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SDT9307		2N3714	3-26
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SE9301	SE9301		—
SE9302	SE9302		—
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SE9307		2N6283	3-172
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SE9401	SE9401		—
SE9402	SE9402		—
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SE9407		2N6286	3-172
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SVT250-3C		2N6308	3-181
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SVT300-10		2N6307	3-181
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SVT300-5		2N6543	3-215
SVT300-5C		2N6307	3-181
SVT350-12		2N6547	3-225
SVT350-3		2N6545	3-221
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Industry Part Number	Motorola Direct Replacement	Motorola Similar Replacement	Page Number
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SVT400-5		2N6543	3-215
SVT400-5C		2N6545	3-221
SVT450-3		2N6545	3-221
SVT450-3C		MJ13335	3-700
SVT450-5		2N6543	3-215
SVT450-5C		MJ13080	3-682
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SVT7534		MJ13080	3-682
SVT7535		MJ16004	3-726
SVT7540		MJ16008	3-742
SVT7541		MJ16008	3-742
SVT7542		MJ16008	3-742
SVT7543		MJ13080	3-682
SVT7544		MJ13080	3-682
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SVT7560		MJ16010	3-758
SVT7561		MJ16012	3-758
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SVT7564		MJ13090	3-688
SVT7565		MJ13090	3-688
SVT7570		MJ16010	3-758
SVT7571		MJ16012	3-758
SVT7573		MJ13090	3-688
SVT7574		MJ13090	3-688
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TIP101	TIP101		3-1091
TIP102	TIP102		3-1091
TIP105	TIP105		3-1091
TIP106	TIP106		3-1091

*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
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
	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##		200 min	4	8 typ	2 typ	6		80
			MJE5850	15 min	2	2	0.5	4		80
	350	MJE5741##		200 min	4	8 typ	2 typ	6		80
			MJE5851	15 min	2	2	0.5	4		80
	400	MJE5742##		200 min	4	8 typ	2 typ	6		80
		MJE13007		5/30	5	3	0.7	5	4	80
			MJE5852	15 min	2	2	0.5	4		80
		MJE16080		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	20 min	4					50
			D45H2	40 min	4					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
			D45H4	20 min	4					50
		D44H5	D45H5	40 min	4					50
	60	BDX33A##	BDX34A##	750 min	4				3	70
		BD807	BD808	15 min	4				1.5	90

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

(continued)

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
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
	100	BDX53C	BDX54C	750 min	3				4	60	TO-220/221A
		BD901	BD902	750 min	3				1	70	TO-220/221A
		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
	120	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)

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

NPN	PNP
TIP100	TIP105
TIP101	TIP106
TIP102	TIP107

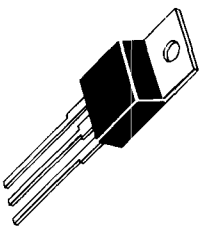
PLASTIC MEDIUM-POWER COMPLEMENTARY SILICON TRANSISTORS

. . . 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
  $V_{CEO(sus)}$ = 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

DARLINGTON 8 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS

60-80-100 VOLTS
80 WATTS



***MAXIMUM RATINGS**

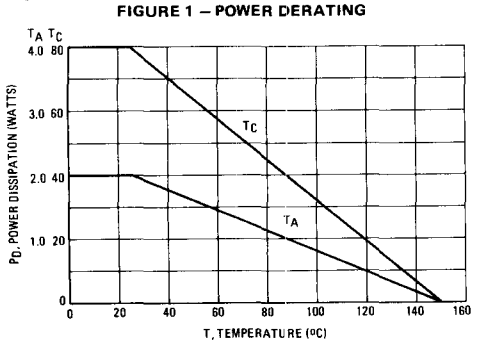
Rating	Symbol	TIP100, TIP105	TIP101, TIP106	TIP102, TIP107	Unit
Collector-Emitter Voltage	V_{CEO}	60	80	100	Vdc
Collector-Base Voltage	V_{CB}	60	80	100	Vdc
Emitter-Base Voltage	V_{EB}	5.0			Vdc
Collector Current – Continuous	I_C	8.0			Adc
Peak		15			
Base Current	I_B	1.0			Adc
Total Power Dissipation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

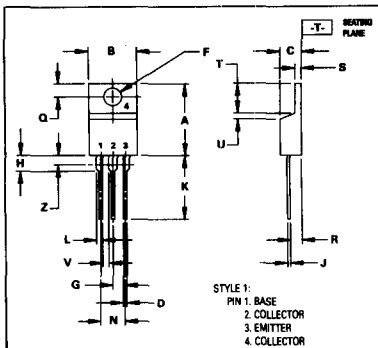
THERMAL CHARACTERISTICS

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

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

FIGURE 1 – POWER DERATING





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

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

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 = 30 mAdc, I_B = 0)	TIP100, TIP105		60	–	
	TIP101, TIP106		80	–	
	TIP102, TIP107		100	–	
Collector Cutoff Current		I_{CEO}			μAdc
(V_{CE} = 30 Vdc, I_B = 0)	TIP100, TIP105		–	50	
(V_{CE} = 40 Vdc, I_B = 0)	TIP101, TIP106		–	50	
(V_{CE} = 50 Vdc, I_B = 0)	TIP102, TIP107		–	50	
Collector Cuttoff Current		I_{CBO}			μAdc
(V_{CB} = 60 Vdc, I_E = 0)	TIP100, TIP105		–	50	
(V_{CB} = 80 Vdc, I_E = 0)	TIP101, TIP106		–	50	
(V_{CB} = 100 Vdc, I_E = 0)	TIP102, TIP107		–	50	
Emitter Cutoff Current		I_{EBO}	–	8.0	mAdc
(V_{BE} = 5.0 Vdc, I_C = 0)					
ON-CHARACTERISTICS (1)					
DC Current Gain		h_{FE}			–
(I_C = 3.0 Adc, V_{CE} = 4.0 Vdc)			1000	20,000	
(I_C = 8.0 Adc, V_{CE} = 4.0 Vdc)			200	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 3.0 Adc, I_B = 6.0 mAdc)			–	2.0	
(I_C = 8.0 Adc, I_B = 80 mAdc)			–	2.5	
Base-Emitter On Voltage		$V_{BE(on)}$			Vdc
(I_C = 8.0 Adc, V_{CE} = 4.0 Vdc)			–	2.8	
DYNAMIC CHARACTERISTICS					
Small-Signal Current Gain		$\|h_{fe}\|$			–
(I_C = 3.0 Adc, V_{CE} = 4.0 Vdc, f = 1.0 MHz)			4.0	–	
Output Capacitance		C_{ob}			pF
(V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)	TIP105, TIP106, TIP107		–	300	
	TIP100, TIP101, TIP102		–	200	

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

FIGURE 2 – SWITCHING TIMES TEST CIRCUIT

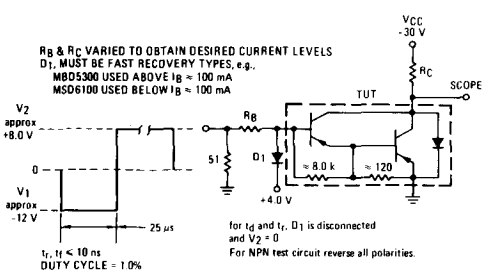


FIGURE 3 – SWITCHING TIMES

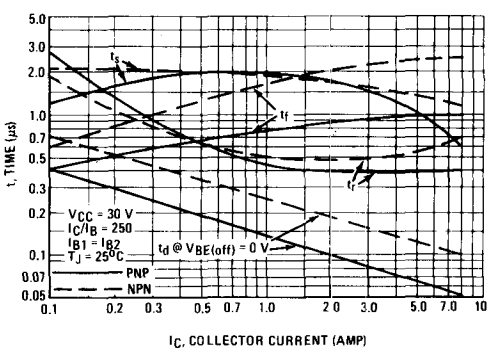


FIGURE 4 – THERMAL RESPONSE

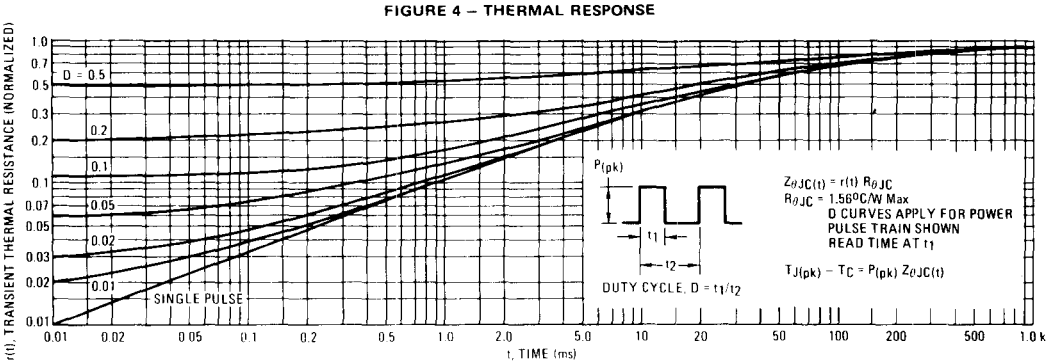
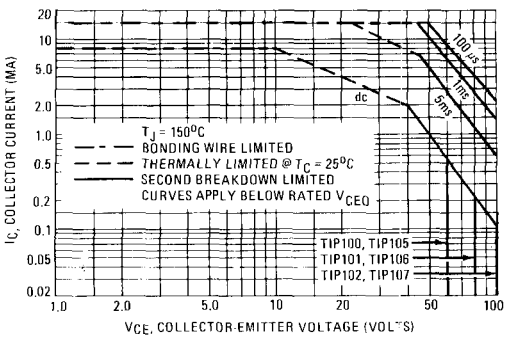


FIGURE 5 – ACTIVE-REGION SAFE OPERATING AREA



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

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FIGURE 6 – SMALL-SIGNAL CURRENT GAIN

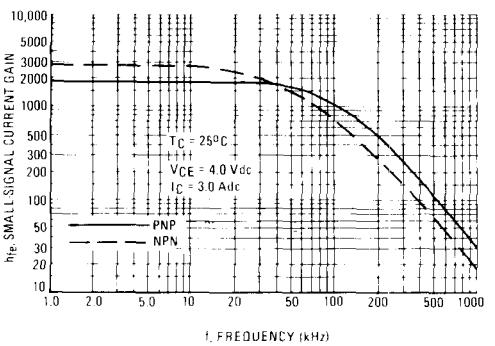
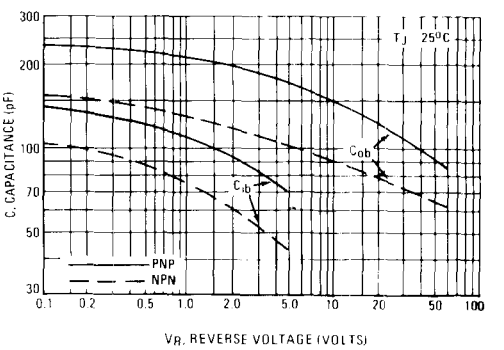


FIGURE 7 – CAPACITANCE



NPN
TIP100, TIP101, TIP102

PNP
TIP105, TIP106, TIP107

FIGURE 8 – DC CURRENT GAIN

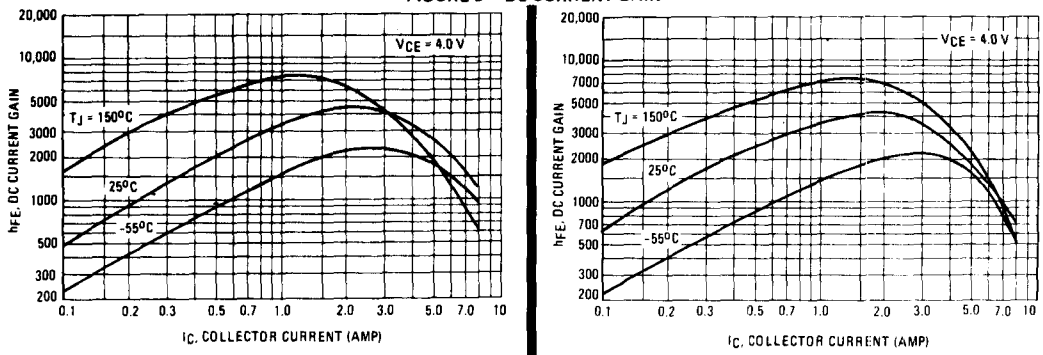


FIGURE 9 – COLLECTOR SATURATION REGION

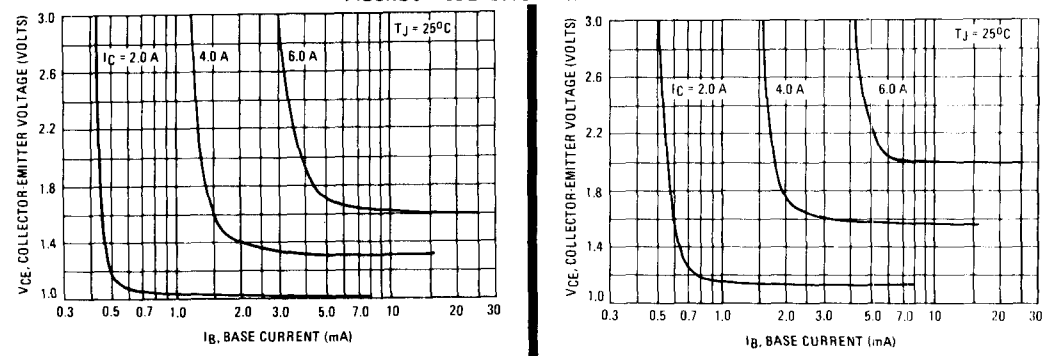
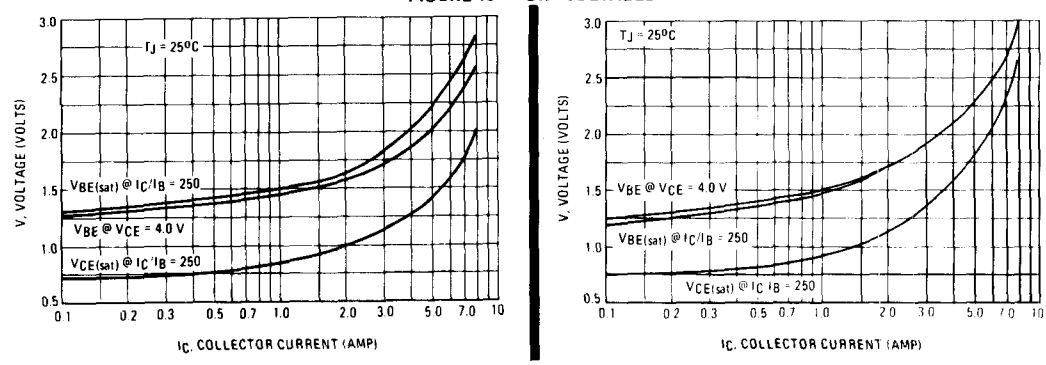


FIGURE 10 – "ON" VOLTAGES



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