

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 : 600 mA
- 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 Circuitry

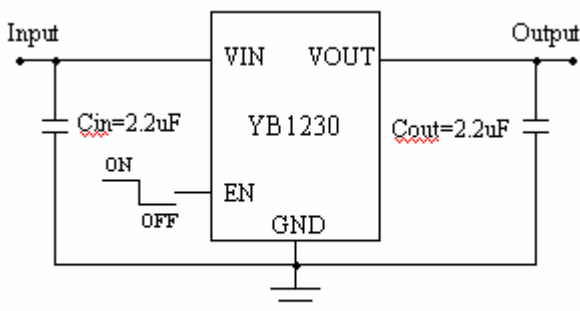


Figure 1-1 : SOT-25 application circuit

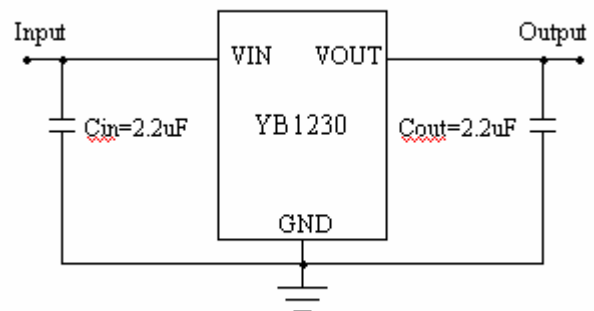


Figure 1-2 : SOT-23, SOT-89 application circuit

Absolute Maximum Ratings

Supply Voltage -0.3V to 7.0V
 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

Input Supply Voltage..... 2V to 6.0V
 Operating Temperature..... -40°C to +85°C
 Thermal Resistance (SOT-23/25, θ_{JC}) 140°C/W
 Thermal Resistance (SOT-23/25, θ_{JA})..... 280°C/W
 Thermal Resistance (SOT-89, θ_{JC}) 46°C/W
 Thermal Resistance (SOT-89, θ_{JA})..... 180°C/W
 Thermal Power Dissipation (SOT-23/25, P_D)....0.4W
 Thermal Power Dissipation (SOT-89, P_D).....0.55W

Electrical Characteristics

Table 2 T_A = 25°C, V_{IN} = (V_{OUT} + 1 V), C_{IN} = C_{OUT} = 2.2μF, V_{EN} = V_{IN}

Function Parameter	Conditions	Min	Typ	Max	Units
Input Voltage Range		2.0		6.0	V
Output Voltage	Predefined	1.8		3.1	V
Output Voltage Accuracy	I _{OUT} = 10mA	-2.0		+2.0	%
Output Current Limit	Short-circuit output		380		mA
Dropout Voltage (Note 1)	V _{out} = 3.2V, I _{out} = 600 mA		500		mV
	V _{out} = 3.0V, I _{out} = 600 mA		520		
	V _{out} = 2.5V, I _{out} = 600 mA		600		
	V _{out} = 2.0V, I _{out} = 600 mA		750		
	V _{out} = 1.8V, I _{out} = 600 mA		850		
Ground Current	I _{ground} = I _{in} - I _{out}		90	150	μA
Line Regulation	V _{in} = (V _{out} + 1V) to 6V, I _{out} = 10 mA		0.3		%/V
Load Regulation	I _{out} = 1mA to 600 mA		2		%
Shutdown Supply Current	EN = 0.4V		0.01		μA
Ripple Rejection (PSRR)	f = 100 Hz, I _{out} = 10 mA		56		dB
	f = 1KHz, I _{out} = 10 mA		56		
	f = 10 KHz, I _{out} = 10 mA		45		
Shutdown Exit Delay (Note 2)	V _{out} = 2.8V, R _{load} = 9 ohm		40	100	μS
EN Logic Low Level	V _{in} = 2.0V to 6.0V			0.4	V
EN Logic High Level	V _{in} = 2.0V to 6.0 V	1.5		V _{in}	V
EN Input Bias Current	V _{in} = EN = V _{out} + 1V		0.01		μA
Thermal Shutdown	Shutdown Temperature		160		°C
Thermal Shutdown Hysteresis	V _{OUT} = 1.8V, I _{OUT} = 100mA		20		°C

Note1 : The drop out voltage varies depending on output voltage selection

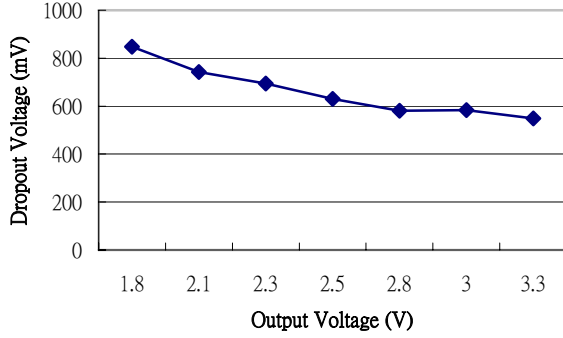
Dropout is defined as V_{IN} – V_{OUT} when V_{OUT} is 100mV below V_{OUT} where V_{in}=V_{out} + 1V for nominal V_{OUT}.

Note 2: Time needed for V_{OUT} to reach 90% of final value.

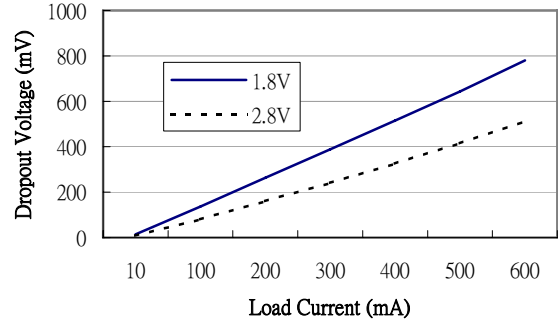
Typical Characteristics

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

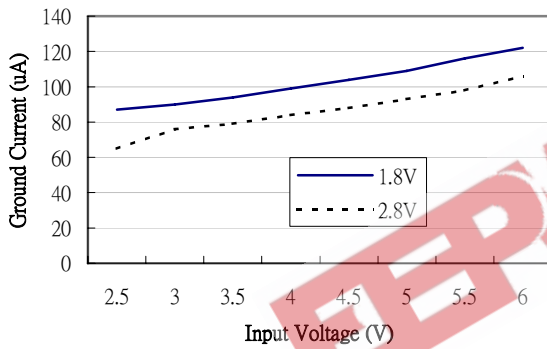
Dropout Voltage vs Output Voltage



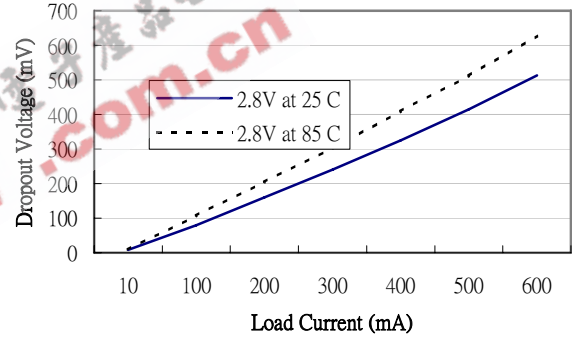
Dropout Voltage vs. Load Current



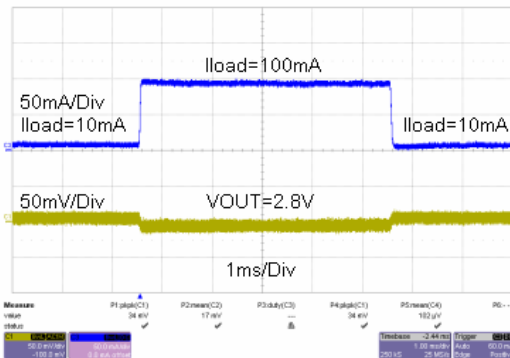
Ground Current vs. Input Voltage



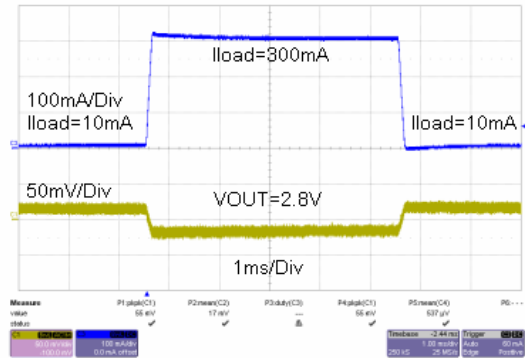
Dropout Voltage vs. Temperature



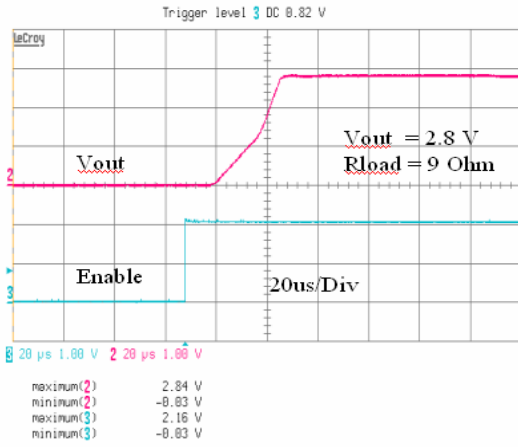
Load Transient Response (1)



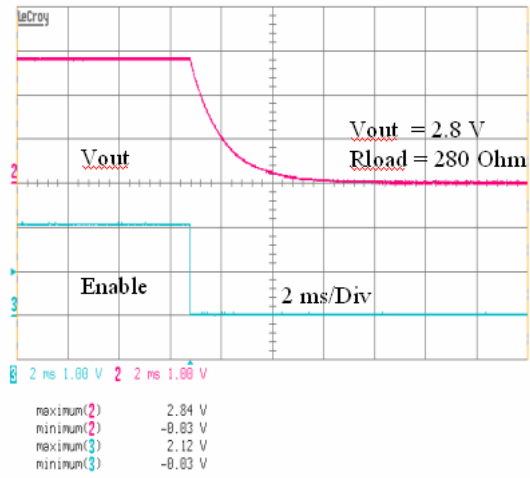
Load Transient Response (2)



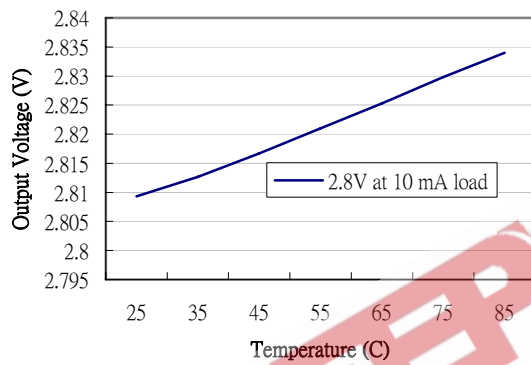
Shutdown Exit Delay



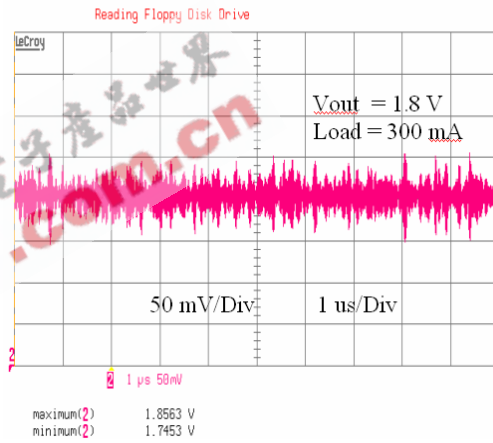
Shutdown Delay



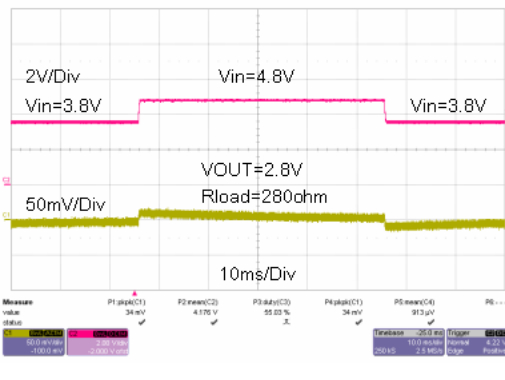
Output Voltage vs. Temperature



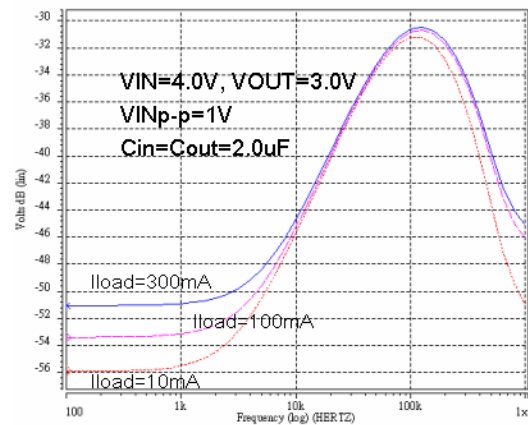
Output Noise Measurement



Line Transient Response (10mA)



PSRR vs Frequency



Functional Block Diagram

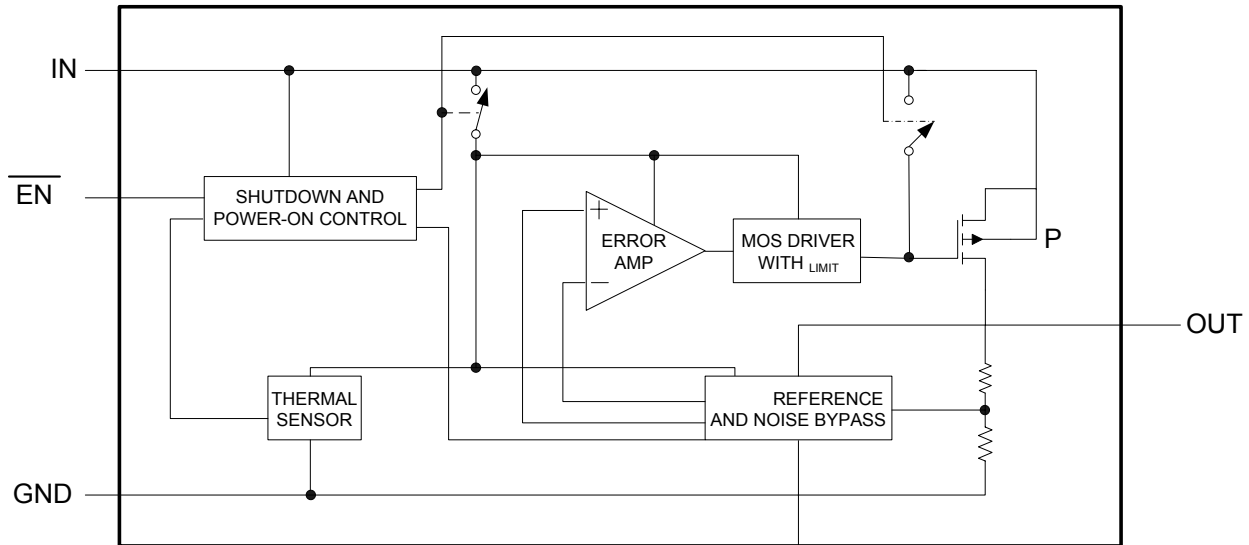


Figure 3. Block Diagram

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 μF . 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 $^{\circ}$ 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 $^{\circ}$ 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

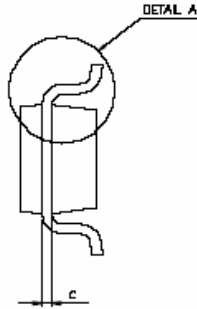
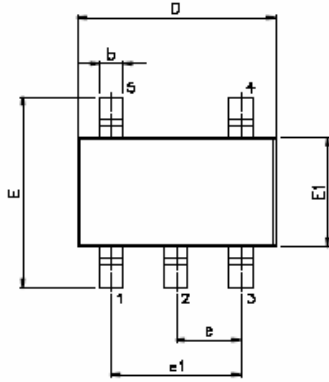
Enable/Shutdown

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.

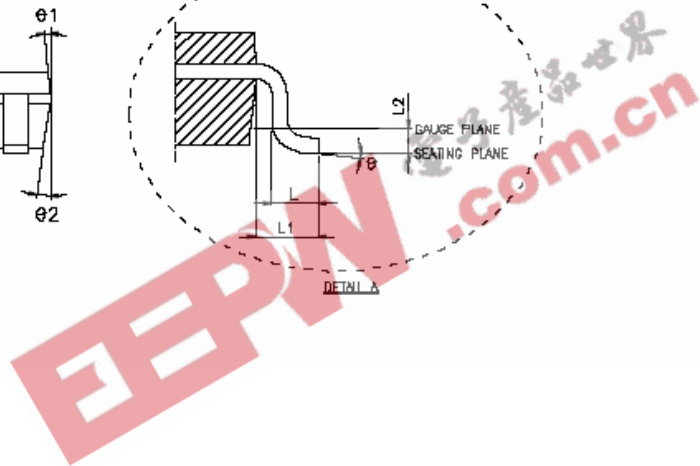
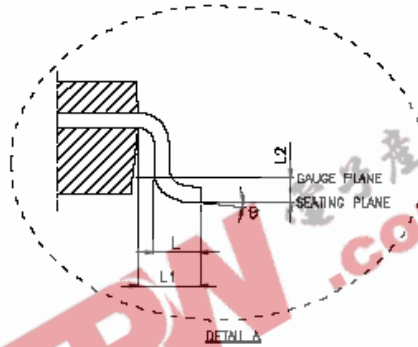
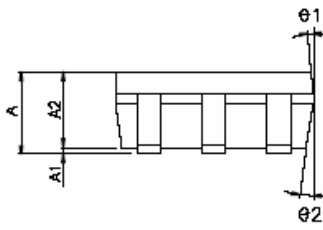
SOT-25 Package Information



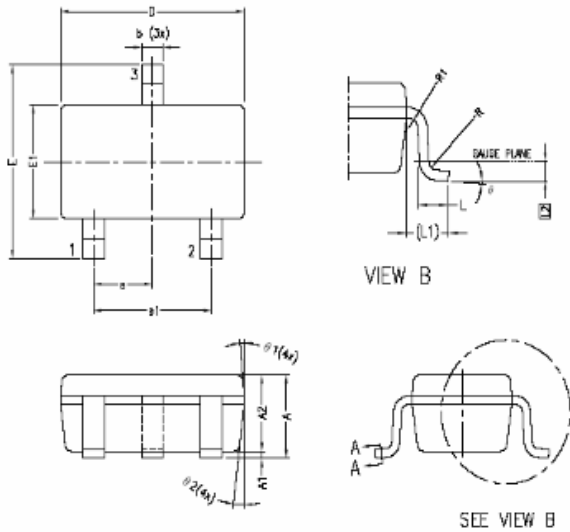
VARIATION (ALL DIMENSIONS SHOWN IN MM)

SYMBOL	MIN.	NGM.	MAX.
A	1.05	1.20	1.35
A1	0.05	0.10	0.15
A2	1.00	1.10	1.20
b	0.25	-	0.50
c	0.08	-	0.20
D	2.70	2.90	3.00
E	2.60	2.90	3.00
E1	1.50	1.80	1.70
e	0.95 BSC.		
e1	1.80 BSC.		
L	0.30	0.45	0.55
L1	0.60 REF.		
L2	0.25 BSC.		
Ø	Ø	5°	10°
Ø1	3°	5°	7°
Ø2	8°	8°	10°

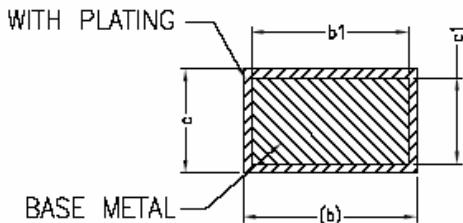
NOTE : 1. JEDEC OUTLINE : MO-17B AA



SOT-23 Package Information



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.05	1.20	1.35
A1	0.05	0.10	0.15
A2	1.00	1.10	1.20
b	0.30	—	0.50
b1	0.30	0.35	0.45
c	0.08	—	0.22
c1	0.08	0.13	0.20
D	2.80	2.90	3.00
E	2.80	2.80	3.00
E1	1.50	1.80	1.70
e	0.95 BSC		
e1	1.90 BSC		
L	0.35	0.43	0.80
L1	0.60 REF		
L2	0.25 BSC.		
R	0.10	—	—
R1	0.10	—	0.25
B	5°	4°	8°
θ1	5°	6°	15°
θ2	5°	8°	15°

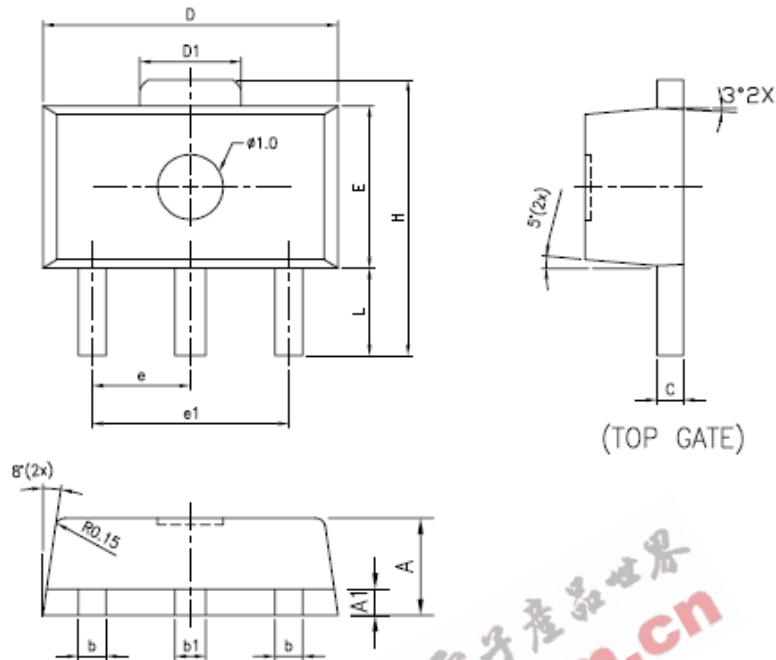


SECTION A-A

NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS SHALL NOT EXCEED 0.25mm PER END.
DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 PER SIDE.
- THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM.
DIMENSIONS D AND E1 ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, THE BAR BURRS. GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY..
- DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION.
ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08mm TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT . MINMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD SHALL NOT BE LESS THAN 0.07mm
- LEAD FRAME MATERIAL:EFTEC 64T

SOT-89 Package Information



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.40	1.50	1.60	0.055	0.059	0.063
A1	0.30	0.40	0.50	0.011	0.015	0.019
L	0.80	—	1.20	0.031	—	0.047
b	0.36	0.42	0.48	0.014	0.016	0.018
b1	0.41	0.47	0.53	0.016	0.018	0.020
C	0.38	0.40	0.43	0.014	0.015	0.017
D	4.40	4.50	4.60	0.173	0.177	0.181
D1	1.40	1.60	1.75	0.055	0.062	0.069
H	3.94	—	4.25	0.155	—	0.167
E	2.40	2.50	2.60	0.094	0.098	0.102
e1	2.90	3.00	3.10	0.114	0.118	0.122
e	1.45	1.50	1.55	0.057	0.059	0.061

NOTES:

1. CONTROLLING DIMENSION : mm
2. LEAD FRAME MATERIAL : COPPER