

# NON-ISOLATED DC/DC CONVERTERS

12V Input 0.9V-3.63V/2A Output



## X7AH-02A1A0

## PRELIMINARY

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Remote On/Off
- Input Under Voltage Lockout
- OCP/SCP
- Wide Range Trim

### Description

The Bel X7AH-02AXX0 modules are a series of non-isolated, step down DC/DC power converters that operate from a nominal 12V source. These converters are available in a range of output voltages from 0.9V to 3.63V. It is packaged in a compact, overmolded package rated at 2A. Optional lead forming provides a vertical mount product for minimal footprint or a surface mount option for a very low profile. The output is closely regulated and the efficiency is typically 88% at full load. Typical features include remote on/off, input under voltage lockout, over current protection and short circuit protection.

### Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Part Number Surface Mount	Part Number Vertical Mount
0.9 – 3.63V	12V	2A	7W	88%	S7AH-02A1A0	V7AH-02A1A0

### Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3V	-	15V	
Output Enable Terminal Voltage	-0.3V	-	15V	
Ambient Temperature	-40°C	-	85°C	
Storage Temperature	-55°C	-	125°C	

### Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	10.8V	-	13.2V	
Input Current (no load)	-	-	50mA	
Input Current (full load)				
Vo=3.3V	-	-	0.85A	
Vo=2.5V	-	-	0.70A	
Vo=1.8V	-	-	0.50A	
Vo=1.5V	-	-	0.45A	
Vo=1.2V	-	-	0.40A	
Vo=0.9V	-	-	0.35A	
Remote Off Input Current	-	3mA	10mA	
Input Reflected Ripple Current (pk-pk)	-	300mA	-	Use a 10nF/25V ceramic cap. at the input.
Input Reflected Ripple Current (RMS)	-	100mA	-	
I <sup>2</sup> t Inrush Current Transient	-	0.01A <sup>2</sup> s	0.02A <sup>2</sup> s	
Turn on Voltage Threshold	-	9.6V	-	
Turn off Voltage Threshold	8.8V	-	9.8V	

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## Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point				Test conditions: Vin=12V, Io=50% full load
Vo=3.3V	3.247V	3.3V	3.353V	
Vo=2.5V	2.460V	2.5V	2.540V	
Vo=1.8V	1.771V	1.8V	1.829V	
Vo=1.5V	1.476V	1.5V	1.524V	
Vo=1.2V	1.181V	1.2V	1.219V	
Vo=0.9V	0.886V	0.9V	0.914V	
Line Regulation				
Vo=3.3V	-	2mV	5mV	
Vo=2.5V	-	2mV	5mV	
Vo=1.8V	-	1mV	5mV	
Vo=1.5V	-	1mV	5mV	
Vo=1.2V	-	1mV	5mV	
Vo=0.9V	-	1mV	5mV	
Load Regulation				
Vo=3.3V	-	10mV	30mV	
Vo=2.5V	-	8mV	20mV	
Vo=1.8V	-	5mV	10mV	
Vo=1.5V	-	5mV	10mV	
Vo=1.2V	-	4mV	10mV	
Vo=0.9V	-	3mV	10mV	
Regulation Over Temperature (-40°C to +85°C)				
Vo=3.3V	-	35mV	45mV	
Vo=2.5V	-	20mV	30mV	
Vo=1.8V	-	15mV	25mV	
Vo=1.5V	-	10mV	20mV	
Vo=1.2V	-	8mV	15mV	
Vo=0.9V	-	2mV	5mV	
Output Current	0A	-	2A	
Current Limit Threshold	2.5A	-	6A	
Short Circuit Surge Transient				
Vo=3.3V	-	0.4A <sup>2</sup> s	0.8A <sup>2</sup> s	
Vo=2.5V	-	0.4A <sup>2</sup> s	0.8A <sup>2</sup> s	
Vo=1.8V	-	0.5A <sup>2</sup> s	1.0A <sup>2</sup> s	
Vo=1.5V	-	0.5A <sup>2</sup> s	1.0A <sup>2</sup> s	
Vo=1.2V	-	0.5A <sup>2</sup> s	1.0A <sup>2</sup> s	
Vo=0.9V	-	0.55A <sup>2</sup> s	1.1A <sup>2</sup> s	
Ripple and Noise (RMS)				Test condition: 0-20MHz BW; with 10uF Tan Cap and 1uF Ceramic Cap.
Vo=3.3V	-	20mV	35mV	
Vo=2.5V	-	15mV	25mV	
Vo=1.8V	-	15mV	25mV	
Vo=1.5V	-	15mV	25mV	
Vo=1.2V	-	10mV	20mV	
Vo=0.9V	-	10mV	20mV	
Ripple and Noise (pk-pk)				
Vo=3.3V	-	60mV	80mV	
Vo=2.5V	-	50mV	70mV	
Vo=1.8V	-	40mV	60mV	
Vo=1.5V	-	35mV	60mV	
Vo=1.2V	-	35mV	60mV	
Vo=0.9V	-	35mV	60mV	
Turn on Time	-	70mS	100mS	
Overshoot at Turn on	-	0%	3%	
Output Capacitance	0uF	-	1000uF	

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## Output Specifications (continued)

Parameter		Min	Typ	Max	Notes
<b>Transient Response</b>					
50% ~ 100% Max Load	Overshoot	Vo=3.3V	-	120mV	150mV
	Settling Time		-	40uS	60uS
100% ~ 50% Max Load	Overshoot	Vo=3.3V	-	120mV	150mV
	Settling Time		-	40uS	60uS
50% ~ 100% Max Load	Overshoot	Vo=2.5V	-	100mV	130mV
	Settling Time		-	40uS	60uS
100% ~ 50% Max Load	Overshoot	Vo=2.5V	-	100mV	130mV
	Settling Time		-	40uS	60uS
50% ~ 100% Max Load	Overshoot	Vo=1.8V	-	90mV	120mV
	Settling Time		-	40uS	60uS
100% ~ 50% Max Load	Overshoot	Vo=1.8V	-	90mV	120mV
	Settling Time		-	40uS	60uS
50% ~ 100% Max Load	Overshoot	Vo=1.5V	-	80mV	110mV
	Settling Time		-	40uS	60uS
100% ~ 50% Max Load	Overshoot	Vo=1.5V	-	80mV	110mV
	Settling Time		-	40uS	60uS
50% ~ 100% Max Load	Overshoot	Vo=1.2V	-	70mV	100mV
	Settling Time		-	40uS	60uS
100% ~ 50% Max Load	Overshoot	Vo=1.2V	-	70mV	100mV
	Settling Time		-	40uS	60uS
50% ~ 100% Max Load	Overshoot	Vo=0.9V	-	60mV	90mV
	Settling Time		-	40uS	60uS
100% ~ 50% Max Load	Overshoot	Vo=0.9V	-	60mV	90mV
	Settling Time		-	40uS	60uS

Test conditions:  
Vin=12V; di/dt=0.1A/uS,  
with 220uF/6.3V Tan Cap.

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

## General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				Measured at Vin=12V, full load and Ta=25°C
Vo=3.3V	85%	88%	-	
Vo=2.5V	83%	86%	-	
Vo=1.8V	79%	82%	-	
Vo=1.5V	75%	78%	-	
Vo=1.2V	71%	74%	-	
Vo=0.9V	67%	70%	-	
Switching Frequency	-	250KHz	-	
Output Trim Range (wide trim)		-	403%Vo	Vo=0.9V
Output Trim Range (narrow trim)				
Vo=1.2V-5.0V	90%Vo	-	110%Vo	
Vo=0.9V	-	-	110%Vo	
MTBF	TBD			Calculated Per Bell Core TR-332 (Io = Nominal; Ta = 25°C)
Dimensions (surface mount)				
Inches (L x W x H)	0.78 x 0.70 x 0.32			
Millimeters (L x W x H)	19.81 x 17.78 x 8.13			
Dimensions (vertical)				
Inches (L x W x H)	0.70 x 0.308 x 0.65			
Millimeters (L x W x H)	17.78 x 7.82 x 16.51			
Weight	-	4.9g	-	

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### Control Specifications

Parameter	Min	Typ	Max	Notes
Signal Low (Unit Off)	-0.3V	-	1V	Remote on/off pin open, unit on.
Signal High (Unit On)	2.5V	-	13.2V	

### Output Trim Equations

Equations for calculating the trim resistor (in k $\Omega$ ) given the desired adjusted voltage ( $V_{adj}$ ) and the nominal output voltage of the converter ( $V_{nom}$ ) are shown below. The Trim Down resistor should be connected between the Trim pin and  $V_{out}$ . The Trim Up resistor should be connected between the Trim pin and Ground. Only one of the resistors should be used for any given application.

$$R_{TrimUp} = \frac{3.712}{V_{adj} - V_{nom}}$$

**Note:** Output voltage  $V_{nom}=0.903V$  when  $R_{trim\_up}$  is not connected.

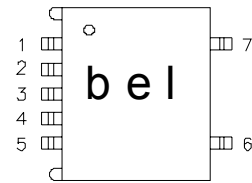
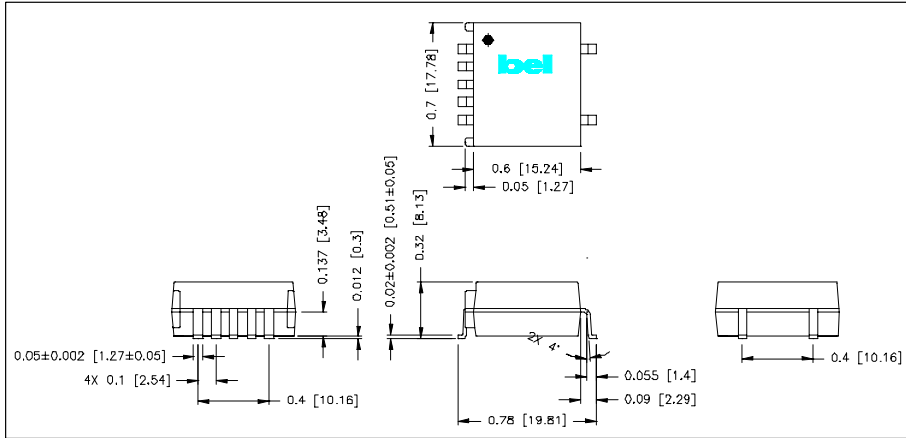
### Voltage Trim:

$$R_t(K\Omega) = \frac{R_s(4.64V_t - 3.712)}{3.712 - R_s(V_{out} - 0.903)}$$

**Note:** Output voltage  $V_{nom}=0.903V$  when  $R_{trim}$  is not connected.

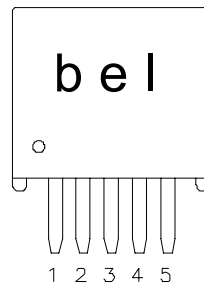
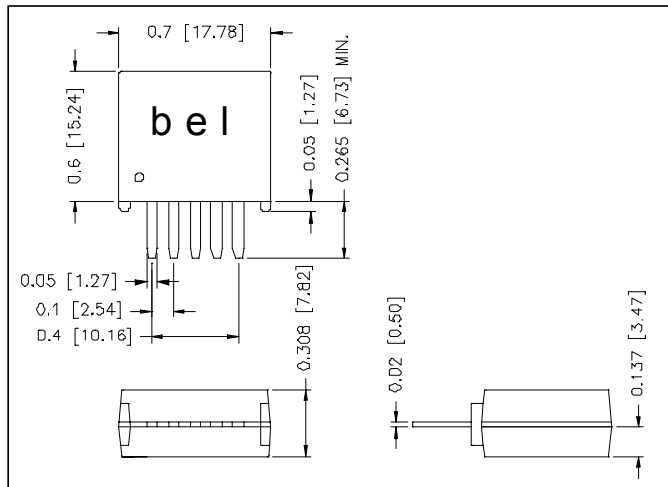
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## Pin Connections

Pin	Function
1	Remote On/Off (option)
2	Vin
3	Ground
4	Vout
5	Trim (option)
6	N/A
7	N/A



## Pin Connections

Pin	Function
1	Remote On/Off (option)
2	Vin
3	Ground
4	Vout
5	Trim (option)

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