NON-ISOLATED DC/DC CONVERTERS

3.0V-5.5V Input 1.0V-3.3V/12A Output

X7AH-12F Series PRELIMINARY

- Non-Isolated
- High Efficiency
- Low Cost
- Excellent Thermal Performance
- Input Under Voltage Lockout
- OCP/SCP
- Wide Range Trim
- Remote On/Off
- Remote Sense (SMD module)

Description

The Bel X7AH-12FXX0 is part of the low cost non-isolated dc to dc converter Power Module series. These converters are available in a range of output voltages from 1.0V to 3.3V. It is packaged in a compact, overmolded package rated at 12A. The output is closely regulated and the efficiency of 3.3V output module is typically 93% 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
3.3V	4.5 – 5.5V	12A	39.6W	91%	S7AH-12F330	V7AH-12F330
2.5V	3.6 – 5.5V	12A	30.0W	89%	S7AH-12F250	V7AH-12F250
1.8V	3.0 – 5.5V	12A	21.6W	87%	S7AH-12F180	V7AH-12F180
1.5V	3.0 – 5.5V	12A	18.0W	85%	S7AH-12F150	V7AH-12F150
1.2V	3.0 – 5.5V	12A	14.4W	83%	S7AH-12F120	V7AH-12F120
1.0V	3.0 – 5.5V	12A	12.0W	81%	S7AH-12F100	V7AH-12F100

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3V	-	6V	
Output Enable Terminal Voltage	-0.3V	-	7V	
Ambient Temperature	-40°C	-	85°C	
Storage Temperature	-55°C	-	105°C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage [1]	3V	-	5.5V	
Input Current (no load)	-	120mA	200mA	
Input Current (full load)				
Vo=3.3V	-	-	11A	
Vo=2.5V	-	-	10.5A	
Vo=1.8V	-	-	9.0A	
Vo=1.5V	-	-	8.1A	
Vo=1.2V	-	-	6.5A	
Vo=1.0V	-	-	5.2A	
Remote Off Input Current	-	2mA	5mA	
Input Reflected Ripple Current (pk-pk)	-	260mA	320mA	With simulated source impedance of 500nH, 5Hz to 20MHz; use a 270uF/6.3V cap with ESR=0.03 ohm max at 100KHz
Input Reflected Ripple Current (RMS)	-	75mA	120mA	
I^2t Inrush Current Transient	-	$0.09A^2s$	$0.2A^2s$	
Turn on Voltage Threshold		2.1V	-	
Turn off Voltage Threshold	-	2V	2.4V	

Note: 1. The input voltage range of 3.3V output module is 4.5V-5.5V and that of 2.5V module is 3.6V-5.5V.

Output Specifications

Parameter			Min	Typ	Max	Notes
Output Voltage Set Point						
	Vo=3.3V		3.234V	3.3V	3.366V	Test conditions: Vin=5V, Io= full load
	Vo=2.5V		2.450V	2.5V	2.550V	
	Vo=1.8V		1.764V	1.8V	1.836V	
	Vo=1.5V		1.470V	1.5V	1.530V	
	Vo=1.2V		1.176V	1.2V	1.224V	
	Vo=1.0V		0.980V	1.0V	1.020V	
Line Regulation						
	Vo=3.3V		-	1mV	4mV	
	Vo=2.5V		-	1mV	4mV	
	Vo=1.8V		-	1mV	4mV	
	Vo=1.5V		-	1mV	4mV	
	Vo=1.2V		-	1mV	4mV	
	Vo=1.0V		-	1mV	4mV	
Load Regulation						
	Vo=3.3V		-	2mV	5mV	
	Vo=2.5V		-	2mV	5mV	
	Vo=1.8V		-	2mV	5mV	
	Vo=1.5V		-	2mV	5mV	
	Vo=1.2V		-	2mV	5mV	
	Vo=1.0V		-	2mV	5mV	
Regulation Over Temperature (-40°C to +85°C)						
	Vo=3.3V		-	10mV	15mV	
	Vo=2.5V		-	9mV	13mV	
	Vo=1.8V		-	7mV	12mV	
	Vo=1.5V		-	6mV	11mV	
	Vo=1.2V		-	5mV	10mV	
	Vo=1.0V		-	4mV	9mV	
Output Current			0A	-	12A	
Current Limit Threshold			20A	-	30A	
Short Circuit Surge Transient			-	$0.3A^2s$	$0.6A^2s$	
Ripple and Noise (RMS)			-	15mV	25mV	Test conditions: 0-20MHz BW; 1uF ceramic cap and 10uF tan cap at output.
Ripple and Noise (pk-pk)			-	60mV	100mV	
Turn on Time			-	5mS	10mS	
Overshoot at Turn on			-	0%	3%	
Output Capacitance			330uF	-	4800uF	
Transient Response						
50% ~ 100% Max Load	Overshoot	Vo=3.3V	-	110mV	150mV	Test conditions: di/dt=0.5A/us, Vin=5V, with330uF external load capacitance.
	Settling Time		-	40uS	80uS	
100% ~ 50% Max Load	Overshoot		-	110mV	150mV	
	Settling Time		-	40uS	80uS	
50% ~ 100% Max Load	Overshoot	Vo=2.5V	-	100mV	150mV	
	Settling Time		-	30uS	60uS	
100% ~ 50% Max Load	Overshoot		-	100mV	150mV	
	Settling Time		-	30uS	60uS	

Output Specifications (continued)

Parameter			Min	Typ	Max	Notes
Transient Response						
50% ~ 100% Max Load	Overshoot	V_O=1.0V - 1.8V	-	90mV	130mV	Test conditions: di/dt=0.5A/us, Vin=5V, with 330uF external load capacitance.
	Settling Time		-	20uS	40uS	
100% ~ 50% Max Load	Overshoot		-	90mV	130mV	
	Settling Time		-	20uS	40uS	

Notes: 1. All specifications are typical at nominal input, full load at 25°C unless otherwise stated.
2. The input voltage range of 3.3V output module is 4.5V-5.5V and that of 2.5V module is 3.6V-5.5V.
3. The turn-off undershoot of the module is below 200mV if a 330uF tantalum capacitor is added at the output.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
V_O=3.3V	88%	91%	-	Vin=5V, full load
V_O=2.5V	86%	89%	-	
V_O=1.8V	84%	87%	-	
V_O=1.5V	82%	85%	-	
V_O=1.2V	80%	83%	-	
V_O=1.0V	78%	81%	-	
Efficiency				
V_O=1.8V	85%	88%	-	Vin=3.3V, full load
V_O=1.5V	83%	86%	-	
V_O=1.2V	81%	84%	-	
V_O=1.0V	79%	82%	-	
Switching Frequency	250KHz	300KHz	350KHz	
Output Trim Range	90%V_O	-	110%V_O	
Remote Sense Compensation	-	-	10%	SMD module
MTBF	TBD			Calculated Per Bell Core TR-332 (I_O = Nominal; T_a = 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 8.128			
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	-	5.1g	-	

Control Specifications

Parameter	Min	Typ	Max	Notes
Signal Low (Unit Off)	-	-	0.9V (Vin=3.0V)	Remote on/off pin open, unit on.
	-	-	1.35V (Vin=4.5V)	
	-	-	3.85V (Vin=5.5V)	
Signal High (Unit On)	0.9V (Vin=3.0V)	-	-	
	1.35V (Vin=4.5V)	-	-	
	3.85V (Vin=5.5V)	-	-	

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.

$$R_{TrimDown} = \frac{A}{V_{nom} - V_{adj}} - B \qquad R_{TrimUp} = \frac{C}{V_{adj} - V_{nom}} - D$$

Vnom	A	B	C	D
3.3	161.391	161.900	43.330	100.000
2.5	111.674	208.900	43.330	147.000
1.8	68.576	287.900	43.330	226.000
1.5	18.850	161.900	43.330	100.000
1.2	31.240	208.900	43.330	147.000
1.0	50.000	287.900	43.330	226.000

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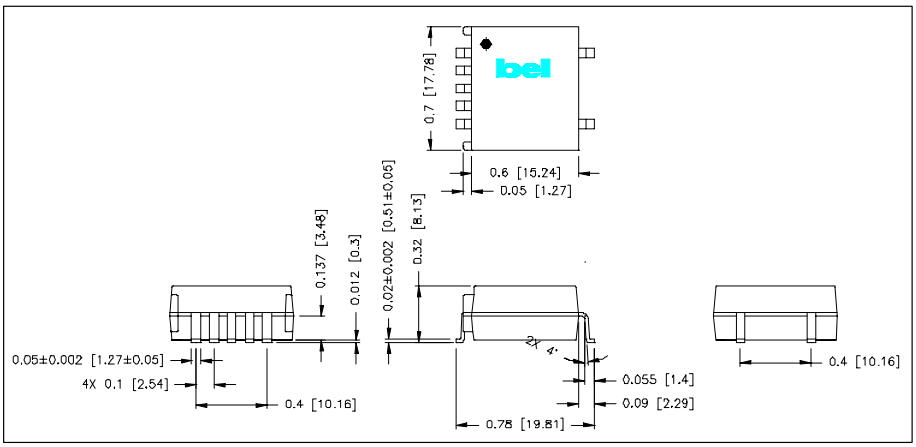
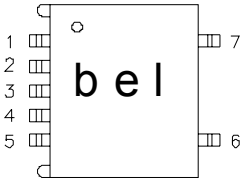
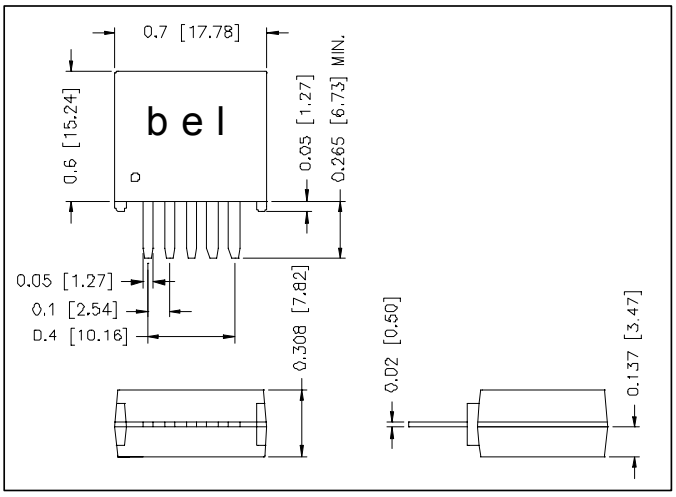
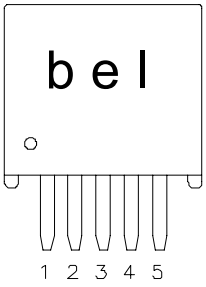




Pin Connections

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





Pin Connections

Pin	Function
1	Remote On/Off (option)
2	Vin
3	Ground
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