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

RN2401/02/03/04/05/06

1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

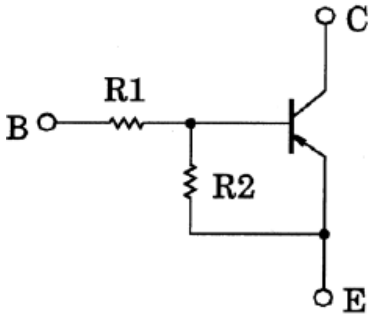
(1) AEC-Q101 qualified (Please see the orderable part number list)

(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 RN1401 to RN1406

3. Equivalent Circuit

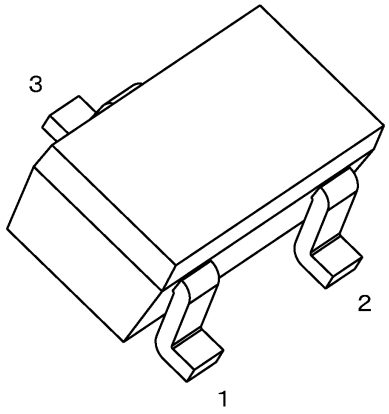


4. Bias Resistor Values

Part No.	R1 (kΩ)	R2 (kΩ)
RN2401	4.7	4.7
RN2402	10	10
RN2403	22	22
RN2404	47	47
RN2405	2.2	47
RN2406	4.7	47

Start of commercial production
1983-06

5. Packaging and Pin Assignment



1: Base
2: Emitter
3: Collector

S-Mini

6. Orderable part number

Orderable part number		AEC-Q101	Note	Note	
RN2401	RN2401,LF	—		General Use	
	RN2401,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2401,LXHF	YES		Automotive Use	
RN2402	RN2402,LF	—		General Use	
	RN2402,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2402,LXHF	YES		Automotive Use	
RN2403	RN2403,LF	—		General Use	
	RN2403,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2403,LXHF	YES		Automotive Use	
RN2404	RN2404,LF	—		General Use	
	RN2404,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2404,LXHF	YES		Automotive Use	
RN2405	RN2405,LF	—		General Use	
	RN2405,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2405,LXHF	YES		Automotive Use	
RN2406	RN2406,LF	—		General Use	
	RN2406,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2406,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	RN2401～RN2406	V_{CBO}	-50	V
Collector-emitter voltage		V_{CEO}	-50	
Emitter-base voltage	RN2401～RN2404	V_{EBO}	-10	
	RN2405,RN2406		-5	
Collector current	RN2401～RN2406	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	RN2401～RN2406	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	RN2401	I_{EBO}	V_{EB} = -10 V, I_C = 0 mA	-0.82	—	-1.52	mA
	RN2402			-0.38	—	-0.71	
	RN2403			-0.17	—	-0.33	
	RN2404			-0.082	—	-0.15	
	RN2405		V_{EB} = -5 V, I_C = 0 mA	-0.078	—	-0.145	
	RN2406			-0.074	—	-0.138	
DC current gain	RN2401	h_{FE}	V_{CE} = -5 V, I_C = -10 mA	30	—	—	—
	RN2402			50	—	—	
	RN2403			70	—	—	
	RN2404			80	—	—	
	RN2405			80	—	—	
	RN2406			80	—	—	
Collector-emitter saturation voltage	RN2401～RN2406	$V_{CE(sat)}$	I_C = -5 mA, I_B = -0.25 mA	—	-0.1	-0.3	V
Input voltage (ON)	RN2401	$V_{I(ON)}$	V_{CE} = -0.2 V, I_C = -5 mA	-1.1	—	-2.0	
	RN2402			-1.2	—	-2.4	
	RN2403			-1.3	—	-3.0	
	RN2404			-1.5	—	-5.0	
	RN2405			-0.6	—	-1.1	
	RN2406			-0.7	—	-1.3	
Input voltage (OFF)	RN2401～RN2404	$V_{I(OFF)}$	V_{CE} = -5 V, I_C = -0.1 mA	-1.0	—	-1.5	
	RN2405, RN2406			-0.5	—	-0.8	
Transition frequency	RN2401～RN2406	f_T	V_{CE} = -10 V, I_C = -5 mA	—	200	—	MHz
Collector output capacitance	RN2401～RN2406	C_{ob}	V_{CB} = -10 V, I_E = 0 mA, f = 1 MHz	—	3	6	pF
Input resistance	RN2401	R_1	-	3.29	4.7	6.11	kΩ
	RN2402			7	10	13	
	RN2403			15.4	22	28.6	
	RN2404			32.9	47	61.1	
	RN2405			1.54	2.2	2.86	
	RN2406			3.29	4.7	6.11	
Resistor ratio	RN2401～RN2404	R1/R2	-	0.9	1.0	1.1	—
	RN2405			0.0421	0.0468	0.0515	
	RN2406			0.09	0.1	0.11	

9. Marking

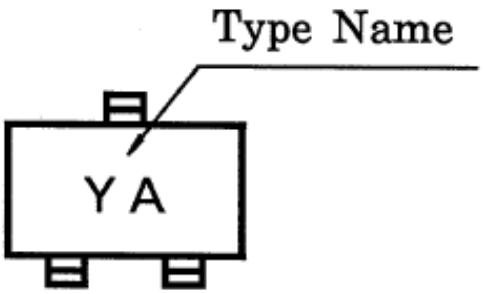


Fig. 9.1 Marking RN2401

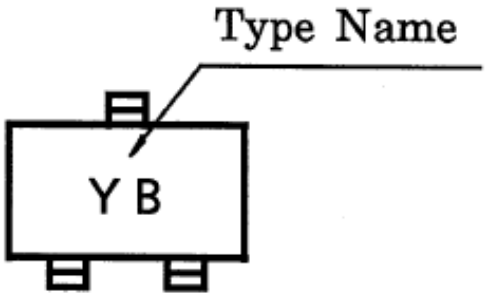


Fig. 9.2 Marking RN2402

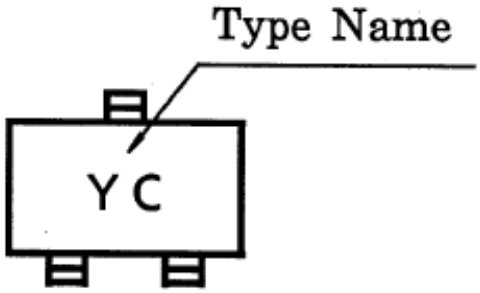


Fig. 9.3 Marking RN2403

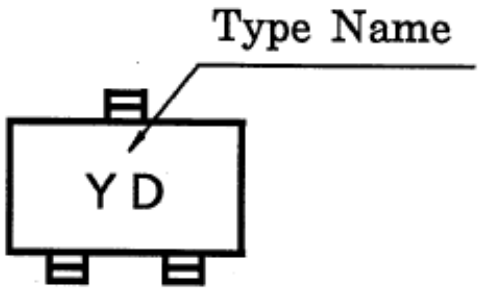


Fig. 9.4 Marking RN2404

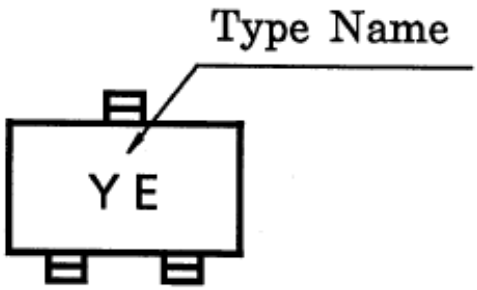


Fig. 9.5 Marking RN2405

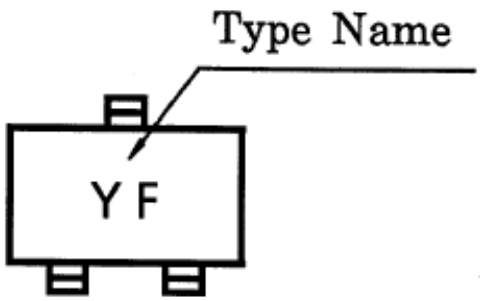


Fig. 9.6 Marking RN2406

10. Characteristics Curves (Note)

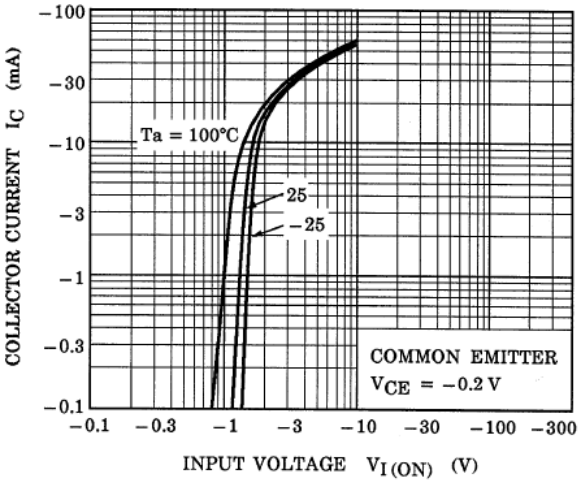


Fig. 10.1 RN2401 I_C-$V_{I(ON)}$

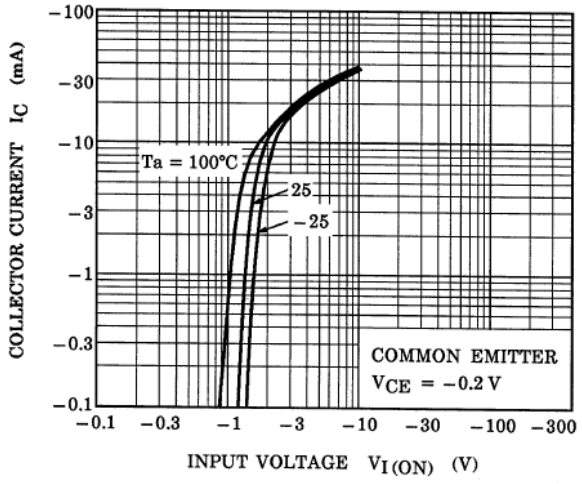


Fig. 10.2 RN2402 I_C-$V_{I(ON)}$

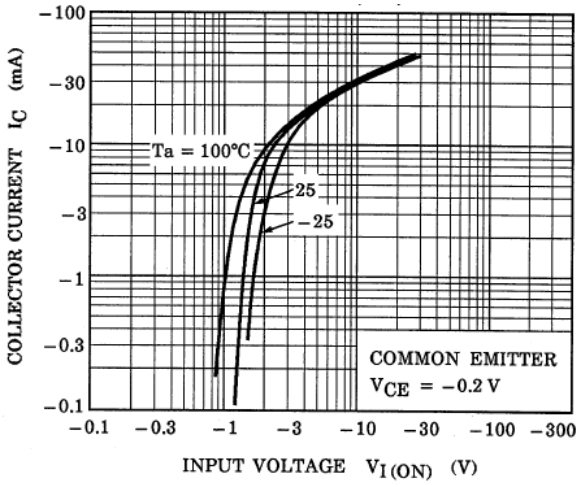


Fig. 10.3 RN2403 I_C-$V_{I(ON)}$

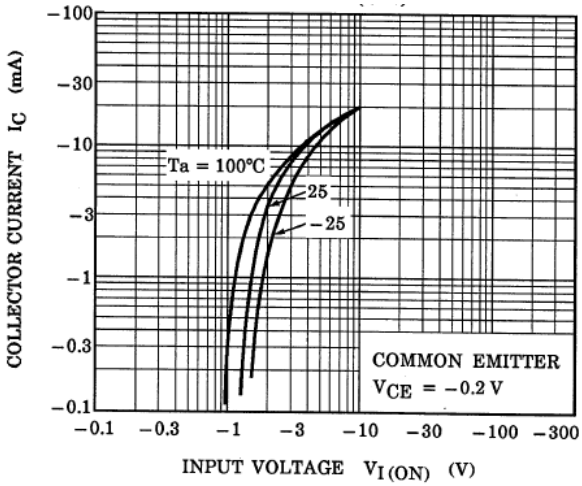


Fig. 10.4 RN2404 I_C-$V_{I(ON)}$

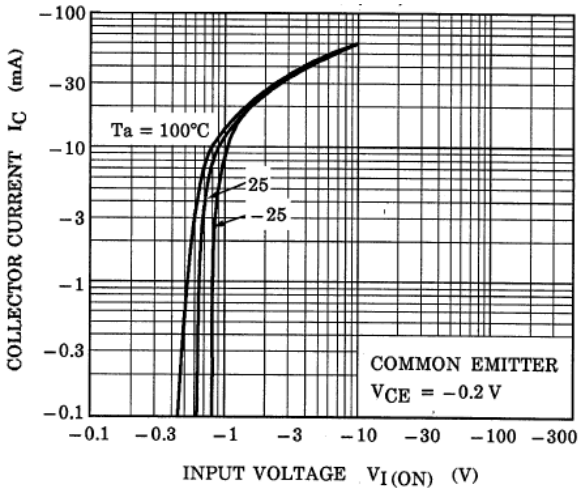


Fig. 10.5 RN2405 I_C-$V_{I(ON)}$

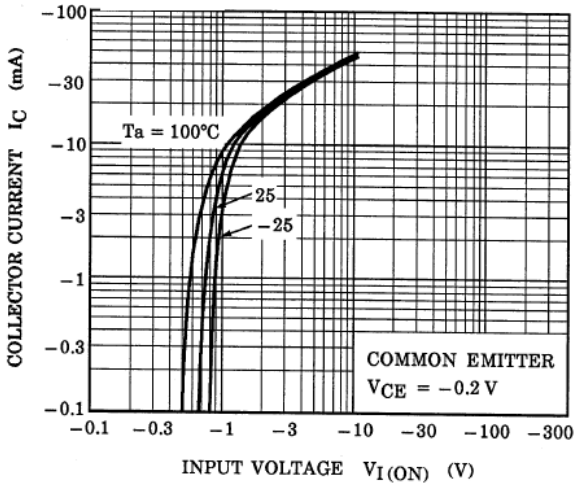


Fig. 10.6 RN2406 I_C-$V_{I(ON)}$

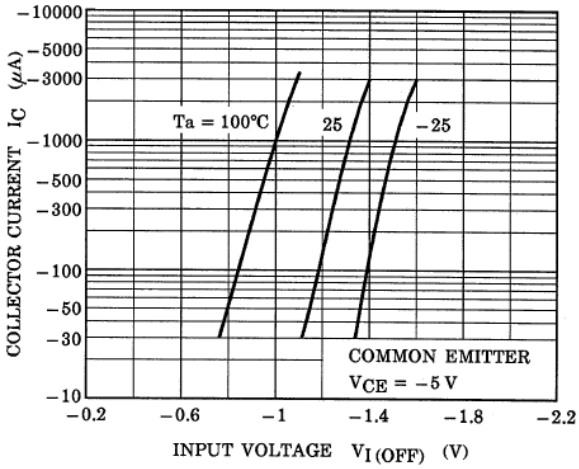


Fig. 10.7 RN2401 I_C-$V_{I(OFF)}$

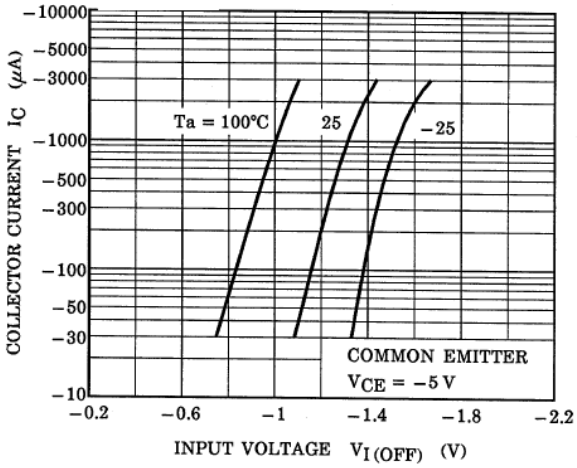


Fig. 10.8 RN2402 I_C-$V_{I(OFF)}$

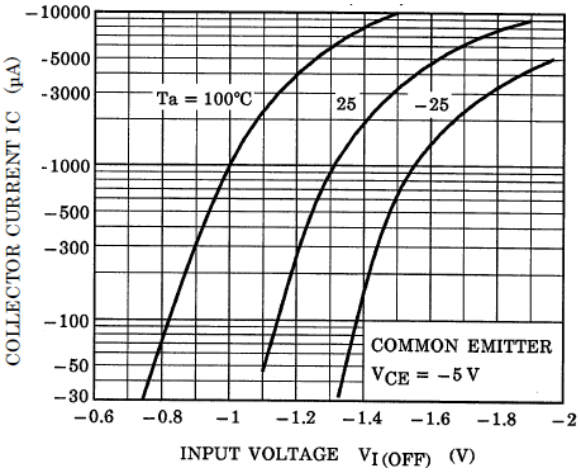


Fig. 10.9 RN2403 I_C-$V_{I(OFF)}$

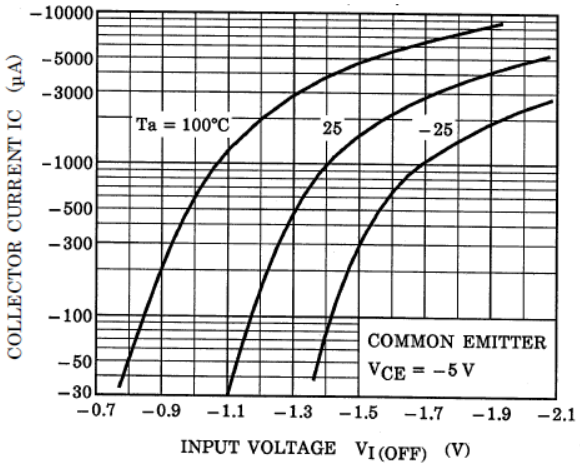


Fig. 10.10 RN2404 I_C-$V_{I(OFF)}$

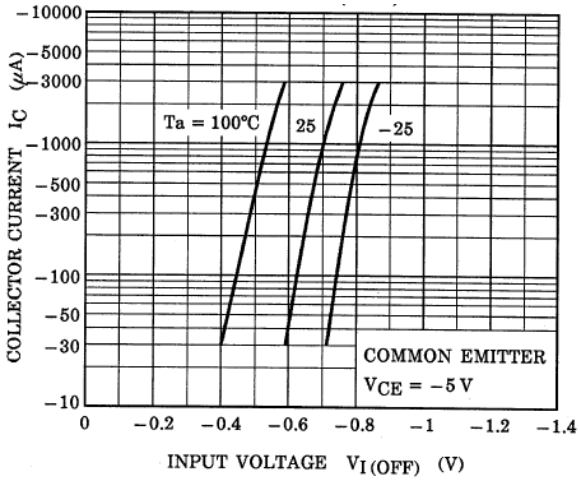


Fig. 10.11 RN2405 I_C-$V_{I(OFF)}$

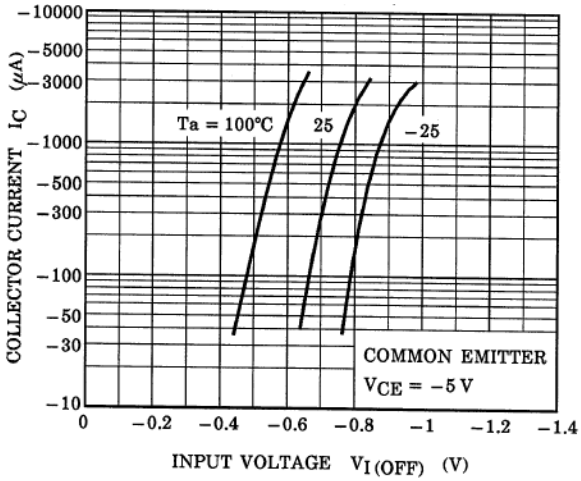


Fig. 10.12 RN2406 I_C-$V_{I(OFF)}$

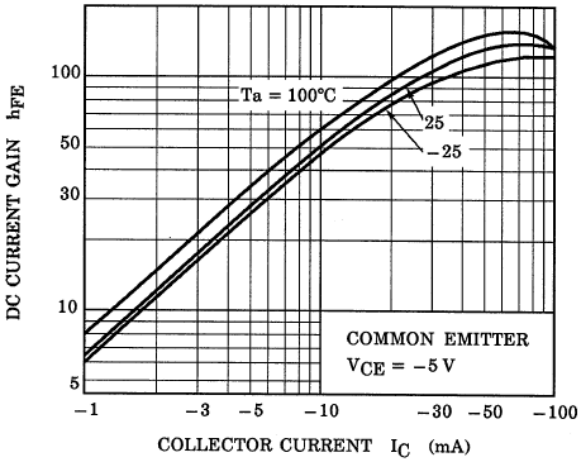


Fig. 10.13 RN2401 h_{FE}-I_C

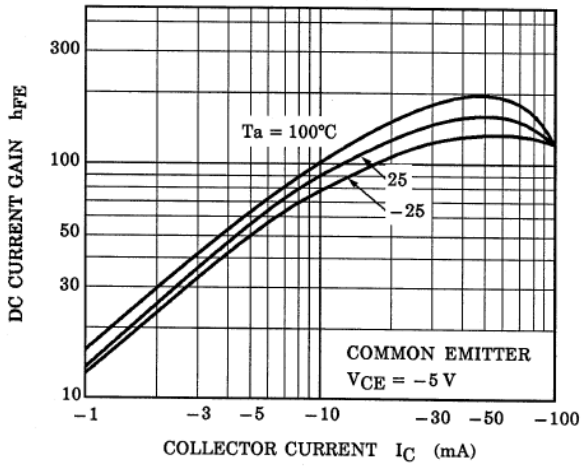


Fig. 10.14 RN2402 h_{FE}-I_C

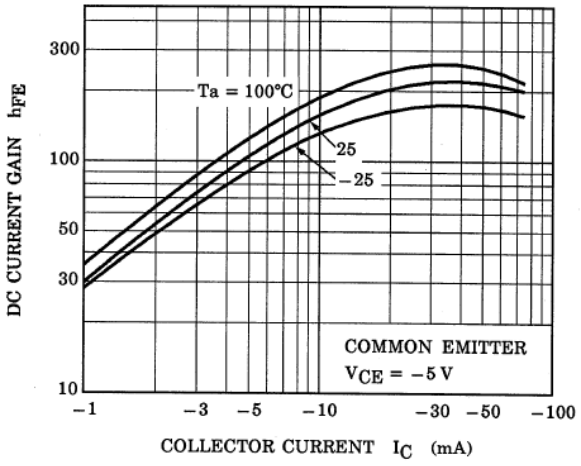


Fig. 10.15 RN2403 h_{FE}-I_C

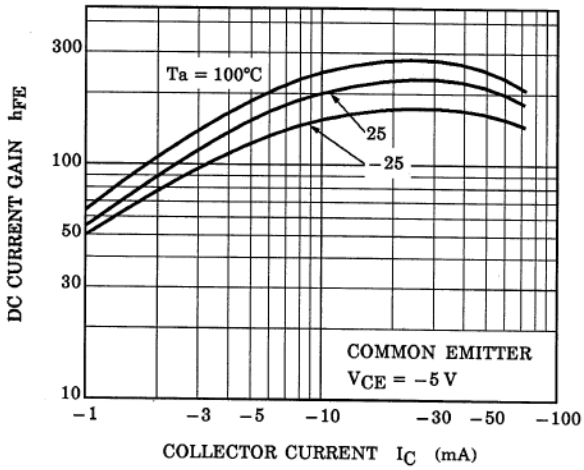


Fig. 10.16 RN2404 h_{FE}-I_C

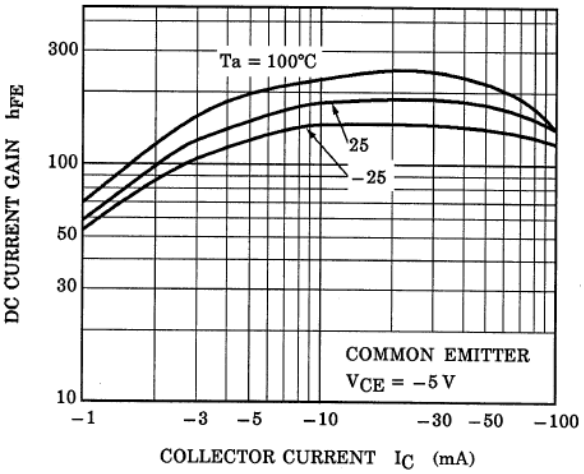


Fig. 10.17 RN2405 h_{FE}-I_C

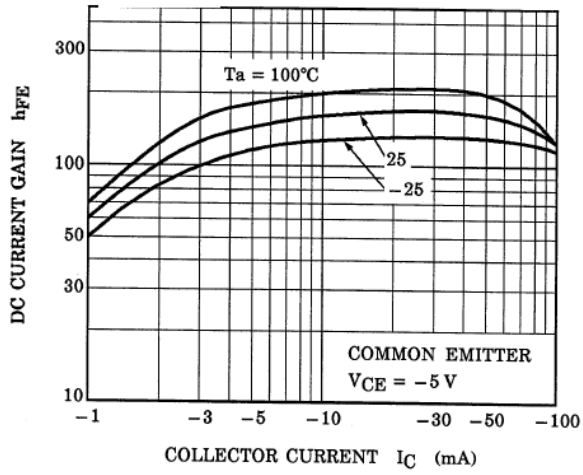


Fig. 10.18 RN2406 h_{FE}-I_C

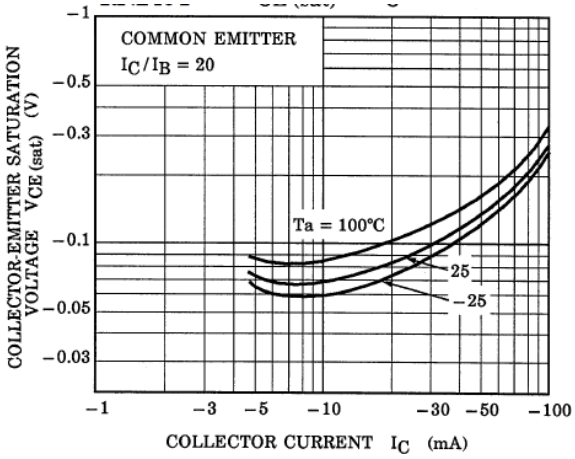


Fig. 10.19 RN2401 $V_{CE(sat)}$-I_C

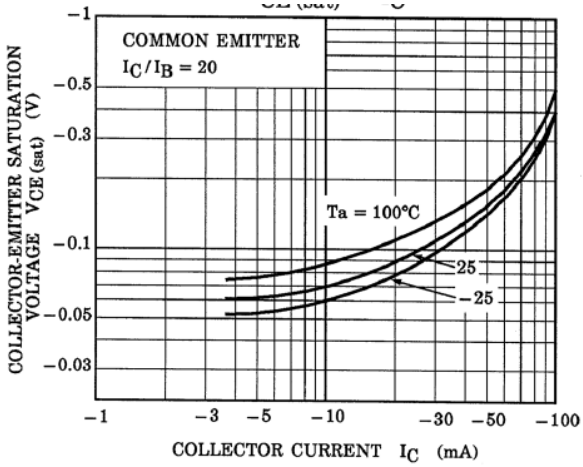


Fig. 10.20 RN2402 $V_{CE(sat)}$-I_C

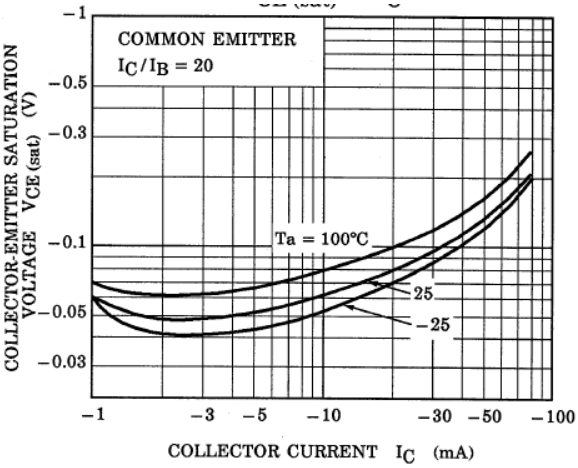


Fig. 10.21 RN2403 $V_{CE(sat)}$-I_C

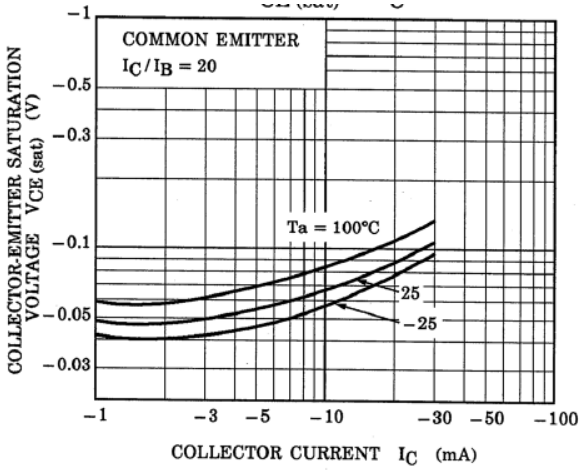


Fig. 10.22 RN2404 $V_{CE(sat)}$-I_C

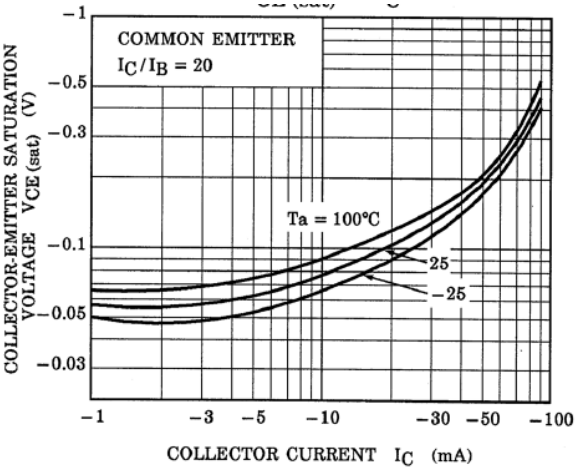


Fig. 10.23 RN2405 $V_{CE(sat)}$-I_C

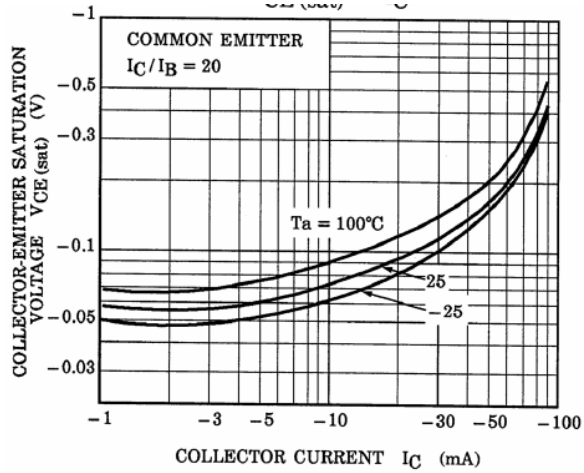
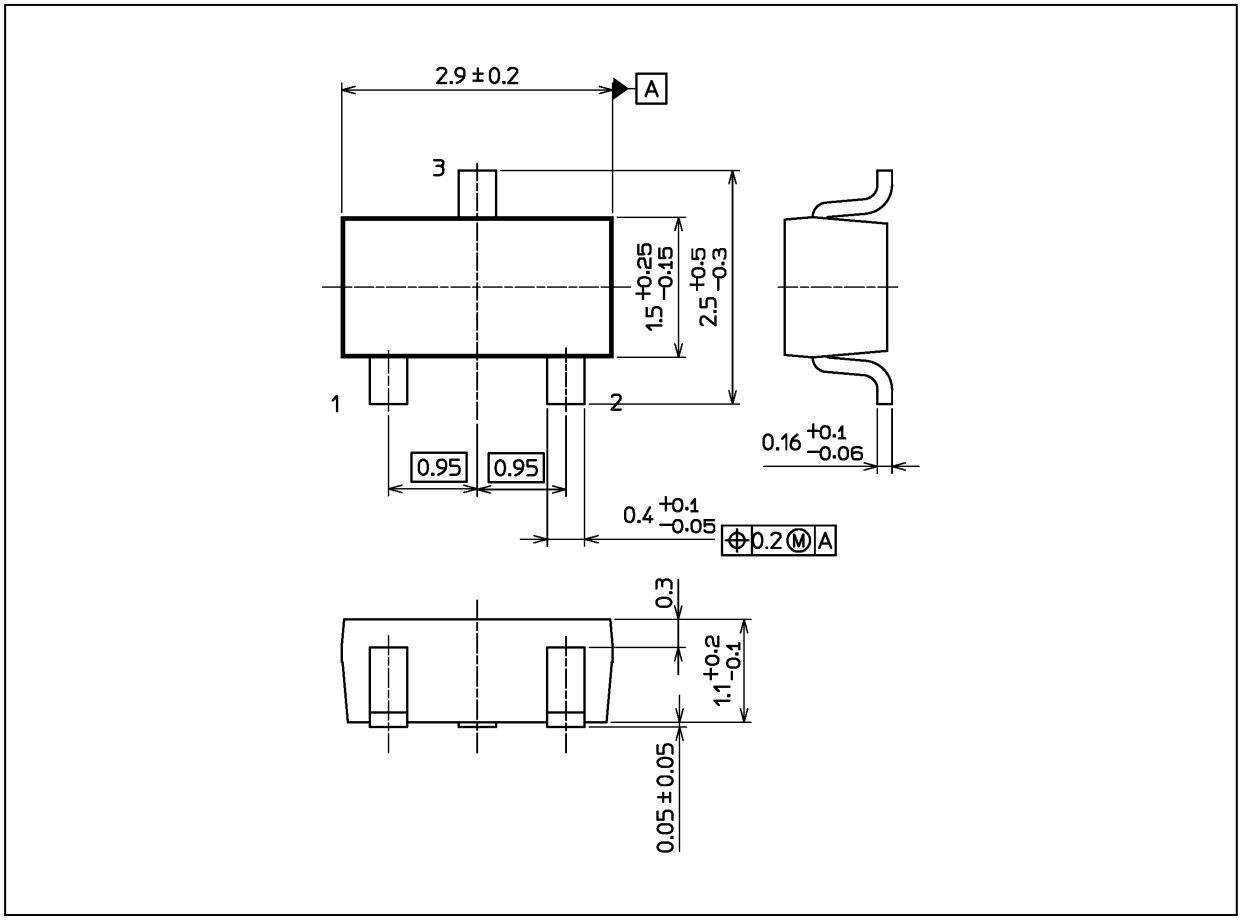


Fig. 10.24 RN2406 $V_{CE(sat)}$-I_C

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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