

TOSHIBA FIELD EFFECT TRANSISTOR
GaAs N CHANNEL SINGLE GATE MODULATION DOPE TYPE

2SK2331

SHF BAND LOW NOISE AMPLIFIER APPLICATIONS

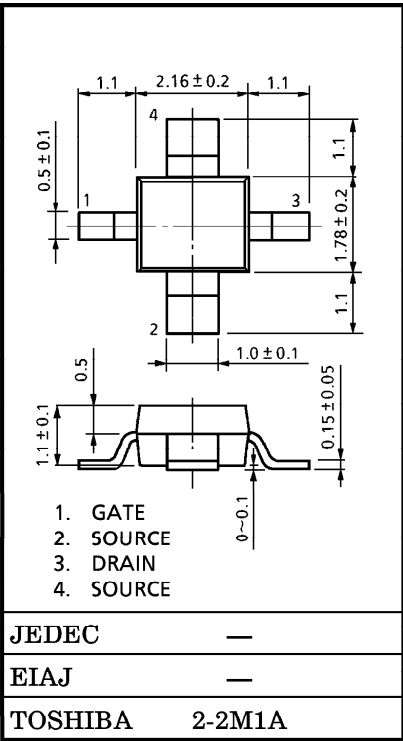
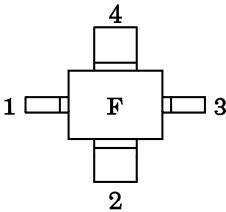
Unit in mm

- Low Noise Figure : NF=0.45dB (f=12GHz)
- High Gain : Ga=11dB (f=12GHz)

MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---------------------------|------------------|---------|------|
| Gate-Drain Voltage | V _{GDO} | -3 | V |
| Gate-Source Voltage | V _{GSO} | -3 | V |
| Drain Current | I _D | 120 | mA |
| Power Dissipation | P _D | 150 | mW |
| Channel Temperature | T _{ch} | 125 | °C |
| Storage Temperature Range | T _{stg} | -55~125 | °C |

Marking



Weight : 0.016g (Typ.)

ELECTRICAL CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------------|-----------------------|----------------------------------------------------|------|------|------|------|
| Gate Leakage Current | I _{GSS} | V _{DS} =0, V _{GS} = -2V | — | — | -20 | μA |
| Drain Current | I _{DSS} | V _{DS} =1V, V _{GS} =0 | 25 | 70 | 120 | mA |
| Gate-Source Cut-off Voltage | V _{GS} (OFF) | V _{DS} =1V, I _D =100μA | -0.2 | -0.8 | -2 | V |
| Forward Transfer Admittance | Y _{fs} | V _{DS} =1V, I _D =20mA, f=1kHz | — | 100 | — | mS |
| Noise Figure | NF | V _{DS} =1V, I _D =20mA, f=12GHz | — | 0.45 | 0.6 | dB |
| Associated Gain | Ga | V _{DS} =1V, I _D =20mA, f=12GHz | 10 | 11 | — | dB |

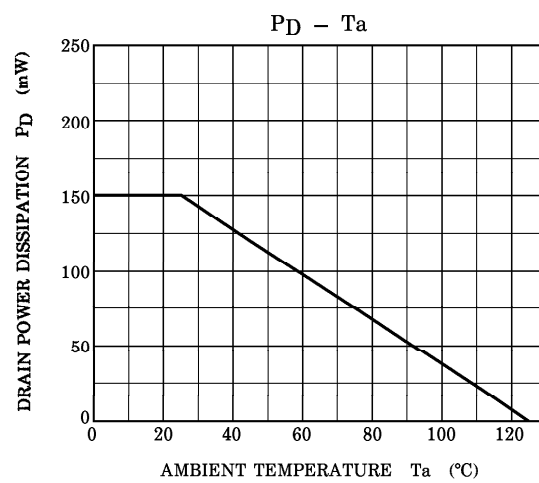
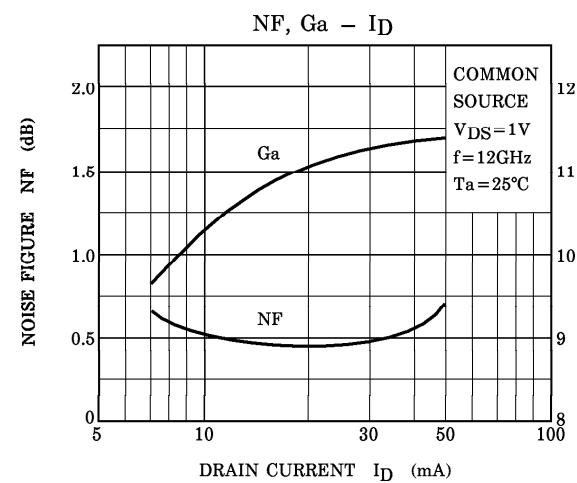
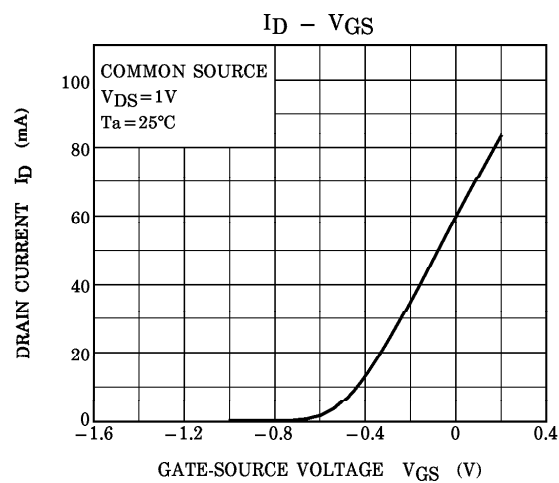
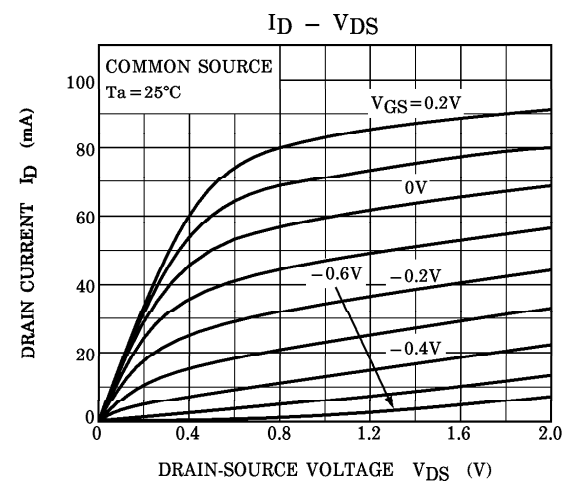
CAUTION

GaAs (Gallium Arsenide) is used in this product. The dust or vapor can be dangerous to humans. Do not break, cut, crush or dissolve chemically. Dispose of this product properly according to law. Do not intermingle with normal industrial or domestic waste.

This device electrostatic sensitivity. Please handle with caution.

961001EAC2

- TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- Gallium arsenide (GaAs) is a substance used in the products described in this document. GaAs dust and fumes are toxic. Do not break, cut or pulverize the product, or use chemicals to dissolve them. When disposing of the products, follow the appropriate regulations. Do not dispose of the products with other industrial waste or with domestic garbage.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.



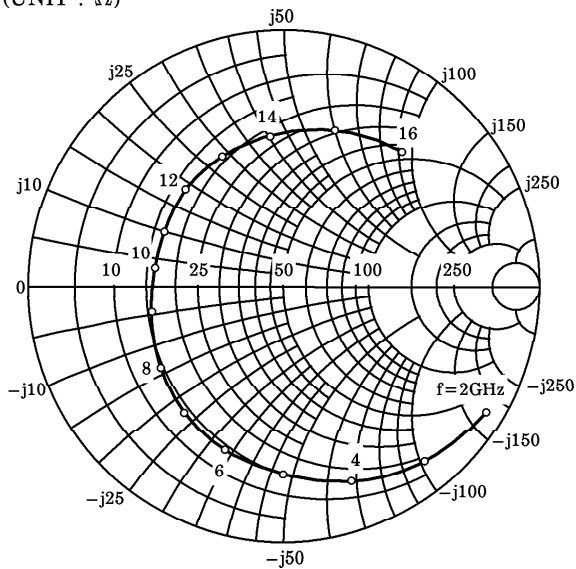
S-PARAMETER

COMMON SOURCE

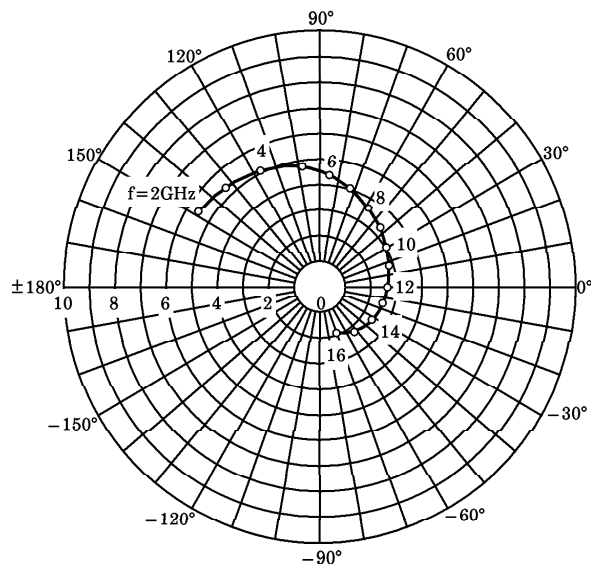
(V_{DS}=1V, I_D=20mA, T_a=25°C, Z₀=50Ω)

| FREQ. (MHz) | S ₁₁ | | S ₂₁ | | S ₁₂ | | S ₂₂ | |
|----------------|-----------------|------|-----------------|-----|-----------------|-----|-----------------|------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 2000 | 0.935 | −32 | 5.581 | 148 | 0.037 | 77 | 0.143 | −11 |
| 3000 | 0.871 | −51 | 5.352 | 133 | 0.054 | 71 | 0.117 | −26 |
| 4000 | 0.803 | −70 | 5.050 | 117 | 0.070 | 61 | 0.084 | −40 |
| 5000 | 0.734 | −90 | 4.741 | 98 | 0.087 | 51 | 0.042 | −81 |
| 6000 | 0.670 | −110 | 4.377 | 84 | 0.098 | 43 | 0.047 | −166 |
| 7000 | 0.622 | −128 | 3.969 | 71 | 0.108 | 34 | 0.071 | 166 |
| 8000 | 0.570 | −147 | 3.637 | 57 | 0.117 | 25 | 0.086 | 139 |
| 9000 | 0.525 | −168 | 3.310 | 42 | 0.120 | 13 | 0.133 | 114 |
| 10000 | 0.518 | 172 | 3.062 | 29 | 0.128 | 5 | 0.177 | 104 |
| 11000 | 0.526 | 156 | 2.874 | 17 | 0.136 | −4 | 0.206 | 95 |
| 12000 | 0.541 | 135 | 2.696 | −1 | 0.143 | −18 | 0.245 | 81 |
| 13000 | 0.564 | 115 | 2.523 | −15 | 0.146 | −29 | 0.287 | 69 |
| 14000 | 0.588 | 95 | 2.401 | −32 | 0.150 | −42 | 0.318 | 57 |
| 15000 | 0.637 | 71 | 2.200 | −52 | 0.156 | −59 | 0.384 | 41 |
| 16000 | 0.688 | 48 | 1.887 | −70 | 0.146 | −74 | 0.469 | 25 |

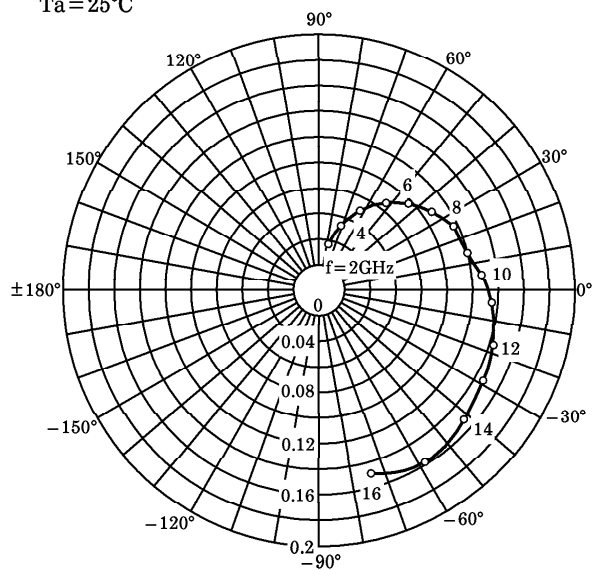
S₁₁
COMMON SOURCE
V_{DS}=1V
I_D=20mA
T_a=25°C
(UNIT : Ω)



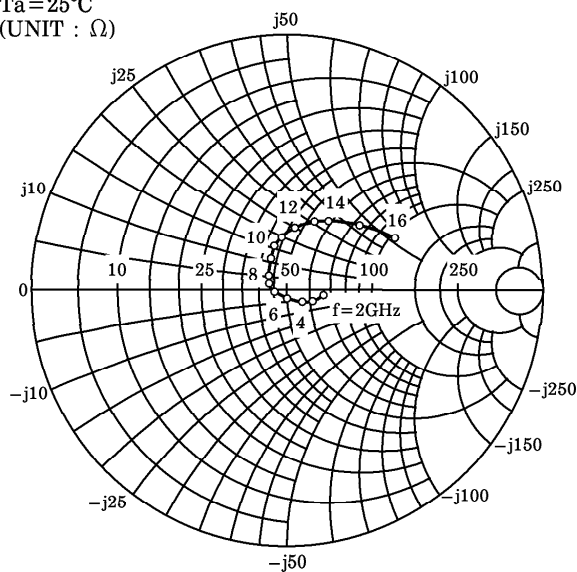
S₂₁
COMMON SOURCE
V_{DS}=1V
I_D=20mA
T_a=25°C



S₁₂
COMMON SOURCE
V_{DS}=1V
I_D=20mA
T_a=25°C



S₂₂
COMMON SOURCE
V_{DS}=1V
I_D=20mA
T_a=25°C
(UNIT : Ω)

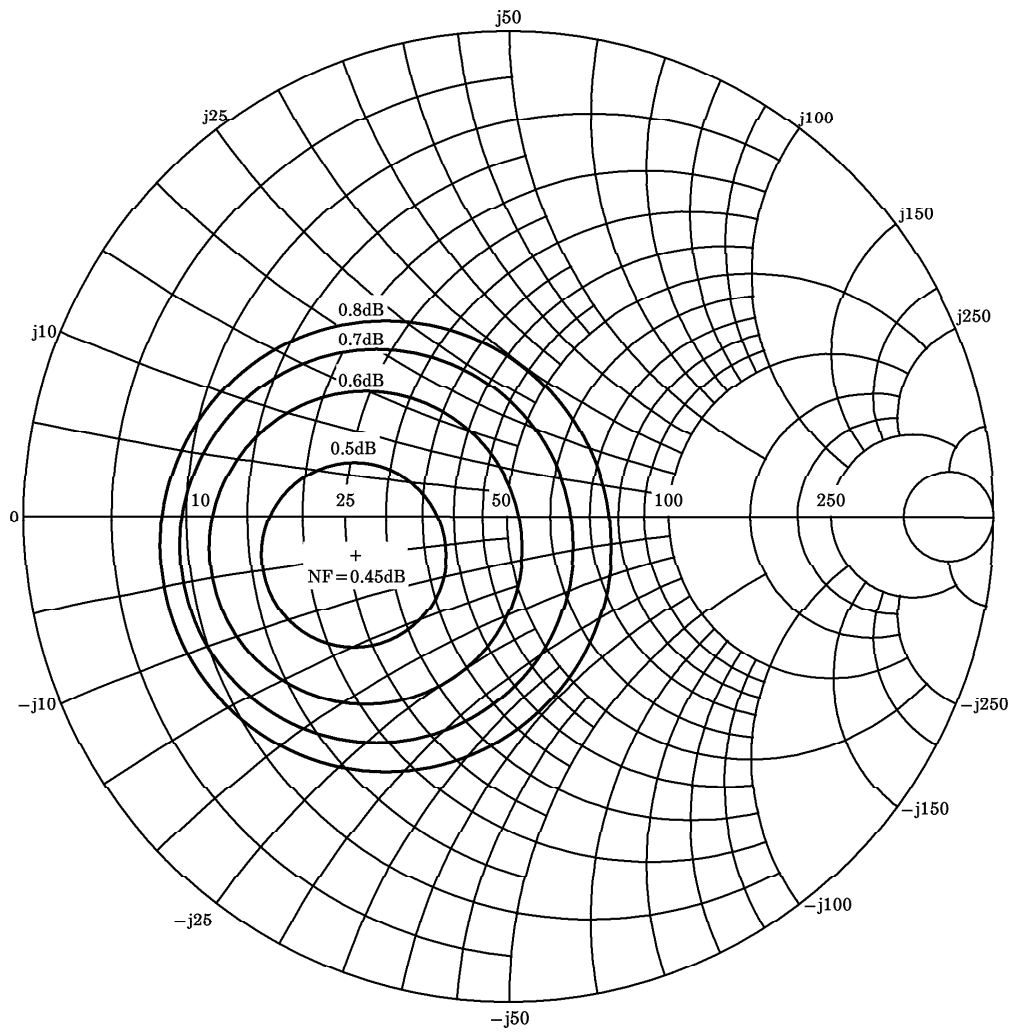


CONSTANT NOISE FIGURE

NF min=0.45dB, $\Gamma_{\text{opt}}=0.33 \angle -167^\circ$, $R_n=1.7\Omega$

@ $V_{\text{DS}}=1\text{V}$, $I_{\text{D}}=20\text{mA}$, $f=12\text{GHz}$

$Z_0=50\Omega$, $T_a=25^\circ\text{C}$



Recommended Methods of Mounting for This Device

| Mounting method | | | | |
|-----------------|---------------------|--------------------|----------------------|----------------|
| Solder flow | Nearinfrared reflow | Farinfrared reflow | VPS & hot air reflow | Soldering iron |
| × | ○ | ◎ | ◎ | ○ |

◎ : Applicable

○ : Applicable only once

× : Not applicable; other methods are recommended.

Note 1 : For either method of mounting, the above table shows whether applicable or not under Toshiba's recommended mounting conditions.

Note 2 : When mounted a number of times, those marked by ◎ can only be used. In this case, mounting is allowed up to three times, with the interval from the first to the third mounting completed within 24 hours.