

MJ14001 (PNP), MJ14002* (NPN), MJ14003* (PNP)

*Preferred Devices

High-Current Complementary Silicon Power Transistors

Designed for use in high-power amplifier and switching circuit applications.

Features

- High Current Capability – I_C Continuous = 60 Amperes
- DC Current Gain – $h_{FE} = 15-100$ @ $I_C = 50$ Adc
- Low Collector-Emitter Saturation Voltage – $V_{CE(sat)} = 2.5$ Vdc (Max) @ $I_C = 50$ Adc
- Pb-Free Packages are Available*

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|----------------|-------------|--------------------------|
| Collector-Emitter Voltage MJ14001 MJ14002/03 | V_{CEO} | 60 80 | Vdc |
| Collector-Base Voltage MJ14001 MJ14002/03 | V_{CBO} | 60 80 | Vdc |
| Emitter-Base Voltage | V_{EBO} | 5.0 | Vdc |
| Collector Current – Continuous | I_C | 60 | Adc |
| Base Current – Continuous | I_B | 15 | Adc |
| Emitter Current – Continuous | I_E | 75 | Adc |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above 25°C | P_D | 300 1.71 | W W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -65 to +200 | $^\circ\text{C}$ |

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.

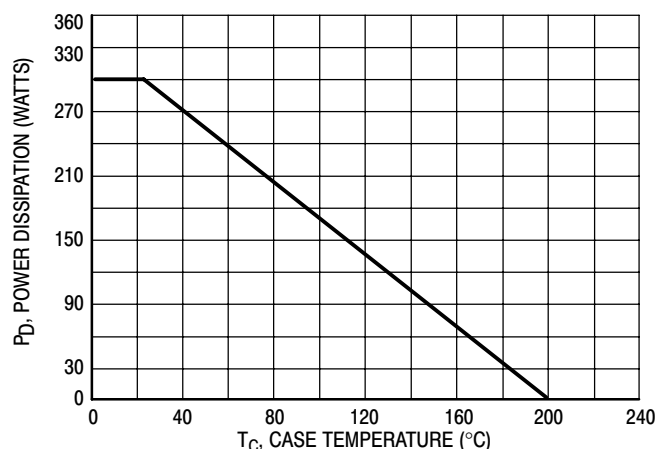


Figure 1. Power Derating

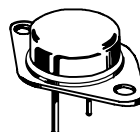


ON Semiconductor®

<http://onsemi.com>

60 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 60-80 VOLTS, 300 WATTS

MARKING DIAGRAM



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



MJ1400x = Device Code
 xx = 1, 2, or 3
G = Pb-Free Package
A = Location Code
YY = Year
WW = Work Week
MEX = Country of Origin

ORDERING INFORMATION

| Device | Package | Shipping |
|----------|-------------------|----------------|
| MJ14001 | TO-3 | 100 Units/Tray |
| MJ14001G | TO-3 (Pb-Free) | 100 Units/Tray |
| MJ14002 | TO-3 | 100 Units/Tray |
| MJ14002G | TO-3 (Pb-Free) | 100 Units/Tray |
| MJ14003 | TO-3 | 100 Units/Tray |
| MJ14003G | TO-3 (Pb-Free) | 100 Units/Tray |

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

*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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THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--------------------------------------|-----------------|-------|----------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.584 | $^{\circ}\text{C/W}$ |

ELECTRICAL CHARACTERISTICS ($T_C = 25^{\circ}\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|--|-----------------------------|---------------|----------|------------|-----|
| Collector-Emitter Sustaining Voltage (Note 1) ($I_C = 200 \text{ mAdc}$, $I_B = 0$) | MJ14001 MJ14002, MJ14003 | $V_{CE(sus)}$ | 60 80 | – – | Vdc |
| Collector Cutoff Current ($V_{CE} = 30 \text{ Vdc}$, $I_B = 0$) ($V_{CE} = 40 \text{ Vdc}$, $I_B = 0$) | MJ14001 MJ14002, MJ14003 | I_{CEO} | – – | 1.0 1.0 | mA |
| Collector Cutoff Current ($V_{CE} = 60 \text{ Vdc}$, $V_{BE(off)} = 1.5 \text{ V}$) ($V_{CE} = 80 \text{ Vdc}$, $V_{BE(off)} = 1.5 \text{ V}$) | MJ14001 MJ14002, MJ14003 | I_{CEX} | – – | 1.0 1.0 | mA |
| Collector Cutoff Current ($V_{CB} = 60 \text{ Vdc}$, $I_E = 0$) ($V_{CB} = 80 \text{ Vdc}$, $I_E = 0$) | MJ14001 MJ14002, MJ14003 | I_{CBO} | – – | 1.0 1.0 | mA |
| Emitter Cutoff Current ($V_{BE} = 5.0 \text{ Vdc}$, $I_C = 0$) | | I_{EBO} | – | 1.0 | mA |

ON CHARACTERISTICS

| | | | | |
|--|---------------|-----------------|-------------------|-----|
| DC Current Gain (Note 1) ($I_C = 25 \text{ Adc}$, $V_{CE} = 3.0 \text{ V}$) ($I_C = 50 \text{ Adc}$, $V_{CE} = 3.0 \text{ V}$) ($I_C = 60 \text{ Adc}$, $V_{CE} = 3.0 \text{ V}$) | h_{FE} | 30 15 5.0 | – 100 – | – |
| Collector-Emitter Saturation Voltage (Note 1) ($I_C = 25 \text{ Adc}$, $I_B = 2.5 \text{ Adc}$) ($I_C = 50 \text{ Adc}$, $I_B = 5.0 \text{ Adc}$) ($I_C = 60 \text{ Adc}$, $I_B = 12 \text{ Adc}$) | $V_{CE(sat)}$ | – – – | 1.0 2.5 3.0 | Vdc |
| Base-Emitter Saturation Voltage (Note 1) ($I_C = 25 \text{ Adc}$, $I_B = 2.5 \text{ Adc}$) ($I_C = 50 \text{ Adc}$, $I_B = 5.0 \text{ Adc}$) ($I_C = 60 \text{ Adc}$, $I_B = 12 \text{ Adc}$) | $V_{BE(sat)}$ | – – – | 2.0 3.0 4.0 | Vdc |

DYNAMIC CHARACTERISTICS

| | | | | |
|---|----------|---|------|----|
| Output Capacitance ($V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $f = 0.1 \text{ MHz}$) | C_{ob} | – | 2000 | pF |
|---|----------|---|------|----|

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

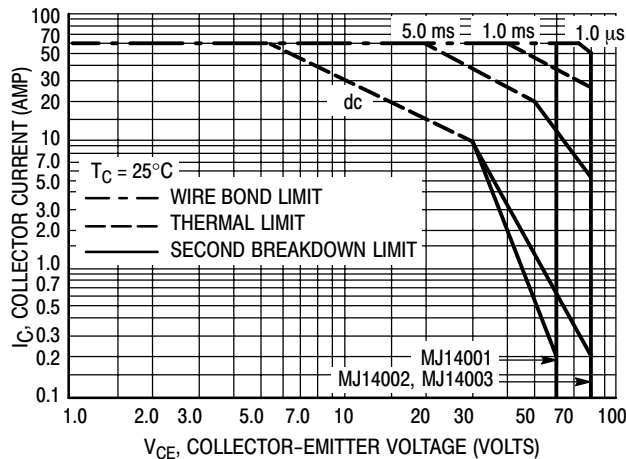


Figure 2. Maximum Rated Forward Biased Safe Operating Area

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. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 200^{\circ}\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 13. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

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TYPICAL ELECTRICAL CHARACTERISTICS

MJ14002 (NPN)

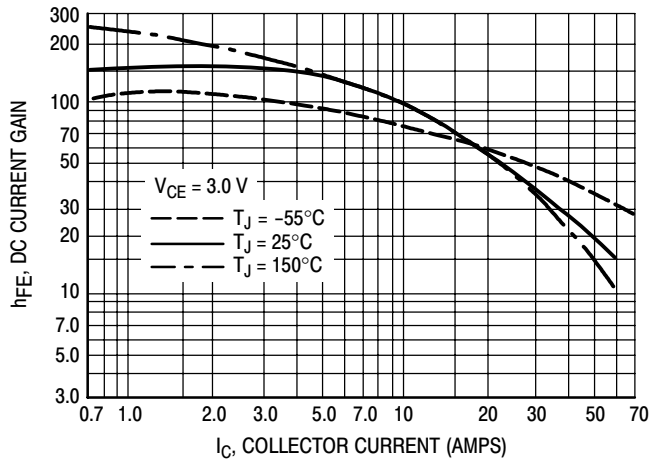


Figure 3. DC Current Gain

MJ14001, MJ14003 (PNP)

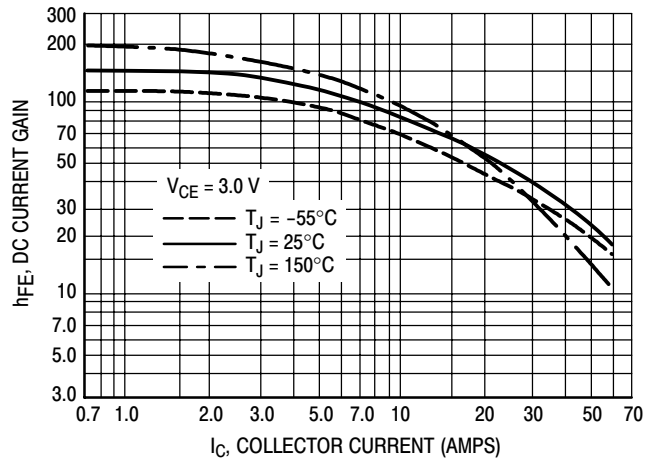


Figure 4. DC Current Gain

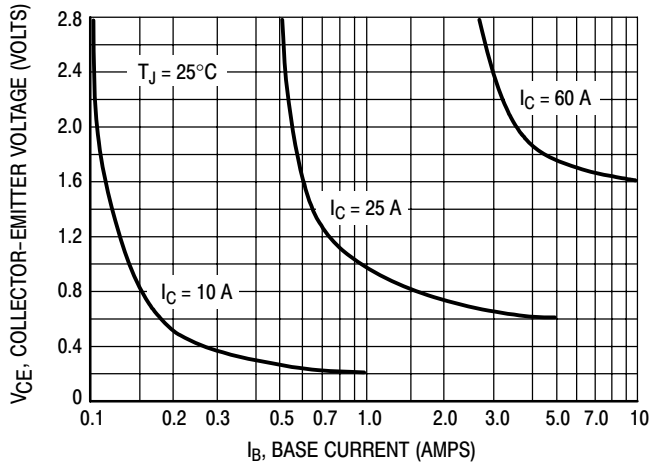


Figure 5. Collector Saturation Region

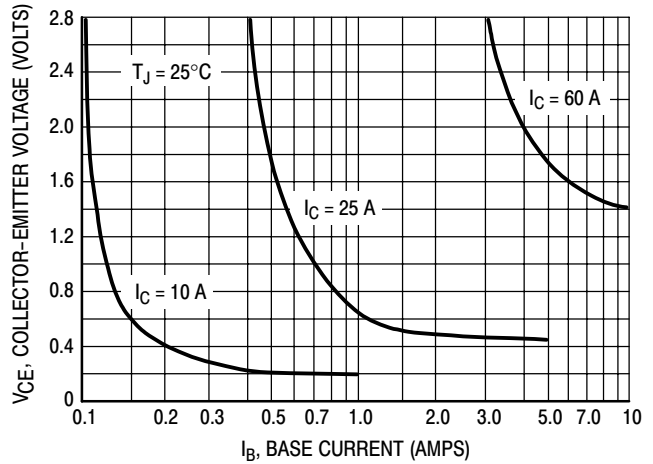


Figure 6. Collector Saturation Region

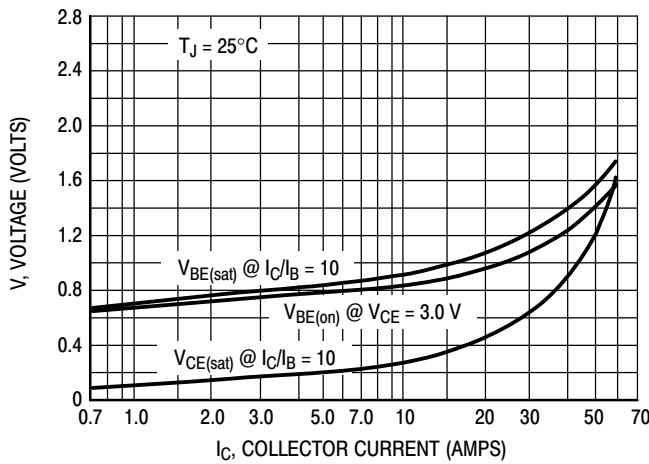


Figure 7. "On" Voltages

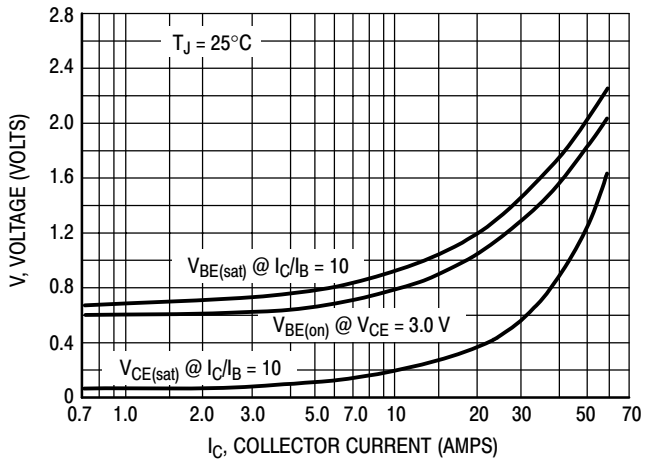


Figure 8. "On" Voltages

MJ14001 (PNP), MJ14002* (NPN), MJ14003* (PNP)

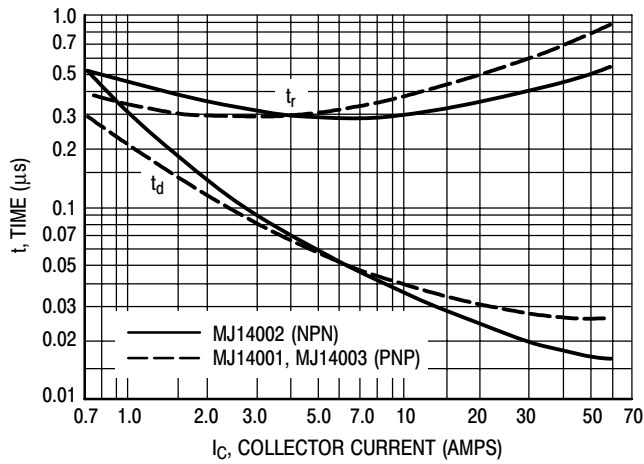


Figure 9. Turn-On Switching Times

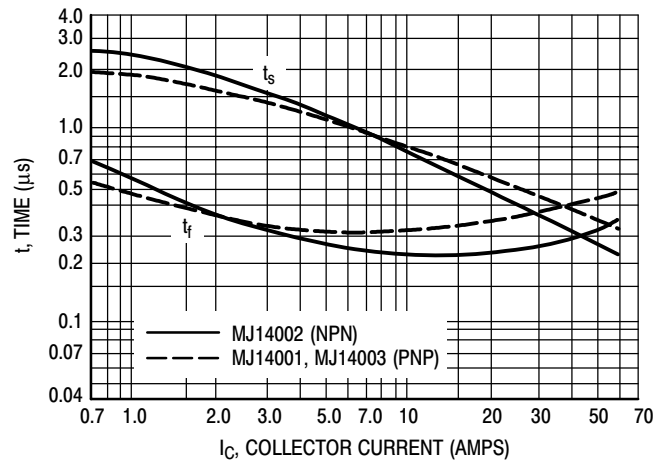


Figure 10. Turn-Off Switching Times

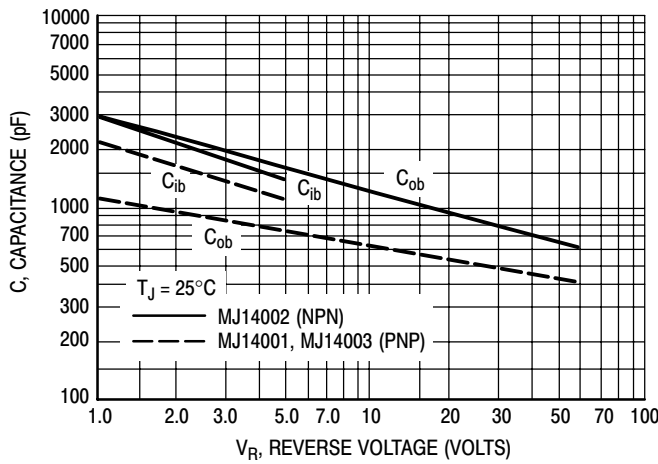
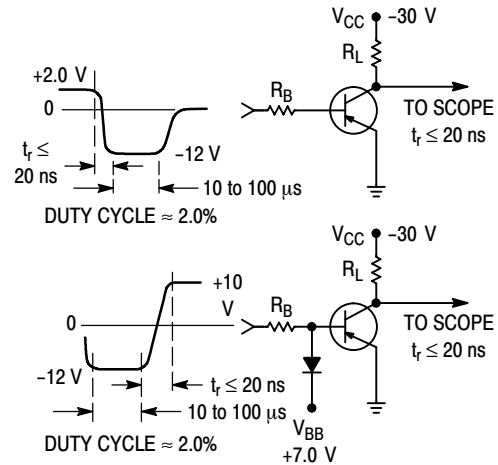


Figure 11. Capacitance Variation



FOR CURVES OF FIGURES 3 & 6, R_B & R_L ARE VARIED.
INPUT LEVELS ARE APPROXIMATELY AS SHOWN.
FOR NPN CIRCUITS, REVERSE ALL POLARITIES.

Figure 12. Switching Test Circuit

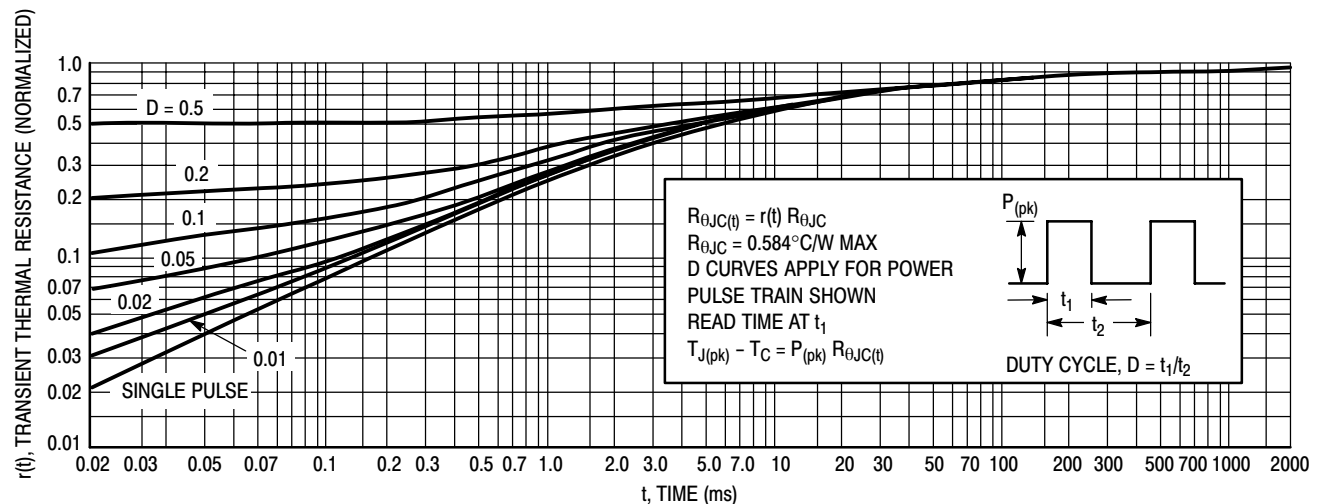
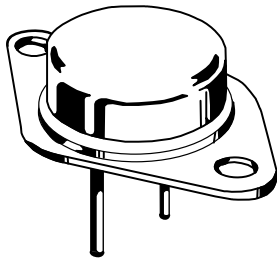


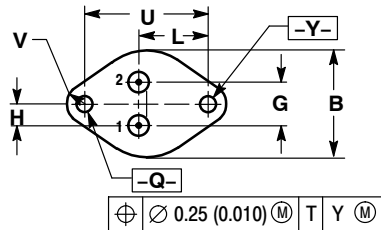
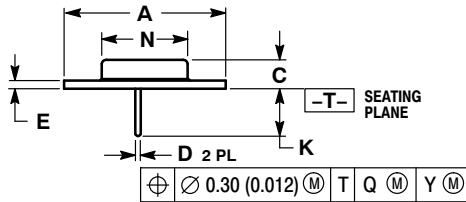
Figure 13. Thermal Response



SCALE 1:1

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

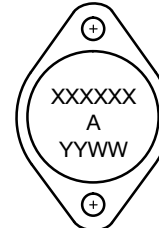
DATE 21 FEB 2000



- 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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