

< Low Noise GaAs HEMT >

MGF4953B

Leadless ceramic package

DESCRIPTION

The MGF4953B super-low noise InGaAs HEMT (High Electron Mobility Transistor) is designed for use in K band amplifiers.

The lead-less ceramic package assures minimum parasitic losses.

FEATURES

Low noise figure @ f=20GHz

NFmin. = 0.55dB (Typ.)

High associated gain @ f=20GHz

Gs = 10.5dB (Typ.)

APPLICATION

C to K band low noise amplifiers

QUALITY GRADE

GG

RECOMMENDED BIAS CONDITIONS

VDS=2V, ID=10mA

ORDERING INFORMATION

Tape & reel 10,000pcs/reel (MGF4953B-01)

Tape & reel 10,000pcs/reel (MGF4953B-70)

RoHS COMPLIANT

MGF4953B is a RoHS compliant product. RoHS compliance is indicated by the letter "G" after the Lot Marking.

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| Symbol | Parameter | Ratings | Unit |
|--------|-------------------------|-------------|------|
| VGDO | Gate to drain voltage | -3 | V |
| VGSO | Gate to source voltage | -3 | V |
| ID | Drain current | 60 | mA |
| PT | Total power dissipation | 50 | mW |
| Tch | Channel temperature | 125 | °C |
| Tstg | Storage temperature | -55 to +125 | °C |

ELECTRICAL CHARACTERISTICS (Ta=25°C)

| Symbol | Parameter | Test conditions | Limits | | | Unit |
|----------|---------------------------------|------------------|--------|------|------|------|
| | | | MIN. | TYP. | MAX | |
| V(BR)GDO | Gate to drain breakdown voltage | IG=-10μA | -3 | -- | -- | V |
| Igss | Gate to source leakage current | VGS=-2V, VDS=0V | -- | -- | 50 | μA |
| IDSS | Saturated drain current | VGS=0V, VDS=2V | 15 | -- | 60 | mA |
| VGS(off) | Gate to source cut-off voltage | VDS=2V, ID=500μA | -0.1 | -- | -1.5 | V |
| Gs | Associated gain | VDS=2V, | 9.0 | 10.5 | -- | dB |
| NFmin. | Minimum noise figure | ID=10mA, f=20GHz | -- | 0.55 | 0.80 | dB |

Note: Gs and NFmin. are tested with sampling inspection.

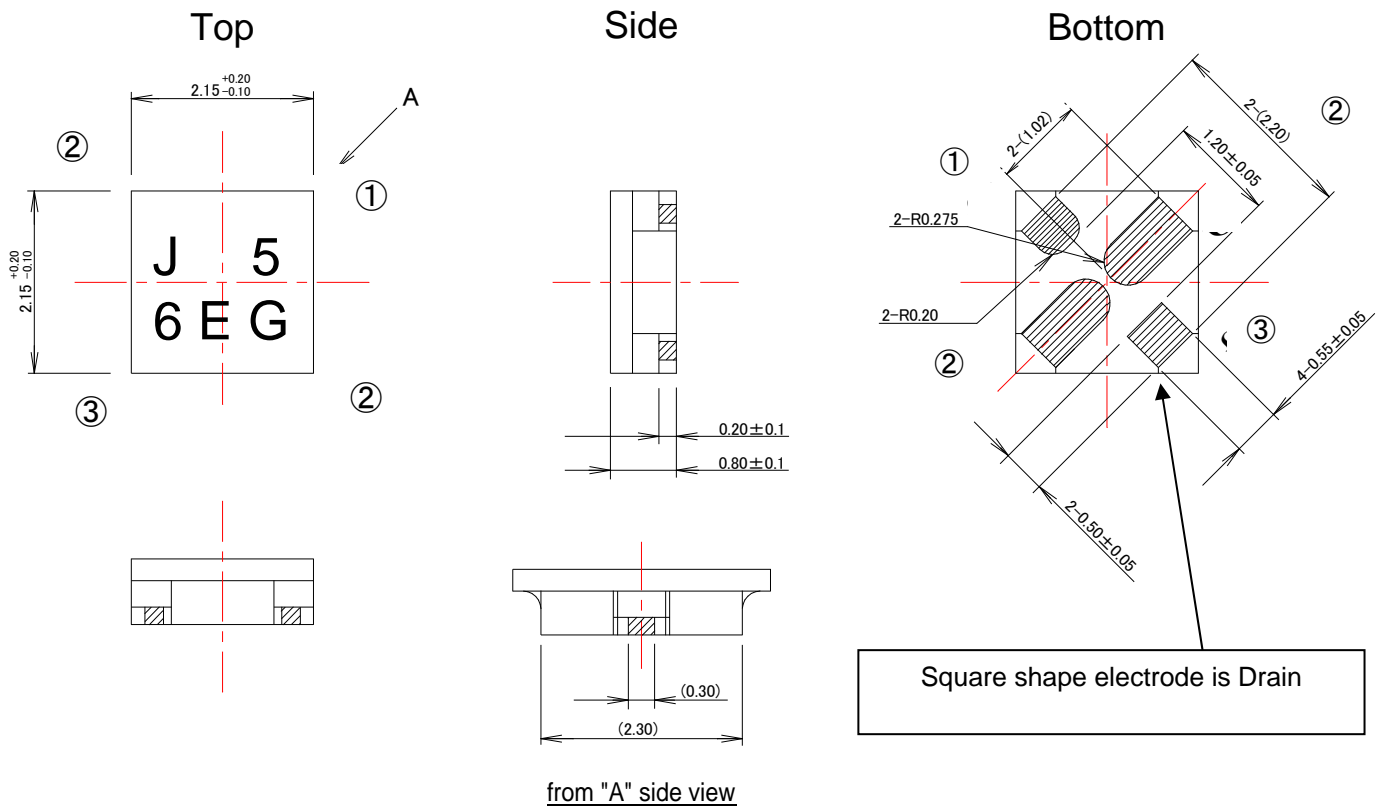
Outline Drawing

Fig.1

MITSUBISHI Proprietary

Not to be reproduced or disclosed without permission by Mitsubishi Electric

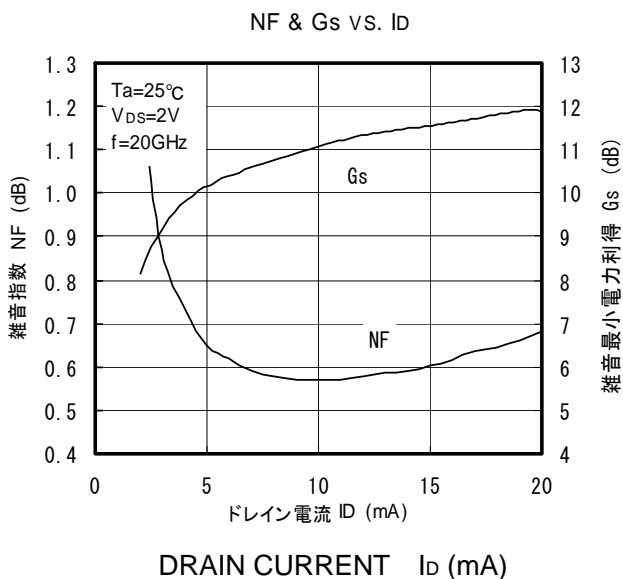
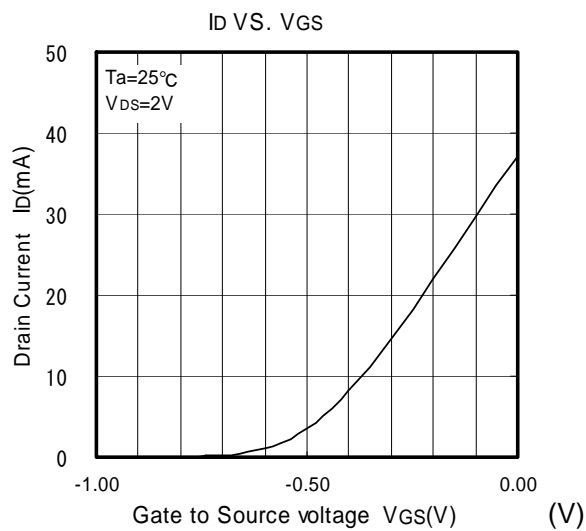
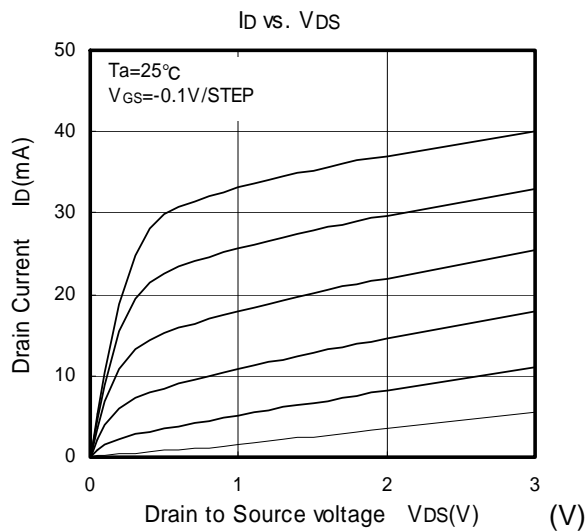
Fig.1



Unit: mm

- ① Gate
- ② Source
- ③ Drain

TYPICAL CHARACTERISTICS (Ta=25°C)



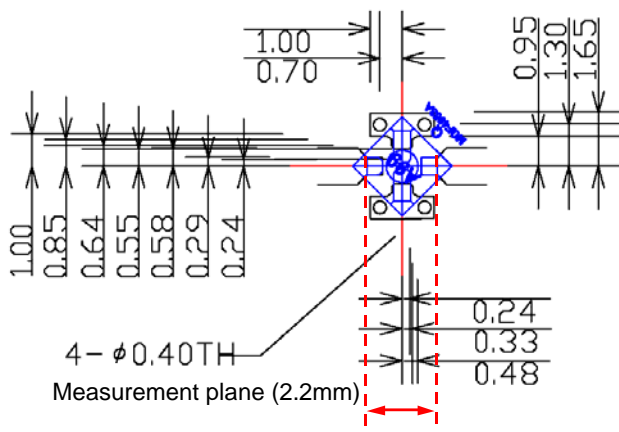
S PARAMETERS

(VDS=2V, ID=10mA, Ta=25°C)

| Freq. (GHz) | S11 | | S21 | | S12 | | S22 | |
|----------------|-------|--------|-------|--------|-------|--------|-------|--------|
| | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) |
| 1 | 0.989 | -4.0 | 5.212 | 166.6 | 0.038 | 82.4 | 0.689 | -10.7 |
| 2 | 0.968 | -20.4 | 5.101 | 152.0 | 0.046 | 72.4 | 0.669 | -21.1 |
| 3 | 0.942 | -36.8 | 4.989 | 137.3 | 0.054 | 62.4 | 0.640 | -31.5 |
| 4 | 0.927 | -53.2 | 4.877 | 122.7 | 0.062 | 52.4 | 0.604 | -41.9 |
| 5 | 0.857 | -69.5 | 4.766 | 108.0 | 0.070 | 42.4 | 0.554 | -52.4 |
| 6 | 0.787 | -85.8 | 4.655 | 93.4 | 0.078 | 32.4 | 0.505 | -62.7 |
| 7 | 0.716 | -101.5 | 4.524 | 79.3 | 0.085 | 23.5 | 0.454 | -72.7 |
| 8 | 0.654 | -119.2 | 4.378 | 64.9 | 0.093 | 13.5 | 0.399 | -84.1 |
| 9 | 0.582 | -135.3 | 4.162 | 52.0 | 0.095 | 4.9 | 0.341 | -93.6 |
| 10 | 0.525 | -152.8 | 4.008 | 39.5 | 0.095 | -2.5 | 0.288 | -102.8 |
| 11 | 0.494 | -170.2 | 3.887 | 27.3 | 0.096 | -8.4 | 0.250 | -113.0 |
| 12 | 0.474 | 171.2 | 3.761 | 15.2 | 0.096 | -14.2 | 0.212 | -124.7 |
| 13 | 0.471 | 152.0 | 3.656 | 2.9 | 0.097 | -20.6 | 0.180 | -140.4 |
| 14 | 0.484 | 134.6 | 3.593 | -9.4 | 0.096 | -26.0 | 0.159 | -156.4 |
| 15 | 0.501 | 118.4 | 3.522 | -21.9 | 0.095 | -33.2 | 0.155 | -175.5 |
| 16 | 0.544 | 101.2 | 3.335 | -36.1 | 0.098 | -37.5 | 0.163 | 153.3 |
| 17 | 0.579 | 86.8 | 3.209 | -49.3 | 0.099 | -42.9 | 0.182 | 132.4 |
| 18 | 0.612 | 73.6 | 3.038 | -62.7 | 0.101 | -49.3 | 0.216 | 110.1 |
| 19 | 0.646 | 62.0 | 2.814 | -73.7 | 0.102 | -56.2 | 0.260 | 90.7 |
| 20 | 0.688 | 50.3 | 2.726 | -85.1 | 0.107 | -63.9 | 0.301 | 76.3 |
| 21 | 0.733 | 39.4 | 2.613 | -96.7 | 0.112 | -75.1 | 0.340 | 59.0 |
| 22 | 0.765 | 28.6 | 2.499 | -108.3 | 0.115 | -86.3 | 0.370 | 48.0 |
| 23 | 0.798 | 17.7 | 2.384 | -120.0 | 0.119 | -97.5 | 0.405 | 37.0 |
| 24 | 0.831 | 6.9 | 2.269 | -131.6 | 0.123 | -108.7 | 0.444 | 30.2 |
| 25 | 0.831 | -3.9 | 2.152 | -143.2 | 0.127 | -119.9 | 0.483 | 23.1 |
| 26 | 0.814 | -14.7 | 2.034 | -154.8 | 0.131 | -131.1 | 0.522 | 17.1 |

NOISE PARAMETERS (VDS=2V, ID=10mA, Ta=25°C)

| Freq. (GHz) | NFmin (dB) | Γ_{opt} | | Rn (Ω) |
|----------------|---------------|----------------|--------|--------------------|
| | | (mag) | (ang) | |
| 12 | 0.38 | 0.44 | 140.9 | 2.5 |
| 13 | 0.40 | 0.40 | 160.3 | 1.5 |
| 14 | 0.43 | 0.38 | -179.4 | 2.0 |
| 15 | 0.45 | 0.36 | -158.4 | 2.0 |
| 16 | 0.48 | 0.36 | -136.6 | 3.0 |
| 17 | 0.50 | 0.36 | -114.2 | 4.0 |
| 18 | 0.53 | 0.38 | -91.2 | 6.0 |
| 19 | 0.57 | 0.39 | -67.9 | 8.5 |
| 20 | 0.63 | 0.41 | -44.5 | 11.5 |
| 21 | 0.72 | 0.45 | -21.1 | 15.0 |
| 22 | 0.80 | 0.48 | 2.1 | 19.0 |
| 23 | 0.92 | 0.54 | 25.2 | 24.0 |
| 24 | 1.00 | 0.57 | 48.1 | 29.5 |
| 25 | 1.14 | 0.61 | 70.9 | 37.5 |
| 26 | 1.24 | 0.63 | 93.6 | 50.0 |



Board; RO4003C (Rogers Corp.)
 $\epsilon_r=3.38$, $t=0.508\text{mm}$, Au (Cu) = 0.035mm

Note:

We are ready to provide nonlinear model for ADS and MWO users. If you are interested, please contact our sales offices.

S PARAMETERS

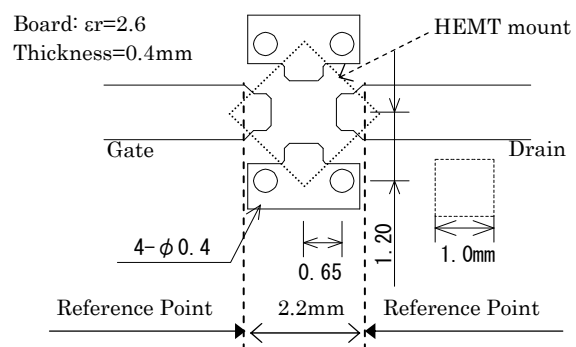
(VDS=2V, ID=10mA, Ta=25°C)

| Freq. (GHz) | S11 | | S21 | | S12 | | S22 | |
|----------------|-------|--------|-------|--------|-------|--------|-------|--------|
| | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) |
| 1 | 0.989 | -13.0 | 4.537 | 165.8 | 0.014 | 78.9 | 0.637 | -9.7 |
| 2 | 0.973 | -25.9 | 4.502 | 152.9 | 0.028 | 71.8 | 0.629 | -19.6 |
| 3 | 0.949 | -38.7 | 4.472 | 140.4 | 0.041 | 62.7 | 0.621 | -29.2 |
| 4 | 0.926 | -52.0 | 4.460 | 127.3 | 0.054 | 53.2 | 0.608 | -39.0 |
| 5 | 0.890 | -64.9 | 4.431 | 114.9 | 0.066 | 44.4 | 0.592 | -48.2 |
| 6 | 0.828 | -81.1 | 4.394 | 99.8 | 0.076 | 33.4 | 0.539 | -60.1 |
| 7 | 0.776 | -95.6 | 4.311 | 86.3 | 0.085 | 24.1 | 0.505 | -70.2 |
| 8 | 0.723 | -110.6 | 4.230 | 73.2 | 0.093 | 15.2 | 0.469 | -80.4 |
| 9 | 0.662 | -126.6 | 4.094 | 59.9 | 0.099 | 5.4 | 0.423 | -90.7 |
| 10 | 0.605 | -142.6 | 3.943 | 47.4 | 0.102 | -4.0 | 0.368 | -100.2 |
| 11 | 0.551 | -158.2 | 3.826 | 35.4 | 0.102 | -12.9 | 0.318 | -108.8 |
| 12 | 0.514 | -174.5 | 3.740 | 23.7 | 0.100 | -19.7 | 0.279 | -116.3 |
| 13 | 0.488 | 167.0 | 3.622 | 11.2 | 0.099 | -28.1 | 0.232 | -126.2 |
| 14 | 0.486 | 149.0 | 3.572 | -1.1 | 0.098 | -32.1 | 0.203 | -138.3 |
| 15 | 0.480 | 131.8 | 3.512 | -12.6 | 0.094 | -38.4 | 0.169 | -148.1 |
| 16 | 0.509 | 113.0 | 3.425 | -26.2 | 0.099 | -43.0 | 0.148 | -175.1 |
| 17 | 0.536 | 95.1 | 3.349 | -39.1 | 0.099 | -49.9 | 0.133 | 157.1 |
| 18 | 0.569 | 78.2 | 3.226 | -52.1 | 0.100 | -58.5 | 0.132 | 120.7 |
| 19 | 0.609 | 62.7 | 3.091 | -66.1 | 0.099 | -66.5 | 0.160 | 92.2 |
| 20 | 0.642 | 47.3 | 2.934 | -79.2 | 0.096 | -75.2 | 0.204 | 67.8 |
| 21 | 0.674 | 34.3 | 2.752 | -91.8 | 0.091 | -83.8 | 0.250 | 50.6 |
| 22 | 0.707 | 21.1 | 2.617 | -104.8 | 0.089 | -92.5 | 0.293 | 37.0 |
| 23 | 0.742 | 9.2 | 2.471 | -117.4 | 0.082 | -102.8 | 0.350 | 23.8 |
| 24 | 0.753 | -2.2 | 2.307 | -130.2 | 0.081 | -111.9 | 0.390 | 13.5 |
| 25 | 0.775 | -12.5 | 2.139 | -142.4 | 0.072 | -118.9 | 0.430 | 2.4 |
| 26 | 0.803 | -22.5 | 2.008 | -155.0 | 0.069 | -135.9 | 0.474 | -5.7 |

NOISE PARAMETERS (VDS=2V, ID=10mA, Ta=25°C)

| Freq. (GHz) | Γ_{opt} | | Rn | NFmin (dB) |
|----------------|----------------|--------|------|---------------|
| | (mag) | (ang) | | |
| 18 | 0.358 | -137.2 | 0.12 | 0.51 |
| 20 | 0.372 | -91.0 | 0.14 | 0.55 |
| 22 | 0.390 | -47.7 | 0.63 | 0.77 |
| 24 | 0.417 | -14.9 | 1.05 | 1.05 |
| 26 | 0.473 | 10.5 | 1.26 | 1.25 |

Note) Rn is normalized by 50ohm



Note:

We are ready to provide nonlinear model for ADS and MWO users. If you are interested, please contact our sales offices.

Keep safety first in your circuit designs!

- Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

- These materials are intended as a reference to assist our customers in the selection of the Mitsubishi semiconductor product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi Electric Corporation or a third party.
- Mitsubishi Electric Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
- All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Mitsubishi Electric Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for the latest product information before purchasing a product listed herein.
The information described here may contain technical inaccuracies or typographical errors.
Mitsubishi Electric Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
Please also pay attention to information published by Mitsubishi Electric Corporation by various means, including the Mitsubishi Semiconductor home page (<http://www.mitsubishielectric.com/>).
- When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
- Mitsubishi Electric Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
- The prior written approval of Mitsubishi Electric Corporation is necessary to reprint or reproduce in whole or in part these materials.
- If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
Any diversion or re-export contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
- Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for further details on these materials or the products contained therein.