



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (\_), the underscore (\_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (\_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at [www.onsemi.com](http://www.onsemi.com). Please email any questions regarding the system integration to [Fairchild\\_questions@onsemi.com](mailto:Fairchild_questions@onsemi.com).

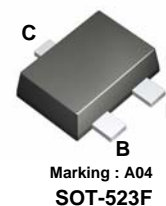
ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

# MMBT3904T

## NPN Epitaxial Silicon Transistor

### Features

- General purpose amplifier transistor.
- Ultra-Small Surface Mount Package for all types.
- Suitable for general switching & amplification
- Well suited for portable application
- As complementary type, PNP MMBT3906T is recommended



### Absolute Maximum Ratings $T_a = 25^\circ\text{C}$ unless otherwise noted

| Symbol    | Parameter                 | Value     | Unit             |
|-----------|---------------------------|-----------|------------------|
| $V_{CBO}$ | Collector-Base Voltage    | 60        | V                |
| $V_{CEO}$ | Collector-Emitter Voltage | 40        | V                |
| $V_{EBO}$ | Emitter-Base Voltage      | 6         | V                |
| $I_C$     | Collector Current         | 200       | mA               |
| $T_J$     | Junction Temperature      | 150       | $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range | -55 ~ 150 | $^\circ\text{C}$ |

- \* 1. These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.  
2. These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

### Thermal Characteristics\* $T_a = 25^\circ\text{C}$ unless otherwise noted

| Symbol          | Parameter                                       | Max | Unit                      |
|-----------------|---|-----|---------------------------|
| $P_C$           | Collector Power Dissipation, by $R_{\theta JA}$ | 250 | mW                        |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient         | 500 | $^\circ\text{C}/\text{W}$ |

\* Minimum land pad.

### Electrical Characteristics\* $T_a = 25^\circ\text{C}$ unless otherwise noted

| Symbol        | Parameter                            | Test Condition   | Min.                        | Max.         | Unit   |
|---------------|--------------------------------------|--|-----------------------------|--------------|--------|
| $BV_{CBO}$    | Collector-Base Breakdown Voltage     | $I_C = 10\mu\text{A}, I_E = 0$   | 60                          |              | V      |
| $BV_{CEO}$    | Collector-Emitter Breakdown Voltage  | $I_C = 1\text{mA}, I_B = 0$  | 40                          |              | V      |
| $BV_{EBO}$    | Emitter-Base Breakdown Voltage       | $I_E = 10\mu\text{A}, I_C = 0$   | 6                           |              | V      |
| $I_{CEX}$     | Collector Cut-off Current            | $V_{CE} = 60\text{V}, V_{EB(OFF)} = 3\text{V}$   |                             | 50           | nA     |
| $h_{FE}$      | DC Current Gain                      | $V_{CE} = 1\text{V}, I_C = 0.1\text{mA}$<br>$V_{CE} = 1\text{V}, I_C = 1\text{mA}$<br>$V_{CE} = 1\text{V}, I_C = 10\text{mA}$<br>$V_{CE} = 1\text{V}, I_C = 50\text{mA}$<br>$V_{CE} = 1\text{V}, I_C = 100\text{mA}$ | 40<br>70<br>100<br>60<br>30 | 300          |        |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C = 10\text{mA}, I_B = 1\text{mA}$<br>$I_C = 50\text{mA}, I_B = 5\text{mA}$   |                             | 0.2<br>0.3   | V<br>V |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage      | $I_C = 10\text{mA}, I_B = 1\text{mA}$<br>$I_C = 50\text{mA}, I_B = 5\text{mA}$   | 0.65                        | 0.85<br>0.95 | V<br>V |
| $f_T$         | Current Gain Bandwidth Product       | $V_{CE} = 20\text{V}, I_C = 10\text{mA}, f = 100\text{MHz}$  | 300                         |              | MHz    |
| $C_{ob}$      | Output Capacitance                   | $V_{CB} = 5\text{V}, I_E = 0, f = 1\text{MHz}$   |                             | 6            | pF     |
| $C_{ib}$      | Input Capacitance                    | $V_{EB} = 0.5\text{V}, I_C = 0, f = 1\text{MHz}$   |                             | 15           | pF     |
| $t_d$         | Delay Time                           | $V_{CC} = 3\text{V}, I_C = 10\text{mA}$  |                             | 35           | ns     |
| $t_r$         | Rise Time                            | $I_{B1} = -I_{B2} = 1\text{mA}$  |                             | 35           | ns     |
| $t_s$         | Storage Time                         |  |                             | 200          | ns     |
| $t_f$         | Fall Time                            |  |                             | 50           | ns     |

\* DC Item are tested by Pulse Test : Pulse Width $\leq$ 300us, Duty Cycle $\leq$ 2%

## Typical Performance Characteristics

Figure 1. DC Current Gain

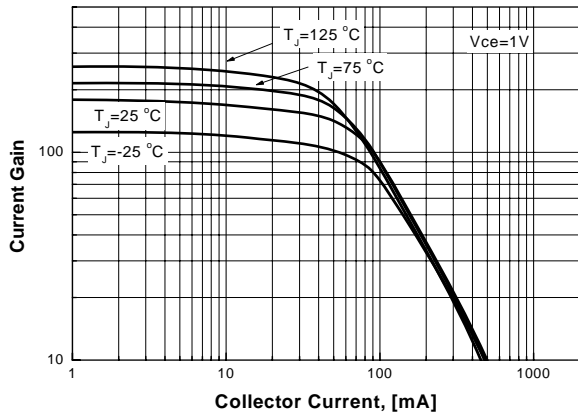


Figure 2. Collector-Emitter Saturation Voltage

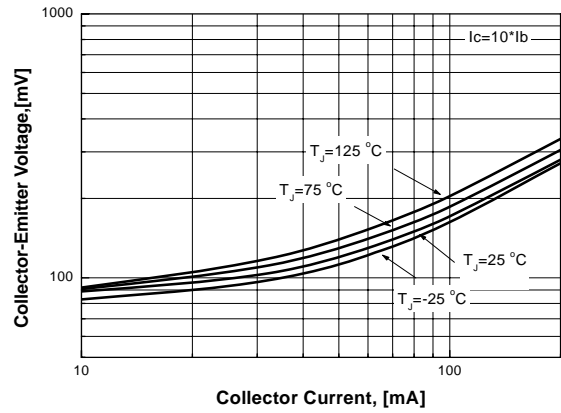


Figure 3. Base- Emitter Saturation Voltage

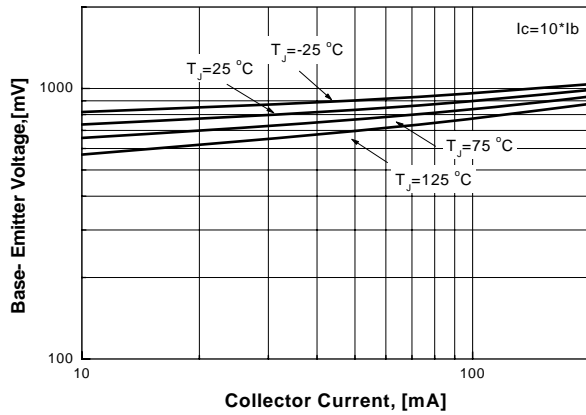


Figure 4. Collector- Base Leakage Current

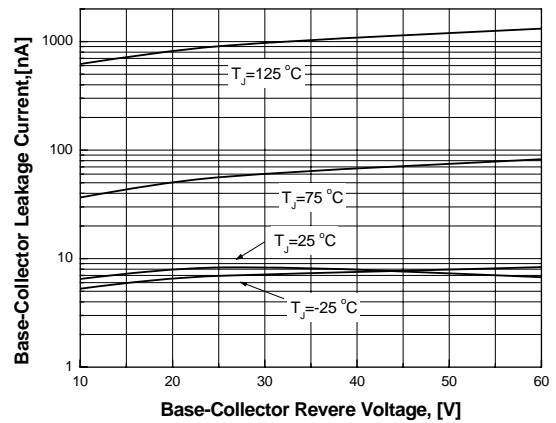


Figure 5. Collector- Base Capacitance

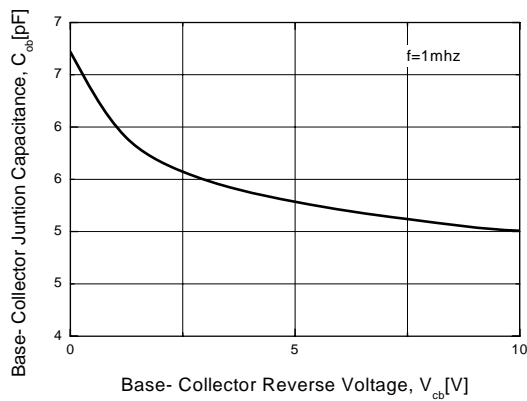
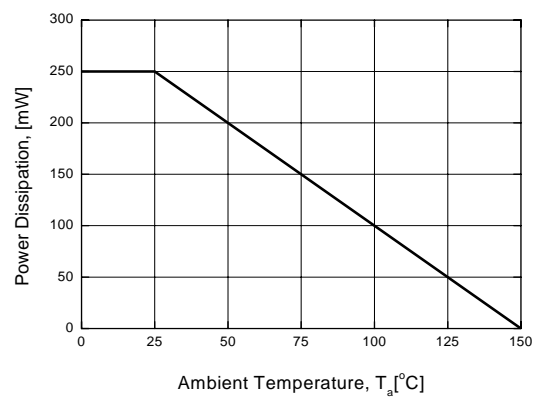


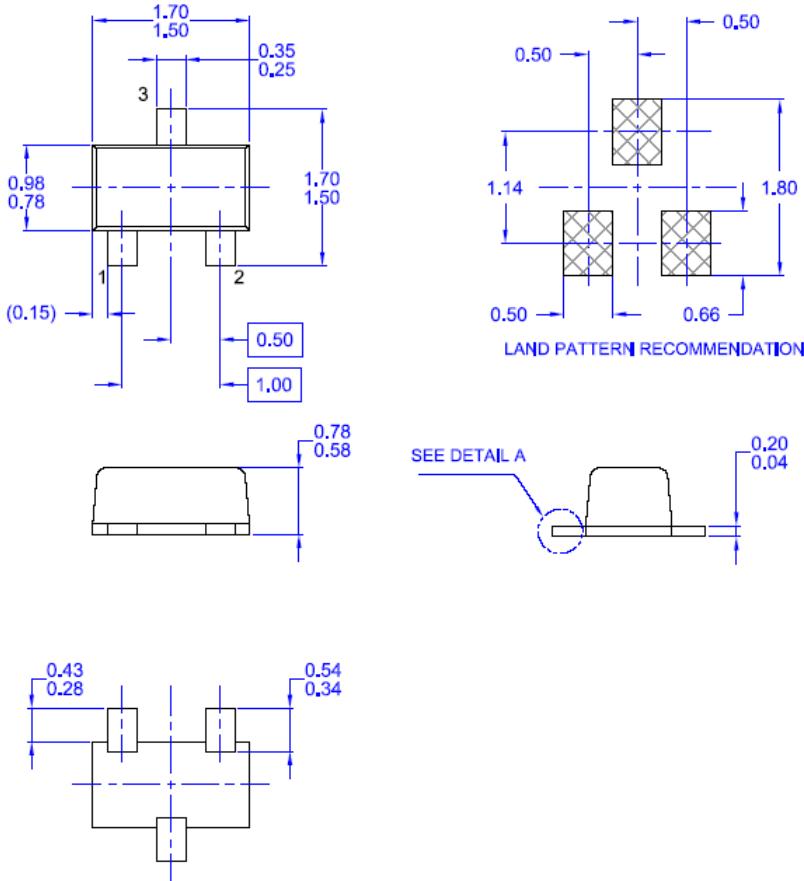
Figure 6. Power Derating



# Package Dimensions

## SOT-523F

- Case : SOT-523F
- Case Material(Molded Plastic): KTMC1060SC
- UL Flammability classification rating : "V0"
- Moisture Sensivity level per JESD22-A1113B : MSL 1
- Lead terminals solderable per MIL-STD7502026 /JESD22A121
- Lead Free Plating : Pure Tin(Matte)






Dimensions in Millimeters



## TRADEMARKS

The following are registered and unregistered trademarks and service marks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

|   |   |  |   |
|---|---|--|---|
| ACEx <sup>®</sup>   | Green FPS <sup>™</sup>  | Power247 <sup>®</sup>                  | SuperSOT <sup>™</sup> -8  |
| Build it Now <sup>™</sup>   | Green FPS <sup>™</sup> e-Series <sup>™</sup>                                      | POWEREDGE <sup>®</sup>                 | SyncFET <sup>™</sup>  |
| CorePLUS <sup>™</sup>   | GTO <sup>™</sup>  | Power-SPM <sup>™</sup>                 | The Power Franchise <sup>®</sup>  |
| CROSSVOLT <sup>™</sup>  | <i>i-Lo</i> <sup>™</sup>  | PowerTrench <sup>®</sup>               |  |
| CTL <sup>™</sup>  | IntelliMAX <sup>™</sup>   | Programmable Active Droop <sup>™</sup> | TinyBoost <sup>™</sup>  |
| Current Transfer Logic <sup>™</sup>   | ISOPLANAR <sup>™</sup>  | QFET <sup>®</sup>                      | TinyBuck <sup>™</sup>   |
| EcoSPARK <sup>®</sup>   | MegaBuck <sup>™</sup>   | QS <sup>™</sup>                        | TinyLogic <sup>®</sup>  |
|  | MICROCOUPLER <sup>™</sup>   | QT Optoelectronics <sup>™</sup>        | TINYOPTO <sup>™</sup>   |
| Fairchild <sup>®</sup>  | MicroFET <sup>™</sup>   | Quiet Series <sup>™</sup>              | TinyPower <sup>™</sup>  |
| Fairchild Semiconductor <sup>®</sup>  | MicroPak <sup>™</sup>   | RapidConfigure <sup>™</sup>            | TinyPWM <sup>™</sup>  |
| FACT Quiet Series <sup>™</sup>  | MillerDrive <sup>™</sup>  | SMART START <sup>™</sup>               | TinyWire <sup>™</sup>   |
| FACT <sup>®</sup>   | Motion-SPM <sup>™</sup>   | SPM <sup>®</sup>                       | μSerDes <sup>™</sup>  |
| FAST <sup>®</sup>   | OPTOLOGIC <sup>®</sup>  | STEALTH <sup>™</sup>                   | UHC <sup>®</sup>  |
| FastvCore <sup>™</sup>  | OPTOPLANAR <sup>®</sup>   | SuperFET <sup>™</sup>                  | UniFET <sup>™</sup>   |
| FPST <sup>™</sup>   |  | SuperSOT <sup>™</sup> -3               | VCX <sup>™</sup>  |
| FRFET <sup>®</sup>  | PDP-SPM <sup>™</sup>  | SuperSOT <sup>™</sup> -6               |   |
| Global Power Resource <sup>SM</sup>   | Power220 <sup>®</sup>   |  |   |

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

- Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
- A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition   |
|--------------------------|------------------------|--|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.   |
| Preliminary              | First Production       | This datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.   |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.                                      |

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative