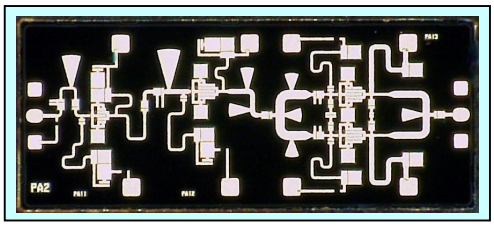
FMM5715X

60GHz Power Amplifier

FEATURES

- High Output Power; P1dB = 16 dBm (Typ.) @ f = 60 GHz
- High Linear Gain: $|S_{21}|$ = 17 dB(Typ) @ f = 60 GHz
- Wide Frequency Band : 57 - 64 GHz
- Impedance Matched Zin/Zout = 50Ω



DESCRIPTION

The FMM5715X is a power amplifier 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 Tc=25°C)

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

RECOMMENDED OPERATING CONDITION (Case Temperature Tc=25°C)

Item	Symbol	Condition	Unit
DC Input Voltage	V_{DD}	3	V
Backside Temperature	T_B	-45 to +85	°C

ELECTRICAL CHARACTERISTICS (Case Temperature Tc=25°C)

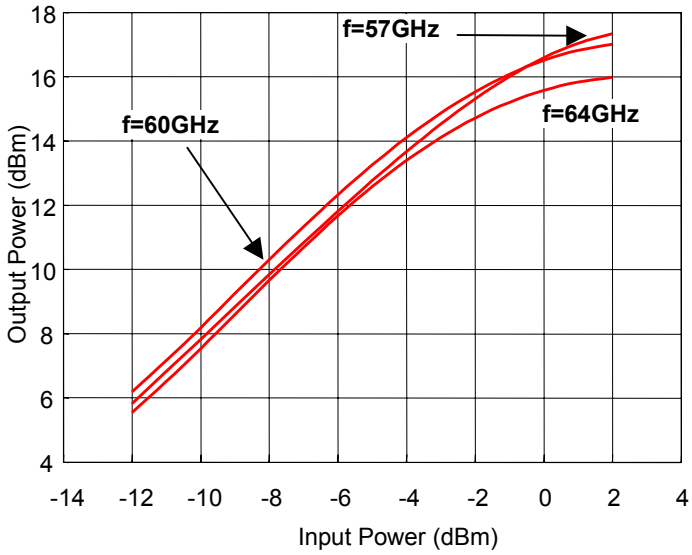
Item	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Output Power at 1dB G.C.P.	P1dB	V_{DD}=3V	12	16	-	dBm
Linear Gain	$\|S_{21}\|$	V_{GG}=0V	14	18	-	dB
Total Drain Current	IDDt	*f = 57~64 GHz*	-	150	-	mA
Input Return Loss	$\|S_{11}\|$		-	8	-	dB
Output Return Loss	$\|S_{22}\|$		-	8	-	dB

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

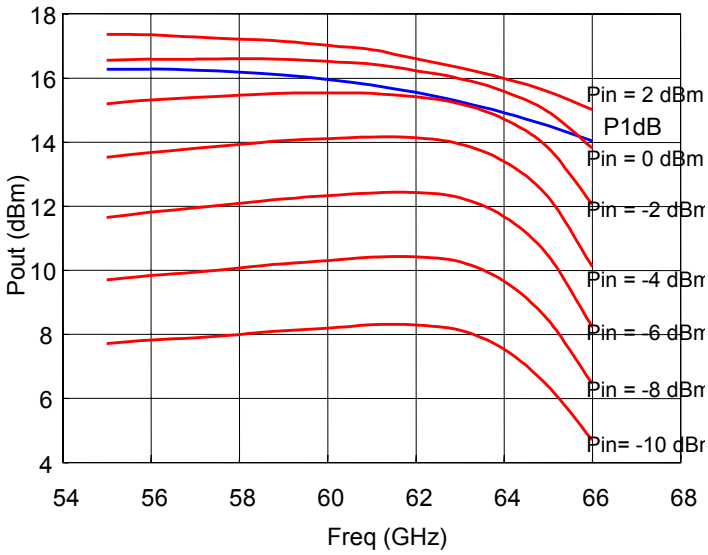
ESD	Class 0	~ 199V

Note : Based on EIAJ ED-4701 C-111A(C=100pF, R=1.5kΩ)

Output Power vs. Input Power
Bias Conditions: V_{DD} = 3V, V_{GG} = 0 V

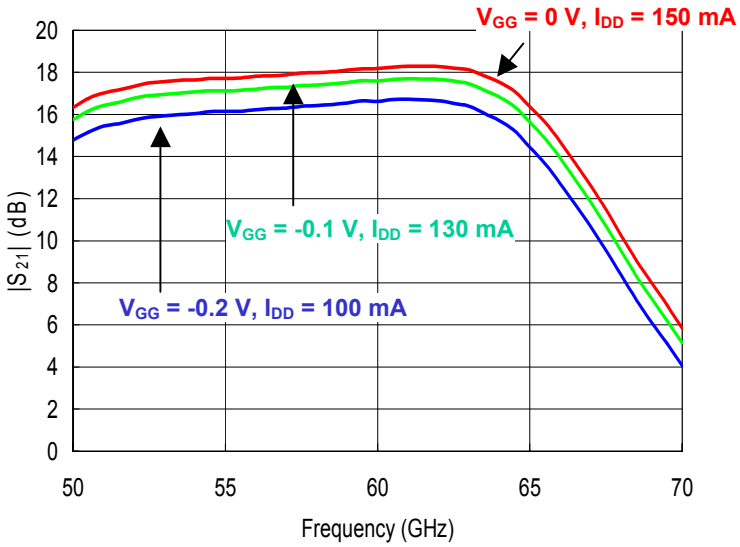


Output Power vs. Frequency
Bias Conditions: V_{DD} = 3V, V_{GG} = 0 V

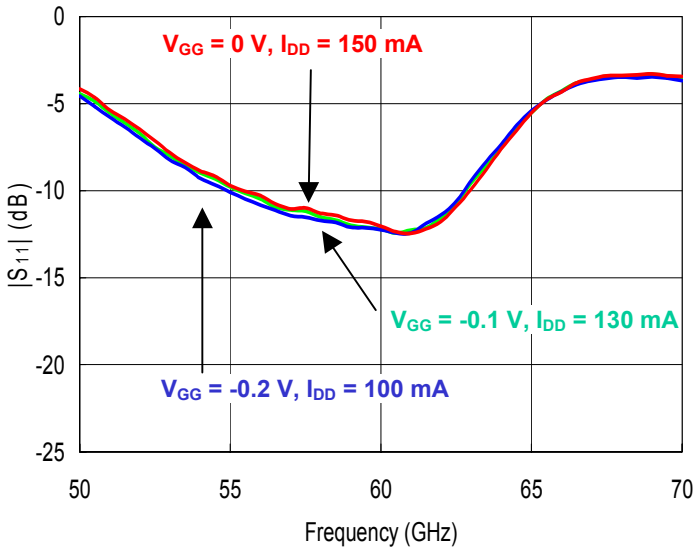


Typical on chip measurements

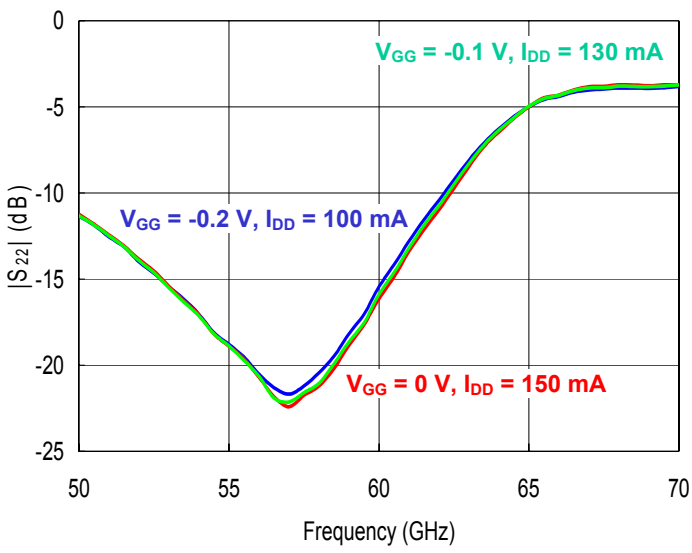
Linear Gain vs. Frequency
Bias Conditions: V_{DD} = 3V, V_{GG} = 0, -0.1, -0.2 V



Input Return Loss vs. Frequency
Bias Conditions: V_{DD} = 3V, V_{GG} = 0, -0.1, -0.2 V

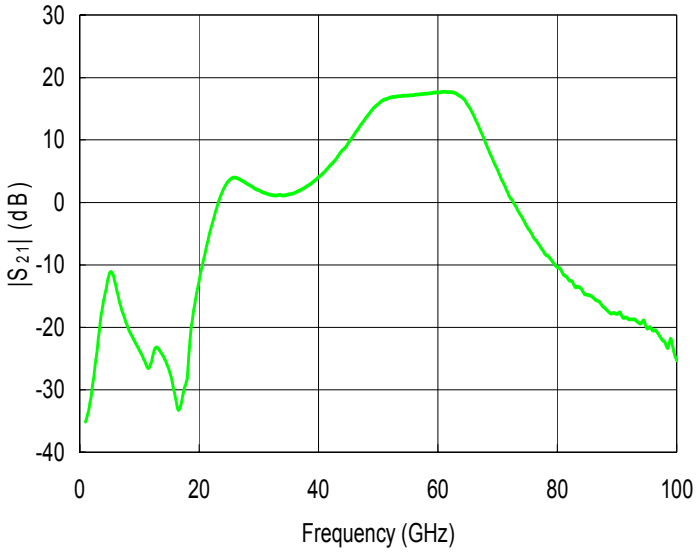


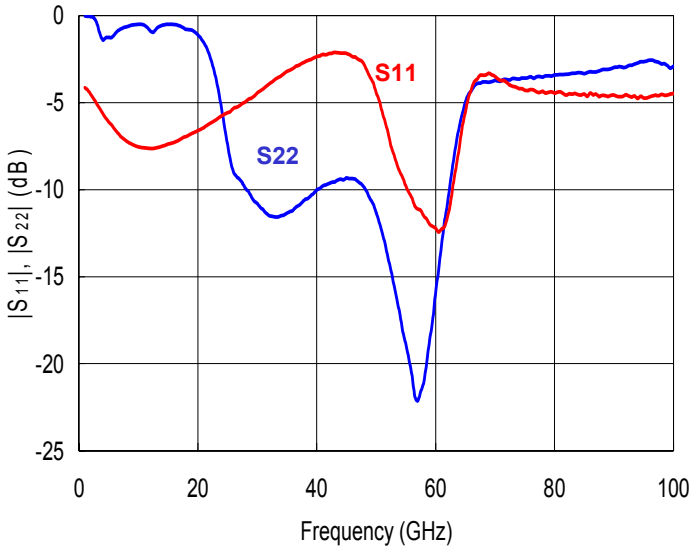
Output Return Loss vs. Frequency
Bias Conditions: V_{DD} = 3V, V_{GG} = 0, -0.1, -0.2 V



Typical on chip measurements

S-PARAMETERS
V_{DD} = 3V, V_{GG} = 0V, I_{DD} = 150 mA





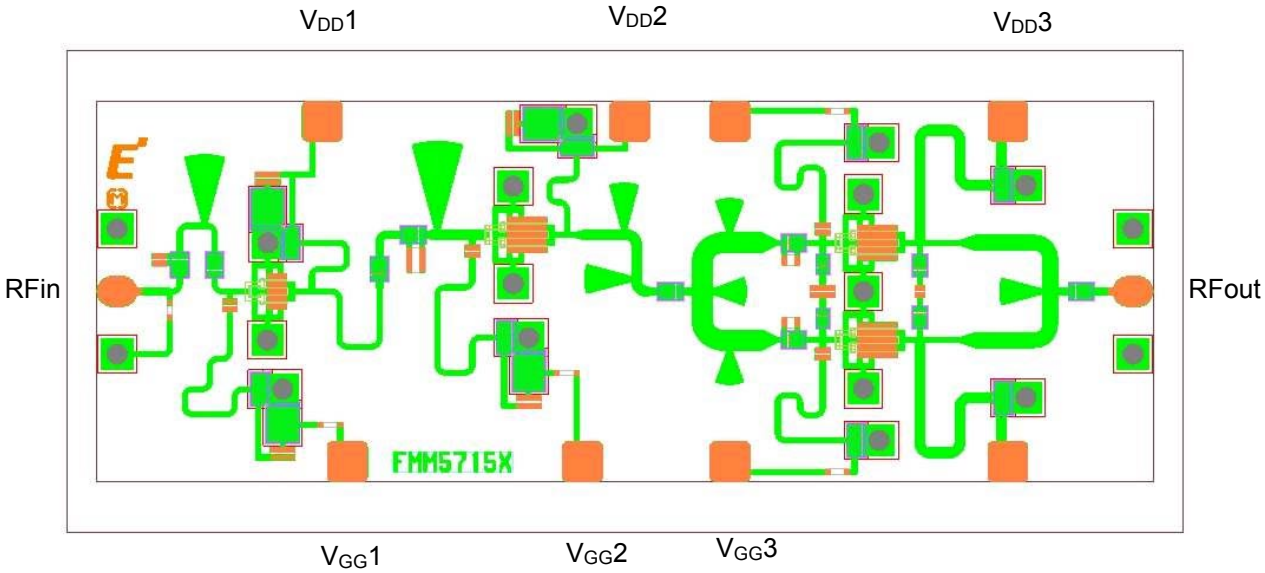
Typical on chip measurements

S-PARAMETERS
VDD = 3V, VGG = 0V, IDD= 150 mA

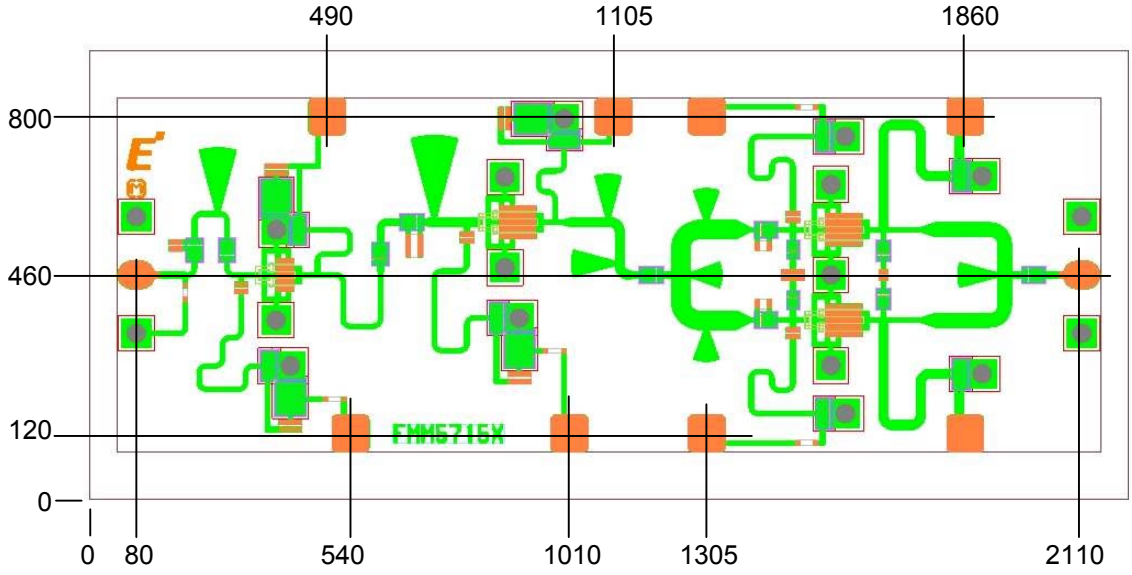
Freq	S11		S21		S12		S22		Freq	S11		S21		S12		S22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1	0.621	-14.4	0.017	-120.8	0.00014	-72.6	0.997	-11.7	51	0.539	63.0	7.091	-170.0	0.00306	86.8	0.239	126.3
2	0.594	-27.8	0.031	163.7	0.00010	99.9	0.994	-23.8	52	0.474	51.1	7.366	164.1	0.00443	77.6	0.203	119.0
3	0.557	-39.5	0.075	95.4	0.00029	65.9	0.952	-37.4	53	0.406	40.2	7.559	138.8	0.00442	66.8	0.170	112.6
4	0.523	-49.5	0.170	10.6	0.00060	-7.4	0.851	-43.9	54	0.360	29.1	7.621	113.2	0.00520	48.4	0.140	104.9
5	0.496	-57.9	0.290	-71.5	0.00072	-95.9	0.867	-50.7	55	0.327	17.3	7.686	89.6	0.00858	35.4	0.114	94.2
6	0.472	-65.8	0.237	-153.2	0.00037	-155.0	0.884	-57.2	56	0.306	3.3	7.781	64.9	0.00716	3.4	0.092	73.9
7	0.451	-72.3	0.153	164.6	0.00018	155.9	0.913	-65.9	57	0.280	-11.1	7.841	41.7	0.00672	-5.2	0.076	47.1
8	0.436	-77.8	0.110	139.6	0.00012	118.3	0.930	-74.8	58	0.272	-26.2	7.938	17.2	0.00558	-17.1	0.087	14.3
9	0.425	-82.9	0.086	122.5	0.00007	-41.9	0.939	-83.6	59	0.260	-41.3	8.046	-7.1	0.00725	-22.4	0.114	-12.7
10	0.419	-87.5	0.071	109.1	0.00017	-169.4	0.944	-92.3	60	0.250	-52.8	8.118	-32.4	0.00711	-57.6	0.156	-29.2
11	0.416	-91.7	0.056	101.6	0.00015	-161.2	0.938	-101.0	61	0.238	-58.3	8.218	-59.3	0.00784	-84.1	0.214	-39.9
12	0.415	-95.6	0.056	112.7	0.00035	177.6	0.904	-108.5	62	0.258	-59.3	8.207	-86.5	0.00681	-108.3	0.282	-49.9
13	0.416	-99.0	0.074	90.6	0.00032	36.7	0.916	-113.1	63	0.319	-62.2	8.059	-117.0	0.00671	-137.5	0.377	-60.3
14	0.420	-102.4	0.063	70.8	0.00026	8.6	0.938	-120.7	64	0.417	-70.1	7.527	-148.2	0.00818	-168.1	0.475	-73.7
15	0.426	-105.7	0.048	59.9	0.00017	-4.8	0.945	-128.4	65	0.529	-82.9	6.591	-179.3	0.00671	149.7	0.562	-87.0
16	0.431	-108.9	0.030	63.3	0.00059	-101.0	0.943	-136.1	66	0.608	-99.0	5.437	150.7	0.00734	112.2	0.608	-100.5
17	0.439	-111.8	0.026	110.9	0.00032	-106.7	0.934	-144.1	67	0.662	-114.1	4.272	122.6	0.00429	98.2	0.643	-111.5
18	0.449	-115.0	0.044	150.1	0.00101	-142.6	0.913	-151.4	68	0.678	-127.9	3.252	98.8	0.00629	70.4	0.651	-120.4
19	0.457	-118.3	0.135	142.7	0.00121	147.0	0.909	-159.4	69	0.685	-139.7	2.512	77.2	0.00633	70.3	0.647	-127.7
20	0.465	-120.9	0.254	122.9	0.00060	93.4	0.881	-168.6	70	0.672	-149.3	1.962	58.0	0.00578	61.1	0.652	-133.5
21	0.477	-123.9	0.424	99.8	0.00019	167.5	0.834	-178.2	71	0.652	-158.2	1.543	39.8	0.00716	52.8	0.652	-138.5
22	0.488	-126.5	0.668	73.6	0.00028	-175.4	0.765	171.7	72	0.644	-165.6	1.209	23.7	0.00683	33.0	0.656	-143.0
23	0.501	-129.5	0.995	42.7	0.00055	-99.4	0.664	162.6	73	0.628	-171.6	1.007	7.4	0.00710	25.4	0.659	-147.5
24	0.513	-132.1	1.341	8.8	0.00103	-157.2	0.540	155.6	74	0.619	-177.6	0.827	-8.1	0.00660	20.9	0.663	-151.0
25	0.525	-135.2	1.607	-27.4	0.00193	168.1	0.424	154.7	75	0.609	177.7	0.675	-21.7	0.00819	19.7	0.658	-154.5
26	0.541	-137.9	1.713	-62.7	0.00154	159.5	0.355	160.3	76	0.605	172.2	0.562	-34.4	0.00823	14.0	0.665	-158.0
27	0.551	-141.2	1.633	-93.4	0.00174	149.5	0.340	165.3	77	0.611	167.2	0.497	-47.0	0.00701	-4.7	0.667	-160.9
28	0.565	-144.1	1.530	-118.8	0.00157	115.7	0.321	166.5	78	0.608	161.8	0.420	-60.0	0.01034	-3.8	0.663	-163.9
29	0.578	-146.8	1.431	-141.8	0.00233	105.5	0.304	168.0	79	0.600	156.2	0.367	-72.4	0.00994	-20.5	0.673	-166.8
30	0.599	-150.1	1.355	-161.5	0.00132	94.0	0.291	170.1	80	0.602	150.6	0.328	-84.8	0.00836	-20.5	0.674	-169.3
31	0.615	-153.4	1.284	-179.5	0.00094	64.0	0.279	172.7	81	0.599	145.5	0.288	-96.8	0.00812	-35.3	0.675	-172.2
32	0.636	-157.1	1.241	164.4	0.00089	83.0	0.268	174.8	82	0.594	139.6	0.262	-112.8	0.00798	-44.6	0.676	-174.6
33	0.655	-160.8	1.223	148.5	0.00098	118.6	0.264	177.4	83	0.592	134.8	0.233	-123.3	0.00873	-59.2	0.680	-177.4
34	0.671	-165.2	1.221	133.4	0.00110	117.8	0.266	-179.6	84	0.591	129.0	0.214	-136.8	0.01010	-62.9	0.683	-179.3
35	0.693	-169.3	1.249	118.5	0.00084	100.7	0.269	-178.2	85	0.596	122.6	0.179	-147.9	0.00993	-79.3	0.679	178.1
36	0.708	-173.5	1.277	105.4	0.00137	97.6	0.274	-177.0	86	0.592	116.9	0.180	-162.7	0.00722	-97.1	0.683	176.0
37	0.723	-178.4	1.349	91.1	0.00151	101.2	0.282	-176.1	87	0.594	110.4	0.174	-175.5	0.00510	-117.5	0.688	174.2
38	0.733	176.6	1.432	77.2	0.00222	84.0	0.294	-176.7	88	0.588	103.9	0.157	168.8	0.00493	-104.3	0.697	172.0
39	0.752	171.3	1.544	63.4	0.00159	75.6	0.301	-177.0	89	0.591	97.1	0.149	154.2	0.00488	-92.7	0.699	169.4
40	0.764	165.7	1.702	49.2	0.00181	85.4	0.313	-178.1	90	0.584	90.6	0.139	137.5	0.00399	-97.3	0.703	167.0
41	0.775	159.6	1.878	34.0	0.00218	51.3	0.321	179.6	91	0.593	82.6	0.133	123.7	0.00317	-136.6	0.714	164.4
42	0.782	153.3	2.114	19.3	0.00182	70.5	0.327	177.2	92	0.584	75.9	0.123	108.4	0.00200	-111.8	0.712	162.3
43	0.788	146.0	2.388	3.2	0.00176	47.2	0.331	174.1	93	0.586	68.4	0.125	91.0	0.00256	-104.6	0.721	159.8
44	0.787	138.6	2.779	-14.0	0.00248	60.8	0.337	170.8	94	0.583	59.6	0.113	72.3	0.00254	14.5	0.735	157.6
45	0.785	130.4	3.178	-32.0	0.00156	37.4	0.341	166.8	95	0.582	53.5	0.115	52.9	0.00210	-8.0	0.737	154.5
46	0.776	121.7	3.717	-50.8	0.00149	38.9	0.340	162.1	96	0.584	45.5	0.104	27.2	0.00369	-8.0	0.743	151.1
47	0.759	110.9	4.379	-71.9	0.00133	123.7	0.333	155.8	97	0.582	37.5	0.091	13.9	0.00491	-9.6	0.739	147.0
48	0.730	99.9	5.101	-93.8	0.00158	65.1	0.321	148.7	98	0.589	30.9	0.078	-13.9	0.00359	-27.7	0.731	144.9
49	0.680	87.9	5.891	-118.2	0.00239	89.0	0.299	142.1	99	0.587	23.4	0.082	-34.7	0.00488	-22.7	0.715	142.2
50	0.620	75.0	6.554	-143.2	0.00188	97.9	0.275	134.2	100	0.595	15.9	0.057	-63.6	0.00667	-38.3	0.717	141.6

Typical on chip measurements

CHIP OUTLINE



Bonding Pad Locations (Dimension in Micron Meters)

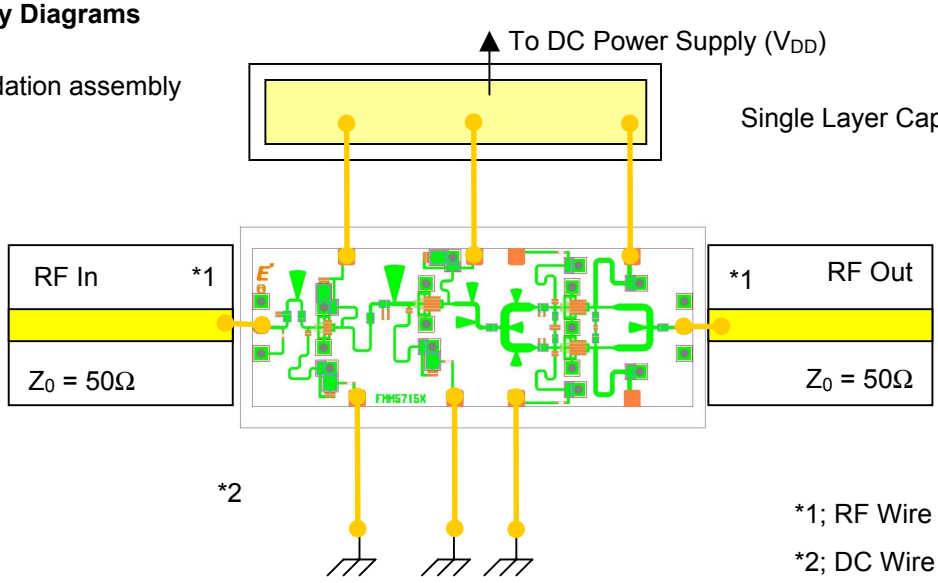


Pad Dimensions
DC Pads; 80 x 80 μm
RF Pads; 80 x 60 μm

Unit; μm
Chip size; 2190 x 920 μm
Chip Thickness; 70 μm

Assembly Diagrams

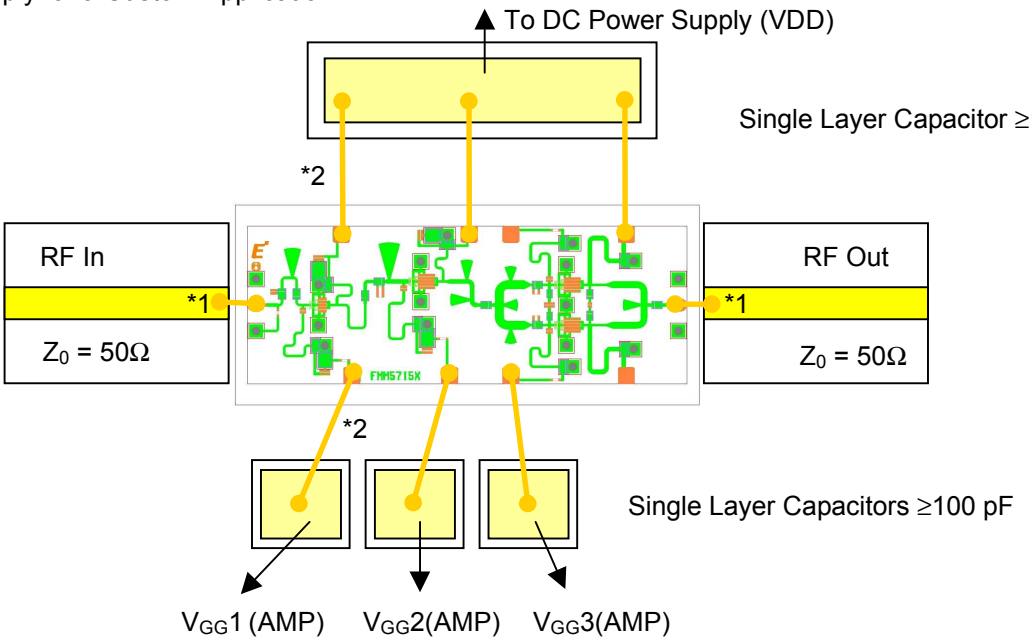
Recommendation assembly



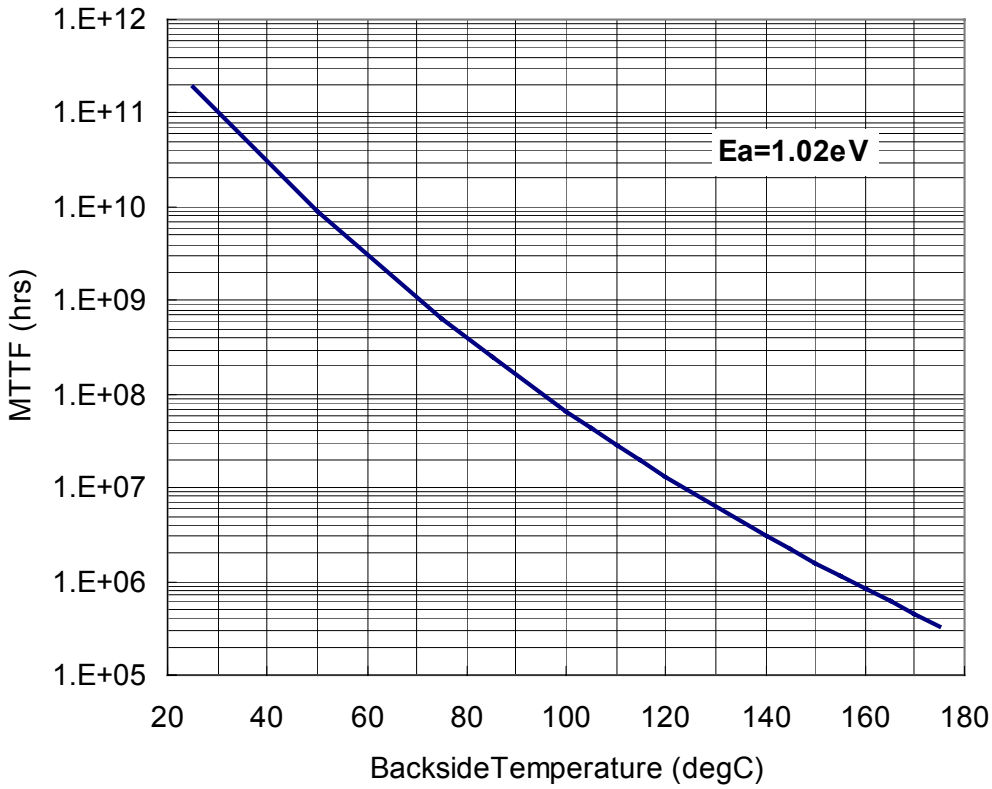
*1; RF Wire Length = 150 µm

*2; DC Wire Length ≤ 1000 µm

DC Power Supply for a Custom Application

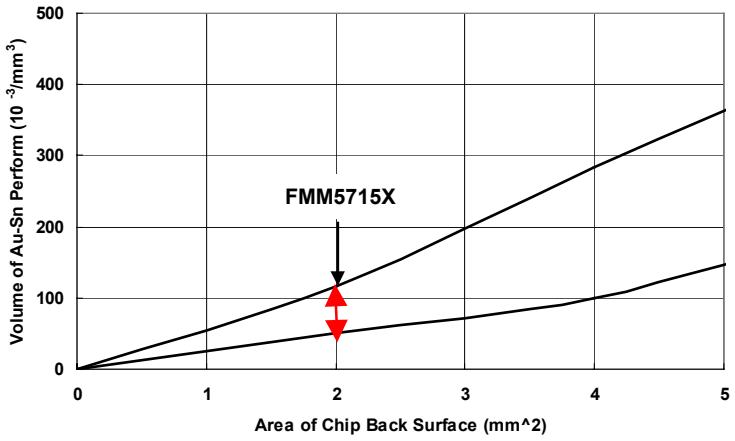


MTTF vs. Backside Temperature



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.