



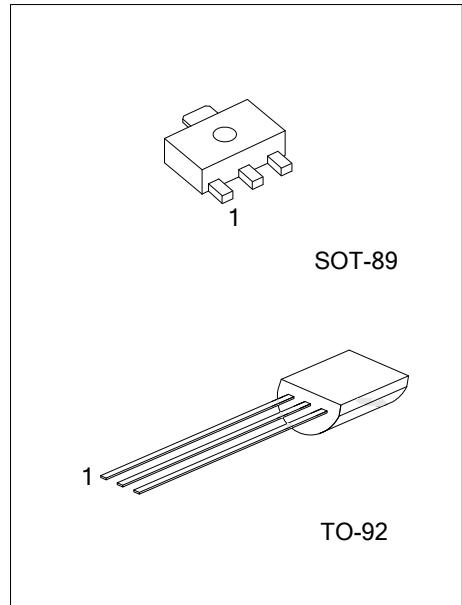
PN2222A

NPN SILICON TRANSISTOR

NPN GENERAL PURPOSE AMPLIFIER

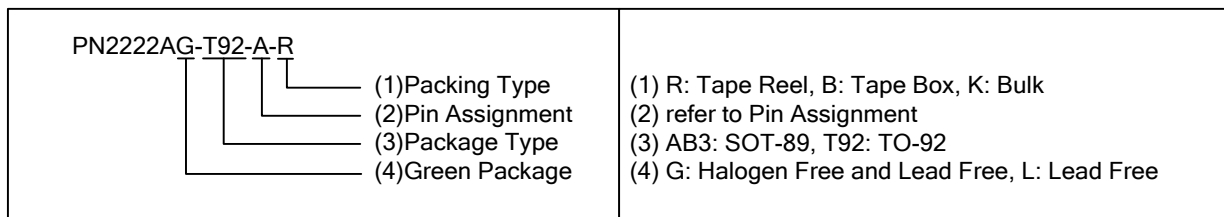
FEATURES

* This device is for use as a medium power amplifier and switch requiring collector currents up to 500mA.

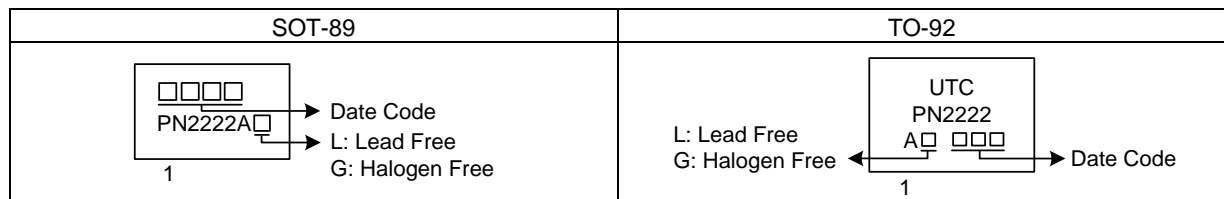


ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|------------------|------------------|---------|----------------|---|---|-----------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| PN2222AL-AB3-R | PN2222AG-AB3-R | SOT-89 | B | C | E | Tape Reel |
| PN2222AL-T92-R | PN2222AG-T92-R | TO-92 | E | B | C | Tape Reel |
| PN2222AL-T92-B | PN2222AG-T92-B | TO-92 | E | B | C | Tape Box |
| PN2222AL-T92-K | PN2222AG-T92-K | TO-92 | E | B | C | Bulk |
| PN2222AL-T92-A-R | PN2222AG-T92-A-R | TO-92 | E | C | B | Tape Reel |
| PN2222AL-T92-A-B | PN2222AG-T92-A-B | TO-92 | E | C | B | Tape Box |
| PN2222AL-T92-A-K | PN2222AG-T92-A-K | TO-92 | E | C | B | Bulk |



MARKING



■ **ABSOLUTE MAXIMUM RATING** ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------------|--------|-----------|------------|--------------------|
| Collector-Base Voltage | | V_{CBO} | 75 | V |
| Collector-Emitter Voltage | | V_{CEO} | 40 | V |
| Emitter-Base Voltage | | V_{EBO} | 6 | V |
| Collector Current | | I_C | 0.6 | A |
| Total Device Dissipation | SOT-89 | P_C | 1.2 | W |
| | TO-92 | | 0.6 | |
| Junction Temperature | | T_J | +150 | $^{\circ}\text{C}$ |
| Storage Temperature | | T_{STG} | -55 ~ +150 | $^{\circ}\text{C}$ |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

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

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------|--------|---------------|---------|----------------------|
| Junction to Ambient | SOT-89 | θ_{JA} | 104 | $^{\circ}\text{C/W}$ |
| | TO-92 | | 200 | |
| Junction to Case | SOT-89 | θ_{JC} | 38 | $^{\circ}\text{C/W}$ |
| | TO-92 | | 80 | |

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

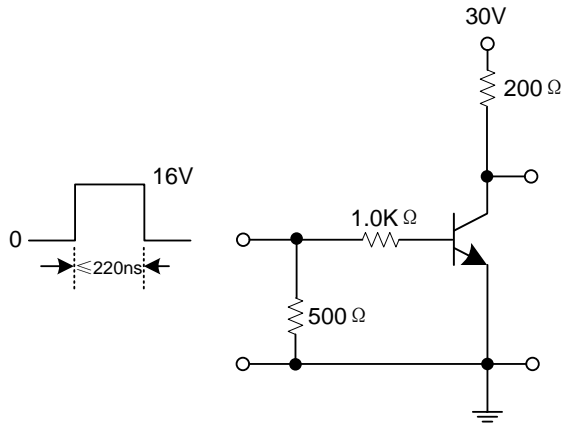
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|---------------------|---|-----|-----|------|---------------|
| OFF CHARACTERISTICS | | | | | | |
| Collector-Base Breakdown Voltage | BV_{CBO} | $I_C=10\mu\text{A}, I_E=0$ | 75 | | | V |
| Collector-Emitter Breakdown Voltage | BV_{CEO} | $I_C=10\text{mA}, I_B=0$ | 40 | | | V |
| Emitter-Base Breakdown Voltage | BV_{EBO} | $I_E=10\mu\text{A}, I_C=0$ | 6 | | | V |
| Collector Cut-off Current | I_{CEO} | $V_{CE}=60\text{V}, V_{EB(OFF)}=3.0\text{V}$ | | | 10 | nA |
| Collector Cut-Off Current | I_{CBO} | $V_{CB}=60\text{V}, I_E=0$ | | | 0.01 | μA |
| Emitter Cut-Off Current | I_{EBO} | $V_{EB}=3.0\text{V}, I_C=0$ | | | 10 | nA |
| Base Cut-Off Current | I_{BL} | $V_{CE}=60\text{V}, V_{EB(OFF)}=3.0\text{V}$ | | | 20 | nA |
| ON CHARACTERISTICS | | | | | | |
| DC Current Gain | h_{FE} | $I_C=0.1\text{mA}, V_{CE}=10\text{V}$ | 35 | | | |
| | | $I_C=1.0\text{mA}, V_{CE}=10\text{V}$ | 50 | | | |
| | | $I_C=10\text{mA}, V_{CE}=10\text{V}$ | 75 | | | |
| | | $I_C=150\text{mA}, V_{CE}=10\text{V}$ (Note) | 100 | | 300 | |
| | | $I_C=150\text{mA}, V_{CE}=1.0\text{V}$ (Note) | 50 | | | |
| | | $I_C=500\text{mA}, V_{CE}=10\text{V}$ (Note) | 40 | | | |
| Collector-Emitter Saturation Voltage (Note) | $V_{CE(SAT)}$ | $I_C=150\text{mA}, I_B=15\text{mA}$ | | | 0.3 | V |
| | | $I_C=500\text{mA}, I_B=50\text{mA}$ | | | 1.0 | |
| Base-Emitter Saturation Voltage (Note) | $V_{BE(SAT)}$ | $I_C=150\text{mA}, I_B=15\text{mA}$ | 0.6 | | 1.2 | V |
| | | $I_C=500\text{mA}, I_B=50\text{mA}$ | | | 2.0 | |
| SMALL SIGNAL CHARACTERISTICS | | | | | | |
| Transition Frequency | f_T | $I_C=20\text{mA}, V_{CE}=20\text{V}, f=100\text{MHz}$ | 300 | | | MHz |
| Output Capacitance | C_{ob0} | $V_{CB}=10\text{V}, I_E=0, f=100\text{kHz}$ | | | 8.0 | pF |
| Input Capacitance | C_{ib0} | $V_{EB}=0.5\text{V}, I_C=0, f=100\text{kHz}$ | | | 25 | pF |
| Collector Base Time Constant | $\tau_{b'c}$ | $I_C=20\text{mA}, V_{CB}=20\text{V}, f=31.8\text{MHz}$ | | | 150 | pS |
| Noise Figure | NF | $I_C=100\mu\text{A}, V_{CE}=10\text{V}, R_S=1.0\text{k}\Omega, f=1.0\text{kHz}$ | | | 4.0 | dB |
| Real Part of Common-Emitter High Frequency Input Impedance | $\text{Re}(h_{iE})$ | $I_C=20\text{mA}, V_{CB}=20\text{V}, f=300\text{MHz}$ | | | 60 | Ω |
| SWITCHING CHARACTERISTICS | | | | | | |
| Delay time | t_D | $V_{CC}=30\text{V}, V_{BE(OFF)}=0.5\text{V}$ | | | 10 | ns |
| Rise time | t_R | $I_C=150\text{mA}, I_{B1}=15\text{mA}$ | | | 25 | ns |
| Storage time | t_S | $V_{CC}=30\text{V}, I_C=150\text{mA}$ | | | 225 | ns |
| Fall time | t_F | $I_{B1}=I_{B2}=15\text{mA}$ | | | 60 | ns |

Note: Pulse test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2.0\%$

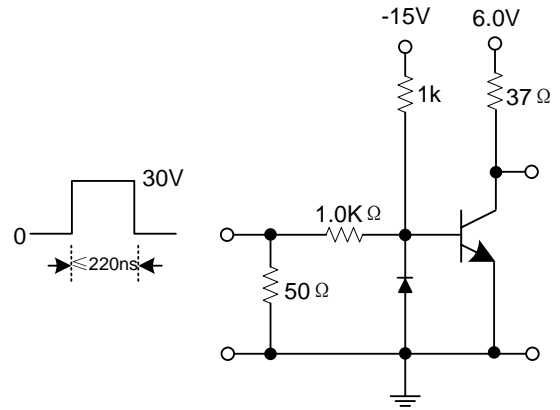
PN2222A

NPN SILICON TRANSISTOR

■ TEST CIRCUIT



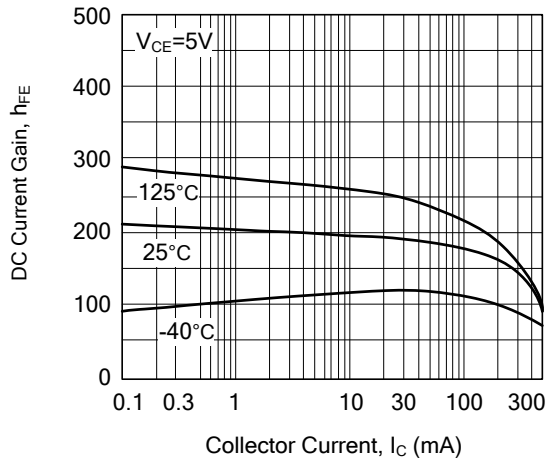
Saturated Turn-On Switching Time



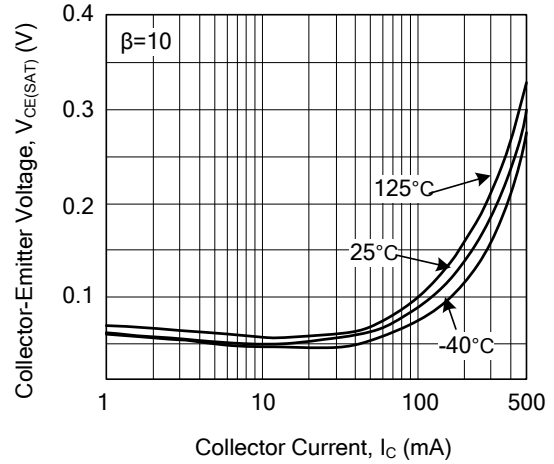
Saturated Turn-Off Switching Time

TYPICAL CHARACTERISTICS

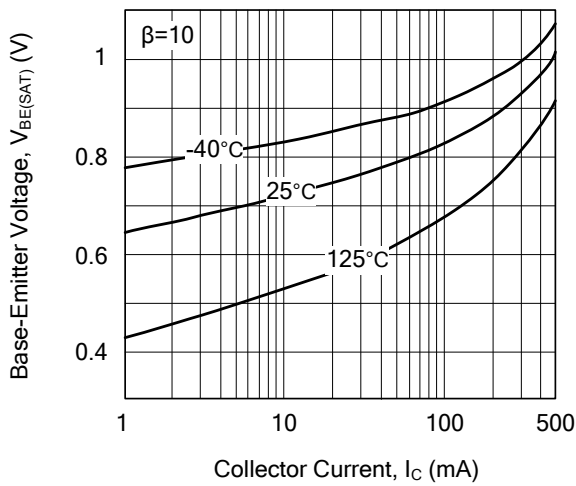
DC Current Gain vs. Collector Current



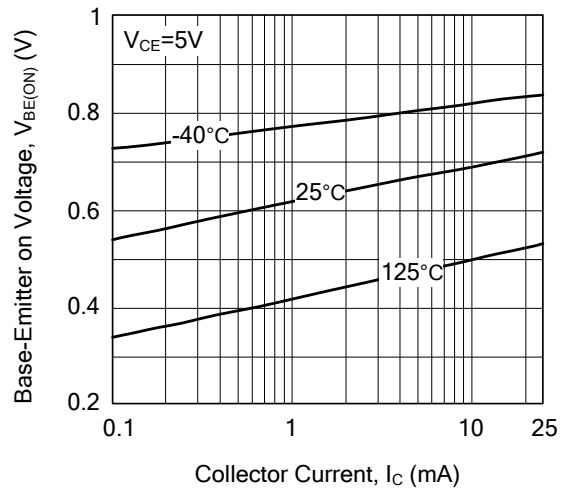
Collector-Emitter Saturation Voltage vs. Collector Current



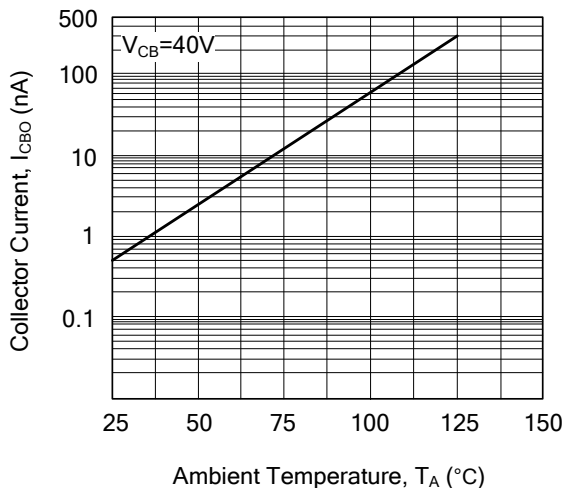
Base-Emitter Saturation Voltage vs. Collector Current



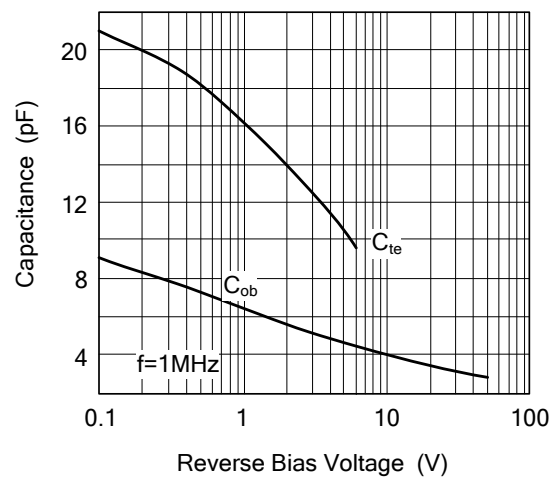
Base-Emitter on Voltage vs. Collector Current



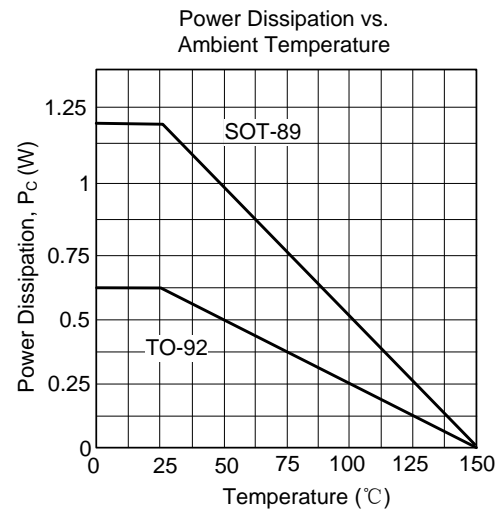
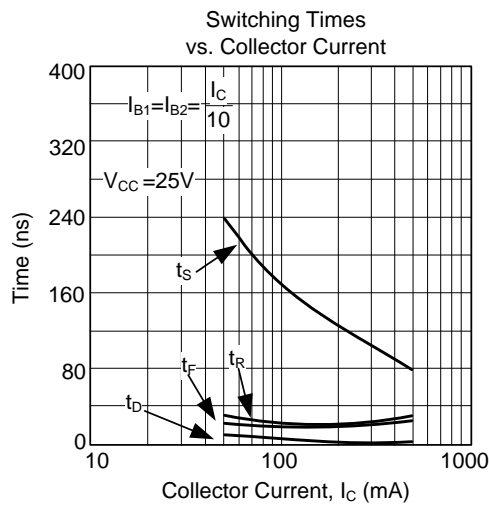
Base-Emitter Saturation Voltage vs. Collector Current



Emitter Transition and Output Capacitance vs. Reverse Bias Voltage



■ TYPICAL CHARACTERISTICS (Cont.)



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