

January 1990  
Edition 1.1



PRODUCT PROFILE

**2SC3044, 2SC3044A**

**Silicon High Speed Power Transistor**

**DESCRIPTION**

The 2SC3044/2SC3044A are silicon NPN planar general purpose, high power switching transistors fabricated with Fujitsu's unique Ring Emitter Transistor (RET) technology. RET devices are constructed with multiple emitters connected through diffused ballast resistors which provide uniform current density. This structure permits the design of high power transistors with superior switching characteristics and frequency response in high current applications.

The 2SC3044/2SC3044A are especially well-suited for high speed/high voltage switching systems or other applications where large SOA is required.

**Features**

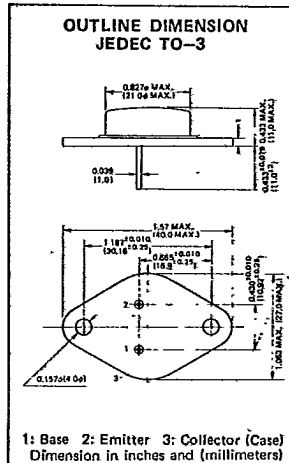
- \* High voltage
- \* Ultra-fast switching
- \* Large safe operating area

**Applications**

- \* Switching regulators
- \* Motor controls
- \* Ultrasonic oscillators
- \* Class C and D amplifiers
- \* Deflection circuits

**ABSOLUTE MAXIMUM RATINGS**

| Rating  | Symbol    | Value      |       | Unit       |
|---|-----------|------------|-------|------------|
|   |           | 3044       | 3044A |            |
| Collector to Emitter Voltage                            | $V_{CEO}$ | 400        | 450   | V          |
| Collector to Base Voltage                               | $V_{CBO}$ | 450        |       | V          |
| Emitter to Base Voltage                                 | $V_{EBO}$ | 7          |       | V          |
| Collector Current-Continuous                            | $I_C$     | 6          |       | A          |
| Collector Current-Pulsed $P_W \leq 10ms, D.R. \leq 2\%$ | $I_{CP}$  | 15         |       | A          |
| Base Current-Continuous                                 | $I_B$     | 4          |       | A          |
| Collector Power Dissipation ( $T_C = 25^\circ C$ )      | $P_C$     | 100        |       | W          |
| Junction Temperature                                    | $T_J$     | +175       |       | $^\circ C$ |
| Storage Temperature Range                               | $T_{stg}$ | -65 ~ +175 |       | $^\circ C$ |



**ELECTRICAL CHARACTERISTICS ( $T_B = 25^\circ C$ )**

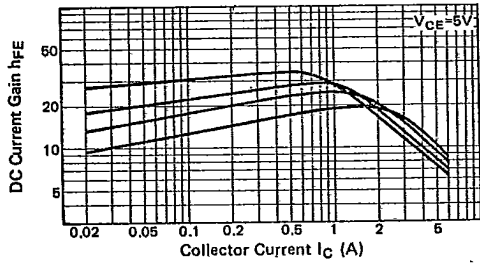
| Parameter                               | Symbol         | Test Conditions   | Limits |      |      | Unit    |
|---|----------------|---|--------|------|------|---------|
|   |                |   | Min.   | Typ. | Max. |         |
| Collector to Base Breakdown Voltage     | $V_{(BR)CBO}$  | $I_C = 1mA, I_E = 0$  | 450    | —    | —    | V       |
| Emitter to Base Breakdown Voltage       | $V_{(BR)EBO}$  | $I_E = 1mA, I_C = 0$  | 7      | —    | —    | V       |
| Collector to Emitter Sustaining Voltage | $V_{CEO(sus)}$ | $I_C = 0.8A, R_{BE} = \infty \Omega$                        | 400    | 450  | —    | V       |
| Collector to Emitter Sustaining Voltage | $V_{CEX(sus)}$ | $I_C = 2A, I_{B2} = -1A, L = 200 \mu H (*1)$                | 450    | —    | —    | V       |
| Collector Cutoff Current                | $I_{CBO}$      | $V_{CB} = 450V, I_E = 0$                                    | —      | —    | 100  | $\mu A$ |
| Collector Cutoff Current                | $I_{CBO}$      | $V_{CB} = 400V, I_E = 0, T_C = 100^\circ C$                 | —      | —    | 1    | mA      |
| Emitter Cutoff Current                  | $I_{EBO}$      | $V_{EB} = 6V, I_C = 0$                                      | —      | —    | 100  | $\mu A$ |
| DC Current Gain                         | $h_{FE}$       | $V_{CE} = 5V, I_C = 3A (*2)$                                | 10     | 15   | 40   | —       |
| Collector to Emitter Saturation Voltage | $V_{CE(sat)}$  | $I_C = 3A, I_B = 0.6A (*2)$                                 | —      | 0.33 | 1.0  | V       |
| Base to Emitter Saturation Voltage      | $V_{BE(sat)}$  |   | —      | 1.0  | 1.5  | V       |
| Output Capacitance                      | $C_{ob}$       | $V_{CB} = 10V, I_E = 0, f = 1MHz$                           | —      | 100  | —    | pF      |
| Gain Bandwidth Product                  | $f_T$          | $V_{CE} = 10V, I_C = 1A$                                    | —      | 30   | —    | MHz     |
| Rise Time                               | $t_r$          | $V_{CC} = 150V (*1)$<br>$I_C = 3A, I_{B1} = -I_{B2} = 0.6A$ | —      | 0.05 | 0.5  | $\mu s$ |
| Storage Time                            | $t_{stg}$      |   | —      | 1.25 | 1.5  | $\mu s$ |
| Fall Time                               | $t_f$          |   | —      | 0.09 | 0.3  | $\mu s$ |

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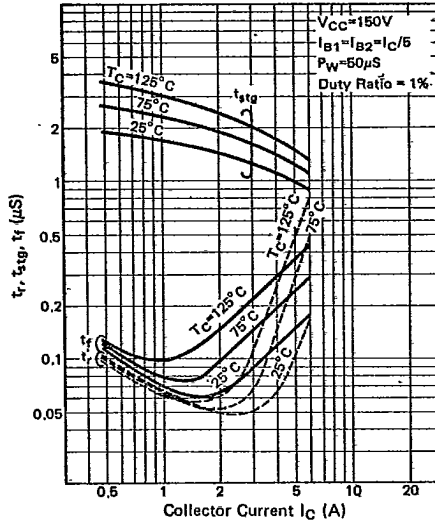
\*1 Test Circuit \*2 Pulsed  $P_W \leq 300 \mu s$ , Duty Ratio  $\leq 6\%$

2SC3044, 2SC3044A

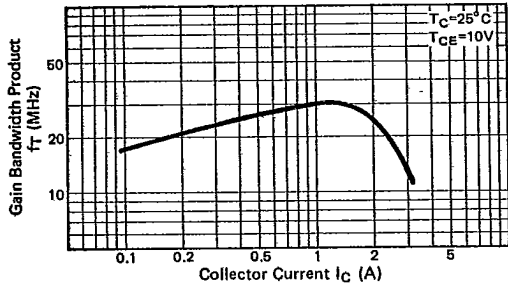
DC CURRENT GAIN



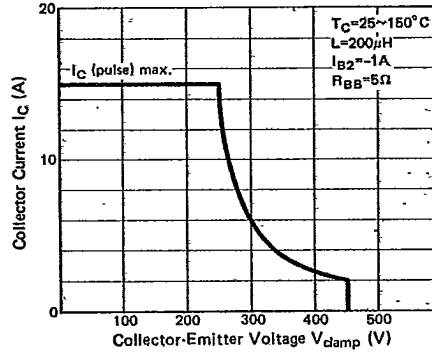
SWITCHING TIME



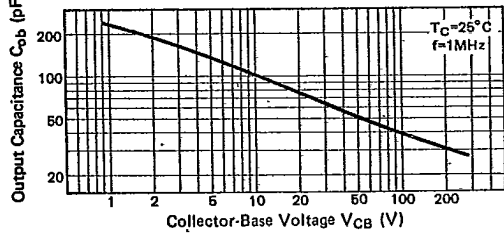
GAIN BANDWIDTH PRODUCT



REVERSE BIAS SAFE OPERATING AREA



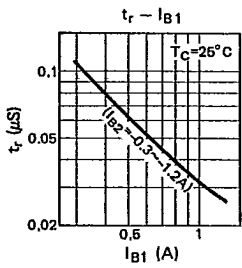
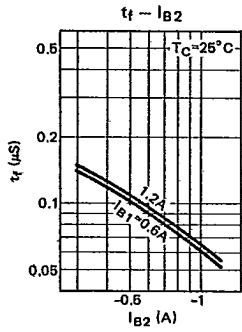
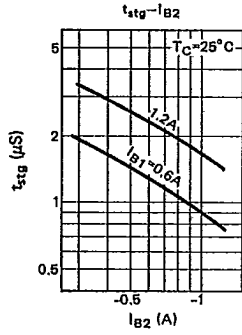
OUTPUT CAPACITANCE



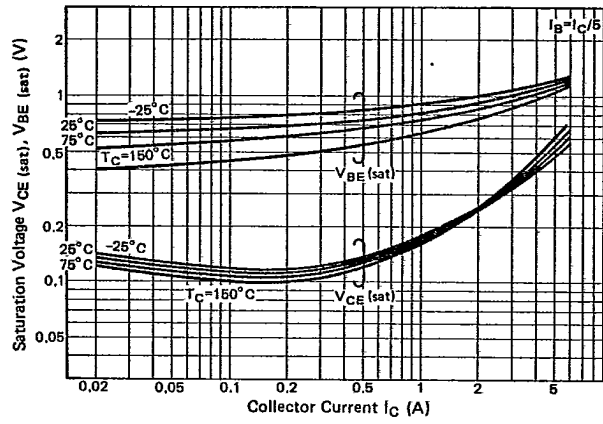
2SC3044, 2SC3044A

SWITCHING TIME

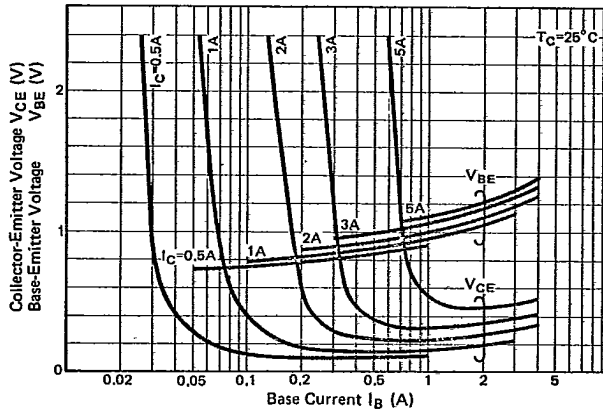
$V_{CC}=150V$   
 $I_C=3A$   
 $P_W=50\mu S$   
 Duty Ratio = 1%



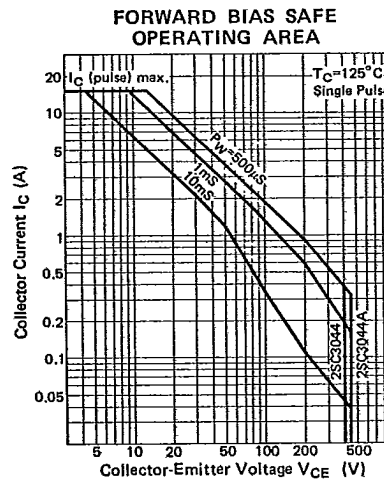
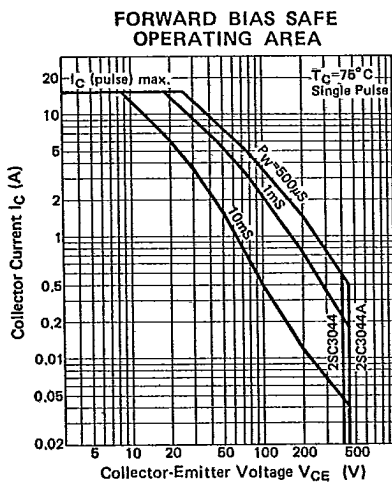
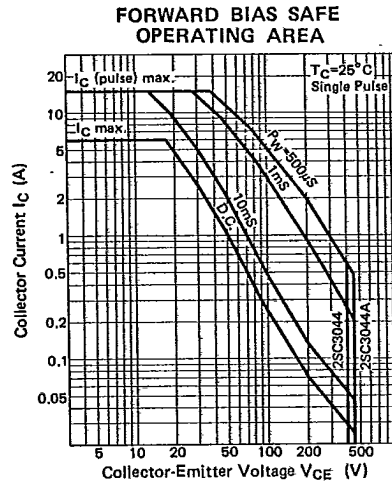
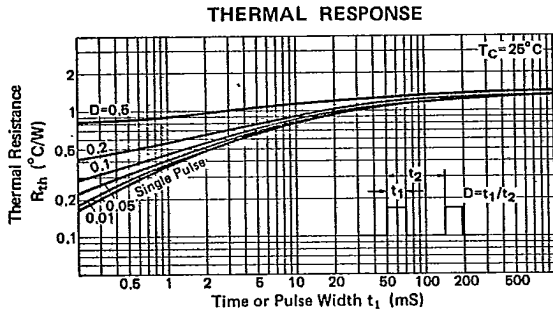
SATURATION VOLTAGE



COLLECTOR SATURATION REGION

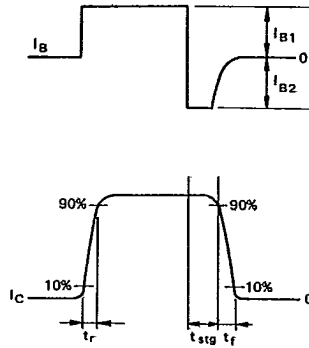
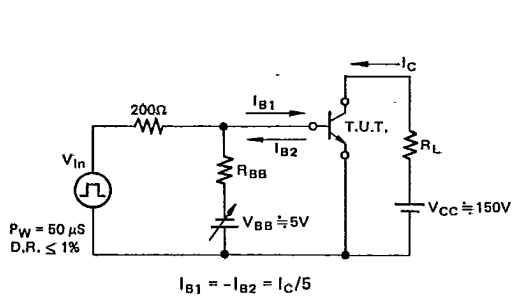


2SC3044, 2SC3044A

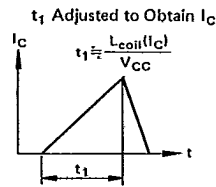
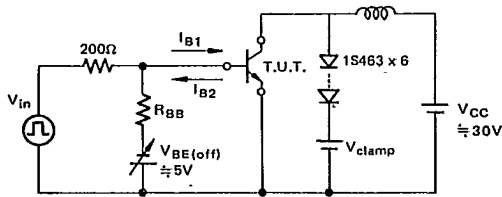


2SC3044, 2SC3044A

TEST CIRCUIT USED FOR MEASUREMENT OF SWITCHING TIME (RESISTIVE)



TEST CIRCUIT USED FOR MEASUREMENT OF VCEX(SUS) AND REVERSE BIAS SAFE OPERATING AREA



(a)  $V_{CEX(SUS)}$   
 $I_C = 2A, I_{B1} = 1A, I_{B2} = -1A, R_{BB} = 5\Omega, V_{clamp} = 450V$

(b) Reverse Bias Safe Operating Area  
 $I_{B1} \leq 4A, I_{B2} = -1A, R_{BB} = 5\Omega$