

# Complementary Silicon Power Plastic Transistors

... designed for low voltage, low-power, high-gain audio amplifier applications.

- Collector-Emitter Sustaining Voltage —  
 $V_{CE(sus)} = 25 \text{ Vdc (Min) @ } I_C = 10 \text{ mAdc}$
- High DC Current Gain —  
 $h_{FE} = 70 \text{ (Min) @ } I_C = 500 \text{ mAdc}$   
 $= 45 \text{ (Min) @ } I_C = 2.0 \text{ Adc}$   
 $= 10 \text{ (Min) @ } I_C = 5.0 \text{ Adc}$
- Low Collector-Emitter Saturation Voltage —  
 $V_{CE(sat)} = 0.3 \text{ Vdc (Max) @ } I_C = 500 \text{ mAdc}$   
 $= 0.75 \text{ Vdc (Max) @ } I_C = 2.0 \text{ Adc}$
- High Current-Gain — Bandwidth Product —  
 $f_T = 65 \text{ MHz (Min) @ } I_C$   
 $= 100 \text{ mAdc}$
- Annular Construction for Low Leakage —  
 $I_{CBO} = 100 \text{ nAdc @ Rated } V_{CB}$

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Base Voltage	$V_{CB}$	40	Vdc
Collector-Emitter Voltage	$V_{CEO}$	25	Vdc
Emitter-Base Voltage	$V_{EB}$	8.0	Vdc
Collector Current — Continuous Peak	$I_C$	5.0 10	Adc
Base Current	$I_B$	1.0	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	15 0.12	Watts W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 0.012	Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

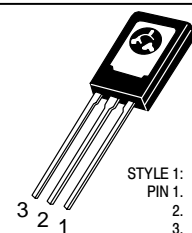
## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$\theta_{JC}$	8.34	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	$\theta_{JA}$	83.4	$^\circ\text{C/W}$

**NPN  
MJE200\*  
PNP  
MJE210\***

\*ON Semiconductor Preferred Device

**5 AMPERE  
POWER TRANSISTORS  
COMPLEMENTARY  
SILICON  
25 VOLTS  
15 WATTS**



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

**CASE 77-09  
TO-225AA**

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

# MJE200 MJE210

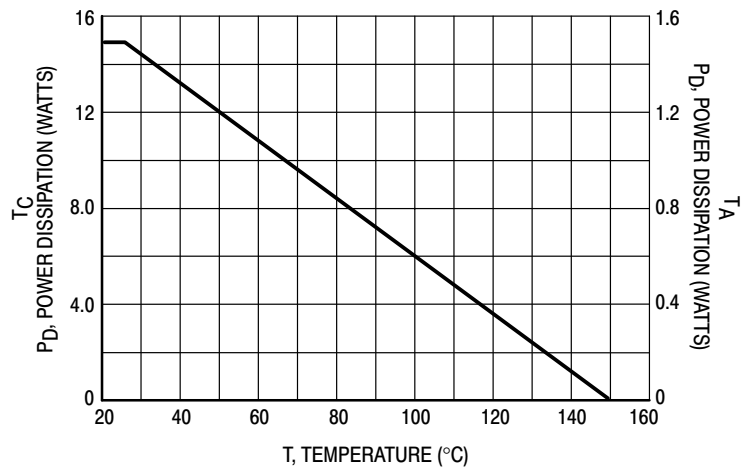


Figure 1. Power Derating

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

Characteristic	Symbol	Min	Max	Unit
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### OFF CHARACTERISTICS

Collector–Emitter Sustaining Voltage (1) ( $I_C = 10\text{ mAdc}$ , $I_B = 0$ )	$V_{CEO(sus)}$	25	—	Vdc
Collector Cutoff Current ( $V_{CB} = 40\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 40\text{ Vdc}$ , $I_E = 0$ , $T_J = 125^\circ\text{C}$ )	$I_{CBO}$	—	100	nAdc $\mu\text{Adc}$
Emitter Cutoff Current ( $V_{BE} = 8.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	—	100	nAdc

### ON CHARACTERISTICS

DC Current Gain (1) ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 1.0\text{ Vdc}$ ) ( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 1.0\text{ Vdc}$ ) ( $I_C = 5.0\text{ Adc}$ , $V_{CE} = 2.0\text{ Vdc}$ )	$h_{FE}$	70 45 10	— 180 —	—
Collector–Emitter Saturation Voltage (1) ( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mAdc}$ ) ( $I_C = 2.0\text{ Adc}$ , $I_B = 200\text{ mAdc}$ ) ( $I_C = 5.0\text{ Adc}$ , $I_B = 1.0\text{ Adc}$ )	$V_{CE(sat)}$	— — —	0.3 0.75 1.8	Vdc
Base–Emitter Saturation Voltage (1) ( $I_C = 5.0\text{ Adc}$ , $I_B = 1.0\text{ Adc}$ )	$V_{BE(sat)}$	—	2.5	Vdc
Base–Emitter On Voltage (1) ( $I_C = 2.0\text{ Adc}$ , $V_{CE} = 1.0\text{ Vdc}$ )	$V_{BE(on)}$	—	1.6	Vdc

### DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product (2) ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 10\text{ MHz}$ )	$f_T$	65	—	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )	$C_{ob}$	—	80 120	pF

(1) Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle  $\approx 2.0\%$ .

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

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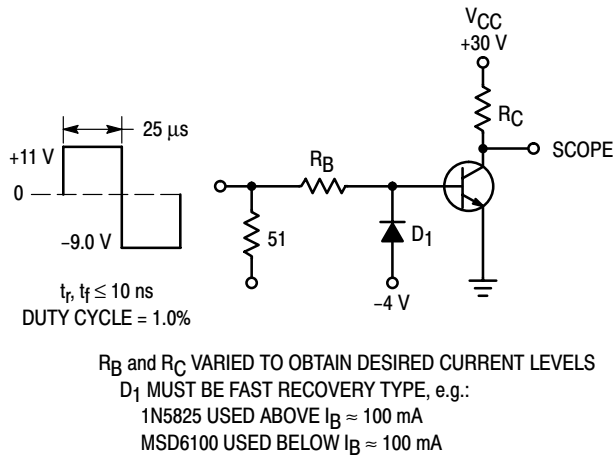


Figure 2. Switching Time Test Circuit

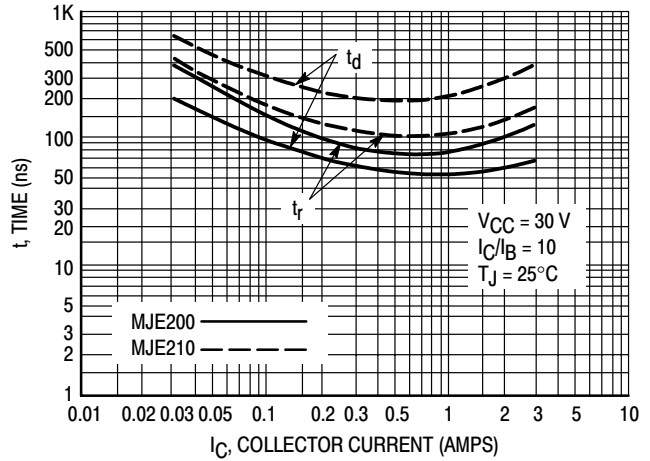


Figure 3. Turn-On Time

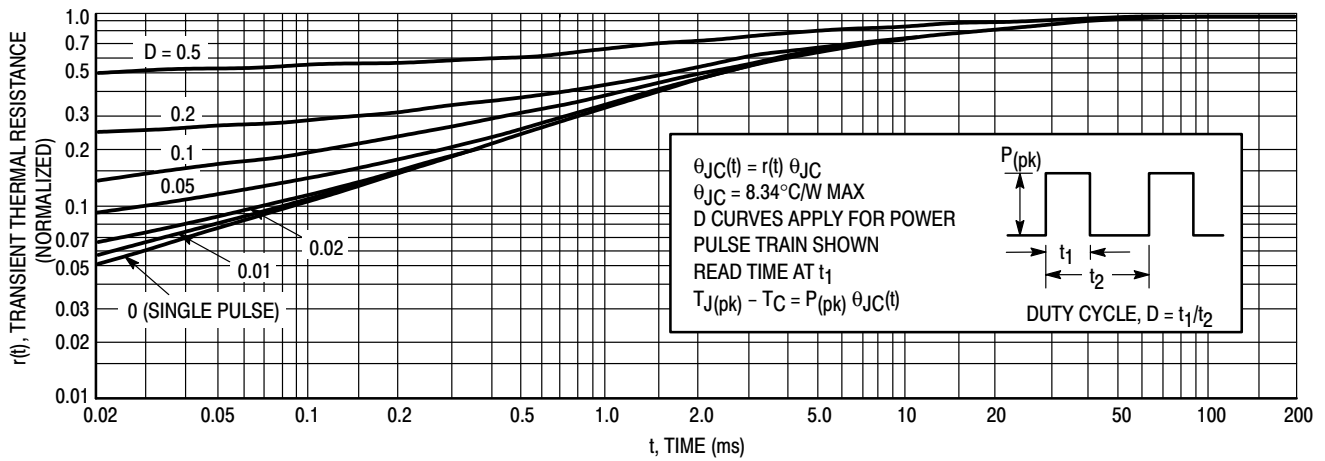


Figure 4. Thermal Response

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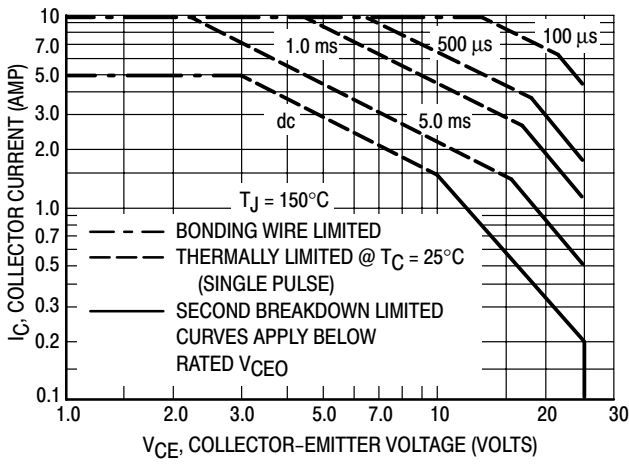


Figure 5. Active Region Safe Operating Area

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.

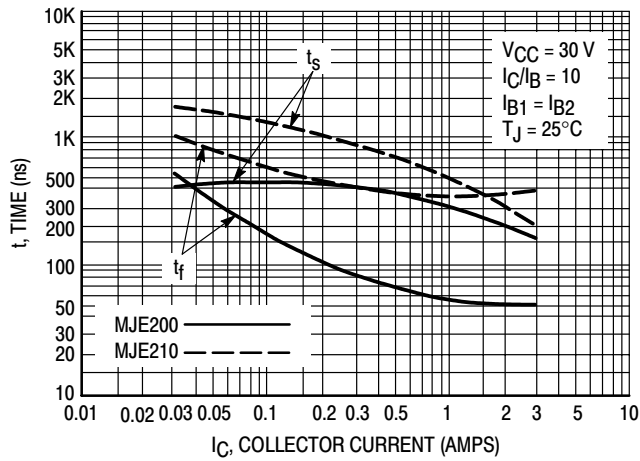


Figure 6. Turn-Off Time

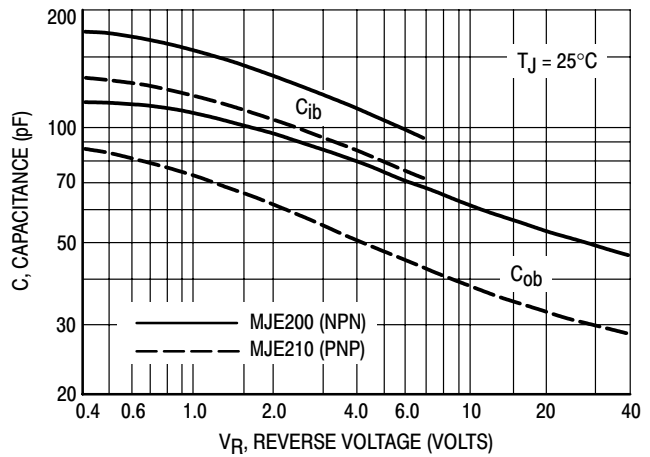
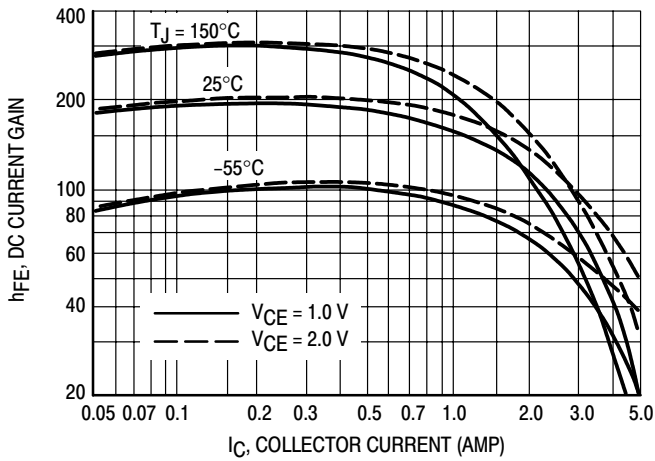


Figure 7. Capacitance

# MJE200 MJE210

**NPN  
MJE200**



**PNP  
MJE210**

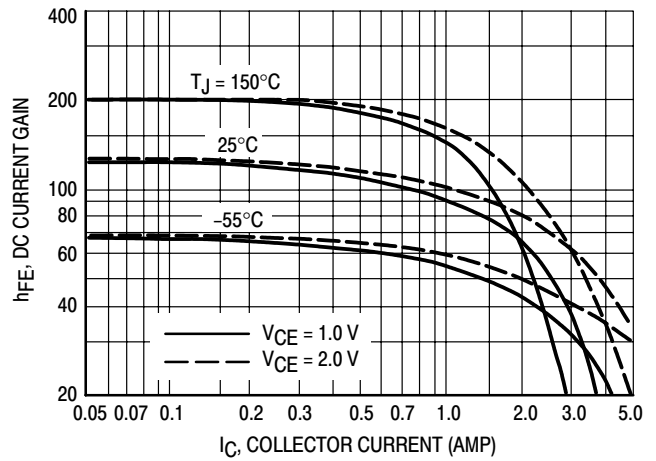


Figure 8. DC Current Gain

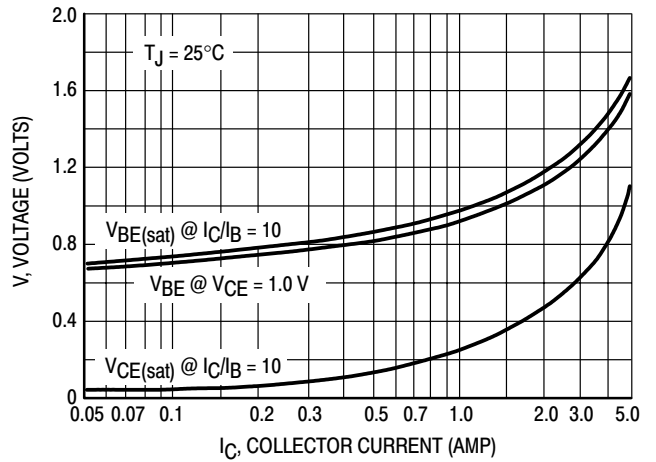
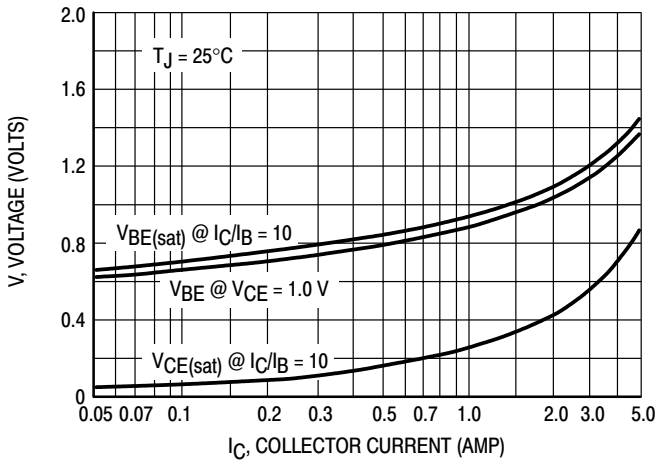


Figure 9. "On" Voltage

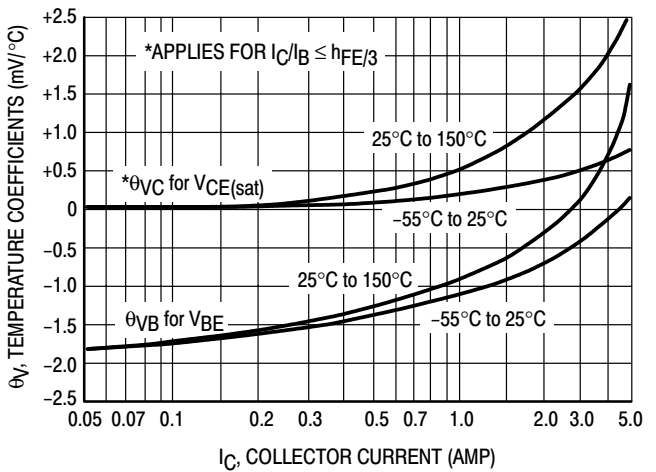
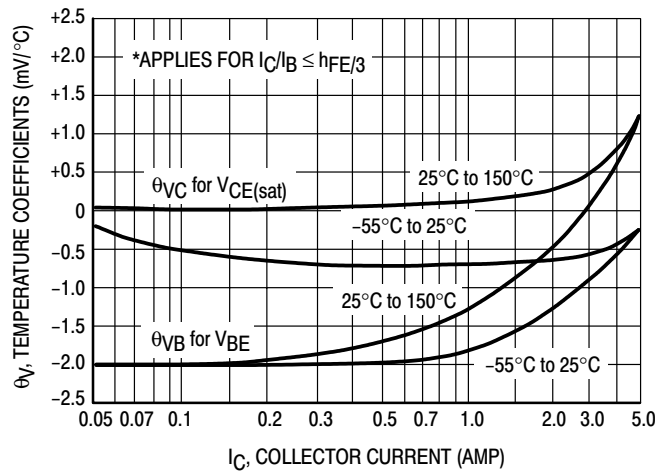
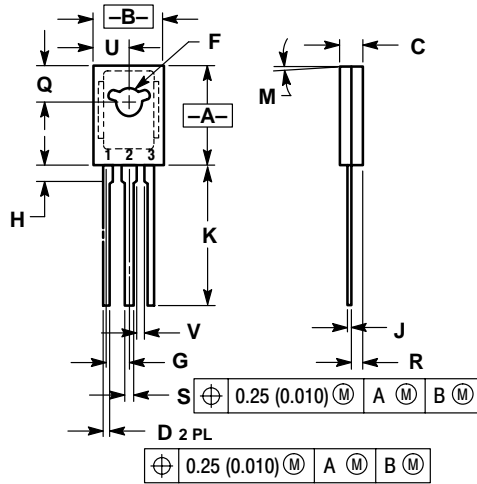


Figure 10. Temperature Coefficients

# MJE200 MJE210

## PACKAGE DIMENSIONS

TO-225AA  
CASE 77-09  
ISSUE W




- 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	0.065	1.15	1.65
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  
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3. BASE

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