

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

## RN1412,RN1413

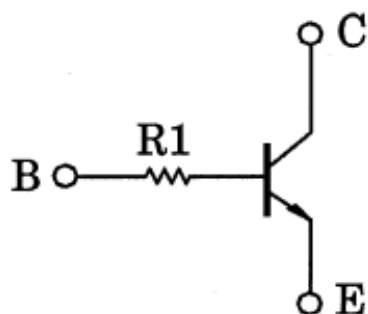
### 1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

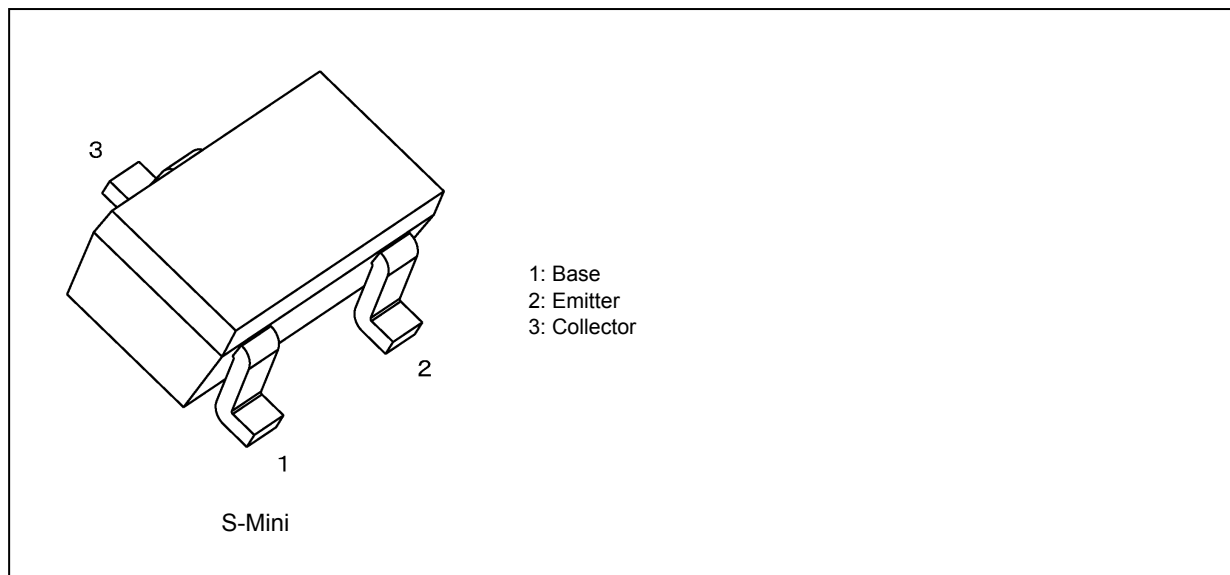
### 2. Features

- (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 RN2412,RN2413

### 3. Equivalent Circuit



### 4. Packaging and Pin Assignment



Start of commercial production

1994-01

### 5. Orderable part number

Orderable part number		AEC-Q101	Note	Note
RN1412	RN1412,LF	—		General Use
	RN1412,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN1412,LXHF	YES		Automotive Use
RN1413	RN1413,LF	—		General Use
	RN1413,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN1413,LXHF	YES		Automotive Use

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

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

Characteristics	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	50	V
Collector-emitter voltage	$V_{CEO}$	50	
Emitter-base voltage	$V_{EBO}$	5	
Collector current	$I_C$	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).

### 7. 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	
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 5\text{ V}, I_C = 0\text{ mA}$	—	—	100		
DC current gain	$h_{FE}$	$V_{CE} = 5\text{ V}, I_C = 1\text{ mA}$	120	—	700	—	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$	—	0.1	0.3	V	
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	
Input resistance	RN1412	$R_1$	-	15.4	22	28.6	k $\Omega$
	RN1413			32.9	47	61.1	

### 8. Marking

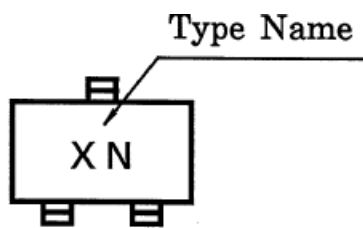


Fig. 8.1 Marking RN1412

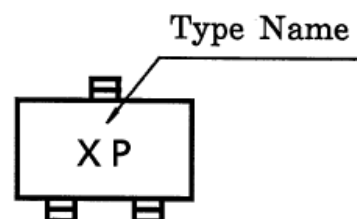


Fig. 8.2 Marking RN1413

## 9. Characteristics Curves (Note)

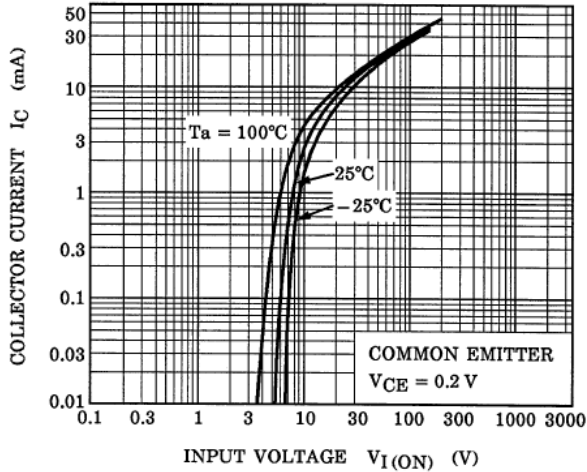


Fig. 9.1 RN1412  $I_C$ - $V_{I(ON)}$

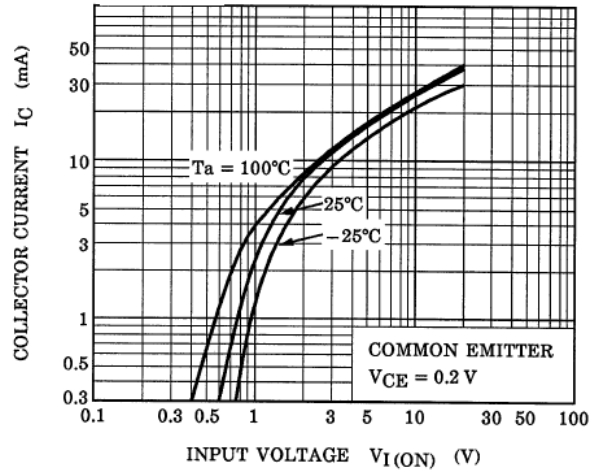


Fig. 9.2 RN1413  $I_C$ - $V_{I(ON)}$

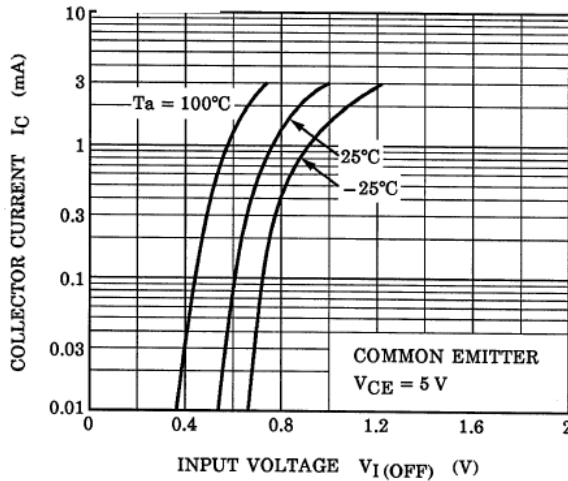


Fig. 9.3 RN1412  $I_C$ - $V_{I(OFF)}$

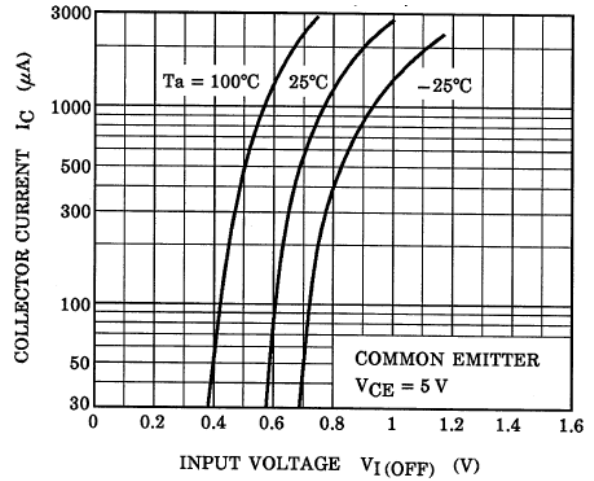


Fig. 9.4 RN1413  $I_C$ - $V_{I(OFF)}$

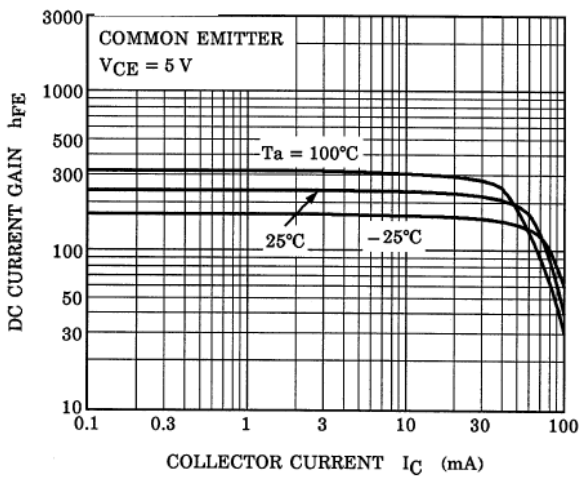


Fig. 9.5 RN1412  $h_{FE}$ - $I_C$

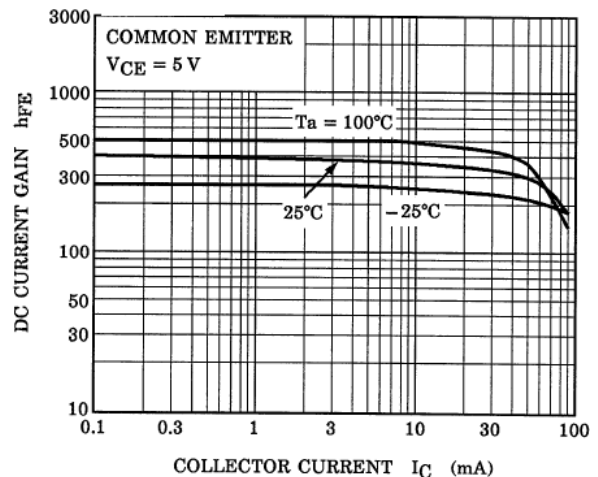


Fig. 9.6 RN1413  $h_{FE}$ - $I_C$

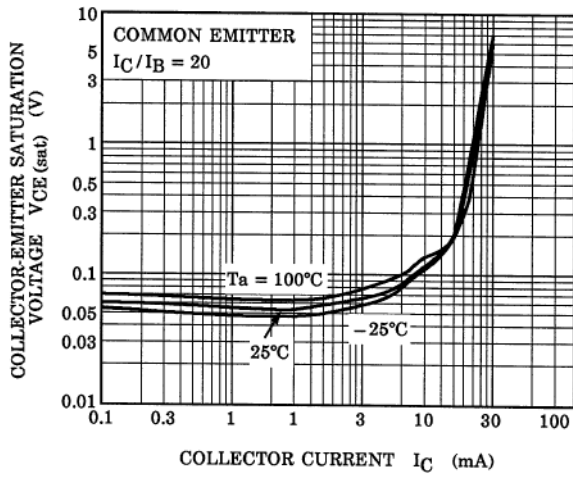


Fig. 9.7 RN1412  $V_{CE(sat)}$ - $I_C$

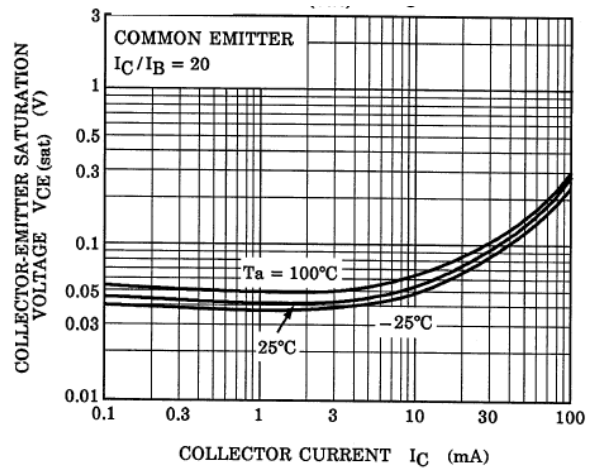
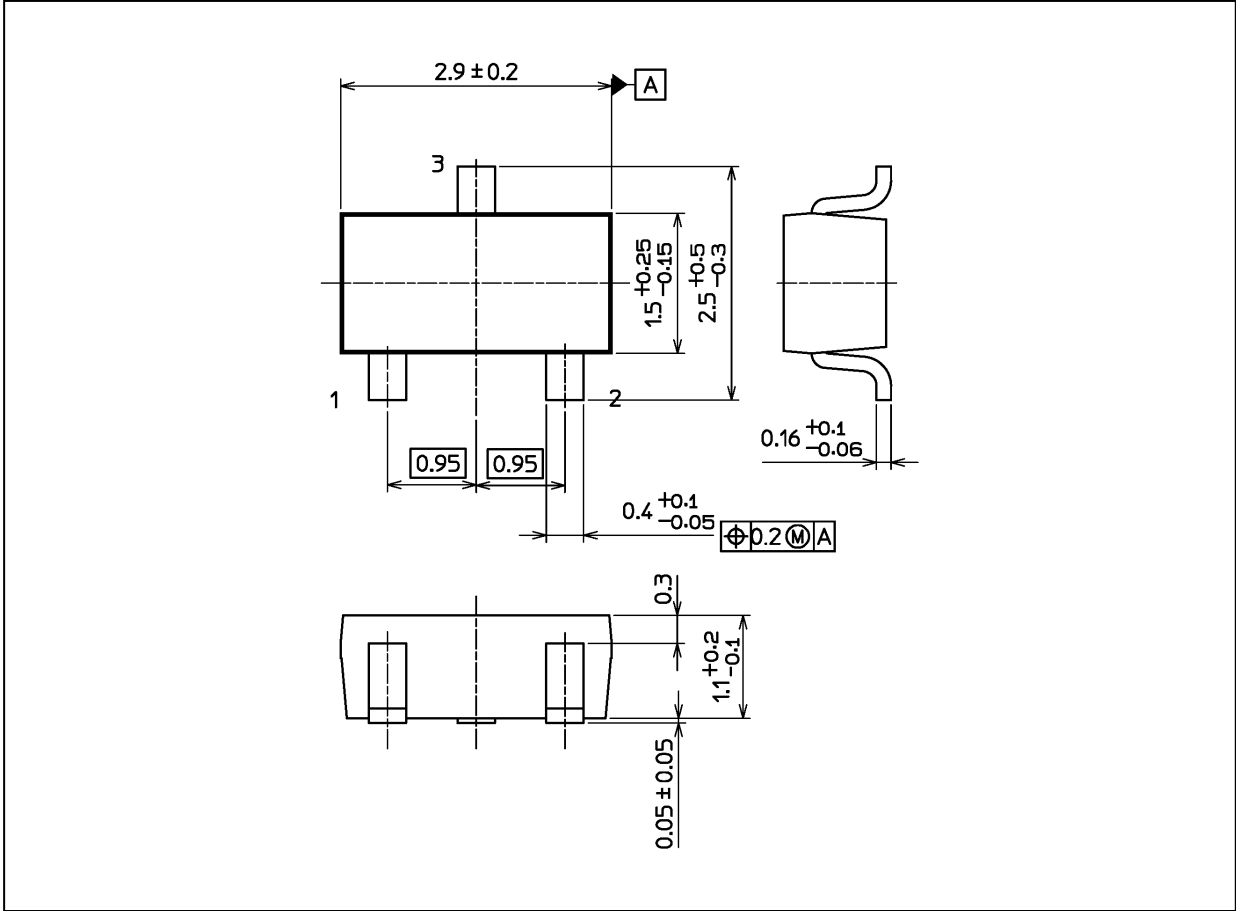


Fig. 9.8 RN1413  $V_{CE(sat)}$ - $I_C$

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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