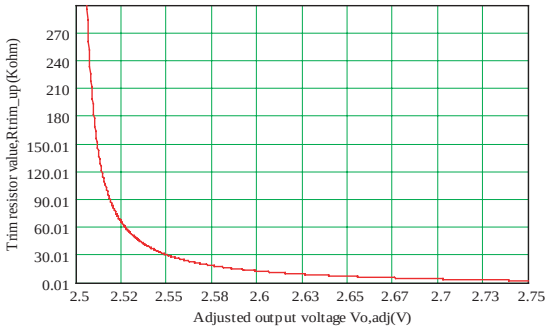
Vo is the nominal output voltage setpoint when trim pin is open ,Vo=2.509V
Vo,adj is the adjusted output voltage.
Rtrim-down is the resistance required between TRIM and Vo.



$$Rtrim\_up = \left(\frac{1.728}{Vo,adj - Vo} - 4.64\right)Kohm$$

where,

Vo is the nominal output voltage setpoint when trim pin is open ,Vo=2.509V
Vo,adj is the adjusted output voltage.
Rtrim-up is the resistance required between TRIM and GND.

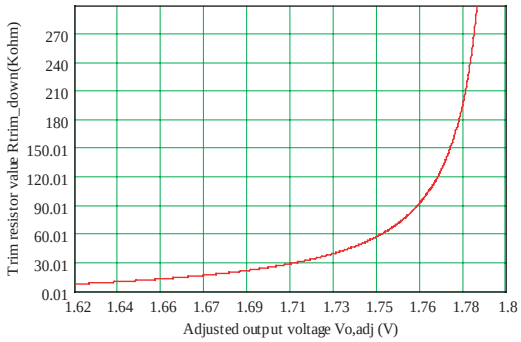


S7DB-12B180 Trim Resistor Calculation

$$Rtrim\_down = \left(\frac{3.869}{Vo - Vo,adj} - 13.84\right)Kohm$$

where,

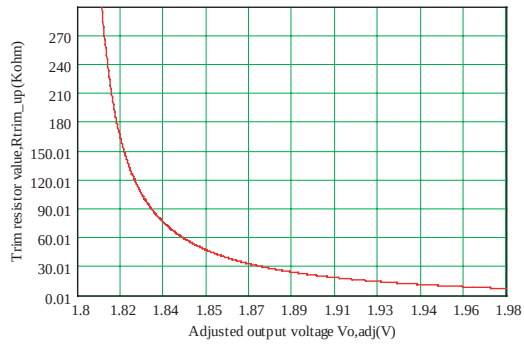
Vo is the nominal output voltage setpoint when trim pin is open ,Vo=1.808V
Vo,adj is the adjusted output voltage.
Rtrim-down is the resistance required between TRIM and Vo.



$$Rtrim\_up = \left(\frac{3.072}{Vo,adj - Vo} - 10\right)Kohm$$

where,

Vo is the nominal output voltage setpoint when trim pin is open ,Vo=1.808V
Vo,adj is the adjusted output voltage.
Rtrim-up is the resistance required between TRIM and GND.



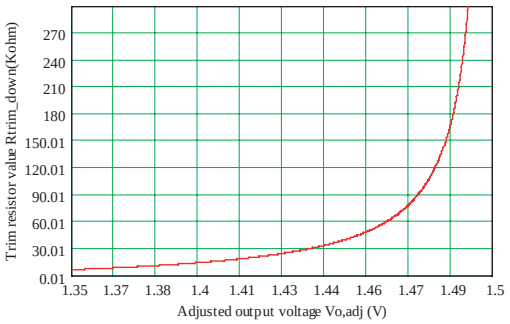
Output Voltage Set-Point Adjustment

S7DB-12B150 Trim Resistor Calculation

$$Rtrim\_down = (\frac{2.716}{Vo - Vo,adj} - 11.71)Kohm$$

where,

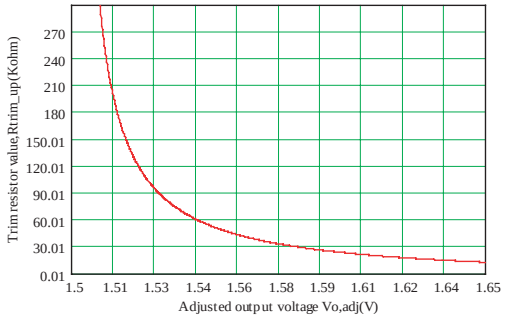
Vo is the nominal output voltage setpoint when trim pin is open ,Vo=1.507V
Vo,adj is the adjusted output voltage.
Rtrim-down is the resistance required between TRIM and Vo.



$$Rtrim\_up = (\frac{3.072}{Vo,adj - Vo} - 7.87)Kohm$$

where,

Vo is the nominal output voltage setpoint when trim pin is open ,Vo=1.507V
Vo,adj is the adjusted output voltage.
Rtrim-up is the resistance required between TRIM and GND.

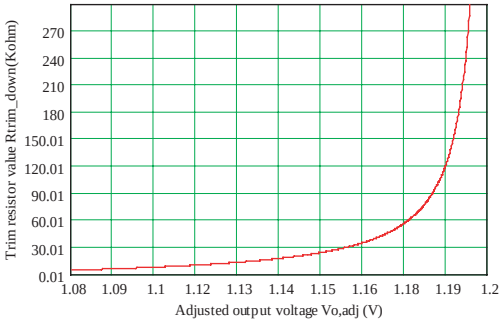


S7DB-12B120 Trim Resistor Calculation

$$Rtrim\_down = (\frac{1.562}{Vo - Vo,adj} - 8.48)Kohm$$

where,

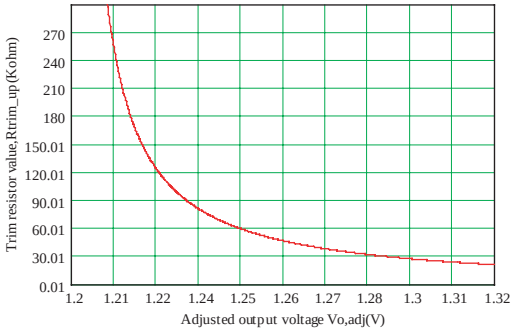
Vo is the nominal output voltage setpoint when trim pin is open ,Vo=1.207V
Vo,adj is the adjusted output voltage.
Rtrim-down is the resistance required between TRIM and Vo.



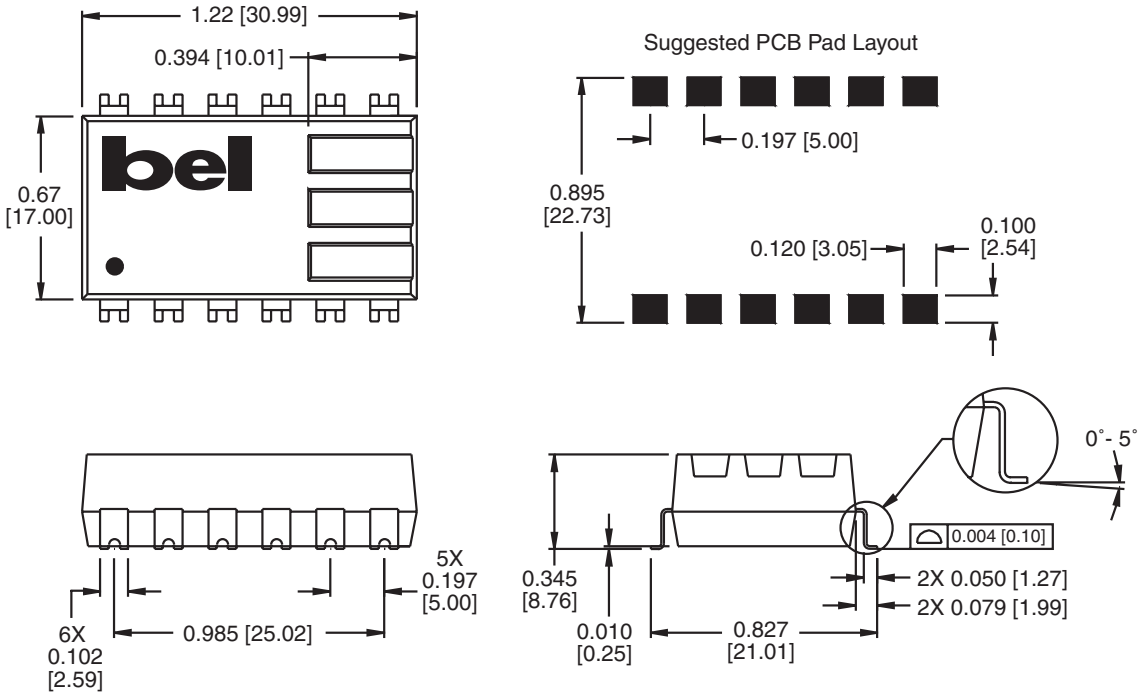
$$Rtrim\_up = (\frac{3.072}{Vo,adj - Vo} - 4.64)Kohm$$

where,

Vo is the nominal output voltage setpoint when trim pin is open ,Vo=1.207V
Vo,adj is the adjusted output voltage.
Rtrim-up is the resistance required between TRIM and GND.

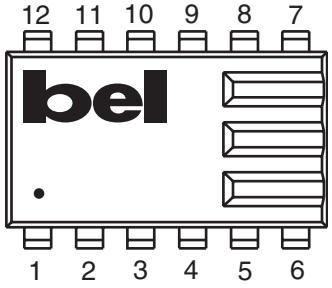


Mechanical



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

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



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