# 3-, 5-, and 10-A Power-Switching Transistors

## High-Voltage N-P-N Type for Off-Line Power Supplies and Other High-Voltage Switching Applications

**Features:**

- *100% High Temperature Tested for 100°C Parameters*
- *Fast Switching Speed*
- *High voltage rating*
  $V_{CEX}$ = 350 V
  = 450 V [2N6545]
- *Low $V_{CE}$[sat] at IC = 3-, 5-, and 10-A*

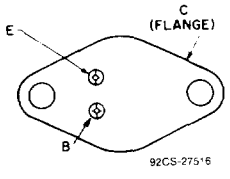
**Applications:**

- *Off-Line Power Supplies*
- *High Voltage Inverters*
- *Switching Regulators*

The 2N6542, 2N6544, 2N6545, and 2N6546 series of silicon n-p-n power transistors feature high-voltage capability, fast switching speeds, and low saturation voltages, together with high safe-operating-area (SOA) ratings. They are specially designed for off-line power supplies, converter circuits and pulse-width-modulated regulators. These high-voltage, high-speed transistors are 100-per-cent tested for parameters that are essential to the design of high-power switching circuits. Switching times, including inductive turn-off time, and saturation voltages are characterized at 100°C; as well as at 25°C, to provide information necessary for worst-case design.

The 2N6542, 2N6544, 2N6545, and 2N6546 transistors are supplied in steel JEDEC TO-204AA hermetic packages.

**TERMINAL DESIGNATIONS**




**JEDEC TO-204AA**

**MAXIMUM RATINGS,** *Absolute-Maximum Values:*

| | 2N6542 | 2N6544 | 2N6545 | 2N6546 | |
|---|---|---|---|---|---|
| *$V_{CEV}$ | | | | | |
| $V_{BE}$ = -1.5 V | 650 | 650 | 850 | 650 | V |
| *$V_{CEX}$ (Clamped) | | | | | |
| $V_{BE}$ = -1.5 V | 350 | 350 | 450 | 350 | V |
| *$V_{CEO}$ | 300 | 300 | 400 | 300 | V |
| *$V_{EBO}$ | 8 | | | | V |
| $I_C$(sat) | 3 | 5 | 5 | 10 | A |
| *$I_C$ | 5 | 8 | 8 | 15 | A |
| *$I_{CM}$ | 10 | 16 | 16 | 30 | A |
| *$I_B$ | 5 | 8 | 8 | 10 | A |
| *$P_T$ | | | | | |
| $T_C$ up to 25°C | 100 | 125 | 125 | 175 | W |
| $T_C$ above 25°C, derate linearly | 0.57 | 0.714 | 0.714 | 1 | W/°C |
| *$T_{stg}$, $T_J$ | | -65 to 200 | | | °C |
| *$T_L$ | | | | | |
| At distance ≥ 1/8 in. (3.17 mm) from seating plane for 5 s max. | | 275 | | | °C |

* In accordance with JEDEC registration data.

**ELECTRICAL CHARACTERISTICS Tc = 25°C**

| | CHARACTERISTIC | TEST CONDITIONS | | | | LIMITS | | | | | | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | VOLTAGE V dc | | CURRENT A dc | | 2N6542 | | 2N6544 | | 2N6545 | | 2N6546 | | |
| | | $V_{CE}$ | $V_{BE}$ | $I_C$ | $I_B$ | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| * | $I_{CEV}$ | 650 | -1.5 | — | — | — | 0.5 | — | 0.5 | — | — | — | 1 | mA |
| | | 850 | -1.5 | — | — | — | — | — | — | — | 0.5 | — | — | |
| * | $I_{EBO}$ | — | -8 | 0 | — | — | 1 | — | 1 | — | 1 | — | 1 | mA |
| * | $V_{CEO(sus)}$[b] | — | — | 0.1[a] | — | 300 | — | 300 | — | 400 | — | 300 | — | V |
| * | hFE | 2 | — | 3[a] | — | 7 | 35 | — | — | — | — | — | — | |
| | | 2 | — | 1.5[a] | — | 12 | 60 | — | — | — | — | — | — | |
| | | 3 | — | 5[a] | — | — | — | 7 | 35 | 7 | 35 | — | — | |
| | | 3 | — | 2.5[a] | — | — | — | 12 | 60 | 12 | 60 | — | — | |
| | | 2 | — | 10[a] | — | — | — | — | — | — | — | 6 | 30 | |
| | | 2 | — | 5[a] | — | — | — | — | — | — | — | 12 | 60 | |
| * | $V_{BE(sat)}$ | — | — | 3[a] | 0.6 | — | 1.4 | — | — | — | — | — | — | V |
| | | — | — | 5[a] | 1 | — | — | — | 1.6 | — | 1.6 | — | — | |
| | | — | — | 10[a] | 2 | — | — | — | — | — | — | — | 1.6 | |
| * | $V_{CE(sat)}$ | — | — | 3[a] | 0.6 | — | 1 | — | — | — | — | — | — | |
| | | — | — | 5[a] | 1 | — | 5 | — | 1.5 | — | 1.5 | — | — | |
| | | — | — | 8[a] | 2 | — | — | — | 5 | — | 5 | — | — | |
| | | — | — | 10[a] | 2 | — | — | — | — | — | — | — | 1.5 | |
| | | — | — | 15[a] | 3 | — | — | — | — | — | — | — | 5 | |
| * | $I_{S/b}$ t = 1 s | 100 | — | — | — | 0.2 | — | 0.2 | — | 0.2 | — | 0.2 | — | A |
| | $f_T$ f = 1 MHz | 10 | — | 0.2 | — | 6 | 28 | — | — | — | — | — | — | MHz |
| | | 10 | — | 0.3 | — | — | — | 6 | 28 | 6 | 28 | — | — | |
| | | 10 | — | 0.5 | — | — | — | — | — | — | — | 6 | 28 | |
| * | $C_{obo}$ f = 1 MHz | 10[d] | — | — | — | 50 | 200 | 75 | 300 | 75 | 300 | 125 | 500 | pF |
| * | $t_d$[e,g] | — | — | 3 | 0.6 | — | 0.05 | — | — | — | — | — | — | μS |
| | | — | — | 5 | 1 | — | — | — | 0.05 | — | 0.05 | — | — | |
| | | — | — | 10 | 2 | — | — | — | — | — | — | — | 0.05 | |
| * | $t_r$[e,g] | — | — | 3 | 0.6 | — | 0.7 | — | — | — | — | — | — | |
| | | — | — | 5 | 1 | — | — | — | 1 | — | 1 | — | — | |
| | | — | — | 10 | 2 | — | — | — | — | — | — | — | 1 | |
| * | $t_s$[e,g] | — | — | 3 | 0.6 | — | 4 | — | — | — | — | — | — | |
| | | — | — | 5 | 1 | — | — | — | 4 | — | 4 | — | — | |
| | | — | — | 10 | 2 | — | — | — | — | — | — | — | 4 | |
| * | $t_f$[e,g] | — | — | 3 | 0.6 | — | 0.8 | — | — | — | — | — | — | |
| | | — | — | 5 | 1 | — | — | — | 1 | — | 1 | — | — | |
| | | — | — | 10 | 2 | — | — | — | — | — | — | — | — | |

* In accordance with JEDEC registration data.

# 2N6542, 2N6544, 2N6545, 2N6546

**ELECTRICAL CHARACTERISTICS** $T_C$ = 100° C

| | CHARACTERISTIC | TEST CONDITIONS | | | | LIMITS | | | | | | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | VOLTAGE V dc | | CURRENT A dc | | 2N6542 | | 2N6544 | | 2N6545 | | 2N6546 | | |
| | | $V_{CE}$ | $V_{BE}$ | $I_C$ | $I_B$ | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | |
| * | $I_{CEV}$ | 650 | -1.5 | — | — | — | 2.5 | — | 2.5 | — | — | — | 4 | mA |
| | | 850 | -1.5 | — | — | — | — | — | — | — | 2.5 | — | — | |
| * | $I_{CER}$ $R_{BE}$ = 50 Ω | 650 | — | — | — | — | 3 | — | 3 | — | — | — | 5 | |
| | | 850 | — | — | — | — | — | — | — | — | 3 | — | — | |
| * | $V_{CEX(sus)}$[b,c] | | | | | | | | | | | | | V |
| | $V_{CC}$ = 20 V | — | — | 2.6[a] | — | 350 | — | — | — | — | — | — | — | |
| | L = 180 μH, | | | | | | | | | | | | | |
| | $R_C$ = 0.05 Ω | — | — | 4.5[a] | — | — | — | 350 | — | 450 | — | — | — | |
| | $V_{clamp}$ = Rated | | | | | | | | | | | | | |
| | $V_{CEX}$ | — | — | 8[a] | — | — | — | — | — | — | — | 350 | — | |
| | $V_{clamp}$ = Rated | | | | | | | | | | | | | |
| | $V_{CEO}$ — 100 V | — | — | 5[a] | — | 200 | — | — | — | — | — | — | — | |
| | | — | — | 8[a] | — | — | — | 200 | — | 300 | — | — | — | |
| | | — | — | 15[a] | — | — | — | — | — | — | — | 200 | — | |
| * | $V_{BE(sat)}$ | — | — | 3[a] | 0.6 | — | 1.4 | — | — | — | — | — | — | V |
| | | — | — | 5[a] | 1 | — | — | — | 1.6 | — | 1.6 | — | — | |
| | | — | — | 10[a] | 2 | — | — | — | — | — | — | — | 1.6 | |
| * | $V_{CE(sat)}$ | — | — | 3[a] | 0.6 | — | 2 | — | — | — | — | — | — | |
| | | — | — | 5[a] | 1 | — | — | — | 2.5 | — | 2.5 | — | — | |
| | | — | — | 10[a] | 2 | — | — | — | — | — | — | — | 2.5 | |
| * | $t_s$[f,g] | — | -5 | 3 | 0.6 | — | 4 | — | — | — | — | — | — | μS |
| | | — | -5 | 5 | 1 | — | — | — | 4 | — | 4 | — | — | |
| | | — | -5 | 10 | 2 | — | — | — | — | — | — | — | 5 | |
| * | $t_f$[f,g] | — | -5 | 3 | 0.6 | — | 0.8 | — | — | — | — | — | — | |
| | | — | -5 | 5 | 1 | — | — | — | 0.9 | — | 0.9 | — | — | |
| | | — | -5 | 10 | 2 | — | — | — | — | — | — | — | 1.5 | |
| * | RθJC | — | — | — | — | — | 1.75 | — | 1.4 | — | 1.4 | — | 1 | °C/W |

* In accordance with JEDEC registration data.
[a] Pulsed: pulse duration = 300 μs, duty factory ≤ 2%.
[b] **CAUTION:** The sustaining voltage $V_{CEO(sus)}$ and $V_{CEX(sus)}$ *MUST NOT* be measured on a curve tracer.
[c] $V_{CC}$ = 20 V, L = 180 μH, $R_C$ = 0.05 Ω
[d] $V_{CB}$ value
[e] Resistive load, $V_{CC}$ = 250 V, $t_p$ = 100 μs, $I_{B_1}$ = -$I_{B_2}$
[f] Inductive load, $V_{clamp}$ = Rated $V_{CEX(sus)}$, $I_{B_1}$ = -IC/5, L = 180 μH, $R_C$ = 0.05 Ω, $V_{CC}$ = 20 V
[g] For switching speed test methods, see Application Note AN-6820.

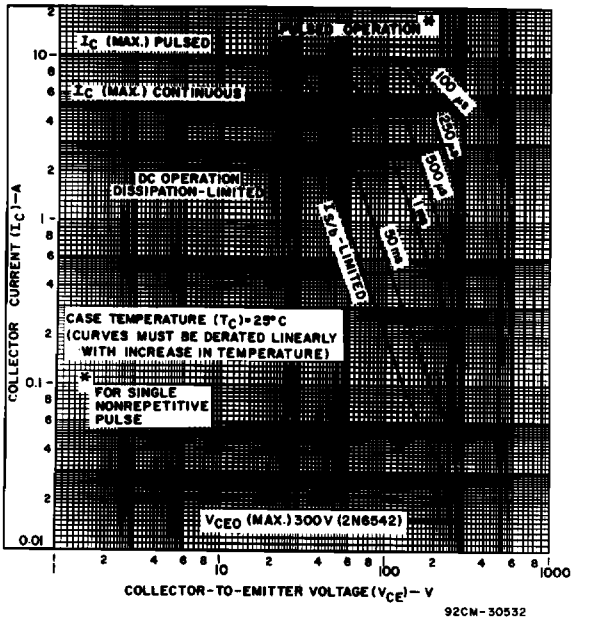



*Fig. 1 - Maximum operating areas for type 2N6542 ($T_C$ = 25°).*

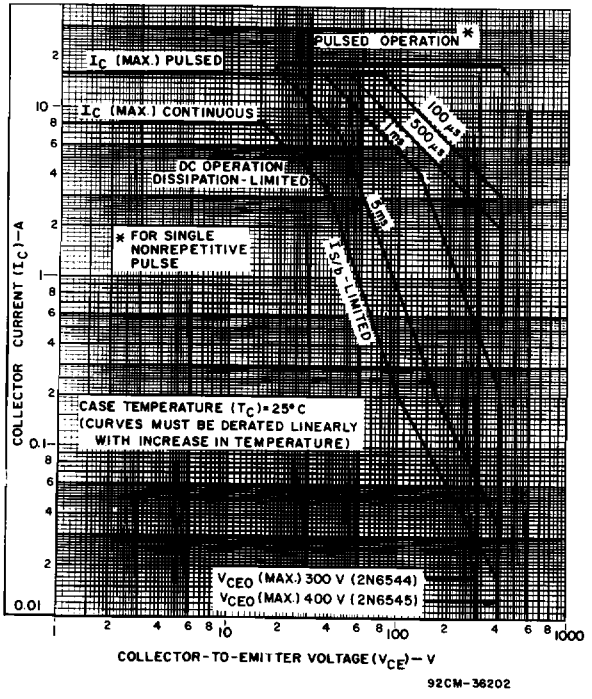



*Fig. 2 - Maximum operating areas for type 2N6544 and 2N6545 ($T_C$ = 25°C).*

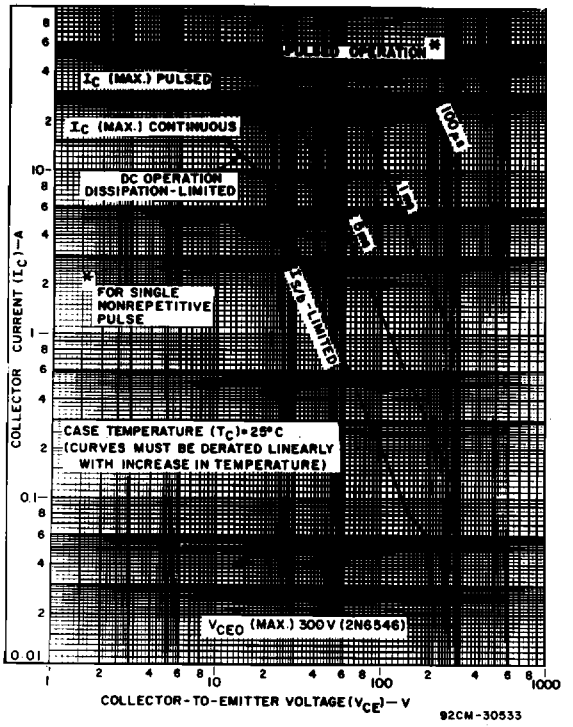



*Fig. 3 - Maximum operating areas for type 2N6546 ($T_C$ = 25°)*

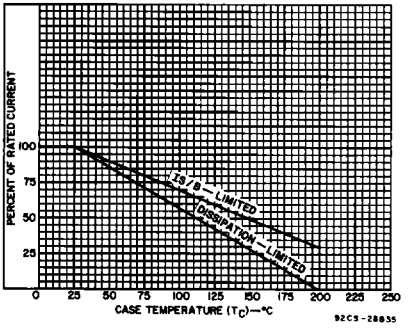



*Fig. 4 - Dissipation and $I_{S/b}$ derating curves for all types.*

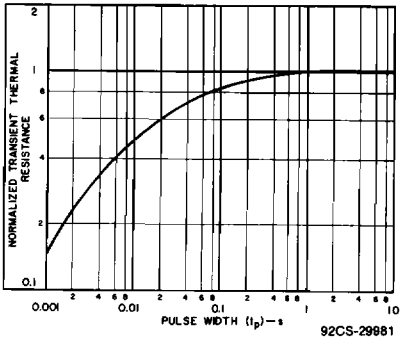



*Fig. 5 — Typical thermal-response characteristics for types 2N6542, 2N6544 and 2N6545.*

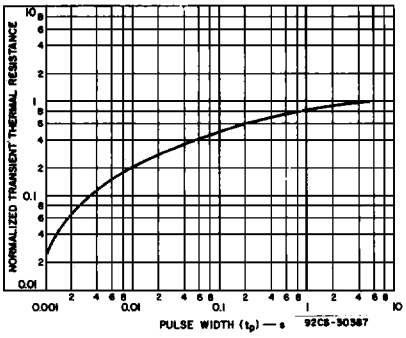



*Fig. 6 — Typical thermal-response characteristics for type 2N6546.*

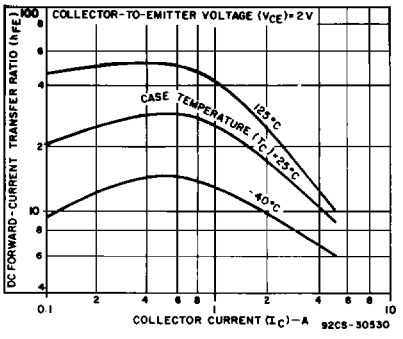



*Fig. 7 — Typical dc beta characteristics for type 2N6542.*

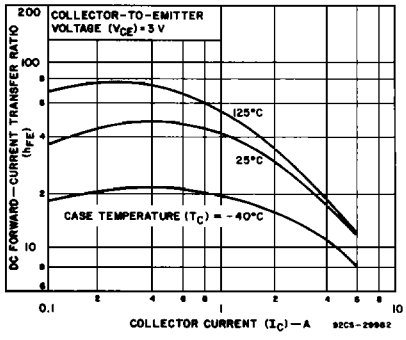



*Fig. 8 — Typical dc beta characteristics for type 2N6544.*

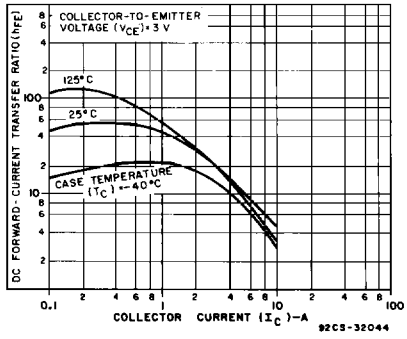



*Fig. 9 — Typical dc beta characteristics for type 2N6545.*

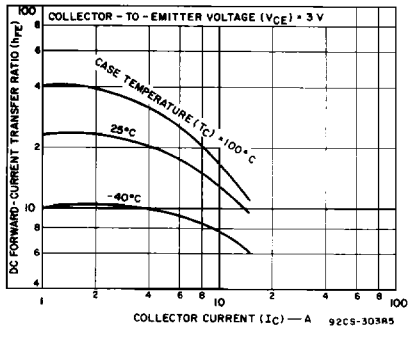



*Fig. 10 — Typical dc beta characteristics for type 2N6546.*

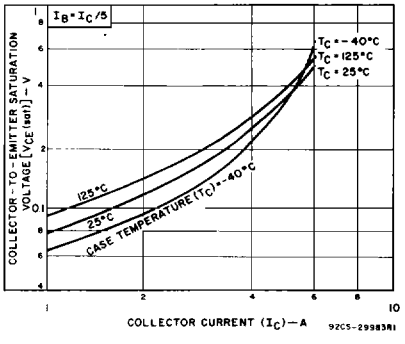



*Fig. 11 — Typical collector-to-emitter saturation voltage as a function of collector current for types 2N6542 and 2N6544.*

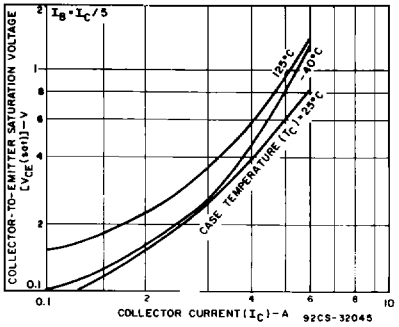



*Fig. 12 — Typical collector-to-emitter saturation voltage as a function of collector current for type 2N6545.*

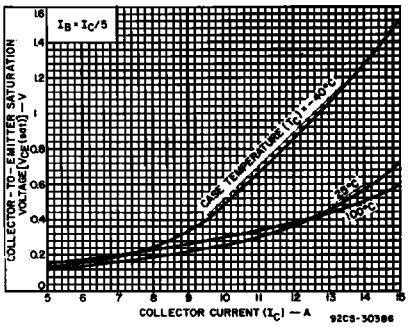



*Fig. 13 — Typical collector-to-emitter saturation voltage characteristics for type 2N6546.*

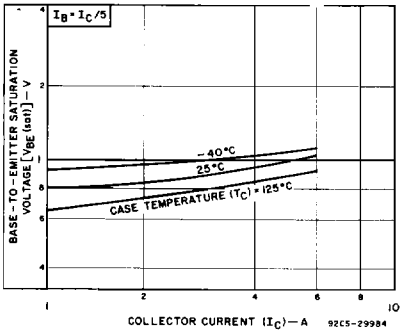



*Fig. 14 — Typical base-to-emitter saturation voltage as a function of collector current for types 2N6542 and 2N6544.*

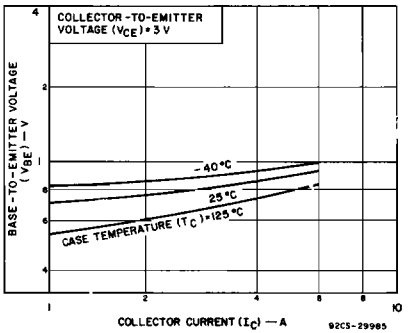



*Fig. 15 — Typical base-to-emitter voltage as a function of collector current for types 2N6542 and 2N6544.*

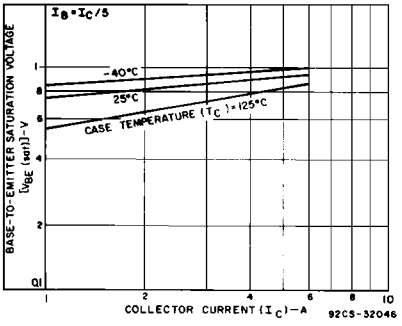



*Fig. 16 — Typical base-to-emitter saturation voltage as a function of collector current for type 2N6545.*

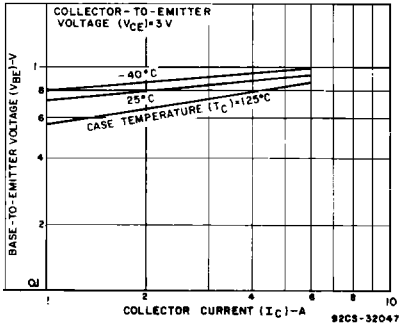



*Fig. 17 — Typical base-to-emitter voltage as a function of collector current for type 2N6545.*

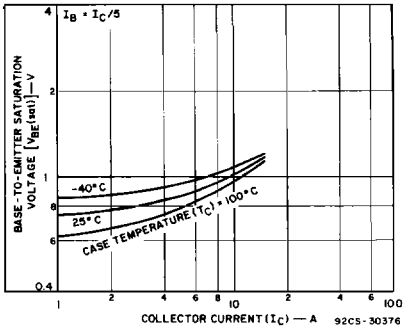



*Fig. 18 — Typical base-to-emitter saturation voltage characteristics for type 2N6546.*

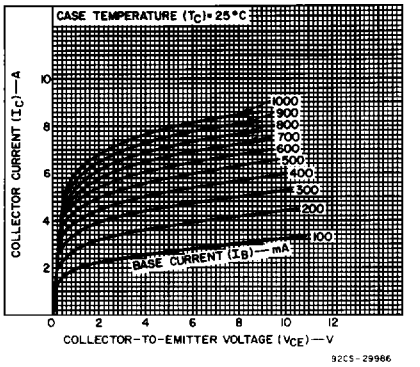



*Fig. 19 — Typical output characteristics for types 2N6542 and 2N6544.*

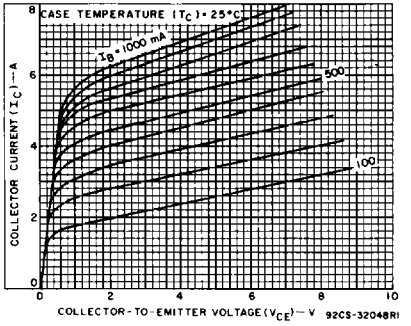



*Fig. 20 — Typical output characteristics for type 2N6545.*

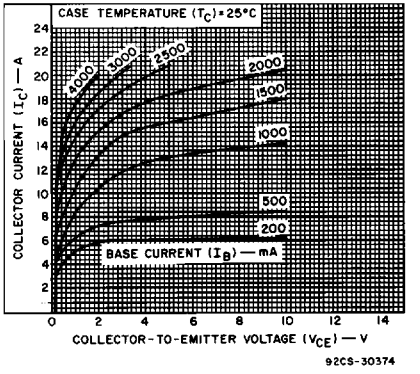



*Fig. 21 — Typical output characteristics for type 2N6546.*

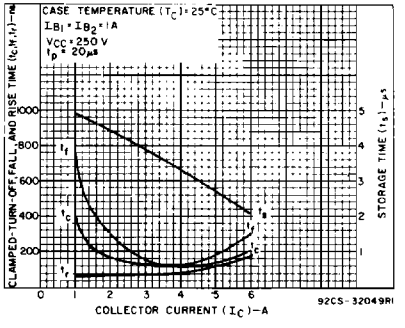



*Fig. 22 — Typical saturated switching time characteristics for type 2N6545.*

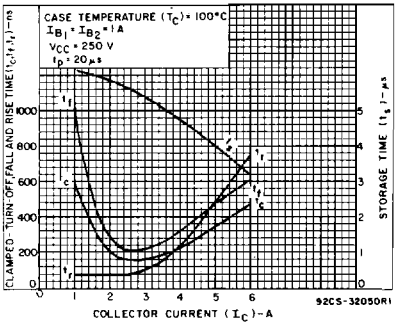



*Fig. 23 — Typical saturated switching time characteristics for type 2N6545.*

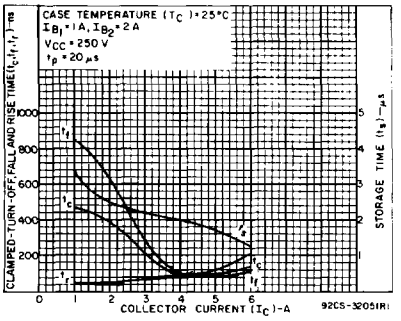



*Fig. 24 — Typical saturated switching time characteristics for type 2N6545.*

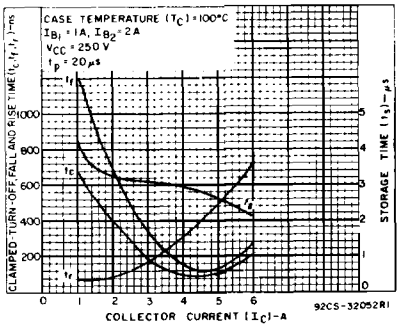



*Fig. 25 — Typical saturated switching time characteristics for type 2N6545.*

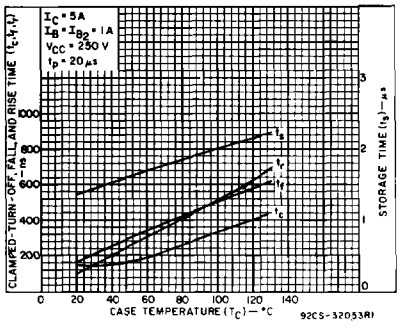



*Fig. 26 — Typical saturated switching time characteristics as a function of case temperature for type 2N6545.*

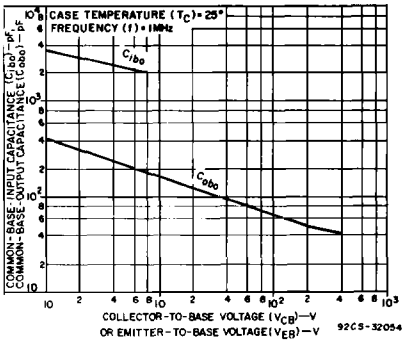



*Fig. 27 — Typical common-base input or output capacitance characteristics as a function of collector-to-base voltage or emitter-to-base voltage for type 2N6545.*