

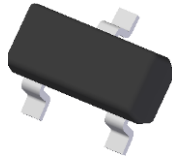
Features

- 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)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

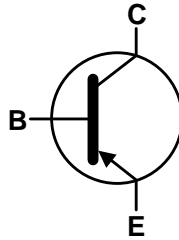
Mechanical Data

- Case: SOT23
- Case 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 (e3)
- Weight: 0.008 grams (Approximate)

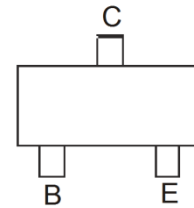
SOT23



Top View



Device Symbol

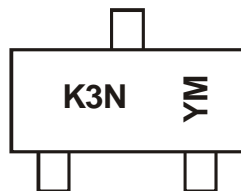

 Top View
Pin-Out

Ordering Information (Notes 4 & 5)

| Product | Status | Compliance | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---------------|--------|------------|---------|--------------------|-----------------|-------------------|
| MMBT3906-7-F | Active | AEC-Q101 | K3N | 7 | 8 | 3,000 |
| MMBT3906Q-7-F | Active | Automotive | K3N | 7 | 8 | 3,000 |
| MMBT3906-13-F | Active | AEC-Q101 | K3N | 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. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to http://www.diodes.com/quality/product_compliance_definitions/.
 5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

Marking Information



K3N = 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 |
|------|------|------|------|------|------|------|------|------|
| Code | C | D | E | F | G | H | I | J |

| 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} | -40 | V |
| Collector-Emitter Voltage | V _{CEO} | -40 | V |
| Emitter-Base Voltage | V _{EBO} | -6.0 | V |
| Collector Current | I _C | -200 | mA |
| Peak Collector Current | I _{CM} | -200 | mA |
| Peak Base Current | I _{BM} | -100 | mA |

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

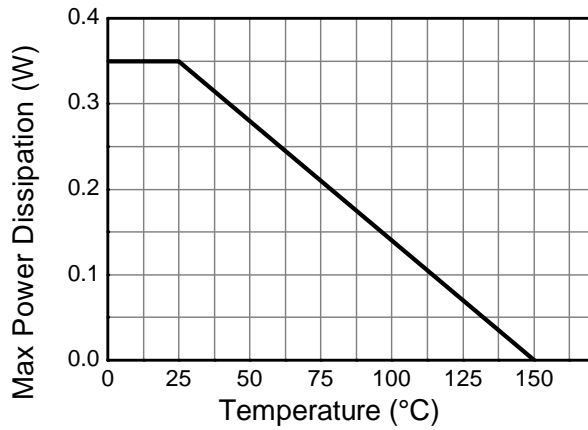
| Characteristic | Symbol | Value | Unit |
|-----------------------------------------|-----------------------------------|-------------|------|
| Power Dissipation | P _D | (Note 6) | 310 |
| | | (Note 7) | 350 |
| Thermal Resistance, Junction to Ambient | R _{θJA} | (Note 6) | 403 |
| | | (Note 7) | 357 |
| Thermal Resistance, Junction to Leads | R _{θJL} | 350 | °C/W |
| Operating and Storage Temperature Range | T _J , T _{STG} | -55 to +150 | °C |

ESD Ratings (Note 9)

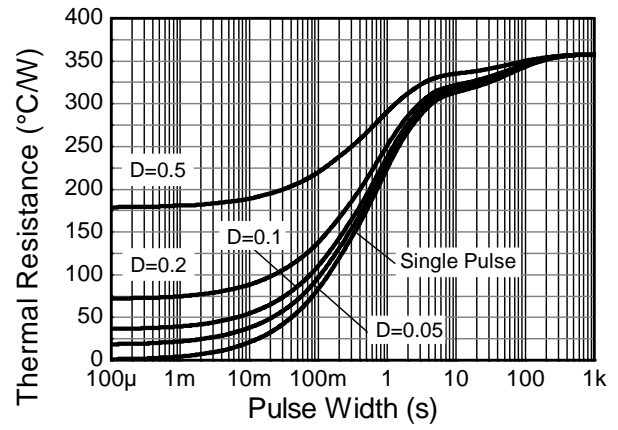
| Characteristic | Symbol | Value | Unit | JEDEC Class |
|--------------------------------------------|---------|-------|------|-------------|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4,000 | V | 3A |
| Electrostatic Discharge - Machine Model | ESD MM | 400 | V | C |

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

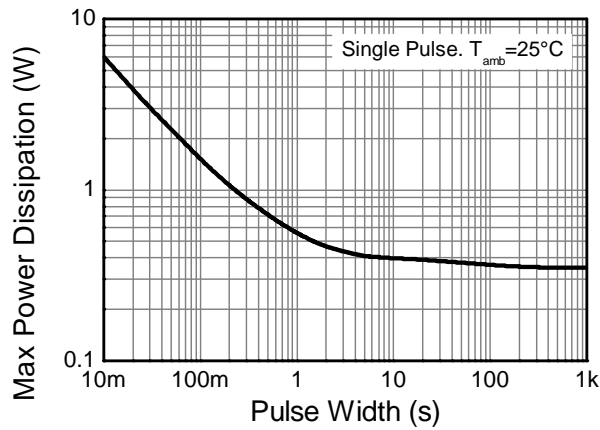
Thermal Characteristics and Derating Information



Derating Curve



Transient Thermal Impedance



Pulse Power Dissipation

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

| Characteristic | Symbol | Min | Max | Unit | Test Condition | |
|-----------------------------------------------|----------------------|-------|-------|--------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| OFF CHARACTERISTICS | | | | | | |
| Collector-Base Breakdown Voltage | BV _{CBO} | -40 | — | V | I _C = -100μA, I _E = 0 | |
| Collector-Emitter Breakdown Voltage (Note 10) | BV _{CEO} | -40 | — | V | I _C = -10mA, I _B = 0 | |
| Emitter-Base Breakdown Voltage | BV _{EBO} | -6.0 | — | V | I _E = -100μA, I _C = 0 | |
| Collector Cutoff Current | I _{CEV} | — | -50 | nA | V _{CE} = -30V, V _{BE} = 3.0V | |
| | | — | -50 | nA | V _{CE} = -30V, V _{BE} = -0.25V | |
| Emitter-Base Cutoff Current | I _{EBO} | — | -50 | nA | V _{EB} = -5V | |
| ON CHARACTERISTICS (Note 10) | | | | | | |
| DC Current Gain | h _{FE} | 60 | — | — | I _C = -100μA, V _{CE} = -1.0V | |
| | | 80 | — | | | |
| | | 100 | 300 | | | I _C = -1.0mA, V _{CE} = -1.0V |
| | | 60 | — | | | I _C = -10mA, V _{CE} = -1.0V |
| | | 30 | — | | | I _C = -50mA, V _{CE} = -1.0V |
| Collector-Emitter Saturation Voltage | V _{CE(sat)} | — | -0.25 | V | I _C = -10mA, I _B = -1.0mA | |
| | | — | -0.40 | | | I _C = -50mA, I _B = -5.0mA |
| Base-Emitter Saturation Voltage | V _{BE(sat)} | -0.65 | -0.85 | V | I _C = -10mA, I _B = -1.0mA | |
| | | — | -0.95 | | | I _C = -50mA, I _B = -5.0mA |
| SMALL SIGNAL CHARACTERISTICS | | | | | | |
| Output Capacitance | C _{obo} | — | 4.5 | pF | V _{CB} = -5.0V, f = 1.0MHz, I _E = 0 | |
| Input Capacitance | C _{ibo} | — | 10 | pF | V _{EB} = -0.5V, f = 1.0MHz, I _C = 0 | |
| Input Impedance | h _{ie} | 2.0 | 12 | kΩ | V _{CE} = 10V, I _C = 1.0mA, f = 1.0kHz | |
| Voltage Feedback Ratio | h _{re} | 0.1 | 10 | x 10 ⁻⁴ | | |
| Small Signal Current Gain | h _{fe} | 100 | 400 | — | | |
| Output Admittance | h _{oe} | 3.0 | 60 | μS | | |
| Current Gain-Bandwidth Product | f _T | 250 | — | MHz | V _{CE} = -20V, I _C = -10mA, f = 100MHz | |
| Noise Figure | NF | — | 4.0 | dB | V _{CE} = -5.0V, I _C = -100μA, R _S = 1.0kΩ, f = 1.0kHz | |
| SWITCHING CHARACTERISTICS | | | | | | |
| Delay Time | t _d | — | 35 | ns | V _{CC} = -3.0V, I _C = -10mA, V _{BE(off)} = 0.5V, I _{B1} = -1.0mA | |
| Rise Time | t _r | — | 35 | ns | | |
| Storage Time | t _s | — | 225 | ns | V _{CC} = -3.0V, I _C = -10mA, I _{B1} = I _{B2} = -1.0mA | |
| Fall Time | t _f | — | 75 | ns | | |

Note: 10. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.

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

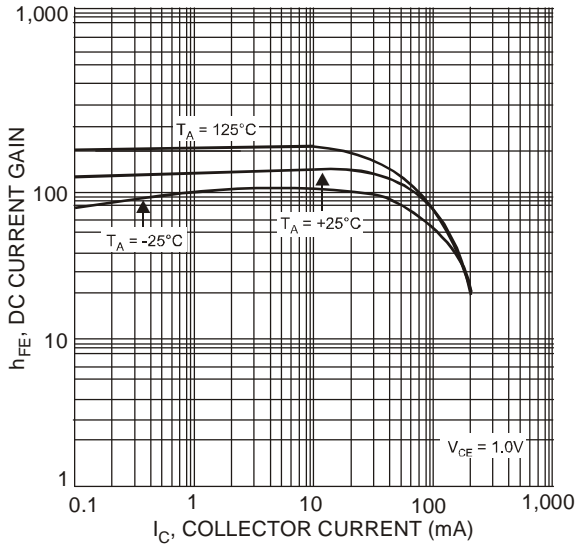


Figure 1 Typical DC Current Gain vs. Collector Current

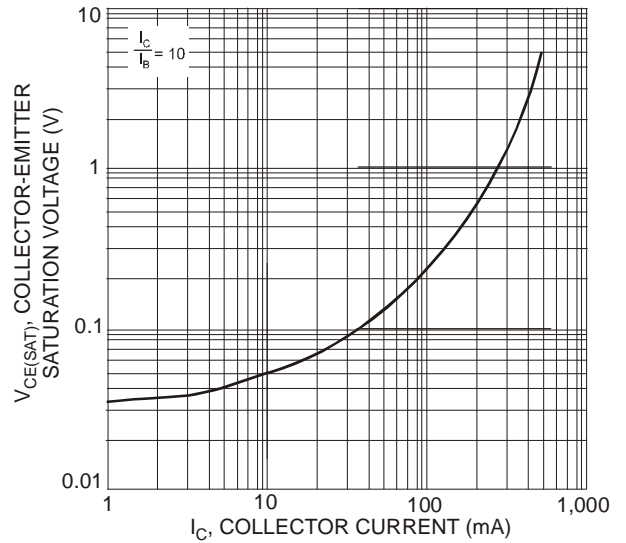


Figure 2 Typical Collector-Emitter Saturation Voltage vs. Collector Current

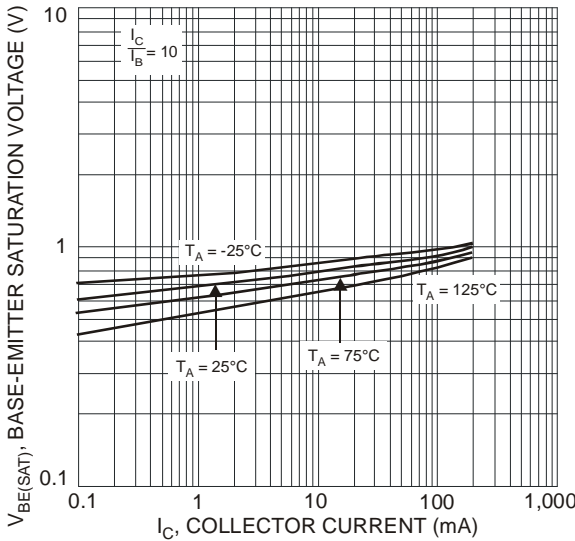


Figure 3 Typical Base-Emitter Saturation Voltage vs. Collector Current

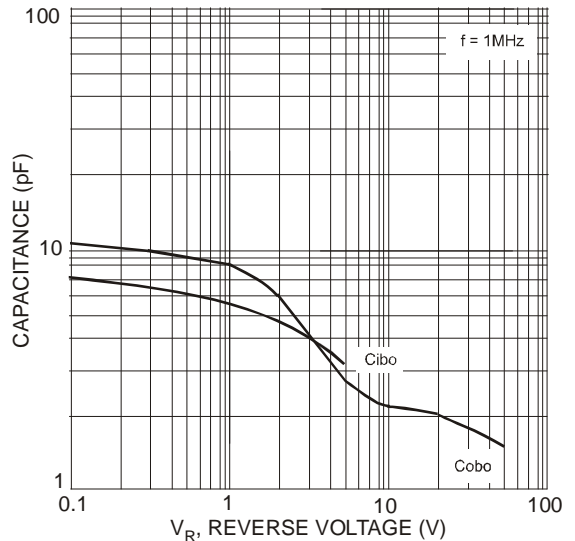
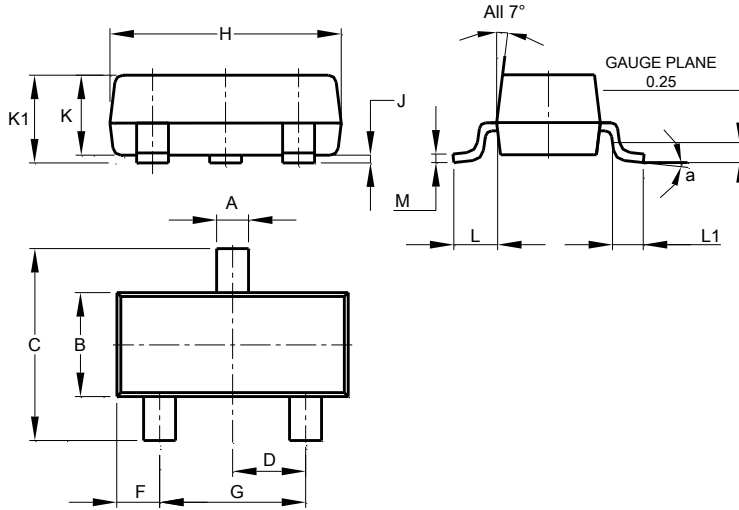


Figure 4 Typical Capacitance Characteristics

Package Outline Dimensions

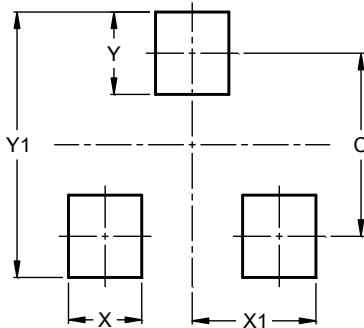
Please see <http://www.diodes.com/package-outlines.html> for the latest version.



| 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.



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

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