

Bipolar Transistors Silicon PNP Epitaxial Type

## TTA502

### 1. Applications

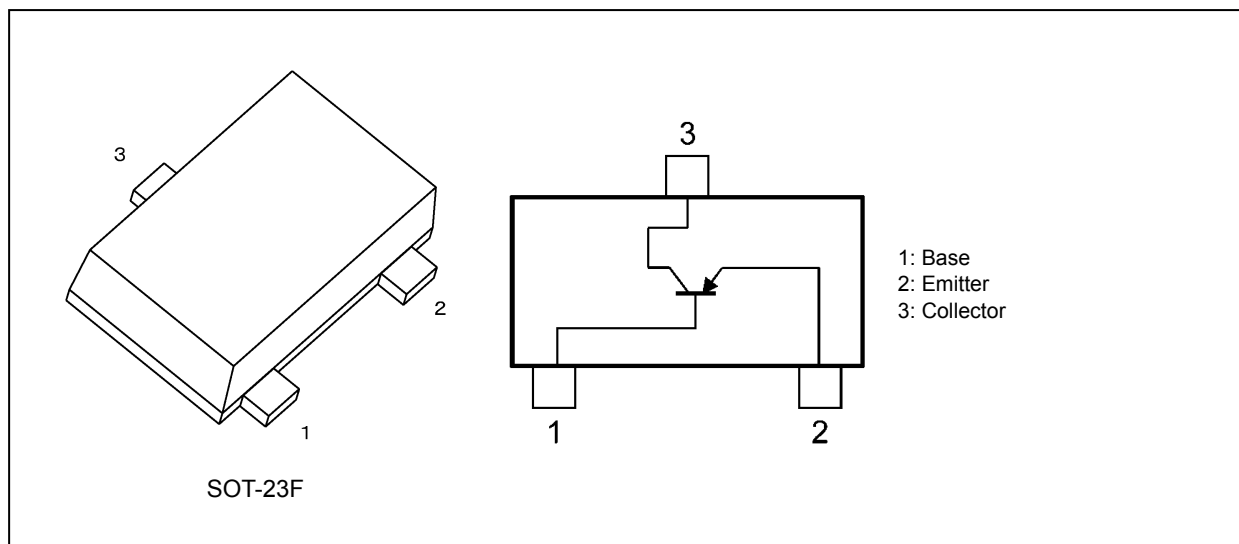
- High-Speed Switching
- DC-DC Converters

### 2. Features

- (1) AEC-Q101 qualified (Note 1)
- (2) High DC current gain:  $h_{FE} = 200$  to  $500$  ( $I_C = -0.5$  A)
- (3) Low collector-emitter saturation voltage:  $V_{CE(sat)} = -0.19$  V (max)
- (4) High-speed switching:  $t_f = 40$  ns (typ.)

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

### 3. Packaging and Internal Circuit



Start of commercial production  
2021-03

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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	-30	V
Collector-emitter voltage	$V_{CEO}$	-20	V
Emitter-base voltage	$V_{EBO}$	-7	V
Collector current (DC) (Note 1)	$I_C$	-2.5	A
Collector current (pulsed) (Note 1)	$I_{CP}$	-4.0	A
Base current	$I_B$	-250	mA
Collector power dissipation DC (Note 2)	$P_C$	1	W
Collector power dissipation (t = 1 s) (Note 2)	$P_C$	1.3	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. Static Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = -30\text{ V}$ , $I_E = 0\text{ mA}$	—	—	-100	nA
Emitter cut-off current	$I_{EBO}$	$V_{EB} = -7\text{ V}$ , $I_C = 0\text{ mA}$	—	—	-100	nA
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = -10\text{ mA}$ , $I_B = 0\text{ mA}$	-20	—	—	V
DC current gain	$h_{FE(1)}$	$V_{CE} = -2\text{ V}$ , $I_C = -0.5\text{ A}$	200	—	500	—
	$h_{FE(2)}$	$V_{CE} = -2\text{ V}$ , $I_C = -1.6\text{ A}$	100	—	—	—
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = -1.6\text{ A}$ , $I_B = -53\text{ mA}$	—	—	-0.19	V
Base-emitter saturation voltage	$V_{BE(sat)}$	$I_C = -1.6\text{ A}$ , $I_B = -53\text{ mA}$	—	—	-1.1	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	$C_{ob}$	$V_{CB} = -10\text{ V}$ , $I_E = 0\text{ mA}$ , $f = 1\text{ MHz}$	—	28	—	pF
Switching time (rise time)	$t_r$	See Figure 5.2.1	—	70	—	ns
Switching time (storage time)	$t_{stg}$	$V_{CC} \approx -12\text{ V}$ , $R_L = 7.5\ \Omega$ , $I_{B1} = 53\text{ mA}$ , $I_{B2} = 53\text{ mA}$	—	150	—	ns
Switching time (fall time)	$t_f$		—	40	—	ns

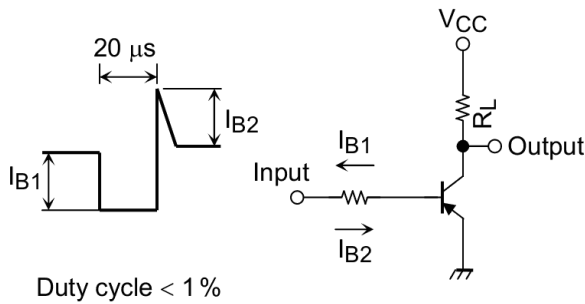


Fig. 5.2.1 Switching Time Test Circuit

## 6. Marking

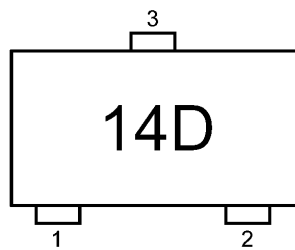


Fig. 6.1 Marking

## 7. Characteristics Curves (Note)

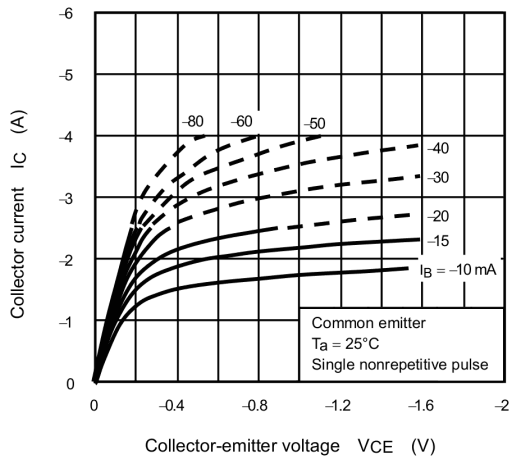


Fig. 7.1  $I_C - V_{CE}$

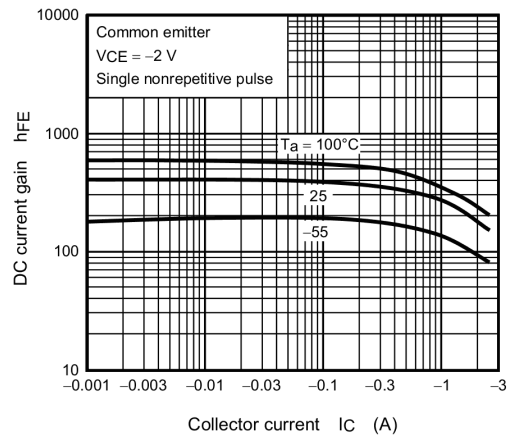


Fig. 7.2  $h_{FE} - I_C$

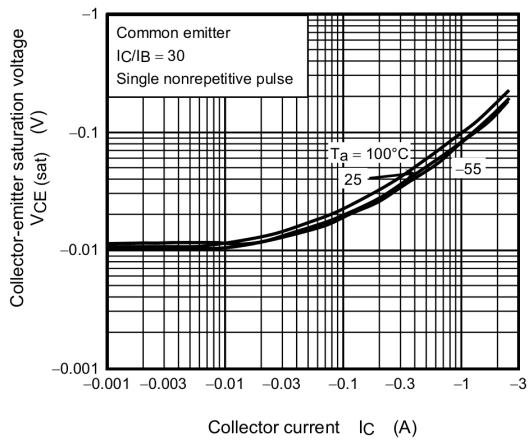


Fig. 7.3  $V_{CE(sat)} - I_C$

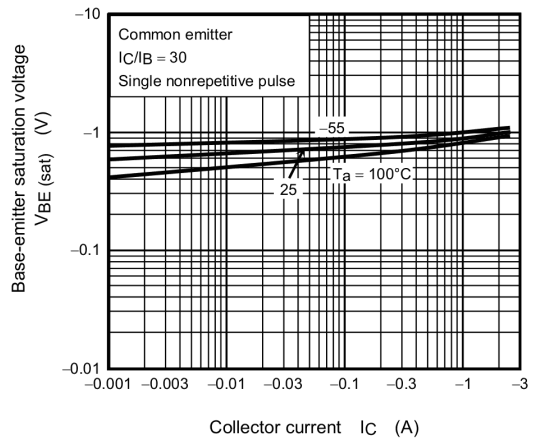


Fig. 7.4  $V_{BE(sat)} - I_C$

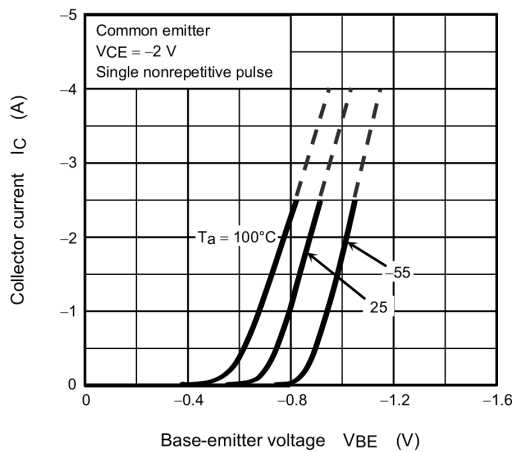


Fig. 7.5  $I_C - V_{BE}$

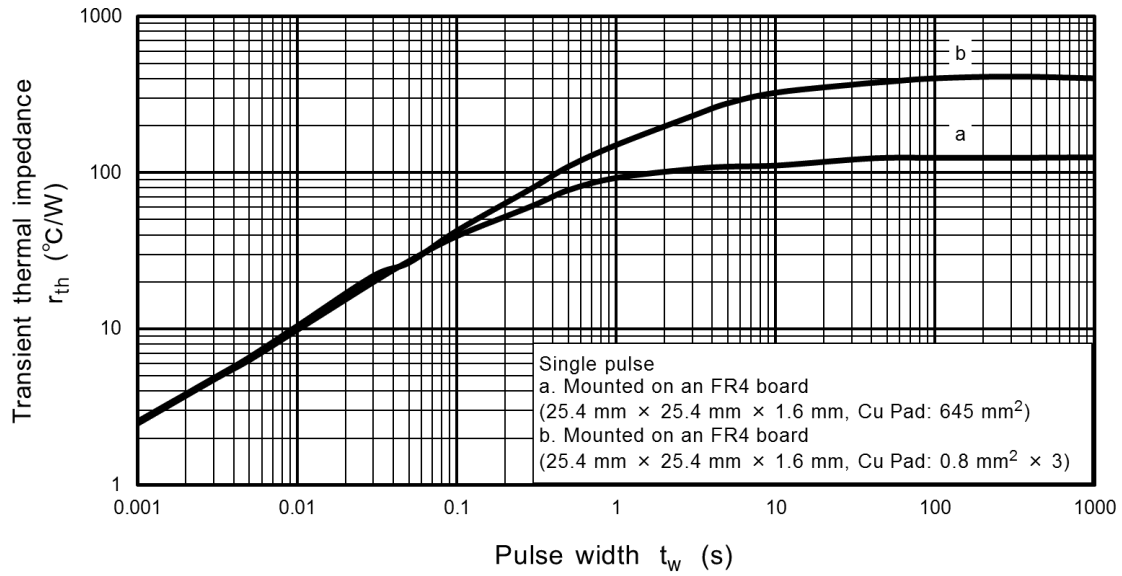


Fig. 7.6  $r_{th} - t_w$

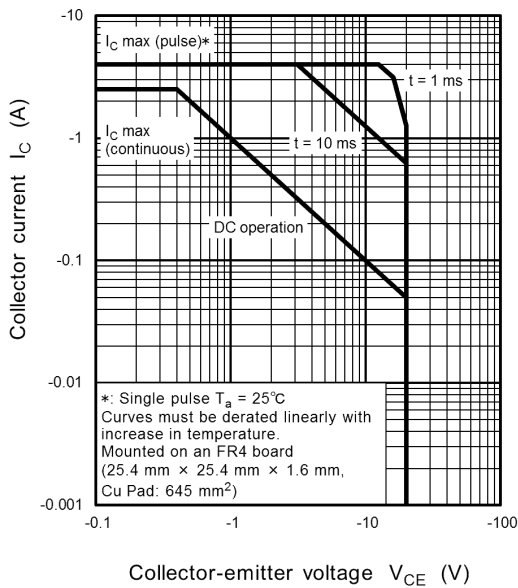
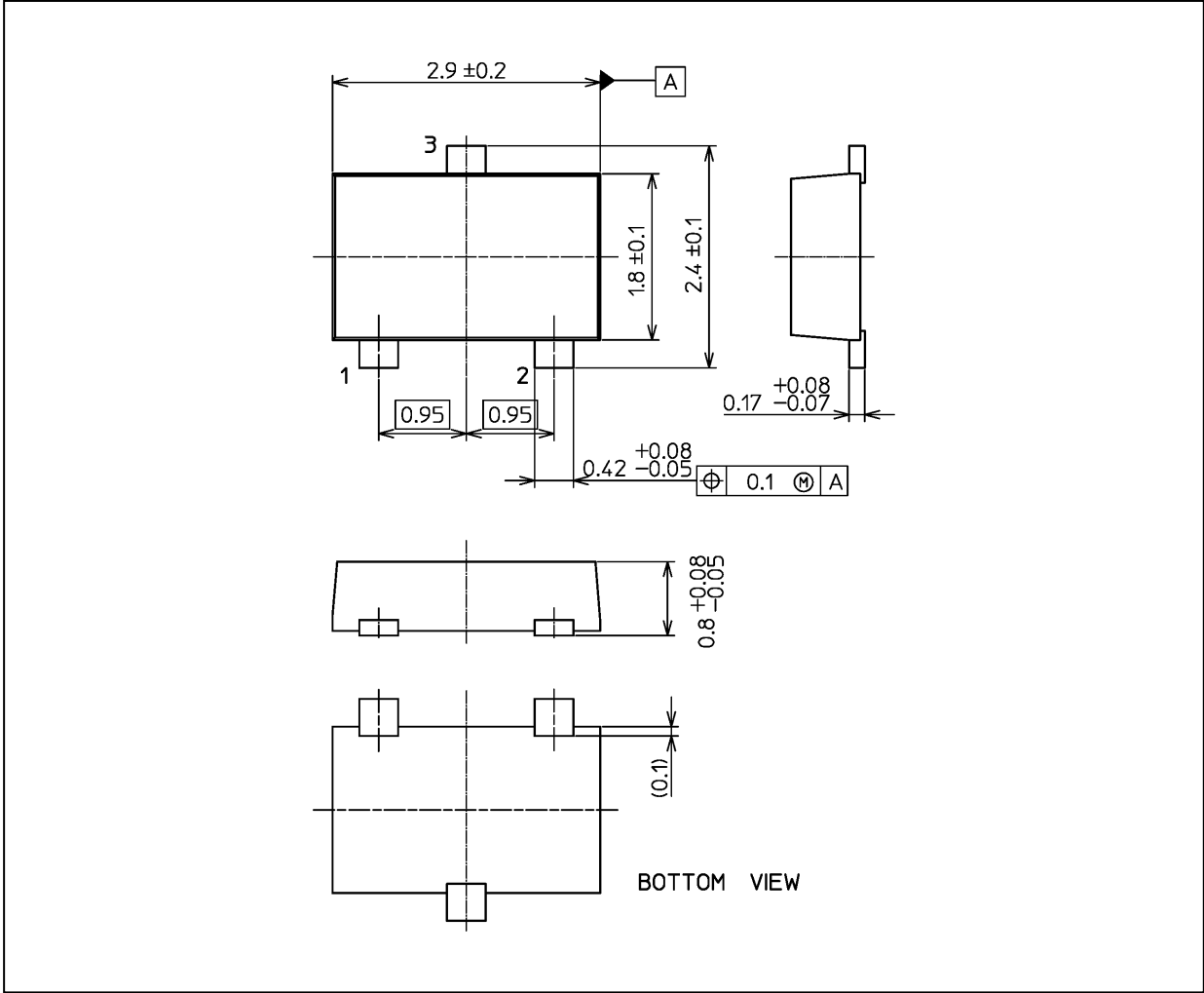


Fig. 7.7 Safe Operating Area

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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