

## NPN POWER SILICON TRANSISTOR

Qualified per MIL-PRF-19500/394

### DEVICES

|                |                |                |
|----------------|----------------|----------------|
| <b>2N4150</b>  | <b>2N5237</b>  | <b>2N5238</b>  |
| <b>2N4150S</b> | <b>2N5237S</b> | <b>2N5238S</b> |

### LEVELS

**JAN**  
**JANTX**  
**JANTXV**  
**JANS**

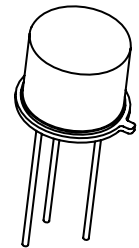
### ABSOLUTE MAXIMUM RATINGS ( $T_C = +25^\circ\text{C}$ unless otherwise noted)

| Parameters / Test Conditions  | Symbol                             | 2N4150<br>2N4150S | 2N5237<br>2N5237S | 2N5238<br>2N5238S | Unit               |
|---|------------------------------------|-------------------|-------------------|-------------------|--------------------|
| Collector-Emitter Voltage   | $V_{CEO}$                          | 70                | 120               | 170               | Vdc                |
| Collector-Base Voltage  | $V_{CBO}$                          | 100               | 150               | 200               | Vdc                |
| Emitter-Base Voltage  | $V_{EBO}$                          | 10                |                   |                   | Vdc                |
| Collector Current   | $I_C$                              | 10                |                   |                   | Adc                |
| Total Power Dissipation<br>@ $T_A = +25^\circ\text{C}$ <sup>(1)</sup><br>@ $T_C = +25^\circ\text{C}$ <sup>(2)</sup> | $P_T$                              | 1.0<br>15         |                   |                   | W                  |
| Operating & Storage Junction Temperature Range  | $T_j, T_{stg}$                     | -65 to +200       |                   |                   | $^\circ\text{C}$   |
| Thermal Resistance, Junction-to Case<br>Junction- to Ambient  | $R_{\theta JC}$<br>$R_{\theta JA}$ | 10<br>175         |                   |                   | $^\circ\text{C/W}$ |

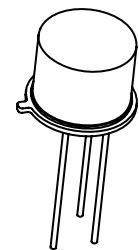
- 1) Derate linearly @ 5.7mW/ $^\circ\text{C}$  for  $T_A > +25^\circ\text{C}$
- 2) Derate linearly @ 100mW/ $^\circ\text{C}$  for  $T_C > +25^\circ\text{C}$

### 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>$I_C = 0.1\text{mA}$  | 2N4150, 2N4150S<br>2N5237, 2N5237S<br>2N5238, 2N5238S | $V_{(BR)CEO}$ | 70<br>120<br>170 | Vdc             |
| Collector-Emitter Cutoff Current<br>$V_{BE} = 0.5\text{Vdc}$ , $V_{CE} = 60\text{Vdc}$<br>$V_{BE} = 0.5\text{Vdc}$ , $V_{CE} = 110\text{Vdc}$<br>$V_{BE} = 0.5\text{Vdc}$ , $V_{CE} = 160\text{Vdc}$ | 2N4150, 2N4150S<br>2N5237, 2N5237S<br>2N5238, 2N5238S | $I_{CEX}$     | 10<br>10<br>10   | $\mu\text{Adc}$ |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 60\text{Vdc}$<br>$V_{CE} = 110\text{Vdc}$<br>$V_{CE} = 160\text{Vdc}$  | 2N4150, 2N4150S<br>2N5237, 2N5237S<br>2N5238, 2N5238S | $I_{CEO}$     | 10<br>10<br>10   | $\mu\text{Adc}$ |
| Emitter-Base Cutoff Current<br>$V_{EB} = 7.0\text{Vdc}$<br>$V_{EB} = 5.0\text{Vdc}$  |   | $I_{EBO}$     | 10<br>0.1        | $\mu\text{Adc}$ |



**TO-5**  
 2N4150, 2N5237, 2N5238



**TO-39**  
**(TO-205AD)**  
 2N4150S, 2N5237S, 2N5238S

## NPN POWER SILICON TRANSISTOR

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

| Parameters / Test Conditions   | Symbol   | Min.          | Max.                  | Unit              |
|--|--|---------------|-----------------------|-------------------|
| Collector-Base Cutoff Current<br>$V_{CB} = 100\text{Vdc}$<br>$V_{CB} = 150\text{Vdc}$<br>$V_{CB} = 200\text{Vdc}$<br>$V_{CB} = 80\text{Vdc}$ | 2N4150, 2N4150S<br>2N5237, 2N5237S<br>2N5238, 2N5238S<br>All Types | $I_{CBO}$     | 10<br>10<br>10<br>0.1 | $\mu\text{Adc}$   |
| <b>ON CHARACTERISTICS <sup>(3)</sup></b>   |  |               |                       |                   |
| Forward-Current Transfer Ratio<br>$I_C = 1.0\text{Adc}$ , $V_{CE} = 5.0\text{Vdc}$   | 2N4150, 2N4150S<br>2N5237, 2N5237S<br>2N5238, 2N5238S              | $h_{FE}$      | 50<br>50<br>50        | 200<br>225<br>225 |
| $I_C = 5.0\text{Adc}$ , $V_{CE} = 5.0\text{Vdc}$<br>$I_C = 10\text{Adc}$ , $V_{CE} = 5.0\text{Vdc}$  | All Types<br>All Types   |               | 40<br>10              | 120<br>-          |
| Collector-Emitter Saturation Voltage<br>$I_C = 5.0\text{Adc}$ , $I_B = 0.5\text{Adc}$<br>$I_C = 10\text{Adc}$ , $I_B = 1.0\text{Adc}$        |  | $V_{CE(sat)}$ |                       | 0.6<br>2.5<br>Vdc |
| Base-Emitter Saturation Voltage<br>$I_C = 5.0\text{Adc}$ , $I_B = 0.5\text{Adc}$<br>$I_C = 10\text{Adc}$ , $I_B = 1.0\text{Adc}$             |  | $V_{BE(sat)}$ |                       | 1.5<br>25<br>Vdc  |

### DYNAMIC CHARACTERISTICS

| Parameters / Test Conditions  | Symbol  | Min.      | Max.           | Unit              |
|---|---|-----------|----------------|-------------------|
| Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 0.2\text{Adc}$ , $V_{CE} = 10\text{Vdc}$ , $f = 10\text{MHz}$ | $ h_{fe} $  | 1.5       | 7.5            |                   |
| Forward Current Transfer Ratio<br>$I_C = 50\text{mAdc}$ , $V_{CE} = 5.0\text{V}$ , $f = 1.0\text{kHz}$  | 2N4150, 2N4150S<br>2N5237, 2N5237S<br>2N5238, 2N5238S | $h_{fe}$  | 40<br>40<br>40 | 160<br>160<br>250 |
| Output Capacitance<br>$V_{CB} = 10\text{Vdc}$ , $I_E = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$   |   | $C_{obo}$ |                | 350<br>pF         |

### SWITCHING CHARACTERISTICS

| Parameters / Test Conditions | Symbol  | Min.  | Max. | Unit          |
|------------------------------|---|-------|------|---------------|
| Delay Time                   | $V_{CC} = 20\text{Vdc}$ , $V_{BB} = 5.0\text{Vdc}$<br>$I_C = 5.0\text{Adc}$ , $I_{B1} = 0.5\text{Adc}$            | $t_d$ | 50   | ns            |
| Rise Time                    |   | $t_r$ | 500  | ns            |
| Storage Time                 | $V_{CC} = 20\text{Vdc}$ , $V_{BB} = 5.0\text{Vdc}$<br>$I_C = 5.0\text{Adc}$ , $I_{B1} = -I_{B2} = -0.5\text{Adc}$ | $t_s$ | 1.5  | $\mu\text{s}$ |
| Fall Time                    |   | $t_f$ | 500  | ns            |

### SAFE OPERATING AREA

|   |  |  |  |  |
|---|--|--|--|--|
| <b>DC Tests</b>   |  |  |  |  |
| $T_C = +25^\circ\text{C}$ , 1 Cycle, $t = 1.0\text{s}$            |  |  |  |  |
| <b>Test 1</b>   |  |  |  |  |
| $V_{CE} = 40\text{Vdc}$ , $I_C = 0.22\text{Adc}$                  |  |  |  |  |
| <b>Test 2</b>   |  |  |  |  |
| $V_{CE} = 70\text{Vdc}$ , $I_C = 90\text{mAdc}$                   |  |  |  |  |
| <b>Test 3</b>   |  |  |  |  |
| $V_{CE} = 120\text{Vdc}$ , $I_C = 15\text{mAdc}$ 2N5237, 2N5237S  |  |  |  |  |
| $V_{CE} = 170\text{Vdc}$ , $I_C = 3.5\text{mAdc}$ 2N5238, 2N5238S |  |  |  |  |

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

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