



EMM5075X

Ku-Band Power Amplifier MMIC

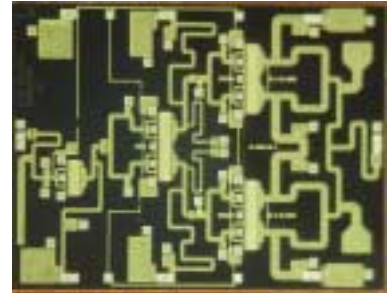
FEATURES

- High Output Power: Pout=33.0dBm (typ.)
- High Linear Gain: GL=26.0dB (typ.)
- Broad Band: 12.7~15.4GHz
- Impedance Matched Zin/Zout=50Ω

DESCRIPTION

The EMM5075X is a MMIC amplifier that contains a three-stages amplifier, internally matched, for standard communications band in the 12.7 to 15.4GHz frequency range.

Sumitomo Electric Device Innovations's stringent Quality Assurance Program assures the highest reliability and consistent performance.



ABSOLUTE MAXIMUM RATING

Item	Symbol	Rating	Unit
Drain-Source Voltage	V_{DD}	10	V
Gate-Source Voltage	V_{GG}	-3	V
Input Power	P_{in}	26	dBm
Storage Temperature	T_{stg}	-55 to +125	°C

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Condition	Unit
Drain-Source Voltage	V_{DD}	≤ 7	V
Input Power	P_{in}	≤ 16	dBm
Operating Case Temperature	T_C	-40 to +85	°C

This Product should be hermetically packaged.

ELECTRICAL CHARACTERISTICS (Case Temperature Ta=25°C)

Item	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
RF Frequency Range	f	$V_{DD}=+6V$	12.7	-	15.4	GHz
Output Power at 1dB G.C.P.	P_{1dB}	$I_{DD(DC)}=1200mA$ typ.	32	33	-	dBm
Power Gain at 1dB G.C.P.	G_{1dB}	$Z_S=Z_L=50\Omega$	22	26	-	dB
Power-added Efficiency at 1dB G.C.P.	η_{add}		-	26	-	%
Drain Current at 1dB G.C.P.	I_{DDRF}		-	1300	1900	mA
3rd. Order Intermodulation Distortion *	IM_3	* df=+10MHz	-40	-47	-	dBc
Input Return Loss (at Pin=-20dBm)	RL_{IN}	Po=20dBm S.C.L	-	-8	-	dB
Output Return Loss (at Pin=-20dBm)	RL_{OUT}		-	-15	-	dB

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

G.C.P. : Gain Compression Point
SCL : Single Carrier Level

ESD	Class 0	~ 249V
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Note : Based on JEDEC JESD22-A114C

RoHS Compliance	Yes
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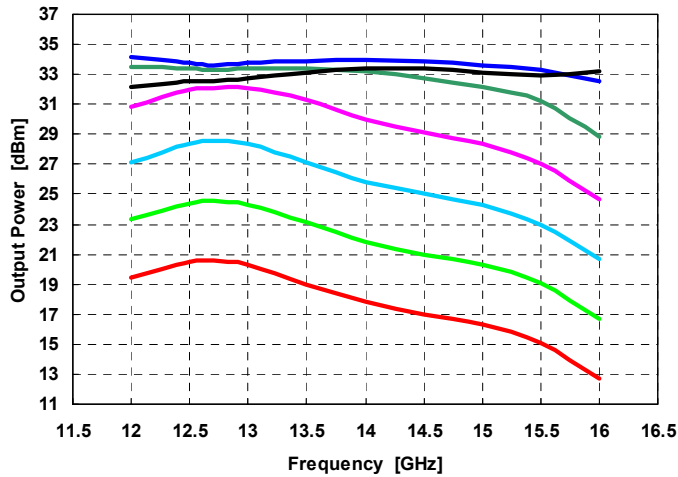


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OUTPUT POWER vs. FREQUENCY

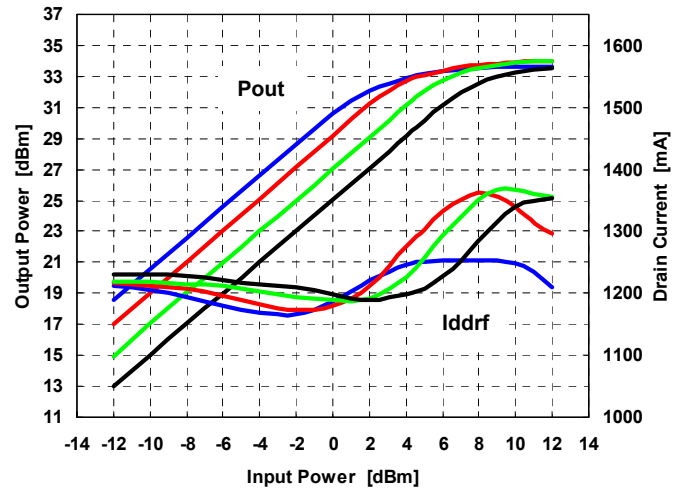
@VDD=6V, IDD(DC)=1200mA



Pin=-10dBm -6dBm -2dBm 2dBm 6dBm 10dBm P1dB

OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER

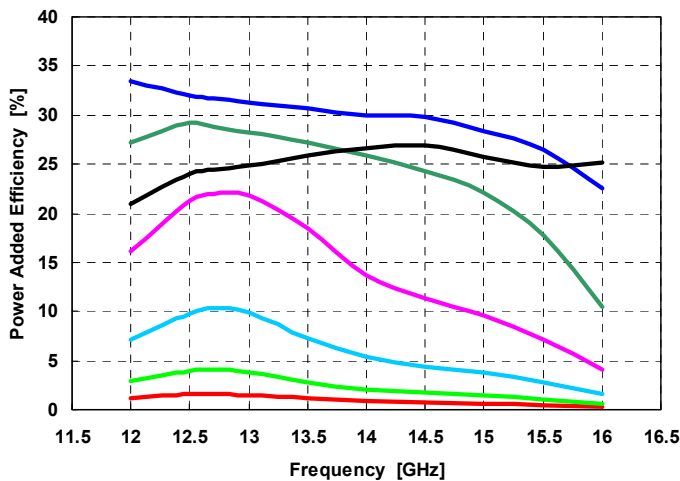
@VDD=6V, IDD(DC)=1200mA



12.7GHz 13.5GHz 14.5GHz 15.4GHz

POWER-ADDED EFFICIENCY vs FREQUENCY

@VDD=6V, IDD(DC)=1200mA



Pin=-10dBm -6dBm -2dBm 2dBm 6dBm 10dBm P1dB

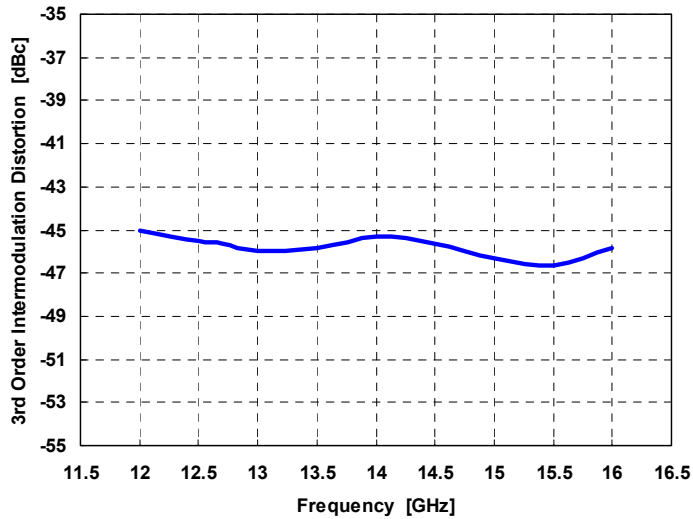


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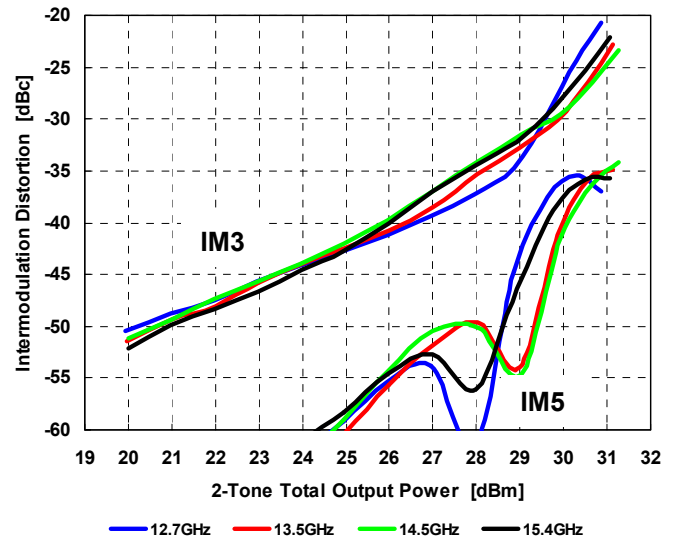
IMD vs. FREQUENCY

@VDD=6V, IDD(DC)=1200mA, Pout=20dBm S.C.L.



IMD vs OUTPUT POWER

@VDD=6V, IDD(DC)=1200mA



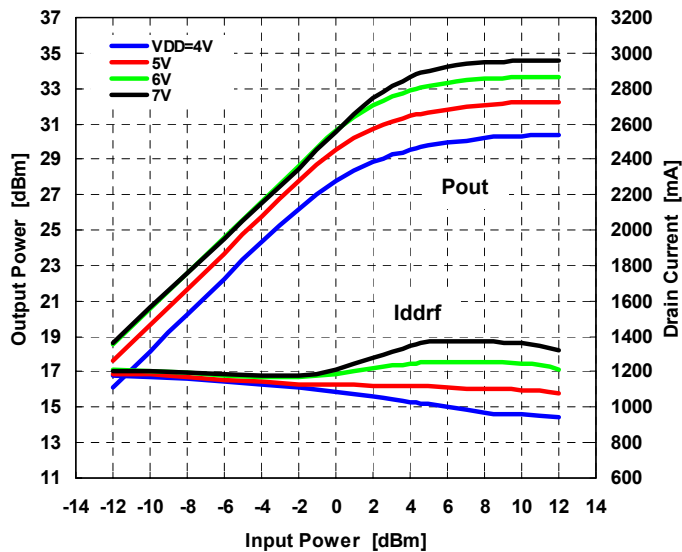


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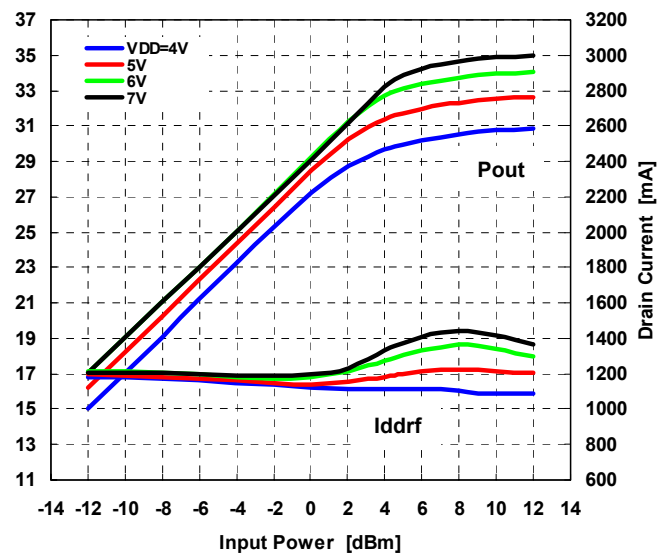
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Drain Voltage

@IDD(DC)=1200mA, f=12.7GHz



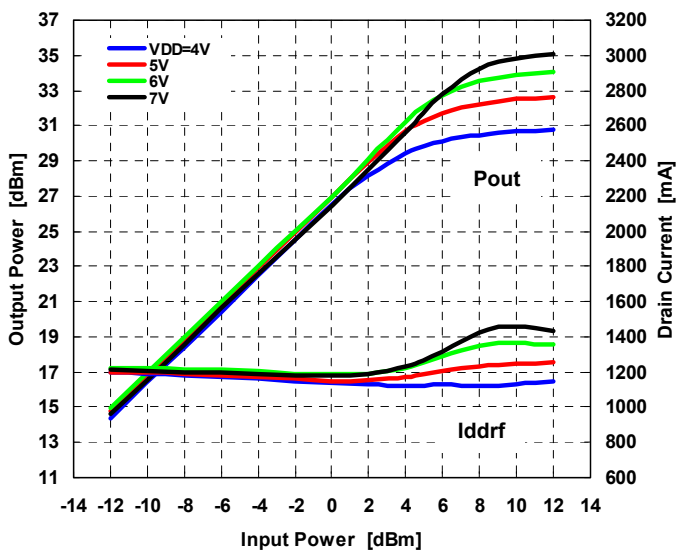
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Drain Voltage

@IDD(DC)=1200mA, f=13.5GHz



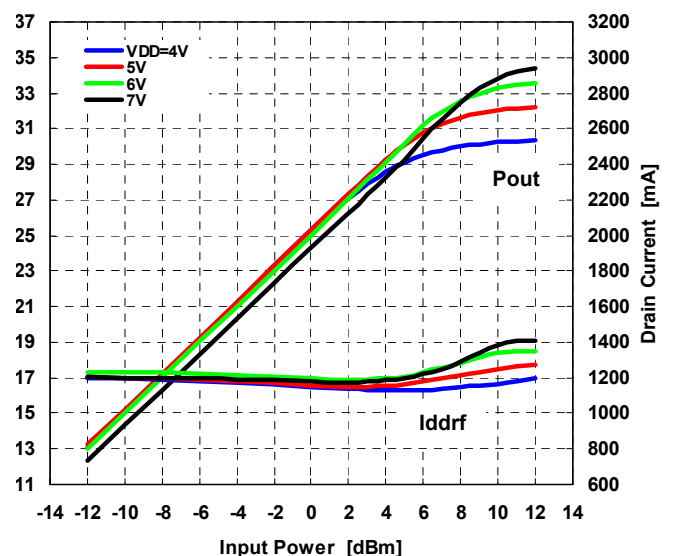
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Drain Voltage

@IDD(DC)=1200mA, f=14.5GHz



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

@IDD(DC)=1200mA, f=15.4GHz



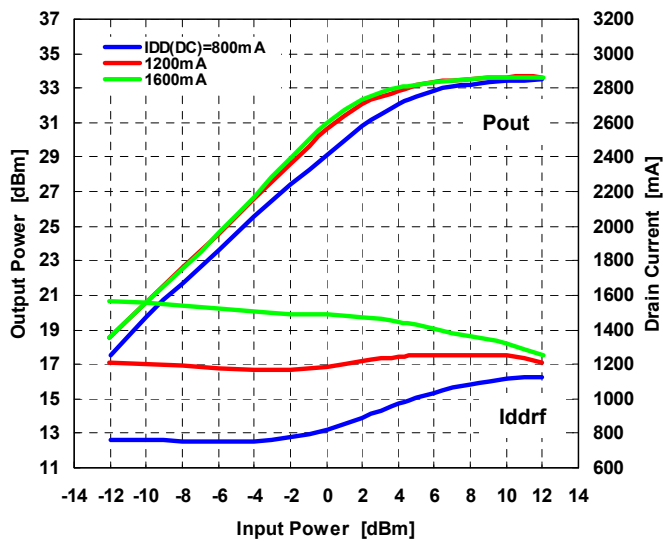


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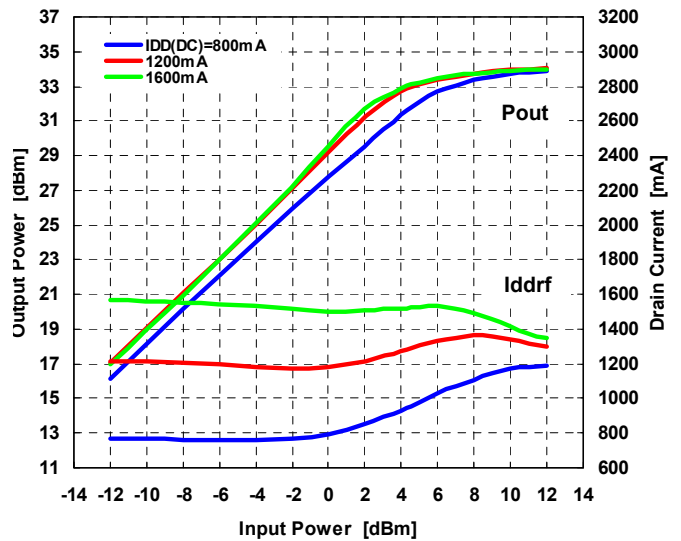
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Drain Current

@VDD=6V, f=12.7GHz



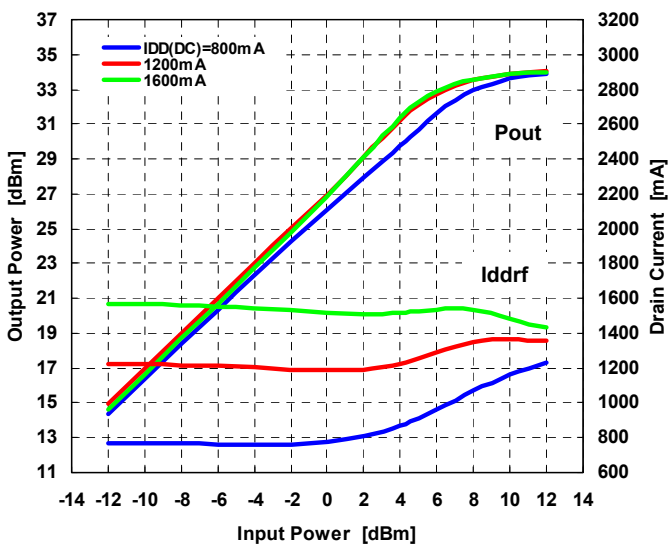
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Drain Current

@VDD=6V, f=13.5GHz



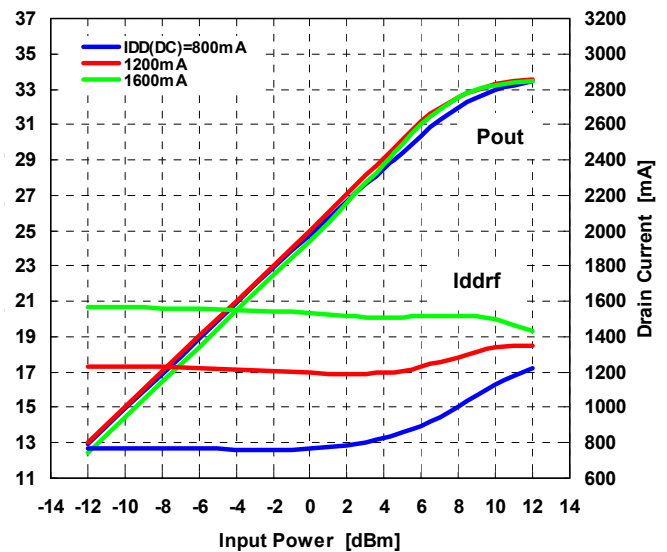
OUTPUT POWER, DRAIN CURRENT
vs. INPUT POWER by Drain Current

@VDD=6V, f=14.5GHz



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

@VDD=6V, f=15.4GHz



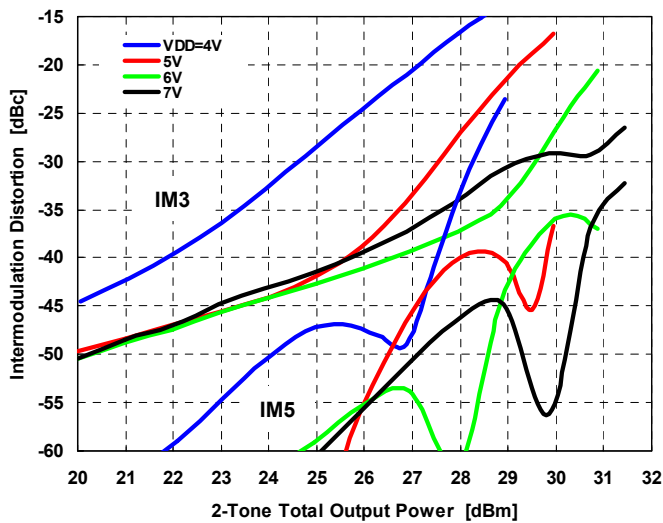


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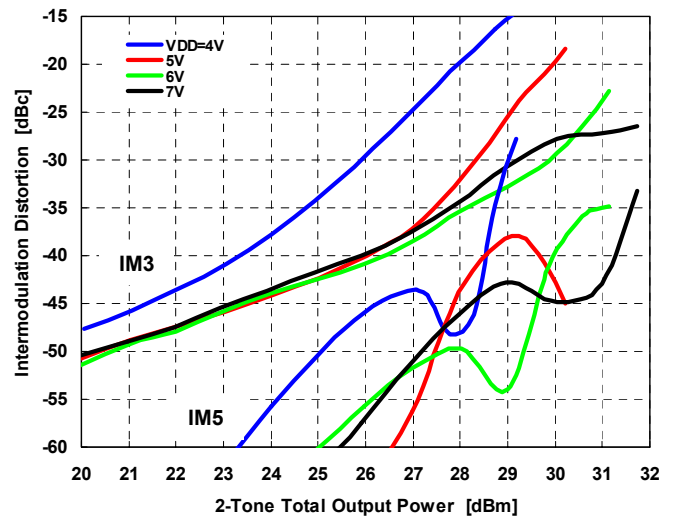
IMD PERFORMANCE vs. OUTPUT POWER by Drain Voltage

@IDD(DC)=1200mA, f=12.7GHz



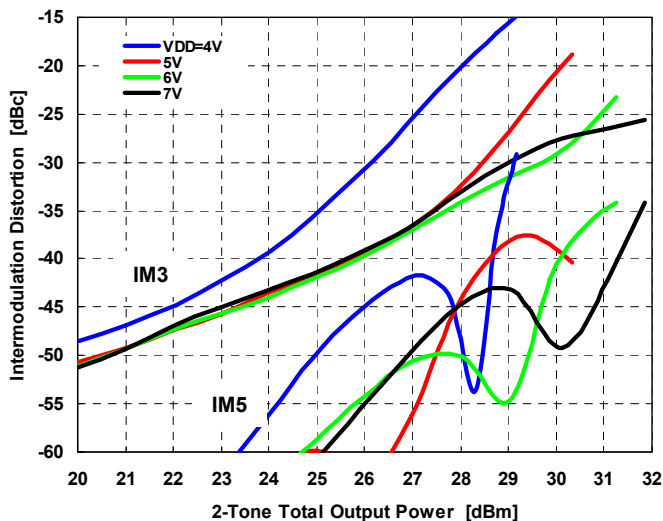
IMD PERFORMANCE vs. OUTPUT POWER by Drain Voltage

@IDD(DC)=1200mA, f=13.5GHz



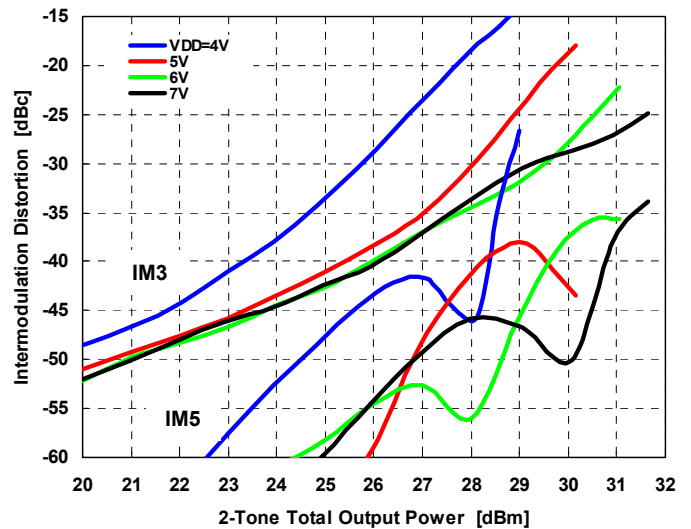
IMD PERFORMANCE vs. OUTPUT POWER by Drain Voltage

@IDD(DC)=1200mA, f=14.5GHz



IMD PERFORMANCE vs. OUTPUT POWER by Drain Voltage

@IDD(DC)=1200mA, f=15.4GHz



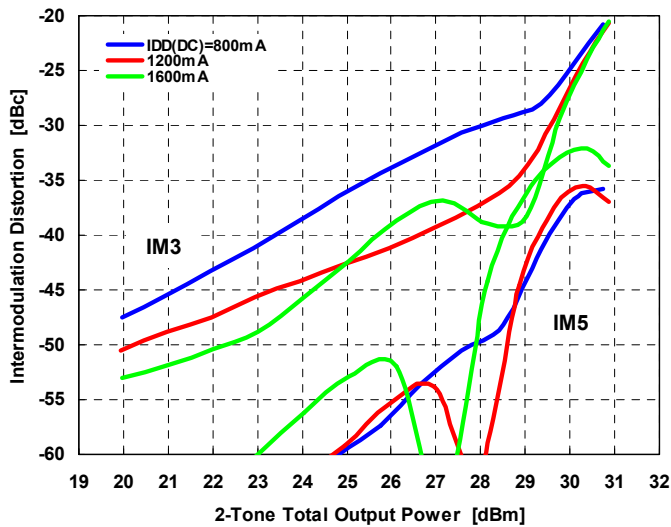


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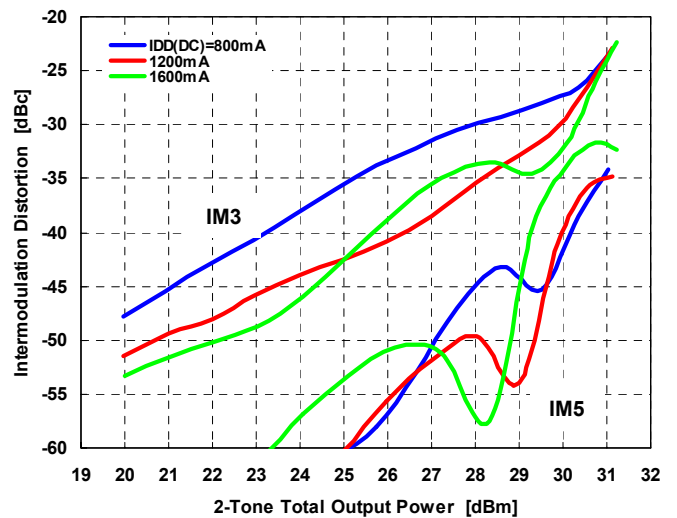
IMD PERFORMANCE vs. OUTPUT POWER by Drain Current

@VDD=6V, f=12.7GHz



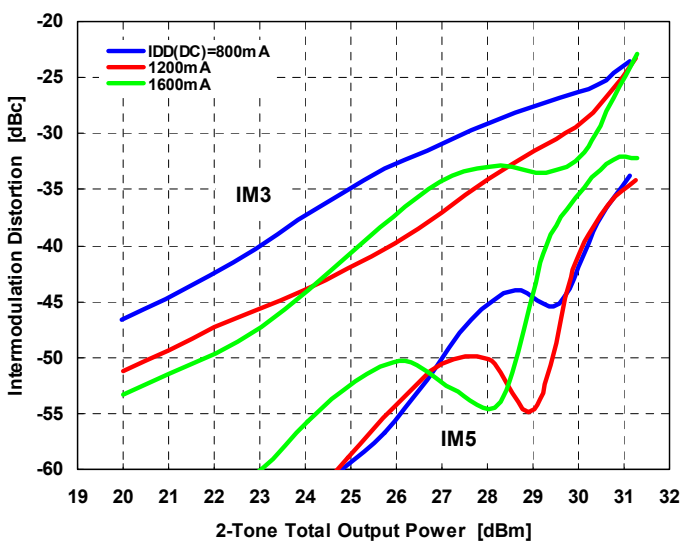
IMD PERFORMANCE vs. OUTPUT POWER by Drain Current

@VDD=6V, f=13.5GHz



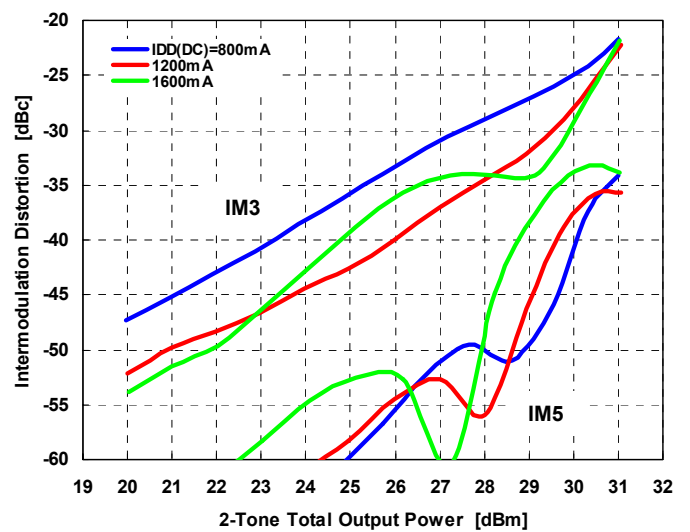
IMD PERFORMANCE vs. OUTPUT POWER by Drain Current

@VDD=6V, f=14.5GHz



IMD PERFORMANCE vs. OUTPUT POWER by Drain Current

@VDD=6V, f=15.4GHz





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S-PARAMETER

VDD=6V, IDD=1200mA

Frequency [GHz]	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
1.0	0.999	-20.0	0.057	43.2	0.001	-43.8	0.996	-31.0
2.0	0.995	-40.2	0.483	-103.8	0.001	-67.7	0.971	-61.9
3.0	0.988	-60.3	0.741	106.2	0.001	-76.9	0.957	-89.7
4.0	0.980	-80.0	0.398	11.6	0.002	-112.8	0.959	-118.8
5.0	0.970	-99.4	0.175	-23.1	0.002	-102.7	0.940	-148.1
6.0	0.959	-118.8	0.155	-34.2	0.002	-97.1	0.906	-177.3
7.0	0.945	-137.6	0.220	36.2	0.001	-89.4	0.867	151.3
8.0	0.940	-156.5	3.477	-40.0	0.002	-120.3	0.789	113.8
9.0	0.927	-176.4	5.789	-167.2	0.003	-103.3	0.645	67.2
10.0	0.911	161.9	8.552	106.8	0.003	-105.4	0.396	3.0
11.0	0.864	135.9	13.901	20.3	0.003	-100.8	0.204	-83.8
12.0	0.661	97.2	25.732	-81.6	0.003	-92.6	0.157	-171.3
12.1	0.614	92.3	27.138	-93.9	0.003	-104.6	0.153	-177.1
12.2	0.563	87.7	28.499	-106.5	0.002	-117.2	0.152	177.3
12.3	0.509	83.3	29.633	-119.6	0.002	-113.1	0.146	171.6
12.4	0.443	79.3	30.557	-132.9	0.003	-91.6	0.144	168.7
12.5	0.378	76.9	31.142	-146.4	0.002	-93.5	0.145	162.0
12.6	0.317	76.6	31.391	-159.8	0.002	-91.2	0.138	154.3
12.7	0.261	77.9	31.335	-173.2	0.003	-66.6	0.129	151.7
12.8	0.210	86.0	30.973	173.8	0.003	-86.0	0.131	146.0
12.9	0.193	97.1	30.442	161.1	0.003	-86.1	0.119	140.5
13.0	0.182	106.4	29.744	148.7	0.003	-85.9	0.117	142.0
13.1	0.197	118.9	28.906	136.7	0.003	-100.5	0.121	129.9
13.2	0.216	121.0	28.126	125.1	0.003	-86.2	0.105	128.4
13.3	0.218	125.1	27.346	113.7	0.003	-81.6	0.105	123.6
13.4	0.243	127.6	26.528	102.7	0.003	-78.3	0.092	110.9
13.5	0.241	124.5	25.904	91.6	0.003	-91.6	0.075	115.6
13.6	0.248	128.0	25.162	81.0	0.003	-86.5	0.075	106.8
13.7	0.261	126.3	24.548	70.4	0.004	-79.0	0.059	99.7
13.8	0.253	125.4	23.955	59.8	0.004	-75.1	0.051	105.0
13.9	0.259	128.6	23.443	49.3	0.002	-98.4	0.043	88.5
14.0	0.260	127.4	22.935	39.1	0.004	-85.0	0.026	79.6
14.1	0.254	129.1	22.536	28.6	0.004	-98.7	0.018	82.8
14.2	0.259	130.6	22.134	18.0	0.004	-97.6	0.005	41.5
14.3	0.259	129.8	21.806	7.6	0.004	-87.6	0.008	-104.3
14.4	0.252	131.6	21.517	-3.1	0.004	-86.4	0.015	-113.8
14.5	0.253	133.9	21.162	-13.9	0.004	-79.7	0.026	-107.0
14.6	0.254	136.0	20.886	-24.7	0.004	-109.3	0.038	-116.2
14.7	0.253	139.0	20.585	-35.8	0.003	-87.3	0.050	-119.0
14.8	0.263	143.5	20.301	-47.0	0.004	-83.1	0.060	-121.9
14.9	0.283	145.2	19.955	-58.3	0.004	-78.1	0.072	-129.5
15.0	0.299	147.0	19.651	-69.7	0.003	-104.4	0.071	-136.3
15.1	0.329	148.3	19.350	-81.5	0.003	-102.4	0.081	-134.6
15.2	0.350	147.1	18.950	-93.5	0.003	-78.0	0.089	-141.4
15.3	0.372	147.8	18.512	-105.6	0.003	-94.5	0.089	-139.8
15.4	0.406	146.3	17.996	-118.0	0.002	-90.2	0.106	-142.4
15.5	0.424	144.6	17.509	-130.5	0.002	-72.8	0.107	-147.2
15.6	0.452	143.5	16.895	-143.0	0.003	-78.7	0.116	-146.8
15.7	0.480	140.8	16.249	-155.7	0.003	-82.3	0.126	-151.5
15.8	0.498	139.2	15.516	-168.6	0.003	-94.9	0.132	-151.9
15.9	0.530	137.2	14.770	178.6	0.004	-92.2	0.150	-155.1
16.0	0.559	133.9	13.983	165.6	0.003	-73.4	0.160	-159.9
17.0	0.716	99.5	5.879	39.2	0.005	-75.7	0.212	127.7
18.0	0.715	64.4	1.768	-65.3	0.005	-88.1	0.184	14.6
19.0	0.659	26.4	0.517	-152.7	0.005	-90.0	0.362	-67.7
20.0	0.588	-22.7	0.148	128.2	0.004	-88.3	0.574	-113.2



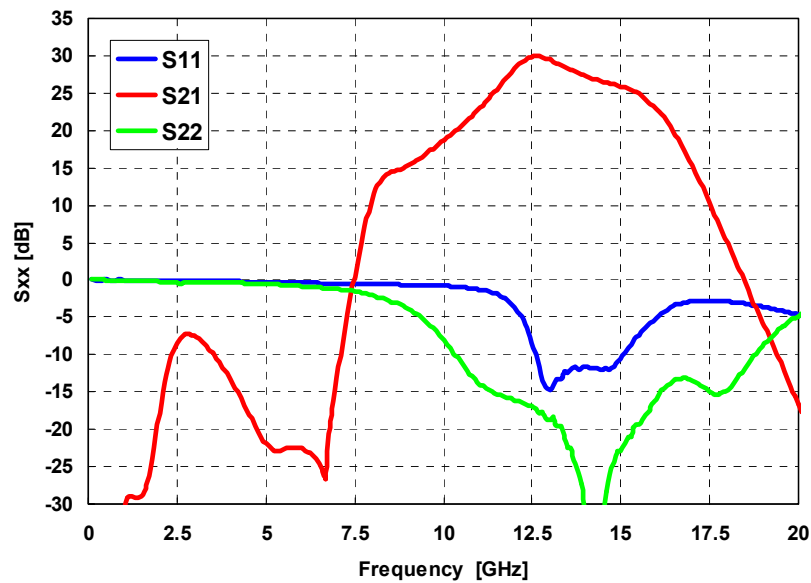


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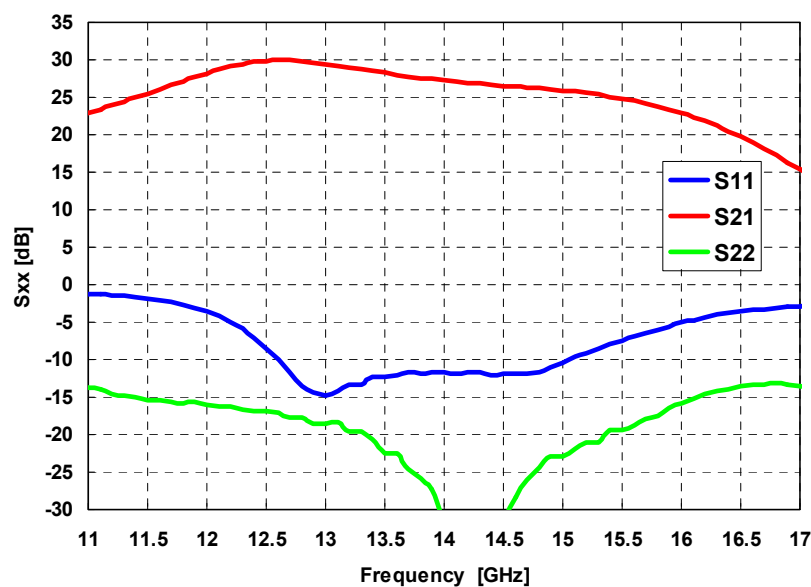
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■ S-PARAMETER

@VDD=6V, IDD=1200mA



@VDD=6V, IDD=1200mA



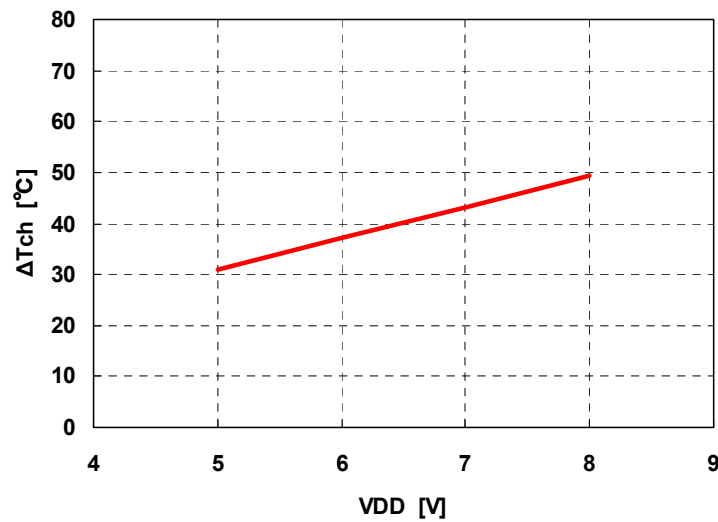


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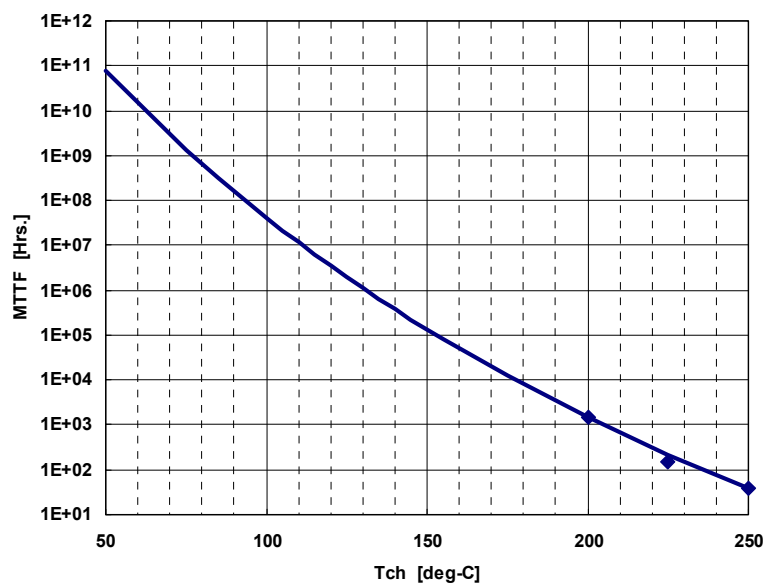
ΔT_{ch} vs. Drain Voltage (Reference)

$I_{DD}(DC)=1200mA$



Note ΔT_{ch} : Temperature Rise from Backside of MMIC to Channel

MTTF vs. T_{ch}



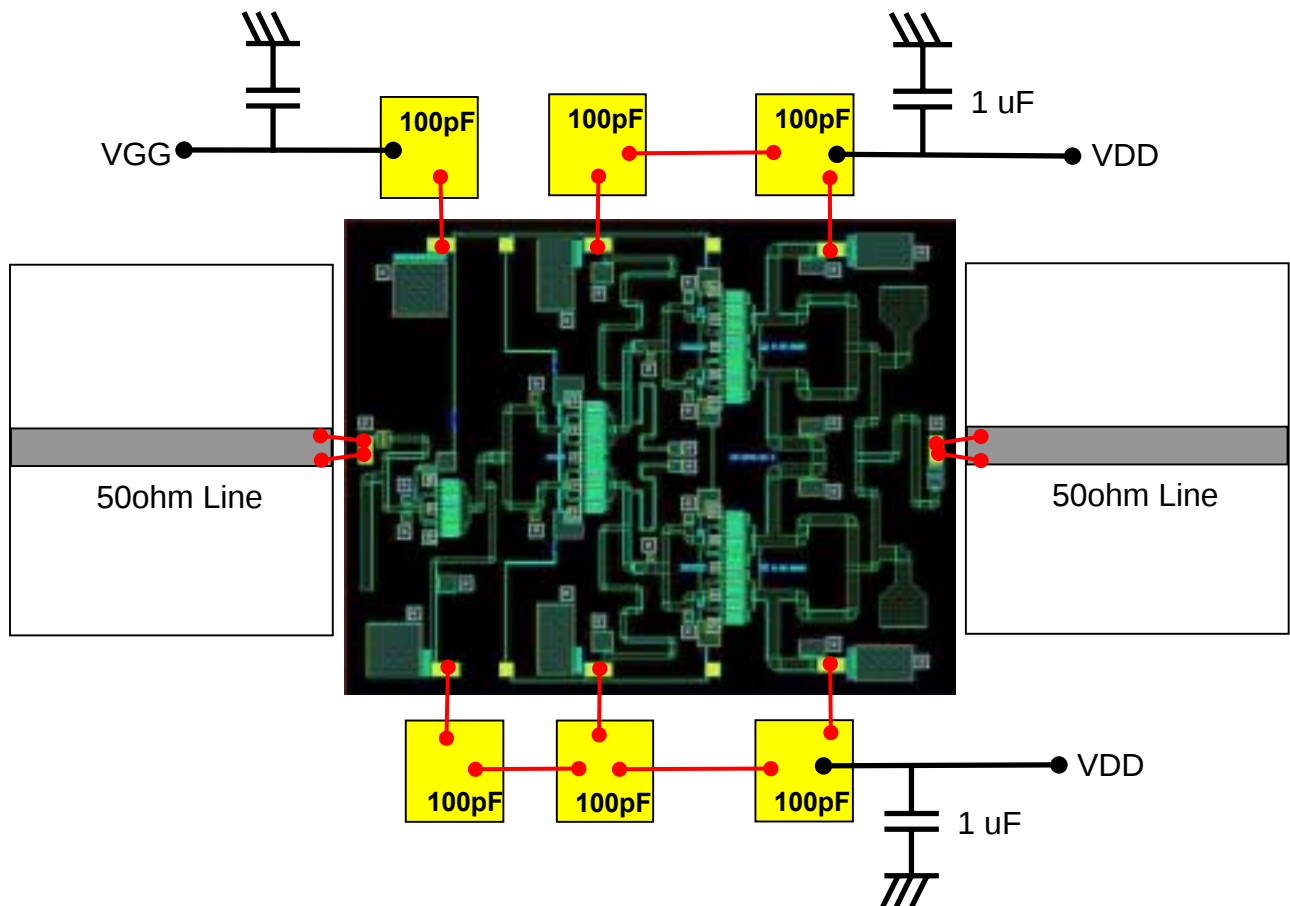


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■ Assembly Diagrams

Recommended assembly



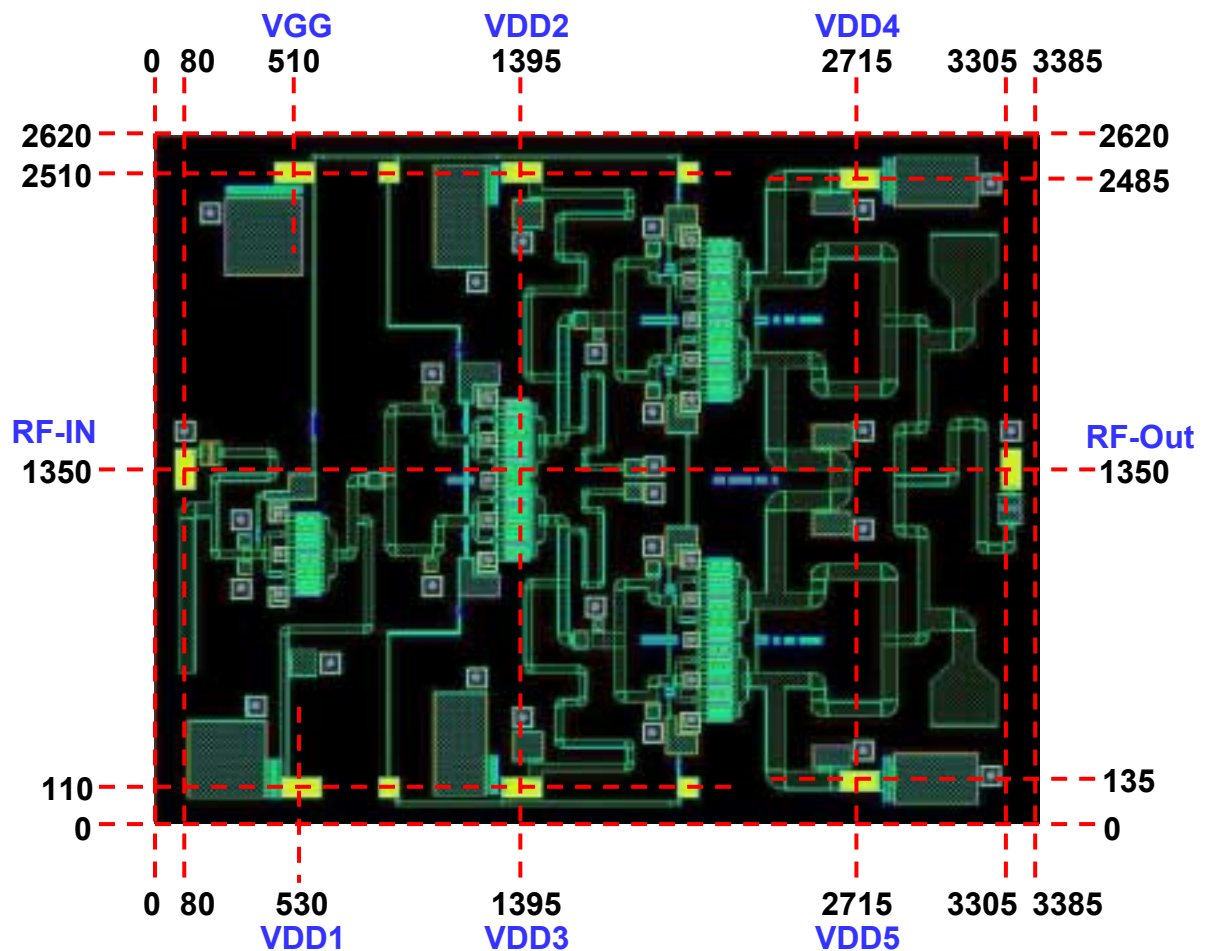
“Copper” is the recommended material for the package or carrier.



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



Chip Size : $3385 \pm 30 \mu\text{m} \times 2620 \pm 30 \mu\text{m}$

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

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



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■ 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.

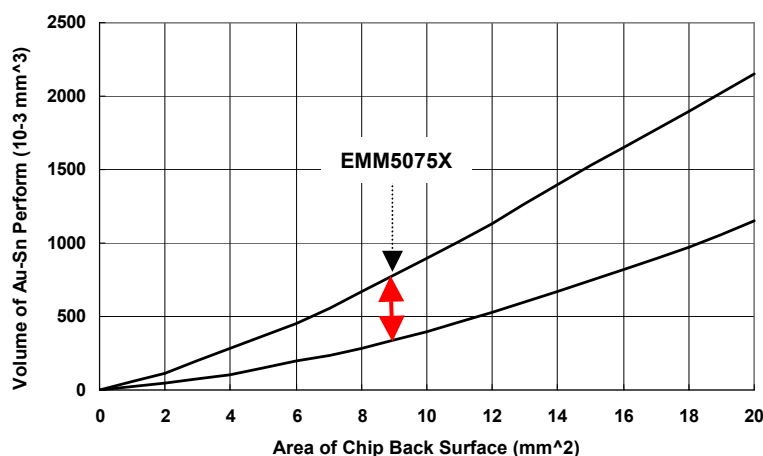
Die attach conditions

Stage Temperature : 300 to 310 deg.C

Time : less than 15 seconds

Die attach material : AuSn

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.

However, when bonding wire on the MMIC, the condition should be verified by customer using their equipment and materials.

- 1) Bonding Equipment and Bonding Tool.

Bonding Equipment : SINKAWA UTC-300 (automatic ball bonder)

Bonding Tool : ADAMANT AD-2-38LB20

- 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 : 0.294 N to 0.882 N

Stage Temperature : 230 deg.C +/- 5 deg.C

Ultrasonic Power : 30 to 90

Ultrasonic Power Time : 10ms to 60ms





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For further information please contact :

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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.

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