

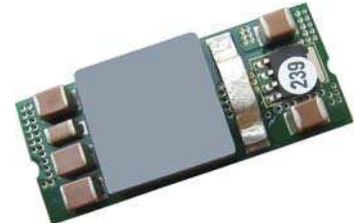
NON-ISOLATED DC/DC CONVERTERS

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



SRBC-16E4Ax RoHS Compliant PRELIMINARY Rev.A

- 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 (V_{in} = 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	-	V_{in}	
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 V_{in} or leave it unconnected.

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Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage				
Vo,set < 3.0 V	4.5 V	-	14 V	
Vo,set ≥ 3.0 V	Vo,set +1.5 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 ² t Inrush Current Transient	-	0.2 A ² s	0.4 A ² s	
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 ² s	3 A ² s	
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.

NON-ISOLATED DC/DC CONVERTERS

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General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
Vo=3.3 V	-	92%	-	Measured at Vin=12 V, full load
Vo=2.5 V	-	90%	-	
Vo=1.8 V	-	88%	-	
Vo=1.5 V	-	87%	-	
Vo=1.2 V	-	85%	-	
Vo=0.75 V	-	79%	-	
Efficiency				
Vo=3.3 V	-	92%	-	Measured at Vin=5 V, full load
Vo=2.5 V	-	90%	-	
Vo=1.8 V	-	87%	-	
Vo=1.5 V	-	86%	-	
Vo=1.2 V	-	83%	-	
Vo=0.75 V	-	78%	-	
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 (Io =80% Iomax; Vo=3.3 V; Vin=12 V; Ta = 25 °C)
Dimensions				
Inches (L × W × H)	1.30 x 0.53 x 0.315			
Millimeters (L × W × H)	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	-	100 mV	200 mV	
Power-Down	-	200 mV	400 mV	

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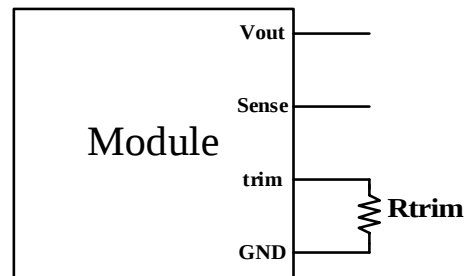
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bel
POWER PRODUCTS

Output Trim Equations

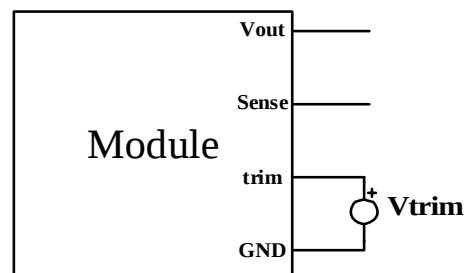
Equation for calculating the trim resistor (in Ω) given the desired output voltage (V_o) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

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



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

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

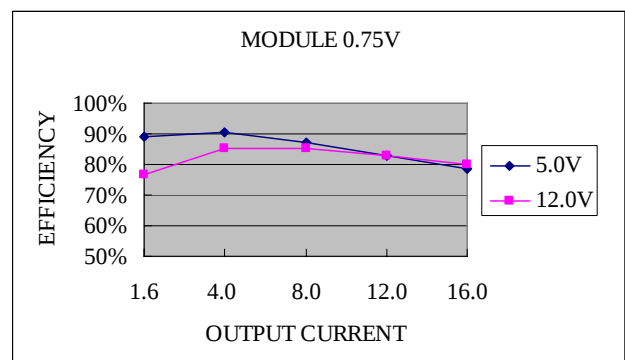
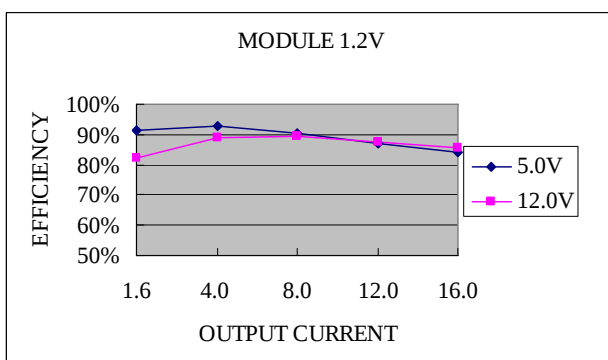
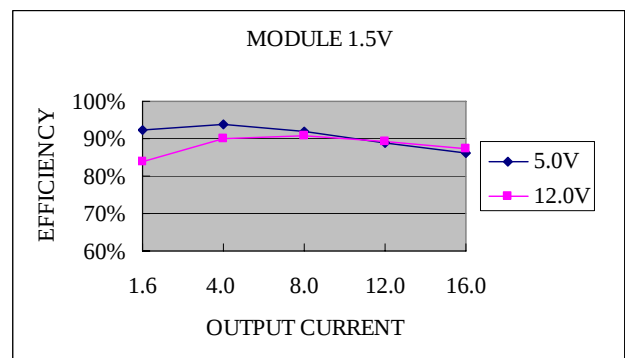
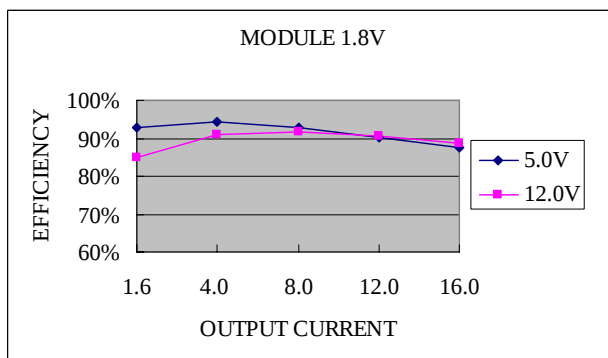
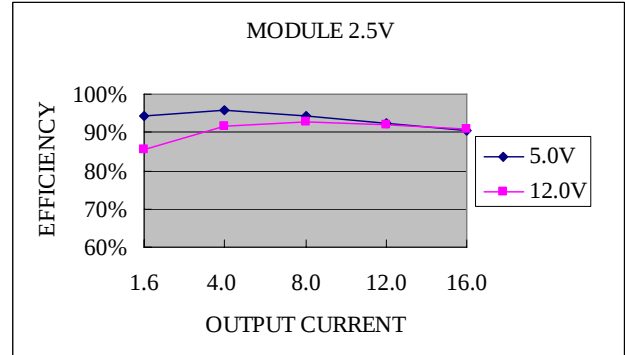
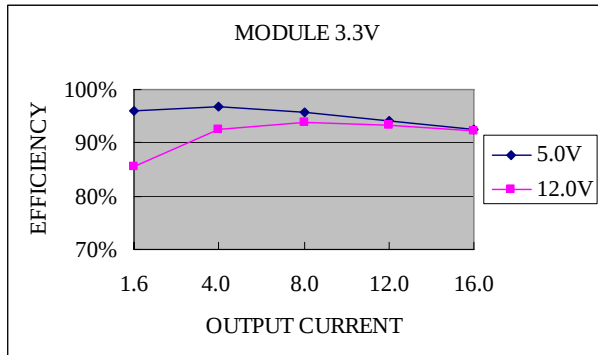


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Efficiency Data

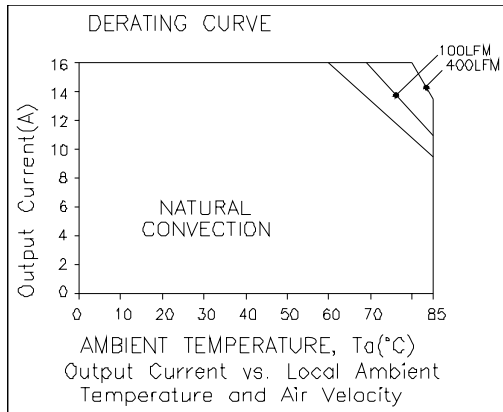


NON-ISOLATED DC/DC CONVERTERS

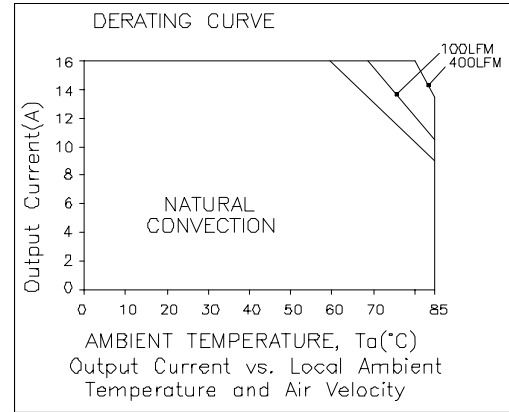
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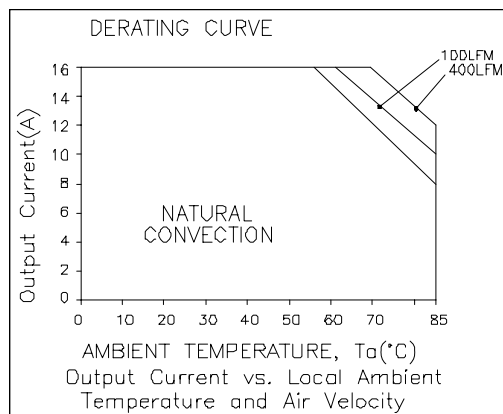
Thermal Derating Curves



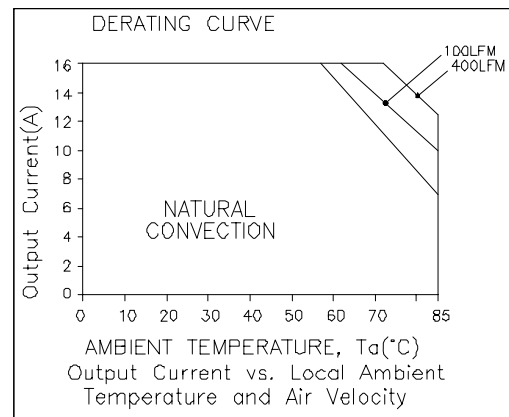
$V_{in}=5\text{ V}$, $V_o=0.75\text{ V}$



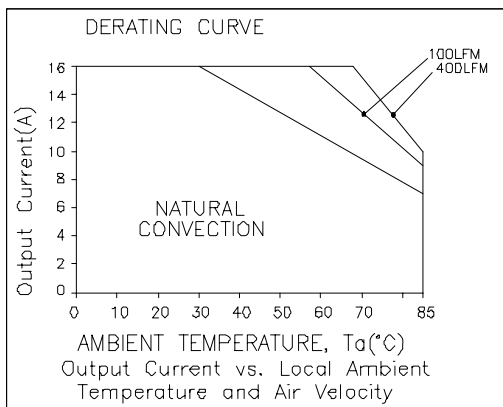
$V_{in}=12\text{ V}$, $V_o=0.75\text{ V}$



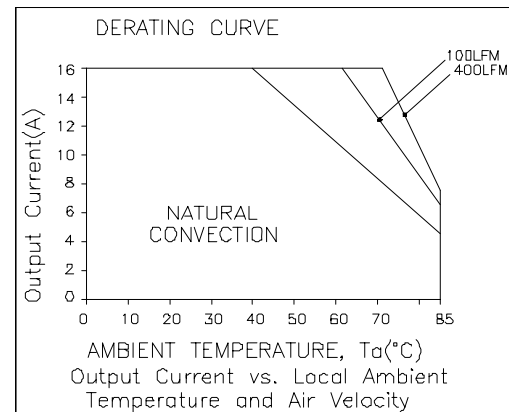
$V_{in}=5\text{ V}$, $V_o=1.8\text{ V}$



$V_{in}=12\text{ V}$, $V_o=1.8\text{ V}$



$V_{in}=5\text{ V}$, $V_o=3.3\text{ V}$



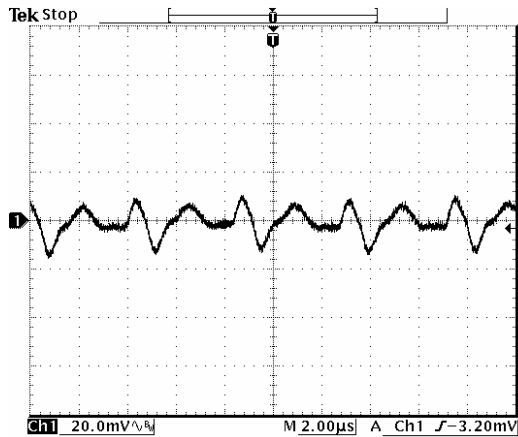
$V_{in}=12\text{ V}$, $V_o=3.3\text{ V}$

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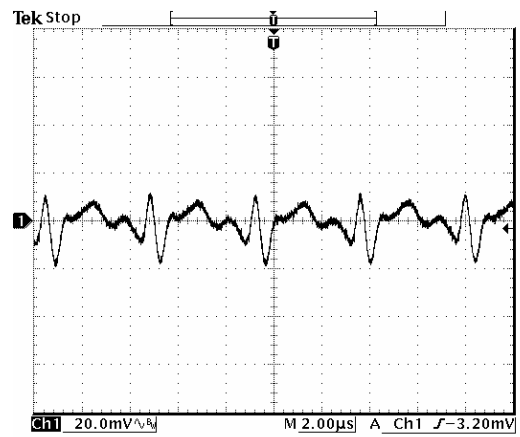
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Ripple and Noise Waveforms



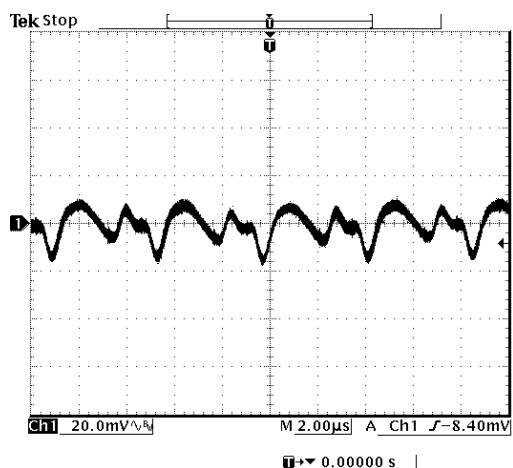
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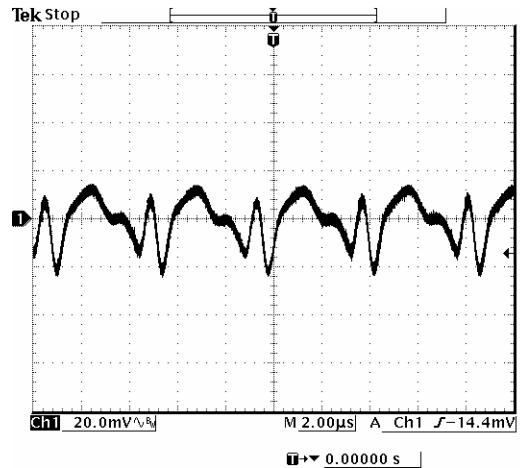
19 Apr 2004
13:09:02

Vin=5 V, Vo=0.7525 V

Vin=12 V, Vo=0.7525 V



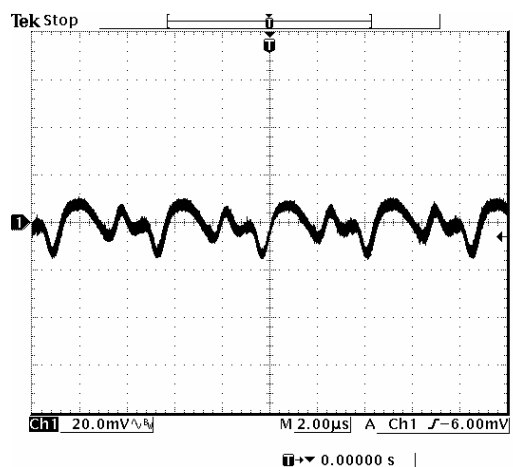
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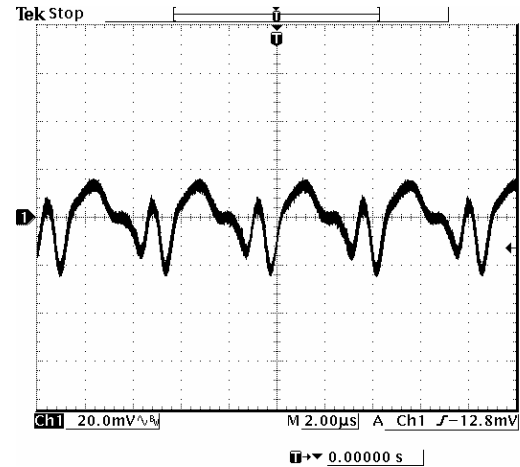
21 Apr 2004
11:16:55

Vin=5 V, Vo=1.2 V

Vin=12 V, Vo=1.2 V



21 Apr 2004
11:17:27



21 Apr 2004
11:17:50

Vin=5 V, Vo=1.5 V

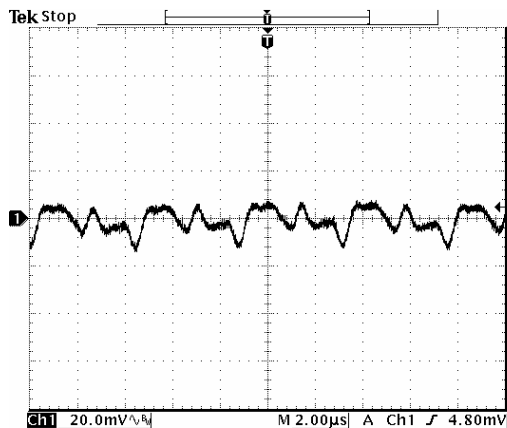
Vin=12 V, Vo=1.5 V

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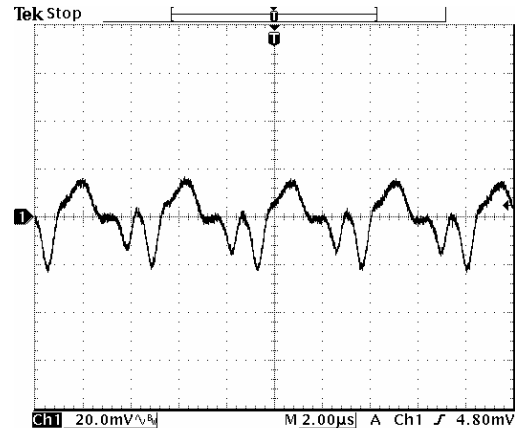
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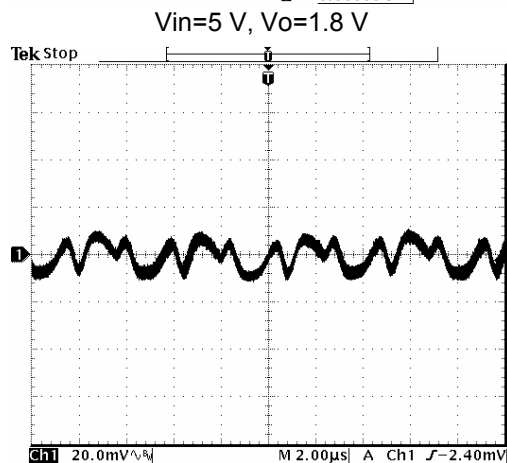
Ripple and Noise Waveforms (continued)



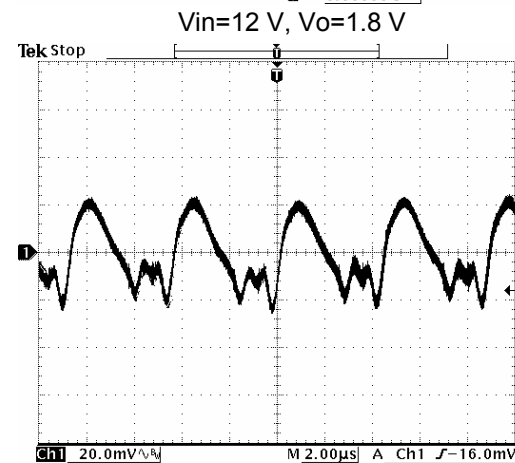
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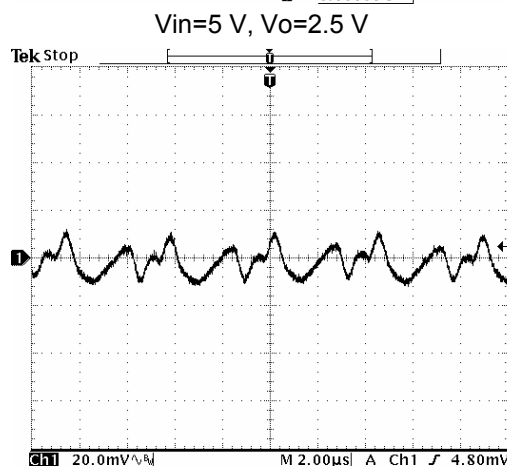
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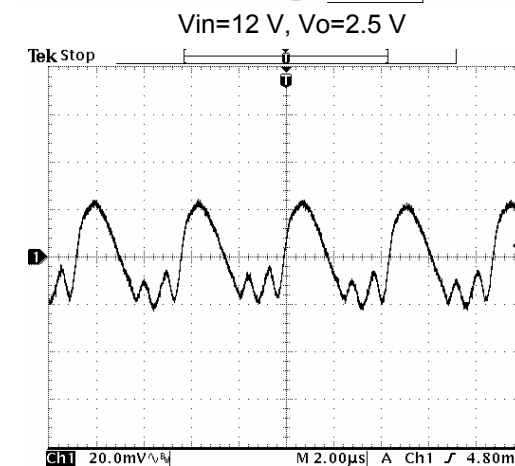
21 Apr 2004
11:19:45



21 Apr 2004
11:20:04



20 Apr 2004
09:45:28



20 Apr 2004
09:45:53

Vin=5 V, Vo=3.3 V

Vin=12 V, Vo=3.3 V

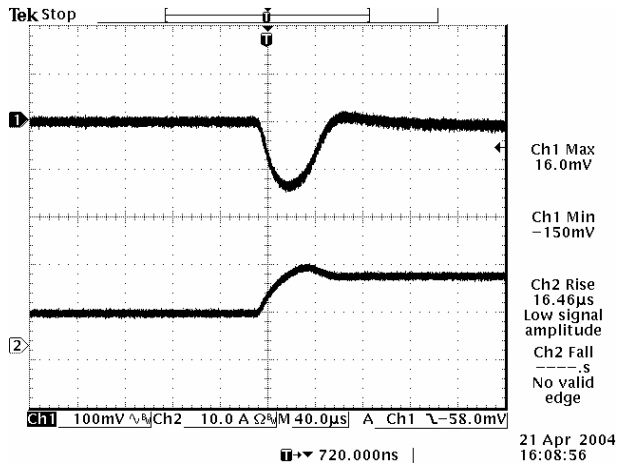
Note: Ripple and noise at full load, with 10μF tantalum capacitor and 1μF ceramic at the output, and Ta=25°C.

NON-ISOLATED DC/DC CONVERTERS

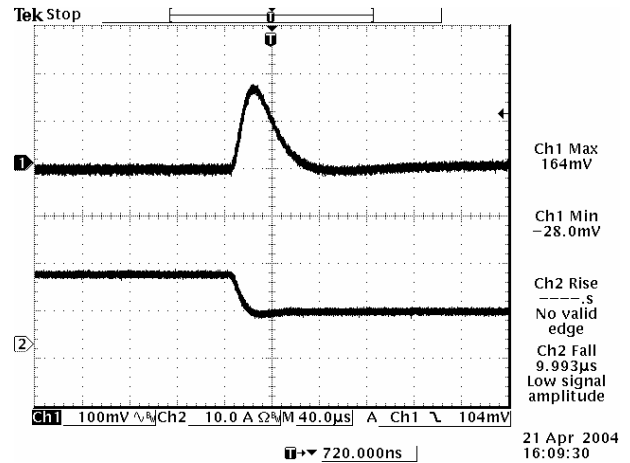
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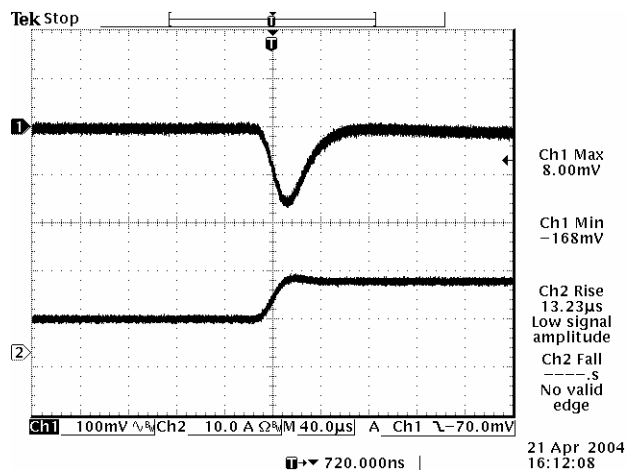
Transient Response Waveforms



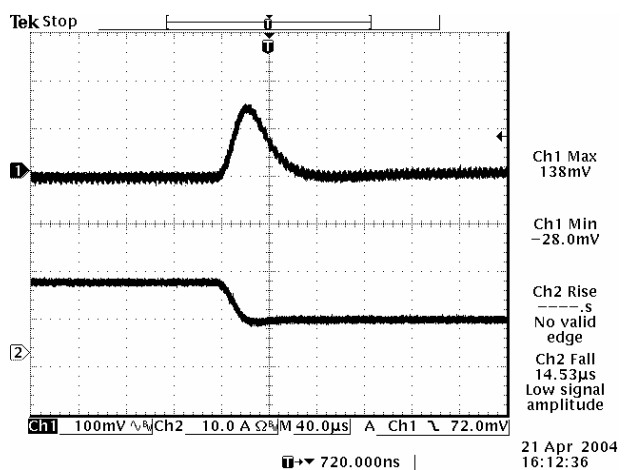
50% to 100% load Transient at $V_{in}=5\text{ V}$, $V_o=0.75\text{ V}$



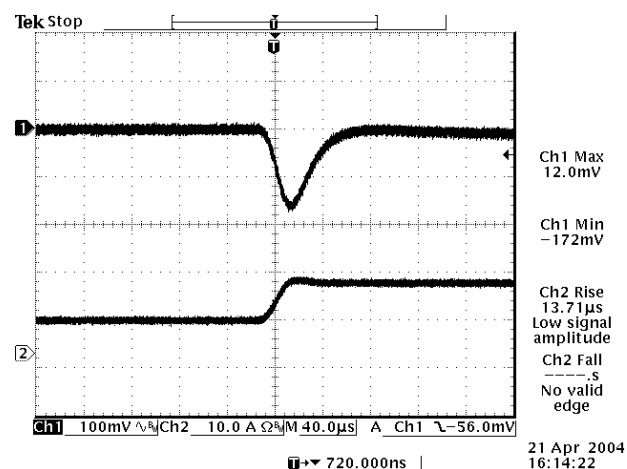
100% to 50% load Transient at $V_{in}=5\text{ V}$, $V_o=0.75\text{ V}$



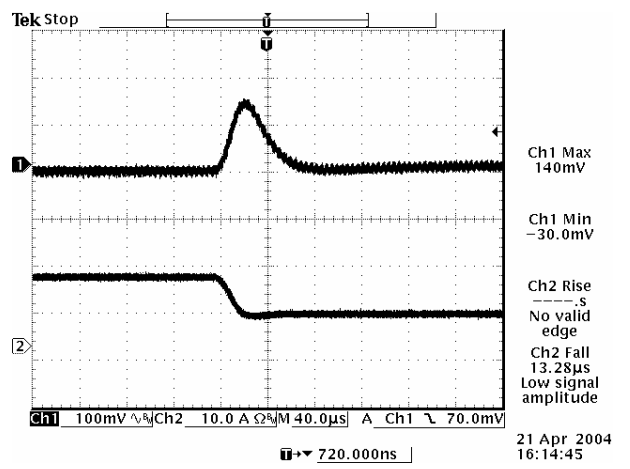
50% to 100% load Transient at $V_{in}=5\text{ V}$, $V_o=1.2\text{ V}$



100% to 50% load Transient at $V_{in}=5\text{ V}$, $V_o=1.2\text{ V}$



50% to 100% load Transient at $V_{in}=5\text{ V}$, $V_o=1.5\text{ V}$



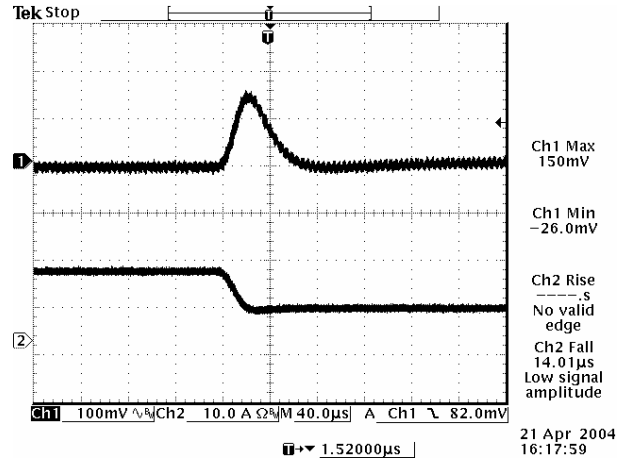
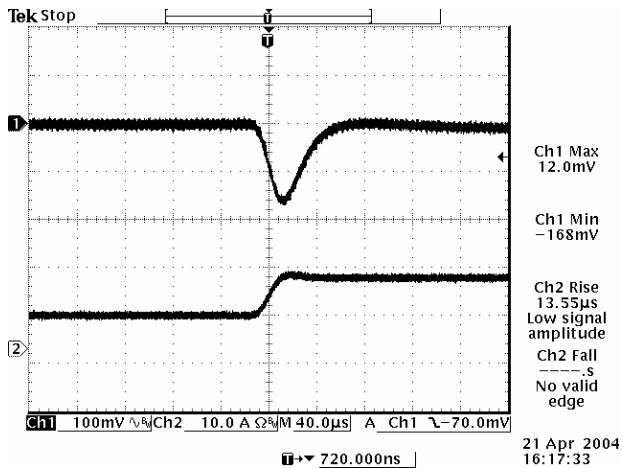
100% to 50% load Transient at $V_{in}=5\text{ V}$, $V_o=1.5\text{ V}$

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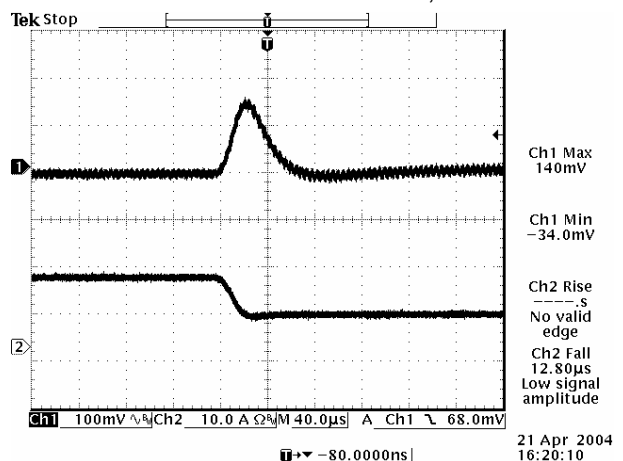
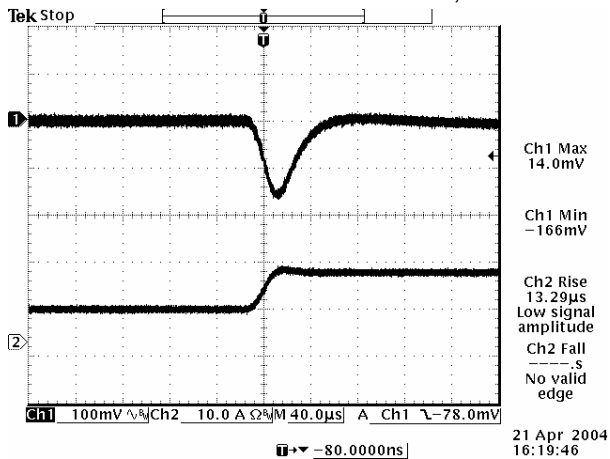


Transient Response Waveforms (continued)



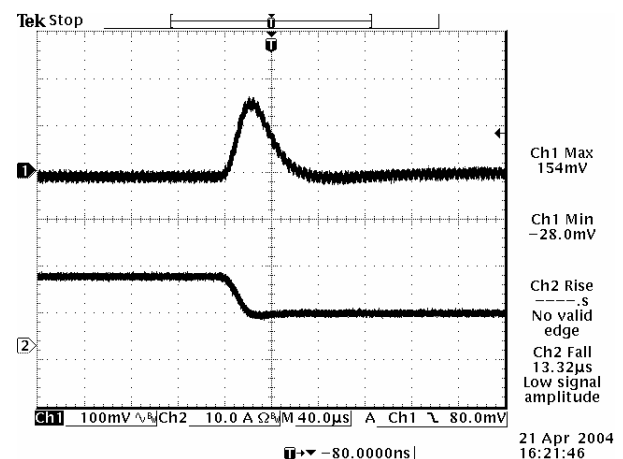
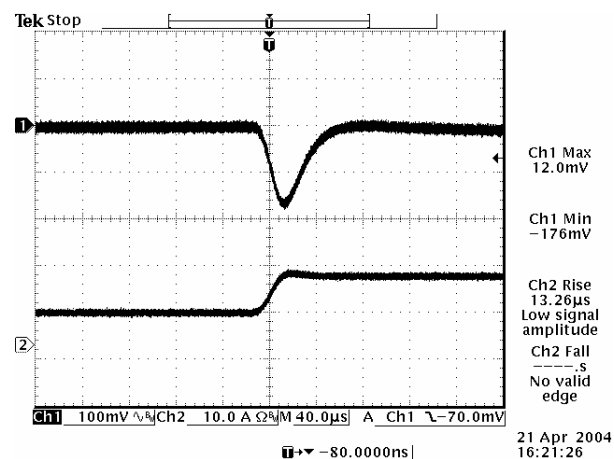
50% to 100% load Transient at Vin=5 V, Vo=1.8 V

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

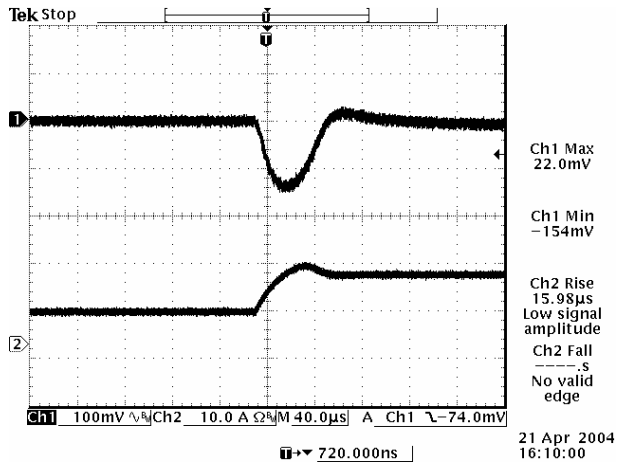
100% to 50% load Transient at Vin=5 V, Vo=3.3 V

NON-ISOLATED DC/DC CONVERTERS

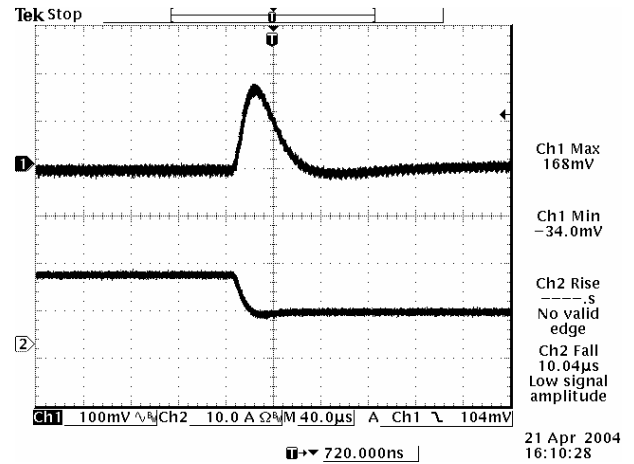
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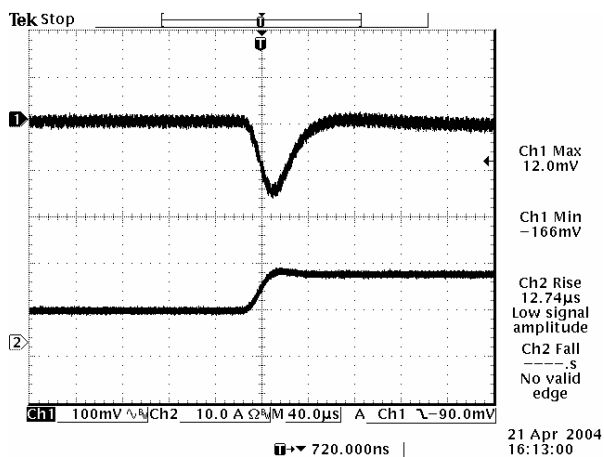
Transient Response Waveforms (continued)



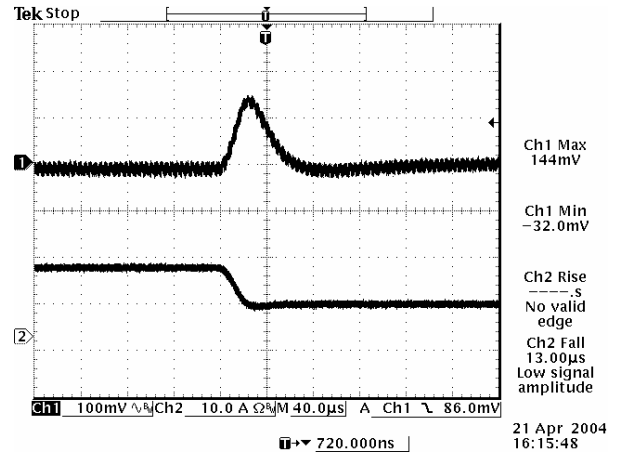
50% to 100% load Transient at Vin=12 V, Vo=0.75 V



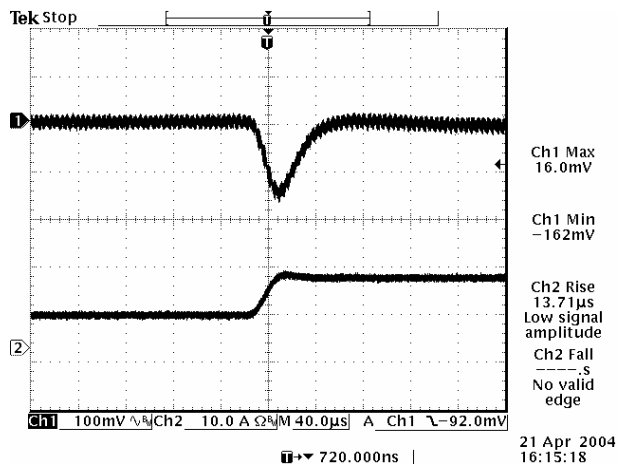
100% to 50% load Transient at Vin=12 V, Vo=0.75 V



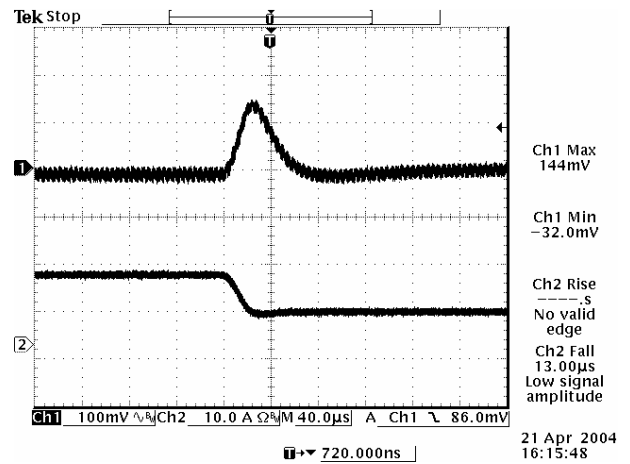
50% to 100% load Transient at Vin=12 V, Vo=1.2 V



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



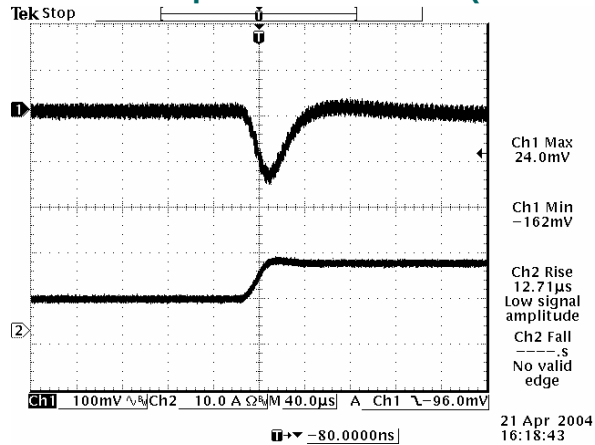
100% to 50% load Transient at Vin=12 V, Vo=1.5 V

NON-ISOLATED DC/DC CONVERTERS

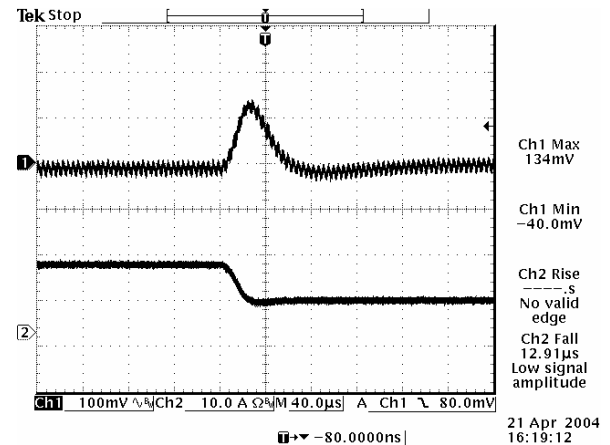
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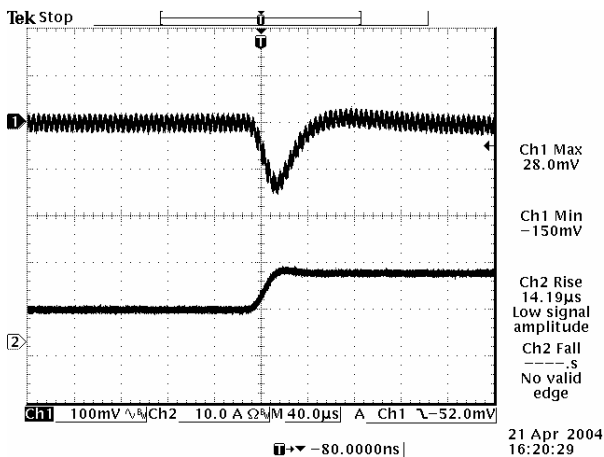
Transient Response Waveforms (continued)



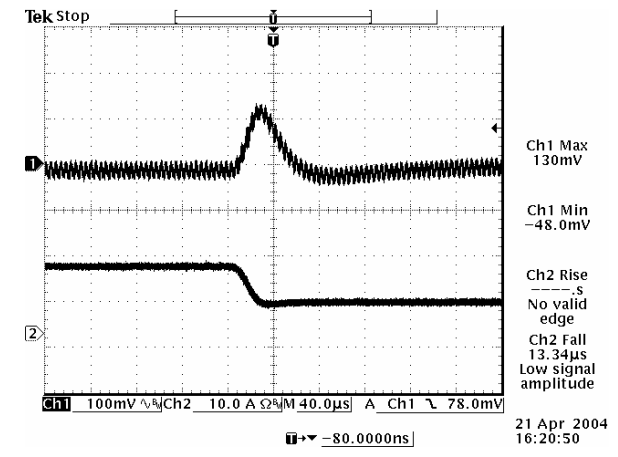
50% to 100% load Transient at Vin=12 V, Vo=1.8 V



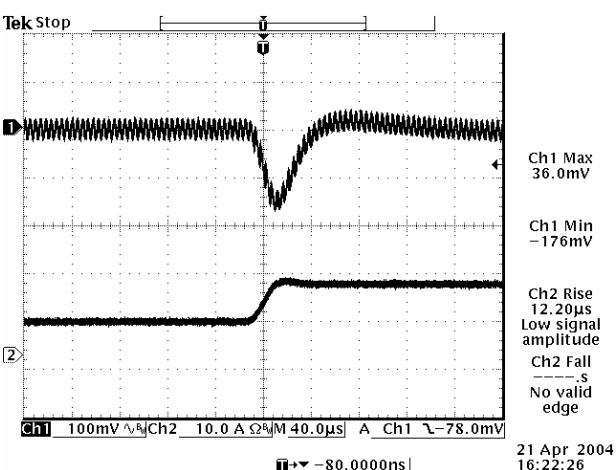
100% to 50% load Transient at Vin=12 V, Vo=1.8 V



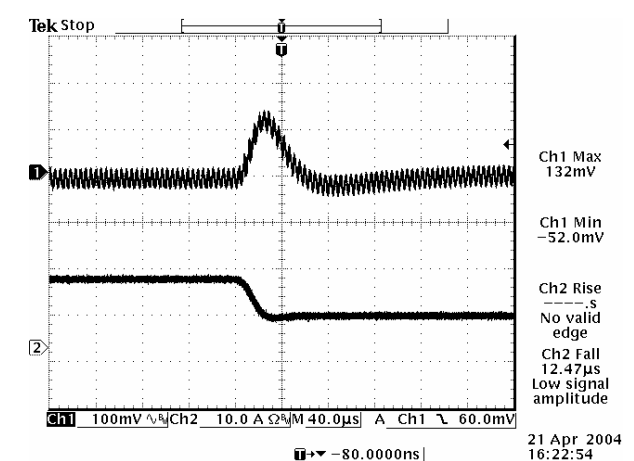
50% to 100% load Transient at Vin=12 V, Vo=2.5 V



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

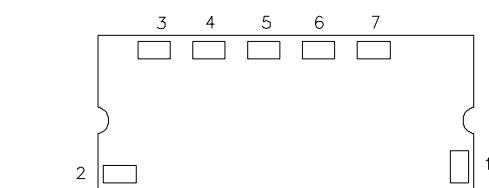
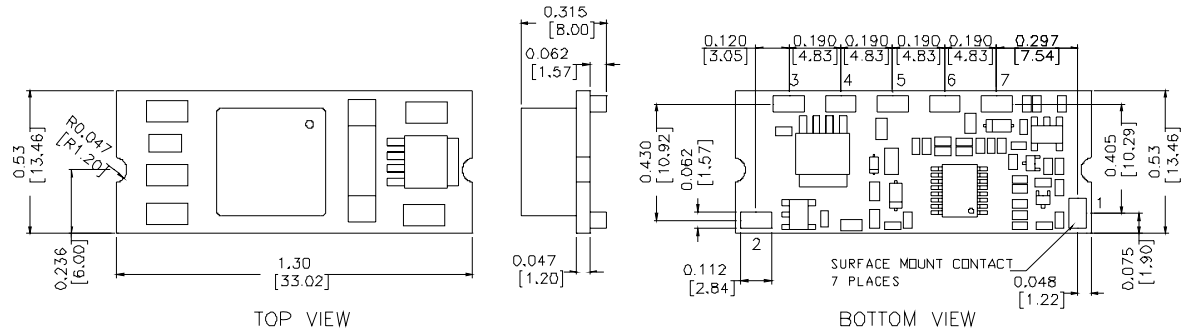
Note: Transient response with external load capacitance Cext=2x150uF (Polymer capacitors), and Ta=25°C.

NON-ISOLATED DC/DC CONVERTERS

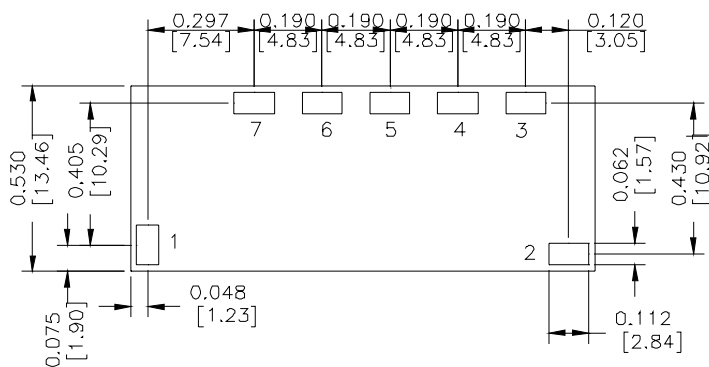
4.5 Vdc - 14 Vdc Input 0.75 Vdc - 3.63 Vdc/16 A Output



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)

Model Number Description:

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

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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