

## NON-ISOLATED DC/DC CONVERTERS

4.5V-32V Input

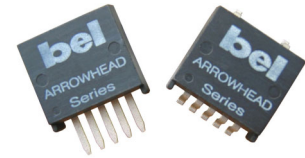
1.2V-5.0V/1A Output

**bel**  
POWER PRODUCTS

### x7AH-01Hxx0

### Series

- Non-Isolated
- Remote On/Off
- Input Under Voltage Lockout (UVLO)
- OCP/SCP
- Trim Function
- Low profile package (7.82mm)



### Description

The Bel x7AH-01Hxx0 series are part of the low cost non-isolated DC/DC converter series. These modules use a SMD or vertical mount package for ease of layout and space savings. The output is closely regulated and the efficiency of 5V output is typically 90% 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 |
|----------------|---------------|---------------------|-------------------|--------------------|---------------------------|----------------------------|
| 5.0V           | 8.0 – 32V     | 1A                  | 5.0W              | 90%                | S7AH-01H500               | V7AH-01H500                |
| 3.3V           | 4.5 – 32V     | 1A                  | 3.3W              | 86%                | S7AH-01H330               | V7AH-01H330                |
| 2.5V           | 4.5 – 32V     | 1A                  | 2.5W              | 83%                | S7AH-01H250               | V7AH-01H250                |
| 1.8V           | 4.5 – 32V     | 1A                  | 1.8W              | 79%                | S7AH-01H180               | V7AH-01H180                |
| 1.5V           | 4.5 – 32V     | 1A                  | 1.5W              | 76%                | S7AH-01H150               | V7AH-01H150                |
| 1.2V           | 4.5 – 32V     | 1A                  | 1.2W              | 73%                | S7AH-01H120               | V7AH-01H120                |

**Note:** Add “0” suffix at the end of the model number to indicate “Tube Packaging”, and “R” for “Reel Packaging”, and “G” for “Tray Packaging”.

### Absolute Maximum Ratings

| Parameter                      | Min   | Typ | Max   | Notes |
|--------------------------------|-------|-----|-------|-------|
| Input Voltage (continuous)     | -0.3V | -   | 34V   |       |
| Output Enable Terminal Voltage | -0.3V | -   | 12V   |       |
| Ambient Temperature            | -40°C | -   | 85°C  |       |
| Storage Temperature            | -40°C | -   | 125°C |       |

### Input Specifications

| Parameter                 | Min  | Typ | Max   | Notes |
|---------------------------|------|-----|-------|-------|
| Input Voltage             |      |     |       |       |
| Vo=5.0V                   | 8.0V | 20V | 32V   |       |
| Vo=1.2V-3.3V              | 4.5V | 20V | 32V   |       |
| Input Current (no load)   | -    | 5mA | 8mA   |       |
| Input Current (full load) |      |     |       |       |
| Vo=5.0V                   | -    | -   | 0.30A |       |
| Vo=3.3V                   | -    | -   | 0.20A |       |
| Vo=2.5V                   | -    | -   | 0.16A |       |
| Vo=1.8V                   | -    | -   | 0.12A |       |
| Vo=1.5V                   | -    | -   | 0.11A |       |
| Vo=1.2V                   | -    | -   | 0.09A |       |
| Remote Off Input Current  | -    | 2mA | 5mA   |       |

## NON-ISOLATED DC/DC CONVERTERS

4.5V-32V Input

1.2V-5.0V/1A Output



### Input Specifications (continued)

| Parameter                                 | Min | Typ                  | Max                 | Notes                                                                                                                                                 |
|-------------------------------------------|-----|----------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Reflected Ripple Current (pk-pk)    | -   | 300mA                | 420mA               | Tested with simulated source impedance of 500nH, 5Hz to 20MHz and one 100uF/50V electrolytic capacitor and a 3.3uF/50V ceramic capacitor at the input |
| Input Reflected Ripple Current (RMS)      | -   | 100mA                | 160mA               |                                                                                                                                                       |
| I <sup>2</sup> t Inrush Current Transient | -   | 0.02A <sup>2</sup> s | 0.1A <sup>2</sup> s |                                                                                                                                                       |
| Turn on Voltage Threshold                 |     |                      |                     |                                                                                                                                                       |
| Vo=5.0V                                   | -   | 5.0V                 | 7.0V                |                                                                                                                                                       |
| Vo=1.2V-3.3V                              | -   | 4.1V                 | 4.5V                |                                                                                                                                                       |
| Turn off Voltage Threshold                |     |                      |                     |                                                                                                                                                       |
| Vo=5.0V                                   | -   | 3.6V                 | 5.0V                |                                                                                                                                                       |
| Vo=1.2V-3.3V                              | -   | 3.3V                 | 4.0V                |                                                                                                                                                       |

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

### Output Specifications

| Parameter                                    | Min    | Typ                  | Max                 | Notes                                         |
|----------------------------------------------|--------|----------------------|---------------------|-----------------------------------------------|
| Output Voltage Set Point                     |        |                      |                     | Test conditions:<br>Vin=20V, Io=50% full load |
| Vo=5.0V                                      | 4.90V  | 5.0V                 | 5.10V               |                                               |
| Vo=3.3V                                      | 3.234V | 3.3V                 | 3.366V              |                                               |
| 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              |                                               |
| Line Regulation                              |        |                      |                     |                                               |
| Vo=5.0V                                      | -      | ±5mV                 | ±10mV               |                                               |
| Vo=3.3V                                      | -      | ±3mV                 | ±6mV                |                                               |
| Vo=2.5V                                      | -      | ±2mV                 | ±5mV                |                                               |
| Vo=1.8V                                      | -      | ±2mV                 | ±4mV                |                                               |
| Vo=1.5V                                      | -      | ±1mV                 | ±3mV                |                                               |
| Vo=1.2V                                      | -      | ±1mV                 | ±2mV                |                                               |
| Load Regulation                              |        |                      |                     |                                               |
| Vo=5.0V                                      | -      | ±5mV                 | ±10mV               |                                               |
| Vo=3.3V                                      | -      | ±3mV                 | ±6mV                |                                               |
| Vo=2.5V                                      | -      | ±2mV                 | ±5mV                |                                               |
| Vo=1.8V                                      | -      | ±2mV                 | ±4mV                |                                               |
| Vo=1.5V                                      | -      | ±1mV                 | ±3mV                |                                               |
| Vo=1.2V                                      | -      | ±1mV                 | ±2mV                |                                               |
| Regulation Over Temperature (-40°C to +85°C) | -      | ±10mV                | ±20mV               |                                               |
| Output Current                               | 0A     | -                    | 1A                  |                                               |
| Current Limit Threshold                      | 2A     | -                    | 3A                  |                                               |
| Short Circuit Surge Transient                | -      | 0.02A <sup>2</sup> s | 0.1A <sup>2</sup> s |                                               |
| Ripple and Noise (RMS)                       | -      | 6mV                  | 10mV                | Test condition: 0-20MHz BW                    |
| Ripple and Noise (pk-pk)                     | -      | 60mV                 | 100mV               |                                               |
| Turn on Time                                 | -      | 6mS                  | 30mS                |                                               |
| Overshoot at Turn on                         | -      | 2%                   | 5%                  |                                               |
| Output Capacitance                           | 0uF    | -                    | 400uF               |                                               |

## NON-ISOLATED DC/DC CONVERTERS

4.5V-32V Input

1.2V-5.0V/1A Output



### Output Specifications (continued)

| Parameter              |               |                   | Min | Typ   | Max   | Notes                                          |
|------------------------|---------------|-------------------|-----|-------|-------|------------------------------------------------|
| Transient Response     |               |                   |     |       |       |                                                |
| 50% ~ 100%<br>Max Load | Overshoot     | Vo=5.0V           | -   | 140mV | 170mV | Test conditions:<br>di/dt = 0.5A/uS; Vin = 20V |
|                        | Settling Time |                   | -   | 100uS | 130uS |                                                |
| 100% ~ 50%<br>Max Load | Overshoot     |                   | -   | 140mV | 170mV |                                                |
|                        | Settling Time |                   | -   | 100uS | 130uS |                                                |
| 50% ~ 100%<br>Max Load | Overshoot     | Vo=3.3V           | -   | 80mV  | 120mV |                                                |
|                        | Settling Time |                   | -   | 150uS | 200uS |                                                |
| 100% ~ 50%<br>Max Load | Overshoot     |                   | -   | 80mV  | 120mV |                                                |
|                        | Settling Time |                   | -   | 150uS | 200uS |                                                |
| 50% ~ 100%<br>Max Load | Overshoot     | Vo=2.5V           | -   | 70mV  | 110mV |                                                |
|                        | Settling Time |                   | -   | 120uS | 160uS |                                                |
| 100% ~ 50%<br>Max Load | Overshoot     |                   | -   | 70mV  | 110mV |                                                |
|                        | Settling Time |                   | -   | 120uS | 160uS |                                                |
| 50% ~ 100%<br>Max Load | Overshoot     | Vo=1.2V -<br>1.8V | -   | 60mV  | 100mV |                                                |
|                        | Settling Time |                   | -   | 100uS | 130uS |                                                |
| 100% ~ 50%<br>Max Load | Overshoot     |                   | -   | 60mV  | 100mV |                                                |
|                        | Settling Time |                   | -   | 100uS | 130uS |                                                |

**Note:** All specifications are typical at 20V input, full load at 25°C unless otherwise stated.

### General Specifications

| Parameter                  |         | Min                                        | Typ    | Max    | Notes                                                           |
|----------------------------|---------|--------------------------------------------|--------|--------|-----------------------------------------------------------------|
| Efficiency                 | Vo=5.0V | 87%                                        | 90%    | -      | Measured at Vin=20V, full load                                  |
|                            | Vo=3.3V | 83%                                        | 86%    | -      |                                                                 |
|                            | Vo=2.5V | 80%                                        | 83%    | -      |                                                                 |
|                            | Vo=1.8V | 76%                                        | 79%    | -      |                                                                 |
|                            | Vo=1.5V | 73%                                        | 76%    | -      |                                                                 |
|                            | Vo=1.2V | 70%                                        | 73%    | -      |                                                                 |
| Switching Frequency        | Vo=5.0V | 130KHz                                     | 150KHz | 170KHz |                                                                 |
|                            | Vo=3.3V | 270KHz                                     | 290KHz | 310KHz |                                                                 |
|                            | Vo=2.5V | 190KHz                                     | 220KHz | 250KHz |                                                                 |
|                            | Vo=1.8V | 150KHz                                     | 170KHz | 190KHz |                                                                 |
|                            | Vo=1.5V | 130KHz                                     | 150KHz | 170KHz |                                                                 |
|                            | Vo=1.2V | 100KHz                                     | 120KHz | 140KHz |                                                                 |
| Output Trim Range          |         | 90%Vo                                      | -      | 110%Vo |                                                                 |
| MTBF                       |         | 8,040,000 hours                            |        |        | Calculated Per Bell Core TR-332 (Io = 0.8A, Vin=20V; Ta = 25°C) |
| Dimensions (surface mount) |         | 0.78 x 0.70 x 0.32<br>19.81 x 17.78 x 8.13 |        |        |                                                                 |
| Inches (L x W x H)         |         |                                            |        |        |                                                                 |
| Millimeters (L x W x H)    |         |                                            |        |        |                                                                 |
| 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   | -      |                                                                 |

## NON-ISOLATED DC/DC CONVERTERS

4.5V-32V Input

1.2V-5.0V/1A Output



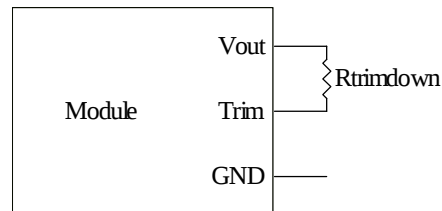
### Control Specifications

| Parameter              | Min   | Typ | Max | Notes                            |
|------------------------|-------|-----|-----|----------------------------------|
| <b>Remote On/Off</b>   |       |     |     |                                  |
| Signal Low (Unit On)   | -0.3V | -   | 1V  | Remote on/off pin open, unit on. |
| Signal High (Unit Off) | 2.8V  | -   | 12V |                                  |

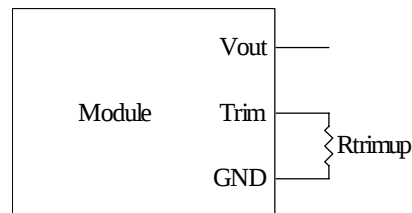
### Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage ( $V_{adj}$ ) and the nominal output voltage of the converter ( $V_o$ ) 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.

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



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



| <b>Vo</b> | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> |
|-----------|----------|----------|----------|----------|
| 5.0       | 153.56   | 85.20    | 29.20    | 48.70    |
| 3.3       | 53.80    | 21.50    | 17.20    | X        |
| 2.5       | 36.70    | 21.50    | 17.20    | X        |
| 1.8       | 21.70    | 21.50    | 17.20    | X        |
| 1.5       | 15.20    | 21.50    | 17.20    | X        |
| 1.2       | 8.70     | 21.50    | 17.20    | X        |

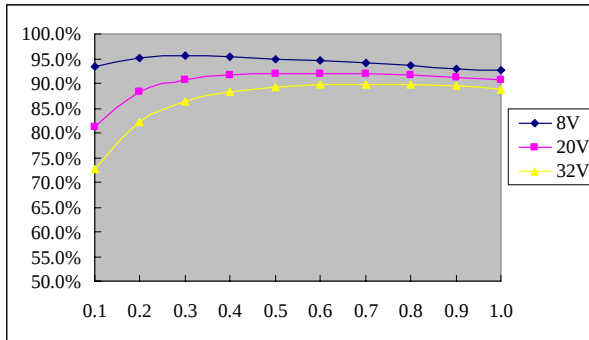
## NON-ISOLATED DC/DC CONVERTERS

4.5V-32V Input

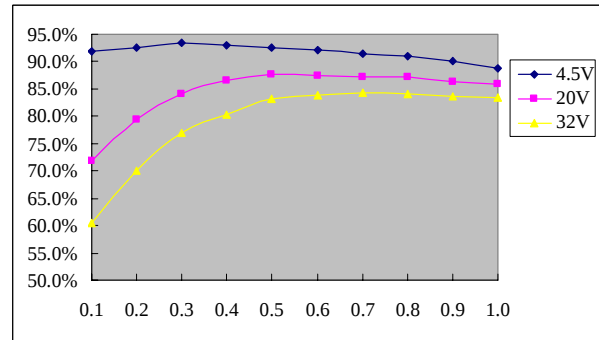
1.2V-5.0V/1A Output

**bel**  
POWER PRODUCTS

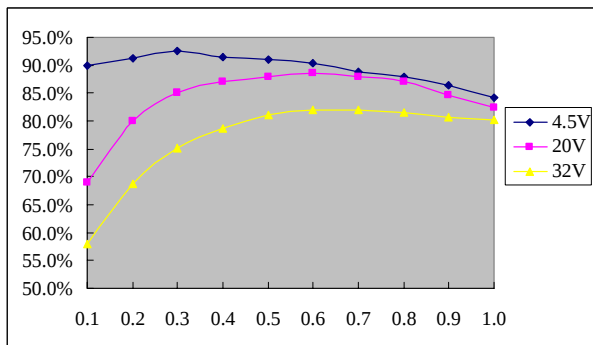
### Efficiency Data



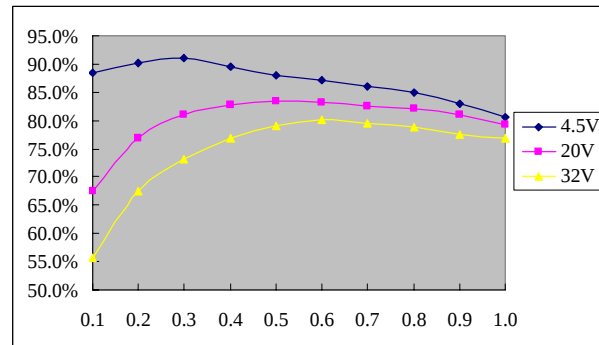
x7AH-01H500



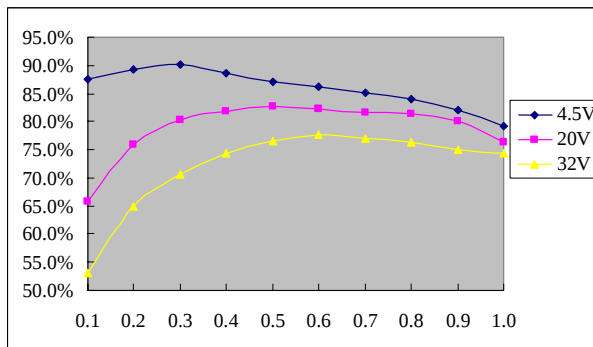
x7AH-01H330



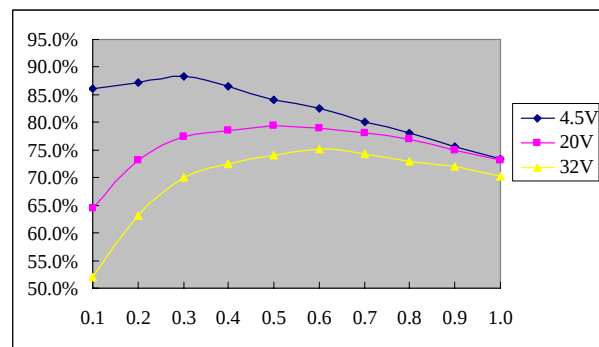
x7AH-01H250



x7AH-01H180



x7AH-01H150



x7AH-01H120

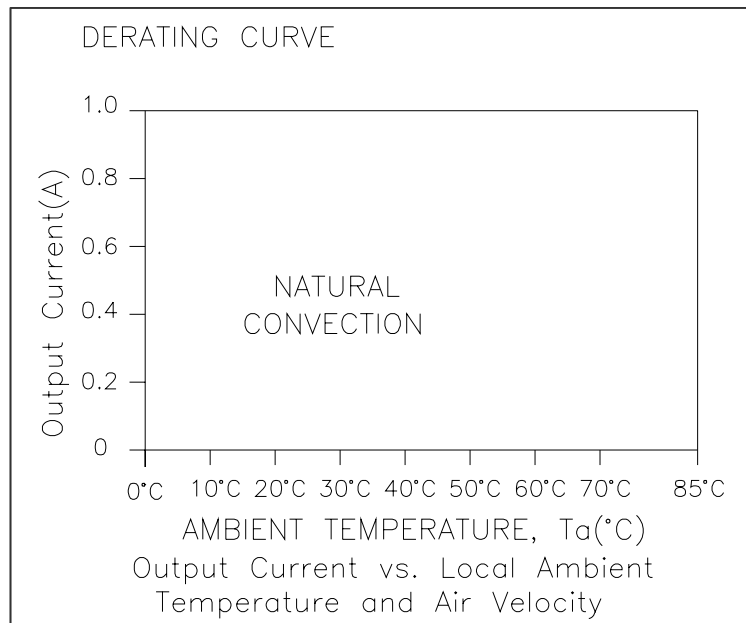
## NON-ISOLATED DC/DC CONVERTERS

4.5V-32V Input

1.2V-5.0V/1A Output

**bel**  
POWER PRODUCTS

### Thermal Derating Curve

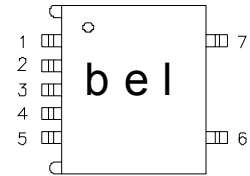
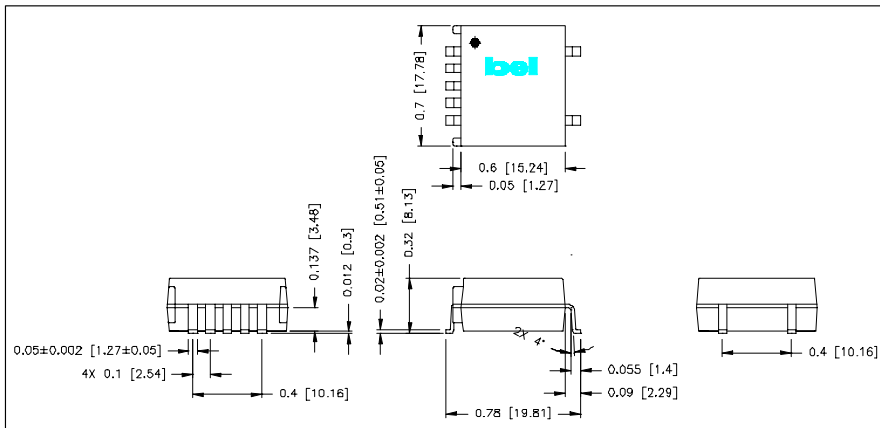


**Test Condition:** Derating curve is tested at nominal input voltage.

# NON-ISOLATED DC/DC CONVERTERS

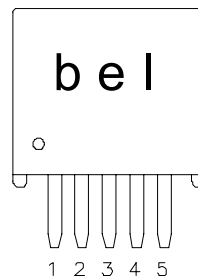
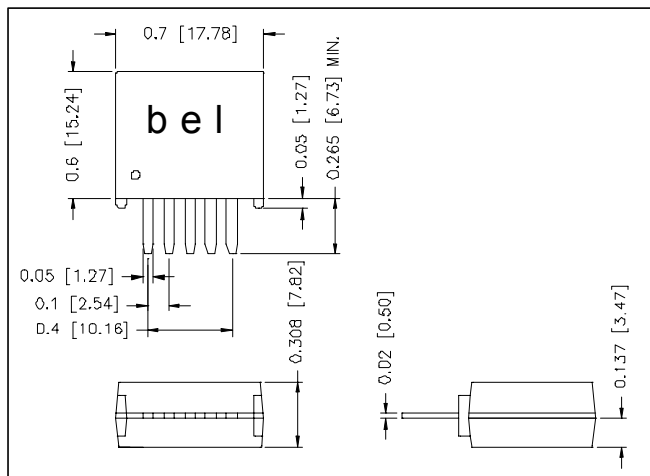
4.5V-32V Input

1.2V-5.0V/1A Output



## Pin Connections

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



## Pin Connections

| Pin | Function               |
|-----|------------------------|
| 1   | Remote On/Off (option) |
| 2   | Vin                    |
| 3   | Ground                 |
| 4   | Vout                   |
| 5   | Trim (option)          |

©2004 Bel Fuse Inc. Specifications subject to change without notice. 112504

## 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)