



**THE DATASHEET OF
MMBT3906T-7-F**



Features

- $BV_{CEO} > -40V$
- $I_C = -200mA$ Collector Current
- Epitaxial Planar Die Construction
- Ultra-Small Surface Mount Package
- Complementary NPN Type: MMBT3904T
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

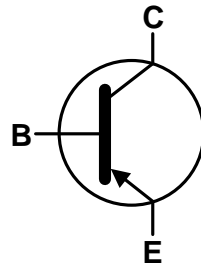
Mechanical Data

- Case: SOT523
- Case Material: Molded Plastic. "Green" Molding Compound.
- UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 ③
- Weight: 0.002 grams (Approximate)

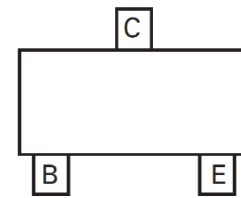
SOT523



Top View



Device Symbol



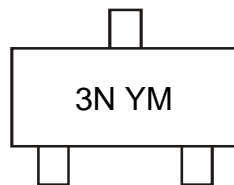
Pin-out Top View

Ordering Information (Note 4)

| Product | Status | Compliance | Marking | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|----------------|--------|------------|---------|--------------------|-----------------|-------------------|
| MMBT3906T-7-F | Active | AEC-Q101 | 3N | 7 | 8 | 3,000 |
| MMBT3906T-13-F | Active | AEC-Q101 | 3N | 13 | 8 | 10,000 |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html 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 <http://www.diodes.com/products/packages.html>.

Marking Information



3N = Product Type Marking Code
 YM = Date Code Marking
 Y or \bar{Y} = Year (ex: D = 2016)
 M or \bar{M} = Month (ex: 9 = September)

Date Code Key

| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | C | D | E | F | G | H | I | J | K | L | M |

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

| Characteristic | Symbol | Value | Unit |
|---------------------------|-----------|-------|------|
| Collector-Base Voltage | V_{CB0} | -40 | V |
| Collector-Emitter Voltage | V_{CEO} | -40 | V |
| Emitter-Base Voltage | V_{EBO} | -5 | V |
| Collector Current | I_C | -200 | mA |

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

| Characteristic | Symbol | Value | Unit |
|--|-----------------|-------------|---------------------------|
| Power Dissipation (Note 5) | P_D | 150 | mW |
| Thermal Resistance, Junction to Ambient (Note 5) | $R_{\theta JA}$ | 833 | $^\circ\text{C}/\text{W}$ |
| Operating and Storage Temperature Range | T_J, T_{STG} | -55 to +150 | $^\circ\text{C}$ |

ESD Ratings (Note 6)

| Characteristic | Symbol | Value | Unit | JEDEC Class |
|--|---------|-------|------|-------------|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4,000 | V | 3A |
| Electrostatic Discharge - Machine Model | ESD MM | 400 | V | C |

- Notes:
- For a device mounted with the collector lead on minimum recommended pad layout 1oz copper that is on a single-sided 1.6mm FR-4 PCB; device is measured under still air conditions whilst operating in a steady-state.
 - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

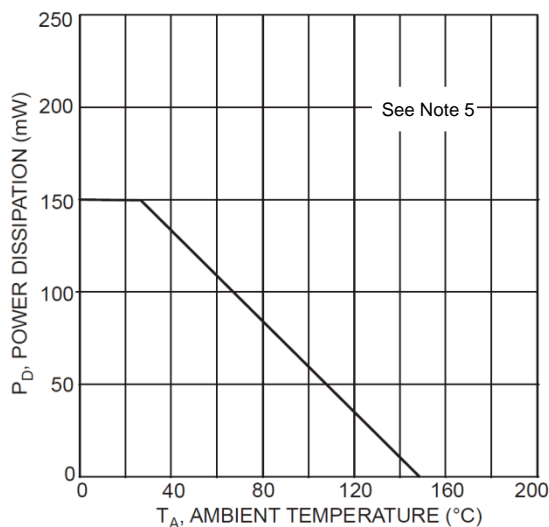
Thermal Characteristics and Derating Information


Fig. 1 Power Derating Curve

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

| Characteristic | Symbol | Min | Max | Unit | Test Condition | |
|--------------------------------------|---------------|-------|----------------|------------------|--|---|
| OFF CHARACTERISTICS (Note 7) | | | | | | |
| Collector-Base Breakdown Voltage | BV_{CBO} | -40 | — | V | $I_C = -10\mu\text{A}, I_E = 0$ | |
| Collector-Emitter Breakdown Voltage | BV_{CEO} | -40 | — | V | $I_C = -1\text{mA}, I_B = 0$ | |
| Emitter-Base Breakdown Voltage | BV_{EBO} | -5 | — | V | $I_E = -10\mu\text{A}, I_C = 0$ | |
| Collector Cutoff Current | I_{CEX} | — | -50 | nA | $V_{CE} = -30\text{V}, V_{EB(OFF)} = -3\text{V}$ | |
| Base Cutoff Current | I_{BL} | — | -50 | nA | $V_{CE} = -30\text{V}, V_{EB(OFF)} = -3\text{V}$ | |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| DC Current Gain | h_{FE} | 60 | — | — | $I_C = -100\mu\text{A}, V_{CE} = -1\text{V}$ | |
| | | 80 | — | | | $I_C = -1\text{mA}, V_{CE} = -1\text{V}$ |
| | | 100 | 300 | | | $I_C = -10\text{mA}, V_{CE} = -1\text{V}$ |
| | | 60 | — | | | $I_C = -50\text{mA}, V_{CE} = -1\text{V}$ |
| | | 30 | — | | | $I_C = -100\text{mA}, V_{CE} = -1\text{V}$ |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | — | -0.25 -0.40 | V | $I_C = -10\text{mA}, I_B = -1\text{mA}$ $I_C = -50\text{mA}, I_B = -5\text{mA}$ | |
| Base-Emitter Saturation Voltage | $V_{BE(SAT)}$ | -0.65 | -0.85 -0.95 | V | $I_C = -10\text{mA}, I_B = -1\text{mA}$ $I_C = -50\text{mA}, I_B = -5\text{mA}$ | |
| SMALL SIGNAL CHARACTERISTICS | | | | | | |
| Output Capacitance | C_{obo} | — | 4.5 | pF | $V_{CB} = -5\text{V}, f = 1.0\text{MHz}, I_E = 0$ | |
| Input Capacitance | C_{ibo} | — | 10 | pF | $V_{EB} = -0.5\text{V}, f = 1.0\text{MHz}, I_C = 0$ | |
| Input Impedance | h_{ie} | 2 | 12 | k Ω | $V_{CE} = -10\text{V}, I_C = -10\text{mA}, f = 1.0\text{MHz}$ | |
| Voltage Feedback Ratio | h_{re} | 0.1 | 10 | $\times 10^{-4}$ | | |
| Small Signal Current Gain | h_{fe} | 100 | 400 | — | | |
| Output Admittance | h_{oe} | 3 | 60 | μS | | |
| Current Gain-Bandwidth Product | f_T | 250 | — | MHz | | $V_{CE} = -20\text{V}, I_C = -10\text{mA}, f = 100\text{MHz}$ |
| Noise Figure | NF | — | 5 | dB | $V_{CC} = 5\text{V}, I_C = 100\mu\text{A}, R_S = 1\text{k}\Omega, f = 1\text{MHz}$ | |
| SWITCHING CHARACTERISTICS | | | | | | |
| Delay Time | t_D | — | 35 | ns | $V_{CC} = -3\text{V}, I_C = -10\text{mA}$ | |
| Rise Time | t_R | — | 35 | ns | $V_{BE(OFF)} = -0.5\text{V}, I_{B1} = -1\text{mA}$ | |
| Storage Time | t_S | — | 225 | ns | $V_{CC} = -3.0\text{V}, I_C = -10\text{mA}$ | |
| Fall Time | t_F | — | 75 | ns | $I_{B1} = -I_{B2} = -1.0\text{mA}$ | |

Note: 7. Measured under pulsed conditions. Pulse width $\leq 300\mu\text{s}$. Duty cycle $\leq 2\%$.

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

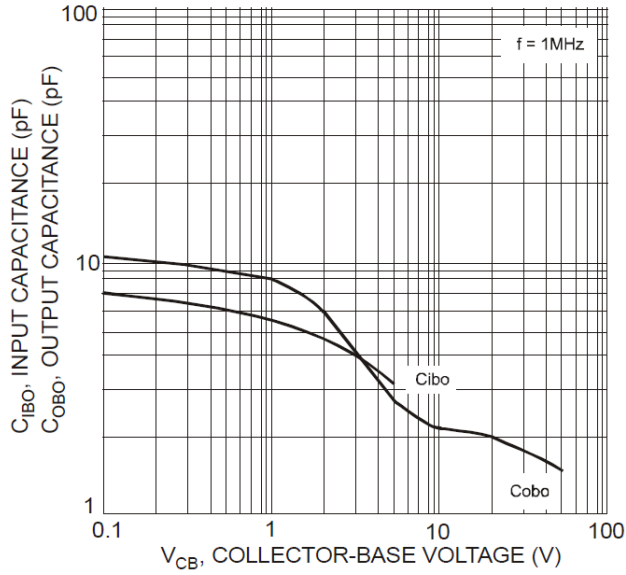


Fig. 2 Typical Input and Output Capacitance vs. Collector-Base Voltage

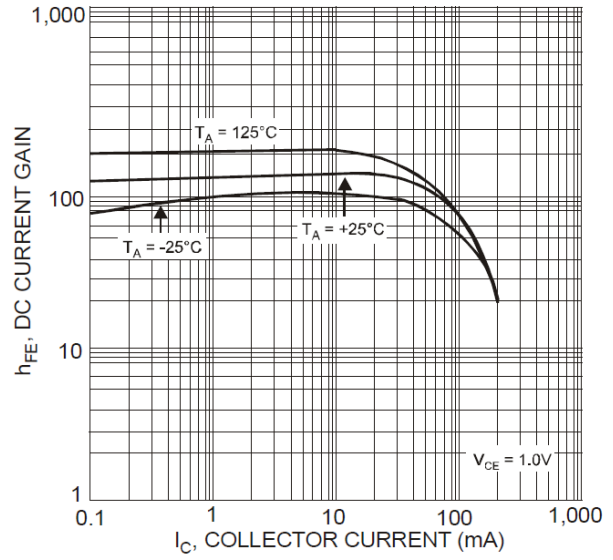


Fig. 3 Typical DC Current Gain vs. Collector Current

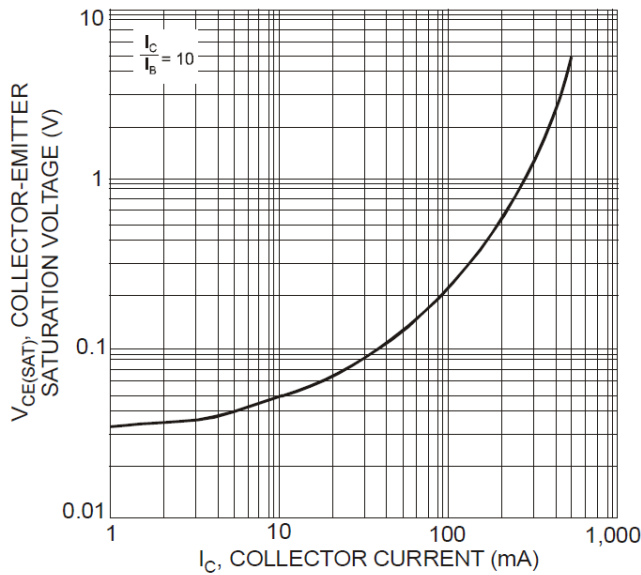


Fig. 4 Typical Collector-Emitter Saturation Voltage vs. Collector Current

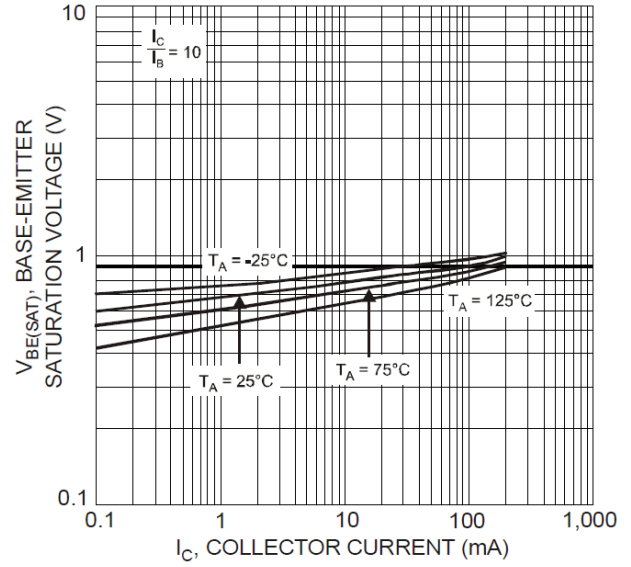
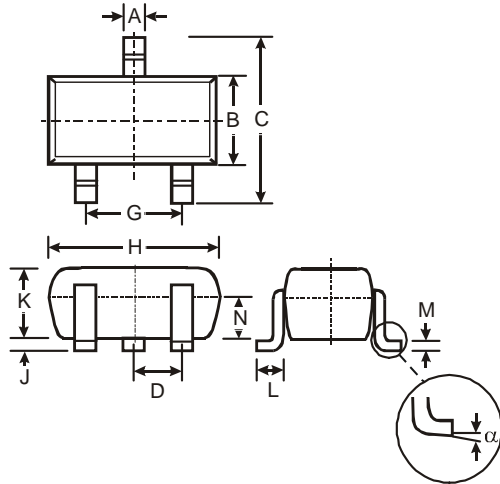


Fig. 5 Typical Base-Emitter Saturation Voltage vs. Collector Current

Package Outline Dimensions

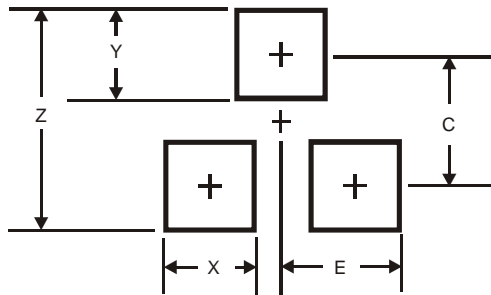
Please see <http://www.diodes.com/package-outlines.html> for the latest version.



| SOT523 | | | |
|----------------------|------|------|------|
| Dim | Min | Max | Typ |
| A | 0.15 | 0.30 | 0.22 |
| B | 0.75 | 0.85 | 0.80 |
| C | 1.45 | 1.75 | 1.60 |
| D | — | — | 0.50 |
| G | 0.90 | 1.10 | 1.00 |
| H | 1.50 | 1.70 | 1.60 |
| J | 0.00 | 0.10 | 0.05 |
| K | 0.60 | 0.80 | 0.75 |
| L | 0.10 | 0.30 | 0.22 |
| M | 0.10 | 0.20 | 0.12 |
| N | 0.45 | 0.65 | 0.50 |
| α | 0° | 8° | — |
| All Dimensions in mm | | | |

Suggested Pad Layout

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



| Dimensions | Value (in mm) |
|------------|---------------|
| Z | 1.8 |
| X | 0.4 |
| Y | 0.51 |
| C | 1.3 |
| E | 0.7 |

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