

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
TIP107	TIP107		3-1091	TIP32F		MJE15031	3-972
TIP110	TIP110		3-1095	TIP33	TIP33		3-1077
TIP111	TIP111		3-1095	TIP33A	TIP33A		3-1077
TIP112	TIP112		3-1095	TIP33B	TIP33B		3-1077
TIP115	TIP115		3-1095	TIP33C	TIP33C		3-1077
TIP116	TIP116		3-1095	TIP34	TIP34		3-1077
TIP117	TIP117		3-1095	TIP34A	TIP34A		3-1077
TIP120	TIP120		3-1098	TIP34B	TIP34B		3-1077
TIP121	TIP121		3-1098	TIP34C	TIP34C		3-1077
TIP122	TIP122		3-1098	TIP35	TIP35		3-1079
TIP125	TIP125		3-1098	TIP35A	TIP35A		3-1079
TIP126	TIP126		3-1098	TIP35B	TIP35B		3-1079
TIP127	TIP127		3-1098	TIP35C	TIP35C		3-1079
TIP140	TIP140		3-1104	TIP36	TIP36		3-1079
TIP140T		TIP100	3-1091	TIP36A	TIP36A		3-1079
TIP141	TIP141		3-1104	TIP36B	TIP36B		3-1079
TIP141T		TIP101	3-1091	TIP36C	TIP36C		3-1079
TIP142	TIP142		3-1104	TIP41	TIP41		3-1083
TIP142T		TIP102	3-1091	TIP41A	TIP41A		3-1083
TIP145	TIP145		3-1104	TIP41B	TIP41B		3-1083
TIP145T		TIP105	3-1091	TIP41C	TIP41C		3-1083
TIP146	TIP146		3-1104	TIP41D		MJE15030	3-972
TIP146T		TIP106	3-1091	TIP41E		MJE15030	3-972
TIP147	TIP147		3-1104	TIP41F		MJE15030	3-972
TIP147T		TIP107	3-1091	TIP42	TIP42		3-1083
TIP150		MJE13006	3-950	TIP42A	TIP42A		3-1083
TIP151		MJE13007	3-950	TIP42B	TIP42B		3-1083
TIP152		MJE13007	3-950	TIP42C	TIP42C		3-1083
TIP160		MJE5740	3-914	TIP42D		MJE15031	3-972
TIP161		MJE5741	3-914	TIP42E		MJE15031	3-972
TIP162		MJE5742	3-914	TIP42F		MJE15031	3-972
TIP29	TIP29		3-1071	TIP47	TIP47		3-1087
TIP2955	TIP2955		3-1108	TIP48	TIP48		3-1087
TIP29A	TIP29A		3-1071	TIP49	TIP49		3-1087
TIP29B	TIP29B		3-1071	TIP50	TIP50		3-1087
TIP29C	TIP29C		3-1071	TIP510		MJ15011	3-716
TIP29D		MJE15030	3-972	TIP511		MJ15011	3-716
TIP29E		MJE15030	3-972	TIP512		MJ15011	3-716
TIP29F		MJE15030	3-972	TIP513		MJ15012	3-716
TIP30	TIP30		3-1071	TIP514		MJE15030	3-972
TIP3055	TIP3055		3-1108	TIP517		2N6339	3-188
TIP30A	TIP30A		3-1071	TIP518		2N6341	3-188
TIP30B	TIP30B		3-1071	TIP519		MJ15012	3-716
TIP30C	TIP30C		3-1071	TIP520		MJ15012	3-716
TIP30D		MJE15031	3-972	TIP521		2N6211	3-161
TIP30E		MJE15031	3-972	TIP522		2N6211	3-161
TIP30F		MJE15031	3-972	TIP523		MJ15012	3-716
TIP31	TIP31		3-1073	TIP524		2N6497	3-211
TIP31A	TIP31A		3-1073	TIP525		MJ15011	3-716
TIP31B	TIP31B		3-1073	TIP526		MJ15011	3-716
TIP31C	TIP31C		3-1073	TIP527		MJ15012	3-716
TIP31D		MJE15030	3-972	TIP528		MJ15012	3-716
TIP31E		MJE15030	3-972	TIP536		MJ16006	3-742
TIP31F		MJE15030	3-972	TIP545		MJ15016	3-9
TIP32	TIP32		3-1073	TIP546		MJ15016	3-9
TIP32A	TIP32A		3-1073	TIP550		MJ12002	3-637
TIP32B	TIP32B		3-1073	TIP551		MJ12003	3-642
TIP32C	TIP32C		3-1073	TIP552		MJ12004	3-644
TIP32D		MJE15031	3-972	TIP553		MJ12004	3-644
TIP32E		MJE15031	3-972	TIP554		MJ13080	3-682

*Consult Motorola if a direct replacement is necessary.

TABLE 5 — PLASTIC TO-220 (Continued)

I _C Cont Amps Max	V _{CEO(sus)} Volts Min	Device Type		hFE Min/Max	@ I _C Amp	Resistive Switching			f _T MHz Min	P _D (Case) Watts @ 25°C
		NPN	PNP			t _s μs Max	t _f μs Max	@ I _C Amp		
2	45	BD239	BD240	15 min	1				3	30
	60	BD239A TIP110##	BD240A TIP115##	15 min 500 min	1 2	1.7 typ	1.3 typ	2	3 25#	30 50
	80	BD239B TIP111##	BD240B TIP116##	15 min 500 min	1 2	1.7 typ	1.3 typ	2	3 25#	30 50
	100	BD239C TIP112##	BD240C TIP117##	25 min 500 min	1 2	1.7 typ	1.3 typ	2	3 25#	30 50
	400	BUX84		30 min	0.1	3.5	1.4	1	4	50
	450	BUX85		30 min	0.1	3.5	1.4	1	4	50
	900	MJE1320		3 min	1	4 typ	0.8 typ	1		80
2.5	700	MJE8500		7.5 min	0.5	4	2	1		65
	750	MJE12007		1.1 min	2		1	2	4 typ	65
	800	MJE8501		7.5 min	0.5	4	2	1		65
3	40	TIP31	TIP32	25 min	1	0.6 typ	0.3 typ	1	3	40
	45	BD241	BD242	25 min	1				3	40
	60	BD241A TIP31A	BD242A TIP32A	25 min 25 min	1 1	0.6 typ	0.3 typ	1	3 3	40 40
	80	BD241B TIP31B	BD242B TIP32B	25 min 25 min	1 1	0.6 typ	0.3 typ	1	3 3	40 40
	100	BD241C TIP31C	BD242C TIP32C	25 min 25 min	1 1	0.6 typ	0.3 typ	1	3 3	40 40
	750	MJE16032		4 min	3	2	1.5	2		80
	850	MJE16034		4 min	3	2	1.5	2		80
4	45	2N6121	2N6124	25/100	1.5	0.4 typ	0.3 typ	1.5	2.5	40
	60	2N6122 BD535 MJE800T##	2N6125 MJE700T##	25/100 25 min 750 min	1.5 2 1.5	0.4 typ	0.3 typ	1.5	2.5 3 1#	40 50 40
	80	2N6123		20/80	1.5	0.4 typ	0.3 typ	1.5	2.5	40
	300	MJE13004		6/30	3	3	0.7	3	4	60
	400	MJE13005		6/30	3	3	0.7	3	4	60
5	60	TIP120##	TIP125##	1k min	3	1.5 typ	1.5 typ	3	4#	65
	80	TIP121##	TIP126##	1k min	3	1.5 typ	1.5 typ	3	4#	65
	100	TIP122##	TIP127##	1k min	3	1.5 typ	1.5 typ	4	4#	75
	250	2N6497		10/75	2.5	1.8	0.8	2.5	5	80
	300	2N6498		10/75	2.5	1.8	0.8	2.5	5	80
	400	MJE13070		8 min	3	1.5	0.5	3		80
	450	MJE16002 MJE16004		5 min 7 min	5 5	3 2.7	0.3 0.35	3 3		80 80
	700	MJE8502		7.5 min	1	4	2	2.5		80
	800	MJE8503		7.5 min	1	4	2	2.5		80
6	40	TIP41	TIP42	15/75	3	0.4 typ	0.15 typ	3	3	65
	45	BD243	BD244	15 min	3				3	65
	60	BD243A TIP41A	BD244A TIP42A	15 min 15/75	3 3	0.4 typ	0.15 typ	3	3 3	65 65
	80	BD243B TIP41B	BD244B TIP42B	15 min 15/75	3 3	0.4 typ	0.15 typ	3	3 3	65 65
	100	BD243C TIP41C	BD244C TIP42C	15 min 15/75	3 3	0.4 typ	0.15 typ	3	3 3	65 65
7	30	2N6288	2N6111	30/150	3	0.4 typ	0.15 typ	3	4	40

[h_{FE}] @ 1 MHz, ## Darlington

(continued)

MOTOROLA SEMICONDUCTOR TECHNICAL DATA

NPN
**TIP41
TIP41A
TIP41B
TIP41C**

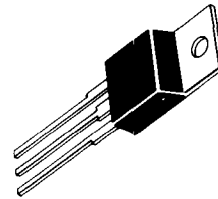
PNP
**TIP42
TIP42A
TIP42B
TIP42C**

COMPLEMENTARY SILICON PLASTIC POWER TRANSISTORS

... designed for use in general purpose amplifier and switching applications.

- Collector-Emitter Saturation Voltage —
 $V_{CE(sat)} = 1.5 \text{ Vdc (Max) @ } I_C = 6.0 \text{ Adc}$
- Collector-Emitter Sustaining Voltage —
 $V_{CE(sus)} = 40 \text{ Vdc (Min) — TIP41, TIP42}$
 $= 60 \text{ Vdc (Min) — TIP41A, TIP42A}$
 $= 80 \text{ Vdc (Min) — TIP41B, TIP42B}$
 $= 100 \text{ Vdc (Min) — TIP41C, TIP42C}$
- High Current Gain — Bandwidth Product
 $f_T = 3.0 \text{ MHz (Min) @ } I_C = 500 \text{ mAdc}$
- Compact TO-220/AB Package
- TO-66 Leadform Also Available

**6 AMPERE
POWER TRANSISTORS
COMPLEMENTARY SILICON**
**40-60-80-100 VOLTS
65 WATTS**



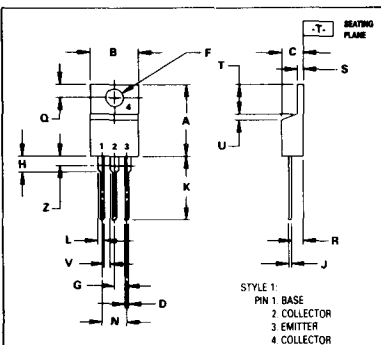
*MAXIMUM RATINGS

Rating	Symbol	TIP41 TIP42	TIP41A TIP42A	TIP41B TIP42B	TIP41C TIP42C	Unit
Collector-Emitter Voltage	V_{CEO}	40	60	80	100	Vdc
Collector-Base Voltage	V_{CB}	40	60	80	100	Vdc
Emitter-Base Voltage	V_{EB}	5.0				Vdc
Collector Current - Continuous	I_C	6				Adc
Collector Current - Peak		10				Adc
Base Current	I_B	2.0				Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	P_D	65				Watts
Derate above 25°C		0.52				W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	2.0				Watts
Derate above 25°C		0.016				W/ $^\circ\text{C}$
Unclamped Inductive Load Energy (1)	E	62.5				mJ
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150				$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.92	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$

(1) $I_C = 2.5 \text{ A}$, $L = 20 \text{ mH}$, P.R.F. = 10 Hz, $V_{CC} = 10 \text{ V}$, $R_{BE} = 100 \Omega$.



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.48	15.75	0.570	0.620
B	9.66	10.28	0.380	0.406
C	4.07	4.82	0.160	0.190
D	0.64	0.80	0.025	0.032
F	3.61	3.73	0.142	0.147
G	2.42	2.66	0.095	0.105
H	2.80	3.93	0.110	0.155
J	0.46	0.71	0.018	0.028
K	12.70	14.27	0.500	0.562
L	1.15	1.39	0.045	0.055
M	4.82	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.79	0.080	0.110
S	1.15	1.39	0.045	0.055
T	5.97	6.47	0.235	0.255
U	0.60	1.27	0.000	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

**CASE 221A-04
TO-220AB**

TIP41, TIP41A, TIP41B, TIP41C, NPN, TIP42, TIP42A, TIP42B, TIP42C, PNP

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage (1) ($I_C = 30\text{ mA}$, $I_B = 0$)	$V_{CE(sus)}$	40 60 80 100	— — — —	Vdc
Collector Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 60\text{ Vdc}$, $I_B = 0$)	I_{CEO}	— —	0.7 0.7	mA
Collector Cutoff Current ($V_{CE} = 40\text{ Vdc}$, $V_{EB} = 0$) ($V_{CE} = 60\text{ Vdc}$, $V_{EB} = 0$) ($V_{CE} = 80\text{ Vdc}$, $V_{EB} = 0$) ($V_{CE} = 100\text{ Vdc}$, $V_{EB} = 0$)	I_{CES}	— — — —	400 400 400 400	μA
Emitter Cutoff Current ($V_{BE} = 5.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	1.0	mA
ON CHARACTERISTICS (1)				
DC Current Gain ($I_C = 0.3\text{ A}$, $V_{CE} = 4.0\text{ Vdc}$) ($I_C = 3.0\text{ A}$, $V_{CE} = 4.0\text{ Vdc}$)	h_{FE}	30 15	— 75	—
Collector-Emitter Saturation Voltage ($I_C = 6.0\text{ A}$, $I_B = 600\text{ mA}$)	$V_{CE(sat)}$	—	1.5	Vdc
Base-Emitter On Voltage ($I_C = 6.0\text{ A}$, $V_{CE} = 4.0\text{ Vdc}$)	$V_{BE(on)}$	—	2.0	Vdc
DYNAMIC CHARACTERISTICS				
Current Gain — Bandwidth Product (2) ($I_C = 500\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f_{test} = 1\text{ MHz}$)	f_T	3.0	—	MHz
Small-Signal Current Gain ($I_C = 0.5\text{ A}$, $V_{CE} = 10\text{ Vdc}$, $f = 1\text{ kHz}$)	$ h_{fe} $	20	—	—

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

(2) $f_T = |h_{fe}| \cdot f_{test}$

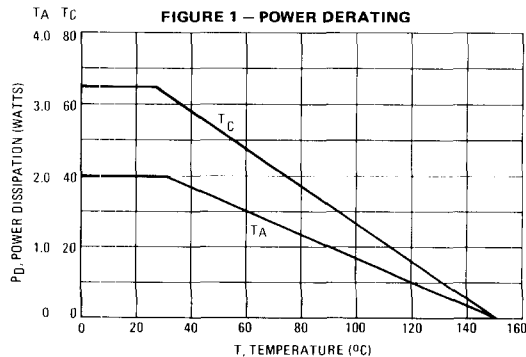


FIGURE 2 — SWITCHING TIME TEST CIRCUIT

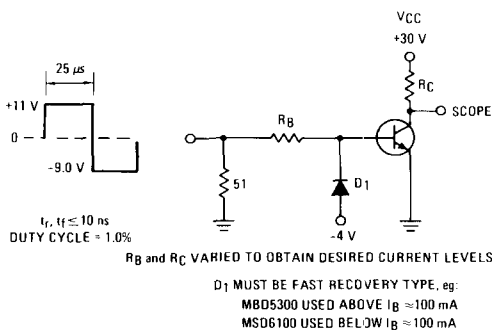
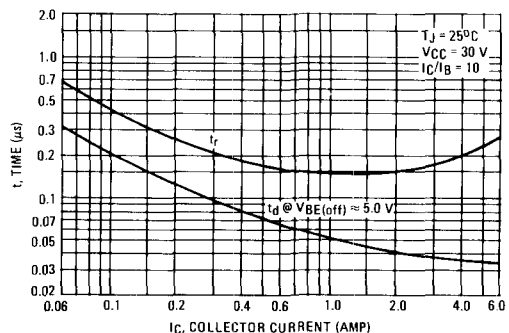


FIGURE 3 — TURN-ON TIME



TIP41, TIP41A, TIP41B, TIP41C, NPN, TIP42, TIP42A, TIP42B, TIP42C, PNP

FIGURE 4 – THERMAL RESPONSE

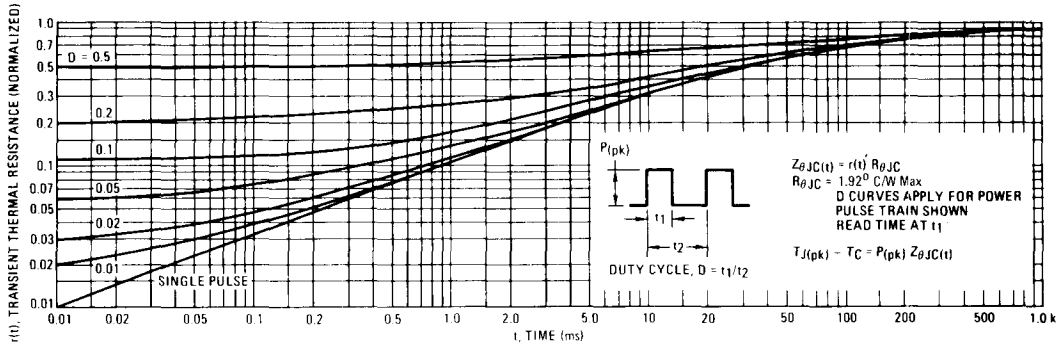
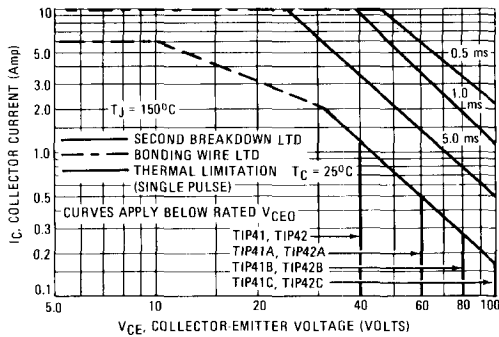


FIGURE 5 – ACTIVE-REGION SAFE OPERATING AREA



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 $T_J(pk) = 150^{\circ}C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_J(pk) \leq 150^{\circ}C$. $T_J(pk)$ 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

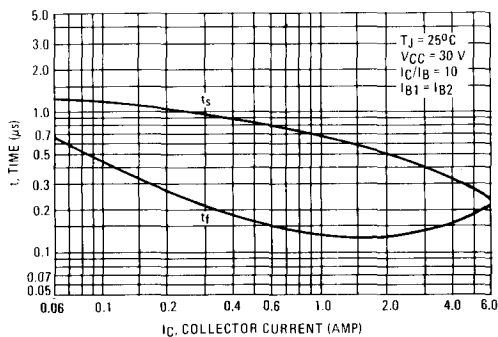
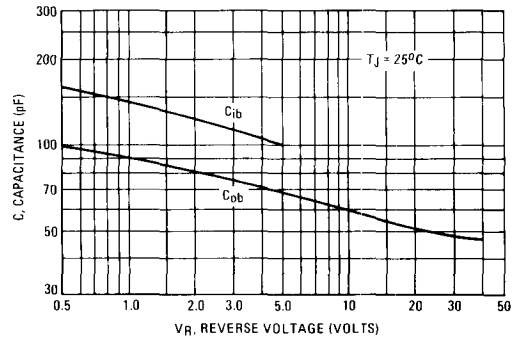


FIGURE 7 – CAPACITANCE



TIP41, TIP41A, TIP41B, TIP41C, NPN, TIP42, TIP42A, TIP42B, TIP42C, PNP

FIGURE 8 – DC CURRENT GAIN

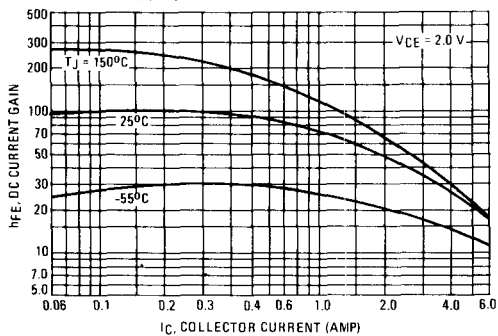


FIGURE 9 – COLLECTOR SATURATION REGION

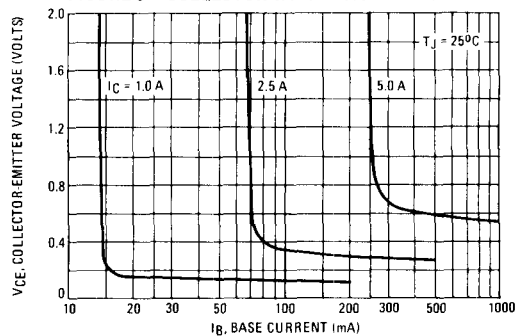


FIGURE 10 – "ON" VOLTAGES

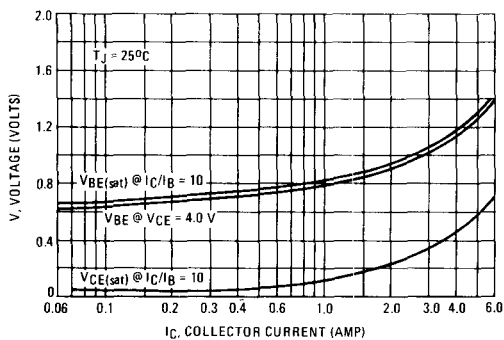


FIGURE 11 – TEMPERATURE COEFFICIENTS

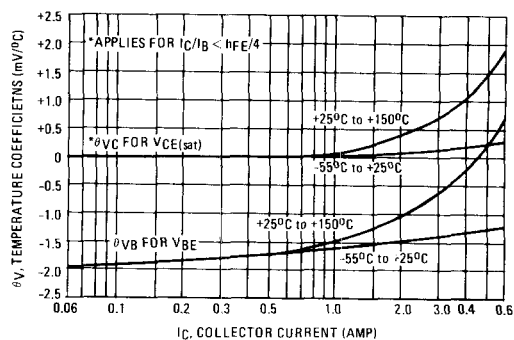


FIGURE 12 – COLLECTOR CUT-OFF REGION

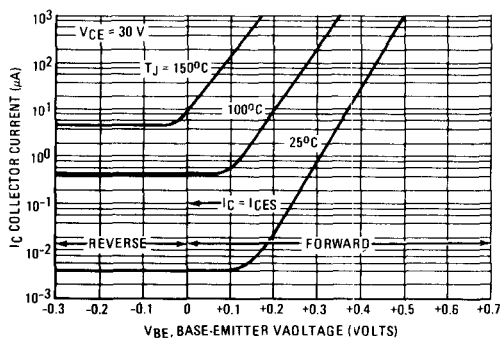


FIGURE 13 – EFFECTS OF BASE-EMITTER RESISTANCE

