NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input 0.5 Vdc - 1.6 Vdc/120 A Outputs

Apr. 01, 2010

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

GRND-C2A160 RoHS Compliant Rev.B

Features

- Non-Isolated
- Fixed Frequency
- High Efficiency
- 8 bit VID Digital Voltage Programming
- Input Under Voltage Lockout
- SCP/OCP
- Remote On/Off
- 2-Wire Remote Sense
- Class 1, Category 2, Non-Isolated DC/DC Converter (refer to IPC-9592)

Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The GRND-C2A160 is a non-isolated step down dc/dc converter providing up to 120 A of output current and designed to be compatible with Intel VRM11.1 requirements. Standard features include current monitor, remote on/off, over current protection, remote sense, 8 bit VID digital voltage programming and a power good signal. This product also makes use of selectable 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
0.5 - 1.6 Vdc	10.8 - 13.2 Vdc	120 A	192 W	84%	GRND-C2A160

Note: Add “G” suffix at the end of the model number to indicate “Tray Packaging”.

Part Number Explanation

G	R	ND	–	C2	A	16	0
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 (0.5-1.6V)
7---Suffix

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	15 V	
Remote On/Off	-0.3 V	-	5 V	
Ambient Temperature	0 °C	-	65 °C	
Storage Temperature	-55 °C	-	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	Notes
Input Voltage	10.8 V	12 V	13.2 V	
Input Current (full load)	-	-	30 A	
Input Current (no load)	-	600 mA	800 mA	
Input Current (no load)		80 mA	100 mA	
Remote Off Input Current	-	10 mA	25 mA	
Input Reflected Ripple Current (pk-pk)	-	80 mA	150 mA	With simulated source impedance of 100 nH, 5 Hz to 20 MHz; use two 1000uF/25 V electrolytic cap with ESR = 0.03 ohm max at 100 kHz.
Input Reflected Ripple Current (rms)	-	25 mA	50 mA	
I^2t Inrush Current Transient	-	-	5 A^2s	
Turn-on Voltage Threshold	9.4 V	10 V	10.6 V	
Under Voltage Threshold	8.0 V	9.0 V	10 V	

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point	1.27 V	1.285 V	1.3 V	VID=0X32, Iout=0
Adaptive Positioning (Droop Impedance)	-	0.8 mOhm	-	
Line Regulation	-	-	±8 mV	
Regulation Over Temperature (0deg.C-65deg.C)	-	-	±8 mV	
Output Current	0		90 A	Thermal design
	0	-	120 A	Peak current rating
Current Limit Threshold	125 A	-	155 A	
Short Circuit Surge Transient	-	-	5 A^2s	
Ripple and Noise (rms)	-	3 mV	5 mV	Measured with 3*330uF/6mOhm ESR SP-CAP, and 10*22uF/0805 + 28*10uF/1206 ceramic capacitors on output
Ripple and Noise (pk-pk)	-	6 mV	10 mV	

Output Specifications (continued)

Parameter		Min	Typ	Max	Notes
Output Ripple and Noise(pk-pk) under worst case		-	-	50 mV	over all operating input voltage, load and ambient temperature condition
Rise time		-	-	5 mS	
Turn on Time		-	2.5 mS	5 mS	
Overshoot at Turn on		-	-	1%	
Output Capacitance		1490 uF	-	-	3*330uF/6mOhm ESR SP-CAP, and 10*22uF/0805 + 28*10uF/1206 ceramic capacitors. Consult factory regarding external capacitance outside of this range
Transient Response					
50% ~ 100% Max Load	Overshoot	All	-	-	50 mV	di/dt=300A/us, Vin=12Vdc, Ta=25°C, with typical cap bank on the output.
	Settling Time		-	-	25 uS	
100% ~ 50% Max Load	Overshoot		-	-	50 mV	
	Settling Time		-	-	25 uS	

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

General Specifications

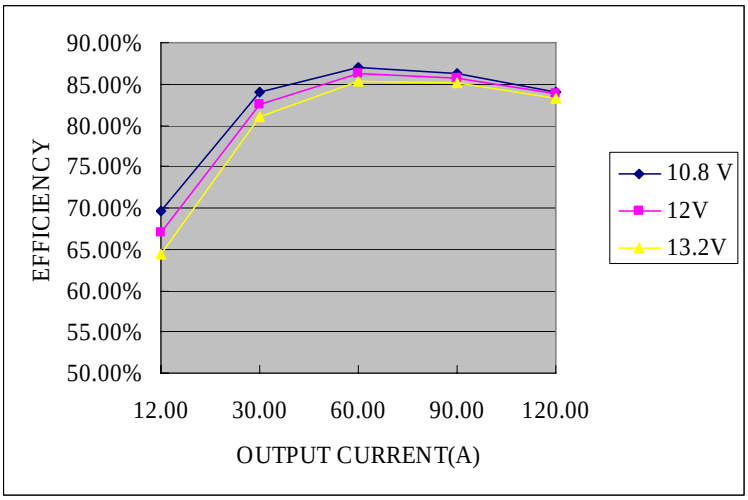
Parameter	Min	Typ	Max	Notes
Efficiency	82%	84%	-	V_{in}=12 V, full load
Switching Frequency	-	400 kHz	-	
FIT		TBD		Calculated Per Bell Core SR-332 (Vin=12 V, Io=80%load, T_a = 25 °C, FIT=10^9/MTBF)
Dimensions Inches (L × W × H) Millimeters (L × W × H)		3.80 x 1.20 x 0.70 96.52 x 30.48 x 17.78		
Weight	-	50 g	-	

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

Control Specifications

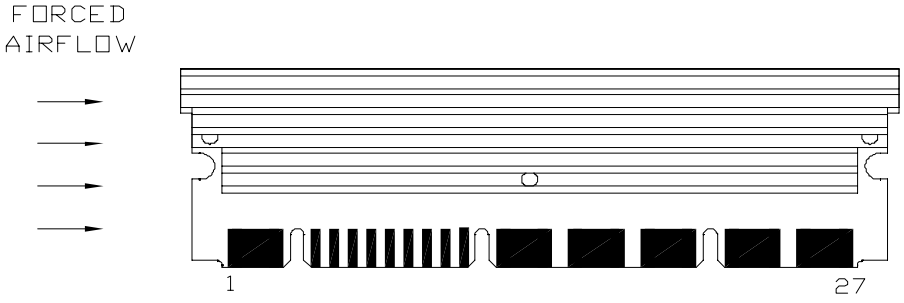
Parameter		Min	Typ	Max	Notes
Remote On/Off					
Signal Low (Unit Off)	Active High	-0.3 V	-	0.4 V	The remote on/off pin open, Unit On.
Signal High (Unit On)		1 V	-	5 V	
Current Sink		0 mA	-	1 mA	

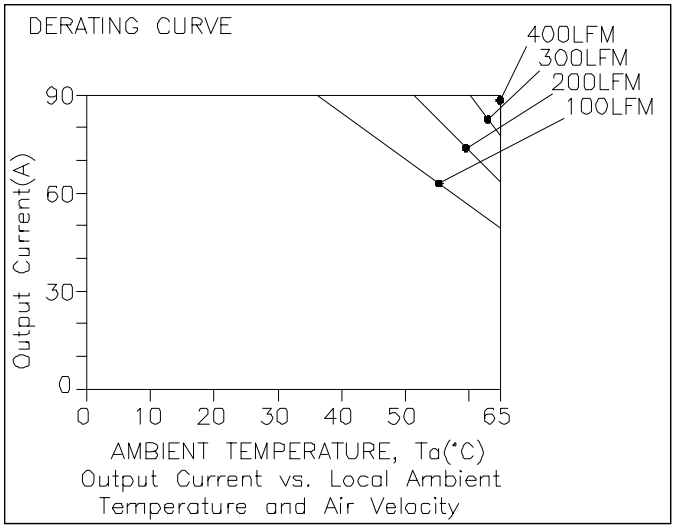
Efficiency Data



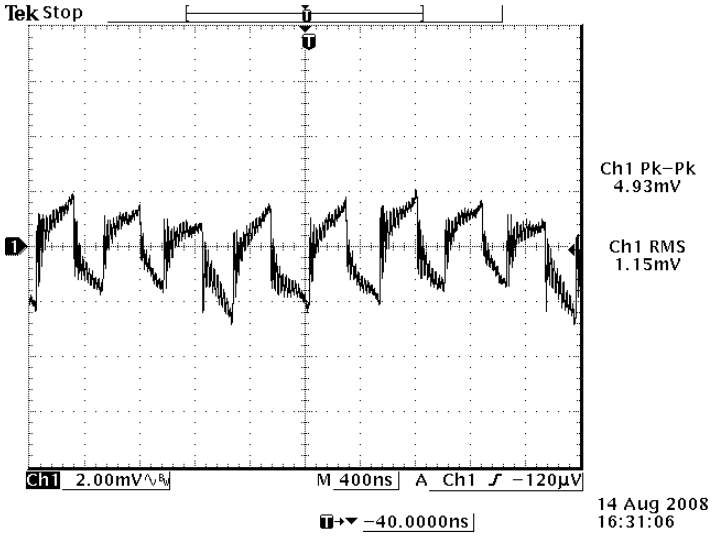
VID=0X32

Thermal Derating Curves



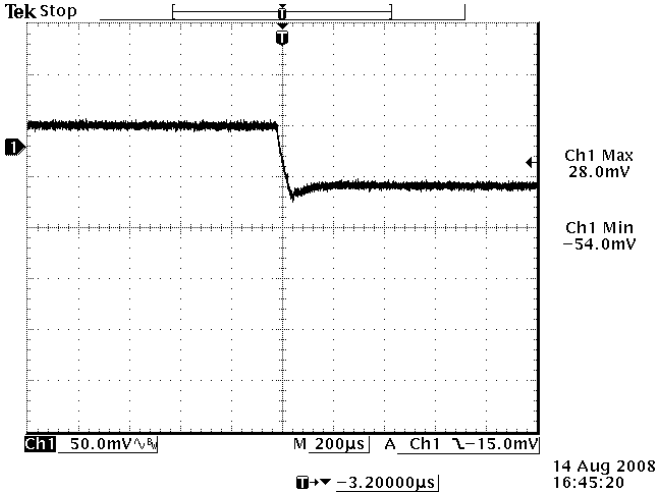


Ripple and Noise Waveform

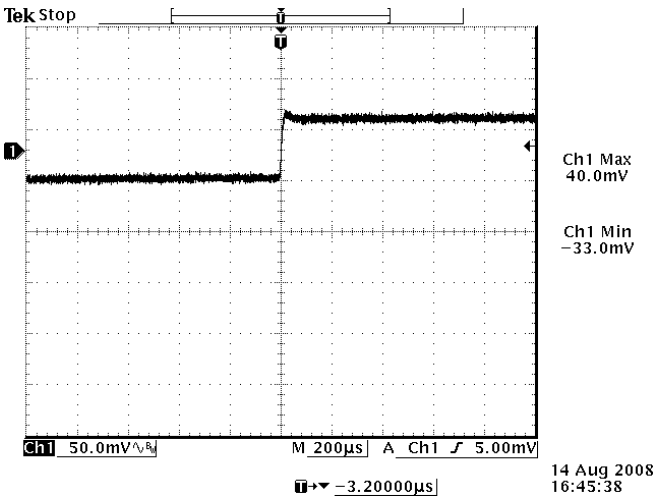


Ripple and noise at full load, 12V input, VID=0X32 and Ta=25 degC

Transient Response Waveforms



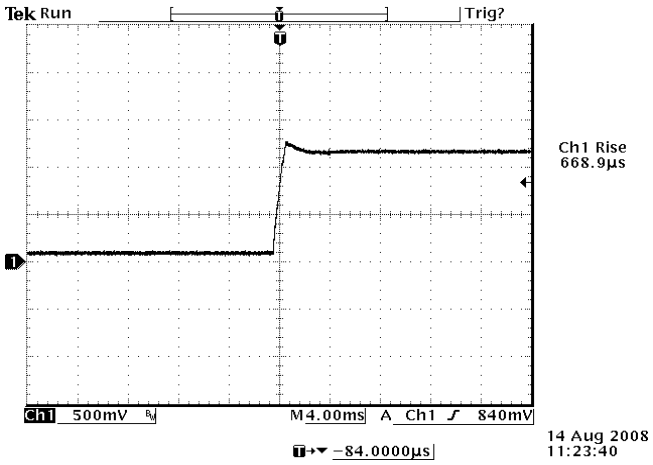
30 A to 90 A Load @ VID=0X32



90 A to 30 A Load @ VID=0X32

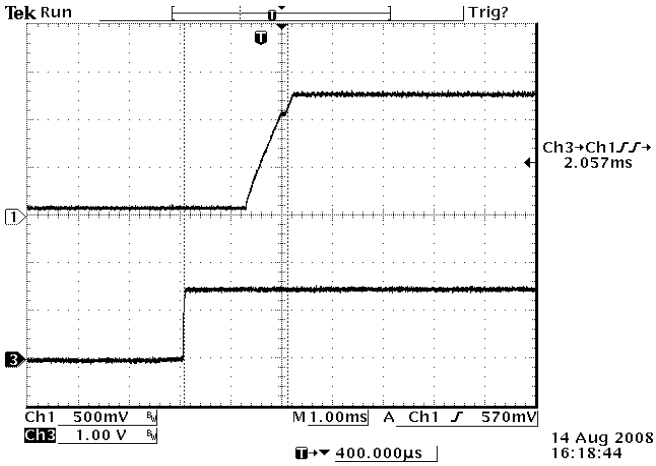
Startup & Shutdown

Rise time



Test Condition: VID=0x32, Iout=120A

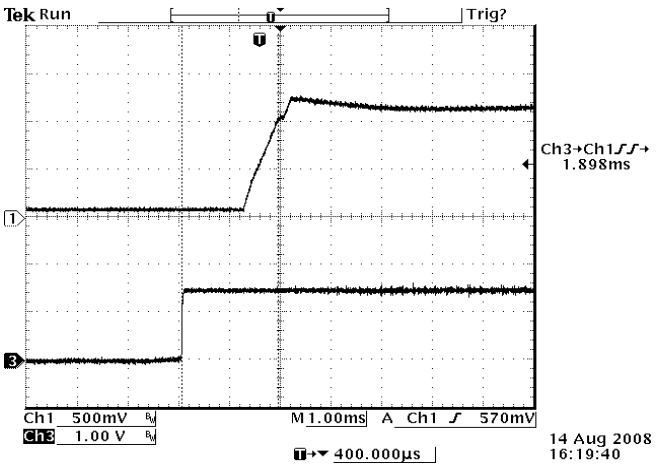
Startup time



Startup from on/off

Ch1: Vo, Ch3: on/off

Test Condition: VID=0x32, Iout=0A



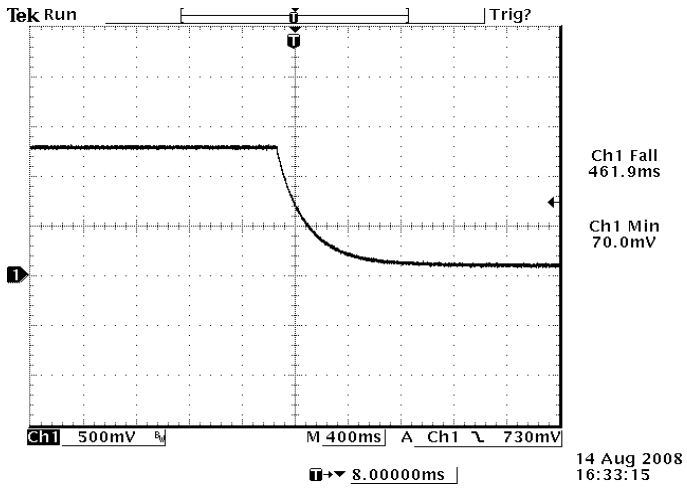
Startup from on/off

Ch1: Vo, Ch3: on/off

Test Condition: VID=0x32, Iout=120A

Startup & Shutdown (continued)

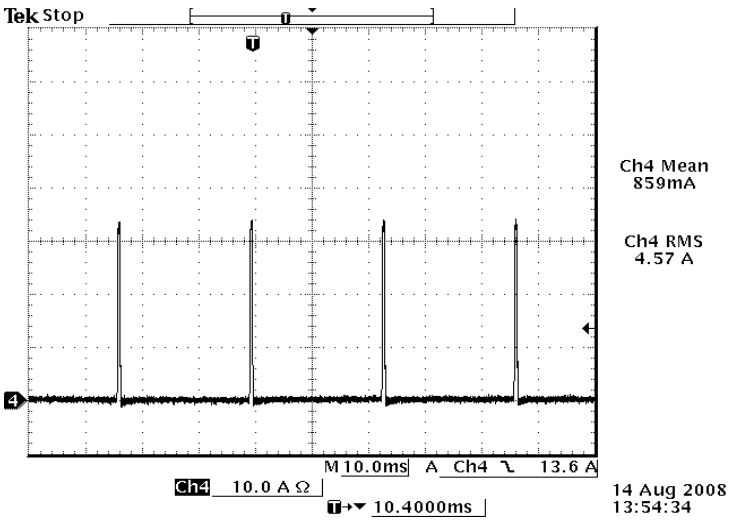
Shutdown



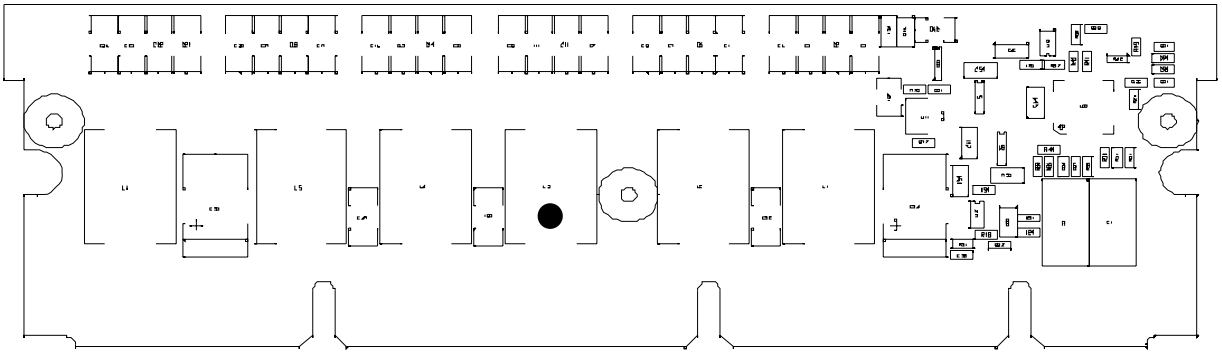
Test Condition: VID=0x32, Iout=0A

Over Current Protection

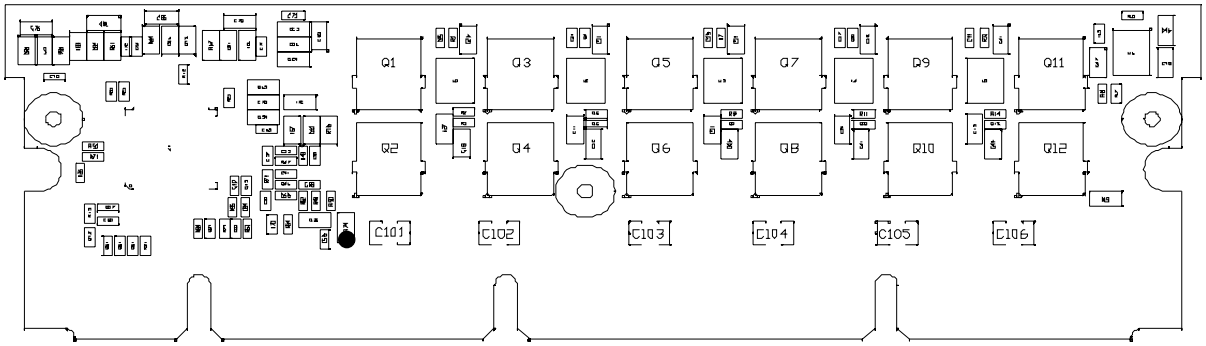
To provide protection in a fault output overload condition, the module is equipped with internal current-limiting circuitry and can endure current limiting for a few mili-seconds. If the overcurrent condition persists beyond a few milliseconds, the module will shut down into hiccup mode and restart once every 400mS. The module operates normally when the output current goes into specified range. The typical average output current is 5A during hiccup.



Over Temperature Protection

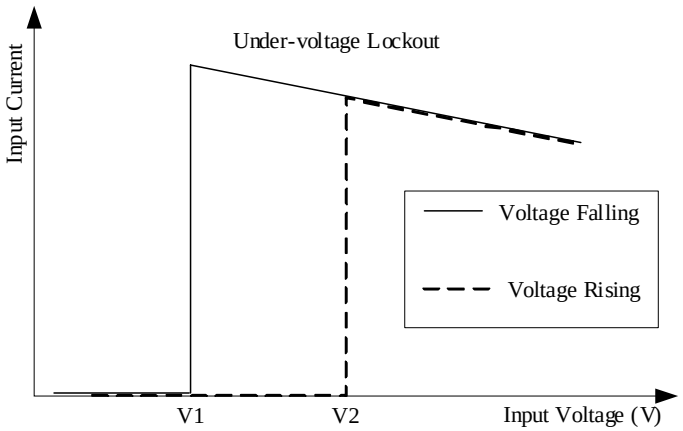


L3 is the hottest component



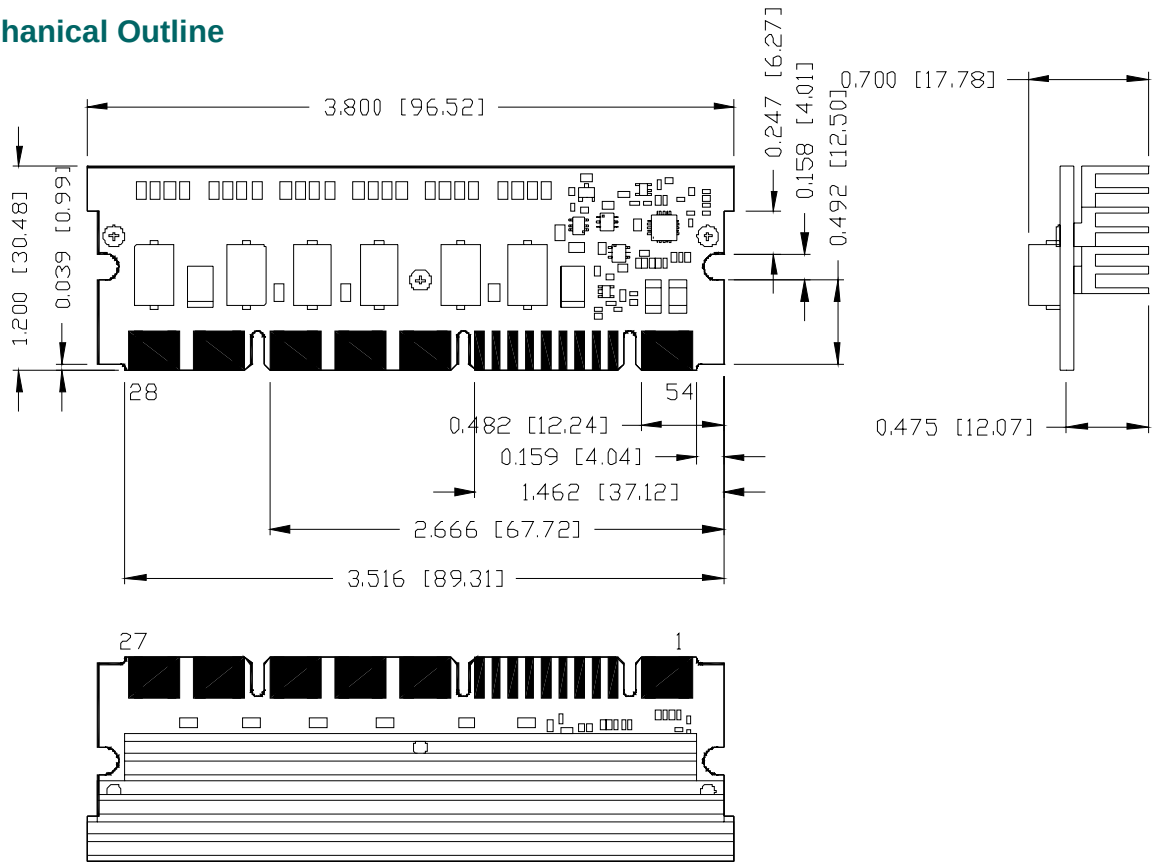
R74 is the thermal sense component

Input Under-voltage Lockout



V1=8.5V
V2=10V

Mechanical Outline



Pin Connections

Row A				Row B			
Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	VIN-	15	VO+	40	VO+	54	VIN+
2	VIN-	16	VO-	39	VO-	53	VIN+
3	VIN-	17	VO-	38	VO-	52	VIN+
4	VID4	18	VO-	37	VO-	51	VID3
5	VID2	19	VO+	36	VO+	50	VID1
6	VID0	20	VO+	35	VO+	49	VID5
7	VO_SEN+	21	VO+	34	VO+	48	VO_SEN-
8	VR_Ready	22	VO-	33	VO-	47	VR_hot#
9	OUTEN	23	VO-	32	VO-	46	VID7
10	IMON	24	VO-	31	VO-	45	PSI
11	VID6	25	VO+	30	VO+	44	VRM_pres#0
12	VRM_pres#2	26	VO+	29	VO+	43	VRM_pres#1
13	VO+	27	VO+	28	VO+	42	VO+
14	VO+					41	VO+

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).

Signal Definitions

Vin+	VRM Input Voltage
Vin-	VRM Input Ground
VID0, VID1, VID2, VID3, VID4, VID5, VID6, VID7	Logic level inputs used to set the output voltage, refer to VID table. Connect VID0 thru VID7 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 5.0V.
VO_SEN+, VO_SEN-	Remote voltage sense lines. Connect these at the point of load, to VO+ and VO- respectively.
VR_Ready	Open drain output signal indicating that the start-up sequence is complete output voltage has moved to the programmed VID value.
VR_HOT#	Open-drain output signal, pulled actively low indicating a thermal event has been detected on the VRM.
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 1.0V to 5.0V
IMON	Analog voltage signal representing the output load current
PSI	Logic level input, indicates when the CPU is in a low power state
VRM_pres#1, VRM_pres#2, VRM_pres#3	VRM11.1 presence indicator(s)
VO+	VRM Output Voltage
VO-	VRM Output Ground

VID CODES (VRM11.0 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
8	0	0.81250
8	1	0.80625
8	2	0.80000
8	3	0.79375
8	4	0.78750
8	5	0.78125
8	6	0.77500
8	7	0.76875
8	8	0.76250
8	9	0.75625
8	A	0.75000
8	B	0.74375
8	C	0.73750
8	D	0.73125
8	E	0.72500
8	F	0.71875

HEX (VID7 - VID0)		Vout (VDC)
9	0	0.71250
9	1	0.70625
9	2	0.70000
9	3	0.69375
9	4	0.68750
9	5	0.68125
9	6	0.67500
9	7	0.66875
9	8	0.66250
9	9	0.65625
9	A	0.65000
9	B	0.64375
9	C	0.63750
9	D	0.63125
9	E	0.62500
9	F	0.61875
A	0	0.61250
A	1	0.60625
A	2	0.60000
A	3	0.59375
A	4	0.58750
A	5	0.58125
A	6	0.57500
A	7	0.56875
A	8	0.56250
A	9	0.55625
A	A	0.55000
A	B	0.54375
A	C	0.53750
A	D	0.53125
A	E	0.52500
A	F	0.51875
B	0	0.51250
B	1	0.50625
B	2	0.50000
F	E	OFF
F	F	OFF

Revision History

Date	Revision	Changes Detail	Approval
2010-4-1	B	1. Change to Bel new datasheet format; remove “Preliminary”. 2. In Absolute Maximum Ratings: 1)add remote on/off voltage; 2)update Ambient and storage temperature 3. Input spec: 1)update turn off voltage 4. Output spec: 1)add load and temperature regulation; 2)add short circuit surge transient; 3)add rise time; 4)update output current limit 5. Update efficiency curve, add thermal derating curve, add startup and shutdown figures, add OCP, OTP and UVLO figure 6. Add Signal Definitions and VID CODES.	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.

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