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

RN1301/02/03/04/05/06

1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

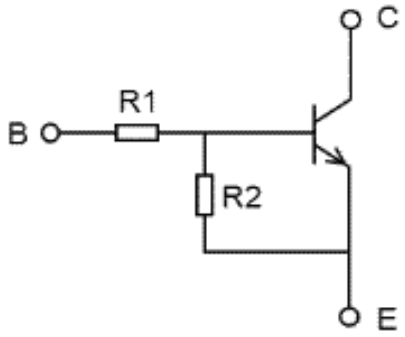
(1) AEC-Q101 qualified (Please see the orderable part number list)

(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 RN2301 to RN2306

3. Equivalent Circuit



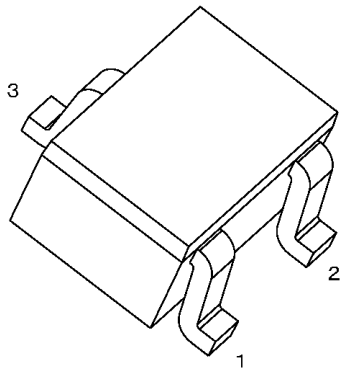
4. Bias Resistor Values

Part No.	R1 (kΩ)	R2 (kΩ)
RN1301	4.7	4.7
RN1302	10	10
RN1303	22	22
RN1304	47	47
RN1305	2.2	47
RN1306	4.7	47

Start of commercial production
1987-09

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5. Packaging and Pin Assignment



1: Base
2: Emitter
3: Collector

USM

6. Orderable part number

Orderable part number		AEC-Q101	Note
RN1301	RN1301,LF	—	General Use
	RN1301,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1301,LXHF	YES	Automotive Use
RN1302	RN1302,LF	—	General Use
	RN1302,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1302,LXHF	YES	Automotive Use
RN1303	RN1303,LF	—	General Use
	RN1303,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1303,LXHF	YES	Automotive Use
RN1304	RN1304,LF	—	General Use
	RN1304,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1304,LXHF	YES	Automotive Use
RN1305	RN1305,LF	—	General Use
	RN1305,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1305,LXHF	YES	Automotive Use
RN1306	RN1306,LF	—	General Use
	RN1306,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1306,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	RN1301 to RN1306	V_{CBO}	50	V
Collector-emitter voltage		V_{CEO}	50	
Emitter-base voltage	RN1301 to RN1304	V_{EBO}	10	
	RN1305		5	
	RN1306		5	
Collector current	RN1301 to RN1306	I_C	100	mA
Collector power dissipation		P_C	100	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	RN1301 to RN1306	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	RN1301	I_{EBO}	V_{EB} = 10 V, I_C = 0 mA	0.82	—	1.52	mA
	RN1302			0.38	—	0.71	
	RN1303			0.17	—	0.33	
	RN1304			0.082	—	0.15	
	RN1305		V_{EB} = 5 V, I_C = 0 mA	0.078	—	0.145	
	RN1306			0.074	—	0.138	
DC current gain	RN1301	h_{FE}	V_{CE} = 5 V, I_C = 10 mA	30	—	—	—
	RN1302			50	—	—	
	RN1303			70	—	—	
	RN1304			80	—	—	
	RN1305			80	—	—	
	RN1306			80	—	—	
Collector-emitter saturation voltage	RN1301 to RN1306	$V_{CE(sat)}$	I_C = 5 mA, I_B = 0.25 mA	—	0.1	0.3	V
Input voltage (ON)	RN1301	$V_{I(ON)}$	V_{CE} = 0.2 V, I_C = 5 mA	1.1	—	2.0	
	RN1302			1.2	—	2.4	
	RN1303			1.3	—	3.0	
	RN1304			1.5	—	5.0	
	RN1305			0.6	—	1.1	
	RN1306			0.7	—	1.3	
Input voltage (OFF)	RN1301 to RN1304	$V_{I(OFF)}$	V_{CE} = 5 V, I_C = 0.1 mA	1.0	—	1.5	
	RN1305			0.5	—	0.8	
	RN1306			0.5	—	0.8	
Transition frequency	RN1301 to RN1306	f_T	V_{CE} = 10 V, I_C = 5 mA	—	250	—	MHz
Collector output capacitance	RN1301 to RN1306	C_{ob}	V_{CB} = 10 V, I_E = 0 mA, f = 1 MHz	—	3	6	pF
Input resistance	RN1301	R_1	-	3.29	4.7	6.11	kΩ
	RN1302			7	10	13	
	RN1303			15.4	22	28.6	
	RN1304			32.9	47	61.1	
	RN1305			1.54	2.2	2.86	
	RN1306			3.29	4.7	6.11	
Resistor ratio	RN1301 to RN1304	R1/R2	-	0.9	1.0	1.1	—
	RN1305			0.0421	0.0468	0.0515	
	RN1306			0.09	0.1	0.11	

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9. Marking

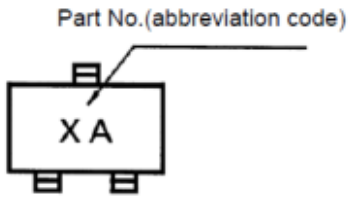


Fig. 9.1 Marking RN1301

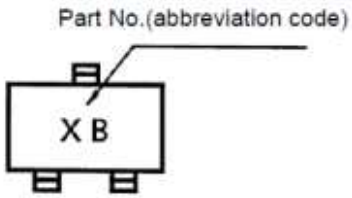


Fig. 9.2 Marking RN1302

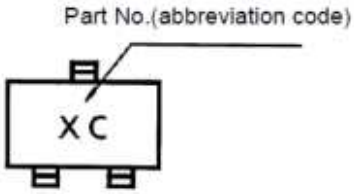


Fig. 9.3 Marking RN1303

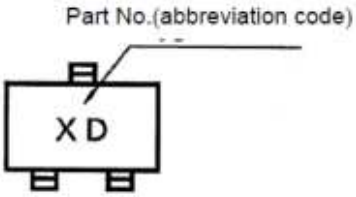


Fig. 9.4 Marking RN1304

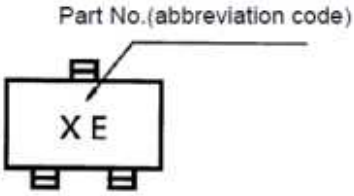


Fig. 9.5 Marking RN1305

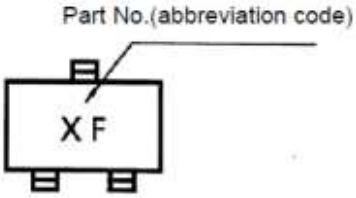


Fig. 9.6 Marking RN1306

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10. Characteristics Curves (Note)

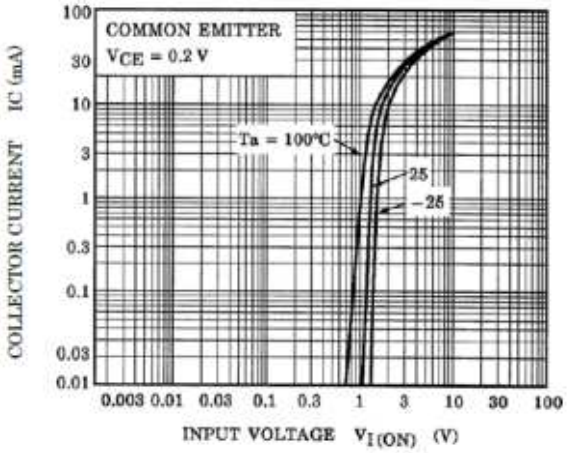


Fig. 10.1 RN1301 I_C-$V_{I(ON)}$

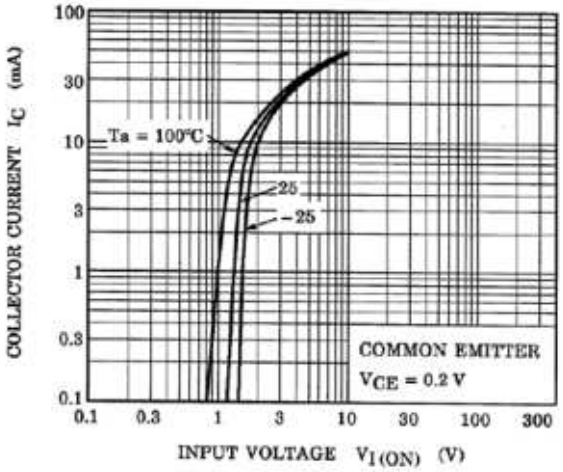


Fig. 10.2 RN1302 I_C-$V_{I(ON)}$

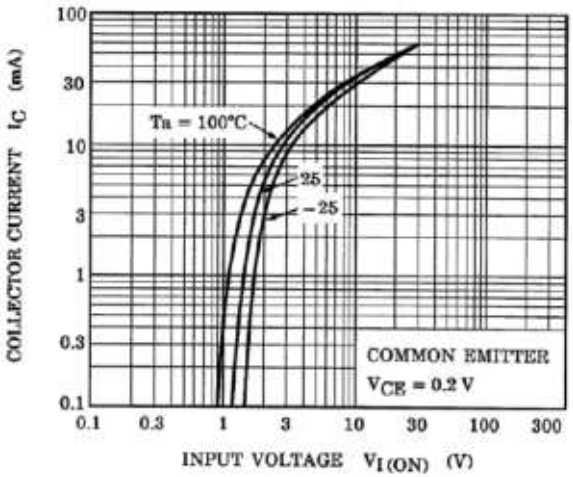


Fig. 10.3 RN1303 I_C-$V_{I(ON)}$

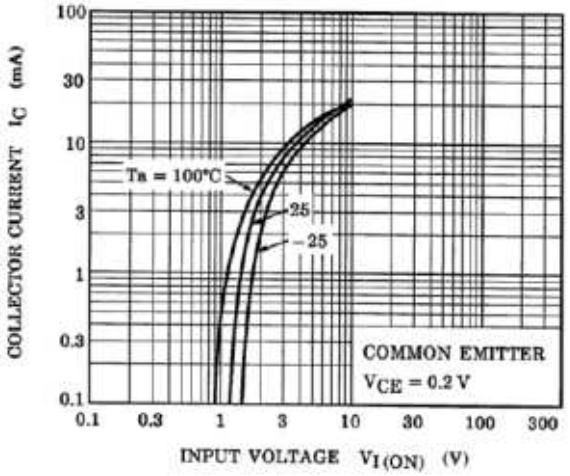


Fig. 10.4 RN1304 I_C-$V_{I(ON)}$

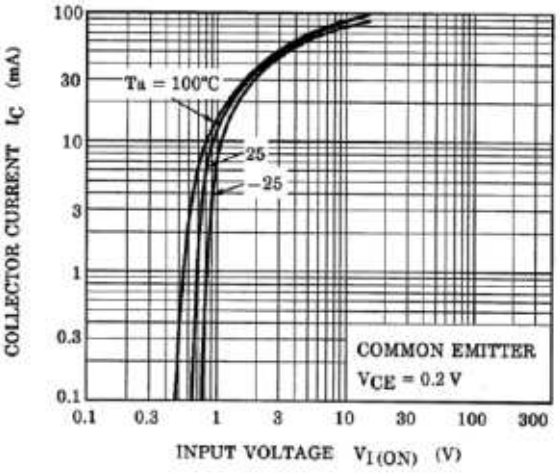


Fig. 10.5 RN1305 I_C-$V_{I(ON)}$

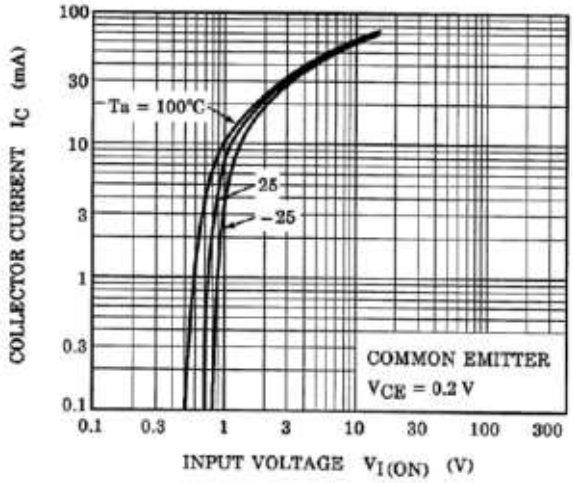


Fig. 10.6 RN1306 I_C-$V_{I(ON)}$

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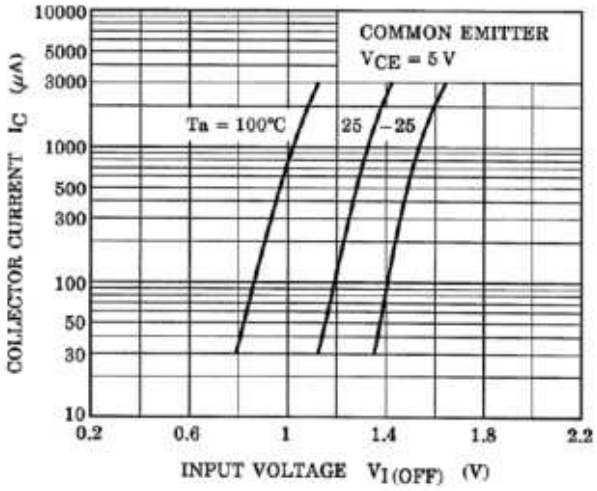


Fig. 10.7 RN1301 I_C-$V_{I(OFF)}$

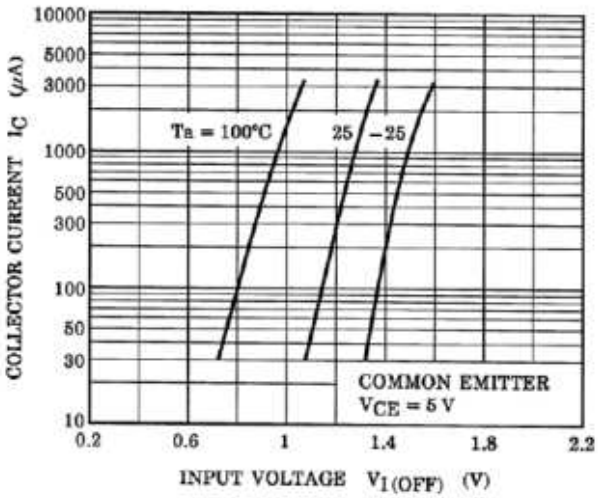


Fig. 10.8 RN1302 I_C-$V_{I(OFF)}$

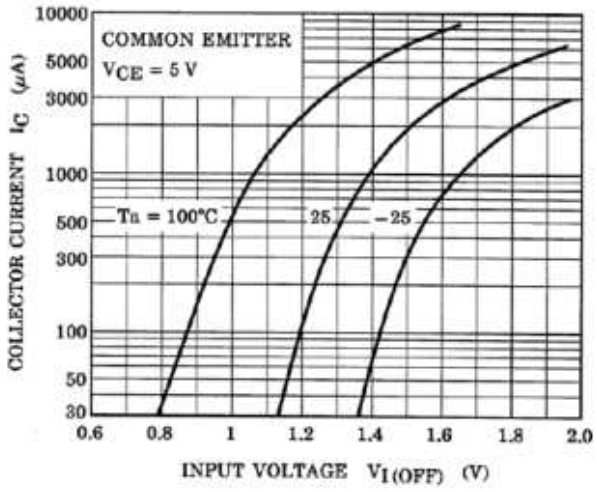


Fig. 10.9 RN1303 I_C-$V_{I(OFF)}$

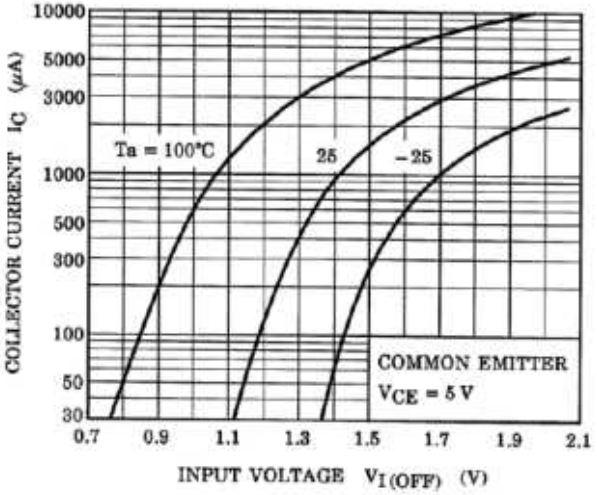


Fig. 10.10 RN1304 I_C-$V_{I(OFF)}$

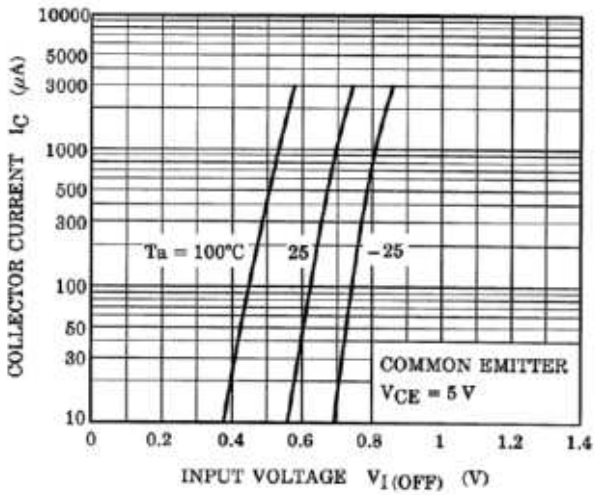


Fig. 10.11 RN1305 I_C-$V_{I(OFF)}$

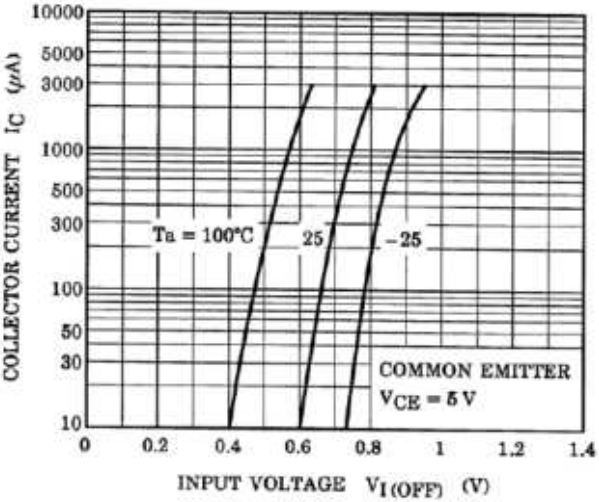


Fig. 10.12 RN1306 I_C-$V_{I(OFF)}$

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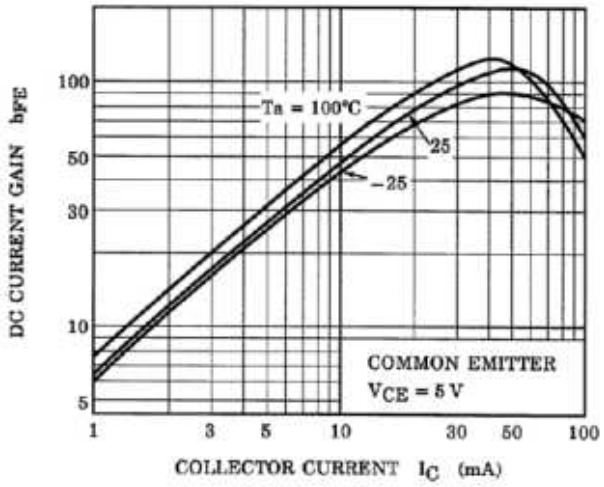


Fig. 10.13 RN1301 h_{FE}-I_C

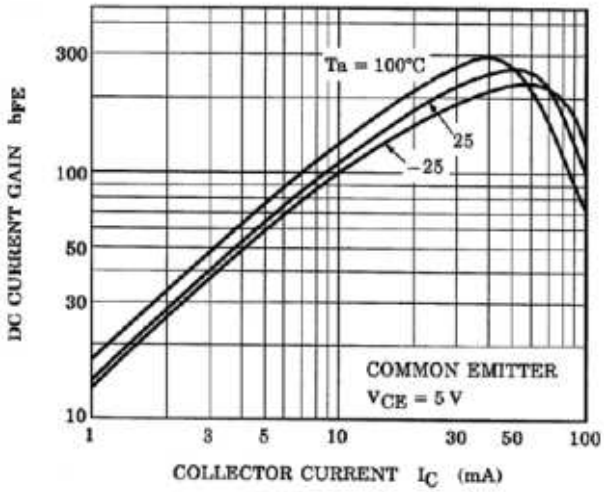


Fig. 10.14 RN1302 h_{FE}-I_C

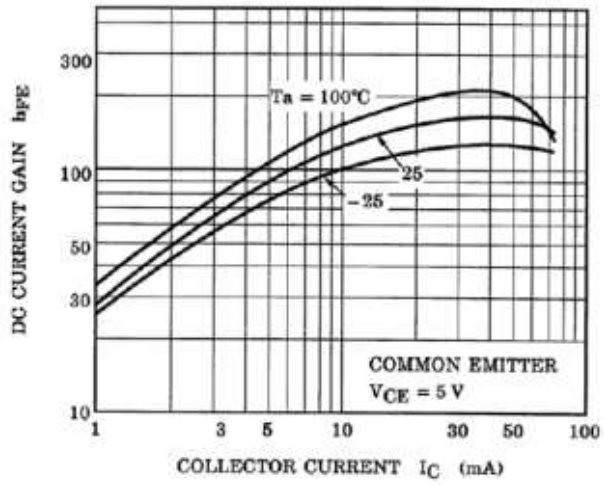


Fig. 10.15 RN1303 h_{FE}-I_C

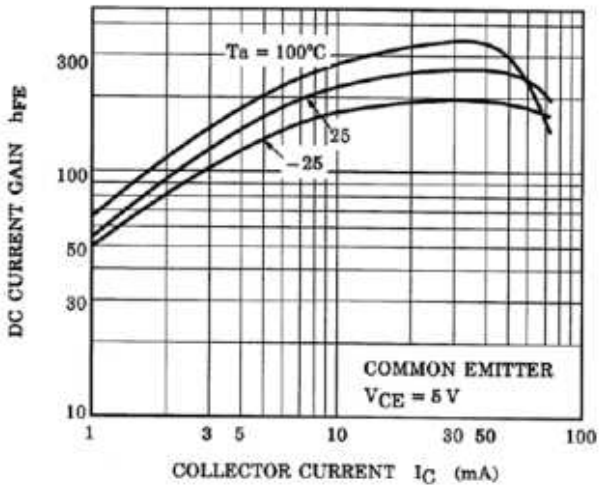


Fig. 10.16 RN1304 h_{FE}-I_C

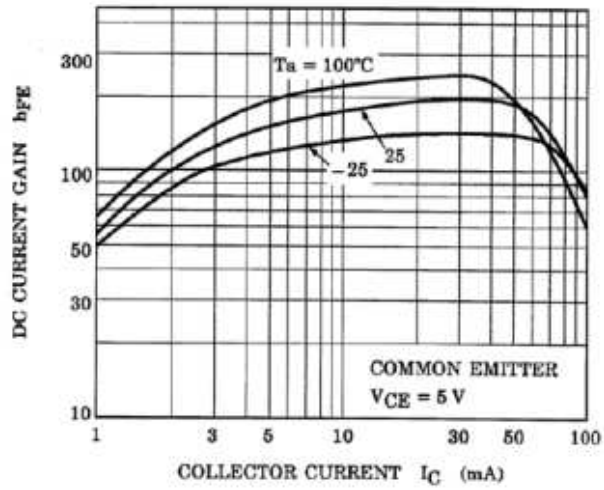


Fig. 10.17 RN1305 $h_{FE(sat)}$-I_C

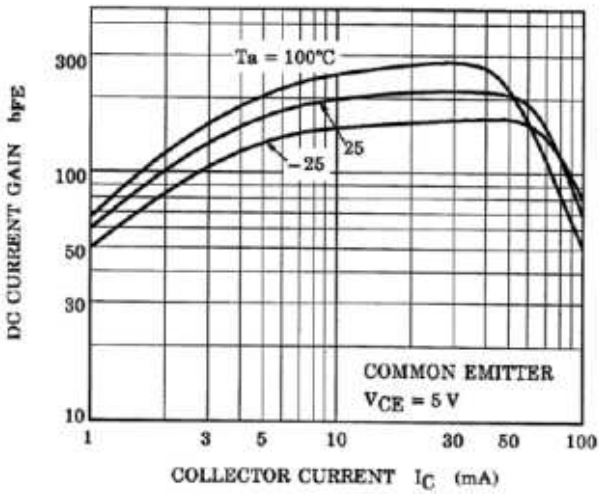


Fig. 10.18 RN1306 h_{FE}-I_C

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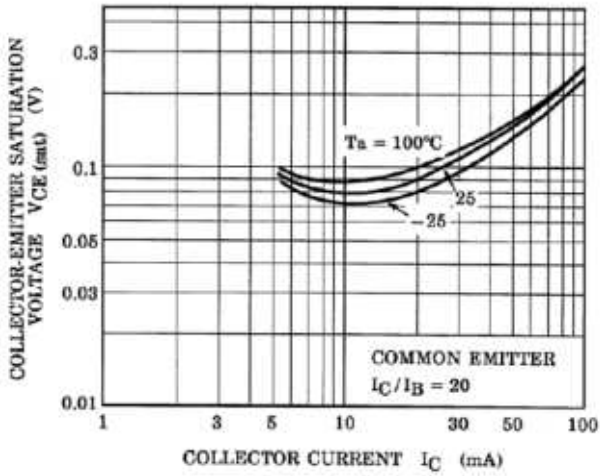


Fig. 10.19 RN1301 $V_{CE(sat)}$-I_C

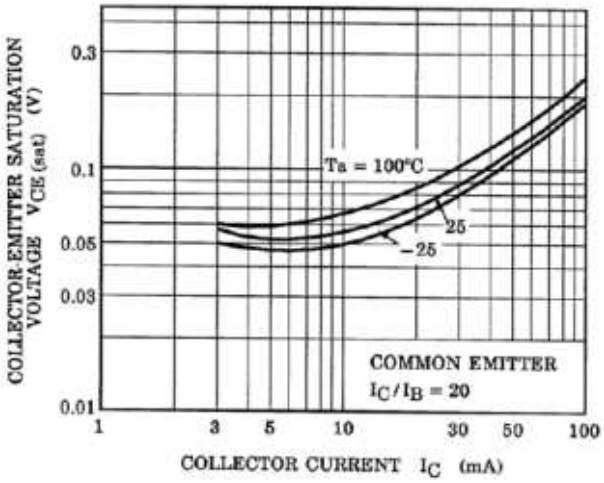


Fig. 10.20 RN1302 $V_{CE(sat)}$-I_C

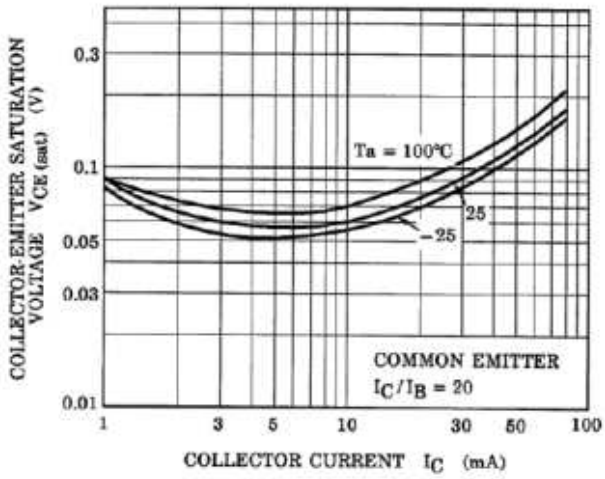


Fig. 10.21 RN1303 $V_{CE(sat)}$-I_C

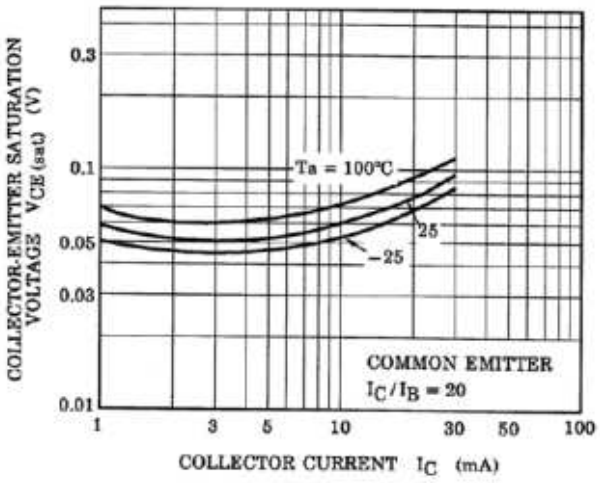


Fig. 10.22 RN1304 $V_{CE(sat)}$-I_C

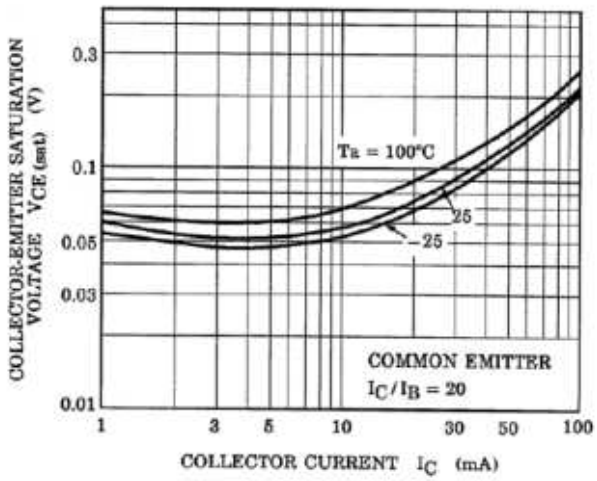


Fig. 10.23 RN1305 $V_{CE(sat)}$-I_C

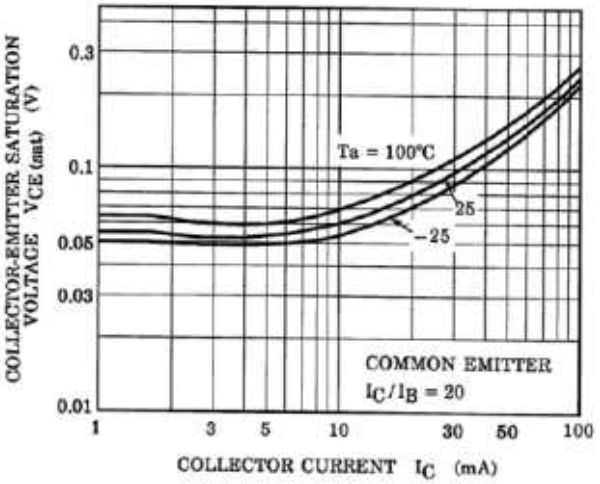


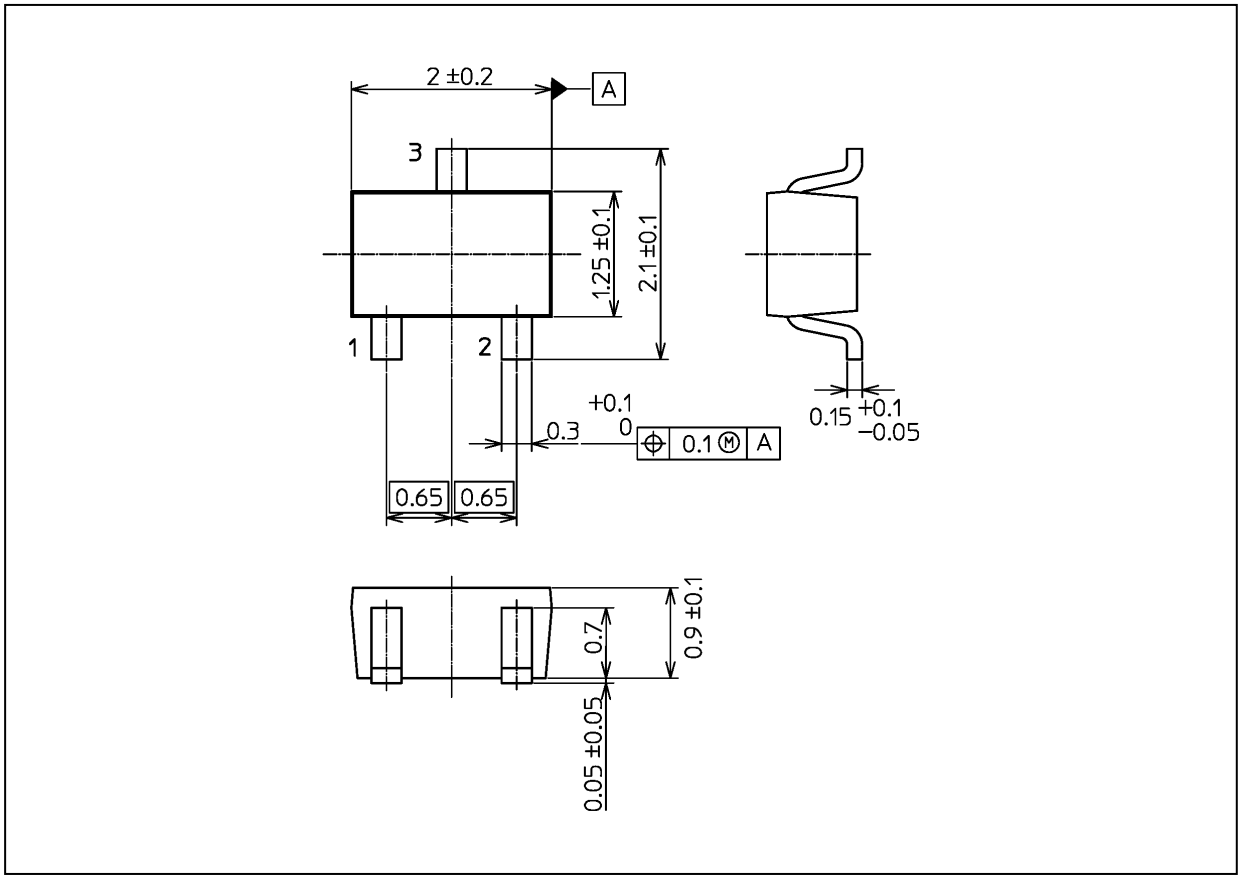
Fig. 10.24 RN1306 $V_{CE(sat)}$-I_C

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: 6.0 mg (typ.)

Package Name(s)
Nickname: USM

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