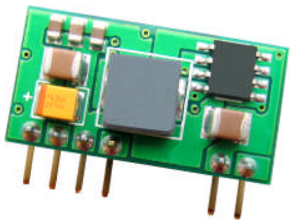
NON-ISOLATED DC/DC CONVERTERS

8.3 Vdc - 14 Vdc Input   0.75 Vdc - 5.5 Vdc/6 A Output

Jan. 25, 2013   *Bel Power, Inc. , a subsidiary of Bel Fuse, Inc.*

VRBA-06A2Ax   RoHS Compliant   Rev.B

- Non-Isolated
- High Efficiency
- High Power Density
- Fixed Frequency
- Remote On/Off
- Active Low/High (Option)
- Certificated to UL60950-1/CSA C22.2 No.60950-1, 2rd edition, am1
- Under-Voltage Lockout (UVLO)
- OCP/SCP
- Wide Input Range
- Wide Trim Range
- Flexible Output Voltage Sequencing



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel VRBA-06A2Ax modules are a series of non-isolated dc/dc converters that deliver up to 6 A of output current with full load efficiency of 92% at 5.0 Vdc output. These modules provide precisely regulated voltage programmable via external resistor from 0.75 Vdc to 5.5 Vdc over a wide range of input voltage (8.3 Vdc - 14 Vdc). These modules have a sequencing feature that enables designers to implement various types of output voltage sequencing when powering multiple voltages on a board. The open-frame construction and small footprint enable designers to develop cost and space-efficient solutions. Standard features include remote On/Off, over current protection, short current protection, wide input, and programmable output voltage.

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	6 A	33 W	92%	VRBA-06A2AL	VRBA-06A2A0

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

Part Number Explanation

V R BA – 06 A 2A 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	
Sequencing Voltage [1]	-0.3 V	-	Vin	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-55 °C	-	125 °C	

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

1. VRBA-06A2Ax series of modules include a sequencing feature that enables users to implement various types of output voltage sequencing in their applications. This is accomplished via an additional sequencing pin. When the sequencing feature is not used, tie the SEQ pin to Vin or leave the SEQ pin floating.

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	8.3 V	12 V	14 V	
Input Current (full load) Vo=5.0 V Vo=3.3 V Vo=2.5 V Vo=1.8 V Vo=0.75 V	 - - - - -	 2.75 A 1.85 A 1.45 A 1.05 A 0.55 A	 4.0 A 2.8 A 2.2 A 1.6 A 0.8 A	
Input Current (no load) Vo=5.0 V Vo=0.75 V	 - -	 - -	 100 mA 20 mA	
Remote Off Input Current	-	1 mA	2 mA	
Input Reflected Ripple Current (pk-pk)	-	120 mA	-	Tested with two 100 uF/25 V tantalum input capacitors & simulated source impedance of 1uH, 5 Hz to 20 MHz.
Input Reflected Ripple Current (rms)	-	40 mA	-	
I^2t Inrush Current Transient	-	0.002 A^2s	0.02 A^2s	
Turn-on Voltage Threshold	-	8.1 V	8.2 V	
Turn-off Voltage Threshold	-	7.5 V	8.0 V	

Note: 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, Io=Iomax
Output Voltage Set Point	-2.5%Vo,set	-	3.5%Vo,set	Over all operating input voltages, resistive loads and temperature conditions
Adjustment Range Selected by External Resistor or Voltage	0.7525 V	-	5.5 V	
Load Regulation	-0.5%Vo,set	0.4%Vo,set	0.5%Vo,set	Io=Io, min to Io, max
Line Regulation	-0.4%Vo,set	0.3%Vo,set	0.4%Vo,set	Vin=Vin, min to Vin, max
Regulation Over Temperature (-40 °C to +85 °C)	-	0.5%Vo,set	-	Tref=Ta, min to Ta, max
Output Current	0 A	-	6 A	

Output Specifications(continued)

Parameter	Min	Typ	Max	Notes
Current Limit Threshold	7.2 A	-	18 A	
Short Circuit Surge Transient	-	0.25 A^2s	-	
Ripple and Noise (pk-pk) Vo=0.75 V Vo=3.3 V Vo=5.0 V	 - - -	 20 mV 60 mV 75 mV	 - - -	Tested with 0-20 MHz, with 10 uF/10 V tantalum capacitor & 1uF/10 V TDK ceramic capacitor at the output.
Ripple and Noise (rms) Vo=0.75 V Vo=3.3 V Vo=5.0 V	 - - -	 7 mV 20 mV 25 mV	 - - -	
Turn on Time	-	8 mS	10 mS	
Overshoot at Turn on	-	0%	3%	
Output Capacitance ESR ≥ 1mohm ESR ≥ 10mohm	 0 uF 0 uF	 - -	 1000 uF 3000 uF	
Transient Response				
50% ~ 100% Max Load — Vo = 0.75 V -5.5 V	-	200 mV	-	di/dt=2.5 A/uS; Vin=12 V; and with 10 uF/10 V tantalum capacitor & 1 uF/10 V ceramic capacitor at the output.
Settling Time	-	50 uS	-	
100% ~ 50% Max Load	-	200 mV	-	
Settling Time	-	50 uS	-	

Note: All specifications are typical at nominal input (Vin=12 V), full load at 25 °C unless otherwise stated.

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency Vo=5.0 V Vo=3.3 V Vo=2.5 V Vo=1.8 V Vo=0.75 V	 87% 85% 82% 80% 68%	 90% 88% 85% 83% 71%	 - - - - -	Measured at Vin=12 V, full load
Switching Frequency	250 kHz	300 kHz	350 kHz	
Over Temperature Shutdown	-	135 °C	-	
Output Trim Range (wide trim)	0.7525 V	-	5.5 V	
MTBF		3,266,517 hours		Calculated Per Bell Core SR-332 (Io = Nominal; Ta = 25 °C)
Dimensions Inches (L × W × H) Millimeters (L × W × H)		 1 x 0.5 x 0.243 25.4 x12.7 x 6.16		
Weight	-	3 g	-	

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

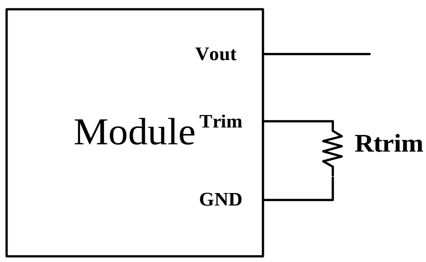
Control Specifications

Parameter	Min	Typ	Max	Notes
Signal Low (Unit Off)	-0.3 V	-	0.4 V	VRBA-06A2A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	2.5 V	-	14 V	
Signal Low (Unit On)	-0.3 V	-	0.4 V	VRBA-06A2AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5 V	-	14 V	
Sequencing Voltage	0 V	-	Vin	Sequencing Voltage applied on SEQ pin should be higher than output voltage.
Sequencing Slew Rate Capability	-	-	2 V/mS	
Sequencing Delay Time	10 mS	-	-	Delay from Vin, min to application of voltage on SEQ pin
Tracking Accuracy				
Power-Up	-	100 mV	200 mV	
Power-Down	-	200 mV	400 mV	

Output Trim Equations

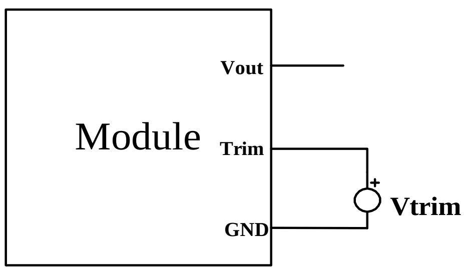
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trim} = \frac{10.507}{V_{adj} - 0.7525} - 1$$

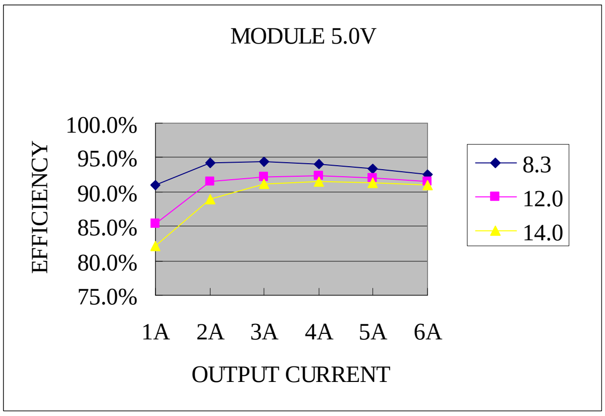


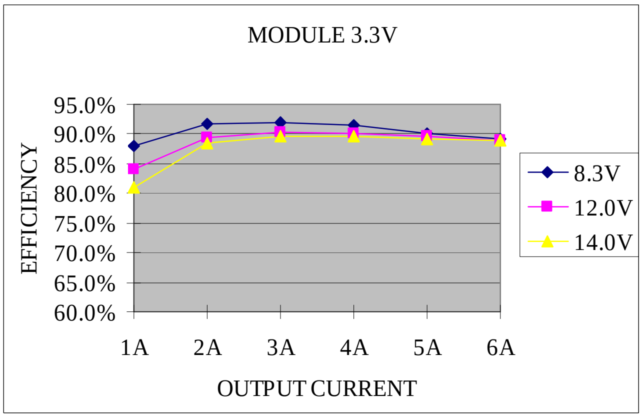
Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

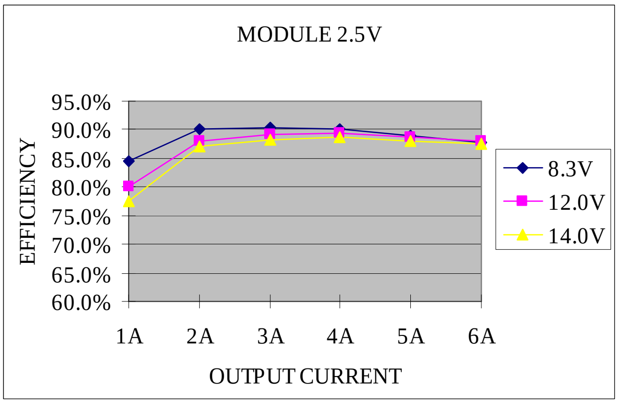
$$V_{trim} = 0.7 - 0.0667 \times (V_{adj} - 0.7525)$$

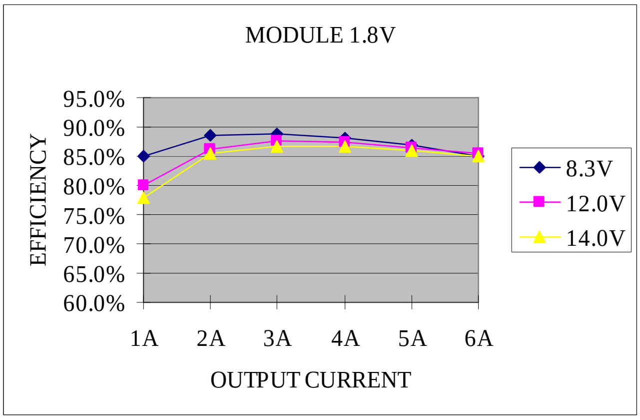


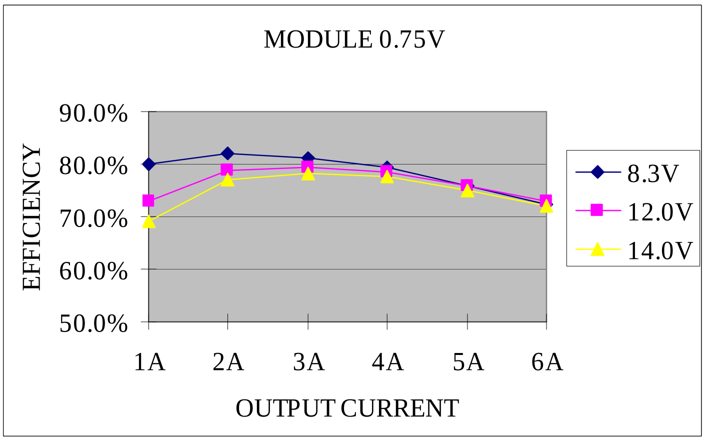
Efficiency Data



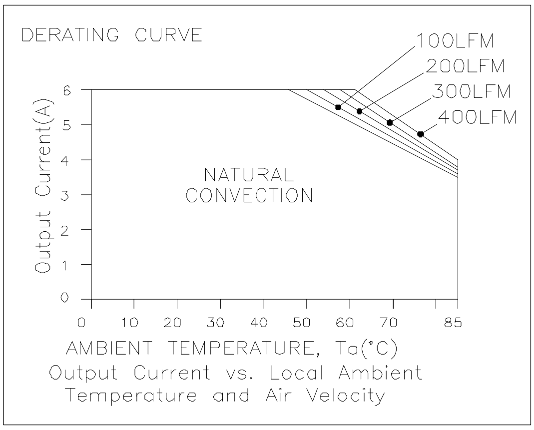




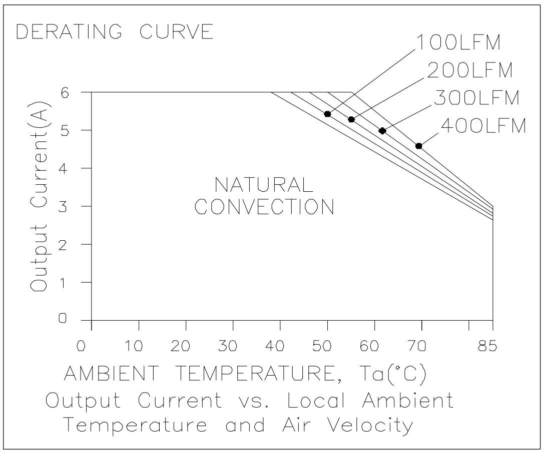




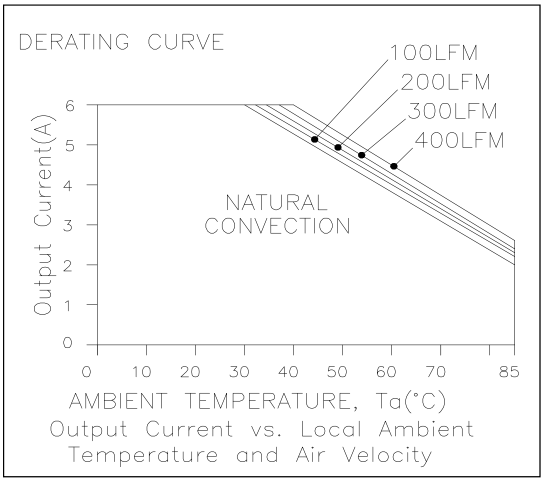
Thermal Derating Curves



Vin=12 V, Vo=0.75 V

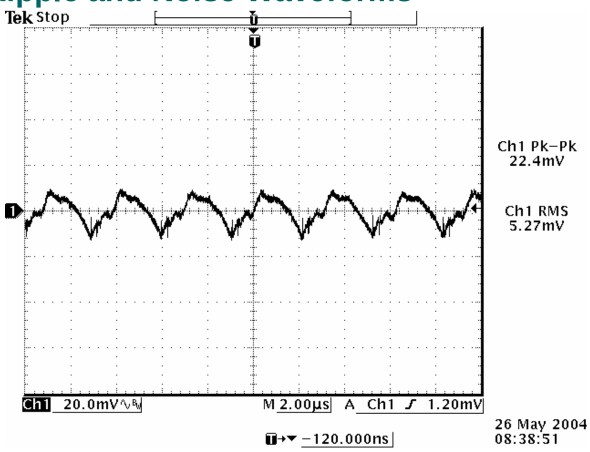


Vin=12 V, Vo=2.5 V

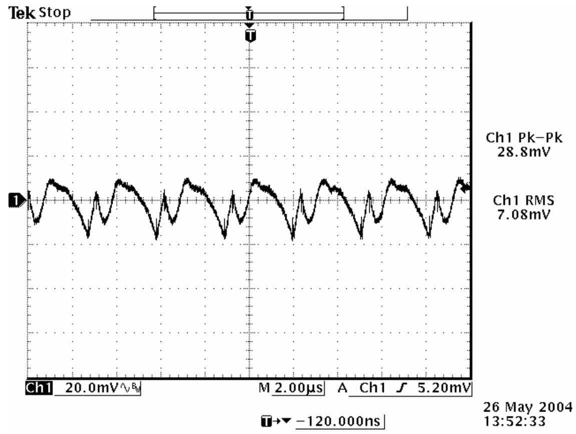


Vin=12 V, Vo=5.0 V

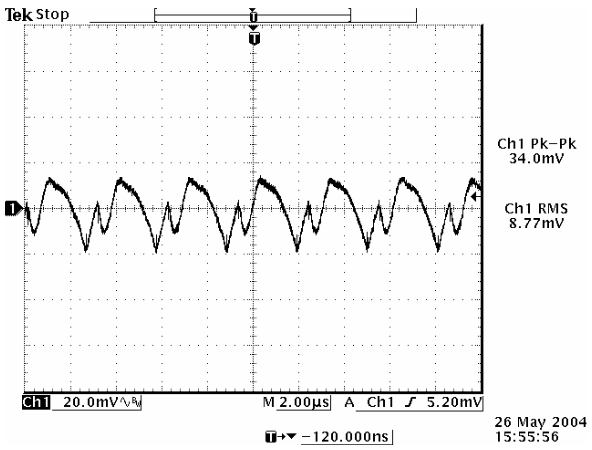
Ripple and Noise Waveforms



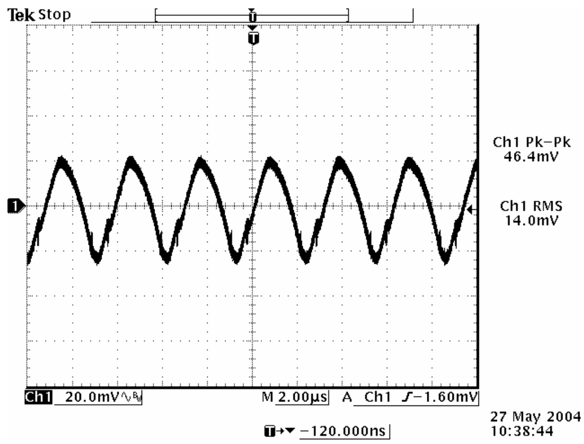
Ripple and noise at full load, Vin=12 V, Vo=0.75 V



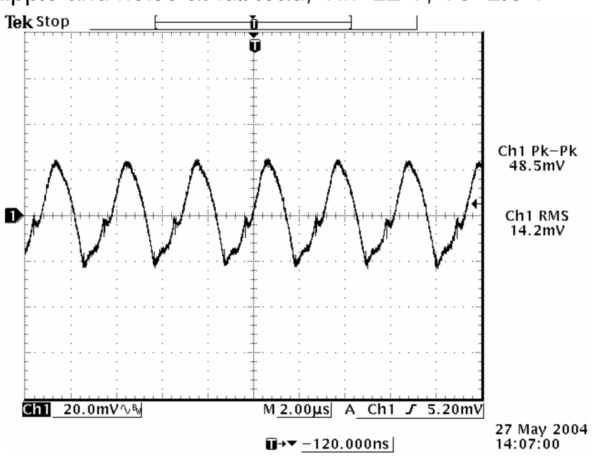
Ripple and noise at full load, Vin=12 V, Vo=1.2 V



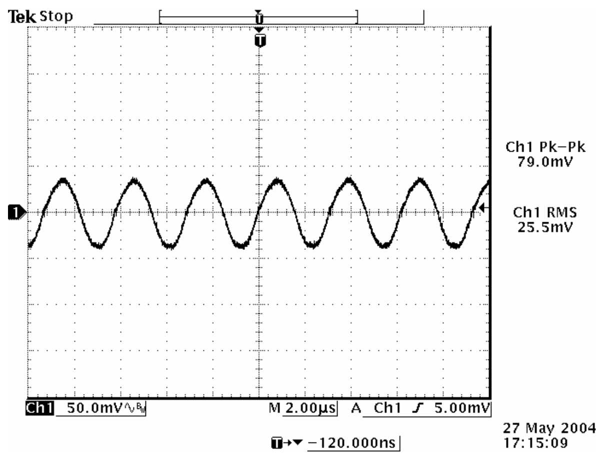
Ripple and noise at full load, Vin=12 V, Vo=1.8 V



Ripple and noise at full load, Vin=12 V, Vo=2.5 V



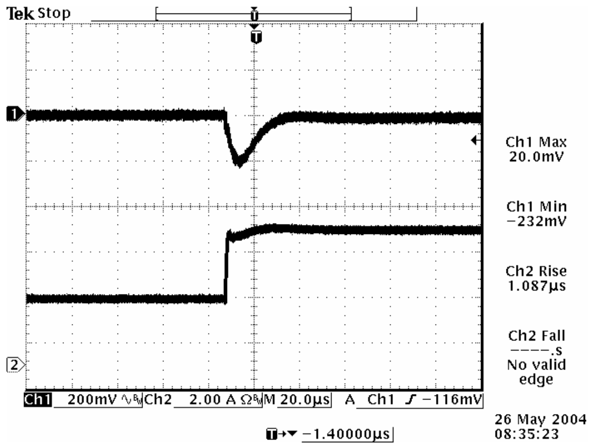
Ripple and noise at full load, Vin=12 V, Vo=3.3 V



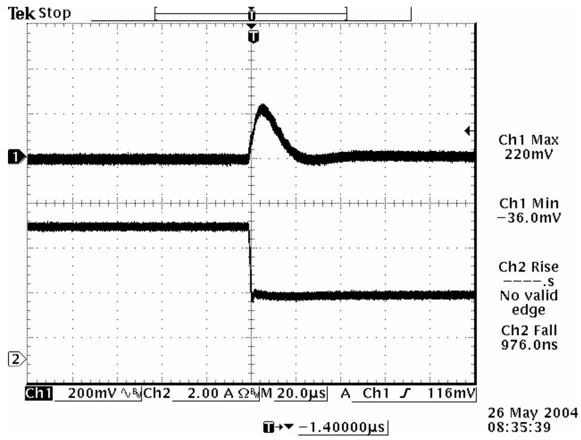
Ripple and noise at full load, Vin=12 V, Vo=5.0 V

Note: The output ripple and noise is tested at 0-20 MHz BW, 10 uF/10 V tantalum capacitor and 1 uF/10 V ceramic capacitor, Ta=25 deg C.

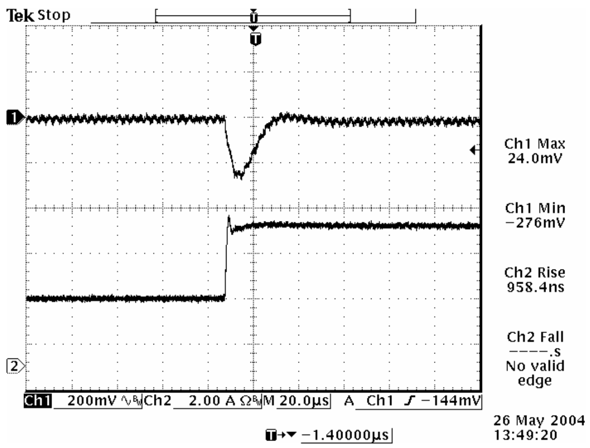
Transient Response Waveforms



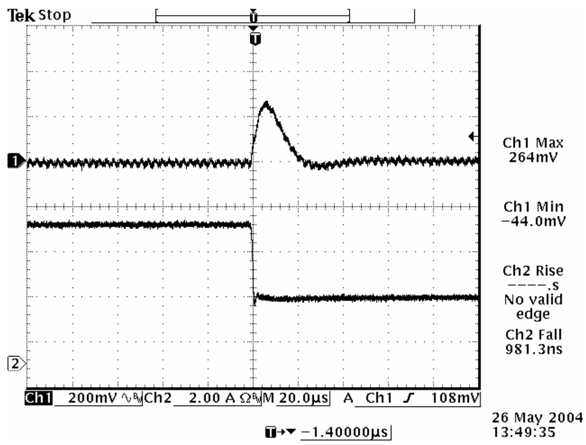
50% to 100% load step at Vin=12 V, Vo=0.75 V



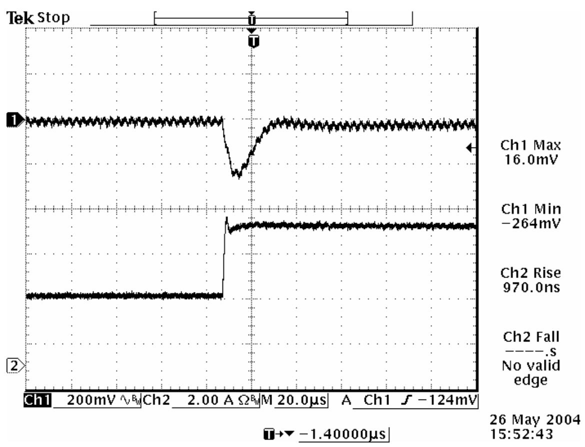
100% to 50% load step at Vin=12 V, Vo=0.75 V



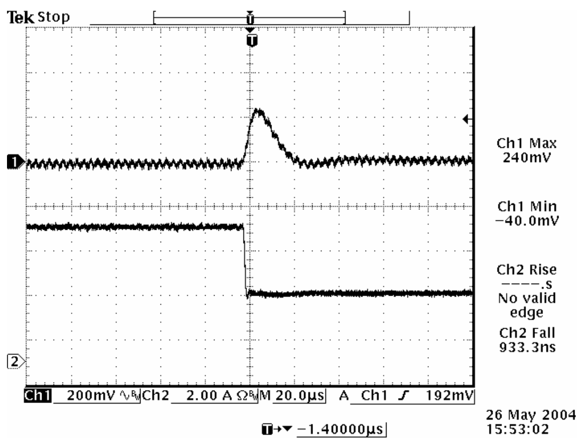
50% to 100% load step at Vin=12 V, Vo=1.2 V



100% to 50% load step at Vin=12 V, Vo=1.2 V

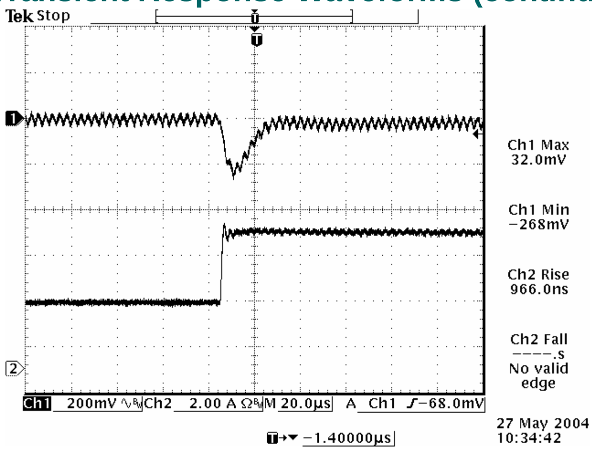


50% to 100% load step at Vin=12 V, Vo=1.8 V

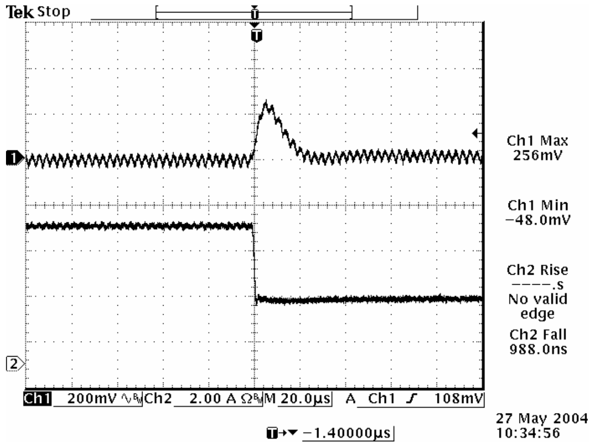


100% to 50% load step at Vin=12 V, Vo=1.8 V

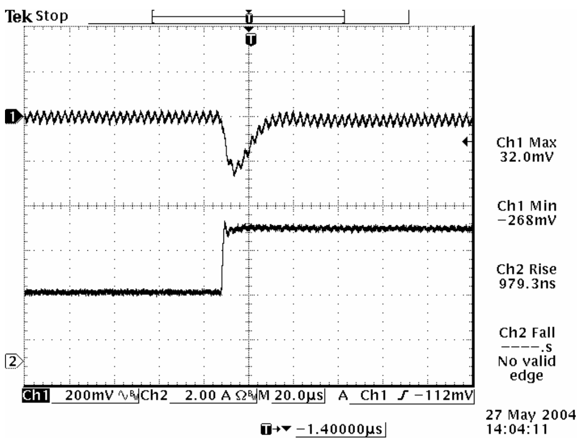
Transient Response Waveforms (continued)



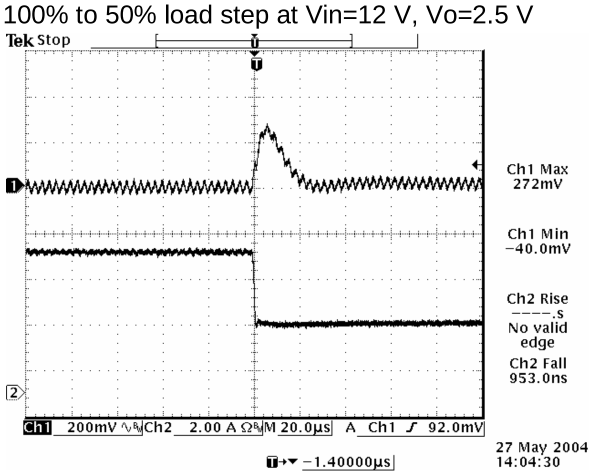
50% to 100% load step at Vin=12 V, Vo=2.5 V



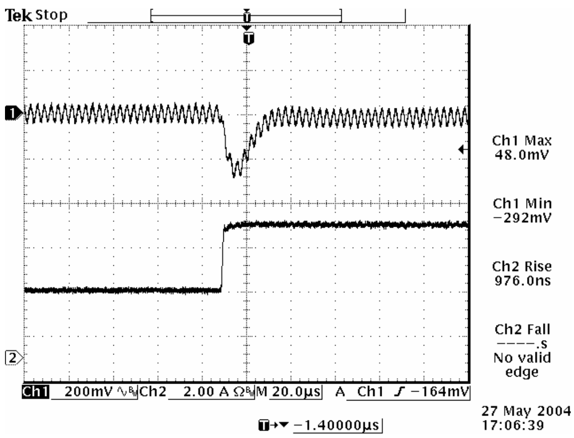
100% to 50% load step at Vin=12 V, Vo=2.5 V



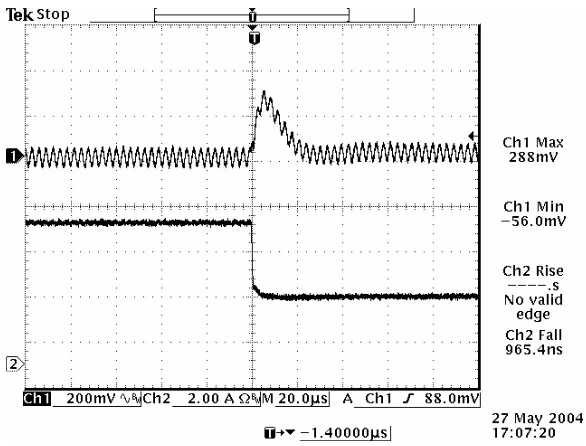
50% to 100% load step at Vin=12 V, Vo=3.3 V



100% to 50% load step at Vin=12 V, Vo=3.3 V



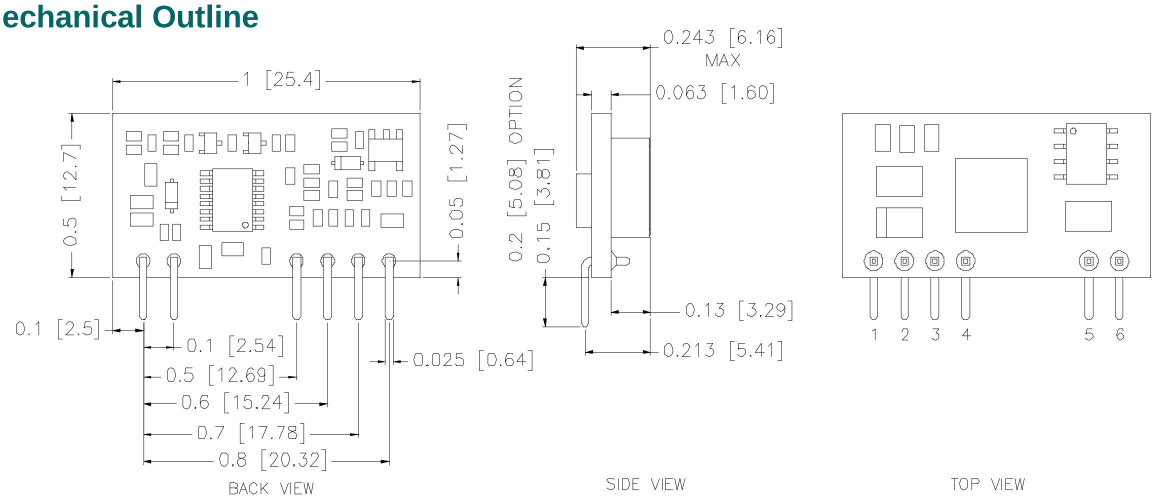
50% to 100% load step at Vin=12 V, Vo=5.0 V

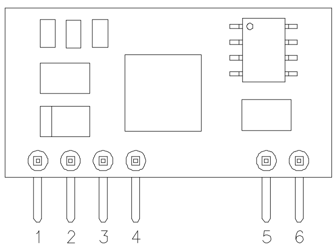


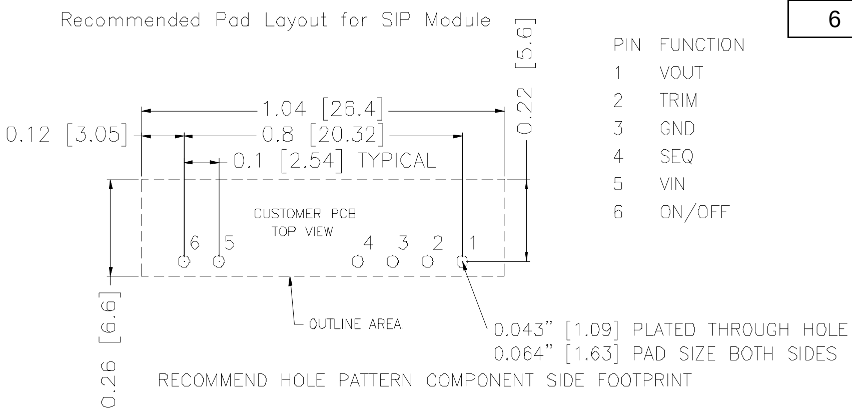
100% to 50% load step at Vin=12 V, Vo=5.0 V

Note: Transient response is tested at di/dt=2.5 A/uS, with 10 uF/10 V tantalum capacitor and 1 uF/10 V ceramic capacitor, Ta=25 deg C.

Mechanical Outline







Pin Connections

Pin	Function
1	Vout+
2	Trim
3	Ground
4	SEQ
5	Vin+
6	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
2007-01-12	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.

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