MGA-24106

High-Gain, Low Current Low Noise Amplifier
with Variable Current and Shutdown Function

Data Sheet

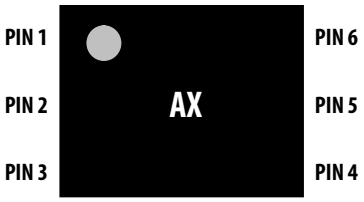
Description

Avago Technologies' MGA-24106 is a low-noise amplifier (LNA) designed for GPS/ISM/WiMAX applications in the (0.9-3.5) GHz frequency range. The LNA uses Avago Technologies' proprietary GaAs Enhancement-mode pHEMT process to achieve high gain with very low noise figure and high linearity. Noise figure distribution is very tightly controlled. A CMOS-compatible shutdown pin is included either for turning the LNA on/off, or for current adjustment.

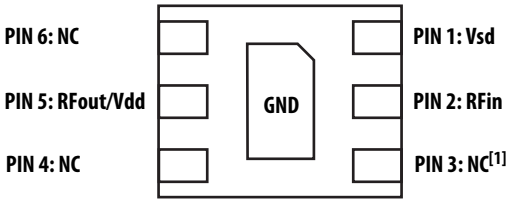
The low noise figure and high gain, coupled with low current consumption make it suitable for use in critical low-power GPS applications or during low-battery operation.

Component Image

Surface Mount 1.5x1.2x0.5 mm³ 6-lead uDFN



Top View



Bottom View

Note:
Package marking provides orientation and identification
"A" = Product Code
"X" = Year & work week of manufacture
[1] PIN 3 must be left unconnected



Attention: Observe precautions for handling electrostatic sensitive devices.
ESD Machine Model = 50 V
ESD Human Body Model = 250 V
Refer to Avago Application Note A004R: Electrostatic Discharge, Damage and Control.

Features

- Very Low Noise Figure : 0.97dB typical
- High Gain : 17.9 dB typical
- High IIP3 and IP1dB
- Advanced GaAs E-pHEMT
- Low external component count
- Shutdown current : < 5 uA
- CMOS compatible shutdown pin (SD) current at 2.7V drawing 80uA
- Useable down to 1.8V supply
- Adjustable current via single external resistor/voltage
- Small package dimension: 1.5(L)x1.2(W)x0.5(H) mm³

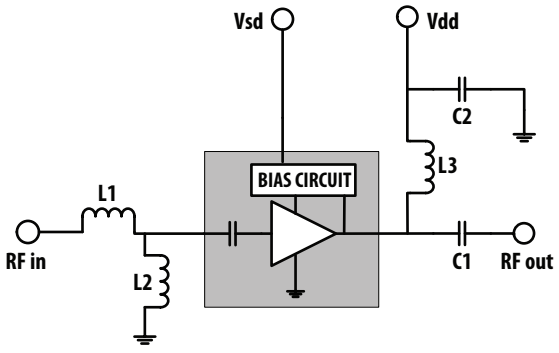
Specifications (Typical performance @ 25°C)

At 1.575GHz

- Vdd = 2.7V, Vsd = 2.7V, Idd = 3.3mA,
  - Gain = 17.9 dB
  - NF = 0.97 dB
  - IIP3 = -2.0 dBm, IP1dB = -9.7 dBm
  - S11 = -9.3 dB, S22 =-13 dB
- Vdd = 3.3V, Vsd = 3.3V, Idd = 6.0 mA,
  - Gain = 19.6 dB
  - NF = 0.87 dB
  - IIP3 = -0.2 dBm, IP1dB = -8.7 dBm
  - S11 = -9.5 dB, S22 =-20 dB

Application

- LNA for GPS, Cellular, PCS , UMTS, WLAN, WiMAX, LTE applications.



Absolute Maximum Rating[1] $T_A = 25°C$

Symbol	Parameter	Units	Absolute Max.
Vdd	Device Drain to Source Voltage[2]	V	4
Idd	Drain Current[2]	mA	15
$P_{in,max}$	CW RF Input Power (Vdd = 2.7V, Idd = 3.3mA)	dBm	13
P_{diss}	Total Power Dissipation 3]	mW	60
T_c[4]	Recommended Operating Temperature[5]	°C	-40 to +85
T_j	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150

Notes:
1. Operation of this device in excess of any of these limits may cause permanent damage.
2. Assuming DC quiescent conditions.
3. Board (module belly) temperature TB is 25°C. Derate 5.4 mW/°C for Tb > 138.9°C.
4. T_c is defined as case temperature, the temperature of the underside of the device where it makes contact with the circuit board.
5. The device will function over the recommended range without degradation in reliability or permanent change in performance, but is not guaranteed to meet the electrical specification.

Thermal Resistance (6)
(Vdd = 2.7V, Idd = 3.3mA)
$\theta_{jc} = 185.0°C/W$

Notes:
6. Thermal resistance measured using Infra-Red measurement technique.

Electrical Specifications

T_A = 25°C, DC bias for RF parameters is as specified below. Freq=1.575GHz – Typical Performance[1]

Table 1a. Performance table under nominal operating conditions (Vdd = Vsd=1.8V, Idd = 3.3mA, R2 = 4.7 kOhm)

Symbol	Parameter and Test Condition	Units	Min.	Typ	Max.
G	Gain	dB	–	16.8	–
NF	Noise Figure	dB	–	1.0	–
IP1dB	Input 1dB Compressed Power	dBm	–	-13.5	–
IIP3[2]	Input 3rd Order Intercept Point (2-tone @ Fc +/- 2.5MHz)	dBm	–	-2.4	–
S11	Input Return Loss	dB	–	-8.5	–
S22	Output Return Loss	dB	–	-12.0	–
S12	Reverse Isolation	dB	–	-23.5	–
Idd	Supply DC current at Vdd pin	mA	–	3.3	–
Isd	Supply DC Current at Vsd pin	mA	–	0.17	–
Ileak	Shutdown Current @ Vsd = 0V	uA	–	0.8	–

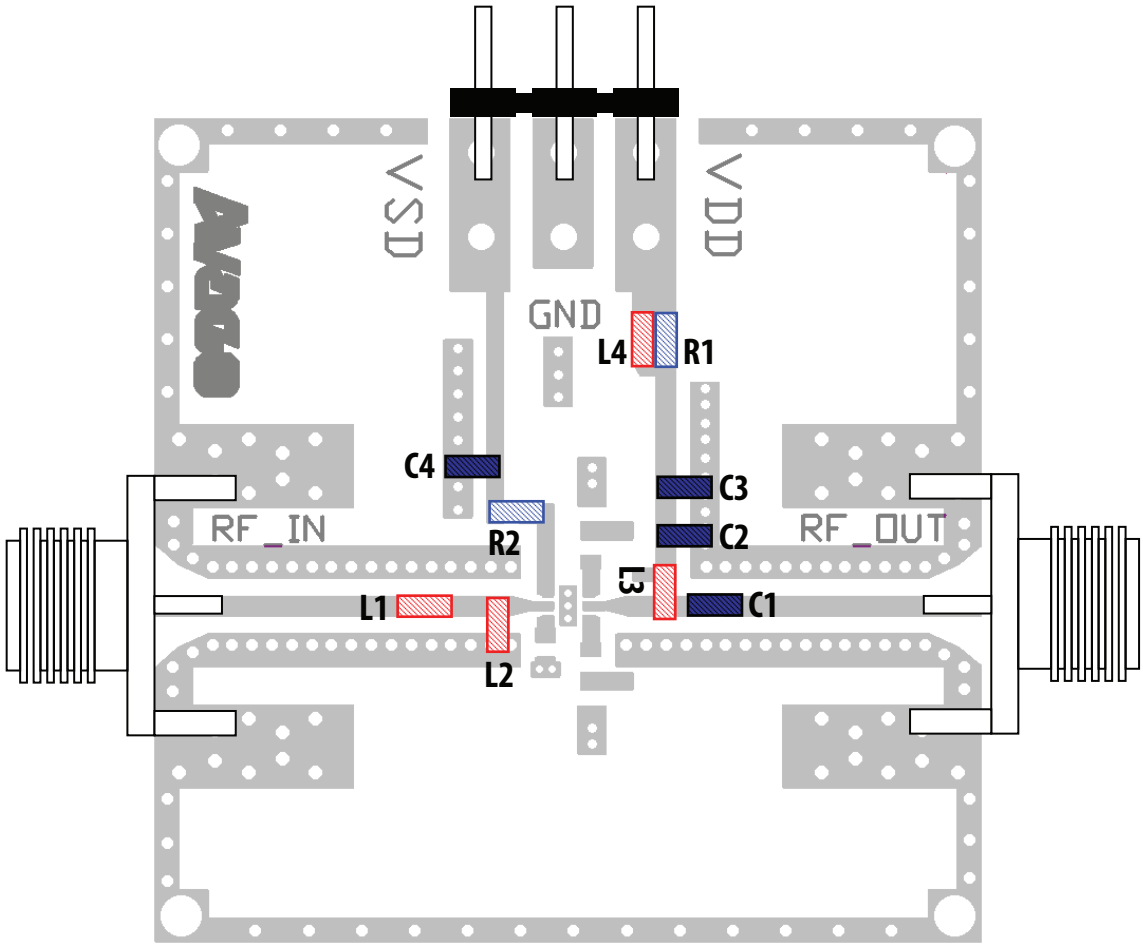
Table 1b. Performance table under nominal operating conditions (Vdd = Vsd =2.7V, Idd = 3.3mA, R2 = 27 kOhm)

Symbol	Parameter and Test Condition	Units	Min.	Typ	Max.
G	Gain	dB	16.2	17.9	20.5
NF	Noise Figure	dB	–	0.97	1.3
IP1dB	Input 1dB Compressed Power	dBm	–	-9.7	–
IIP3[2]	Input 3rd Order Intercept Point (2-tone @ Fc +/- 2.5MHz)	dBm	–	-2.0	–
S11	Input Return Loss	dB	–	-9.3	–
S22	Output Return Loss	dB	–	-13.0	–
S12	Reverse Isolation	dB	–	-24.0	–
Idd	Supply DC current at Vdd pin	mA	–	3.3	4.5
Isd	Supply DC Current at Vsd pin	mA	–	0.08	–
Ileak	Shutdown Current @ Vsd = 0V	uA	–	0.8	–

Table 1c. Performance table under nominal operating conditions (Vdd = Vsd =3.3V, Idd = 6.0mA, R2 = 11 kOhm)

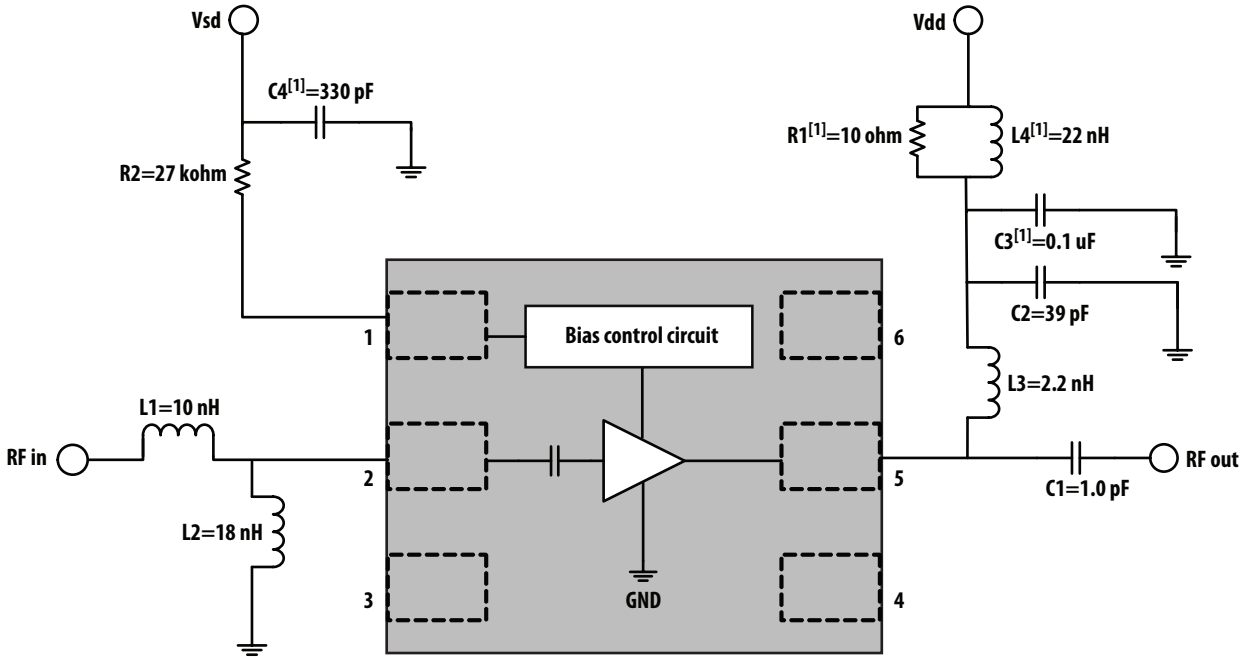
Symbol	Parameter and Test Condition	Units	Min.	Typ	Max.
G	Gain	dB	–	19.6	–
NF	Noise Figure	dB	–	0.87	–
IP1dB	Input 1dB Compressed Power	dBm	–	-8.7	–
IIP3[2]	Input 3rd Order Intercept Point (2-tone @ Fc +/- 2.5MHz)	dBm	–	0	–
S11	Input Return Loss	dB	–	-9.5	–
S22	Output Return Loss	dB	–	-20	–
S12	Reverse Isolation	dB	–	-26	–
Idd	Supply DC current at Vdd pin	mA	–	6.0	–
Isd	Supply DC Current at Vsd pin	mA	–	0.13	–
Ileak	Shutdown Current @ Vsd = 0V	uA	–	0.8	–

Notes:
1. Measurements at 1.575GHz obtained using demo board described in Figures 4 and 5.
2. 1.575GHz IIP3 test condition: F_{RF1} = 1572.5 MHz, F_{RF2} = 1577.5 MHz with input power of -30dBm per tone measured at the worst case side band



Circuit Symbol	Size	Description
L1	0402	10nH Inductor (Toko LL1005-FHL10NJ)
L2	0402	18nH Inductor (Toko LL1005-FHL18NJ)
L3	0402	2.2nH Inductor (Toko LL1005-FHL2N2S)
L4	0402	22nH Inductor (Toko LL1005-FHL22NJ) (Optional – see note 1 at figure 5)
C1	0402	1pF Capacitor (Murata GRM1555C1H1R0CZ01D)
C2	0402	39pF Capacitor (Murata GRM1555C1H390JZ01)
C3	0402	0.1uF Capacitor (Murata GRM155F51C104ZA01) (Optional – see note 1 at figure 5)
C4	0402	330pF Capacitor (Murata GRM1555C1H331JA01) (Optional – see note 1 at figure 5)
R1	0402	10 ohm Resistor (Optional – see note 1 at figure 5)
R2	0402	27 Kohm Resistor

Figure 1. Demo Board and application circuit components table for GPS applications @ 1.575GHz



Notes:
1. R1, L4, C3, and C4 are not required in actual application. These are added on demoboard to mitigate power supply noise in the test environment.
2. Pin 3 must be left unconnected.
3. L1and L2 form the input matching network. C1, C2 and L3 form a matching network at the output of the LNA.
4. Bias control is achieved by either varying the SD voltage with/ without R2, or fixing the SD voltage to Vdd and adjusting R2 for desired current. R2 = 27 kOhm will result in 3.3mA.

Figure 2. Demo board and application schematic diagram for 1.575 GHz

Unless otherwise stated, all data is taken at Freq = 1.575GHz based on the demoboard components of Figs 4 and 5. Deembedding was made to account for the board losses in measurements.

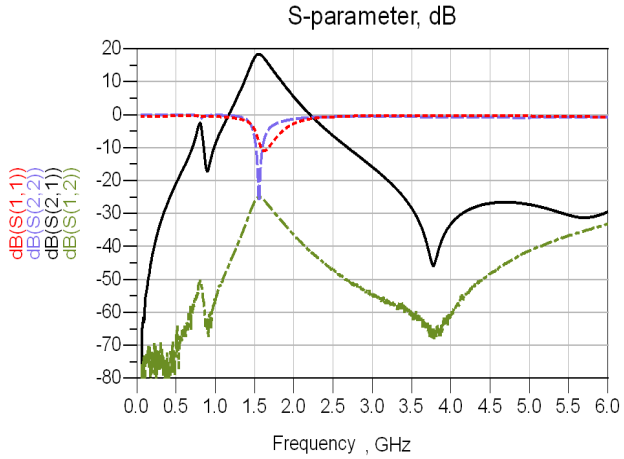


Figure 3. Frequency response up to 6GHz at Vdd=2.7V, Idd=3.3mA – tuned for GPS application

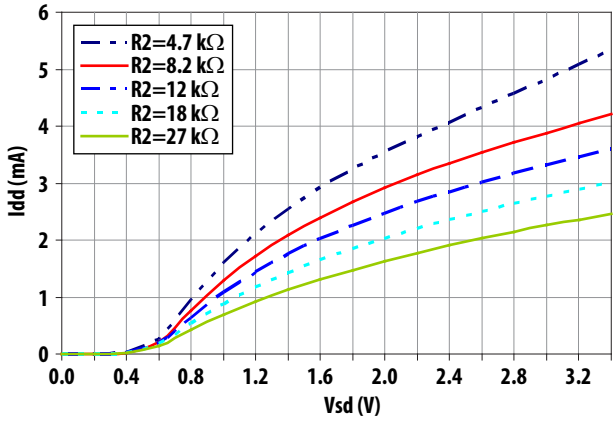


Figure 4. Idd vs Vsd with Vdd=1.8V

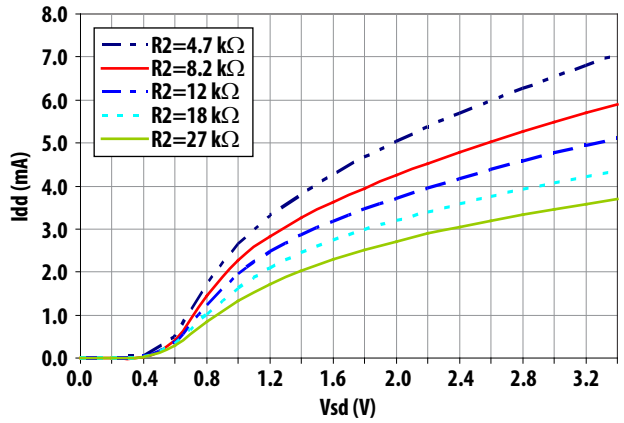


Figure 5. Idd vs Vsd with Vdd=2.7V

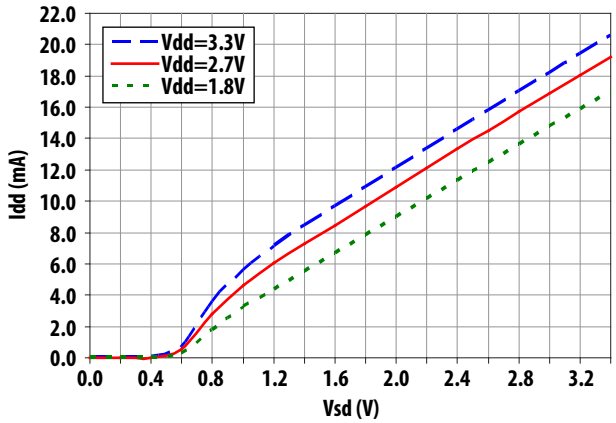


Figure 6. Idd vs Vsd with R2 =0 ohm

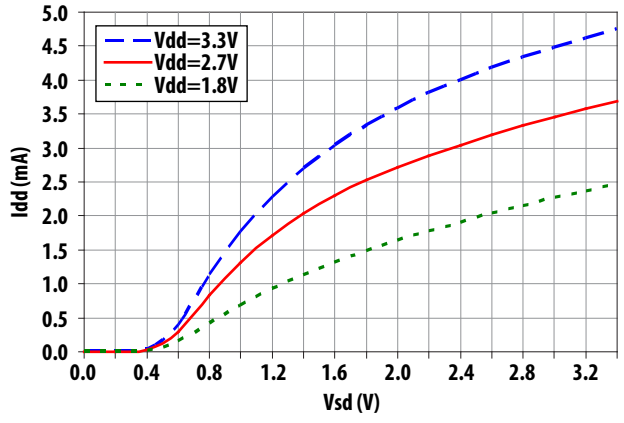


Figure 7. Idd vs Vsd with R2 = 27k ohm

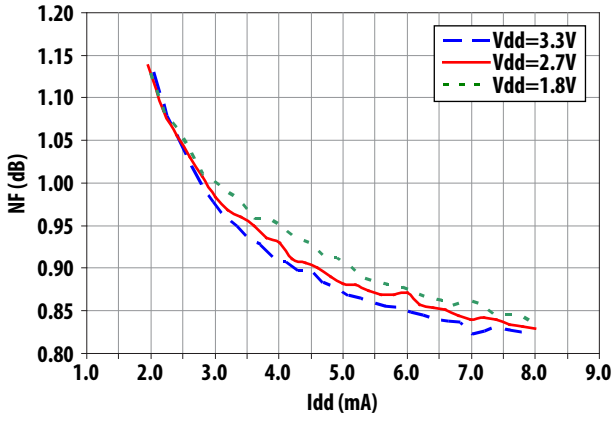


Figure 8. NF vs Idd

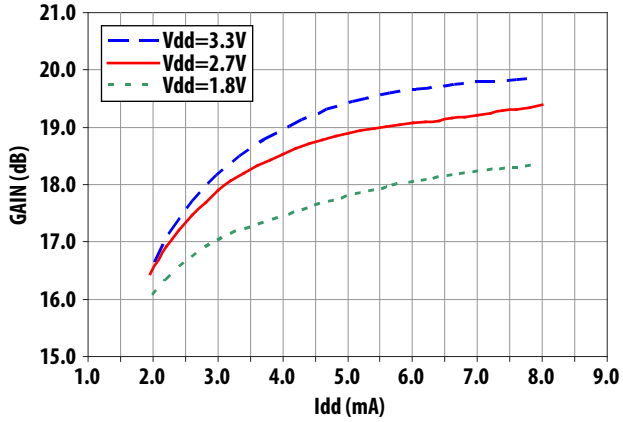


Figure 9. Gain vs Idd

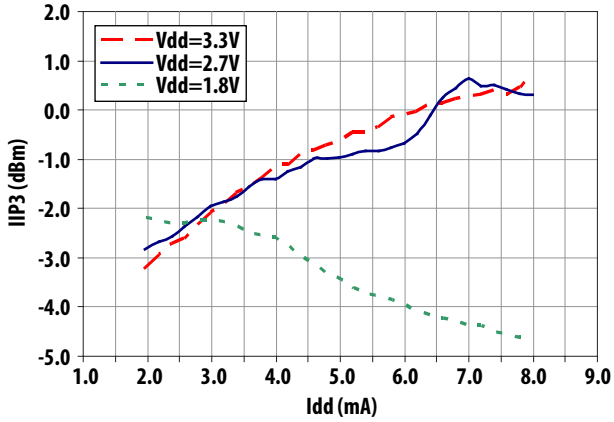


Figure 10. IIP3 vs Idd

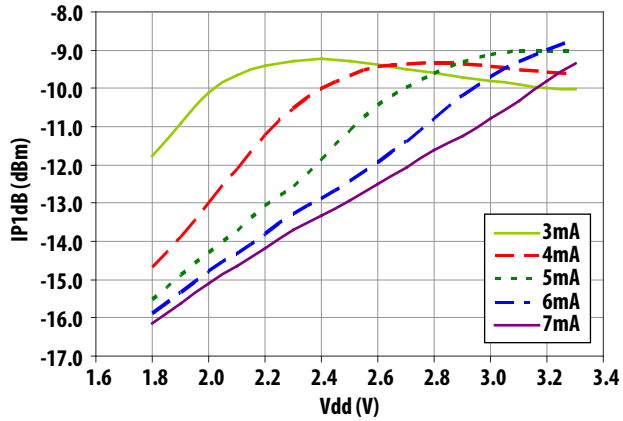


Figure 11. IP1dB vs Vdd

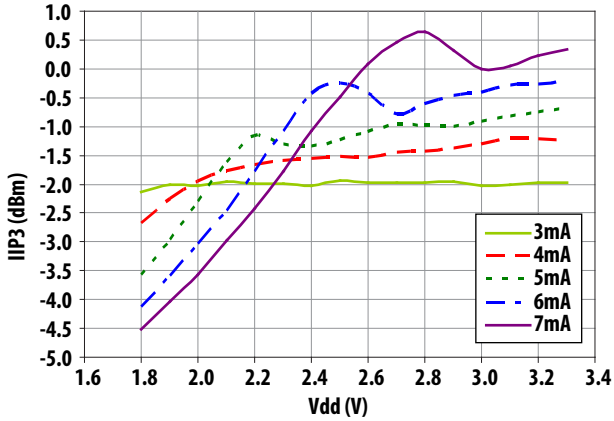


Figure 12. IIP3 vs Vdd

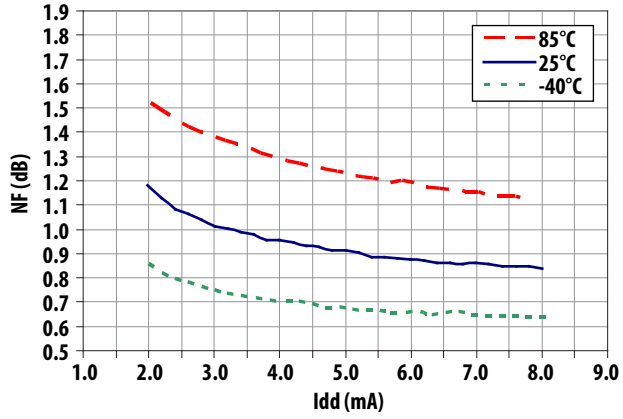


Figure 13. NF vs Idd over temperature at Vdd=1.8V

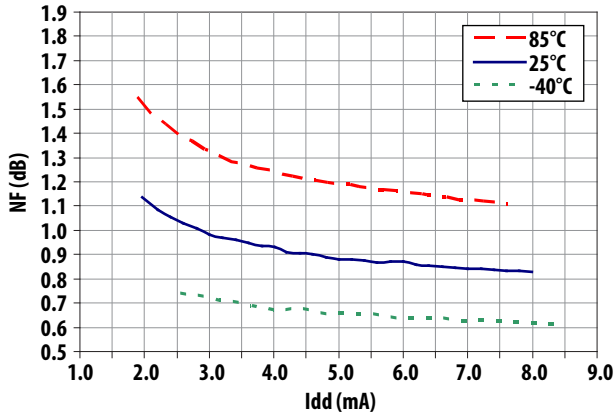


Figure 14. NF vs Idd over temperature at Vdd=2.7V

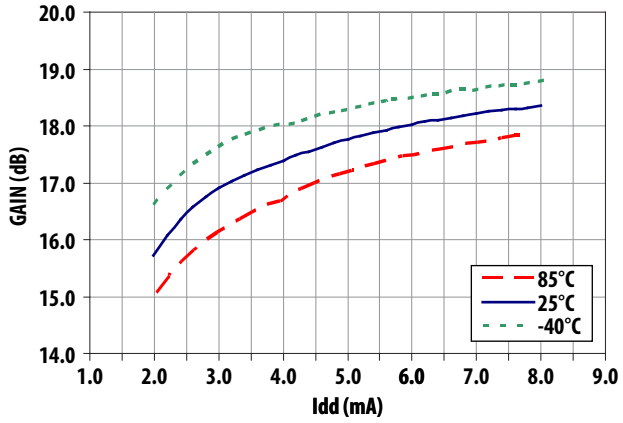


Figure 15. Gain vs Idd over temperature at Vdd=1.8V

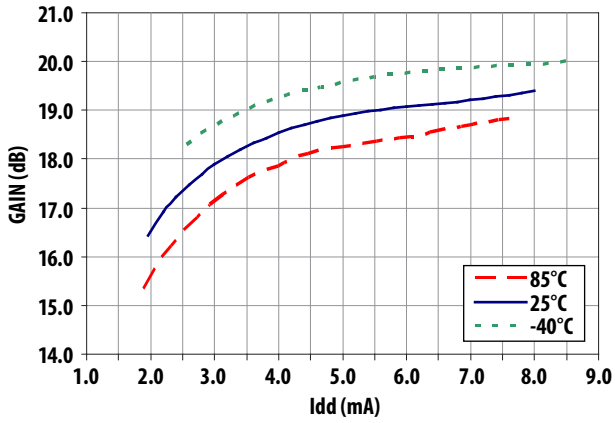


Figure 16. Gain vs Idd over temperature at Vdd=2.7V

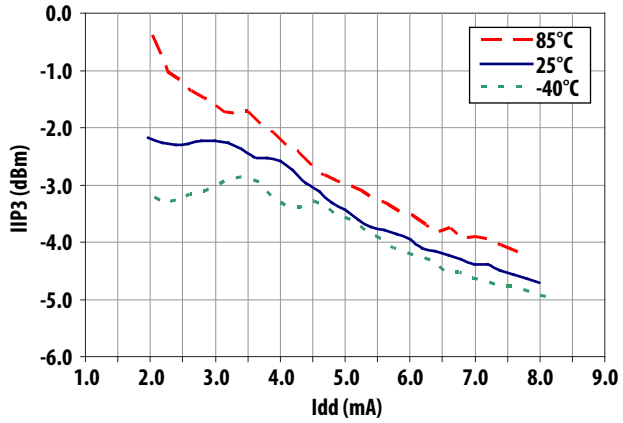


Figure 17. IIP3 vs Idd over temperature at Vdd=1.8V

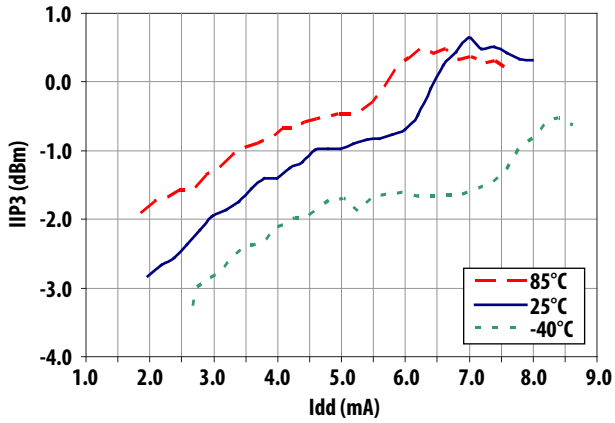


Figure 18. IIP3 vs Idd over temperature at Vdd=2.7V

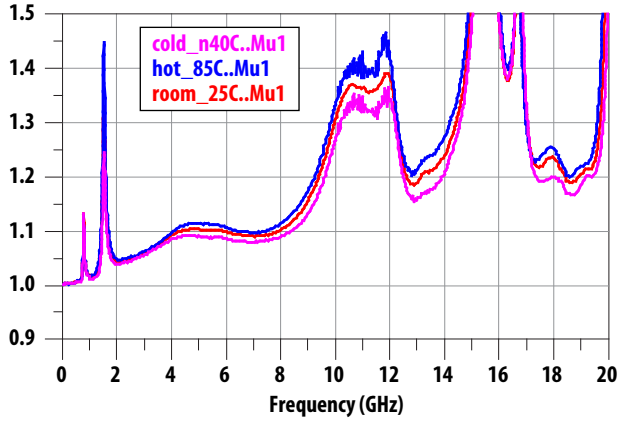


Figure 19. Edwards-Sinsky Output Stability Factor (Mu) vs Frequnecy over temperature. Biasing condition: Vdd=2.7V, Idd=3.3mA

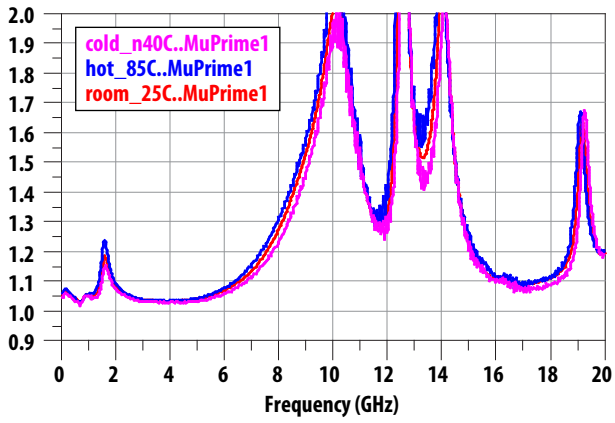


Figure 20. Edwards-Sinsky Output Stability Factor (Mu') vs Frequency over temperature. Biasing condition: Vdd=2.7V, Idd=3.3mA

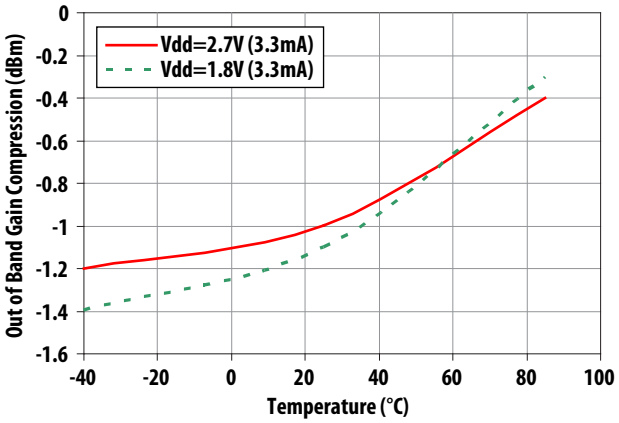


Figure 21. Input signal required at 928MHz interference signal to cause 1dB gain compression at 1.575GHz

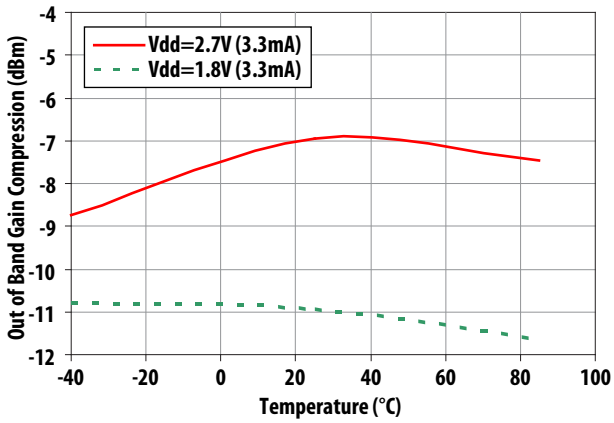


Figure 22. Input signal required at 1710MHz interference signal to cause 1dB gain compression at 1.575GHz

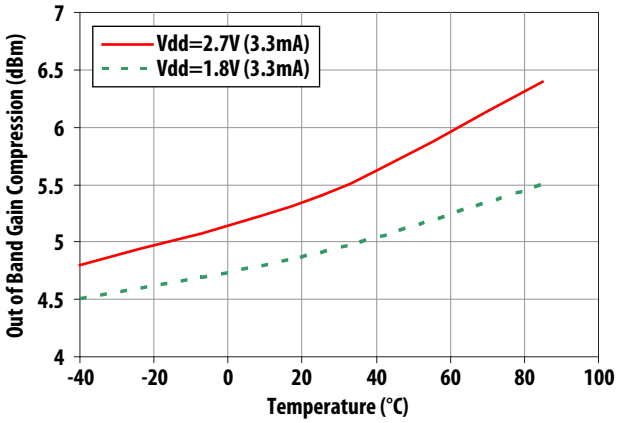


Figure 23. Input signal required at 2400MHz interference signal to cause 1dB gain compression at 1.575GHz

MGA-24106 Scattering Parameter Measurement Reference Planes

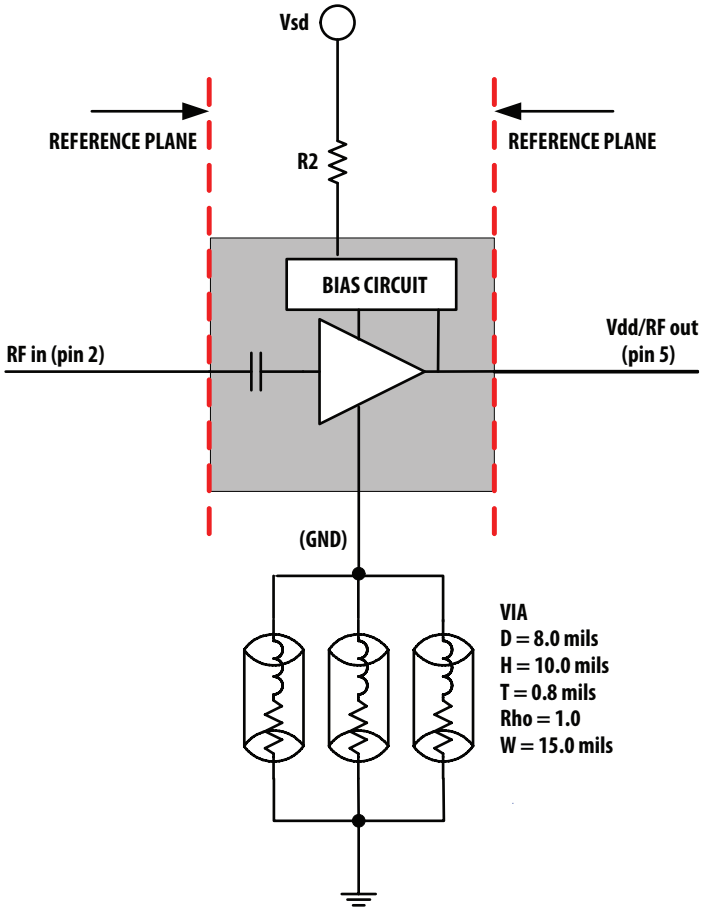


Figure 24. Scattering parameters measurement reference planes

MGA-24106 Scattering Parameter Measurement with Vdd=1.8V, Idd=3.3mA

The S-parameters measurement reference planes are described in Figure 27. The PCB is 10mils Rogers RO4350

Freq (GHz)	magS11	angS11	magS21	angS21	magS12	angS12	magS22	angS22
0.1	0.9950	-2.64	3.2341	176.15	0.0023	78.10	0.7983	-5.23
0.2	0.9909	-5.37	3.1876	168.45	0.0036	78.10	0.7968	-12.21
0.3	0.9855	-8.14	3.1683	161.54	0.0053	78.44	0.7921	-18.60
0.4	0.9787	-10.92	3.1313	155.10	0.0075	78.69	0.7897	-24.89
0.5	0.9711	-13.59	3.0769	149.26	0.0091	75.89	0.7919	-30.92
0.6	0.9622	-16.21	3.0210	143.46	0.0108	72.39	0.7957	-36.95
0.7	0.9527	-18.73	2.9635	137.75	0.0123	70.73	0.7996	-42.88
0.8	0.9422	-21.36	2.8997	132.03	0.0139	67.19	0.8051	-48.75
0.9	0.9306	-23.86	2.8316	126.42	0.0152	65.42	0.8106	-54.50
1.0	0.9201	-25.79	2.7183	121.52	0.0162	63.14	0.8175	-58.86
1.1	0.9087	-27.70	2.6201	116.65	0.0171	61.91	0.8236	-63.25
1.2	0.8950	-30.11	2.5573	111.08	0.0182	60.01	0.8298	-68.97
1.3	0.8809	-32.53	2.4916	105.58	0.0192	57.17	0.8358	-74.50
1.4	0.8664	-34.90	2.4219	100.13	0.0199	55.39	0.8427	-79.93
1.5	0.8520	-37.27	2.3487	94.67	0.0206	52.87	0.8488	-85.33
1.575	0.8465	-37.89	2.1122	90.50	0.0209	50.85	0.8552	-91.78
1.6	0.8371	-39.58	2.2713	89.33	0.0211	51.28	0.8557	-90.54
1.7	0.8218	-41.86	2.1945	84.04	0.0216	49.77	0.8626	-95.66
1.8	0.8070	-44.01	2.1137	78.85	0.0218	48.20	0.8697	-100.69
1.9	0.7915	-46.18	2.0303	73.75	0.0219	46.54	0.8770	-105.55
2.0	0.7761	-48.29	1.9498	68.68	0.0216	45.36	0.8841	-110.27
2.1	0.7621	-50.34	1.8686	63.71	0.0216	44.12	0.8905	-114.90
2.2	0.7475	-52.36	1.7874	58.84	0.0212	42.98	0.8975	-119.36
2.3	0.7336	-54.31	1.7063	54.10	0.0209	42.85	0.9036	-123.68
2.4	0.7196	-56.20	1.6273	49.39	0.0205	43.11	0.9097	-127.93
2.5	0.7064	-58.03	1.5498	44.76	0.0199	42.93	0.9159	-132.01
2.6	0.6933	-59.84	1.4740	40.23	0.0191	43.88	0.9209	-135.99
2.7	0.6809	-61.61	1.3990	35.76	0.0187	44.81	0.9263	-139.84
2.8	0.6685	-63.30	1.3264	31.40	0.0180	46.58	0.9309	-143.62
2.9	0.6568	-64.98	1.2566	27.08	0.0174	49.11	0.9355	-147.25
3.0	0.6450	-66.61	1.1889	22.81	0.0167	51.79	0.9396	-150.81
3.1	0.6348	-68.24	1.1225	18.62	0.0162	55.79	0.9435	-154.24
3.2	0.6237	-69.87	1.0581	14.44	0.0161	59.95	0.9467	-157.64
3.3	0.6137	-71.41	0.9964	10.39	0.0158	65.08	0.9505	-160.87
3.4	0.6041	-73.06	0.9368	6.33	0.0157	71.12	0.9534	-164.05
3.5	0.5949	-74.54	0.8796	2.31	0.0161	75.66	0.9557	-167.17
4.0	0.5559	-82.17	0.6214	-17.26	0.0220	99.37	0.9647	178.87
5.0	0.5010	-95.75	0.2514	-59.80	0.0485	110.78	0.9691	156.77
6.0	0.4427	-106.43	0.1032	-167.99	0.0899	104.26	0.9510	135.91
7.0	0.3874	-123.00	0.2420	116.43	0.1406	90.57	0.9182	113.58
8.0	0.3792	-144.86	0.3667	85.51	0.1948	76.45	0.8878	96.48
9.0	0.4036	-162.34	0.4650	63.76	0.2592	63.07	0.8469	84.96
10.0	0.4046	177.73	0.5524	43.93	0.3374	47.94	0.7860	74.01
11.0	0.4236	151.10	0.6183	24.03	0.4184	30.29	0.7230	62.90
12.0	0.4477	132.16	0.6661	5.00	0.4986	11.75	0.6653	49.83
13.0	0.4009	116.28	0.7093	-13.57	0.5821	-7.85	0.6045	35.03
14.0	0.3892	113.01	0.7105	-20.29	0.6051	-14.03	0.5959	27.82
15.0	0.3452	87.82	0.7264	-34.96	0.6588	-30.54	0.5640	25.33
16.0	0.2991	60.89	0.7302	-49.15	0.6982	-47.27	0.5239	25.74
17.0	0.2439	54.79	0.7222	-63.52	0.7189	-65.01	0.4893	16.06
18.0	0.1454	64.57	0.7066	-80.77	0.7198	-86.81	0.4618	6.02
19.0	0.2180	138.48	0.5878	-97.08	0.6013	-108.76	0.5189	1.63
20.0	0.4335	106.92	0.5786	-93.09	0.5482	-115.87	0.3983	-27.87

MGA-24106 Scattering Parameter Measurement with Vdd=2.7V, Idd=3.3mA

The S-parameters measurement reference planes are described in Figure 27. The PCB is 10mils Rogers RO4350.

Freq (GHz)	magS11	angS11	magS21	angS21	magS12	angS12	magS22	angS22
0.1	0.9946	-2.54	3.4277	176.86	0.0019	78.29	0.8446	-4.80
0.2	0.9902	-5.14	3.3937	168.73	0.0033	77.10	0.8444	-12.14
0.3	0.9852	-7.83	3.3721	161.57	0.0045	82.22	0.8379	-18.70
0.4	0.9788	-10.50	3.3262	155.05	0.0060	76.77	0.8330	-25.03
0.5	0.9715	-13.09	3.2598	149.22	0.0075	74.99	0.8330	-31.05
0.6	0.9625	-15.61	3.1980	143.44	0.0090	73.01	0.8351	-37.05
0.7	0.9530	-18.04	3.1329	137.77	0.0102	70.56	0.8373	-42.92
0.8	0.9426	-20.57	3.0621	132.09	0.0114	67.58	0.8409	-48.75
0.9	0.9312	-22.98	2.9852	126.52	0.0125	65.28	0.8448	-54.47
1.0	0.9207	-24.81	2.8643	121.70	0.0133	63.39	0.8500	-58.79
1.1	0.9096	-26.70	2.7549	116.85	0.0142	61.85	0.8543	-63.19
1.2	0.8959	-29.00	2.6859	111.33	0.0148	59.83	0.8590	-68.86
1.3	0.8818	-31.32	2.6149	105.88	0.0156	57.12	0.8635	-74.37
1.4	0.8675	-33.61	2.5359	100.49	0.0163	55.42	0.8688	-79.81
1.5	0.8527	-35.87	2.4583	95.09	0.0166	53.35	0.8732	-85.18
1.575	0.8414	-37.49	2.3965	91.12	0.0169	51.71	0.8774	-89.15
1.6	0.8378	-38.12	2.3754	89.80	0.0171	51.42	0.8790	-90.39
1.7	0.8226	-40.28	2.2900	84.59	0.0173	49.81	0.8841	-95.50
1.8	0.8077	-42.38	2.2033	79.46	0.0174	48.50	0.8897	-100.51
1.9	0.7919	-44.47	2.1145	74.38	0.0174	47.05	0.8954	-105.40
2.0	0.7768	-46.49	2.0256	69.44	0.0172	46.02	0.9009	-110.10
2.1	0.7622	-48.47	1.9394	64.51	0.0171	44.83	0.9062	-114.72
2.2	0.7472	-50.39	1.8522	59.77	0.0169	44.59	0.9115	-119.18
2.3	0.7330	-52.27	1.7663	55.04	0.0163	44.94	0.9166	-123.52
2.4	0.7189	-54.04	1.6840	50.42	0.0162	45.65	0.9213	-127.77
2.5	0.7047	-55.83	1.6008	45.87	0.0153	45.59	0.9257	-131.86
2.6	0.6911	-57.55	1.5208	41.44	0.0152	47.16	0.9301	-135.84
2.7	0.6781	-59.23	1.4417	37.06	0.0145	48.29	0.9344	-139.70
2.8	0.6652	-60.83	1.3652	32.76	0.0140	50.98	0.9380	-143.48
2.9	0.6531	-62.41	1.2917	28.55	0.0137	54.27	0.9417	-147.11
3.0	0.6403	-63.98	1.2203	24.36	0.0133	57.68	0.9450	-150.67
3.1	0.6291	-65.50	1.1507	20.25	0.0130	62.47	0.9480	-154.11
3.2	0.6173	-67.02	1.0841	16.16	0.0127	66.53	0.9510	-157.53
3.3	0.6065	-68.46	1.0198	12.19	0.0128	72.31	0.9536	-160.75
3.4	0.5964	-70.03	0.9571	8.23	0.0131	78.27	0.9562	-163.92
3.5	0.5860	-71.39	0.8974	4.28	0.0136	82.68	0.9577	-167.05
4.0	0.5425	-78.39	0.6304	-14.89	0.0191	105.43	0.9646	178.98
6.0	0.4167	-97.83	0.1028	-164.48	0.0745	109.44	0.9520	135.97
7.0	0.3574	-109.87	0.2397	121.12	0.1170	97.52	0.9247	113.47
8.0	0.3403	-128.32	0.3631	91.11	0.1650	85.03	0.8998	96.05
9.0	0.3661	-143.75	0.4609	70.10	0.2244	72.91	0.8640	84.04
10.0	0.3724	-160.49	0.5515	51.00	0.3013	59.01	0.8065	72.21
11.0	0.3858	174.07	0.6286	31.60	0.3909	41.91	0.7374	59.70
12.0	0.4215	154.08	0.6885	12.36	0.4858	22.83	0.6665	45.40
13.0	0.3984	140.52	0.7399	-6.26	0.5853	2.58	0.5917	29.39
14.0	0.3979	138.01	0.7401	-13.02	0.614	-3.80	0.5767	22.61
15.0	0.3528	113.32	0.7636	-28.52	0.6839	-22.16	0.526	20.77
16.0	0.2999	85.18	0.7691	-43.70	0.7317	-40.99	0.4773	23.55
17.0	0.2631	76.18	0.7613	-58.84	0.7542	-60.66	0.4485	15.50
18.0	0.1919	86.78	0.7366	-76.69	0.7409	-84.09	0.4361	6.81
19.0	0.2872	134.62	0.6034	-92.36	0.5986	-106.49	0.5151	1.84
20.0	0.472	110.23	0.5904	-90.65	0.5272	-116.95	0.4126	-26.47

MGA-24106 Scattering Parameter Measurement with Vdd=3.3V, Idd=6.0mA

The S-parameters measurement reference planes are described in Figure 27. The PCB is 10mils Rogers RO4350

Freq (GHz)	magS11	angS11	magS21	angS21	magS12	angS12	magS22	angS22
0.1	0.9946	-2.61	4.7525	176.78	0.0012	63.40	0.7977	-3.53
0.2	0.9890	-5.32	4.7119	168.23	0.0030	78.08	0.8025	-11.02
0.3	0.9830	-8.08	4.6729	160.77	0.0040	78.23	0.7979	-17.46
0.4	0.9747	-10.79	4.6020	153.97	0.0051	80.18	0.7945	-23.60
0.5	0.9650	-13.40	4.5035	147.83	0.0068	77.66	0.7960	-29.45
0.6	0.9538	-15.92	4.4064	141.81	0.0079	75.07	0.7998	-35.26
0.7	0.9418	-18.34	4.3046	135.90	0.0092	73.48	0.8037	-40.97
0.8	0.9285	-20.83	4.1978	130.01	0.0103	72.49	0.8093	-46.63
0.9	0.9143	-23.14	4.0824	124.24	0.0114	70.12	0.8150	-52.21
1.0	0.9015	-24.86	3.9010	119.20	0.0121	67.76	0.8226	-56.44
1.1	0.8882	-26.62	3.7427	114.13	0.0129	66.05	0.8293	-60.71
1.2	0.8720	-28.73	3.6356	108.50	0.0136	64.66	0.8360	-66.30
1.3	0.8557	-30.87	3.5280	102.91	0.0144	62.40	0.8422	-71.75
1.4	0.8390	-32.92	3.4113	97.41	0.0151	60.14	0.8494	-77.13
1.5	0.8230	-34.92	3.2913	91.93	0.0157	58.92	0.8560	-82.47
1.575	0.8106	-36.32	3.2003	87.91	0.0158	56.80	0.8617	-86.41
1.6	0.8066	-36.87	3.1696	86.58	0.0159	57.29	0.8637	-87.65
1.7	0.7905	-38.72	3.0439	81.31	0.0164	55.35	0.8705	-92.77
1.8	0.7752	-40.49	2.9192	76.14	0.0165	53.52	0.8779	-97.79
1.9	0.7589	-42.21	2.7930	71.06	0.0163	52.13	0.8853	-102.68
2.0	0.7440	-43.88	2.6678	66.08	0.0163	51.30	0.8926	-107.43
2.1	0.7302	-45.42	2.5452	61.21	0.0162	50.23	0.8991	-112.08
2.2	0.7165	-46.97	2.4235	56.44	0.0160	49.96	0.9059	-116.60
2.3	0.7037	-48.42	2.3048	51.78	0.0155	49.45	0.9121	-120.98
2.4	0.6914	-49.86	2.1899	47.23	0.0151	50.03	0.9184	-125.28
2.5	0.6794	-51.21	2.0761	42.74	0.0147	50.94	0.9240	-129.42
2.6	0.6682	-52.56	1.9670	38.35	0.0140	52.57	0.9293	-133.47
2.7	0.6579	-53.84	1.8619	34.06	0.0135	54.63	0.9345	-137.39
2.8	0.6481	-55.06	1.7596	29.85	0.0127	58.58	0.9389	-141.23
2.9	0.6388	-56.30	1.6614	25.74	0.0127	63.16	0.9434	-144.92
3.0	0.6300	-57.52	1.5672	21.68	0.0123	67.31	0.9472	-148.55
3.1	0.6222	-58.73	1.4765	17.70	0.0121	72.94	0.9512	-152.05
3.2	0.6140	-59.95	1.3894	13.75	0.0120	79.35	0.9546	-155.52
3.3	0.6071	-61.11	1.3059	9.94	0.0126	85.65	0.9575	-158.80
3.4	0.6004	-62.38	1.2260	6.14	0.0132	93.21	0.9607	-162.03
3.5	0.5941	-63.56	1.1488	2.37	0.0139	97.63	0.9626	-165.20
4.0	0.5705	-69.92	0.8122	-15.74	0.0221	116.57	0.9710	-179.43
5.0	0.5420	-82.33	0.3435	-52.33	0.0495	118.94	0.9751	158.10
6.0	0.5056	-92.16	0.1007	-136.46	0.0897	109.54	0.9589	137.06
7.0	0.4587	-107.18	0.2213	122.30	0.1377	94.75	0.9296	114.45
8.0	0.4426	-128.25	0.3637	89.92	0.1885	79.96	0.9024	96.95
9.0	0.4613	-146.57	0.4727	68.46	0.2468	66.67	0.8655	85.01
10.0	0.4569	-165.68	0.5701	49.22	0.3197	52.27	0.8076	73.38
11.0	0.4595	168.47	0.6481	29.54	0.4006	35.33	0.7425	61.28
12.0	0.4799	148.57	0.7057	10.42	0.4846	17.23	0.6766	47.05
13.0	0.4423	133.92	0.7582	-8.11	0.5796	-1.84	0.6024	30.92
14.0	0.4319	126.43	0.7580	-16.34	0.6034	-9.53	0.5884	24.95
15.0	0.3802	100.23	0.7761	-32.09	0.6713	-27.00	0.5412	23.21
16.0	0.3117	68.99	0.7660	-47.70	0.7158	-45.52	0.5009	26.11
17.0	0.2231	60.20	0.7290	-62.34	0.7266	-64.59	0.4830	17.71
18.0	0.1267	94.23	0.6898	-77.90	0.7171	-86.78	0.4687	6.97
19.0	0.3014	141.11	0.5817	-91.61	0.6039	-109.56	0.5287	2.25
20.0	0.5223	107.69	0.5858	-85.63	0.5215	-120.32	0.4260	-24.45

Noise Parameters

The Noise parameters are measured using source pull method. Figure 27 shows the input and output reference planes. The PCB is 10mils Rogers RO4350.

MGA-24106 Typical Noise Parameters

25˚C, Freq = 1.575GHz, Vdd=1.8V, Idd=3.3mA

Freq (GHz)	Fmin (dB)	Gamma Opt		
		Mag.	Ang.	Rn/50
0.45	0.69	0.788	8.60	0.689
0.70	0.59	0.805	13.66	0.598
1.0	0.48	0.804	18.2	0.557
1.575	0.68	0.717	32.3	0.499
2.0	0.84	0.696	49.0	0.430
2.5	1.02	0.626	61.8	0.401

25˚C, Freq = 1.575GHz, Vdd=2.7V, Idd=3.3mA

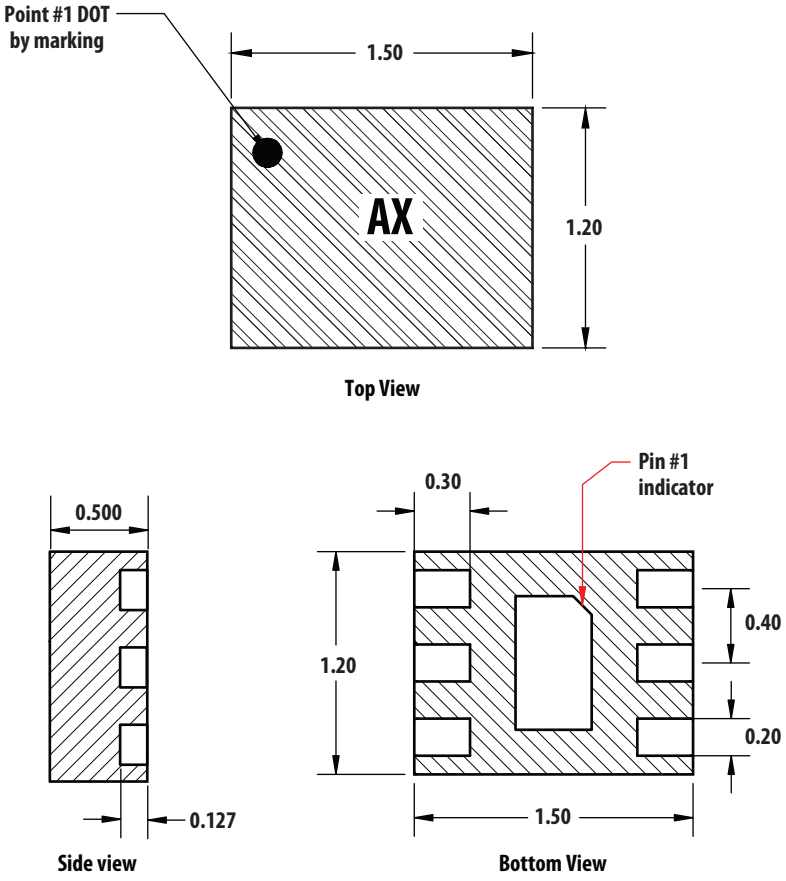
Freq (GHz)	Fmin (dB)	Gamma Opt		
		Mag.	Ang.	Rn/50
0.45	0.78	0.856	12.2	0.645
0.70	0.59	0.786	14.1	0.564
1.0	0.46	0.774	18.7	0.534
1.575	0.64	0.711	31.6	0.455
2.0	0.82	0.706	48.3	0.407
2.5	0.91	0.624	56.4	0.394

25˚C, Freq = 1.575GHz, Vdd=3.3V, Idd=6.0mA

Freq (GHz)	Fmin (dB)	Gamma Opt		
		Mag.	Ang.	Rn/50
0.45	0.60	0.792	7.8	0.510
0.7	0.44	0.755	16.5	0.448
1.0	0.41	0.720	20.6	0.395
1.575	0.54	0.652	32.3	0.347
2.0	0.70	0.615	43.1	0.306
2.5	0.79	0.521	58.3	0.276

Package Dimensions

Dimensions are in millimeters

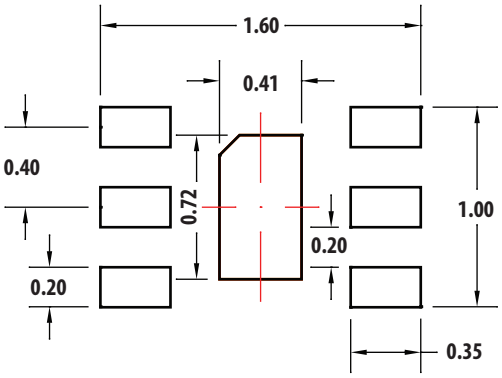


Part Number Ordering Information

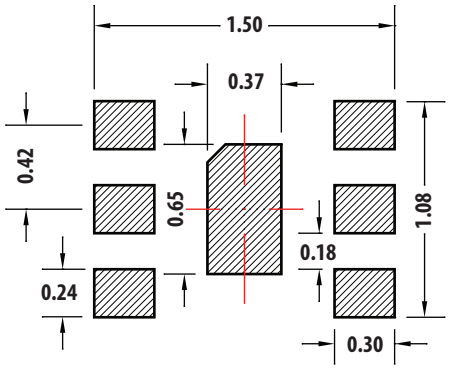
Part Number	No. of Devices	Container
MGA-24106-BLKG	100	Antistatic bag
MGA-24106-TR1G	3000	7″ Reel
MGA-24106-TR2G	10000	13″ Reel

PCB Land Patterns and Stencil Design

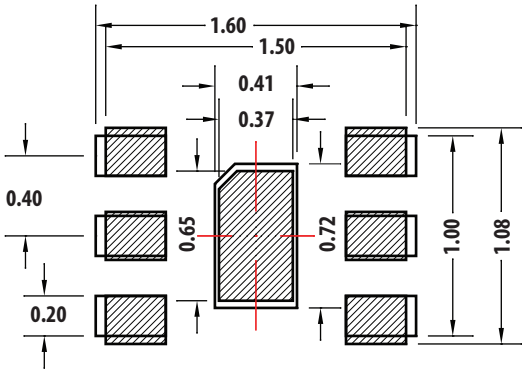
Dimensions are in millimeters



Land Pattern

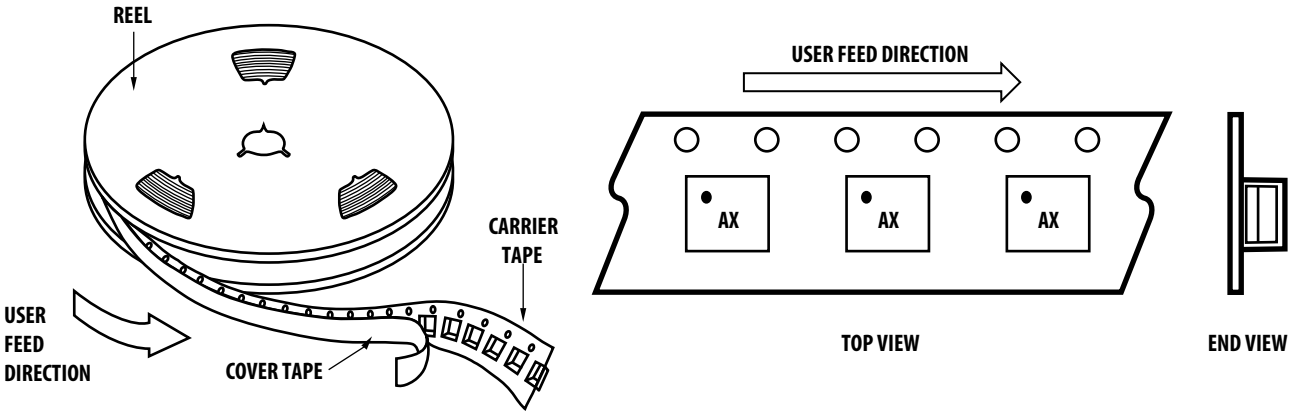


Stencil Opening

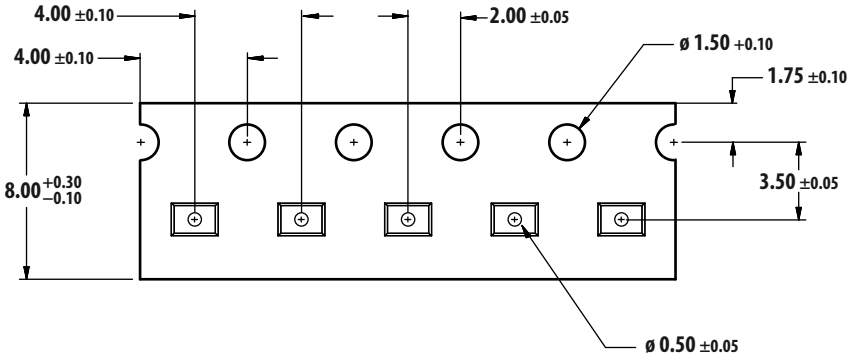


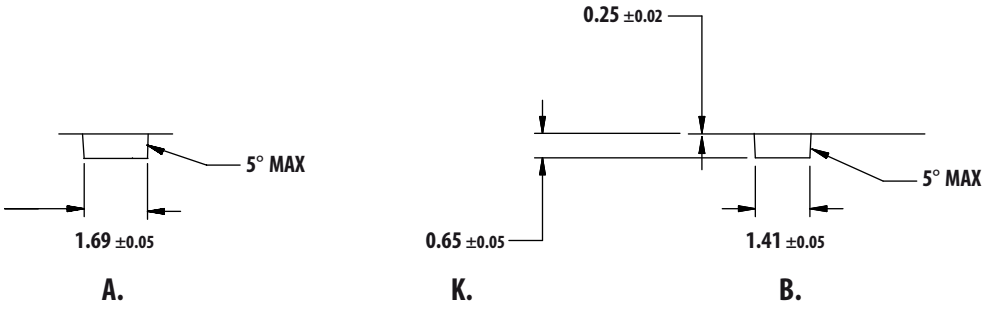
Combination of Land Pattern and Stencil Opening

Device Orientation



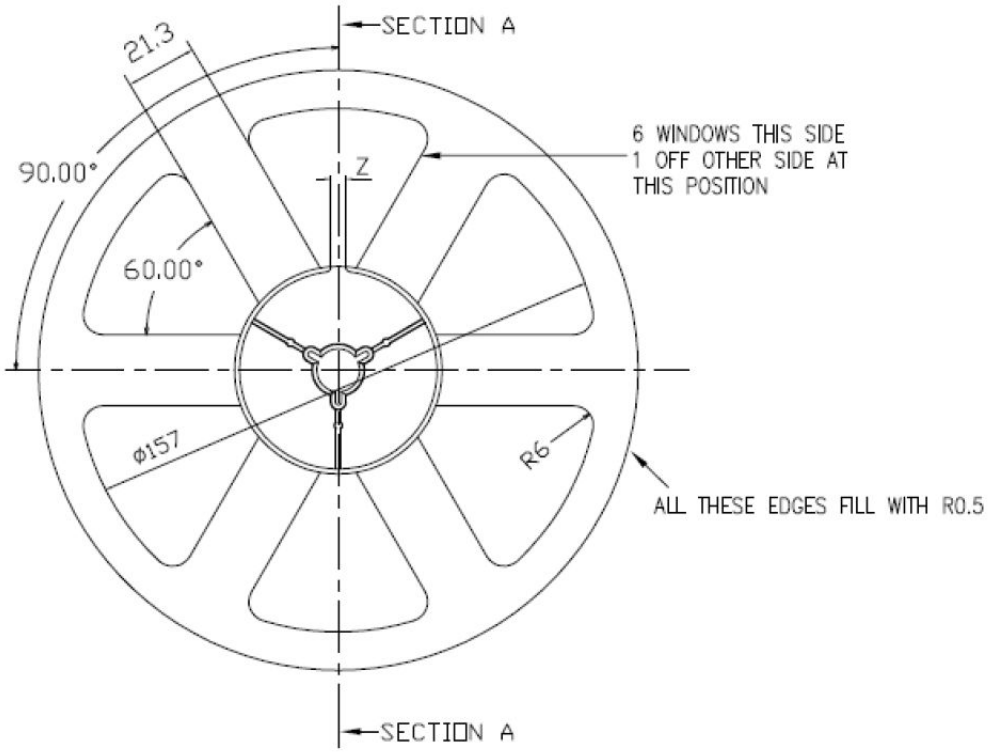
Tape Dimensions

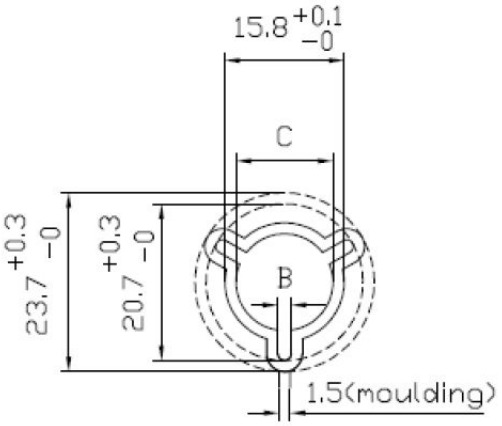




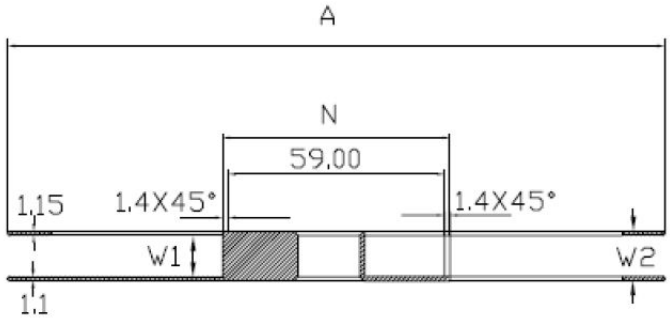
Notes:
1. Leader and Trailer – 200 empty pockets
2. Dimensions are in millimeters

Reel Dimension 7 inch



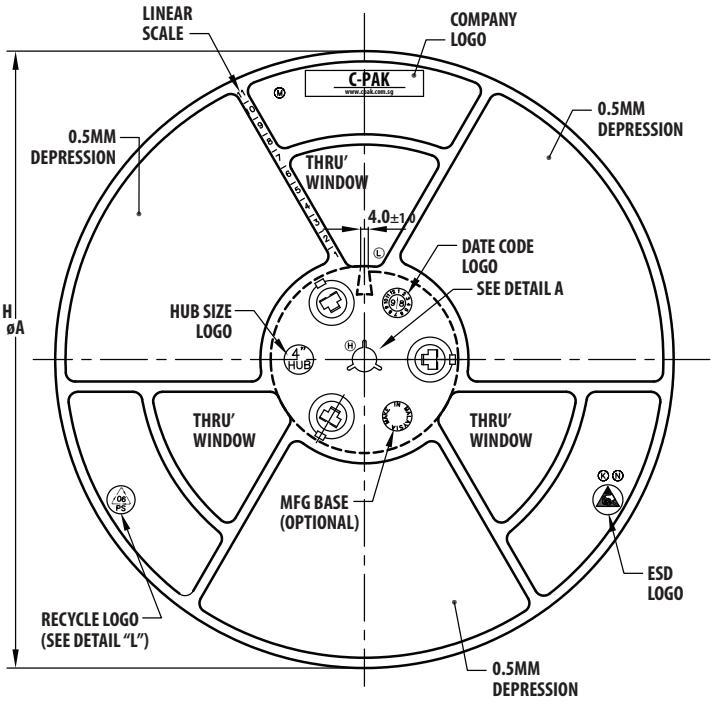


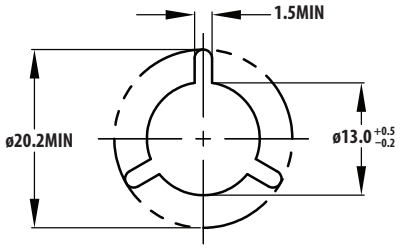
HUB DETAIL



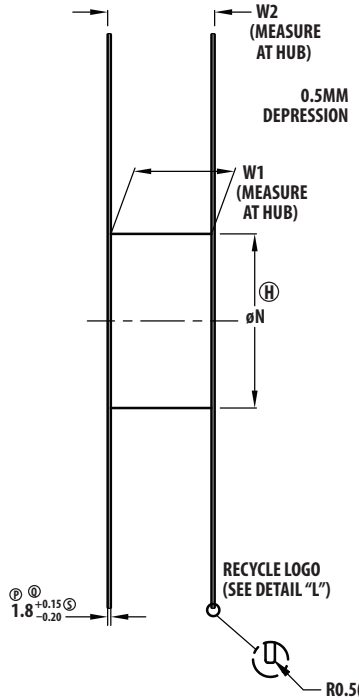
SECTION A

Reel Dimension 13 inch





ARBOR HOLE
DETAIL A
SCALE 3:1



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