

# Complementary Silicon Power Transistors

... designed for general-purpose switching and amplifier applications.

- DC Current Gain —  $h_{FE} = 20-70 @ I_C = 4 \text{ Adc}$
- Collector-Emitter Saturation Voltage —  
 $V_{CE(sat)} = 1.1 \text{ Vdc (Max) @ } I_C = 4 \text{ Adc}$
- Excellent Safe Operating Area

## MAXIMUM RATINGS

| Rating                                                                                | Symbol         | Value        | Unit                         |
|---------------------------------------------------------------------------------------|----------------|--------------|------------------------------|
| Collector-Emitter Voltage                                                             | $V_{CEO}$      | 60           | Vdc                          |
| Collector-Emitter Voltage                                                             | $V_{CER}$      | 70           | Vdc                          |
| Collector-Base Voltage                                                                | $V_{CB}$       | 100          | Vdc                          |
| Emitter-Base Voltage                                                                  | $V_{EB}$       | 7            | Vdc                          |
| Collector Current — Continuous                                                        | $I_C$          | 15           | A <sub>dc</sub>              |
| Base Current                                                                          | $I_B$          | 7            | A <sub>dc</sub>              |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 115<br>0.657 | Watts<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range                                      | $T_J, T_{stg}$ | -65 to +200  | $^\circ\text{C}$             |

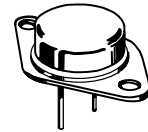
## THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max  | Unit               |
|--------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.52 | $^\circ\text{C/W}$ |

**NPN**  
**2N3055 \***  
**PNP**  
**MJ2955 \***

\*Motorola Preferred Device

**15 AMPERE**  
**POWER TRANSISTORS**  
**COMPLEMENTARY**  
**SILICON**  
**60 VOLTS**  
**115 WATTS**



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

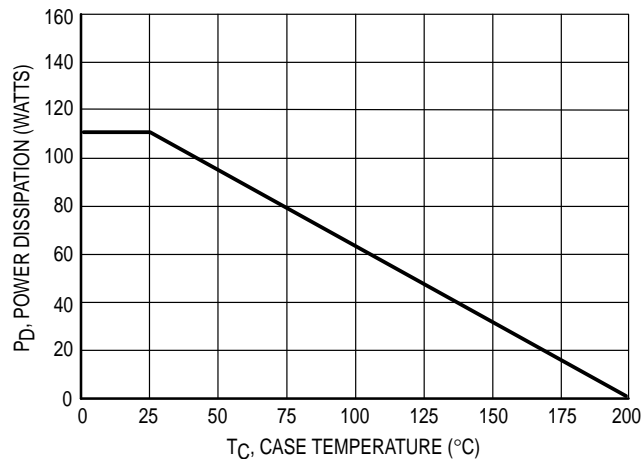


Figure 1. Power Derating

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

## 2N3055 MJ2955

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

| Characteristic                                                                                                                                                                           | Symbol         | Min | Max        | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----|------------|------|
| <b>*OFF CHARACTERISTICS</b>                                                                                                                                                              |                |     |            |      |
| Collector–Emitter Sustaining Voltage (1)<br>( $I_C = 200\text{ mAdc}$ , $I_B = 0$ )                                                                                                      | $V_{CEO(sus)}$ | 60  | —          | Vdc  |
| Collector–Emitter Sustaining Voltage (1)<br>( $I_C = 200\text{ mAdc}$ , $R_{BE} = 100\text{ Ohms}$ )                                                                                     | $V_{CER(sus)}$ | 70  | —          | Vdc  |
| Collector Cutoff Current<br>( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ )                                                                                                                     | $I_{CEO}$      | —   | 0.7        | mAcd |
| Collector Cutoff Current<br>( $V_{CE} = 100\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ )<br>( $V_{CE} = 100\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ ) | $I_{CEX}$      | —   | 1.0<br>5.0 | mAcd |
| Emitter Cutoff Current<br>( $V_{BE} = 7.0\text{ Vdc}$ , $I_C = 0$ )                                                                                                                      | $I_{EBO}$      | —   | 5.0        | mAcd |

### \*ON CHARACTERISTICS (1)

|                                                                                                                                                    |               |           |            |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------|------------|-----|
| DC Current Gain<br>( $I_C = 4.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )<br>( $I_C = 10\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )                 | $h_{FE}$      | 20<br>5.0 | 70<br>—    | —   |
| Collector–Emitter Saturation Voltage<br>( $I_C = 4.0\text{ Adc}$ , $I_B = 400\text{ mAdc}$ )<br>( $I_C = 10\text{ Adc}$ , $I_B = 3.3\text{ Adc}$ ) | $V_{CE(sat)}$ | —         | 1.1<br>3.0 | Vdc |
| Base–Emitter On Voltage<br>( $I_C = 4.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ )                                                                  | $V_{BE(on)}$  | —         | 1.5        | Vdc |

### SECOND BREAKDOWN

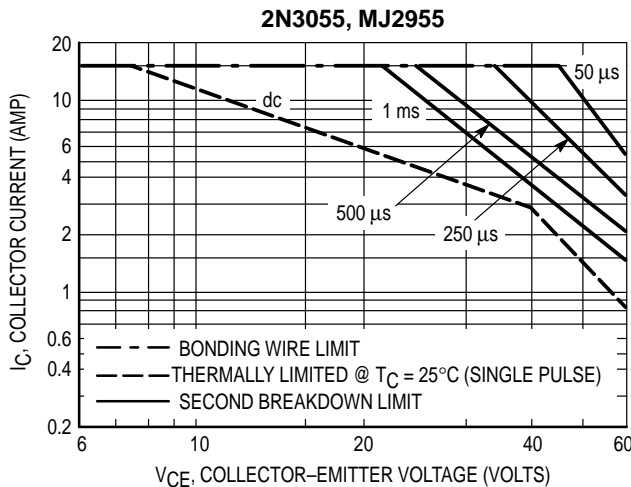
|                                                                                                                                 |           |      |   |     |
|---------------------------------------------------------------------------------------------------------------------------------|-----------|------|---|-----|
| Second Breakdown Collector Current with Base Forward Biased<br>( $V_{CE} = 40\text{ Vdc}$ , $t = 1.0\text{ s}$ , Nonrepetitive) | $I_{s/b}$ | 2.87 | — | Adc |
|---------------------------------------------------------------------------------------------------------------------------------|-----------|------|---|-----|

### DYNAMIC CHARACTERISTICS

|                                                                                                                              |           |     |     |     |
|------------------------------------------------------------------------------------------------------------------------------|-----------|-----|-----|-----|
| Current Gain — Bandwidth Product<br>( $I_C = 0.5\text{ Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )             | $f_T$     | 2.5 | —   | MHz |
| *Small–Signal Current Gain<br>( $I_C = 1.0\text{ Adc}$ , $V_{CE} = 4.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                  | $h_{fe}$  | 15  | 120 | —   |
| *Small–Signal Current Gain Cutoff Frequency<br>( $V_{CE} = 4.0\text{ Vdc}$ , $I_C = 1.0\text{ Adc}$ , $f = 1.0\text{ kHz}$ ) | $f_{hfe}$ | 10  | —   | kHz |

\* Indicates Within JEDEC Registration. (2N3055)

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



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 2 is based on  $T_C = 25^\circ\text{C}$ ;  $T_{J(pk)}$  is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated for temperature according to Figure 1.

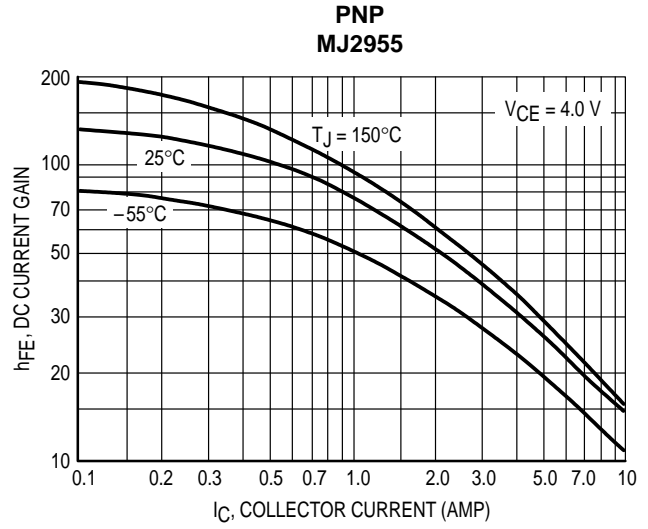
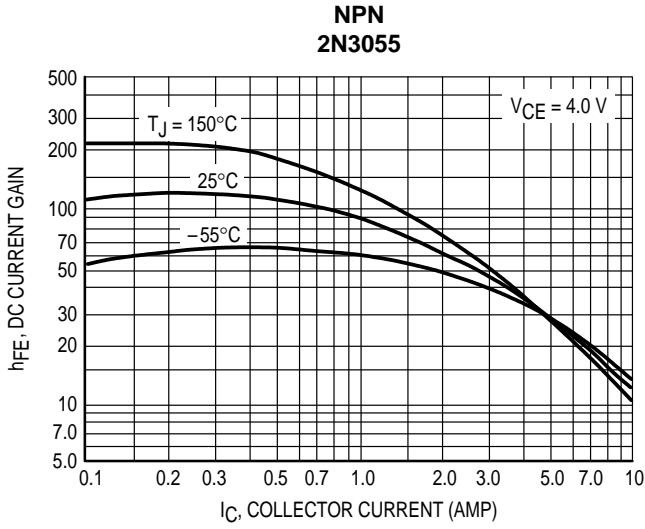


Figure 3. DC Current Gain

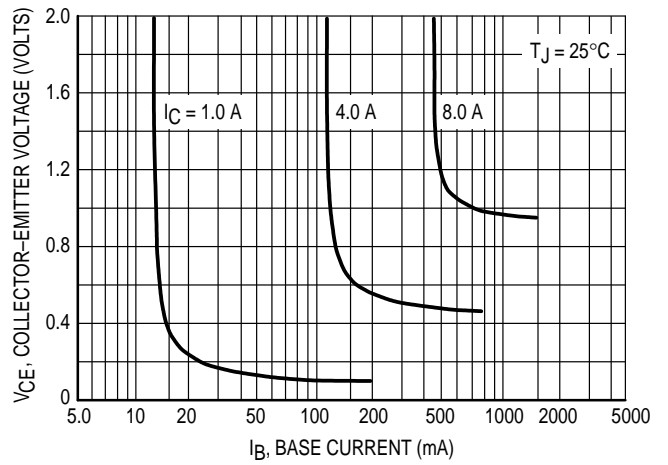
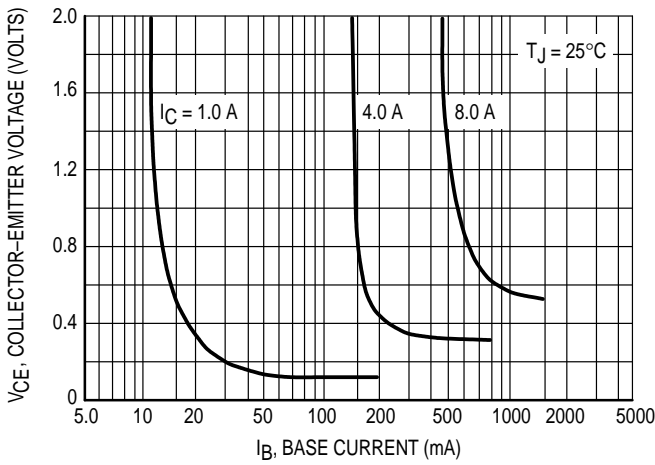


Figure 4. Collector Saturation Region

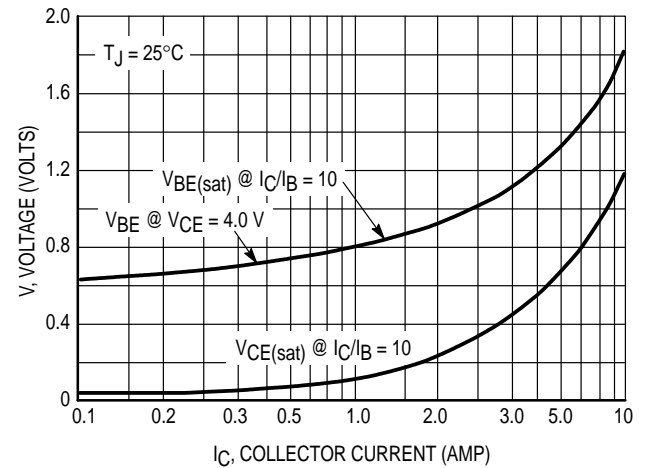
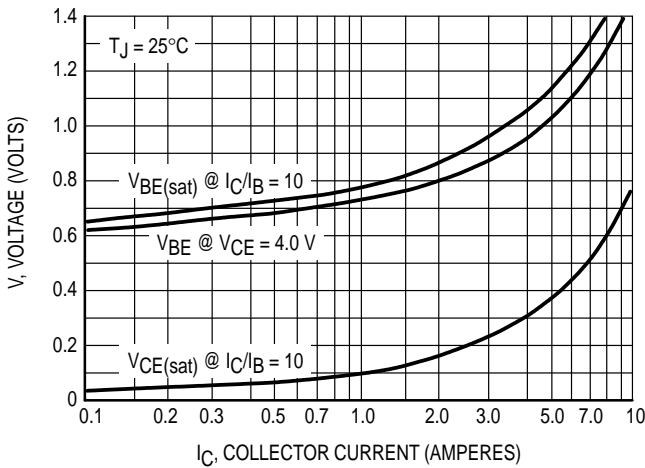
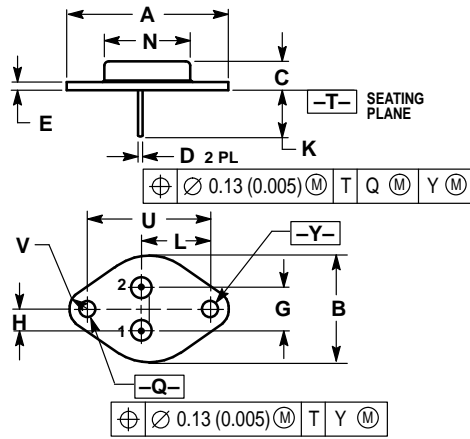


Figure 5. "On" Voltages

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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