ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

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*Consult Motorola if a direct replacement is necessary.

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

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	Resistive Switching t_s µs Max	Resistive Switching t_f µs Max	Resistive Switching @ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C
6	375	BU326		30 typ	0.6	3.5	1**	2.5	6	90
	400	BU326A		30 typ	0.6	3.5	1**	2.5	6	90
7.5	80	2N3448		40/120	5	2	0.35	5	10	115
8	60	MJ1000##	MJ900##	1k min	3					90
		2N6055##	2N6053##	750/18k	4	1.5 typ	1.5 typ	4	4#	100
	80	MJ1001##	MJ901##	1k min	3					90
		2N6056##	2N6054##	750/18k	4	1.5 typ	1.5 typ	4	4#	100
	250	2N6306		15/75	3	1.6	0.4	3	5	125
	300	2N6307		15/75	3	1.6	0.4	3	5	125
	350	2N6308		12/60	3	1.6	0.4	5	5	125
	400	2N6545		7/35	5	4	1	5	6	125
			MJ6503	15 min	2	2	0.5	4		125
		MJ13080		8 min	5	1.5	0.5	5		150
	450	MJ16006		5 min	8	2.5	0.25	5		150
		MJ16008		7 min	8	2.2	0.25	5		150
		2N6835		10/30	5	2.5	0.25	5	10	150
	500	MJ16006A		5 min	8	3	0.4	5		150
	850*	MJ12021		5 min	8		0.1 typ	5		150
	1400*	MJ10011##		20 min	4		1	4		80
	1500*	MJ12005		5 min	5		1	5		100
9	400	BUX47		7 min	6	2	0.4	6		150
	450	BUX47A		7 min	5	2	0.4	5		150
10	40	2N6383##	2N6648##	1k/20k	5				20#	100
	60		2N3789	15 min	3	0.3 typ	0.4 typ	5	4	150
		2N3715	2N3791	30 min	3	0.3 typ	0.4 typ	5	4	150
		2N5877	2N5875	20/100	4	1	0.8	4	4	150
		2N6384##		1k/20k	5				20#	100
		MJ3000##	MJ2500##	1k min	5					150
	80	2N3714	2N3790	15 min	3	0.3 typ	0.4 typ	5	4	150
		2N3716	2N3792	30 min	3	0.3 typ	0.4 typ	5	4	150
		2N5878	2N5876	20/100	4	1	0.8	4	4	150
		2N6385##		1k/20k	5				20#	100
		MJ3001##	MJ2501##	1k min	5					150
	140	2N5634		15/60	5	0.9 typ	0.9 typ	5	1	150
		2N3442		20/70	4					117

* $V_{(BR)CEX}$, # $|h_{fe}|$ @ 1 MHz, ## Darlington

(continued)

JAN, JTX, JTXV Available

TABLE 12 — POWER DARLINGTONS (continued)

I_C Cont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type NPN	Device Type PNP	h_{FE} Min/Max	@ I_C Amp	Resistive Switching t_s µs Max	Resistive Switching t_f µs Max	Resistive Switching @ I_C Amp	$\|h_{fe}\|$ @ 1 MHz Min	P_D (Case) Watts @ 25°C	Case JEDEC/MOT
4	40	**MJE3300**	**MJE3310**	1k min	1				20	15	TO-225AA/77R
		2N6037	**2N6034**	750/1k	2	1.7 typ	1.2 typ	2	25	40	TO-225AA/77
	45	**BD675**	**BD676**	750 min	1.5					40	TO-225AA/77
		BD675A	**BD676A**	750 min	2					40	TO-225AA/77
			BD776	750 min	2				20	15	TO-225AA/77
	60	**BD677**	**BD678**	750 min	1.5					15	TO-225AA/77
		BD677A	**BD678A**	750 min	2					40	TO-225AA/77
		BD777	**BD778**	750 min	2				20	40	TO-225AA/77
		MJE3301		1k min	1				20	15	TO-225AA/77R
		MJE800	**MJE700**	750 min	1.5				1	40	TO-225AA/77
		MJE800T	**MJE700T**	750 min	1.5				1	40	TO-220/221A
		MJE801	**MJE701**	750 min	2				1	40	TO-225AA/77
		2N6038	**2N6035**	750/18k	2	1.7 typ	1.2 typ	2	25	40	TO-225AA/77
		2N6294	**2N6296**	750/18k	2	0.9 typ	0.7 typ	2	4	50	TO-213AA/80
	80	**BD679**	**BD680**	750 min	1.5					40	TO-225AA/77
		BD679A	**BD680A**	750 min	2					40	TO-225AA/77
		BD779	**BD780**	750 min	2				20	15	TO-225AA/77
		MJD6039	**MJD6036**	1k/12k	2	1.7 typ	1.2 typ	2	25	20	TO-252/369A-04
		MJE802	**MJE702**	750 min	1.5					40	TO-225AA/77
		MJE803	**MJE703**	750 min	2					40	TO-225AA/77
		2N6039	**2N6036**	750/18k	2	1.7 typ	1.2 typ	2	25	40	TO-225AA/77
		2N6295	**2N6297**	750/18k	2	0.9 typ	0.7 typ	2	4	50	TO-213AA/80
	100	**BD681**	**BD682**	750 min	1.5					40	TO-225AA/77
5	60	**MJE1100**	**MJE1090**	750 min	3A				1	70	TO-225AB/90
		MJE1101	**MJE1091**	750 min	4A				1	70	TO-225AB/90
		TIP120	**TIP125**	1k min	3	1.5 typ	1.5 typ	3	4	65	TO-220/221A
	80	**MJE1102**	**MJE1092**	750 min	3A				1	70	TO-225AB/90
		MJE1103	**MJE1102**	750 min	4A				1	70	TO-225AB/90
		TIP121	**TIP126**	1k min	3	1.5 typ	1.5 typ	3	4	65	TO-220/221A
	100	**MJF122**	**MJF127**	2k min	3	1.5 typ	1.5 typ	3	4	28	—/221C-02
		TIP122	**TIP127**	1k min	3	1.5 typ	1.5 typ	3	4	65	TO-220/221A
7	300	**MJ3041**		250 min	2.5					100	TO-204/1
	350	**MJ3042**		250 min	2.5					100	TO-204/1
	375	**BU522**		250 min	2.5				7.5	75	TO-220/221A
	425	**BU522A**		250 min	2.5				7.5	75	TO-220/221A
	450	**BU522B**		250 min	2.5				7.5	75	TO-220/221A
8	40	**2N6386**		1k/20k	3				20	65	TO-220/221A
	45	**BDX53**	**BDX54**	750 min	3				4	60	TO-220/221A
		BD895	**BD896**	750 min	3				1	70	TO-220/221A
		BD895A	**BD896A**	750 min	4				1	70	TO-220/221A
	60	**BDX53A**	**BDX54A**	750 min	3				4	60	TO-220/221A
		BD897	**BD898**	750 min	3				1	70	TO-220/221A
		BD897A	**BD898A**	750 min	4				1	70	TO-220/221A
		MJ1000	**MJ900**	1k min	3					90	TO-204/1
		TIP100	**TIP105**	1k/20k	3	1.5 typ	1.5 typ	3	4	80	TO-220/221A
		2N6043	**2N6040**	1k/10k	4	1.5 typ	1.5 typ	3	4	75	TO-220/221A
		2N6300	**2N6298**	750k/18k	4	1.5 typ	1.5 typ	4	4	75	TO-213AA/80
		2N6055	**2N6053**	750k/18k	4	1.5 typ	1.5 typ	4	4	100	TO-204/1
		MJE6043	**MJE6040**	1k/20k	4	1.5 typ	1.5 typ	4	2	75	TO-225AB/90
	80	**BDX53B**	**BDX54B**	750 min	3				4	60	TO-220/221A
		BD899	**BD900**	750 min	3				1	70	TO-220/221A
		BD899A	**BD900A**	750 min	4				1	70	TO-220/221A

(continued)

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

2N6053, 2N6054
2N6298, 2N6299 PNP
2N6055, 2N6056
2N6300, 2N6301 NPN

DARLINGTON COMPLEMENTARY SILICON POWER TRANSISTORS

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

- High DC Current Gain —
  h_{FE} = 3000 (Typ) @ I_C = 4.0 Adc
- Collector-Emitter Sustaining Voltage — @ 100 mA
  $V_{CEO(sus)}$ = 60 Vdc (Min) — 2N6053, 2N6055, 2N6298, 2N6300
  = 80 Vdc (Min) — 2N6054, 2N6056, 2N6299, 2N6301
- Low Collector-Emitter Saturation Voltage —
  $V_{CE(sat)}$ = 2.0 Vdc (Max) @ I_C = 4.0 Adc
  = 3.0 Vdc (Max) @ I_C = 8.0 Adc
- Monolithic Construction with Built-In Base-Emitter Shunt Resistors

DARLINGTON 8 AMPERE

COMPLEMENTARY SILICON POWER TRANSISTORS

60-80 VOLTS
75,100 WATTS

*MAXIMUM RATINGS

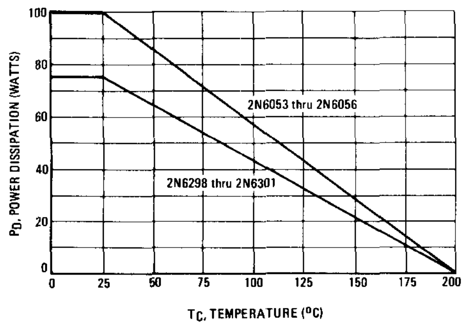
Rating	Symbol	2N6053 2N6055 2N6298 2N6300	2N6054 2N6056 2N6299 2N6301	Unit
Collector-Emitter Voltage	V_{CEO}	60	80	Vdc
Collector-Base Voltage	V_{CB}	60	80	Vdc
Emitter-Base Voltage	V_{EB}	5.0		Vdc
Collector Current — Continuous Peak	I_C	8.0 16		Adc
Base Current	I_B	120		mAdc
		2N6053 2N6054 2N6055 2N6056	2N6298 2N6299 2N6300 2N6301	
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	100 0.571	75 0.428	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200		°C

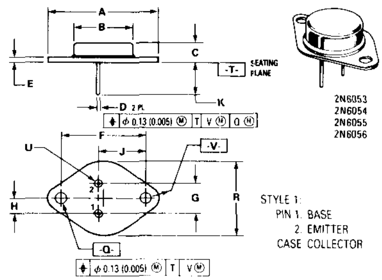
THERMAL CHARACTERISTICS

Characteristic	Symbol	2N6053 2N6054 2N6055 2N6056	2N6298 2N6299 2N6300 2N6301	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.75	2.33	°C/W

*Indicates JEDEC Registered Data.

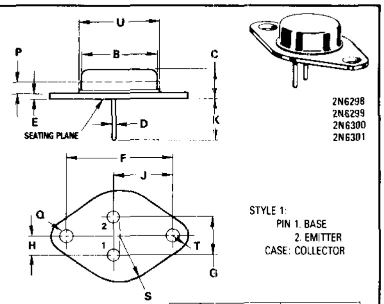
FIGURE 1 — POWER DERATING





DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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		1.187 BSC	
G	10.92 BSC		0.430 BSC	
H	5.46 BSC		0.215 BSC	
J	16.89 BSC		0.665 BSC	
K	11.13	12.19	0.440	0.480
Q	3.84	4.19	0.151	0.165
R	—	26.67	—	1.050
U	4.83	5.33	0.190	0.210
V	3.84	4.19	0.151	0.165

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



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
B	11.94	12.70	0.470	0.500
C	6.35	8.64	0.250	0.340
D	0.71	0.86	0.028	0.034
E	1.27	1.91	0.050	0.075
F	24.33	24.43	0.958	0.962
G	4.83	5.33	0.190	0.210
H	2.41	2.67	0.095	0.105
J	14.48	14.99	0.570	0.590
K	9.14	—	0.360	—
P	—	1.27	—	0.050
Q	3.61	3.86	0.142	0.152
S	—	8.89	—	0.350
T	—	3.68	—	0.145
U	—	15.75	—	0.620

CASE 80-02
TO-213AA
(TO-66)

All JEDEC Dimensions and Notes Apply.

3

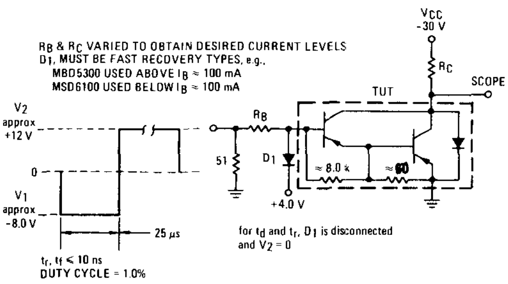
***ELECTRICAL CHARACTERISTICS** (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage (1)	$V_{CEO(sus)}$			Vdc
(I_C = 100 mAdc, I_B = 0) 2N6053, 2N6055, 2N6298, 2N6300		60	–	
2N6054, 2N6056, 2N6299, 2N6301		80	–	
Collector Cutoff Current	I_{CEO}			mAdc
(V_{CE} = 30 Vdc, I_B = 0) 2N6053, 2N6055, 2N6298, 2N6300		–	0.5	
(V_{CE} = 40 Vdc, I_B = 0) 2N6054, 2N6056, 2N6299, 2N6301		–	0.5	
Collector Cutoff Current	I_{CEX}			mAdc
(V_{CE} = Rated V_{CB}, $V_{BE(off)}$ = 1.5 Vdc)		–	0.5	
(V_{CE} = Rated V_{CB}, $V_{BE(off)}$ = 1.5 Vdc, T_C = 150°C)		–	5.0	
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)	I_{EBO}	–	2.0	mAdc
ON CHARACTERISTICS (1)				
DC Current Gain	h_{FE}			–
(I_C = 4.0 Adc, V_{CE} = 3.0 Vdc)		750	18000	
(I_C = 8.0 Adc, V_{CE} = 3.0 Vdc)		100	–	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			Vdc
(I_C = 4.0 Adc, I_B = 16 mAdc)		–	2.0	
(I_C = 8.0 Adc, I_B = 80 mAdc)		–	3.0	
Base-Emitter Saturation Voltage (I_C = 8.0 Adc, I_B = 80 mAdc)	$V_{BE(sat)}$	–	4.0	Vdc
Base-Emitter On Voltage (I_C = 4.0 Adc, V_{CE} = 3.0 Vdc)	$V_{BE(on)}$	–	2.8	Vdc
DYNAMIC CHARACTERISTICS				
Magnitude of Common Emitter Small-Signal Short Circuit Current Transfer Ratio (I_C = 3.0 Adc, V_{CE} = 3.0 Vdc, f = 1.0 MHz)	$\|h_{fe}\|$	4.0	–	–
Output Capacitance	C_{ob}			pF
(V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz) 2N6053, 2N6054, 2N6298, 2N6299		–	300	
2N6055, 2N6056, 2N6300, 2N6301		–	200	
Small-Signal Current Gain (I_C = 3.0 Adc, V_{CE} = 3.0 Vdc, f = 1.0 kHz)	h_{fe}	300	–	–

*Indicates JEDEC Registered Data.

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

FIGURE 2 – SWITCHING TIMES TEST CIRCUIT



For NPN test circuit reverse diode, polarities and input pulses.

FIGURE 3 – SWITCHING TIMES

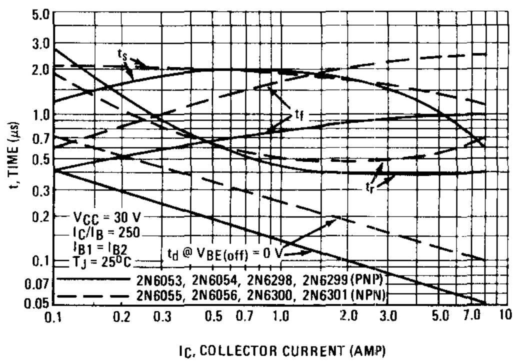
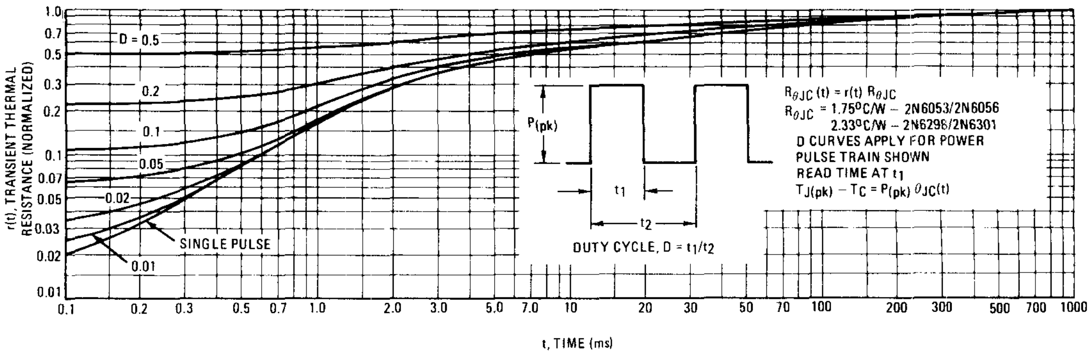


FIGURE 4 – THERMAL RESPONSE



ACTIVE-REGION SAFE OPERATING AREA

FIGURE 5 – 2N6053 thru 2N6056

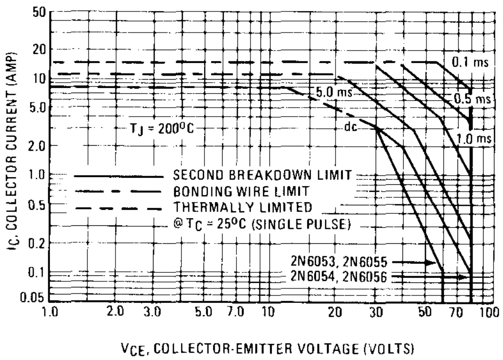
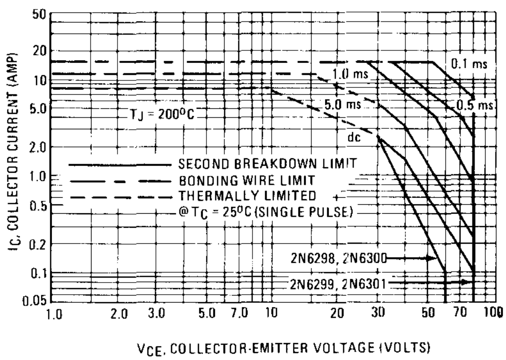


FIGURE 6 – 2N6298 thru 2N6301



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 Figures 5 and 6 is based on $T_{J(pk)} = 200°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 200°C$. $T_{J(pk)}$ 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 7 – SMALL-SIGNAL CURRENT GAIN

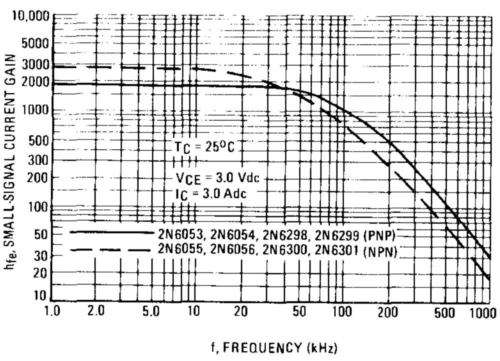
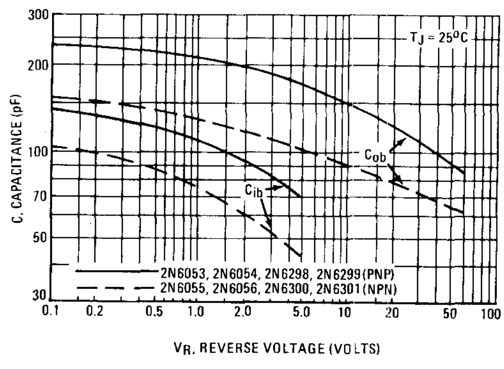


FIGURE 8 – CAPACITANCE



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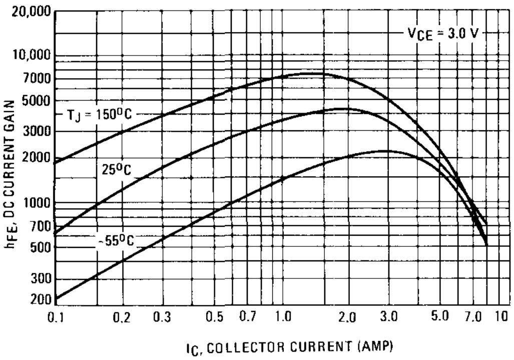
PNP — 2N6053, 2N6054, 2N6298, 2N6299

NPN — 2N6055, 2N6056, 2N6300, 2N6301

FIGURE 9 — DC CURRENT GAIN



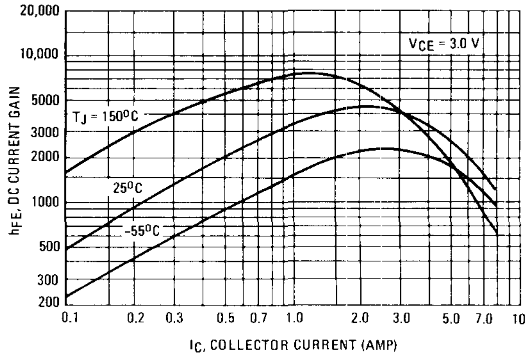
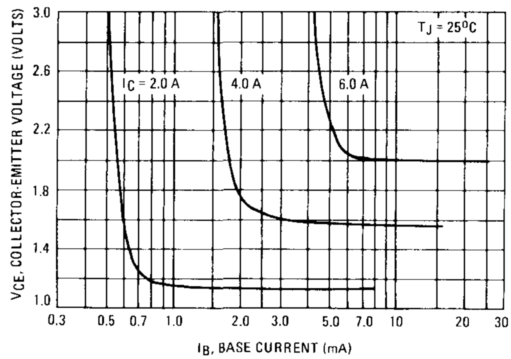


FIGURE 10 — COLLECTOR SATURATION REGION



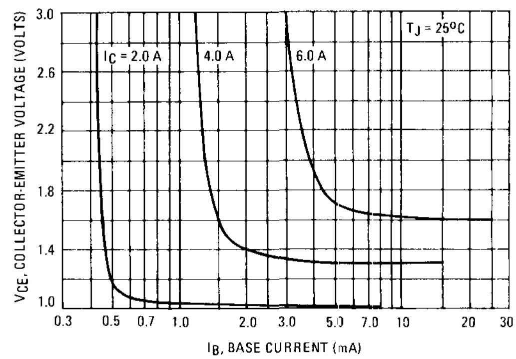
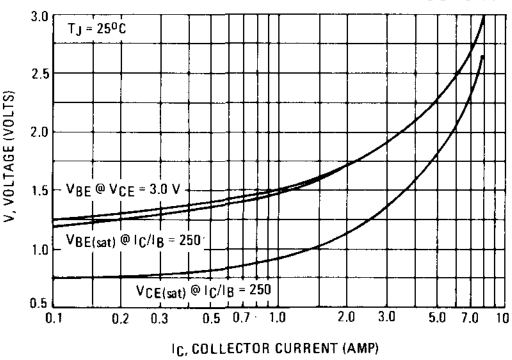
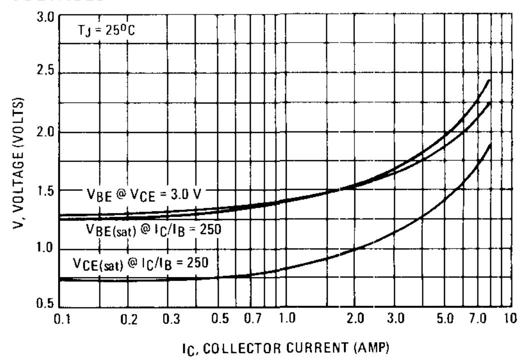


FIGURE 11 — "ON" VOLTAGES





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