

Complementary Silicon High-Power Transistors

...PowerBase™ complementary transistors designed for high power audio, stepping motor and other linear applications. These devices can also be used in power switching circuits such as relay or solenoid drivers, dc-to-dc converters, inverters, or for inductive loads requiring higher safe operating area than the 2N3055.

- Current-Gain — Bandwidth-Product @ $I_C = 1.0 \text{ A dc}$
 $f_T = 0.8 \text{ MHz (Min) - NPN}$
 $= 2.2 \text{ MHz (Min) - PNP}$
- Safe Operating Area — Rated to 60 V and 120 V, Respectively

*MAXIMUM RATINGS

Rating	Symbol	2N3055A	MJ15015 MJ15016	Unit
Collector-Emitter Voltage	V_{CEO}	60	120	Vdc
Collector-Base Voltage	V_{CBO}	100	200	Vdc
Collector-Emitter Voltage Base Reversed Biased	V_{CEV}	100	200	Vdc
Emitter-Base Voltage	V_{EBO}	7.0		Vdc
Collector Current — Continuous	I_C	15		A dc
Base Current	I_B	7.0		A dc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	115 0.65	180 1.03	Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		$^\circ\text{C}$

THERMAL CHARACTERISTICS

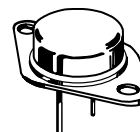
Characteristic	Symbol	Max	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.52	0.98	$^\circ\text{C/W}$

*Indicates JEDEC Registered Data. (2N3055A)

NPN
2N3055A
MJ15015 *
PNP
MJ15016 *

*ON Semiconductor Preferred Device

**15 AMPERE
 COMPLEMENTARY
 SILICON
 POWER TRANSISTORS
 60, 120 VOLTS
 115, 180 WATTS**



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

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

2N3055A MJ15015 MJ15016

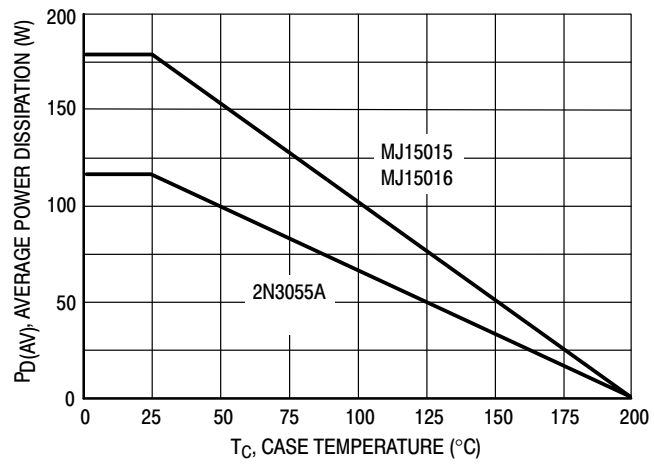


Figure 1. Power Derating

2N3055A MJ15015 MJ15016

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

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS (1)

*Collector–Emitter Sustaining Voltage ($I_C = 200\text{ mA}$, $I_B = 0$)	2N3055A MJ15015, MJ15016	$V_{CEO(sus)}$	60 120	— —	Vdc
Collector Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $V_{BE(off)} = 0\text{ Vdc}$) ($V_{CE} = 60\text{ Vdc}$, $V_{BE(off)} = 0\text{ Vdc}$)	2N3055A MJ15015, MJ15016	I_{CEO}	— —	0.7 0.1	mA
*Collector Cutoff Current ($V_{CEV} = \text{Rated Value}$, $V_{BE(off)} = 1.5\text{ Vdc}$)	2N3055A MJ15015, MJ15016	I_{CEV}	— —	5.0 1.0	mA
Collector Cutoff Current ($V_{CEV} = \text{Rated Value}$, $V_{BE(off)} = 1.5\text{ Vdc}$, $T_C = 150^\circ\text{C}$)	2N3055A MJ15015, MJ15016	I_{CEV}	— —	30 6.0	mA
Emitter Cutoff Current ($V_{EB} = 7.0\text{ Vdc}$, $I_C = 0$)	2N3055A MJ15015, MJ15016	I_{EBO}	— —	5.0 0.2	mA

*SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased ($t = 0.5\text{ s}$ non-repetitive) ($V_{CE} = 60\text{ Vdc}$)	2N3055A MJ15015, MJ15016	$I_{S/b}$	1.95 3.0	— —	A
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*ON CHARACTERISTICS (1)

DC Current Gain ($I_C = 4.0\text{ A}$, $V_{CE} = 2.0\text{ Vdc}$) ($I_C = 4.0\text{ A}$, $V_{CE} = 4.0\text{ Vdc}$) ($I_C = 10\text{ A}$, $V_{CE} = 4.0\text{ Vdc}$)	h_{FE}	10 20 5.0	70 70 —	—
Collector–Emitter Saturation Voltage ($I_C = 4.0\text{ A}$, $I_B = 400\text{ mA}$) ($I_C = 10\text{ A}$, $I_B = 3.3\text{ A}$) ($I_C = 15\text{ A}$, $I_B = 7.0\text{ A}$)	$V_{CE(sat)}$	— — —	1.1 3.0 5.0	Vdc
Base–Emitter On Voltage ($I_C = 4.0\text{ A}$, $V_{CE} = 4.0\text{ Vdc}$)	$V_{BE(on)}$	0.7	1.8	Vdc

*DYNAMIC CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 1.0\text{ A}$, $V_{CE} = 4.0\text{ Vdc}$, $f = 1.0\text{ MHz}$)	2N3055A, MJ15015 MJ15016	f_T	0.8 2.2	6.0 18	MHz
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)		C_{ob}	60	600	pF

*SWITCHING CHARACTERISTICS (2N3055A only)

RESISTIVE LOAD					
Delay Time	$(V_{CC} = 30\text{ Vdc}$, $I_C = 4.0\text{ A}$, $I_{B1} = I_{B2} = 0.4\text{ A}$, $t_p = 25\text{ }\mu\text{s}$ Duty Cycle $\leq 2\%$)	t_d	—	0.5	μs
Rise Time		t_r	—	4.0	μs
Storage Time		t_s	—	3.0	μs
Fall Time		t_f	—	6.0	μs

(1) Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2\%$.

*Indicates JEDEC Registered Data. (2N3055A)

2N3055A MJ15015 MJ15016

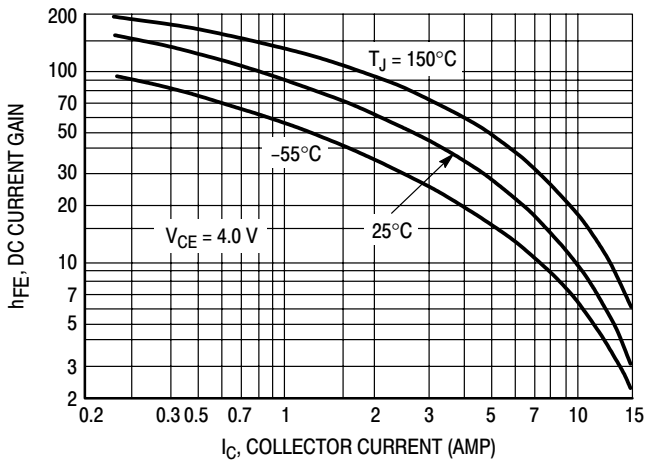


Figure 2. DC Current Gain

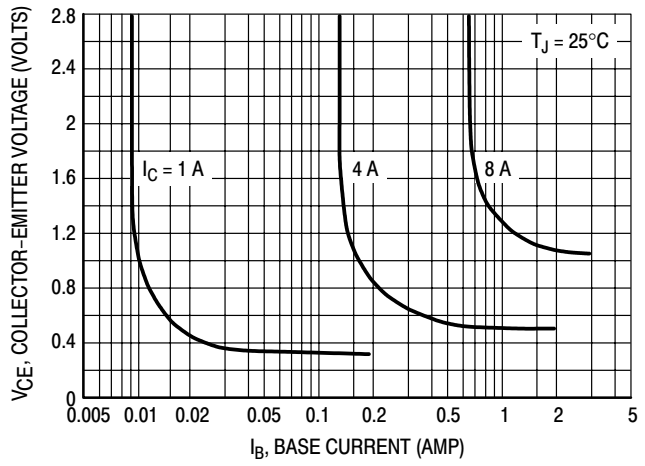


Figure 3. Collector Saturation Region

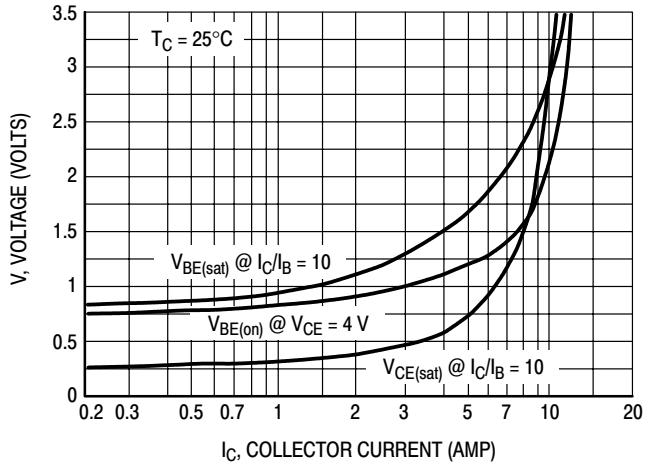


Figure 4. "On" Voltages

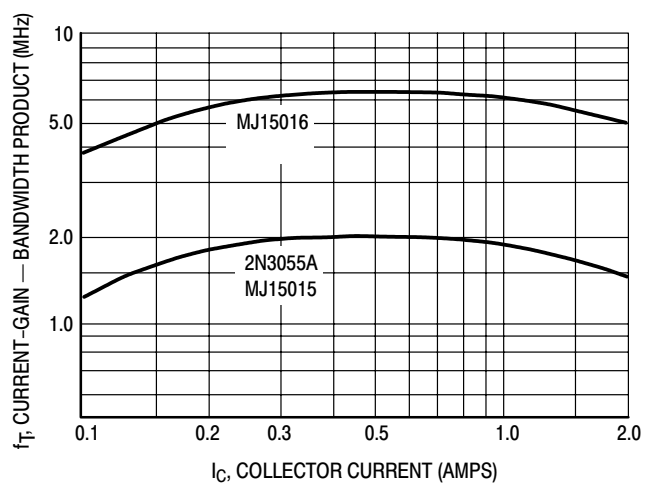


Figure 5. Current-Gain — Bandwidth Product

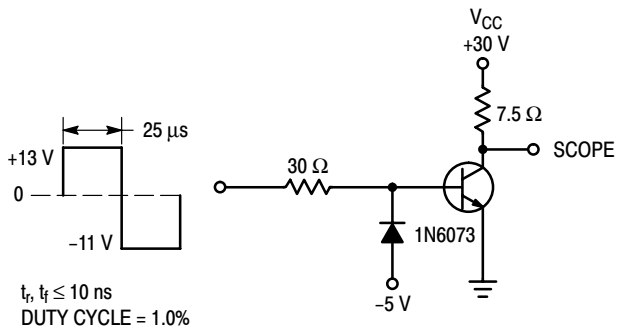


Figure 6. Switching Times Test Circuit (Circuit shown is for NPN)

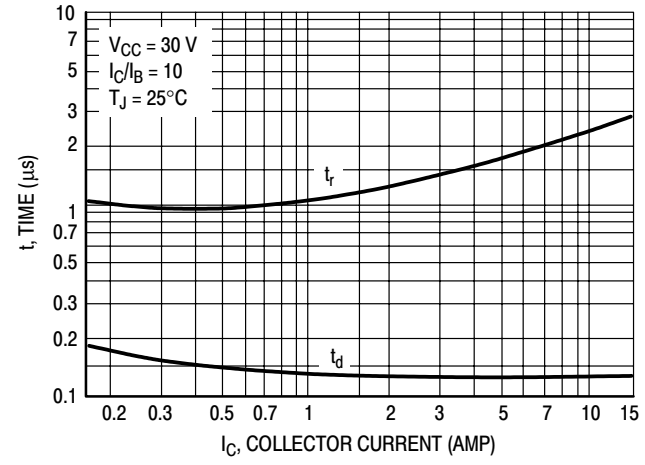


Figure 7. Turn-On Time

2N3055A MJ15015 MJ15016

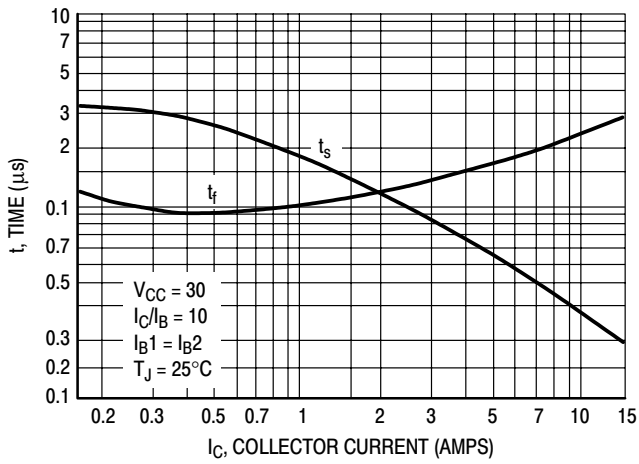


Figure 8. Turn-Off Times

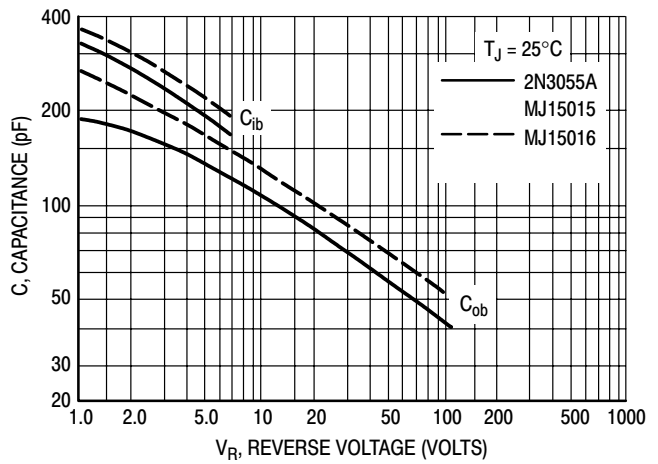


Figure 9. Capacitances

COLLECTOR CUT-OFF REGION

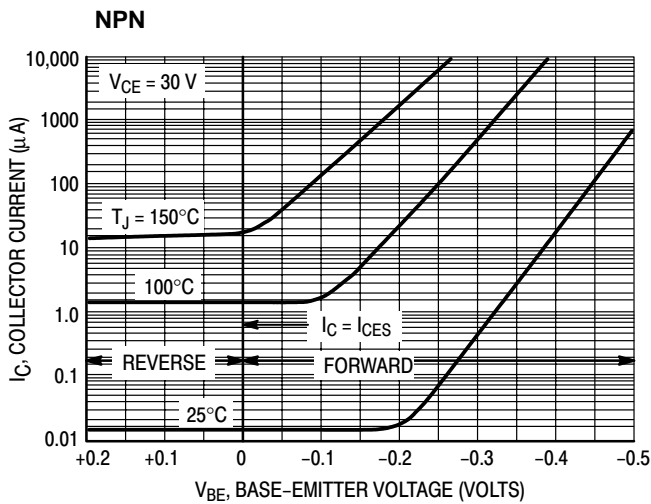


Figure 10. 2N3055A, MJ15015

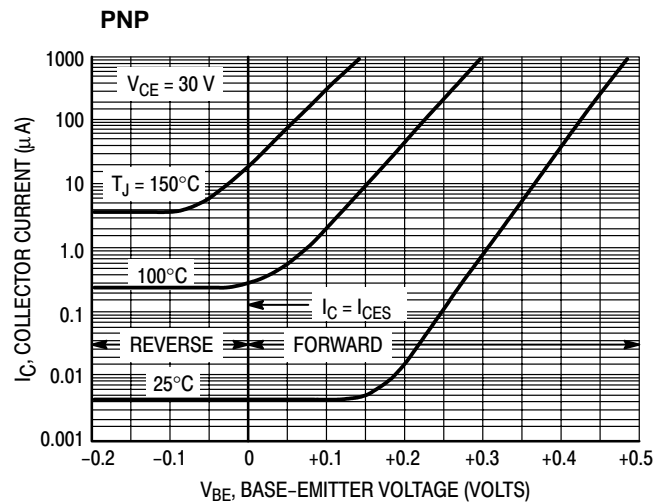
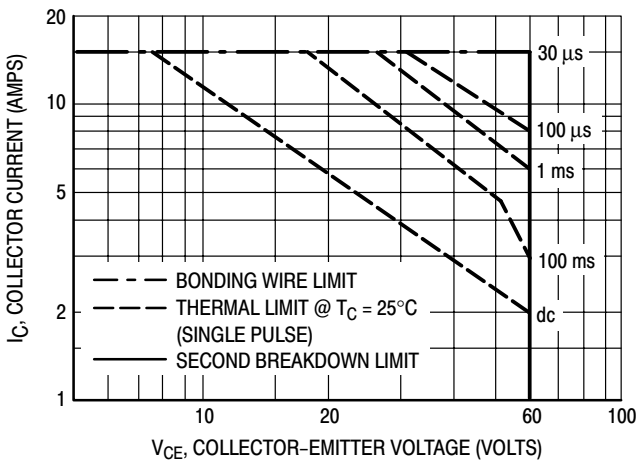
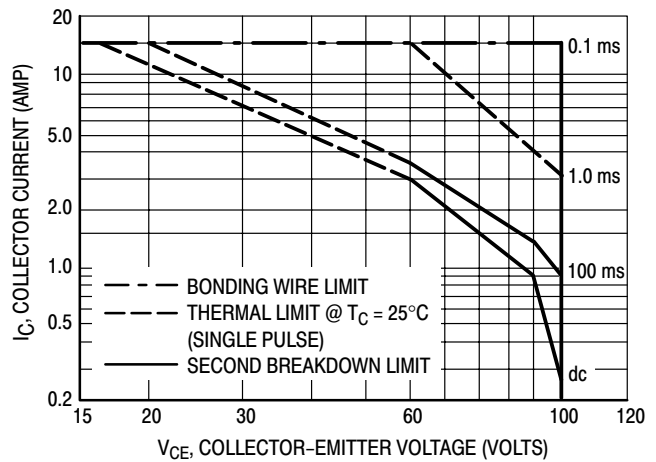


Figure 11. MJ15016



**Figure 12. Forward Bias Safe Operating Area
2N3055A**



**Figure 13. Forward Bias Safe Operating Area
MJ15015, MJ15016**

2N3055A MJ15015 MJ15016

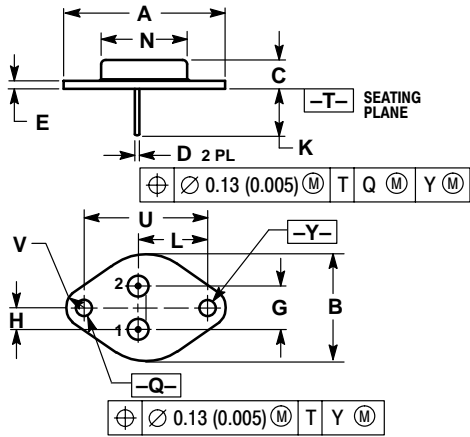
There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe Operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation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

The data of Figures 12 and 13 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.

2N3055A MJ15015 MJ15016

PACKAGE DIMENSIONS

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



- 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

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JAPAN: ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031
Phone: 81-3-5740-2700
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