ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
2N6410		MJE200	3-866
2N6411		MJE210	3-866
2N6412		MJE180	3-862
2N6413		MJE181	3-862
2N6414		MJE170	3-862
2N6415		MJE171	3-862
2N6416		MJE243	3-870
2N6417		MJE243	3-870
2N6418		MJE253	3-870
2N6419		MJE253	3-870
2N6420	2N6420		3-20
2N6421	2N6421		3-20
2N6422	2N6422		3-20
2N6423		2N6212	3-161
2N6424		2N6212	3-161
2N6425		2N6212	3-161
2N6436	2N6436		3-203
2N6437	2N6437		3-203
2N6437JAN	2N6437JAN		3-203
2N6437JTX	2N6437JTX		3-203
2N6437JTXV	2N6437JTXV		3-203
2N6438	2N6438		3-203
2N6438JAN	2N6438JAN		3-203
2N6438JTX	2N6438JTX		3-203
2N6438JTXV	2N6438JTXV		3-203
2N6465		MJE15030	3-972
2N6466		MJE15030	3-972
2N6467		MJE15031	3-972
2N6468		MJE15031	3-972
2N6469		2N5879	3-123
2N6470		2N5881	3-123
2N6471		2N5881	3-123
2N6472		2N5882	3-123
2N6473		MJE15028	3-972
2N6474		MJE15028	3-972
2N6475		MJE15029	3-972
2N6476		MJE15029	3-972
2N6477		MJE15028	3-972
2N6478		MJE15030	3-972
2N6486	2N6486		3-207
2N6487	2N6487		3-207
2N6488	2N6488		3-207
2N6489	2N6489		3-207
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2N6495		2N5428	3-101
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2N6497	2N6497		3-211
2N6498	2N6498		3-211
2N6499		MJE13005	3-944
2N6500		2N5430	3-101
2N6510		2N6306	3-181
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2N6512		2N6545	3-221
2N6513		2N6545	3-221
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Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
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2N6532		TIP102	3-1091
2N6534		2N6301	3-147
2N6535		TIP102	3-1091
2N6536		TIP102	3-1091
2N6542	2N6543		3-215
2N6543	2N6543		3-215
2N6544	2N6545		3-221
2N6545	2N6545		3-221
2N6546	2N6546		3-225
2N6546JAN	2N6546JAN		3-225
2N6546JTX	2N6546JTX		3-225
2N6547	2N6547		3-225
2N6547JAN	2N6547JAN		3-225
2N6547JTX	2N6547JTX		3-225
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2N6553		2N4923	3-79
2N6554		2N4919	3-75
2N6555		2N4919	3-75
2N6556		2N4919	3-75
2N6557		MJE340	3-876
2N6558		MJE340	3-876
2N6559		MJE340	3-876
2N6569		2N3055	3-6
2N6573		2N6546	3-225
2N6574		2N6546	3-225
2N6575		2N6547	3-225
2N6576	2N6576		3-229
2N6577	2N6577		3-229
2N6578	2N6578		3-229
2N6609	2N6609		3-52
2N6648	2N6648		3-195
2N6648JAN	2N6648JAN		3-195
2N6648JTX	2N6648JTX		3-195
2N6648JTXV	2N6648JTXV		3-195
2N6649		2N6054	3-147
2N6649JAN	2N6649JAN		—
2N6649JTX	2N6649JTX		—
2N6649JTXV	2N6649JTXV		—
2N6650JAN	2N6650JAN		—
2N6650JTX	2N6650JTX		—
2N6650JTXV	2N6650JTXV		—
2N6666		2N6667	3-232
2N6667	2N6667		3-232
2N6668	2N6668		3-232
2N6671JAN	2N6671JAN		—
2N6671JTX	2N6671JTX		—
2N6671JTXV	2N6671JTXV		—
2N6673JAN	2N6673JAN		—
2N6673JTX	2N6673JTX		—
2N6673JTXV	2N6673JTXV		—
2N6676		MJ16010	3-758
2N6677		MJ16010	3-758
2N6678		MJ16010	3-758
2N6833	2N6833		3-236
2N6834	2N6834		3-236
2N6835	MJ16006		3-742

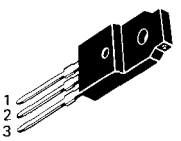
*Consult Motorola if a direct replacement is necessary.

TABLE 5 — PLASTIC TO-220 (continued)

I_C Cont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type 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
10	60	D44H7	D45H7	20 min	4					50
		D44H8	D45H8	40 min	4					50
			D45H9	40 min	4					50
		MJE2801T		25/100	3					75
		MJE3055T	MJE2955T	20/70	4					75
		2N6387##	2N6667##	1k/20k	5				20#	65
		SE9300##	SE9400##	1k min	4				1#	70
	80	BDX33B##	BDX34B##	750 min	3				3	70
		BD809	BD810	15 min	4				1.5	90
		D44E3##		1000 min	5	2 typ	0.5 typ	10		50
			D45H12	40 min	4					50
		2N6388##	2N6668##	1k/20k	5				20#	65
		D44H10	D45H10	20 min	4	0.5 typ	0.14 typ	5	50 typ	50
		D44H11	D45H11	40 min	4	0.5 typ	0.14 typ	5	50 typ	50
		SE9301##	SE9401##	1k min	4				1#	70
	100	BDX33C##	BDX34C##	750 min	3				3	70
		SE9302##	SE9402##	1k min	4				1#	70
12	300	MJE13008		6/30	8	3	0.7	8	4	100
	400	MJE13009		6/30	8	3	0.7	8	4	100
15	30	D44VH1	D45VH1	20 min	4	0.7	0.09	8	50 typ	83
	40	2N6486	2N6489	20/150	5	0.6 typ	0.3 typ	5	5	75
	45	BDW39	BDW44	1 k min	5	1 typ	1.5 typ	5	4	85
		D44VH4	D45VH4	20 min	4	0.5	0.09	8	50 typ	83
	60	2N6487	2N6490	20/150	5	0.6 typ	0.3 typ	5	5	75
		BDW40	BDW45	1 k min	5	1 typ	1.5 typ	5	4	85
		D44VH7		20 min	4	0.5	0.09	8	50 typ	85
	80	2N6488	2N6491	20/150	5	0.6 typ	0.3 typ	5	5	75
		BDW41	BDW46	1 k min	5	1 typ	1.5 typ	5	4	85
		D44VH10	D45VH10	20 min	4	0.5	0.09	8	50 typ	83
	100	BDW42	BDW47	1 k min	5	1 typ	1.5 typ	5	4	85
	120	BDW43	BDW48	1 k min	5	1 typ	1.5 typ	5	4	85

$|h_{fe}|$ @ 1 MHz, ## Darlington

TABLE 6 — PLASTIC Full Pak (TO-220 Type)



CASE 221C-02

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	f_T MHz Min	P_D (Case) Watts @ 25°C
1	250	MJF47		30/150	0.3	2 typ	0.17 typ	0.3	10	28
5	100	MJF122##	MJF127##	2000 min	3	1.5 typ	1.5 typ	3	4#	28
8	80		MJF6107	30/90	2	0.5 typ	0.13 typ	2	4	35
	100	MJF102##	MJF107##	3000 min	3	1.5 typ	1.5 typ	3	4#	35
	150	MJF15030	MJF15031	40 min	3	1 typ	0.15 typ	3	30	35
10	60	MJF3055	MJF2955	20/100	4				2	40

$|h_{fe}|$ @ 1 MHz, ## Darlington

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

NPN	PNP
2N6486	2N6489
2N6487	2N6490
2N6488	2N6491

COMPLEMENTARY SILICON PLASTIC POWER TRANSISTORS

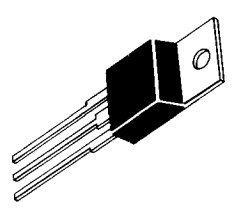
. . . designed for use in general-purpose amplifier and switching applications.

- DC Current Gain Specified to 15 Amperes
  h_{FE} = 20–150 @ I_C = 5.0 Adc
  = 5.0 (Min) @ I_C = 15 Adc
- Collector-Emitter Sustaining Voltage –
  $V_{CEO(sus)}$ = 40 Vdc (Min) – 2N6486, 2N6489
  = 60 Vdc (Min) – 2N6487, 2N6490
  = 80 Vdc (Min) – 2N6488, 2N6491
- High Current Gain – Bandwidth Product
  f_T = 5.0 MHz (Min) @ I_C = 1.0 Adc
- TO-220AB Compact Package
- TO-66 Leadform Also Available

15 AMPERE

COMPLEMENTARY SILICON POWER TRANSISTORS

40-60-80 VOLTS
75 WATTS



***MAXIMUM RATINGS**

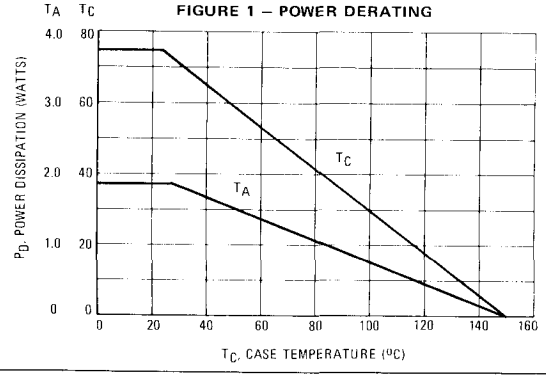
Rating	Symbol	2N6486 2N6489	2N6487 2N6490	2N6488 2N6491	Unit
Collector-Emitter Voltage	V_{CEO}	40	60	80	Vdc
Collector-Base Voltage	V_{CB}	50	70	90	Vdc
Emitter-Base Voltage	V_{EB}	5.0			Vdc
Collector Current – Continuous	I_C	15			Adc
Base Current	I_B	5.0			Adc
Total Power Dissipation @ T_C = 25°C	P_D	75			Watts
Derate above 25°C		0.6			W/°C
Total Power Dissipation @ T_A = 25°C	P_D	1.8			Watts
Derate above 25°C		0.014			W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150			°C

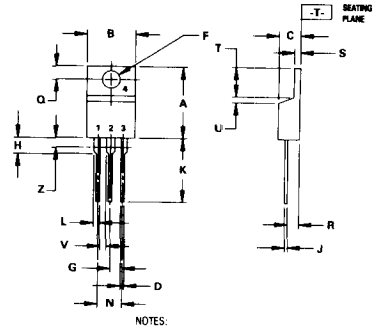
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.67	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	70	°C/W

*Indicates JEDEC Registered Data

FIGURE 1 – POWER DERATING





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 MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	14.48	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	0.64	0.88	0.025	0.035
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
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

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

CASE 221A-04
TO-220AB

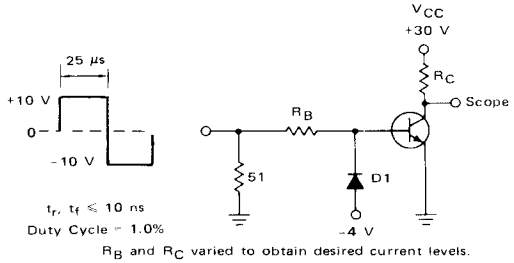
3

***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 = 200 mAdc, I_B = 0)	2N6486, 2N6489		40	–	
	2N6487, 2N6490		60	–	
	2N6488, 2N6491		80	–	
Collector-Emitter Sustaining Voltage (1)		V_{CEX}			Vdc
(I_C = 200 mAdc, V_{BE} = 1.5 Vdc)	2N6486, 2N6489		50	–	
	2N6487, 2N6490		70	–	
	2N6488, 2N6491		90	–	
Collector Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 20 Vdc, I_B = 0)	2N6486, 2N6489		–	1.0	
(V_{CE} = 30 Vdc, I_B = 0)	2N6487, 2N6490		–	1.0	
(V_{CE} = 40 Vdc, I_B = 0)	2N6488, 2N6491		–	1.0	
Collector Cutoff Current		I_{CEX}			μAdc
(V_{CE} = 45 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N6486, 2N6489		–	500	
(V_{CE} = 65 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N6487, 2N6490		–	500	
(V_{CE} = 85 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N6488, 2N6491		–	500	
(V_{CE} = 40 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C)	2N6486, 2N6489		–	5.0	mAdc
(V_{CE} = 60 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C)	2N6487, 2N6490		–	5.0	
(V_{CE} = 80 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 150°C)	2N6488, 2N6491		–	5.0	
Emitter Cutoff Current		I_{EBO}	–	1.0	mAdc
(V_{BE} = 5.0 Vdc, I_C = 0)					
ON CHARACTERISTICS					
DC Current Gain		h_{FE}			–
(I_C = 5.0 Adc, V_{CE} = 4.0 Vdc)			20	150	
(I_C = 15 Adc, V_{CE} = 4.0 Vdc)			5.0	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 5.0 Adc, I_B = 0.5 Adc)			–	1.3	
(I_C = 15 Adc, I_B = 5.0 Adc)			–	3.5	
Base-Emitter On Voltage		$V_{BE(on)}$			Vdc
(I_C = 5.0 Adc, V_{CE} = 4.0 Vdc)			–	1.3	
(I_C = 15 Adc, V_{CE} = 4.0 Vdc)			–	3.5	
DYNAMIC CHARACTERISTICS					
Current Gain – Bandwidth Product (2)		f_T	5.0	–	MHz
(I_C = 1.0 Adc, V_{CE} = 4.0 Vdc, f_{test} = 1.0 MHz)					
Small-Signal Current Gain		h_{fe}	25	–	–
(I_C = 1.0 Adc, V_{CE} = 4.0 Vdc, f = 1.0 kHz)					

*Indicates JEDEC Registered Data.
(1)Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
(2)$f_T = |h_{fe}| \bullet f_{test}$.

FIGURE 2 – SWITCHING TIME TEST CIRCUIT



R_B and R_C varied to obtain desired current levels.
For PNP reverse all polarities.

D1 must be fast recovery type, e.g.:
MBD5300 used above $I_B \approx 100$ mA
MSD6100 used below $I_B \approx 100$ mA

FIGURE 3 – TURN-ON TIME

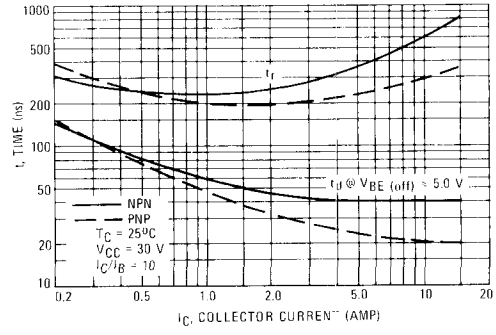


FIGURE 4 – THERMAL RESPONSE

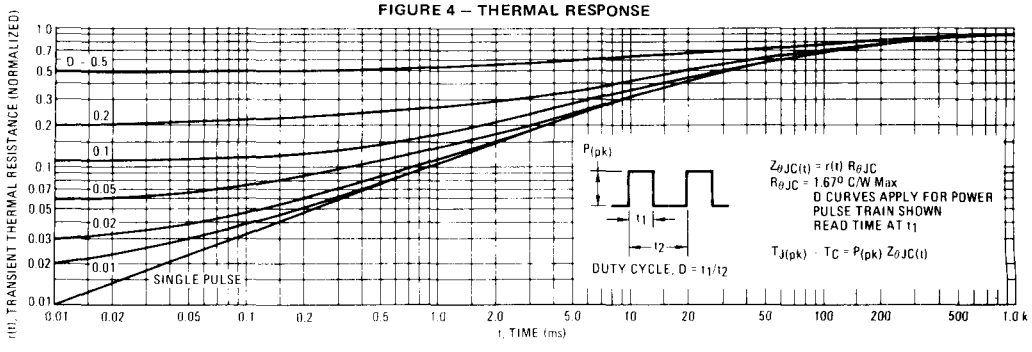
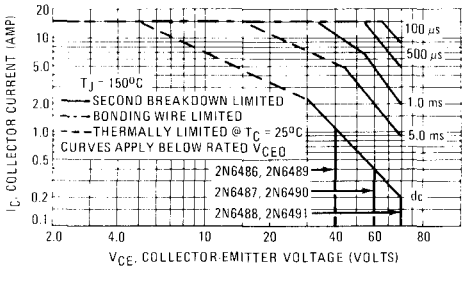


FIGURE 5 – ACTIVE-REGION SAFE OPERATING AREA



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 $T_{J(pk)} = 150^oC$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leqslant 150^oC$. $T_{J(pk)}$ 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

3

FIGURE 6 – TURN-OFF TIME

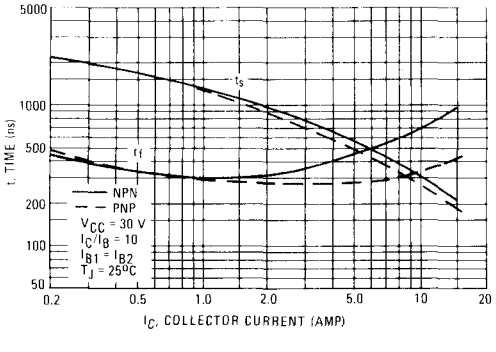
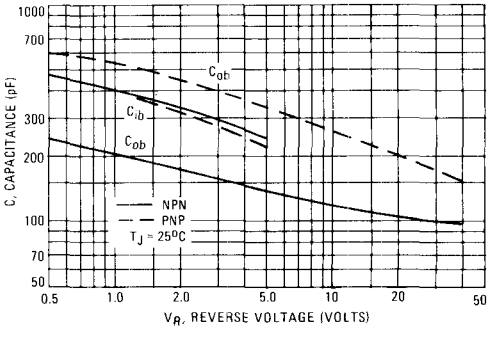


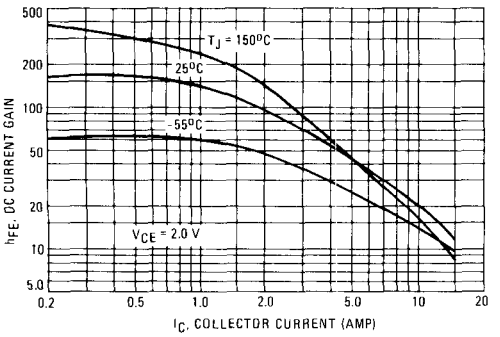
FIGURE 7 – CAPACITANCES



NPN
2N6486, 2N6487, 2N6488

PNP
2N6489, 2N6490, 2N6491

FIGURE 8 – DC CURRENT GAIN



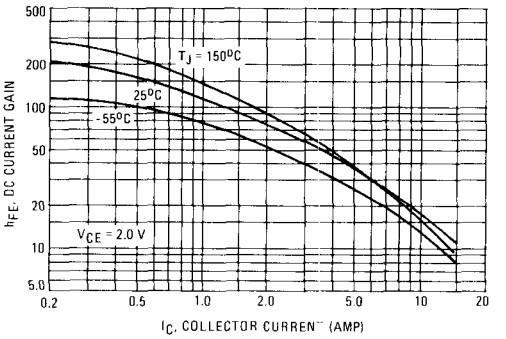
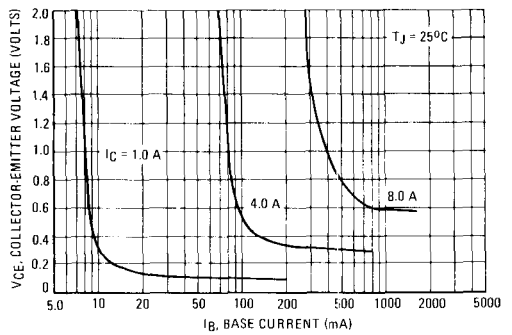


FIGURE 9 – COLLECTOR SATURATION REGION



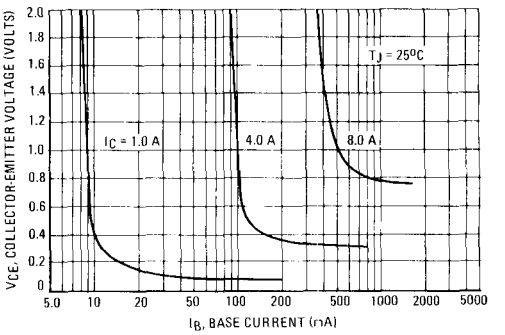
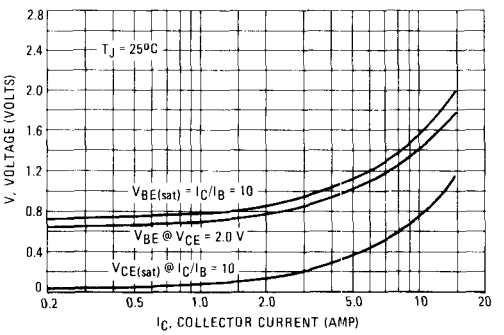
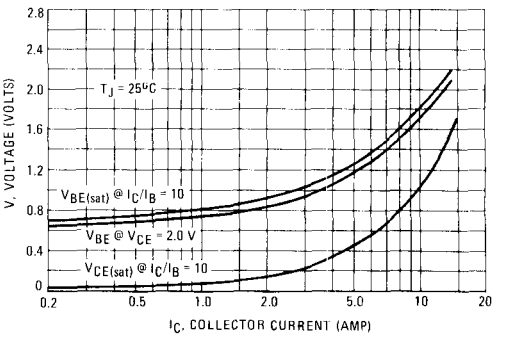


FIGURE 10 – "ON" VOLTAGES





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