

## NON-ISOLATED DC/DC CONVERTERS

8.3V-14V Input

0.75V-5.0V/6A Output

**bel**  
POWER PRODUCTS

### S7BA-06A2AX Series PRELIMINARY

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Remote On/Off
- Flexible Output Voltage Sequencing
- Under-voltage Lockout (UVLO)
- Over Temperature Protection
- OCP/SCP
- Wide Input
- Wide Trim
- Active Low/High (option)



### Description

The Bel S7BA-06A2AX modules are a series of non-isolated dc-dc converters that deliver up to 6A of output current with full load efficiency of 89% at 3.3V output. These modules provide precisely regulated voltage programmable via external resistor from 0.75V to 5.0V over a wide range of input voltage (8.3-14V). These modules have a sequencing feature that enables designers to implement various types of output voltage sequencing when powering multiple voltages on a board. The open-frame construction and small footprint enable designers to develop cost and space-efficient solutions. Standard features include remote On/Off, over current protection, short current protection, wide input, and programmable output voltage.

### Part Selection

| Output Voltage | Input Voltage | Max. Output Current | Max. Output Power | Typical Efficiency | Model Number Active Low | Model Number Active High |
|----------------|---------------|---------------------|-------------------|--------------------|-------------------------|--------------------------|
| 0.75 - 5.0V    | 8.3 - 14V     | 6A                  | 30.0W             | 89%                | S7BA-06A2AL             | S7BA-06A2A0              |

### Absolute Maximum Ratings

| Parameter                       | Min   | Typ | Max             | Notes |
|---------------------------------|-------|-----|-----------------|-------|
| Input Voltage (continuous)      | -0.3V | -   | 15V             |       |
| 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           |       |

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

1. S7BA-06A2AX 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

8.3V-14V Input      0.75V-5.0V/6A Output



## Input Specifications

| Parameter                              | Min  | Typ                   | Max                  | Notes   |
|--|------|-----------------------|----------------------|---|
| Input Voltage                          |      |                       |                      |   |
| $V_o, \text{set} \leq 3.63\text{V}$    | 8.3V | 12V                   | 14V                  |   |
| $V_o, \text{set} > 3.63\text{V}$       | 8.3V | 12V                   | 13.2V                |   |
| Input Current (full load)              |      |                       |                      |   |
| $V_o=5.0\text{V}$                      | -    | 2.75A                 | 4.0A                 |   |
| $V_o=3.3\text{V}$                      | -    | 1.85A                 | 2.8A                 |   |
| $V_o=2.5\text{V}$                      | -    | 1.45A                 | 2.2A                 |   |
| $V_o=1.8\text{V}$                      | -    | 1.05A                 | 1.6A                 |   |
| $V_o=1.5\text{V}$                      | -    | 0.95A                 | 1.4A                 |   |
| $V_o=1.2\text{V}$                      | -    | 0.75A                 | 1.1A                 |   |
| $V_o=1.0\text{V}$                      | -    | 0.65A                 | 1.0A                 |   |
| $V_o=0.75\text{V}$                     | -    | 0.55A                 | 0.8A                 |   |
| Input Current (no load)                |      |                       |                      |   |
| $V_o=5.0\text{V}$                      | -    | -                     | 100mA                |   |
| $V_o=0.75\text{V}$                     | -    | -                     | 20mA                 |   |
| Remote Off Input Current               | -    | 1mA                   | 2mA                  |   |
| Input Reflected Ripple Current (pk-pk) | -    | 120mA                 | -                    | Tested with two 100uF/25V tan input capacitors & simulated source impedance of 1uH, 5Hz to 20MHz. |
| Input Reflected Ripple Current (RMS)   | -    | 40mA                  | -                    |   |
| $I^2t$ Inrush Current Transient        | -    | 0.002A <sup>2</sup> s | 0.02A <sup>2</sup> s |   |
| Turn-on Voltage Threshold              | -    | 8.1V                  | 8.2V                 |   |
| Turn-off Voltage Threshold             | -    | 7.5V                  | 8.0V                 |   |

## Output Specifications

| Parameter   | Min                              | Typ                    | Max                    | Notes  |
|---|----------------------------------|------------------------|------------------------|--|
| Output Voltage Set Point                                  | -2% $V_o, \text{set}$            | -                      | 2% $V_o, \text{set}$   | $V_{in}=12\text{V}$ , full load  |
| Output Voltage Set Point                                  | -2.5% $V_o, \text{set}$          | -                      | 3.5% $V_o, \text{set}$ | Over all operating input voltages, resistive loads and temperature conditions                                    |
| Adjustment Range Selected by External Resistor or Voltage | 0.7525V                          | -                      | 5.0V                   |  |
| Load Regulation   | -                                | 0.4% $V_o, \text{set}$ | -                      | $I_o=I_o$ , min to $I_o$ , max   |
| Line Regulation   | -                                | 0.3% $V_o, \text{set}$ | -                      | $V_{in}=V_{in}$ , min to $V_{in}$ , max  |
| Regulation Over Temperature (-40°C to +85°C)              | -                                | 0.5% $V_o, \text{set}$ | -                      | $T_{ref}=T_a$ , min to $T_a$ , max   |
| Output Current  | 0A                               | -                      | 6A                     |  |
| Current Limit Threshold                                   | 7.2A                             | -                      | 18A                    |  |
| Short Circuit Surge Transient                             | -                                | 0.25A <sup>2</sup> s   | -                      |  |
| Ripple and Noise (pk-pk)                                  | -                                | 50mV                   | 75mV                   | Tested with 0-20MHz, with 10uF tantalum cap. & 1uF ceramic cap.  |
| Ripple and Noise (RMS)                                    | -                                | 15mV                   | 30mV                   |  |
| Turn on Time  | -                                | 8mS                    | 10mS                   |  |
| Overshoot at Turn on                                      | -                                | 0%                     | 3%                     |  |
| Output Capacitance  |                                  |                        |                        |  |
| ESR $\geq 1\text{mohm}$                                   | 0uF                              | -                      | 1000uF                 |  |
| ESR $\geq 10\text{mohm}$                                  | 0uF                              | -                      | 3000uF                 |  |
| <b>Transient Response</b>                                 |                                  |                        |                        |  |
| 50% ~ 100% Max Load                                       | $V_o = 0.75\text{V} - 5\text{V}$ | -                      | 200mV                  | $di/dt=2.5\text{A}/\mu\text{S}$ ; $V_{in}=12\text{V}$ ; and with 10uF tantalum cap. & 1uF ceramic cap. at output |
| Settling Time   |                                  | -                      | 50uS                   |  |
| 100% ~ 50% Max Load                                       |                                  | -                      | 200mV                  |  |
| Settling Time   |                                  | -                      | 50uS                   |  |

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

# NON-ISOLATED DC/DC CONVERTERS

8.3V-14V Input      0.75V-5.0V/6A Output



## General Specifications

| Parameter                 | Min                  | Typ    | Max    | Notes |                                |
|---------------------------|----------------------|--------|--------|-------|--------------------------------|
| Efficiency                | Vo=5.0V              | 90%    | 92%    | -     | Measured at Vin=12V, full load |
|                           | Vo=3.3V              | 87%    | 89%    | -     |                                |
|                           | Vo=2.5V              | 85%    | 88%    | -     |                                |
|                           | Vo=1.8V              | 83%    | 86%    | -     |                                |
|                           | Vo=1.5V              | 81%    | 84%    | -     |                                |
|                           | Vo=1.2V              | 79%    | 82%    | -     |                                |
|                           | Vo=1.0V              | 76%    | 79%    | -     |                                |
|                           | Vo=0.75V             | 71%    | 74%    | -     |                                |
| Switching Frequency       | 250KHz               | 300KHz | 350KHz |       |                                |
| Over Temperature Shutdown | -                    | 150°C  | -      |       |                                |
| Dimensions                |                      |        |        |       |                                |
| Inches (L × W × H)        | 0.8 x 0.45 x 0.251   |        |        |       |                                |
| Millimeters (L × W × H)   | 20.32 x 11.42 x 6.38 |        |        |       |                                |
| Weight                    | -                    | 5g     | -      |       |                                |

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

## Control Specifications

| Parameter                       | Min        | Typ | Max   | Notes  |
|---------------------------------|------------|-----|-------|--|
| Signal Low (Unit Off)           | -0.3V      | -   | 0.4V  | S7BA-06A2A0; Remote On/Off pin open, Unit on.            |
| Signal High (Unit On)           | 2.5V       | -   | 14V   |  |
| Signal Low (Unit On)            | -0.3V      | -   | 0.4V  | S7BA-06A2AL; Remote On/Off pin open, Unit on.            |
| Signal High (Unit Off)          | 2.5V       | -   | 14V   |  |
| 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 |  |
|                                 | Power-Down | -   | 200mV |  |

## 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.

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

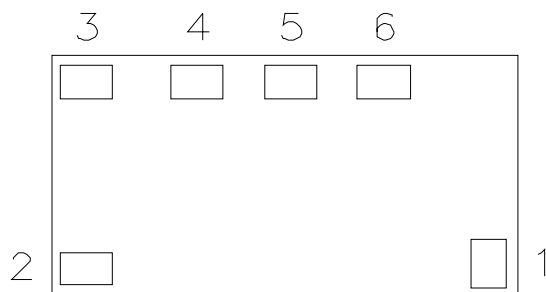
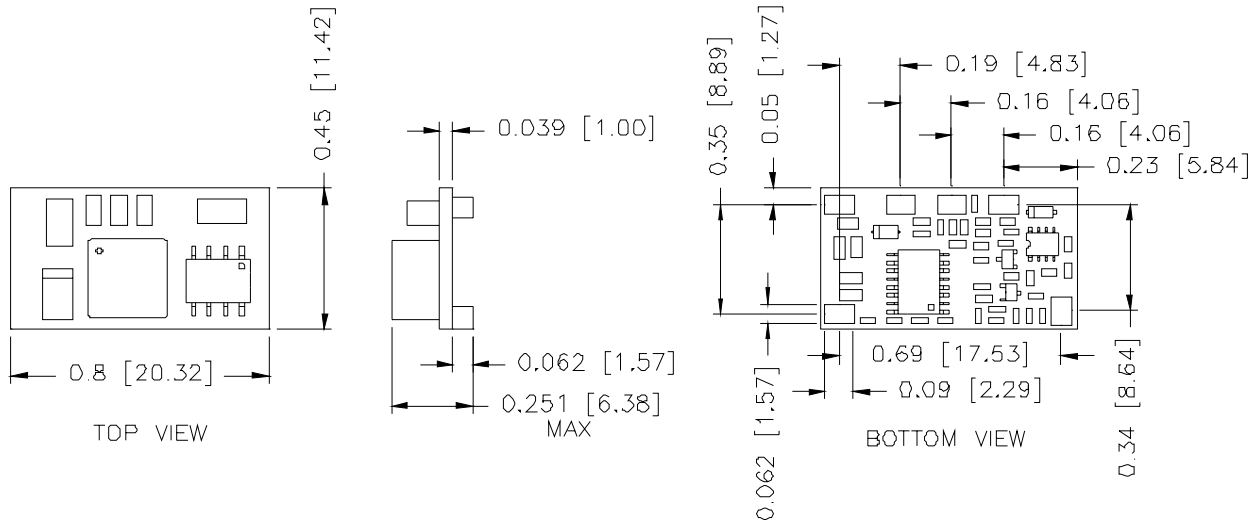
Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

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

# NON-ISOLATED DC/DC CONVERTERS

8.3V-14V Input

0.75V-5.0V/6A Output



BOTTOM VIEW

## Pin Connections

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

©2004 Bel Fuse Inc. Specifications subject to change without notice. 041204

### CORPORATE

**Bel Fuse Inc.**  
 206 Van Vorst Street  
 Jersey City, NJ 07302  
 Tel 201-432-0463  
 Fax 201-432-9542  
[www.belfuse.com](http://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](http://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](http://www.belfuse.com)