

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

## 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<br>MJ11028/29<br>MJ11030<br>MJ11032/33                                                  | $V_{CEO}$      | 60<br>90<br>120 | Vdc       |
| Collector-Base Voltage<br>MJ11028/29<br>MJ11030<br>MJ11032/33                                                     | $V_{CBO}$      | 60<br>90<br>120 | Vdc       |
| Emitter-Base Voltage                                                                                              | $V_{EBO}$      | 5.0             | Vdc       |
| Collector Current – Continuous<br>– Peak (Note 1)                                                                 | $I_C$          | 50<br>100       | Adc       |
| Base Current – Continuous                                                                                         | $I_B$          | 2.0             | Adc       |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$ | $P_D$          | 300<br>1.71     | W<br>W/°C |
| Operating and Storage Junction<br>Temperature Range                                                               | $T_J, T_{stg}$ | -55 to +200     | °C        |

### THERMAL CHARACTERISTICS

| Characteristic                                                           | Symbol          | Max  | Unit |
|--------------------------------------------------------------------------|-----------------|------|------|
| Maximum Lead Temperature for<br>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  $\leq 10\%$ .

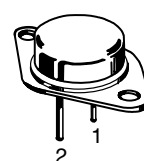
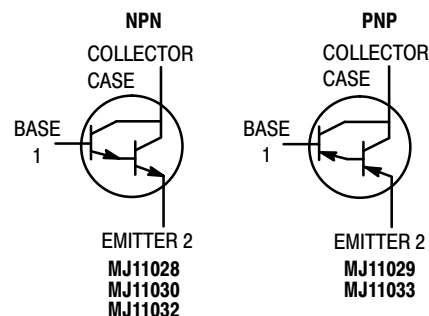
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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## 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)

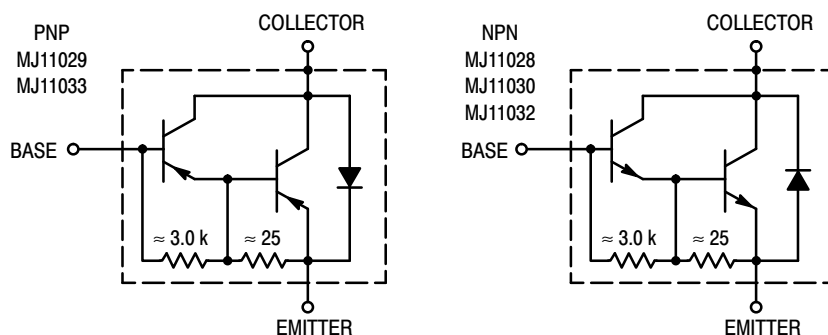


Figure 1. Darlington Circuit Schematic

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

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

# MJ11028, MJ11030, MJ11032 (NPN)

## ORDERING INFORMATION

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

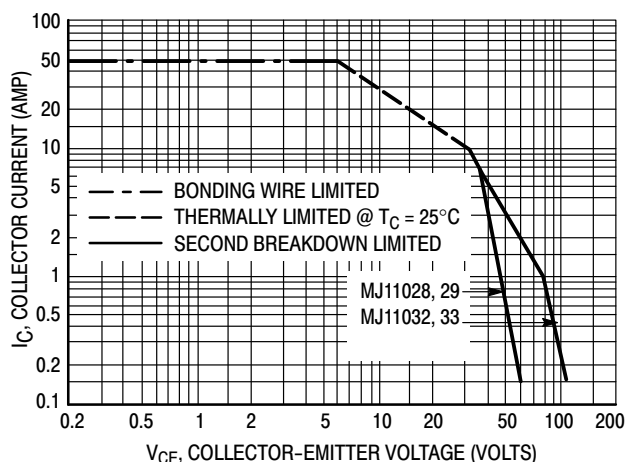


Figure 2. DC Safe Operating Area

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.

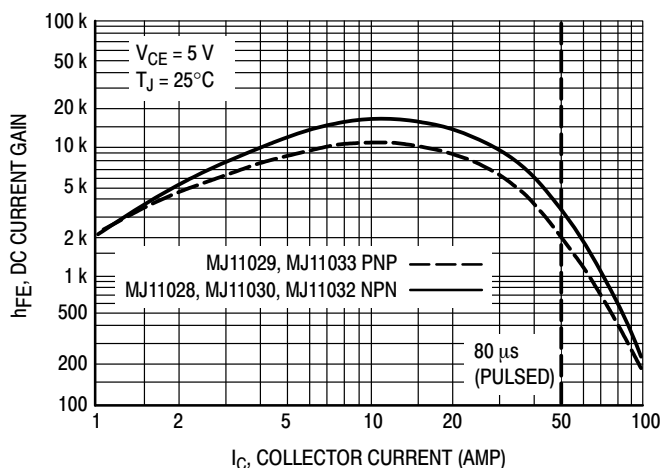


Figure 3. DC Current Gain

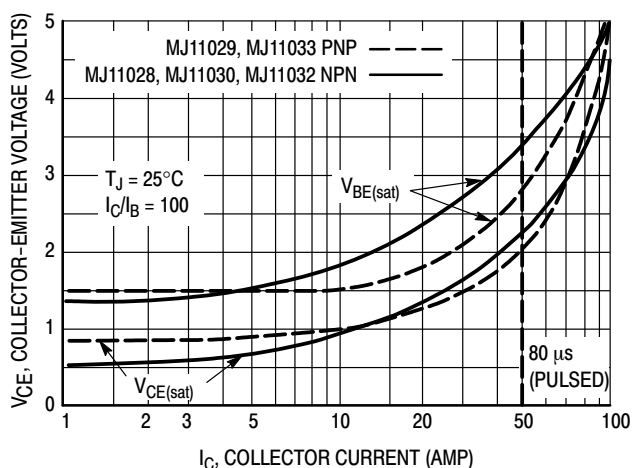
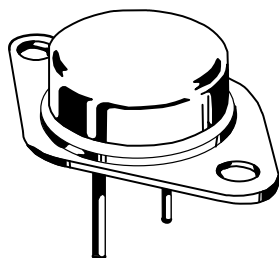


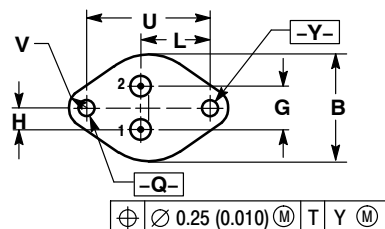
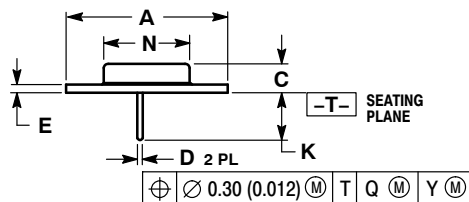
Figure 4. "On" Voltage



SCALE 1:1

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

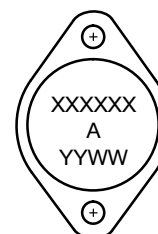
DATE 21 FEB 2000



- 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. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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

|                  |               |                                                                                                                                                                                     |
|------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | TO-204 (TO-3) | PAGE 1 OF 1                                                                                                                                                                         |

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