FEATURES
- Frequency Band: 81 to 86GHz
- High Output Power: 26.5dBm (Typ.)
- Liner Gain: 26dB (typ.)
- 32 dBm output Third Order Intercept (OIP3)

DESCRIPTION
The Power Amplifier is a four stage GaAs HEMT MMIC, with an integrated Power Detector, which operates between 81 and 86 GHz. The Power Amplifier features small signal gain of 26dB, output power of 24.5 dBm at 1dB gain compression and saturated power of 26.5 dBm. Sumitomo Electric’s stringent Quality Assurance Program assures the highest reliability and consistent performance.

ABSOLUTE MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Voltage</td>
<td>V_D</td>
<td>4.5</td>
<td>V</td>
</tr>
<tr>
<td>Gate Voltage</td>
<td>V_G</td>
<td>-0.5 to +0.3</td>
<td>V</td>
</tr>
<tr>
<td>Input Power Level</td>
<td>P_IN</td>
<td>+18</td>
<td>dBm</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>T_STG</td>
<td>-40 to +125</td>
<td>deg.C</td>
</tr>
</tbody>
</table>

RECOMMENDED OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain Voltage</td>
<td>V_D</td>
<td>4.0</td>
<td>V</td>
</tr>
<tr>
<td>Gate Voltage</td>
<td>V_G</td>
<td>-0.5 to +0.5</td>
<td>V</td>
</tr>
<tr>
<td>Input Power Level</td>
<td>P_IN</td>
<td>Up to +6</td>
<td>dBm</td>
</tr>
<tr>
<td>Operating Backside Temperature</td>
<td>T_OP</td>
<td>-40 to +85</td>
<td>deg.C</td>
</tr>
</tbody>
</table>

ELECTRICAL CHARACTERISTICS (Case Temperature Tc=25deg.C)

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Limit Min.</th>
<th>Typical</th>
<th>Limit Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Range</td>
<td>f</td>
<td>V_D1=V_D2=V_D3=V_D4</td>
<td>81</td>
<td>-</td>
<td>86</td>
<td>GHz</td>
</tr>
<tr>
<td>Gain</td>
<td>G_a</td>
<td>=V_D5=V_D6=V_D7=V_D8=4.0V</td>
<td>20.0</td>
<td>26.0</td>
<td>32.0</td>
<td>dB</td>
</tr>
<tr>
<td>Output Power at 1dB G.C.P.</td>
<td>P_1dB</td>
<td>I_D=1300mA*</td>
<td>-</td>
<td>24.5</td>
<td>-</td>
<td>dBmA</td>
</tr>
<tr>
<td>Saturation Power</td>
<td>P_sat</td>
<td>G.C.P. : Gain Compression Point</td>
<td>25</td>
<td>26.5</td>
<td>-</td>
<td>dBm</td>
</tr>
<tr>
<td>3rd Order Output Intercept Point *1</td>
<td>OIP_3</td>
<td>*1: Pout @ 2tone=+20 dBm</td>
<td>28</td>
<td>32</td>
<td>-</td>
<td>dBm</td>
</tr>
<tr>
<td>Input Return Loss</td>
<td>R_LIN</td>
<td></td>
<td>-</td>
<td>15</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Output Return Loss</td>
<td>R_LOUT</td>
<td></td>
<td>-</td>
<td>15</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Total Current Consumption</td>
<td>I_D</td>
<td>**: Vref(without RF)-Vdet(RF)</td>
<td>-</td>
<td>1300</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Detector Voltage** at Pout=15 dBm</td>
<td>V_diff1</td>
<td></td>
<td>-</td>
<td>115</td>
<td>-</td>
<td>mV/dB</td>
</tr>
<tr>
<td>Detector Voltage** at Pout=24 dBm</td>
<td>V_diff2</td>
<td></td>
<td>-</td>
<td>500</td>
<td>-</td>
<td>mV/dB</td>
</tr>
<tr>
<td>Detector Voltage Slope at @Pout from 15 to 16 dB</td>
<td>V_diff1</td>
<td></td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>mV/dB</td>
</tr>
<tr>
<td>Detector Voltage Slope at @Pout from 20 to 21 dB</td>
<td>V_diff2</td>
<td></td>
<td>-</td>
<td>45</td>
<td>-</td>
<td>mV/dB</td>
</tr>
</tbody>
</table>

* Adjust V_G Voltage between -0.5 to +0.3V to set to I_D=I_D1+I_D2+I_D3+I_D4+I_D5+I_D6+I_D7+I_D8=1300mA

ESD Class 0B 125 to 249V
Based on ANSI/ESDA/JEDEC/ JS-001-2017 (C=100pF, R=1.5k ohm)

RoHS COMPLIANCE Yes
Gain, P1dB, Psat, OIP3 vs. Frequency

Gain, P1dB, Psat, OIP3 vs. Frequency

Output Power vs. Frequency

Output Power vs. Frequency

Output Power vs. Input Power

Output Power vs. Input Power

IM3 vs. Output Power

IM3 vs. Output Power
Output Power vs. Input Power by Drain Current
@ Tc=25deg.C
Freq. = 81GHz
V_d = 4.0V

Output Power vs. Input Power by Drain Current
@ Tc=25deg.C
Freq. = 86GHz
V_d = 4.0V

Output Power vs. Input Power by Drain Voltage
@ Tc=25deg.C
Freq. = 81GHz, V_g = const.
Initial Conditions: I_d = 1300mA @ V_d = 4.0V

Output Power vs. Input Power by Drain Voltage
@ Tc=25deg.C
Freq. = 86GHz, V_g = const.
Initial Conditions: I_d = 1300mA @ V_d = 4.0V
IM3 vs. Output Power by Drain Current

@ Tc=25deg.C
Freq.=81GHz, Δf=+10MHz
Vd=4.0V

IM3 vs. Output Power by Drain Current

@ Tc=25deg.C
Freq.=86GHz, Δf=+10MHz
Vd=4.0V

IM3 vs. Output Power by Drain Voltage

@ Tc=25deg.C
Freq.=81GHz, Δf=+10MHz
Vg-Const.
Initial Conditions:
Id=1300mA@Vd=4.0V

IM3 vs. Output Power by Drain Voltage

@ Tc=25deg.C
Freq.=86GHz, Δf=+10MHz
Vg-Const.
Initial Conditions:
Id=1300mA@Vd=4.0V
Output Power vs. Input Power by Temperature

Freq. = 81GHz
Vd = 4.0V, Vg - Const.
(Initial Id = 1300mA @ +25deg.C)

Output Power vs. Input Power by Temperature

Freq. = 86GHz
Vd = 4.0V, Vg - Const.
(Initial Id = 1300mA @ +25deg.C)

IM3 vs. Output Power by Temperature

Freq. = 81GHz, Δf = +10MHz
Vd = 4.0V, Vg - Const.
(Initial Id = 1300mA @ +25deg.C)

IM3 vs. Output Power by Temperature

Freq. = 86GHz, Δf = +10MHz
Vd = 4.0V, Vg - Const.
(Initial Id = 1300mA @ +25deg.C)
**Power Detector vs. Output Power**

Detector Voltage = Vref - Vdet @ Tc=25deg.C

Detector Voltage (V)

Output Power (dBm)

- 81GHz
- 83.5GHz
- 86GHz

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**Power Detector vs. Output Power by temperature**

Detector Voltage = Vref - Vdet

Freq.=81GHz  
Vd=4.0V, Vg-Const.  
(Initial Id=1300mA@+25deg.C)

Detector Voltage (V)

Output Power (dBm)

- -40deg.C
- +25deg.C
- +85deg.C

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**Power Detector vs. Output Power by temperature**

Detector Voltage = Vref - Vdet

Freq.=86GHz  
Vd=4.0V, Vg-Const.  
(Initial Id=1300mA@+25deg.C)

Detector Voltage (V)

Output Power (dBm)

- -40deg.C
- +25deg.C
- +85deg.C
S-PARAMETERS

- S11
- S21
- S22

Frequency (GHz)

Vd=4.0V, Id=1300mA

Sxx (dB)
Chip outline and Pin Assignment

<table>
<thead>
<tr>
<th>No.</th>
<th>Pin</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RF Input</td>
<td>90</td>
<td>1925</td>
</tr>
<tr>
<td>2</td>
<td>VG1</td>
<td>175</td>
<td>95</td>
</tr>
<tr>
<td>3</td>
<td>VD1</td>
<td>475</td>
<td>95</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>775</td>
<td>95</td>
</tr>
<tr>
<td>5</td>
<td>VD2</td>
<td>1075</td>
<td>95</td>
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<tr>
<td>6</td>
<td>NC</td>
<td>1375</td>
<td>95</td>
</tr>
<tr>
<td>7</td>
<td>VD3</td>
<td>1675</td>
<td>95</td>
</tr>
<tr>
<td>8</td>
<td>NC</td>
<td>1975</td>
<td>95</td>
</tr>
<tr>
<td>9</td>
<td>VD4</td>
<td>2275</td>
<td>95</td>
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<tr>
<td>10</td>
<td>Vdet</td>
<td>2575</td>
<td>95</td>
</tr>
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<td>11</td>
<td>NC</td>
<td>2860</td>
<td>95</td>
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<tr>
<td>12</td>
<td>RF Output</td>
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<td>1925</td>
</tr>
<tr>
<td>13</td>
<td>NC</td>
<td>2860</td>
<td>3755</td>
</tr>
<tr>
<td>14</td>
<td>Vref</td>
<td>2575</td>
<td>3755</td>
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<td>VD8</td>
<td>2275</td>
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<td>16</td>
<td>NC</td>
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<td>3755</td>
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<td>VD7</td>
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<td>3755</td>
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<td>18</td>
<td>NC</td>
<td>1375</td>
<td>3755</td>
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<tr>
<td>19</td>
<td>VD6</td>
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<tr>
<td>20</td>
<td>NC</td>
<td>775</td>
<td>3755</td>
</tr>
<tr>
<td>21</td>
<td>VD5</td>
<td>475</td>
<td>3755</td>
</tr>
<tr>
<td>22</td>
<td>VG2</td>
<td>175</td>
<td>3755</td>
</tr>
</tbody>
</table>

Chip Size: 2950±30μm x 3850±30μm
Thickness: 60±20μm
RF Pad Size: 80μm x 80μm
DC Pad Size: 110μm x 90μm
Typical Application

Component List

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Capacitor</td>
<td>100pF</td>
</tr>
<tr>
<td>C2</td>
<td>Capacitor</td>
<td>0.1uF</td>
</tr>
</tbody>
</table>
■ BARE DIE INDEMNIFICATION

All devices are DC probed and visually inspected at SEI, and non-compliant devices are removed. The RF electrical characteristics of the bare dice are warranted by the sampling inspection procedures. The standard sampling inspection procedure shall include the number of the sampling dice, position of the sampling dice in the wafer and RF electrical characteristics of the sampling dice measured in the test fixture. Customer shall understand that all the bare dice will not be 100% RF tested by SEI. It is the customer responsibility to verify performance of the devices.

Customer shall comply with the storage and handling requirements for condition and period of storage of the bare dice agreed by customer and SEI. Warranty will not apply when customer disregards the storage and handling requirements.

Warranty will not apply to the electrical characteristics and product quality to the bare dice after assembly by customer.

SEI will indemnify customer for warranty failures, provided however that the indemnification to customer shall be limited to supply of bare dice for substitution.

CAUTION

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.