

## NPN POWER SWITCHING SILICON TRANSISTOR

Qualified per MIL-PRF-19500/374

### Devices

2N3996      2N3997      2N3998      2N3999

### Qualified Level

JAN  
JANTX  
JANTXV

### MAXIMUM RATINGS

| Ratings                                                                                                                  | Symbol         | Value                    | Unit               |
|--------------------------------------------------------------------------------------------------------------------------|----------------|--------------------------|--------------------|
| Collector-Emitter Voltage                                                                                                | $V_{CEO}$      | 80                       | Vdc                |
| Collector-Base Voltage                                                                                                   | $V_{CBO}$      | 100                      | Vdc                |
| Emitter-Base Voltage                                                                                                     | $V_{EBO}$      | 8.0                      | Vdc                |
| Base Current                                                                                                             | $I_B$          | 0.5                      | Adc                |
| Collector Current                                                                                                        | $I_C$          | 5.0<br>10 <sup>(1)</sup> | Adc                |
| Total Power Dissipation<br>@ $T_A = +25^{\circ}\text{C}$ <sup>(2)</sup><br>@ $T_C = +100^{\circ}\text{C}$ <sup>(3)</sup> | $P_T$          | 2.0<br>30                | W                  |
| Operating & Storage Junction Temperature Range                                                                           | $T_J, T_{stg}$ | -65 to +200              | $^{\circ}\text{C}$ |

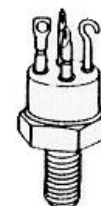
### THERMAL CHARACTERISTICS

| Characteristics                      | Symbol          | Max. | Unit                 |
|--------------------------------------|-----------------|------|----------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 3.33 | $^{\circ}\text{C/W}$ |

1) This value applies for  $t_p \leq 1.0$  ms, duty cycle  $\leq 50\%$

2) Derate linearly 11.4 mW/ $^{\circ}\text{C}$  for  $T_A > +25^{\circ}\text{C}$

3) Derate linearly 300 mW/ $^{\circ}\text{C}$  for  $T_C > +100^{\circ}\text{C}$



TO-111\*

\*See appendix A for package outline

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

| Characteristics | Symbol | Min. | Max. | Unit |
|-----------------|--------|------|------|------|
|-----------------|--------|------|------|------|

### OFF CHARACTERISTICS

|                                                                         |               |     |           |                         |
|-------------------------------------------------------------------------|---------------|-----|-----------|-------------------------|
| Collector-Emitter Breakdown Voltage<br>$I_C = 50$ mAdc                  | $V_{(BR)CEO}$ | 80  |           | Vdc                     |
| Collector-Emitter Breakdown Voltage<br>$I_C = 10$ $\mu$ Adc             | $V_{(BR)CBO}$ | 100 |           | Vdc                     |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 60$ Vdc                   | $I_{CEO}$     |     | 10        | $\mu$ Adc               |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 80$ Vdc, $V_{BE} = 0$     | $I_{CES}$     |     | 200       | $\eta$ Adc              |
| Emitter-Base Cutoff Current<br>$V_{EB} = 5.0$ Vdc<br>$V_{EB} = 8.0$ Vdc | $I_{EBO}$     |     | 200<br>10 | $\eta$ Adc<br>$\mu$ Adc |

**ELECTRICAL CHARACTERISTICS (con't)**

| Characteristics                                                                                                                                                                                                                                                                                                                                                  | Symbol        | Min.                                 | Max.               | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|--------------------|------|
| <b>ON CHARACTERISTICS <sup>(4)</sup></b>                                                                                                                                                                                                                                                                                                                         |               |                                      |                    |      |
| Forward-Current Transfer Ratio<br>$I_C = 50 \text{ mAdc}, V_{CE} = 2.0 \text{ Vdc}$<br>$I_C = 1.0 \text{ Adc}, V_{CE} = 2.0 \text{ Vdc}$<br>$I_C = 5.0 \text{ Adc}, V_{CE} = 5.0 \text{ Vdc}$<br><br>$I_C = 50 \text{ mAdc}, V_{CE} = 2.0 \text{ Vdc}$<br>$I_C = 1.0 \text{ Adc}, V_{CE} = 2.0 \text{ Vdc}$<br>$I_C = 5.0 \text{ Adc}, V_{CE} = 5.0 \text{ Vdc}$ | $h_{FE}$      | 30<br>40<br>15<br><br>60<br>80<br>20 | 120<br><br><br>240 |      |
| Collector-Emitter Saturation Voltage<br>$I_C = 1.0 \text{ Adc}, I_B = 0.1 \text{ Adc}$<br>$I_C = 5.0 \text{ Adc}, I_B = 0.5 \text{ Adc}$                                                                                                                                                                                                                         | $V_{CE(sat)}$ |                                      | 0.25<br>2.0        | Vdc  |
| Base-Emitter Saturation Voltage<br>$I_C = 1.0 \text{ Adc}, I_B = 0.1 \text{ Adc}$<br>$I_C = 5.0 \text{ Adc}, I_B = 0.5 \text{ Adc}$                                                                                                                                                                                                                              | $V_{BE(sat)}$ | 0.6                                  | 1.2<br>1.6         | Vdc  |

**DYNAMIC CHARACTERISTICS**

|                                                                                                                                                                   |            |     |     |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|-----|----|
| Magnitude of Common Emitter Small-Signal Short-Circuit<br>Forward Current Transfer Ratio<br>$I_C = 1.0 \text{ Adc}, V_{CE} = 5.0 \text{ Vdc}, f = 10 \text{ MHz}$ | $ h_{fe} $ | 3.0 | 12  |    |
| Output Capacitance<br>$V_{CB} = 10 \text{ Vdc}, I_E = 0, 100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$                                                             | $C_{obo}$  |     | 150 | pF |

**SAFE OPERATING AREA****DC Tests** $T_C = 100^\circ\text{C}, 1 \text{ Cycle}, t = 1.0 \text{ s}$ **Test 1** $V_{CE} = 80 \text{ Vdc}, I_C = 0.08 \text{ Adc}$ **Test 2** $V_{CE} = 20 \text{ Vdc}, I_C = 1.5 \text{ Adc}$ (4) Pulse Test: Pulse Width = 300 $\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .