

Bipolar Transistors Silicon PNP/NPN Epitaxial Type

# HN1B04FE

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

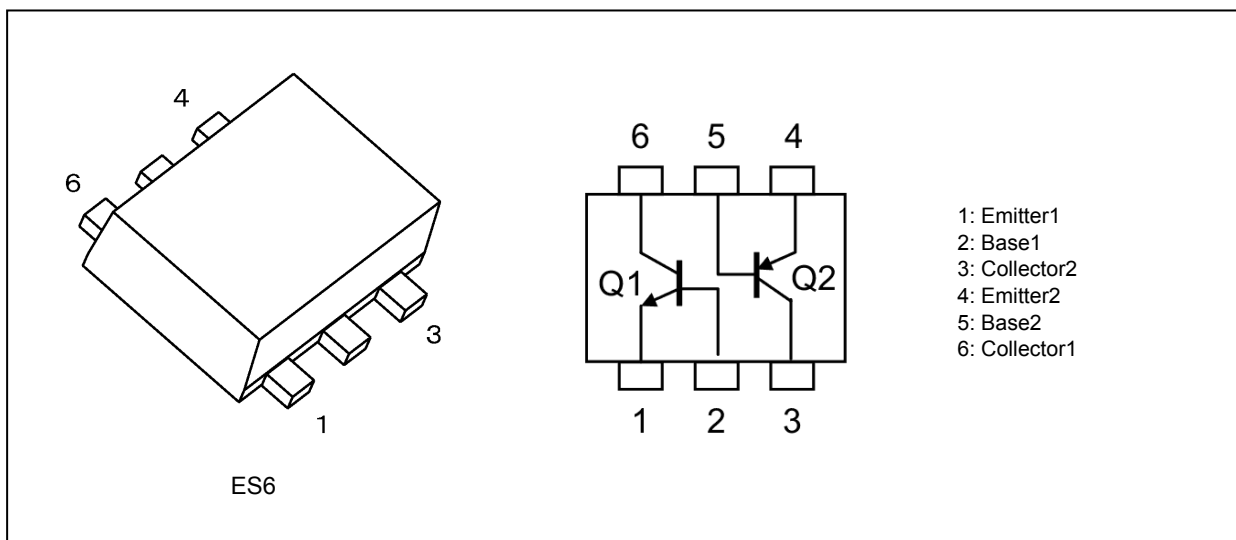
## 3. Q2 Features

- (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

2000-05

### 6. Orderable part number

Orderable part number		AEC-Q101	Note
HN1B04FE-Y	HN1B04FE-Y,LF	—	General Use
	HN1B04FE-Y,LXGF	YES (Note 1)	Unintended Use (Note 1)
	HN1B04FE-Y,LXHF	YES	Automotive Use
HN1B04FE-GR	HN1B04FE-GR,LF	—	General Use
	-HN1B04FEGR,LXGF	YES (Note 1)	Unintended Use (Note 1)
	HN1B04FE-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	$V_{CBO}$	60	V
Collector-emitter voltage	$V_{CEO}$	50	
Emitter-base voltage	$V_{EBO}$	5	
Collector current	$I_C$	150	mA
Base current	$I_B$	30	

### 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	
Emitter-base voltage	$V_{EBO}$	-5	
Collector current (DC)	$I_C$	-150	mA
Base current	$I_B$	-30	

### 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 1)	$P_C$	100	mW
Junction temperature	$T_j$	150	°C
Storage temperature	$T_{stg}$	-55 to 150	

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

### 10. Q1 Electrical Characteristics (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 60\text{ V}, I_E = 0\text{ mA}$	—	—	100	nA
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 5\text{ V}, I_C = 0\text{ mA}$	—	—	100	
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	$f_T$	$V_{CE} = 10\text{ V}, I_C = 1\text{ mA}$	80	—	—	MHz
Collector output capacitance	$C_{ob}$	$V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	2	—	pF

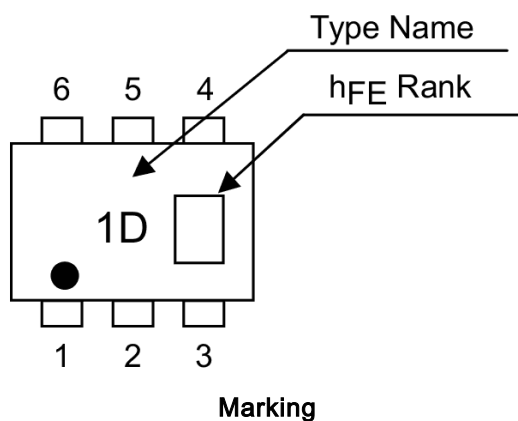
Note:  $h_{FE}$  classification Y (Y): 120 to 240, GR (G): 200 to 400  
( ) marking symbol

### 11. Q2 Electrical Characteristics (Note) (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = -50\text{ V}, I_E = 0\text{ mA}$	—	—	-100	nA
Emitter cut-off current	$I_{EBO}$	$V_{EB} = -5\text{ V}, I_C = 0\text{ mA}$	—	—	-100	
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	$f_T$	$V_{CE} = -10\text{ V}, I_C = -1\text{ mA}$	80	—	—	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)

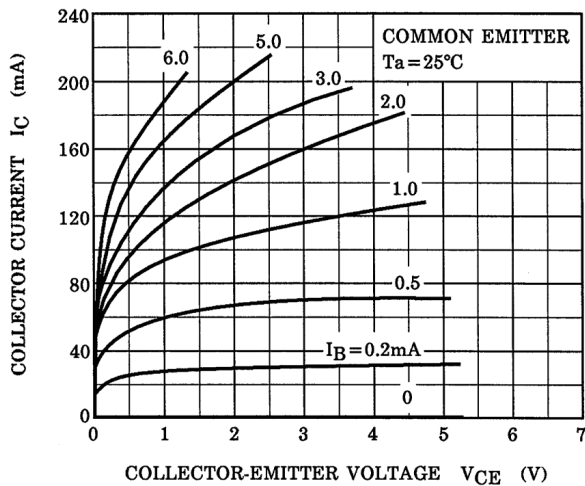


Fig. 13.1  $I_C - V_{CE}$

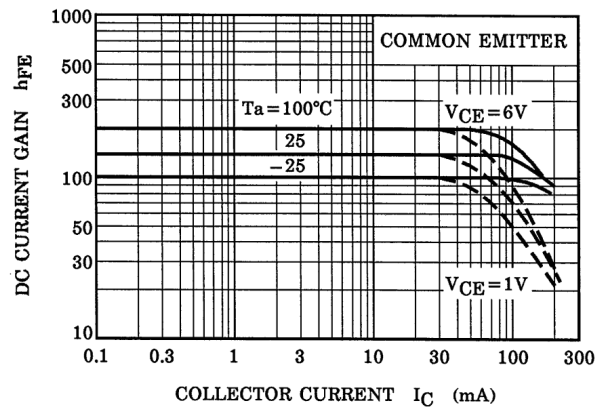


Fig. 13.2  $h_{FE} - I_C$

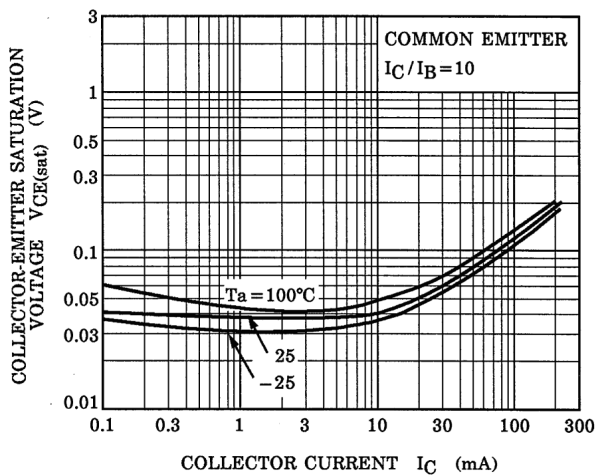


Fig. 13.3  $V_{CE(sat)} - I_C$

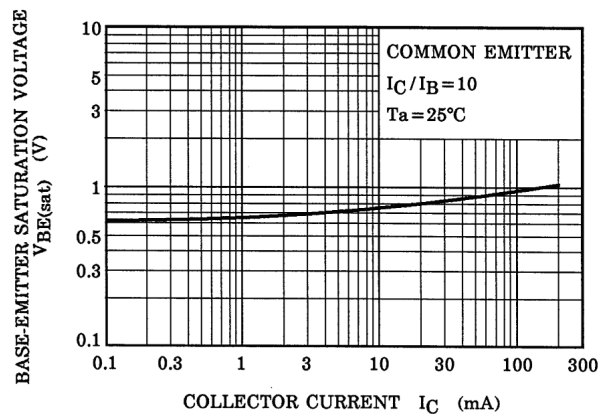


Fig. 13.4  $V_{BE(sat)} - I_C$

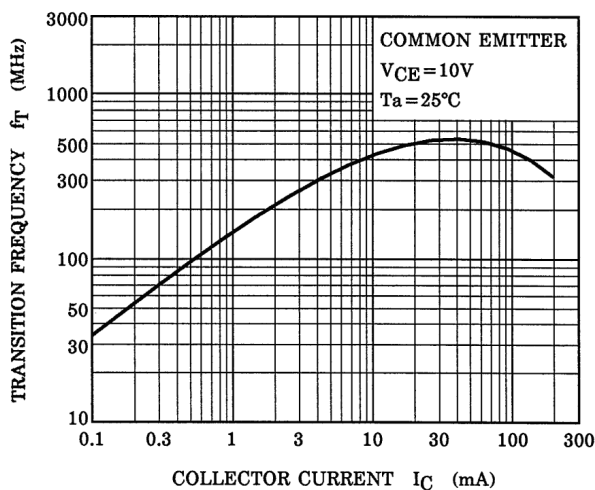


Fig. 13.5  $f_T - I_C$

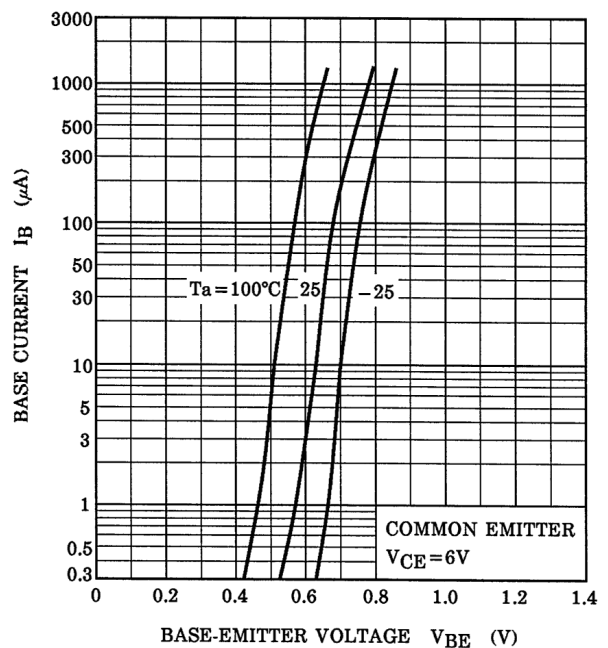


Fig. 13.6  $I_B - V_{BE}$

### 14. Q2 Characteristics Curves (Note)

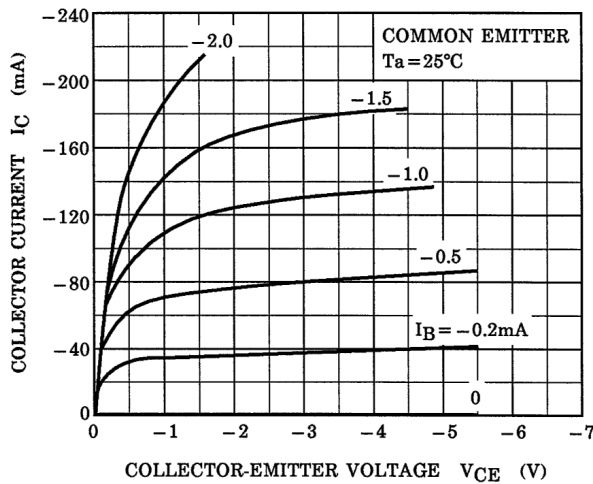


Fig. 14.1  $I_C - V_{CE}$

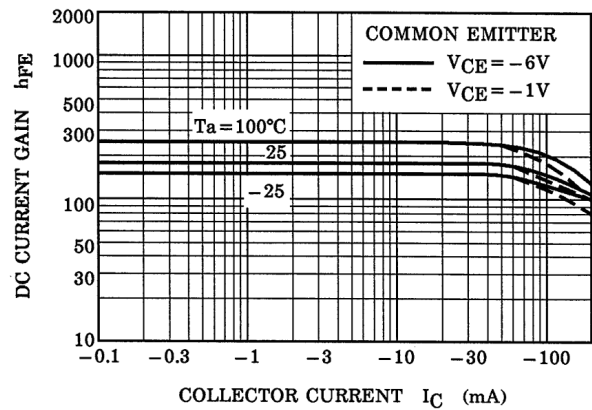


Fig. 14.2  $h_{FE} - I_C$

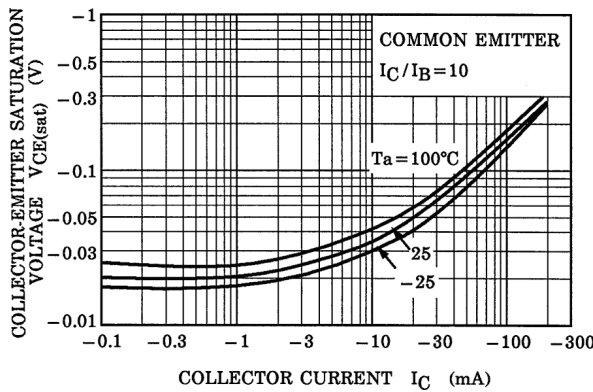


Fig. 14.3  $V_{CE(sat)} - I_C$

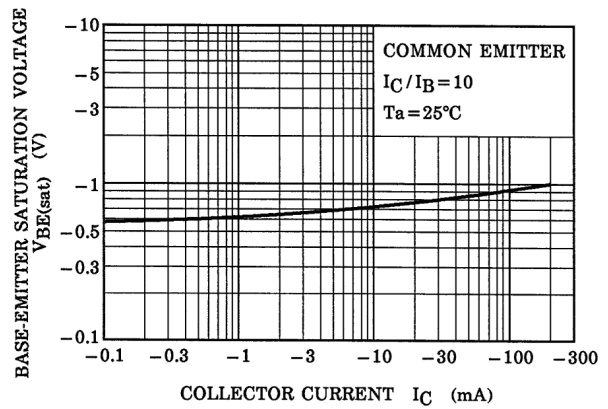


Fig. 14.4  $V_{BE(sat)} - I_C$

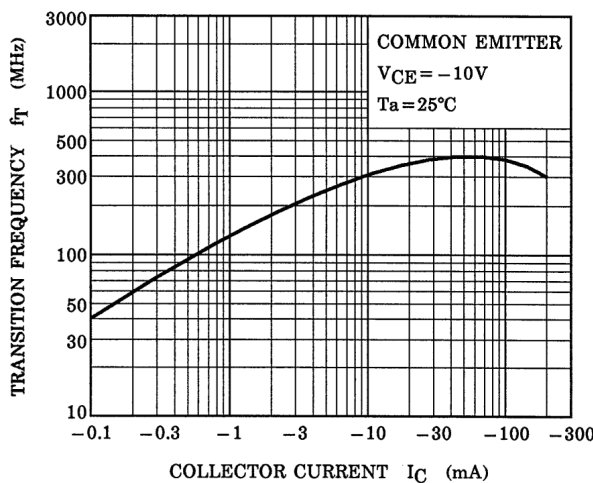


Fig. 14.5  $f_T - I_C$

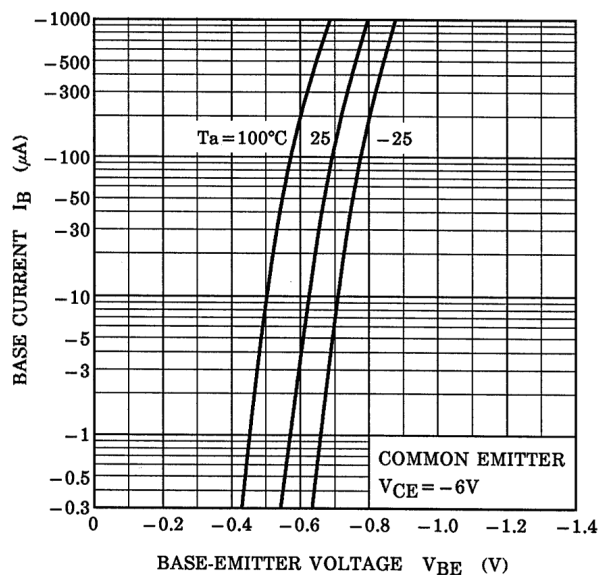


Fig. 14.6  $I_B - V_{BE}$

15. Q1, Q2 Common Characteristics Curves (Note)

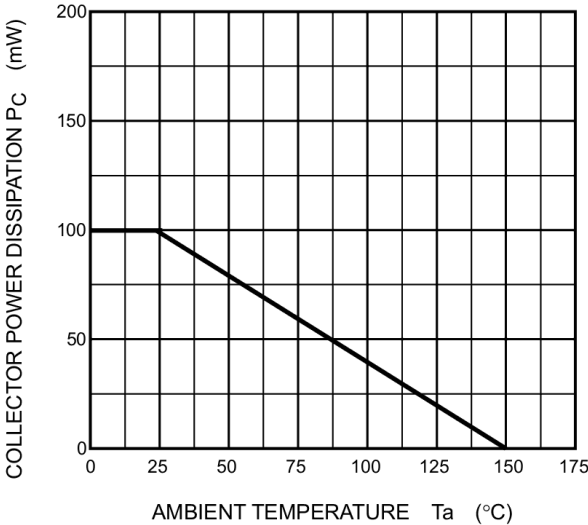
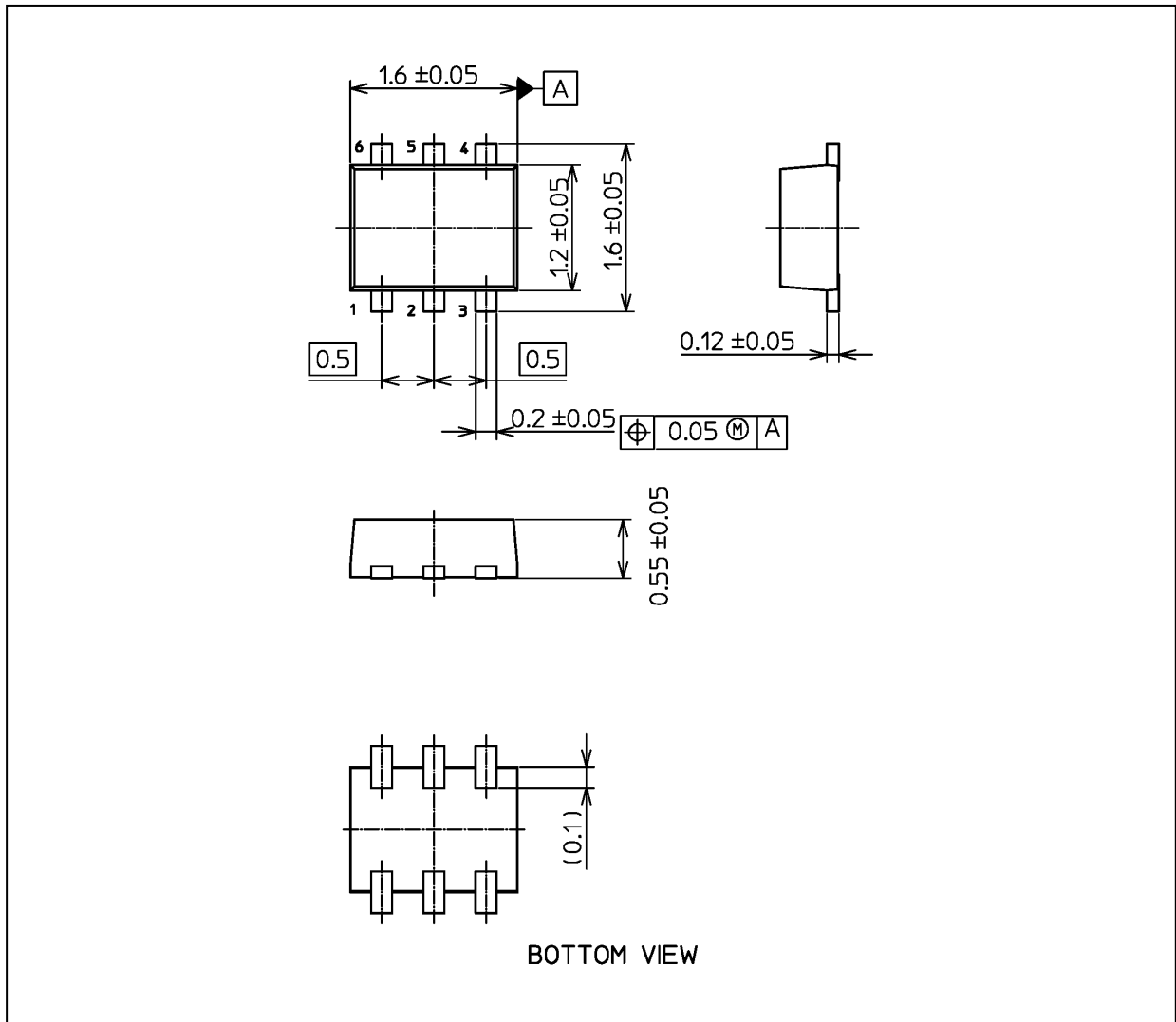


Fig. 15.1  $P_C$  (Note1) -  $T_a$

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

## Package Dimensions

Unit: mm



Weight: 3.0 mg (typ.)

Package Name(s)
TOSHIBA: 1-2X1S
Nickname: ES6

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