

# High-Current Complementary Silicon 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

Rating	Symbol	MJ11028 MJ11029	MJ11030 MJ11031	MJ11032 MJ11033	Unit
Collector-Emitter Voltage	$V_{CEO}$	60	90	120	Vdc
Collector-Base Voltage	$V_{CB}$	60	90	120	Vdc
Emitter-Base Voltage	$V_{EB}$	5			Vdc
Collector Current — Continuous Peak	$I_C$ $I_{CM}$	50 100			Adc
Base Current — Continuous	$I_B$	2			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	$T_J, T_{stg}$	-55 to +200			°C

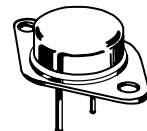
## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Maximum Lead Temperature for Soldering Purposes for $\leq 10$ seconds	$T_L$	275	°C
Thermal Resistance Junction to Case	$R_{\theta JC}$	0.584	°C

**NPN**  
**MJ11028**  
**MJ11030**  
**MJ11032\***  
**PNP**  
**MJ11029**  
**MJ11031**  
**MJ11033\***

\*Motorola Preferred Device

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



**CASE 197A-05  
TO-204AE (TO-3)**

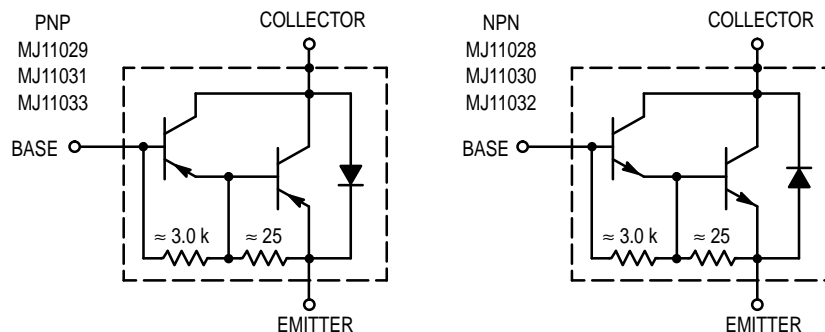


Figure 1. Darlington Circuit Schematic

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

# MJ11028 MJ11030 MJ11032 MJ11029 MJ11031 MJ11033

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage (1) (I <sub>C</sub> = 1 00 mAdc, I <sub>B</sub> = 0)	MJ11028, MJ11029 MJ11030, MJ11031 MJ11032, MJ11033	V <sub>(BR)CEO</sub>	60 90 120	Vdc
Collector–Emitter Leakage Current (V <sub>CE</sub> = 60 Vdc, R <sub>BE</sub> = 1 k ohm) (V <sub>CE</sub> = 90 Vdc, R <sub>BE</sub> = 1 k ohm) (V <sub>CE</sub> = 120 Vdc, R <sub>BE</sub> = 1 k ohm) (V <sub>CE</sub> = 60 Vdc, R <sub>BE</sub> = 1 k ohm, T <sub>C</sub> = 150°C) (V <sub>CE</sub> = 90 Vdc, R <sub>BE</sub> = 1 k ohm, T <sub>C</sub> = 150°C) (V <sub>CE</sub> = 120 Vdc, R <sub>BE</sub> = 1 k ohm, T <sub>C</sub> = 150°C)	MJ11028, MJ11029 MJ11030, MJ11031 MJ11032, MJ11033 MJ11028, MJ11029 MJ11030, MJ11031 MJ11032, MJ11033	I <sub>CER</sub>	— — — — — —	2 2 2 10 10 10
Emitter Cutoff Current (V <sub>BE</sub> = 5 Vdc, I <sub>C</sub> = 0)		I <sub>EBO</sub>	—	5
Collector–Emitter Leakage Current (V <sub>CE</sub> = 50 Vdc, I <sub>B</sub> = 0)		I <sub>CEO</sub>	—	2
<b>ON CHARACTERISTICS (1)</b>				
DC Current Gain (I <sub>C</sub> = 25 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 50 Adc, V <sub>CE</sub> = 5 Vdc)		h <sub>FE</sub>	1 k 400	18 k —
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 25 Adc, I <sub>B</sub> = 250 mAdc) (I <sub>C</sub> = 50 Adc, I <sub>B</sub> = 500 mAdc)		V <sub>CE(sat)</sub>	— —	2.5 3.5
Base–Emitter Saturation Voltage (I <sub>C</sub> = 25 Adc, I <sub>B</sub> = 200 mAdc) (I <sub>C</sub> = 50 Adc, I <sub>B</sub> = 300 mAdc)		V <sub>BE(sat)</sub>	— —	3.0 4.5

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

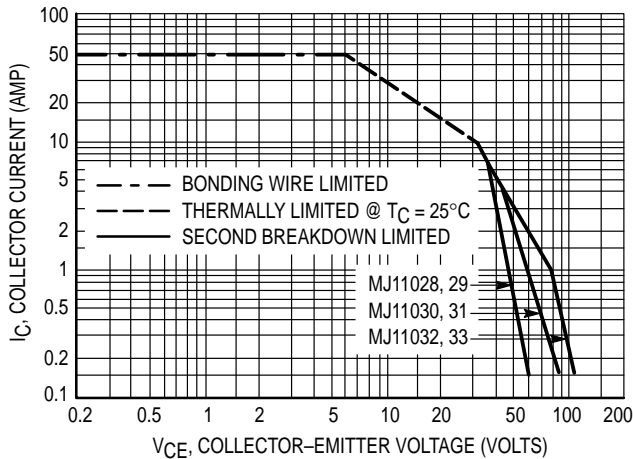


Figure 2. DC Safe Operating Area

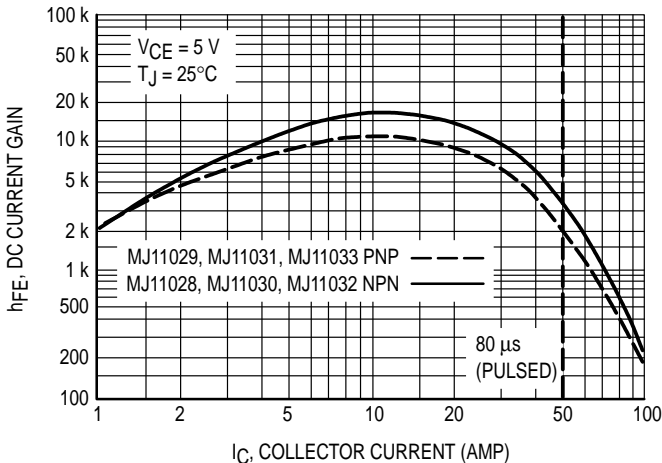


Figure 3. DC Current Gain

There are two limitations on the power-handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate I<sub>C</sub> – V<sub>CE</sub> 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<sub>J(pk)</sub> = 200°C; T<sub>C</sub> 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.

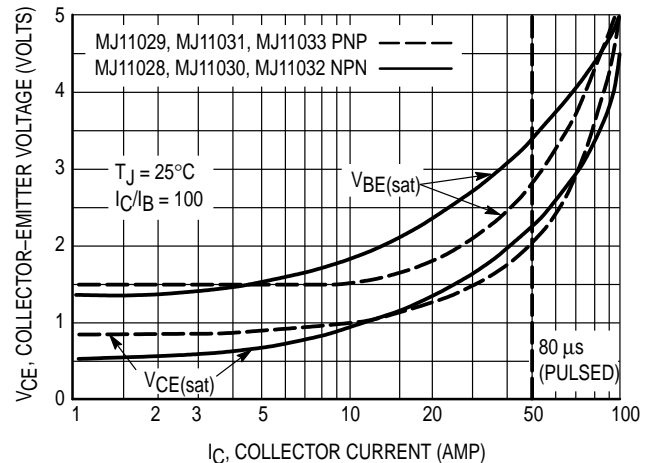
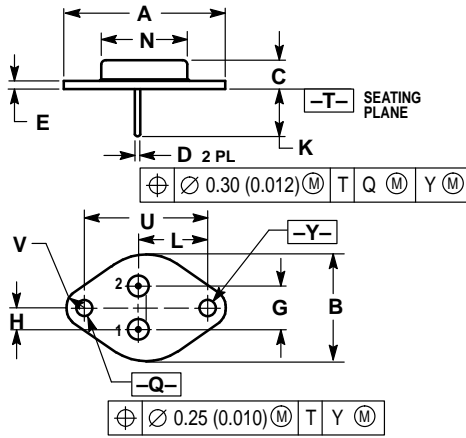


Figure 4. "On" Voltage

PACKAGE DIMENSIONS




- 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

CASE 197A-05  
 TO-204AE (TO-3)  
 ISSUE J

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