NON-ISOLATED DC/DC CONVERTERS

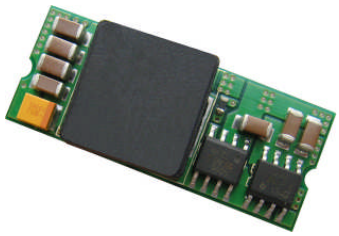
2.4 Vdc - 5.5 Vdc Input 0.75 Vdc - 3.63 Vdc/10 A Output

Jan. 25, 2013

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

SRBC-10F1Ax RoHS Compliant Rev.C

- Non-Isolated
- High Efficiency
- High Power Density
- Fixed Frequency (300 kHz)
- Remote On/Off
- Converter Can Sink and Source Current
- Under-voltage Lockout (UVLO)
- Over Temperature Protection
- OCP/SCP
- Wide Input
- Wide Trim
- Remote Sense
- Active Low/High (Option)
- Certificated to UL60950-1/CSA C22.2 No.60950-1, 2rd edition, am1



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel SRBC-10F1Ax 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. 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 - 3.63 V[1]	2.4 V - 5.5 V	10 A	36 W	95%	SRBC-10F1AL	SRBC-10F1A0

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	1A	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.

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	
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	2.4 V	-	5.5 V	Vo, set ≤ Vin-0.5 V
Input Current (full load) Vo=3.3 V Vo=2.5 V Vo=1.8 V Vo=1.5 V Vo=1.2 V Vo=0.75 V	 - - - - - -	 7.0 A 5.5 A 4.0 A 3.5 A 3.0 A 2.0 A	 8.0 A 9.5 A 9.0 A 7.5 A 6.0 A 4.0 A	
Input Current (no load)	-	80 mA	-	
Remote Off Input Current	-	15 mA	-	
Input Reflected Ripple Current (pk-pk)	-	140 mA	-	With simulated source impedance of 1 uH, 5 Hz to 20 MHz and two 100 uF /10 V external input Tantalum capacitors at the input.
Input Reflected Ripple Current (rms)	-	40 mA	-	
I^2t Inrush Current Transient	-	-	0.2 A^2s	
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% Vo,set	-	2% Vo,set	Vin=5 V, Io=Io max
Output Voltage Set Point	-3% Vo,set	-	3% Vo,set	Over all operating input voltage, resistive load, and temperature conditions
Load Regulation	-	0.4% Vo,set	-	Io=Iomin to Iomax
Line Regulation	-	0.3% Vo,set	-	Vin=Vinmin to Vinmax
Regulation Over Temperature (-40 °C to +85 °C)	-	0.5% Vo,set	-	
Output Current	0 A	-	10 A	
Current Limit Threshold	15 A	-	27 A	
Short Circuit Surge Transient	-	-	1.5 A^2s	

Output Specifications (continued)

Parameter		Min	Typ	Max	Notes
Ripple and Noise (pk-pk)		-	25 mV	50 mV	Tested with 0-20MHz, with external 10uF/16V tantalum capacitor & 1uF/10V TDK ceramic capacitor
Ripple and Noise (rms)		-	8 mV	15 mV	
Turn on Time		-	4 mS	8 mS	
Overshoot at Turn on		-	0%	3%	
Output Capacitance ESR ≥1 mohm ESR ≥10 mohm		 0 uF 0 uF	 - -	 1000 uF 4700 uF	
Transient Response					
50% ~ 100% Max Load	Vo = 3.3 V	-	130 mV	-	di/dt=2.5 A/uS; Vin=5 V; and with external 2 × 150 uF/16 V Tantalum capacitors and 1 uF /10 V ceramic capacitor at the output
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	150 mV	-	
Settling Time		-	50 uS	-	
50% ~ 100% Max Load	Vo = 2.5 V	-	130 mV	-	
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	130 mV	-	
Settling Time		-	50 uS	-	
50% ~ 100% Max Load	Vo = 1.8 V	-	120 mV	-	
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	120 mV	-	
Settling Time		-	50 uS	-	
50% ~ 100% Max Load	Vo = 1.5 V	-	120 mV	-	
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	120 mV	-	
Settling Time		-	50 uS	-	
50% ~ 100% Max Load	Vo =1.2 V	-	130 mV	-	
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	130 mV	-	
Settling Time		-	50 uS	-	
50% ~ 100% Max Load	Vo = 0.75 V	-	120 mV	-	
Settling Time		-	50 uS	-	
100% ~ 50% Max Load		-	140 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	92%	95%	-	Measured at Vin=5 V, full load
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 Voltage Trim Range	0.7525 V	-	3.63 V	Total adjustment of trim, setpoint and remote sense combined should not exceed 3.63 V. Vo=0.7525 V when trim pin open
Remote Sense Compensation	-	10%	-	
MTBF	6,643,156 hours			Calculated Per Bell Core SR-332 (Io = 80% Io, max; Vo=1.8 V; Vin=5.0 V; Ta = 25 °C)
Dimensions				
Inches (L × W × H)	1.3 x 0.53 x 0.315			
Millimeters (L × W × H)	33.02 x 13.46 x 8.00			
Weight	-	6.6 g	-	

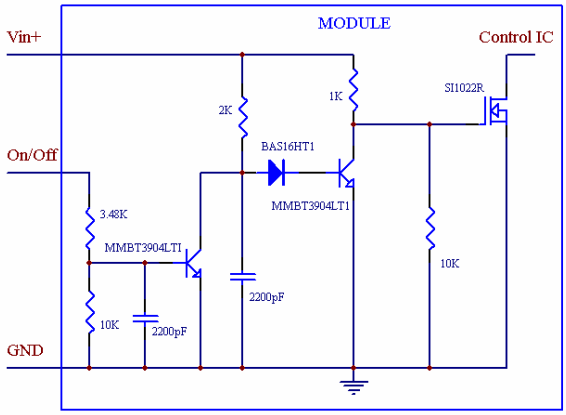
Note: All specifications are typical at 25 °C unless otherwise stated.

Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.3 V	-	0.3 V	SRBC-10F1A0; 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-10F1AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	1.5 V	-	5.8 V	

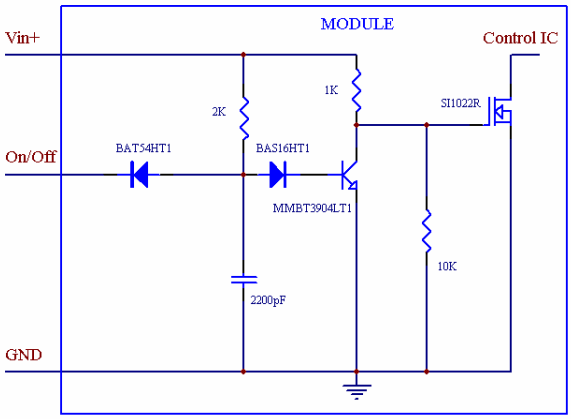
Remote Enable Specifications

The SRBC-10F1AL modules feature an enable pin with negative logic. If not using the enable pin, leave the pin open (the module will be on). During logic_high, the module is turned off, during logic_low, the module is turned on. It inner circuit impedance is showed as figure.



SRBC-10F1AL

The SRBC-10F1A0 modules feature an enable pin with Positive logic. If not using the enable pin, leave the pin open (the module will be on). During logic_high, the module is turned on, during logic_low, the module is turned off. It inner circuit impedance is showed as figure.

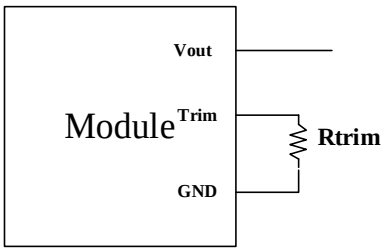


SRBC-10F1A0

Output Trim Equations

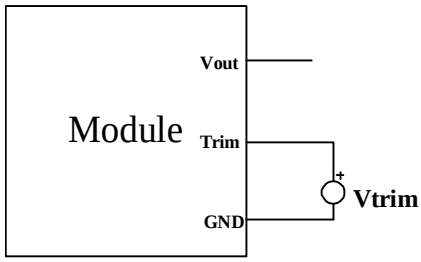
Equation for calculating the trim resistor (in KΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

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

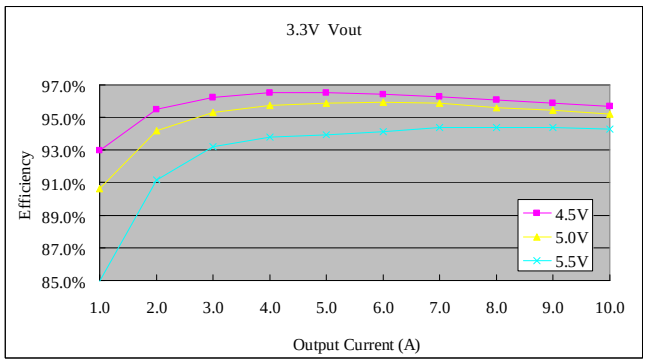


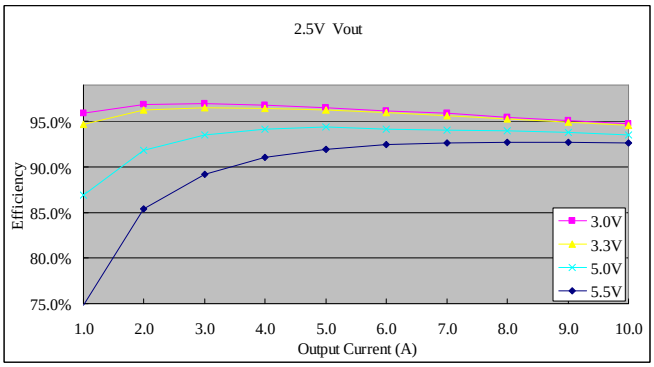
Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

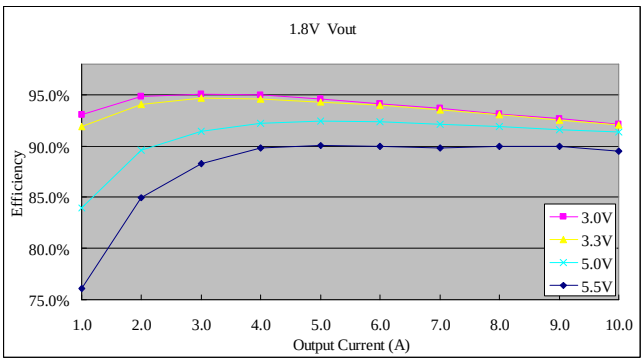
$$V_{trim} = 0.7 - 0.1698 \times (V_{adj} - 0.7525)$$

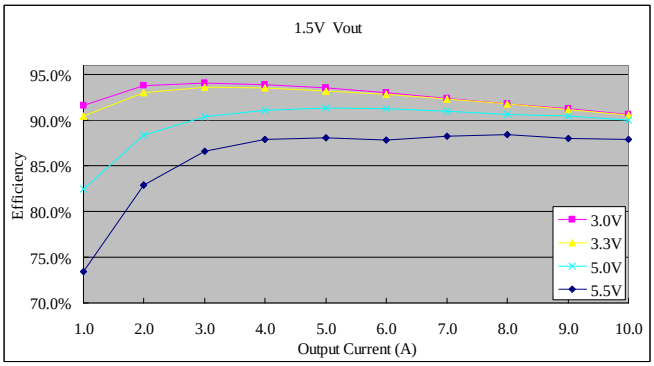


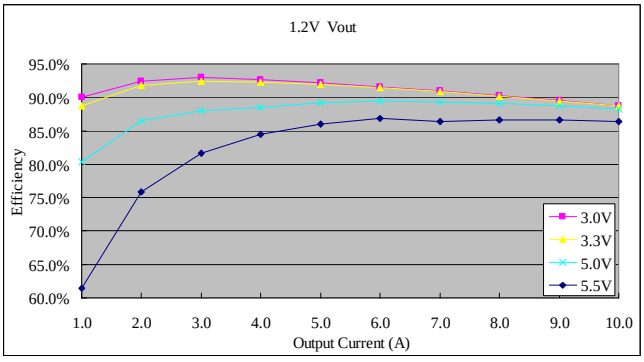
Efficiency Data

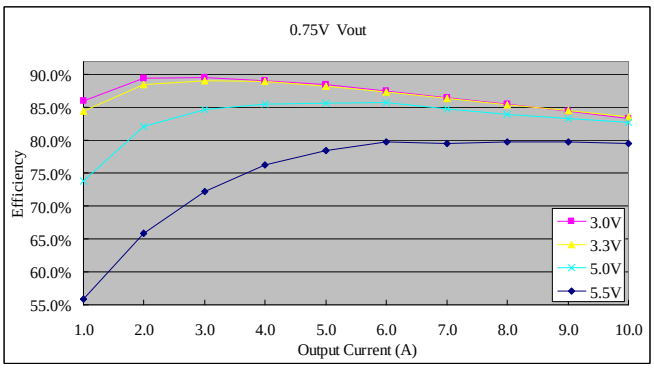




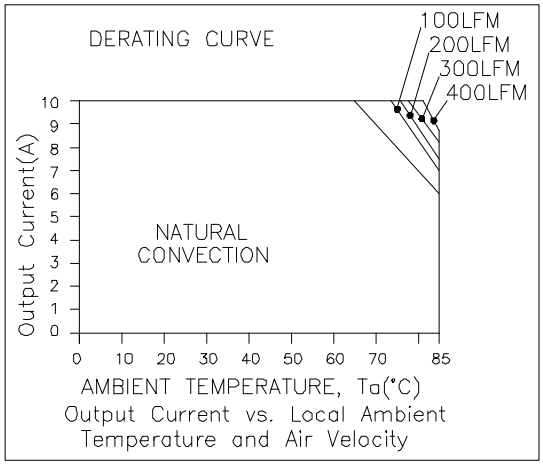




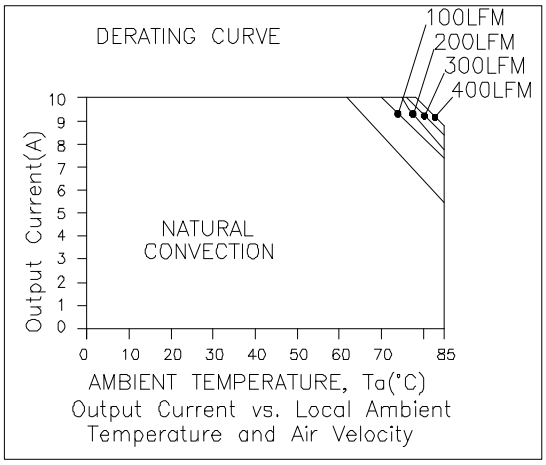




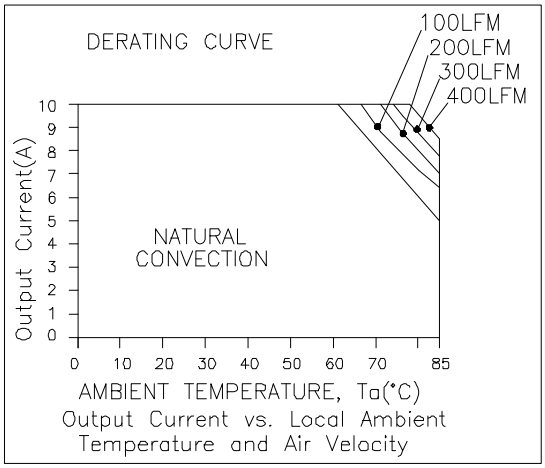
Thermal Derating Curves



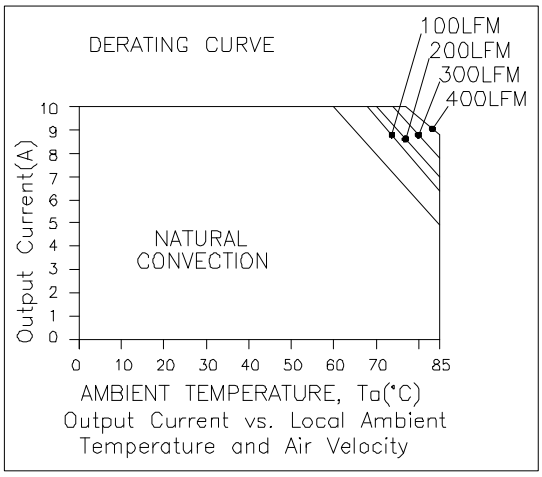
Vin=5.0 V, Vo=0.75 V



Vin=5.0 V, Vo=1.5 V

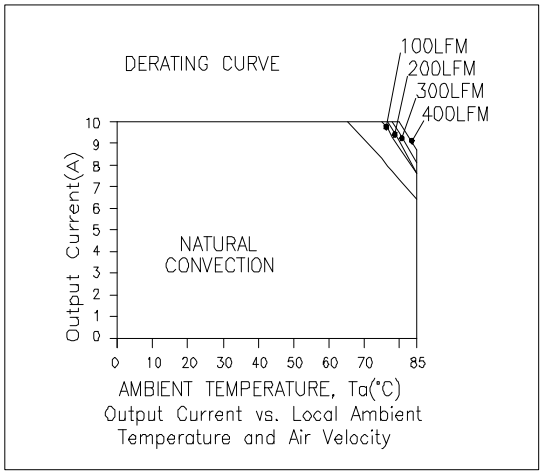


Vin=5.0 V, Vo=2.5 V

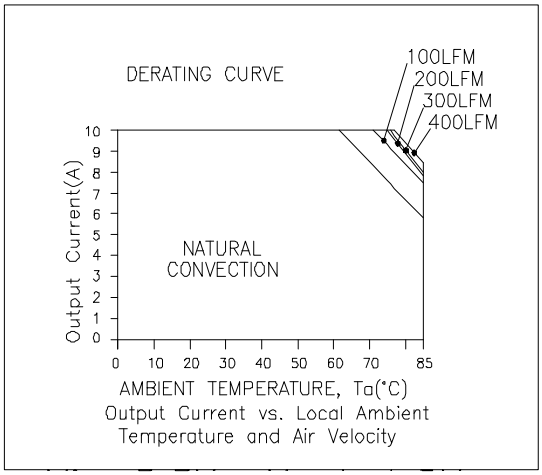


Vin=5.0 V, Vo=3.3 V

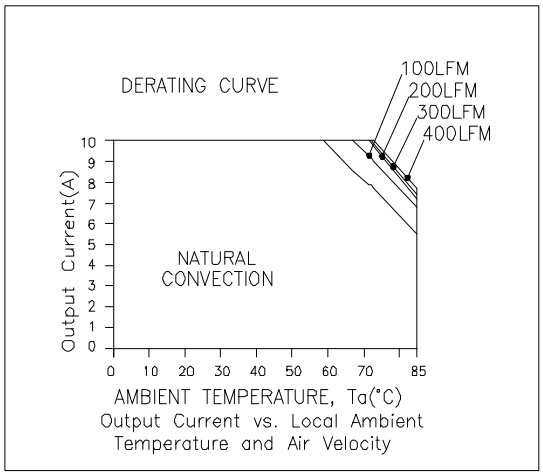
Thermal Derating Curves (continued)



Vin=3.3 V, Vo=0.75 V

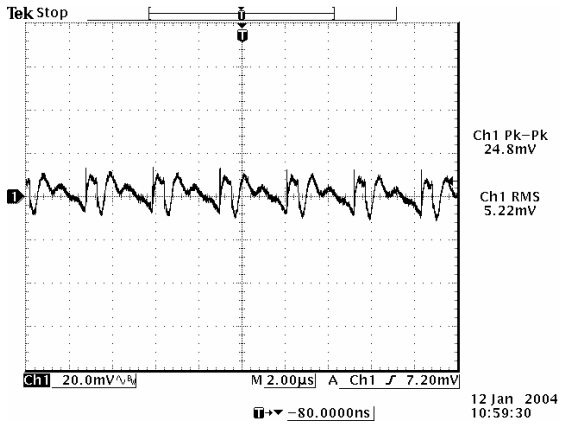


Vin=3.3 V, Vo=1.5 V

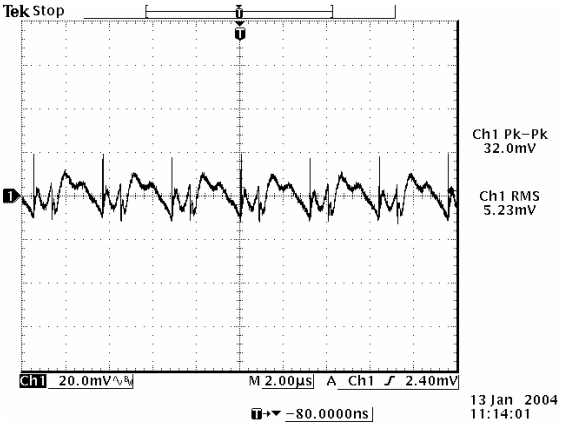


Vin=3.3 V, Vo=2.5 V

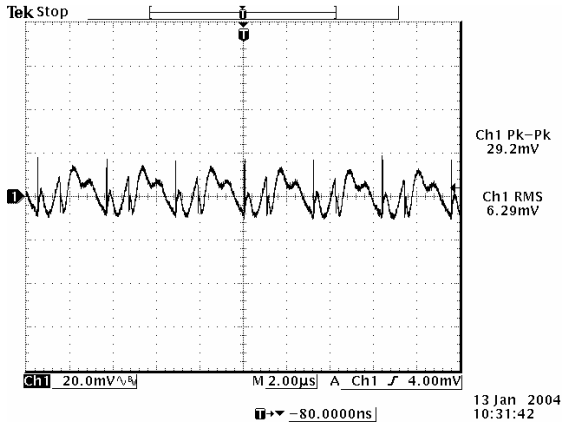
Ripple and Noise Waveforms



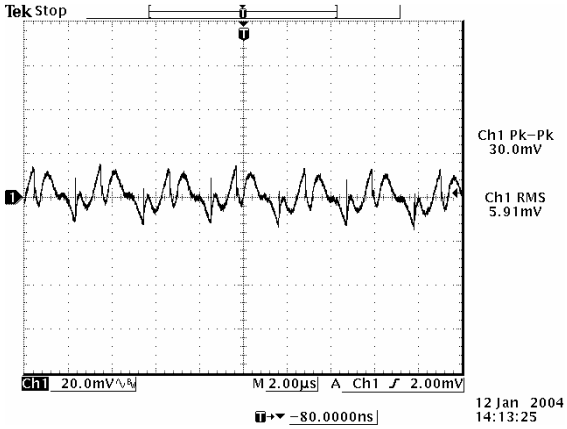
Vin=5.0 V, Vo=0.75 V



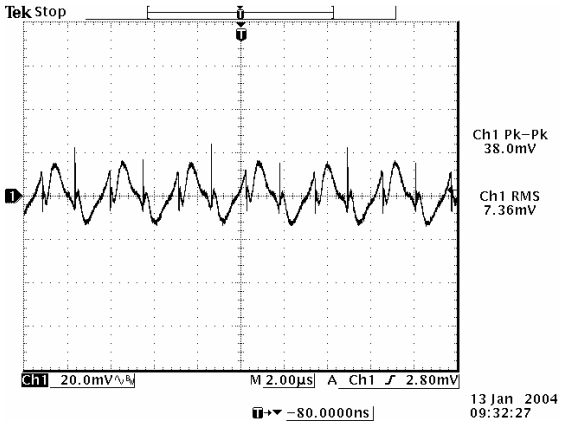
Vin=5.0 V, Vo=1.2 V



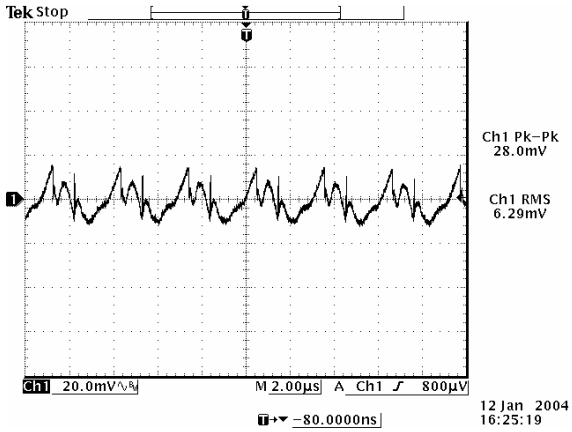
Vin=5.0 V, Vo=1.5 V



Vin=5.0 V, Vo=1.8 V



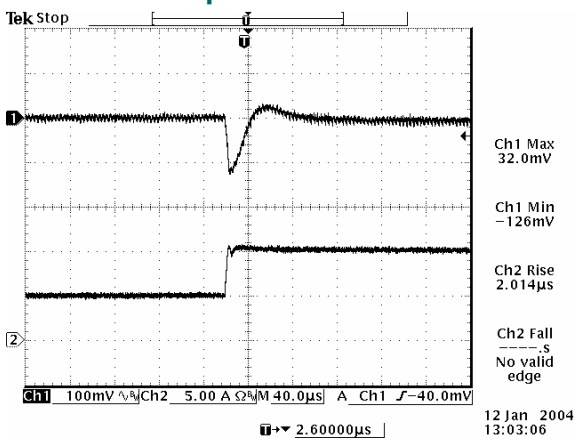
Vin=5.0 V, Vo=2.5 V



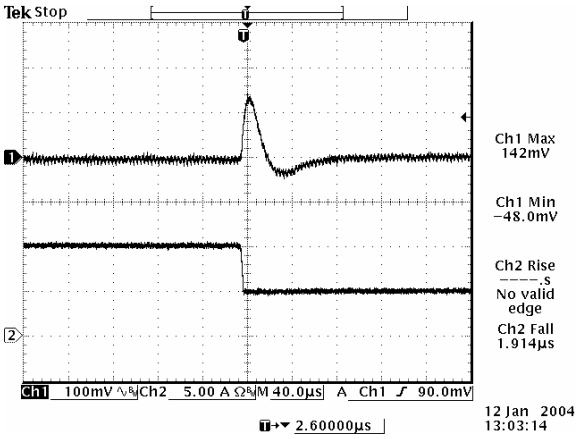
Vin=5.0 V, Vo=3.3 V

Note: Ripple and noise is tested at 0-20 MHz BW, 10 uF/16 V tantalum capacitor and 1 uF/10 V ceramic capacitor, full load, and Ta=25 deg C.

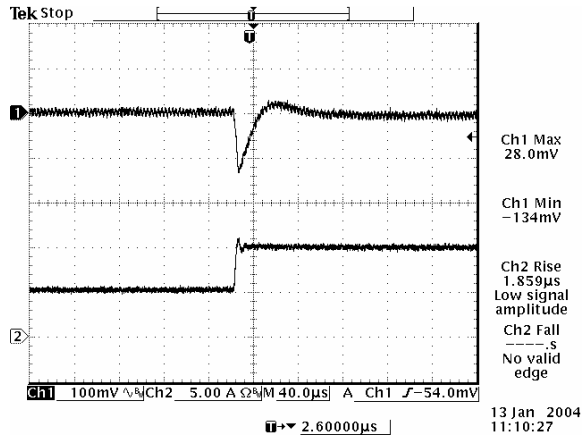
Transient Response Waveforms



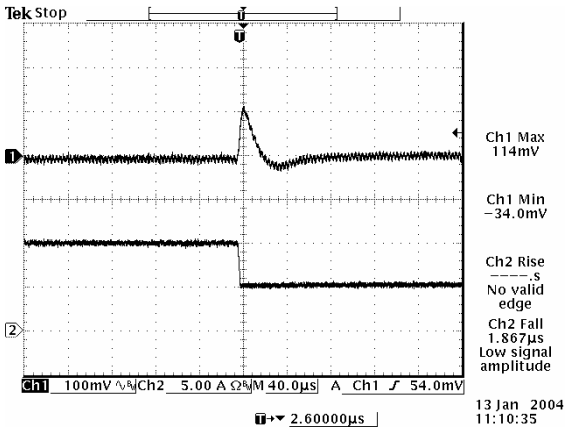
50% to 100% load step at Vin=5 V, Vo=0.75 V



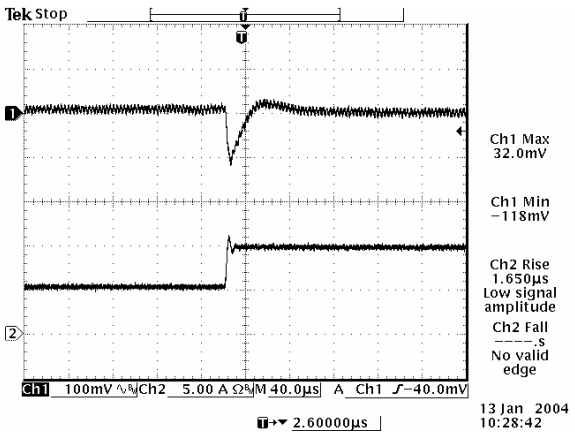
100% to 50% load step at Vin=5 V, Vo=0.75 V



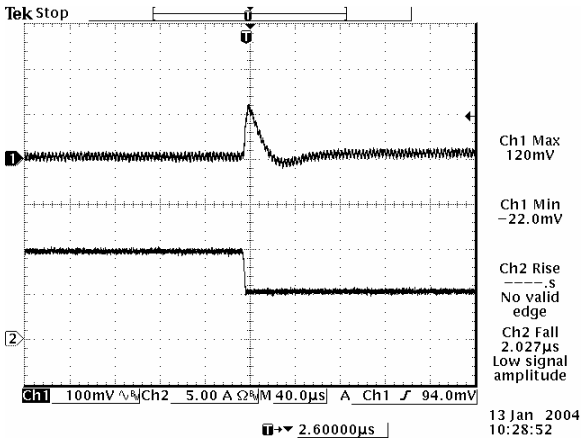
50% to 100% load step at Vin=5 V, Vo=1.2 V



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

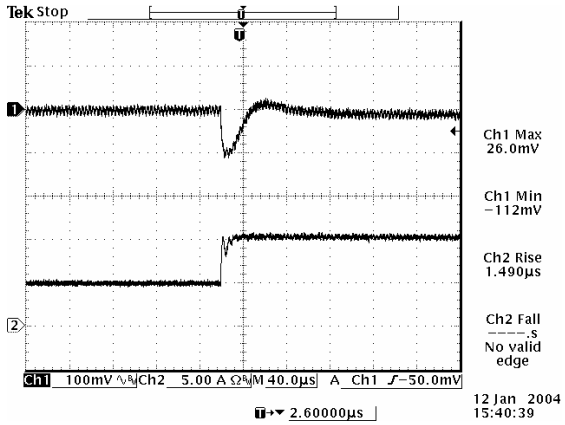


50% to 100% load step at Vin=5 V, Vo=1.5 V

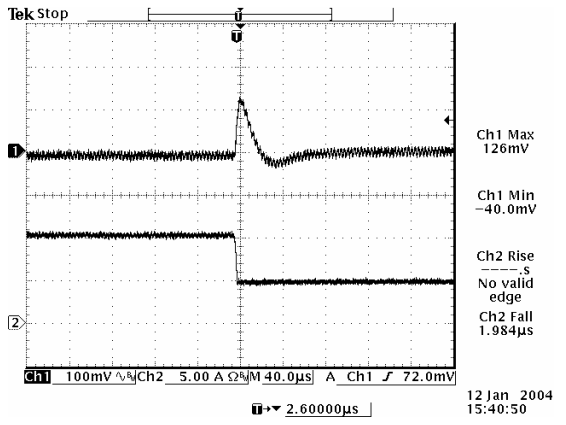


100% to 50% load step at Vin=5 V, Vo=1.5 V

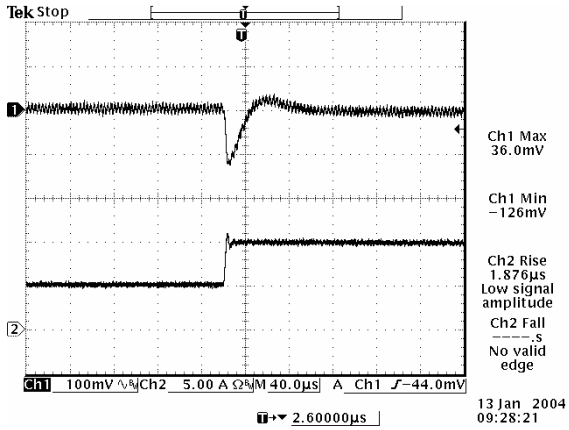
Transient Response Waveforms (continued)



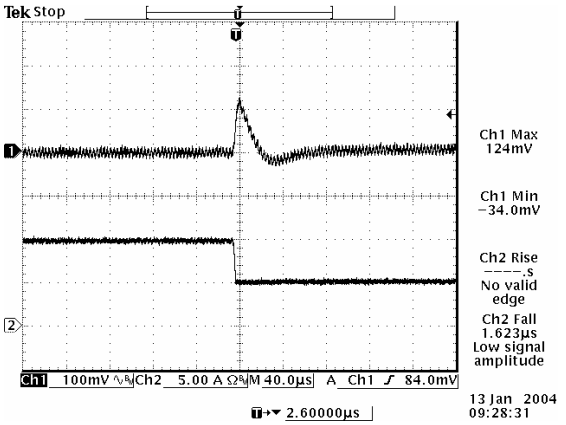
50% to 100% load step at Vin=5 V, Vo=1.8 V



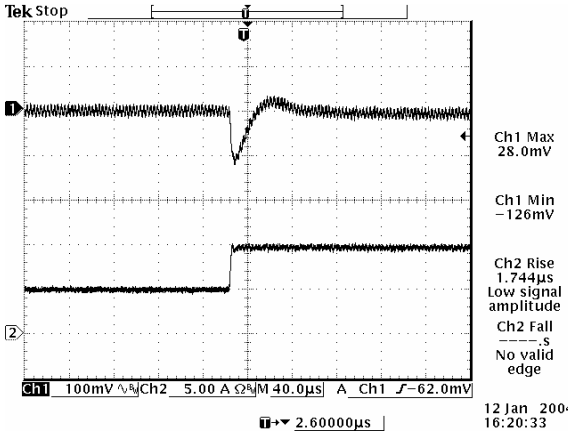
100% to 50% load step at Vin=5 V, Vo=1.8 V



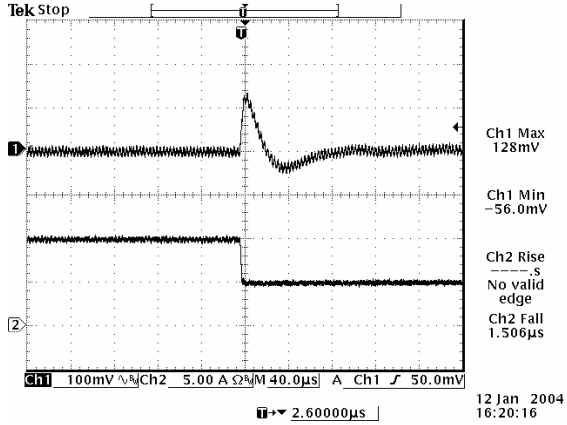
50% to 100% load step at Vin=5 V, Vo=2.5 V



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



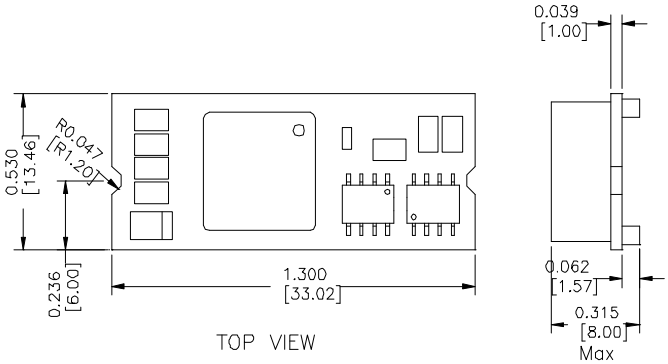
50% to 100% load step at Vin=5 V, Vo=3.3 V

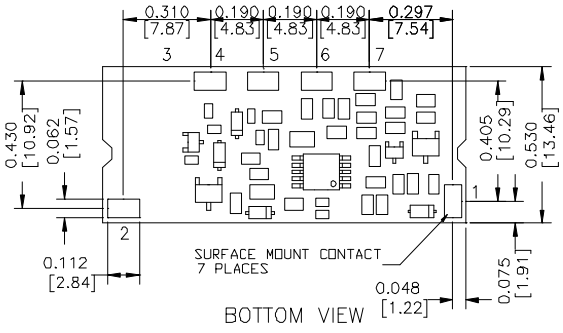


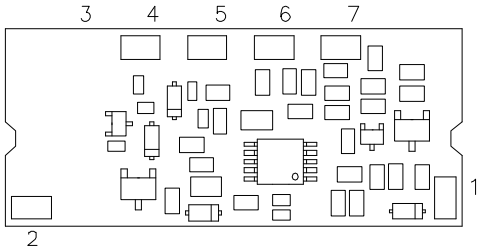
100% to 50% load step at Vin=5 V, Vo=3.3 V

Note: Transient response is tested at di/dt=2.5 A/uS, with two 150 uF/16 V tantalum capacitors and 1uF/10 V ceramic capacitor, Ta=25 deg C.

Mechanical Outline

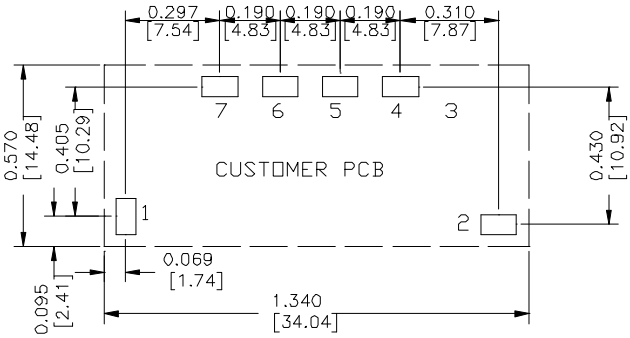






BOTTOM VIEW

RECOMMENDED PAD LAYOUT



Pin Connections

Pin	Function
1	Remote On/Off
2	Vin
3	N/A
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.

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
2007-01-18	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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