



6 Lake Street, Lawrence, MA 01841  
1-800-446-1158 / (978) 620-2600 / Fax: (978) 689-0803  
Website: <http://www.microsemi.com>

# TECHNICAL DATA SHEET

## RADIATION HARDENED NPN SILICON SWITCHING TRANSISTOR *Qualified per MIL-PRF-19500/255*

### DEVICES

|            |            |
|------------|------------|
| 2N2221A    | 2N2222A    |
| 2N2221AL   | 2N2222AL   |
| 2N2221AUA  | 2N2222AUA  |
| 2N2221AUB  | 2N2222AUB  |
| 2N2221AUBC | 2N2222AUBC |

### LEVELS

JANSM – 3K Rads (Si)  
JANS D – 10K Rads (Si)  
JANSP – 30K Rads (Si)  
JANSL – 50K Rads (Si)  
JANSR – 100K Rads (Si)  
JANSF – 300K Rads (Si)  
JANS G – 500K Rads (Si)  
JANS H – 1MEG Rads (Si)

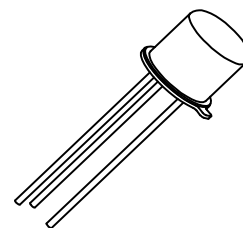
### ABSOLUTE MAXIMUM RATINGS ( $T_C = +25^{\circ}\text{C}$ unless otherwise noted)

| Parameters / Test Conditions                          | Symbol            | Value       | Unit               |
|-------------------------------------------------------|-------------------|-------------|--------------------|
| Collector-Emitter Voltage                             | $V_{CEO}$         | 50          | Vdc                |
| Collector-Base Voltage                                | $V_{CBO}$         | 75          | Vdc                |
| Emitter-Base Voltage                                  | $V_{EBO}$         | 6.0         | Vdc                |
| Collector Current                                     | $I_C$             | 800         | mA dc              |
| Total Power Dissipation @ $T_A = +25^{\circ}\text{C}$ |                   |             |                    |
| 2N2221A, L      2N2222A, L                            | $P_T$             | 0.5         | W                  |
| 2N2221AUA      2N2222AUA                              |                   | 0.65        |                    |
| 2N2221AUB, UBC      2N2222AUB, UBC                    |                   | 0.50        |                    |
| Operating & Storage Junction Temperature Range        | $T_{op}, T_{stg}$ | -65 to +200 | $^{\circ}\text{C}$ |

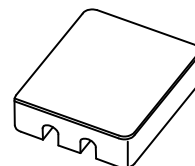
### THERMAL CHARACTERISTICS

| Parameters / Test Conditions            | Symbol          | Max. | Unit                        |
|-----------------------------------------|-----------------|------|-----------------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ |      |                             |
| 2N2221A, L      2N2222A, L              |                 | 325  | $^{\circ}\text{C}/\text{W}$ |
| 2N2221AUA      2N2222AUA                |                 | 210  |                             |
| 2N2221AUB, UBC      2N2222AUB, UBC      |                 | 325  |                             |

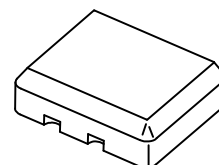
- Derate linearly 3.08 mW/ $^{\circ}\text{C}$  above  $T_A > +37.5^{\circ}\text{C}$
- Derate linearly 4.76 mW/ $^{\circ}\text{C}$  above  $T_A > +63.5^{\circ}\text{C}$



TO-18 (TO-206AA)  
2N2221A, 2N2222A



4 PIN  
2N2221AUA, 2N2222AUA



3 PIN  
2N2221AUB, 2N2222AUB  
2N2221AUBC, 2N2222AUBC  
(UBC = Ceramic Lid Version)



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### 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>$I_C = 10\text{mA}_{dc}$                                                                                                                                                                                                                                                  | $V_{(BR)CEO}$                                                                                                                                                                                                        | 50       |                                                            | Vdc                                       |
| Collector-Base Cutoff Current<br>$V_{CB} = 75\text{Vdc}$<br>$V_{CB} = 60\text{Vdc}$                                                                                                                                                                                                                              | $I_{CBO}$                                                                                                                                                                                                            |          | 10<br>10                                                   | $\mu\text{A}_{dc}$<br>$\eta\text{A}_{dc}$ |
| Emitter-Base Cutoff Current<br>$V_{EB} = 6.0\text{Vdc}$<br>$V_{EB} = 4.0\text{Vdc}$                                                                                                                                                                                                                              | $I_{EBO}$                                                                                                                                                                                                            |          | 10<br>10                                                   | $\mu\text{A}_{dc}$<br>$\eta\text{A}_{dc}$ |
| Collector-Emitter Cutoff Current<br>$V_{CE} = 50\text{Vdc}$                                                                                                                                                                                                                                                      | $I_{CES}$                                                                                                                                                                                                            |          | 50                                                         | $\eta\text{A}_{dc}$                       |
| <b>ON CHARACTERISTICS <sup>(3)</sup></b>                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                      |          |                                                            |                                           |
| Forward-Current Transfer Ratio<br>$I_C = 0.1\text{mA}_{dc}$ , $V_{CE} = 10\text{Vdc}$<br>$I_C = 1.0\text{mA}_{dc}$ , $V_{CE} = 10\text{Vdc}$<br>$I_C = 10\text{mA}_{dc}$ , $V_{CE} = 10\text{Vdc}$<br>$I_C = 150\text{mA}_{dc}$ , $V_{CE} = 10\text{Vdc}$<br>$I_C = 500\text{mA}_{dc}$ , $V_{CE} = 10\text{Vdc}$ | 2N2221A, L, UA, UB, UBC<br>2N2222A, L, UA, UB, UBC<br>2N2221A, L, UA, UB, UBC<br>2N2222A, L, UA, UB, UBC<br>2N2221A, L, UA, UB, UBC<br>2N2222A, L, UA, UB, UBC<br>2N2221A, L, UA, UB, UBC<br>2N2222A, L, UA, UB, UBC | $h_{FE}$ | 30<br>50<br>35<br>75<br>40<br>100<br>40<br>100<br>20<br>30 | 150<br>325<br>120<br>300                  |
| Collector-Emitter Saturation Voltage<br>$I_C = 150\text{mA}_{dc}$ , $I_B = 15\text{mA}_{dc}$<br>$I_C = 500\text{mA}_{dc}$ , $I_B = 50\text{mA}_{dc}$                                                                                                                                                             | $V_{CE(sat)}$                                                                                                                                                                                                        |          | 0.3<br>1.0                                                 | Vdc                                       |
| Base-Emitter Voltage<br>$I_C = 150\text{mA}_{dc}$ , $I_B = 15\text{mA}_{dc}$<br>$I_C = 500\text{mA}_{dc}$ , $I_B = 50\text{mA}_{dc}$                                                                                                                                                                             | $V_{BE(sat)}$                                                                                                                                                                                                        | 0.6      | 1.2<br>2.0                                                 | Vdc                                       |



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### DYNAMIC CHARACTERISTICS

| Parameters / Test Conditions                                                                                                                                                            | Symbol     | Min. | Max.     | Unit |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|----------|------|
| Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 1.0\text{mA}$ , $V_{CE} = 10\text{Vdc}$ , $f = 1.0\text{kHz}$<br>2N2221A, L, UA, UB, UBC<br>2N2222A, L, UA, UB, UBC | $h_{fe}$   |      | 30<br>50 |      |
| Magnitude of Small-Signal Short-Circuit Forward Current Transfer Ratio<br>$I_C = 20\text{mA}$ , $V_{CE} = 20\text{Vdc}$ , $f = 100\text{MHz}$                                           | $ h_{fe} $ |      | 2.5      |      |
| Output Capacitance<br>$V_{CB} = 10\text{Vdc}$ , $I_E = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$                                                                                   | $C_{obo}$  |      | 8.0      | pF   |
| Input Capacitance<br>$V_{EB} = 0.5\text{Vdc}$ , $I_C = 0$ , $100\text{kHz} \leq f \leq 1.0\text{MHz}$                                                                                   | $C_{ibo}$  |      | 25       | pF   |

### SWITCHING CHARACTERISTICS

| Parameters / Test Conditions                       | Symbol    | Min. | Max. | Unit |
|----------------------------------------------------|-----------|------|------|------|
| Turn-On Time<br>See figure 8 of MIL-PRF-19500/255  | $t_{on}$  |      | 35   | ns   |
| Turn-Off Time<br>See Figure 9 of MIL-PRF-19500/255 | $t_{off}$ |      | 300  | ns   |

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