

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°C | P_D | 15 0.12 | Watts W/ $^\circ\text{C}$ |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°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 | $^\circ\text{C}$ |

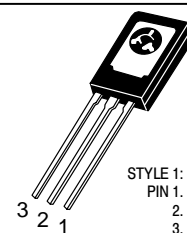
THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---------------|------|--------------------|
| Thermal Resistance, Junction to Case | θ_{JC} | 8.34 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Ambient | θ_{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

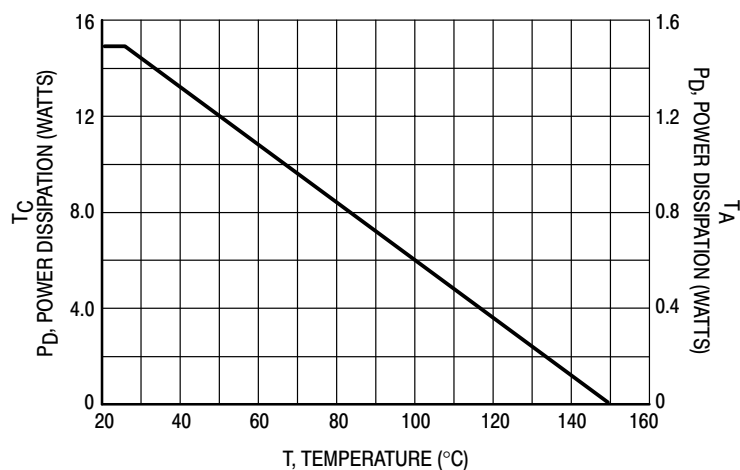


Figure 1. Power Derating

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

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 μAdc |
| 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 μs , Duty Cycle $\approx 2.0\%$.

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

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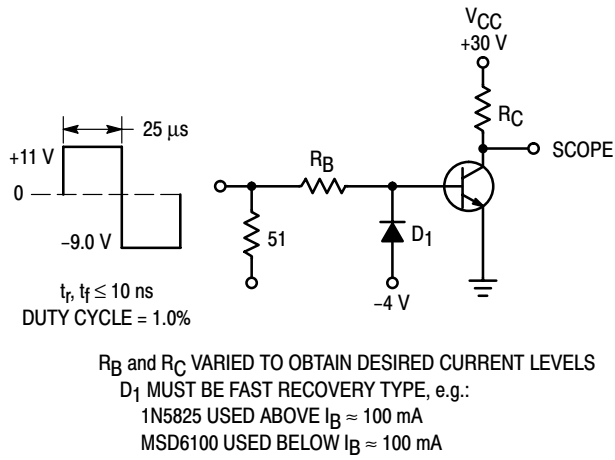


Figure 2. Switching Time Test Circuit

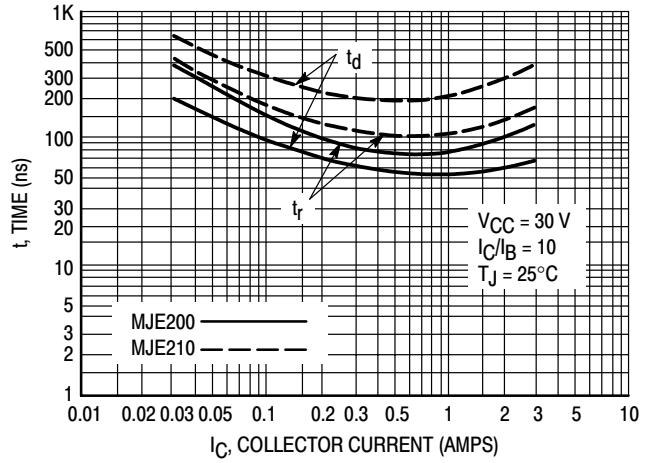


Figure 3. Turn-On Time

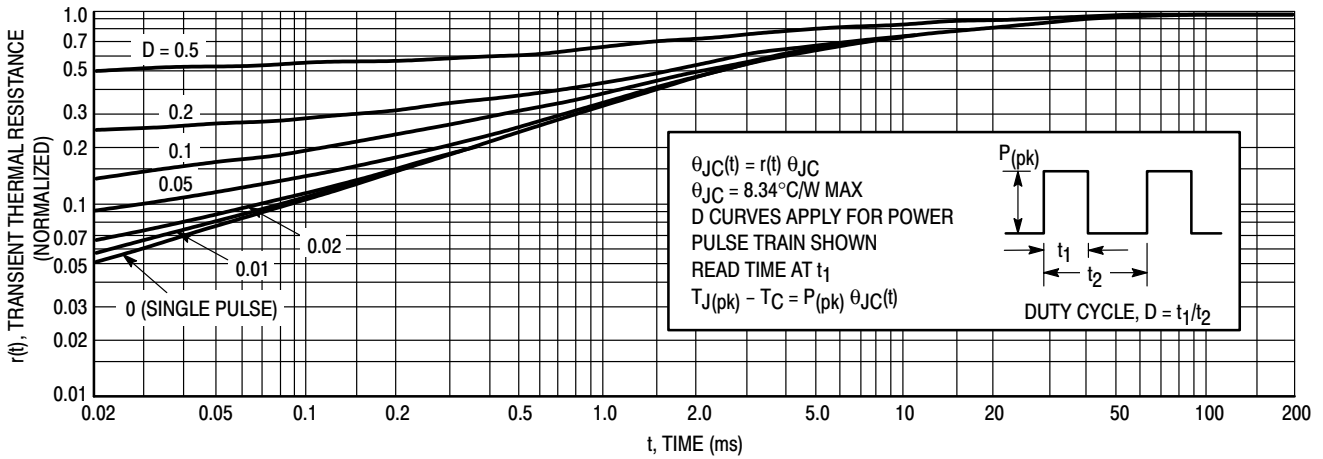


Figure 4. Thermal Response

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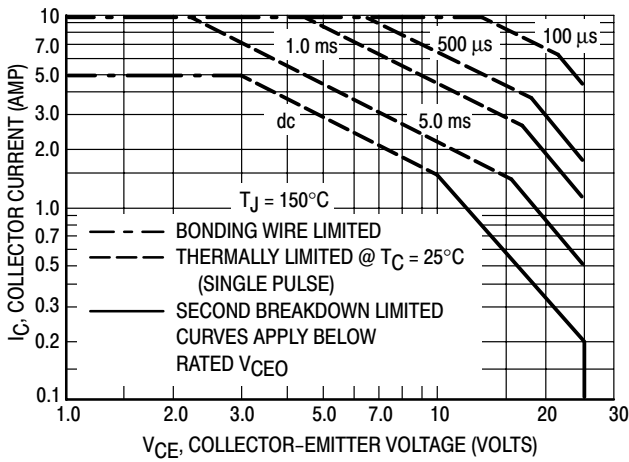


Figure 5. Active Region Safe Operating Area

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.

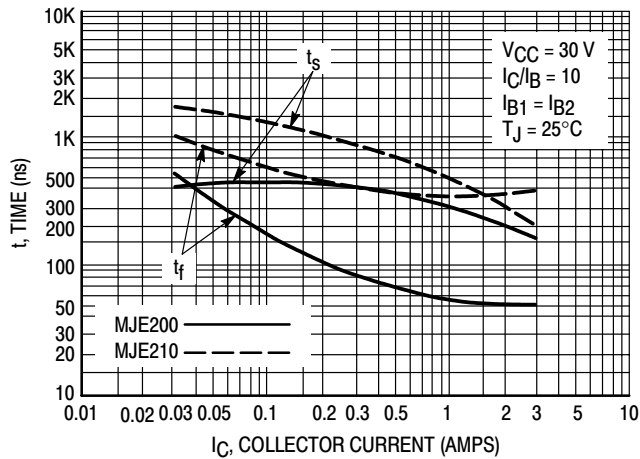


Figure 6. Turn-Off Time

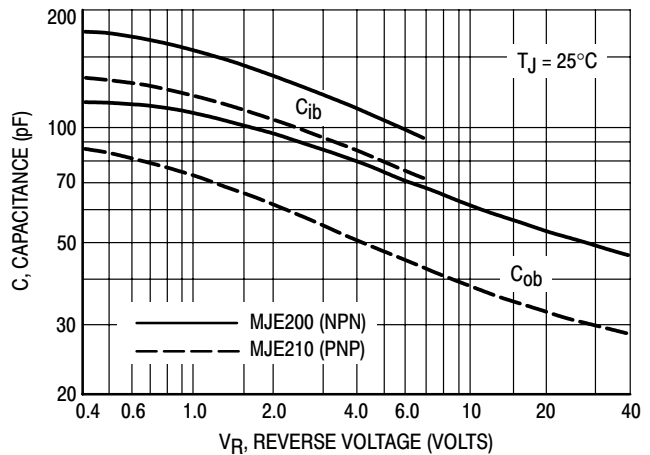
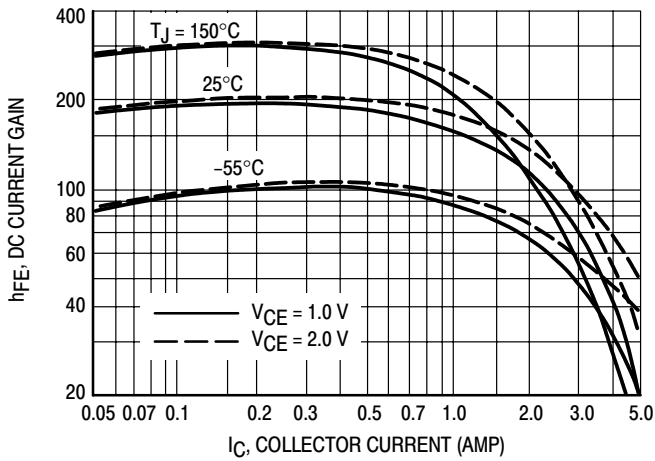


Figure 7. Capacitance

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**NPN
MJE200**



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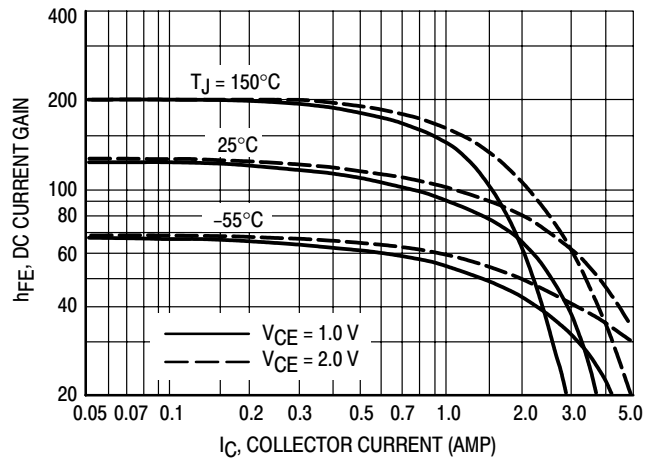


Figure 8. DC Current Gain

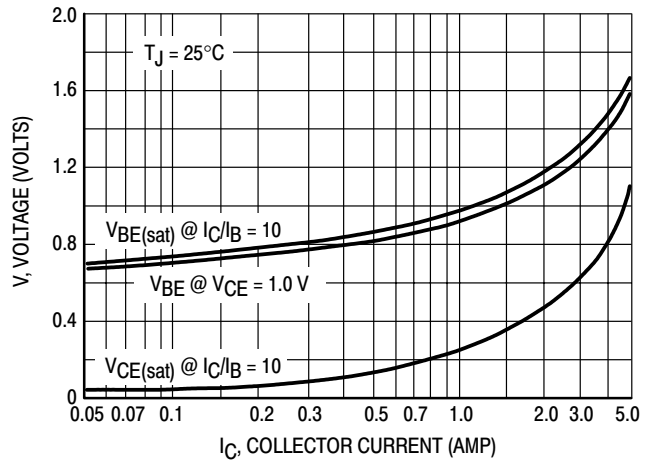
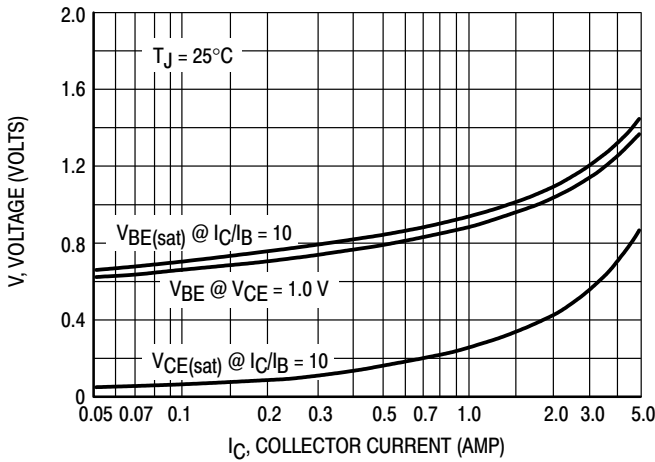


Figure 9. "On" Voltage

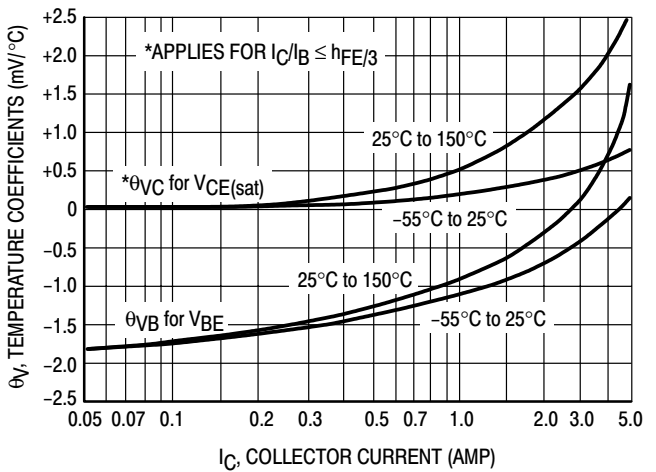
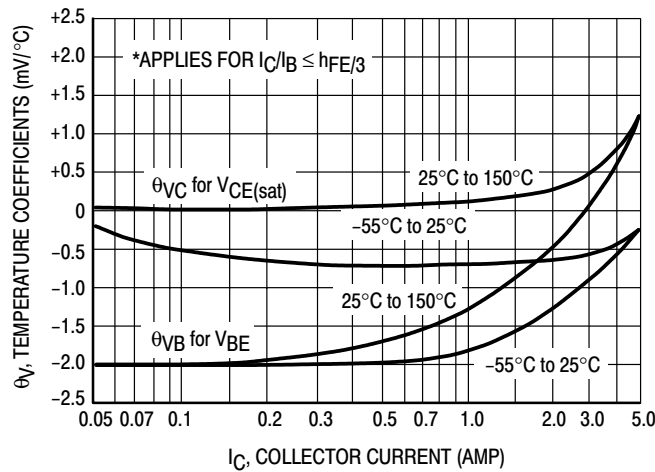
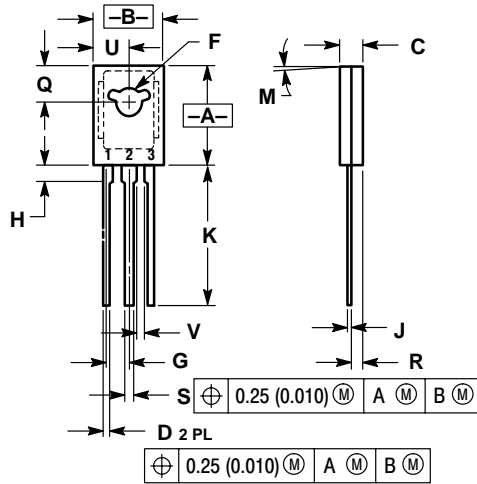


Figure 10. Temperature Coefficients

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
2. COLLECTOR
3. BASE

Notes

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