

# NON-ISOLATED DC/DC CONVERTERS

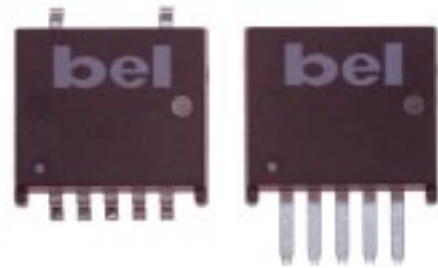
## 3.3V Input / 0.9V – 2.5V Output / 7A



BP03x7AH-07C

### S7AH-07C / V7AH-07C 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
- Industrial temperature range -40° to +85° C



### Description

The Bel S7AH-07C and V7AH-07C 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 0.9V to 2.5V. They are packaged in a compact, overmolded package rated at 7A. Optional lead forming provides a vertical mount product for minimal footprint or a surface mount option for a very low profile. Standard features include remote on/off, over current and short circuit protection, 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

### Options

- Wide range adjustable output

### Part Number Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number Surface Mount	Part Number Vertical Mount
2.5V	3.3V	7A	17.5W	92%	S7AH-07C250	V7AH-07C250
1.8V	3.3V	7A	12.6W	88%	S7AH-07C180	V7AH-07C180
1.5V	3.3V	7A	10.5W	86%	S7AH-07C150	V7AH-07C150
1.2V	3.3V	7A	8.4W	83%	S7AH-07C120	V7AH-07C120
0.9V	3.3V	7A	6.3W	80%	S7AH-07C090	V7AH-07C090
0.9V - 2.5V	3.3V	7A	17.5W	92%	S7AH-07C1A0	V7AH-07C1A0

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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	-40		125	°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		3.6	V
Input Current	2.5V 1.8V 1.5V 1.2V 0.9V	lin			6.6 5.3 4.6 3.8 3.0	A
No Load Input Current	All				110	mA
Remote Off Input Current				7	15	mA
Input Reflected Ripple Current <sup>1</sup>	All			50	80	mA <sub>rms</sub>
Input Reflected Ripple Current (P-P) <sup>1</sup>	All			150	250	mApk
I <sup>2</sup> t Inrush Current Transient	All			0.08	0.16	A <sup>2</sup> s
Turn On Voltage Threshold	All		2.5		2.8	V
Turn Off Voltage Threshold	All			2.4		V

Note: Input capacitance 270µF/16V, ESR = 0.03 Ω max at 100kHz @ 25° C.  
 1. With simulated source impedance of 500nH, 5Hz to 20MHz.

# NON-ISOLATED DC/DC CONVERTERS

## 3.3V Input / 0.9V – 2.5V Output / 7A



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### Output Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Output Voltage Set Point <sup>1</sup>	2.5V	Vout	2.450 1.764 1.470 1.176 0.882	2.500 1.800 1.500 1.200 0.900	2.550 1.836 1.530 1.224 0.918	V
	1.8V					
	1.5V					
	1.2V					
	0.9V					
Load Regulation	2.5V			3 3 3 1 1	10 10 10 5 5	mV
	1.8V					
	1.5V					
	1.2V					
	0.9V					
Line Regulation	2.5V			3 3 3 1 1	10 10 10 5 5	mV
	1.8V					
	1.5V					
	1.2V					
	0.9V					
Regulation Over Temperature (-40° to +85° C)	2.5V			20 15 15 10 8	40 30 30 20 15	mV
	1.8V					
	1.5V					
	1.2V					
	0.9V					
Total Output Voltage Regulation	2.5V			26 21 21 12 10	60 50 50 30 25	mV
	1.8V					
	1.5V					
	1.2V					
	0.9V					
Output Ripple and Noise <sup>2</sup>	2.5V			40 40 40 40 40	80 80 80 80 70	mVp-p
	1.8V					
	1.5V					
	1.2V					
	0.9V					
Output Ripple and Noise <sup>2</sup>	All			10	20	mVrms
Output Current Range	All	Iout	0		7	A
Output DC Current Limit	All	Ioutlim	8.4		16	A
Short Circuit Surge	All	Ioutsurge		0.08	0.12	A <sup>2</sup> s
Turn on Time	All	Ton		7	15	ms
Overshoot at Turn On	All			0	1	%
Output Capacitance	All	Cout	0		2200	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			120	180	mV
Settling Time		Ts		40	80	$\mu s$
$\Delta V$ 100% to 50% of Max Load				120	180	mV
Settling Time		Ts		40	80	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.8V			120	180	mV
Settling Time		Ts		40	80	$\mu s$
$\Delta V$ 100% to 50% of Max Load				120	180	mV
Settling Time		Ts		40	80	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.5V			100	150	mV
Settling Time		Ts		40	80	$\mu s$
$\Delta V$ 100% to 50% of Max Load				100	150	mV
Settling Time		Ts		40	80	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	1.2V			50	100	mV
Settling Time		Ts		40	80	$\mu s$
$\Delta V$ 100% to 50% of Max Load				50	100	mV
Settling Time		Ts		40	80	$\mu s$
<b>Transient Response <sup>3</sup></b>						
$\Delta V$ 50% to 100% of Max Load	0.9V			50	100	mV
Settling Time		Ts		40	80	$\mu s$
$\Delta V$ 100% to 50% of Max Load				50	100	mV
Settling Time		Ts		40	80	$\mu s$

Note: All specifications are typical at nominal input, full load at 25° C unless otherwise stated.  
 3. di/dt = 0.5A/ $\mu s$ , Ta = 25° C without external load capacitance.

# NON-ISOLATED DC/DC CONVERTERS

## 3.3V Input / 0.9V – 2.5V Output / 7A



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### General Specifications

Parameter	Module	Symbol	Min	Typical	Max	Units
Efficiency <sup>1</sup>	2.5V	$\eta$	90	92		%
	1.8V		86	88		
	1.5V		84	86		
	1.2V		81	83		
	0.9V		78	80		
Switching Frequency	All	Fsw	250	300	340	kHz
Output Voltage Trim Range <sup>2</sup>	1.8V		50		146	%
Weight	All			5		g

1. Vin=3.3V, full load and Ta=25° C.

2. See graphs on page 9.

### Control Specifications

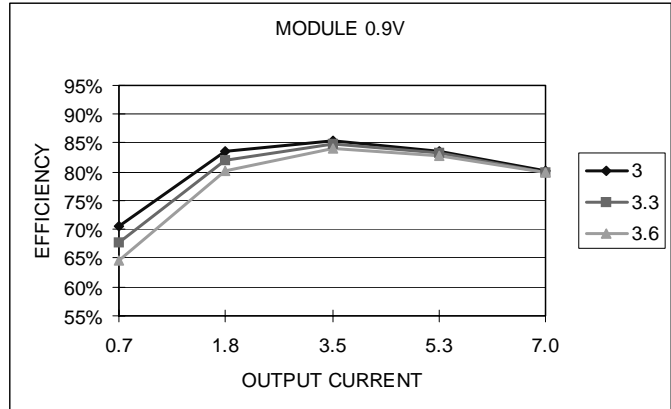
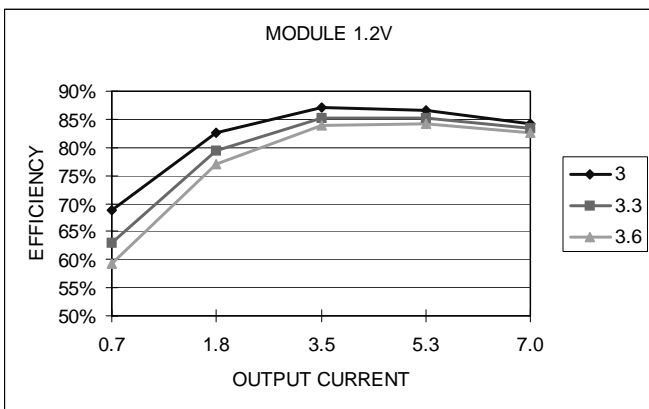
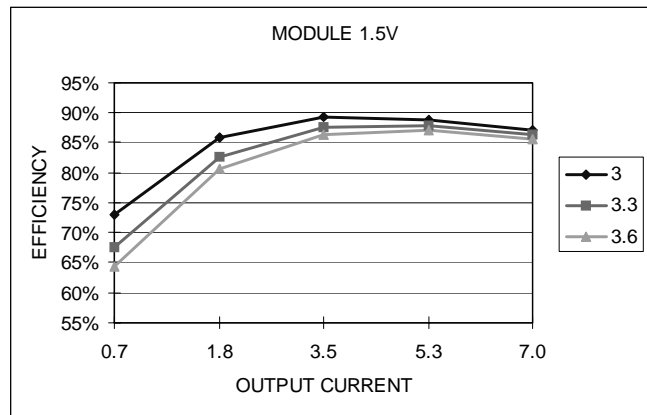
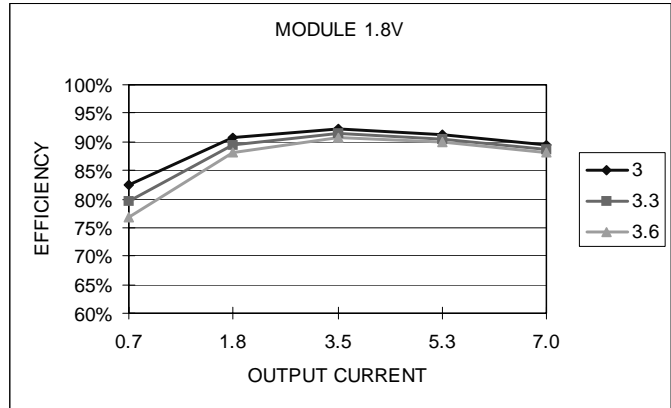
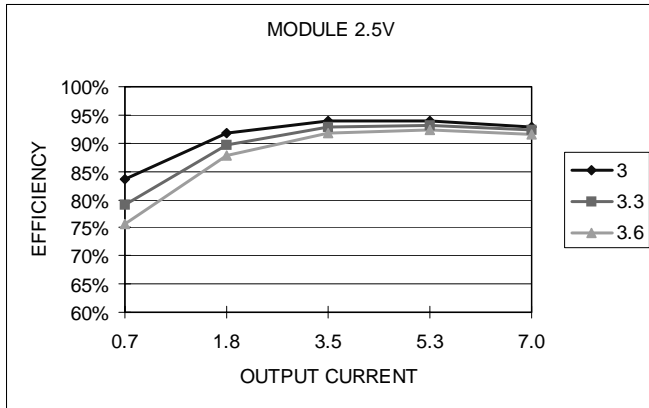
Parameter	Module	Symbol	Min	Typical	Max	Units
Remote On/Off <sup>3</sup>	All	Vouten				V
Signal Low (Unit Off)	All		-0.3		1	V
Signal High (Unit On)	All		1.8		3.6	V

3. With remote on/off pin 1 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

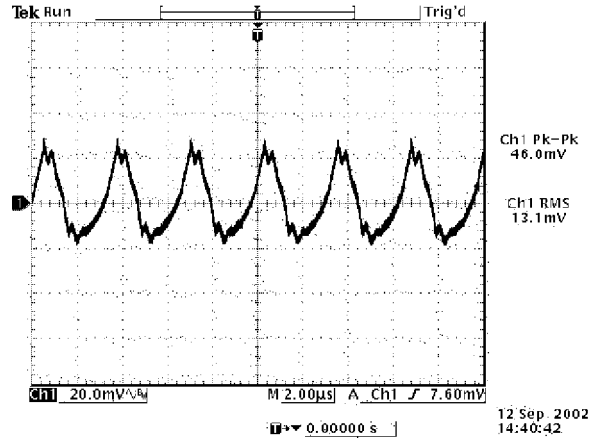
## 3.3V Input / 0.9V – 2.5V Output / 7A



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### Ripple and Noise

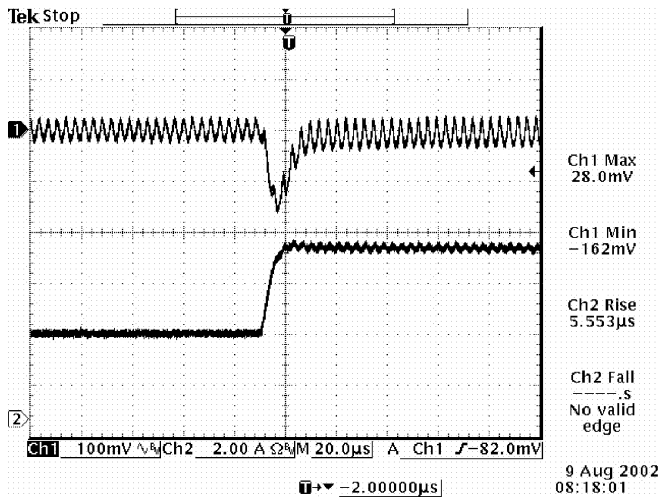
1 $\mu$ F ceramic cap and 10 $\mu$ F aluminum cap added at the output.



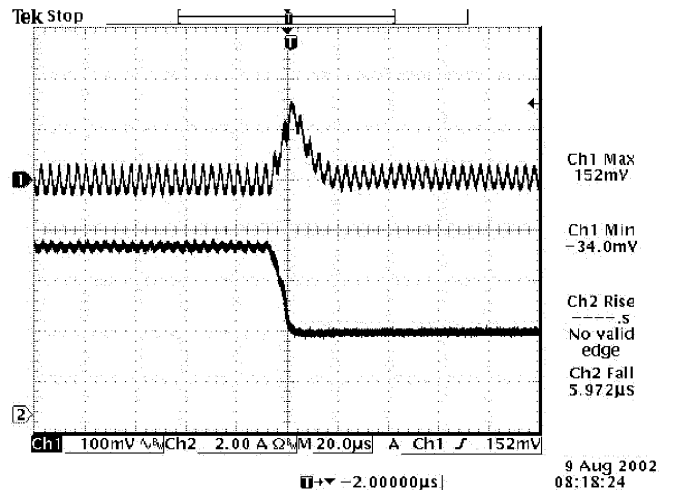
Ripple and noise at full load and 3.3Vdc input, 1.8Vdc output and Ta=25° C

### Transient Response

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



Vout=1.8V  
50% to 100% load transients at 3.3V input and Ta=25° C

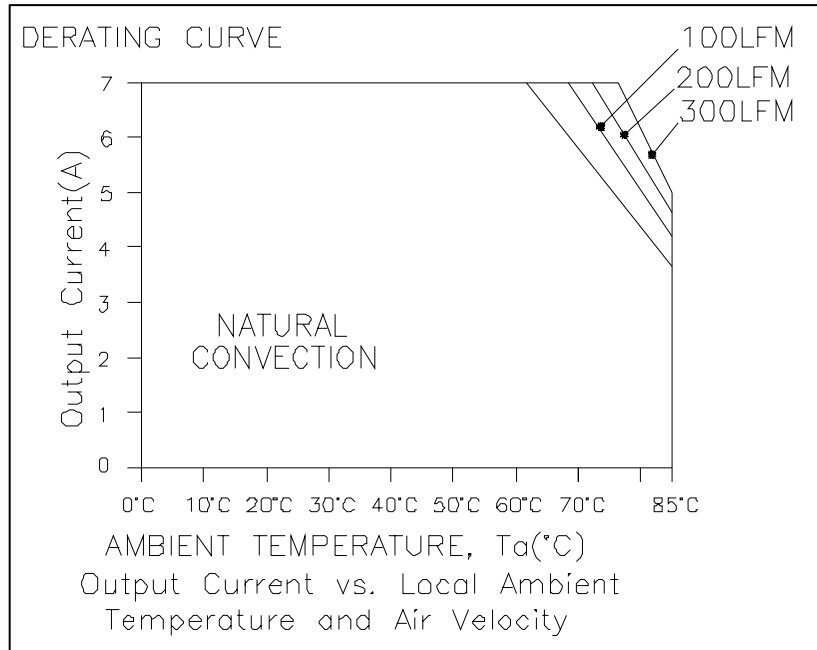


Vout=1.8V  
100% to 50% load transients at 3.3V input and Ta=25° C

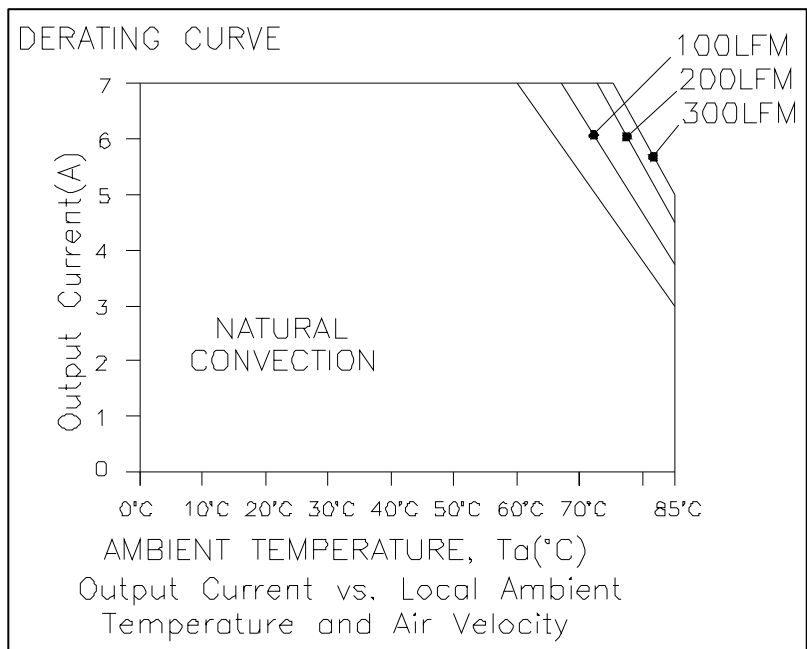
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**Thermal Considerations**

**S7AH-07C**



**V7AH-07C**





# NON-ISOLATED DC/DC CONVERTERS

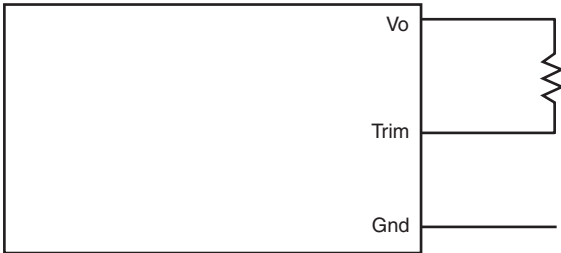
3.3V Input / 0.9V – 2.5V Output / 7A



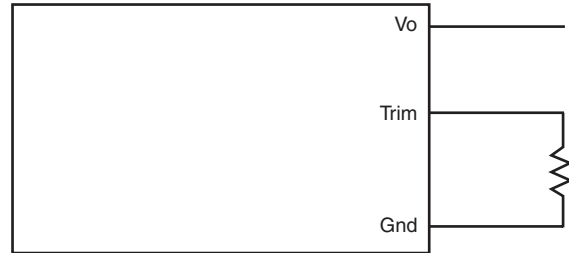
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## Output Voltage Set-Point Adjustment

Trim Down Test Circuit



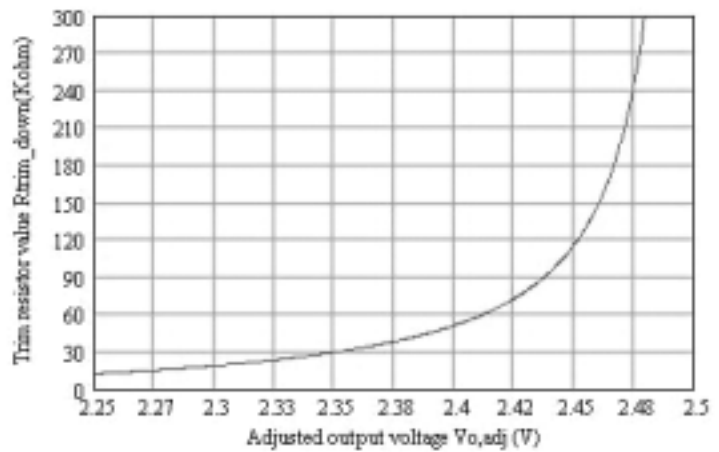
Trim Up Test Circuit



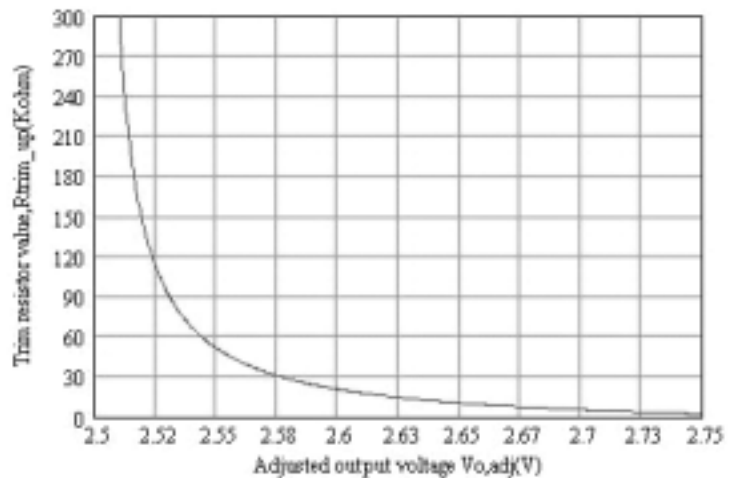
## Output Voltage Set-Point Adjustment

### x7AH-07C250 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{6.4943}{V_o - V_{o, \text{adj}}} - 13.83 \right) \text{ Kohm}$$



$$R_{\text{trim up}} = \left( \frac{3.064}{V_{o, \text{adj}} - V_o} - 10 \right) \text{ Kohm}$$



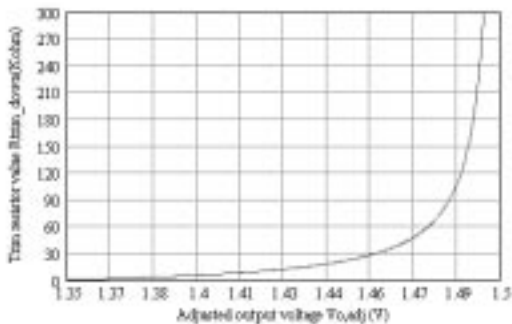
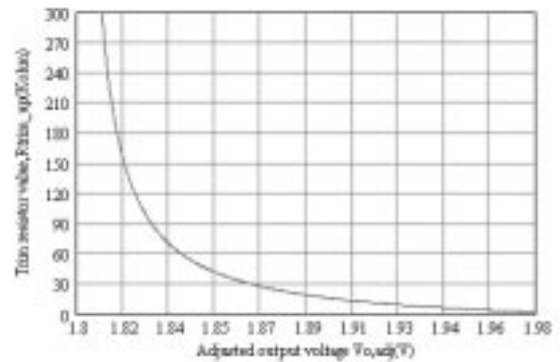
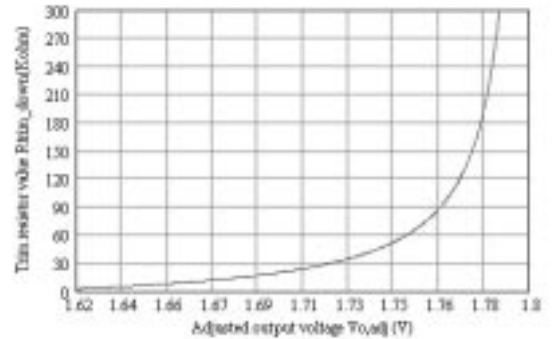
BP03x7AH-07C

### Output Voltage Set-Point Adjustment

#### x7AH-07C180 Trim Resistor Calculation

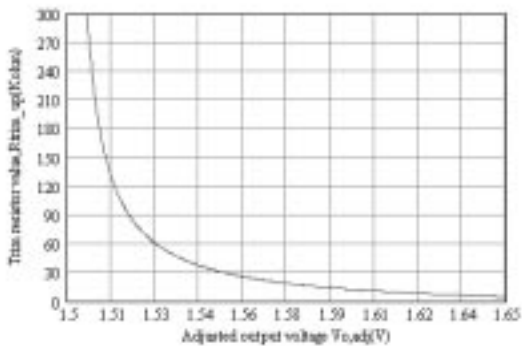
$$R_{\text{trim down}} = \left( \frac{3.8488}{V_o - V_{o, \text{adj}}} - 18.83 \right) \text{ Kohm}$$

$$R_{\text{trim up}} = \left( \frac{3.064}{V_{o, \text{adj}} - V_o} - 15 \right) \text{ Kohm}$$



#### x7AH-07C150 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{1.7874}{V_o - V_{o, \text{adj}}} - 11.7 \right) \text{ Kohm}$$



$$R_{\text{trim up}} = \left( \frac{2.088}{V_{o, \text{adj}} - V_o} - 9.09 \right) \text{ Kohm}$$

# NON-ISOLATED DC/DC CONVERTERS

## 3.3V Input / 0.9V – 2.5V Output / 7A

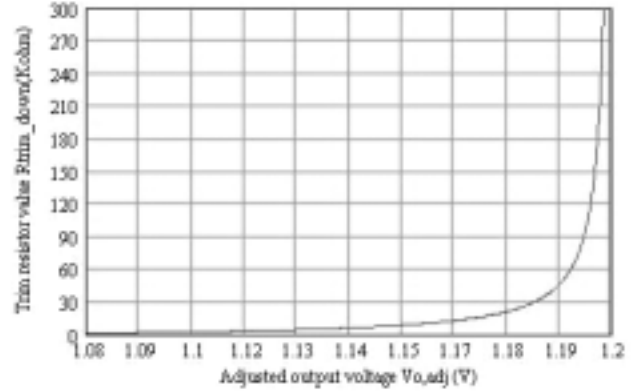


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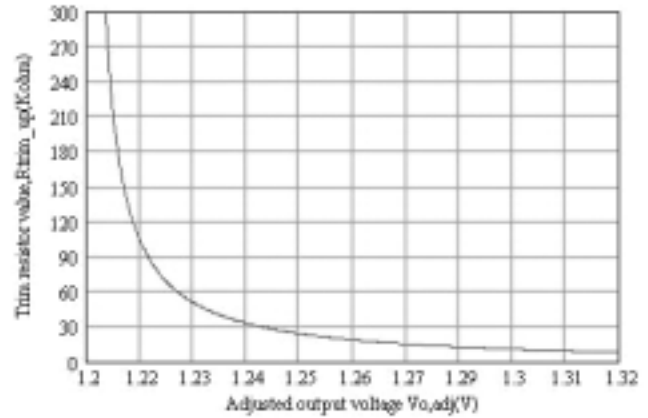
### Output Voltage Set-Point Adjustment

#### x7AH-07C120 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{0.622}{V_o - V_{o, \text{adj}}} - 4.15 \right) \text{ Kohm}$$

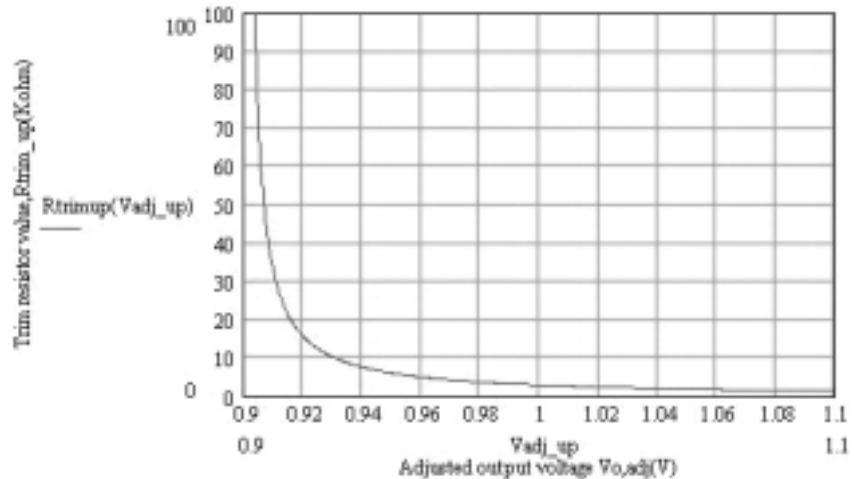


$$R_{\text{trim up}} = \left( \frac{1.232}{V_{o, \text{adj}} - V_o} - 2.61 \right) \text{ Kohm}$$



#### x7AH-07C090 Trim Resistor Calculation

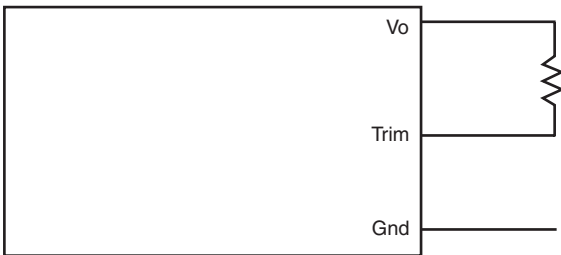
$$R_{\text{trim up}} = \left( \frac{0.3064}{V_{o, \text{adj}} - V_o} - 0.178 \right) \text{ Kohm}$$



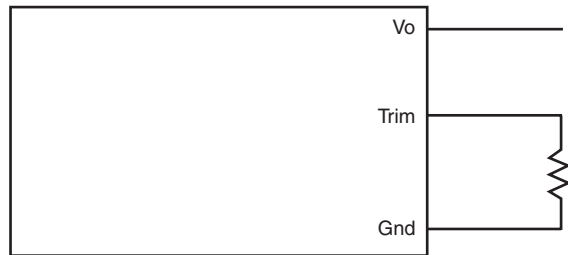
BP03x7AH-07C

**Output Voltage Set-Point Adjustment**

Trim Down Test Circuit



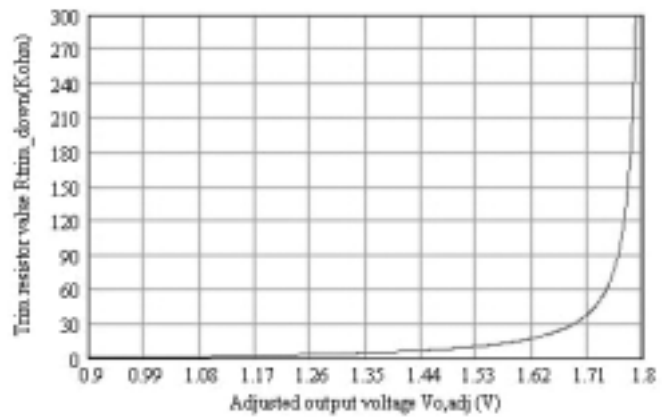
Trim Up Test Circuit



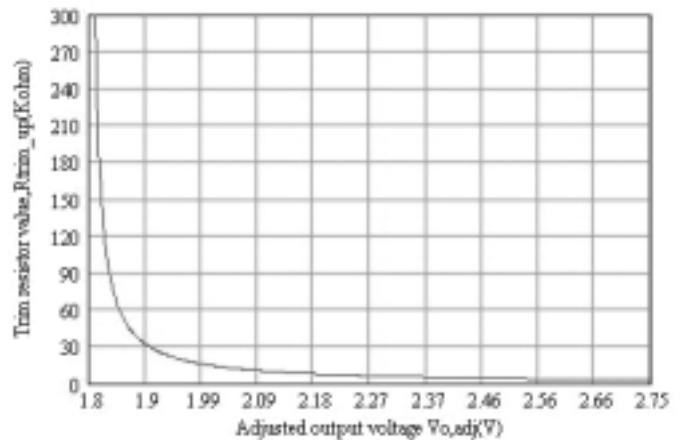
**Output Voltage Set-Point Adjustment**

x7AH-07C1A0 Trim Resistor Calculation

$$R_{\text{trim down}} = \left( \frac{3.8488}{V_o - V_{o, \text{adj}}} - 4.091 \right) \text{ Kohm}$$



$$R_{\text{trim up}} = \left( \frac{3.064}{V_{o, \text{adj}} - V_o} - 0.261 \right) \text{ Kohm}$$



# NON-ISOLATED DC/DC CONVERTERS

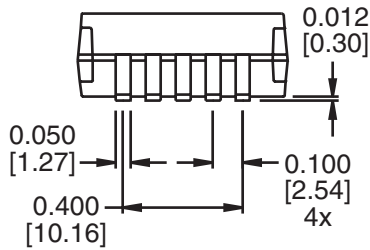
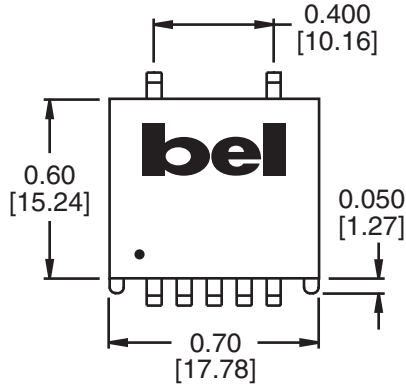
3.3V Input / 0.9V – 2.5V Output / 7A



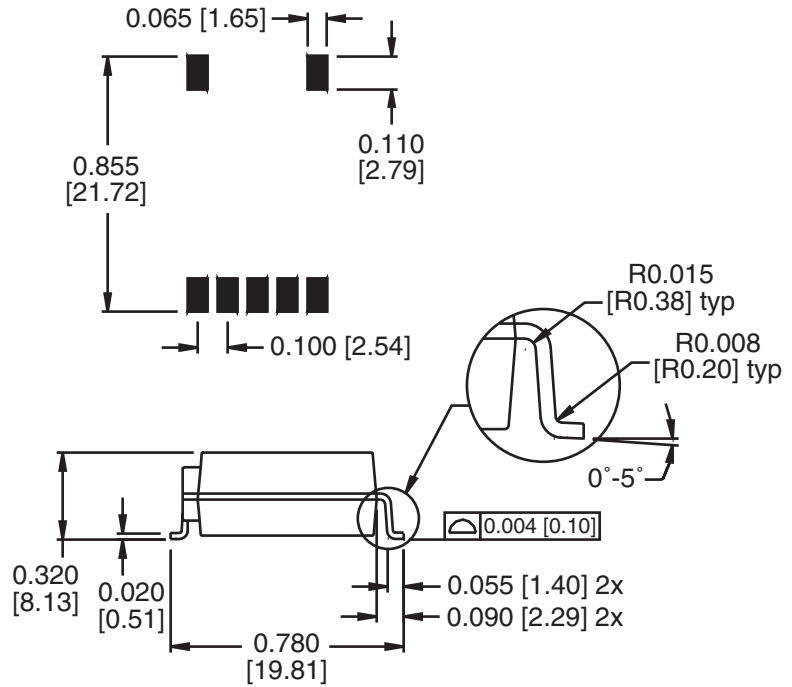
BP03x7AH-07C

## Mechanical

S7AH-07C

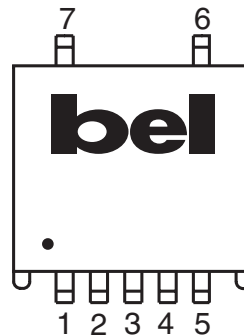


### Suggested PCB Pad Layout



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

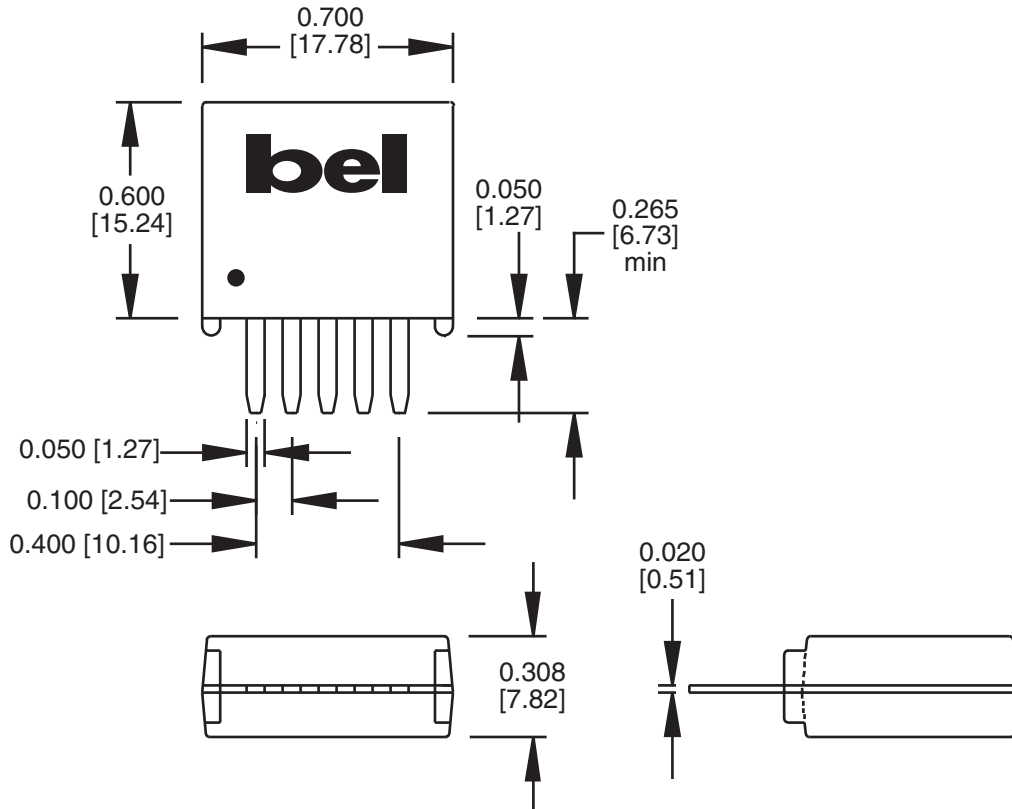
Pin	Function
1	Remote On/Off
2	+Vin
3	Ground
4	+Vo
5	Trim
6	No Connection
7	No Connection



BP03x7AH-07C

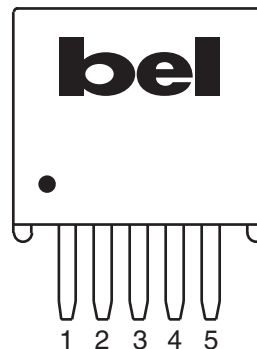
### Mechanical

V7AH-07C



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

Pin	Function
1	Remote On/Off
2	+Vin
3	Ground
4	+Vo
5	Trim



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