

# MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

## MMBT3904LP(MS)

Product specification

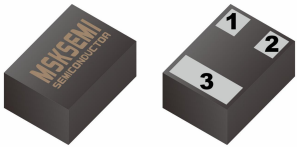
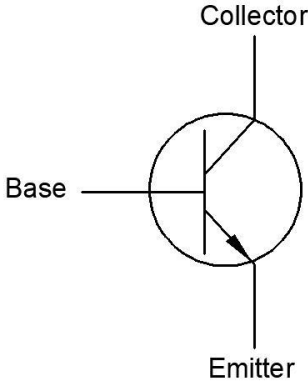

## Features

- Low profile package
- Ideal for automated placement
- Low saturation voltages
- High voltage capability
- High Stability and High Reliability
- RoHS Compliant

## Applications

- amplifying signal
- Electronic switch
- Oscillating circuit
- Variable resistance
- Lighting applications

## Appearance & Symbol

| PACKAGE OUTLINE  | Pin Configuration  | Marking   |
|--|--|---|
|  <p>1: Base<br/>2: Emitter<br/>3: Collector</p> |  |  |
| <p>DFN1006-3</p>   |  |   |

**Absolute Maximum Ratings (T=25°C unless otherwise noted)**

| 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 Continuous   | $I_C$     | 0.2         | A    |
| Power Dissipation              | $P_D$     | 0.3         | W    |
| Operating Junction temperature | $T_J$     | -55 to +150 | °C   |
| Storage Temperature Range      | $T_{STG}$ | -55 to +150 | °C   |

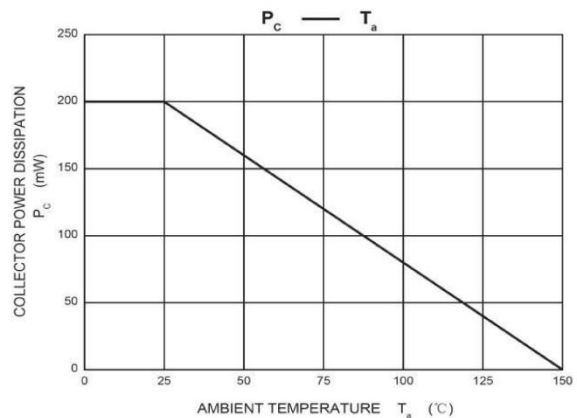
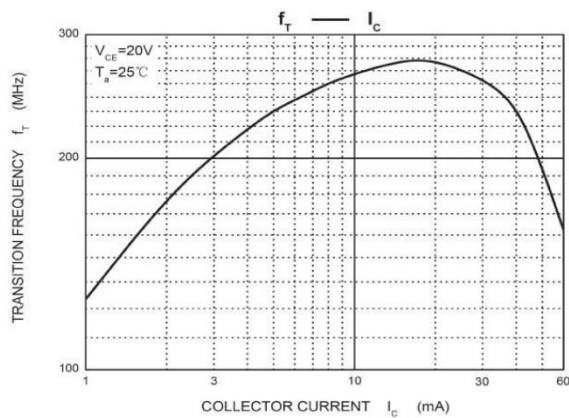
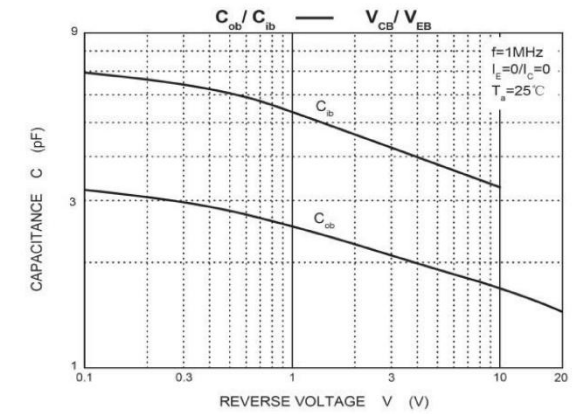
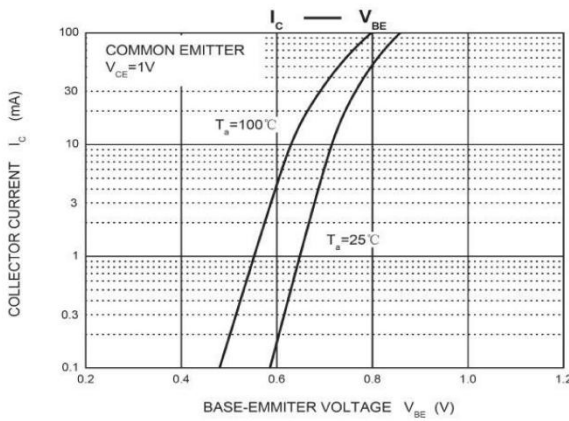
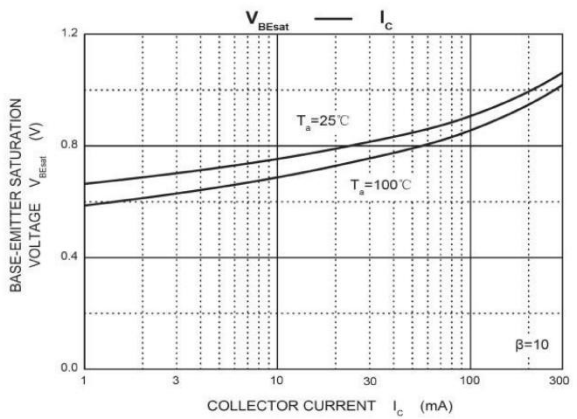
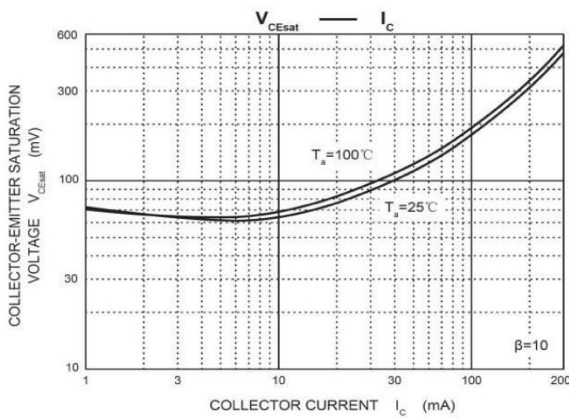
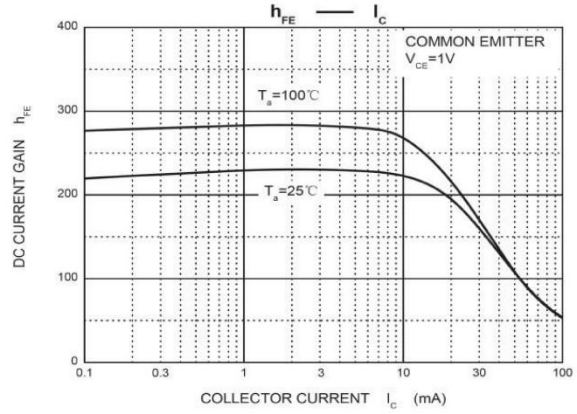
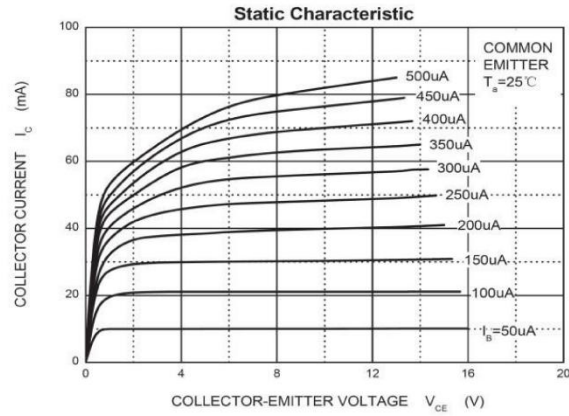
**Electrical Characteristics (T=25°C unless otherwise noted)**

| Parameter                            | Symbol        | Test conditions                                      | Min | Typ | Max  | Unit |
|--------------------------------------|---------------|--|-----|-----|------|------|
| Collector-Base Breakdown Voltage     | $V_{CBO}$     | $I_C=10\mu A, I_E=0$                                 | 60  |     |      | V    |
| Collector-Emitter Breakdown Voltage  | $V_{CER}$     | $I_C=1mA, I_B=0$                                     | 40  |     |      | V    |
| Emitter-Base Breakdown Voltage       | $V_{EBO}$     | $I_E=10\mu A, I_C=0$                                 | 6   |     |      | V    |
| Collector Cut-Off Current            | $I_{CBO}$     | $V_{CB}=60V, I_E=0$                                  |     |     | 100  | nA   |
| Collector Cut-Off Current            | $I_{CEX}$     | $V_{CE}=30V, V_{EB(off)}=3V$                         |     |     | 50   | nA   |
| Emitter Cut-Off Current              | $I_{EBO}$     | $V_{EB}=5V, I_C=0$                                   |     |     | 100  | nA   |
| DC current gain                      | $h_{FE}$      | $V_{CE}=1V, I_C=0.1mA$                               | 40  |     |      |      |
|                                      |               | $V_{CE}=1V, I_C=1mA$                                 | 70  |     |      |      |
|                                      |               | $V_{CE}=1V, I_C=10mA$                                | 100 |     | 300  |      |
|                                      |               | $V_{CE}=1V, I_C=50mA$                                | 60  |     |      |      |
|                                      |               | $V_{CE}=1V, I_C=100mA$                               | 30  |     |      |      |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C=50mA, I_B=5mA$                                  |     |     | 0.3  | V    |
| Base -emitter saturation voltage     | $V_{BE(sat)}$ | $I_C=50mA, I_B=5mA$                                  |     |     | 0.95 | V    |
| Transition frequency                 | $f_T$         | $V_{CE}=20V, I_C=10mA, f=100MHz$                     | 300 |     |      | MHZ  |
| Delay Time                           | $t_d$         | $V_{CC}=3V, I_C=10mA, V_{BE(off)}=-0.5V, I_{B1}=1mA$ |     | 35  |      |      |
| Rise time                            | $t_r$         |  |     | 35  |      | ns   |
| Storage time                         | $t_s$         | $V_{CC}=3V, I_C=10mA, I_{B1}=I_{B2}=1mA$             |     | 200 |      | us   |
| Fall time                            | $t_f$         |  |     | 50  |      | ns   |

**Classification of  $h_{FE}$** 

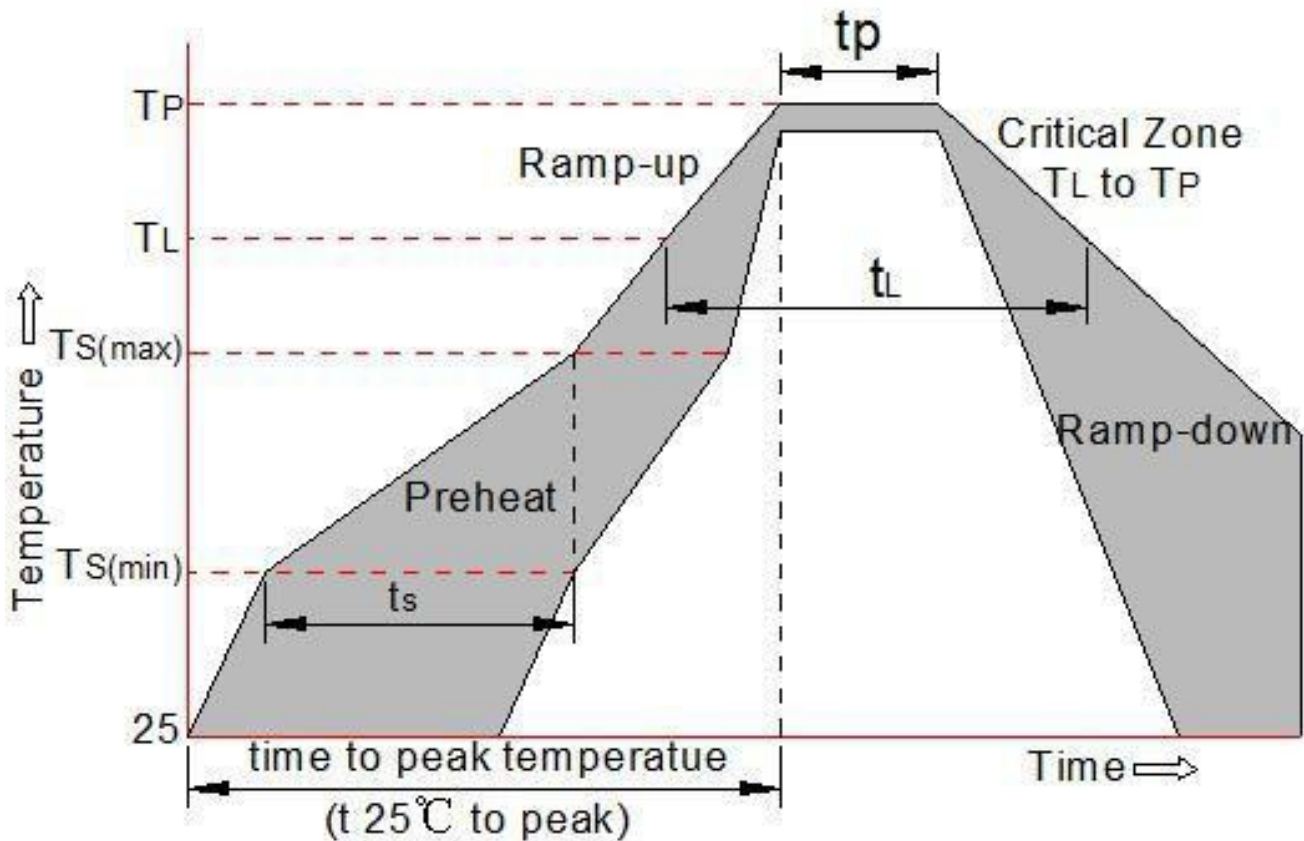
|       |         |
|-------|---------|
| Range | 100-300 |
|-------|---------|

Typical Characteristics

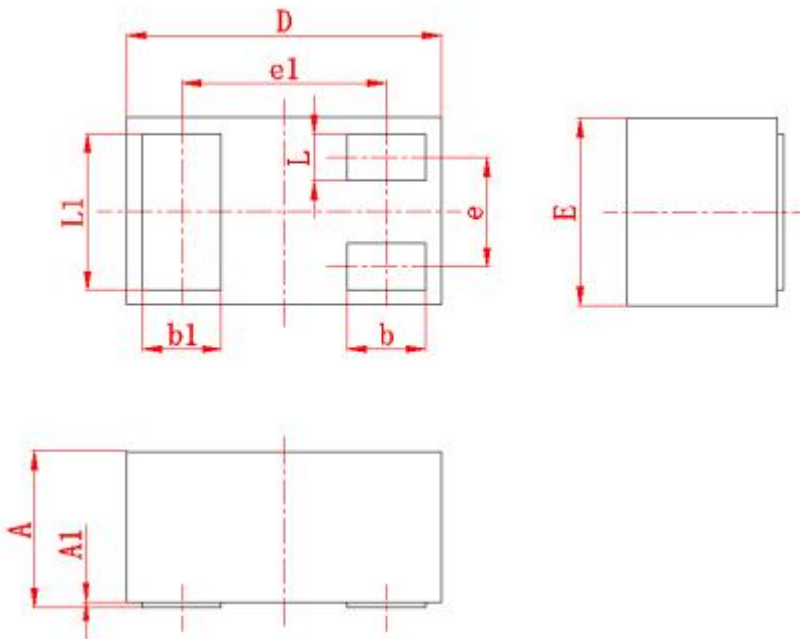


Soldering parameters

| Reflow Condition  |                                   | Pb-Free assembly<br>(see as below) |
|---|-----------------------------------|------------------------------------|
| Pre Heat  | -Temperature Min ( $T_{s(min)}$ ) | +150°C                             |
|   | -Temperature Max( $T_{s(max)}$ )  | +200°C                             |
|   | -Time (Min to Max) ( $t_s$ )      | 60-180 secs.                       |
| Average ramp up rate (Liquid us Temp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max                       |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3°C/sec. Max                       |
| Reflow  | -Temperature( $T_L$ ) (Liquid us) | +217°C                             |
|   | -Temperature( $t_L$ )             | 60-150 secs.                       |
| Peak Temp ( $T_p$ )                                     |                                   | +260(+0/-5)°C                      |
| Time within 5°C of actual Peak Temp ( $t_p$ )           |                                   | 30 secs. Max                       |
| Ramp-down Rate  |                                   | 6°C/sec. Max                       |
| Time 25°C to Peak Temp ( $T_p$ )                        |                                   | 8 min. Max                         |
| Do not exceed   |                                   | +260°C                             |

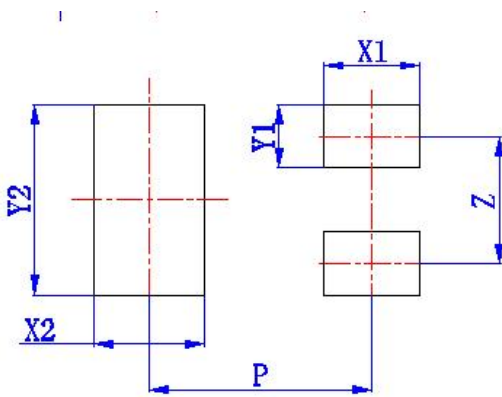


Package mechanical data



| Symbol | Millimeters |      |
|--------|-------------|------|
|        | min         | max  |
| A      | 0.4         | 0.5  |
| A1     | 0           | 0.05 |
| D      | 0.9         | 1.1  |
| E      | 0.55        | 0.65 |
| e      | (0.35)      |      |
| e1     | (0.65)      |      |
| b      | 0.2         | 0.3  |
| b1     | 0.2         | 0.3  |
| L      | 0.1         | 0.2  |
| L1     | 0.45        | 0.55 |

Suggested Land Pattern



| Symbol | Dimension in Millimeters |
|--------|--------------------------|
|        | typ                      |
| X1     | (0.3)                    |
| X2     | (0.35)                   |
| Y1     | (0.2)                    |
| Y2     | (0.6)                    |
| Z      | (0.4)                    |
| P      | (0.7)                    |

REEL SPECIFICATION

| P/N            | PKG       | QTY   |
|----------------|-----------|-------|
| MMBT3904LP(MS) | DFN1006-3 | 10000 |

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