**MGFG5H1503**

Ku band GaN MMIC Power Amplifier

13.75 – 14.5 GHz BAND / 20W

**DESCRIPTION**

The MGFG5H1503, a 20W 4-stage GaN MMIC Power Amplifier including a linearizer, is designed for Ku-band applications.

**FEATURES**

- High voltage operation: \( VDS = 24V \)
- High output power: \( P_o = 43.0 \text{dBm (TYP.)} \) @ \( \text{Pin} = 27 \text{dBm} \)
- High efficiency: \( \text{PAE} = 20\% \) (TYP.) @ \( \text{Pin} = 27 \text{dBm} \)
- Input and output matched to 50Ωm
- DC block capacitors built in
- 0.25μm GaN HEMT Technology
- Independently adjustable bias pins
- Compact metal package with screw holes

**APPLICATION**

- Amplifier for Ku-band SATCOM

**QUALITY**

- General & Industrial

**Packaging**

- Tray: 12 devices in one tray

---

### Absolute Maximum Ratings (\( Ta=25^\circ C \))

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Vd )</td>
<td>Drain to Source Voltage</td>
<td>27</td>
<td>V</td>
</tr>
<tr>
<td>( Vg )</td>
<td>Gate to Source Voltage</td>
<td>-10</td>
<td>V</td>
</tr>
<tr>
<td>( Vl )</td>
<td>Linearizer Voltage</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td>( \text{Pin} )</td>
<td>RF Input Power</td>
<td>30</td>
<td>dBm</td>
</tr>
<tr>
<td>( Vd_{on} )</td>
<td>Drain to Source Voltage under RF operation</td>
<td>27</td>
<td>V</td>
</tr>
<tr>
<td>( T_{ch} )</td>
<td>Channel Temperature</td>
<td>230</td>
<td>°C</td>
</tr>
<tr>
<td>( T_{stg} )</td>
<td>Storage Temperature</td>
<td>-55 to 125</td>
<td>°C</td>
</tr>
</tbody>
</table>

*1: \( T_{c}=25^\circ C \)

### Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Typ.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Vd )</td>
<td>Drain Voltage</td>
<td>24</td>
<td>V</td>
</tr>
<tr>
<td>( Id_{dB} )</td>
<td>Drain Current of buffer amp. without RF Drive</td>
<td>180</td>
<td>mA</td>
</tr>
<tr>
<td>( Id_{1} )</td>
<td>Drain Current of 1st stage without RF Drive</td>
<td>360</td>
<td>mA</td>
</tr>
<tr>
<td>( Id_{2} )</td>
<td>Drain Current of 2ndstage without RF Drive</td>
<td>720</td>
<td>mA</td>
</tr>
<tr>
<td>( Id_{3} )</td>
<td>Drain Current of 3rd stage without RF Drive</td>
<td>1440</td>
<td>mA</td>
</tr>
<tr>
<td>( Vg )</td>
<td>Gate Voltage</td>
<td>-2.7 to -1.7</td>
<td>V</td>
</tr>
<tr>
<td>( Vl )</td>
<td>Control Voltage of Linearizer</td>
<td>0</td>
<td>V</td>
</tr>
<tr>
<td>( T_{ch} )</td>
<td>Channel Temperature</td>
<td>≤ 175</td>
<td>°C</td>
</tr>
</tbody>
</table>

**Publication Date**: July/2021
MGFG5H1503
Ku band GaN MMIC Power Amplifier
13.75 – 14.5 GHz BAND / 20W

Electrical Characteristics  (Ta=25°C)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test conditions</th>
<th>Limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vg(off)</td>
<td>Gate to source cut-off voltage</td>
<td>Vd=24V, IdB=1.2mA, Id1=2.4mA, Id2=4.8mA, Id3=9.6mA</td>
<td>-2</td>
<td>5 V</td>
</tr>
<tr>
<td>Freq.</td>
<td>Operational Frequency</td>
<td>Vd=24V, Vl=0V</td>
<td>13.75</td>
<td>14.5  GHz</td>
</tr>
<tr>
<td>Psat *2</td>
<td>Saturated Power</td>
<td>IdqB=180mA, Idq=1=360mA, Idq2=720mA, Idq3=1440mA,</td>
<td>43</td>
<td>dBm</td>
</tr>
<tr>
<td>Glp *3</td>
<td>Linear Power Gain</td>
<td></td>
<td>22</td>
<td>dB</td>
</tr>
<tr>
<td>IM3 *4</td>
<td>3rd Order Intermodulation Distortion</td>
<td>*2: Pin=27dBm *3: Pin=0dBm *4: Pout=34dBm (SCL)</td>
<td>-25</td>
<td>dBc</td>
</tr>
<tr>
<td>Rth(ch-c) *5</td>
<td>Thermal resistance</td>
<td>ΔVf method</td>
<td>1.2</td>
<td>1.5°C/W</td>
</tr>
</tbody>
</table>

*5:Channel-case
Specifications are subject to change without notice.

ESD *6 Class 0 -199~
*6:Based on EIAJ ED-4701 C-111A(C=100pF,R=1.5kΩ)

Pin Configuration

Pin Number Symbol Description
1 VdB Drain Voltage of Buffer Stage
2 Vd1 Drain Voltage of 1st Stage
3 Vg2 Gate Voltage of 2nd Stage
4 Vd2 Drain Voltage of 2nd Stage
5 Vg3 Gate Voltage of 3rd Stage
6 Vd3 Drain Voltage of 3rd Stage
7 Pout RF Output
8 Vd3 Drain Voltage of 3rd Stage
9 Vg3 Gate Voltage of 3rd Stage
10 Vd2 Drain Voltage of 2nd Stage
11 Vd1 Drain Voltage of 1st Stage
12 Vgb1 Gate Voltage of 1st Stage and Buffer Stage
13 Vl Control Voltage of Linearizer
14 Pin RF Input

VI: Control voltage to optimize distortion characteristics such as AMAM, AMPM, and IMD.

Vg3 and Vd1,2,3 must be biased from both sides as follows:

Vd1: 2 and 11
Vd2: 4 and 10
Vg3: 5 and 9
Vd3: 6 and 8

CTHA-210709-03
MGFG5H1503
Ku band GaN MMIC Power Amplifier
13.75 – 14.5 GHz BAND / 20W

MGFG5H1503 stand-alone

1. Po / GLP / PAE vs. freq
   (Temperature Dependence)

Vd=24V, Vi=0V, IdqB=180mA, Idq1=360mA, Idq2=720mA, Idq3=1440mA,
Tc=-15°C/+25°C/+85°C

Fig.1-1 Psat@Pin=27dBm vs. Freq.
Fig.1-2 GLP@Pin=0dBm vs. Freq.
Fig.1-3 PAE@Pin=27dBm vs. Freq.
2. Pin - Po Characteristics
(Temperature Dependence)

Vd=24V, Vi=0V, IdqB=180mA, Idq1=360mA, Idq2=720mA, Idq3=1440mA,
Tc=−15°C/+25°C/+85°C

Fig.2 Pin - Po Characteristics

3. TWO-TONE Characteristics
(Temperature Dependence)

Vd=24V, Vi=0V, IdqB=180mA, Idq1=360mA, Idq2=720mA, Idq3=1440mA,
Δf=5MHz in 2-tone test, Tc=−15°C/+25°C/+85°C

Fig.3 IM3 - Po Characteristics
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.

Note: This product is based on results obtained from a project subsidized by the New Energy and Industrial Technology Development Organization (NEDO).

CTHA-210709-03

© Mitsubishi Electric Corporation
Publication Date : July/2021