

# Medium-Power Complementary Silicon Transistors

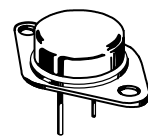
... for use as output devices in complementary general purpose amplifier applications.

- High DC Current Gain —  $h_{FE} = 6000$  (Typ) @  $I_C = 3.0$  Adc
- Monolithic Construction with Built-in Base-Emitter Shunt Resistors

**NPN**  
**MJ1000**  
**MJ1001\***

\*Motorola Preferred Device

**10 AMPERE**  
**DARLINGTON**  
**POWER TRANSISTORS**  
**COMPLEMENTARY**  
**SILICON**  
**60-80 VOLTS**  
**90 WATTS**



**CASE 1-07**  
**TO-204AA**  
**(TO-3)**

## MAXIMUM RATINGS

| Rating   | Symbol         | MJ1000      | MJ1001 | Unit                |
|--|----------------|-------------|--------|---------------------|
| Collector-Emitter Voltage  | $V_{CEO}$      | 60          | 80     | Vdc                 |
| Collector-Base Voltage   | $V_{CB}$       | 60          | 80     | Vdc                 |
| Emitter-Base Voltage   | $V_{EB}$       | 5.0         |        | Vdc                 |
| Collector Current  | $I_C$          | 10          |        | Adc                 |
| Base Current   | $I_B$          | 0.1         |        | Adc                 |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 90          |        | Watts               |
|  |                | 0.515       |        | W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range                                       | $T_J, T_{stg}$ | -55 to +200 |        | $^\circ\text{C}$    |

## THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max  | Unit               |
|--------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.94 | $^\circ\text{C/W}$ |

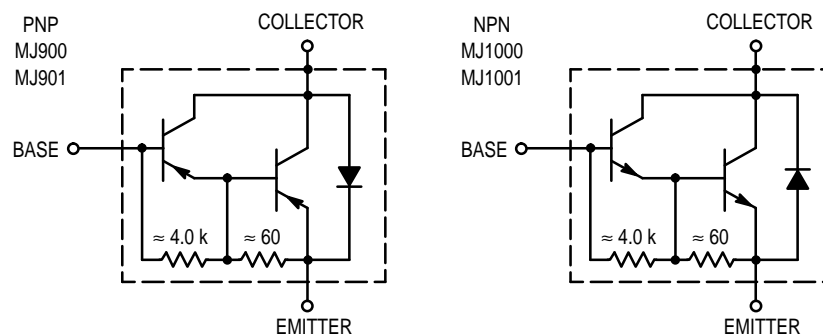


Figure 1. Darlington Circuit Schematic

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

REV 7

# MJ1000 MJ1001

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

| Characteristic  | Symbol                               | Min           | Max              | Unit                     |                 |
|---|--------------------------------------|---------------|------------------|--------------------------|-----------------|
| <b>OFF CHARACTERISTICS</b>  |                                      |               |                  |                          |                 |
| Collector–Emitter Breakdown Voltage <sup>(1)</sup> ( $I_C = 100\text{ mA}$ , $I_B = 0$ )  | MJ1000<br>MJ1001                     | $V_{(BR)CEO}$ | 60<br>80         | —<br>—                   | Vdc             |
| Collector Emitter Leakage Current<br>( $V_{CB} = 60\text{ Vdc}$ , $R_{BE} = 1.0\text{ k}\Omega$ )<br>( $V_{CB} = 80\text{ Vdc}$ , $R_{BE} = 1.0\text{ k}\Omega$ )<br>( $V_{CB} = 60\text{ Vdc}$ , $R_{BE} = 1.0\text{ k}\Omega$ , $T_C = 150^\circ\text{C}$ )<br>( $V_{CB} = 80\text{ Vdc}$ , $R_{BE} = 1.0\text{ k}\Omega$ , $T_C = 150^\circ\text{C}$ ) | MJ1000<br>MJ1001<br>MJ1000<br>MJ1001 | $I_{CER}$     | —<br>—<br>—<br>— | 1.0<br>1.0<br>5.0<br>5.0 | mAdc            |
| Emitter Cutoff Current ( $V_{BE} = 5.0\text{ Vdc}$ , $I_C = 0$ )  |                                      | $I_{EBO}$     | —                | 2.0                      | mAdc            |
| Collector Emitter Leakage Current ( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ )  | MJ1000<br>MJ1001                     | $I_{CEO}$     | —<br>—           | 500<br>500               | $\mu\text{Adc}$ |

## ON CHARACTERISTICS

|   |               |             |            |     |
|---|---------------|-------------|------------|-----|
| DC Current Gain <sup>(1)</sup> ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )<br>( $I_C = 4.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )               | $h_{FE}$      | 1000<br>750 | —<br>—     | —   |
| Collector Emitter Saturation Voltage <sup>(1)</sup> ( $I_C = 30\text{ Adc}$ , $I_B = 12\text{ mAdc}$ )<br>( $I_C = 8.0\text{ Adc}$ , $I_B = 40\text{ mAdc}$ ) | $V_{CE(sat)}$ | —<br>—      | 2.0<br>4.0 | Vdc |
| Base Emitter Voltage <sup>(1)</sup> ( $I_C = 3.0\text{ Adc}$ , $V_{CE} = 3.0\text{ Vdc}$ )  | $V_{BE(on)}$  | —           | 2.5        | Vdc |

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

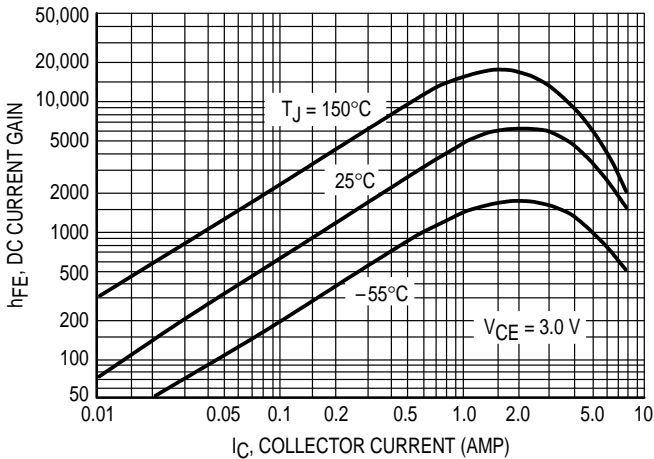


Figure 2. DC Current Gain

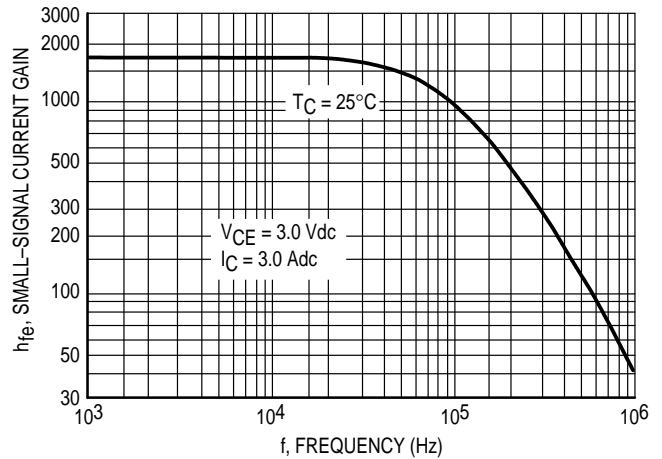


Figure 3. Small-Signal Current Gain

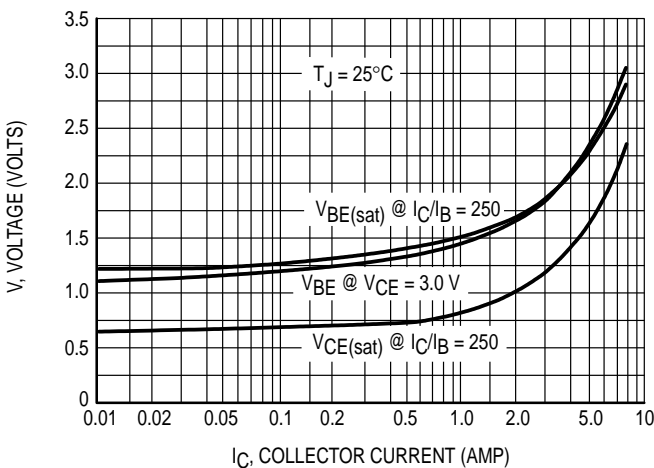


Figure 4. "On" Voltages

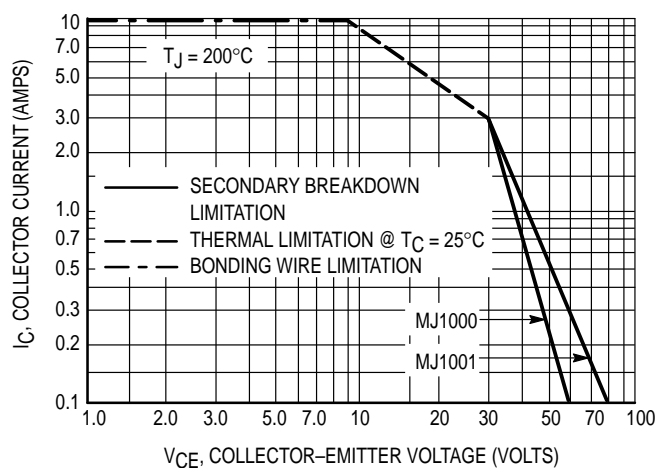


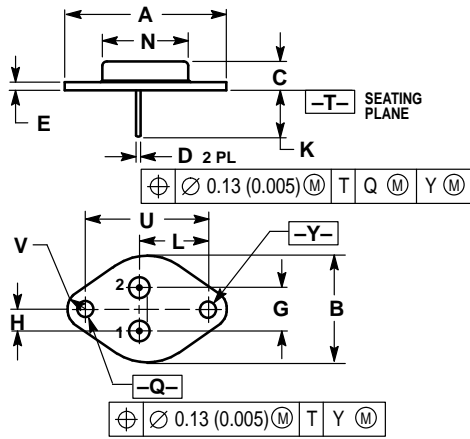
Figure 5. DC Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and secondary breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; e.g., the transistor must not be subjected to greater

dissipation than the curves indicate.

At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown.

PACKAGE DIMENSIONS




- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 1.550 REF |       | 39.37 REF   |       |
| B   | —         | 1.050 | —           | 26.67 |
| C   | 0.250     | 0.335 | 6.35        | 8.51  |
| D   | 0.038     | 0.043 | 0.97        | 1.09  |
| E   | 0.055     | 0.070 | 1.40        | 1.77  |
| G   | 0.430 BSC |       | 10.92 BSC   |       |
| H   | 0.215 BSC |       | 5.46 BSC    |       |
| K   | 0.440     | 0.480 | 11.18       | 12.19 |
| L   | 0.665 BSC |       | 16.89 BSC   |       |
| N   | —         | 0.830 | —           | 21.08 |
| Q   | 0.151     | 0.165 | 3.84        | 4.19  |
| U   | 1.187 BSC |       | 30.15 BSC   |       |
| V   | 0.131     | 0.188 | 3.33        | 4.77  |

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

CASE 1-07  
 TO-204AA (TO-3)  
 ISSUE Z

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