

Bipolar Transistors Silicon PNP/NPN Epitaxial Type

HN1B04FU

1. Applications

- Low-Frequency Amplifiers

2. Q1 Features

- (1) High voltage: $V_{CEO} = 50\text{ V}$
- (2) High collector current: $I_C = 150\text{ mA (max)}$
- (3) High h_{FE} : $h_{FE} = 120\text{ to }400$
- (4) Excellent h_{FE} linearity: $h_{FE}(I_C = 0.1\text{ mA})/h_{FE}(I_C = 2\text{ mA}) = 0.95\text{ (typ.)}$

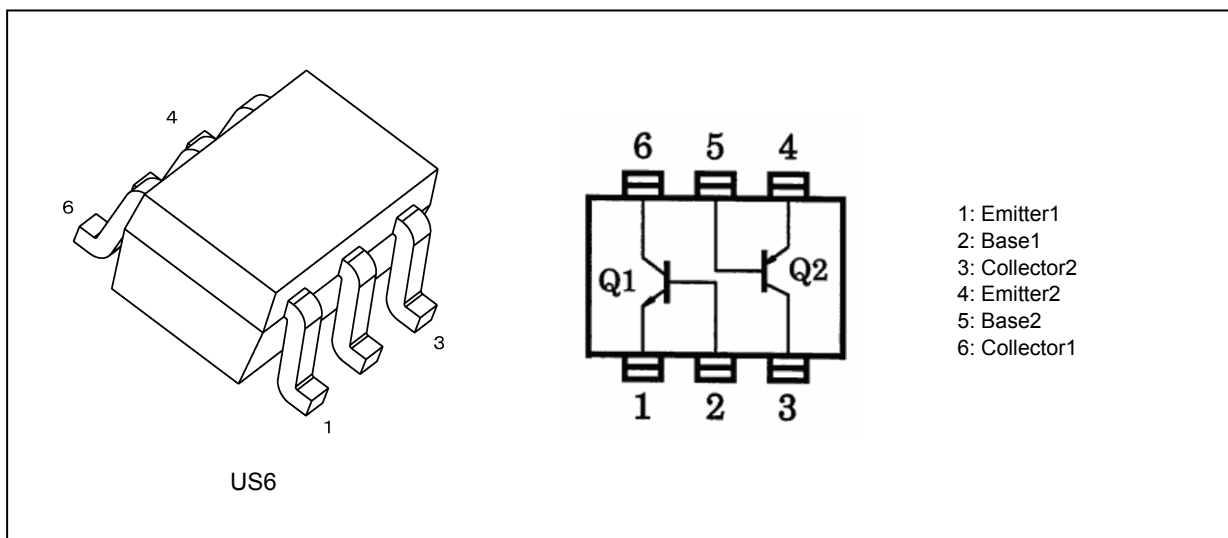
3. Q2 Features

- (1) High voltage: $V_{CEO} = -50\text{ V}$
- (2) High collector current: $I_C = -150\text{ mA (max)}$
- (3) High h_{FE} : $h_{FE} = 120\text{ to }400$
- (4) Excellent h_{FE} linearity: $h_{FE}(I_C = -0.1\text{ mA})/h_{FE}(I_C = -2\text{ mA}) = 0.95\text{ (typ.)}$

4. Q1, Q2 Common Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)

5. Packaging and Internal Circuit



Start of commercial production

1992-10

6. Orderable part number

| Orderable part number | | AEC-Q101 | Note |
|-----------------------|------------------|--------------|-------------------------|
| HN1B04FU-Y | HN1B04FU-Y,LF | — | General Use |
| | HN1B04FU-Y,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| | HN1B04FU-Y,LXHF | YES | Automotive Use |
| HN1B04FU-GR | HN1B04FU-GR,LF | — | General Use |
| | HN1B04FU-GR,LXGF | YES (Note 1) | Unintended Use (Note 1) |
| | HN1B04FU-GR,LXHF | YES | Automotive Use |

Note 1: For more information, please contact our sales or use the inquiry form on our website.

7. Q1 Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|---------------------------|-----------|--------|------|
| Emitter-base voltage | V_{EBO} | 60 | V |
| Collector-emitter voltage | V_{CEO} | 50 | V |
| Emitter-base voltage | V_{EBO} | 5 | V |
| Collector current | I_C | 150 | mA |
| Base current | I_B | 30 | mA |

8. Q2 Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|---------------------------|-----------|--------|------|
| Collector-base voltage | V_{CBO} | -50 | V |
| Collector-emitter voltage | V_{CEO} | -50 | V |
| Emitter-base voltage | V_{EBO} | -5 | V |
| Collector current | I_C | -150 | mA |
| Base current | I_B | -30 | mA |

9. Q1, Q2 Common Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|--------------------------------------|-----------|----------|------------|
| Collector power dissipation (Note 4) | P_C | 200 | mW |
| Junction temperature | T_j | (Note 2) | 150 |
| | | (Note 3) | 125 |
| Storage temperature | T_{stg} | (Note 2) | -55 to 150 |
| | | (Note 3) | -55 to 125 |

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 2: For devices with the ordering part number ending in LF(T).

Note 3: For devices with the ordering part number ending in XGF(T, XHF(T).

Note 4: Device mounted on an FR4 board.(total rating)(25.4 mm × 25.4 mm × 1.6 mm, Cu pad: 0.32 mm² × 6)

10. Q1 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} | $V_{CB} = 60\text{ V}, I_E = 0\text{ mA}$ | — | — | 0.1 | μA |
| Emitter cut-off current | I_{EBO} | $V_{EB} = 5\text{ V}, I_C = 0\text{ mA}$ | — | — | 0.1 | μA |
| DC current gain (Note) | h_{FE} | $V_{CE} = 6\text{ V}, I_C = 2\text{ mA}$ | 120 | — | 400 | — |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = 100\text{ mA}, I_B = 10\text{ mA}$ | — | 0.1 | 0.25 | V |
| Transition frequency | f_T | $V_{CE} = 10\text{ V}, I_C = 1\text{ mA}$ | — | 150 | — | MHz |
| Collector output capacitance | C_{ob} | $V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$ | — | 2 | — | pF |

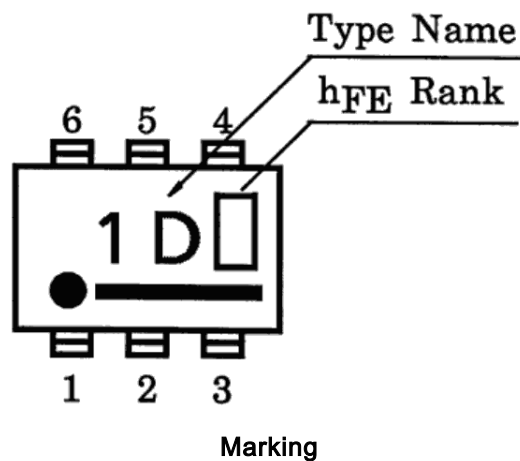
Note: h_{FE} classification Y (Y): 120 to 240, GR (G): 200 to 400
() marking symbol

11. Q2 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} | $V_{CB} = -50\text{ V}, I_E = 0\text{ mA}$ | — | — | -0.1 | μA |
| Emitter cut-off current | I_{EBO} | $V_{EB} = -5\text{ V}, I_C = 0\text{ mA}$ | — | — | -0.1 | μA |
| DC current gain (Note) | h_{FE} | $V_{CE} = -6\text{ V}, I_C = -2\text{ mA}$ | 120 | — | 400 | — |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C = -100\text{ mA}, I_B = -10\text{ mA}$ | — | -0.1 | -0.3 | V |
| Transition frequency | f_T | $V_{CE} = -10\text{ V}, I_C = -1\text{ mA}$ | — | 120 | — | MHz |
| Collector output capacitance | C_{ob} | $V_{CB} = -10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$ | — | 4 | — | pF |

Note: h_{FE} classification Y (Y): 120 to 240, GR (G): 200 to 400
() marking symbol

12. Marking



13. Q1 Characteristics Curves (Note)

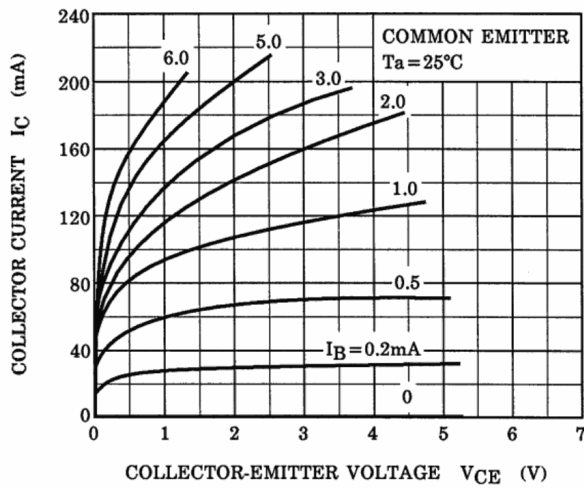


Fig. 13.1 $I_C - V_{CE}$

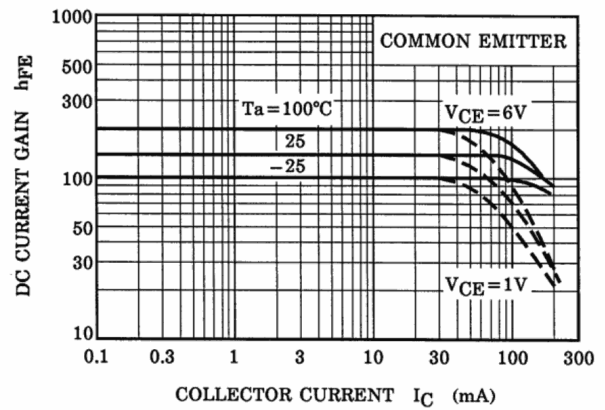


Fig. 13.2 $h_{FE(ON)} - I_C$

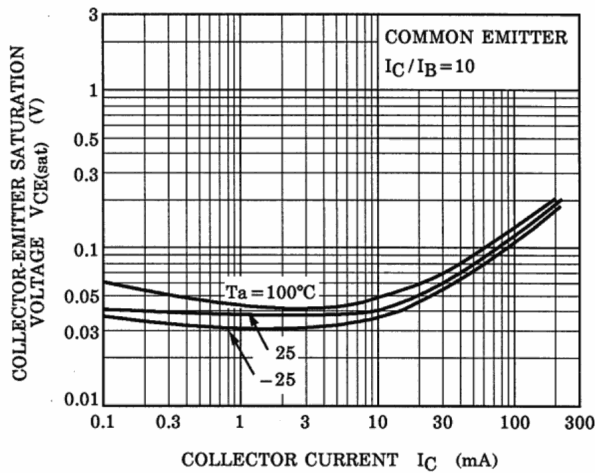


Fig. 13.3 $V_{CE(sat)} - I_C$

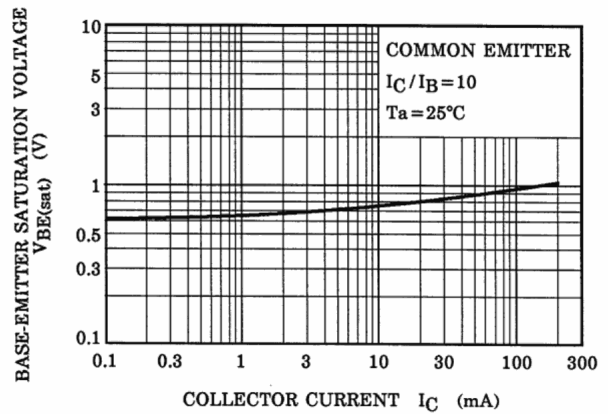


Fig. 13.4 $V_{BE(sat)} - I_C$

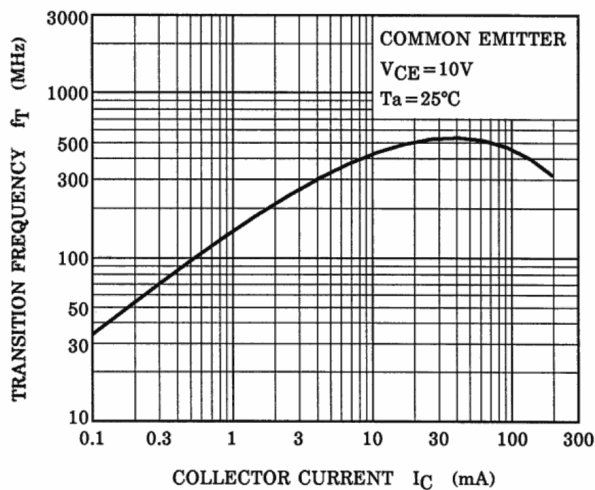


Fig. 13.5 $f_T - I_C$

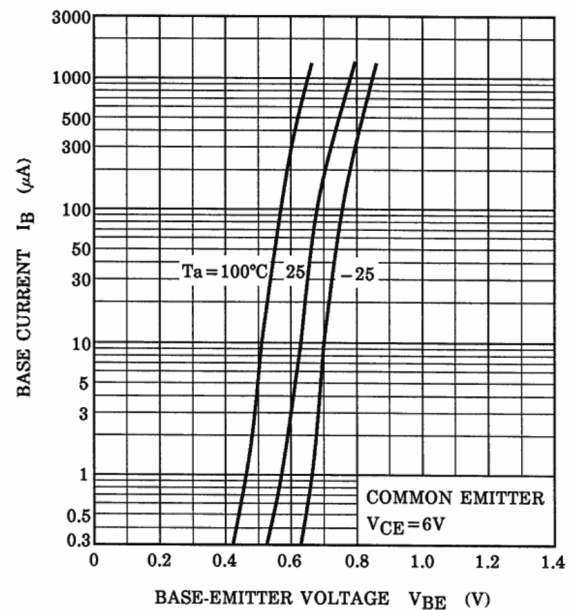


Fig. 13.6 $I_B - V_{BE}$

14. Q2 Characteristics Curves (Note)

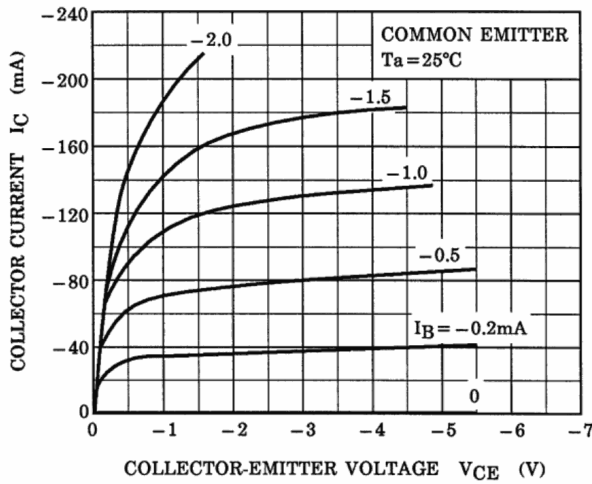


Fig. 14.1 $I_C - V_{CE}$

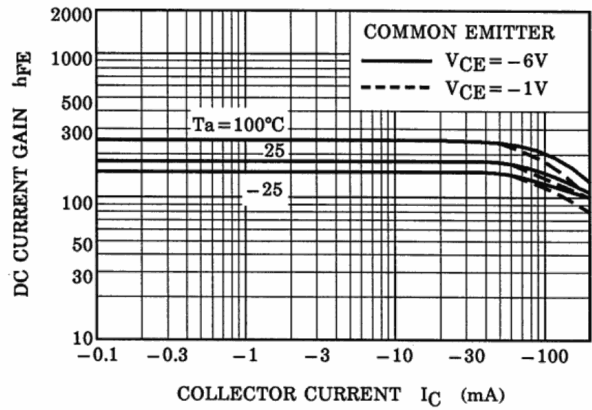


Fig. 14.2 $h_{FE} - I_C$

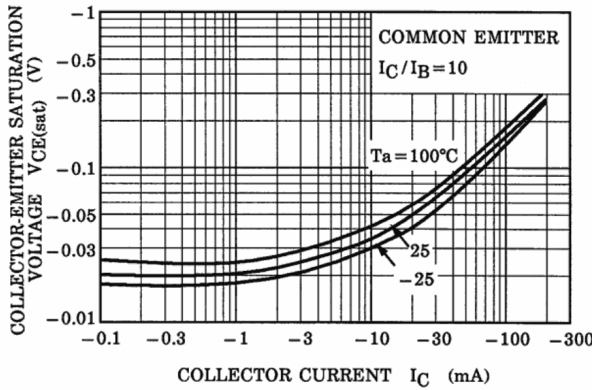


Fig. 14.3 $V_{CE(sat)} - I_C$

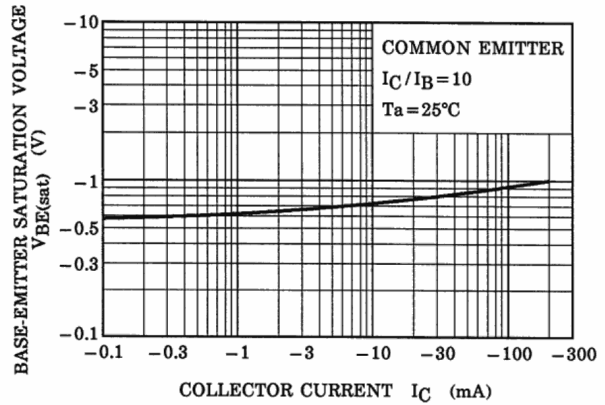


Fig. 14.4 $V_{BE(sat)} - I_C$

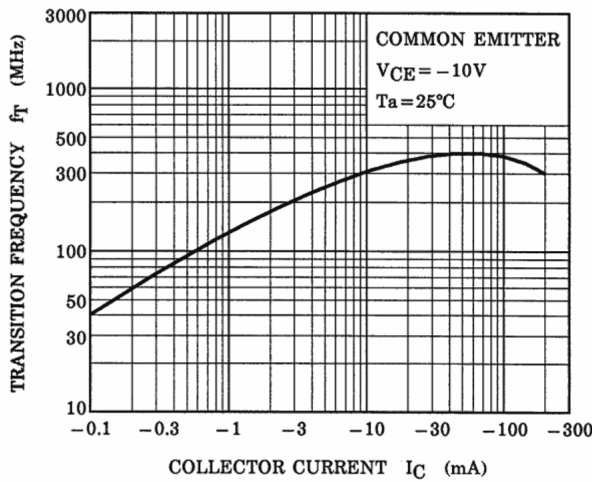


Fig. 14.5 $f_T - I_C$

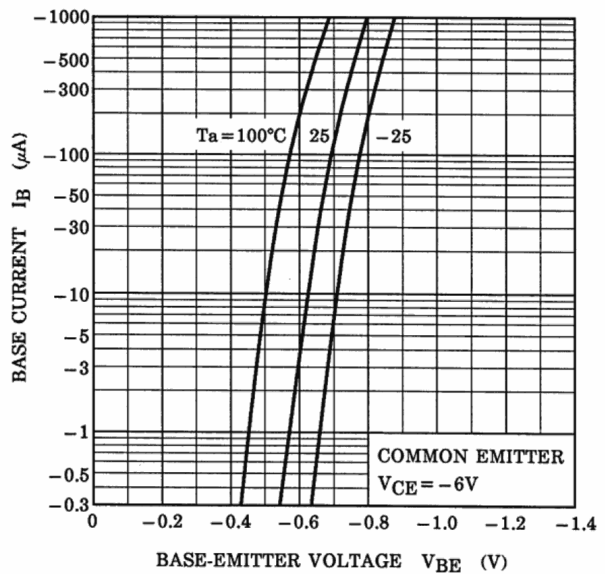


Fig. 14.6 $I_B - V_{BE}$

15. Q1, Q2 Common Characteristics Curves (Note)

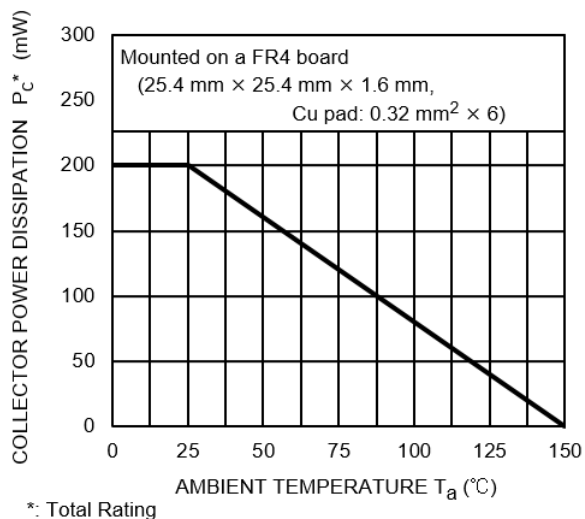
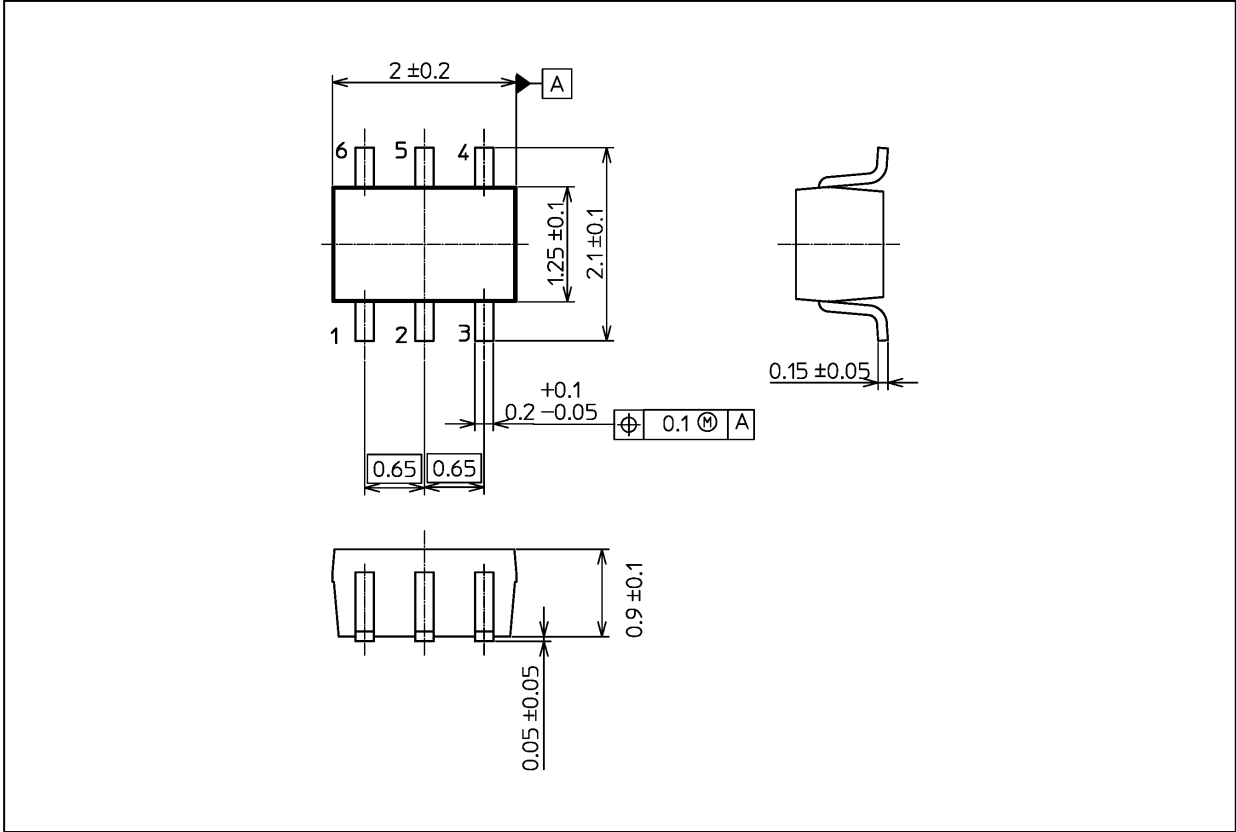


Fig. 15.1 $P_C - T_a$
Reference only with T_j of 150 °C.

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

Package Dimensions

Unit: mm



Weight: 6.8 mg (typ.)

| Package Name(s) |
|-----------------|
| TOSHIBA: 1-2T1S |
| Nickname: US6 |

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