

# MJ21294

## NPN Silicon Power Transistor

With superior safe operating area performance, this power transistor is ideal for high temperature linear control circuits.

### Features

- Exceptional Safe Operating Area
- Dual Die Device with Standard 40 mil pins
- Pb-Free Package is Available\*

### Benefits

- More Reliable Performance at Higher Powers
- Designed for Higher Temperature SOA
- Interchangeable with Standard Single Die TO-3 Devices

### Applications

- Linear Power Supplies
- Battery Conditioning
- DC Motor Control
- Positioners
- DC Heating Controls
- High Power Audio Amplifiers

### MAXIMUM RATINGS

| Rating  | Symbol         | Value       | Unit                     |
|---|----------------|-------------|--------------------------|
| Collector-Emitter Voltage   | $V_{CEO}$      | 250         | Vdc                      |
| Collector-Base Voltage  | $V_{CBO}$      | 400         | Vdc                      |
| Emitter-Base Voltage  | $V_{EBO}$      | 5.0         | Vdc                      |
| Collector-Emitter Voltage - 1.5 V   | $V_{CEX}$      | 400         | Vdc                      |
| Collector Current - Continuous<br>Peak (Note 1)                                       | $I_C$          | 20<br>40    | Adc                      |
| Base Current - Continuous   | $I_B$          | 5.0         | Adc                      |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate Above $25^\circ\text{C}$ | $P_D$          | 350<br>2.0  | W<br>W/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                   | $T_J, T_{stg}$ | -65 to +200 | $^\circ\text{C}$         |

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max  | Unit                      |
|--------------------------------------|-----------------|------|---------------------------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.50 | $^\circ\text{C}/\text{W}$ |

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  $\leq 10\%$ . (continued)

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

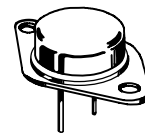


ON Semiconductor®

<http://onsemi.com>

**20 AMPS  
250 VOLTS  
350 WATTS**

### MARKING DIAGRAM



TO-204AA  
(TO-3)  
CASE 1-07



MJ21294 = Specific Device Code  
G = Pb-Free Package  
A = Assembly Site  
YY = Year  
WW = Work Week  
MEX = Assembly Location

### ORDERING INFORMATION

| Device   | Package           | Shipping         |
|----------|-------------------|------------------|
| MJ21294  | TO-3              | 100 Units / Tray |
| MJ21294G | TO-3<br>(Pb-Free) | 100 Units / Tray |

# MJ21294

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

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

### OFF CHARACTERISTICS

|   |                       |     |   |     |      |
|---|-----------------------|-----|---|-----|------|
| Collector–Emitter Sustaining Voltage<br>(I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 0) | V <sub>CEO(sus)</sub> | 250 | – | –   | Vdc  |
| Collector Cutoff Current<br>(V <sub>CE</sub> = 200 Vdc, I <sub>B</sub> = 0)             | I <sub>CEO</sub>      | –   | – | 100 | μAdc |
| Emitter Cutoff Current<br>(V <sub>CE</sub> = 5 Vdc, I <sub>C</sub> = 0)                 | I <sub>EBO</sub>      | –   | – | 10  | μAdc |
| Collector Cutoff Current<br>(V <sub>CE</sub> = 250 Vdc, V <sub>BE(off)</sub> = 1.5 Vdc) | I <sub>CEX</sub>      | –   | – | 100 | μAdc |

### SECOND BREAKDOWN

|   |                  |     |   |   |     |
|---|------------------|-----|---|---|-----|
| Second Breakdown Collector Current with Base Forward Biased<br>(V <sub>CE</sub> = 40 Vdc, t = 1 s (non-repetitive)) | I <sub>S/b</sub> | 6.0 | – | – | Adc |
|---|------------------|-----|---|---|-----|

### ON CHARACTERISTICS

|   |                      |          |        |            |     |
|---|----------------------|----------|--------|------------|-----|
| DC Current Gain<br>(I <sub>C</sub> = 8 Adc, V <sub>CE</sub> = 5 Vdc)<br>(I <sub>C</sub> = 16 Adc, V <sub>CE</sub> = 5 Vdc)                        | h <sub>FE</sub>      | 40<br>15 | –<br>– | 100<br>–   |     |
| Base–Emitter On Voltage<br>(I <sub>C</sub> = 8 Adc, V <sub>CE</sub> = 5 Vdc)  | V <sub>BE(on)</sub>  | –        | –      | 1.4        | Vdc |
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 0.8 Adc)<br>(I <sub>C</sub> = 16 Adc, I <sub>B</sub> = 3.2 Adc) | V <sub>CE(sat)</sub> | –<br>–   | –<br>– | 0.5<br>1.0 | Vdc |

### DYNAMIC CHARACTERISTICS

|   |                 |   |   |     |     |
|---|-----------------|---|---|-----|-----|
| Current Gain Bandwidth Product<br>(I <sub>C</sub> = 1 Adc, V <sub>CE</sub> = 10 Vdc, f <sub>test</sub> = 1 MHz) | f <sub>T</sub>  | 4 | – | –   | MHz |
| Output Capacitance<br>(V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f <sub>test</sub> = 1 MHz)                 | C <sub>ob</sub> | – | – | 500 | pF  |

NOTE: Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2%

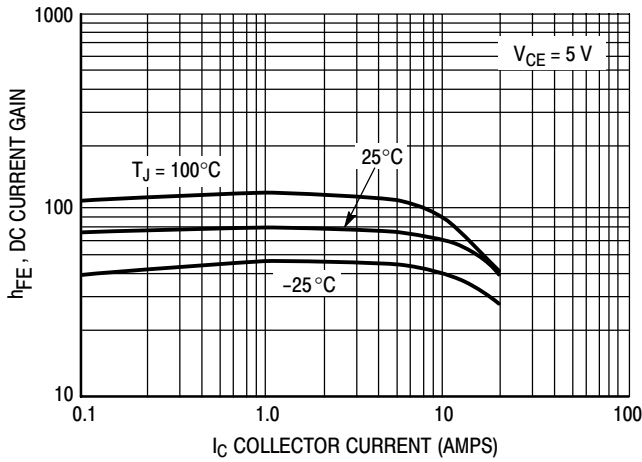


Figure 1. DC Current Gain

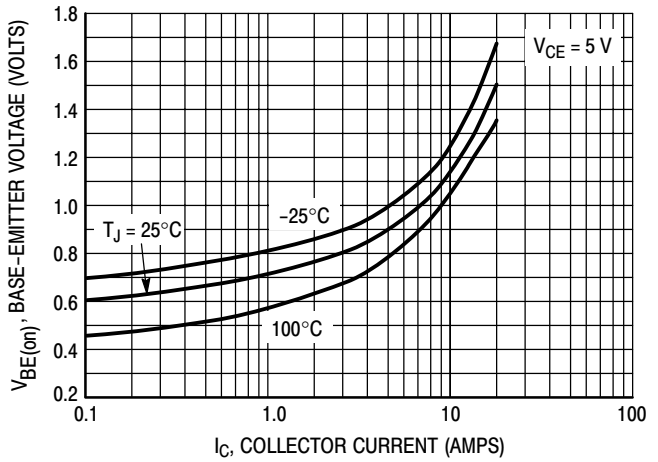


Figure 2. Base-Emitter Voltage

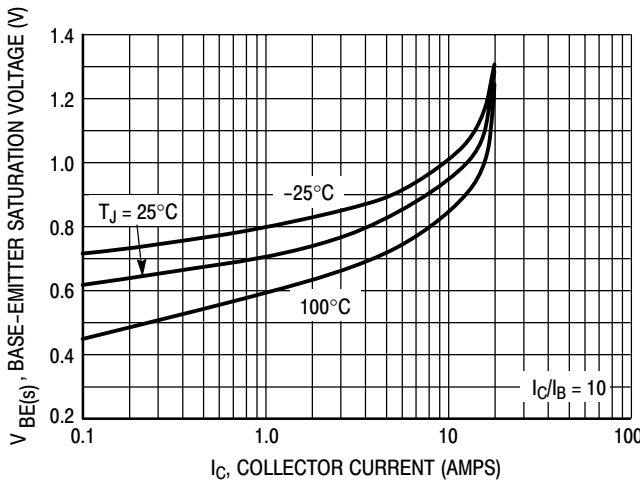


Figure 3. Base-Emitter Saturation Voltage

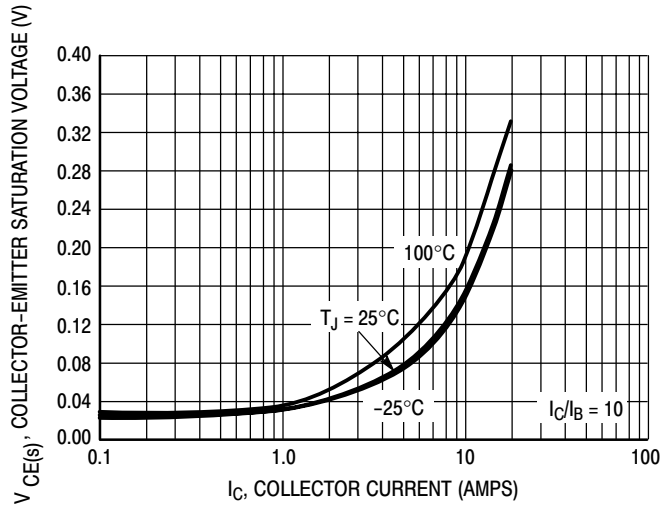


Figure 4. Collector-Emitter Saturation Voltage

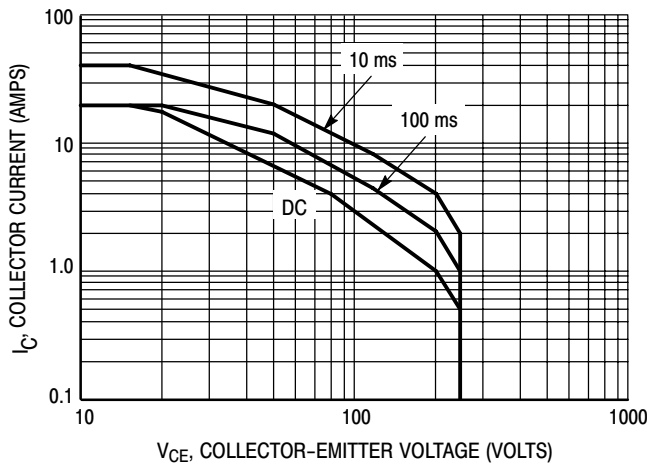


Figure 5. Active Region Safe Operating Area

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 operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

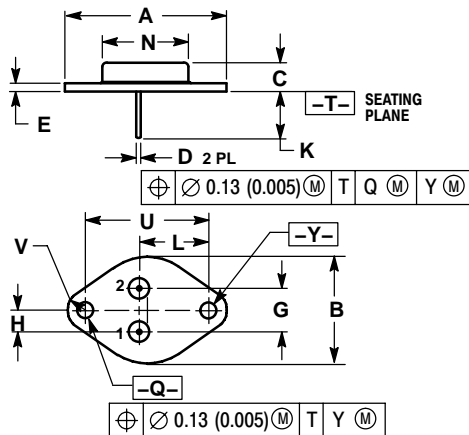
The data of Figure 5 is based on  $T_{J(pk)} = 200^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power than can be handled to values less than the limitations imposed by second breakdown.

# MJ21294

## PACKAGE DIMENSIONS

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



#### NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- 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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