

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

# RN1414/15/16/17/18

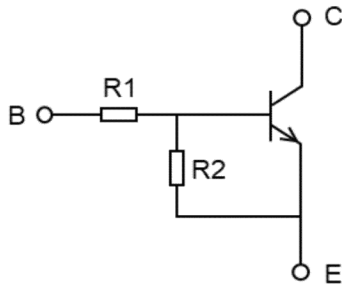
## 1. Applications

- 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



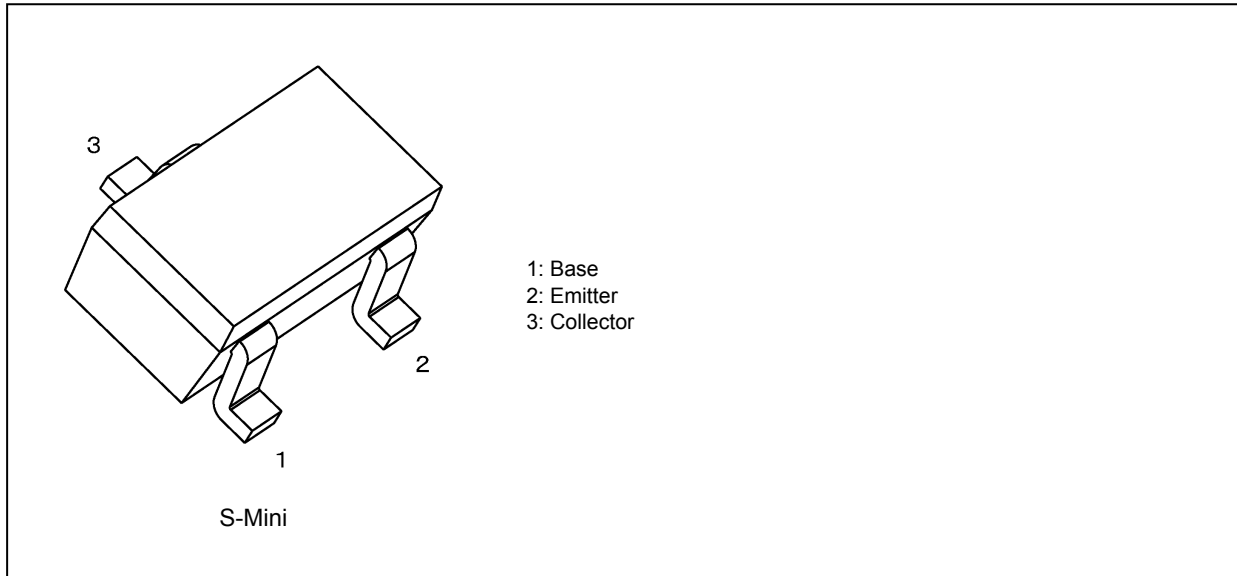
## 4. Bias Resistor Values

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



### 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, $T_a = 25\text{ }^\circ\text{C}$ )

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	$^\circ\text{C}$
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, $T_a = 25\text{ }^\circ\text{C}$ )

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1414 to RN1418	$I_{CBO}$	$V_{CB} = 50\text{ V}, I_E = 0\text{ mA}$	—	—	100	nA
		$I_{CEO}$	$V_{CE} = 50\text{ V}, I_B = 0\text{ mA}$	—	—	500	
Emitter cut-off current	RN1414	$I_{EBO}$	$V_{EB} = 5\text{ V}, I_C = 0\text{ mA}$	0.35	—	0.65	mA
	RN1415		$V_{EB} = 6\text{ V}, I_C = 0\text{ mA}$	0.37	—	0.71	
	RN1416		$V_{EB} = 7\text{ V}, I_C = 0\text{ mA}$	0.36	—	0.68	
	RN1417		$V_{EB} = 15\text{ V}, I_C = 0\text{ mA}$	0.78	—	1.46	
	RN1418		$V_{EB} = 25\text{ V}, I_C = 0\text{ mA}$	0.33	—	0.63	
DC current gain	RN1414 to RN1416, RN1418	$h_{FE}$	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}$	50	—	—	—
	RN1417			30	—	—	
Collector-emitter saturation voltage	RN1414 to RN1418	$V_{CE(sat)}$	$I_C = 5\text{ mA}, I_B = 0.25\text{ mA}$	—	0.1	0.3	V
Input voltage (ON)	RN1414	$V_{I(ON)}$	$V_{CE} = 0.2\text{ V}, I_C = 5\text{ mA}$	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	$V_{I(OFF)}$	$V_{CE} = 5\text{ V}, I_C = 0.1\text{ mA}$	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	$f_T$	$V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$	—	250	—	MHz
Collector output capacitance	RN1414 to RN1418	$C_{ob}$	$V_{CB} = 10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	3.0	6.0	pF
Input resistance	RN1414	$R_1$	-	0.7	1.0	1.3	k $\Omega$
	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

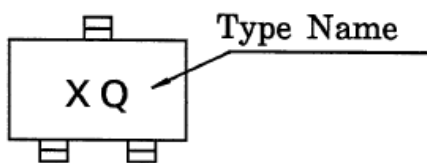


Fig. 9.1 Marking RN1414

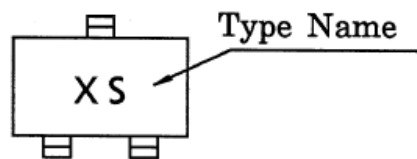


Fig. 9.2 Marking RN1415

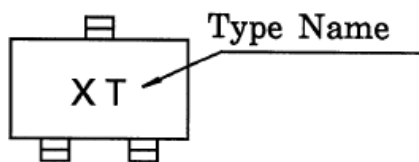


Fig. 9.3 Marking RN1416

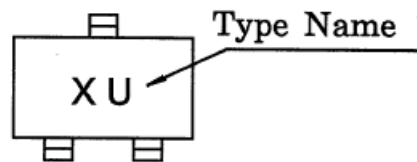


Fig. 9.4 Marking RN1417

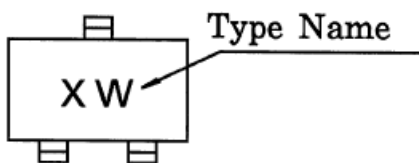


Fig. 9.5 Marking RN1418

### 10. Characteristics Curves (Note)

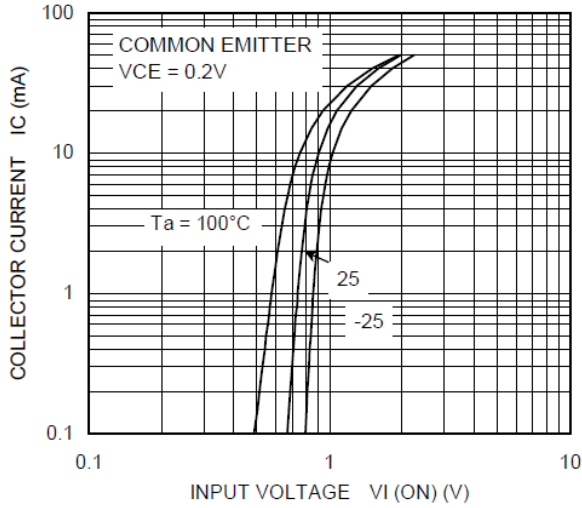


Fig. 10.1 RN1414  $I_C$ - $V_{I(ON)}$

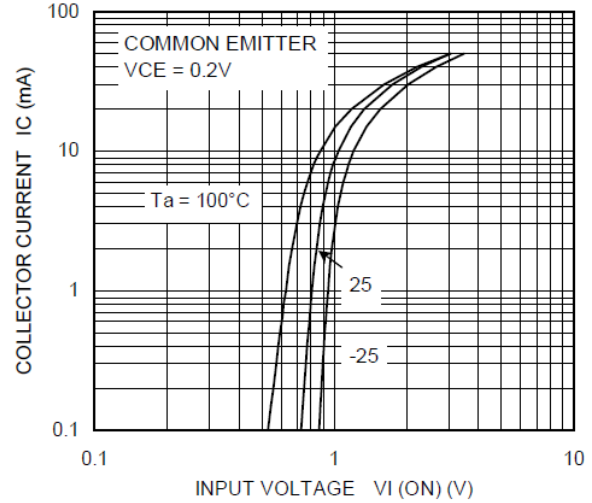


Fig. 10.2 RN1415  $I_C$ - $V_{I(ON)}$

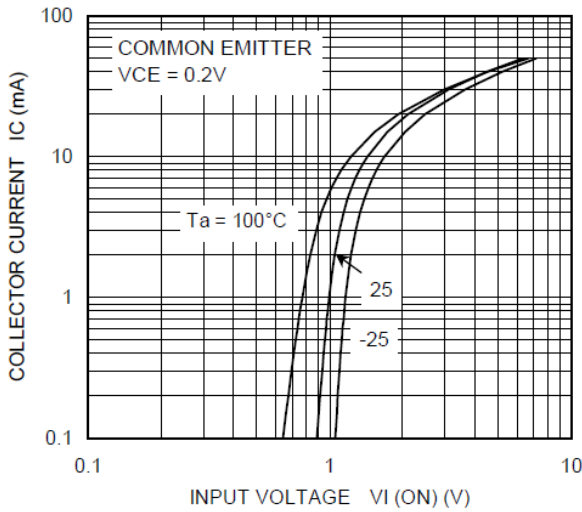


Fig. 10.3 RN1416  $I_C$ - $V_{I(ON)}$

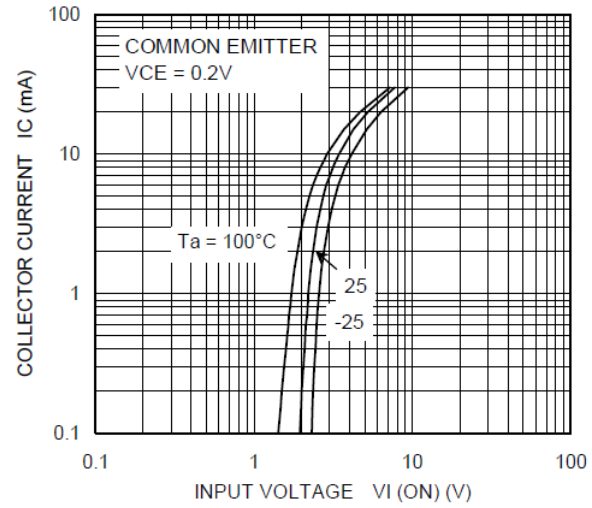


Fig. 10.4 RN1417  $I_C$ - $V_{I(ON)}$

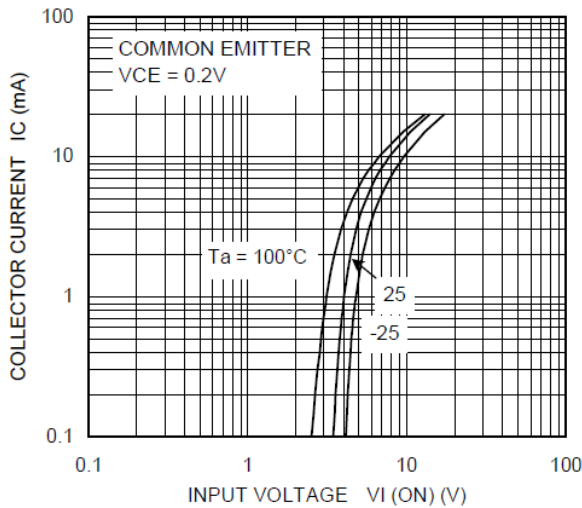


Fig. 10.5 RN1418  $I_C$ - $V_{I(ON)}$

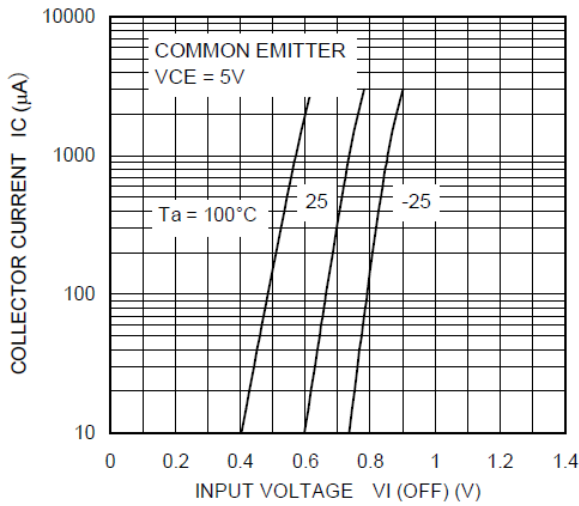


Fig. 10.6 RN1414  $I_C$ - $V_I$ (OFF)

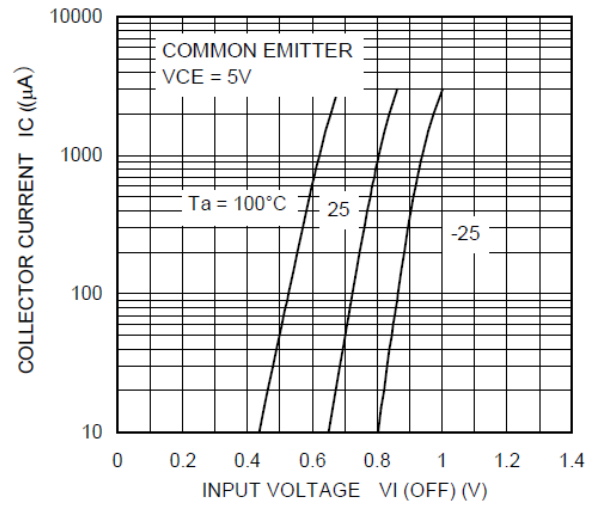


Fig. 10.7 RN1415  $I_C$ - $V_I$ (OFF)

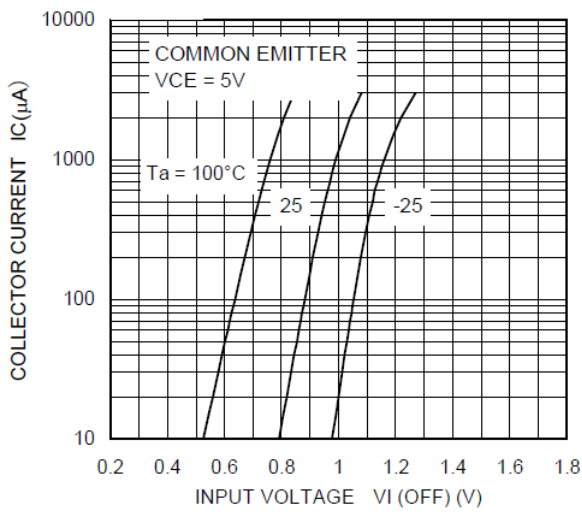


Fig. 10.8 RN1416  $I_C$ - $V_I$ (OFF)

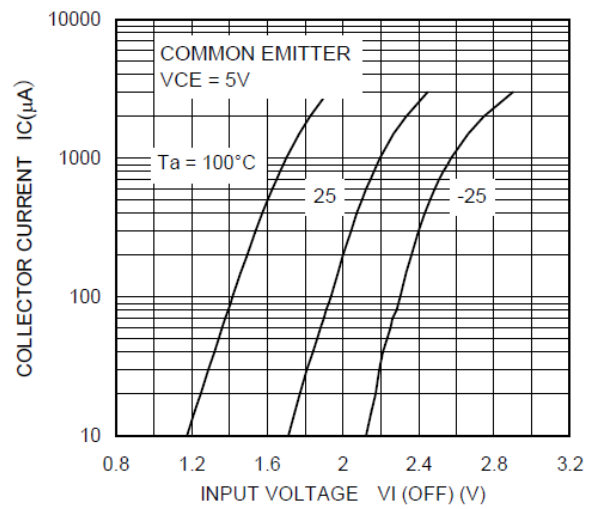


Fig. 10.9 RN1417  $I_C$ - $V_I$ (OFF)

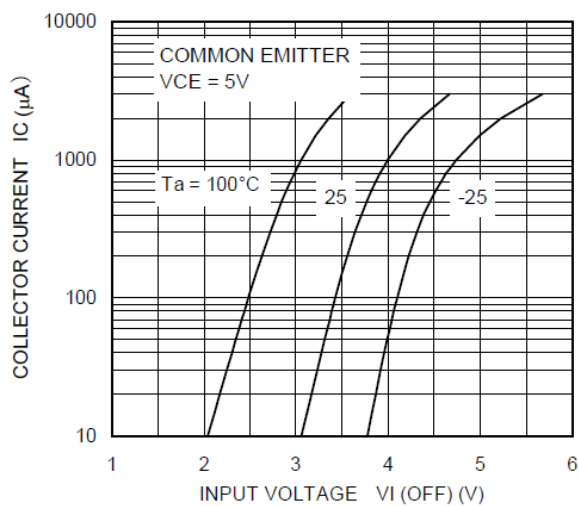


Fig. 10.10 RN1418  $I_C$ - $V_I$ (OFF)

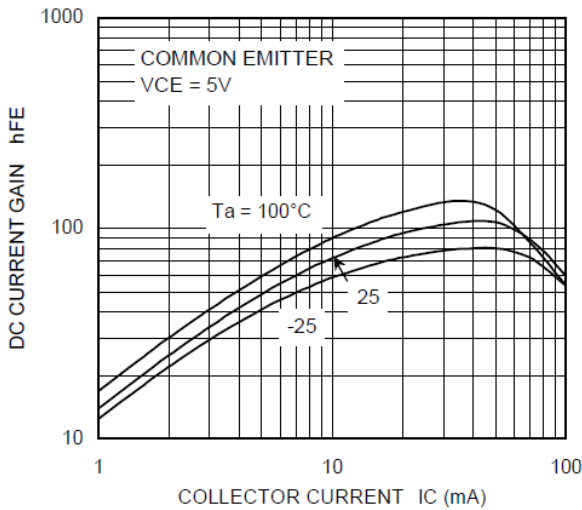


Fig. 10.11 RN1414  $h_{FE}-I_C$

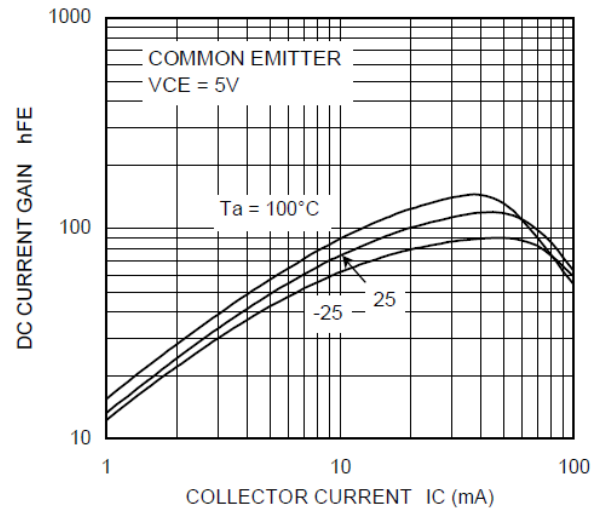


Fig. 10.12 RN1415  $h_{FE}-I_C$

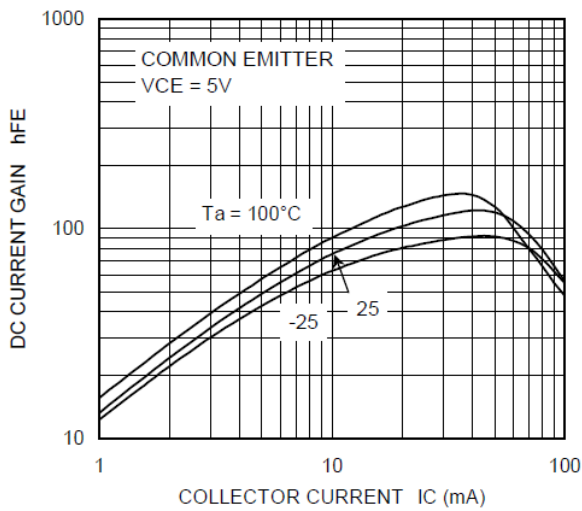


Fig. 10.13 RN1416  $h_{FE}-I_C$

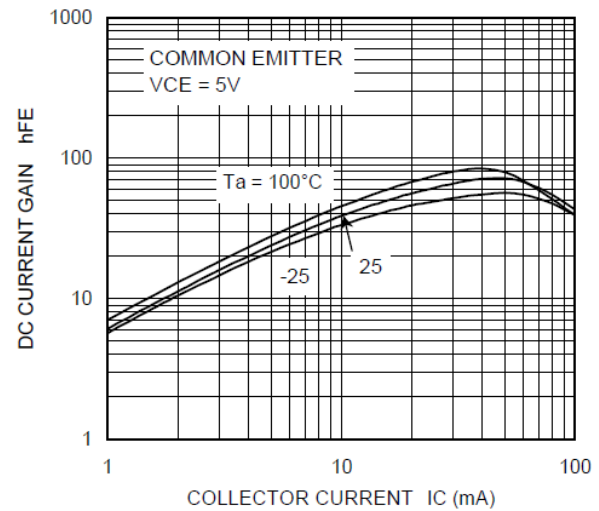


Fig. 10.14 RN1417  $h_{FE}-I_C$

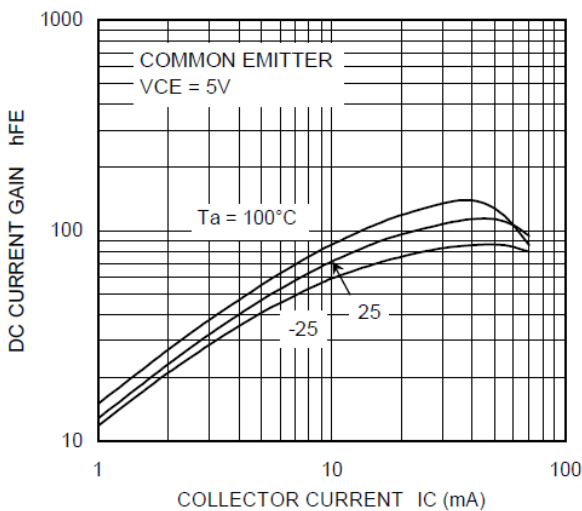
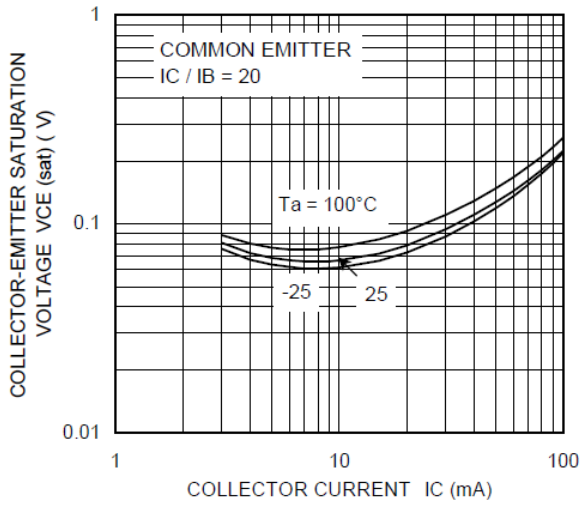
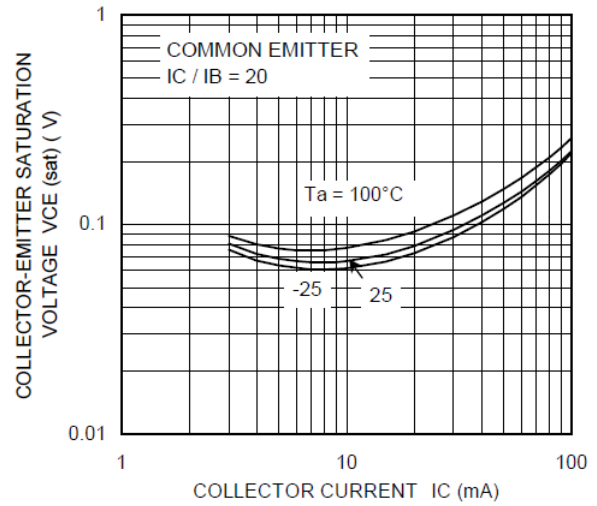


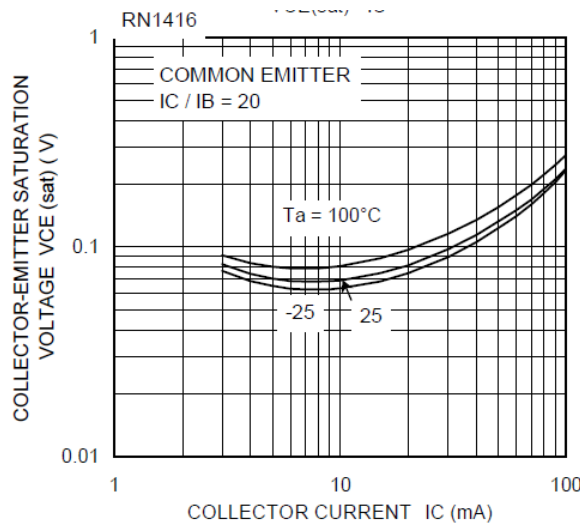
Fig. 10.15 RN1418  $h_{FE}-I_C$



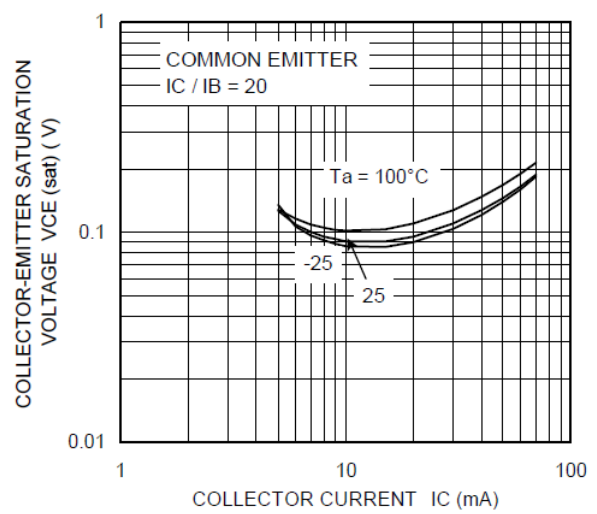
**Fig. 10.16 RN1414  $V_{CE(sat)}$ - $I_C$**



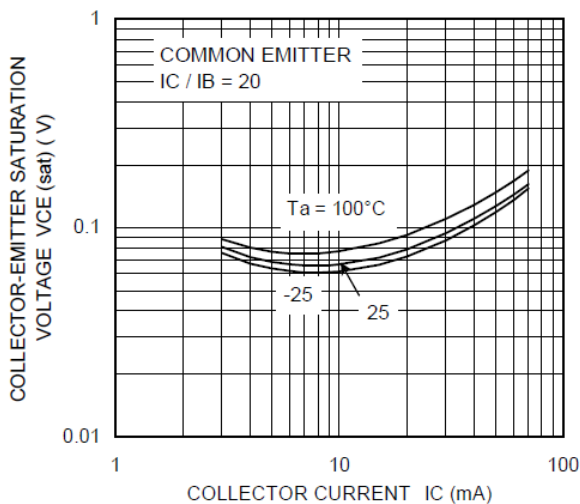
**Fig. 10.17 RN1415  $V_{CE(sat)}$ - $I_C$**



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



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

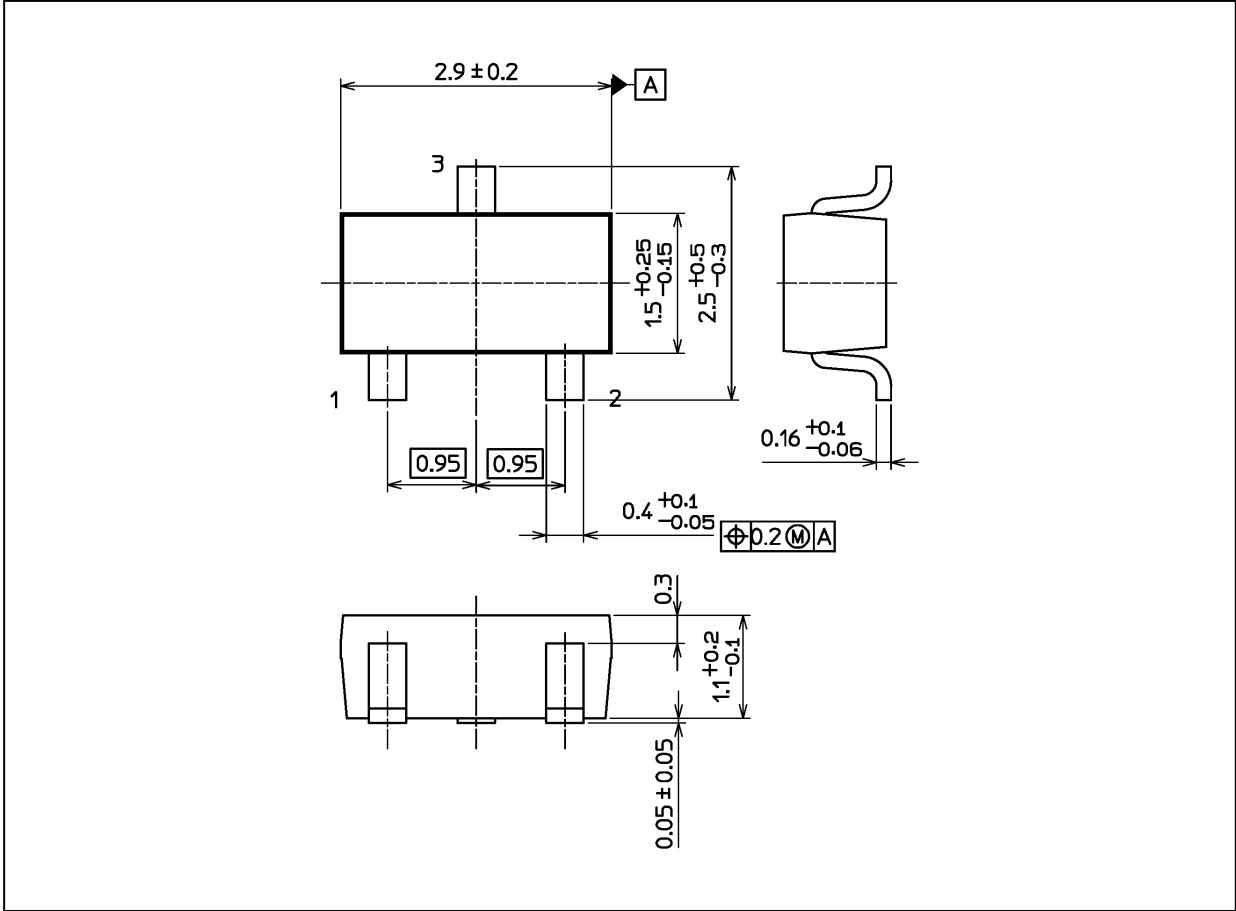


**Fig. 10.20 RN1418  $V_{CE(sat)}$ - $I_C$**

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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