

# (NPN) MJ11028, MJ11030, MJ11032 (PNP) MJ11029, MJ11033



## High-Current Complementary Silicon Power Transistors

... for use as output devices in complementary general purpose amplifier applications.

- High DC Current Gain –  
 $h_{FE} = 1000$  (Min) @  $I_C = 25$  Adc  
 $h_{FE} = 400$  (Min) @  $I_C = 50$  Adc
- Curves to 100 A (Pulsed)
- Diode Protection to Rated  $I_C$
- Monolithic Construction with Built-In Base-Emitter Shunt Resistor
- Junction Temperature to +200°C

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Collector-Emitter Voltage MJ11028/29 MJ11030 MJ11032/33	$V_{CEO}$	60 90 120	Vdc
Collector-Base Voltage MJ11028/29 MJ11030 MJ11032/33	$V_{CBO}$	60 90 120	Vdc
Emitter-Base Voltage	$V_{EBO}$	5.0	Vdc
Collector Current – Continuous – Peak (Note 1)	$I_C$	50 100	Adc
Base Current – Continuous	$I_B$	2.0	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above $25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	$P_D$	300 1.71	Watts W/°C
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-5 5 to +200	°C

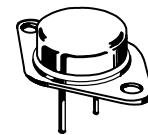
### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Maximum Lead Temperature for Soldering Purposes for $\leq 10$ seconds	$T_L$	275	°C
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.58	°C/W

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Pulse Test: Pulse Width = 5  $\mu\text{s}$ , Duty Cycle  $\leq 10\%$ .

**50 AMPERE  
COMPLEMENTARY  
DARLINGTON POWER  
TRANSISTORS  
60 – 120 VOLTS  
300 WATTS**



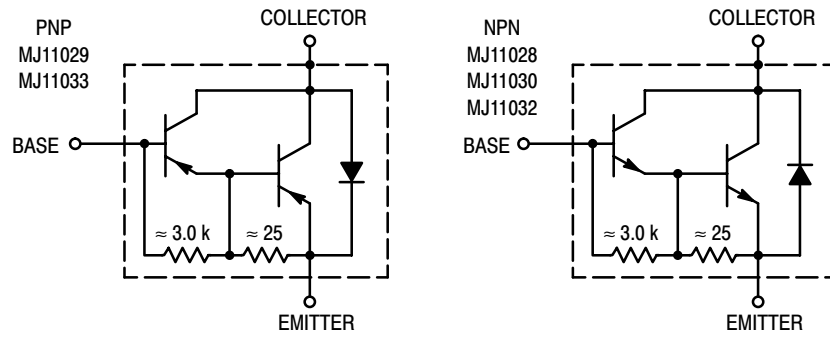
TO-204 (TO-3)  
CASE 197A  
STYLE 1

### MARKING DIAGRAM



xx = 28, 29, 30, 32, 33  
A = Location Code  
YY = Year  
WW = Work Week

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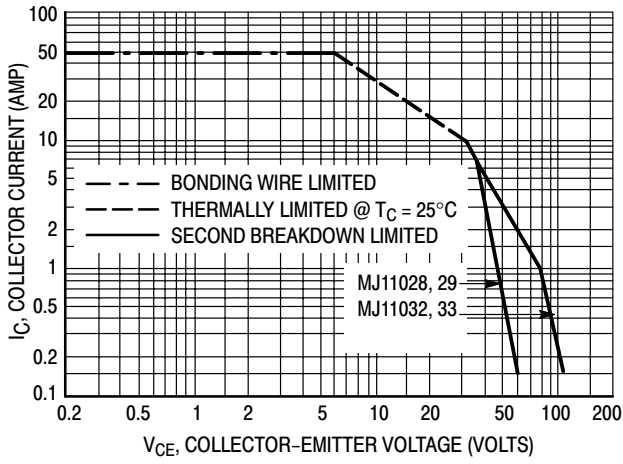
**Figure 1. Darlington Circuit Schematic**

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

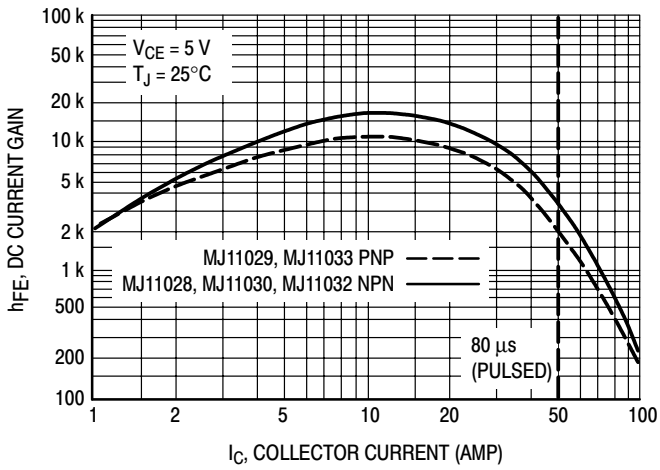
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage (Note 1) ( $I_C = 1.00\text{ mA}$ , $I_B = 0$ )	$V_{(BR)CEO}$	60 90 120	—	Vdc
Collector–Emitter Leakage Current ( $V_{CE} = 60\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ ) ( $V_{CE} = 90\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ ) ( $V_{CE} = 120\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ ) ( $V_{CE} = 60\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ , $T_C = 150^\circ\text{C}$ ) ( $V_{CE} = 120\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ , $T_C = 150^\circ\text{C}$ )	$I_{CER}$	— — — — —	2 2 2 10 10	mAdc
Emitter Cutoff Current ( $V_{BE} = 5\text{ Vdc}$ , $I_C = 0$ )	$I_{EBO}$	—	5	mAdc
Collector–Emitter Leakage Current ( $V_{CE} = 50\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	—	2	mAdc
<b>ON CHARACTERISTICS</b> (Note 1)				
DC Current Gain ( $I_C = 25\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ ) ( $I_C = 50\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )	$h_{FE}$	1 k 400	18 k —	—
Collector–Emitter Saturation Voltage ( $I_C = 25\text{ Adc}$ , $I_B = 250\text{ mA}$ ) ( $I_C = 50\text{ Adc}$ , $I_B = 500\text{ mA}$ )	$V_{CE(sat)}$	— —	2.5 3.5	Vdc
Base–Emitter Saturation Voltage ( $I_C = 25\text{ Adc}$ , $I_B = 200\text{ mA}$ ) ( $I_C = 50\text{ Adc}$ , $I_B = 300\text{ mA}$ )	$V_{BE(sat)}$	— —	3.0 4.5	Vdc

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

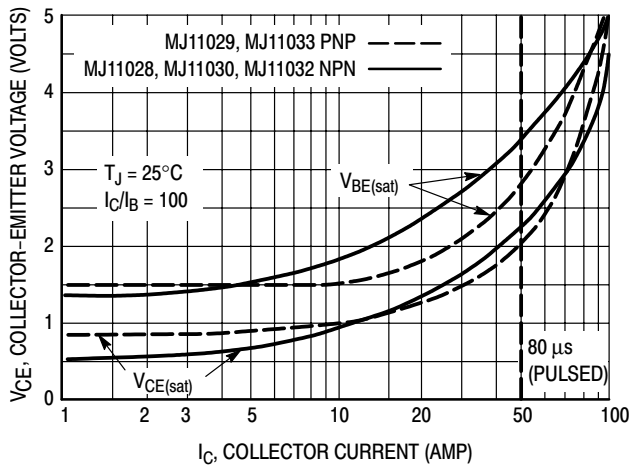
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**Figure 2. DC Safe Operating Area**



**Figure 3. DC Current Gain**



**Figure 4. "On" Voltage**

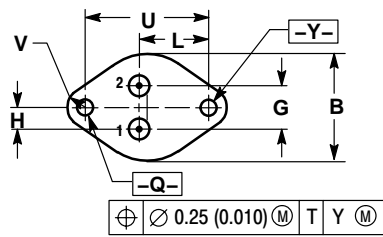
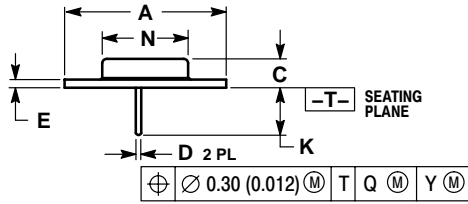
There are two limitations on the power-handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation, i.e., the transistor must not be subjected to greater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

The data of Figure 2 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

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## PACKAGE DIMENSIONS

TO-204 (TO-3)  
CASE 197A-05  
ISSUE K



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.530 REF		38.86 REF	
B	0.990	1.050	25.15	26.67
C	0.250	0.335	6.35	8.51
D	0.057	0.063	1.45	1.60
E	0.060	0.070	1.53	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	0.760	0.830	19.31	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