

Bipolar Transistors Silicon NPN Epitaxial Type

TTC502

1. Applications

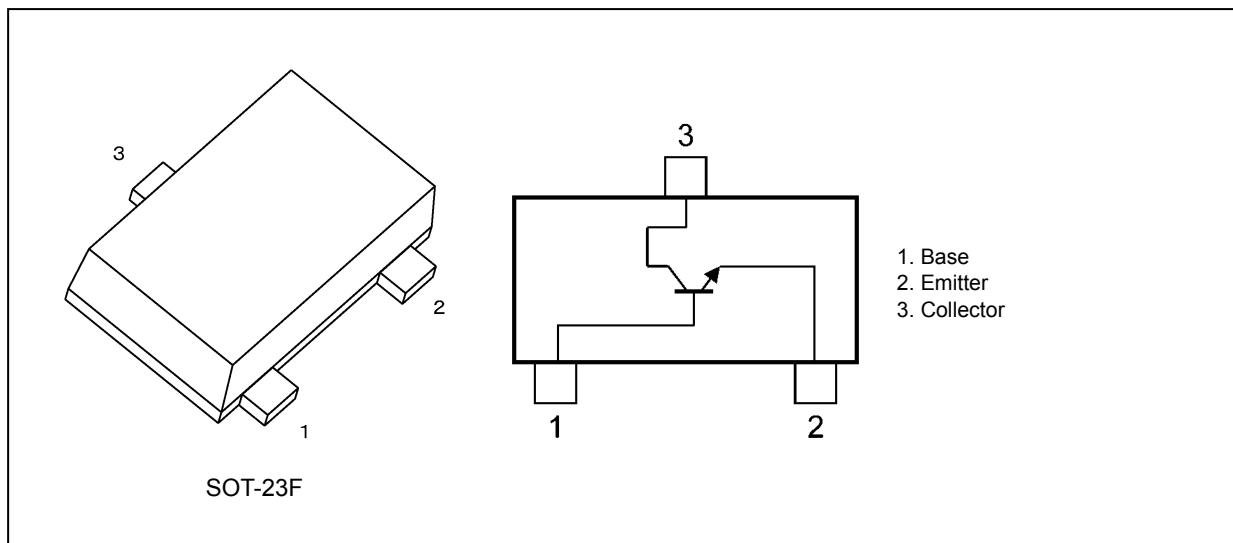
- High-Speed Switching
- DC-DC Converters

2. Features

- (1) AEC-Q101 qualified (Note 1)
- (2) High DC current gain: $h_{FE} = 120$ to 300 ($I_C = 0.1$ A)
- (3) Low collector-emitter saturation voltage: $V_{CE(sat)} = 0.14$ V (max)
- (4) High-speed switching: $t_f = 200$ 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, $T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Rating	Unit		
Collector-base voltage	V_{CBO}	180	V		
Collector-emitter voltage	V_{CEO}	120	V		
Emitter-base voltage	V_{EBO}	7	V		
Collector current (DC)	(Note 1)	I_C	1.0	A	
Collector current (pulsed)	(Note 1)	I_{CP}	2.0	A	
Base current	I_B	100	mA		
Collector power dissipation	DC	(Note 2)	P_C	1	W
Collector power dissipation	($t = 1\text{ s}$)	(Note 2)	P_C	1.8	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°C .

Note 2: Device mounted on an FR4 board. (25.4 mm \times 25.4 mm \times 1.6 mm, Cu pad: 645 mm 2)

5. Electrical Characteristics

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	$V_{CB} = 180\text{ V}$, $I_E = 0\text{ mA}$	—	—	100	nA
Emitter cut-off current	I_{EBO}	$V_{EB} = 7\text{ V}$, $I_C = 0\text{ mA}$	—	—	100	nA
Collector-base breakdown voltage	$V_{(BR)CBO}$	$I_C = 1\text{ mA}$, $I_B = 0\text{ mA}$	180	—	—	V
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = 10\text{ mA}$, $I_B = 0\text{ mA}$	120	—	—	V
DC current gain	$h_{FE}(1)$	$V_{CE} = 2\text{ V}$, $I_C = 1\text{ mA}$	100	—	—	—
	$h_{FE}(2)$	$V_{CE} = 2\text{ V}$, $I_C = 0.1\text{ A}$	120	—	300	—
	$h_{FE}(3)$	$V_{CE} = 2\text{ V}$, $I_C = 0.3\text{ A}$	60	—	—	—
Collector-emitter saturation voltage	$V_{CE(\text{sat})}$	$I_C = 0.3\text{ A}$, $I_B = 10\text{ mA}$	—	—	0.14	V
Base-emitter saturation voltage	$V_{BE(\text{sat})}$	$I_C = 0.3\text{ A}$, $I_B = 10\text{ mA}$	—	—	1.10	V

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

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Switching time (rise time)	t_r	See Figure 5.2.1 $V_{cc} \approx 72\text{ V}$, $R_L = 240\Omega$, $I_{B1} = 10\text{ mA}$, $I_{B2} = 10\text{ mA}$	—	100	—	ns
Switching time (storage time)	t_{stg}	—	—	1500	—	ns
Switching time (fall time)	t_f	—	—	200	—	ns

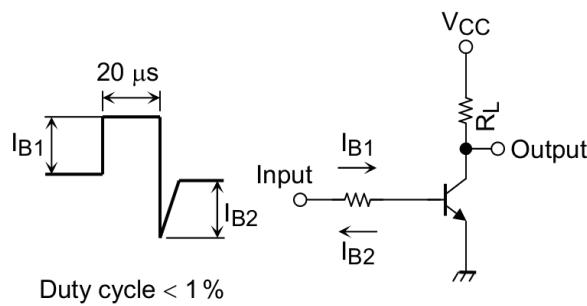


Fig. 5.2.1 Switching Time Test Circuit

6. Marking

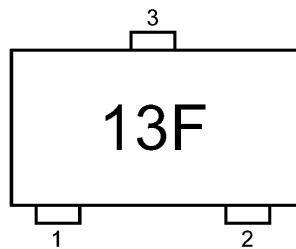


Fig. 6.1 Marking

7. Characteristics Curves (Note)

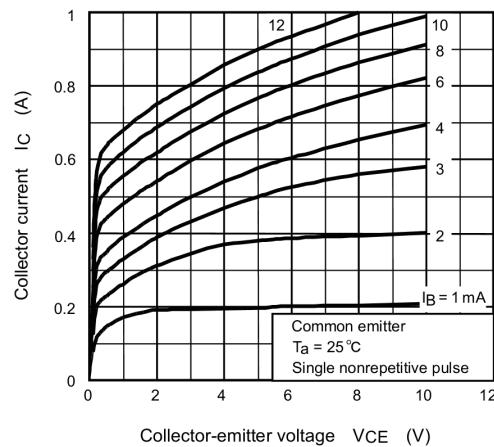


Fig. 7.1 $I_C - V_{CE}$

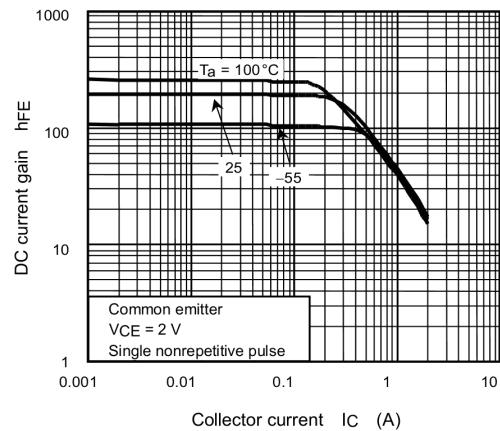


Fig. 7.2 $h_{FE} - I_C$

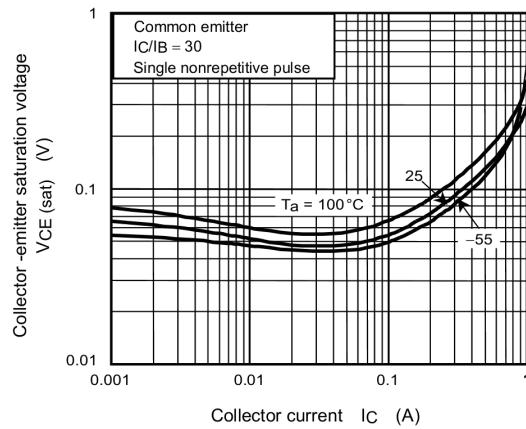


Fig. 7.3 $V_{CE(\text{sat})} - I_C$

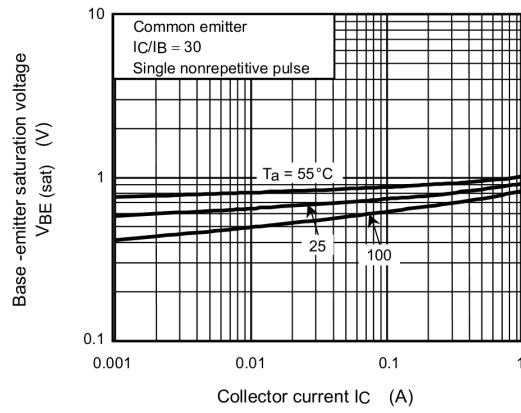


Fig. 7.4 $V_{BE(\text{sat})} - I_C$

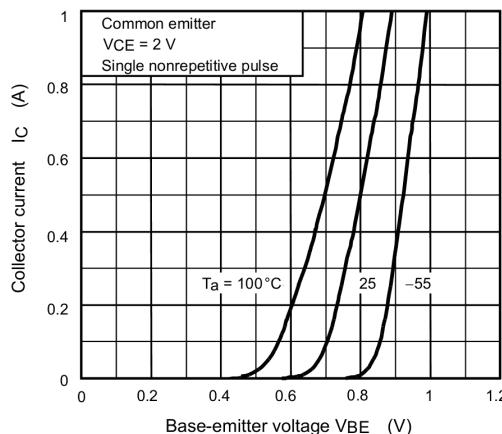


Fig. 7.5 $I_C - V_{BE}$

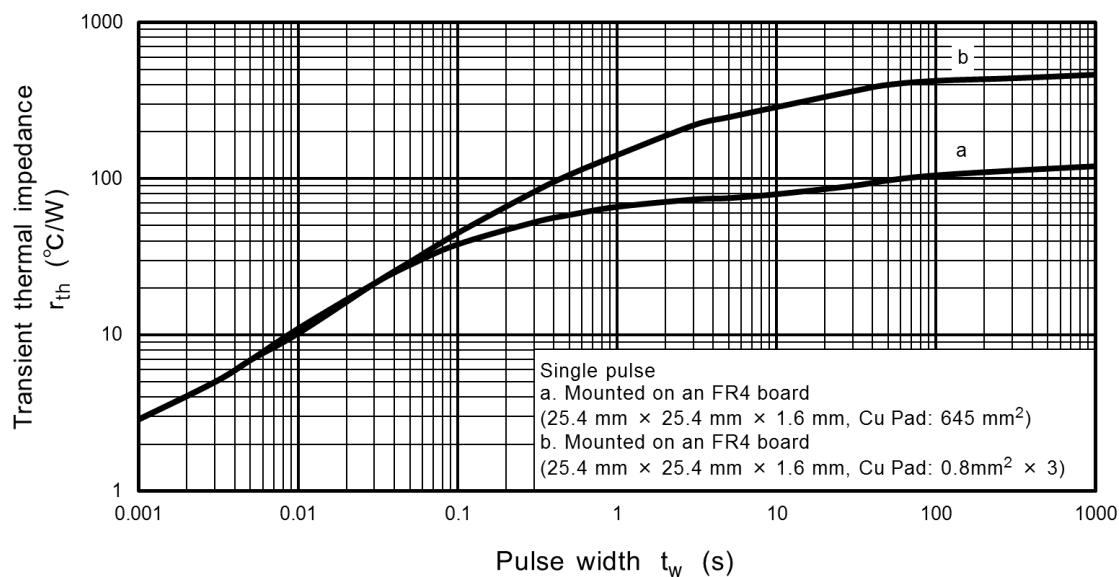
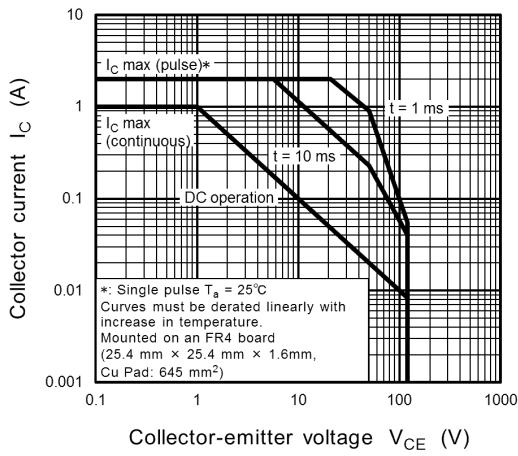
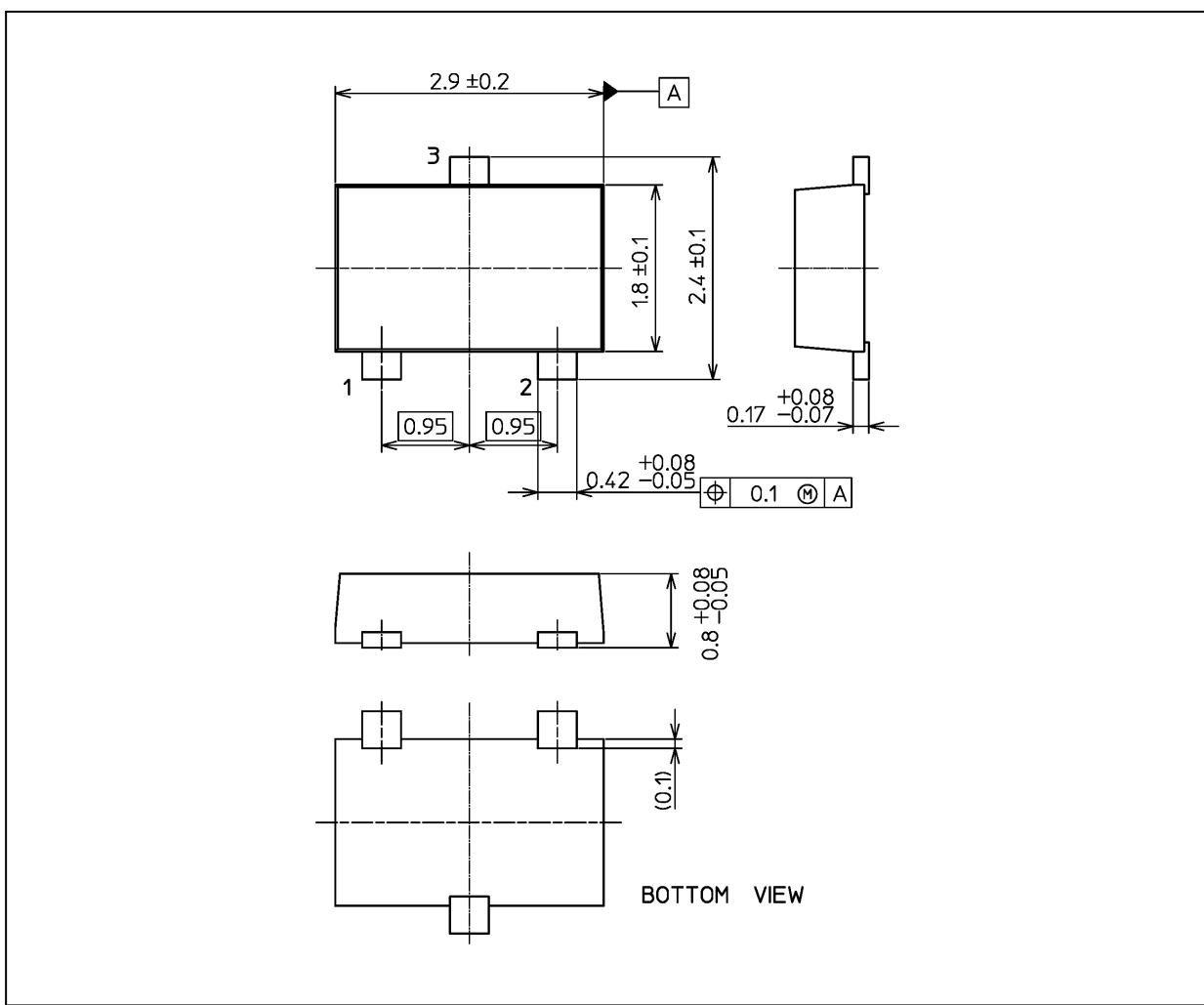
Fig. 7.6 r_{th} - t_w 

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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