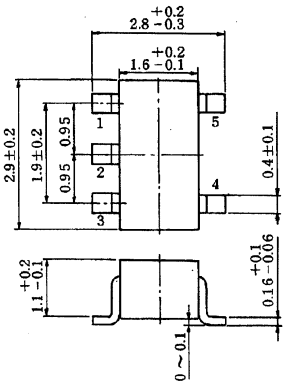
TOSHIBA MULTI CHIP DISCRETE DEVICE

HN2E05J

Super High Speed Switching Application
Interface Circuit
Driver Circuit Applications

Unit: mm



1.BASE
2.EMITTER
3.ANODE
4.CATHODE
5.COLLECTOR

SMV

JEDEC	—
JEITA	—
TOSHIBA	2-3L1E

Weight:0.014g (typ.)

Q1

Since bias resistor is built in the transistor, the miniaturization of the apparatus by curtailment of the number of parts and laborsaving of an assembly are possible.

Q2

Low Forward Voltage Drop	:$V_{F(3)}$=0.98V(typ.)
Fast Reverse Recovery Time	:t_{rr}=1.6ns(typ.)
Low Total Capacitance	:C_T=0.5pF(typ.)

Q1(Transistor) : RN2104F equivalent

Q2(Transistor) : 1SS352 equivalent

Q1(Transistor) Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	−50	V
Collector-emitter voltage	V_{CEO}	−50	V
Emitter-base voltage	V_{EBO}	−10	V
Collector current	I_C	−100	mA

Q2(Diode) Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Maximum (peak) reverse voltage	V_{RM}	85	V
Reverse voltage	V_R	80	V
Maximum (peak) forward current	I_{FM}	200	mA
Average forward current	I_O	100	mA
Surge current (10ms)	I_{FSM}	1	A

Maximum Ratings (Ta = 25°C) (Q1, Q2 Common)

Characteristic	Symbol	Rating	Unit
Collector power dissipation	P_C*	300	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55~150	°C

* Total rating. 200mW per 1 element must not be exceeded.

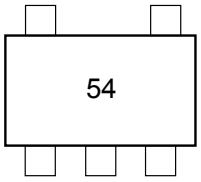
Q1(Transistor) Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	V_{CB} = −50 V, I_E = 0	—	—	−100	nA
	I_{CEO}	V_{CE} = −50 V, I_B = 0	—	—	−500	
Emitter cut-off current	I_{EBO}	V_{EB} = −10 V, I_C = 0	−0.082	—	−0.15	mA
DC current gain	h_{FE}	V_{CE} = −5 V, I_C = −10 mA	80	—	—	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_C = −5 mA, I_B = −0.25 mA	—	−0.1	−0.3	V
Input voltage (ON)	$V_{I\ (ON)}$	V_{CE} = −0.2 V, I_C = −5 mA	−1.5	—	−5.0	V
Input voltage (OFF)	$V_{I\ (OFF)}$	V_{CE} = −5 V, I_C = −0.1 mA	−1.0	—	−1.5	V
Transition frequency	f_T	V_{CE} = −10 V, I_C = −5 mA	—	200	—	MHz
Collector output capacitance	C_{ob}	V_{CB} = −10 V, I_E = 0, f = 1 MHz	—	3	6	pF
Input resistor	R1	—	32.9	47	61.1	kΩ
Resistor ratio	R1/R2	—	0.9	1.0	1.1	

Q2(Diode) Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Forward voltage	$V_{F\ (1)}$	—	I_F = 1mA	—	0.62	—	V
	$V_{F\ (2)}$	—	I_F = 10mA	—	0.75	—	
	$V_{F\ (3)}$	—	I_F = 100mA	—	0.98	1.20	
Reverse current	$I_{R\ (1)}$	—	V_R = 30V	—	—	0.1	μA
	$I_{R\ (2)}$	—	V_R = 80V	—	—	0.5	
Total capacitance	C_T	—	V_R = 0, f = 1MHz	—	0.5	—	pF
Reverse recovery time	t_{rr}	—	I_F = 10mA (fig.1)	—	1.6	—	ns

Marking



Equivalent Circuit (Top View)

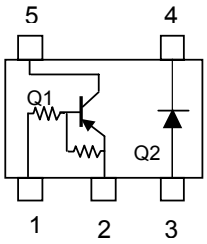
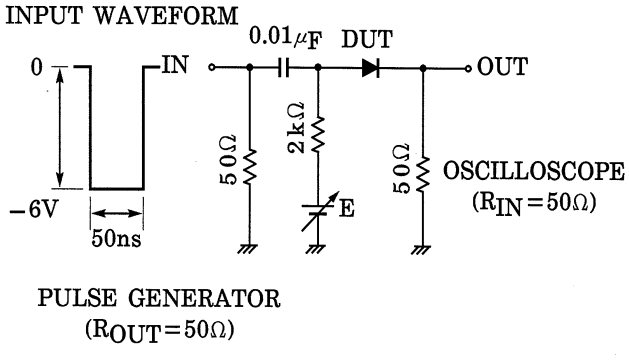
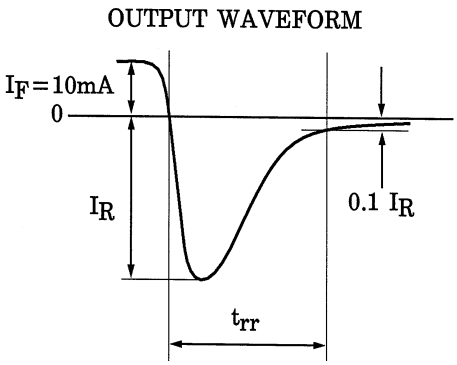
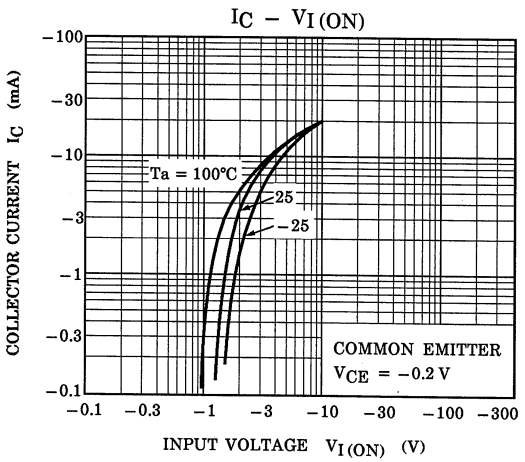


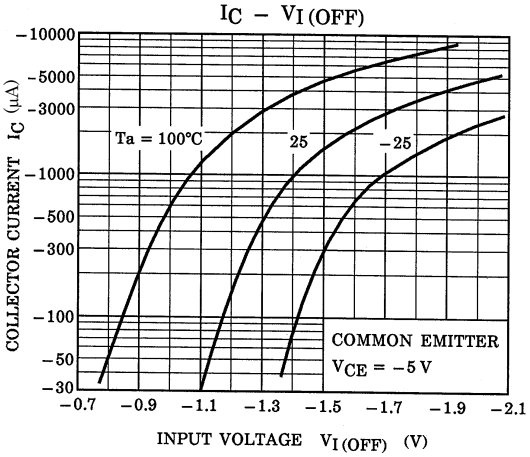
Fig.1 : Reverse Recovery Time (t_{rr}) Test Circuit

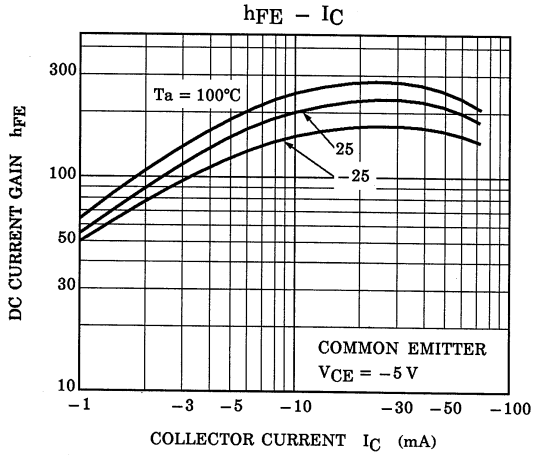


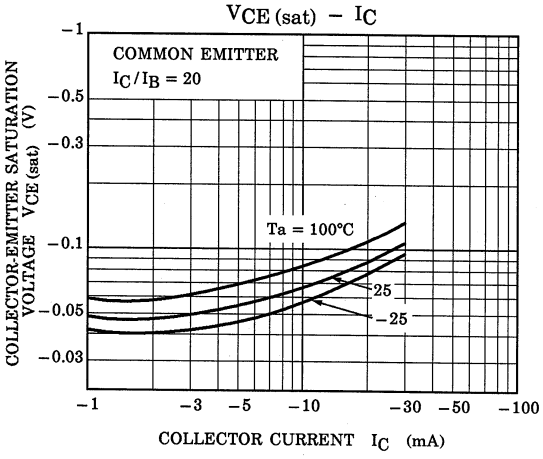


Q1

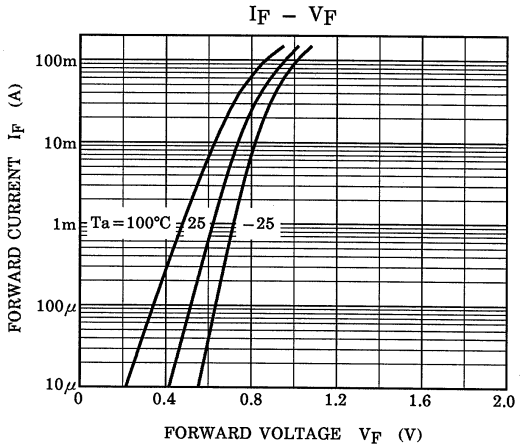

I_C – $V_{I(ON)}$
COLLECTOR CURRENT I_C (mA)
−100
−30
−10
−3
−1
−0.3
−0.1
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −0.2 V
−0.1 −0.3 −1 −3 −10 −30 −100 −300
INPUT VOLTAGE $V_{I(ON)}$ (V)

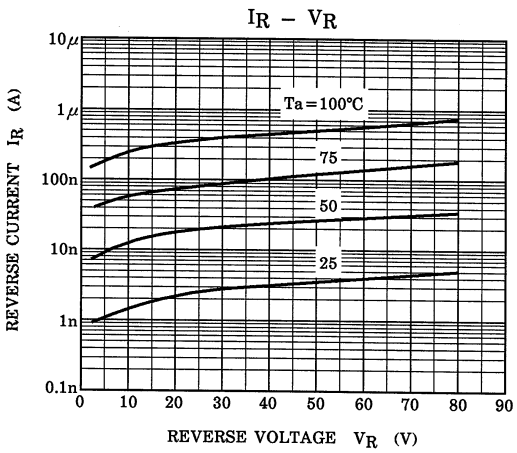

I_C – $V_{I(OFF)}$
COLLECTOR CURRENT I_C (μA)
−10000
−5000
−3000
−1000
−500
−300
−100
−50
−30
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −5 V
−0.7 −0.9 −1.1 −1.3 −1.5 −1.7 −1.9 −2.1
INPUT VOLTAGE $V_{I(OFF)}$ (V)

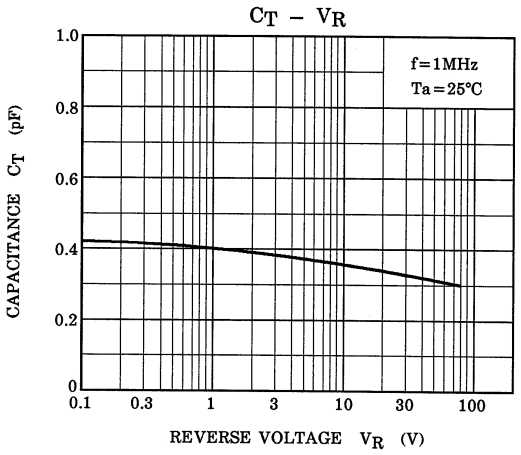

h_{FE} – I_C
DC CURRENT GAIN h_{FE}
300
100
50
30
10
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = −5 V
−1 −3 −5 −10 −30 −50 −100
COLLECTOR CURRENT I_C (mA)


$V_{CE(sat)}$ – I_C
COLLECTOR-EMITTER SATURATION VOLTAGE $V_{CE(sat)}$ (V)
−1
−0.5
−0.3
−0.1
−0.05
−0.03
COMMON EMITTER
I_C / I_B = 20
Ta = 100°C
25
−25
−1 −3 −5 −10 −30 −50 −100
COLLECTOR CURRENT I_C (mA)

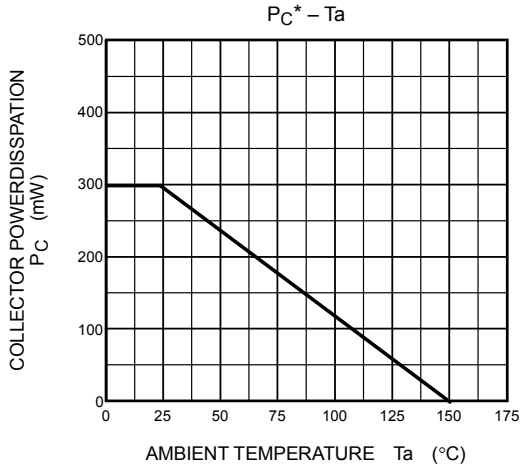
Q2


I_F – V_F
FORWARD CURRENT I_F (A)
100m
10m
1m
100μ
10μ
Ta = 100°C
25
−25
0
0.4
0.8
1.2
1.6
2.0
FORWARD VOLTAGE V_F (V)


I_R – V_R
REVERSE CURRENT I_R (A)
10μ
1μ
100n
10n
1n
0.1n
Ta = 100°C
75
50
25
0
10
20
30
40
50
60
70
80
90
REVERSE VOLTAGE V_R (V)


C_T – V_R
CAPACITANCE C_T (pF)
1.0
0.8
0.6
0.4
0.2
0
f = 1MHz
Ta = 25°C
0.1
0.3
1
3
10
30
100
REVERSE VOLTAGE V_R (V)

Q1,Q2 Common



*Total Rating.

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