

Bipolar Transistors Silicon NPN Epitaxial Type

# TTC501

## 1. Applications

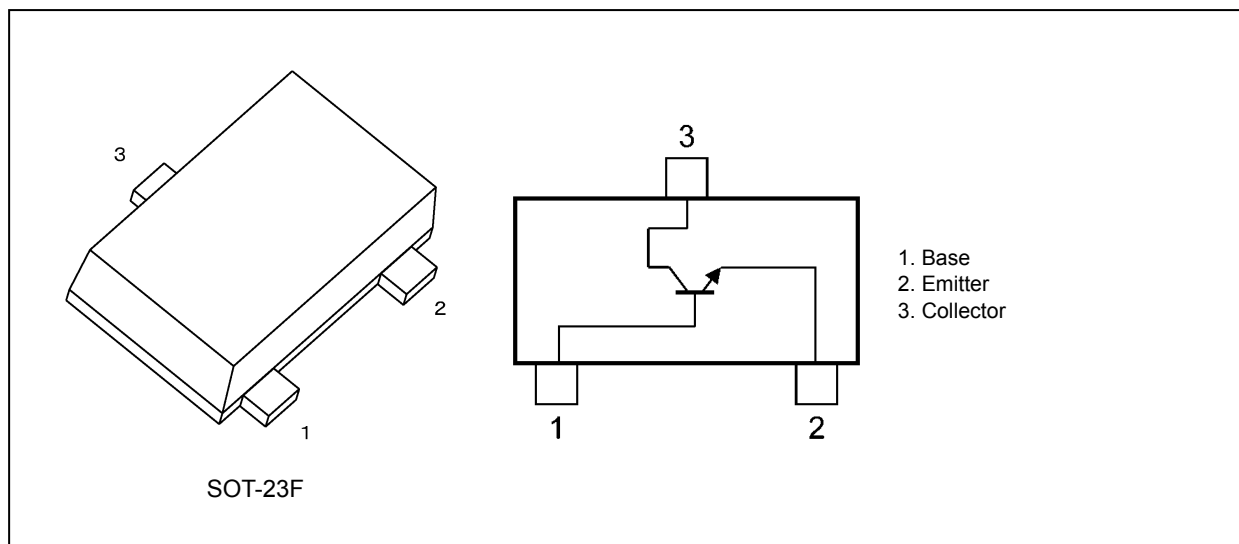
- High-Speed Switching
- DC-DC Converters

## 2. Features

- (1) AEC-Q101 qualified (Note 1)
- (2) High DC current gain:  $h_{FE} = 400$  to  $1000$  ( $I_C = 0.3$  A)
- (3) Low collector-emitter saturation voltage:  $V_{CE(sat)} = 0.14$  V (max)
- (4) High-speed switching:  $t_f = 120$  ns (typ.)

Note 1: For detail information, please contact our sales.

## 3. Packaging and Internal Circuit



Start of commercial production

2021-01

## 4. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	100	V
Collector-emitter voltage	$V_{CEX}$	80	V
Collector-emitter voltage	$V_{CEO}$	50	V
Emitter-base voltage	$V_{EBO}$	7	V
Collector current (DC)	$I_C$	2.5	A
Collector current (pulsed)	$I_{CP}$	4.0	A
Base current	$I_B$	250	mA
Collector power dissipation	$P_C$	1	W
Collector power dissipation	$P_C$	1.7	W
Junction temperature	$T_j$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	- 55 to 150	$^\circ\text{C}$

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc.).

Note 1: Ensure that the channel temperature does not exceed  $150\text{ }^\circ\text{C}$ .

Note 2: Device mounted on an FR4 board. (25.4 mm × 25.4 mm × 1.6 mm ,Cu pad: 645 mm<sup>2</sup>)

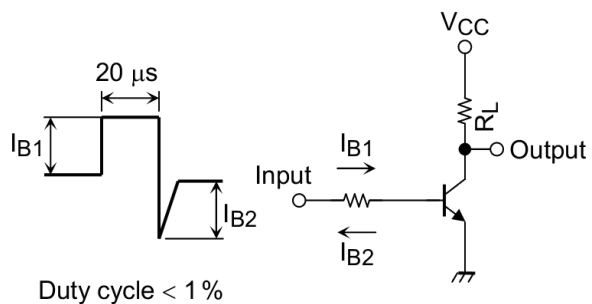
## 5. Electrical Characteristics

### 5.1. Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 100\text{ V}$ , $I_E = 0\text{ mA}$	—	—	100	nA
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 7\text{ V}$ , $I_C = 0\text{ mA}$	—	—	100	nA
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = 10\text{ mA}$ , $I_B = 0\text{ mA}$	50	—	—	V
DC current gain	$h_{FE(1)}$	$V_{CE} = 2\text{ V}$ , $I_C = 0.3\text{ A}$	400	—	1000	—
	$h_{FE(2)}$	$V_{CE} = 2\text{ V}$ , $I_C = 1\text{ A}$	200	—	—	—
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 1\text{ A}$ , $I_B = 20\text{ mA}$	—	—	0.14	V
Base-emitter saturation voltage	$V_{BE(sat)}$	$I_C = 1\text{ A}$ , $I_B = 20\text{ mA}$	—	—	1.10	V

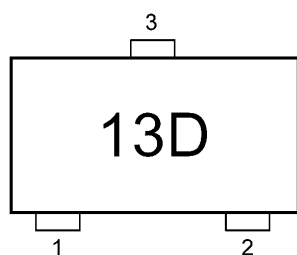
### 5.2. Dynamic Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector output capacitance	$C_{ob}$	$V_{CB} = 10\text{ V}$ , $I_E = 0\text{ mA}$ , $f = 1\text{ MHz}$	—	13	—	pF
Switching time (rise time)	$t_r$	See Figure 5.2.1 $V_{CC} \approx 30\text{ V}$ , $R_L = 30\ \Omega$ , $I_{B1} = 33.3\text{ mA}$ , $I_{B2} = 33.3\text{ mA}$	—	40	—	ns
Switching time (storage time)	$t_{stg}$		—	500	—	ns
Switching time (fall time)	$t_f$		—	120	—	ns



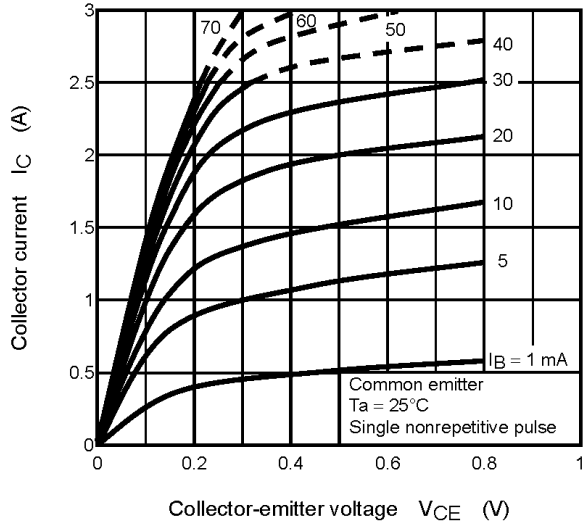
**Fig. 5.2.1 Switching Time Test Circuit**

## 6. Marking

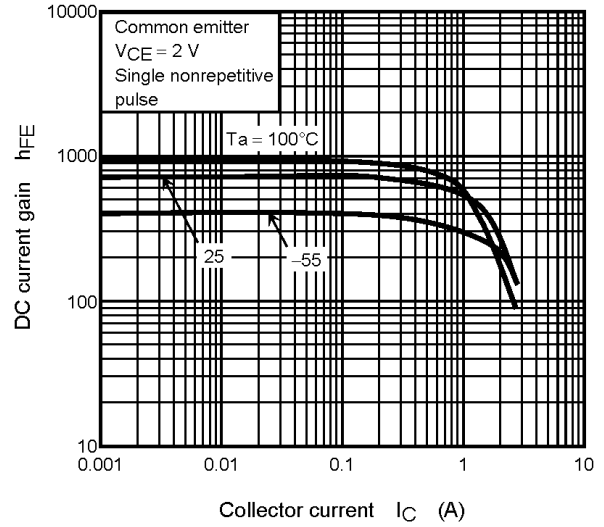


**Fig. 6.1 Marking**

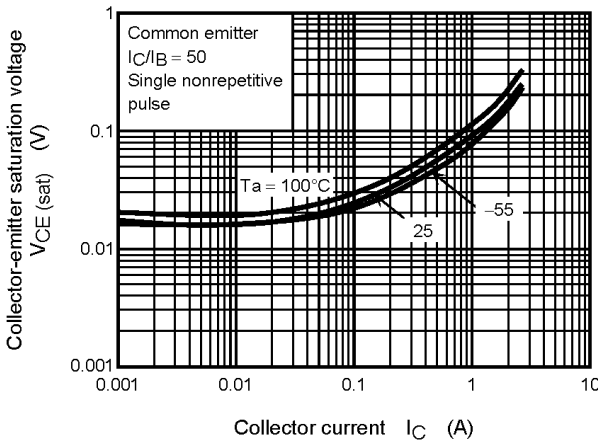
**7. Characteristics Curves (Note)**



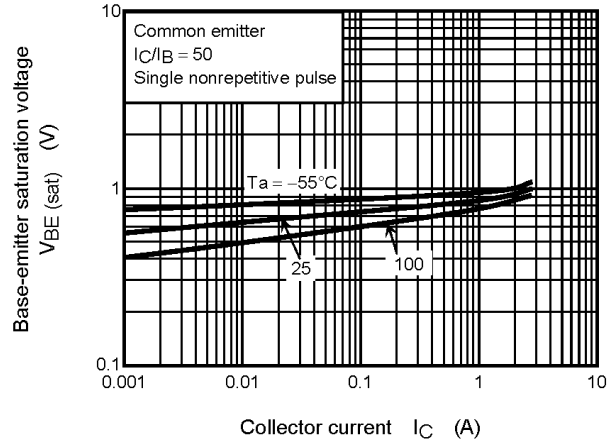
**Fig. 7.1  $I_C - V_{CE}$**



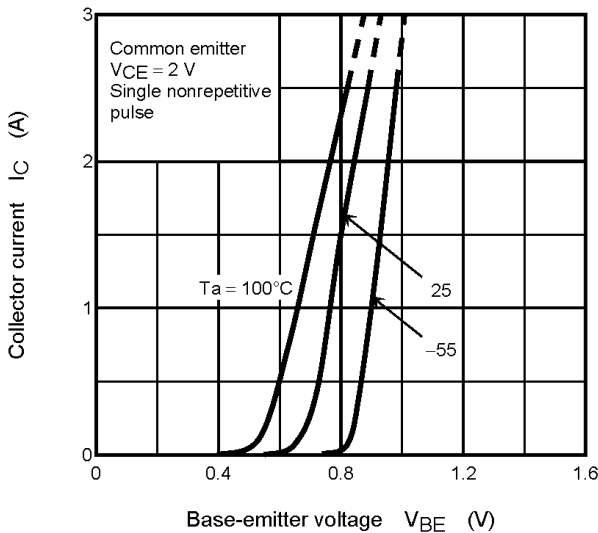
**Fig. 7.2  $h_{FE} - I_C$**



**Fig. 7.3  $V_{CE(sat)} - I_C$**



**Fig. 7.4  $V_{BE(sat)} - I_C$**



**Fig. 7.5  $I_C - V_{BE}$**

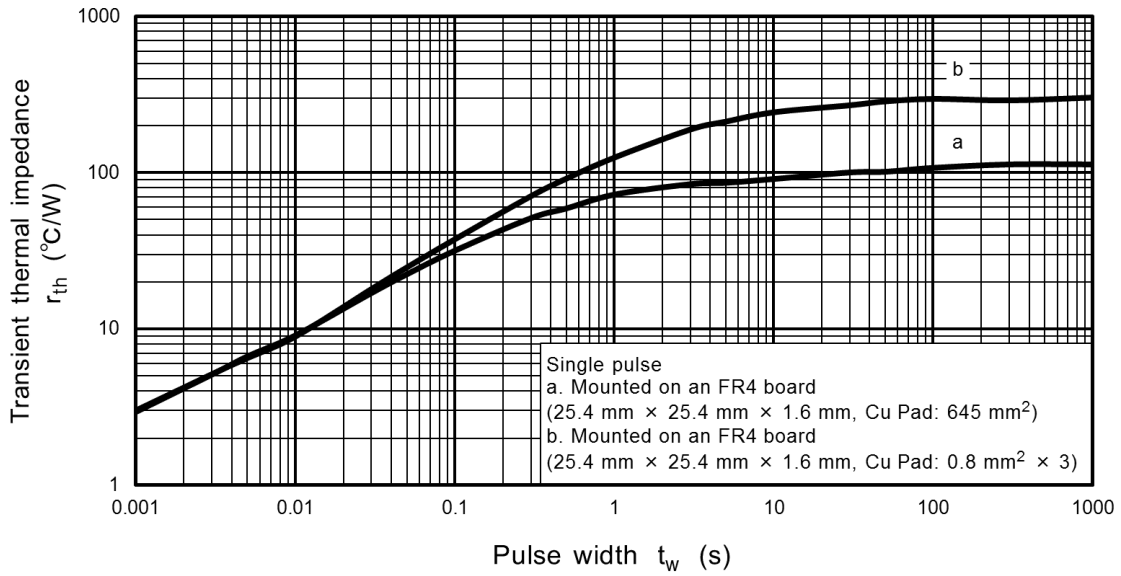


Fig. 7.6  $r_{th} - t_w$

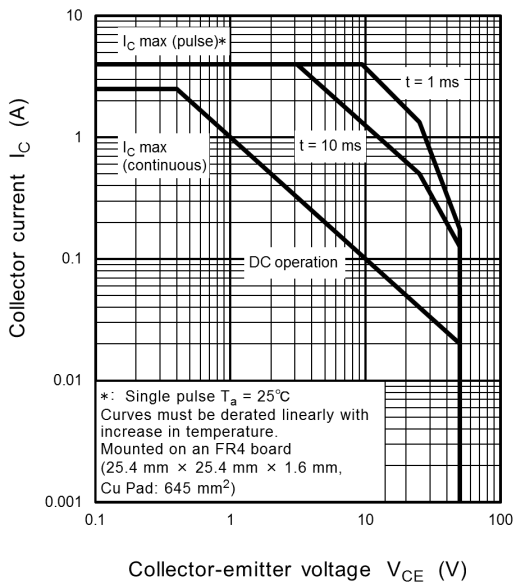
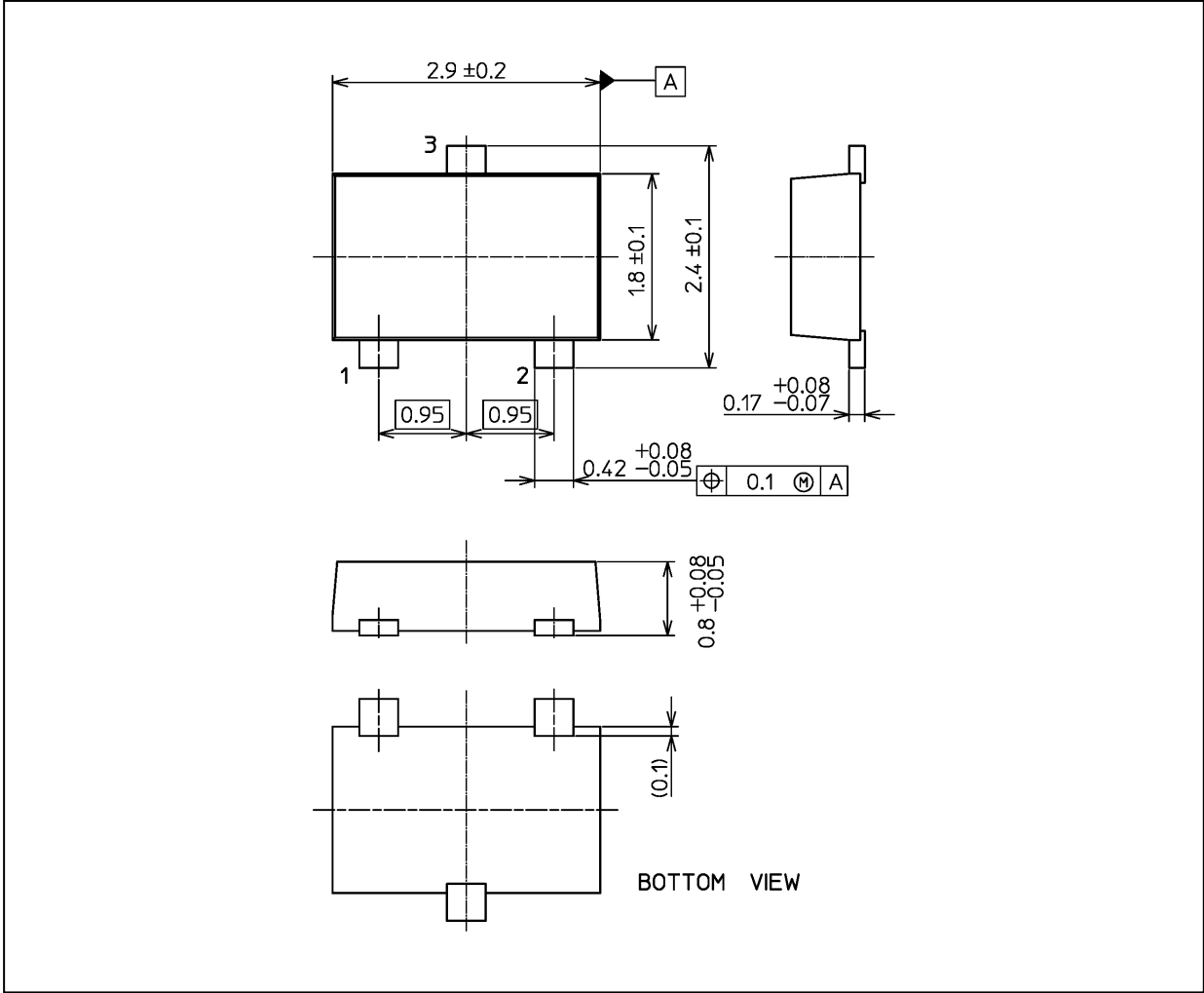


Fig. 7.7 Safe Operating Area

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 0.011 g (typ.)

Package Name(s)
Nickname: SOT-23F

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