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

RN1407/08/09

1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

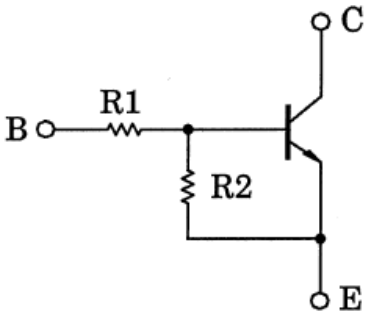
(1) AEC-Q101 qualified (Please see the orderable part number list)

(2) The integrated bias resistor reduces the number of external parts required, making it possible to reduce system size and assembly time.

(3) Toshiba offers transistors with a wide range of resistance to accommodate various circuit designs.

(4) Complementary to RN2407 to RN2409

3. Equivalent Circuit

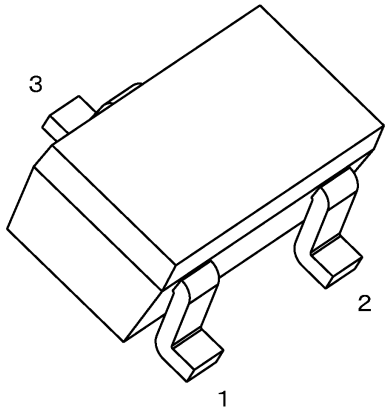


4. Bias Resistor Values

Part No.	R1 (kΩ)	R2 (kΩ)
RN1407	10	47
RN1408	22	47
RN1409	47	22

Start of commercial production
1985-05

5. Packaging and Pin Assignment



1: Base
2: Emitter
3: Collector

S-Mini

6. Orderable part number

Orderable part number		AEC-Q101	Note	Note	
RN1407	RN1407,LF	—		General Use	
	RN1407,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1407,LXHF	YES		Automotive Use	
RN1408	RN1408,LF	—		General Use	
	RN1408,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1408,LXHF	YES		Automotive Use	
RN1409	RN1409,LF	—		General Use	
	RN1409,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1409,LXHF	YES		Automotive Use	

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

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

Characteristics		Symbol	Rating	Unit
Collector-base voltage	RN1407～RN1409	V_{CBO}	50	V
Collector-emitter voltage		V_{CEO}	50	
Emitter-base voltage	RN1407	V_{EBO}	6	V
	RN1408		7	
	RN1409		15	
Collector current	RN1407～RN1409	I_C	100	mA
Collector power dissipation		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).

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1407～RN1409	I_{CBO}	V_{CB} = 50 V, I_E = 0 mA	—	—	100	nA
		I_{CEO}	V_{CE} = 50 V, I_B = 0 mA	—	—	500	
Emitter cut-off current	RN1407	I_{EBO}	V_{EB} = 6 V, I_C = 0 mA	0.081	—	0.15	mA
	RN1408		V_{EB} = 7 V, I_C = 0 mA	0.078	—	0.145	
	RN1409		V_{EB} = 15 V, I_C = 0 mA	0.167	—	0.311	
DC current gain	RN1407	h_{FE}	V_{CE} = 5 V, I_C = 10 mA	80	—	—	—
	RN1408			80	—	—	
	RN1409			70	—	—	
Collector-emitter saturation voltage	RN1407～RN1409	$V_{CE(sat)}$	I_C = 5 mA, I_B = 0.25 mA	—	0.1	0.3	V
Input voltage (ON)	RN1407	$V_{I(ON)}$	V_{CE} = 0.2 V, I_C = 5 mA	0.7	—	1.8	V
	RN1408			1.0	—	2.6	
	RN1409			2.2	—	5.8	
Input voltage (OFF)	RN1407	$V_{I(OFF)}$	V_{CE} = 5 V, I_C = 0.1 mA	0.5	—	1.0	V
	RN1408			0.6	—	1.16	
	RN1409			1.5	—	2.6	
Transition frequency	RN1407～RN1409	f_T	V_{CE} = 10 V, I_C = 5 mA	—	250	—	MHz
Collector output capacitance	RN1407～RN1409	C_{ob}	V_{CB} = 10 V, I_E = 0 mA, f = 1 MHz	—	3	6	pF
Input resistance	RN1407	R_1	-	7	10	13	kΩ
	RN1408			15.4	22	28.6	
	RN1409			32.9	47	61.1	
Resistor ratio	RN1407	R1/R2	-	0.191	0.213	0.232	—
	RN1408			0.421	0.468	0.515	
	RN1409			1.92	2.14	2.35	

9. Marking

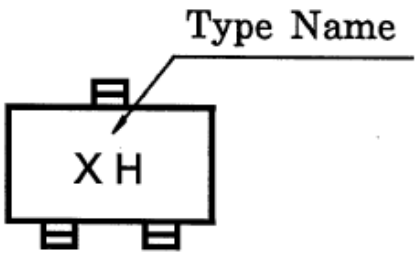


Fig. 9.1 Marking RN1407

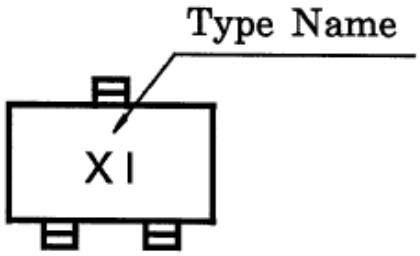


Fig. 9.2 Marking RN1408

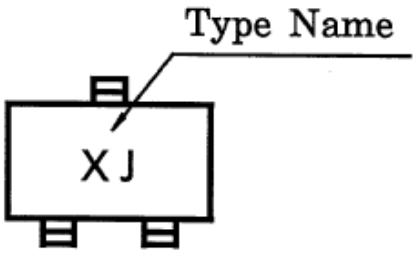


Fig. 9.3 Marking RN1409

10. Characteristics Curves (Note)

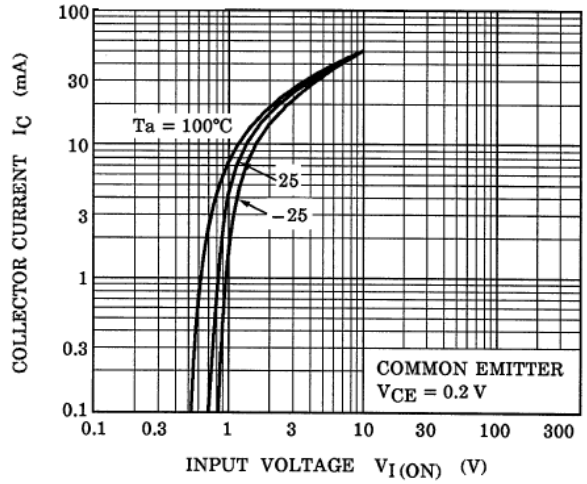


Fig. 10.1 RN1407 I_C-$V_{I(ON)}$

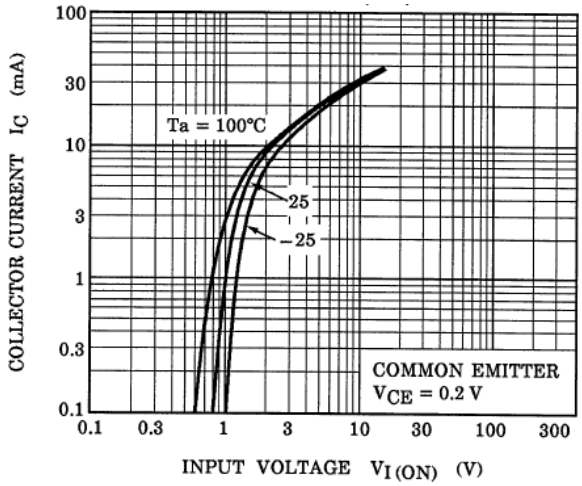


Fig. 10.2 RN1408 I_C-$V_{I(ON)}$

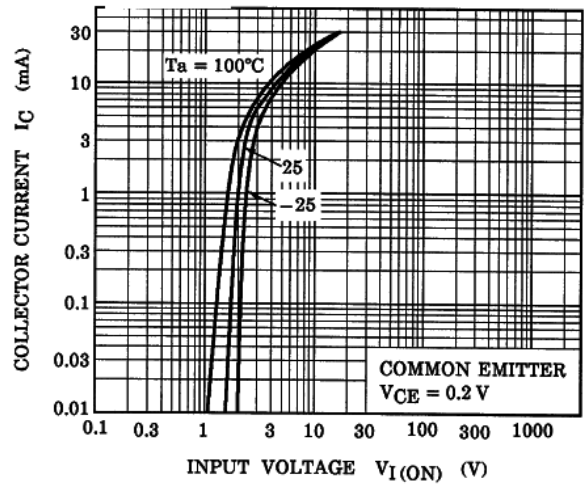


Fig. 10.3 RN1409 I_C-$V_{I(ON)}$

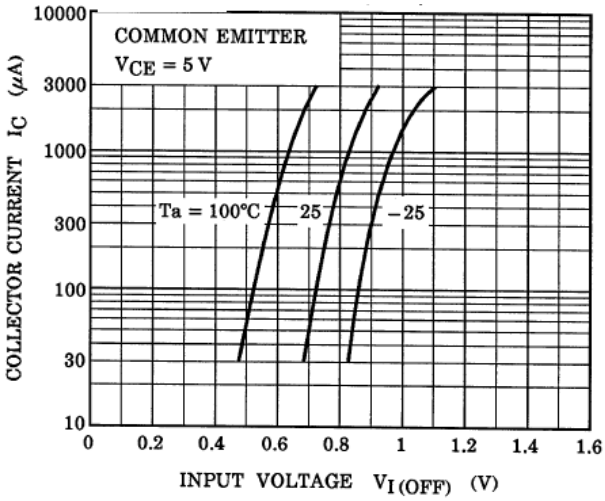


Fig. 10.4 RN1407 I_C-$V_{I(OFF)}$

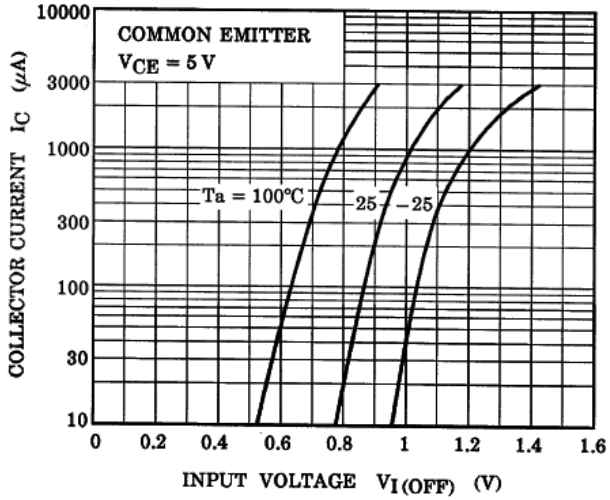


Fig. 10.5 RN1408 I_C-$V_{I(OFF)}$

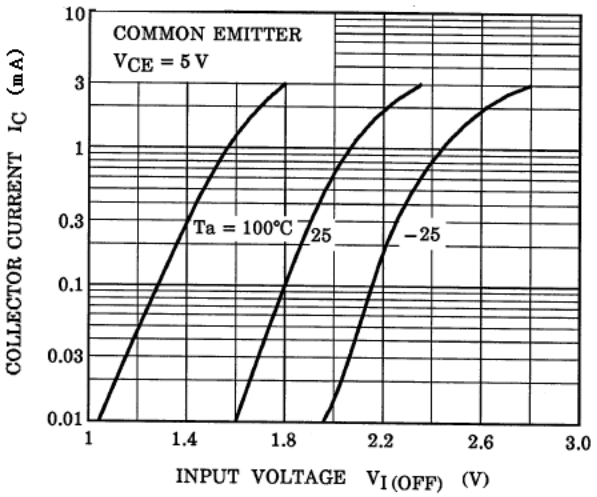


Fig. 10.6 RN1409 I_C-$V_{I(OFF)}$

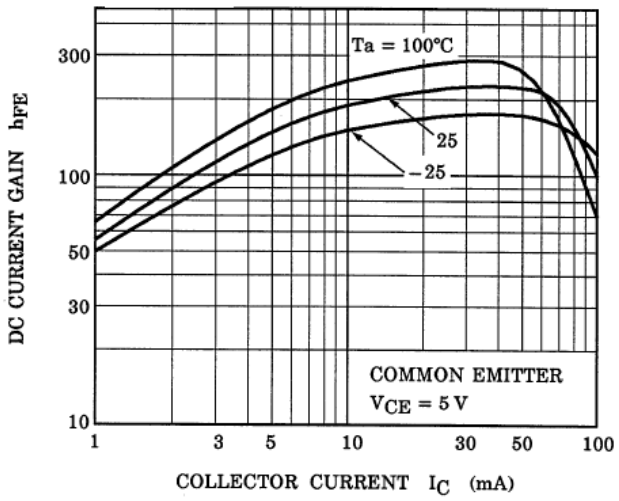


Fig. 10.7 RN1407 h_{FE}-I_C

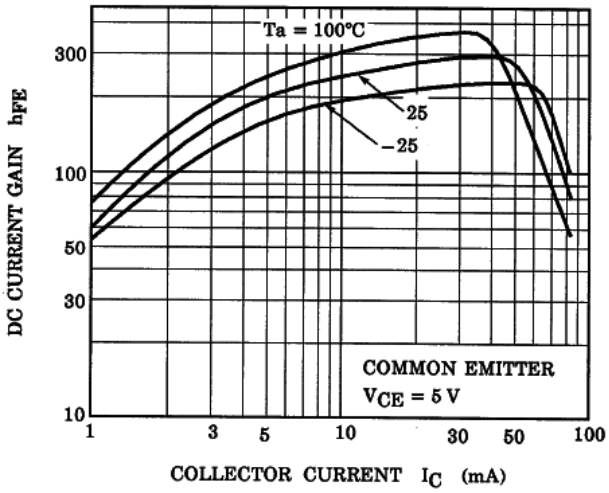


Fig. 10.8 RN1408 h_{FE}-I_C

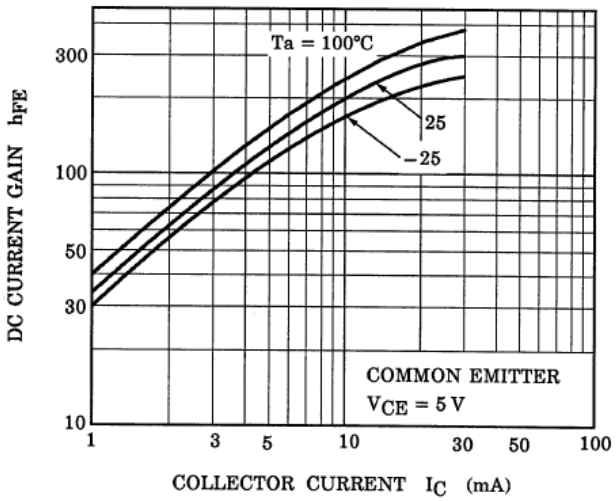


Fig. 10.9 RN1409 h_{FE}-I_C

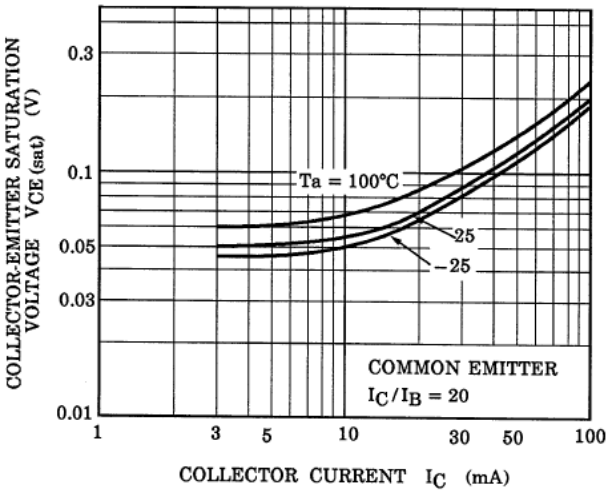


Fig. 10.10 RN1407 $V_{CE(sat)}$-I_C

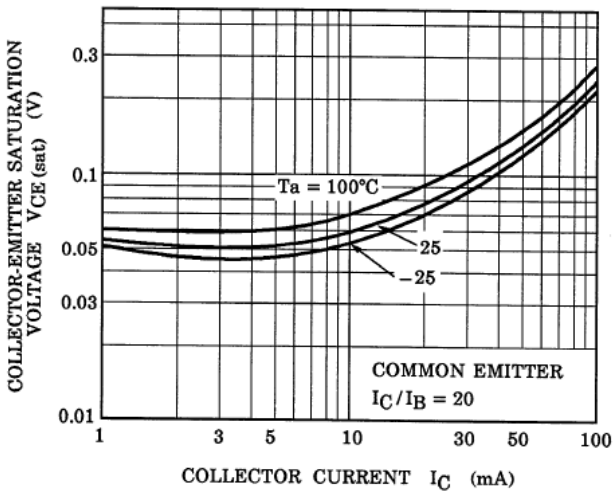


Fig. 10.11 RN1408 $V_{CE(sat)}$-I_C

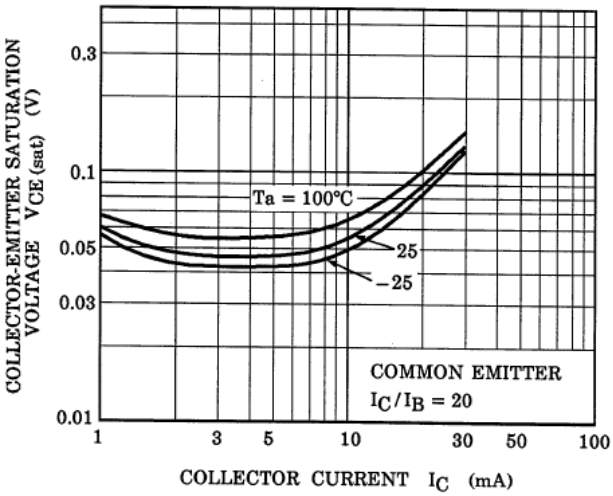
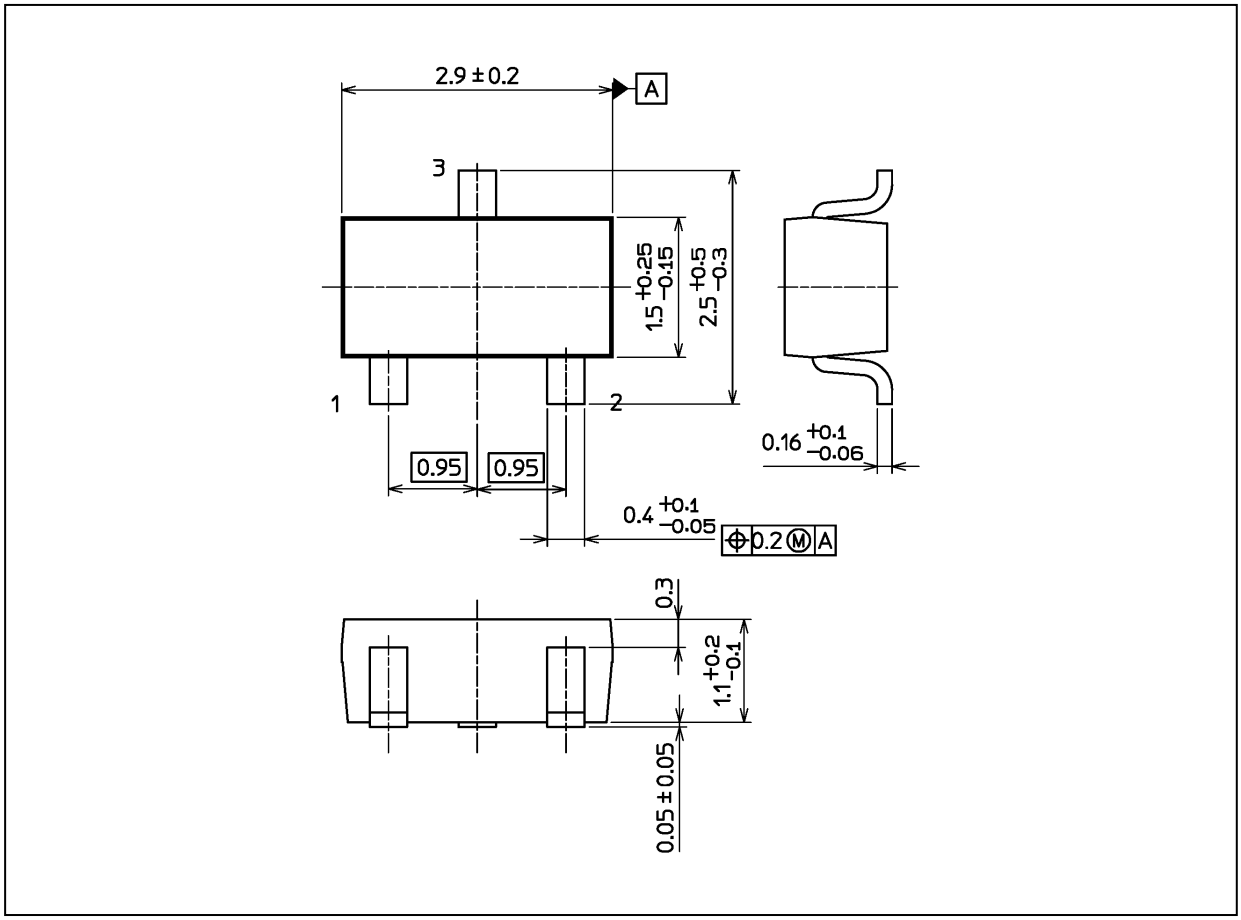


Fig. 10.12 RN1409 $V_{CE(sat)}$-I_C

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

Package Dimensions

Unit: mm



Weight: 12 mg (typ.)

Package Name(s)
TOSHIBA: 2-3F1S
Nickname: S-Mini

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