2N3546

CASE 22-03, STYLE 1
TO-18 (TO-206AA)

SWITCHING TRANSISTOR

PNP SILICON

4

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	12	Vdc
Collector-Base Voltage	V_{CBO}	15	Vdc
Emitter-Base Voltage	V_{EBO}	4.5	Vdc
DC Collector Current	I_C	200	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	0.36 2.06	Watt mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.2 6.9	Watts mW/°C
Operating and Storage Temperature Temperature Range	T_J, T_{stg}	−65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.15	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	0.49	°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)	$V_{(BR)CEO}$	12	—	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	$V_{(BR)CBO}$	15	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	4.5	—	Vdc
Base Cutoff Current (V_{CE} = 10 Vdc, $V_{BE(off)}$ = 3.0 Vdc)	I_{BEV}	—	0.10	μAdc
Collector Cutoff Current (V_{CE} = 10 Vdc, $V_{BE(off)}$ = 3.0 Vdc)	I_{CEX}	—	0.010	μAdc
Collector Cutoff Current (V_{CB} = 10 Vdc) (V_{CB} = 10 Vdc, T_A = 150°C)	I_{CBO}	— —	0.010 10	μAdc
ON CHARACTERISTICS				
DC Current Gain (1) (I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc) (I_C = 10 mAdc, V_{CE} = 1.0 Vdc) (I_C = 10 mAdc, V_{CE} = 1.0 Vdc, T_A = −55°C) (I_C = 50 mAdc, V_{CE} = 1.0 Vdc) (I_C = 100 mAdc, V_{CE} = 1.0 Vdc)	h_{FE}	 20 30 15 25 15	 — 120 — — —	—
Collector-Emitter Saturation Voltage (1) (I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 5.0 mAdc) (I_C = 100 mAdc, I_B = 10 mAdc)	$V_{CE(sat)}$	 — — —	 0.15 0.25 0.50	Vdc
Base-Emitter Saturation Voltage (1) (I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 5.0 mAdc) (I_C = 100 mAdc, I_B = 10 mAdc)	$V_{BE(sat)}$	 0.7 0.8 —	 0.9 1.3 1.6	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product (I_C = 10 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)	f_T	700	—	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	—	6.0	pF
Input Capacitance (V_{BE} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	—	5.0	pF

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

Characteristic		Symbol	Min	Max	Unit
SWITCHING CHARACTERISTICS					
Delay Time	I_C = 50 mA, I_{B1} = 5 .0 mA	t_d	—	10	ns
Rise Time	V_{BE} = 2.0 V, V_{CC} = 3.0 V	t_r	—	15	ns
Storage Time	I_C = 50 mA, I_{B1} = I_{B2} = 5.0 mA	t_s	—	20	ns
Fall Time	V_{CC} = 3.0 V	t_f	—	15	ns
Turn-On Time		t_{on}	—	40	ns
Turn-Off Time		t_{off}	—	30	ns
Total Control Charge (I_C = 50 mA, I_B = 5.0 mA, V_{CC} = 3.0 V)		Q_T	—	400	pC

(1) Pulse Test: PW = 300 μs, Duty Cycle ≤ 2.0%.

4

FIGURE 1

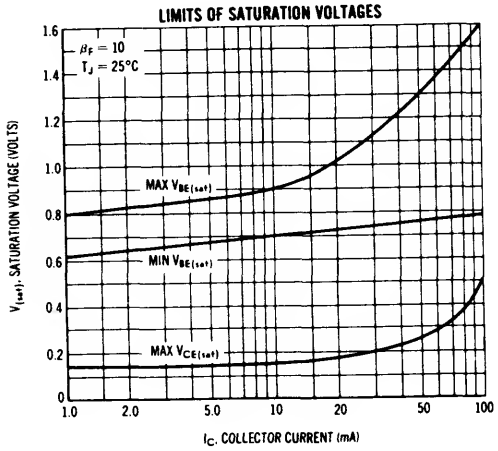


FIGURE 2

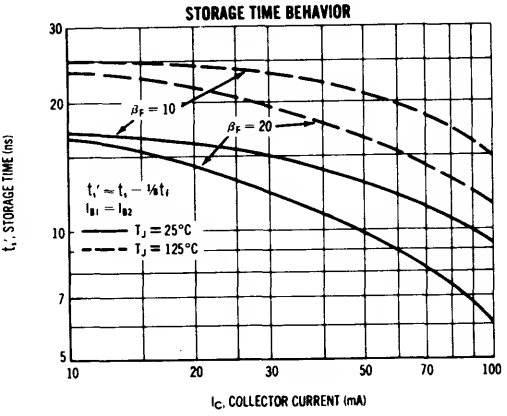
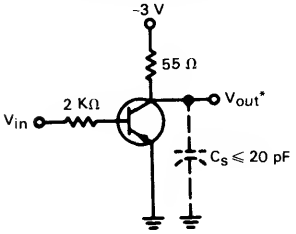
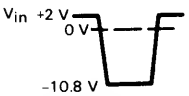


FIGURE 3

DELAY AND RISE TIME EQUIVALENT TEST CIRCUIT



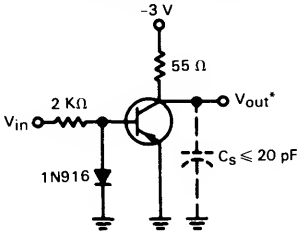


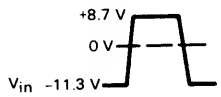
PULSE WIDTH = 200 ns
RISE TIME ≤ 2 ns
DUTY CYCLE ≤ 10%

*OSCILLOSCOPE RISE TIME ≤ 1 ns

FIGURE 4

STORAGE AND FALL TIME EQUIVALENT TEST CIRCUIT

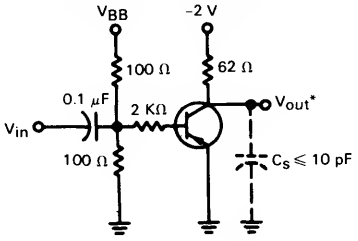




PULSE WIDTH = 200 ns
RISE TIME ≤ 2 ns
DUTY CYCLE ≤ 10%

FIGURE 5

SWITCHING TIME TEST CIRCUIT



PULSE WIDTH > 200 ns
RISE TIME < 2 ns
Z_{in} = 50 Ω

t_{on}: V_{BB} = +3 V, V_{in} = -7 V
t_{off}: V_{BB} = -4 V, V_{in} = +6 V

FIGURE 6

MINIMUM CURRENT GAIN CHARACTERISTICS