NON-ISOLATED DC/DC CONVERTERS

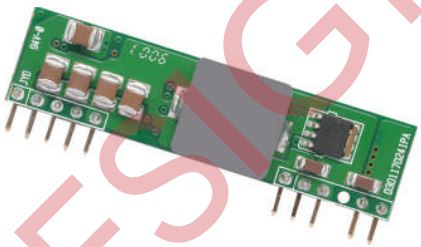
8.3 Vdc - 14 Vdc Input 0.75 Vdc - 5.5 Vdc/16 A Output

Jan. 25, 2013

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

VRBC-16A1Ax RoHS Compliant Rev.A

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Fixed Frequency
- Able to Sink & Source Current
- Vout Prebias
- Industrial Temperature Range
- Under-voltage Lockout (UVLO)
- Over Temperature Shutdown
- OCP/SCP
- Wide Input
- Wide Trim
- Remote On/Off
- Active Low/High (option)
- Remote Sense
- Certificated to UL60950-1/CSA C22.2 No.60950-1, 2rd edition, am1



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel VRBC-16A1Ax is part of the non-isolated dc/dc converter Power Module series. The modules use a SIP package. These converters are available in a range of output voltages from 0.75 Vdc to 5.0 Vdc over a wide range of input voltage (Vin = 8.3 Vdc - 14 Vdc).The efficiency is typically 92% at 3.3 Vout at full load.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active Low	Model Number Active High
0.75 V - 5.5 V	8.3 V - 14 V	16 A	80 W	94%	VRBC-16A1AL	VRBC-16A1A0

Notes: 1.Change the last character to “C” to indicate 0.20’’ pin length and active low.
2. Add “G” suffix at the end of the model number to indicate Tray Packaging.

Part Number Explanation

V	R	BC	–	16	A	1A	x
1	2	3		4	5	6	7

1---Vertical mount
2---RoHS 6, change “R” to “7” means RoHS 5
3---Series name
4---Series code
5---Wide input range (8.3-14V)
6---Wide trim
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	-	15 V	
Output Enable Terminal Voltage	-0.3 V	-	15 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

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

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage Vo, set≤3.63 V Vo, set >3.63 V	 8.3 V 8.3 V	 12 V 12 V	 14 V 13.2 V	
Input Current[1] (full load)	-	-	11 A	
Input Current (no load)	-	100 mA	-	
Remote Off Input Current	-	2 mA	-	
Input Reflected Ripple Current (rms)	-	-	150 mA	With simulated source impedance of 1000 nH, 5 Hz to 20 MHz, use a 1000 uF/25 V AL-Cap with ESR=0.03 ohm max and 6 x 47 uF/16 V tantalum cap with ESR=0.013 ohm max, at 100 kHz
Input Reflected Ripple Current (pk-pk)	-	-	400 mA	
I^2t Inrush Current Transient	-	0.2 A^2s	0.4 A^2s	
Turn-on Voltage Threshold	-	7.8 V	-	
Turn-off Voltage Threshold	-	7.3 V	-	

Notes: 1.This power module is not internally fused. An input line fuse must always be used.
All specifications are typical at 25 °C unless otherwise stated.

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point	-2% Vo,set	-	2% Vo,set	Vin=12 V, full load
Load Regulation	-	0.2% Vo,set	-	Io=Io, min to Io, max
Line Regulation	-	0.3% Vo,set	-	Vin=Vin, min to Vin, max
Regulation Over Temperature (-40°C to +85°C)	-	0.3% Vo,set	-	Tref=Ta, min to Ta, max
Output Current	0 A	-	16 A	
Current Limit Threshold	-	180% Io,out	-	
Short Circuit Surge Transient	-	1 A^2s	3 A^2s	
Ripple and Noise (pk-pk)	-	50 mV	100 mV	Tested with 0-20 MHz, 10 uF tantalum capacitor &1 uF ceramic capacitor at the output
Ripple and Noise (rms)	-	30 mV	45 mV	
Turn on Time	-	8 mS	20 mS	

Output Specifications(continued)

Parameter		Min	Typ	Max	Notes
Overshoot at Turn on		-	-	1% Vo,set	
Output Capacitance		0 uF	-	5000 uF	ESR≥10 mohm
Transient Response					
50% ~ 100% Max Load	All	-	100 mV	-	di/dt=2.5 A/uS; Vin=12 V; and with 330 uF tantalum capacitors at the output
Settling Time		-	80 uS	-	
100% ~ 50% Max Load		-	100 mV	-	
Settling Time		-	80 uS	-	

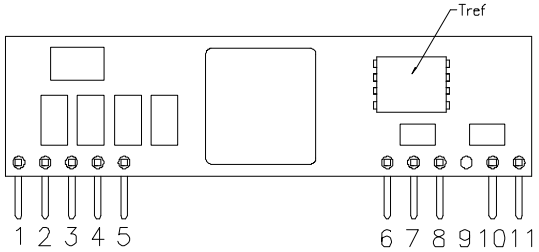
Note: All specifications are typical at nominal input, full load at 25 °C unless otherwise stated.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
Vo=5.0 V	-	94%	-	Measured at Vin=12 V, full load
Vo=3.3 V	-	92%	-	
Vo=2.5 V	-	90%	-	
Vo=1.8 V	-	88%	-	
Vo=1.5 V	-	87%	-	
Vo=1.2 V	-	85%	-	
Vo=0.75 V	-	78%	-	
Switching Frequency	250 kHz	280 kHz	310 kHz	
Over Temperature Shutdown[1]	-	130 °C	-	
Output Trim Range (Wide Trim)	0.7525 V	-	5.5 V	
Remote Sense Compensation	-	-	0.5 V	
MTBF	4,619,490 hours			Calculated Per Bell Core SR-332 (Io = 80% load; Vin=12 V; Vo=3.3 V; Ta = 25 °C)
Dimensions				
Inches (L × W × H)	2.0x 0.5 x 0.32			
Millimeters (L × W × H)	50.8 x 12.7 x 8.13			
Weight	-	7.1 g	-	

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

1. The Tref temperature measurement location:



Control Specifications

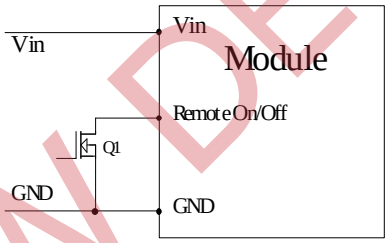
Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.2 V	-	0.3 V	VRBC-16A1A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	-	-	Vin, max	
Signal Low (Unit On)	-0.2 V	-	0.3 V	VRBC-16A1AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5 V	-	Vin, max	

Remote On/Off

For Active High Modules (Positive Logic)

When the transistor Q1 is in the Off state, the power module is ON.

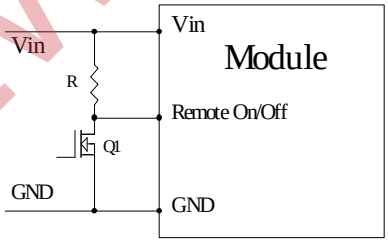
When the transistor Q1 is turned On, the power module is OFF.



For Active Low Modules (Negative Logic)

When the transistor Q1 is in the Off state, the power module is OFF.

When the transistor Q1 is turned On, the power module is ON.

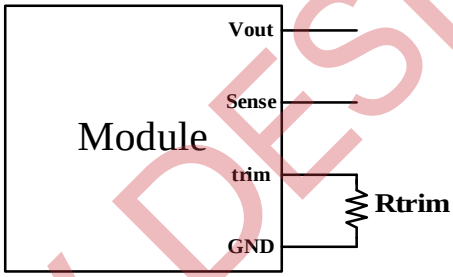


Output Trim Equations

Equation for calculating the trim resistor given the desired output voltage (Vo) is shown below. Rtrim is the required resistance between the trim pin and GND pin, Vtrim is the required voltage between the trim and GND pin.

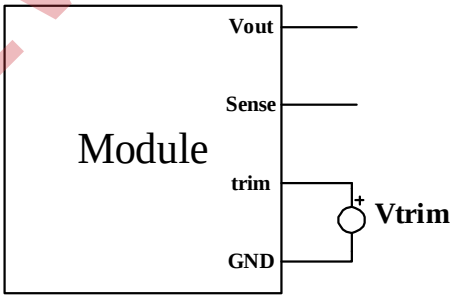
$$Rtrim = \left[\frac{10500}{Vo - 0.7525} - 1000 \right]$$

Vo (V)	Rtrim (KΩ)
0.7525	Open
1.2	22.46
1.5	13.05
1.8	9.024
2.5	5.009
3.3	3.122
5.0	1.472

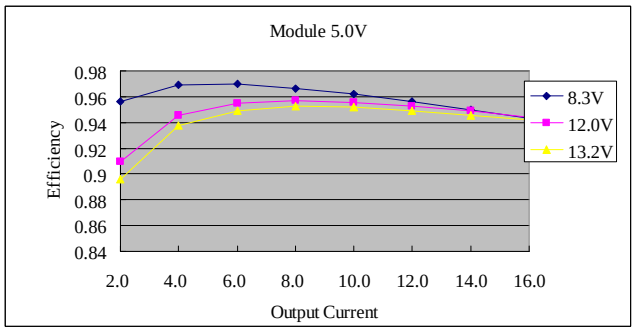


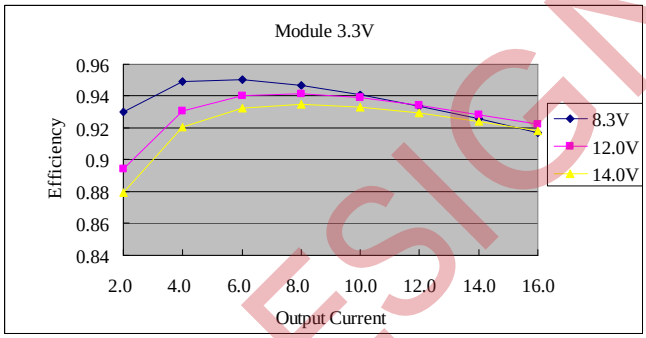
$$Vtrim = \{0.7 - 0.0667 \times (Vo - 0.7525)\}$$

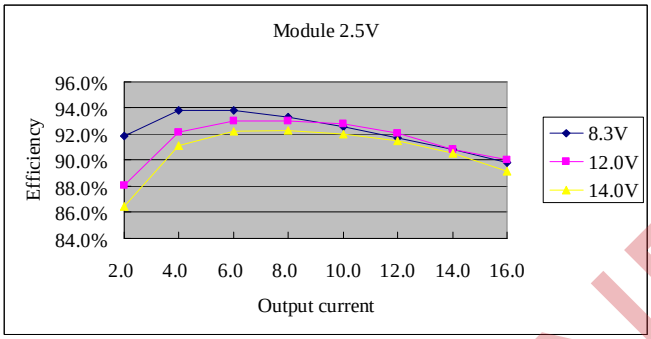
Vo (V)	Vtrim (V)
0.7525	Open
1.2	0.67
1.5	0.65
1.8	0.63
2.5	0.583
3.3	0.53
5.0	0.42

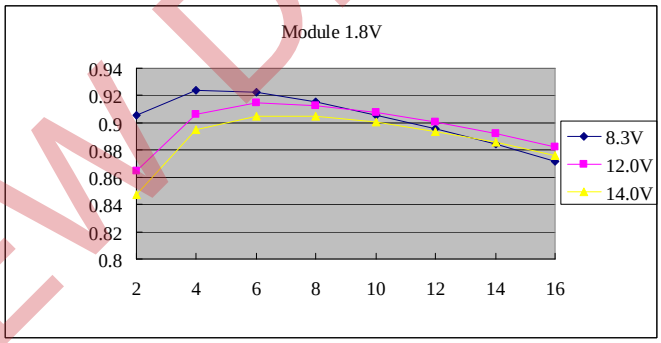


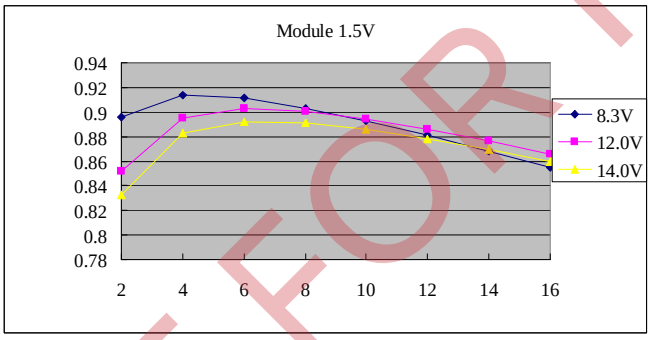
Efficiency Data

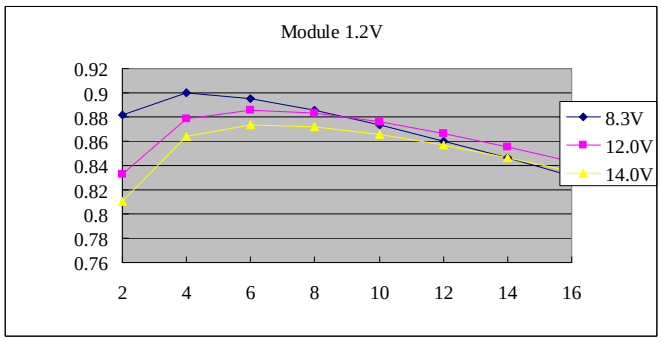


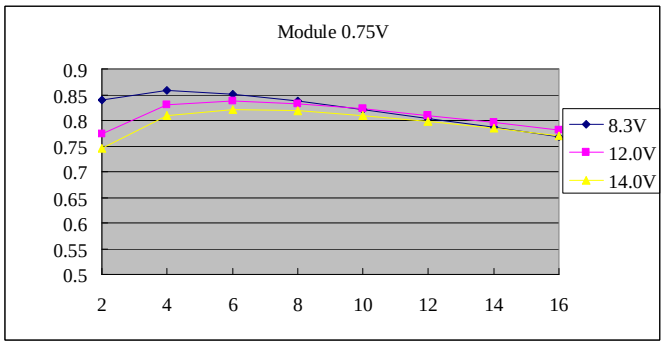




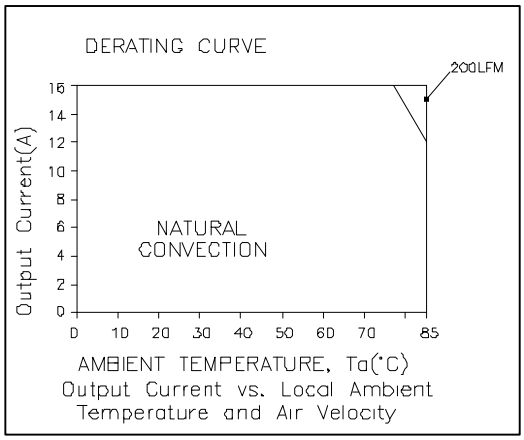




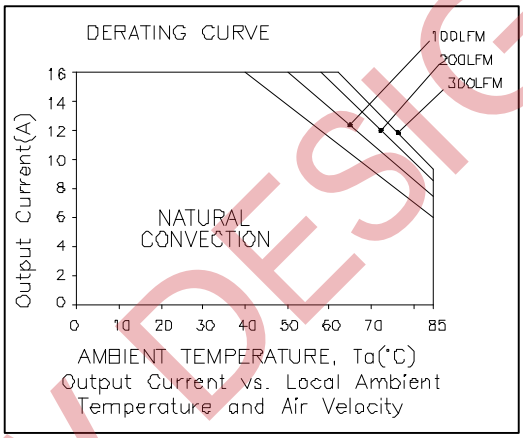




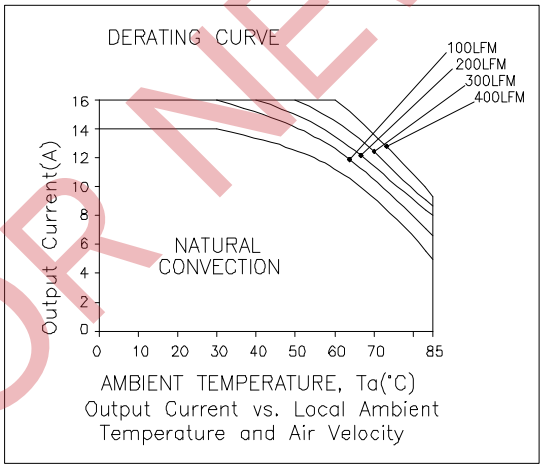
Thermal Derating Curves



Vo=0.75 V; Vin=12.0 V

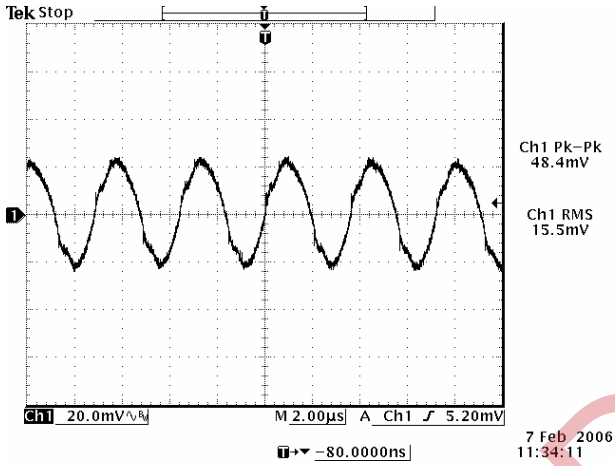


Vo=1.8 V; Vin=12.0 V

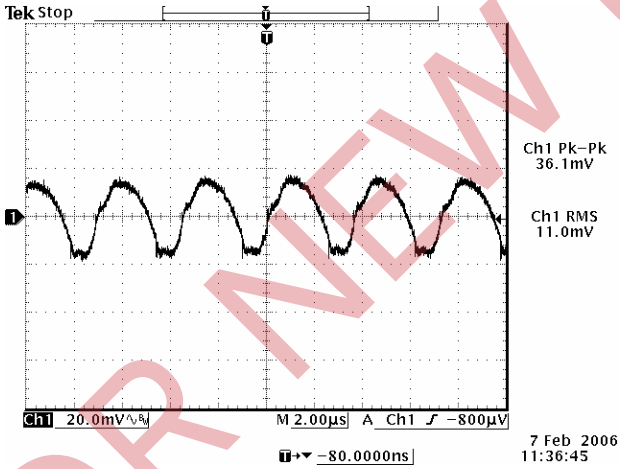


Vo=3.3 V; Vin=12.0 V

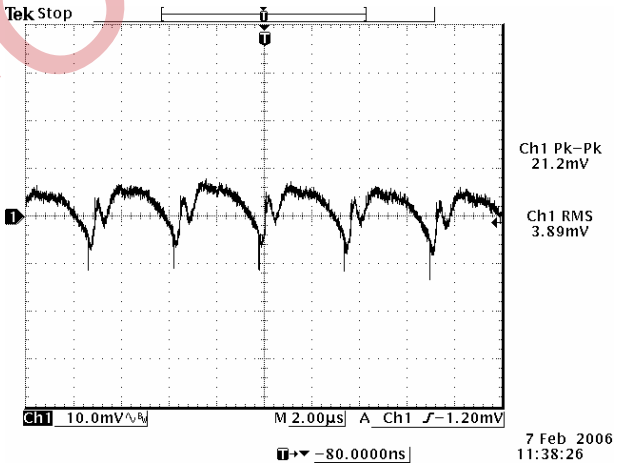
Ripple and Noise Waveforms



Ripple and noise at full load, 12 Vdc input, 5.0 Vdc output



Ripple and noise at full load, 12 Vdc input, 3.3 Vdc output

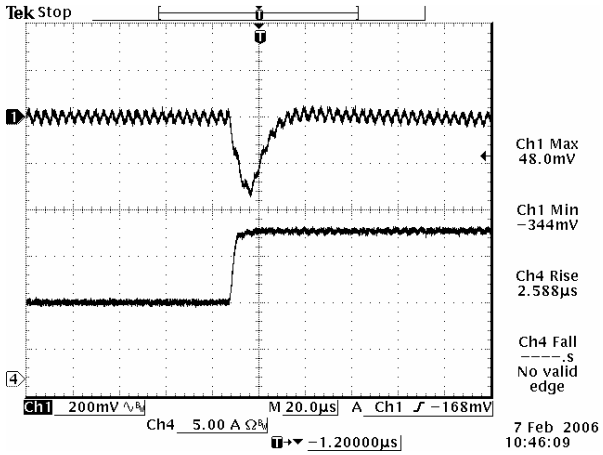


Ripple and noise at full load, 12 Vdc input, 0.75 Vdc output

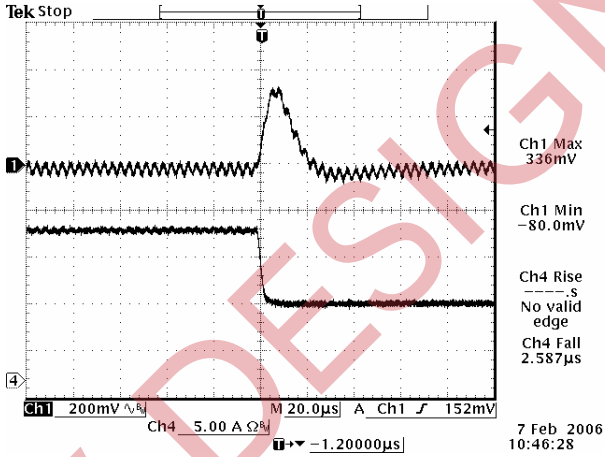
Note: External load with 10uF tantalum capacitor and 1uF ceramic at the output, and Ta=25 deg C.

Transient Response Waveforms

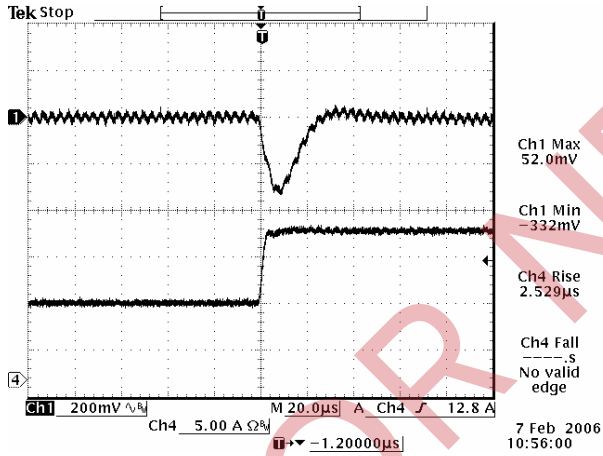
External load capacitor Cext=0 uF, di/dt=2.5 A/us



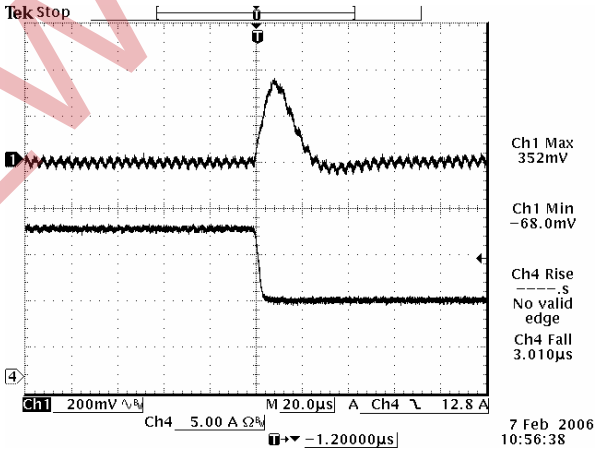
50% to 100% load Transient at 5.0 Vdc output



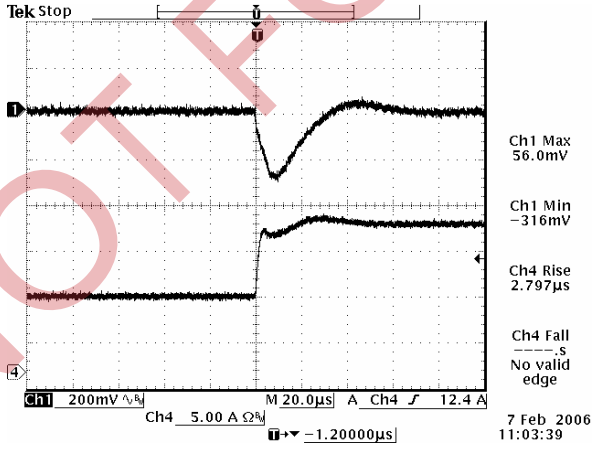
100% to 50% load Transient at 5.0 Vdc output



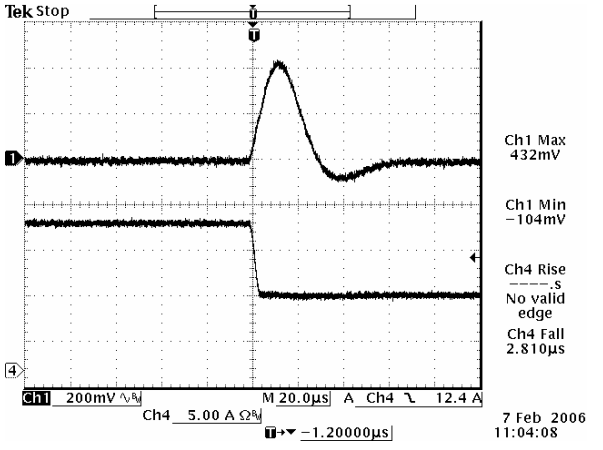
50% to 100% load Transient at 3.3 Vdc output



100% to 50% load Transient at 3.3 Vdc output



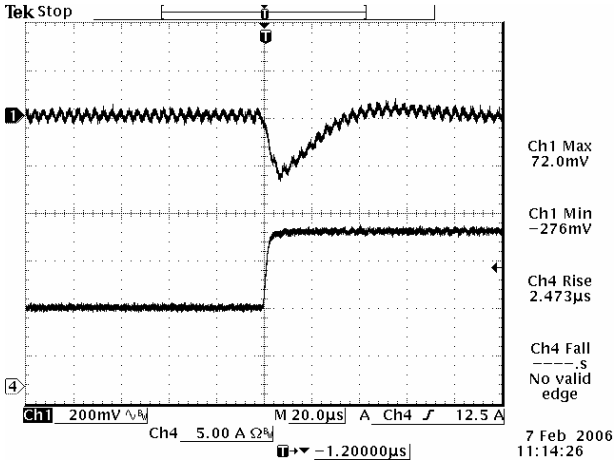
50% to 100% load Transient at 0.75 Vdc output



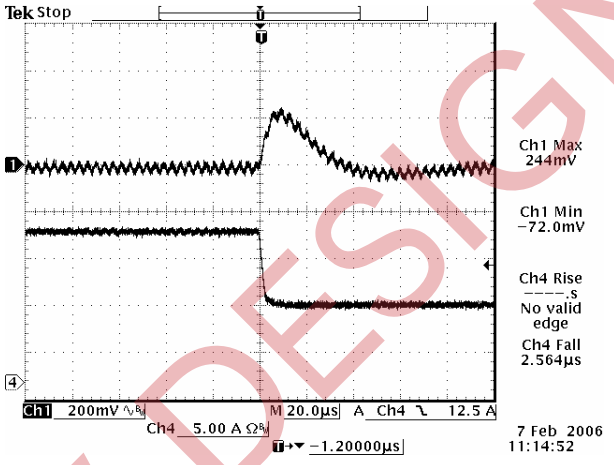
100% to 50% load Transient at 0.75 Vdc output

Transient Response (continued)

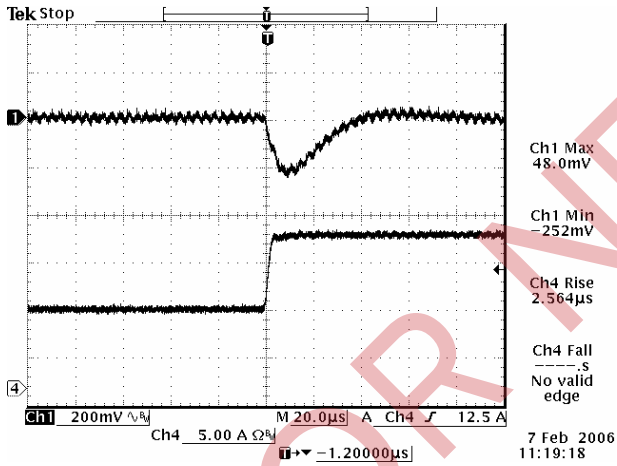
External load capacitor Cext=330 uF Tantalum capacitor, di/dt=2.5 A/us



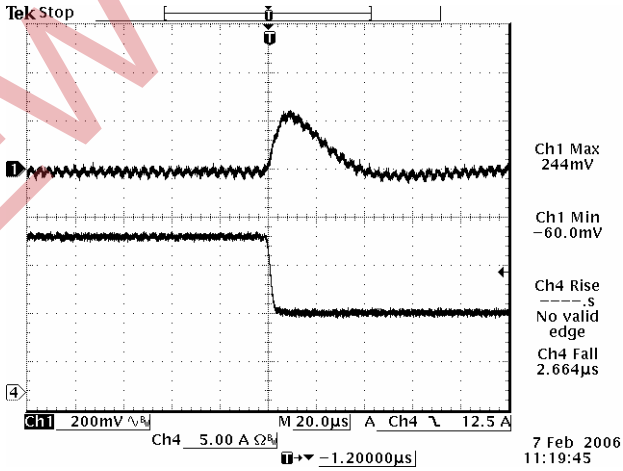
50% to 100% load Transient at 5.0 Vdc output



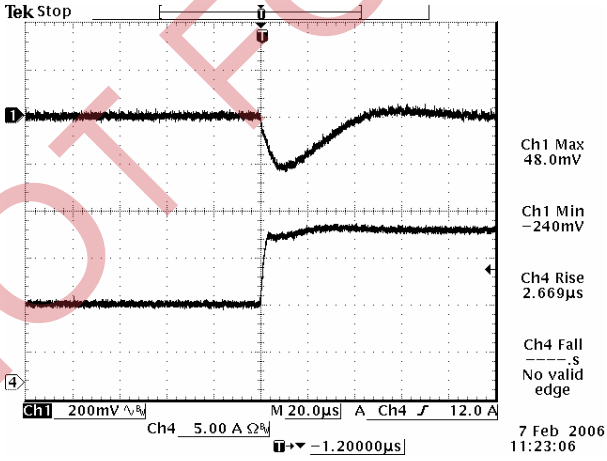
100% to 50% load Transient at 5.0 Vdc output



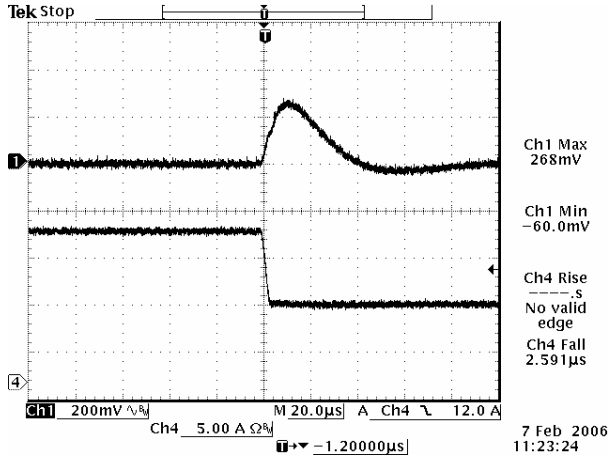
50% to 100% load Transient at 3.3 Vdc output



100% to 50% load Transient at 3.3 Vdc output



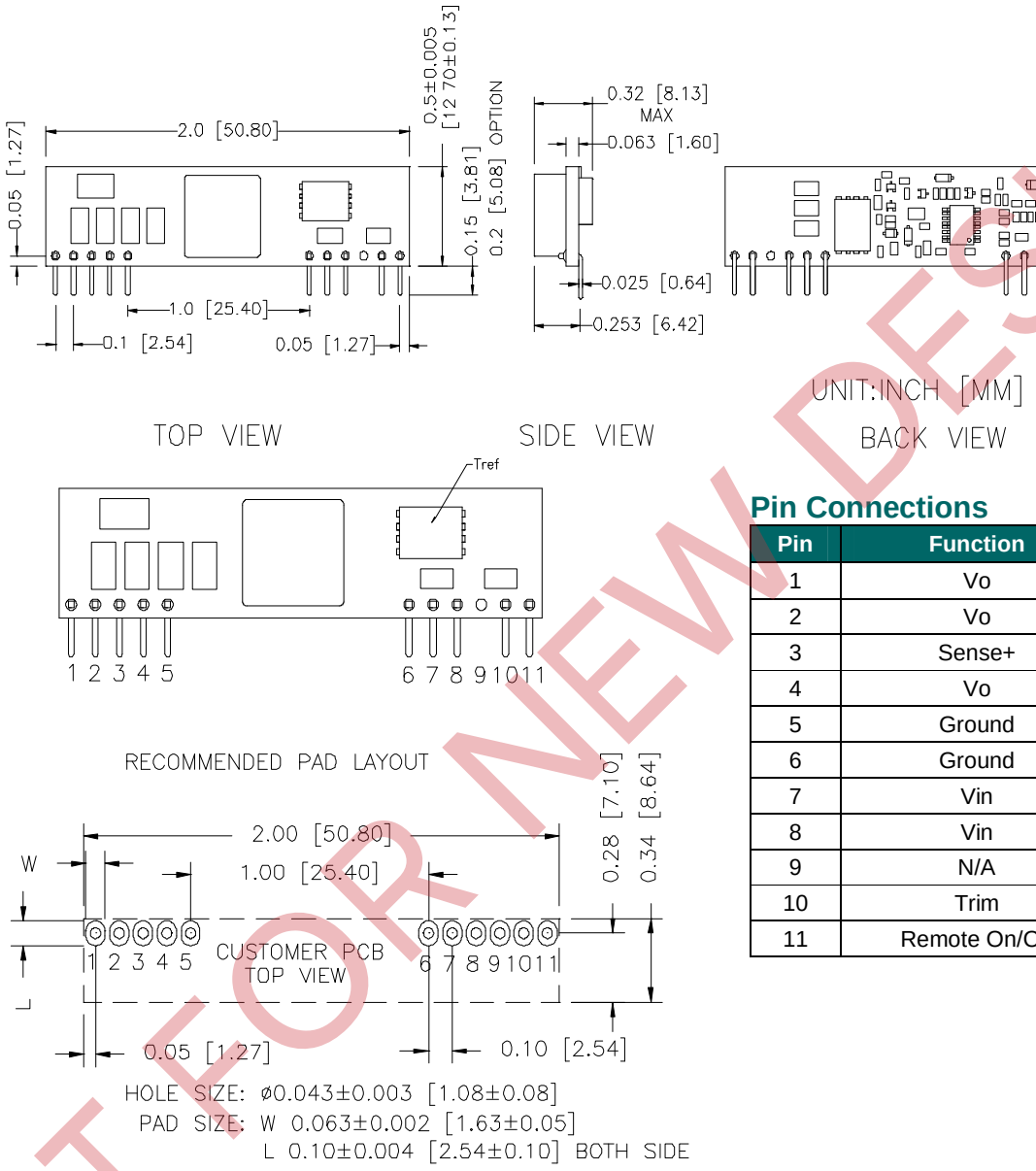
50% to 100% load Transient 0.75 Vdc output



100% to 50% load Transient at 0.75 Vdc output

Note: All specifications are typical at 12Vdc input and Ta=25 deg C.

Mechanical Outline



Pin Connections

Pin	Function
1	Vo
2	Vo
3	Sense+
4	Vo
5	Ground
6	Ground
7	Vin
8	Vin
9	N/A
10	Trim
11	Remote On/Off

Note:

1) All Pins: Material - Copper Alloy;
Finish – 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate.

2) Undimensioned components are shown for visual reference only.

3) All dimensions in inches (mm); Tolerances: x.xx +/-0.02 in. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm).

Revision History

Date	Revision	Changes Detail	Approval
2007-01-17	A	Change version to A	Lynn
2013-01-25	B	Update UL.	HL

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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