

High-Power NPN Silicon Transistors

... designed for use in industrial–military power amplifier and switching circuit applications.

- High Collector–Emitter Sustaining Voltage —
 - $V_{CEO(sus)} = 100 \text{ Vdc (Min)} — 2N6338$
 - $= 120 \text{ Vdc (Min)} — 2N6339$
 - $= 140 \text{ Vdc (Min)} — 2N6340$
 - $= 150 \text{ Vdc (Min)} — 2N6341$
- High DC Current Gain —
 - $h_{FE} = 30 - 120 @ I_C = 10 \text{ Adc}$
 - $= 12 \text{ (Min)} @ I_C = 25 \text{ Adc}$
- Low Collector–Emitter Saturation Voltage —
 - $V_{CE(sat)} = 1.0 \text{ Vdc (Max)} @ I_C = 10 \text{ Adc}$
- Fast Switching Times @ $I_C = 10 \text{ Adc}$
 - $t_r = 0.3 \text{ ms (Max)}$
 - $t_s = 1.0 \text{ ms (Max)}$
 - $t_f = 0.25 \text{ ms (Max)}$
- Complement to 2N6436–38

*MAXIMUM RATINGS

| Rating | Symbol | 2N6338 | 2N6339 | 2N6340 | 2N6341 | Unit |
|---|----------------|-------------|--------|--------|--------|------------------------------|
| Collector–Base Voltage | V_{CB} | 120 | 140 | 160 | 180 | Vdc |
| Collector–Emitter Voltage | V_{CEO} | 100 | 120 | 140 | 150 | Vdc |
| Emitter–Base Voltage | V_{EB} | 6.0 | | | | Vdc |
| Collector Current Continuous Peak | I_C | 25 50 | | | | A dc |
| Base Current | I_B | 10 | | | | A dc |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 200 1.14 | | | | Watts W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | –65 to +200 | | | | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS

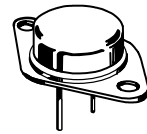
| Characteristic | Symbol | Max | Unit |
|--------------------------------------|---------------|-------|--------------------|
| Thermal Resistance, Junction to Case | θ_{JC} | 0.875 | $^\circ\text{C/W}$ |

*Indicates JEDEC Registered Data.

2N6338
2N6339
2N6340
2N6341 *

*ON Semiconductor Preferred Device

**25 AMPERE
POWER TRANSISTORS
NPN SILICON
100, 120, 140, 150 VOLTS
200 WATTS**



**CASE 1–07
TO–204AA
(TO–3)**

Preferred devices are ON Semiconductor recommended choices for future use and best overall value.

2N6338 2N6339 2N6340 2N6341

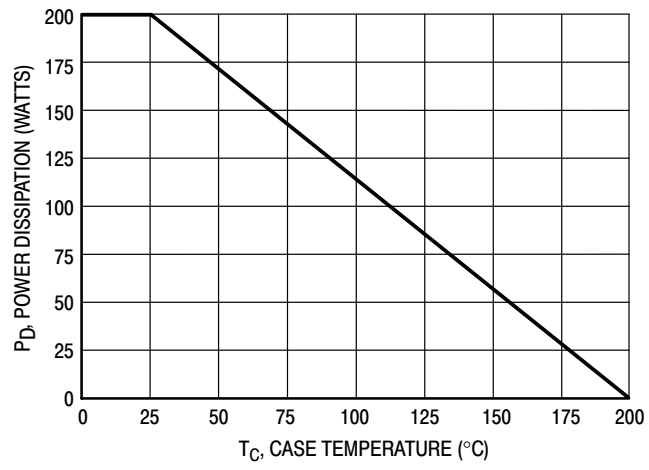


Figure 1. Power Derating

2N6338 2N6339 2N6340 2N6341

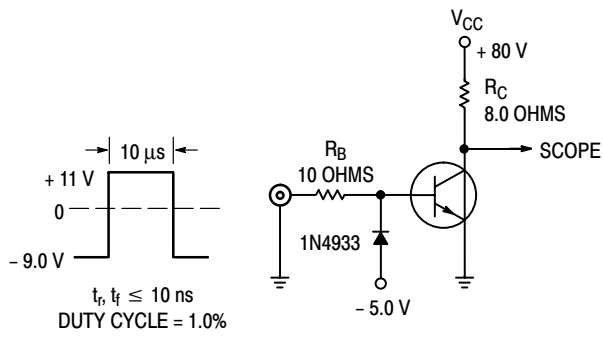
***ELECTRICAL CHARACTERISTICS** ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | | Symbol | Min | Max | Unit |
|--|--------------------------------------|---------------|--------------------------|----------------------|-------------------------|
| OFF CHARACTERISTICS | | | | | |
| Collector–Emitter Sustaining Voltage (1) ($I_C = 50\text{ mAdc}$, $I_B = 0$) | 2N6338 2N6339 2N6340 2N6341 | $V_{CE(sus)}$ | 100 120 140 150 | — — — — | Vdc |
| Collector Cutoff Current ($V_{CE} = 50\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 60\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 70\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 75\text{ Vdc}$, $I_B = 0$) | 2N6338 2N6339 2N6340 2N6341 | I_{CEO} | — — — — | 50 50 50 50 | μAdc |
| Collector Cutoff Current ($V_{CE} = \text{Rated } V_{CEO}$, $V_{EB(off)} = 1.5\text{ Vdc}$) ($V_{CE} = \text{Rated } V_{CEO}$, $V_{EB(off)} = 1.5\text{ Vdc}$, $T_C = 150^\circ\text{C}$) | | I_{CEX} | — — | 10 1.0 | μAdc mAdc |
| Collector Cutoff Current ($V_{CB} = \text{Rated } V_{CB}$, $I_E = 0$) | | I_{CBO} | — | 10 | μAdc |
| Emitter Cutoff Current ($V_{BE} = 6.0\text{ Vdc}$, $I_C = 0$) | | I_{EBO} | — | 100 | μAdc |
| ON CHARACTERISTICS (1) | | | | | |
| DC Current Gain ($I_C = 0.5\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) ($I_C = 10\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) ($I_C = 25\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) | | h_{FE} | 50 30 12 | — 120 — | — |
| Collector Emitter Saturation Voltage ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$) ($I_C = 25\text{ Adc}$, $I_B = 2.5\text{ Adc}$) | | $V_{CE(sat)}$ | — — | 1.0 1.8 | Vdc |
| Base–Emitter Saturation Voltage ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$) ($I_C = 25\text{ Adc}$, $I_B = 2.5\text{ Adc}$) | | $V_{BE(sat)}$ | — — | 1.8 2.5 | Vdc |
| Base–Emitter On Voltage ($I_C = 10\text{ Adc}$, $V_{CE} = 2.0\text{ Vdc}$) | | $V_{BE(on)}$ | — | 1.8 | Vdc |
| DYNAMIC CHARACTERISTICS | | | | | |
| Current–Gain — Bandwidth Product (2) ($I_C = 1.0\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f_{test} = 10\text{ MHz}$) | | f_T | 40 | — | MHz |
| Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 0.1\text{ MHz}$) | | C_{ob} | — | 300 | pF |
| SWITCHING CHARACTERISTICS | | | | | |
| Rise Time ($V_{CC} \approx 80\text{ Vdc}$, $I_C = 10\text{ Adc}$, $I_{B1} = 1.0\text{ Adc}$, $V_{BE(off)} = 6.0\text{ Vdc}$) | | t_r | — | 0.3 | μs |
| Storage Time ($V_{CC} \approx 80\text{ Vdc}$, $I_C = 10\text{ Adc}$, $I_{B1} = I_{B2} = 1.0\text{ Adc}$) | | t_s | — | 1.0 | μs |
| Fall Time ($V_{CC} \approx 80\text{ Vdc}$, $I_C = 10\text{ Adc}$, $I_{B1} = I_{B2} = 1.0\text{ Adc}$) | | t_f | — | 0.25 | μs |

*Indicates JEDEC Registered Data.

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

(2) $f_T = |h_{fe}| \cdot f_{test}$.



NOTE: For information on Figures 3 and 6, R_B and R_C were varied to obtain desired test conditions.

Figure 2. Switching Time Test Circuit

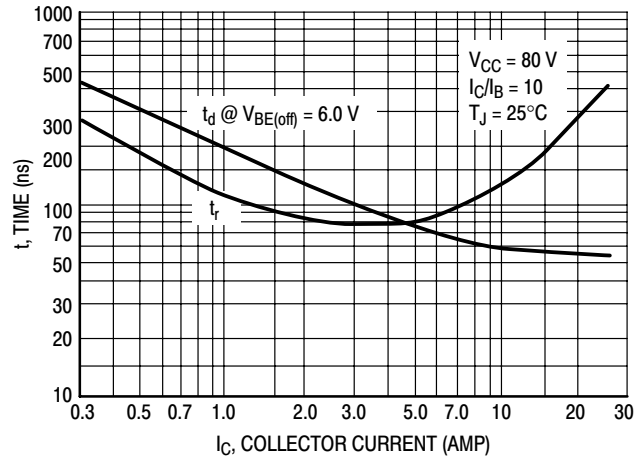


Figure 3. Turn-On Time

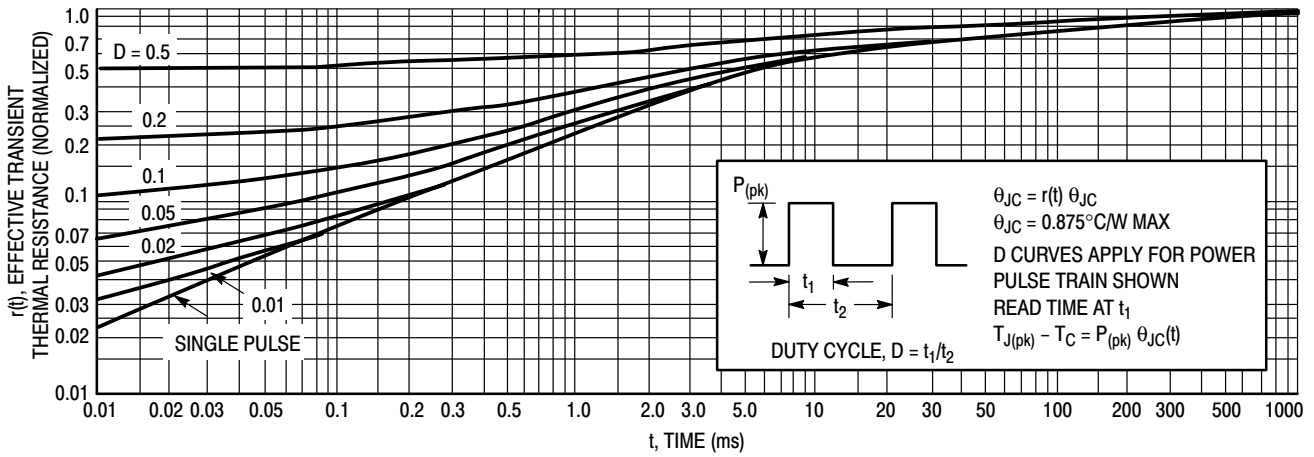


Figure 4. Thermal Response

2N6338 2N6339 2N6340 2N6341

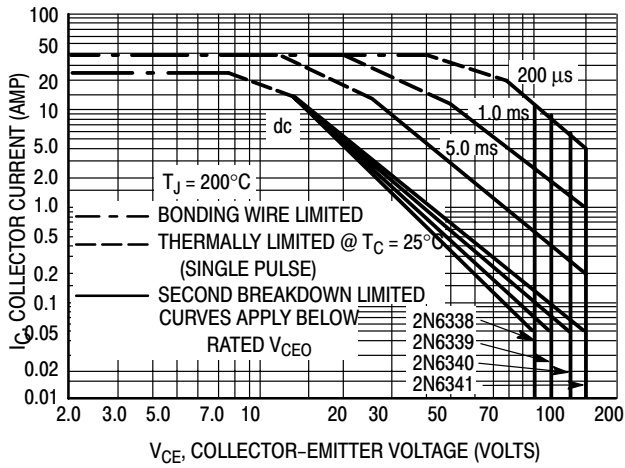


Figure 5. Active Region Safe Operating Area

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 Figure 5 is based on $T_{J(pk)} = 200^\circ\text{C}$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 200^\circ\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

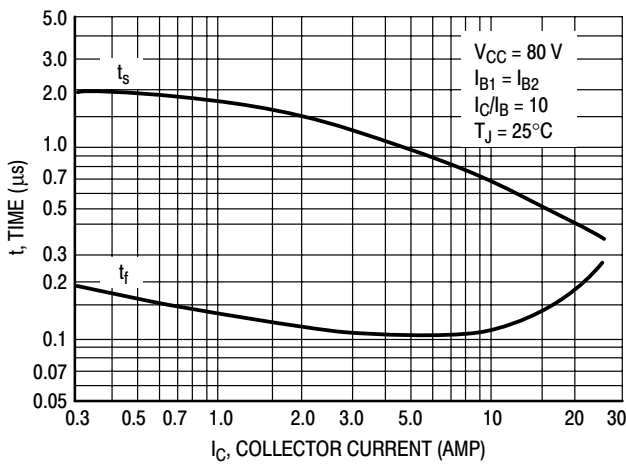


Figure 6. Turn-Off Time

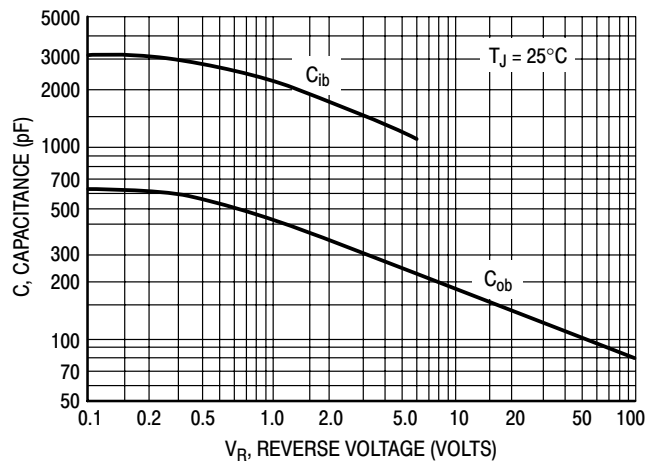
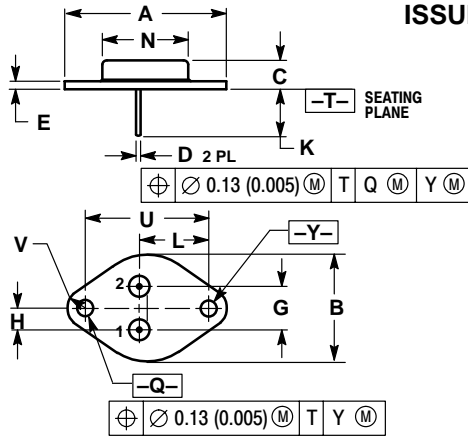


Figure 7. Capacitance

2N6338 2N6339 2N6340 2N6341

PACKAGE DIMENSIONS

CASE 1-07 TO-204AA (TO-3) ISSUE Z




- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.550 REF | | 39.37 REF | |
| B | --- | 1.050 | --- | 26.67 |
| C | 0.250 | 0.335 | 6.35 | 8.51 |
| D | 0.038 | 0.043 | 0.97 | 1.09 |
| E | 0.055 | 0.070 | 1.40 | 1.77 |
| G | 0.430 BSC | | 10.92 BSC | |
| H | 0.215 BSC | | 5.46 BSC | |
| K | 0.440 | 0.480 | 11.18 | 12.19 |
| L | 0.665 BSC | | 16.89 BSC | |
| N | --- | 0.830 | --- | 21.08 |
| Q | 0.151 | 0.165 | 3.84 | 4.19 |
| U | 1.187 BSC | | 30.15 BSC | |
| V | 0.131 | 0.188 | 3.33 | 4.77 |

STYLE 1:
PIN 1. BASE
2. EMITTER
CASE: COLLECTOR

Notes

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