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

RN1401/02/03/04/05/06

1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

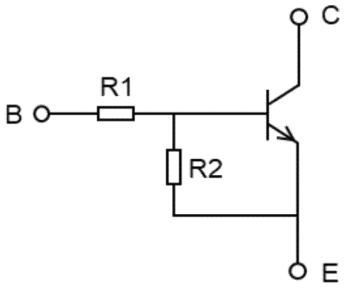
(1) AEC-Q101 qualified (Please see the orderable part number list)

(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 RN2401 to RN2406

3. Equivalent Circuit



4. Bias Resistor Values

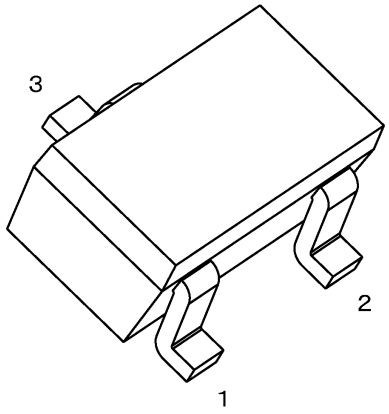
Part No.	R1 (kΩ)	R2 (kΩ)
RN1401	4.7	4.7
RN1402	10	10
RN1403	22	22
RN1404	47	47
RN1405	2.2	47
RN1406	4.7	47

Start of commercial production
1983-06

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5. Packaging and Pin Assignment



1: Base
2: Emitter
3: Collector

S-Mini

6. Orderable part number

Orderable part number		AEC-Q101		Note	
RN1401	RN1401,LF	—		General Use	
	RN1401,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1401,LXHF	YES		Automotive Use	
RN1402	RN1402,LF	—		General Use	
	RN1402,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1402,LXHF	YES		Automotive Use	
RN1403	RN1403,LF	—		General Use	
	RN1403,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1403,LXHF	YES		Automotive Use	
RN1404	RN1404,LF	—		General Use	
	RN1404,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1404,LXHF	YES		Automotive Use	
RN1405	RN1405,LF	—		General Use	
	RN1405,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1405,LXHF	YES		Automotive Use	
RN1406	RN1406,LF	—		General Use	
	RN1406,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN1406,LXHF	YES		Automotive Use	

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

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

Characteristics		Symbol	Rating	Unit
Collector-base voltage	RN1401 to RN1406	V_{CBO}	50	V
Collector-emitter voltage		V_{CEO}	50	
Emitter-base voltage	RN1401 to RN1404	V_{EBO}	10	
	RN1405,RN1406		5	
Collector current	RN1401 to RN1406	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).

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1401 to RN1406	I_{CBO}	V_{CB} = 50 V, I_E = 0 mA	—	—	100	nA
Collector cut-off current		I_{CEO}	V_{CE} = 50 V, I_B = 0 mA	—	—	500	
Emitter cut-off current	RN1401	I_{EBO}	V_{EB} = 10 V, I_C = 0 mA	0.82	—	1.52	mA
	RN1402			0.38	—	0.71	
	RN1403			0.17	—	0.33	
	RN1404			0.082	—	0.15	
	RN1405		V_{EB} = 5 V, I_C = 0 mA	0.078	—	0.145	
	RN1406			0.074	—	0.138	
DC current gain	RN1401	h_{FE}	V_{CE} = 5 V, I_C = 10 mA	30	—	—	—
	RN1402			50	—	—	
	RN1403			70	—	—	
	RN1404			80	—	—	
	RN1405			80	—	—	
	RN1406			80	—	—	
Collector-emitter saturation voltage	RN1401 to RN1406	$V_{CE(sat)}$	I_C = 5 mA, I_B = 0.25 mA	—	0.1	0.3	V
Input voltage (ON)	RN1401	$V_{I(ON)}$	V_{CE} = 0.2 V, I_C = 5 mA	1.1	—	2.0	
	RN1402			1.2	—	2.4	
	RN1403			1.3	—	3.0	
	RN1404			1.5	—	5.0	
	RN1405			0.6	—	1.1	
	RN1406			0.7	—	1.3	
Input voltage (OFF)	RN1401 to RN1404	$V_{I(OFF)}$	V_{CE} = 5 V, I_C = 0.1 mA	1.0	—	1.5	
	RN1405, RN1406			0.5	—	0.8	
Transition frequency	RN1401 to RN1406	f_T	V_{CE} = 10 V, I_C = 5 mA	—	250	—	MHz
Collector output capacitance		C_{ob}	V_{CB} = 10 V, I_E = 0 mA, f = 1 MHz	—	3	6	pF
Input resistance	RN1401	R_1	-	3.29	4.7	6.11	kΩ
	RN1402			7	10	13	
	RN1403			15.4	22	28.6	
	RN1404			32.9	47	61.1	
	RN1405			1.54	2.2	2.86	
	RN1406			3.29	4.7	6.11	
Resistor ratio	RN1401 to RN1404	R1/R2	-	0.9	1.0	1.1	—
	RN1405			0.0421	0.0468	0.0515	
	RN1406			0.09	0.1	0.11	

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9. Marking

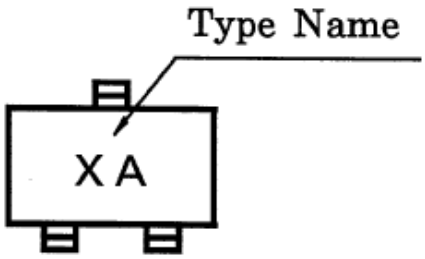


Fig. 9.1 Marking RN1401

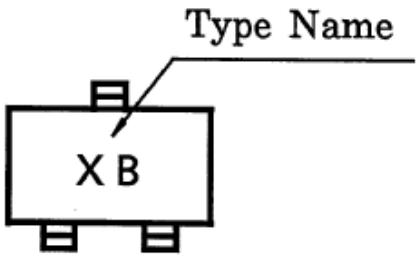


Fig. 9.2 Marking RN1402

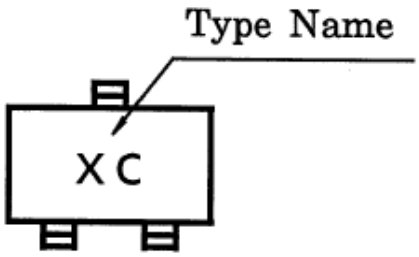


Fig. 9.3 Marking RN1403

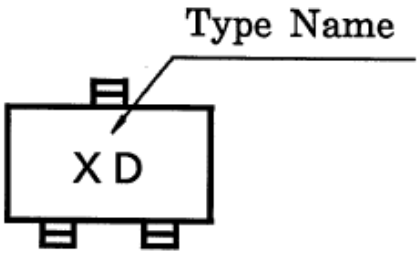


Fig. 9.4 Marking RN1404

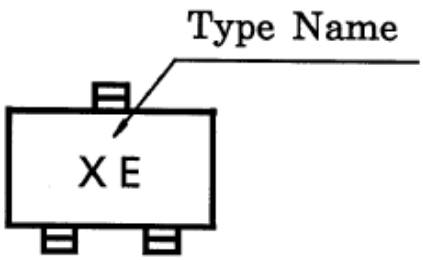


Fig. 9.5 Marking RN1405

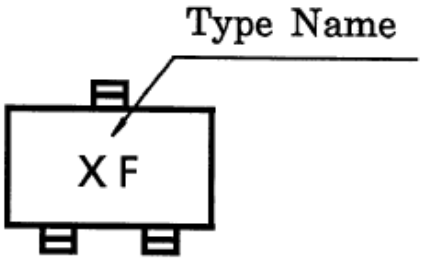


Fig. 9.6 Marking RN1406

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10. Characteristics Curves (Note)

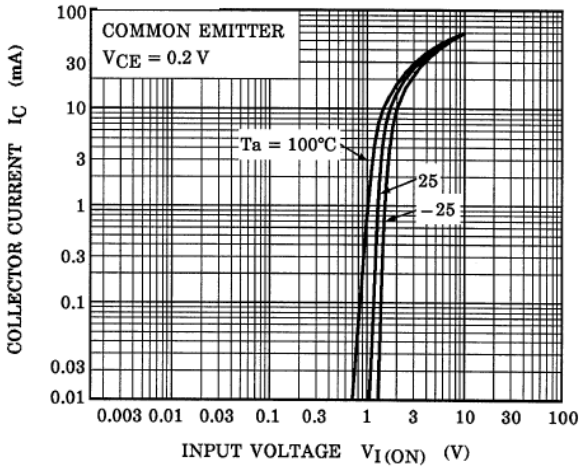


Fig. 10.1 RN1401 I_C-$V_{I(ON)}$

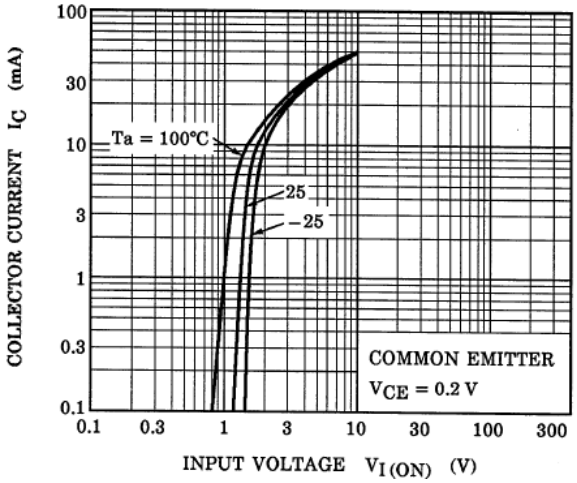


Fig. 10.2 RN1402 I_C-$V_{I(ON)}$

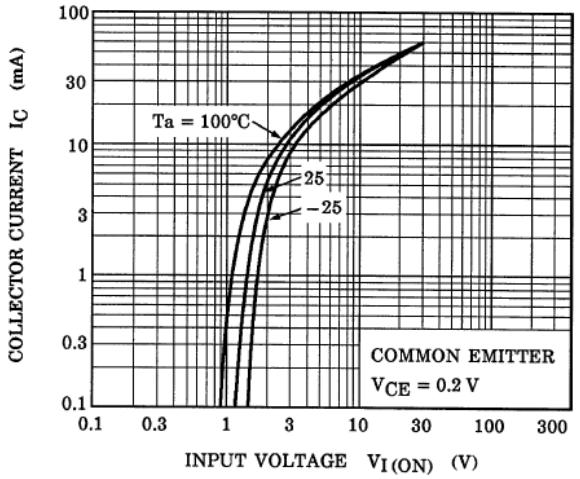


Fig. 10.3 RN1403 I_C-$V_{I(ON)}$

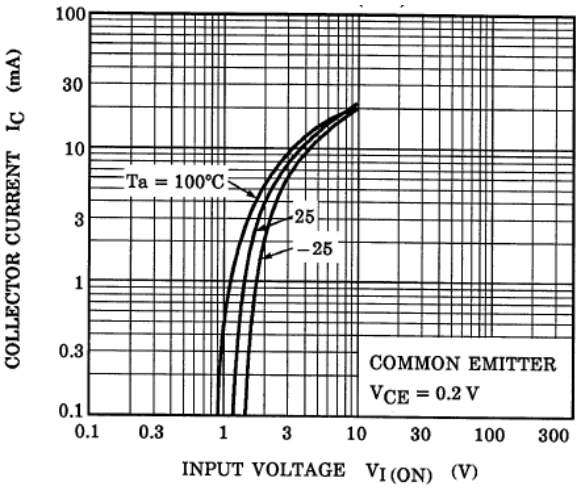


Fig. 10.4 RN1404 I_C-$V_{I(ON)}$

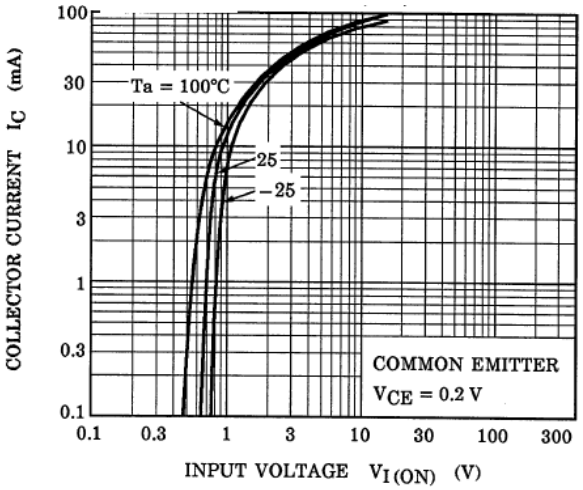


Fig. 10.5 RN1405 I_C-$V_{I(ON)}$

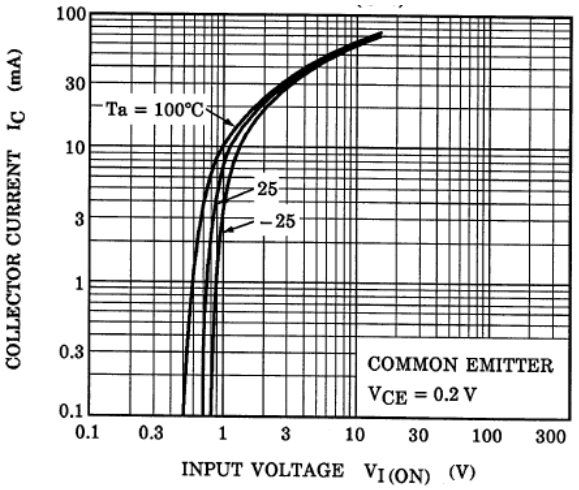


Fig. 10.6 RN1406 I_C-$V_{I(ON)}$

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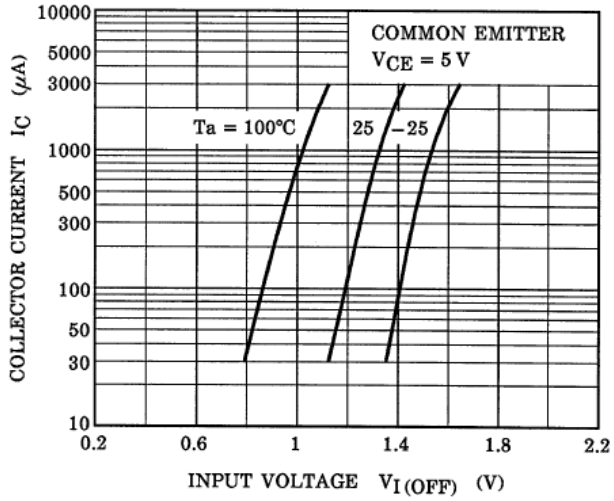


Fig. 10.7 RN1401 I_C-$V_{I(OFF)}$

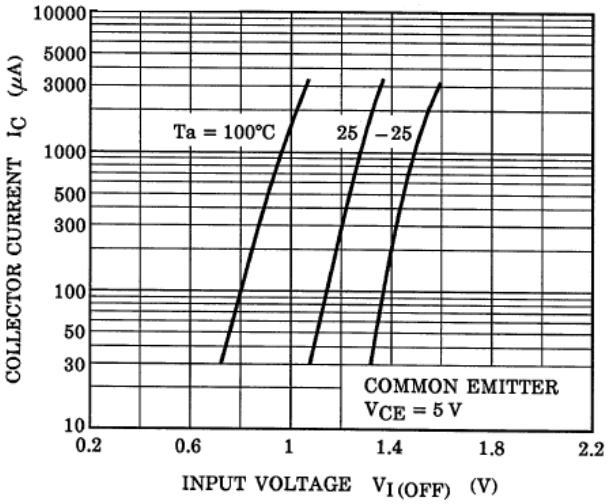


Fig. 10.8 RN1402 I_C-$V_{I(OFF)}$

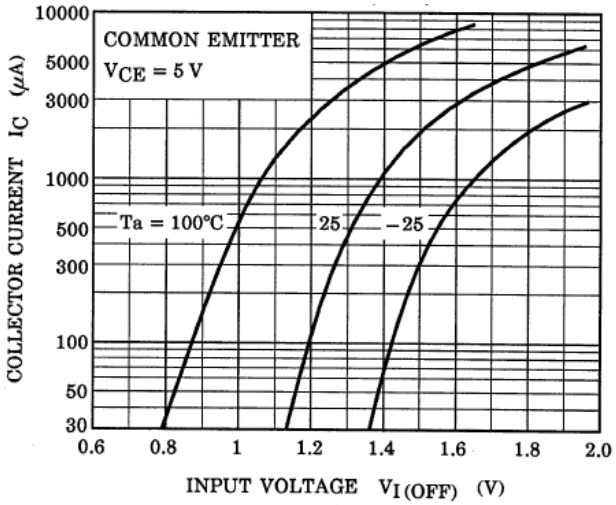


Fig. 10.9 RN1403 I_C-$V_{I(OFF)}$

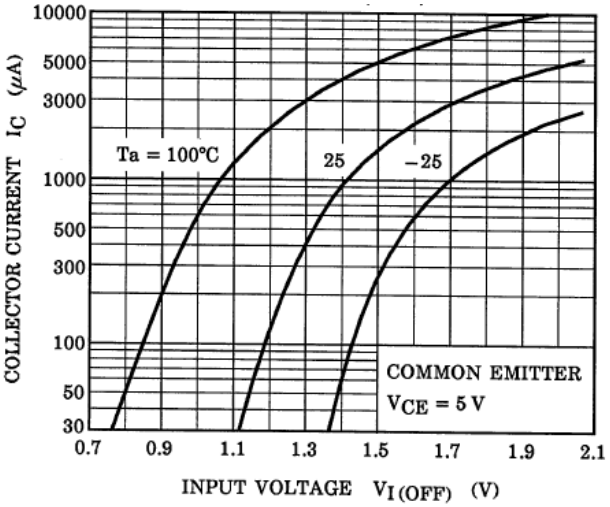


Fig. 10.10 RN1404 I_C-$V_{I(OFF)}$

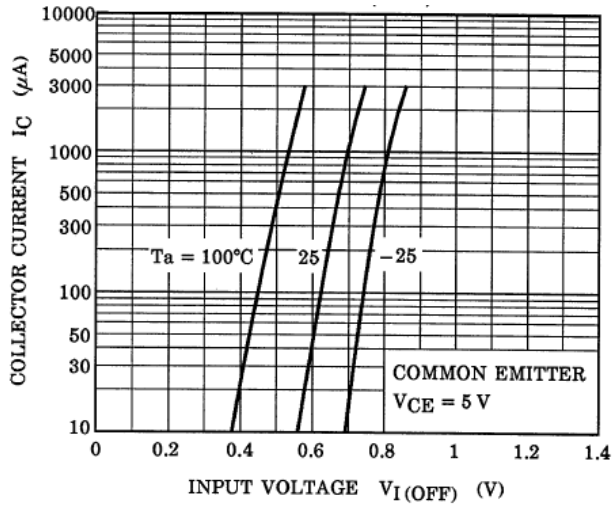


Fig. 10.11 RN1405 I_C-$V_{I(OFF)}$

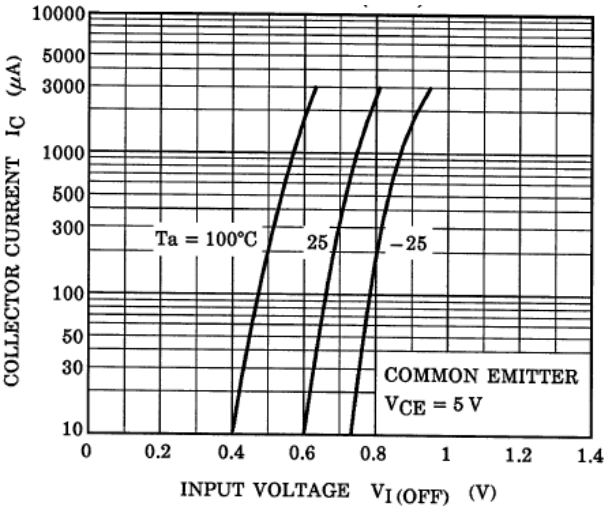


Fig. 10.12 RN1406 I_C-$V_{I(OFF)}$

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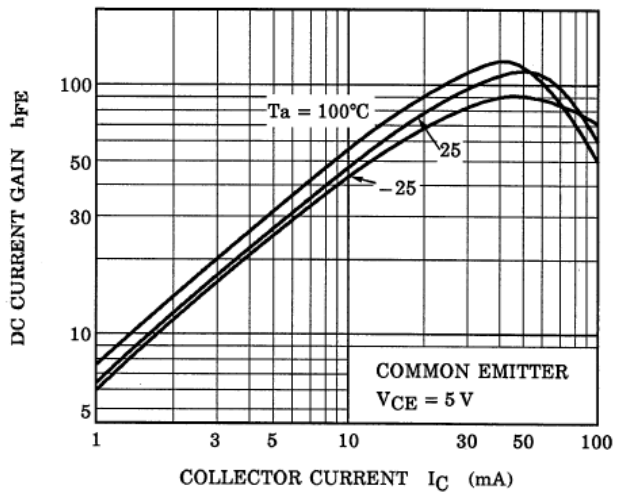


Fig. 10.13 RN1401 h_{FE}-I_C

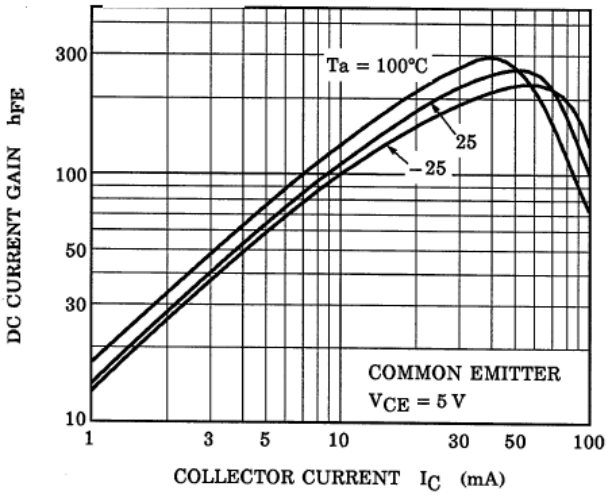


Fig. 10.14 RN1402 h_{FE}-I_C

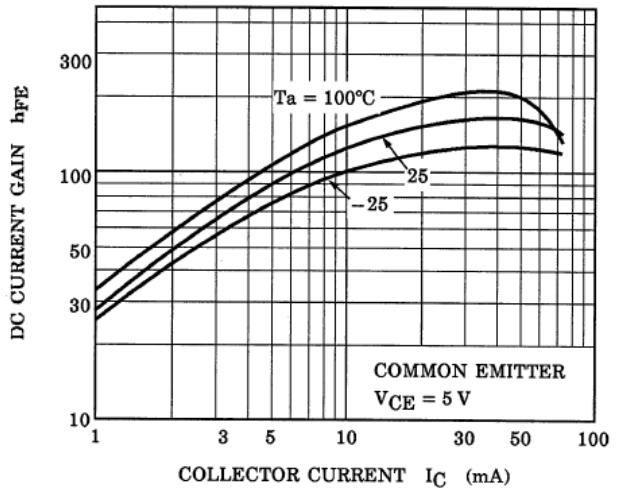


Fig. 10.15 RN1403 h_{FE}-I_C

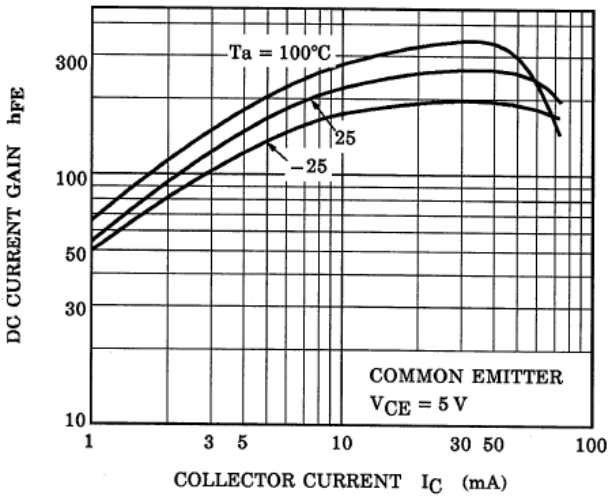


Fig. 10.16 RN1404 h_{FE}-I_C

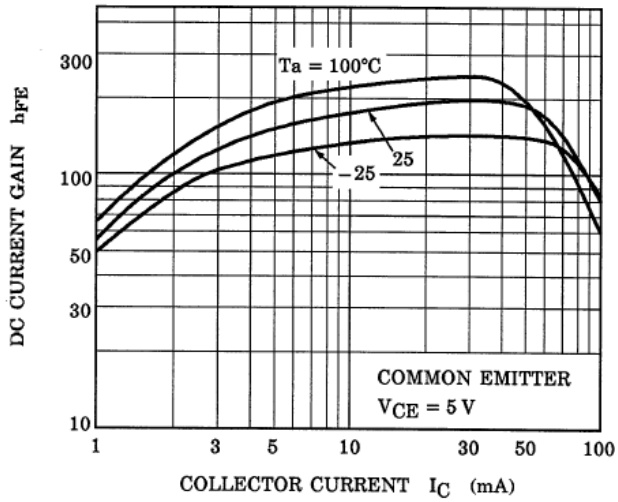


Fig. 10.17 RN1405 h_{FE}-I_C

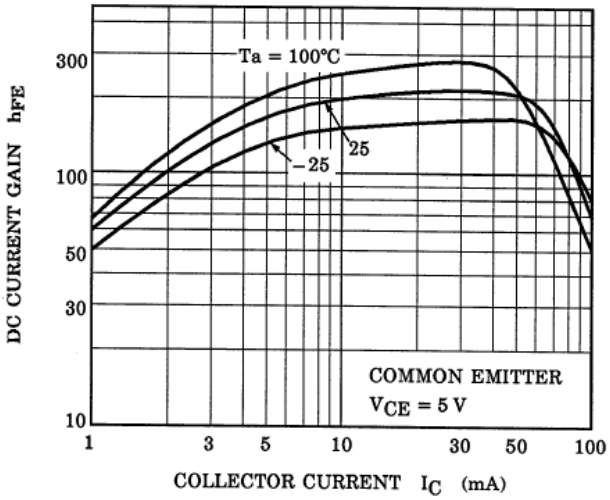


Fig. 10.18 RN1406 h_{FE}-I_C

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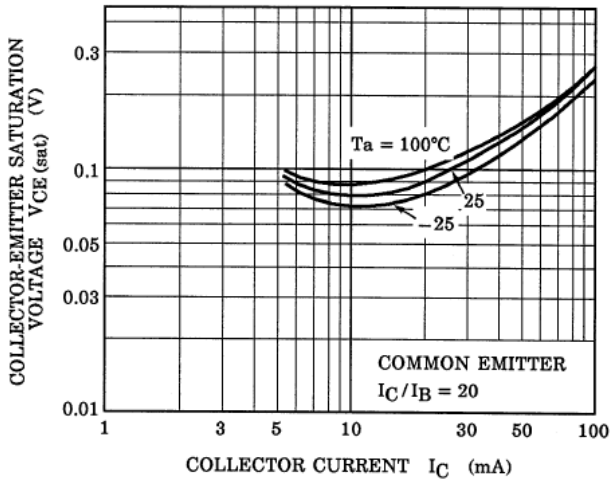


Fig. 10.19 RN1401 $V_{CE(sat)}$-I_C

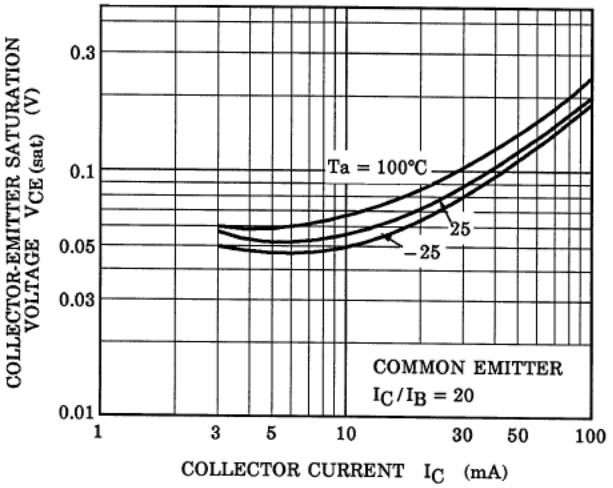


Fig. 10.20 RN1402 $V_{CE(sat)}$-I_C

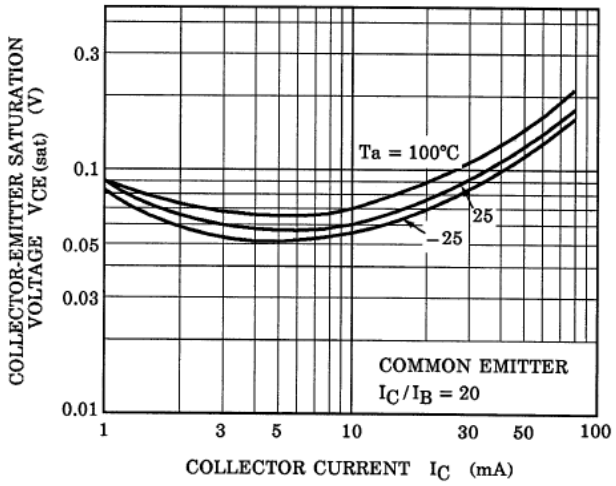


Fig. 10.21 RN1403 $V_{CE(sat)}$-I_C

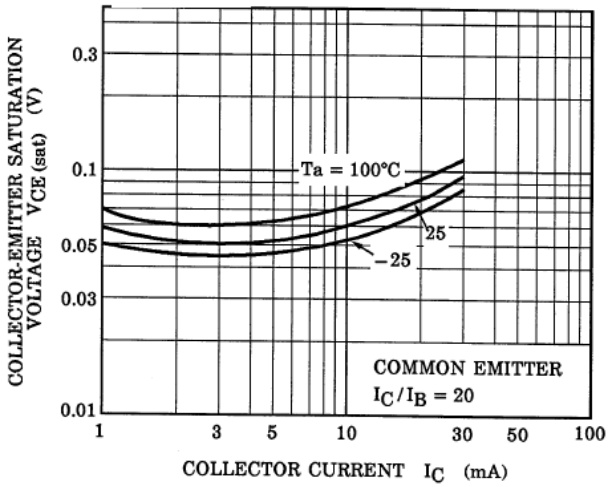


Fig. 10.22 RN1404 $V_{CE(sat)}$-I_C

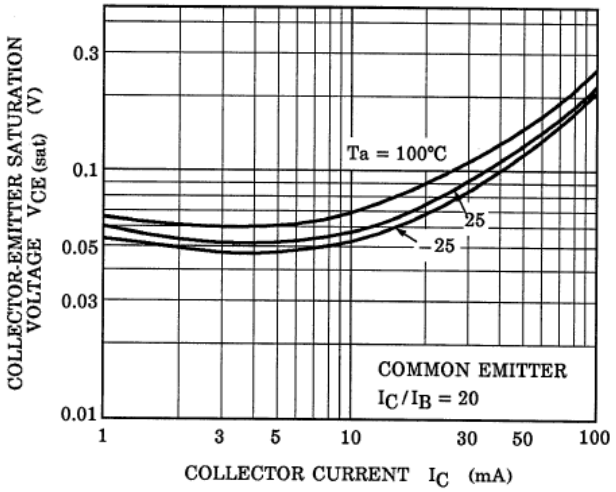


Fig. 10.23 RN1405 $V_{CE(sat)}$-I_C

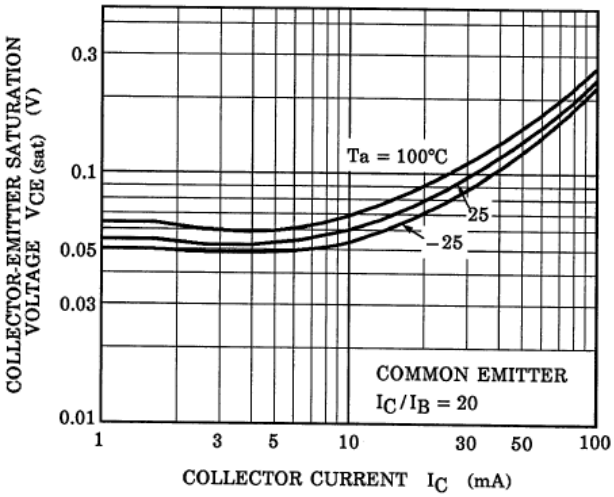


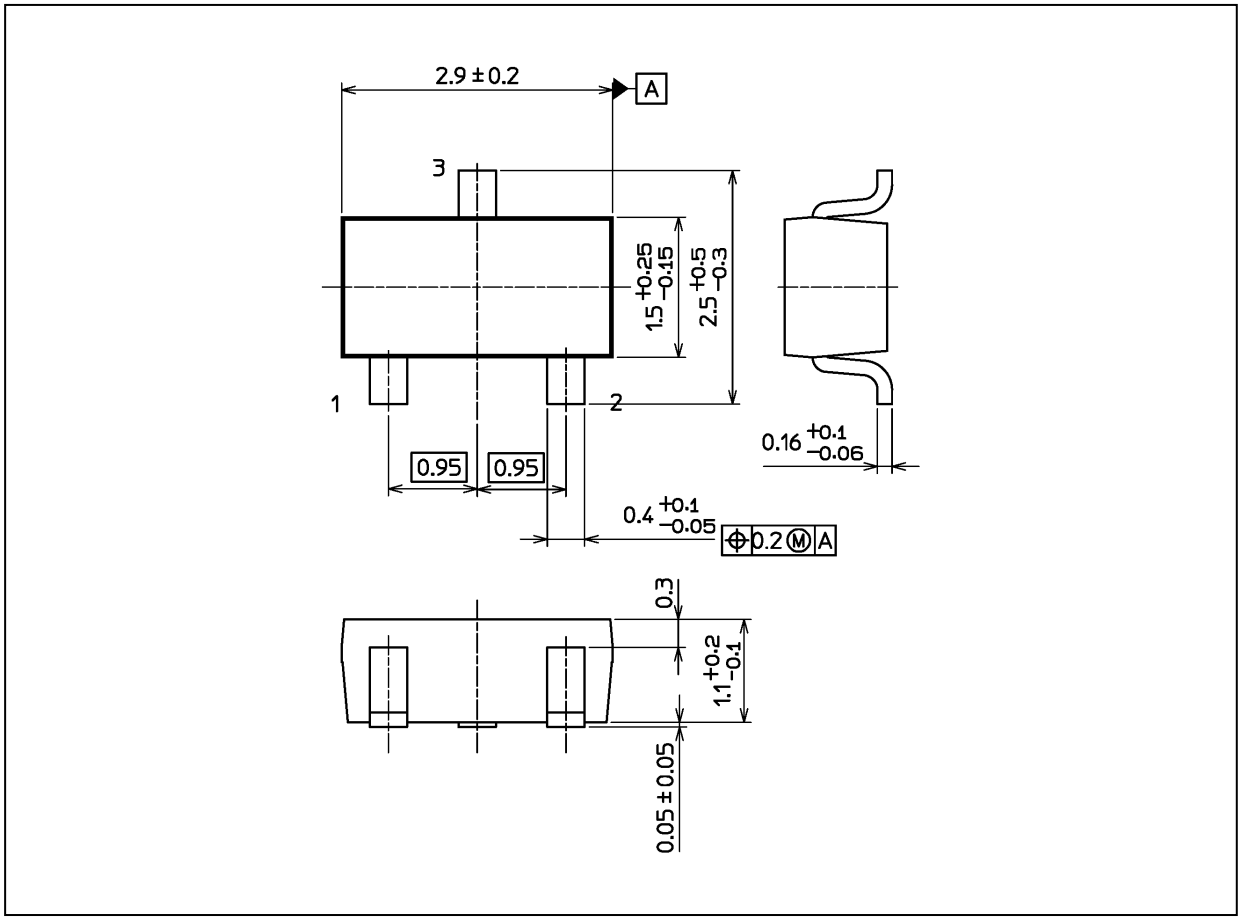
Fig. 10.24 RN1406 $V_{CE(sat)}$-I_C

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

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Package Dimensions

Unit: mm



Weight: 12 mg (typ.)

Package Name(s)
Nickname: S-Mini

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