

Bipolar Transistors Silicon PNP/NPN Epitaxial Type

# HN1B10NU

## 1. Applications

- Low-Frequency Amplifiers

## 2. Features

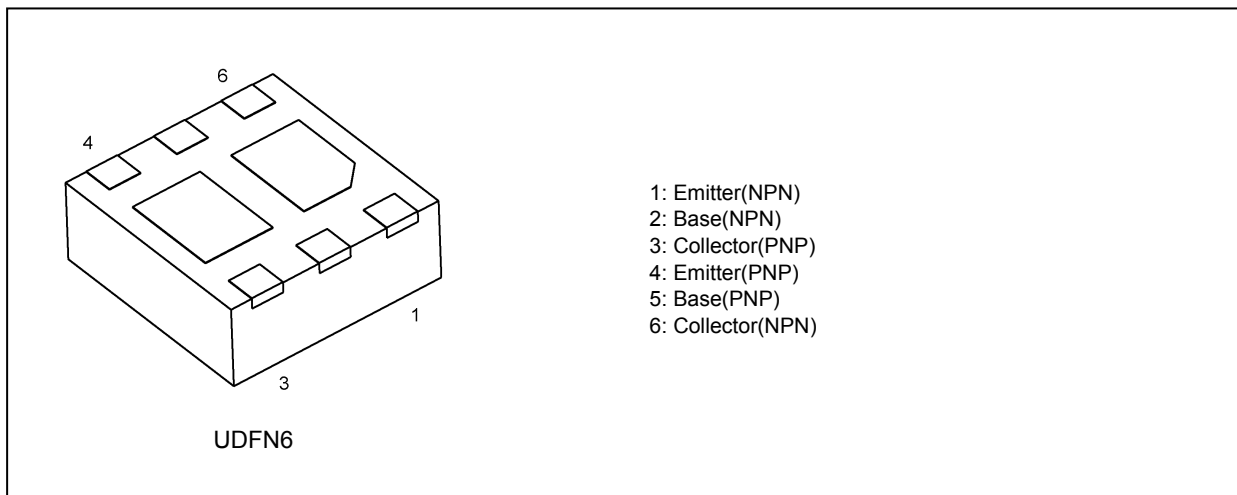
### 2.1. Q1 NPN

- (1) High voltage and high current:  $V_{CEO} = 50 \text{ V}$ ,  $I_C = 1.0 \text{ A (Max)}$
- (2) High DC current gain:  $h_{FE} = 400 \text{ to } 1000$  ( $I_C = 0.1 \text{ A}$ )
- (3) Low collector-emitter saturation voltage:  $V_{CE(sat)} = 0.12 \text{ V (Max)}$

### 2.2. Q2 PNP

- (1) High voltage and high current:  $V_{CEO} = -50 \text{ V}$ ,  $I_C = -1.0 \text{ A (Max)}$
- (2) High DC current gain:  $h_{FE} = 200 \text{ to } 500$  ( $I_C = -0.1 \text{ A}$ )
- (3) Low collector-emitter saturation voltage:  $V_{CE(sat)} = -0.2 \text{ V (Max)}$

## 3. Packaging and Internal Circuit



## 4. Absolute Maximum Ratings (Note) ( $T_a = 25 \text{ }^\circ\text{C}$ ) (Q1, Q2 Common)

Characteristics	Symbol	Rating	Unit
Collector power dissipation (Note 1)	$P_C$	1.0	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: Total rating

Mounted on an FR4 board. (25.4 mm × 25.4 mm × 1.6 mm, Cu Pad: 645 mm<sup>2</sup>)

Start of commercial production

2026-01

### 4.1. Q1 Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CB0}$	50	V
Collector-emitter voltage	$V_{CEO}$	50	V
Emitter-base voltage	$V_{EBO}$	7	V
Collector current (DC)	$I_C$	1.0	A
Collector current (pulsed)	$I_{CP}$	2.0	A
Base current	$I_B$	100	mA

### 4.2. Q2 Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CB0}$	-50	V
Collector-emitter voltage	$V_{CEO}$	-50	V
Emitter-base voltage	$V_{EBO}$	-7	V
Collector current (DC)	$I_C$	-1.0	A
Collector current (pulsed)	$I_{CP}$	-2.0	A
Base current	$I_B$	-100	mA

## 5. Electrical Characteristics

### 5.1. Q1 NPN Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )

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	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 7\text{ V}, I_C = 0\text{ mA}$	—	—	0.1	$\mu\text{A}$
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = 10\text{ mA}, I_B = 0\text{ mA}$	50	—	—	V
DC current gain	$h_{FE1}$	$V_{CE} = 2\text{ V}, I_C = 0.1\text{ A}$	400	—	1000	—
DC current gain	$h_{FE2}$	$V_{CE} = 2\text{ V}, I_C = 0.3\text{ A}$	200	—	—	—
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 0.3\text{ A}, I_B = 6\text{ mA}$	—	—	0.12	V
Base-emitter saturation voltage	$V_{BE(sat)}$	$I_C = 0.3\text{ A}, I_B = 6\text{ mA}$	—	—	1.1	V

### 5.2. Q1 NPN Dynamic Characteristics ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector output capacitance	$C_{ob}$	$V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	6	—	pF
Switching time (rise time)	$t_r$	$V_{CC} \approx 30\text{ V}, R_L = 100\ \Omega, I_{B1} = 10\text{ mA}, I_{B2} = -10\text{ mA}$ See Fig. 5.2.1	—	40	—	ns
Switching time (storage time)	$t_{stg}$		—	525	—	ns
Switching time (fall time)	$t_f$		—	145	—	ns

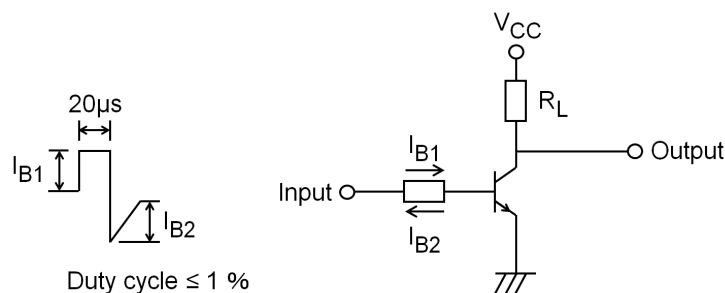


Fig. 5.2.1 Switching Test Circuit

### 5.3. Q2 PNP Electrical Characteristics ( $T_a = 25\text{ }^\circ\text{C}$ )

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	$\mu\text{A}$
Emitter cut-off current	$I_{EBO}$	$V_{EB} = -7\text{ V}$ , $I_C = 0\text{ mA}$	—	—	-0.1	$\mu\text{A}$
Collector-emitter breakdown voltage	$V_{(BR)CEO}$	$I_C = -10\text{ mA}$ , $I_B = 0\text{ mA}$	-50	—	—	V
DC current gain	$h_{FE1}$	$V_{CE} = -2\text{ V}$ , $I_C = -0.1\text{ A}$	200	—	500	—
	$h_{FE2}$	$V_{CE} = -2\text{ V}$ , $I_C = -0.3\text{ A}$	125	—	—	—
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = -0.3\text{ A}$ , $I_B = 6\text{ mA}$	—	—	-0.2	V
Base-emitter saturation voltage	$V_{BE(sat)}$	$I_C = 0.3\text{ A}$ , $I_B = 6\text{ mA}$	—	—	-1.1	V

### 5.4. Q2 PNP Dynamic Characteristics ( $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector output capacitance	$C_{ob}$	$V_{CB} = -10\text{ V}$ , $I_E = 0\text{ mA}$ , $f = 1\text{ MHz}$	—	9	—	pF
Switching time (rise time)	$t_r$	$V_{CC} \approx -30\text{ V}$ , $R_L = 100\ \Omega$ , $I_{B1} = -10\text{ mA}$ , $I_{B2} = 10\text{ mA}$ See Fig. 5.4.1	—	60	—	ns
Switching time (storage time)	$t_{stg}$		—	225	—	ns
Switching time (fall time)	$t_f$		—	90	—	ns

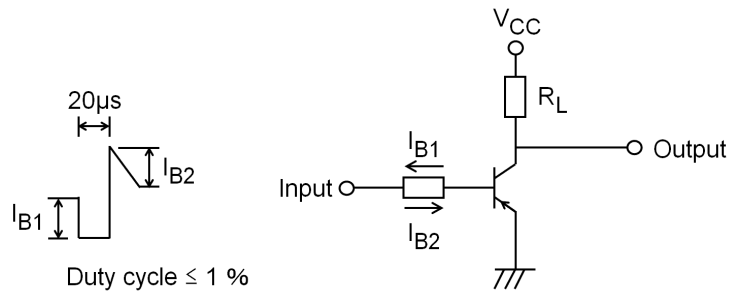
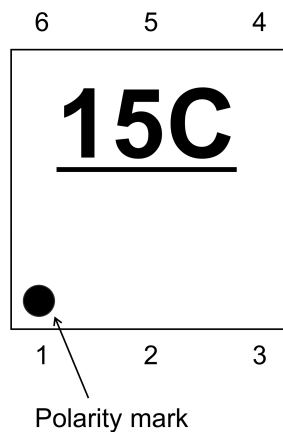


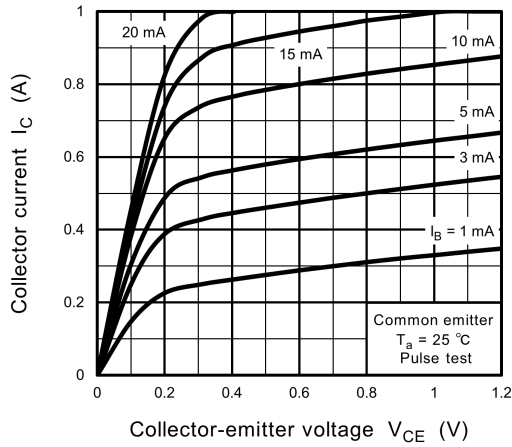
Fig. 5.4.1 Switching Time Test Circuit

## 6. Marking

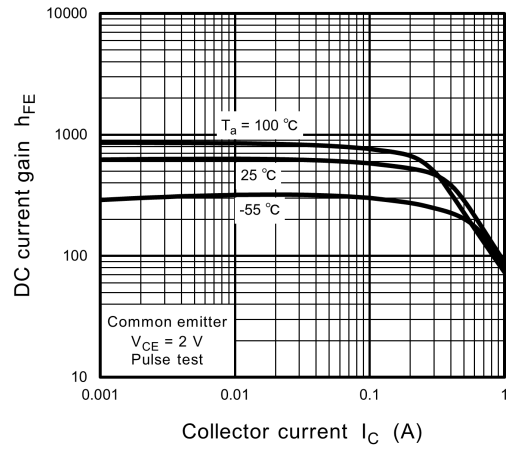


### 7. Characteristics Curves (Note)

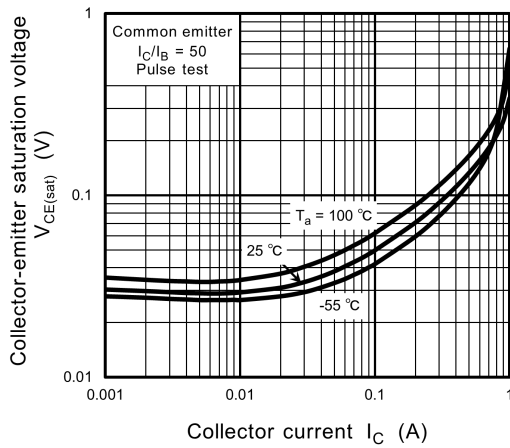
#### 7.1. Q1



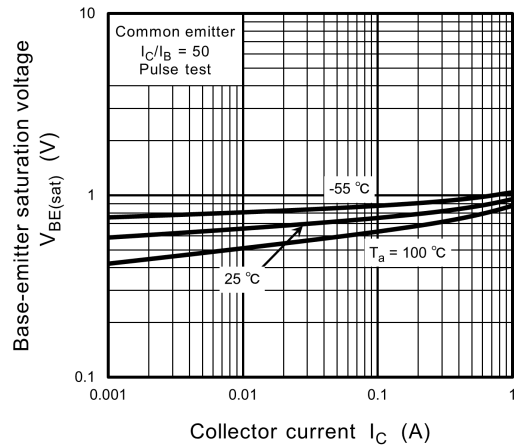
**Fig. 7.1.1  $I_C - V_{CE}$**



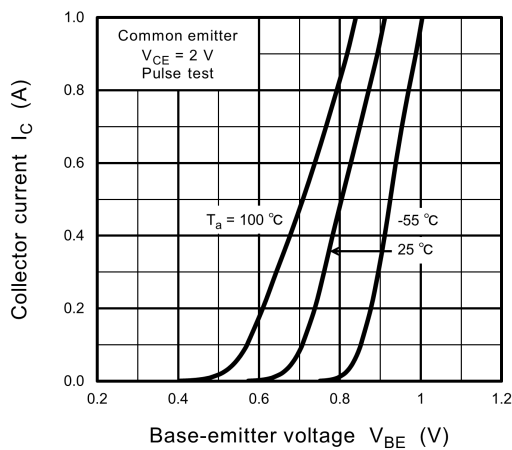
**Fig. 7.1.2  $h_{FE} - I_C$**



**Fig. 7.1.3  $V_{CE(sat)} - I_C$**

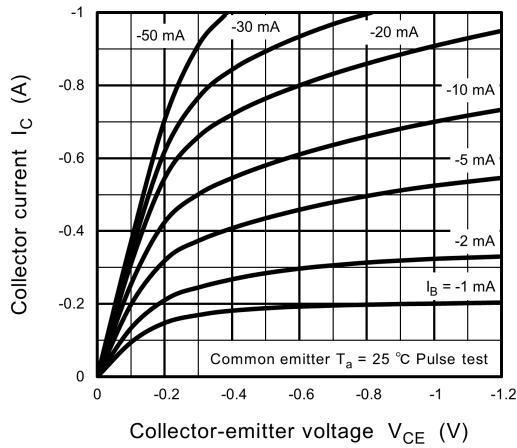


**Fig. 7.1.4  $V_{BE(sat)} - I_C$**

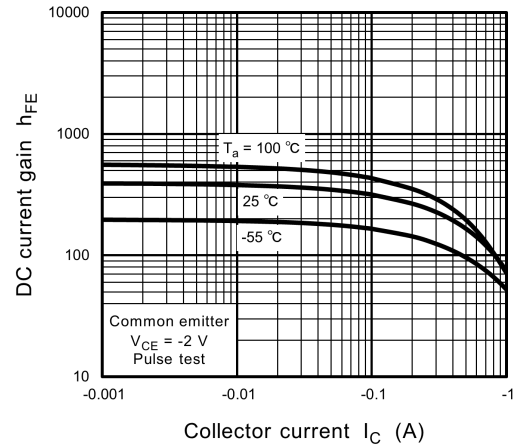


**Fig. 7.1.5  $I_C - V_{BE}$**

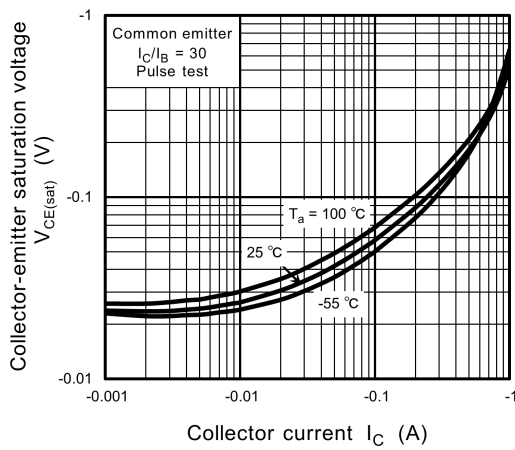
### 7.2. Q2



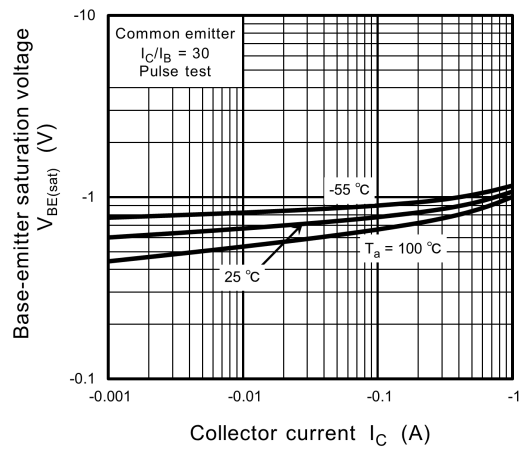
**Fig. 7.2.1  $I_C - V_{CE}$**



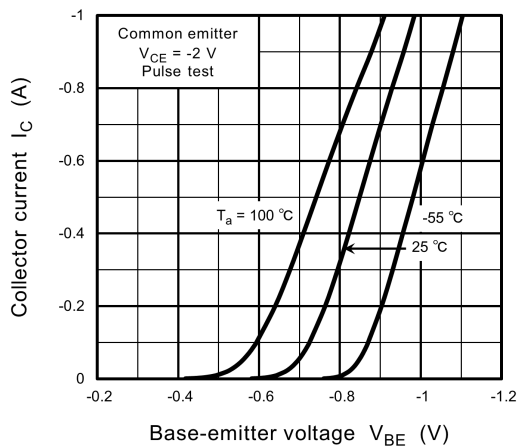
**Fig. 7.2.2  $h_{FE} - I_C$**



**Fig. 7.2.3  $V_{CE(sat)} - I_C$**



**Fig. 7.2.4  $V_{BE(sat)} - I_C$**

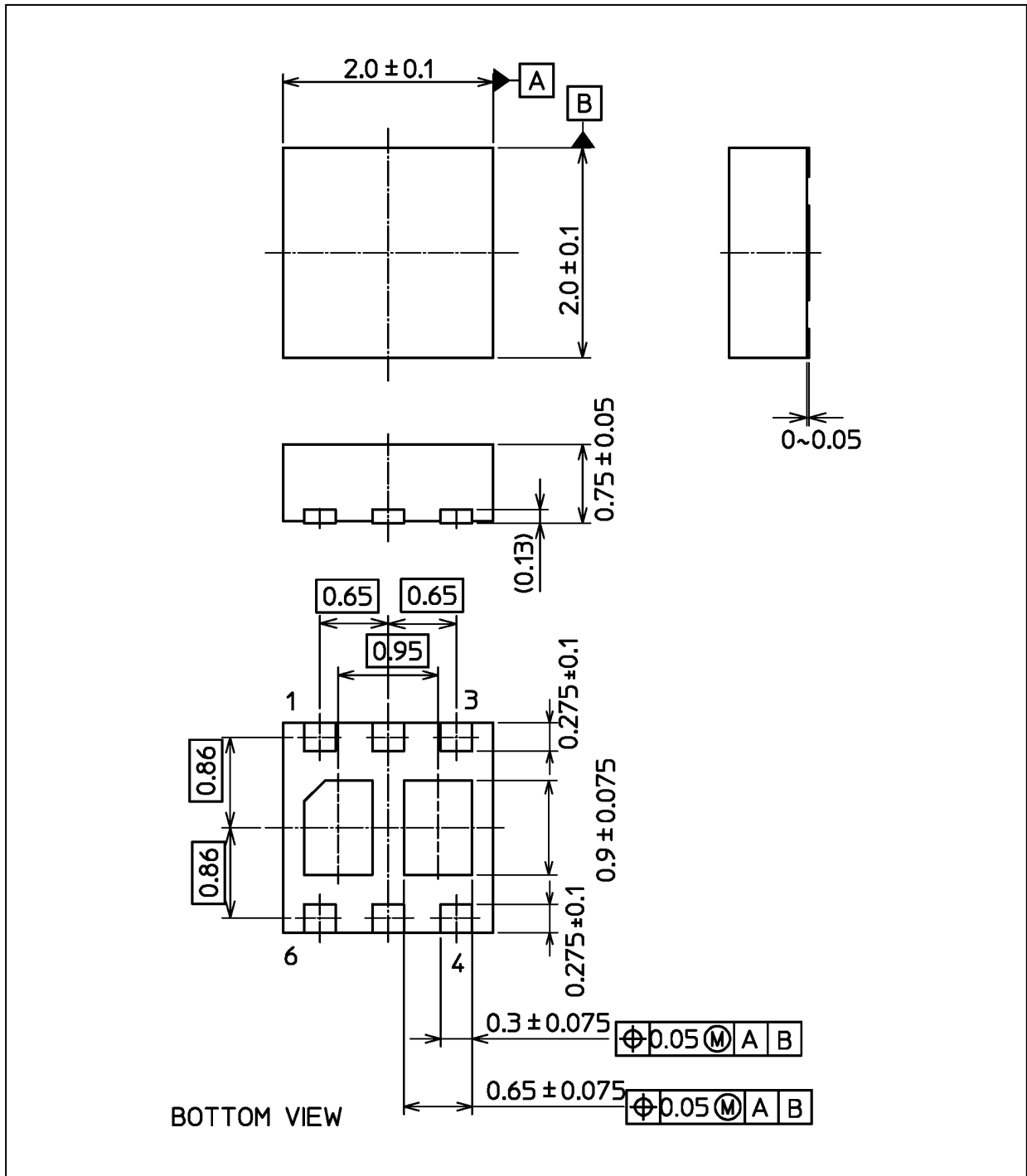


**Fig. 7.2.5  $I_C - V_{BE}$**

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

### Package Dimensions

Unit: mm



Weight: 8.5 mg (typ.)

Package Name(s)
Nickname: UDFN6

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