

# 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 –  $h_{FE} = 20-70 @ I_C = 4 \text{ A}$
- Collector-Emitter Saturation Voltage –  
 $V_{CE(sat)} = 1.1 \text{ Vdc (Max) } @ I_C = 4 \text{ A}$
- 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
Base Current	$I_B$	7	A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above $25^\circ\text{C}$	$P_D$	115 0.657	W 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.

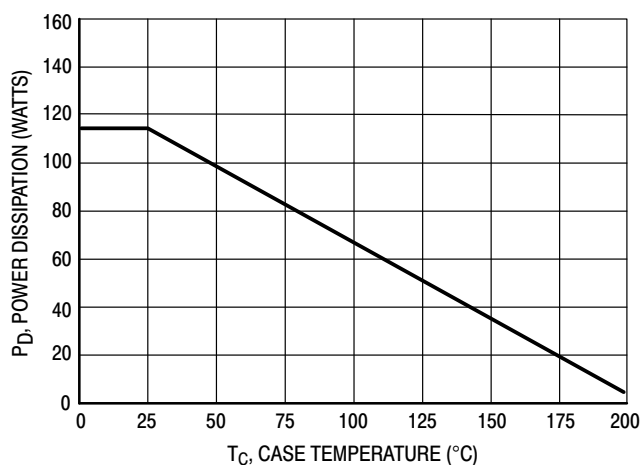
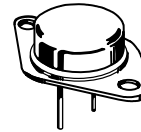


Figure 1. Power Derating

\*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 (Pb-Free)	100 Units / Tray
MJ2955	TO-204AA	100 Units / Tray
MJ2955G	TO-204AA (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	°C/W

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

Characteristic	Symbol	Min	Max	Unit
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#### OFF CHARACTERISTICS\*

Collector-Emitter Sustaining Voltage (Note 1) ( $I_C = 200\text{ mA}$ , $I_B = 0$ )	$V_{CEO(sus)}$	60	–	Vdc
Collector-Emitter Sustaining Voltage (Note 1) ( $I_C = 200\text{ mA}$ , $R_{BE} = 100\ \Omega$ )	$V_{CER(sus)}$	70	–	Vdc
Collector Cutoff Current ( $V_{CE} = 30\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	–	0.7	mA
Collector Cutoff Current ( $V_{CE} = 100\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ ) ( $V_{CE} = 100\text{ Vdc}$ , $V_{BE(off)} = 1.5\text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )	$I_{CEX}$	–	1.0 5.0	mA
Emitter Cutoff Current ( $V_{BE} = 7.0\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	–	5.0	mA

#### ON CHARACTERISTICS\* (Note 1)

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

#### SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased ( $V_{CE} = 40\text{ Vdc}$ , $t = 1.0\text{ s}$ , Nonrepetitive)	$I_{S/b}$	2.87	–	A
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#### DYNAMIC CHARACTERISTICS

Current Gain – Bandwidth Product ( $I_C = 0.5\text{ A}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$f_T$	2.5	–	MHz
*Small-Signal Current Gain ( $I_C = 1.0\text{ A}$ , $V_{CE} = 4.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	15	120	–
*Small-Signal Current Gain Cutoff Frequency ( $V_{CE} = 4.0\text{ Vdc}$ , $I_C = 1.0\text{ A}$ , $f = 1.0\text{ kHz}$ )	$f_{hfe}$	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  $\leq 2.0\%$ .

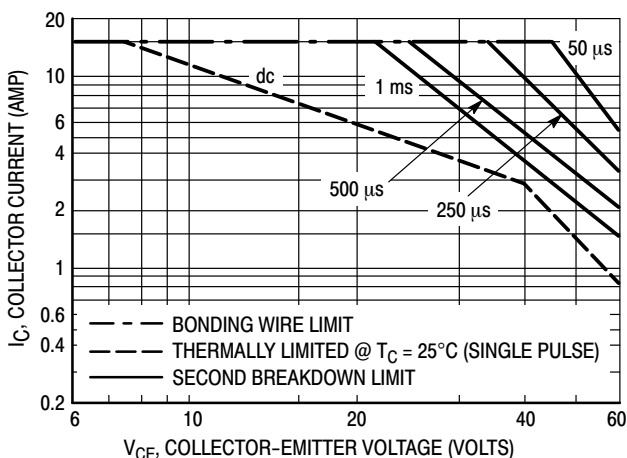


Figure 2. Active Region Safe Operating Area

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)

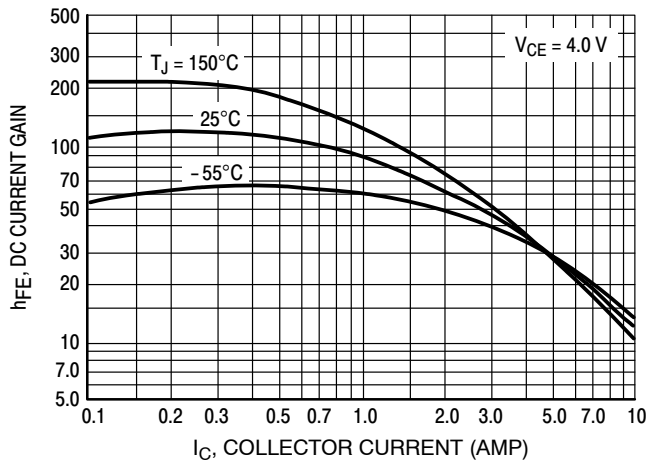


Figure 3. DC Current Gain, 2N3055 (NPN)

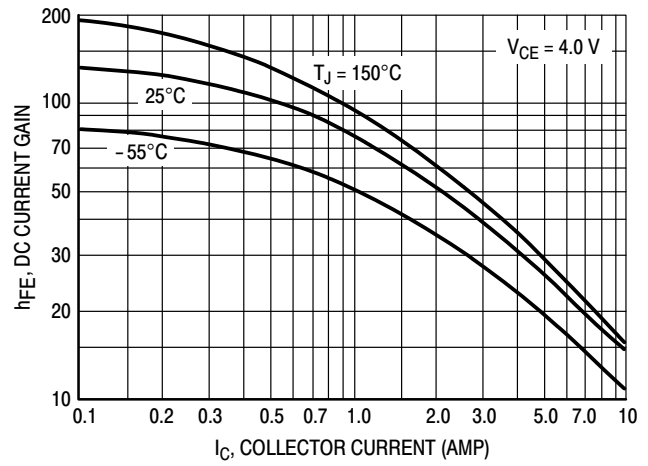


Figure 4. DC Current Gain, MJ2955 (PNP)

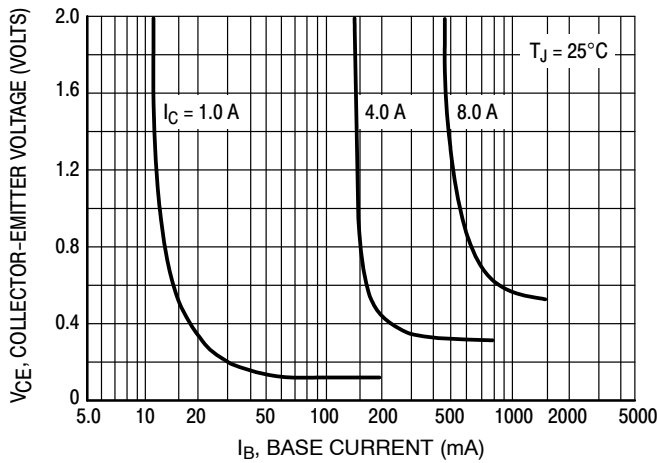


Figure 5. Collector Saturation Region, 2N3055 (NPN)

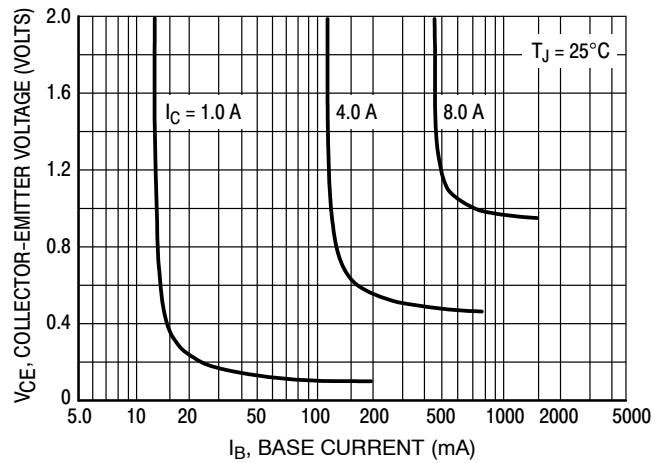


Figure 6. Collector Saturation Region, MJ2955 (PNP)

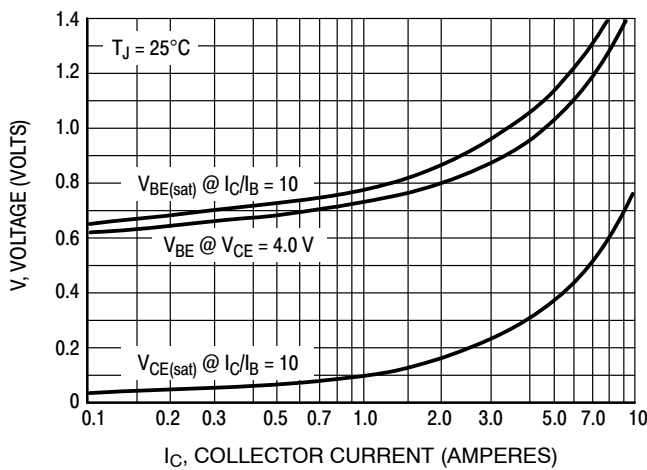


Figure 7. "On" Voltages, 2N3055 (NPN)

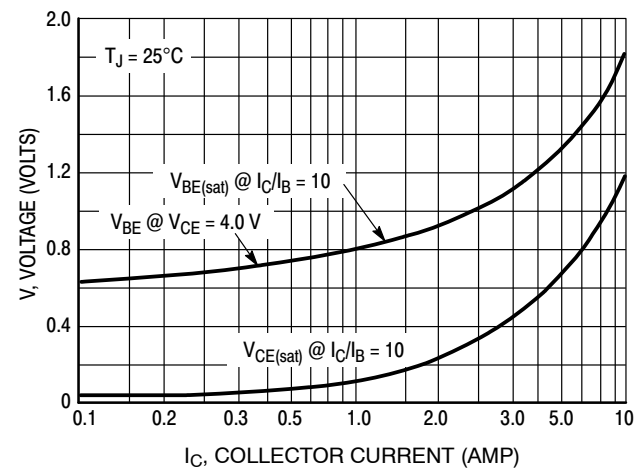
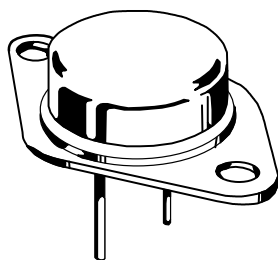


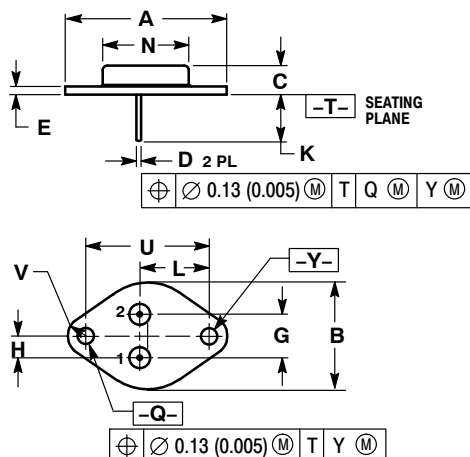
Figure 8. "On" Voltages, MJ2955 (PNP)



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

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

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

STYLE 3:  
PIN 1. GATE  
2. SOURCE  
CASE: DRAIN

STYLE 4:  
PIN 1. GROUND  
2. INPUT  
CASE: OUTPUT

STYLE 5:  
PIN 1. CATHODE  
2. EXTERNAL TRIP/DELAY  
CASE: ANODE

STYLE 6:  
PIN 1. GATE  
2. EMITTER  
CASE: COLLECTOR

STYLE 7:  
PIN 1. ANODE  
2. OPEN  
CASE: CATHODE

STYLE 8:  
PIN 1. CATHODE #1  
2. CATHODE #2  
CASE: ANODE

STYLE 9:  
PIN 1. ANODE #1  
2. ANODE #2  
CASE: CATHODE

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