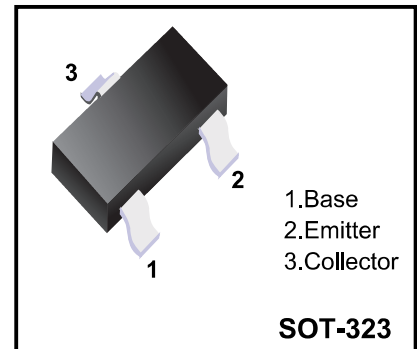


**NPN Silicon Epitaxial Planar Transistor**

for switching and amplifier applications



| Marking Code |    |
|--------------|----|
| MMBT3904W    | 1E |

**Absolute Maximum Ratings (Ta = 25°C)**

| Parameter                 | 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   |
| Total Power Dissipation   | $P_{tot}$ | 200           | mW   |
| Junction Temperature      | $T_j$     | 150           | °C   |
| Storage Temperature Range | $T_{stg}$ | - 55 to + 150 | °C   |

**Characteristics at Ta = 25°C**

| Parameter                                                                                                                              | Symbol        | Min.      | Max.         | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------|--------------|------|
| DC Current Gain                                                                                                                        |               |           |              |      |
| at $V_{CE} = 1\text{ V}$ , $I_C = 0.1\text{ mA}$                                                                                       | $h_{FE}$      | 40        | -            | -    |
| at $V_{CE} = 1\text{ V}$ , $I_C = 1\text{ mA}$                                                                                         | $h_{FE}$      | 70        | -            | -    |
| at $V_{CE} = 1\text{ V}$ , $I_C = 10\text{ mA}$                                                                                        | $h_{FE}$      | 100       | 300          | -    |
| at $V_{CE} = 1\text{ V}$ , $I_C = 50\text{ mA}$                                                                                        | $h_{FE}$      | 60        | -            | -    |
| at $V_{CE} = 1\text{ V}$ , $I_C = 100\text{ mA}$                                                                                       | $h_{FE}$      | 30        | -            | -    |
| Collector Emitter Cutoff Current<br>at $V_{CE} = 30\text{ V}$                                                                          | $I_{CES}$     | -         | 50           | nA   |
| Emitter Base Cutoff Current<br>at $V_{EB} = 3\text{ V}$                                                                                | $I_{EBO}$     | -         | 50           | nA   |
| Collector Base Breakdown Voltage<br>at $I_C = 10\text{ }\mu\text{A}$                                                                   | $V_{(BR)CBO}$ | 60        | -            | V    |
| Collector Emitter Breakdown Voltage<br>at $I_C = 1\text{ mA}$                                                                          | $V_{(BR)CEO}$ | 40        | -            | V    |
| Emitter Base Breakdown Voltage<br>at $I_E = 10\text{ }\mu\text{A}$                                                                     | $V_{(BR)EBO}$ | 6         | -            | V    |
| Collector Emitter Saturation Voltage<br>at $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$<br>at $I_C = 50\text{ mA}$ , $I_B = 5\text{ mA}$ | $V_{CE(sat)}$ | -<br>-    | 0.2<br>0.3   | V    |
| Base Emitter Saturation Voltage<br>at $I_C = 10\text{ mA}$ , $I_B = 1\text{ mA}$<br>at $I_C = 50\text{ mA}$ , $I_B = 5\text{ mA}$      | $V_{BE(sat)}$ | 0.65<br>- | 0.85<br>0.95 | V    |
| Transition Frequency<br>at $V_{CE} = 20\text{ V}$ , $-I_E = 10\text{ mA}$ , $f = 100\text{ MHz}$                                       | $f_T$         | 300       | -            | MHz  |
| Collector Output Capacitance<br>at $V_{CB} = 10\text{ V}$ , $f = 100\text{ KHz}$                                                       | $C_{ob}$      | -         | 4            | pF   |
| Delay Time<br>at $V_{CC} = 3\text{ V}$ , $V_{BE(OFF)} = 0.5\text{ V}$ , $I_C = 10\text{ mA}$ , $I_{B1} = 1\text{ mA}$                  | $t_d$         | -         | 35           | ns   |
| Rise Time<br>at $V_{CC} = 3\text{ V}$ , $V_{BE(OFF)} = 0.5\text{ V}$ , $I_C = 10\text{ mA}$ , $I_{B1} = 1\text{ mA}$                   | $t_r$         | -         | 35           | ns   |
| Storage Time<br>at $V_{CC} = 3\text{ V}$ , $I_C = 10\text{ mA}$ , $I_{B1} = -I_{B2} = 1\text{ mA}$                                     | $t_{stg}$     | -         | 200          | ns   |
| Fall Time<br>at $V_{CC} = 3\text{ V}$ , $I_C = 10\text{ mA}$ , $I_{B1} = -I_{B2} = 1\text{ mA}$                                        | $t_f$         | -         | 50           | ns   |

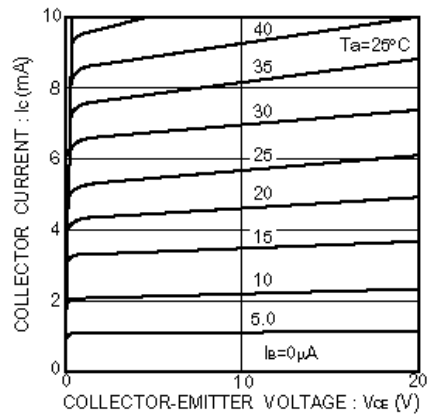


Fig.1 Grounded emitter output characteristics

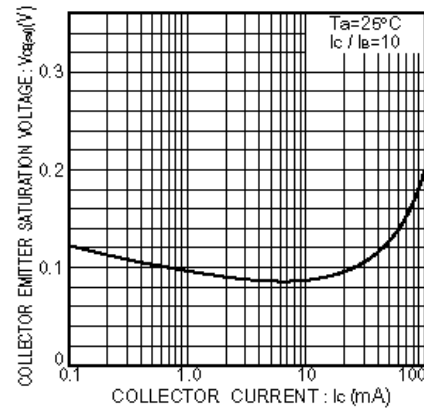


Fig.2 Collector-emitter saturation voltage vs. collector current

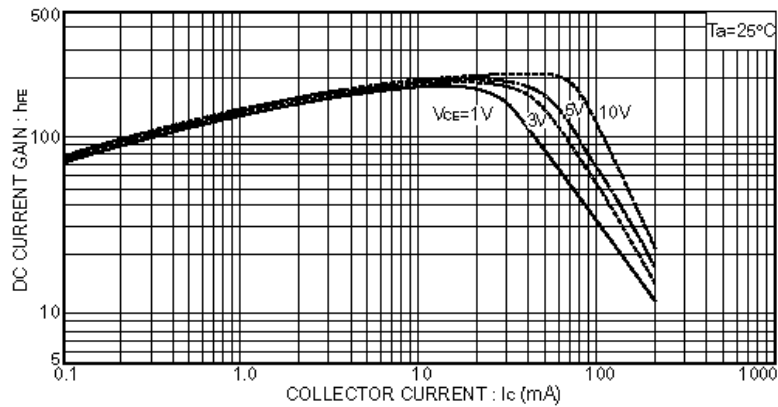


Fig.3 DC current gain vs. collector current ( I )

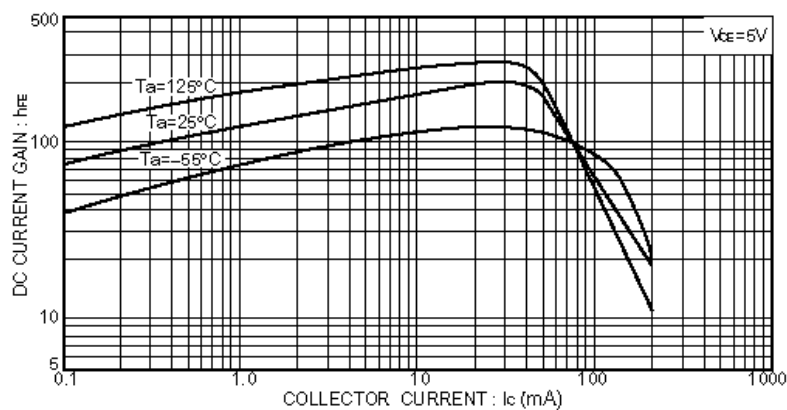


Fig.4 DC current gain vs. collector current ( II )

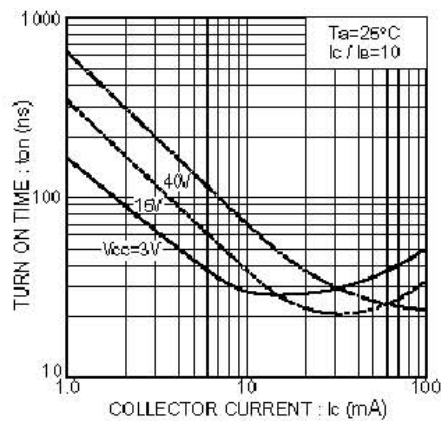


Fig.5 Turn-on time vs. collector current

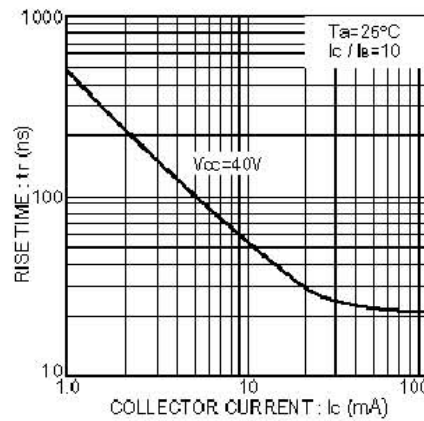


Fig.6 Rise time vs. collector current

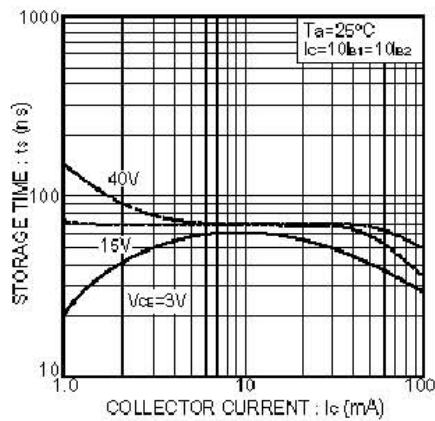


Fig.7 Storage time vs. collector current

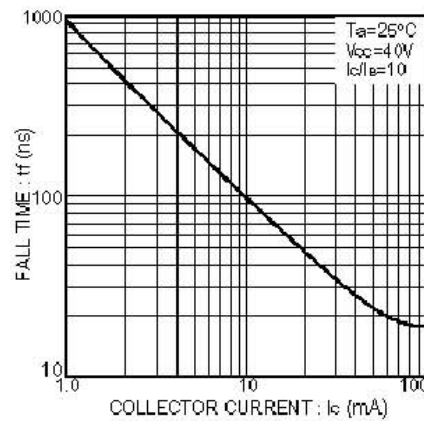


Fig.8 Fall time vs. collector current

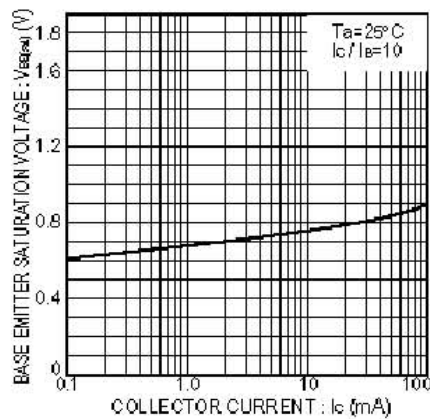


Fig.9 Base-emitter saturation voltage vs. collector current

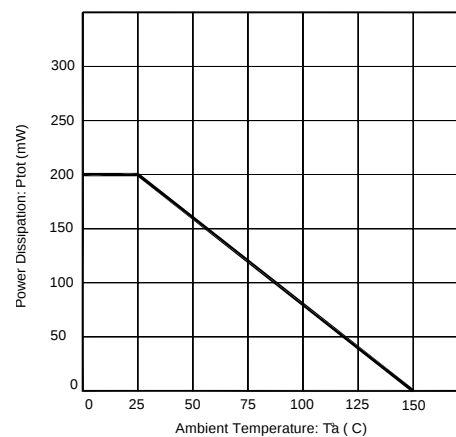


Fig.10 Power Dissipation vs Ambient Temperature

**Ordering information**

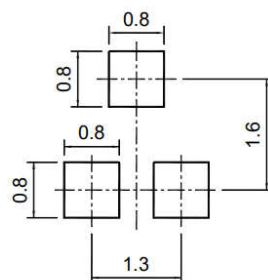
| Package | Packing Description | Base Quantity | Packing Quantity              |
|---------|---------------------|---------------|-------------------------------|
| SOT-323 | Tape/Reel, 7" reel  | 3000pcs/Reel  | 24000PCS/Box 120000PCS/Carton |

**Package Dimensions**

**SOT-323**

| Dim. | Millimeter (mm) |      | mil  |      |
|------|-----------------|------|------|------|
|      | Min.            | Max. | Min. | Max. |
| A    | 0.8             | 1.1  | 32   | 43   |
| A1   | 0.1             |      | 4    |      |
| bp   | 0.3             | 0.4  | 12   | 16   |
| C    | 0.10            | 0.25 | 4    | 10   |
| D    | 1.8             | 2.2  | 71   | 87   |
| E    | 1.15            | 1.35 | 45   | 53   |
| E    | 1.3             |      | 51   |      |
| E1   | 0.65            |      | 26   |      |
| HE   | 2.0             | 2.2  | 79   | 87   |
| Lp   | 0.15            | 0.45 | 6    | 18   |
| Q    | 0.13            | 0.23 | 5.1  | 9    |
| v    | 0.2             |      | 8    |      |
| W    | 0.2             |      | 8    |      |

**The recommended mounting pad size**



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