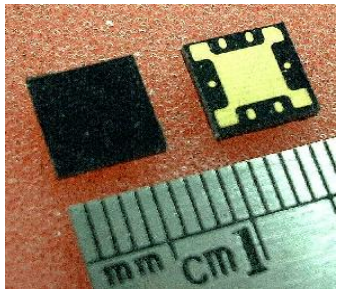
EMM5717YF

Ku / K Band Low Noise Amplifier MMIC



FEATURES

- Low Noise Figure : NF = 2.0dB (Typ.) @ f=18 GHz
- High Associated Gain : Gas = 23dB (Typ.) @ f=18 GHz
- Broad Band : 12.7 - 24.0 GHz
- High Output Power : P1dB = 17.5dBm (Typ.)
- Impedance Matched Zin/Zout = 50ohm

DESCRIPTION

The EMM5717YF is a LNA MMIC designed for applications in the 12.7 - 24.0 GHz frequency range. This product is well suited for satellite communications, 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
Gate-Source Voltage	V_{GG}	-3	V
Input Power	P_{in}	0	dBm
Storage Temperature	T_{stg}	-55 to +125	°C

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Conditions	Unit
Drain-Source Voltage	V_{DD}	<=3	V
Gate-Source Voltage	V_{GG}	-1~0	V
Input Power	P_{in}	<=0	dBm
Operating Backside Temperature	Top	-40 to +85	℃

ELECTRICAL CHARACTERISTICS (Ambient Temperature Ta=25°C)

Item	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Frequency	Freq	VDD=3.0V	12.7		24	GHz
Noise Figure	NF	IDD(DC)=170mA (typ.)	-	2.5[*1]	3.0[*1]	dB
		Zs=Zl=50ohm	-	3.0[*2]	3.5[*2]	
Associated Gain	Gas	*1:f=12.7GHz	20[*1]	23[*1]	-	dB
		*2:f=24GHz	19[*2]	22[*2]	-	
Output Power at 1dB G.C.P.	P_{1dB}		-	17.5	-	dBm
Third Order Output Intercept Point	OIP3		-	29	-	dBm
Drain Current at 1dB G.C.P.	I_{DD}		-	180	-	mA
Input Return Loss (at Pin=-20dBm)	RL_{in}		-	-10	-	dB
Output Return Loss (at Pin=-20dBm)	RL_{out}		-	-10	-	dB

G.C.P.:Gain Compression Point

ESD	Class 0	~ 250V

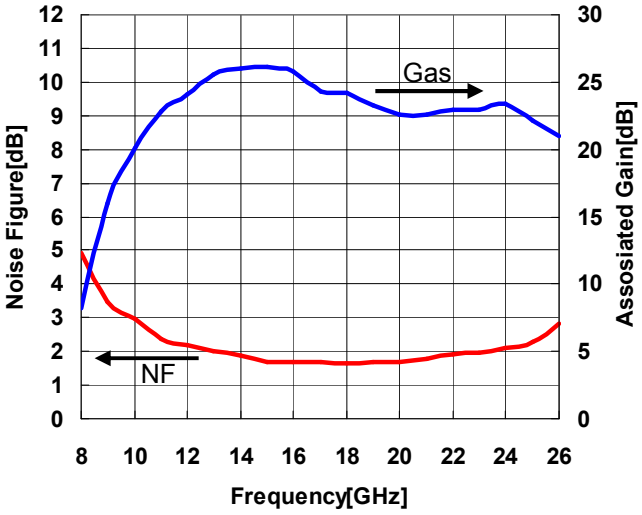
Note : Based on JEDEC JESD22-A114-C

Case Style	YF

RoHS Compliance	Yes

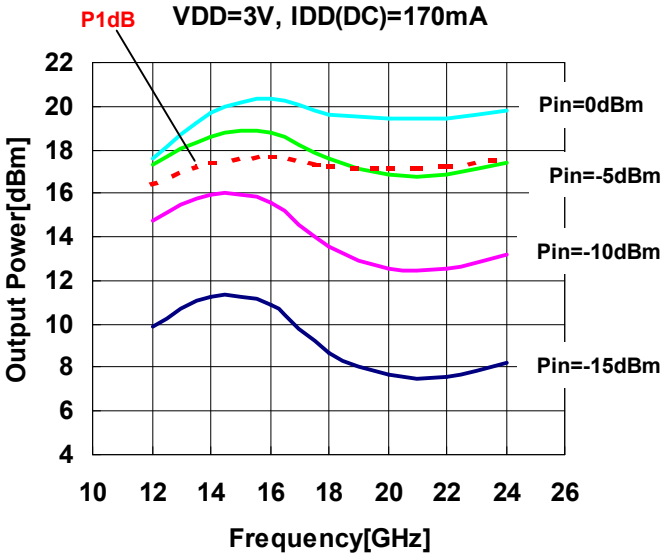
NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY

VDD=3V, IDD(DC)=170mA



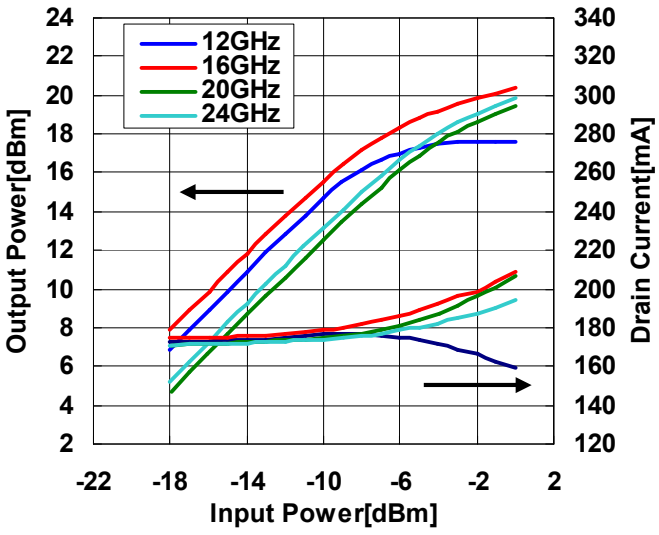
OUTPUT POWER vs. FREQUENCY

VDD=3V, IDD(DC)=170mA



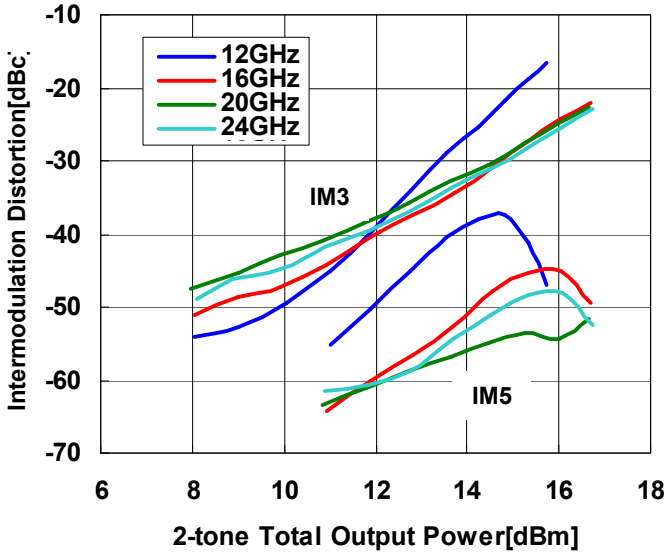
OUTPUT POWER , DRAIN CURRENT vs. INPUT POWER

VDD=3V, IDD(DC)=170mA

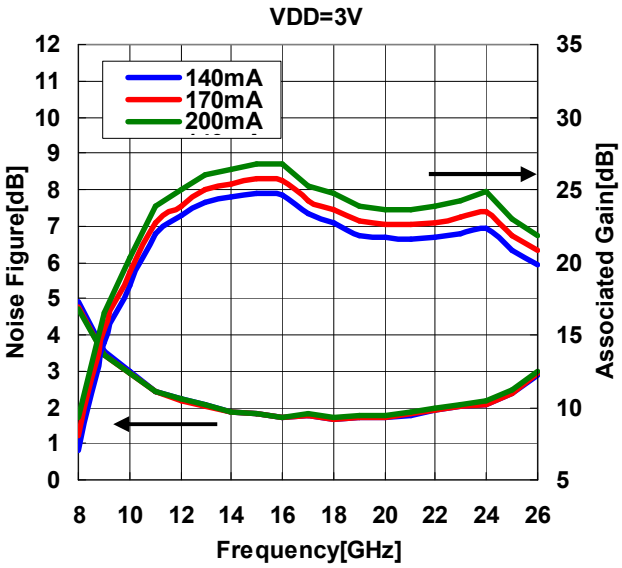


IMD PERFORMANCE vs. TOTAL OUTPUT POWER

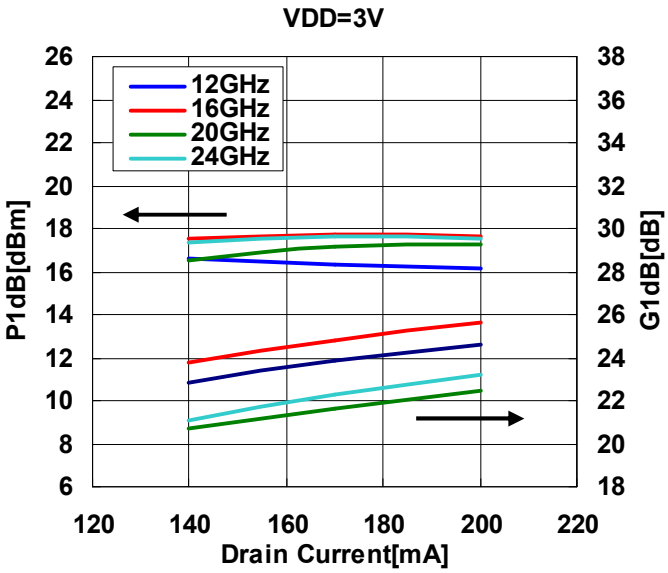
VDD=3V, IDD(DC)=170mA



NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY by Drain Current

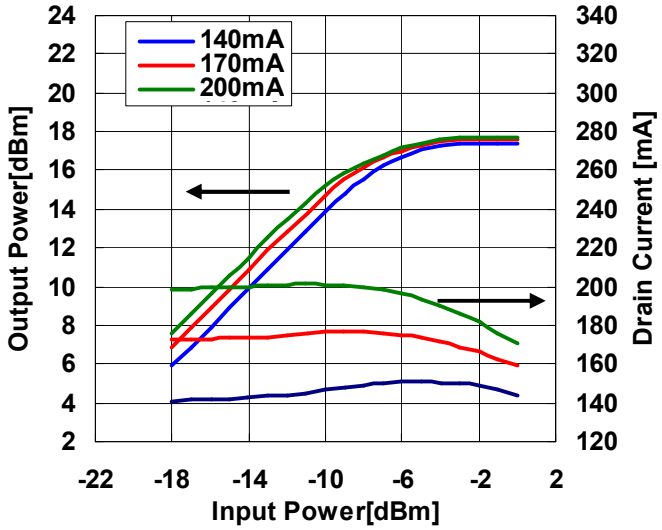


OUTPUT POWER, GAIN vs. Drain Current



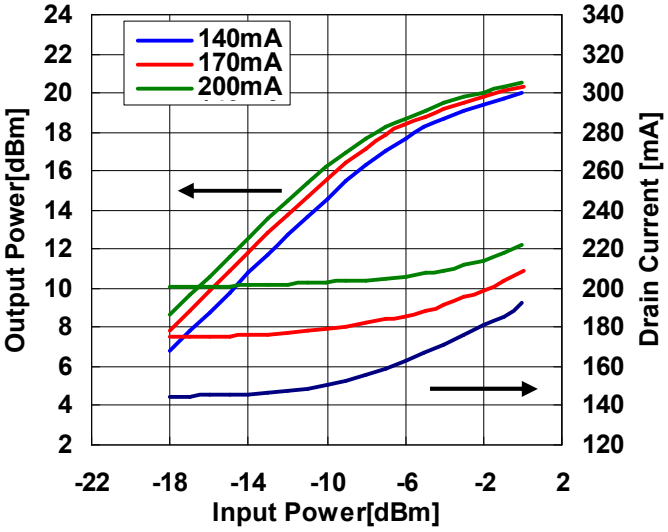
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

VDD=3V, f=12GHz



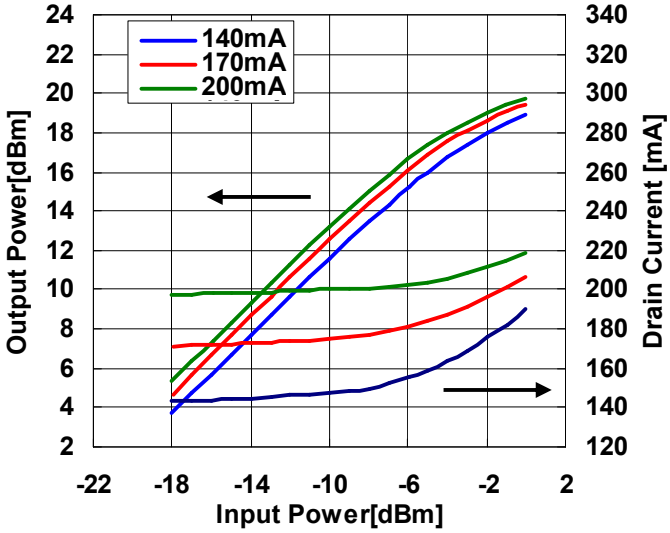
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

VDD=3V, f=16GHz



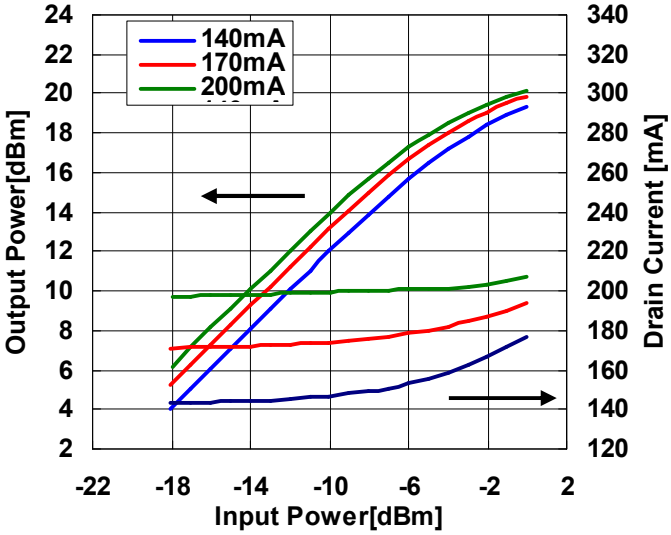
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

VDD=3V, f=20GHz



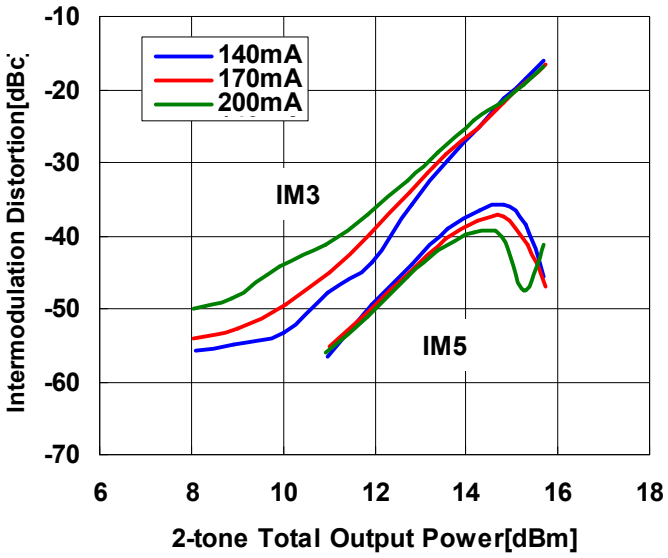
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

VDD=3V, f=24GHz



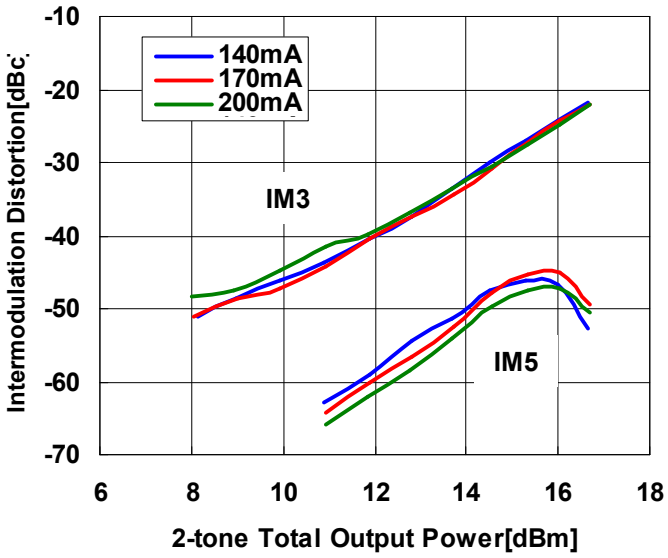
IMD PERFORMANCE vs OUTPUT POWER
by Drain Current

VDD=3V, f=12GHz



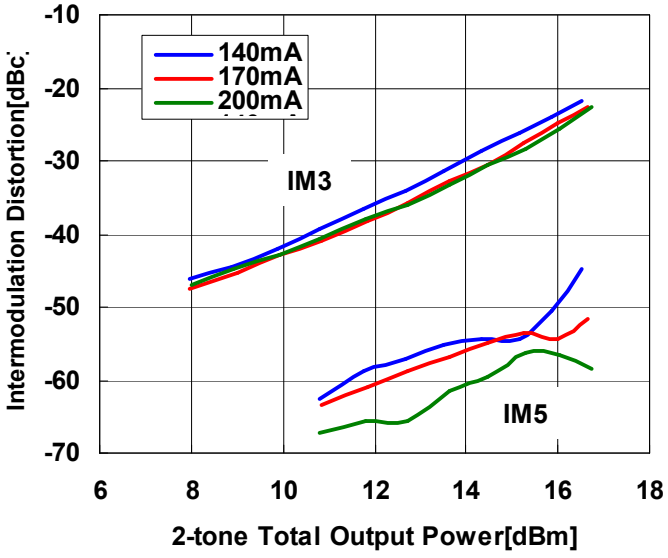
IMD PERFORMANCE vs OUTPUT POWER
by Drain Current

VDD=3V, f=16GHz



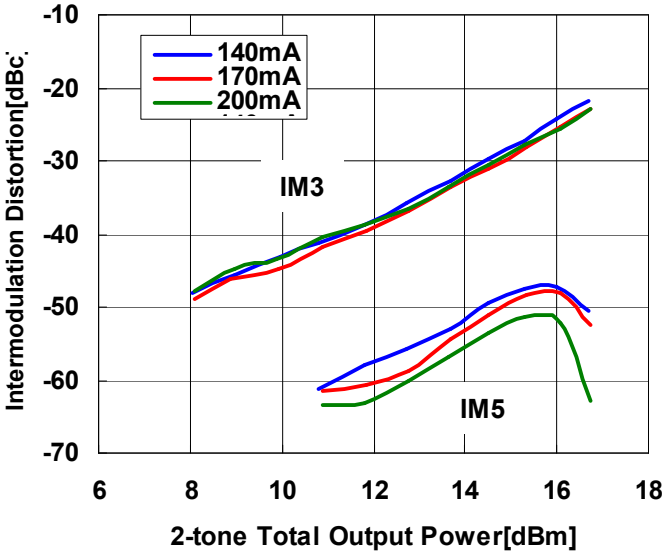
IMD PERFORMANCE vs OUTPUT POWER
by Drain Current

VDD=3V, f=20GHz

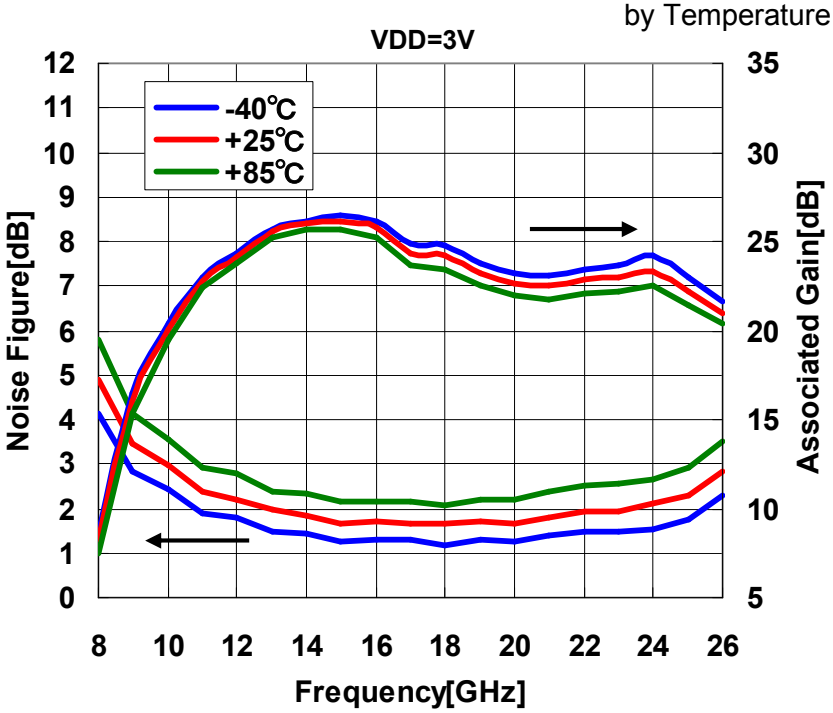


IMD PERFORMANCE vs OUTPUT POWER
by Drain Current

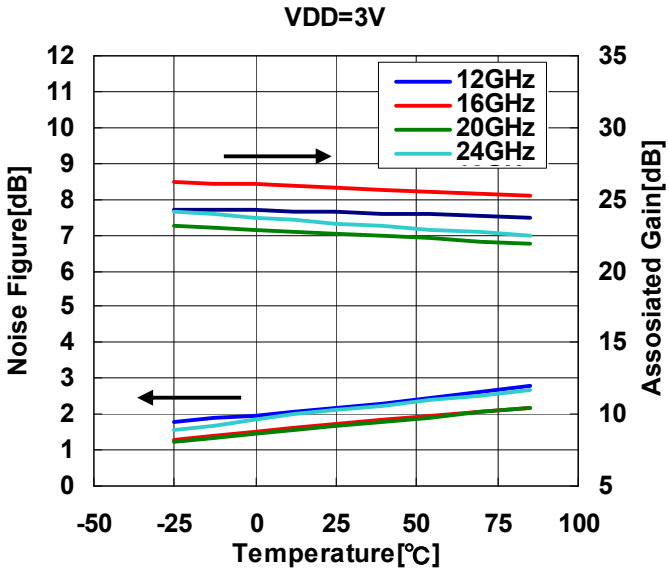
VDD=3V, f=24GHz



NOISE FIGURE, ASSOCIATED GAIN vs. FREQUENCY
by Temperature

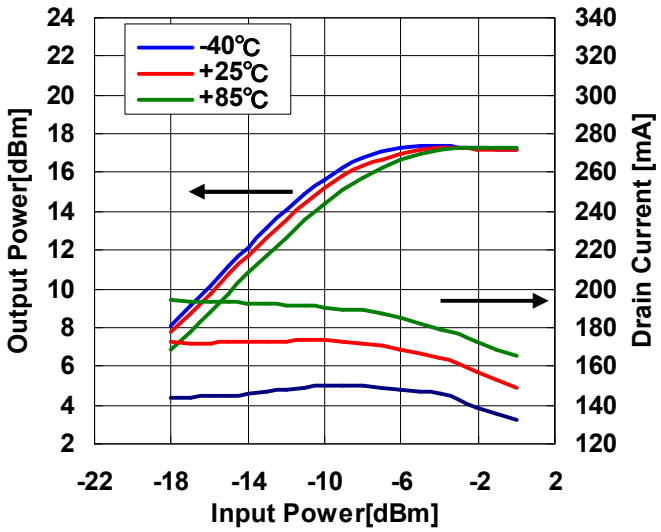


NOISE FIGURE, ASSOCIATED GAIN
vs. TEMPERATURE



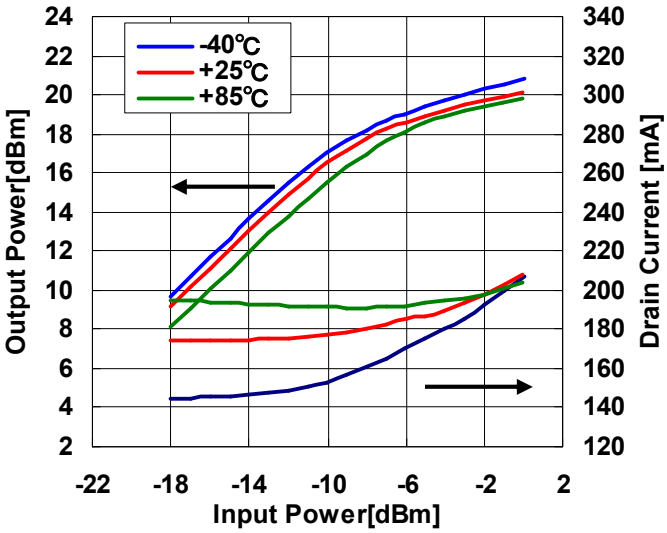
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Temperature

VDD=3V/170mA@25deg, f=12GHz



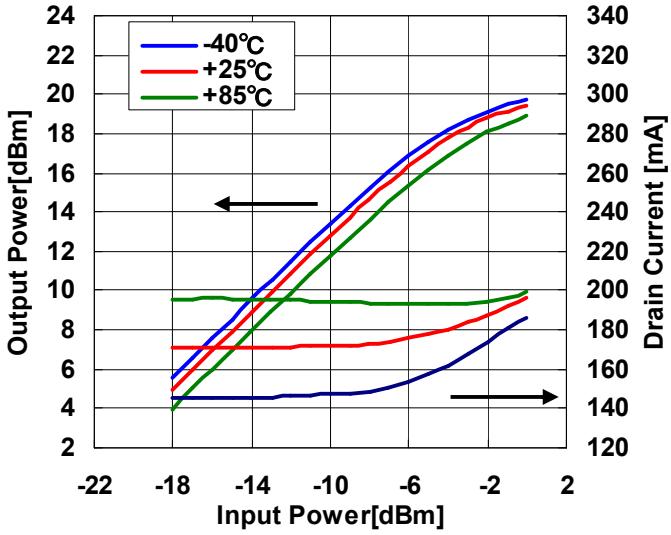
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Temperature

VDD=3V/170mA@25deg, f=16GHz



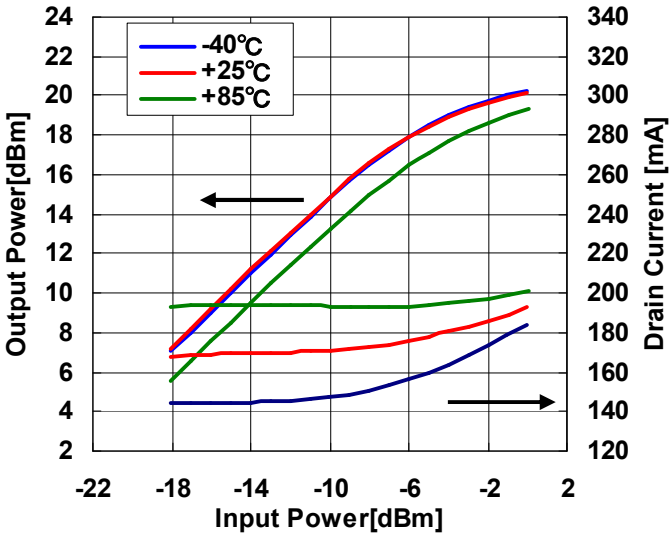
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Temperature

VDD=3V/170mA@25deg, f=20GHz



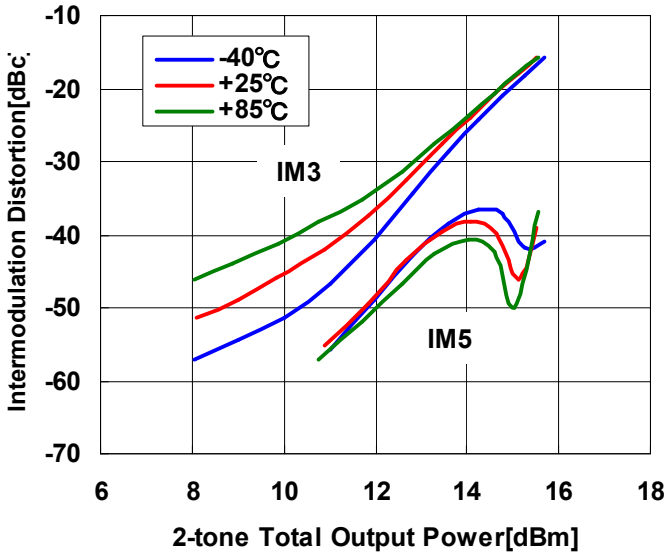
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Temperature

VDD=3V/170mA@25deg, f=24GHz



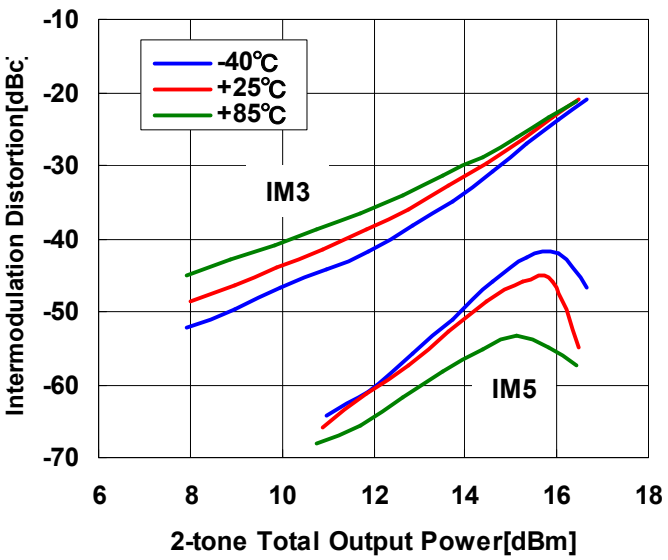
IMD PERFORMANCE vs OUTPUT POWER
by Temperature

VDD=3V/170mA@25deg, f=12GHz



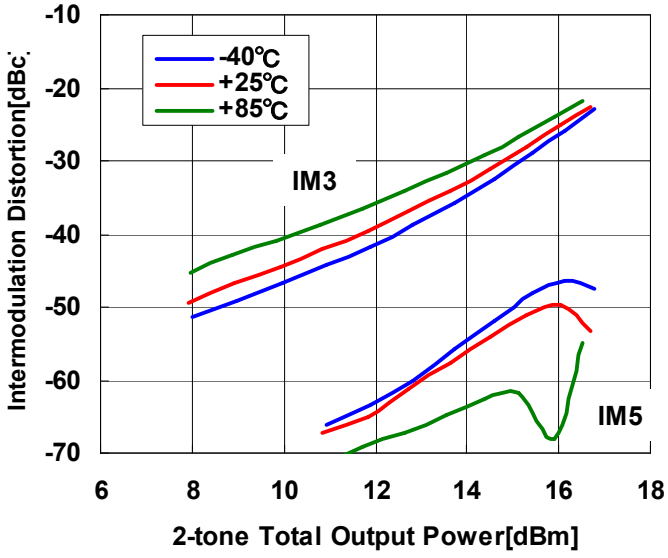
IMD PERFORMANCE vs OUTPUT POWER
by Temperature

VDD=3V/170mA@25deg, f=16GHz



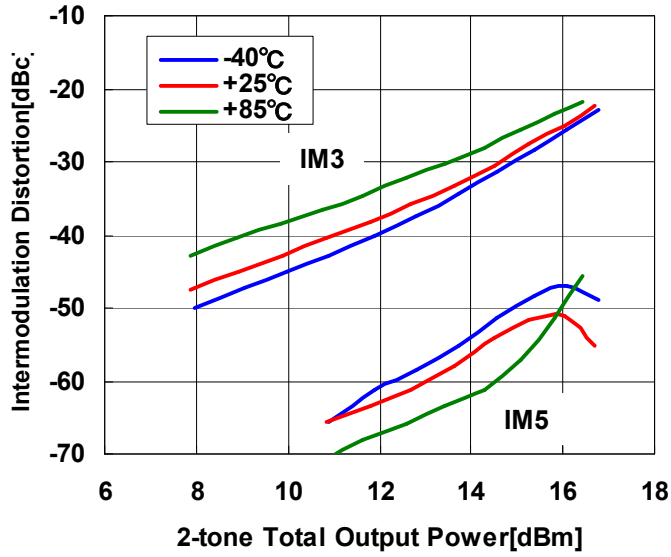
IMD PERFORMANCE vs OUTPUT POWER
by Temperature

VDD=3V/170mA@25deg, f=20GHz

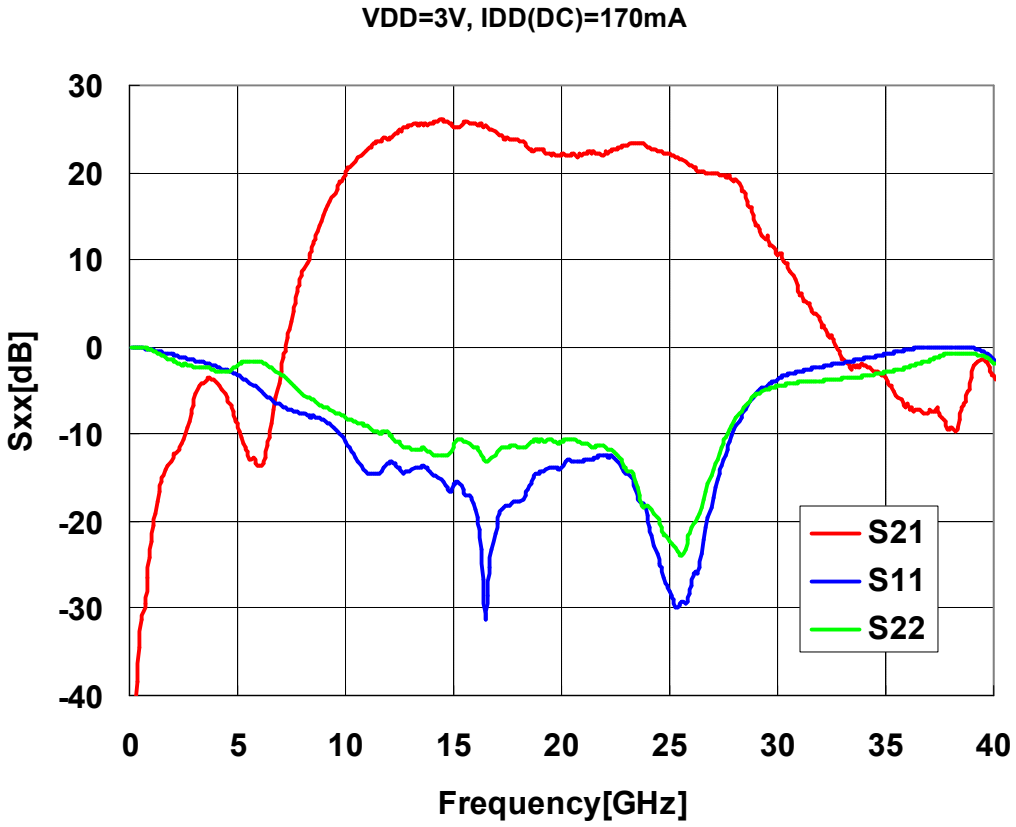


IMD PERFORMANCE vs OUTPUT POWER
by Temperature

VDD=3V/170mA@25deg, f=24GHz



■S-PARAMETER

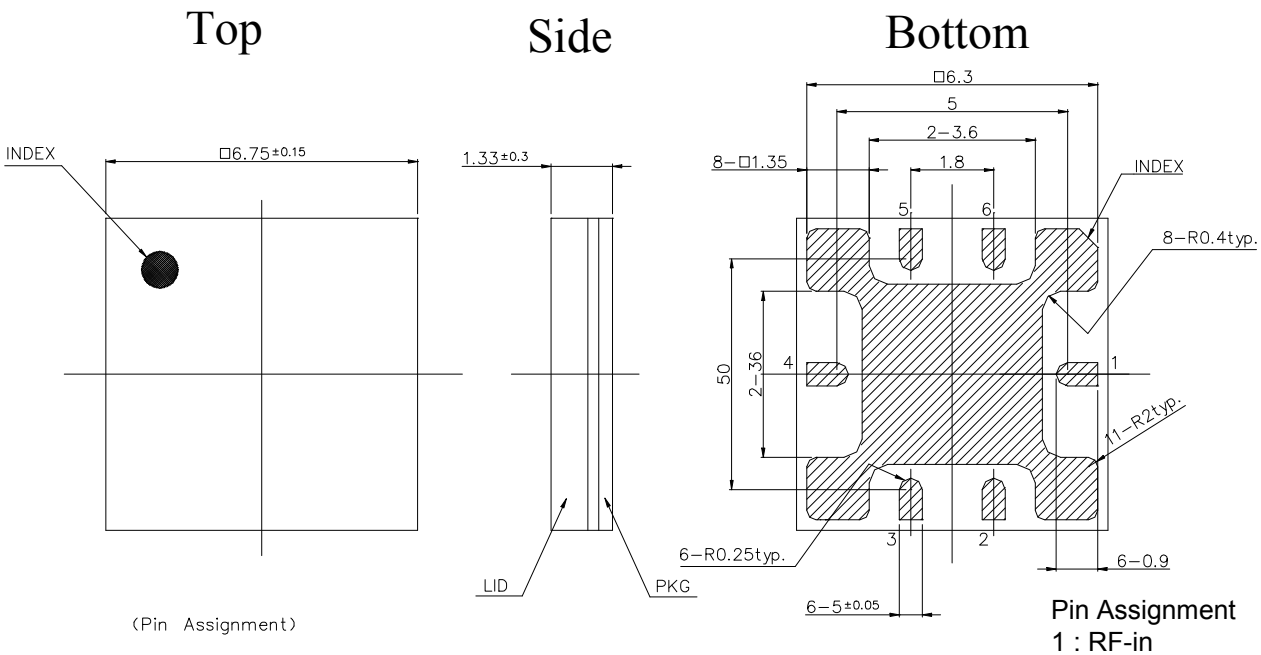

VDD=3V, IDD(DC)=170mA
30
20
10
0
-10
-20
-30
-40
Sxx[dB]
0
5
10
15
20
25
30
35
40
Frequency[GHz]
S21
S11
S22

■S-PARAMETER

VDD=3V, IDD(DC)=170mA

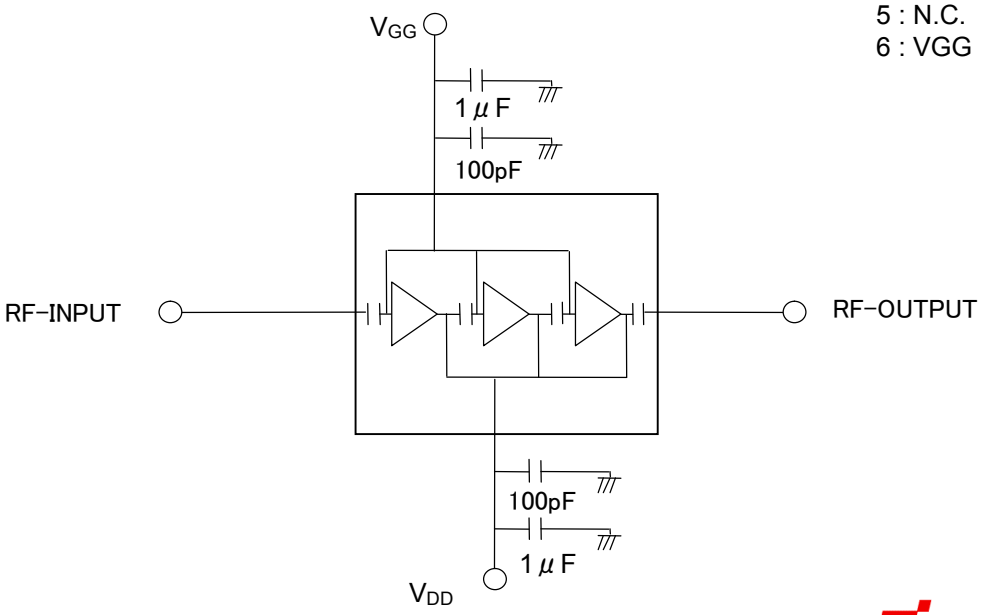
Frequency	S11		S21		S12		S22	
[GHz]	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.0	0.964	−57.0	0.077	1.5	0.000	90.0	0.956	−62.6
2.0	0.900	−110.2	0.237	−107.6	0.001	−136.0	0.830	−120.2
3.0	0.839	−160.1	0.460	−156.3	0.001	109.0	0.768	−171.5
4.0	0.774	149.2	0.631	100.6	0.006	54.4	0.729	136.4
5.0	0.690	93.2	0.368	47.5	0.006	3.1	0.783	88.1
6.0	0.567	26.9	0.208	59.9	0.006	−50.8	0.823	22.9
7.0	0.460	−48.6	0.717	89.9	0.006	−99.8	0.694	−42.4
8.0	0.415	−124.3	2.538	36.5	0.003	−127.3	0.544	−100.8
9.0	0.380	171.8	5.734	−34.8	0.003	179.1	0.453	−152.6
10.0	0.288	119.6	9.733	−109.9	0.002	173.6	0.389	157.5
11.0	0.189	95.3	13.585	174.6	0.001	−177.4	0.353	114.0
12.0	0.215	78.9	16.020	101.3	0.002	174.5	0.314	74.0
13.0	0.194	49.7	18.673	31.8	0.003	129.4	0.262	44.8
14.0	0.187	11.4	18.903	−35.3	0.002	83.1	0.243	18.1
15.0	0.161	−10.7	18.188	−103.8	0.005	55.0	0.268	4.6
16.0	0.117	−61.2	18.918	−164.9	0.004	−24.0	0.268	−31.7
17.0	0.097	−8.4	16.938	129.5	0.003	−77.9	0.248	−40.8
18.0	0.130	−44.5	15.412	71.5	0.003	−86.6	0.267	−66.9
19.0	0.190	−68.4	13.401	18.3	0.004	−137.2	0.290	−87.7
20.0	0.204	−97.1	12.605	−32.1	0.005	−153.2	0.284	−110.9
21.0	0.221	−128.3	12.847	−85.1	0.006	166.2	0.280	−140.7
22.0	0.239	−164.4	13.081	−141.2	0.008	147.0	0.268	−173.8
23.0	0.189	147.2	14.320	158.5	0.010	106.7	0.201	139.3
24.0	0.107	86.6	14.014	90.9	0.009	65.5	0.123	91.1
25.0	0.040	36.4	12.726	28.6	0.009	46.4	0.077	25.4
26.0	0.043	13.7	10.940	−34.7	0.009	25.6	0.093	9.2
27.0	0.137	1.7	9.785	−95.6	0.011	−4.3	0.197	−8.0
28.0	0.333	−41.2	8.816	−165.3	0.012	−31.5	0.378	−44.5
29.0	0.536	−85.1	5.101	125.2	0.011	−72.6	0.532	−84.4
30.0	0.652	−121.8	3.323	65.7	0.011	−96.4	0.597	−117.8
31.0	0.723	−151.4	1.992	7.7	0.011	−135.7	0.625	−144.5
32.0	0.768	−176.4	1.301	−32.9	0.008	−155.5	0.640	−167.7
33.0	0.811	160.5	0.866	−73.5	0.007	−172.8	0.658	171.1
34.0	0.857	138.8	0.787	−109.9	0.007	157.7	0.679	150.7
35.0	0.906	116.2	0.668	−158.0	0.006	133.3	0.715	129.3
36.0	0.961	92.0	0.469	168.2	0.005	100.6	0.763	106.3
37.0	0.993	65.1	0.433	122.2	0.004	64.2	0.831	80.0
38.0	0.992	33.3	0.337	85.8	0.003	23.7	0.915	47.0
39.0	0.991	−1.8	0.665	58.6	0.002	123.2	0.919	8.8
40.0	0.846	−42.3	0.679	−36.1	0.001	−74.1	0.812	−33.0

■ Package Outline and Pin Assignment

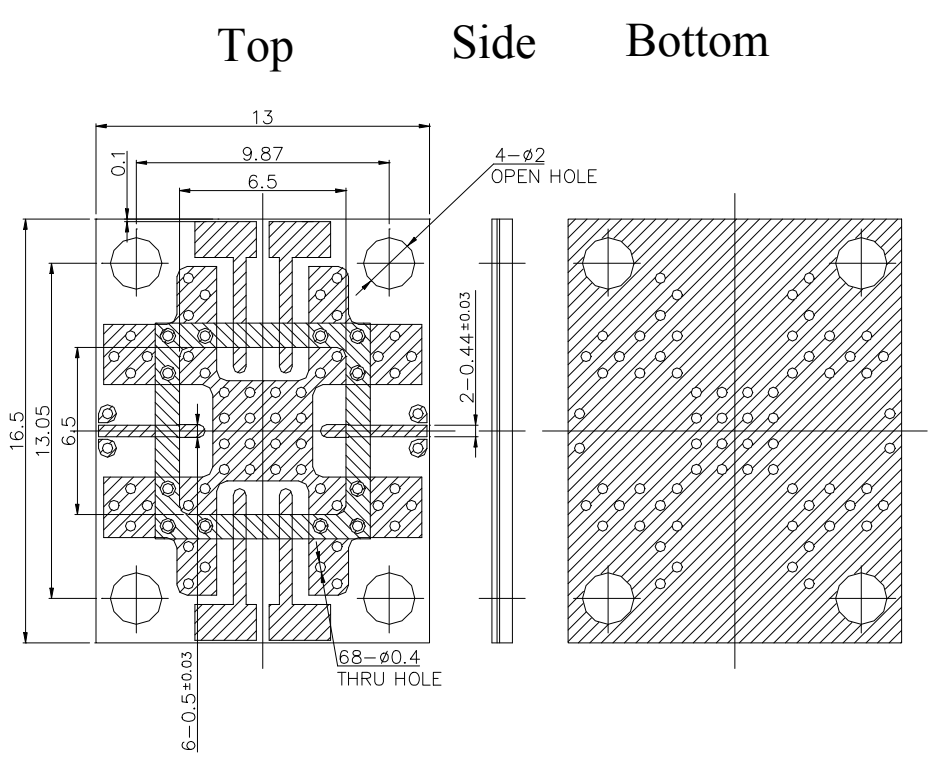


Pin Assignment
1 : RF-in
2 : VDD
3 : N.C.
4 : RF-out
5 : N.C.
6 : VGG

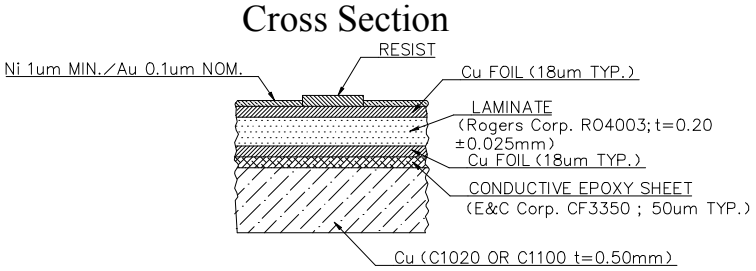
■ Block Diagram and External Component



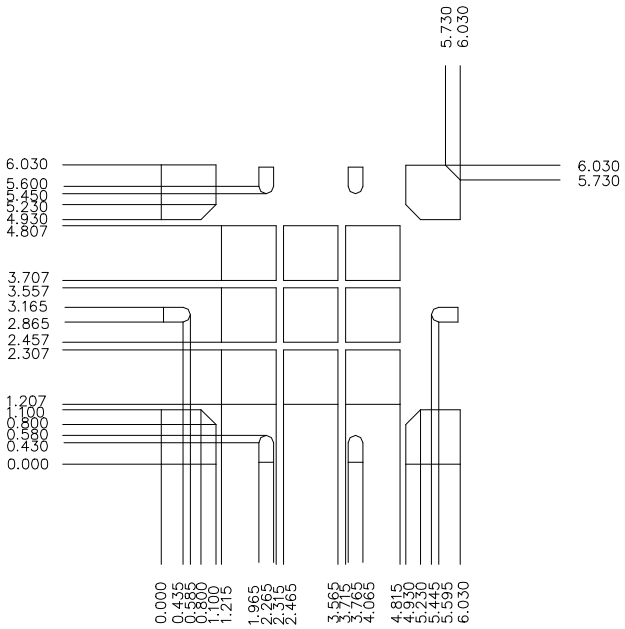
■ Recommended Foot Pattern Layout



NOTES.
1) .LAMINATE ; RO4003 CORE THICKNESS 0.2±0.025mm.
Cu FOIL THICKNESS 18um Typ.
2) . ; PATTARN AND METAL PLACE
3) . ; RESIST
4) .FINISH ; Ni 1um MIN./Au 0.1um NOM.
5) .GENERAL PATTERN TOLERRANCE ; ±0.05mm



■ Recommended Stencil Pattern



* thickness : 0.1mm

■ Mounting Method of SMD(Surface Mount Devices) for Lead-free Solder

Mounting Condition

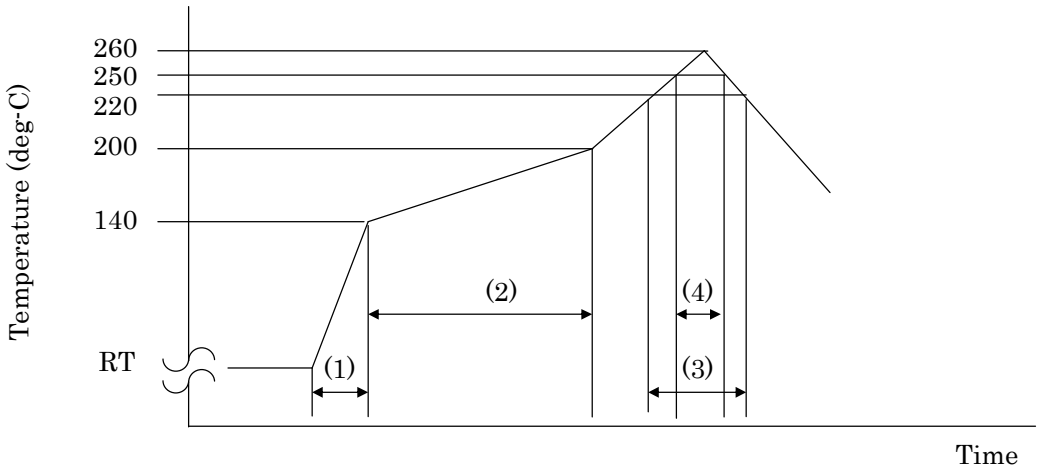
(1)For soldering, Lead-free solder (Sn-3.0Ag-0.5Cu)*1 or equivalent shall be used.
(*1: The figure displays with weight %. A predominantly tin-rich alloy with 3.0% silver and 0.5% copper.)

(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 cycles 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 – 200deg-C 60 – 120 sec.
(3) Main heating: 220deg-C over. 10 – 40 sec.
(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.

■ Moisture Sensitivity levels(MSL)

* Floor life

Table 1. Moisture classification level and floor life

Level	Floor life(*1)	
	Time	Condition
1	Unlimited	=<30 degC / 85%RH
2	1year	=<30 degC / 60%RH
2a	4weeks	=<30 degC / 60%RH
3	168hours	=<30 degC / 60%RH
4	72hours	=<30 degC / 60%RH
5	48hours	=<30 degC / 60%RH
5a	24hours	=<30 degC / 60%RH
6	<24hours (*2)	=<30 degC / 60%RH

*1 Floor life means the maximum time allowed between open the bag and mounting reflow at the customer's factory.
*2 Device classified as level 6 must be dried by baking, then reflowed within the time limit specified each device.
Table 1 is an extract from IPC/JEDEC J-STD-020B.

* MSL of device

Package Type	MSL
YC, YD,YE,YF	3

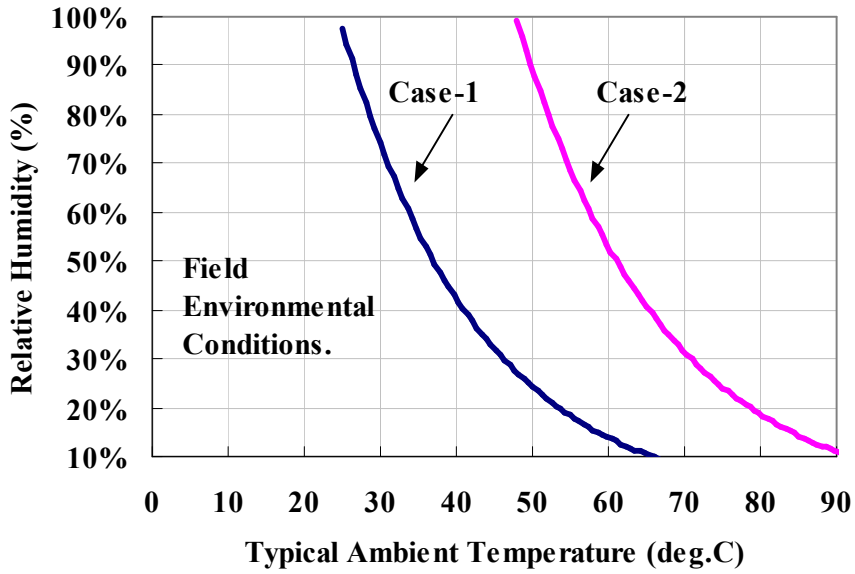
If storage time, temperature or humidity condition is exceeded for floor life, please bake the device.
Baking condition : 125degC, 24hours

■ Humidity Lifetime for LNA MMIC

The following graph shows the lifetime of moisture resistance for the **LNA MMIC**. Each line in graph indicates the lifetime that is the estimated for the failure rate of **0.1% at 10 years** (Confidential Level = 90 %) and calculated from the results of pressure cooker (autoclave) bias test. A horizontal-axis shows typical ambient temperature. A vertical-axis shows relative humidity. The left side of the area delimited in each line indicates more than 10 years of lifetime. The Case-2 condition is around 15 times longer than the Case-1 condition.

Representative of device type :		FET
Test condition :		120deg.C,85% RH
Bias condition :	Case-1:	VDS = 3V, VGS = -1V
	Case-2:	VDS = 3V, VGS = 0V

The field environmental conditions for a lifetime of 10 years (0.1% F.R , C.L.90%)



Field environmental conditions for operation

In case of that **LNA MMIC** is mounted to non-hermetic package, the following things will be considered.

Note 1. Eudyna recommends our customers to use **LNA MMIC** within the left side area separating by a line in the graph.

Note 2. LNA MMIC under the environment conditions of no dew condensation.

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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.