

## AME8847

## 800mA CMOS LDO

### ■ General Description

The AME8847 of positive, linear regulators feature low quiescent current (30 $\mu$ A typ.) with low dropout voltage, making them ideal for battery applications. The space-saving SOT-223 & SOT-89 packages are attractive for "Pocket" and "Hand Held" applications.

These rugged devices have both thermal shutdown, and current fold-back to prevent device failure under the "Worst" operating conditions.

The AME8847 is stable with an output capacitance of 2.2 $\mu$ F or greater.

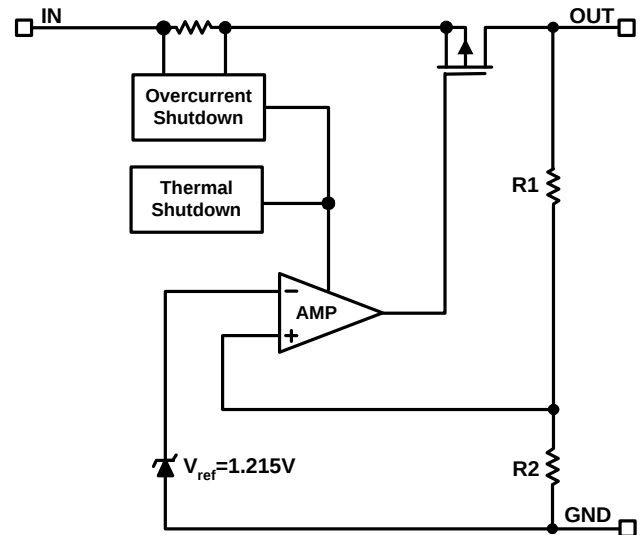
### ■ Features

- Very Low Dropout Voltage
- Guaranteed 800mA Output
- Accurate to within  $\pm 1.5\%$
- 30 $\mu$ A Quiescent Current
- Over-Temperature Shutdown
- Current Limiting
- Short Circuit Current Fold-back
- Space-Saving SOT-223 & SOT-89 Packages
- Factory Pre-set Output Voltages
- Low Temperature Coefficient
- All AME's Lead Free Products Meet RoHS Standards

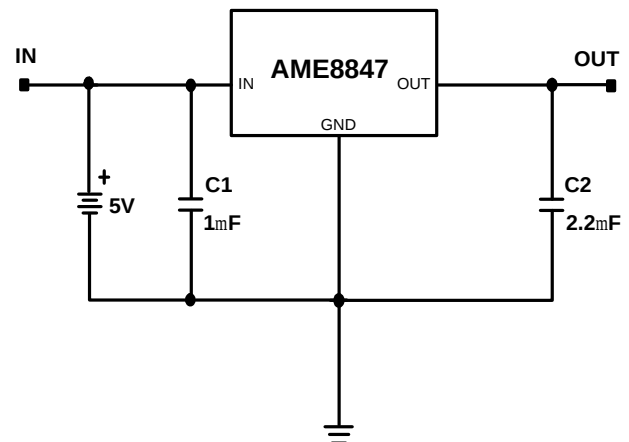
### ■ Applications

- Instrumentation
- Portable Electronics
- Wireless Devices
- Cordless Phones
- PC Peripherals
- Battery Powered Widgets

### ■ Functional Block Diagram



### ■ Typical Application

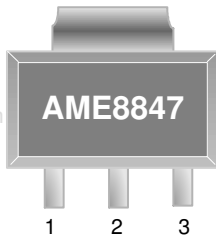


## AME8847

## 800mA CMOS LDO

### ■ Pin Configuration

SOT-223  
Top View

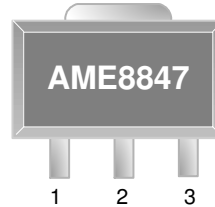


AME8847AEGT

1. GND
2. OUT (TAB)
3. IN

\* Die Attach:  
Non-Conductive Epoxy

SOT-89  
Top View

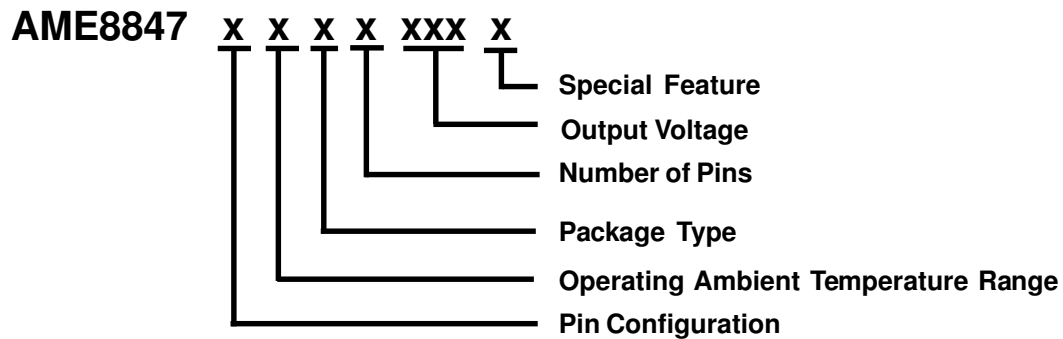


AME8847AEFT

1. GND
2. IN (TAB)
3. OUT

\* Die Attach:  
Non-Conductive Epoxy

### ■ Ordering Information



| Pin Configuration                                                                   | Operating Ambient Temperature Range | Package Type            | Number of Pins | Output Voltage                            | Special Feature |
|-------------------------------------------------------------------------------------|-------------------------------------|-------------------------|----------------|-------------------------------------------|-----------------|
| A: 1. GND<br>(SOT-89) 2. IN<br>3. OUT<br><br>A: 1. GND<br>(SOT-223) 2. OUT<br>3. IN | E: -40°C to 85°C                    | F: SOT-89<br>G: SOT-223 | T: 3           | 180: V=1.8V<br>250: V=2.5V<br>330: V=3.3V | Z: Lead Free    |



■ Ordering Information

| Part Number     | Marking*       | Output Voltage | Package | Operating Ambient Temperature Range |
|-----------------|----------------|----------------|---------|-------------------------------------|
| AME8847AEFT180Z | A8847<br>A18ww | 1.8V           | SOT-89  | - 40°C to 85°C                      |
| AME8847AEGT180Z | BHlyww         | 1.8V           | SOT-223 | - 40°C to 85°C                      |
| AME8847AEFT250Z | A8847<br>A25ww | 2.5V           | SOT-89  | - 40°C to 85°C                      |
| AME8847AEGT250Z | BHJyww         | 2.5V           | SOT-223 | - 40°C to 85°C                      |
| AME8847AEFT330Z | A8847<br>A33ww | 3.3V           | SOT-89  | - 40°C to 85°C                      |
| AME8847AEGT330Z | BFWyww         | 3.3V           | SOT-223 | - 40°C to 85°C                      |

Note: ww & yww represents the date code pls refer to Date Code Rule on Package Dimension.

\* A line on top of the first letter represents lead free plating such as A8847

Please consult AME sales office or authorized Rep./Distributor for output voltage and package type availability.

## ■ Absolute Maximum Ratings

| Parameter             | Maximum                     | Unit |
|-----------------------|-----------------------------|------|
| Input Voltage         | 8                           | V    |
| Output Current        | 1                           | A    |
| Input, Output Voltage | GND - 0.3 to $V_{IN} + 0.3$ | V    |
| ESD Classification    | B*                          |      |

Caution: Stress above the listed absolute maximum rating may cause permanent damage to the device.

\*HBM B:2000V~3999V

## ■ Recommended Operating Conditions

| Parameter                  | Symbol    | Rating      | Unit |
|----------------------------|-----------|-------------|------|
| Ambient Temperature Range  | $T_A$     | - 40 to 85  | °C   |
| Junction Temperature Range | $T_J$     | - 40 to 125 | °C   |
| Storage Temperature Range  | $T_{STG}$ | - 65 to 150 | °C   |

## ■ Thermal Information

| Parameter                                   | Package | Die Attach              | Symbol        | Maximum | Unit   |
|---------------------------------------------|---------|-------------------------|---------------|---------|--------|
| Thermal Resistance*<br>(Junction to Case)   | SOT-89  | Non-Conductive<br>Epoxy | $\theta_{JC}$ | 46      | °C / W |
|                                             | SOT-223 |                         |               | 31      |        |
| Thermal Resistance<br>(Junction to Ambient) | SOT-89  |                         | $\theta_{JA}$ | 180     | °C / W |
|                                             | SOT-223 |                         |               | 135     |        |
| Internal Power Dissipation                  | SOT-89  |                         | $P_D$         | 550     | mW     |
|                                             | SOT-223 |                         |               | 800     |        |
| Solder Iron(10 Sec)**                       |         |                         |               | 350     | °C     |

\* Measure  $\theta_{JC}$  on backside center of tab.

\*\* MIL-STD-202G 210F

## ■ Electrical Specifications

$T_A = 25^\circ\text{C}$  unless otherwise noted

| Parameter                              | Symbol       | Test Condition                                                           |                                                  | Min    | Typ       | Max  | Units                 |
|----------------------------------------|--------------|--------------------------------------------------------------------------|--------------------------------------------------|--------|-----------|------|-----------------------|
| Input Voltage                          | $V_{IN}$     |                                                                          |                                                  | Note 1 |           | 7    | V                     |
| Output Voltage Accuracy                | $V_{OUT}$    | $I_{OUT} = 1\text{mA}$                                                   |                                                  | -1.5   |           | 1.5  | %                     |
| Dropout Voltage                        | $V_{DROP}$   | $I_{OUT} = 800\text{mA}$<br>$V_{OUT} = V_{OUT(NOM)} - 2.0\%$             | $1.8\text{V} \leq V_{OUT(NOM)} \leq 2.0\text{V}$ |        | See chart | 1400 | mV                    |
|                                        |              |                                                                          | $2.0\text{V} < V_{OUT(NOM)} \leq 2.8\text{V}$    |        |           | 1000 |                       |
|                                        |              |                                                                          | $2.8\text{V} < V_{OUT(NOM)}$                     |        |           | 800  |                       |
| Output Current                         | $I_{OUT}$    | $V_{OUT} \geq 1.8\text{V}$                                               |                                                  | 800    |           |      | mA                    |
| Output Current Limit                   | $I_{LIM}$    | $V_{OUT} \geq 1.8\text{V}$                                               |                                                  | 900    |           |      | mA                    |
| Output Short Circuit Current           | $I_{SC}$     | $V_{OUT} < 0.8\text{V}$                                                  |                                                  |        | 400       | 800  | mA                    |
| Quiescent Current                      | $I_Q$        | $I_{OUT} = 0\text{mA}$                                                   |                                                  |        | 30        | 50   | $\mu\text{A}$         |
| Ground Pin Current                     | $I_{GND}$    | $I_{OUT} = 1\text{mA to } 800\text{mA}$                                  |                                                  |        | 35        |      | $\mu\text{A}$         |
| Output Voltage Line Regulation         | $REG_{LINE}$ | $I_{OUT} = 1\text{mA}$<br>$V_{IN} = V_{OUT} + 1 \text{ to } V_{OUT} + 2$ | $1.8\text{V} \leq V_{OUT} \leq 2.0\text{V}$      | -0.15  |           | 0.15 | %                     |
|                                        |              |                                                                          | $2.0\text{V} < V_{OUT} < 4.0\text{V}$            | -0.1   | 0.02      | 0.1  |                       |
|                                        |              |                                                                          | $V_{OUT} \geq 4.0\text{V}$                       | -0.4   | 0.2       | 0.4  |                       |
| Output Voltage Load Regulation         | $REG_{LOAD}$ | $I_{OUT} = 1\text{mA to } 800\text{mA}$                                  |                                                  |        | 0.2       | 1    | %                     |
| Thermal Shutdown Temperature           | $T_{SHDN}$   |                                                                          |                                                  |        | 150       |      | $^\circ\text{C}$      |
| Temperature Hysteresis                 | $T_{HYS}$    |                                                                          |                                                  |        | 30        |      | $^\circ\text{C}$      |
| Output Voltage Temperature Coefficient | $T_C$        |                                                                          |                                                  |        | 30        |      | ppm/ $^\circ\text{C}$ |
| Power Supply Ripple Rejection          | PSRR         | $I_{OUT} = 100\text{mA}$<br>$C_{OUT} = 2.2\mu\text{F}$                   | $f = 100\text{Hz}$                               |        | 60        |      | dB                    |
|                                        |              |                                                                          | $f = 1\text{KHz}$                                |        | 50        |      |                       |
|                                        |              |                                                                          | $f = 10\text{KHz}$                               |        | 20        |      |                       |
| Output Voltage Noise                   | $e_N$        | $f = 10\text{Hz to } 100\text{KHz}$<br>$I_{OUT} = 10\text{mA}$           | $C_{OUT} = 2.2\mu\text{F}$                       |        | 30        |      | $\mu\text{Vrms}$      |

Note1:  $V_{IN(MIN)} = V_{OUT} + V_{DROP}$

Note2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.



## ■ Detailed Description

The AME8847 of CMOS regulators contains a PMOS pass transistor, voltage reference, error amplifier, over-current protection, and thermal shutdown.

The P-channel pass transistor receives data from the error amplifier, over-current shutdown, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds 150°C, or the current exceeds 900mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120°C.

The AME8847 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress. The AME8847 also incorporates current foldback to reduce power dissipation when the output is short circuited. This feature becomes active when the output drops below 0.8 volts, and reduces the current flow by 65%. Full current is restored when the voltage exceeds 0.8 volts.

## ■ External Capacitors

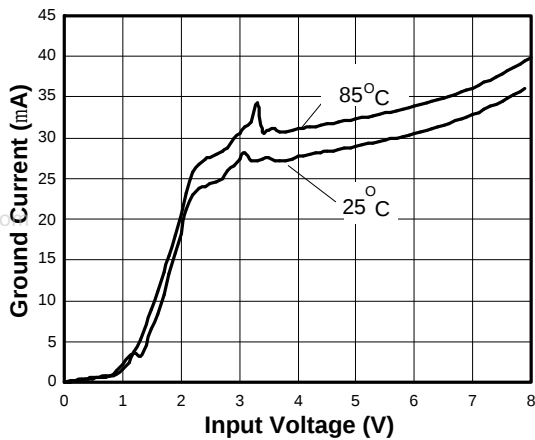
The AME8847 is stable with an output capacitor to ground of 2.2μF or greater. Ceramic capacitors have the lowest ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the highest ESR, resulting in the poorest AC response. Unfortunately, large value ceramic capacitors are comparatively expensive. One option is to parallel a 0.1μF ceramic capacitor with a 10μF Aluminum Electrolytic. The benefit is low ESR, high capacitance, and low overall cost.

A second capacitor is recommended between the input and ground to stabilize  $V_{in}$ . The input capacitor should be at least 0.1μF to have a beneficial effect.

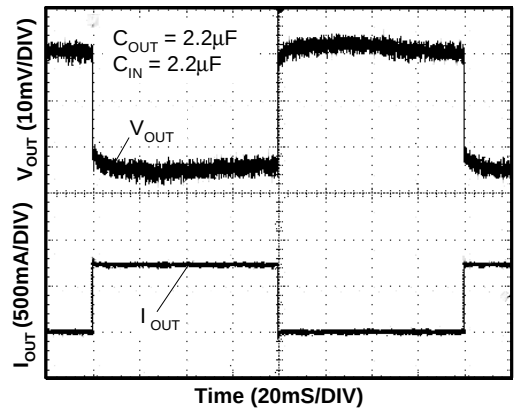
All capacitors should be placed in close proximity to the pins. A "Quiet" ground termination is desirable. This can be achieved with a "Star" connection.



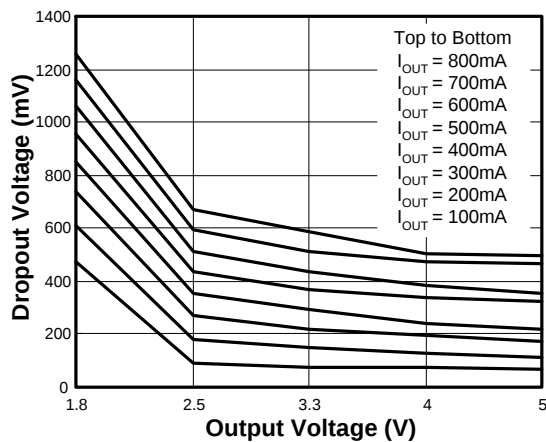
Ground Current vs. Input Voltage



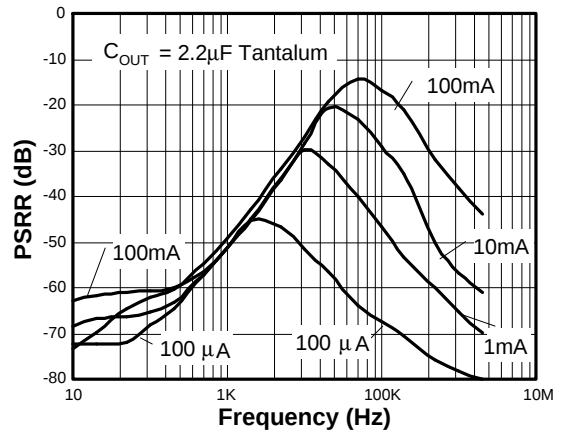
Load Step (1mA-800mA)



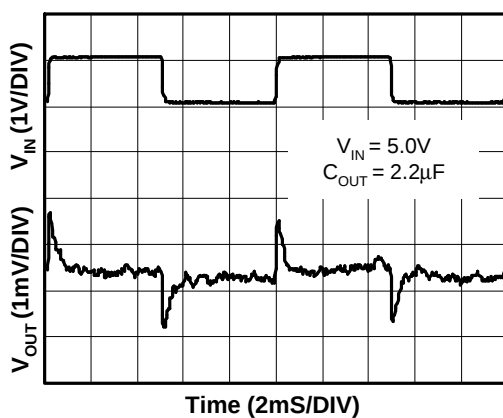
Dropout Voltage vs. Output Voltage



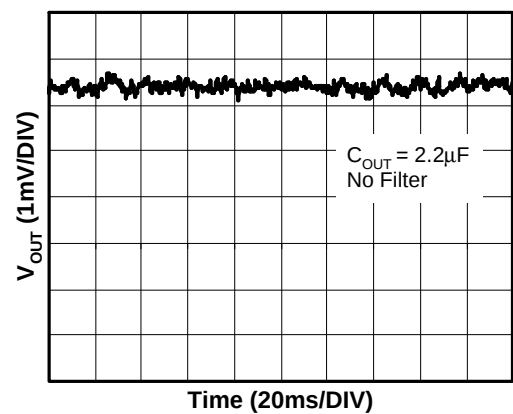
Power Supply Ripple Rejection Ratio



Line Transient Response

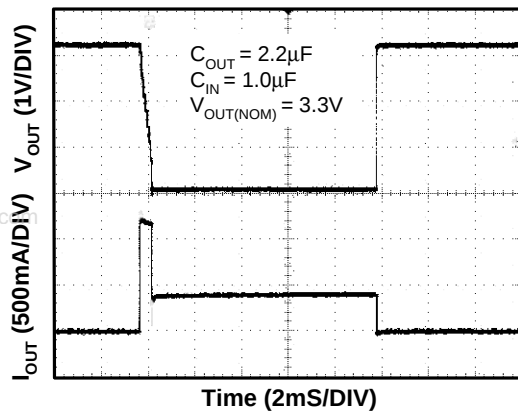


Noise Measurement

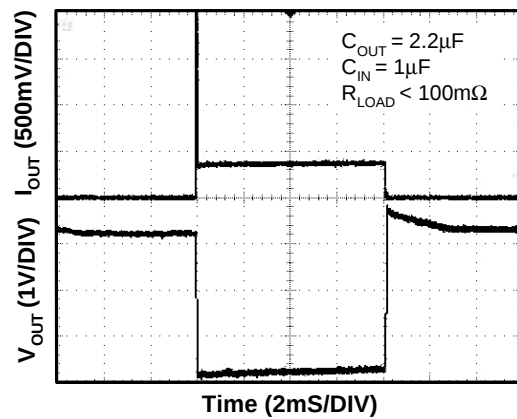




Current Limit Response



Short Circuit Response



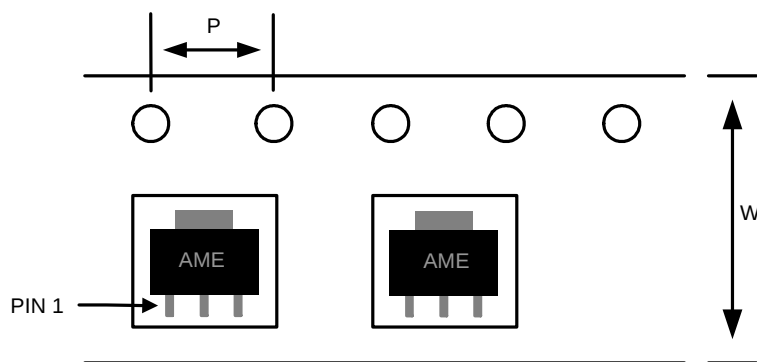


### ■ Date Code Rule

| Marking |          |          | Date Code |          | Year |
|---------|----------|----------|-----------|----------|------|
| A       | A        | A        | W         | W        | xxx0 |
| A       | A        | A        | W         | <u>W</u> | xxx1 |
| A       | A        | A        | <u>W</u>  | W        | xxx2 |
| A       | A        | A        | <u>W</u>  | <u>W</u> | xxx3 |
| A       | A        | <u>A</u> | W         | W        | xxx4 |
| A       | A        | <u>A</u> | W         | <u>W</u> | xxx5 |
| A       | A        | <u>A</u> | <u>W</u>  | W        | xxx6 |
| A       | A        | <u>A</u> | <u>W</u>  | <u>W</u> | xxx7 |
| A       | <u>A</u> | A        | W         | W        | xxx8 |
| A       | <u>A</u> | A        | W         | <u>W</u> | xxx9 |

### ■ Tape and Reel Dimension

#### SOT-89

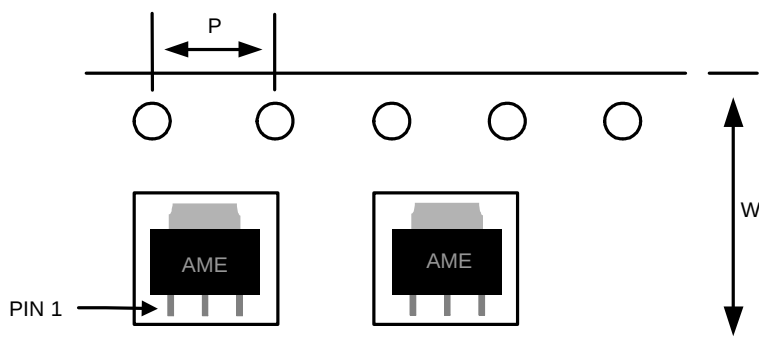


Carrier Tape, Number of Components Per Reel and Reel Size

| Package | Carrier Width (W) | Pitch (P)  | Part Per Full Reel | Reel Size |
|---------|-------------------|------------|--------------------|-----------|
| SOT-89  | 12.0±0.1 mm       | 4.0±0.1 mm | 1000pcs            | 180±1 mm  |

# **■ Tape and Reel Dimension**

## **SOT-223**

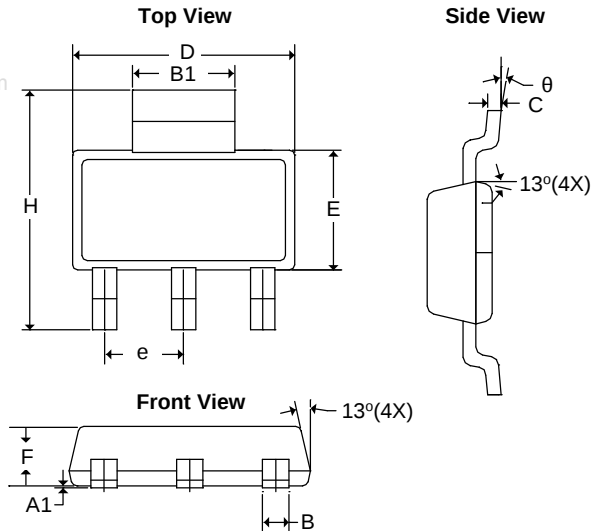


**Carrier Tape, Number of Components Per Reel and Reel Size**

| Package | Carrier Width (W) | Pitch (P)  | Part Per Full Reel | Reel Size |
|---------|-------------------|------------|--------------------|-----------|
| SOT-223 | 12.0±0.1 mm       | 4.0±0.1 mm | 2500pcs            | 330±1 mm  |

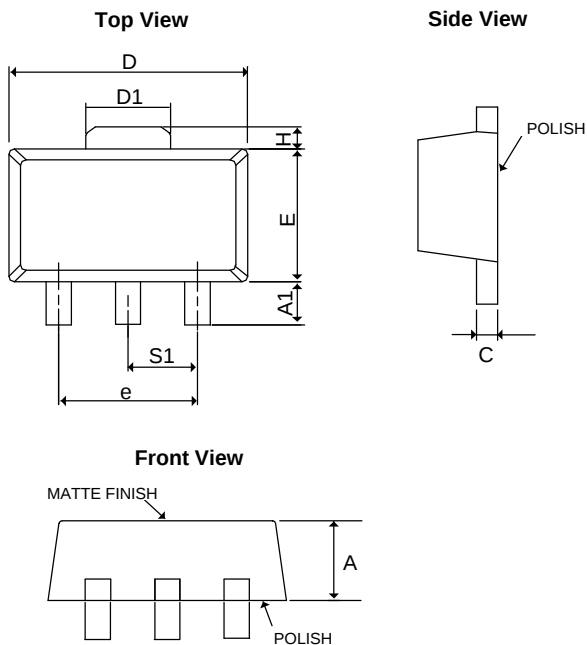
## ■ Package Dimension

### SOT-223



| SYMBOLS        | MILLIMETERS |      | INCHES     |        |
|----------------|-------------|------|------------|--------|
|                | MIN         | MAX  | MIN        | MAX    |
| A <sub>1</sub> | 0.01        | 0.10 | 0.0004     | 0.0039 |
| B              | 0.60        | 0.84 | 0.0236     | 0.0330 |
| B <sub>1</sub> | 2.90        | 3.15 | 0.1140     | 0.1240 |
| C              | 0.24        | 0.38 | 0.0094     | 0.0150 |
| D              | 6.30        | 6.71 | 0.2480     | 0.2640 |
| E              | 3.30        | 3.71 | 0.1299     | 0.1460 |
| e              | 2.30 BSC    |      | 0.0906 BSC |        |
| F              | 1.40        | 1.80 | 0.0551     | 0.0709 |
| H              | 6.70        | 7.30 | 0.2638     | 0.2874 |
| q              | 0°          | 10°  | 0°         | 10°    |

### SOT-89



| SYMBOLS        | MILLIMETERS |      | INCHES    |         |
|----------------|-------------|------|-----------|---------|
|                | MIN         | MAX  | MIN       | MAX     |
| A              | 1.39        | 1.60 | 0.05472   | 0.06299 |
| A <sub>1</sub> | 0.8REF      |      | 0.0315REF |         |
| C              | 0.35        | 0.44 | 0.01378   | 0.01732 |
| D              | 4.39        | 4.60 | 0.17283   | 0.1811  |
| D <sub>1</sub> | 1.35        | 1.83 | 0.05315   | 0.07205 |
| E              | 2.28        | 3.60 | 0.08976   | 0.14173 |
| e              | 3.00REF     |      | 0.1181REF |         |
| H              | 0.70REF     |      | 0.0276REF |         |
| S <sub>1</sub> | 1.50REF     |      | 0.0590REF |         |



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