

# MMJT9435

Preferred Device

## Bipolar Power Transistors

### PNP Silicon

#### Features

- Pb-Free Packages are Available
- Collector -Emitter Sustaining Voltage –  
 $V_{CE(sus)} = 30 \text{ Vdc (Min) @ } I_C = 10 \text{ mAdc}$
- High DC Current Gain –  
 $h_{FE} = 125 \text{ (Min) @ } I_C = 0.8 \text{ Adc}$   
 $= 90 \text{ (Min) @ } I_C = 3.0 \text{ Adc}$
- Low Collector -Emitter Saturation Voltage –  
 $V_{CE(sat)} = 0.275 \text{ Vdc (Max) @ } I_C = 1.2 \text{ Adc}$   
 $= 0.55 \text{ Vdc (Max) @ } I_C = 3.0 \text{ Adc}$
- SOT-223 Surface Mount Packaging
- Epoxy Meets UL 94, V-0 @ 0.125 in
- ESD Ratings: Human Body Model, 3B; > 8000 V  
Machine Model, C; > 400 V



**ON Semiconductor®**

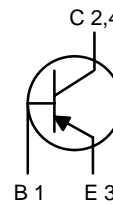
<http://onsemi.com>

#### POWER BJT

**$I_C = 3.0 \text{ AMPERES}$**

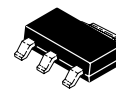
**$BV_{CEO} = 30 \text{ VOLTS}$**

**$V_{CE(sat)} = 0.275 \text{ VOLTS}$**

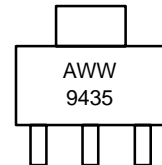


Schematic

#### MARKING DIAGRAM

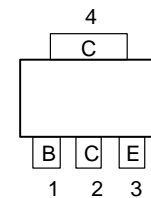


SOT-223  
CASE 318E  
STYLE 1



9435 = Specific Device Code  
A = Assembly Location  
WW = Work Week

#### PIN ASSIGNMENT



Top View Pinout

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 745 of this data sheet.

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

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## MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

| Rating   | Symbol                            | Value                     | Unit            |
|--|-----------------------------------|---------------------------|-----------------|
| Collector–Emitter Voltage  | V <sub>CEO</sub>                  | 30                        | Vdc             |
| Collector–Base Voltage   | V <sub>CB</sub>                   | 45                        | Vdc             |
| Emitter–Base Voltage   | V <sub>EB</sub>                   | 6.0                       | Vdc             |
| Base Current – Continuous  | I <sub>B</sub>                    | 1.0                       | Adc             |
| Collector Current – Continuous<br>– Peak   | I <sub>C</sub>                    | 3.0<br>5.0                | Adc             |
| Total Power Dissipation @ T <sub>C</sub> = 25°C<br>Derate above 25°C<br>Total P <sub>D</sub> @ T <sub>A</sub> = 25°C mounted on 1" sq. (645 sq. mm) Collector pad on FR–4 bd material<br>Total P <sub>D</sub> @ T <sub>A</sub> = 25°C mounted on 0.012" sq. (7.6 sq. mm) Collector pad on FR–4 bd material | P <sub>D</sub>                    | 3.0<br>24<br>1.56<br>0.72 | W<br>mW/°C<br>W |
| Operating and Storage Junction Temperature Range   | T <sub>J</sub> , T <sub>stg</sub> | –55 to +150               | °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.

## THERMAL CHARACTERISTICS

| Characteristic   | Symbol   | Max             | Unit |
|--|--|-----------------|------|
| Thermal Resistance, Junction–to–Case<br>– Junction–to–Ambient on 1" sq. (645 sq. mm) Collector pad on FR–4 bd material<br>– Junction–to–Ambient on 0.012" sq. (7.6 sq. mm) Collector pad on FR–4 bd material | R <sub>θJC</sub><br>R <sub>θJA</sub><br>R <sub>θJA</sub> | 42<br>80<br>174 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds  | T <sub>L</sub>   | 260             | °C   |

## ORDERING INFORMATION

| Device      | Package              | Shipping†          |
|-------------|----------------------|--------------------|
| MMJT9435T1  | SOT–223              | 1000 / Tape & Reel |
| MMJT9435T1G | SOT–223<br>(Pb–Free) | 1000 / Tape & Reel |
| MMJT9435T3  | SOT–223              | 4000 / Tape & Reel |
| MMJT9435T3G | SOT–223<br>(Pb–Free) | 4000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

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

### OFF CHARACTERISTICS

|  |                       |     |   |           |     |
|--|-----------------------|-----|---|-----------|-----|
| Collector–Emitter Sustaining Voltage<br>(I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0 A)   | V <sub>CEO(sus)</sub> | 30  | – | –         | Vdc |
| Emitter–Base Voltage<br>(I <sub>E</sub> = 50 μA, I <sub>C</sub> = 0 A)   | V <sub>EBO</sub>      | 6.0 | – | –         | Vdc |
| Collector Cutoff Current<br>(V <sub>CE</sub> = 25 Vdc, R <sub>BE</sub> = 200 Ω)<br>(V <sub>CE</sub> = 25 Vdc, R <sub>BE</sub> = 200 Ω, T <sub>J</sub> = 125°C) | I <sub>CER</sub>      | –   | – | 20<br>200 | μA  |
| Emitter Cutoff Current<br>(V <sub>BE</sub> = 5.0 Vdc)  | I <sub>EBO</sub>      | –   | – | 10        | μA  |

### ON CHARACTERISTICS (Note 3)

|  |                      |                  |       |                         |     |
|--|----------------------|------------------|-------|-------------------------|-----|
| Collector–Emitter Saturation Voltage<br>(I <sub>C</sub> = 0.8 A, I <sub>B</sub> = 20 mA)<br>(I <sub>C</sub> = 1.2 A, I <sub>B</sub> = 20 mA)<br>(I <sub>C</sub> = 3.0 A, I <sub>B</sub> = 0.3 A) | V <sub>CE(sat)</sub> | –                | 0.155 | 0.210<br>0.275<br>0.550 | Vdc |
| Base–Emitter Saturation Voltage<br>(I <sub>C</sub> = 3.0 A, I <sub>B</sub> = 0.3 A)  | V <sub>BE(sat)</sub> | –                | –     | 1.25                    | Vdc |
| Base–Emitter On Voltage<br>(I <sub>C</sub> = 1.2 A, V <sub>CE</sub> = 4.0 Vdc)   | V <sub>BE(on)</sub>  | –                | –     | 1.10                    | Vdc |
| DC Current Gain<br>(I <sub>C</sub> = 0.8 A, V <sub>CE</sub> = 1.0 Vdc)<br>(I <sub>C</sub> = 1.2 A, V <sub>CE</sub> = 1.0 Vdc)<br>(I <sub>C</sub> = 3.0 A, V <sub>CE</sub> = 1.0 Vdc)             | h <sub>FE</sub>      | 125<br>110<br>90 | 220   | –                       | –   |

### DYNAMIC CHARACTERISTICS

|   |                 |   |     |     |     |
|---|-----------------|---|-----|-----|-----|
| Output Capacitance<br>(V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0 A, f = 1.0 MHz)   | C <sub>ob</sub> | – | 100 | 150 | pF  |
| Input Capacitance<br>(V <sub>EB</sub> = 8.0 Vdc)  | C <sub>ib</sub> | – | 135 | –   | pF  |
| Current–Gain – Bandwidth Product (Note 4)<br>(I <sub>C</sub> = 500 mA, V <sub>CE</sub> = 10 V, f <sub>test</sub> = 1.0 MHz) | f <sub>T</sub>  | – | 110 | –   | MHz |

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

4. f<sub>T</sub> = |h<sub>FE</sub>| • f<sub>test</sub>

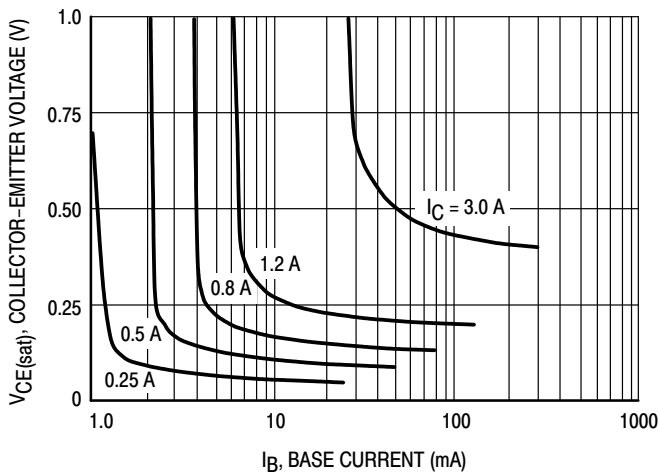


Figure 1. Collector Saturation Region

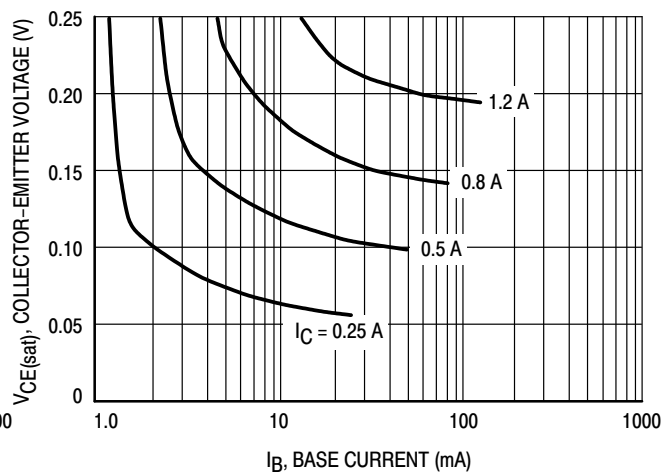


Figure 2. Collector Saturation Region

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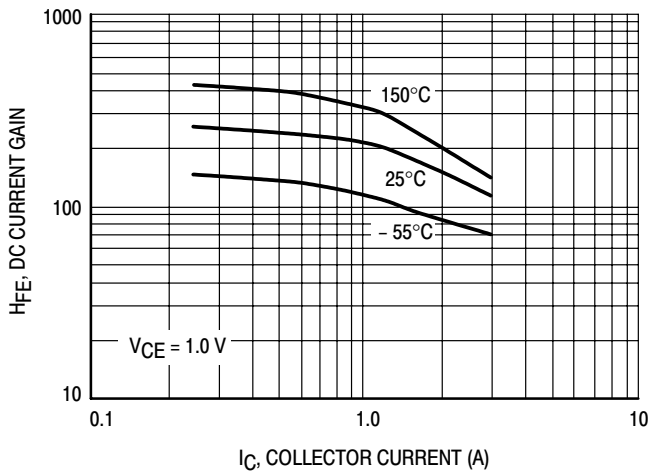


Figure 3. DC Current Gain

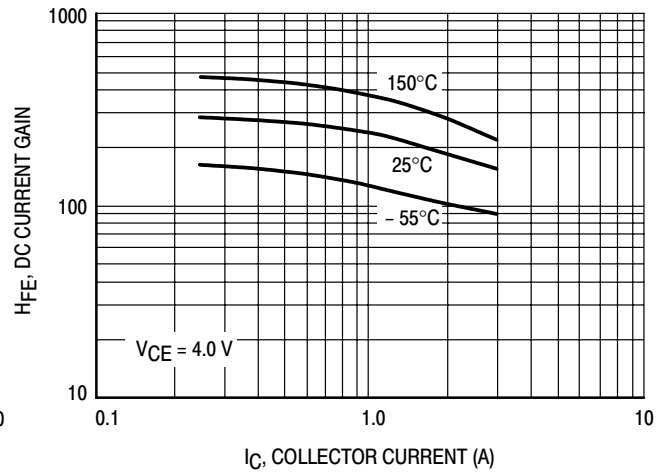


Figure 4. DC Current Gain

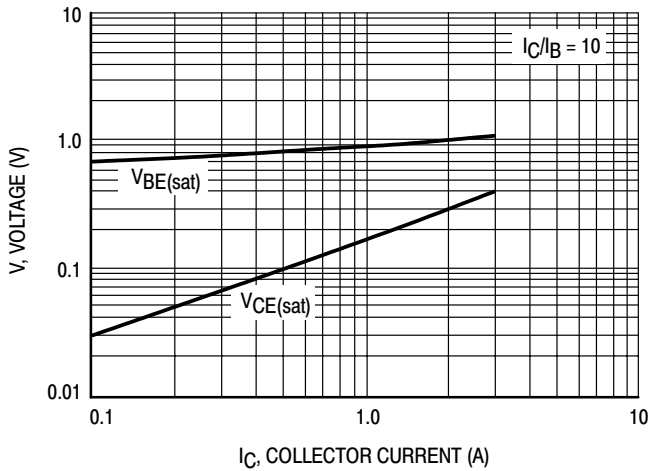


Figure 5. "On" Voltages

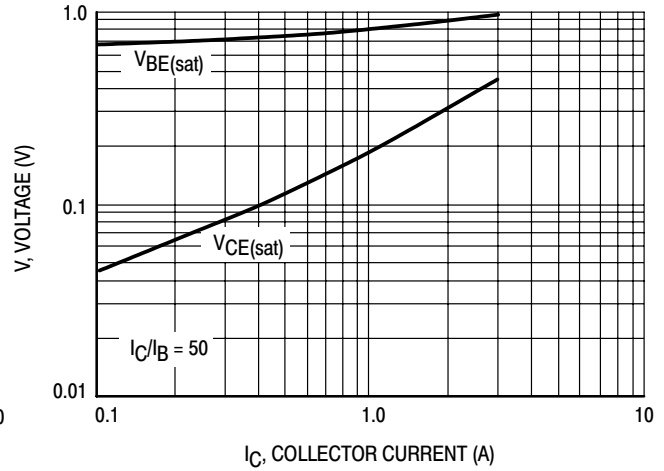


Figure 6. "On" Voltages

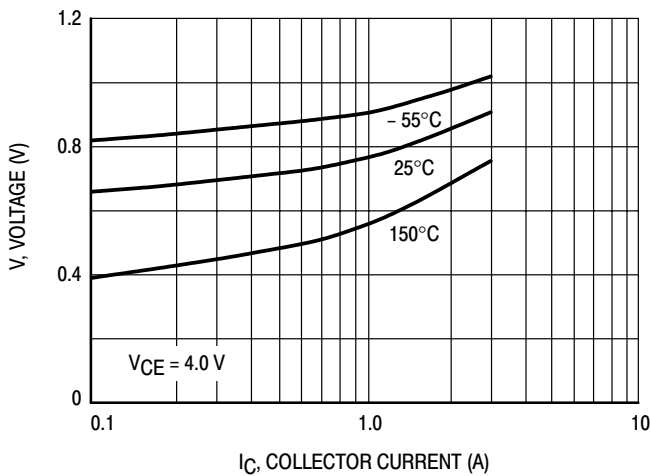


Figure 7.  $V_{BE(on)}$  Voltage

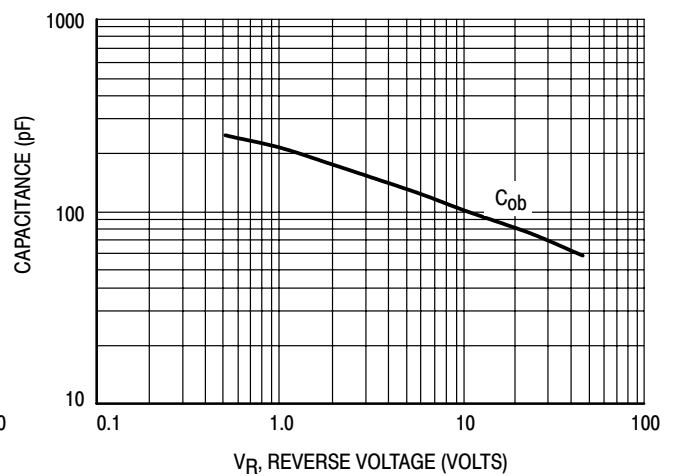


Figure 8. Output Capacitance

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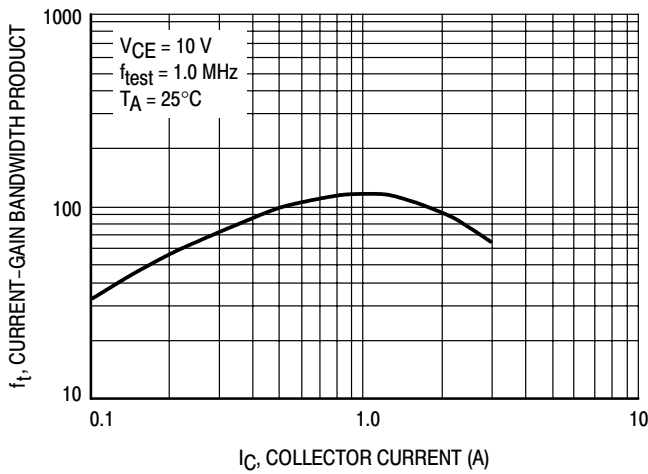


Figure 9. Current-Gain Bandwidth Product

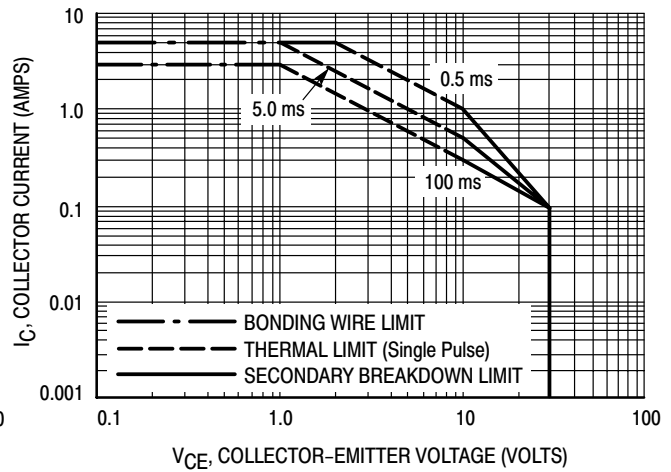


Figure 10. Active Region Safe Operating Area

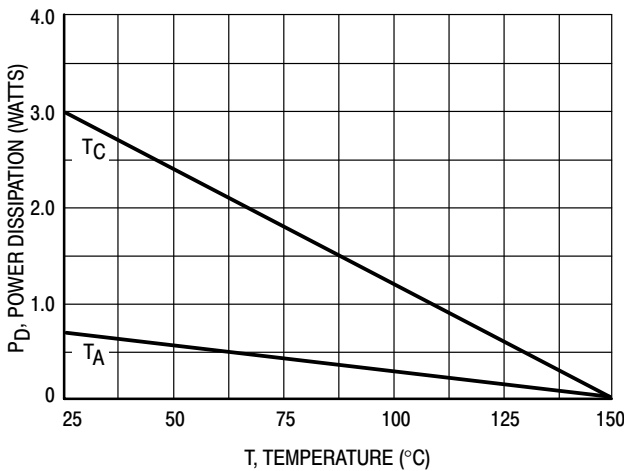


Figure 11. Power Derating

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 10 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Secondary breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^\circ\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 12. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by secondary breakdown.

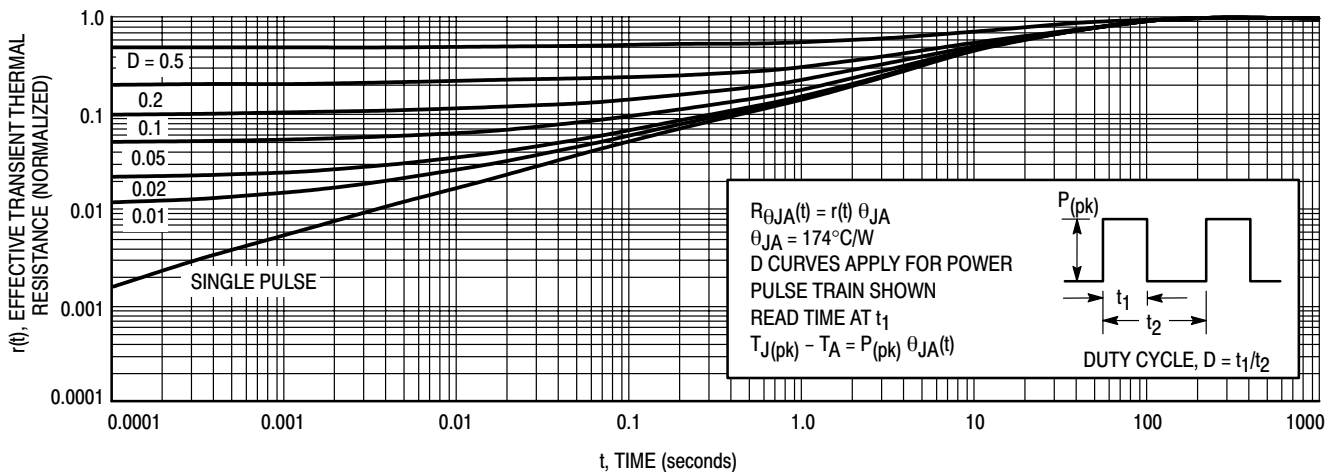


Figure 12. Thermal Response