

NON-ISOLATED DC/DC CONVERTERS

2.4 Vdc - 5.5 Vdc Input

0.75 Vdc - 3.63 Vdc/10 A Output



Jan. 25, 2013

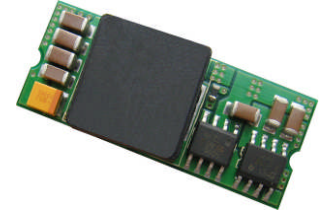
Bel Power, Inc. , a subsidiary of Bel Fuse, Inc.

SRBC-10F2Ax

RoHS Compliant

Rev.C

- Non-Isolated
- High Efficiency
- High Power Density
- Fixed Frequency(300 kHz)
- OCP/SCP
- Flexible Output Voltage Sequencing
- Remote Sense
- Certified to UL60950-1/CSA C22.2 No.60950-1, 2nd edition, am1
- Under-Voltage Lockout (UVLO)
- Over Temperature Protection
- Wide Input Range
- Wide Trim Range
- Remote On/Off
- Converter Can Sink and Source Current



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel SRBC-10F2Ax modules are a series of non-isolated dc/dc converters that deliver up to 10 A of output current with full load efficiency of 95% at 3.3 Vdc output. These modules provide precisely regulated voltage programmable via external resistor from 0.75 Vdc to 3.63 Vdc over a wide range of input voltage (2.4 Vdc - 5.5 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, remote sense, 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 - 3.63 V ¹	2.4 V - 5.5 V	10 A	36.3 W	95%	SRBC-10F2AL	SRBC-10F2A0

Notes: 1. These modules use a buck topology, so the output voltages must be 0.5 V less than the input voltage.
2. Add "G" to the end of the Model Number to indicate Tray Packaging.

Part Number Explanation

S R BC - 10 F 2A x
1 2 3 4 5 6 7

1---Surface mount

2---RoHS 6, change "R" to "7" means RoHS 5

3---Series name

4---Series code

5---Wide input range (2.4-5.5V)

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.

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	5.8 V	
Output Enable Terminal Voltage	-0.3 V	-	5.8 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-10F2Ax 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 V_{in} or leave the SEQ pin floating.

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	2.4 V	-	5.5 V	V _{o, set} ≤ V _{in} -0.5 V
Input Current (full load)				
V _o =3.3 V	-	7.0 A	8.0 A	
V _o =2.5 V	-	5.5 A	9.5 A	
V _o =1.8 V	-	4.0 A	9.0 A	
V _o =1.5 V	-	3.5 A	7.5 A	
V _o =1.2 V	-	3.0 A	6.0 A	
V _o =0.75 V	-	2.0 A	4.0 A	
Input Current (no load)	-	80 mA	-	
Remote Off Input Current	-	15 mA	-	
Input Reflected Ripple Current (pk-pk)	-	140 mA	-	Tested with two 100 uF/10 V tantalum input capacitors & simulated source impedance of 1uH, 5 Hz to 20 MHz.
Input Reflected Ripple Current (rms)	-	40 mA	-	
I ² t Inrush Current Transient	-	-	0.2 A ² s	
Turn-on Voltage Threshold	-	2.2 V	-	
Turn-off Voltage Threshold	-	2.0 V	-	

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

Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point	-2% V _{o, set}	-	2% V _{o, set}	V _{in} =5 V, I _o =I _{o max} full load
Output Voltage Set Point	-3% V _{o, set}	-	3% V _{o, set}	Over all operating input voltages, resistive loads and temperature conditions
Load Regulation	-	0.4% V _{o, set}	-	I _o =I _{o min} to I _{o max}
Line Regulation	-	0.3% V _{o, set}	-	V _{in} =V _{in min} to V _{in max}
Regulation Over Temperature (-40 °C to +85 °C)	-	0.5% V _{o, set}	-	T _{ref} =T _{amin} to T _{amax}
Output Current	0 A	-	10 A	
Current Limit Threshold	15 A	-	27 A	
Short Circuit Surge Transient	-	-	1.5 A ² s	
Ripple and Noise (pk-pk)	-	25 mV	50 mV	Tested with 0-20 MHz, 10 uF/16 V tantalum capacitor & 1 uF/10 V TDK ceramic capacitor at the output
Ripple and Noise (rms)	-	8 mV	15 mV	

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Parameter		Min	Typ	Max	Notes
Turn on Time		-	4 mS	8 mS	Turn on Time
Overshoot at Turn on		-	0% $V_{o,set}$	3% $V_{o,set}$	Overshoot at Turn on
Output Capacitance					Output Capacitance
ESR $\geq 1\text{m ohm}$		0 μF	-	1000 μF	ESR $\geq 1\text{m ohm}$
ESR $\geq 10\text{m ohm}$		0 μF	-	4700 μF	ESR $\geq 10\text{m ohm}$
Transient Response					
50% ~ 100% Max Load	$V_o=3.3\text{ V}$	-	130 mV	-	di/dt=2.5 A/ μS ; $V_{in}=5\text{ V}$; and with two 150 $\mu\text{F}/16\text{ V}$ tantalum capacitors & 1 $\mu\text{F}/10\text{ V}$ ceramic capacitor at the output
Settling Time		-	50 μS	-	
100% ~ 50% Max Load		-	150 mV	-	
Settling Time		-	50 μS	-	
50% ~ 100% Max Load	$V_o=2.5\text{ V}$	-	130 mV	-	
Settling Time		-	50 μS	-	
100% ~ 50% Max Load		-	130 mV	-	
Settling Time		-	50 μS	-	
50% ~ 100% Max Load	$V_o=1.8\text{ V}$	-	120 mV	-	
Settling Time		-	50 μS	-	
100% ~ 50% Max Load		-	120 mV	-	
Settling Time		-	50 μS	-	
50% ~ 100% Max Load	$V_o=1.5\text{ V}$	-	120 mV	-	
Settling Time		-	50 μS	-	
100% ~ 50% Max Load		-	120 mV	-	
Settling Time		-	50 μS	-	
50% ~ 100% Max Load	$V_o=1.2\text{ V}$	-	130 mV	-	
Settling Time		-	50 μS	-	
100% ~ 50% Max Load		-	130 mV	-	
Settling Time		-	50 μS	-	
50% ~ 100% Max Load	$V_o=0.75\text{ V}$	-	120 mV	-	
Settling Time		-	50 μS	-	
100% ~ 50% Max Load		-	140 mV	-	
Settling Time		-	50 μS	-	

Note: All specifications are typical at nominal input ($V_{in}=5\text{ V}$), full load at 25 °C unless otherwise stated.

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General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				Measured at Vin=5 V, full load
Vo=3.3 V	92%	95%	-	
Vo=2.5 V	90%	93%	-	
Vo=1.8 V	88%	91%	-	
Vo=1.5 V	87%	90%	-	
Vo=1.2 V	85%	88%	-	
Vo=0.75 V	79%	82%	-	
Switching Frequency	250 kHz	300 kHz	350 kHz	
Over Temperature Shutdown	-	125 °C	-	
Output Trim Range (Wide Trim)	0.7525 V	-	3.63 V	
Remote Sense Compensation	-	10%	-	
MTBF	6,643,156 hours			Calculated Per Bell Core SR-332 (Io = Nominal; Ta = 25 °C)
Dimensions				
Inches (L × W × H)	1.30 × 0.53 × 0.315			
Millimeters (L × W × H)	33.02 × 13.46 × 8.00			
Weight	-	6.6 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	-	0.3 V	SRBC-10F2A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	1.5 V	-	5.8 V	
Signal Low (Unit On)	-0.3 V	-	0.3 V	SRBC-10F2AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	1.5 V	-	5.8 V	
Sequencing Voltage	0.05 V	-	Vin	Sequencing Voltage 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	

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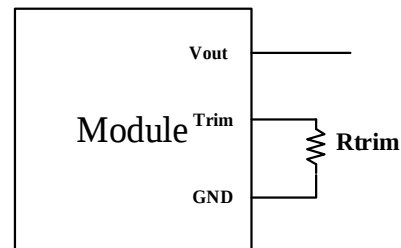
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Output Trim Equations

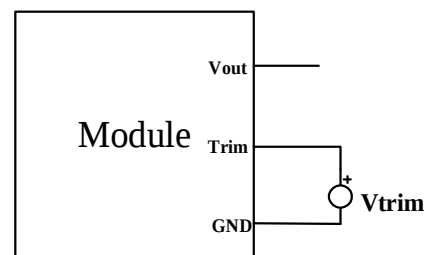
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (V_{adj}) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

$$R_{trim} = \frac{21.07}{V_{adj} - 0.7525} - 5.11$$



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

$$V_{trim} = 0.7 - 0.1698 \times (V_{adj} - 0.7525)$$



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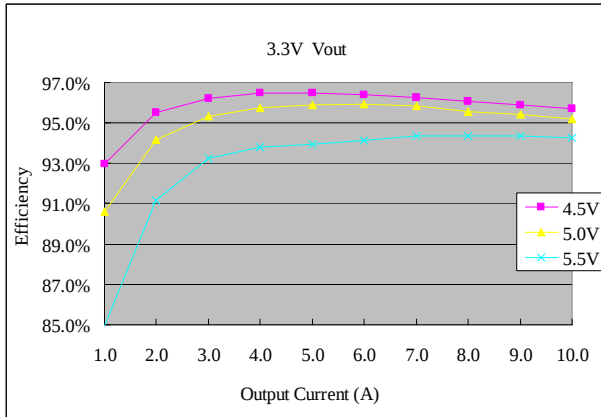
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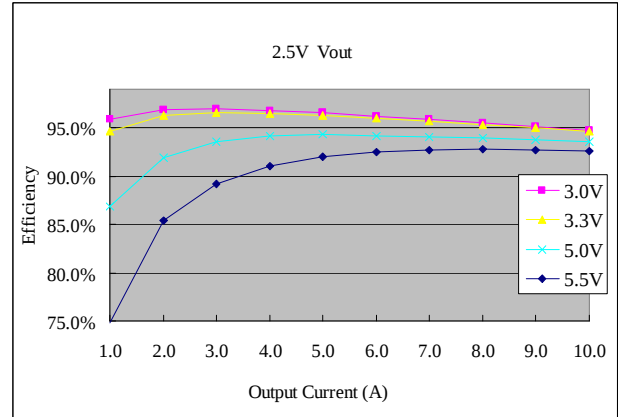
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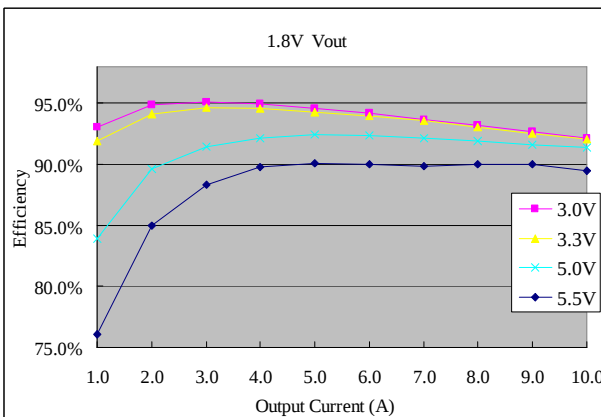
Efficiency Data



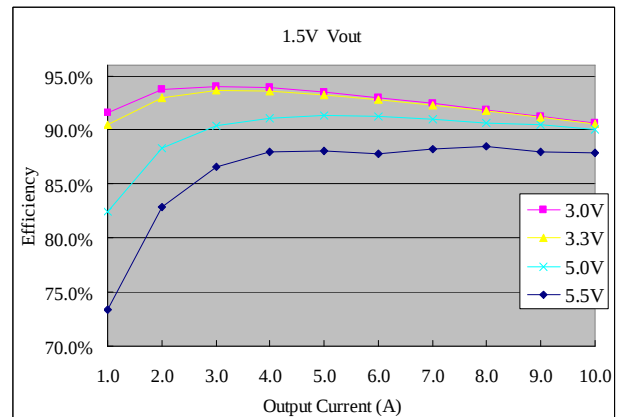
Vo=3.3 V



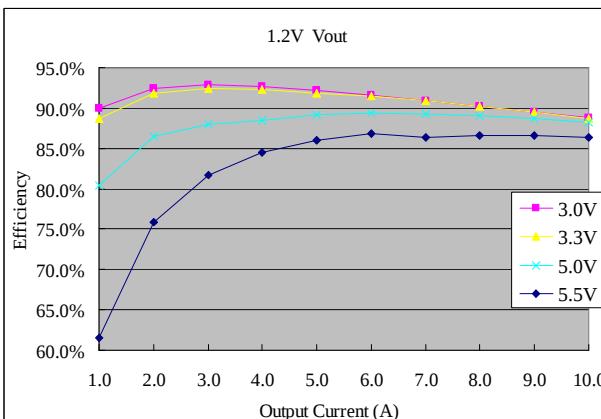
Vo=2.5 V



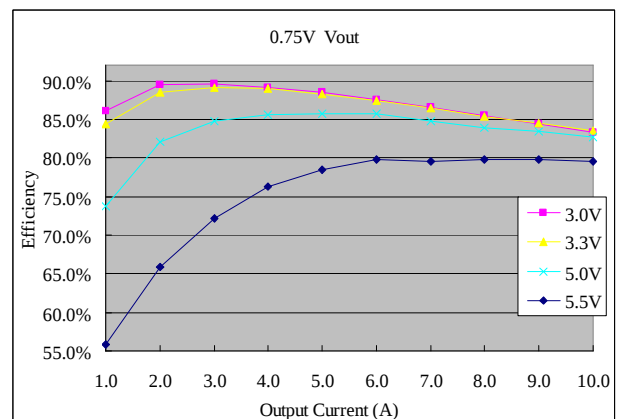
Vo=1.8 V



Vo=1.5 V



Vo=1.2 V



Vo=0.7525 V

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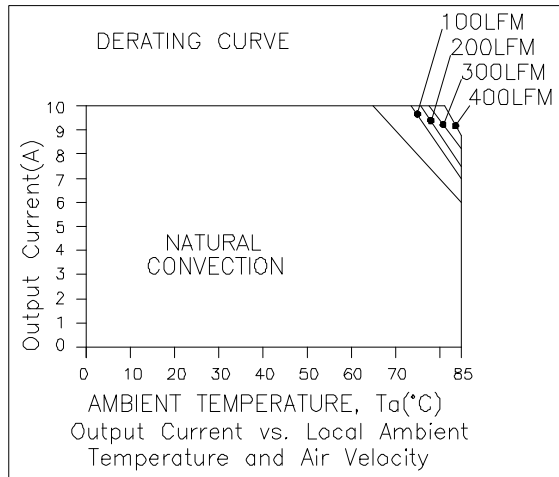
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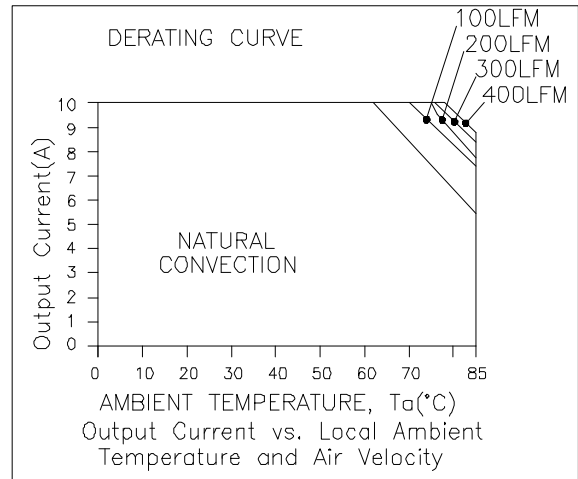
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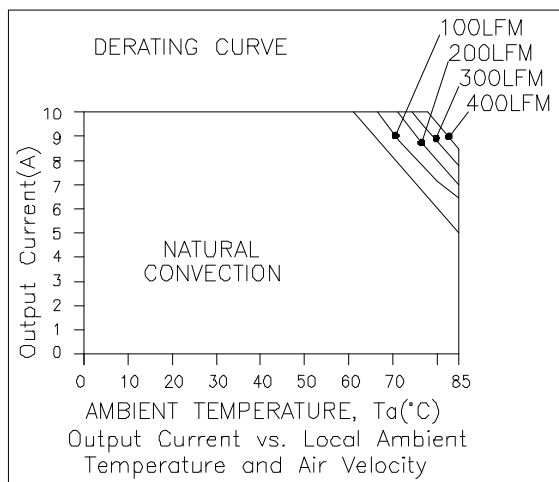
Thermal Derating Curves



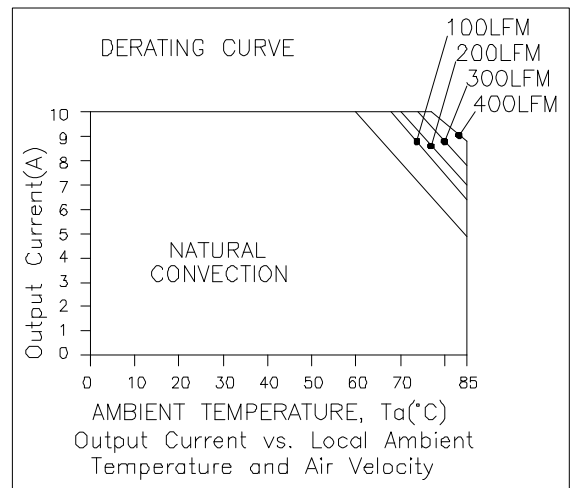
Vin=5.0 V, Vo=0.75 V



Vin=5.0 V, Vo=1.5 V



Vin=5.0 V, Vo=2.5 V



Vin=5.0 V, Vo=3.3 V

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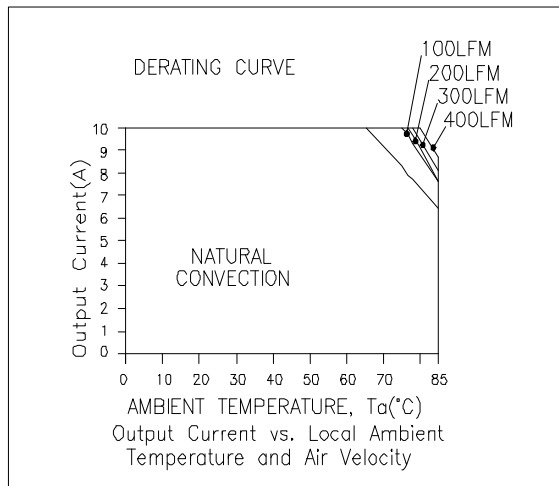
0.75 Vdc - 3.63 Vdc/10 A Output



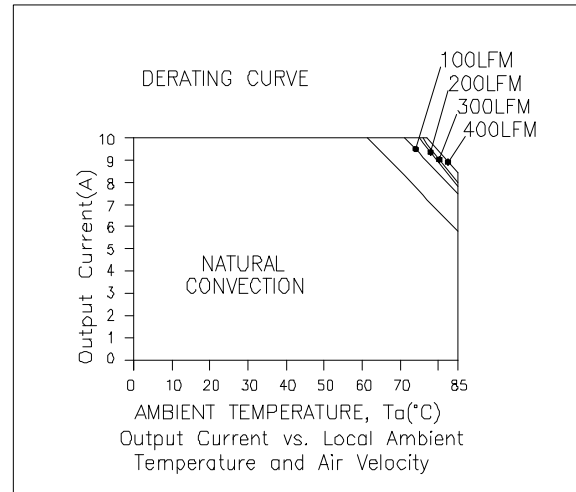
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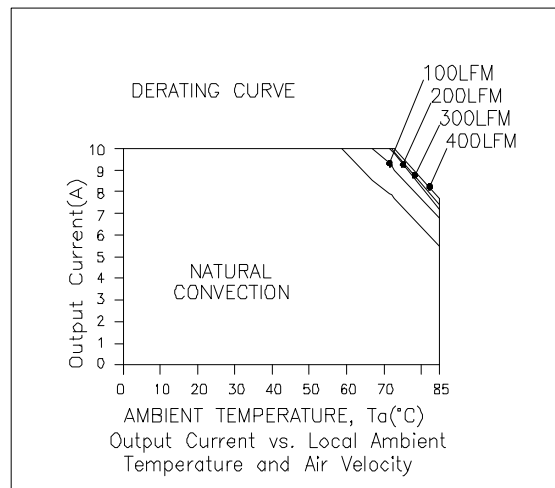
Thermal Derating Curves (continued)



$V_{in}=3.3\text{ V}$, $V_o=0.75\text{ V}$



$V_{in}=3.3\text{ V}$, $V_o=1.5\text{ V}$



$V_{in}=3.3\text{ V}$, $V_o=2.5\text{ V}$

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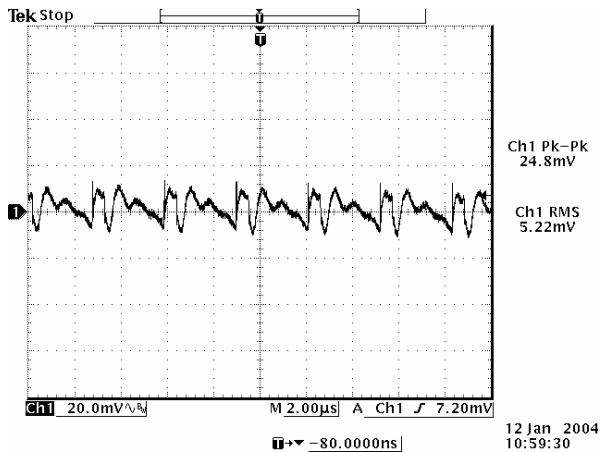
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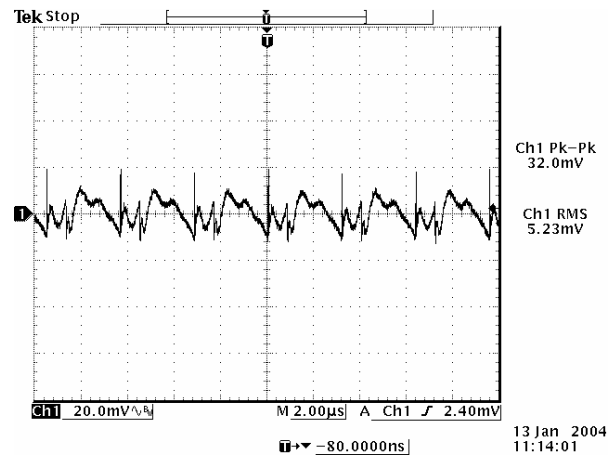
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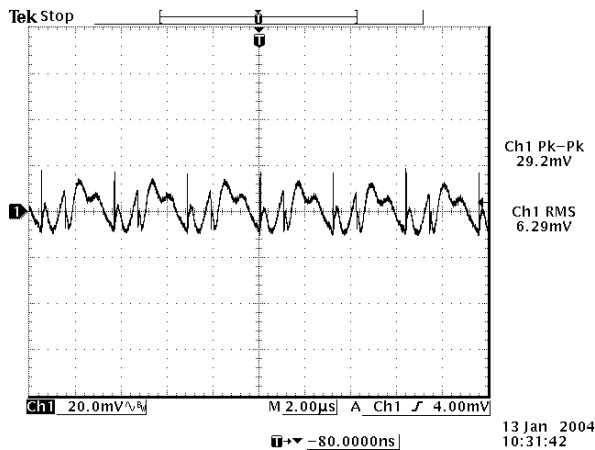
Ripple and Noise Waveforms



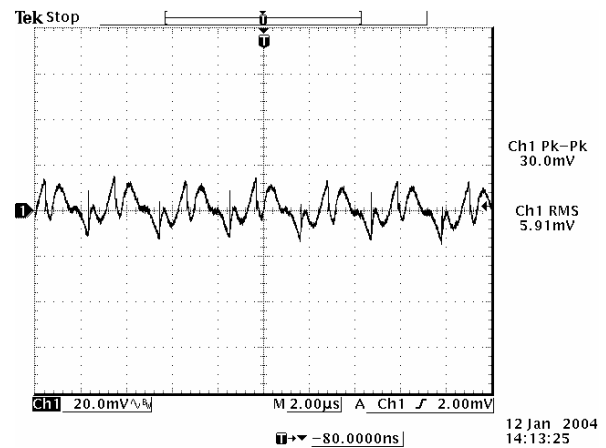
Ripple and noise at full load, 0.75 V output



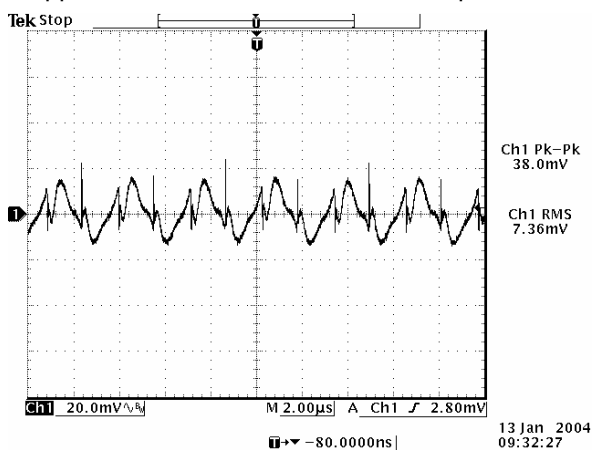
Ripple and noise at full load, 1.2 V output



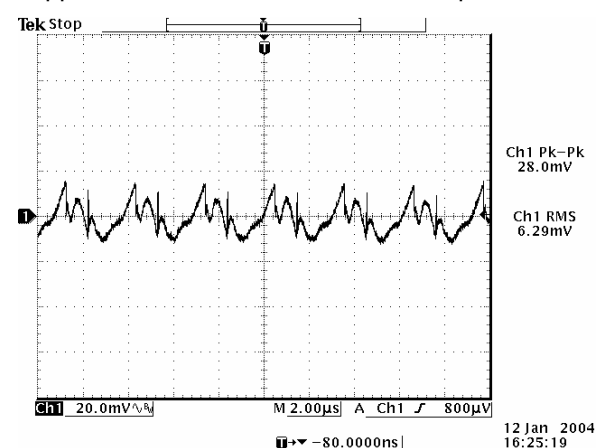
Ripple and noise at full load, 1.5 V output



Ripple and noise at full load, 1.8 V output



Ripple and noise at full load, 2.5 V output



Ripple and noise at full load, 3.3 V output

Note: Ripple and noise at 5.0 V input, 0-20MHz BW, 10 µF/16 V tantalum cap and 1µF/10 V ceramic capacitor, Ta=25 deg C.

NON-ISOLATED DC/DC CONVERTERS

2.4 Vdc - 5.5 Vdc Input

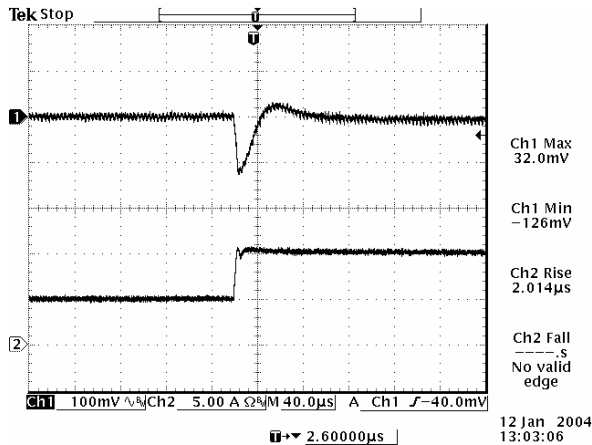
0.75 Vdc - 3.63 Vdc/10 A Output



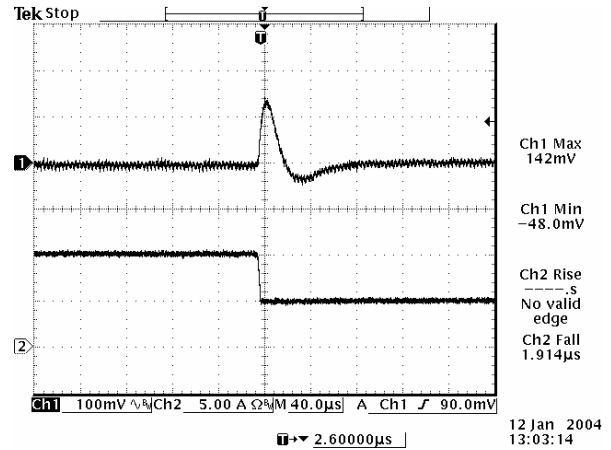
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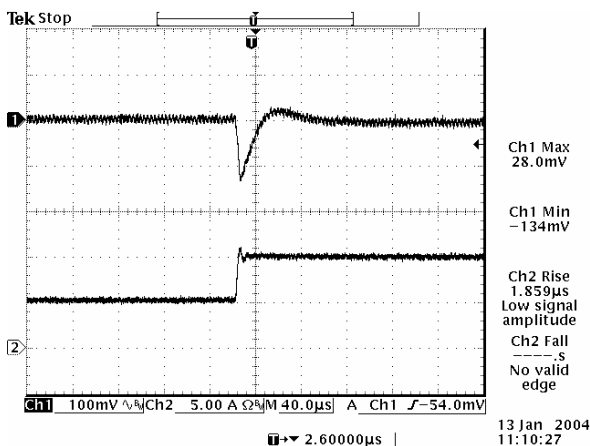
Transient Response Waveforms



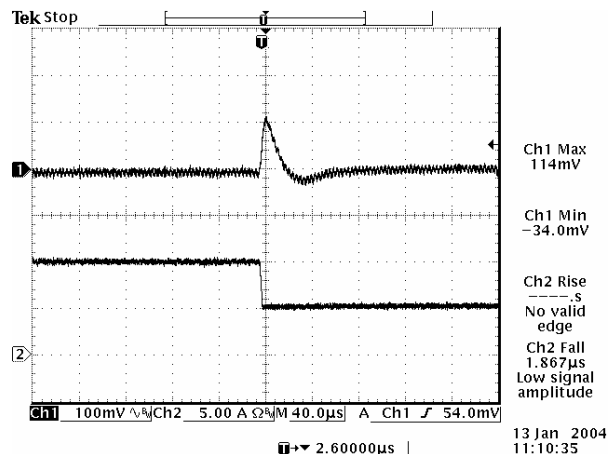
50% to 100% load step at 0.75 V output



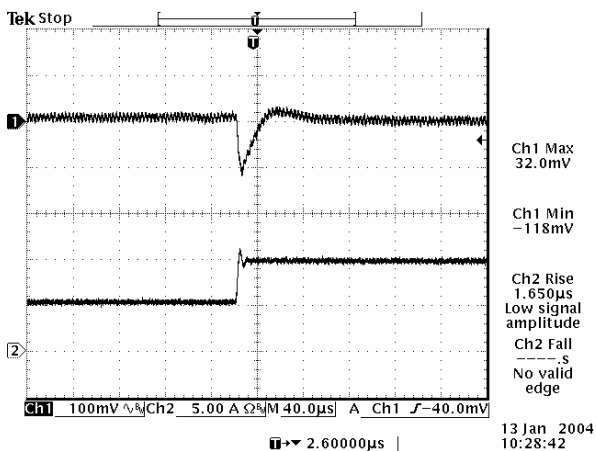
100% to 50% load step at 0.75 V output



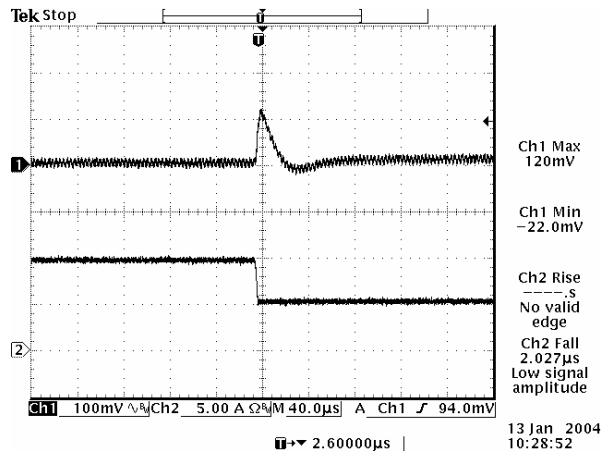
50% to 100% load step at 1.2 V output



100% to 50% load step at 1.2 V output



50% to 100% load step at 1.5 V output



100% to 50% load step at 1.5 V output

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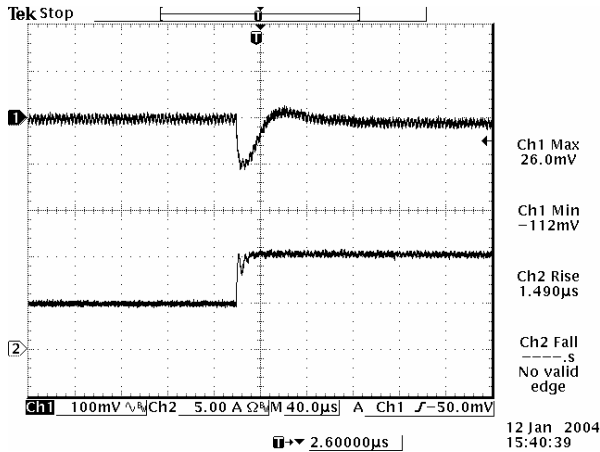
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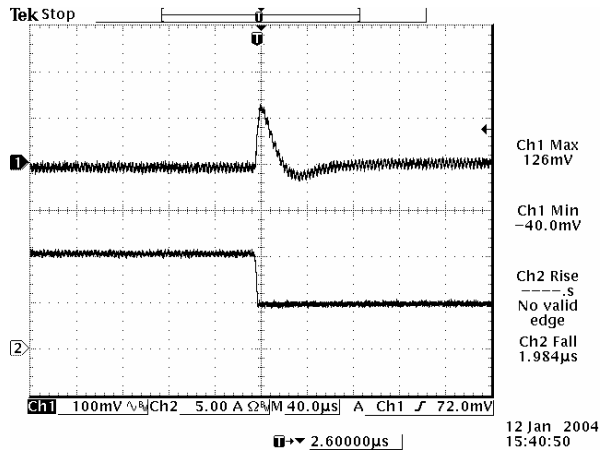
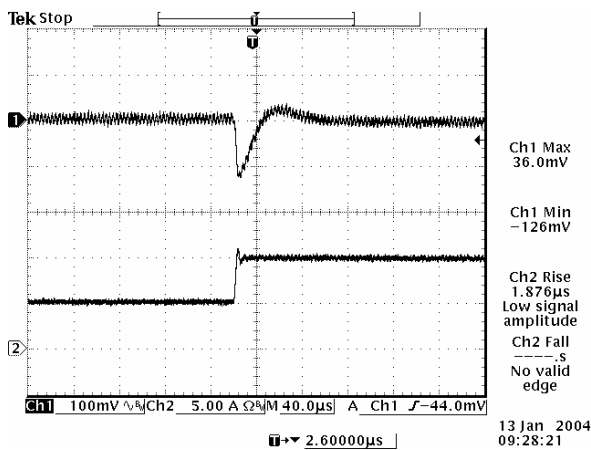
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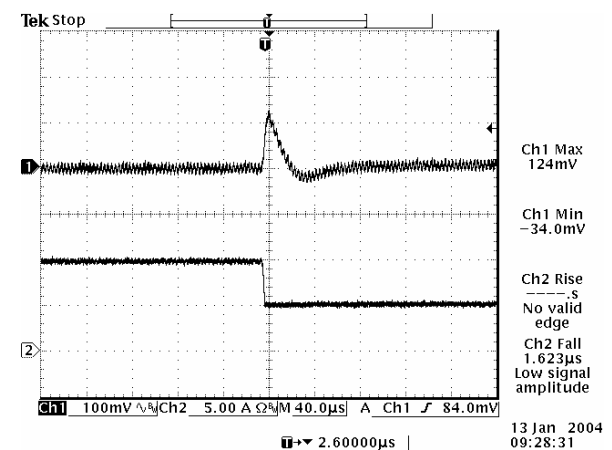
Transient Response Waveforms (continued)



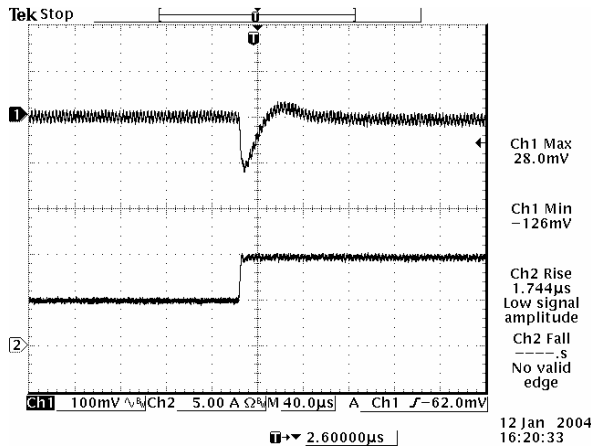
50% to 100% load step at 1.8 V output



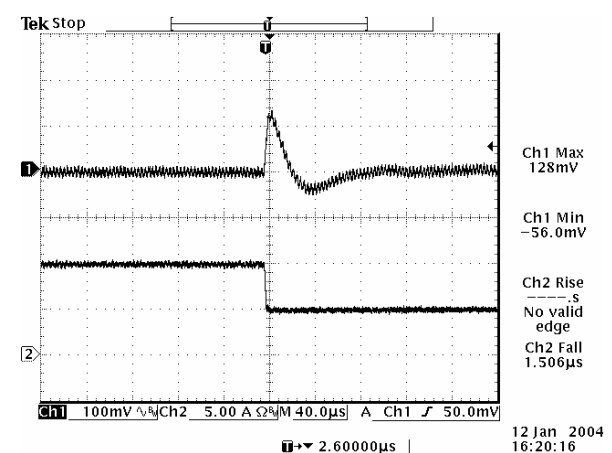
100% to 50% load step at 1.8 V output



50% to 100% load step at 2.5 V output



100% to 50% load step at 2.5 V output



50% to 100% load step at 3.3 V output

100% to 50% load step at 3.3 V output

Note: Transient response at 5.0 V input, $di/dt=2.5$ A/µs, with two 150 µF/16 V tantalum capacitors and 1 µF/10 V ceramic capacitor, $T_a=25$ deg C.

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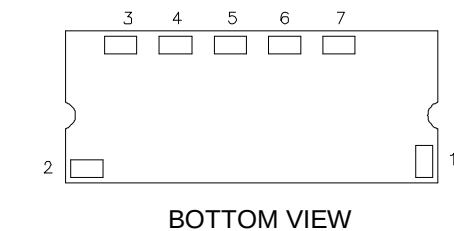
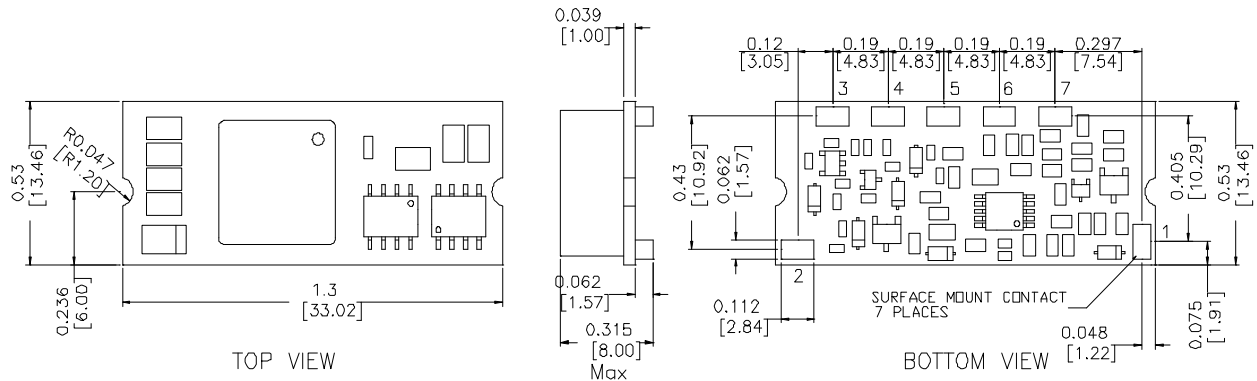
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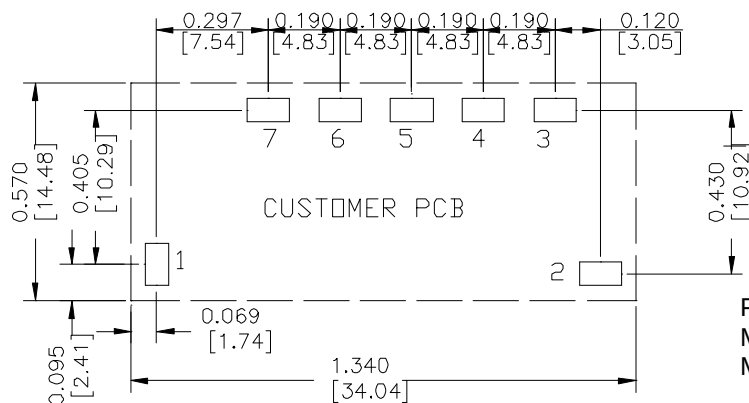
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Mechanical Outline



RECOMMENDED PAD LAYOUT



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

Pin Connections

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

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.

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Revision History

Date	Revision	Changes Detail	Approval
2007-01-17	A	Change version to A	Lynn
2011-08-25	B	Update the reflow solder temperature.	HL
2013-01-25	C	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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CORPORATE

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