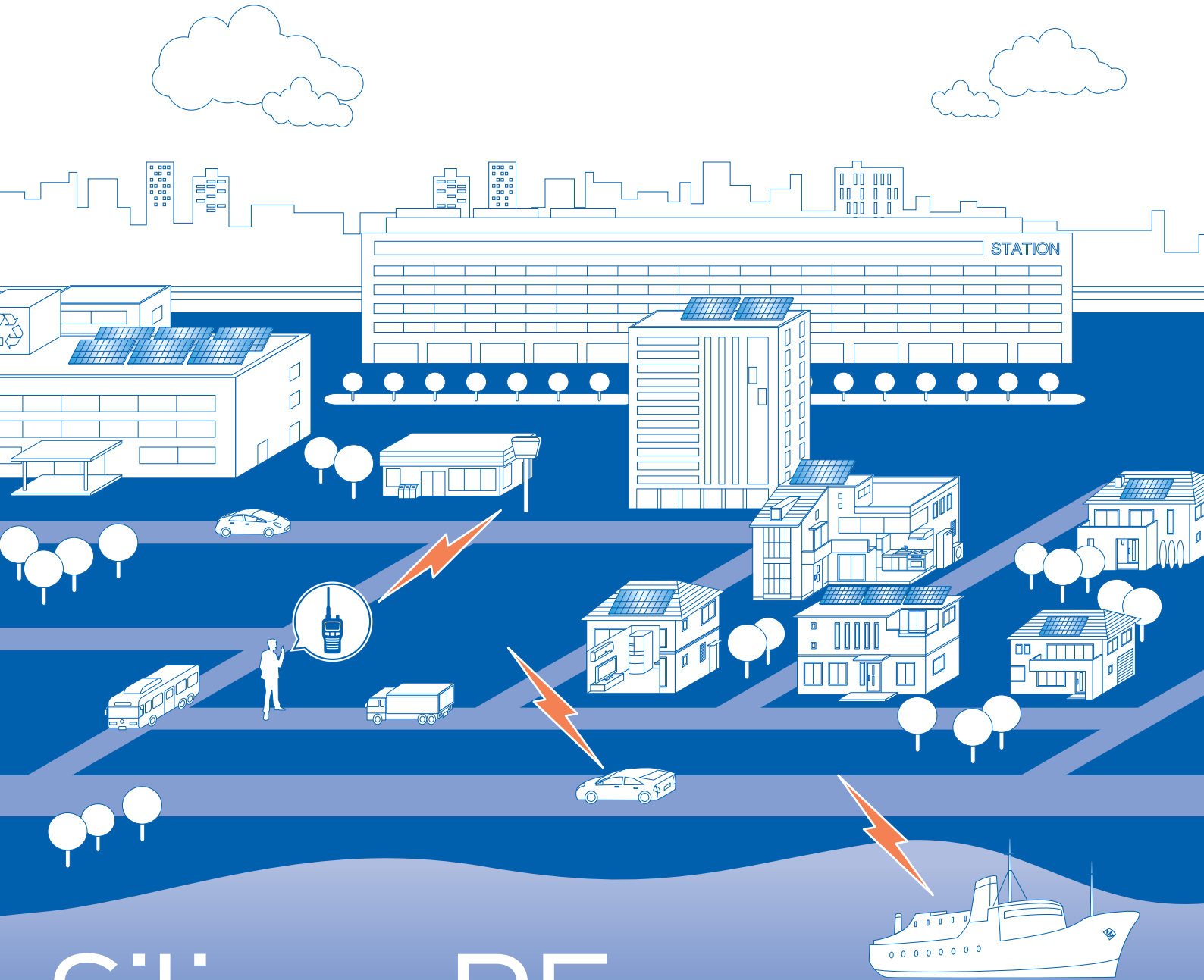
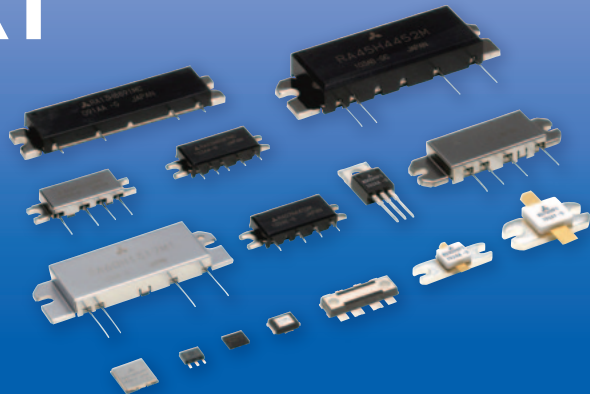


SILICON RF DEVICES



Silicon RF Devices



for a greener tomorrow



Better Performance for Radio Communication Network

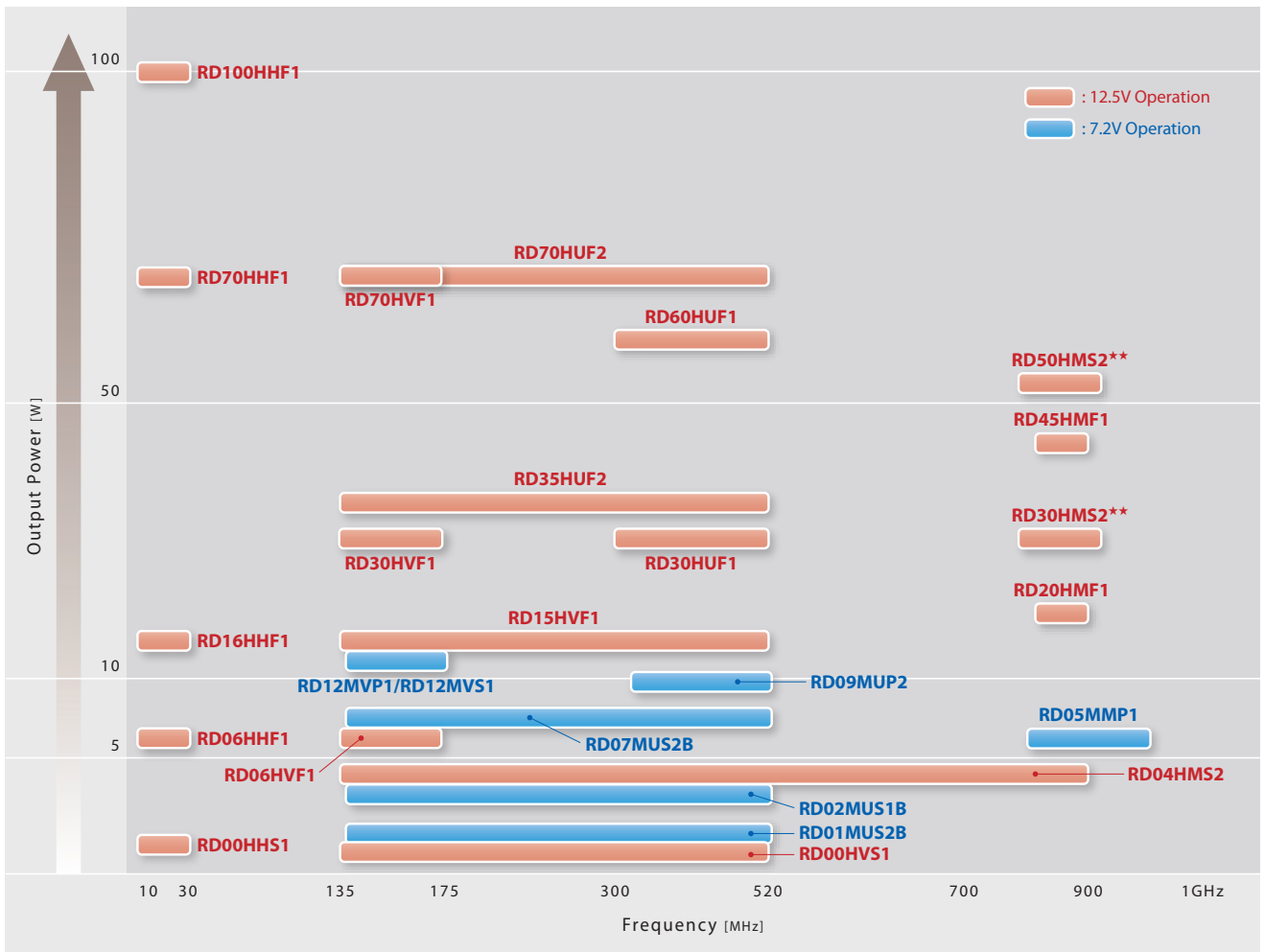
Mitsubishi Electric Silicon RF Devices are Key parts of RF Power Amplifications for various kind of Mobile Radio, Professional Mobile Radios, Amateur Radios, Car Phones for GSM/AMPS and TELEMATICS for automotive. Mitsubishi Electric Silicon RF Devices strongly support for Radio communication network.

LINE UP

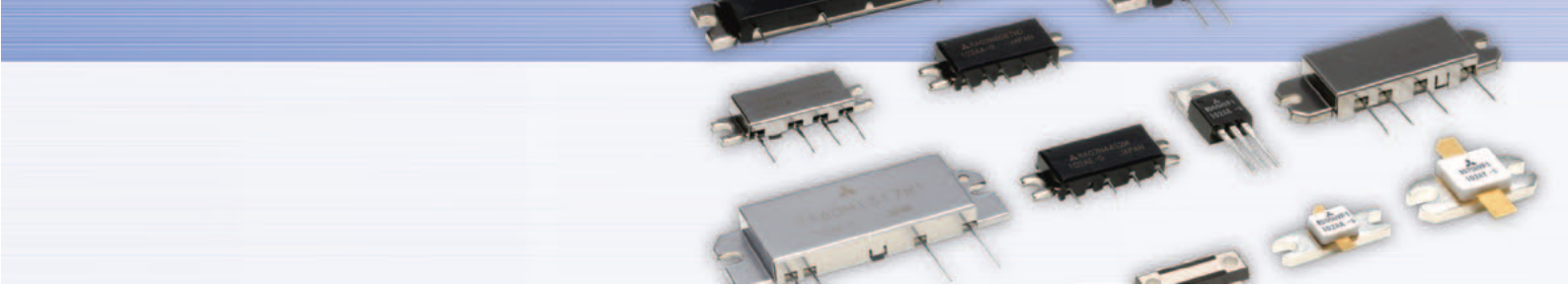
| Silicon RF Devices | FET | Hybrid IC | MAP For SELECTION | | PRODUCT LIST | |
|--------------------|-----|-----------|---|------|--------------|------|
| | | | Page | Page | Page | Page |
| | | | 7.2v Operation High Output Power Si MOS FET (Discrete) | 1 | 3 | 3 |
| | | | 12.5v Operation High Output Power Si MOS FET (Discrete) | 1 | 3 | 3 |
| | | | 7.2v Operation High Output Power Si MOS FET Module | 2 | 5 | 5 |
| | | | 9.6v Operation High Output Power Si MOS FET Module | 2 | 5 | 5 |
| | | | 12.5v Operation High Output Power Si MOS FET Module | 2 | 6 | 6 |

SELECTION MAP

HIGH OUTPUT POWER Si MOS FET (DISCRETE)



★★: Under Development



HIGH OUTPUT POWER Si MOS FET MODULE



** : Under Development

PRODUCT LIST

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

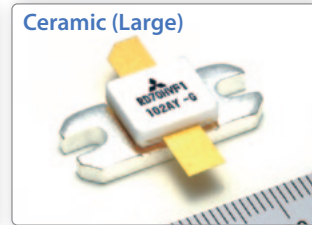
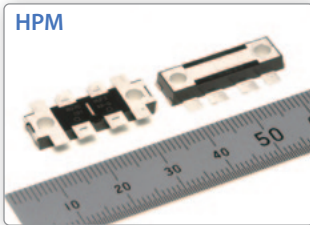
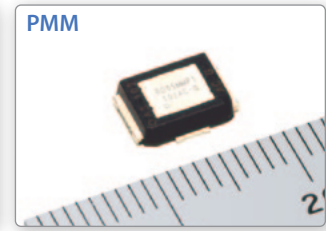
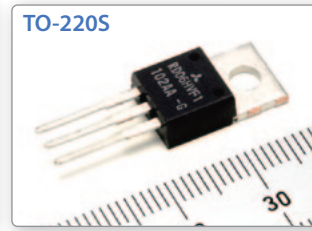
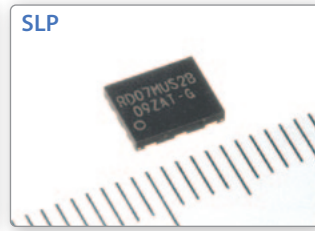
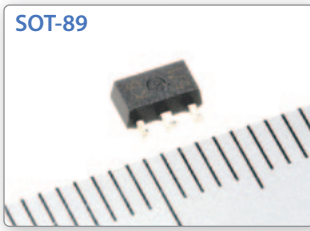
| Type Number | Structure | Max.ratings | | Vdd [V] | f [MHz] | Pin [W] | Po (min) [W] | nd (min) [%] | Package Outline |
|-------------|----------------------|-------------|---------|---------|---------|-----------|--------------|--------------|-----------------|
| | | VDSS [V] | Pch [W] | | | | | | |
| 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 |
| 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) |
| RD30HMS2** | Si, MOS [†] | 40 | 166 | 12.5 | 135~175 | 3 | 45typ. | 72typ. | HPM |
| | | | | | 450~530 | 3 | 43typ. | 60typ. | |
| | | | | | 900 | 5 | 40typ. | 55typ. | |
| RD35HUF2 | Si, MOS [†] | 40 | 166 | 12.5 | 135~175 | 3 | 45typ. | 72typ. | HPM |
| | | | | | 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. | HPM |
| | | | | | 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. | HPM |
| | | | | | 450~530 | 5.5 | 75typ. | 64typ. | |
| RD100HHF1 | Si, MOS | 50 | 176.5 | 12.5 | 30 | 7 | 100 | 55 | Ceramic (Large) |

Ta=25°C †: Gate Protection Diode ** : 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)

C Operation Voltage (V)

D Frequency Range (MHz)

E Outline

F Serial Number

B Output Power (W)

| Symbol | Voltage |
|--------|---------|
| M | 7.2V |
| N | 9.6V |
| H | 12.5V |

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

| Symbol | Segment |
|--------|-----------------|
| S | Mold |
| F | Flange |
| P | Power Mold Mini |

HIGH OUTPUT POWER Si MOS FET MODULE

RA 07 M 4452 M

A B C D E

A Module

C Operation Voltage (V)

D Frequency Range (MHz)

E Frequency Unit

B Output Power (W)

| Symbol | Voltage |
|--------|---------|
| M | 7.2V |
| N | 9.6V |
| H | 12.5V |

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

| 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 |
| RA03M9595M | 9.2 | 952 | 954 | 8 | 0.05 | 3 | - | 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 |

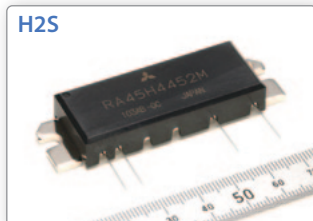
Ta=25°C *1: When Po=2.5W *2: When Po=6.3W

9.6V OPERATION HIGH OUTPUT POWER Si MOS FET MODULE

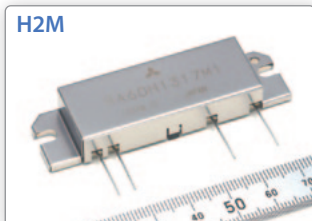
| Type Number | Max.ratings Vdd [V] | f [MHz] | | Vdd [V] | Pin [W] | Po (min) [W] | nd (min) [%] | Package Outline |
|-------------|------------------------|---------|-----|---------|---------|-----------------|-----------------|--------------------|
| | | min | max | | | | | |
| RA07N3340M | 12.5 | 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

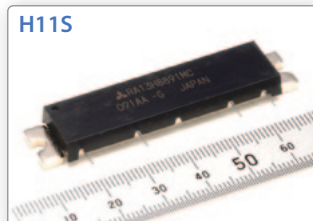
H2S



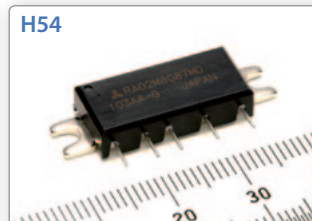
H2M



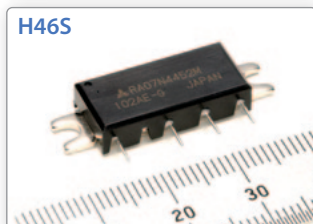
H11S



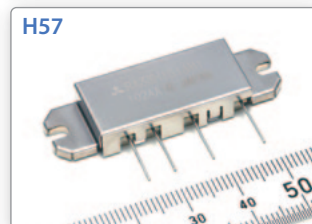
H54



H46S



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 | | | | | |
| RA06H8285M | 17 | 820 | 851 | 12.5 | 0.001 | 6 | 35 | H11S |
| 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 (5-pins) |
| RA08H4547MD | 18 | 450 | 470 | 12.5 | 0.3m | 7.9 | 17 | H2S (5-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 |
| 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 |
| 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 |
| 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 |
| RA45H8994M1 | 17 | 896 | 941 | 12.8 | 0.05 | 45 | 33 | H2M |
| 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 | 520 | 12.5 | 0.05 | 45 (490-520) 55 (440-490) | 35 (490-520) 43 (440-490) | H2S |
| RA60H1317M | 17 | 135 | 175 | 12.5 | 0.05 | 60 | 40 | H2S |
| RA60H1317M1A | 17 | 136 | 174 | 12.5 | 0.05 | 60 | 45 | H2M |
| RA60H3847M1 | 17 | 378 | 470 | 12.5 | 0.05 | 60 | 40 | H2M |
| RA60H4047M1 | 17 | 400 | 470 | 12.5 | 0.05 | 60 | 40 | H2M |
| RA60H4452M1 | 17 | 440 | 520 | 12.5 | 0.05 | 60 | 40 | H2M |
| RA80H1415M1** | 17 | 144 136 | 148 174 | 12.5 | 0.05 | 80 60 | 50 | H2M |

Ta=25°C ** : Under Development

All Products Here Are RoHS Compliant

LINE UP

SELECTION MAP

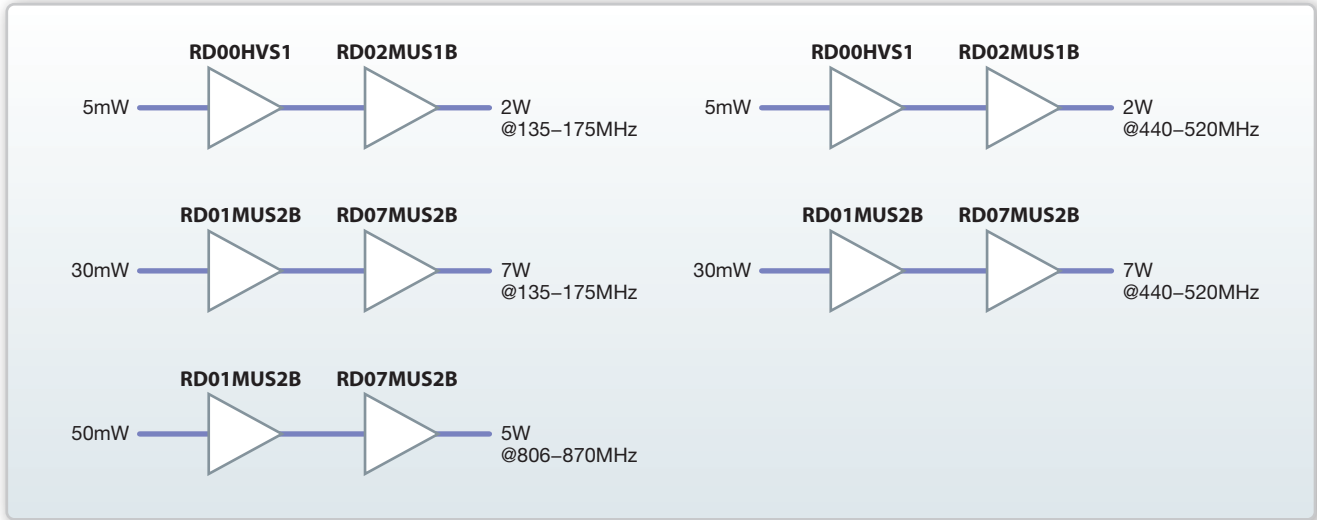
PRODUCT LIST

APPLICATION

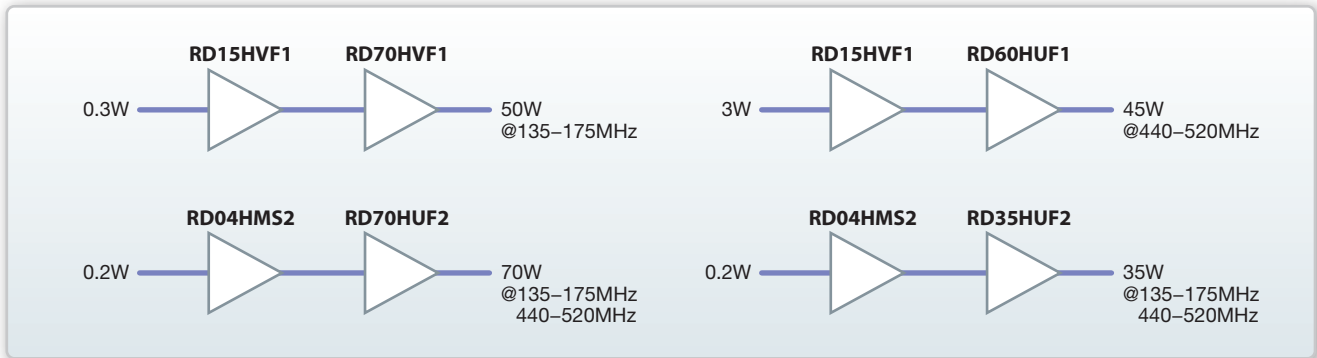
PACKAGE OUTLINE

APPLICATION

VHF~800MHZ BAND 7.2V OPERATION RECOMMENDED LINE UP



VHF~UHF BAND 12.5V OPERATION RECOMMENDED LINE UP



LINE UP

SELECTION MAP

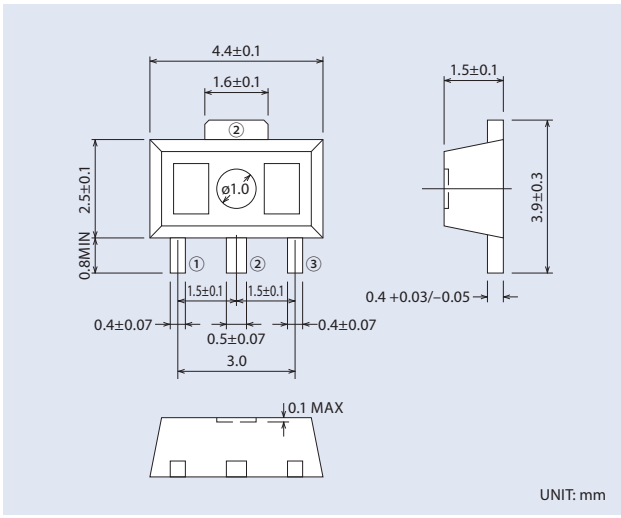
PRODUCT LIST

APPLICATION

PACKAGE OUTLINE

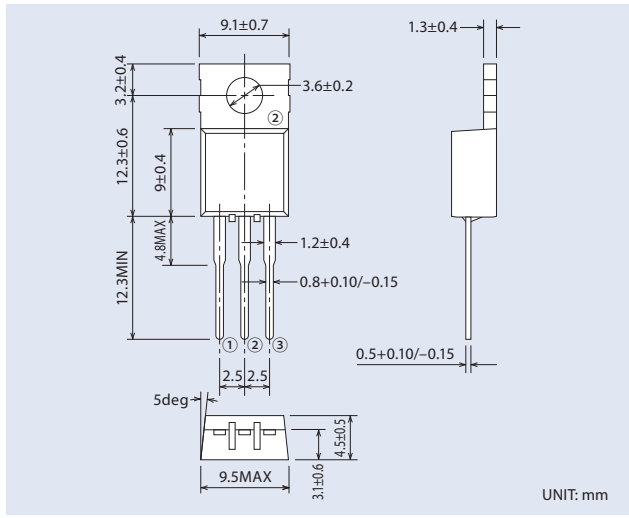
SOT-89

- ① Gate
- ② Source
- ③ Drain



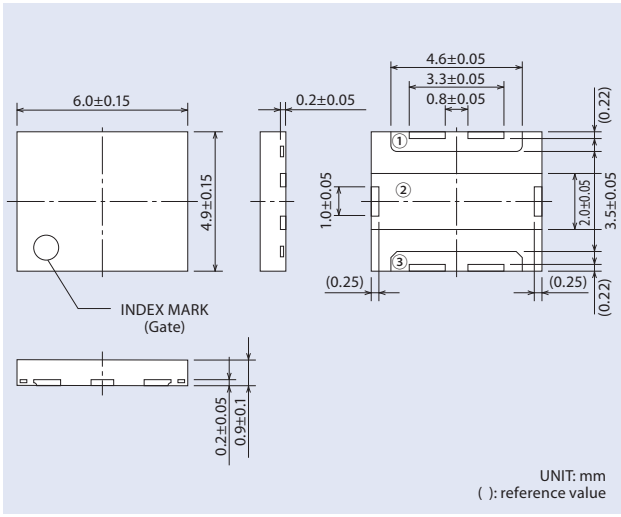
TO-220S

- ① Gate
- ② Source
- ③ Drain



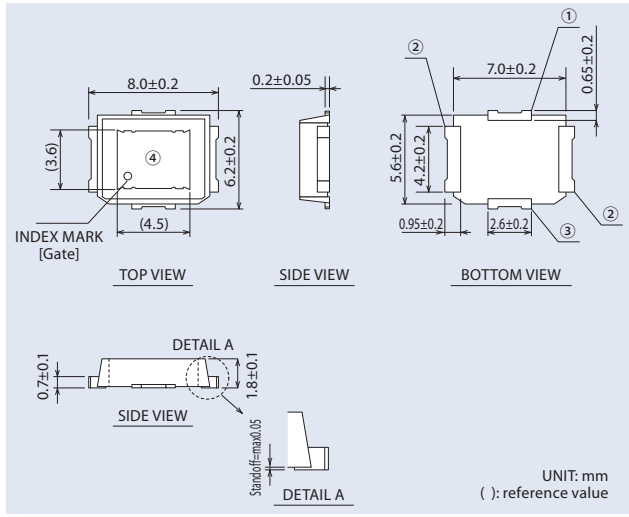
SLP

- ① Drain
- ② Source
- ③ Gate



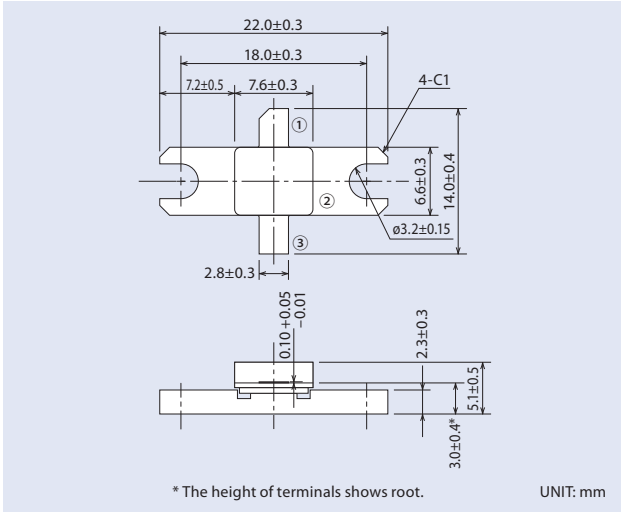
PMM

- ① Drain [output]
- ② Source [GND]
- ③ Gate [input]
- ④ Source



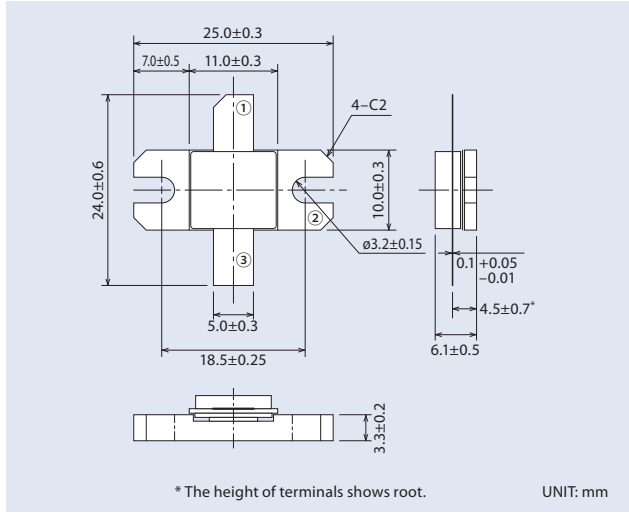
Ceramic (Small)

- ① Drain
- ② Source
- ③ Gate



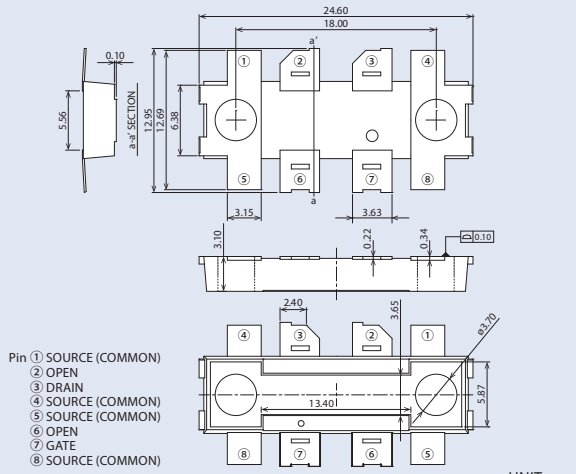
Ceramic (Large)

- ① Drain
- ② Source
- ③ Gate

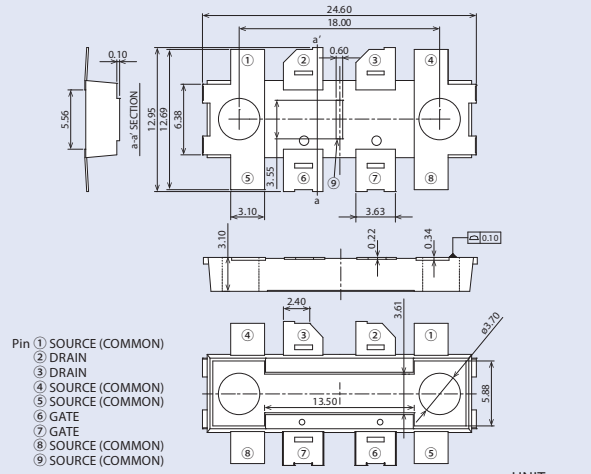


PACKAGE OUTLINE

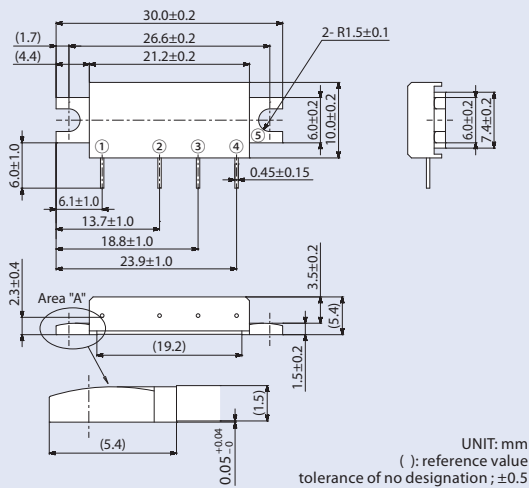
HPM



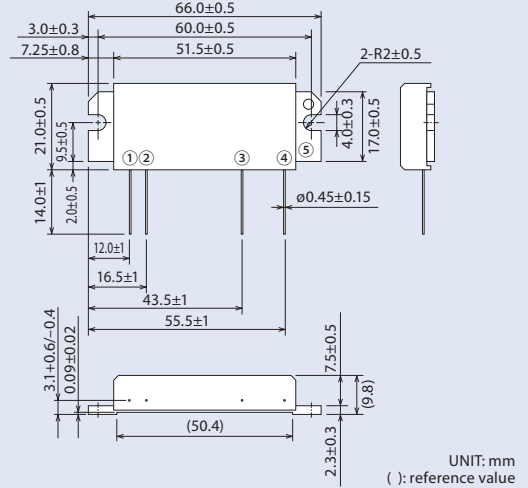
HPM (with CenterSourceElectrode)



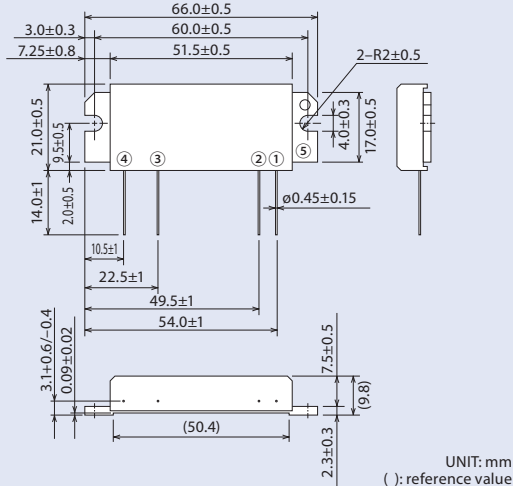
H46S ① RF Input(P_{in}) ③ Drain Voltage(V_{DD}) ⑤ RF Ground(F_{in})
 ② Gate Voltage(V_{GG}) ④ RF Output(P_{out})



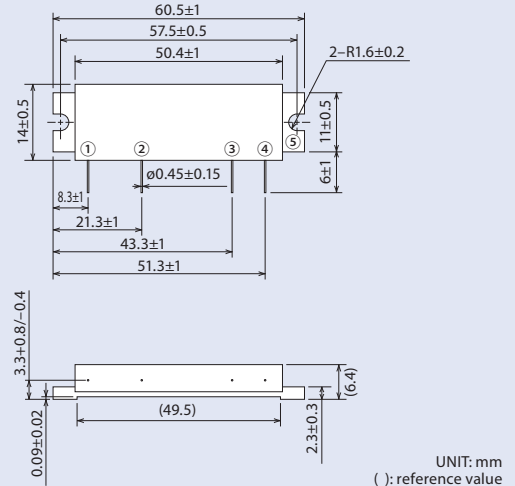
H2S ① RF Input(P_{in}) ③ Drain Voltage(V_{DD}) ⑤ RF Ground(F_{in})
 ② Gate Voltage(V_{GG}) ④ RF Output(P_{out})



H2RS ① RF Input(P_{in}) ③ Drain Voltage(V_{DD}) ⑤ RF Ground(F_{in})
 ② Gate Voltage(V_{GG}) ④ RF Output(P_{out})



H11S ① RF Input(P_{in}) ③ Drain Voltage(V_{DD}) ⑤ RF Ground(F_{in})
 ② Gate Voltage(V_{GG}) ④ RF Output(P_{out})



LINE UP

SELECTION MAP

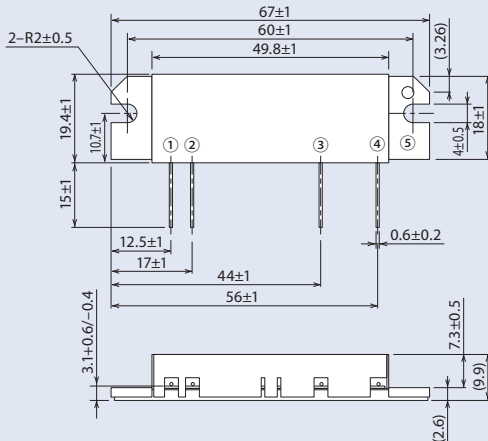
PRODUCT LIST

APPLICATION

PACKAGE OUTLINE

H2M

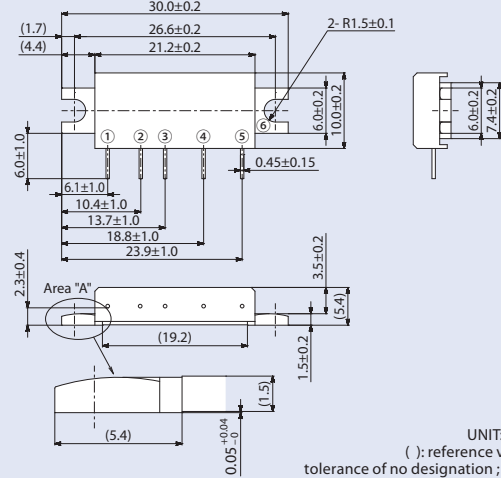
- ① RF Input(P_{in}) ③ Drain Voltage(V_{DD}) ⑤ RF Ground(F_{in})
 ② Gate Voltage(V_{GG}) ④ RF Output(P_{out})



UNIT: mm
 (): reference value

H54

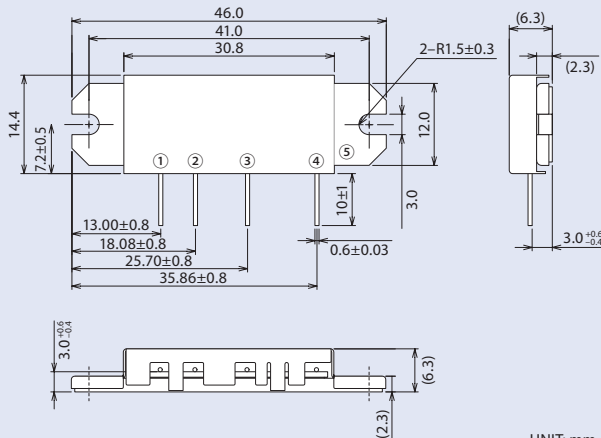
- ① RF Input(P_{in}) ③ Final Stage Gate Voltage(V_{GG2}) ⑤ RF Output(P_{out})
 ② First Stage Gate Voltage(V_{GG1}) ④ Drain Voltage(V_{DD}) ⑥ RF Ground(F_{in})



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

H57

- ① RF Input(P_{in}) ③ Drain Voltage(V_{DD}) ⑤ RF Ground(F_{in})
 ② Gate Voltage(V_{GG}) ④ RF Output(P_{out})



UNIT: mm
 (): reference value

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

- 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.
- 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.
- RA series and RD series products use MOSFET semiconductor technology. They are sensitive to ESD voltage therefore appropriate ESD precautions are required.
- 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.
- 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.
- 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.
- For specific precautions regarding assembly of these products into the equipment, please refer to the supplementary items in the specification sheet.
- 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.
- For additional "Safety first" in your circuit design and notes regarding the materials, please refer the last page of this manual.
- 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.

Notes regarding these materials

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