2N5977 2N5978 2N5979 (SILICON)
MJE5977 MJE5978 MJE5979

NPN SILICON PLASTIC POWER TRANSISTORS

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

- DC Current Gain Specified to 5 Amperes
  h_{FE} = 20-120 @ I_C = 2.5 Adc
  = 7.0 (Min) @ I_C = 5.0 Adc
- Collector-Emitter Sustaining Voltage –
  $V_{CEO(sus)}$ = 40 Vdc (Min) – 2N5977, MJE5977
  = 60 Vdc (Min) – 2N5978, MJE5978
  = 80 Vdc (Min) – 2N5979, MJE5979
- High Current Gain – Bandwidth Product
  f_T = 2.0 MHz (Min) @ I_C = 500 mAdc
- Complement to PNP Transistors –
  2N5974, 2N5975, 2N5976 and MJE5974, MJE5975, MJE5976
- Choice of Packages – 2N5977 Series – Case 90
  MJE5977 Series – Case 199

5 AMPERE POWER TRANSISTORS
NPN SILICON
40-60-80 VOLTS
75 WATTS

*MAXIMUM RATINGS

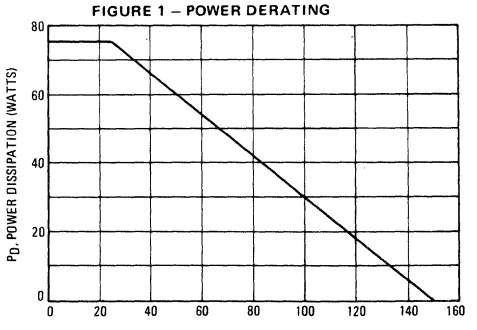
Rating	Symbol	2N5977 MJE5977	2N5978 MJE5978	2N5979 MJE5979	Unit
Collector-Emitter Voltage	V_{CEO}	40	60	80	Vdc
Collector-Base Voltage	V_{CB}	60	80	100	Vdc
Emitter-Base Voltage	V_{EB}	5.0			Vdc
Collector Current - Continuous	I_C	5.0			Adc
Peak		10			
Base Current	I_B	2.0			Adc
Total Device Dissipation @ T_C = 25°C	P_D	75			Watts
Derate above 25°C		0.60			W/°C
Operating and Storage Junction Temperature Range	T_J,T_{stg}	-65 to +150			°C

THERMAL CHARACTERISTICS

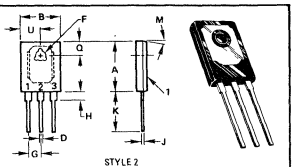
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	1.67	°C/W

*Indicates JEDEC Registered Data for 2N5977 Series.

FIGURE 1 – POWER DERATING



2N5977
2N5978
2N5979



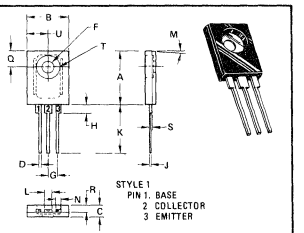
STYLE 2
PIN 1 EMITTER
2 COLLECTOR
3 BASE

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	16.13	16.38	0.635	0.645
B	12.57	12.83	0.495	0.505
C	3.18	3.43	0.125	0.135
D	1.09	1.24	0.043	0.049
F	3.51	3.76	0.138	0.148
G	4.22 BSC		0.166 BSC	
H	2.67	2.92	0.105	0.115
J	0.813	0.864	0.032	0.034
K	15.11	16.38	0.595	0.645
M	90° TYP		90° TYP	
Q	4.70	4.95	0.185	0.195
R	1.91	2.16	0.075	0.085
U	6.22	6.48	0.245	0.255

NOTE
1 LEADS WITHIN .005" RAD OF TRUE POSITION (TP) AT MMC

CASE 90-05

MJE5977
MJE5978
MJE5979



STYLE 1
PIN 1. BASE
2 COLLECTOR
3 EMITTER

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	16.08	16.33	0.633	0.643
B	12.57	12.83	0.495	0.505
C	3.18	3.43	0.125	0.135
D	0.51	0.76	0.020	0.030
F	3.61	3.86	0.142	0.152
G	2.54 BSC		0.100 BSC	
H	2.67	2.92	0.105	0.115
J	0.43	0.69	0.017	0.027
K	14.73	14.99	0.580	0.590
L	2.16	2.41	0.085	0.095
M	30° TYP		30° TYP	
N	1.47	1.73	0.058	0.068
Q	4.78	5.03	0.188	0.198
R	1.91	2.16	0.075	0.085
S	0.81	0.86	0.032	0.034
T	6.99	7.24	0.275	0.285
U	6.22	6.48	0.245	0.255

1 DIM "G" IS TO CENTER LINE OF LEADS

CASE 199-04

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

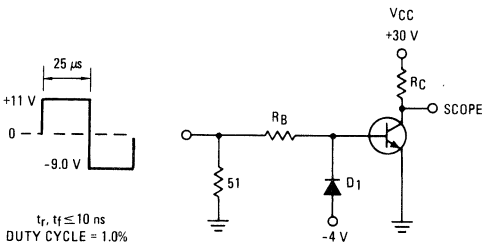
Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage (1)		$V_{CEO(sus)}$			Vdc
(I_C = 100 mAdc, I_B = 0)	2N5977, MJE5977		40	–	
	2N5978, MJE5978		60	–	
	2N5979, MJE5979		80		
Collector Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 20 Vdc, I_B = 0)	2N5977, MJE5977		–	1.0	
(V_{CE} = 30 Vdc, I_B = 0)	2N5978, MJE5978		–	1.0	
(V_{CE} = 40 Vdc, I_B = 0)	2N5979, MJE5979		–	1.0	
Collector Cutoff Current		I_{CEX}			
(V_{CE} = 60 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N5977, MJE5977		–	100	μAdc
(V_{CE} = 80 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N5978, MJE5978		–	100	
(V_{CE} = 100 Vdc, $V_{EB(off)}$ = 1.5 Vdc)	2N5979, MJE5979		–	100	
(V_{CE} = 40 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 125°C)	2N5977, MJE5977		–	1.0	mAdc
(V_{CE} = 60 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 125°C)	2N5978, MJE5978		–	1.0	
(V_{CE} = 80 Vdc, $V_{EB(off)}$ = 1.5 Vdc, T_C = 125°C)	2N5979, MJE5979		–	1.0	
Emitter Cutoff Current		I_{EBO}			mAdc
(V_{BE} = 5.0 Vdc, I_C = 0)			–	1.0	
ON CHARACTERISTICS					
DC Current Gain		h_{FE}			–
(I_C = 0.5 Adc, V_{CE} = 2.0 Vdc)			40	–	
(I_C = 2.5 Adc, V_{CE} = 2.0 Vdc)			20	120	
(I_C = 5.0 Adc, V_{CE} = 2.0 Vdc)			7.0	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 2.5 Adc, I_B = 250 mAdc)			–	0.6	
(I_C = 5.0 Adc, I_B = 750 mAdc)			–	1.7	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = 5.0 Adc, I_B = 750 mAdc)			–	2.5	
Base-Emitter On Voltage		$V_{BE(on)}$			Vdc
(I_C = 2.5 Adc, V_{CE} = 2.0 Vdc)			–	1.4	
DYNAMIC CHARACTERISTICS					
Current Gain – Bandwidth Product (2)		f_T			MHz
(I_C = 500 mAdc, V_{CE} = 10 Vdc, f_{test} = 1.0 MHz)			2.0	–	
Output Capacitance		C_{ob}			pF
(V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)			–	200	
Small-Signal Current Gain		h_{fe}			–
(I_C = 0.5 Adc, V_{CE} = 4.0 Vdc, f = 1.0 kHz)			20	–	

*Indicates JEDEC Registered Data for 2N5977 Series.

(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

D_1 MUST BE FAST RECOVERY TYPE, eg:
MBD5300 USED ABOVE $I_B \approx 100$ mA
MSD6100 USED BELOW $I_B \approx 100$ mA

FIGURE 3 – TURN-ON TIME

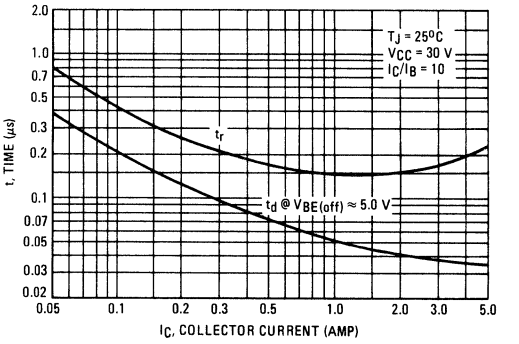


FIGURE 4 – THERMAL RESPONSE

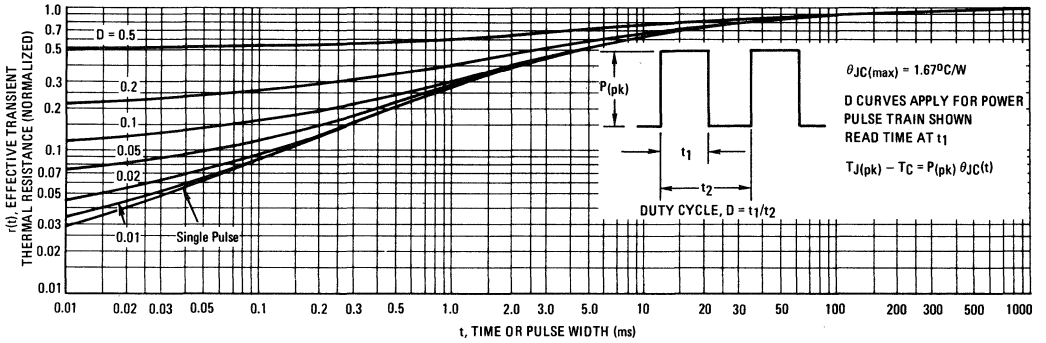
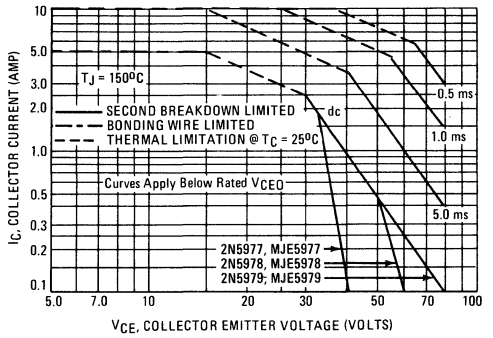


FIGURE 5 – ACTIVE-REGION SAFE OPERATING AREA



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°C; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150°C$. $T_{J(pk)}$ 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-415)

FIGURE 6 – TURN-OFF TIME

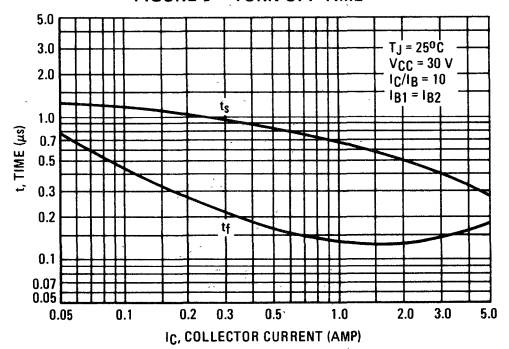


FIGURE 7 – CAPACITANCE

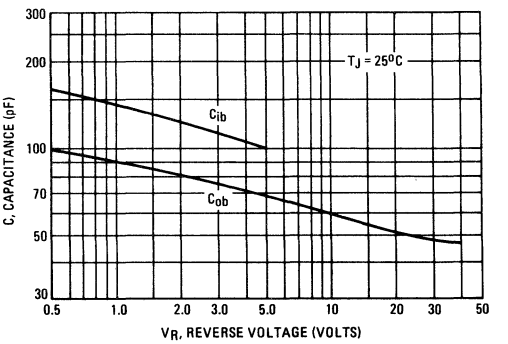


FIGURE 8 – DC CURRENT GAIN

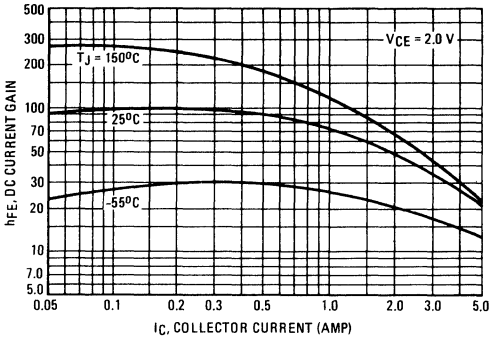


FIGURE 9 – COLLECTOR SATURATION REGION

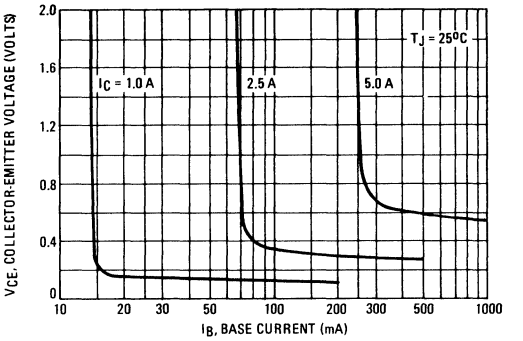


FIGURE 10 – "ON" VOLTAGES

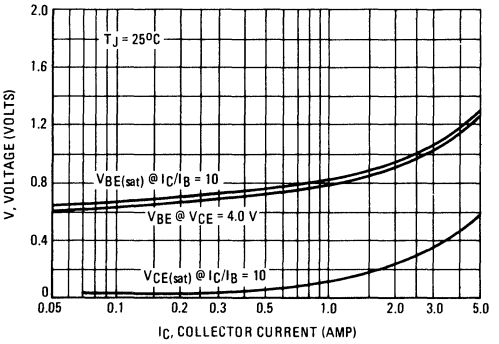


FIGURE 11 – TEMPERATURE COEFFICIENTS

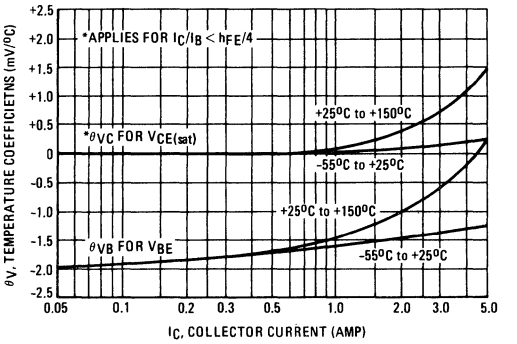


FIGURE 12 – COLLECTOR CUT-OFF REGION

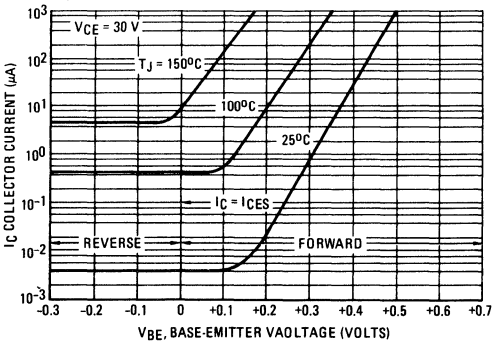


FIGURE 13 – EFFECTS OF BASE-EMITTER RESISTANCE