

# ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

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SVT250-10		2N6306	3-181	SVT7561		MJ16012	3-758
SVT250-10C		MJ15024	3-720	SVT7563		MJ13090	3-688
SVT250-3C		2N6308	3-181	SVT7564		MJ13090	3-688
SVT250-5		2N6308	3-181	SVT7565		MJ13090	3-688
SVT250-5C		2N6306	3-181	SVT7570		MJ16010	3-758
SVT300-10		2N6307	3-181	SVT7571		MJ16012	3-758
SVT300-10C		MJ13090	3-688	SVT7573		MJ13090	3-688
SVT300-3C		2N6307	3-181	SVT7574		MJ13090	3-688
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SVT350-5		2N6308	3-181	TIP106	TIP106		3-1091

\*Consult Motorola if a direct replacement is necessary.

**TABLE 5 — PLASTIC TO-220 (continued)**

I <sub>C</sub> Cont Amps Max	V <sub>CE0(sus)</sub> Volts Min	Device Type		h <sub>FE</sub> Min/Max	@ I <sub>C</sub> Amp	Resistive Switching			f <sub>T</sub> MHz Min	P <sub>D</sub> (Case) Watts @ 25°C
		NPN	PNP			t <sub>s</sub> μs Max	t <sub>f</sub> μs Max	@ I <sub>C</sub> Amp		
7	45	BD795	BD796	25 min	3				3	65
	50	2N6290	2N6109	30/150	2.5	0.4 typ	0.15 typ	3	4	40
	60	BD797	BD798	25 min	3				3	65
	70	2N6292	2N6107	30/150	3	0.4 typ	0.15 typ	3	4	40
	80	BD799	BD800	15 min	3				3	65
	100	BD801	BD802	15 min	3				3	65
	150	BU407,D		30 min	1.5		0.75	5	10	60
	200	BU406,D		30 min	1.5		0.75	5	10	60
	375	BU522##		250 min	2.5				7.5	75
	425	BU522A##		250 min	2.5				7.5	75
450	BU522B##		250 min	2.5				7.5	75	
8	40	2N6386##		1k/20k	3				20#	65
	45	BDX53##	BDX54##	750 min	3				4#	60
		BD895##	BD896##	750 min	3				1#	70
		BD895A##	BD896A##	750 min	4				1#	70
	60	2N6043##	2N6040##	1k/10k	4	1.5 typ	1.5 typ	3	4#	75
		BDX53A##	BDX54A##	750 min	3				4#	60
		BD897##	BD898##	750 min	3				1#	70
		BD897A##	BD898A##	750 min	4				1#	70
		TIP100##	TIP105##	1k/20k	3	1.5 typ	1.5 typ	3	4#	80
	80	2N6044##	2N6041##	1k/10k	4	1.5 typ	1.5 typ	3	4#	75
		BDX53B##	BDX54B##	750 min	3				4#	60
		BD899##	BD900##	750 min	3				1#	70
		BD899A##	BD900A##	750 min	4				1#	70
		TIP101##	TIP106##	1k/20k	3	1.5 typ	1.5 typ	3	4#	80
	100	2N6045##	2N6042##	1k/10k	3	1.5 typ	1.5 typ	3	4#	75
		BDX53C##	BDX54C##	750 min	3				4#	60
		BD901##	BD902##	750 min	3				1#	70
		TIP102##	TIP107##	1k/20k	3	1.5 typ	1.5 typ	3	4#	80
120	BDX53D##	BDX54D##	750 min	3				4#	60	
	MJE15028	MJE15029	20 min	4				30	50	
150	MJE15030	MJE15031	20 min	4				30	50	
	BU807##		100 min	5	0.55 typ	0.2 typ	5	60	60	
200	BU806##		100 min	5	0.55 typ	0.2 typ	5		60	
300	MJE13006		5/30	5	3	0.7	5	4	80	
	MJE5740##	MJE5850	200 min 15 min	4 2	8 typ 2	2 typ 0.5	6 4	80 80		
350	MJE5741##		200 min 15 min	4 2	8 typ 2	2 typ 0.5	6 4	80 80		
	MJE5742##		200 min	4	8 typ	2 typ	6	80		
400	MJE13007		5/30	5	3	0.7	5	4	80	
	MJE16080	MJE5852	15 min	2	2	0.5	4	80		
	MJE16106		5 min	8	2	0.5	5	80		
	MJE16106		6/25	8	2 typ	0.1 typ	5	100		
450	MJE16081		5 min	8	2	0.5	5	80		
10	30		D45H1 D45H2	20 min 40 min	4 4				50 50	
		40	D44E1##	1000 min	5	2 typ	0.5 typ	10	50	
	45	BDX33##	BDX34##	750 min	4				3	70
		BD805	BD806	15 min	4				1.5	90
		D44H5	D45H4 D45H5	20 min 40 min	4 4				50 50	
60	BDX33A##	BDX34A##	750 min	4				3	70	
BD807	BD808	15 min	4				1.5	90		

# I<sub>hfe</sub> @ 1 MHz, ## Darlington

(continued)

**TABLE 12 — POWER DARLINGTONS (continued)**

I <sub>C</sub> Cont Amps Max	V <sub>CEO(sus)</sub> Volts Min	Device Type		h <sub>FE</sub> Min/Max	@ I <sub>C</sub> Amp	Resistive Switching			h <sub>FE</sub>   @ 1 MHz Min	P <sub>D</sub> (Case) Watts @ 25°C	Case JEDEC/MOT	
		NPN	PNP			t <sub>s</sub> μs Max	t <sub>f</sub> μs Max	@ I <sub>C</sub> Amp				
8	80	MJ1001	MJ901	1k min	3					90	TO-204/1	
		TIP101	TIP106	1k/20k	3	1.5 typ	1.5 typ	3	4	80	TO-220/221A	
		2N6044	2N6041	1k/10k	4	1.5 typ	1.5 typ	3	4	75	TO-220/221A	
		2N6301	2N6299	750k/18k	4	1.5 typ	1.5 typ	4	4	75	TO-213A/80	
		2N6056	2N6054	750k/18k	4	1.5 typ	1.5 typ	4	4	100	TO-204A/1	
		MJE6044	MJE6041	1k/20k	4	1.5 typ	1.5 typ	4	2	75	TO-225AB/90	
		BDX53C	BDX54C	750 min	3				4	60	TO-220/221A	
		BD901	BD902	750 min	3				1	70	TO-220/221A	
	100	MJE6045			1k/20k	4	1.5 typ	1.5 typ	4	2	75	TO-225AB/90
		MJD122	MJD127		1k/12k	4	1.5 typ	2 typ	4	4	20	TO-252/369A-04
		MJF102	MJF107		3k min	3	1.5 typ	1.5 typ	3	4	35	—/221C-02
		TIP102	TIP107		1k/20k	3	1.5 typ	1.5 typ	3	4	80	TO-220/221A
		2N6045	2N6042		1k/10k	4	1.5 typ	1.5 typ	3	4	75	TO-220/221A
		BDX53D	BDX54D		750 min	3				4	60	TO-220/221A
150	BU807●			100 min	5	0.55 typ	0.2 typ	5		60	TO-220/221A	
200	BU806●			100 min	5	0.55 typ	0.2 typ	5		60	TO-220/221A	
300	MJE5740			200/400	4	8 typ	2 typ	6		80	TO-220/221A	
350	MJE5741			200/400	4	8 typ	2 typ	6		80	TO-220/221A	
400	MJE5742			200/400	4	8 typ	2 typ	6		80	TO-220/221A	
500	BUT50P●			30 min	2	0.75 typ	0.1 typ	5		100	TO-218/340D	
1400*	MJ10011			20 min	4				1	4	80	TO-204/1
10	40	2N6383	2N6648	1k/20k	5					20	100	TO-204/1
		D44E1		1000 min	5	2 typ	0.5 typ	10		50	TO-220/221A	
	45	BDX33	BDX34		750 min	4				3	70	TO-220/221A
	60	BDV65	BDV64		1k min	5					125	TO-218/340D
		BDX33A	BDX34A		750 min	4				3	70	TO-220/221A
		MJ3000	MJ2500		1k min	5					150	TO-204/1
		2N6387	2N6667		1k/20k	5				20	65	TO-220/221A
		2N6384			1k/20k	5				20	100	TO-204/1
		D44E2			1000 min	5	2 typ	0.5 typ	10		50	TO-220/221A
	TIP140	TIP145		500 min	10	2.5 typ	2.5 typ	5	4	125	TO-218/340	
	80	2N6388	2N6668		1k/20k	5				20	65	TO-220/221A
		2N6385			1k/20k	5				20	100	TO-204/1
		BDV65A	BDV64A		1k min	5					125	TO-218/340D
		BDX33B	BDX34B		750 min	3				3	70	TO-220/221A
		D44E3			1000 min	5	2 typ	0.5 typ	10		50	TO-220/221A
		MJD44E3			1k min	5	2 typ	0.5 typ	10		20	TO-252/369A-04
	TIP141	TIP146		500 min	10	2.5 typ	2.5 typ	5	4	125	TO-218/340	
	100	BDV65B	BDV64B		1k min	5					125	TO-218/340D
BDX33C		BDX34C		750 min	3				3	70	TO-220/221A	
TIP142	TIP147		500 min	10	2.5 typ	2.5 typ	5	4	125	TO-218/340		
120	BDV65C	BDV64C		1k min	5					125	TO-218/340D	
	BDX33D	BDX34D		750 min	3				3	70	TO-220/221A	
200	BU323P			150 min	6	15	15	6		125	TO-218/340D	
250	BU323AP			150 min	6	15	15	6		125	TO-218/340D	
350	BU323			150 min	6	7.5 typ	5.2 typ	6		175	TO-204/1	
	MJ10002			30/300	5	2.5	1	5	10	150	TO-204/1	
	MJ10006●			30/300	5	1.5	0.5	5	10	150	TO-204/1	
400	BU323A			150 min	6	7.5 typ	5.2 typ	6		175	TO-204/1	
	MJH10012			100/2k	6	15	15	6		118	TO-218/340	
	MJ10007●			30/300	5	1.5	0.5	5	10	150	TO-204/1	

● Darlington with speed-up diode.

(continued)

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# MOTOROLA SEMICONDUCTOR TECHNICAL DATA

**NPN**  
**TIP100**  
**TIP101**  
**TIP102**

**PNP**  
**TIP105**  
**TIP106**  
**TIP107**

## PLASTIC MEDIUM-POWER COMPLEMENTARY SILICON TRANSISTORS

... designed for general-purpose amplifier and low-speed switching applications.

- High DC Current Gain –  
 $h_{FE} = 2500$  (Typ) @  $I_C = 4.0$  Adc
- Collector-Emitter Sustaining Voltage – @ 30 mAdc  
 $V_{CE(sus)} = 60$  Vdc (Min) – TIP100, TIP105  
 $= 80$  Vdc (Min) – TIP101, TIP106  
 $= 100$  Vdc (Min) – TIP102, TIP107
- Low Collector-Emitter Saturation Voltage –  
 $V_{CE(sat)} = 2.0$  Vdc (Max) @  $I_C = 3.0$  Adc  
 $= 2.5$  Vdc (Max) @  $I_C = 8.0$  Adc
- Monolithic Construction with Built-In Base-Emitter Shunt Resistors
- TO-220AB, Compact Package
- TO-66 Leadform Also Available

### \*MAXIMUM RATINGS

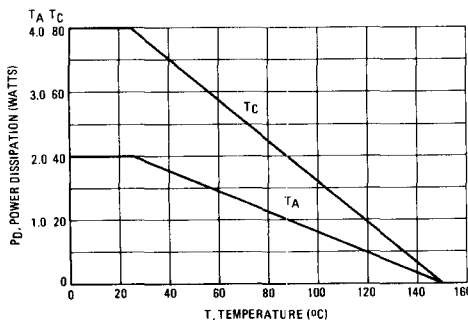
Rating	Symbol	TIP100, TIP105	TIP101, TIP106	TIP102, TIP107	Unit
Collector-Emitter Voltage	$V_{CEO}$	60	80	100	Vdc
Collector-Base Voltage	$V_{CB}$	60	80	100	Vdc
Emitter-Base Voltage	$V_{EB}$	← 5.0 →			Vdc
Collector Current – Continuous	$I_C$	← 8.0 →			Adc
Peak		← 15 →			
Base Current	$I_B$	← 1.0 →			Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$P_D$	← 80 →			Watts
Derate above $25^\circ\text{C}$		← 0.64 →			
Unclamped Inductive Load Energy (1)	E	← 30 →			mJ
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	← 2.0 →			Watts
Derate above $25^\circ\text{C}$		← 0.016 →			
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	← -65 to +150 →			$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.56	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C}/\text{W}$

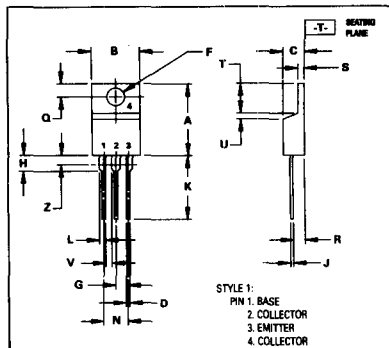
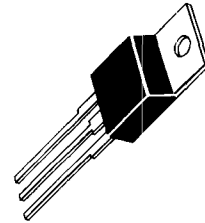
(1)  $I_C = 1.1$  A,  $L = 50$  mH, P.R.F. = 10 Hz,  $V_{CC} = 20$  V,  $R_{BE} = 100 \Omega$ .

FIGURE 1 – POWER DERATING



## DARLINGTON 8 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS

60-80-100 VOLTS  
80 WATTS



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	14.46	15.75	0.570	0.620
B	9.66	10.28	0.380	0.405
C	4.07	4.82	0.160	0.190
D	0.94	0.98	0.035	0.035
F	3.61	3.73	0.142	0.147
G	2.42	2.86	0.095	0.105
H	2.80	3.80	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
N	4.83	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	0.00	1.27	0.000	0.050
V	1.15	—	0.045	—
Z	—	2.04	—	0.080

CASE 221A-04  
TO-220AB

# TIP100, TIP101, TIP102 NPN/TIP105, TIP106, TIP107 PNP

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Sustaining Voltage (1) (I <sub>C</sub> = 30 mA <sub>dc</sub> , I <sub>B</sub> = 0)	TIP100, TIP105 TIP101, TIP106 TIP102, TIP107	V <sub>CE(sus)</sub>	60 80 100	— — —	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 30 V <sub>dc</sub> , I <sub>B</sub> = 0) (V <sub>CE</sub> = 40 V <sub>dc</sub> , I <sub>B</sub> = 0) (V <sub>CE</sub> = 50 V <sub>dc</sub> , I <sub>B</sub> = 0)	TIP100, TIP105 TIP101, TIP106 TIP102, TIP107	I <sub>CEO</sub>	— — —	50 50 50	μA <sub>dc</sub>
Collector Cutoff Current (V <sub>CB</sub> = 60 V <sub>dc</sub> , I <sub>E</sub> = 0) (V <sub>CB</sub> = 80 V <sub>dc</sub> , I <sub>E</sub> = 0) (V <sub>CB</sub> = 100 V <sub>dc</sub> , I <sub>E</sub> = 0)	TIP100, TIP105 TIP101, TIP106 TIP102, TIP107	I <sub>CBO</sub>	— — —	50 50 50	μA <sub>dc</sub>
Emitter Cutoff Current (V <sub>BE</sub> = 5.0 V <sub>dc</sub> , I <sub>C</sub> = 0)		I <sub>EBO</sub>	—	8.0	mA <sub>dc</sub>

### ON-CHARACTERISTICS (1)

DC Current Gain (I <sub>C</sub> = 3.0 A <sub>dc</sub> , V <sub>CE</sub> = 4.0 V <sub>dc</sub> ) (I <sub>C</sub> = 8.0 A <sub>dc</sub> , V <sub>CE</sub> = 4.0 V <sub>dc</sub> )	h <sub>FE</sub>	1000 200	20,000 —	—
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 3.0 A <sub>dc</sub> , I <sub>B</sub> = 6.0 mA <sub>dc</sub> ) (I <sub>C</sub> = 8.0 A <sub>dc</sub> , I <sub>B</sub> = 80 mA <sub>dc</sub> )	V <sub>CE(sat)</sub>	— —	2.0 2.5	V <sub>dc</sub>
Base-Emitter On Voltage (I <sub>C</sub> = 8.0 A <sub>dc</sub> , V <sub>CE</sub> = 4.0 V <sub>dc</sub> )	V <sub>BE(on)</sub>	—	2.8	V <sub>dc</sub>

### DYNAMIC CHARACTERISTICS

Small-Signal Current Gain (I <sub>C</sub> = 3.0 A <sub>dc</sub> , V <sub>CE</sub> = 4.0 V <sub>dc</sub> , f = 1.0 MHz)	h <sub>fe</sub>	4.0	—	—
Output Capacitance (V <sub>CB</sub> = 10 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 0.1 MHz)	C <sub>ob</sub>	— —	300 200	pF

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

FIGURE 2 – SWITCHING TIMES TEST CIRCUIT

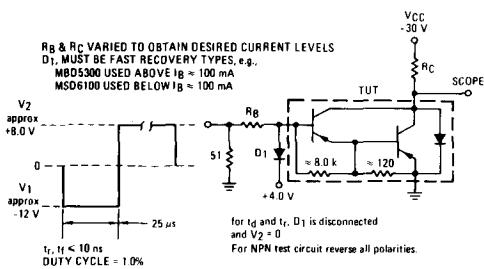
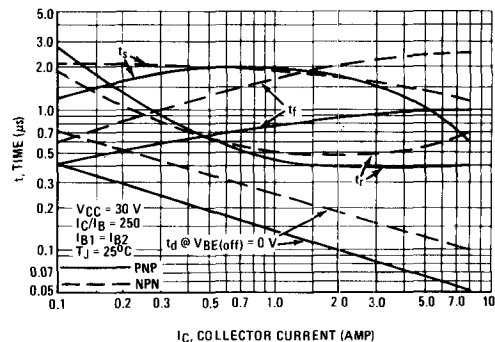


FIGURE 3 – SWITCHING TIMES



TIP100, TIP101, TIP102 NPN/TIP105, TIP106, TIP107 PNP

FIGURE 4 – THERMAL RESPONSE

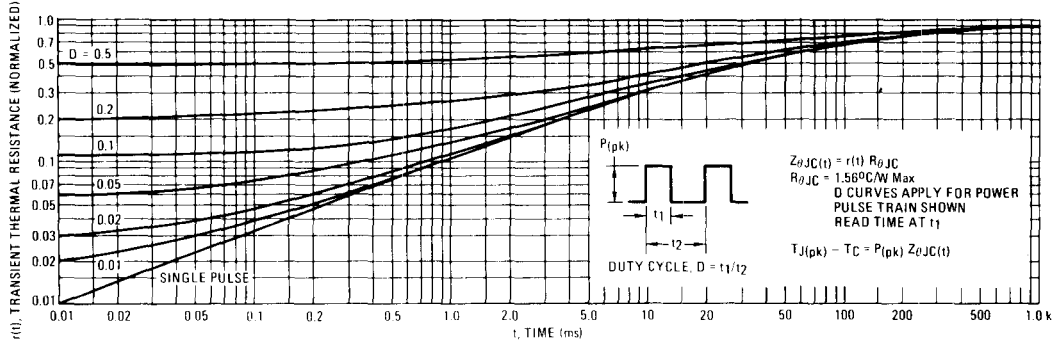
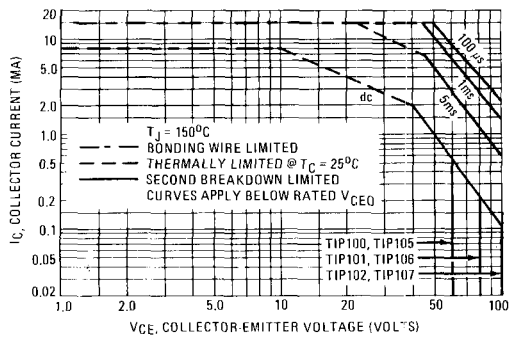


FIGURE 5 – ACTIVE-REGION SAFE OPERATING AREA



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  $T_{J(pk)} = 150^{\circ}\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 150^{\circ}\text{C}$ .  $T_{J(pk)}$  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 – SMALL-SIGNAL CURRENT GAIN

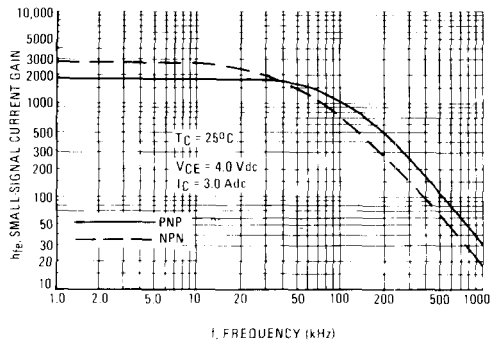
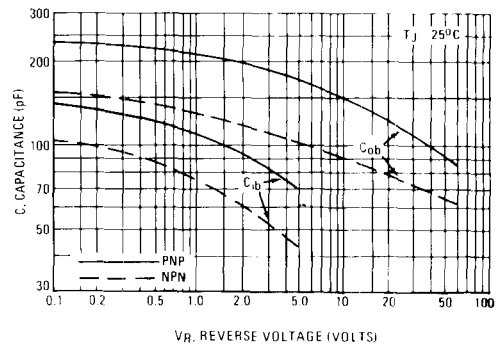
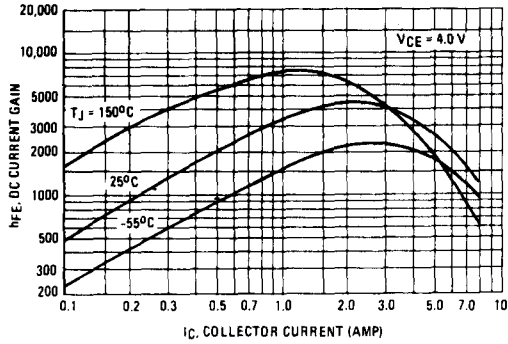


FIGURE 7 – CAPACITANCE



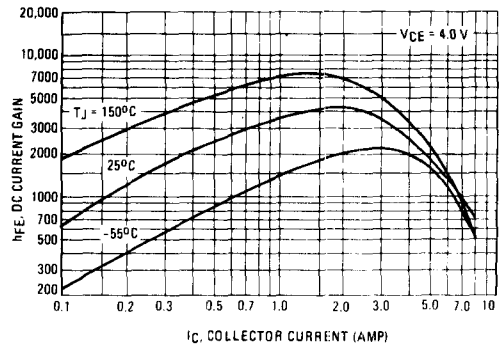
# TIP100, TIP101, TIP102 NPN/TIP105, TIP106, TIP107 PNP

**NPN**  
TIP100, TIP101, TIP102

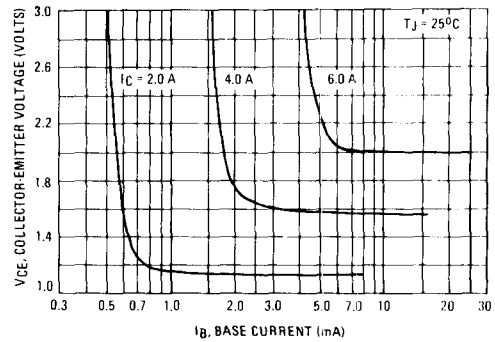
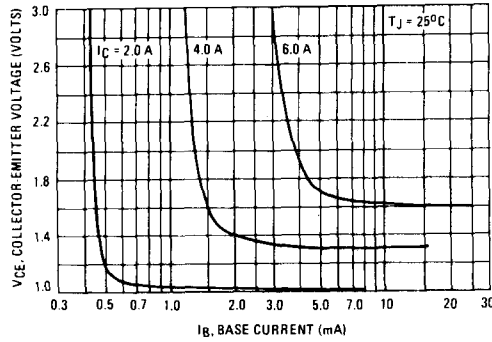


**FIGURE 8 - DC CURRENT GAIN**

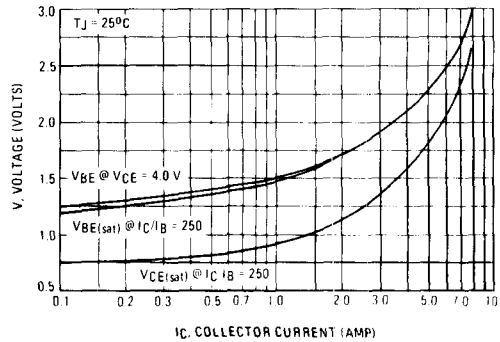
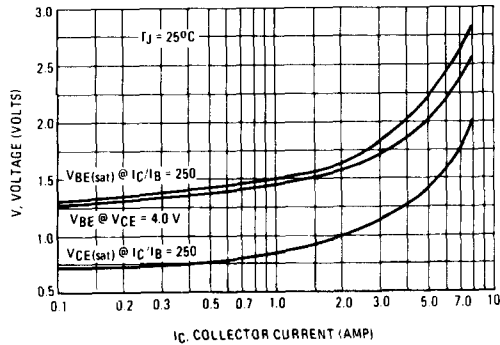
**PNP**  
TIP105, TIP106, TIP107



**FIGURE 9 - COLLECTOR SATURATION REGION**



**FIGURE 10 - "ON" VOLTAGES**



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