
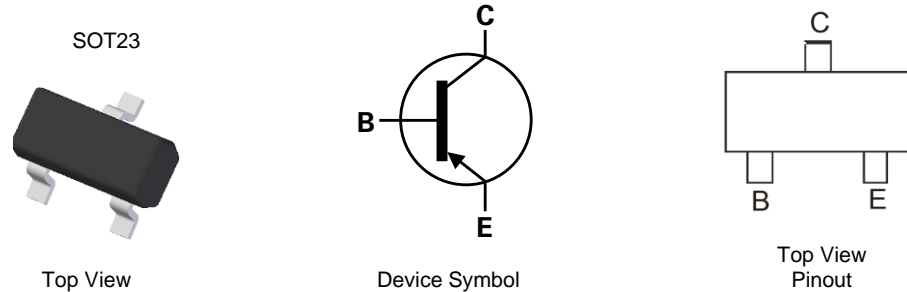


## Features

- Epitaxial Planar Die Construction
- Ideal for Medium-Power Amplification and Switching
- Complementary NPN Type: [MMBT3904](#)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **An automotive-compliant part is available under separate datasheet ([MMBT3906Q](#))**

## Mechanical Data

- Package: SOT23
- Package Material: Molded Plastic, "Green" Molding Compound.  
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish—Matte Tin Plated Leads,  
Solderable per MIL-STD-202, Method 208 
- Weight: 0.008 grams (Approximate)



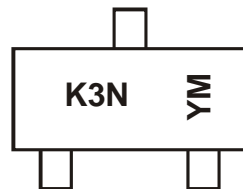
## Ordering Information (Note 4)

| Orderable Part Number | Package | Marking | Reel Size (inches) | Tape Width (mm) | Packing |         |
|-----------------------|---------|---------|--------------------|-----------------|---------|---------|
|                       |         |         |                    |                 | Qty.    | Carrier |
| MMBT3906-7-F          | SOT23   | K3N     | 7                  | 8               | 3000    | Reel    |
| MMBT3906-13-F         | SOT23   | K3N     | 13                 | 8               | 10,000  | Reel    |

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



K3N = Product Type Marking Code  
YM = Date Code Marking  
Y or  $\bar{Y}$  or  $\underline{Y}$  = Year (ex: M = 2025)  
M or  $\bar{M}$  = Month (ex: 9 = September)

### Date Code Key

| Year | 2003 | - | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 |
|------|------|---|------|------|------|------|------|------|------|------|------|------|
| Code | P    | - | M    | N    | P    | R    | S    | T    | U    | V    | W    | X    |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | O   | N   | D   |

**Absolute Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic            | Symbol           | Value | Unit |
|---------------------------|------------------|-------|------|
| Collector-Base Voltage    | V <sub>CBO</sub> | -40   | V    |
| Collector-Emitter Voltage | V <sub>CEO</sub> | -40   | V    |
| Emitter-Base Voltage      | V <sub>EBO</sub> | -6.0  | V    |
| Collector Current         | I <sub>C</sub>   | -200  | mA   |
| Peak Collector Current    | I <sub>CM</sub>  | -200  | mA   |
| Peak Base Current         | I <sub>BM</sub>  | -100  | mA   |

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                          | Symbol                            | Value       | Unit |
|-----------------------------------------|-----------------------------------|-------------|------|
| Power Dissipation                       | P <sub>D</sub>                    | 310         | mW   |
|                                         |                                   | 350         |      |
| Thermal Resistance, Junction to Ambient | R <sub>θJA</sub>                  | 403         | °C/W |
|                                         |                                   | 357         |      |
| Thermal Resistance, Junction to Leads   | R <sub>θJL</sub>                  | 350         | °C/W |
| Operating and Storage Temperature Range | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C   |

**ESD Ratings** (Note 8)

| Characteristic                           | Symbol  | Value | Unit | JEDEC Class |
|------------------------------------------|---------|-------|------|-------------|
| Electrostatic Discharge—Human Body Model | ESD HBM | 4000  | V    | 3A          |
| Electrostatic Discharge—Machine Model    | ESD MM  | 400   | V    | C           |

- Notes:
5. For a device mounted on minimum recommended pad layout 1oz copper that is on a single-sided FR4 PCB; the device is measured under still air conditions while operating in a steady state.
  6. Same as Note 5, except the device is mounted on 15mm x 15mm 1oz copper.
  7. Thermal resistance from junction to solder-point (at the end of the leads).
  8. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

## Thermal Characteristics and Derating Information

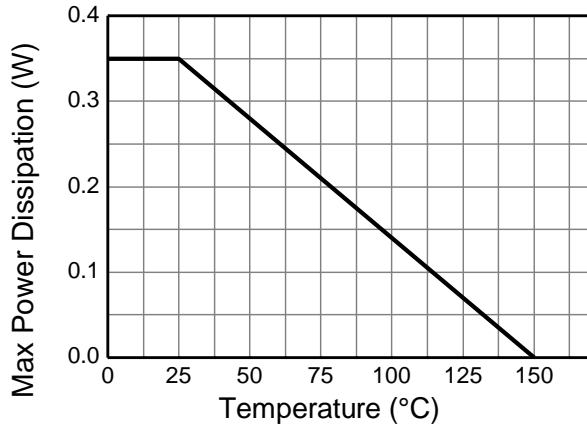


Figure 1. Derating Curve

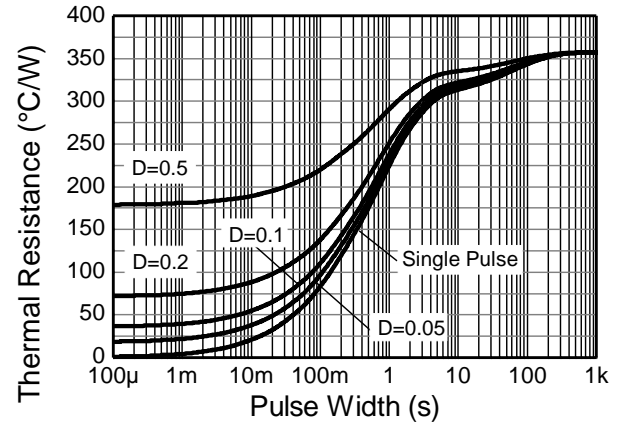


Figure 2. Transient Thermal Impedance

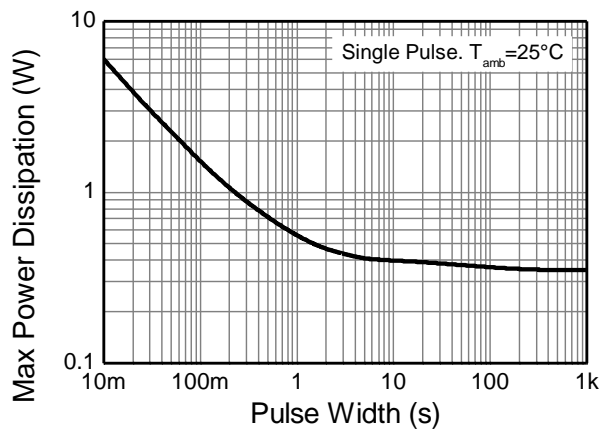


Figure 3. Pulse Power Dissipation

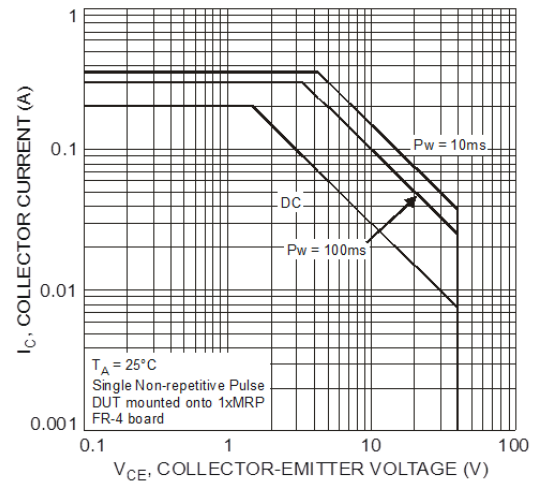


Figure 4. Typical Collector Current vs. Collector-Emitter Voltage

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                               | Symbol               | Min        | Max            | Unit               | Test Condition                                                                                     |
|----------------------------------------------|----------------------|------------|----------------|--------------------|----------------------------------------------------------------------------------------------------|
| OFF CHARACTERISTICS                          |                      |            |                |                    |                                                                                                    |
| Collector-Base Breakdown Voltage             | BV <sub>CBO</sub>    | -40        | —              | V                  | I <sub>C</sub> = -100μA, I <sub>E</sub> = 0                                                        |
| Collector-Emitter Breakdown Voltage (Note 9) | BV <sub>CEO</sub>    | -40        | —              | V                  | I <sub>C</sub> = -10mA, I <sub>B</sub> = 0                                                         |
| Emitter-Base Breakdown Voltage               | BV <sub>EBO</sub>    | -6.0       | —              | V                  | I <sub>E</sub> = -100μA, I <sub>C</sub> = 0                                                        |
| Collector Cutoff Current                     | I <sub>CEV</sub>     | —          | -50            | nA                 | V <sub>CE</sub> = -30V, V <sub>BE</sub> = 3.0V                                                     |
|                                              |                      | —          | -50            | nA                 | V <sub>CE</sub> = -30V, V <sub>BE</sub> = -0.25V                                                   |
| Emitter-Base Cutoff Current                  | I <sub>EBO</sub>     | —          | -50            | nA                 | V <sub>EB</sub> = -5V                                                                              |
| ON CHARACTERISTICS (Note 9)                  |                      |            |                |                    |                                                                                                    |
| DC Current Gain                              | h <sub>FE</sub>      | 60         | —              | —                  | I <sub>C</sub> = -100μA, V <sub>CE</sub> = -1.0V                                                   |
|                                              |                      | 80         | —              |                    | I <sub>C</sub> = -1.0mA, V <sub>CE</sub> = -1.0V                                                   |
|                                              |                      | 100        | 300            |                    | I <sub>C</sub> = -10mA, V <sub>CE</sub> = -1.0V                                                    |
|                                              |                      | 60         | —              |                    | I <sub>C</sub> = -50mA, V <sub>CE</sub> = -1.0V                                                    |
|                                              |                      | 30         | —              |                    | I <sub>C</sub> = -100mA, V <sub>CE</sub> = -1.0V                                                   |
| Collector-Emitter Saturation Voltage         | V <sub>CE(sat)</sub> | —<br>—     | -0.25<br>-0.40 | V                  | I <sub>C</sub> = -10mA, I <sub>B</sub> = -1.0mA<br>I <sub>C</sub> = -50mA, I <sub>B</sub> = -5.0mA |
| Base-Emitter Saturation Voltage              | V <sub>BE(sat)</sub> | -0.65<br>— | -0.85<br>-0.95 | V                  | I <sub>C</sub> = -10mA, I <sub>B</sub> = -1.0mA<br>I <sub>C</sub> = -50mA, I <sub>B</sub> = -5.0mA |
| SMALL-SIGNAL CHARACTERISTICS                 |                      |            |                |                    |                                                                                                    |
| Output Capacitance                           | C <sub>obo</sub>     | —          | 4.5            | pF                 | V <sub>CB</sub> = -5.0V, f = 1.0MHz, I <sub>E</sub> = 0                                            |
| Input Capacitance                            | C <sub>ibo</sub>     | —          | 10             | pF                 | V <sub>EB</sub> = -0.5V, f = 1.0MHz, I <sub>C</sub> = 0                                            |
| Input Impedance                              | h <sub>IE</sub>      | 2.0        | 12             | kΩ                 | V <sub>CE</sub> = 10V, I <sub>C</sub> = 1.0mA<br>f = 1.0kHz                                        |
| Voltage Feedback Ratio                       | h <sub>RE</sub>      | 0.1        | 10             | × 10 <sup>-4</sup> |                                                                                                    |
| Small-Signal Current Gain                    | h <sub>FE</sub>      | 100        | 400            | —                  |                                                                                                    |
| Output Admittance                            | h <sub>OE</sub>      | 3.0        | 60             | μS                 |                                                                                                    |
| Current Gain-Bandwidth Product               | f <sub>T</sub>       | 250        | —              | MHz                | V <sub>CE</sub> = -20V, I <sub>C</sub> = -10mA<br>f = 100MHz                                       |
| Noise Figure                                 | NF                   | —          | 4.0            | dB                 | V <sub>CE</sub> = -5.0V, I <sub>C</sub> = -100μA<br>R <sub>S</sub> = 1.0kΩ, f = 1.0kHz             |
| SWITCHING CHARACTERISTICS                    |                      |            |                |                    |                                                                                                    |
| Delay Time                                   | t <sub>d</sub>       | —          | 35             | ns                 | V <sub>CC</sub> = -3.0V, I <sub>C</sub> = -10mA                                                    |
| Rise Time                                    | t <sub>r</sub>       | —          | 35             | ns                 | V <sub>BE(off)</sub> = 0.5V, I <sub>B1</sub> = -1.0mA                                              |
| Storage Time                                 | t <sub>s</sub>       | —          | 225            | ns                 | V <sub>CC</sub> = -3.0V, I <sub>C</sub> = -10mA                                                    |
| Fall Time                                    | t <sub>f</sub>       | —          | 75             | ns                 | I <sub>B1</sub> = I <sub>B2</sub> = -1.0mA                                                         |

Note: 9. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

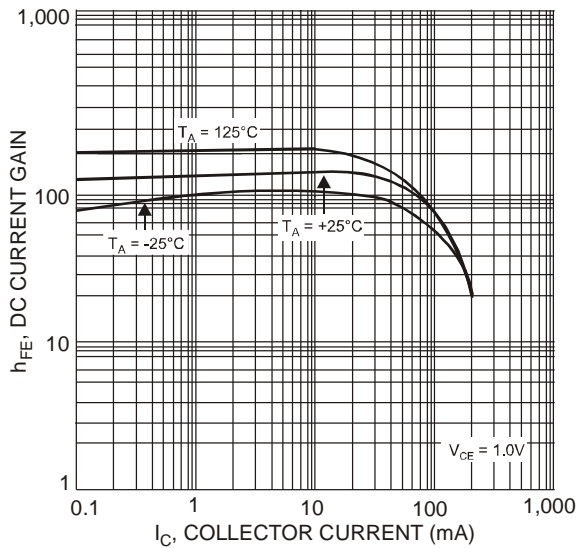


Figure 5. Typical DC Current Gain vs. Collector Current

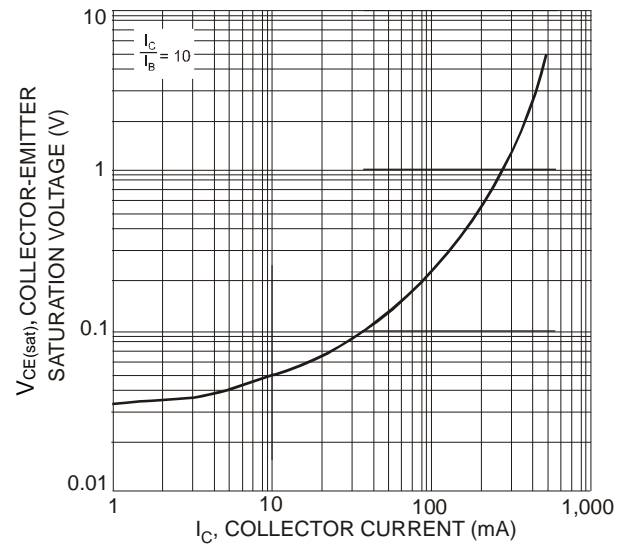


Figure 6. Typical Collector-Emitter Saturation Voltage vs. Collector Current

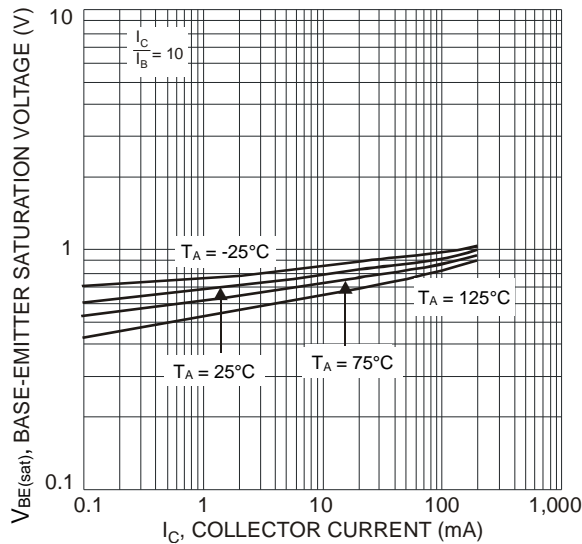


Figure 7. Typical Base-Emitter Saturation Voltage vs. Collector Current

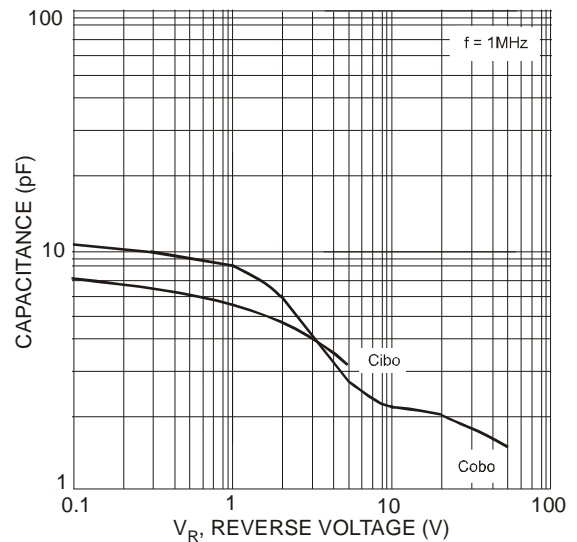
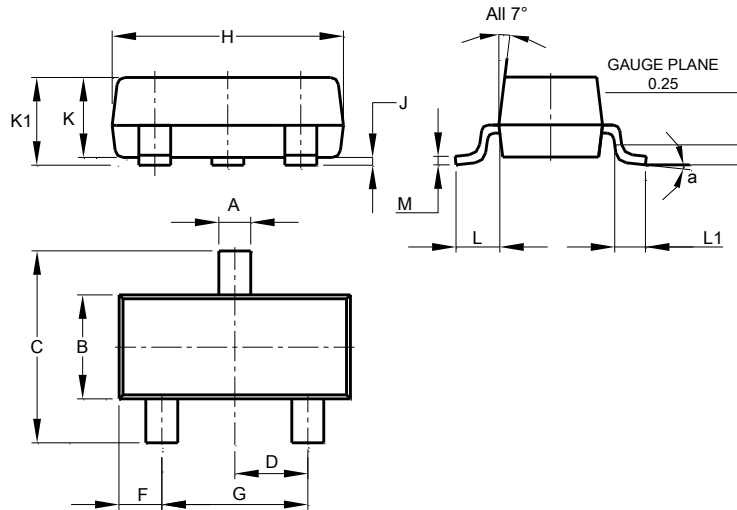


Figure 8. Typical Capacitance Characteristics

## Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### SOT23

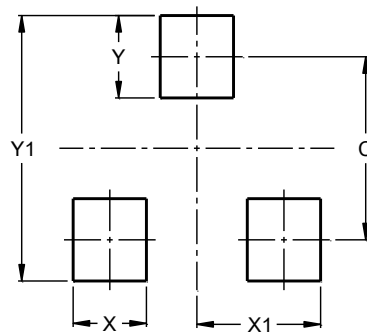


| SOT23                |       |       |       |
|----------------------|-------|-------|-------|
| Dim                  | Min   | Max   | Typ   |
| A                    | 0.37  | 0.51  | 0.40  |
| B                    | 1.20  | 1.40  | 1.30  |
| C                    | 2.30  | 2.50  | 2.40  |
| D                    | 0.89  | 1.03  | 0.915 |
| F                    | 0.45  | 0.60  | 0.535 |
| G                    | 1.78  | 2.05  | 1.83  |
| H                    | 2.80  | 3.00  | 2.90  |
| J                    | 0.013 | 0.10  | 0.05  |
| K                    | 0.890 | 1.00  | 0.975 |
| K1                   | 0.903 | 1.10  | 1.025 |
| L                    | 0.45  | 0.61  | 0.55  |
| L1                   | 0.25  | 0.55  | 0.40  |
| M                    | 0.085 | 0.150 | 0.110 |
| a                    | 0°    | 8°    | --    |
| All Dimensions in mm |       |       |       |

## Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### SOT23



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 2.0           |
| X          | 0.8           |
| X1         | 1.35          |
| Y          | 0.9           |
| Y1         | 2.9           |

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