# 2N6406, 2N6407 PNP (SILICON)
# 2N6408, 2N6409 NPN

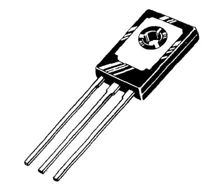
## COMPLEMENTARY PLASTIC SILICON ANNULAR POWER TRANSISTORS

. . . designed for low power audio amplifier and low current, high speed switching applications.

- Collector-Emitter Sustaining Voltage —
  $V_{CEO(sus)}$ = 60 Vdc — 2N6406, 2N6408
  = 80 Vdc — 2N6407, 2N6409
- DC Current Gain —
  $h_{FE}$ = 30 (Min) @ $I_C$ = 0.5 Adc
  = 12 (Min) @ $I_C$ = 1.5 Adc
- Current-Gain — Bandwidth Product —
  $f_T$ = 50 MHz (Min) @ $I_C$ = 100 mAdc
- Pin Compatible With TO-220AB Package

**2 AMPERE**
**POWER TRANSISTORS**
**COMPLEMENTARY SILICON**

**60-80 VOLTS**
**12.5 WATTS**



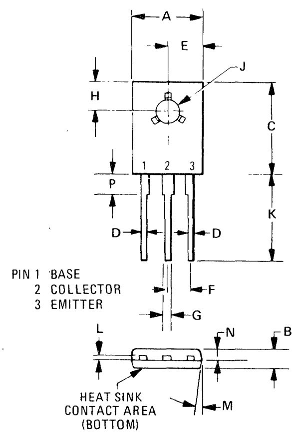
## *MAXIMUM RATINGS

| Rating | Symbol | 2N6406 2N6408 | 2N6407 2N6409 | Unit |
|---|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | 60 | 80 | Vdc |
| Collector-Base Voltage | $V_{CBO}$ | 80 | 100 | Vdc |
| Emitter-Base Voltage | $V_{EB}$ | ← 6.0 → | | Vdc |
| Collector Current — Continuous<br>Peak | $I_C$ | ← 2.0 →<br>← 4.0 → | | Adc |
| Base Current | $I_B$ | ← 1.0 → | | Adc |
| Total Power Dissipation @ $T_C$ = 25°C<br>Derate Above 25°C | $P_D$ | ← 12.5 →<br>← 0.10 → | | Watts<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J, T_{stg}$ | ← −65 to +150 → | | °C |

## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 10 | °C/W |

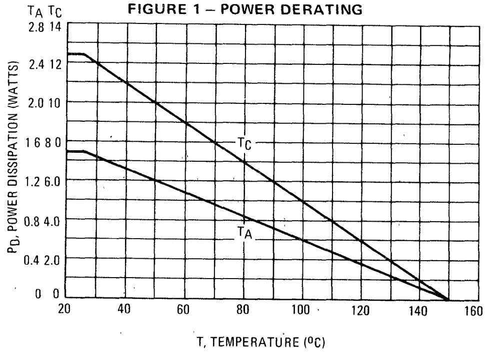
*Indicates JEDEC Registered Data.




| DIM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | 0.295 | 0.305 | 7.490 | 7.750 |
| B | 0.095 | 0.105 | 2.410 | 2.670 |
| C | 0.425 | 0.435 | 10.800 | 11.050 |
| D | 0.020 | 0.026 | 0.508 | 0.660 |
| E | 0.145 | 0.155 | 3.680 | 3.940 |
| F | 0.093 TP | | 2.360 TP | |
| G | 0.025 | 0.035 | 0.635 | 0.889 |
| H | 0.148 | 0.158 | 3.760 | 4.010 |
| J | 0.115 | 0.118 | 2.920 | 3.000 |
| K | 0.595 | 0.645 | 15.110 | 16.380 |
| L | 0.015 | 0.025 | 0.381 | 0.635 |
| M | 3° TYP | | 3° TYP | |
| N | 0.045 | 0.055 | 1.140 | 1.400 |
| P | 0.085 | 0.095 | 2.160 | 2.410 |

CASE 77-03

FIGURE 1 — POWER DERATING

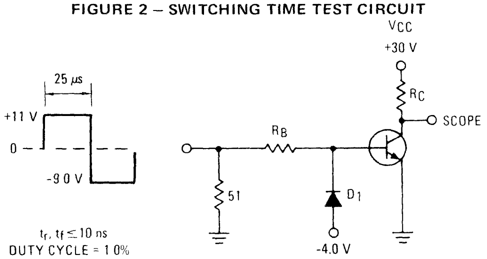


***ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted.)

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Emitter Sustaining Voltage (1) | | $V_{CEO(sus)}$ | | | Vdc |
| ($I_C$ = 10 mAdc, $I_B$ = 0) | 2N6406, 2N6408 | | 60 | – | |
| | 2N6407, 2N6409 | | 80 | – | |
| Collector Cutoff Current | | $I_{CEO}$ | | | μAdc |
| ($V_{CE}$ = 30 Vdc, $I_B$ = 0) | 2N6406, 2N6408 | | – | 500 | |
| ($V_{CE}$ = 40 Vdc, $I_B$ = 0) | 2N6407, 2N6409 | | – | 500 | |
| Collector Cutoff Current | | $I_{CEX}$ | | | μAdc |
| ($V_{CE}$ = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc) | 2N6406, 2N6408 | | – | 1.0 | |
| ($V_{CE}$ = 100 Vdc, $V_{BE(off)}$ = 1.5 Vdc) | 2N6407, 2N6409 | | – | 1.0 | |
| ($V_{CE}$ = 40 Vdc, $V_{BE(off)}$ = 1.5 Vdc $T_C$ = 125°C) | 2N6406, 2N6408 | | – | 0.1 | mAdc |
| ($V_{CE}$ = 50 Vdc, $V_{BE(off)}$ = 1.5 Vdc, $T_C$ = 125°C) | 2N6407, 2N6409 | | – | 0.1 | |
| Emitter Cutoff Current ($V_{EB}$ = 6.0 Vdc, $I_C$ = 0) | | $I_{EBO}$ | – | 1.0 | μAdc |
| **ON CHARACTERISTICS (1)** | | | | | |
| DC Current Gain | | $h_{FE}$ | | | |
| ($I_C$ = 100 mAdc, $V_{CE}$ = 2.0 Vdc) | | | 50 | 250 | |
| ($I_C$ = 500 mAdc, $V_{CE}$ = 2.0 Vdc) | | | 30 | – | |
| ($I_C$ = 1.5 Adc, $V_{CE}$ = 2.0 Vdc) | | | 12 | – | |
| ($I_C$ = 2.0 Adc, $V_{CE}$ = 2.0 Vdc) | | | 5.0 | – | |
| Collector-Emitter Saturation Voltage | | $V_{CE(sat)}$ | | | Vdc |
| ($I_C$ = 500 mAdc, $I_B$ = 50 mAdc) | | | – | 0.5 | |
| ($I_C$ = 1.5 Adc, $I_B$ = 150 mAdc) | | | – | 1.4 | |
| ($I_C$ = 2.0 Adc, $I_B$ = 400 mAdc) | | | – | 2.0 | |
| Base-Emitter Saturation Voltage ($I_C$ = 1.5 Adc, $I_B$ = 150 mAdc) | | $V_{BE(sat)}$ | – | 1.5 | Vdc |
| Base-Emitter on Voltage ($I_C$ = 100 mAdc, $V_{CE}$ = 2.0 Vdc) | | $V_{BE(on)}$ | – | 1.2 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Current-Gain — Bandwidth Product ($I_C$ = 100 mAdc, $V_{CE}$ = 10 Vdc, f = 10 MHz) | | $f_T$ | 50 | – | MHz |
| Output Capacitance | | $C_{ob}$ | | | pF |
| ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 0.1 MHz) | 2N6406, 2N6407 | | – | 50 | |
| | 2N6408, 2N6409 | | – | 30 | |
| Small-Signal Current Gain ($I_C$ = 100 mAdc, $V_{CE}$ = 10 Vdc, f = 1.0 kHz) | | $h_{fe}$ | 10 | – | – |

*Indicates JEDEC Registered Data.
(1) Pulse test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

**FIGURE 2 — SWITCHING TIME TEST CIRCUIT**




RB and RC VARIED TO OBTAIN DESIRED CURRENT LEVELS
D1 MUST BE FAST RECOVERY TYPE, eg
MBD5300 USED ABOVE IB ≈ 100 mA
MSD6100 USED BELOW IB ≈ 100 mA
FOR PNP TEST CIRCUIT, REVERSE ALL POLARITIES.

**FIGURE 3 — TURN-ON TIME**

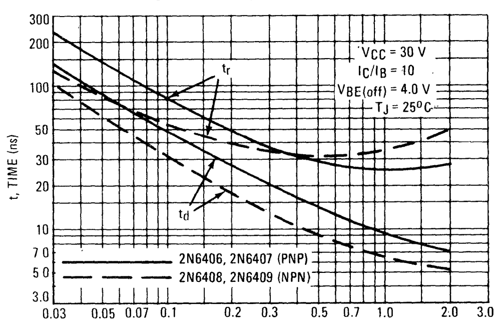
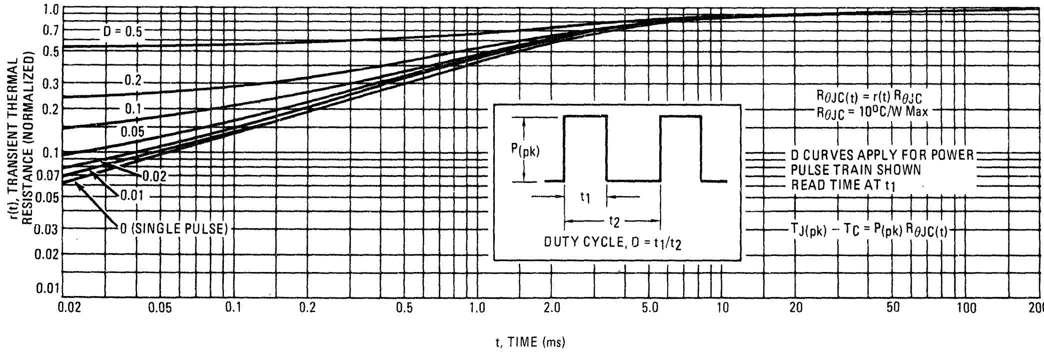


FIGURE 4 — THERMAL RESPONSE




## ACTIVE-REGION SAFE OPERATING AREA

FIGURE 5 — 2N6406, 2N6407

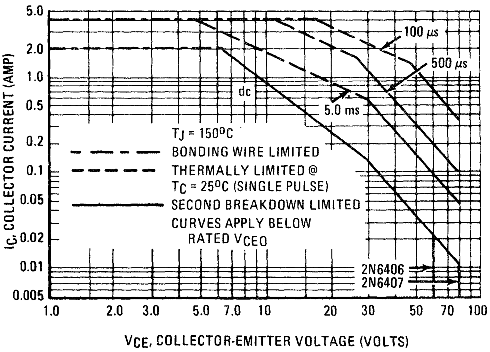
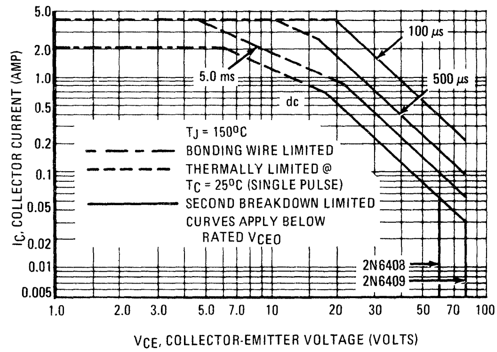



FIGURE 6 — 2N6408, 2N6409




There are two limitations on the power handling ability of a transistor — average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figures 5 and 6 is based on $T_{J(pk)} = 150^{\circ}C$; $T_C$ is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150^{\circ}C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperature, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown. (See AN-415A)

FIGURE 7 — TURN-OFF TIME

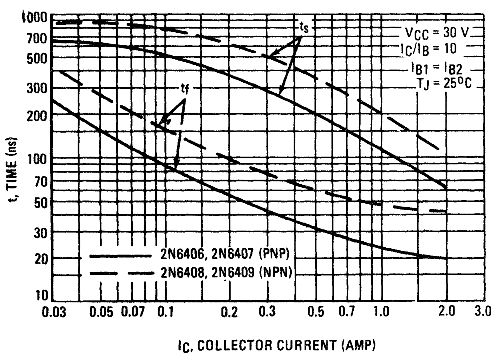
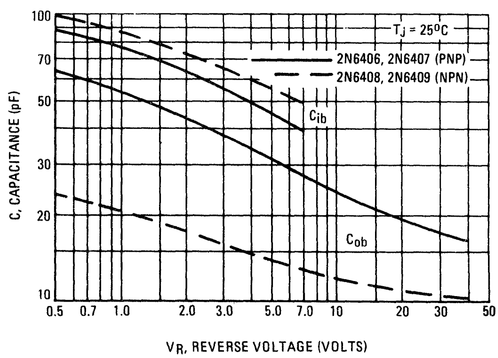



FIGURE 8 — CAPACITANCE



**PNP**
**2N6406, 2N6407**

**NPN**
**2N6408, 2N6409**

**FIGURE 9 – DC CURRENT GAIN**

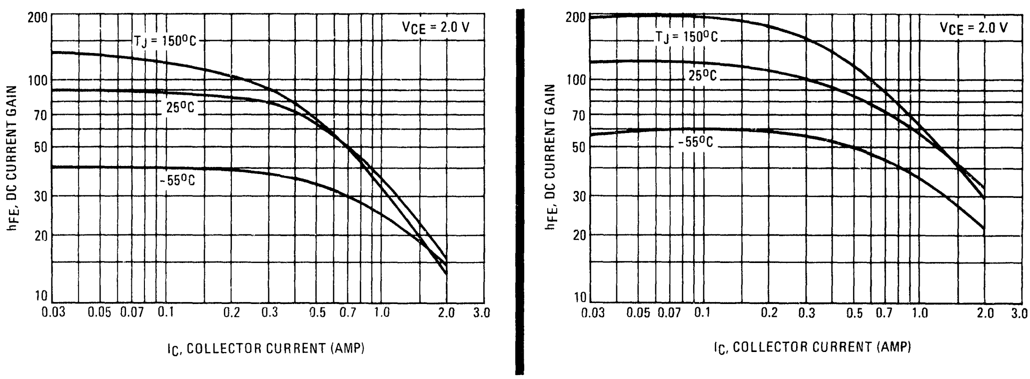



**FIGURE 10 – "ON" VOLTAGES**

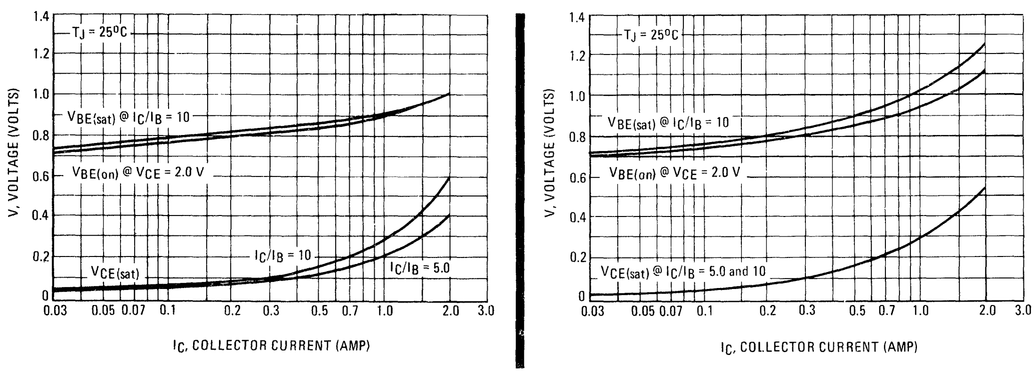



**FIGURE 11 – TEMPERATURE COEFFICIENTS**