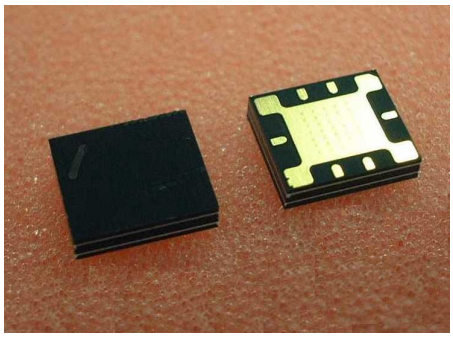
Preliminary

ES/FMM5709YC

K-Band Low-Noise Amplifier MMIC

FEATURES

- Low Noise Figure : NF = 3.5dB (Typ.) @ f=30GHz
- High Associated Gain : Gas = 21dB (Typ.) @f=30GHz
- Broad Band : 17.5~30GHz
- High Output Power : P1dB = 12.5dBm (Typ.) @f=30GHz
- Laminate SMT Package(YC-pkg)
- Impedance Matched Zin/Zout = 50Ω



DESCRIPTION

The FMM5709YC is a LNA MMIC designed for applications in the 17.5~30 GHz frequency range. This product is well suited for fixed wireless access, radio link, and applications where low noise and high dynamic range are required.

Eudyna's stringent Quality Assurance Program assures the highest reliability and consistent performance.

ABSOLUTE MAXIMUM RATING

Item	Symbol	Rating	Unit
Drain-Source Voltage	V_{DD}	4	V
Input Power	P_{in}	-3	dBm
Storage Temperature	T_{stg}	-55 to +125	°C

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Recommend	Unit
Drain-Source Voltage	V_{DD}	3	V
Operating Case Temperature	T_{op}	-40 to +85	°C

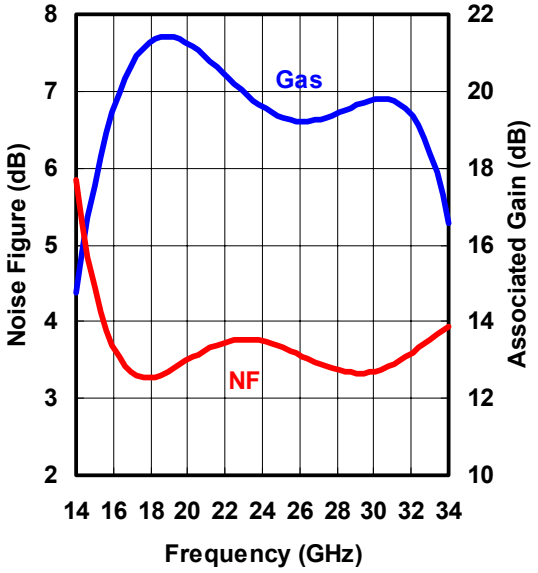
ELECTRICAL CHARACTERISTICS (Ambient Temperature Ta=25°C)

Item	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Noise Figure	NF	Freq.=30GHz	-	3.5	4	dB
Associated Gain	Gas	V_{DD}=3V	19	21	24	dB
Drain Current	I_{DD}	Z_S=Z_L=50Ω	-	60	75	mA
Output Power at 1dB G.C.P.	P_{1dB}		-	12.5	-	dBm
Output intercept point 3rd order	OIP_3		-	22.5	-	dB
Input Return Loss (at P_{in}=-20dBm)	RLin		-	-10	-	dB
Output Return Loss (at P_{in}=-20dBm)	RLout		-	-10	-	dB

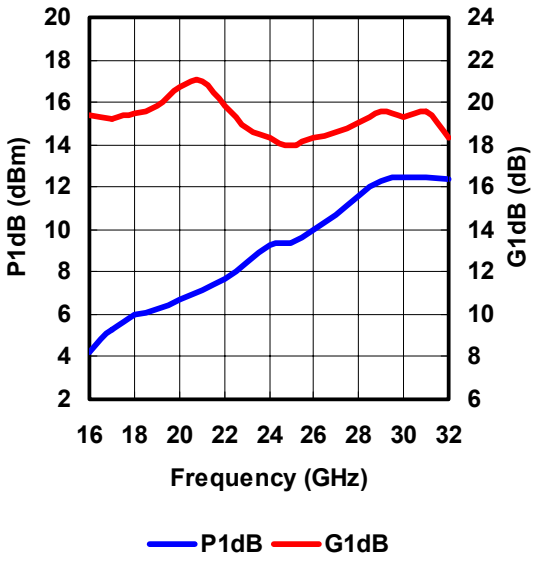
G.C.P. : Gain Compression Point

ESD	Class 0	~ 199V
Note : Based on EIAJ ED-4701 C-111A(C=100pF, R=1.5kW)		
CASE STYLE	YC	

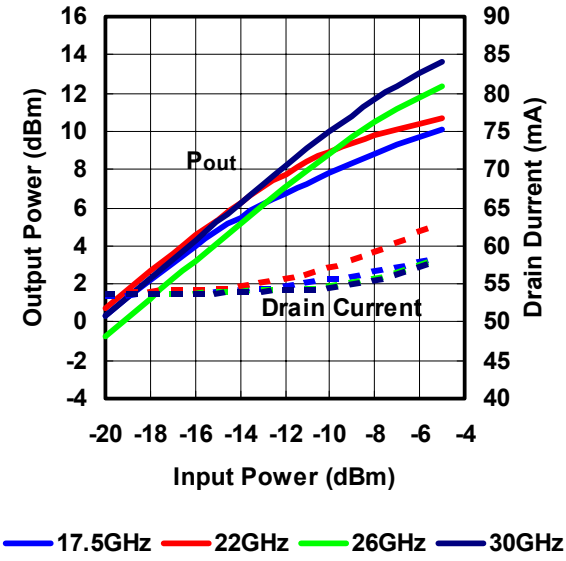
Noise Figure, Associated Gain vs. Frequency
@ VDD=3V



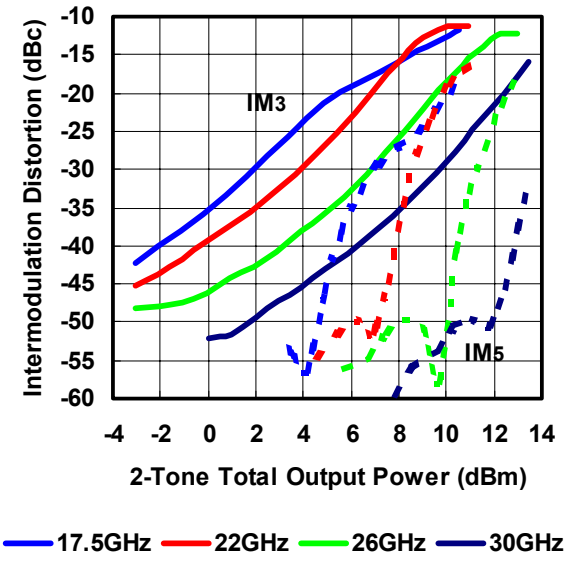
P1dB, G1dB vs. Frequency
@ VDD=3V



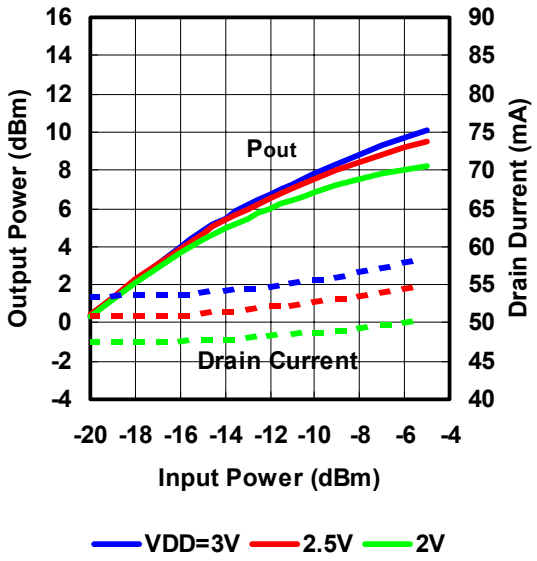
Output Power, Drain Current vs. Input Power
@ VDD=3V



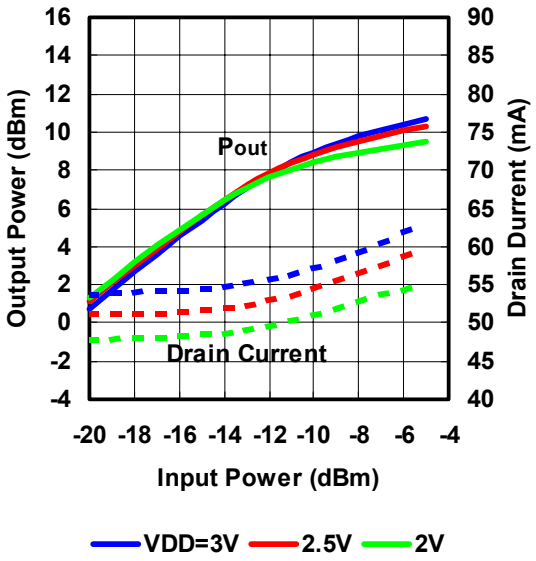
Intermodulation distortion vs. Output Power
@VDD=3V, Δf=+10MHz, 2-Tone Test



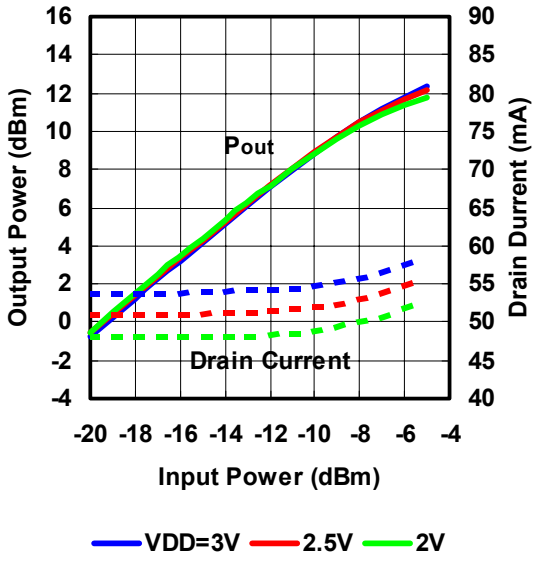
Output Power, Drain Current vs. Input Power by Drain Voltage @ f=17.5GHz



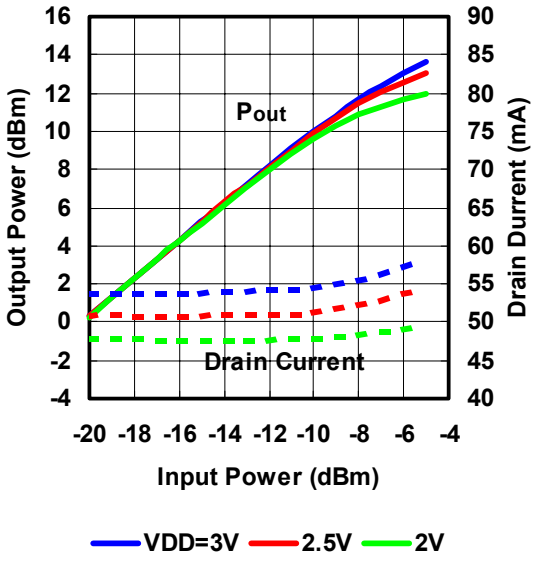
Output Power, Drain Current vs. Input Power by Drain Voltage @ f=22GHz



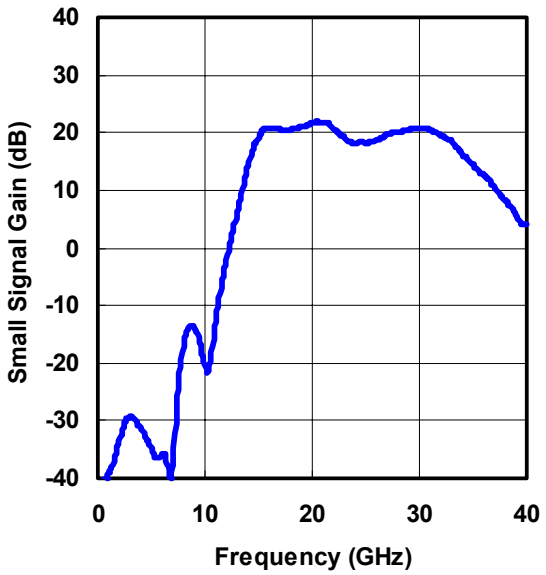
Output Power, Drain Current vs. Input Power by Drain Voltage @ f=26GHz



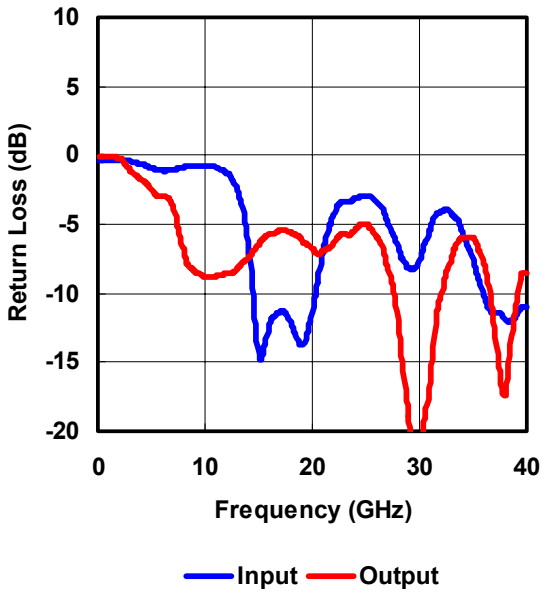
Output Power, Drain Current vs. Input Power by Drain Voltage @ f=30GHz



Small Signal Gain vs. Frequency
@ VDD=3V



Return Loss vs. Frequency
@ VDD=3V

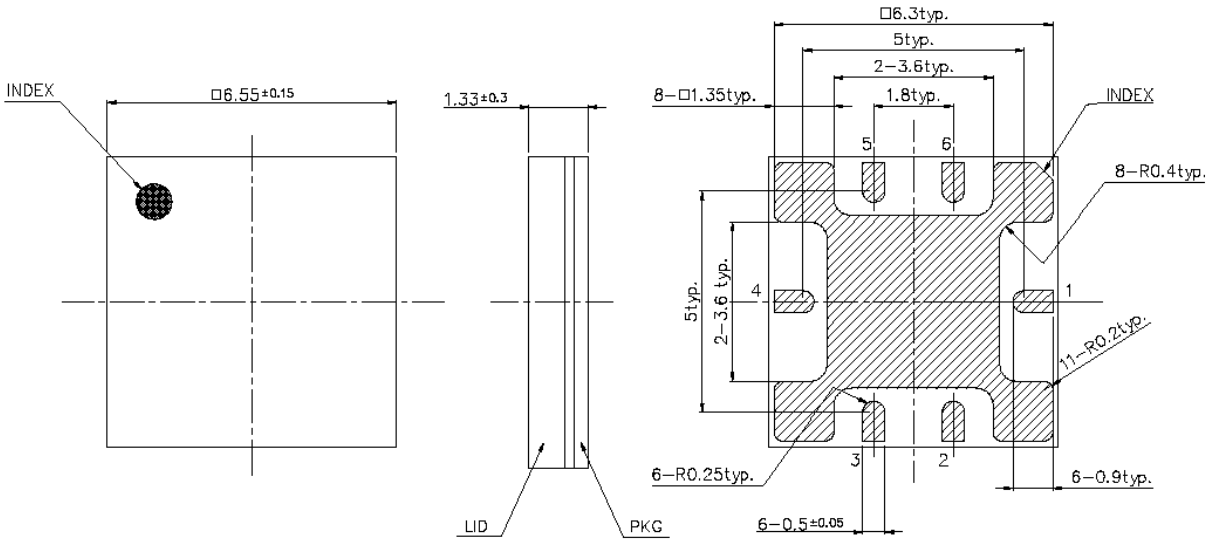


■ S-Parameter

@ VDD=3V

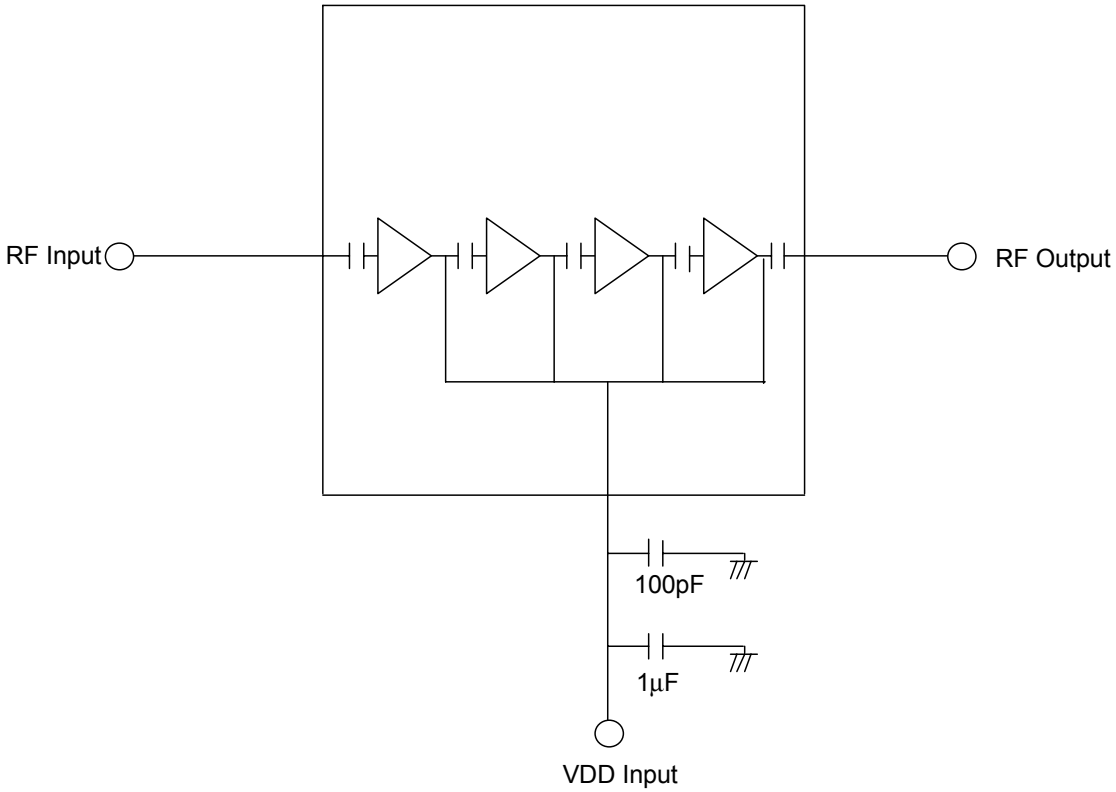
Freq.	S11		S21		S12		S22	
MHz	mag.	ang.	mag.	ang.	mag.	ang.	mag.	ang.
1000	0.962	-52.3	0.014	-161.2	0.001	3.5	0.995	-43.8
2000	0.962	-101.8	0.020	94.7	0.001	-81.5	0.974	-88.5
3000	0.953	-149.7	0.031	-6.5	0.003	176.0	0.882	-132.0
4000	0.929	161.9	0.032	-126.4	0.004	85.6	0.821	-172.4
5000	0.901	109.7	0.020	105.0	0.006	43.6	0.751	143.2
6000	0.879	51.6	0.014	77.9	0.013	-9.3	0.709	97.9
7000	0.886	-9.0	0.005	-87.1	0.015	-74.1	0.659	32.8
8000	0.907	-64.6	0.144	28.8	0.012	-120.7	0.442	-31.2
9000	0.920	-111.6	0.212	-99.2	0.010	-163.6	0.379	-80.6
10000	0.914	-150.9	0.083	-165.8	0.006	150.7	0.362	-124.3
11000	0.907	173.2	0.225	-133.3	0.005	138.2	0.364	-159.1
12000	0.870	136.1	0.756	166.6	0.004	114.6	0.373	170.8
13000	0.753	96.2	1.950	93.6	0.003	111.0	0.390	147.5
14000	0.496	51.4	5.006	9.4	0.005	99.2	0.422	122.7
15000	0.182	47.4	9.334	-94.8	0.005	56.3	0.476	97.8
16000	0.239	62.9	11.186	164.2	0.006	23.0	0.518	68.8
17000	0.276	37.1	10.617	76.3	0.005	-23.3	0.537	40.7
18000	0.247	9.3	10.730	3.0	0.006	-62.6	0.524	12.7
19000	0.199	2.9	11.204	-67.2	0.005	-96.0	0.496	-12.4
20000	0.267	4.3	12.045	-139.0	0.004	-123.7	0.461	-34.5
21000	0.454	-13.4	12.318	144.3	0.004	-149.3	0.454	-48.3
22000	0.601	-47.0	10.744	71.1	0.006	-161.1	0.486	-65.4
23000	0.684	-82.5	8.952	7.3	0.008	168.9	0.524	-90.4
24000	0.710	-111.2	8.097	-47.1	0.006	148.3	0.537	-112.4
25000	0.712	-142.3	8.221	-107.1	0.012	127.0	0.568	-139.2
26000	0.676	-176.7	8.519	-163.9	0.014	88.2	0.507	-171.8
27000	0.579	142.9	9.580	135.2	0.020	48.6	0.392	149.8
28000	0.459	103.4	10.289	70.9	0.022	12.4	0.247	107.6
29000	0.392	63.5	10.674	6.9	0.024	-29.5	0.124	49.1
30000	0.416	25.2	10.837	-61.8	0.025	-67.1	0.073	-47.3
31000	0.534	-20.1	10.630	-131.2	0.025	-104.9	0.144	-63.0
32000	0.611	-66.2	9.427	158.2	0.020	-145.7	0.306	-100.6
33000	0.608	-108.4	8.361	90.7	0.019	-169.2	0.421	-134.1
34000	0.529	-141.9	6.327	24.8	0.013	160.2	0.504	-164.1
35000	0.409	-168.4	5.428	-38.0	0.011	126.4	0.504	164.2
36000	0.311	173.2	4.233	-99.1	0.012	100.8	0.412	134.9
37000	0.266	162.2	3.347	-164.8	0.010	62.3	0.235	121.2
38000	0.263	133.4	2.590	136.3	0.005	-5.6	0.125	144.2
39000	0.244	97.5	1.963	72.9	0.004	43.2	0.276	168.9
40000	0.312	62.6	1.356	16.8	0.002	6.3	0.476	134.4

■ Package Outline



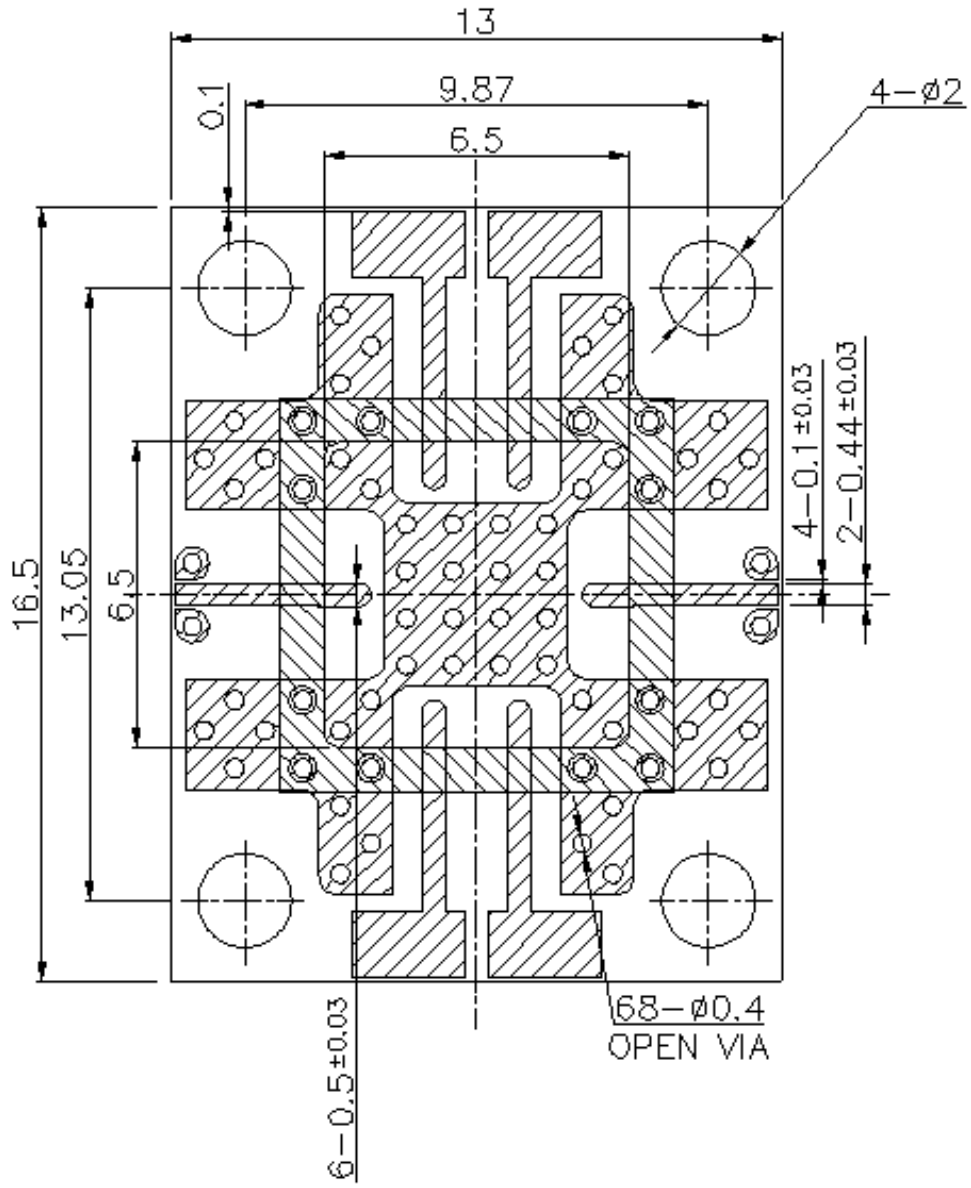
Pin Assignment
1 : RF Input
2 : N.C.
3 : V_{DD}
4 : RF Output
5 : N.C.
6 : N.C.

■ Block Diagram and External Component



Note) : The capacitors are recommended on the bias supply line, close to the package, in order to prevent video oscillations which could damage the module.

■ **Recommended Foot Pattern Layout**



Notes :
1.LAMINATE : Rogers Corporation RO4003, Thickness t=0.2mm, Cu Foil 18μm
2. ▨ : Finish to copper foil ; Ni 0.1μm min./Au 0.1±0.08μm (Both side)
3. ▨ : Resist

■ Mounting Instructions for YC Package for Lead-free solder

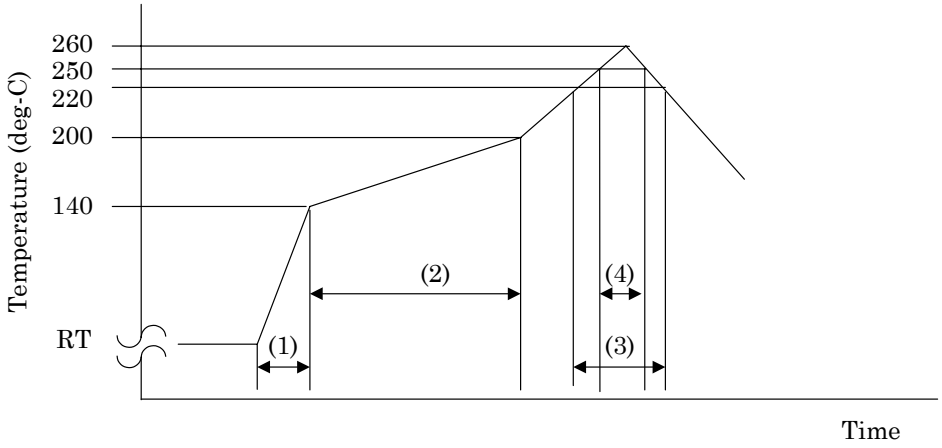
Mounting Condition

1. For soldering, Lead-free solder (Sn-3.0Ag-0.5Cu)*1 or equivalent shall be used.
   (*1:The figure displays with weight %. A predominantly tin-rich alloy with 3.0% silver and 0.5% copper.)
2. A rosin type flux with a chlorine content of 0.2% or less shall be used. The rosin flux with low halogen content is recommended.
3. When soldering, use one of the following time/ temperature methods for acceptable solder joints. Make sure the devices have been properly prepared with flux prior soldering.

*** Reflow soldering method (Infrared reflow / Heat circulation reflow / Hot plate reflow):**

Limit solder to 3 reflow cycles because resin is used in the modules manufacturing process. Excessive reflow will effect the resin resulting in a potential failure or latent defect. The recommended reflow temperature profile is shown below. The temperature of the reflow profile must be measured at the device lead.

Reflow temperature profile and condition:



(1) Temperature rise:	5deg-C/sec.	
(2) Preheating:	140 - 220deg-C	60 - 120sec.
(3) Main heating:	220deg-C over.	10 - 40sec.
(4) Main heating:	250deg-C over.	10 sec. (260deg-C max.)

* Measurement point: Device lead.

4. The above-recommended conditions were confirmed using the manufacture's equipment and materials. However, when soldering these products, the soldering condition should be verified by customer using their equipment and materials.

For further information please contact :

Eudyna Devices USA Inc.
2355 Zanker Rd.
San Jose, CA 95131-1138, U.S.A.
TEL: +1 408 232-9500
FAX: +1 408 428-9111

Eudyna Devices Europe Ltd.
Network House
Norreys Drive
Maidenhead, Berkshire SL6 4FJ
United Kingdom
TEL: +44 (0) 1628 504800
FAX: +44 (0) 1628 504888

Eudyna Devices International Srl
Via Teglio 8/2 - 20158
Milano, Italy
TEL: +39-02-8738-1695

Eudyna Devices Asia Pte. Ltd.
Hong Kong Branch
Suite 1906B, Tower 6, China Hong Kong City
33 Canton Road, Tsimshatsui, Kowloon
Hong Kong
TEL: +852-2377-0227
FAX: +852-2377-3921

Eudyna Devices Inc.
1000 Kamisukiahara, showa-cho
Nakakomagun, Yamanashi
409-3883, Japan
(Kokubo Industrial Park)
TEL +81-55-275-4411
FAX +81-55-275-9461
Sales Division
1, Kanai-cho, Sakae-ku
Yokohama, 244-0845, Japan
TEL +81-45-853-8156
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.