

ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number	Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
2N6283	2N6283		3-172	2N6323		MJ10015	3-606
2N6283JAN	2N6283JAN		3-172	2N6324		MJ10015	3-606
2N6283JTX	2N6283JTX		3-172	2N6325		MJ10015	3-606
2N6283JTXV	2N6283JTXV		3-172	2N6326	2N6328		—
2N6284	2N6284		3-172	2N6327	2N6328		—
2N6284JAN	2N6284JAN		3-172	2N6328	2N6328		—
2N6284JTX	2N6284JTX		3-172	2N6329		2N5884	3-127
2N6284JTXV	2N6284JTXV		3-172	2N6330		2N5884	3-127
2N6285	2N6285		3-172	2N6331		2N5884	3-127
2N6286	2N6286		3-172	2N6338	2N6338		3-188
2N6286JAN	2N6286JAN		3-172	2N6338JAN	2N6338JAN		3-188
2N6286JTX	2N6286JTX		3-172	2N6338JTX	2N6338JTX		3-188
2N6286JTXV	2N6286JTXV		3-172	2N6338JTXV	2N6338JTXV		3-188
2N6287	2N6287		3-172	2N6339	2N6339		3-188
2N6287JAN	2N6287JAN		3-172	2N6340	2N6340		3-188
2N6287JTX	2N6287JTX		3-172	2N6341	2N6341		3-188
2N6287JTXV	2N6287JTXV		3-172	2N6341JAN	2N6341JAN		3-188
2N6288	2N6288		3-151	2N6341JTX	2N6341JTX		3-188
2N6289		2N6288	3-151	2N6341JTXV	2N6341JTXV		3-188
2N6290	2N6292		3-151	2N6354		2N6339	3-188
2N6291	2N6292		3-151	2N6355		2N6057	3-143
2N6292	2N6292		3-151	2N6356		2N6057	3-143
2N6293		2N6292	3-151	2N6357		2N6058	3-143
2N6294	2N6294		3-177	2N6358		2N6058	3-143
2N6295	2N6295		3-177	2N6359		2N5885	3-127
2N6296	2N6296		3-177	2N6371		2N3055	3-6
2N6297	2N6297		3-177	2N6372		2N5428	3-101
2N6298	2N6298		3-147	2N6373		2N5428	3-101
2N6298JAN	2N6298JAN		3-147	2N6374		2N5428	3-101
2N6298JTX	2N6298JTX		3-147	2N6377	2N6377		3-191
2N6298JTXV	2N6298JTXV		3-147	2N6378	2N6378		3-191
2N6299	2N6299		3-147	2N6378JAN	2N6378JAN		3-191
2N6299JAN	2N6299JAN		3-147	2N6378JTX	2N6378JTX		3-191
2N6299JTX	2N6299JTX		3-147	2N6378JTXV	2N6378JTXV		3-191
2N6299JTXV	2N6299JTXV		3-147	2N6379	2N6379		3-191
2N6300	2N6300		3-147	2N6379JAN	2N6379JAN		3-191
2N6300JAN	2N6300JAN		3-147	2N6379JTX	2N6379JTX		3-191
2N6300JTX	2N6300JTX		3-147	2N6379JTXV	2N6379JTXV		3-191
2N6300JTXV	2N6300JTXV		3-147	2N6380		2N6377	3-191
2N6301	2N6301		3-147	2N6381		2N6378	3-191
2N6301JAN	2N6301JAN		3-147	2N6382		2N6379	3-191
2N6301JTX	2N6301JTX		3-147	2N6383	2N6383		3-195
2N6301JTXV	2N6301JTXV		3-147	2N6383JAN	2N6383JAN		3-195
2N6302		2N5630	3-105	2N6383JTX	2N6383JTX		3-195
2N6303	2N6303		3-32	2N6383JTXV	2N6383JTXV		3-195
2N6306	2N6306		3-181	2N6384	2N6384		3-195
2N6306JAN	2N6306JAN		3-181	2N6384JAN	2N6384JAN		3-195
2N6306JTX	2N6306JTX		3-181	2N6384JTX	2N6384JTX		3-195
2N6307	2N6307		3-181	2N6384JTXV	2N6384JTXV		3-195
2N6308	2N6308		3-181	2N6385	2N6385		3-195
2N6308JAN	2N6308JAN		3-181	2N6385JAN	2N6385JAN		3-195
2N6308JTX	2N6308JTX		3-181	2N6385JTX	2N6385JTX		3-195
2N6312	2N6318		3-185	2N6385JTXV	2N6385JTXV		3-191
2N6313		2N6318	3-185	2N6386	2N6386		3-199
2N6314		2N6318	3-185	2N6387	2N6387		3-199
2N6315		2N5428	3-101	2N6388	2N6388		3-199
2N6316		2N5428	3-101	2N6406		MJE171	3-862
2N6317	2N6317		3-185	2N6407		MJE172	3-862
2N6318	2N6318		3-185	2N6408		MJE181	3-862
2N6322		MJ10015	3-606	2N6409		MJE182	3-862

*Consult Motorola if a direct replacement is necessary.

2N6338
thru
2N6341

HIGH-POWER NPN SILICON TRANSISTORS

... designed for use in industrial-military power amplifier and switching circuit applications.

- High Collector-Emitter Sustaining Voltage —
 $V_{CE(sus)} = 100 \text{ Vdc (Min)} - 2N6338$
 $= 120 \text{ Vdc (Min)} - 2N6339$
 $= 140 \text{ Vdc (Min)} - 2N6340$
 $= 150 \text{ Vdc (Min)} - 2N6341$
- High DC Current Gain —
 $h_{FE} = 30-120 @ I_C = 10 \text{ Adc}$
 $= 12 \text{ (Min)} @ I_C = 25 \text{ Adc}$
- Low Collector-Emitter Saturation Voltage —
 $V_{CE(sat)} = 1.0 \text{ Vdc (Max)} @ I_C = 10 \text{ Adc}$
- Fast Switching Times @ $I_C = 10 \text{ Adc}$
 $t_r = 0.3 \mu\text{s (Max)}$
 $t_s = 1.0 \mu\text{s (Max)}$
 $t_f = 0.25 \mu\text{s (Max)}$
- Complement to 2N6436-38

***MAXIMUM RATINGS**

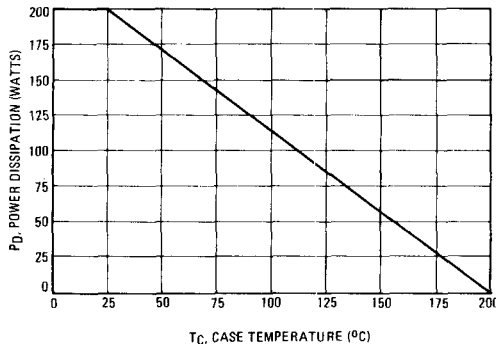
Rating	Symbol	2N6338	2N6339	2N6340	2N6341	Unit
Collector-Base Voltage	V_{CB}	120	140	160	180	Vdc
Collector-Emitter Voltage	V_{CEO}	100	120	140	150	Vdc
Emitter-Base Voltage	V_{EB}	6.0				Vdc
Collector Current — Continuous	I_C	25				Adc
Peak		50				
Base Current	I_B	10				Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$	P_D	200				Watts
Derate above 25°C		1.14				W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200				$^\circ\text{C}$

THERMAL CHARACTERISTICS

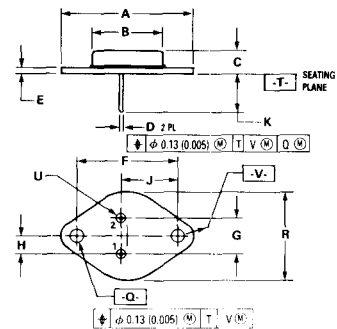
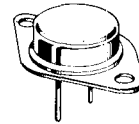
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	0.875	$^\circ\text{C/W}$

*Indicates JEDEC Registered Data.

FIGURE 1 — POWER DERATING



25 AMPERE
POWER TRANSISTORS
NPN SILICON
100, 120, 140, 150 VOLTS
200 WATTS



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	—	39.37	—	1.550
B	—	21.08	—	0.830
C	6.35	8.25	0.250	0.325
D	0.97	1.09	0.038	0.043
E	1.40	1.77	0.055	0.070
F	30.15 BSC			
G	10.92 BSC			
H	5.46 BSC			
J	16.89 BSC			
K	11.18	12.19	0.440	0.480
Q	3.84	4.19	0.151	0.165
R	26.67			
U	4.83	5.33	0.190	0.210
V	3.84	4.19	0.151	0.165

STYLE 1:
PIN 1. BASE
2. EMITTER
CASE COLLECTOR

CASE 1-06
TO-204AA
(TO-3)

TABLE 1 — METAL TO-204, TO-204AE (continued)

IcCont Amps Max	VCEO(sus) Volts Min	Device Type		hFE Min/Max	@ Ic Amp	Resistive Switching			fT MHz Min	PD (Case) Watts @ 25°C
						ts μs Max	tf μs Max	@ Ic Amp		
		NPN	PNP							
25	60	2N5885	2N5883	20/100	10	1	0.8	10	4	200
	80	2N5886	2N5884 2N6436	20/100 30/120	10 10	1 1	0.8 0.25	10 10	4 40	200 200
	100	2N6338	2N6437	30/120	10	1	0.25	10	40	200
	120	2N6339	2N6438	30/120	10	1	0.25	10	40	200
	125	BUV10 BUV10N		10 min 10 min	20 20	1.2 1.55	0.25 0.45	20 15	8 10	150 175
	140	2N6340		30/120	10	1	0.25	10	40	200
	150	2N6341		30/120	10	1	0.25	10	40	200
	500	BUT14# #		15 min	16	2.8	0.8	16		175
28	400	BUT13# #		20 min	20	2.6	0.8	18		175
30	40	2N3771 2N5301	2N4398	15/60 15/60	15 15		1	10	2 2	150 200
	60	2N5302 MJ11012# #	2N4399 MJ11011# #	15/60 1k min	15 20	2	1	10	2 4#	200 200
	90	BUX39 MJ11014# #	MJ11013# #	8 min 1k min	20 20	1	0.25	20	8 4#	120 200
	100	2N6328 MJ802	MJ4502	6/30 25/100	30 7.5				3 2	200 200
	120	MJ11016# #	MJ11015# #	1k min	20				4#	200
	325	BUV23●		8 min	16	1.8	0.4	16	8	250
	400	BUS98● BUX98		8 min	20	2.3 3	0.4 0.8	20 20		250 250
	450	BUS98A● BUX98A MJ16020● MJ16022●		8 min 5 min 7 min	16 30 30	2.3 3 1.8 1.5	0.4 0.8 0.2 0.15	16 16 20 20		250 250 250 250
40	160	BUV21N●		10 min	40	1	0.2	40	8	250
	200	BUV21●		10 min	25	1.8	0.4	25	8	150
	250	BUS52● BUV22●		15 min 10 min	40 20	1.1	0.35	20	8	350 250
	350	MJ10022●# #		50/600	120	2.5	0.9	20		250
	400	MJ10023●# #		50/600	10	2.5	0.9	20		250
	700	BUT35●# #		15 min	24	4	1.2	24		250
50	60	2N5685● MJ11028●# #	2N5683● MJ11029●# #	15/60 400 min	25 50	0.5 typ	0.3 typ	25	2	300 300
	80	2N5686●	2N5684● 2N6377●	15/60 30/120	25 20	0.5 typ 0.8	0.3 typ 0.25	25 20	2 30	300 250
	90	MJ11030●# #	MJ11031●# #	400 min	50					300
	100	2N6274●	2N6378●	30/120	20	0.8	0.25	20	30	250
	120	2N6275● MJ11032●# #	2N6379● MJ11033●# #	30/120 400 min	20 50	0.8	0.25	20	30	250 300
	125	BUV20●		10 min	50	1.2	0.25	50	8	250
	150	2N6277●		30/120	20	0.8	0.25	20	30	250

● Modified TO-3 60 mil pins, # |h_{FE}| @ 1 MHz, ## Darlington

(continued)

JAN, JTX, JTXV Available

TABLE 13 — POWER SWITCHING TRANSISTORS (continued)

I _C Cont Amps Max	V _{CEO} (sus) Volts Min	Device Type		h _{FE} Min/Max	@ I _C Amp	Resistive Switching			f _T MHz Min	P _D (Case) Watts @ 25°C	Case JEDEC/MOT
		NPN	PNP			t _s μs Max	t _f μs Max	@ I _C Amp			
4	30	BD185		15 min	2				20	40	TO-225AA/77
	45	BD785	BD786	20 min	2				50	15	TO-225AA/77
	60	2N4877 BD189 BD787	BD788	20/100 15 min 20 min	4 2 2	1.5	0.5	4	30 20 50	10 40 15	TO-205AD/79 TO-225AA/77 TO-225AA/77
	80	BD789	BD790	10 min	2				40	15	TO-225AA/77
	100	BD791	BD792	10 min	2				40	15	TO-225AA/77
5	80	2N5337	2N6191	60/240	2	2	0.2	2	30	10	TO-205AD/79
	100	2N5339	2N6193	60/240	2	2	0.2	2	30	10	TO-205AD/79
7	60	2N6315	2N6317	20/100	2.5	1	0.8	2.5	4	90	TO-213AA/80
	80	2N5428 2N6316	2N6318	60/240 20/100	2 2.5	2 1	0.2 0.8	2 2.5	30 4	60 90	TO-213AA/80 TO-213AA/80
	100	2N5430		60/240	2	2	0.2	2	30	60	TO-213AA/80
7.5	60	2N3447		40/120	5	2	0.35	5	10	115	TO-204/1
	80	2N3448		40/120	5	2	0.35	5	10	115	TO-204/1
8	120	MJE15028	MJE15029	20 min	4	0.4 typ	0.18 typ	5	30	50	TO-220/221A
	150	MJE15030	MJE15031	20 min	4	0.4 typ	0.18 typ	5	30	50	TO-220/221A
10	60	2N5877	2N5875	20/100	4	1	0.8	4	4	150	TO-204/1
	80	2N5878	2N5876	20/100	4	1	0.8	4	4	150	TO-204/1
15	60	2N5881	2N5879	20/100	6	1	0.8	6	4	160	TO-204/1
	80	2N5882	2N5880	20/100	6	1	0.8	6	4	160	TO-204/1
18	160	BUX41N		8 min	12	1.2	0.25	12	8	120	TO-204/1
20	75	2N5039		20/100	10	1.5	0.5	10	60	140	TO-204/1
	80	2N5303	2N5745	15/60	10	2	1	10	2	200	TO-204/1
	90	2N5038		20/100	12	1.5	0.5	12	60	140	TO-204/1
	125	BUX40		8 min	15	1	0.25	15	8	120	TO-204/1
	160	BUV11N		10 min	15	1.2	0.25	15	8	150	TO-204/1
25	60	2N5885	2N5883	20/100	10	1	0.8	10	4	200	TO-204/1
	80	2N5886	2N5884 2N6436	20/100 30/120	10 10	1 1	0.8 0.25	10 10	4 40	200 200	TO-204/1 TO-204/1
	100	2N6338	2N6437	30/120	10	1	0.25	10	40	200	TO-204/1
	120	2N6339	2N6438	30/120	10	1	0.25	10	40	200	TO-204/1
	125	BUV10 BUV10N		10 min 10 min	20 20	1.2 1.55	0.25 0.45	20 15	8 10	150 175	TO-204/1 TO-204/1
	140	2N6340		30/120	10	1	0.25	10	40	200	TO-204/1
	150	2N6341		30/120	10	1	0.25	10	40	200	TO-204/1
30	40	2N5301	2N4398	15/60	15	2	1	10	2	200	TO-204/1
	60	2N5302	2N4399	15/60	15	2	1	10	2	200	TO-204/1
	90	BUX39		8 min	20	1	0.25	20	8	120	TO-204/1

(continued)

2N6338 thru 2N6341

*ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage (1) ($I_C = 50 \text{ mA dc}, I_B = 0$)	$V_{CE(sus)}$	100 120 140 150	— — — —	Vdc
Collector Cutoff Current ($V_{CE} = 50 \text{ Vdc}, I_B = 0$) ($V_{CE} = 60 \text{ Vdc}, I_B = 0$) ($V_{CE} = 70 \text{ Vdc}, I_B = 0$) ($V_{CE} = 75 \text{ Vdc}, I_B = 0$)	I_{CEO}	— — — —	50 50 50 50	$\mu\text{A dc}$
Collector Cutoff Current ($V_{CE} = \text{Rated } V_{CEO}, V_{BE(off)} = 1.5 \text{ Vdc}$) ($V_{CE} = \text{Rated } V_{CEO}, V_{BE(off)} = 1.5 \text{ Vdc}, T_C = 150^\circ\text{C}$)	I_{CEX}	— —	10 1.0	$\mu\text{A dc}$ mA dc
Collector Cutoff Current ($V_{CB} = \text{Rated } V_{CB}, I_E = 0$)	I_{CBO}	—	10	$\mu\text{A dc}$
Emitter Cutoff Current ($V_{BE} = 6.0 \text{ Vdc}, I_C = 0$)	I_{EBO}	—	100	$\mu\text{A dc}$

ON CHARACTERISTICS (1)

DC Current Gain ($I_C = 0.5 \text{ A dc}, V_{CE} = 2.0 \text{ Vdc}$) ($I_C = 10 \text{ A dc}, V_{CE} = 2.0 \text{ Vdc}$) ($I_C = 25 \text{ A dc}, V_{CE} = 2.0 \text{ Vdc}$)	h_{FE}	50 30 12	— 120 —	—
Collector-Emitter Saturation Voltage ($I_C = 10 \text{ A dc}, I_B = 1.0 \text{ A dc}$) ($I_C = 25 \text{ A dc}, I_B = 2.5 \text{ A dc}$)	$V_{CE(sat)}$	— —	1.0 1.8	Vdc
Base-Emitter Saturation Voltage ($I_C = 10 \text{ A dc}, I_B = 1.0 \text{ A dc}$) ($I_C = 25 \text{ A dc}, I_B = 2.5 \text{ A dc}$)	$V_{BE(sat)}$	— —	1.8 2.5	Vdc
Base-Emitter On Voltage ($I_C = 10 \text{ A dc}, V_{CE} = 2.0 \text{ Vdc}$)	$V_{BE(on)}$	—	1.8	Vdc

DYNAMIC CHARACTERISTICS

Current-Gain-Bandwidth Product (2) ($I_C = 1.0 \text{ A dc}, V_{CE} = 10 \text{ Vdc}, f_{test} = 10 \text{ MHz}$)	f_T	40	—	MHz
Output Capacitance ($V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 0.1 \text{ MHz}$)	C_{ob}	—	300	pF

SWITCHING CHARACTERISTICS

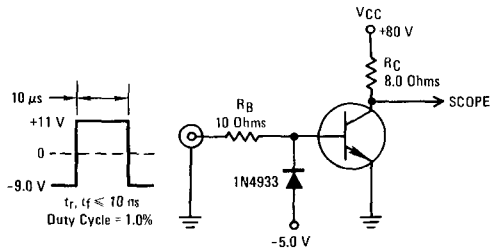
Rise Time ($V_{CC} \approx 80 \text{ Vdc}, I_C = 10 \text{ A dc}, I_{B1} = 1.0 \text{ A dc}, V_{BE(off)} = 6.0 \text{ Vdc}$)	t_r	—	~ 0.3	μs
Storage Time ($V_{CC} \approx 80 \text{ Vdc}, I_C = 10 \text{ A dc}, I_{B1} = I_{B2} = 1.0 \text{ A dc}$)	t_s	—	1.0	μs
Fall Time ($V_{CC} \approx 80 \text{ Vdc}, I_C = 10 \text{ A dc}, I_{B1} = I_{B2} = 1.0 \text{ A dc}$)	t_f	—	0.25	μs

* Indicates JEDEC Registered Data

(1) Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

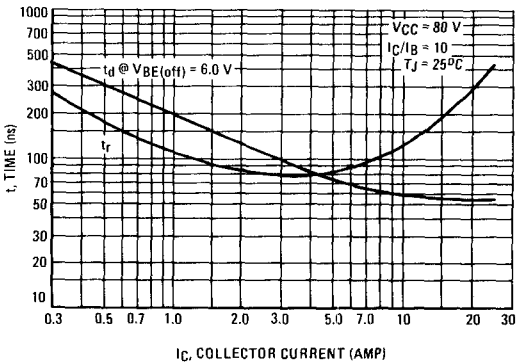
(2) $t_T = t_{re} + t_{test}$

FIGURE 2 – SWITCHING TIME TEST CIRCUIT



Note: For information on Figures 3 and 5, R_B and R_C were varied to obtain desired test conditions.

FIGURE 3 – TURN-ON TIME



2N6338 thru 2N6341

FIGURE 4 – THERMAL RESPONSE

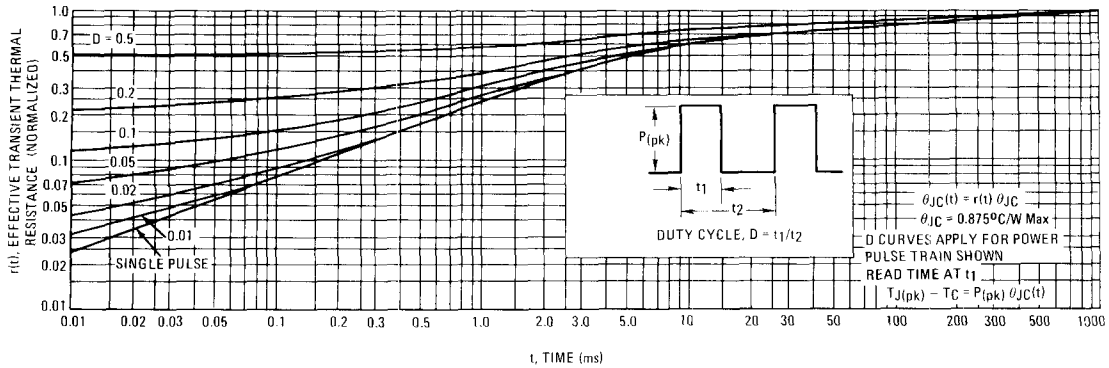
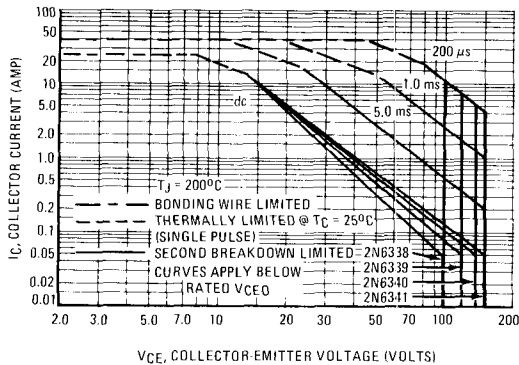


FIGURE 5 – ACTIVE REGION SAFE OPERATING AREA



There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate I_C - V_{CE} limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on $T_{J(pk)} = 200^\circ\text{C}$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 200^\circ\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

FIGURE 6 – TURN-OFF TIME

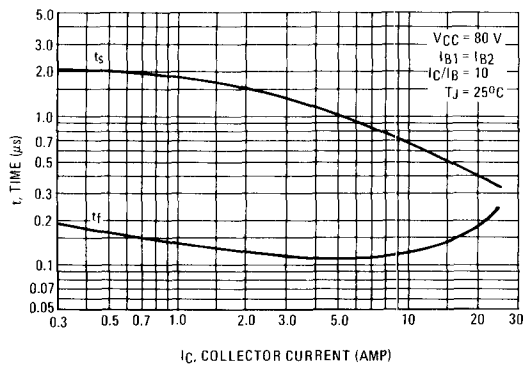


FIGURE 7 – CAPACITANCE

