MITSUBISHI RF POWER MOS FET

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

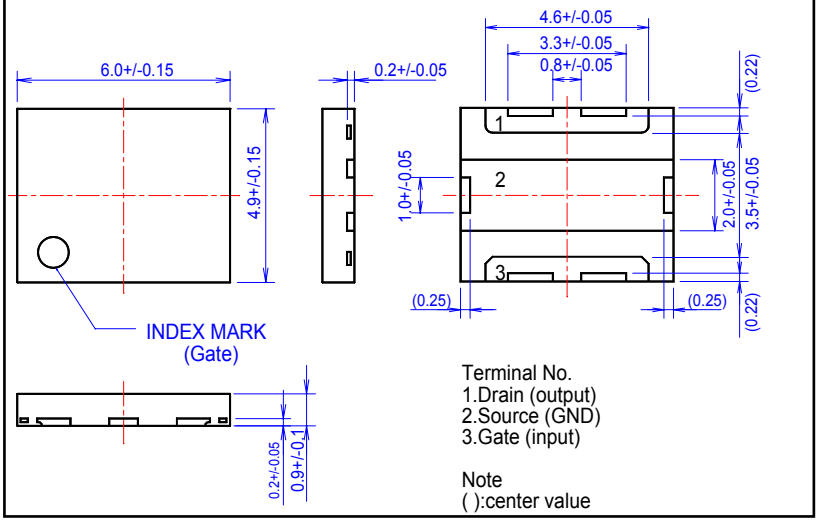
# RD07MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor,175MHz,527MHz,7W**

## DESCRIPTION

RD07MUS2B is a MOS FET type transistor specifically designed for VHF/UHF RF power amplifiers applications.

OUTLINE DRAWING




## FEATURES

High power gain and High Efficiency.
- Gp>13.2dB 58%min. (175MHz)
- Gp> 12.4dB 58%min. (527MHz)
- Gp> 11.5dB 58%Typ. (870MHz)

Integrated gate protection diode.

## APPLICATION

For output stage of high power amplifiers in VHF/UHF-band mobile radio sets.
The recommended frequency is 135-527MHz.

## RoHS COMPLIANT

RD07MUS2B is a RoHS compliant product. RoHS compliance is indicating by the letter “G” after the Lot Marking. This product includes the lead in high melting temperature type solders.
However, it is 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.)

## ABSOLUTE MAXIMUM RATINGS (Tc=25°C UNLESS OTHERWISE NOTED)

| SYMBOL | PARAMETER | CONDITIONS | RATINGS | UNIT |
|---|---|---|---|---|
| VDSS | Drain to source voltage | Vgs=0V | 25 | V |
| VGSS | Gate to source voltage | Vds=0V | -5/+10 | V |
| Pch | Channel dissipation | Tc=25°C | 50 | W |
| Pin | Input Power | Zg=Zl=50Ω | 0.8* | W |
| ID | Drain Current | - | 3 | A |
| Tch | Junction Temperature | - | 150 | °C |
| Tstg | Storage temperature | - | -40 to +125 | °C |
| Rth j-c | Thermal resistance | Junction to case | 2.5 | °C/W |

Note: Above parameters are guaranteed independently.
*: 175MHz spec. is 0.6W

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

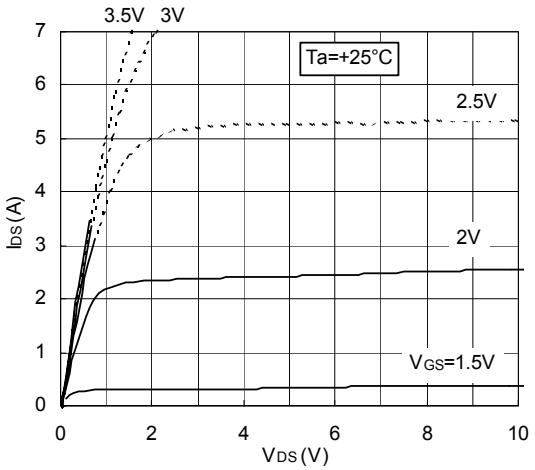
| SYMBOL | PARAMETER | CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX. | |
| IDSS | Drain cutoff current | VDS=17V, VGS=0V | - | - | 10 | uA |
| IGSS | Gate cutoff current | VGS=5V, VDS=0V | - | - | 1 | uA |
| VTH | Gate threshold Voltage | VDS=7.2V, IDS=1mA | - | 1 | - | V |
| Pout1 | Output power | f=175MHz,VDD=7.2V | 6.3** | 7.2** | - | W |
| ηD1 | Drain efficiency | Pin=0.3W,Idq=250mA | 58** | 65** | - | % |
| Pout2 | Output power | f=527MHz ,VDD=7.2V | 7*** | 8*** | - | W |
| ηD2 | Drain efficiency | Pin=0.4W,Idq=250mA | 58*** | 63*** | - | % |
| VSWRT1 | Load VSWR tolerance1 | VDD=9.5V,Po=6.3W(Pin Control)<br>f=175MHz,Idq=250mA,Zg=50Ω<br>Load VSWR=20:1(All Phase) | No destroy | | | - |
| VSWRT2 | Load VSWR tolerance2 | VDD=9.5V,Po=7W(Pin Control)<br>f=527MHz,Idq=250mA,Zg=50Ω<br>Load VSWR=20:1(All Phase) | No destroy | | | - |

Note: Above parameters, ratings, limits and conditions are subject to change.
** At 135-175MHz broad matching *** At 450-527MHz broad matching

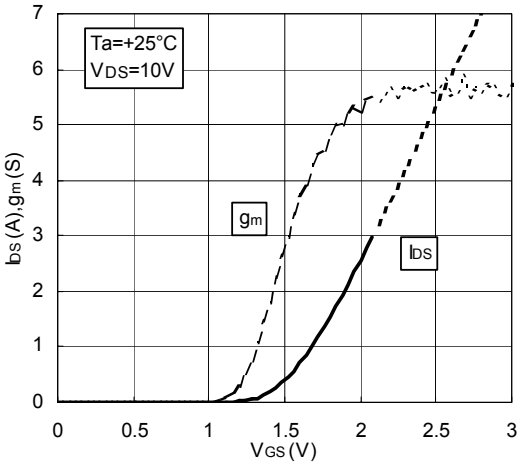
## TYPICAL CHARACTERISTICS

(These are only typical curves and devices are not necessarily guaranteed at these curves.)

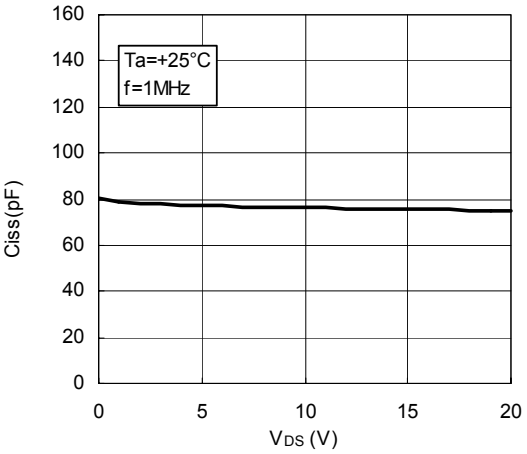
**VDS-IDS CHARACTERISTICS**



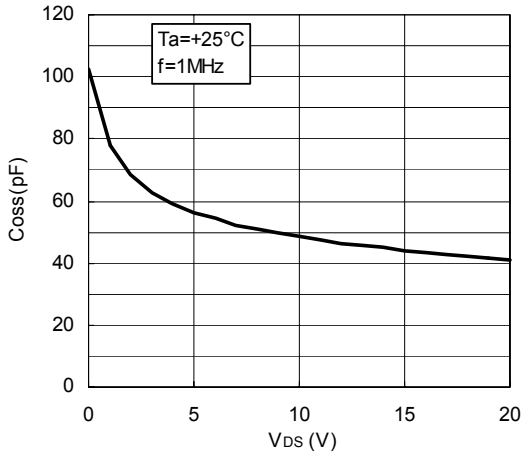

**VGS-IDS CHARACTERISTICS**



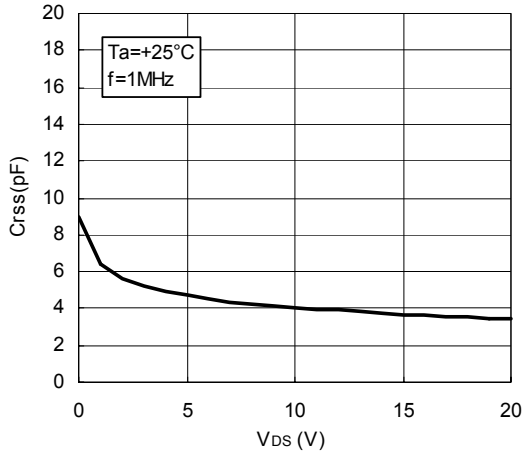

**VDS VS. Ciss CHARACTERISTICS**




**VDS VS. Coss CHARACTERISTICS**




**VDS VS. Crss CHARACTERISTICS**



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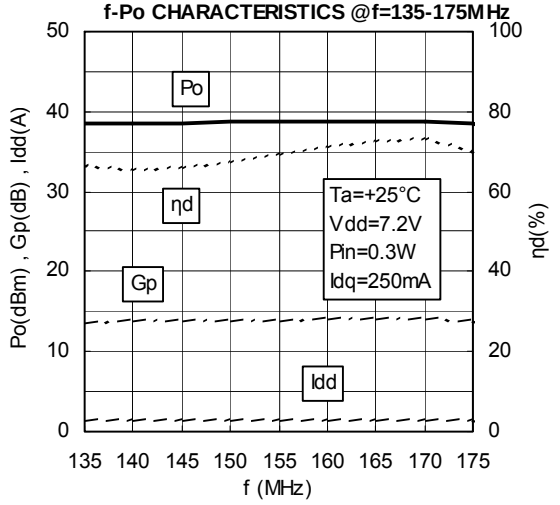
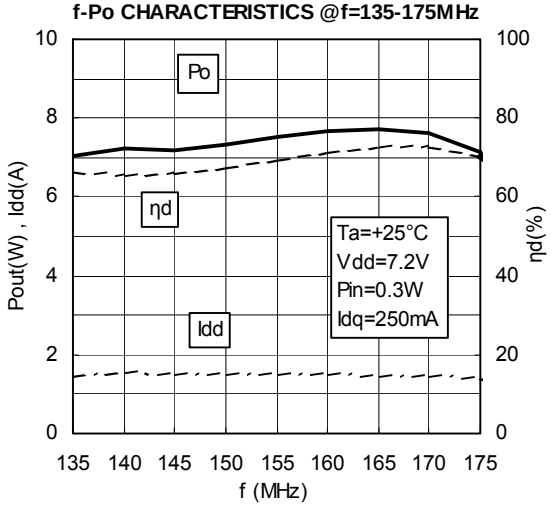
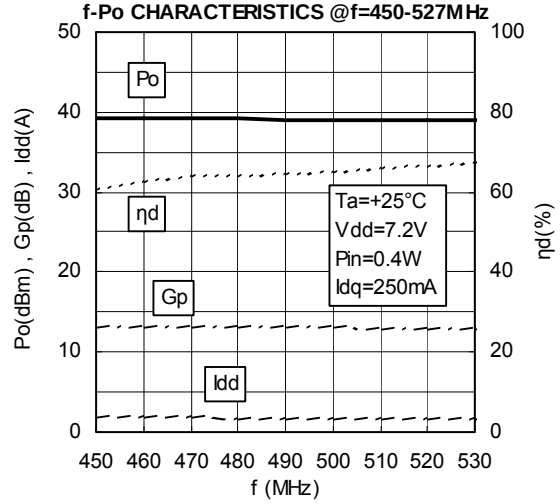
f-Po CHARACTERISTICS @f=135-175MHz



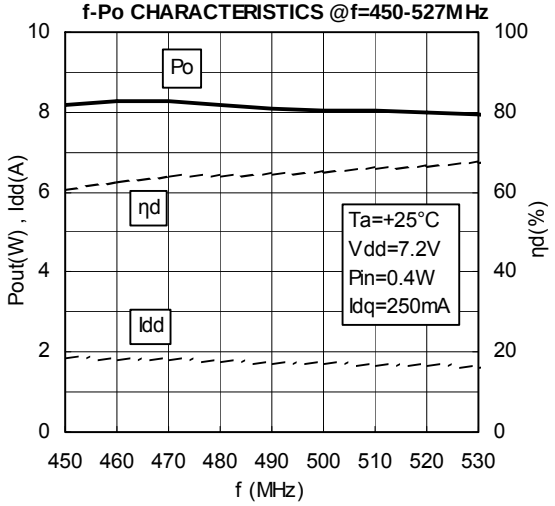

f-Po CHARACTERISTICS @f=135-175MHz



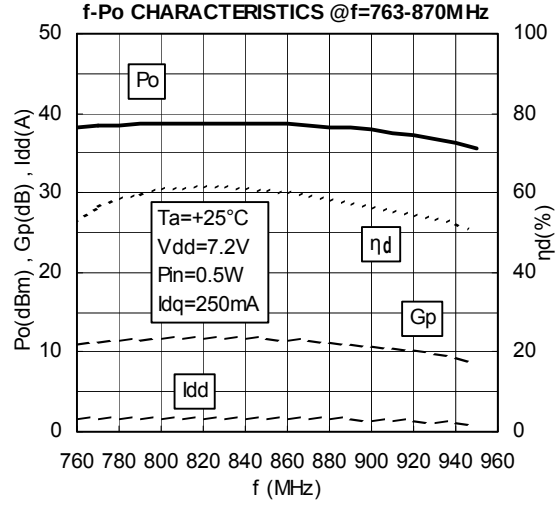

f-Po CHARACTERISTICS @f=450-527MHz



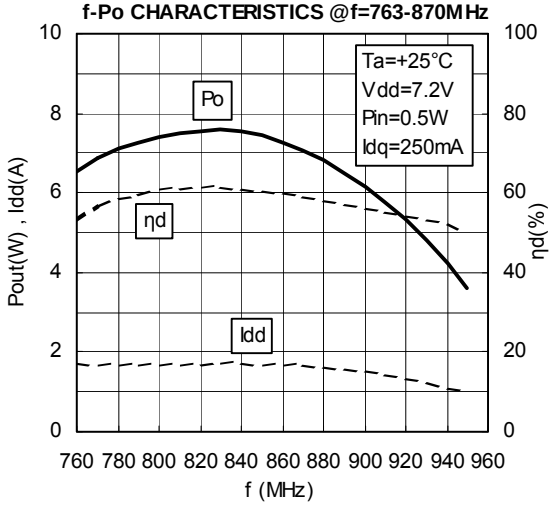

f-Po CHARACTERISTICS @f=450-527MHz




f-Po CHARACTERISTICS @f=763-870MHz




f-Po CHARACTERISTICS @f=763-870MHz



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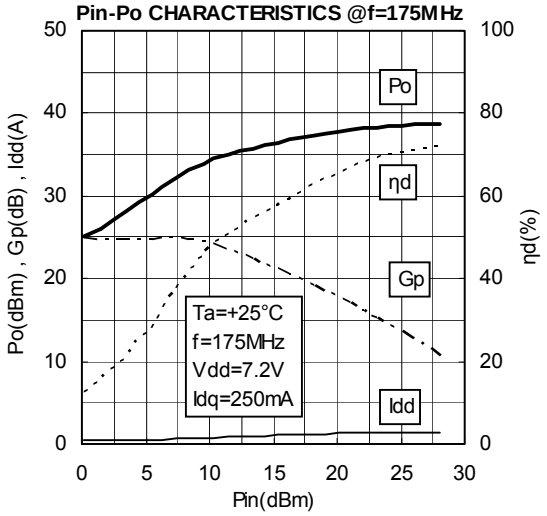
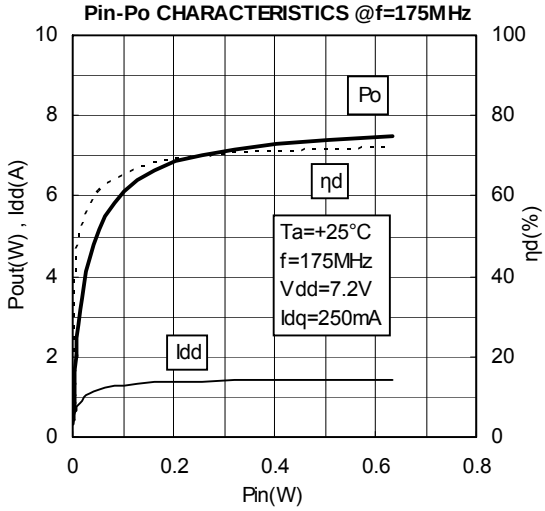
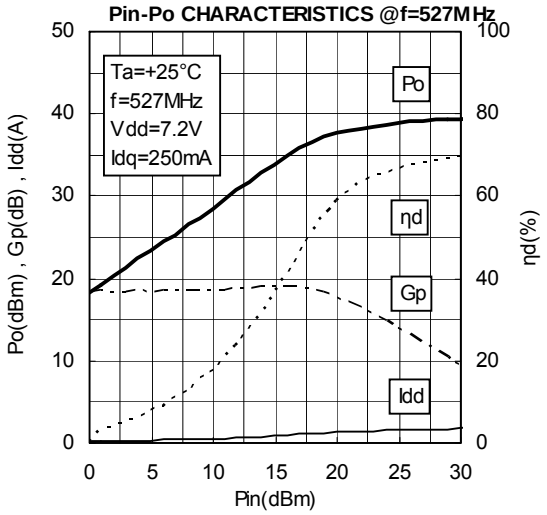
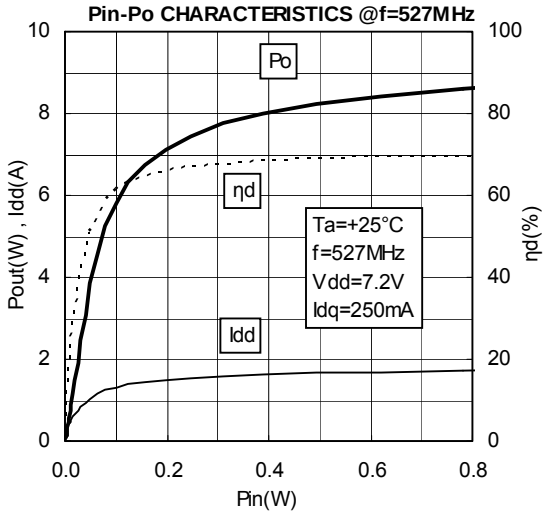
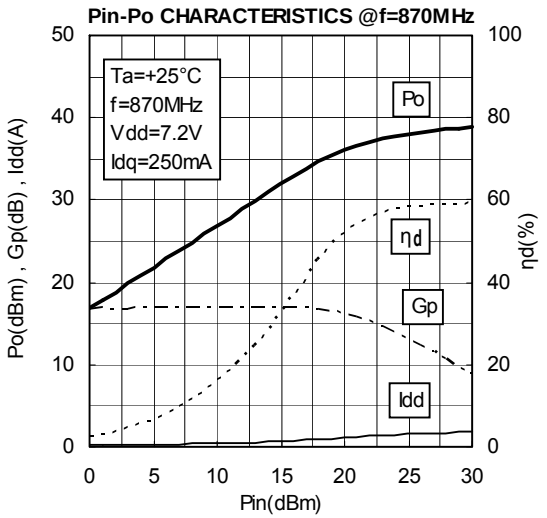
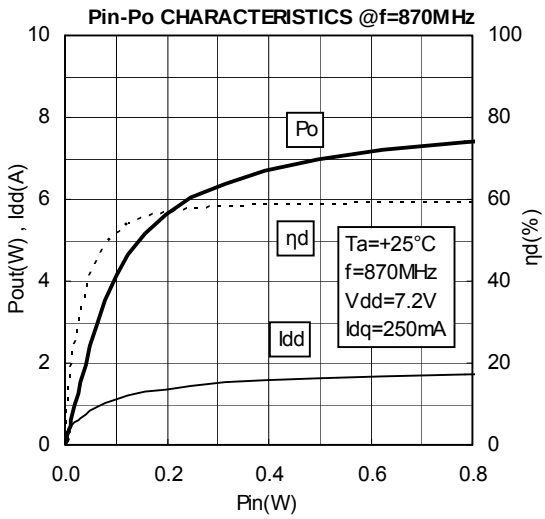


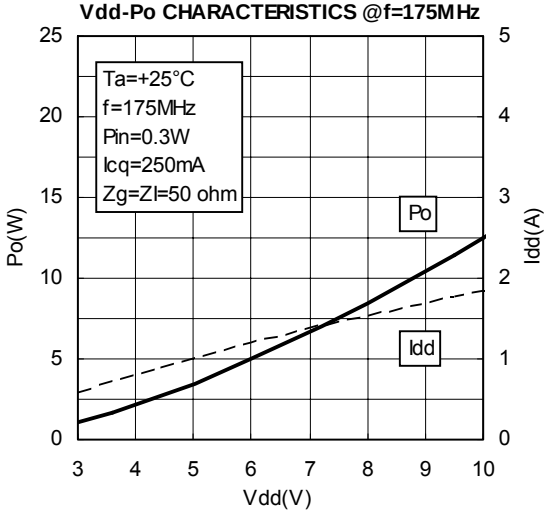



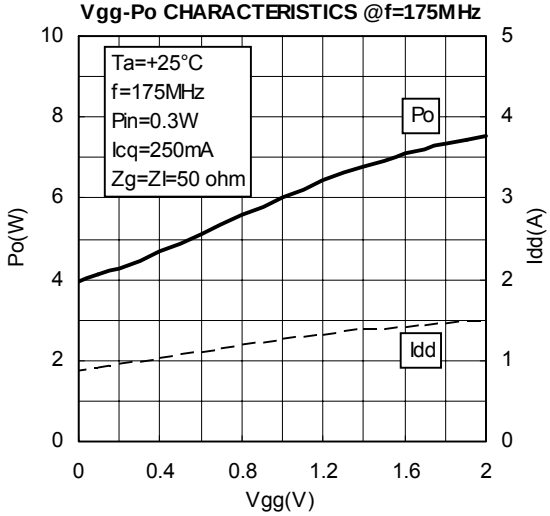
## TYPICAL CHARACTERISTICS

(These are only typical curves and devices are not necessarily guaranteed at these curves.)

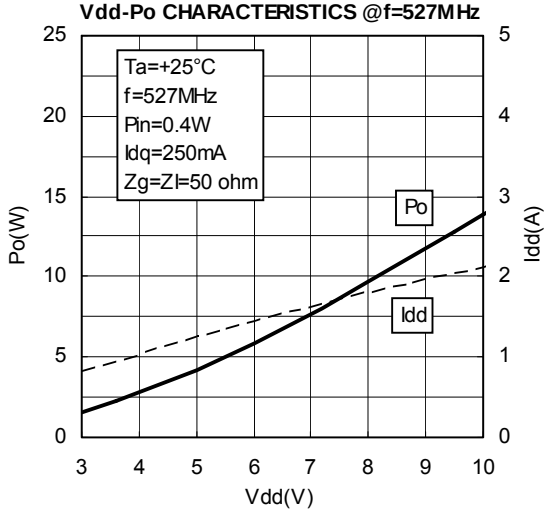
Vdd-Po CHARACTERISTICS @f=175MHz



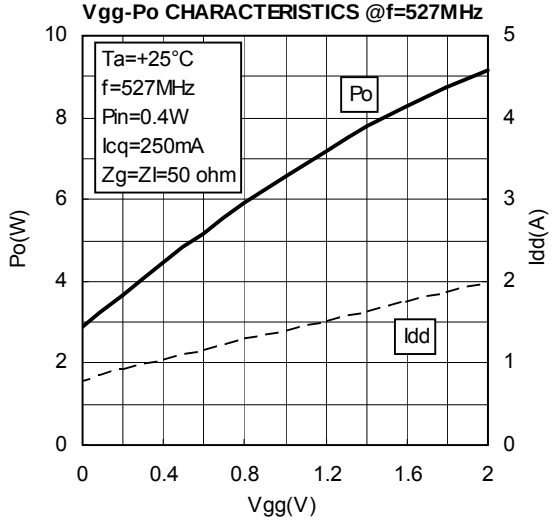

Vgg-Po CHARACTERISTICS @f=175MHz



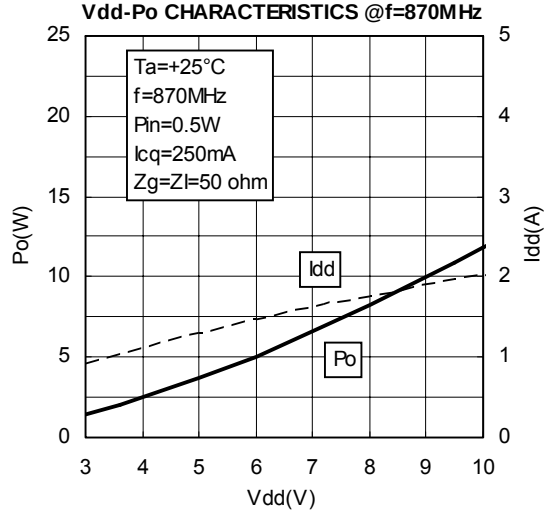

Vdd-Po CHARACTERISTICS @f=527MHz




Vgg-Po CHARACTERISTICS @f=527MHz




Vdd-Po CHARACTERISTICS @f=870MHz



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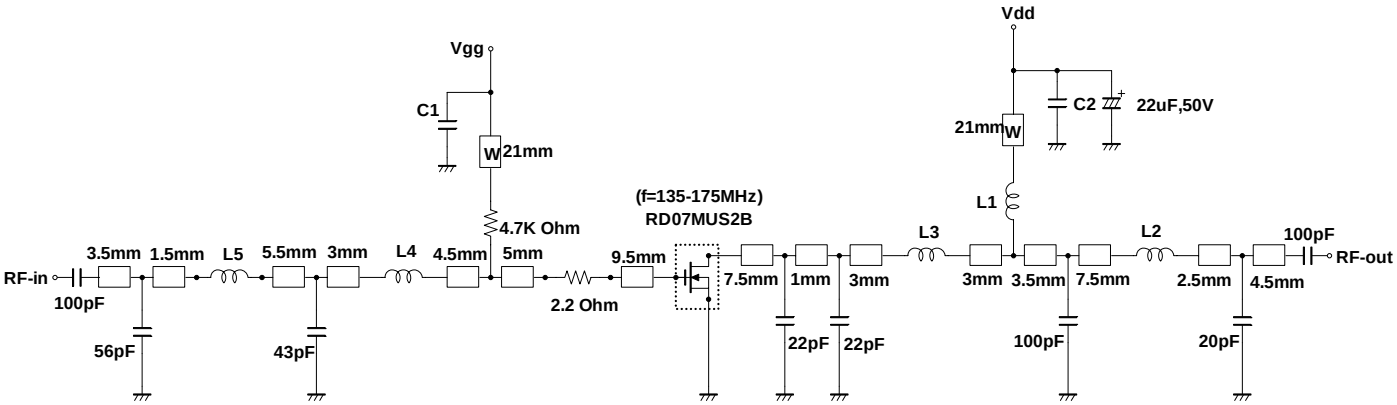
# RD07MUS2B

RoHS Compliance, Silicon MOSFET Power Transistor,175MHz,527MHz,7W

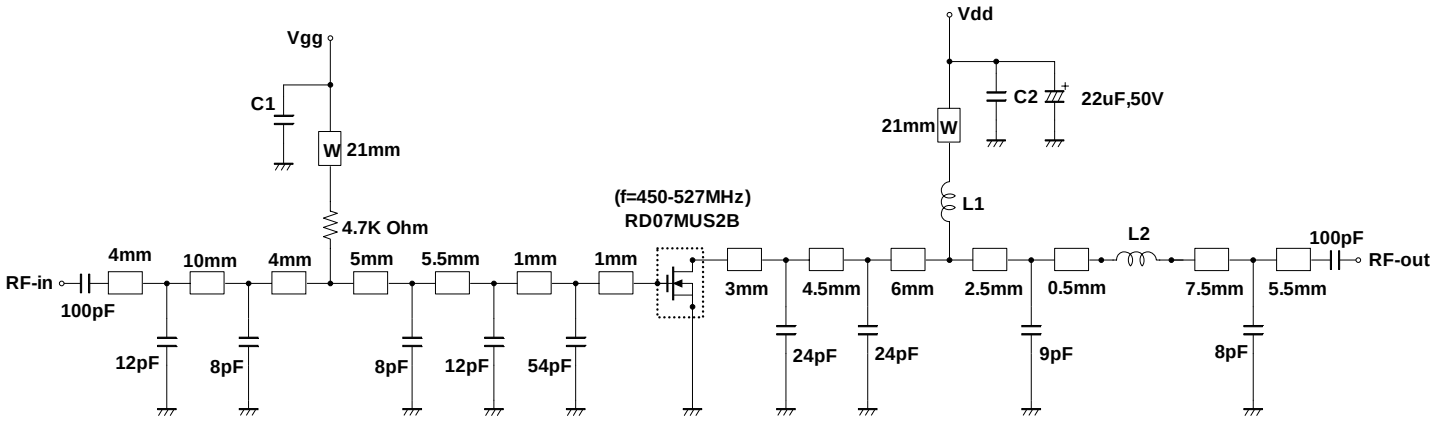
## TEST CIRCUIT(f=135-175MHz)




Note:Board material- Glass-Epoxy Substrate
Micro strip line width=1.3mm/50OHM,er:4.8,t=0.8mm
W:Line width=1.0mm

L1,L2 : 31.0nH, Enameled wire 6Turns,D:0.23mm,1.66mmO.D
L3,L5 : 6.6nH, Enameled wire 2Turns,D:0.23mm,1.66mmO.D
L4 : 10.8nH, Enameled wire 4Turns,D:0.43mm,1.66mmO.D
C1,C2 : 1000pF,0.022uF in parallel

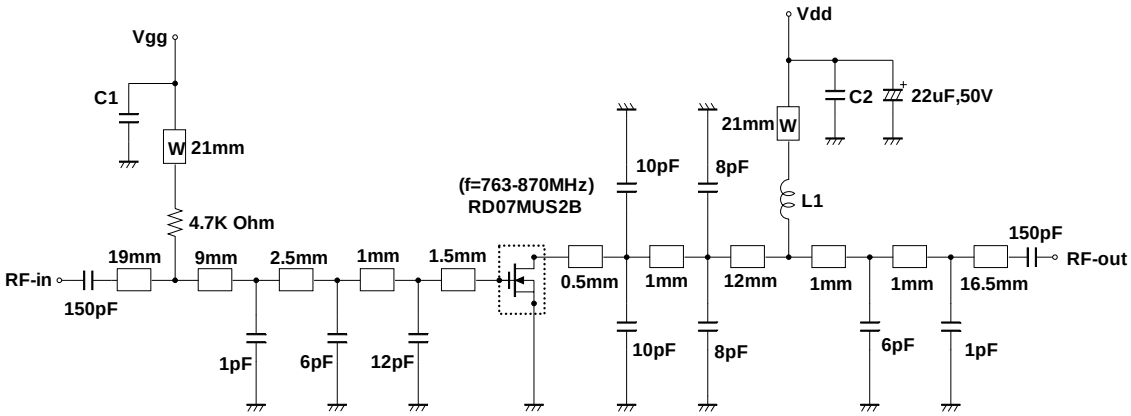
## TEST CIRCUIT(f=450-527MHz)




Note:Board material- Glass-Epoxy Substrate
Micro strip line width=1.3mm/50OHM,er:4.8,t=0.8mm
W:Line width=1.0mm

L1 : 34.5nH, Enameled wire 5Turns,D:0.43mm,2.46mmO.D
L2 : 6.6nH, Enameled wire 2Turns,D:0.23mm,1.60mmO.D
C1,C2 : 1000pF,0.022uF in parallel

## TEST CIRCUIT(f=763-870MHz)




Note:Board material- Glass-Epoxy Substrate
Micro strip line width=1.3mm/50OHM,er:4.8,t=0.8mm
W:Line width=1.0mm

L1 : 37.8nH, Enameled wire 7Turns,D:0.23mm,1.6mmO.D
C1,C2 : 1000pF,100pF in parallel

ELECTROSTATIC SENSITIVE DEVICE
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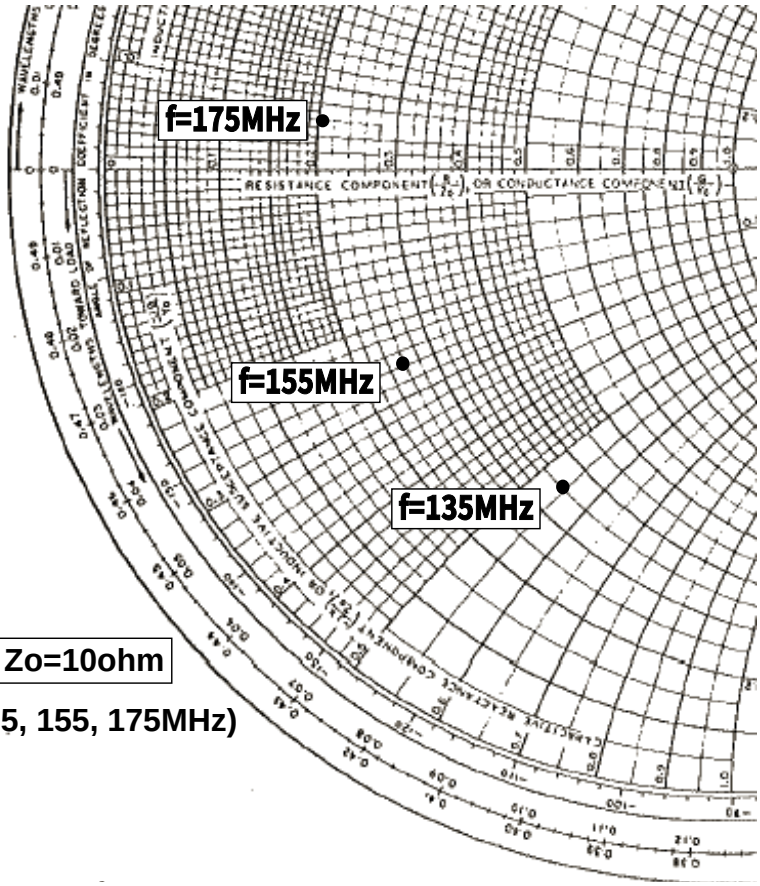
# RD07MUS2B

RoHS Compliance, Silicon MOSFET Power Transistor,175MHz,527MHz,7W

## Input / Output Impedance VS. Frequency Characteristics



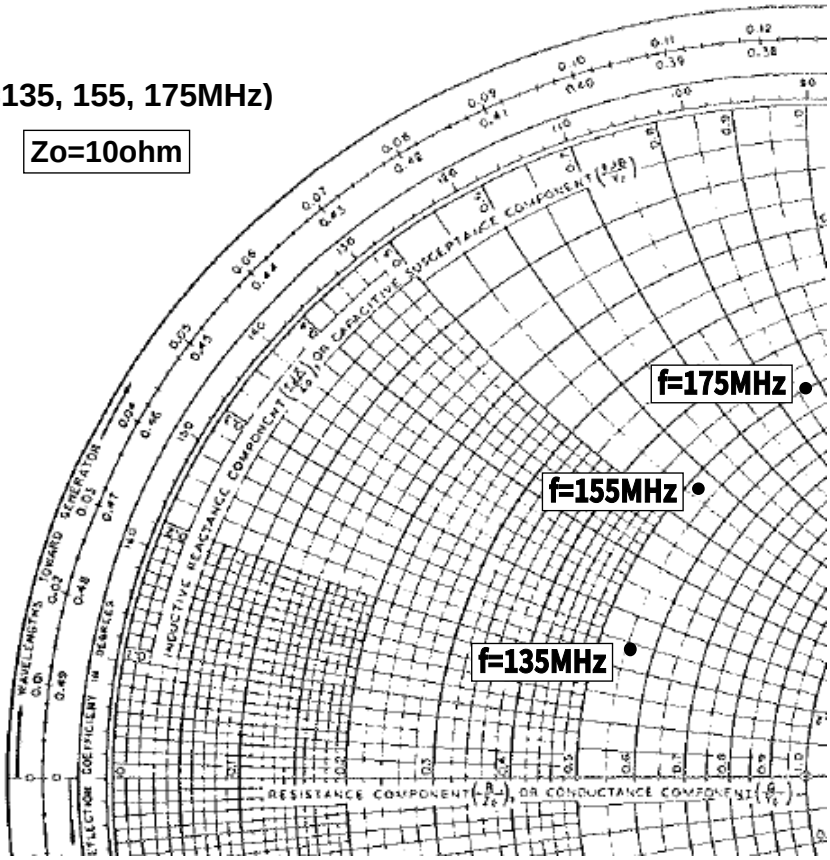

@Pin=0.3W, Vdd=7.2V,
Idq=250mA(Vgg adj.)

| f (MHz) | Zout* (ohm) |
|---|---|
| 135 | 3.50-j5.54 |
| 155 | 2.57-j2.57 |
| 175 | 2.06+j0.62 |

Zo=10ohm

Zout* ( f=135, 155, 175MHz)

Zout*: Complex conjugate of output impedance




Zin* ( f=135, 155, 175MHz)

Zo=10ohm

@Pin=0.3W, Vdd=7.2V,
Idq=250mA(Vgg adj.)

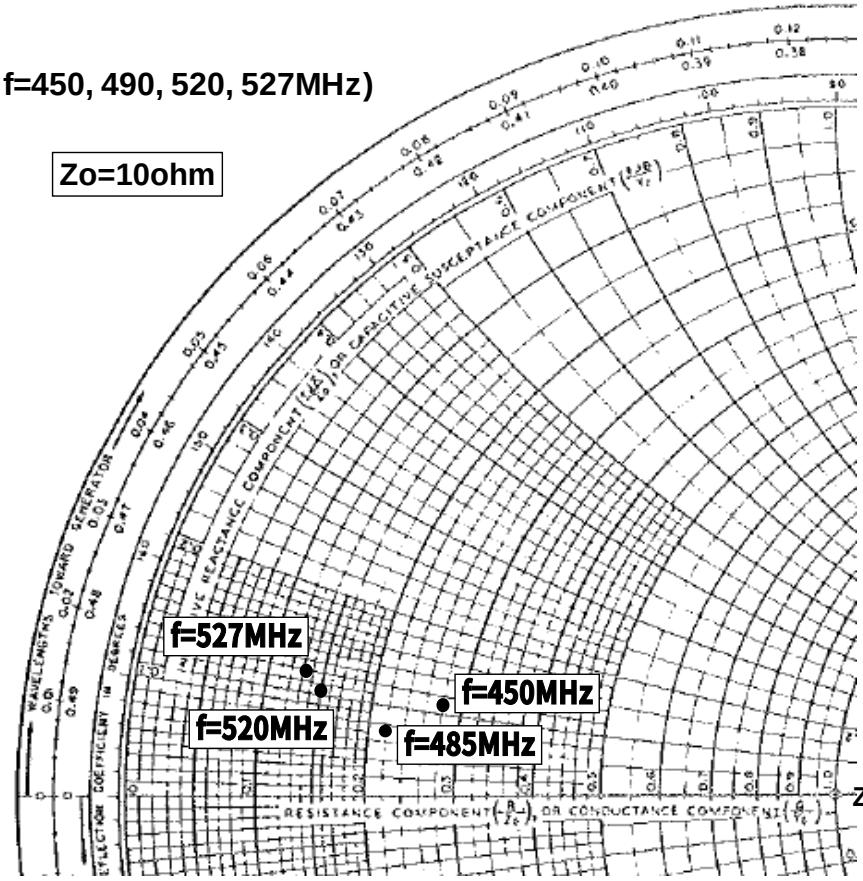
| f (MHz) | Zin* (ohm) |
|---|---|
| 135 | 5.58+j2.43 |
| 155 | 5.25+j5.60 |
| 175 | 5.01+j8.65 |

Zin*: Complex conjugate of input impedance

## Input / Output Impedance VS. Frequency Characteristics

**Zout* ( f=450, 490, 520, 527MHz)**

**Zo=10ohm**



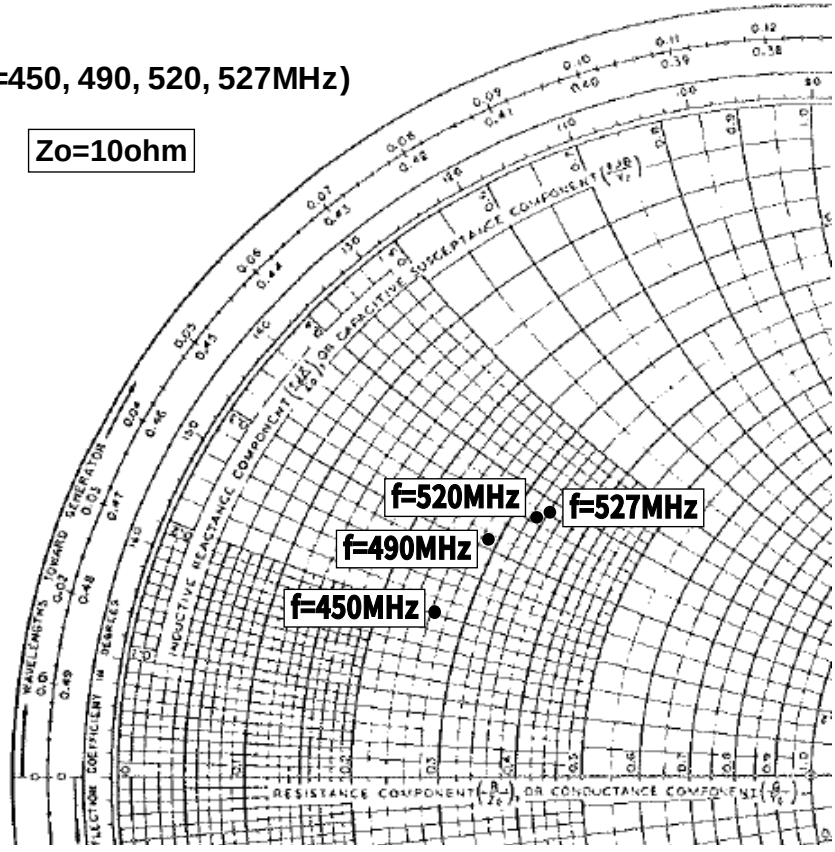

**@Pin=0.4W, Vdd=7.2V, Idq=250mA(Vgg adj.)**

| f (MHz) | Zout* (ohm) |
|---|---|
| 450 | 2.80+j1.07 |
| 490 | 2.25+j0.75 |
| 520 | 1.51+j1.04 |
| 527 | 1.36+j1.20 |

**Zout*: Complex conjugate of output impedance**

**Zin* ( f=450, 490, 520, 527MHz)**

**Zo=10ohm**




**@Pin=0.4W, Vdd=7.2V, Idq=250mA(Vgg adj.)**

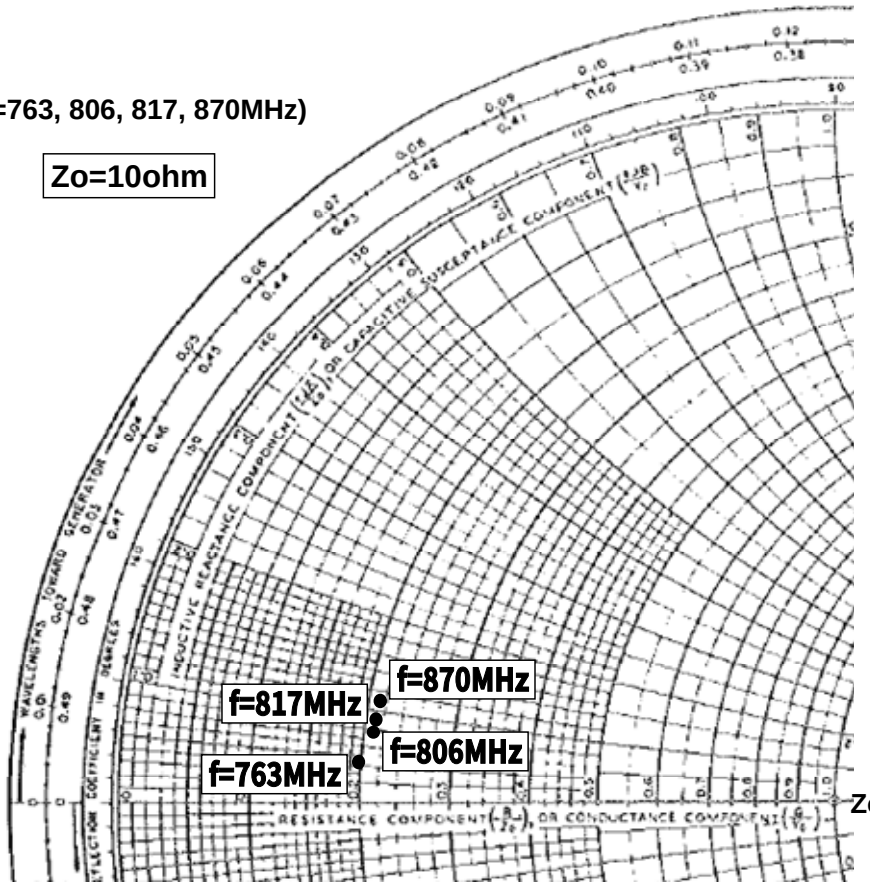
| f (MHz) | Zin* (ohm) |
|---|---|
| 450 | 2.62+j2.02 |
| 490 | 2.90+j3.07 |
| 520 | 3.29+j3.70 |
| 527 | 3.40+j3.81 |

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

## In put / Output Impedance VS. Frequency Characteristics

Zout* ( f=763, 806, 817, 870MHz)

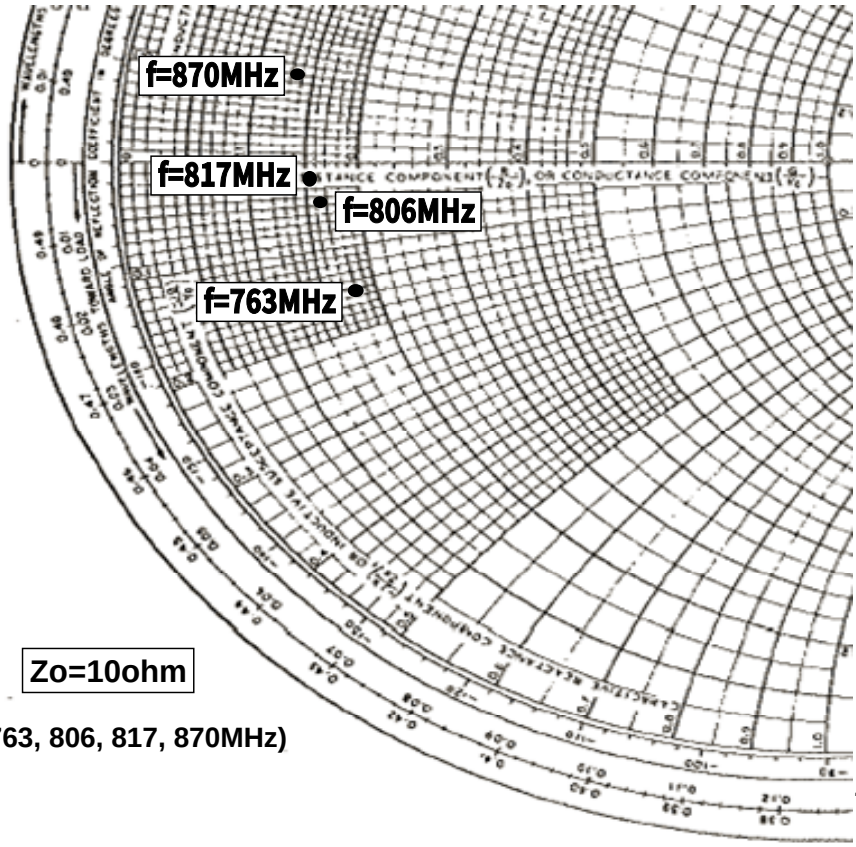
Zo=10ohm




@Pin=0.5W, Vdd=7.2V, Idq=250mA(Vgg adj.)

| f (MHz) | Zout* (ohm) |
|---|---|
| 763 | 2.01+j0.43 |
| 806 | 2.16+j0.80 |
| 817 | 2.17+j0.85 |
| 870 | 2.17+j1.07 |

Zout*: Complex conjugate of output impedance




@Pin=0.5W, Vdd=7.2V, Idq=250mA(Vgg adj.)

| f (MHz) | Zin* (ohm) |
|---|---|
| 763 | 1.72-j1.54 |
| 806 | 1.55-j0.50 |
| 817 | 1.46-j0.23 |
| 870 | 1.28+j0.95 |

Zo=10ohm

Zin* ( f=763, 806, 817, 870MHz)

Zin*: Complex conjugate of input impedance

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# RD07MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor,175MHz,527MHz,7W**

## RD07MUS2B S-PARAMETER DATA (@Vdd=7.2V, Id=250mA)

| Freq. | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| [MHz] | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) |
| 100 | 0.850 | -170.8 | 10.060 | 79.2 | 0.016 | -9.1 | 0.745 | -168.8 |
| 135 | 0.857 | -173.2 | 7.300 | 73.1 | 0.016 | -14.2 | 0.759 | -169.5 |
| 150 | 0.858 | -173.7 | 6.509 | 70.7 | 0.015 | -15.2 | 0.763 | -170.0 |
| 175 | 0.863 | -174.6 | 5.435 | 66.9 | 0.015 | -18.8 | 0.773 | -170.7 |
| 200 | 0.871 | -175.4 | 4.687 | 63.5 | 0.014 | -23.8 | 0.781 | -170.6 |
| 250 | 0.881 | -176.8 | 3.556 | 56.7 | 0.013 | -27.4 | 0.806 | -171.0 |
| 300 | 0.889 | -178.1 | 2.791 | 51.2 | 0.013 | -32.8 | 0.825 | -171.7 |
| 350 | 0.903 | -179.0 | 2.261 | 45.7 | 0.011 | -36.7 | 0.843 | -172.4 |
| 400 | 0.910 | -180.0 | 1.861 | 40.9 | 0.010 | -39.7 | 0.859 | -173.2 |
| 450 | 0.918 | 178.8 | 1.559 | 36.7 | 0.009 | -41.9 | 0.874 | -173.9 |
| 500 | 0.927 | 177.7 | 1.320 | 33.0 | 0.008 | -44.9 | 0.888 | -174.5 |
| 520 | 0.928 | 177.2 | 1.236 | 31.5 | 0.008 | -45.1 | 0.893 | -174.8 |
| 527 | 0.929 | 177.2 | 1.212 | 31.2 | 0.008 | -44.2 | 0.894 | -174.9 |
| 550 | 0.931 | 176.7 | 1.130 | 29.5 | 0.008 | -46.4 | 0.896 | -175.4 |
| 600 | 0.934 | 175.6 | 0.974 | 26.5 | 0.007 | -46.4 | 0.909 | -176.0 |
| 650 | 0.940 | 174.4 | 0.848 | 23.4 | 0.006 | -48.0 | 0.915 | -176.5 |
| 700 | 0.943 | 173.5 | 0.745 | 20.9 | 0.005 | -46.0 | 0.921 | -177.4 |
| 750 | 0.946 | 172.6 | 0.660 | 18.6 | 0.005 | -45.9 | 0.928 | -177.8 |
| 763 | 0.948 | 172.3 | 0.638 | 18.0 | 0.004 | -44.9 | 0.931 | -178.0 |
| 800 | 0.950 | 171.5 | 0.587 | 16.5 | 0.004 | -42.0 | 0.931 | -178.3 |
| 806 | 0.951 | 171.7 | 0.578 | 16.3 | 0.004 | -45.4 | 0.931 | -178.3 |
| 817 | 0.950 | 171.3 | 0.563 | 15.8 | 0.004 | -43.6 | 0.933 | -178.6 |
| 850 | 0.950 | 170.8 | 0.522 | 14.5 | 0.003 | -41.8 | 0.934 | -178.8 |
| 870 | 0.955 | 170.6 | 0.502 | 13.8 | 0.003 | -39.4 | 0.935 | -178.9 |
| 900 | 0.952 | 170.0 | 0.471 | 12.9 | 0.003 | -33.7 | 0.941 | -179.2 |
| 950 | 0.956 | 169.2 | 0.427 | 11.1 | 0.002 | -26.6 | 0.943 | -179.5 |
| 1000 | 0.957 | 168.4 | 0.387 | 9.7 | 0.002 | -17.3 | 0.943 | 179.9 |
| 1050 | 0.960 | 167.7 | 0.353 | 8.1 | 0.002 | -7.4 | 0.949 | 179.7 |
| 1100 | 0.961 | 167.1 | 0.323 | 6.9 | 0.002 | 8.9 | 0.949 | 179.6 |

## RD07MUS2B S-PARAMETER DATA (@Vdd=3.6V, Id=250mA)

| Freq. | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| [MHz] | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) |
| 100 | 0.850 | -172.3 | 8.581 | 78.7 | 0.016 | -9.3 | 0.782 | -171.0 |
| 135 | 0.855 | -174.2 | 6.239 | 73.0 | 0.016 | -13.3 | 0.793 | -171.6 |
| 150 | 0.856 | -174.7 | 5.564 | 70.6 | 0.016 | -17.3 | 0.797 | -172.0 |
| 175 | 0.862 | -175.3 | 4.661 | 66.8 | 0.015 | -20.0 | 0.806 | -172.5 |
| 200 | 0.869 | -176.2 | 4.030 | 63.5 | 0.015 | -23.1 | 0.812 | -172.7 |
| 250 | 0.881 | -177.4 | 3.057 | 56.8 | 0.014 | -28.7 | 0.831 | -173.0 |
| 300 | 0.887 | -178.5 | 2.400 | 51.3 | 0.013 | -32.8 | 0.849 | -173.6 |
| 350 | 0.901 | -179.5 | 1.945 | 46.0 | 0.012 | -36.0 | 0.863 | -174.3 |
| 400 | 0.909 | 179.6 | 1.606 | 41.2 | 0.010 | -40.7 | 0.877 | -175.0 |
| 450 | 0.917 | 178.6 | 1.345 | 37.2 | 0.009 | -42.4 | 0.890 | -175.5 |
| 500 | 0.927 | 177.5 | 1.139 | 33.2 | 0.008 | -45.0 | 0.902 | -176.2 |
| 520 | 0.929 | 177.0 | 1.068 | 31.9 | 0.008 | -45.4 | 0.904 | -176.3 |
| 527 | 0.926 | 176.9 | 1.048 | 31.6 | 0.008 | -44.5 | 0.907 | -176.4 |
| 550 | 0.929 | 176.4 | 0.975 | 29.9 | 0.008 | -45.1 | 0.909 | -176.9 |
| 600 | 0.933 | 175.3 | 0.841 | 26.9 | 0.007 | -47.2 | 0.918 | -177.4 |
| 650 | 0.937 | 174.2 | 0.732 | 23.8 | 0.006 | -47.4 | 0.925 | -178.0 |
| 700 | 0.944 | 173.4 | 0.644 | 21.4 | 0.005 | -46.7 | 0.931 | -178.6 |
| 750 | 0.945 | 172.5 | 0.571 | 19.2 | 0.005 | -44.2 | 0.935 | -179.0 |
| 763 | 0.947 | 172.2 | 0.552 | 18.4 | 0.005 | -44.2 | 0.939 | -179.1 |
| 800 | 0.949 | 171.6 | 0.508 | 17.0 | 0.004 | -43.7 | 0.938 | -179.3 |
| 806 | 0.949 | 171.5 | 0.502 | 16.8 | 0.004 | -42.8 | 0.938 | -179.5 |
| 817 | 0.951 | 171.4 | 0.488 | 16.2 | 0.004 | -42.3 | 0.940 | -179.6 |
| 850 | 0.949 | 170.8 | 0.454 | 15.0 | 0.003 | -40.8 | 0.941 | -179.8 |
| 870 | 0.953 | 170.5 | 0.436 | 14.3 | 0.003 | -37.7 | 0.940 | -180.0 |
| 900 | 0.952 | 169.9 | 0.408 | 13.3 | 0.003 | -32.1 | 0.946 | 179.8 |
| 950 | 0.957 | 169.2 | 0.370 | 11.8 | 0.003 | -25.2 | 0.949 | 179.5 |
| 1000 | 0.959 | 168.2 | 0.335 | 10.3 | 0.002 | -18.0 | 0.949 | 179.0 |
| 1050 | 0.960 | 167.7 | 0.306 | 8.6 | 0.002 | -6.7 | 0.955 | 178.8 |
| 1100 | 0.960 | 167.0 | 0.280 | 7.4 | 0.002 | 6.9 | 0.954 | 178.7 |

**ELECTROSTATIC SENSITIVE DEVICE**
OBSERVE HANDLING PRECAUTIONS

## Precautions for the use of MITSUBISHI silicon RF power amplifier devices

1. The specifications of mention are not guarantee values in this data sheet. Please confirm additional details regarding operation of these products from the formal specification sheet. For copies of the formal specification sheets, please contact one of our sales offices.
2. RA series products (RF power amplifier modules) and RD series products (RF power transistors) are designed for consumer mobile communication terminals and were not specifically designed for use in other applications. In particular, while these products are highly reliable for their designed purpose, they are not manufactured under a quality assurance testing protocol that is sufficient to guarantee the level of reliability typically deemed necessary for critical communications elements. Examples of critical communications elements would include transmitters for base station applications and fixed station applications that operate with long term continuous transmission and a higher on-off frequency during transmitting, especially for systems that may have a high impact to society.
3. RA series and RD series products use MOSFET semiconductor technology. They are sensitive to ESD voltage therefore appropriate ESD precautions are required.
4. In the case of use in below than recommended frequency, there is possibility to occur that the device is deteriorated or destroyed due to the RF-swing exceed the breakdown voltage.
5. In order to maximize reliability of the equipment, it is better to keep the devices temperature low. It is recommended to utilize a sufficient sized heat-sink in conjunction with other cooling methods as needed (fan, etc.) to keep the case temperature for RA series products lower than 60deg/C under standard conditions, and less than 90deg/C under extreme conditions.
6. RA series products are designed to operate into a nominal load impedance of 50 ohms. Under the condition of operating into a severe high load VSWR approaching an open or short, an over load condition could occur. In the worst case there is risk for burn out of the transistors and burning of other parts including the substrate in the module.
7. The formal specification includes a guarantee against parasitic oscillation under a specified maximum load mismatch condition. The inspection for parasitic oscillation is performed on a sample basis on our manufacturing line. It is recommended that verification of no parasitic oscillation be performed at the completed equipment level also.
8. For specific precautions regarding assembly of these products into the equipment, please refer to the supplementary items in the specification sheet.
9. Warranty for the product is void if the products protective cap (lid) is removed or if the product is modified in any way from it's original form.
10. For additional "Safety first" in your circuit design and notes regarding the materials, please refer the last page of this data sheet.
11. Please refer to the additional precautions in the formal specification sheet.

**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.

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.

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