

# Complementary Silicon Plastic Power Transistors

... designed for use as high-frequency drivers in audio amplifiers.

- DC Current Gain Specified to 4.0 Amperes  
 $h_{FE} = 40$  (Min) @  $I_C = 3.0$  Adc  
 $= 20$  (Min) @  $I_C = 4.0$  Adc
- Collector-Emitter Sustaining Voltage —  
 $V_{CEO(sus)} = 120$  Vdc (Min) — MJE15028, MJE15029  
 $= 150$  Vdc (Min) — MJE15030, MJE15031
- High Current Gain — Bandwidth Product  
 $f_T = 30$  MHz (Min) @  $I_C = 500$  mAdc
- TO-220AB Compact Package

## MAXIMUM RATINGS

Rating	Symbol	MJE15028 MJE15029	MJE15030 MJE15031	Unit
Collector-Emitter Voltage	$V_{CEO}$	120	150	Vdc
Collector-Base Voltage	$V_{CB}$	120	150	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0		Vdc
Collector Current — Continuous — Peak	$I_C$	8.0 16		Adc
Base Current	$I_B$	2.0		Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	50 0.40		Watts W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2.0 0.016		Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150		$^\circ\text{C}$

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	2.5	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C}/\text{W}$

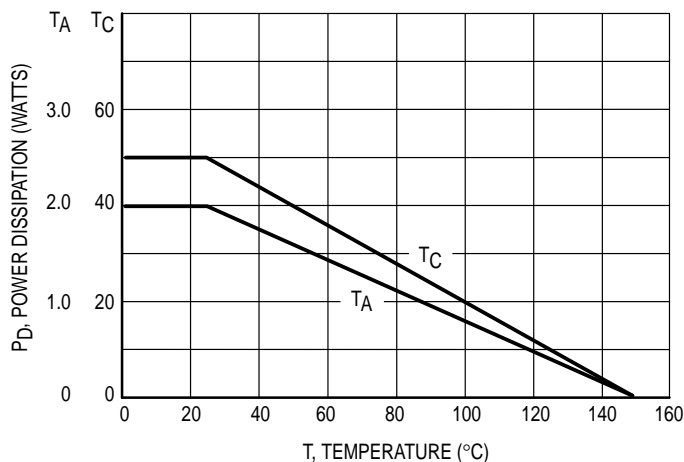


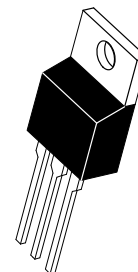
Figure 1. Power Derating

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

**NPN**  
**MJE15028\***  
**MJE15030\***  
**PNP**  
**MJE15029\***  
**MJE15031\***

\*Motorola Preferred Device

**8 AMPERE**  
**POWER TRANSISTORS**  
**COMPLEMENTARY**  
**SILICON**  
**120-150 VOLTS**  
**50 WATTS**



CASE 221A-06  
TO-220AB

# MJE15028 MJE15030 MJE15029 MJE15031

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage (1) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	120 150	— —	Vdc
Collector Cutoff Current (V <sub>CE</sub> = 120 Vdc, I <sub>B</sub> = 0) (V <sub>CE</sub> = 150 Vdc, I <sub>B</sub> = 0)	I <sub>CEO</sub>	— —	0.1 0.1	mAdc
Collector Cutoff Current (V <sub>CB</sub> = 120 Vdc, I <sub>E</sub> = 0) (V <sub>CB</sub> = 150 Vdc, I <sub>E</sub> = 0)	I <sub>CBO</sub>	— —	10 10	μAdc
Emitter Cutoff Current (V <sub>BE</sub> = 5.0 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	—	10	μAdc

## ON CHARACTERISTICS (1)

DC Current Gain (I <sub>C</sub> = 0.1 Adc, V <sub>CE</sub> = 2.0 Vdc) (I <sub>C</sub> = 2.0 Adc, V <sub>CE</sub> = 2.0 Vdc) (I <sub>C</sub> = 3.0 Adc, V <sub>CE</sub> = 2.0 Vdc) (I <sub>C</sub> = 4.0 Adc, V <sub>CE</sub> = 2.0 Vdc)	h <sub>FE</sub>	40 40 40 20	— — — —	—
DC Current Gain Linearity (V <sub>CE</sub> From 2.0 V to 20 V, I <sub>C</sub> From 0.1 A to 3 A) (NPN TO PNP)	h <sub>FE</sub>	Typ 2 3		
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 1.0 Adc, I <sub>B</sub> = 0.1 Adc)	V <sub>CE(sat)</sub>	—	0.5	Vdc
Base–Emitter On Voltage (I <sub>C</sub> = 1.0 Adc, V <sub>CE</sub> = 2.0 Vdc)	V <sub>BE(on)</sub>	—	1.0	Vdc

## DYNAMIC CHARACTERISTICS

Current Gain — Bandwidth Product (2) (I <sub>C</sub> = 500 mAdc, V <sub>CE</sub> = 10 Vdc, f <sub>test</sub> = 10 MHz)	f <sub>T</sub>	30	—	MHz
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- (1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.  
 (2) f<sub>T</sub> = |h<sub>fe</sub>| • f<sub>test</sub>.

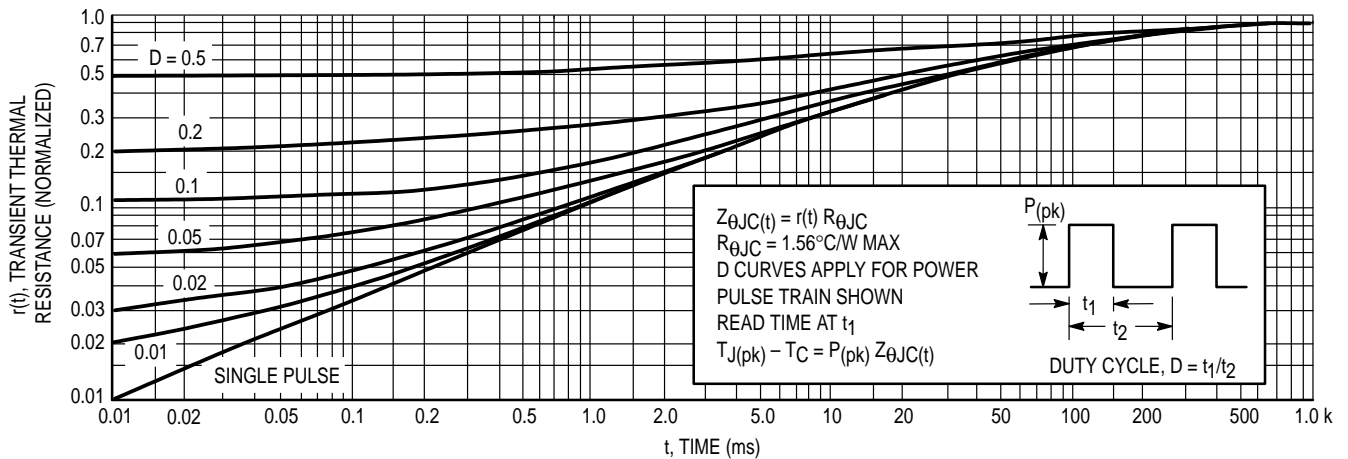


Figure 2. Thermal Response

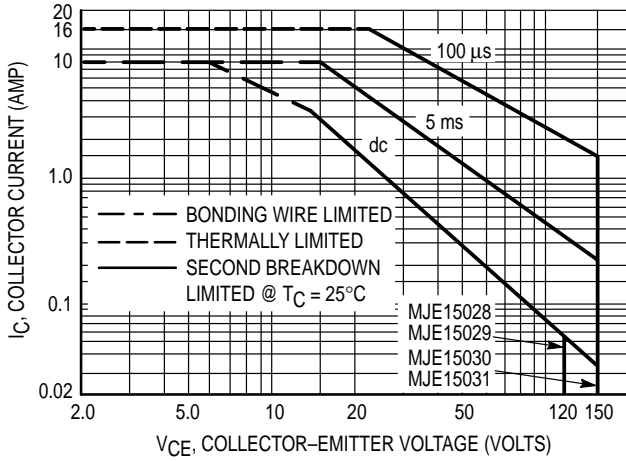


Figure 3. Forward Bias Safe Operating Area

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 Figures 3 and 4 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} < 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 2. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

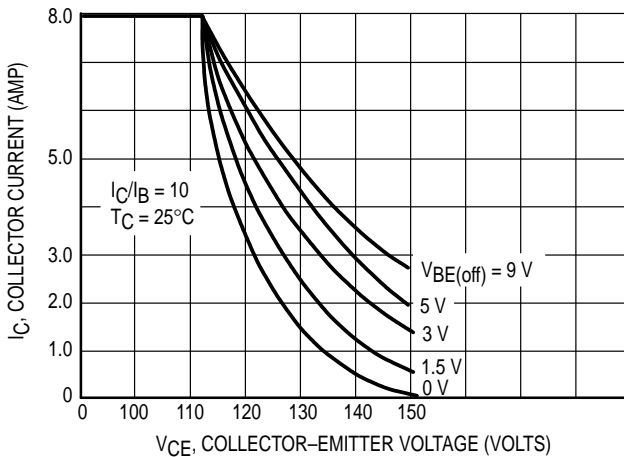


Figure 4. Reverse-Bias Switching Safe Operating Area

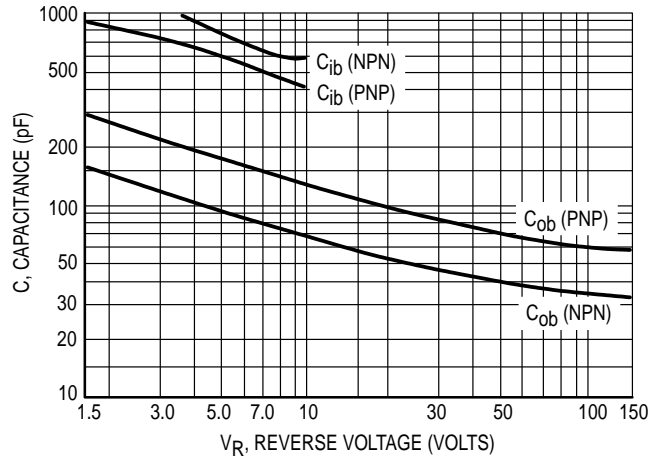


Figure 5. Capacitances

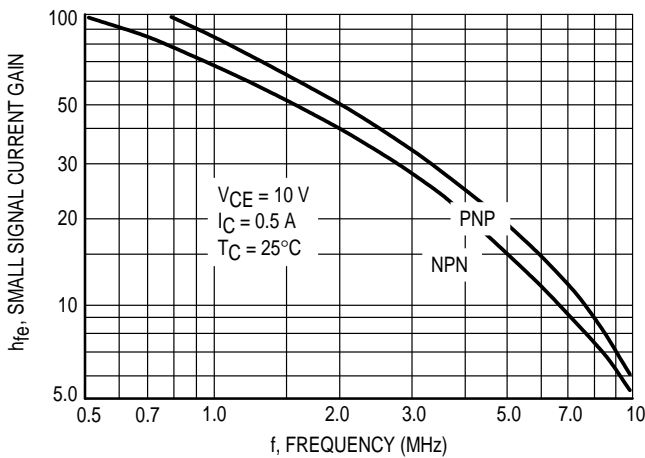


Figure 6. Small-Signal Current Gain

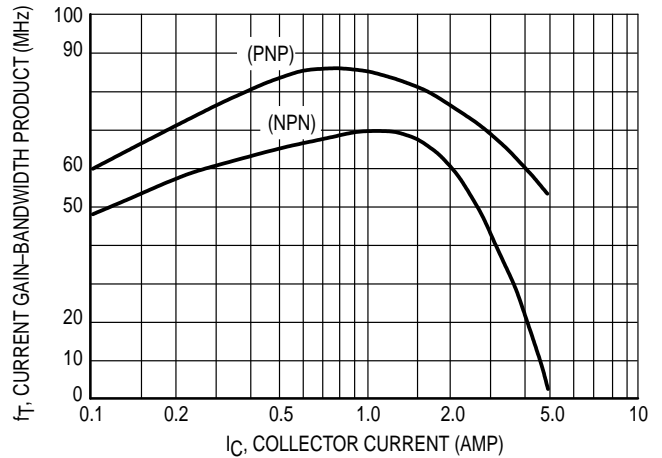
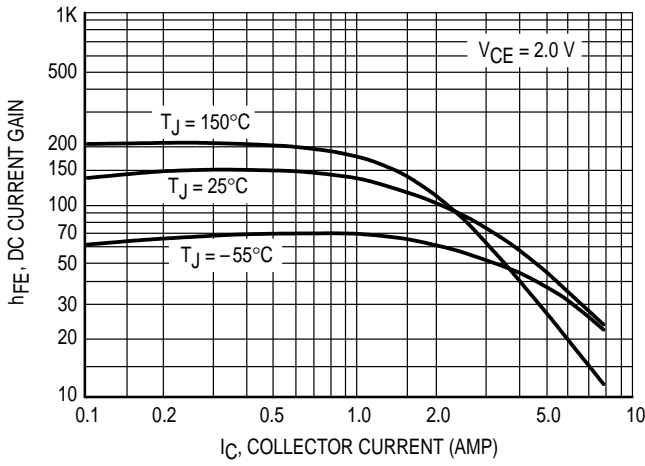


Figure 7. Current Gain-Bandwidth Product

NPN — MJE15028 MJE15030



PNP — MJE15029 MJE15031

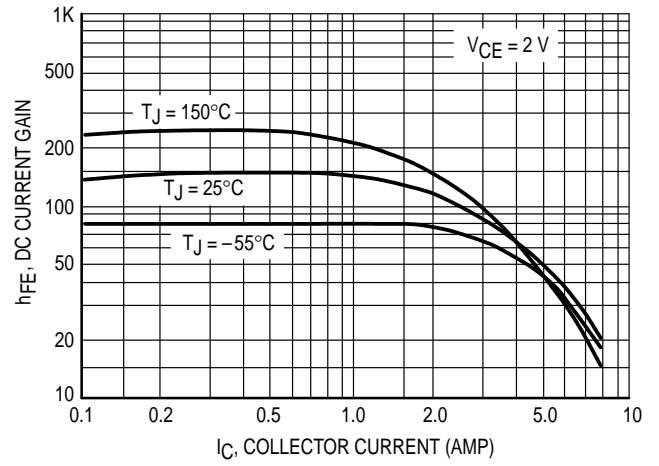
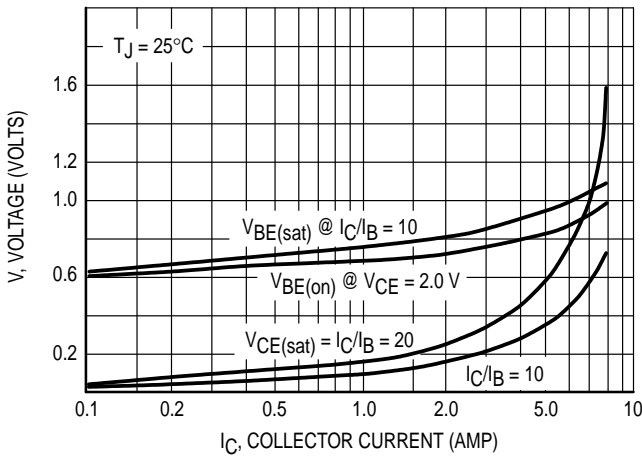


Figure 8. DC Current Gain

NPN



PNP

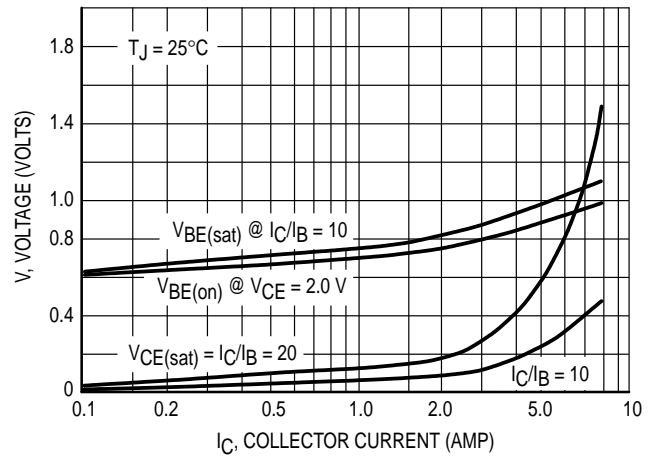


Figure 9. "On" Voltage

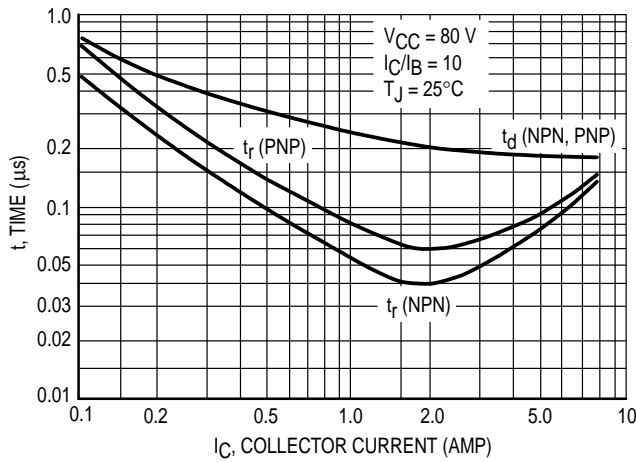


Figure 10. Turn-On Times

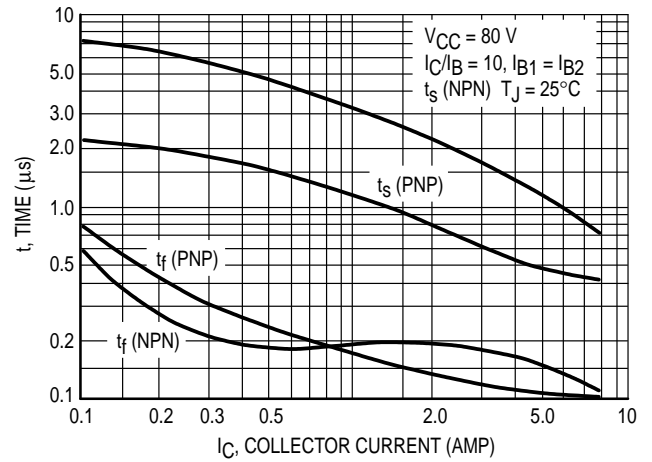


Figure 11. Turn-Off Times

PACKAGE DIMENSIONS




- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

- STYLE 1:
- PIN 1. BASE
  - COLLECTOR
  - EMITTER
  - COLLECTOR

CASE 221A-06  
TO-220AB  
ISSUE Y

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