2N4406
2N4407

CASE 79, STYLE 1
TO-39 (TO-205AD)

GENERAL PURPOSE TRANSISTORS

PNP SILICON

4

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	80	Vdc
Collector-Base Voltage	V_{CBO}	80	Vdc
Emitter-Base Voltage	V_{EBO}	5.0	Vdc
Collector Current — Continuous	I_C	2.0	Amps
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.25 7.15	Watts mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	8.75 50	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	20	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	140	°C/W

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1)	(I_C = 10 mAdc, I_B = 0)	$V_{(BR)CEO}$	80	–	Vdc
Collector-Base Breakdown Voltage	(I_C = 10 μAdc, I_E = 0)	$V_{(BR)CBO}$	80	—	Vdc
Emitter-Base Breakdown Voltage	(I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	5.0	—	Vdc
Collector Cutoff Current	(V_{CB} = 60 Vdc, I_E = 0)	I_{CBO}	—	25	μAdc
Emitter Cutoff Current	(V_{BE} = 3.0 Vdc, I_C = 0)	I_{EBO}	—	25	μAdc
ON CHARACTERISTICS					
DC Current Gain(1)		h_{FE}			—
(I_C = 10 mAdc, V_{CE} = 5.0 Vdc)	2N4406		30	—	
	2N4407		80	—	
(I_C = 150 mAdc, V_{CE} = 5.0 Vdc)	2N4406		30	—	
	2N4407		80	—	
(I_C = 500 mAdc, V_{CE} = 5.0 Vdc)	2N4406		30	120	
	2N4407		80	240	
(I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	2N4406		20	—	
	2N4407		30	—	
(I_C = 1.5 Adc, V_{CE} = 5.0 Vdc)	2N4406, 2N4407		10	—	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)			—	0.2	
(I_C = 500 mAdc, I_B = 50 mAdc)			—	0.4	
(I_C = 1.0 Adc, I_B = 100 mAdc)			—	0.7	
(I_C = 1.5 Adc, I_B = 150 mAdc)			—	1.5	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)			—	0.9	
(I_C = 1.0 Adc, I_B = 100 mAdc)			0.9	1.3	
(I_C = 1.5 Adc, I_B = 150 mAdc)			—	1.5	
Base-Emitter On Voltage		$V_{BE(on)}$			Vdc
(I_C = 500 mAdc, V_{CE} = 1.0 Vdc)			—	1.0	
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product		f_T			MHz
(I_C = 50 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)			150	750	
Collector-Base Capacitance		C_{cb}			pF
(V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)			—	15	
Emitter-Base Capacitance		C_{eb}			pF
(V_{BE} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)			—	160	
SWITCHING CHARACTERISTICS					
Delay Time	(V_{CC} = 30 Vdc, $V_{BE(off)}$ = 2.0 Vdc,	t_d	—	15	ns
Rise Time	I_C = 1.0 Adc, I_{B1} = 100 mAdc)	t_r	—	60	ns
Storage Time	(V_{CC} = 30 Vdc, I_C = 1.0 Adc,	t_s	—	175	ns
Fall Time	I_{B1} = I_{B2} = 100 mAdc)	t_f	—	50	ns

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%. *Indicates Data in addition to JEDEC Requirements.

STATIC CHARACTERISTICS

FIGURE 1 — DC CURRENT GAIN

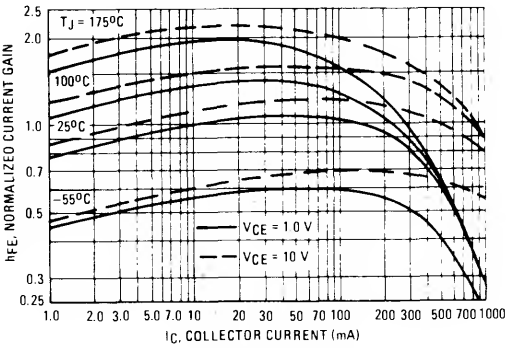


FIGURE 2 — COLLECTOR SATURATION REGION

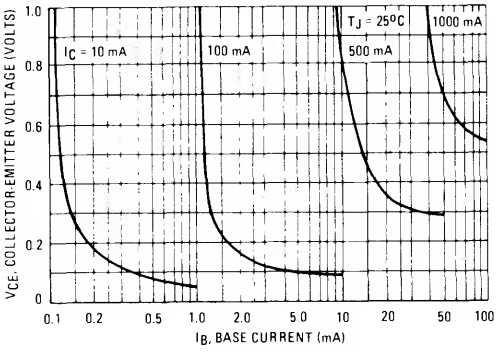


FIGURE 3 — "ON" VOLTAGES

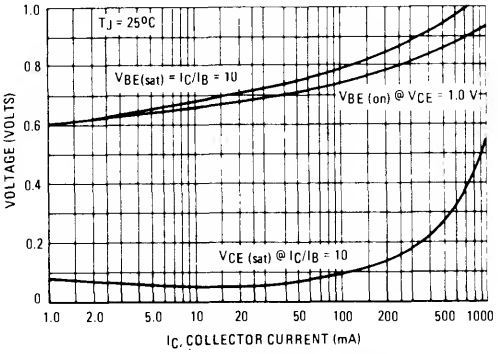


FIGURE 4 — TEMPERATURE COEFFICIENTS

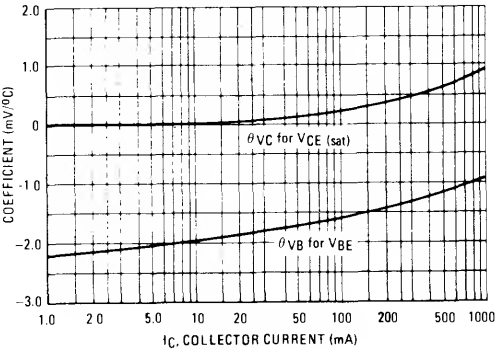
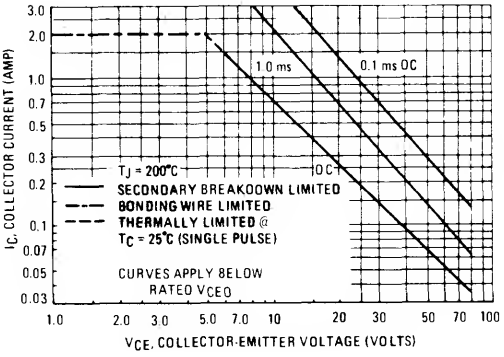


FIGURE 5 — SAFE OPERATING AREA



The safe operating area curves indicate I_C–V_{CE} limits of the transistor that must be observed for reliable operation. Collector load lines for specific circuits must fall below the limits indicated by the applicable curve.

The data of Figure 5 is based upon $T_{J(pk)}$ = 200°C; T_C is variable depending upon conditions. Pulse curves are valid for duty cycles to 10% provided $T_{J(pk)} \leq$ 200°C. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

TRANSIENT CHARACTERISTICS

——— 25°C — — — 100°C

FIGURE 7 - CAPACITANCES

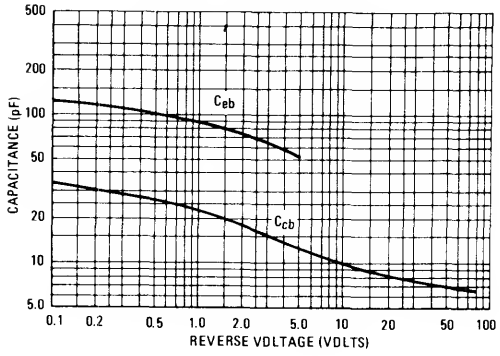


FIGURE 8 - CHARGE DATA

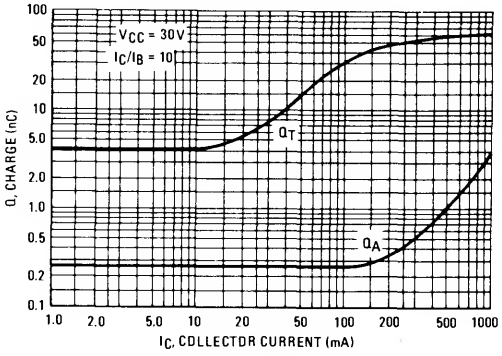


FIGURE 9 - TURN-ON TIME

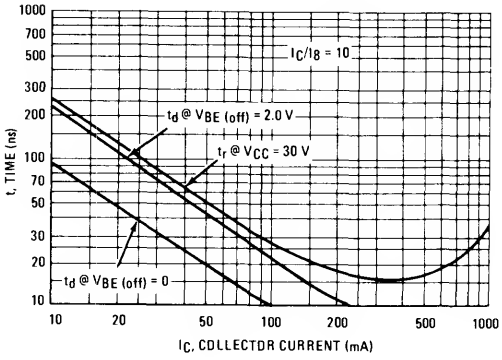
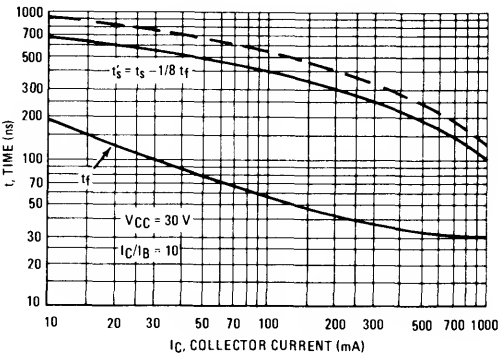


FIGURE 10 - TURN-OFF TIME



SWITCHING TIME EQUIVALENT TEST CIRCUITS

FIGURE 11 - TURN-ON TIME

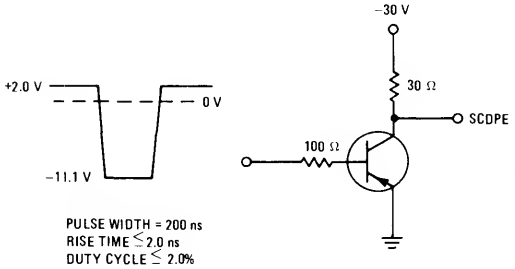


FIGURE 12 - TURN-OFF TIME