

# 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 <sup>1</sup>	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 <sup>2</sup> t Inrush Current Transient	-	0.09A <sup>2</sup> s	0.2A <sup>2</sup> s	
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.

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## 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 <sup>2</sup> s	0.6A <sup>2</sup> s		
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		
<b>Transient Response</b>						
50% ~ 100% Max Load	Overshoot	Vo=3.3V	-	110mV	150mV	Test conditions: di/dt=0.5A/us, Vin=5V, with 330uF 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	

# NON-ISOLATED DC/DC CONVERTERS

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



## Output Specifications (continued)

Parameter		Min	Typ	Max	Notes	
<b>Transient Response</b>						
50% ~ 100% Max Load	Overshoot	Vo=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				
Vo=3.3V	88%	91%	-	Vin=5V, full load
Vo=2.5V	86%	89%	-	
Vo=1.8V	84%	87%	-	
Vo=1.5V	82%	85%	-	
Vo=1.2V	80%	83%	-	
Vo=1.0V	78%	81%	-	
Efficiency				
Vo=1.8V	85%	88%	-	Vin=3.3V, full load
Vo=1.5V	83%	86%	-	
Vo=1.2V	81%	84%	-	
Vo=1.0V	79%	82%	-	
Switching Frequency	250KHz	300KHz	350KHz	
Output Trim Range	90%Vo	-	110%Vo	
Remote Sense Compensation	-	-	10%	SMD module
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 8.128			
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	-	5.1g	-	

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3.0V-5.5V Input

1.0V-3.3V/12A Output



## 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 ( $V_{adj}$ ) 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.

$$R_{TrimDown} = \frac{A}{V_{nom} - V_{adj}} - B$$

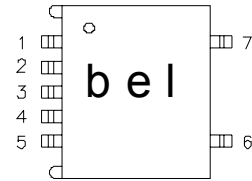
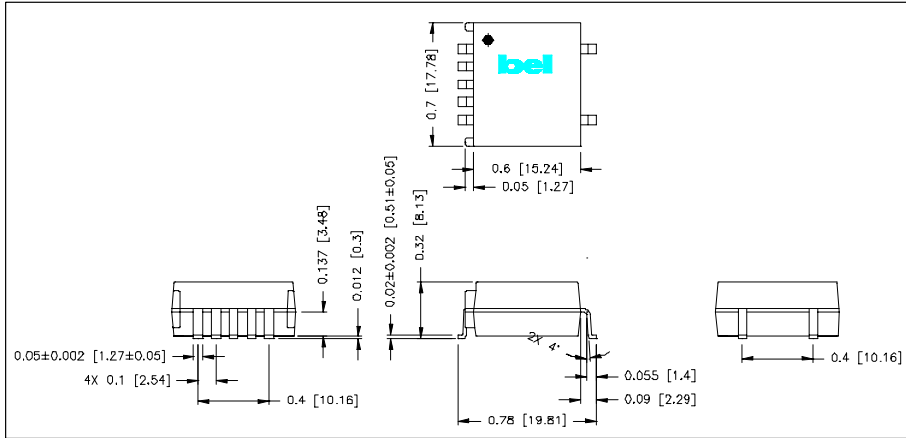
$$R_{TrimUp} = \frac{C}{V_{adj} - V_{nom}} - D$$

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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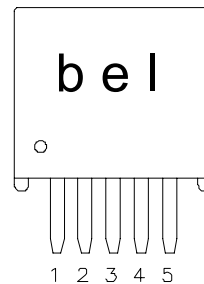
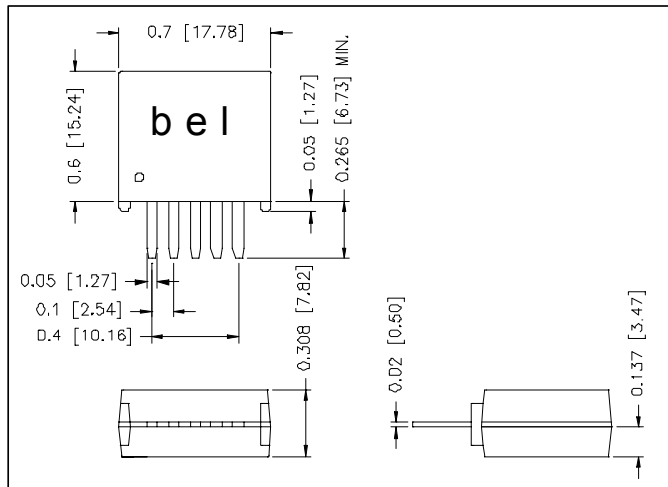
3.0V-5.5V Input

1.0V-3.3V/12A Output



## 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)

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