

▪ Description

The YB1230 is a series of low-noise, low dropout (LDO) linear regulators with 2.0% output voltage accuracy. The YB1230 regulators achieve a low 500mV dropout at 600mA load current of 3.1V output and are available in voltages ranging from 1.8V to 3.1 V with 0.1 V per step (custom voltage is considerable at request).

The YB1230 regulators are optimized to work with low-ESR and low cost ceramic capacitors, reducing the amount of board space critical in hand-held devices. The YB1230 requires only 2.2 μ F output capacitor for stability with any load and consumes less than 1 μ A in shutdown mode.

Built-in thermal shutdown and short-circuit protect offer secure protection against fault operation. The YB1230 regulators are available in SOT-23 / SOT-25 / SOT-89 packages.

▪ Features

- 2.0% Accuracy Output Voltage
- Output Voltage Range 1.8V ~ 3.1V
- Low-Noise Low-Drop-Out
- Stable with 2.2 μ F Ceramic Capacitor for Any Load
- Typical Output Current : 600mA
- Low Quiescent Current : ~90 μ A
- 500mV Dropout at 600mA Load (3.1V)
- Only Need Input and Output Capacitors
- Power Saving Shutdown Mode (<1 μ A)
- Thermal Protection Shutdown
- Built-In Internal Soft-Start
- Output Short-Circuit Current Limit Protection
- Green package (RoHS) available

▪ Applications

- PDA, Palmtops and Notebook Computers
- DSC, Handset Camera Modules
- PCMCIA Cards, PC Cameras
- USB Based Portable Devices (MP3, PMP)
- GSM/GPRS/3G RF Transceiver Modules
- Wireless LANs
- Bluetooth Portable Radios

Typical Application Circuit

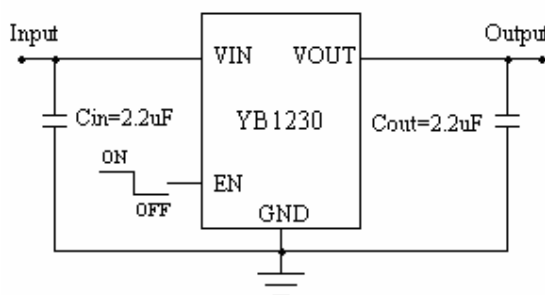


Figure 1-1: SOT-25 Application Circuit

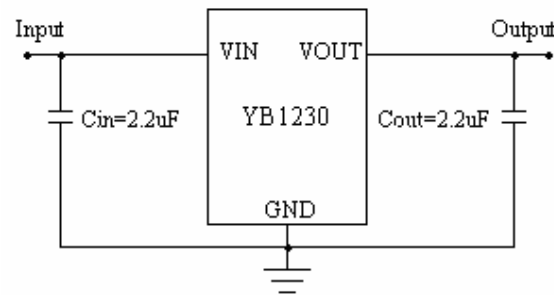


Figure 1-2: SOT-23/SOT-89 Application Circuit

Pin Configuration

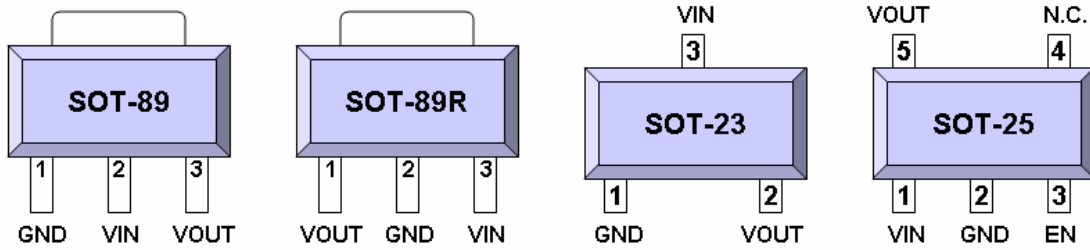


Figure 2: Pin Configuration

Pin Description

Table 1

| Name | Description |
|------|---|
| VIN | Unregulated input supply. Bypass with a capacitor to GND. |
| GND | Ground pin. |
| EN | Pull high to enable the regulator. |
| VOUT | Regulated output voltage. Bypass with a capacitor to GND. |

Ordering Information

Y B 1 2 3 0 X

Output Voltage
 1 8 0 : 1.8 V
 1 9 0 : 1.9 V
 :
 3 1 0 : 3.1 V

X : reserved

Package Type
 ST23 : SOT-23
 ST25 : SOT-25
 ST89 : SOT-89
 ST8R : SOT-89R

- Order example :
YB1230ST89X250 for YB1230 of 2.5V output and SOT-89 package
- Shipping Quantity :
 SOT-23 : 3000 units tape & reel
 SOT-25 : 3000 units tape & reel
 SOT-89 : 1000 units tape & reel
 SOT-89R : 1000 units tape & reel
- Only green package

Marking Information

X E

Package Type

Output Voltage

V : SOT-23, T : SOT25, S : SOT-89, R : SOT-89R

| | | | | | | | | | | |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code | A | B | C | D | E | F | G | H | I | J |
| Voltage | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 |
| Code | K | L | M | N | | | | | | |
| Voltage | 2.8 | 2.9 | 3.0 | 3.1 | | | | | | |

Absolute Maximum Ratings (Note 1)

Supply Voltage -0.3V to 6V
 Output Voltage -0.3V to (V_{IN}+0.3V)
 Output Short-Circuit Duration..... Infinite
 Junction Temperature Range +150°C
 Storage Temperature Range -65°C to +150°C
 Lead Temperature +250°C

Recommended Operating Conditions (Note 2)

Input Supply Voltage 2.0V to 5.5V
 Operating Temperature -40°C to +85°C

Thermal Information (Note 3)

Thermal Resistance (SOT-23/25, θ_{JA}) ... 280°C/W
 Thermal Resistance (SOT-89, θ_{JA}) 180°C/W
 Internal Power Dissipation (SOT-23/25, P_D) . 0.4W
 Internal Power Dissipation (SOT-89, P_D) 0.55W

Note:

1. Exceeding these ratings may damage the device.
2. The device is not guaranteed to function outside of its operating conditions.
3. θ_{JA} is measured in free air at T_A = 25°C on a low effective thermal conductivity board.

Electrical Characteristics

Table 2 $V_{IN} = (V_{OUT} + 1V)$, $C_{IN} = C_{OUT} = 2.2\mu F$, $V_{EN} = V_{IN}$, $T_A = 25^\circ C$, unless otherwise noted.

| Description | Symbol | Test Conditions | MIN | TYP | MAX | Units |
|------------------------------|-------------------|---|------|------|----------|------------|
| Input Voltage Range | V_{IN} | | 2.0 | | 5.5 | V |
| Output Voltage | V_{OUT} | Predefined | 1.8 | | 3.1 | V |
| Output Voltage Accuracy | ΔV_{OUT} | $I_{OUT} = 10mA$ | -2.0 | | +2.0 | % |
| Output Current Limit | I_{SC} | Short-Circuit Output | | 380 | | mA |
| Dropout Voltage (Note 1) | V_{DROP} | $V_{OUT} = 3.2V, I_{OUT} = 600mA$ | | 500 | | mV |
| | | $V_{OUT} = 3.0V, I_{OUT} = 600mA$ | | 520 | | |
| | | $V_{OUT} = 2.5V, I_{OUT} = 600mA$ | | 600 | | |
| | | $V_{OUT} = 2.0V, I_{OUT} = 600mA$ | | 750 | | |
| | | $V_{OUT} = 1.8V, I_{OUT} = 600mA$ | | 850 | | |
| Ground Current | I_G | $I_{ground} = I_{IN} - I_{OUT}$ | | 90 | 150 | μA |
| Line Regulation | ΔV_{LINE} | $V_{IN} = (V_{OUT} + 1V)$ to 5.5V, $I_{OUT} = 10mA$ | | 0.3 | | %/V |
| Load Regulation | ΔV_{LOAD} | $I_{OUT} = 1mA$ to 600mA | | 2 | | % |
| Shutdown Supply Current | I_{SD} | $EN = 0V$ | | | 1 | μA |
| Ripple Rejection (PSRR) | PSRR | $f = 100Hz, I_{OUT} = 10mA$ | | 56 | | dB |
| | | $f = 1KHz, I_{OUT} = 10mA$ | | 56 | | |
| | | $f = 10KHz, I_{OUT} = 10mA$ | | 45 | | |
| Shutdown Exit Delay (Note 2) | | $V_{OUT} = 2.8V, R_{load} = 9\ ohm$ | | 40 | 100 | μs |
| EN Logic Low Level | V_{IL} | $V_{IN} = 2.0V$ to 5.5V | | | 0.4 | V |
| EN Logic High Level | V_{IH} | $V_{IN} = 2.0V$ to 5.5V | 1.5 | | V_{IN} | V |
| EN Input Bias Current | I_{BEN} | $V_{IN} = EN = V_{OUT} + 1V$ | | 0.01 | | μA |
| Thermal Shutdown | T_{SD} | Shutdown Temperature | | 160 | | $^\circ C$ |
| Thermal Hysteresis | T_{HYS} | $V_{OUT} = 1.8V, I_{OUT} = 100mA$ | | 20 | | $^\circ C$ |

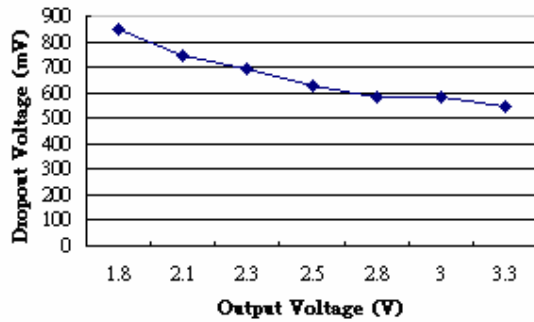
Note :

- The drop out voltage varies depending on output voltage selection. Dropout is defined as $V_{IN} - V_{OUT}$ when V_{OUT} is 100mV below nominal V_{OUT} where $V_{IN} = V_{OUT} + 1V$ for nominal V_{OUT} .
- Time needed for V_{OUT} to reach 90% of final value.

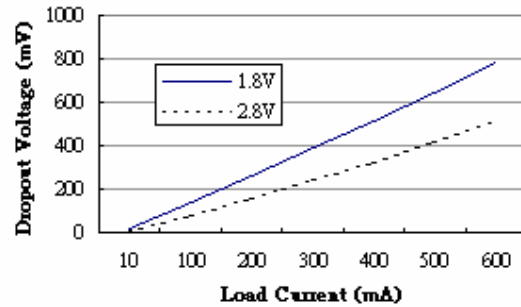
Typical Performance Characteristics

$V_{IN} = (V_{OUT} + 1V)$, $C_{IN} = C_{OUT} = 2.2\mu F$, $V_{EN} = V_{IN}$, $T_A = 25^\circ C$, unless otherwise noted.

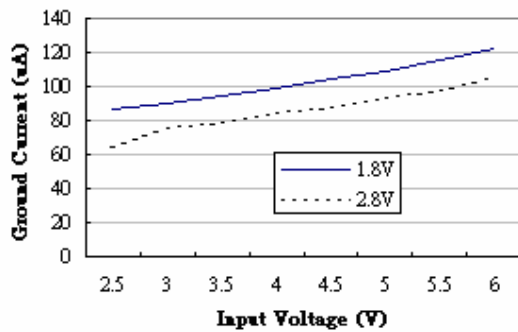
Dropout Voltage vs. Output Voltage



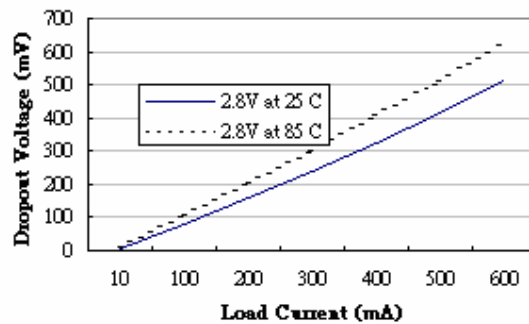
Dropout Voltage vs. Load Current



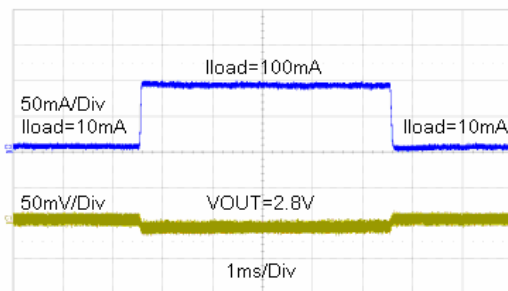
Ground Current vs. Input Voltage



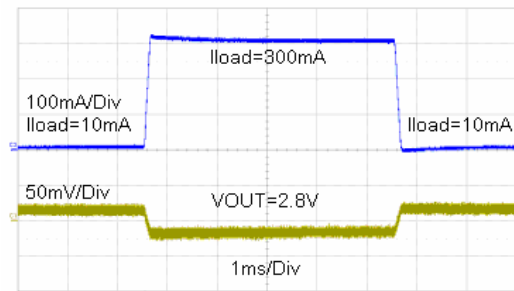
Dropout Voltage vs. Temperature



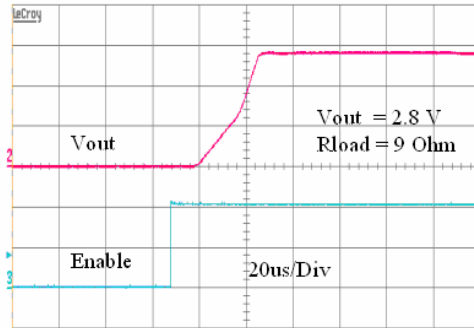
Load Transient Response (1)



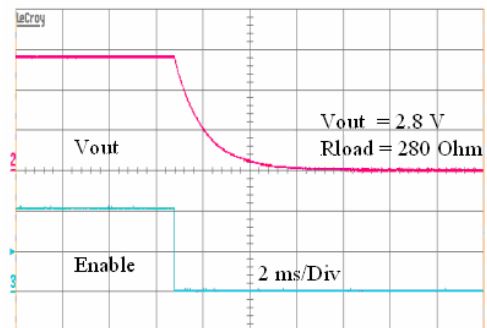
Load Transient Response (2)



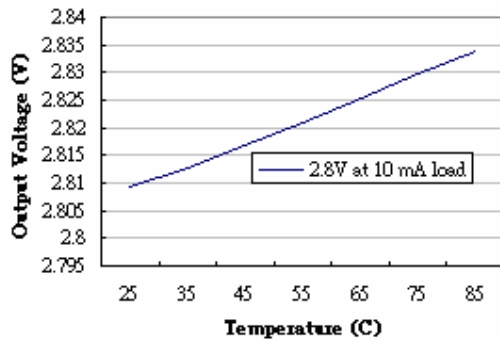
Shutdown Exit Delay



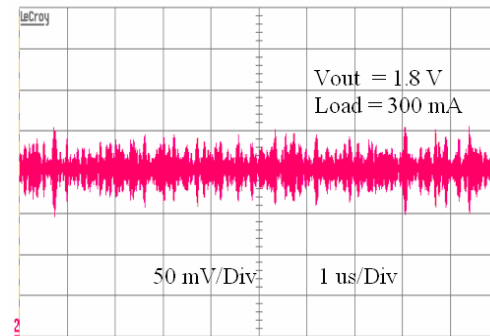
Shutdown Delay



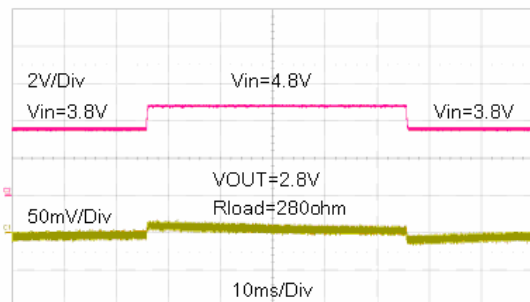
Output Voltage vs. Temperature



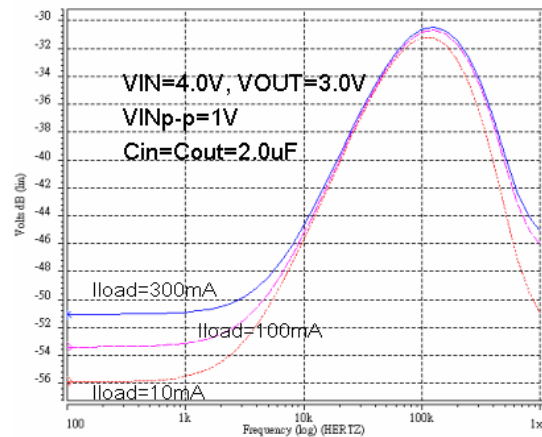
Output Noise Measurement



Line Transient Response (10mA)



PSRR vs. Frequency



Function Block

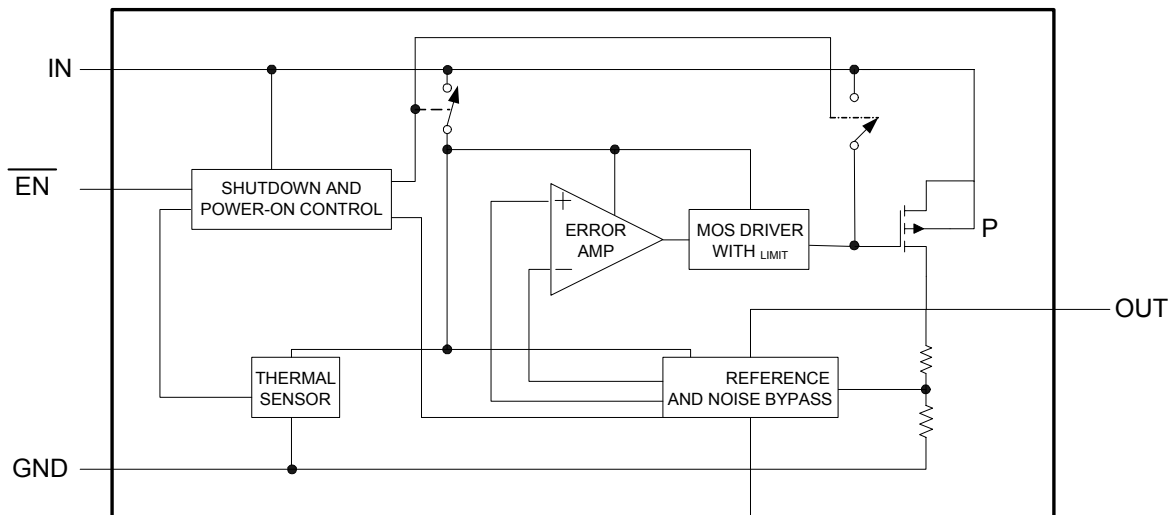


Figure 3: Function Block

Functional Description

The YB1230 is an low-noise, low-quiescent current, low-dropout linear regulator. It is supplied in a SOT-23 / SOT-25 / SOT-89 package for different applications. These devices can supply loads up to 600mA. As shown in the *Functional Block Diagram*, the YB1230 consists of a reference and noise bypass circuit, error amplifier, output drive transistor, internal feedback voltage divider, thermal sensor, and short circuit current limiter. The internal reference is connected to the error amplifier's inverting input. The error amplifier compares this reference with the feedback voltage and amplifies the difference. If the feedback voltage is lower than the reference voltage, the pass-transistor gate is pulled low. This allows more current to pass to the output and increases the output voltage. If the

feedback voltage is too high, the pass transistor gate is pulled high, allowing less current to pass to the output. The parts are available with preset output voltages ranging from 1.8V to 3.1V.

Stability

The YB1230 is a high performance LDO emphasizing stability with low output capacitance. It is able to maintain stability with an output capacitor as low as 2.2 μ F. The output capacitor can also be increased to optimize performance. The YB1230 will remain stable and in regulation with no load, unlike many other voltage regulators.

Internal P-Channel Pass Transistor

The YB1230 features a low impedance P-channel MOSFET pass transistor. This provides several advantages over similar designs using a PNP pass transistor,

including low operating power and longer battery life. The YB1230 consumes only 90 μ A of quiescent current under most conditions.

Output Short-Circuit Current Limit

The YB1230 includes a current limiter, which monitors and controls the pass transistor's gate voltage, limiting the output current to about 380mA, for example, in a short-circuit output situation.

Shutdown

The YB1230 also features a low-power active shutdown mode. It has a switch that turns off the device when disabled. This allows the output capacitor and load to discharge and de-energize the load. In the shutdown mode, the internal functional blocks, such as voltage reference and the error amplifier, are turned off completely, and the quiescent current is less than 1 μ A.

Thermal Protection Shutdown

The thermal protection shutdown function protects the device from operating in over temperature condition. When the junction temperature exceeds +160°C, the thermal sensor signals the shutdown logic, turning off the pass transistor and allowing the IC to cool down. The thermal sensor turns the pass transistor on again after the IC's junction temperature drops to +140°C.

Soft-Start Circuitry

The YB1230 includes a soft-start circuitry to limit inrush current at turn-on. During power up, the output capacitor and output load are charged with a reduced output current. Shortly after the initial power up, the

soft-start feature is terminated and normal operation is resumed.

Application Information

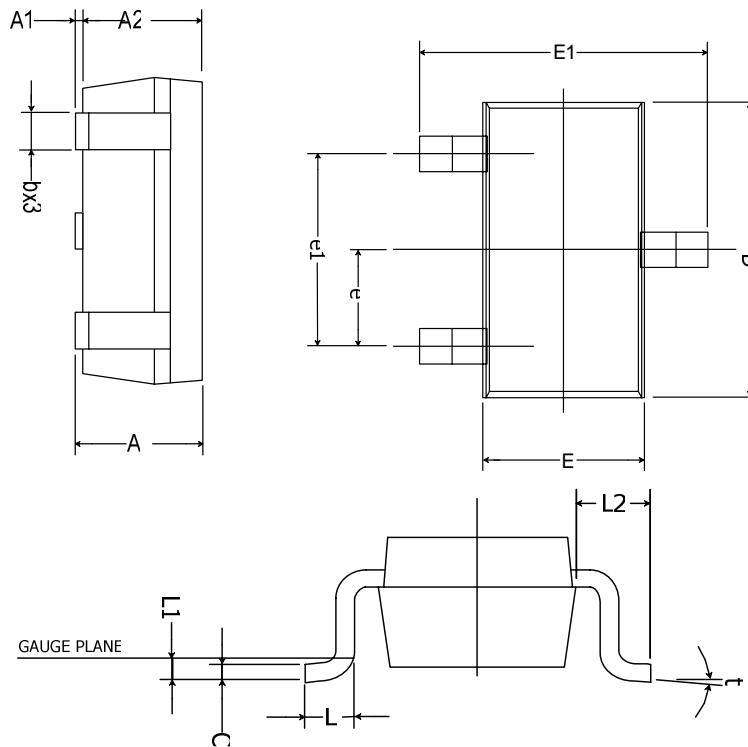
Enable/Shutdown

The YB1230 comes with an active-high enable pin that allows the regulator to be enabled. Forcing the enable pin low disables the regulator and puts it into the shutdown mode. This pin cannot be left floating as it may cause an undetermined state.

Input/Output Capacitor

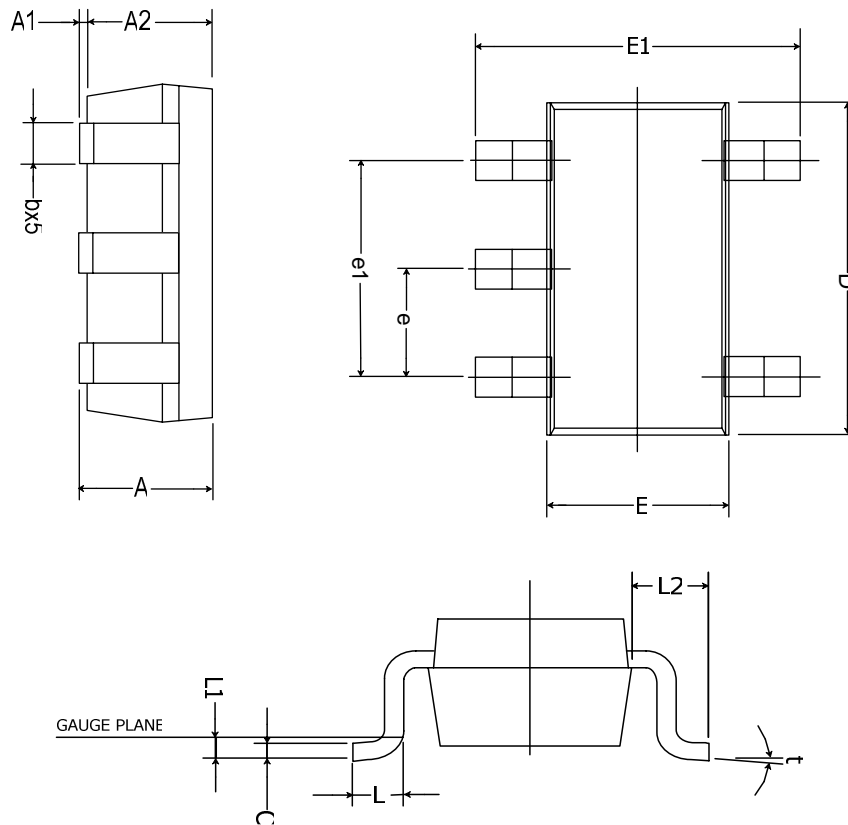
It is recommended to use a 2.2 μ F capacitor on the YB1230 input and a 2.2 μ F capacitor on the output. For high regulation performance, larger input capacitor values and lower ESRs provide better noise rejection and line-transient response. The output noise, load-transient response, stability, and power-supply rejection can be improved by using large output capacitors. Low ESR ceramic capacitors provide optimal performance and save space.

Package Information (SOT-23)



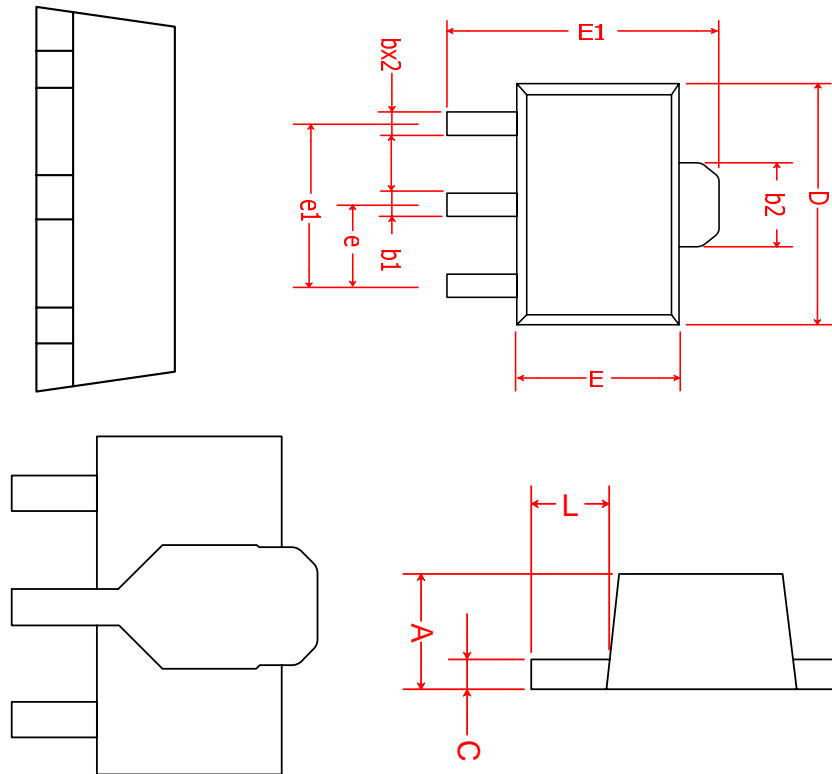
| Symbol | millimeters | | Inches | |
|--------|-------------|------|------------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.95 | 1.45 | .037 | .057 |
| A1 | 0.05 | 0.15 | .002 | .006 |
| A2 | 0.90 | 1.30 | .035 | .051 |
| b | 0.30 | 0.50 | .0118 | .019 |
| C | 0.08 | 0.20 | .0031 | .0078 |
| D | 2.84 | 3.00 | .1118 | .118 |
| E | 1.50 | 1.70 | .059 | .0669 |
| E1 | 2.60 | 3.00 | .102 | .118 |
| e | 0.95 BSC. | | .0374 BSC. | |
| e1 | 1.90 BSC. | | .0748 BSC. | |
| L | 0.35 | 0.55 | .0137 | .0216 |
| L1 | 0.10 BSC. | | .0039 BSC. | |
| L2 | 0.60 REF. | | .0236 REF. | |
| t | 0° | 8° | 0° | 8° |

Package Information (SOT-25)



| Symbol | millimeters | | Inches | |
|--------|-------------|------|------------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.95 | 1.45 | .037 | .057 |
| A1 | 0.05 | 0.15 | .002 | .006 |
| A2 | 0.90 | 1.30 | .035 | .051 |
| b | 0.30 | 0.50 | .0118 | .019 |
| C | 0.08 | 0.20 | .0031 | .0078 |
| D | 2.84 | 3.00 | .1118 | .118 |
| E | 1.50 | 1.70 | .059 | .0669 |
| E1 | 2.60 | 3.00 | .102 | .118 |
| e | 0.95 BSC. | | .0374 BSC. | |
| e1 | 1.90 BSC. | | .0748 BSC. | |
| L | 0.35 | 0.55 | .0137 | .0216 |
| L1 | 0.10 BSC. | | .0039 BSC. | |
| L2 | 0.60 REF. | | .0236 REF. | |
| t | 0° | 8° | 0° | 8° |

Package Information (SOT-89)



| Symbol | millimeters | | Inches | |
|--------|-------------|------|-----------|------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 1.40 | 1.60 | .055 | .063 |
| b | 0.36 | 0.48 | .014 | .019 |
| b1 | 0.44 | 0.56 | .017 | .022 |
| b2 | 1.50 | 1.83 | .059 | .072 |
| C | 0.35 | 0.44 | .014 | .017 |
| D | 4.40 | 4.60 | .173 | .181 |
| E | 2.29 | 2.60 | .090 | .102 |
| E1 | 3.94 | 4.25 | .155 | .167 |
| e | 1.50 BSC. | | .059 BSC. | |
| e1 | 3.00 BSC. | | .118 BSC. | |
| L | 0.89 | 1.20 | .035 | .047 |

NOTICE:

- The information described herein is subject to change without notice.
- Yobon does not assume any responsibility for use of any circuitry or applications described herein, nor does it convey any patent license.