NEC

PNP SILICON POWER TRANSISTORS

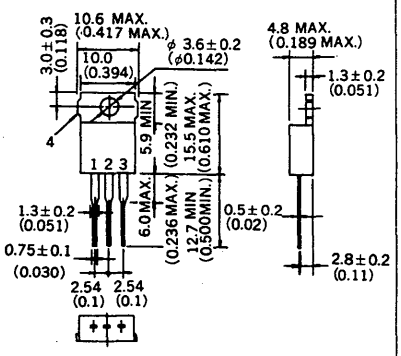
2SA1009,2SA1009A

DESCRIPTION The 2SA1009, 2SA1009A are PNP triple diffused transistors designed for switching regulator, DC-DC converter and high frequency power amplifier application.

FEATURES

- Low Collector Saturation Voltage.
- High Speed Switching.
- Wide Reverse Bias Safe Operating Area.

PACAKGE DIMENSIONS
in millimeters (inches)



1. Base (B)
2. Collector (C)
3. Emitter (E)
4. Fin (Collector)

JEDEC: TO-220AB

ABSOLUTE MAXIMUM RATINGS

Maximum Temperatures

Storage Temperature . . . . . −55 to +150 °C

Junction Temperature . . . . . 150 °C Maximum

Maximum Power Dissipation (T_c = 25 °C)

Total Power Dissipation . . . . . 15 W

Maximum Voltages and Currents (T_a = 25 °C)

		2SA1009/2SA1009A	
V_{CBO}	Collector to Base Voltage	−350/ −400	V
V_{CEO}	Collector to Emitter Voltage . .	−350/ −400	V
V_{EBO}	Emitter to Base Voltage	−7.0	V
$I_{C(DC)}$	Collector Current (DC)	−2.0	A
$I_{C(pulse)}$	Collector Current (pulse)*	−4.0	A
$I_{B(DC)}$	Base Current (DC)	−1.0	A

* PW ≦ 300 μs, Duty Cycle ≦ 10 %

ELECTRICAL CHARACTERISTICS (T_a = 25 °C)

SYMBOL	CHARACTERISTIC	MIN.	TYP.	MAX.	UNIT.	TEST CONDITIONS
t_{on}	Turn-on Time			1.0	μs	I_C = −0.3 A, I_{B1} = −I_{B2} = −60 mA, R_L = 500 Ω, V_{CC} ≒ −150 V
t_{stg}	Storage Time			2.5	μs	
t_f	Fall Time			1.0	μs	
h_{FE1}	DC Current Gain**	20		200	—	V_{CE} = −5.0 V, I_C = −0.1 A
h_{FE2}	DC Current Gain**	10			—	V_{CE} = −5.0 V, I_C = −0.3 A
$V_{CE(sat)}$	Collector Saturation Voltage**			−1.0	V	I_C = −0.3 A, I_B = −60 mA
$V_{BE(sat)}$	Base Saturation Voltage**			−1.2	V	I_C = −0.3 A, I_B = −60 mA
$V_{CEO(SUS)}$	Collector to Emitter Sustaining Voltage	−350/−400			V	I_C = −0.3 A, I_B = −60 mA, L = 1 mH
$V_{CEX(SUS)1}$	Collector to Emitter Sustaining Voltage	−350/−400			V	I_C = −0.3 A, I_{B1} = −I_{B2} = −60 mA, L = 180 μH, Clamped
$V_{CEX(SUS)2}$	Collector to Emitter Sustaining Voltage	−350/−400			V	I_C = −0.6 A, I_{B1} = −0.2 A, −I_{B2} = 60 mA, L = 180 μH, Clamped
I_{CBO}	Collector Cutoff Current			−10	μA	V_{CB} = −350/−400 V, I_E = 0
I_{CER}	Collector Cutoff Current			−1.0	mA	V_{CE} = −350/−400 V, R_{BE} = 51 Ω, T_a = 125 °C
I_{CEX1}	Collector Cutoff Current			−10	μA	V_{CE} = −350/−400 V, $V_{BE(OFF)}$ = 1.5 V
I_{CEX2}	Collector Cutoff Current			−1.0	mA	V_{CE} = −350/−400 V, $V_{BE(OFF)}$ = 1.5 V, T_a = 125 °C
I_{EBO}	Emitter Cutoff Current			−10	μA	V_{EB} = −5.0 V, I_C = 0

**PW ≦ 350 μs, Duty Cycle ≦ 2 %

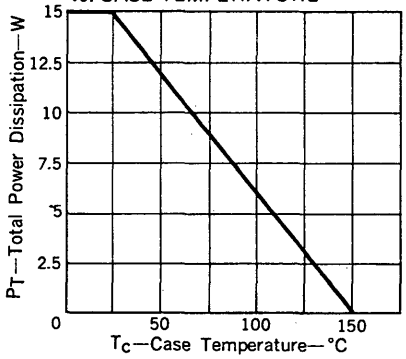
Classification of h_{FE1}

Rank	M	L	K	J	H
Range	20 to 40	30 to 60	40 to 80	60 to 120	100 to 200

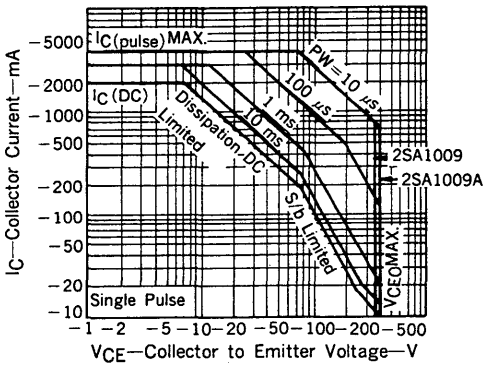
Test Conditions: V_{CE} = −5.0 V, I_C = −0.1 A

TYPICAL CHARACTERISTICS (T_a = 25 °C)

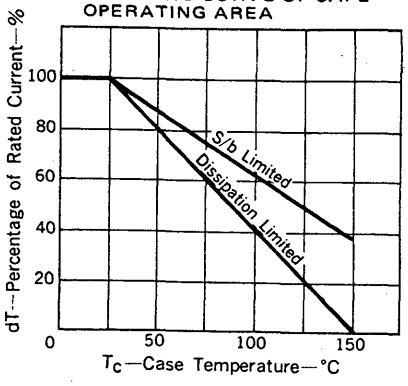
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



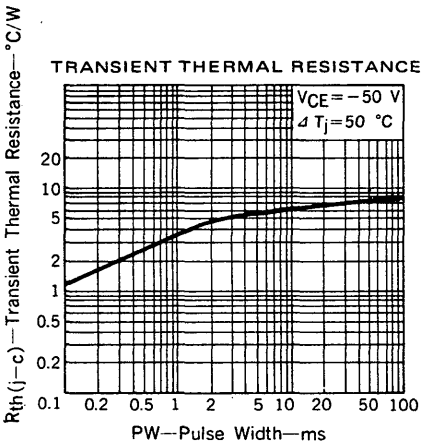
FORWARD BIAS SAFE OPERATING AREA



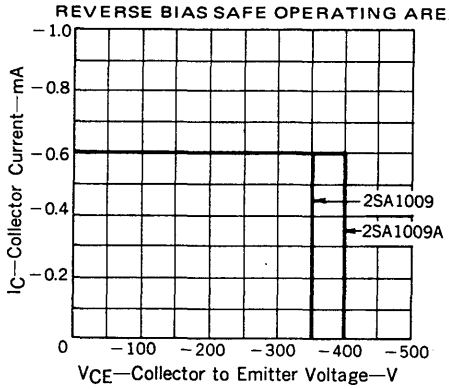
DERATING CURVE OF SAFE OPERATING AREA



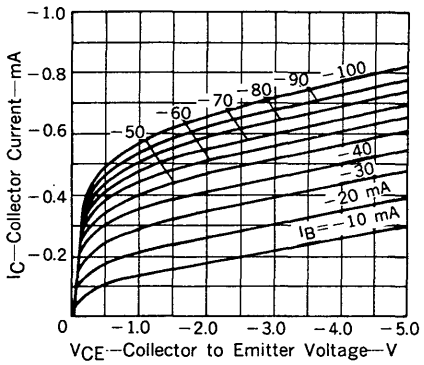
TRANSIENT THERMAL RESISTANCE



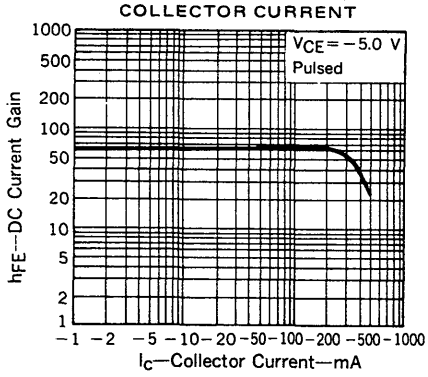
REVERSE BIAS SAFE OPERATING AREA



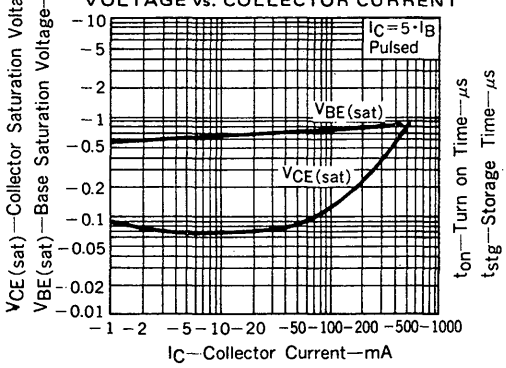
COLLECTOR CURRRENT vs. COLLECTOR TO EMITTER VOLTAGE



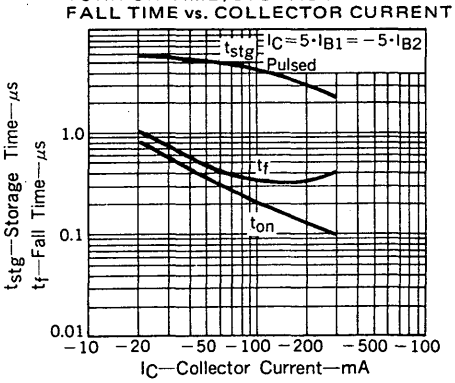
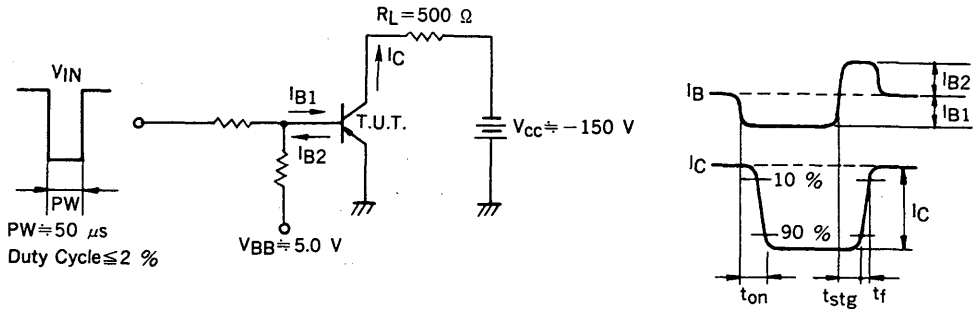
DC CURRENT GAIN vs. COLLECTOR CURRENT



BASE AND COLLECTOR SATURATION VOLTAGE vs. COLLECTOR CURRENT



TURN ON TIME, STORAGE TIME AND FALL TIME vs. COLLECTOR CURRENT



SWITCHING TIME (t_{on}, t_{stg}, t_f) TEST CIRCUIT