

Features

- $BV_{CEO} > 40V$
- $I_C = 200mA$ Collector Current
- Epitaxial Planar Die Construction
- Ultra-Small Surface Mount Package
- Complementary PNP Type: MMBT3906T
- **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**

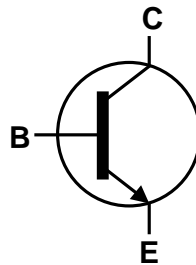
Mechanical Data

- 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 (B3)
- Weight: 0.002 grams (Approximate)

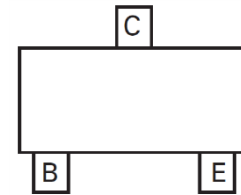
SOT523



Top View



Device Symbol



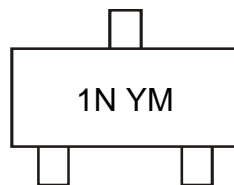
Pin-Out Top View

Ordering Information (Note 4)

| Product | Status | Compliance | Marking | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|----------------|--------|------------|---------|--------------------|-----------------|-------------------|
| MMBT3904T-7-F | Active | AEC-Q101 | 1N | 7 | 8 | 3,000 |
| MMBT3904T-13-F | Active | AEC-Q101 | 1N | 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



1N = Product Type Marking Code
 YM = Date Code Marking
 Y or \bar{Y} = Year (ex: A = 2013)
 M or \bar{M} = Month (ex: 9 = September)

Date Code Key

| Year | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | A | B | C | D | E | F | G | H | I | J | K |

| 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°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---------------------------|------------------|-------|------|
| Collector-Base Voltage | V _{CBO} | 60 | V |
| Collector-Emitter Voltage | V _{CEO} | 40 | V |
| Emitter-Base Voltage | V _{EBO} | 6 | V |
| Collector Current | I _C | 200 | mA |

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|--|-----------------------------------|-------------|------|
| Power Dissipation (Note 5) | P _D | 150 | mW |
| Thermal Resistance, Junction to Ambient (Note 5) | R _{θJA} | 833 | °C/W |
| Operating and Storage Temperature Range | T _J , T _{STG} | -55 to +150 | °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: 5. For a device mounted with the collector lead on minimum recommended pad layout 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in a steady-state.
6. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristics and Derating Information

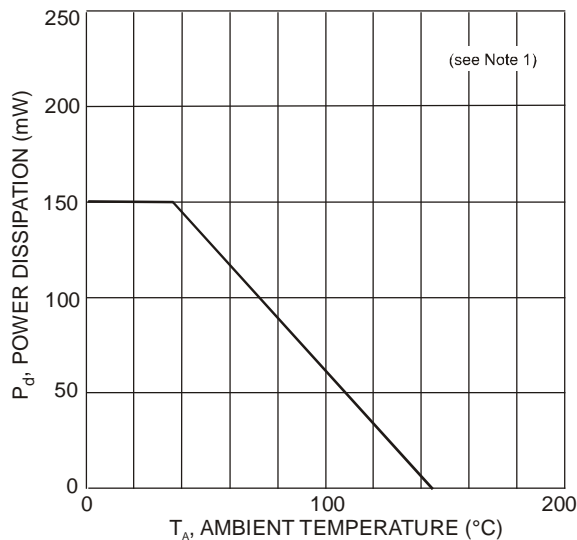


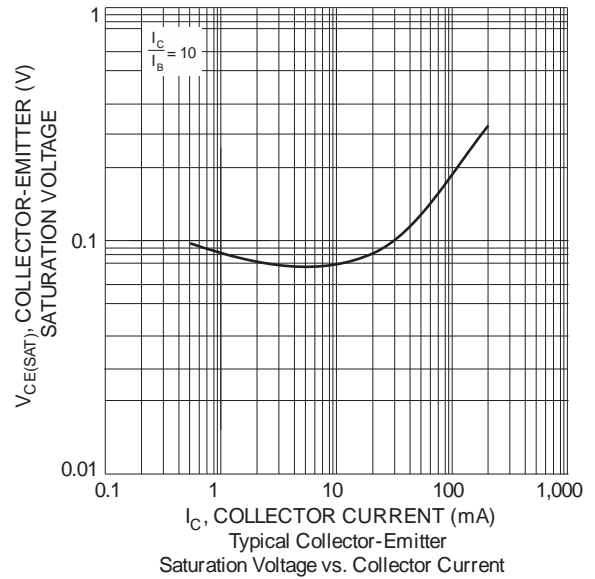
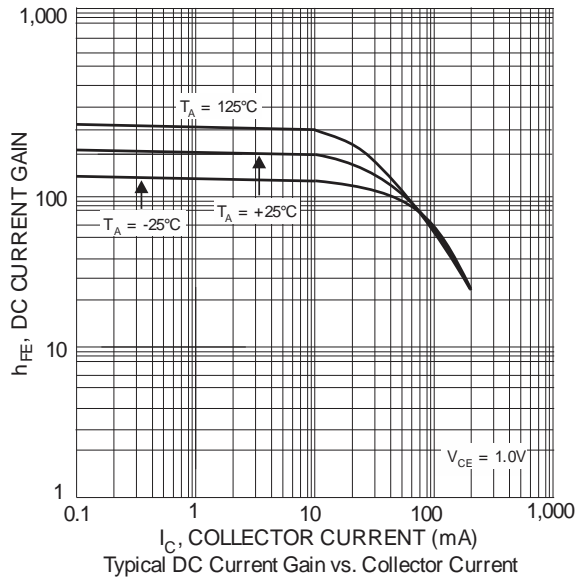
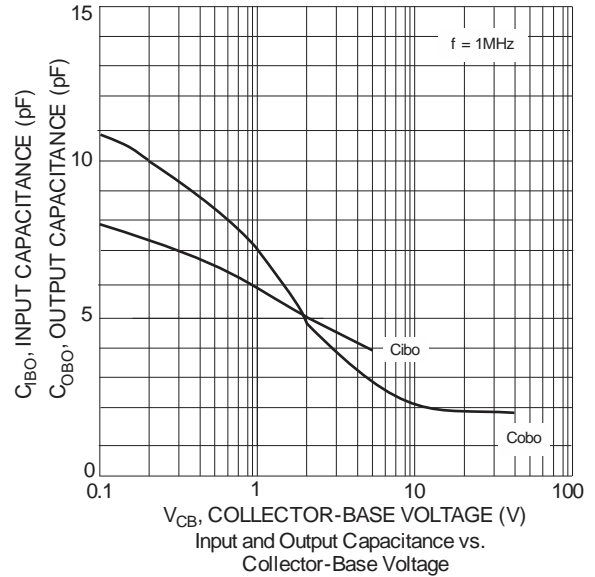
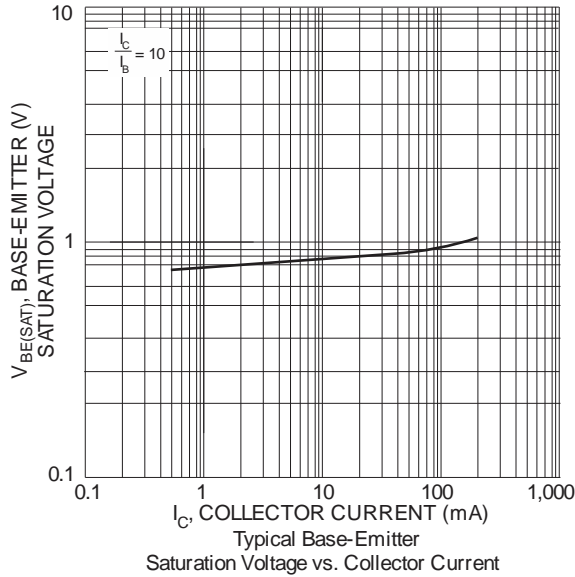
Fig. 1, Power Derating Curve

Electrical Characteristics (@T_A = +25°C unless otherwise specified.)

| Characteristic | Symbol | Min | Max | Unit | Test Condition | |
|--------------------------------------|----------------------|-----------|--------------|--------------------|---|--|
| OFF CHARACTERISTICS (Note 7) | | | | | | |
| Collector-Base Breakdown Voltage | BV _{CBO} | 60 | — | V | I _C = 10μA, I _E = 0 | |
| Collector-Emitter Breakdown Voltage | BV _{CEO} | 40 | — | V | I _C = 1mA, I _B = 0 | |
| Emitter-Base Breakdown Voltage | BV _{EBO} | 6 | — | V | I _E = 10μA, I _C = 0 | |
| Collector Cutoff Current | I _{CEX} | — | 50 | nA | V _{CE} = 30V, V _{EB(OFF)} = 3V | |
| Base Cutoff Current | I _{BL} | — | 50 | nA | V _{CE} = 30V, V _{EB(OFF)} = 3V | |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| DC Current Gain | h _{FE} | 40 | — | — | I _C = 100μA, V _{CE} = 1V | |
| | | 70 | — | | | I _C = 1mA, V _{CE} = 1V |
| | | 100 | 300 | | | I _C = 10mA, V _{CE} = 1V |
| | | 60 | — | | | I _C = 50mA, V _{CE} = 1V |
| | | 30 | — | | | I _C = 100mA, V _{CE} = 1V |
| Collector-Emitter Saturation Voltage | V _{CE(SAT)} | — | 0.20 0.30 | V | I _C = 10mA, I _B = 1mA I _C = 50mA, I _B = 5mA | |
| Base-Emitter Saturation Voltage | V _{BE(SAT)} | 0.65 — | 0.85 0.95 | V | I _C = 10mA, I _B = 1mA I _C = 50mA, I _B = 5mA | |
| SMALL SIGNAL CHARACTERISTICS | | | | | | |
| Output Capacitance | C _{OBO} | — | 4 | pF | V _{CB} = 5V, f = 1.0MHz, I _E = 0 | |
| Input Capacitance | C _{IBO} | — | 8 | pF | V _{EB} = 0.5V, f = 1.0MHz, I _C = 0 | |
| Input Impedance | h _{iE} | 1 | 10 | kΩ | V _{CE} = 10V, I _C = 1mA, f = 1.0MHz | |
| Voltage Feedback Ratio | h _{RE} | 0.5 | 8.0 | x 10 ⁻⁴ | | |
| Small Signal Current Gain | h _{FE} | 100 | 400 | — | | |
| Output Admittance | h _{OE} | 1 | 40 | μS | | |
| Current Gain-Bandwidth Product | f _T | 300 | — | MHz | V _{CE} = 20V, I _C = 10mA, f = 100MHz | |
| Noise Figure | NF | — | 5 | dB | V _{CC} = 5V, I _C = 100μA, R _S = 1kΩ, f = 1MHz | |
| SWITCHING CHARACTERISTICS | | | | | | |
| Delay Time | t _D | — | 35 | ns | V _{CC} = 3V, I _C = 10mA, V _{BE(OFF)} = -0.5V, I _{B1} = 1mA | |
| Rise Time | t _R | — | 35 | ns | | |
| Storage Time | t _S | — | 200 | ns | V _{CC} = 3.0V, I _C = 10mA I _{B1} = - I _{B2} = 1.0mA | |
| Fall Time | t _F | — | 50 | ns | | |

Note: 7. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

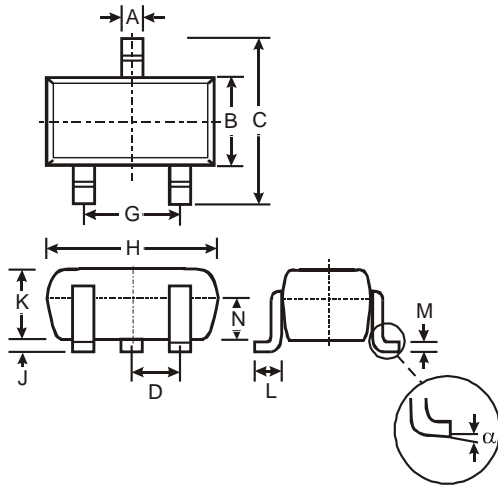
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



Package Outline Dimensions

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

SOT523

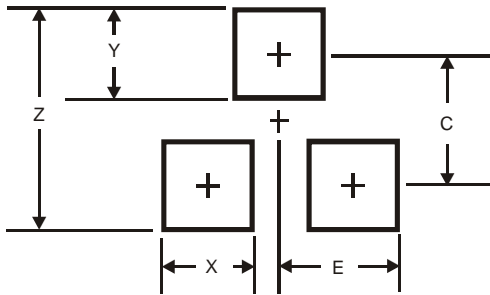


| SOT523 | | | |
|----------------------|------|------|------|
| Dim | Min | Max | Typ |
| A | 0.15 | 0.30 | 0.22 |
| B | 0.75 | 0.85 | 0.80 |
| C | 1.45 | 1.75 | 1.60 |
| D | — | — | 0.50 |
| G | 0.90 | 1.10 | 1.00 |
| H | 1.50 | 1.70 | 1.60 |
| J | 0.00 | 0.10 | 0.05 |
| K | 0.60 | 0.80 | 0.75 |
| 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.

SOT523



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

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