MITSUBISHI ELECTRIC

< Silicon RF Power MOS FET (Discrete) >

RD04LUS2

RoHS Compliance,Silicon MOSFET Power Transistor,527MHz,4W,3.6V

DESCRIPTION

RD04LUS2 is a MOS FET type transistor specifically designed for VHF/UHF RF power amplifiers applications.

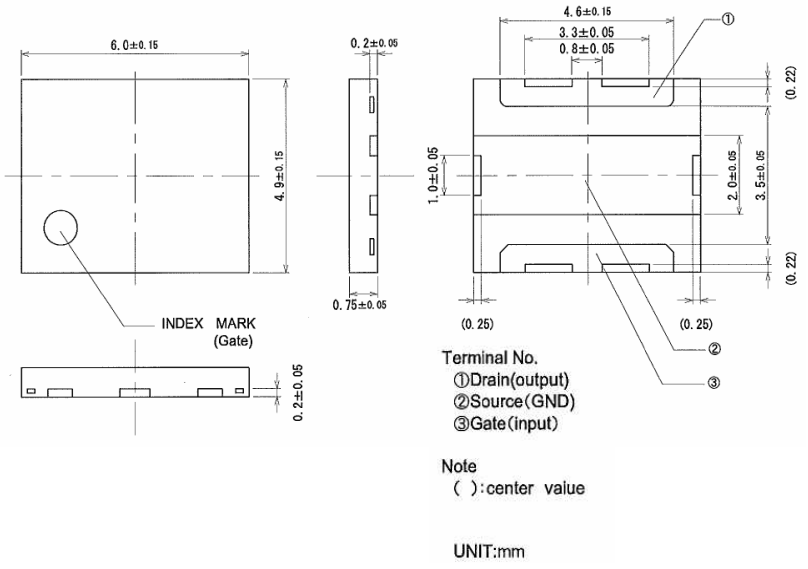
FEATURES

High power gain and High Efficiency.
Pout=4Wtyp, Drain Effi. =65%typ
@ Vds=3.6V, Idq=280mA, Pin=0.4W, f=527MHz
Integrated gate protection diode.

APPLICATION

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

OUTLINE DRAWING



RoHS COMPLIANT

RD04LUS2-501, T512, T514 is EU RoHS compliant.
RoHS compliance is indicating by the letter “G” after the Lot Marking.

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

SYMBOL	PARAMETER	CONDITIONS	RATINGS	UNIT
VDSS	Drain to source voltage	V_{GS}=0V	25	V
VGSS	Gate to source voltage	V_{DS}=0V	-5/+10	V
Pch*	Channel dissipation	Tc=25°C	46	W
Pin	Input Power	Zg=Zl=50Ω	0.8	W
Pout	Output Power	Zg=Zl=50Ω	7	W
ID	Drain Current	-	3.0	A
Tch	Junction Temperature	-	150	°C
Tstg	Storage temperature	-	-40 to +125	°C

Note: Above parameters are guaranteed independently.

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

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

SYMBOL	PARAMETER	CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX.	
I_{DSS}	Drain cutoff current	V_{DS}=17V, V_{GS}=0V	-	-	50	uA
I_{GSS}	Gate cutoff current	V_{GS}=5V, V_{DS}=0V	-	-	1	uA
V_{TH}	Gate threshold Voltage	V_{DS}=3.6V, I_{DS}=1mA	0.5	1	1.5	V
Pout	Output power	f=527MHz ,V_{DS}=3.6V Pin=0.4W,Idq=280mA	3.6*	4* (4.5**)	-	W
ηD	Drain efficiency		56*	60* (65**)	-	%
VSWRT	Load VSWR tolerance	V_{DS}=4.2V,Po=4W(Pin Control) f=135MHz,Idq=280mA,Zg=50Ω Load VSWR=20:1(All Phase)	No destroy			-

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

* In Mitsubishi 527MHz Test fixture of clamping mechanism.

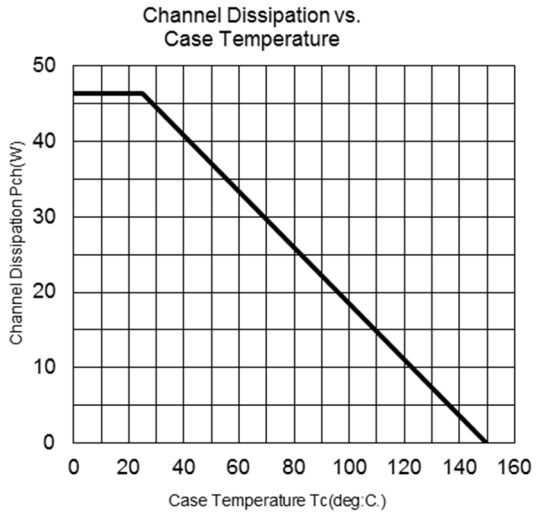
** In Mitsubishi 527MHz Evaluation Board.

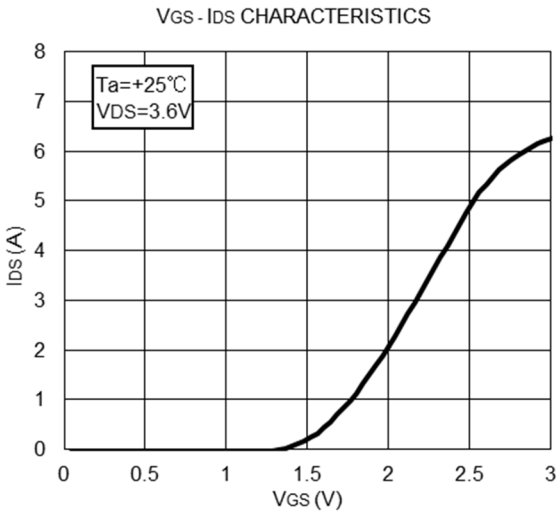
TEMPERATURE CHARACTERISTICS (Tc=25°C UNLESS OTHERWISE NOTED)

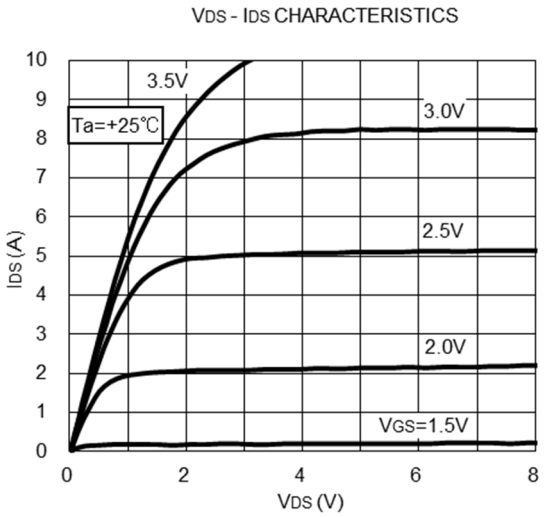
SYMBOL	PARAMETER	CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
Rth(j-c)	Thermal Resistance	Junction to Case	-	2.0	2.7	°C /W

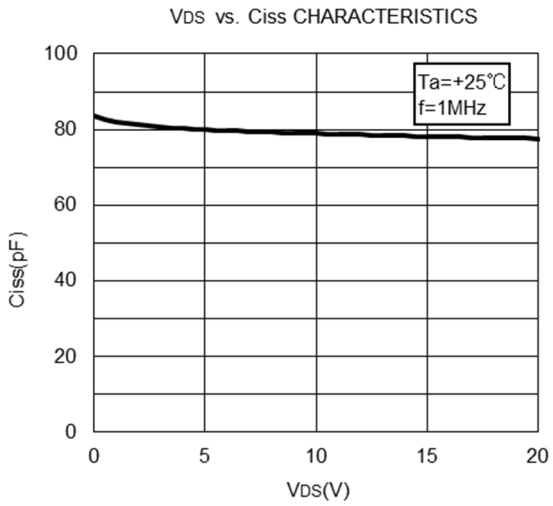
TYPICAL CHARACTERISTICS

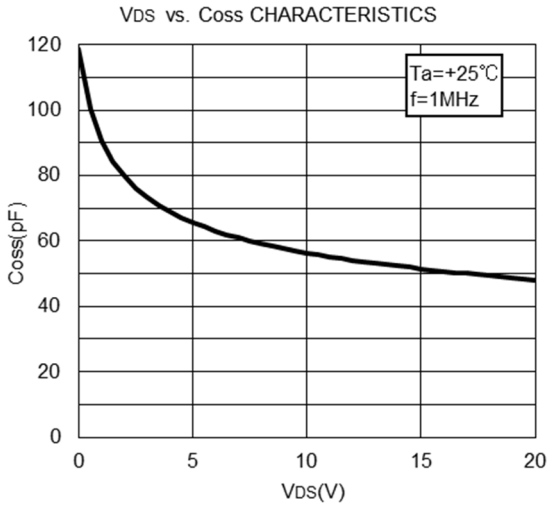
(These are only typical curves and devices are not necessarily guaranteed at these curves.)

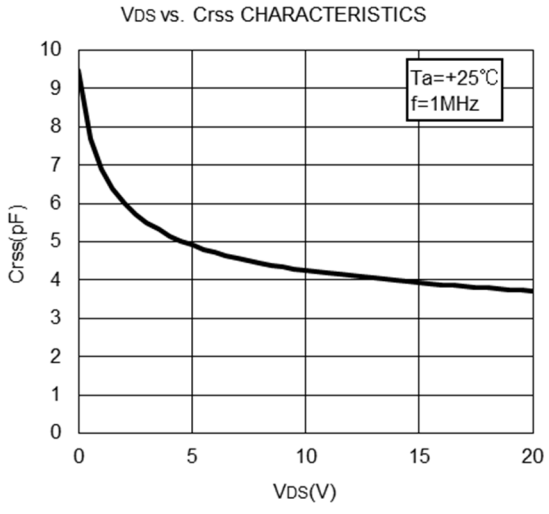












TYPICAL CHARACTERISTICS (f=450-527MHz)

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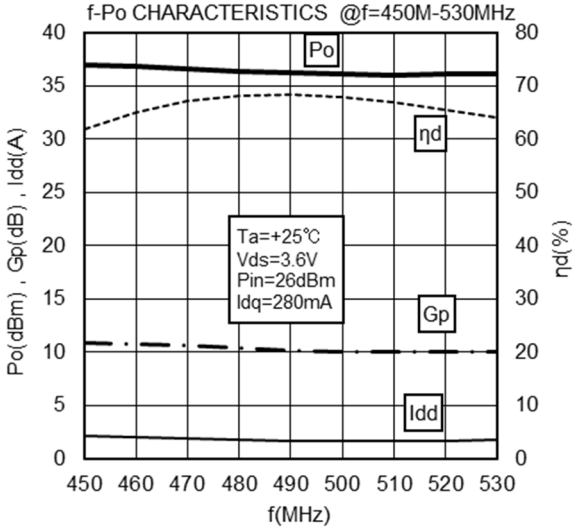

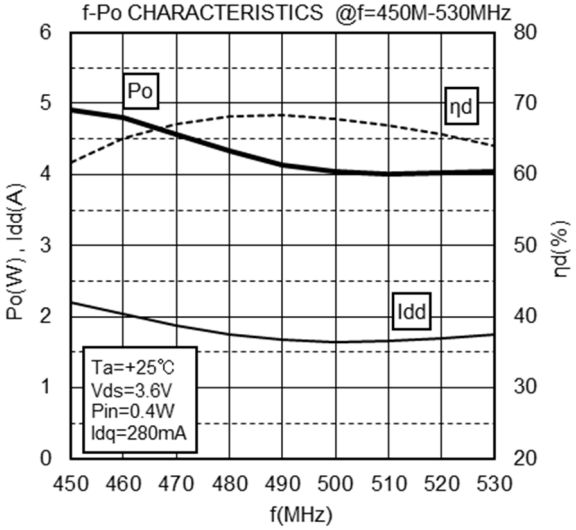

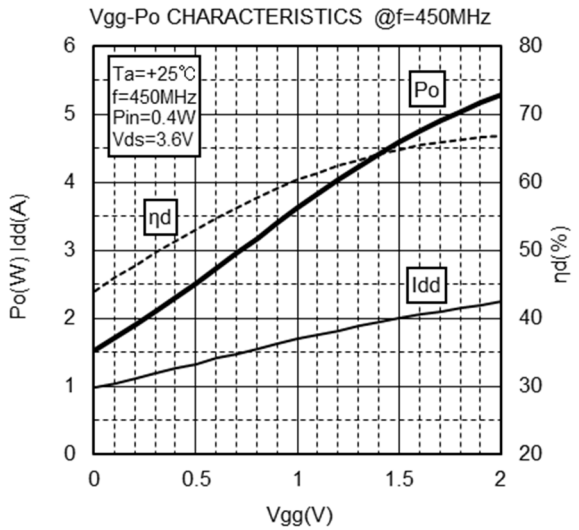

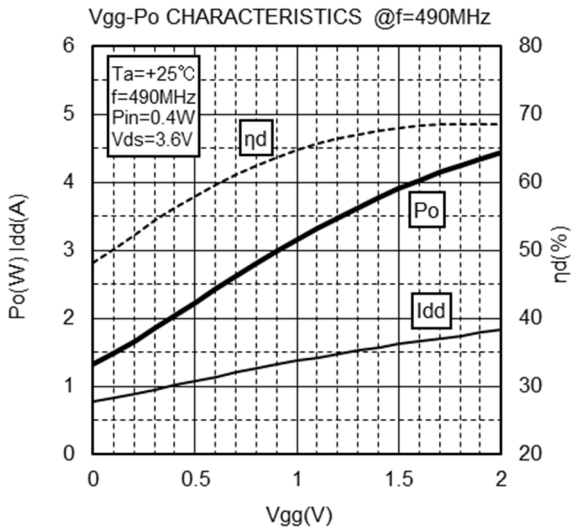

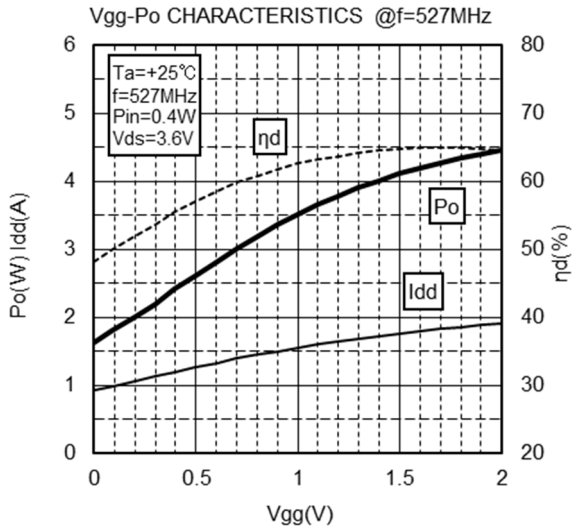

TYPICAL CHARACTERISTICS (f=450-527MHz)

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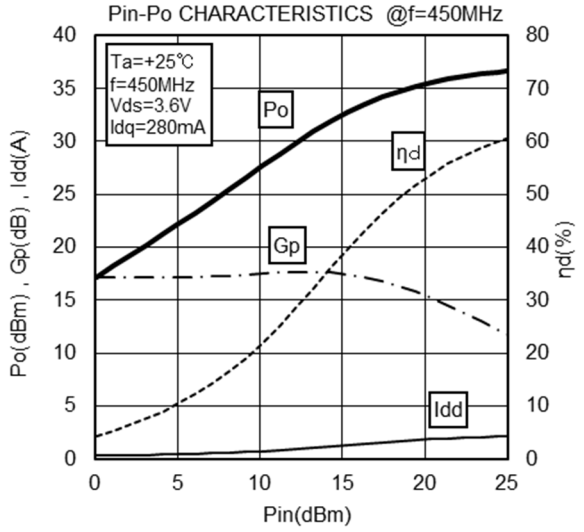
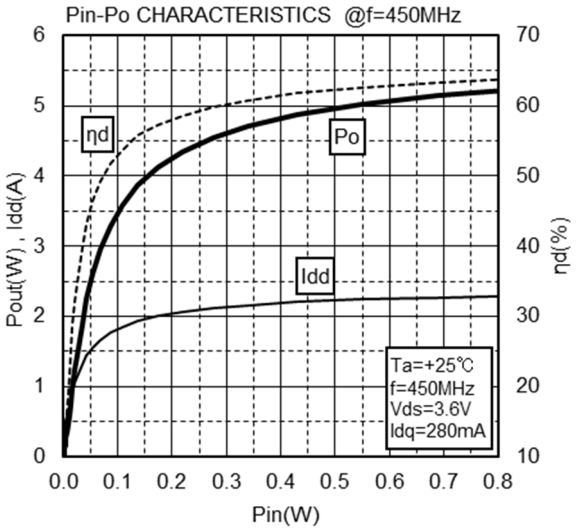
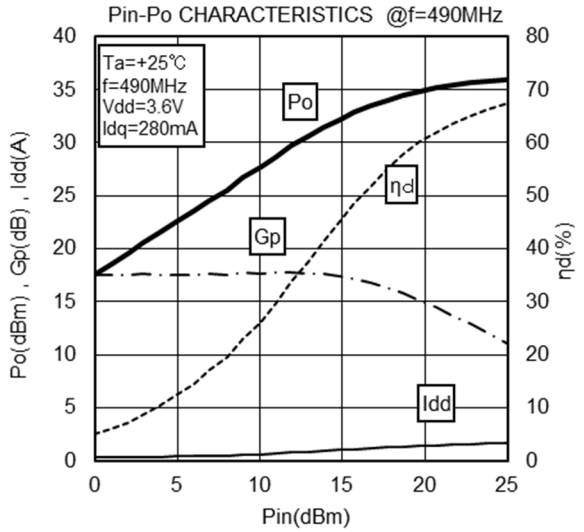
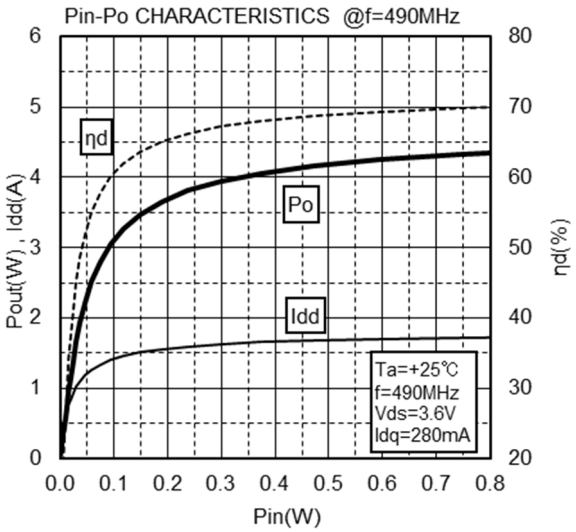
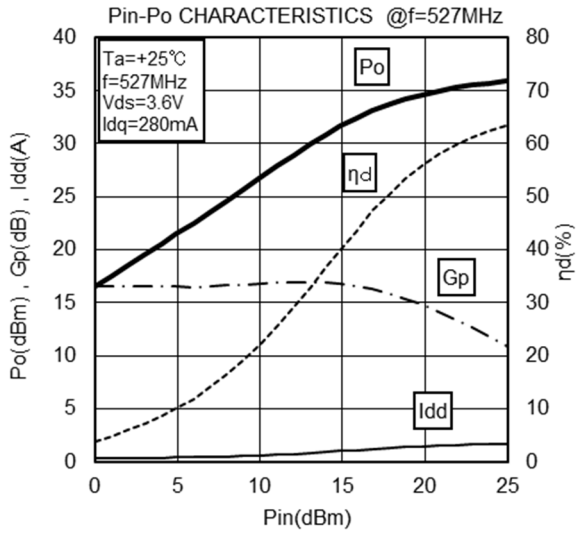
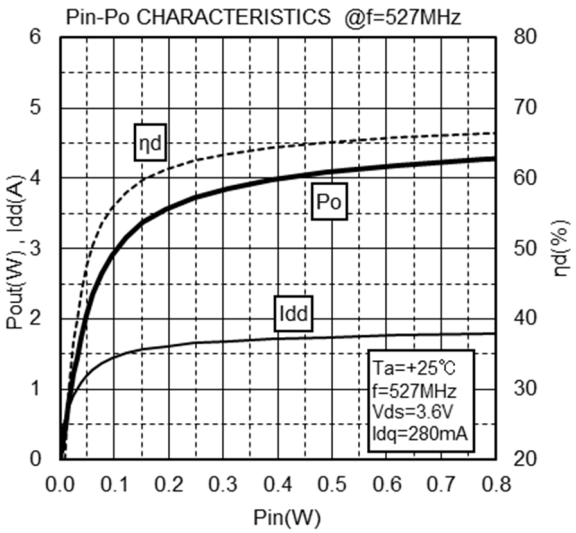








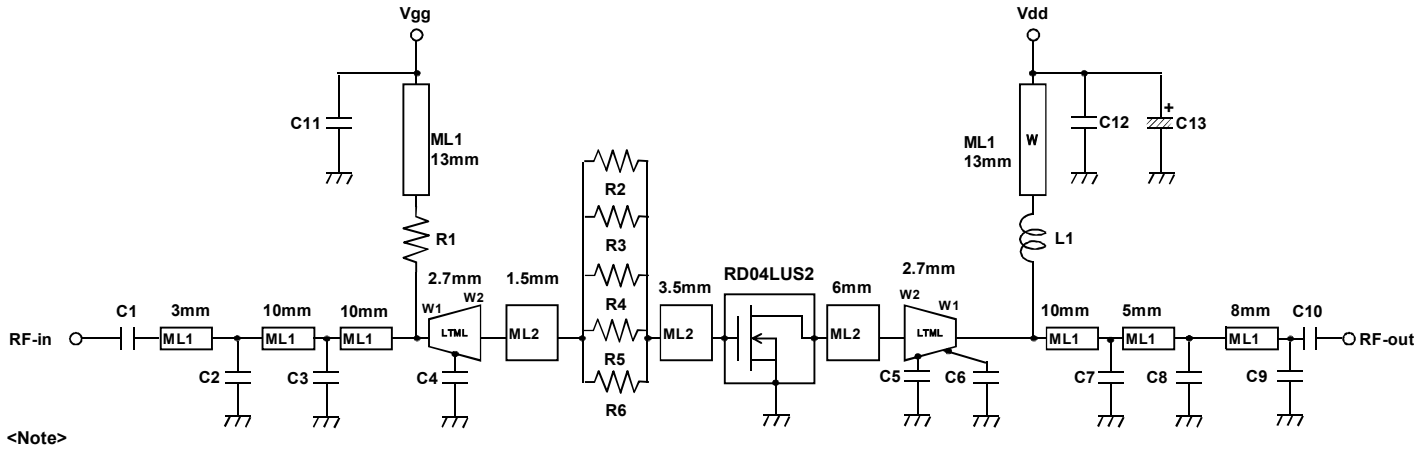




RD04LUS2

RoHS Compliance,Silicon MOSFET Power Transistor,527MHz,4W,3.6V

EQUIVALENT CIRCUITRY for UHF Circuit for f=450-527MHz



<Note>
Board meterial: Glass-Epoxy Substrate(εr=4.8, t=0.6mm, TanD=0.018@1.0GHz)
ML1 : Microstrip line (width=1.0mm / 50 Ω),
ML2:Microstrip line (width=6.0mm / 15 Ω)
LTML : Linear tapered microstrip line (w1=1.0mm, w2=6.0mm, L=2.7mm)

No.	Description	P/N	Manufacturer
Tr	MOSFET	RD04LUS2	Mitsubishi Electric Corporation
C 1	100 pF	GQM2195C2E101JB12	MURATA MANUFACTURING CO.
C 2	10 pF	GQM1882C1H100JB01	MURATA MANUFACTURING CO.
C 3	20 pF	GQM1882C1H200JB01	MURATA MANUFACTURING CO.
C 4	62 pF	GQM2195C2E620JB12	MURATA MANUFACTURING CO.
C 5	51 pF	GQM2195C2E510JB12	MURATA MANUFACTURING CO.
C 6	20 pF	GQM2195C2E200JB12	MURATA MANUFACTURING CO.
C 7	3 pF	GQM2195C2E3R0CB12	MURATA MANUFACTURING CO.
C 8	16 pF	GQM2195C2E160JB12	MURATA MANUFACTURING CO.
C 9	1 pF	GQM2195C2E1R0JB12	MURATA MANUFACTURING CO.
C 10	100 pF	GQM2195C2E101JB12	MURATA MANUFACTURING CO.
C 11	1000 pF	GRM1882C1H102JA01	MURATA MANUFACTURING CO.
C 12	0.22 uF	GRM21BR71H224KA01	MURATA MANUFACTURING CO.
C 13	330 uF	UVZ1H331MPD	NICHICON CORPORATION
L 1	29nH Enameled wire 6Turns, Diameter:0.4mm,φ2.46mm (the out side diameter)	4006C	Yoneda Processing Place Co.,Ltd.
R 1	4.7 kΩ	RPC05 472-J	TAIYOSHA ELECTRIC CO.
R 2	2.2 Ω	RPC10 2R2-J	TAIYOSHA ELECTRIC CO.
R 3	2.2 Ω	RPC10 2R2-J	TAIYOSHA ELECTRIC CO.
R 4	2.2 Ω	RPC10 2R2-J	TAIYOSHA ELECTRIC CO.
R 5	2.2 Ω	RPC10 2R2-J	TAIYOSHA ELECTRIC CO.
R 6	2.2 Ω	RPC10 2R2-J	TAIYOSHA ELECTRIC CO.

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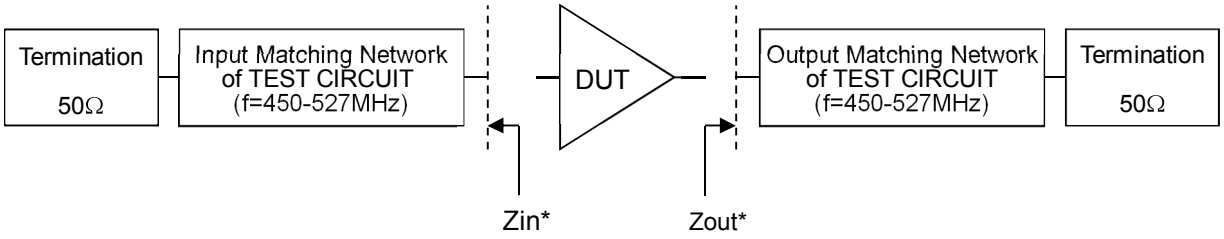
input / Output Impedance VS. Frequency Characteristics for f=450-527MHz

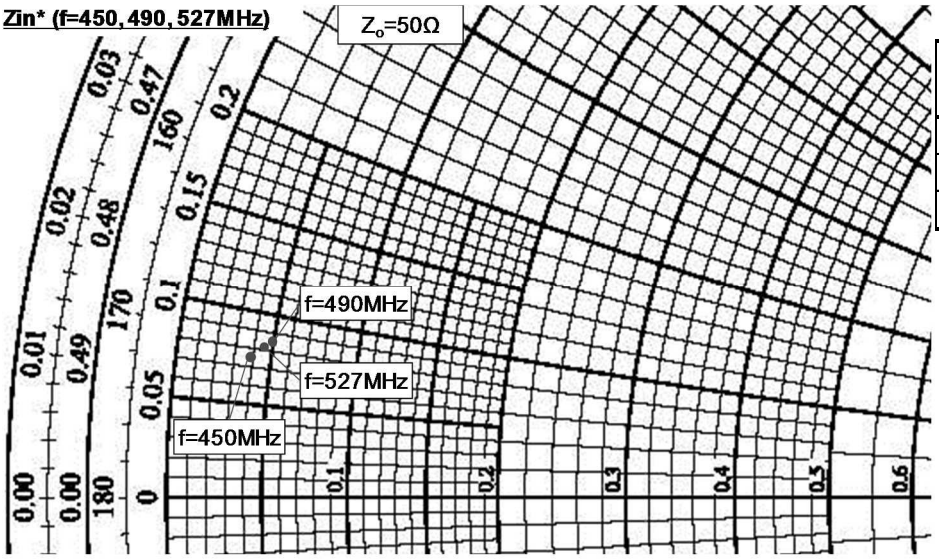
Method of Measurement



Zin*: Input Matching Network impedance measured from DUT

Zout*: Output Matching Network impedance measured from DUT

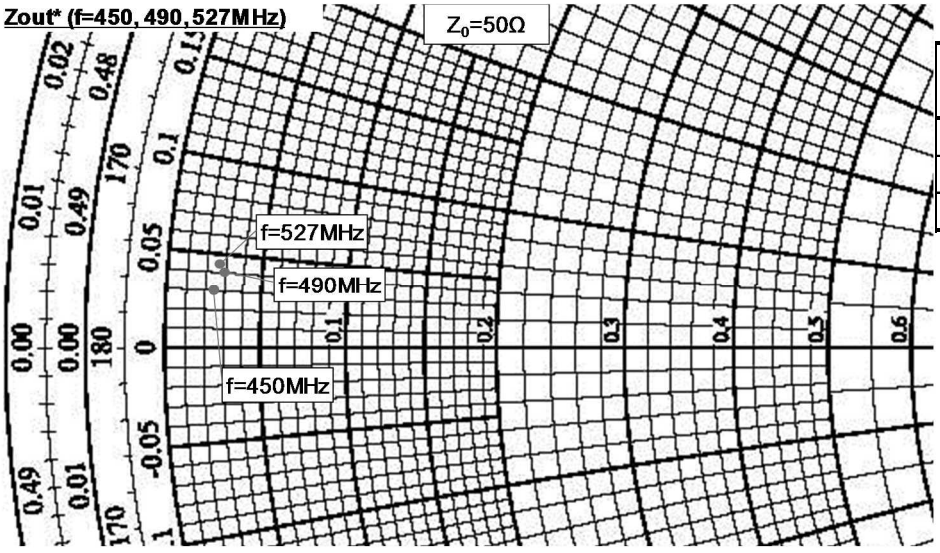
Z_0: Characteristic impedance



@Pin=0.4W, Vds=3.6V,Idq=0.28A

f (MHz)	Zin* (Ω)
450	1.99 + j 3.72
490	2.49 + j 4.27
527	2.35 + j 4.06

Zin*: Complex conjugate of input impedance



@Pin=0.4W, Vds=3.6V,Idq=0.28A

f (MHz)	Zout* (Ω)
450	1.32 + j 1.50
490	1.51 + j 1.98
527	1.39 + j 2.15

Zout*: Complex conjugate of output impedance

TYPICAL CHARACTERISTICS (f=135-175MHz)

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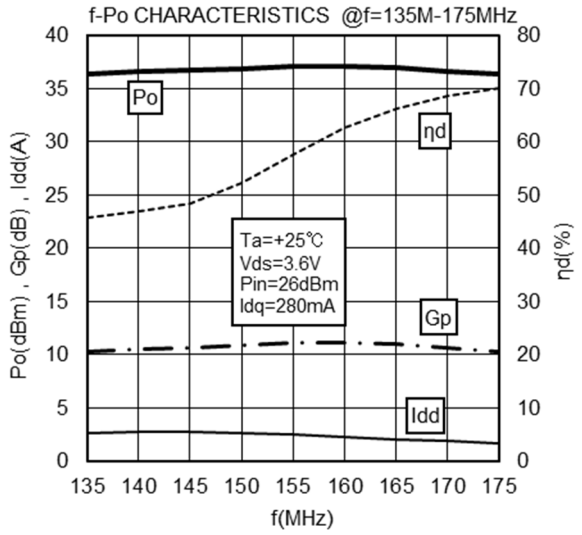

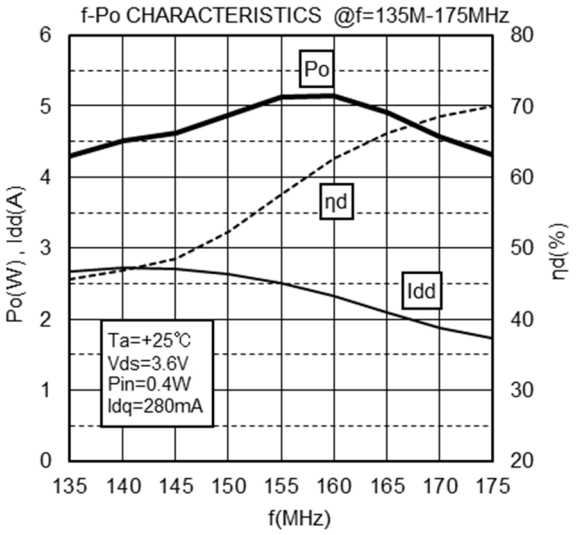

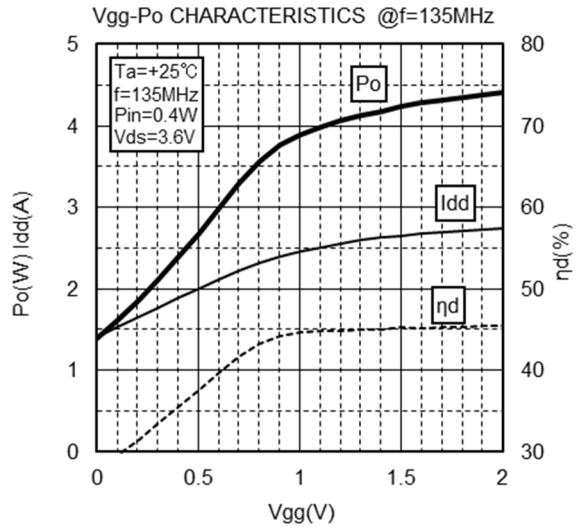

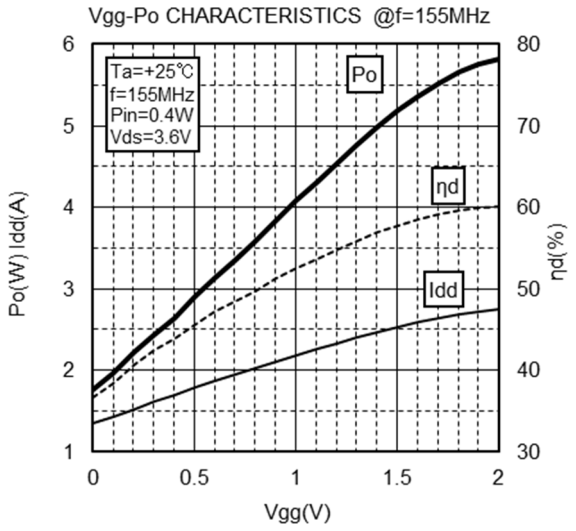

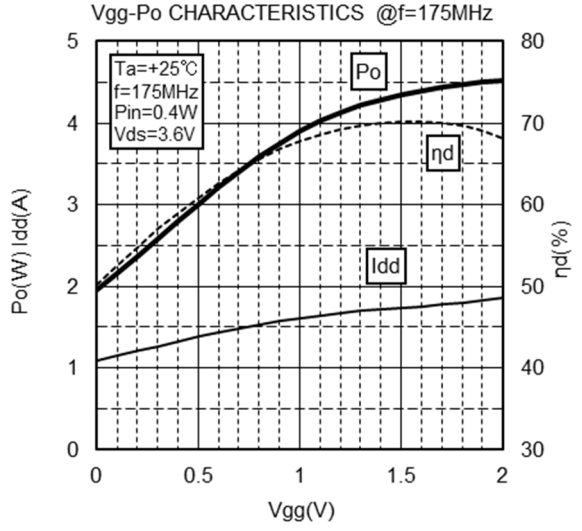

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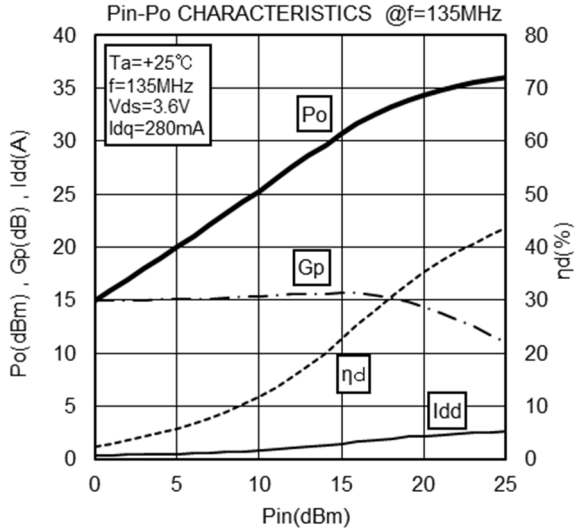

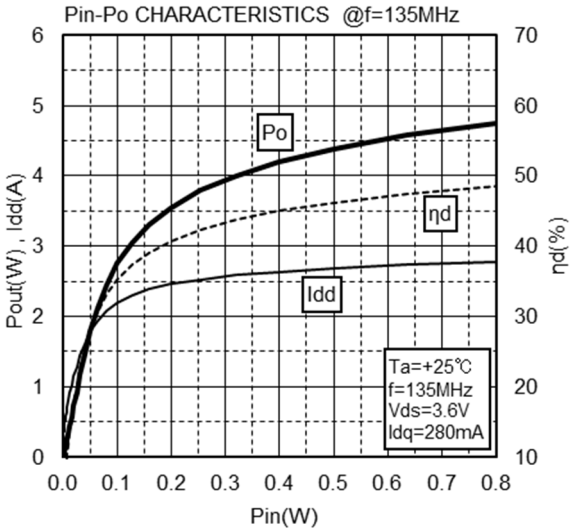

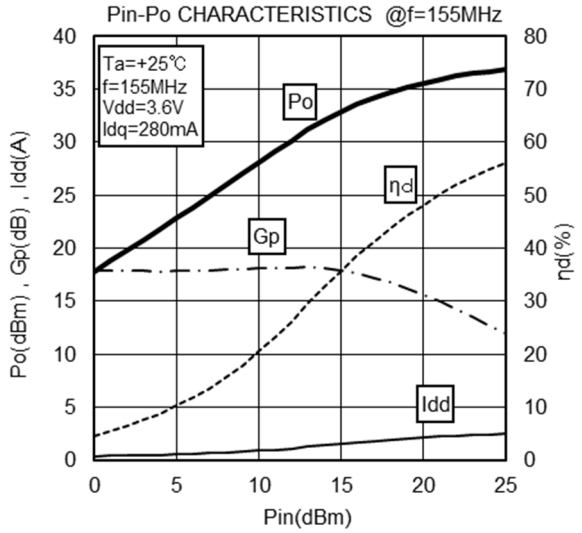

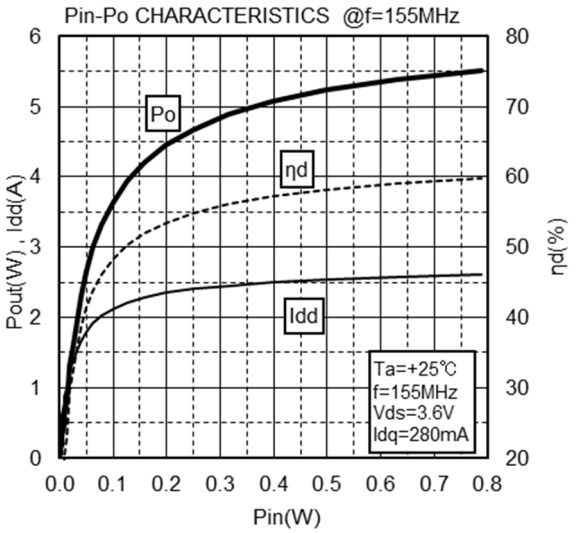

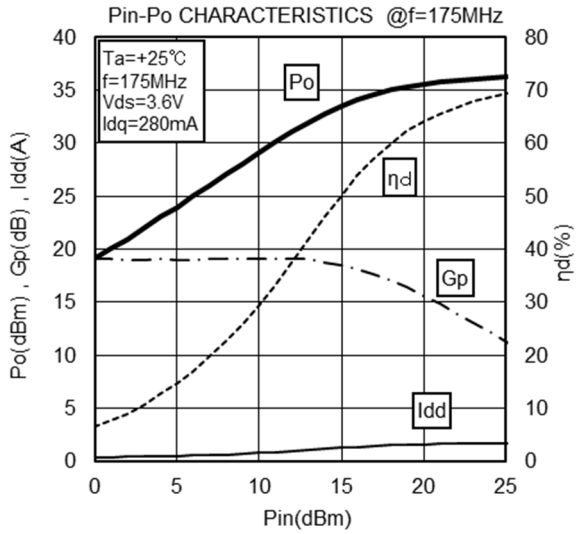

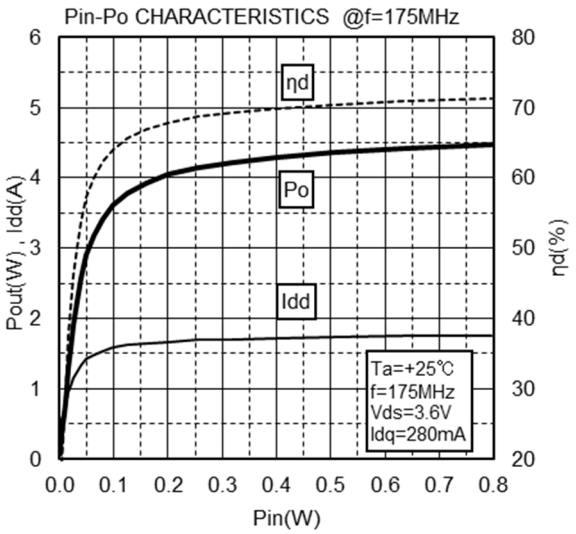

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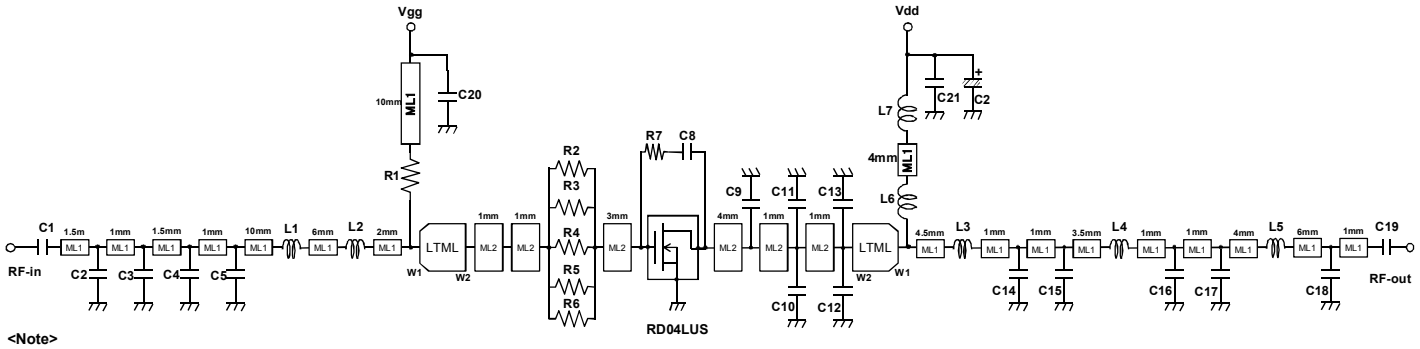

<Note>
Board meterial: Glass-Epoxy Substrate(εr=4.8, t=0.6mm,TanD=0.018@f=1GHz)
Micro strip line1(ML1): width=1.0mm / 50 Ω)
Micro strip line2(ML2): width=6.0mm / 15 Ω)
Linear Taper Microstrip Line(LTML) : Width1 = 1.0mm,Width2 = 6.0mm.L=2.7mm

No.	Description	P/N	Manufacturer
Tr	MOSFET	RD04LUS2	Mitsubishi Electric Corporation
C 1	100 pF	GQM2195C2E101JB12	MURATA MANUFACTURING CO.
C 2	7.5 pF	GQM1882C1H7R5CB01	MURATA MANUFACTURING CO.
C 3	7.5 pF	GQM1882C1H7R5CB01	MURATA MANUFACTURING CO.
C 4	13 pF	GQM1882C1H130JB01	MURATA MANUFACTURING CO.
C 5	13 pF	GQM1882C1H130JB01	MURATA MANUFACTURING CO.
C 6	20 pF	GQM1882C1H200JB01	MURATA MANUFACTURING CO.
C 7	30 pF	GQM1882C1H300JB01	MURATA MANUFACTURING CO.
C 8	56 pF	GQM1882C1H560JB01	MURATA MANUFACTURING CO.
C 9	100 pF	GQM1882C1H101JB01	MURATA MANUFACTURING CO.
C 10	100 pF	GQM1882C1H101JB01	MURATA MANUFACTURING CO.
C 11	100 pF	GQM1882C1H101JB01	MURATA MANUFACTURING CO.
C 12	51 pF	GQM1882C1H510JB01	MURATA MANUFACTURING CO.
C 13	51 pF	GQM1882C1H510JB01	MURATA MANUFACTURING CO.
C 14	47 pF	GQM1882C1H470JB01	MURATA MANUFACTURING CO.
C 15	47 pF	GQM1882C1H470JB01	MURATA MANUFACTURING CO.
C 16	5.1 pF	GQM1882C1H5R1CB01	MURATA MANUFACTURING CO.
C 17	5.1 pF	GQM1882C1H5R1CB01	MURATA MANUFACTURING CO.
C 18	15 pF	GQM1882C1H150JB01	MURATA MANUFACTURING CO.
C 19	100 pF	GQM2195C2E101JB12	MURATA MANUFACTURING CO.
C 20	1000 pF	GRM1882C1H102JA01	MURATA MANUFACTURING CO.
C 21	1000 pF	GRM1882C1H102JA01	MURATA MANUFACTURING CO.
C 22	22 uF	UVZ1H220MDD	NICHICON CORPORATION
L 1	8nH Enameled wire 3Turns, Diameter:0.23mm,φ1.62mm (the out side diameter)	2303A	Yoneda Processing Place Co.,Ltd.
L 2	12nH Enameled wire 3Turns, Diameter:0.23mm,φ1.62mm (the out side diameter)	2303A	Yoneda Processing Place Co.,Ltd.
L 3	8nH Enameled wire 2Turns, Diameter:0.23mm,φ1.62mm (the out side diameter)	2302S	Yoneda Processing Place Co.,Ltd.
L 4	8nH Enameled wire 2Turns, Diameter:0.23mm,φ1.62mm (the out side diameter)	2302S	Yoneda Processing Place Co.,Ltd.
L 5	8nH Enameled wire 2Turns, Diameter:0.23mm,φ1.62mm (the out side diameter)	2302S	Yoneda Processing Place Co.,Ltd.
L 6	33nH Enameled wire 6Turns, Diameter:0.4mm,φ2.46mm (the out side diameter)	4006C	Yoneda Processing Place Co.,Ltd.
L 7	37nH Enameled wire 7Turns, Diameter:0.4mm,φ2.46mm (the out side diameter)	4007C	Yoneda Processing Place Co.,Ltd.
R 1	4.7 kΩ	RPC05 472-J	TAIYOSHA ELECTRIC CO.
R 2	10 Ω	RPC05 100-J	TAIYOSHA ELECTRIC CO.
R 3	10 Ω	RPC05 100-J	TAIYOSHA ELECTRIC CO.
R 4	10 Ω	RPC05 100-J	TAIYOSHA ELECTRIC CO.
R 5	10 Ω	RPC05 100-J	TAIYOSHA ELECTRIC CO.
R 6	10 Ω	RPC05 100-J	TAIYOSHA ELECTRIC CO.
R 7	270 Ω	RPC05 271-J	TAIYOSHA ELECTRIC CO.

RD04LUS2

RoHS Compliance,Silicon MOSFET Power Transistor,527MHz,4W,3.6V

RD04LUS2 S-Parameter data (Vdd=3.6V, Id=280mA)

Freq.	S11		S21		S12		S22	
(MHz)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)
100	0.85	-172	8.41	79	0.01	-10	0.81	-172
135	0.85	-174	6.11	73	0.01	-15	0.82	-173
155	0.86	-174	5.25	70	0.01	-17	0.83	-173
175	0.86	-174	4.58	67	0.01	-20	0.83	-174
200	0.87	-175	3.92	64	0.01	-23	0.84	-174
250	0.88	-175	2.99	57	0.01	-28	0.86	-174
300	0.89	-176	2.36	51	0.01	-32	0.87	-175
350	0.90	-177	1.91	46	0.01	-36	0.89	-175
380	0.91	-177	1.70	44	0.01	-38	0.89	-175
400	0.91	-177	1.57	42	0.01	-39	0.90	-176
435	0.92	-178	1.39	39	0.01	-41	0.91	-176
450	0.92	-178	1.32	38	0.01	-42	0.91	-176
470	0.92	-178	1.23	36	0.01	-42	0.91	-176
500	0.93	-179	1.12	34	0.01	-43	0.92	-177
527	0.93	-179	1.03	32	0.01	-44	0.92	-177
550	0.93	-179	0.96	31	0.01	-45	0.92	-177
600	0.94	-180	0.83	28	0.01	-46	0.93	-178
650	0.94	179	0.73	26	0.01	-46	0.94	-178
700	0.95	179	0.64	23	0.00	-45	0.94	-179
750	0.95	178	0.57	21	0.00	-44	0.95	-179
800	0.95	177	0.51	19	0.00	-41	0.95	-180
850	0.96	177	0.46	17	0.00	-38	0.95	179
900	0.96	176	0.42	15	0.00	-33	0.96	179
950	0.96	176	0.38	14	0.00	-24	0.96	178
1000	0.96	175	0.35	12	0.00	-16	0.96	178

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 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.

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