

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

# RN4988

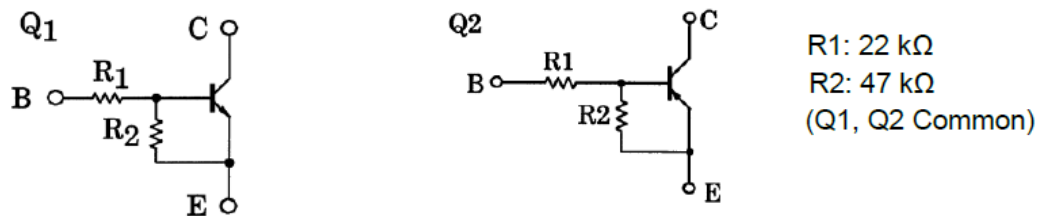
## 1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

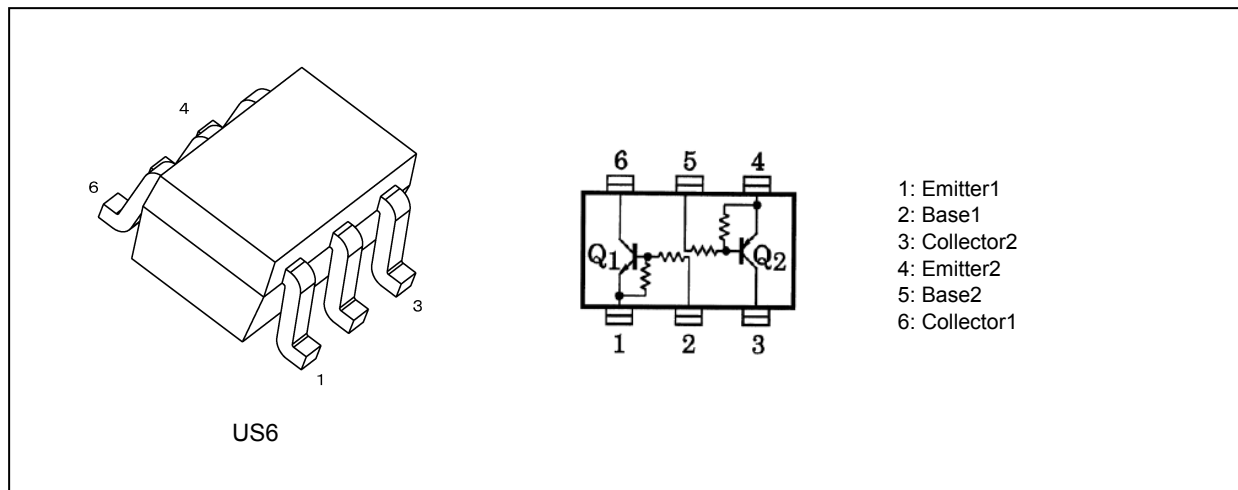
## 2. Features

- (1) AEC-Q101 qualified (Please see the orderable part number list)
- (2) Including two devices in US6 (ultra super mini type with 6 leads)
- (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



## 4. Packaging and Pin Assignment



## 5. Orderable part number

Orderable part number	AEC-Q101	Note
RN4988,LF	—	General Use
RN4988,LXGF	YES (Note 1)	Unintended Use (Note 1)
RN4988,LXHF	YES	Automotive Use

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

Start of commercial production  
1992-10

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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CB0}$	50	V
Collector-emitter voltage	$V_{CE0}$	50	
Emitter-base voltage	$V_{EB0}$	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	$V_{CB0}$	-50	V
Collector-emitter voltage	$V_{CE0}$	-50	
Emitter-base voltage	$V_{EB0}$	-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)	$P_C$	200	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	$I_{CB0}$	$V_{CB} = 50\text{ V}, I_E = 0\text{ mA}$	—	—	100	nA
Collector cut-off current	$I_{CE0}$	$V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$	—	—	500	
Emitter cut-off current	$I_{EB0}$	$V_{EB} = 7\text{ V}, I_C = 0\text{ mA}$	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

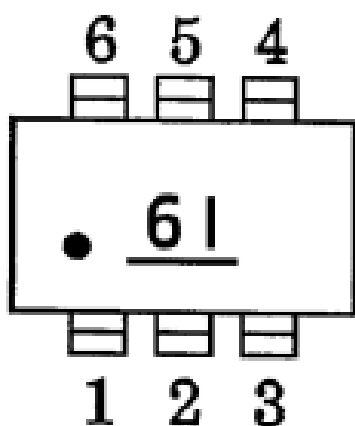
## 10. Q2 Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

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	$f_T$	$V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$	—	200	—	MHz
Collector output capacitance	$C_{ob}$	$V_{CB} = -10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	3	6	pF

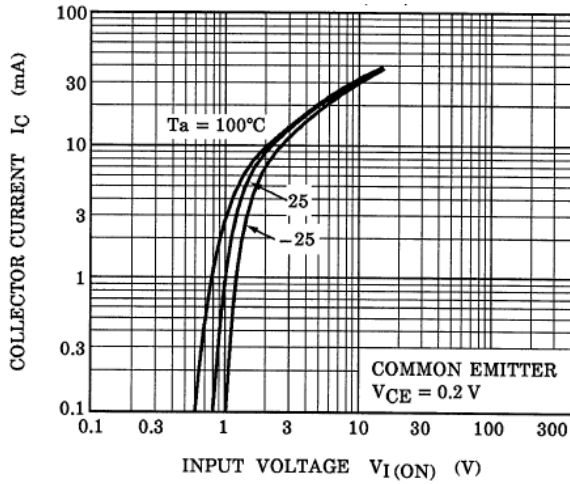
## 11. Q1, Q2 Common Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Input resistance	$R_1$	-	15.4	22	28.6	$k\Omega$
Resistor ratio	$R1/R2$	-	0.421	0.468	0.515	—

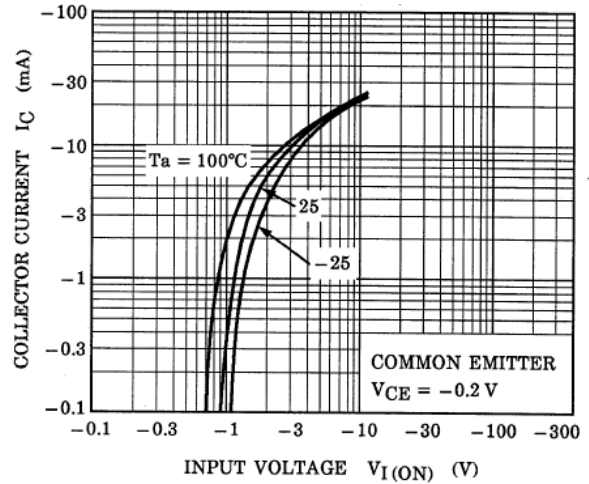
## 12. Marking



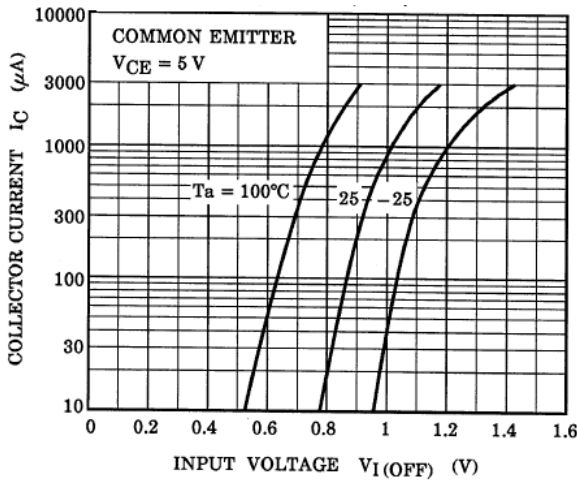
**13. Characteristics Curves (Note)**



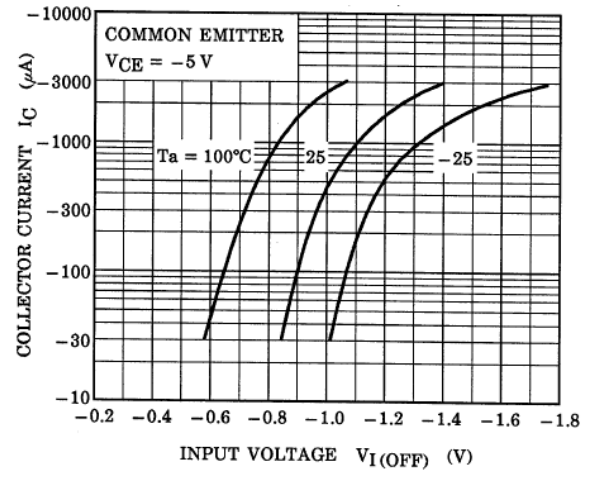
**Fig. 13.1 Q1  $I_C$ - $V_{I(ON)}$**



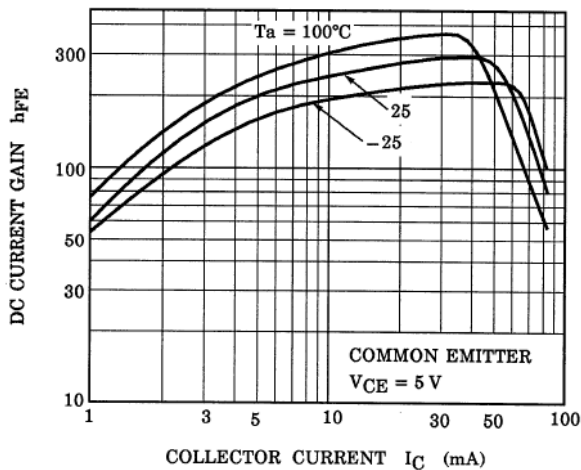
**Fig. 13.2 Q2  $I_C$ - $V_{I(ON)}$**



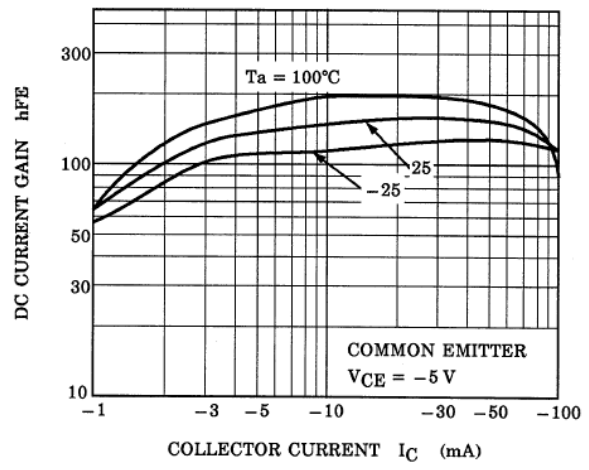
**Fig. 13.3 Q1  $I_C$ - $V_{I(OFF)}$**



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



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

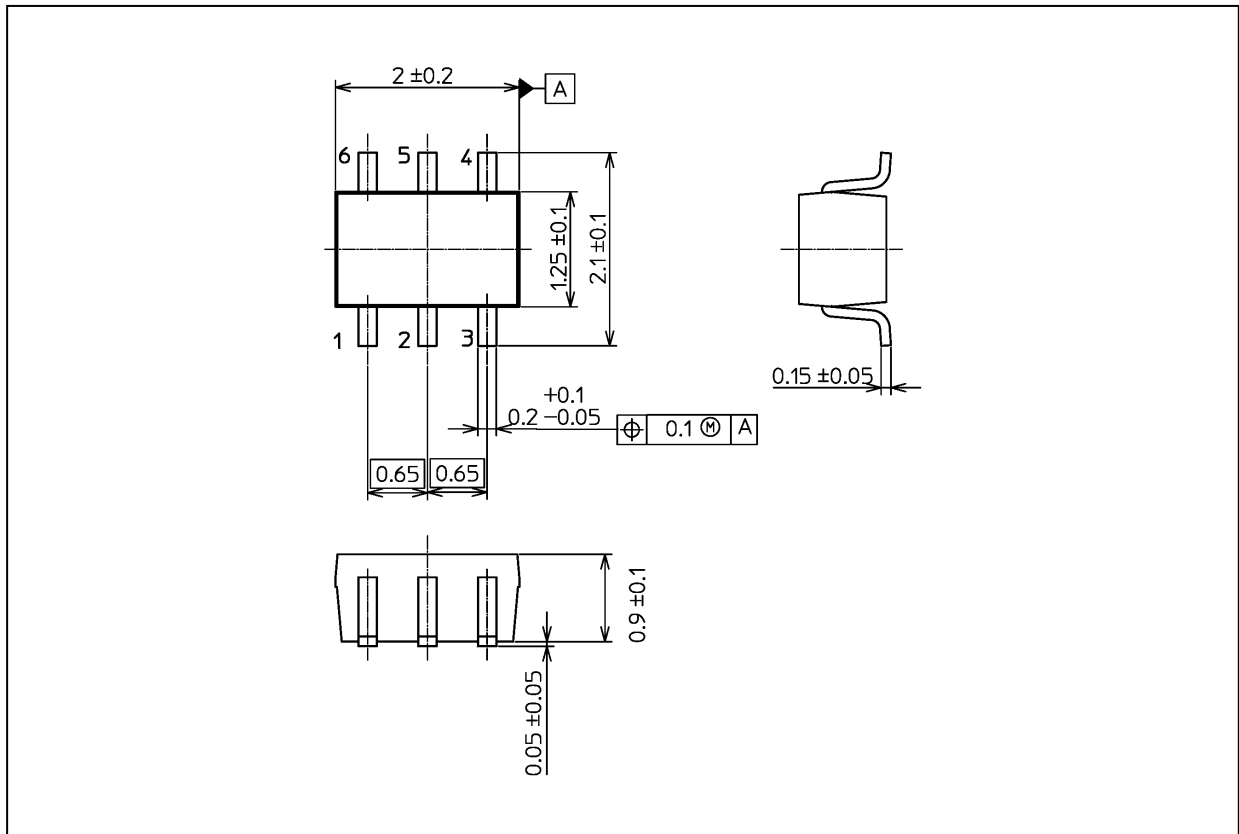


**Fig. 13.6 Q2  $h_{FE}$ - $I_C$**

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

## Package Dimensions

Unit: mm



Weight: 6.8 mg (typ.)

Package Name(s)
TOSHIBA: 1-2T1S
Nickname: US6

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