

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



ON Semiconductor®

<http://onsemi.com>

## High-Current Complementary Silicon Power Transistors

High-Current Complementary Silicon Power Transistors are for use as output devices in complementary general purpose amplifier applications.

### Features

- 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
- Pb-Free Packages are Available\*

### 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	W W/°C
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +200	°C

### THERMAL CHARACTERISTICS

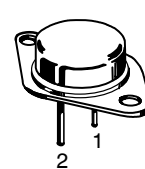
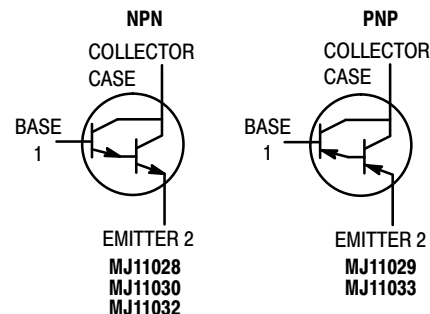
Characteristic	Symbol	Max	Unit
Maximum Lead Temperature for Soldering Purposes for $\leq 10$ seconds	$T_L$	275	°C
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.58	°C/W

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  $\leq 10\%$ .

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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



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

### MARKING DIAGRAM



MJ110xx = Device Code  
xx = 28, 29, 30, 32, 33  
G = Pb-Free Package  
A = Location Code  
YY = Year  
WW = Work Week  
MEX = Country of Origin

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

# MJ11028, MJ11030, MJ11032 (NPN)

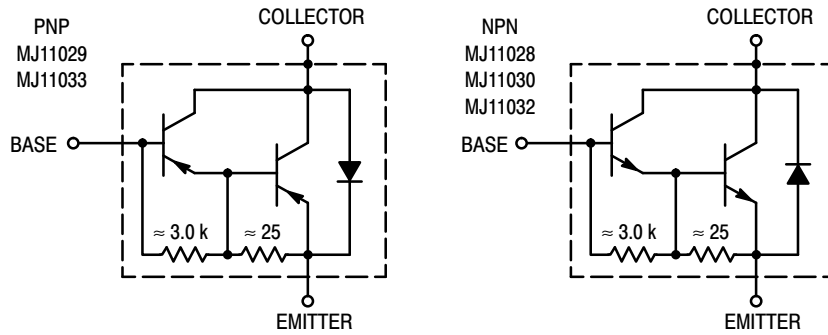


Figure 1. Darlington Circuit Schematic

## 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) ( $I_C = 1\text{ mA dc}$ , $I_B = 0$ )	MJ11028, MJ11029 MJ11030 MJ11032, MJ11033	$V_{(BR)CEO}$	60 90 120	Vdc
Collector-Emitter Leakage Current ( $V_{CE} = 60\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ ) ( $V_{CE} = 90\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ ) ( $V_{CE} = 120\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ ) ( $V_{CE} = 60\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ , $T_C = 150^\circ\text{C}$ ) ( $V_{CE} = 120\text{ Vdc}$ , $R_{BE} = 1\text{ k}\Omega$ , $T_C = 150^\circ\text{C}$ )	MJ11028, MJ11029 MJ11030 MJ11032, MJ11033 MJ11028, MJ11029 MJ11032, MJ11033	$I_{CER}$	- - - - -	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 (Note 1)</b>				
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 ( $I_C = 25\text{ Adc}$ , $I_B = 250\text{ mAdc}$ ) ( $I_C = 50\text{ Adc}$ , $I_B = 500\text{ mAdc}$ )		$V_{CE(sat)}$	- -	2.5 3.5 Vdc
Base-Emitter Saturation Voltage ( $I_C = 25\text{ Adc}$ , $I_B = 200\text{ mAdc}$ ) ( $I_C = 50\text{ Adc}$ , $I_B = 300\text{ mAdc}$ )		$V_{BE(sat)}$	- -	3.0 4.5 Vdc

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

# MJ11028, MJ11030, MJ11032 (NPN)

## ORDERING INFORMATION

Device	Package	Shipping
MJ11028	TO-204	100 Units / Tray
MJ11028G	TO-204 (Pb-Free)	
MJ11029	TO-204	
MJ11029G	TO-204 (Pb-Free)	
MJ11030	TO-204	
MJ11030G	TO-204 (Pb-Free)	
MJ11032	TO-204	
MJ11032G	TO-204 (Pb-Free)	
MJ11033	TO-204	
MJ11033G	TO-204 (Pb-Free)	



Figure 2. DC 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 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.

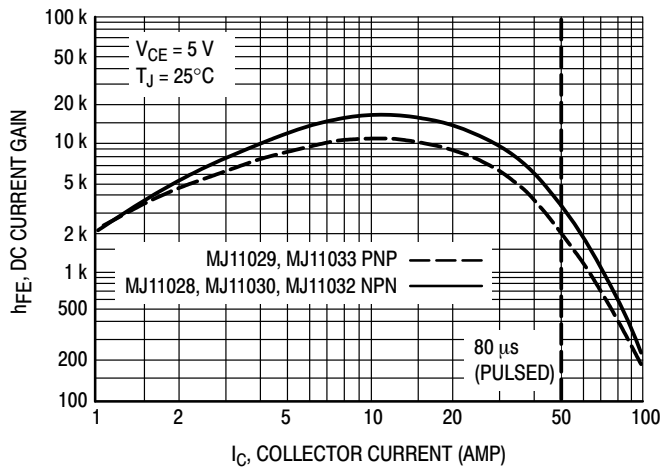


Figure 3. DC Current Gain

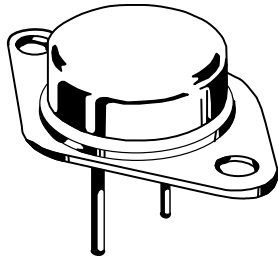


Figure 4. "On" Voltage

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

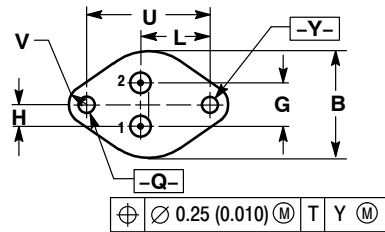
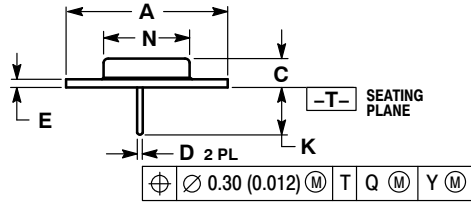
ON Semiconductor®



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

DATE 21 FEB 2000

SCALE 1:1



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

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

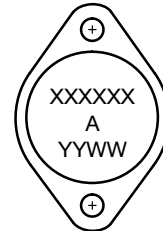
STYLE 3:  
PIN 1. GATE  
2. SOURCE  
CASE: DRAIN

STYLE 4:  
PIN 1. ANODE = 1  
2. ANODE = 2  
CASE: CATHODES

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

### GENERIC MARKING DIAGRAM\*



XXXXXX = Specific Device Code  
A = Assembly Location  
YY = Year  
WW = Work Week

\*This information is generic. Please refer to device data sheet for actual part marking.

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NEW STANDARD:		
DESCRIPTION:	TO-204 (TO-3)	PAGE 1 OF 2



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