## Description

The YB1300S is a switched capacitor DC/DC boost converter that produces a regulated 5V output. The input voltage range is from 2.7V to 5.0V that makes the YB1300S ideally for a single cell Li-Ion battery source.

The YB1300S works well for step-up applications without the need for an inductor. The 1MHz switching frequency allows the use of small SMD capacitors. The YB1300S provides thermal protection, short-circuit current limit protection. In order to prevent in-rush current effectively, it provides automatic soft-start. The shutdown current is less than 0.1μA. The YB1300S is available in a 6-pin SOT23 package.

## Features

- Switched-Capacitor Step-Up Operation
- Input Range : 2.7V to 5.0V
- Shutdown Mode
- 5V/4.5V Fix Output Voltage
- 1MHz Internal Oscillator
- Thermal Protection Shutdown
- Output Short-circuit Current Limit Protection
- Automatic Soft-Start Reduces In-Rush Current
- SOT23-6 Package

## Applications

- Cellular Phones
- White LED Drivers
- Smart Card Reader
- PCMCIA Cards
- Li-Ion Battery Backup Supplies

## Typical Application Circuit

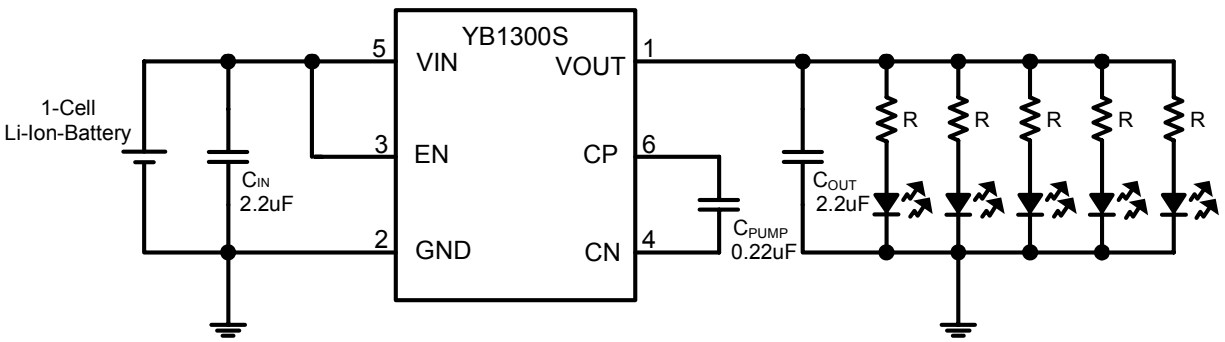



**Figure 1: Typical Application Circuit**

## Pin Configuration

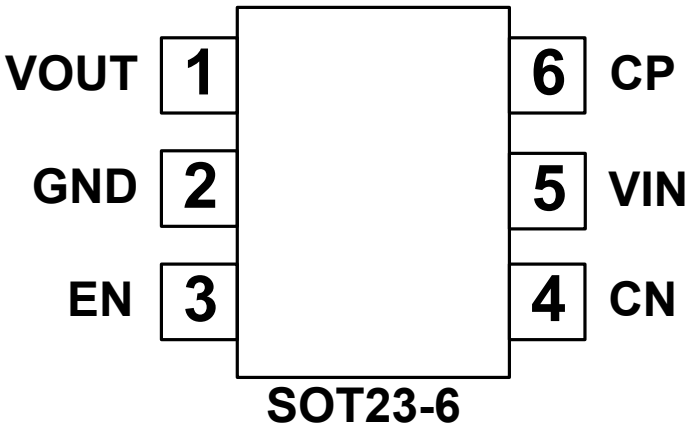



**Figure 2: Pin Configuration**

## Pin Description

**Table 1**

| Pin | Name | Description |
|---|---|---|
| 1 | VOUT | Regulated output voltage. $V_{OUT}$ should be bypassed with a low ESR capacitor for the best performance. |
| 2 | GND | Ground pin. |
| 3 | EN | 1.2V or above will turn on the IC. Below 0.4V will put the chip in the shutdown mode. |
| 4 | CN | Pumping capacitor negative terminal. |
| 5 | VIN | Input supply voltage. $V_{IN}$ should be bypassed with a 2.2μF low ESR capacitor. |
| 6 | CP | Pumping capacitor positive terminal. |

## Ordering Information

| Order Number | Package Type | Supplied As | Package Marking |
|---|---|---|---|
| YB1300ST26S450 | SOT23-6 | 3000 Units Tape & Reel | TBB |
| YB1300ST26S500 | SOT23-6 | 3000 Units Tape & Reel | TBA |

## Absolute Maximum Ratings (Note 1)

Supply Voltage.....5.5V
Output Voltage.....5.5V
Output Short-Circuit Duration..... Continuous
Junction Temperature Range..... 125°C
Storage Temperature Range..... -65°C to 150°C
Lead Temperature..... 250°C
ESD HBM (Human Body Mode) ..... 2KV
ESD MM (Machine Mode).....200V

## Recommended Operating Conditions

(Note 2)

Input Supply Voltage..... 2.7V to 5V
Operating Temperature.....-40°C to 85°C

## Thermal Information

(Note 3)

SOT23-6 $\theta_{JA}$..... .220℃/W

**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

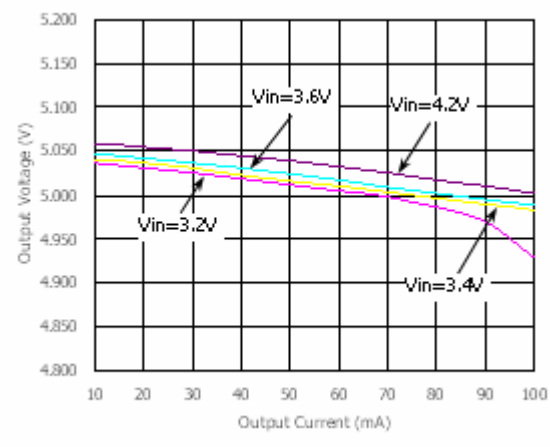
**Table 2**
**($V_{IN}$ = 3.2V, $I_{OUT}$ = 10mA, $C_{IN}$ = $C_{OUT}$ =2.2μF, $C_{PUMP}$ = 0.22μF, $V_{EN}$ = $V_{IN}$, $T_A$=25°C, unless otherwise noted.)**

| Description | Symbol | Test Conditions | MIN | TYP | MAX | Units |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | 2.7 | | 5.0 | V |
| Output Voltage | $V_{OUT}$ | $V_{IN}$ = 3.3V, $I_{OUT}$ = 60mA | 4.8 | 5.0 | 5.2 | V |
| Maximum Output Current | $I_{OUT}$ | $V_{IN}$ = 3.2V | 100 | | 250 | mA |
| Short Circuit Current | $I_{SC}$ | $V_{IN}$ = 4.5V | | 80 | | mA |
| Oscillator Frequency | $F_{OSC}$ | | 0.8 | 1 | 1.2 | MHz |
| Efficiency | η | $I_{OUT}$ = 20mA, $V_{IN}$ =2.7V | | 90 | | % |
| Ripple Voltage | $V_R$ | $V_{IN}$ =3.4V, $I_{OUT}$ =60mA | | 35 | | $mV_{PP}$ |
| Enable Control (High) | $V_{IH}$ | $V_{IN}$ = 5.0V | 1.2 | | $V_{IN}$ | V |
| Enable Control (Low) | $V_{IL}$ | $V_{IN}$ = 5.0V | -0.2 | | 0.4 | V |
| Thermal Shutdown | $T_{ST}$ | Shutdown Temperature | | 160 | | ℃ |
| Thermal Recovery | $T_{RT}$ | Recovery Temperature | | 140 | | ℃ |
| Supply Current (Quiescent) | $I_{QC}$ | $V_{IN}$ = 3.4V, $I_{OUT}$ = 0mA | | 1 | | mA |
| Supply Current (Shutdown) | $I_{SD}$ | $V_{IN}$ = 2.7 to 5.0V, Enable = 0V | | 0.1 | | μA |

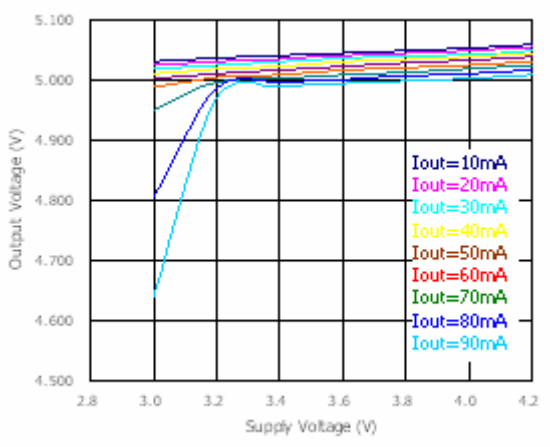
## Typical Performance Characteristics

**$V_{IN}$ = 3.2V, $I_{OUT}$ = 10mA, $C_{IN}$ = $C_{OUT}$ =2.2µF, $C_{PUMP}$ = 0.22µF, $V_{EN}$ = $V_{IN}$, $T_A$=25°C, unless otherwise noted.**

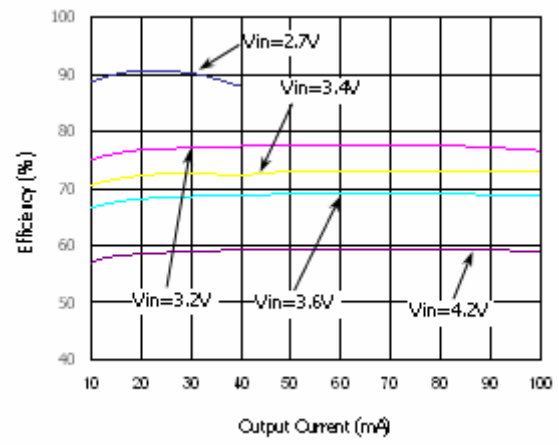
### Output Voltage vs. Output Current



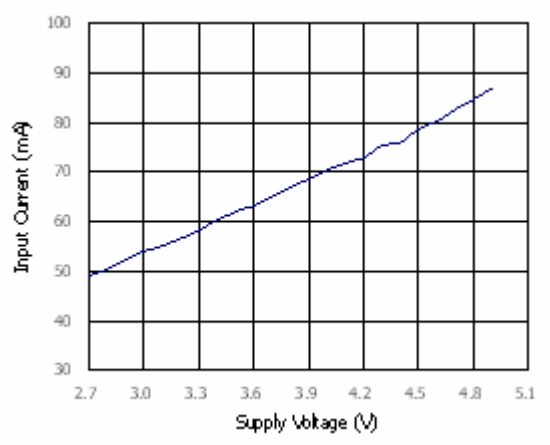

### Output Voltage vs. Input Voltage



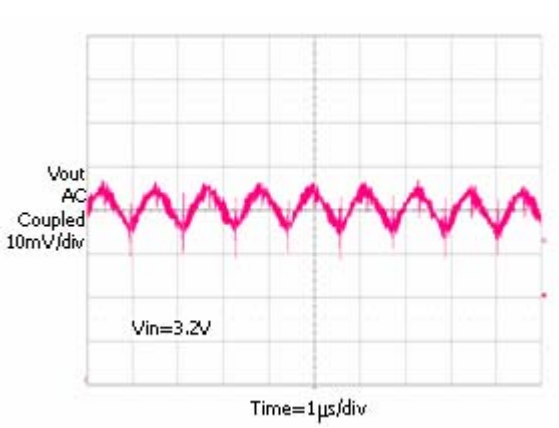

### Efficiency vs. Output Current



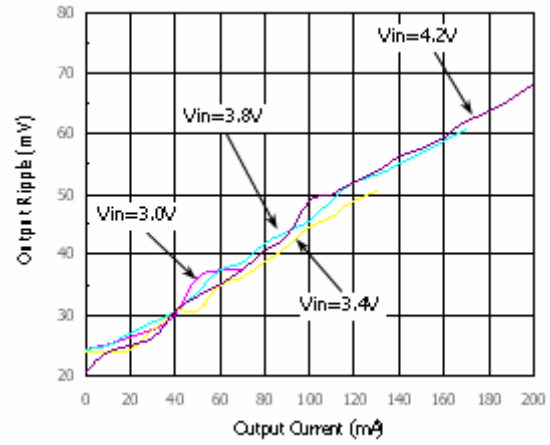

### Input Short-Circuit Current vs. Input Voltage



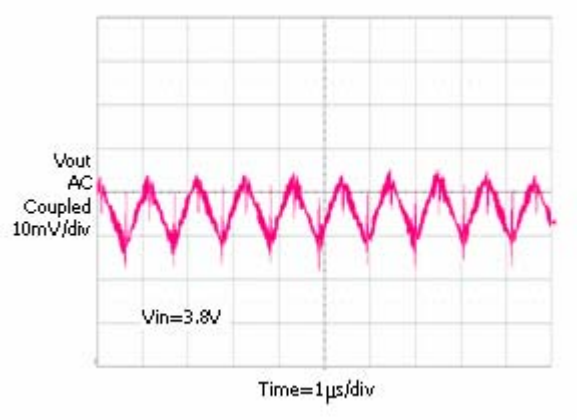

### Output Ripple with $I_{OUT}$ = 60mA



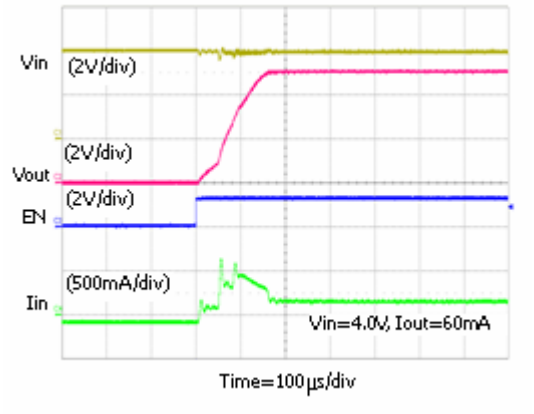

### Output Ripple vs. Output Current



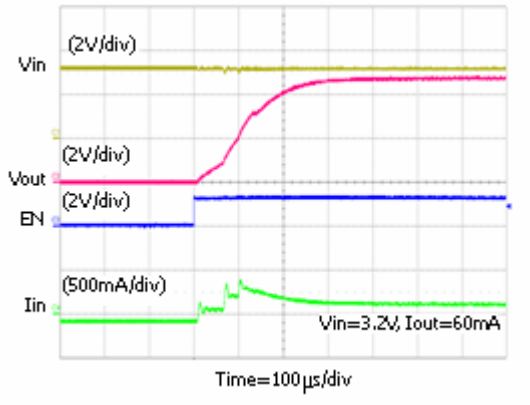
### Output Ripple with $I_{OUT}$ = 100mA



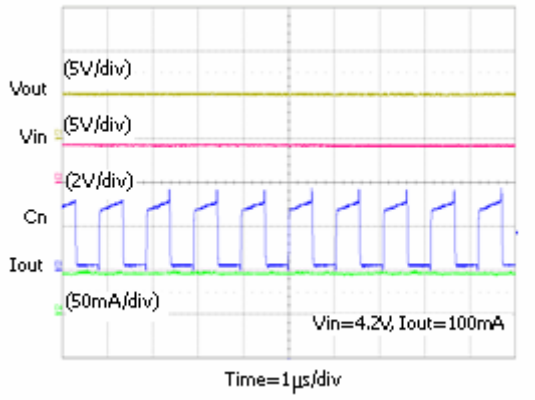

### Inrush Current and Start Up Time



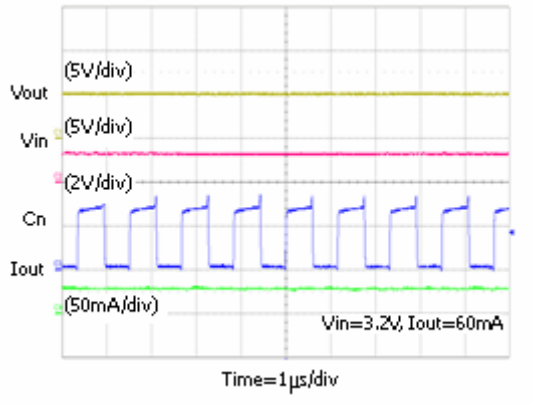

### Inrush Current and Start Up Time



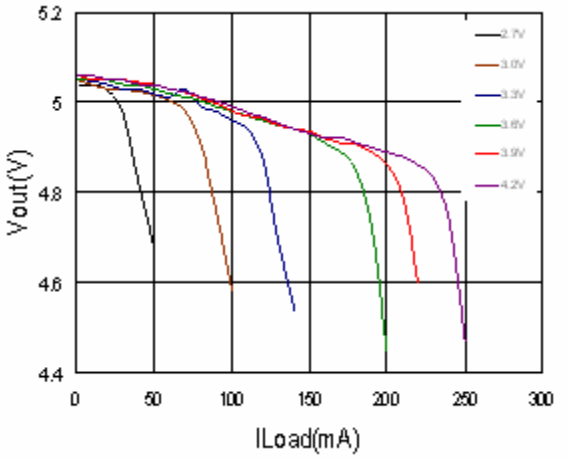

### Normal Operation




### Normal Operation




### Output Voltage vs. Output Current



## Function Block

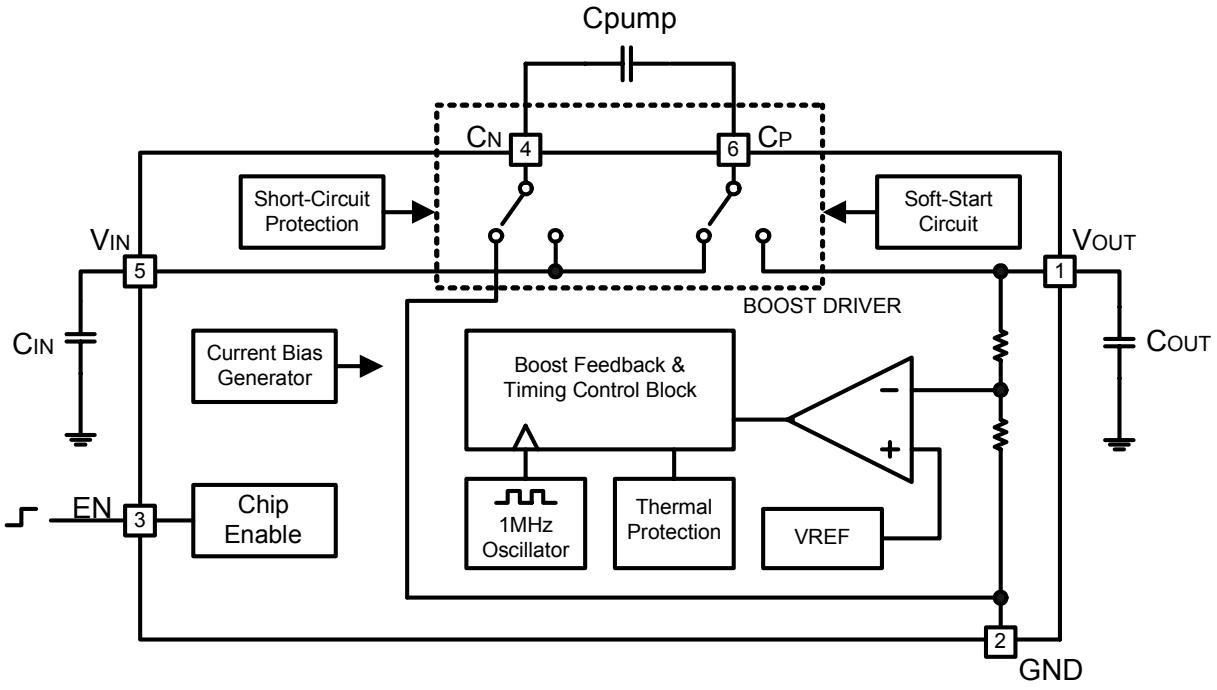



**Figure 3: Function Block**

## Function Description

The YB1300S regulated charge pump provides a regulated 5V output voltage for input voltages between 2.7V and 5V. This is accomplished by a step-up or boost mode of operation. A conversion clock of 50% duty cycle is generated. During the first half cycle, the pumping capacitor $C_{PUMP}$ charges to $V_{IN}$. During the second half cycle, the voltage on $C_{PUMP}$ is added to $V_{IN}$, then deliver to $V_{OUT}$. The output voltage is regulated by skipping clock cycles as necessary.

### Soft-Start and Short-Circuit Protection Circuitry

The YB1300S includes soft-start circuitry to limit inrush current at turn-on. When starting up, the output capacitor is charged through the charge-pump capacitor with a limited current source. When the output voltage approached to its design value, the soft-start is terminated and normal operation begins. If an overload condition occurs, for example, the output is shorted to ground, the output current is limited by the YB1300S switching technique.

### Thermal Protection

The regulator has thermal shutdown circuitry that protects it from damage caused by high temperature conditions. The thermal protection circuitry shut down the device when the junction temperature reached approximately 160℃, allowing the device to cool. When the junction temperature cools to approximately 140℃,

the device is automatically reenabled. Continuously running the regulator into thermal shutdown can degrade reliability.

**Shutdown Mode**

A control pin on the regulator can be used to place the device into an energy-saving shutdown mode. In this mode, the output is disconnected from the input.

## Layout Consideration

Due to large transient currents and high switching frequency produced by the YB1300S, careful consideration of PCB layout is necessary. In order to minimize both input and output ripple, keep the capacitors as close as possible to the regulator using short, direct circuit traces. A ground plane and short connections to all capacitors will improve performance and ensure proper regulation under all conditions. Figure 4 and Figure 5 show the recommended layout configuration.

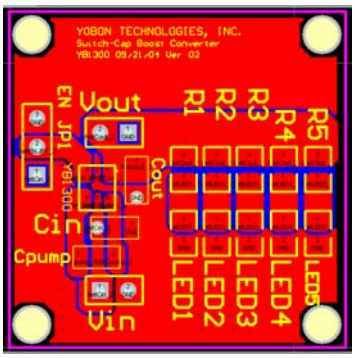



**Figure 4: Top Layer**

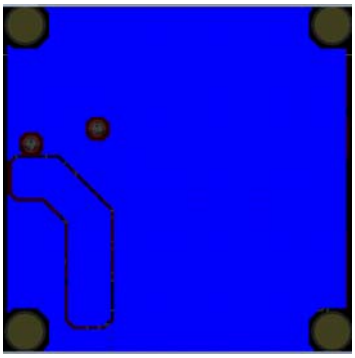
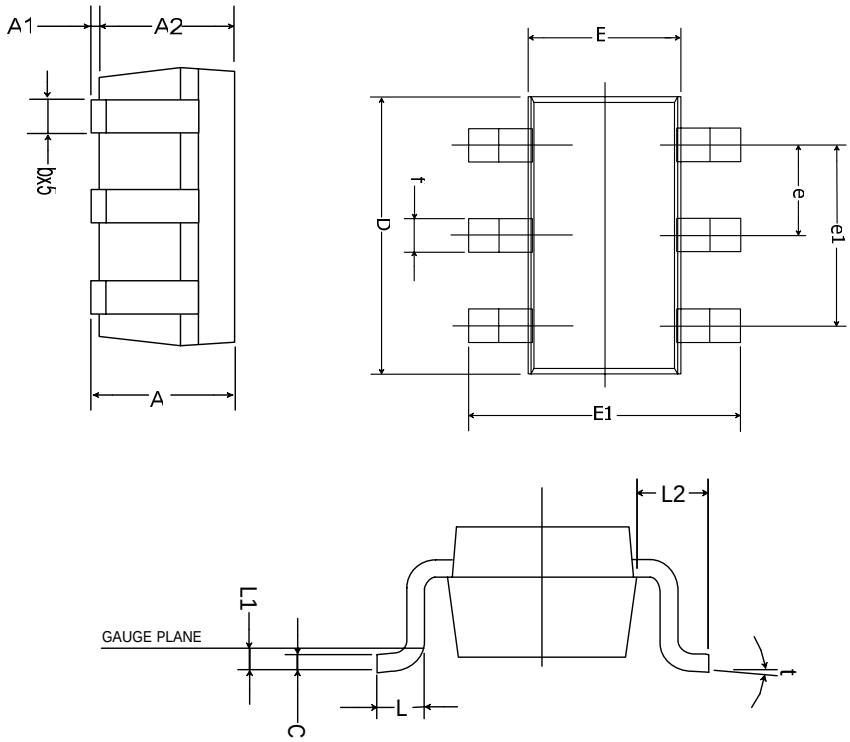


**Figure 5: Bottom Layer**

## Package Information (SOT23-6)




| 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. | |
| f | 0.50 BSC. | | .0197 BSC. | |
| L | 0.35 | 0.55 | .0137 | .0216 |
| L1 | 0.10 BSC. | | .0039 BSC. | |
| L2 | 0.60 BSC. | | .0236 BSC. | |
| t | 0° | 8° | 0° | 8° |

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