

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

# RN4989FE

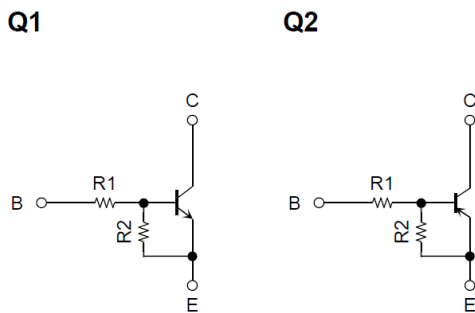
### 1. Applications

- 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

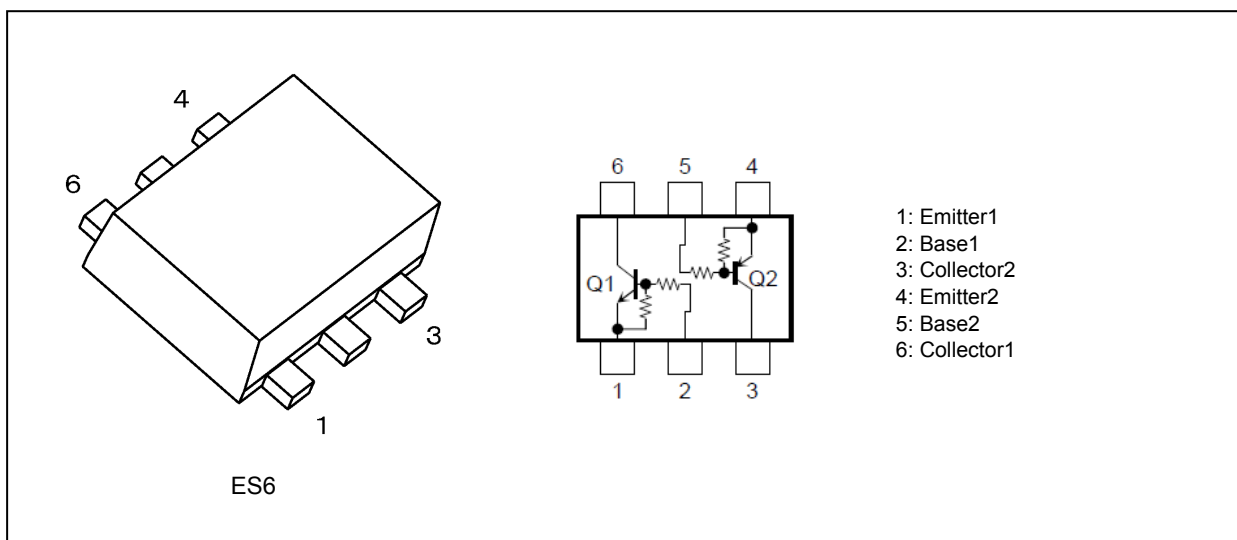


R1: 47 kΩ

R2: 22 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
RN4989FE,LF	—	General Use
RN4989FE,LXGF	YES (Note 1)	Unintended Use (Note 1)
RN4989FE,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	$V_{EBO}$	15	
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	$V_{EBO}$	-15	
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
	$I_{CEO}$	$V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$	—	—	500	
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 15\text{ V}, I_C = 0\text{ mA}$	0.167	—	0.311	mA
DC current gain	$h_{FE}$	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	70	—	—	—
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)	$V_{I(ON)}$	$V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$	2.2	—	5.8	
Input voltage (OFF)	$V_{I(OFF)}$	$V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$	1.5	—	2.6	
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

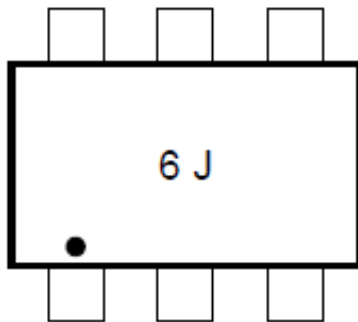
## 10. Q2 Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

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
	$I_{CEO}$	$V_{CE} = -50\text{ V}, I_B = 0\text{ mA}$	—	—	-500	
Emitter cut-off current	$I_{EBO}$	$V_{EB} = -15\text{ V}, I_C = 0\text{ mA}$	-0.167	—	-0.311	mA
DC current gain	$h_{FE}$	$V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$	70	—	—	—
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)	$V_{I(ON)}$	$V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$	-2.2	—	-5.8	
Input voltage (OFF)	$V_{I(OFF)}$	$V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$	-1.5	—	-2.6	
Transition frequency	$f_T$	$V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$	—	200	—	MHz
Collector output capacitance	$C_{ob}$	$V_{CB} = -10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	3	6	pF

## 11. Q1, Q2 Common Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input resistance	$R_1$	-	32.9	47	61.1	k $\Omega$
Resistor ratio	R1/R2	-	1.92	2.14	2.35	—

## 12. Marking



## 13. Characteristics Curves (Note)

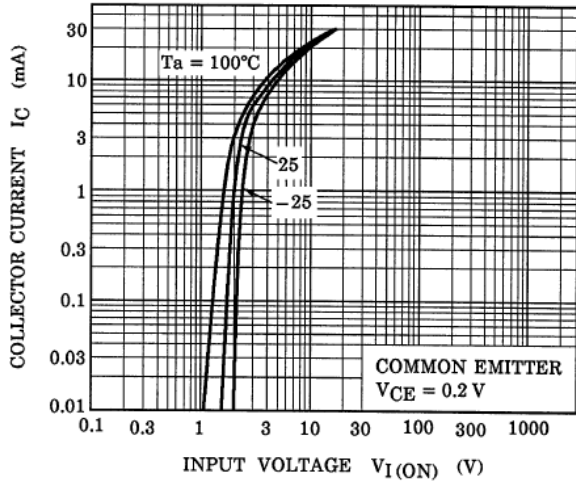


Fig. 13.1 Q1  $I_C$ - $V_{I(ON)}$

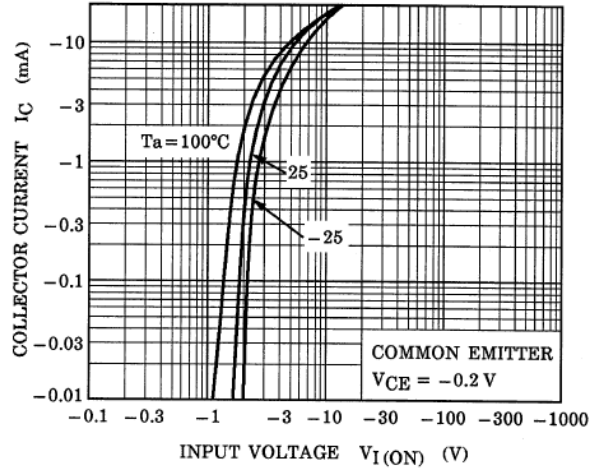


Fig. 13.2 Q2  $I_C$ - $V_{I(ON)}$

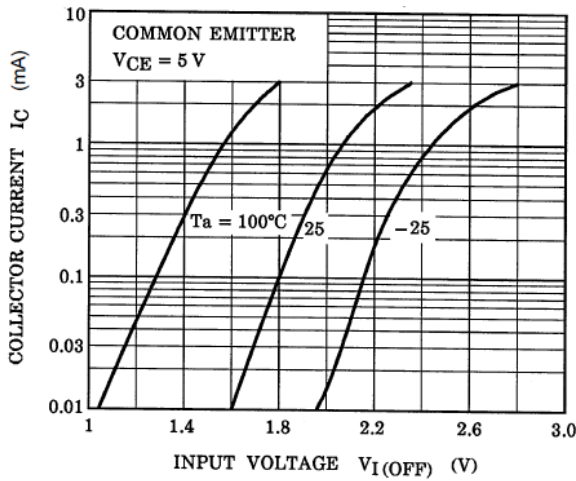


Fig. 13.3 Q1  $I_C$ - $V_{I(OFF)}$

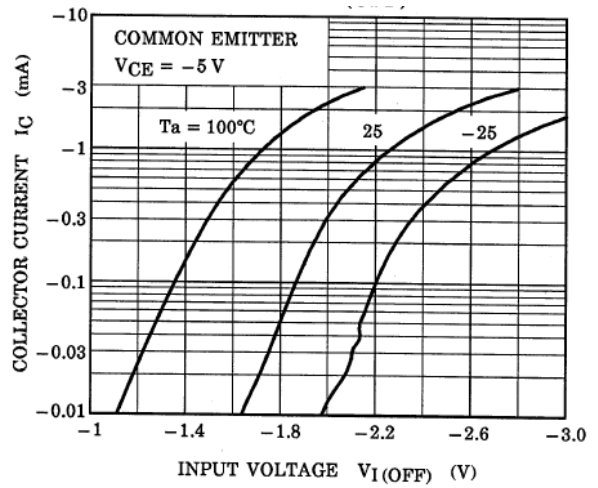


Fig. 13.4 Q2  $I_C$ - $V_{I(OFF)}$

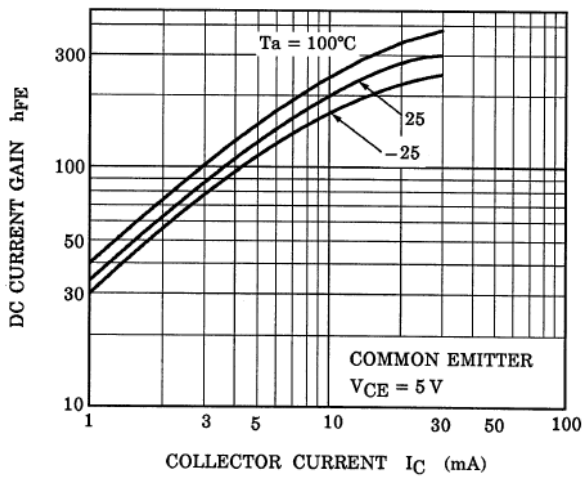


Fig. 13.5 Q1  $h_{FE}$ - $I_C$

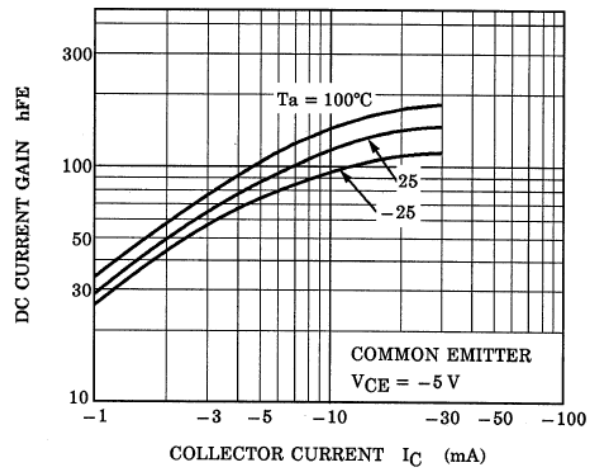


Fig. 13.6 Q2  $h_{FE}$ - $I_C$

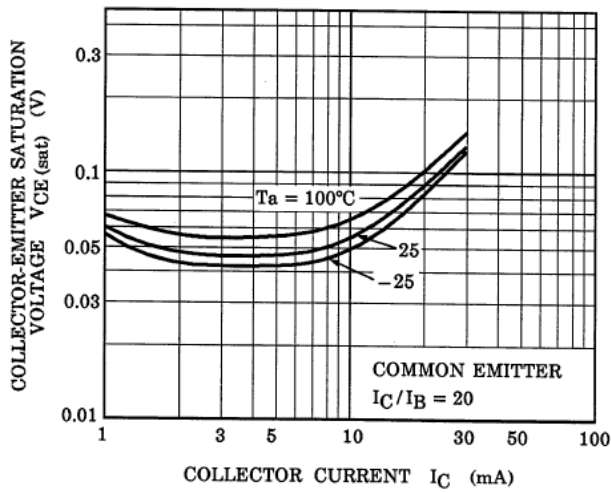


Fig. 13.7 Q1  $V_{CE(sat)}-I_C$

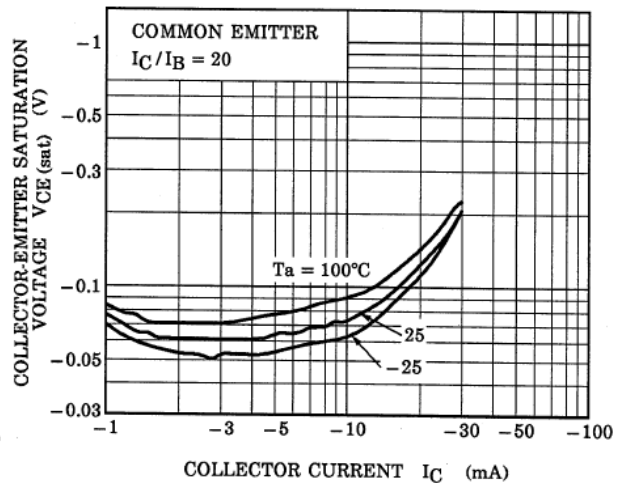
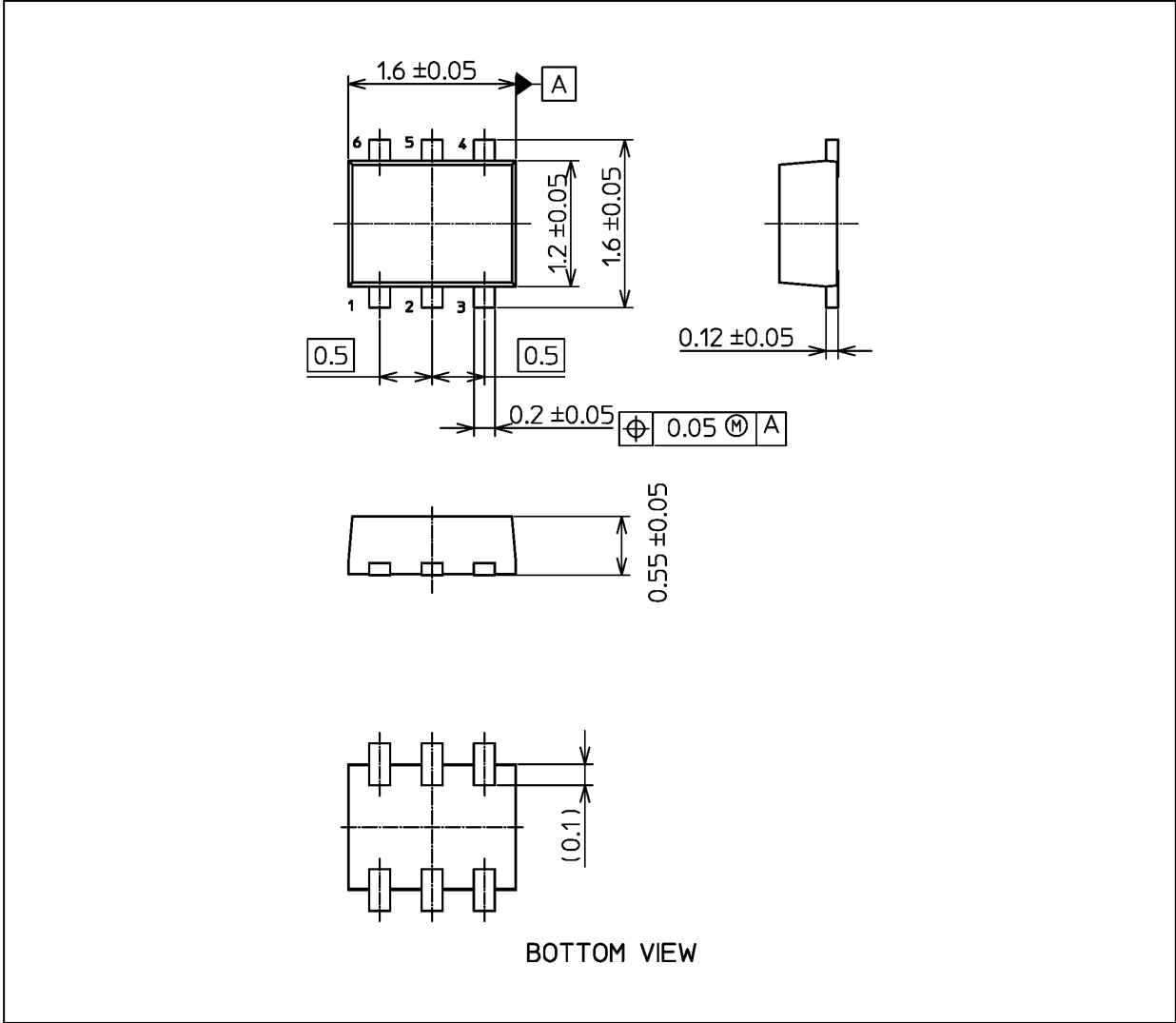


Fig. 13.8 Q2  $V_{CE(sat)}-I_C$

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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