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

RN1414/15/16/17/18

1. Applications

- Switching
- Inverter Circuits
- Interfacing
- Driver Circuits

2. Features

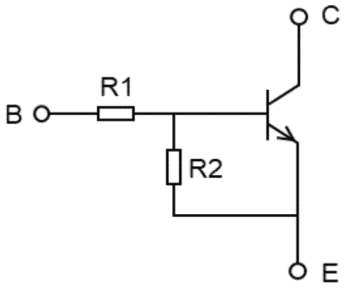
(1) AEC-Q101 qualified (Please see the orderable part number list)

(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 RN2414 to RN2418

3. Equivalent Circuit

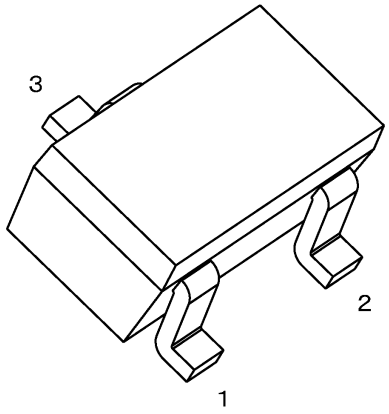


4. Bias Resistor Values

Part No.	R1 (kΩ)	R2 (kΩ)
RN1414	1	10
RN1415	2.2	10
RN1416	4.7	10
RN1417	10	4.7
RN1418	47	10

Start of commercial production
1994-08

5. Packaging and Pin Assignment



1: Base
2: Emitter
3: Collector

S-Mini

6. Orderable part number

Orderable part number		AEC-Q101	Note
RN1414	RN1414,LF	—	General Use
	RN1414,LXGF	YES (Note 1)	Unintended Use (Note 1)
RN1415	RN1415,LF	—	General Use
	RN1415,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1415,LXHF	YES	Automotive Use
RN1416	RN1416,LF	—	General Use
	RN1416,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1416,LXHF	YES	Automotive Use
RN1417	RN1417,LF	—	General Use
	RN1417,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1417,LXHF	YES	Automotive Use
RN1418	RN1418,LF	—	General Use
	RN1418,LXGF	YES (Note 1)	Unintended Use (Note 1)
	RN1418,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	RN1414 to RN1418	V_{CBO}	50	V
Collector-emitter voltage		V_{CEO}	50	
Emitter-base voltage	RN1414	V_{EBO}	5	V
	RN1415		6	
	RN1416		7	
	RN1417		15	
	RN1418		25	
Collector current	RN1414 to RN1418	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	RN1414 to RN1418	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	RN1414	I_{EBO}	V_{EB} = 5 V, I_C = 0 mA	0.35	—	0.65	mA
	RN1415		V_{EB} = 6 V, I_C = 0 mA	0.37	—	0.71	
	RN1416		V_{EB} = 7 V, I_C = 0 mA	0.36	—	0.68	
	RN1417		V_{EB} = 15 V, I_C = 0 mA	0.78	—	1.46	
	RN1418		V_{EB} = 25 V, I_C = 0 mA	0.33	—	0.63	
DC current gain	RN1414 to RN1416, RN1418	h_{FE}	V_{CE} = 5 V, I_C = 10 mA	50	—	—	—
	RN1417			30	—	—	
Collector-emitter saturation voltage	RN1414 to RN1418	$V_{CE(sat)}$	I_C = 5 mA, I_B = 0.25 mA	—	0.1	0.3	V
Input voltage (ON)	RN1414	$V_{I(ON)}$	V_{CE} = 0.2 V, I_C = 5 mA	0.6	—	2.0	V
	RN1415			0.7	—	2.5	
	RN1416			0.8	—	2.5	
	RN1417			1.5	—	3.5	
	RN1418			2.5	—	10.0	
Input voltage (OFF)	RN1414	$V_{I(OFF)}$	V_{CE} = 5 V, I_C = 0.1 mA	0.3	—	0.9	V
	RN1415			0.3	—	1.0	
	RN1416			0.3	—	1.1	
	RN1417			0.3	—	2.3	
	RN1418			0.5	—	5.7	
Transition frequency	RN1414 to RN1418	f_T	V_{CE} = 10 V, I_C = 5 mA	—	250	—	MHz
Collector output capacitance	RN1414 to RN1418	C_{ob}	V_{CB} = 10 V, I_E = 0 mA, f = 1 MHz	—	3.0	6.0	pF
Input resistance	RN1414	R_1	-	0.7	1.0	1.3	kΩ
	RN1415			1.54	2.2	2.86	
	RN1416			3.29	4.7	6.11	
	RN1417			7.0	10.0	13.0	
	RN1418			32.9	47.0	61.1	
Resistor ratio	RN1414	R1/R2	-	—	0.1	—	—
	RN1415			—	0.22	—	
	RN1416			—	0.47	—	
	RN1417			—	2.13	—	
	RN1418			—	4.7	—	

9. Marking

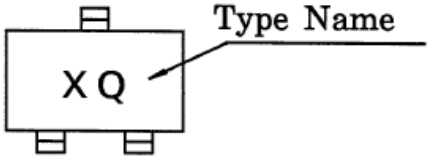


Fig. 9.1 Marking RN1414

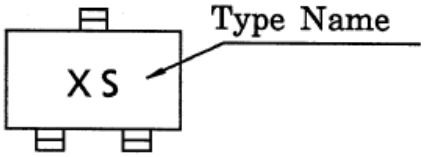


Fig. 9.2 Marking RN1415

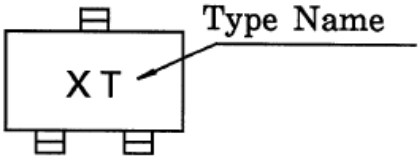


Fig. 9.3 Marking RN1416

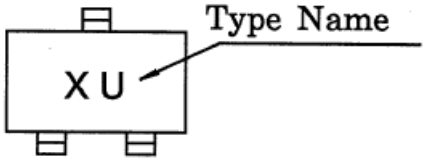


Fig. 9.4 Marking RN1417

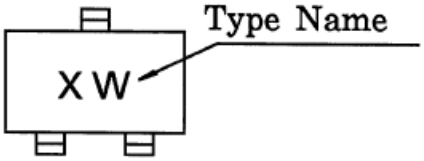


Fig. 9.5 Marking RN1418

10. Characteristics Curves (Note)

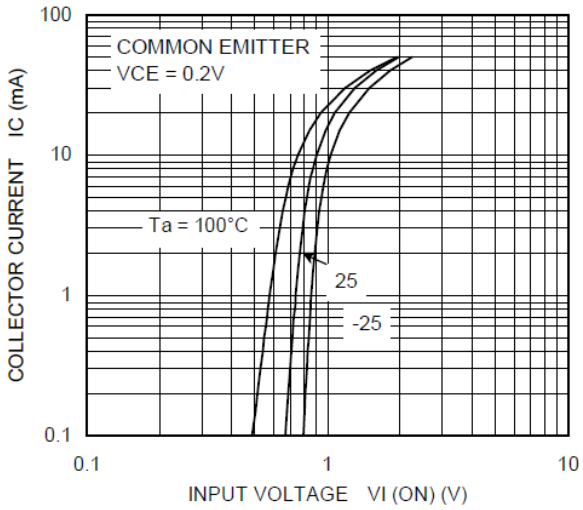


Fig. 10.1 RN1414 I_C-$V_{I(ON)}$

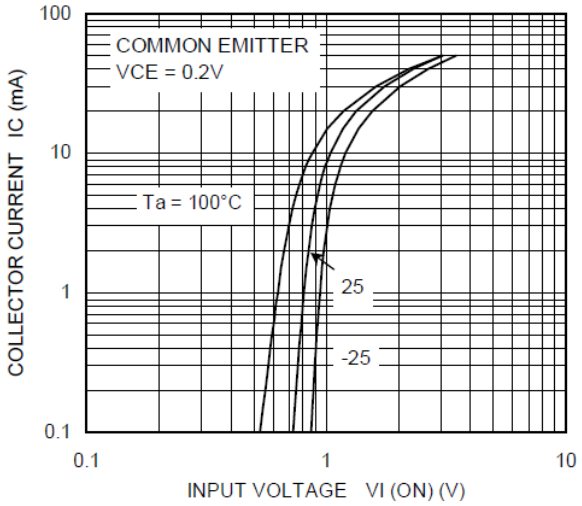


Fig. 10.2 RN1415 I_C-$V_{I(ON)}$

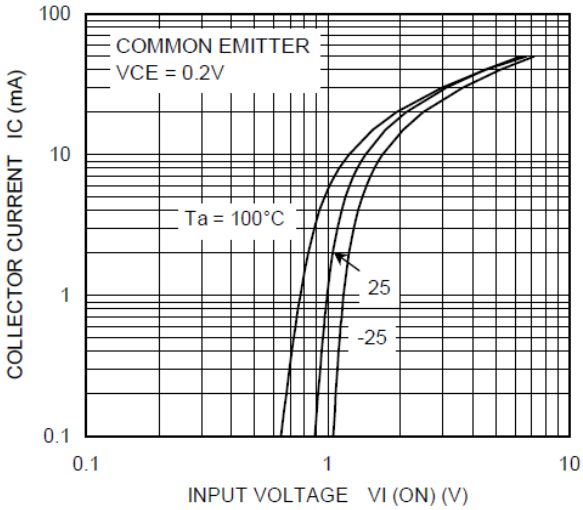


Fig. 10.3 RN1416 I_C-$V_{I(ON)}$

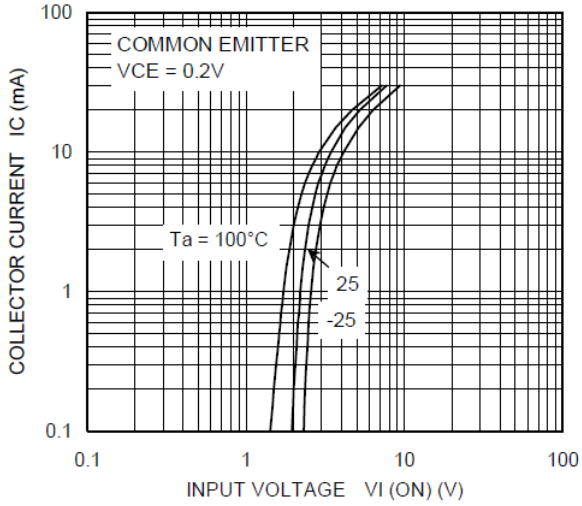


Fig. 10.4 RN1417 I_C-$V_{I(ON)}$

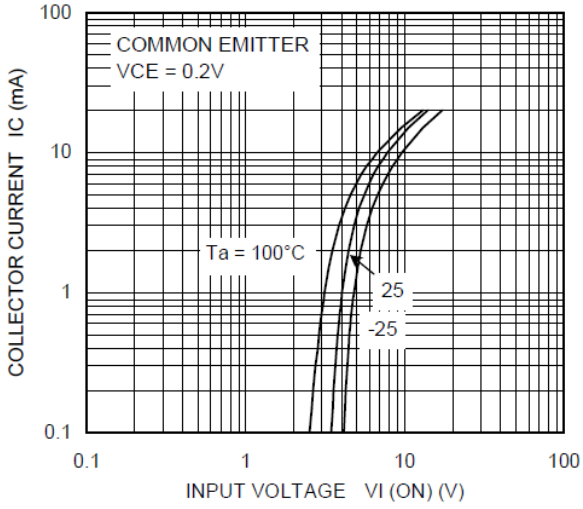


Fig. 10.5 RN1418 I_C-$V_{I(ON)}$

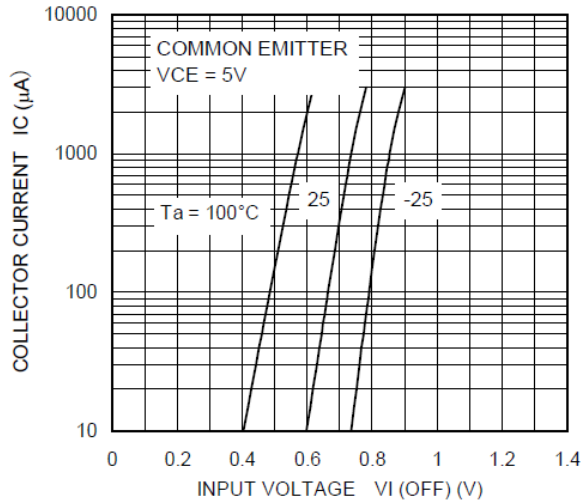


Fig. 10.6 RN1414 I_C-$V_{I(OFF)}$

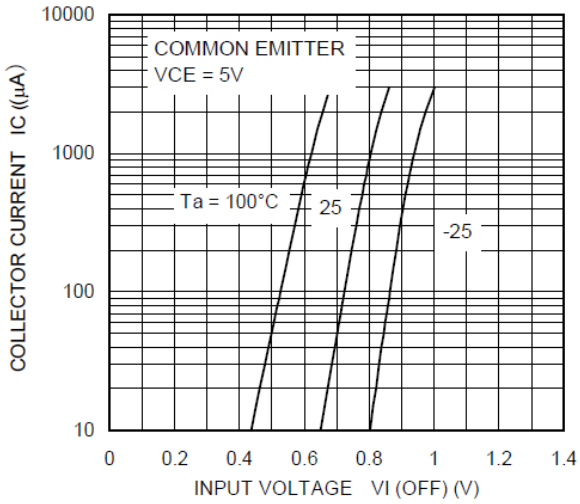


Fig. 10.7 RN1415 I_C-$V_{I(OFF)}$

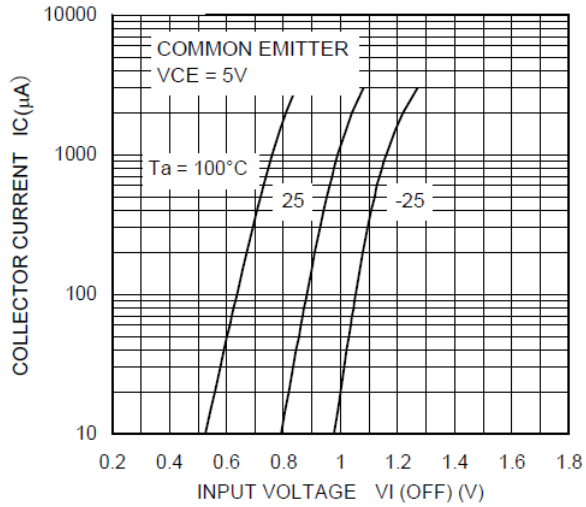


Fig. 10.8 RN1416 I_C-$V_{I(OFF)}$

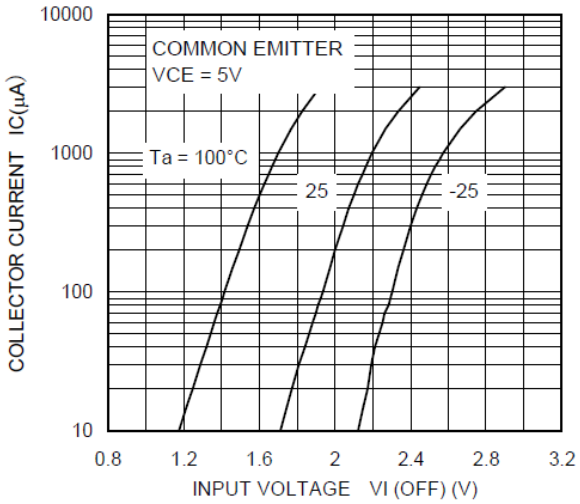


Fig. 10.9 RN1417 I_C-$V_{I(OFF)}$

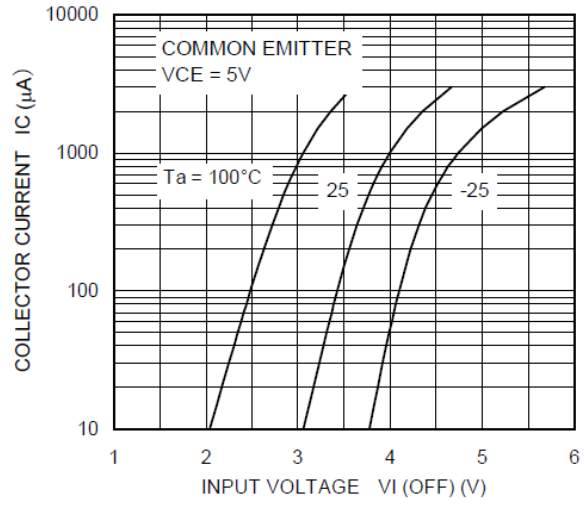


Fig. 10.10 RN1418 I_C-$V_{I(OFF)}$

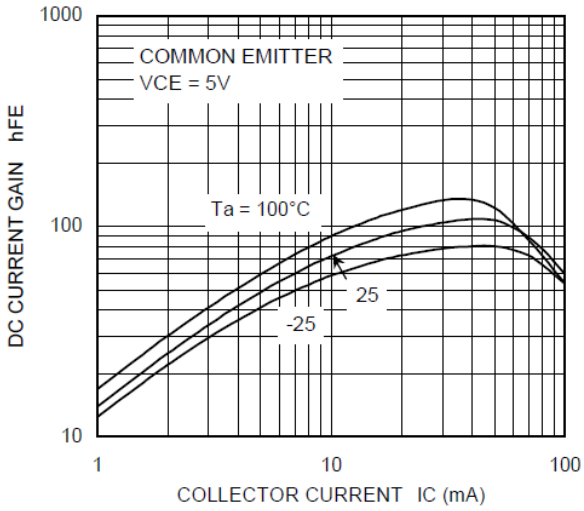


Fig. 10.11 RN1414 h_{FE}-I_C

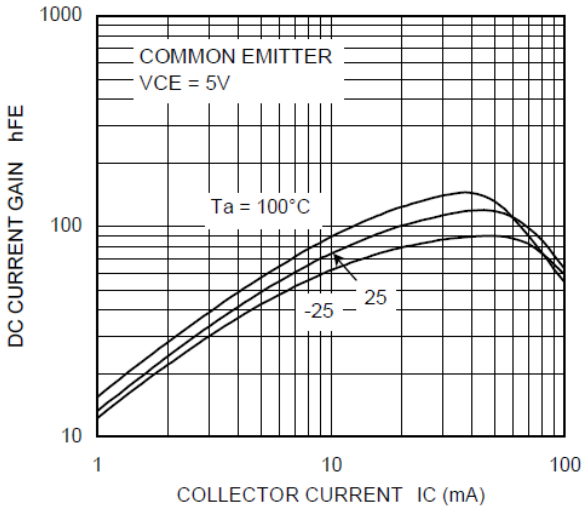


Fig. 10.12 RN1415 h_{FE}-I_C

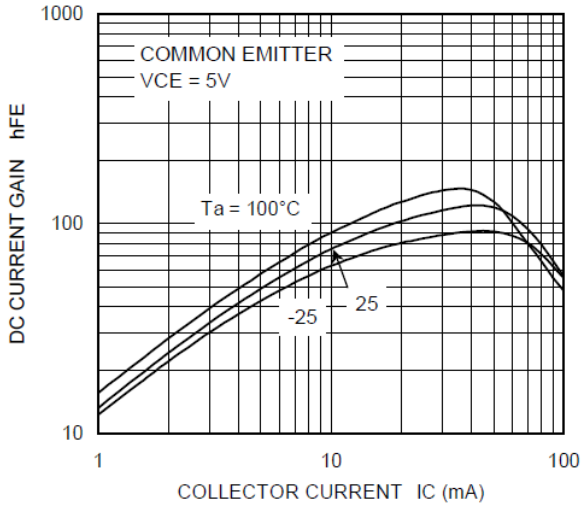


Fig. 10.13 RN1416 h_{FE}-I_C

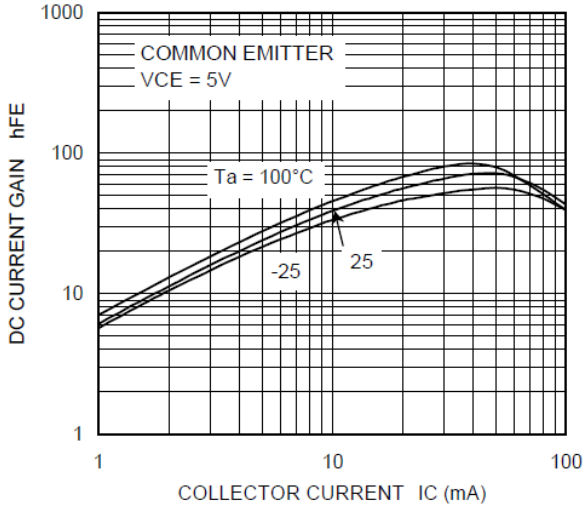


Fig. 10.14 RN1417 h_{FE}-I_C

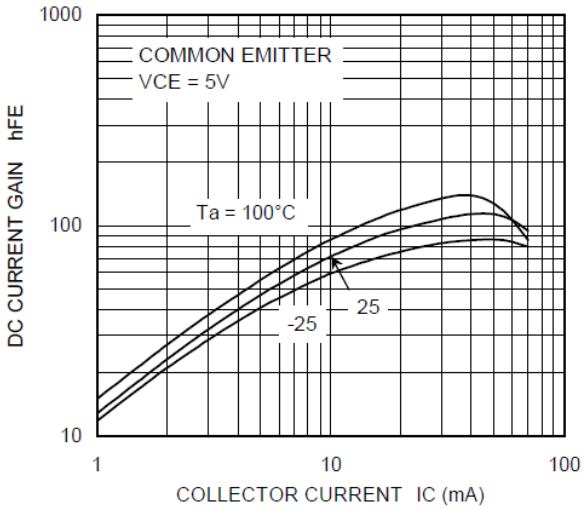


Fig. 10.15 RN1418 h_{FE}-I_C

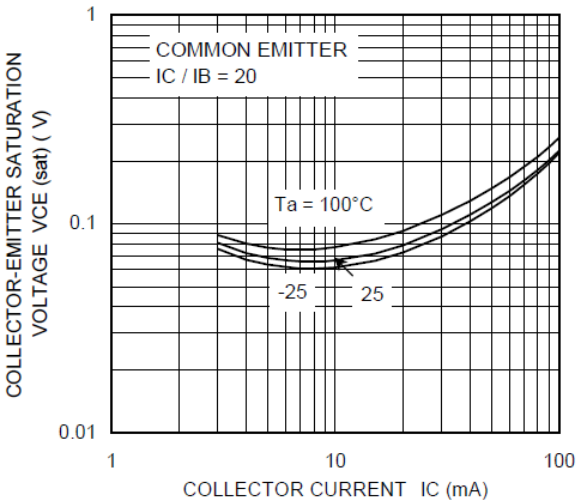


Fig. 10.16 RN1414 $V_{CE(sat)}$-I_C

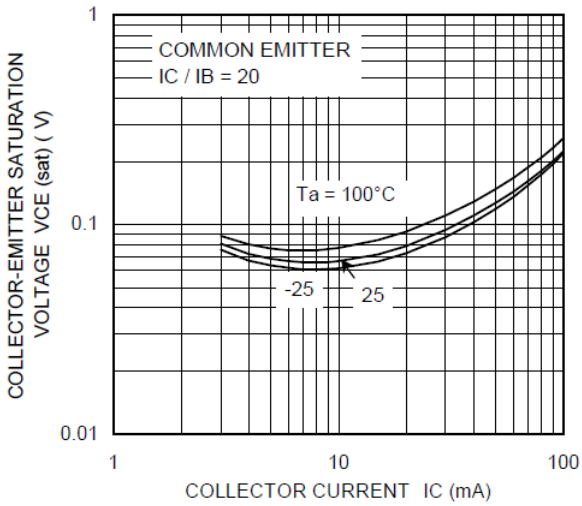


Fig. 10.17 RN1415 $V_{CE(sat)}$-I_C

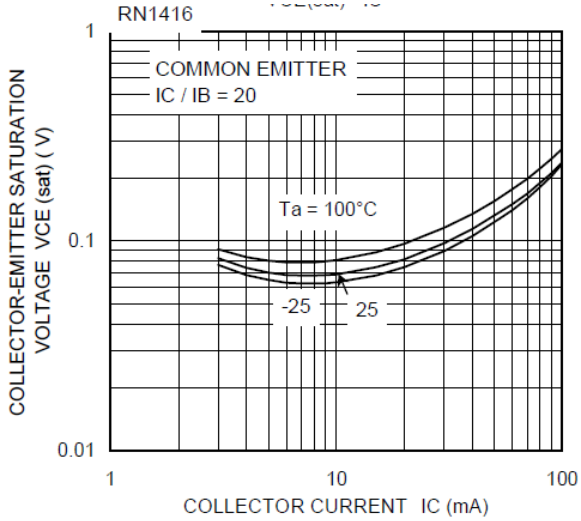


Fig. 10.18 RN1416 $V_{CE(sat)}$-I_C

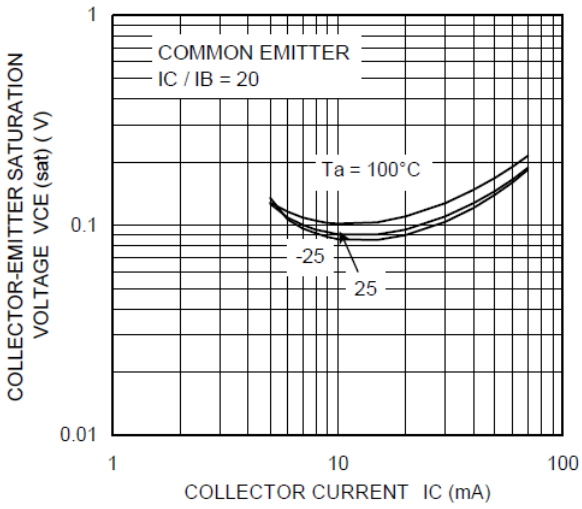


Fig. 10.19 RN1417 $V_{CE(sat)}$-I_C

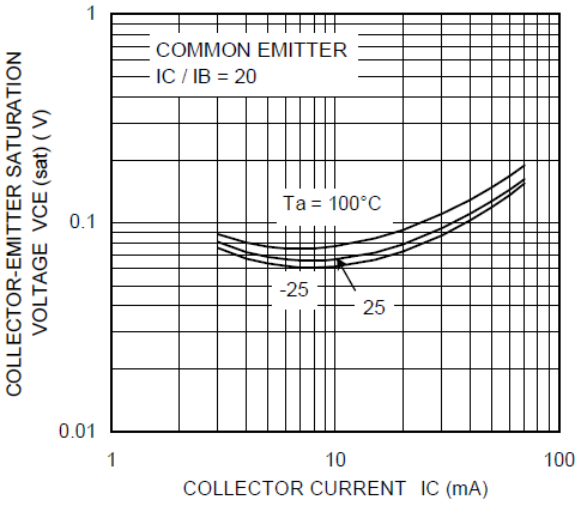
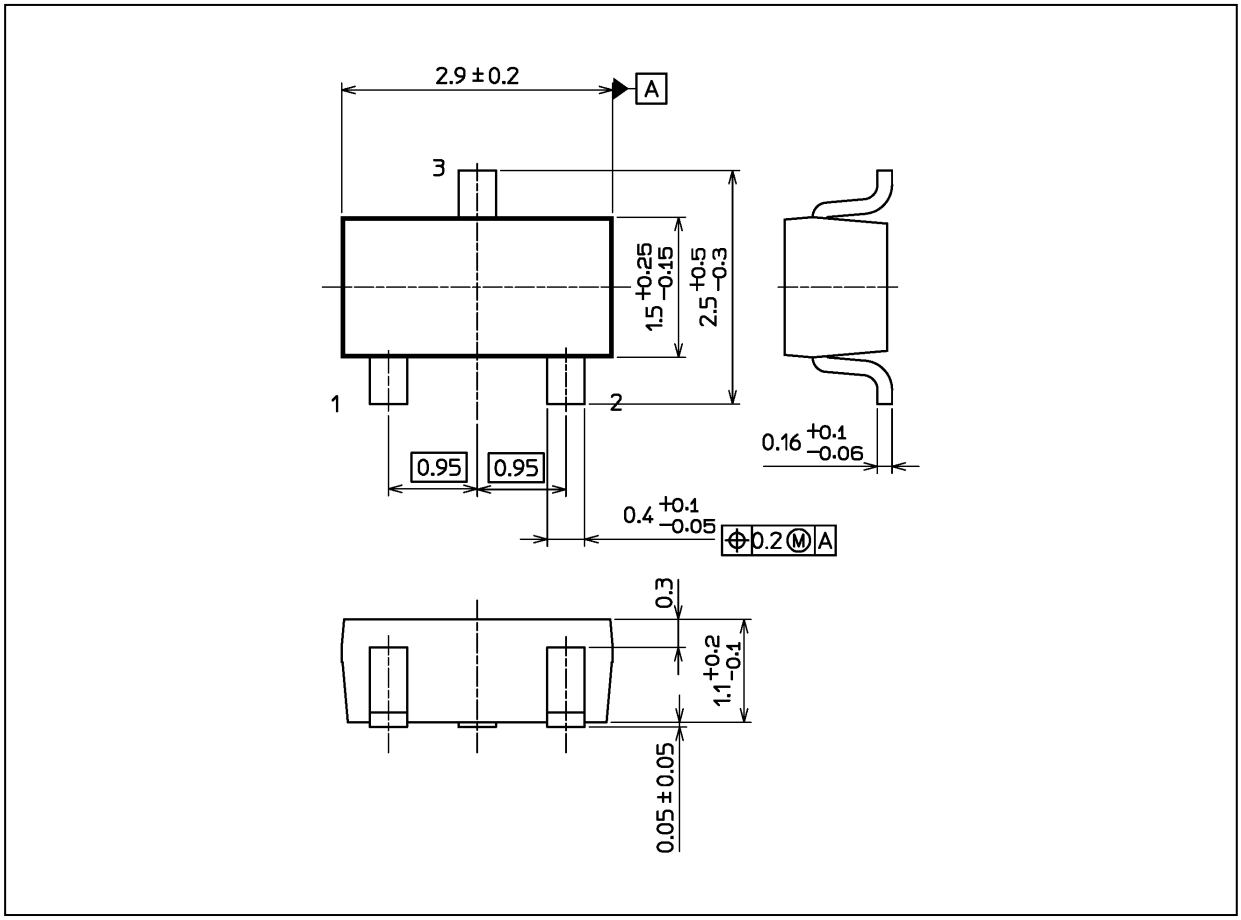


Fig. 10.20 RN1418 $V_{CE(sat)}$-I_C

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)
Nickname: S-Mini

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