



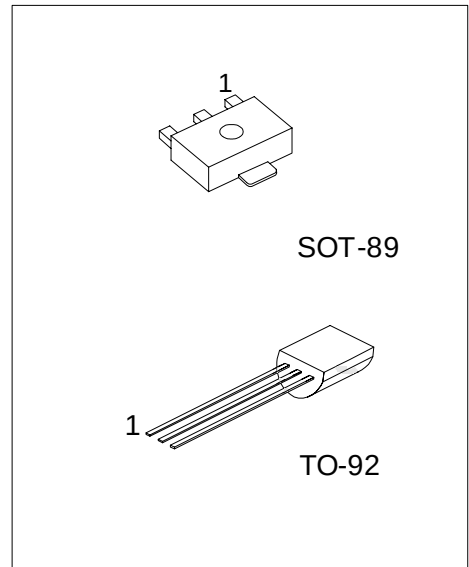
## PN2222A

## 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.



\*Pb-free plating product number: PN2222AL

#### ■ ORDERING INFORMATION

| Order Number  |                   | Package | Pin Assignment |   |   | Packing   |
|---------------|-------------------|---------|----------------|---|---|-----------|
| Normal        | Lead Free Plating |         | 1              | 2 | 3 |           |
| PN2222A-AB3-R | PN2222AL-AB3-R    | SOT-89  | B              | C | E | Tape Reel |
| PN2222A-AB3-T | PN2222AL-AB3-T    | SOT-89  | B              | C | E | Tube      |
| PN2222A-T92-B | PN2222AL-T92-B    | TO-92   | E              | B | C | Tape Box  |
| PN2222A-T92-K | PN2222AL-T92-K    | TO-92   | E              | B | C | Bulk      |

|                                                                                            |  |                                                                                                                                         |
|--------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------|
| <p>PN2222AL-AB3-R</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Lead Plating</p> |  | <p>(1) B: Tape Box, K: Bulk, R: Tape Reel, T: Tube</p> <p>(2) AB3: SOT-89, T92: TO-92</p> <p>(3) L: Lead Free Plating, Blank: Pb/Sn</p> |
|--------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------|

■ ABSOLUTE MAXIMUM RATING (Ta=25°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  |           | 625        | mW   |
| Junction Temperature      |        | $T_J$     | +150       | °C   |
| Storage Temperature       |        | $T_{STG}$ | -55 ~ +150 | °C   |

Note 1. 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.

2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

■ THERMAL DATA (Ta=25°C, unless otherwise noted)

| PARAMETER                               |        | SYMBOL        | RATINGS | UNIT |
|-----------------------------------------|--------|---------------|---------|------|
| Thermal resistance, junction to Ambient | SOT-89 | $\theta_{JA}$ | 104     | °C/W |
|                                         | TO-92  |               | 200     | °C/W |

■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified)

| PARAMETER                                                  | SYMBOL               | TEST CONDITIONS                                                              | MIN | TYP | MAX  | UNIT |
|------------------------------------------------------------|----------------------|------------------------------------------------------------------------------|-----|-----|------|------|
| OFF CHARACTERISTICS                                        |                      |                                                                              |     |     |      |      |
| Collector-Base Breakdown Voltage                           | BV <sub>CBO</sub>    | I <sub>C</sub> =10μA, I <sub>E</sub> =0                                      | 75  |     |      | V    |
| Collector-Emitter Breakdown Voltage                        | BV <sub>CEO</sub>    | I <sub>C</sub> =10mA, I <sub>B</sub> =0                                      | 40  |     |      | V    |
| Emitter-Base Breakdown Voltage                             | BV <sub>EBO</sub>    | I <sub>E</sub> =10μA, I <sub>C</sub> =0                                      | 6   |     |      | V    |
| Collector Cut-off Current                                  | I <sub>CEO</sub>     | V <sub>CE</sub> =60V, V <sub>EB(OFF)</sub> =3.0V                             |     |     | 10   | nA   |
| Collector Cut-Off Current                                  | I <sub>CBO</sub>     | V <sub>CB</sub> =60V, I <sub>E</sub> =0                                      |     |     | 0.01 | μA   |
|                                                            |                      | V <sub>CB</sub> =60V, I <sub>E</sub> =0, T <sub>a</sub> =150°C               |     |     | 10   | μA   |
| Emitter Cut-Off Current                                    | I <sub>EBO</sub>     | V <sub>EB</sub> =3.0V, I <sub>C</sub> =0                                     |     |     | 10   | nA   |
| Base Cut-Off Current                                       | I <sub>BL</sub>      | V <sub>CE</sub> =60V, V <sub>EB(OFF)</sub> =3.0V                             |     |     | 20   | nA   |
| ON CHARACTERISTICS                                         |                      |                                                                              |     |     |      |      |
| DC Current Gain                                            | h <sub>FE</sub>      | I <sub>C</sub> =0.1mA, V <sub>CE</sub> =10V                                  | 35  |     |      |      |
|                                                            |                      | I <sub>C</sub> =1.0mA, V <sub>CE</sub> =10V                                  | 50  |     |      |      |
|                                                            |                      | I <sub>C</sub> =10mA, V <sub>CE</sub> =10V                                   | 75  |     |      |      |
|                                                            |                      | I <sub>C</sub> =10mA, V <sub>CE</sub> =10V, T <sub>a</sub> =-55°C            | 35  |     |      |      |
|                                                            |                      | I <sub>C</sub> =150mA, V <sub>CE</sub> =10V*                                 | 100 |     | 300  |      |
|                                                            |                      | I <sub>C</sub> =150mA, V <sub>CE</sub> =1.0V*                                | 50  |     |      |      |
|                                                            |                      | I <sub>C</sub> =500mA, V <sub>CE</sub> =10V*                                 | 40  |     |      |      |
| Collector-Emitter Saturation Voltage*                      | V <sub>CE(SAT)</sub> | I <sub>C</sub> =150mA, I <sub>B</sub> =15mA                                  |     |     | 0.3  | V    |
|                                                            |                      | I <sub>C</sub> =500mA, I <sub>B</sub> =50mA                                  |     |     | 1.0  | V    |
| Base-Emitter Saturation Voltage*                           | V <sub>BE(SAT)</sub> | I <sub>C</sub> =150mA, I <sub>B</sub> =15mA                                  | 0.6 |     | 1.2  | V    |
|                                                            |                      | I <sub>C</sub> =500mA, I <sub>B</sub> =50mA                                  |     |     | 2.0  | V    |
| SMALL SIGNAL CHARACTERISTICS                               |                      |                                                                              |     |     |      |      |
| Transition Frequency                                       | f <sub>T</sub>       | I <sub>C</sub> =20mA, V <sub>CE</sub> =20V, f=100MHz                         | 300 |     |      | MHz  |
| Output Capacitance                                         | C <sub>obo</sub>     | V <sub>CB</sub> =10V, I <sub>E</sub> =0, f=100kHz                            |     |     | 8.0  | pF   |
| Input Capacitance                                          | C <sub>ibo</sub>     | V <sub>EB</sub> =0.5V, I <sub>C</sub> =0, f=100kHz                           |     |     | 25   | pF   |
| Collector Base Time Constant                               | rb'C <sub>c</sub>    | I <sub>C</sub> =20mA, V <sub>CB</sub> =20V, f=31.8MHz                        |     |     | 150  | pS   |
| Noise Figure                                               | NF                   | I <sub>C</sub> =100μA, V <sub>CE</sub> =10V, R <sub>S</sub> =1.0kΩ, f=1.0kHz |     |     | 4.0  | dB   |
| Real Part of Common-Emitter High Frequency Input Impedance | Re(h <sub>je</sub> ) | I <sub>C</sub> =20mA, V <sub>CB</sub> =20V, f=300MHz                         |     |     | 60   | Ω    |

## ■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified)

| PARAMETER                 | SYMBOL | TEST CONDITIONS                     | MIN | TYP | MAX | UNIT |
|---------------------------|--------|-------------------------------------|-----|-----|-----|------|
| SWITCHING CHARACTERISTICS |        |                                     |     |     |     |      |
| Delay time                | $t_D$  | $V_{CC}=30V$ , $V_{BE(OFF)}=0.5V$ , |     |     | 10  | ns   |
| Rise time                 | $t_R$  | $I_C=150mA$ , $I_{B1}=15mA$         |     |     | 25  | ns   |
| Storage time              | $t_S$  | $V_{CC}=30V$ , $I_C=150mA$ ,        |     |     | 225 | ns   |
| Fall time                 | $t_F$  | $I_{B1}=I_{B2}=15mA$                |     |     | 60  | ns   |

Note 1. \*Pulse test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$

### ■ TEST CIRCUIT

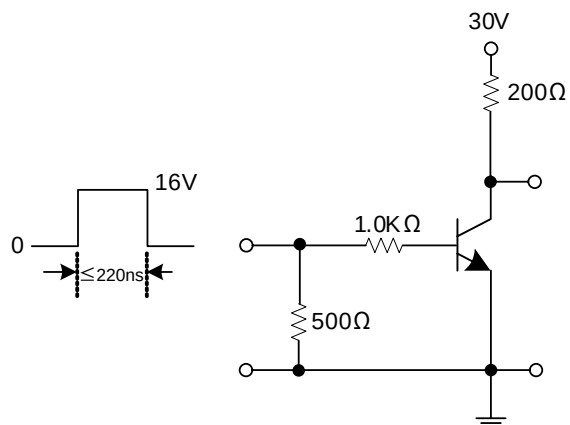


Fig 1. Saturated Turn-On Switching Time

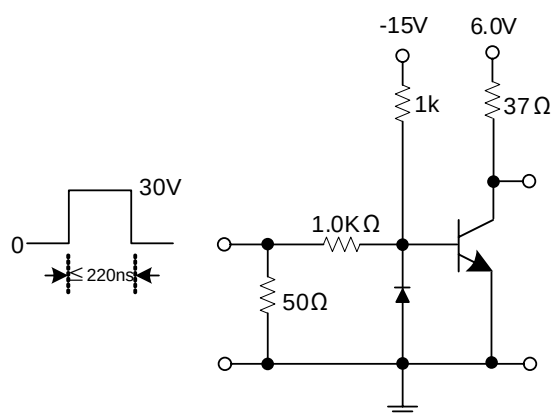
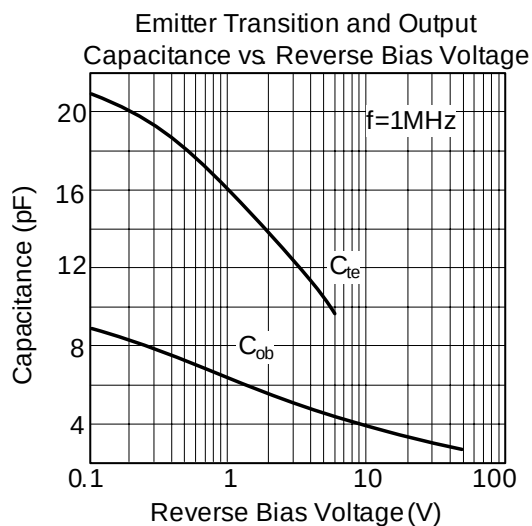
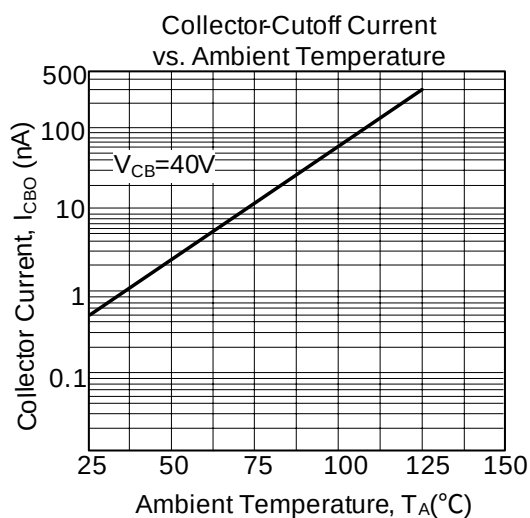
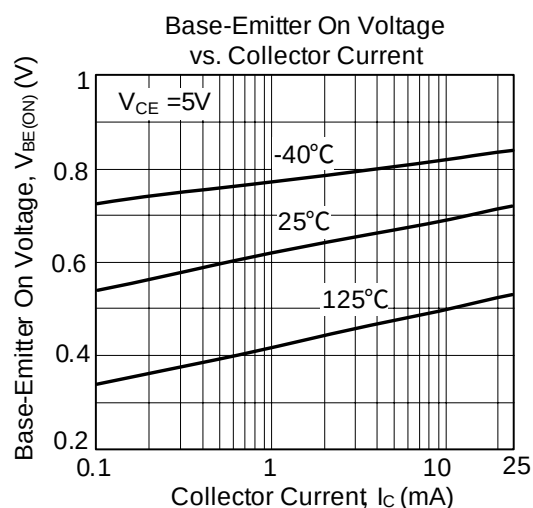
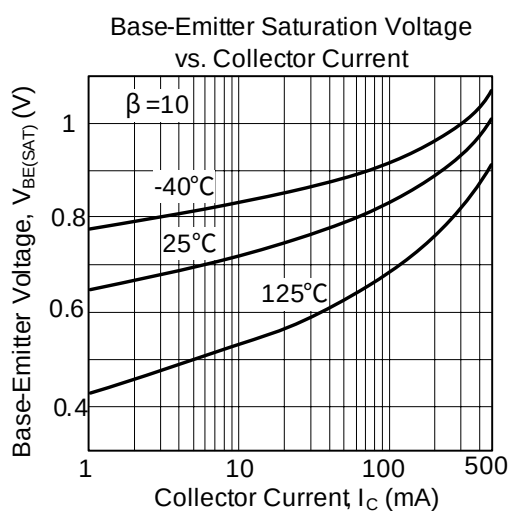
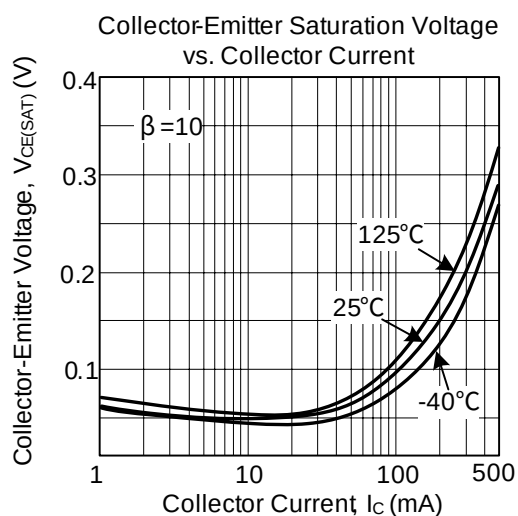
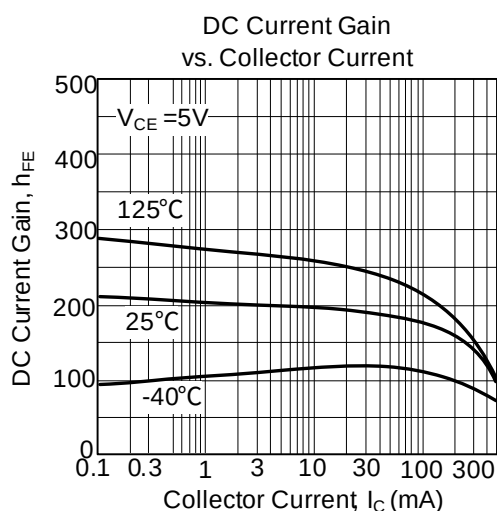
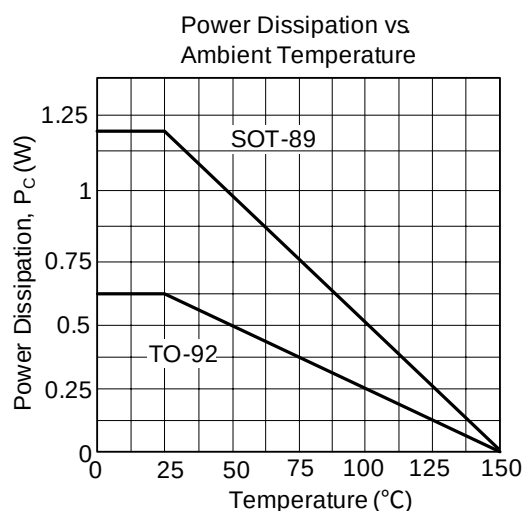
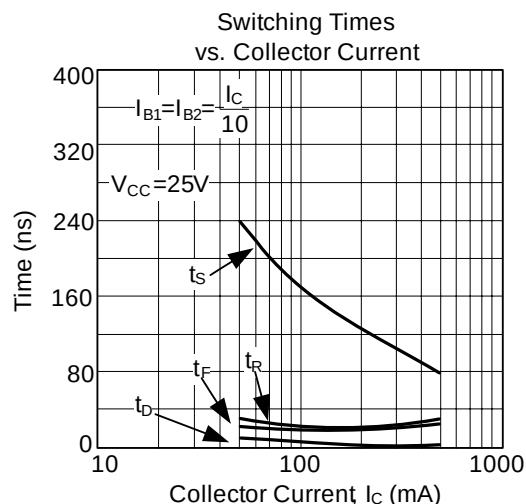
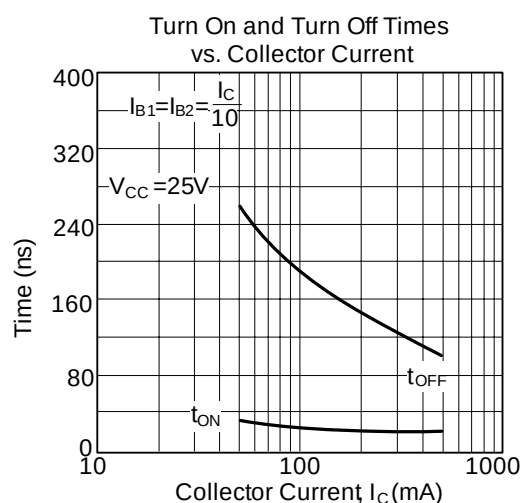


Fig 2. Saturated Turn-Off Switching Time

■ TYPICAL CHARACTERISTICS



# ■ TYPICAL CHARACTERISTICS(Cont.)



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.