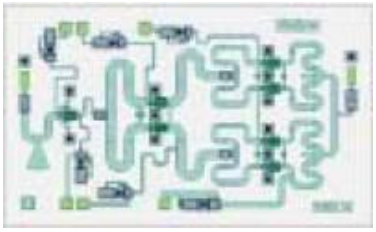
FMM5714X

37-42GHz Low Noise Amplifier MMIC

FEATURES

- Low Noise Figure : NF = 3dB (Typ.)
- High Associated Gain : Gas = 22dB (Typ.)
- Wide Frequency Band : 37 to 42GHz
- High Output Power : P1dB = 20dBm (Typ.) @f=42GHz
- Impedance Matched Zin/Zout = 50ohm



DESCRIPTION

The FMM5714X is a LNA MMIC designed for applications in the 37 to 42 GHz frequency range. This product is well suited for satellite communications, radio link, and applications where low noise and high dynamic range are required.
Sumitomo Electric'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}	18	dBm
Storage Temperature	T_{stg}	-55 to +125	deg.C

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Condition	Unit
Drain-Source Voltage	V_{DD}	<= 3	V
Inpur Power	P_{in}	8	dBm
Operating Backside Temperature	T_{op}	-40 to +85	deg.C

* This product should be hermetically packaged.

ELECTRICAL CHARACTERISTICS (Ambient Temperature Ta=25deg.C)

Item	Symbol	Test Conditions	Limit			Unit
			Min.	Typ.	Max.	
Frequency	Freq.	V_{DD}=3V $I_{DD(DC)}$=200mA f=37GHz	37	-	42	GHz
Associate Gain	Gas		17	22	-	dB
Noise Figure	NF		-	3	4	dB
Gate Voltage	Vgg		-0.8	-0.25	-0.01	V
Input Return Loss	RL_{IN}		-	-10	-	dB
Output Return Loss	RL_{OUT}		-	-10	-	dB
1dB Compression Output Power	P1db	V_{DD}=3V, $I_{DD(DC)}$=200mA *1: f=37GHz, *2: f=42GHz	-	17 *1 20 *2	-	dBm

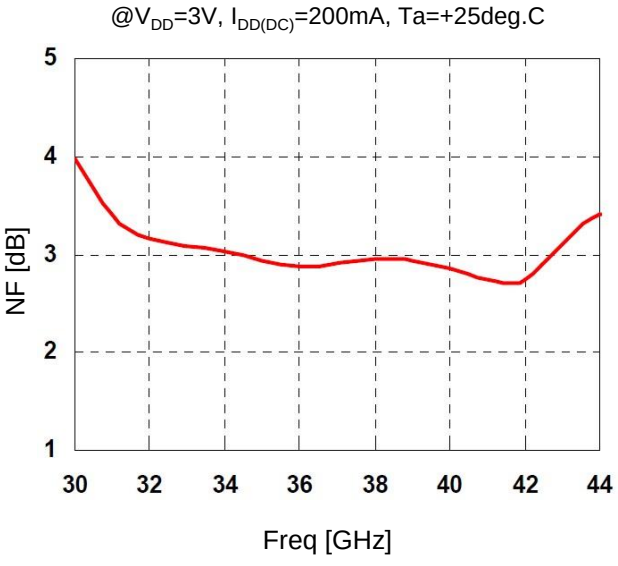
* The Electrical Characteristics are guaranteed by the wafer acceptance test, the number of the sample is 10pcs/wafer.
Criteria (accept,reject)=(0,1)

ESD	Class 0A	Up to 125V

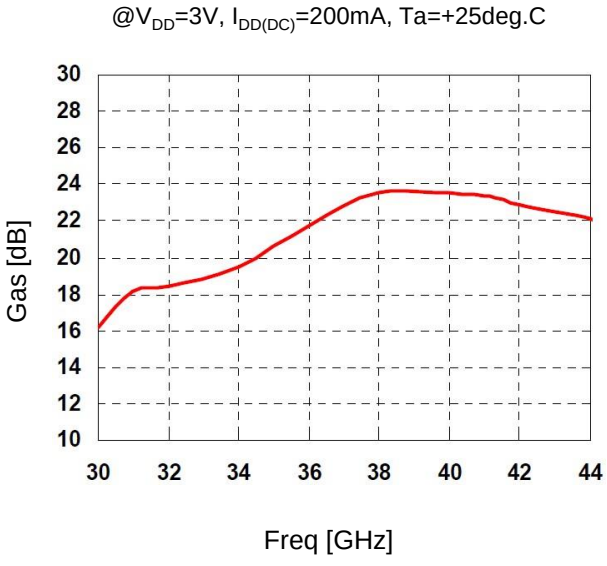
Note : Based on ANSI/ESDA/JEDEC JS-001-2012 (C=100 pF, R=1500 ohm)

RoHS Compliance	Yes

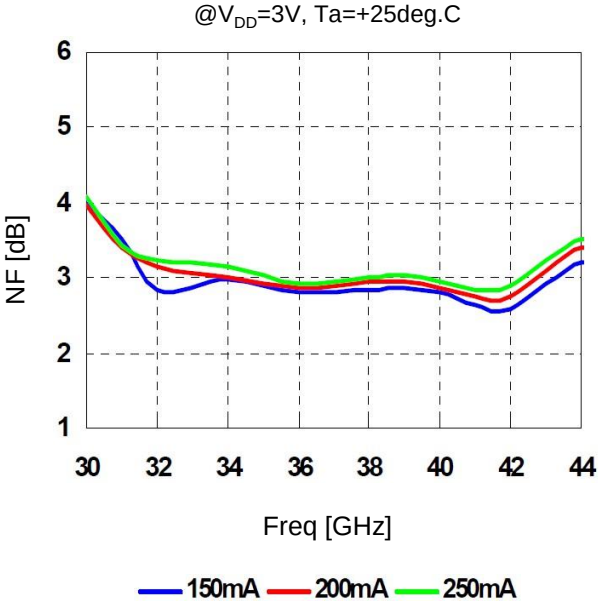
Frequency vs. NF



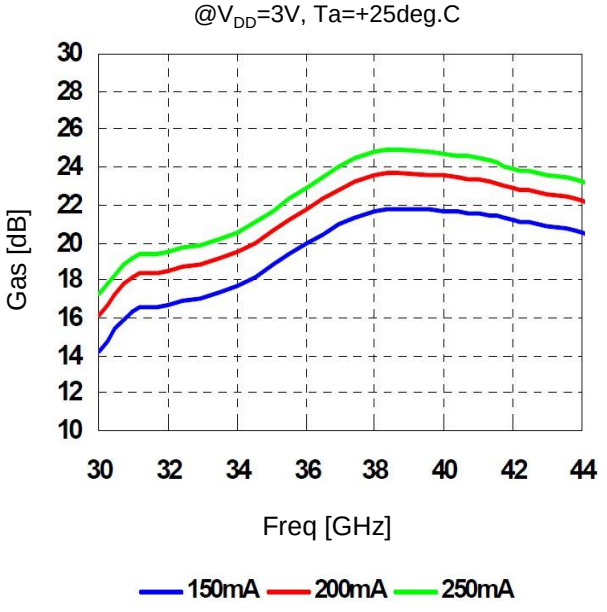
Frequency vs. Gas



Frequency vs. NF by Drain Current

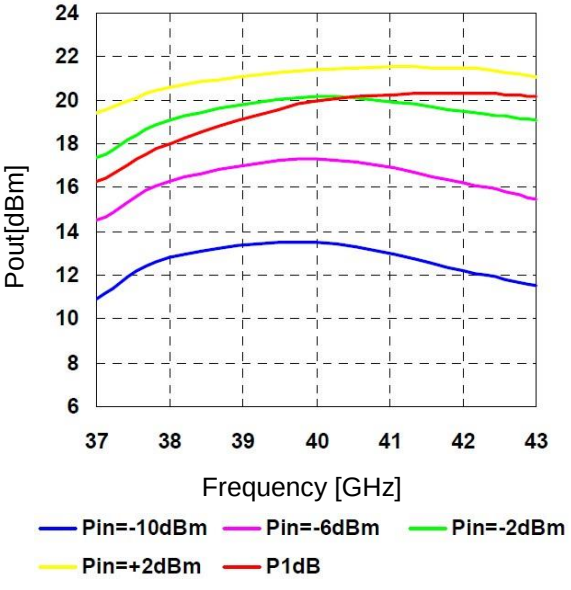


Frequency vs. Gas by Drain Current



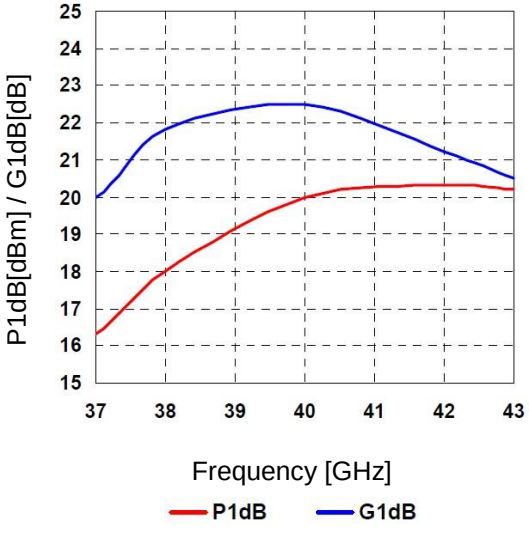
Frequency vs. Output Power

V_{DD}=3V, $I_{DD(DC)}$=200mA, Ta=+25deg.C



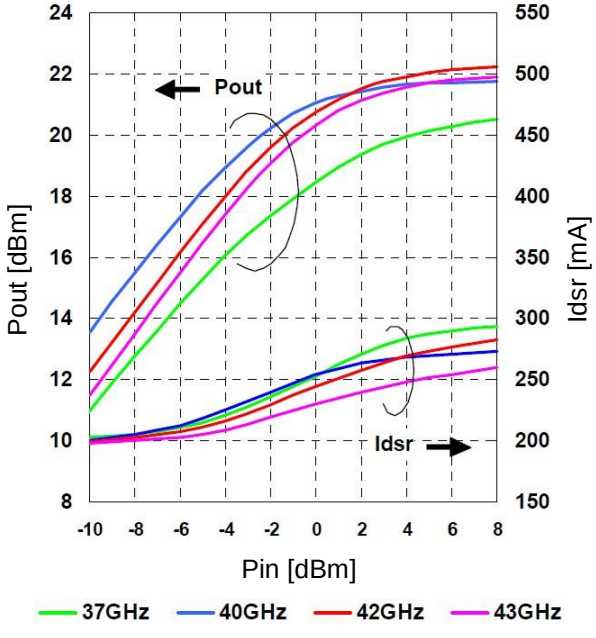
Frequency vs. P1dB, G1dB

V_{DD}=3V, $I_{DD(DC)}$=200mA, Ta=+25deg.C



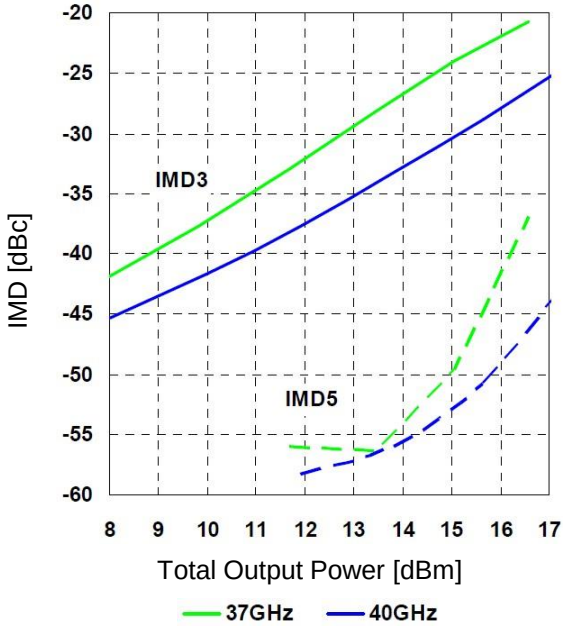
Input Power vs. Output Power by Frequency

V_{DD}=3V, $I_{DD(DC)}$=200mA, Ta=+25deg.C

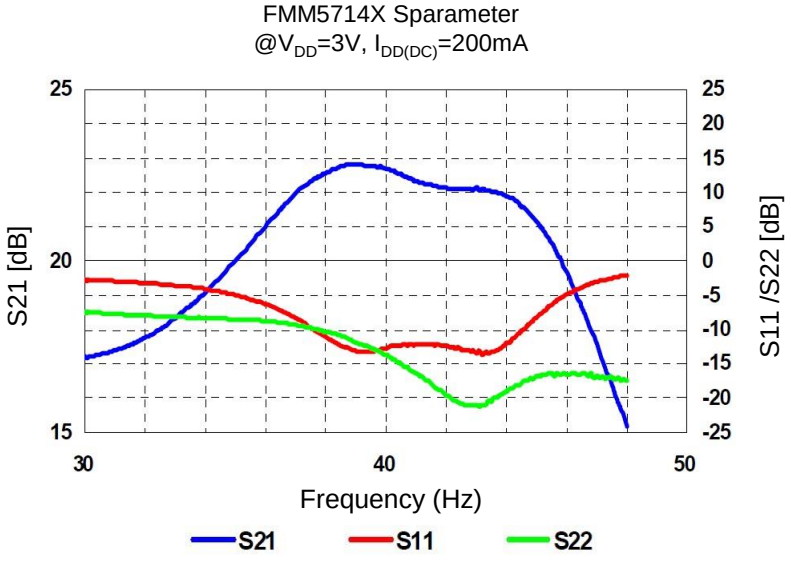


Output Power vs. IMD by Frequency

V_{DD}=3V, $I_{DD(DC)}$=200mA, Ta=+25deg.C

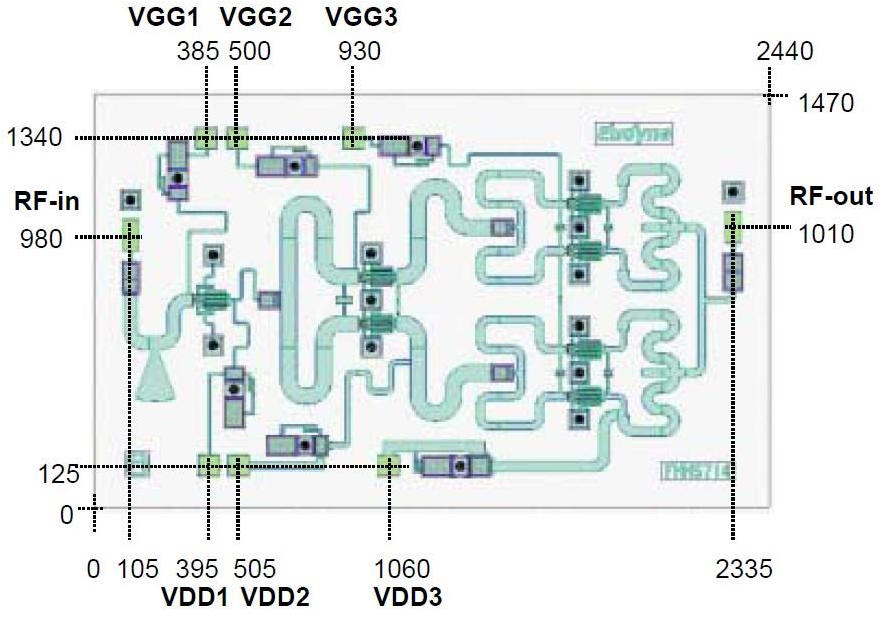


Frequency vs. S-parameter



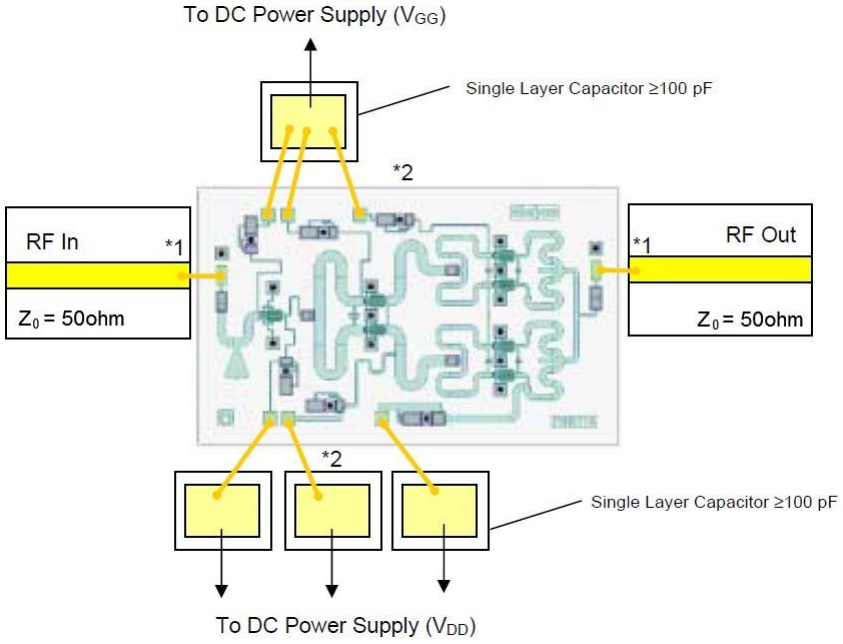
Freq	S11		S21		S12		S22	
[GHz]	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
20	7.307E-01	161.795	6.344E+00	33.064	1.120E-03	60.408	6.547E-01	94.414
21	7.491E-01	150.815	6.074E+00	7.843	7.360E-04	56.073	6.498E-01	84.424
22	7.621E-01	139.992	6.057E+00	-17.404	9.560E-04	39.483	6.442E-01	74.011
23	7.704E-01	129.143	6.234E+00	-43.478	1.120E-03	23.603	6.317E-01	62.861
24	7.770E-01	118.029	6.524E+00	-70.991	6.550E-04	57.911	6.162E-01	50.954
25	7.805E-01	106.767	6.828E+00	-99.959	8.850E-04	16.203	5.890E-01	39.121
26	7.782E-01	95.403	7.065E+00	-129.682	1.080E-03	37.569	5.534E-01	27.537
27	7.731E-01	83.326	7.176E+00	-159.922	9.330E-04	21.448	5.139E-01	16.458
28	7.648E-01	71.303	7.201E+00	170.493	1.190E-03	4.984	4.790E-01	6.739
29	7.520E-01	58.741	7.198E+00	141.590	1.550E-03	-6.654	4.487E-01	-2.352
30	7.356E-01	45.543	7.250E+00	113.695	1.610E-03	-21.313	4.285E-01	-11.528
31	7.173E-01	31.728	7.417E+00	86.259	1.180E-03	-40.743	4.119E-01	-20.788
32	6.932E-01	16.475	7.737E+00	58.927	1.900E-03	-56.644	4.011E-01	-30.733
33	6.635E-01	-0.340	8.256E+00	31.147	1.610E-03	-85.699	3.905E-01	-41.355
34	6.227E-01	-19.267	9.020E+00	2.457	2.220E-03	-100.607	3.839E-01	-52.903
35	5.653E-01	-42.284	1.002E+01	-27.979	2.130E-03	-121.943	3.756E-01	-65.667
36	4.844E-01	-69.836	1.124E+01	-60.421	2.670E-03	-159.016	3.651E-01	-80.545
37	3.859E-01	-105.954	1.254E+01	-95.784	2.920E-03	165.831	3.432E-01	-97.616
38	2.787E-01	-153.478	1.344E+01	-133.615	3.300E-03	131.808	3.065E-01	-116.820
39	2.236E-01	143.119	1.381E+01	-172.525	4.080E-03	101.869	2.565E-01	-139.190
40	2.301E-01	83.597	1.364E+01	149.372	6.110E-03	80.131	2.070E-01	-161.072
41	2.485E-01	33.693	1.310E+01	112.139	6.660E-03	30.864	1.526E-01	173.676
42	2.426E-01	-11.429	1.279E+01	76.178	6.710E-03	-0.401	1.045E-01	140.538
43	2.125E-01	-65.985	1.281E+01	38.666	4.130E-03	-61.339	9.016E-02	90.072
44	2.528E-01	-136.481	1.243E+01	-1.992	4.050E-03	-56.373	1.116E-01	30.051
45	3.872E-01	160.895	1.143E+01	-44.778	3.620E-03	-81.657	1.458E-01	-10.864
46	5.721E-01	115.906	9.624E+00	-87.747	6.370E-03	-114.300	1.490E-01	-41.133
47	7.046E-01	80.994	7.553E+00	-127.596	6.920E-03	179.801	1.459E-01	-66.783
48	7.907E-01	54.301	5.752E+00	-163.638	2.290E-03	139.551	1.343E-01	-88.721

Chip Outline and Bonding PAD Locations



Chip Size : 2.44 x 1.47 mm
Chip Thickness : 60 um +/- 20um
Bonding Pad Size
RF-in/out : 60 x 120 um
DC : 80 x 80 um

Bonding Layout and Recommended External Circuit

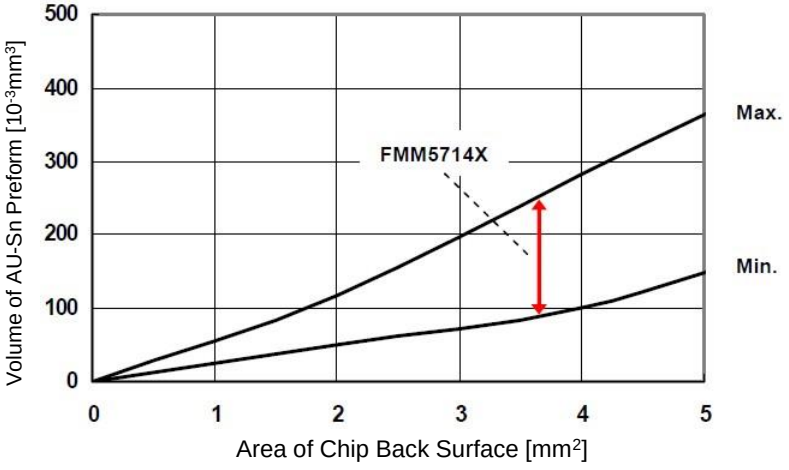


*1; RF Wire Length < 200 µm
*2; DC Wire Length < 1000 µm

"Copper" is the recommended material for the package or carrier.

■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 Preform Volume : see below Figure



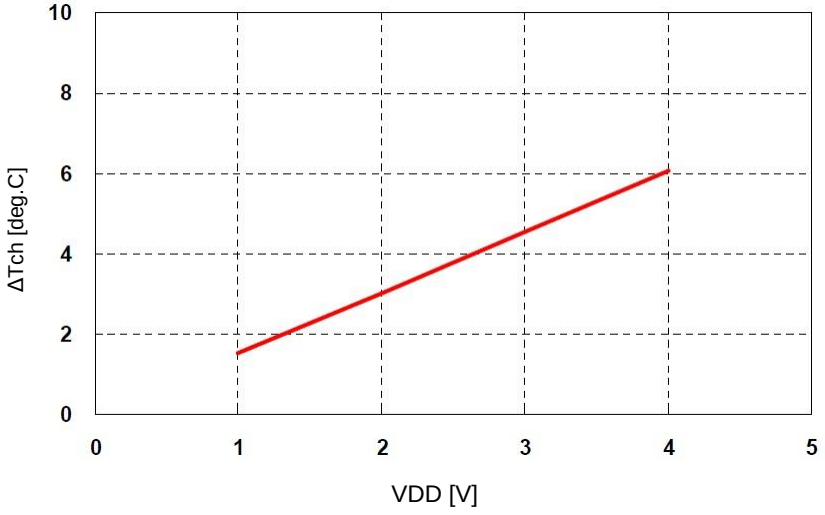
■ WIRE BONDING

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

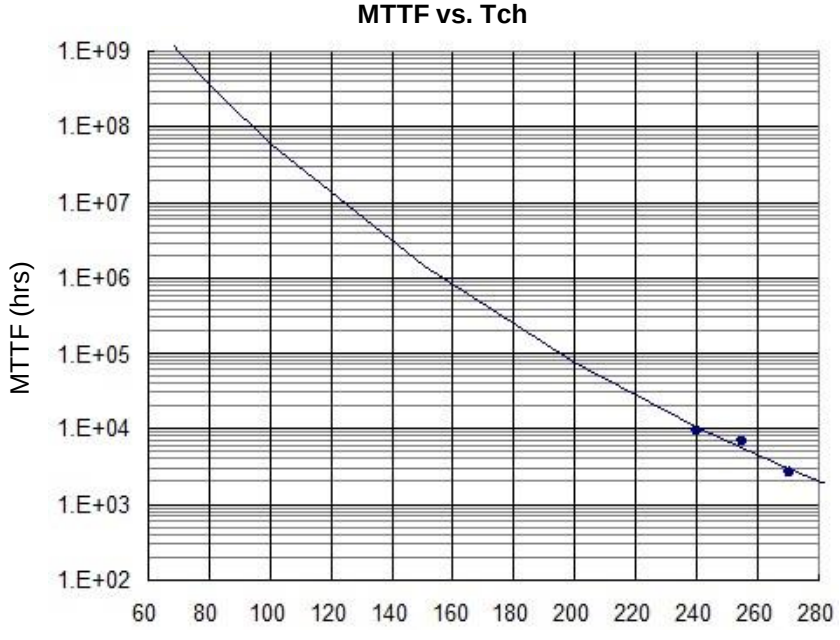
Reliability Data

⊿Tch vs. Drain Voltage
(Reference)
IDD=200mA



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

MTTF vs. Tch



■ BARE DIE INDEMNIFICATION

All devices are DC probed and visually inspected at SEI, and non-compliant devices are removed. The RF electrical characteristics of the bare dice are warranted by the sampling inspection procedures. The standard sampling inspection procedure shall include the number of the sampling dice, position of the sampling dice in the wafer and RF electrical characteristics of the sampling dice measured in the test fixture. Customer shall understand that all the bare dice will not be 100% RF tested by SEI. It is the customer responsibility to verify performance of the devices.

Customer shall comply with the storage and handling requirements for condition and period of storage of the bare dice agreed by customer and SEI. Warranty will not apply when customer disregards the storage and handling requirements.

Warranty will not apply to the electrical characteristics and product quality to the bare dice after assembly by customer.

SEI will indemnify customer for warranty failures, provided however that the indemnification to customer shall be limited to supply of bare dice for substitution.

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.