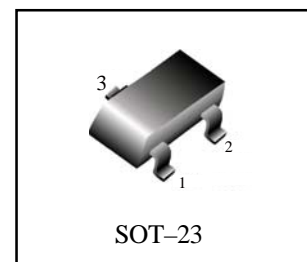


## Darlington Amplifier Transistors

- We declare that the material of product compliance with RoHS requirements.

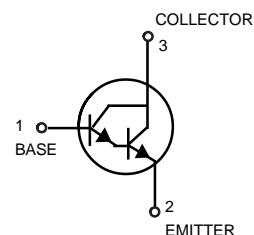
### ORDERING INFORMATION

| Device  | Marking | Shipping         |
|---------|---------|------------------|
| MMBTA13 | 1M      | 3000/Tape & Reel |
| MMBTA14 | 1N      | 3000/Tape & Reel |



### MAXIMUM RATINGS

| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector-Emitter Voltage      | $V_{CES}$ | 30    | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | 30    | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | 10    | Vdc  |
| Collector Current — Continuous | $I_C$     | 300   | mAdc |



### THERMAL CHARACTERISTICS

| Characteristic   | Symbol          | Max         | Unit                       |
|--|-----------------|-------------|----------------------------|
| Total Device Dissipation FR-5 Board, (1)<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$        | $P_D$           | 225<br>1.8  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction to Ambient  | $R_{\theta JA}$ | 556         | $^\circ\text{C}/\text{W}$  |
| Total Device Dissipation<br>Alumina Substrate, (2) $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 300<br>2.4  | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction to Ambient  | $R_{\theta JA}$ | 417         | $^\circ\text{C}/\text{W}$  |
| Junction and Storage Temperature   | $T_J, T_{stg}$  | -55 to +150 | $^\circ\text{C}$           |

### DEVICE MARKING

MMBTA13 = 1M, MMBTA14 = 1N

### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted.)

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

|   |               |    |     |      |
|---|---------------|----|-----|------|
| Collector-Emitter Breakdown Voltage<br>( $I_C = 100 \mu\text{Adc}$ , $V_{BE} = 0$ ) | $V_{(BR)CEO}$ | 30 | —   | Vdc  |
| Collector Cutoff Current<br>( $V_{CB} = 30\text{Vdc}$ , $I_E = 0$ )                 | $I_{CBO}$     | —  | 100 | nAdc |
| Emitter Cutoff Current<br>( $V_{EB} = 10\text{Vdc}$ , $I_C = 0$ )                   | $I_{EBO}$     | —  | 100 | nAdc |

1. FR-5 = 1.0 x 0.75 x 0.062 in.

2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Continued)

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

**ON CHARACTERISTICS (3)**

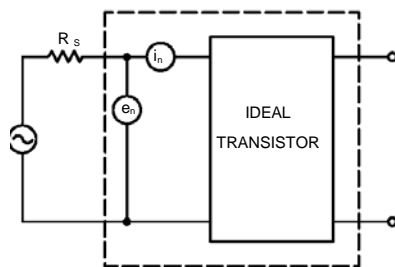
|   |               |        |     |     |
|---|---------------|--------|-----|-----|
| DC Current Gain<br>( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )                     | $h_{FE}$      | 5,000  | —   | —   |
|   | MMBTA13       | 10,000 | —   |     |
|   | MMBTA14       | 10,000 | —   |     |
| ( $I_C = 100 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )                                       | MMBTA13       | 20,000 | —   |     |
|   | MMBTA14       |        |     |     |
| Collector–Emitter Saturation Voltage<br>( $I_C = 100 \text{ mAdc}$ , $I_B = 0.1 \text{ mAdc}$ ) | $V_{CE(sat)}$ | —      | 1.5 | Vdc |
| Base–Emitter On Voltage<br>( $I_C = 100 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )            | $V_{BE}$      | —      | 2.0 | Vdc |

**SMALL–SIGNAL CHARACTERISTICS**

|   |       |     |   |     |
|---|-------|-----|---|-----|
| Current – Gain–Bandwidth Product(4)<br>( $V_{CE} = 5.0 \text{ Vdc}$ , $I_C = 10 \text{ mAdc}$ , $f = 100 \text{ MHz}$ ) | $f_T$ | 125 | — | MHz |
|---|-------|-----|---|-----|

3. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

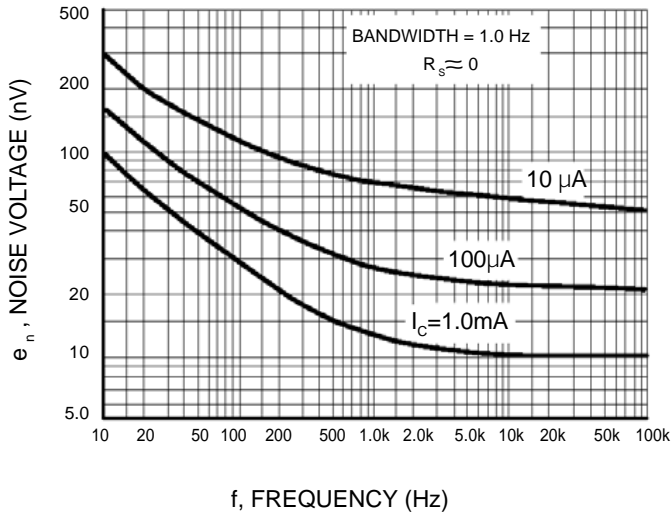
4.  $f_T = |h_{fe}| \cdot f_{test}$ .



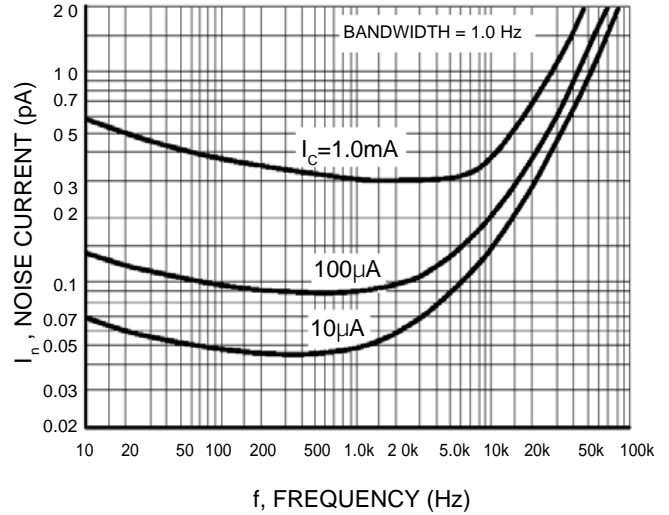
**Figure 1. Transistor Noise Model**

## NOISE CHARACTERISTICS

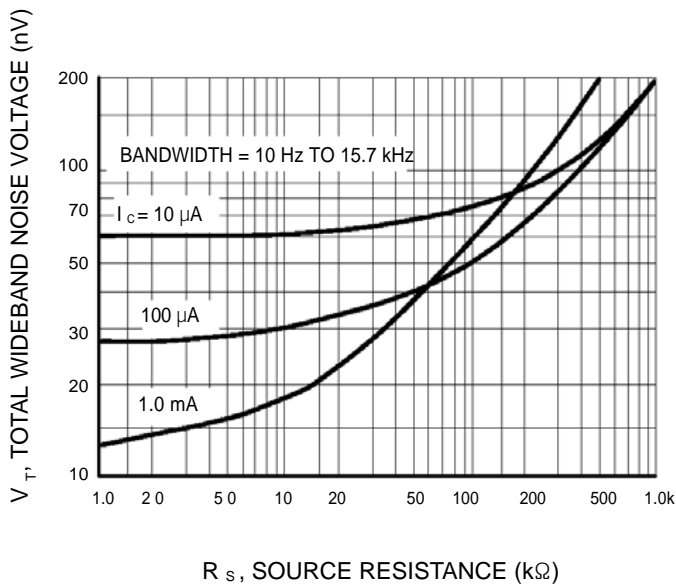
( $V_{CE} = 5.0 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )



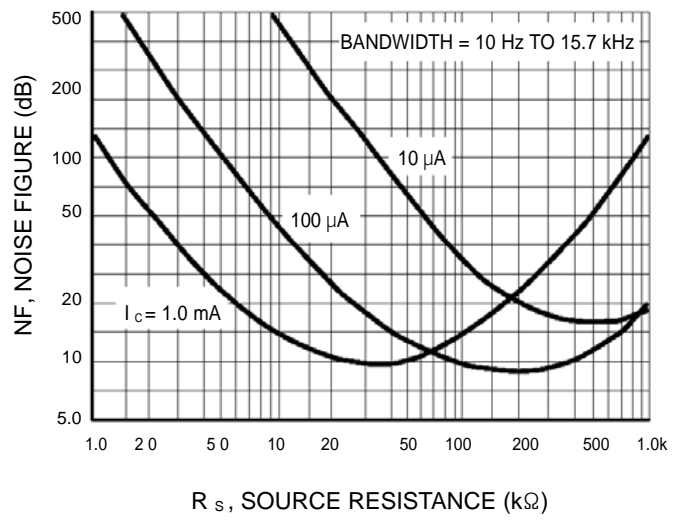
**Figure 2. Noise Voltage**



**Figure 3. Noise Current**



**Figure 4. Total Wideband Noise Voltage**



**Figure 5. Wideband Noise Figure**

## SMALL-SIGNAL CHARACTERISTICS

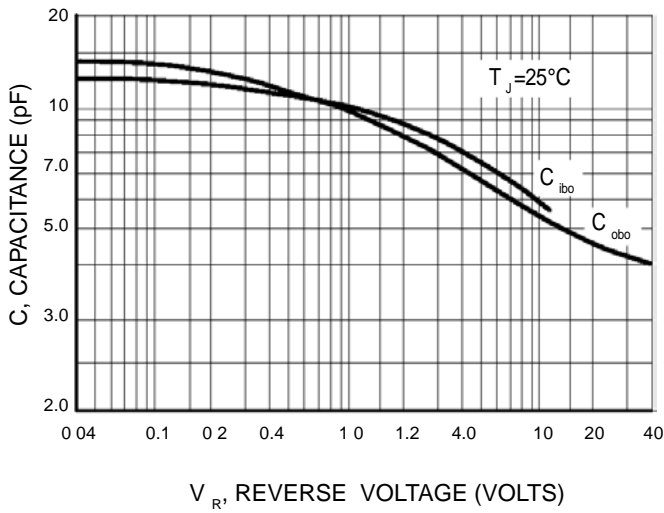


Figure 6. Capacitance

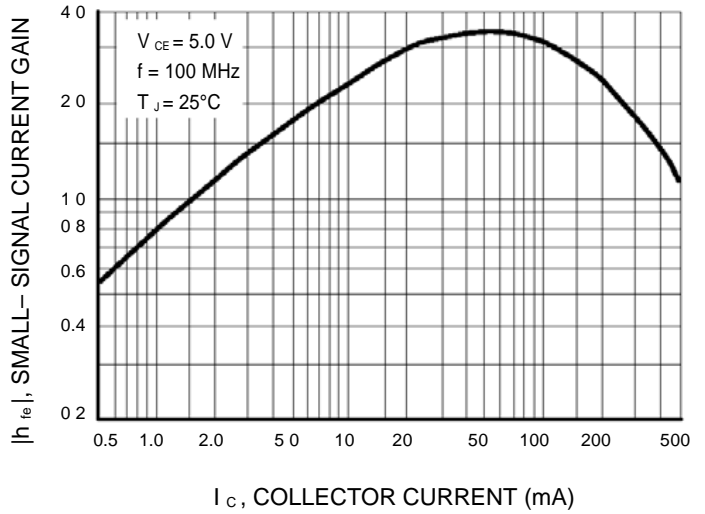


Figure 7. High Frequency Current Gain

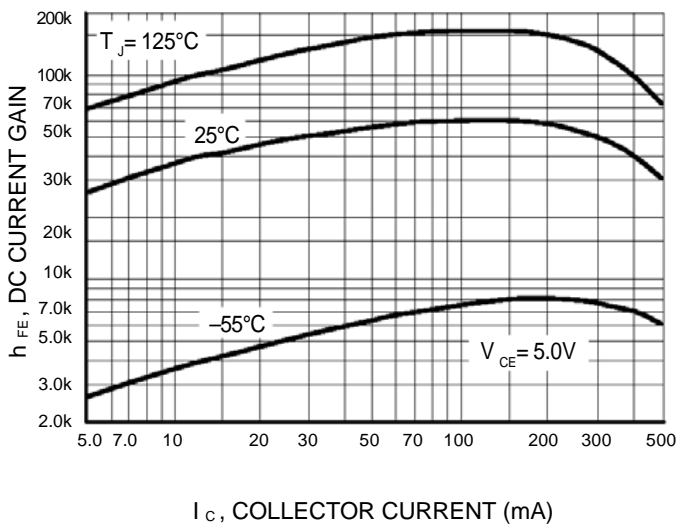


Figure 8. DC Current Gain

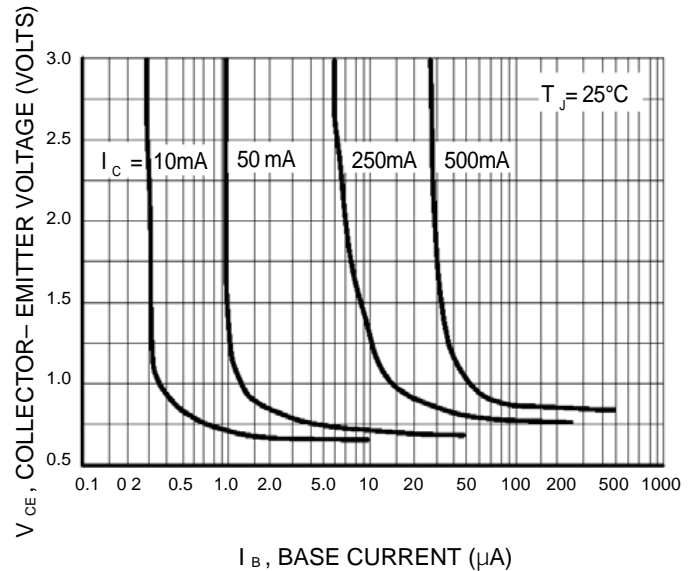


Figure 9. Collector Saturation Region

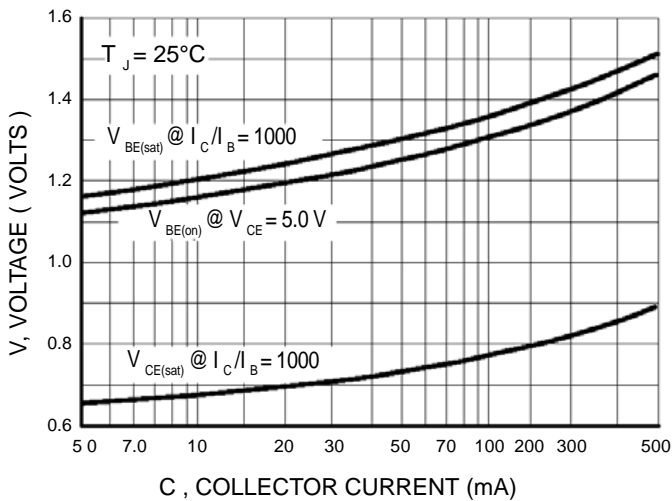


Figure 17. "ON" Voltages

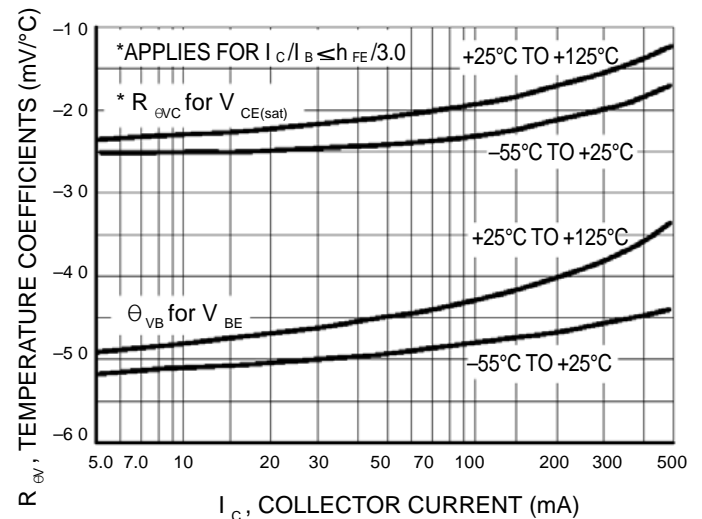
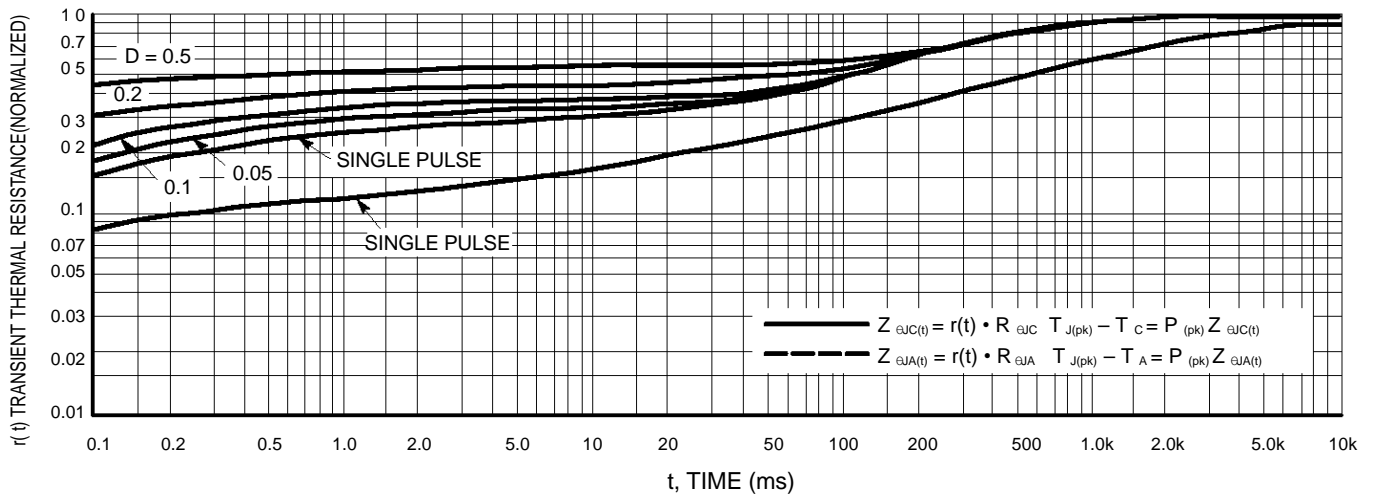
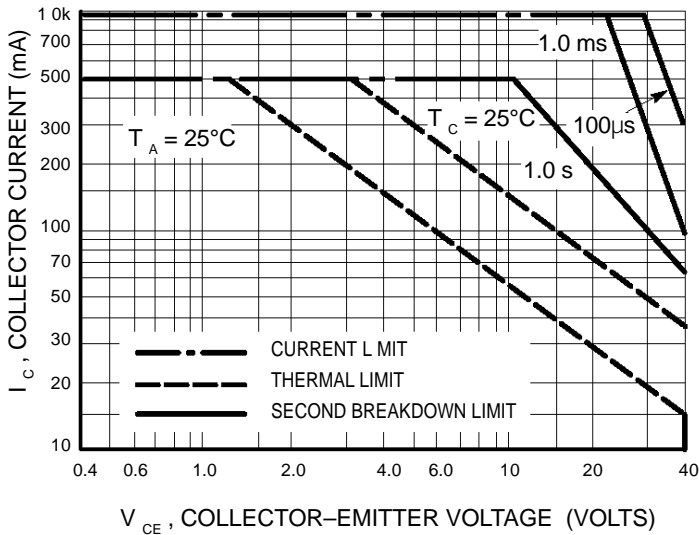


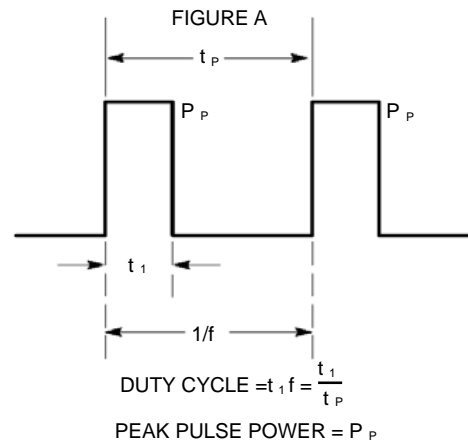
Figure 18. Temperature Coefficients



**Figure 12. Thermal Response**

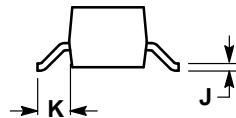
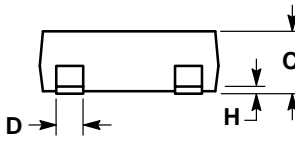
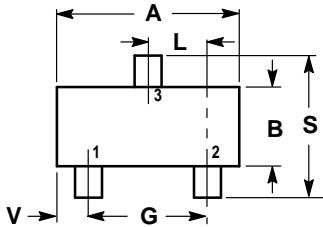


**Figure 13. Active Region Safe Operating Area**



**Design Note: Use of Transient Thermal Resistance Data**

## SOT-23 (TO-236AB)

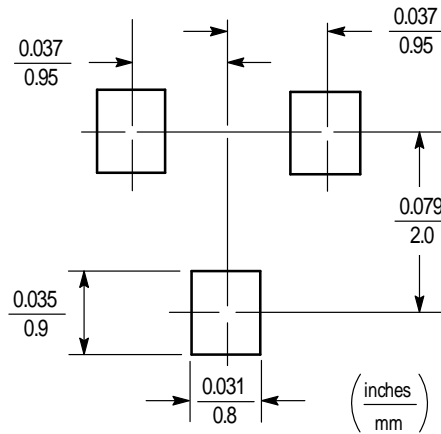


### NOTES:

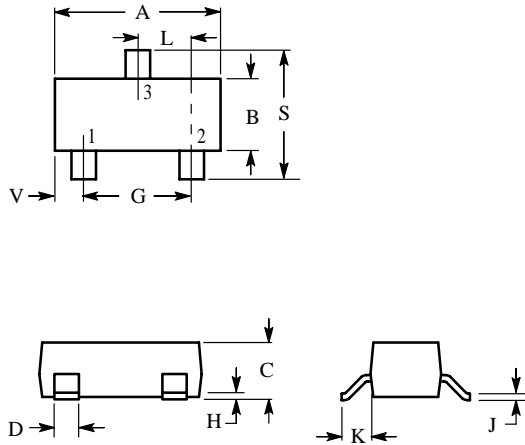
1. CONTROLLING DIMENSION: MILLIMETERS
2. LEAD THICKNESS SPECIFIED PER L / F DRAWING WITH SOLDER PLATING.

| DIM | INCHES |        | MILLIMETERS |       |
|-----|--------|--------|-------------|-------|
|     | MIN    | MAX    | MIN         | MAX   |
| A   | 0.1102 | 0.1197 | 2.80        | 3.04  |
| B   | 0.0472 | 0.0551 | 1.20        | 1.40  |
| C   | 0.0350 | 0.0440 | 0.89        | 1.11  |
| D   | 0.0150 | 0.0200 | 0.37        | 0.50  |
| G   | 0.0701 | 0.0807 | 1.78        | 2.04  |
| H   | 0.0005 | 0.0040 | 0.013       | 0.100 |
| J   | 0.0034 | 0.0070 | 0.085       | 0.177 |
| K   | 0.0180 | 0.0236 | 0.45        | 0.60  |
| L   | 0.0350 | 0.0401 | 0.89        | 1.02  |
| S   | 0.0830 | 0.0984 | 2.10        | 2.50  |
| V   | 0.0177 | 0.0236 | 0.45        | 0.60  |

- STYLE1 1:  
 PIN 1. ANODE  
 2. NO CONNECTION  
 3. CATHODE



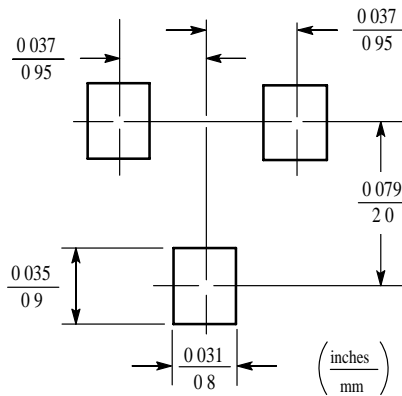
## SOT-23



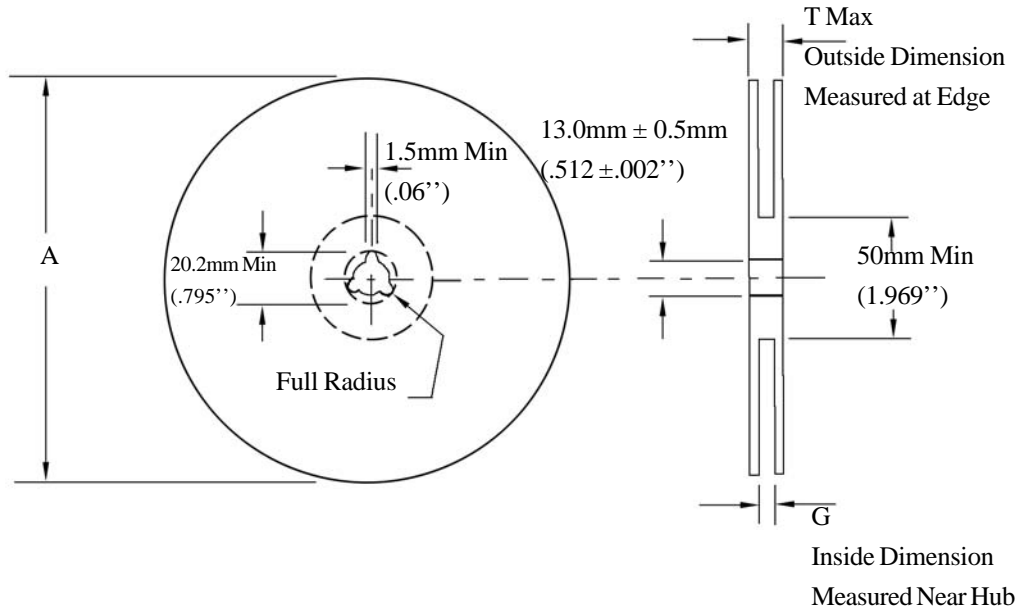
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES |        | MILLIMETERS |       |
|-----|--------|--------|-------------|-------|
|     | MIN    | MAX    | MIN         | MAX   |
| A   | 0.1102 | 0.1197 | 2.80        | 3.04  |
| B   | 0.0472 | 0.0551 | 1.20        | 1.40  |
| C   | 0.0350 | 0.0440 | 0.89        | 1.11  |
| D   | 0.0150 | 0.0200 | 0.37        | 0.50  |
| G   | 0.0701 | 0.0807 | 1.78        | 2.04  |
| H   | 0.0005 | 0.0040 | 0.013       | 0.100 |
| J   | 0.0034 | 0.0070 | 0.085       | 0.177 |
| K   | 0.0140 | 0.0285 | 0.35        | 0.69  |
| L   | 0.0350 | 0.0401 | 0.89        | 1.02  |
| S   | 0.0830 | 0.1039 | 2.10        | 2.64  |
| V   | 0.0177 | 0.0236 | 0.45        | 0.60  |



## EMBOSSED TAPE AND REEL DATA FOR DISCRETES



| Size | A Max               | G   | T Max             |
|------|---------------------|---|-------------------|
| 8 mm | 330mm<br>(12.992'') | 8.4mm+1.5mm, -0.0<br>(.33'+.059'', -0.00) | 14.4mm<br>(.56'') |

### Reel Dimensions

Metric Dimensions Govern — English are in parentheses for reference only

### Storage Conditions

Temperature: 5 to 40 Deg.C (20 to 30 Deg. C is preferred)

Humidity: 30 to 80 RH (40 to 60 is preferred )

Recommended Period: One year after manufacturing

(This recommended period is for the soldering condition only. The characteristics and reliabilities of the products are not restricted to this limitation)