

Bipolar Transistors Silicon NPN/PNP Epitaxial Type (PCT Process)(Bias Resistor built-in Transistor)

# RN4988FE

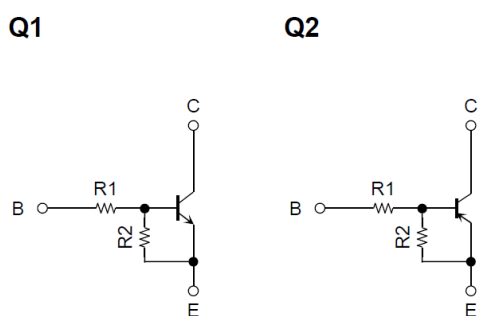
## 1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

## 2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) Small package (Dual type)
- (3) The integrated bias resistor reduces the number of external parts required, making it possible to reduce system size and assembly time.

## 3. Equivalent Circuit

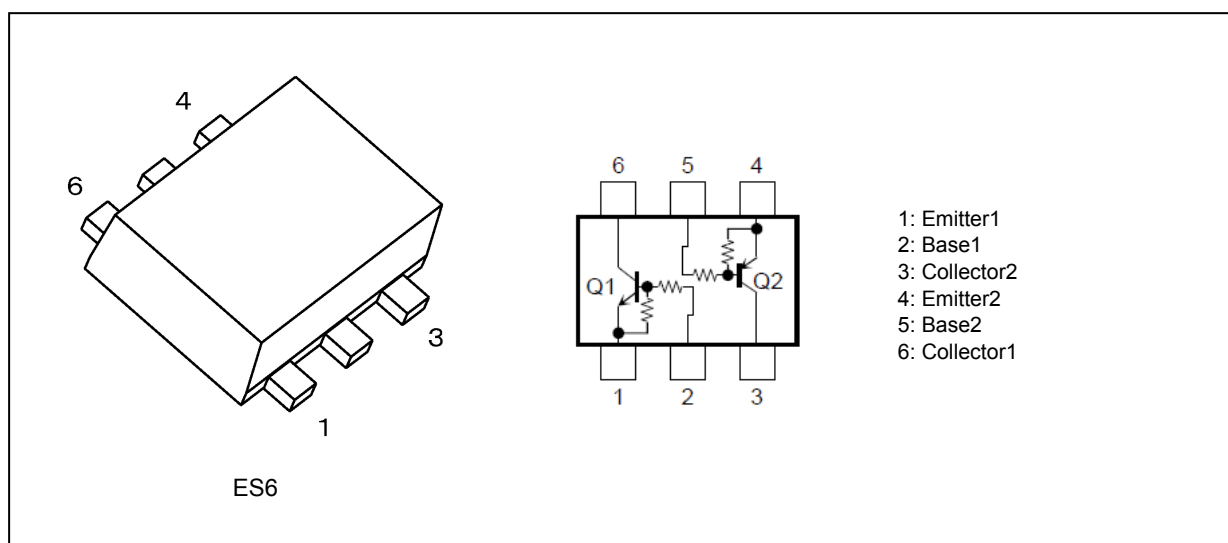


R1: 22 kΩ

R2: 47 kΩ

(Q1, Q2 common)

## 4. Packaging and Pin Assignment



Start of commercial production

2000-05

## 5. Orderable part number

Orderable part number	AEC-Q101	Note
RN4988FE,LF	—	General Use
RN4988FE,LXGF	YES (Note 1)	Unintended Use (Note 1)
RN4988FE,LXHF	YES	Automotive Use

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

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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	50	V
Collector-emitter voltage	$V_{CEO}$	50	
Emitter-base voltage	$V_{EBO}$	7	
Collector current	$I_C$	100	mA

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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	-50	V
Collector-emitter voltage	$V_{CEO}$	-50	
Emitter-base voltage	$V_{EBO}$	-7	
Collector current	$I_C$	-100	mA

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

Characteristics	Symbol	Rating	Unit
Collector power dissipation (Note 1)	$P_C$	100	mW
Junction temperature	$T_j$	150	$^{\circ}\text{C}$
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 (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
Collector cut-off current	$I_{CEO}$	$V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$	—	—	500	
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 7\text{ V}, I_C = 0\text{ mA}$	0.078	—	0.145	mA
DC current gain	$h_{FE}$	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	80	—	—	—
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$	—	0.1	0.3	V
Input voltage (ON)	$V_{I(ON)}$	$V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$	1.0	—	2.6	
Input voltage (off)	$V_{I(off)}$	$V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$	0.6	—	1.16	
Transition frequency	$f_T$	$V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$	—	250	—	MHz
Collector output capacitance	$C_{ob}$	$V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	3	6	pF

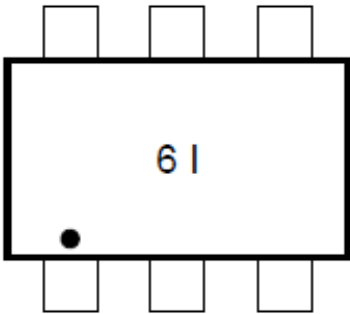
10. Q2 Electrical Characteristics (Unless otherwise specified, T<sub>a</sub> = 25 °C)

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	—	—	-100	nA
Collector cut-off current	I <sub>CEO</sub>	V <sub>CE</sub> = -50 V, I <sub>B</sub> = 0 mA	—	—	-500	
Emitter cut-off current	I <sub>EBO</sub>	V <sub>EB</sub> = -7 V, I <sub>C</sub> = 0 mA	-0.078	—	-0.145	mA
DC current gain	h <sub>FE</sub>	V <sub>CE</sub> = -5 V, I <sub>C</sub> = -10 mA	80	—	—	—
Collector-emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = -5 mA, I <sub>B</sub> = -0.25 mA	—	-0.1	-0.3	V
Input voltage (ON)	V <sub>I(ON)</sub>	V <sub>CE</sub> = -0.2 V, I <sub>C</sub> = -5 mA	-1.0	—	-2.6	
Input voltage (off)	V <sub>I(off)</sub>	V <sub>CE</sub> = -5 V, I <sub>C</sub> = -0.1 mA	-0.6	—	-1.16	
Transition frequency	f <sub>T</sub>	V <sub>CE</sub> = -10 V, I <sub>C</sub> = -5 mA	—	200	—	MHz
Collector output capacitance	C <sub>ob</sub>	V <sub>CB</sub> = -10 V, I <sub>E</sub> = 0 mA, f = 1 MHz	—	3	6	pF

11. Q1, Q2 Common Electrical Characteristics (Unless otherwise specified, T<sub>a</sub> = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input resistance	R <sub>1</sub>	-	15.4	22	28.6	kΩ
Resistor ratio	R1/R2	-	0.421	0.468	0.515	—

12. Marking



## 13. Characteristics Curves (Note)

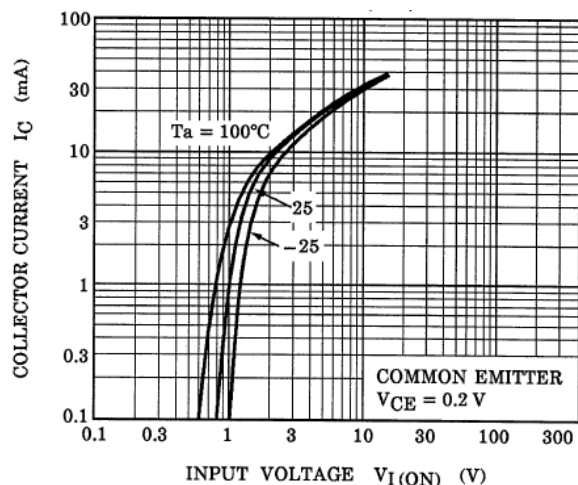


Fig. 13.1 Q1  $I_C$ - $V_{I(ON)}$

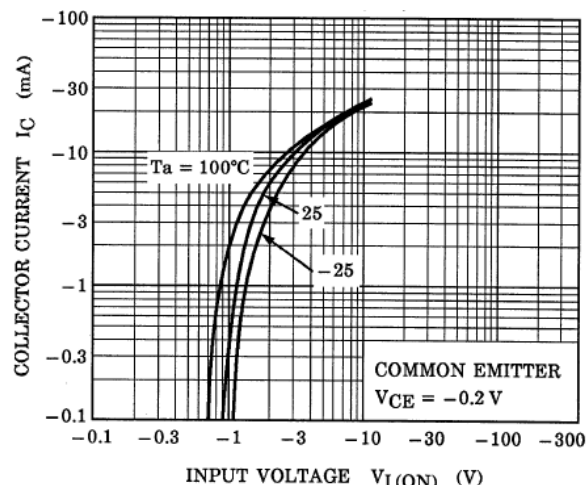


Fig. 13.2 Q2  $I_C$ - $V_{I(ON)}$

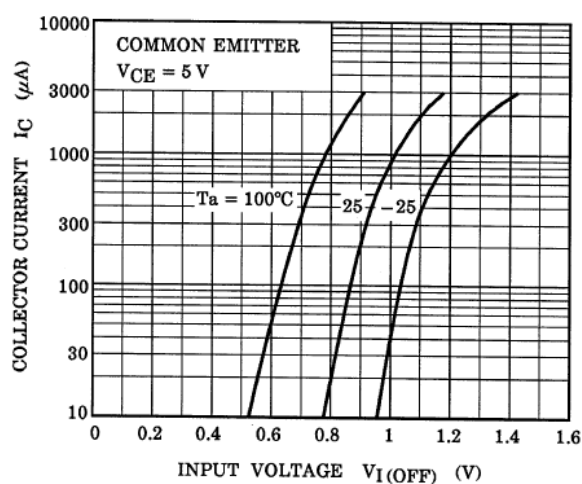


Fig. 13.3 Q1  $I_C$ - $V_{I(OFF)}$

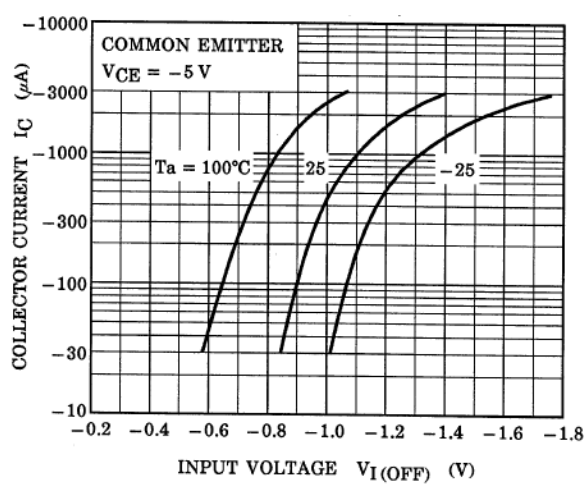


Fig. 13.4 Q2  $I_C$ - $V_{I(OFF)}$

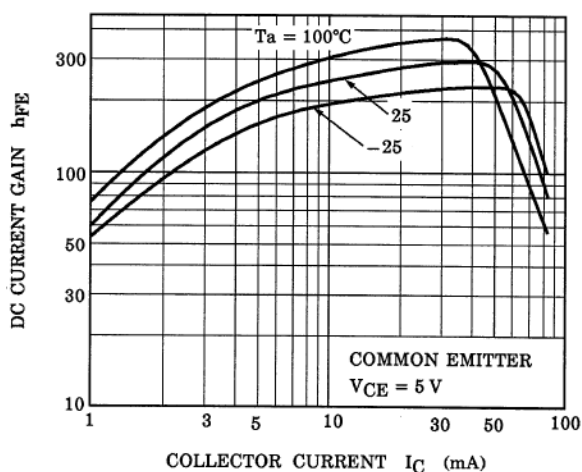


Fig. 13.5 Q1  $h_{FE}$ - $I_C$

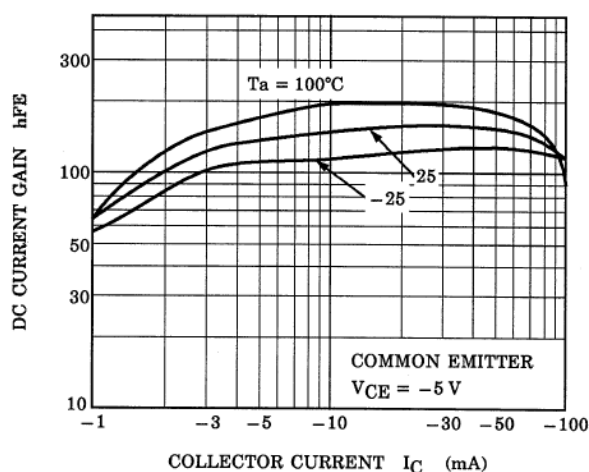


Fig. 13.6 Q2  $h_{FE}$ - $I_C$

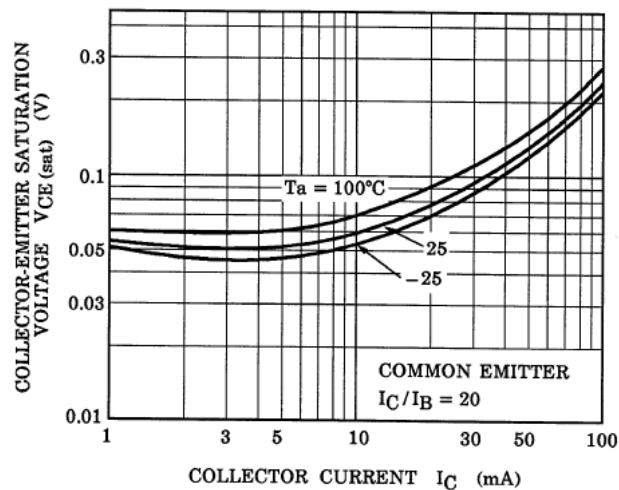


Fig. 13.7 Q1  $V_{CE(sat)}$ - $I_C$

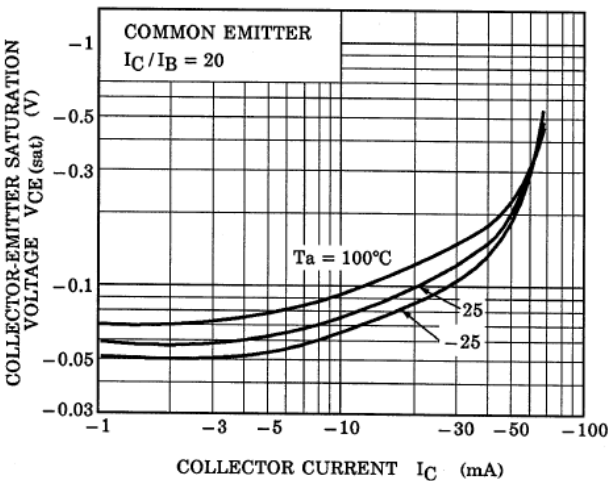
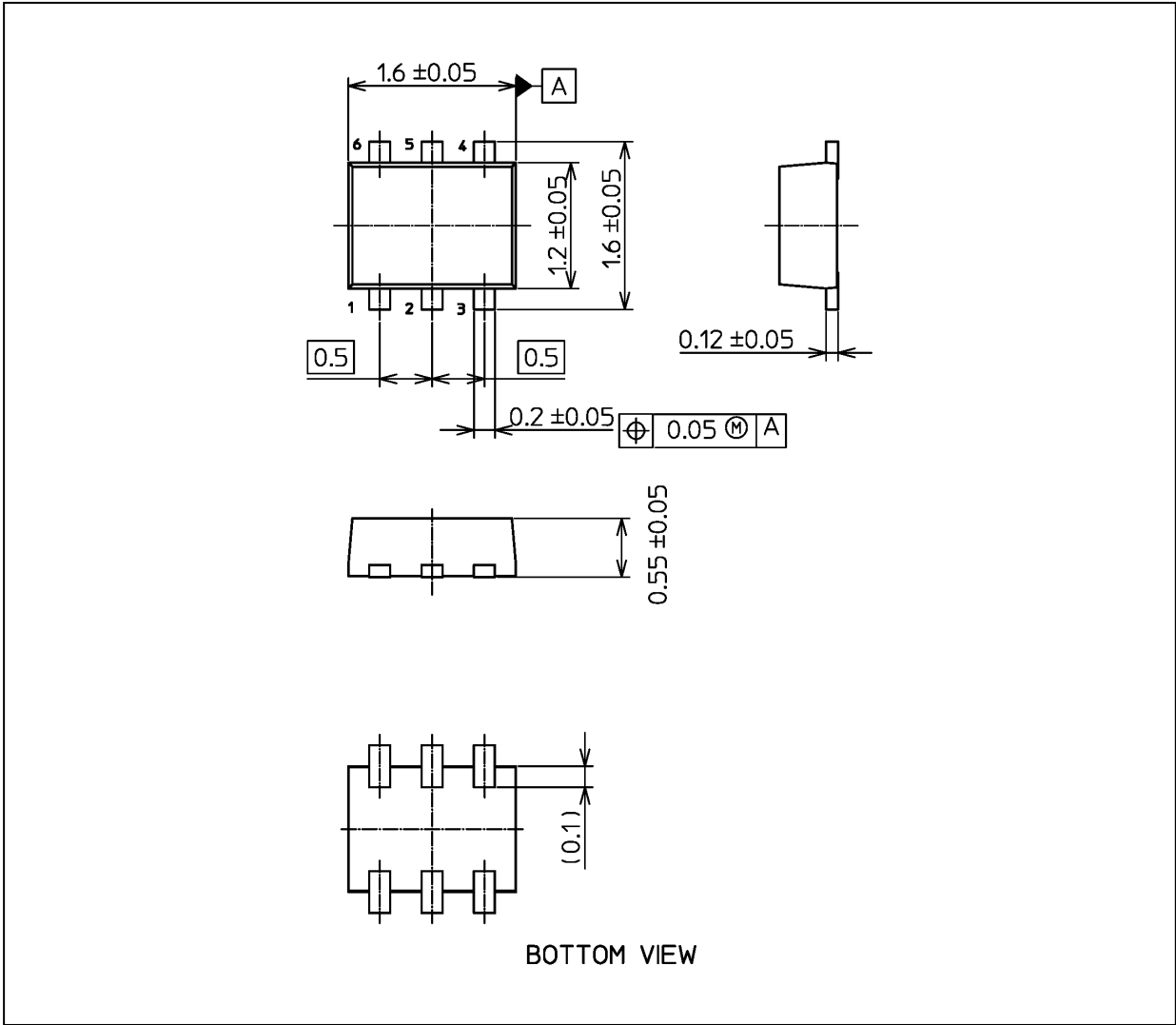


Fig. 13.8 Q2  $V_{CE(sat)}$ - $I_C$

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

Package Dimensions

Unit: mm



Weight: 3.0 mg (typ.)

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

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