

## TTA013

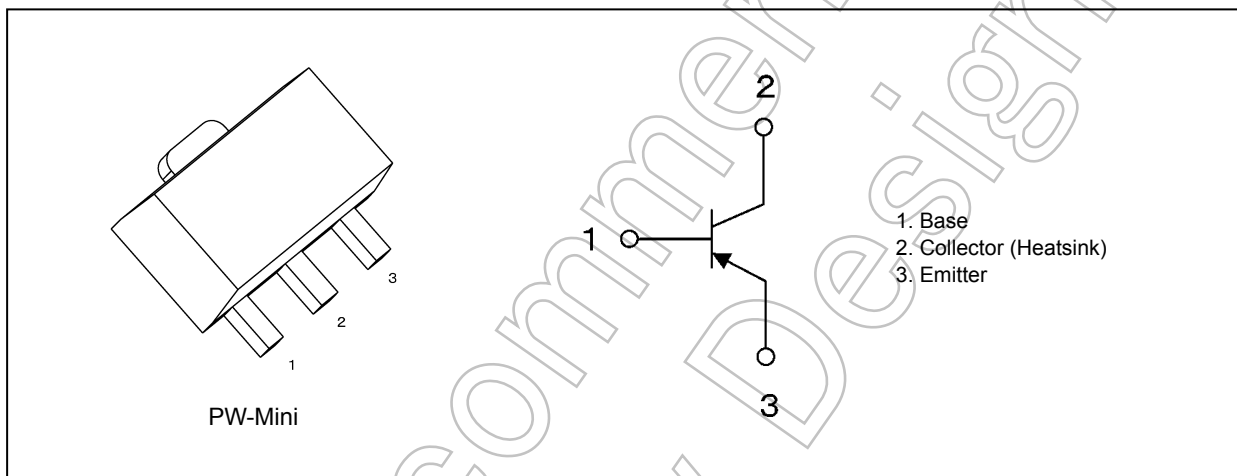
### 1. Applications

- High-Speed Switching
- DC-DC Converters

### 2. Features

- (1) High DC current gain:  $h_{FE} = 120$  to  $240$  ( $V_{CE} = -2$  V,  $I_C = -0.25$  A)
- (2) Low collector-emitter saturation voltage:  $V_{CE(sat)} = -0.32$  V (max) ( $I_C = -0.75$  A,  $I_B = -75$  mA)
- (3) High-speed switching:  $t_f = 65$  ns (typ.) ( $I_C = -0.75$  A)

### 3. Packaging and Internal Circuit



Start of commercial production

2022-10

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

| Characteristics             | Symbol            | Rating     | Unit             |
|-----------------------------|-------------------|------------|------------------|
| Collector-base voltage      | $V_{CB0}$         | -120       | V                |
| Collector-emitter voltage   | $V_{CEO}$         | -120       | V                |
| Emitter-base voltage        | $V_{EBO}$         | -7         | V                |
| Collector current (DC)      | $I_C$ (Note 1)    | -2.5       | A                |
| Collector current (pulsed)  | $I_{CP}$ (Note 1) | -5         | A                |
| Base current                | $I_B$             | -0.25      | A                |
| Collector power dissipation | $P_C$ (Note 2)    | 1.0        | W                |
| Collector power dissipation | $P_C$ (Note 3)    | 2.5        | 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 junction temperature does not exceed  $150\text{ }^\circ\text{C}$ .

Note 2: Device mounted on a  $25.4\text{ mm} \times 25.4\text{ mm} \times 1.6\text{ mm}$  FR-4 glass epoxy board (with a dissipating copper surface of  $645\text{ mm}^2$ )

Note 3: Device mounted on a  $40.0\text{ mm} \times 40.0\text{ mm} \times 0.8\text{ mm}$  ceramic board (with a dissipating copper surface of  $1600\text{ mm}^2$ )

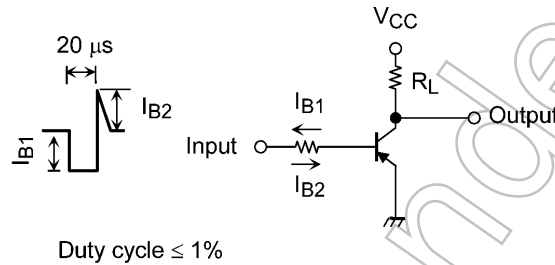
## 5. Electrical Characteristics

### 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            | $I_{CB0}$        | $V_{CB} = -120\text{ V}, I_E = 0\text{ A}$   | —    | —     | -100  | nA   |
| Emitter cut-off current              | $I_{EBO}$        | $V_{EB} = -7\text{ V}, I_C = 0\text{ A}$     | —    | —     | -100  | nA   |
| Collector-emitter breakdown voltage  | $V_{(BR)CEO}$    | $I_C = -10\text{ mA}, I_B = 0\text{ A}$      | -120 | —     | —     | V    |
| DC current gain                      | $h_{FE(1)}$      | $V_{CE} = -2\text{ V}, I_C = -0.25\text{ A}$ | 120  | —     | 240   | —    |
|                                      | $h_{FE(2)}$      | $V_{CE} = -2\text{ V}, I_C = -0.75\text{ A}$ | 90   | —     | —     |      |
| Collector-emitter saturation voltage | $V_{CE(sat)(1)}$ | $I_C = -0.25\text{ A}, I_B = -25\text{ mA}$  | —    | -0.06 | -0.12 | V    |
|                                      | $V_{CE(sat)(2)}$ | $I_C = -0.75\text{ A}, I_B = -75\text{ mA}$  | —    | -0.13 | -0.32 |      |
| Base-emitter saturation voltage      | $V_{BE(sat)}$    | $I_C = -0.75\text{ A}, I_B = -75\text{ mA}$  | —    | -0.93 | -1.10 | V    |

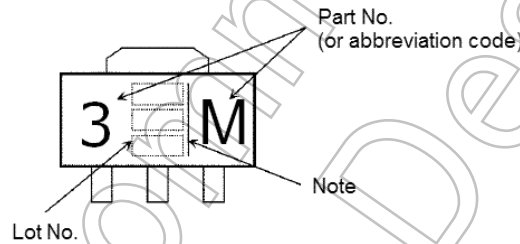
## 5.2. Dynamic Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

| Characteristics               | Symbol    | Test Condition   | Min | Typ. | Max | Unit |
|-------------------------------|-----------|--|-----|------|-----|------|
| Collector output capacitance  | $C_{ob}$  | $V_{CB} = -10\text{ V}$ , $I_E = 0\text{ A}$ , $f = 1\text{ MHz}$  | —   | 33   | —   | pF   |
| Switching time (rise time)    | $t_r$     | See Figure 5.2.1   | —   | 25   | —   | ns   |
| Switching time (storage time) | $t_{stg}$ | $V_{CC} \approx -30\text{ V}$ , $R_L = 40\ \Omega$ ,<br>$I_{B1} = -75\text{ mA}$ , $I_{B2} = 75\text{ mA}$ | —   | 500  | —   |      |
| Switching time (fall time)    | $t_f$     |  | —   | 65   | —   |      |



**Fig. 5.2.1 Switching Time Test Circuit**

## 6. Marking (Note)



**Fig. 6.1 Marking**

Note: A line beside a Lot No. identifies the indication of product Labels.

[[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.

The RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

## 7. Characteristics Curves (Note)

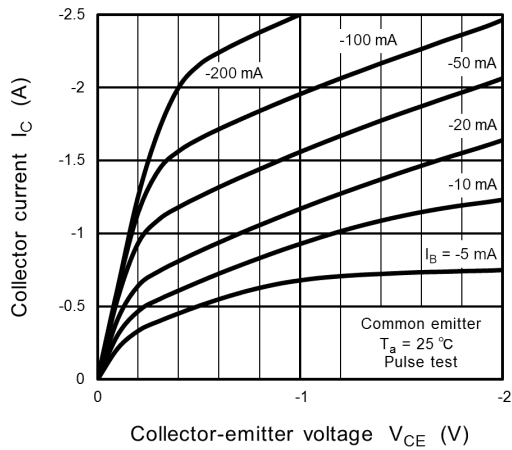


Fig. 7.1  $I_C - V_{CE}$

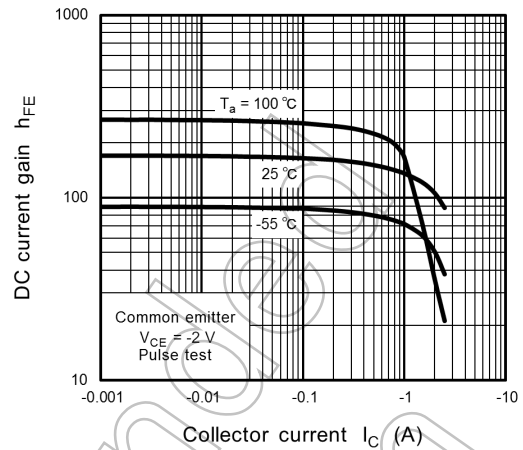


Fig. 7.2  $h_{FE} - I_C$

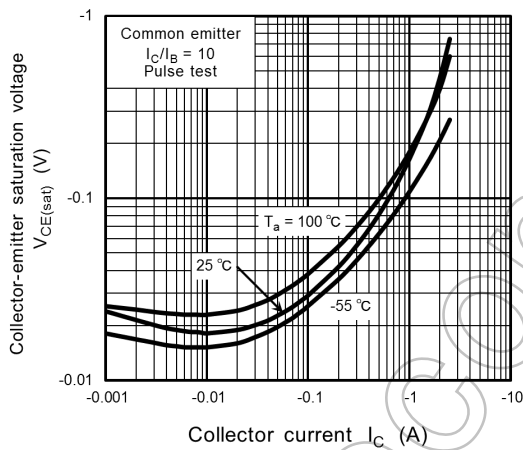


Fig. 7.3  $V_{CE(sat)} - I_C$

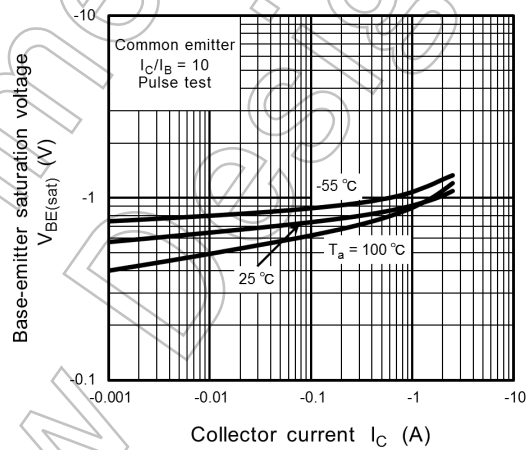


Fig. 7.4  $V_{BE(sat)} - I_C$

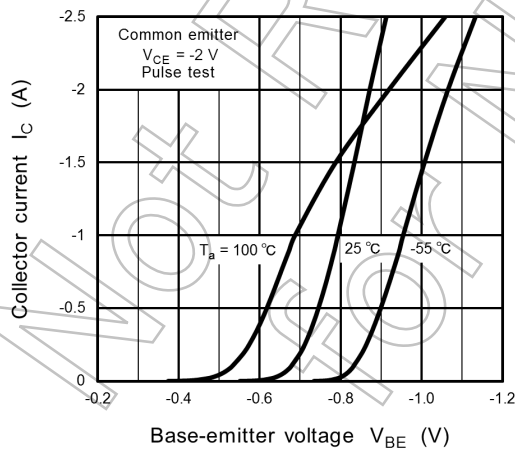
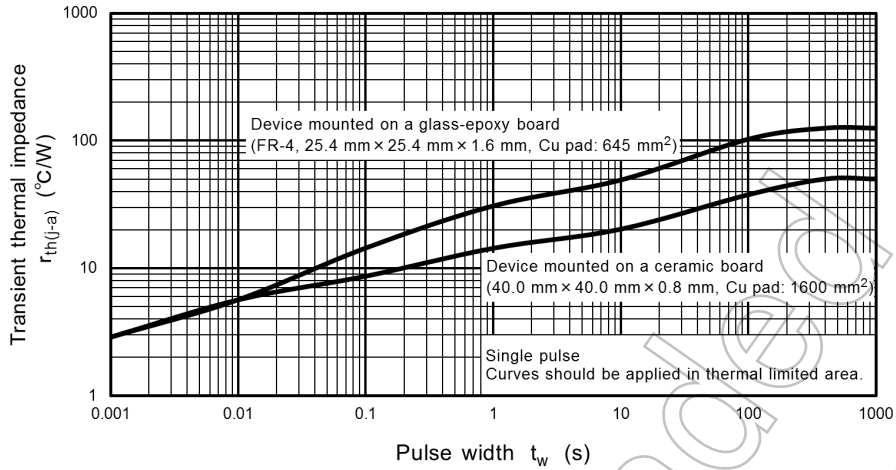
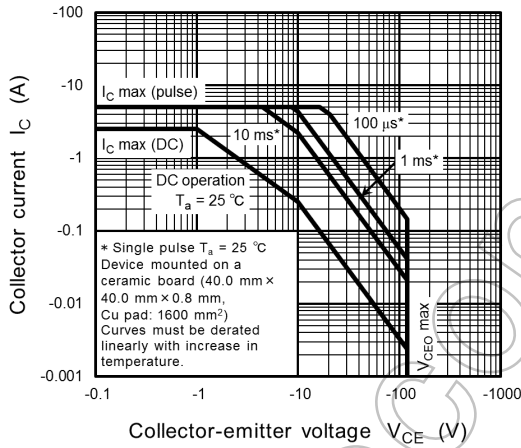


Fig. 7.5  $I_C - V_{BE}$



**Fig. 7.6  $r_{th} - t_w$**   
(Guaranteed Maximum)

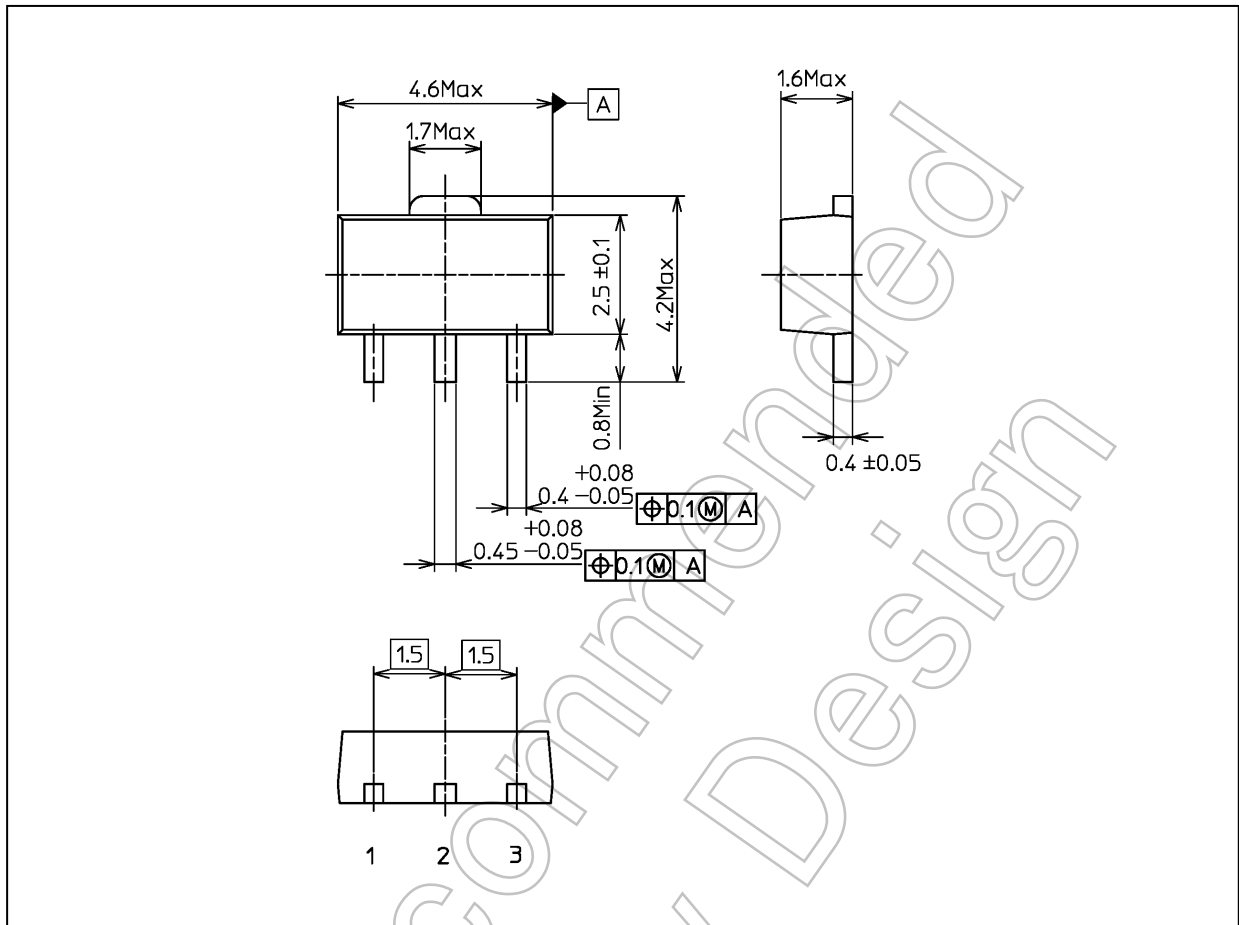


**Fig. 7.7 Safe Operating Area**  
(Guaranteed Maximum)

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

## Package Dimensions

Unit: mm



Weight: 0.05 g (typ.)

| Package Name(s)   |
|-------------------|
| TOSHIBA: 2-5K1S   |
| Nickname: PW-Mini |

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