

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:  $h_{FE} (I_C = 0.1 \text{ mA})/h_{FE} (I_C = 2 \text{ mA}) = 0.95 \text{ (typ.)}$

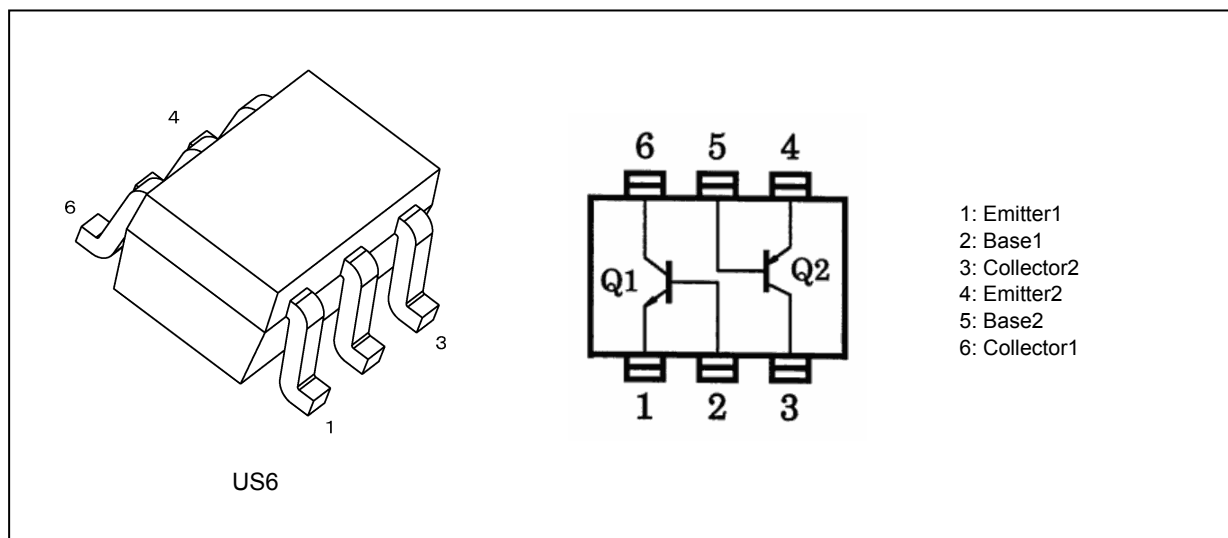
## 3. Q2 Features

- (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 |
|---------------------------|-----------|--------|------|
| Collector-base voltage    | $V_{CB0}$ | 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    | $V_{CB0}$ | -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                 | $T_j$     | 150        | $^\circ\text{C}$ |
|                                      |           | 125        |                  |
| Storage temperature                  | $T_{stg}$ | -55 to 150 | $^\circ\text{C}$ |
|                                      |           | -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 mm<sup>2</sup> × 6)

10. Q1 Electrical Characteristics (Unless otherwise specified, T<sub>a</sub> = 25 °C)

| Characteristics                      | Symbol               | Test Condition                                           | Min | Typ. | Max  | Unit |
|--------------------------------------|----------------------|----------------------------------------------------------|-----|------|------|------|
| Collector cut-off current            | I <sub>CBO</sub>     | V <sub>CB</sub> = 60 V, I <sub>E</sub> = 0 mA            | —   | —    | 0.1  | μA   |
| Emitter cut-off current              | I <sub>EBO</sub>     | V <sub>EB</sub> = 5 V, I <sub>C</sub> = 0 mA             | —   | —    | 0.1  | μA   |
| DC current gain (Note)               | h <sub>FE</sub>      | V <sub>CE</sub> = 6 V, I <sub>C</sub> = 2 mA             | 120 | —    | 400  | —    |
| Collector-emitter saturation voltage | V <sub>CE(sat)</sub> | I <sub>C</sub> = 100 mA, I <sub>B</sub> = 10 mA          | —   | 0.1  | 0.25 | V    |
| Transition frequency                 | f <sub>T</sub>       | V <sub>CE</sub> = 10 V, I <sub>C</sub> = 1 mA            | —   | 150  | —    | MHz  |
| Collector output capacitance         | C <sub>ob</sub>      | V <sub>CB</sub> = 10 V, I <sub>E</sub> = 0 mA, f = 1 MHz | —   | 2    | —    | pF   |

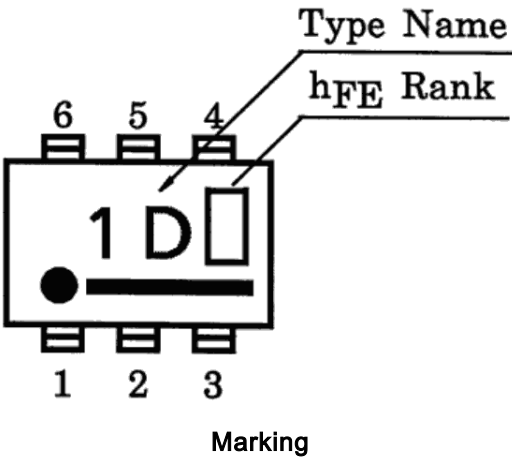
Note: h<sub>FE</sub> classification Y (Y): 120 to 240, GR (G): 200 to 400  
( ) marking symbol

11. Q2 Electrical Characteristics (Unless otherwise specified, T<sub>a</sub> = 25 °C)

| Characteristics                      | Symbol               | Test Condition                                            | Min | Typ. | Max  | Unit |
|--------------------------------------|----------------------|-----------------------------------------------------------|-----|------|------|------|
| Collector cut-off current            | I <sub>CBO</sub>     | V <sub>CB</sub> = -50 V, I <sub>E</sub> = 0 mA            | —   | —    | -0.1 | μA   |
| Emitter cut-off current              | I <sub>EBO</sub>     | V <sub>EB</sub> = -5 V, I <sub>C</sub> = 0 mA             | —   | —    | -0.1 | μA   |
| DC current gain (Note)               | h <sub>FE</sub>      | V <sub>CE</sub> = -6 V, I <sub>C</sub> = -2 mA            | 120 | —    | 400  | —    |
| Collector-emitter saturation voltage | V <sub>CE(sat)</sub> | I <sub>C</sub> = -100 mA, I <sub>B</sub> = -10 mA         | —   | -0.1 | -0.3 | V    |
| Transition frequency                 | f <sub>T</sub>       | V <sub>CE</sub> = -10 V, I <sub>C</sub> = -1 mA           | —   | 120  | —    | MHz  |
| Collector output capacitance         | C <sub>ob</sub>      | V <sub>CB</sub> = -10 V, I <sub>E</sub> = 0 mA, f = 1 MHz | —   | 4    | —    | pF   |

Note: h<sub>FE</sub> classification Y (Y): 120 to 240, GR (G): 200 to 400  
( ) marking symbol

12. Marking



## 13. Q1 Characteristics Curves (Note)

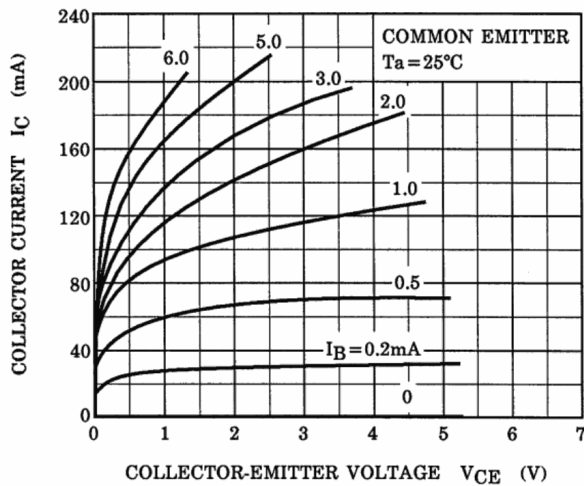


Fig. 13.1  $I_C - V_{CE}$

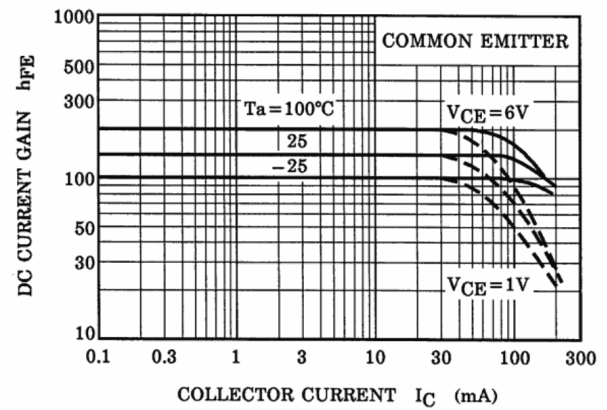


Fig. 13.2  $h_{FE(ON)} - I_C$

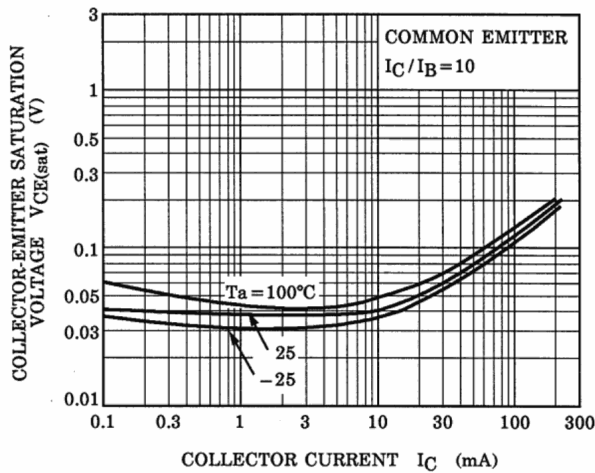


Fig. 13.3  $V_{CE(sat)} - I_C$

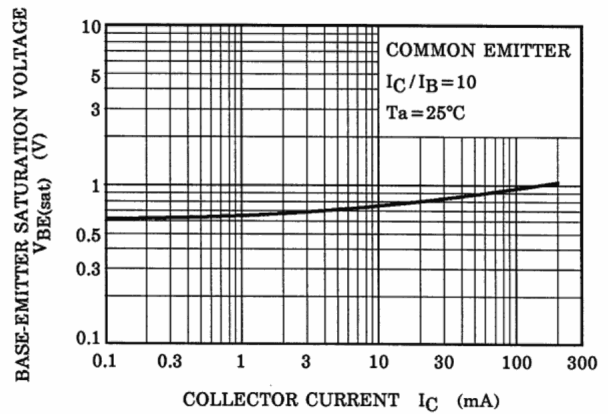


Fig. 13.4  $V_{BE(sat)} - I_C$

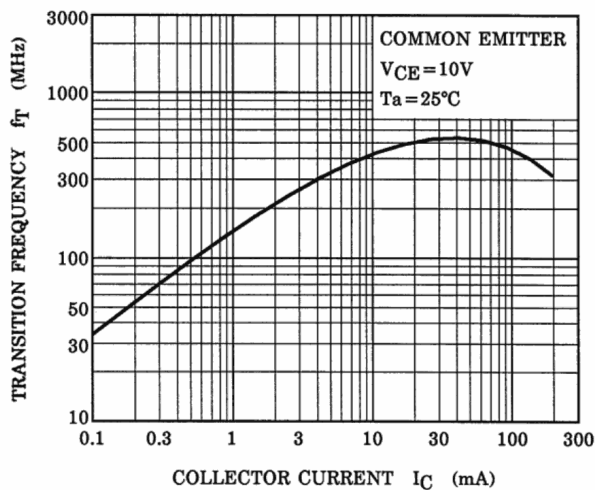


Fig. 13.5  $f_T - I_C$

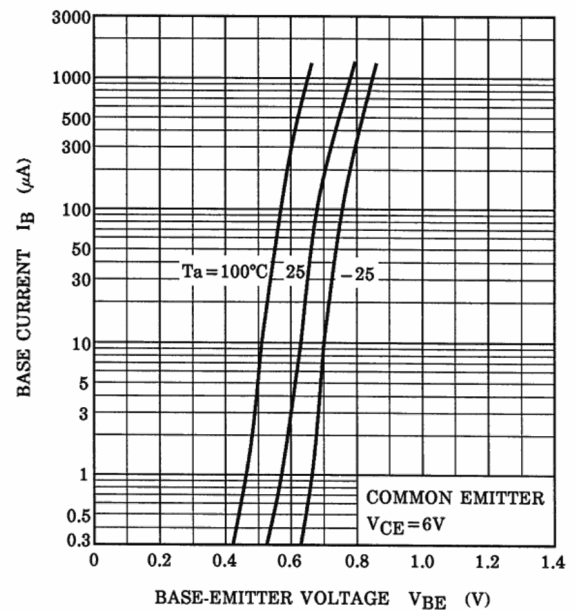


Fig. 13.6  $I_B - V_{BE}$

14. Q2 Characteristics Curves (Note)

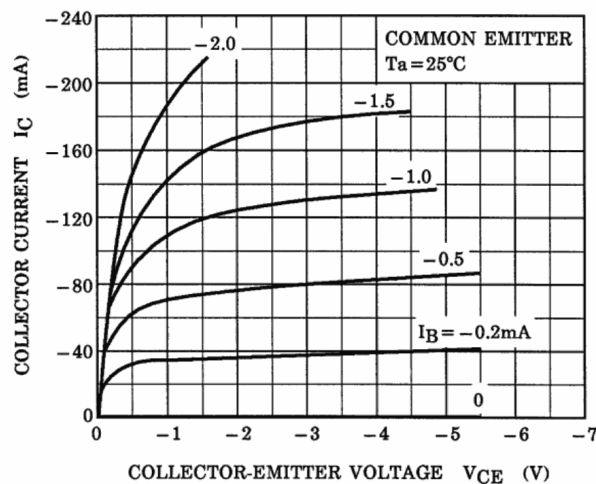


Fig. 14.1 IC - VCE

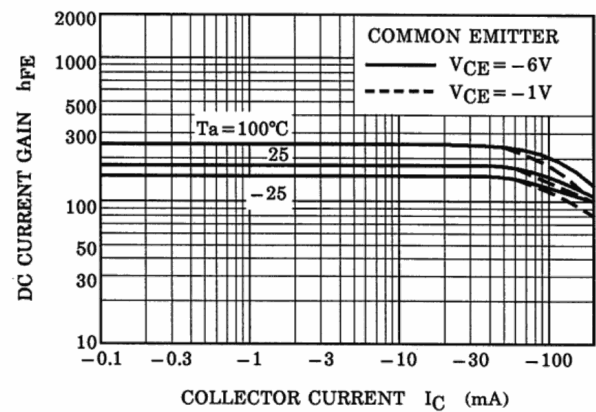


Fig. 14.2 hFE - IC

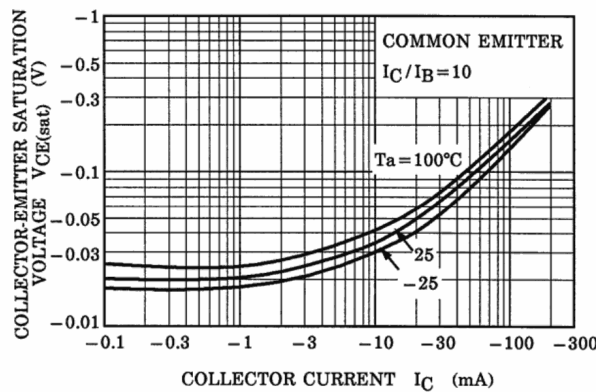


Fig. 14.3 VCE(sat) - IC

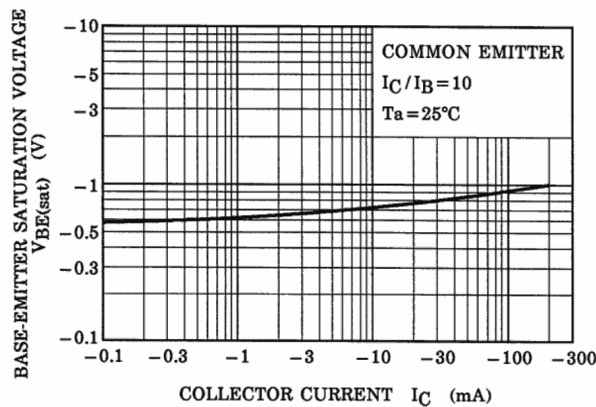


Fig. 14.4 VBE(sat) - IC

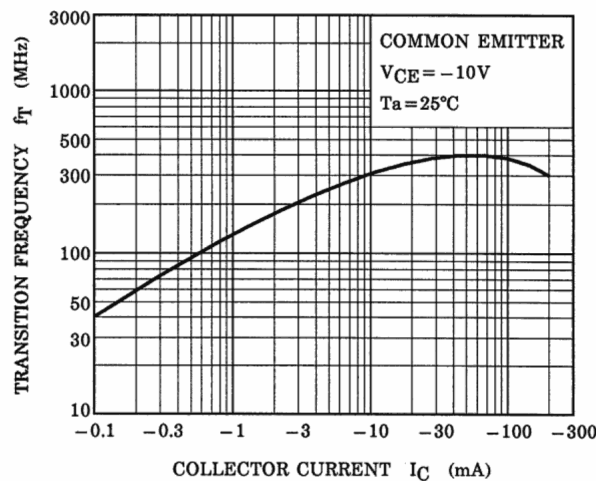


Fig. 14.5 fT - IC

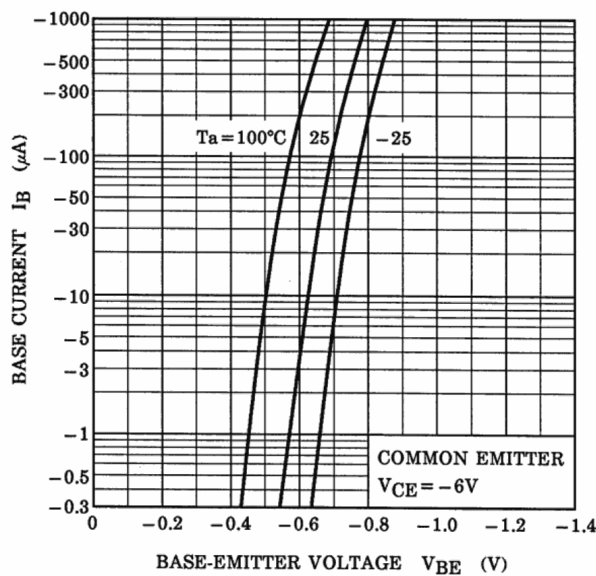
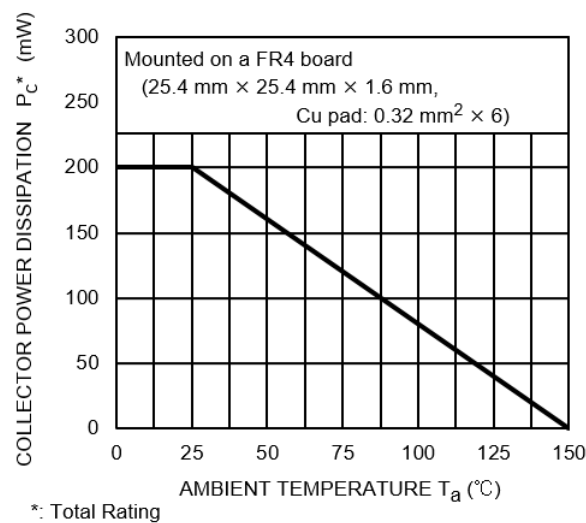


Fig. 14.6 IB - VBE

15. Q1, Q2 Common Characteristics Curves (Note)

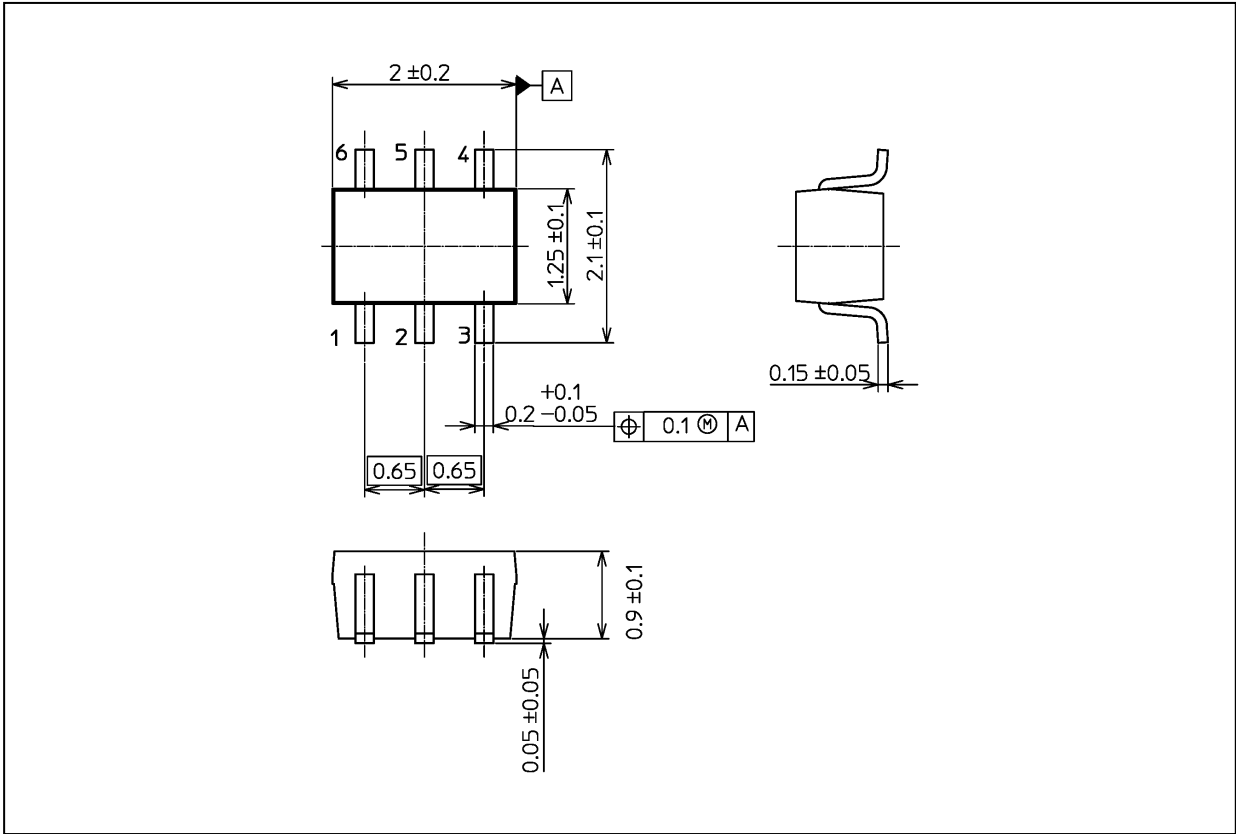


**Fig. 15.1  $P_C - T_a$**   
**Reference only with  $T_j$  of 150 °C.**

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) |
|-----------------|
| Nickname: US6   |

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