

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

# RN1407/08/09

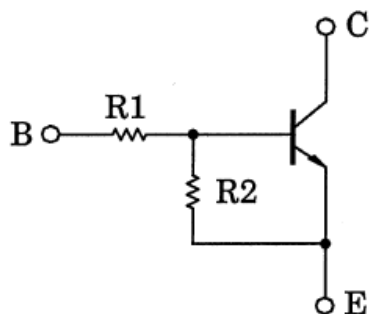
## 1. Applications

- 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



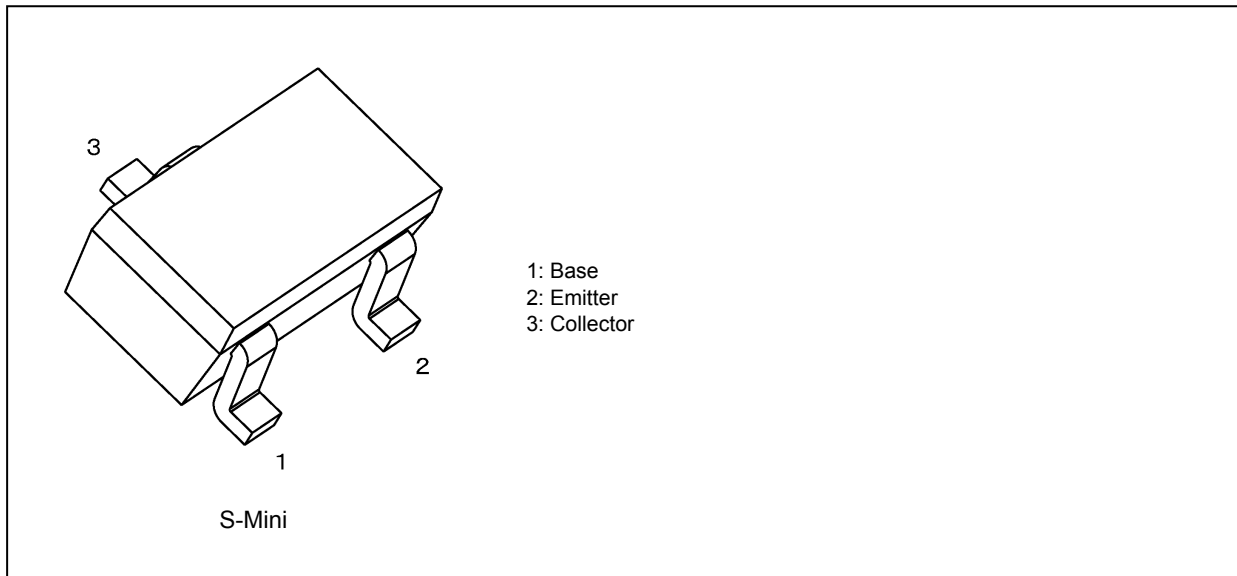
## 4. Bias Resistor Values

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



### 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, $T_a = 25\text{ }^\circ\text{C}$ )

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	$^\circ\text{C}$
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).

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1407~RN1409	$I_{CBO}$	$V_{CB} = 50\text{ V}, I_E = 0\text{ mA}$	—	—	100	nA
		$I_{CEO}$	$V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$	—	—	500	
Emitter cut-off current	RN1407	$I_{EBO}$	$V_{EB} = 6\text{ V}, I_C = 0\text{ mA}$	0.081	—	0.15	mA
	RN1408			0.078	—	0.145	
	RN1409			0.167	—	0.311	
DC current gain	RN1407	$h_{FE}$	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	80	—	—	—
	RN1408			80	—	—	
	RN1409			70	—	—	
Collector-emitter saturation voltage	RN1407~RN1409	$V_{CE(sat)}$	$I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$	—	0.1	0.3	V
Input voltage (ON)	RN1407	$V_{I(ON)}$	$V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$	0.7	—	1.8	V
	RN1408			1.0	—	2.6	
	RN1409			2.2	—	5.8	
Input voltage (OFF)	RN1407	$V_{I(OFF)}$	$V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$	0.5	—	1.0	V
	RN1408			0.6	—	1.16	
	RN1409			1.5	—	2.6	
Transition frequency	RN1407~RN1409	$f_T$	$V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$	—	250	—	MHz
Collector output capacitance	RN1407~RN1409	$C_{ob}$	$V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	3	6	pF
Input resistance	RN1407	$R_1$	-	7	10	13	k $\Omega$
	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

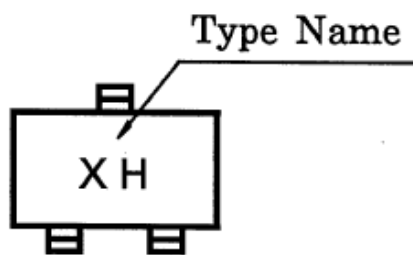


Fig. 9.1 Marking RN1407

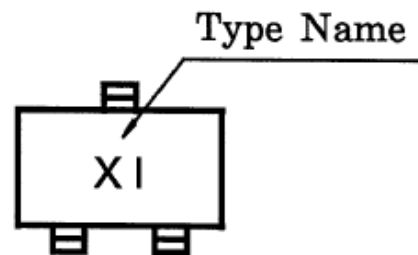


Fig. 9.2 Marking RN1408

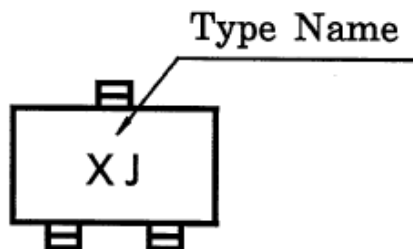


Fig. 9.3 Marking RN1409

### 10. Characteristics Curves (Note)

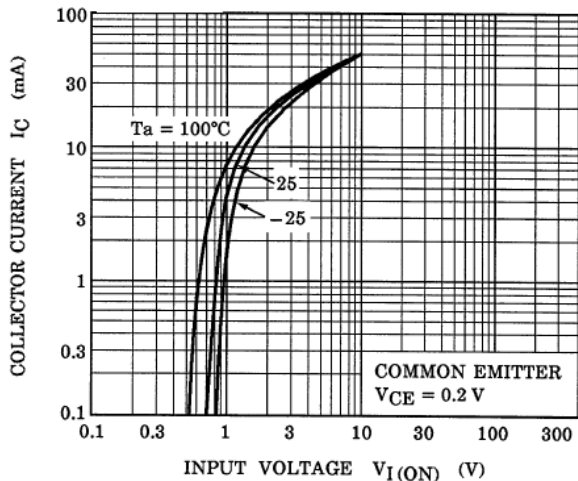


Fig. 10.1 RN1407  $I_C$ - $V_{I(ON)}$

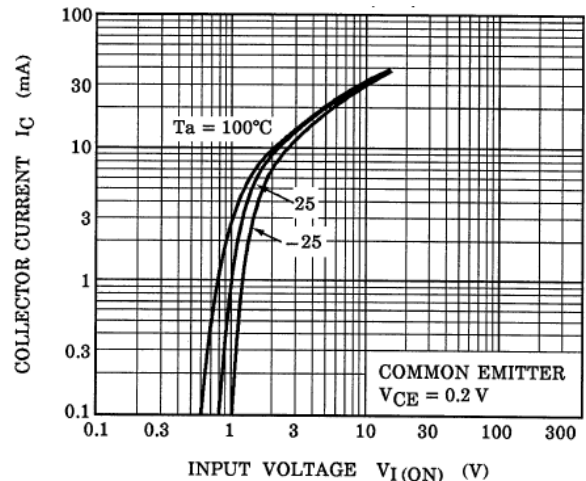


Fig. 10.2 RN1408  $I_C$ - $V_{I(ON)}$

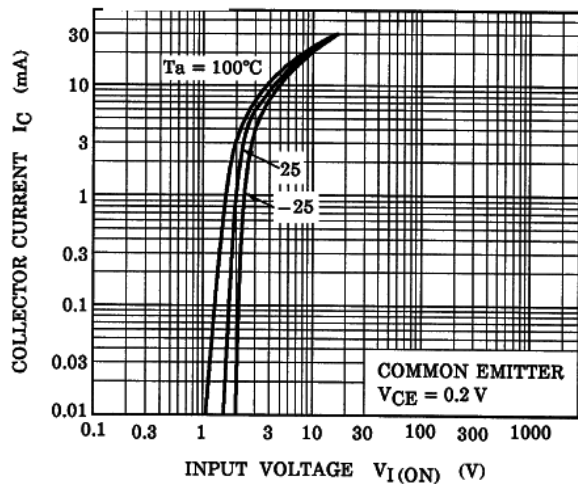


Fig. 10.3 RN1409  $I_C$ - $V_{I(ON)}$

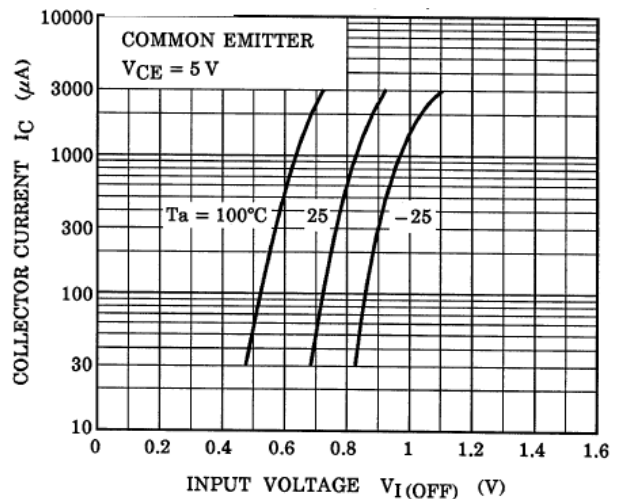


Fig. 10.4 RN1407  $I_C$ - $V_{I(OFF)}$

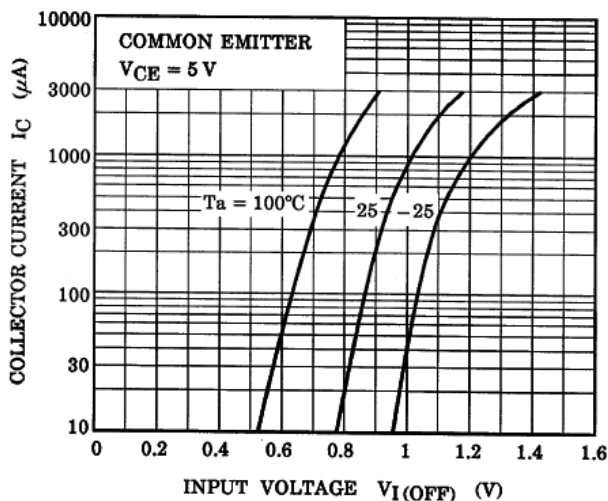


Fig. 10.5 RN1408  $I_C$ - $V_{I(OFF)}$

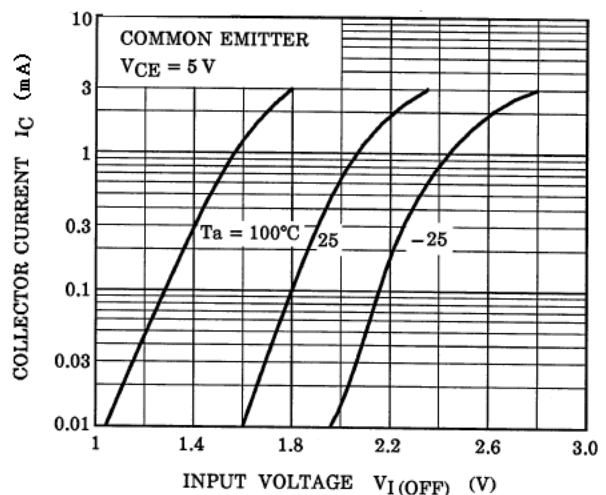


Fig. 10.6 RN1409  $I_C$ - $V_{I(OFF)}$

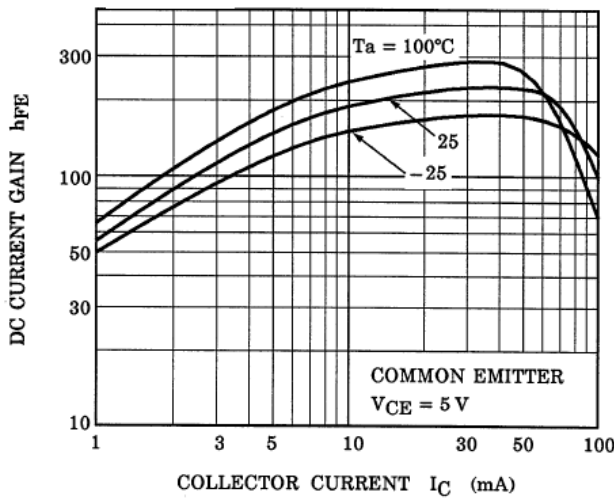


Fig. 10.7 RN1407  $h_{FE}-I_C$

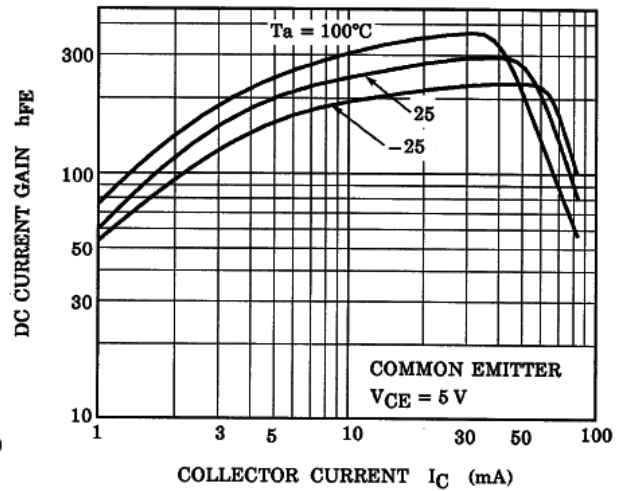


Fig. 10.8 RN1408  $h_{FE}-I_C$

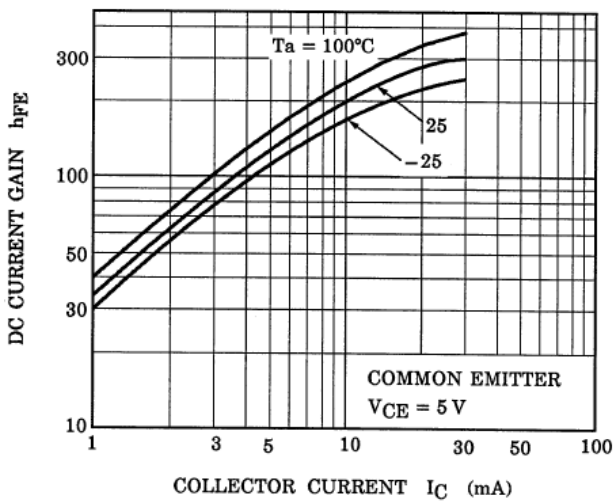


Fig. 10.9 RN1409  $h_{FE}-I_C$

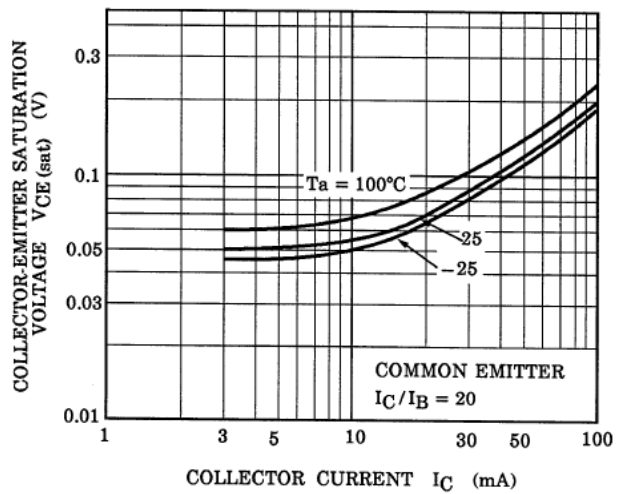


Fig. 10.10 RN1407  $V_{CE(sat)}-I_C$

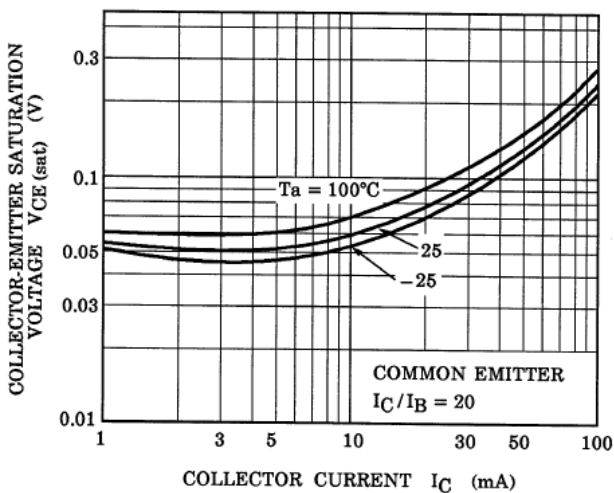


Fig. 10.11 RN1408  $V_{CE(sat)}-I_C$

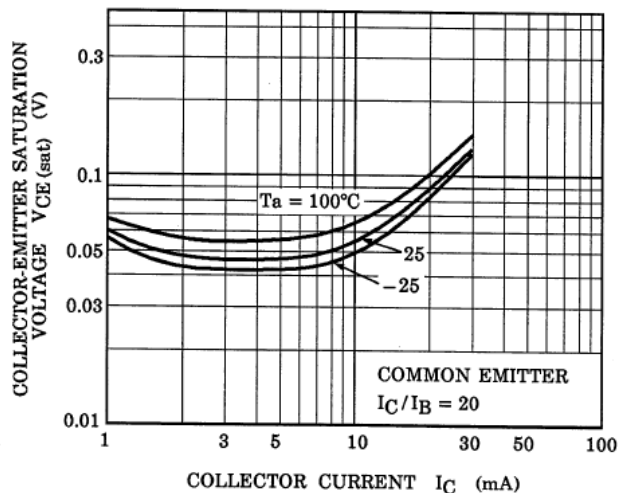
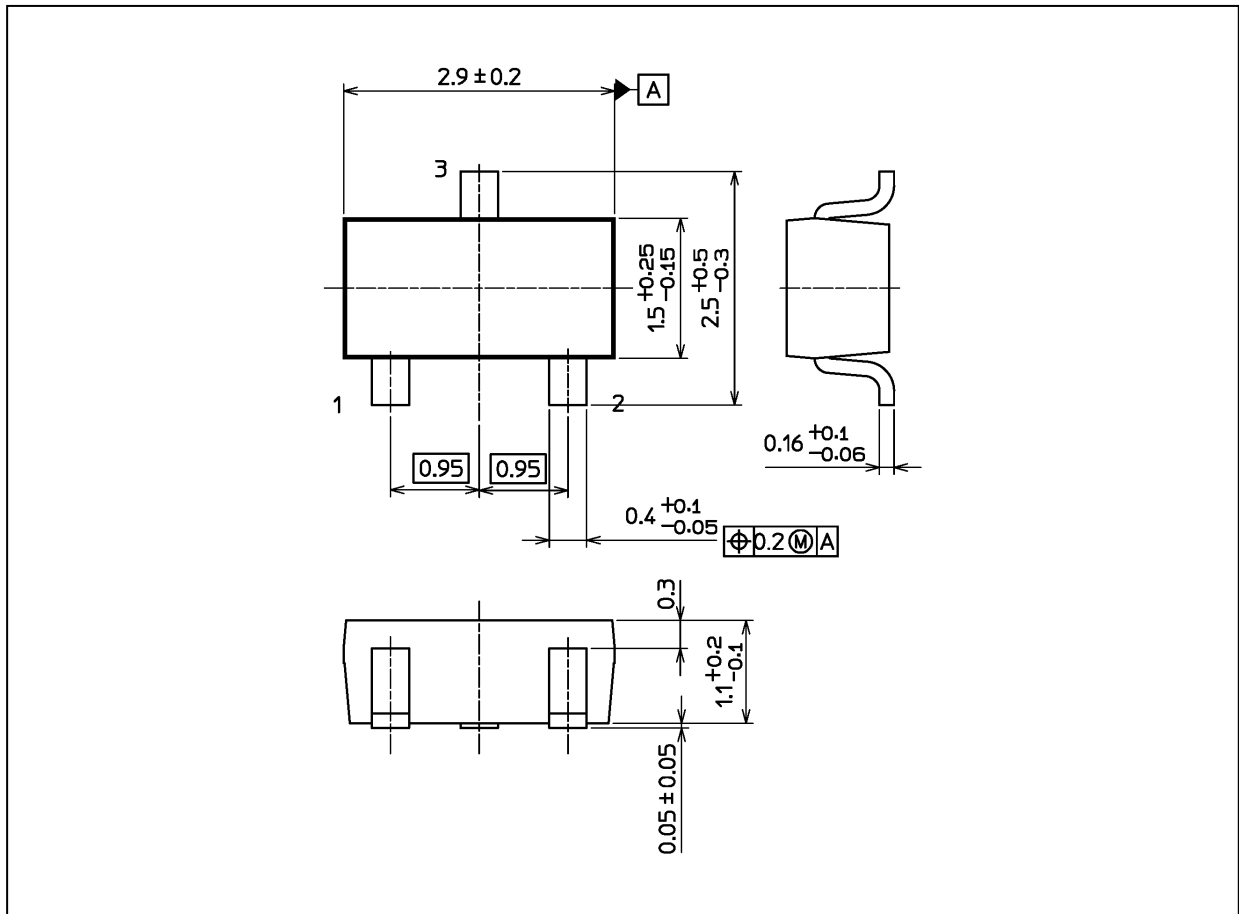


Fig. 10.12 RN1409  $V_{CE(sat)}-I_C$

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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