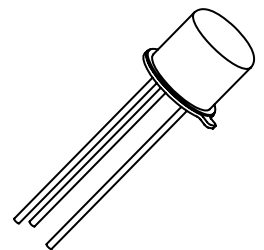


## NPN SILICON SWITCHING TRANSISTOR

Qualified per MIL-PRF-19500/399

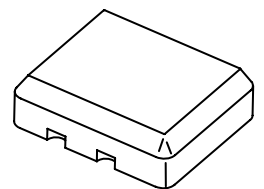
**DEVICES**
**2N3960**
**2N3960UB**
**LEVELS**
**JAN**
**JANTX**
**JANTXV**
**ABSOLUTE MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$  unless otherwise noted)**

| Parameters / Test Conditions                        | Symbol            | Value       | Unit             |
|---|-------------------|-------------|------------------|
| Collector-Emitter Voltage                           | $V_{CEO}$         | 12          | Vdc              |
| Collector-Base Voltage                              | $V_{CBO}$         | 20          | Vdc              |
| Emitter-Base Voltage                                | $V_{EBO}$         | 4.5         | Vdc              |
| Total Power Dissipation @ $T_A = +25^\circ\text{C}$ | $P_T^{(1)}$       | 0.4         | W                |
| Operating & Storage Junction Temperature Range      | $T_{op}, T_{stg}$ | -65 to +200 | $^\circ\text{C}$ |


**TO-18 – 2N3960**
**Note:**

 Derate linearly 2.3mW/ $^\circ\text{C}$  above  $T_A = +25^\circ\text{C}$ 
**ELECTRICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)**

| Parameters / Test Conditions   | Symbol                   | Min. | Max.   | Unit                                |
|--|--------------------------|------|--------|-------------------------------------|
| <b>OFF CHARACTERISTICS</b>   |                          |      |        |                                     |
| Collector-Emitter Breakdown Voltage<br>$I_C = 10\mu\text{Adc}$   | $V_{(BR)CEO}$            | 12   |        | Vdc                                 |
| Collector-Base Cutoff Current<br>$V_{CB} = 20\text{Vdc}$   | $I_{CBO}$                |      | 10     | $\mu\text{Adc}$                     |
| Emitter-Base Cutoff Current<br>$V_{EB} = 4.5\text{Vdc}$  | $I_{EBO}$                |      | 10     | $\mu\text{Adc}$                     |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 10\text{Vdc}, V_{BE} = 0.4\text{Vdc}$<br>$V_{CE} = 10\text{Vdc}, V_{BE} = 2.0\text{Vdc}$ | $I_{CEX1}$<br>$I_{CEX2}$ |      | 1<br>5 | $\mu\text{Adc}$<br>$\eta\text{Adc}$ |


**UB – 2N3960UB**

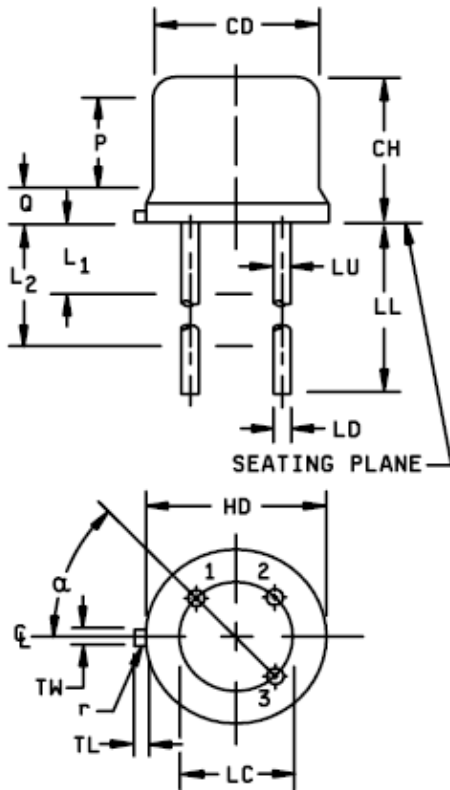
**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)

| Parameters / Test Conditions  | Symbol        | Min.           | Max.       | Unit |
|---|---------------|----------------|------------|------|
| <b>ON CHARACTERISTICS</b>   |               |                |            |      |
| Forward-Current Transfer Ratio<br>$I_C = 1\text{mA}_{dc}$ , $V_{CE} = 1\text{V}_{dc}$<br>$I_C = 10\text{mA}_{dc}$ , $V_{CE} = 1\text{V}_{dc}$<br>$I_C = 30\text{mA}_{dc}$ , $V_{CE} = 1\text{V}_{dc}$ | $h_{FE}$      | 40<br>60<br>30 | 300        |      |
| Collector-Emitter Saturation Voltage<br>$I_C = 1.0\text{mA}_{dc}$ , $I_B = 0.1\text{mA}_{dc}$<br>$I_C = 30\text{mA}_{dc}$ , $I_B = 3.0\text{mA}_{dc}$   | $V_{CE(sat)}$ |                | 0.2<br>0.3 | Vdc  |
| Base-Emitter Saturation Voltage<br>$V_{CE} = 1.0\text{V}_{dc}$ , $I_C = 1.0\text{mA}_{dc}$<br>$V_{CE} = 1.0\text{V}_{dc}$ , $I_C = 3.0\text{mA}_{dc}$   | $V_{BE(sat)}$ |                | 0.8<br>1.0 | Vdc  |

**DYNAMIC CHARACTERISTICS**

| Parameters / Test Conditions  | Symbol     | Min.           | Max. | Unit |
|---|------------|----------------|------|------|
| Magnitude of Small – Signal Short – Circuit - Forward Current Transfer Ratio<br>$I_C = 5.0\text{mA}_{dc}$ , $V_{CE} = 4\text{V}_{dc}$ , $f = 100\text{MHz}$<br>$I_C = 10.0\text{mA}_{dc}$ , $V_{CE} = 4\text{V}_{dc}$ , $f = 100\text{MHz}$<br>$I_C = 30.0\text{mA}_{dc}$ , $V_{CE} = 4\text{V}_{dc}$ , $f = 100\text{MHz}$ | $ h_{fe} $ | 13<br>14<br>12 |      |      |
| Output Capacitance<br>$V_{CB} = 4\text{V}_{dc}$ , $I_E = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$   | $C_{obo}$  |                | 2.5  | pF   |
| Input Capacitance<br>$V_{EB} = 0.5\text{V}_{dc}$ , $I_C = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$  | $C_{ibo}$  |                | 2.5  | pF   |

## PACKAGE DIMENSIONS



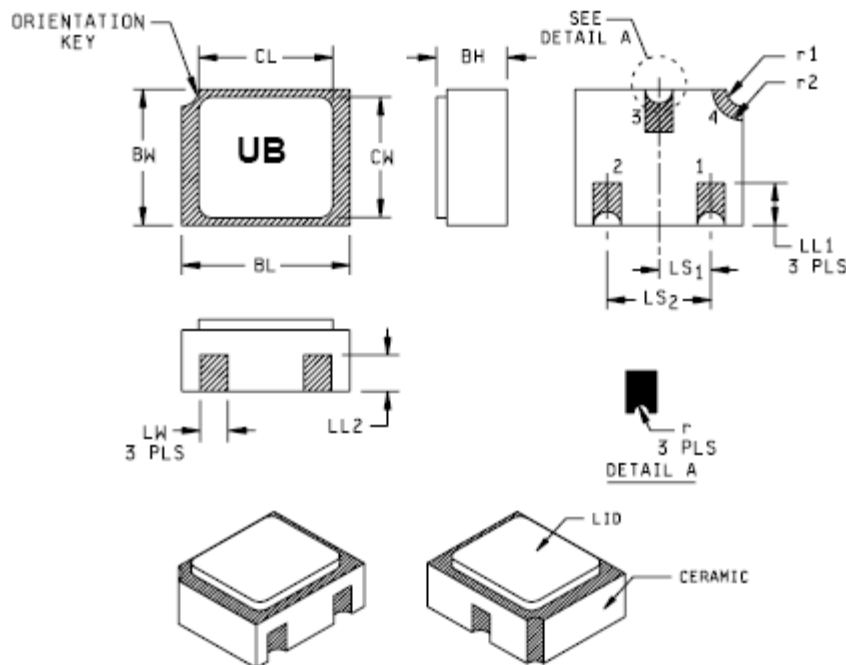
| Symbol         | Dimensions |      |             |       | Note |
|----------------|------------|------|-------------|-------|------|
|                | Inches     |      | Millimeters |       |      |
|                | Min        | Max  | Min         | Max   |      |
| CD             | .178       | .195 | 4.52        | 4.95  |      |
| CH             | .170       | .210 | 4.32        | 5.33  |      |
| HD             | .209       | .230 | 5.31        | 5.84  |      |
| LC             | .100 TP    |      | 2.54 TP     |       | 6    |
| LD             | .016       | .021 | 0.41        | 0.53  | 7,11 |
| LL             | .500       | .750 | 12.70       | 19.05 | 7    |
| LU             | .016       | .019 | 0.41        | 0.48  | 12   |
| L <sub>1</sub> |            | .050 |             | 1.27  | 7    |
| L <sub>2</sub> | .250       |      | 6.35        |       | 7    |
| P              | .100       |      | 2.54        |       | 5    |
| Q              |            | .040 |             | 1.02  | 4    |
| TL             | .028       | .048 | 0.71        | 1.22  | 3    |
| TW             | .036       | .046 | 0.91        | 1.17  | 9    |
| r              |            | .010 |             | 0.25  | 10   |
| α              | 45° TP     |      | 45° TP      |       | 6    |

### NOTES:

1. Dimensions are in inches.
- \* 2. Millimeters are given for general information only.
3. Symbol TL is measured from HD maximum.
4. Details of outline in this zone are optional.
5. Symbol CD shall not vary more than .010 (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane .054 (1.37 mm) +.001 inch (0.03 mm) -.000 inch (0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) relative to tab. Device may be measured by direct methods or by gauge.
7. Symbol LD applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum.
8. Lead number three is electrically connected to case.
9. Beyond r maximum, TW shall be held for a minimum length of .011 inch (0.28 mm).
10. Symbol r applied to both inside corners of tab.
11. Measured in a zone beyond .250 (6.35 mm) from the seating plane.
12. Measured in the zone between .050 (1.27 mm) and .250 (6.35mm) from the seating plane.
- \* 13. In accordance with ASME Y14.5M, diameters are equivalent to φx symbology.
- \* 14. Lead 1 = emitter, lead 2 = base, and case is collector.

\*FIGURE 1. Physical dimensions (similar to TO-18)

6 Lake Street, Lawrence, MA 01841  
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 Website: <http://www.microsemi.com>



| Symbol          | Dimensions |      |             |      | Note |
|-----------------|------------|------|-------------|------|------|
|                 | Inches     |      | Millimeters |      |      |
|                 | Min        | Max  | Min         | Max  |      |
| BH              | .046       | .056 | 1.17        | 1.42 |      |
| BL              | .115       | .128 | 2.92        | 3.25 |      |
| BW              | .085       | .108 | 2.16        | 2.74 |      |
| CL              |            | .128 |             | 3.25 |      |
| CW              |            | .108 |             | 2.74 |      |
| LL <sub>1</sub> | .022       | .038 | 0.56        | 0.96 |      |
| LL <sub>2</sub> | 0.17       | .035 | 0.43        | 0.89 |      |

| Symbol          | Dimensions |      |             |      | Note |
|-----------------|------------|------|-------------|------|------|
|                 | Inches     |      | Millimeters |      |      |
|                 | Min        | Max  | Min         | Max  |      |
| LS <sub>1</sub> | .036       | .040 | 0.91        | 1.02 |      |
| LS <sub>2</sub> | .071       | .079 | 1.81        | 2.01 |      |
| LW              | .016       | .024 | 0.41        | 0.61 |      |
| r               |            | .008 |             | .203 |      |
| r <sub>1</sub>  |            | .012 |             | .306 |      |
| r <sub>2</sub>  |            | .022 |             | .559 |      |

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metalized areas.
4. Lid material: Kovar.
5. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
6. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi$ x symbology.

**FIGURE 2. Physical dimensions, 2N3960UB, surface mount**