

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

# RN2414/15/16/17/18

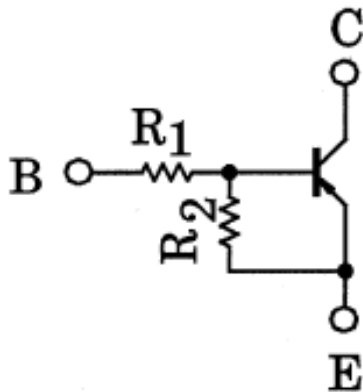
## 1. Applications

- 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 RN1414 to RN1418

## 3. Equivalent Circuit



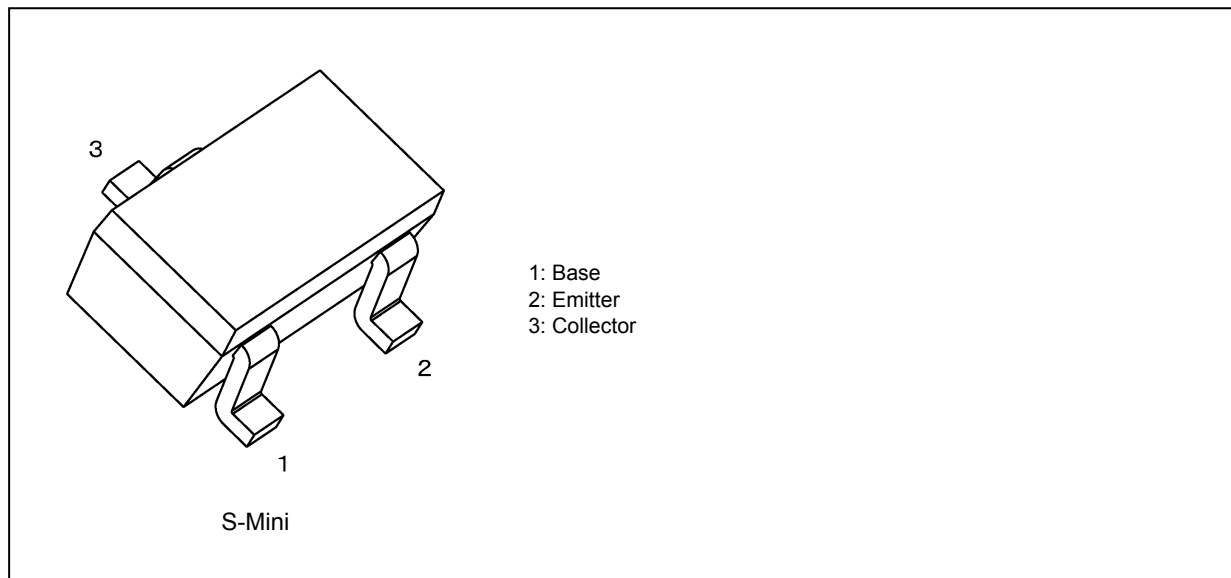
## 4. Bias Resistor Values

Part No.	R1 (kΩ)	R2 (kΩ)
RN2414	1	10
RN2415	2.2	10
RN2416	4.7	10
RN2417	10	4.7
RN2418	47	10

Start of commercial production

1994-08

### 5. Packaging and Pin Assignment



### 6. Orderable part number

Orderable part number		AEC-Q101	Note	Note
RN2414	RN2414(TE85L,F)	—		General Use
	—	YES	(Note 1)	Unintended Use (Note 1)
RN2415	RN2415,LF	—		General Use
	RN2415,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2415,LXHF	YES		Automotive Use
RN2416	RN2416,LF	—		General Use
	RN2416,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2416,LXHF	YES		Automotive Use
RN2417	RN2417,LF	—		General Use
	RN2417,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2417,LXHF	YES		Automotive Use
RN2418	RN2418,LF	—		General Use
	RN2418,LXGF	YES	(Note 1)	Unintended Use (Note 1)
	RN2418,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	RN2414~RN2418	$V_{CBO}$	-50	V
Collector-emitter voltage		$V_{CEO}$	-50	
Emitter-base voltage	RN2414	$V_{EBO}$	-5	V
	RN2415		-6	
	RN2416		-7	
	RN2417		-15	
	RN2418		-25	
Collector current	RN2414~RN2418	$I_C$	-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	RN2414~ RN2418	$I_{CBO}$	$V_{CB} = -50\text{ V}, I_E = 0\text{ mA}$	—	—	-100	nA
		$I_{CEO}$	$V_{CE} = -50\text{ V}, I_B = 0\text{ mA}$	—	—	-500	
Emitter cut-off current	RN2414	$I_{EBO}$	$V_{EB} = -5\text{ V}, I_C = 0\text{ mA}$	-0.35	—	-0.65	mA
	RN2415		$V_{EB} = -6\text{ V}, I_C = 0\text{ mA}$	-0.37	—	-0.71	
	RN2416		$V_{EB} = -7\text{ V}, I_C = 0\text{ mA}$	-0.36	—	-0.68	
	RN2417		$V_{EB} = -15\text{ V}, I_C = 0\text{ mA}$	-0.78	—	-1.46	
	RN2418		$V_{EB} = -25\text{ V}, I_C = 0\text{ mA}$	-0.33	—	-0.63	
DC current gain	RN2414 ~ RN2416, RN2418	$h_{FE}$	$V_{CE} = -5\text{ V}, I_C = -10\text{ mA}$	50	—	—	—
	RN2417			30	—	—	
Collector-emitter saturation voltage	RN2414~ RN2418	$V_{CE(sat)}$	$I_C = -5\text{ mA}, I_B = -0.25\text{ mA}$	—	-0.1	-0.3	V
Input voltage (ON)	RN2414	$V_{I(ON)}$	$V_{CE} = -0.2\text{ V}, I_C = -5\text{ mA}$	-0.5	—	-2.0	V
	RN2415			-0.6	—	-2.5	
	RN2416			-0.7	—	-2.5	
	RN2417			-1.5	—	-3.5	
	RN2418			-2.5	—	-10.0	
Input voltage (OFF)	RN2414	$V_{I(OFF)}$	$V_{CE} = -5\text{ V}, I_C = -0.1\text{ mA}$	-0.3	—	-0.9	V
	RN2415			-0.3	—	-1.0	
	RN2416			-0.3	—	-1.1	
	RN2417			-0.3	—	-3.0	
	RN2418			-0.5	—	-5.7	
Transition frequency	RN2414~ RN2418	$f_T$	$V_{CE} = -10\text{ V}, I_C = -5\text{ mA}$	—	200	—	MHz
Collector output capacitance	RN2414~ RN2418	$C_{ob}$	$V_{CB} = -10\text{ V}, I_E = 0\text{ mA}, f = 1\text{ MHz}$	—	3.0	6.0	pF
Input resistance	RN2414	$R_1$	-	0.7	1.0	1.3	k $\Omega$
	RN2415			1.54	2.2	2.86	
	RN2416			3.29	4.7	6.11	
	RN2417			7.0	10.0	13.0	
	RN2418			32.9	47.0	61.1	
Resistor ratio	RN2414	R1/R2	-	—	0.1	—	—
	RN2415			—	0.22	—	
	RN2416			—	0.47	—	
	RN2417			—	2.13	—	
	RN2418			—	4.7	—	

## 9. Marking

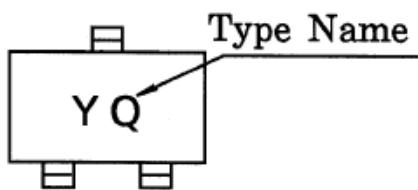


Fig. 9.1 Marking RN2414

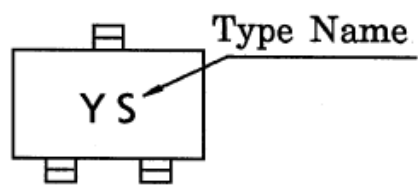


Fig. 9.2 Marking RN2415

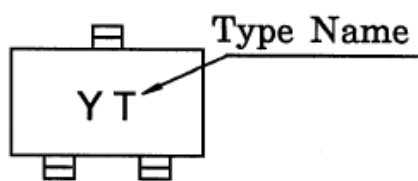


Fig. 9.3 Marking RN2416

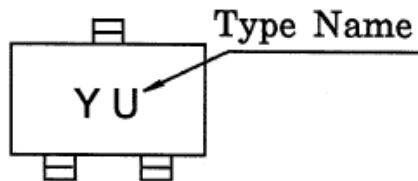


Fig. 9.4 Marking RN2417

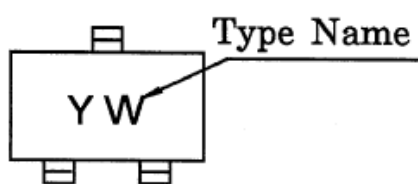


Fig. 9.5 Marking RN2418

### 10. Characteristics Curves (Note)

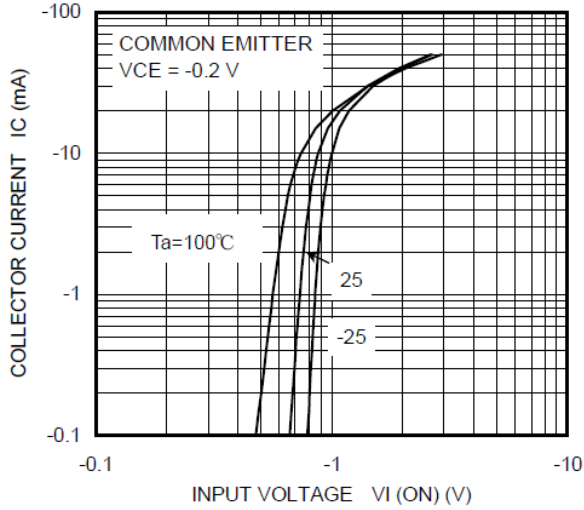


Fig. 10.1 RN2414  $I_C$ - $V_{I(ON)}$

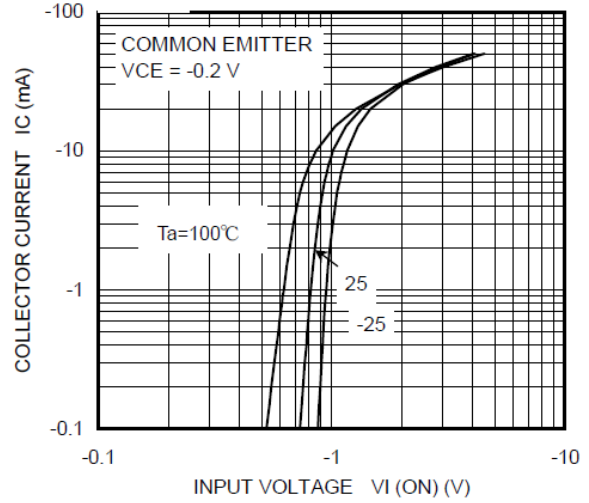


Fig. 10.2 RN2415  $I_C$ - $V_{I(ON)}$

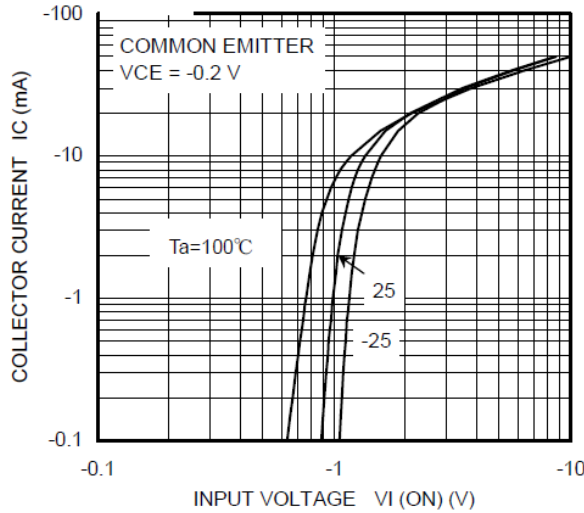


Fig. 10.3 RN2416  $I_C$ - $V_{I(ON)}$

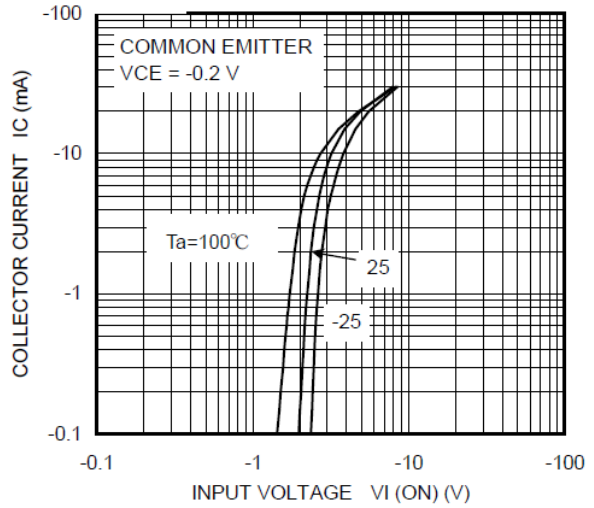


Fig. 10.4 RN2417  $I_C$ - $V_{I(ON)}$

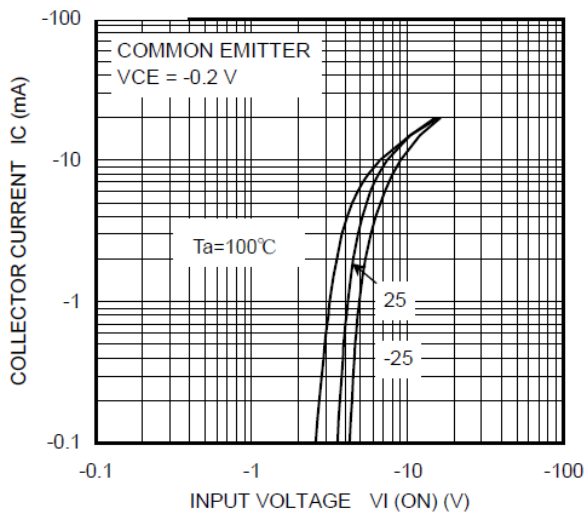
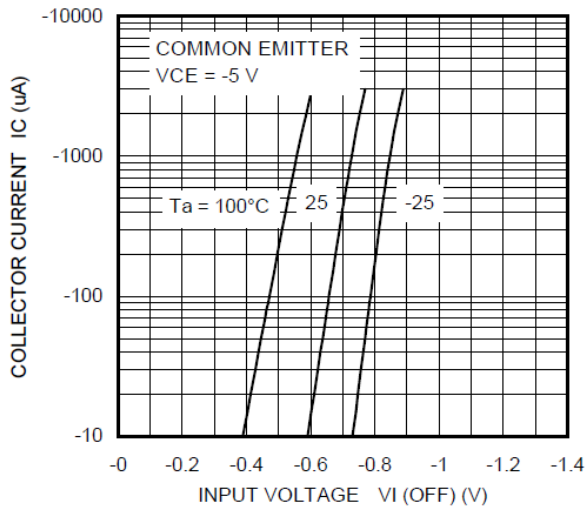
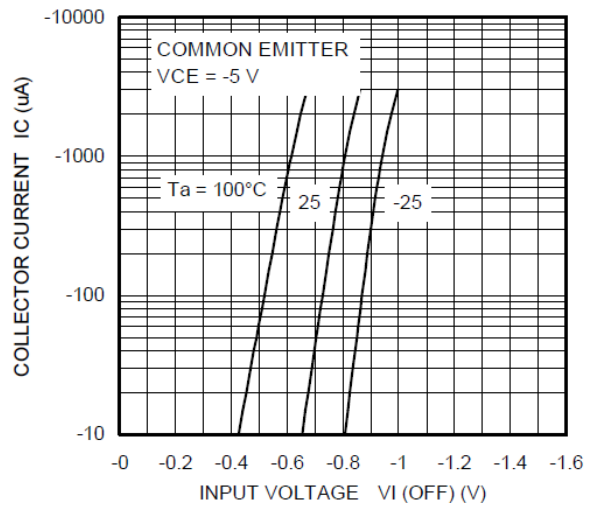


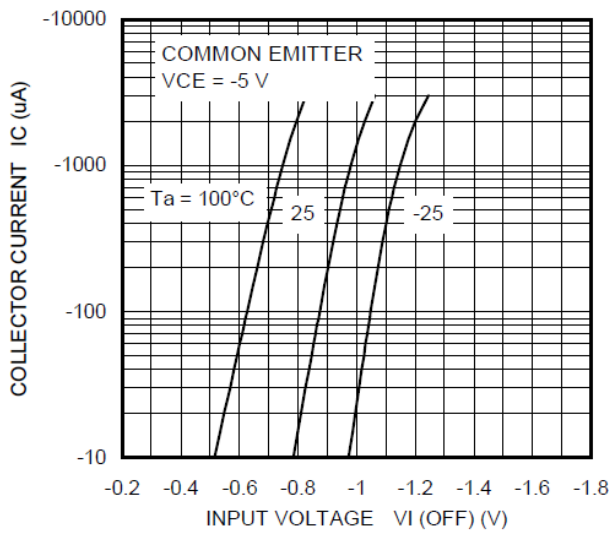
Fig. 10.5 RN2418  $I_C$ - $V_{I(ON)}$



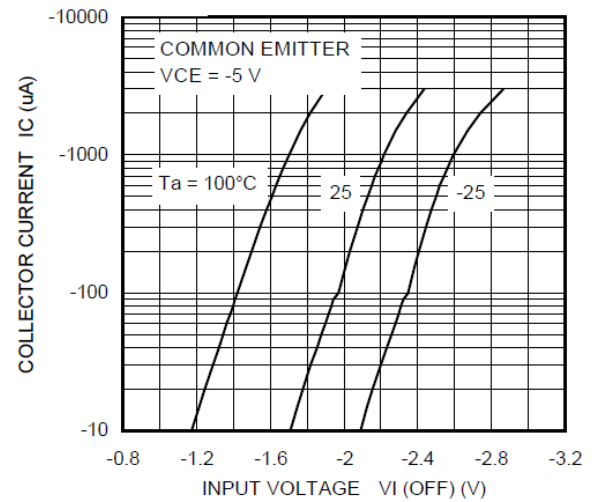
**Fig. 10.6 RN2414  $I_C$ - $V_{I(OFF)}$**



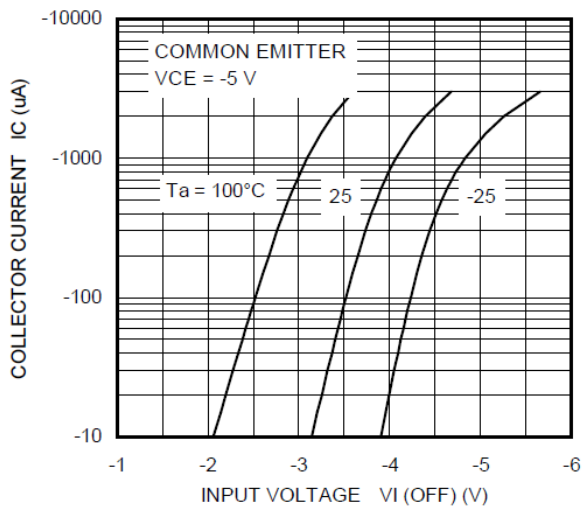
**Fig. 10.7 RN2415  $I_C$ - $V_{I(OFF)}$**



**Fig. 10.8 RN2416  $I_C$ - $V_{I(OFF)}$**



**Fig. 10.9 RN2417  $I_C$ - $V_{I(OFF)}$**



**Fig. 10.10 RN2418  $I_C$ - $V_{I(OFF)}$**

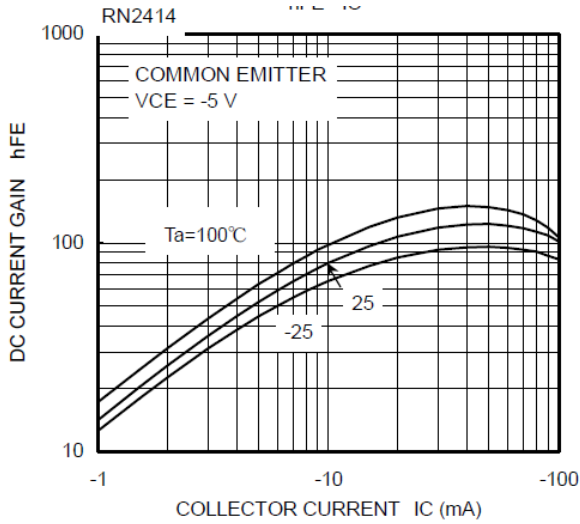


Fig. 10.11 RN2414  $h_{FE}$ - $I_C$

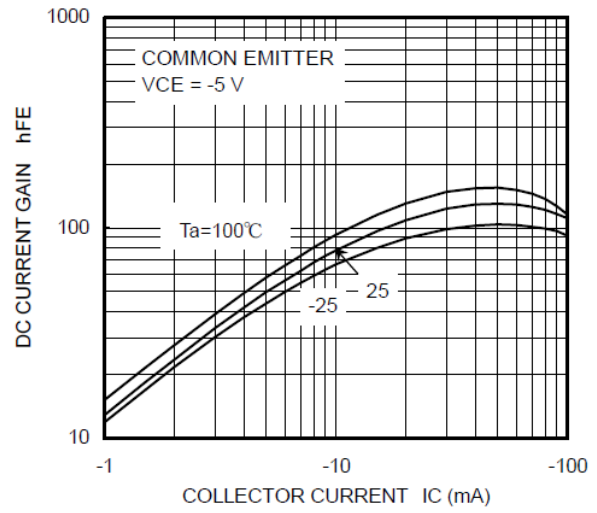


Fig. 10.12 RN2415  $h_{FE}$ - $I_C$

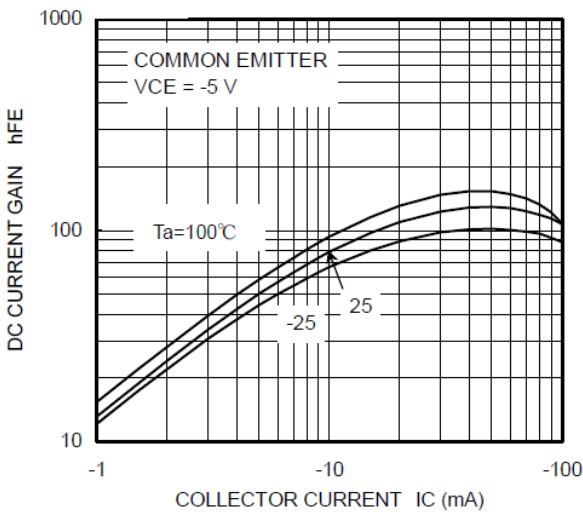


Fig. 10.13 RN2416  $h_{FE}$ - $I_C$

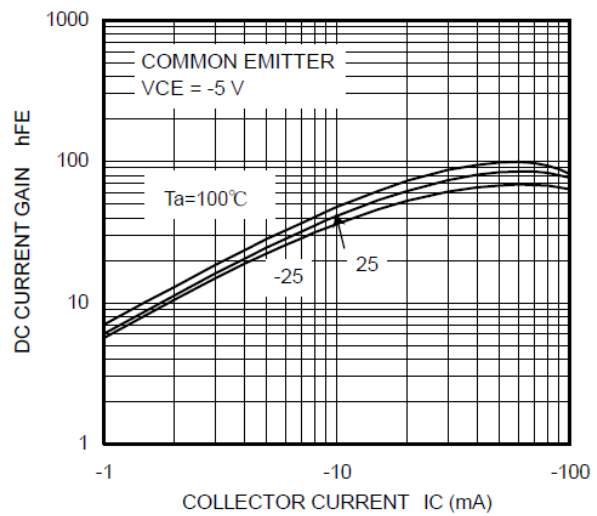


Fig. 10.14 RN2417  $h_{FE}$ - $I_C$

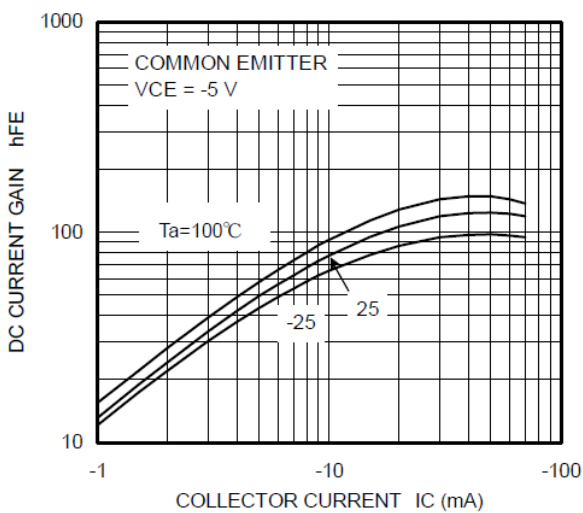


Fig. 10.15 RN2418  $h_{FE}$ - $I_C$



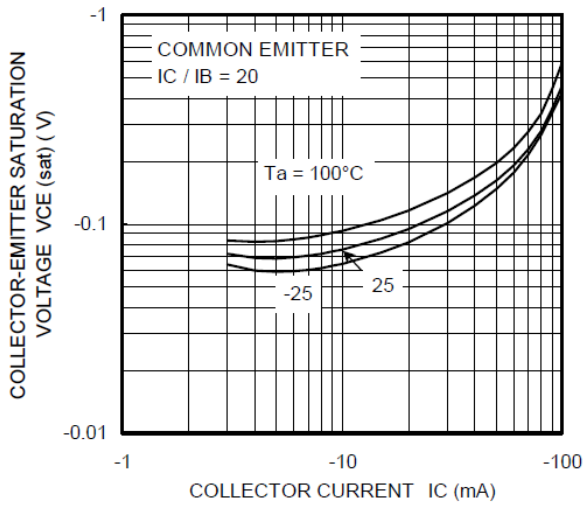


Fig. 10.16 RN2414  $V_{CE(sat)}$ - $I_C$

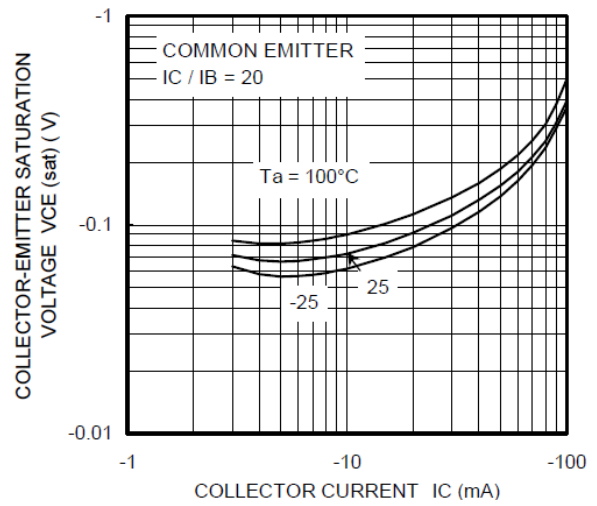


Fig. 10.17 RN2415  $V_{CE(sat)}$ - $I_C$

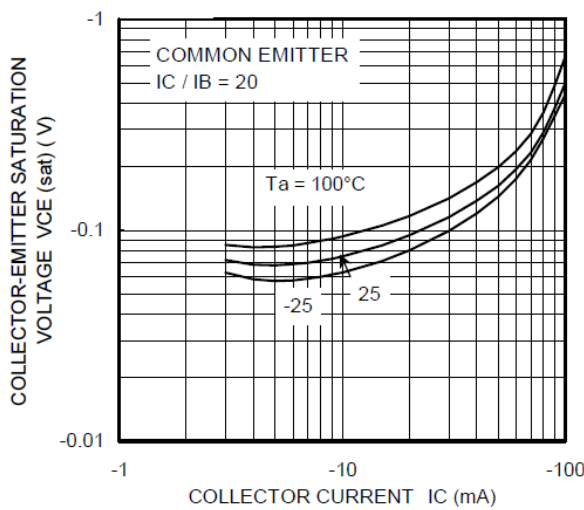


Fig. 10.18 RN2416  $V_{CE(sat)}$ - $I_C$

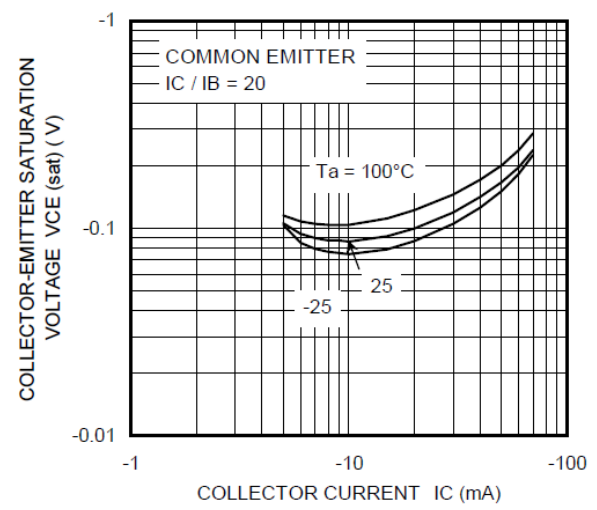


Fig. 10.19 RN2417  $V_{CE(sat)}$ - $I_C$

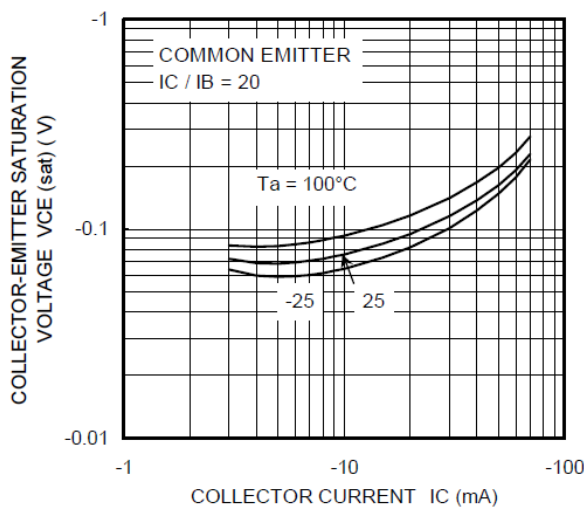
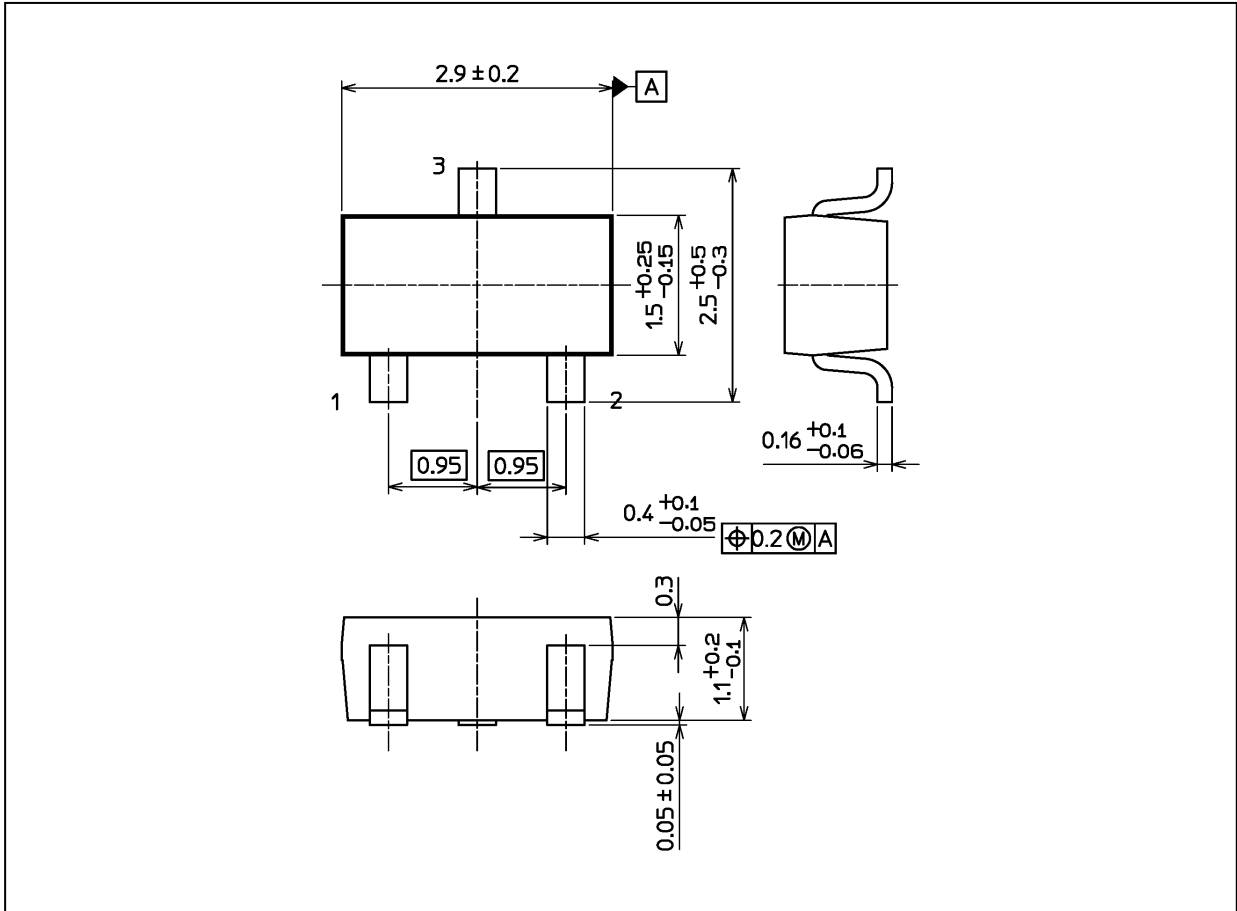


Fig. 10.20 RN2418  $V_{CE(sat)}$ - $I_C$

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)
TOSHIBA: 2-3F1S
Nickname: S-Mini

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