

FMM5125X

15/60GHz Frequency Multiplier MMIC

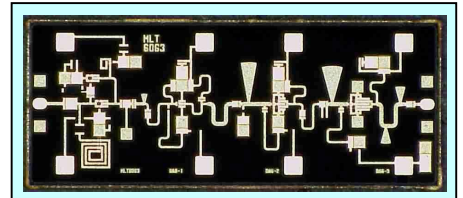
FEATURES

- Input/Output Frequency : 15 / 60 GHz
- Wide Frequency Band : 57 - 64 GHz
- Conversion Loss : $L_c = 5\text{dB}$ (Typ.) @ $f_{\text{out}} = 60\text{ GHz}$, $P_{\text{in}} = 10\text{ dBm}$
- High Output Power : $P_o = 5\text{dBm}$ (Typ.) @ $f_{\text{out}} = 60\text{ GHz}$, $P_{\text{in}} = 10\text{ dBm}$
- Impedance Matched $Z_{\text{in}}/Z_{\text{out}} = 50\Omega$

DESCRIPTION

The FMM5125X is a by 4 frequency multiplier MMIC designed for applications in the 57-64 GHz frequency range. This product is well suited for wireless LAN and point-to-point radio.

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



ABSOLUTE MAXIMUM RATING (Case Temperature $T_c=25^\circ\text{C}$)

Item	Symbol	Rating	Unit
DC Input Voltage	VDD	+4	V
DC Input Voltage	VGG	-3	V
Input Power	P_{in}	15	dBm
Storage Temperature	T_{stg}	-55 to +125	$^\circ\text{C}$

RECOMMENDED OPERATING CONDITION (Case Temperature $T_c=25^\circ\text{C}$)

Item	Symbol	Condition	Unit
DC Input Voltage	VDD	3	V
Backside Temperature	T_b	-45 to + 85	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS (Case Temperature $T_c=25^\circ\text{C}$)

Item	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Output Power	P_{out}	$V_{\text{DD}}=3\text{V}$ $V_{\text{GG}}=0\text{V}$ $P_{\text{in}}=10\text{ dBm}$	-5	5	-	dBm
Total Drain Current	I_{DDt}	$f = 14.25\sim 16\text{ GHz}$	-	100	-	mA
Input Return Loss	RL_{in}	$f = 14.25\sim 16\text{ GHz}$	-	8	-	dB
Output Return Loss	RL_{out}	$f = 57\sim 64\text{ GHz}$	-	12	-	dB

These values are representative for CW on chip measurements that are made without bonding wires at the RF ports.

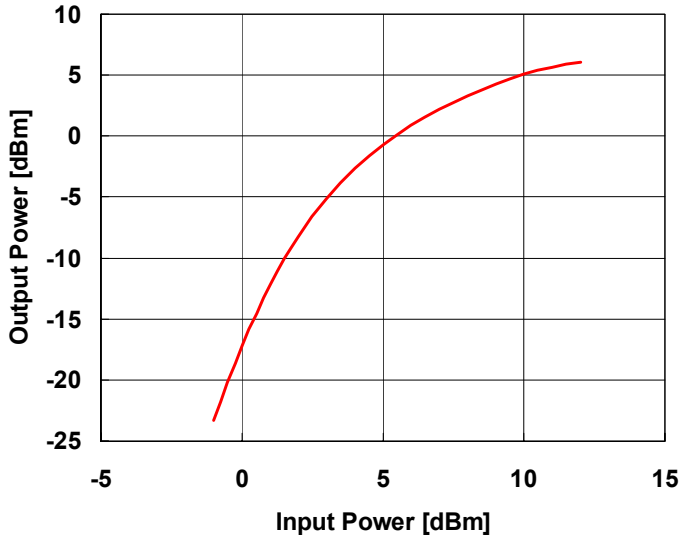
ESD	Class 0	~ 199V
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Note : Based on EIAJ ED-4701 C-111A(C=100pF, R=1.5k Ω)

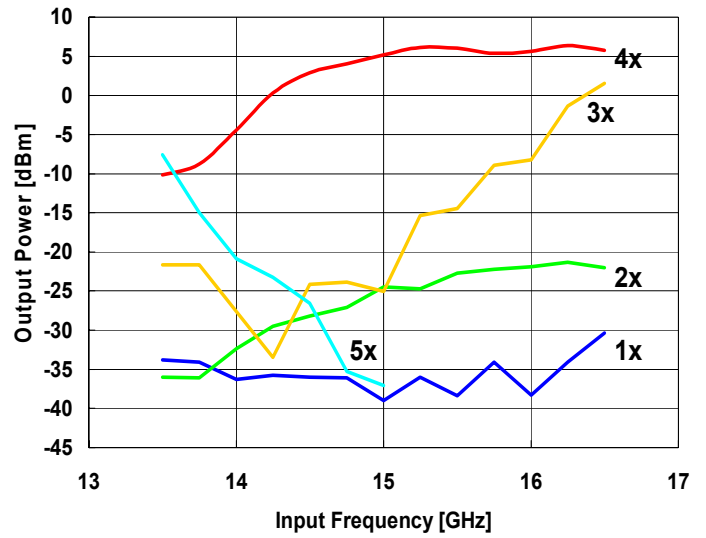
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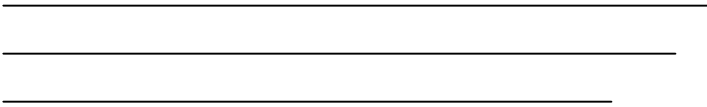
Output Power vs. Input Power
Bias Condition: Vdd = 3V, Idd = 100 mA
fin = 15 GHz



Output Power vs. Frequency
Bias Condition: Vdd = 3V, Idd = 100 mA
Pin = 10 dBm



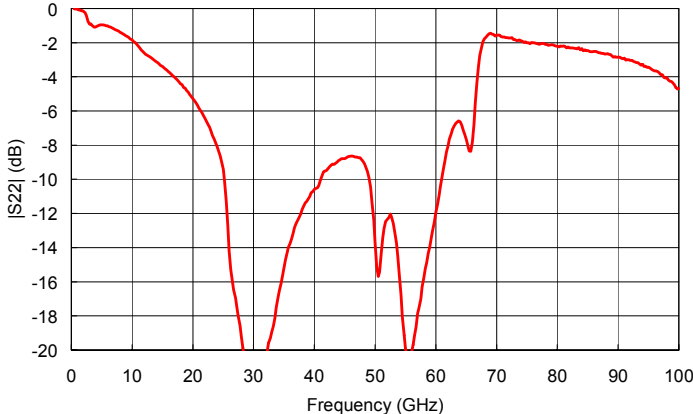
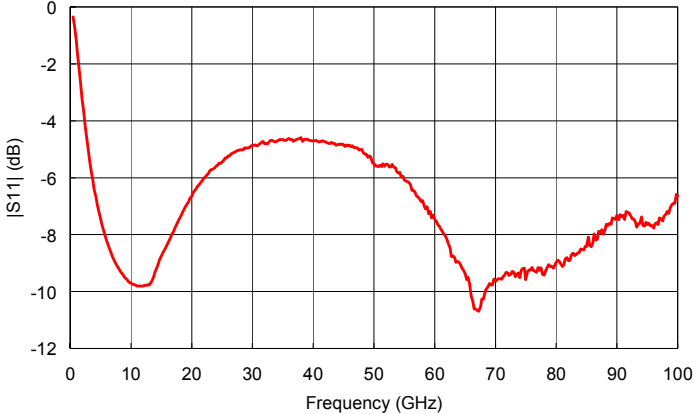
Typical on chip measurements



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S-PARAMETERS
 $V_{DD} = 3V, V_{GG} = 0V, I_{DD} = 100\text{ mA}$



Typical on chip measurements



FMM5125X

15/60GHz Frequency Multiplier MMIC

S-PARAMETERS Vdd = 3V, Vgg = 0V, Idd = 100 mA

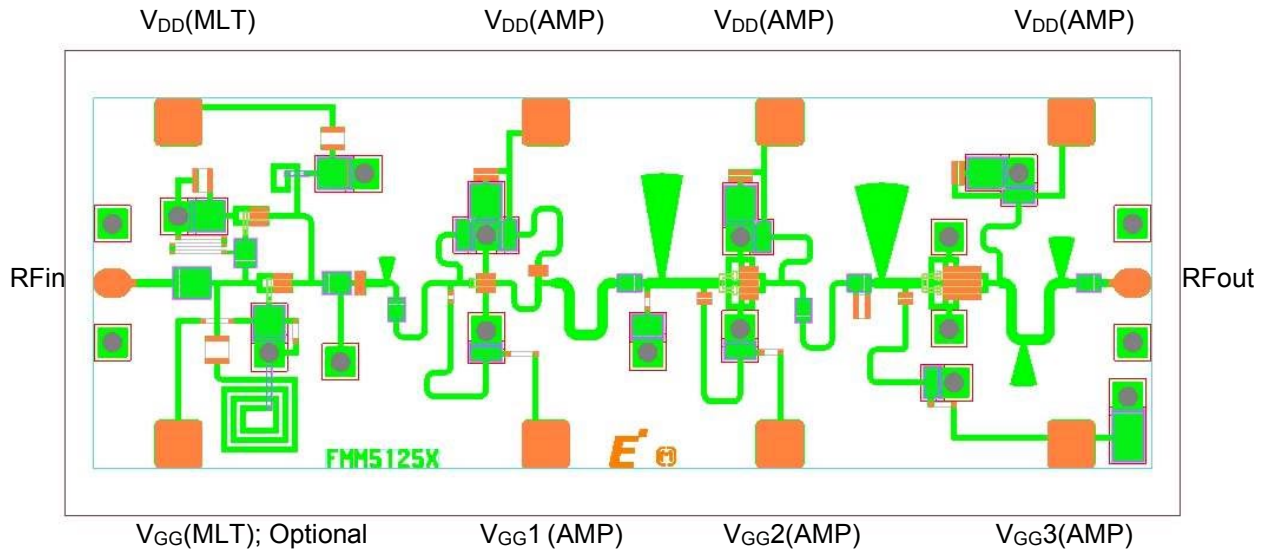
Freq. GHz	S11			S21			S12			S22			Freq. GHz	S11			S21			S12			S22		
	MAG	ANG		MAG	ANG		MAG	ANG		MAG	ANG			MAG	ANG		MAG	ANG		MAG	ANG		MAG	ANG	
1	0.874	-40.2	0.003	85.0	0.0003	107.0	0.995	-12.2		51	0.528	120.6	4.543	-4.8	0.0009	-17.5	0.191	-123.7							
2	0.689	-68.7	0.005	-71.0	0.0007	35.7	0.982	-24.5		52	0.530	117.0	4.181	-45.6	0.0020	-20.6	0.241	-130.1							
3	0.558	-88.1	0.011	55.7	0.0008	-62.7	0.899	-35.3		53	0.529	112.8	4.203	-76.5	0.0020	-25.7	0.235	-143.6							
4	0.477	-101.9	0.006	-115.6	0.0004	-91.0	0.882	-43.0		54	0.511	108.2	4.486	-109.2	0.0003	-19.5	0.165	-153.1							
5	0.425	-112.0	0.002	-164.9	0.0003	-100.2	0.896	-52.3		55	0.496	104.3	4.754	-140.3	0.0011	-140.8	0.101	-133.9							
6	0.389	-119.8	0.001	-176.4	0.0004	-125.0	0.890	-62.5		56	0.487	100.2	5.109	-172.8	0.0017	85.7	0.098	-105.3							
7	0.364	-125.5	0.001	176.9	0.0003	-147.4	0.873	-72.5		57	0.465	96.5	5.270	154.7	0.0019	34.9	0.128	-85.1							
8	0.347	-129.5	0.001	150.1	0.0004	-152.2	0.853	-82.0		58	0.457	92.4	5.457	122.9	0.0023	66.4	0.162	-75.1							
9	0.335	-132.6	0.001	120.1	0.0006	-157.7	0.833	-91.3		59	0.433	89.0	5.609	91.7	0.0027	42.3	0.201	-71.7							
10	0.327	-134.5	0.002	93.8	0.0010	170.6	0.810	-100.5		60	0.423	84.4	5.793	59.5	0.0048	33.0	0.253	-68.3							
11	0.324	-135.7	0.004	46.7	0.0015	124.2	0.779	-109.6		61	0.407	81.3	5.935	25.8	0.0044	23.8	0.320	-68.6							
12	0.323	-136.4	0.007	-18.1	0.0014	60.1	0.741	-117.3		62	0.390	77.1	6.042	-7.2	0.0036	-6.3	0.396	-74.1							
13	0.325	-136.1	0.009	-63.8	0.0013	-9.1	0.720	-124.7		63	0.365	73.1	5.809	-42.6	0.0035	-31.3	0.453	-83.2							
14	0.342	-135.0	0.010	-127.1	0.0004	-59.7	0.699	-132.5		64	0.356	72.3	5.888	-75.8	0.0031	-20.4	0.465	-92.8							
15	0.365	-136.3	0.008	-169.1	0.0001	-50.7	0.676	-140.2		65	0.340	66.9	6.089	-112.6	0.0018	-32.9	0.414	-95.5							
16	0.383	-137.9	0.006	171.6	0.0005	-81.6	0.654	-148.0		66	0.310	64.5	6.186	-160.6	0.0006	-72.2	0.406	-77.4							
17	0.403	-139.6	0.006	153.8	0.0007	-97.3	0.629	-156.1		67	0.293	66.1	4.622	144.4	0.0027	55.5	0.677	-76.4							
18	0.424	-141.9	0.008	140.9	0.0012	-143.2	0.603	-164.4		68	0.307	67.7	2.634	103.0	0.0044	22.5	0.816	-94.1							
19	0.446	-144.3	0.008	111.4	0.0013	165.8	0.576	-173.1		69	0.327	63.1	1.520	74.8	0.0046	22.1	0.847	-106.4							
20	0.465	-147.0	0.008	78.8	0.0008	142.1	0.545	177.7		70	0.330	58.4	0.956	54.1	0.0043	12.7	0.836	-114.9							
21	0.484	-150.3	0.008	60.0	0.0005	132.6	0.512	167.6		71	0.332	53.1	0.634	37.2	0.0064	-5.4	0.825	-121.4							
22	0.501	-153.4	0.007	42.1	0.0002	115.1	0.476	156.6		72	0.341	48.2	0.454	23.1	0.0056	-36.7	0.819	-127.0							
23	0.515	-156.8	0.006	11.7	0.0004	-78.1	0.438	144.3		73	0.342	42.4	0.348	9.0	0.0050	-16.5	0.810	-132.1							
24	0.525	-159.7	0.004	-0.5	0.0007	-112.1	0.395	129.4		74	0.334	37.0	0.277	-5.3	0.0058	0.9	0.804	-136.1							
25	0.534	-162.4	0.002	-23.0	0.0019	-164.0	0.337	107.2		75	0.332	30.8	0.217	-18.1	0.0031	-28.4	0.794	-139.9							
26	0.547	-165.8	0.001	101.2	0.0024	144.1	0.195	86.3		76	0.348	23.8	0.184	-31.1	0.0056	-52.0	0.795	-143.6							
27	0.555	-168.7	0.004	91.9	0.0019	121.6	0.142	84.4		77	0.348	19.1	0.149	-48.1	0.0046	-58.7	0.785	-146.7							
28	0.561	-172.0	0.005	59.6	0.0016	114.9	0.110	69.6		78	0.338	13.2	0.133	-63.5	0.0025	-18.6	0.786	-150.8							
29	0.564	-174.8	0.010	56.2	0.0017	70.4	0.085	51.8		79	0.350	5.7	0.106	-79.4	0.0025	-69.9	0.784	-153.1							
30	0.571	-177.7	0.014	31.8	0.0009	110.1	0.073	30.9		80	0.356	-0.3	0.094	-91.7	0.0041	-66.0	0.775	-156.6							
31	0.572	-179.9	0.016	5.1	0.0005	59.0	0.080	7.8		81	0.350	-6.2	0.080	-102.5	0.0061	-46.0	0.776	-159.6							
32	0.575	176.5	0.019	-12.3	0.0010	73.4	0.094	-9.4		82	0.358	-13.8	0.064	-124.4	0.0055	-55.7	0.767	-162.8							
33	0.583	174.1	0.023	-28.2	0.0013	91.6	0.113	-24.5		83	0.366	-21.0	0.062	-136.6	0.0057	-69.6	0.764	-166.4							
34	0.581	171.6	0.026	-43.4	0.0019	100.2	0.141	-33.2		84	0.376	-27.5	0.054	-149.5	0.0049	-74.6	0.764	-169.7							
35	0.585	168.3	0.030	-56.1	0.0010	83.5	0.174	-42.2		85	0.379	-35.4	0.041	-172.5	0.0064	-61.5	0.754	-172.8							
36	0.588	165.8	0.037	-69.6	0.0019	79.1	0.205	-52.7		86	0.385	-42.5	0.027	177.1	0.0040	-79.0	0.749	-175.5							
37	0.583	163.1	0.042	-84.2	0.0017	99.0	0.235	-61.5		87	0.403	-51.5	0.020	150.8	0.0062	-69.7	0.743	-179.0							
38	0.590	159.7	0.052	-100.7	0.0012	87.2	0.258	-69.3		88	0.405	-57.8	0.015	152.4	0.0060	-95.9	0.736	178.1							
39	0.586	157.4	0.058	-105.8	0.0020	74.4	0.277	-76.4		89	0.415	-68.2	0.012	150.3	0.0063	-98.4	0.725	174.5							
40	0.582	154.3	0.071	-121.8	0.0023	42.6	0.295	-83.0		90	0.430	-78.3	0.014	162.0	0.0066	-120.6	0.720	171.4							
41	0.579	151.3	0.091	-130.3	0.0023	48.0	0.314	-86.2		91	0.430	-88.3	0.005	135.0	0.0064	-134.0	0.716	168.1							
42	0.580	148.5	0.115	-142.9	0.0019	19.1	0.336	-94.2		92	0.435	-97.7	0.005	-110.8	0.0024	-152.3	0.705	163.7							
43	0.578	145.6	0.152	-155.1	0.0018	54.7	0.350	-100.6		93	0.419	-108.5	0.008	141.6	0.0061	-151.9	0.694	160.4							
44	0.573	142.7	0.210	-167.3	0.0016	31.8	0.359	-106.0		94	0.428	-118.2	0.006	173.6	0.0037	-137.3	0.687	156.3							
45	0.572	139.3	0.292	179.9	0.0010	30.8	0.363	-112.4		95	0.415	-131.3	0.008	147.2	0.0027	-167.1	0.675	152.1							
46	0.572	136.4	0.435	166.3	0.0016	45.9	0.370	-118.9		96	0.409	-142.4	0.012	-141.5	0.0038	175.0	0.656	147.5							
47	0.566	132.7	0.683	149.6	0.0021	49.3	0.368	-126.3		97	0.426	-155.2	0.002	17.8	0.0036	-177.8	0.642	141.8							
48	0.562	129.2	1.161	129.5	0.0015	64.2	0.357	-135.4		98	0.432	-169.3	0.007	-50.6	0.0029	150.4	0.627	137.7							
49	0.544	125.2	2.157	100.7	0.0027	43.9	0.319	-147.3		99	0.449	177.4	0.007	-115.4	0.0006	-12.8	0.607	132.1							
50	0.531	122.6	3.905	52.8	0.0027	46.9	0.206	-155.1		100	0.466	158.1	0.010	-150.4	0.0011	-177.0	0.583	128.9							

Typical on chip measurements

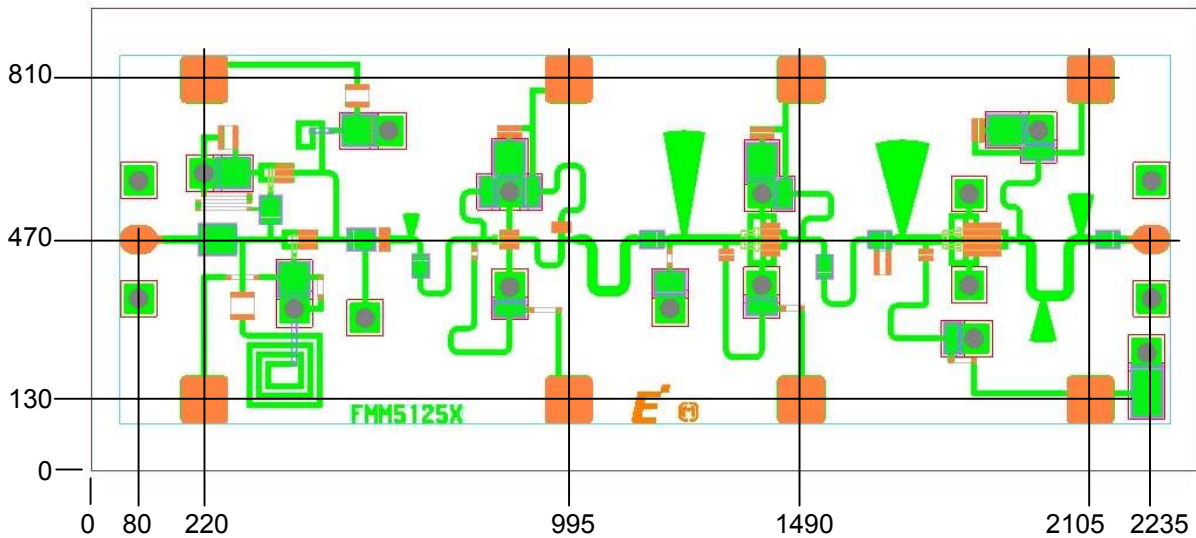
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CHIP OUTLINE



Bonding Pad Locations (Dimension in Micron Meters)



Pad Dimensions Unit; μm
 DC Pads; 100 x 100 μm Chip size; 2315 x 940 μm
 RF Pads; 80 x 60 μm Chip Thickness; 70 μm

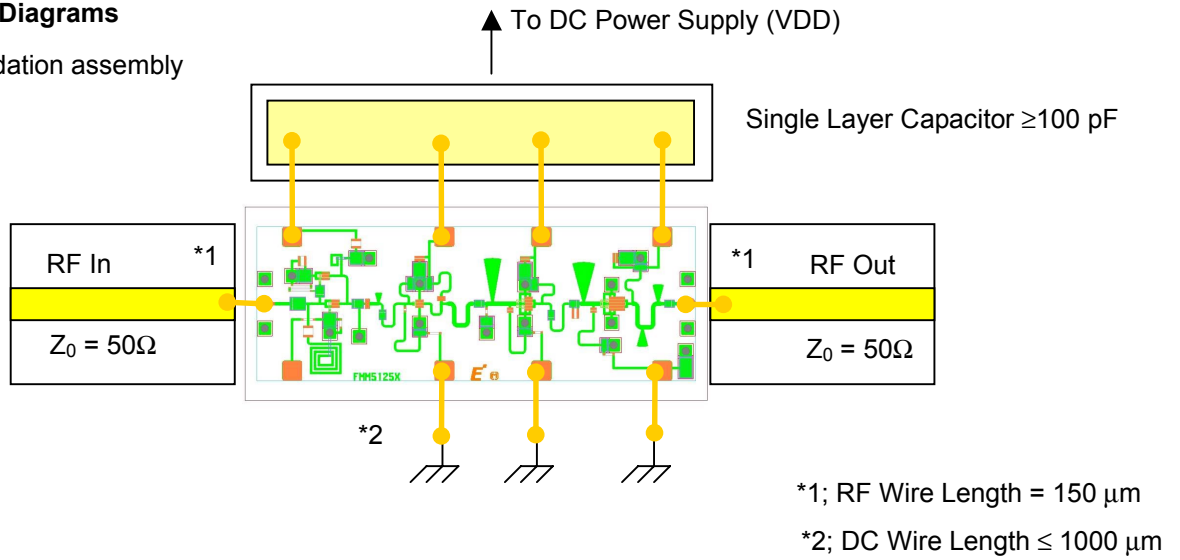
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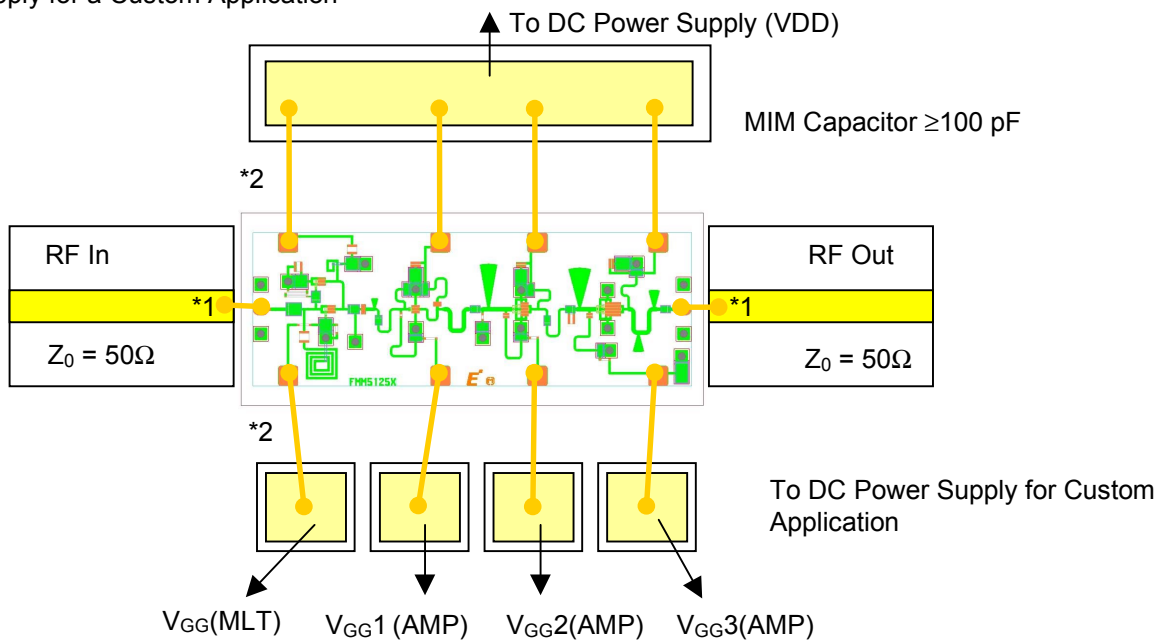
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Assembly Diagrams

Recommendation assembly



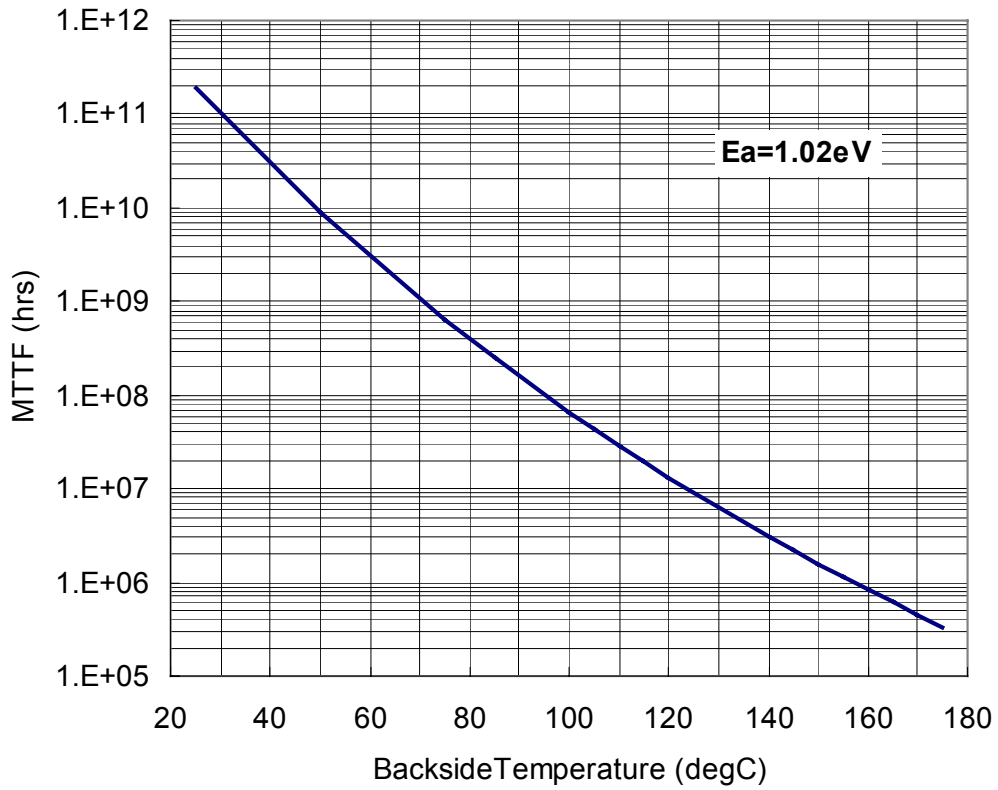
DC Power Supply for a Custom Application



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MTTF vs. Backside Temperature



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15/60GHz Frequency Multiplier MMIC

DIE ATTACH

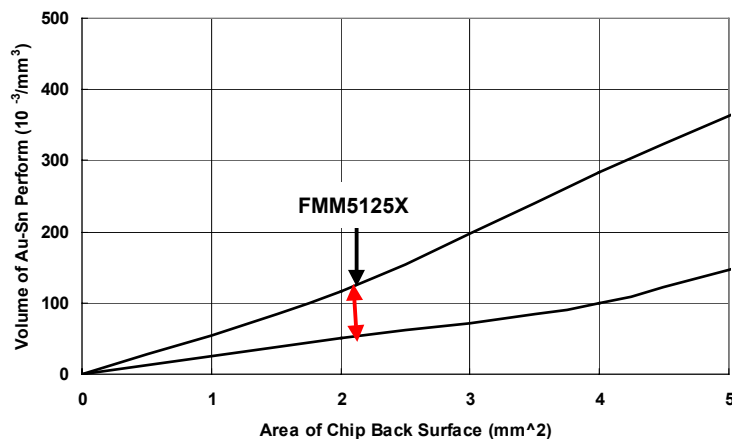
- 1) The die-attach station must have accurate temperature control, and an inert forming gas should be used.
- 2) Chips should be kept at room temperature except during die-attach.
- 3) Place package or carrier on the heated stage.
- 4) Lightly grasp the chip edges by the longer side using tweezers.

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

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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.

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