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

RN2301/02/03/04/05/06

1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

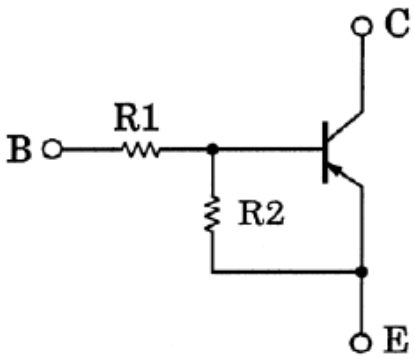
(1) AEC-Q101 qualified (Please see the orderable part number list)

(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 RN1301 to RN1306

3. Equivalent Circuit

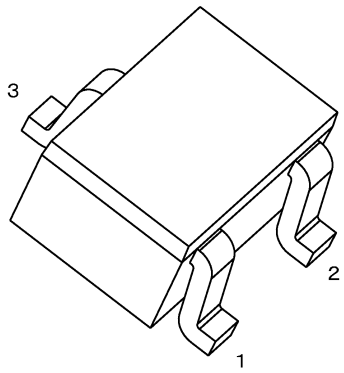


4. Bias Resistor Values

Part No.	R1 (kΩ)	R2 (kΩ)
RN2301	4.7	4.7
RN2302	10	10
RN2303	22	22
RN2304	47	47
RN2305	2.2	47
RN2306	4.7	47

Start of commercial production
1987-09

5. Packaging and Pin Assignment



1: Base
2: Emitter
3: Collector

USM

6. Orderable part number

Orderable part number		AEC-Q101	Note	Note	
RN2301	RN2301,LF	—		General Use	
	RN2301,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2301,LXHF	YES		Automotive Use	
RN2302	RN2302,LF	—		General Use	
	RN2302,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2302,LXHF	YES		Automotive Use	
RN2303	RN2303,LF	—		General Use	
	RN2303,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2303,LXHF	YES		Automotive Use	
RN2304	RN2304,LF	—		General Use	
	RN2304,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2304,LXHF	YES		Automotive Use	
RN2305	RN2305,LF	—		General Use	
	RN2305,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2305,LXHF	YES		Automotive Use	
RN2306	RN2306,LF	—		General Use	
	RN2306,LXGF	YES	(Note 1)	Unintended Use	(Note 1)
	RN2306,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	RN2301～RN2306	V_{CBO}	-50	V
Collector-emitter voltage		V_{CEO}	-50	
Emitter-base voltage	RN2301～RN2304	V_{EBO}	-10	
	RN2305,RN2306		-5	
Collector current	RN2301～RN2306	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).

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

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN2301～RN2306	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	RN2301	I_{EBO}	V_{EB} = -10 V, I_C = 0 mA	-0.82	—	-1.52	mA
	RN2302			-0.38	—	-0.71	
	RN2303			-0.17	—	-0.33	
	RN2304			-0.082	—	-0.15	
	RN2305		V_{EB} = -5 V, I_C = 0 mA	-0.078	—	-0.145	
	RN2306			-0.074	—	-0.138	
DC current gain	RN2301	h_{FE}	V_{CE} = -5 V, I_C = -10 mA	30	—	—	—
	RN2302			50	—	—	
	RN2303			70	—	—	
	RN2304			80	—	—	
	RN2305			80	—	—	
	RN2306			80	—	—	
Collector-emitter saturation voltage	RN2301～RN2306	$V_{CE(sat)}$	I_C = -5 mA, I_B = -0.25 mA	—	-0.1	-0.3	V
Input voltage (ON)	RN2301	$V_{I(ON)}$	V_{CE} = -0.2 V, I_C = -5 mA	-1.1	—	-2.0	
	RN2302			-1.2	—	-2.4	
	RN2303			-1.3	—	-3.0	
	RN2304			-1.5	—	-5.0	
	RN2305			-0.6	—	-1.1	
	RN2306			-0.7	—	-1.3	
Input voltage (OFF)	RN2301～RN2304	$V_{I(OFF)}$	V_{CE} = -5 V, I_C = -0.1 mA	-1.0	—	-1.5	
	RN2305, RN2306			-0.5	—	-0.8	
Transition frequency	RN2301～RN2306	f_T	V_{CE} = -10 V, I_C = -5 mA	—	200	—	MHz
Collector output capacitance	RN2301～RN2306	C_{ob}	V_{CB} = -10 V, I_E = 0 mA, f = 1 MHz	—	3	6	pF
Input resistance	RN2301	R_1	-	3.29	4.7	6.11	kΩ
	RN2302			7	10	13	
	RN2303			15.4	22	28.6	
	RN2304			32.9	47	61.1	
	RN2305			1.54	2.2	2.86	
	RN2306			3.29	4.7	6.11	
Resistor ratio	RN2301～RN2304	R1/R2	-	0.9	1.0	1.1	—
	RN2305			0.0421	0.0468	0.0515	
	RN2306			0.09	0.1	0.11	

9. Marking

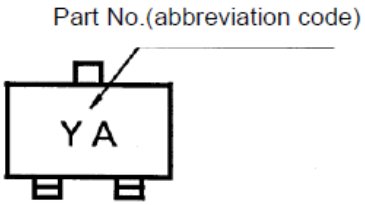


Fig. 9.1 Marking RN2301

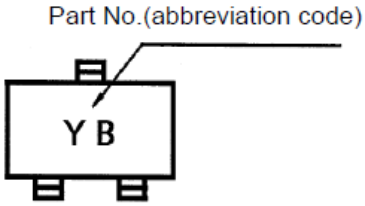


Fig. 9.2 Marking RN2302

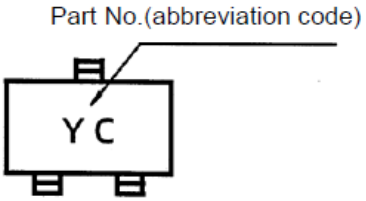


Fig. 9.3 Marking RN2303

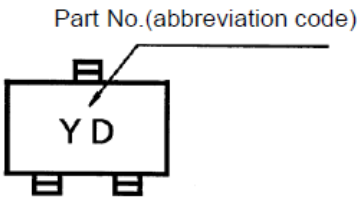


Fig. 9.4 Marking RN2304

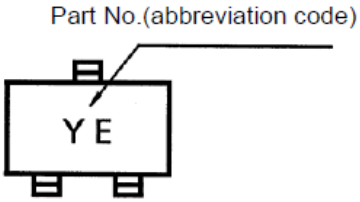


Fig. 9.5 Marking RN2305

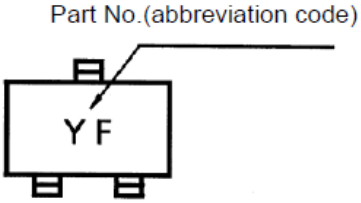


Fig. 9.6 Marking RN2306

10. Characteristics Curves (Note)

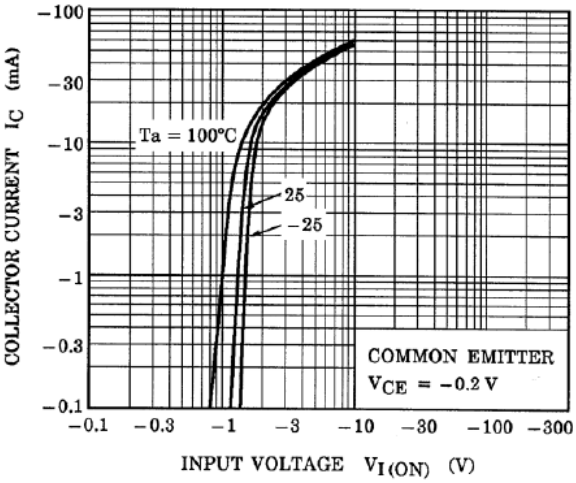


Fig. 10.1 RN2301 I_C-$V_{I(ON)}$

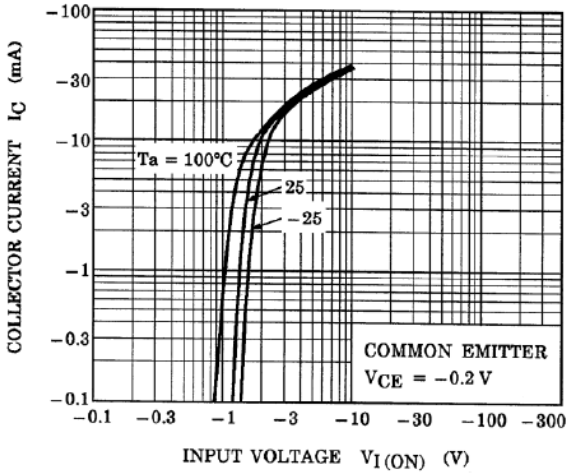


Fig. 10.2 RN2302 I_C-$V_{I(ON)}$

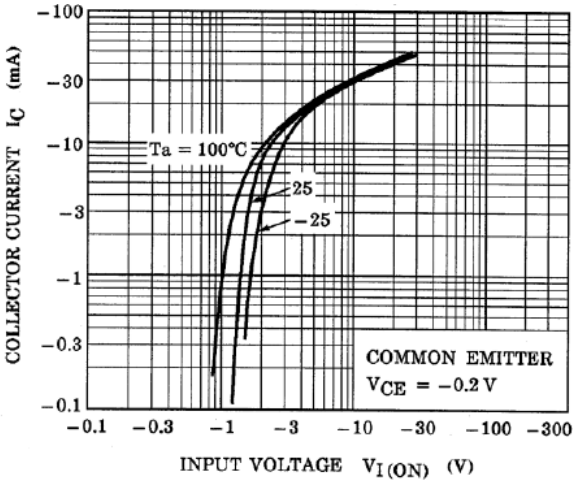


Fig. 10.3 RN2303 I_C-$V_{I(ON)}$

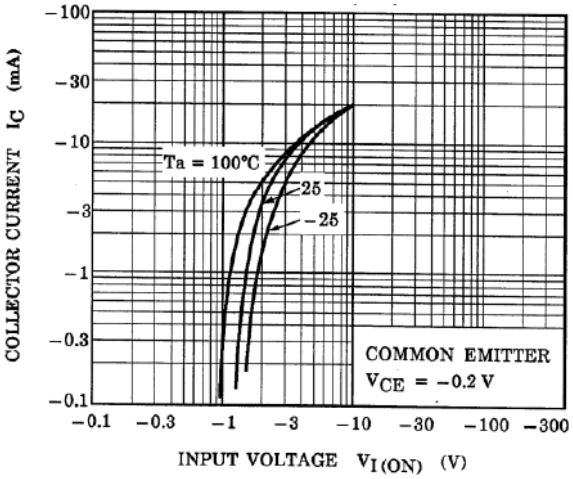


Fig. 10.4 RN2304 I_C-$V_{I(ON)}$

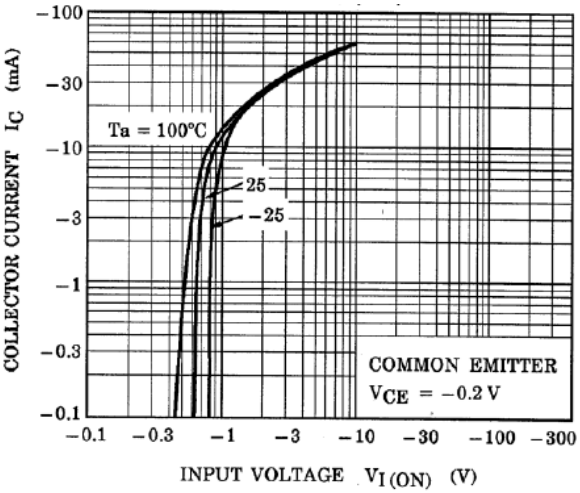


Fig. 10.5 RN2305 I_C-$V_{I(ON)}$

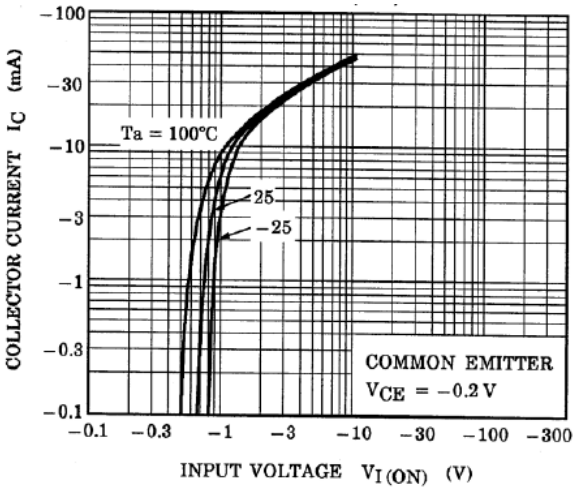


Fig. 10.6 RN2306 I_C-$V_{I(ON)}$

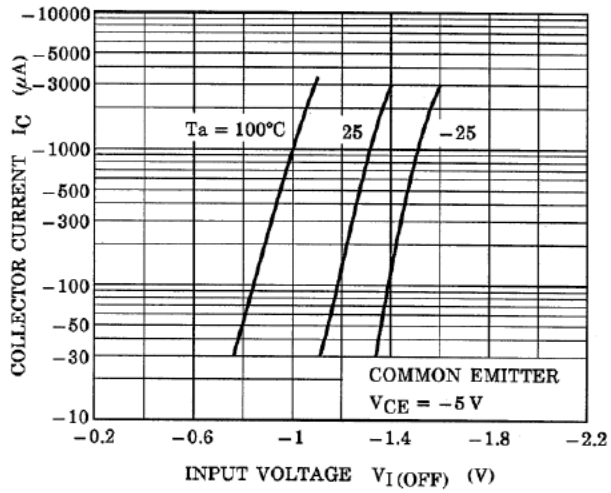


Fig. 10.7 RN2301 I_C-$V_{I(OFF)}$

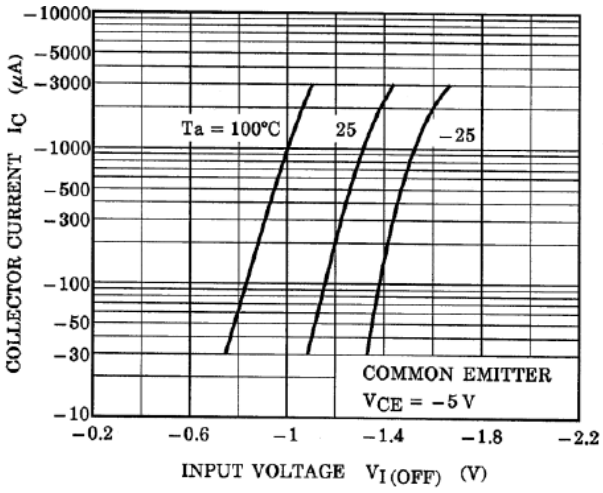


Fig. 10.8 RN2302 I_C-$V_{I(OFF)}$

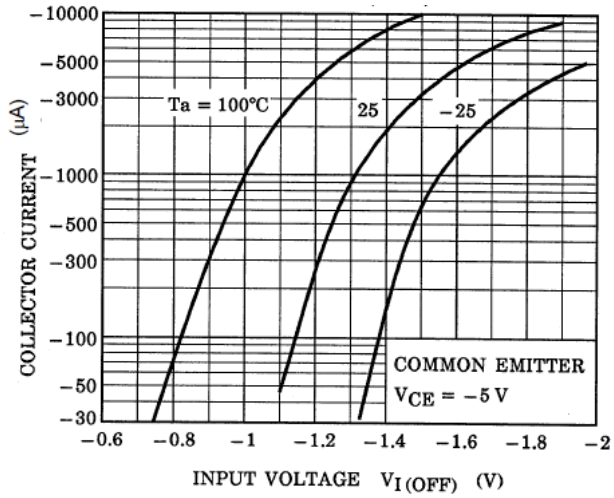


Fig. 10.9 RN2303 I_C-$V_{I(OFF)}$

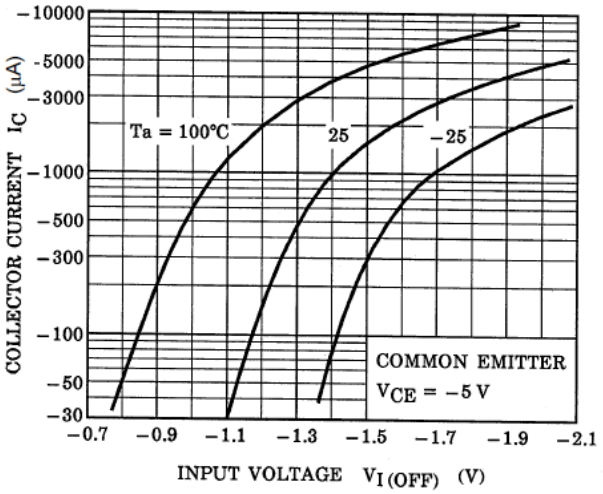


Fig. 10.10 RN2304 I_C-$V_{I(OFF)}$

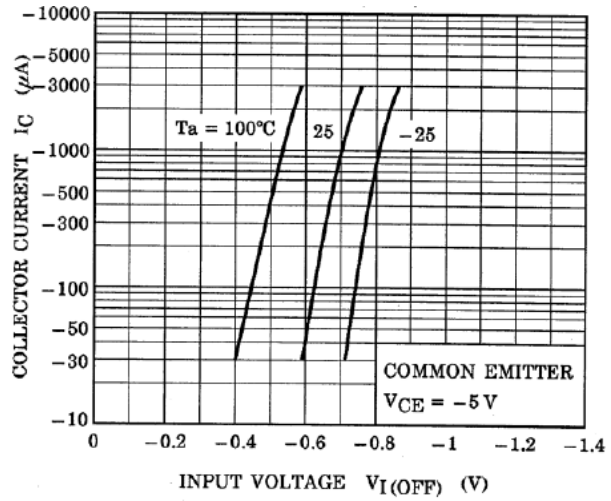


Fig. 10.11 RN2305 I_C-$V_{I(OFF)}$

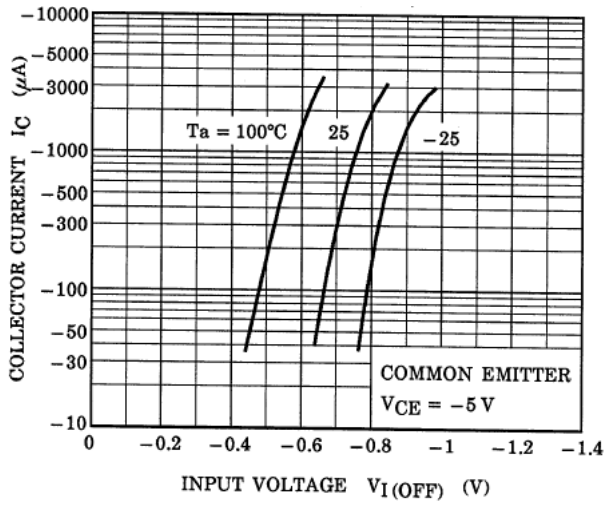


Fig. 10.12 RN2306 I_C-$V_{I(OFF)}$

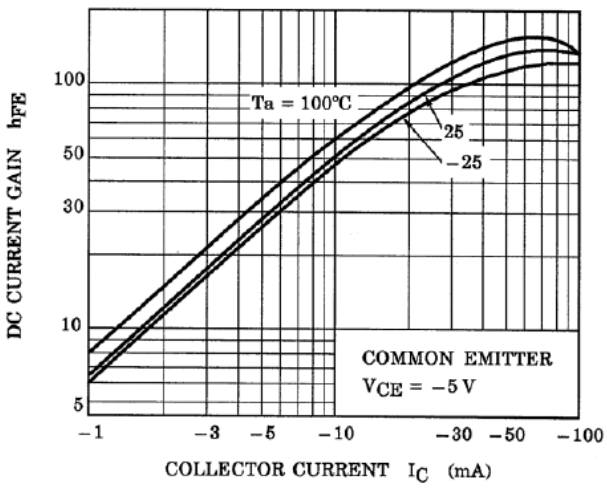


Fig. 10.13 RN2301 h_{FE}-I_C

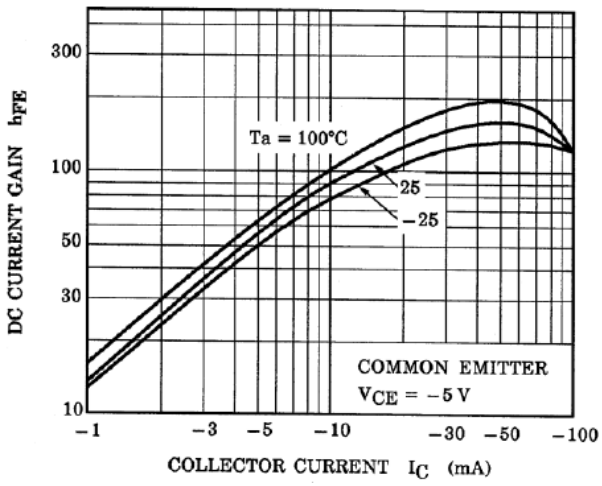


Fig. 10.14 RN2302 h_{FE}-I_C

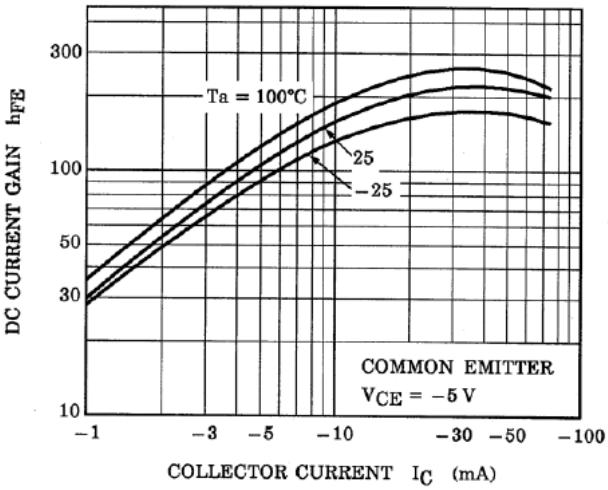


Fig. 10.15 RN2303 h_{FE}-I_C

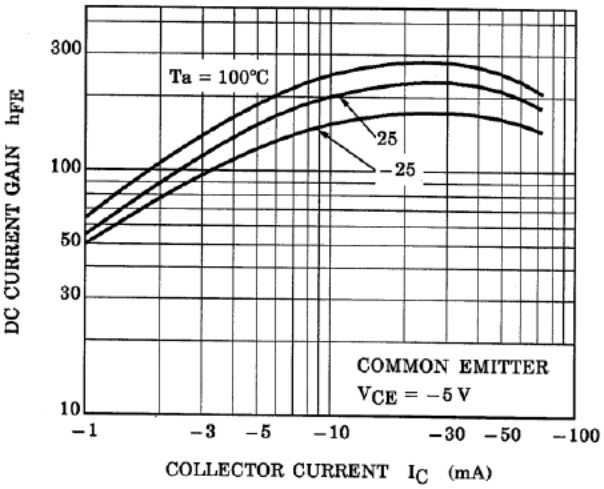


Fig. 10.16 RN2304 h_{FE}-I_C

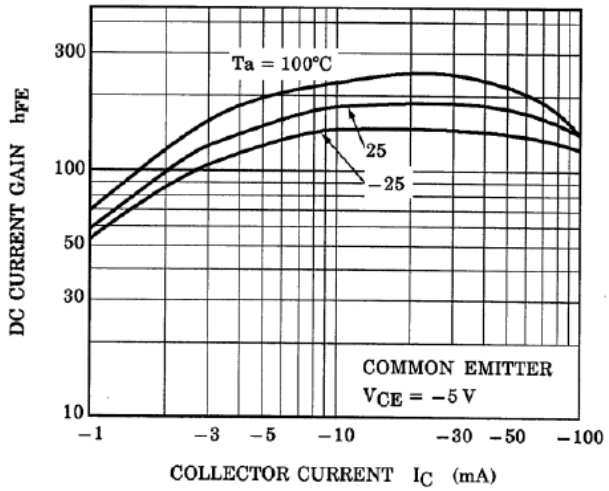


Fig. 10.17 RN2305 h_{FE}-I_C

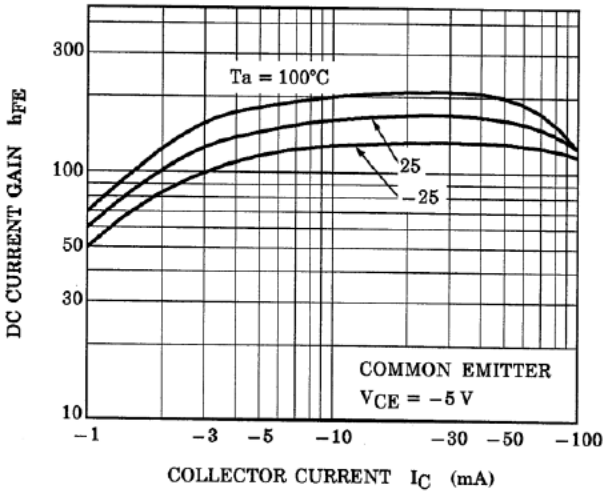


Fig. 10.18 RN2306 h_{FE}-I_C

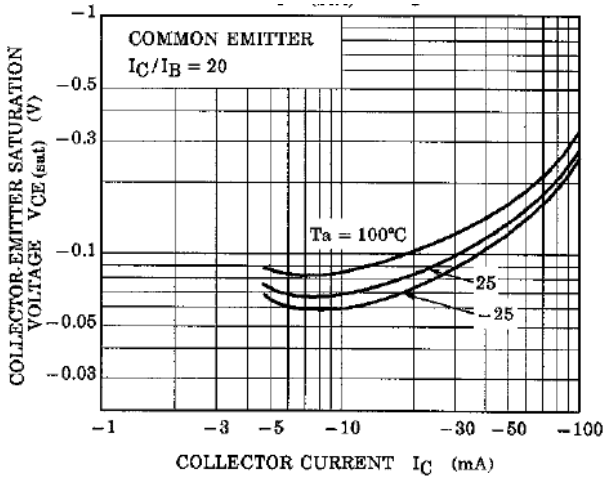


Fig. 10.19 RN2301 $V_{CE(sat)}$-I_C

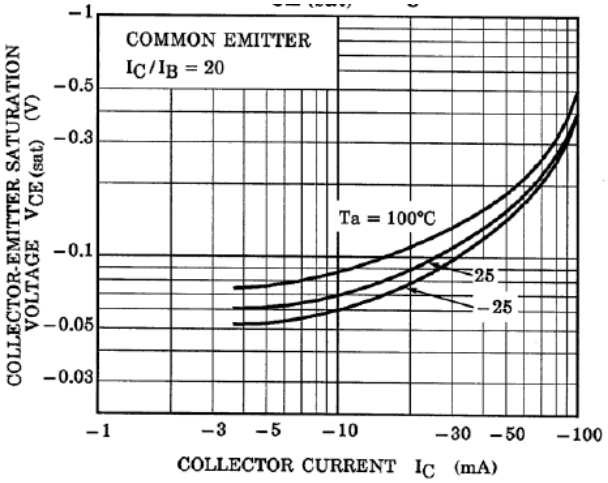


Fig. 10.20 RN2302 $V_{CE(sat)}$-I_C

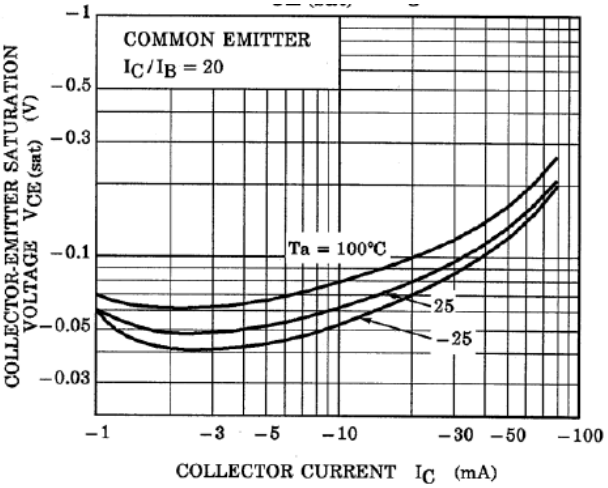


Fig. 10.21 RN2303 $V_{CE(sat)}$-I_C

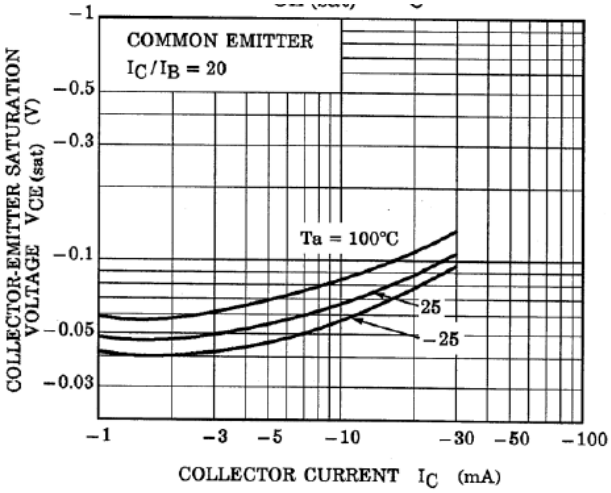


Fig. 10.22 RN2304 $V_{CE(sat)}$-I_C

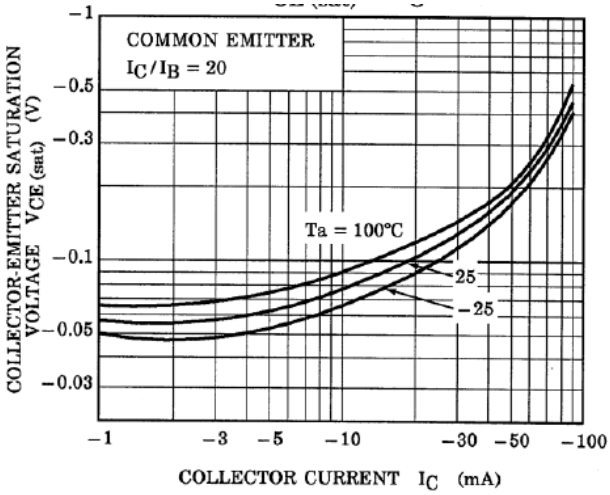


Fig. 10.23 RN2305 $V_{CE(sat)}$-I_C

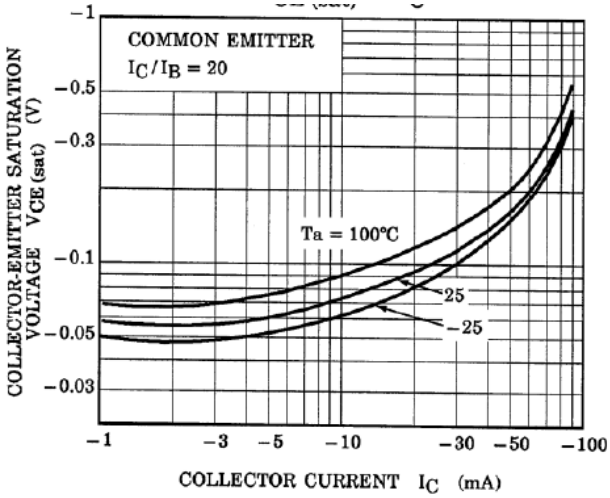
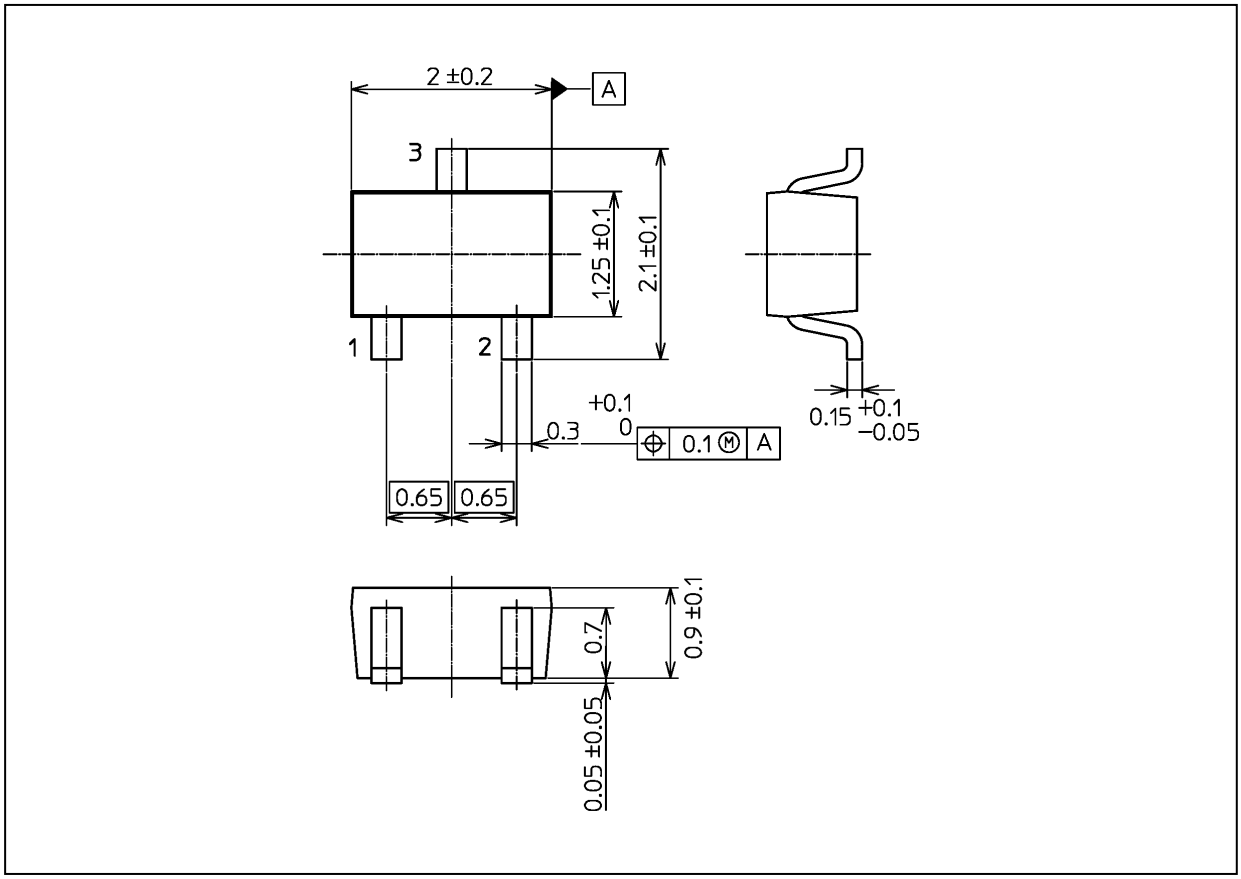


Fig. 10.24 RN2306$V_{CE(sat)}$-I_C

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

Package Dimensions

Unit: mm



Weight: 6.0 mg (typ.)

Package Name(s)
TOSHIBA: 2-2E1S
Nickname: USM

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