

2N3713 thru 2N3716 NPN

361-392

SILICON NPN POWER TRANSISTORS

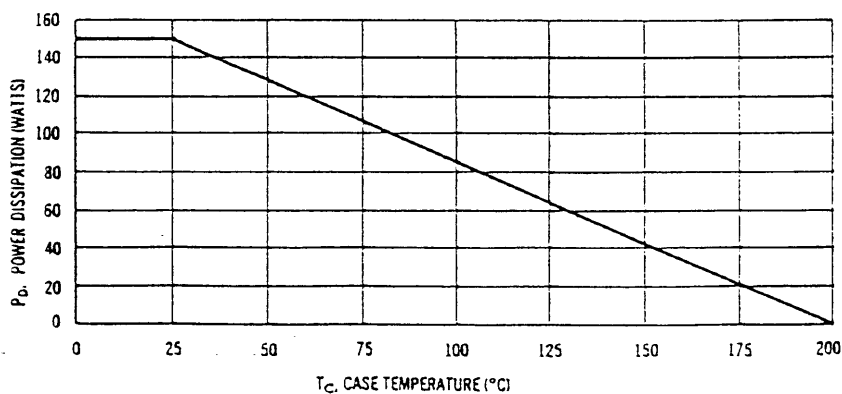
... designed for medium-speed switching and amplifier applications.
These devices feature:

- Total Switching Time at 3 A typically 1.15 μ s
- Gain Ranges Specified at 1 A and 3 A
- Low $V_{CE(sat)}$: typically 0.5V at $I_C = 5A$ and $I_B = 0.5A$
- Excellent Safe Operating Areas
- Complement to 2N3789-92

MAXIMUM RATINGS

Rating	Symbol	2N3713 2N3715	2N3714 2N3716	Unit
Collector-Base Voltage	V_{CB}	80	100	Volts
Collector-Emitter Voltage	V_{CEO}	60	80	Volts
Emitter-Base Voltage	V_{EB}	7.0	7.0	Volts
Collector Current	I_C	10	10	Amps
Base Current	I_B	4.0	4.0	Amps
Power Dissipation	P_D	150	150	Watts
Thermal Resistance	θ_{JC}	1.17	1.17	$^{\circ}C/W$
Operating Junction and Storage Temperature Range	T_J and T_{stg}	-65 to +200		$^{\circ}C$

FIGURE 1 — POWER-TEMPERATURE DERATING CURVE

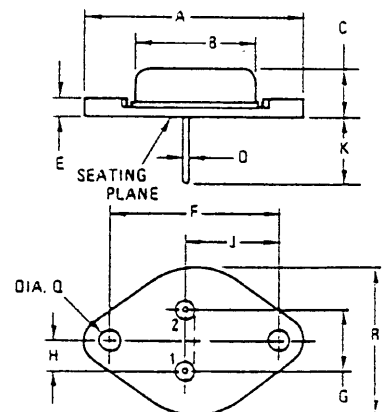
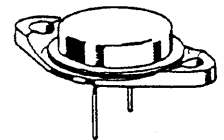


Safe Area Limits are indicated by Figures 12, 13. Both limits are applicable and must be observed.

10 AMPERE

POWER TRANSISTORS
SILICON NPN

60-80 VOLTS
150 WATTS



STYLE 1:

PIN 1: BASE

2: EMITTER

CASE: COLLECTOR

NOTE:

1. DIM "Q" IS DIA.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	—	39.37	—	1.550
B	—	21.08	—	0.830
C	6.35	7.62	0.250	0.300
D	0.99	1.09	0.039	0.043
E	—	3.43	—	0.135
F	29.90	30.40	1.177	1.197
G	10.67	11.18	0.420	0.440
H	5.33	5.59	0.210	0.220
J	16.64	17.15	0.655	0.675
K	11.18	12.19	0.440	0.480
Q	3.84	4.09	0.151	0.161
R	—	26.67	—	1.050

Collector connected to case.

CASE 11-01

(TO-3)

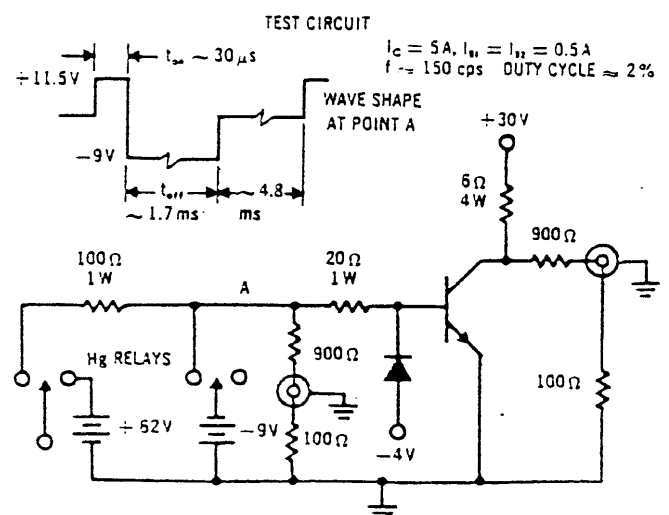
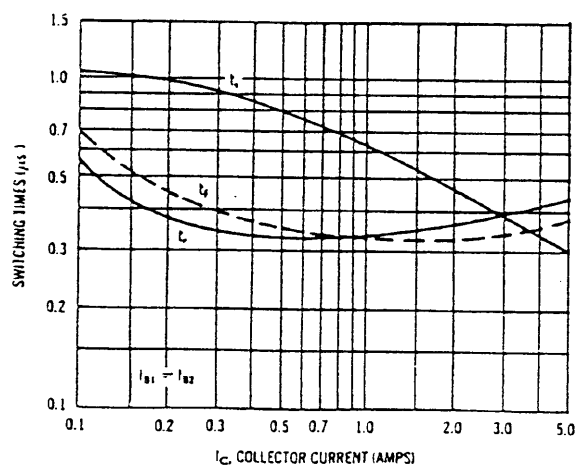
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ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
Emitter-Base Cutoff Current ($V_{EB} = 7\text{ Vdc}$)	All Types	I_{EBO}	—	5	mAdc
Collector-Emitter Cutoff Current ($V_{CE} = 80\text{ Vdc}$, $V_{BE} = -1.5\text{ Vdc}$) ($V_{CE} = 100\text{ Vdc}$, $V_{BE} = -1.5\text{ Vdc}$) ($V_{CE} = 60\text{ Vdc}$, $V_{BE} = -1.5\text{ Vdc}$, $T_C = 150^\circ\text{C}$) ($V_{CE} = 80\text{ Vdc}$, $V_{BE} = -1.5\text{ Vdc}$, $T_C = 150^\circ\text{C}$)	2N3713, 2N3715 2N3714, 2N3716 2N3713, 2N3715 2N3714, 2N3716	I_{CEX}	— — — —	1 1 10 10	mAdc
Collector-Emitter Sustaining Voltage* ($I_C = 200\text{ mAdc}$, $I_B = 0$)	2N3713, 2N3715 2N3714, 2N3716	$V_{CEO(sus)}^*$	60 80	— —	Vdc
DC Current Gain* ($I_C = 1\text{ Adc}$, $V_{CE} = 2\text{ Vdc}$) ($I_C = 3\text{ Adc}$, $V_{CE} = 2\text{ Vdc}$)	2N3713, 2N3714 2N3715, 2N3716 2N3713, 2N3714 2N3715, 2N3716	h_{FE}^*	25 50 15 30	90 150 — —	—
Collector-Emitter Saturation Voltage* ($I_C = 5\text{ Adc}$, $I_B = 0.5\text{ Adc}$)	2N3713, 2N3714 2N3715, 2N3716	$V_{CE(sat)}^*$	— —	1.0 0.8	Vdc
Base-Emitter Saturation Voltage* ($I_C = 5\text{ Adc}$, $I_B = 0.5\text{ Adc}$)	2N3713, 2N3714 2N3715, 2N3716	$V_{BE(sat)}^*$	— —	2.0 1.5	Vdc
Base-Emitter Voltage* ($I_C = 3\text{ Adc}$, $V_{CE} = 2\text{ Vdc}$)	All Types	V_{BE}^*	—	1.5	Vdc
Small Signal Current Gain ($V_{CE} = 10\text{ Vdc}$, $I_C = 0.5\text{ Adc}$, $f = 1\text{ MHz}$)	All Types	h_{fe}	4	—	—
Switching Times (Figure 2) ($I_C = 5\text{ A}$, $I_{B1} = I_{B2} = 0.5\text{ Adc}$)			Typ		μs
Rise Time		t_r		0.45	
Storage Time		t_s		0.3	
Fall Time		t_f		0.4	

*Use sweep test to prevent overheating

FIGURE 2 – TYPICAL SWITCHING TIMES



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FIGURE 3 - COLLECTOR CURRENT versus BASE CURRENT

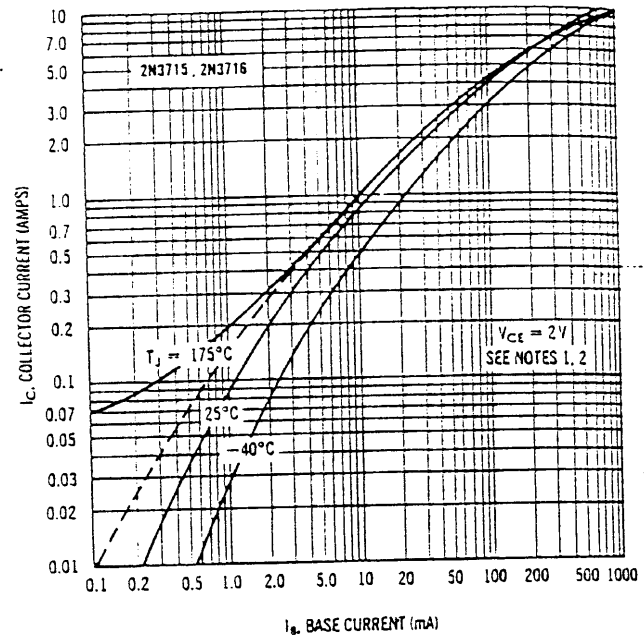
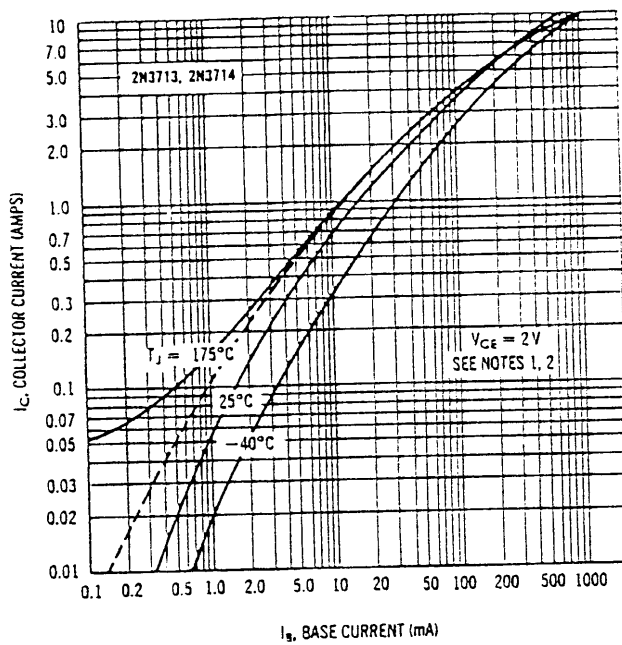


FIGURE 4 - BASE CURRENT-VOLTAGE VARIATIONS

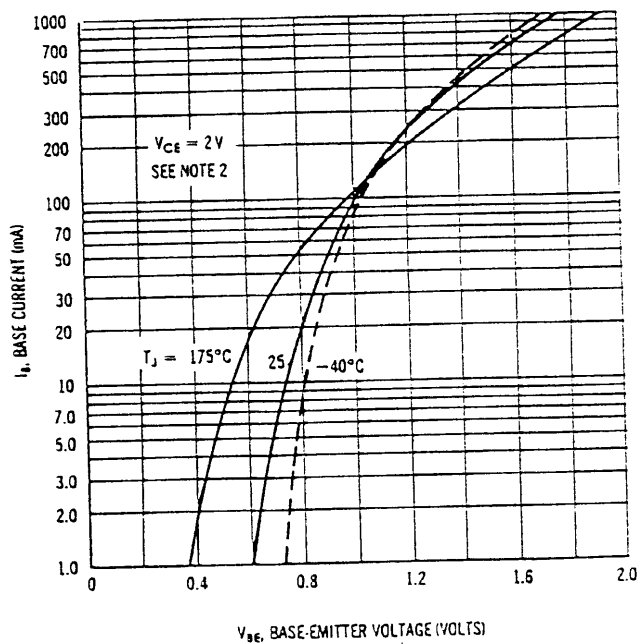
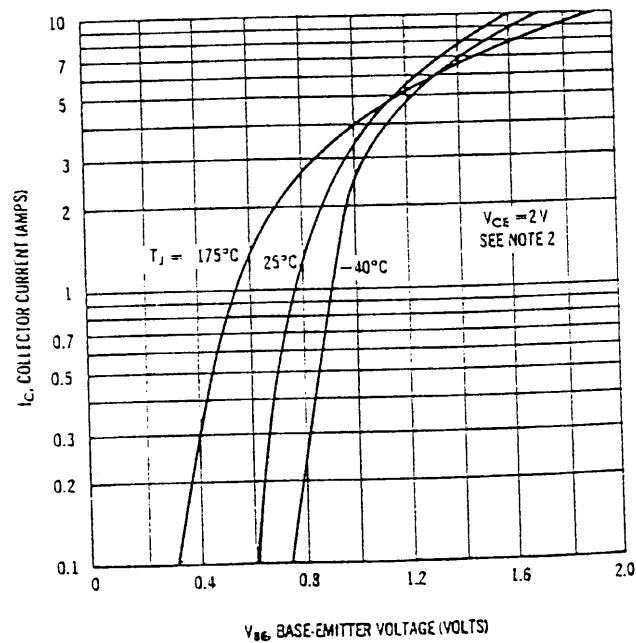


FIGURE 5 - COLLECTOR CURRENT-VOLTAGE VARIATIONS



NOTE 1. Dotted line indicates metered base current plus the I_{CBO} of the transistor at 175°C .

NOTE 2. Pulse test: pulse width $\approx 200 \mu\text{sec}$, duty cycle $\approx 1.5\%$

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FIGURE 6 - COLLECTOR-EMITTER SATURATION VOLTAGE VARIATIONS

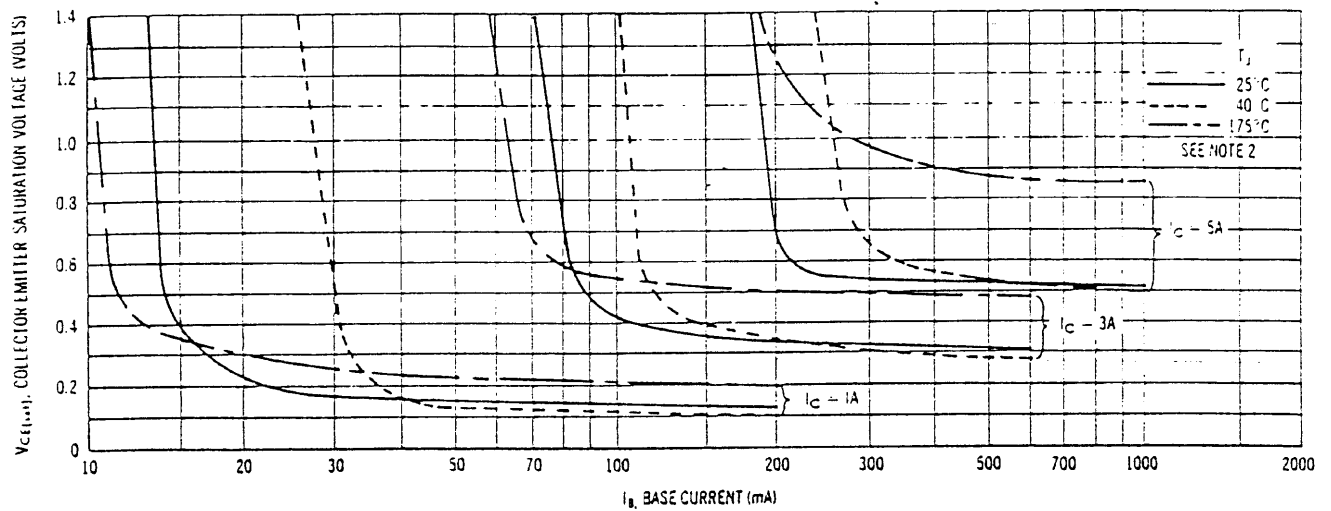


FIGURE 7 - BASE-EMITTER SATURATION VOLTAGE VARIATIONS

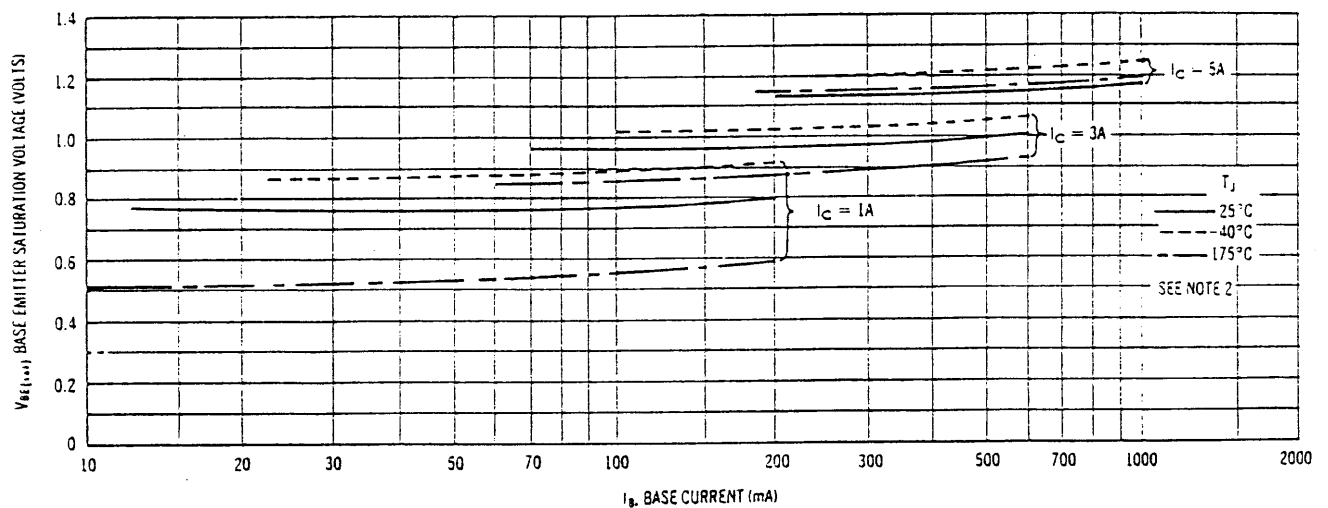


FIGURE 8 - COLLECTOR CURRENT versus BASE-EMITTER VOLTAGE

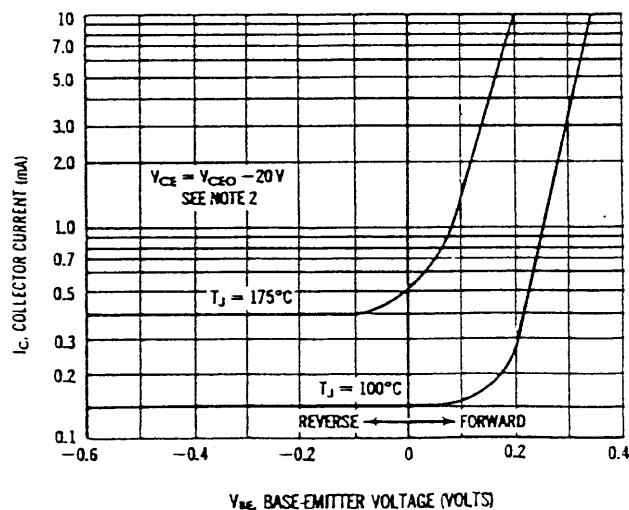
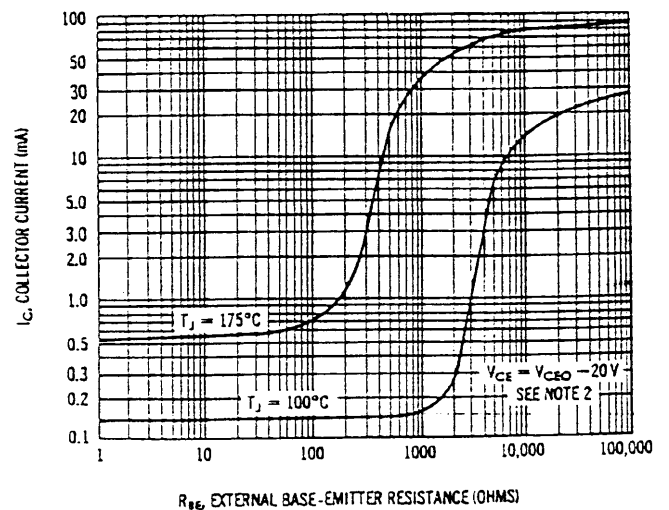


FIGURE 9 - COLLECTOR CURRENT versus BASE-EMITTER RESISTANCE



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FIGURE 10 – CURRENT GAIN VARIATIONS

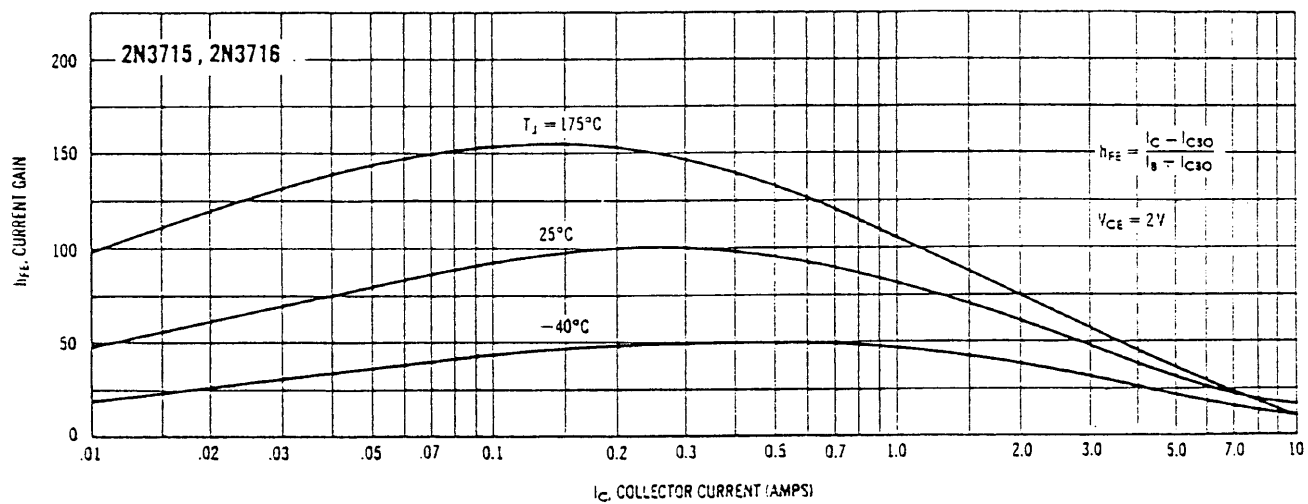
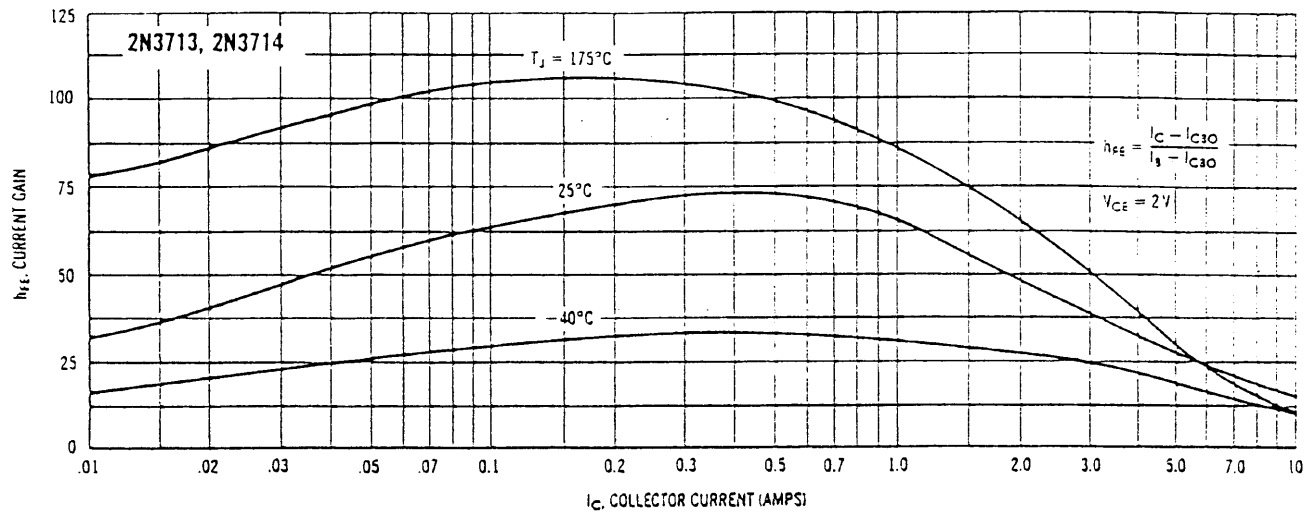
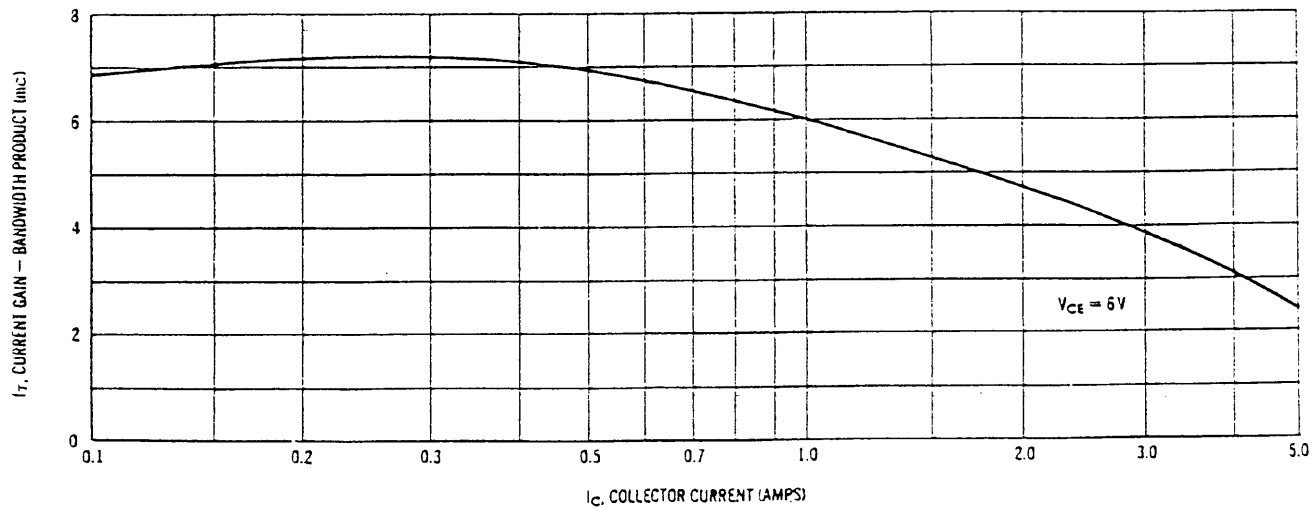


FIGURE 11 – CURRENT GAIN – BANDWIDTH PRODUCT versus COLLECTOR CURRENT



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SAFE OPERATING AREAS

FIGURE 12 - 2N3713, 2N3715

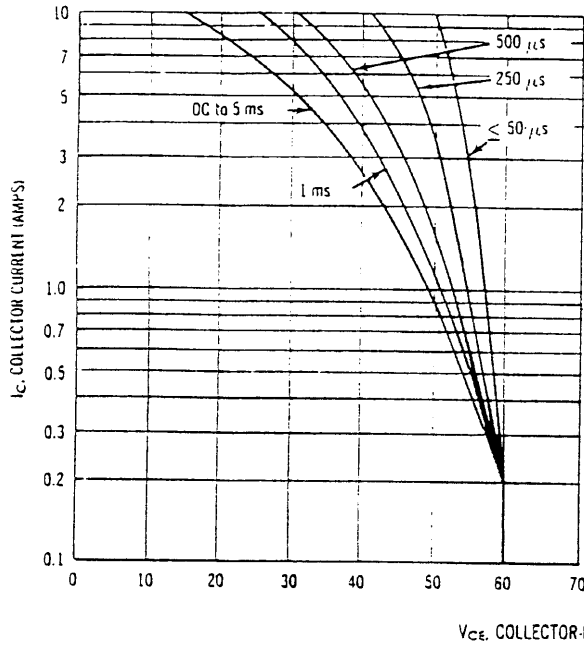
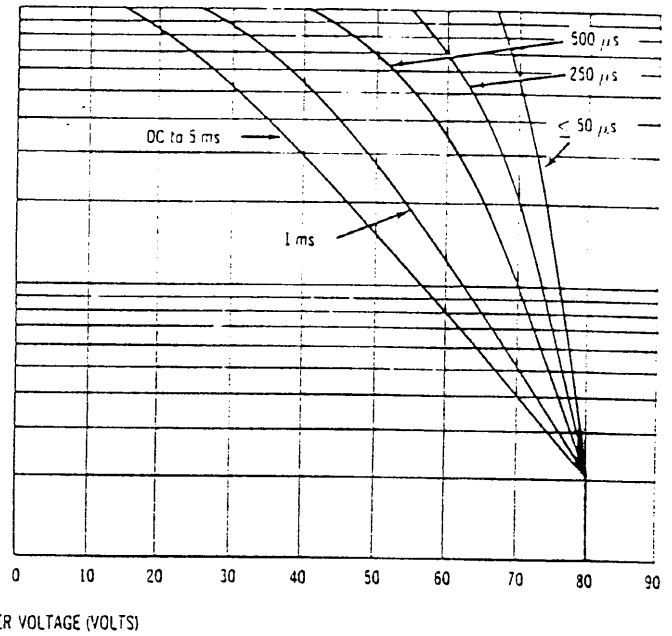


FIGURE 13 - 2N3714, 2N3716



The Safe Operating Area Curves indicate $I_C - V_{CE}$ limits below which the device will not go into secondary breakdown. Collector load lines for specific circuits must fall within the applicable Safe Area to avoid causing a collector-emitter short. (Duty cycle of the excursions make no signifi-

cant change in these safe areas.) To insure operation below the maximum T_J , the power-temperature derating curve must be observed for both steady state and pulse power conditions.