

# NON-ISOLATED DC/DC CONVERTERS

## 5V Input / 1.2V – 3.3V Output / 8A



BP02S7DB-08B

### S7DB-08B 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-08B 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. 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 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	8A	26.4W	93%	S7DB-08B330
2.5V	5V	8A	20W	91%	S7DB-08B250
1.8V	5V	8A	14.4W	87%	S7DB-08B180
1.5V	5V	8A	12W	86%	S7DB-08B150
1.2V	5V	8A	9.6W	83%	S7DB-08B120

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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			7.2 5.6 4.6 3.9 3.0	A
No Load Input Current	All			50		mA
Remote Off Input Current				4	8	mA
Input Reflected Ripple Current <sup>1</sup>				30	50	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	0.07	A <sup>2</sup> s
Turn On Voltage Threshold				4.3	4.5	V
Turn Off Voltage Threshold				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 <sup>1</sup>	3.3V	Vout	3.234	3.3	3.366	V
	2.5V		2.45	2.5	2.55	
	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	3.3V			4.0	10	mV
	2.5V		4.0	10		
	1.8V		3.0	8		
	1.5V		3.0	8		
	1.2V		3.0	8		
Line Regulation	All		2.0	5	mV	
Regulation Over Temperature	3.3V			20	40	mV
	2.5V		15	30		
	1.8V		12	25		
	1.5V		10	20		
	1.2V		10	20		
Total Output Voltage Regulation	3.3V				55	mV
	2.5V		45			
	1.8V		38			
	1.5V		33			
	1.2V		33			
Output Ripple and Noise <sup>2</sup>	All			30	50	mVp-p
Output Ripple and Noise <sup>2</sup>	All			10	20	mVrms
Output Current Range	All	Iout	0		8	A
Output DC Current Limit	All	Ioutlim	10.4		20	A
Short Circuit Surge	3.3V	Ioutsurge		0.1	0.3	A <sup>2</sup> s
	2.5V		0.3	0.6		
	1.8V		0.4	0.8		
	1.5V		0.5	1.0		
	1.2V		0.6	1.2		
Turn on Time	All	Ton		12	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 = 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
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	3.3V			90	120	mV
Settling Time		Ts		25	50	$\mu s$
$\Delta V$ 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		25	50	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	2.5V			90	120	mV
Settling Time		Ts		25	50	$\mu s$
$\Delta V$ 100% to 50% of Max Load				90	120	mV
Settling Time		Ts		25	50	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.8V			70	100	mV
Settling Time		Ts		25	50	$\mu s$
$\Delta V$ 100% to 50% of Max Load				70	100	mV
Settling Time		Ts		25	50	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.5V			70	100	mV
Settling Time		Ts		25	50	$\mu s$
$\Delta V$ 100% to 50% of Max Load				70	100	mV
Settling Time		Ts		25	50	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.2V			70	100	mV
Settling Time		Ts		25	50	$\mu s$
$\Delta V$ 100% to 50% of Max Load				70	100	mV
Settling Time		Ts		25	50	$\mu s$

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 without external load capacitance.

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## 5V Input / 1.2V – 3.3V Output / 8A



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### General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency <sup>1</sup>	3.3V	$\eta$	90	93		%
	2.5V		88	91		
	1.8V		84	87		
	1.5V		83	86		
	1.2V		80	83		
Switching Frequency	All	Fsw	260	300	340	kHz
Output Voltage Trim Range <sup>2</sup>	All	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			10.5		g

1. Vin=5.0V, 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 On)	All		0		1	V
Signal High (Unit Off)	All		2.5		5.5	V

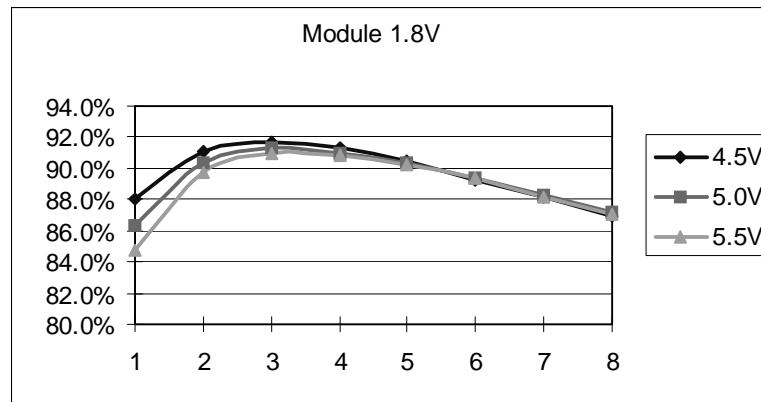
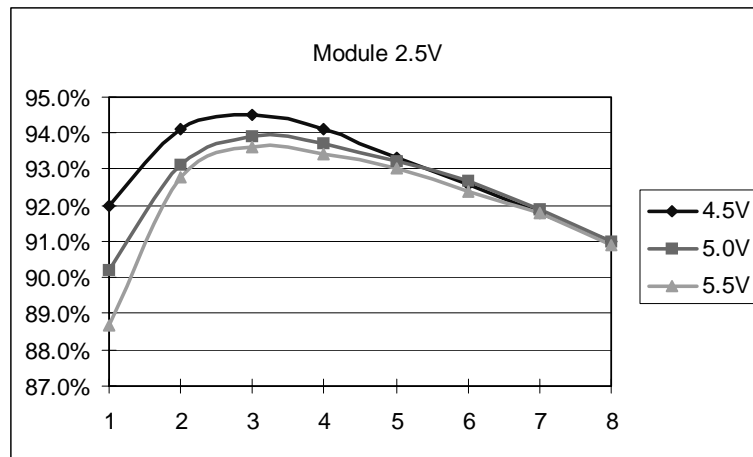
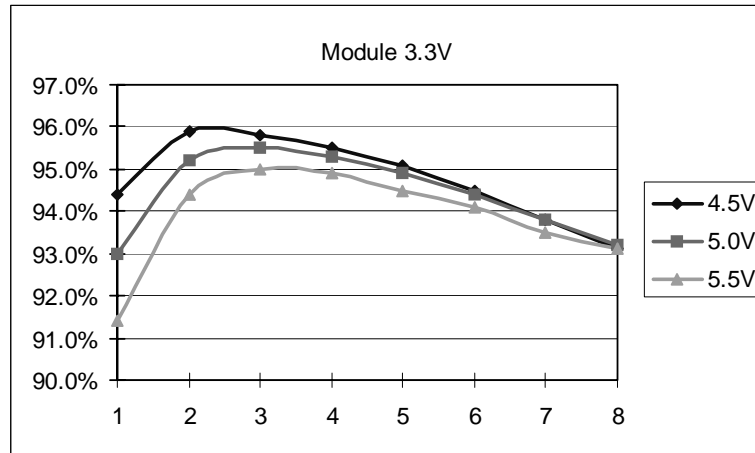
3. With remote on/off pin 8 open, the module is on.

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

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**Efficiency Data**



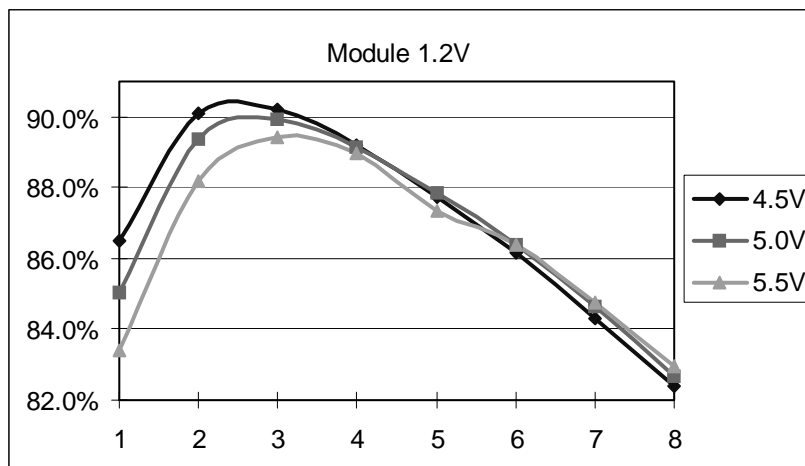
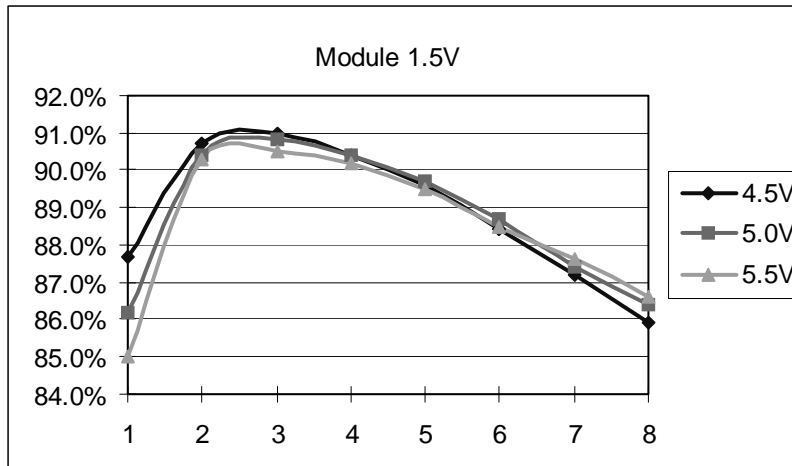
# NON-ISOLATED DC/DC CONVERTERS

5V Input / 1.2V – 3.3V Output / 8A



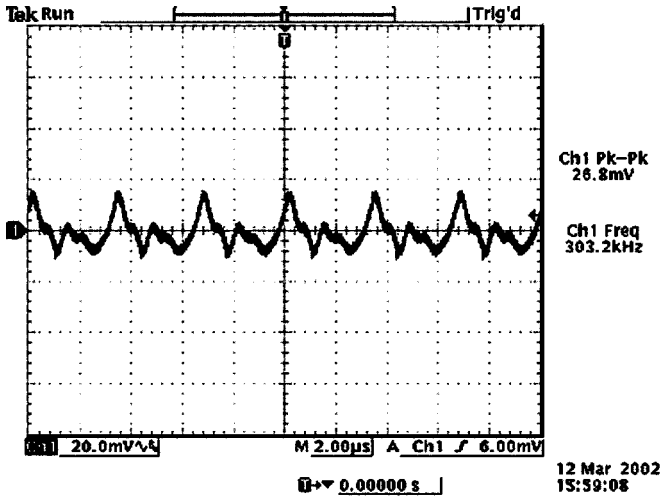
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## Efficiency Data

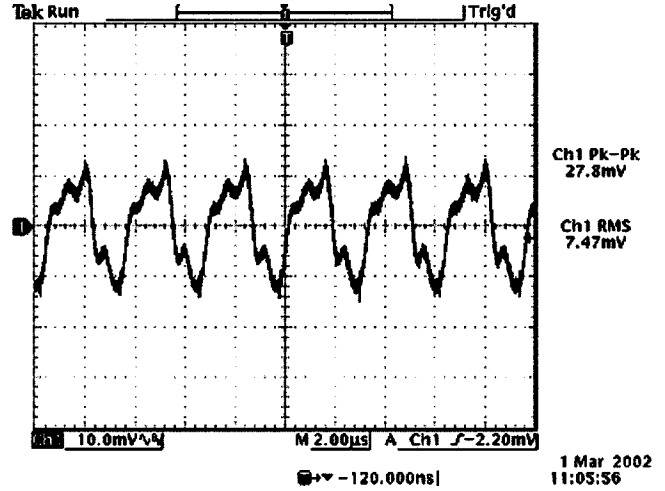


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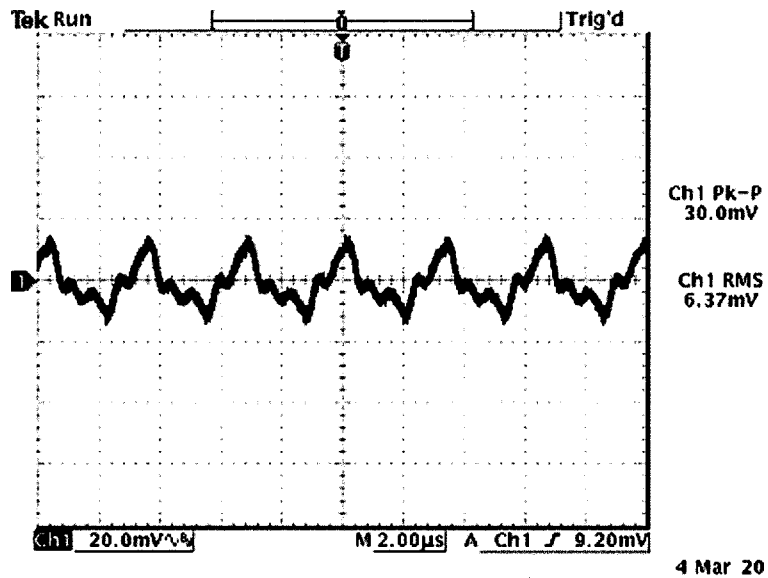
**Ripple and Noise**



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



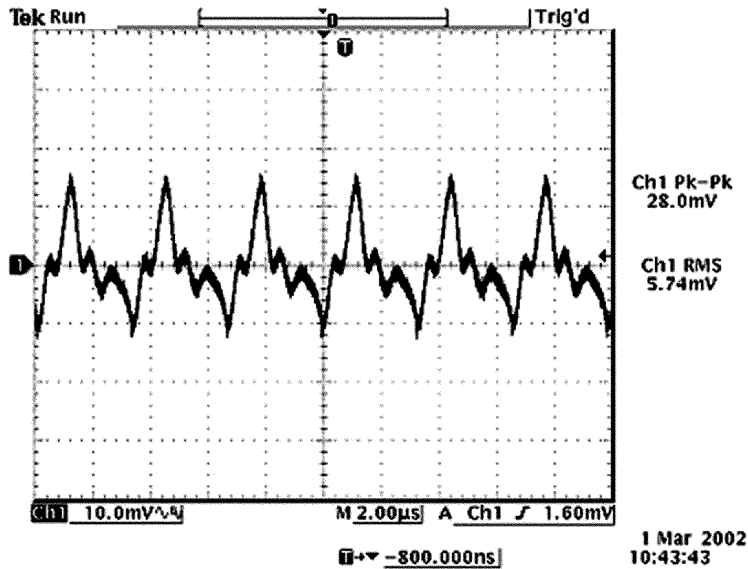
# NON-ISOLATED DC/DC CONVERTERS

5V Input / 1.2V – 3.3V Output / 8A

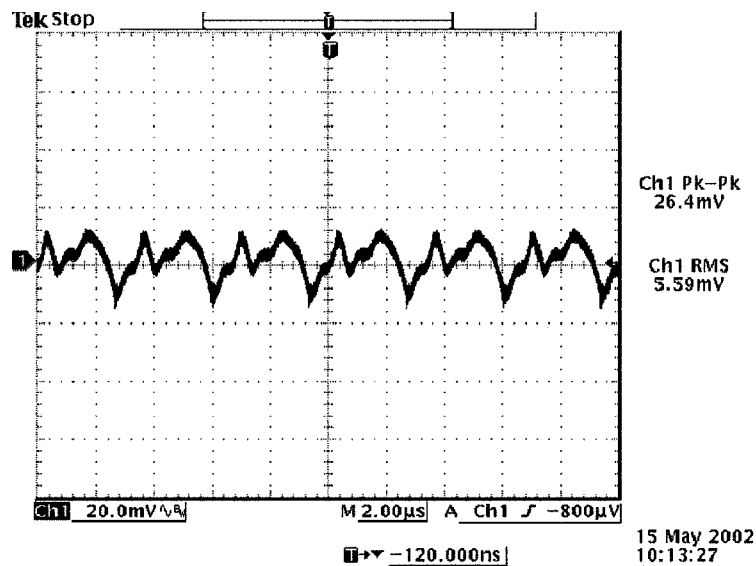


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## Ripple and Noise



Ripple and noise at full load and 5Vdc input, 1.5Vdc output and  $T_a=25^\circ\text{C}$

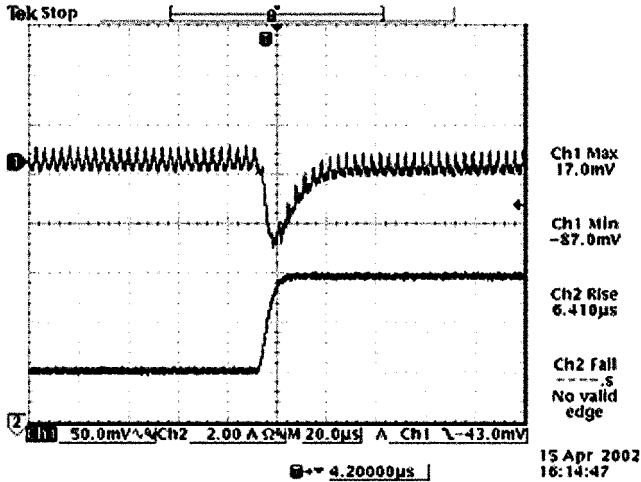


Ripple and noise at full load and 5Vdc input, 1.2Vdc output and  $T_a=25^\circ\text{C}$

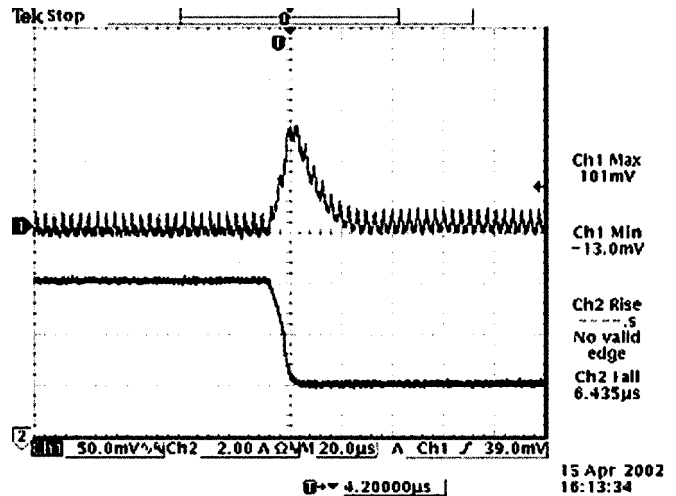
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### Transient Response

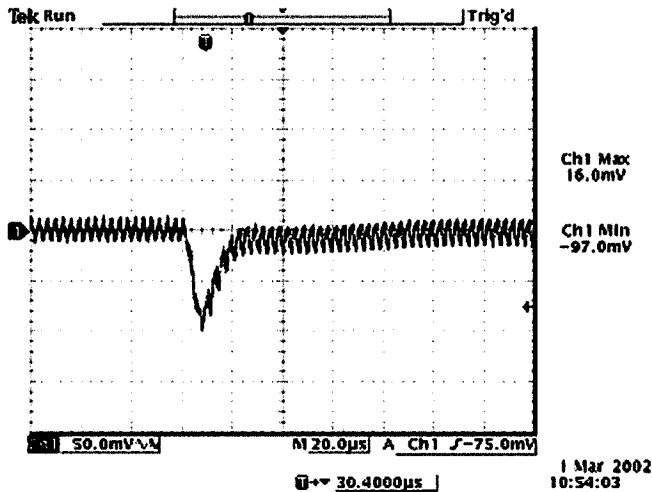
Transient response:  $di/dt = 0.5A/\mu S$



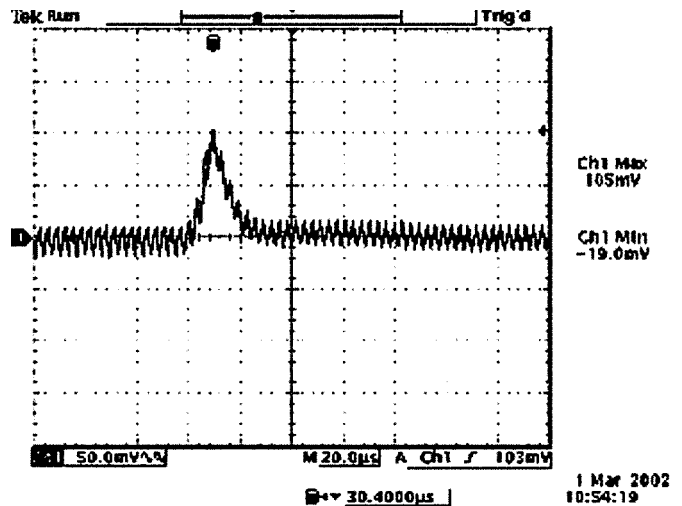
Vout=3.3V  
50% to 100% load transients at 5V input and Ta=25°C



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

# NON-ISOLATED DC/DC CONVERTERS

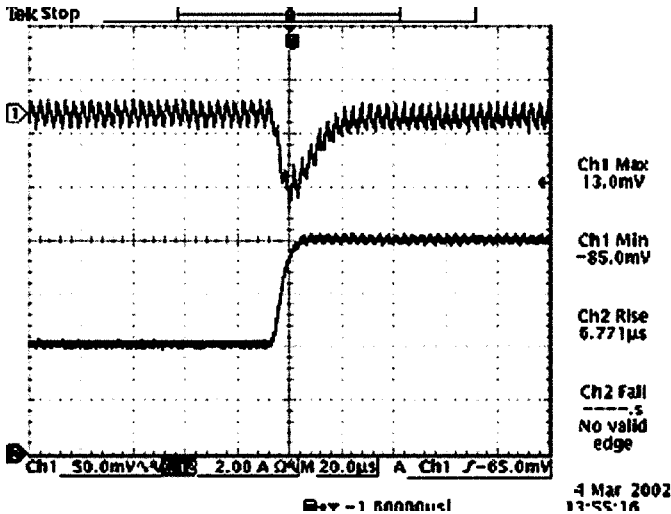
5V Input / 1.2V – 3.3V Output / 8A



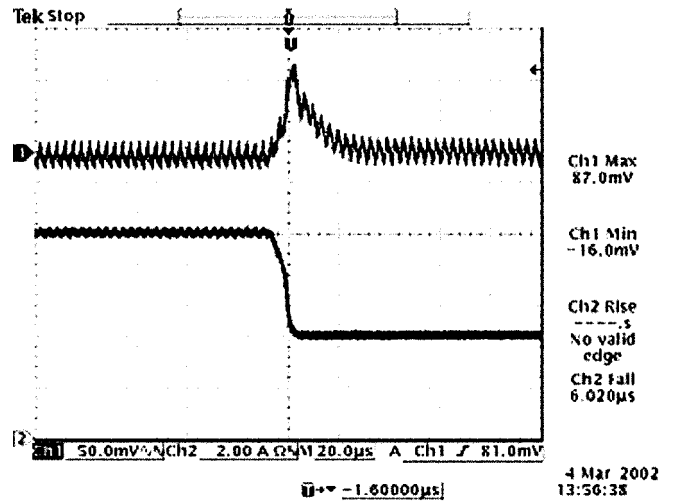
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## Transient Response

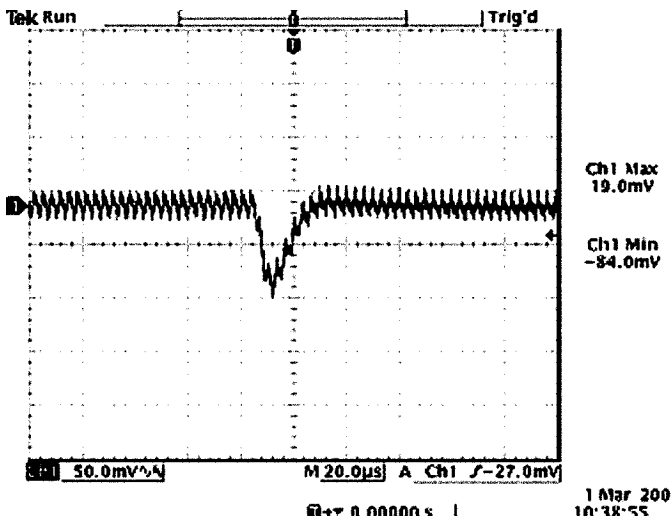
Transient response:  $di/dt = 0.5A/\mu S$



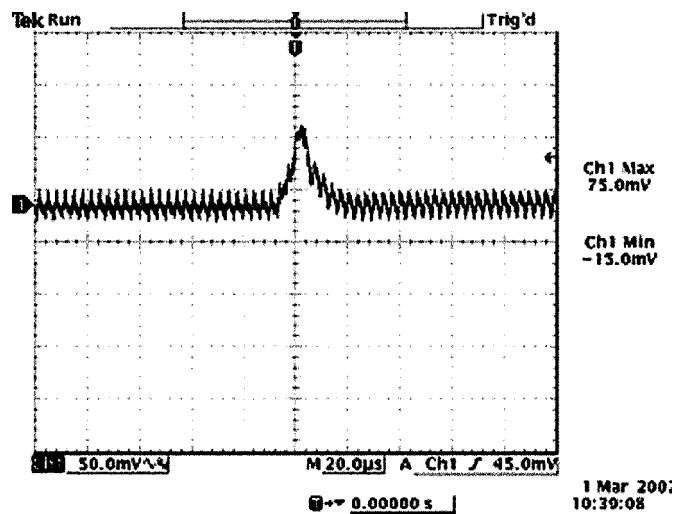
Vout=1.8V  
 50% to 100% load transients at 5V input and Ta=25° C



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



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

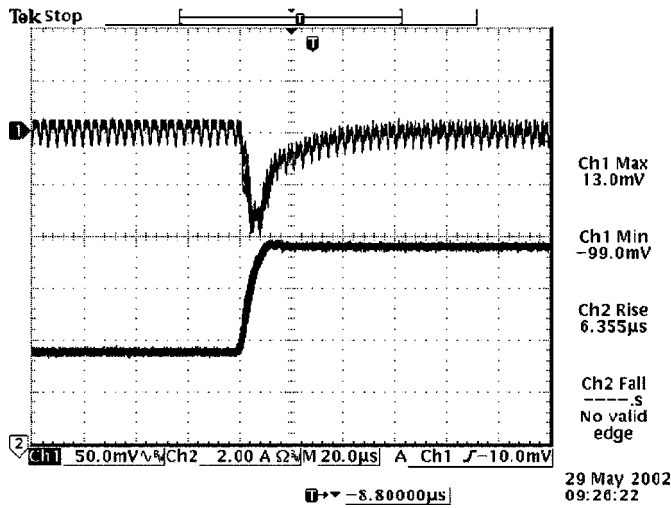


Vout=1.5V  
 100% to 50% load transients at 5V input and Ta=25° C

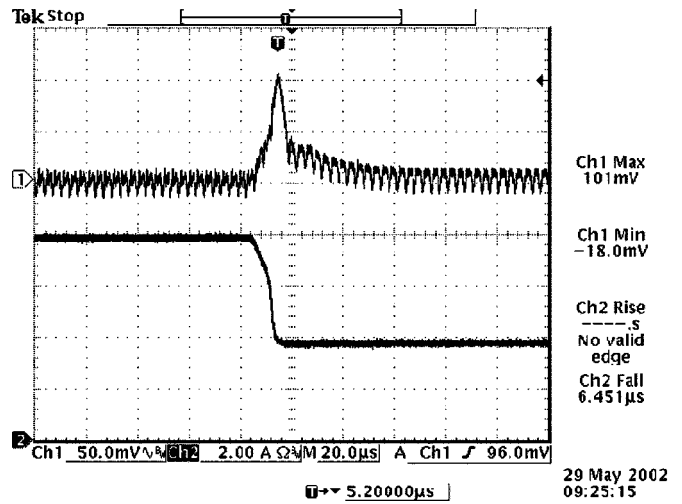
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### Transient Response

Transient response:  $di/dt = 0.5A/\mu S$

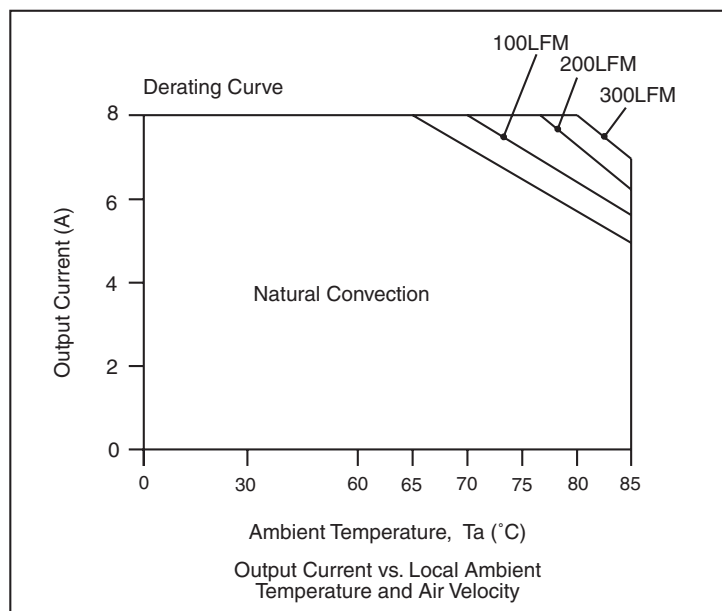


Vout=1.2V  
50% to 100% load transients at 5V input and Ta=25° C



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

### Thermal Considerations



# NON-ISOLATED DC/DC CONVERTERS

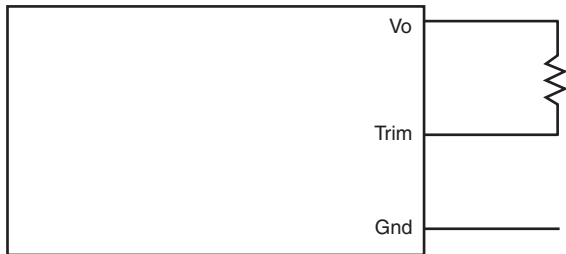
5V Input / 1.2V – 3.3V Output / 8A



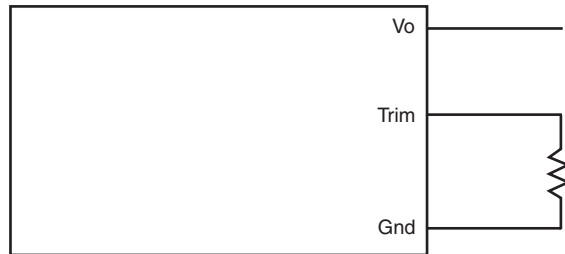
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## Output Voltage Set-Point Adjustment

Trim Down Test Circuit



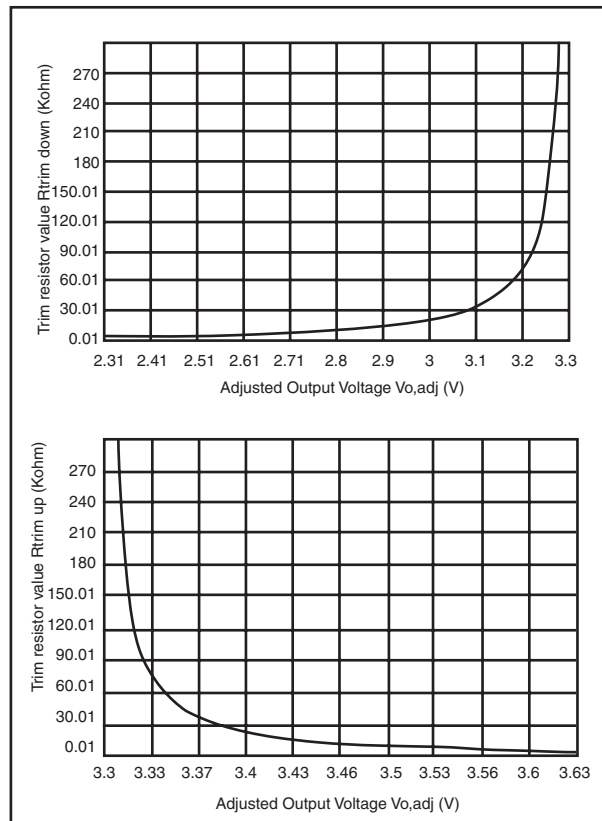
Trim Up Test Circuit



### S7DB-08B330 Trim Resistor Calculation

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

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



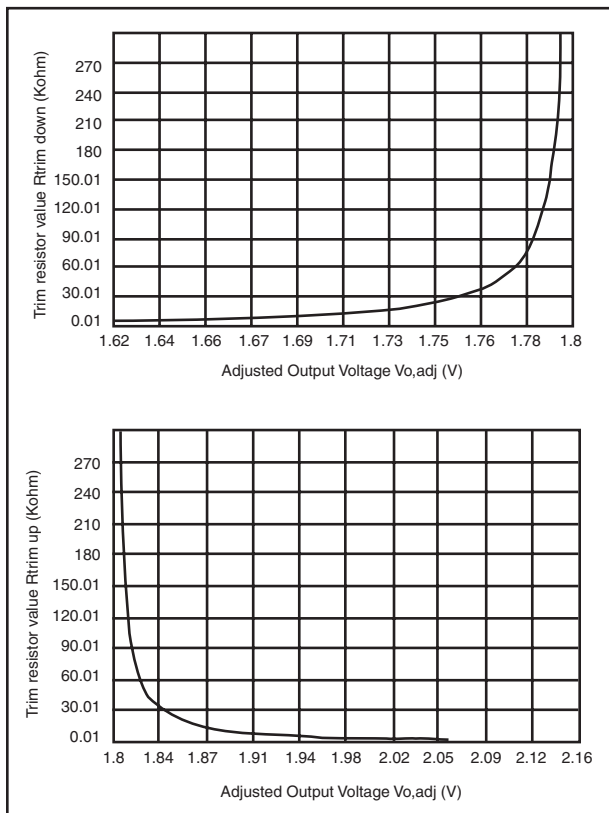
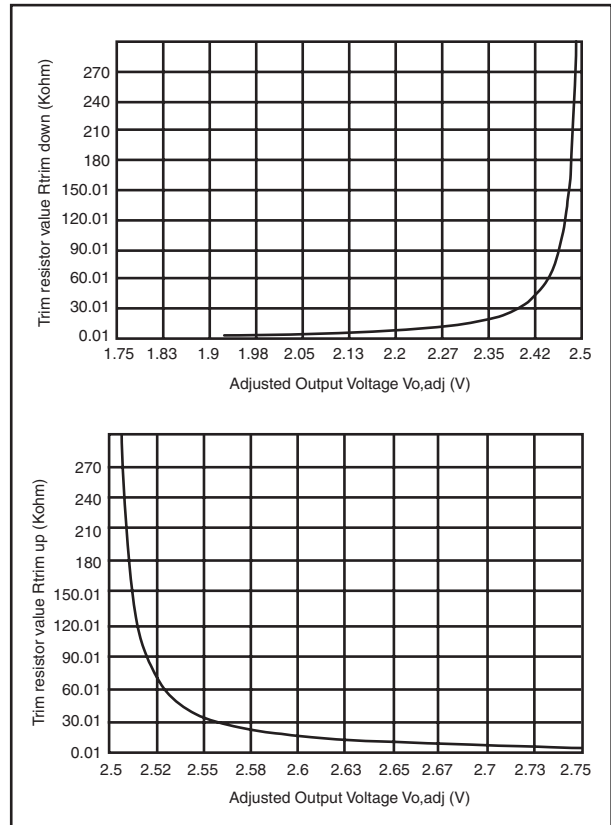
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### Output Voltage Set-Point Adjustment

#### S7DB-08B250 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{3.691}{V_o - V_{o, \text{adj}}} - 4.12 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{1.728}{V_{o, \text{adj}} - V_o} - 1.96 \right) \text{ Kohm}$$



#### S7DB-08B180 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{1.52}{V_o - V_{o, \text{adj}}} - 4.12 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{1.208}{V_{o, \text{adj}} - V_o} - 2.61 \right) \text{ Kohm}$$

# NON-ISOLATED DC/DC CONVERTERS

## 5V Input / 1.2V – 3.3V Output / 8A



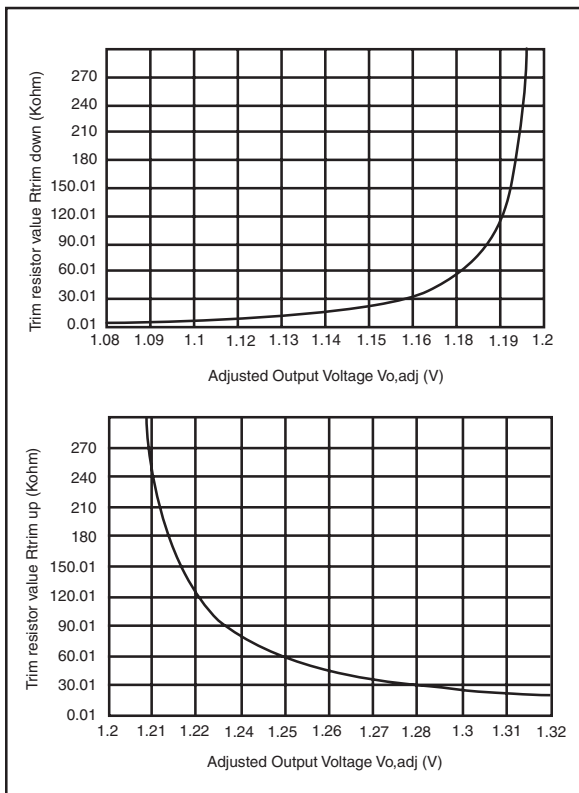
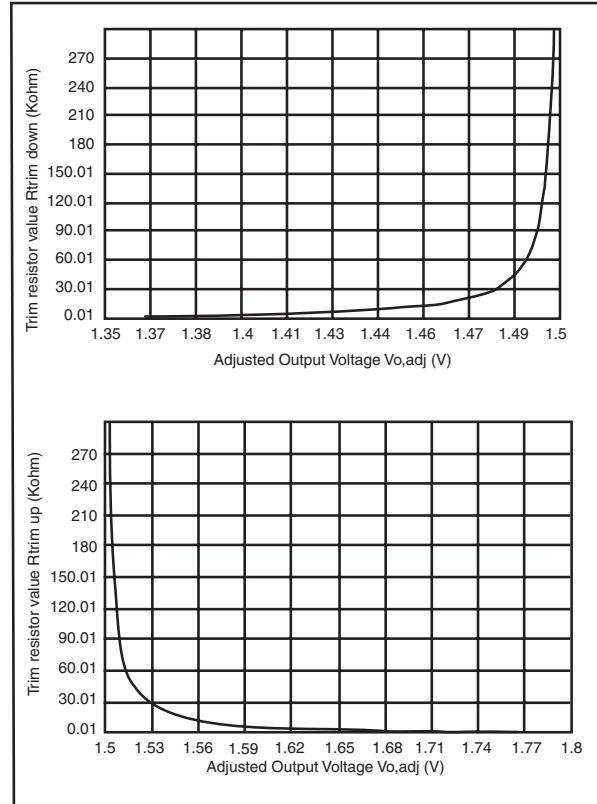
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### Output Voltage Set-Point Adjustment

#### S7DB-08B150 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{0.749}{V_o - V_{o, \text{adj}}} - 3.21 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{0.848}{V_{o, \text{adj}} - V_o} - 2.15 \right) \text{ Kohm}$$



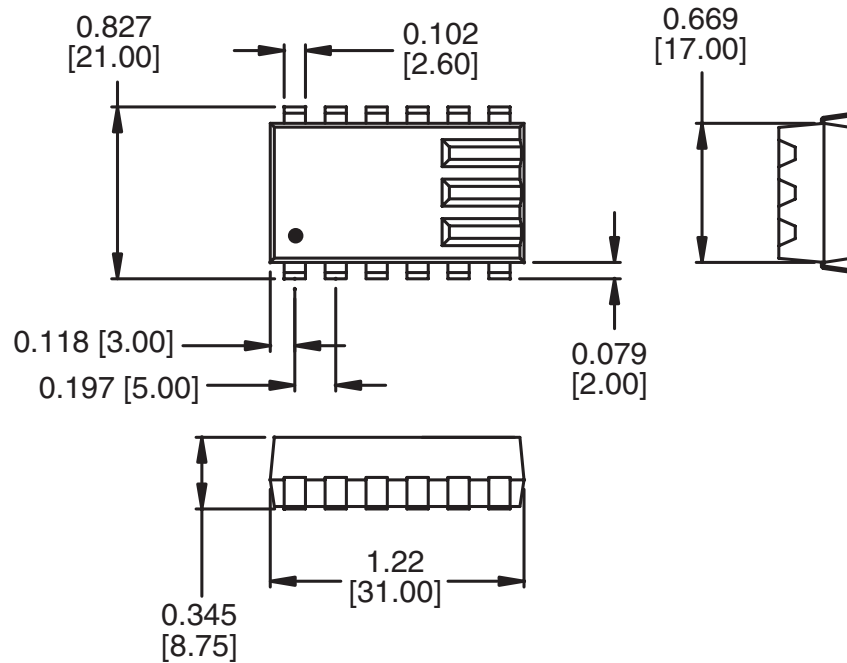
#### S7DB-08B120 Trim Resistor Calculation

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

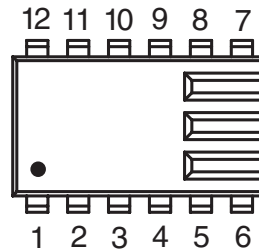
$$R_{\text{trim up}} = \left( \frac{3.064}{V_{o, \text{adj}} - V_o} - 4.64 \right) \text{ Kohm}$$

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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



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