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

RN4988

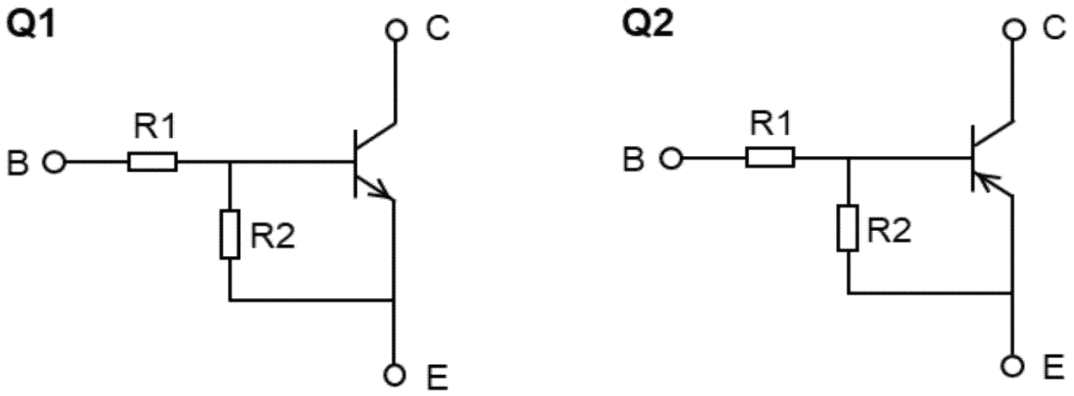
1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

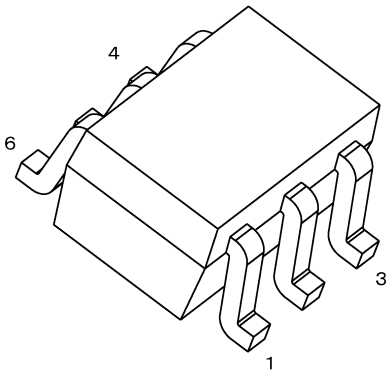
(1) AEC-Q101 qualified (Please see the orderable part number list)
(2) Including two devices in US6 (ultra super mini type with 6 leads)
(3) The integrated bias resistor reduces the number of external parts required, making it possible to reduce system size and assembly time.

3. Equivalent Circuit

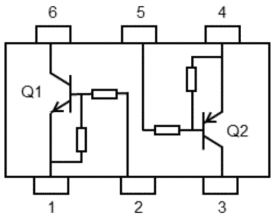


Note: R1 = 22 kΩ, R2 = 47 kΩ (Q1, Q2 Common)

4. Packaging and Pin Assignment



US6



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

Start of commercial production
1992-10

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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.

6. Q1 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}	7	
Collector current	I_C	100	mA

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}	-7	
Collector current	I_C	-100	mA

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	200	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 (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
Collector cut-off current	I_{CEO}	V_{CE} = 50 V, I_B = 0 mA	—	—	500	
Emitter cut-off current	I_{EBO}	V_{EB} = 7 V, I_C = 0 mA	0.078	—	0.145	mA
DC current gain	h_{FE}	V_{CE} = 5 V, I_C = 10 mA	80	—	—	—
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C = 5 mA, I_B = 0.25 mA	—	0.1	0.3	V
Input voltage (ON)	$V_{I(ON)}$	V_{CE} = 0.2 V, I_C = 5 mA	1.0	—	2.6	
Input voltage (off)	$V_{I(off)}$	V_{CE} = 5 V, I_C = 0.1 mA	0.6	—	1.16	
Transition frequency	f_T	V_{CE} = 10 V, I_C = 5 mA	—	250	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = 10 V, I_E = 0 mA, f = 1 MHz	—	3	6	pF

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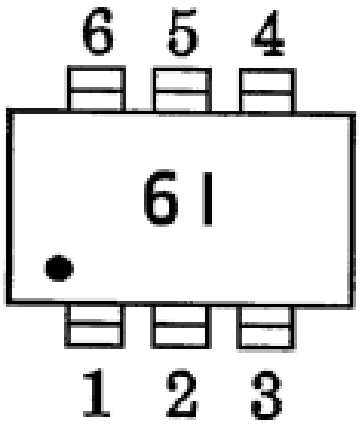
10. Q2 Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = -50 V, I_E = 0 mA	—	—	-100	nA
Collector cut-off current	I_{CEO}	V_{CE} = -50 V, I_B = 0 mA	—	—	-500	
Emitter cut-off current	I_{EBO}	V_{EB} = -7 V, I_C = 0 mA	-0.078	—	-0.145	mA
DC current gain	h_{FE}	V_{CE} = -5 V, I_C = -10 mA	80	—	—	—
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C = -5 mA, I_B = -0.25 mA	—	-0.1	-0.3	V
Input voltage (ON)	$V_{I(ON)}$	V_{CE} = -0.2 V, I_C = -5 mA	-1.0	—	-2.6	
Input voltage (off)	$V_{I(off)}$	V_{CE} = -5 V, I_C = -0.1 mA	-0.6	—	-1.16	
Transition frequency	f_T	V_{CE} = -10 V, I_C = -5 mA	—	200	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = -10 V, I_E = 0 mA, f = 1 MHz	—	3	6	pF

11. Q1, Q2 Common Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

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

12. Marking



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13. Characteristics Curves (Note)

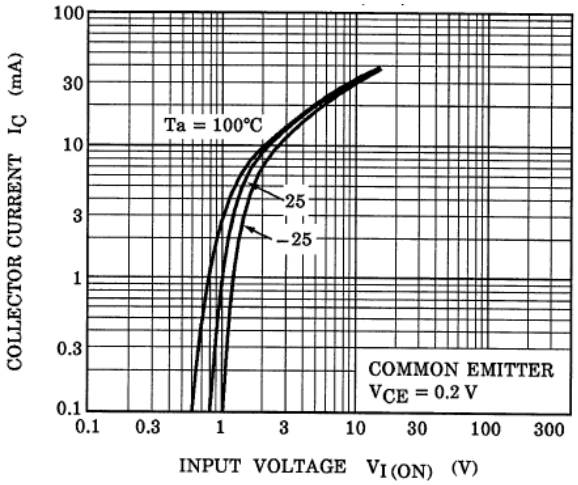


Fig. 13.1 Q1 I_C-$V_{I(ON)}$

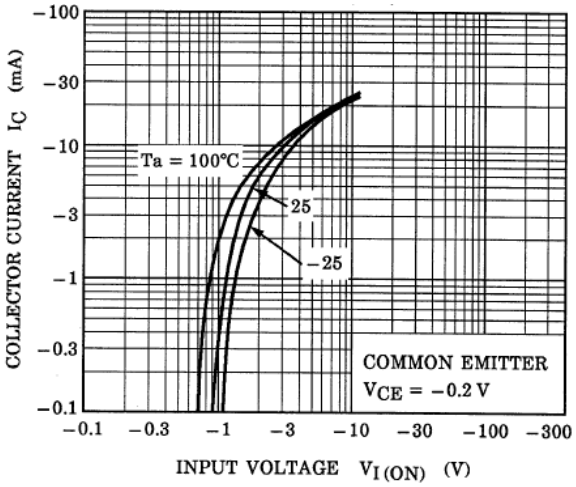


Fig. 13.2 Q2 I_C-$V_{I(ON)}$

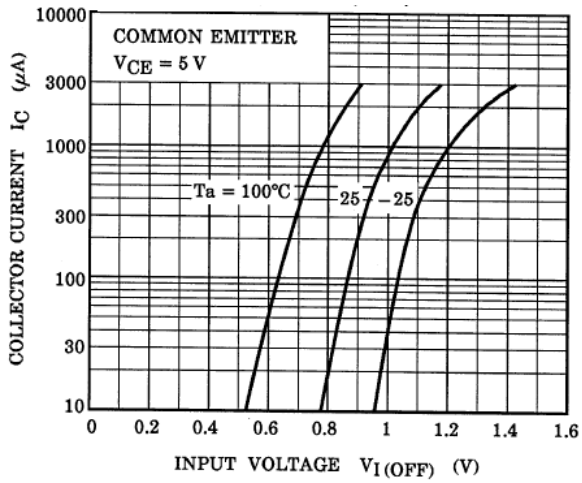


Fig. 13.3 Q1 I_C-$V_{I(OFF)}$

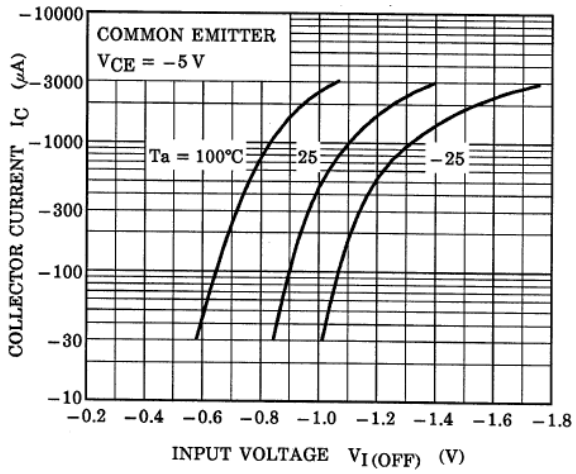


Fig. 13.4 Q2 I_C-$V_{I(OFF)}$

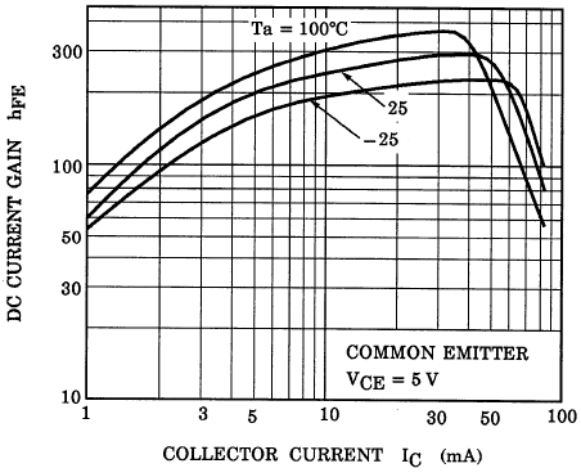


Fig. 13.5 Q1 h_{FE}-I_C

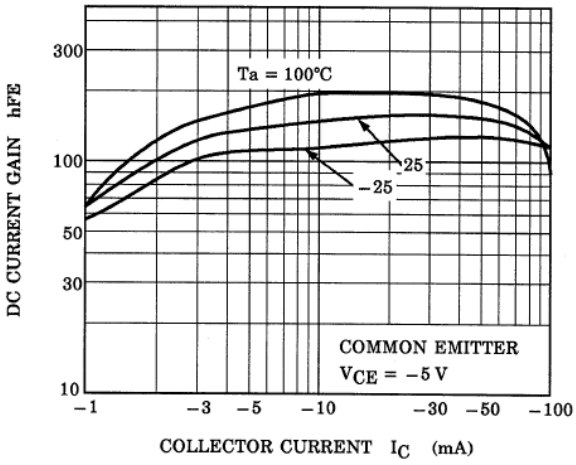


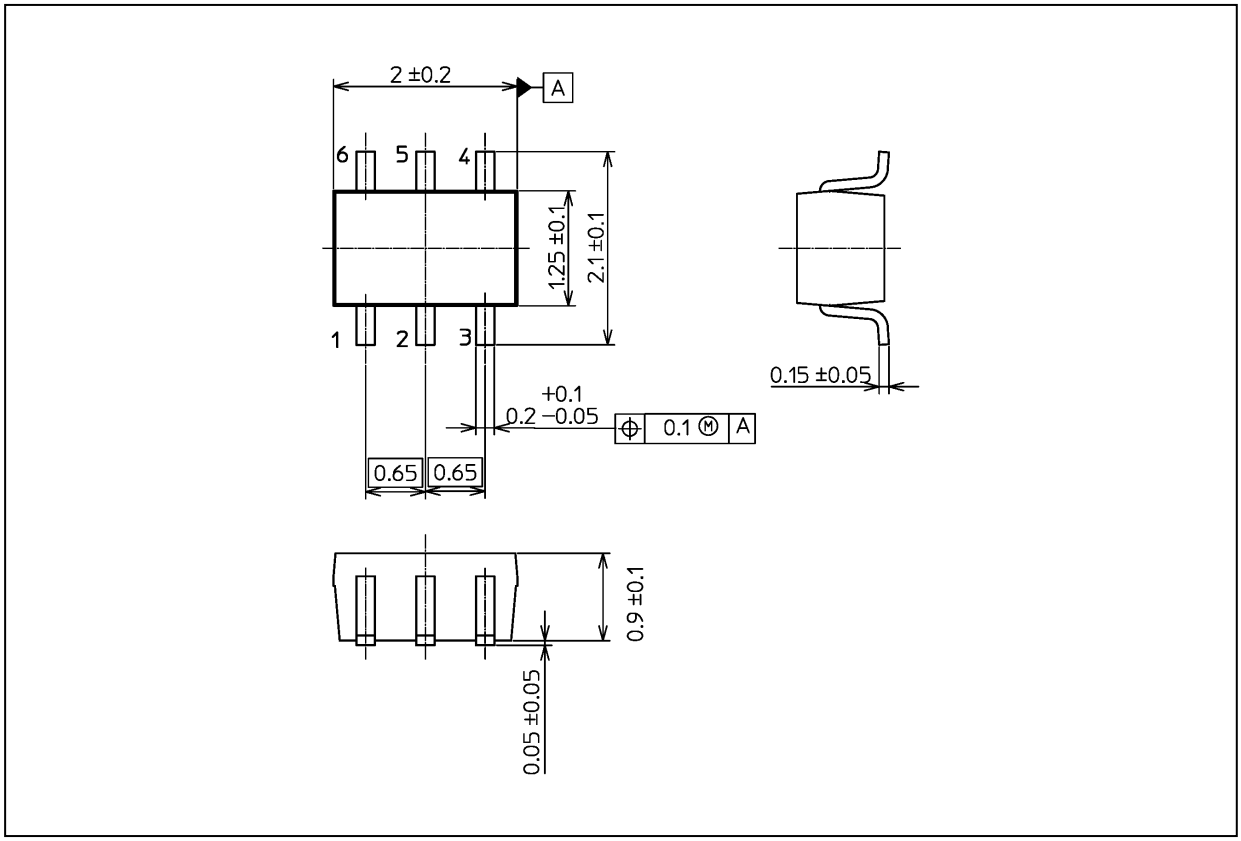
Fig. 13.6 Q2 h_{FE}-I_C

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

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Package Dimensions

Unit: mm



Weight: 6.8 mg (typ.)

Package Name(s)
Nickname: US6

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