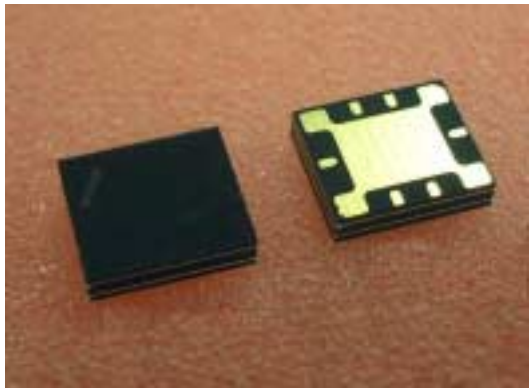
FMM5804YD

K-Band Power Amplifier MMIC

FEATURES

- High Output Power; P_{1dB} = 24.5 dBm (Typ.)
- High Linear Gain; G_L = 17 dB(Typ.)
- Frequency Band ; 17.5 – 26.5 GHz
- SMT Laminate Package (YD Package)
- Impedance Matched Zin/Zout = 50Ω



DESCRIPTION

The FMM5804YD is a power amplifier MMIC that contains a four stage amplifier, internally matched, for standard communications band in 17.5 to 26.5GHz frequency range. This product is well suited for P-to-P, Ka-band V-SAT applications.

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

ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Unit
Drain-Source Voltage	V_{DD}	10	V
Gate-Source Voltage	V_{GG}	-3	V
Input Power	P_{in}	16	dBm
Storage Temperature	T_{stg}	-55 to +125	°C

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Recommend	Unit
Dorain-Source Voltage	V_{DD}	<= 6	V
Input Power	P_{in}	<= +13	dBm
Operating Case Temperature	T_C	-40 to +85	°C

ELECTRICAL CHARACTERISTICS (Ambient Temperature Ta=25°C)

Item	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Frequency Range	f	V_{DD}=6V typ. $I_{DD(DC)}$=250mA typ. Z_S=Z_L=50ohm	17.5		26.5	GHz
Output Power at 1dB G.C.P.	P_{1dB}		22.5	24.5	-	dBm
Power Gain at 1dB G.C.P.	G_{1dB}		13	16	-	dB
Power-added Efficiency at 1dB G.C.P.	η_{add}		-	10	-	%
Drain Current at 1dB G.C.P.	I_{DDRF}		-	350	430	mA
Input Return Loss (at Pin=-20dBm)	RL_{in}		-	-15	-	dB
Output Return Loss (at Pin=-20dBm)	RL_{out}		-	-8	-	dB

G.C.P. : Gain Compression Point

ESD	Class 0	~ 250V

Note : Based on JEDEC JESD22-A114-C

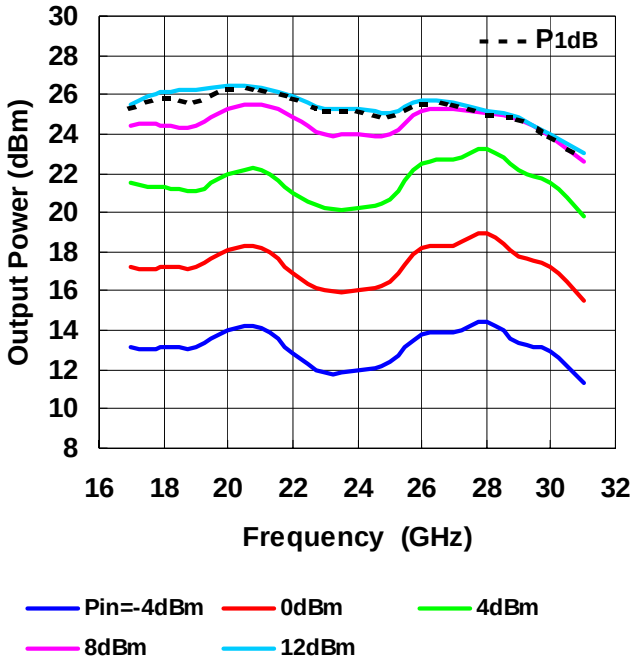
Case Style	YD

RoHS Compliance	Yes

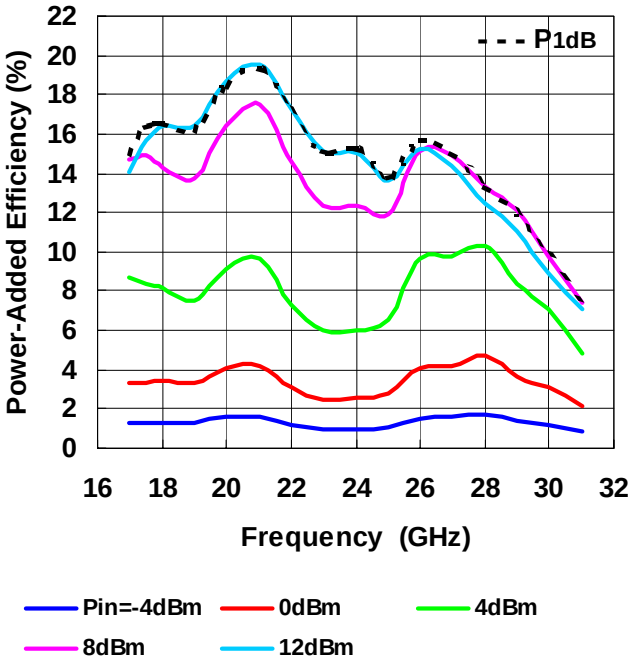
ORDERING INFORMATION

Part Number	**Order Unit**	**Packing**
FMM5804YD	No Limitatio	64 pcs./Tray × 4 Tray = 256 pcs./Packing

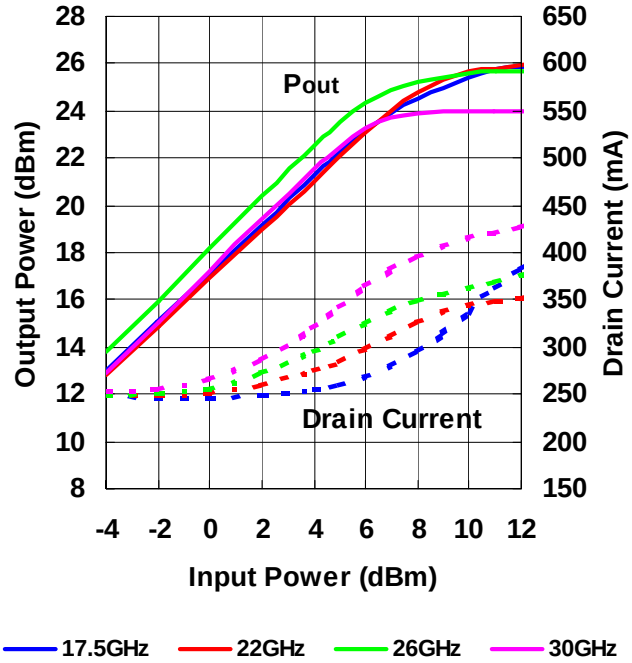
Output Power vs. Frequency
@ V_{DD}=6V, $I_{DD(DC)}$=250mA



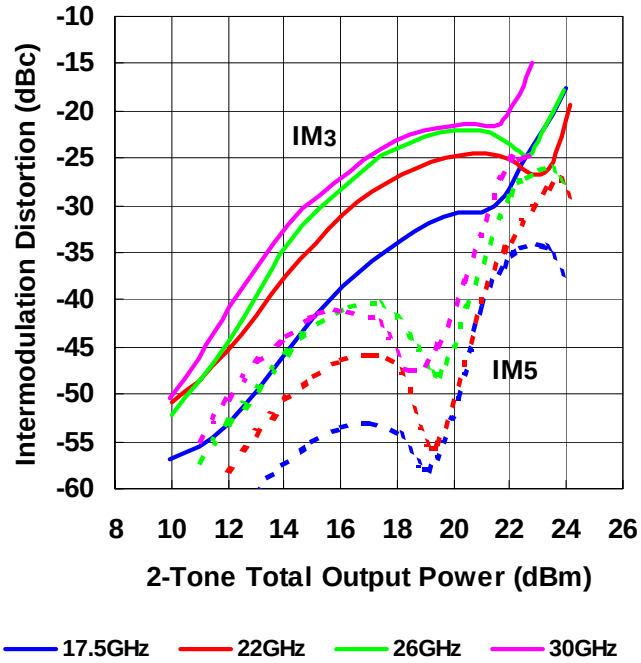
Power Added Efficiency vs. Frequency
@ V_{DD}=6V, $I_{DD(DC)}$=250mA



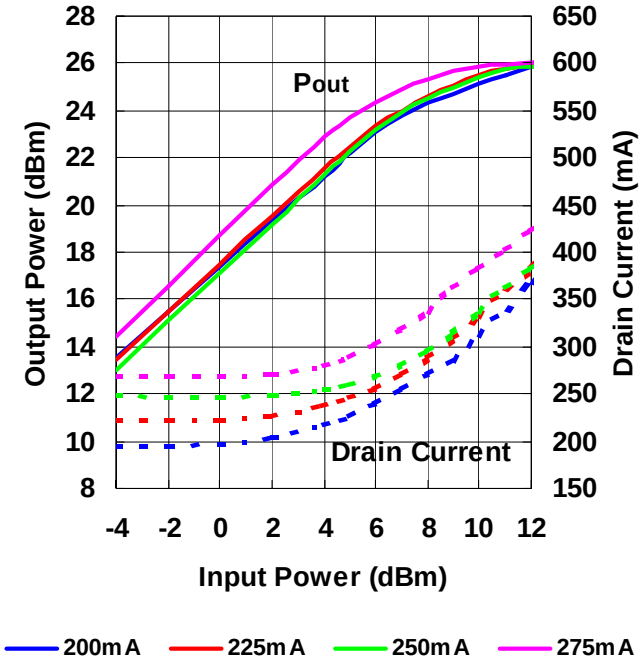
Output Power, Drain Current vs. Input Power
@ V_{DD}=6V, $I_{DD(DC)}$=250mA



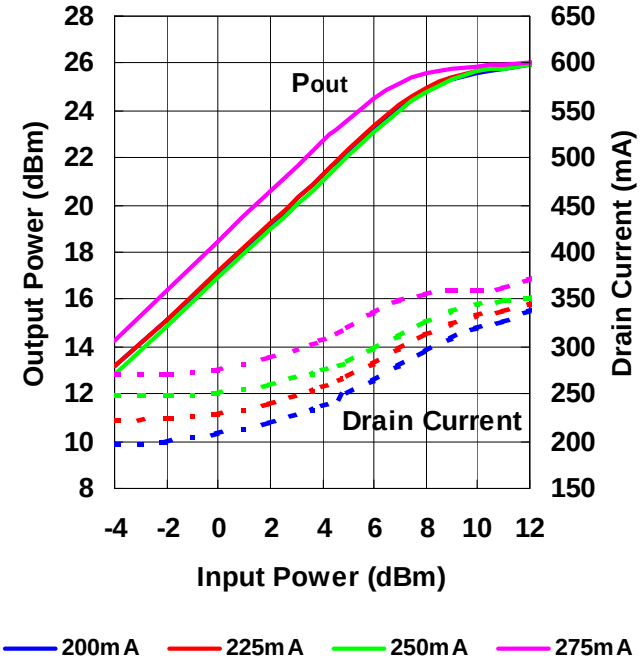
IMD Performance vs. Total Output Power
@ V_{DD}=6V, $I_{DD(DC)}$=250mA
Δf=+10MHz, 2-Tone test



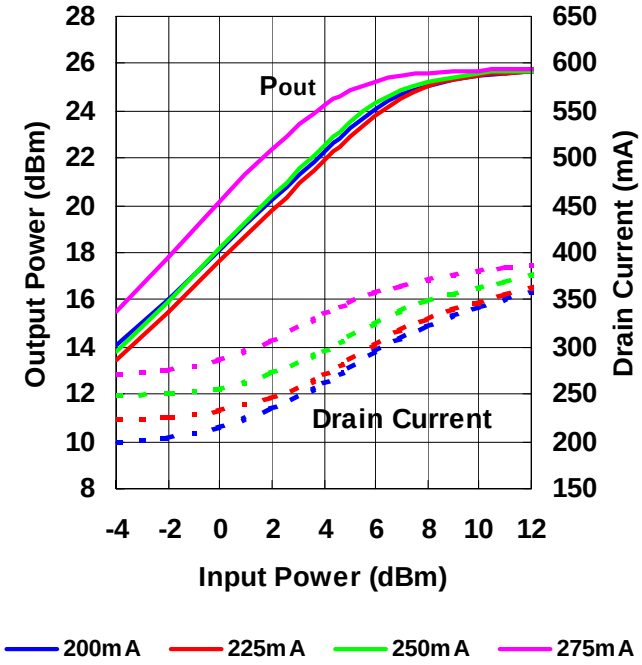
Output Power, Drain Current vs.
Input Power by Drain Current
@ freq.=17.5GHz, VDD=6V



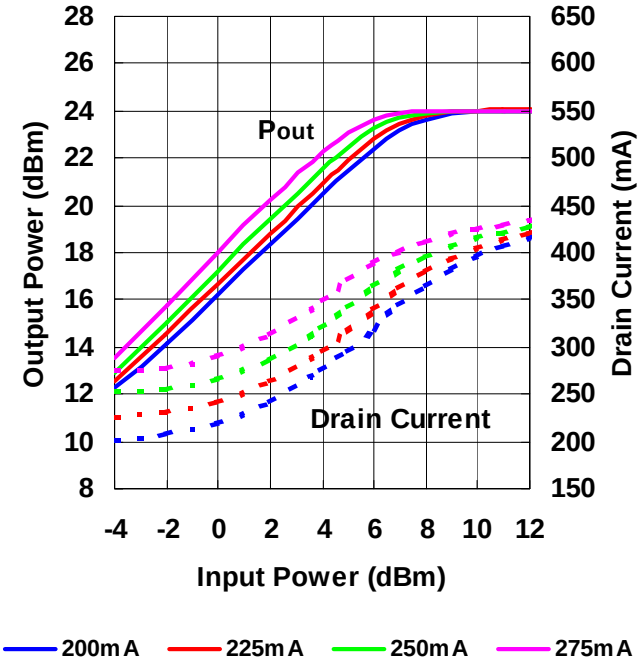
Output Power, Drain Current vs.
Input Power by Drain Current
@ freq.=22GHz, VDD=6V



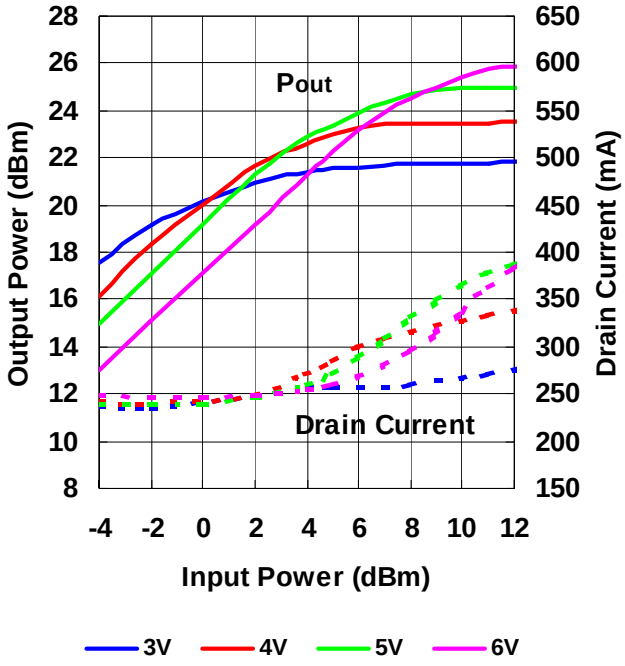
Output Power, Drain Current vs.
Input Power by Drain Current
@ freq.=26GHz, VDD=6V



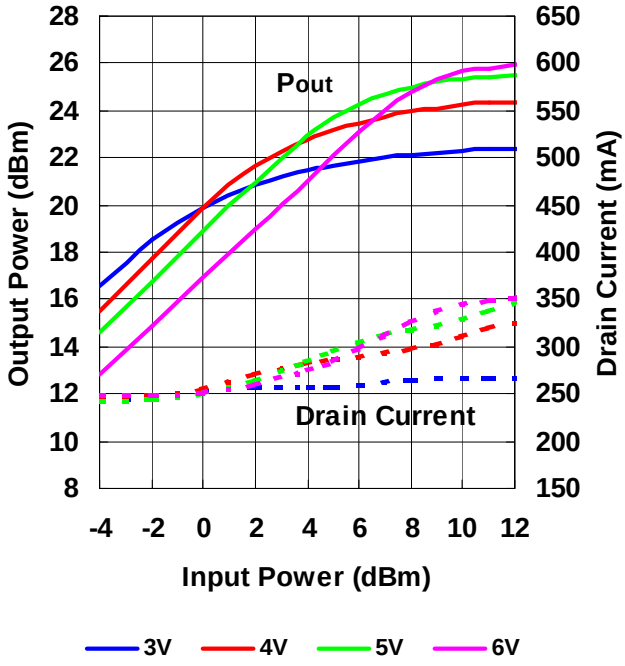
Output Power, Drain Current vs.
Input Power by Drain Current
@ freq.=30GHz, VDD=6V



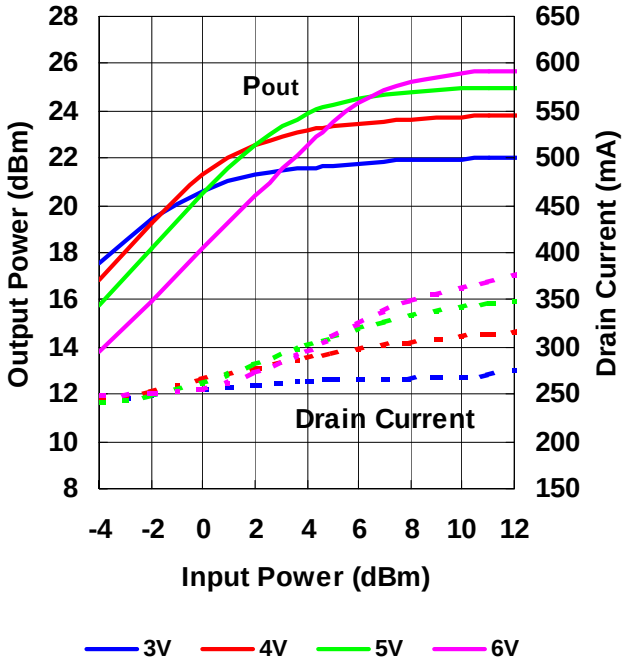
Output Power, Drain Current vs.
Input Power by Drain Voltage
@ freq.=17.5GHz, IDD(DC)=250mA



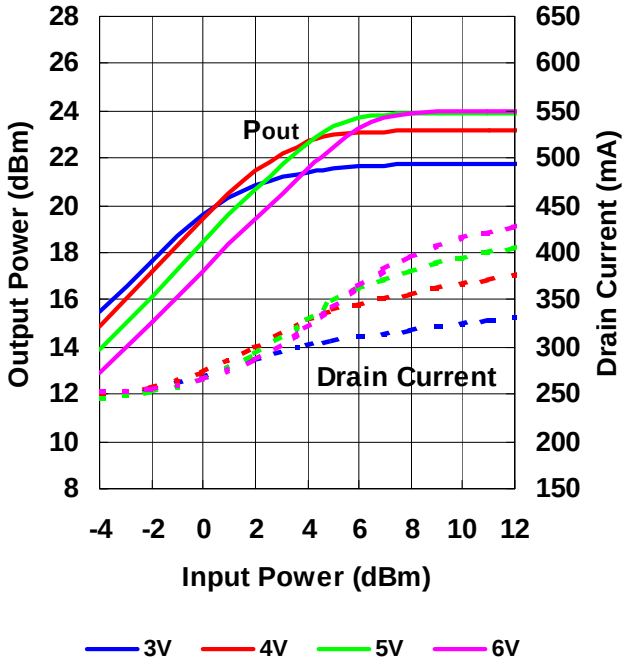
Output Power, Drain Current vs.
Input Power by Drain Voltage
@ freq.=22GHz, IDD(DC)=250mA



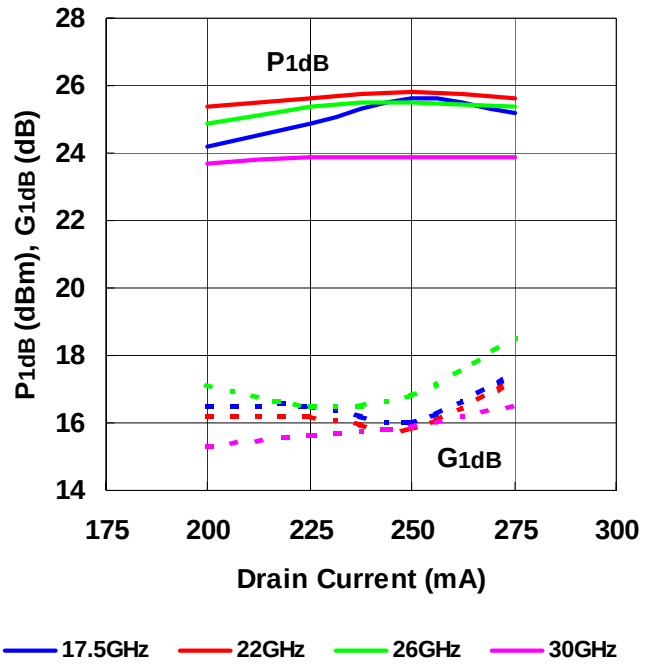
Output Power, Drain Current vs.
Input Power by Drain Voltage
@ freq.=26GHz, IDD(DC)=250mA



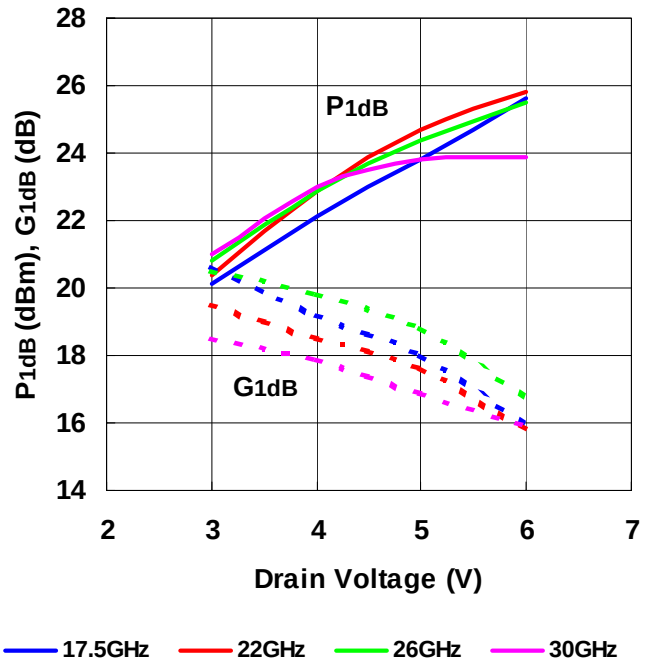
Output Power, Drain Current vs.
Input Power by Drain Voltage
@ freq.=30GHz, IDD(DC)=250mA



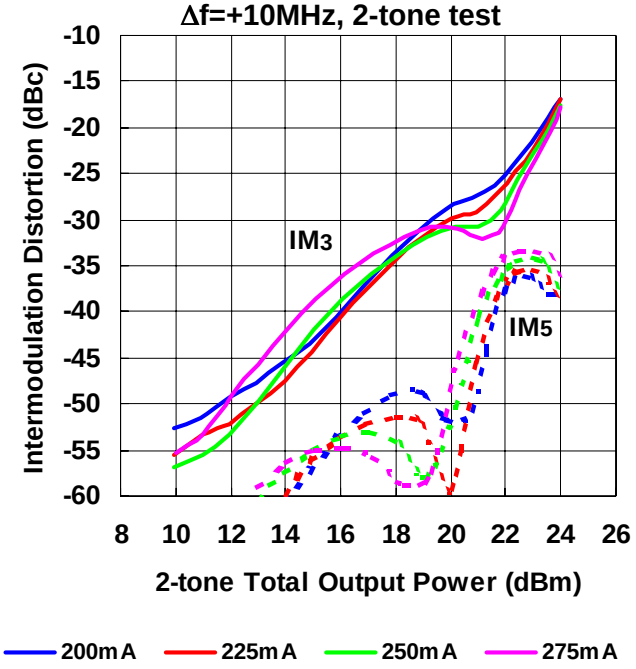
P_{1dB}, G_{1dB} vs. Drain Current @ V_{DD}=6V



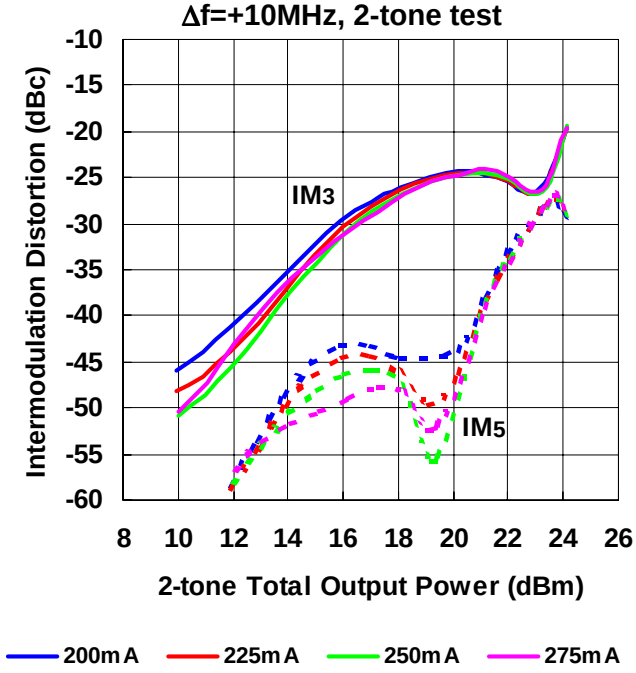
P1dB, G1dB vs. Drain Voltage @ $I_{DD(DC)}$=250mA



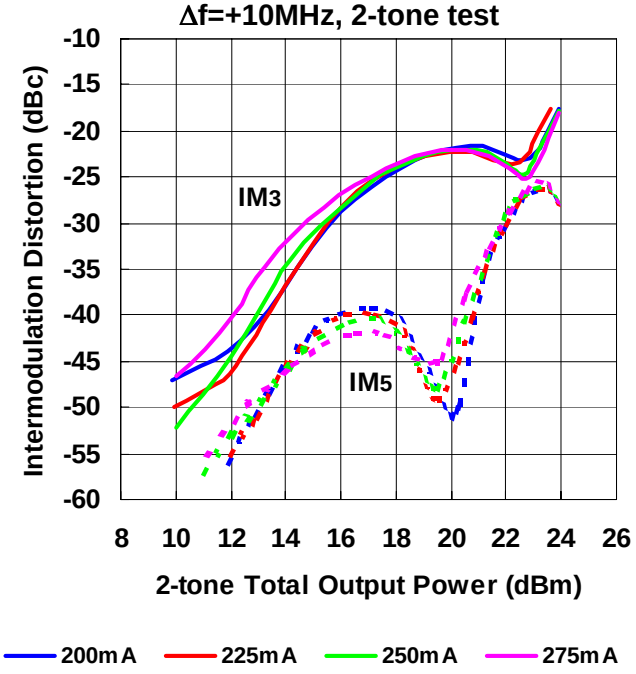
IMD Performance vs. Total Output Power
by Drain Current
@ freq.=17.5GHz, VDD=6V
Δf=+10MHz, 2-tone test



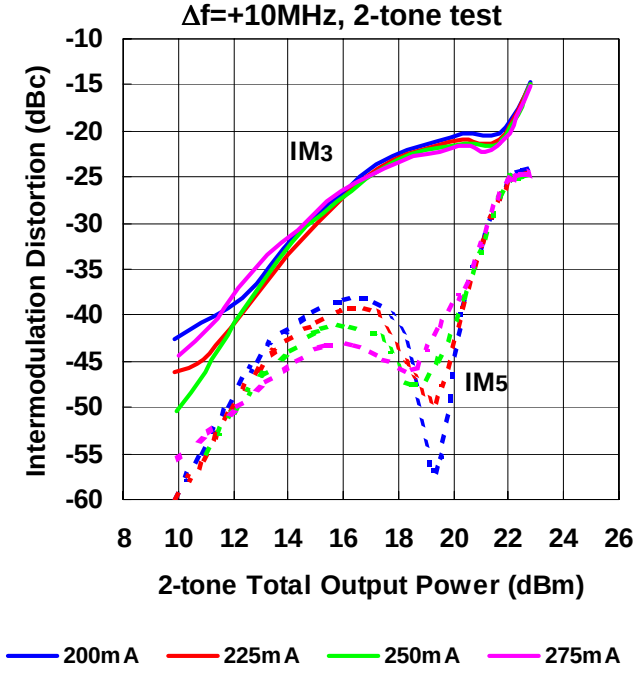
IMD Performance vs. Total Output Power
by Drain Current
@ freq.=22GHz, VDD=6V
Δf=+10MHz, 2-tone test



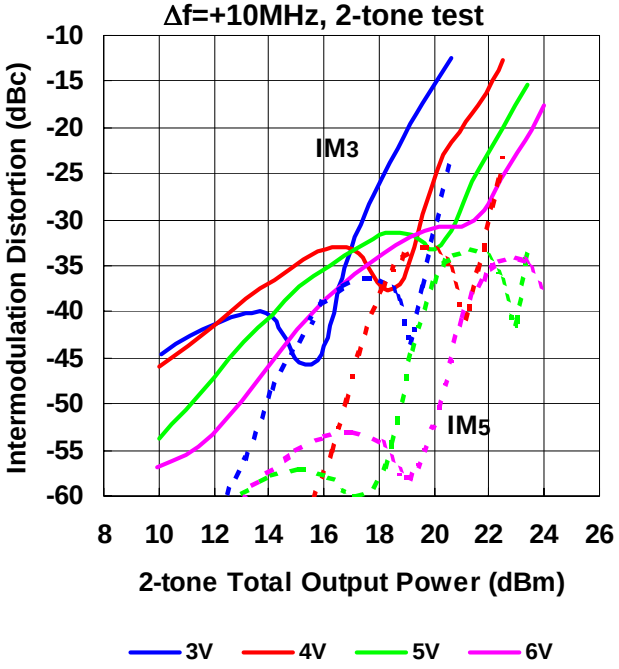
IMD Performance vs. Total Output Power
by Drain Current
@ freq.=26GHz, VDD=6V
Δf=+10MHz, 2-tone test



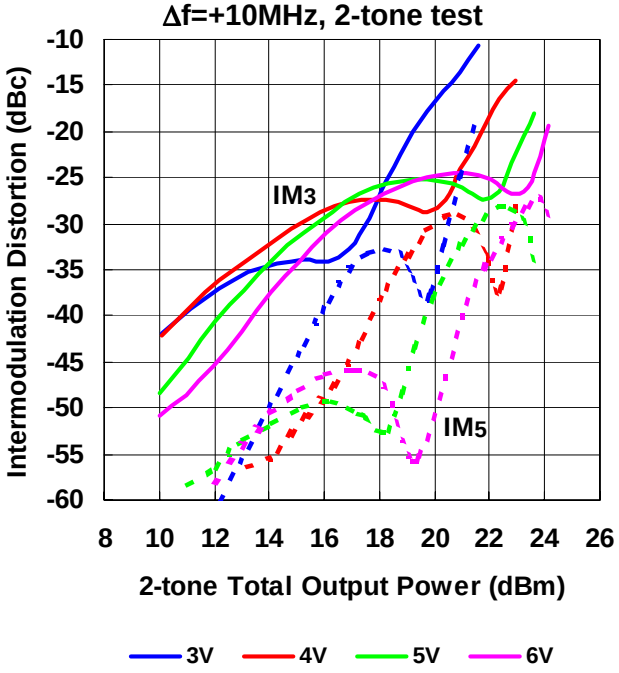
IMD Performance vs. Total Output Power
by Drain Current
@ freq.=30GHz, VDD=6V
Δf=+10MHz, 2-tone test



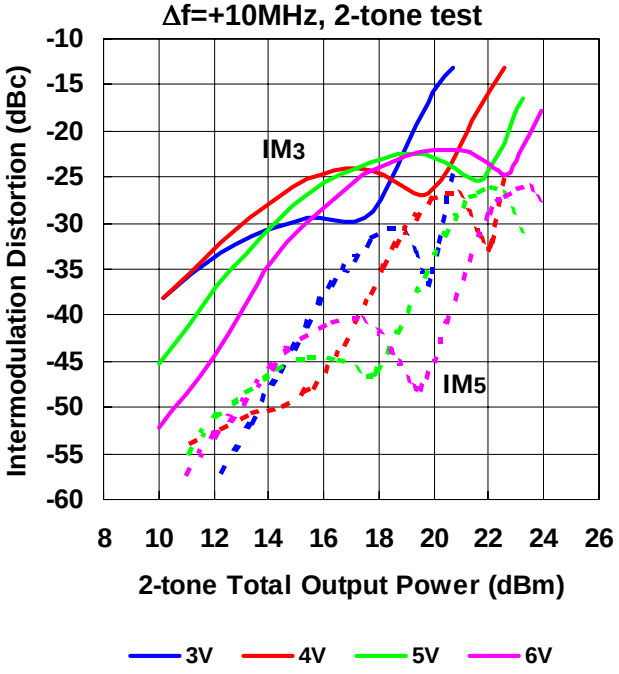
IMD Performance vs. Total Output Power
by Drain Voltage
@ freq.=17.5GHz, IDD(DC)=250mA
Δf=+10MHz, 2-tone test



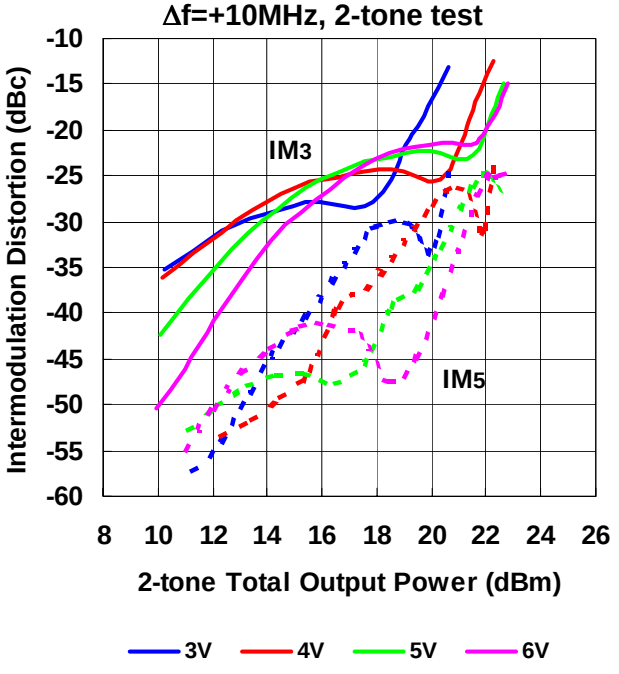
IMD Performance vs. Total Output Power
by Drain Voltage
@ freq.=22GHz, IDD(DC)=250mA
Δf=+10MHz, 2-tone test



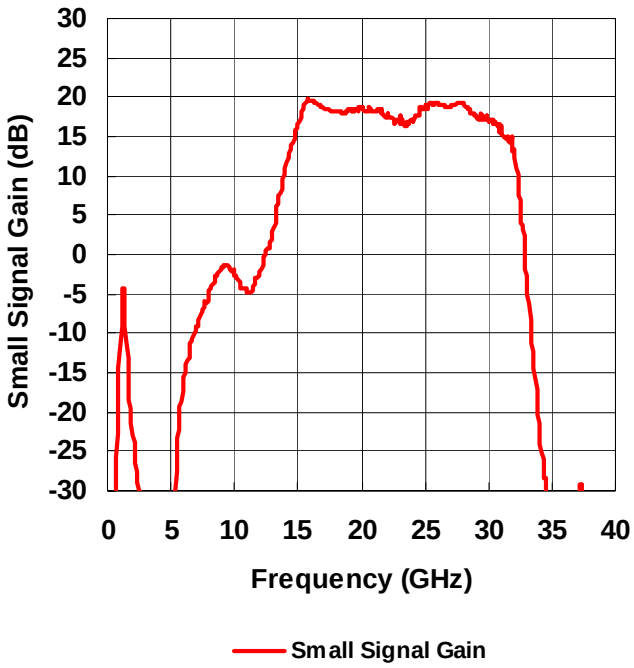
IMD Performance vs. Total Output Power
by Drain Voltage
@ freq.=26GHz, IDD(DC)=250mA
Δf=+10MHz, 2-tone test



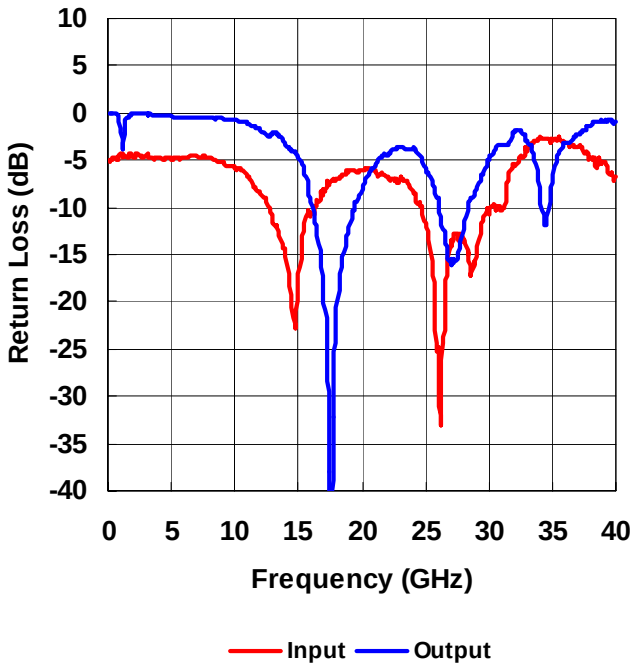
IMD Performance vs. Total Output Power
by Drain Voltage
@ freq.=30GHz, IDD(DC)=250mA
Δf=+10MHz, 2-tone test



Small Signal Gain vs. Frequency
@ V_{DD}=6V, $I_{DD(DC)}$=250mA



Return Loss vs. Frequency
@ V_{DD}=6V, $I_{DD(DC)}$=250mA

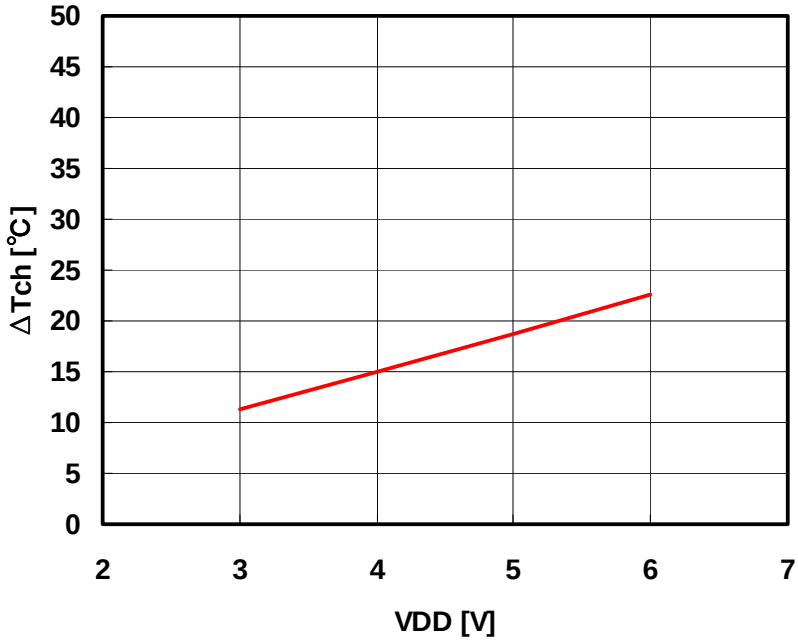


■ S-Parameters

@ V_{DD}=6V, $I_{DD(DC)}$=250mA

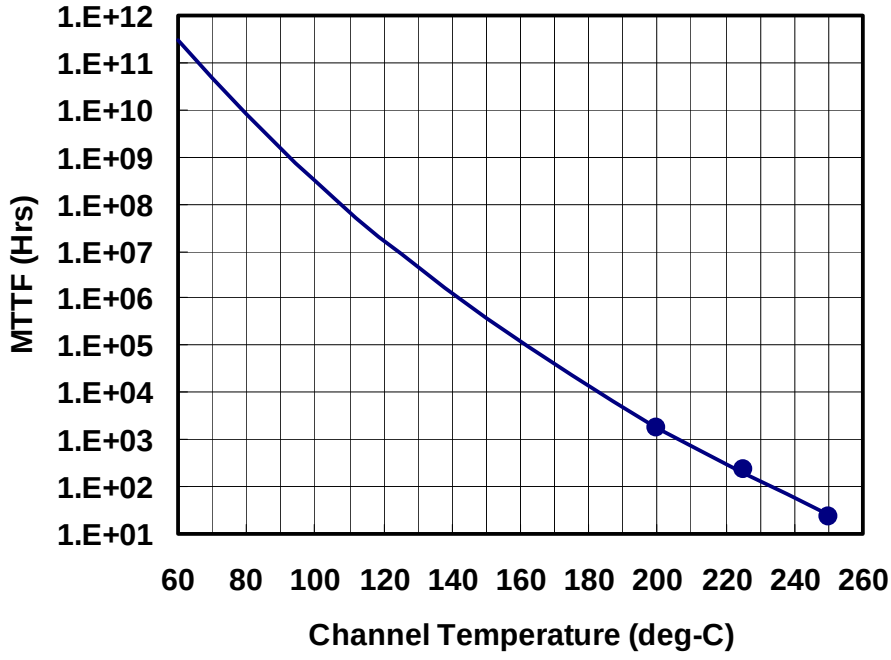
FREQ.	S11		S21		S12		S22	
[MHz]	mag.	ang.	mag.	ang.	mag.	ang.	mag.	ang.
1000	0.607	141.1	0.258	5.5	0.001	-120.2	0.835	-87.5
2000	0.583	100.0	0.070	-4.1	0.000	129.0	0.994	-130.4
3000	0.591	54.5	0.028	-62.0	0.001	-24.5	0.999	172.2
4000	0.577	10.3	0.022	-72.4	0.004	-23.9	0.974	121.5
5000	0.574	-30.7	0.016	-78.4	0.004	-51.4	0.959	71.8
6000	0.582	-70.4	0.154	-94.9	0.005	-72.3	0.947	23.2
7000	0.590	-105.6	0.347	170.6	0.005	-87.7	0.944	-24.5
8000	0.575	-138.3	0.554	84.9	0.006	-94.3	0.947	-68.5
9000	0.552	-169.3	0.820	-2.6	0.005	-107.6	0.938	-109.2
10000	0.506	164.9	0.761	-87.0	0.005	-65.6	0.917	-145.6
11000	0.460	137.2	0.601	-137.9	0.007	-88.3	0.879	-179.5
12000	0.374	109.7	0.771	-169.9	0.007	-103.3	0.809	148.8
13000	0.274	85.5	1.366	142.2	0.009	-95.3	0.790	119.8
14000	0.172	73.4	3.505	73.6	0.007	-99.8	0.681	82.7
15000	0.129	137.6	6.838	-16.2	0.010	-113.4	0.587	46.5
16000	0.290	98.6	9.513	-125.7	0.006	-67.6	0.340	0.8
17000	0.390	68.6	8.599	143.0	0.009	-118.1	0.105	-42.2
18000	0.449	39.5	8.189	63.0	0.006	-102.4	0.084	103.9
19000	0.496	8.2	8.098	-14.0	0.006	-100.4	0.249	66.2
20000	0.503	-24.1	8.316	-93.7	0.007	-99.9	0.397	29.7
21000	0.483	-54.8	8.051	-172.5	0.008	-100.8	0.533	-9.8
22000	0.462	-85.4	7.427	108.2	0.008	-113.5	0.607	-50.5
23000	0.464	-113.8	6.774	32.2	0.009	-149.0	0.662	-89.5
24000	0.378	-145.3	7.104	-36.3	0.006	153.5	0.646	-128.7
25000	0.253	176.0	8.354	-118.1	0.010	46.2	0.506	-179.5
26000	0.057	138.3	9.016	153.5	0.016	7.6	0.345	127.0
27000	0.212	-137.3	8.667	65.2	0.023	-30.1	0.156	82.8
28000	0.209	142.8	9.179	-29.5	0.024	-62.7	0.241	19.3
29000	0.174	62.2	7.605	-126.1	0.018	-65.0	0.393	-42.8
30000	0.287	-24.6	7.114	125.1	0.026	-86.9	0.564	-80.9
31000	0.307	-65.9	6.564	9.4	0.021	-130.5	0.673	-121.1
32000	0.532	-91.7	4.711	-141.2	0.003	-117.6	0.792	-148.9
33000	0.630	-115.8	0.696	59.2	0.018	-50.9	0.712	163.0
34000	0.739	-147.1	0.085	-59.4	0.021	-103.4	0.402	91.2
35000	0.732	-171.0	0.015	-153.7	0.018	-158.0	0.424	-85.2
36000	0.700	170.6	0.019	100.1	0.014	90.6	0.694	-149.9
37000	0.657	148.5	0.030	0.6	0.015	-1.4	0.764	-177.9
38000	0.581	132.1	0.022	-53.3	0.016	-38.7	0.858	158.4
39000	0.545	118.6	0.005	-38.3	0.013	-56.7	0.909	135.9
40000	0.464	97.9	0.013	-64.6	0.010	-63.0	0.887	114.4

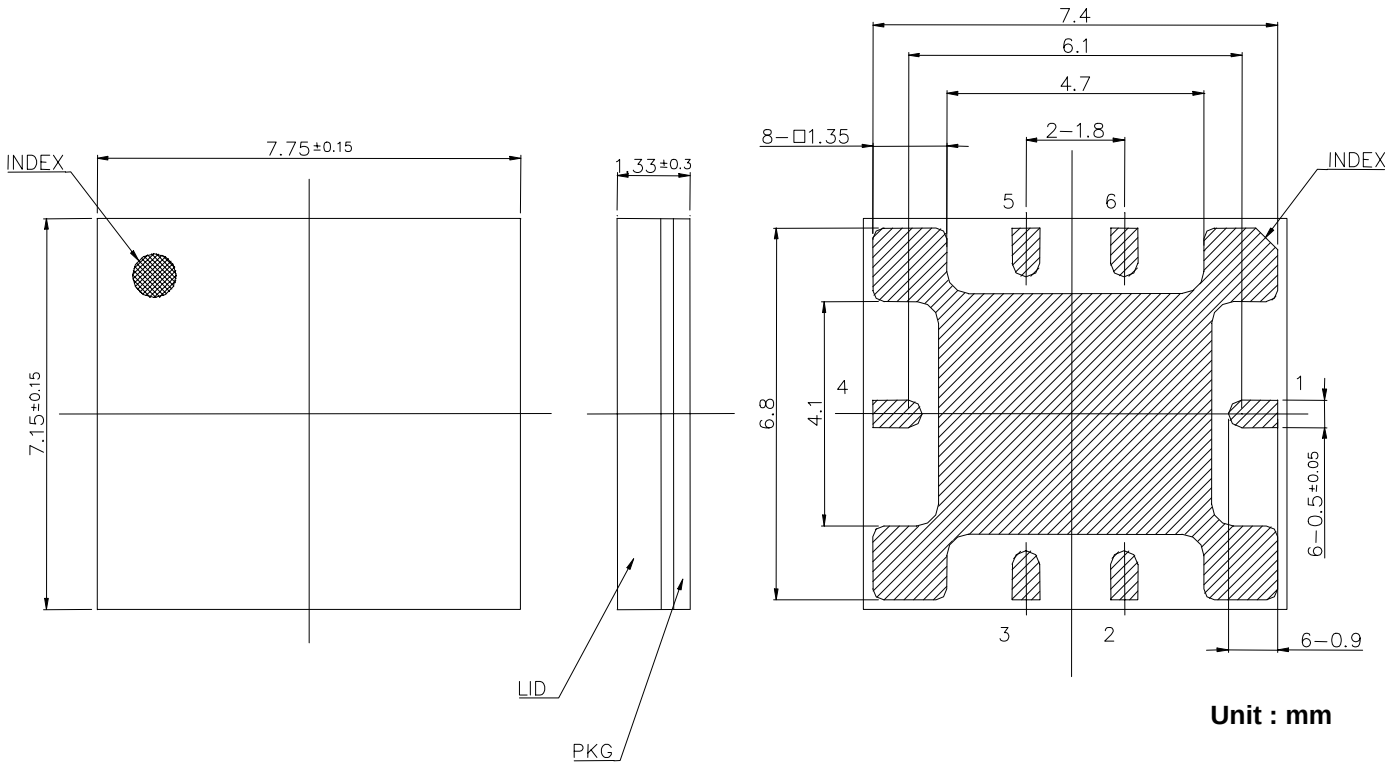
ΔTch vs. Drain Voltage
(Reference)
IDD=250mA



Note : ΔTch :Temperature Rise from Backside of the Package to Channel.

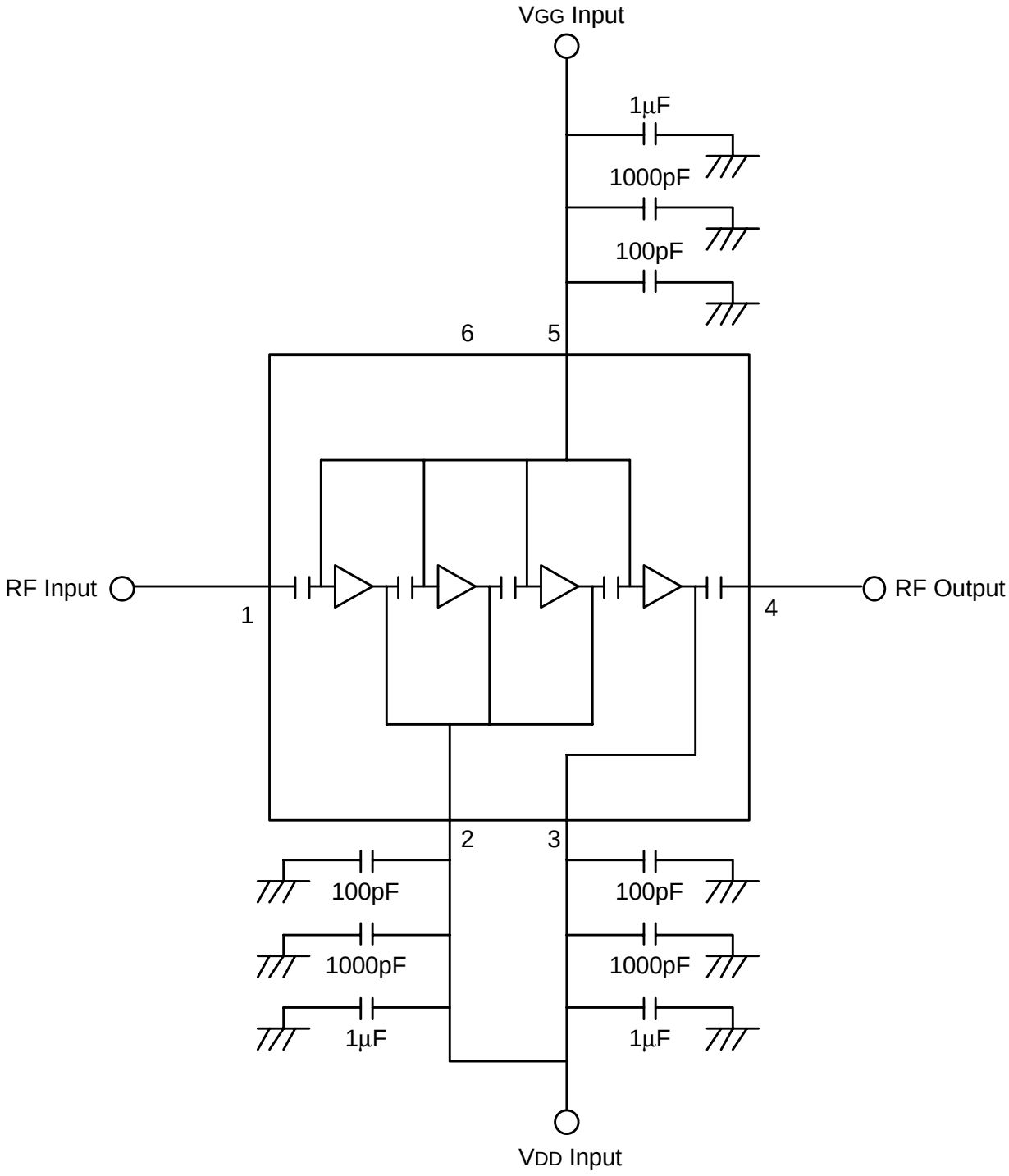
MTTF vs. Tch



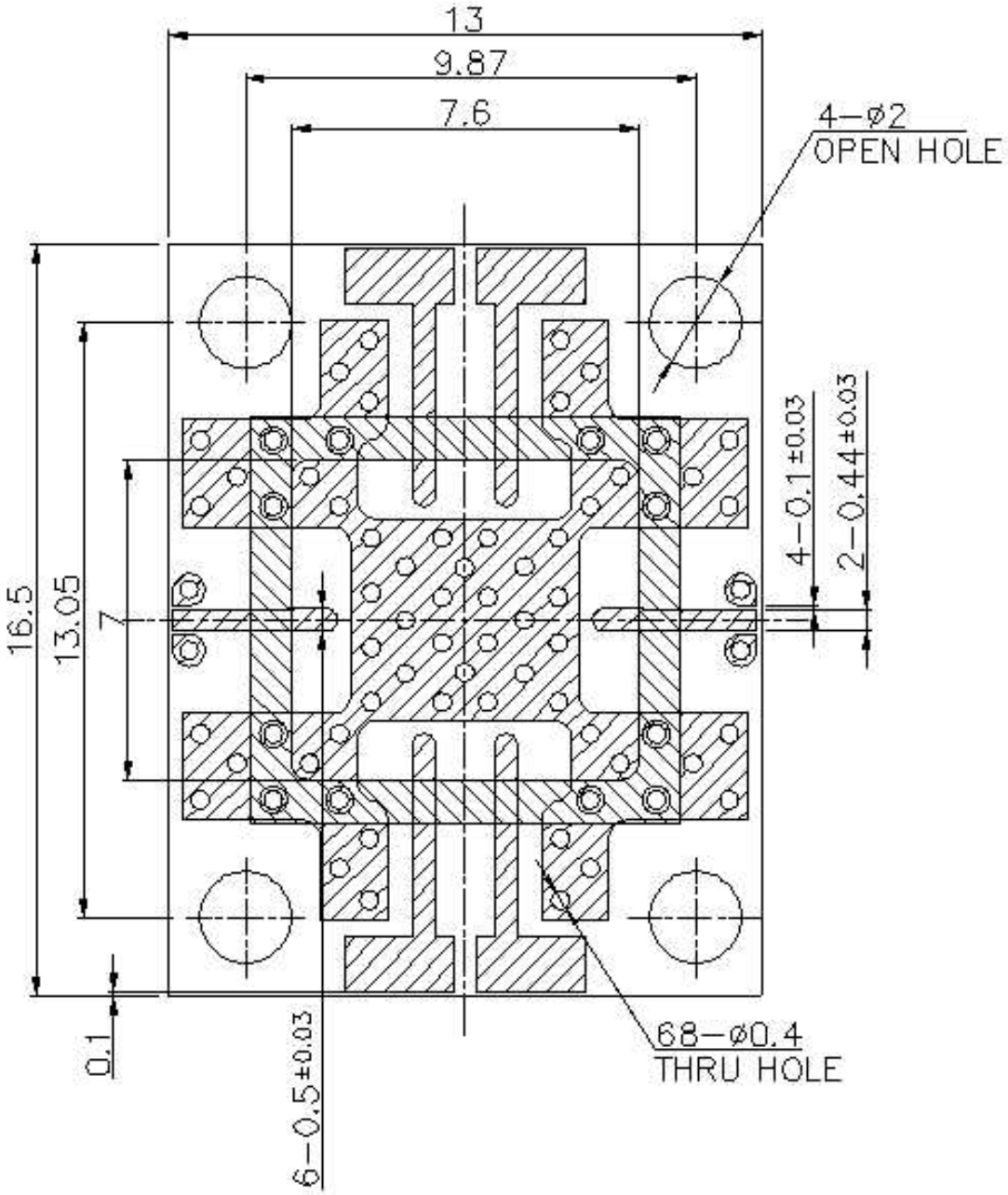


Unit : mm

Pin Assignment
1 : RF-in
2 : VDD1
3 : VDD2
4 : RF-out
5 : VGG
6 : N.C.



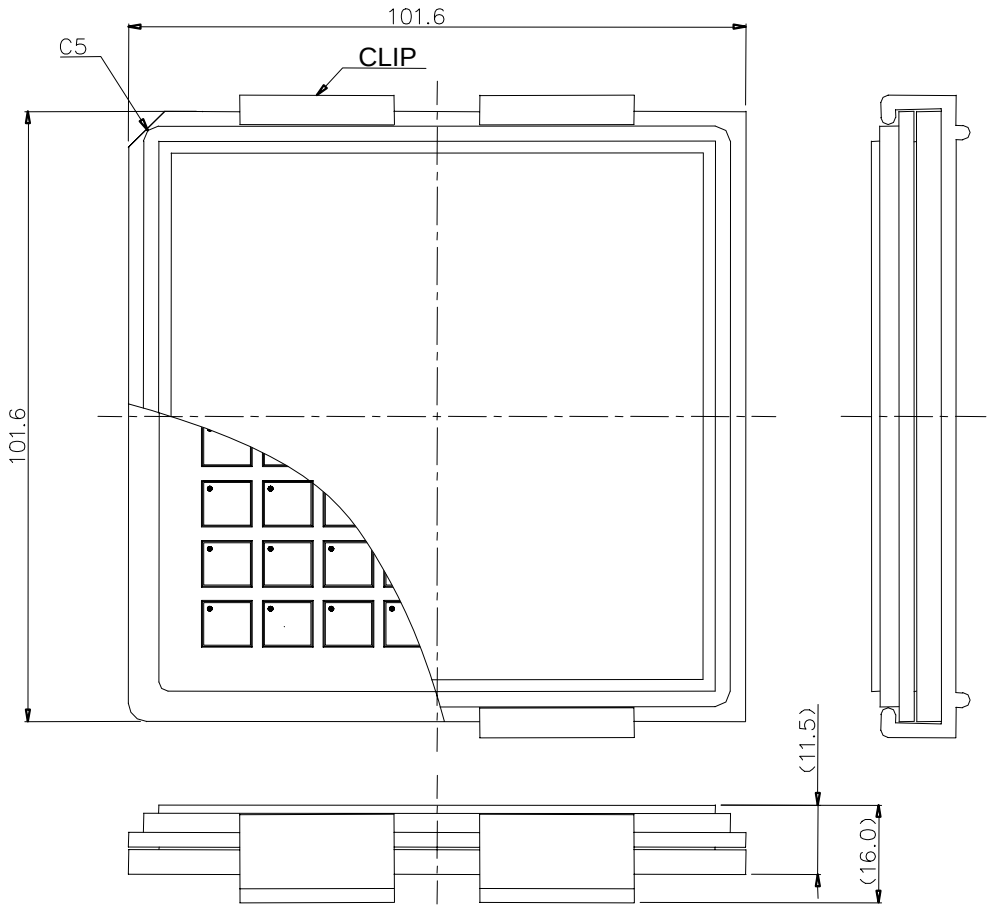
Note) : The capacitors are recommended on the bias supply line, close to the package, in order to prevent video oscillations which could damage the module.



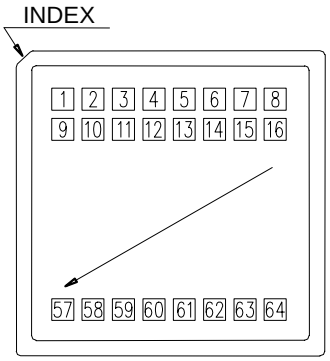
Unit : mm

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

■ **4-inch Tray Packing (Part No. : FMM5804YD)**



(unit in mm)



(1) Maximum Quantity : 64pcs./Tray
(2) Tray Material : Conductive PPE
(3) Clip Material : Conductive PP

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

Mounting Condition

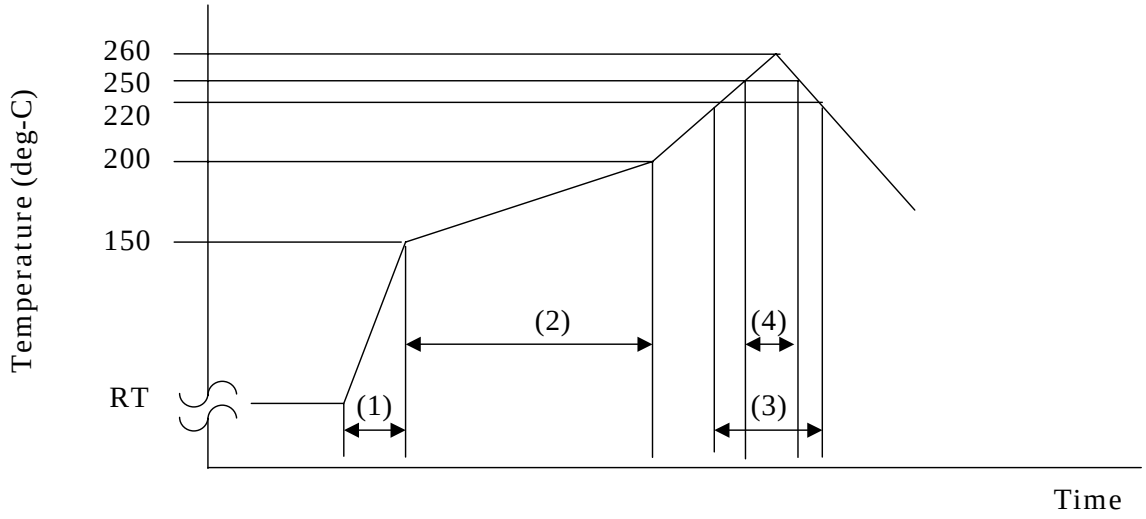
(1)For soldering, Lead-free solder (Sn-3.0Ag-0.5Cu)*1 or equivalent shall be used.
(*1: The figure displays with weight %. A predominantly tin-rich alloy with 3.0% silver and 0.5% copper.)

(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: 3deg-C /seconds.
(2) Preheating: 150 – 200deg-C, 60 – 180 seconds.
(3) Main heating: 220deg-C, 60 seconds max...
(4) Main heating: 260deg-C max. more than 250deg-C,10 seconds 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 FMM5804YD

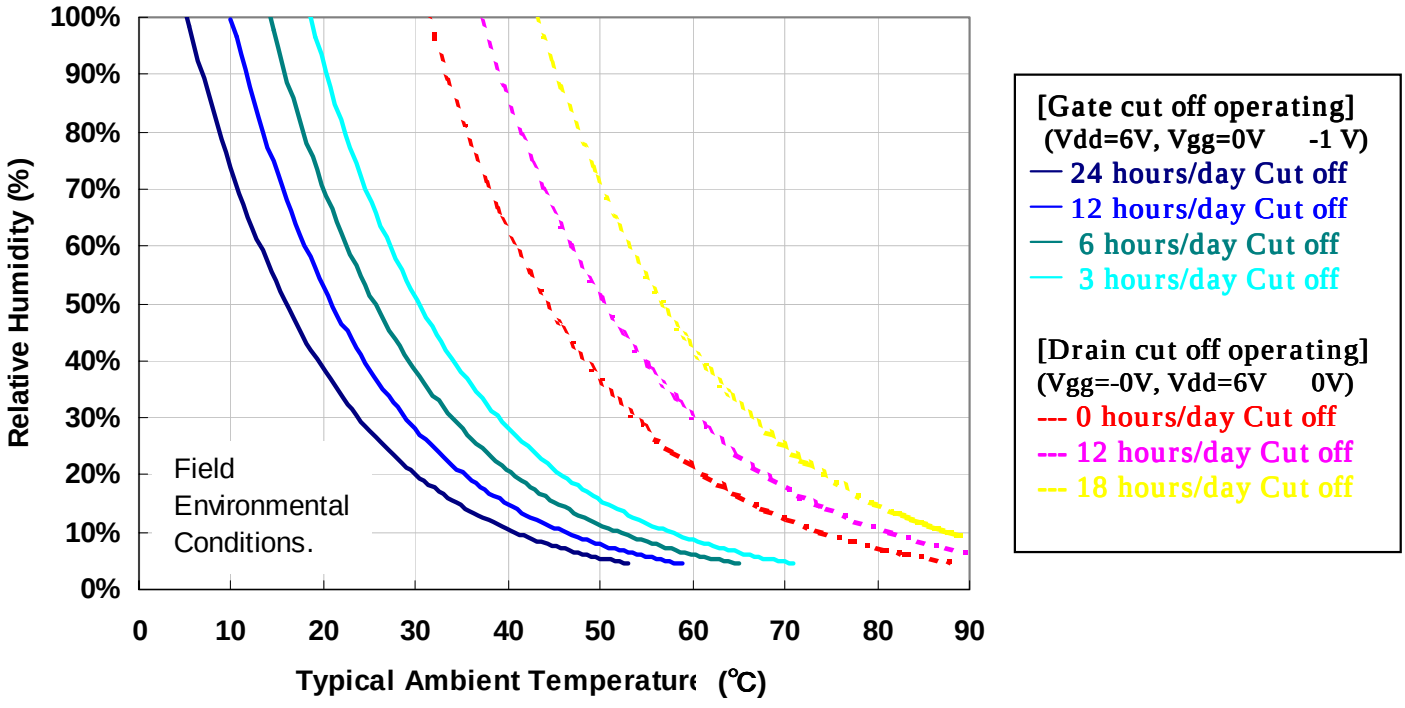
The following graph shows the lifetime of moisture resistance for the **FMM5804YD**. Each line in the graph indicates the lifetime that is the estimated failure rate of **0.1% at 10 years** (Confidence Level = 90 %) and calculated from the results of pressure cooker (autoclave) bias test. The horizontal-axis shows typical ambient temperature. The vertical-axis shows relative humidity. The left side of the area delimited in each line indicates more than 10 years of lifetime.

Field environmental conditions for operation

In the case that **FMM5804YD** is mounted in a non-hermetic package, please refer to the following recommendations.

Note 1. The graph lines are drawn using the operating conditions as shown in the box below. SEDI recommends our customers use **FMM5804YD** within the left side area separated by each line in the graph below.
Note 2. Please cut off the drain current by drain bias, not by gate bias. The humidity lifetime becomes shorter in case of gate cut off operation.
Note 3. Please use ES/FMM5804YD under environmental conditions of no dew condensation.

Field Environmental Conditions for a 10 years Lifetime



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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.