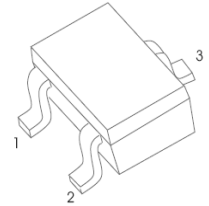


Features

- Epitaxial Planar Die Construction
- Complementary NPN Type Available MMBT3904AT
- Also Available in Lead Free Version



SOT-523

- 1. BASE
- 2. EMITTER
- 3. COLLECTOR

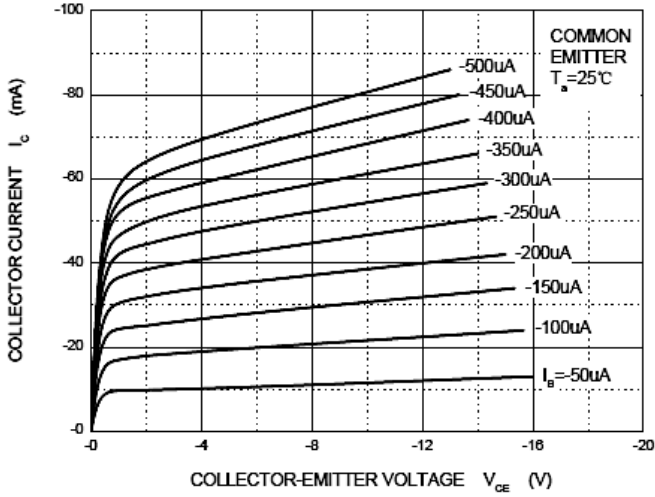
Absolute Maximum Ratings ($T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------------|---------------------------|
| Collector-Base Voltage | V_{CBO} | -40 | V |
| Collector-Emitter Voltage | V_{CEO} | -40 | V |
| Emitter-Base Voltage | V_{EBO} | -5 | V |
| Collector Current - Continuous | I_C | -200 | mA |
| Collector Power Dissipation | P_C | 150 | mW |
| Thermal Resistance from Junction to Ambient | $R_{\theta JA}$ | 833 | $^\circ\text{C}/\text{W}$ |
| Junction Temperature | T_J | -55 to +150 | $^\circ\text{C}$ |
| Storage Temperature | T_{STG} | -55 to +150 | $^\circ\text{C}$ |

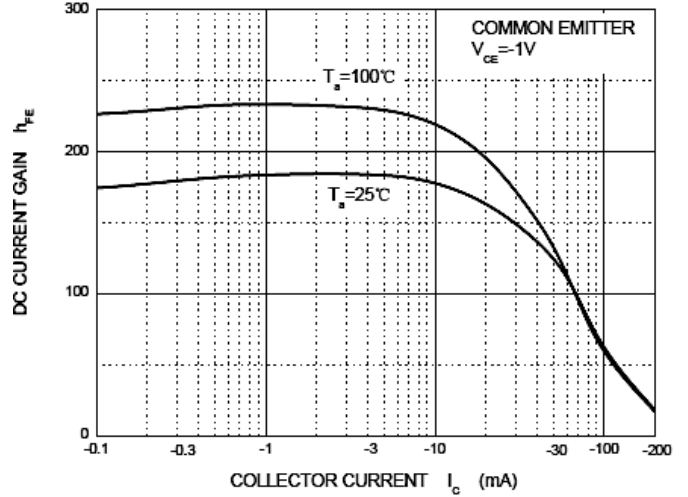
Electrical Characteristics ($T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min | Max | Unit |
|--------------------------------------|----------------|---|-------|-------|---------------|
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | $I_C = -10\mu\text{A}, I_E = 0$ | -40 | - | V |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CEO}$ | $I_C = -1\text{mA}, I_B = 0$ | -40 | - | V |
| Emitter-Base Breakdown Voltage | $V_{(BR)EBO}$ | $I_E = -10\mu\text{A}, I_C = 0$ | -5 | - | V |
| Collector Cut-Off Current | I_{CBO} | $V_{CB} = -30\text{V}, I_E = 0$ | - | -0.1 | μA |
| Emitter Cut-Off Current | I_{EBO} | $V_{EB} = -5\text{V}, I_C = 0$ | - | -0.1 | μA |
| Collector Cut-Off Current | I_{CEX} | $V_{CB} = -30\text{V}, V_{BE(off)} = -3\text{V}$ | - | -0.05 | μA |
| DC Current Gain | $h_{FE(1)}$ | $V_{CE} = -1\text{V}, I_C = -0.1\text{mA}$ | 60 | - | - |
| | $h_{FE(2)}$ | $V_{CE} = -1\text{V}, I_C = -1\text{mA}$ | 80 | - | - |
| | $h_{FE(3)}$ | $V_{CE} = -1\text{V}, I_C = -10\text{mA}$ | 100 | 300 | - |
| | $h_{FE(4)}$ | $V_{CE} = -1\text{V}, I_C = -50\text{mA}$ | 60 | - | - |
| | $h_{FE(5)}$ | $V_{CE} = -1\text{V}, I_C = -100\text{mA}$ | 30 | - | - |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)1}$ | $I_C = -10\text{mA}, I_B = -1\text{mA}$ | - | -0.25 | V |
| | $V_{CE(sat)2}$ | $I_C = -50\text{mA}, I_B = -5\text{mA}$ | - | -0.4 | V |
| Base-Emitter Saturation Voltage | $V_{BE(sat)1}$ | $I_C = -10\text{mA}, I_B = -1\text{mA}$ | -0.65 | -0.85 | V |
| | $V_{BE(sat)2}$ | $I_C = -50\text{mA}, I_B = -5\text{mA}$ | - | -0.95 | V |
| Transition Frequency | f_T | $V_{CE} = -20\text{V}, I_C = -10\text{mA}, f = 100\text{MHz}$ | 250 | - | MHz |
| Collector Output Capacitance | C_{obo} | $V_{CB} = -5\text{V}, I_E = 0, f = 1\text{MHz}$ | - | 4.5 | pF |
| Input Capacitance | C_{iob} | $V_{EB} = -0.5\text{V}, I_E = 0, f = 1\text{MHz}$ | - | 10 | pF |
| Noise Figure | NF | $V_{CE} = -5\text{V}, I_C = 0.1\text{mA}$ | - | 4 | dB |
| Delay Time | t_d | $V_{CC} = -3\text{V}, V_{BE(OFF)} = -0.5\text{V}$ $I_C = -10\text{mA}, I_{B1} = -1\text{mA}$ | - | 35 | nS |
| Rise Time | t_r | | - | 35 | nS |
| Storage Time | t_s | $V_{CC} = -3\text{V}, I_C = -10\text{mA}$ | - | 225 | nS |
| Fall Time | t_f | $I_{B1} = I_{B2} = -1\text{mA}$ | - | 75 | nS |

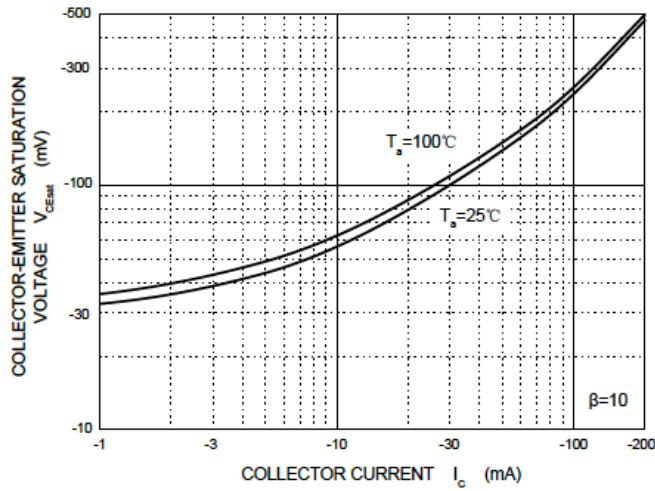
Typical Characteristic Curves



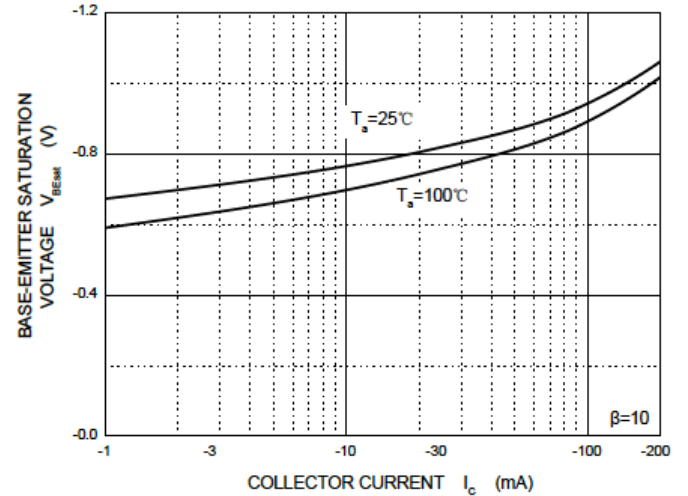
Static Characteristic



$h_{FE} - I_c$

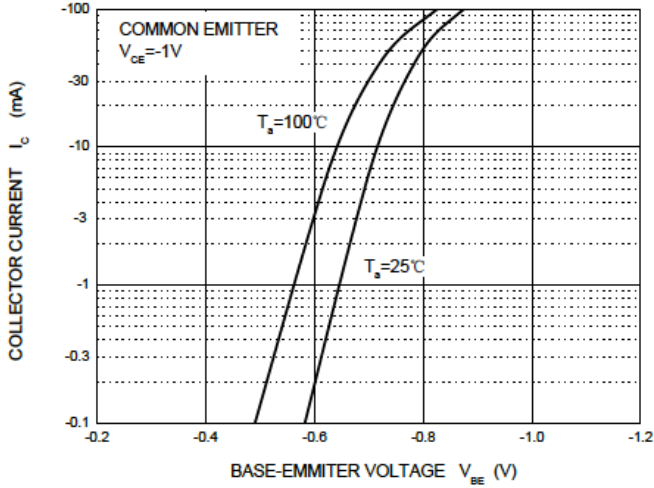


$V_{CEsat} - I_c$

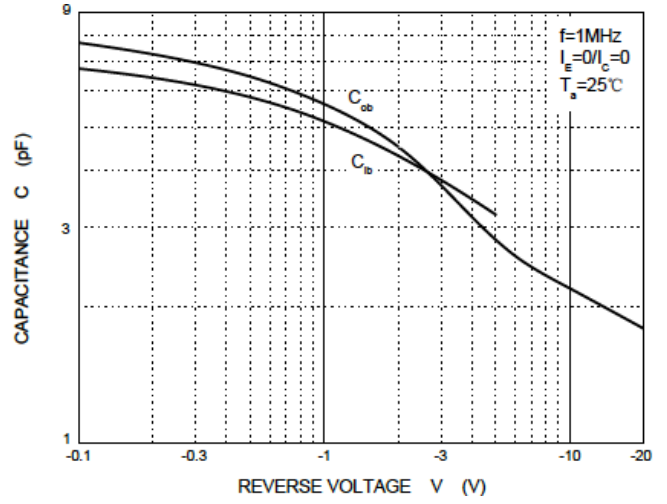


$V_{BEsat} - I_c$

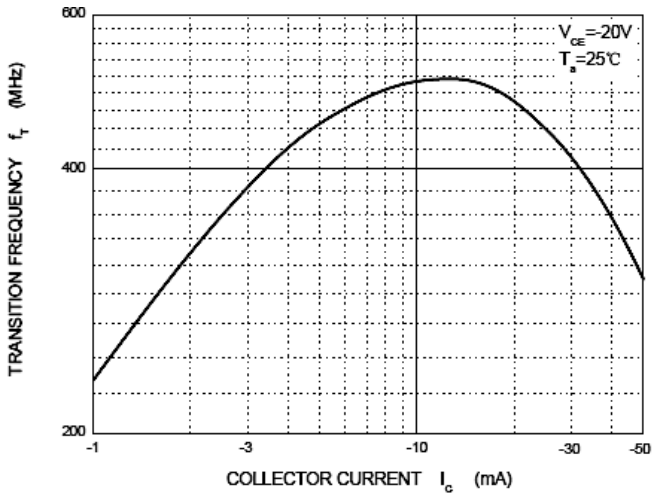
Typical Characteristic Curves



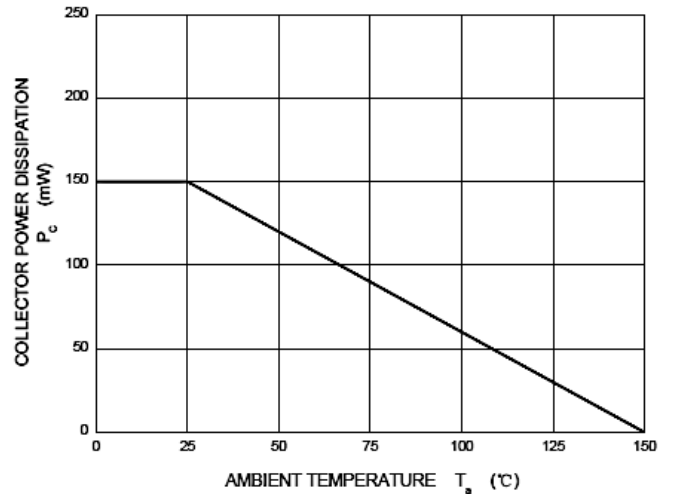
I_c — V_{BE}



C_{ob}/C_{ib} — V_{CB}/V_{EB}

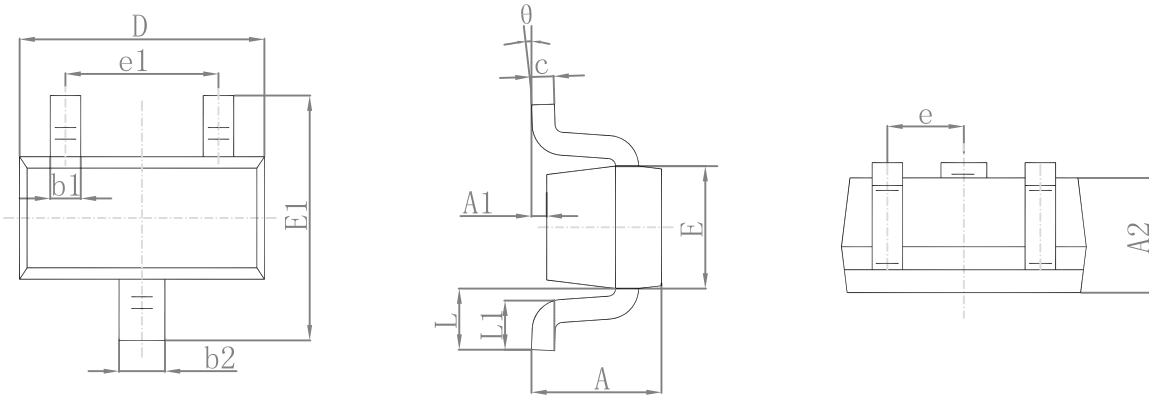


f_T — I_c



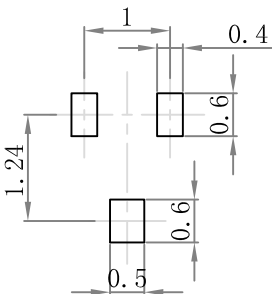
P_c — T_a

Package Outline Dimensions SOT-523



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.700 | 0.900 | 0.028 | 0.035 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.700 | 0.800 | 0.028 | 0.031 |
| b1 | 0.150 | 0.250 | 0.006 | 0.010 |
| b2 | 0.250 | 0.350 | 0.010 | 0.014 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 1.500 | 1.700 | 0.059 | 0.067 |
| E | 0.700 | 0.900 | 0.028 | 0.035 |
| E1 | 1.450 | 1.750 | 0.057 | 0.069 |
| e | 0.500 TYP. | | 0.020 TYP. | |
| e1 | 0.900 | 1.100 | 0.035 | 0.043 |
| L | 0.400 REF. | | 0.016 REF. | |
| L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| θ | 0° | 8° | 0° | 8° |

Suggested Pad Layout



- Note:
1. Controlling dimension: in millimeters.
 2. General tolerance: $\pm 0.05\text{mm}$.
 3. The pad layout is for reference purposes only.

Marking and Ordering Information

| Device | Package | Marking | Quantity | HSF Status |
|------------|---------|---------|----------------|----------------|
| MMBT3906AT | SOT-523 | 3N | 3000pcs / Reel | RoHS Compliant |