# MJE170, MJE171, MJE172 (PNP), MJE180, MJE181, MJE182 (NPN)

**Preferred Device**

# Complementary Plastic Silicon Power Transistors

The MJE170/180 series is designed for low power audio amplifier and low current, high speed switching applications.

### Features

- Collector−Emitter Sustaining Voltage −
  $V_{CEO(sus)}$ = 40 Vdc − MJE170, MJE180
  = 60 Vdc − MJE171, MJE181
  = 80 Vdc − MJE172, MJE182
- DC Current Gain −
  $h_{FE}$ = 30 (Min) @ $I_C$ = 0.5 Adc
  = 12 (Min) @ $I_C$ = 1.5 Adc
- Current−Gain − Bandwidth Product −
  $f_T$ = 50 MHz (Min) @ $I_C$ = 100 mAdc
- Annular Construction for Low Leakages −
  $I_{CBO}$ = 100 nA (Max) @ Rated $V_{CB}$
- Epoxy Meets UL 94 V−0 @ 0.125 in
- ESD Ratings: Machine Model, C
  Human Body Model, 3B
- Pb−Free Packages are Available*

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−Base Voltage<br>MJE170, MJE180<br>MJE171, MJE181<br>MJE172, MJE182 | $V_{CB}$ | <br>60<br>80<br>100 | Vdc |
| Collector−Emitter Voltage<br>MJE170, MJE180<br>MJE171, MJE181<br>MJE172, MJE182 | $V_{CEO}$ | <br>40<br>60<br>80 | Vdc |
| Emitter−Base Voltage | $V_{EB}$ | 7.0 | Vdc |
| Collector Current − Continuous<br>− Peak | $I_C$ | 3.0<br>6.0 | Adc |
| Base Current | $I_B$ | 1.0 | Adc |
| Total Power Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 1.5<br>0.012 | W<br>W/°C |
| Total Power Dissipation @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 12.5<br>0.1 | W<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −65 to +150 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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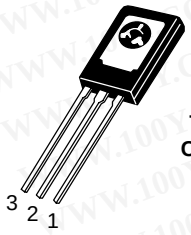
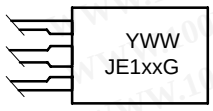
**3 AMPERES**
**POWER TRANSISTORS**
**COMPLEMENTARY SILICON**
**40 − 60 − 80 VOLTS**
**12.5 WATTS**




**TO−225AA**
**CASE 77−09**
**STYLE 1**

### MARKING DIAGRAM




Y = Year
WW = Work Week
JE1xx = Specific Device Code
x = 70, 71, 72, 80, 81, or 82
G = Pb−Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

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

## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction−to−Case | $\theta_{JC}$ | 10 | °C/W |
| Thermal Resistance, Junction−to−Ambient | $\theta_{JA}$ | 83.4 | °C/W |

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

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector−Emitter Sustaining Voltage ($I_C$ = 10 mAdc, $I_B$ = 0) | MJE170, MJE180<br>MJE171, MJE181<br>MJE172, MJE182 | $V_{CEO(sus)}$ | 40<br>60<br>80 | <br>−<br>− | Vdc |
| Collector Cutoff Current | | $I_{CBO}$ | | | μAdc |
| ($V_{CB}$ = 60 Vdc, $I_E$ = 0) | MJE170, MJE180 | | − | 0.1 | |
| ($V_{CB}$ = 80 Vdc, $I_E$ = 0) | MJE171, MJE181 | | − | 0.1 | |
| ($V_{CB}$ = 100 Vdc, $I_E$ = 0) | MJE172, MJE182 | | − | 0.1 | mAdc |
| ($V_{CB}$ = 60 Vdc, $I_E$ = 0, $T_C$ = 150°C) | MJE170, MJE180 | | | | |
| ($V_{CB}$ = 80 Vdc, $I_E$ = 0, $T_C$ = 150°C) | MJE171, MJE181 | | − | 0.1 | |
| ($V_{CB}$ = 100 Vdc, $I_E$ = 0, $T_C$ = 150°C) | MJE172, MJE182 | | − | 0.1 | |
| Emitter Cutoff Current ($V_{BE}$ = 7.0 Vdc, $I_C$ = 0) | | $I_{EBO}$ | − | 0.1 | μAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain | | $h_{FE}$ | | | − |
| ($I_C$ = 100 mAdc, $V_{CE}$ = 1.0 Vdc) | | | 50 | 250 | |
| ($I_C$ = 500 mAdc, $V_{CE}$ = 1.0 Vdc) | | | 30 | − | |
| ($I_C$ = 1.5 Adc, $V_{CE}$ = 1.0 Vdc) | | | 12 | − | |
| Collector−Emitter Saturation Voltage | | $V_{CE(sat)}$ | | | Vdc |
| ($I_C$ = 500 mAdc, $I_B$ = 50 mAdc) | | | − | 0.3 | |
| ($I_C$ = 1.5 Adc, $I_B$ = 150 mAdc) | | | − | 0.9 | |
| ($I_C$ = 3.0 Adc, $I_B$ = 600 mAdc) | | | − | 1.7 | |
| Base−Emitter Saturation Voltage | | $V_{BE(sat)}$ | | | Vdc |
| ($I_C$ = 1.5 Adc, $I_B$ = 150 mAdc) | | | − | 1.5 | |
| ($I_C$ = 3.0 Adc, $I_B$ = 600 mAdc) | | | − | 2.0 | |
| Base−Emitter On Voltage ($I_C$ = 500 mAdc, $V_{CE}$ = 1.0 Vdc) | | $V_{BE(on)}$ | − | 1.2 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Current−Gain − Bandwidth Product (Note 1) ($I_C$ = 100 mAdc, $V_{CE}$ = 10 Vdc, $f_{test}$ = 10 MHz) | | $f_T$ | 50 | − | MHz |
| Output Capacitance | | $C_{ob}$ | | | pF |
| ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 0.1 MHz) | MJE171/MJE172 | | − | 60 | |
| | MJE181/MJE182 | | − | 40 | |

1. $f_T = |h_{fe}| \bullet f_{test}$.

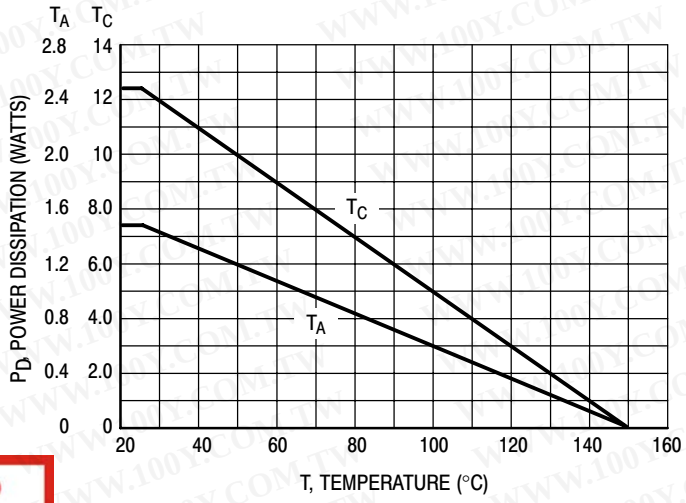



Figure 1. Power Derating



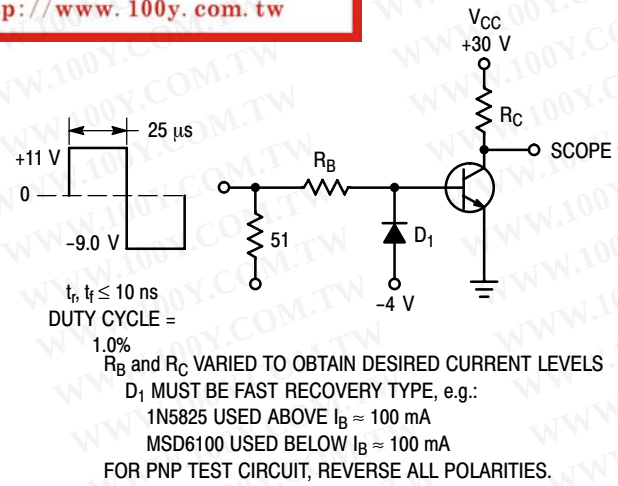



Figure 2. Switching Time Test Circuit

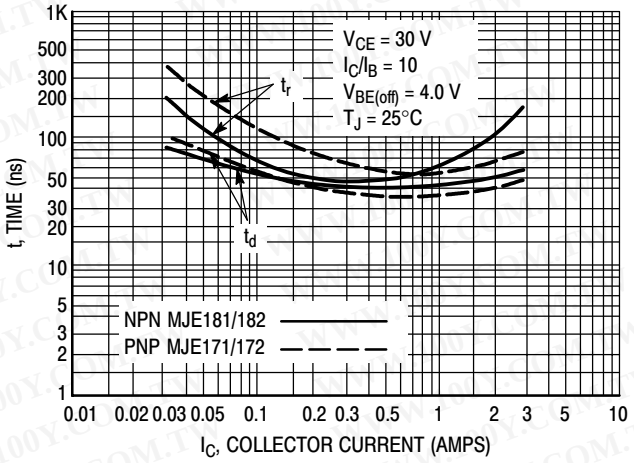



Figure 3. Turn−On Time

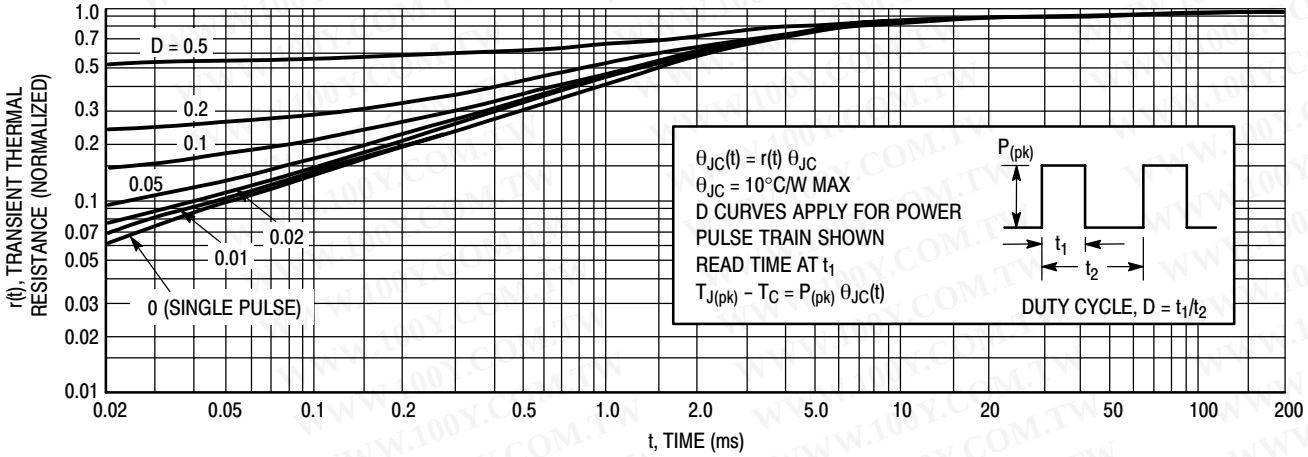



Figure 4. Thermal Response

## ACTIVE−REGION SAFE OPERATING AREA

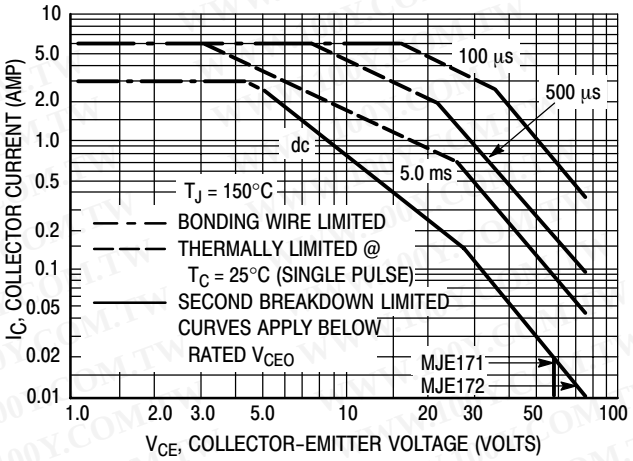



**Figure 5. MJE171, MJE172**

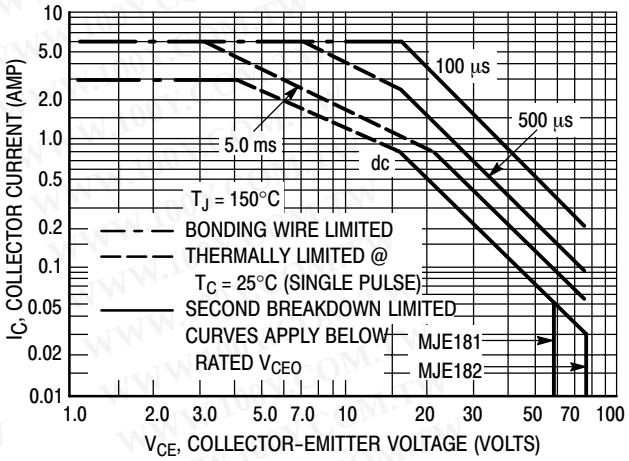



**Figure 6. MJE181, MJE182**

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

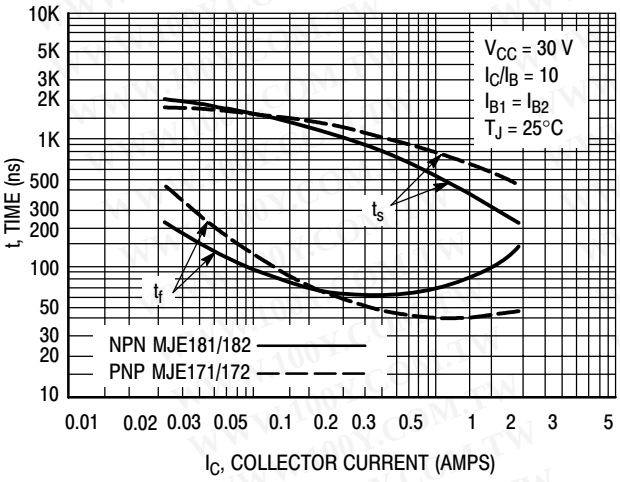



**Figure 7. Turn−Off Time**

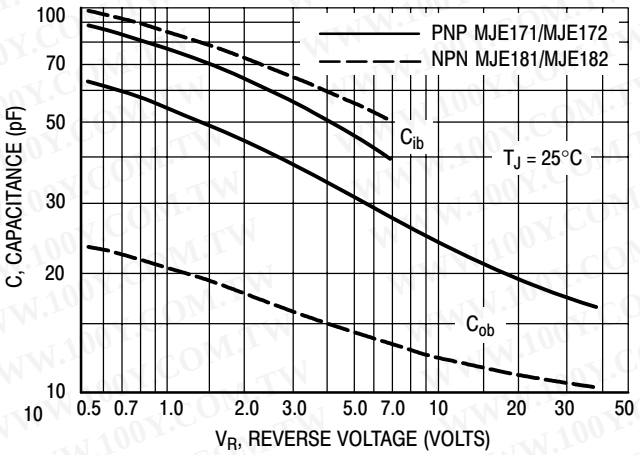


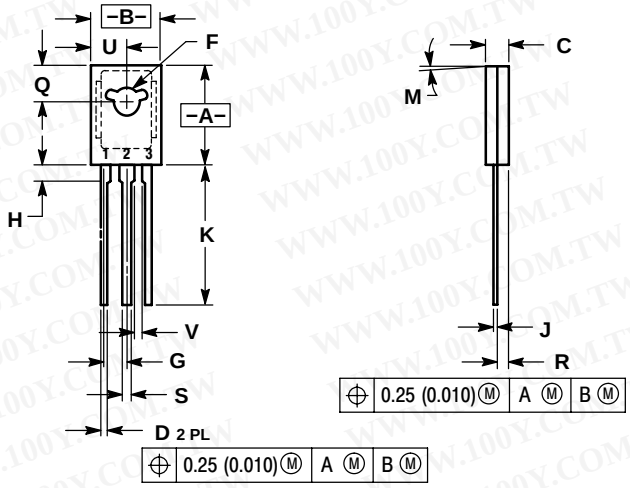

**Figure 8. Capacitance**

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MJE170 | TO−225 | 500 Units / Box |
| MJE170G | TO−225 (Pb−Free) | |
| MJE171 | TO−225 | |
| MJE171G | TO−225 (Pb−Free) | |
| MJE172 | TO−225 | |
| MJE172G | TO−225 (Pb−Free) | |
| MJE180 | TO−225 | |
| MJE180G | TO−225 (Pb−Free) | |
| MJE181 | TO−225 | |
| MJE181G | TO−225 (Pb−Free) | |
| MJE182 | TO−225 | |
| MJE182G | TO−225 (Pb−Free) | |

## PACKAGE DIMENSIONS

**TO−225**
CASE 77−09
ISSUE Z




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 077−01 THRU −08 OBSOLETE, NEW STANDARD 077−09.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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





## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
Literature Distribution Center for ON Semiconductor
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**MJE171/D**