NON-ISOLATED DC/DC CONVERTERS

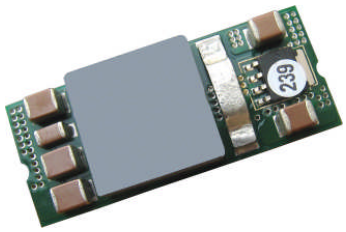
4.5 Vdc - 14 Vdc Input 0.75 Vdc - 3.63 Vdc/16 A Output

Aug. 8, 2011

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

SRBC-16E4Ax RoHS Compliant PRELIMINARY Rev.B

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Flexible Output Voltage Sequencing (option)
- Able to Sink & Source Current
- Industrial Temperature Range
- Under-voltage Lockout (UVLO)
- Over Temperature Protection
- OCP/SCP
- Wide Input
- Wide Trim
- Remote On/Off
- Active Low/High (option)
- Remote Sense



Description

The Bel SRBC-16E4Ax is part of the non-isolated dc/dc converter series. The modules use a SMT package. These converters are available in a range of output voltages from 0.75 Vdc to 3.63 Vdc over a wide range of input voltage (Vin = 4.5 Vdc - 14 Vdc). The Bel SRBC-16E4Ax has a sequencing feature that enables designers to implement various types of output voltage sequencing when powering. The efficiency is typically 92% at 3.3 Vdc output 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 - 3.63 V	4.5 V - 14 V	16 A	58 W	92%	SRBC-16E4AL	SRBC-16E4A0

Notes: 1. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.
2. Add “G” suffix at the end of the model number to indicate Tray Packaging.
3. See the last page for model number information.

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. SRBC-16E4Ax 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 not using the sequencing feature, either, tie the SEQ pin to Vin or leave it unconnected.

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage Vo,set < 3.0 V Vo,set ≥ 3.0 V	 4.5 V Vo,set +1.5 V	 - -	 14 V 14 V	
Input Current (full load)	-	-	15 A	
Input Current (no load)	-	100 mA	-	
Remote Off Input Current	-	2 mA	-	
Input Reflected Ripple Current (pk-pk)	-	-	400 mA	Tested with one 1000 uF/25 V AL input capacitor with ESR=0.03 ohm max and 6 × 47 uF/16 V tantalum capacitors with ESR=0.013 ohm max at 100 kHz, & simulated source impedance of 1000 nH, 5 Hz to 20 MHz.
Input Reflected Ripple Current (rms)	-	-	150 mA	
I^2t Inrush Current Transient	-	0.2 A^2s	0.4 A^2s	
Turn-on Voltage Threshold	-	4.2 V	-	
Turn-off Voltage Threshold	3.7 V	-	4.2 V	

Output Specifications

Parameter		Min	Typ	Max	Notes
Output Voltage Set Point		-2% Vo,set	-	2% Vo,set	Vin=12 V, full load
Load Regulation		-	0.1% Vo,set	-	Io=Iomin to Iomax
Line Regulation		-	0.1% Vo,set	-	Vin=Vinmin to Vinmax
Regulation Over Temperature (-40 °C to +85 °C)		-	0.3% Vo,set	-	Tref=Tamin to Tamax
Output Current		0 A	-	16 A	
Current Limit Threshold		-	180% Io	-	
Short Circuit Surge Transient		-	1 A^2s	3 A^2s	
Ripple and Noise (pk-pk)		-	30 mV	75 mV	Tested with 0-20 MHz, 1100 uF tantalum capacitor & 1 uF TDK ceramic capacitor at the output
Ripple and Noise (rms)		-	12 mV	30 mV	
Turn on Time		-	12 mS	20 mS	
Overshoot at Turn on		-	-	1% Vo,set	
Output Capacitance			1100 uF		
Transient Response					
50% ~ 100% Max Load	All	-	150 mV	-	di/dt=2.5 A/uS; Vin=12 V; and with 1100 uF ceramic capacitors at the output
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	150 mV	-	
Settling Time		-	50 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=3.3 V Vo=2.5 V Vo=1.8 V Vo=1.5 V Vo=1.2 V Vo=0.75 V	 - - - - - -	 92% 90% 88% 87% 85% 79%	 - - - - - -	Measured at Vin=12 V, full load
Efficiency Vo=3.3 V Vo=2.5 V Vo=1.8 V Vo=1.5 V Vo=1.2 V Vo=0.75 V	 - - - - - -	 92% 90% 87% 86% 83% 78%	 - - - - - -	Measured at Vin=5 V, full load
Switching Frequency	200 kHz	230 kHz	260 kHz	
Over Temperature Shutdown[1]	-	130 °C	-	
Output Trim Range (Wide Trim)	0.7525 V	-	3.63 V	
Remote Sense Compensation	-	-	0.5 V	
MTBF	2,666,488 hours			Calculated Per Bell Core SR-332 (I_O =80% Iomax; Vo=3.3 V; Vin=12 V; T_a = 25 °C)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 1.30 x 0.53 x 0.315 33.02 x 13.46 x 8.00			
Weight	-	8 g	-	

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

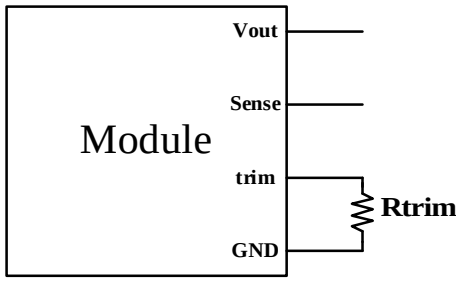
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.2 V	-	0.3 V	SRBC-16E4A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	-	-	Vin, max	
Signal Low (Unit On)	-0.2 V	-	0.3 V	SRBC-16E4AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	2.5 V	-	Vin, max	
Voltage Sequencing				
Sequencing Delay Time	25 mS	-	-	Delay from Vinmin to application of voltage on SEQ pin
Sequencing Slew Rate Capability	-	-	2 V/mS	Vinmin to Vinmax; Iomin to Iomax; Vseq<Vo
Tracking Accuracy Power-Up Power-Down	 - -	 100 mV 200 mV	 200 mV 400 mV	

Output Trim Equations

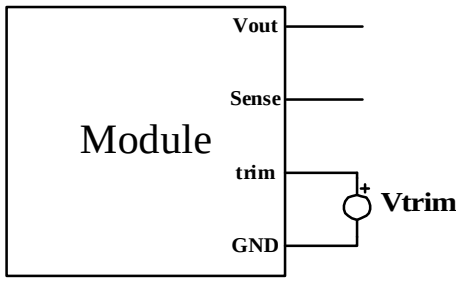
Equation for calculating the trim resistor (in Ω) given the desired output voltage (Vo) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trimup} = \frac{10500}{Vo - 0.7525} - 1000$$

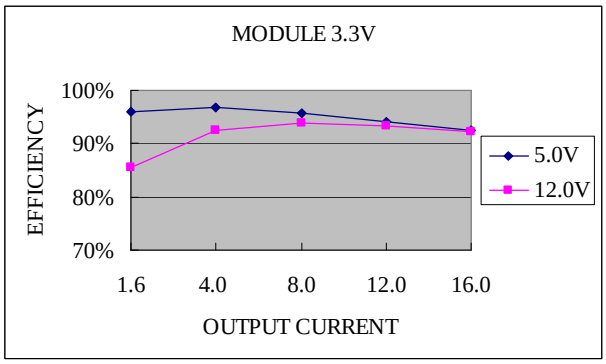


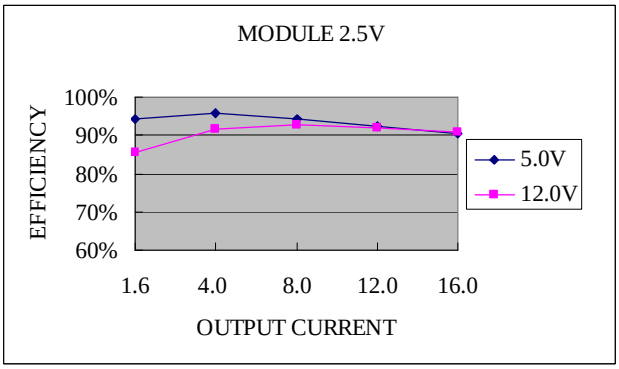
Equation for calculating the trim voltage (in V) given the desired output voltage (Vo) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

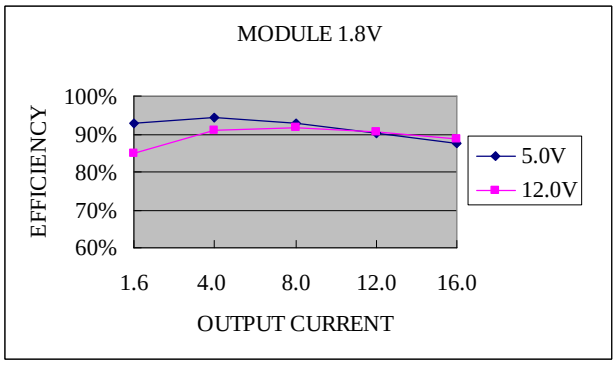
$$V_{trimup} = 0.7 - 0.0667 \times (Vo - 0.7525)$$

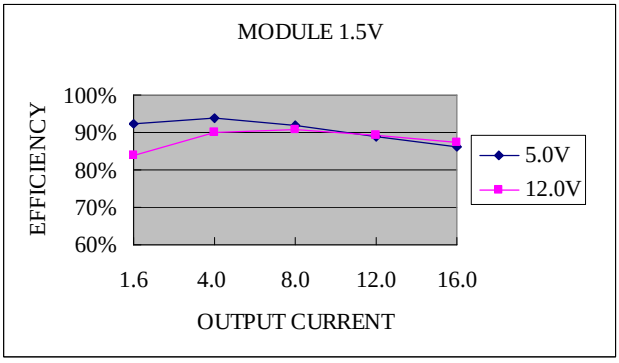


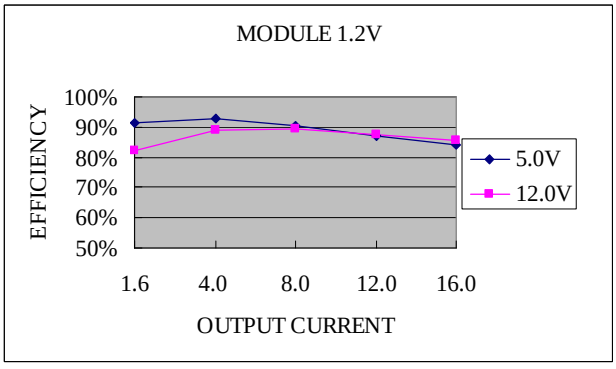
Efficiency Data

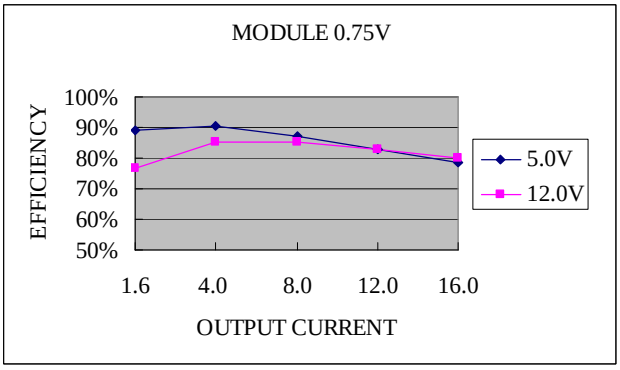




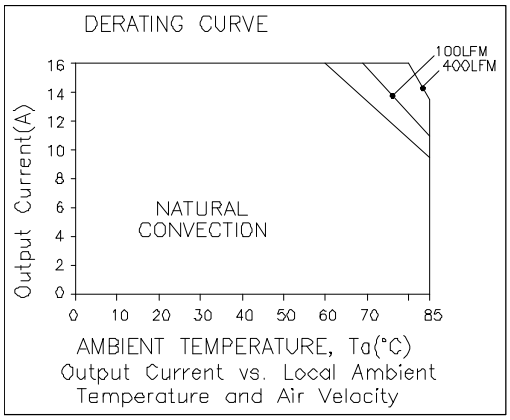




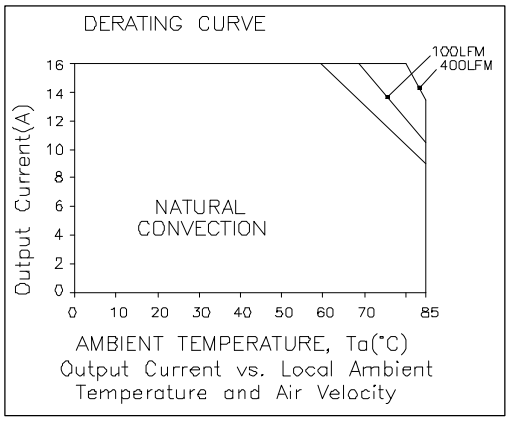




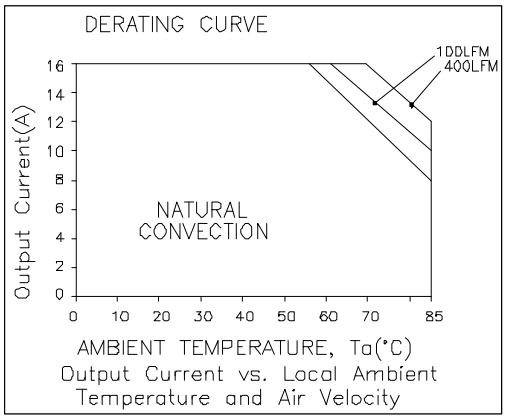
Thermal Derating Curves



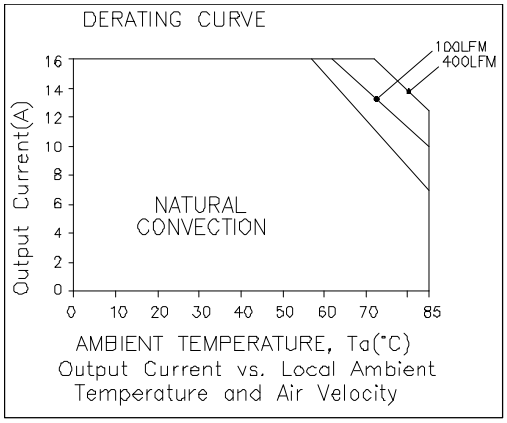
Vin=5 V, Vo=0.75 V



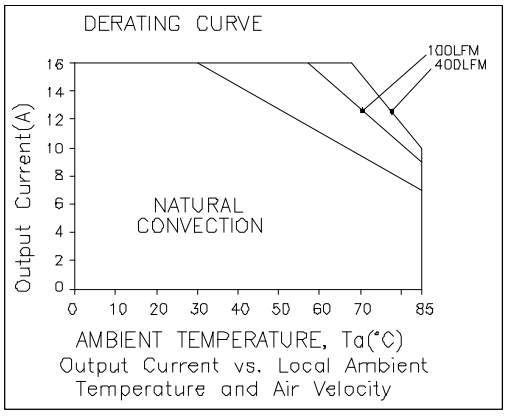
Vin=12 V, Vo=0.75 V



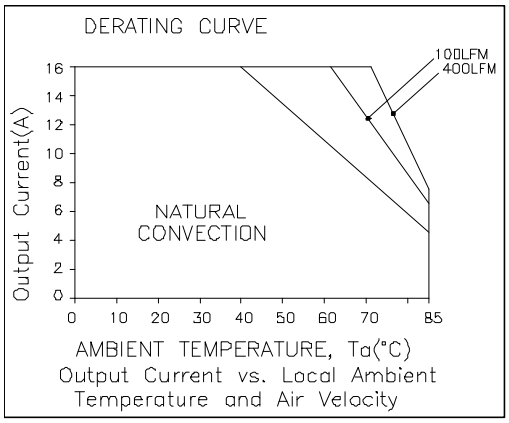
Vin=5 V, Vo=1.8 V



Vin=12 V, Vo=1.8 V

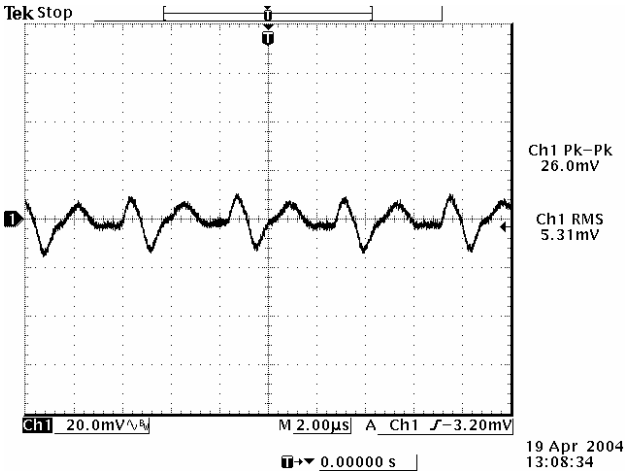


Vin=5 V, Vo=3.3 V

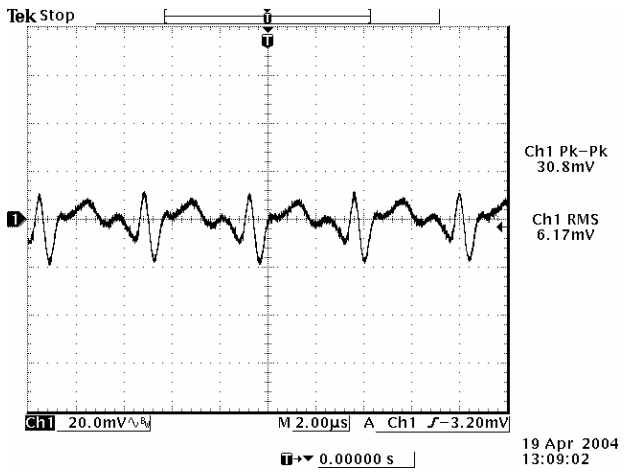


Vin=12 V, Vo=3.3 V

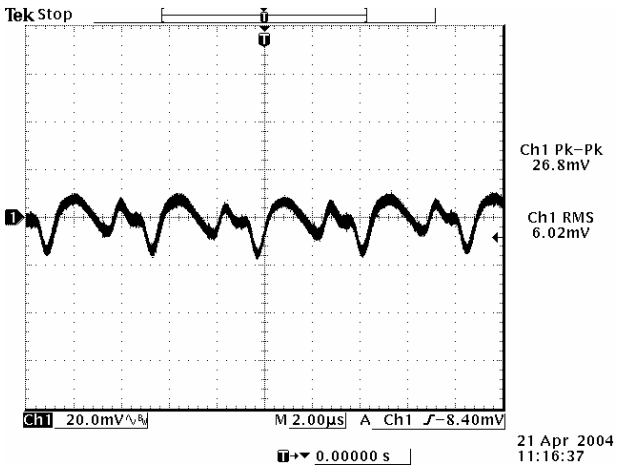
Ripple and Noise Waveforms



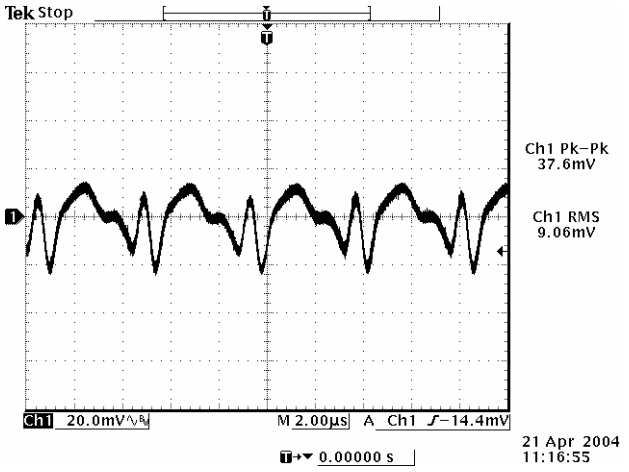
Vin=5 V, Vo=0.7525 V



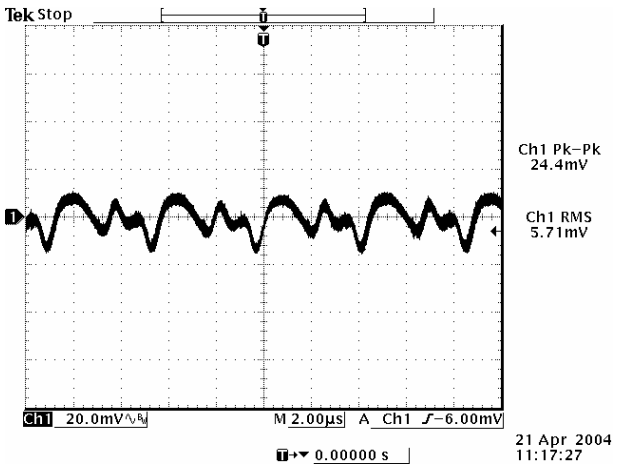
Vin=12 V, Vo=0.7525 V



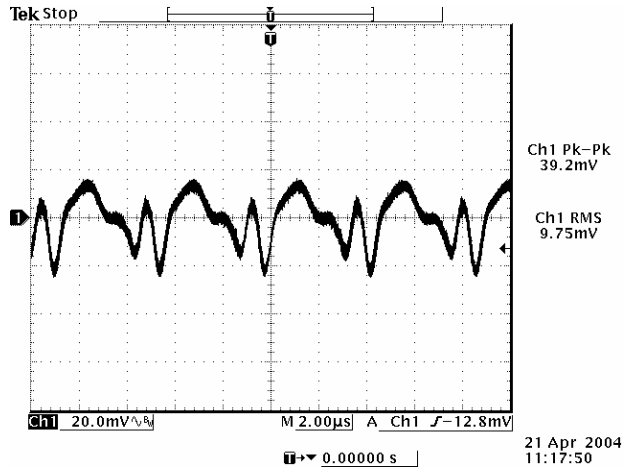
Vin=5 V, Vo=1.2 V



Vin=12 V, Vo=1.2 V

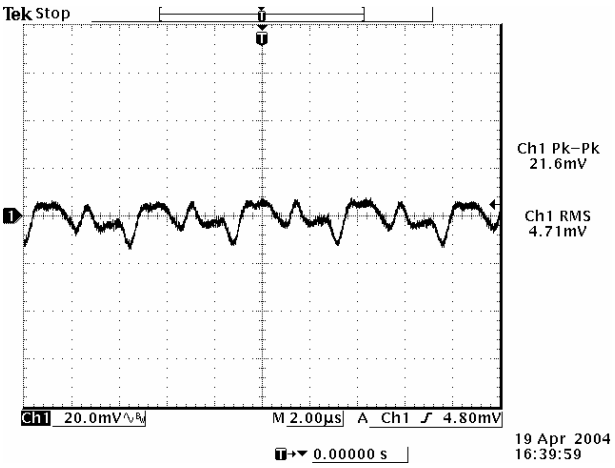


Vin=5 V, Vo=1.5 V

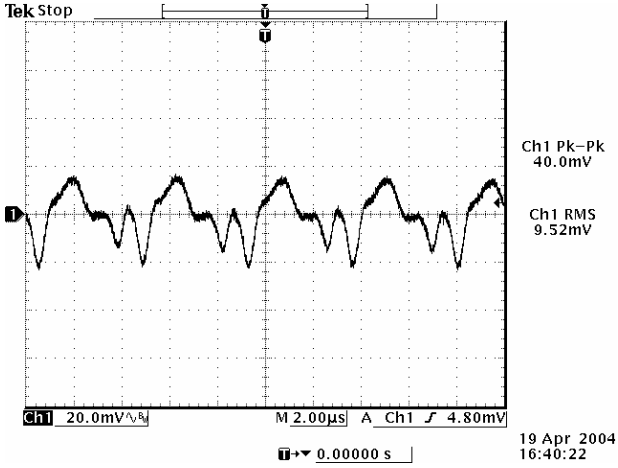


Vin=12 V, Vo=1.5 V

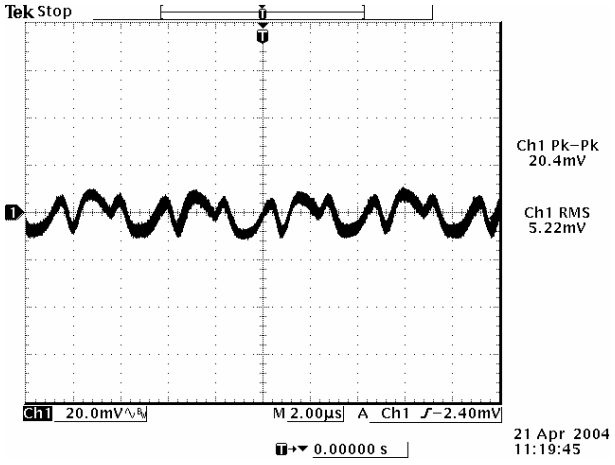
Ripple and Noise Waveforms (continued)



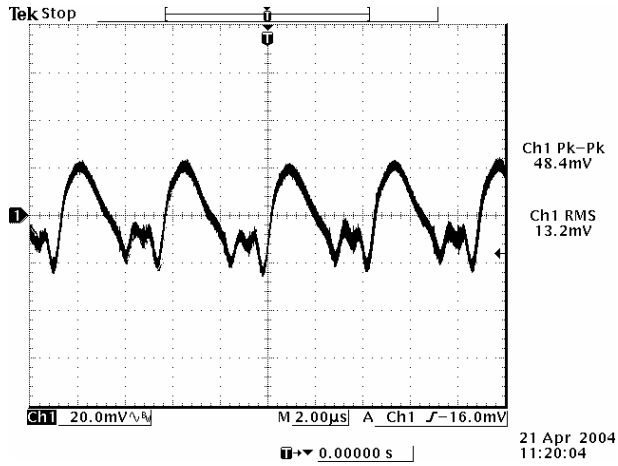
Vin=5 V, Vo=1.8 V



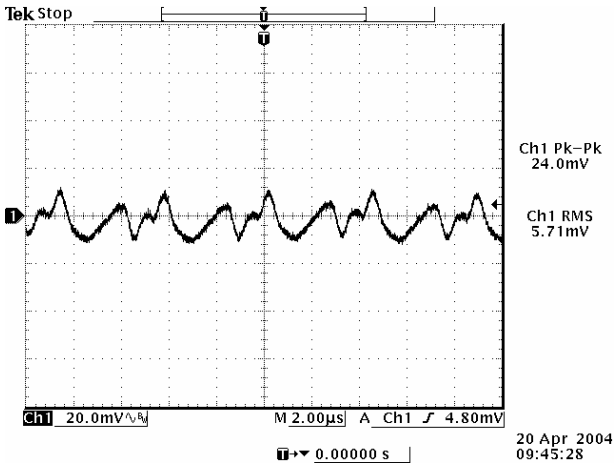
Vin=12 V, Vo=1.8 V



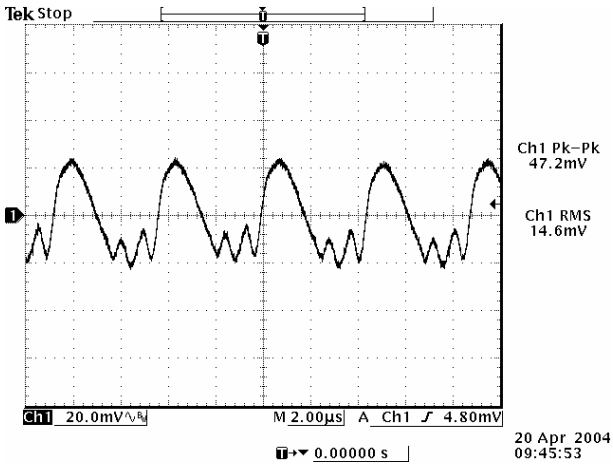
Vin=5 V, Vo=2.5 V



Vin=12 V, Vo=2.5 V



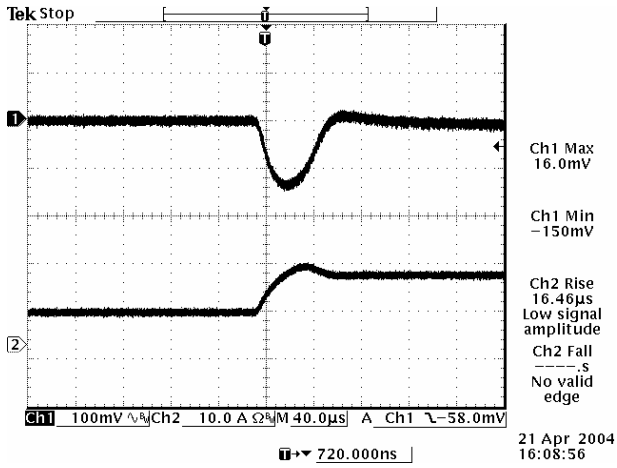
Vin=5 V, Vo=3.3 V



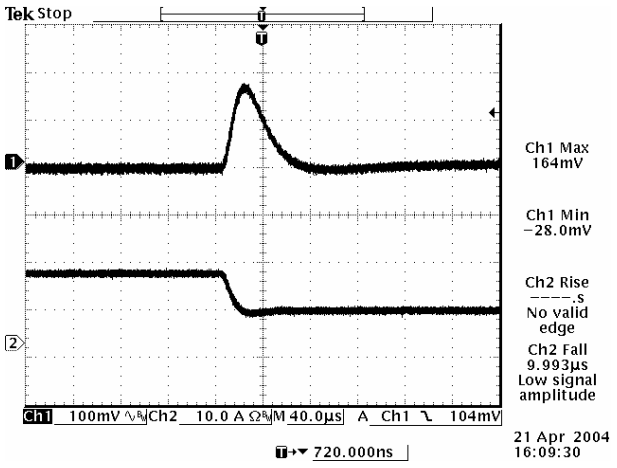
Vin=12 V, Vo=3.3 V

Note: Ripple and noise at full load, with 10uF tantalum capacitor and 1uF ceramic at the output, and Ta=25℃.

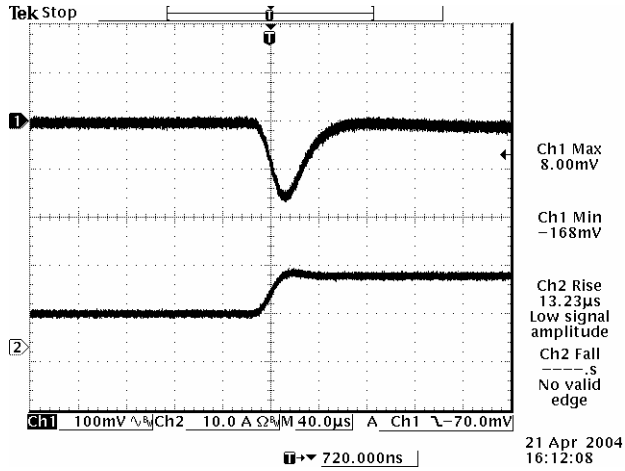
Transient Response Waveforms



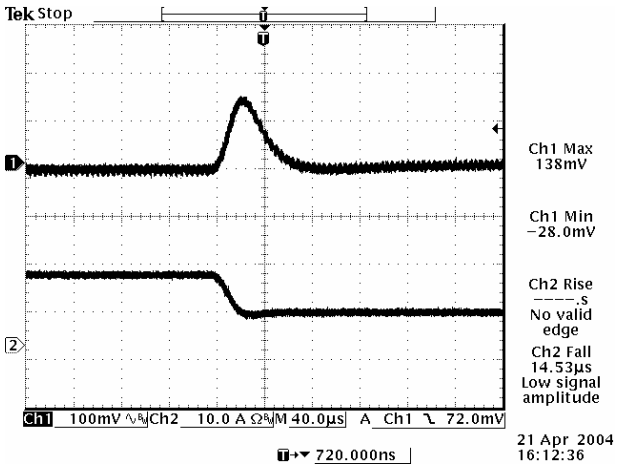
50% to 100% load Transient at Vin=5 V, Vo=0.75 V



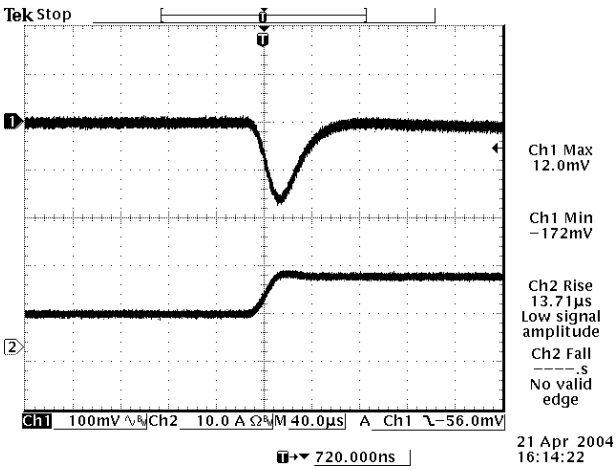
100% to 50% load Transient at Vin=5 V, Vo=0.75 V



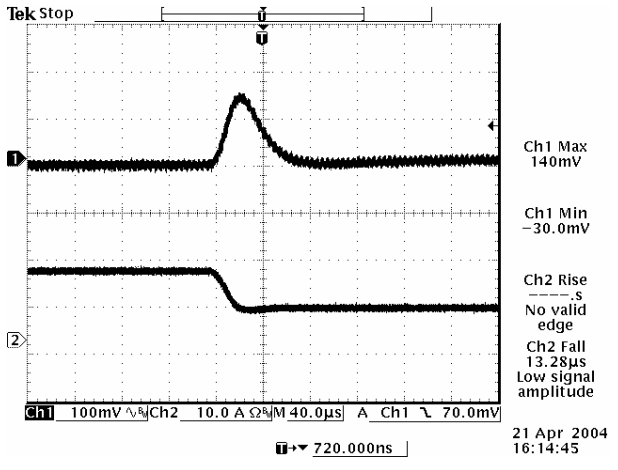
50% to 100% load Transient at Vin=5 V, Vo=1.2 V



100% to 50% load Transient at Vin=5 V, Vo=1.2 V

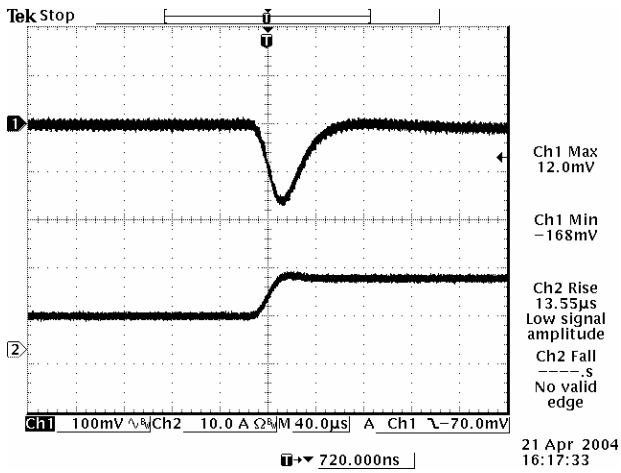


50% to 100% load Transient at Vin=5 V, Vo=1.5 V

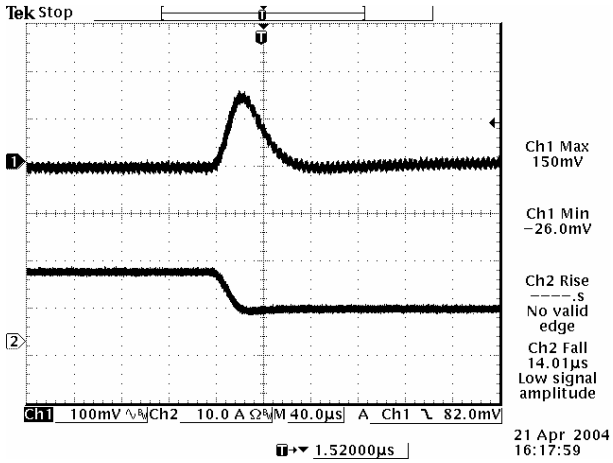


100% to 50% load Transient at Vin=5 V, Vo=1.5 V

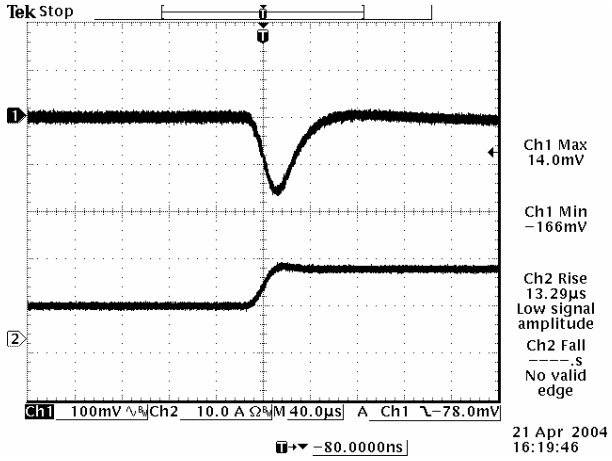
Transient Response Waveforms (continued)



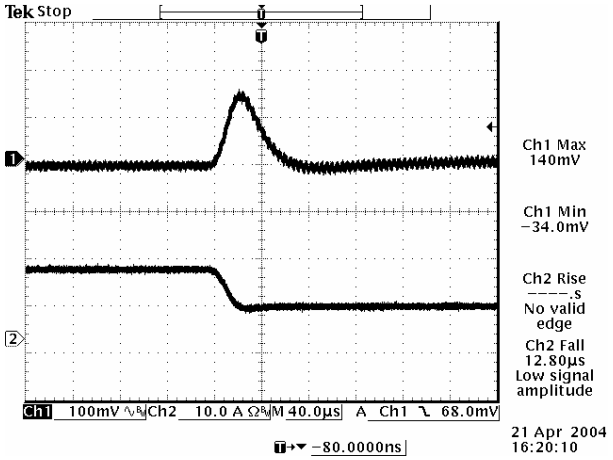
50% to 100% load Transient at Vin=5 V, Vo=1.8 V



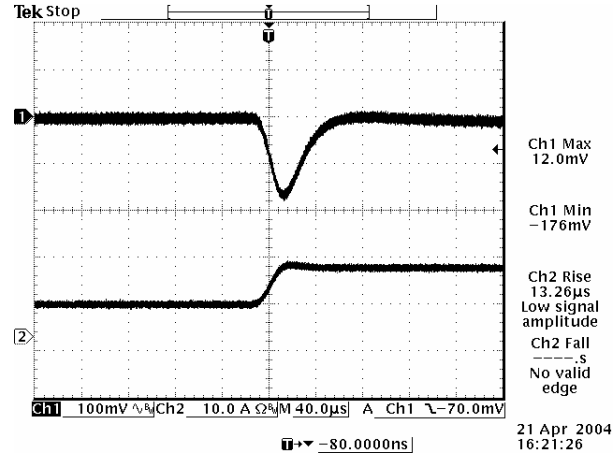
100% to 50% load Transient at Vin=5 V, Vo=1.8 V



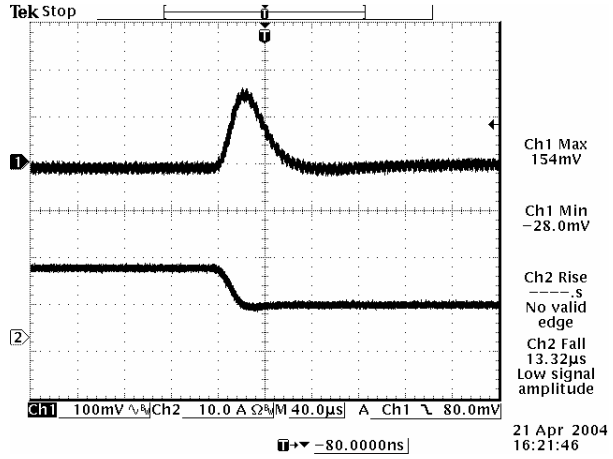
50% to 100% load Transient at Vin=5 V, Vo=2.5 V



100% to 50% load Transient at Vin=5 V, Vo=2.5 V

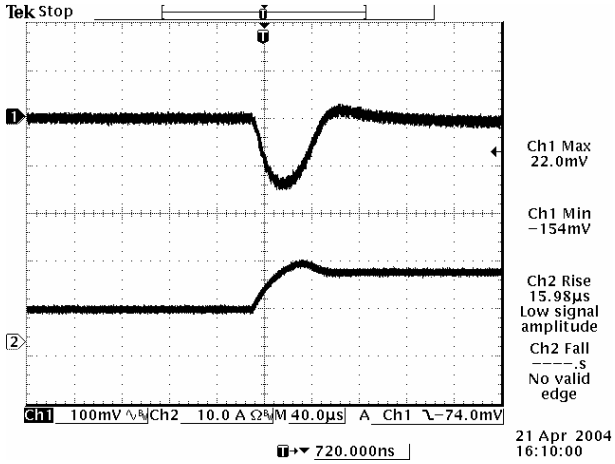


50% to 100% load Transient at Vin=5 V, Vo=3.3 V

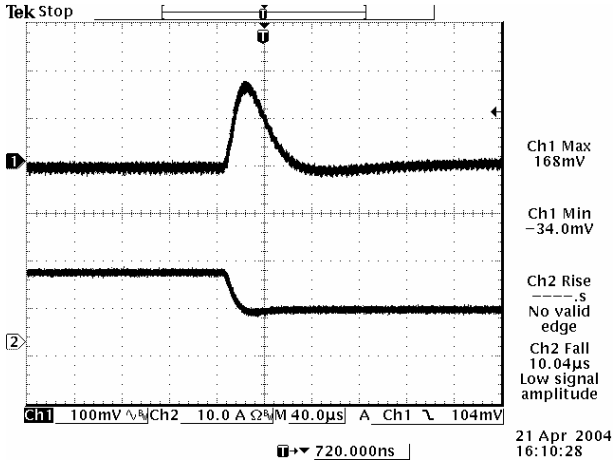


100% to 50% load Transient at Vin=5 V, Vo=3.3 V

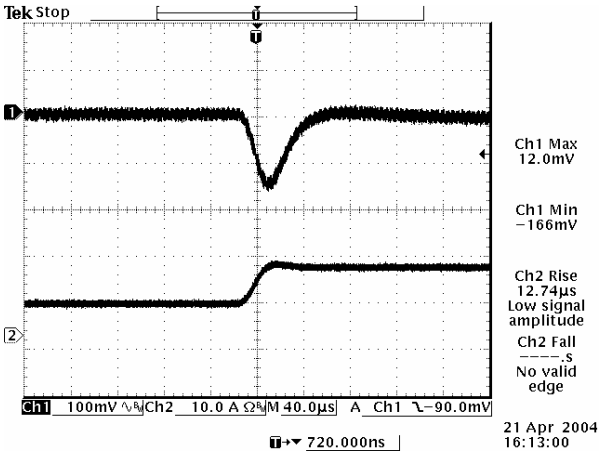
Transient Response Waveforms (continued)



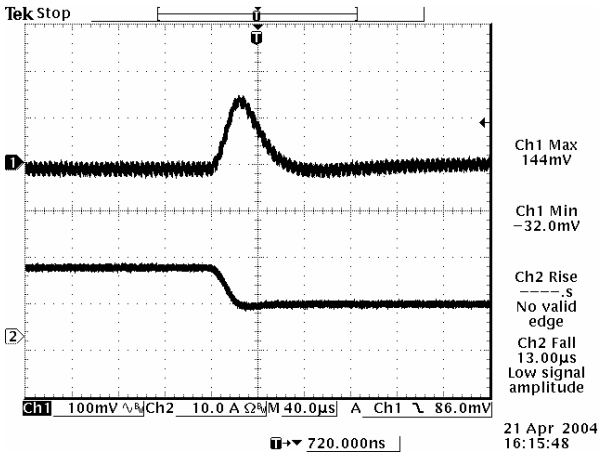
50% to 100% load Transient at Vin=12 V, Vo=0.75 V



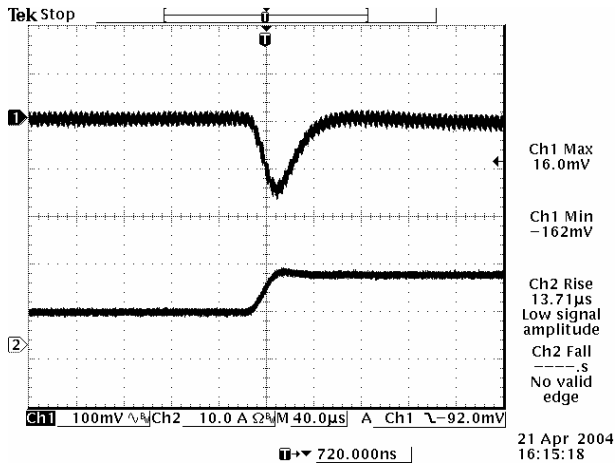
100% to 50% load Transient at Vin=12 V, Vo=0.75 V



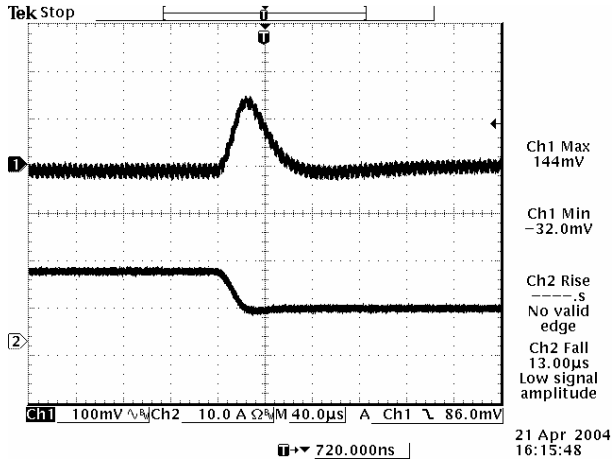
50% to 100% load Transient at Vin=12 V, Vo=1.2 V



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

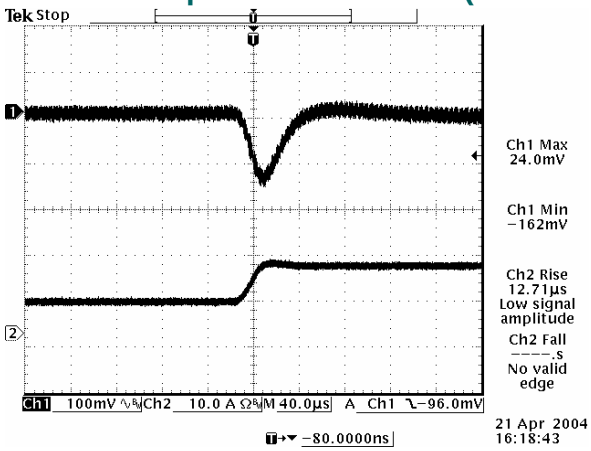


50% to 100% load Transient at Vin=12 V, Vo=1.5 V

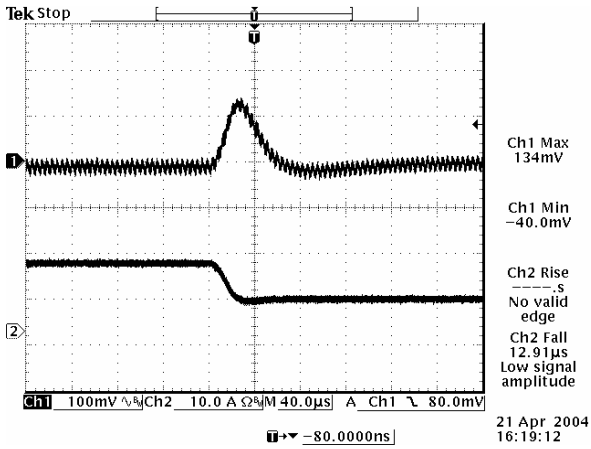


100% to 50% load Transient at Vin=12 V, Vo=1.5 V

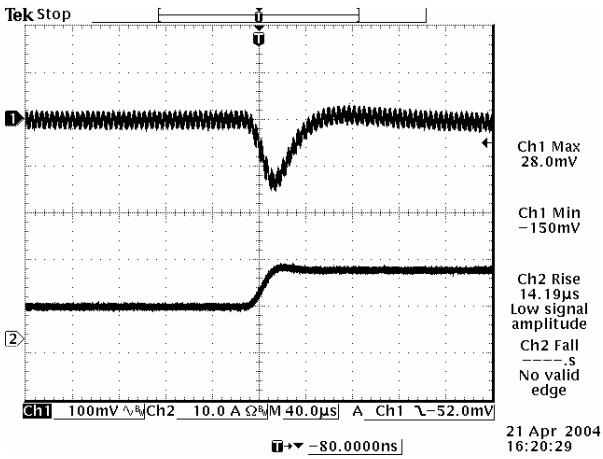
Transient Response Waveforms (continued)



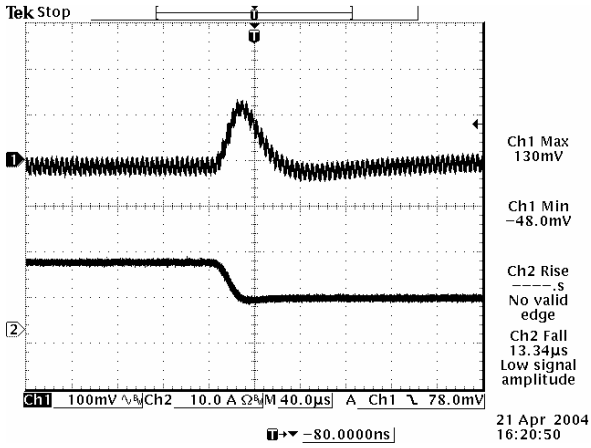
50% to 100% load Transient at Vin=12 V, Vo=1.8 V



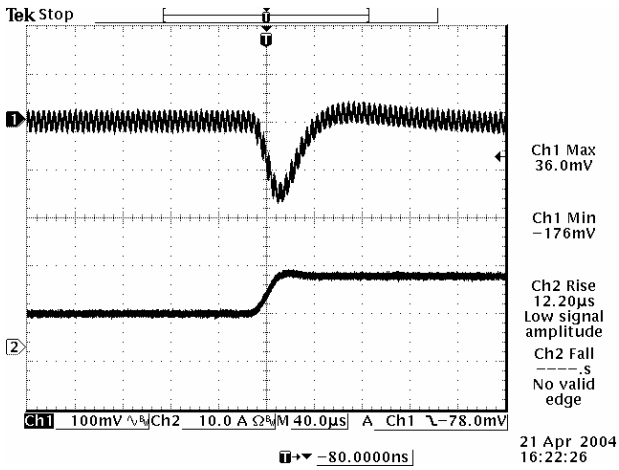
100% to 50% load Transient at Vin=12 V, Vo=1.8 V



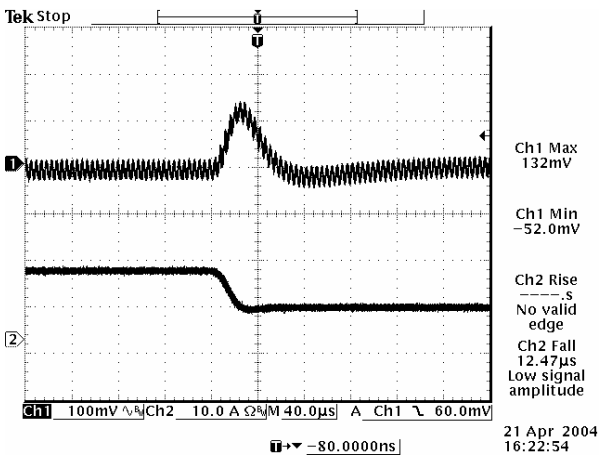
50% to 100% load Transient at Vin=12 V, Vo=2.5 V



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



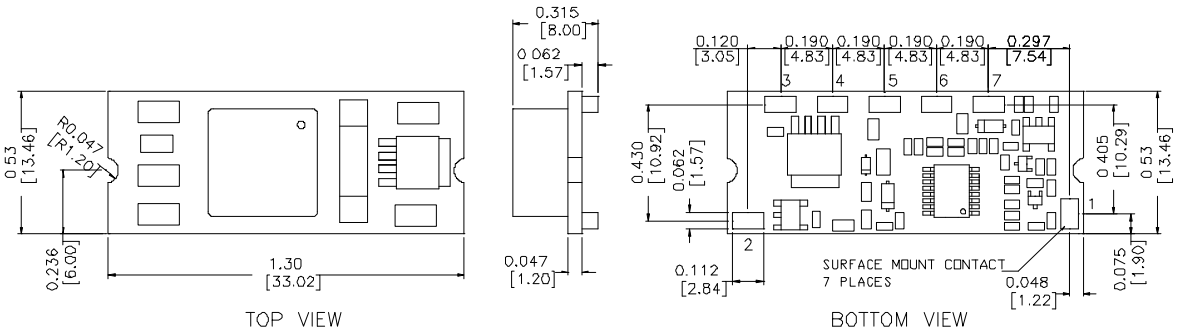
50% to 100% load Transient at Vin=12 V, Vo=3.3 V

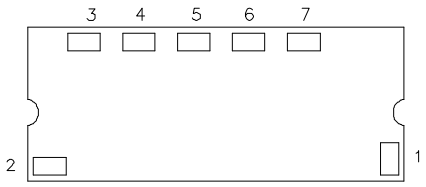


100% to 50% load Transient at Vin=12 V, Vo=3.3 V

Note: Transient response with external load capacitance Cext=2x150uF (Polymer capacitors), and Ta=25℃.

Mechanical Outline

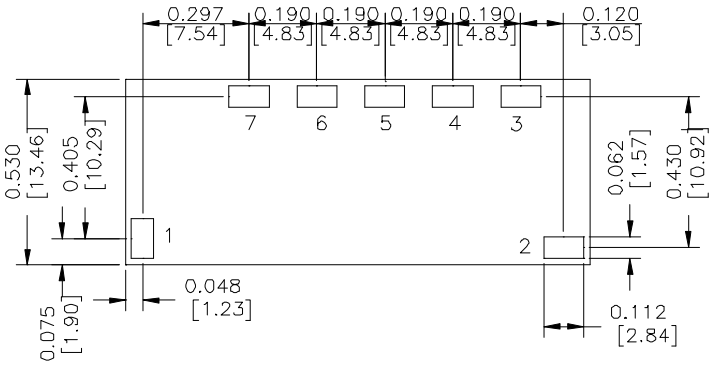




RECOMMENDED PAD LAYOUT

Pin Connections

Pin	Function
1	Remote On/Off
2	Vin
3	SEQ
4	Ground
5	Vout
6	Trim
7	Remote Sense



PAD SIZE:
MIN: 0.14"* 0.095" (3.56mm * 2.41mm)
MAX: 0.165"* 0.11" (4.19mm * 2.79mm)

Note: These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 245 °C.

Model Number Description:

SRBC-16E4Ax: Compensated for 11 X 100uF ceramic external capacitor.

NON-ISOLATED DC/DC CONVERTERS

4.5 Vdc - 14 Vdc Input 0.75 Vdc - 3.63 Vdc/16 A Output

Revision History

Date	Revision	Changes Detail	Approval
2007-04-18	PA	First Release	HL/XP Chen
2011-08-08	PB	Update the reflow solder temperature.	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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