MJ500 (SILICON)
MJ501

MEDIUM-POWER PNP SILICON TRANSISTORS

. . . designed for switching and wide-band amplifier applications.

- Low Collector Emitter Saturation Voltage –
  $V_{CE(sat)}$ = 1.2 Vdc (Max) @ I_C = 7.0 Adc
- DC Current Gain Specified to 5 Amperes
- Excellent Safe Operating Area
- Packaged in the Compact, High Dissipation TO-59 Case
- Collector Common to Case

7 AMPERE
POWER TRANSISTORS
PNP SILICON

60-80 VOLTS
60 WATTS

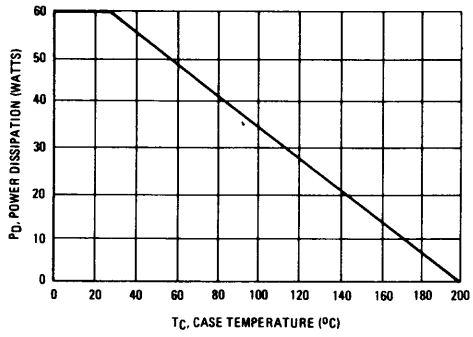
MAXIMUM RATINGS

Rating	Symbol	MJ500	MJ501	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 – Continuous	I_C	7.0		Adc
Base Current – Continuous	I_B	1.0		Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	60 343		Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		°C

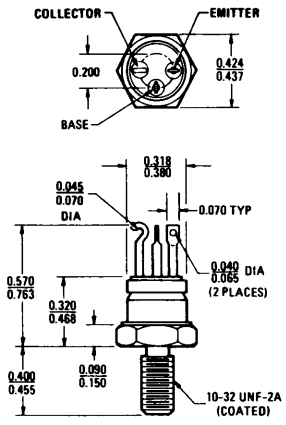
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	2.91	°C/W

FIGURE 1 – POWER-TEMPERATURE DERATING CURVE



Safe Area Curves are indicated by Figure 2.
All limits are applicable and must be observed.



CASE 160A
TO-59
Collector Common
to Case

MJ3801 (SILICON)
MJ3802

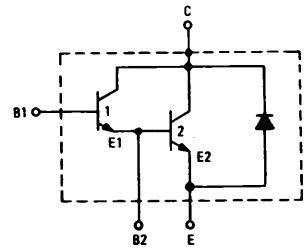
MEDIUM POWER NPN SILICON TRANSISTORS

. . . designed for use in industrial and military amplifier and switching systems.

- High DC Current Gain –
  h_{FE} = 1,000 (Min) @ I_C = 10 Adc
- Low Collector-Emitter Cutoff Current –
  I_{CE2S} = 10 μAdc (Max) @ V_{CE2} = 80 Vdc
- Darlington Connection

10 AMPERE
POWER TRANSISTORS
NPN SILICON

80 VOLTS
40 WATTS

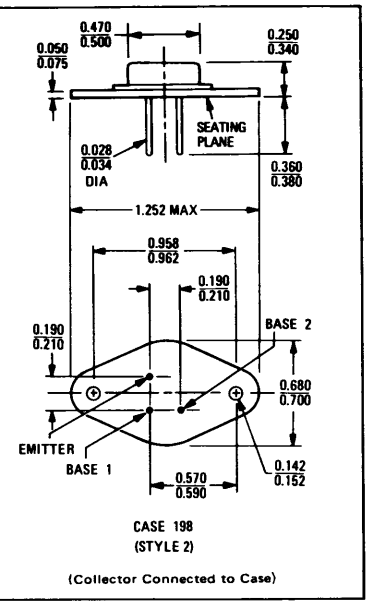


MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CE20}	80	Vdc
Collector-Base Voltage	V_{CB1}	80	Vdc
Collector-Base Voltage	V_{CB2}	80	Vdc
Emitter-Base Voltage	V_{E2B1}	15	Vdc
Emitter-Base Voltage	V_{E2B2}	7.5	Vdc
Emitter-Base Voltage	V_{E1B1}	7.5	Vdc
Collector Current – Continuous Peak	I_C	10 15	Adc
Base Current	I_{B1}	0.5	Adc
Base Current	I_{B2}	2.0	Adc
Commutating-Diode Current	I_D	10	Adc
Total Device Dissipation @ T_C = 25°C Derate linearly from 25°C	P_D	40 0.228	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200	°C

THERMAL CHARACTERISTICS

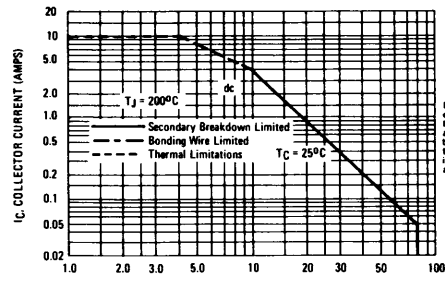
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	4.38	°C/W



CASE 198
(STYLE 2)

(Collector Connected to Case)

FIGURE 1 – DC SAFE OPERATING AREA



The Safe Operating Area Curves indicate I_C-V_{CE} limits below which the device will not enter secondary breakdown. Collector load lines for specific circuits must fall within the applicable Safe Area to avoid causing a catastrophic failure. To insure operation below the maximum T_J, power-temperature derating must be observed for both steady state and pulse power conditions.

NPN
2N3055A · MJ15015
PNP
MJ2955A · MJ15016

COMPLEMENTARY SILICON HIGH-POWER TRANSISTORS

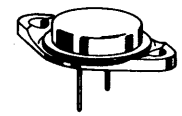
. . . PowerBase complementary transistors designed for high power audio, stepping motor and other linear applications. These devices can also be used in power switching circuits such as relay or solenoid drivers, dc-to-dc converters, inverters, or for inductive loads requiring higher safe operating area than the 2N3055 and MJ2955.

- Current-Gain – Bandwidth-Product @ I_C = 1 Adc
  f_T = 0.8 MHz (Min) – NPN
  = 2.2 MHz (Min) – PNP
- Safe Operating Area – Rated to 60 V and 120 V, Respectively

15 AMPERE

COMPLEMENTARY SILICON POWER TRANSISTORS

60, 120 VOLTS
115, 180 WATTS



***MAXIMUM RATINGS**

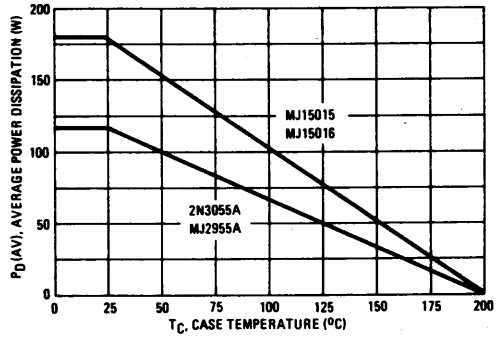
Rating	Symbol	2N3055A MJ2955A	MJ15015 MJ15016	Unit
Collector-Emitter Voltage	V_{CEO}	60	120	Vdc
Collector-Base Voltage	V_{CBO}	100	200	Vdc
Collector-Emitter Voltage Base Reversed Biased	V_{CEV}	100	200	Vdc
Emitter-Base Voltage	V_{EBO}	7.0		Vdc
Collector Current – Continuous	I_C	15		Adc
Base Current	I_B	7.0		Adc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	115 0.65	180 1.03	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +200		°C

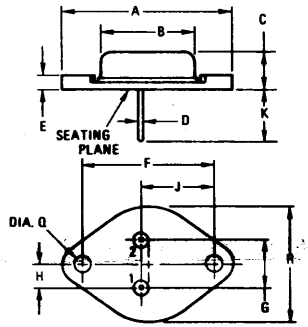
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	1.52	0.98	°C/W

*Indicates JEDEC Registered Data (2N3055A)

FIGURE 1 – POWER DERATING





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

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	–	39.37	–	1.550
B	–	21.08	–	0.830
C	6.35	7.62	0.250	0.300
D	0.99	1.09	0.039	0.043
E	–	3.43	–	0.135
F	29.90	30.40	1.177	1.197
G	10.67	11.18	0.420	0.440
H	5.33	5.59	0.210	0.220
J	16.64	17.15	0.655	0.675
K	11.18	12.19	0.440	0.480
Q	3.84	4.09	0.151	0.161
R	–	26.67	–	1.050

Collector connected to case.
CASE 11-01
(TO-3)

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted).

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS (1)					
*Collector-Emitter Sustaining Voltage (I_C = 200 mAdc, I_B = 0)	2N3055A, MJ2955A MJ15015, MJ15016	$V_{CEO(sus)}$	60 120	– –	Vdc
Collector Cutoff Current		I_{CEO}			mAdc
(V_{CE} = 30 Vdc, $V_{BE(off)}$ = 0 Vdc)	2N3055A, MJ2955A		–	0.7	
(V_{CE} = 60 Vdc, $V_{BE(off)}$ = 0 Vdc)	MJ15015, MJ15016		–	0.1	
*Collector Cutoff Current (V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc)	2N3055A, MJ2955A MJ15015, MJ15016	I_{CEV}	– –	5.0 1.0	mAdc
Collector Cutoff Current	2N3055A, MJ2955A	I_{CEV}	–	30	mAdc
(V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc, T_C = 150°C)	MJ15015, MJ15016		–	6.0	
*Emitter Cutoff Current (V_{EB} = 7 Vdc, I_C = 0)	2N3055A, MJ2955A MJ15015, MJ15016	I_{EBO}	– –	5.0 0.2	mAdc
***SECOND BREAKDOWN**					
Second Breakdown Collector Current with Base Forward Biased		$I_{S/b}$			Adc
(t = 0.5 s non-repetitive) (V_{CE} = 60 Vdc)	2N3055A, MJ2955A MJ15015, MJ15016		1.95 3.0	– –	
***ON CHARACTERISTICS (1)**					
DC Current Gain		h_{FE}			–
(I_C = 4.0 Adc, V_{CE} = 2.0 Vdc)			10	70	
(I_C = 4.0 Adc, V_{CE} = 4.0 Vdc)			20	70	
(I_C = 10 Adc, V_{CE} = 4.0 Vdc)			5.0	–	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = 4.0 Adc, I_B = 400 mAdc)			–	1.1	
(I_C = 10 Adc, I_B = 3.3 Adc)			–	3.0	
(I_C = 15 Adc, I_B = 7.0 Adc)			–	5.0	
Base-Emitter On Voltage (I_C = 4.0 Adc, V_{CE} = 4.0 Vdc)		$V_{BE(on)}$	0.7	1.8	Vdc
***DYNAMIC CHARACTERISTICS**					
Current-Gain–Bandwidth Product	2N3055A, MJ15015	f_T	0.8	6.0	MHz
(I_C = 1.0 Adc, V_{CE} = 4.0 Vdc, f = 1.0 MHz)	MJ2955A, MJ15016		2.2	18	
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)		C_{ob}	60	600	pF
***SWITCHING CHARACTERISTICS (2N3055A only)**					
RESISTIVE LOAD					
Delay Time	(V_{CC} = 30 Vdc, I_C = 4.0 Adc, I_{B1} = I_{B2} = 0.4 Adc, t_p = 25 μs Duty Cycle < 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 < 2%.
*Indicates JEDEC Registered Data (2N3055A)

FIGURE 2 – DC CURRENT GAIN

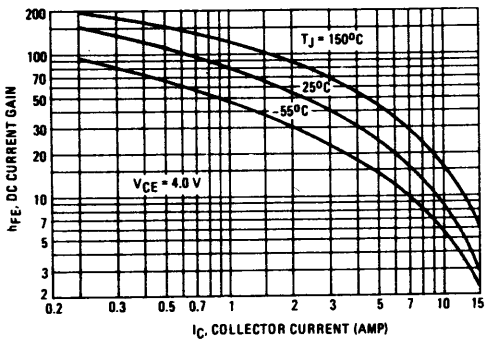


FIGURE 3 – COLLECTOR SATURATION REGION

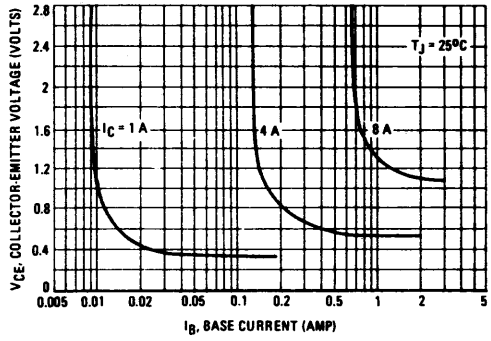


FIGURE 4 – "ON" VOLTAGES

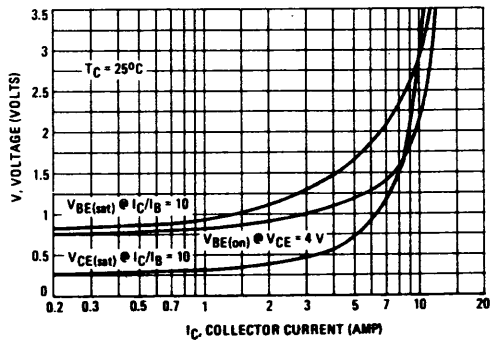


FIGURE 5 – CURRENT-GAIN–BANDWIDTH PRODUCT

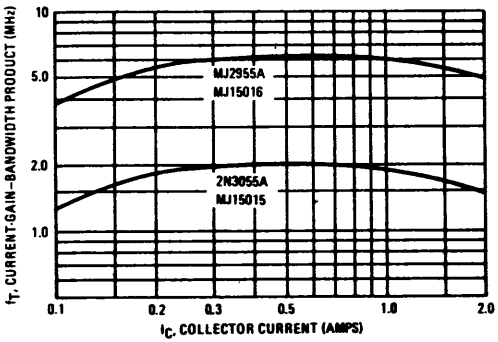


FIGURE 6 – SWITCHING TIMES TEST CIRCUIT
(Circuit shown is for NPN)

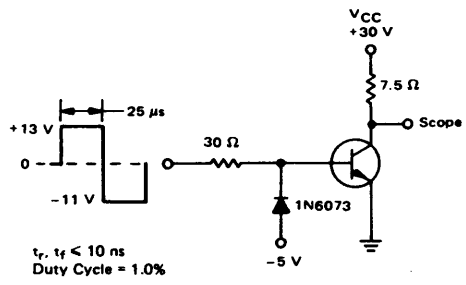


FIGURE 7 – TURN-ON TIME

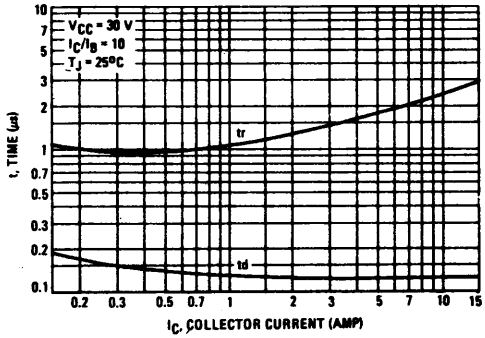


FIGURE 8 – TURN-OFF TIMES

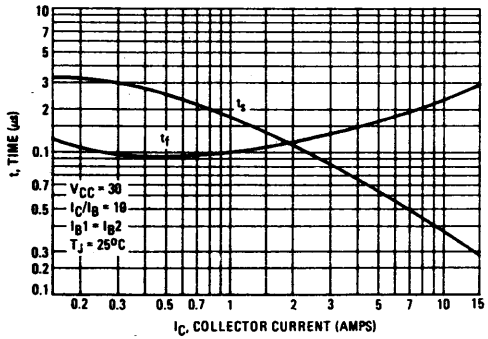
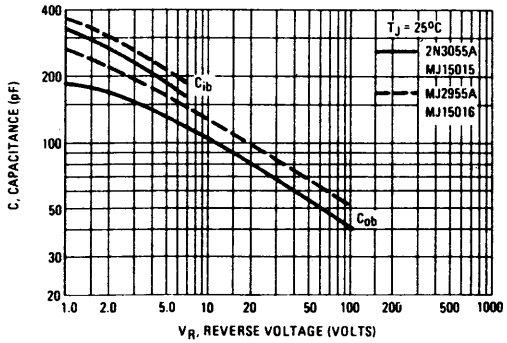


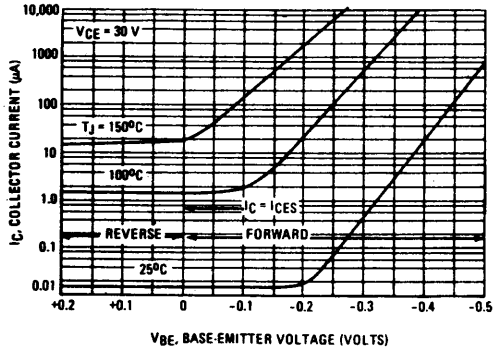
FIGURE 9 – CAPACITANCES



COLLECTOR CUT-OFF REGION

NPN

FIGURE 10 – 2N3065A, MJ15015



PNP

FIGURE 11 – MJ2955A, MJ15016

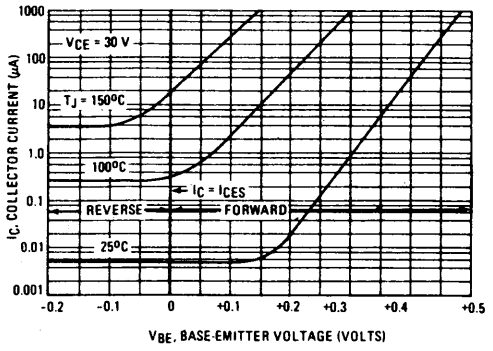


FIGURE 12 – FORWARD BIAS SAFE OPERATING AREA
2N3065A, MJ2955A

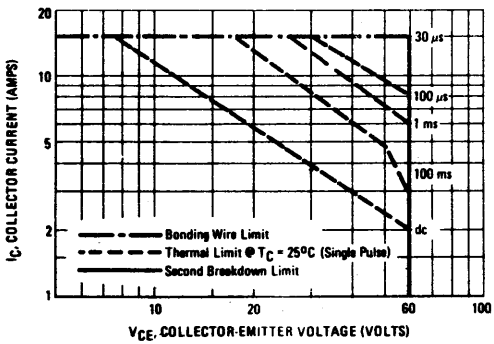
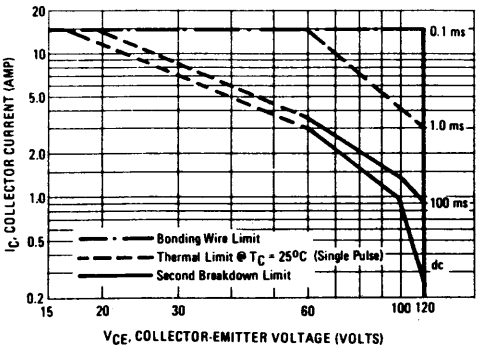


FIGURE 13 – FORWARD BIAS SAFE OPERATING AREA
MJ15015, MJ15016



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°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.