NON-ISOLATED DC/DC CONVERTERS

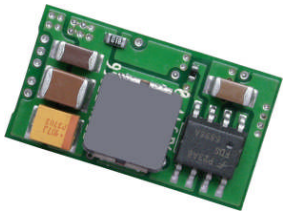
2.4 Vdc - 5.5 Vdc Input 0.75 Vdc - 3.63 Vdc/6 A Output

Jan. 25, 2013

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

SRBA-06F1Ax RoHS Compliant Rev.D

Feature



- Non-Isolated
- High Efficiency
- High Power Density
- Fixed Frequency (300 kHz)
- Converter Can Sink and Source Current
- Vout Prebias
- Under-voltage Lockout (UVLO)
- Wide Trim
- OCP/SCP
- Remote On/Off
- Active Low/High (Option)
- Certificated to UL60950-1/CSA C22.2 No.60950-1, 2rd edition, am1
- Class 2, Category 2, Non-Isolated DC/DC Converter(refer to IPC-9592A)

Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel SRBA-06F1Ax modules are a series of non-isolated dc/dc converters that deliver up to 6 A of output current with full load efficiency of 93% 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). 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 circuit 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	6 A	21.8 W	93%	SRBA-06F1AL	SRBA-06F1A0

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	BA	–	06	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.

Please read our datasheet & drawing disclaimer here.

Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	5.8 V	
Output Enable Terminal Voltage	-0.3 V	-	5.5 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=3.3V Vo=2.5V Vo=1.8V Vo=1.5V Vo=1.2V Vo=0.75V	 - - - - - -	 - - - - - -	 4.73 A 3.66 A 4.09 A 4.31 A 3.57 A 2.40 A	
Input Current (no load) Vo=3.3 V Vo=0.75 V	 - -	 50 mA 25 mA	 - -	
Remote Off Input Current	-	0.6 mA	-	
Input Reflected Ripple Current (pk-pk)	-	120 mA	-	Tested with simulated source impedance of 1 uH, 5 Hz to 20 MHz, one 1000 uF/25 V AL capacitor and two 100 uF/ 10 V Tantalum capacitor at the input.
Input Reflected Ripple Current (rms)	-	35 mA	-	
I^2t Inrush Current Transient	-	-	0.04 A^2s	
Turn-on Voltage Threshold	-	2.05 V	2.4 V	
Turn-off Voltage Threshold	1.8 V	2.0 V	-	

Note: All specifications are typical at nominal input, full load 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=50%Io,max
Output Voltage Set Point	-3% Vo,set	-	3% Vo,set	Over all operating input voltages, resistive loads and temperature conditions
Adjustment Range Selected by External Resistor or Voltage	0.7525 V	-	3.63 V	
Load Regulation	-	0.4% Vo,set	-	Io=Iomin to 50%Iomax
Line Regulation	-	0.3% Vo,set	-	Vin=50% Vinmin to Vinmax
Regulation Over Temperature (-40 °C to +85 °C)	-	0.4% Vo,set	-	Tref=Tamin to Tamax
Output Current	0 A	-	6 A	
Current Limit Threshold	9 A	-	18 A	
Short Circuit Surge Transient	-	0.32 A^2s	-	
Ripple and Noise (pk-pk)	-	40 mV	70 mV	Tested with 0-20 MHz, with 10 uF Tantalum capacitor & 1 uF/10 V ceramic capacitor at the output.
Ripple and Noise (rms)	-	10 mV	30 mV	

Output Specifications (continued)

Parameter	Min	Typ	Max	Notes
Turn on Time	-	6 mS	10 mS	
Overshoot at Turn on	-	-	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 - 3.63 V	-	130 mV	-	di/dt=2.5 A/uS; Vin=5 V; and with 10 uF Tantalum capacitor & 1 uF/10 V TDK ceramic capacitor at the output
Settling Time		-	25 uS	-	
100% ~ 50% Max Load		-	130 mV	-	
Settling Time		-	25 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	 - - - - - -	 93% 91% 88% 87% 84% 78%	 - - - - - -	Measured at Vin=5 V, full load
Switching Frequency	250 kHz	300 kHz	350 kHz	
Over Temperature Shutdown	-	135 °C	-	
Output Voltage Trim Range	0.7525 V	-	3.63 V	
MTBF	6,954,974 hours			Calculated Per Bell Core SR-332 (Vin=5 V; Vo=0.75 V; Io = 4.8 A; Ta = 25°C)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	 1.0 x 0.5 x 0.243 25.4 x 12.7 x 6.16			
Weight	-	5 g	-	

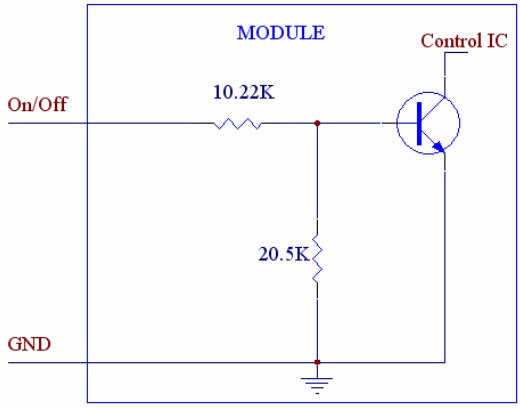
Note: All specifications are typical at 25 °C unless otherwise stated.

Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.2 V	-	0.3 V	SRBA-06F1A0; Remote On/Off pin open, Unit on.
Signal High (Unit On)	-	-	Vin, max	
Signal Low (Unit On)	-0.2 V	-	0.3 V	SRBA-06F1AL; Remote On/Off pin open, Unit on.
Signal High (Unit Off)	1.5 V	-	Vin, max	

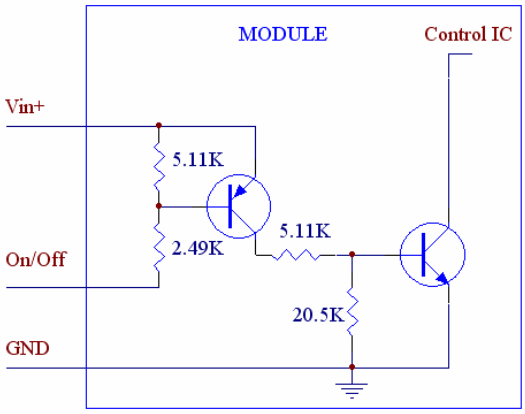
Remote Enable Specifications

The SRBA-06F1AL 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.



SRBA-06F1AL

The SRBA-06F1A0 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.

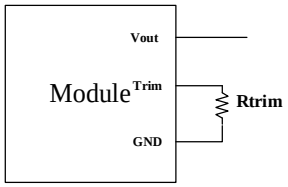


SRBA-06F1A0

Output Trim Equations

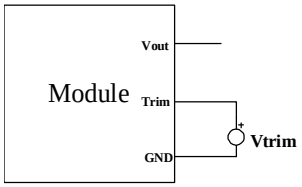
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

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

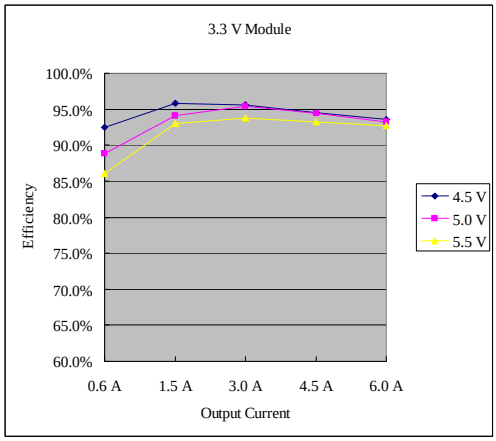


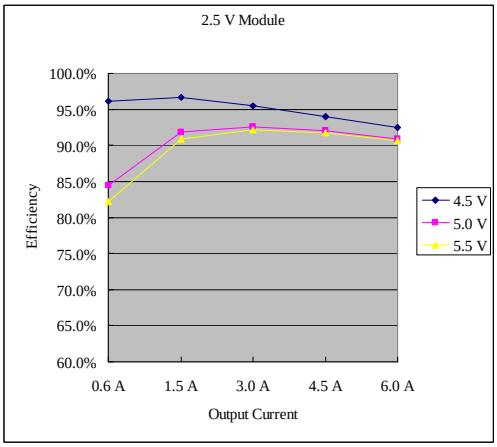
Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

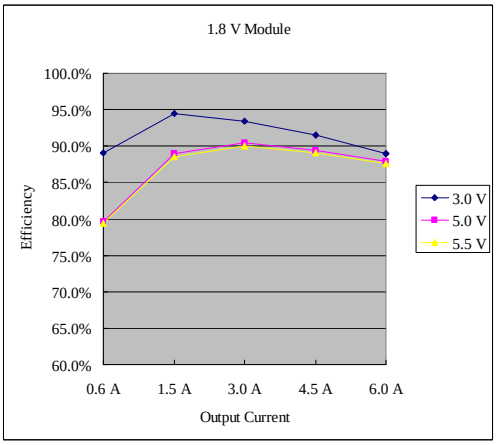
$$V_{trim} = 0.7 - 0.1698 \times (V_{adj} - 0.7525)$$

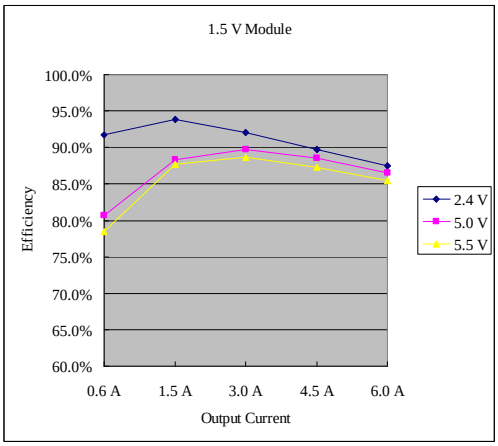


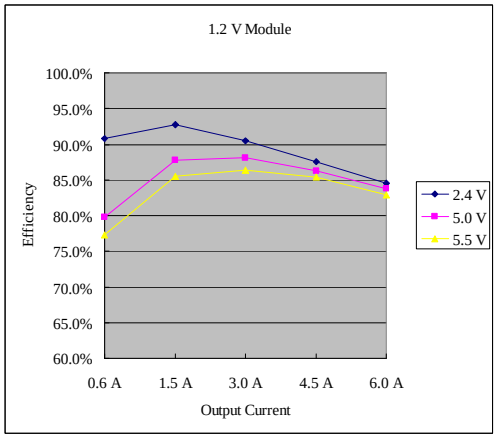
Efficiency Data

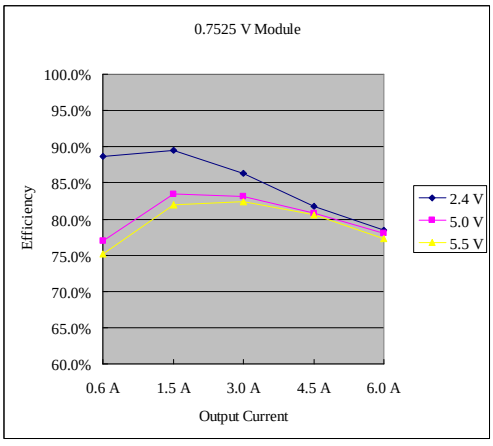




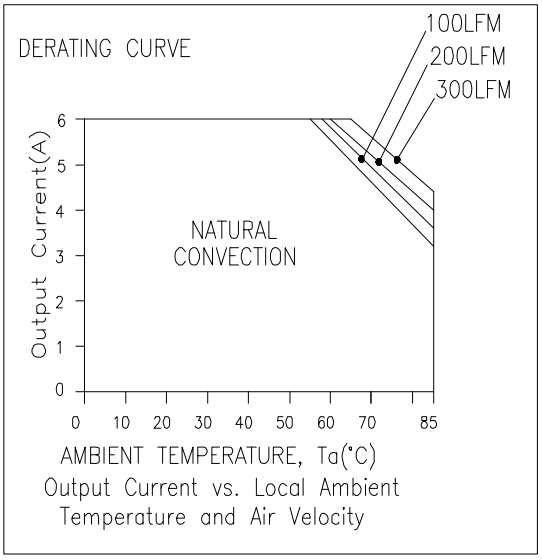




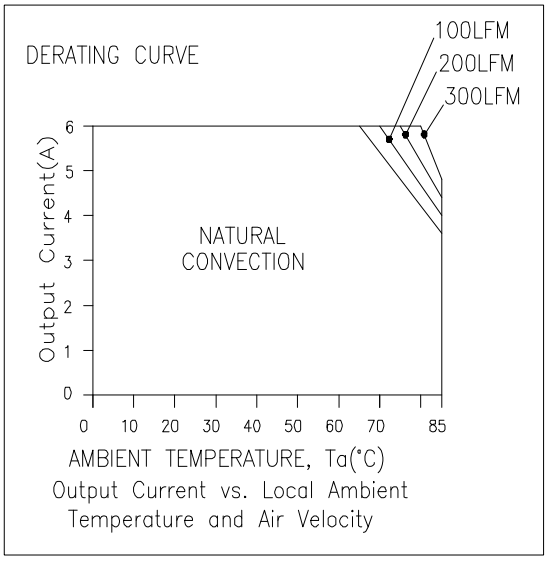




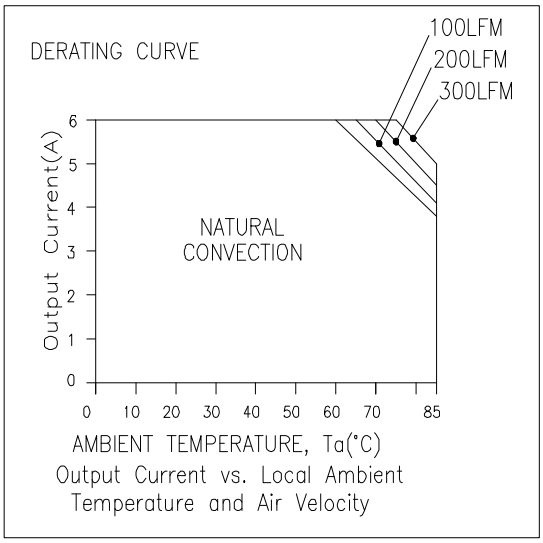
Thermal Derating Curves



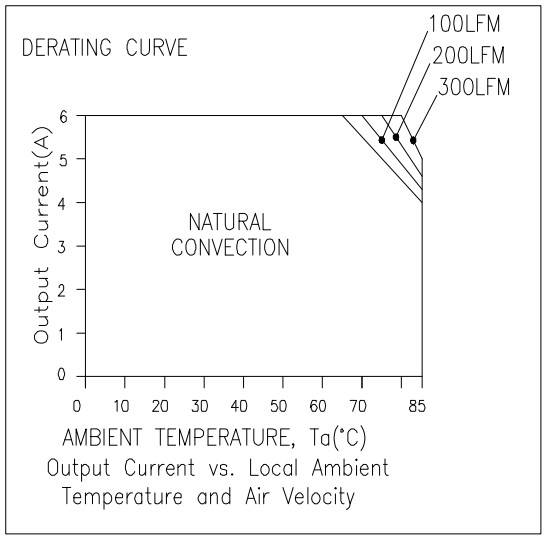
Vin=5 V, Vo = 3.3 V



Vin=5 V, Vo = 0.75 V

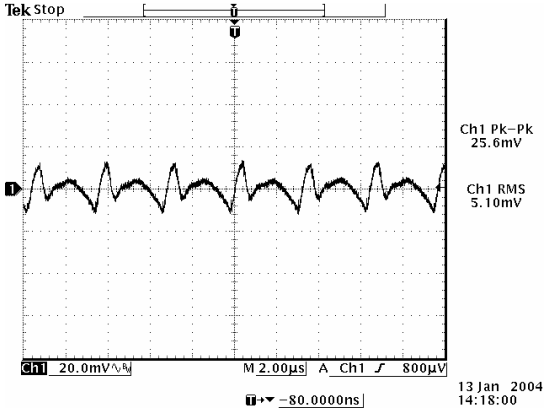


Vin=4.5 V, Vo = 2.5 V

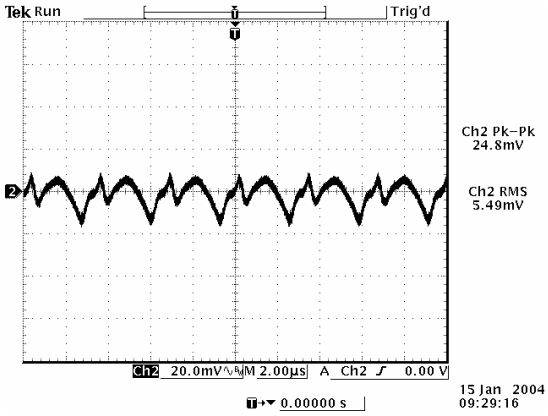


Vin=3.3 V, Vo = 0.75 V

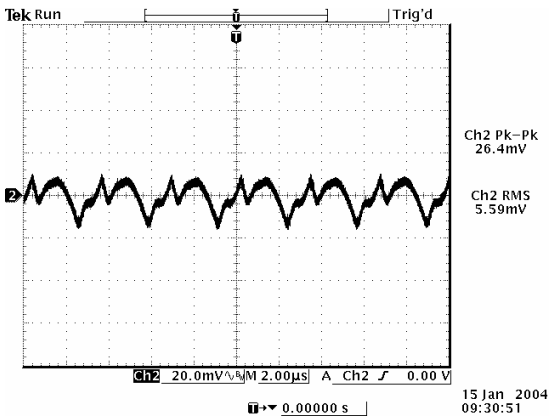
Ripple and Noise Waveforms



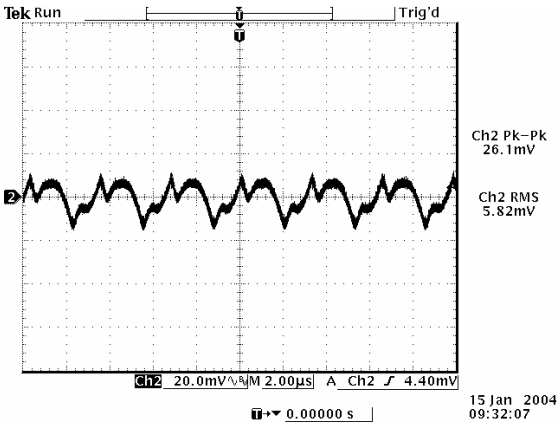
Ripple and noise at full load, Vin=5.0 V, Vo=0.7525 V



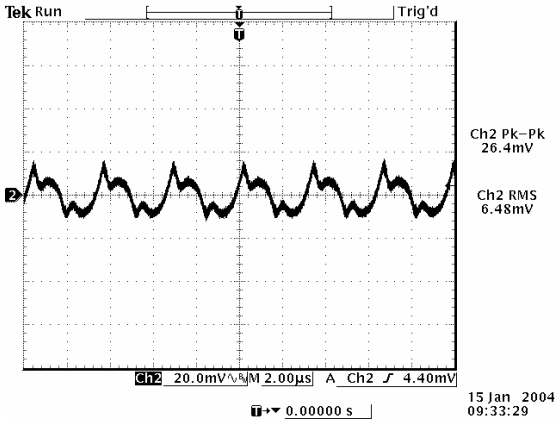
Ripple and noise at full load, Vin=5.0 V, Vo=1.2 V



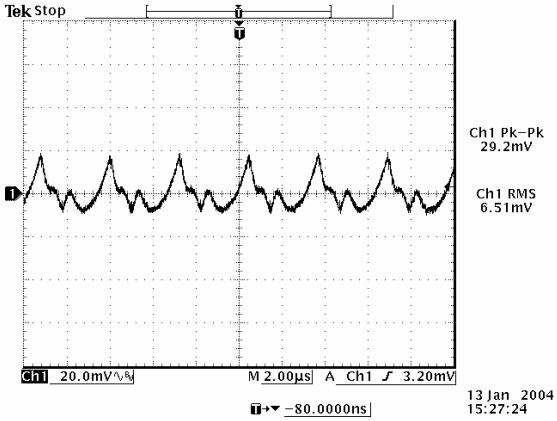
Ripple and noise at full load, Vin=5.0 V, Vo=1.5 V



Ripple and noise at full load, Vin=5.0 V, Vo=1.8 V



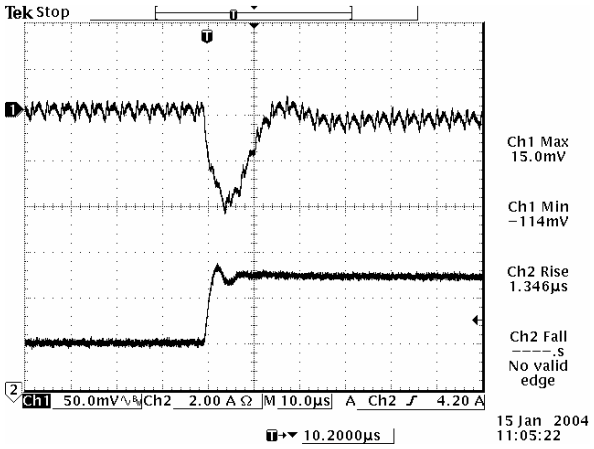
Ripple and noise at full load, Vin=5.0 V, Vo=2.5 V



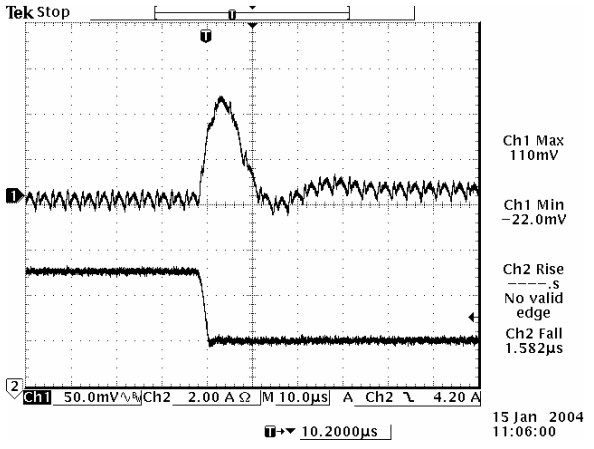
Ripple and noise at full load, Vin=5.0 V, Vo=3.3 V

Note: 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.

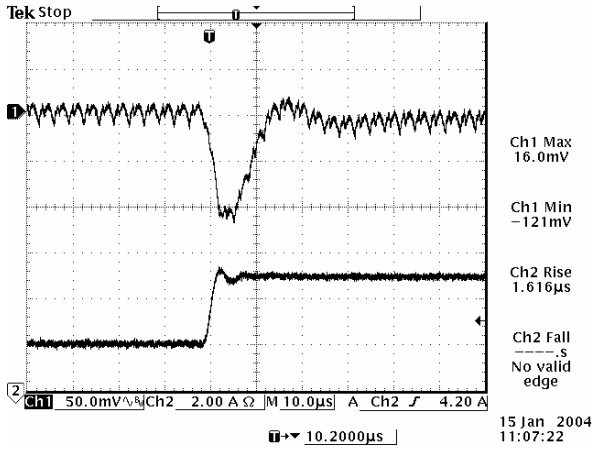
Transient Response Waveforms



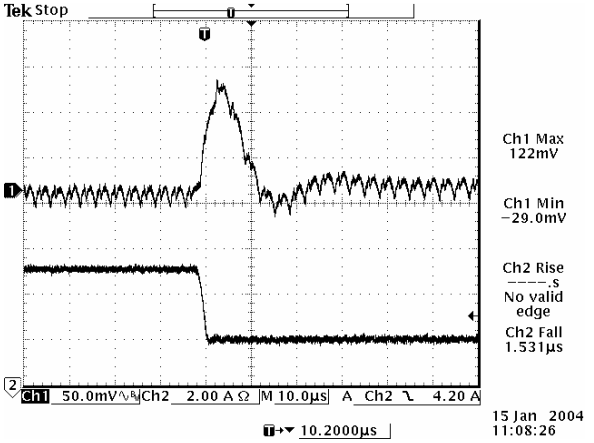
50% to 100% load step at Vin=5 V, Vo=0.75 V



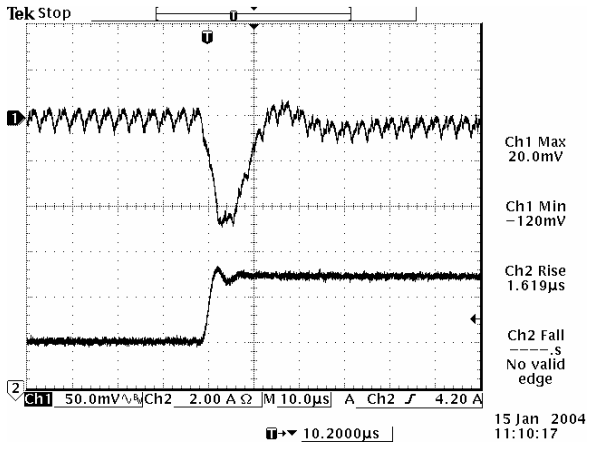
100% to 50% load step at Vin=5 V, Vo=0.75 V



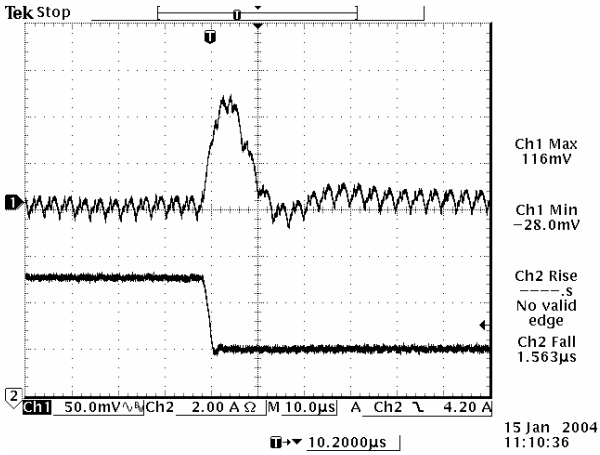
50% to 100% load step at Vin=5 V, Vo=1.2 V



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

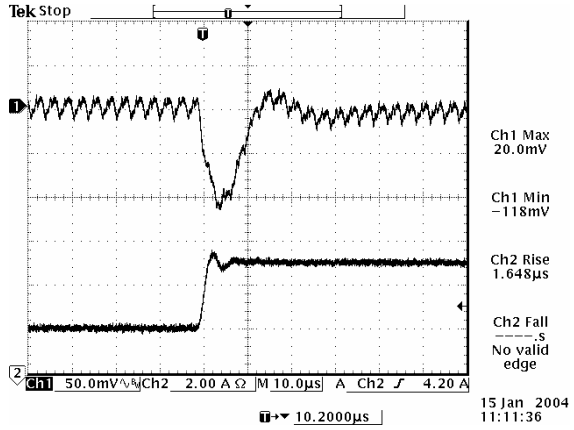


50% to 100% load step at Vin=5 V, Vo=1.5 V

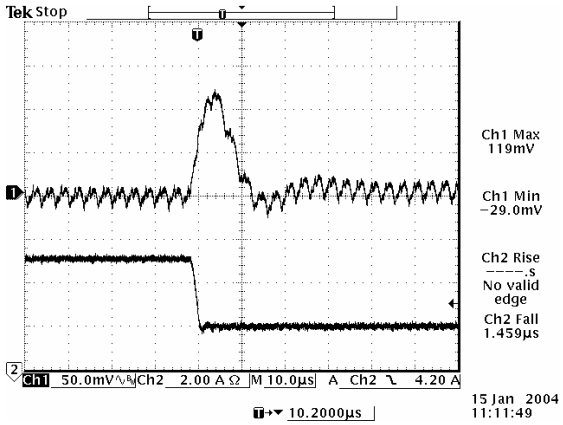


100% to 50% load step at Vin=5 V, Vo=1.5 V

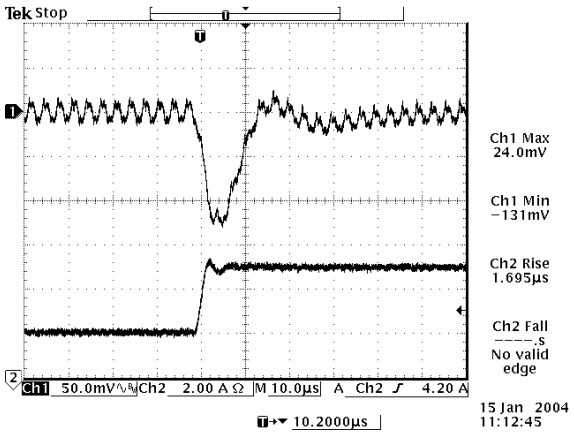
Transient Response Waveforms (continued)



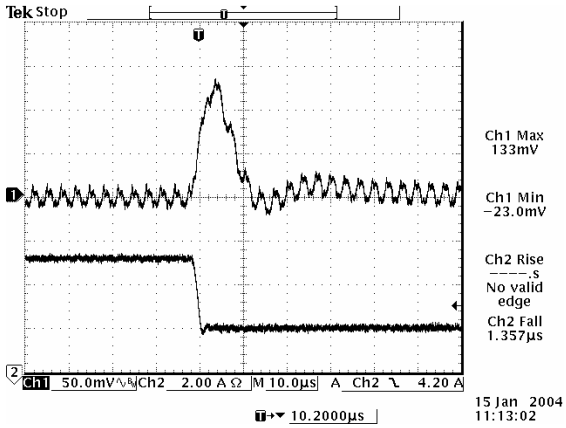
50% to 100% load step at Vin=5 V, Vo=1.8 V



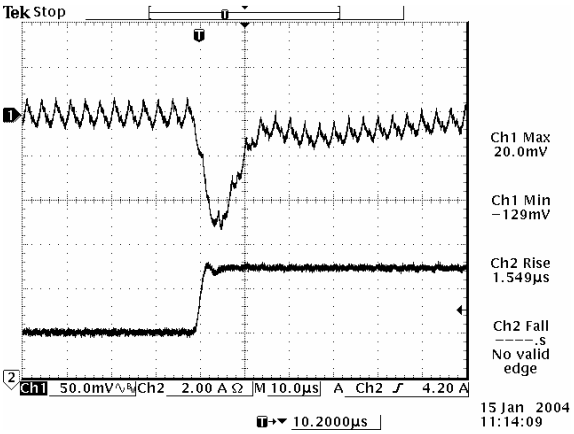
100% to 50% load step at Vin=5 V, Vo=1.8 V



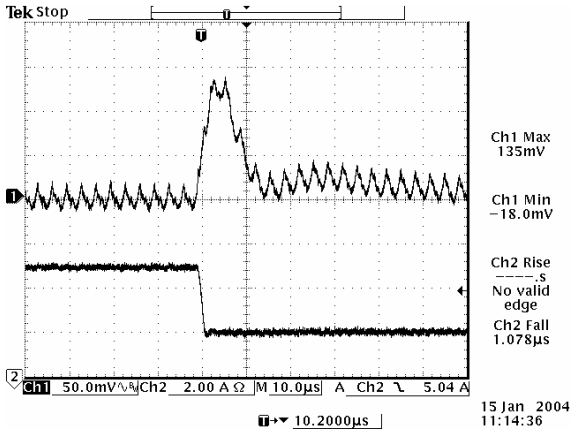
50% to 100% load step at Vin=5 V, Vo=2.5 V



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



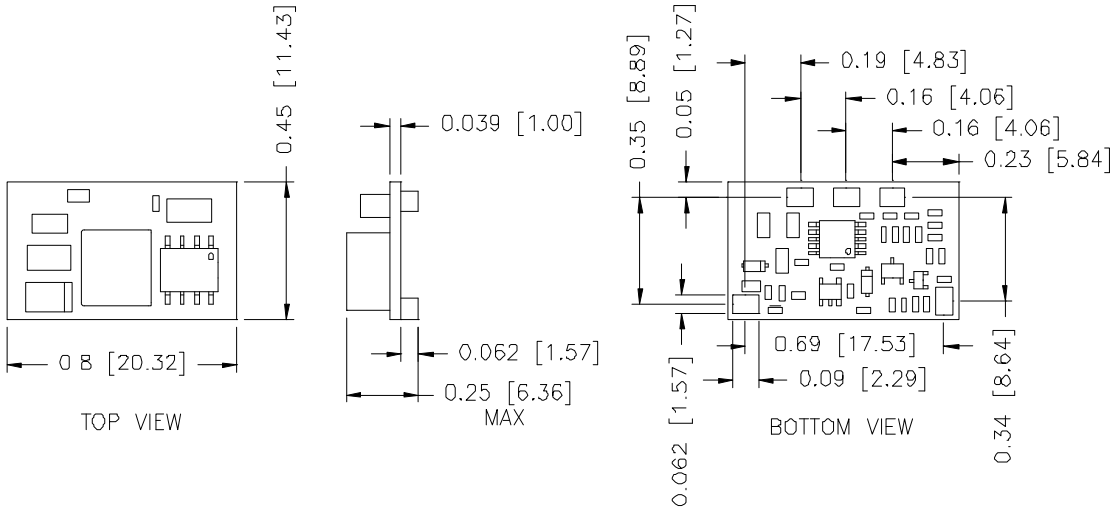
50% to 100% load step at Vin=5 V, Vo=3.3 V

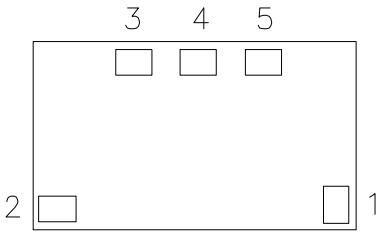


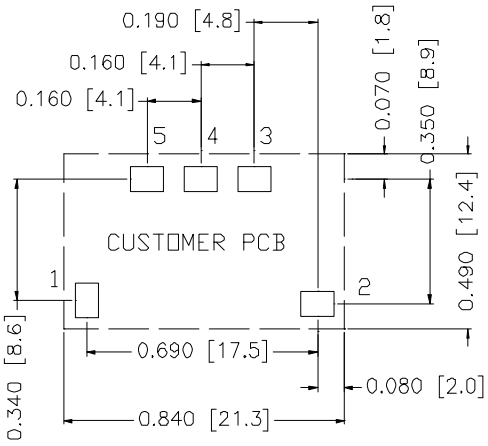
100% to 50% load step at Vin=5 V, Vo=3.3 V

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

Mechanical Outline







PAD SIZE:
MIN: 0.12"* 0.095" (3.05mm * 2.41mm)
MAX: 0.135"* 0.11" (3.43mm * 2.79mm)

Pin Connections

Pin	Function
1	Remote On/Off
2	Vin
3	Ground
4	Trim
5	Vout

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.

Revision History

Date	Revision	Changes Detail	Approval
2007-01-12	A	Change version to A;RoHS	Lynn
2011-08-25	B	Update the reflow solder temperature.	HL
2012-06-19	C	Update the Features.	XF Jiang
2013-01-25	D	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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