

< Silicon RF Power MOS FET (Discrete) >

# RD02LUS2

RoHS Compliance, Silicon MOSFET Power Transistor 470MHz, 2W, 3.6V

## DESCRIPTION

RD02LUS2 is a MOS FET type transistor designed for VHF/UHF RF driver device.

## FEATURES

- High Power Gain and High Efficiency  
 $P_{out} > 2.0W$ ,  $G_p = 10dB$ , Drain Eff. = 60%typ  
@  $f = 470MHz$ ,  $V_{DS} = 3.6V$ ,  $I_{dq} = 140mA$ ,  $P_{in} = 0.2W$
- Integrated gate protection diode

## APPLICATION

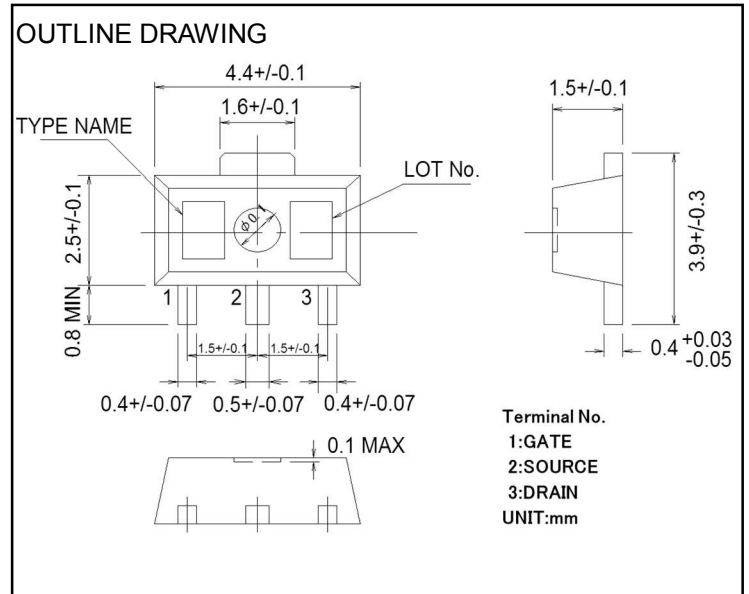
For driver stage of high power amplifiers in VHF/UHF Band mobile radio sets.

## RoHS COMPLIANT

RD02LUS2-501, T513 is EU RoHS compliant. This product includes the lead in high melting temperature type solders.

However, it is applicable to the following exceptions of RoHS Directions.

- Lead in high melting temperature type solders (i.e. tin-lead solder alloys containing more than 85% lead.)



## ABSOLUTE MAXIMUM RATINGS

( $T_c = 25^\circ C$  UNLESS OTHERWISE NOTED)

SYMBOL	PARAMETER	CONDITIONS	RATINGS	UNIT
$V_{DSS}$	Drain to source voltage	$V_{GS} = 0V$	25	V
$V_{GSS}$	Gate to source voltage	$V_{DS} = 0V$	-5/+10	V
$P_{ch}^*$	Channel dissipation	$T_c = 25^\circ C$	15.6	W
$P_{in}$	Input Power	$Z_g = Z_l = 50\Omega$	400	mW
$I_D$	Drain Current	-	2.2	A
$T_{ch}$	Channel Temperature	-	150	$^\circ C$
$T_{stg}$	Storage temperature	-	-40 to +125	$^\circ C$

Note: Above parameters are guaranteed independently.

\* Theoretical value in case of mounted on infinite heat sink.

## ELECTRICAL CHARACTERISTICS

( $T_c = 25^\circ C$ , 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	$\mu A$
$I_{GSS}$	Gate to source leak current	$V_{GS} = 10V$ , $V_{DS} = 0V$	-	-	1	$\mu A$
$V_{th}$	Gate threshold Voltage	$V_{DS} = 3.6V$ , $I_{DS} = 1mA$	0.5	1.0	1.5	V
$P_{out}$	Output power	$V_{DD} = 3.6V$ , $P_{in} = 0.2W$	-	2.3	-	W
$\eta_D$	Drain efficiency	$f = 470MHz$ , $I_{dq} = 140mA$	-	70	-	%

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

## TEMPERATURE CHARACTERISTICS

( $T_c = 25^\circ C$  UNLESS OTHERWISE NOTED)

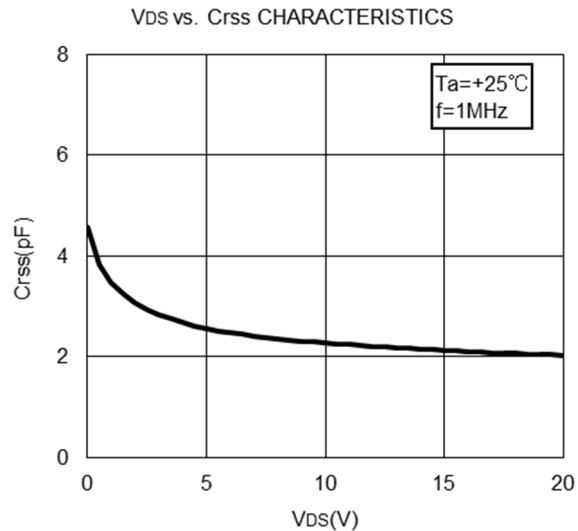
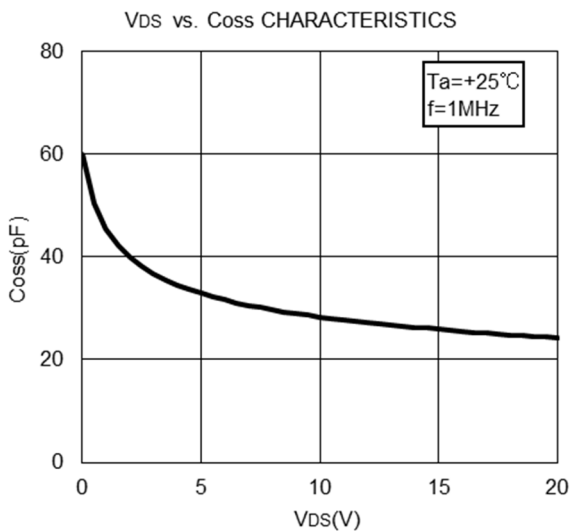
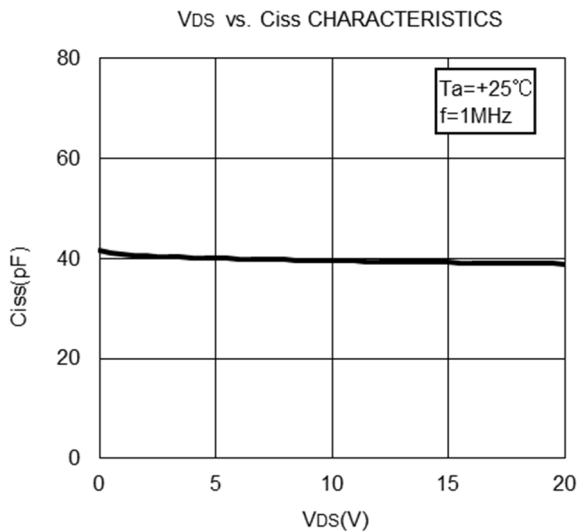
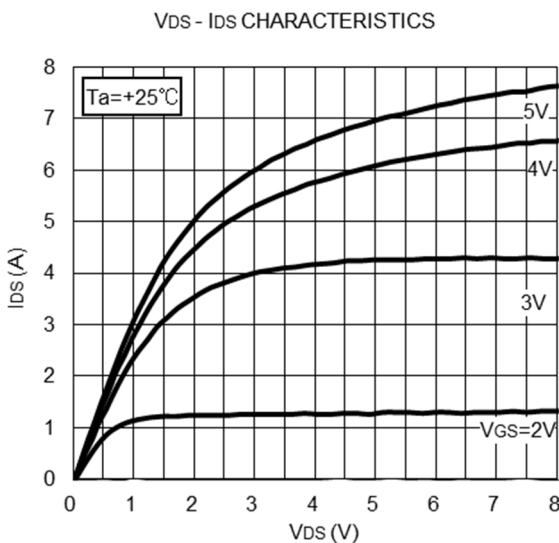
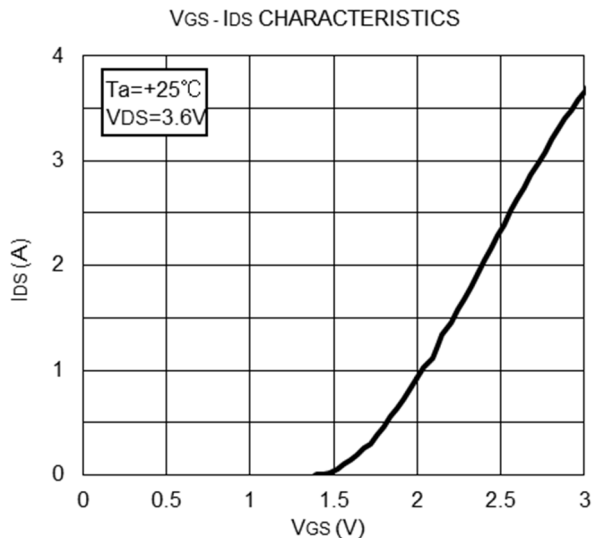
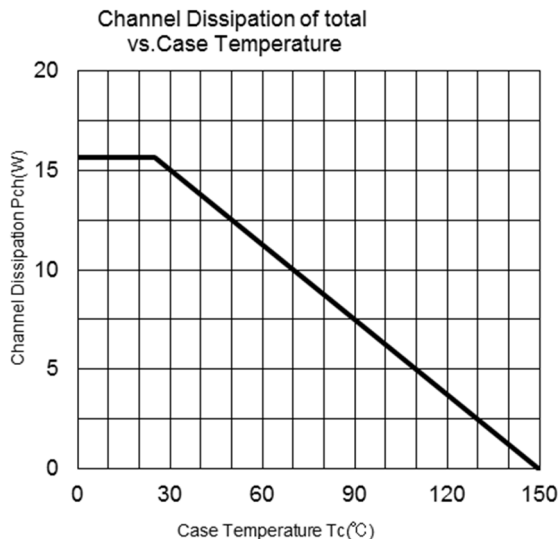
SYMBOL	PARAMETER	CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
$R_{th(j-c)}$	Thermal Resistance	Junction to Case	-	2.4	8.0	$^\circ C/W$

# RD02LUS2

RoHS Compliance, Silicon MOSFET Power Transistor 470MHz, 2W, 3.6V

## TYPICAL CHARACTERISTICS

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

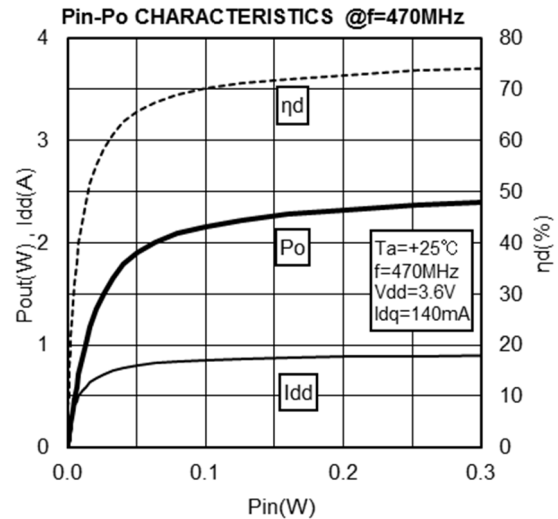
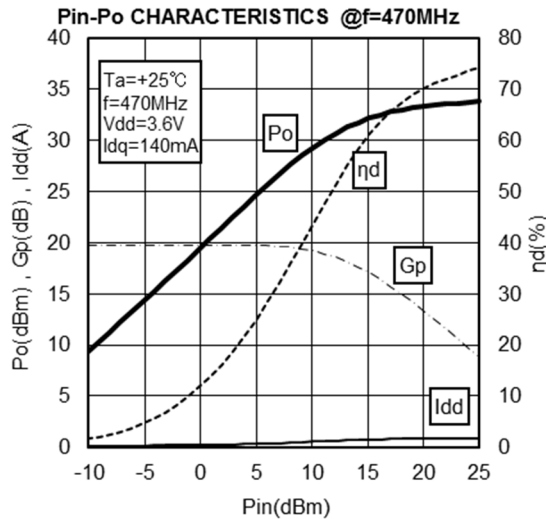


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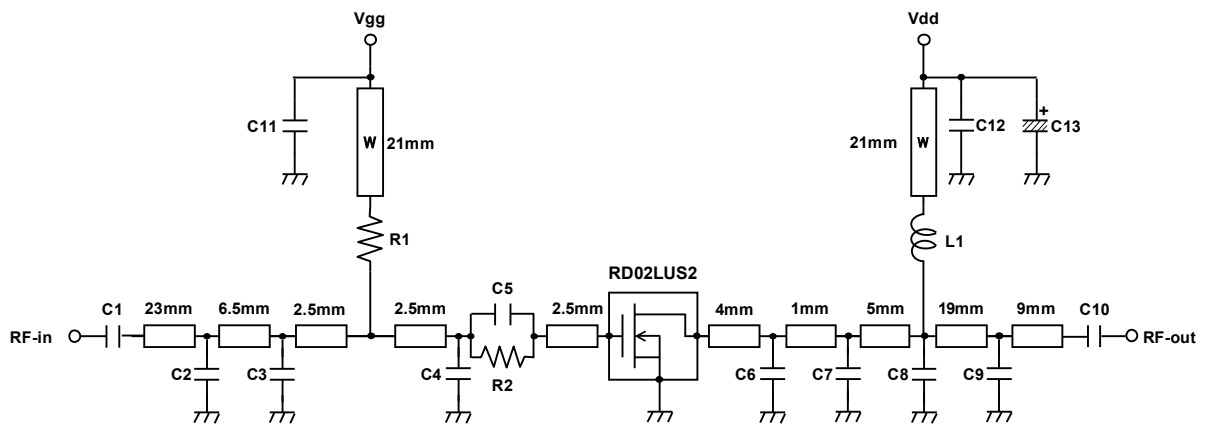
RoHS Compliance, Silicon MOSFET Power Transistor 470MHz, 2W, 3.6V

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## EQUIVALENT CIRCUITRY for UHF CIRCUIT (f=470MHz)



<Note>  
 Board material: Glass-Epoxy Substrate(εr=4.8, t=0.8mm)  
 Micro strip line width=1.3mm / 50 Ω  
 W line width=1.0mm

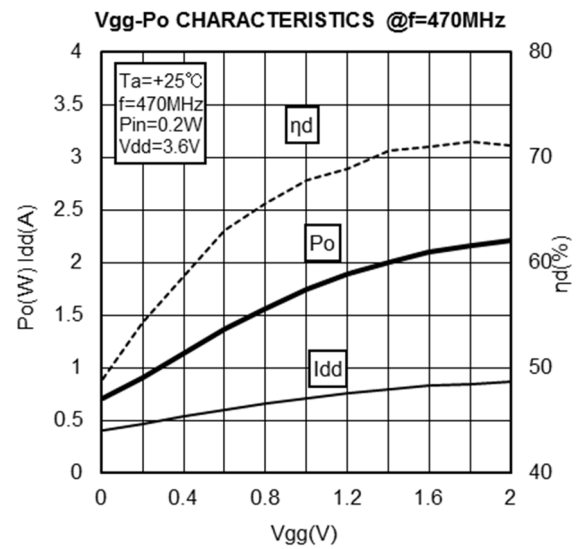
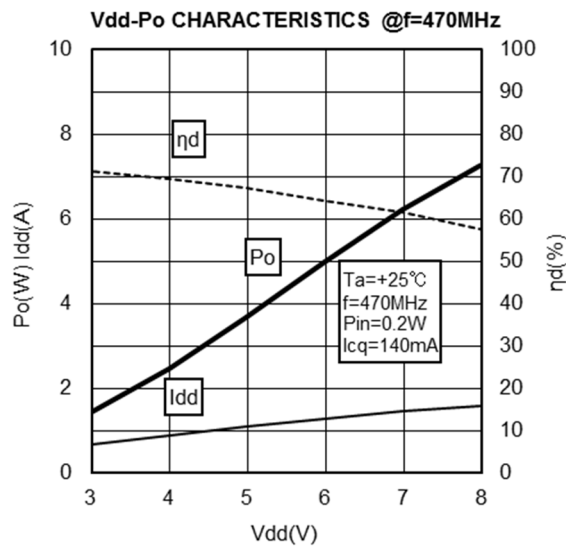
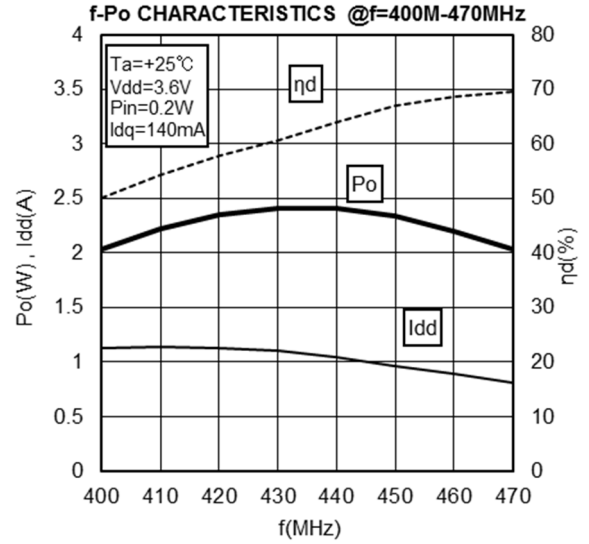
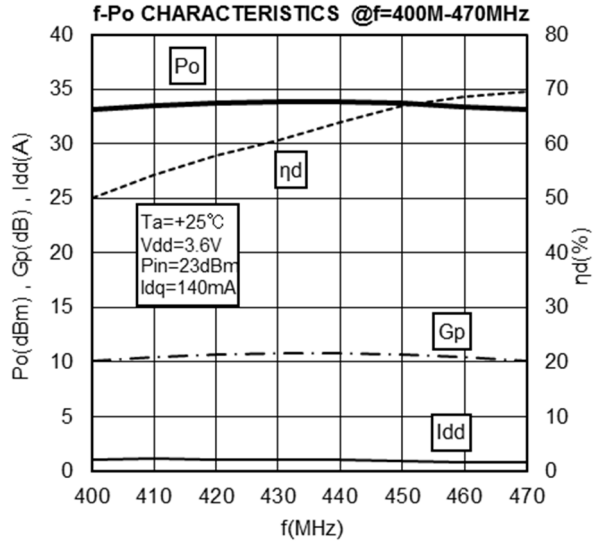
Part	Description	Part number	Manufacturer
C1, C10	200 pF	GRM2162C1H201JA01	MURATA MANUFACTURING CO.
C2	36 pF	GRM2162C1H360JZ01	MURATA MANUFACTURING CO.
C3	3 pF	GRM2162C1H3R0JA01	MURATA MANUFACTURING CO.
C4	43 pF	GRM2162C1H430JZ01	MURATA MANUFACTURING CO.
C5	100 pF	GRM1882C1H101JA01	MURATA MANUFACTURING CO.
C6, C7	24 pF	GQM2195C2E240JB12	MURATA MANUFACTURING CO.
C8	3 pF	GQM2195C2E3R0CB12	MURATA MANUFACTURING CO.
C9	10 pF	GQM2195C2E100JB12	MURATA MANUFACTURING CO.
C11, C12	910 pF	GRM2162C1H911JA01	MURATA MANUFACTURING CO.
C13	22 μF	UVZ1H220MDD	NICHICON CORPORATION
L1	37nH Enameled wire 7Turns, Diameter:0.4mm,φ2.46mm (the out side diameter)	4007C	Yoneda Processing Place Co.,Ltd.
R1	5.1 kΩ	RPC10 512-J	TAIYOSHA ELECTRIC CO.
R2	68 Ω	RPC05 680-J	TAIYOSHA ELECTRIC CO.

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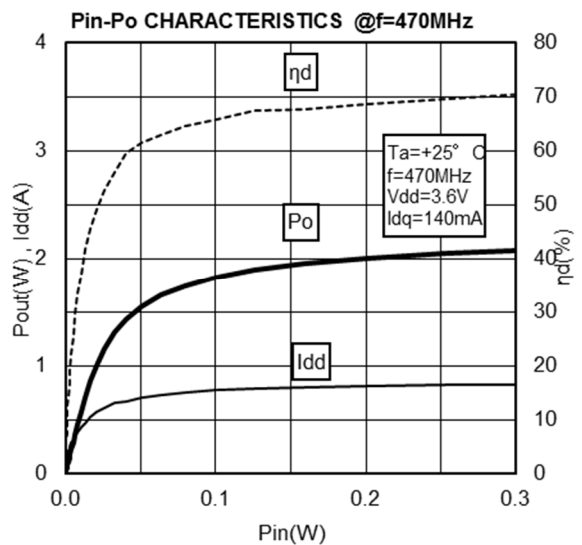
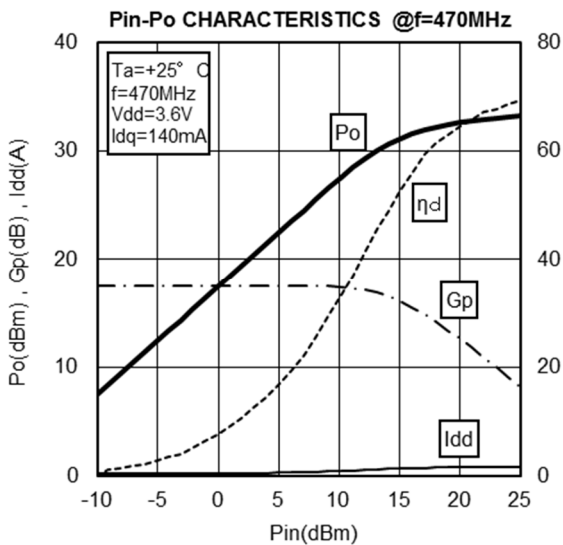
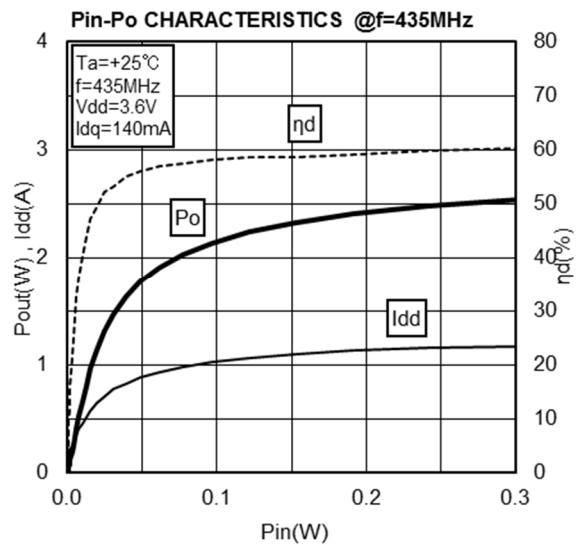
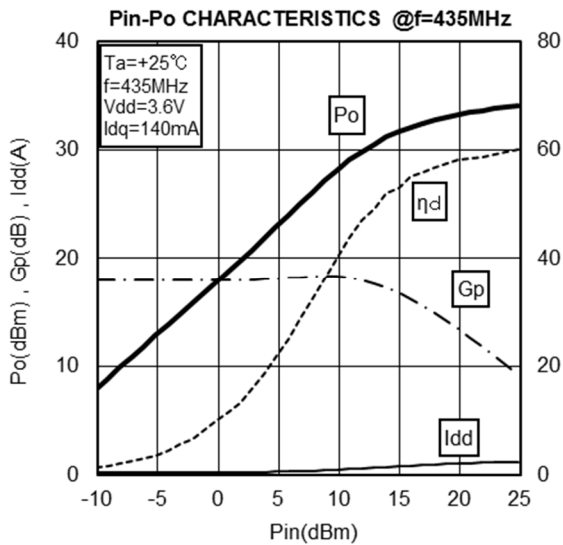
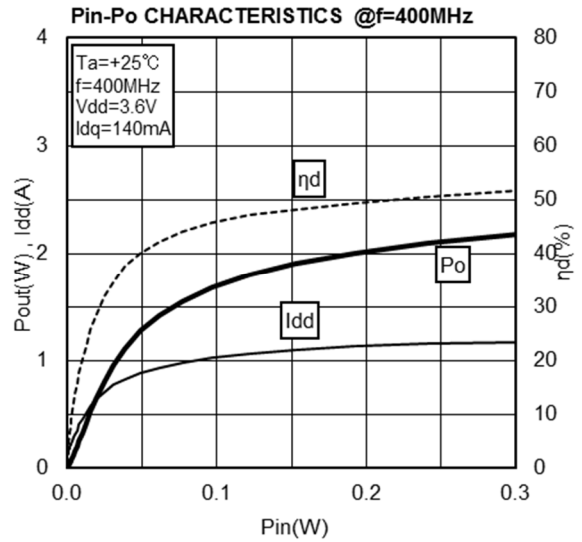
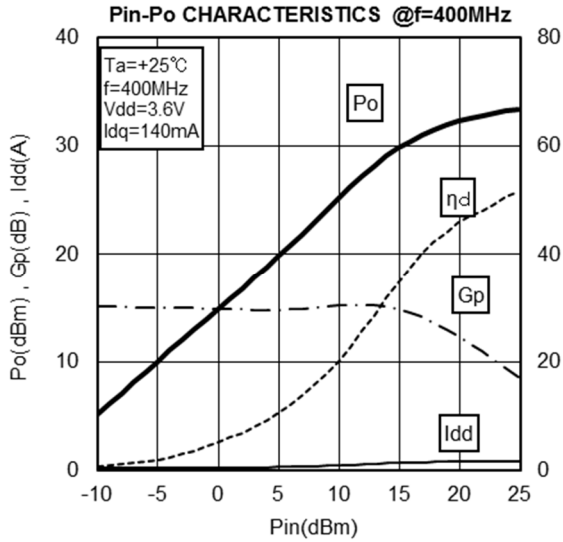


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## TYPICAL CHARACTERISTICS

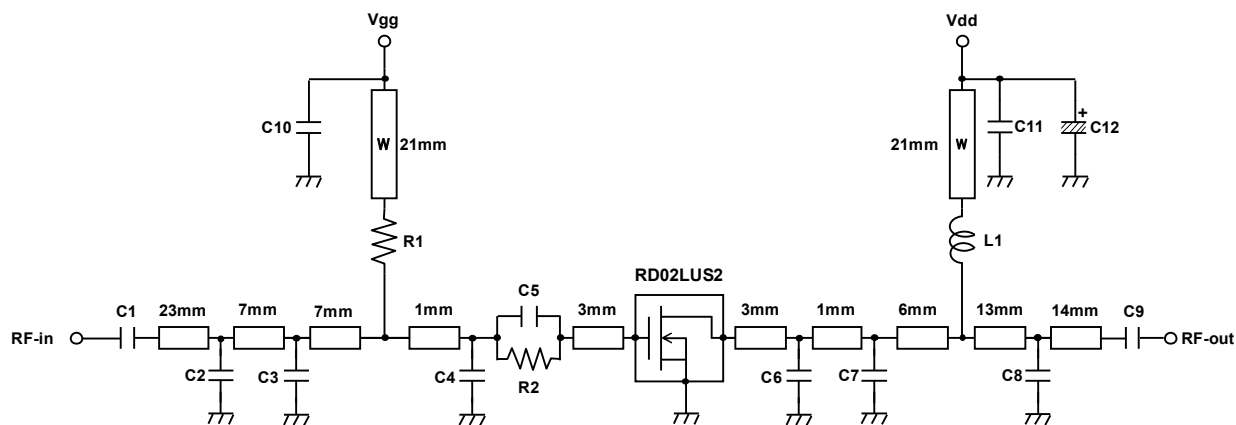
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# RD02LUS2

RoHS Compliance, Silicon MOSFET Power Transistor 470MHz, 2W, 3.6V

## EQUIVALENT CIRCUITRY for UHF CIRCUIT (f=400-470MHz)



<Note>  
 Board material: Glass-Epoxy Substrate( $\epsilon_r=4.8$ ,  $t=0.8\text{mm}$ )  
 Micro strip line width=1.3mm / 50  $\Omega$   
 W line width=1.0mm

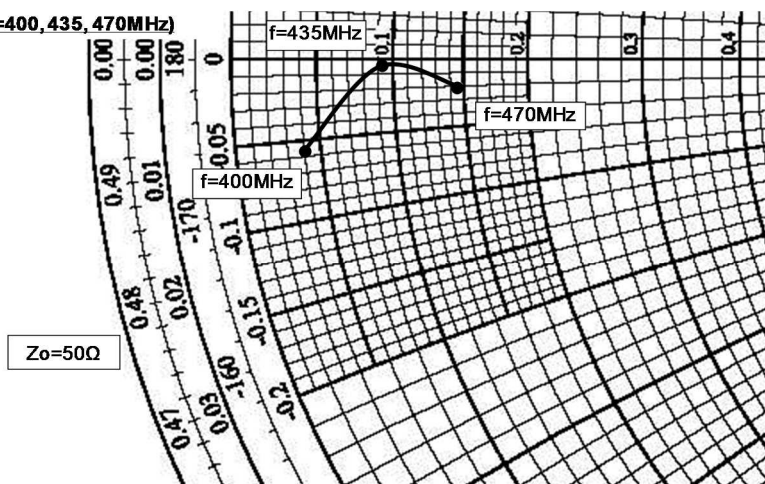
Part	Description	Part number	Manufacturer
C1, C9	200 pF	GRM2162C1H201JA01	MURATA MANUFACTURING CO.
C2	15 pF	GRM2162C1H150JZ01	MURATA MANUFACTURING CO.
C3	20 pF	GRM2162C1H200JZ01	MURATA MANUFACTURING CO.
C4	43 pF	GRM2162C1H430JZ01	MURATA MANUFACTURING CO.
C5	100 pF	GRM1882C1H101JA01	MURATA MANUFACTURING CO.
C6, C7	24 pF	GQM2195C2E240JB12	MURATA MANUFACTURING CO.
C8	12 pF	GRM2162C1H120JZ01	MURATA MANUFACTURING CO.
C10, C11	910 pF	GRM2162C1H911JA01	MURATA MANUFACTURING CO.
C12	22 $\mu\text{F}$	UVZ1H220MDD	NICHICON CORPORATION
L1	37nH Enameled wire 7Turns, Diameter:0.4mm, $\phi$ 2.46mm (the out side diameter)	4007C	Yoneda Processing Place Co.,Ltd.
R1	5.1 k $\Omega$	RPC10 512-J	TAIYOSHA ELECTRIC CO.
R2	68 $\Omega$	RPC05 680-J	TAIYOSHA ELECTRIC CO.

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## INPUT / OUTPUT IMPEDANCE VS. FREQUENCY CHARACTERISTICS

Zin\* (f=400, 435, 470MHz)

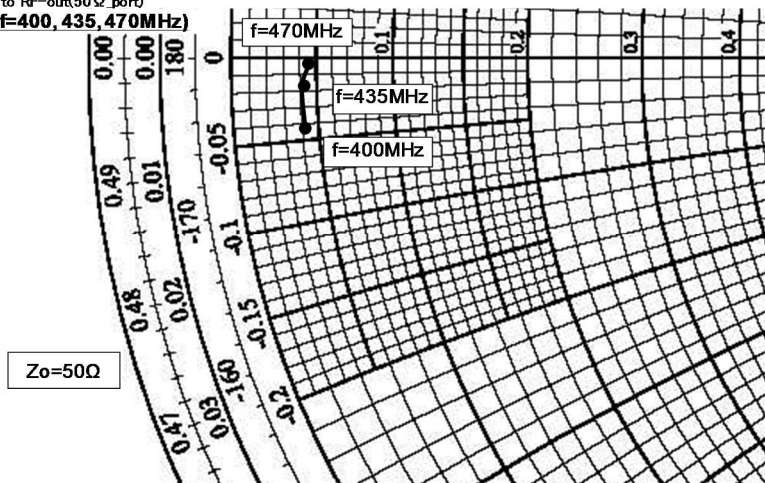


f (MHz)	Zin* (Ω)
400	3.44 - j 1.97
435	4.88 - j 0.49
470	6.80 - j 1.16

Zin\*: Complex conjugate of input impedance

from drain to RF-out(50Ω port)

Zout\* (f=400, 435, 470MHz)



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

Zout\*: Complex conjugate of output impedance

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## S-PARAMETER DATA( $V_{DS}=3.6V$ , $I_{dq}=140mA$ )

Freq. (MHz)	S11		S21		S12		S22	
	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)
100	0.76	-155	14.59	87	0.03	-2	0.70	-155
135	0.77	-160	10.70	80	0.02	-9	0.71	-159
155	0.77	-161	9.23	76	0.02	-12	0.72	-161
175	0.78	-163	8.09	73	0.02	-15	0.73	-162
200	0.79	-164	6.95	69	0.02	-18	0.74	-163
250	0.81	-166	5.34	62	0.02	-24	0.76	-164
300	0.82	-168	4.25	56	0.02	-29	0.79	-166
350	0.84	-169	3.47	51	0.02	-34	0.81	-167
400	0.86	-171	2.88	46	0.02	-38	0.83	-168
450	0.87	-172	2.43	42	0.02	-41	0.85	-169
500	0.88	-173	2.07	38	0.02	-44	0.86	-170
520	0.89	-174	1.95	36	0.01	-45	0.87	-171
530	0.89	-174	1.89	36	0.01	-45	0.87	-171
550	0.90	-174	1.78	34	0.01	-46	0.88	-172
600	0.91	-176	1.55	31	0.01	-49	0.89	-173
650	0.91	-177	1.36	28	0.01	-50	0.90	-174
700	0.92	-178	1.20	25	0.01	-52	0.91	-175
750	0.93	-179	1.07	23	0.01	-52	0.92	-176
800	0.93	-180	0.95	21	0.01	-52	0.93	-176
850	0.94	-179	0.86	18	0.01	-52	0.93	-177
900	0.94	-178	0.77	16	0.01	-52	0.94	-178
950	0.95	-177	0.70	14	0.01	-50	0.94	-179
1000	0.95	-177	0.64	13	0.00	-47	0.95	-180
1050	0.95	-176	0.59	11	0.00	-43	0.95	-179
1100	0.95	-175	0.54	9	0.00	-37	0.95	-179
1150	0.96	-174	0.49	8	0.00	-26	0.95	-178
1200	0.96	-173	0.46	6	0.00	-13	0.96	-177
1250	0.96	-172	0.42	5	0.00	3	0.96	-177
1300	0.96	-172	0.39	4	0.00	22	0.96	-176
1350	0.96	-171	0.36	3	0.00	36	0.96	-176
1400	0.96	-170	0.34	1	0.00	46	0.96	-175
1450	0.96	-169	0.32	0	0.00	54	0.96	-175
1500	0.96	-169	0.30	-1	0.00	61	0.96	-174



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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.

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10. Please avoid use in the place where water or organic solvents can adhere directly to the product and the environments with the possibility of caustic gas, dust, salinity, etc. Reliability could be markedly decreased and also there is a possibility failures could result causing a serious accident. Likewise, there is a possibility of causing a serious accident if used in an explosive gas environment. Please allow for adequate safety margin in your designs.

11. 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.

## **Notes regarding these materials**

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