TOSHIBA MULTI CHIP DISCRETE DEVICE

HN2E01F

Super High Speed Switching Application
Audio Frequency Amplifier Application
General Switching Application

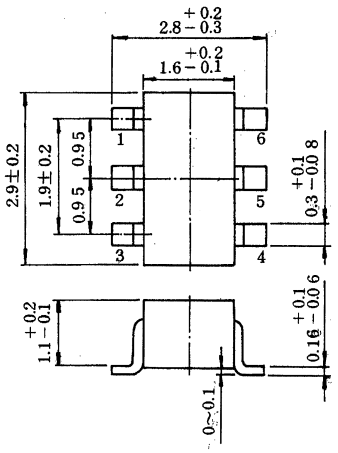
Q1

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.)

Q2

High DC Current Gain	:	h_{FE}=600~3600
High Voltage	:	V_{CEO}=50V
High Collector Current	:	I_C=150mA(max.)
Q1 (Diode)	:	1SS352 Equivalent
Q2 (Transistor)	:	2SC4666 Equivalent

Unit: mm



1.Anode
2.Base
3.Collector
4.Emitter
5.NC
6.Cathode

SM6

JEDEC	—
JEITA	—
TOSHIBA	2-3N1D

Weight: 0.015g (typ.)

Q1 (Diode) Absolute 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}	300	mA
Average forward current	I_O	100	mA
Surge current (10ms)	I_{FSM}	1	A

Q2 (Transistor) Absolute 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}	5	V
Collector current	I_C	150	mA
Base current	I_B	30	mA

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

Characteristic	Symbol	Rating	Unit
Collector power dissipation	P_C*	300	mW
Junction temperature	T_j	125	°C
Storage temperature range	T_{stg}	−55~125	°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).

* Total rating: 200mW per element should not be exceeded.

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

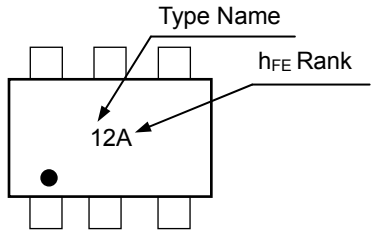
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Forward voltage	$V_{F\ (1)}$	—	I_F = 1mA	—	0.62	—	V
	$V_{F\ (2)}$	—	I_F = 10mA	—	0.75	—	
	$V_{F\ (3)}$	—	I_F = 100mA	—	0.98	1.2	
Reverse current	$I_{R\ (1)}$	—	V_R = 30V	—	—	0.1	μA
	$I_{R\ (2)}$	—	V_R = 80V	—	—	0.5	
Total capacitance	C_T	—	V_R = 0, f = 1MHz	—	0.5	—	pF
Reverse recovery time	t_{rr}	—	I_F = 10mA (fig.1)	—	1.6	—	ns

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

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	—	V_{CB} = 50V, I_E = 0	—	—	100	nA
Emitter cut-off current	I_{EBO}	—	V_{EB} = 5V, I_C = 0	—	—	100	nA
DC current gain	h_{FE} *	—	V_{CE} = 6V, I_C = 2mA	600	—	3600	
Collector-emitter saturation voltage	$V_{CE(sat)}$	—	I_C =100mA, I_B =10mA	—	0.12	0.25	V
Transition frequency	f_T	—	V_{CE} = 10V, I_C =10mA	—	250	—	MHz
Collector output capacitance	C_{ob}	—	V_{CB} = 10V, I_E = 0,f=1MHz	—	3.5	—	pF

* h_{FE} Rank A : 600~1800, B : 1200~3600

Marking



Equivalent Circuit (Top View)

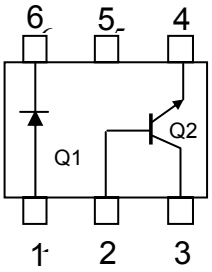
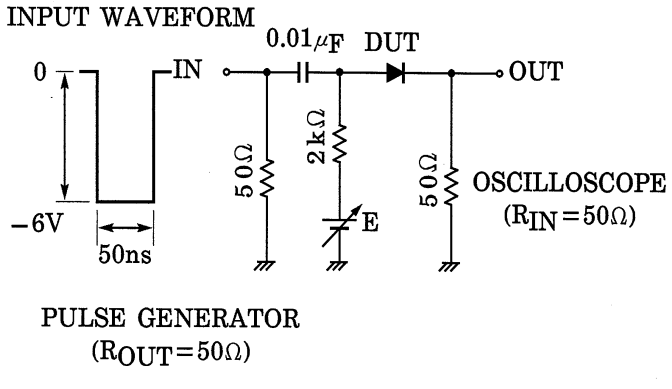
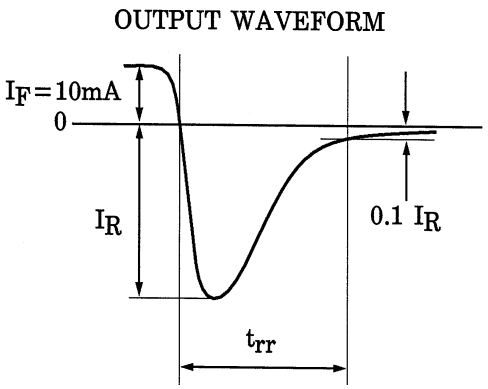
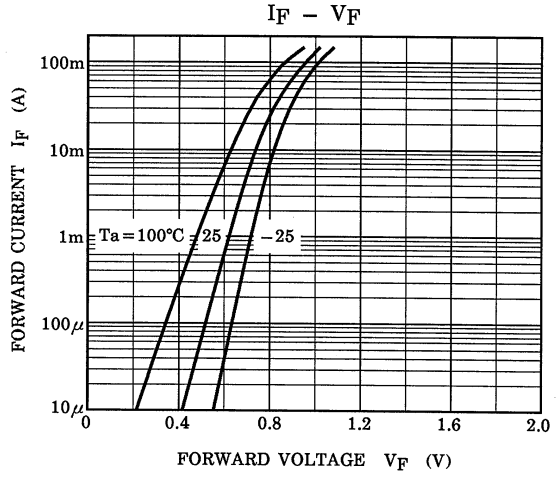


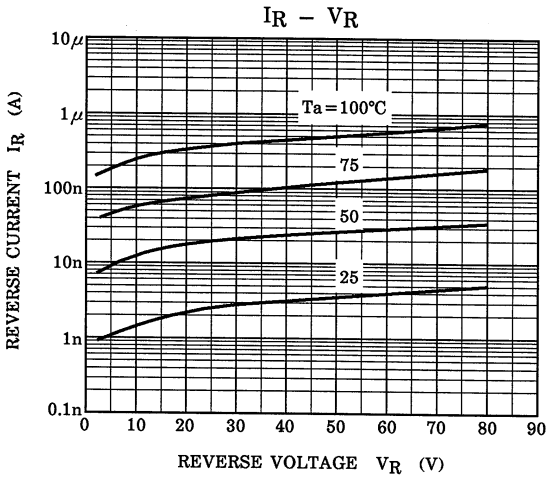
Fig. 1 : Reverse Recovery Time (t_{rr}) Test Circuit

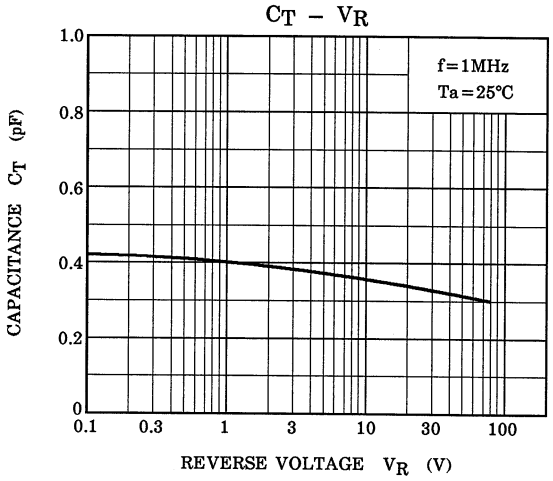




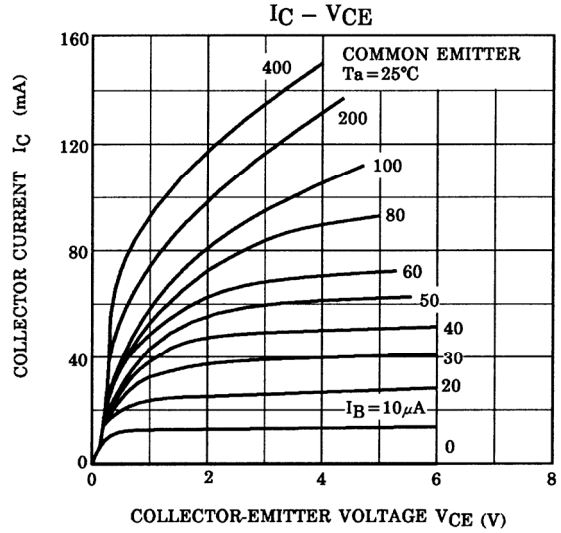
Q1

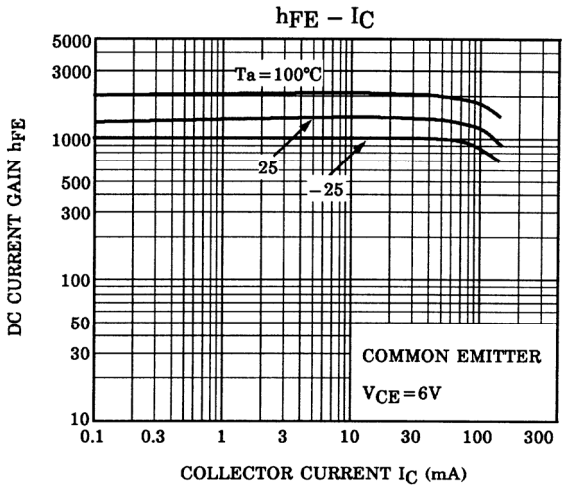

I_F – V_F
FORWARD CURRENT I_F (A)
100m
10m
1m
100μ
10μ
Ta = 100°C
25
−25
0
0.4
0.8
1.2
1.6
2.0
FORWARD VOLTAGE V_F (V)

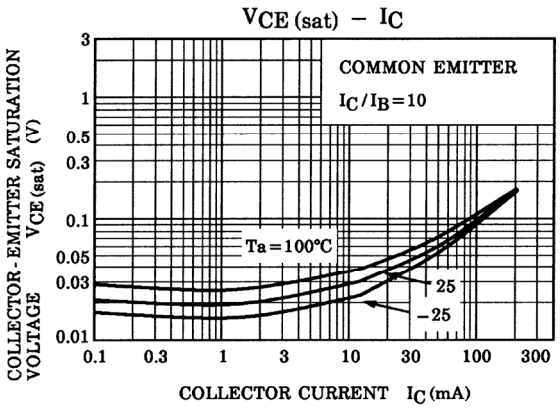

I_R – V_R
REVERSE CURRENT I_R (A)
10μ
1μ
100n
10n
1n
0.1n
Ta = 100°C
75
50
25
0
10
20
30
40
50
60
70
80
90
REVERSE VOLTAGE V_R (V)

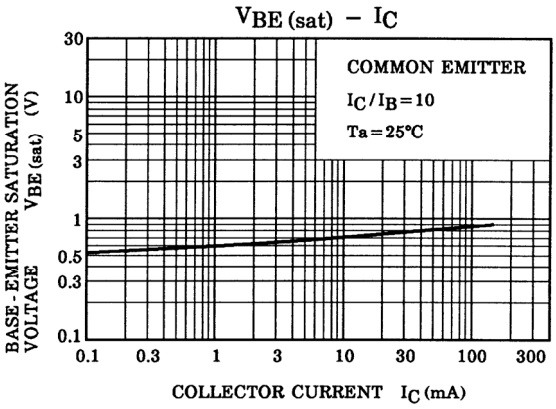

C_T – V_R
CAPACITANCE C_T (pF)
1.0
0.8
0.6
0.4
0.2
0
f = 1MHz
Ta = 25°C
0.1
0.3
1
3
10
30
100
REVERSE VOLTAGE V_R (V)

Q2

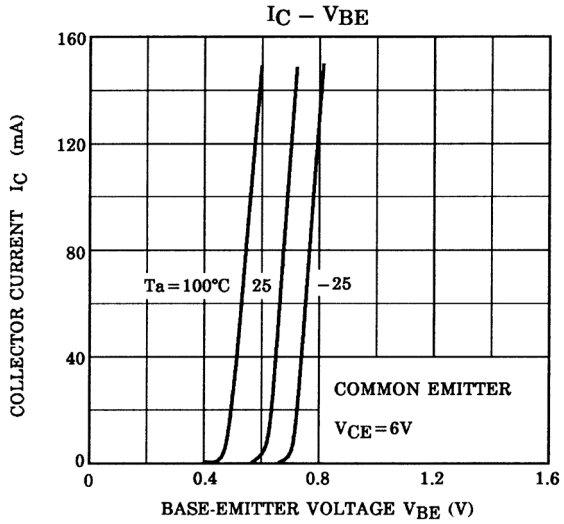

$I_C - V_{CE}$
COMMON EMITTER
Ta = 25°C
400
200
100
80
60
50
40
30
20
I_B = 10μA
0
COLLECTOR CURRENT I_C (mA)
COLLECTOR-EMITTER VOLTAGE V_{CE} (V)

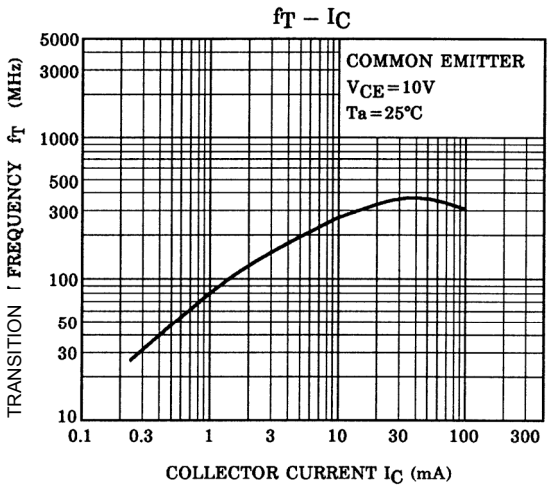

$h_{FE} - I_C$
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 6V
DC CURRENT GAIN h_{FE}
COLLECTOR CURRENT I_C (mA)

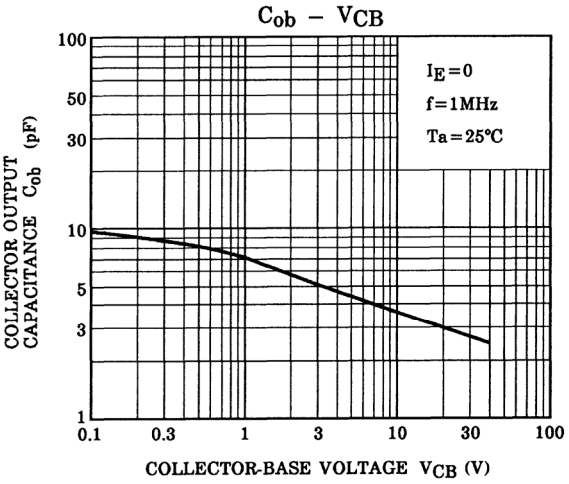

$V_{CE\,(sat)} - I_C$
COMMON EMITTER
I_C / I_B = 10
Ta = 100°C
25
−25
COLLECTOR - EMITTER SATURATION VOLTAGE $V_{CE\,(sat)}$ (V)
COLLECTOR CURRENT I_C (mA)


$V_{BE\,(sat)} - I_C$
COMMON EMITTER
I_C / I_B = 10
Ta = 25°C
BASE - EMITTER SATURATION VOLTAGE $V_{BE\,(sat)}$ (V)
COLLECTOR CURRENT I_C (mA)

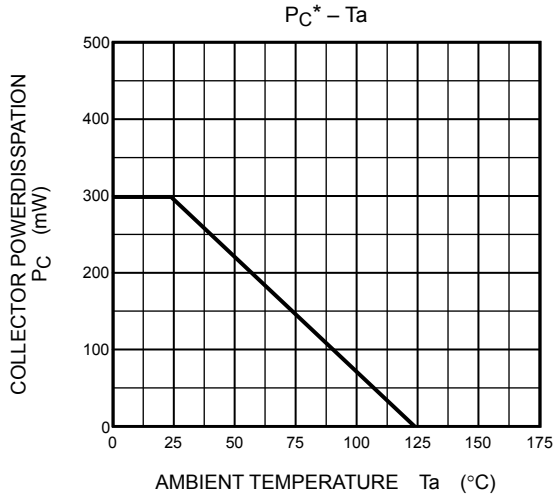
Q2


$I_C - V_{BE}$
COLLECTOR CURRENT I_C (mA)
160
120
80
40
0
Ta = 100°C
25
−25
COMMON EMITTER
V_{CE} = 6V
0
0.4
0.8
1.2
1.6
BASE-EMITTER VOLTAGE V_{BE} (V)


$f_T - I_C$
TRANSITION FREQUENCY f_T (MHz)
5000
3000
1000
500
300
100
50
30
10
COMMON EMITTER
V_{CE} = 10V
Ta = 25°C
0.1
0.3
1
3
10
30
100
300
COLLECTOR CURRENT I_C (mA)


$C_{ob} - V_{CB}$
COLLECTOR OUTPUT CAPACITANCE C_{ob} (pF)
100
50
30
10
5
3
1
I_E = 0
f = 1MHz
Ta = 25°C
0.1
0.3
1
3
10
30
100
COLLECTOR-BASE VOLTAGE V_{CB} (V)

Q1, Q2 Common



*Total Rating.

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20070701-EN GENERAL

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