

NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

GRND-90A161

RoHS Compliant

Rev.A

Features

- Non-Isolated
- High Efficiency
- Fixed Frequency
- Wide Input
- Remote On/Off
- Class 1, Category 2, Non-Isolated DC/DC Converter (refer to IPC-9592)
- Input Under-Voltage Lockout
- OCP/SCP
- 2-Wire Remote sense
- 7 bit VID Digital Voltage Programming
- I2C/SMBus Available – Consult Factory



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The GRND-90A Series are non-isolated step down dc/dc converters providing up to 90 A of output current and designed to be compatible with the Intel VRM11 requirements. Standard features include remote on/off, over current protection, remote sense, VR_Hot signal and a power good signal. This product also makes use of adaptive positioning to improve transient response performance. These products may be used almost anywhere low-voltage silicon is being employed and a nominal 12 Vdc source is available. Typical applications include file servers, work stations and other computing applications.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active High
0.82 Vdc - 1.6 Vdc	10.8 Vdc - 13.2 Vdc	90 A	144 W	83%	GRND-90A161

Notes: Add "G" suffix at the end of the model number to indicate Tray Packaging.

Part Number Explanation

G R ND - 90 A 16 1
1 2 3 4 5 6 7

- 1---Goldfinger
- 2---RoHS 6, change "R" to "7" means RoHS 5
- 3---Series name
- 4---Series code
- 5---Wide input range (10.8-13.2V)
- 6---Wide output range (0.82-1.6V)
- 7---Suffix

NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Continuous non-operating Input Voltage	-0.3	-	15	V	
Remote On/Off	-0.3	-	5.5	V	
Ambient Temperature	0	-	70	°C	
Storage Temperature	-55	-	125	°C	

Note: Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

Input Specifications

Parameter	Min	Typ	Max	Unit	Notes
Operating Input Voltage	10.8	12	13.2	V	
Input Current (full load)	-	-	16	A	
Input Current (no load)	-	-	700	mA	
Remote Off Input Current	-	17	-	mA	
Input Reflected Ripple Current (rms)	-	50	100	mA	With simulated source impedance of 200nH, 5Hz to 20MHz. Use 2 * 220uF/16V Oscon capacitor
Input Reflected Ripple Current (pk-pk)	-	150	200	mA	
I ² t Inrush Current Transient	-	-	1	A ² s	
Turn-on Voltage Threshold	9.5	10	10.5	V	
Turn-off Voltage Threshold	8.4	8.9	9.4	V	

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

Output Specifications

Parameter	Min	Typ	Max	Unit	Notes
Output Voltage Set Point	1.27	1.285	1.3	V	No load, excluding adaptive positioning, VRM11 VID 0x32
Adaptive Positioning	-	1.25	-	mOhm	Droop Impedance
Line Regulation	-	±5	±10	mV	
Regulation Over Temperature (0deg.C-70deg.C)	-	±5	±10	mV	
Ripple and Noise (pk-pk)	-	-	25	mV	0-20 MHz BW
Ripple and Noise (rms)	-	-	10	mV	
Ripple and Noise (pk-pk) under worst case	-	-	30	mV	over all operating input voltage, load and temperature conditions.
Output Current Range	0	-	70	A	Thermal Design Current
	-	-	90	A	Peak Current Rating
Output DC Current Limit	95	-	120	A	

NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

Output Specifications (continued)

Parameter	Min	Typ	Max	Unit	Notes	
Short Circuit Surge Transient	-	-	5	A ² s		
Turn on Time	-	3.5	5	mS		
Overshoot at Turn on	-	-	1	%		
Output Capacitance	See Note 1	3710	See Note 1	uF	Consult factory regarding external capacitance outside of this range	
Transient Response						
ΔV50%~100% of Max Load	Overshoot	-	-	50	mV	di/dt=300A/us, Vin=12Vdc, Ta=25°C
	Settling Time	-	-	25	uS	
ΔV100%~50% of Max Load	Overshoot	-	-	50	mV	
	Settling Time	-	-	25	uS	

Notes: 1. Measured with 7*470uF/7mOhm ESR SP-CAP, and 42*10uF/1206 ceramic capacitors on output.
2. All specifications are typical at nominal input, full load at 25°C unless otherwise stated.

General Specifications

Parameter	Min	Typ	Max	Unit	Notes
Efficiency	81	83	-	%	Vin =12V, Iout=70A; VID=0x32
Switching Frequency	-	400	-	kHz	
Over Temperature Alert	100	-	110	°C	
Over Voltage Protection	-	Vo,set + 0.175	-	V	
Weight	-	46	-	g	
FIT	500			-	Calculated Per Bell Core SR-332 (Vin=12 V, Io=70A, Ta = 25 °C, FIT=10 ⁹ /MTBF)
Dimensions Inches (L x W x H) Millimeters (L x W x H)	3.80 x 1.06 x 0.84 96.52 x 26.80 x 21.21			-	

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

Remote On/Off

Parameter	Min	Typ	Max	Unit	Notes	
Signal Low (Unit Off)	Active High	-0.3	-	0.4	V	The remote on/off pin open, Unit on.
Signal High (Unit On)		0.8	-	5.5	V	
Current Sink	0	-	1	mA		

NON-ISOLATED DC/DC CONVERTERS

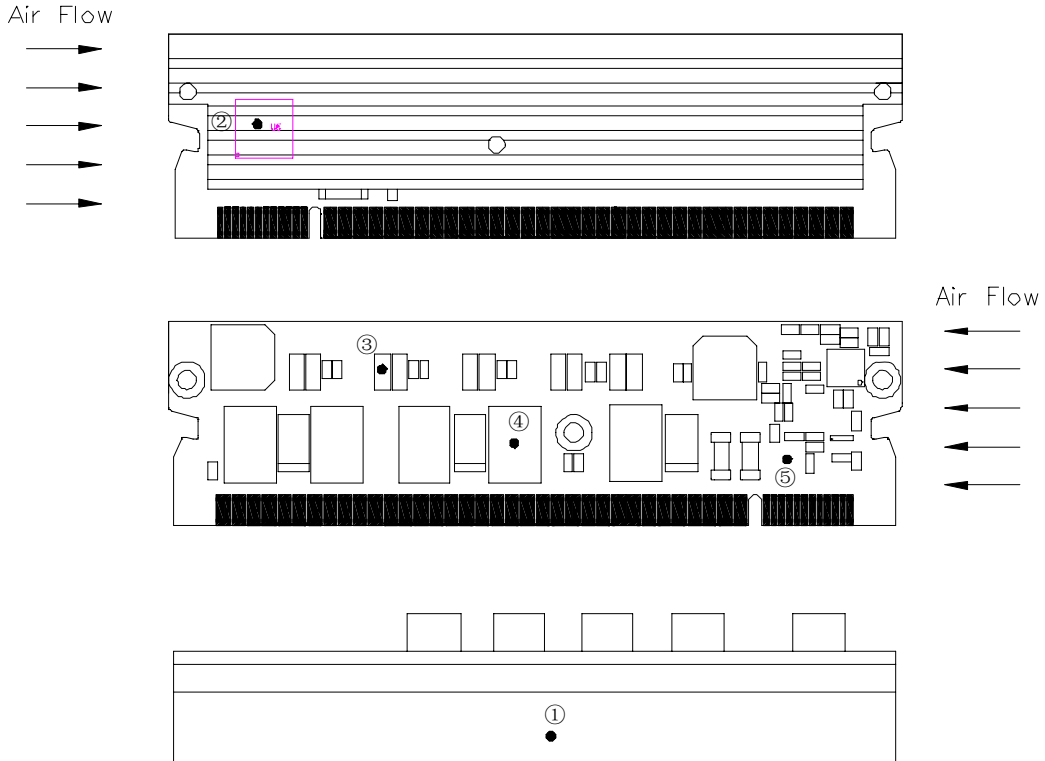
10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



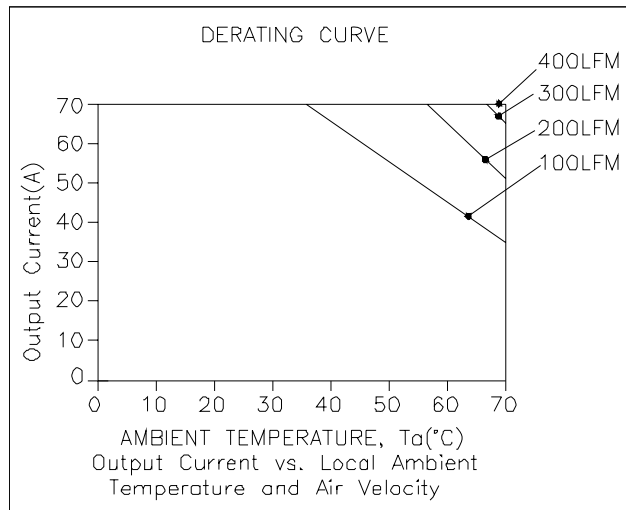
Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

Thermal Derating Curves



The thermal reference point Tref is shown above. For reliable operation this temperature should not exceed 110°C. The output power of the module should not exceed the rated power for the module.



Vin=12V, VID=0x32

Maximum junction temperature of semiconductors derated to 120 degree C.

NON-ISOLATED DC/DC CONVERTERS

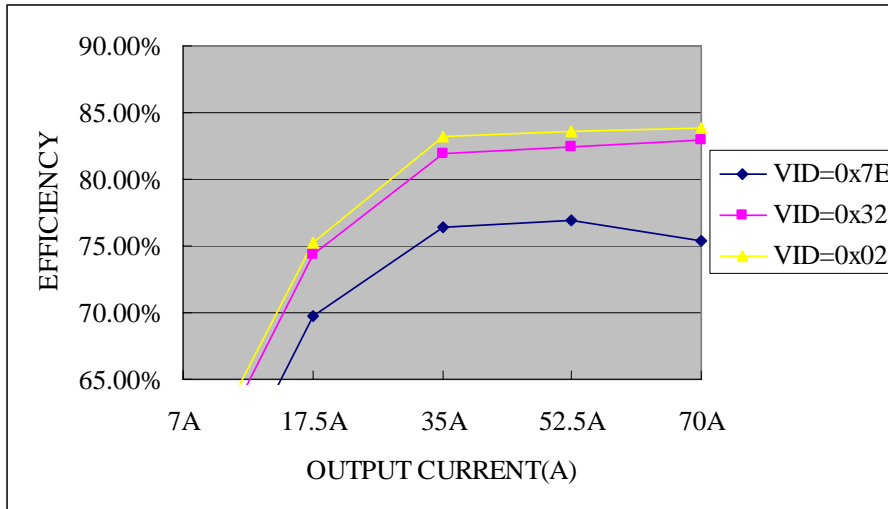
10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



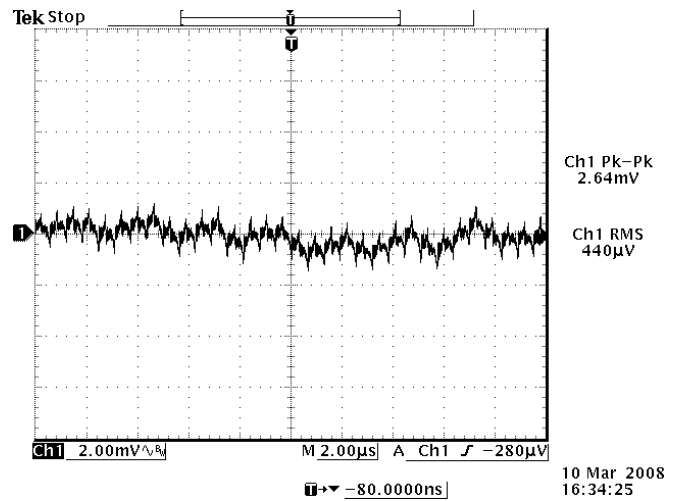
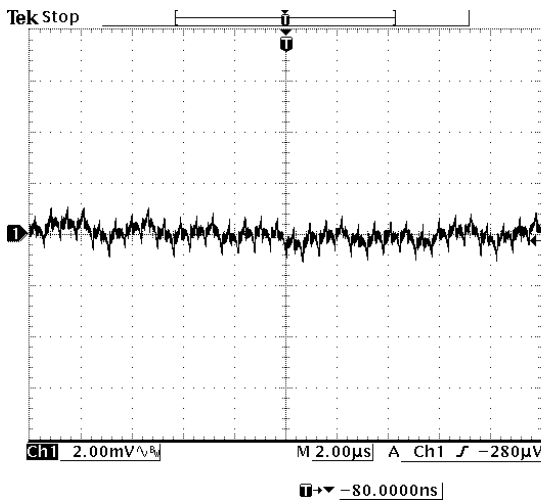
Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

Efficiency Data



Ripple and Noise Waveforms



Ripple and noise at 12Vdc input, VID=0x32, Iout=0A

Ripple and noise at 12Vdc input, VID=0x32, Iout=70A

Note: Ripple and noise at 0-20MHz BW, and Ta=25 deg C.

NON-ISOLATED DC/DC CONVERTERS

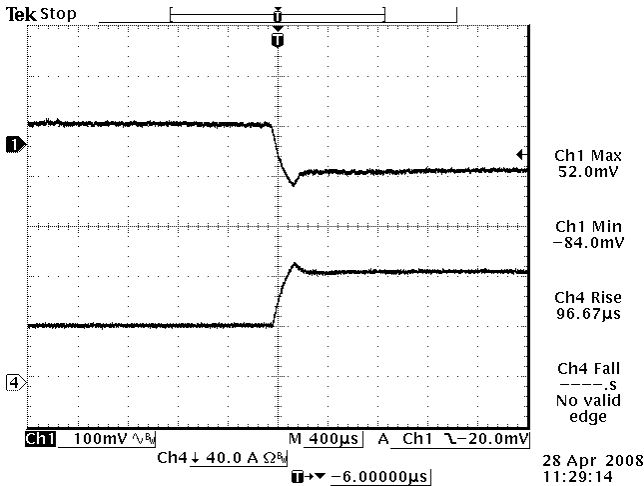
10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



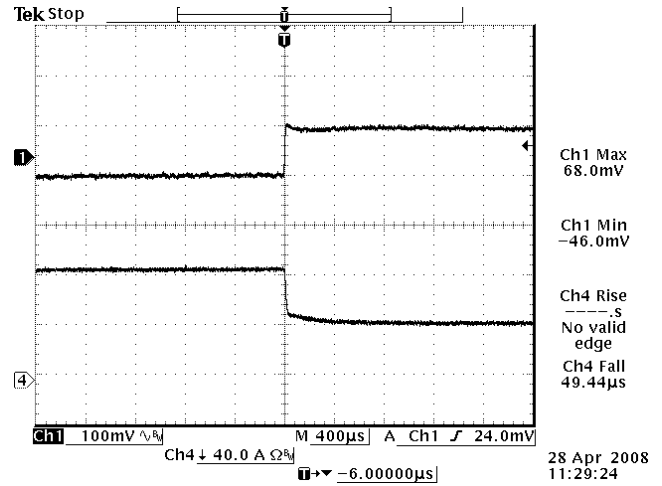
Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

Transient Response Waveforms



VID=0x32 45A-90A Load Transients

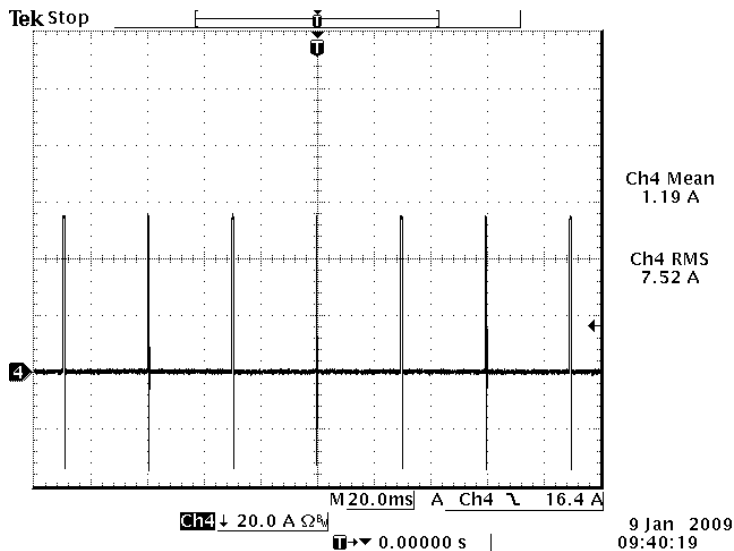


VID=0x32 90A-45A Load Transients

Note: Transient Response at $V_{in}=48V$, $di/dt=5A/\mu S$, with typical cap bank on output, and $T_a=25$ deg C.

Over Current Protection

To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for a few milli-seconds. If the overcurrent condition persists beyond a few milliseconds, the module will shut down into hiccup mode. The module operates normally when the output current goes into specified range.



$V_{in}=12V$, VID=0x32

NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible

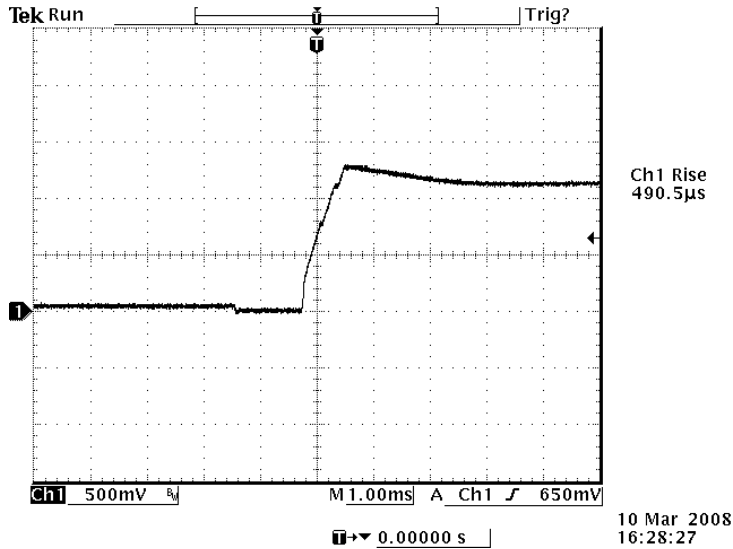


Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

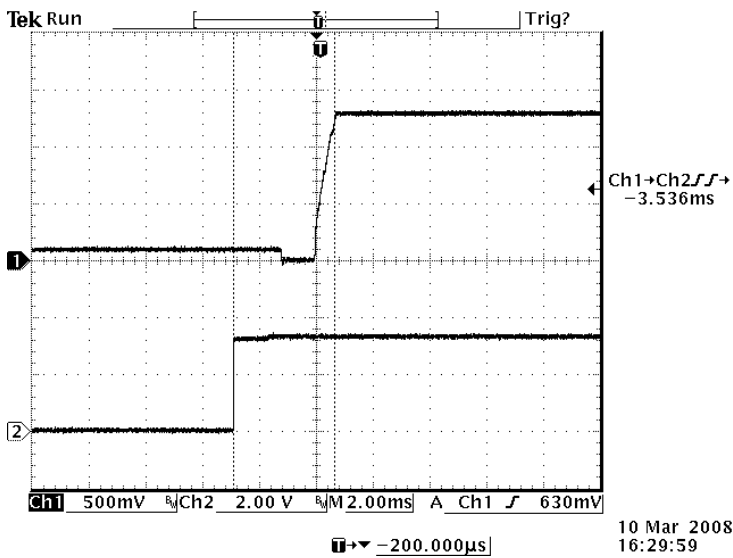
Startup & Shutdown

Rise time



VID=0x32,
Vin=12V,
Iout=70A

Startup time



VID=0x32,
Vin=12V,
Iout=70A,
Ch1: Vout
Ch3: OUTEN

NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



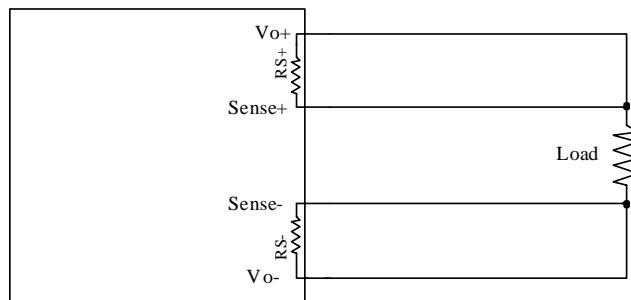
Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

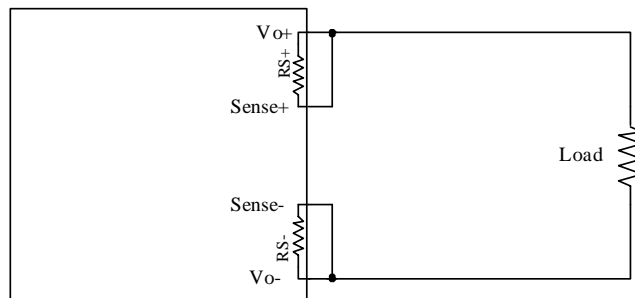
Remote Sense

This module has remote sense compensation feature. It can minimize the effects of resistance between module's output and load in system layout and facilitates accurate voltage regulation at load terminals or other selected point.

1. The remote sense lines carries very little current and hence do not require a large cross-sectional area.
2. This module compensates for a maximum drop of 10% of the nominal output voltage.
3. When using remote sense compensation, all the resistance, parasitic inductance and capacitance of the system are incorporated within the feedback loop of this module. It can make an effect on the module's compensation, affecting the stability and dynamic response. A 0.1 μ F ceramic capacitor can be connected at the point of load to de-couple noise on the sense wires.
4. Recommend the connection of remote sense compensation as below figure. There are a resistor RS+ (51.1 ohm) from Vo+ to Sense+ and a resistor RS- (51.1 ohm) from Vo- to Sense- inside of this module.



5. If not using remote sense compensation, please connect sense directly to output at module's pin, that is, connect sense+ to Vo+ and sense- to Vo- at module's pin, the shorter the better. See below figure.



NON-ISOLATED DC/DC CONVERTERS

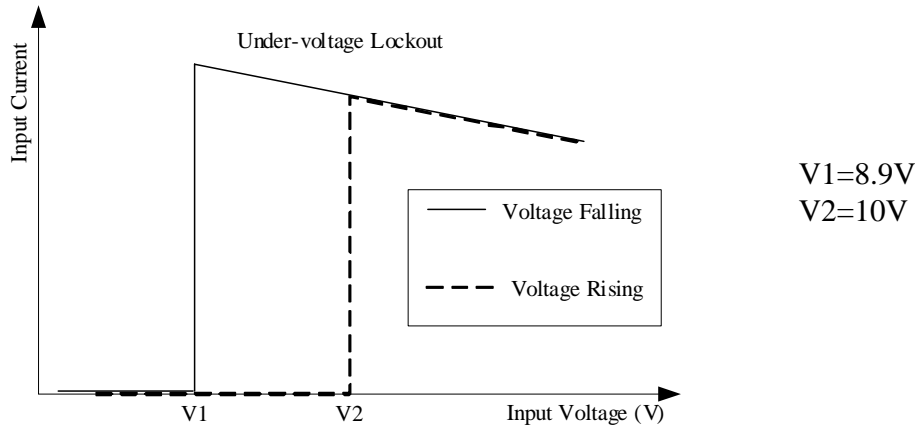
10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



Apr. 01, 2010

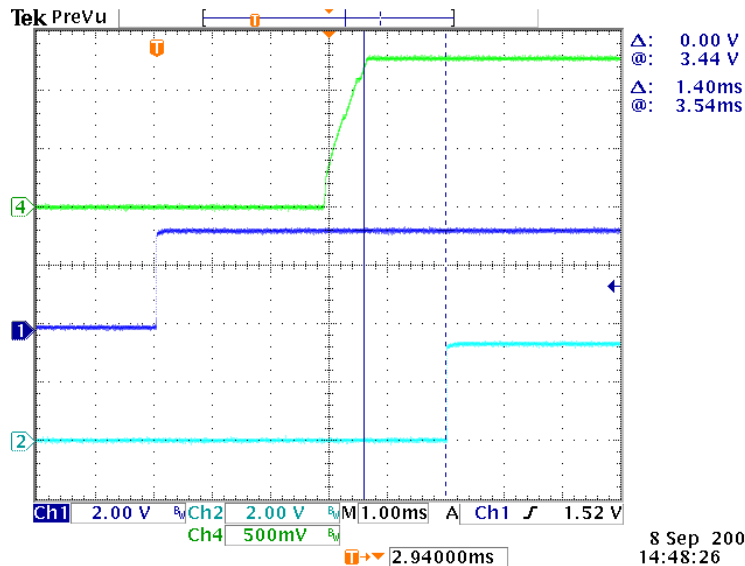
Bel Power Inc., a subsidiary of Bel Fuse Inc.

Input Under-voltage Lockout



Power Good

1. This module has a power good indicator output. Power good pin used positive logic and is open collector.
2. Power good pin can sink 1mA.
3. The maximum voltage pulled up externally on Power Good pin should not exceed 5V.
4. When the output is within 10% of the VID setting, the power good pin will be pulled high.



Typical Start-up Using Remote ON/OFF($V_{in}=12.0V$, $VID=0x32$, $I_o=0A$)

Ch1: OUTEN
Ch2: PWRGD
Ch4: VOUT

NON-ISOLATED DC/DC CONVERTERS

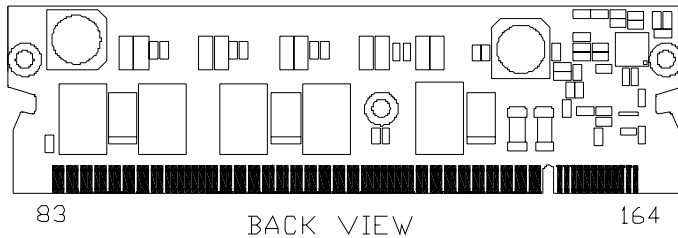
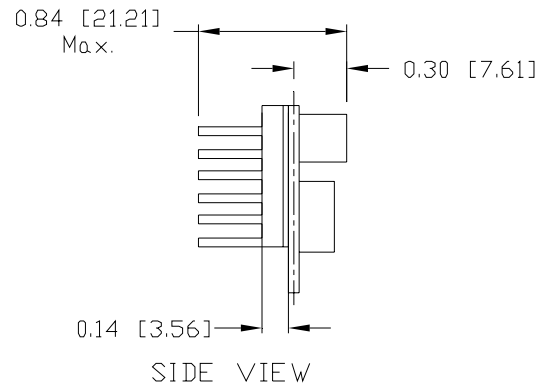
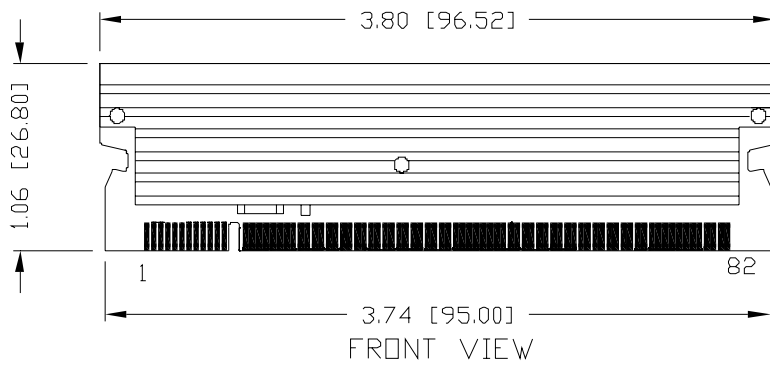
10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

Mechanical Outline



Unit: Inch[mm]

Row A				Row B			
Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	PWRGD	25-26	GND	139-140	GND	164	VBIAS
2	SC	27-30	VOUT	135-138	VOUT	163	SD
3	OUTEN	31-34	GND	131-134	GND	162	LL0
4	LL1	35-38	VOUT	127-130	VOUT	161	VID6
5	VID5	39-42	GND	123-126	GND	160	VID4
6	VID3	43-46	VOUT	119-122	VOUT	159	VID2
7	VID1	47-48	GND	117-118	GND	158	VID0
8	Reserved	49-52	VOUT	113-116	VOUT	157	Reserved
9	+SENSE	53-56	GND	109-112	GND	156	-SENSE
10	SP	57-60	VOUT	105-108	VOUT	155	VIDSEL
11	VR_HOT	61-64	GND	101-104	GND	154	VRM_PRES
12	Reserved	65-68	VOUT	97-100	VOUT	153	BUSS ADD
-	Key	69-70	GND	95-96	GND	-	Key
13-16	VIN	71-74	VOUT	91-94	VOUT	149-152	VIN
17-20	GND	75-78	GND	87-90	GND	145-148	GND
21-24	VOUT	79-82	VOUT	83-86	VOUT	141-144	VOUT

Note:

- 1) Undimensioned components are shown for visual reference only.
- 2) All dimensions in inches (mm); Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm).

NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

Signal Definitions

Vin	Input power to the converter
GND	Common return for both input and output
VID0, VID1, VID2, VID3, VID4, VID5, VID6	Logic level inputs used to set the output voltage, refer to VID table. Connect VID0 thru VID6 pins to open-drain outputs with external pull-up resistors. Valid logic low is -0.3V to 0.4V, valid logic high level is 0.8V to 5.5V.
VIDSEL	Digital input used to select between extended VR10 and VR11 VID tables. Internally pulled up to 3.3V to select VRM11.
PWRGD	The open drain power good signal indicates the output voltage is within 10% of the VID setpoint.
Vsense+, Vsense-	Remote voltage sense lines. Connect these at the point of load, to VOUT and GND respectively.
VOUT	Output voltage available to the load.
OUTEN	Logic level input used to enable the converter when high. Valid logic low is -0.3V to 0.4V, valid logic high level is 0.8V to 5.5V
LL0/LL1	Load line select pins. Working in conjunction with VID_SEL, LL0/LL1 are used to select load line slope. Currently only 1.25mOhm slope is supported. Module can be configured to support multiple load line slopes.
SC SD	Optional serial clock and data pins respectively for SMBus interface.
SP	Optional programming pin for set point and over current protection mode.
VR_HOT#	Open-drain output signal, pulled actively low indicating a thermal event has been detected on the VRM.
VRM_PRES	Signal used by system to indicate the VRM is present in the design.
BUSS_ADD	Optional addressing pin when using SMBus feature.

NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



Apr. 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

VID CODES (VRM11.0 VID CODES)

HEX (VID6 - VID0)	Vout (VDC)	
0	0	OFF
0	1	OFF
0	2	1.60000
0	3	1.59375
0	4	1.58750
0	5	1.58125
0	6	1.57500
0	7	1.56875
0	8	1.56250
0	9	1.55625
0	A	1.55000
0	B	1.54375
0	C	1.53750
0	D	1.53125
0	E	1.52500
0	F	1.51875
1	0	1.51250
1	1	1.50625
1	2	1.50000
1	3	1.49375
1	4	1.48750
1	5	1.48125
1	6	1.47500
1	7	1.46875
1	8	1.46250
1	9	1.45625
1	A	1.45000
1	B	1.44375
1	C	1.43750
1	D	1.43125
1	E	1.42500
1	F	1.41875
2	0	1.41250
2	1	1.40625
2	2	1.40000
2	3	1.39375
2	4	1.38750
2	5	1.38125
2	6	1.37500
2	7	1.36875
2	8	1.36250
2	9	1.35625
2	A	1.35000
2	B	1.34375
2	C	1.33750
2	D	1.33125
2	E	1.32500
2	F	1.31875

HEX (VID7 - VID0)	Vout (VDC)	
3	0	1.31250
3	1	1.30625
3	2	1.30000
3	3	1.29375
3	4	1.28750
3	5	1.28125
3	6	1.27500
3	7	1.26875
3	8	1.26250
3	9	1.25625
3	A	1.25000
3	B	1.24375
3	C	1.23750
3	D	1.23125
3	E	1.22500
3	F	1.21875
4	0	1.21250
4	1	1.20625
4	2	1.20000
4	3	1.19375
4	4	1.18750
4	5	1.18125
4	6	1.17500
4	7	1.16875
4	8	1.16250
4	9	1.15625
4	A	1.15000
4	B	1.14375
4	C	1.13750
4	D	1.13125
4	E	1.12500
4	F	1.11875
5	0	1.11250
5	1	1.10625
5	2	1.10000
5	3	1.09375
5	4	1.08750
5	5	1.08125
5	6	1.07500
5	7	1.06875
5	8	1.06250
5	9	1.05625
5	A	1.05000
5	B	1.04375
5	C	1.03750
5	D	1.03125
5	E	1.02500
5	F	1.01875

HEX (VID7 - VID0)	Vout (VDC)	
6	0	1.01250
6	1	1.00625
6	2	1.00000
6	3	0.99375
6	4	0.98750
6	5	0.98125
6	6	0.97500
6	7	0.96875
6	8	0.96250
6	9	0.95625
6	A	0.95000
6	B	0.94375
6	C	0.93750
6	D	0.93125
6	E	0.92500
6	F	0.91875
7	0	0.91250
7	1	0.90625
7	2	0.90000
7	3	0.89375
7	4	0.88750
7	5	0.88125
7	6	0.87500
7	7	0.86875
7	8	0.86250
7	9	0.85625
7	A	0.85000
7	B	0.84375
7	C	0.83750
7	D	0.83125
7	E	0.82500
7	F	0.81875

Note: VIDs with VID7=1 not shown because this VRM does not have a VID7 pin.

NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input, 0.82 Vdc - 1.6 Vdc Output, VRM11.0 Compatible



Apr 01, 2010

Bel Power Inc., a subsidiary of Bel Fuse Inc.

Revision History

Date	Revision	Changes Detail	Approval
2009-9-8	A	First release	Jack Fan
2010-4-1	B	1. Update output current limit; 2. Update MD(the model height change to 0.84" max)	Jack Fan

RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products.



©2010 Bel Fuse Inc. Specifications subject to change without notice. 040110

13

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