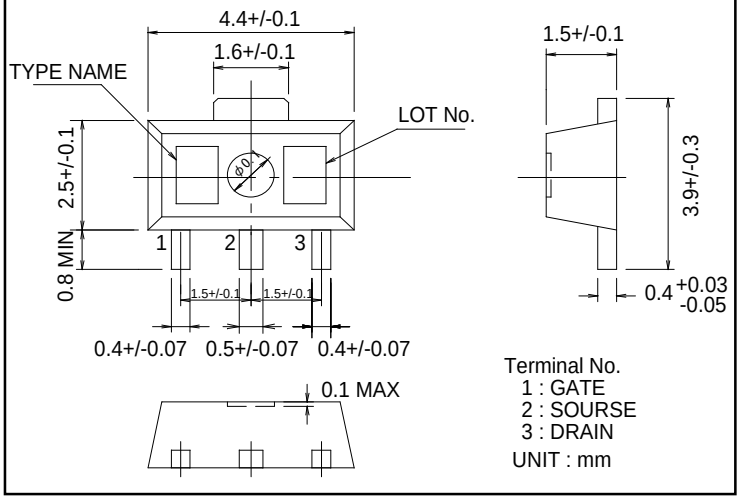
MITSUBISHI ELECTRIC

**< Silicon RF Power MOS FET (Discrete) >**

# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

OUTLINE DRAWING




## DESCRIPTION

RD01MUS2B is a MOS FET type transistor specifically designed for VHF/UHF RF amplifiers applications.
This device has an internal monolithic zener diode from gate to source for ESD protection.

## FEATURES

•High power gain and High Efficiency.
Pout 1.6W Typ, Gp 15dBTyp, 70%Typ
@Vdd=7.2V,f=527MHz

•Integrated gate protection diode

## APPLICATION

For output stage of high power amplifiers in VHF/UHF Band mobile radio sets.

## RoHS COMPLIANCE

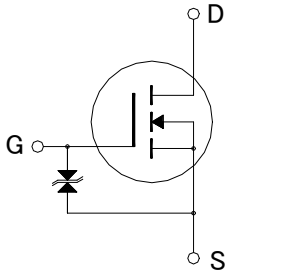
RD01MUS2B-101,T113 is a RoHS compliant products.
This product includes the lead in high melting temperature type solders.
However, it is applicable to the following exceptions of RoHS Directions.

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 | 3.6 | W |
| Pin | Input Power | Zg=Zl=50Ω | 100 | mW |
| ID | Drain Current | - | 600 | mA |
| Tch | Channel Temperature | - | 150 | °C |
| Tstg | Storage temperature | - | -40 to +125 | °C |
| Rth j-c | Thermal resistance | Junction to case | 34.5 | °C/W |




SCHEMATIC DRAWING

Note: 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 | - | - | 50 | uA |
| $I_{GSS}$ | Gate to source leak current | $V_{GS}$=10V, $V_{DS}$=0V | - | - | 1 | uA |
| Vth | Gate threshold Voltage | $V_{DS}$=7.2V, $I_{DS}$=1mA | 0.5 | 1.0 | 1.5 | V |
| Pout | Output power | $V_{DD}$=7.2V, Pin=30mW | 1.0 | 1.6 | - | W |
| ηd | Drain efficiency | f=527MHz*, Idq= 40mA | 60 | 70 | - | % |

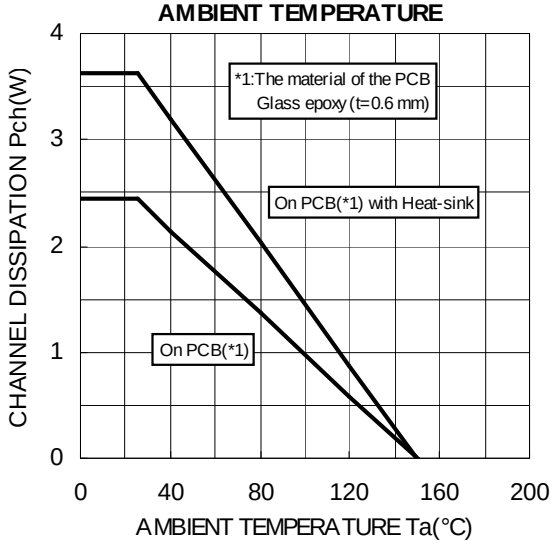
Note: Above parameters, ratings, limits and conditions are subject to change.

* In Mitsubishi 527MHz Test Circuit

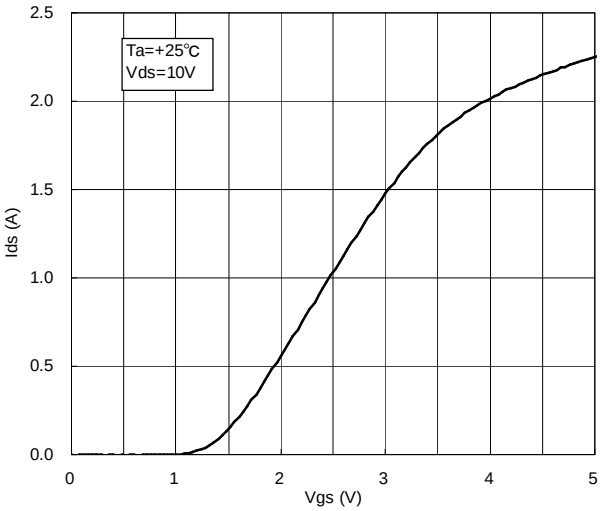
## TYPICAL CHARACTERISTICS

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

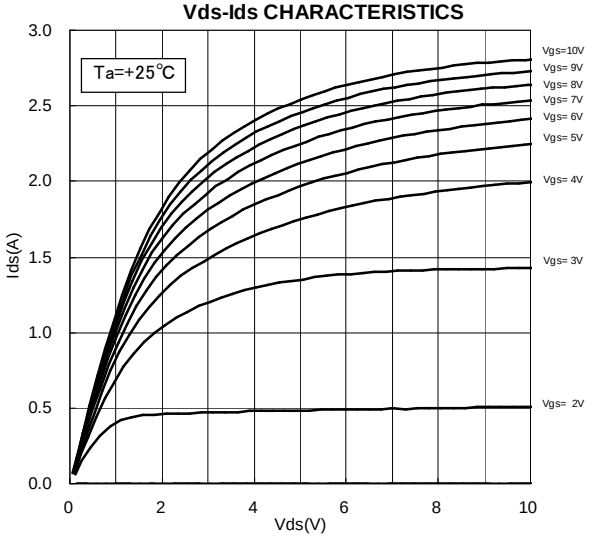
**CHANNEL DISSIPATION VS. AMBIENT TEMPERATURE**



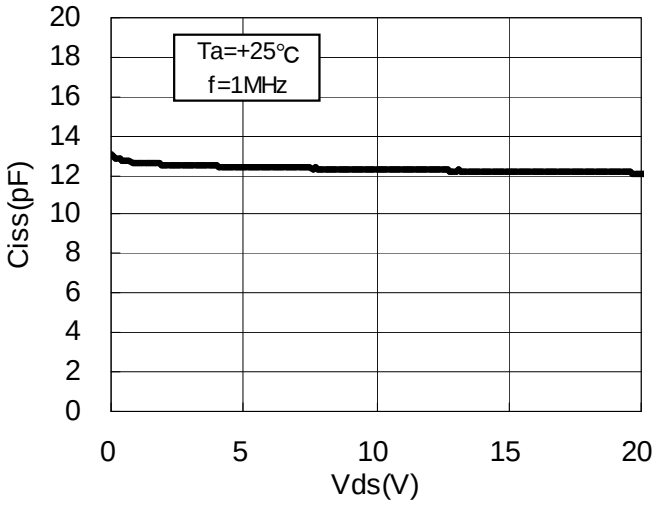

**Vgs-Ids CHARACTERISTICS**



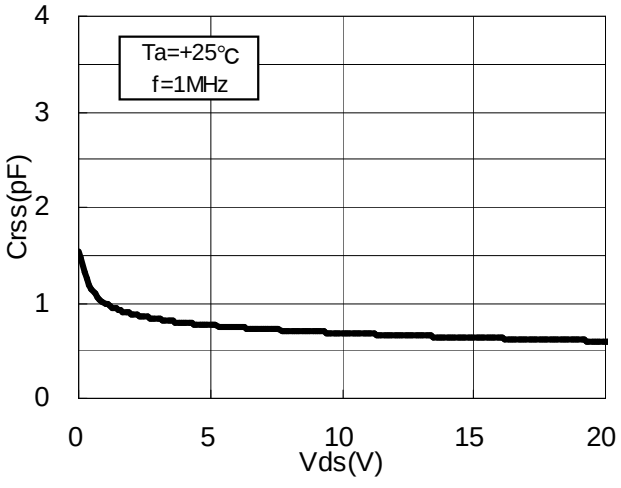

**Vds-Ids CHARACTERISTICS**



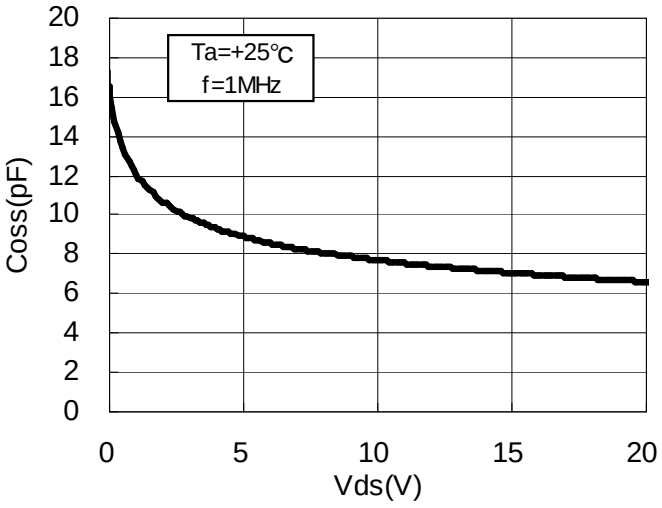

**Vds VS. Ciss CHARACTERISTICS**




**Vds VS. Crss CHARACTERISTICS**




**Vds VS. Coss CHARACTERISTICS**

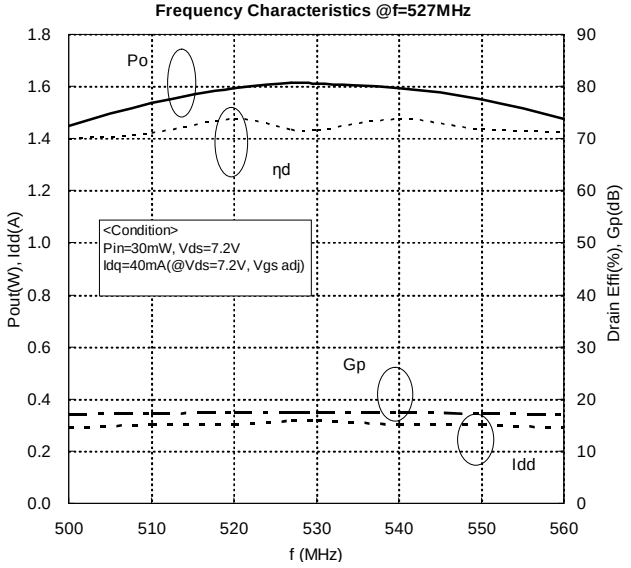


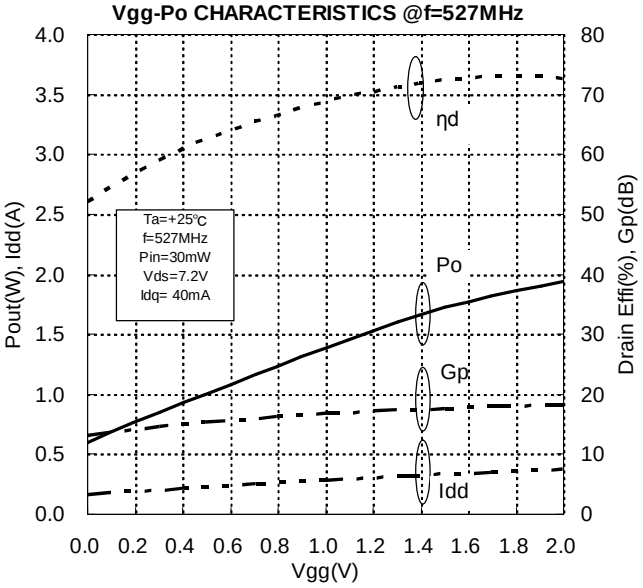
# RD01MUS2B

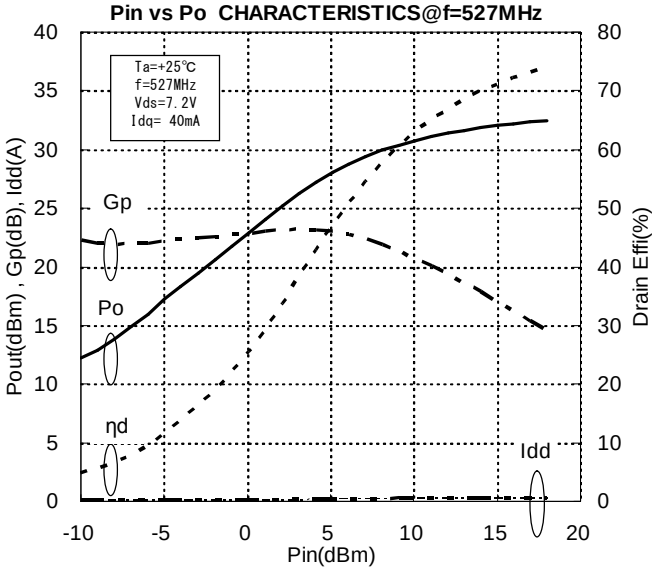
**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

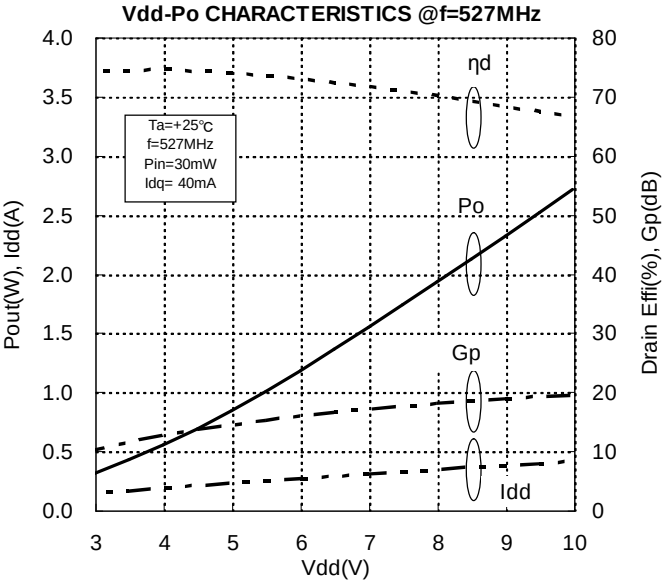
## UHF-band,527MHz, TYPICAL CHARACTERISTICS

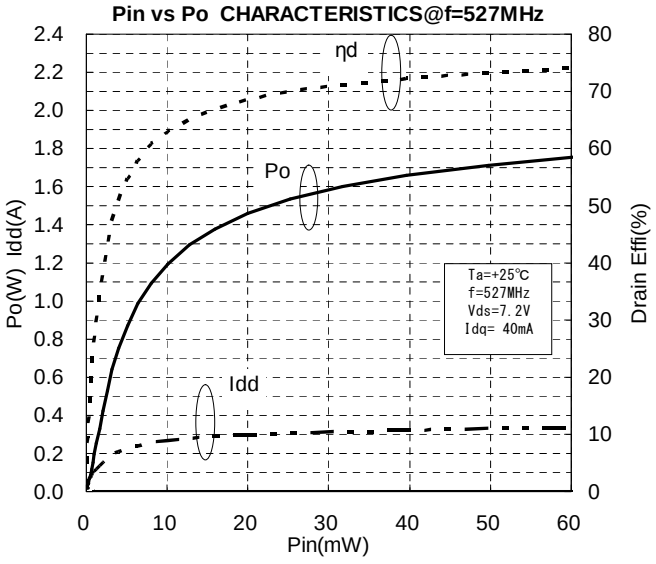
(These are only typical curves and devices are not necessarily guaranteed at these curves.)



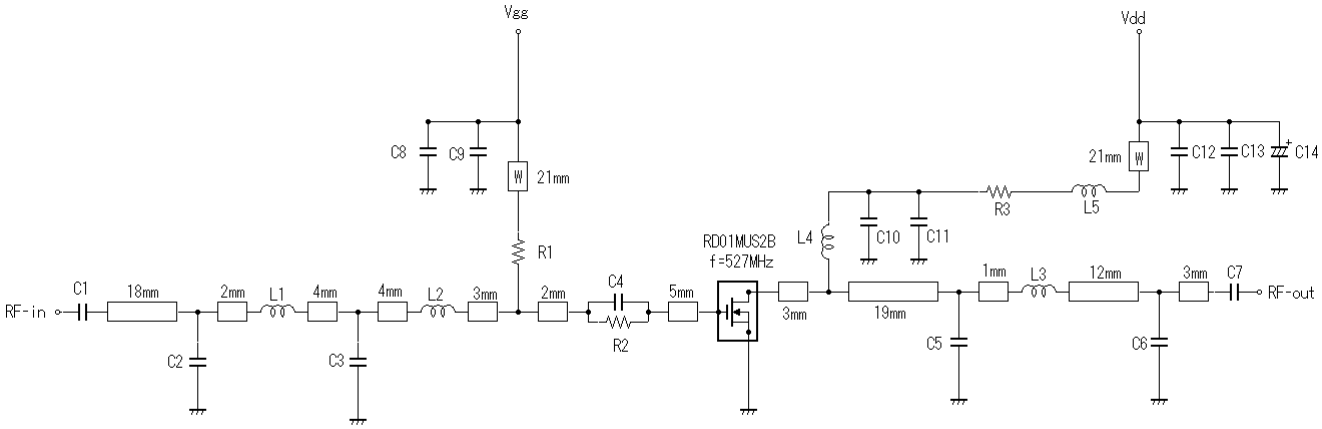



# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

## EQUIVALENT CIRCUITRY for Test Circuit (f=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

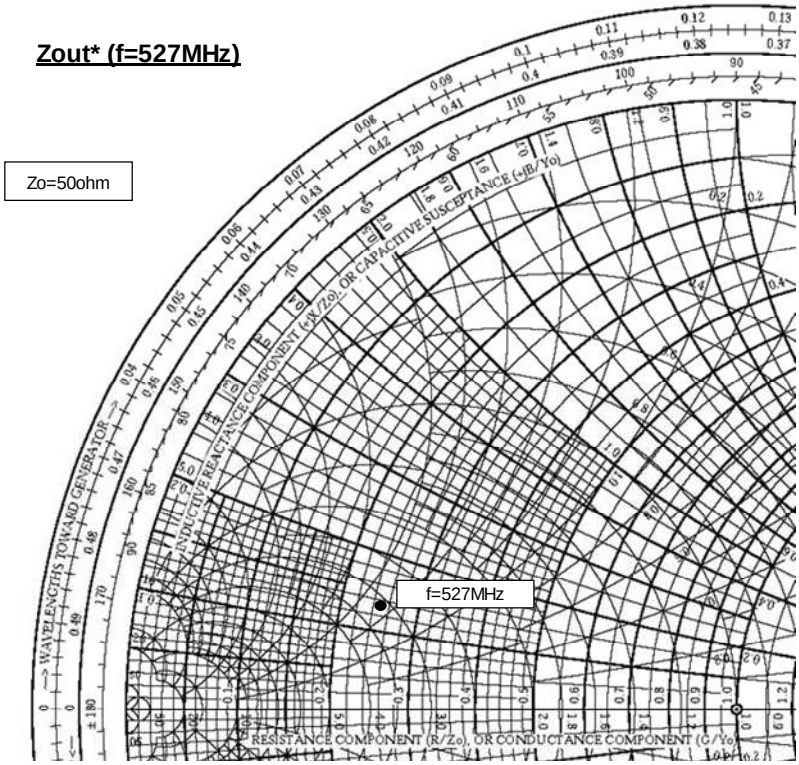
| | | |
|---|---|---|
| C1 | 1000 pF | Chip Ceramic Capacitiors |
| C2 | 10 pF | Chip Ceramic Capacitiors |
| C3 | 33 pF | Chip Ceramic Capacitiors |
| C4 | 22 pF | Chip Ceramic Capacitiors |
| C5 | 12 pF | Chip Ceramic Capacitiors |
| C6 | 3 pF | Chip Ceramic Capacitiors |
| C7 | 1000 pF | Chip Ceramic Capacitiors |
| C8 | 0.022 μF | Chip Ceramic Capacitiors |
| C9 | 1000 pF | Chip Ceramic Capacitiors |
| C10 | 82 pF | Chip Ceramic Capacitiors |
| C11 | 82 pF | Chip Ceramic Capacitiors |
| C12 | 0.022 μF | Chip Ceramic Capacitiors |
| C13 | 1000 pF | Chip Ceramic Capacitiors |
| C14 | 22 μF | Electrolytic Capacitior |
| R1 | 4.7K ohm | Chip Resistors |
| R2 | 100 ohm | Chip Resistors |
| R3 | 0 ohm | Chip Resistors |
| L1 | 8 nH | Enameled wire 2Turns, D:0.23mm, Inside: 1.1mm |
| L2 | 8 nH | Enameled wire 2Turns, D:0.23mm, Inside: 1.1mm |
| L3 | 12 nH | Enameled wire 3Turns, D:0.23mm, Inside: 1.1mm |
| L4 | 12 nH | Enameled wire 3Turns, D:0.23mm, Inside: 1.1mm |
| L5 | 29 nH | Enameled wire 6Turns, D:0.40mm, Inside: 1.6mm |

* Inductor of Rolling Coil measurement condition : f=100MHz

# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

**Zout* (f=527MHz)**

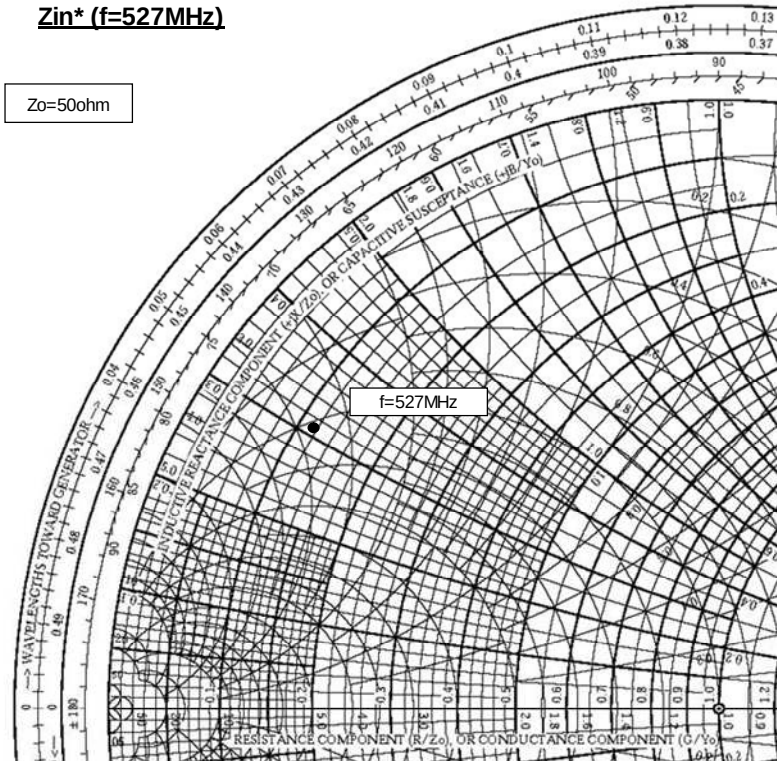



@Pin=30mW, Vds=7.2V,Idq=40mA

| f (MHz) | Zout* (ohm) |
|---|---|
| 527 | 12.67 + j 6.67 |

Zout*: Complex conjugate of output impedance

**Zin* (f=527MHz)**




@Pin=30mW, Vds=7.2V,Idq=40mA

| f (MHz) | Zin* (ohm) |
|---|---|
| 527 | 5.93 + j 15.54 |

Zin*: Complex conjugate of intput impedance

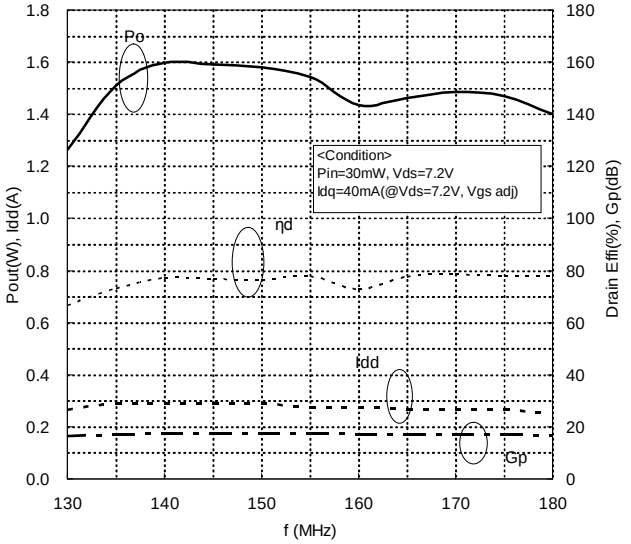
# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

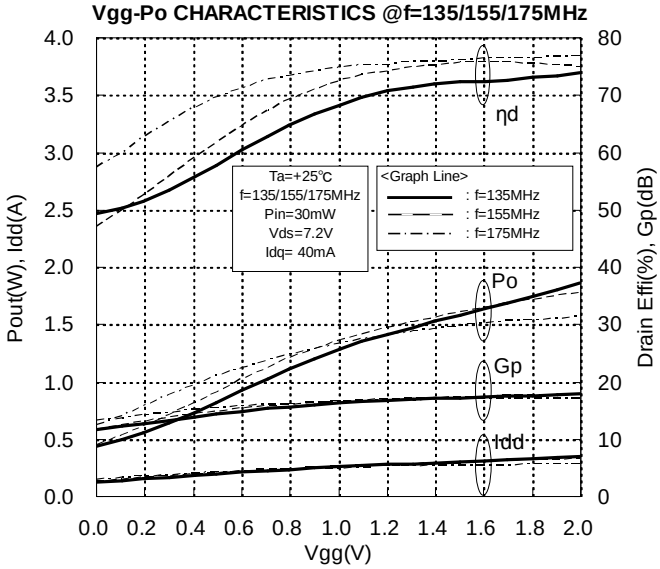
## VHF-band TYPICAL CHARACTERISTICS

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

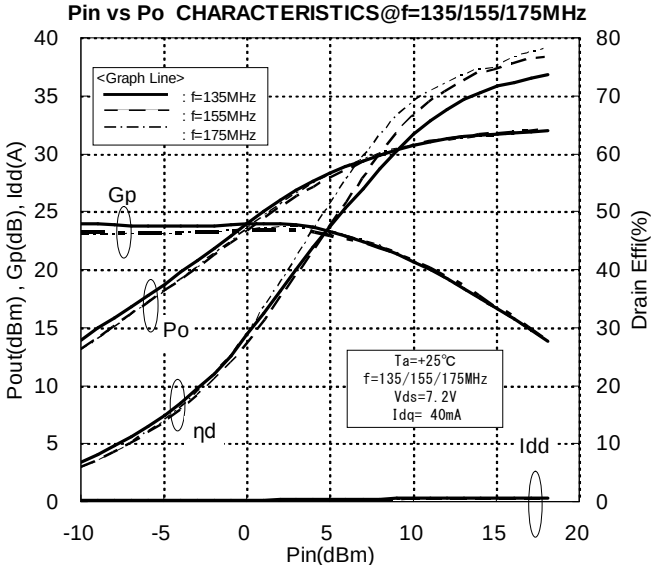
**Frequency Characteristics @f=135-175MHz**



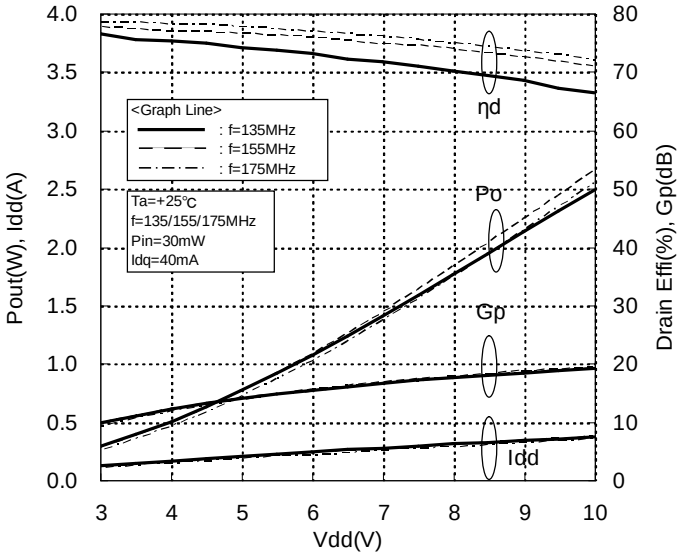

**Vgg-Po CHARACTERISTICS @f=135/155/175MHz**



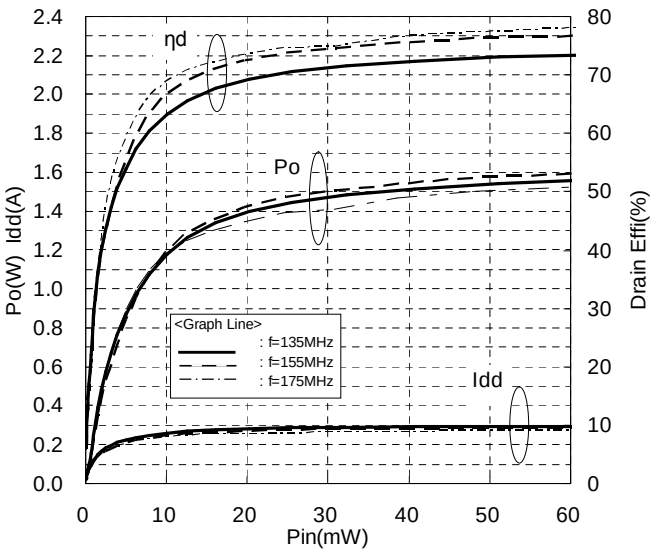

**Pin vs Po CHARACTERISTICS@f=135/155/175MHz**




**Vdd-Po CHARACTERISTICS @f=135/155/175MHz**



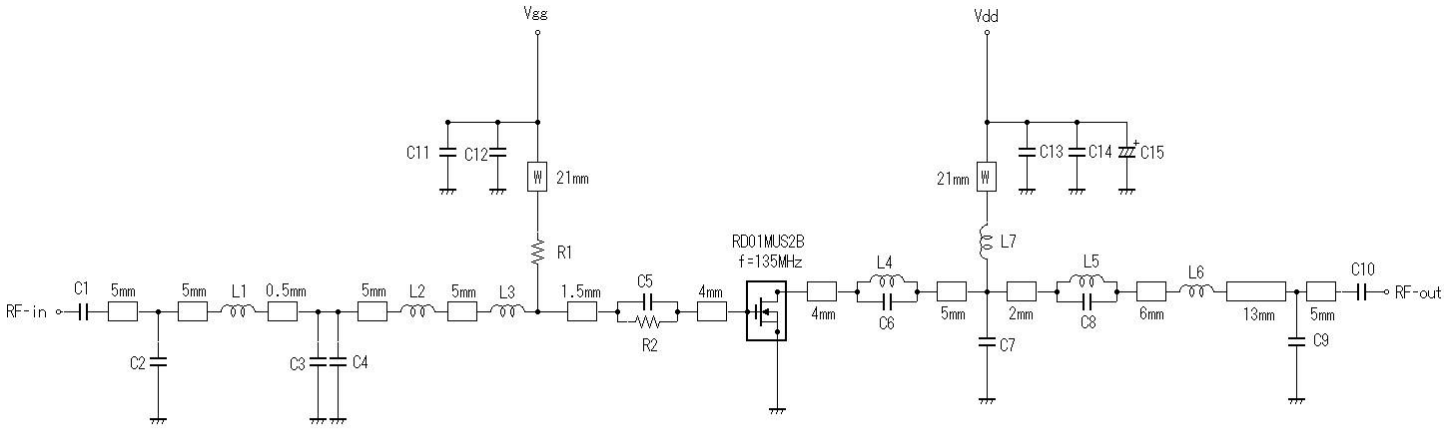

**Pin vs Po CHARACTERISTICS@f=135/155/175MHz**



# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

## EQUIVALENT CIRCUITRY for VHF EVALUATION BOARD (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

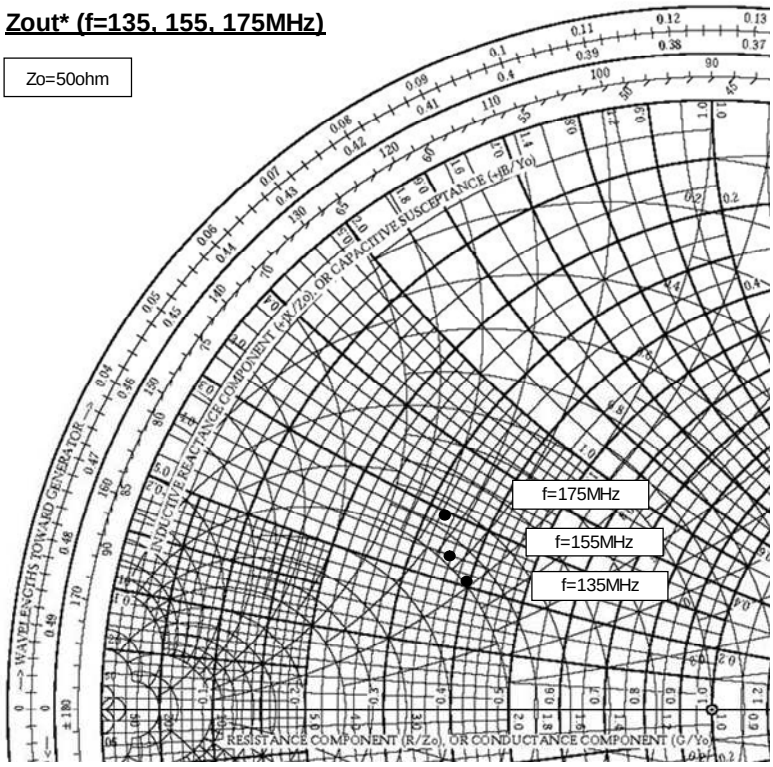
| | | |
|---|---|---|
| C1 | 160 pF | Chip Ceramic Capacitiors |
| C2 | 36 pF | Chip Ceramic Capacitiors |
| C3 | 22 pF | Chip Ceramic Capacitiors |
| C4 | 27 pF | Chip Ceramic Capacitiors |
| C5 | 22 pF | Chip Ceramic Capacitiors |
| C6 | 430 pF | Chip Ceramic Capacitiors |
| C7 | 10 pF | Chip Ceramic Capacitiors |
| C8 | 7 pF | Chip Ceramic Capacitiors |
| C9 | 18 pF | Chip Ceramic Capacitiors |
| C10 | 160 pF | Chip Ceramic Capacitiors |
| C11 | 1000 pF | Chip Ceramic Capacitiors |
| C12 | 0.022 µF | Chip Ceramic Capacitiors |
| C13 | 1000 pF | Chip Ceramic Capacitiors |
| C14 | 0.022 µF | Chip Ceramic Capacitiors |
| C15 | 22 µF | Electrolytic Capacitior |
| R1 | 4.7K ohm | Chip Resistors |
| R2 | 47 ohm | Chip Resistors |
| L1 | 40 nH | Enameled wire 9Turns, D:0.23mm, Inside: 1.1mm |
| L2 | 51 nH | Enameled wire 11Turns, D:0.23mm, Inside: 1.1mm |
| L3 | 40 nH | Enameled wire 9Turns, D:0.23mm, Inside: 1.1mm |
| L4 | 12 nH | Enameled wire 3Turns, D:0.23mm, Inside: 1.1mm |
| L5 | 17 nH | Enameled wire 4Turns, D:0.23mm, Inside: 1.1mm |
| L6 | 12 nH | Enameled wire 3Turns, D:0.23mm, Inside: 1.1mm |
| L7 | 37 nH | Enameled wire 7Turns, D:0.4mm, Inside: 1.6mm |

* Inductor of Rolling Coil measurement condition : f=100MHz

**For more information regarding this evaluation board, refer to APPLICATION NOTE "AN-VHF-055"**

## Input / Output Impedance VS. Frequency Characteristics

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

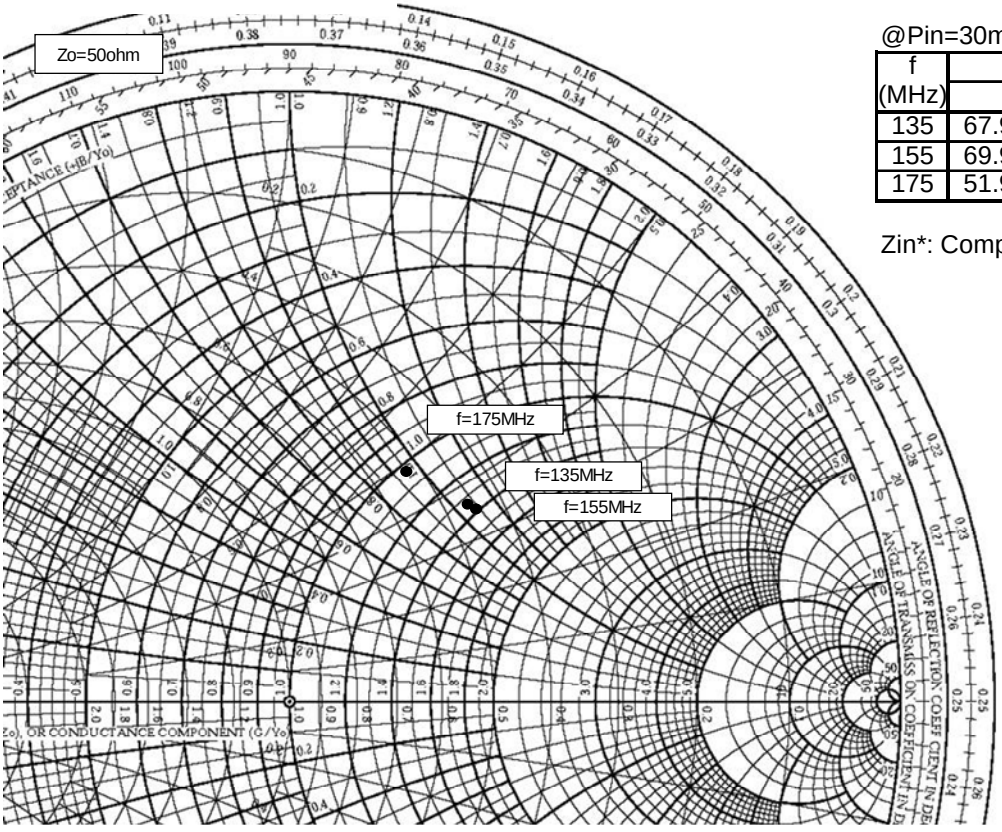



@Pin=30mW, Vds=7.2V,Idq=40mA

| f (MHz) | Zout* (ohm) |
|---|---|
| 135 | 19.81 + j 10.17 |
| 155 | 18.09 + j 11.73 |
| 175 | 16.62 + j 14.82 |

Zout*: Complex conjugate of output impedance

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




@Pin=30mW, Vds=7.2V,Idq=40mA

| f (MHz) | Zin* (ohm) |
|---|---|
| 135 | 67.91 + j 54.09 |
| 155 | 69.90 + j 54.62 |
| 175 | 51.90 + j 47.13 |

Zin*: Complex conjugate of intput impedance

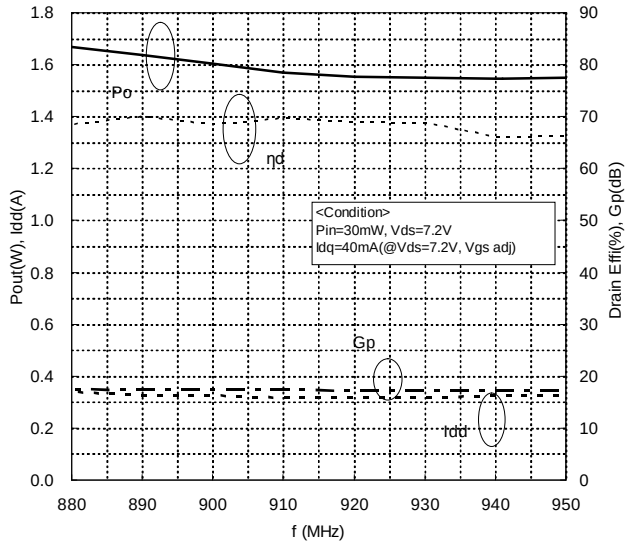
# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

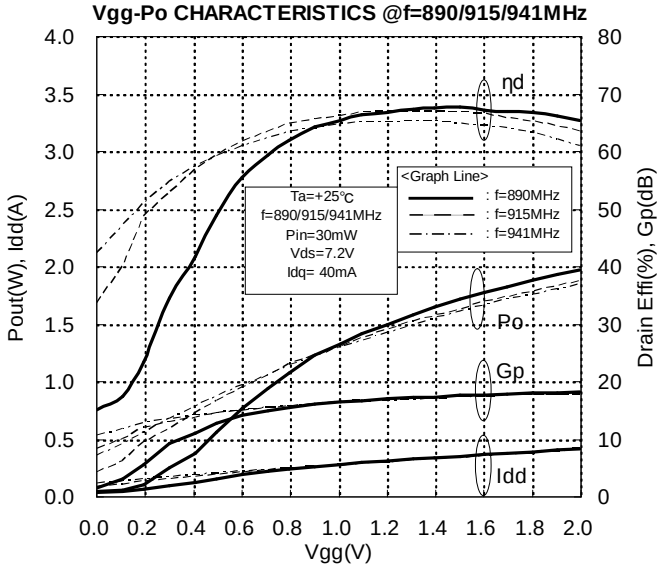
## 900MHz-band TYPICAL CHARACTERISTICS

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

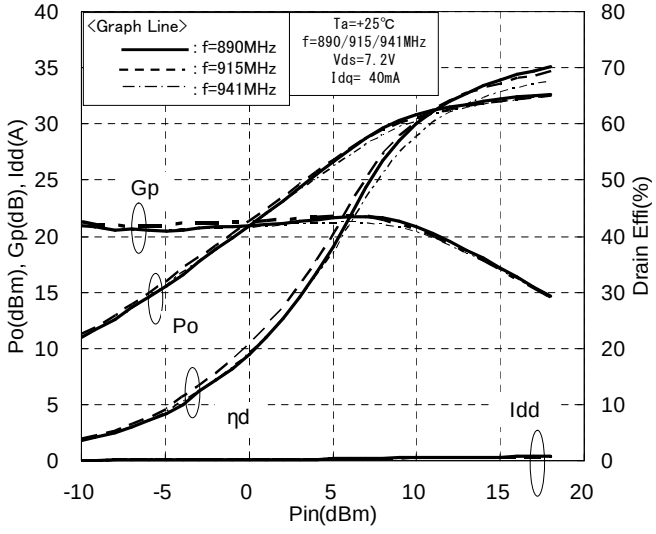
**Frequency Characteristics @f=890-941MHz**



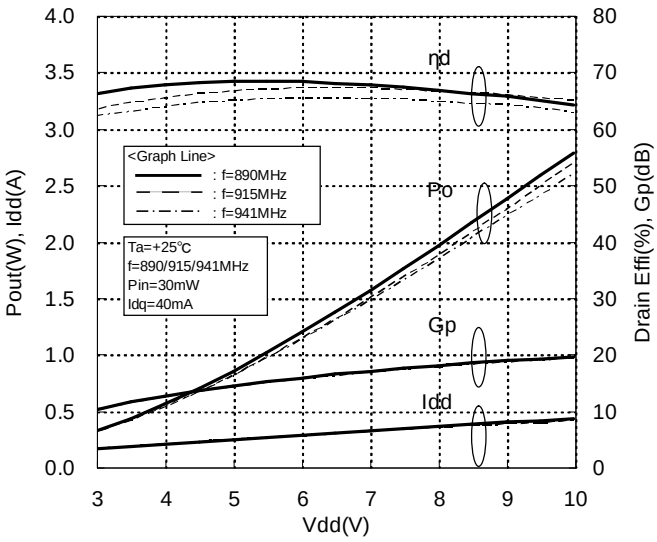

**Vgg-Po CHARACTERISTICS @f=890/915/941MHz**



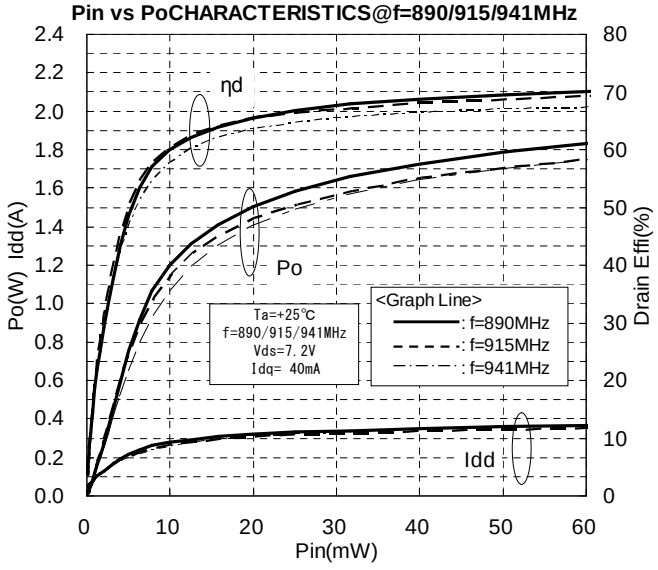

**Pin vs Po CHARACTERISTICS@f=890/915/941MHz**




**Vdd-Po CHARACTERISTICS @f=890/915/941MHz**



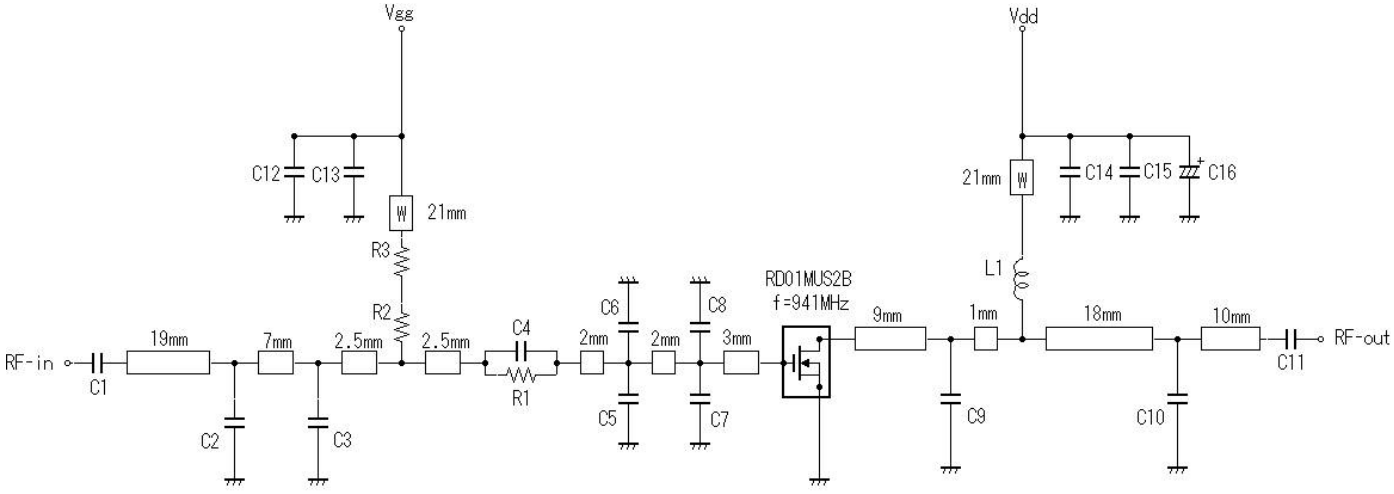

**Pin vs PoCHARACTERISTICS@f=890/915/941MHz**



# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

## EQUIVALENT CIRCUITRY for 900MHz EVALUATION BOARD (f=890 – 941MHz)




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

| | | |
|---|---|---|
| C1 | 150 pF | Chip Ceramic Capacitiors |
| C2 | 4 pF | Chip Ceramic Capacitiors |
| C3 | 4 pF | Chip Ceramic Capacitiors |
| C4 | 30 pF | Chip Ceramic Capacitiors |
| C5 | 10 pF | Chip Ceramic Capacitiors |
| C6 | 10 pF | Chip Ceramic Capacitiors |
| C7 | 10 pF | Chip Ceramic Capacitiors |
| C8 | 10 pF | Chip Ceramic Capacitiors |
| C9 | 8 pF | Chip Ceramic Capacitiors |
| C10 | 2 pF | Chip Ceramic Capacitiors |
| C11 | 150 pF | Chip Ceramic Capacitiors |
| C12 | 100 pF | Chip Ceramic Capacitiors |
| C13 | 1000 pF | Chip Ceramic Capacitiors |
| C14 | 100 pF | Chip Ceramic Capacitiors |
| C15 | 1000 pF | Chip Ceramic Capacitiors |
| C16 | 22 µF | Electrolytic Capacitior |
| R1 | 18 ohm | Chip Resistors |
| R2 | 4.7K ohm | Chip Resistors |
| R3 | 0 ohm | Chip Resistors |
| L1 | 37 nH | Enameled wire 7Turns, D:0.40mm, Inside: 1.6mm |

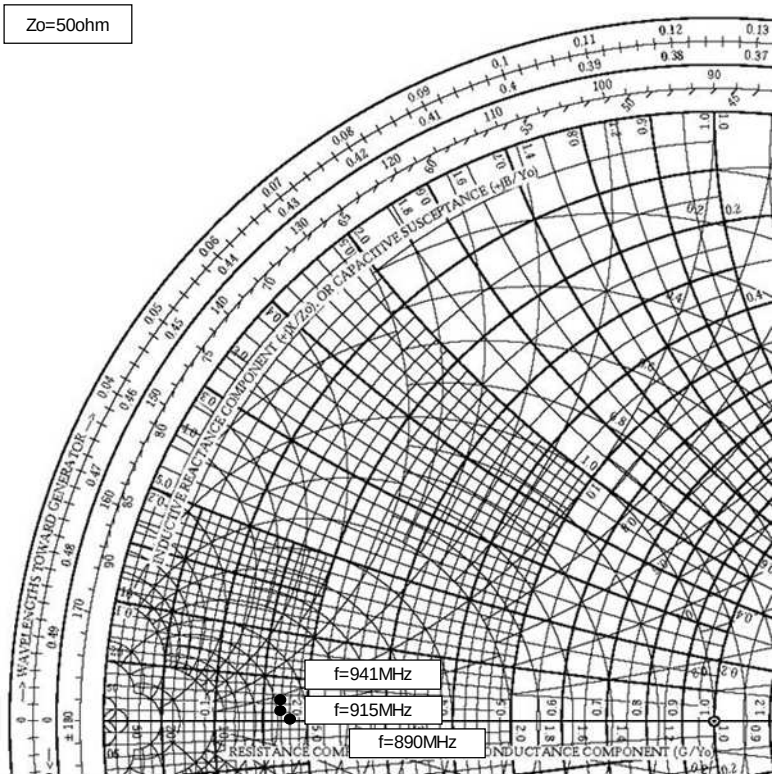
*Inductor of Rolling Coil measurement condition : f=100MHz

**For more information regarding this evaluation board, refer to APPLICATION NOTE "AN-900-046"**

# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

**Zout* (f=890, 915, 941MHz)**

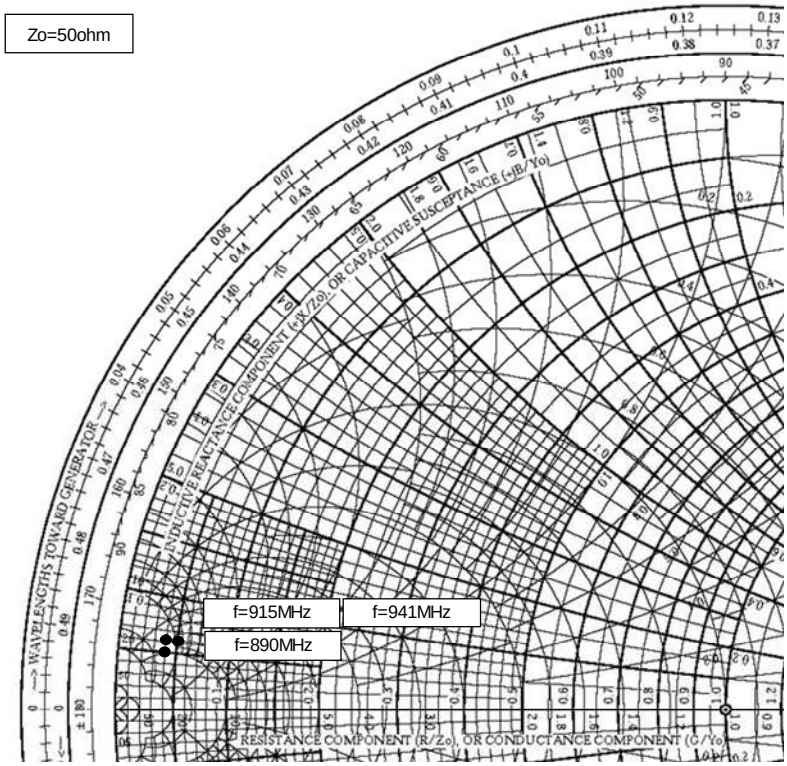



@Pin=30mW, Vds=7.2V,Idq=40mA

| f (MHz) | Zout* (ohm) |
|---|---|
| 890 | 8.80 - j 0.18 |
| 915 | 8.60 + j 0.37 |
| 941 | 8.39 + j 1.01 |

Zout*: Complex conjugate of output impedance

**Zin* (f=890, 915, 941MHz)**




@Pin=30mW, Vds=7.2V,Idq=40mA

| f (MHz) | Zin* (ohm) |
|---|---|
| 890 | 2.09 + j 2.48 |
| 915 | 2.19 + j 2.78 |
| 941 | 2.37 + j 2.82 |

Zin*: Complex conjugate of intput impedanc

# RD01MUS2B

**RoHS Compliance, Silicon MOSFET Power Transistor 527MHz,1W**

## RD01MUS2B S-PARAMETER DATA (@Vdd=7.2V, Id=40mA)

| Freq. | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| [ MHz ] | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) | (mag) | (ang) |
| 100 | 0.896 | -71.0 | 22.155 | 135.1 | 0.029 | 46.0 | 0.775 | -56.6 |
| 135 | 0.862 | -84.5 | 19.556 | 126.6 | 0.033 | 37.5 | 0.730 | -68.2 |
| 155 | 0.847 | -92.3 | 17.994 | 121.7 | 0.035 | 32.3 | 0.705 | -74.9 |
| 175 | 0.835 | -99.1 | 16.612 | 117.4 | 0.036 | 28.1 | 0.685 | -80.9 |
| 200 | 0.823 | -106.4 | 15.109 | 112.9 | 0.038 | 23.9 | 0.667 | -87.3 |
| 250 | 0.809 | -118.1 | 12.570 | 105.0 | 0.039 | 17.0 | 0.647 | -97.8 |
| 300 | 0.803 | -127.0 | 10.682 | 98.8 | 0.039 | 10.9 | 0.640 | -105.8 |
| 350 | 0.800 | -134.0 | 9.167 | 93.6 | 0.039 | 6.3 | 0.641 | -112.5 |
| 400 | 0.801 | -139.4 | 7.939 | 89.5 | 0.038 | 2.7 | 0.648 | -118.1 |
| 450 | 0.806 | -144.1 | 6.970 | 85.5 | 0.037 | -0.2 | 0.660 | -122.9 |
| 500 | 0.810 | -148.0 | 6.160 | 82.2 | 0.036 | -3.1 | 0.673 | -127.2 |
| 520 | 0.813 | -149.4 | 5.834 | 80.9 | 0.036 | -4.4 | 0.679 | -128.6 |
| 530 | 0.814 | -150.1 | 5.698 | 80.5 | 0.035 | -5.0 | 0.682 | -129.4 |
| 550 | 0.816 | -151.4 | 5.455 | 79.7 | 0.034 | -5.8 | 0.687 | -131.0 |
| 600 | 0.825 | -154.5 | 4.898 | 77.1 | 0.033 | -7.0 | 0.702 | -134.4 |
| 650 | 0.831 | -157.2 | 4.406 | 74.1 | 0.032 | -8.9 | 0.718 | -137.6 |
| 700 | 0.838 | -159.6 | 3.969 | 72.6 | 0.030 | -10.3 | 0.733 | -140.6 |
| 750 | 0.845 | -161.9 | 3.606 | 70.9 | 0.029 | -11.5 | 0.746 | -143.5 |
| 800 | 0.852 | -164.0 | 3.249 | 68.9 | 0.027 | -12.6 | 0.760 | -146.2 |
| 850 | 0.859 | -166.1 | 2.960 | 67.1 | 0.026 | -12.8 | 0.774 | -148.6 |
| 900 | 0.865 | -167.9 | 2.703 | 67.2 | 0.025 | -13.7 | 0.784 | -151.1 |
| 950 | 0.870 | -169.6 | 2.487 | 65.5 | 0.023 | -14.2 | 0.795 | -153.4 |
| 1000 | 0.876 | -171.3 | 2.290 | 65.1 | 0.022 | -14.7 | 0.805 | -155.5 |
| 1050 | 0.882 | -172.9 | 2.108 | 64.2 | 0.021 | -13.9 | 0.816 | -157.6 |
| 1100 | 0.887 | -174.4 | 1.941 | 64.6 | 0.020 | -15.9 | 0.825 | -159.5 |
| 1150 | 0.891 | -175.9 | 1.809 | 62.7 | 0.017 | -16.5 | 0.832 | -161.4 |
| 1200 | 0.894 | -177.3 | 1.695 | 63.2 | 0.017 | -13.3 | 0.841 | -163.1 |
| 1250 | 0.898 | -178.5 | 1.580 | 63.9 | 0.015 | -13.3 | 0.849 | -164.9 |
| 1300 | 0.902 | -179.8 | 1.487 | 63.3 | 0.014 | -12.0 | 0.856 | -166.5 |
| 1350 | 0.907 | 179.0 | 1.387 | 62.5 | 0.013 | -10.5 | 0.863 | -168.2 |
| 1400 | 0.912 | 177.7 | 1.296 | 63.0 | 0.012 | -8.3 | 0.868 | -169.7 |
| 1450 | 0.914 | 176.6 | 1.250 | 62.2 | 0.011 | -8.2 | 0.875 | -171.1 |
| 1500 | 0.917 | 175.5 | 1.147 | 61.9 | 0.010 | -5.0 | 0.880 | -172.6 |

**ATTENTION:**

1.High Temperature ; This product might have a heat generation while operation,Please take notice that have a possibility to receive a burn to touch the operating product directly or touch the product until cold after switch off. At the near the product,do not place the combustible material that have possibilities to arise the fire.

2.Generation of High Frequency Power ; This product generate a high frequency power. Please take notice that do not leakage the unnecessary electric wave and use this products without cause damage for human and property per normal operation.

3.Before use; Before use the product,Please design the equipment in consideration of the risk for human and electric wave obstacle for equipment.

**PRECAUTIONS FOR THE USE OF MITSUBISHI SILICON RF POWER 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 and In the application, which is base station applications and fixed station applications that operate with long term continuous transmission and a higher on-off frequency during transmitting, please consider the derating, the redundancy system, appropriate setting of the maintain period and others as needed. For the reliability report which is described about predicted operating life time of Mitsubishi Silicon RF Products , please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor.

3. 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 channel temperature for RD series products lower than 120deg/C(in case of Tchmax=150deg/C) ,140deg/C(in case of Tchmax=175deg/C) under standard conditions.

6. 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.

7. For specific precautions regarding assembly of these products into the equipment, please refer to the supplementary items in the specification sheet.

8. 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.

9. For additional "Safety first" in your circuit design and notes regarding the materials, please refer the last page of this data sheet.

10. Please refer to the additional precautions in the formal specification sheet.

## 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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