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)				
V_O=3.3V	-	-	0.85A	
V_O=2.5V	-	-	0.70A	
V_O=1.8V	-	-	0.50A	
V_O=1.5V	-	-	0.45A	
V_O=1.2V	-	-	0.40A	
V_O=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^2t Inrush Current Transient	-	$0.01A^2s$	$0.02A^2s$	
Turn on Voltage Threshold	-	9.6V	-	
Turn off Voltage Threshold	8.8V	-	9.8V	

Output Specifications

Parameter		Min	Typ	Max	Notes
Output Voltage Set Point					
	Vo=3.3V	3.247V	3.3V	3.353V	Test conditions: Vin=12V, Io=50% full load
	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	-	$0.4A^2s$	$0.8A^2s$	
	Vo=2.5V	-	$0.4A^2s$	$0.8A^2s$	
	Vo=1.8V	-	$0.5A^2s$	$1.0A^2s$	
	Vo=1.5V	-	$0.5A^2s$	$1.0A^2s$	
	Vo=1.2V	-	$0.5A^2s$	$1.0A^2s$	
	Vo=0.9V	-	$0.55A^2s$	$1.1A^2s$	
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	

Output Specifications (continued)

Parameter			Min	Typ	Max	Notes
Transient Response						
50% ~ 100% Max Load	Overshoot	Vo=3.3V	-	120mV	150mV	Test conditions: Vin=12V; di/dt=0.1A/uS, with 220uF/6.3V Tan Cap.
	Settling Time		-	40uS	60uS	
100% ~ 50% Max Load	Overshoot		-	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		-	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		-	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		-	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		-	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		-	60mV	90mV	
	Settling Time		-	40uS	60uS	

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
Vo=3.3V	85%	88%	-	Measured at Vin=12V, full load and Ta=25°C
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 × W × H)	0.78 x 0.70 x 0.32			
Millimeters (L × W × H)	19.81 x 17.78 x 8.13			
Dimensions (vertical)				
Inches (L × W × H)	0.70 x 0.308 x 0.65			
Millimeters (L × W × H)	17.78 x 7.82 x 16.51			
Weight	-	4.9g	-	

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 kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom) are shown below. The Trim Down resistor should be connected between the Trim pin and Vout. 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:

$$Rt(K\Omega) = \frac{Rs(4.64Vt - 3.712)}{3.712 - Rs(Vout - 0.903)}$$

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

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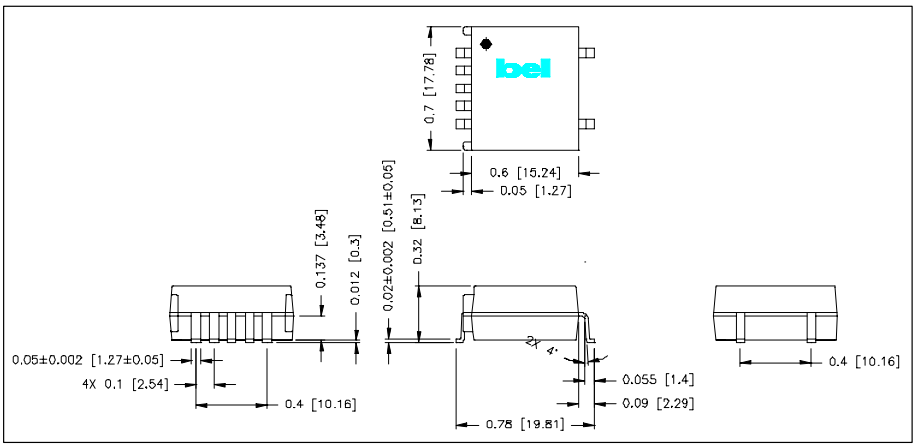
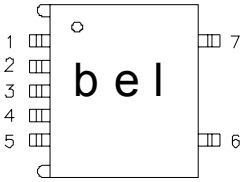
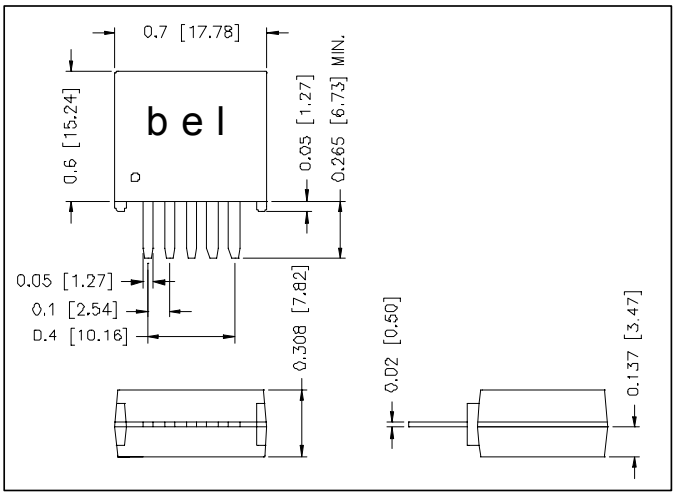
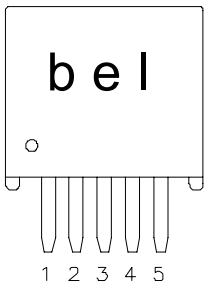




Pin Connections

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





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Pin	Function
1	Remote On/Off (option)
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4	Vout
5	Trim (option)

CORPORATE

Bel Fuse Inc.
206 Van Vorst Street
Jersey City, NJ 07302
Tel 201-432-0463
Fax 201-432-9542
www.belfuse.com

FAR EAST

Bel Fuse Ltd.
8F/ 8 Luk Hop Street
San Po Kong
Kowloon, Hong Kong
Tel 852-2328-5515
Fax 852-2352-3706
www.belfuse.com

EUROPE

Bel Fuse Europe Ltd.
Preston Technology Management Centre
Marsh Lane, Suite G7, Preston
Lancashire, PR1 8UD, U.K.
Tel 44-1772-556601
Fax 44-1772-888366
www.belfuse.com