

## NON-ISOLATED DC/DC CONVERTERS

3.3V Input / 1.2V – 2.5V Output / 8A



BP02S7DB-08C

### S7DB-08C 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-08C 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. 8A 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 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	8A	20W	92%	S7DB-08C250
1.8V	3.3V	8A	14.4W	88%	S7DB-08C180
1.5V	3.3V	8A	12W	86%	S7DB-08C150
1.2V	3.3V	8A	9.6W	83%	S7DB-08C120

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## 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>			7.9 6.3 5.3 4.4	A
No Load Input Current	All				100	mA
Remote Off Input Current				10	20	mA
Input Reflected Ripple Current <sup>1</sup>				20	40	mA <sub>rms</sub>
Input Reflected Ripple Current (P-P) <sup>1</sup>				60	100	mApk
I <sup>2</sup> t Inrush Current Transient				0.05	0.1	A <sup>2</sup> s
Turn On Voltage Threshold				2.85		V
Turn Off Voltage Threshold				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 / 8A



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### Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Output Voltage Set Point <sup>1</sup>	2.5V	Vout	2.45	2.5	2.55	V
	1.8V		1.764	1.8	1.836	
	1.5V		1.47	1.5	1.53	
	1.2V		1.176	1.2	1.224	
Load Regulation	2.5V			7.0	15	mV
	1.8V			7.0	15	
	1.5V			6.0	15	
	1.2V			6.0	15	
Line Regulation	All			2.0	5	mV
Regulation Over Temperature	2.5V			10	25	mV
	1.8V			8	20	
	1.5V			5	15	
	1.2V			4	12	
Total Output Voltage Regulation	2.5V				45	mV
	1.8V				40	
	1.5V				35	
	1.2V				32	
Output Ripple and Noise <sup>2</sup>	2.5V			55	100	mVp-p
	1.8V			40	75	
	1.5V			40	75	
	1.2V			40	75	
Output Ripple and Noise <sup>2</sup>	All			10	25	mVrms
Output Current Range	All	Iout	0		8	A
Output DC Current Limit	All	Ioutlim	10.4		20	A
Short Circuit Surge	2.5V	Ioutsurge		0.06	0.12	A <sup>2</sup> s
	1.8V			0.07	0.14	
	1.5V			0.09	0.18	
	1.2V			0.15	0.22	
Turn on Time	All	Ton		10	20	ms
Overshoot at Turn On	All			0	3	%
Output Capacitance	All	Cout	0		3200	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.

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## 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			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
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.5V			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
<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/1 $\mu$ S, Ta = 25° C with a 470 $\mu$ F Tantalum cap at output.

# NON-ISOLATED DC/DC CONVERTERS

## 3.3V Input / 1.2V – 2.5V Output / 8A



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### General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency <sup>1</sup>	2.5V	$\eta$	89	92		%
	1.8V		85	88		
	1.5V		83	86		
	1.2V		80	83		
Switching Frequency	All	Fsw	250	300	340	kHz
Output Voltage Trim Range <sup>2</sup>	2.5V		80		105	%
	1.8V		90		110	
	1.5V		90		110	
	1.2V		90		110	
Remote Sense Compensation	2.5V				5	%
	1.8V				10	
	1.5V				10	
	1.2V				10	
Weight	All			10.5		g

1. Vin=3.3V, full load and Ta=25° C.

2. See graphs on pages 12-14.

### 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

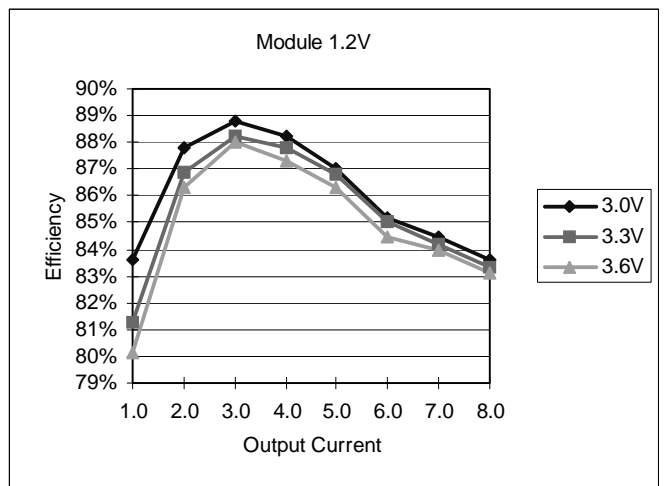
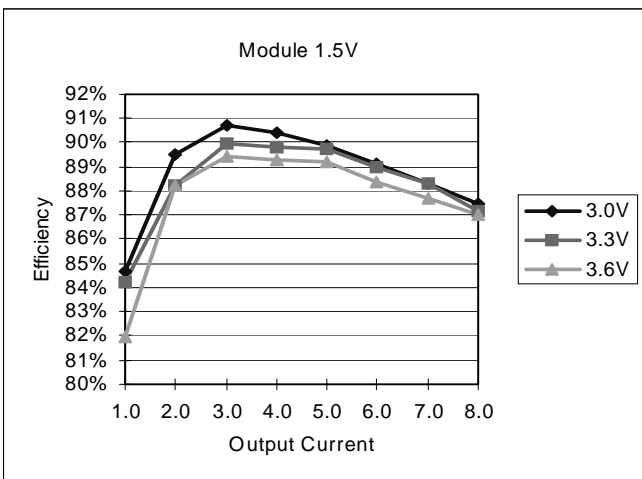
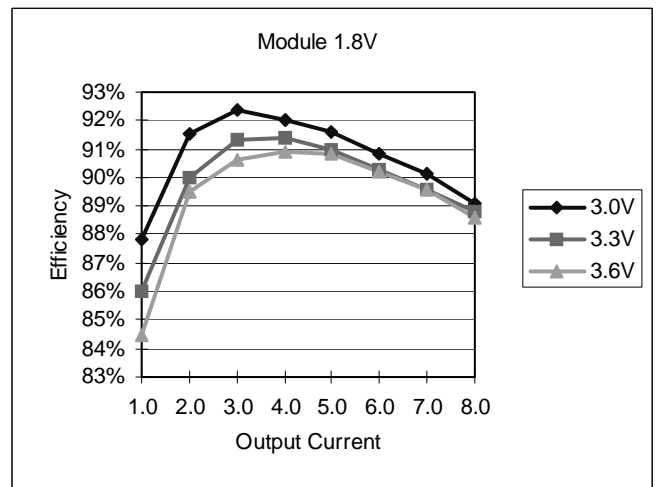
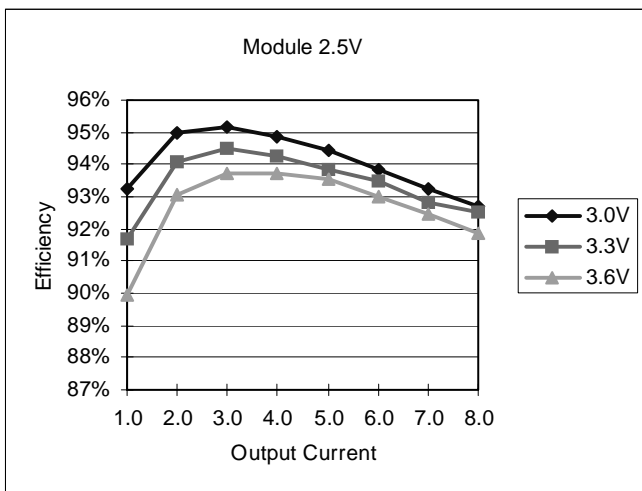
3. With remote on/off pin 8 open, the module is on.

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

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### Efficiency Data



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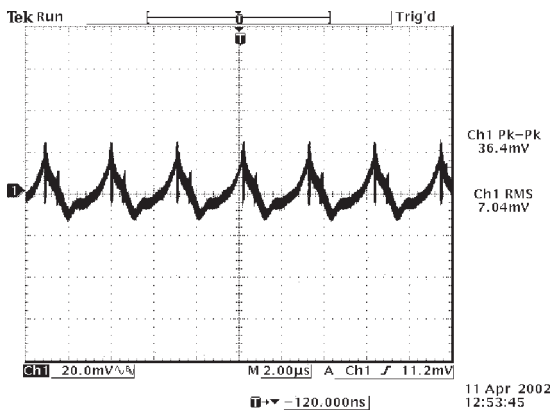
3.3V Input / 1.2V – 2.5V Output / 8A



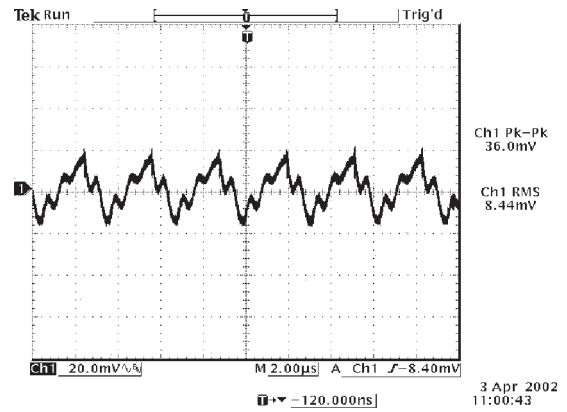
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## Ripple and Noise

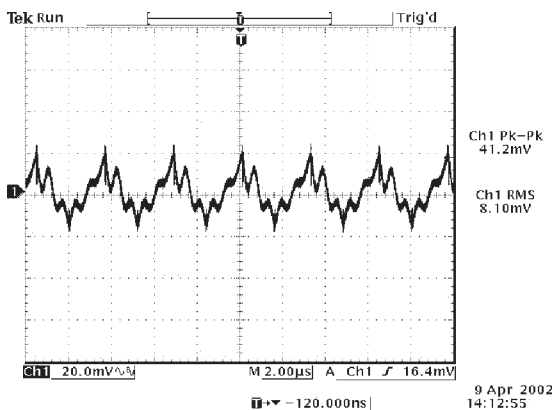
1 $\mu$ F ceramic cap and 10 $\mu$ F aluminum electrolytic cap are added at the output.



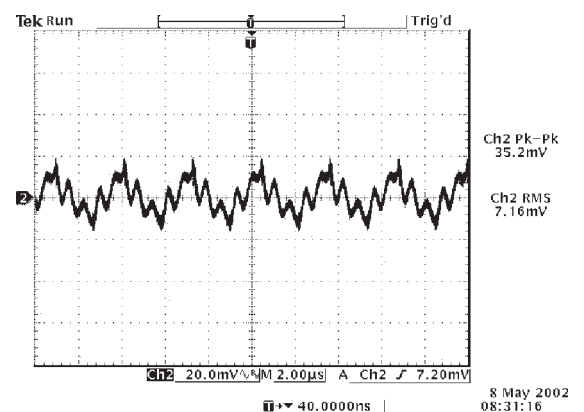
Ripple and noise at full load and 3.3Vdc input, 2.5Vdc output and Ta=25° C



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

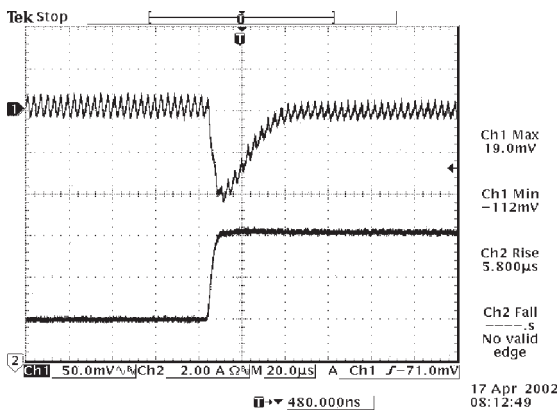


Ripple and noise at full load and 3.3Vdc input, 1.2Vdc output and Ta=25° C

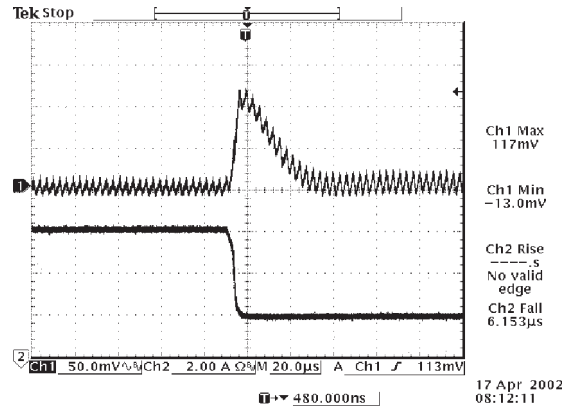
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### Transient Response

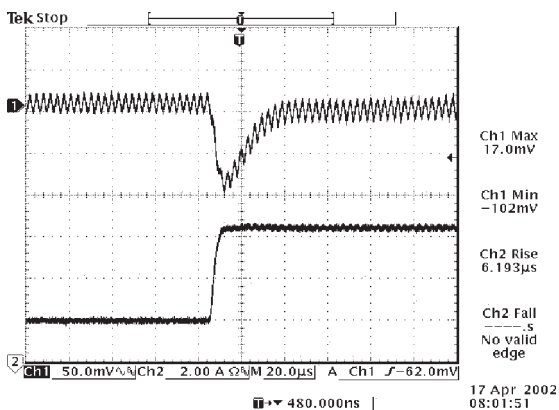
Transient response:  $di/dt = 0.5A/\mu S$ , external load capacitance  $C_o=470\mu F$  (Tantalum capacitor)



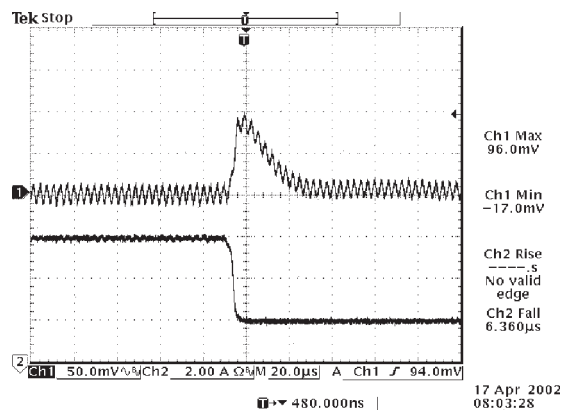
Vout=2.5V  
50% to 100% load transients at 3.3V input and Ta=25° C



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



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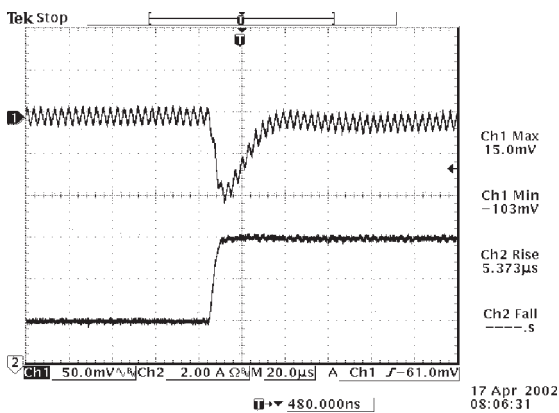
## 3.3V Input / 1.2V – 2.5V Output / 8A



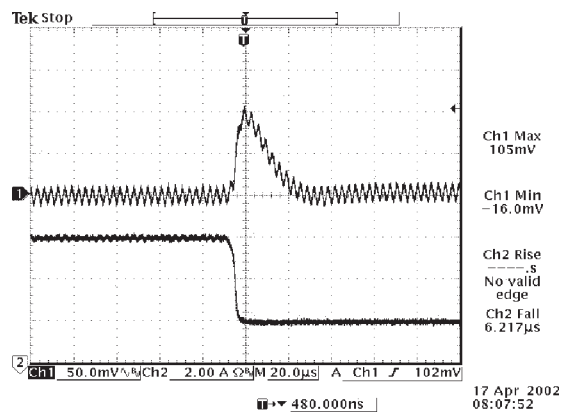
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### Transient Response

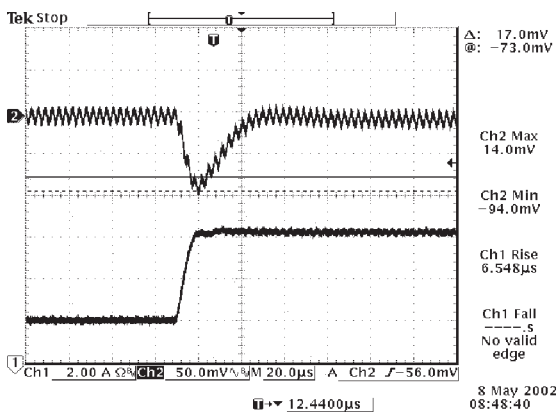
Transient response:  $di/dt = 0.5A/\mu S$ , external load capacitance  $Co=470\mu F$  (Tantalum capacitor)



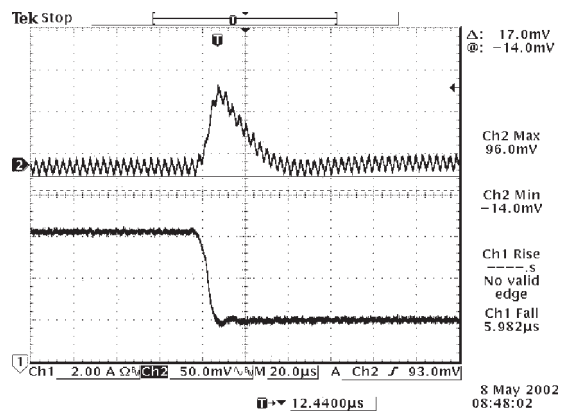
Vout=1.5V  
50% to 100% load transients at 3.3V input and Ta=25° C



Vout=1.5V  
100% to 50% load transients at 3.3V input and Ta=25° C



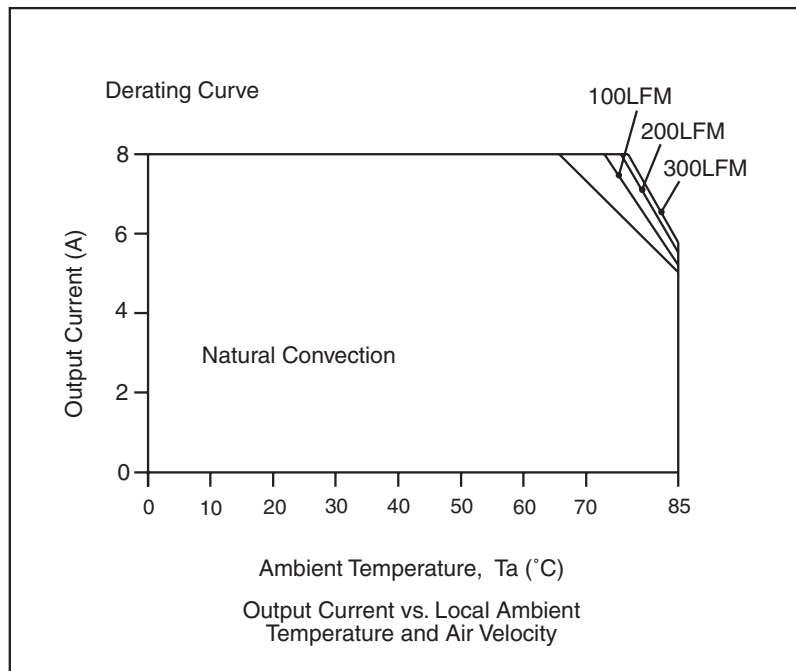
Vout=1.2V  
50% to 100% load transients at 3.3V input and Ta=25° C



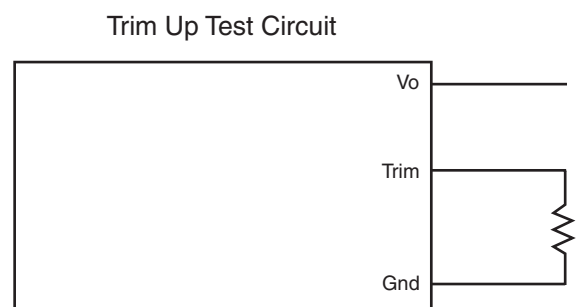
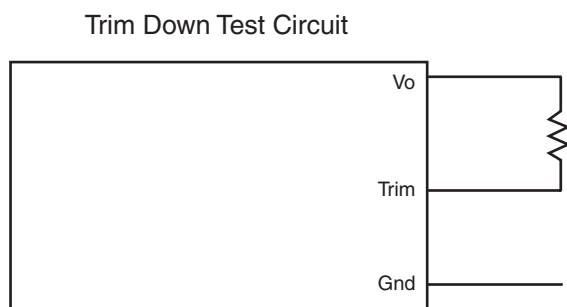
Vout=1.2V  
100% to 50% load transients at 3.3V input and Ta=25° C

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### Thermal Considerations



### Output Voltage Set-Point Adjustment



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## 3.3V Input / 1.2V – 2.5V Output / 8A



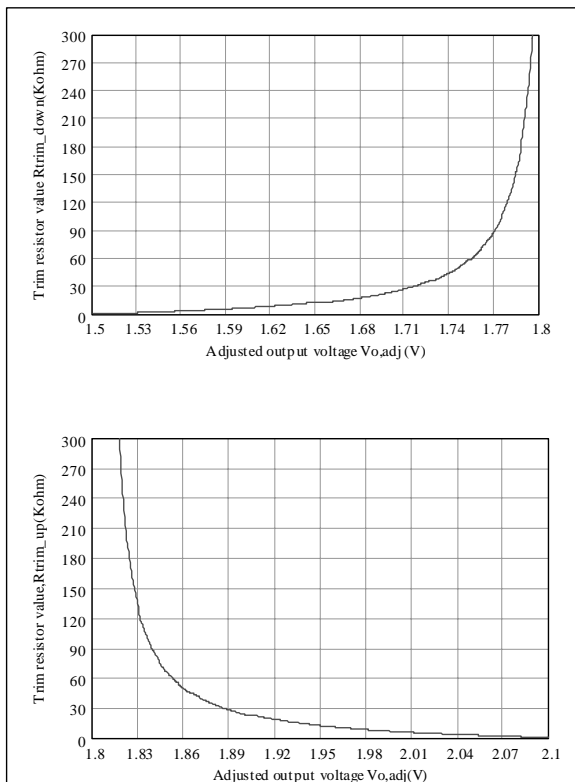
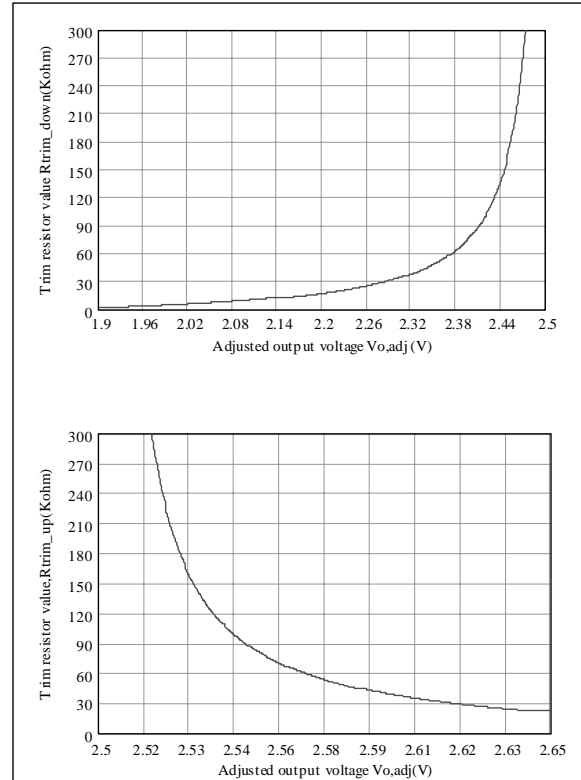
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### Output Voltage Set-Point Adjustment

#### S7DB-08C250 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{9.590}{V_o - V_{o, \text{adj}}} - 14.29 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{4.504}{V_{o, \text{adj}} - V_o} - 8.66 \right) \text{ Kohm}$$



#### S7DB-08C180 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{3.869}{V_o - V_{o, \text{adj}}} - 12.5 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.072}{V_{o, \text{adj}} - V_o} - 8.66 \right) \text{ Kohm}$$

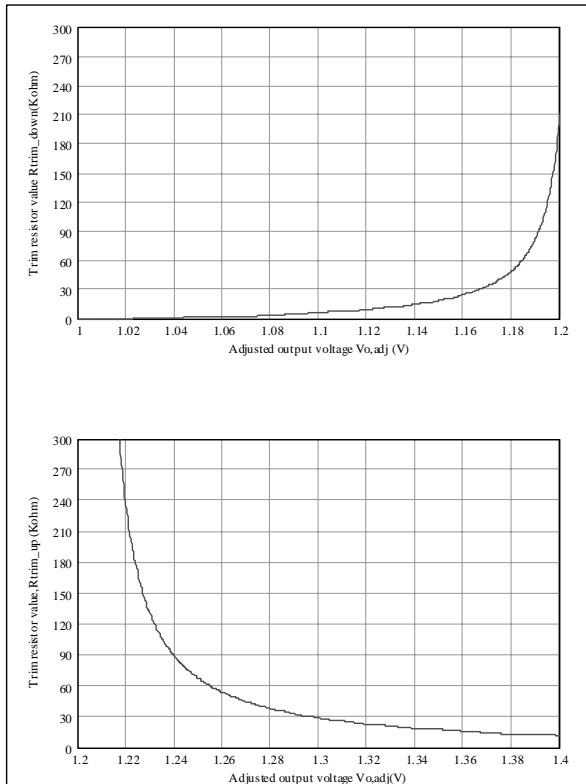
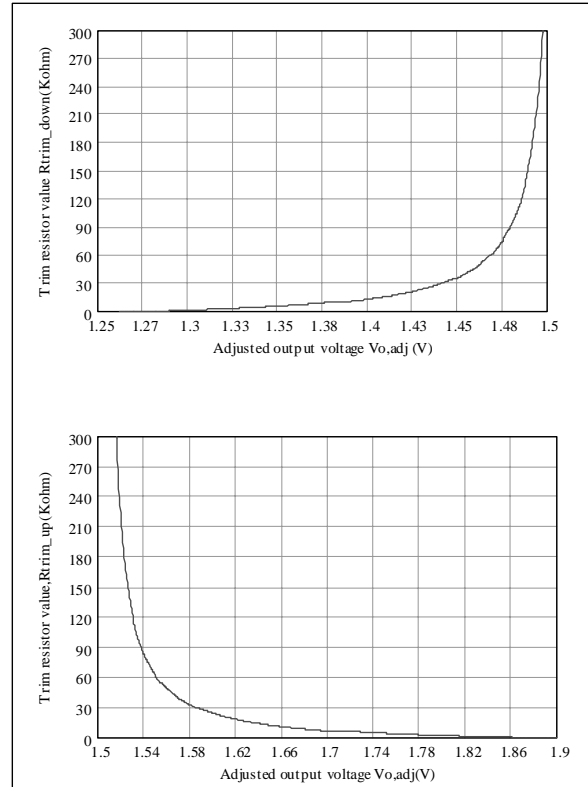
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### Output Voltage Set-Point Adjustment

#### S7DB-08C150 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{2.712}{V_o - V_{o, \text{adj}}} - 12.5 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.072}{V_{o, \text{adj}} - V_o} - 8.66 \right) \text{ Kohm}$$



#### S7DB-08C120 Trim Resistor Calculation

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

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

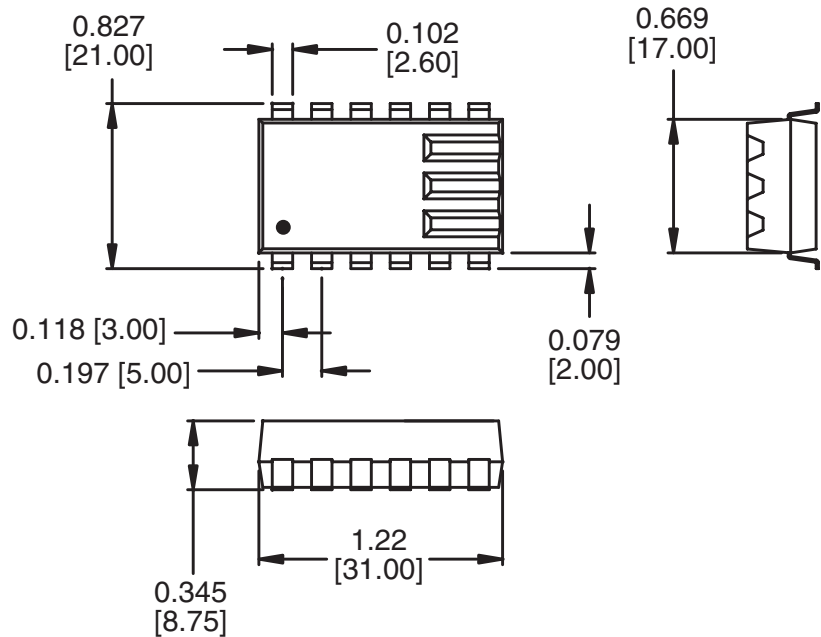
# NON-ISOLATED DC/DC CONVERTERS

3.3V Input / 1.2V – 2.5V Output / 8A

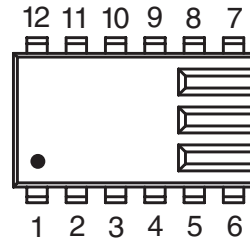


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## Mechanical



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  $\pm 0.005$  [0.13] unless otherwise noted.

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