NON-ISOLATED DC/DC CONVERTERS

3.3 Vdc Input **0.9 Vdc - 2.5 Vdc/3 A Output**

xRAH-03C Series RoHS Compliant Rev.A

- Non-Isolated
- High Efficiency
- Low Cost
- Excellent Thermal Performance
- Input Under Voltage Lockout
- OCP/SCP
- Wide Range Trim
- Remote On/Off
- Industrial Temperature Range
- UL60950-1 Recognized (UL/cUL)

Description

The Bel xRAH-03C1A0 modules are a series of non-isolated, step down dc/dc converters that operate from a nominal 3.3 Vdc source. These converters are available in a range of output voltages from 0.9 Vdc to 2.5 Vdc. It is packaged in a compact, overmolded package rated at 3 A. Optional lead forming provides a vertical mount product for minimal footprint or a surface mount option for a very low profile. The output is closely regulated and the efficiency for 2.5 Vdc output 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
0.9 Vdc - 2.5 Vdc	3.3 Vdc	3 A	7.5 W	93%	SRAH-03C1A0	VRAH-03C1A0
2.5 Vdc	3.3 Vdc	3 A	7.5 W	93%	SRAH-03C250	VRAH-03C250
1.8 Vdc	3.3 Vdc	3 A	5.4 W	89%	SRAH-03C180	VRAH-03C180
1.5 Vdc	3.3 Vdc	3 A	4.5 W	87%	SRAH-03C150	VRAH-03C150
1.2 Vdc	3.3 Vdc	3 A	3.6 W	84%	SRAH-03C120	VRAH-03C120
0.9 Vdc	3.3 Vdc	3 A	2.7 W	81%	SRAH-03C090	VRAH-03C090

Notes: 1. Add “0” suffix at the end of the model number to indicate “Tube Packaging”, and “R” for “Reel Packaging”, and “G” for “Tray Packaging”.
2. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	6 V	
Output Enable Terminal Voltage	-0.3 V	-	6 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	3 V	-	3.6 V	
Input Current (no load)	-	-	110mA	
Input Current (full load)				
V_O=2.5 V	-	-	3.1 A	
V_O=1.8 V	-	-	2.3 A	
V_O=1.5 V	-	-	1.9 A	
V_O=1.2 V	-	-	1.6 A	
V_O=0.9 V	-	-	1.2 A	
Remote Off Input Current	-	7 mA	14 mA	

Input Specifications (continued)

Parameter	Min	Typ	Max	Notes
Input Reflected Ripple Current (pk-pk)	-	50 mA	100 mA	With simulated source impedance of 500 nH, 5 Hz to 20 MHz; use a 270 uF/6.3 V capacitor with ESR=0.03 ohm max, at 100 kHz.
Input Reflected Ripple Current (rms)	-	15 mA	25 mA	
I^2t Inrush Current Transient	-	0.01 A^2s	0.02 A^2s	
Turn on Voltage Threshold	-	2.7 V	-	
Turn off Voltage Threshold	-	2.4 V	-	

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point				
Vo=2.5 V	2.450 V	2.5 V	2.550 V	Test conditions: Vin=3.3 V, Io= full load
Vo=1.8 V	1.764 V	1.8 V	1.836 V	
Vo=1.5 V	1.470 V	1.5 V	1.530 V	
Vo=1.2 V	1.176 V	1.2 V	1.224 V	
Vo=0.9 V	0.882 V	0.9 V	0.918 V	
Line Regulation				
Vo=2.5 V	-	1 mV	5 mV	
Vo=1.8 V	-	1 mV	5 mV	
Vo=1.5 V	-	1 mV	5 mV	
Vo=1.2 V	-	1 mV	5 mV	
Vo=0.9 V	-	1 mV	5 mV	
Load Regulation				
Vo=2.5 V	-	1 mV	5 mV	
Vo=1.8 V	-	1 mV	5 mV	
Vo=1.5 V	-	1 mV	5 mV	
Vo=1.2 V	-	1 mV	5 mV	
Vo=0.9 V	-	1 mV	5 mV	
Regulation Over Temperature (-40 °C to +85 °C)				
Vo=2.5 V	-	10 mV	20 mV	
Vo=1.8 V	-	10 mV	20 mV	
Vo=1.5 V	-	10 mV	20 mV	
Vo=1.2 V	-	10 mV	20 mV	
Vo=0.9 V	-	10 mV	20 mV	
Output Current	0 A	-	3 A	
Current Limit Threshold	5 A	-	9 A	
Short Circuit Surge Transient				
Vo=2.5 V	-	0.04 A^2s	0.08 A^2s	
Vo=1.8 V	-	0.04 A^2s	0.08 A^2s	
Vo=1.5 V	-	0.04 A^2s	0.08 A^2s	
Vo=1.2 V	-	0.04 A^2s	0.08 A^2s	
Vo=0.9 V	-	0.04 A^2s	0.08 A^2s	

Output Specifications (continued)

Parameter			Min	Typ	Max	Notes
Ripple and Noise (rms)						Test conditions: 0-20 MHz BW; 0.1 uF ceramic capacitor and 10 uF tantalum capacitor at the output.
	Vo=2.5 V		-	10 mV	20 mV	
	Vo=1.8 V		-	10 mV	20 mV	
	Vo=1.5 V		-	10 mV	20 mV	
	Vo=1.2 V		-	10 mV	20 mV	
	Vo=0.9 V		-	10 mV	20 mV	
Ripple and Noise (pk-pk)						
	Vo=2.5 V		-	45 mV	70 mV	
	Vo=1.8 V		-	45 mV	70 mV	
	Vo=1.5 V		-	45 mV	70 mV	
	Vo=1.2 V		-	45 mV	70 mV	
	Vo=0.9 V		-	45 mV	70 mV	
Turn on Time			-	7 mS	15 mS	
Overshoot at Turn on			-	0%	1%	
Output Capacitance			0 uF	-	1200 uF	
Transient Response						
50% ~ 100% Max Load	Overshoot	Vo=2.5 V	-	100 mV	130 mV	Test conditions: di/dt=0.5 A/us, Vin=3.3 V, without any external capacitor at the output.
	Settling Time		-	30 uS	60 uS	
100% ~ 50% Max Load	Overshoot		-	100 mV	130 mV	
	Settling Time		-	30 uS	60 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.8 V	-	100 mV	130 mV	
	Settling Time		-	30 uS	60 uS	
100% ~ 50% Max Load	Overshoot		-	100 mV	130 mV	
	Settling Time		-	30 uS	60 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.5 V	-	90 mV	120 mV	
	Settling Time		-	30 uS	60 uS	
100% ~ 50% Max Load	Overshoot		-	90 mV	120 mV	
	Settling Time		-	30 uS	60 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.2 V	-	90 mV	120 mV	
	Settling Time		-	30 uS	60 uS	
100% ~ 50% Max Load	Overshoot		-	90 mV	120 mV	
	Settling Time		-	30 uS	60 uS	
50% ~ 100% Max Load	Overshoot	Vo=0.9 V	-	90 mV	120 mV	
	Settling Time		-	30 uS	60 uS	
100% ~ 50% Max Load	Overshoot		-	90 mV	120 mV	
	Settling Time		-	30 uS	60 uS	

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency V_O=2.5 V V_O=1.8 V V_O=1.5 V V_O=1.2 V V_O=0.9 V	 90% 86% 84% 81% 78%	 93% 89% 87% 84% 81%	 - - - - -	Measured at Vin=3.3 V, full load and Ta=25 °C
Switching Frequency	250 kHz	300 kHz	340 kHz	
Output Trim Range (wide trim)	0	-	292%V_O	Vo=0.9 V
Output Trim Range (narrow trim) Vo=1.2 V - 2.5 V Vo=0.9 V	 90%Vo -	 - -	 110%Vo 110%Vo	
MTBF	3,131,719 hours			Calculated Per Bell Core SR-332 (I_O = Nominal; T_a = 25 °C)
Dimensions (surface mount) Inches (L × W × H) Millimeters (L × W × H)	 0.78 x 0.70 x 0.32 19.81 x 17.78 x 8.13			
Dimensions (vertical) Inches (L × W × H) Millimeters (L × W × H)	 0.70 x 0.308 x 0.65 17.78 x 7.82 x 16.51			
Weight	-	5 g	-	

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

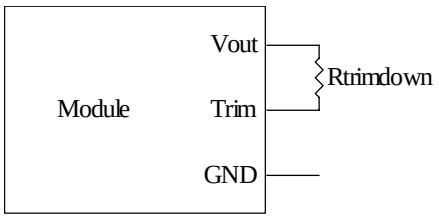
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.3 V	-	0.3 V	Remote on/off pin open, unit on.
Signal High (Unit On)	1.8 V	-	3.6 V	

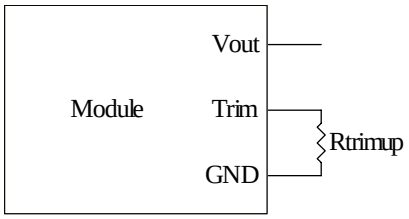
Output Trim Equations

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.

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

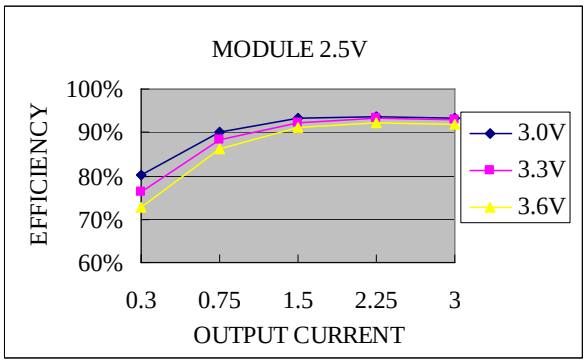


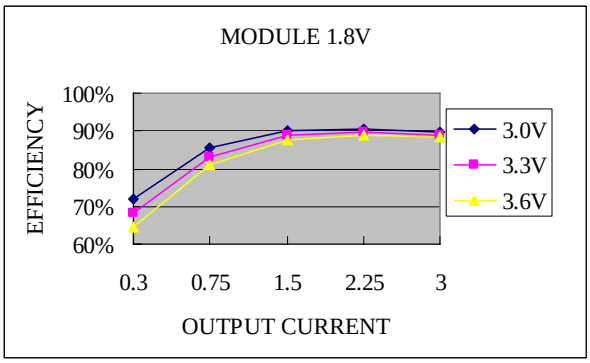
$$R_{trimup} = \frac{C}{V_{adj} - V_{nom}} - D$$

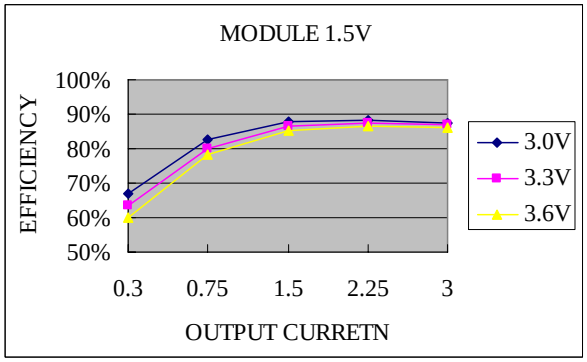


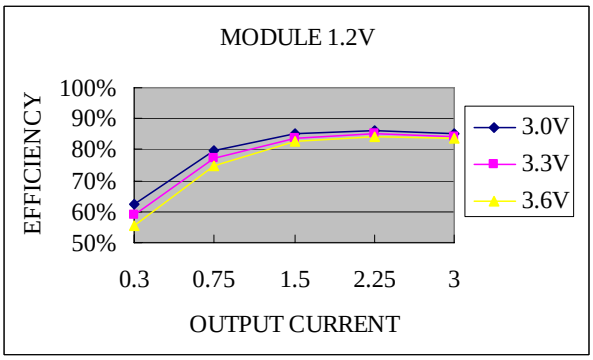
Vnom	A	B	C	D	Notes
0.9 - 2.5	N/A	N/A	3.712	1.54	Vo=0.9 V when Rtrim is open
2.5	7.9117	16.14	3.712	11.5	Vo=2.505 V when Rtrim is open
1.8	4.6538	20.84	3.712	16.2	Vo=1.803 V when Rtrim is open
1.5	3.2633	16.14	3.712	11.5	Vo=1.503 V when Rtrim is open
1.2	1.8699	11.45	3.712	6.81	Vo=1.203 V when Rtrim is open
0.9	N/A	N/A	3.712	33.2	Vo=0.903 V when Rtrim is open

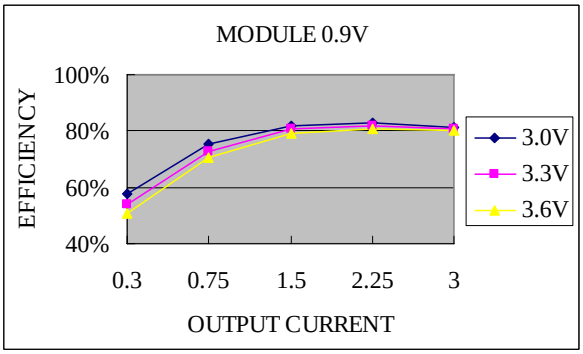
Efficiency Data



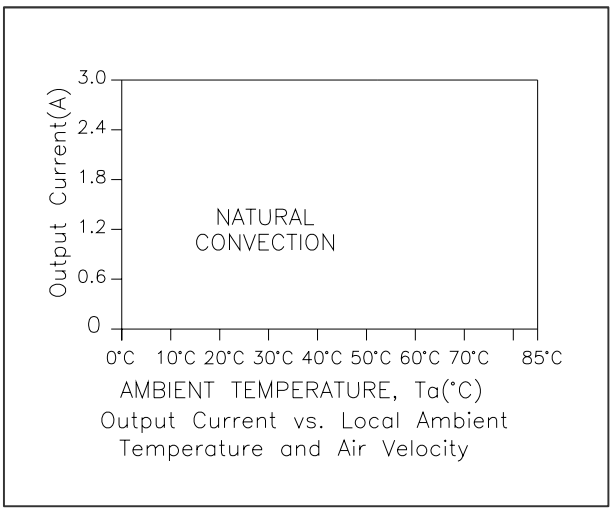




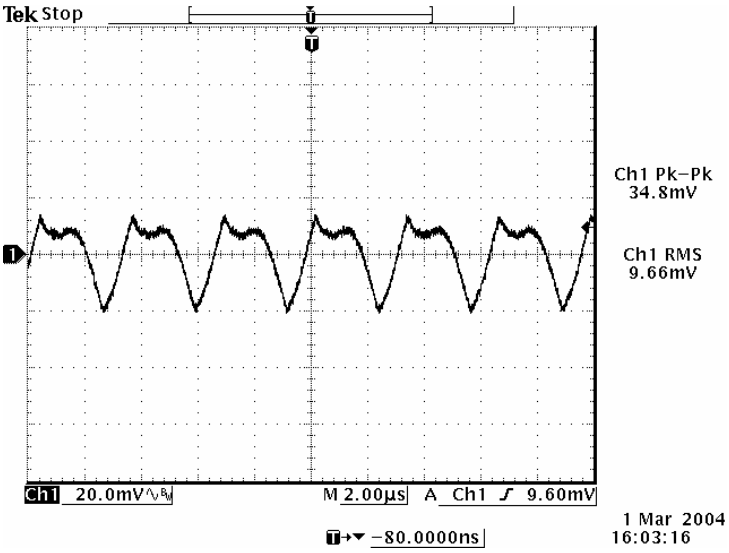




Thermal Derating Curve



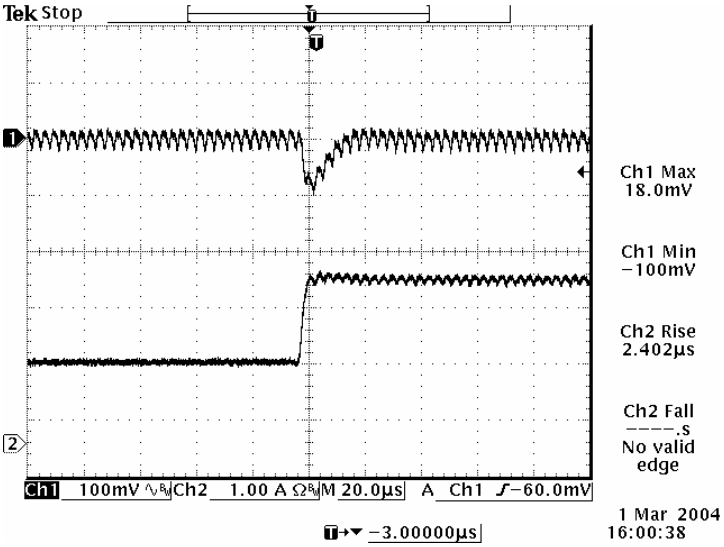
Ripple and Noise Waveform



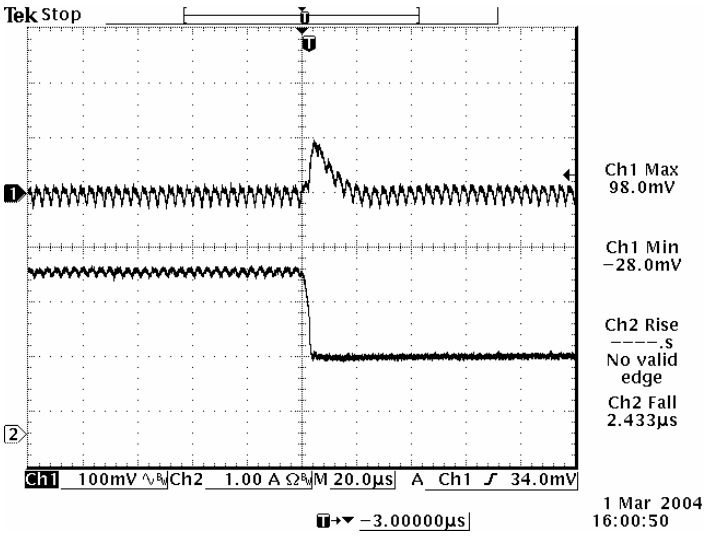
Ripple and noise at full load, 3.3 V input, 2.5 V output

Note: Ripple and Noise with 0.1 uF/16 V X7R ceramic capacitor and 10 uF tantalum capacitor at the output, Ta=25 deg C.

Transient Response Waveforms



50% to 100% load Transient at 3.3 V input, 2.5 V output



100% to 50% load Transient at 3.3 V input, 2.5 V output

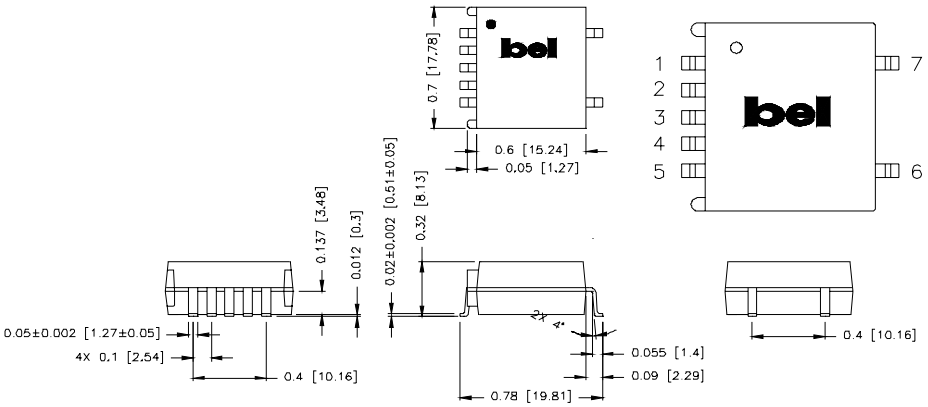
Note: Transient Response at di/dt=0.5A/uS, Ta=25 deg C.

NON-ISOLATED DC/DC CONVERTERS

3.3 Vdc Input **0.9 Vdc - 2.5 Vdc/3 A Output**

Mechanical Outline

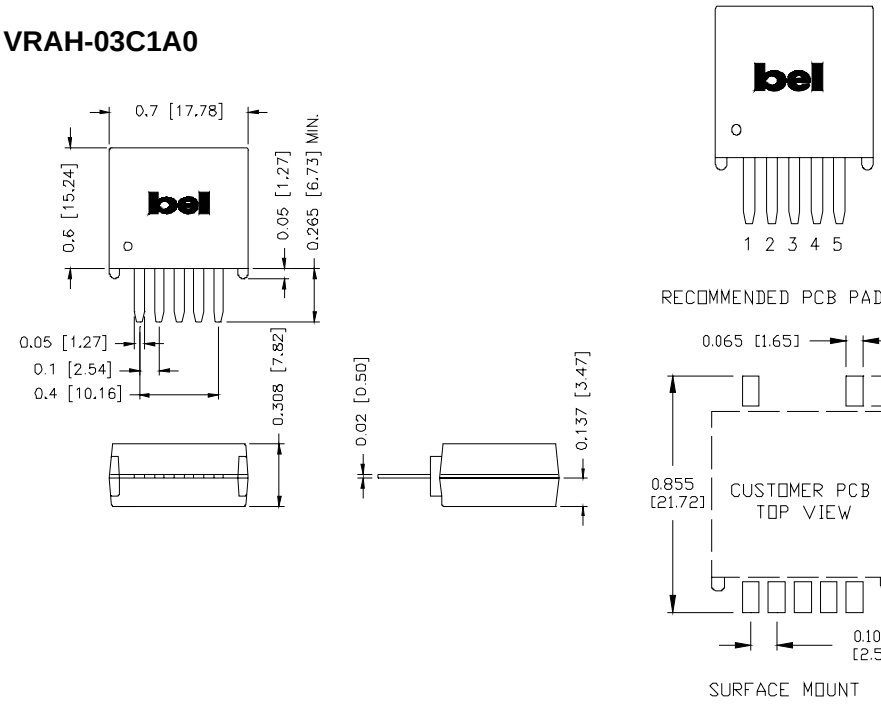
SRAH-03C1A0



Pin Connections

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

VRAH-03C1A0



Pin Connections

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

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products. These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 240 ºC.

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