## Description

The YB1253 is a series of ultra-low-noise, high PSRR, and low quiescent current low dropout (LDO) linear regulators with 2.0% output voltage accuracy. The YB1253 regulators achieve a low 300mA dropout at 300mA load current of 3.6V output and are available in voltages ranging from 1.2V to 3.6V with 0.1 V per step (custom voltage is considerate at request).

The YB1253 regulators are optimized to work with low-ESR and low cost ceramic capacitors, reducing the amount of board space critical in portable devices. The YB1253 requires only 1.0μF output capacitor for stability with any load and consumes less than 1μA in shutdown mode.

Built-in thermal shutdown and short-circuit current limit offer secure protection against fault operation. YB1253 regulators also include an auto-discharge function. The YB1253 regulators are available in SOT-23 / SOT-25 / SOT-89 packages.

## Features

- High Accuracy Output Voltage : ± 2%
- Wide Output Voltage Range : 1.2~3.6V
- Ultra-Low-Noise Low-Drop-Out
- Typical Output Current : 300 mA
- Low Quiescent Current: ~10μA
- 300mV Dropout at 300mA 3.6V Output
- Stable with 1.0μF Ceramic Capacitor
- Only Need Input and Output Capacitors
- Thermal Protection Shutdown
- Auto discharge function
- Green Package (RoHS) Available

## Applications

- PDA, Notebook, PC Computers
- DSC, Cellular phones
- PCMCIA Cards, PC Cameras
- USB Based Portable Devices
- GSM/GPRS/3G RF Transceiver
- Wireless LANs
- Bluetooth Portable Radios
- Battery-Powered Devices

## Typical Application Circuitry

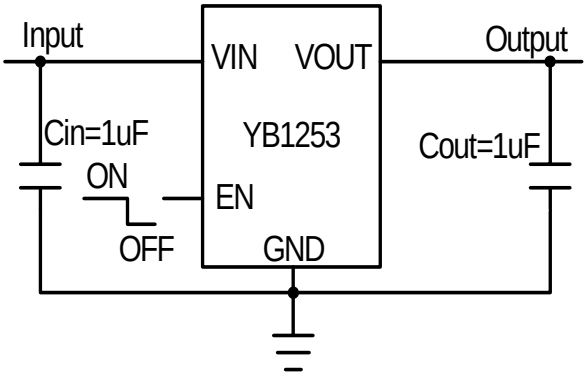



Figure 1-1 : SOT-25 application circuit

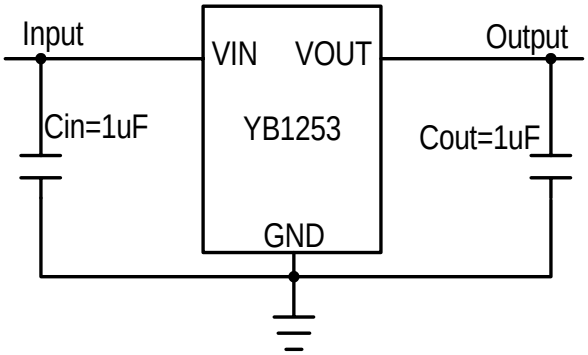



Figure 1-2 : SOT-23 application circuit

## Pin Configuration

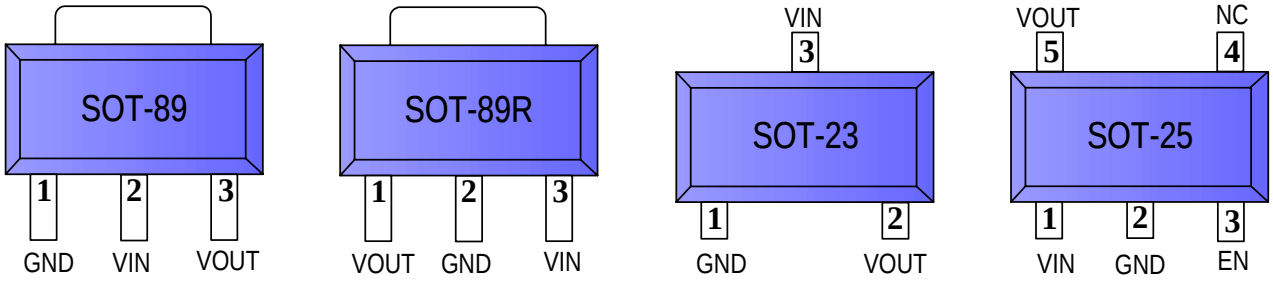


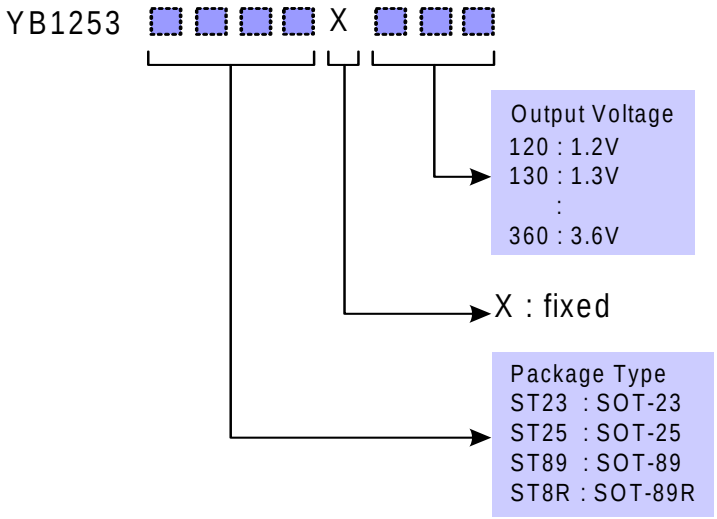

Figure 2 : pin configuration

## Pin Description

**Table 1**

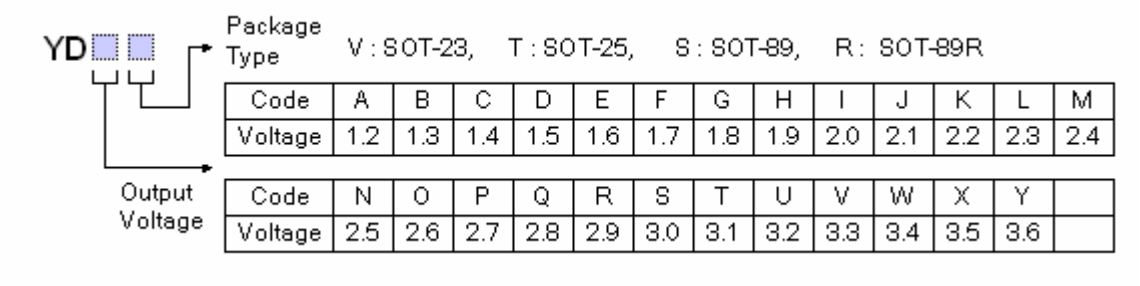
| Pin Name | Pin Function |
|---|---|
| VIN | Unregulated Input Supply. Bypass with a capacitor to GND |
| GND | Ground pin |
| EN | Pull high to enable the regulator |
| NC | No connection is required |
| VOUT | Regulated Output Voltage |

## Ordering Information




*Order example :
YB1253 ST89X250 for YB1253 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




| Code | A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 |

| Code | N | O | P | Q | R | S | T | U | V | W | X | Y | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Voltage | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | |

### Absolute Maximum Ratings (Note 1)

Supply Voltage .....-0.3V to 6.0V
Output Voltage .....-0.3V to ($V_{IN}$+0.3V)
Output Short-Circuit Duration..... Infinite
Junction Temperature Range.....+150℃
Storage Temperature Range..... -65℃ to +150℃
Lead Temperature.....+250℃
ESD Susceptibility (HBM)…… ……2KV
ESD Susceptibility (MM) ..... 200V

### Recommended Operating Conditions (Note 2)

Input Supply Voltage.....2V to 5.5V
Operating Temperature.....-40℃ to +85℃

### Thermal Information (Note 3)

Thermal Resistance (SOT-23/25, $\theta_{JA}$).280℃/W
Thermal Resistance (SOT-89, $\theta_{JA}$)…...180℃/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. $\theta_{JA}$ is measured in free air at $T_A$ = 25℃ on a low effective thermal conductivity board.

## Electrical Characteristics

**Table 2**

**$T_A$ = 25℃, $V_{IN}$ = ( $V_{OUT}$ + 1 V ), $C_{IN}$ = $C_{OUT}$ = 1.0μF, $V_{EN}$ = $V_{IN}$, unless otherwise**

| Function Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Input Voltage Range | | 2.0 | | 5.5 | V |
| Output Voltage, VOUT | Predefined | 1.2 | | 3.6 | V |
| Output Voltage Accuracy | $I_{OUT}$ = 10mA, VOUT >= 1.3V | -2.0 | | +2.0 | % |
| | $I_{OUT}$ = 10mA, VOUT = 1.2V | 0 | | +4.0 | % |
| Output Current Limit | Short-circuit output | | 500 | | mA |
| Dropout Voltage (Note 1) | Vout = 3.6V, Iout = 300 mA | | 300 | | mV |
| | Vout = 3.3V, Iout = 300 mA | | 350 | | |
| | Vout = 2.8V, Iout = 300 mA | | 430 | | |
| | Vout = 1.8V, Iout = 300 mA | | 600 | | |
| | Vout = 1.2V, Iout = 300 mA | | 900 | | |
| Ground Current | $I_{ground}$ = Iin - Iout | | 10 | | μA |
| Line Regulation | Vin = (Vout+1V) to 5.5V, Iout =10mA | | 0.10 | 0.20 | %/V |
| Load Regulation | Iout = 1mA to 300 mA | | 0.005 | 0.01 | %/mA |
| Shutdown Supply Current | EN = Vin=0V | | | 1 | μA |
| Ripple Rejection (PSRR) | (Note 2) | | 50 | | dB |
| Start Up Delay (Note 3) | Rload=100ohm | | 200 | | μS |
| Shutdown Delay | Rload=10K ohm, VOUT=1.5V | | 1 | | mS |
| | Rload=10K ohm, VOUT=1.2V | | 1 | | mS |
| EN Logic Low Level | Vin = 2.0V to 5.5V | | | 0.4 | V |
| EN Logic High Level | Vin = 2.0V to 5.5V | 1.2 | | Vin | V |
| EN Input Bias Current | Vin = EN = 3V | | 1.5 | | μA |
| Thermal Shutdown | Shutdown Temperature | | 160 | | °C |
| Thermal Hysteresis | | | 20 | | °C |

Note 1: The dropout 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 Vin=Vout + 1V for nominal $V_{OUT}$.

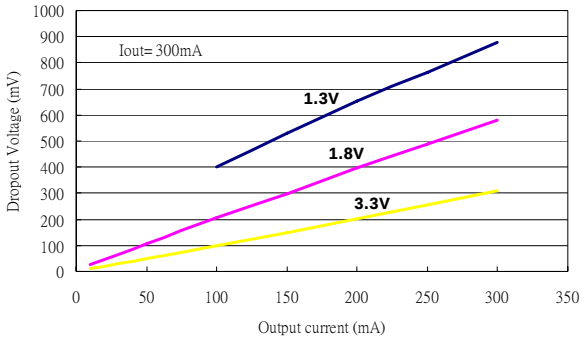
Note 2: PSRR is tested at Vin=3.8+1Vppac, Vout=2.8V, I_load=1mA.

Note 3: Time needed for $V_{OUT}$ to reach 90% of final value.

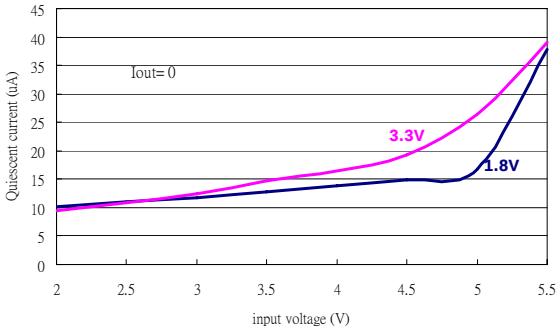
## Typical Characteristics

**At $T_A$=25℃, $V_{IN}$=($V_{OUT}$+1V), $C_{IN}$=$C_{OUT}$=1.0μF, $V_{EN}$=$V_{IN}$, unless otherwise noted.**

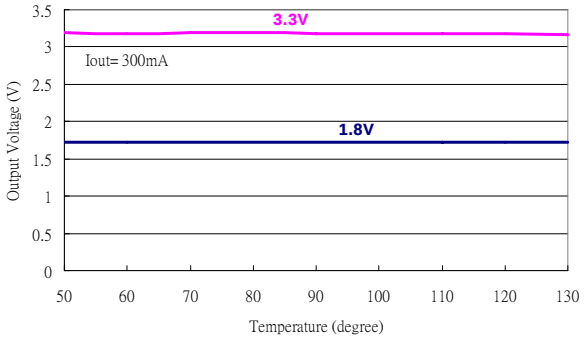
Output Curent VS Dropout voltage



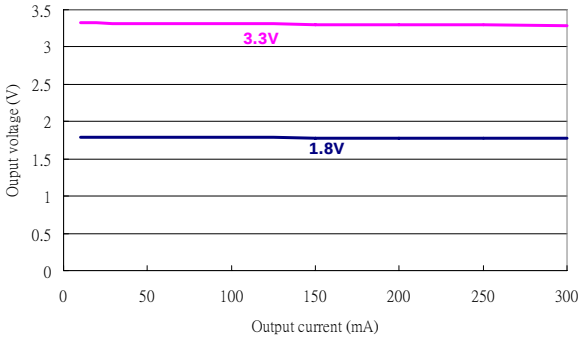

Input voltage VS Quiescent current



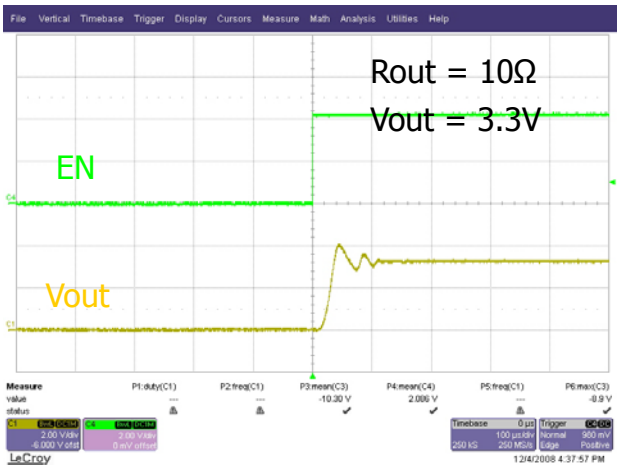

Output voltage VS Temperature



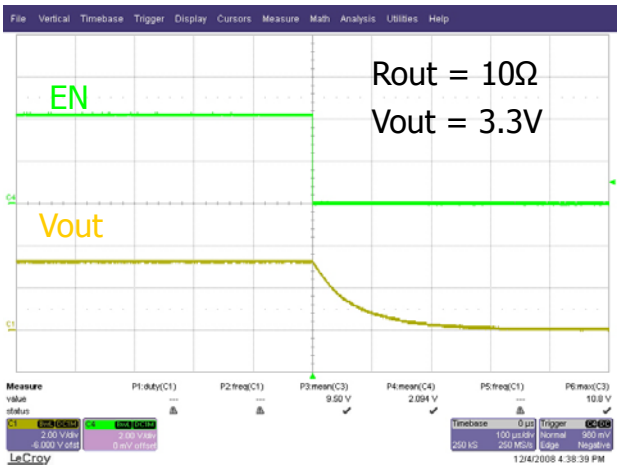

Output voltage VS Output current



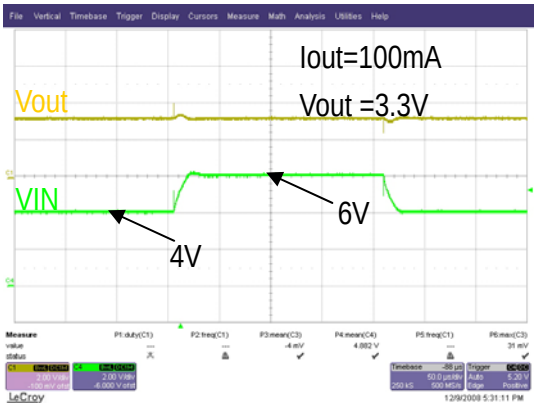

Startup delay time



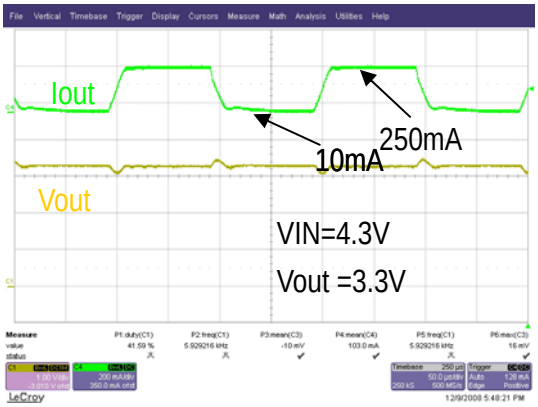

Shutdown delay time



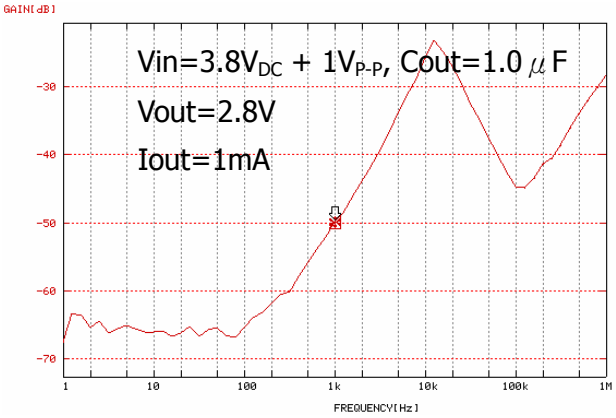
Input transient response



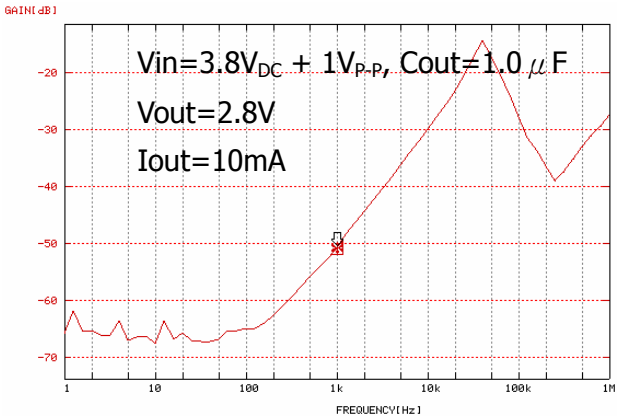

Load transient response




Power supply rejection ratio




Power supply rejection ratio



## Functional Block Diagram

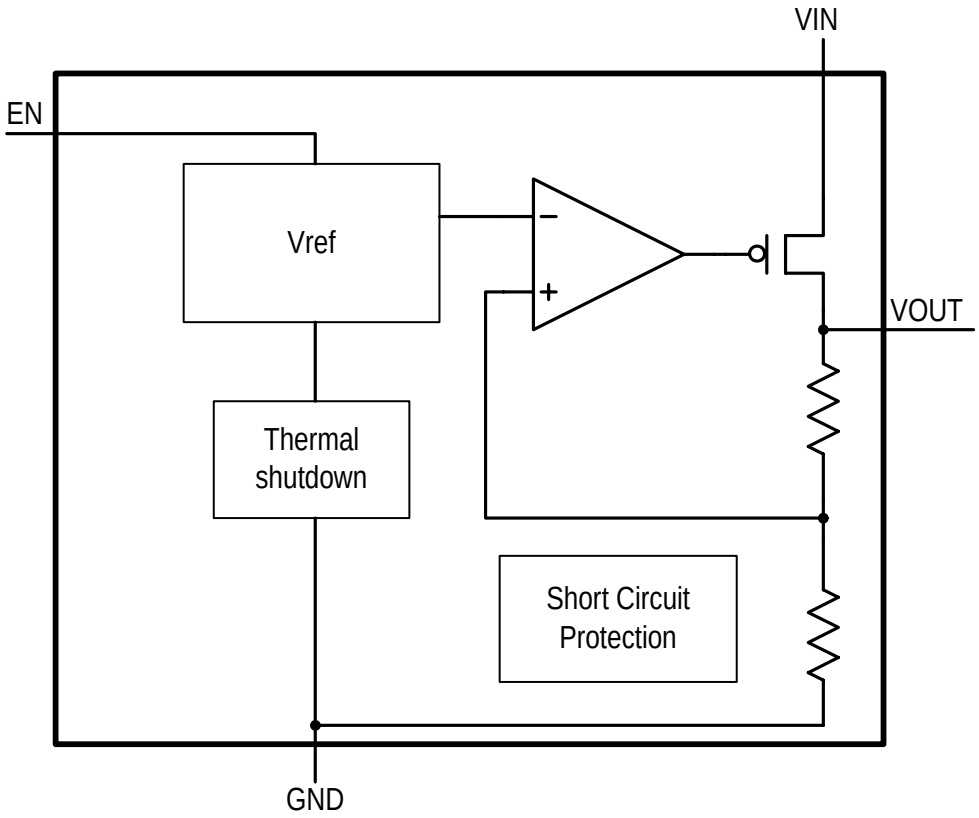



Figure 3 : Function diagram

## Functional Description

The YB1253 is an ultra-low-noise, low-quiescent current, low-dropout linear regulator. It is supplied in a SOT-23 / SOT-25 / SOT-89 package for different applications. YB1253 can supply load current up to 300mA (typical operation, not maximum) with good line and load regulation. Output voltages are preset and ranging from 1.2V to 3.6V.

As shown in the *Functional Block Diagram*, the YB1253 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 gate of the pass-transistor 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 gate of the pass transistor is pulled high, allowing less current to pass to the output.

### Stability

The YB1253 is a high performance LDO emphasizing stability with low output capacitance. It is able to maintain stability with an output capacitor as low as 1.0µF. The output capacitor can also be increased to optimize performance. The YB1253 will remain stable and in regulation with no load, unlike many other voltage regulators.

### Internal P-Channel Pass Transistor

The YB1253 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 YB1253 consumes only 10μA of quiescent current under most conditions.

### Output Short-Circuit Current Limit

The YB1253 includes a current limiter, which monitors and controls the pass transistor's gate voltage, limiting the output current to about 500mA, for example, in a short-circuit output situation.

### Shutdown

The YB1253 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 1μA.

### 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.

## Application Information

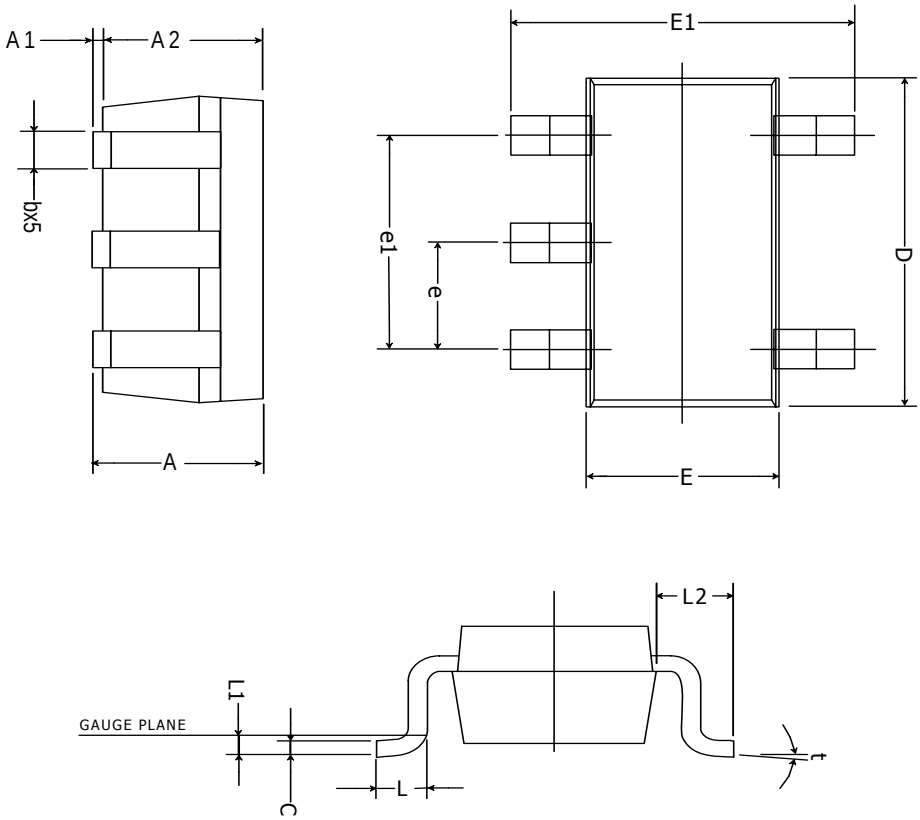
### Enable/Shutdown

The YB1253 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

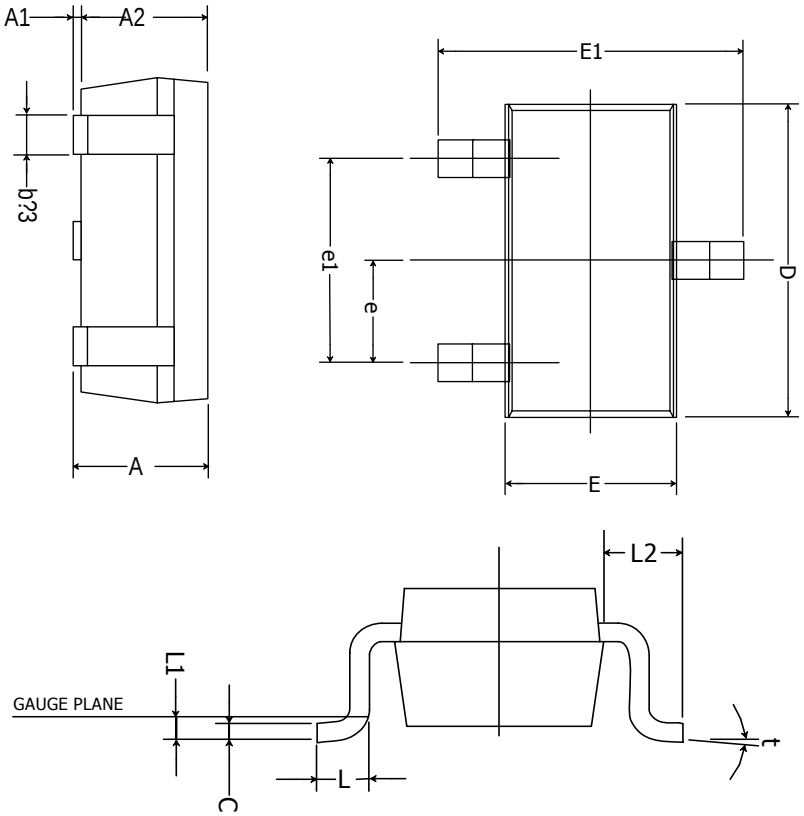
It is recommended to use a 1.0μF capacitor in the YB1253 input and a 1.0μF capacitor in the output. For high regulation performance, larger input capacitor values and lower ESRs provide better noise rejection and line-transient response. The output noise, load-transient response, stability, and power-supply rejection can be improved by using large output capacitors. Low ESR ceramic capacitors provide optimal performance and save space.

## SOT-25 Package Information



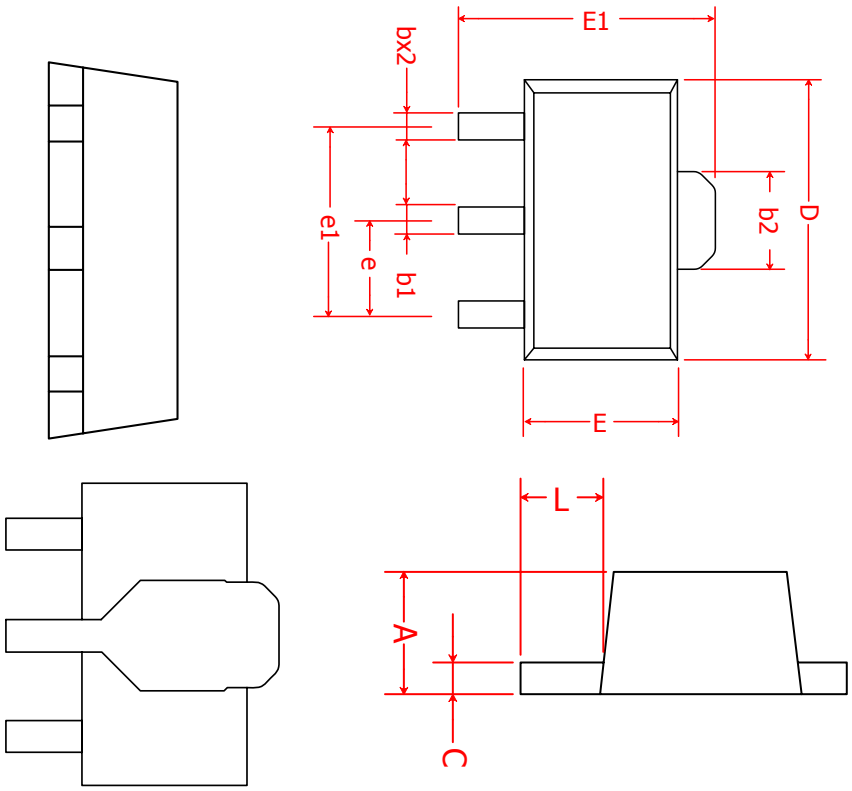

| Symbol | milimeters | | Inches | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.95 | 1.45 | .037 | .057 |
| A1 | 0.05 | 0.15 | .002 | .006 |
| A2 | 0.90 | 1.30 | .035 | .051 |
| b | 0.30 | 0.50 | .0118 | .019 |
| C | 0.08 | 0.20 | .0031 | .0078 |
| D | 2.84 | 3.00 | .1118 | .118 |
| 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° |

## SOT-23 Package Information




| Symbol | milimeters | | 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° |

## SOT-89 Package Information




| Symbol | milimeters | | 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 |