

# Complementary Silicon Power Transistors

## 2N3055(NPN), MJ2955(PNP)

Complementary silicon power transistors are designed for general-purpose switching and amplifier applications.

### Features

- DC Current Gain –  $h_{FE} = 20-70 @ I_C = 4 \text{ A dc}$
- Collector–Emitter Saturation Voltage –  $V_{CE(sat)} = 1.1 \text{ Vdc (Max) @ } I_C = 4 \text{ A dc}$
- Excellent Safe Operating Area
- Pb–Free Packages are Available\*

### 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 dc                     |
| Base Current  | $I_B$          | 7            | A dc                     |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$          | 115<br>0.657 | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range                                      | $T_J, T_{stg}$ | -65 to +200  | $^\circ\text{C}$         |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

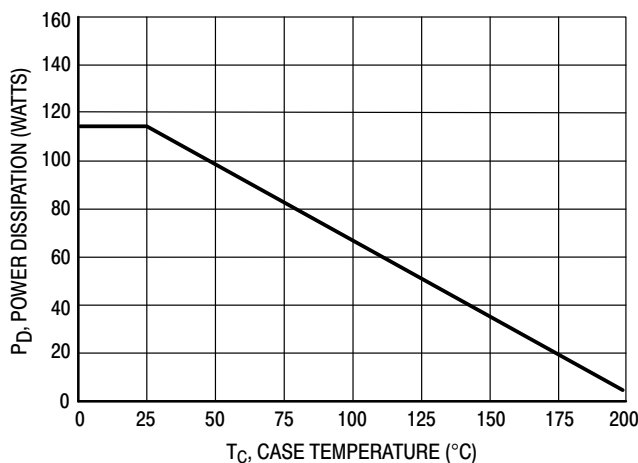
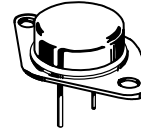


Figure 1. Power Derating

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

## 15 AMPERE POWER TRANSISTORS COMPLEMENTARY SILICON 60 VOLTS, 115 WATTS



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

### MARKING DIAGRAM



xxxx55 = Device Code  
xxxx = 2N30 or MJ20  
G = Pb–Free Package  
A = Location Code  
YY = Year  
WW = Work Week  
MEX = Country of Origin

### ORDERING INFORMATION

| Device  | Package               | Shipping         |
|---------|-----------------------|------------------|
| 2N3055  | TO-204AA              | 100 Units / Tray |
| 2N3055G | TO-204AA<br>(Pb–Free) | 100 Units / Tray |
| MJ2955  | TO-204AA              | 100 Units / Tray |
| MJ2955G | TO-204AA<br>(Pb–Free) | 100 Units / Tray |

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

## 2N3055(NPN), MJ2955(PNP)

### THERMAL CHARACTERISTICS

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

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

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

#### OFF CHARACTERISTICS\*

|  |                |    |            |      |
|--|----------------|----|------------|------|
| Collector-Emitter Sustaining Voltage (Note 1) ( $I_C = 200 \text{ mAdc}$ , $I_B = 0$ )   | $V_{CEO(sus)}$ | 60 | –          | Vdc  |
| Collector-Emitter Sustaining Voltage (Note 1) ( $I_C = 200 \text{ mAdc}$ , $R_{BE} = 100 \Omega$ )   | $V_{CER(sus)}$ | 70 | –          | Vdc  |
| Collector Cutoff Current ( $V_{CE} = 30 \text{ Vdc}$ , $I_B = 0$ )   | $I_{CEO}$      | –  | 0.7        | mAdc |
| 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 | mAdc |
| Emitter Cutoff Current ( $V_{BE} = 7.0 \text{ Vdc}$ , $I_C = 0$ )  | $I_{EBO}$      | –  | 5.0        | mAdc |

#### ON CHARACTERISTICS\* (Note 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 ( $I_C = 4.0 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ )   | $V_{BE(on)}$  | –         | 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 |
|---|-----------|------|---|-----|

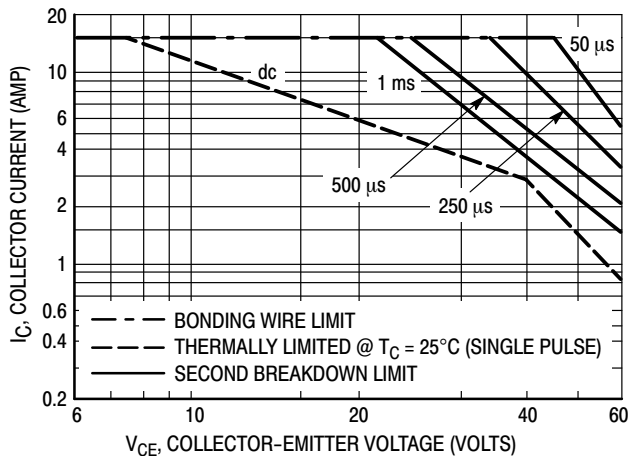
#### DYNAMIC CHARACTERISTICS

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

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

\*Indicates Within JEDEC Registration. (2N3055)

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



**Figure 2. 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 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.

## 2N3055(NPN), MJ2955(PNP)

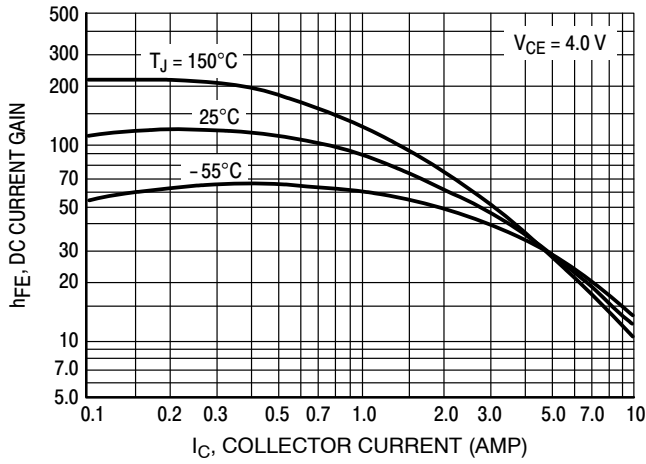


Figure 3. DC Current Gain, 2N3055 (NPN)

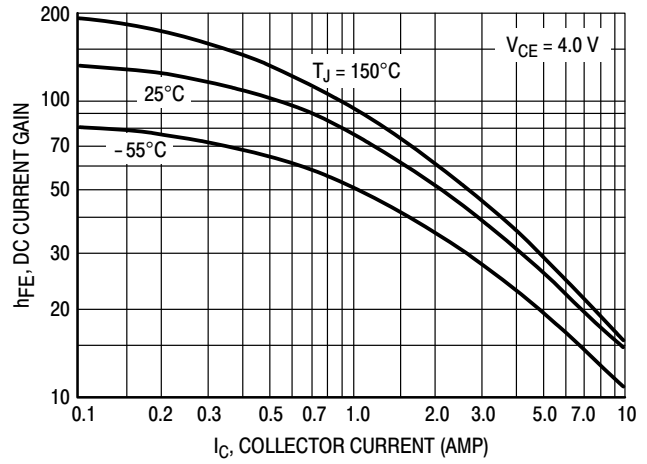


Figure 4. DC Current Gain, MJ2955 (PNP)

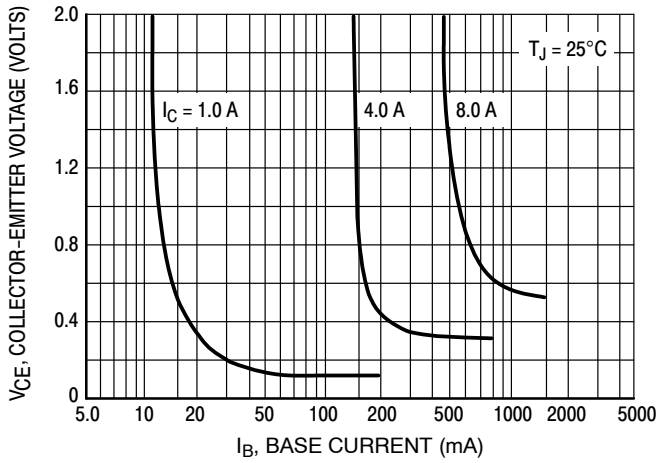


Figure 5. Collector Saturation Region, 2N3055 (NPN)

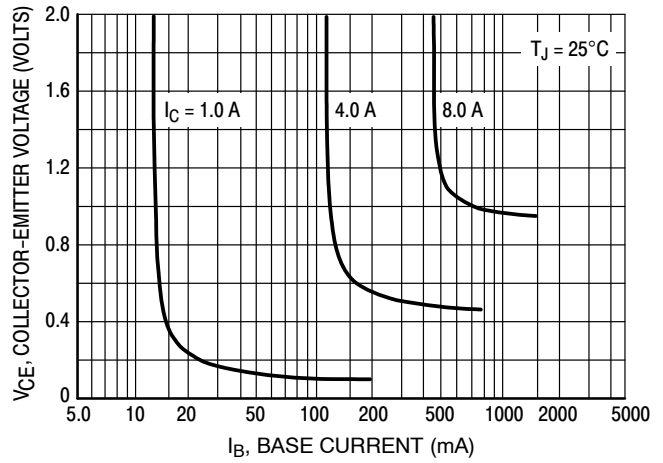


Figure 6. Collector Saturation Region, MJ2955 (PNP)

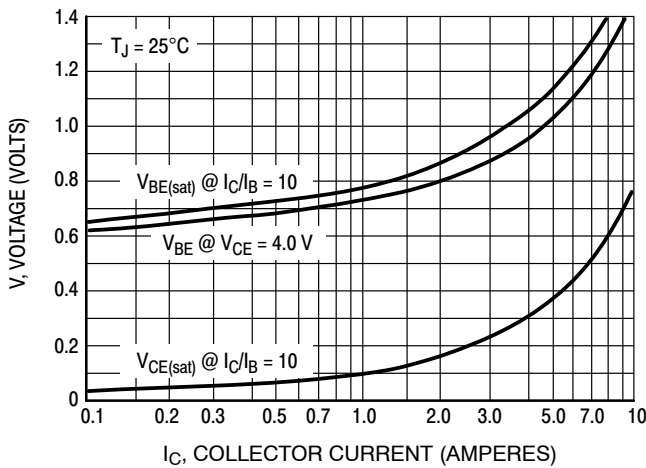


Figure 7. "On" Voltages, 2N3055 (NPN)

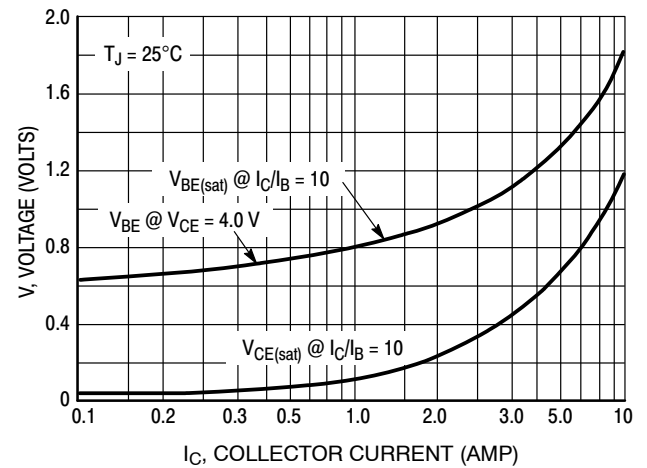
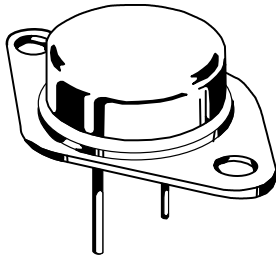


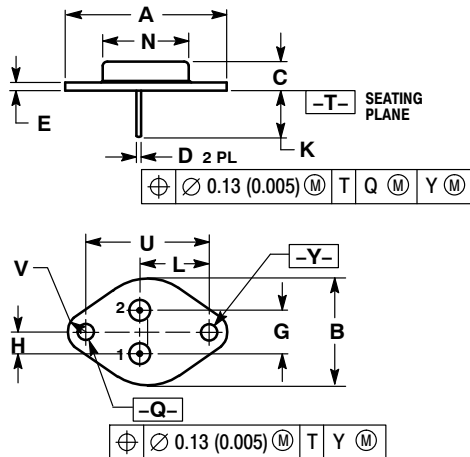
Figure 8. "On" Voltages, MJ2955 (PNP)



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

DATE 10 MAR 2000

SCALE 1:1



- 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  |

- |  |  |   |   |   |
|--|--|---|---|---|
| <p>STYLE 1:<br/>PIN 1. BASE<br/>2. EMITTER<br/>CASE: COLLECTOR</p> | <p>STYLE 2:<br/>PIN 1. BASE<br/>2. COLLECTOR<br/>CASE: EMITTER</p> | <p>STYLE 3:<br/>PIN 1. GATE<br/>2. SOURCE<br/>CASE: DRAIN</p>           | <p>STYLE 4:<br/>PIN 1. GROUND<br/>2. INPUT<br/>CASE: OUTPUT</p>       | <p>STYLE 5:<br/>PIN 1. CATHODE<br/>2. EXTERNAL TRIP/DELAY<br/>CASE: ANODE</p> |
| <p>STYLE 6:<br/>PIN 1. GATE<br/>2. EMITTER<br/>CASE: COLLECTOR</p> | <p>STYLE 7:<br/>PIN 1. ANODE<br/>2. OPEN<br/>CASE: CATHODE</p>     | <p>STYLE 8:<br/>PIN 1. CATHODE #1<br/>2. CATHODE #2<br/>CASE: ANODE</p> | <p>STYLE 9:<br/>PIN 1. ANODE #1<br/>2. ANODE #2<br/>CASE: CATHODE</p> |   |

|                  |               |   |
|------------------|---------------|---|
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| DESCRIPTION:     | TO-204 (TO-3) | PAGE 1 OF 1   |

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