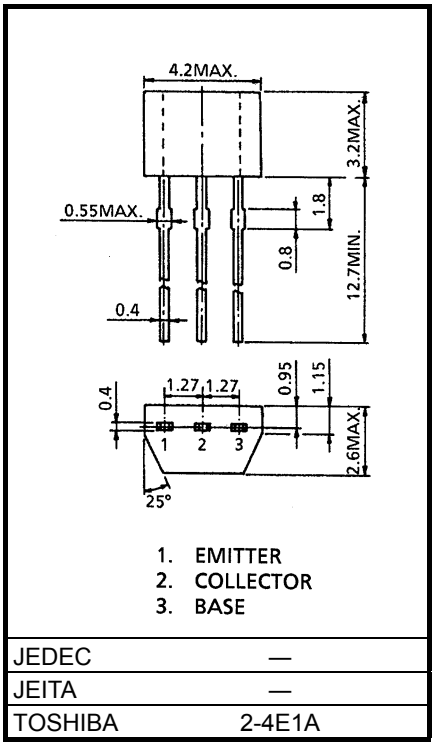
TOSHIBA Transistor Silicon NPN Epitaxial Type (PCT Process)

RN1221,RN1222,RN1223,RN1224 RN1225,RN1226,RN1227

Unit: mm

Switching, Inverter Circuit, Interface Circuit
And Driver Circuit Applications

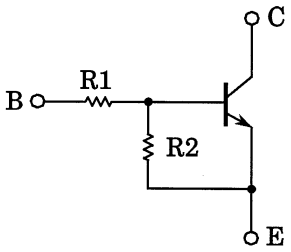
- High current type ($I_{C(MAX)}$ = 800mA)
- With built-in bias resistors.
- Simplify circuit design
- Reduce a quantity of parts and manufacturing process
- Low $V_{CE\ (sat)}$
- Complementary to RN2221~2227



JEDEC	—
JEITA	—
TOSHIBA	2-4E1A

Weight: 0.13g (typ.)

Equivalent Circuit



Type No.	R1 (kΩ)	R2 (kΩ)
RN1221	1	1
RN1222	2.2	2.2
RN1223	4.7	4.7
RN1224	10	10
RN1225	0.47	10
RN1226	1	10
RN1227	2.2	10

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Collector-base voltage	RN1221~1227	V_{CBO}	50	V
Collector-emitter voltage		V_{CEO}	50	V
Emitter-base voltage	RN1221~1224	V_{EBO}	10	V
	RN1225, 1226		5	
	RN1227		6	
Collector current	RN1221~1227	I_c	800	mA
Collector power dissipation		P_c	300	mW
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	−55~150	°C

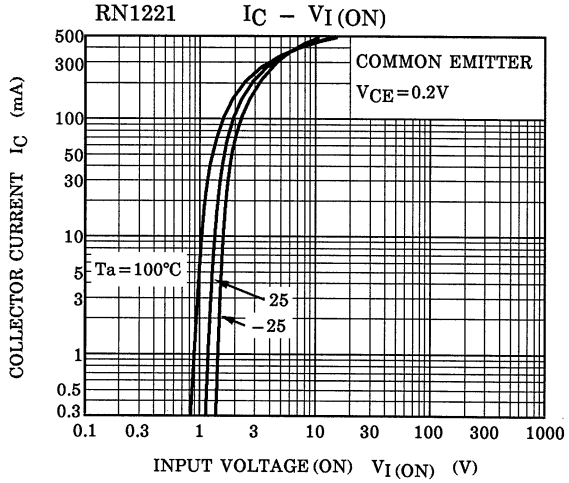
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

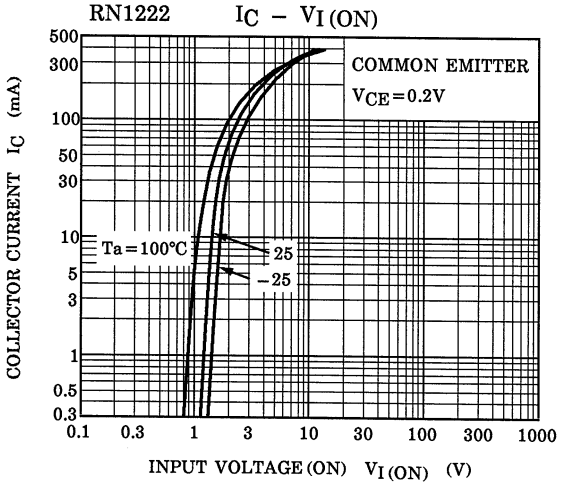
Electrical Characteristics (Ta = 25°C)

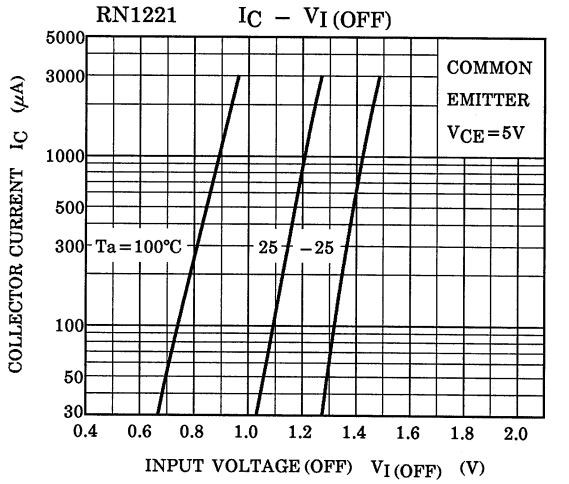
Characteristic		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	RN1221~1227	I_{CBO}	—	V_{CB} = 50V, I_E = 0	—	—	100	nA
		I_{CEO}	—	V_{CE} = 50V, I_B = 0	—	—	500	
Emitter cut-off current	RN1221	I_{EBO}	—	V_{EB} = 10V, I_C = 0	3.85	—	7.14	mA
	RN1222		—		1.75	—	3.25	
	RN1223		—		0.82	—	1.52	
	RN1224		—		0.38	—	0.71	
	RN1225		—	V_{EB} = 5V, I_C = 0	0.365	—	0.682	
	RN1226		—		0.35	—	0.65	
	RN1227		—	V_{EB} = 6V, I_C = 0	0.378	—	0.703	
DC current gain	RN1221	h_{FE}	—	V_{CE} = 5V, I_C = 100mA	60	—	—	—
	RN1222		—		65	—	—	
	RN1223		—		70	—	—	
	RN1224		—		90	—	—	
	RN1225		—		90	—	—	
	RN1226		—		90	—	—	
	RN1227		—		90	—	—	
Collector-emitter saturation voltage	RN1221	$V_{CE\ (sat)}$	—	I_C = 50mA, I_B = 2mA	—	—	0.25	V
	RN1222~1227			I_C = 50mA, I_B = 1mA				
Input voltage (ON)	RN1221	$V_{I\ (ON)}$	—	V_{CE} = 0.2V, I_C = 100mA	1.0	—	3.5	V
	RN1222		—		1.4	—	4.5	
	RN1223		—		2.0	—	6.5	
	RN1224		—		3.0	—	12.0	
	RN1225		—		0.6	—	2.0	
	RN1226		—		0.7	—	2.5	
	RN1227		—		1.0	—	3.0	
Input voltage (OFF)	RN1221~1224	$V_{I\ (OFF)}$	—	V_{CE} = 5V, I_C = 0.1mA	0.8	—	1.3	V
	RM1225, 1226		—		0.4	—	0.8	
	RN1227		—		0.5	—	1.0	
Translation frequency	RN1221~1227	f_T	—	V_{CE} = 5V, I_C = 20mA	—	300	—	MHz
Collector output capacitance	RN1221~1227	C_{ob}	—	V_{CB} = 10V, I_E = 0, f = 1MHz	—	7	—	pF

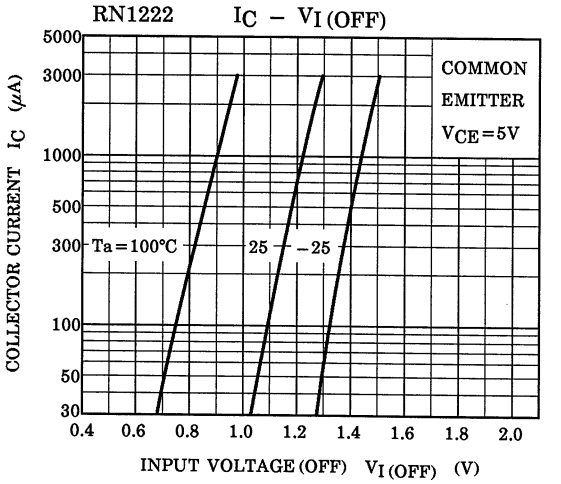
Electrical Characteristics (Ta = 25°C)

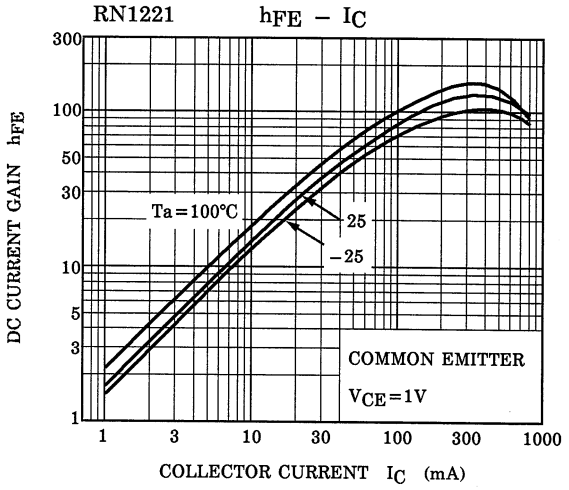
Characteristic		Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input resistor	RN1221	R1	—	—	0.7	1.0	1.3	kΩ
	RN1222		—		1.54	2.2	2.86	
	RN1223		—		3.29	4.7	6.11	
	RN1224		—		7	10	13	
	RN1225		—		0.329	0.47	0.61	
	RN1226		—		0.7	1.0	1.3	
	RN1227		—		1.54	2.2	2.86	
Resistor ratio	RN1221~1224	R1/R2	—	—	0.9	1.0	1.1	—
	RN1225		—		0.0423	0.047	0.0517	
	RN1226		—		0.09	0.1	0.11	
	RN1227		—		0.2	0.22	0.24	

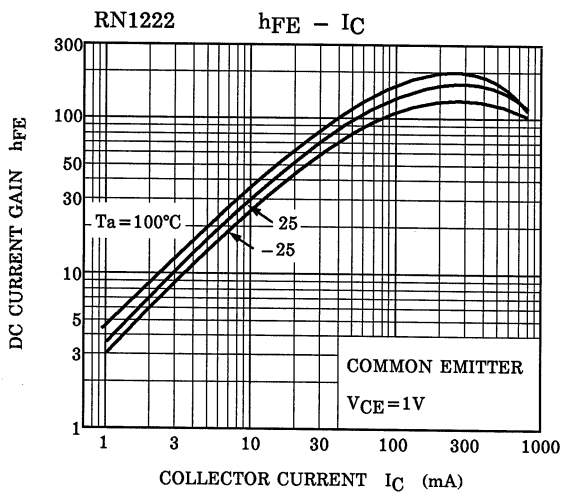

RN1221 I_C – $V_{I(ON)}$
COMMON EMITTER
V_{CE}=0.2V
Ta=100°C
25
−25
COLLECTOR CURRENT I_C (mA)
INPUT VOLTAGE (ON) $V_{I(ON)}$ (V)


RN1222 I_C – $V_{I(ON)}$
COMMON EMITTER
V_{CE}=0.2V
Ta=100°C
25
−25
COLLECTOR CURRENT I_C (mA)
INPUT VOLTAGE (ON) $V_{I(ON)}$ (V)

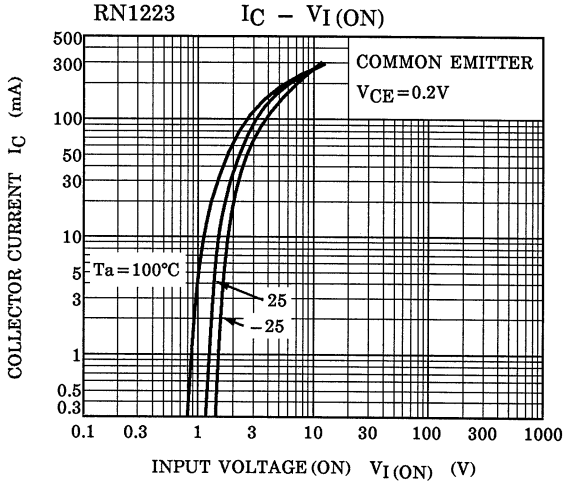

RN1221 I_C – $V_{I(OFF)}$
COMMON EMITTER
V_{CE}=5V
Ta=100°C
25
−25
COLLECTOR CURRENT I_C (μA)
INPUT VOLTAGE (OFF) $V_{I(OFF)}$ (V)


RN1222 I_C – $V_{I(OFF)}$
COMMON EMITTER
V_{CE}=5V
Ta=100°C
25
−25
COLLECTOR CURRENT I_C (μA)
INPUT VOLTAGE (OFF) $V_{I(OFF)}$ (V)

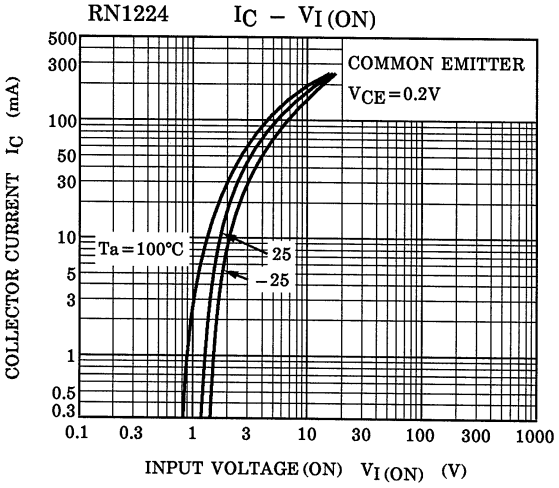

RN1221 h_{FE} – I_C
COMMON EMITTER
V_{CE}=1V
Ta=100°C
25
−25
DC CURRENT GAIN h_{FE}
COLLECTOR CURRENT I_C (mA)


RN1222 h_{FE} – I_C
COMMON EMITTER
V_{CE}=1V
Ta=100°C
25
−25
DC CURRENT GAIN h_{FE}
COLLECTOR CURRENT I_C (mA)

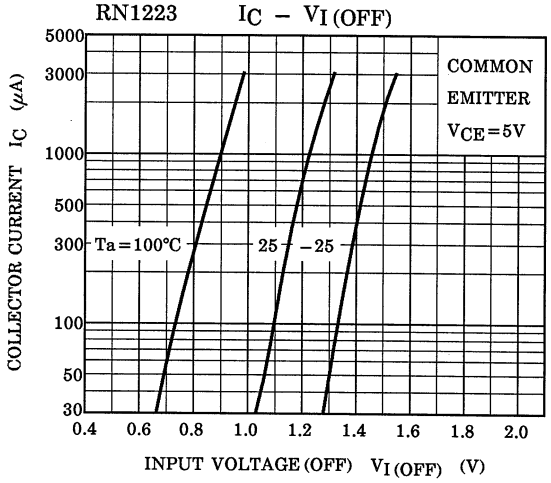
RN1223 $I_C - V_{I(ON)}$



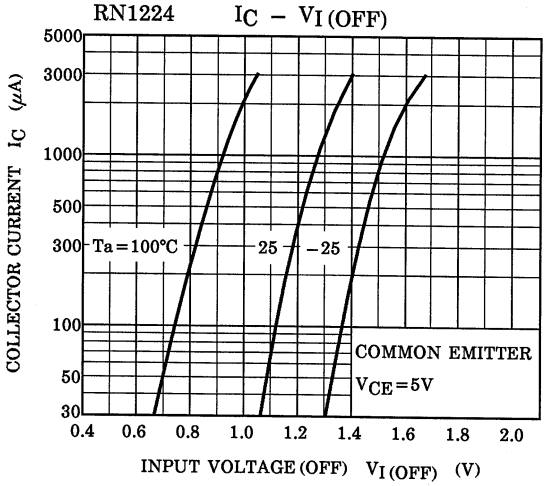
RN1224 $I_C - V_{I(ON)}$



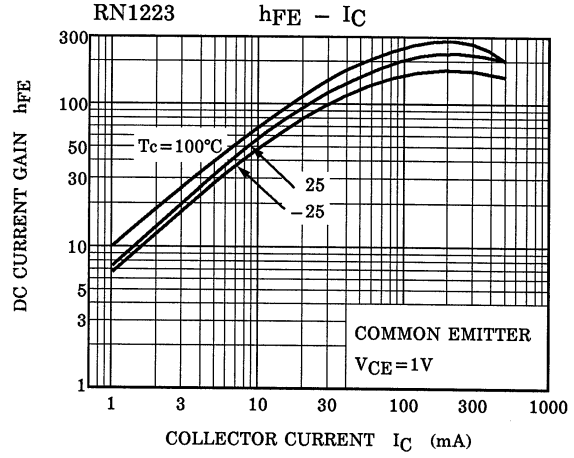
RN1223 $I_C - V_{I(OFF)}$



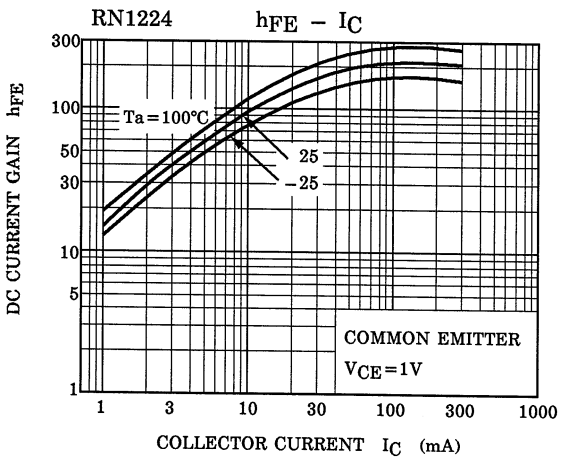
RN1224 $I_C - V_{I(OFF)}$

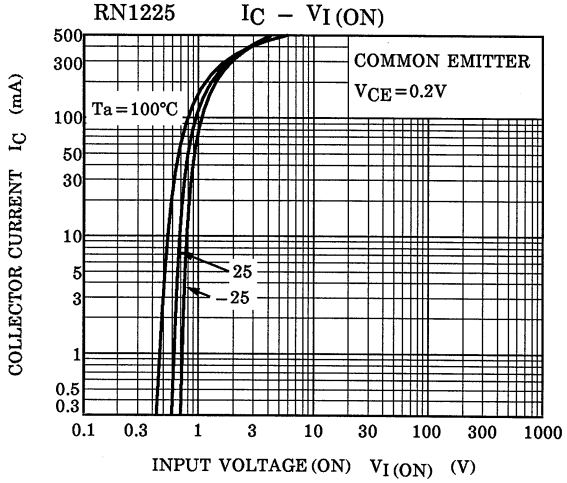


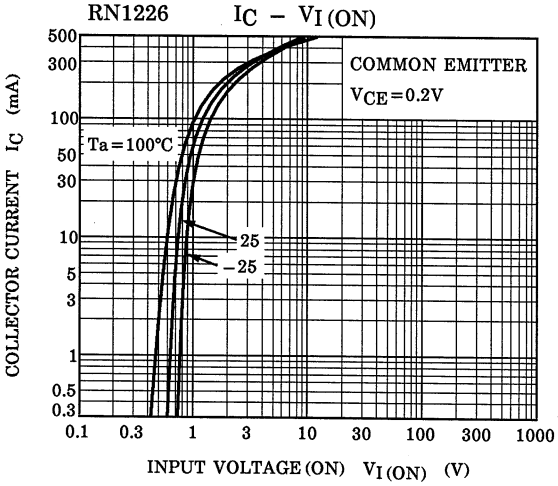
RN1223 $h_{FE} - I_C$

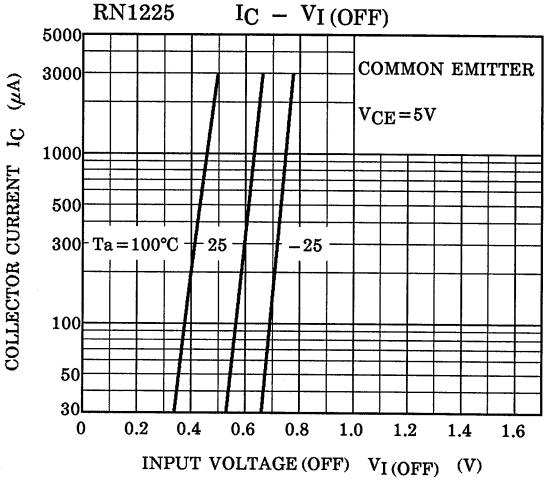


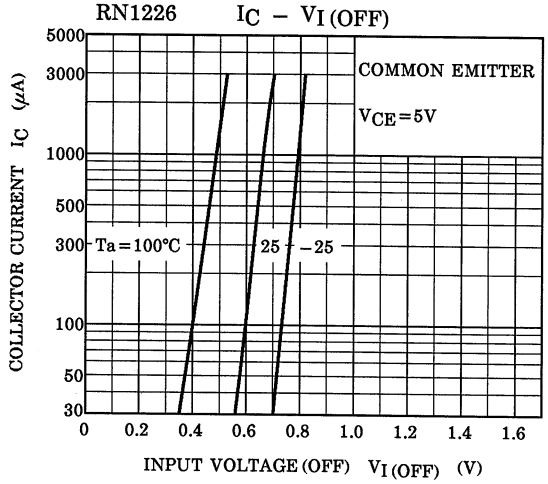
RN1224 $h_{FE} - I_C$

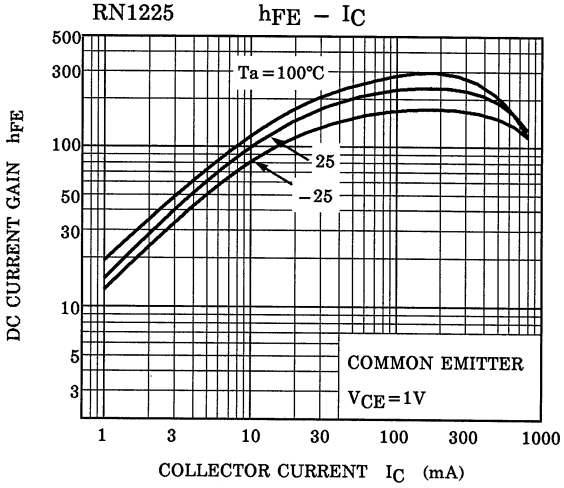


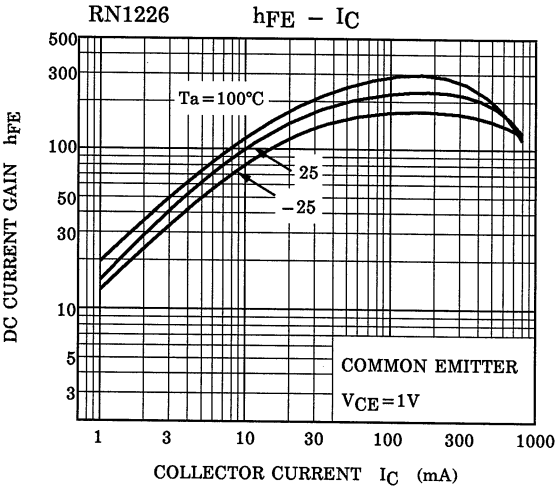

RN1225 I_C – $V_{I(ON)}$
COMMON EMITTER
V_{CE}=0.2V
Ta=100°C
25
−25
COLLECTOR CURRENT I_C (mA)
INPUT VOLTAGE (ON) $V_{I(ON)}$ (V)

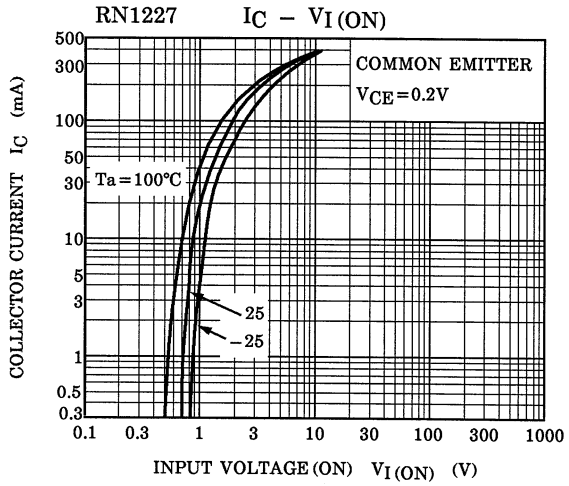

RN1226 I_C – $V_{I(ON)}$
COMMON EMITTER
V_{CE}=0.2V
Ta=100°C
25
−25
COLLECTOR CURRENT I_C (mA)
INPUT VOLTAGE (ON) $V_{I(ON)}$ (V)

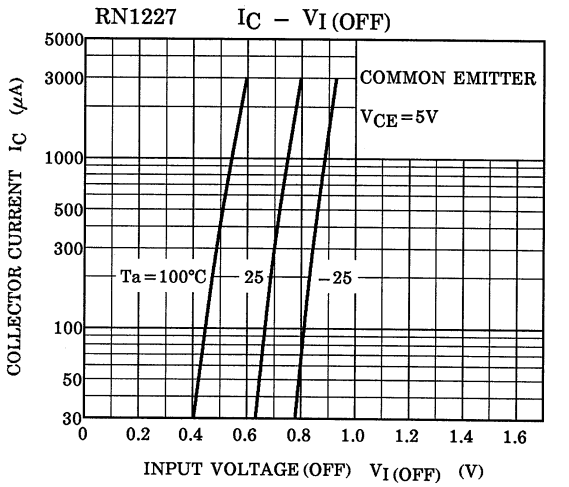

RN1225 I_C – $V_{I(OFF)}$
COMMON EMITTER
V_{CE}=5V
Ta=100°C
25
−25
COLLECTOR CURRENT I_C (μA)
INPUT VOLTAGE (OFF) $V_{I(OFF)}$ (V)

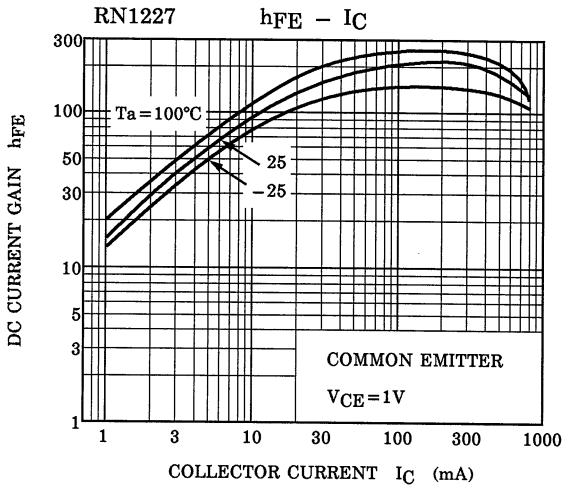

RN1226 I_C – $V_{I(OFF)}$
COMMON EMITTER
V_{CE}=5V
Ta=100°C
25
−25
COLLECTOR CURRENT I_C (μA)
INPUT VOLTAGE (OFF) $V_{I(OFF)}$ (V)


RN1225 h_{FE} – I_C
Ta=100°C
25
−25
COMMON EMITTER
V_{CE}=1V
DC CURRENT GAIN h_{FE}
COLLECTOR CURRENT I_C (mA)


RN1226 h_{FE} – I_C
Ta=100°C
25
−25
COMMON EMITTER
V_{CE}=1V
DC CURRENT GAIN h_{FE}
COLLECTOR CURRENT I_C (mA)


RN1227 I_C – $V_{I(ON)}$
COMMON EMITTER
V_{CE}=0.2V
Ta=100°C
25
–25
COLLECTOR CURRENT I_C (mA)
INPUT VOLTAGE (ON) $V_{I(ON)}$ (V)
500
300
100
50
30
10
5
3
1
0.5
0.3
0.1
0.3
1
3
10
30
100
300
1000


RN1227 I_C – $V_{I(OFF)}$
COMMON EMITTER
V_{CE}=5V
Ta=100°C
25
–25
COLLECTOR CURRENT I_C (μA)
INPUT VOLTAGE (OFF) $V_{I(OFF)}$ (V)
5000
3000
1000
500
300
100
50
30
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6


RN1227 h_{FE} – I_C
Ta=100°C
25
–25
COMMON EMITTER
V_{CE}=1V
DC CURRENT GAIN h_{FE}
COLLECTOR CURRENT I_C (mA)
300
100
50
30
10
5
3
1
1
3
10
30
100
300
1000

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