**RD70HUF2**

RoHS Compliance, Silicon MOSFET Power Transistor, 175MHz, 530MHz, 70W

**DESCRIPTION**
RD70HUF2 is MOS FET type transistor specifically designed for VHF/UHF RF power amplifiers applications.

**FEATURES**
1. Supply with Tape and Reel. 500 Units per Reel
2. Employing Mold Package
3. High Power and High Efficiency
   - $P_{out}=75\text{W}_{\text{typ}}$, Drain Effi.$=64\%_{\text{typ}}$
   - @ $V_{ds}=12.5\text{V}$  $I_{dq}=1.0\text{A}$  $P_{in}=5.5\text{W}$  $f=530\text{MHz}$
   - $P_{out}=84\text{W}_{\text{typ}}$, Drain Effi.$=74\%_{\text{typ}}$
   - @ $V_{ds}=12.5\text{V}$  $I_{dq}=1.0\text{A}$  $P_{in}=4.0\text{W}$  $f=175\text{MHz}$
4. Integrated gate protection diode

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

**RoHS COMPLIANT**
RD70HUF2 is a RoHS compliant product. RoHS compliance is indicating by the letter “G” after the Lot Marking. This product includes the lead in high melting temperature type solders. However, it is applicable to the following exceptions of RoHS Directions.
1. Lead in high melting temperature type solders. (i.e. tin-lead solder alloys containing more than 85% lead.)
## ABSOLUTE MAXIMUM RATINGS (Tc=25°C UNLESS OTHERWISE NOTED)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>RATINGS</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDSS</td>
<td>Drain to Source Voltage</td>
<td>Vgs=0V</td>
<td>40</td>
<td>V</td>
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<tr>
<td>VGSS</td>
<td>Gate to Source Voltage</td>
<td>Vds=0V</td>
<td>-5/+10</td>
<td>V</td>
</tr>
<tr>
<td>Pch</td>
<td>Channel Dissipation</td>
<td>Tc=25°C</td>
<td>300</td>
<td>W</td>
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<tr>
<td>Pin</td>
<td>Input Power</td>
<td>Zg=Zl=50Ω</td>
<td>12</td>
<td>W</td>
</tr>
<tr>
<td>ID</td>
<td>Drain Current</td>
<td>-</td>
<td>20</td>
<td>A</td>
</tr>
<tr>
<td>Tch</td>
<td>Channel Temperature</td>
<td>-</td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>Tstg</td>
<td>Storage Temperature</td>
<td>-</td>
<td>-40 to +175</td>
<td>°C</td>
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<tr>
<td>Rthjc</td>
<td>Thermal Resistance</td>
<td>Junction to Case</td>
<td>0.5</td>
<td>°C/W</td>
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</table>

Note: Above parameters are guaranteed independently.

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

<table>
<thead>
<tr>
<th>SYMBOL</th>
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<th>LIMITS</th>
<th>UNIT</th>
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</thead>
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<tr>
<td>IDSS*</td>
<td>Zero Gate Voltage Drain Current</td>
<td>Vds=37V, Vgs=0V</td>
<td>-150</td>
<td>μA</td>
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<tr>
<td>IGSS*</td>
<td>Gate to Source Leak Current</td>
<td>Vgs=10V, Vds=0V</td>
<td>-2.5</td>
<td>μA</td>
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<tr>
<td>VTH*</td>
<td>Gate Threshold Voltage</td>
<td>Vds=12V, Ids=1mA</td>
<td>1.6</td>
<td>2.0</td>
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<td>Pout1</td>
<td>Output Power</td>
<td>f=530MHz**, Vds=12.5V,</td>
<td>-75</td>
<td>-</td>
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<tr>
<td>ηD1</td>
<td>Drain Efficiency</td>
<td>Pin=5.5W, Idq=2x500mA</td>
<td>-64</td>
<td>-</td>
</tr>
<tr>
<td>Pout2</td>
<td>Output Power</td>
<td>f=175MHz***, Vds=12.5V,</td>
<td>-84</td>
<td>-</td>
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<tr>
<td>ηD2</td>
<td>Drain Efficiency</td>
<td>Pin=4.0W, Idq=2x500mA</td>
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<td>-</td>
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<td>VSWRT</td>
<td>Load VSWR Tolerance</td>
<td>All phase, Vds=16.3V increased after</td>
<td>20:1</td>
<td>-</td>
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</table>

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

* Unilateral Measurement (Measured per Single Side)
** In Mitsubishi UHF Evaluation Board
*** In Mitsubishi VHF Evaluation Board
TYPICAL CHARACTERISTICS
(These are only typical curves and devices are not necessarily guaranteed at these curves.)
(These are Unilateral Measurement (Measured per Single Side))
RD70HUF2
RoHS Compliance, Silicon MOSFET Power Transistor, 175MHz, 530MHz, 70W

VHF-band TYPICAL CHARACTERISTICS
(These are only typical curves and devices are not necessarily guaranteed at these curves.)

Frequency Characteristics @f=135 to 175MHz
Ta=+25deg.C,
Vds=12.5V,Idq=Total 1A/One side 0.5A, Pin=4.0W
VHF-band TYPICAL CHARACTERISTICS
(These are only typical curves and devices are not necessarily guaranteed at these curves.)

Output Power versus Input Power

Input Return Loss versus Output Power

Gain versus Output Power

Drain Efficiency versus Output Power

Publication Date: Oct. 2011
VHF-band TYPICAL CHARACTERISTICS
(These are only typical curves and devices are not necessarily guaranteed at these curves.)
UHF-band TYPICAL CHARACTERISTICS
(These are only typical curves and devices are not necessarily guaranteed at these curves.)

Frequency Characteristics @f=450 to 530MHz

Ta=+25deg.C,
Vds=12.5V, Idq=Total 1A/One side 0.5A, Pin=5.5W
< Silicon RF Power MOS FET (Discrete) >

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UHF-band TYPICAL CHARACTERISTICS
(These are only typical curves and devices are not necessarily guaranteed at these curves.)

Output Power versus Input Power

Input Return Loss versus Output Power

Gain versus Output Power

Drain Efficiency versus Output Power

Publication Date : Oct. 2011
**UHF-band TYPICAL CHARACTERISTICS**
(These are only typical curves and devices are not necessarily guaranteed at these curves.)

**Output Power versus Biasing Current**

- Pin=5.5W
- Ta=+25deg.C, Vds=12.5V

**Drain Efficiency versus Biasing Current**

- Pin=5.5W
- Ta=+25deg.C, Vds=12.5V

**Output Power versus Supply Voltage**

- Pin=5.5W
- Ta=+25deg.C, Idq=Total 1A/One side 0.5A

**Drain Efficiency versus Supply Voltage**

- Pin=5.5W
- Ta=+25deg.C, Idq=Total 1A/One side 0.5A
RD70HUF2
RoHS Compliance, Silicon MOSFET Power Transistor, 175MHz, 530MHz, 70W

EQUIVALENT CIRCUITRY for VHF EVALUATION BOARD (f=135 - 175MHz)

For more information regarding this evaluation board, refer to APPLICATION NOTE "AN-VHF-049"
EQUIVALENT CIRCUITRY for UHF EVALUATION BOARD (f=450 - 530MHz)

Board material: Glass Epoxy Substrate--
er=4.8, TanD=0.018 @1GHz
Micro Strip Line Substrate Thickness:
ML1, T=0.2
ML2, T=1.1

Via Hole Dimensions, Diameter=0.8 Length=1.6

UNIT: W/L/T, mm

C1 330 pF  3.2*1.6  Chip Ceramic Capacitors
C2  6 pF   1.6*0.8  High Q Chip Ceramic Capacitors
C3  4 pF   1.6*0.8  High Q Chip Ceramic Capacitors
C4, C5 100 pF  1.6*0.8  High Q Chip Ceramic Capacitors
C6, C7 22 pF   1.6*0.8  High Q Chip Ceramic Capacitors
C8, C9 27 pF   1.6*0.8  High Q Chip Ceramic Capacitors
C10, C11 1000 pF  1.6*0.8  Chip Ceramic Capacitors
C12, C13, C14, C15 100 pF  2.0*1.2  High Q Chip Ceramic Capacitors
C16, C17 12 pF   1.6*0.8  High Q Chip Ceramic Capacitors
C18, C19 1000 pF  1.6*0.8  Chip Ceramic Capacitors
C37, C38, C39, C40, C41, C42 1000 pF  2.0*1.2  Chip Ceramic Capacitors
R1 2.2 ohm  2.0*1.2  Chip Resistors
R2, R3 100 ohm  2.0*1.2  Chip Resistors
R4, R5 2.2k ohm  1.8*0.8  Chip Resistors

C20, C21 39 pF   2.0*1.2  High Q Chip Ceramic Capacitors
C22, C23 36 pF   2.0*1.2  High Q Chip Ceramic Capacitors
C24, C25 10 pF   2.0*1.2  High Q Chip Ceramic Capacitors
C26, C27 24 pF   2.0*1.2  High Q Chip Ceramic Capacitors
C28, C29 3.6 pF   2.0*1.2  High Q Chip Ceramic Capacitors
C30, C31 1 pF    2.0*1.2  High Q Chip Ceramic Capacitors
C32  9 pF    2.0*1.2  High Q Chip Ceramic Capacitors
C33  100 pF   3.2*2.5  High Q Chip Ceramic Capacitors
C34, C35 1000 pF  2.0*1.2  Chip Ceramic Capacitors
C36  220 uF    -35V, Electrolytic Capacitor
L1  25 nH    - 5Turn Rolling Coil

For more information regarding this evaluation board, refer to APPLICATION NOTE “AN-UHF-113”
## Input / Output Impedance VS. Frequency Characteristics

### Zout* (f=135, 155, 175MHz)

- **Zo=10ohm**
- \(f=135MHz\) \(\text{Zout}^* = 1.08 + j1.00\)
- \(f=155MHz\) \(\text{Zout}^* = 1.33 + j1.17\)
- \(f=175MHz\) \(\text{Zout}^* = 0.98 + j1.29\)

**Device Under Test**

- **Pin=4W, Vds=12.5V, Idq=One Side 0.5/Total 1.0A**

### Zin* (f=135, 155, 175MHz)

- **Zo=10ohm**
- \(f=135MHz\) \(\text{Zin}^* = 5.29 + j1.22\)
- \(f=155MHz\) \(\text{Zin}^* = 4.10 + j2.00\)
- \(f=175MHz\) \(\text{Zin}^* = 3.30 + j2.96\)

**Device Under Test**

- **Pin=4W, Vds=12.5V, Idq=One Side 0.5/Total 1.0A**

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**Gate**

- Edge of a footprint pad placed for a pin
- Boundary surface between a pin and package plastics

**Drain**

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**Publication Date:** Oct. 2011
RD70HUF2
RoHS Compliance, Silicon MOSFET Power Transistor, 175MHz, 530MHz, 70W

Input / Output Impedance VS. Frequency Characteristics

Zout* (f=450, 490, 530MHz)

Zin* (f=450, 490, 530MHz)

Zout*: Complex conjugate of output impedance

Zin*: Complex conjugate of input impedance

Zo=10ohm

Publication Date: Oct. 2011
## Small Signal Parameter of One Side of RD70HUF2

**Bias Condition:** Vds=12.5V, Idq=One Side 0.5A/Total 1.0A

<table>
<thead>
<tr>
<th>Freq [MHz]</th>
<th>S11 (mag)</th>
<th>S11 (ang)</th>
<th>S21 (mag)</th>
<th>S21 (ang)</th>
<th>S12 (mag)</th>
<th>S12 (ang)</th>
<th>S22 (mag)</th>
<th>S22 (ang)</th>
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<tbody>
<tr>
<td>100</td>
<td>0.887</td>
<td>-173.4</td>
<td>5.086</td>
<td>72.4</td>
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<td>0.978</td>
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<td>111.5</td>
<td>0.982</td>
<td>174.0</td>
</tr>
</tbody>
</table>
ATTENTION:
1. High Temperature; This product might have a heat generation while operation. Please take notice that there is 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 in this data sheet 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 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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