MITSUBISHI ELECTRIC

< Silicon RF Power MOS FET (Discrete) >

RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

DESCRIPTION

RD06LUS2 is a MOSFET type transistor specifically designed for VHF/UHF RF power amplifiers.

FEATURES

High Power and High Efficiency.
Pout=6.5Wtyp, Drain Effi. =65%typ
@ Vdd=3.6V, Idq=0.52A,
Pin=0.6W, f=520MHz
Integrated gate protection diode.

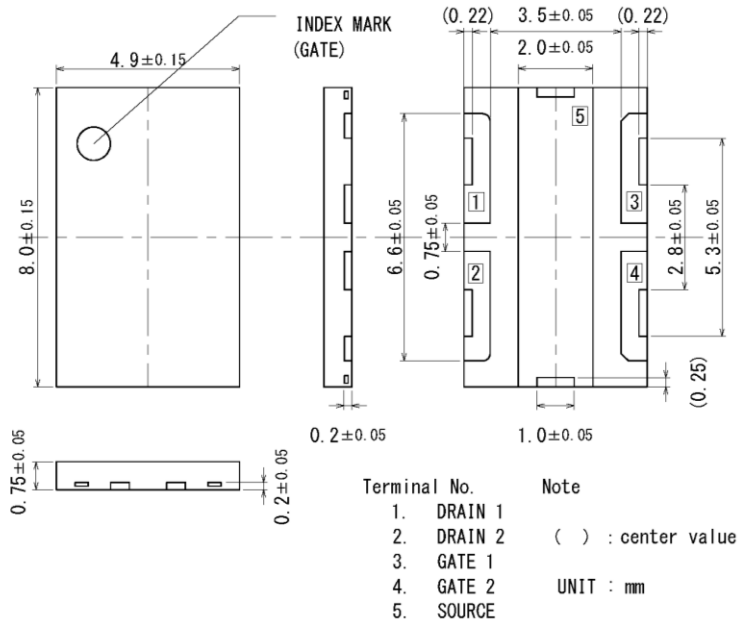
APPLICATION

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

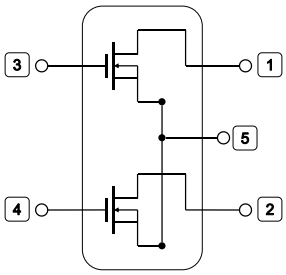
RoHS COMPLIANT

RD06LUS2 is RoHS compliant product.

OUTLINE DRAWING



PIN CONNECTIONS



ORDERING INFORMATION

ORDER NUMBER	SUPPLY FORM
RD06LUS2-601	Pallet (25pcs/pallet), for evaluation
RD06LUS2-T612	Tape & Reel (2,000pcs/reel)
RD06LUS2-T614	Tape & Reel (4,000pcs/reel)

RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

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

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{DSS}	Drain to Source Voltage	V_{GS}=0V	14	V
V_{GSS}	Gate to Source Voltage	V_{DS}=0V	-5/+5	V
V_{DD}	Operating Voltage	-	5	V
P_D *	Power Dissipation	Tc=25°C	100	W
P_{in}	Input Power	f=520MHz	1.3	W
I_{DS}	Drain Current	-	6	A
$Tj_{(op)}$	Operating Junction Temperature	-	+150	°C
T_{stg}	Storage Temperature	-	-40 to +125	°C

Note: Above parameters are guaranteed independently.

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

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

SYMBOL	PARAMETER	TEST CONDITIONS	LIMIT			UNIT
			MIN	TYP	MAX.	
I_{DSS}**	Drain cutoff current	V_{DS}=10V, 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	0.8	-	1.8	V
Pout	Output power	f=520MHz, V_{DD}=3.6V	6	6.5	-	W
ηD	Drain efficiency	Pin=0.6W, Idq =0.52A(0.26Ax2)	60	65	-	%
VSWRT	Load VSWR tolerance	f=135MHz, V_{DD}=4.4V, Idq=0.52A (0.26Ax2), Po=6W(Pin-controlled @Z_G=Z_L=50Ω) Load VSWR=20:1(All Phase)	No destruction			-

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

** Measured each FET individually.

THERMAL CHARACTERISTICS (Ta=25°C UNLESS OTHERWISE NOTED)

SYMBOL	PARAMETER	TEST CONDITIONS	LIMIT			UNIT
			MIN	TYP	MAX	
Rthj-c	Thermal Resistance	ΔVF method	-	0.8	1.25	°C /W

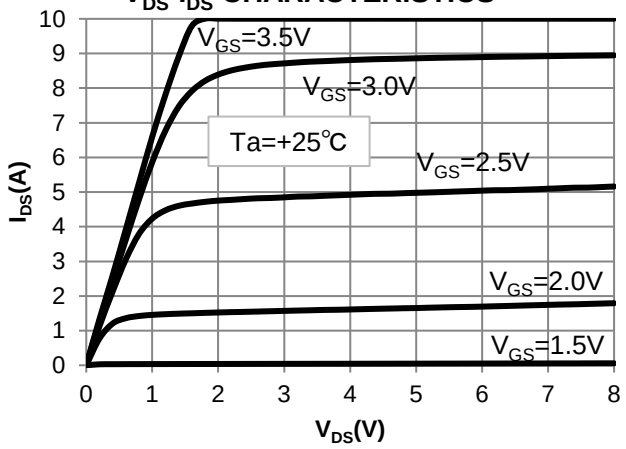
RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

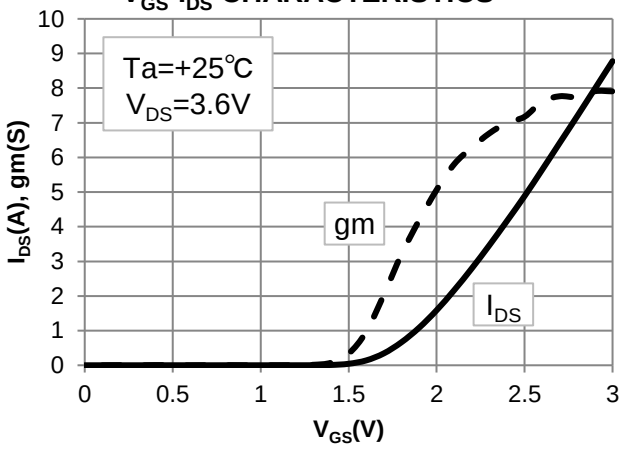
TYPICAL CHARACTERISTICS (One side characteristics of 2 FETs)

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

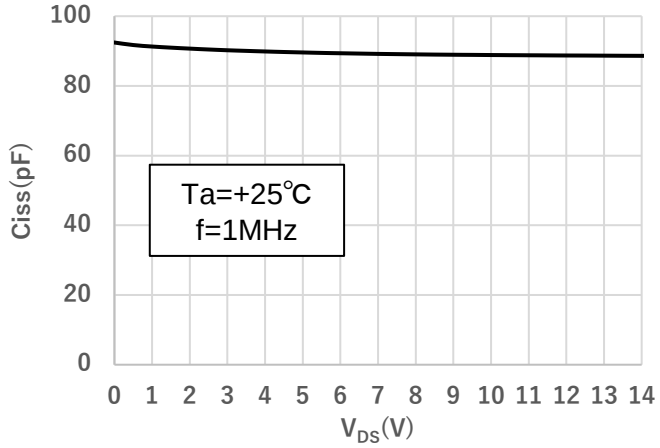
V_{DS}-I_{DS} CHARACTERISTICS



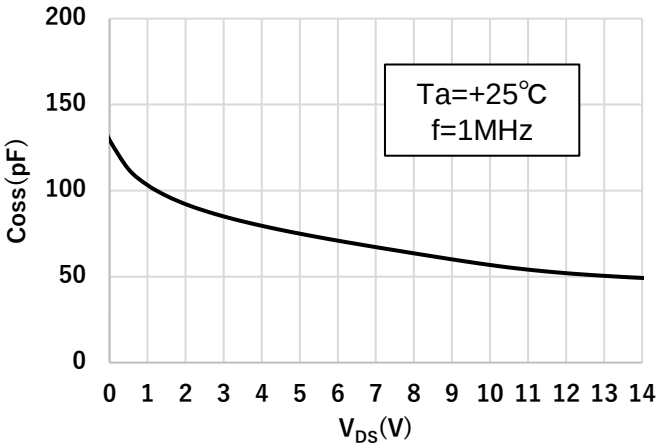
V_{GS}-I_{DS} CHARACTERISTICS



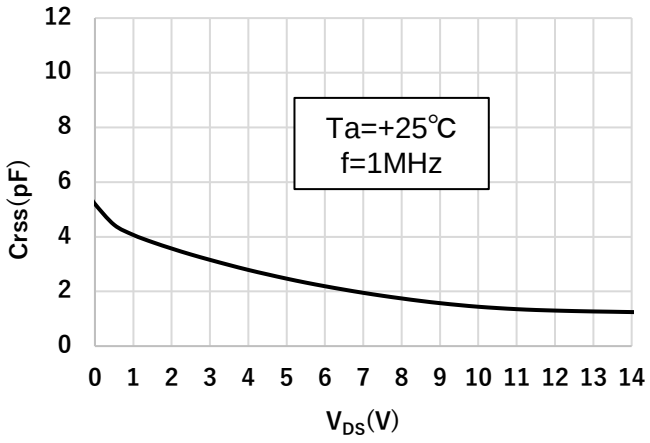
V_{DS}-Ciss CHARACTERISTICS



V_{DS}-Coss CHARACTERISTICS



V_{DS}-Crss CHARACTERISTICS

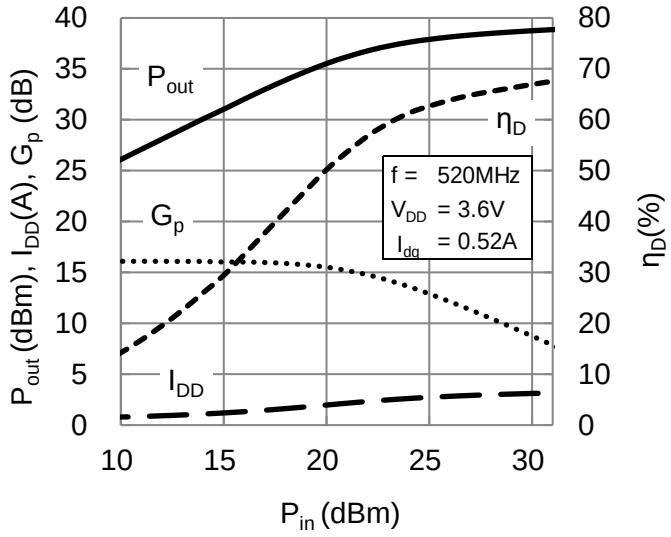


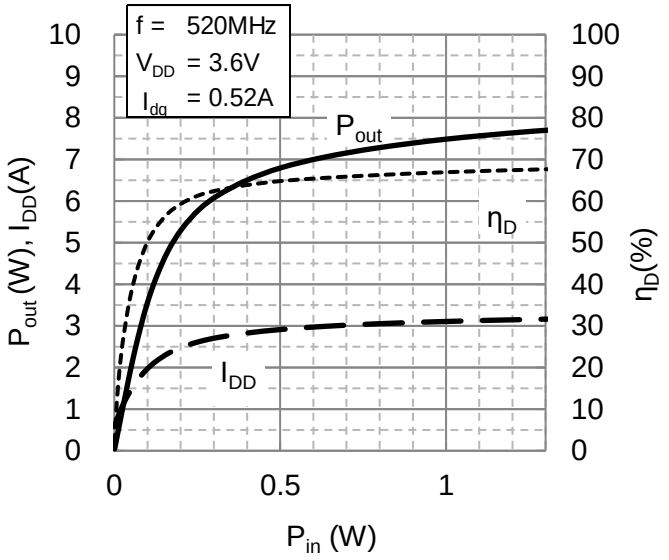
RD06LUS2

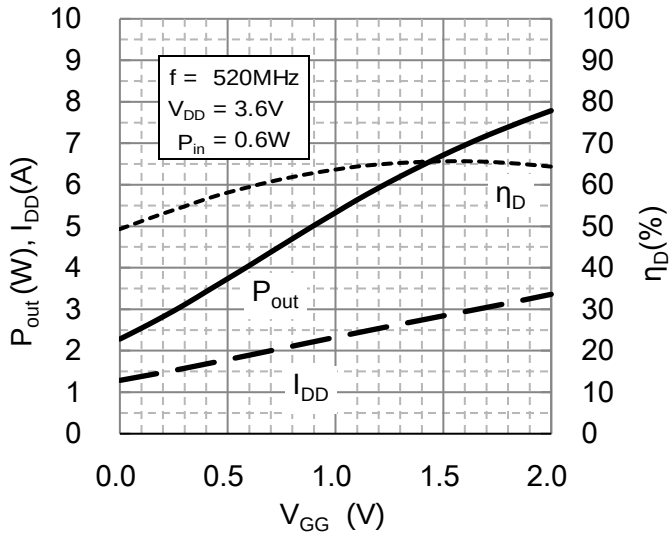
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

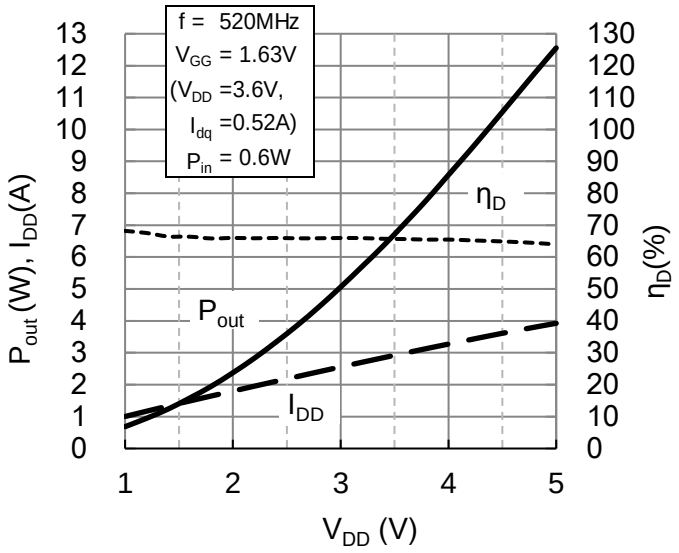
TYPICAL CHARACTERISTICS WITH TEST FIXTURE (f=520MHz, Ta=25°C)

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





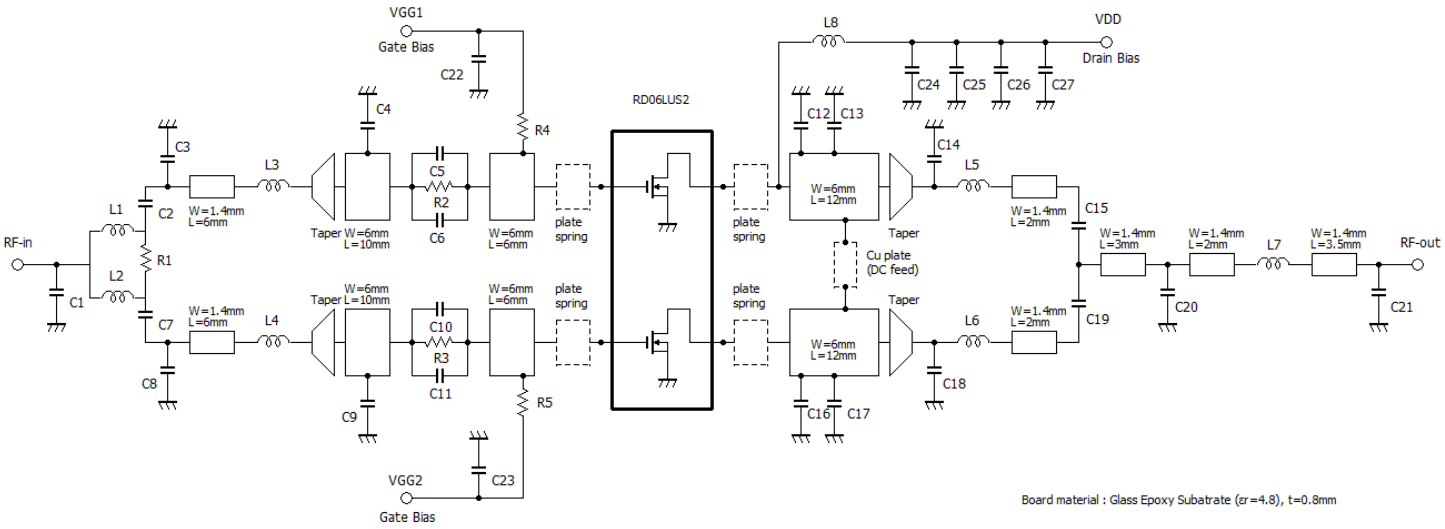




RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

Equivalent Circuitry of TEST FIXTURE (f=520MHz)



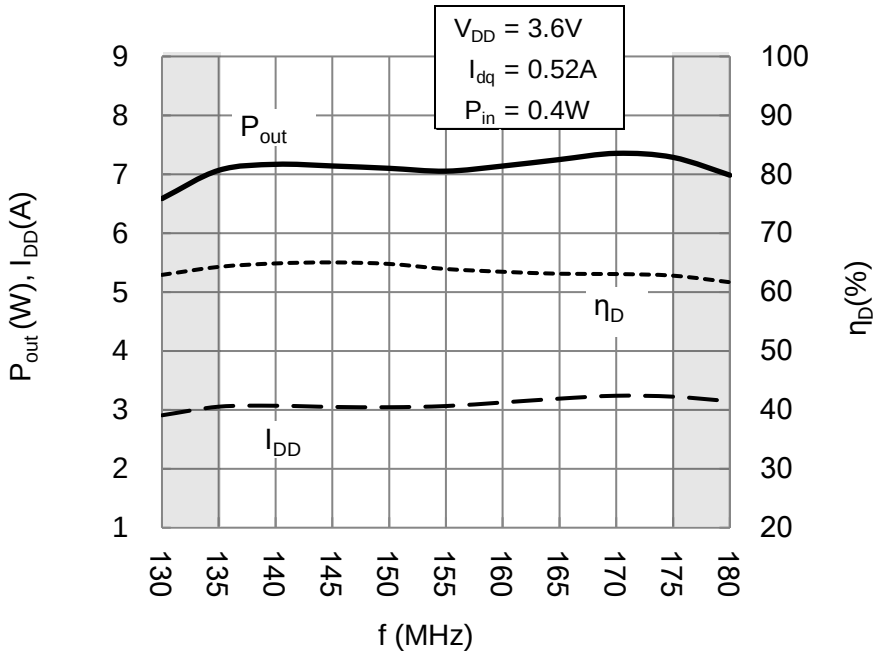
Component List of TEST FIXTURE (f=520MHz)

Parts Type	No.	Description	
Capacitor	C1	8 pF	
	C2, C5, C6, C7, C10, C11, C15, C19	100 pF	
	C3, C8	15 pF	
	C4, C9	27 pF	
	C12, C16	22 pF	
	C13, C17	18 pF	
	C14, C18	10 pF	
	C20	12 pF	
	C21	6 pF	
	C22, C23, C24	1000 pF	
	C25	22000 pF	
	C26	220000 pF	
	C27	22 µF	
Inductor	L1, L2	24 nH	Enameled wire Φ0.23mm, 5Turns, Φ1.6mm (Outside)
	L3, L4, L5, L6	1.1 nH	Copper Bridge
	L7	8 nH	Enameled wire Φ0.4mm, 2Turns, Φ2.46mm (Outside)
	L8	25 nH	Enameled wire Φ0.4mm, 5Turns, Φ2.46mm (Outside)
Resistor	R1, R2, R3	100 Ω	
	R4, R5	4700 Ω	

TYPICAL CHARACTERISTICS WITH EVB (f=135-175MHz, Ta=25°C)

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

Frequency characteristics @ P_{in}= 26 dBm (0.4W), V_{DD}= 3.6V, I_{dq}= 0.52A(0.26Ax2)

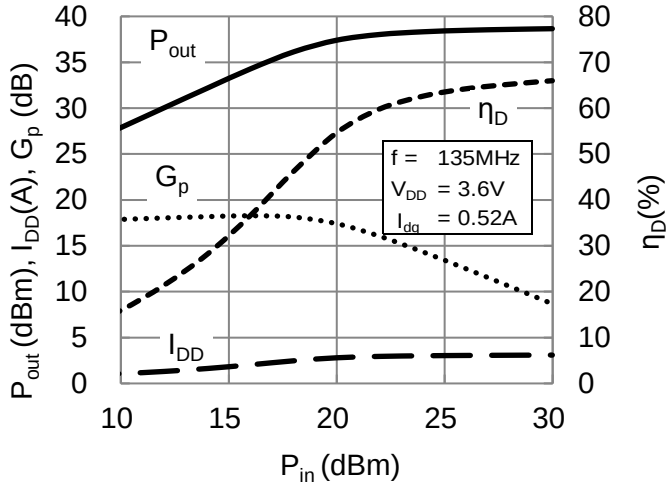


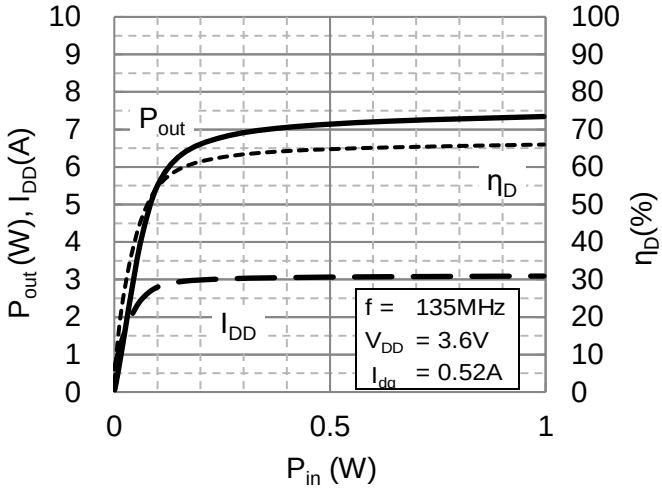
RD06LUS2

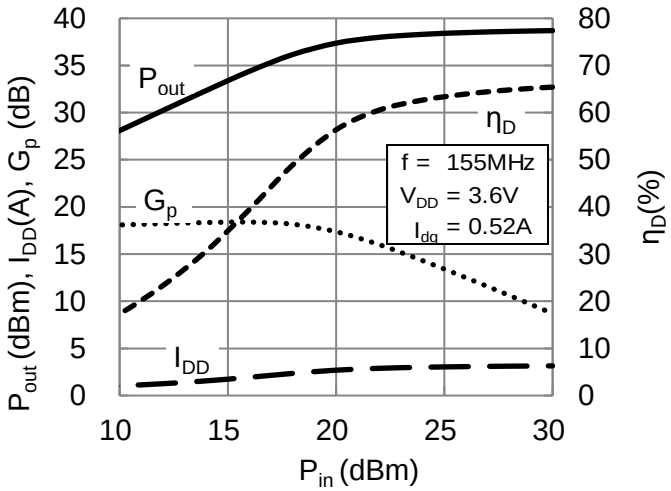
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

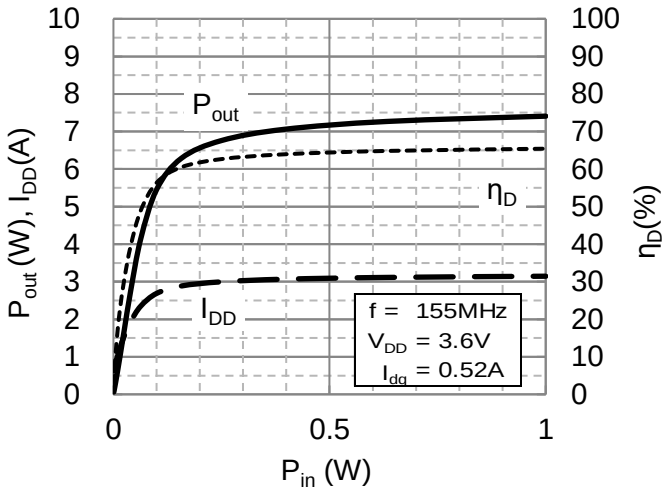
TYPICAL CHARACTERISTICS WITH EVB (f=135-175MHz, Ta=25°C)

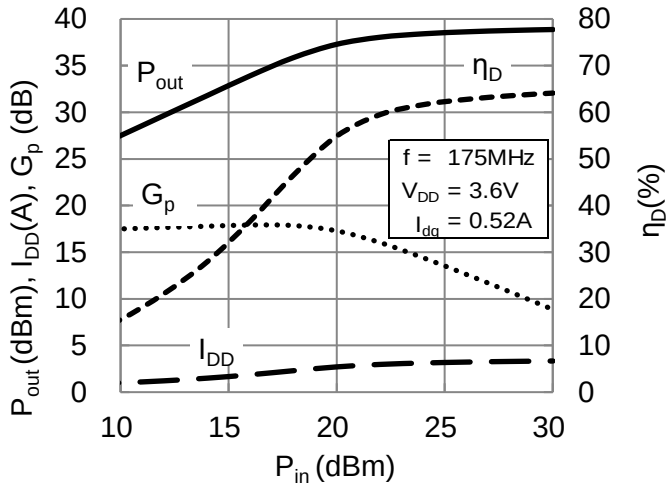
P_{out} vs. P_{in} characteristics @ V_{DD} = 3.6V, I_{dq} = 0.52A(0.26Ax2)

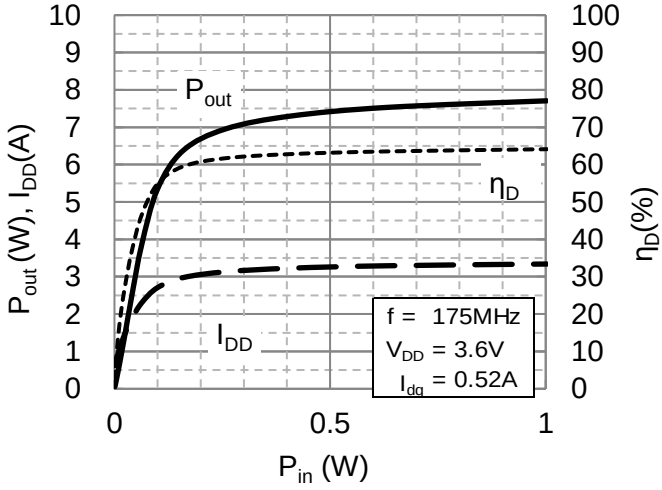










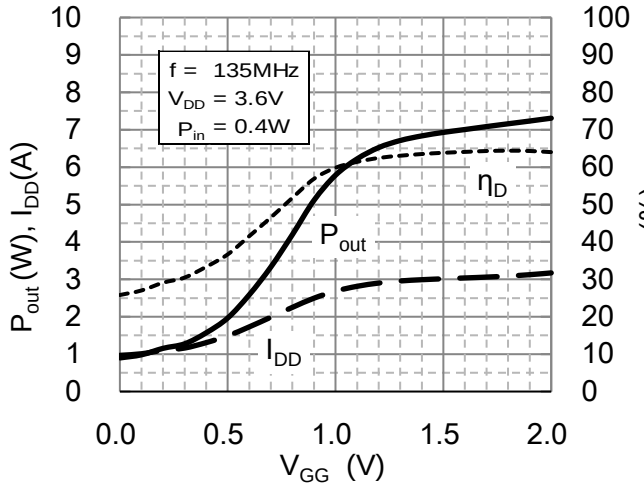


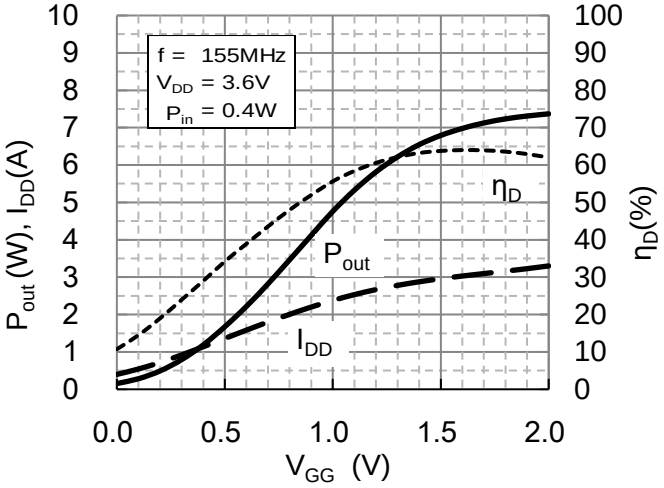
RD06LUS2

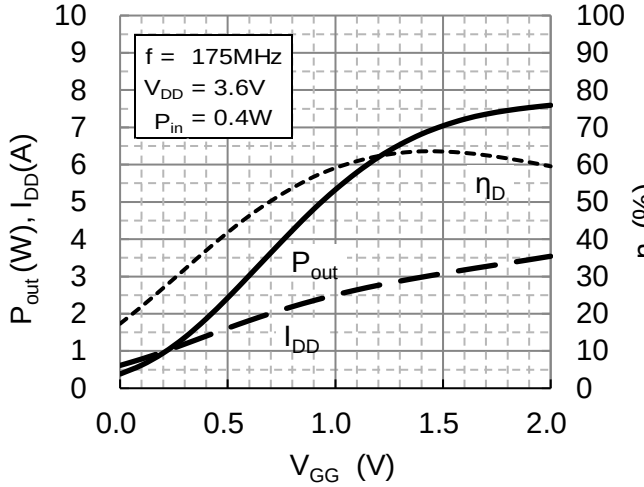
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

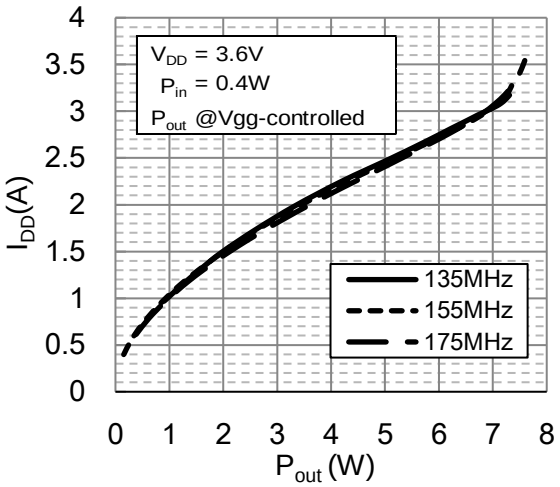
TYPICAL CHARACTERISTICS WITH EVB (f=135-175MHz, Ta=25°C)

P_{out} vs. V_{GG} characteristics @ V_{GG}=V_{GG}1=V_{GG}2, V_{DD}= 3.6V, P_{in}= 26dBm (0.4W)







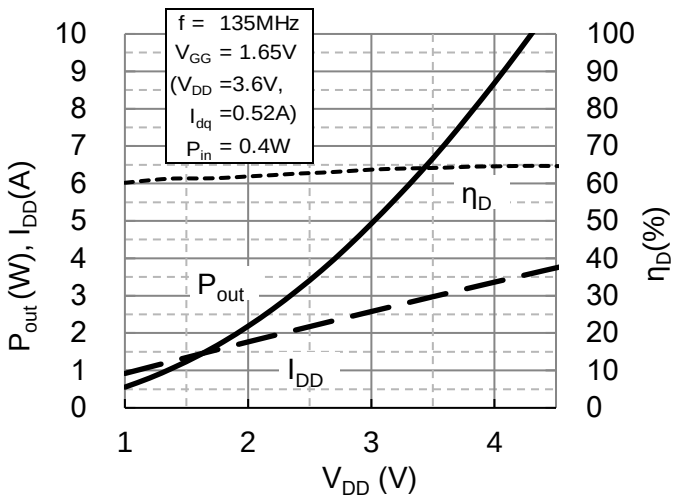


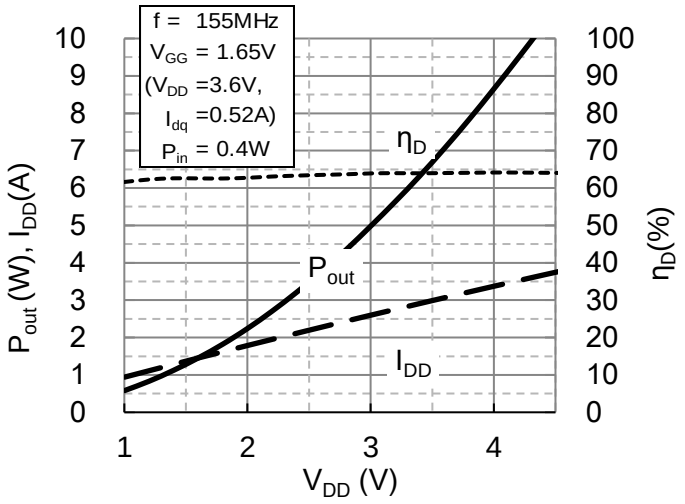
RD06LUS2

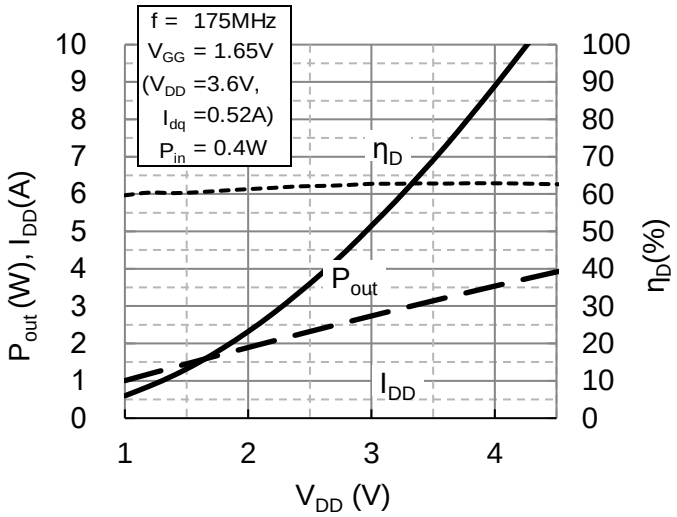
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

TYPICAL CHARACTERISTICS WITH EVB (f=135-175MHz, Ta=25°C)

P_{out} vs. V_{DD} characteristics @ $V_{GG}1=V_{GG}2=1.65V$(0.52A(0.26Ax2)@V_{DD}=3.6V), P_{in}= 26dBm (0.4W)



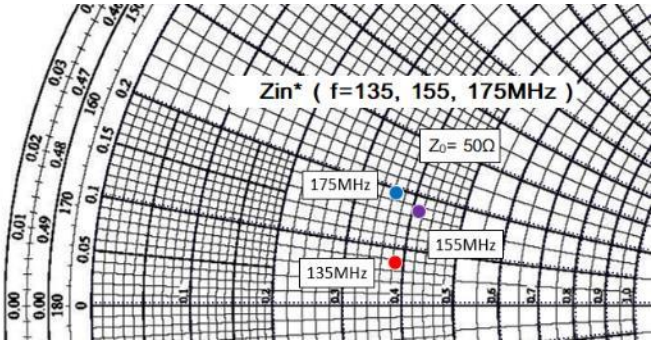




RD06LUS2

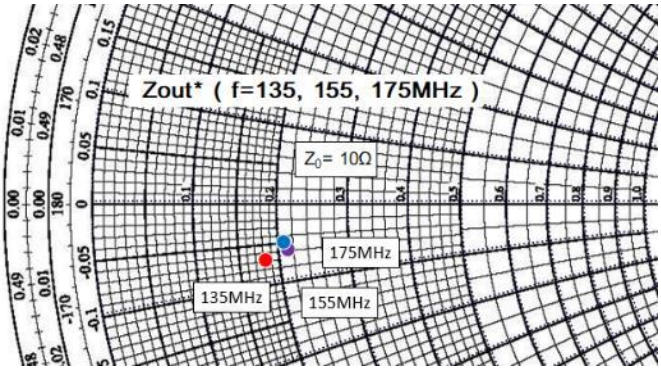
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

Input / Output Impedance of EVB (f=135-175MHz, One side characteristics of 2 FETs)



f (MHz)	Zin* (Ω)
135	19.25 + j 3.43
155	20.71 + j 8.29
175	18.26 + j 9.35

Zin*:Complex conjugate of input impedance

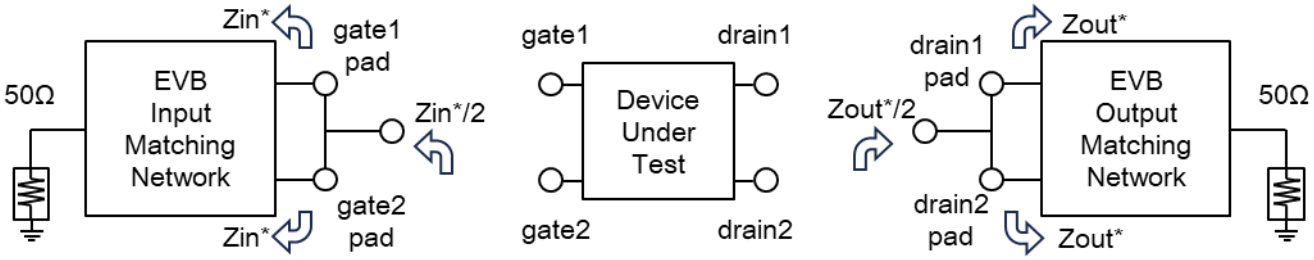


f (MHz)	Zout* (Ω)
135	1.82 - j -0.74
155	2.13 - j -0.64
175	2.09 - j -0.54

Zout*:Complex conjugate of output impedance

Note: These data represent measured circuit impedances and may not accurately represent device target impedances.

Measurement Method of Input / Output Impedance

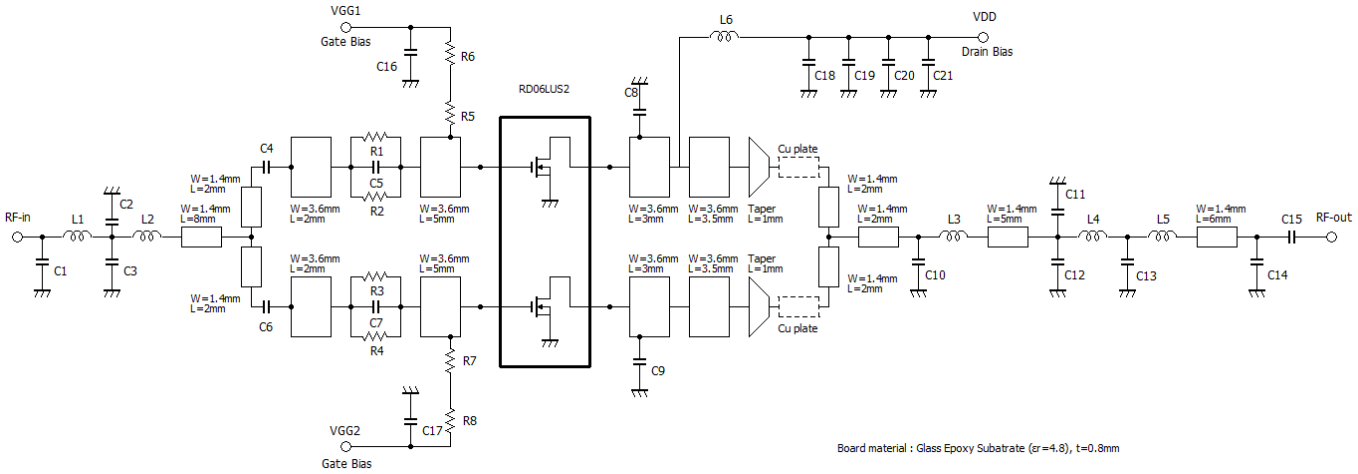


Zin* is the circuit impedance to estimate the matching impedance of one side of the two FETs. It is difficult to measure directly so it is calculated from the impedance measured with the two gate pads connected. The same goes for Zout* and drain pads.

RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

Equivalent Circuitry of EVB (f=135-175MHz)



Component List of EVB (f=135-175MHz)

Parts Type	No.	Description	Parts Number	Size	Manufacturer
Capacitor	C1, C3	39 pF	GRM1882C1H390JA01D	1608	Murata
	C2	82 pF	GRM1882C1H820JA01D		
	C4, C6, C15, C16, C17, C18	1000 pF	GRM1882C1H102JA01D	1608	Murata
	C5, C7	56 pF	GRM1882C1H560JA01D	1608	Murata
	C8, C9	220 pF	GRM1882C1H221JA01D	1608	Murata
	C10	130 pF	GRM1882C1H131JA01D	1608	Murata
	C11	75 pF	GRM1882C1H750JA01D	1608	Murata
	C12	68 pF	GRM1882C1H680JA01D	1608	Murata
	C13	15 pF	GRM1882C1H150JA01D	1608	Murata
	C14	27 pF	GRM1882C1H270JA01D	1608	Murata
	C19	22000 pF	GRM216R11H223KA01D	2012	Murata
	C20	220000 pF	GRM21BR71H224KA01L	2012	Murata
	C21	22 µF	UVZ1H220MDD	-	Nichicon
Inductor	L1	29 nH Enameled wire Φ0.23mm, 7Turns, Φ1.6mm (Outside)	2307A	-	YC
	L2	16 nH Enameled wire Φ0.23mm, 4Turns, Φ1.6mm (Outside)	2304A	-	YC
	L3	3.3 nH	ASS050221-3R3NJ	-	KORIN
	L4	8 nH Enameled wire Φ0.4mm, 2Turns, Φ2.46mm (Outside)	4002A	-	YC
	L5	25 nH Enameled wire Φ0.4mm, 5Turns, Φ2.46mm (Outside)	4005A	-	YC
	L6	38 nH Enameled wire Φ0.4mm, 7Turns, Φ2.46mm (Outside)	4007A	-	YC
Resistor	R1, R2, R3, R4	56 Ω	RPC05 560	1608	TAIYOSHA
	R5, R7	4700 Ω	RPC05 472	1608	TAIYOSYA
	R6, R8	0 Ω	RPC05 Jumper	1608	TAIYOSYA

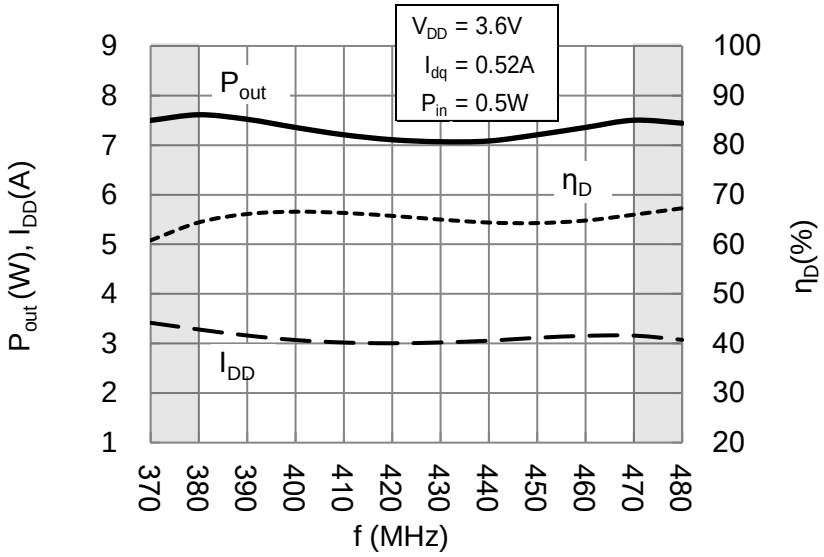
RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

TYPICAL CHARACTERISTICS WITH EVB (f=380-470MHz, Ta=25°C)

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

Frequency characteristics @ P_{in}= 27 dBm (0.5W), V_{DD}= 3.6V, I_{dq}= 0.52A(0.26Ax2)

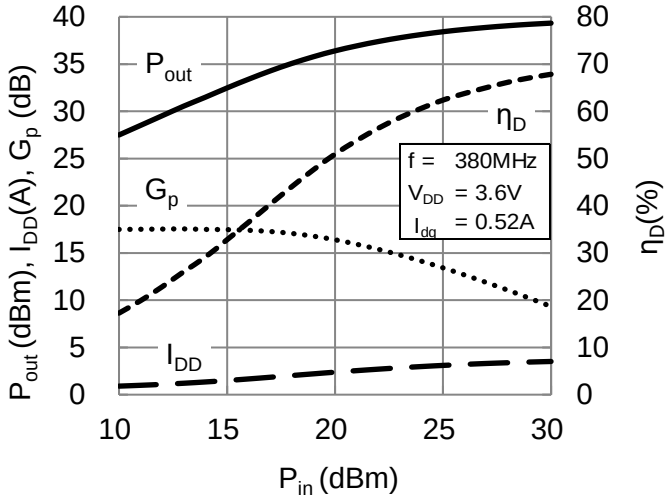


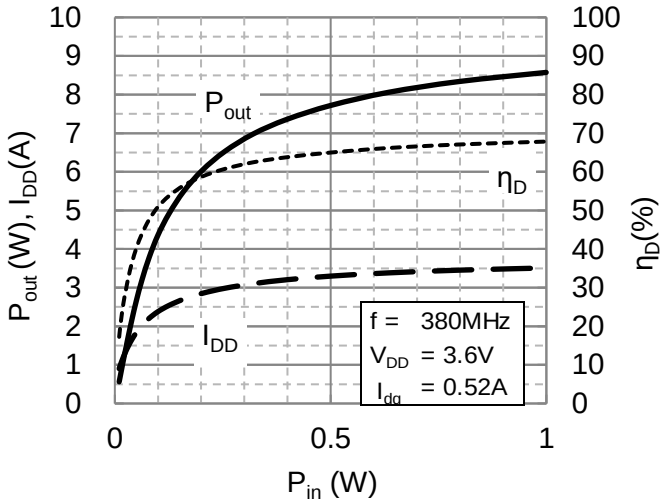
RD06LUS2

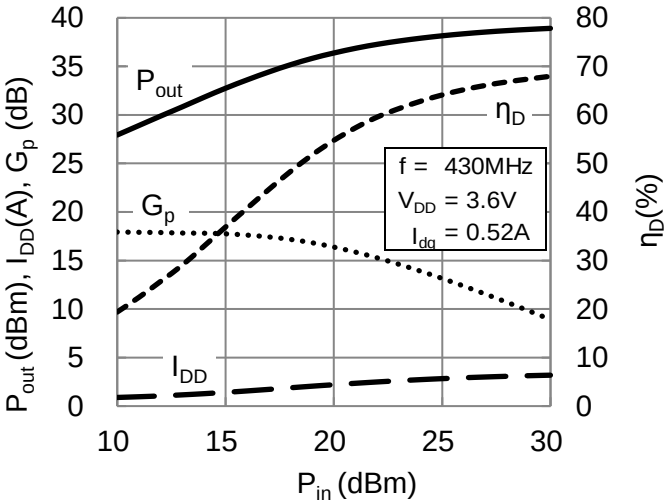
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

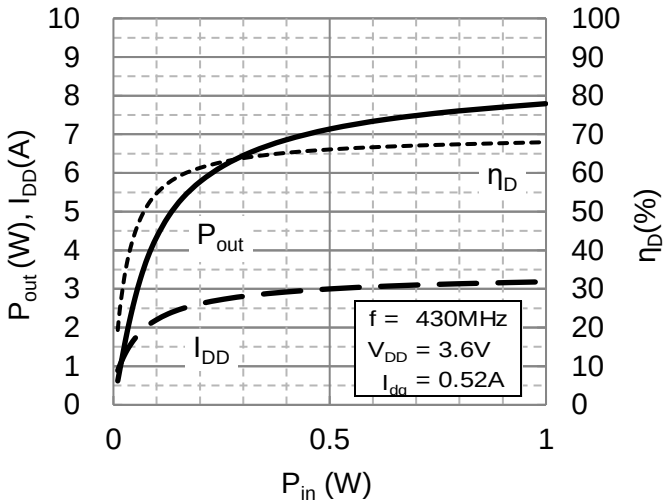
TYPICAL CHARACTERISTICS WITH EVB (f=380-470MHz, Ta=25°C)

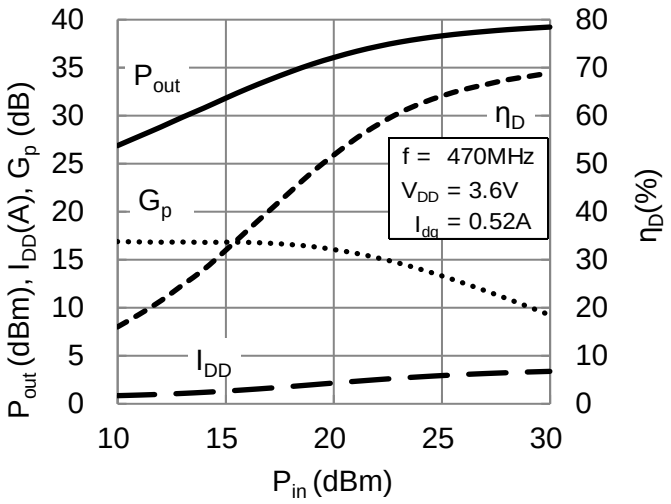
P_{out} vs. P_{in} characteristics @ V_{DD} = 3.6V, I_{dq} = 0.52A(0.26Ax2)

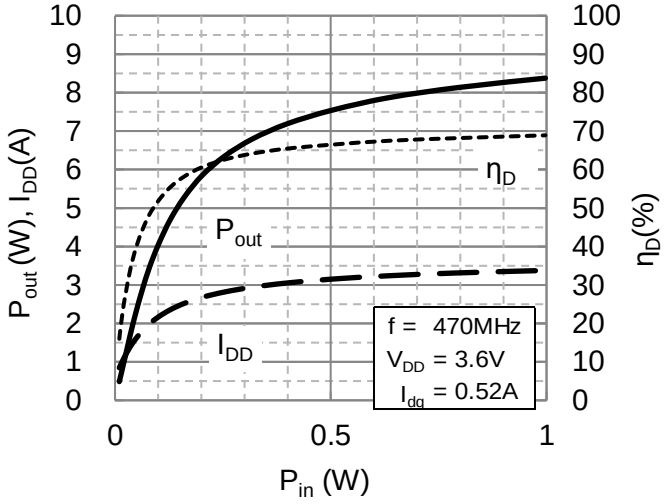










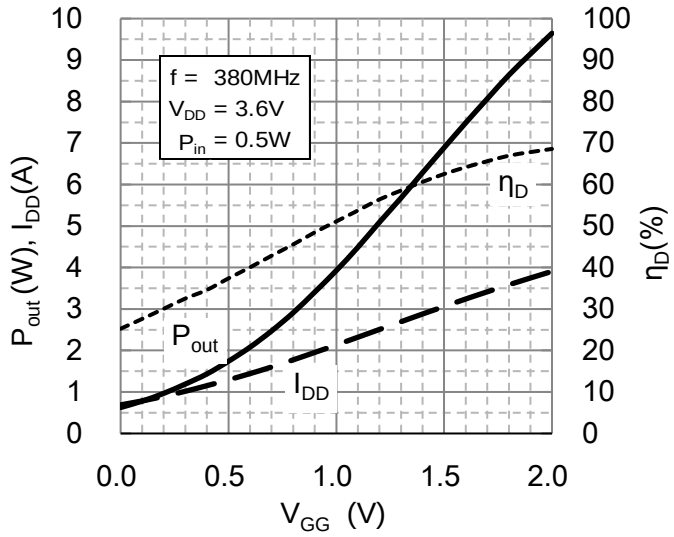


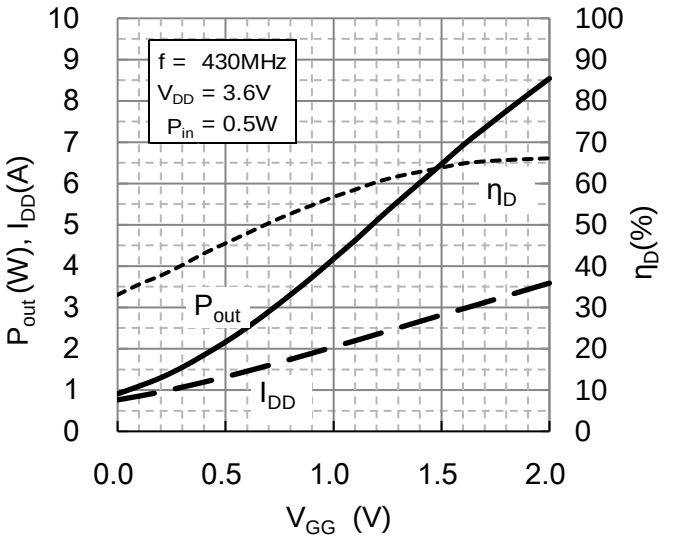
RD06LUS2

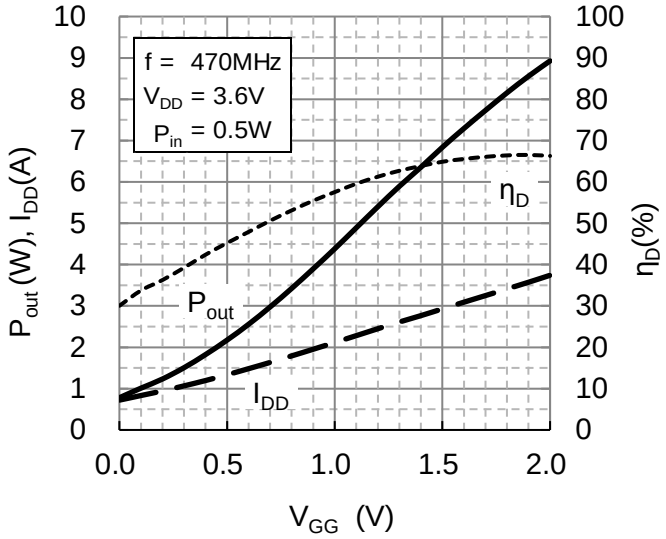
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

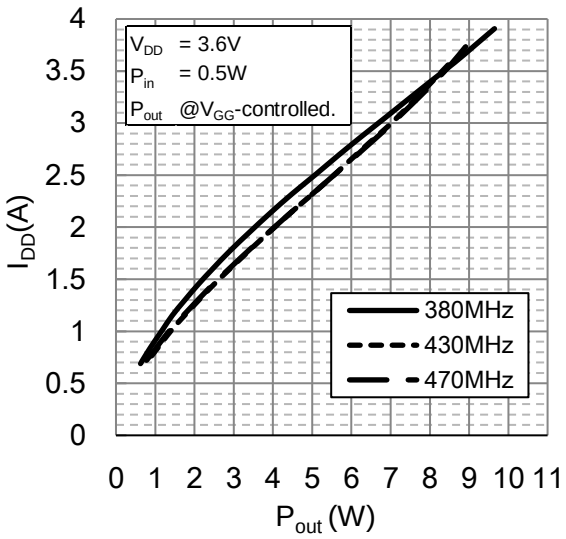
TYPICAL CHARACTERISTICS WITH EVB (f=380-470MHz, Ta=25°C)

P_{out} vs. V_{GG} characteristics @ V_{GG}=V_{GG}1=V_{GG}2, V_{DD}= 3.6V, P_{in}= 27dBm (0.5W)







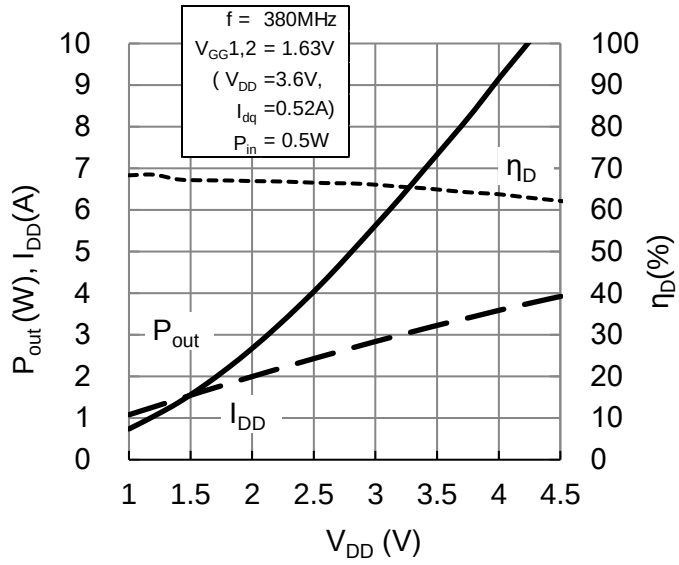


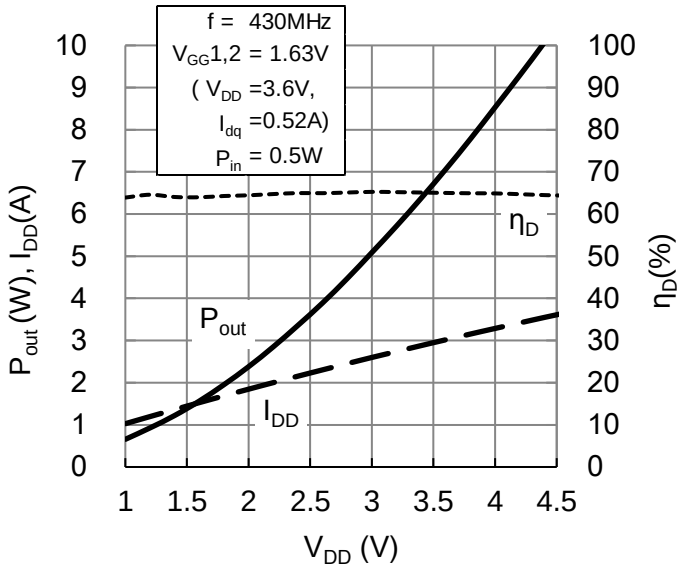
RD06LUS2

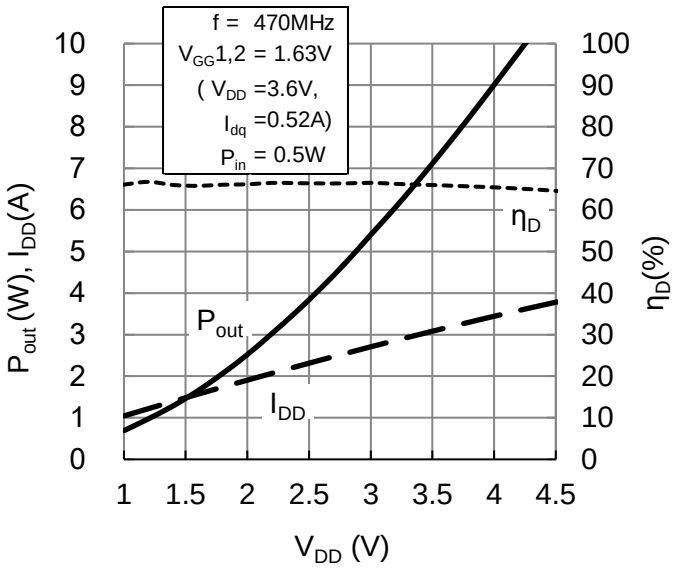
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

TYPICAL CHARACTERISTICS WITH EVB (f=380-470MHz, Ta=25°C)

P_{out} vs. V_{DD} characteristics @ $V_{GG}1=V_{GG}2=1.63V$(0.52A(0.26Ax2)@V_{DD}=3.6V), P_{in}= 27dBm (0.5W)



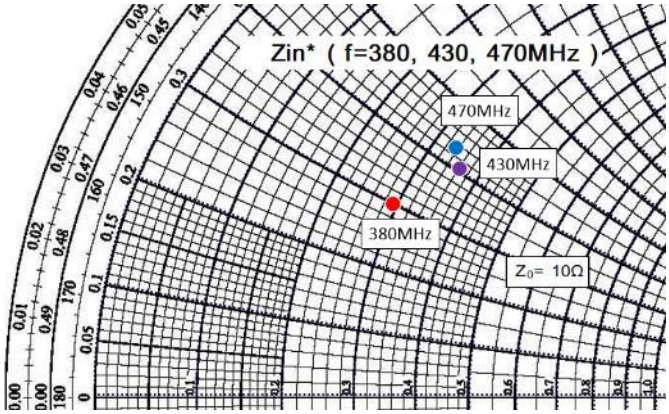




RD06LUS2

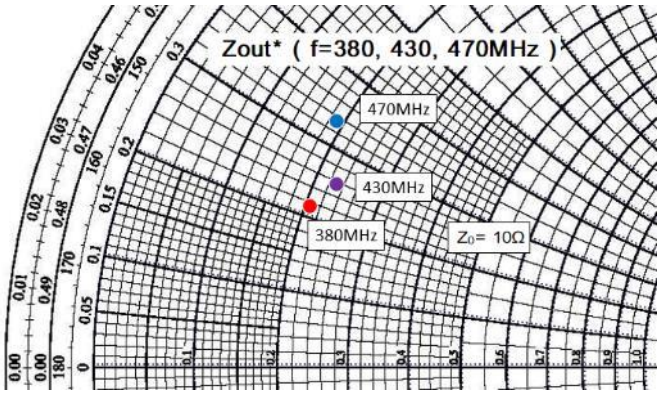
RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

Input / Output Impedance of EVB (f=380-470MHz, One side characteristics of 2 FETs)



f (MHz)	Zin* (Ω)
380	2.94 + j 2.98
430	3.62 + j 4.04
470	3.36 + j 4.31

Zin*:Complex conjugate of input impedance

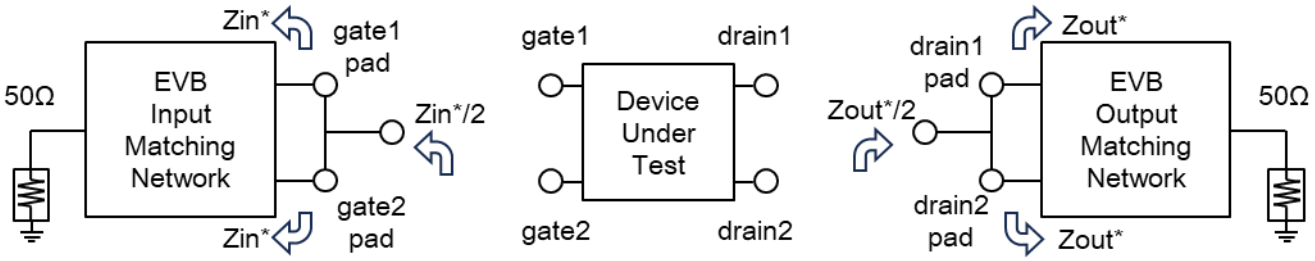


f (MHz)	Zout* (Ω)
380	2.06 + j 2.12
430	2.29 + j 2.53
470	1.90 + j 3.31

Zout*:Complex conjugate of output impedance

Note: These data represent measured circuit impedances and may not accurately represent device target impedances.

Measurement Method of Input / Output Impedance

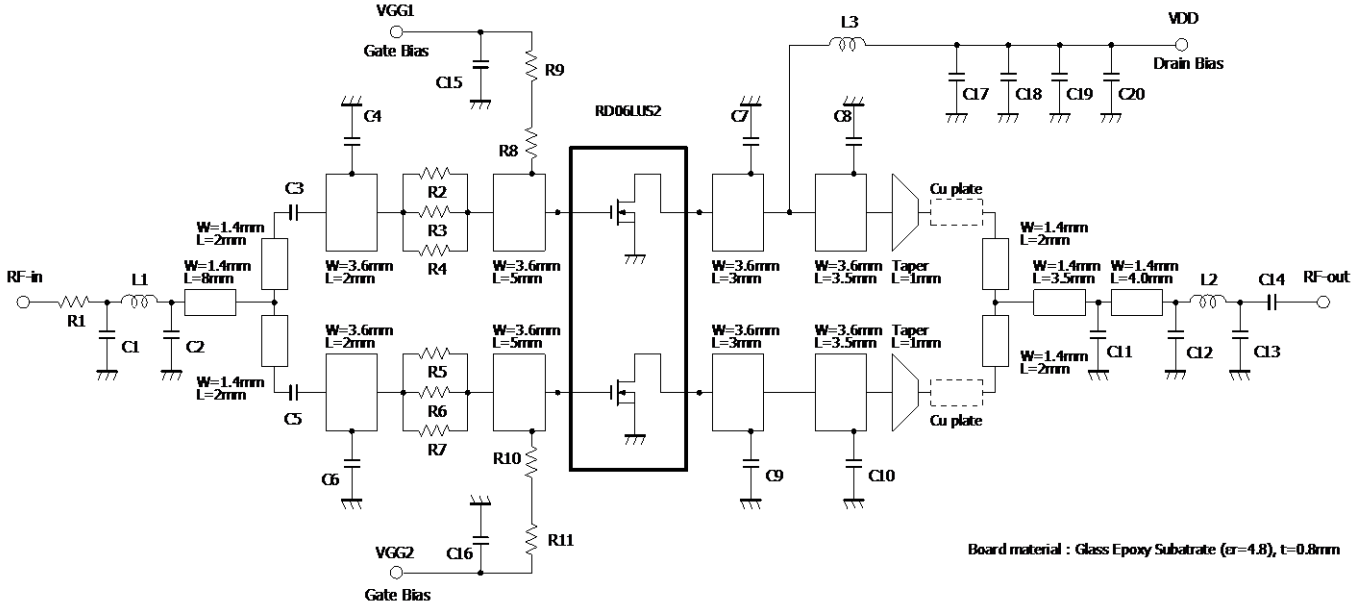


Zin* is the circuit impedance to estimate the matching impedance of one side of the two FETs. It is difficult to measure directly so it is calculated from the impedance measured with the two gate pads connected. The same goes for Zout* and drain pads.

RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

Equivalent Circuitry of EVB (f=380-470MHz)



Component List of EVB (f=380-470MHz)

Parts Type	No.	Description	Parts Number	Size	Manufacturer
Capacitor	C1	10 pF	GRM1882C1H100JA01D	1608	Murata
	C2	33 pF	GRM1882C1H330JA01D	1608	Murata
	C3, 5, 14	100 pF	GRM1882C1H101JA01D	1608	Murata
	C4, 6	51 pF	GRM1882C1H510JA01D	1608	Murata
	C7, 9	47 pF High Q	GQM1872C2E470JB12D	1608	Murata
	C8, 10	39 pF High Q	GQM1872C2E390JB12D	1608	Murata
	C11	30 pF High Q	GQM1872C2E300JB12D	1608	Murata
	C12	15 pF High Q	GQM1872C2E150JB12D	1608	Murata
	C13	12 pF High Q	GQM1872C2E120JB12D	1608	Murata
	C15, 16, 17	1000 pF	GRM1882C1H102JA01D	1608	Murata
	C18	22000 pF	GRM216R11H223KA01D	2012	Murata
	C19	220000 pF	GRM21BR71H224KA01L	2012	Murata
	C20	22 µF	UVZ1H220MDD	-	Nichicon
Inductor	L1, 2	8 nH Enameled wire Φ0.4mm, 2Turns, Φ2.46mm (Outside)	4002A	-	YC
	L3	25 nH Enameled wire Φ0.4mm, 5Turns, Φ2.46mm (Outside)	4005A	-	YC
Resistor	R1, 9, 11	0 Ω	RPC10 0R0	2012	TAIYOSHA
	R2～7	2.2 Ω	RPC10 2R2	2012	TAIYOSHA
	R8, 10	4700 Ω	RPC05 472	1608	TAIYOSYA

RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

S-PARAMETER DATA of DEVICE (One side characteristics of 2 FETs)

V_{DS}=3.6V, Idq=0.26A, Ta=25℃

Freq.	S11		S21		S12		S22	
(MHz)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)
100	0.84	-167	10.64	74	0.010	-12	0.77	-169
135	0.85	-169	7.67	66	0.010	-18	0.80	-170
155	0.86	-170	6.53	62	0.009	-21	0.81	-170
175	0.87	-170	5.62	58	0.009	-23	0.82	-170
200	0.88	-171	4.72	54	0.008	-27	0.84	-171
300	0.92	-174	2.64	41	0.006	-33	0.89	-173
380	0.94	-176	1.81	33	0.005	-34	0.92	-174
400	0.94	-176	1.66	31	0.005	-33	0.92	-175
430	0.94	-177	1.47	29	0.004	-32	0.93	-175
470	0.95	-178	1.26	26	0.004	-29	0.93	-176
500	0.95	-178	1.13	24	0.003	-26	0.94	-177
520	0.96	-179	1.05	23	0.003	-24	0.94	-177
600	0.96	180	0.81	19	0.003	-9	0.95	-178
700	0.97	178	0.62	15	0.002	13	0.96	-179
800	0.97	177	0.48	12	0.003	34	0.97	179
900	0.98	176	0.39	9	0.003	48	0.97	178
1000	0.98	175	0.32	7	0.003	57	0.98	177
1100	0.98	174	0.27	5	0.004	63	0.98	176
1200	0.98	173	0.23	3	0.005	67	0.98	175
1300	0.99	171	0.19	2	0.005	70	0.99	174
1400	0.99	170	0.17	0	0.006	71	0.99	173
1500	0.99	169	0.15	-1	0.007	72	0.99	172

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.

RD06LUS2

RoHS Compliance, Silicon MOSFET Power Transistor, 520MHz, 6.5W, 3.6V

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

- These materials are intended as a reference to assist our customers in the selection of the Mitsubishi Electric Semiconductor product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi Electric Corporation or a third party.
- Mitsubishi Electric Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
- All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Mitsubishi Electric Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Mitsubishi Electric Corporation or an authorized Mitsubishi Electric Semiconductor product distributor for the latest product information before purchasing a product listed herein.
  The information described here may contain technical inaccuracies or typographical errors. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
  Please also pay attention to information published by Mitsubishi Electric Corporation by various means, including the Mitsubishi Electric Semiconductor home page (http://www.MitsubishiElectric.com/semiconductor/).
- When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
- Mitsubishi Electric Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Electric Semiconductor product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
- The prior written approval of Mitsubishi Electric Corporation is necessary to reprint or reproduce in whole or in part these materials.
- If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
  Any diversion or re-export contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
- Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Electric Semiconductor product distributor for further details on these materials or the products contained therein.

G2K-Si-240701-1

Publication Date : Jul. 2024