

< Silicon RF Power MOS FET (Discrete) >

RD02LUS2

RoHS Compliance, Silicon MOSFET Power Transistor 470MHz,2W

DESCRIPTION

RD02LUS2 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

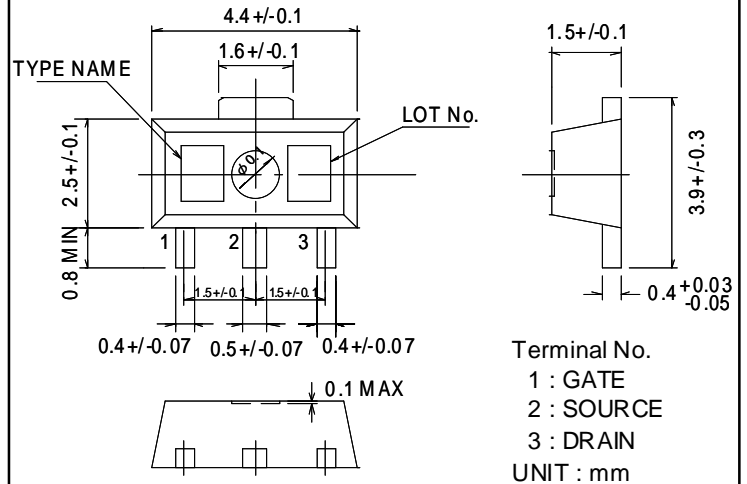
- High power gain and High Efficiency.

$P_{out} = 2.3W_{Typ}$
 $G_p @ P_{out} 2W = 15dB_{Typ}$
 $G_p @ P_{out} 1.5W = 18dB_{Typ}$
 $\eta_d @ P_{out} 2.2W = 70\%_{Typ}$

@Vdd=3.6V, f=470MHz

- Integrated gate protection diode

OUTLINE DRAWING



APPLICATION

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

RoHS COMPLIANCE

RD02LUS2 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.)

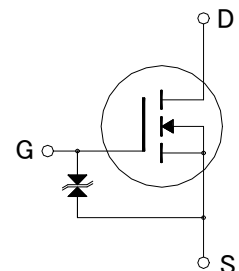
RD02LUS2

RoHS Compliance, Silicon MOSFET Power Transistor 470MHz,2W

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	15.6	W
Pin	Input Power	Zg=Zl=50Ω	400	mW
ID	Drain Current	-	2.2	A
Tch	Channel Temperature	-	150	°C
Tstg	Storage temperature	-	-40 to +125	°C
Rth j-c	Thermal resistance	Junction to case	8	°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	
IDSS	Zero gate voltage drain current	VDS=17V, VGS=0V	-	-	50	uA
IGSS	Gate to source leak current	VGS=10V, VDS=0V	-	-	1	uA
Vth	Gate threshold Voltage	VDS=3.6V, IDS=1mA	0.5	1.0	1.5	V
Pout	Output power	VDD=3.6V, Pin=0.2W	-	2.3	-	W
ηd	Drain efficiency	f=470MHz, Idq= 140mA	-	70	-	%

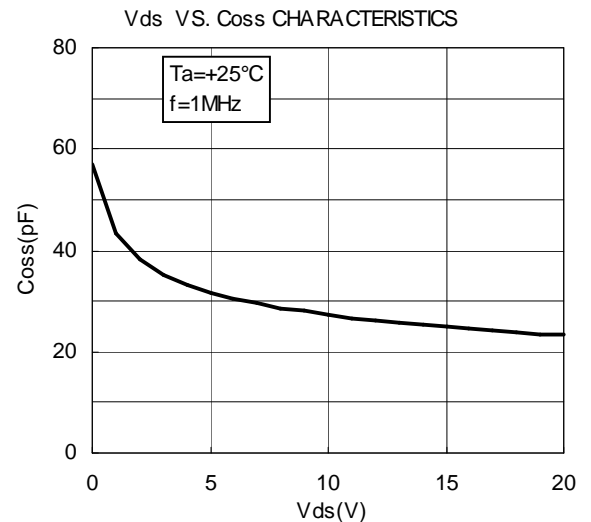
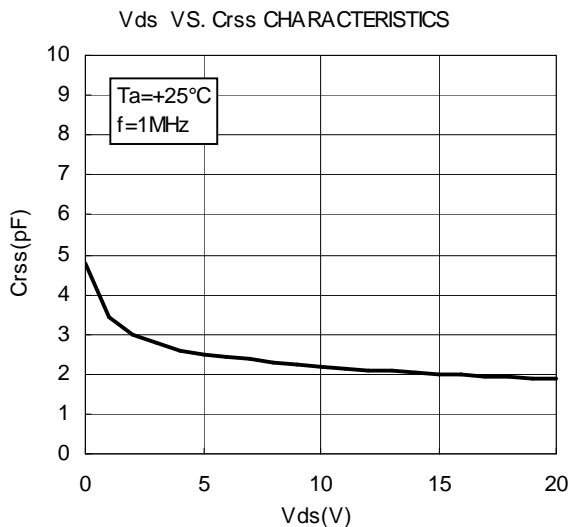
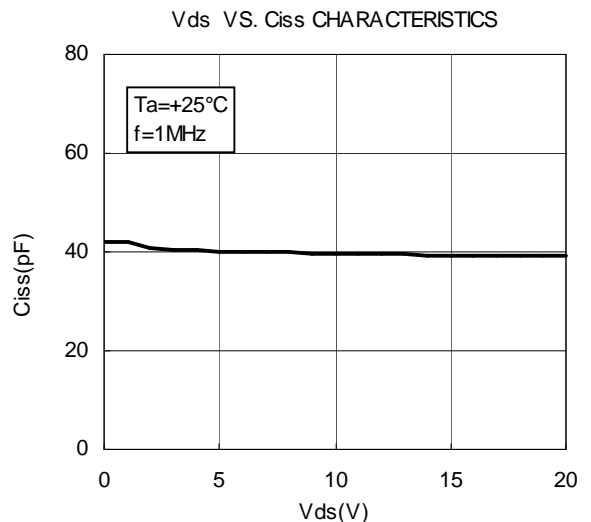
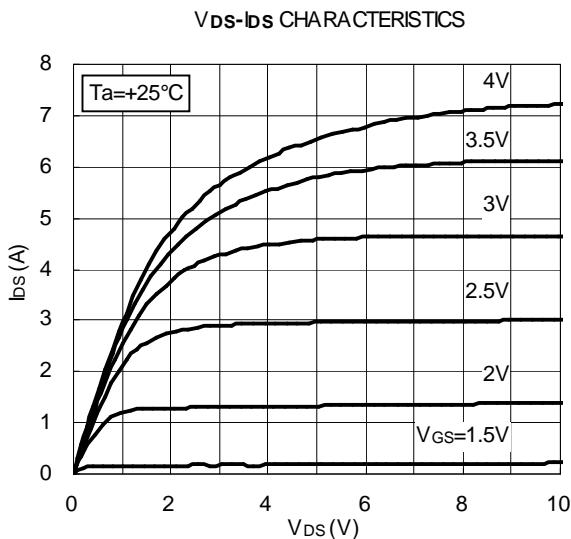
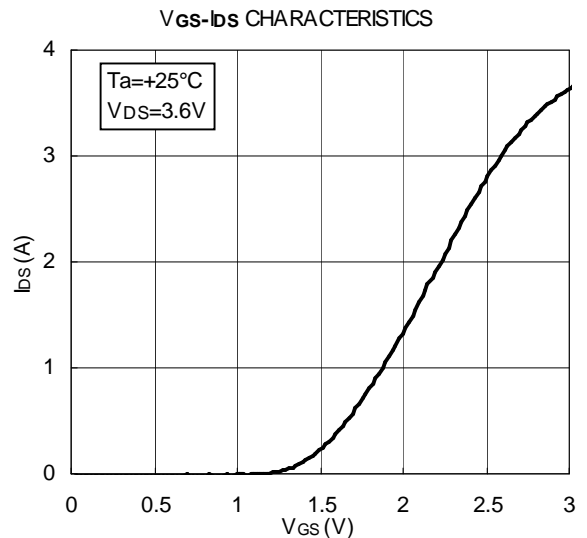
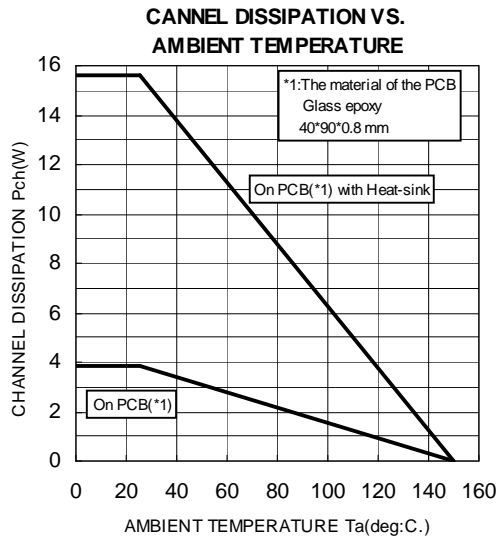
Note: Above parameters, ratings, limits and conditions are subject to change.

RD02LUS2

RoHS Compliance, Silicon MOSFET Power Transistor 470MHz,2W

TYPICAL DC CHARACTERISTICS

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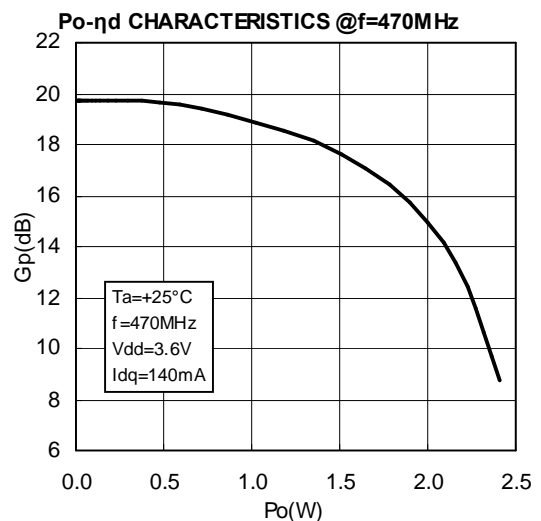
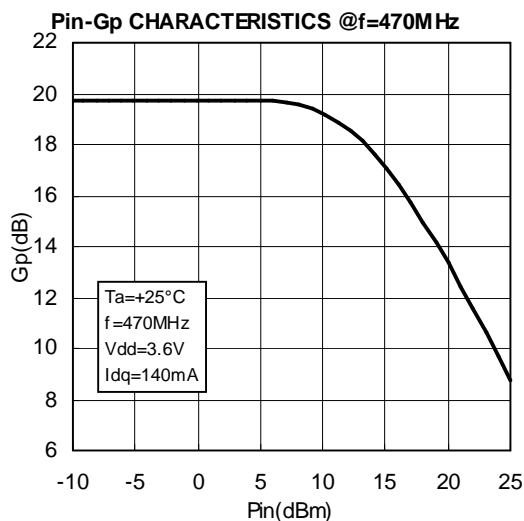
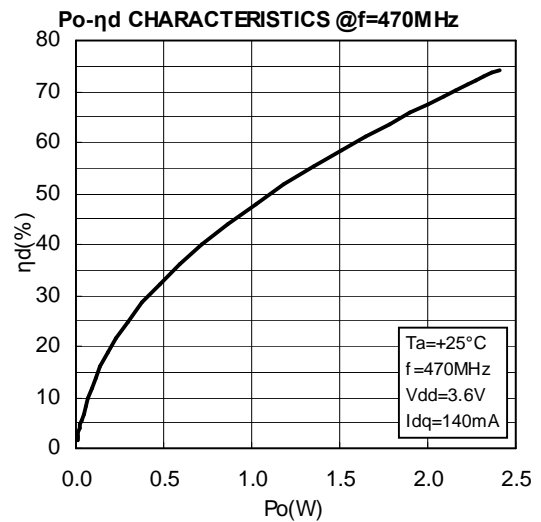
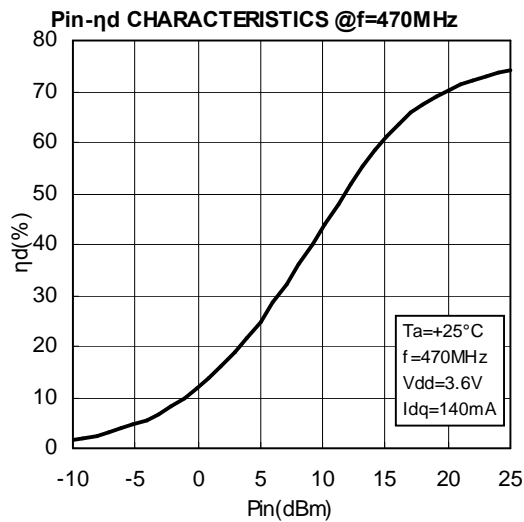
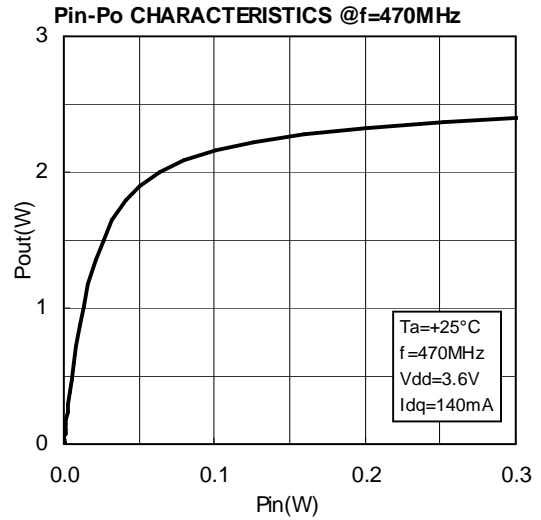
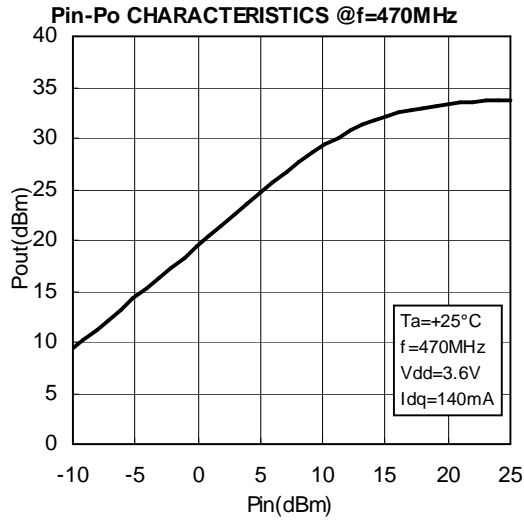


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UHF TYPICAL CHARACTERISTICS(f=470MHz)

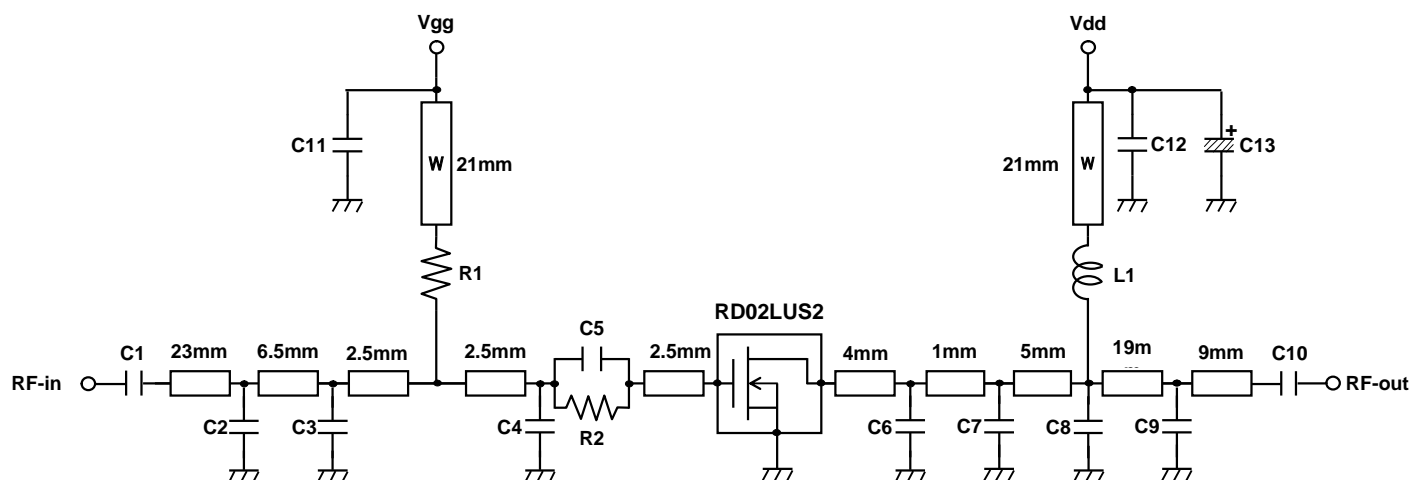
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EQUIVALENT CIRCUITRY for UHF Circuit (f=470MHz)



<Note>

Board material: Glass-Epoxy Substrate($\epsilon_r=4.8$, $t=0.8\text{mm}$)

Micro strip line width=1.3mm / 50 ohm

W line width=1.0mm

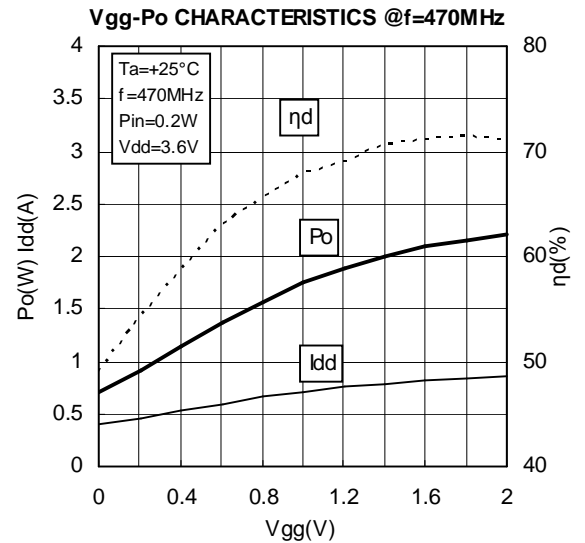
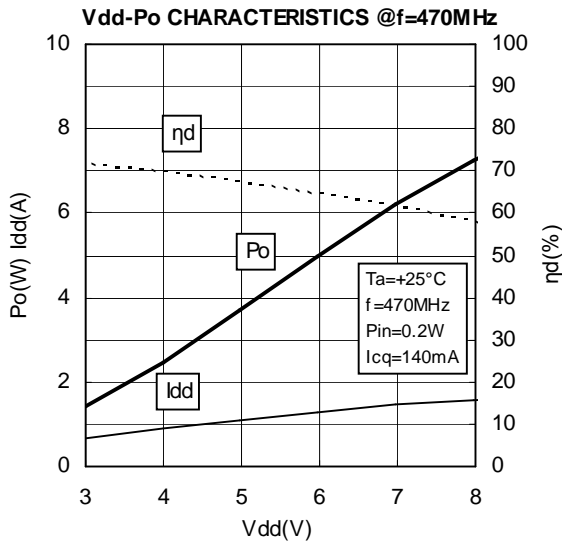
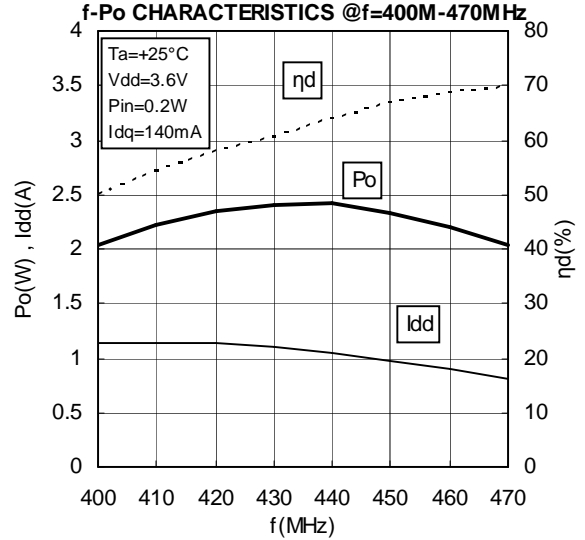
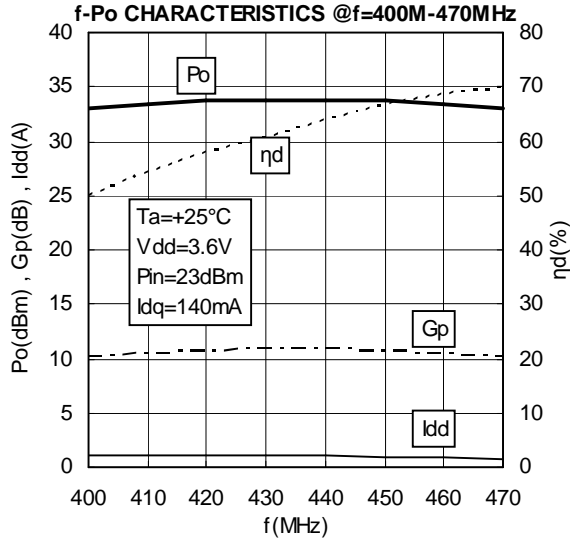
No.	Description	P/N	Manufacturer
Tr	MOSFET	RD02LUS2	Mitsubishi Electric Corporation
C 1	200 pF	GRM2162C1H201JA01	MURATA MANUFACTURING CO.
C 2	36 pF	GRM2162C1H360JZ01	MURATA MANUFACTURING CO.
C 3	3 pF	GRM2162C1H3R0JA01	MURATA MANUFACTURING CO.
C 4	43 pF	GRM2162C1H430JZ01	MURATA MANUFACTURING CO.
C 5	100 pF	GRM1882C1H101JA01	MURATA MANUFACTURING CO.
C 6	24 pF	GQM2195C2E240JB12	MURATA MANUFACTURING CO.
C 7	24 pF	GQM2195C2E240JB12	MURATA MANUFACTURING CO.
C 8	3 pF	GQM2195C2E3R0CB12	MURATA MANUFACTURING CO.
C 9	10 pF	GQM2195C2E100JB12	MURATA MANUFACTURING CO.
C 10	200 pF	GRM2162C1H201JA01	MURATA MANUFACTURING CO.
C 11	910 pF	GRM2162C1H911JA01	MURATA MANUFACTURING CO.
C 12	910 pF	GRM2162C1H911JA01	MURATA MANUFACTURING CO.
C 13	22 uF	UVZ1H220MDD	NICHICON CORPORATION
L 1	37nH Enameled wire 7Turns, Diameter:0.4mm, ϕ 2.46mm (the out side diameter)	4007C	Yoneda Processing Place Co.,Ltd.
R 1	5.1k ohm	RPC10 512-J	TAIYOSHA ELECTRIC CO.
R 2	68 ohm	RPC05 680-J	TAIYOSHA ELECTRIC CO.

RD02LUS2

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UHF-band TYPICAL CHARACTERISTICS(f=400M-470MHz)

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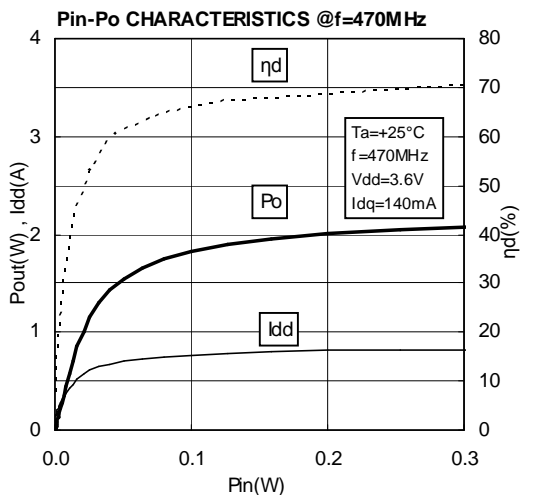
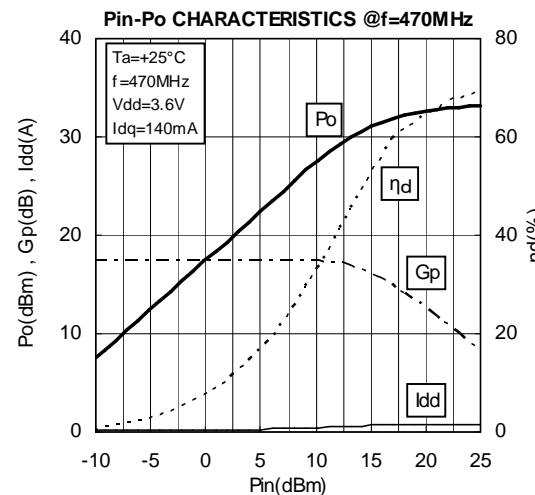
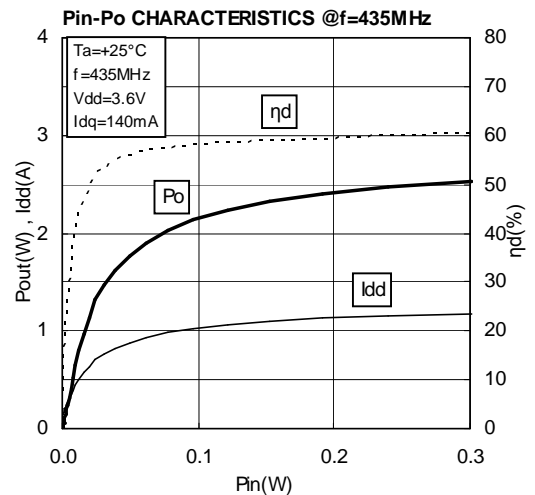
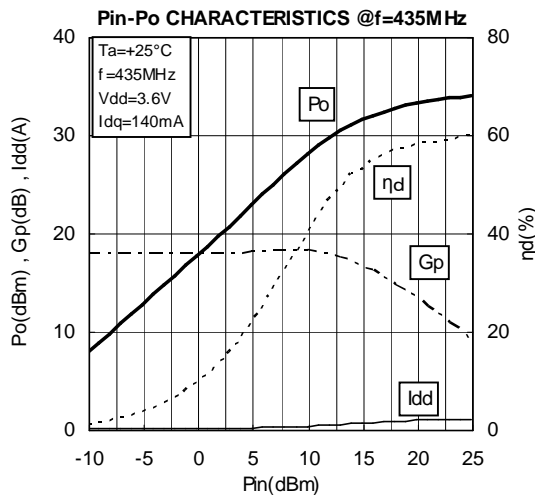
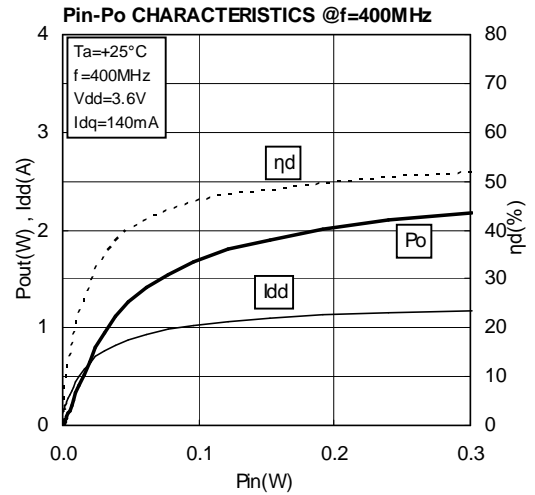
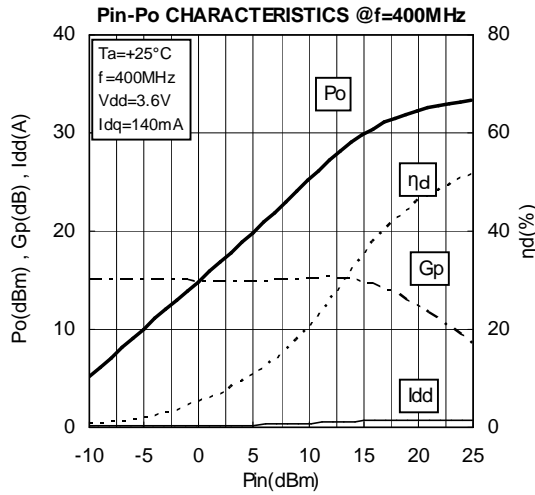


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UHF-band TYPICAL CHARACTERISTICS(400M-470MHz)

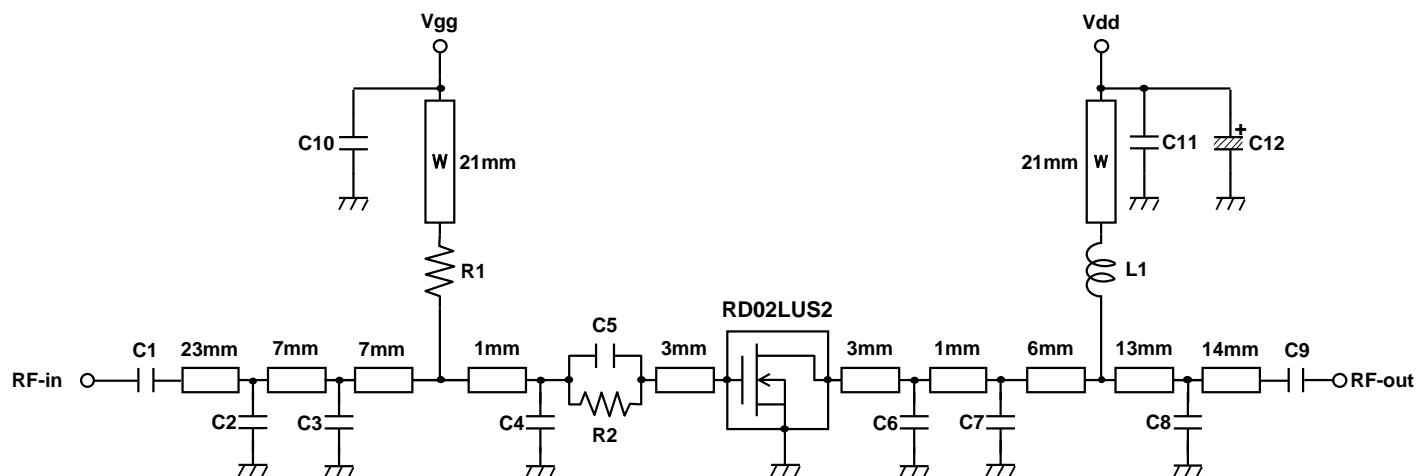
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EQUIVALENT CIRCUITRY for UHF-band Circuit (f=400M-470MHz)



<Note>

Board material: Glass-Epoxy Substrate($\epsilon_r=4.8$, $t=0.8\text{mm}$)

Micro strip line width=1.3mm / 50 ohm

W line width=1.0mm

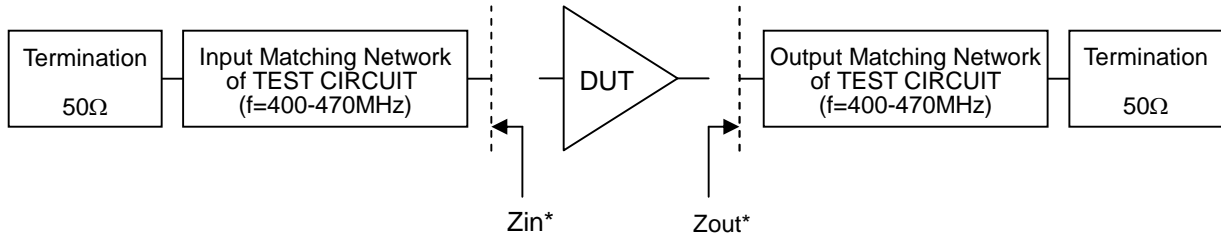
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C 5	100 pF	GRM1882C1H101JA01	MURATA MANUFACTURING CO.
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C 7	24 pF	GRM2162C1H240JZ01	MURATA MANUFACTURING CO.
C 8	12 pF	GRM2162C1H120JZ01	MURATA MANUFACTURING CO.
C 9	200 pF	GRM2162C1H201JA01	MURATA MANUFACTURING CO.
C 10	910 pF	GRM2162C1H911JA01	MURATA MANUFACTURING CO.
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Input / Output Impedance VS. Frequency Characteristics(f=400M-470MHz)

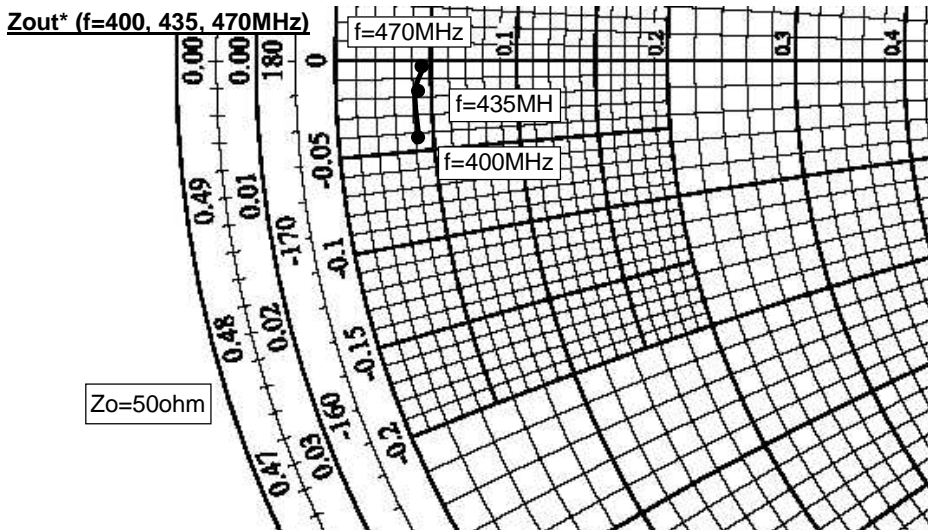
Method of Measurement



Zin*: Input Matching Network impedance measured from DUT

Zout*: Output Matching Network impedance measured from DUT

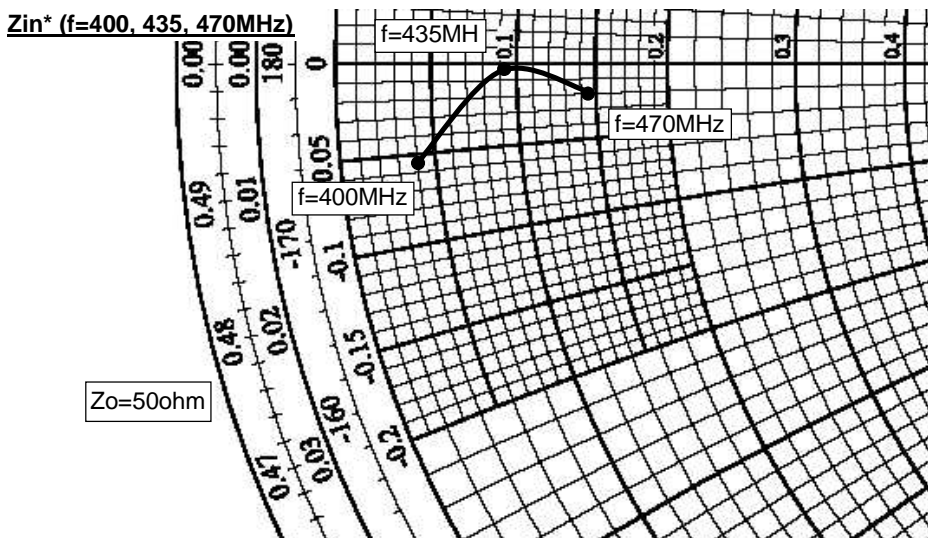
Z₀: Characteristic impedance



@ Pin=0.2W, Vds=3.6V, Idq=0.14A

f (MHz)	Zin* (ohm)
400	2.06 - j 2.07
435	2.20 - j 0.99
470	2.33 - j 0.33

Zout*: Complex conjugate of output impedance



@ Pin=0.2W, Vds=3.6V, Idq=0.14A

f (MHz)	Zin* (ohm)
400	3.44 - j 1.97
435	4.88 - j 0.49
470	6.80 - j 1.16

Zin*: Complex conjugate of input impedance

RD02LUS2

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RD02LUS2 S-Parameter data (Vdd=3.6V, Id=140mA)

Freq. [MHz]	S11		S21		S12		S22	
	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)
100	0.776	-155.6	14.549	87.1	0.025	-1.7	0.690	-154.8
135	0.779	-160.9	10.777	79.7	0.025	-8.8	0.702	-159.2
155	0.782	-163.0	9.269	76.2	0.024	-11.9	0.710	-160.8
175	0.787	-164.6	8.094	72.8	0.024	-14.7	0.719	-161.9
200	0.795	-166.3	6.842	68.7	0.024	-18.1	0.732	-163.1
250	0.809	-168.4	5.515	62.9	0.022	-23.6	0.750	-164.4
300	0.828	-170.5	4.268	56.2	0.021	-29.1	0.777	-165.9
350	0.841	-172.0	3.502	51.3	0.020	-33.8	0.798	-166.8
400	0.856	-173.4	2.919	46.4	0.018	-37.8	0.817	-168.0
435	0.865	-174.3	2.588	43.3	0.017	-40.5	0.831	-168.9
470	0.875	-175.3	2.314	40.7	0.016	-42.9	0.845	-169.6
500	0.884	-176.1	2.075	37.9	0.016	-44.6	0.855	-170.5
550	0.893	-177.1	1.833	34.8	0.015	-46.9	0.869	-171.4
600	0.904	-178.3	1.565	31.4	0.013	-49.4	0.883	-172.4
650	0.912	-179.3	1.374	28.5	0.011	-51.6	0.895	-173.4
700	0.919	-179.7	1.214	25.9	0.011	-53.1	0.903	-174.3
750	0.928	-178.8	1.091	23.2	0.009	-52.6	0.914	-175.3
800	0.934	-177.9	0.976	21.1	0.009	-54.0	0.921	-176.0
850	0.938	-177.1	0.880	19.2	0.008	-54.8	0.928	-177.0
900	0.944	-176.1	0.782	16.6	0.007	-56.7	0.935	-177.8
950	0.948	-175.3	0.719	14.8	0.006	-56.8	0.940	-178.6
1000	0.950	-174.7	0.651	13.1	0.005	-54.8	0.944	-179.3
1050	0.953	-174.0	0.603	11.7	0.004	-50.9	0.947	-179.8
1100	0.956	-173.2	0.554	10.1	0.004	-48.9	0.950	-179.6
1150	0.958	-172.4	0.509	8.3	0.003	-48.7	0.954	-179.1
1200	0.959	-171.6	0.470	7.5	0.002	-38.8	0.956	-178.4
1250	0.959	-170.9	0.433	5.5	0.002	-23.2	0.957	-177.9
1300	0.959	-170.2	0.411	4.4	0.002	-1.1	0.960	-177.3
1350	0.959	-169.4	0.381	2.7	0.002	15.5	0.961	-176.8
1400	0.959	-168.5	0.357	2.5	0.002	32.4	0.963	-176.4
1450	0.959	-167.8	0.339	1.6	0.002	42.3	0.965	-175.8
1500	0.957	-166.9	0.313	-0.2	0.002	59.0	0.964	-175.4

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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.

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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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