KODENSHI AUK

# MMBT4401

**NPN Silicon Transistor**

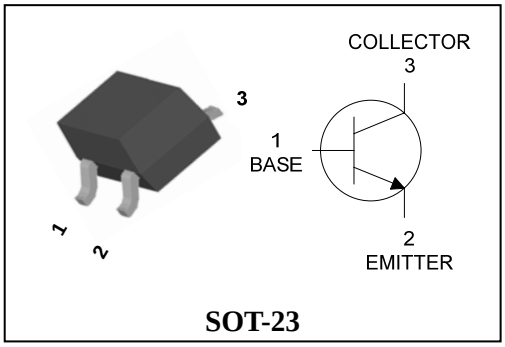
## Descriptions

- General purpose application
- Switching application

## Features

- Low Leakage current
- Low collector saturation voltage enabling low voltage operation
- Complementary pair with MMBT4403

## PIN Connection




**SOT-23**

## Ordering Information

| Type NO. | Marking | Package Code |
|---|---|---|
| MMBT4401 | 4P □<br>① ② | SOT-23 |

①Device Code ②Year& Week Code

## Absolute maximum ratings

**Ta=25°C**

| Characteristic | Symbol | Ratings | Unit |
|---|---|---|---|
| Collector-Base voltage | $V_{CBO}$ | 60 | V |
| Collector-Emitter voltage | $V_{CEO}$ | 40 | V |
| Emitter-base voltage | $V_{EBO}$ | 6 | V |
| Collector current | $I_C$ | 0.6 | A(DC) |
| | $I_{CP}$* | 1.2 | A(Pulse) |
| Collector dissipation | $P_C$ | 200 | mW |
| | $P_C$** | 350 | mW |
| Junction temperature | $T_j$ | 150 | °C |
| Storage temperature range | $T_{stg}$ | -55~150 | °C |

* : Single pulse, tp= 300 μs

** : Package mounted on 99.5% alumina 10×8×0.6mm

| Characteristic | | Symbol | Typ. | Max | Unit |
|---|---|---|---|---|---|
| Thermal resistance | Junction-ambient | $R_{th(J-A)}$ | - | 625.0 | ℃/W |
| | | $R_{th(J-A)**}$ | - | 357.1 | ℃/W |

## Electrical Characteristics

Ta=25°C

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector-Base breakdown voltage | $BV_{CBO}$ | $I_C$= 100μA, $I_E$= 0 | 60 | - | - | V |
| Collector-Emitter breakdown voltage | $BV_{CEO}$ | $I_C$= 1mA, $I_B$= 0 | 40 | - | - | V |
| Emitter-Base breakdown voltage | $BV_{EBO}$ | $I_E$= 100μA, $I_C$= 0 | 6 | - | - | V |
| Collector cut-off current | $I_{CBO}$ | $V_{CB}$= 60V, $I_E$= 0 | - | - | 0.1 | uA |
| Collector cut-off current | $I_{CEX}$ | $V_{CB}$= 35V, $V_{EB}$= 0.4V | - | - | 0.1 | uA |
| Emitter cut-off current | $I_{EBO}$ | $V_{EB}$= 6V, $I_E$= 0 | - | - | 0.1 | uA |
| DC current gain | $h_{FE}$ | $V_{CE}$= 1V, $I_C$= 0.1mA | 20 | - | - | - |
| | | $V_{CE}$= 1V, $I_C$= 1.0mA | 40 | - | - | - |
| | | $V_{CE}$= 1V, $I_C$= 10mA | 80 | - | - | - |
| | | $V_{CE}$= 1V, $I_C$= 150mA | 100 | - | 300 | - |
| | | $V_{CE}$= 2V, $I_C$= 500mA | 40 | - | - | - |
| Collector-Emitter saturation voltage | $V_{CE(sat)}$ | $I_C$= 150mA, $I_B$= 15mA | - | - | 0.4 | V |
| | | $I_C$= 500mA, $I_B$= 50mA | - | - | 0.75 | V |
| Base-Emitter saturation voltage | $V_{BE(sat)}$ | $I_C$= 150mA, $I_B$= 15mA | 0.75 | - | 0.95 | V |
| | | $I_C$= 500mA, $I_B$= 50mA | - | - | 1.2 | V |
| Transition frequency | $f_T$ | $V_{CE}$= 10V, $I_C$= 20mA, f= 100MHz | 250 | - | - | MHz |
| Collector-Base capacitance | $C_{cb}$ | $V_{CB}$= 5V, $I_E$= 0, f= 1MHz | - | - | 6.5 | pF |
| Emitter-Base capacitance | $C_{eb}$ | $V_{EB}$= 0.5V, $I_C$= 0, f= 1MHz | - | - | 30 | pF |
| Input Impedance | $h_{ie}$ | $I_C$= 1.0mA, $V_{CE}$= 10$V_{DC}$, f= 1MHz | 1 | - | 15 | kΩ |
| Voltage Feedback Ratio | $h_{re}$ | $I_C$= 1.0mA, $V_{CE}$= 10$V_{DC}$, f= 1MHz | 0.1 | - | 8.0 | $\times 10^{-4}$ |
| Small-Signal Current Gain | $h_{fe}$ | $I_C$= 1.0mA, $V_{CE}$= 10$V_{DC}$, f= 1MHz | 40 | - | 500 | - |
| Output Admittance | $h_{oe}$ | $I_C$= 1.0mA, $V_{CE}$= 10$V_{DC}$, f= 1MHz | 1 | - | 30 | umhos |
| Delay time | $t_d$ | $V_{CC}$= 30$V_{dc}$, $V_{EB}$= 2$V_{dc}$, $I_C$= 150m$A_{dc}$, $I_{B1}$= 15m$A_{dc}$ | - | - | 15 | ns |
| Rise time | $t_r$ | | - | - | 20 | ns |
| Storage time | $t_s$ | $V_{CC}$= 30$V_{dc}$, $I_C$= 150m$A_{dc}$, $I_{B1}$= $I_{B2}$= 15m$A_{dc}$ | - | - | 225 | ns |
| Fall Time | $t_f$ | | - | - | 30 | ns |

Fig.1 $P_C$ - Ta

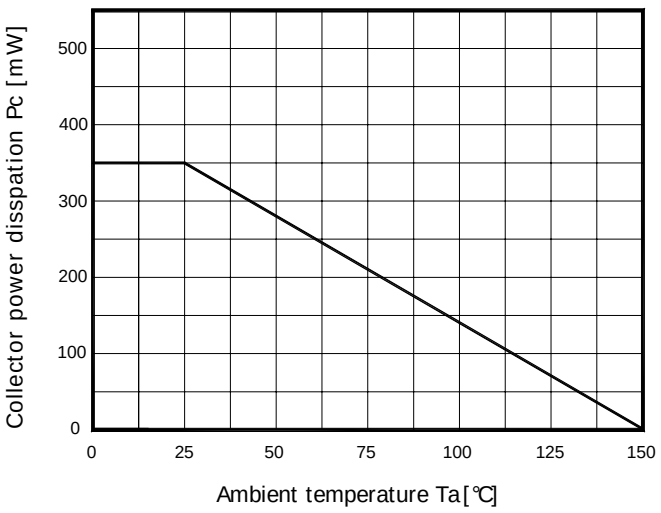



Fig.2 $V_{BE(ON)}$ - $I_C$

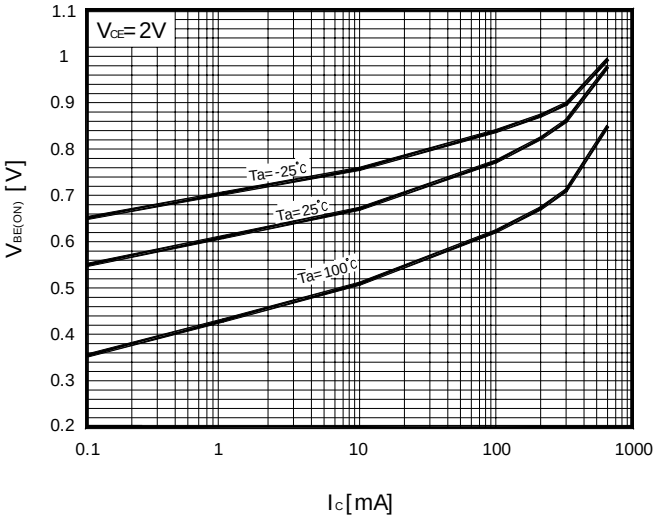



Fig.3 $V_{CE(SAT)}$ - $I_C$

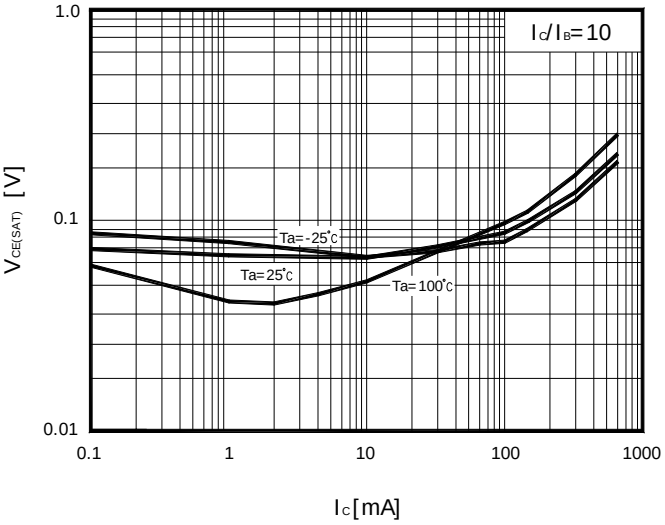



Fig.4 $V_{BE(SAT)}$ - $I_C$

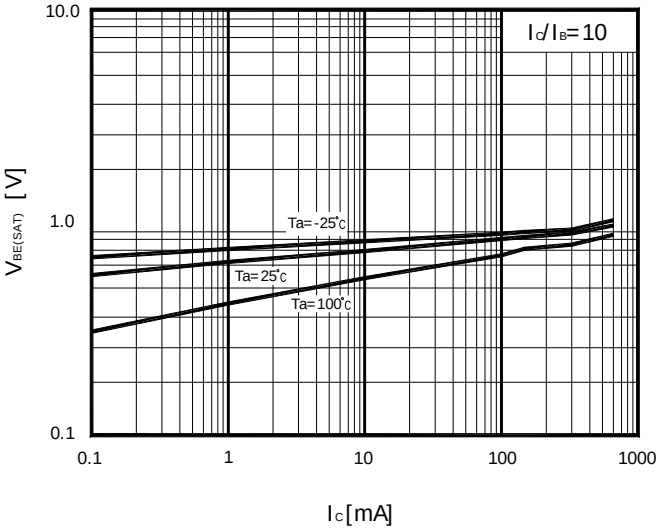



Fig.5 $h_{FE}$ - $I_C$

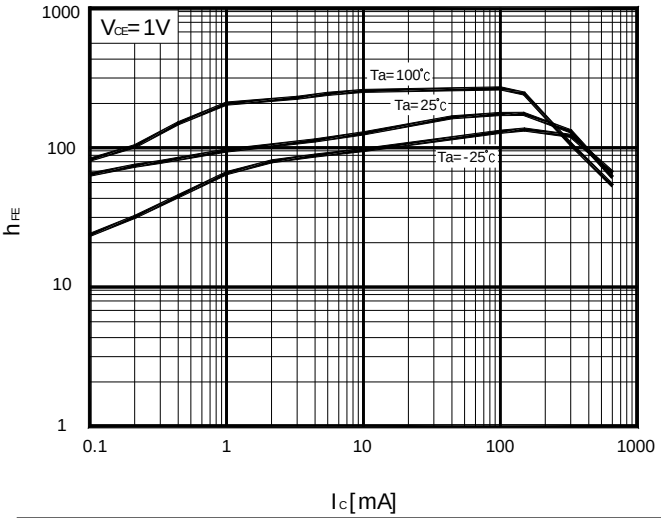



Fig.6 Ccb - Vcb

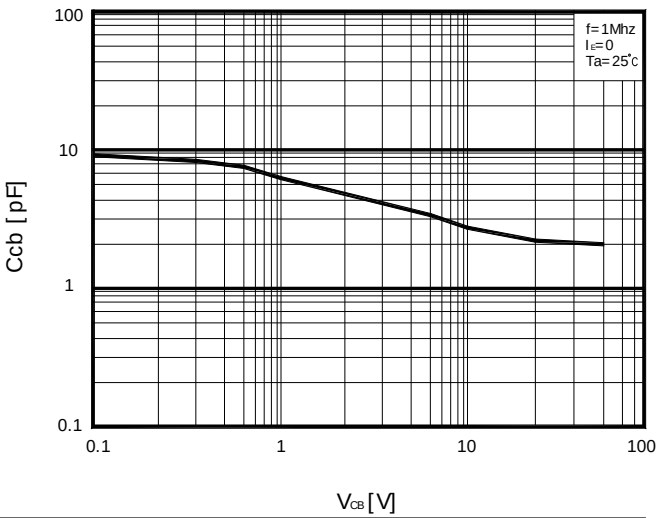


Fig.7 Ceb - $V_{EB}$

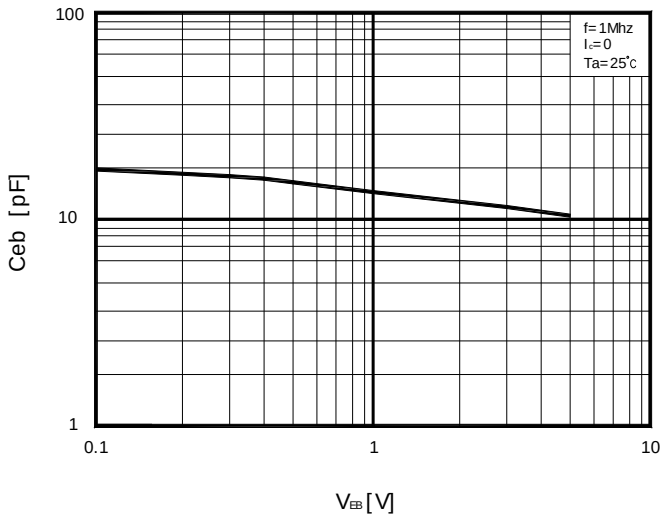



Fig.8 $f_T$ - $I_E$

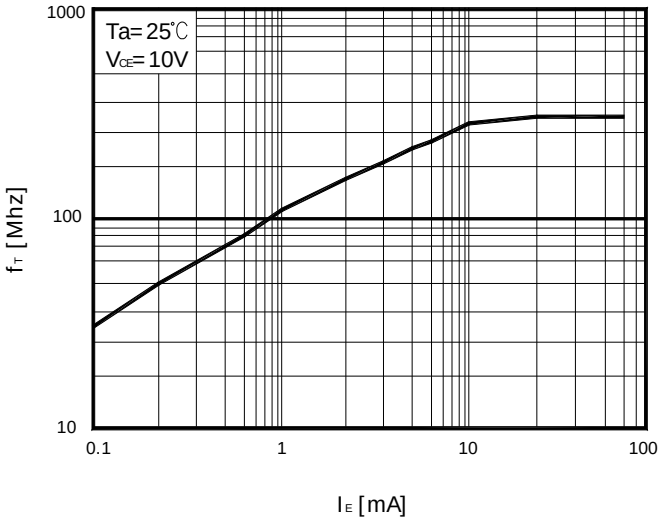
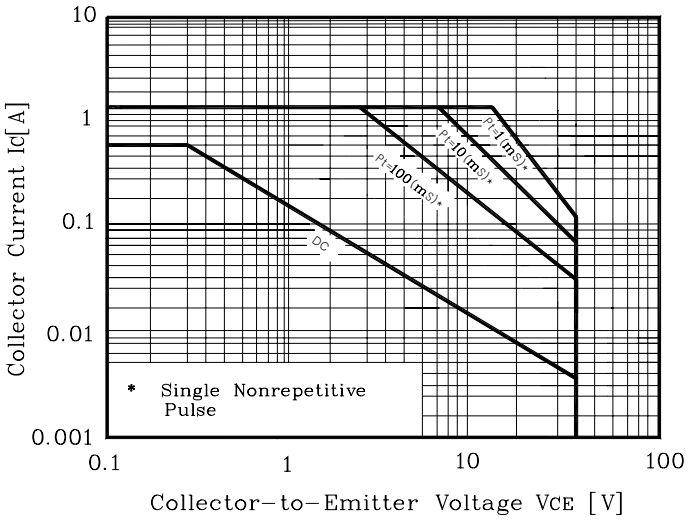
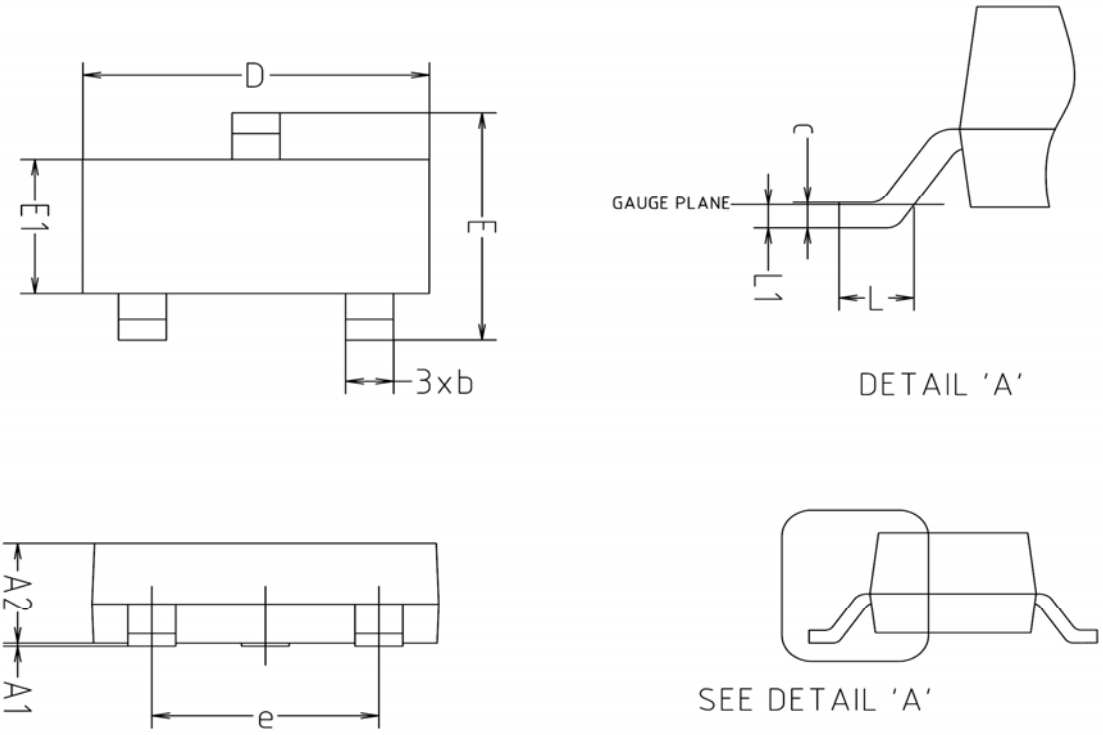



Fig. 9 Safe Operating Area

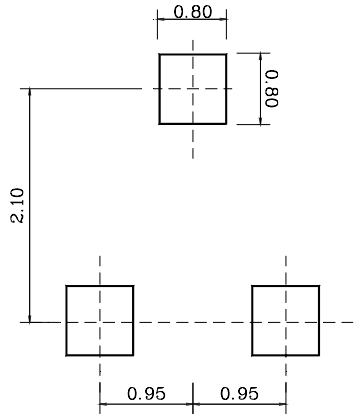


## Outline Dimension




| SYMBOL | MILLIMETERS | | | NOTE |
|---|---|---|---|---|
| | MINIMUM | NOMINAL | MAXIMUM | |
| A1 | 0.00 | - | 0.10 | |
| A2 | 0.82 | - | 1.02 | |
| b | 0.39 | 0.42 | 0.45 | |
| c | 0.09 | 0.12 | 0.15 | |
| D | 2.80 | 2.90 | 3.00 | |
| E | 2.20 | 2.40 | 2.60 | |
| E1 | 1.20 | 1.30 | 1.40 | |
| e | 1.90BSC | | | |
| L | 0.20 | - | - | |
| L1 | 0.12BSC | | | |

**※Recommend PCB solder land [Unit: mm]**



**The AUK Corp. products are intended for the use as components in general electronic equipment (Office and communication equipment, measuring equipment, home appliance, etc.).**

**Please make sure that you consult with us before you use these AUK Corp. products in equipments which require high quality and / or reliability, and in equipments which could have major impact to the welfare of human life(atomic energy control, airplane, spaceship, transportation, combustion control, all types of safety device, etc.). AUK Corp. cannot accept liability to any damage which may occur in case these AUK Corp. products were used in the mentioned equipments without prior consultation with AUK Corp..**

**Specifications mentioned in this publication are subject to change without notice.**