

Bipolar Transistors Silicon PNP Epitaxial Type

TTA011

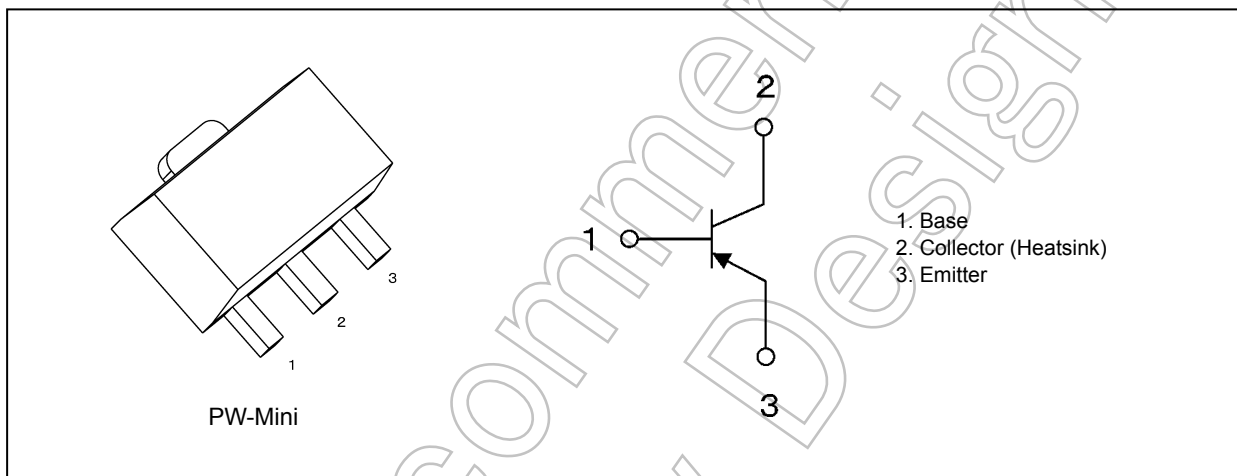
1. Applications

- High-Speed Switching
- DC-DC Converters

2. Features

- (1) High DC current gain: $h_{FE} = 200$ to 500 ($V_{CE} = -2$ V, $I_C = -0.5$ A)
- (2) Low collector-emitter saturation voltage: $V_{CE(sat)} = -0.27$ V (max) ($I_C = -1.6$ A, $I_B = -53$ mA)
- (3) High-speed switching: $t_f = 60$ ns (typ.) ($I_C = -1.6$ 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} | -50 | V |
| Collector-emitter voltage | V_{CEO} | -50 | V |
| Emitter-base voltage | V_{EBO} | -7 | V |
| Collector current (DC) | I_C (Note 1) | -5 | A |
| Collector current (pulsed) | I_{CP} (Note 1) | -10 | A |
| Base current | I_B | -0.5 | 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 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 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} | $V_{CB} = -50\text{ V}, I_E = 0\text{ A}$ | — | — | -100 | nA |
| Emitter cut-off current | I_{EBO} | $V_{EB} = -7\text{ V}, I_C = 0\text{ A}$ | — | — | -100 | nA |
| Collector-emitter breakdown voltage | $V_{(BR)CEO}$ | $I_C = -10\text{ mA}, I_B = 0\text{ A}$ | -50 | — | — | V |
| DC current gain | $h_{FE(1)}$ | $V_{CE} = -2\text{ V}, I_C = -0.5\text{ A}$ | 200 | — | 500 | — |
| | $h_{FE(2)}$ | $V_{CE} = -2\text{ V}, I_C = -1.6\text{ A}$ | 120 | — | — | — |
| Collector-emitter saturation voltage | $V_{CE(sat)(1)}$ | $I_C = -0.5\text{ A}, I_B = -17\text{ mA}$ | — | -0.06 | -0.12 | V |
| | $V_{CE(sat)(2)}$ | $I_C = -1.6\text{ A}, I_B = -0.16\text{ A}$ | — | -0.12 | -0.21 | |
| | $V_{CE(sat)(3)}$ | $I_C = -1.6\text{ A}, I_B = -53\text{ mA}$ | — | -0.16 | -0.27 | |
| Base-emitter saturation voltage | $V_{BE(sat)}$ | $I_C = -1.6\text{ A}, I_B = -53\text{ mA}$ | — | -0.89 | -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} | $V_{CB} = -10\text{ V}$, $I_E = 0\text{ A}$, $f = 1\text{ MHz}$ | — | 40 | — | pF |
| Switching time (rise time) | t_r | See Figure 5.2.1 | — | 55 | — | ns |
| Switching time (storage time) | t_{stg} | $V_{CC} \approx -24\text{ V}$, $R_L = 15\ \Omega$, $I_{B1} = -53\text{ mA}$, $I_{B2} = 53\text{ mA}$ | — | 300 | — | |
| Switching time (fall time) | t_f | | — | 60 | — | |

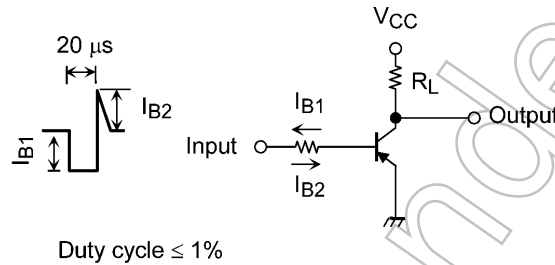


Fig. 5.2.1 Switching Time Test Circuit

6. Marking (Note)

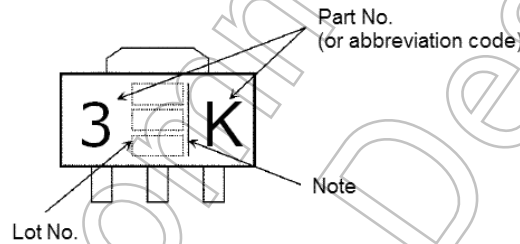


Fig. 6.1 Marking

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)

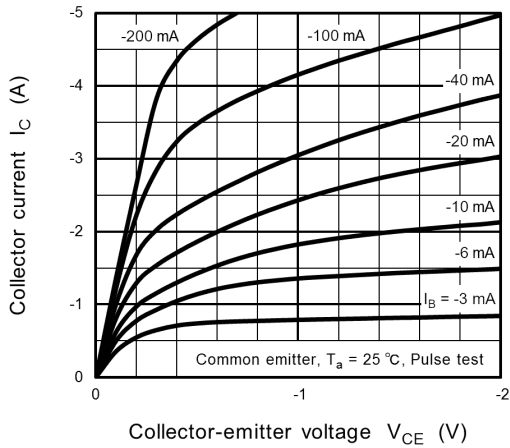


Fig. 7.1 $I_C - V_{CE}$

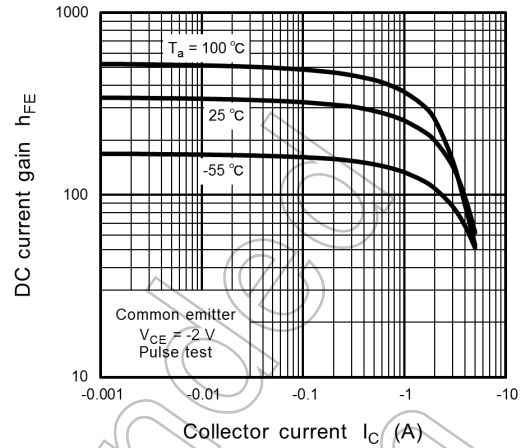


Fig. 7.2 $h_{FE} - I_C$

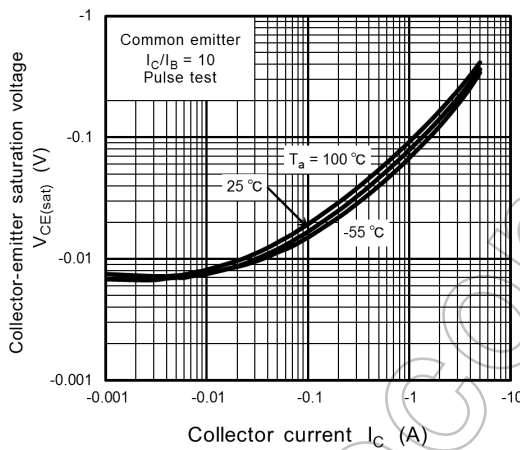


Fig. 7.3 $V_{CE(sat)} - I_C$

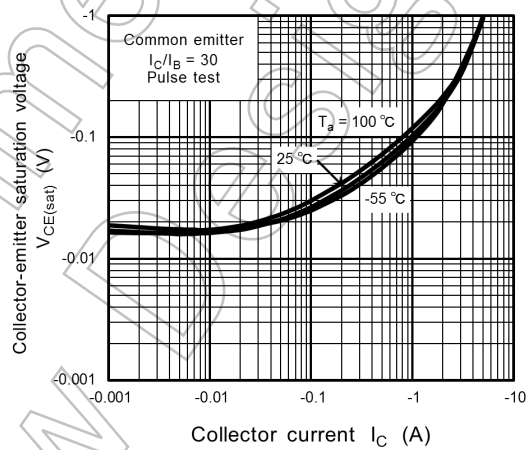


Fig. 7.4 $V_{CE(sat)} - I_C$

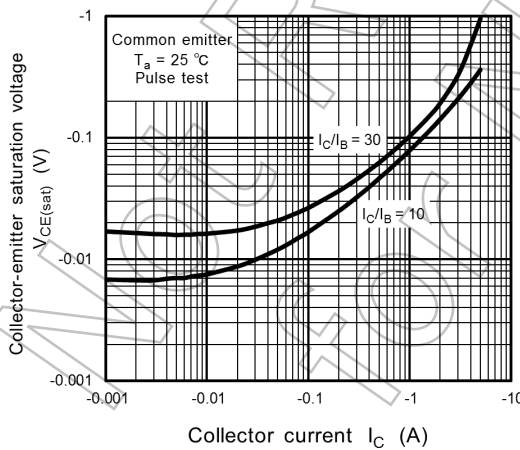


Fig. 7.5 $V_{CE(sat)} - I_C$

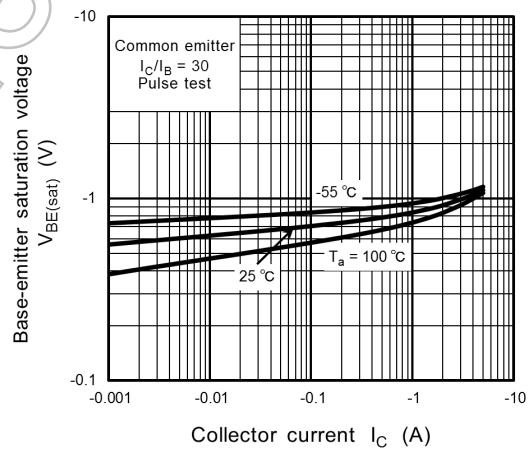
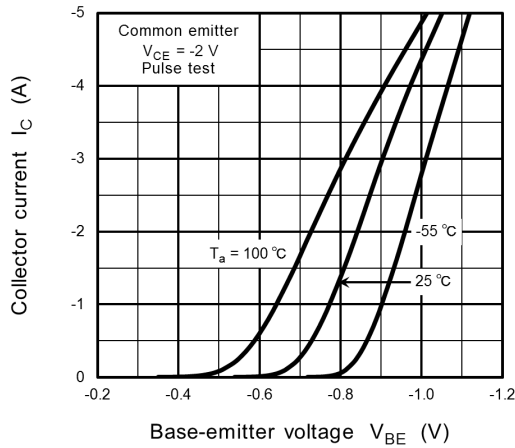
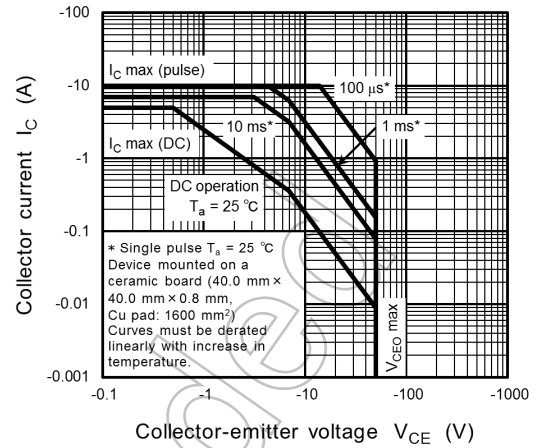


Fig. 7.6 $V_{BE(sat)} - I_C$



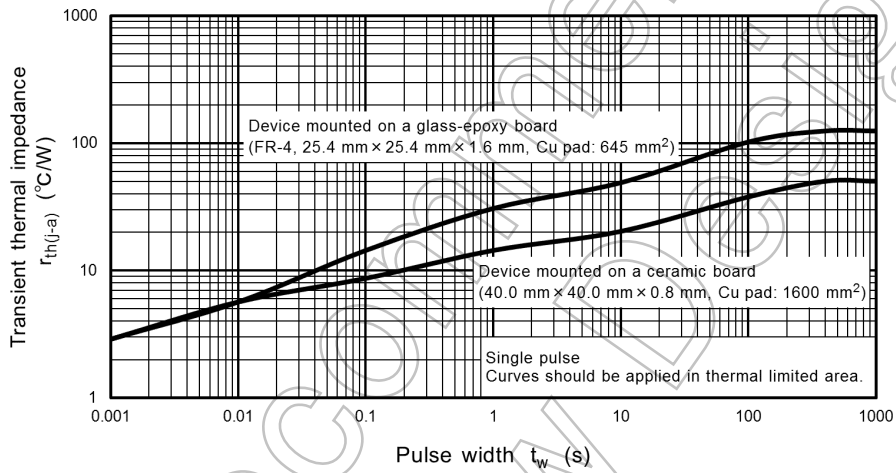
Base-emitter voltage V_{BE} (V)

Fig. 7.7 $I_C - V_{BE}$



Collector-emitter voltage V_{CE} (V)

Fig. 7.8 Safe Operating Area (Guaranteed Maximum)



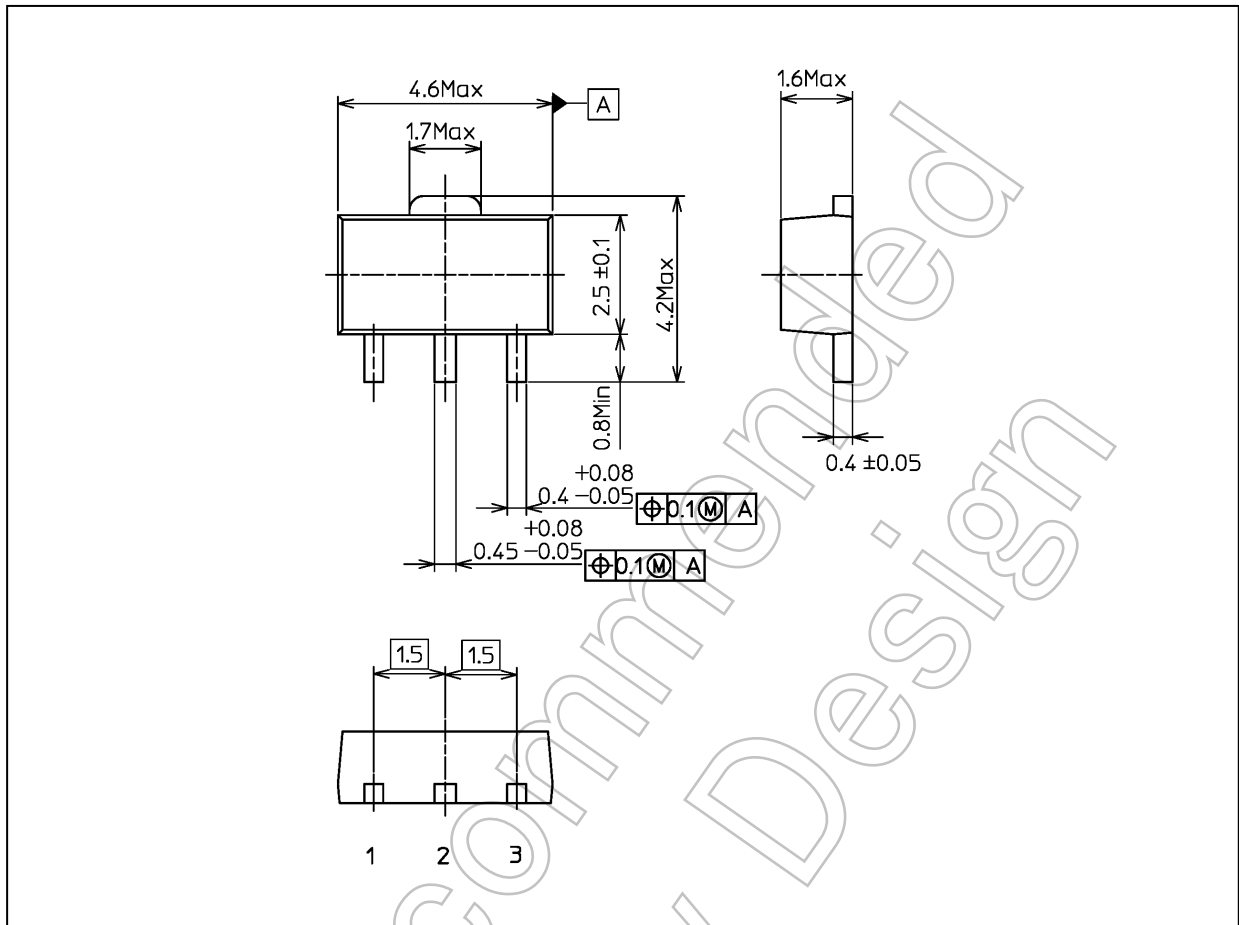
Pulse width t_w (s)

Fig. 7.9 $r_{th} - t_w$ (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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