

## -40V, PNP General-Purpose Transistor

### FEATURES

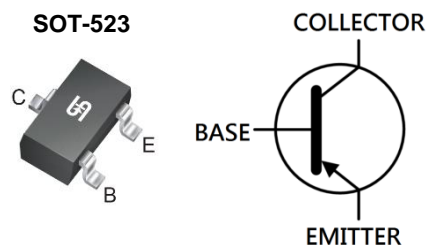
- Complementary NPN Type: MMBT3904T
- Epitaxial Planar Type
- $V_{CEO} > -40V$
- $I_C = -200mA$  Collector Current
- RoHS Compliant
- Halogen-free according to IEC 61249-2-21

### KEY PERFORMANCE PARAMETERS

| PARAMETER     |                         | VALUE | UNIT |
|---------------|-------------------------|-------|------|
| $V_{CBO}$     |                         | -40   | V    |
| $V_{CEO}$     |                         | -40   | V    |
| $I_C$         |                         | -200  | mA   |
| $V_{CE(sat)}$ | $I_C = 10mA, I_B = 1mA$ | -0.25 | V    |

### APPLICATION

- Consumer electronics
- Low frequency amplifier
- Driver



**Notes:** MSL 1 (Moisture Sensitivity Level) per J-STD-020

| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ C$ 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   | $I_C$     | -200        | mA         |
| Power Dissipation   | $P_D$     | 150         | mW         |
| Junction temperature  | $T_J$     | -55 to +150 | $^\circ C$ |
| Storage temperature   | $T_{STG}$ | -55 to +150 | $^\circ C$ |

| THERMAL PERFORMANCE                    |                 |     |              |
|--|-----------------|-----|--------------|
| PARAMETER                              | SYMBOL          | TYP | UNIT         |
| Junction-to-ambient thermal resistance | $R_{\theta JA}$ | 403 | $^\circ C/W$ |

**Thermal Performance Note:** Units mounted on PCB (10mm x 5mm Cu pad test board)

**ELECTRICAL SPECIFICATIONS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| PARAMETER                            | CONDITIONS  | SYMBOL        | MIN   | TYP | MAX   | UNIT |
|--------------------------------------|---|---------------|-------|-----|-------|------|
| <b>Static<sup>(1)</sup></b>          |   |               |       |     |       |      |
| Collector-Emitter Breakdown Voltage  | $I_C = -1.0\text{mA}, I_B = 0\text{A}$  | $V_{(BR)CEO}$ | -40   | -   | -     | V    |
| Collector-Base Breakdown Voltage     | $I_C = -10\mu\text{A}, I_E = 0\text{A}$   | $V_{(BR)CBO}$ | -40   | -   | -     | V    |
| Emitter-Base Breakdown Voltage       | $I_E = -10\mu\text{A}, I_C = 0\text{A}$   | $V_{(BR)EBO}$ | -5    | -   | -     | V    |
| Emitter Cut-Off Current              | $V_{CB} = -30\text{V}, I_E = 0\text{A}$   | $I_{CBO}$     | -     | -   | -50   | nA   |
| Collector Cut-Off Current            | $V_{EB} = -5\text{V}, I_E = 0\text{A}$  | $I_{EBO}$     | -     | -   | -50   | nA   |
| Collector-Emitter Saturation Voltage | $I_C = -10\text{mA}, I_B = -1.0\text{mA}$   | $V_{CE(sat)}$ |       |     | -0.25 | V    |
|                                      | $I_C = -50\text{mA}, I_B = -5.0\text{mA}$   |               |       |     | -0.4  | V    |
| Base-Emitter Saturation Voltage      | $I_C = -10\text{mA}, I_B = -1.0\text{mA}$   | $V_{BE(sat)}$ | -0.65 | -   | -0.85 | V    |
|                                      | $I_C = -50\text{mA}, I_B = -5.0\text{mA}$   |               | -     | -   | -0.95 | V    |
| Output Capacitance                   | $V_{CB} = -5.0\text{V}, I_E = 0, f = 1\text{MHz}$   | $C_{obo}$     | -     | -   | 4.5   | pF   |
| Input Capacitance                    | $V_{EB} = -0.5\text{V}, I_C = 0, f = 1\text{MHz}$   | $C_{ibo}$     | -     | -   | 10    | pF   |
| DC Current Gain                      | $I_C = -0.1\text{mA}, V_{CE} = -1.0\text{V}$  | $h_{FE}$      | 60    | -   | -     |      |
|                                      | $I_C = -1.0\text{mA}, V_{CE} = -1.0\text{V}$  |               | 80    | -   | -     |      |
|                                      | $I_C = -10\text{mA}, V_{CE} = -1.0\text{V}$   |               | 100   | -   | 300   |      |
|                                      | $I_C = -50\text{mA}, V_{CE} = -1.0\text{V}$   |               | 60    | -   | -     |      |
|                                      | $I_C = -100\text{mA}, V_{CE} = -1.0\text{V}$  |               | 30    | -   | -     |      |
| <b>Dynamic<sup>(2)</sup></b>         |   |               |       |     |       |      |
| Transition Frequency                 | $I_C = -10\text{mA}, V_{CE} = -20\text{V}, f = 100\text{MHz}$                                   | $f_T$         | 250   | -   | -     | MHz  |
| Delay Time                           | $V_{CC} = -3.0\text{V}, V_{BE(OFF)} = -0.5\text{V}, I_C = -10\text{mA}, I_{B1} = -1.0\text{mA}$ | $t_d$         | -     | -   | 35    | ns   |
| Rise Time                            |   | $t_r$         | -     | -   | 35    | ns   |
| Storage Time                         | $V_{CC} = -3.0\text{V}, I_C = -10\text{mA}$   | $t_s$         | -     | -   | 225   | ns   |
| Fail Time                            | $I_{B1} = I_{B2} = -1.0\text{mA}$   | $t_f$         | -     | -   | 75    | ns   |

**Notes:**

1. Pulse test:  $\leq 380\mu\text{s}$ , duty cycle  $\leq 2\%$
2. For DESIGN AID ONLY, not subject to production testing

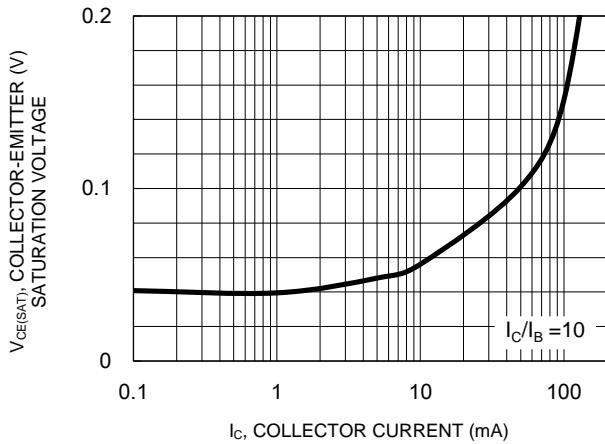
**ORDERING INFORMATION**

| ORDERING CODE | PACKAGE | PACKING                |
|---------------|---------|------------------------|
| MMBT3906T RSG | SOT-523 | 3,000 / 7" Tape & Reel |

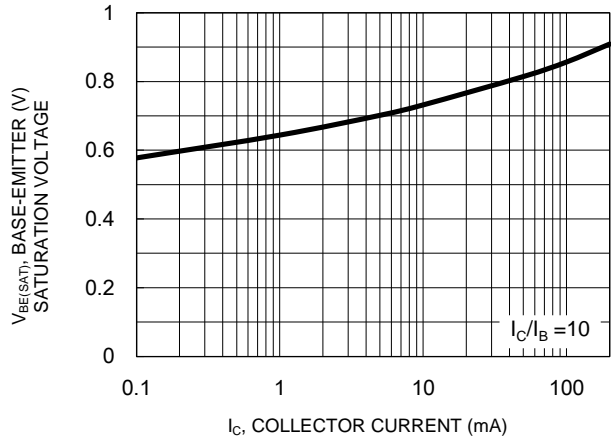
**CHARACTERISTICS CURVES**

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

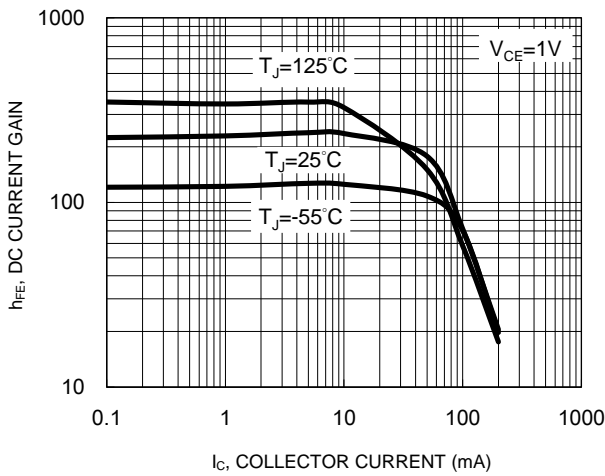
**Fig.1 Collector-Emitter Saturation Voltage vs. Collector Current**



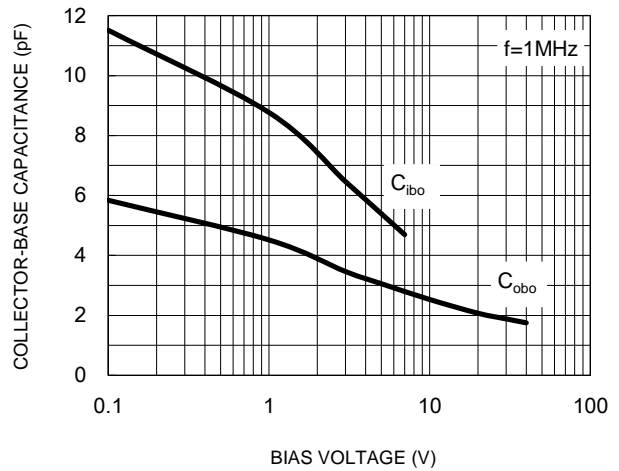
**Fig.2 Base-Emitter Saturation Voltage vs. Collector Current**



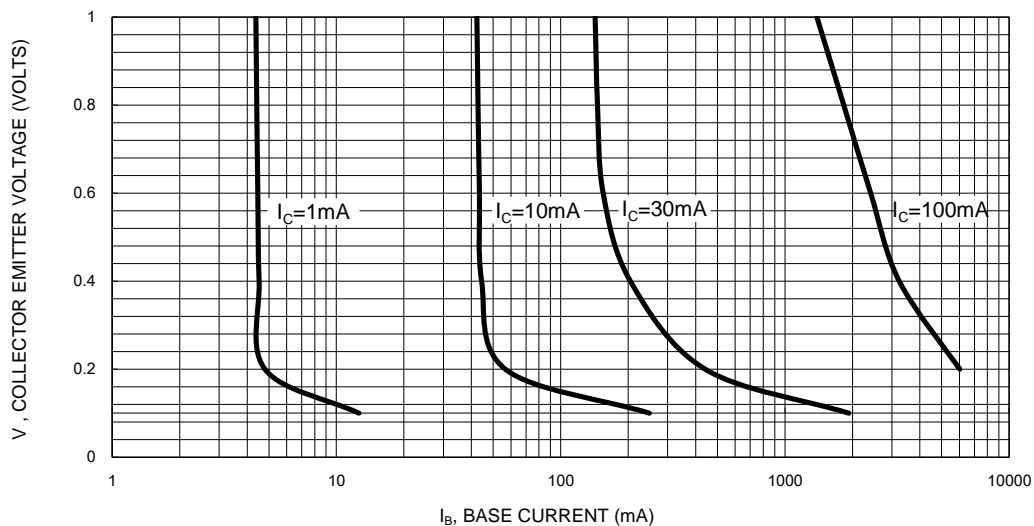
**Fig.3 DC Current Gain vs. Collector Current**



**Fig.4 Collector-Base Capacitance vs. Bias Voltage**

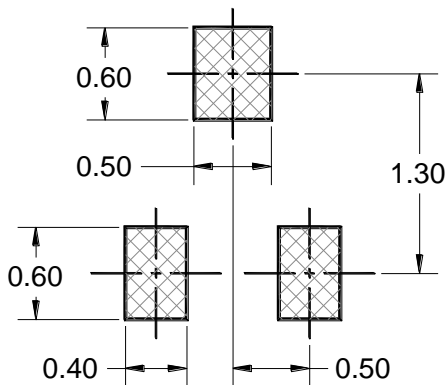
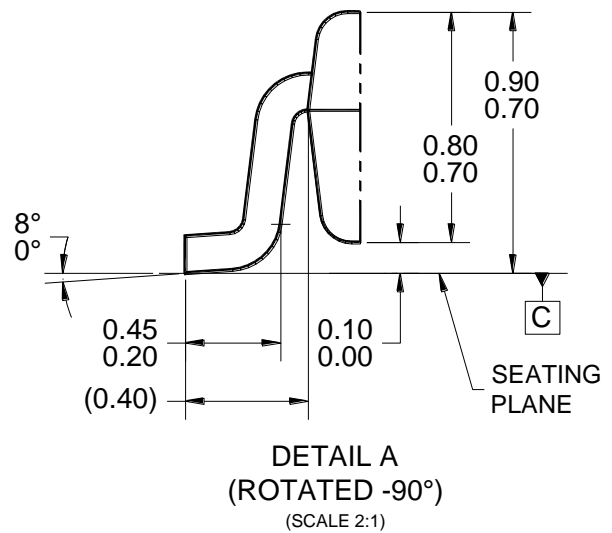
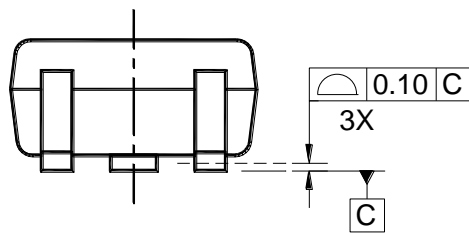
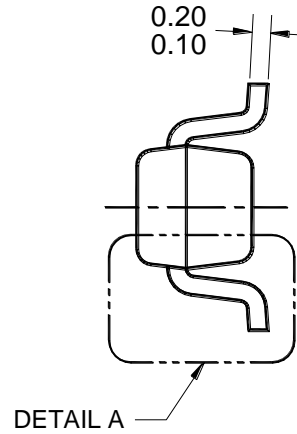
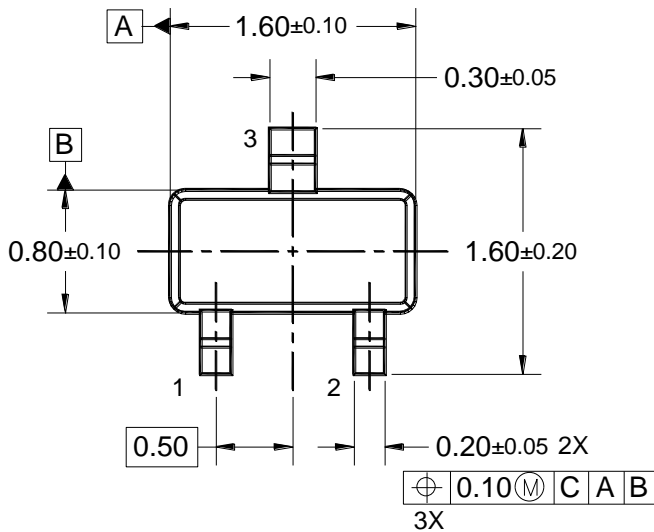


**Fig.5 Collector Saturation Region**



**PACKAGE OUTLINE DIMENSIONS**

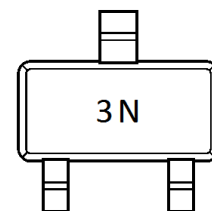
**SOT-523**



**SUGGESTED PAD LAYOUT**

**NOTES: UNLESS OTHERWISE SPECIFIED**

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. PACKAGE OUTLINE REFERENCE: EIAJ ED-7500A, SC-75.
4. MOLDED PLASTIC BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
5. DWG NO. REF: HQ2SD07-SOT523-029 REV A.



**MARKING DIAGRAM**

3N = MARKING CODE

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