

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 ² t Inrush Current Transient	All			0.1	0.2	A ² 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.

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Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Output Voltage Set Point ¹	2.5V 1.8V 1.5V 1.2V	V _{out}	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	I _{out}	0		12	A
Output DC Current Limit	All	I _{outlim}	15.6		30	A
Short Circuit Surge	2.5V 1.8V 1.5V 1.2V	I _{outsurge}		0.1 0.2 0.5 0.6	0.2 0.4 1 1.2	A ² s
Turn on Time	All	T _{on}		10	20	ms
Overshoot at Turn On	All			0	3	%
Output Capacitance	All	C _{out}	0		4800	μF

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.

1. V_{in} = 3.3V, I_{out} = full load, T_a = 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 470 μF (ESR=0.90 ohm) tantalum cap at output.

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General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency ¹	2.5V	η	88	91		%
	1.8V		84	87		
	1.5V		81	84		
	1.2V		79	82		
Switching Frequency	All	F _{sw}	250	300	340	kHz
Output Voltage Trim Range ²	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 ³	All	V _{outen}				V
Signal Low (Unit Off)	All		-0.3		0.8	V
Signal High (Unit On)	All		2.8		4	V

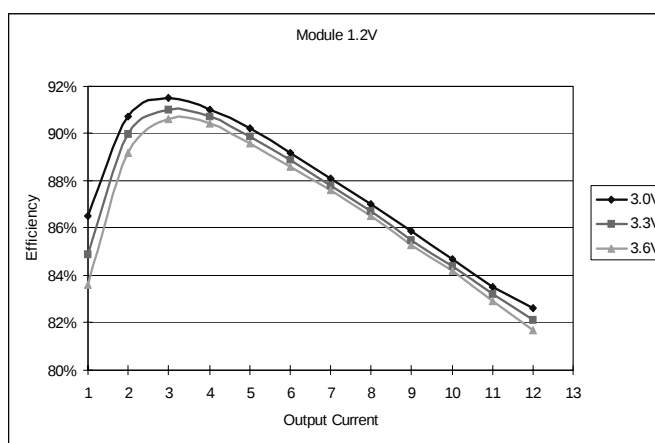
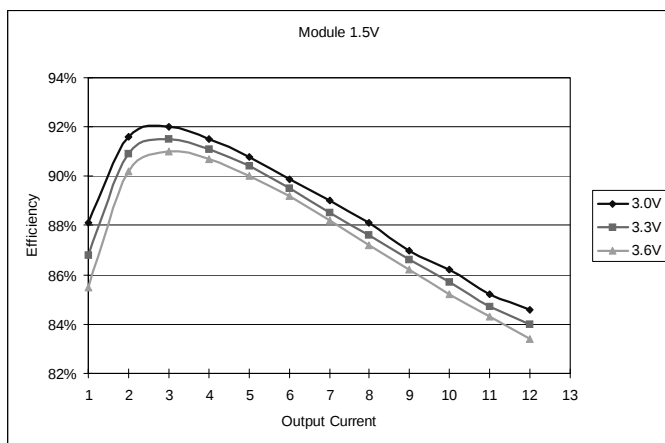
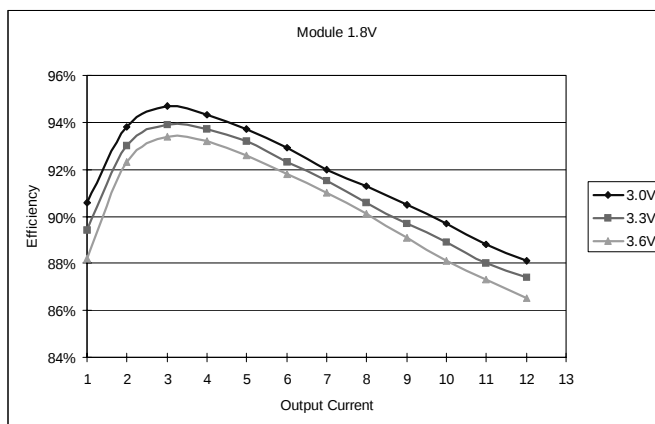
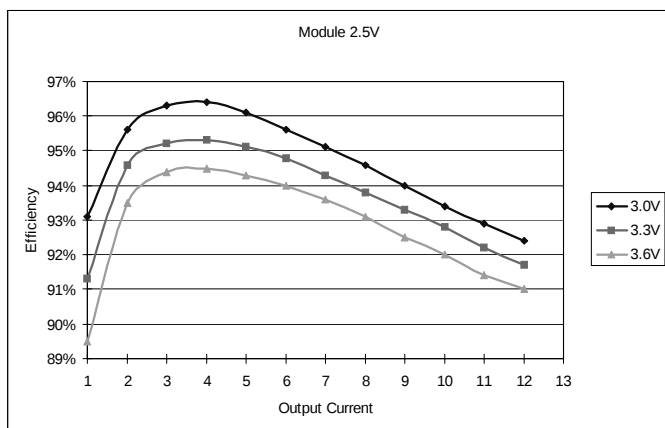
3. With remote on/off pin 8 open, the module is on.

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

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Efficiency Data



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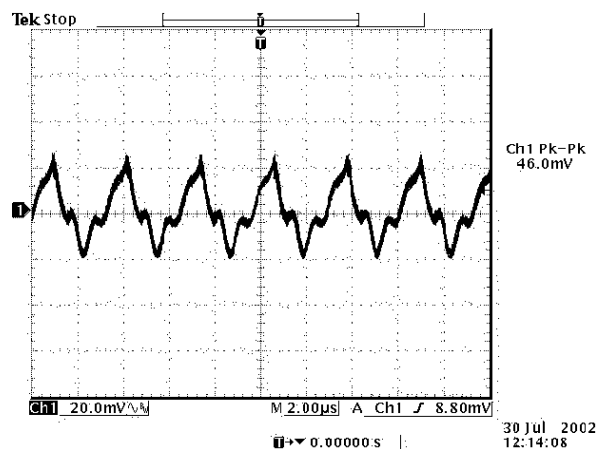
3.3V Input / 1.2V – 2.5V Output / 12A



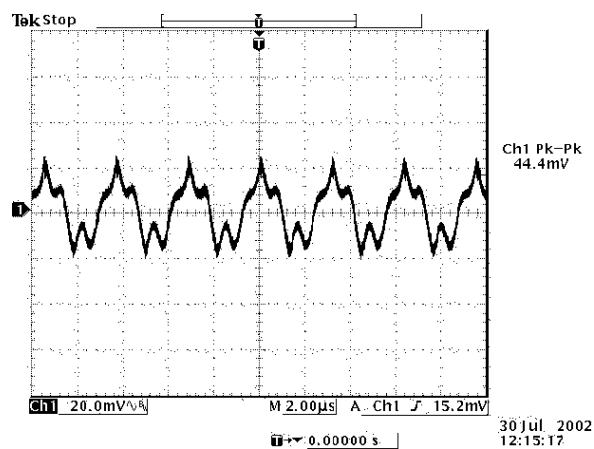
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Ripple and Noise

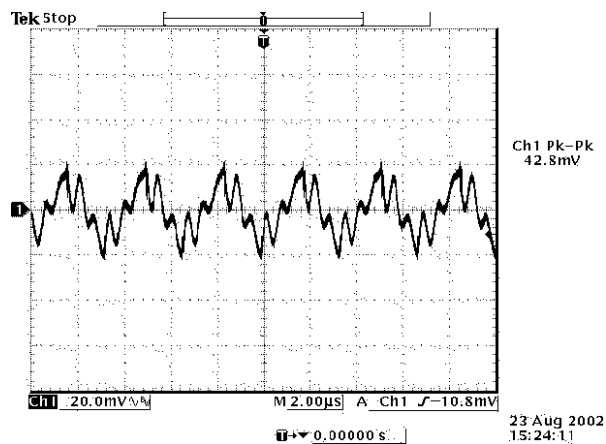
1 μ F ceramic cap and 10 μ F aluminum electrolytic cap added at the output.



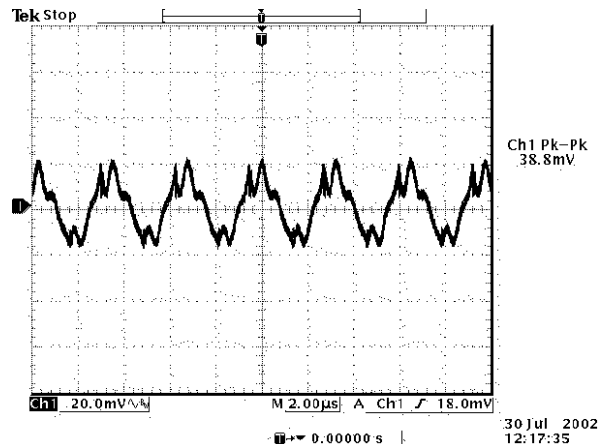
Ripple and noise at full load and 3.3Vdc input, 2.5Vdc output and Ta=25° C



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

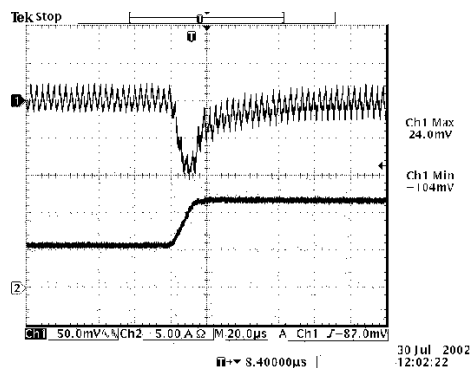


Ripple and noise at full load and 3.3Vdc input, 1.2Vdc output and Ta=25° C

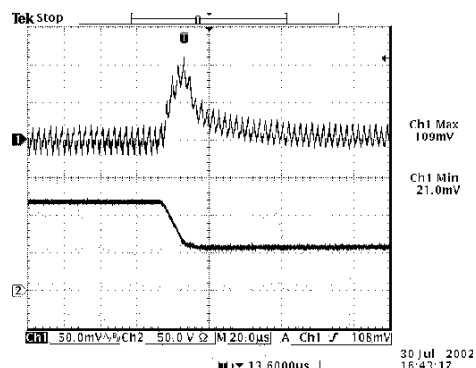
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Transient Response

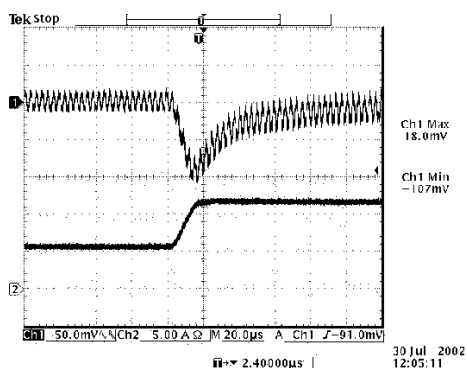
Transient response: $di/dt = 0.5A/\mu S$, external load capacitance $C_o = 470\mu F$ (tantalum capacitor ESR=0.9 ohm)



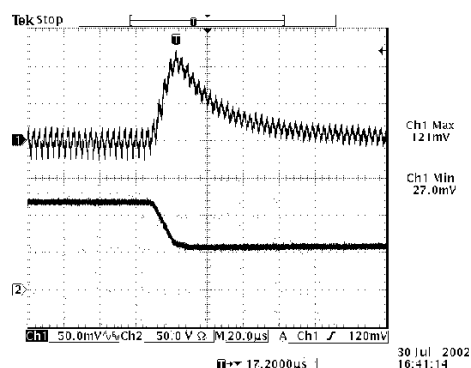
Vout=2.5V
50% to 100% load transients at 3.3V input and $T_a = 25^\circ C$



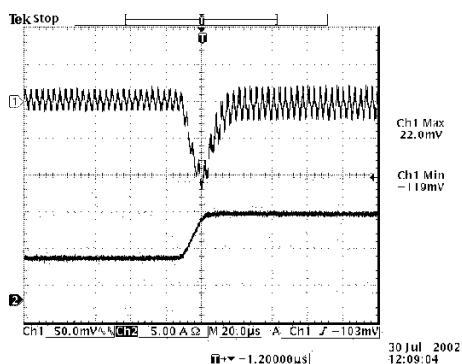
Vout=2.5V
100% to 50% load transients at 3.3V input and $T_a = 25^\circ C$



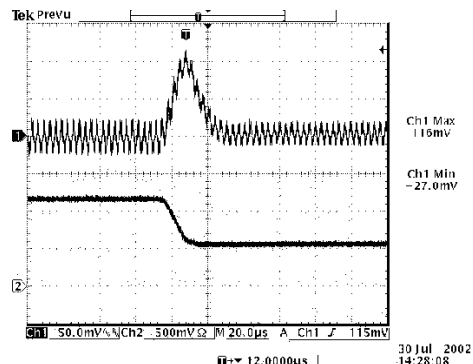
Vout=1.8V
50% to 100% load transients at 3.3V input and $T_a = 25^\circ C$



Vout=1.8V
100% to 50% load transients at 3.3V input and $T_a = 25^\circ C$



Vout=1.5V
50% to 100% load transients at 3.3V input and $T_a = 25^\circ C$



Vout=1.5V
100% to 50% load transients at 3.3V input and $T_a = 25^\circ C$

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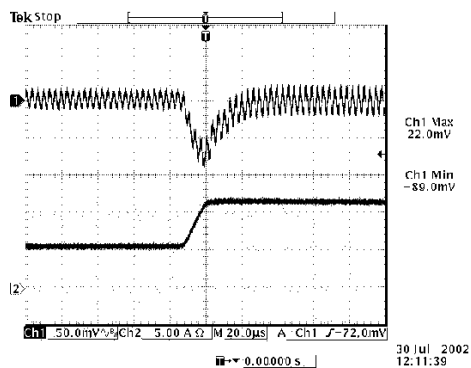
3.3V Input / 1.2V – 2.5V Output / 12A



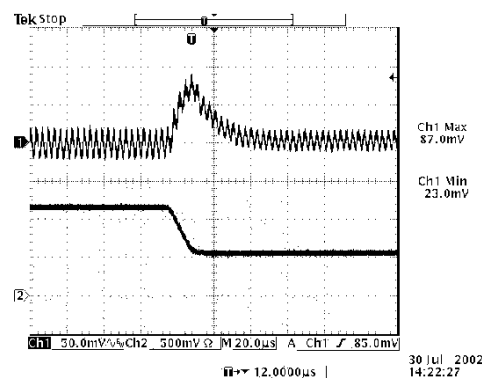
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Transient Response

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

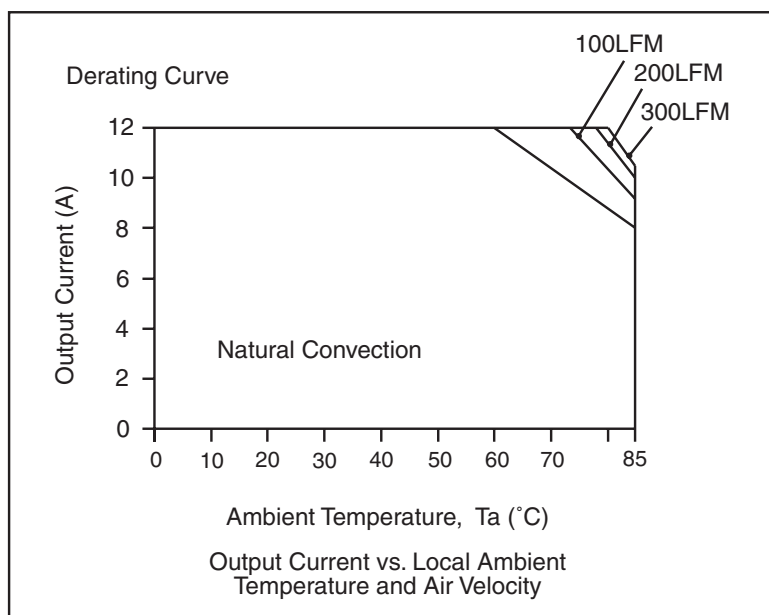


Vout=1.2V
50% to 100% load transients at 3.3V input and $T_a=25^\circ\text{C}$



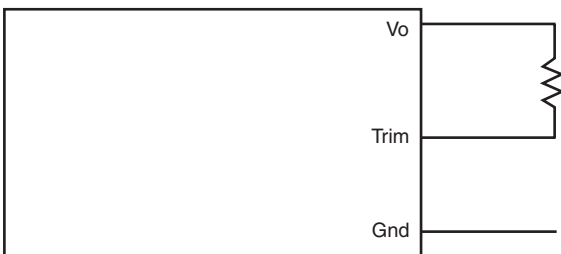
Vout=1.2V
100% to 50% load transients at 3.3V input and $T_a=25^\circ\text{C}$

Thermal Considerations

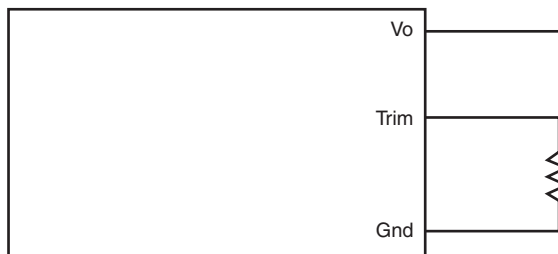


Output Voltage Set-Point Adjustment

Trim Down Test Circuit



Trim Up Test Circuit



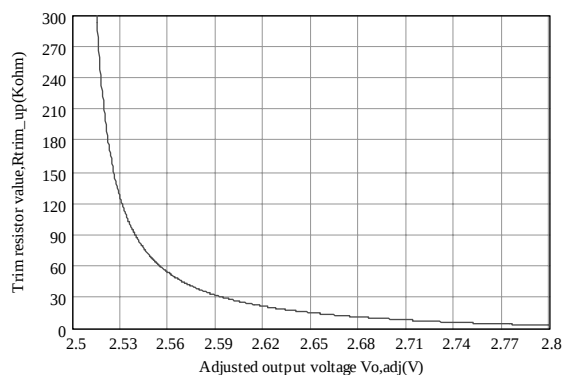
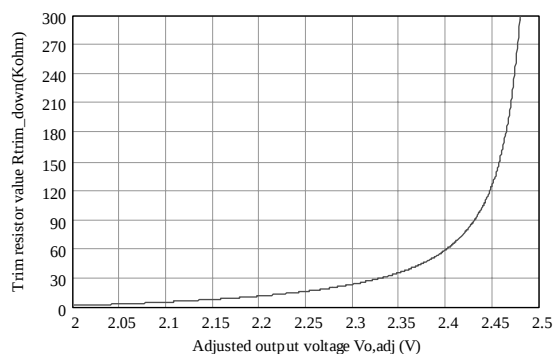
Output Voltage Set-Point Adjustment

S7DB-12C250 Trim Resistor Calculation

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

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

Rtrimup = function



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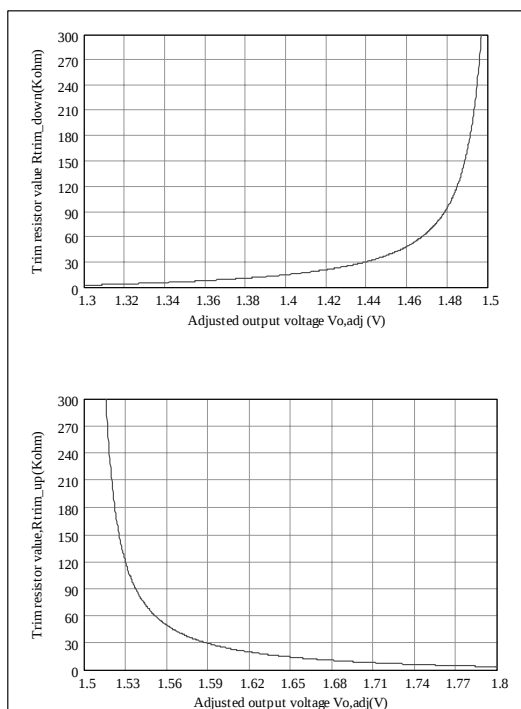
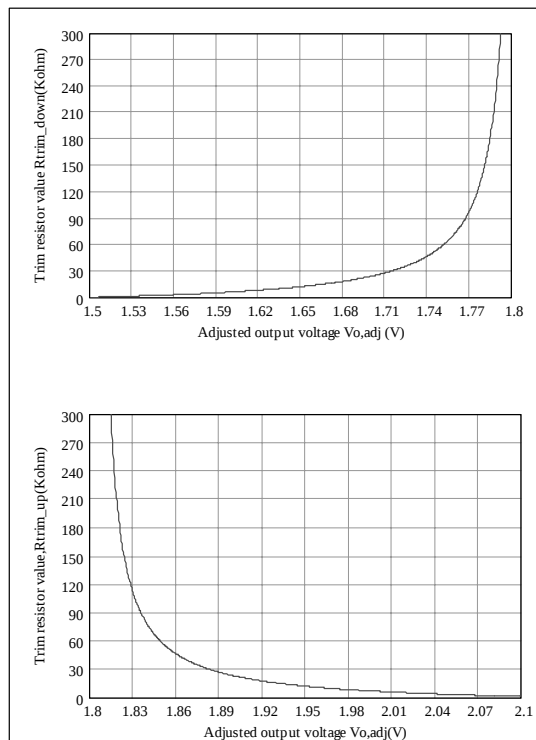
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Output Voltage Set-Point Adjustment

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

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

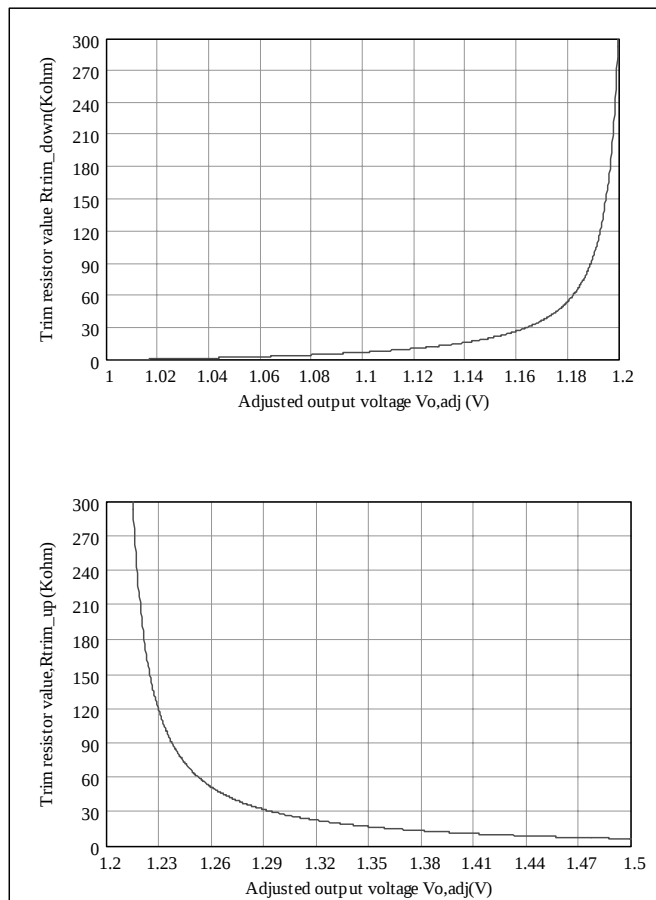
$$R_{\text{trim up}} = \left(\frac{3.072}{V_{o, \text{adj}} - V_o} - 7.15 \right) \text{ Kohm}$$

Output Voltage Set-Point Adjustment

S7DB-12C120 Trim Resistor Calculation

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

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



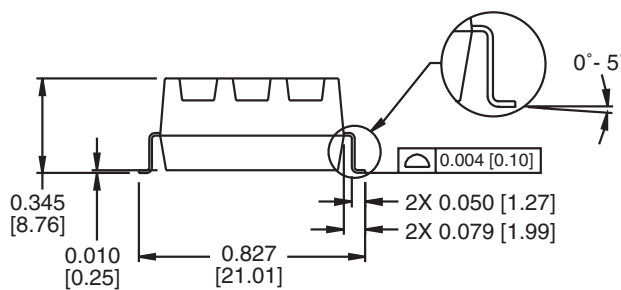
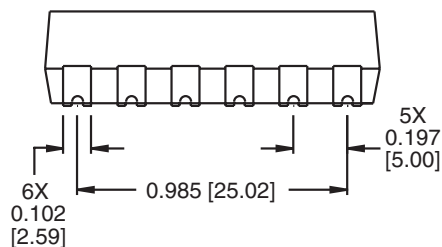
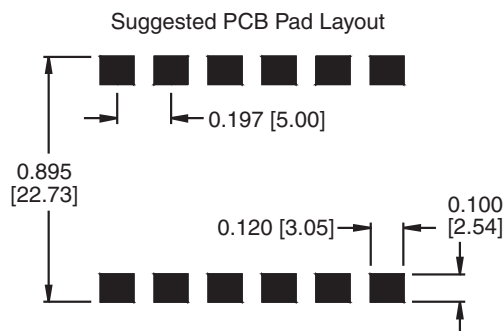
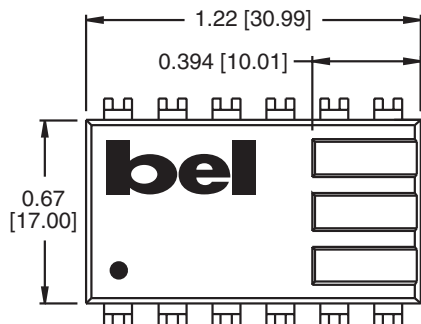
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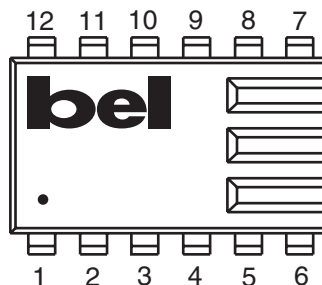
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Mechanical



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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