**FEATURES**

- High Output Power: \( P_{\text{out}} = 33.0 \text{dBm} \) (typ.)
- High Linear Gain: \( G_L = 26.0 \text{dB} \) (typ.)
- Broad Band: 12.7 to 15.4 GHz
- Impedance Matched \( Z_{\text{in}}/Z_{\text{out}} = 50 \Omega \)

**DESCRIPTION**

The EMM5075X is a MMIC amplifier that contains a three-stages amplifier, internally matched, for standard communications band in the 12.7 to 15.4 GHz frequency range.

Sumitomo Electric Device Innovations’s stringent Quality Assurance Program assures the highest reliability and consistent performance.

**ABSOLUTE MAXIMUM RATING**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>( V_{\text{DD}} )</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>( V_{\text{GG}} )</td>
<td>-3</td>
<td>V</td>
</tr>
<tr>
<td>Input Power</td>
<td>( P_{\text{in}} )</td>
<td>26</td>
<td>dBm</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>( T_{\text{stg}} )</td>
<td>-55 to +125</td>
<td>℃</td>
</tr>
</tbody>
</table>

**RECOMMENDED OPERATING CONDITIONS**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>( V_{\text{DD}} )</td>
<td>( \leq 7 )</td>
<td>V</td>
</tr>
<tr>
<td>Input Power</td>
<td>( P_{\text{in}} )</td>
<td>( \leq 16 )</td>
<td>dBm</td>
</tr>
<tr>
<td>Operating Case Temperature</td>
<td>( T_C )</td>
<td>-40 to +85</td>
<td>℃</td>
</tr>
</tbody>
</table>

This Product should be hermetically packaged.

**ELECTRICAL CHARACTERISTICS (Case Temperature \( T_a = 25^\circ \text{C} \))**

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Frequency Range</td>
<td>( f )</td>
<td>( V_{\text{DD}} = +6 \text{V} )</td>
<td>12.7, 15.4</td>
<td>GHz</td>
</tr>
<tr>
<td>Output Power at 1dB G.C.P.</td>
<td>( P_{1\text{dB}} )</td>
<td>( I_{\text{DD,DC}} = 1200 \text{mA} ) typ.</td>
<td>32, 33</td>
<td>dBm</td>
</tr>
<tr>
<td>Power Gain at 1dB G.C.P.</td>
<td>( G_{1\text{dB}} )</td>
<td>( Z_S = Z_L = 50 \Omega )</td>
<td>22, 26</td>
<td>dB</td>
</tr>
<tr>
<td>Power-added Efficiency at 1dB G.C.P.</td>
<td>( N_{\text{add}} )</td>
<td>-</td>
<td>26</td>
<td>%</td>
</tr>
<tr>
<td>Drain Current at 1dB G.C.P.</td>
<td>( I_{\text{DRF}} )</td>
<td>-</td>
<td>1300, 1900</td>
<td>mA</td>
</tr>
<tr>
<td>3rd. Order Intermodulation Distortion *</td>
<td>( IM_3 )</td>
<td>( df = +10 \text{MHz} )</td>
<td>-40, -47, -</td>
<td>dBc</td>
</tr>
<tr>
<td>Input Return Loss (at Pin=-20dBm)</td>
<td>( R_{\text{LIN}} )</td>
<td>( P_0 = 20 \text{dBm} ) S.C.L</td>
<td>-8</td>
<td>dB</td>
</tr>
<tr>
<td>Output Return Loss (at Pin=-20dBm)</td>
<td>( R_{\text{OUT}} )</td>
<td>-</td>
<td>-15</td>
<td>dB</td>
</tr>
</tbody>
</table>

*Note: RF parameter sample size 10ps. Criteria (accept/reject)=(0/1) G.C.P. : Gain Compression Point SCL : Single Carrier Level

**ESD**

| Class | ~ 249V
|-------|-------

**RoHS Compliance**

| Yes |
EMM5075X
Ku-Band Power Amplifier MMIC

OUTPUT POWER vs. FREQUENCY

@VDD=6V, IDD(DC)=1200mA

OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER

@VDD=6V, IDD(DC)=1200mA

POWER-ADDED EFFICIENCY vs FREQUENCY

@VDD=6V, IDD(DC)=1200mA
EMM5075X
Ku-Band Power Amplifier MMIC

IMD vs. FREQUENCY
@VDD=6V, IDD(DC)=1200mA, Pout=20dBm S.C.L.

IMD vs OUTPUT POWER
@VDD=6V, IDD(DC)=1200mA

3rd Order Intermodulation Distortion [dBc]
2-Tone Total Output Power [dBm]

Frequency [GHz]

11.5 12 12.5 13 13.5 14 14.5 15 15.5 16 16.5

-60 -55 -50 -45 -40 -35 -30 -25 -20


12.7GHz 13.5GHz 14.5GHz 15.4GHz

IM3 IM5
EMM5075X
Ku-Band Power Amplifier MMIC

IMD PERFORMANCE vs. OUTPUT POWER by Drain Voltage

@\(\text{IDD(DC)}=1200\text{mA}, f=12.7\text{GHz}\)

@\(\text{IDD(DC)}=1200\text{mA}, f=13.5\text{GHz}\)

@\(\text{IDD(DC)}=1200\text{mA}, f=14.5\text{GHz}\)

@\(\text{IDD(DC)}=1200\text{mA}, f=15.4\text{GHz}\)

IM3
IM5

2-Tone Total Output Power [dBm]

Intermodulation Distortion [dBc]
EMM5075X
Ku-Band Power Amplifier MMIC

IMD PERFORMANCE vs. OUTPUT POWER by Drain Current

@VDD=6V, f=12.7GHz

IMD PERFORMANCE vs. OUTPUT POWER by Drain Current

@VDD=6V, f=13.5GHz

IMD PERFORMANCE vs. OUTPUT POWER by Drain Current

@VDD=6V, f=14.5GHz

IMD PERFORMANCE vs. OUTPUT POWER by Drain Current

@VDD=6V, f=15.4GHz
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>0.999</td>
<td>-20.0</td>
<td>0.057</td>
<td>43.2</td>
<td>0.001</td>
<td>-43.8</td>
<td>0.996</td>
<td>-31.0</td>
</tr>
<tr>
<td>2.0</td>
<td>0.995</td>
<td>-40.2</td>
<td>0.483</td>
<td>-103.8</td>
<td>0.001</td>
<td>-67.7</td>
<td>0.971</td>
<td>-118.8</td>
</tr>
<tr>
<td>3.0</td>
<td>0.988</td>
<td>-60.3</td>
<td>0.741</td>
<td>106.2</td>
<td>0.001</td>
<td>-79.9</td>
<td>0.957</td>
<td>-89.7</td>
</tr>
<tr>
<td>4.0</td>
<td>0.980</td>
<td>-80.0</td>
<td>0.398</td>
<td>11.6</td>
<td>0.002</td>
<td>-112.8</td>
<td>0.949</td>
<td>-118.8</td>
</tr>
<tr>
<td>5.0</td>
<td>0.970</td>
<td>-99.4</td>
<td>0.155</td>
<td>-34.2</td>
<td>0.002</td>
<td>-97.1</td>
<td>0.905</td>
<td>-154.3</td>
</tr>
<tr>
<td>6.0</td>
<td>0.945</td>
<td>-137.6</td>
<td>0.220</td>
<td>36.2</td>
<td>0.001</td>
<td>-89.4</td>
<td>0.867</td>
<td>151.3</td>
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<tr>
<td>7.0</td>
<td>0.940</td>
<td>-156.5</td>
<td>0.477</td>
<td>-40.0</td>
<td>0.002</td>
<td>-120.3</td>
<td>0.789</td>
<td>113.8</td>
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<tr>
<td>8.0</td>
<td>0.927</td>
<td>-176.4</td>
<td>3.477</td>
<td>-167.2</td>
<td>0.003</td>
<td>-103.3</td>
<td>0.645</td>
<td>67.2</td>
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<tr>
<td>9.0</td>
<td>0.911</td>
<td>161.9</td>
<td>8.552</td>
<td>106.8</td>
<td>0.003</td>
<td>-105.4</td>
<td>0.396</td>
<td>13.0</td>
</tr>
<tr>
<td>10.0</td>
<td>0.864</td>
<td>135.9</td>
<td>13.901</td>
<td>20.3</td>
<td>0.003</td>
<td>-100.8</td>
<td>0.204</td>
<td>-83.8</td>
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<tr>
<td>11.0</td>
<td>0.861</td>
<td>97.2</td>
<td>25.732</td>
<td>-81.6</td>
<td>0.003</td>
<td>-92.6</td>
<td>0.240</td>
<td>-83.8</td>
</tr>
<tr>
<td>12.0</td>
<td>0.614</td>
<td>92.3</td>
<td>27.138</td>
<td>-93.9</td>
<td>0.003</td>
<td>-104.6</td>
<td>0.145</td>
<td>-162.0</td>
</tr>
<tr>
<td>13.0</td>
<td>0.317</td>
<td>76.9</td>
<td>31.142</td>
<td>-159.8</td>
<td>0.002</td>
<td>-91.2</td>
<td>0.138</td>
<td>-171.3</td>
</tr>
<tr>
<td>14.0</td>
<td>0.261</td>
<td>77.9</td>
<td>31.335</td>
<td>-173.2</td>
<td>0.003</td>
<td>-66.6</td>
<td>0.129</td>
<td>151.7</td>
</tr>
<tr>
<td>15.0</td>
<td>0.210</td>
<td>86.0</td>
<td>30.973</td>
<td>173.8</td>
<td>0.003</td>
<td>-86.0</td>
<td>0.131</td>
<td>146.0</td>
</tr>
</tbody>
</table>

**VDD=6V, IDD=1200mA**
EMM5075X
Ku-Band Power Amplifier MMIC

S-PARAMETER

@VDD=6V, IDD=1200mA

@VDD=6V, IDD=1200mA
EMM5075X
Ku-Band Power Amplifier MMIC

ΔTch vs. Drain Voltage
(Reference)

IDD(DC)=1200mA

MTTF vs. Tch

Note  ΔTch : Temperature Rise from Backside of MMIC to Channel
Assembly Diagrams

Recommended assembly

“Copper” is the recommended material for the package or carrier.
EMM5075X
Ku-Band Power Amplifier MMIC

Chip Outline and Bonding Pad Locations (Dimension in Micro-Meters)

- Chip Size: 3385±30um x 2620±30um
- Chip Thickness: 60±20um
- Bonding Pad Size: 160um x 80um
DIE ATTACH

1) The die-attach station must have accurate temperature control and an inert forming gas should be used.
2) Chips should be kept at room temperature except during die-attach.
3) Place package or carrier on the heated stage.
4) Lightly grasp the chip edges by the longer side using tweezers.

Die attach conditions

Stage Temperature : 300 to 310 deg.C
Time : less than 15 seconds

Die attach material : AuSn

AuSn Preform Volume : per next Figure

WIRE BONDING

The bonding equipment must be properly grounded. The following or equivalent equipment, tools, materials, and conditions are recommended. However, when bonding wire on the MMIC, the condition should be verified by customer using their equipment and materials.

1) Bonding Equipment and Bonding Tool.
   Bonding Equipment : SINKAWA UTC-300 (automatic ball bonder)
   Bonding Tool : ADAMANT AD-2-38LB20

2) Bonding Wire
   Material : Hard or Half hard gold
   Diameter : 0.7 to 1.0 mil

3) Bonding Conditions
   Method : Thermal Compression Bonding with Ultrasonic Power
   Tool Force : 0.294 N to 0.882 N
   Stage Temperature : 230 deg.C +/- 5 deg.C
   Ultrasonic Power : 30 to 90
   Ultrasonic Power Time : 10ms to 60ms
EMM5075X
Ku-Band Power Amplifier MMIC

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Sumitomo Electric Device Innovations, Inc. products contain gallium arsenide (GaAs) which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- Do not put these products into the mouth.
- Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.
- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

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