

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

# RN2101/02/03/04/05/06

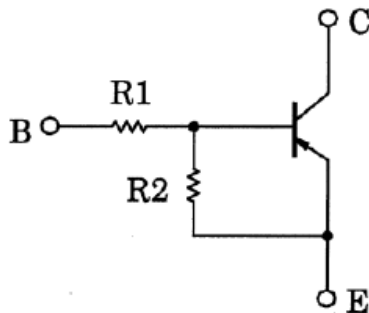
## 1. Applications

- 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 RN1101 to RN1106

## 3. Equivalent Circuit

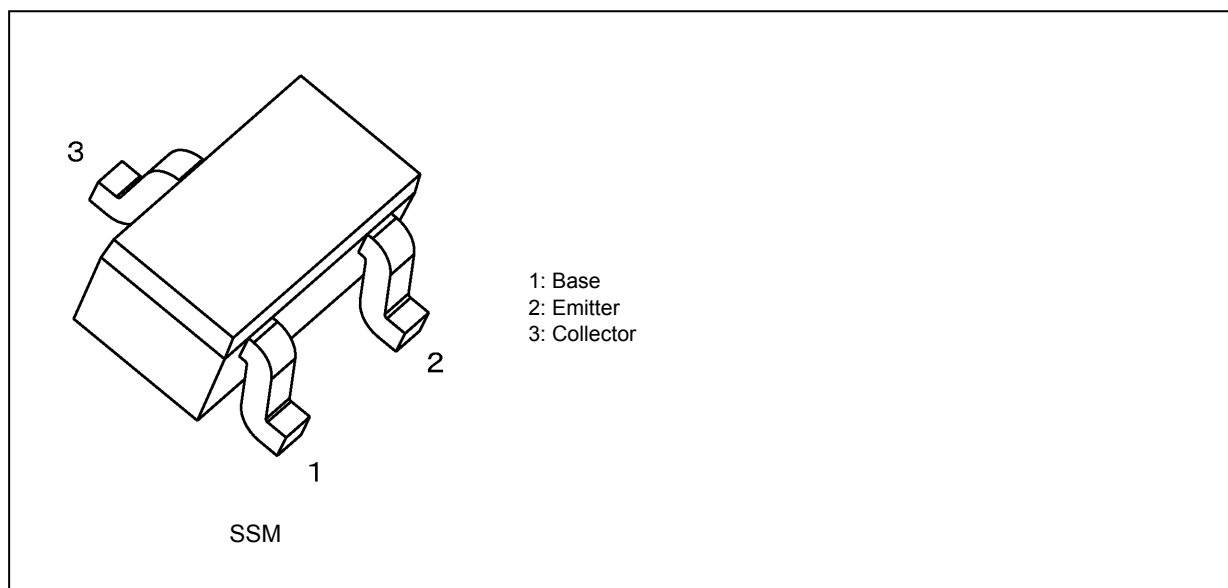


## 4. Bias Resistor Values

Part No.	R1 (kΩ)	R2 (kΩ)
RN2101	4.7	4.7
RN2102	10	10
RN2103	22	22
RN2104	47	47
RN2105	2.2	47
RN2106	4.7	47

Start of commercial production  
1990-12

## 5. Packaging and Pin Assignment



## 6. Orderable part number

Orderable part number		AEC-Q101	Note	Note
RN2101	RN2101,LF	—		General Use
	RN2101,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2101,LXHf	YES		Automotive Use
RN2102	RN2102,LF	—		General Use
	RN2102,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2102,LXHf	YES		Automotive Use
RN2103	RN2103,LF	—		General Use
	RN2103,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2103,LXHf	YES		Automotive Use
RN2104	RN2104,LF	—		General Use
	RN2104,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2104,LXHf	YES		Automotive Use
RN2105	RN2105,LF	—		General Use
	RN2105,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2105,LXHf	YES		Automotive Use
RN2106	RN2106,LF	—		General Use
	RN2106,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2106,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	RN2101~RN2106	$V_{CBO}$	-50	V
Collector-emitter voltage		$V_{CEO}$	-50	
Emitter-base voltage	RN2101~RN2104	$V_{EBO}$	-10	
	RN2105,RN2106		-5	
Collector current	RN2101~RN2106	$I_C$	-100	mA
Collector power dissipation		$P_C$	100	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, $T_a = 25^\circ\text{C}$ )

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN2101~ RN2106	$I_{CBO}$	$V_{CB} = -50\text{ V}, I_E = 0\text{ mA}$	—	—	-100	nA
		$I_{CEO}$	$V_{CE} = -50\text{ V}, I_B = 0\text{ mA}$	—	—	-500	
Emitter cut-off current	RN2101	$I_{EBO}$	$V_{EB} = -10\text{ V}, I_C = 0\text{ mA}$	-0.82	—	-1.52	mA
	RN2102			-0.38	—	-0.71	
	RN2103			-0.17	—	-0.33	
	RN2104			-0.082	—	-0.15	
	RN2105		$V_{EB} = -5\text{ V}, I_C = 0\text{ mA}$	-0.078	—	-0.145	
	RN2106			-0.074	—	-0.138	
DC current gain	RN2101	$h_{FE}$	$V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$	30	—	—	—
	RN2102			50	—	—	
	RN2103			70	—	—	
	RN2104			80	—	—	
	RN2105			80	—	—	
	RN2106			80	—	—	
Collector-emitter saturation voltage	RN2101~ RN2106	$V_{CE(sat)}$	$I_C = -5\text{ mA}, I_B = -0.25\text{ mA}$	—	-0.1	-0.3	V
Input voltage (ON)	RN2101	$V_{I(ON)}$	$V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$	-1.1	—	-2.0	V
	RN2102			-1.2	—	-2.4	
	RN2103			-1.3	—	-3.0	
	RN2104			-1.5	—	-5.0	
	RN2105			-0.6	—	-1.1	
	RN2106			-0.7	—	-1.3	
Input voltage (OFF)	RN2101~ RN2104	$V_{I(OFF)}$	$V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$	-1.0	—	-1.5	V
	RN2105, RN2106			-0.5	—	-0.8	
Transition frequency	RN2101~ RN2106	$f_T$	$V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$	—	200	—	MHz
Collector output capacitance	RN2101~ RN2106	$C_{ob}$	$V_{CB} = -10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	3	6	pF
Input resistance	RN2101	$R_1$	-	3.29	4.7	6.11	k $\Omega$
	RN2102			7	10	13	
	RN2103			15.4	22	28.6	
	RN2104			32.9	47	61.1	
	RN2105			1.54	2.2	2.86	
	RN2106			3.29	4.7	6.11	
Resistor ratio	RN2101~ RN2104	R1/R2	-	0.9	1.0	1.1	—
	RN2105			0.0421	0.0468	0.0515	
	RN2106			0.09	0.1	0.11	

## 9. Marking

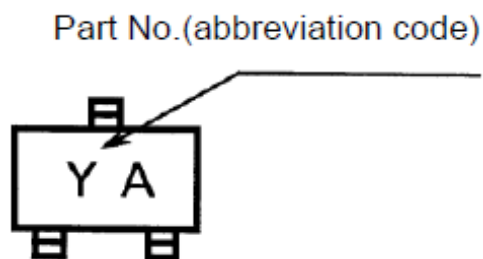


Fig. 9.1 Marking RN2101

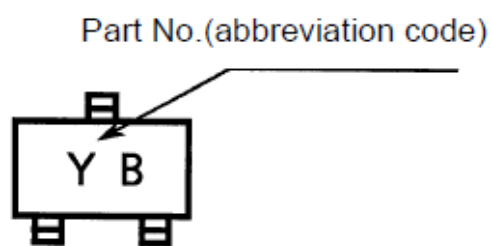


Fig. 9.2 Marking RN2102

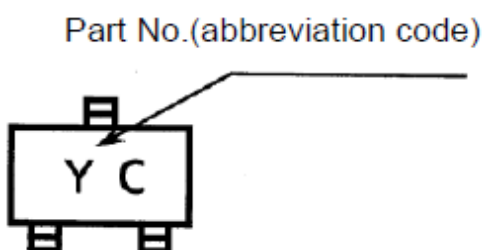


Fig. 9.3 Marking RN2103

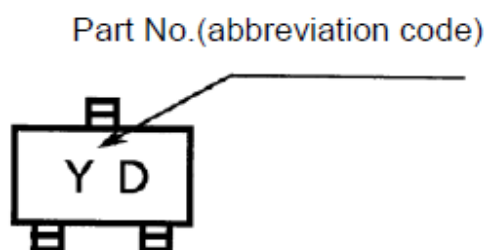


Fig. 9.4 Marking RN2104

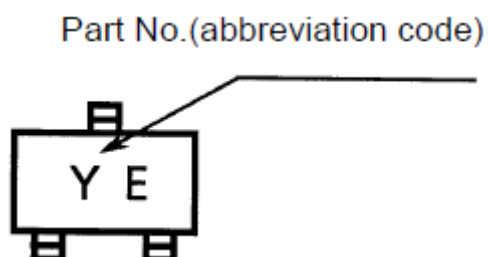


Fig. 9.5 Marking RN2105

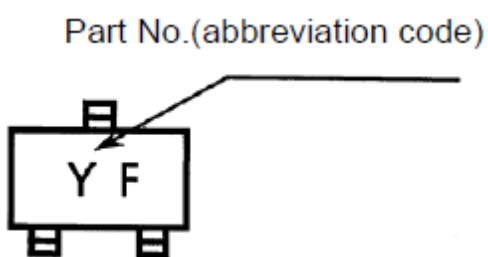


Fig. 9.6 Marking RN2106

### 10. Characteristics Curves (Note)

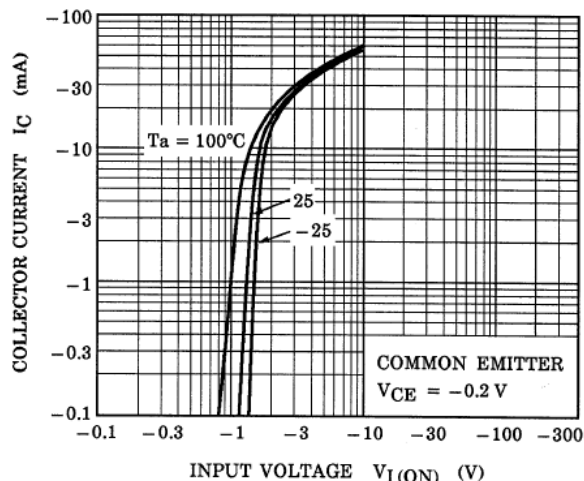


Fig. 10.1 RN2101  $I_C$ - $V_{I(ON)}$

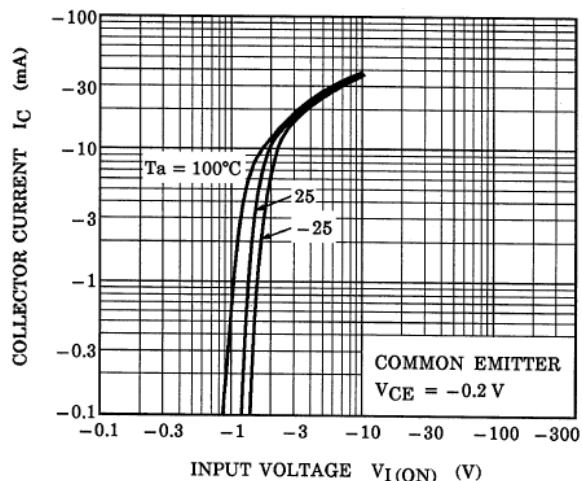


Fig. 10.2 RN2102  $I_C$ - $V_{I(ON)}$

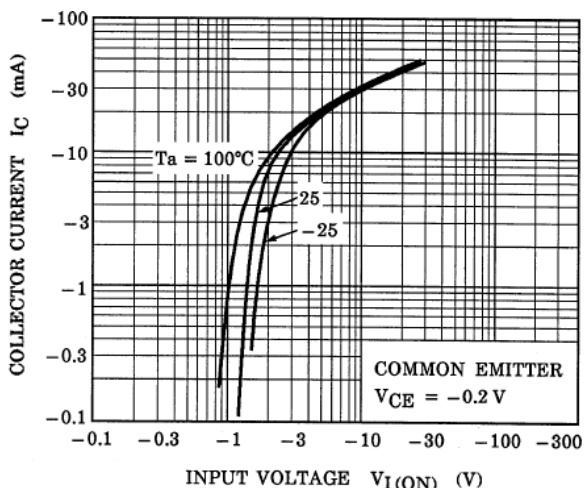


Fig. 10.3 RN2103  $I_C$ - $V_{I(ON)}$

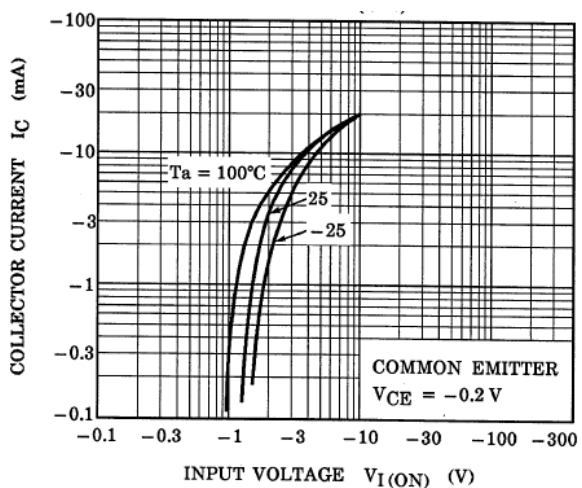


Fig. 10.4 RN2104  $I_C$ - $V_{I(ON)}$

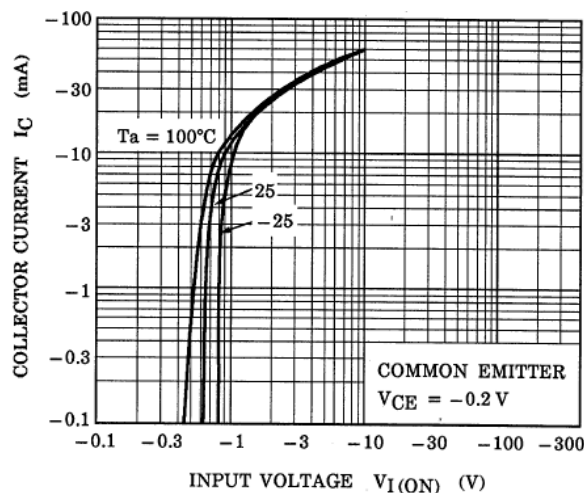


Fig. 10.5 RN2105  $I_C$ - $V_{I(ON)}$

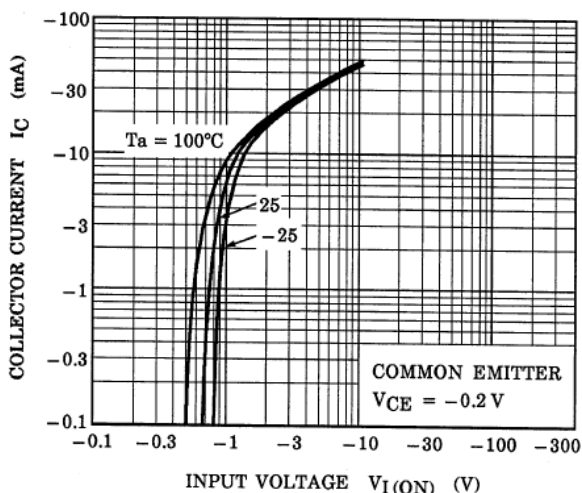


Fig. 10.6 RN2106  $I_C$ - $V_{I(ON)}$

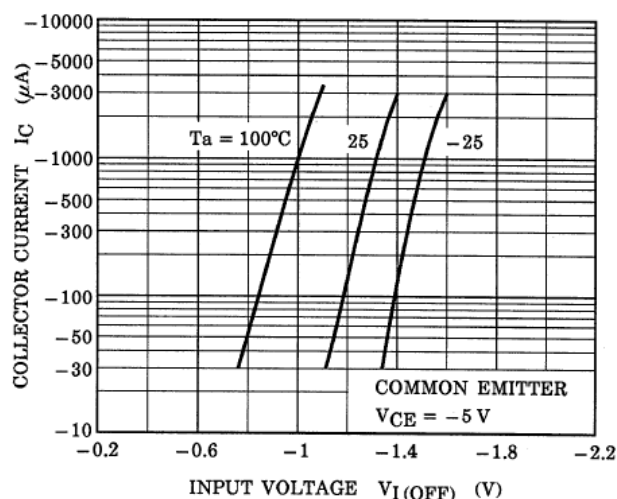


Fig. 10.7 RN2101  $I_C$ - $V_{I(OFF)}$

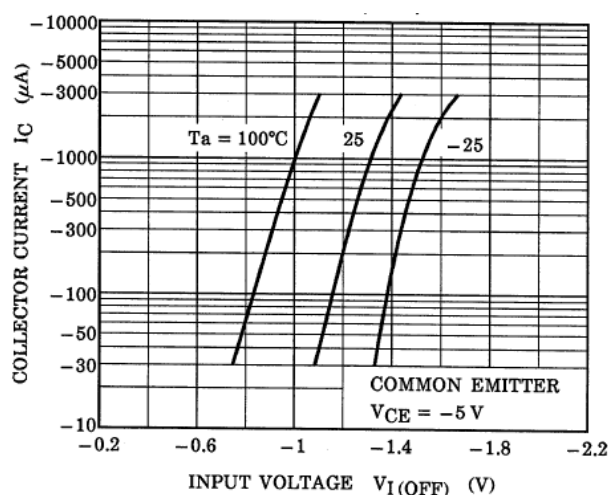


Fig. 10.8 RN2102  $I_C$ - $V_{I(OFF)}$

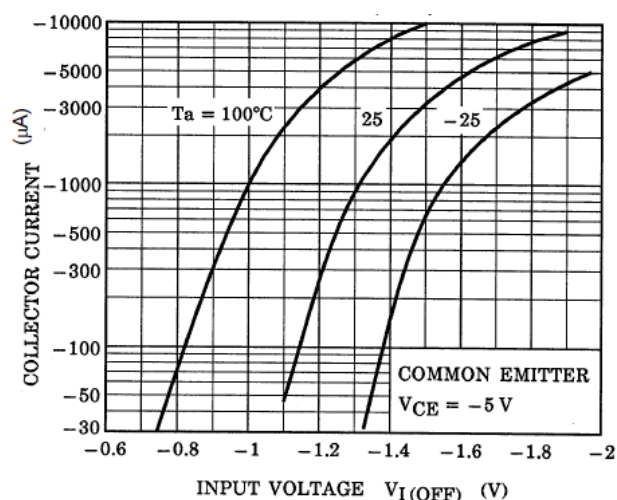


Fig. 10.9 RN2103  $I_C$ - $V_{I(OFF)}$

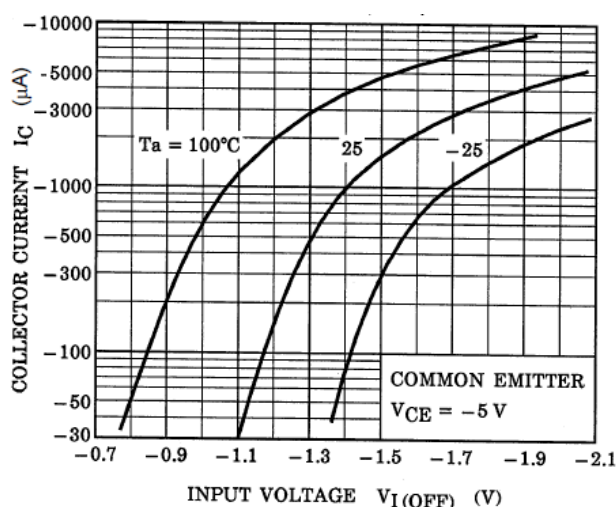


Fig. 10.10 RN2104  $I_C$ - $V_{I(OFF)}$

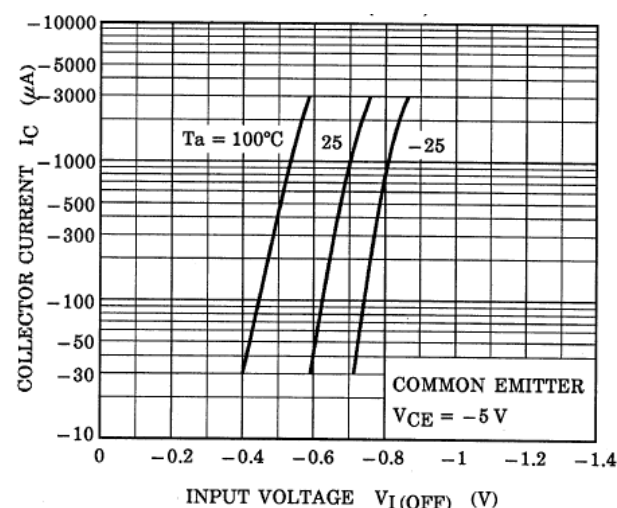


Fig. 10.11 RN2105  $I_C$ - $V_{I(OFF)}$

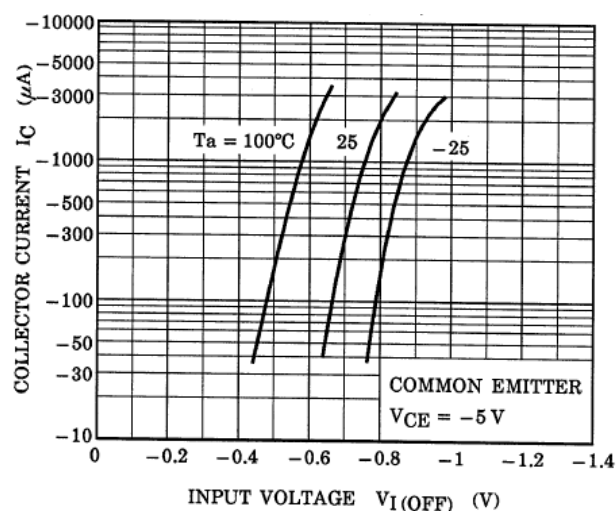


Fig. 10.12 RN2106  $I_C$ - $V_{I(OFF)}$



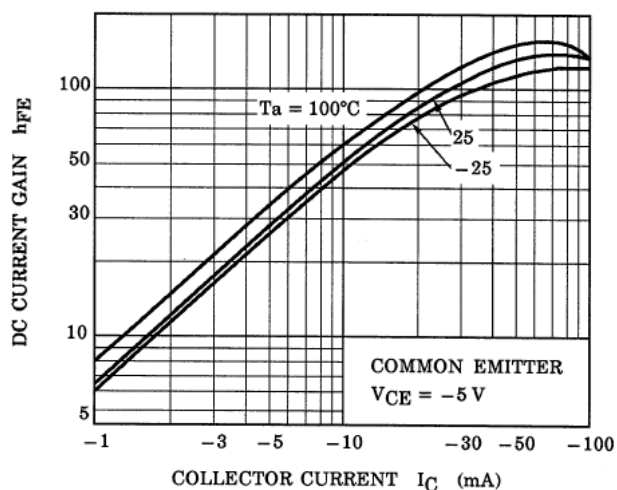


Fig. 10.13 RN2101  $h_{FE}$ - $I_C$

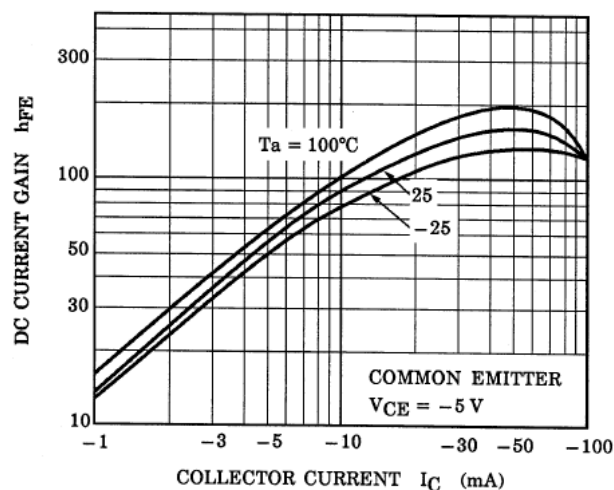


Fig. 10.14 RN2102  $h_{FE}$ - $I_C$

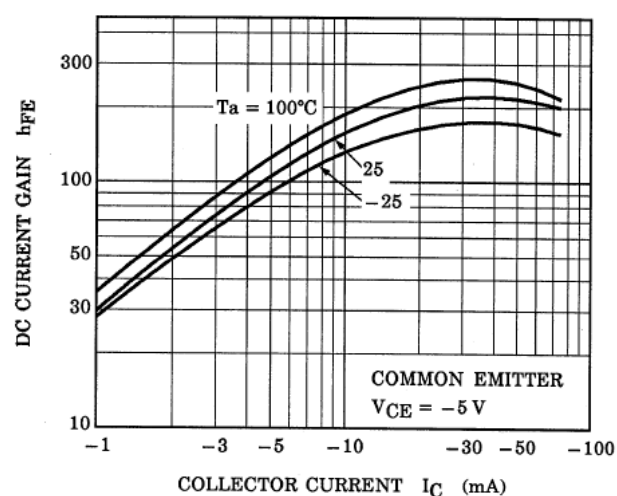


Fig. 10.15 RN2103  $h_{FE}$ - $I_C$

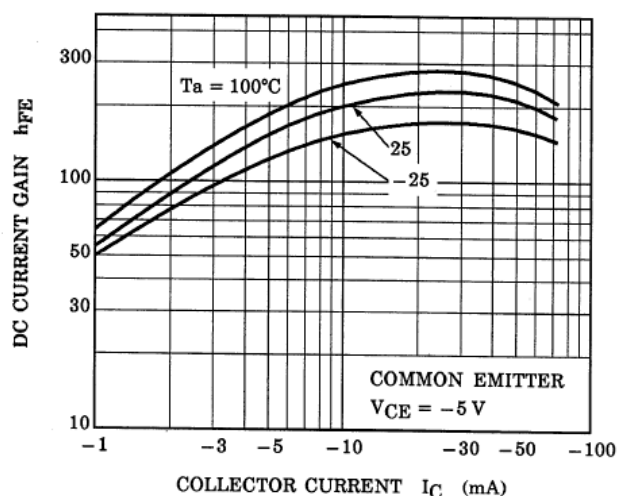


Fig. 10.16 RN2104  $h_{FE}$ - $I_C$

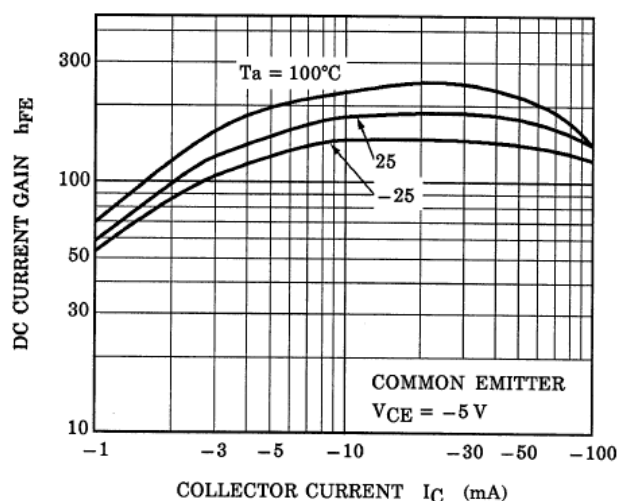


Fig. 10.17 RN2105  $h_{FE}$ - $I_C$

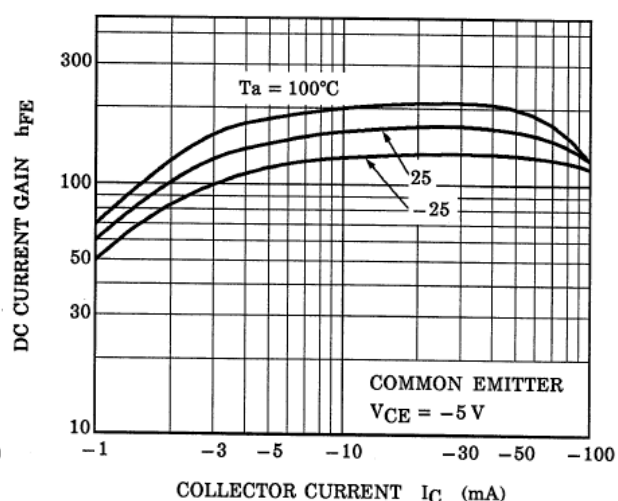


Fig. 10.18 RN2106  $h_{FE}$ - $I_C$



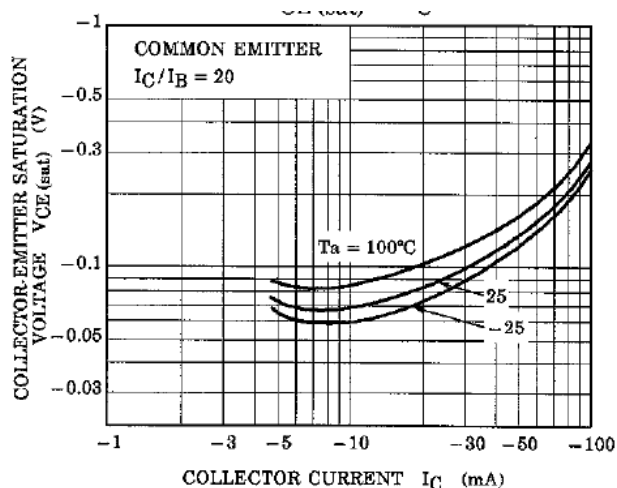


Fig. 10.19 RN2101  $V_{CE(sat)}-I_C$

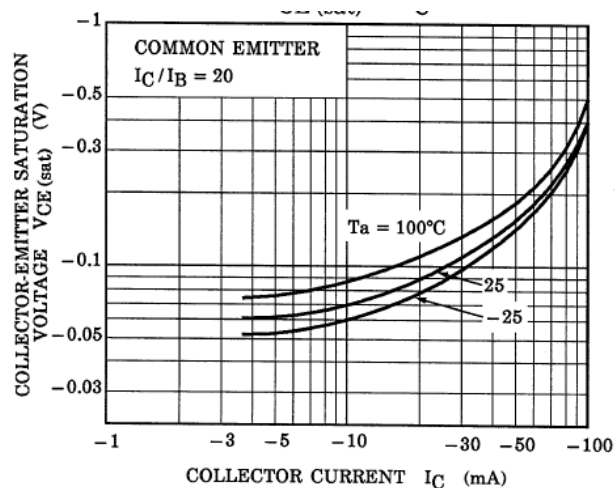


Fig. 10.20 RN2102  $V_{CE(sat)}-I_C$

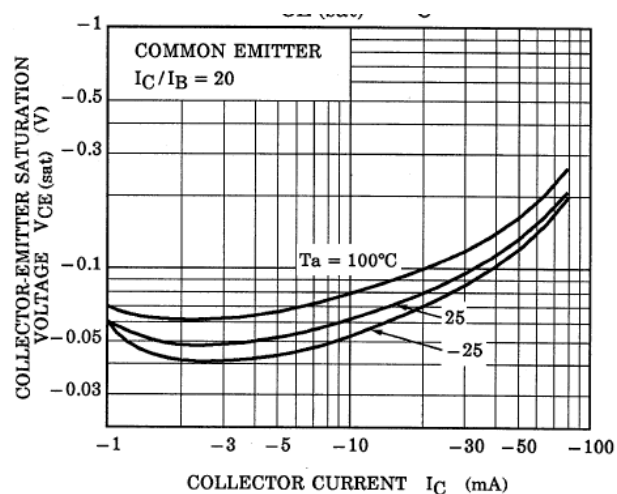


Fig. 10.21 RN2103  $V_{CE(sat)}-I_C$

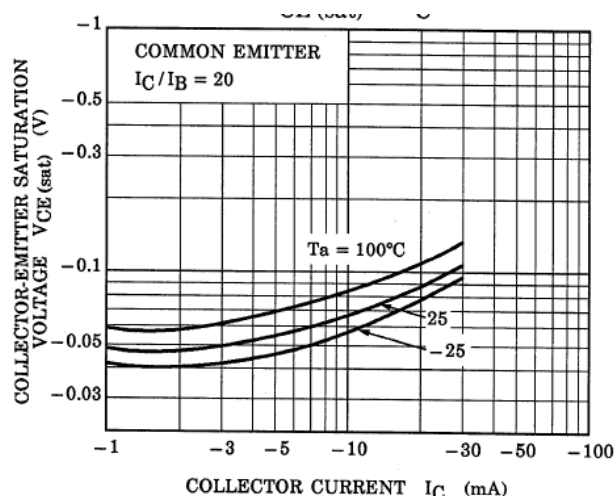


Fig. 10.22 RN2104  $V_{CE(sat)}-I_C$

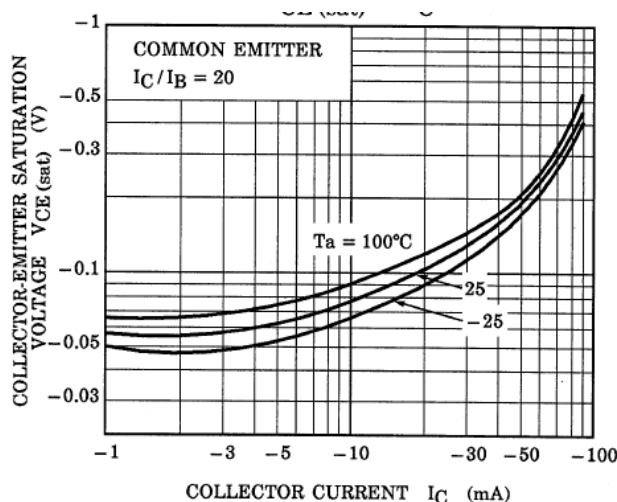


Fig. 10.23 RN2105  $V_{CE(sat)}-I_C$

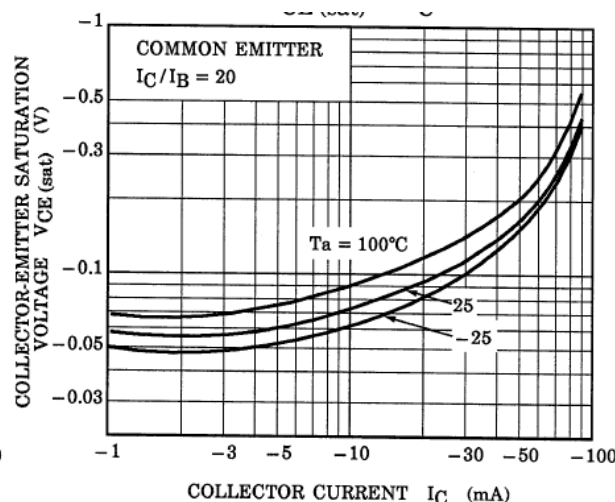
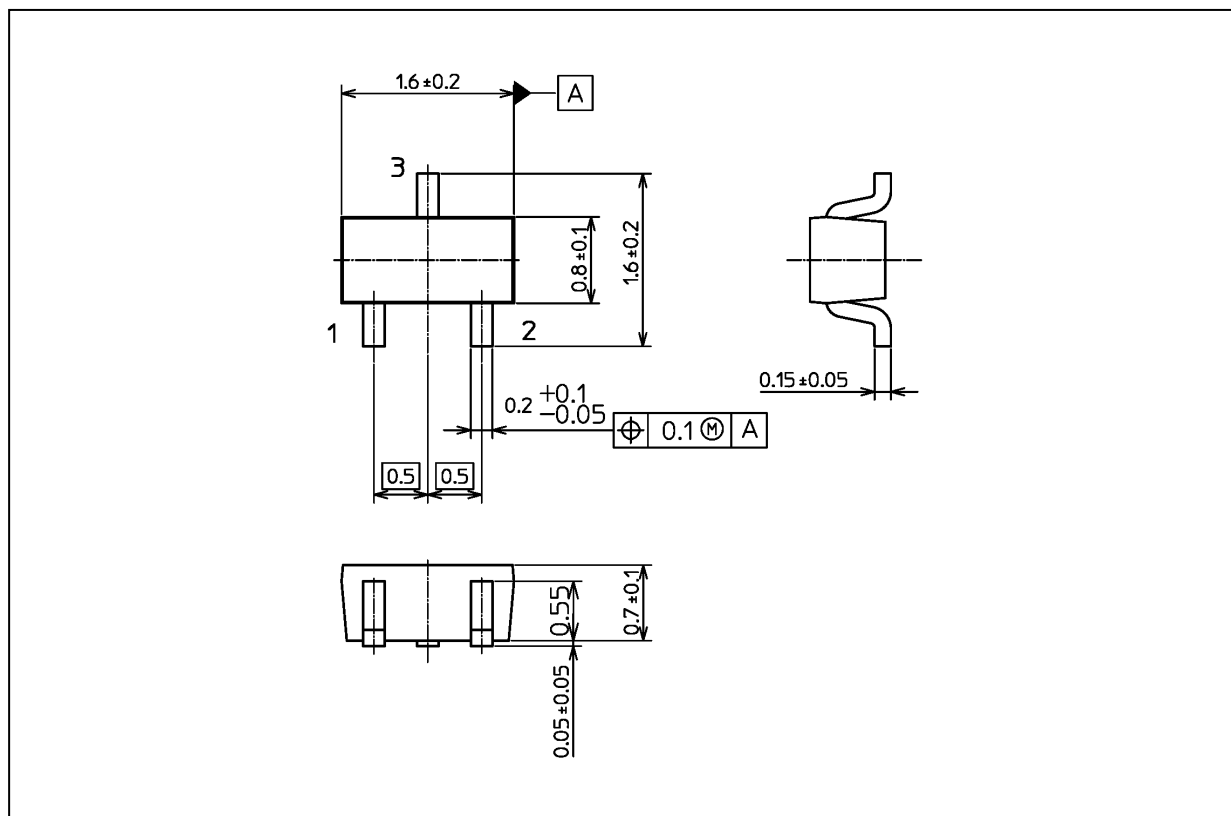


Fig. 10.24 RN2106  $V_{CE(sat)}-I_C$

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

## Package Dimensions

Unit: mm



Weight: 2.4 mg (typ.)

Package Name(s)
TOSHIBA: 2-2H1S
Nickname: SSM

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