

TABLE 7 — PLASTIC TO-225 Type (continued)

I _C Cont Amps Max	V _{CEO(sus)} Volts Min	Device Type		h _{FE} Min/Max	@ I _C Amp	Resistive Switching			f _T MHz Min	P _D (Case) Watts @ 25°C
		NPN	PNP			t _s μs Max	t _f μs Max	@ I _C Amp		
3	45		BD176 BD176.6 BD176.10 BD176.16	40/250 40/100 63/160 100/250	0.15 0.15 0.15 0.15				3 3 3 3	30 30 30 30
		MJE181	MJE171	50/250	0.1	0.6 typ	0.12 typ	0.1	50	12.5
		BD179 BD179.6 BD179.10 BD179.16 MJE182	BD180 BD180.6 BD180.10 BD180.16 MJE172	40/250 40/100 63/160 100/250 50/250	0.15 0.15 0.15 0.15 0.1				3 3 3 3 50	30 30 30 30 12.5
		BUY49P		30 min	0.5				25	20
	200									
4	30	BD185		15 min	2				20	40
	40	2N5190 MJE521 2N6037##	2N5193 MJE371 2N6034##	25/100 40 min 750/18k	1.5 1 2	0.4 typ 1 1.7 typ	0.4 typ 1 1.2 typ	1.5 1 2	2 2 25	40 40 40
		BD437 BD675## BD675A## BD785	BD438 BD676## BD676A## BD786 BD776##	40 min 750 min 750 min 20 min 750 min	2 1.5 2 2 2				3 50 20	36 40 40 15 15
	60	BD189		15 min	2				20	40
		BD677## BD677A## BD787 BD777## 2N5191 MJE800## MJE801## 2N6038##	BD440 BD678## BD678A## BD788 BD778## 2N5194 MJE700## MJE701## 2N6035##	25 min 750 min 750 min 20 min 750 min 25/100 750 min 750 min 750/18k	2 1.5 2 2 2 1.5 1.5 2 2				3 50 20 2 1# 1# 25	36 40 40 15 15 40 40 40
						0.4 typ	0.4 typ	1.5		
						1.7 typ	1.2 typ	2		
		2N5192 BD441 BD679## BD679A## BD789 BD779## MJE240 MJE241 MJE802## MJE803## 2N6039##	2N5195 BD442 BD680## BD680A## BD790 BD780## MJE250 MJE251 MJE702## MJE703## 2N6036##	25/100 15 min 750 min 750 min 10 min 750 min 40/200 40/120 750 min 750 min 750/18k	1.5 2 1.5 2 2 2 0.2 0.2 1.5 2 2	0.4 typ 1.5 1.5 1.5 1.5 0.2 0.2 1.5 2 2	0.4 typ 1.5 1.5 1.5 1.5 0.15 typ 0.15 typ 0.07 typ 0.07 typ 1.7 typ	1.5 1.5 1.5 1.5 1.5 2 2 2 2 2	2 3 40 40 20 40 40 40 1# 1# 25	40 36 40 40 15 15 15 15 40 40 40
	80									
	100	BD681## BD791 MJE243 MJE244	BD682## BD792 MJE253 MJE254	750 min 10 min 40/120 25 min	1.5 2 0.2 0.2				40 40 40 40	40 15 15 15
						0.15 typ 0.15 typ	0.07 typ 0.07 typ	2 2		
5	25	MJE200	MJE210	45/180	2	0.13 typ	0.035 typ	2	65	15

● Case 77 (Style 3), # [h_{FE}] @ 1 MHz, ## Darlington

TABLE 13 — POWER SWITCHING TRANSISTORS (continued)

I _C Cont Amps Max	V _{CEO(sus)} Volts Min	Device Type		h _{FE} Min/Max	@ I _C Amp	Resistive Switching			f _T MHz Min	P _D (Case) Watts @ 25°C	Case JEDEC/MOT
		NPN	PNP			t _s μs Max	t _f μs Max	@ I _C Amp			
4	30	BD185		15 min	2				20	40	TO-225AA/77
	45	BD785	BD786	20 min	2				50	15	TO-225AA/77
	60	2N4877 BD189 BD787	BD788	20/100 15 min 20 min	4 2 2	1.5	0.5	4	30 20 50	10 40 15	TO-205AD/79 TO-225AA/77 TO-225AA/77
	80	BD789	BD790	10 min	2				40	15	TO-225AA/77
	100	BD791	BD792	10 min	2				40	15	TO-225AA/77
5	80	2N5337	2N6191	60/240	2	2	0.2	2	30	10	TO-205AD/79
	100	2N5339	2N6193	60/240	2	2	0.2	2	30	10	TO-205AD/79
7	60	2N6315	2N6317	20/100	2.5	1	0.8	2.5	4	90	TO-213AA/80
	80	2N5428 2N6316	2N6318	60/240 20/100	2 2.5	2 1	0.2 0.8	2 2.5	30 4	60 90	TO-213AA/80 TO-213AA/80
	100	2N5430		60/240	2	2	0.2	2	30	60	TO-213AA/80
7.5	60	2N3447		40/120	5	2	0.35	5	10	115	TO-204/1
	80	2N3448		40/120	5	2	0.35	5	10	115	TO-204/1
8	120	MJE15028	MJE15029	20 min	4	0.4 typ	0.18 typ	5	30	50	TO-220/221A
	150	MJE15030	MJE15031	20 min	4	0.4 typ	0.18 typ	5	30	50	TO-220/221A
10	60	2N5877	2N5875	20/100	4	1	0.8	4	4	150	TO-204/1
	80	2N5878	2N5876	20/100	4	1	0.8	4	4	150	TO-204/1
15	60	2N5881	2N5879	20/100	6	1	0.8	6	4	160	TO-204/1
	80	2N5882	2N5880	20/100	6	1	0.8	6	4	160	TO-204/1
18	160	BUX41N		8 min	12	1.2	0.25	12	8	120	TO-204/1
20	75	2N5039		20/100	10	1.5	0.5	10	60	140	TO-204/1
	80	2N5303	2N5745	15/60	10	2	1	10	2	200	TO-204/1
	90	2N5038		20/100	12	1.5	0.5	12	60	140	TO-204/1
	125	BUX40		8 min	15	1	0.25	15	8	120	TO-204/1
	160	BUV11N		10 min	15	1.2	0.25	15	8	150	TO-204/1
25	60	2N5885	2N5883	20/100	10	1	0.8	10	4	200	TO-204/1
	80	2N5886	2N5884 2N6436	20/100 30/120	10 10	1 1	0.8 0.25	10 10	4 40	200 200	TO-204/1 TO-204/1
	100	2N6338	2N6437	30/120	10	1	0.25	10	40	200	TO-204/1
	120	2N6339	2N6438	30/120	10	1	0.25	10	40	200	TO-204/1
	125	BUV10 BUV10N		10 min 10 min	20 20	1.2 1.55	0.25 0.45	20 15	8 10	150 175	TO-204/1 TO-204/1
	140	2N6340		30/120	10	1	0.25	10	40	200	TO-204/1
	150	2N6341		30/120	10	1	0.25	10	40	200	TO-204/1
30	40	2N5301	2N4398	15/60	15	2	1	10	2	200	TO-204/1
	60	2N5302	2N4399	15/60	15	2	1	10	2	200	TO-204/1
	90	BUX39		8 min	20	1	0.25	20	8	120	TO-204/1

(continued)

MOTOROLA SEMICONDUCTOR TECHNICAL DATA

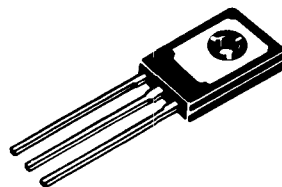
**NPN
BD785, BD787
PNP
BD786, BD788**

COMPLEMENTARY PLASTIC SILICON ANNULAR[♦] POWER TRANSISTORS

... designed for low power audio amplifier and low current, high-speed switching applications.

- Low Collector-Emitter Sustaining Voltage –
V_{CEO} (sus) 45 Vdc (Min) – BD785, BD786
60 Vdc (Min) – BD787, BD788
- High Current-Gain – Bandwidth Product –
f_T = 50 MHz (Min) @ I_C = 100 mAdc
- DC Current Gain Specified at 0.2, 1.0, 2.0 and 4.0 Adc
- Collector-Emitter Saturation Voltage Specified at 0.5, 1.0, 2.0 and 4.0 Adc

**4 AMPERE
POWER TRANSISTORS
COMPLEMENTARY SILICON
45, 60VOLTS
15 WATTS**

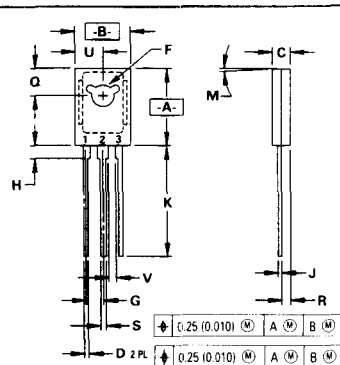
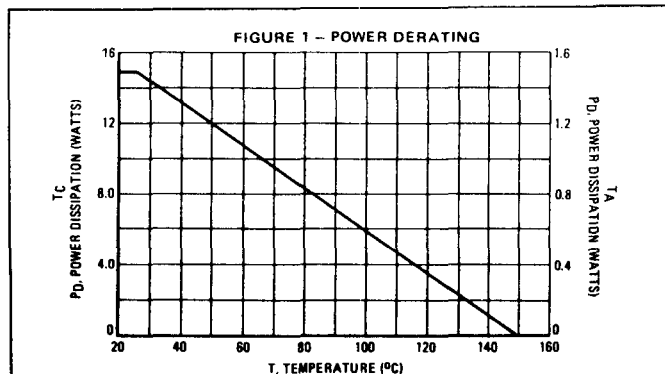


*MAXIMUM RATINGS

Rating	Symbol	BD785 BD786	BD787 BD788	Unit
Collector-Emitter Voltage	V _{CEO}	45	60	Vdc
Collector-Base Voltage	V _{CBO}	60	80	Vdc
Emitter-Base Voltage	V _{EBO}	6.0		Vdc
Collector Current – Continuous	I _C	4.0		Adc
– Peak		8.0		Adc
Base Current	I _B	1.0		Adc
Total Power Dissipation @ T _C = 25°C	P _D	15		Watts
Derate Above 25°C		0.12		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 _{θJC}	8.34	°C/W



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.80	11.04	0.425	0.435
B	7.50	7.74	0.295	0.305
C	2.42	2.66	0.095	0.105
D	0.51	0.66	0.020	0.026
F	2.93	3.17	0.115	0.125
G	2.39 BSC		0.094 BSC	
H	1.27	2.41	0.050	0.095
J	0.39	0.63	0.015	0.025
K	14.61	16.63	0.575	0.655
M	3° TYP		3° TYP	
Q	3.76	4.01	0.148	0.158
R	1.15	1.39	0.045	0.055
S	0.64	0.88	0.025	0.035
U	3.69	3.93	0.145	0.155
V	1.02		0.040	

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

**CASE 77-06
TO-225AA TYPE**

3

Characteristic	Symbol	Min	Max	Unit
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DC Current Gain ($I_C = 200 \text{ mA dc}$, $V_{CE} = 3.0 \text{ V dc}$) ($I_C = 1.0 \text{ A dc}$, $V_{CE} = 3.0 \text{ V dc}$) ($I_C = 2.0 \text{ A dc}$, $V_{CE} = 3.0 \text{ V dc}$) ($I_C = 4.0 \text{ A dc}$, $V_{CE} = 3.0 \text{ V dc}$)	h_{FE}	40 25 20 5.0	250 — — —	—
Collector-Emitter Saturation Voltage ($I_C = 500 \text{ mA dc}$, $I_B = 50 \text{ mA dc}$) ($I_C = 1.0 \text{ A dc}$, $I_B = 100 \text{ mA dc}$) ($I_C = 2.0 \text{ A dc}$, $I_B = 200 \text{ mA dc}$) ($I_C = 4.0 \text{ A dc}$, $I_B = 800 \text{ mA dc}$)	$V_{CE(sat)}$	— — — —	0.4 0.6 0.8 2.5	Vdc
Base-Emitter Saturation Voltage ($I_C = 2.0 \text{ A dc}$, $I_B = 200 \text{ mA dc}$)	$V_{BE(sat)}$	—	2.0	Vdc
Base-Emitter on Voltage ($I_C = 2.0 \text{ A dc}$, $V_{CE} = 3.0 \text{ V dc}$)	$V_{BE(on)}$	—	1.8	Vdc

Current-Gain – Bandwidth Product ($I_C = 100 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 10 \text{ MHz}$)	f_T	50	–	MHz
Output Capacitance ($V_{CB} = 10 \text{ V}$, $I_C = 0$) $f = 0.1 \text{ MHz}$	C_{ob}	– –	50 70	pF
Small-Signal Current Gain ($I_C = 200 \text{ mA}$, $V_{CE} = 10 \text{ V}$, $f = 1.0 \text{ kHz}$)	h_{fe}	10	–	–

FOR PNP TEST CIRCUIT, REVERSE ALL POLARITIES

3-305

BD785, BD787 NPN BD786, BD788 PNP

FIGURE 4 – THERMAL RESPONSE

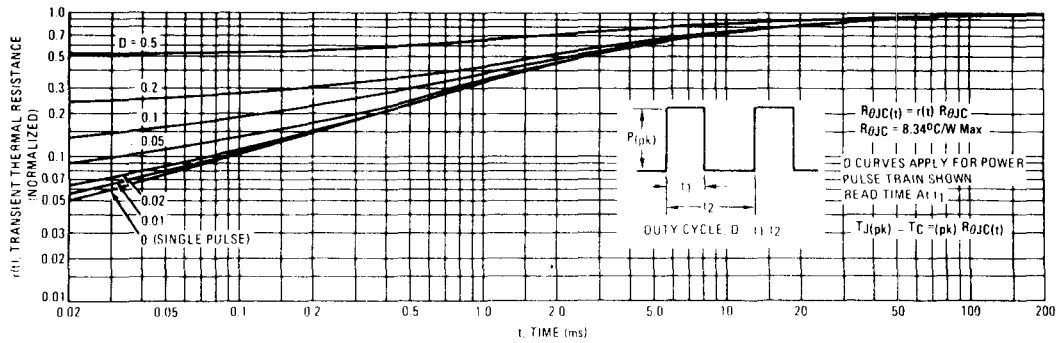
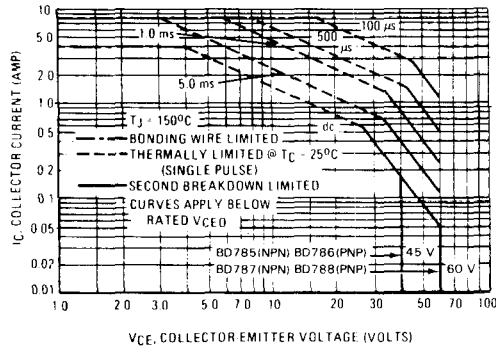


FIGURE 5 – ACTIVE REGION SAFE OPERATING AREA



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 $T_{J(pk)} \leq 150^\circ\text{C}$. $T_{J(pk)}$ 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 (See AN-415A).

FIGURE 6 – TURN OFF TIME

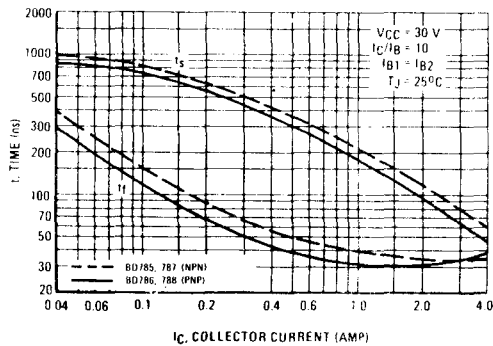
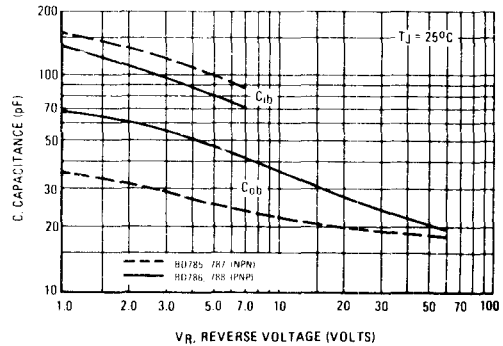


FIGURE 7 – CAPACITANCE



BD785, BD787 NPN BD786, BD788 PNP

NPN
BD785, BD787

PNP
BD786, BD788

FIGURE 8 – DC CURRENT GAIN

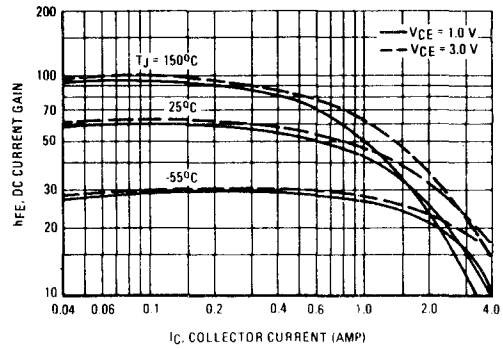
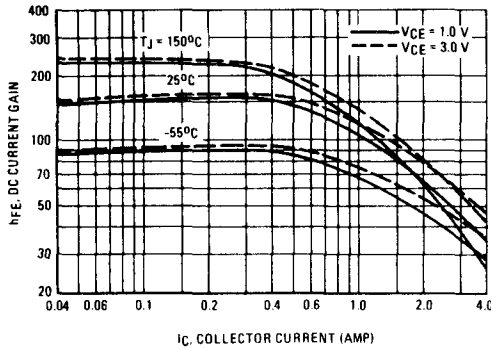


FIGURE 9 – "ON" VOLTAGES

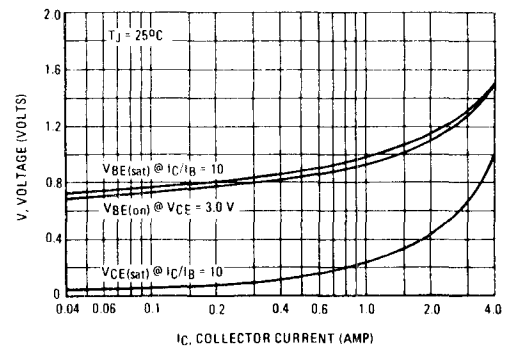
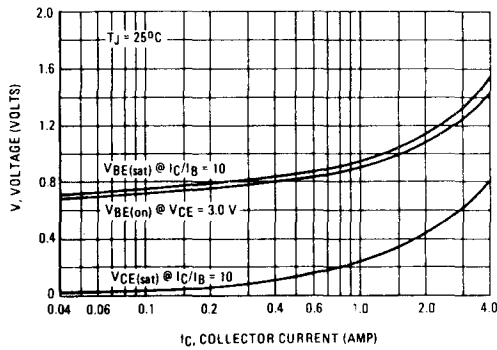


FIGURE 10 – TEMPERATURE COEFFICIENTS

