

## NON-ISOLATED DC/DC CONVERTERS

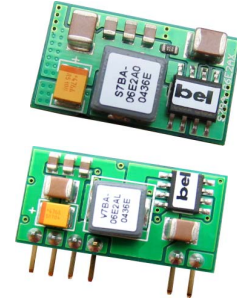
4.5V-14V Input

0.75V-5.0V/6A Output

**bel**  
POWER PRODUCTS

### x7BA-06E2Ax Series

- Non-Isolated
- High Efficiency
- High Power Density
- Fixed Frequency
- Flexible Output Voltage Sequencing
- Active Low/High (option)
- Under-voltage Lockout (UVLO)
- Remote On/Off
- OCP/SCP
- Wide Input
- Wide Trim Range



### Description

The Bel x7BA-06E2Ax modules are a series of non-isolated DC/DC converters that can deliver up to 6A of output current with full load efficiency of 92% at 5.0V output. These modules provide precisely regulated voltage programmable via external resistor from 0.75V to 5.0V over a wide range of input voltage. These modules have a sequencing feature that enables designers to implement various types of output voltage sequencing when powering multiple voltages on a board. Their open-frame construction and small footprint enable designers to develop cost and space-efficient solutions. Standard features include remote On/Off, programmable output voltage and over current protection.

### Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Surface Mount	Model Number Vertical Mount
5.0V	7.0V - 14V	6A	30.0W	92%	S7BA-06E2Ax	V7BA-06E2Ax
0.75V – 3.3V	4.5V - 14V	6A	19.8W	88%	S7BA-06E2Ax	V7BA-06E2Ax

**Note:** Use “0” to replace “x” for remote on/off active high logic and use “L” for active low logic. Add “G” suffix at the end of the model numbers to indicate Tray Packaging.

### Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3V	-	15V	All specifications are typical at 25°C unless otherwise stated.
Output Enable Terminal Voltage	-0.3V	-	15V	
Sequencing Voltage <sup>1</sup>	-0.3V	-	V <sub>in</sub>	
Ambient Temperature	-40°C	-	85°C	
Storage Temperature	-55°C	-	125°C	

**Note:** 1. x7BA-06E2Ax series of modules include a sequencing feature that enables users to implement various types of output voltage sequencing in their applications. This is accomplished via an additional sequencing pin. When the sequencing feature is not used, tie the SEQ pin to V<sub>in</sub>.

# NON-ISOLATED DC/DC CONVERTERS

4.5V-14V Input

0.75V-5.0V/6A Output



## Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage				
Vo, set ≤ 3.3V	4.5V	12V	14V	
Vo, set = 5.0V	7.0V	12V	14V	
Input Current (full load)				
Vo=5.0V	-	2.75A	4.8A	
Vo=3.3V	-	1.85A	4.8A	
Vo=1.8V	-	1.05A	3.2A	
Vo=0.75V	-	0.55A	1.8A	
Input Current (no load)				
Vo=5.0V	-	-	100mA	
Vo=0.75V	-	-	20mA	
Remote Off Input Current	-	3mA	5mA	
Input Reflected Ripple Current (pk-pk)	-	120mA	200mA	Tested with two 100uF/25V input Tantalum capacitors & simulated source impedance of 1uH, 5Hz to 20MHz.
Input Reflected Ripple Current (RMS)	-	60mA	100mA	
I <sup>2</sup> t Inrush Current Transient	-	0.002A <sup>2</sup> s	0.02A <sup>2</sup> s	
Turn-on Voltage Threshold				
Vo, set ≤ 3.3V	-	4.3V	4.5V	
Vo, set = 5.0V	-	6.0V	6.5V	
Turn-off Voltage Threshold				Shut down or below 90% set point.
Vo, set ≤ 3.3V	-	4.0V	4.3V	
Vo, set = 5.0V	-	5.5V	6.0V	

## Output Specifications

Parameter	Min	Typ	Max	Notes	
Output Voltage Set Point	-2%Vo,set	-	2%Vo,set	Vin=12V, full load	
Output Voltage Set Point <sup>1</sup>	-2.5%Vo,set	-	3.5%Vo,set		
Load Regulation	-0.7%Vo,set	0.4%Vo,set	0.7%Vo,set	Io=Io, min to Io, max	
Line Regulation	-0.7%Vo,set	0.3%Vo,set	0.7%Vo,set	Vin=Vin, min to Vin, max	
Regulation Over Temperature (-40°C to +85°C)	-	0.5%Vo,set	-	Tref=Ta, min to Ta, max	
Output Current	0A	-	6A		
Current Limit Threshold	6.8A	-	15A		
Short Circuit Surge Transient	-	0.25A <sup>2</sup> s	-		
Ripple and Noise (pk-pk)				Tested with 0-20MHz, with 10uF/10V tantalum capacitor & 1uF/10V ceramic capacitor at the output	
Vo=5.0V	-	100mV	140mV		
Vo=3.3V	-	80mV	120mV		
Ripple and Noise (RMS)					
Vo=5.0V	-	35mV	50mV		
Vo=3.3V	-	25mV	40mV		
Vo=0.75V	-	10mV	15mV		
Turn on Time	-	6mS	12mS		
Overshoot at Turn on	-	0%	3%		
Output Capacitance					
ESR ≥ 1mohm	0uF	-	1000uF		
ESR ≥ 10mohm	0uF	-	2200uF		
<b>Transient Response</b>					
50% ~ 100% Max Load	Vo = 0.75V -5.0V	-	200mV	350mV	di/dt=2.5A/uS; Vin=12V; and with 10uF/10V tantalum capacitor & 1uF/10V ceramic capacitor at the output.
Settling Time		-	25uS	50uS	
100% ~ 50% Max Load		-	200mV	350mV	
Settling Time		-	25uS	50uS	

**Notes:** All specifications are typical at nominal input (Vin=12V), full load at 25°C unless otherwise stated.  
1. Over all operating input voltages, resistive loads and temperature conditions.

# NON-ISOLATED DC/DC CONVERTERS

4.5V-14V Input

0.75V-5.0V/6A Output



## General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				Measured at Vin=12V, full load
Vo=5.0V	88%	92%	-	
Vo=3.3V	85%	88%	-	
Vo=1.8V	80%	84%	-	
Vo=0.75V	68%	73%	-	
Switching Frequency	220KHz	250KHz	280KHz	
Output Voltage Trim Range (wide trim)	0.7525V	-	5V	
MTBF	3,079,469 hours			Calculated Per Bell Core TR-332 (Io = Nominal; Ta = 25°C)
Dimensions				Surface Mount
Inches (L x W x H)	0.8 x 0.45 x 0.251			
Millimeters (L x W x H)	20.32 x 11.42 x 6.38			
Dimensions				Vertical Mount
Inches (L x W x H)	1.0 x 0.5 x 0.243			
Millimeters (L x W x H)	25.4 x 12.7 x 6.16			
Weight	-	5g	-	

**Note:** All specifications are typical at 25°C unless otherwise stated.

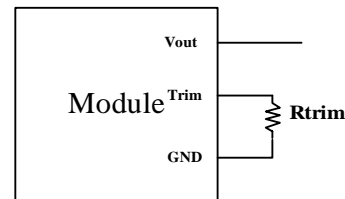
## Control Specifications

Parameter	Min	Typ	Max	Notes
<b>Remote On/Off</b>				
Signal Low (Unit Off)	-0.3V	-	0.4V	x7BA-06E2A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	2.5V	-	14V	
Signal Low (Unit On)	-0.3V	-	0.4V	x7BA-06E2AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5V	-	14V	
<b>Voltage Sequencing</b>				
Sequencing Voltage	0.05V	-	Vin	Sequencing Voltage should be higher than output voltage.
Sequencing Slew Rate Capability	-	-	2V/mS	
Sequencing Delay Time	10mS	-	-	Delay from Vin, min to application of voltage on SEQ pin
Tracking Accuracy				
Power-Up	-	100mV	200mV	
Power-Down	-	200mV	400mV	

## Output Trim Equations

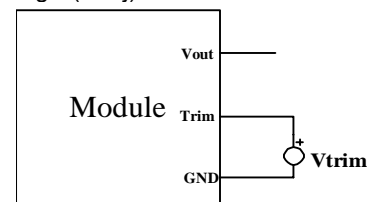
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trim} = \frac{10.507}{V_{adj} - 0.7525} - 1$$



Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

$$V_{trim} = 0.7 - 0.0667 \times (V_{adj} - 0.7525)$$



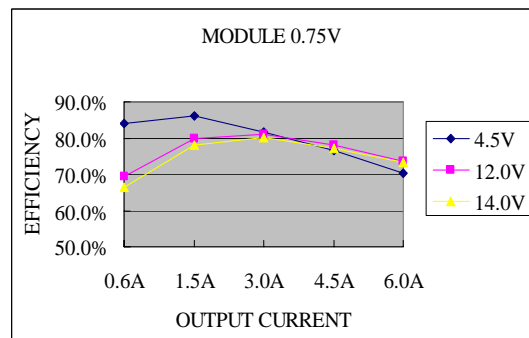
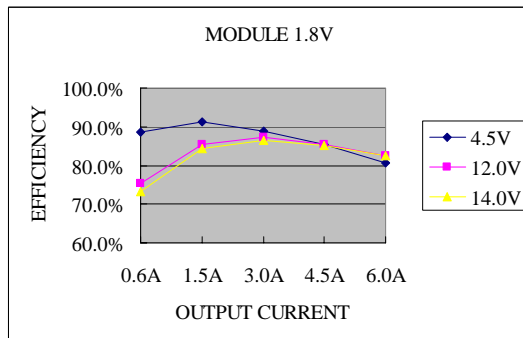
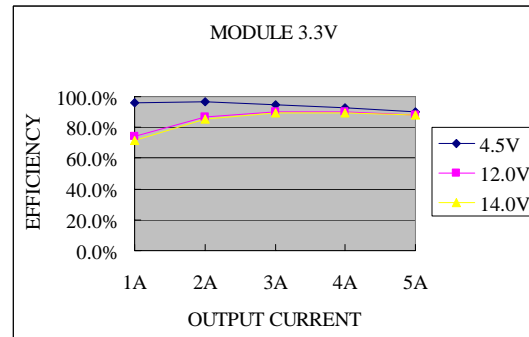
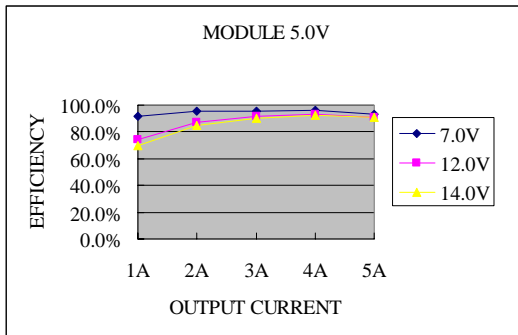
# NON-ISOLATED DC/DC CONVERTERS

4.5V-14V Input

0.75V-5.0V/6A Output



## Efficiency Data



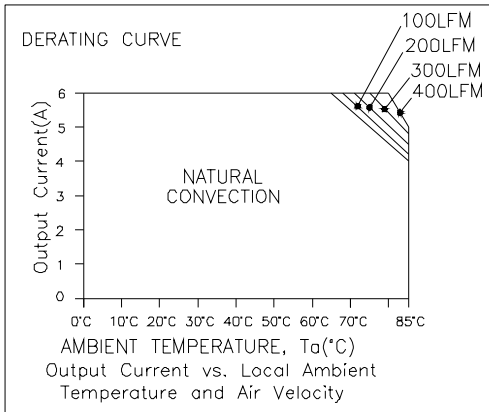
# NON-ISOLATED DC/DC CONVERTERS

4.5V-14V Input

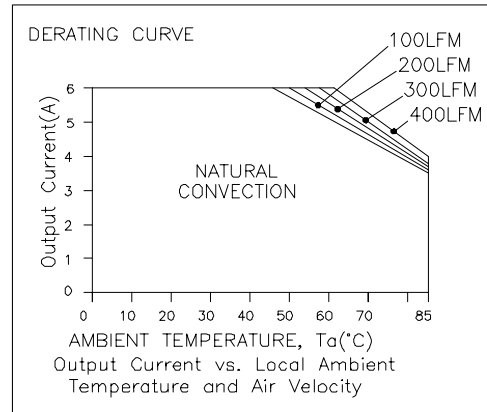
0.75V-5.0V/6A Output



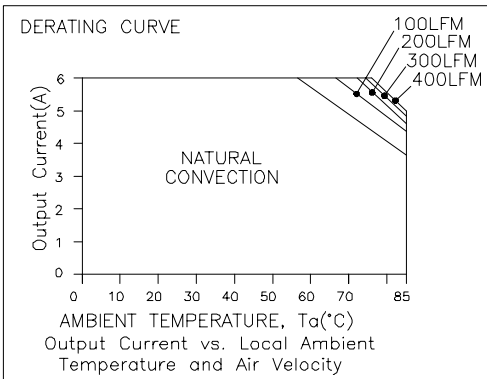
## Thermal Derating Curves



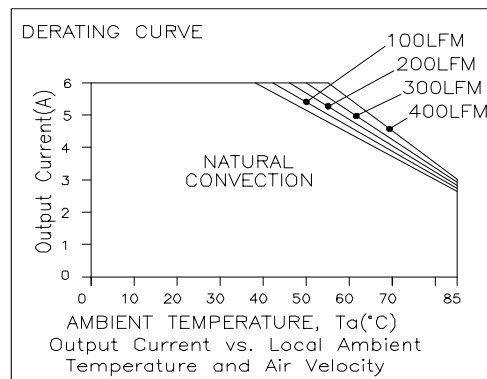
S7BA-06E2Ax, Vo=0.75V



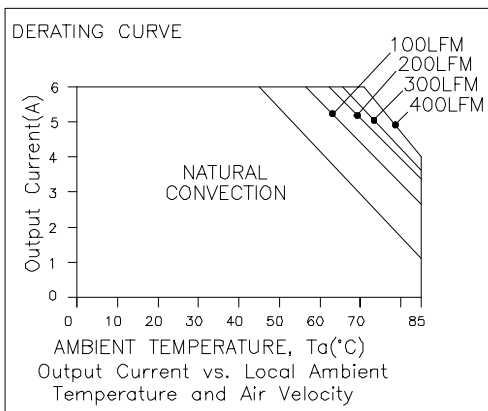
V7BA-06E2Ax, Vo=0.75V



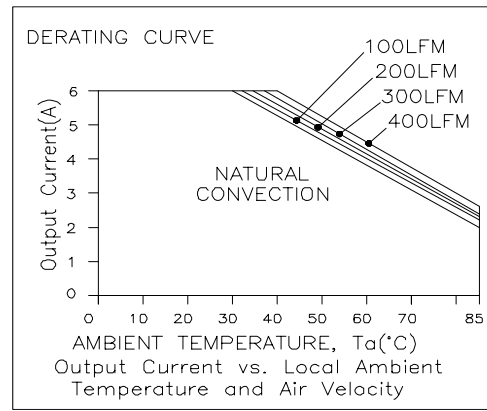
S7BA-06E2Ax, Vo=2.5V



V7BA-06E2Ax, Vo=2.5V



S7BA-06E2Ax, Vo=5.0V



V7BA-06E2Ax, Vo=5.0V

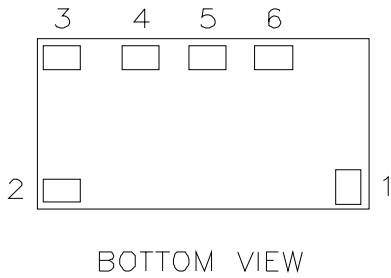
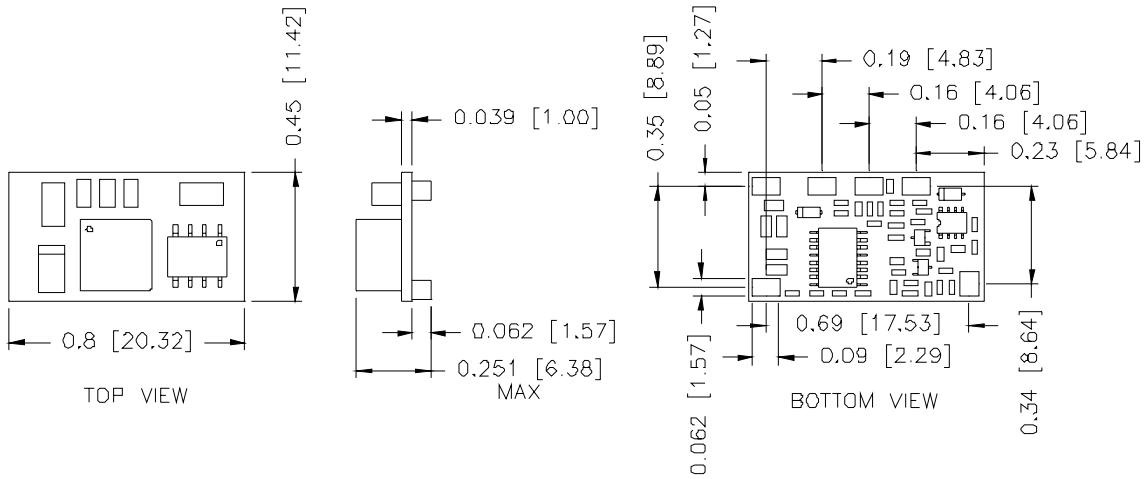
# NON-ISOLATED DC/DC CONVERTERS

4.5V-14V Input

0.75V-5.0V/6A Output



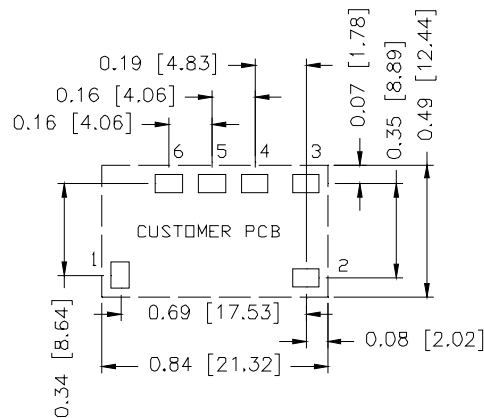
## S7BA-06E2Ax



### Pin Connections

Pin	Function
1	Remote On/Off
2	Vin+
3	SEQ
4	Ground
5	Trim
6	Vout+

### RECOMMENDED PAD LAYOUT



### PAD SIZE:

MIN: 0.12" \* 0.095" (3.05mm \* 2.41mm)

MAX: 0.135" \* 0.11" (3.43mm \* 2.79mm)

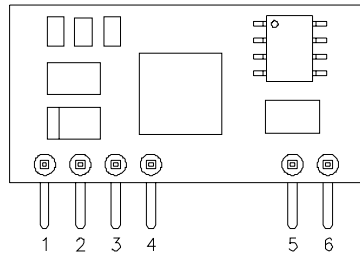
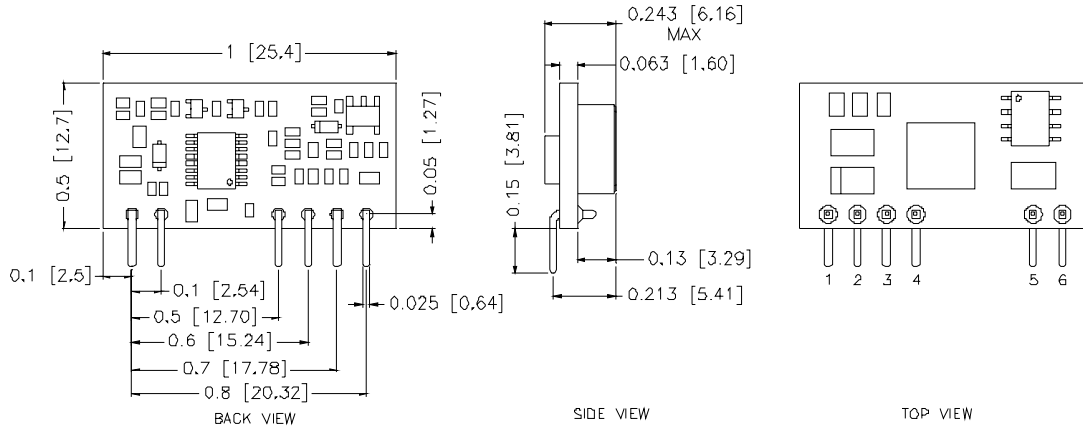
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4.5V-14V Input

0.75V-5.0V/6A Output



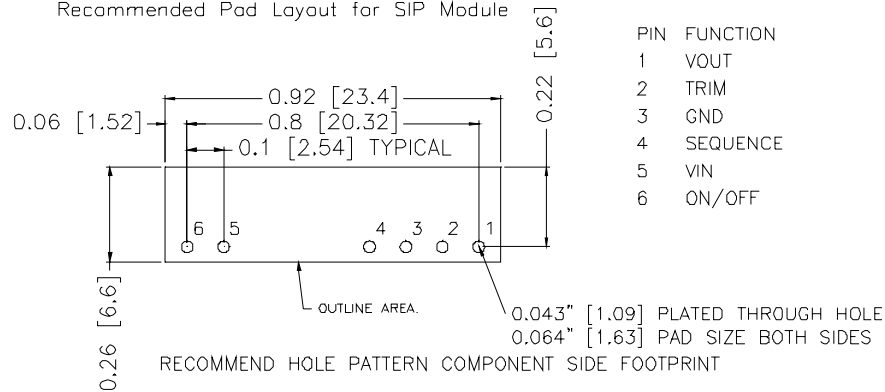
## V7BA-06E2Ax



### Pin Connections

Pin	Function
1	Vout+
2	Trim
3	Ground
4	SEQ
5	Vin+
6	Remote On/Off

Recommended Pad Layout for SIP Module



PIN	FUNCTION
1	VOUT
2	TRIM
3	GND
4	SEQUENCE
5	VIN
6	ON/OFF

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