

## NPN POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/464

### DEVICES

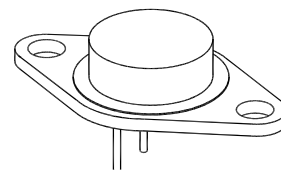
**2N5685      2N5686**

### LEVELS

**JAN  
JANTX  
JANTV**

### ABSOLUTE MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$ unless otherwise noted)

| Parameters / Test Conditions                   | Symbol         | 2N5685                                      | 2N5686 | Unit             |   |
|--|----------------|---|--------|------------------|---|
| Collector-Emitter Voltage                      | $V_{CEO}$      | 60  | 80     | Vdc              |   |
| Collector-Base Voltage                         | $V_{CBO}$      | 60  | 80     | Vdc              |   |
| Emitter-Base Voltage                           | $V_{EBO}$      | 5.0   | 5.0    | Vdc              |   |
| Base Current                                   | $I_B$          | 15  | 15     | Adc              |   |
| Collector Current                              | $I_C$          | 50  | 50     | Adc              |   |
| Total Power Dissipation                        | $P_T$          | @ $T_C = +25^\circ\text{C}$ <sup>(1)</sup>  | 300    | 300              | W |
|  |                | @ $T_C = +100^\circ\text{C}$ <sup>(1)</sup> | 171    | 171              | W |
| Operating & Storage Junction Temperature Range | $T_J, T_{stg}$ | -55 to +200                                 |        | $^\circ\text{C}$ |   |



**TO-3 (TO-204AE)**

### THERMAL CHARACTERISTICS

| Parameters / Test Conditions         | Symbol          | Max.  | Unit                      |
|--------------------------------------|-----------------|-------|---------------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | .0584 | $^\circ\text{C}/\text{W}$ |

### Note:

- Derate linearly 1.715 W/ $^\circ\text{C}$  between  $T_C = 25^\circ\text{C}$  and  $T_C = 200^\circ\text{C}$

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

| Parameters / Test Conditions  | Symbol        | Min.   | Max. | Unit          |
|---|---------------|--------|------|---------------|
| <b>OFF CHARACTERISTICS <sup>(1)</sup></b>   |               |        |      |               |
| Collector-Emitter Breakdown Voltage<br>$I_C = 100\text{mA}$                         | $V_{(BR)CEO}$ | 2N5685 | 60   | Vdc           |
|   |               | 2N5686 | 80   |               |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 30\text{Vdc}$                         | $I_{CEO}$     | 2N5685 | 500  | $\mu\text{A}$ |
| $V_{CE} = 40\text{Vdc}$   |               | 2N5686 | 500  |               |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 60\text{Vdc}, V_{BE} = 1.5\text{Vdc}$ | $I_{CEX}$     | 2N5685 | 10   | $\mu\text{A}$ |
| $V_{CE} = 80\text{Vdc}, V_{BE} = 1.5\text{Vdc}$                                     |               | 2N5686 | 10   |               |
| Collector-Base Cutoff Current<br>$V_{CE} = 60\text{Vdc}$                            | $I_{CBO}$     | 2N5685 | 2.0  | mA            |
| $V_{CE} = 80\text{Vdc}$   |               | 2N5686 | 2.0  |               |
| Emitter-Base Cutoff Current<br>$V_{EB} = 5.0\text{Vdc}$                             | $I_{EBO}$     |        | 1.0  | mA            |

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

| Parameters / Test Conditions   | Symbol        | Min.            | Max.       | Unit |
|--|---------------|-----------------|------------|------|
| <b>ON CHARACTERISTICS</b> <sup>(2)</sup>   |               |                 |            |      |
| Forward-Current Transfer Ratio<br>$I_C = 5.0\text{A dc}$ , $V_{CE} = 2.0\text{V dc}$<br>$I_C = 25\text{A dc}$ , $V_{CE} = 2.0\text{V dc}$<br>$I_C = 50\text{A dc}$ , $V_{CE} = 5.0\text{V dc}$ | $h_{FE}$      | 30<br>15<br>5.0 | 60         |      |
| Collector-Emitter Saturation Voltage<br>$I_C = 25\text{A dc}$ , $I_B = 2.5\text{A dc}$<br>$I_C = 50\text{A dc}$ , $I_B = 10\text{A dc}$  | $V_{CE(sat)}$ |                 | 1.0<br>5.0 | Vdc  |
| Base-Emitter Saturation Voltage<br>$I_C = 25\text{A dc}$ , $I_B = 2.5\text{A dc}$  | $V_{BE(sat)}$ |                 | 2.0        | Vdc  |
| Base-Emitter Voltage<br>$I_C = 25\text{A dc}$ , $V_{CE} = 2.0\text{A dc}$  | $V_{BE(ON)}$  |                 | 2.0        | Vdc  |

**DYNAMIC CHARACTERISTICS**

| Parameters / Test Conditions  | Symbol     | Min. | Max. | Unit |
|---|------------|------|------|------|
| Magnitude of Common Emitter Small-Signal Short-Circuit, Forward Current Transfer Ratio<br>$I_C = 5.0\text{A dc}$ , $V_{CE} = 10\text{V dc}$ , $f = 1.0\text{MHz}$ | $ h_{fe} $ | 2.0  | 20   |      |
| Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 10\text{A dc}$ , $V_{CE} = 5.0\text{V dc}$ , $f = 1.0\text{kHz}$                              | $h_{fe}$   | 15   |      |      |
| Output Capacitance<br>$V_{CB} = 10\text{V dc}$ , $I_E = 0$ , $0.1\text{MHz} \leq f \leq 1.0\text{MHz}$  | $C_{obo}$  |      | 1200 | pF   |

**SWITCHING CHARACTERISTICS**

| Parameters / Test Conditions  | Symbol    | Min. | Max. | Unit          |
|---|-----------|------|------|---------------|
| Turn-On Time<br>$V_{CC} = 30\text{V dc}$ ; $I_C = 25\text{A dc}$ ; $I_{B1} = 2.5\text{A dc}$            | $t_{on}$  |      | 1.5  | $\mu\text{s}$ |
| Turn-Off Time<br>$V_{CC} = 30\text{V dc}$ ; $I_C = 25\text{A dc}$ ; $I_{B1} = -I_{B2} = 2.5\text{A dc}$ | $t_{off}$ |      | 3.0  | $\mu\text{s}$ |

**SAFE OPERATING AREA**

|   |        |
|---|--------|
| <b>DC Tests</b><br>$T_C = +25^\circ\text{C}$ , 1 Cycle, $t = 1.0\text{s}$ |        |
| <b>Test 1</b><br>$V_{CE} = 6.0\text{V dc}$ , $I_C = 50\text{A dc}$        |        |
| <b>Test 2</b><br>$V_{CE} = 30\text{V dc}$ , $I_C = 10\text{A dc}$         |        |
| <b>Test 3</b><br>$V_{CE} = 50\text{V dc}$ , $I_C = 560\text{m dc}$        | 2N5685 |
| $V_{CE} = 60\text{V dc}$ , $I_C = 640\text{m dc}$                         | 2N5686 |

(2) Pulse Test: Pulse Width =  $300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$