TOSHIBA MULTI CHIP DISCRETE DEVICE

HN2E04F

Super High Speed Switching Application
Audio Frequency Amplifier Application
Audio Low Noise Amplifier Application

Q1

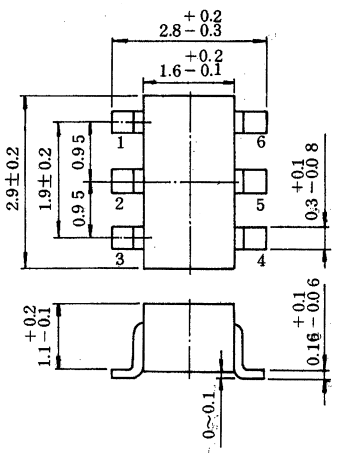
High Voltage : V_{CEO} = 120V
High DC Current Gain : h_{FE} = 200 to 700
Good h_{FE} Linearity : $h_{FE}(I_C$ = 0.1mA)/ $h_{FE}(I_C$ = 2mA) = 0.95

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) : 2SA1587 equivalent
Q2 (Diode) : 1SS352 equivalent

Unit: mm



SM6

JEDEC	—
JEITA	—
TOSHIBA	2-3N1E

Weight: 0.015g (typ.)

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

Characteristic	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	−120	V
Collector-emitter voltage	V_{CEO}	−120	V
Emitter-base voltage	V_{EBO}	−5	V
Collector current	I_C	−100	mA
Base current	I_B	−20	mA

Q2 (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

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 to 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: Power dissipation per element should not exceed 200mW per element.

Start of commercial production
2000-02

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

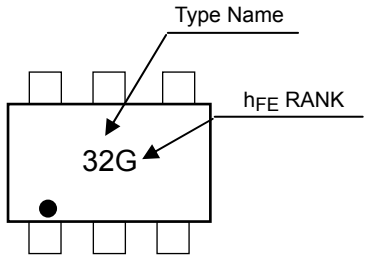
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	—	V_{CB} = −120V, I_E = 0	—	—	−100	nA
Emitter cut-off current	I_{EBO}	—	V_{EB} = −5V, I_C = 0	—	—	−100	nA
DC current gain	h_{FE}*	—	V_{CE} = − 6V, I_C = −2mA	200	—	700	
Collector-emitter saturation voltage	$V_{CE(sat)}$	—	I_C = −10mA, I_B = −1mA	—	—	−0.3	V
Transition Frequency	f_T	—	V_{CE} = −6V, I_C = −1mA	—	100	—	MHz
Collector Output Capacitance	C_{ob}	—	V_{CB} = −10V, I_E = 0, f=1MHz	—	4	—	pF
Noise figure	NF	—	V_{CE} = −6 V, I_C = −0.1 mA f = 1 kHz, R_g = 10 kΩ	—	1.0	—	dB

*: h_{FE} Classifications GR(G): 200 to 400 , BL(L): 350 to 700 ( )Marking Symbol

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)

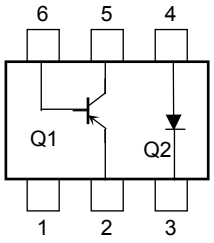
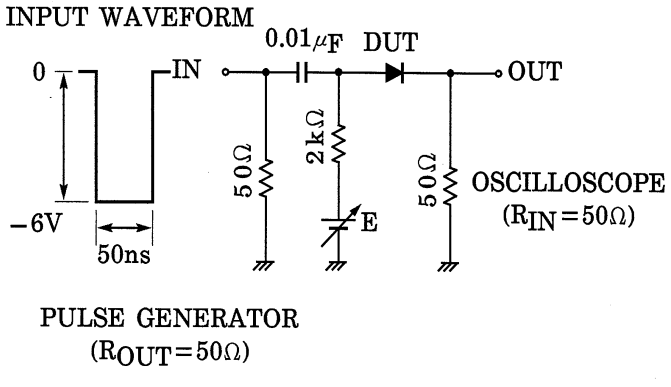
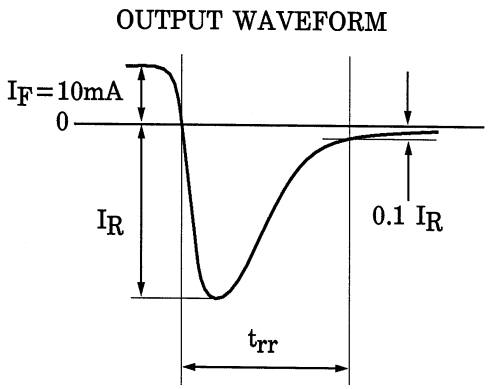


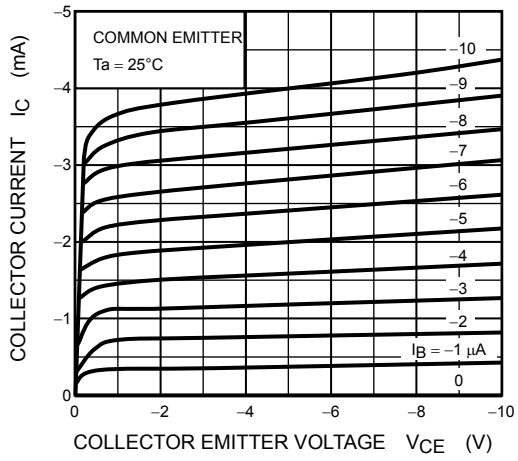
Fig. 1: Reverse Recovery Time (t_{rr}) Test Circuit



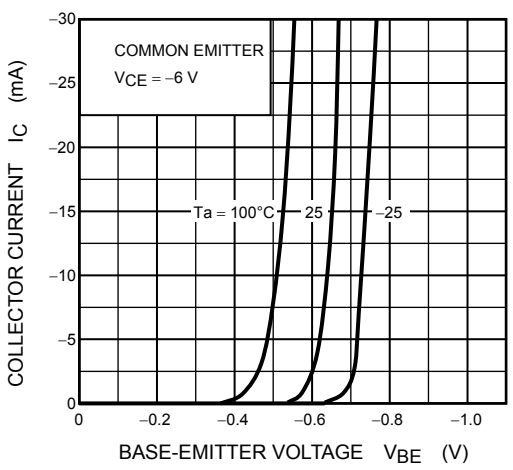


Q1

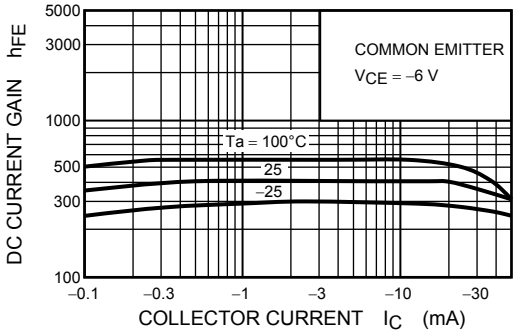
$I_C - V_{CE}$



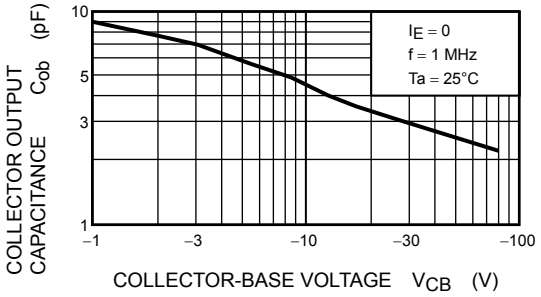
$I_C - V_{BE}$



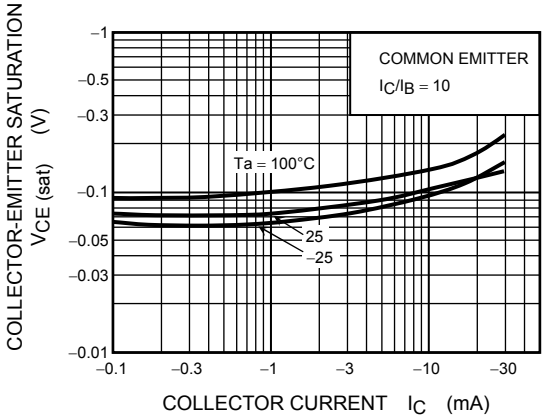
$h_{FE} - I_C$



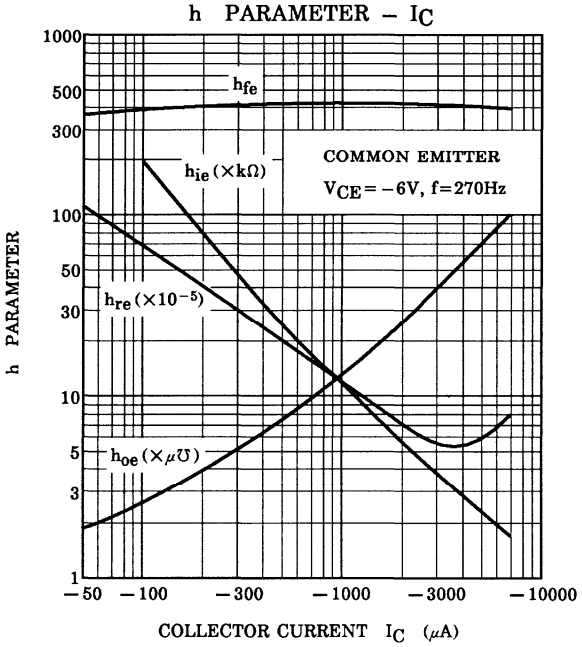
$C_{ob} - V_{CB}$



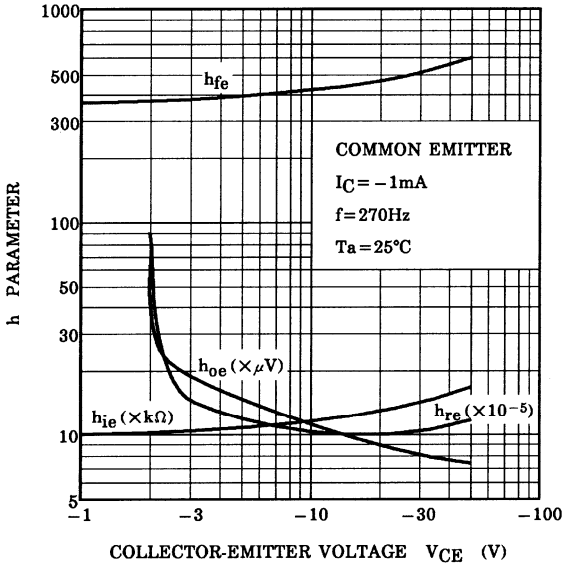
$V_{CE\ (sat)} - I_C$



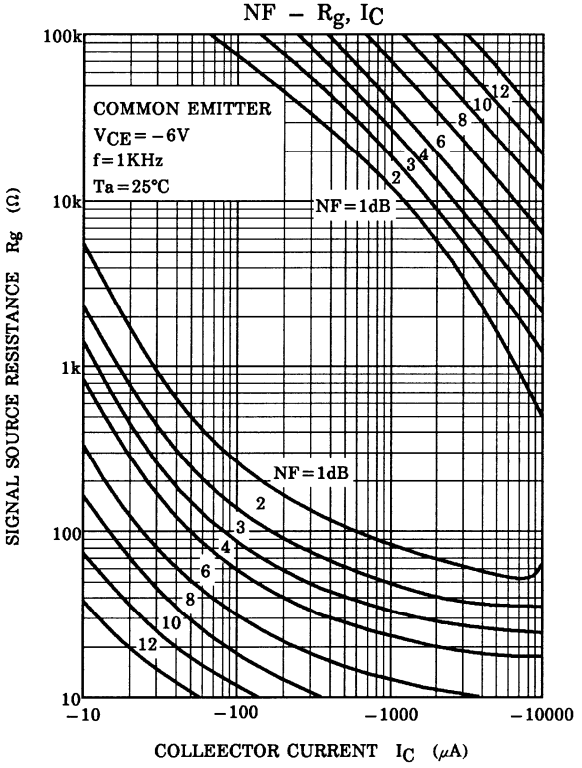
h PARAMETER – I_C



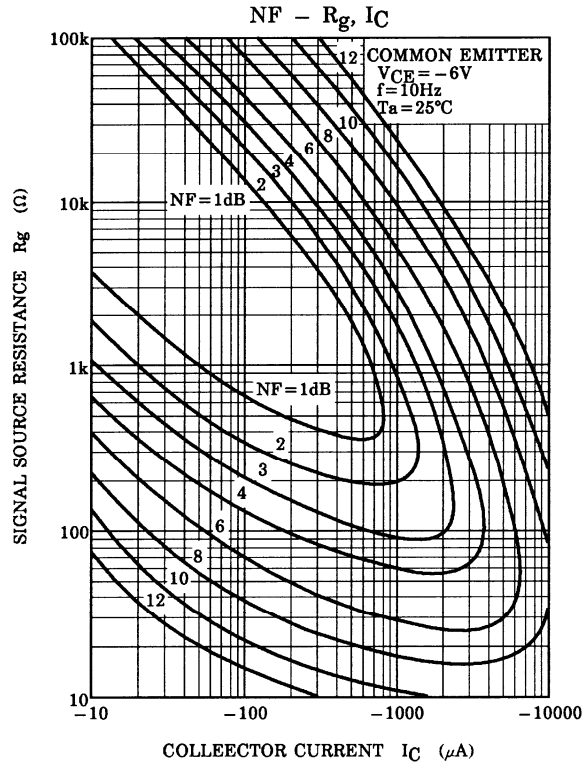
h PARAMETER – V_{CE}



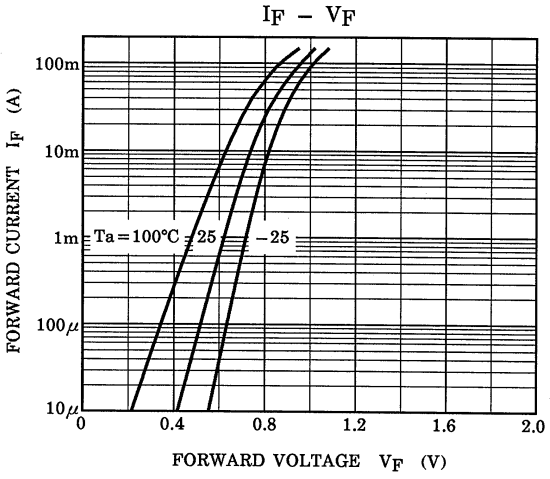
NF – R_g, I_C

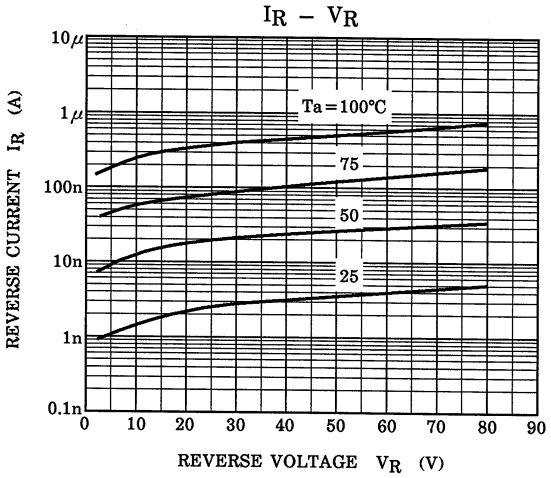


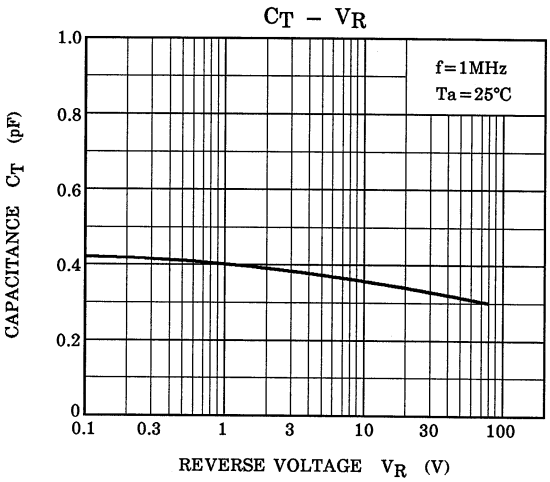
NF – R_g, I_C



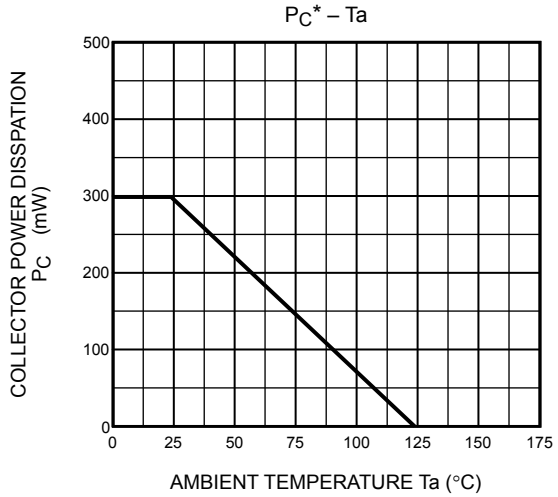
Q2


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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