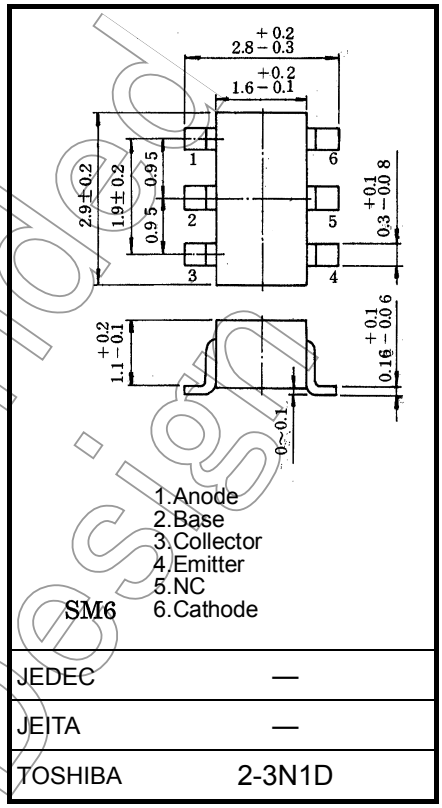
TOSHIBA MULTI CHIP DISCRETE DEVICE

# HN2E02F

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

Unit: mm




| | |
|---|---|
| SM6 | |
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-3N1D |

Weight: 0.015g (typ.)

## 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 Voltage : $V_{CEO}$=50V
- High Collector Current : $I_C$=150mA(max.)
- Good $h_{FE\ Linearity}$ : $h_{FE(}I_C$=0.1mA)/ $h_{FE(}I_C$=2mA) =0.95

- Q1 (Diode) : 1SS352 Equivalent
- Q2 (Transistor) : 2SC4738 Equivalent

## 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 | $V_{CBO}$ | 60 | 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: Power dissipation per element should not exceed 200mW per element.

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

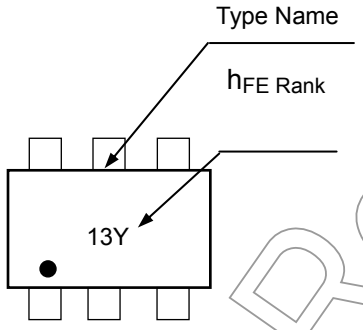
| Characteristic | Symbol | Test Circuit | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Forward voltage | $V_{F\ (1)}$ | — | $I_F$ = 1mA | — | 0.62 | — | V |
| | $V_{F\ (2)}$ | — | $I_F$ = 10mA | — | 0.75 | — | |
| | $V_{F\ (3)}$ | — | $I_F$ = 100mA | — | 0.98 | 1.2 | |
| 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)

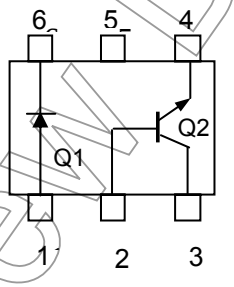
| Characteristic | Symbol | Test Circuit | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| Collector cut-off current | $I_{CBO}$ | — | $V_{CB}$ = 60V, $I_E$ = 0 | — | — | 100 | nA |
| Emitter cut-off current | $I_{EBO}$ | — | $V_{EB}$ = 5V, $I_C$ = 0 | — | — | 100 | nA |
| DC current gain | $h_{FE}$* | — | $V_{CE}$ = 6V, $I_C$ = 2mA | 120 | — | 700 | |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | — | $I_C$ =100mA, $I_B$ =10mA | — | 0.1 | 0.25 | V |
| Transition Frequency | $f_T$ | — | $V_{CE}$ = 10V, $I_C$ =10mA | 60 | — | — | MHz |
| Collector Output Capacitance | $C_{ob}$ | — | $V_{CB}$ = 10V, $I_E$ = 0,f=1MHz | — | 2.0 | — | pF |

* $h_{FE}$ Rank Y(Y) : 120~240, GR(G) : 200~400,BL(L) : 350~700 ( ) Marking Symbol

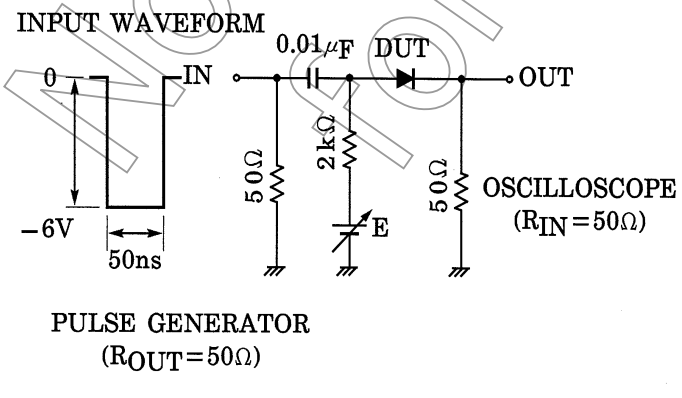
## Marking

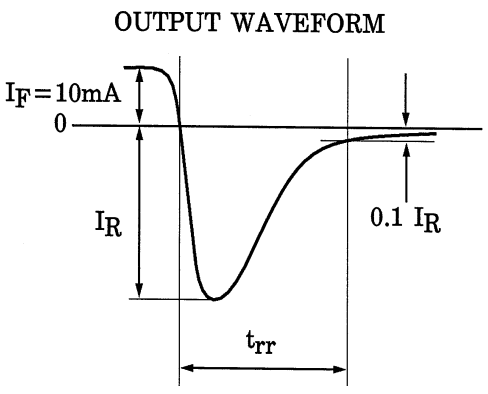



## Equivalent Circuit (Top View)



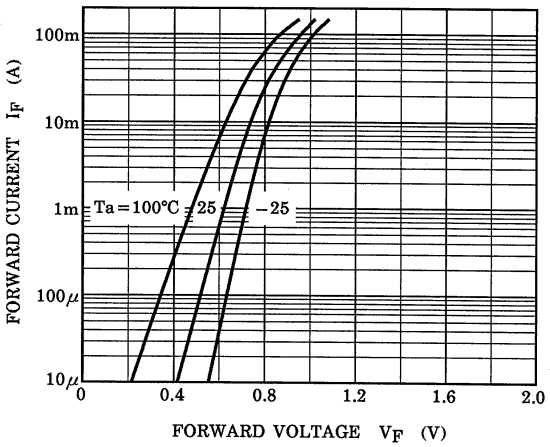

## Fig. 1 : Reverse Recovery Time ($t_{rr}$) Test Circuit



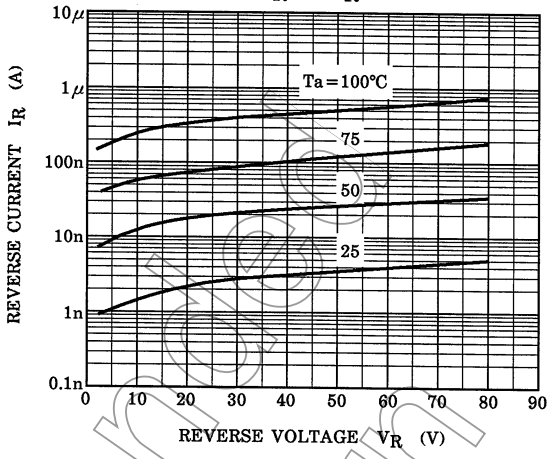



## Q1

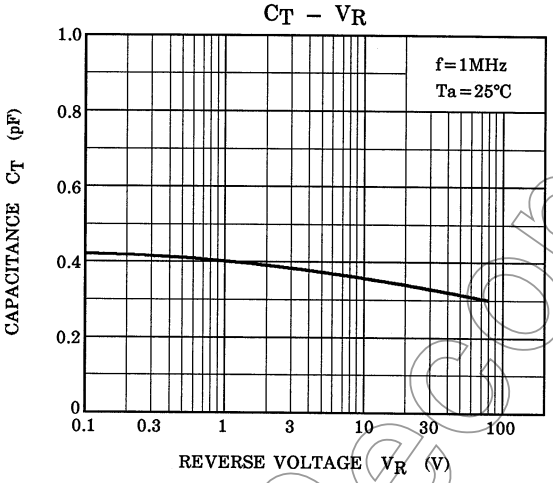
$I_F - V_F$




$I_R - V_R$

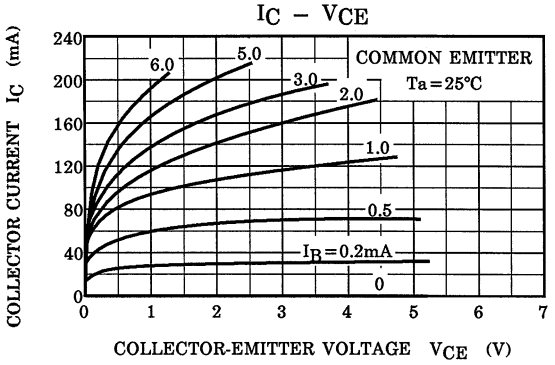



$C_T - V_R$

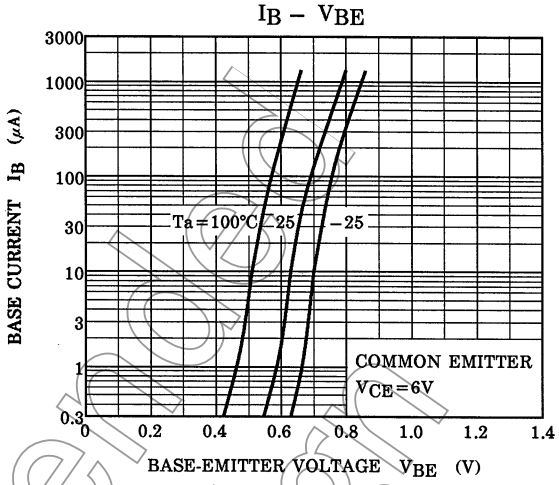


## Q2

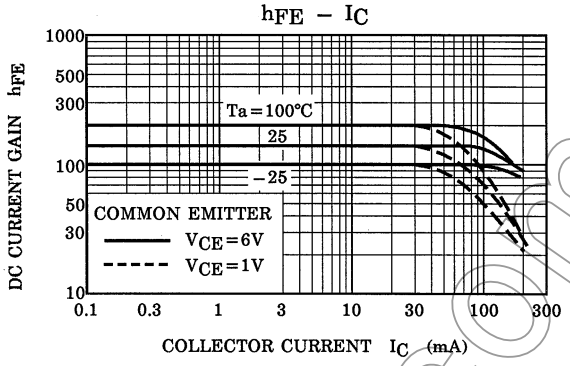
$I_C$ – $V_{CE}$



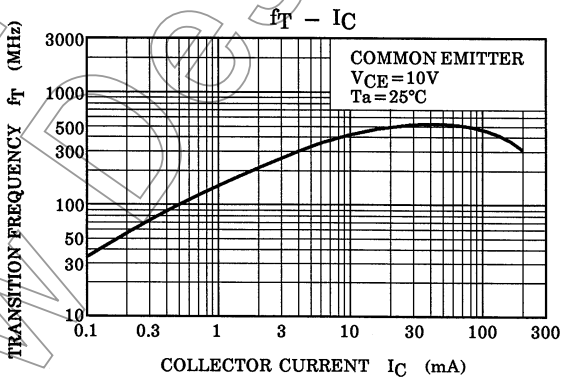

$I_B$ – $V_{BE}$



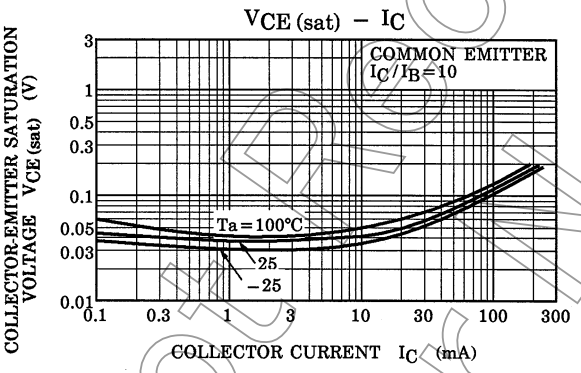

$h_{FE}$ – $I_C$



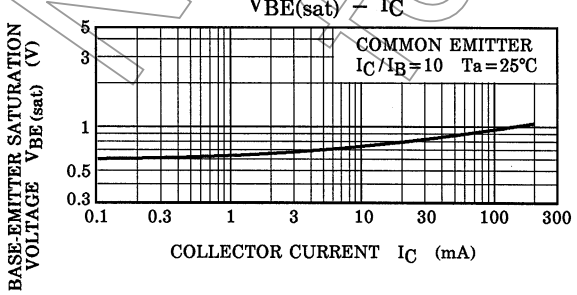

$f_T$ – $I_C$



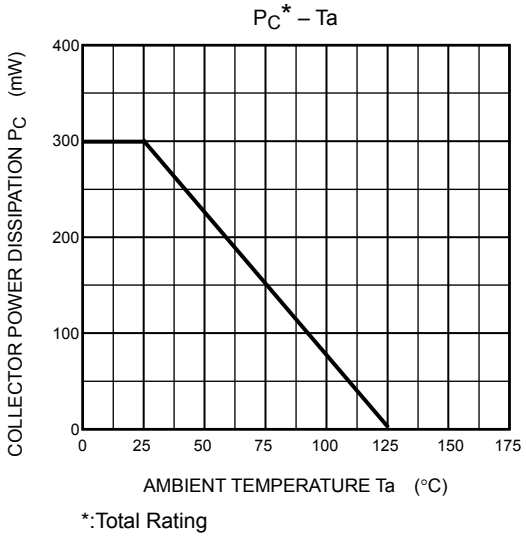

$V_{CE\,(sat)}$ – $I_C$




$V_{BE(sat)}$ – $I_C$



## Q1, Q2 Common




*:Total Rating

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