MITSUBISHI RF POWER MOS FET

# RD02MUS2

**ELECTROSTATIC SENSITIVE DEVICE**
OBSERVE HANDLING PRECAUTIONS

**RoHS Compliance,Silicon MOSFET Power Transistor 175MHz,520MHz,2W**

## DESCRIPTION

RD02MUS2 is a MOS FET type transistor specifically designed for VHF/UHF RF po -wer amplifiers applications.
This device have an interal monolithic zener diode from gate to source for ESD protection.

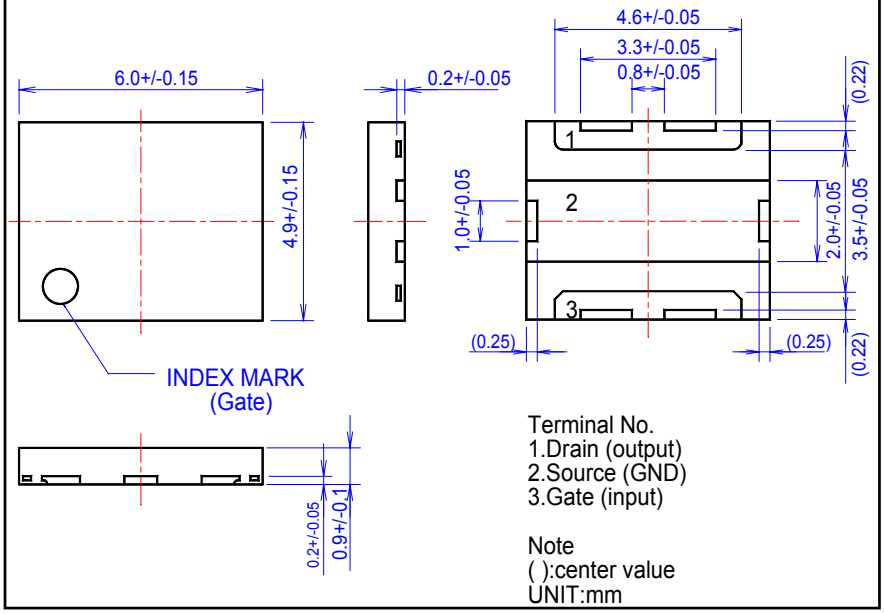
## FEATURES

•High power gain:
Pout>2W, Gp>16dB
@Vdd=7.2V,f=175MHz,520MHz
•High Efficiency:65%typ.(175MHz)
•High Efficiency:65%typ.(520MHz)
•Integrated gate protection diode

## APPLICATION

For output stage of high power amplifiers
In VHF/UHF band mobile radio sets.

OUTLINE DRAWING




## RoHS COMPLIANT

RD02MUS2-101,T112 is a RoHS compliant products.
RoHS compliance is indicate by the letter “G” after the Lot Marking.
This product include the lead in high melting temperature type solders.
How ever,it applicable to the following exceptions of RoHS Directions.
1.Lead in high melting temperature type solders(i.e.tin-lead solder alloys containing more than85% lead.)

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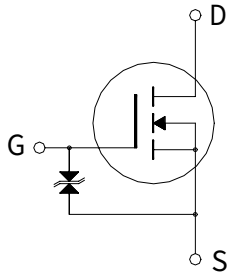
## ABSOLUTE MAXIMUM RATINGS

(Tc=25°C UNLESS OTHERWISE NOTED)

| SYMBOL | PARAMETER | CONDITIONS | RATINGS | UNIT |
|---|---|---|---|---|
| VDSS | Drain to source voltage | Vgs=0V | 30 | V |
| VGSS | Gate to source voltage | Vds=0V | -5/+10 | V |
| Pch | Channel dissipation | Tc=25°C | 21.9 | W |
| Pin | Input Power | Zg=Zl=50Ω | 0.1 | W |
| ID | Drain Current | - | 1.5 | A |
| Tch | Junction temperature | - | 150 | °C |
| Tstg | Storage temperature | - | -40 to +125 | °C |
| Rth j-c | Thermal resisitance | Junction to case | 5.7 | °C/W |



SCHEMATIC DRAWING

Note 1: Above parameters are guaranteed independently.

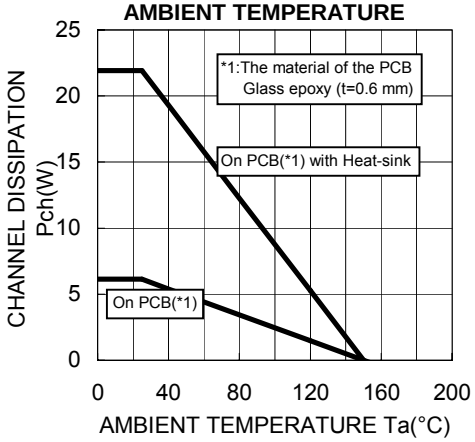
## ELECTRICAL CHARACTERISTICS (Tc=25°C, UNLESS OTHERWISE NOTED)

| SYMBOL | PARAMETER | CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX. | |
| $I_{DSS}$ | Zero gate Voltage drain current | $V_{DS}$=17V, $V_{GS}$=0V | - | - | 100 | uA |
| $I_{GSS}$ | Gate to source leak current | $V_{GS}$=10V, $V_{DS}$=0V | - | - | 1 | uA |
| $V_{th}$ | Gate threshold Voltage | $V_{DS}$=12V, $I_{DS}$=1mA | 1 | 1.8 | 3 | V |
| Pout1 | Output power | $V_{DD}$=7.2V, Pin=50mW, | 2 | 3 | - | W |
| $\eta_{D1}$ | Drain efficiency | f=175MHz Idq=200mA | 55 | 65 | - | % |
| Pout2 | Output power | $V_{DD}$=7.2V, Pin=50mW, | 2 | 3 | - | W |
| $\eta_{D2}$ | Drain efficiency | f=520MHz Idq=200mA | 50 | 65 | - | % |
| | Load VSWR tolerance | $V_{DD}$=9.2V,Po=2W(Pin Control)<br>f=175MHz,Idq=200mA,Zg=50Ω<br>Load VSWR=20:1(All Phase) | No destroy | | | - |
| | Load VSWR tolerance | $V_{DD}$=9.2V,Po=2W(Pin Control)<br>f=520MHz,Idq=200mA,Zg=50Ω<br>Load VSWR=20:1(All Phase) | No destroy | | | - |

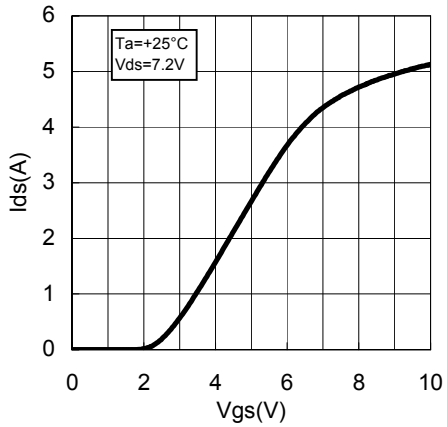
Note : Above parameters , ratings , limits and conditions are subject to change.

## TYPICAL CHARACTERISTICS

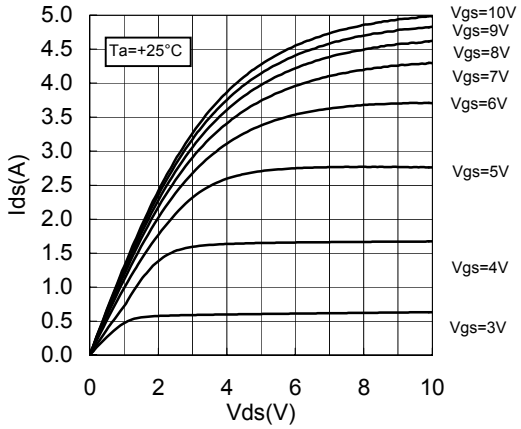
**DRAIN DISSIPATION VS. AMBIENT TEMPERATURE**



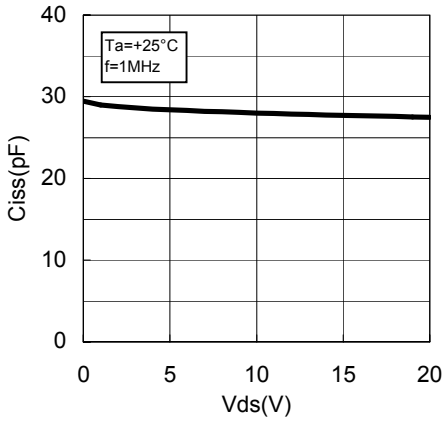

**Vgs-Ids CHARACTERISTICS**



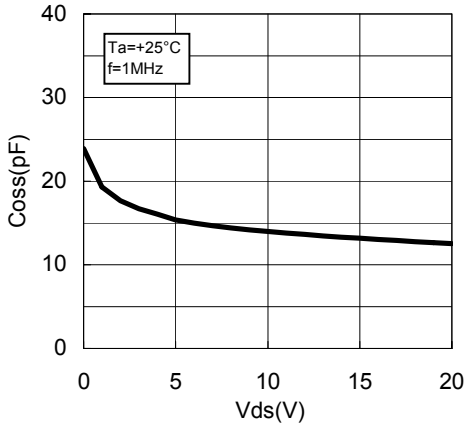

**Vds-Ids CHARACTERISTICS**



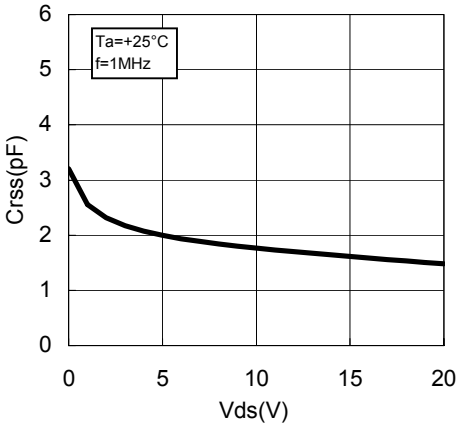

**Vds VS. Ciss CHARACTERISTICS**




**Vds VS. Coss CHARACTERISTICS**

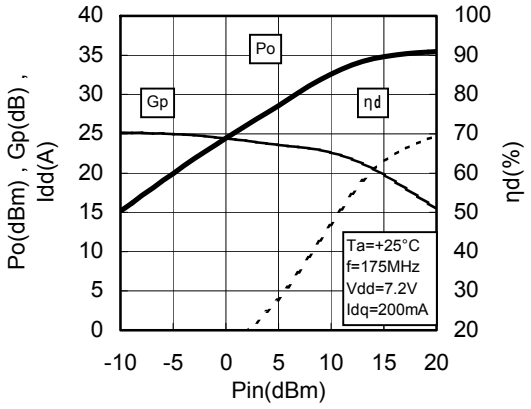



**Vds VS. Crss CHARACTERISTICS**

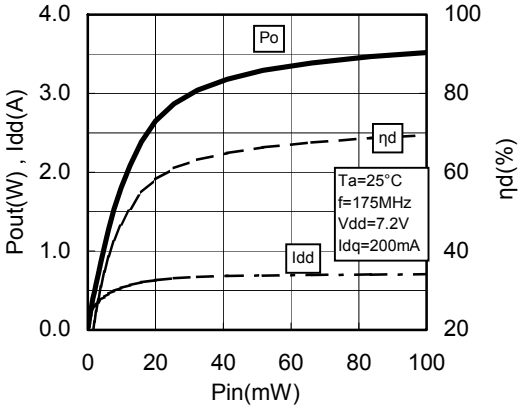


## TYPICAL CHARACTERISTICS

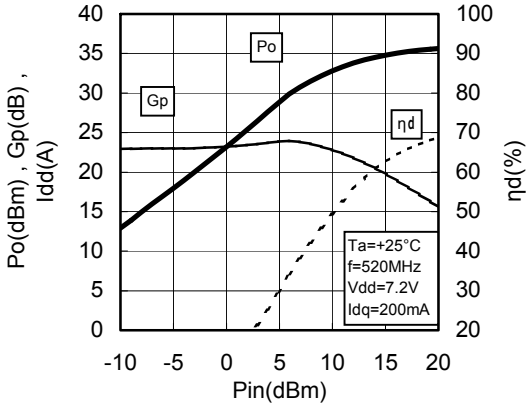
**Pin-Po CHARACTERISTICS @f=175MHz**



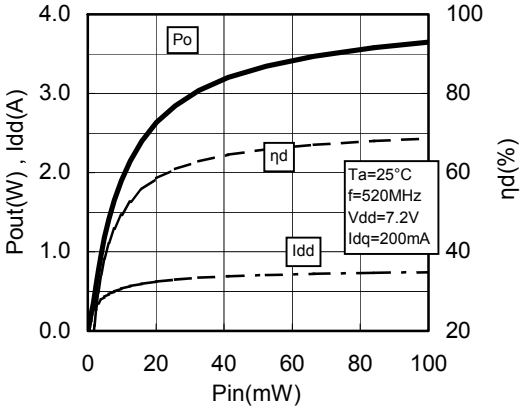

**Pin-Po CHARACTERISTICS @f=175MHz**



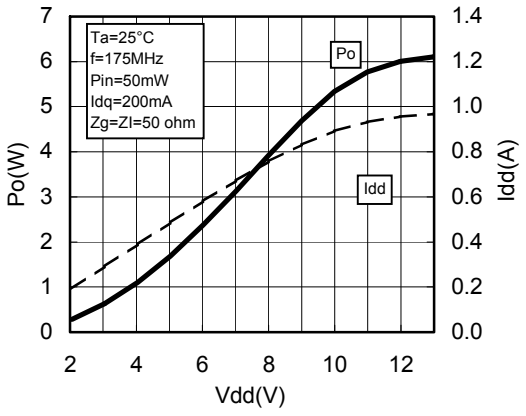

**Pin-Po CHARACTERISTICS @f=520MHz**



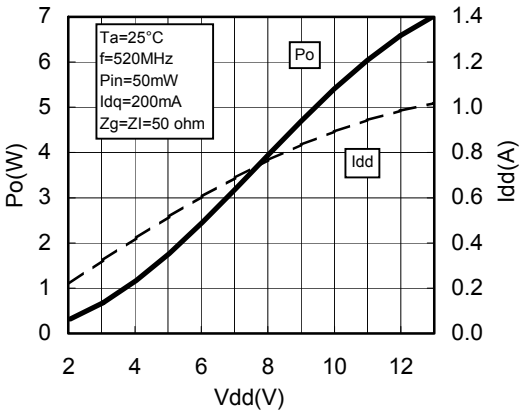

**Pin-Po CHARACTERISTICS @f=520MHz**




**Vdd-Po CHARACTERISTICS @f=175MHz**

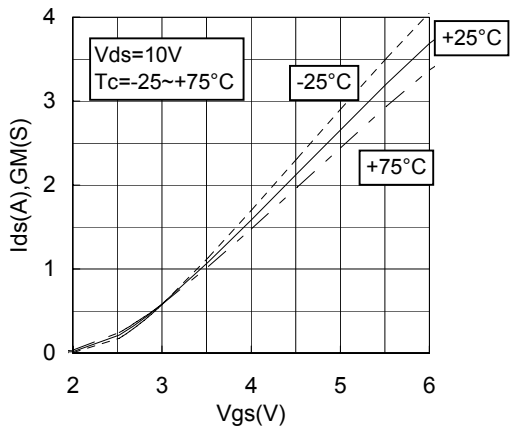



**Vdd-Po CHARACTERISTICS @f=520MHz**

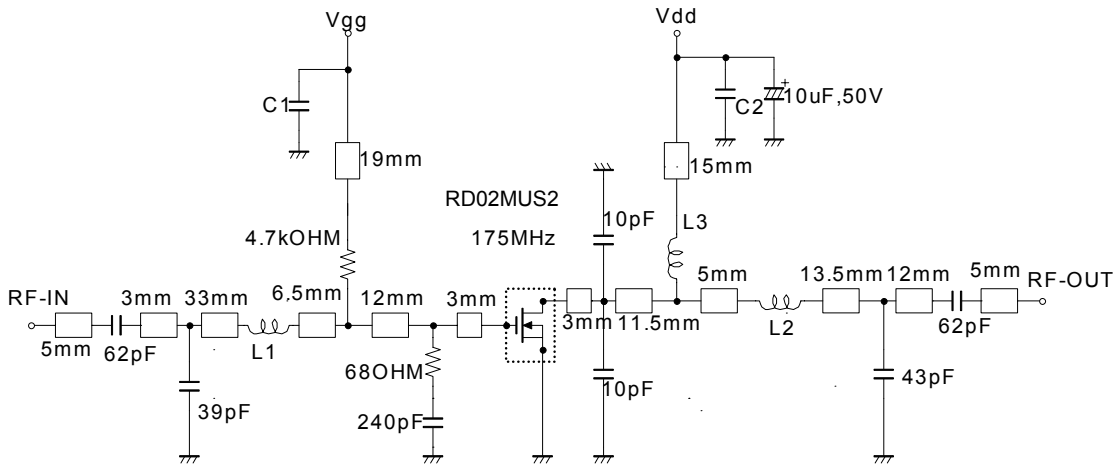


## TYPICAL CHARACTERISTICS

**Vgs-Ids CHARACTORISTICS 2**



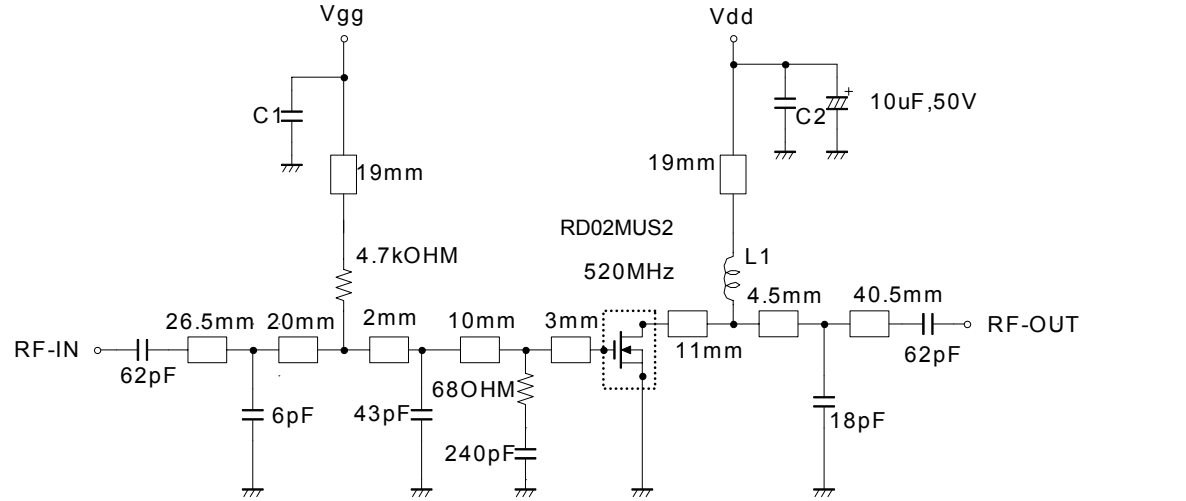
## TEST CIRCUIT(f=175MHz)




L1: Enameled wire 5Turns,D:0.43mm,2.46mmO.D
L2: Enameled wire 3Turns,D:0.43mm,2.46mmO.D
L3: Enameled wire 9Turns,D:0.43mm,2.46mmO.D
C1,C2:1000pF,0.0022uF in parallel

Note:Board material-Teflon substrate
Micro strip line width=2.2mm/50OHM,er:2.7,t=0.8mm

## TEST CIRCUIT(f=520MHz)

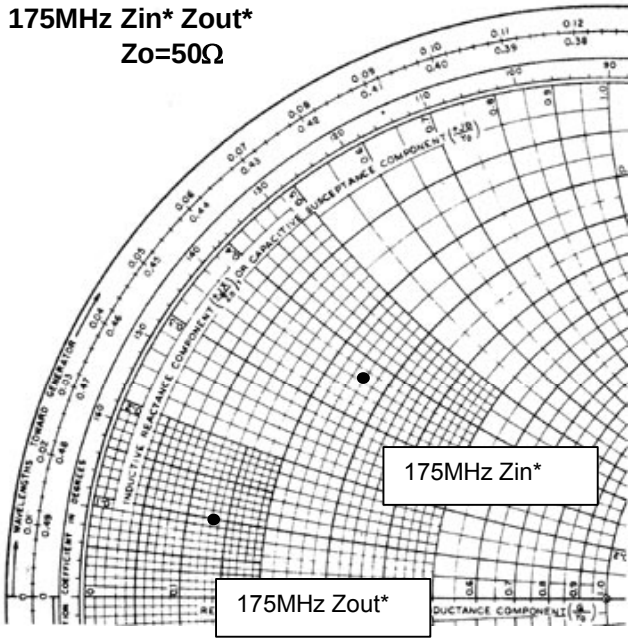



L1: Enameled wire 9Turns,D:0.43mm,2.46mmO.D
C1,C2:1000pF,0.022uF in parallel

Note:Board material-Teflon substrate
Micro strip line width=2.2mm/50OHM,er:2.7,t=0.8mm

## INPUT/OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS

**175MHz Zin* Zout***
**Zo=50Ω**

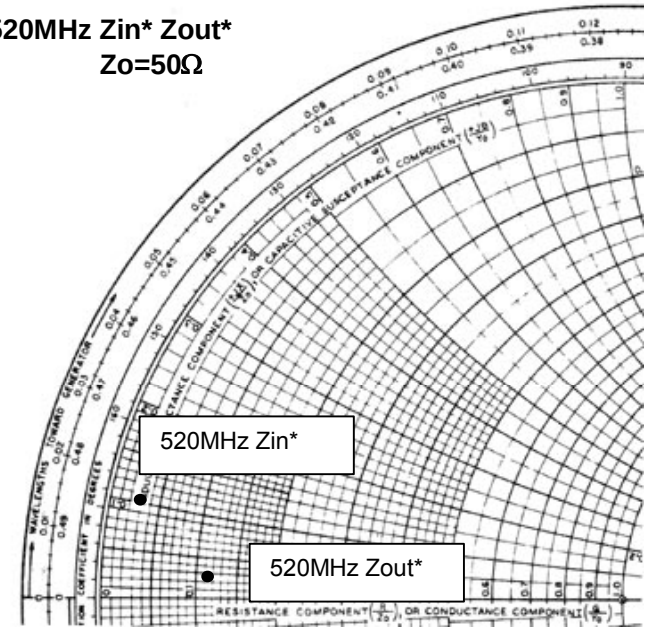



Vdd=7.2V, Idq=200mA(Vgg adj.),Pin=0.05W

**Zin*=11.61+j17.88**
**Zout*=6.83+j5.21**

Zin*: Complex conjugate of input impedance
Zout*: Complex conjugate of input impedance

**520MHz Zin* Zout***
**Zo=50Ω**




Vdd=7.2V, Idq=200mA(Vgg adj.),Pin=0.05W

**Zin*=1.20+j5.47**
**Zout*=5.56+j1.31**

Zin*: Complex conjugate of input impedance
Zout*: Complex conjugate of input impedance

## RD02MSU2 S-PARAMETER DATA (@Vdd=7.2V, Id=200mA)

| Freq. | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| [MHz] | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) |
| 100 | 0.827 | -137.1 | 16.666 | 99.9 | 0.038 | 10.7 | 0.571 | -126.8 |
| 150 | 0.819 | -151.1 | 11.358 | 88.9 | 0.039 | 1.0 | 0.561 | -139.9 |
| 175 | 0.816 | -155.3 | 9.733 | 84.7 | 0.039 | -3.4 | 0.565 | -143.5 |
| 200 | 0.813 | -158.5 | 8.455 | 81.1 | 0.040 | -5.7 | 0.573 | -146.3 |
| 250 | 0.819 | -163.4 | 6.704 | 74.4 | 0.037 | -12.7 | 0.586 | -149.9 |
| 300 | 0.823 | -166.9 | 5.469 | 68.6 | 0.036 | -17.0 | 0.604 | -152.6 |
| 350 | 0.832 | -169.4 | 4.593 | 63.6 | 0.036 | -22.1 | 0.626 | -154.8 |
| 400 | 0.836 | -171.5 | 3.904 | 58.8 | 0.034 | -26.4 | 0.646 | -156.6 |
| 450 | 0.841 | -173.2 | 3.362 | 54.3 | 0.033 | -29.9 | 0.669 | -158.2 |
| 500 | 0.851 | -174.9 | 2.941 | 50.1 | 0.032 | -33.6 | 0.690 | -159.6 |
| 520 | 0.854 | -175.5 | 2.793 | 48.5 | 0.032 | -34.5 | 0.697 | -160.2 |
| 550 | 0.857 | -176.4 | 2.572 | 46.2 | 0.031 | -35.7 | 0.710 | -161.1 |
| 600 | 0.864 | -177.7 | 2.298 | 42.8 | 0.028 | -39.1 | 0.732 | -162.5 |
| 650 | 0.869 | -179.1 | 2.041 | 39.1 | 0.028 | -41.1 | 0.745 | -163.7 |
| 700 | 0.878 | 179.6 | 1.836 | 35.8 | 0.026 | -43.6 | 0.762 | -165.3 |
| 750 | 0.882 | 178.7 | 1.652 | 32.9 | 0.024 | -46.5 | 0.779 | -166.5 |
| 800 | 0.888 | 177.6 | 1.490 | 30.1 | 0.023 | -49.7 | 0.788 | -167.9 |
| 850 | 0.893 | 176.4 | 1.357 | 27.1 | 0.022 | -54.7 | 0.802 | -168.9 |
| 900 | 0.894 | 175.5 | 1.232 | 24.9 | 0.019 | -52.1 | 0.813 | -170.0 |
| 950 | 0.899 | 174.7 | 1.131 | 22.8 | 0.019 | -54.9 | 0.823 | -171.3 |
| 1000 | 0.903 | 173.8 | 1.043 | 20.2 | 0.017 | -55.3 | 0.835 | -172.0 |
| 1050 | 0.907 | 172.9 | 0.957 | 18.5 | 0.016 | -56.1 | 0.844 | -173.1 |
| 1100 | 0.909 | 172.1 | 0.882 | 16.3 | 0.015 | -54.1 | 0.853 | -173.9 |

## RD02MSU2 S-PARAMETER DATA (@Vdd=12.5V, Id=200mA)

| Freq. | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| [MHz] | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) |
| 100 | 0.844 | -132.5 | 17.379 | 102.5 | 0.037 | 12.8 | 0.541 | -122.6 |
| 150 | 0.832 | -147.7 | 11.947 | 91.0 | 0.037 | 2.1 | 0.533 | -136.2 |
| 175 | 0.829 | -152.5 | 10.288 | 86.5 | 0.037 | -1.8 | 0.538 | -140.2 |
| 200 | 0.830 | -156.2 | 8.975 | 82.5 | 0.037 | -4.7 | 0.541 | -143.1 |
| 250 | 0.832 | -161.5 | 7.098 | 75.9 | 0.037 | -12.5 | 0.559 | -147.2 |
| 300 | 0.836 | -165.3 | 5.821 | 70.1 | 0.036 | -17.0 | 0.578 | -149.8 |
| 350 | 0.841 | -168.3 | 4.863 | 64.7 | 0.034 | -21.0 | 0.601 | -151.9 |
| 400 | 0.849 | -170.6 | 4.167 | 59.9 | 0.034 | -25.3 | 0.624 | -153.9 |
| 450 | 0.853 | -172.8 | 3.597 | 55.1 | 0.032 | -28.8 | 0.648 | -155.3 |
| 500 | 0.861 | -174.6 | 3.139 | 50.9 | 0.030 | -31.6 | 0.669 | -156.9 |
| 520 | 0.859 | -175.3 | 2.965 | 49.2 | 0.030 | -34.7 | 0.677 | -157.6 |
| 550 | 0.865 | -176.1 | 2.759 | 46.9 | 0.028 | -35.4 | 0.691 | -158.3 |
| 600 | 0.869 | -177.5 | 2.440 | 43.3 | 0.028 | -39.0 | 0.710 | -159.9 |
| 650 | 0.877 | -178.9 | 2.179 | 39.7 | 0.026 | -41.6 | 0.729 | -161.4 |
| 700 | 0.881 | 179.9 | 1.958 | 36.7 | 0.024 | -43.3 | 0.745 | -162.9 |
| 750 | 0.890 | 178.9 | 1.772 | 33.5 | 0.023 | -46.6 | 0.765 | -164.2 |
| 800 | 0.894 | 177.9 | 1.597 | 30.8 | 0.022 | -47.9 | 0.777 | -165.4 |
| 850 | 0.897 | 176.6 | 1.448 | 28.2 | 0.020 | -48.2 | 0.790 | -166.8 |
| 900 | 0.902 | 175.7 | 1.331 | 25.4 | 0.018 | -48.2 | 0.800 | -167.9 |
| 950 | 0.905 | 174.7 | 1.212 | 23.3 | 0.018 | -50.7 | 0.814 | -169.2 |
| 1000 | 0.910 | 174.0 | 1.110 | 20.8 | 0.017 | -52.3 | 0.825 | -170.3 |
| 1050 | 0.913 | 173.1 | 1.026 | 18.8 | 0.015 | -55.2 | 0.834 | -171.4 |
| 1100 | 0.914 | 172.4 | 0.953 | 16.7 | 0.014 | -56.5 | 0.843 | -172.1 |

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

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.

**warning !**

Do not use the device at the exceeded the maximum rating condition. In case of plastic molded devices, the exceeded maximum rating condition may cause blowout, smoldering or catch fire of the molding resin due to extreme short current flow between the drain and the source of the device. These results causes in fire or injury.