

# EMM5074X

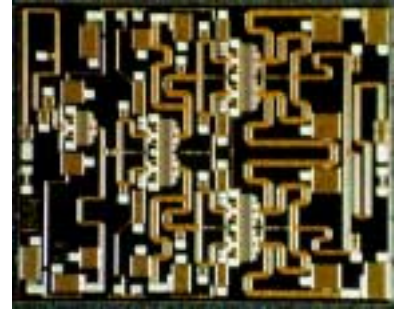
## C-Band Power Amplifier MMIC

### FEATURES

- High Output Power: Pout = 32.5 dBm (Typ.)
- High Linear Gain: GL = 28 dB(Typ.)
- Broad Band: 5.8 - 8.5 GHz
- Impedance Matched Zin/Zout = 50Ω

### DESCRIPTION

The EMM5074X is a wide band power amplifier MMIC that contains a three stage amplifier, internally matched, for standard communications band in 5.8 to 8.5GHz frequency range. Eudyna's stringent Quality Assurance Program assures the highest reliability and consistent performance.



### ABSOLUTE MAXIMUM RATING

| Item                 | Symbol           | Rating      | Unit |
|----------------------|------------------|-------------|------|
| Drain-Source Voltage | V <sub>DD</sub>  | 10          | V    |
| Gate-Source Voltage  | V <sub>GG</sub>  | -3          | V    |
| Input Power          | P <sub>in</sub>  | +26         | dBm  |
| Storage Temperature  | T <sub>stg</sub> | -55 to +125 | °C   |

### RECOMMENDED OPERATING CONDITIONS

| Item                           | Symbol          | Condition  | Unit |
|--------------------------------|-----------------|------------|------|
| Drain-Source Voltage           | V <sub>DD</sub> | ≤6         | V    |
| Input Power                    | P <sub>in</sub> | ≤10        | dBm  |
| Operating Backside Temperature | T <sub>op</sub> | -40 to +85 | °C   |

This product should be hermetically packaged.

### ELECTRICAL CHARACTERISTICS (Ambient Temperature Ta=25°C)

| Item                                 | Symbol            | Test Conditions                                                           | Limits                               |                                          |                                          | Unit |
|--------------------------------------|-------------------|---------------------------------------------------------------------------|--------------------------------------|------------------------------------------|------------------------------------------|------|
|                                      |                   |                                                                           | Min.                                 | Typ.                                     | Max.                                     |      |
| Frequency Range                      | f                 | V <sub>DD</sub> =6V                                                       | 5.8                                  | -                                        | 8.5                                      | GHz  |
| Output Power at 1dB G.C.P.           | P <sub>1dB</sub>  | I <sub>DD</sub> (DC)=1400mA typ.<br>Z <sub>s</sub> =Z <sub>L</sub> =50ohm | 30 <sup>*1</sup><br>31 <sup>*2</sup> | 32 <sup>*1</sup><br>32.5 <sup>*2</sup>   | -                                        | dBm  |
| Power Gain at 1dB G.C.P.             | G <sub>1dB</sub>  | *1:f=5.8~7.1GHz                                                           | 23                                   | 27                                       | -                                        | dB   |
| Power-added Efficiency at 1dB G.C.P. | η <sub>add</sub>  | *2:f=7.1~8.5GHz                                                           | -                                    | 18 <sup>*1</sup><br>21 <sup>*2</sup>     | -                                        | %    |
| Third Order Intermodulation*         | IM <sub>3</sub>   | *:Δf=10MHz ,                                                              | -37                                  | -42                                      | -                                        | dBc  |
| Drain Current at 1dB G.C.P.          | I <sub>DD</sub>   | 2-Tone Test ,<br>Pout=20dBm S.C.L.                                        | -                                    | 1450 <sup>*1</sup><br>1450 <sup>*2</sup> | 1900 <sup>*1</sup><br>1900 <sup>*2</sup> | mA   |
| Input Return Loss (at Pin=-20dBm)    | RL <sub>in</sub>  |                                                                           | -                                    | 10                                       | -                                        | dB   |
| Output Return Loss (at Pin=-20dBm)   | RL <sub>out</sub> |                                                                           | -                                    | 10                                       | -                                        | dB   |

Note : RF parameter sample size 10pcs. Criteria (accept/reject)=(0/1)

G.C.P.:Gain Compression Point

S.C.L.:Single Carrier Level

|     |         |        |
|-----|---------|--------|
| ESD | Class 0 | ~ 249V |
|-----|---------|--------|

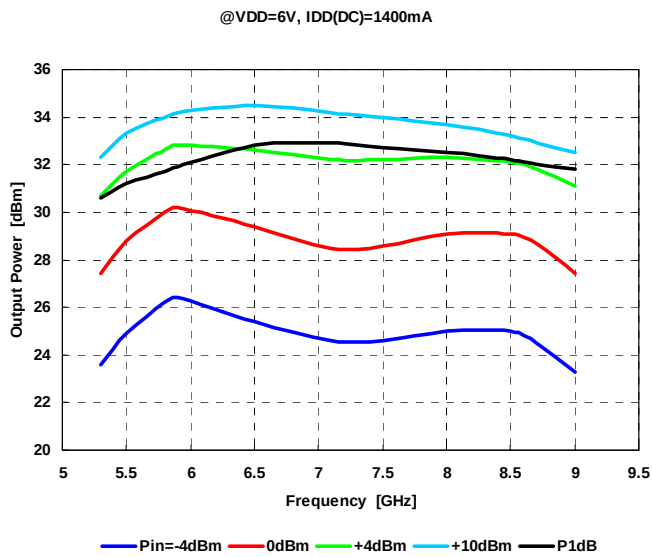
Note : Based on JEDEC JESD22-A114C

|                 |     |
|-----------------|-----|
| RoHs Compliance | Yes |
|-----------------|-----|

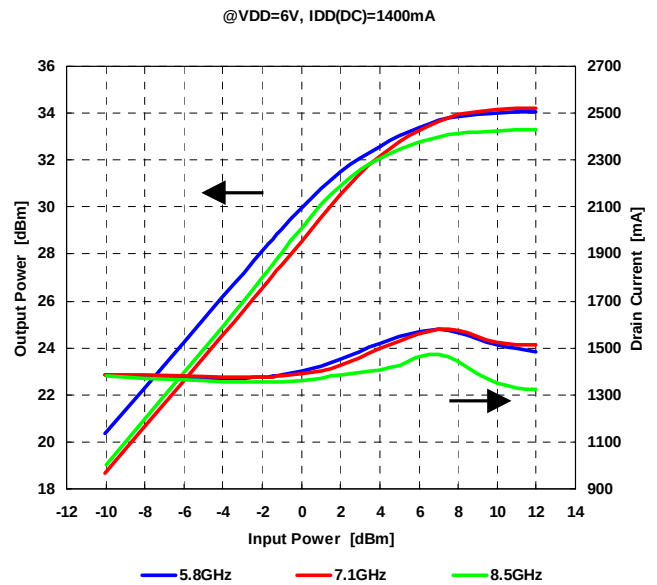
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## C-band Power Amplifier MMIC

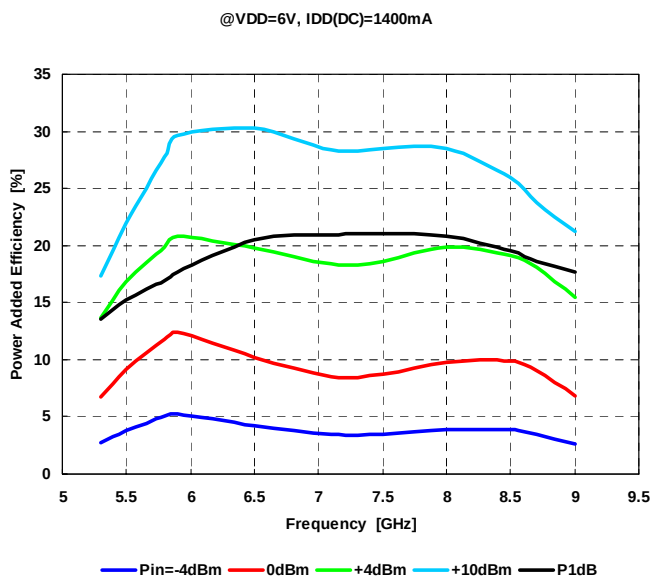
Output Power vs. Frequency



Output Power, Drain Current vs. Input Power



Power Added Efficiency vs. Frequency



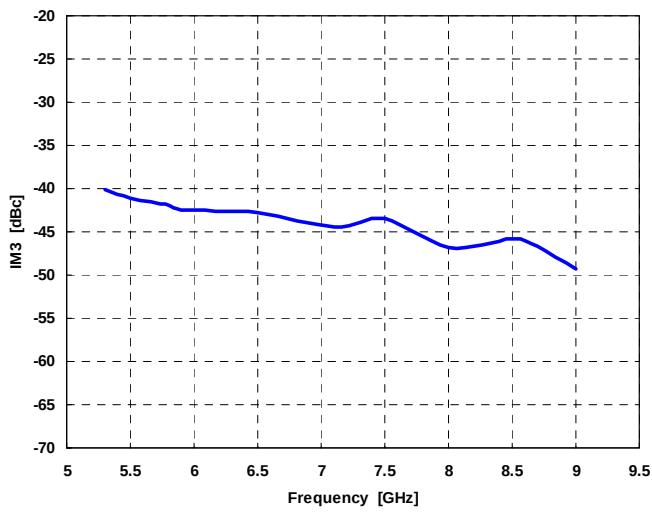
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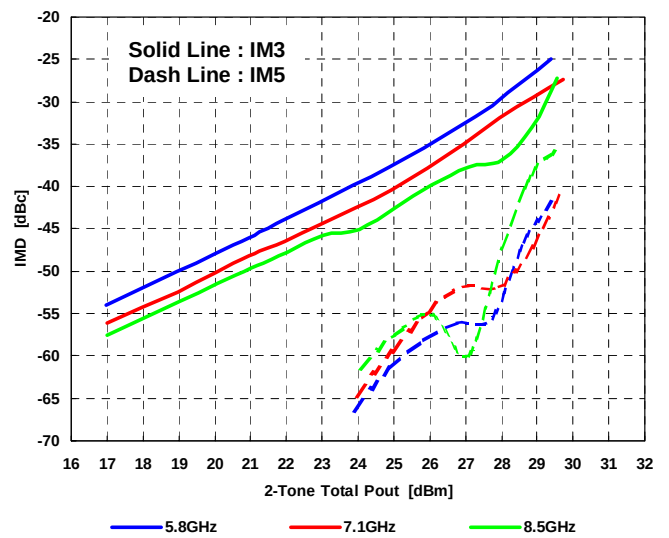
### IM3 vs. Frequency

@VDD=6V, IDD(DC)=1400mA, @Po=20dBm S.C.L.



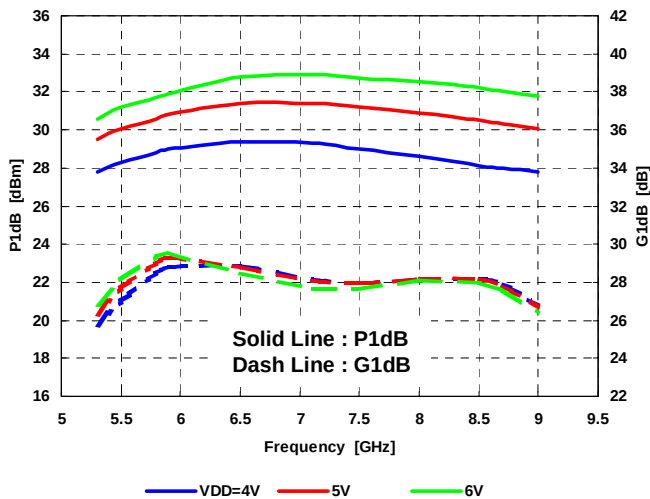
### IMD vs. Output Power

@VDD=6V, IDD(DC)=1400mA



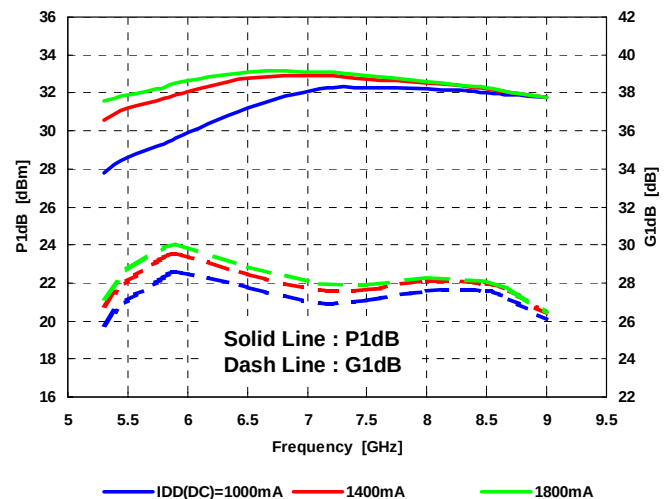
### P1dB, G1dB vs. Frequency by Drain Voltage

@IDD(DC)=1400mA



### P1dB, G1dB vs. Frequency by Drain Current

@VDD=6V

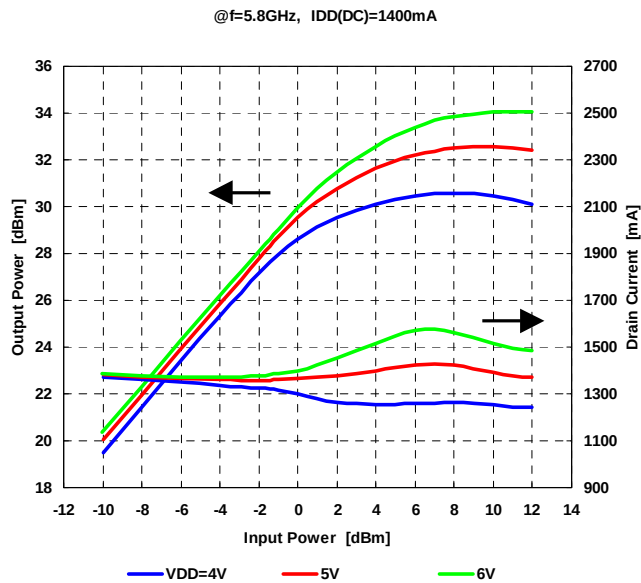


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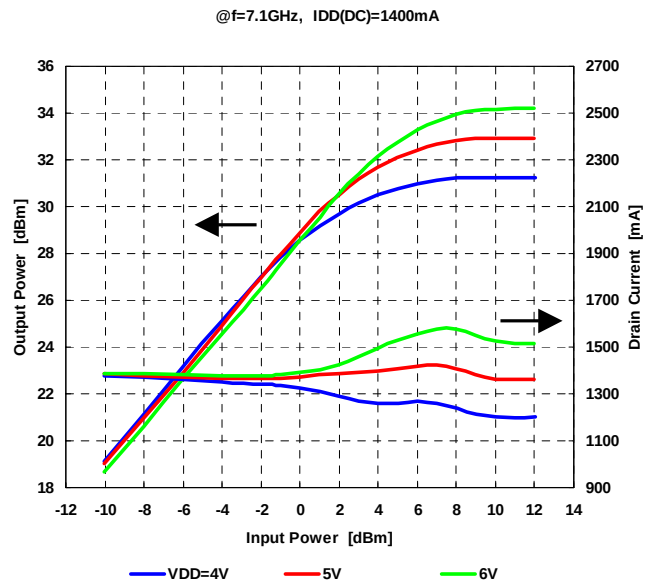
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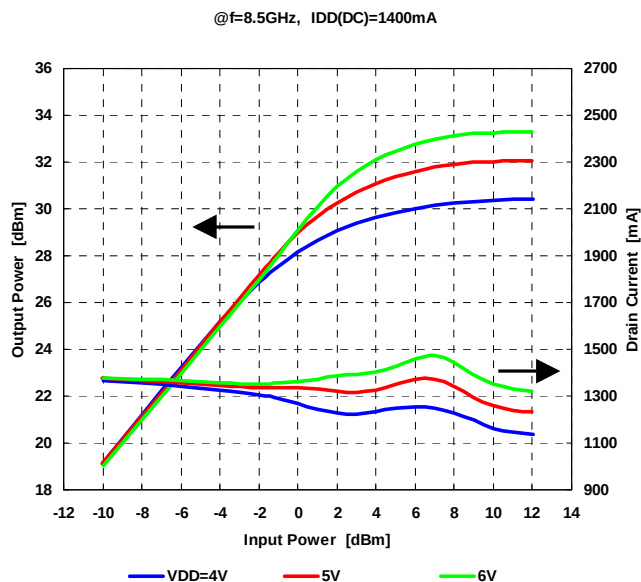
Output Power, Drain Current vs. Input Power  
by Drain Voltage



Output Power, Drain Current vs. Input Power  
by Drain Voltage



Output Power, Drain Current vs. Input Power  
by Drain Voltage



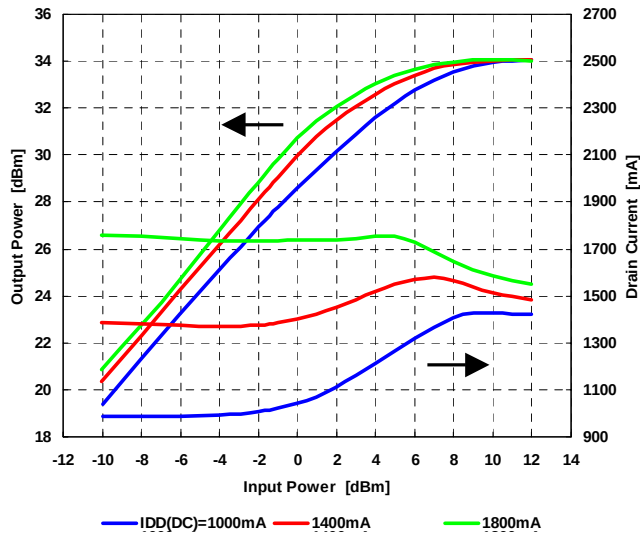
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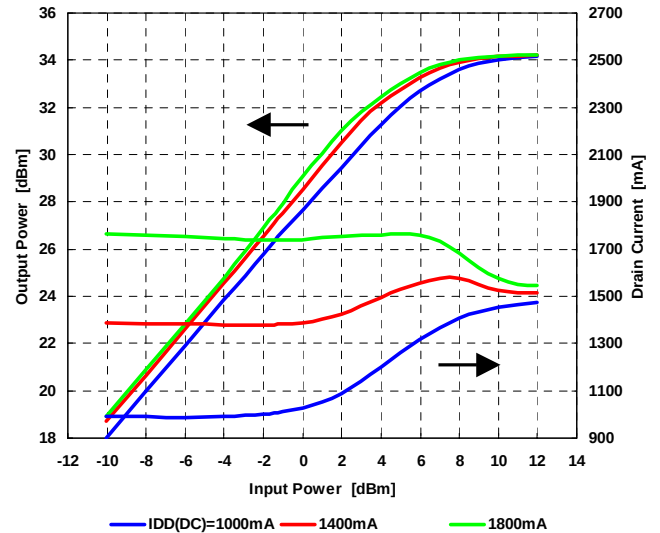
Output Power, Drain Current vs. Input Power  
by Drain Current

@f=5.8GHz, VDD=6V



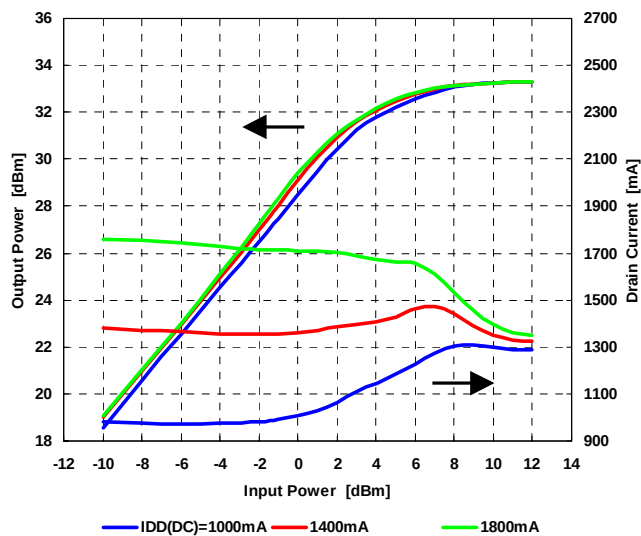
Output Power, Drain Current vs. Input Power  
by Drain Current

@f=7.1GHz, VDD=6V



Output Power, Drain Current vs. Input Power  
by Drain Current

@f=8.5GHz, VDD=6V



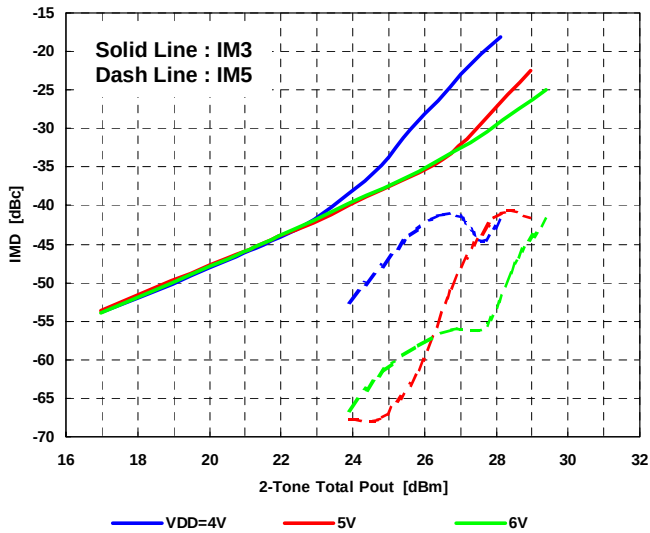
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## C-band Power Amplifier MMIC

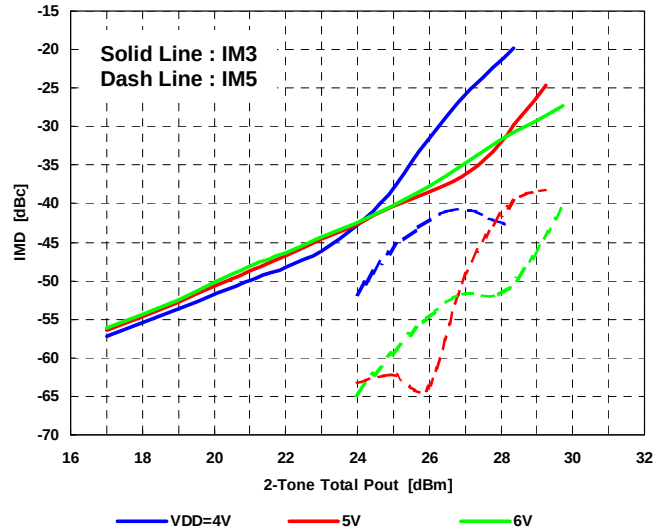
IMD vs. Output Power by Drain Voltage

@f=5.8GHz, IDD(DC)=1400mA



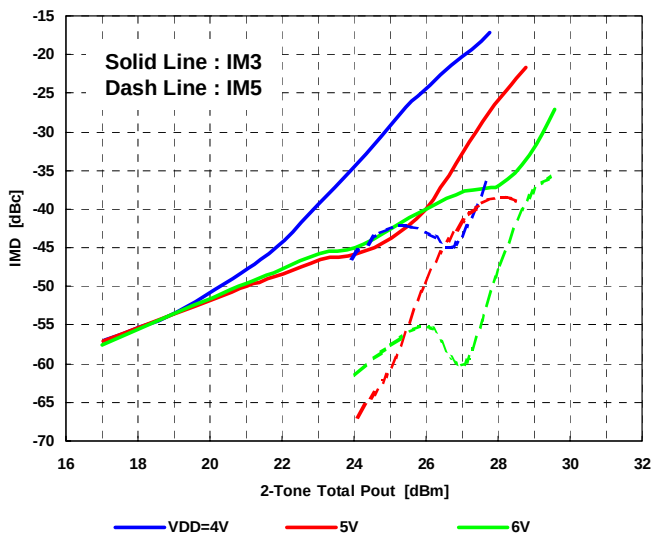
IMD vs. Output Power by Drain Voltage

@f=7.1GHz, IDD(DC)=1400mA



IMD vs. Output Power by Drain Voltage

@f=8.5GHz, IDD(DC)=1400mA



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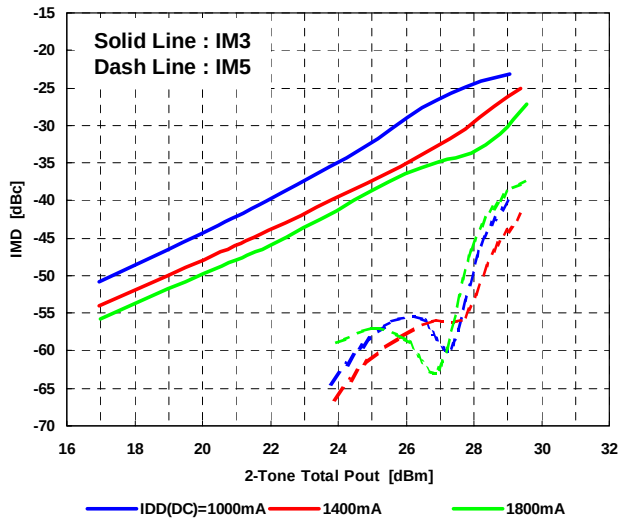
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## C-Band Power Amplifier MMIC

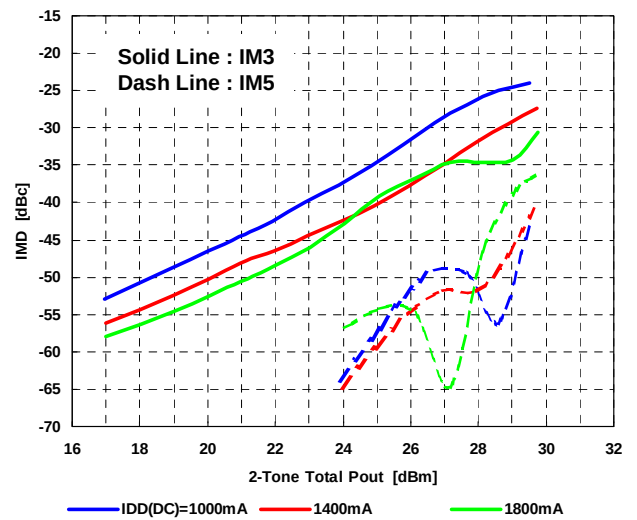
IMD vs. Output Power by Drain Current

@f=5.8GHz, VDD=6V



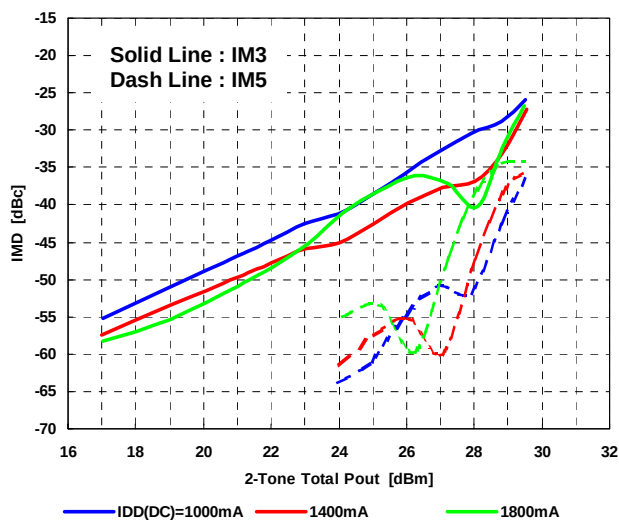
IMD vs. Output Power by Drain Current

@f=7.1GHz, VDD=6V



IMD vs. Output Power by Drain Current

@f=8.5GHz, VDD=6V

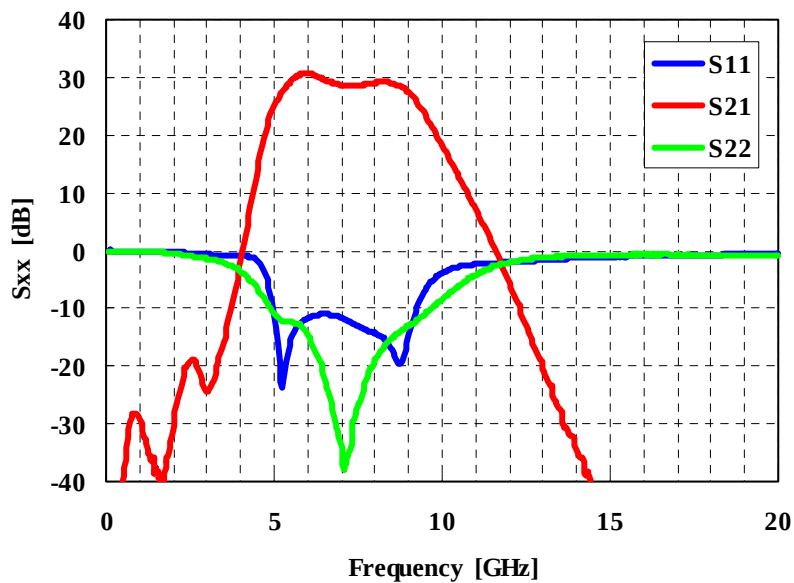


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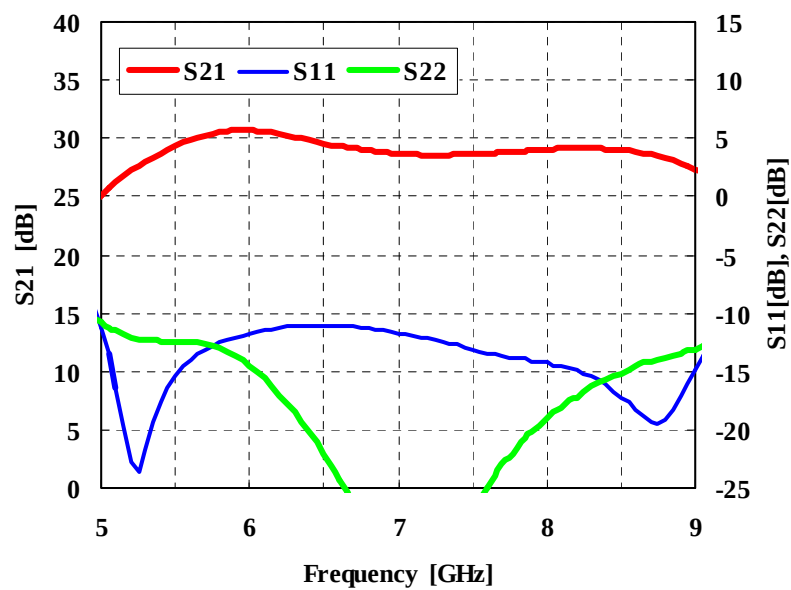
## C-band Power Amplifier MMIC

### ■ S-Parameter

VDD/IDD(DC)=6V/1400mA



VDD/IDD(DC)=6V/1400mA



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## C-Band Power Amplifier MMIC

### ■ S-Parameter

VDD=6V, IDD(DC)=1400mA

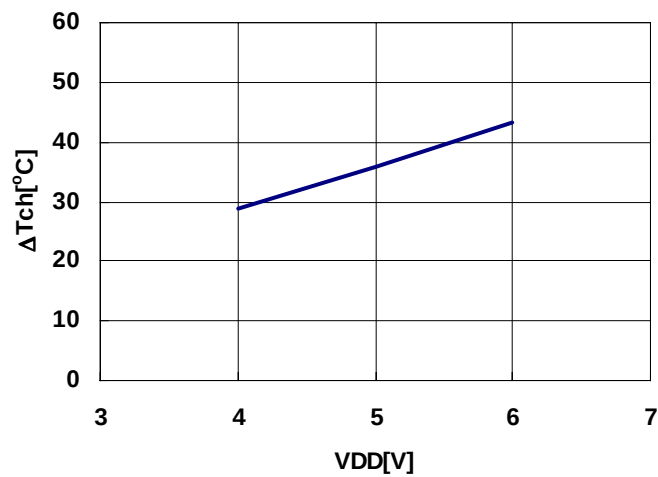
| Frequency<br>[GHz] | S11   |        | S21    |        | S12   |        | S22   |        |
|--------------------|-------|--------|--------|--------|-------|--------|-------|--------|
|                    | MAG   | ANG    | MAG    | ANG    | MAG   | ANG    | MAG   | ANG    |
| 1.0                | 0.985 | -34.4  | 0.035  | -49.4  | 0.001 | 20.0   | 0.973 | -60.9  |
| 2.0                | 0.977 | -69.7  | 0.031  | -71.2  | 0.001 | 58.0   | 0.944 | -120.1 |
| 3.0                | 0.927 | -107.3 | 0.059  | 173.4  | 0.001 | -41.0  | 0.848 | -178.4 |
| 4.0                | 0.903 | -153.7 | 0.805  | -178.7 | 0.000 | -11.9  | 0.654 | 106.3  |
| 5.0                | 0.274 | 107.2  | 18.066 | -1.9   | 0.001 | 4.7    | 0.288 | -21.5  |
| 5.5                | 0.170 | -156.5 | 29.370 | -117.9 | 0.000 | 146.8  | 0.238 | -123.6 |
| 5.6                | 0.200 | -159.3 | 31.168 | -140.1 | 0.000 | 68.8   | 0.238 | -142.2 |
| 5.7                | 0.222 | -162.6 | 32.705 | -162.1 | 0.001 | -38.4  | 0.233 | -161.6 |
| 5.8                | 0.237 | -165.1 | 33.710 | 176.0  | 0.001 | -168.9 | 0.223 | -178.4 |
| 5.9                | 0.248 | -168.3 | 34.202 | 154.4  | 0.000 | 36.8   | 0.206 | 164.9  |
| 6.0                | 0.258 | -171.5 | 34.182 | 133.5  | 0.000 | 161.7  | 0.187 | 150.2  |
| 6.1                | 0.267 | -175.2 | 33.668 | 113.1  | 0.001 | 32.5   | 0.166 | 136.3  |
| 6.2                | 0.274 | -177.7 | 32.891 | 93.7   | 0.001 | 166.4  | 0.140 | 124.8  |
| 6.3                | 0.277 | 178.7  | 31.970 | 75.2   | 0.000 | 38.5   | 0.119 | 114.2  |
| 6.4                | 0.281 | 175.4  | 30.974 | 57.3   | 0.001 | -133.8 | 0.098 | 106.3  |
| 6.5                | 0.281 | 171.4  | 30.116 | 40.2   | 0.000 | 173.7  | 0.079 | 96.5   |
| 6.6                | 0.281 | 168.0  | 29.261 | 23.6   | 0.000 | -54.1  | 0.061 | 89.3   |
| 6.7                | 0.276 | 164.5  | 28.534 | 7.4    | 0.001 | -17.9  | 0.048 | 82.1   |
| 6.8                | 0.272 | 160.5  | 27.961 | -8.4   | 0.000 | 161.2  | 0.036 | 71.2   |
| 6.9                | 0.269 | 156.9  | 27.493 | -23.8  | 0.001 | -37.8  | 0.027 | 63.1   |
| 7.0                | 0.260 | 153.5  | 27.148 | -39.3  | 0.001 | 145.0  | 0.018 | 40.2   |
| 7.1                | 0.253 | 150.6  | 26.950 | -54.6  | 0.001 | 98.2   | 0.013 | 7.1    |
| 7.2                | 0.246 | 147.4  | 26.852 | -69.8  | 0.001 | 161.0  | 0.017 | -36.5  |
| 7.3                | 0.238 | 144.6  | 26.825 | -85.1  | 0.001 | 133.7  | 0.024 | -67.4  |
| 7.4                | 0.232 | 141.2  | 26.895 | -100.5 | 0.001 | 134.1  | 0.034 | -82.2  |
| 7.5                | 0.221 | 138.7  | 27.048 | -115.9 | 0.001 | -48.5  | 0.046 | -88.3  |
| 7.6                | 0.213 | 135.9  | 27.216 | -131.7 | 0.001 | -3.4   | 0.056 | -99.2  |
| 7.7                | 0.207 | 133.0  | 27.492 | -147.6 | 0.001 | 1.9    | 0.071 | -109.0 |
| 7.8                | 0.202 | 129.9  | 27.758 | -163.7 | 0.000 | -113.2 | 0.083 | -116.7 |
| 7.9                | 0.197 | 126.4  | 28.024 | 179.7  | 0.001 | 8.1    | 0.097 | -127.3 |
| 8.0                | 0.196 | 121.9  | 28.307 | 163.0  | 0.001 | 64.0   | 0.113 | -135.7 |
| 8.1                | 0.186 | 116.2  | 28.510 | 145.9  | 0.001 | 18.4   | 0.123 | -146.5 |
| 8.2                | 0.179 | 109.1  | 28.622 | 128.3  | 0.000 | 15.3   | 0.138 | -157.6 |
| 8.3                | 0.170 | 100.1  | 28.709 | 110.4  | 0.001 | -86.4  | 0.153 | -168.9 |
| 8.4                | 0.156 | 88.9   | 28.501 | 92.3   | 0.001 | -56.6  | 0.163 | 179.9  |
| 8.5                | 0.138 | 73.5   | 28.234 | 73.5   | 0.001 | -39.2  | 0.175 | 166.7  |
| 8.6                | 0.121 | 52.2   | 27.745 | 54.7   | 0.000 | 175.0  | 0.186 | 154.9  |
| 8.7                | 0.107 | 23.7   | 26.911 | 35.6   | 0.001 | -116.4 | 0.194 | 141.0  |
| 8.8                | 0.111 | -11.9  | 25.993 | 16.2   | 0.001 | -139.4 | 0.203 | 127.4  |
| 8.9                | 0.138 | -44.9  | 24.774 | -3.3   | 0.000 | -138.8 | 0.213 | 114.3  |
| 9.0                | 0.182 | -71.4  | 23.345 | -22.8  | 0.000 | 40.3   | 0.222 | 100.1  |
| 10.0               | 0.643 | 161.9  | 8.145  | 156.8  | 0.000 | -65.9  | 0.381 | -3.8   |
| 11.0               | 0.758 | 91.3   | 2.269  | 4.4    | 0.000 | 56.9   | 0.613 | -63.8  |
| 12.0               | 0.795 | 37.2   | 0.520  | -140.8 | 0.001 | -162.3 | 0.791 | -107.0 |
| 13.0               | 0.827 | -8.7   | 0.093  | 95.0   | 0.001 | 41.9   | 0.871 | -138.9 |
| 14.0               | 0.859 | -47.8  | 0.019  | -17.5  | 0.001 | 23.2   | 0.898 | -163.8 |
| 15.0               | 0.883 | -80.7  | 0.004  | -134.6 | 0.001 | -174.7 | 0.915 | 175.6  |
| 16.0               | 0.898 | -107.9 | 0.001  | 157.8  | 0.002 | 143.3  | 0.928 | 157.3  |
| 17.0               | 0.914 | -131.6 | 0.002  | 167.0  | 0.001 | 138.7  | 0.924 | 140.6  |
| 18.0               | 0.922 | -152.0 | 0.003  | 85.1   | 0.001 | 115.0  | 0.914 | 124.0  |
| 19.0               | 0.926 | -169.5 | 0.001  | 146.9  | 0.001 | 110.2  | 0.906 | 106.4  |
| 20.0               | 0.928 | 174.7  | 0.004  | 123.8  | 0.002 | 35.3   | 0.888 | 85.8   |

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C-band Power Amplifier MMIC

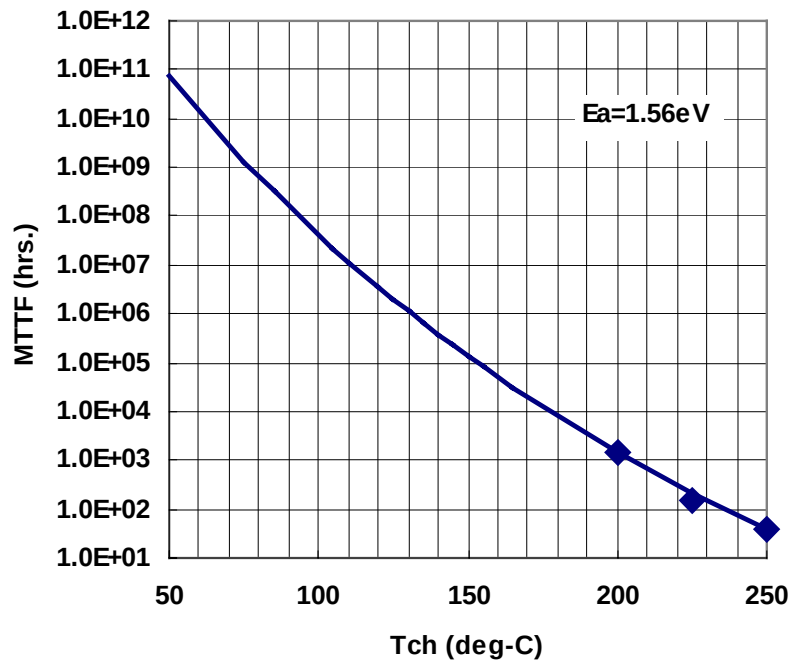
$\Delta T_{ch}$  vs. DRAIN VOLTAGE  
(Reference Data)

$I_{DD}(DC)=1400mA$



Note :  $\Delta T_{ch}$  : Temperature Rise from Backside of MMIC to Channel

MTTF vs.  $T_{ch}$

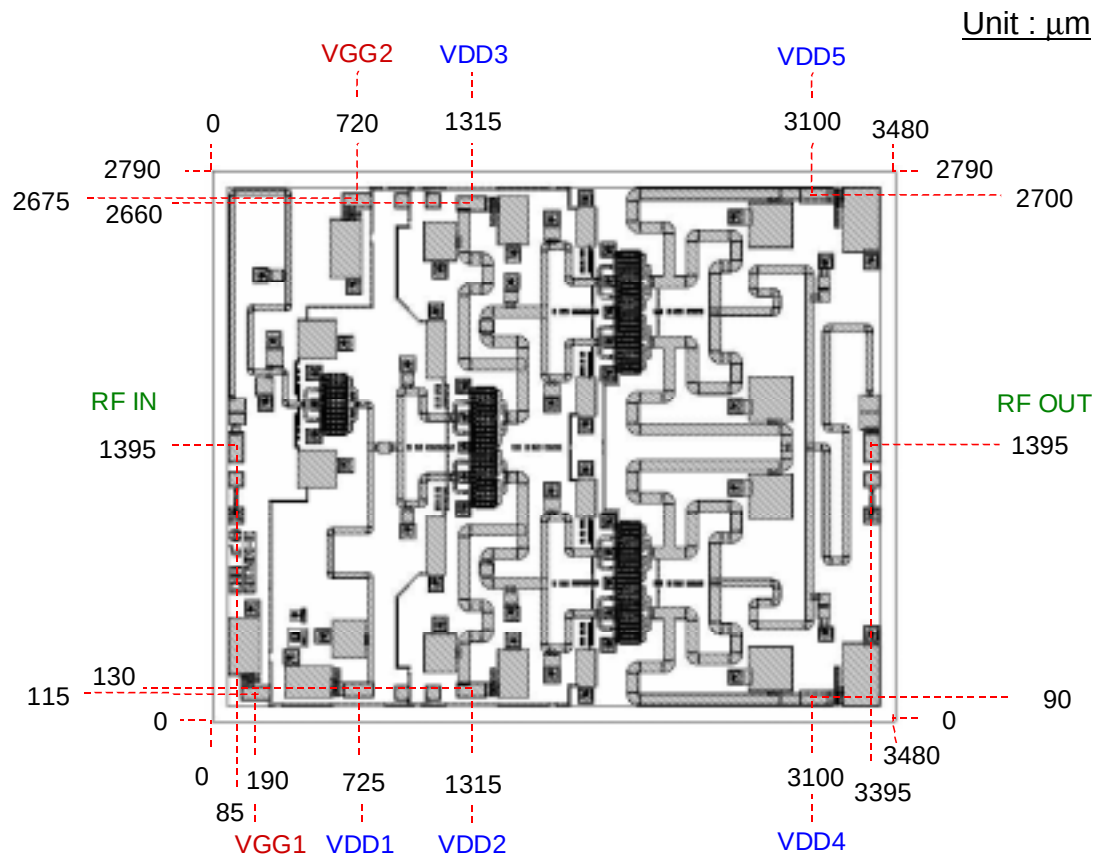


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# EMM5074X

## C-Band Power Amplifier MMIC

### ■ CHIP OUTLINE



Chip Size :  $3480 \pm 30 \mu\text{m} \times 2790 \pm 30 \mu\text{m}$

Chip Thickness :  $60 \pm 20 \mu\text{m}$

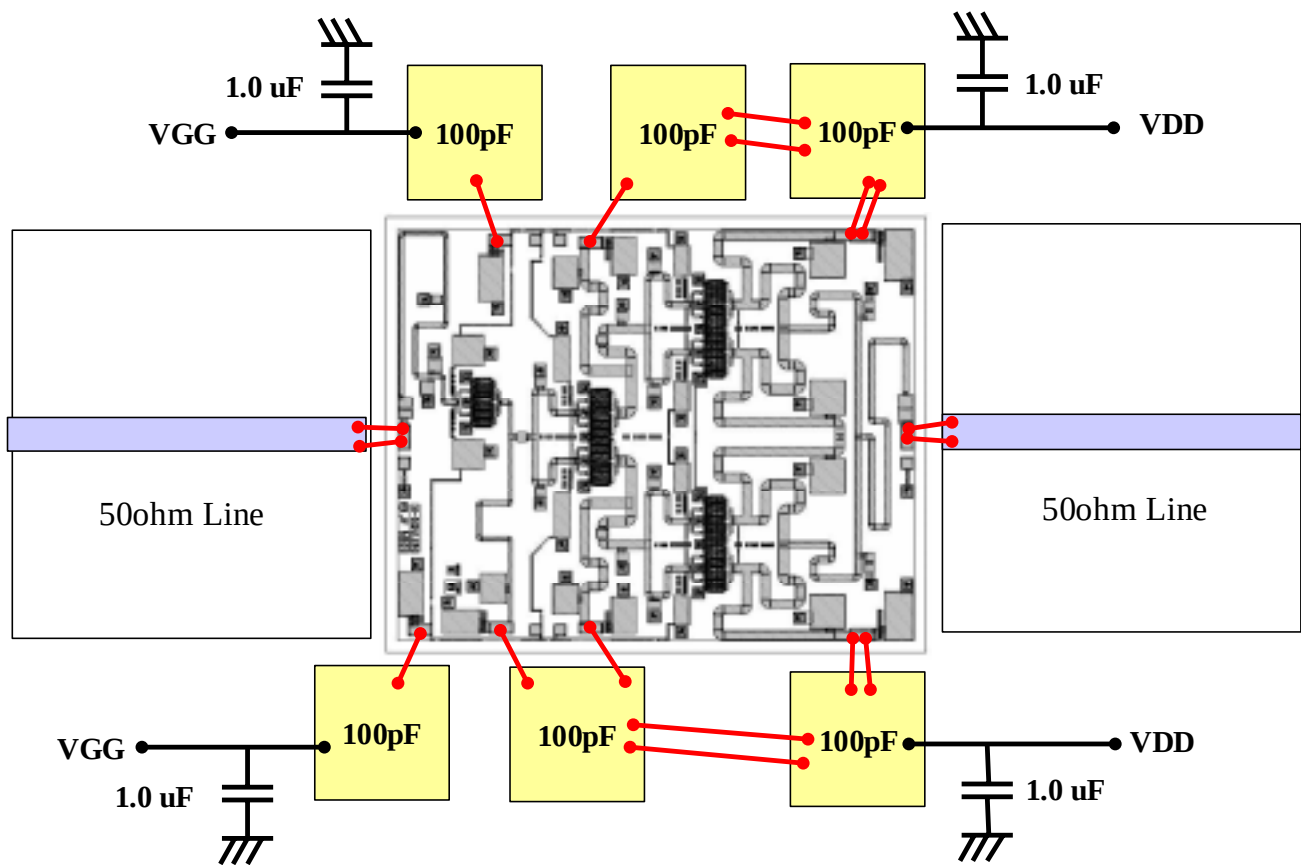
Bonding Pad Size :  $80 \mu\text{m} \times 160 \mu\text{m}$

**Note :** Gate voltage is required from either or both bonding pad( VGG1 or/and VGG2).

# EMM5074X

C-band Power Amplifier MMIC

## ■ BONDUNG DIAGRAM & RECOMMENDED EXTERNAL CIRCUIT



“Copper” is the recommended material for the package or carrier.

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## EMM5074X

C-Band Power Amplifier MMIC

### ■ DIE ATTACH

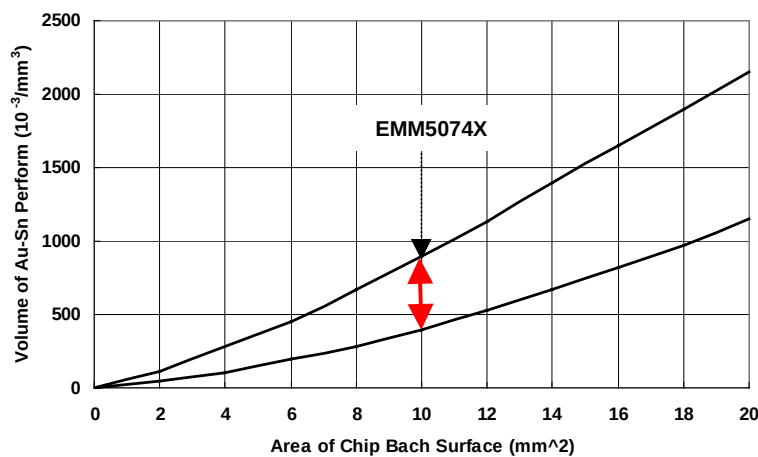
- 1) The die-attach station must have accurate temperature control, and an inert forming gas should be used.
- 2) Chips should be kept at room temperature except during die-attach.
- 3) Place package or carrier on the heated stage.
- 4) Lightly grasp the chip edges by the longer side using tweezers.

Die attach conditions

Stage Temperature : 300 to 310 deg.C

Time : less than 15 seconds

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.

#### 1) Bonding Equipment and Bonding Tool.

Bonding Equipment : West Bond Model 7400 (Manual Bonder)

Bonding Tool : CCOD-1/16-S-437-60-F-2010-MP (Deweyl)

#### 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 :  $0.196 \text{ N} \pm 0.0196 \text{ N}$

Stage Temperature :  $215 \text{ deg.C} \pm 5 \text{ deg.C}$

Tool Heater : None

Ultrasonic Power Transmitter : West Bond Model 1400

Duration : 150 mS/Bond

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# EMM5074X

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## C-band Power Amplifier MMIC

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For further information please contact :

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FAX +81-45-853-8170

### CAUTION

Eudyna Devices 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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