



**NEW ENGLAND SEMICONDUCTOR**

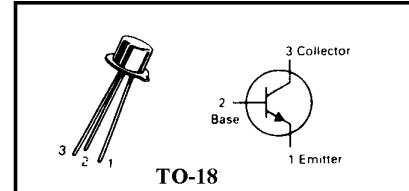
**2N2221**  
**2N2221A\***  
**2N2222**  
**2N2222A\***

\*also available as  
 JAN, JANTX,  
 JANTXV

**MAXIMUM RATINGS**

| Rating   | Symbol         | 2N2221<br>2N2222 | 2N2221A<br>2N2222A | Unit           |
|--|----------------|------------------|--------------------|----------------|
| Collector-Emitter Voltage  | $V_{CEO}$      | 30               | 40                 | Vdc            |
| Collector-Base Voltage   | $V_{CBO}$      | 60               | 75                 | Vdc            |
| Emitter-Base Voltage   | $V_{EBO}$      | 5.0              | 6.0                | Vdc            |
| Collector Current - Continuous   | $I_C$          | 800              |                    | mAdc           |
| Total Device Dissipation @ $T_A = 25^\circ C$<br>Derate above $25^\circ C$ | $P_D$          | 0.5              |                    | Watts          |
|  |                | 2.28             |                    | mW/ $^\circ C$ |
| Total Device Dissipation @ $T_C = 25^\circ C$<br>Derate above $25^\circ C$ | $P_D$          | 1.2              |                    | Watts          |
|  |                | 6.85             |                    | mW/ $^\circ C$ |
| Operating and Storage Junction<br>Temperature Range                        | $T_J, T_{stg}$ | -65 to +200      |                    | $^\circ C$     |

**GENERAL PURPOSE  
 TRANSISTORS  
 NPN SILICON**



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

| Characteristics  | Symbol        | Min        | Max                      | Unit              |
|--|---------------|------------|--------------------------|-------------------|
| <b>OFF CHARACTERISTICS</b>   |               |            |                          |                   |
| Collector-Emitter Breakdown Voltage<br>$I_C = 10 \text{ mAdc}, I_B = 0$  | $V_{(BR)CEO}$ | 30<br>40   |                          | Vdc               |
| Collector-Base Breakdown Voltage<br>$I_C = 10 \mu\text{Adc}, I_E = 0$  | $V_{(BR)CBO}$ | 60<br>75   |                          | Vdc               |
| Emitter-Base Breakdown Voltage<br>$I_E = 10 \mu\text{Adc}, I_C = 0$  | $V_{(BR)EBO}$ | 5.0<br>6.0 |                          | Vdc               |
| Collector Cutoff Current<br>$V_{CE} = 60 \text{ Vdc}, V_{EB(off)} = 3.0 \text{ Vdc}$   | $I_{CEX}$     |            | 10                       | nAdc              |
| Collector Cutoff Current<br>$V_{CB} = 50 \text{ Vdc}, I_E = 0$<br>$V_{CB} = 60 \text{ Vdc}, I_E = 0$<br>$V_{CB} = 50 \text{ Vdc}, I_E = 0, T_A = 150^\circ C$<br>$V_{CB} = 60 \text{ Vdc}, I_E = 0, T_A = 150^\circ C$ | $I_{CBO}$     |            | 0.01<br>0.01<br>10<br>10 | $\mu \text{ Adc}$ |
| Emitter Cutoff Current<br>$V_{EB} = 3.0 \text{ Vdc}, I_C = 0$  | $I_{EBO}$     |            | 10                       | nAdc              |
| Base Cutoff Current<br>$V_{CE} = 60 \text{ Vdc}, V_{EB(off)} = 3.0 \text{ Vdc}$  | $I_{BL}$      |            | 20                       | nAdc              |

**ON CHARACTERISTICS**

| DC Current Gain   | Symbol   | Min | Max | Unit |
|---|----------|-----|-----|------|
| $I_C = 0.1 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$                   | $h_{FE}$ | 20  |     | -    |
|   |          | 35  |     |      |
| $I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$                   | $h_{FE}$ | 25  |     |      |
|   |          | 50  |     |      |
| $I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$                    | $h_{FE}$ | 35  |     |      |
|   |          | 75  |     |      |
| $I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, T_A = -55^\circ C$ | $h_{FE}$ | 15  |     |      |
|   |          | 35  |     |      |
| $I_C = 150 \text{ mAdc}, V_{CE} = 10 \text{ Vdc (1)}$               | $h_{FE}$ | 40  | 120 |      |
|   |          | 100 | 300 |      |
| $I_C = 150 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc (1)}$              | $h_{FE}$ | 20  |     |      |
|   |          | 50  |     |      |
| $I_C = 500 \text{ mAdc}, V_{CE} = 10 \text{ Vdc (1)}$               | $h_{FE}$ | 20  |     |      |
|   |          | 30  |     |      |
|   |          | 25  |     |      |
|   |          | 40  |     |      |

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6 Lake Street Lawrence, MA 01841  
 1-800-446-1158 / (978) 794-1666 / FAX: (978) 689-0803

T4-4.8-860-346 REV: --



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**2N2221A\***  
**2N2222**  
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JAN, JANTX,  
JANTXV

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

| Characteristics   | Symbol        | Min        | Max                      | Unit |
|---|---------------|------------|--------------------------|------|
| <b>ON CHARACTERISTICS (CONTINUED)</b>   |               |            |                          |      |
| <b>Collector-Emitter Saturation Voltage (1)</b><br>$I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$<br>2N2221, 2N2222<br>2N2221A, 2N2222A<br>$I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$<br>2N2221, 2N2222<br>2N2221A, 2N2222A | $V_{CE(sat)}$ |            | 0.4<br>0.3<br>1.6<br>1.0 | Vdc  |
| <b>Base-Emitter Saturation Voltage (1)</b><br>$I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$<br>2N2221, 2N2222<br>2N2221A, 2N2222A<br>$I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$<br>2N2221, 2N2222<br>2N2221A, 2N2222A      | $V_{BE(sat)}$ | 0.6<br>0.6 | 1.3<br>1.2<br>2.6<br>2.0 | Vdc  |

**SMALL-SIGNAL CHARACTERISTICS**

|   |           |                           |                           |       |
|---|-----------|---------------------------|---------------------------|-------|
| <b>Current-Gain -- Bandwidth Product (2)</b><br>$I_C = 20 \text{ mAdc}, V_{CE} = 20 \text{ Vdc}, f = 100 \text{ MHz}$<br>2N2221A<br>2N2222A   | $f_T$     | 250<br>300                |                           | MHz   |
| <b>Output Capacitance</b><br>$V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 100 \text{ kHz}$  | $C_{obo}$ |                           | 8.0                       | pF    |
| <b>Input Capacitance</b><br>$V_{EB} = 0.5 \text{ Vdc}, I_C = 0, f = 100 \text{ kHz}$<br>2N2221, 2N2222<br>2N2221A, 2N2222A  | $C_{ibo}$ |                           | 30<br>25                  | pF    |
| <b>Input Impedance</b><br>$I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$<br>2N2221A<br>2N2222A<br>$I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$<br>2N2221A<br>2N2222A | $h_{ie}$  | 1.0<br>2.0<br>0.2<br>0.25 | 3.5<br>8.0<br>1.0<br>1.25 | kohms |
| <b>Small-Signal Current Gain</b><br>$I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$<br>2N2221A<br>2N2222A<br>$I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$<br>2N2221A  | $h_{fe}$  | 30<br>50<br>50<br>75      | 150<br>300<br>300<br>375  |       |
| <b>Noise Figure</b><br>$I_C = 100 \mu\text{Adc}, V_{CE} = 10 \text{ Vdc},$<br>$R_S = 1.0 \text{ kohm}, f = 1.0 \text{ kHz}$<br>2N2222A  | NF        |                           | 4.0                       | dB    |

**SWITCHING CHARACTERISTICS**

|                     |   |       |     |    |
|---------------------|---|-------|-----|----|
| <b>Delay time</b>   | $V_{CC} = 30 \text{ Vdc}, V_{BE(off)} = 0.5 \text{ Vdc},$ | $t_d$ | 10  | ns |
| <b>Rise Time</b>    | $I_C = 150 \text{ mAdc}, I_{B1} = 15 \text{ mAdc}$        | $t_r$ | 25  | ns |
| <b>Storage Time</b> | $V_{CC} = 30 \text{ Vdc}, I_C = 150 \text{ mAdc},$        | $t_s$ | 225 | ns |
| <b>Fall Time</b>    | $I_{B1} = I_{B2} = 15 \text{ mAdc}$                       | $t_f$ | 60  | ns |

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

(2)  $f_T$  is defined as the frequency at which  $|h_{fe}|$  extrapolates to unity.

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