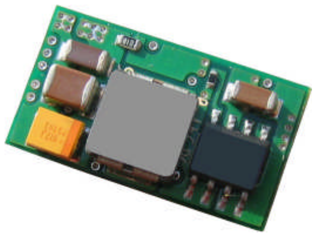
## SRBA-06F2Ax RoHS Compliant Rev.C



- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Remote On/Off
- Flexible Output Voltage
- Sequencing
- Under-voltage Lockout (UVLO)
- OCP/SCP
- Wide Input
- Wide Trim Range
- Active Low/High (option)
- Able to Sink & Source Current
- Fixed Frequency (300 kHz)
- Certificated to UL60950-1/CSA C22.2 No.60950-1, 2rd edition, am1

## Applications

- Networking
- Computers and peripherals
- Telecommunications

## Description

The Bel SRBA-06F2Ax 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). 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, 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-06F2AL | SRBA-06F2A0 |

**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.
3. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.

### Part Number Explanation

**S R BA – 06 F 2 x**
**1 2 3 4 5 6 7**

**1---Surface mount Vertical 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 | - | 5.5 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. SRBA-06F2Ax 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 Vin or leave the SEQ pin floating.

## 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 | - | - | 4.73 A | |
| Vo=2.5 V | - | - | 5.49 A | |
| Vo=1.8 V | - | - | 5.11 A | |
| Vo=1.5 V | - | - | 4.31 A | |
| Vo=1.2 V | - | - | 3.57 A | |
| Vo=0.75 V | - | - | 2.40 A | |
| Input Current (no load) | | | | |
| Vo=3.3 V | - | 50 mA | - | |
| Vo=0.75 V | - | 25 mA | - | |
| Remote Off Input Current | - | 0.6 mA | - | |
| Input Reflected Ripple Current (pk-pk) | - | 120 mA | - | Tested with simulated source impedance of 1uH, 5 Hz to 20 MHz. |
| 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 | - | |

## Output Specifications

| Parameter | Min | Typ | Max | Notes |
|---|---|---|---|---|
| Output Voltage Set Point | -2%Vo,set | - | 2%Vo,set | Vin=5 V, 50% full load |
| 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=0%~50% full load; Io=50%~100% full load |
| Line Regulation | - | 0.3%Vo,set | - | Vin=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 | Hiccup mode |
| Short Circuit Surge Transient | - | 0.32 $A^2s$ | - | |

## Output Specifications(continued)

| Parameter | | Min | Typ | Max | Notes |
|---|---|---|---|---|---|
| Ripple and Noise (pk-pk) | | - | 40 mV | 70 mV | Tested with 0-20 MHz, with 10 uF tantalum capacitor & 1uF/10 V ceramic capacitor at output |
| Ripple and Noise (rms) | | - | 10 mV | 30 mV | |
| Turn on Time | | - | 6 mS | 10 mS | |
| Overshoot at Turn on | | - | 0% | 3% | |
| Output Capacitance<br>ESR ≥ 1mohm<br>ESR ≥ 10mohm | | <br>0 uF<br>0 uF | <br>-<br>- | <br>1000 uF<br>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 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 | - | 93% | - | Measured at Vin=5 V, full load |
| Vo=2.5 V | - | 91% | - | |
| Vo=1.8 V | - | 88% | - | |
| Vo=1.5 V | - | 87% | - | |
| Vo=1.2 V | - | 84% | - | |
| Vo=0.75 V | - | 78% | - | |
| Switching Frequency | 250 kHz | 300 kHz | 350 kHz | |
| Over Temperature Shutdown | - | 135 °C | - | |
| Output Voltage Trim Range | 0.7525 V | - | 3.63 V | |
| MTBF | 6,976,379 hours | | | Calculated Per Bell Core SR-332 (Vin=5 V; Vo=0.75 V, Io = 4.8 A; Ta = 25 °C) |
| Dimensions<br>Inches (L × W × H)<br>Millimeters (L × W × H) | <br>0.8 x 0.45 x 0.25<br>20.32 x 11.42 x 6.36 | | | |
| Weight | - | 5 g | - | |

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

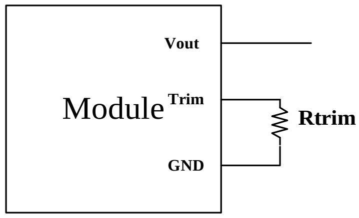
## Control Specifications

| Parameter | Min | Typ | Max | Notes |
|---|---|---|---|---|
| **Remote On/Off** | | | | |
| Signal Low (Unit Off) | -0.2 V | - | 0.3 V | Active High: SRBA-06F2A0; Remote On/Off pin open, Unit on. |
| Signal High (Unit On) | - | - | Vin, max | |
| Signal Low (Unit On) | -0.2 V | - | 0.3 V | Active Low: SRBA-06F2AL; Remote On/Off pin open, Unit on. |
| Signal High (Unit Off) | 1.5 V | - | Vin, max | |
| Sequencing Voltage | 0 V | - | Vin | Sequencing Voltage applied on SEQ pin should be higher than output voltage. |
| Sequencing Slew Rate Capability | - | - | 2 V/ mS | |
| Sequencing Delay Time | 10 mS | - | - | Delay from Vinmin to application of voltage on SEQ pin |
| Tracking Accuracy<br>Power-Up<br>Power-Down | <br>-<br>- | <br>100 mV<br>200 mV | <br>200 mV<br>400 mV | |

## Output Trim Equations

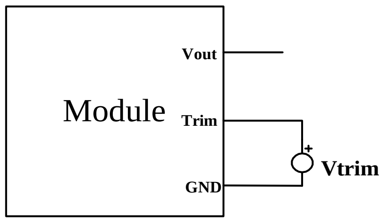
Equation for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

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

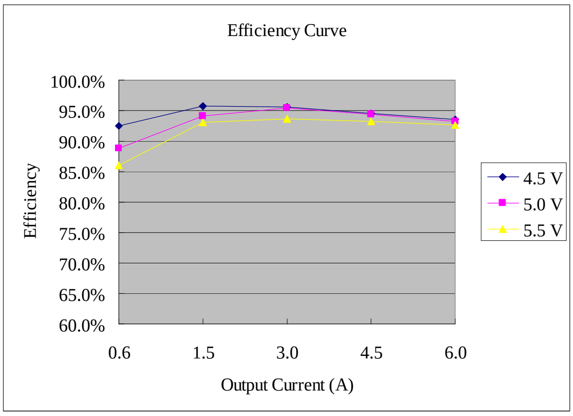



Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

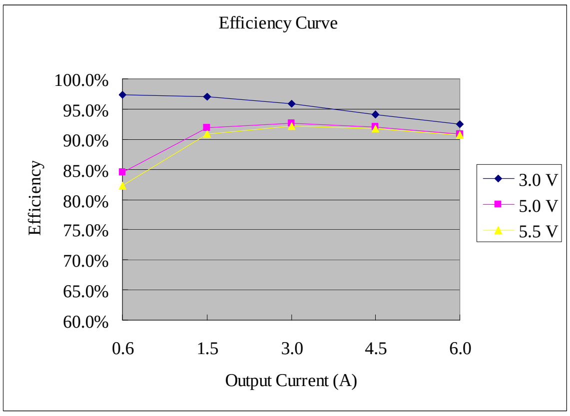
$$V_{TrimUp} = 0.7 - 0.1698 \times (V_{adj} - 0.7525)$$



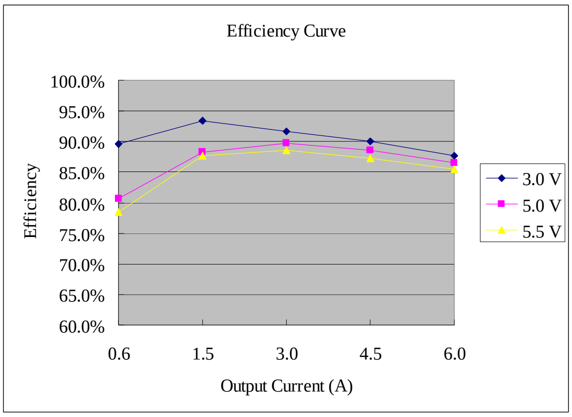
## Efficiency Data



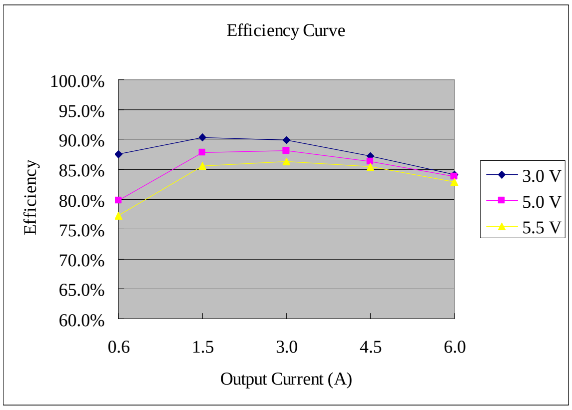

Vo=3.3 V



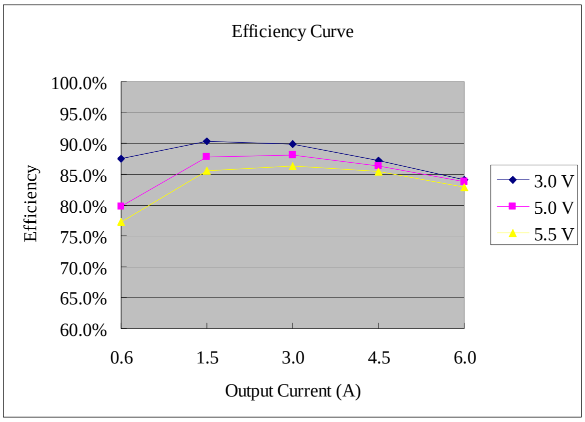

Vo=2.5 V



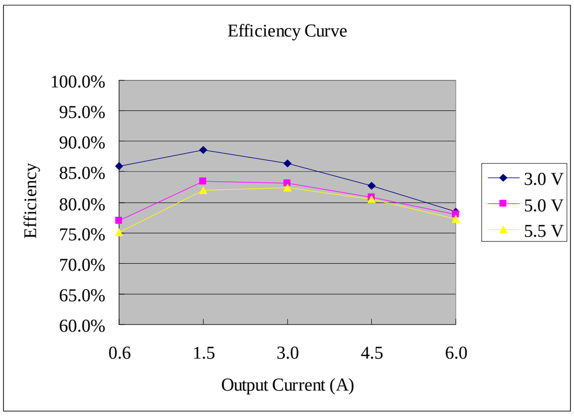

Vo=1.8 V




Vo=1.5 V

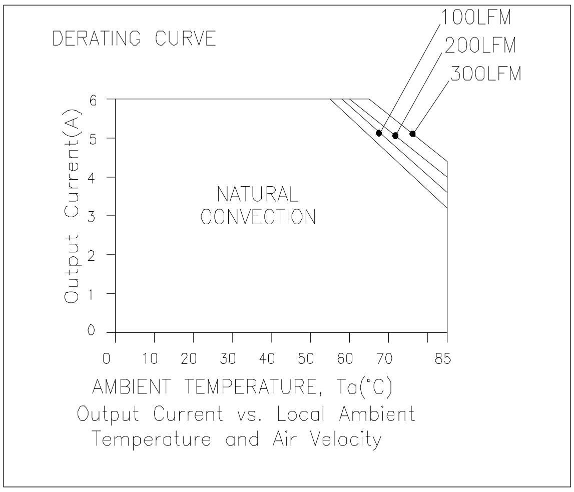



Vo=1.2 V

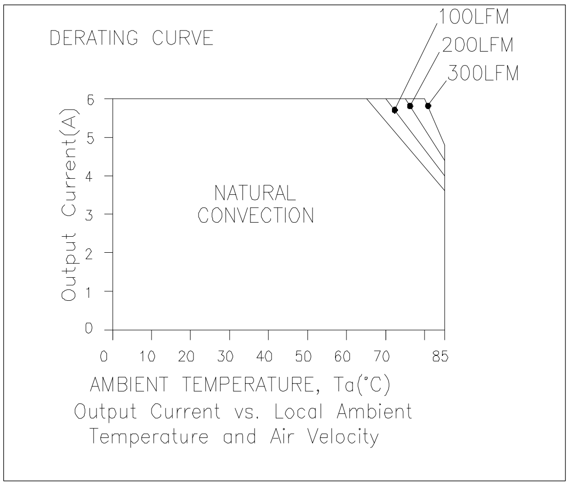



Vo=0.7525 V

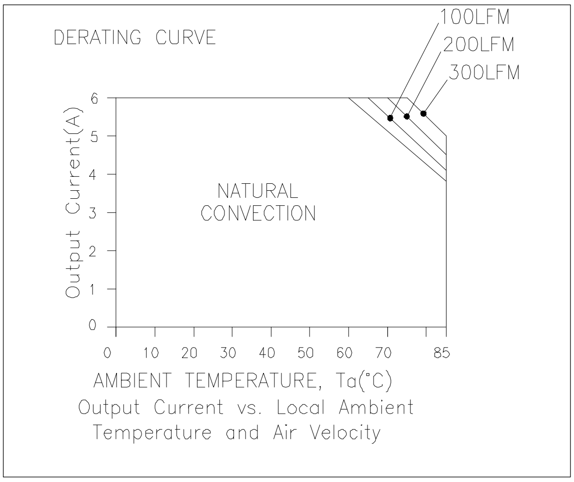
## Thermal Derating Curves



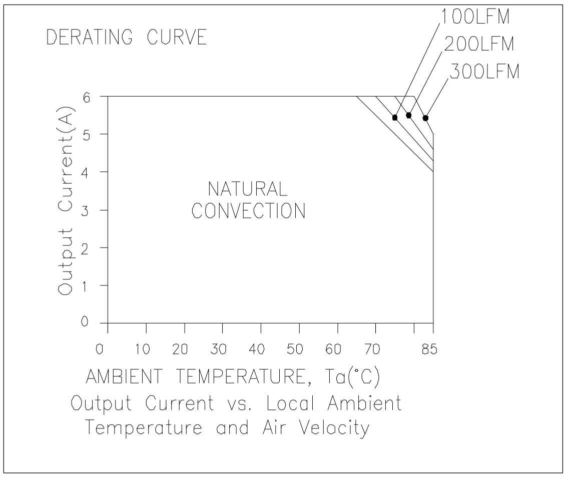

Vin=5.0 V, Vo=3.3 V




Vin=5.0 V, Vo=0.75 V

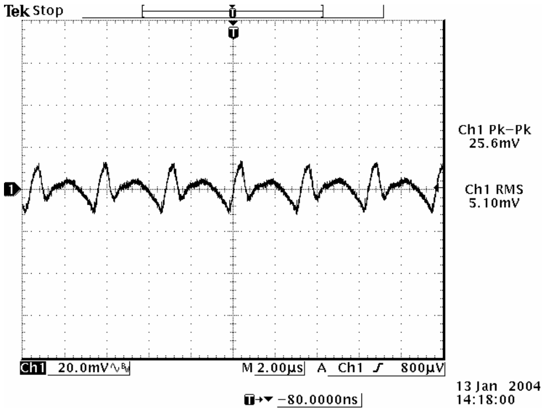



Vin=3.3 V, Vo=2.5 V

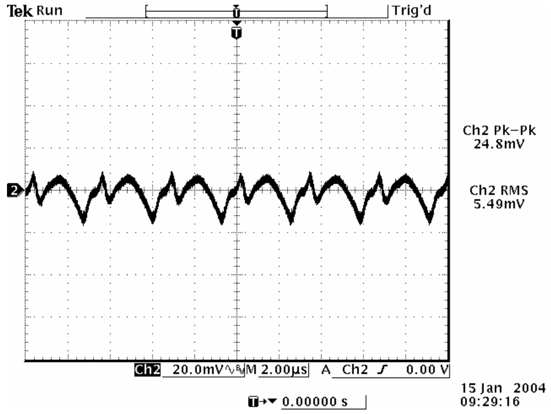



Vin=3.3 V, Vo=0.75 V

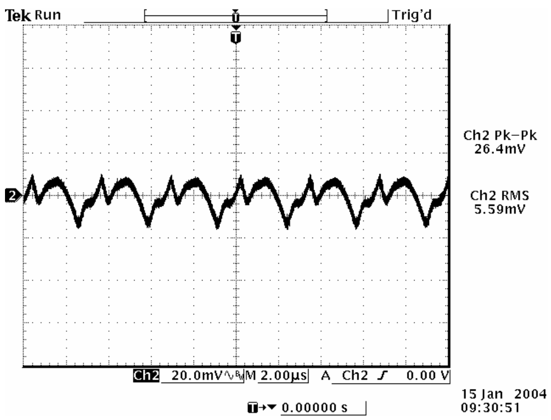
## Ripple and Noise Waveforms



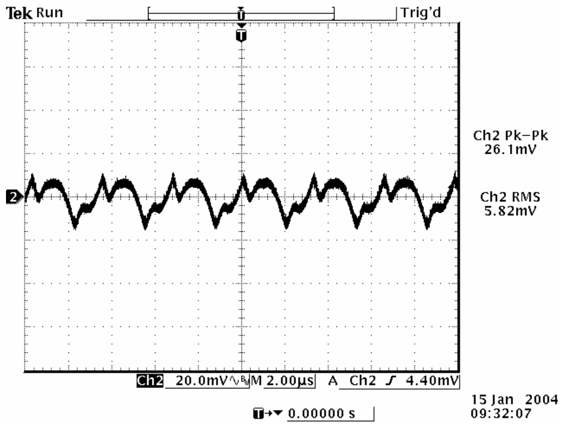

Ripple and noise at full load, Vin=5.0 V, Vo=0.7525 V



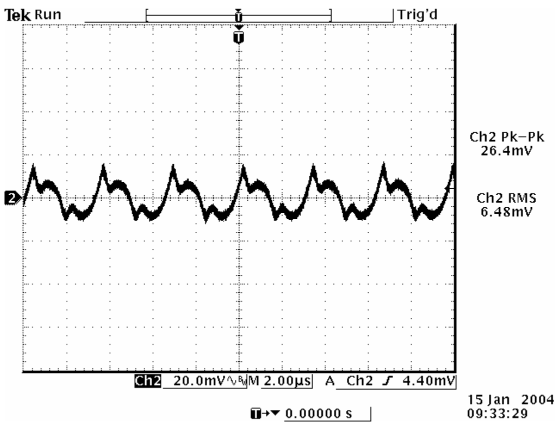

Ripple and noise at full load, Vin=5.0 V, Vo=1.2 V



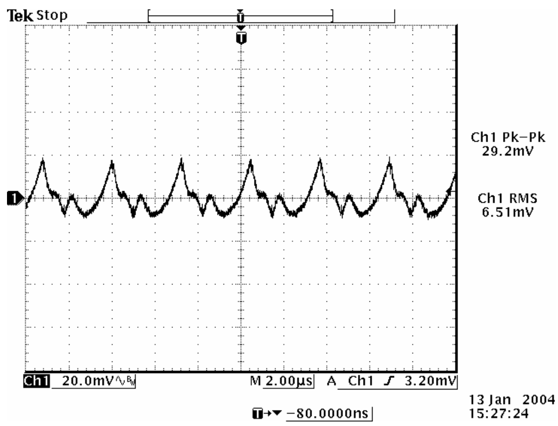

Ripple and noise at full load, Vin=5.0 V, Vo=1.5 V




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



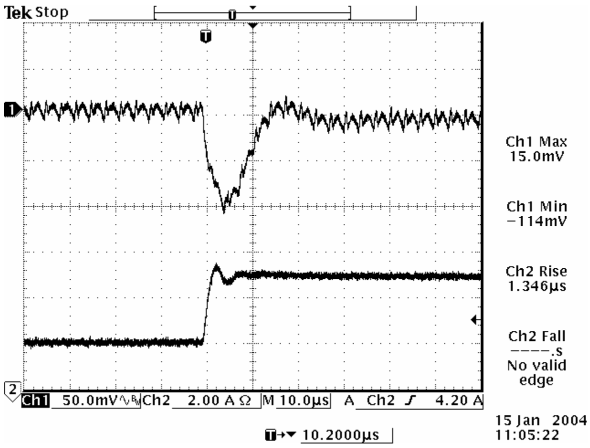

Ripple and noise at full load, Vin=5.0 V, Vo=2.5 V



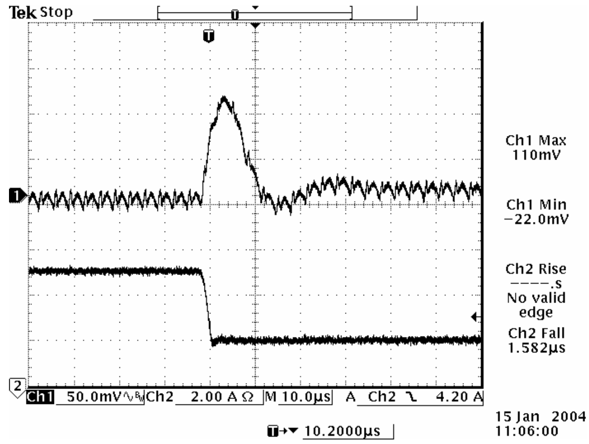

Ripple and noise at full load, Vin=5.0 V, Vo=3.3 V

**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.

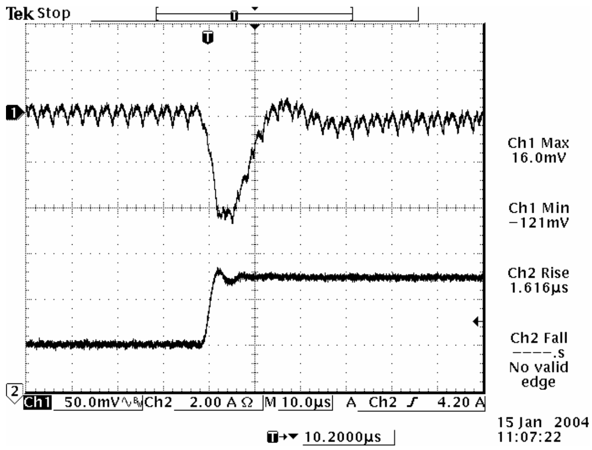
## Transient Response Waveforms



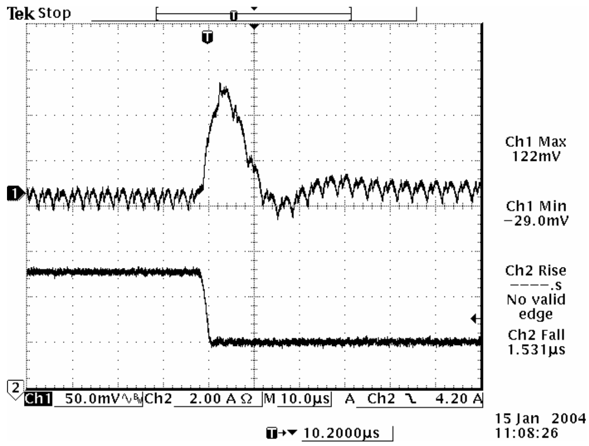

50% to 100% load step at Vin=5 V, Vo=0.75 V



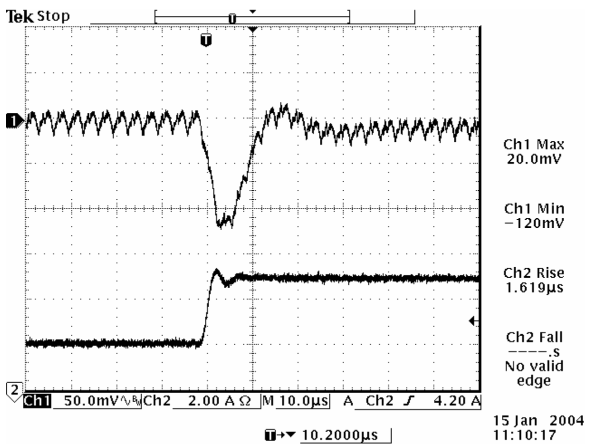

100% to 50% load step at Vin=5 V, Vo=0.75 V



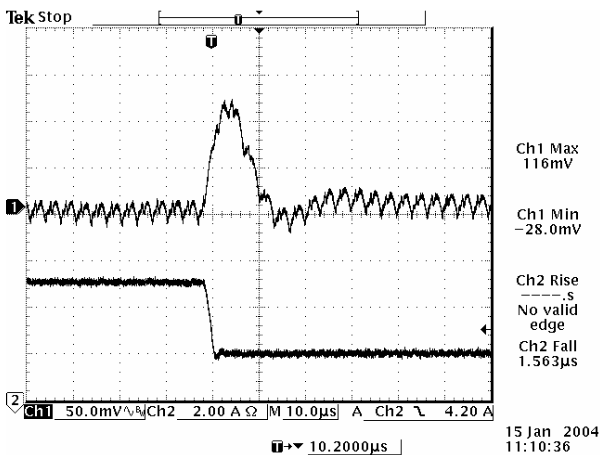

50% to 100% load step at Vin=5 V, Vo=1.2 V




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

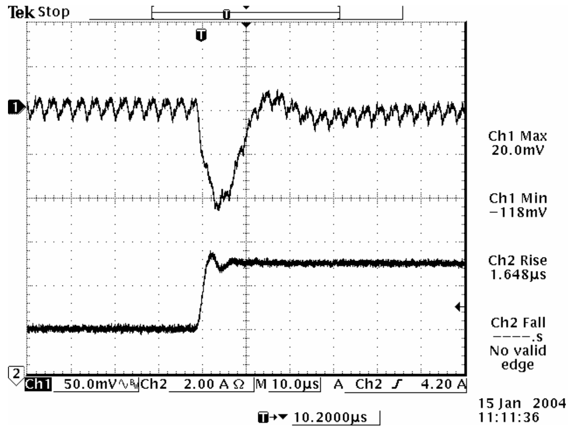



50% to 100% load step at Vin=5 V, Vo=1.5 V

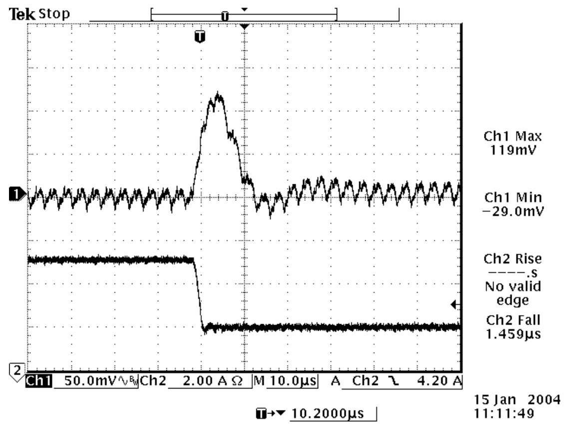



100% to 50% load step at Vin=5 V, Vo=1.5 V

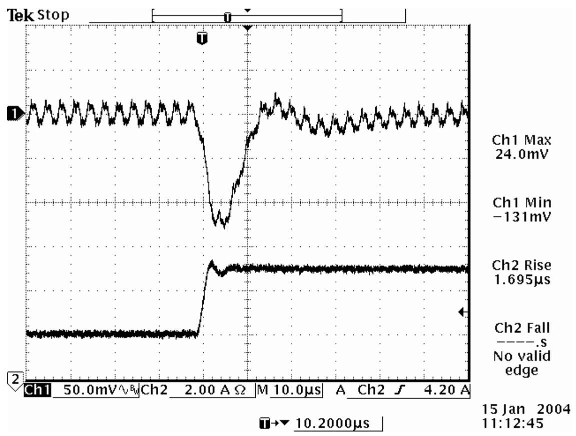
## Transient Response Waveforms (continued)



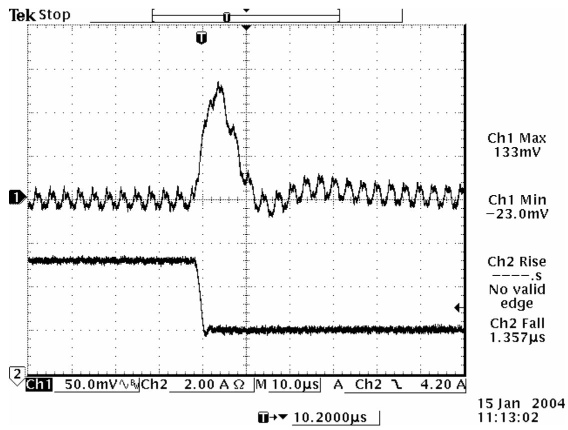

50% to 100% load step at Vin=5 V, Vo=1.8 V



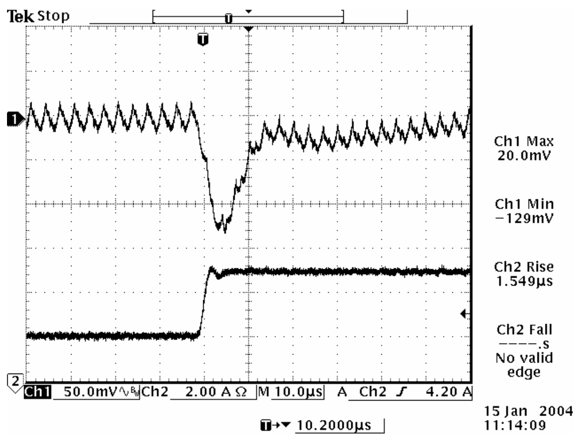

100% to 50% load step at Vin=5 V, Vo=1.8 V



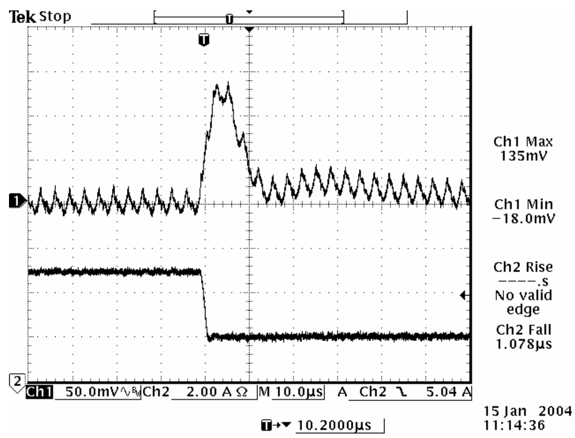

50% to 100% load step at Vin=5 V, Vo=2.5 V




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



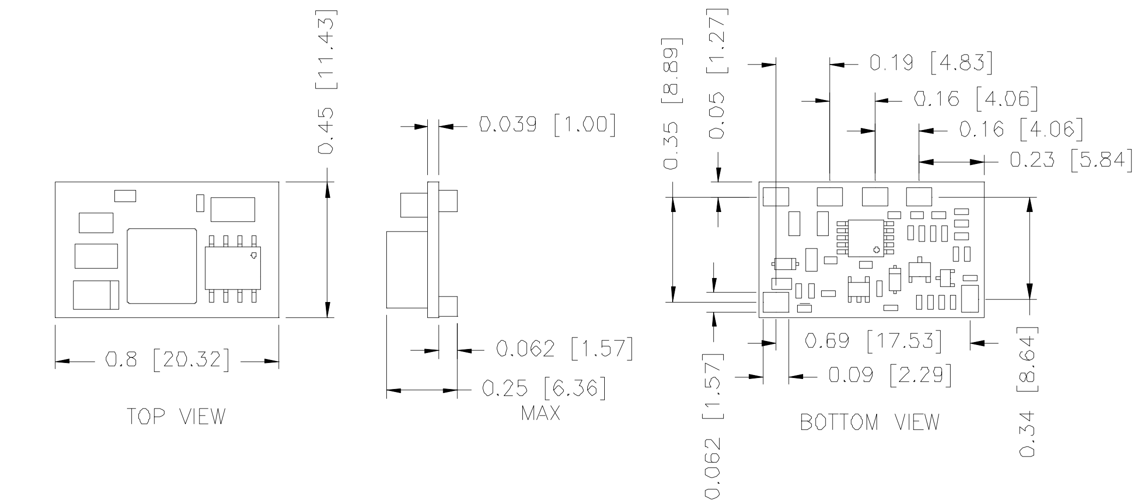

50% to 100% load step at Vin=5 V, Vo=3.3 V

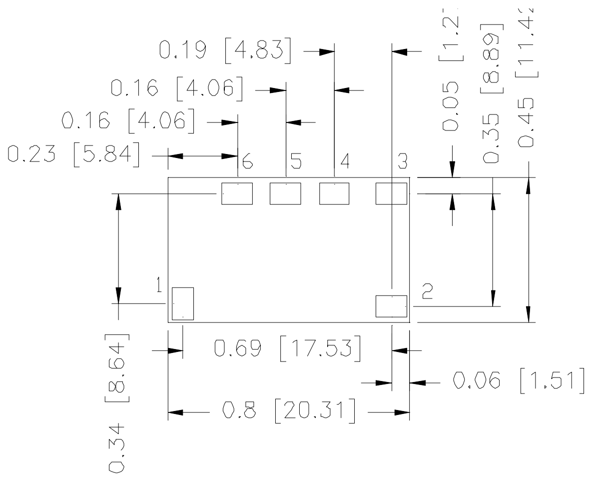


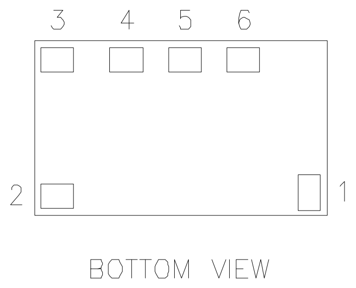

100% to 50% load step at Vin=5 V, Vo=3.3 V

**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: 0.012"* 0.0095" (3.05mm * 2.41mm)

MAX: 0.0135"* 0.011" (3.43mm * 2.79mm)

## Pin Connections

| Pin | Function |
|---|---|
| 1 | Remote On/Off |
| 2 | Vin+ |
| 3 | SEQ |
| 4 | Ground |
| 5 | Trim |
| 6 | 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 |
|---|---|---|---|
| 2006-12-13 | 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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OCEAN CHIPS

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Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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