

# Complementary Plastic Silicon Power Transistors

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

- Collector-Emitter Sustaining Voltage —  
 $V_{CEO(sus)} = 60 \text{ Vdc}$  — MJE171, MJE181  
 $= 80 \text{ Vdc}$  — MJE172, MJE182
- DC Current Gain —  
 $h_{FE} = 30 \text{ (Min) @ } I_C = 0.5 \text{ Adc}$   
 $= 12 \text{ (Min) @ } I_C = 1.5 \text{ Adc}$
- Current-Gain — Bandwidth Product —  
 $f_T = 50 \text{ MHz (Min) @ } I_C = 100 \text{ mAdc}$
- Annular Construction for Low Leakages —  
 $I_{CBO} = 100 \text{ nA (Max) @ Rated } V_{CB}$

**PNP**  
**MJE171\***  
**MJE172\***  
**NPN**  
**MJE181\***  
**MJE182\***

\*Motorola Preferred Device

**3 AMPERE**  
**POWER TRANSISTORS**  
**COMPLEMENTARY**  
**SILICON**  
**60-80 VOLTS**  
**12.5 WATTS**

## MAXIMUM RATINGS

Rating	Symbol	MJE171 MJE181	MJE172 MJE182	Unit
Collector-Base Voltage	$V_{CB}$	80	100	Vdc
Collector-Emitter Voltage	$V_{CEO}$	60	80	Vdc
Emitter-Base Voltage	$V_{EB}$	7.0		Vdc
Collector Current — Continuous Peak	$I_C$	3.0 6.0		Adc
Base Current	$I_B$	1.0		Adc
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 0.012		Watts W/ $^\circ\text{C}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	12.5 0.1		Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150		$^\circ\text{C}$



## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$\theta_{JC}$	10	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	$\theta_{JA}$	83.4	$^\circ\text{C/W}$

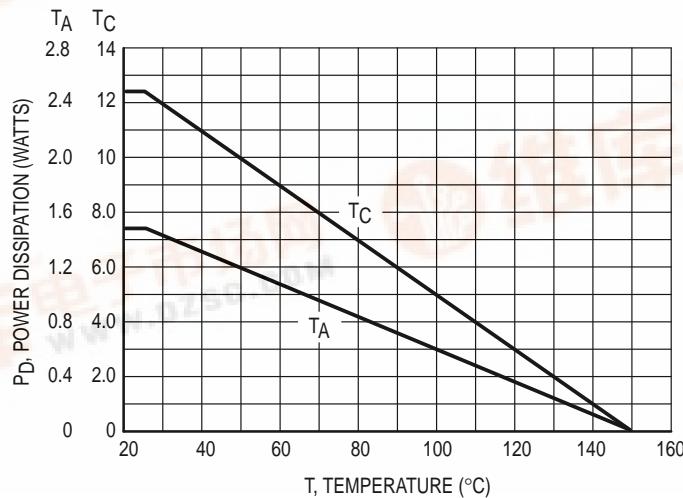


Figure 1. Power Derating

Preferred devices are Motorola recommended choices for future use and best overall value.

REV 2

# MJE171 MJE172 MJE181 MJE182

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	60 80	— —	Vdc
Collector Cutoff Current (V <sub>CB</sub> = 80 Vdc, I <sub>E</sub> = 0) (V <sub>CB</sub> = 100 Vdc, I <sub>E</sub> = 0) (V <sub>CB</sub> = 80 Vdc, I <sub>E</sub> = 0, T <sub>C</sub> = 150°C) (V <sub>CB</sub> = 100 Vdc, I <sub>E</sub> = 0, T <sub>C</sub> = 150°C)	I <sub>CBO</sub>	— — — —	0.1 0.1 0.1 0.1	μAdc mAdc
Emitter Cutoff Current (V <sub>BE</sub> = 7.0 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	—	0.1	μAdc

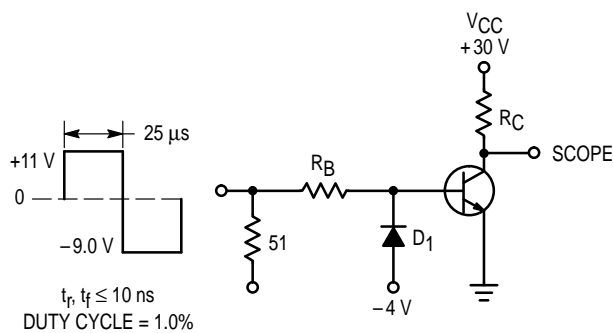
## ON CHARACTERISTICS

DC Current Gain (I <sub>C</sub> = 100 mA, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 500 mA, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 1.5 Adc, V <sub>CE</sub> = 1.0 Vdc)	h <sub>FE</sub>	50 30 12	250 — —	—
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 500 mA, I <sub>B</sub> = 50 mA) (I <sub>C</sub> = 1.5 Adc, I <sub>B</sub> = 150 mA) (I <sub>C</sub> = 3.0 Adc, I <sub>B</sub> = 600 mA)	V <sub>CE(sat)</sub>	— — —	0.3 0.9 1.7	Vdc
Base–Emitter Saturation Voltage (I <sub>C</sub> = 1.5 Adc, I <sub>B</sub> = 150 mA) (I <sub>C</sub> = 3.0 Adc, I <sub>B</sub> = 600 mA)	V <sub>BE(sat)</sub>	— —	1.5 2.0	Vdc
Base–Emitter On Voltage (I <sub>C</sub> = 500 mA, V <sub>CE</sub> = 1.0 Vdc)	V <sub>BE(on)</sub>	—	1.2	Vdc

## DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product (1) (I <sub>C</sub> = 100 mA, V <sub>CE</sub> = 10 Vdc, f <sub>test</sub> = 10 MHz)	f <sub>T</sub>	50	—	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 0.1 MHz)	C <sub>ob</sub>	— —	60 40	pF

(1)  $f_T = |h_{fe}| \cdot f_{test}$



R<sub>B</sub> and R<sub>C</sub> VARIED TO OBTAIN DESIRED CURRENT LEVELS  
 D<sub>1</sub> MUST BE FAST RECOVERY TYPE, e.g.:  
 1N5825 USED ABOVE I<sub>B</sub> ≈ 100 mA  
 MSD6100 USED BELOW I<sub>B</sub> ≈ 100 mA  
 FOR PNP TEST CIRCUIT, REVERSE ALL POLARITIES.

Figure 2. Switching Time Test Circuit

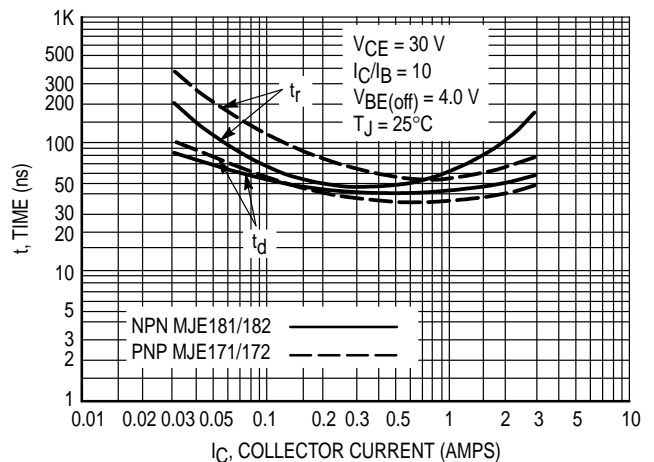


Figure 3. Turn–On Time

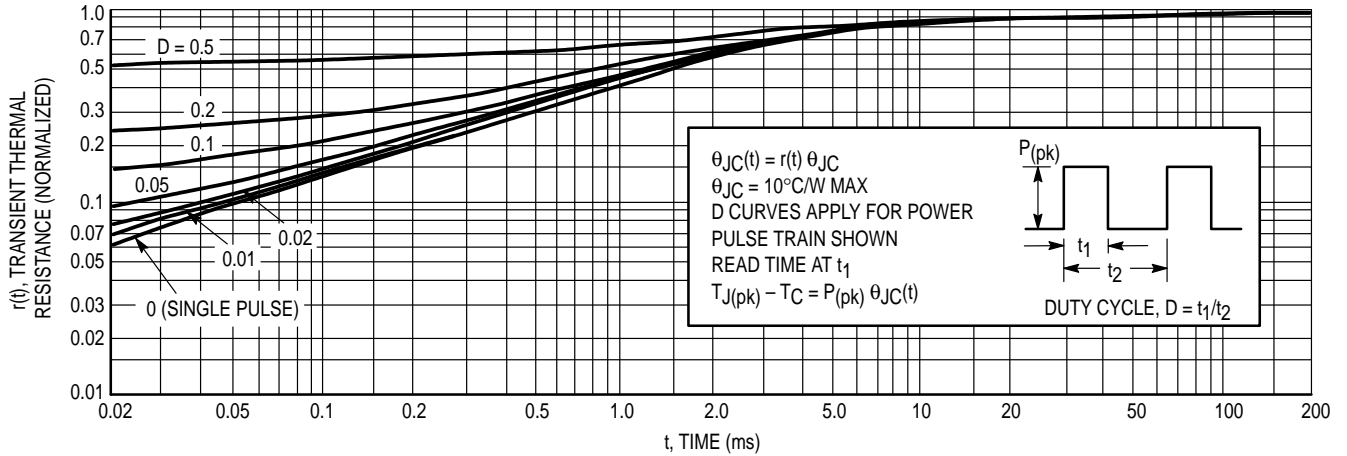


Figure 4. Thermal Response

ACTIVE-REGION SAFE OPERATING AREA

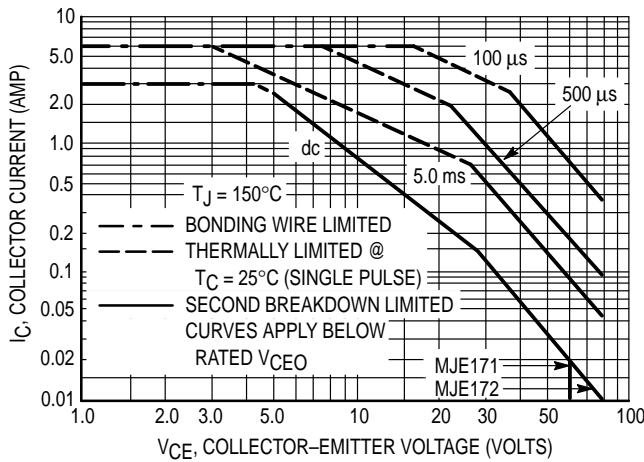


Figure 5. MJE171, MJE172

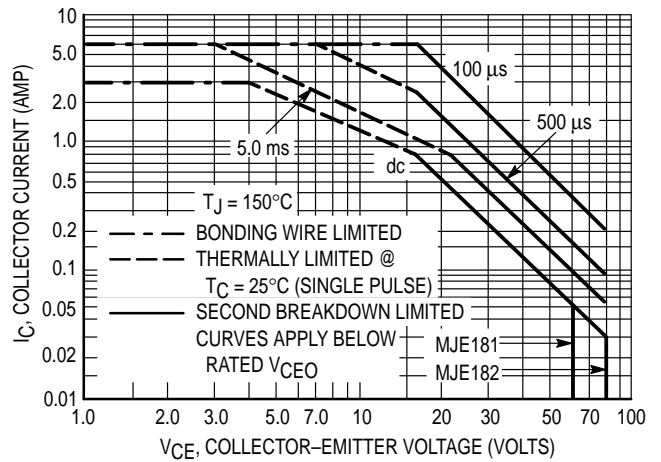


Figure 6. MJE181, MJE182

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 Figures 5 and 6 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  $T_{J(pk)} < 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperature, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

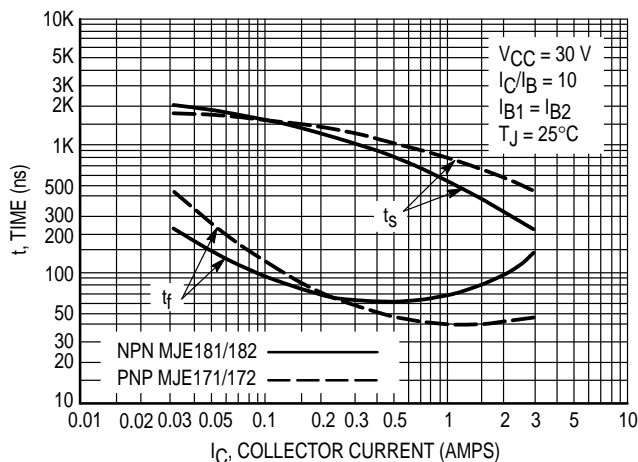


Figure 7. Turn-Off Time

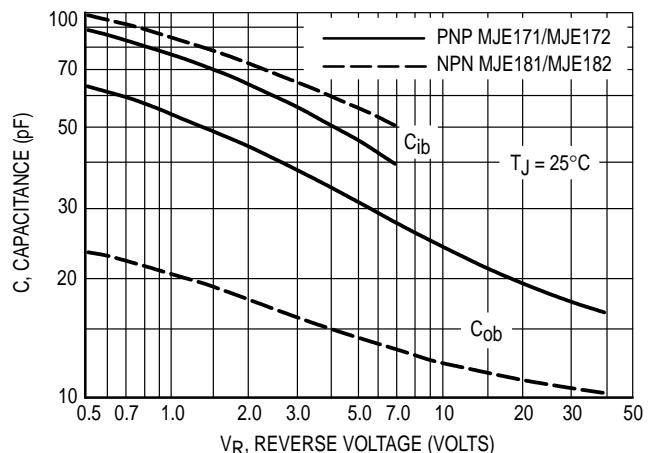
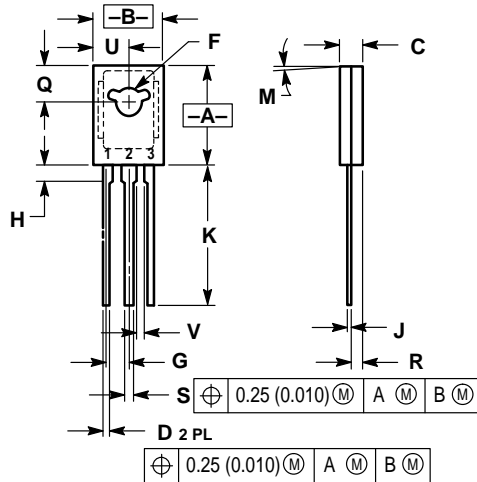


Figure 8. Capacitance

**MJE171 MJE172 MJE181 MJE182**

**PACKAGE DIMENSIONS**



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.425	0.435	10.80	11.04
B	0.295	0.305	7.50	7.74
C	0.095	0.105	2.42	2.66
D	0.020	0.026	0.51	0.66
F	0.115	0.130	2.93	3.30
G	0.094 BSC		2.39 BSC	
H	0.050	0.095	1.27	2.41
J	0.015	0.025	0.39	0.63
K	0.575	0.655	14.61	16.63
M	5° TYP		5° TYP	
Q	0.148	0.158	3.76	4.01
R	0.045	0.055	1.15	1.39
S	0.025	0.035	0.64	0.88
U	0.145	0.155	3.69	3.93
V	0.040	—	1.02	—

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

**CASE 77-08  
 TO-225AA  
 ISSUE V**

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