

# High-Current Complementary Silicon Transistors

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

- High DC Current Gain —  
 $h_{FE} = 1000 \text{ (Min) @ } I_C = 20 \text{ Adc}$
- Monolithic Construction with Built-in Base Emitter Shunt Resistor
- Junction Temperature to +200°C

## MAXIMUM RATINGS

| Rating   | Symbol         | MJ11012     | MJ11015<br>MJ11016 | Unit          |
|--|----------------|-------------|--------------------|---------------|
| Collector-Emitter Voltage  | $V_{CEO}$      | 60          | 120                | Vdc           |
| Collector-Base Voltage   | $V_{CB}$       | 60          | 120                | Vdc           |
| Emitter-Base Voltage   | $V_{EB}$       | 5           |                    | Vdc           |
| Collector Current  | $I_C$          | 30          |                    | Adc           |
| Base Current   | $I_B$          | 1           |                    | Adc           |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$ | $P_D$          | 200         | 1.15               | Watts<br>W/°C |
| Operating Storage Junction Temperature Range   | $T_J, T_{stg}$ | -55 to +200 |                    | °C            |

## THERMAL CHARACTERISTICS

| Characteristic   | Symbol          | Max  | Unit |
|--|-----------------|------|------|
| Thermal Resistance, Junction to Case                                   | $R_{\theta JC}$ | 0.87 | °C/W |
| Maximum Lead Temperature for Soldering Purposes for $\leq 10$ Seconds. | $T_L$           | 275  | °C   |

**PNP  
MJ11015  
NPN  
MJ11012  
MJ11016\***

\*ON Semiconductor Preferred Device

**30 AMPERE  
DARLINGTON  
POWER TRANSISTORS  
COMPLEMENTARY  
SILICON  
60-120 VOLTS  
200 WATTS**

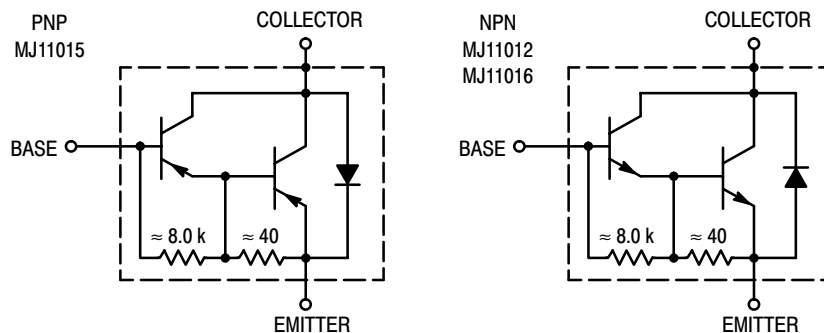
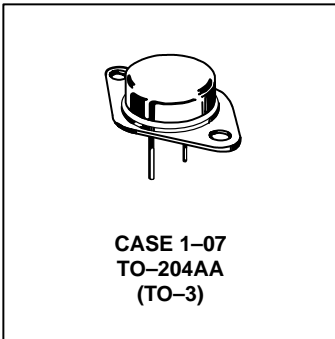


Figure 1. Darlington Circuit Schematic

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

# MJ11015 MJ11012 MJ11016

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

| Characteristics   | Symbol   | Min                  | Max              | Unit             |      |
|---|--|----------------------|------------------|------------------|------|
| <b>OFF CHARACTERISTICS</b>  |  |                      |                  |                  |      |
| Collector–Emitter Breakdown Voltage(1)<br>(I <sub>C</sub> = 100 mA, I <sub>B</sub> = 0)   | MJ11012<br>MJ11015, MJ11016                                | V <sub>(BR)CEO</sub> | 60<br>120        | —<br>—           | Vdc  |
| Collector–Emitter Leakage Current<br>(V <sub>CE</sub> = 60 Vdc, R <sub>BE</sub> = 1k ohm)<br>(V <sub>CE</sub> = 120 Vdc, R <sub>BE</sub> = 1k ohm)<br>(V <sub>CE</sub> = 60 Vdc, R <sub>BE</sub> = 1k ohm, T <sub>C</sub> = 150°C)<br>(V <sub>CE</sub> = 120 Vdc, R <sub>BE</sub> = 1k ohm, T <sub>C</sub> = 150°C) | MJ11012<br>MJ11015, MJ11016<br>MJ11012<br>MJ11015, MJ11016 | I <sub>CER</sub>     | —<br>—<br>—<br>— | 1<br>1<br>5<br>5 | mAdc |
| Emitter Cutoff Current<br>(V <sub>BE</sub> = 5 Vdc, I <sub>C</sub> = 0)   |  | I <sub>EBO</sub>     | —                | 5                | mAdc |
| Collector–Emitter Leakage Current<br>(V <sub>CE</sub> = 50 Vdc, I <sub>B</sub> = 0)   |  | I <sub>CEO</sub>     | —                | 1                | mAdc |
| <b>ON CHARACTERISTICS(1)</b>  |  |                      |                  |                  |      |
| DC Current Gain<br>(I <sub>C</sub> = 20 Adc, V <sub>CE</sub> = 5 Vdc)<br>(I <sub>C</sub> = 30 Adc, V <sub>CE</sub> = 5 Vdc)   |  | h <sub>FE</sub>      | 1000<br>200      | —<br>—           | —    |
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = 20 Adc, I <sub>B</sub> = 200 mAdc)<br>(I <sub>C</sub> = 30 Adc, I <sub>B</sub> = 300 mAdc)  |  | V <sub>CE(sat)</sub> | —<br>—           | 3<br>4           | Vdc  |
| Base–Emitter Saturation Voltage<br>(I <sub>C</sub> = 20 A, I <sub>B</sub> = 200 mAdc)<br>(I <sub>C</sub> = 30 A, I <sub>B</sub> = 300 mAdc)   |  | V <sub>BE(sat)</sub> | —<br>—           | 3.5<br>5         | Vdc  |
| <b>DYNAMIC CHARACTERISTICS</b>  |  |                      |                  |                  |      |
| Current–Gain Bandwidth Product<br>(I <sub>C</sub> = 10 A, V <sub>CE</sub> = 3 Vdc, f = 1 MHz)   |  | h <sub>fe</sub>      | 4                | —                | MHz  |

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

# MJ11015 MJ11012 MJ11016

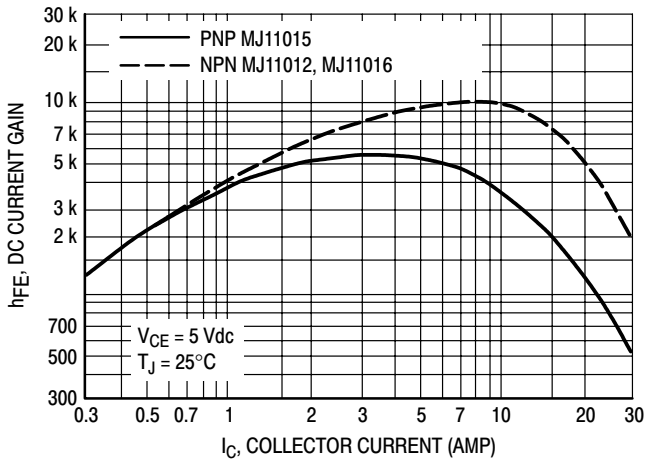


Figure 2. DC Current Gain (1)

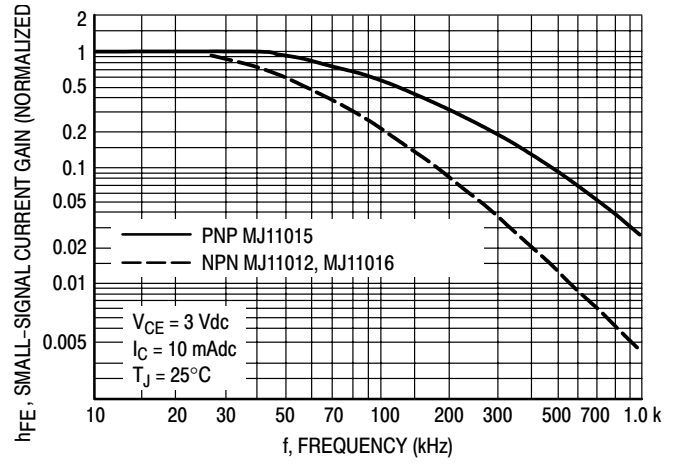


Figure 3. Small-Signal Current Gain

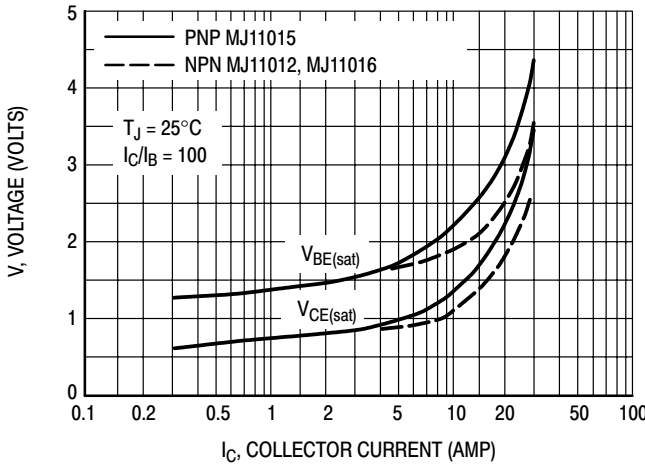


Figure 4. "On" Voltages (1)

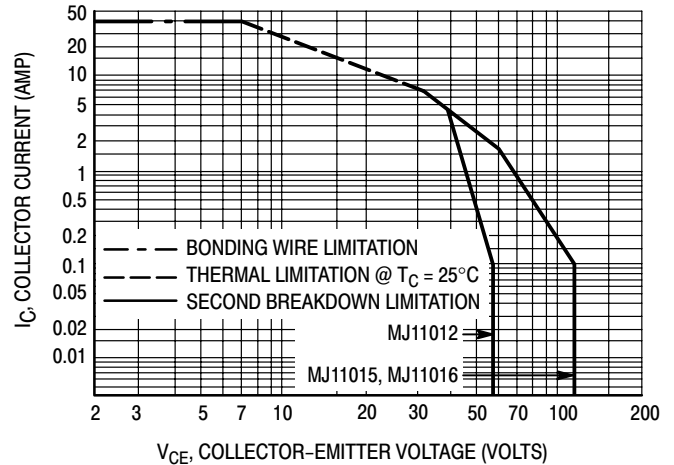


Figure 5. Active Region DC Safe Operating Area

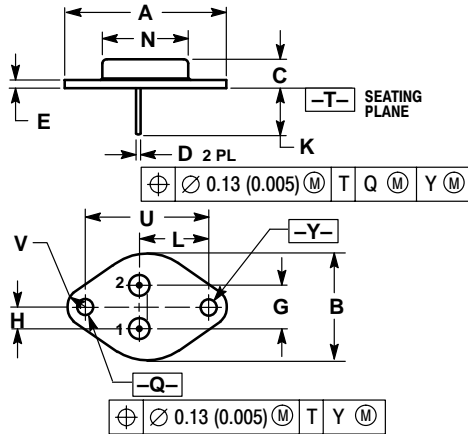
There are two limitations on the power handling ability of a transistor average junction temperature and secondary breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operations e.g., the transistor must not be subjected to greater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

At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown.

# MJ11015 MJ11012 MJ11016

## PACKAGE DIMENSIONS


### CASE 1-07 TO-204AA (TO-3) ISSUE Z



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO-204AA OUTLINE SHALL APPLY.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 1.550 REF |       | 39.37 REF   |       |
| B   | ---       | 1.050 | ---         | 26.67 |
| C   | 0.250     | 0.335 | 6.35        | 8.51  |
| D   | 0.038     | 0.043 | 0.97        | 1.09  |
| E   | 0.055     | 0.070 | 1.40        | 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   | ---       | 0.830 | ---         | 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

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