Bipolar Transistors Silicon PNP/NPN Epitaxial Type

HN1B04FE

1. Applications

- Low-Frequency Amplifiers

2. Q1 Features

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

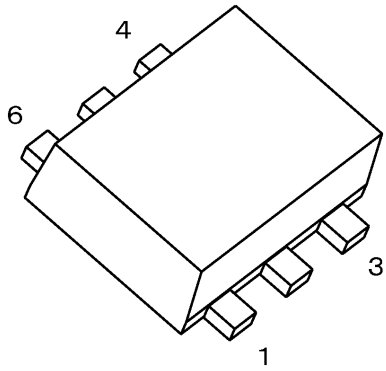
3. Q2 Features

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

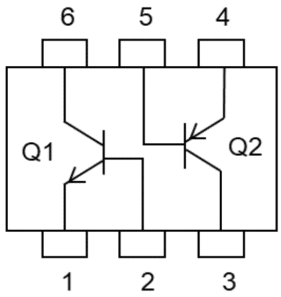
4. Q1, Q2 Common Features

(1) AEC-Q101 qualified

5. Packaging and Internal Circuit



ES6



1: Emitter1
2: Base1
3: Collector2
4: Emitter2
5: Base2
6: Collector1

6. Q1 Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25°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	

Start of commercial production
2000-05

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7. Q2 Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25°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	

8. Q1, Q2 Common Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25°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

9. Q1 Electrical Characteristics (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	V_{CB} = 60 V, I_E = 0 mA	—	—	100	nA
Emitter cut-off current		I_{EBO}	V_{EB} = 5 V, I_C = 0 mA	—	—	100	
DC current gain	(Note)	h_{FE}	V_{CE} = 6 V, I_C = 2 mA	120	—	400	—
Collector-emitter saturation voltage		$V_{CE(sat)}$	I_C = 100 mA, I_B = 10 mA	—	0.1	0.25	V
Transition frequency		f_T	V_{CE} = 10 V, I_C = 1 mA	80	—	—	MHz
Collector output capacitance		C_{ob}	V_{CB} = 10 V, I_E = 0 mA, f = 1 MHz	—	2	—	pF

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

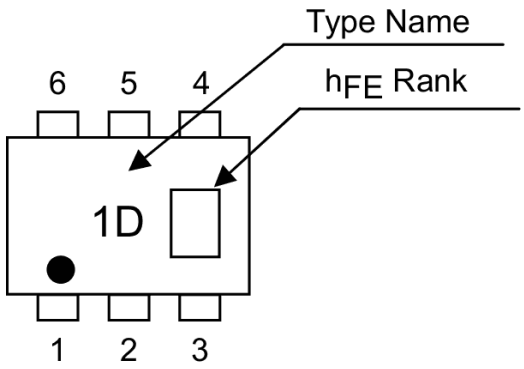
10. Q2 Electrical Characteristics (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current		I_{CBO}	V_{CB} = -50 V, I_E = 0 mA	—	—	-100	nA
Emitter cut-off current		I_{EBO}	V_{EB} = -5 V, I_C = 0 mA	—	—	-100	
DC current gain	(Note)	h_{FE}	V_{CE} = -6 V, I_C = -2 mA	120	—	400	—
Collector-emitter saturation voltage		$V_{CE(sat)}$	I_C = -100 mA, I_B = -10 mA	—	-0.1	-0.3	V
Transition frequency		f_T	V_{CE} = -10 V, I_C = -1 mA	80	—	—	MHz
Collector output capacitance		C_{ob}	V_{CB} = -10 V, I_E = 0 mA, f = 1 MHz	—	4	—	pF

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

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11. Marking



Marking

12. Q1 Characteristics Curves (Note)

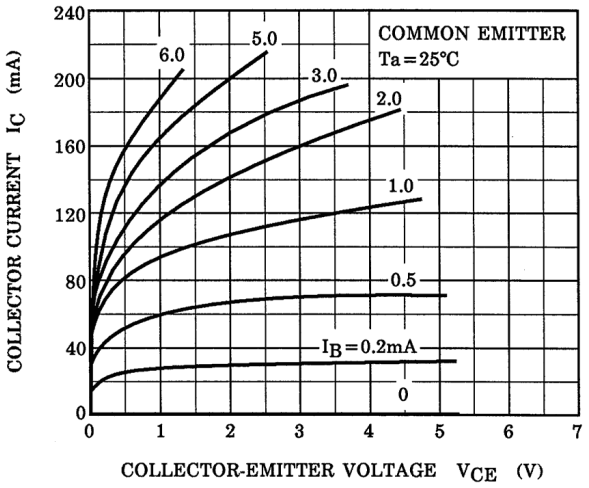


Fig. 12.1 I_C - V_{CE}

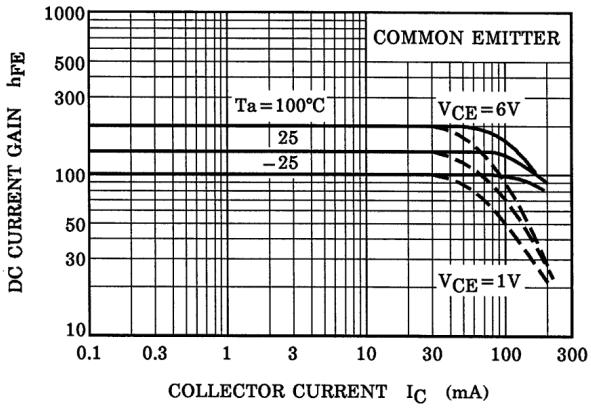


Fig. 12.2 h_{FE} - I_C

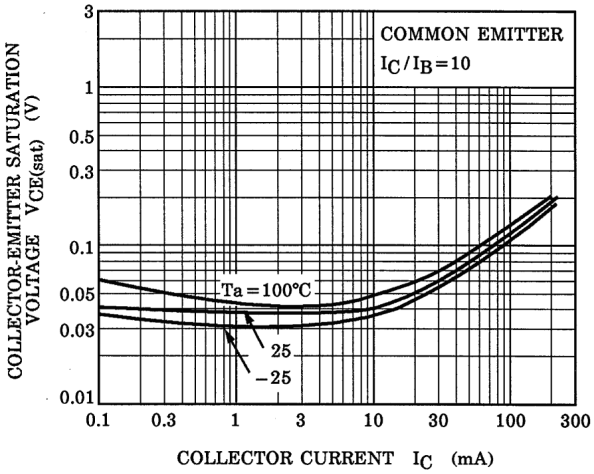


Fig. 12.3 $V_{CE(sat)}$ - I_C

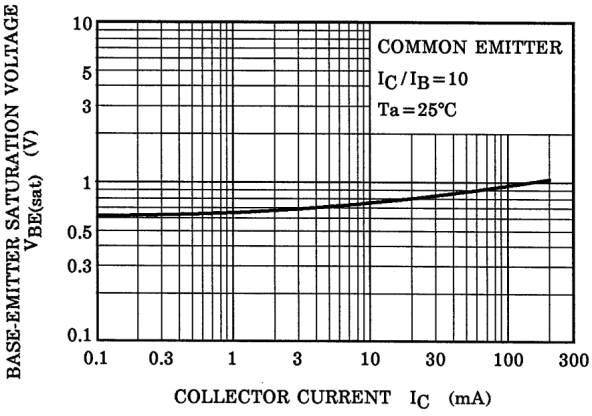


Fig. 12.4 $V_{BE(sat)}$ - I_C

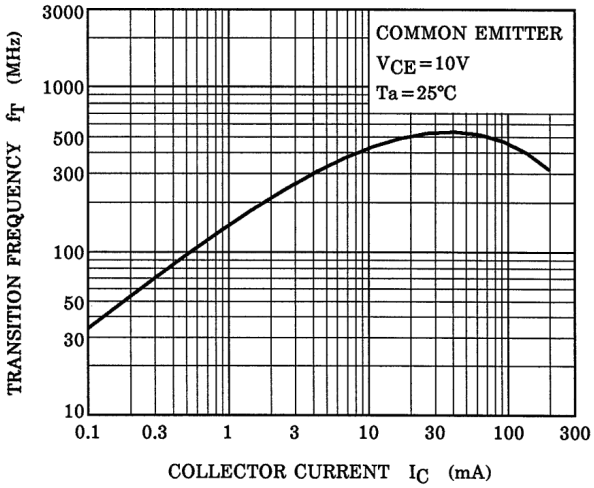


Fig. 12.5 f_T - I_C

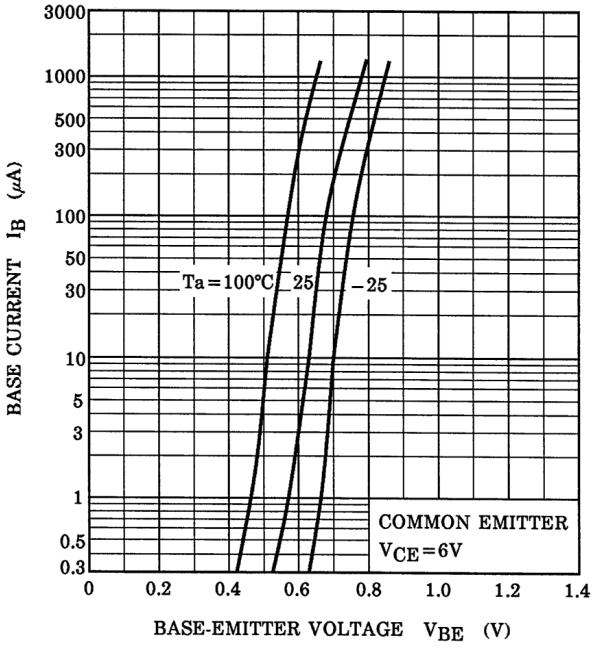


Fig. 12.6 I_B - V_{BE}

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13. Q2 Characteristics Curves (Note)

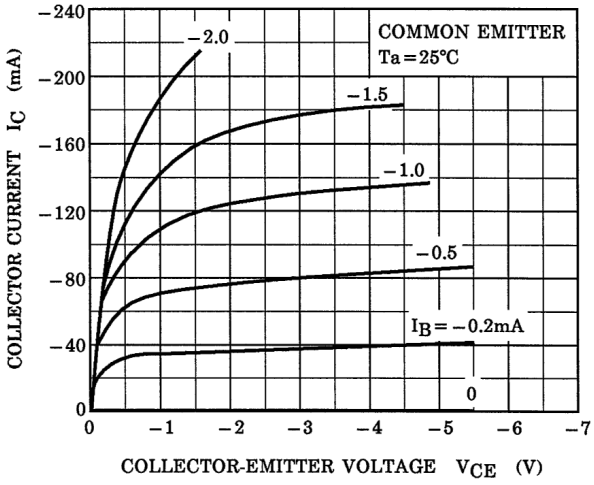


Fig. 13.1 I_C - V_{CE}

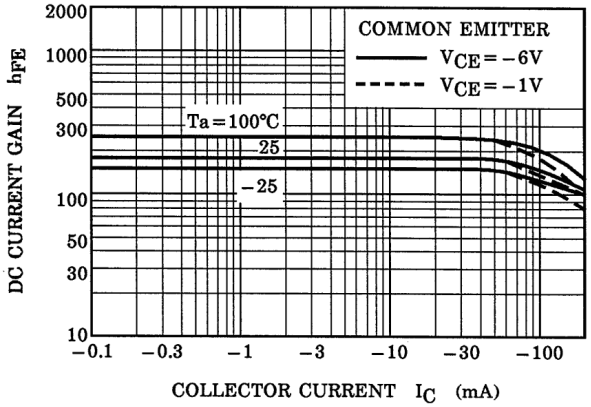


Fig. 13.2 h_{FE} - I_C

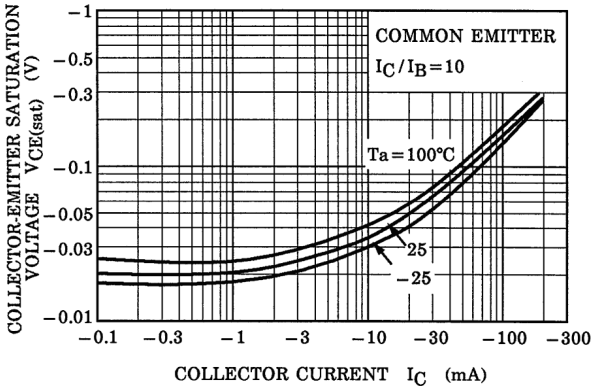


Fig. 13.3 $V_{CE(sat)}$ - I_C

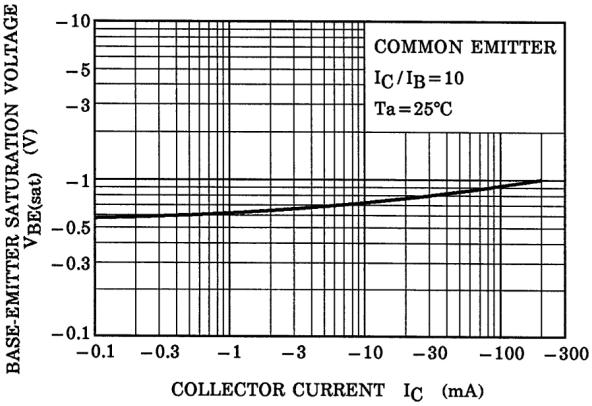


Fig. 13.4 $V_{BE(sat)}$ - I_C

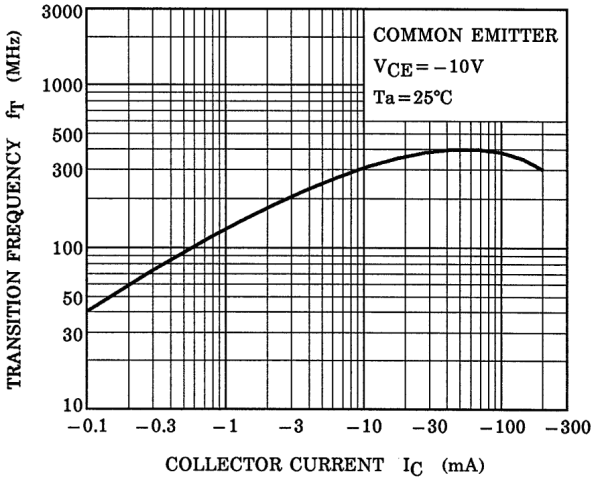


Fig. 13.5 f_T - I_C

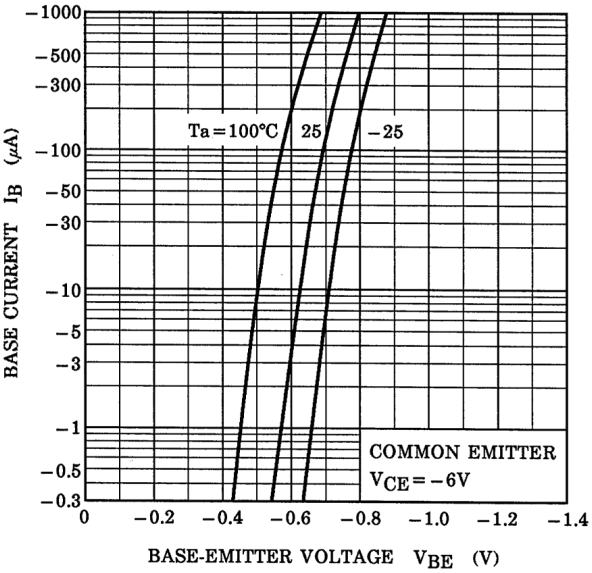


Fig. 13.6 I_B - V_{BE}

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14. Q1, Q2 Common Characteristics Curves (Note)

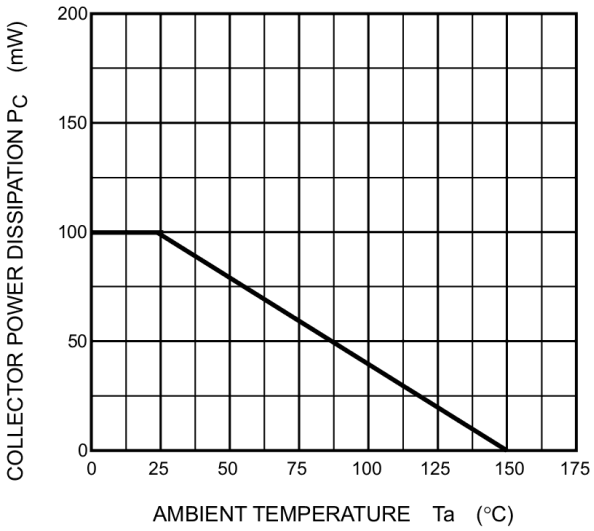


Fig. 14.1 P_C (Note1) - T_a

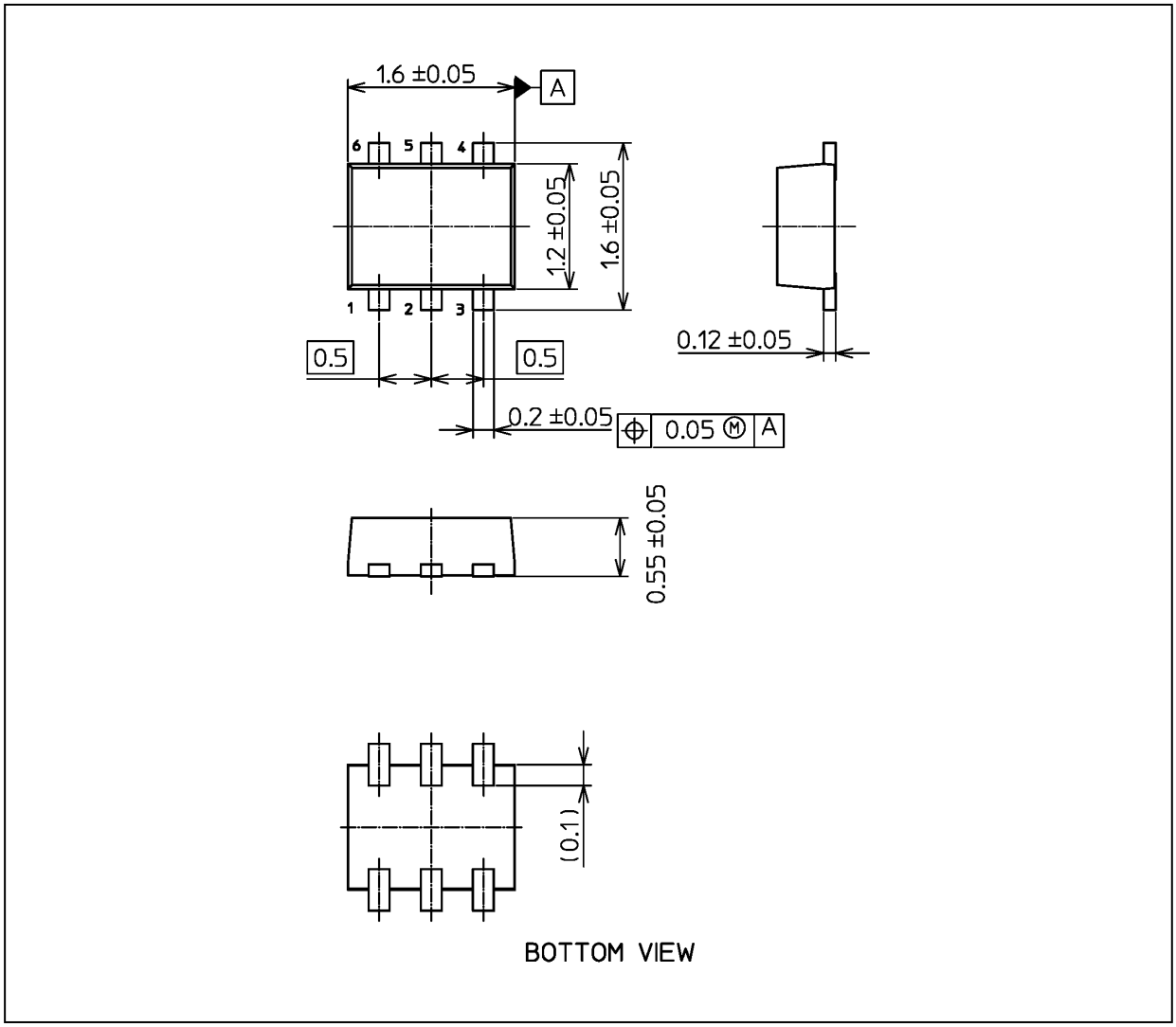
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Note 1: Total rating

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Package Dimensions

Unit: mm



Weight: 3.0 mg (typ.)

Package Name(s)
Nickname: ES6

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