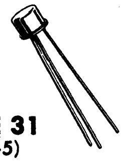
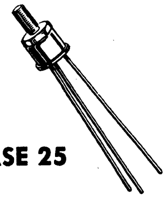
2N1204, A (GERMANIUM)
2N1494, A
2N1495
2N1496
2N2096
2N2097
2N2099
2N2100

PNP germanium epitaxial mesa transistors for high-speed, high-current switching in line and core driver applications.



CASE 31
(TO-5)

2N1204,A
2N1495
2N2099
2N2100



CASE 25

2N1494,A
2N1496
2N2096
2N2097

Collector connected to case

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CB}		Vdc
2N1204, 2N1204A, 2N1494, 2N1494A		20	
2N2096, 2N2099		25	
2N1495, 2N1496, 2N2097, 2N2100		40	
Collector-Emitter Voltage	V_{CEO}		Vdc
2N2096, 2N2099		12	
2N1204, 2N1204A, 2N1494A		15	
2N2097, 2N2100		20	
2N1495, 2N1496		25	
Collector-Emitter Voltage	V_{CES}		Vdc
2N1204, 2N1204A, 2N1494, 2N1494A		20	
2N2096, 2N2099		25	
2N1495, 2N1496, 2N2097, 2N2100		40	
Emitter-Base Voltage	V_{EB}	4.0	Vdc
Collector Current	I_C	500	mAdc
Total Device Dissipation @ T_C = 25°C	P_D		
All Types		750	mW
Derate above 25°C		10	mW/°C
Total Device Dissipation @ T_A = 25°C	P_D		
TO-5 Case			
2N1204, 2N1204A, 2N1495, 2N2099, 2N2100		300	mW
Derate above 25°C		4.0	mW/°C
Case 25			
2N1494, 2N1494A, 2N1496, 2N2096, 2N2097		500	mW
Derate above 25°C		6.67	mW/°C
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-65 to +100	°C

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

Characteristics		Symbol	Minimum	Typical	Maximum	Unit
Collector-Base Breakdown Voltage		BV_{CBO}				Vdc
(I_C = 100 μAdc, I_E = 0)	2N1204, 2N1204A, 2N1494, 2N1494A		20	40	–	
	2N2096, 2N2099		25	–	–	
	2N1495, 2N1496, 2N2097, 2N2100		40	–	–	
Collector-Emitter Breakdown Voltage		BV_{CES}				Vdc
(I_C = 100 μAdc, V_{BE} = 0)	2N1204, 2N1204A, 2N1494, 2N1494A		20	40	–	
	2N2096, 2N2099		25	–	–	
	2N1495, 2N1496, 2N2097, 2N2100		40	–	–	
Collector-Emitter Breakdown Voltage		BV_{CEO}				Vdc
(I_C = 2 mAdc, I_B = 0)	2N1204, 2N1204A, 2N1494, 2N1494A		15	25	–	
(I_C = 10 mAdc, I_B = 0)	2N2096, 2N2099		12	–	–	
	2N2097, 2N2100		20	–	–	
	2N1495, 2N1496		25	–	–	
Emitter-Base Breakdown Voltage		BV_{EBO}				Vdc
(I_E = 1 mAdc, I_C = 0)	2N1204, 2N1204A, 2N1494 thru 2N1496, 2N1494A		4.0	–	–	
(I_E = 10 mAdc, I_C = 0)	2N2096, 2N2097, 2N2099, 2N2100		4.0	–	–	
Collector Cutoff Current		I_{CBO}				μAdc
(V_{CB} = 5 Vdc, I_E = 0)	2N1204, 2N1204A, 2N1494 thru 2N1496, 2N1494A		–	0.4	7.0	
(V_{CB} = 12 Vdc, I_E = 0)	2N2096, 2N2099		–	–	12	
(V_{CB} = 15 Vdc, I_E = 0)	2N2097, 2N2100		–	–	12	
Emitter Cutoff Current		I_{EBO}				μAdc
(V_{BE} = 0.5 Vdc, I_C = 0)	2N1494 thru 2N1496, 2N1494A		–	–	50	
(V_{BE} = 1 Vdc, I_C = 0)	2N2096, 2N2097, 2N2099, 2N2100		–	10	50	
DC Current Gain		h_{FE}				–
(I_C = 200 mAdc, V_{CE} = 0.5 Vdc)	2N1204A, 2N1494A, 2N1495, 2N1496		25	–	–	
(I_C = 200 mAdc, V_{CE} = 1 Vdc)	2N2097, 2N2100		30	70	–	
(I_C = 400 mAdc, V_{CE} = 1.5 Vdc)*	2N1204, 2N1494, 2N2096, 2N2099		15	35	–	
	2N2097, 2N2100		20	50	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$				Vdc
(I_C = 50 mAdc, I_B = 2.5 mAdc)	2N2097, 2N2100		–	–	0.3	
(I_C = 200 mAdc, I_B = 10 mAdc)	2N1204, 2N1204A, 2N1494, 2N1494A		–	–	0.4	
	2N2097, 2N2100		–	–	0.5	
	2N2096, 2N2099		–	–	0.6	
(I_C = 200 mAdc, I_B = 20 mAdc)	2N1495, 2N1496		–	–	0.3	
(I_C = 400 mAdc, I_B = 25 mAdc)**	2N1204A, 2N1494A, 2N1495, 2N1496		–	–	0.7	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$				Vdc
(I_C = 50 mAdc, I_B = 2.5 mAdc)	2N2097, 2N2100		–	–	0.5	
(I_C = 200 mAdc, I_B = 10 mAdc)	2N1204, 2N1204A, 2N1494 thru 2N1496, 2N1494A		0.40	0.60	0.72	
	2N2097, 2N2100		–	–	0.8	
	2N2096, 2N2099		–	–	0.9	
Collector Output Capacitance		C_{ob}				pF
(V_{CB} = 10 Vdc, I_E = 0, f = 4 MHz)	2N1204, 2N1204A, 2N1494 thru 2N1496, 2N1494A		–	3.5	6.5	
	2N2096, 2N2097, 2N2099, 2N2100		–	3.5	20	
Input Capacitance		C_{ib}				pF
(V_{BE} = 1 Vdc, I_C = 0, f = 4 MHz)	All Types		–	8.0	50	
AC Current Gain		h_{fe}				–
(I_C = 20 mA, V_{CE} = 10 V, f = 100 MHz)	2N1204, 2N1204A, 2N1494, 2N1494A		1.1	2.0	–	
	2N1495, 2N1496		1.5	–	–	
Rise Time (Figure 5)		t_r				ns
	2N2097, 2N2100		–	–	20	
	2N1204, 2N1204A, 2N1494, 2N1494A, 2N2096, 2N2099		–	–	35	
	2N1495, 2N1496		–	–	55	
Minority Carrier Storage Time Constant (Figure 4)		τ_s				ns
	2N1204, 2N1204A, 2N1494, 2N1494A		–	30	75	
	2N1495, 2N1496		–	–	90	
Storage Time (Figure 6)		t_s				ns
	2N2097, 2N2100		–	–	50	
	2N2096, 2N2099		–	–	70	
Fall Time (Figure 6)		t_f				ns
	2N2097, 2N2100		–	–	40	
	2N2096, 2N2099		–	–	60	

*Pulse Test: Pulse width ≤ 1 ms, Duty cycle ≤ 6%
**Pulse Test: Pulse width ≤ 5 ms, Duty cycle ≤ 2%

FIGURE 1 — TYPICAL RISE AND FALL TIME BEHAVIOR

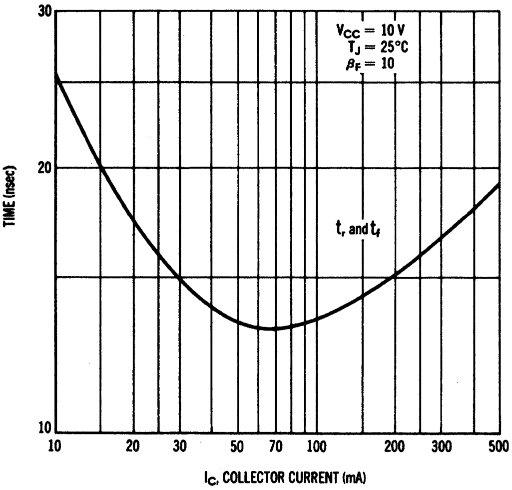


FIGURE 2 — STORAGE TIME VARIATIONS

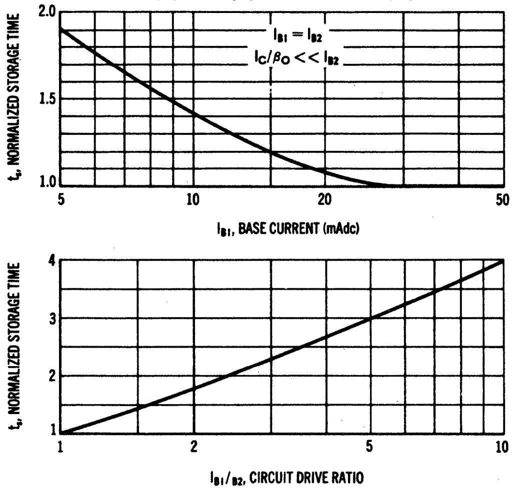


FIGURE 3 — TOTAL CONTROL CHARGE

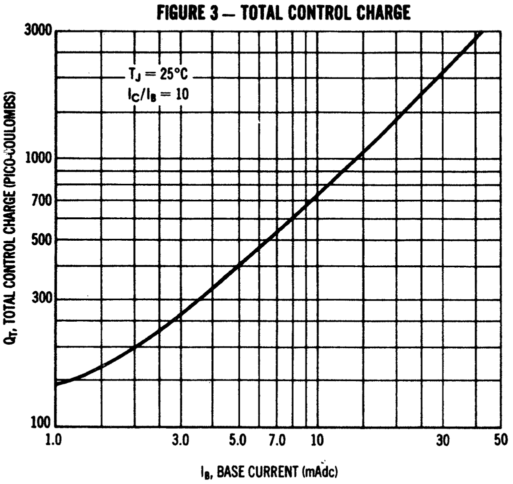
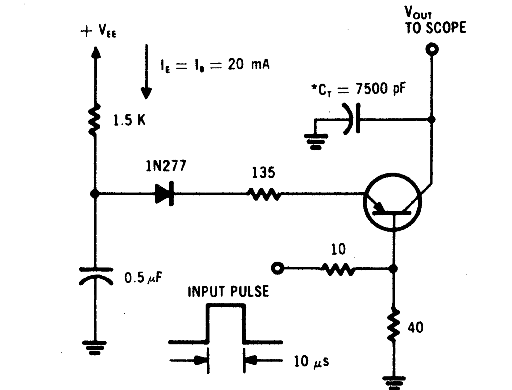


FIGURE 4 — CARRIER STORAGE TIME CONSTANT TEST CIRCUIT



*ADD SCOPE AND PROBE CAPACITANCE TO C_T FOR CORRECT CALCULATION OF τ_S (K's).

$$\tau_s = \frac{C_T V_{OUT}}{I_E}$$

FIGURE 5 — RISE TIME TEST CIRCUIT

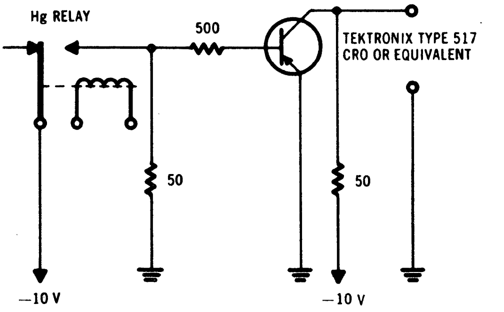
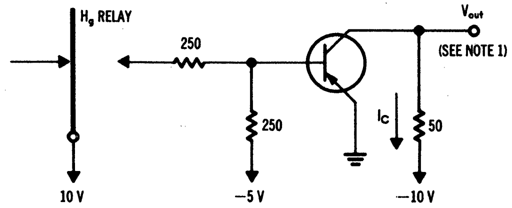


FIGURE 6 — STORAGE AND FALL TIME TEST CIRCUIT



NOTE 1: SCOPE IMPEDANCE SUFFICIENTLY HIGH SO THAT DOUBLING OR HALVING ITS VALUE DOES NOT CHANGE THE READING.
SCOPE RISE TIME FAST ENOUGH SO THAT DOUBLING OR HALVING ITS VALUE DOES NOT CHANGE THE READING.

FIGURE 7 — COLLECTOR-EMITTER SATURATION VOLTAGES versus BASE CURRENT

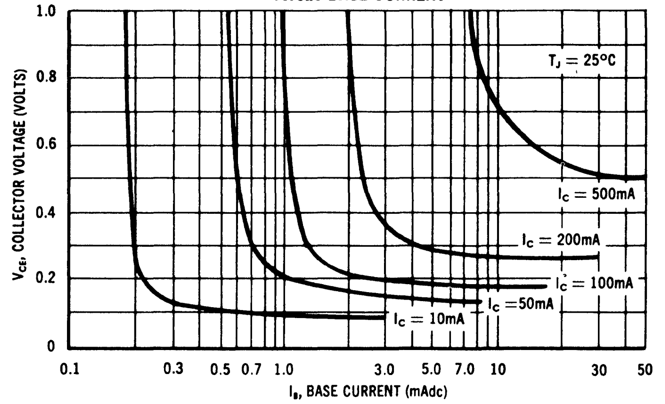


FIGURE 8 — BASE-EMITTER VOLTAGE versus COLLECTOR CURRENT

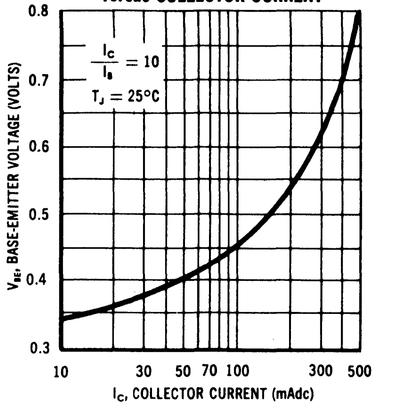


FIGURE 9 — TEMPERATURE COEFFICIENTS

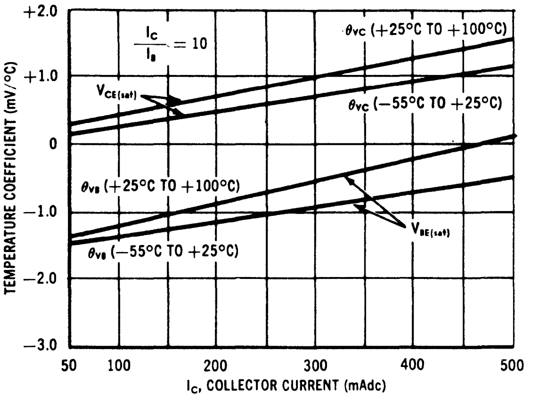


FIGURE 10 — NORMALIZED CURRENT GAIN CHARACTERISTICS

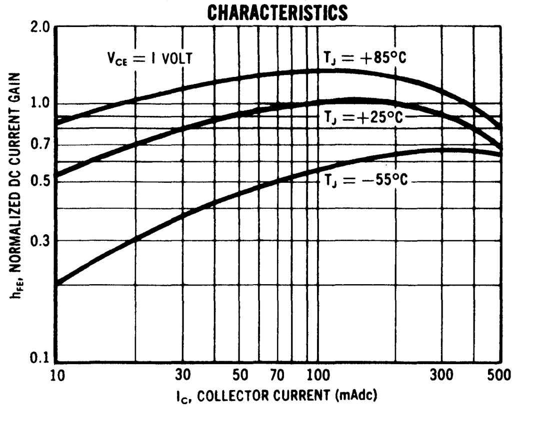


FIGURE 11 — LEAKAGE CHARACTERISTICS COMMON EMITTER

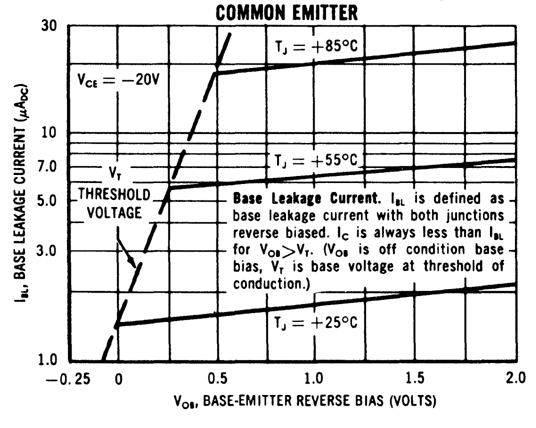


FIGURE 12 — JUNCTION CAPACITANCE versus REVERSE VOLTAGE