# **Complementary Silicon Plastic Power Transistors**

These devices are designed for use in general–purpose amplifier and switching applications.

#### **Features**

- High DC Current Gain
- High Current Gain Bandwidth Product
- TO-220 Compact Package
- These Devices are Pb-Free and are RoHS Compliant\*

#### MAXIMUM RATINGS (Note 1)

| Rating  | Symbol                            | Value          | Unit      |
|---|-----------------------------------|----------------|-----------|
| Collector–Emitter Voltage<br>2N6111, 2N6288<br>2N6109<br>2N6107, 2N6292 | V <sub>CEO</sub>                  | 30<br>50<br>70 | Vdc       |
| Collector–Base Voltage<br>2N6111, 2N6288<br>2N6109<br>2N6107, 2N6292    | V <sub>CB</sub>                   | 40<br>60<br>80 | Vdc       |
| Emitter-Base Voltage  | V <sub>EB</sub>                   | 5.0            | Vdc       |
| Collector Current – Continuous  | I <sub>C</sub>                    | 7.0            | Adc       |
| Collector Current – Peak  | I <sub>CM</sub>                   | 10             | Adc       |
| Base Current  | I <sub>B</sub>                    | 3.0            | Adc       |
| Total Power Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C       | P <sub>D</sub>                    | 40<br>0.32     | W<br>W/°C |
| Operating and Storage Junction<br>Temperature Range                     | T <sub>J</sub> , T <sub>stg</sub> | -65 to +150    | °C        |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

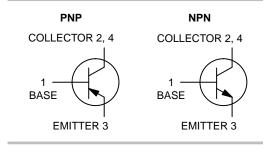
| Characteristics                      | Symbol          | Max   | Unit |
|--------------------------------------|-----------------|-------|------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 3.125 | °C/W |



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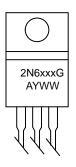
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# 7 AMPERE POWER TRANSISTORS COMPLEMENTARY SILICON 30 – 50 – 70 VOLTS, 40 WATTS





#### MARKING DIAGRAM



2N6xxx = Specific Device Code xxx = See Table on Page 4 G = Pb-Free Package A = Assembly Location

Y = Year WW = Work Week

#### **ORDERING INFORMATION**

See detailed ordering, marking, and shipping information in the package dimensions section on page 4 of this data sheet.

<sup>1.</sup> Indicates JEDEC Registered Data.

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

# **ELECTRICAL CHARACTERISTICS** ( $T_C = 25^{\circ}C$ unless otherwise noted) (Note 2)

| Characteristic  | Symbol                | Min                   | Max                    | Unit     |
|---|-----------------------|-----------------------|------------------------|----------|
| OFF CHARACTERISTICS   |                       |                       | •                      | •        |
| Collector–Emitter Sustaining Voltage (Note 3) $ \begin{pmatrix} I_C = 100 \text{ mAdc, } I_B = 0 \end{pmatrix} $ $ 2N6111, 2N6288 $ $ 2N6109 $ $ 2N6107, 2N6292 $   | V <sub>CEO(sus)</sub> | 30<br>50<br>70        | -<br>-<br>-            | Vdc      |
| Collector Cutoff Current<br>(V <sub>CE</sub> = 20 Vdc, I <sub>B</sub> = 0)<br>2N6111, 2N6288  | I <sub>CEO</sub>      | -                     | 1.0                    | mAdc     |
| (V <sub>CE</sub> = 40 Vdc, I <sub>B</sub> = 0)<br>2N6109<br>(V <sub>CE</sub> = 60 Vdc, I <sub>B</sub> = 0)<br>2N6107, 2N6292  |                       | -                     | 1.0<br>1.0             |          |
| Collector Cutoff Current (V <sub>CE</sub> = 40 Vdc, V <sub>EB(off)</sub> = 1.5 Vdc) 2N6111, 2N6288  | ICEX                  | -                     | 100                    | μAdc     |
| (V <sub>CE</sub> = 60 Vdc, V <sub>EB(off)</sub> = 1.5 Vdc)<br>2N6109<br>(V <sub>CE</sub> = 80 Vdc, V <sub>EB(off)</sub> = 1.5 Vdc)<br>2N6107, 2N6292  |                       | -                     | 100<br>100             |          |
| (V <sub>CE</sub> = 30 Vdc, V <sub>EB(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 150°C)<br>2N6111, 2N6288<br>(V <sub>CE</sub> = 50 Vdc, V <sub>EB(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 150°C)  |                       | -                     | 2.0                    | mAdc     |
| 2N6109<br>(V <sub>CE</sub> = 70 Vdc, V <sub>EB(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 150°C)<br>2N6107, 2N6292  |                       | -                     | 2.0                    |          |
| Emitter Cutoff Current<br>(V <sub>BE</sub> = 5.0 Vdc, I <sub>C</sub> = 0)   | I <sub>EBO</sub>      | -                     | 1.0                    | mAdc     |
| ON CHARACTERISTICS (Note 3)   |                       |                       |                        |          |
| DC Current Gain $ \begin{aligned} &(I_C = 2.0 \text{ Adc, } V_{CE} = 4.0 \text{ Vdc}) \\ &2N6107, 2N6292 \\ &(I_C = 2.5 \text{ Adc, } V_{CE} = 4.0 \text{ Vdc}) \\ &2N6109 \\ &(I_C = 3.0 \text{ Adc, } V_{CE} = 4.0 \text{ Vdc}) \\ &2N6111, 2N6288 \\ &(I_C = 7.0 \text{ Adc, } V_{CE} = 4.0 \text{ Vdc}) \\ &All \text{ Devices} \end{aligned} $ | h <sub>FE</sub>       | 30<br>30<br>30<br>2.3 | 150<br>150<br>150<br>– | -        |
| Collector–Emitter Saturation Voltage (I <sub>C</sub> = 7.0 Adc, I <sub>B</sub> = 3.0 Adc)   | V <sub>CE(sat)</sub>  | -                     | 3.5                    | Vdc      |
| Base–Emitter On Voltage $(I_C = 7.0 \text{ Adc}, V_{CE} = 4.0 \text{ Vdc})$   | V <sub>BE(on)</sub>   | -                     | 3.0                    | Vdc      |
| DYNAMIC CHARACTERISTICS   | <del>,</del>          |                       | T                      | <b>T</b> |
| Current Gain – Bandwidth Product (Note 4) ( $I_C = 500 \text{ mAdc}$ , $V_{CE} = 4.0 \text{ Vdc}$ , $f_{test} = 1.0 \text{ MHz}$ ) 2N6288, 2N6292 2N6107, 2N6109, 2N6111  | f⊤                    | 4.0<br>10             | <u>-</u>               | MHz      |
| Output Capacitance ( $V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 1.0 \text{ MHz}$ )  | C <sub>ob</sub>       | -                     | 250                    | pF       |
| Small–Signal Current Gain ( $I_C = 0.5 \text{ Adc}$ , $V_{CE} = 4.0 \text{ Vdc}$ , $f = 50 \text{ kHz}$ )   | h <sub>fe</sub>       | 20                    | -                      | _        |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Indicates JEDEC Registered Data.

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

<sup>4.</sup>  $f_T = |h_{fe}| \cdot f_{test}$ 

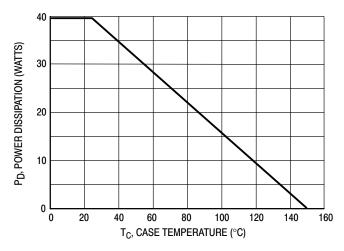
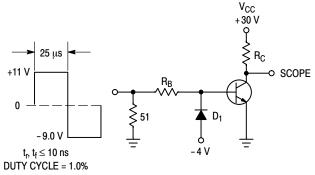


Figure 1. Power Derating



R<sub>B</sub> and R<sub>C</sub> ARE VARIED TO OBTAIN DESIRED CURRENT LEVELS

D1 MUST BE FAST RECOVERY TYPE, eg: 1N5825 USED ABOVE IB  $\approx$  100 mA MSD6100 USED BELOW IB  $\approx$  100 mA

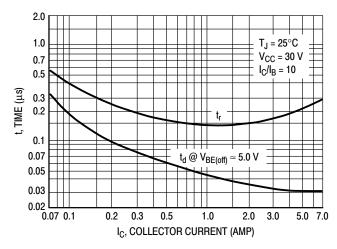


Figure 3. Turn-On Time

Figure 2. Switching Time Test Circuit

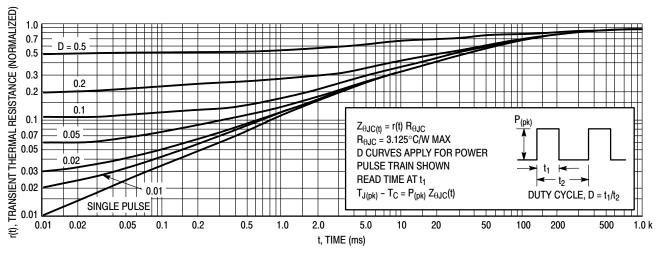


Figure 4. Thermal Response

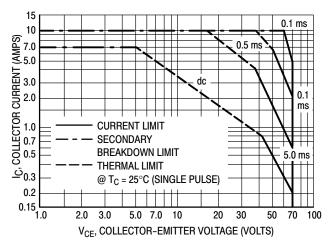


Figure 5. Active-Region Safe Operating Area

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 5 is based on  $T_{J(pk)} = 150^{\circ}C$ ;  $T_{C}$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^{\circ}C$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

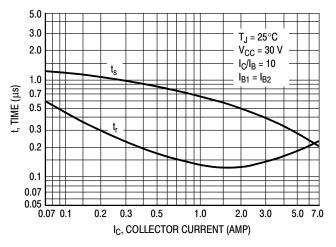


Figure 6. Turn-Off Time

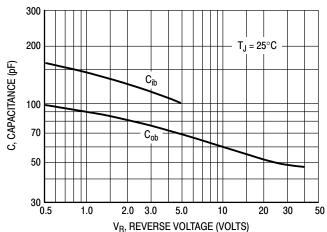


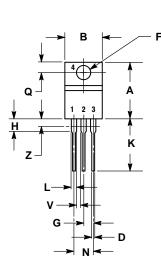
Figure 7. Capacitance

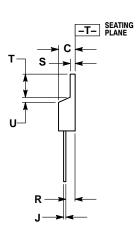
## **ORDERING INFORMATION**

| Device  | Device Marking | Package             | Shipping        |
|---------|----------------|---------------------|-----------------|
| 2N6107G | 2N6107         | TO-220<br>(Pb-Free) | 50 Units / Rail |
| 2N6109G | 2N6109         | TO-220<br>(Pb-Free) | 50 Units / Rail |
| 2N6111G | 2N6111         | TO-220<br>(Pb-Free) | 50 Units / Rail |
| 2N6288G | 2N6288         | TO-220<br>(Pb-Free) | 50 Units / Rail |
| 2N6292G | 2N6292         | TO-220<br>(Pb-Free) | 50 Units / Rail |

#### PACKAGE DIMENSIONS

TO-220 CASE 221A-09 **ISSUE AH** 





- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. CONTROLLING DIMENSION: INCH.
- DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE

|     | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
| DIM | MIN    | MAX   | MIN         | MAX   |
| Α   | 0.570  | 0.620 | 14.48       | 15.75 |
| В   | 0.380  | 0.415 | 9.66        | 10.53 |
| С   | 0.160  | 0.190 | 4.07        | 4.83  |
| D   | 0.025  | 0.038 | 0.64        | 0.96  |
| F   | 0.142  | 0.161 | 3.61        | 4.09  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| Н   | 0.110  | 0.161 | 2.80        | 4.10  |
| J   | 0.014  | 0.024 | 0.36        | 0.61  |
| K   | 0.500  | 0.562 | 12.70       | 14.27 |
| L   | 0.045  | 0.060 | 1.15        | 1.52  |
| N   | 0.190  | 0.210 | 4.83        | 5.33  |
| Q   | 0.100  | 0.120 | 2.54        | 3.04  |
| R   | 0.080  | 0.110 | 2.04        | 2.79  |
| S   | 0.045  | 0.055 | 1.15        | 1.39  |
| Т   | 0.235  | 0.255 | 5.97        | 6.47  |
| U   | 0.000  | 0.050 | 0.00        | 1.27  |
| ٧   | 0.045  |       | 1.15        |       |
| Z   |        | 0.080 |             | 2.04  |

STYLE 1:

BASE PIN 1.

COLLECTOR

**EMITTER** 3

COLLECTOR

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