MITSUBISHI ELECTRIC

Changes for the Better

SILICON RF DEVICES

for a greener tomorrow

Silicon RF Devices

2015

Better Performance for Radio Communication Network

Mitsubishi Electric Silicon RF Devices are Key parts of RF Power Amplifications for various kind of Mobile Radio, Professional Mobile Radios, Amateur Radios and TELEMATICS for automotive.
Mitsubishi Electric Silicon RF Devices strongly support for Radio communication network.

LINE UP

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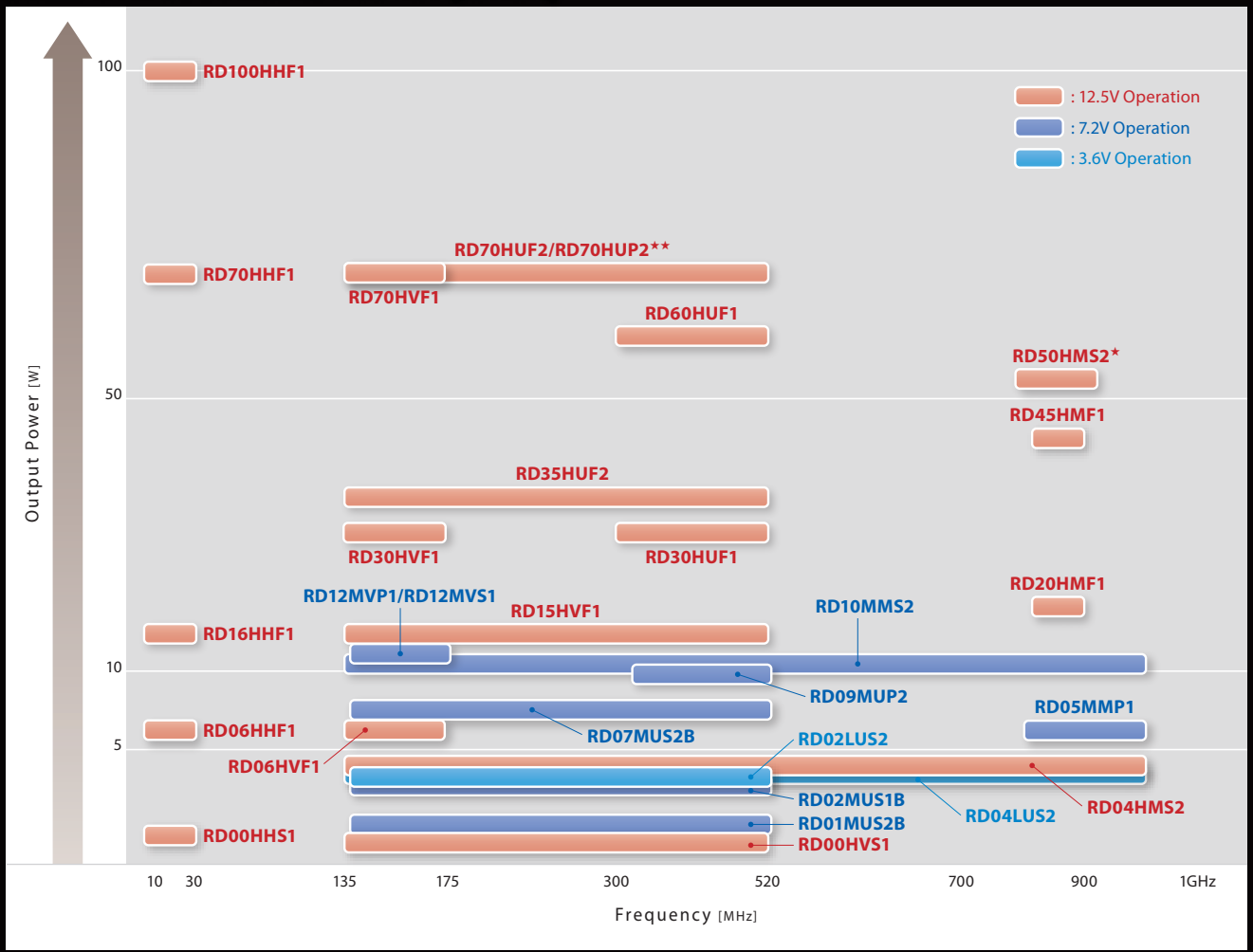
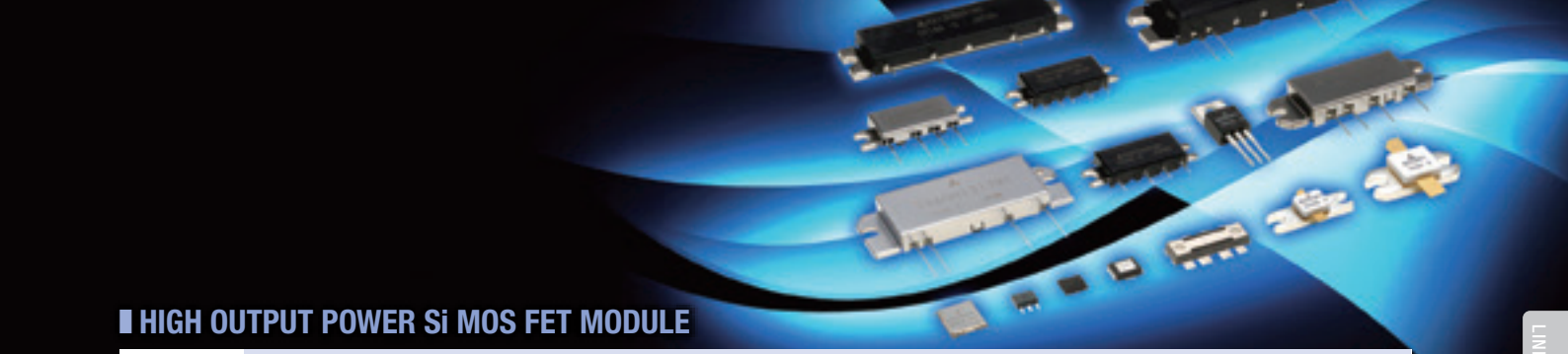
SELECTION MAP

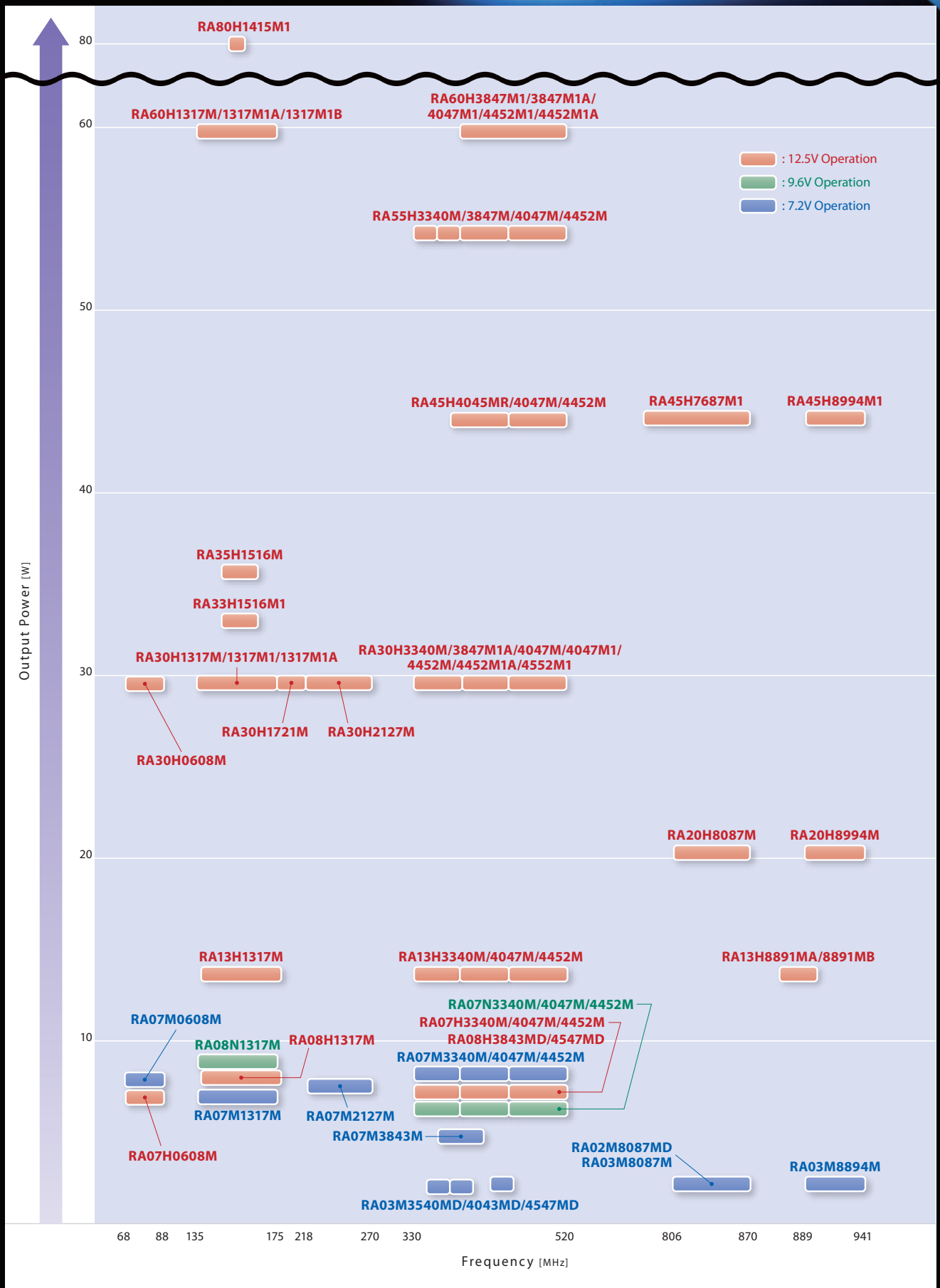
HIGH OUTPUT POWER Si MOS FET (DISCRETE)



★: New Product ★★: Under Development



HIGH OUTPUT POWER Si MOS FET MODULE



PRODUCT LIST

3.6V OPERATION HIGH OUTPUT POWER Si MOS FET (DISCRETE)

Type Number	Structure	Max.ratings		Vdd [V]	f [MHz]	Pin [W]	Po (min) [W]	nd (min) [%]	Package Outline
		VDSS [V]	Pch [W]						
RD02LUS2	Si, MOS†	25	15.6	3.6	470	0.2	2.3typ.	70typ.	SOT-89
RD04LUS2	Si, MOS†	25	46.3	3.6	527	0.4	4.5typ.	65typ.	SLP

Ta=25°C †: Gate Protection Diode

7.2V OPERATION HIGH OUTPUT POWER Si MOS FET (DISCRETE)

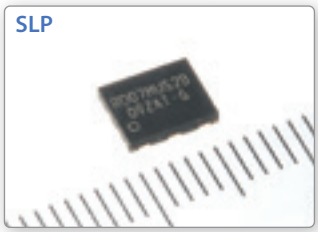
Type Number	Structure	Max.ratings		Vdd [V]	f [MHz]	Pin [W]	Po (min) [W]	nd (min) [%]	Package Outline
		VDSS [V]	Pch [W]						
RD01MUS2B	Si, MOS†	25	3.6	7.2	527	0.03	1.6typ.	70typ.	SOT-89
RD02MUS1B	Si, MOS	30	21.9	7.2	175/520	0.05/0.05	2/2	55/50	SLP
RD05MMP1	Si, MOS	30	73	7.2	941	0.7	5.5	43	PMM
RD07MUS2B	Si, MOS†	25	50	7.2	135~175	0.3	6.3	58	SLP
					450~527	0.4	7	58	
RD09MUP2	Si, MOS†	30	83	7.2	520	0.8	8	50	PMM
RD10MMS2	Si, MOS†	40	62	7.2	870	1	12typ.	58typ.	SLP
RD12MVP1	Si, MOS	50	125	7.2	175	0.5	10	55	PMM
RD12MVS1	Si, MOS	50	50	7.2	175	1	11.5	55	SLP

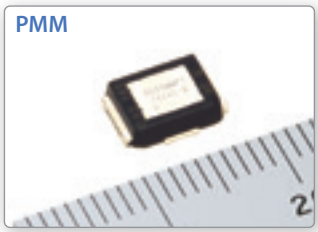
Ta=25°C †: Gate Protection Diode

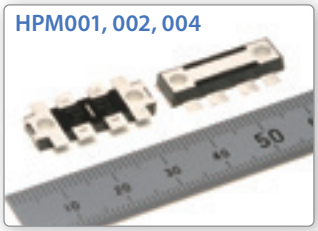
12.5V OPERATION HIGH OUTPUT POWER Si MOS FET (DISCRETE)

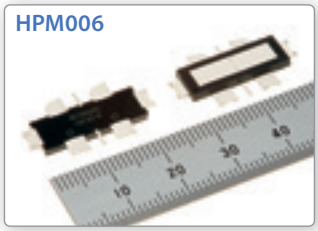
Type Number	Structure	Max.ratings		Vdd [V]	f [MHz]	Pin [W]	Po (min) [W]	nd (min) [%]	Package Outline
		VDSS [V]	Pch [W]						
RD00HHS1	Si, MOS	30	3.1	12.5	30	0.004	0.3	55	SOT-89
RD00HVS1	Si, MOS	30	3.1	12.5	175	0.005	0.5	50	SOT-89
RD04HMS2	Si, MOS†	40	50	12.5	135~175	0.2	5.5typ.	73typ.	SLP
					380~470	0.2	6typ.	62typ.	
					890~950	0.2	5typ.	53typ.	
RD06HHF1	Si, MOS	50	27.8	12.5	30	0.15	6	55	TO-220S
RD06HVF1	Si, MOS	50	27.8	12.5	175	0.3	6	60	TO-220S
RD15HVF1	Si, MOS	30	48	12.5	175/520	0.6/3	15/15	55/50	TO-220S
RD16HHF1	Si, MOS	50	56.8	12.5	30	0.4	16	55	TO-220S
RD20HMF1	Si, MOS	30	71.4	12.5	900	3	20	50	Ceramic (Small)
RD30HVF1	Si, MOS	30	75	12.5	175	1	30	55	Ceramic (Small)
RD30HUF1	Si, MOS	30	75	12.5	520	3	30	50	Ceramic (Small)
RD35HUF2	Si, MOS†	40	166	12.5	135~175	3	45typ.	72typ.	HPM001
					450~530	3	43typ.	60typ.	
RD45HMF1	Si, MOS	30	125	12.5	900	15	45	45	Ceramic (Large)
RD50HMS2★	Si, MOS†	40	300	12.5	135~175	4	84typ.	74typ.	HPM004
					450~530	5.5	75typ.	64typ.	
					900	7	57typ.	55typ.	
RD60HUF1	Si, MOS	30	150	12.5	520	10	60	50	Ceramic (Large)
RD70HHF1	Si, MOS	50	150	12.5	30	3.5	70	55	Ceramic (Large)
RD70HVF1	Si, MOS	30	150	12.5	175/520	6/10	70/50	55/50	Ceramic (Large)
RD70HUF2	Si, MOS†	40	300	12.5	135~175	4	84typ.	74typ.	HPM002
					450~530	5.5	75typ.	64typ.	
RD70HUP2★★	Si, MOS	40	300	12.5	135~175	4	85typ.	74typ.	HPM006
					450~530	5	80typ.	64typ.	
RD100HHF1	Si, MOS	50	176.5	12.5	30	7	100	55	Ceramic (Large)

Ta=25°C †: Gate Protection Diode ★: New Product ★★: Under Development









Type Name Definition of Silicon RF Devices

HIGH OUTPUT POWER Si MOS FET (Discrete Devices)

RD 07 M U S 2B
A B C D E F

A Si MOS FET (Discrete)

B Output Power (W)

C Operation Voltage (V)

Symbol	Voltage
M	7.2V
N	9.6V
H	12.5V

D Frequency Range (MHz)

Symbol	Frequency Range
H	30MHz
V	175MHz
U	520MHz
M	800MHz

E Outline

Symbol	Segment
S	Mold
F	Flange
P	Power Mold Mini

F Serial Number

HIGH OUTPUT POWER Si MOS FET MODULE

RA 07 M 4452 M
A B C D E

A Module

B Output Power (W)

C Operation Voltage (V)

Symbol	Voltage
M	7.2V
N	9.6V
H	12.5V

D Frequency Range (MHz)

Symbol (Example)	Frequency Range (Example)
4452	440~ 520MHz
1317	135~ 175MHz

E Frequency Unit

Symbol	Unit
M	MHz
G	GHz

Note: Type number show the outline of products. For detail specification, Please confirm a formal specification.

PRODUCT LIST

7.2V OPERATION HIGH OUTPUT POWER Si MOS FET MODULE

Type Number	Max.ratings Vdd [V]	f [MHz]		Vdd [V]	Pin [W]	Po (min) [W]	nd (min) [%]	Package Outline
		min	max					
RA02M8087MD	9.2	806	869	7.2	0.01	1.2	30*1	H54
RA03M3540MD	9.2	350	400	7.2	0.01	3.2	34*2	H54
RA03M4043MD	9.2	400	430	7.2	0.01	3.2	34*2	H54
RA03M4547MD	9.2	450	470	7.2	0.01	3.2	34*2	H54
RA03M8087M	9.2	806	870	7.2	0.05	3.6	32	H46S
RA03M8894M	9.2	889	941	7.2	0.05	3.6	32	H46S
RA07M0608M	9.2	66	88	7.2	0.03	7	45	H46S
RA07M1317M	9.2	135	175	7.2	0.02	6.5	45	H46S
RA07M2127M	9.2	215	270	7.2	0.02	7	45	H46S
RA07M3340M	9.2	330	400	7.2	0.05	7	40	H46S
RA07M3843M	9.2	378	430	7.2	0.05	7	40	H46S
RA07M4047M	9.2	400	470	7.2	0.05	7	40	H46S
RA07M4452M	9.2	440	520	7.2	0.05	7	40	H46S

Ta=25°C *1: When Po=2.5W *2: When Po=6.3W

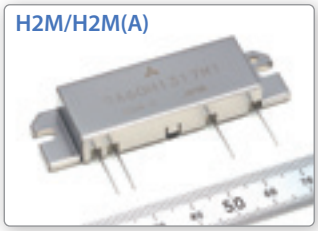
9.6V OPERATION HIGH OUTPUT POWER Si MOS FET MODULE

Type Number	Max.ratings Vdd [V]	f [MHz]		Vdd [V]	Pin [W]	Po (min) [W]	nd (min) [%]	Package Outline
		min	max					
RA07N3340M	12.5	330	400	9.6	0.02	7.5	43	H46S
RA07N4047M	12.5	400	470	9.6	0.02	7.5	43	H46S
RA07N4452M	12.5	440	520	9.6	0.02	7.5	43	H46S
RA08N1317M	12.5	135	175	9.6	0.02	8	50	H46S

Ta=25°C

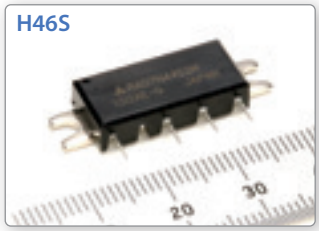
H2S

H2M/H2M(A)

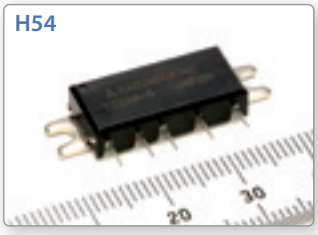


H11S

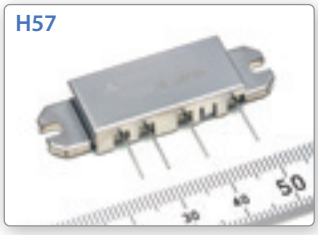
H46S



H54



H57



12.5V OPERATION HIGH OUTPUT POWER Si MOS FET MODULE

Type Number	Max.ratings Vdd [V]	f [MHz]		Vdd [V]	Pin [W]	Po (min) [W]	nd (min) [%]	Package Outline
		min	max					
RA07H0608M	13.2	68	88	12.5	0.03	7	38	H46S
RA07H3340M	13.2	330	400	12.5	0.02	7	40	H46S
RA07H4047M	13.2	400	470	12.5	0.02	7	40	H46S
RA07H4452M	13.2	440	520	12.5	0.02	7	40	H46S
RA08H1317M	13.2	135	175	12.5	0.02	8	40	H46S
RA08H3843MD	17	380	430	13.2	1.4m	6.3	15	H2S (6-pins)
RA08H4547MD	18	450	470	12.5	0.3m	7.9	17	H2S (6-pins)
RA13H1317M	17	135	175	12.5	0.05	13	40	H2S
RA13H3340M	17	330	400	12.5	0.05	13	40	H2S
RA13H4047M	17	400	470	12.5	0.05	13	40	H2S
RA13H4452M	17	440	520	12.5	0.05	13	40	H2S
RA13H8891MA	17	889	915	12.5	0.2	13	30	H2S
RA13H8891MB	17	880	915	12.5	0.001	13	35	H11S
RA20H8087M	17	806	870	12.5	0.05	20	25	H2S
RA20H8994M	17	896	941	12.5	0.05	20	25	H2S
RA30H0608M	17	66	88	12.5	0.05	30	40	H2S
RA30H1317M	17	135	175	12.5	0.05	30	40	H2S
RA30H1317M1	17	135	175	12.5	0.05	30	40	H2M
RA30H1317M1A*	17	136	174	12.5	0.05	30	45	H2M(A)
RA30H1721M	17	175	215	12.5	0.05	30	40	H2S
RA30H2127M	17	210	270	12.5	0.05	30	40	H2S
RA30H3340M	17	330	400	12.5	0.05	30	40	H2S
RA30H3847M1A*	17	378	470	12.5	0.05	30	40	H2M(A)
RA30H4047M	17	400	470	12.5	0.05	30	40	H2S
RA30H4047M1	17	400	470	12.5	0.05	30	42	H2M
RA30H4452M	17	440	520	12.5	0.05	30	40	H2S
RA30H4452M1A*	17	440	520	12.5	0.05	30	40	H2M(A)
RA30H4552M1	17	450	520	12.5	0.05	30	42	H2M
RA33H1516M1	17	154	162	12.5	0.01	33	50	H57
RA35H1516M	17	154	162	12.5	0.05	40	50	H2S
RA45H4045MR	17	400	450	12.5	0.05	45	35	H2RS
RA45H4047M	17	400	470	12.5	0.05	45	35	H2S
RA45H4452M	17	440	520	12.5	0.05	45	35	H2S
RA45H7687M1*	17	763	870	12.8	0.05	45	33	H2M(A)
RA45H8994M1*	17	896	941	12.8	0.05	45	33	H2M(A)
RA55H3340M	17	330	400	12.5	0.05	55	35	H2S
RA55H3847M	17	380	470	12.5	0.05	55	38	H2S
RA55H4047M	17	400	470	12.5	0.05	55	35	H2S
RA55H4452M	17	440	490	12.5	0.05	55	43	H2S
		490	520			45	35	
RA60H1317M	17	135	175	12.5	0.05	60	40	H2S
RA60H1317M1A	17	136	174	12.5	0.05	60	45	H2M
RA60H1317M1B*	17	136	174	12.5	0.05	60	45	H2M(A)
RA60H3847M1	17	378	470	12.5	0.05	60	40	H2M
RA60H3847M1A*	17	378	470	12.5	0.05	60	40	H2M(A)
RA60H4047M1	17	400	470	12.5	0.05	60	40	H2M
RA60H4452M1	17	440	520	12.5	0.05	60	40	H2M
RA60H4452M1A*	17	440	520	12.5	0.05	60	40	H2M(A)
RA80H1415M1	17	144	148	12.5	0.05	80	50	H2M
		136	174			60		

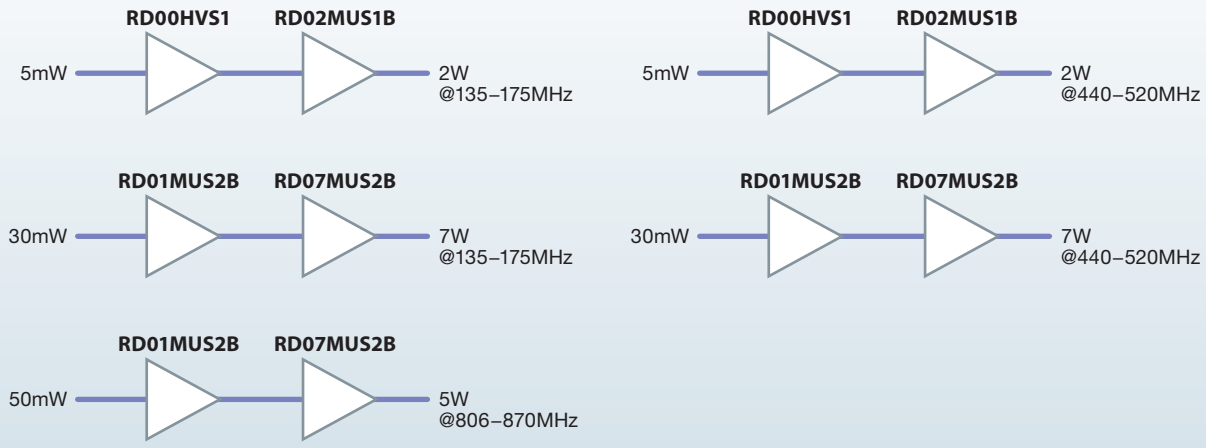
Ta=25°C *: V_{GG1}, V_{GG2} Separation type

SiRF devices are compliant with the RoHS (2011/65/EU).

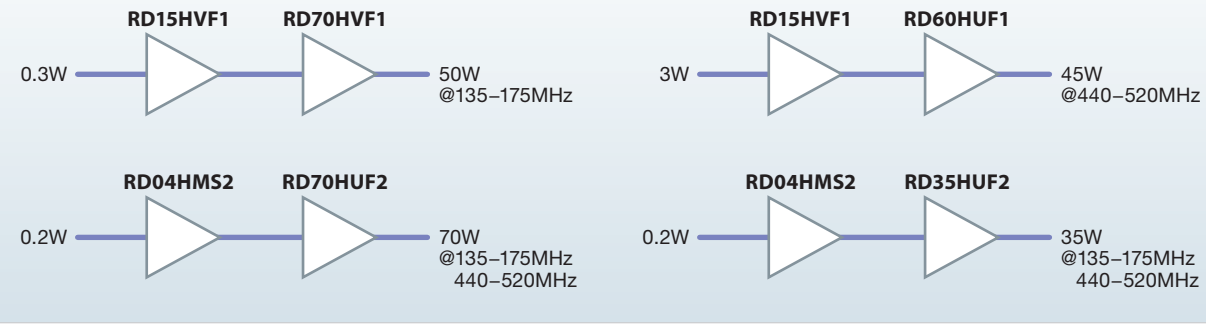
RoHS: Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

APPLICATION

VHF~800MHZ BAND 7.2V OPERATION RECOMMENDED LINE UP



VHF~UHF BAND 12.5V OPERATION RECOMMENDED LINE UP



Precautions for the use of Mitsubishi Electric silicon RF power amplifier devices

01.This general catalog do not guarantee the product specifications. 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 from the list of contact addresses listed on the last page for further information.

02.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. Examples of critical communications elements would include transmitters for base station applications and fixed station applications that operate with long term continuous transmission and a higher on-off frequency during transmitting, especially for systems that may have a high impact to society.

03.RA series and RD series products use MOSFET semiconductor technology. They are sensitive to ESD voltage therefore appropriate ESD precautions are required.

04.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 case temperature for RA series products lower than 60deg/C under standard conditions, and less than 90deg/C under extreme conditions.

05.RA series products are designed to operate into a nominal load impedance of 50 ohms. Under the condition of operating into a severe high load VSWR approaching an open or short, an over load condition could occur. In the worst case there is risk for burn out of the transistors and smoking of other parts including the substrate in the module.

06.The formal specification includes a guarantee against parasitic oscillation under a specified maximum load mismatch condition. The inspection for parasitic oscillation is performed on a sample basis on our manufacturing line. It is recommended that verification of no parasitic oscillation be performed at the completed equipment level also.

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

08.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.

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

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

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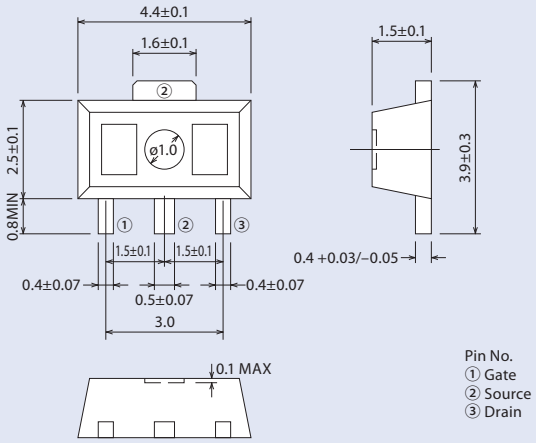
GLOBAL WEB SITE

http://www.MitsubishiElectric.com/semiconductors/

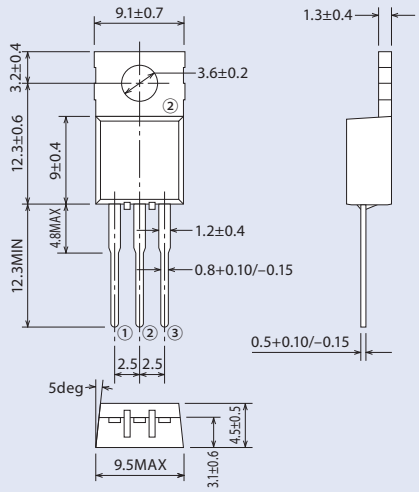
SOT-89



Pin No.
① Gate
② Source
③ Drain

UNIT: mm

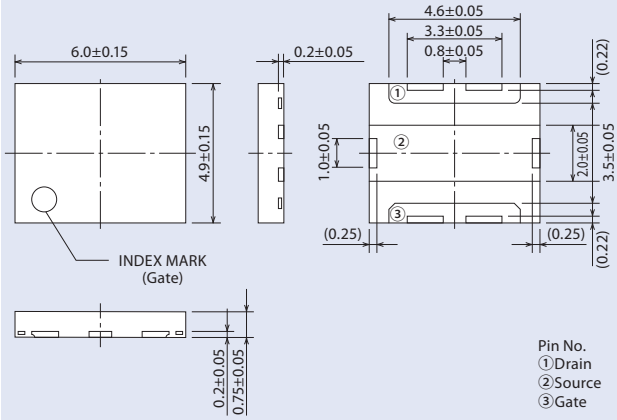
TO-220S



Pin No.
①Gate
②Source
③Drain

UNIT: mm

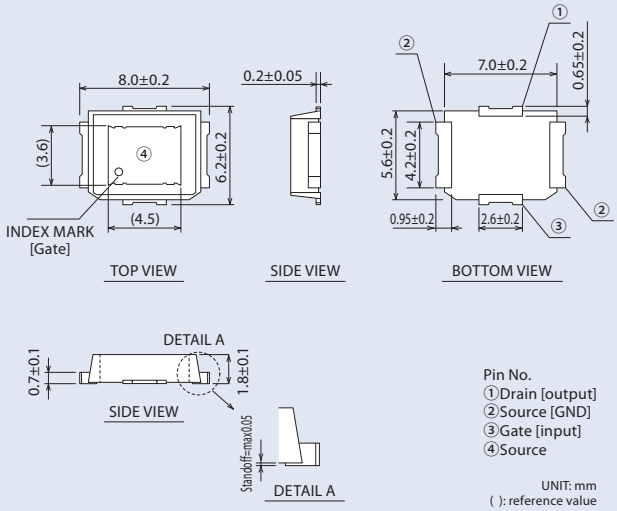
SLP



Pin No.
①Drain
②Source
③Gate

UNIT: mm
( ): reference value

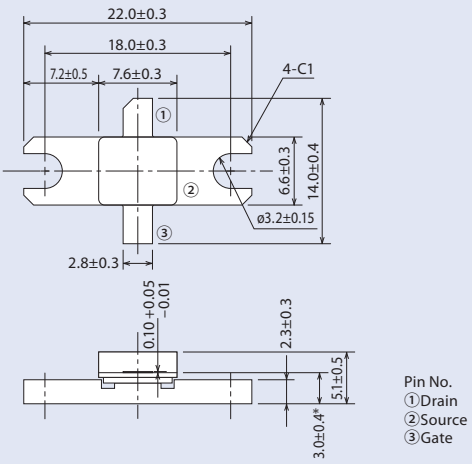
PMM



Pin No.
①Drain [output]
②Source [GND]
③Gate [input]
④Source

UNIT: mm
( ): reference value

Ceramic (Small)

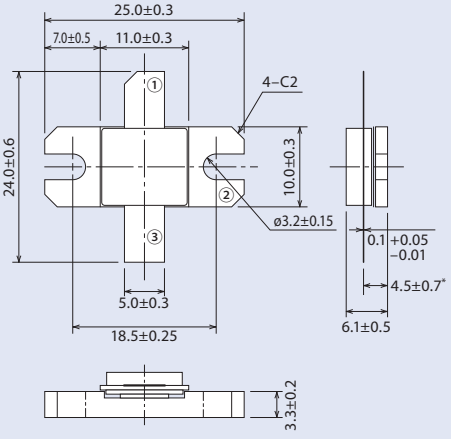


* The height of terminals shows root.

Pin No.
①Drain
②Source
③Gate

UNIT: mm

Ceramic (Large)



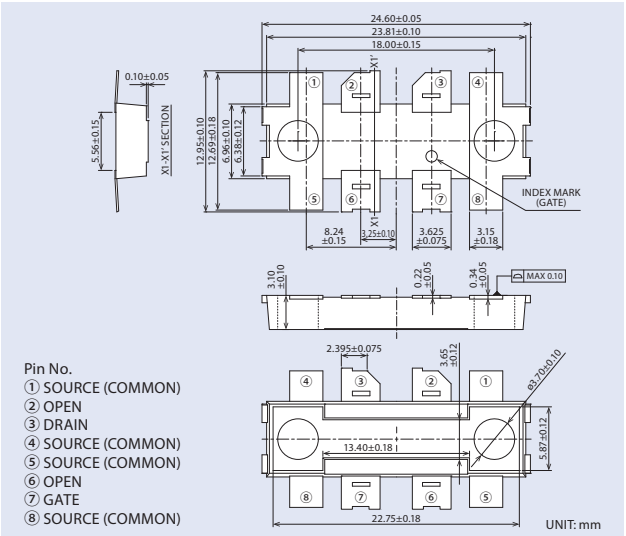
* The height of terminals shows root.

Pin No.
①Drain
②Source
③Gate

UNIT: mm

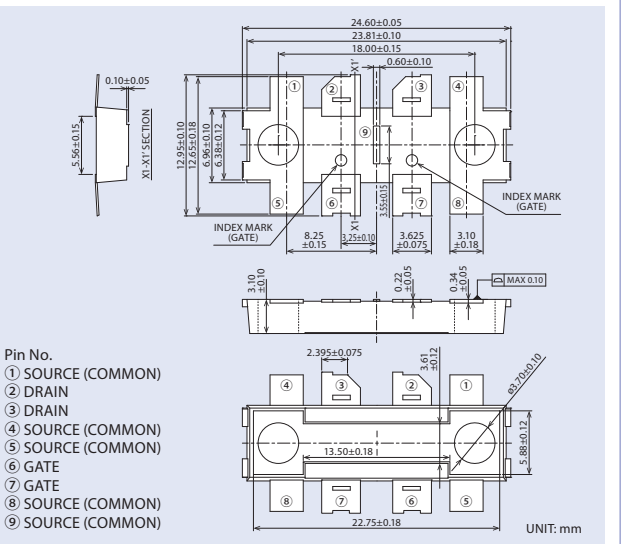
PACKAGE OUTLINE

HPM001



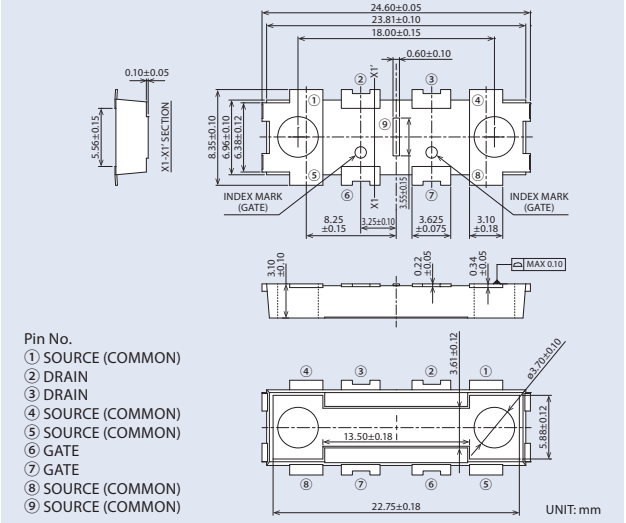
Pin No.
① SOURCE (COMMON)
② OPEN
③ DRAIN
④ SOURCE (COMMON)
⑤ SOURCE (COMMON)
⑥ OPEN
⑦ GATE
⑧ SOURCE (COMMON)

HPM002 (with CenterSourceElectrode)



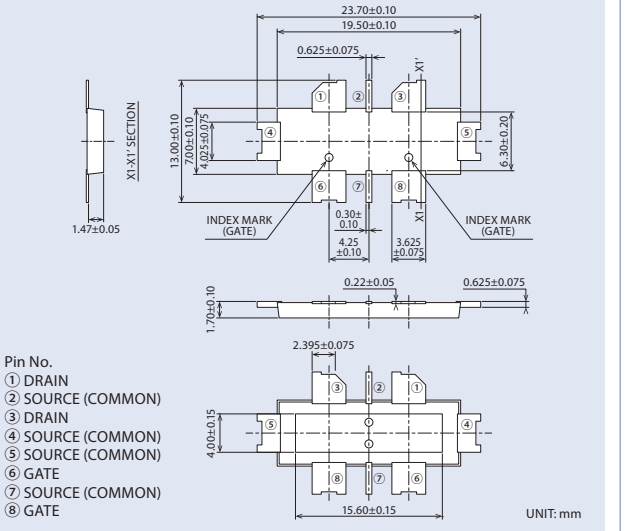
Pin No.
① SOURCE (COMMON)
② DRAIN
③ DRAIN
④ SOURCE (COMMON)
⑤ SOURCE (COMMON)
⑥ GATE
⑦ GATE
⑧ SOURCE (COMMON)
⑨ SOURCE (COMMON)

HPM004 (with CenterSourceElectrode)



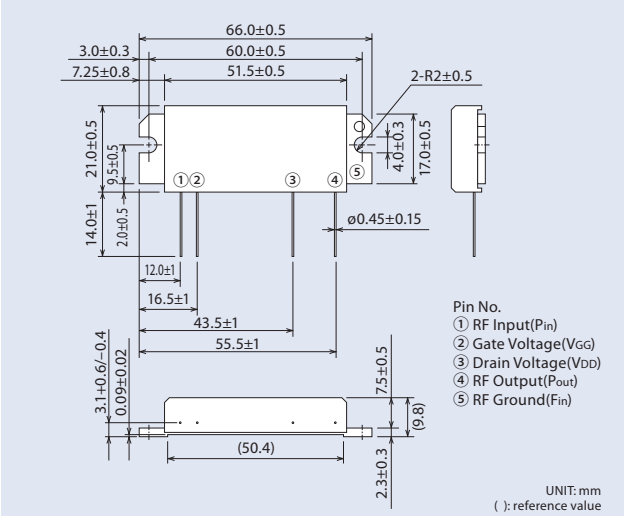
Pin No.
① SOURCE (COMMON)
② DRAIN
③ DRAIN
④ SOURCE (COMMON)
⑤ SOURCE (COMMON)
⑥ GATE
⑦ GATE
⑧ SOURCE (COMMON)
⑨ SOURCE (COMMON)

HPM006



Pin No.
① DRAIN
② SOURCE (COMMON)
③ DRAIN
④ SOURCE (COMMON)
⑤ SOURCE (COMMON)
⑥ GATE
⑦ SOURCE (COMMON)
⑧ GATE

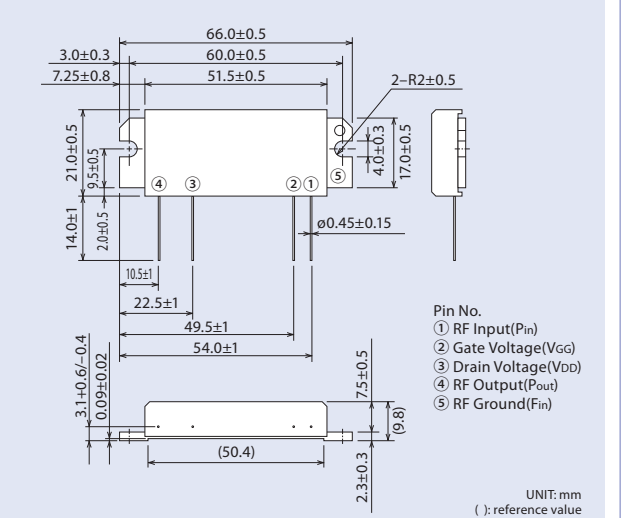
H2S



Pin No.
① RF Input(P_{IN})
② Gate Voltage(V_{GG})
③ Drain Voltage(V_{DD})
④ RF Output(P_{OUT})
⑤ RF Ground(F_{IN})

UNIT: mm
( ): reference value

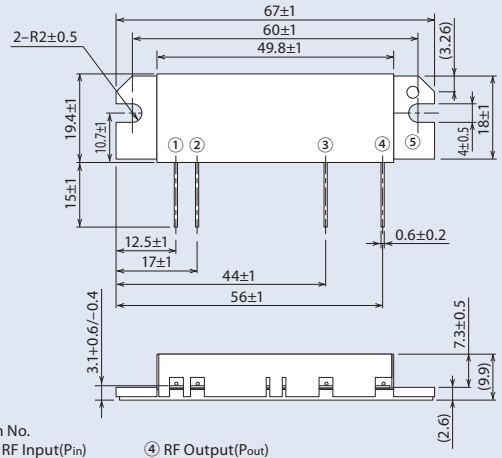
H2RS



Pin No.
① RF Input(P_{IN})
② Gate Voltage(V_{GG})
③ Drain Voltage(V_{DD})
④ RF Output(P_{OUT})
⑤ RF Ground(F_{IN})

UNIT: mm
( ): reference value

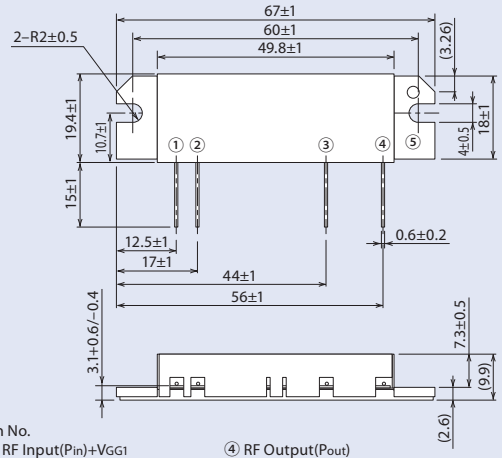
H2M



Pin No.
① RF Input(Pin)
② Gate Voltage(VGG)
③ Drain Voltage(VDD)
④ RF Output(Pout)
⑤ RF Ground(Fin)

UNIT: mm
( ): reference value

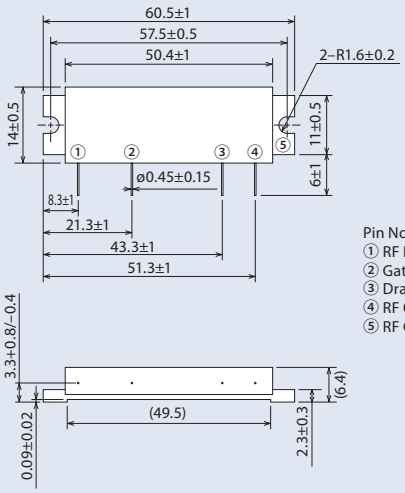
H2M(A)



Pin No.
① RF Input(Pin)+VGG1
② Final Stage Gate Voltage(VGG2)
③ Drain Voltage(VDD)
④ RF Output(Pout)
⑤ RF Ground(Fin)

UNIT: mm
( ): reference value

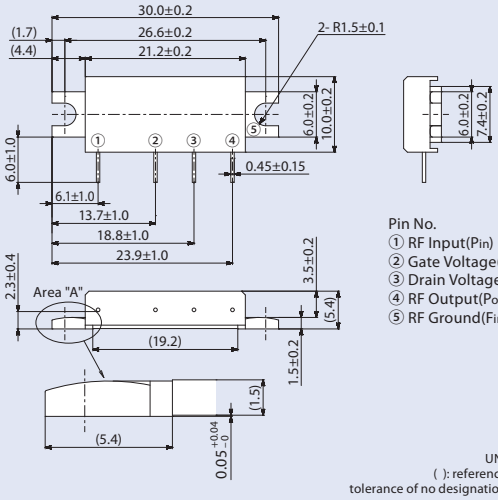
H11S



Pin No.
① RF Input(Pin)
② Gate Voltage(VGG)
③ Drain Voltage(VDD)
④ RF Output(Pout)
⑤ RF Ground(Fin)

UNIT: mm
( ): reference value

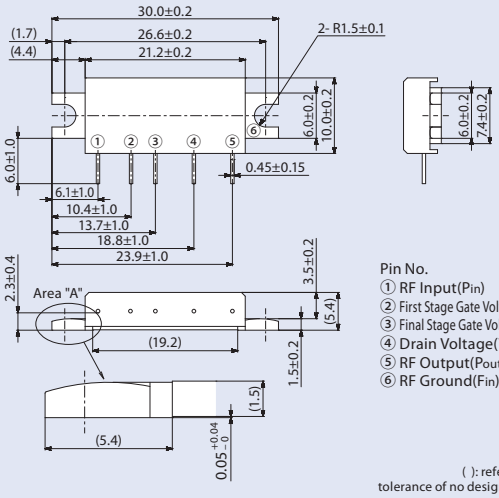
H46S



Pin No.
① RF Input(Pin)
② Gate Voltage(VGG)
③ Drain Voltage(VDD)
④ RF Output(Pout)
⑤ RF Ground(Fin)

UNIT: mm
( ): reference value
tolerance of no designation ; ±0.5

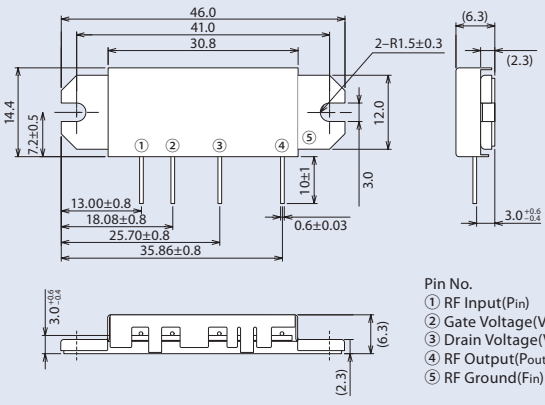
H54



Pin No.
① RF Input(Pin)
② First Stage Gate Voltage(VGG1)
③ Final Stage Gate Voltage(VGG2)
④ Drain Voltage(VDD)
⑤ RF Output(Pout)
⑥ RF Ground(Fin)

UNIT: mm
( ): reference value
tolerance of no designation ; ±0.5

H57



Pin No.
① RF Input(Pin)
② Gate Voltage(VGG)
③ Drain Voltage(VDD)
④ RF Output(Pout)
⑤ RF Ground(Fin)

UNIT: mm
( ): reference value

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HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
www.MitsubishiElectric.com

New publication effective Aug. 2015.
Specifications subject to change without notice.

H-CX624-N KI-1508 Printed in Japan (TOT)