ISOLATED DC/DC CONVERTERS

36 Vdc - 75 Vdc Input 1.2 Vdc /60 A, 3.3V/60A Outputs

Feb 10, 2010

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

0RHW-D0Txxx RoHS Compliant Rev.G

Features

- Fixed Frequency
- Isolated
- High Efficiency
- High Power Density
- Input Under Voltage Protection
- Basic Insulation
- Output Over Voltage Protection
- Over Temperature Protection
- SCP/OCP
- Low Cost
- Remote On/Off
- Class 1, Category 2, Isolated DC/DC Converter (refer to IPC-9592)
- UL60950-1 Recognized (UL/cUL) (Pending)

Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The 0RHW-D0Txxx series are isolated dc/dc converters that operate from a nominal 48 Vdc source. This converter provides up to 200 W of output power. Features include remote on/off, short circuit protection, over current protection, over-temperature protection, output over-voltage protection, input under-voltage protection. This converter is provided in an industry standard half brick package that is easy to use and provides good thermal performance.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active High	Model Number Active Low
1.2 Vdc	36 Vdc - 75 Vdc	60 A	72 W	86%	0RHW-D0TV20	0RHW-D0TV2L
3.3 Vdc	36 Vdc - 75 Vdc	60 A	200 W	92%	0RHW-D0T033	0RHW-D0T03L

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

Part Number Explanation

0 R HW – D0 T V2 x
1 2 3 4 5 6 7

1---Through hole
2---RoHS 6, change “R” to “7” means RoHS 5
3---Series name, 1/2 Brick
4---Series code
5---Input range
6---Output voltage, “V2” mean 1.2Vout and “03” mean 3.3Vout
7---Option, “x” of the model part number to be 0-9, A-Z, which will represent the special request of customer.

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	80 V	
Input Transient Voltage	-	-	100 V	100 mS maximum
Remote On/Off	-0.3 V	-	18 V	
Ambient Temperature	-40 °C	-	85 °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	36 V	48 V	75 V	
Input Current (no load) Vo=1.2V Vo=3.3V	 - -	 50 mA 80 mA	 100 mA 150 mA	
Input Current (full load) Vo=1.2V Vo=3.3V	 - -	 - -	 2.7 A 8 A	
Remote Off Input Current	-	2 mA	5 mA	
Input Reflected Ripple Current (pk-pk)	-	10 mA	20 mA	With simulated source impedance of 10uH, 5Hz to 20MHz. Use a 100uF/100V electrolytic capacitor with ESR=1 ohm max, at 200KHz@25°C.
Input Reflected Ripple Current (rms)	-	2 mA	5 mA	
I^2t Inrush Current Transient	-	-	1 A^2s	
Turn-on Voltage Threshold	32 V	34 V	35 V	
Turn-off Voltage Threshold	30 V	32 V	34 V	

CAUTION: This converter is not internally fused. An input line fuse must be used in application.
Recommend a fast-acting fuse with maximum rating of 4A@1.2Vout or 10A@3.3Vout on system board. Refer to the fuse manufacture's datasheet for further information.

Notes: 1. This converter has internal C-L-C (0.47uF-2.2uH-4.4uF) filter.
2. All specifications are typical at 25 °C unless otherwise stated.

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point Vo=1.2V Vo=3.3V	 1.176 V 3.234 V	 1.2 V 3.3 V	 1.224 V 3.366 V	V_{in}=48 V, Io=50%Load
Line Regulation Vo=1.2V Vo=3.3V	 - -	 2 mV 5 mV	 5 mV 10 mV	Vin=36-75 V, full load
Load Regulation Vo=1.2V Vo=3.3V	 - -	 5 mV 8 mV	 10 mV 15 mV	Vin=48 V, Iout=0-60 A
Regulation Over Temperature (-40 °C to 85 °C) Vo=1.2V Vo=3.3V	 - -	 - -	 10 mV 20 mV	Vin=48 V, Iout=0-60 A
Output Current	0 A	-	60 A	
Current Limit Threshold	65 A	75 A	85 A	
Ripple and Noise (pk-pk) Vo=1.2V Vo=3.3V	 - -	 60 mV 60 mV	 100 mV 100 mV	0-20MHz BW, with a 1µF ceramic capacitor and a 10uF Tantalum cap at output.
Ripple and Noise (rms) Vo=1.2V Vo=3.3V	 - -	 15 mV 15 mV	 30 mV 40 mV	
Ripple and Noise (pk-pk) Vo=1.2V Vo=3.3V	 - -	 - -	 150 mV 150 mV	over all operating input voltage, load and ambient temperature condition
Rise Time Vo=1.2V Vo=3.3V	 0.5 mS 5 mS	 - -	 5 mS 10 mS	
Turn on Time Vo=1.2V Vo=3.3V	 - -	 30 mS 30 mS	 50 mS 50 mS	Enable form Vin and ON/OFF
Overshoot at Turn on	-	-	3%	
Output Capacitance Vo=1.2V Vo=3.3V	 0 470	 - -	 30,000 uF 20,000 uF	

Transient Response						
50% ~ 75% Max Load	Overshoot	Vo=1.2 V	-	60 mV	120 mV	di/dt=0.1A/us, Vin=48Vdc, Ta=25 °C
	Settling Time		-	150 uS	200 uS	
75% ~ 50% Max Load	Overshoot		-	60 mV	120 mV	
	Settling Time		-	150 uS	200 uS	
50% ~ 75% Max Load	Overshoot	Vo=3.3 V	-	60 mV	120 mV	
	Settling Time		-	150 uS	200 uS	
75% ~ 50% Max Load	Overshoot		-	60 mV	120 mV	
	Settling Time		-	150 uS	200 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 Vo=1.2V Vo=3.3V	 86% 90%	 88% 92.5%	 - -	Vin=48 V, full load
Switching Frequency Vo=1.2V Vo=3.3V	 270 kHz 340 kHz	 280 kHz 350 kHz	 300 kHz 360 kHz	
Remote Sense Compensation	-	-	10%	The voltage increased by trim and sense should not exceed 110%Vout.
Output Voltage Trim Range	80%	-	110%	
Over Temperature Protection	-	120 ℃	130 ℃	
Over Voltage Protection (Static) Vo=1.2V Vo=3.3V	 1.35 V 3.5 V	 - -	 1.7 V 5 V	
Over Voltage Protection (Dynamic) Vo=1.2V Vo=3.3V	 - -	 - -	 1.8 V 5.6 V	The transient over voltage must be measured at Rtrimup≥5K
FIT	634			Calculated Per Bell Core SR-332 (Vin=48 V, Vo=1.2 V, Io=80%,Ta = 25 °C, FIT=10^9/MTBF)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 2.28 x 2.40 x 0.50 57.91 x 60.96 x 12.70			
Weight	-	93.5 g	-	
Isolation characteristics				
Input to Output	-	-	1500 V	
Input to Case	-	-	1500 V	
Output to Case	-	-	500 V	
Isolation Resistance	10M ohm	-		
Isolation Capacitance	-	1500 pF	-	

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

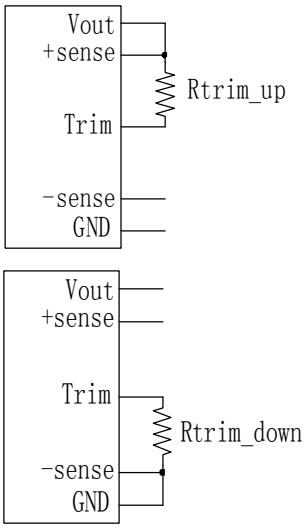
Control Specifications

Parameter		Min	Typ	Max	Notes
Remote On/Off					
Signal Low (Unit On)	Active Low	-0.3 V	-	0.8 V	The Remote On/Off pin is open, Unit off.
Signal High (Unit Off)		2.4 V	-	18 V	
Signal Low (Unit Off)	Active High	-0.3 V	-	0.8 V	The Remote On/Off pin is open, Unit on.
Signal High (Unit On)		2.4 V	-	18 V	
Signal High (Unit On)		0 mA	-	1 mA	

Output Trim Equations

For 1.2V Model

Equations for calculating the trim resistor are shown below. The Trim Down resistor should be connected the Trim pin, Sense(-) pin and GND pin. The Trim Up resistor should be connected the Trim pin Sense(+) pin and Vout pin. Only one of the resistors should be used for any given application.



$$Rtrimup = \frac{5.1 \cdot Vo(100 + delta)}{0.6 \cdot delta} - \frac{510}{delta} - 6.1[k\Omega]$$

$$Rtrimdown = \frac{510}{|delta|} - 6.1[k\Omega]$$

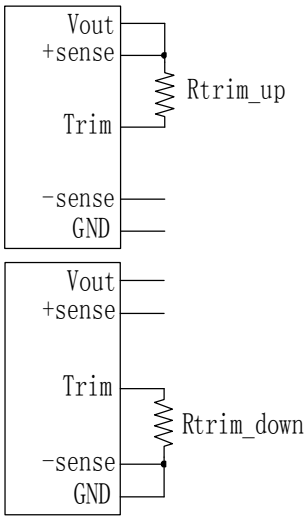
Note:

$$delta = \frac{(Vadj - Vo)}{Vo} \times 100[\%]$$

Output voltage Vo=1.201 V@Iout=0

For 3.3V Model

Equations for calculating the trim resistor are shown below. The Trim Down resistor should be connected the Trim pin and GND pin. The Trim Up resistor should be connected the Trim pin and Vout pin. Only one of the resistors should be used for any given application.



$$R_{trimup} = \frac{(100 + \Delta\%) \cdot V_0}{1.225 \cdot \Delta\%} - \frac{100 + 2 \cdot \Delta\%}{\Delta\%} \quad [k\Omega]$$

$$R_{trimdown} = \frac{100}{\Delta\%} - 2 \quad [k\Omega]$$

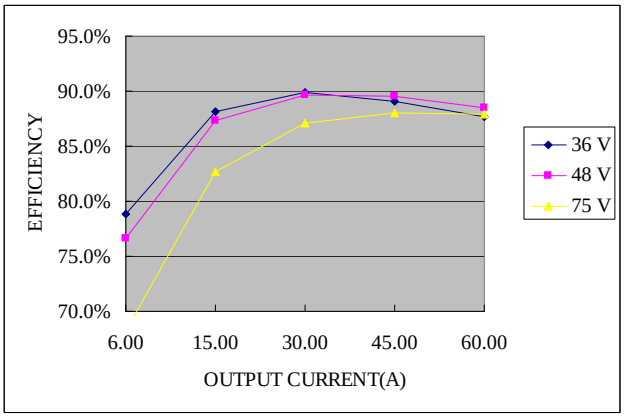
Note:

$$\Delta\% = \left| \frac{V_{DES} - V_o}{V_o} \right| \times 100$$

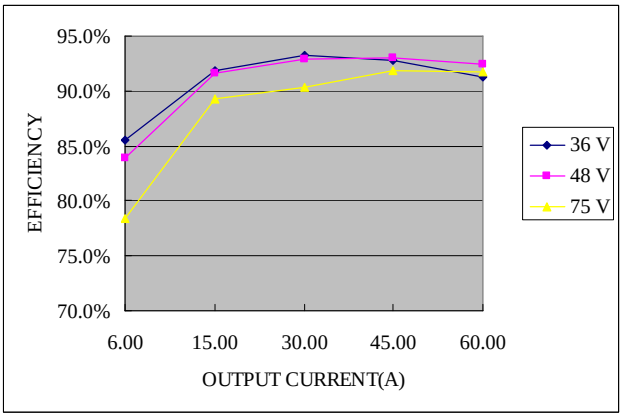
Vo_req=Desired(trimmed) output voltage[V]

Output voltage Vo=3.3V

Efficiency Data

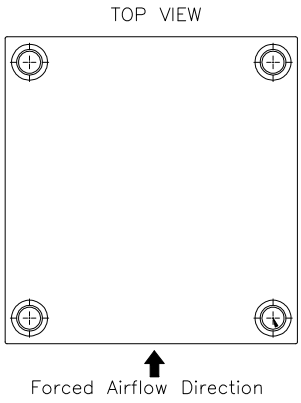


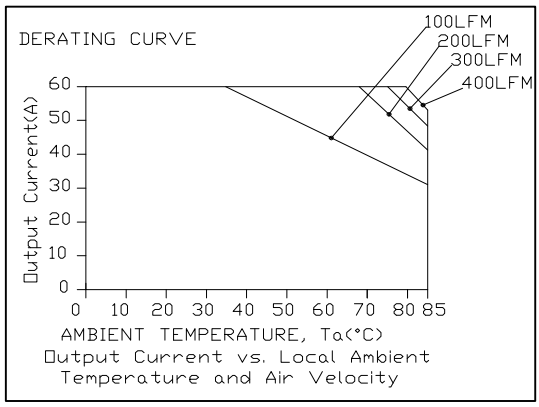
Vo=1.2 V



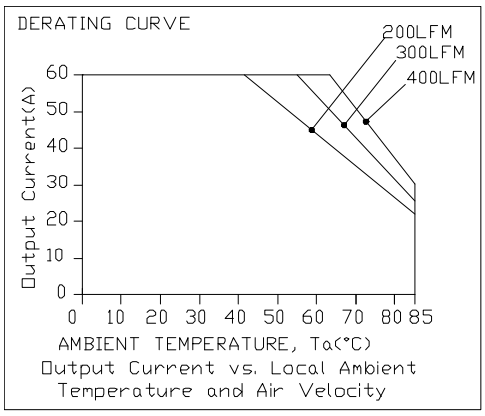
Vo=3.3 V

Thermal Derating Curves



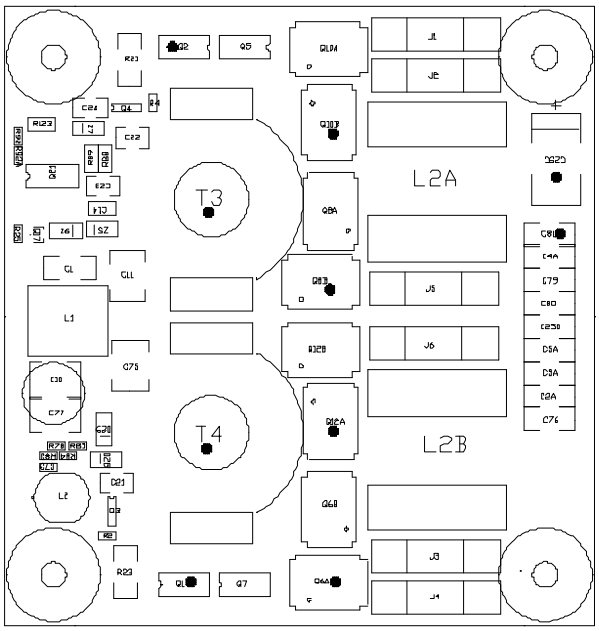


Vo=1.2V

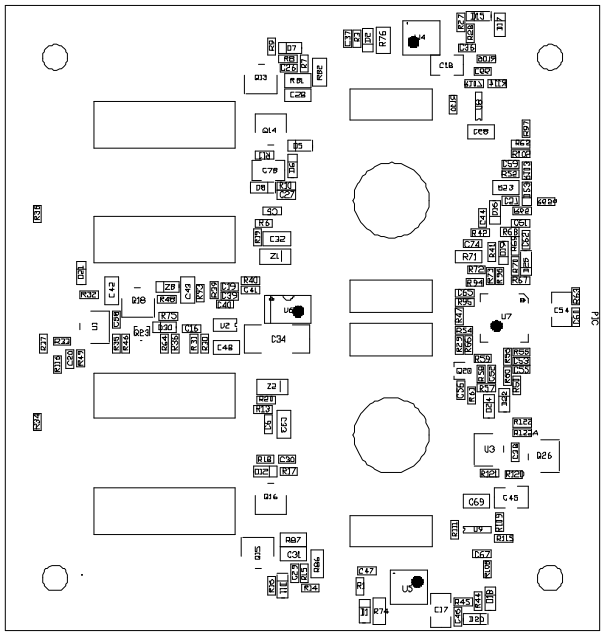


Vo=3.3V

Thermal Derating Curves (continued)

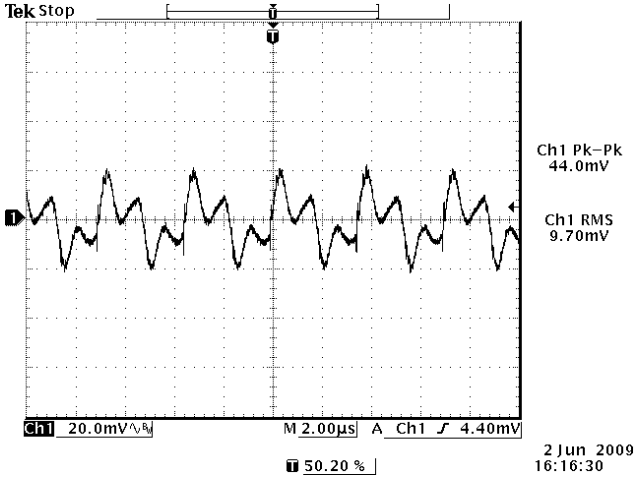


Temperature reference points on top side

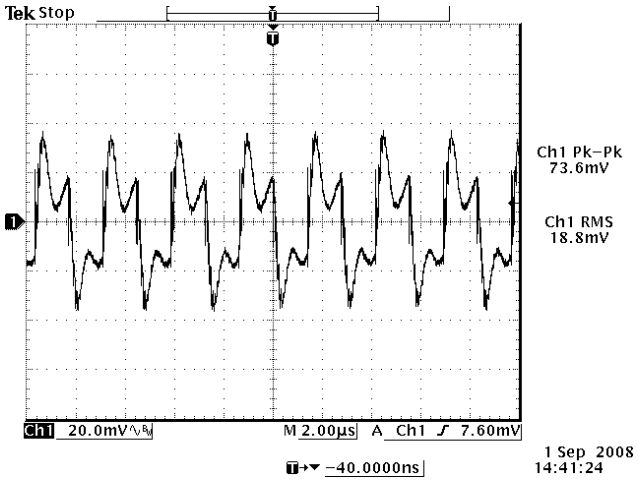


Temperature reference points on bottom side

Ripple and Noise Waveform



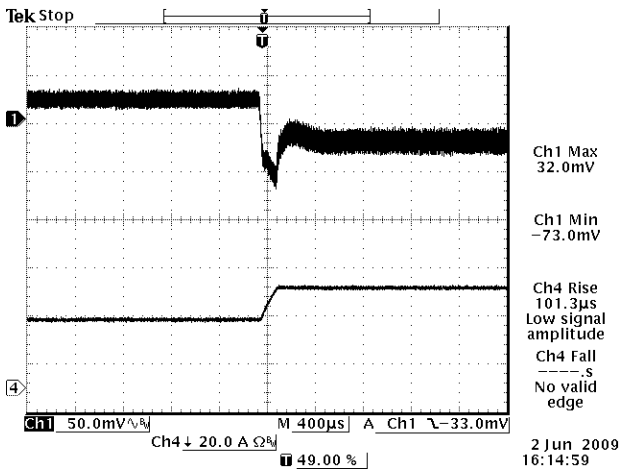
Ripple and noise at 48 V input, 1.2 V output



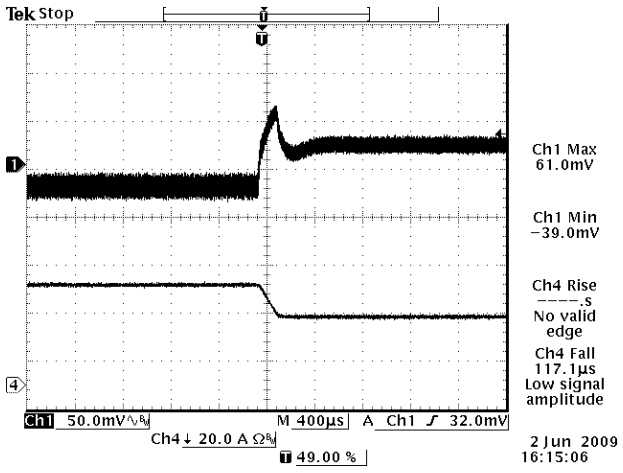
Ripple and noise at 48 V input, 3.3 V output

Note: Output ripple and noise at full load, 0-20MHz BW, with 10 uF/10 V Tan Cap and 1uF/50V ceramic cap at the output, Ta=25 deg C.

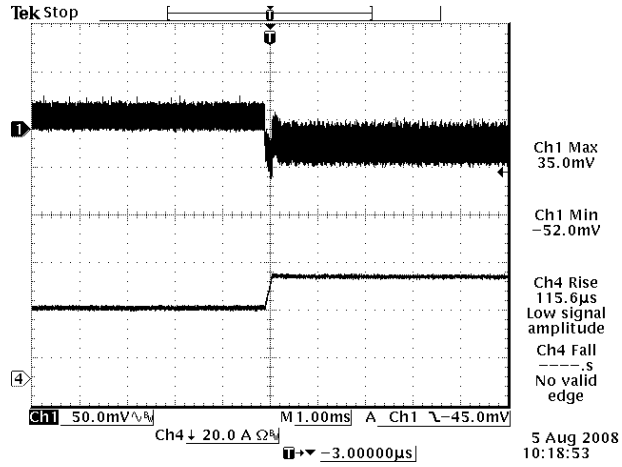
Transient Response Waveforms



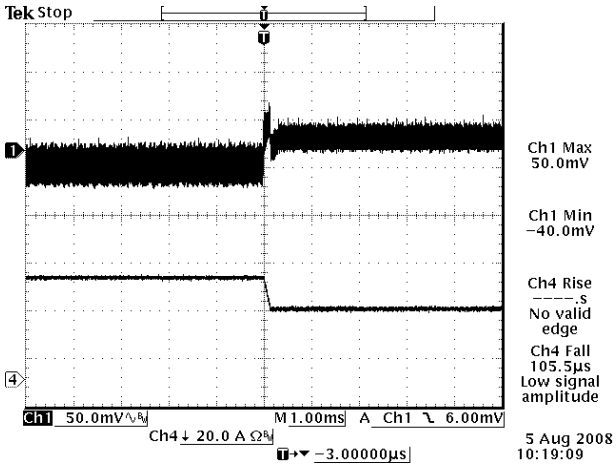
50%-75% Load Transients at Vin=48 V, Vo=1.2 V



75%-50% Load Transients at Vin=48 V, Vo=1.2 V



50%-75% Load Transients at Vin=48 V, Vo=3.3 V

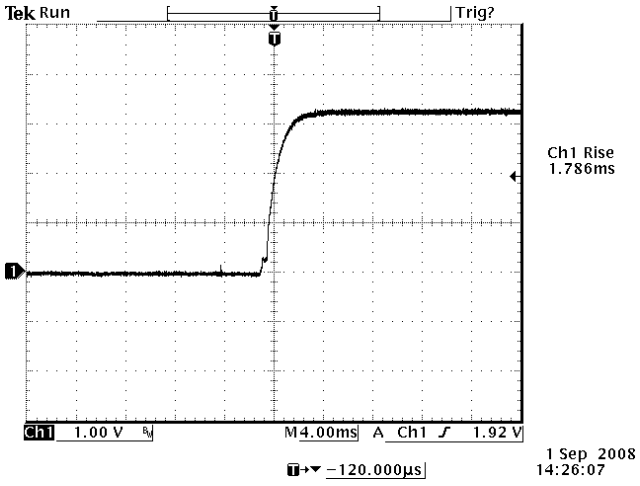


75%-50% Load Transients at Vin=48 V, Vo=3.3 V

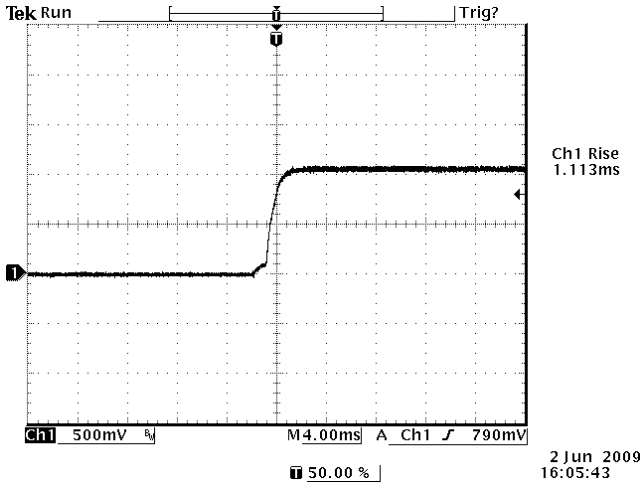
Note: Transient response at di/dt=0.1A/uS, with 10uF/10V Tan cap and 1uF/50V ceramic cap at the output, Ta=25 deg C.

Start Up

Rise Time

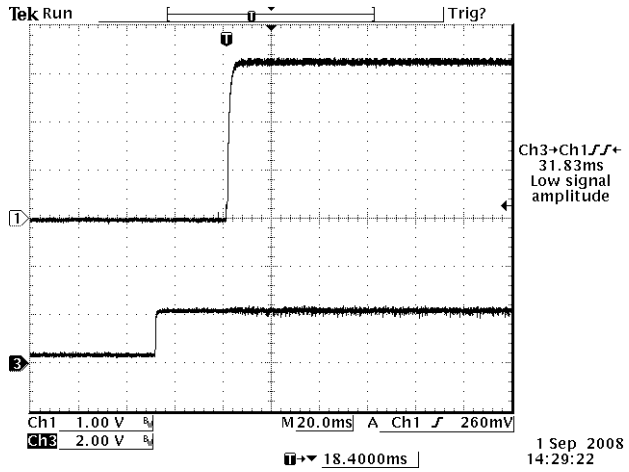


Vin=48V, Vo=3.3V, Io=60A

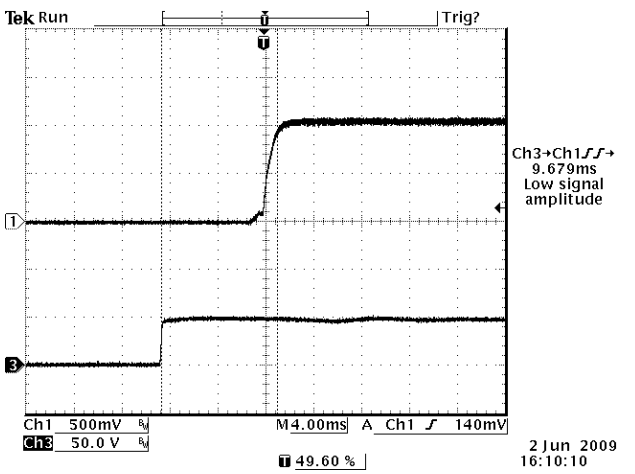


Vin=48V, Vo=1.2V, Io=60A

Startup time



Startup from Vin
Ch1: Vo, Ch3: Vin
Vin=48V, Vo=3.3V, Io=60A



Startup from Vin
Ch1: Vo, Ch3: Vin
Vin=48V, Vo=1.2V, Io=60A

Safety & EMC

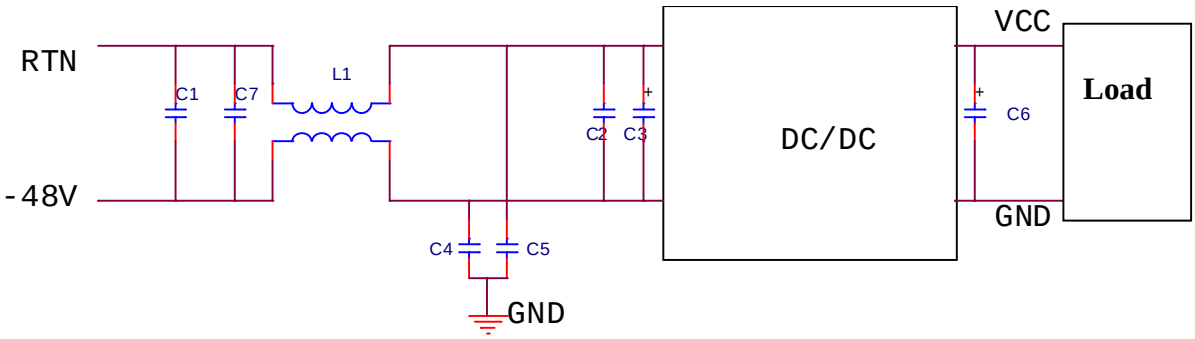
Safety

1. Material flammability UL94V-0
2. UL Certification UL60950-1

EMC

1. Surge IEC61000-4-5
2. DC-DIP IEC61000-4-29
3. Conductive EMI EN55022 class A

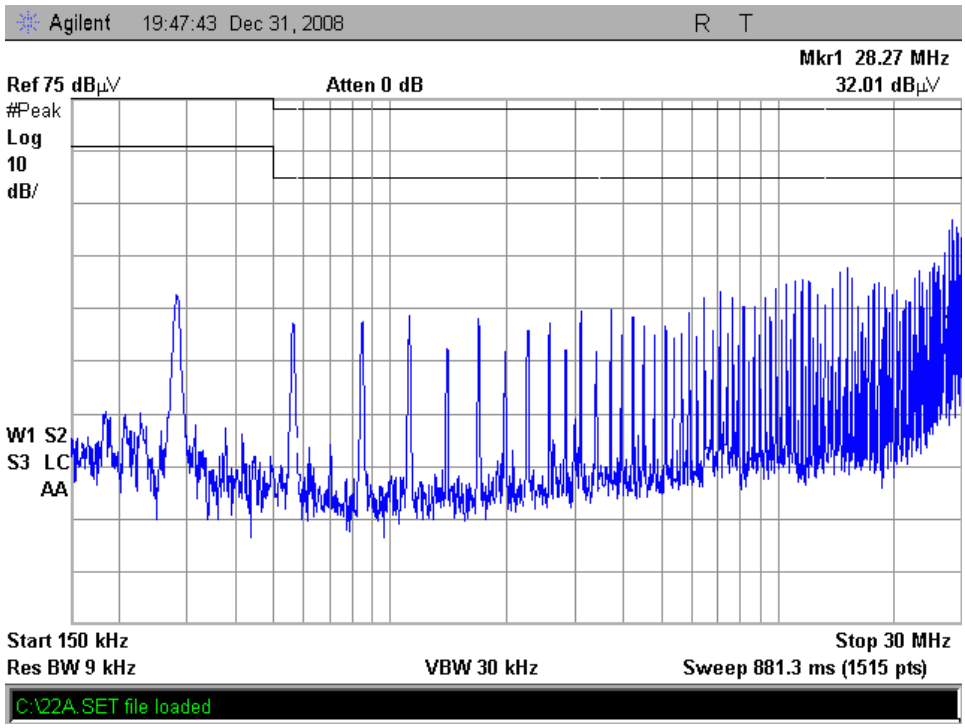
Compliance to EN55022 class A (both q.peak and average) with the following inductive and capacitive filter



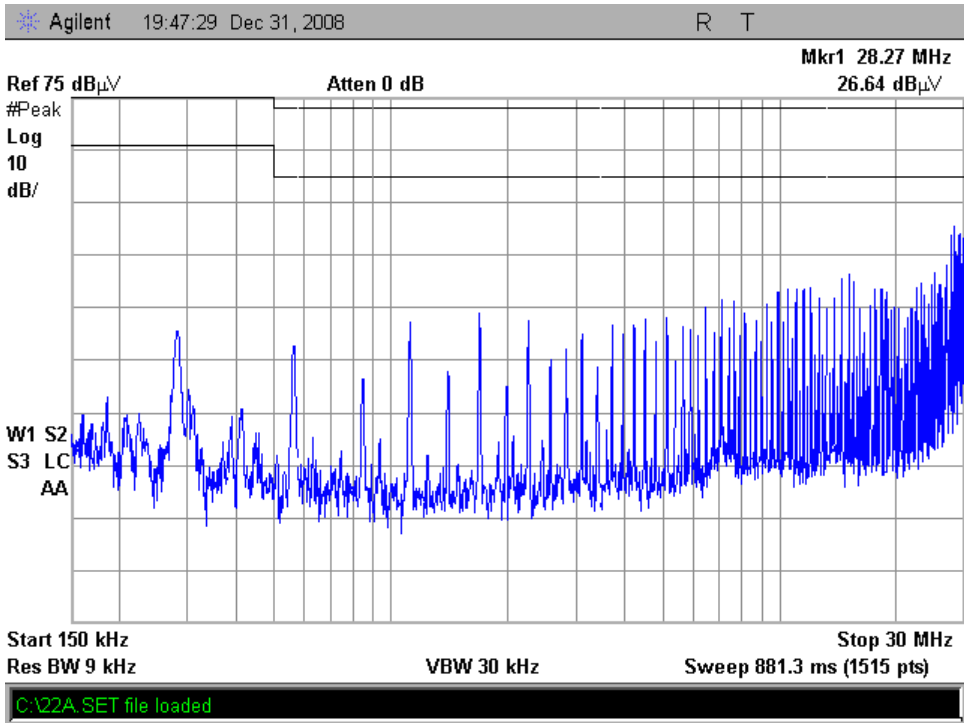
Item	Designator	Parameter	Vendor	Vendor P/N
1	C1	1uF/100V,ceramic	Murata	GRM32ER72A105KA01L
2	C2	0.1uF/100V, ceramic	TDK	C3216X7R2A104K
3	C3	100uF/100V, AL cap	Nichicon	UVZ2A101MPD
4	C4	100nF/1000V,ceramic	Johanson	102S47W104KV4
5	C5	100nF/1000V,ceramic	Johanson	102S47W104KV4
6	C6	N/A		
7	C7	1uF/100V,ceramic	Murata	GRM32ER72A105KA01L
8	T1	1.3mH, common mode	Pulse	P0402NL

Safety & EMC (continued)

Positive: Vo=1.2V

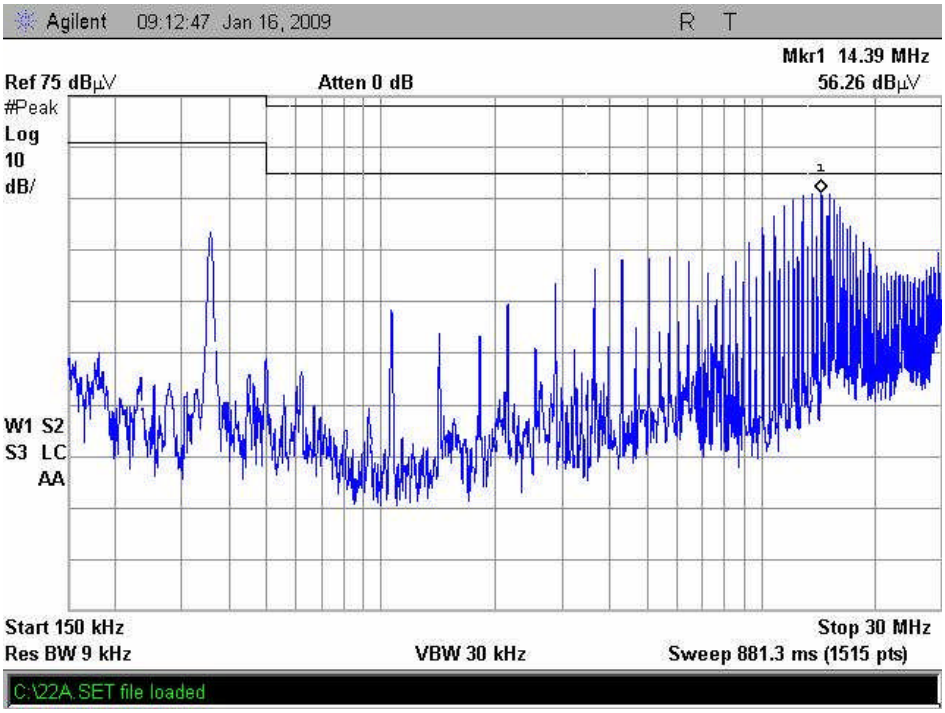


Negative: Vo=1.2V

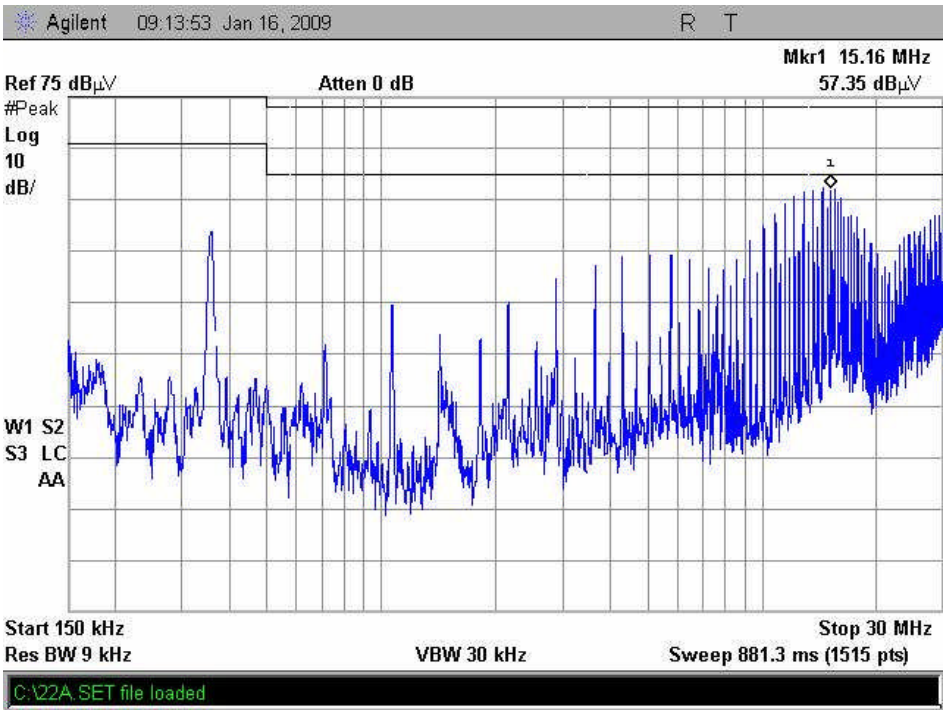


Safety & EMC (continued)

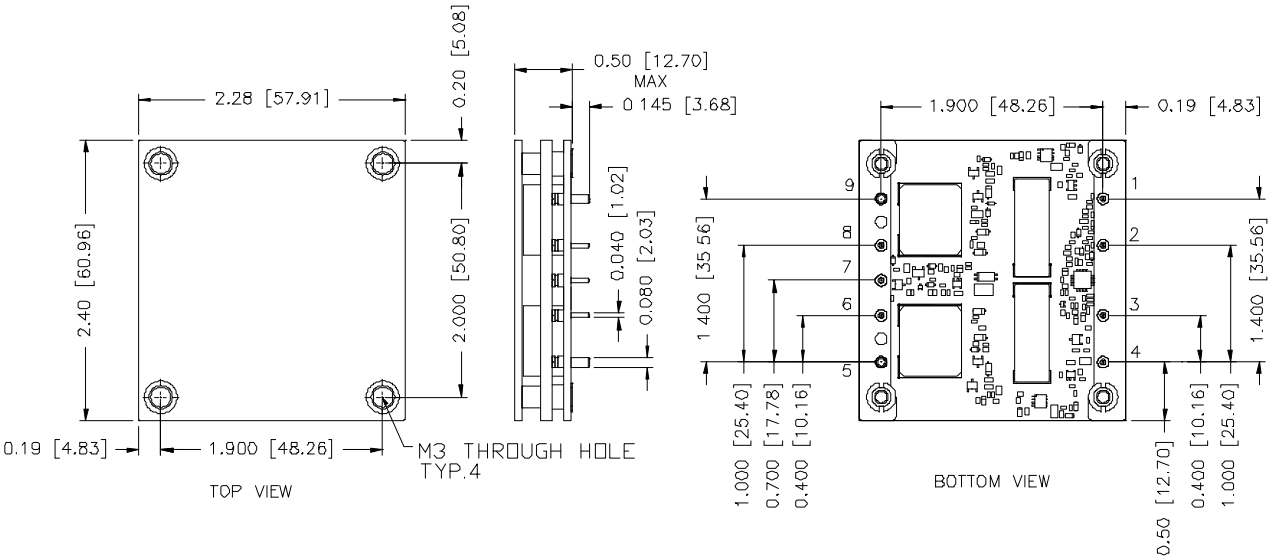
Positive: Vo=3.3V

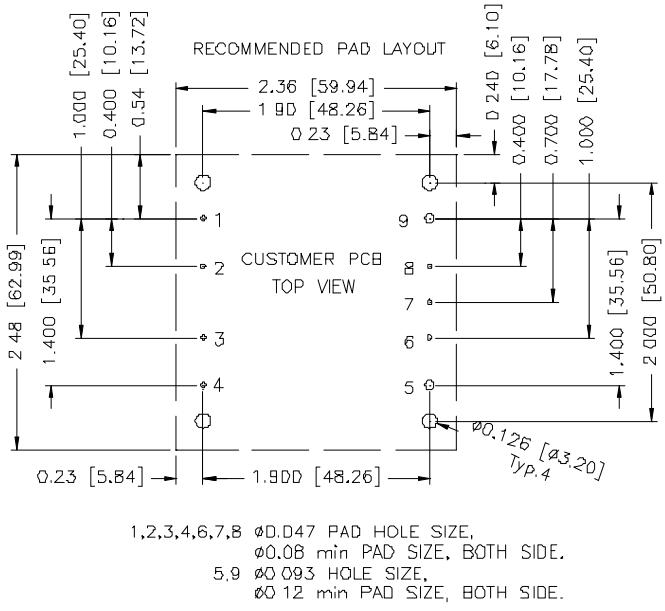


Negative: Vo=3.3V

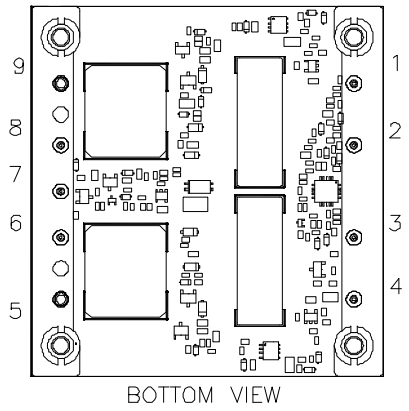


Mechanical Outline





1,2,3,4,6,7,8 ø0.047 PAD HOLE SIZE,
ø0.08 min PAD SIZE, BOTH SIDE.
5,9 ø0.093 HOLE SIZE,
ø0.12 min PAD SIZE, BOTH SIDE.



Pin Connections

Pin	Function	Pin Size
1	Vin(+)	0.040”
2	CNT	0.040”
3	NC	-
4	Vin(-)	0.040”
5	Vo(-)	0.080”
6	Sense(-)	0.040”
7	Trim	0.040”
8	Sense(+)	0.040”
9	Vo(+)	0.080”

Notes: 1. Pin 6 must be connected to Vo(-).
2. Pin 8 must be connected to Vo(+).

Revision History

Date	Revision	Changes Detail	Approval
2009-12-17	F	1. Update to Bel new datasheet version, add part number explanation, start-up, safety and so on; 2. add 1.2Vout spec	YP/Falling
2010-1-29	G	1. Update thermal derating curve for 3.3Vout.	YP/Falling
2010-2-10	H	1. Update thermal derating curve for 1.2Vout. Chang the figure of air direction	YP/Falling

RoHS Compliance

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

CORPORATE

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