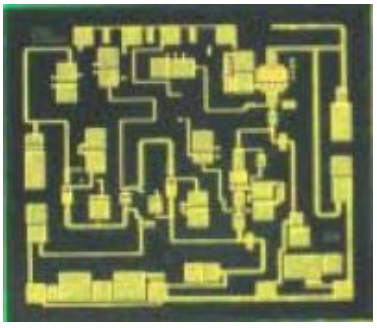
FMM5709X

K / Ka Band Low Noise Amplifier MMIC



FEATURES

- Low Noise Figure: NF = 2.5dB (Typ.) @ f=30GHz
- High Associated Gain: Gas = 23dB (Typ.) @f=30GHz
- Broad Band: 17.5 to 32GHz
- High Output Power: P1dB = 12.5dBm (Typ.) @f=30GHz
- Impedance Matched Zin/Zout = 50ohm

DESCRIPTION

The FMM5709X is a LNA MMIC designed for applications in the 17.5 to 32 GHz frequency range. This product is well suited for satellite communications, radio link, and applications where low noise and high dynamic range are required.
Sumitomo Electric's stringent Quality Assurance Program assures the highest reliability and consistent performance.

ABSOLUTE MAXIMUM RATING

Item	Symbol	Rating	Unit
Drain Voltage	V_{DD}	4	V
Input Power	P_{in}	-3	dBm
Storage Temperature	T_{stg}	-65 to +175	deg.C

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Recommend	Unit
Drain Voltage	V_{DD}	<= 3	V
Operating Backside Temperature	T_{op}	-45 to +85	deg.C

ELECTRICAL CHARACTERISTICS (Ambient Temperature Ta=25deg.C)

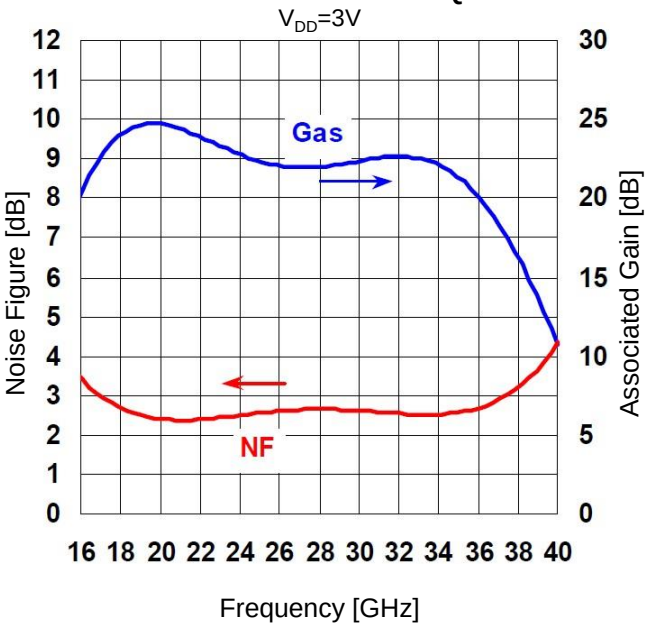
Item	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Noise Figure	NF	V_{DD}=3V f=30GHz Z_L=Z_S=50ohm	-	2.5	3.0	dB
Associated Gain	Gas		20	23	26	dB
Output Power at 1dB G.C.P.	P_{1db}		-	12.5	-	dBm
Output 3rd order intercept point	OIP3		-	22.5	-	dBm
Drain Current at 1dB G.C.P.	I_{ddef}		-	60	75	mA
Input Return Loss	RLin		-	-10	-	dB
Output Return Loss	RLout		-	-10	-	dB

ESD	Class 0A	Up to 125V

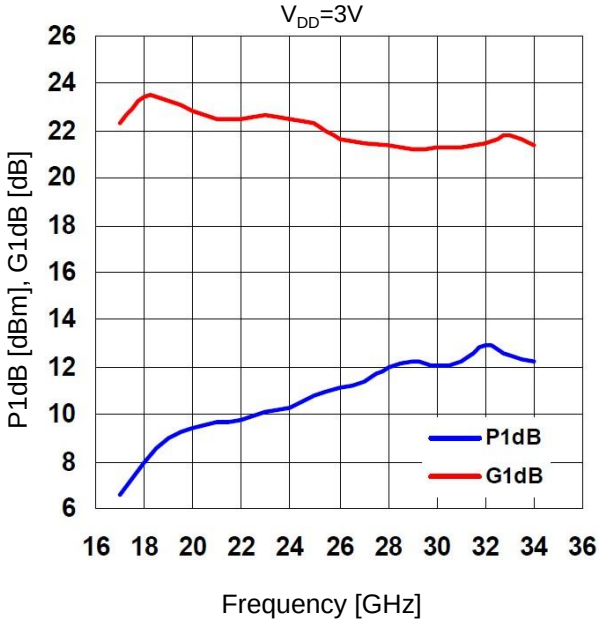
Note : Based on ANSI/ESDA/JEDEC JS-001-2012 (C=100 pF, R=1500 ohm)

RoHS Compliance	Yes

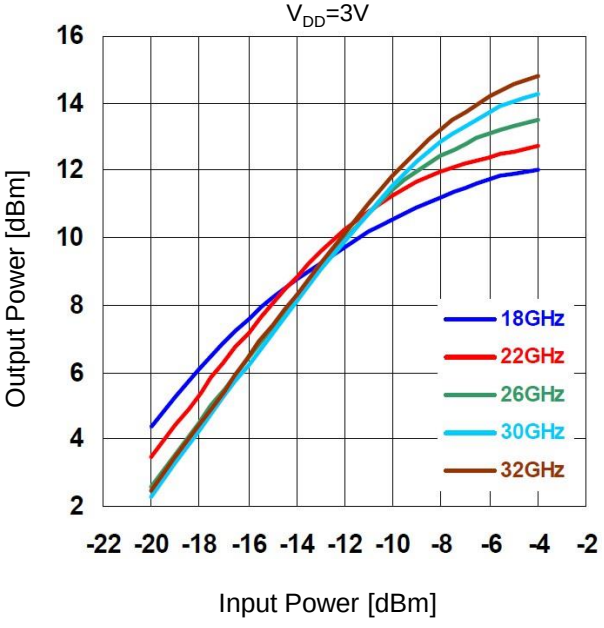
NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY



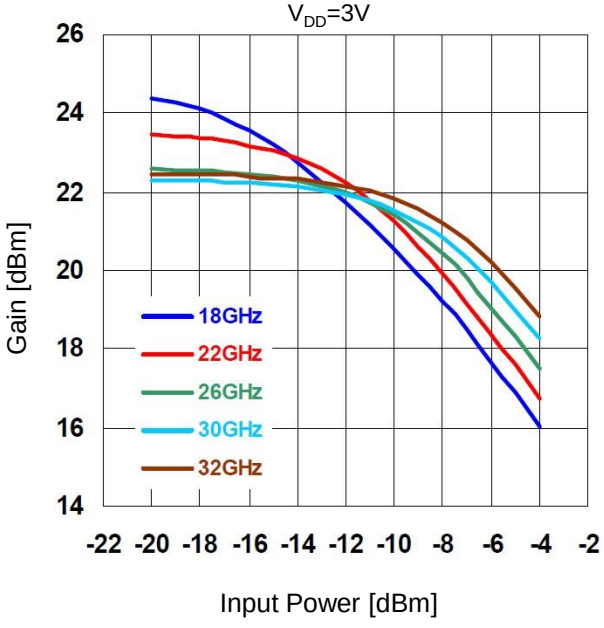
P1dB, G1dB vs. FREQUENCY



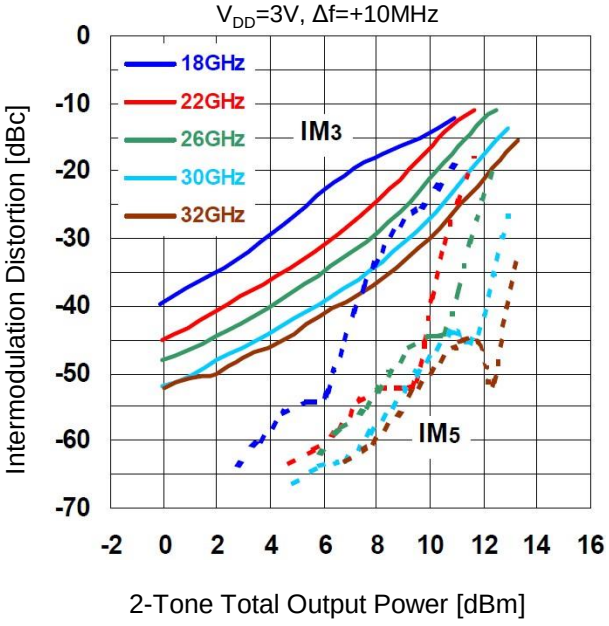
OUTPUT POWER vs. INPUT POWER



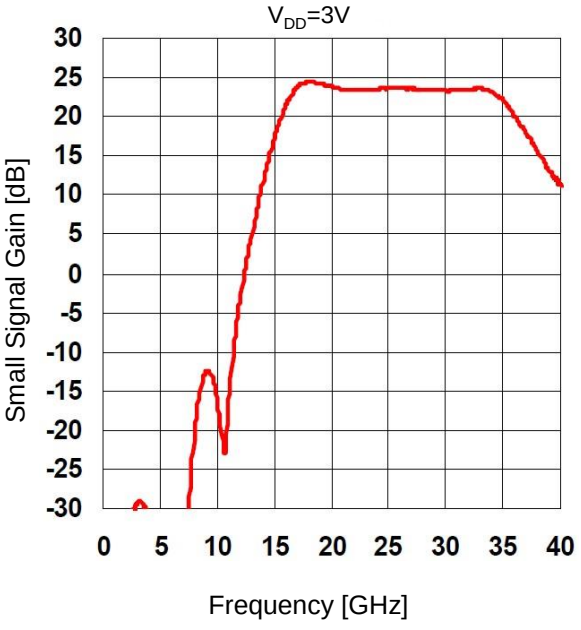
GAIN vs. INPUT POWER



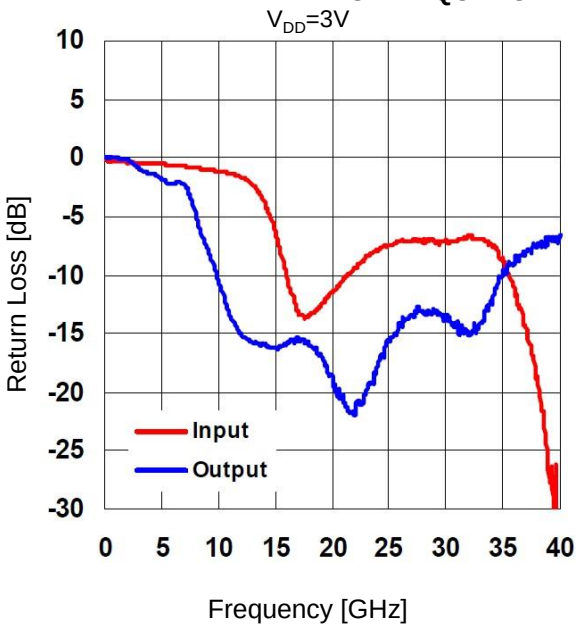
IMD PERFORMANCE vs. TOTAL OUTPUT POWER



SMALL SIGNAL GAIN vs. FREQUENCY



INPUT/OUTPUT RETURN LOSS vs. FREQUENCY



■ S-Parameter

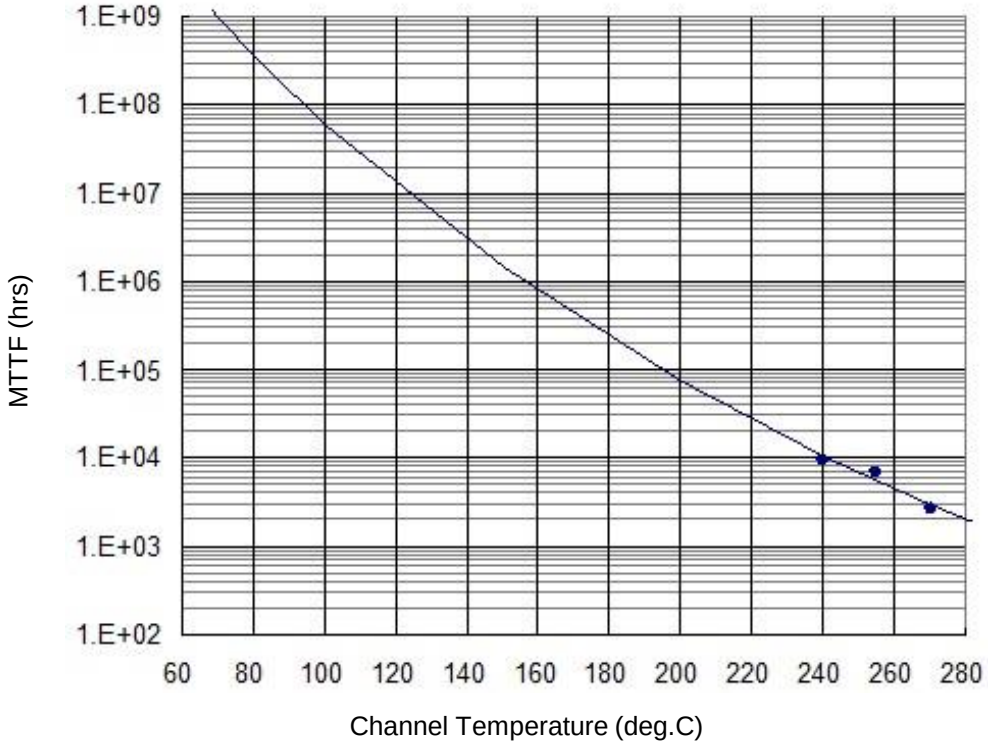
VDD=3V

Freq	S11		S21		S12		S22	
(MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1000	0.959	-25.9	0.008	-156.9	0.001	-10.3	0.997	-19.1
2000	0.955	-51.0	0.019	154.9	0.001	-25.6	0.983	-39.1
3000	0.952	-75.9	0.035	65.7	0.001	-171.1	0.908	-59.1
4000	0.946	-99.9	0.031	-22.8	0.001	173.6	0.858	-75.7
5000	0.938	-123.2	0.018	-92.8	0.001	-1.3	0.816	-94.7
6000	0.930	-146.1	0.012	-102.3	0.001	-133.3	0.771	-112.0
7000	0.919	-168.5	0.009	-106.0	0.001	147.2	0.770	-137.7
8000	0.906	169.2	0.086	-80.9	0.000	131.7	0.586	-168.1
9000	0.890	146.8	0.233	175.3	0.001	161.3	0.415	176.9
10000	0.878	123.8	0.161	97.4	0.001	136.4	0.303	162.8
11000	0.860	98.9	0.138	156.8	0.001	89.5	0.217	156.2
12000	0.828	71.7	0.655	122.9	0.001	149.3	0.179	156.1
13000	0.769	40.9	1.666	71.2	0.002	13.5	0.165	154.9
14000	0.657	6.8	3.671	17.1	0.001	-15.4	0.162	149.5
15000	0.488	-27.9	7.153	-44.3	0.001	110.3	0.155	141.8
16000	0.319	-54.0	11.694	-111.8	0.002	-133.8	0.159	136.8
17000	0.222	-66.7	15.274	-179.8	0.001	-93.7	0.170	122.7
18000	0.210	-73.7	16.572	117.2	0.002	-103.6	0.158	109.1
19000	0.233	-91.4	16.251	61.8	0.002	83.2	0.146	91.6
20000	0.266	-112.2	15.490	13.4	0.003	159.7	0.115	80.0
21000	0.304	-134.9	15.034	-30.5	0.002	101.3	0.090	81.2
22000	0.342	-155.9	14.888	-71.8	0.002	122.4	0.079	90.9
23000	0.376	-177.1	14.901	-111.9	0.004	118.6	0.099	98.6
24000	0.402	162.2	15.063	-151.4	0.001	-5.9	0.130	94.2
25000	0.424	141.7	15.153	169.5	0.002	64.4	0.165	86.2
26000	0.441	123.4	15.263	130.8	0.005	43.5	0.196	69.3
27000	0.444	105.3	15.068	92.7	0.003	1.9	0.209	52.1
28000	0.437	88.5	14.910	55.4	0.004	24.1	0.222	33.2
29000	0.439	72.7	14.657	18.6	0.003	-31.2	0.221	14.3
30000	0.447	57.9	14.717	-18.1	0.003	-48.2	0.213	-1.9
31000	0.441	42.1	14.839	-54.9	0.002	6.4	0.202	-16.6
32000	0.457	25.4	14.982	-93.4	0.005	-11.1	0.179	-22.8
33000	0.453	5.3	15.122	-133.5	0.006	-132.4	0.196	-29.9
34000	0.414	-17.9	14.577	-176.8	0.008	103.9	0.238	-43.6
35000	0.365	-43.2	12.651	139.2	0.004	109.2	0.327	-69.5
36000	0.276	-67.3	10.093	97.6	0.005	161.1	0.355	-98.2
37000	0.188	-89.6	7.902	59.6	0.007	42.3	0.401	-127.4
38000	0.112	-107.1	6.067	26.8	0.006	63.4	0.416	-152.8
39000	0.053	-116.3	4.710	-3.9	0.010	23.4	0.446	179.1
40000	0.005	56.6	3.687	-31.8	0.010	16.7	0.459	160.2

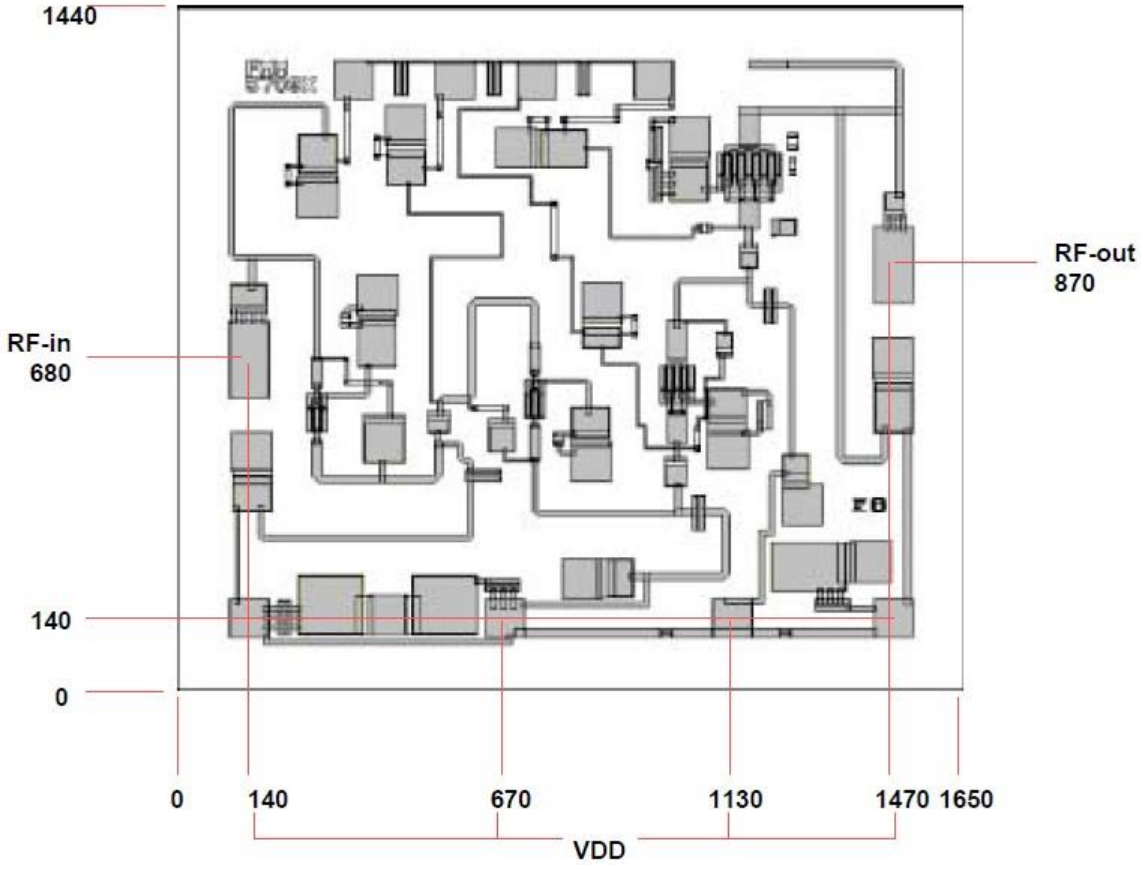
THERMAL INFORMATION (REFERENCE DATA)

	V_{DD}=3V, I_{DD}=60mA	
ΔTch	18	deg.C

MTTF vs Tch

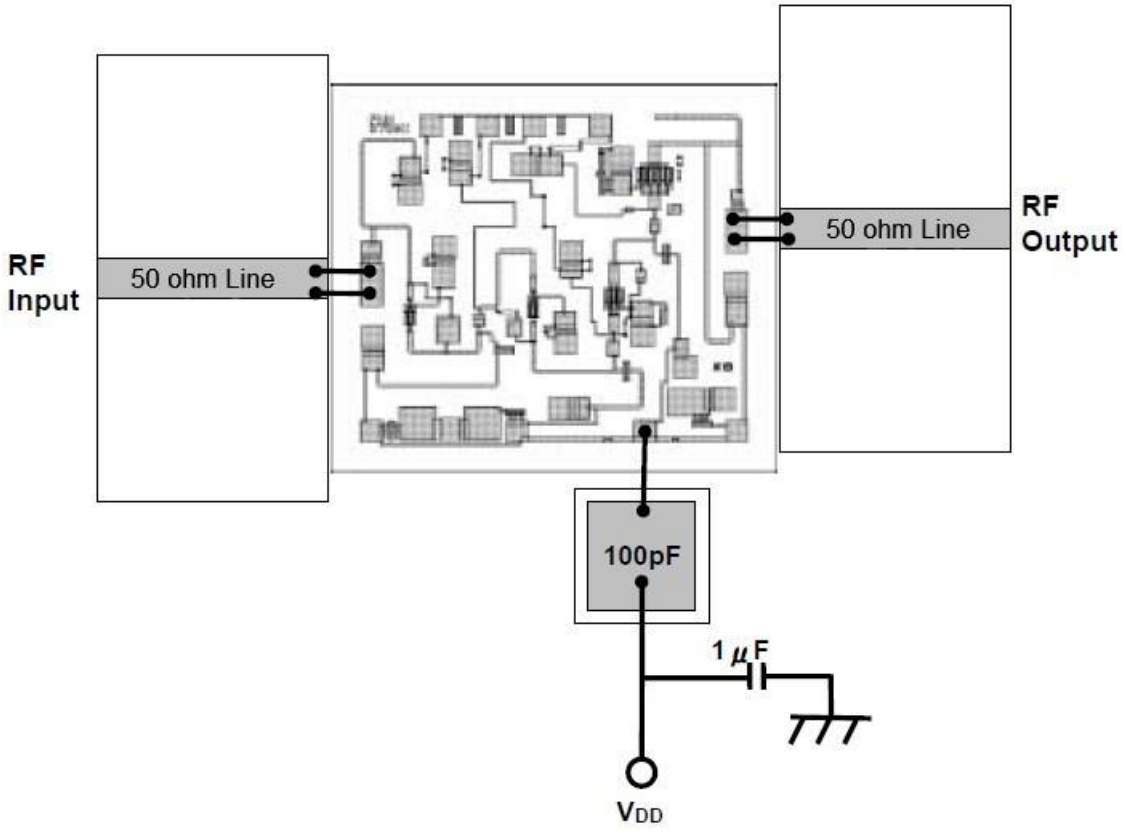


■ Chip Outline and Bonding Pad Locations (Dimension in Micro-Meters)



Chip Size: 1650 +/-30um x 1440 +/-30um
Chip Thickness: 85um +/-20um
Bonding Pad Size :
RF-Pad: 80um x 160um
VDD-Pad: 80um x 80um

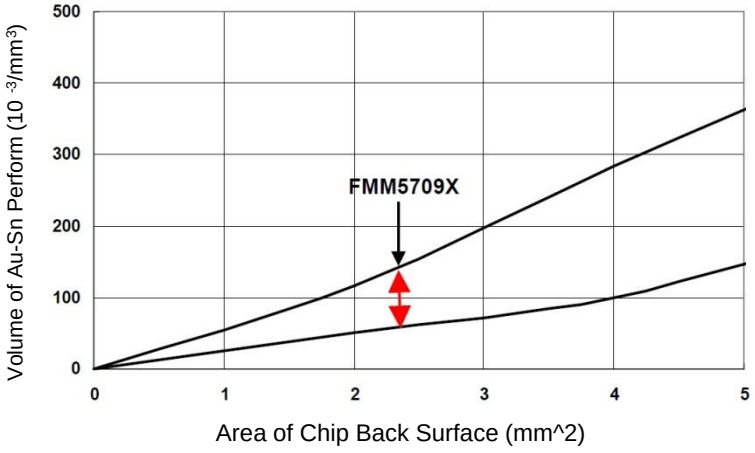
■ BONDING LAYOUT / EXTERNAL CIRCUIT



"Copper" is recommended material of the package or carrier.

■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 Perform 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 N +/- 0.0196 N
   Stage Temperature : 215 deg.C +/- 5 deg.C
   Tool Heater : None
   Ultrasonic Power Transmitter : West Bond Model 1400
   Duration : 150 mS/Bond

■ **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.