

Data Sheet

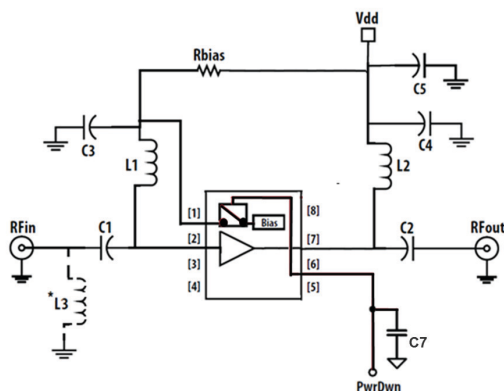
Description

Avago Technologies' MGA-621P8 is an economical, easy-to-use GaAs MMIC Low Noise Amplifier (LNA). The LNA has low noise and high linearity achieved through the use of Avago Technologies' proprietary 0.25 μm GaAs Enhancement-mode pHEMT process.

It is housed in the miniature 2.0 mm $\times$ 2.0 mm $\times$ 0.75 mm 8-pin Dual-Flat-Non-Lead (DFN) package. The device is designed for optimum use from 450 MHz up to 1.5 GHz. For optimum performance at higher frequency from 1.5 GHz to 4.0 GHz, MGA-622P8 is recommended. Both MGA-621P8 and MGA-622P8 share the same package and pinout configuration.

The compact footprint and low profile coupled with low noise, high gain and high linearity make this an ideal choice as a low noise amplifier for small cell base station application.

Simplified Schematic



*L3: Optional for S11 improvement.

Features

- Low noise figure
- High linearity performance
- GaAs E-pHEMT Technology (see Note)
- Low cost small package size 2.0 mm $\times$ 2.0 mm $\times$ 0.75 mm
- Integrated power down control pin

NOTE Enhancement mode technology employs positive gate voltage, thereby eliminating the need of negative gate voltage associated with conventional depletion mode devices.

Specifications

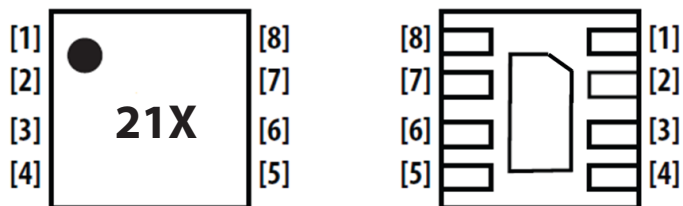
Typical performance at 900 MHz; 4V, 65 mA

- 19.3 dB Gain
- 0.67 dB Noise Figure
- 36.5 dBm Output IP3

Applications

- Low noise amplifier for small cell base station applications.
- Other low noise applications.

Pin Configuration and Package Marking



Pin1 – Vbias

Pin2 – RFinpu

Pin3 – Not used

Pin4 – Not used

Pin5 – PwrDown

Pin6 – Not used

Pin7 – RFoutput/Vdd

Pin8 – Not used

Center Tab – Ground

NOTE Package marking provides orientation and identification. "21" is the device code, and "X" is the month code.

Absolute Maximum Rating $T_A=25^{\circ}\text{C}$ (see Note)

Symbol	Parameter	Units	Absolute Maximum
V _{dd}	Device Voltage, RF output to ground	V	5.5
I _{dd}	Drain Current	mA	90
P _{in,max}	CW RF Input Power (V _{dd} =4V, I _d =65mA)	dBm	+20
P _{diss}	Total Power Dissipation ^a	W	0.5
T _j	Junction Temperature	°C	150
T _{STG}	Storage Temperature	°C	–65 to 150
T _{amb}	Ambient Temperature	°C	–40 to 85

a. Power dissipation with device turned on. Derate at 16.25mW/°C for T_B > 134°C.

NOTE Operation of this device in excess of any of these limits may cause permanent damage.

Thermal Resistance

Thermal Resistance ^a
V _{dd} = 4.0V (I _{dd} = 65mA), Θ _{jc} = 61°C/W

a. Thermal resistance measured using Infra-Red Measurement Technique.

Electrical Specifications

RF performance at $T_A = 25^\circ\text{C}$, $Z_0 = 50\ \Omega$, $V_{dd} = 4\text{V}$, measured on the circuit board in Figure 6 with component list in Table 1 for 900 MHz.

Symbol	Parameter and Test Condition	Frequency (MHz)	Unit	Min	Typ	Max
Vdd	Device operating voltage		V	—	4.0	—
Idd	Device current		mA	50	65	80
Gain	Gain	900	dB	18.5	19.3	20.0
NF	Noise Figure	900	dB	—	0.67	1.0
OIP3 ^a	Output Third order intercept point	900	dBm	33.5	36.5	—
OP1dB	Output Power at 1dB Gain Compression	900	dBm	—	21.8	—
IRL	Input Return Loss, 50 Ω source	900	dB	—	15.0	—
ORL	Output Return Loss, 50 Ω load	900	dB	—	18.0	—

a. 2-tone OIP3 test condition: FRF1, FRF2 = 1MHz separation with input power = -10dBm per tone.

NOTE

- Measurements at 900 MHz obtained using demo board described in Figure 6.
- For NF data, board losses of the input have not been de-embedded.

Truth Table

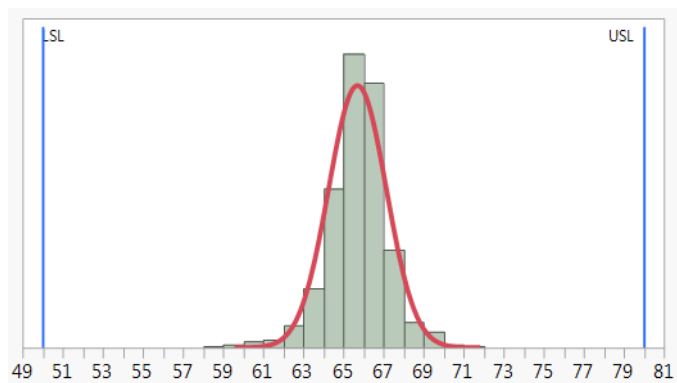
	VpwrDwn(V)
LNA Mode	0 or open
Power Down Mode	3.3

Product Consistency Distribution Charts (see Notes)

NOTE

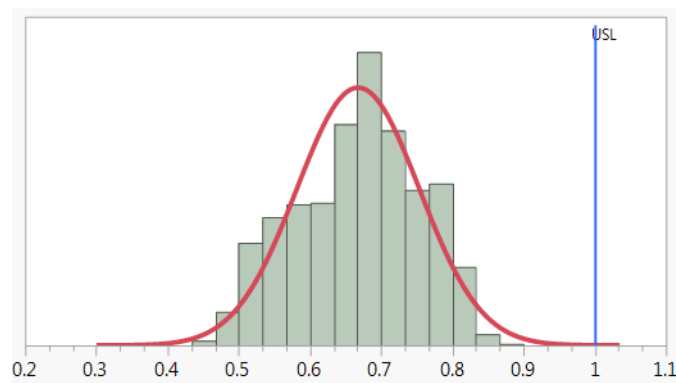
1. Distribution data samples are 2000 samples taken from 2 different wafers. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.
2. Circuit Losses have not been de-embedded from the actual measurements.

Figure 1 Idd @ 0.9 GHz, 4V, Mean = 65 mA



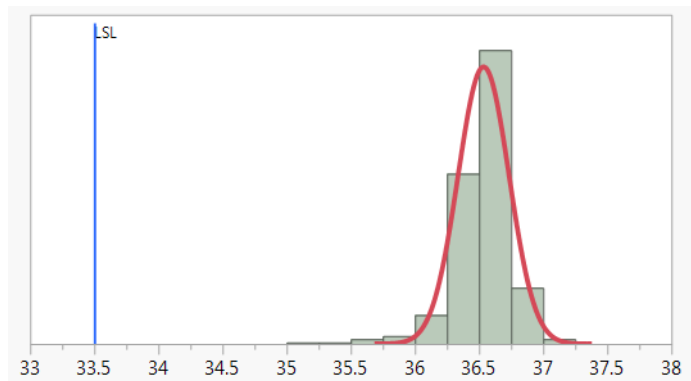
Idd, Max = 80, Min = 50

Figure 2 NF @ 0.9 GHz, 4V, Mean = 0.67 dB



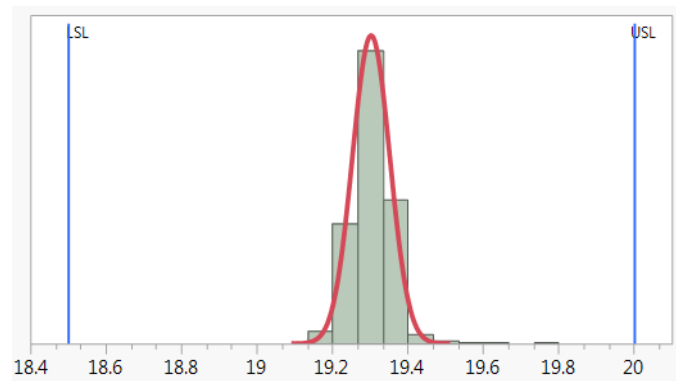
NF, Max = 1.0

Figure 3 OIP3 @ 0.9 GHz, 4V, Mean = 37.5 dBm



OIP3, Min = 33.5

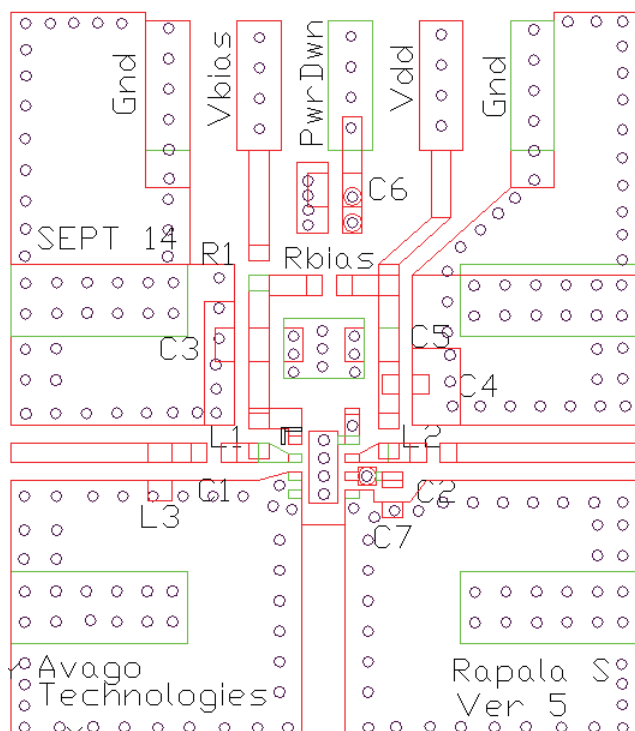
Figure 4 Gain @ 0.9 GHz, 4V, Mean=19.3 dB



Gain, Max = 20.0, Min = 18.5

Demo Board Layout

Figure 5 Demo Board Layout Diagram



NOTE

- Recommended PCB material is 10 mils Rogers RO4350.
- Suggested component values may vary according to layout and PCB material.

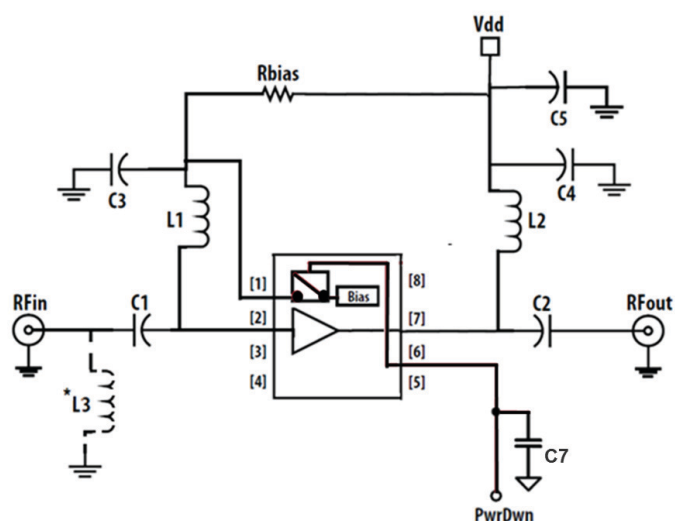
Table 1 Component List for 450 MHz to 1.5 GHz Matching

Part	Size	Value	Detail Part Number
C1, C2	0402	100 pF (Murata)	GRM1555C1H101JA01D
C3, C5	0603	4.7 μ F (Murata)	GRM188R60J475KE19D
C4	0402	33 pF (Murata)	GRM1555C1H330JZ01D
C6	0603		Not Used
C7	0402	10 pF (Murata)	GRM1555C1H100JA01D
L1, L2	0402	33 nH (Murata)	LQP15MN33NG02
L3	0402		Not used
Rbias	0402		Not used

NOTE C1, C2 are DC Blocking capacitors; L1 connect DC bias from Pin1 to Pin2, L2 RFchoke and output match for OIP3; C3, C4, C5, C7 are bypass capacitors; L3 is optional for S11 improvement; Rbias is not use for this product.

Demo Board Schematic

Figure 6 Demo Board Schematic Diagram



NOTE Detail of the components needed for this product is shown in [Table 1](#).

MGA-621P8 Typical Performance Vdd = 4V, Idd = 65 mA

Figure 7 NF vs. Frequency and Temperature

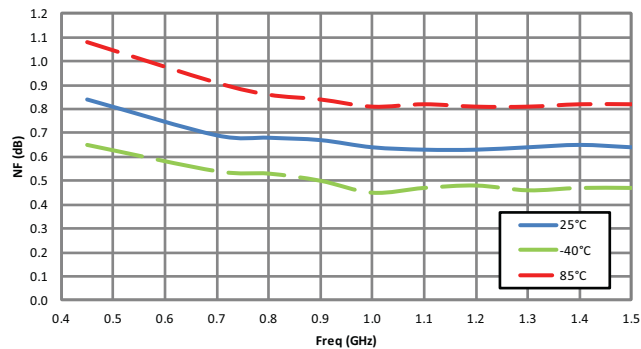


Figure 8 Gain vs. Frequency and Temperature

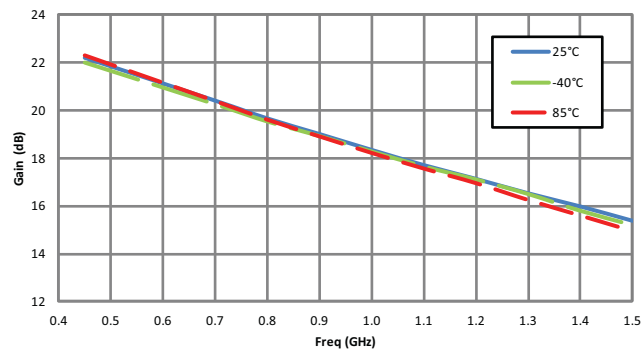


Figure 9 OIP3 vs. Frequency and Temperature

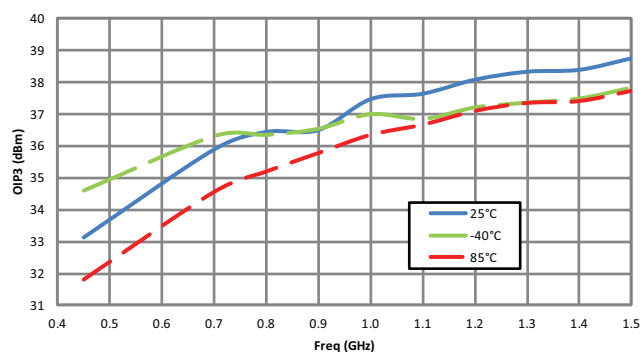


Figure 10 OP1dB vs. Frequency and Temperature

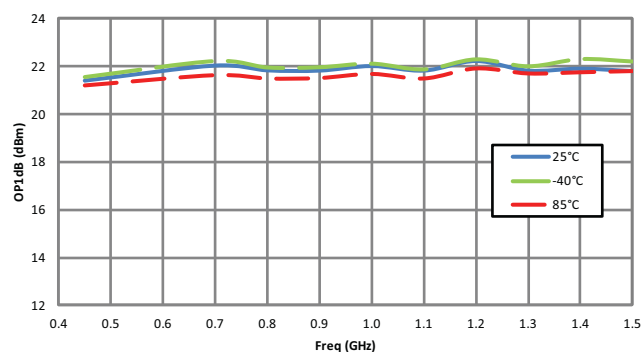


Figure 11 S-Parameter Performance vs. Frequency and Temperature

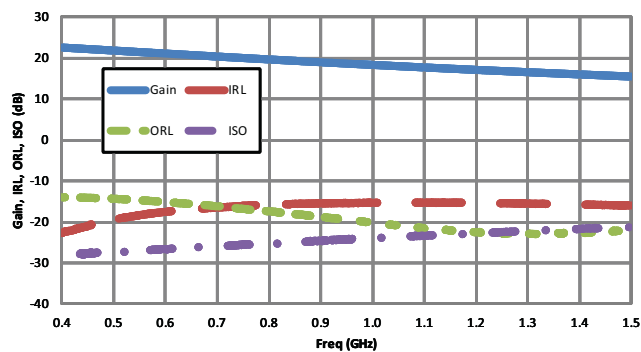


Figure 12 K-factor vs. Frequency and Temperature

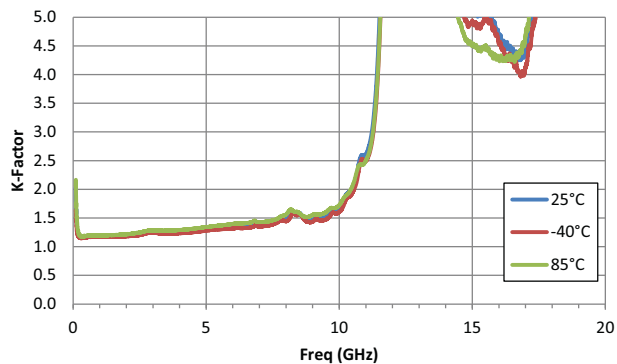


Figure 13 Idd vs. PwrDwn

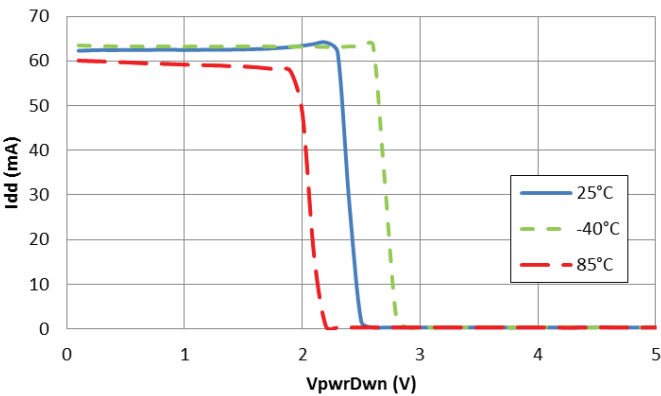


Figure 14 Schematic for Idd Adjustment

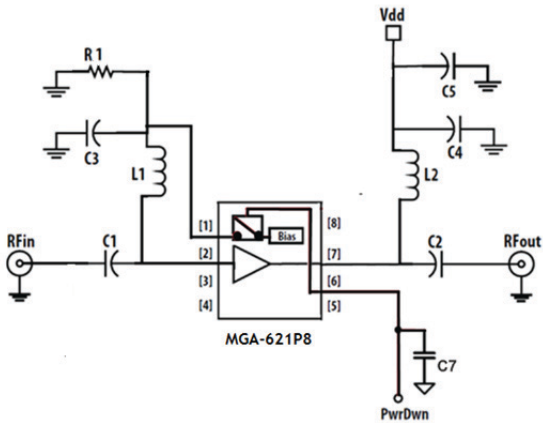
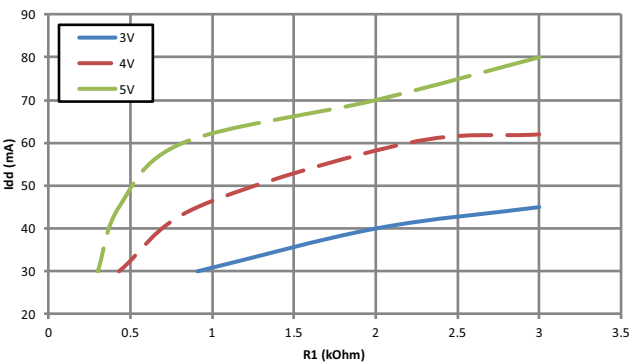


Figure 15 Idd vs. R1 at Vdd



NOTE Component list in Table 1 remains unchanged except $R1$ is adjusted for a different I_{dd} .

MGA-621P8 over Idd Performance Vdd = 3V

Figure 16 OIP3 vs. Frequency at Vdd = 3V

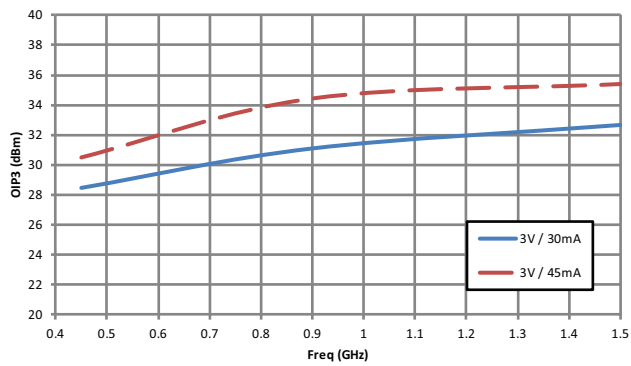


Figure 17 P1dB vs. Frequency at Vdd = 3V

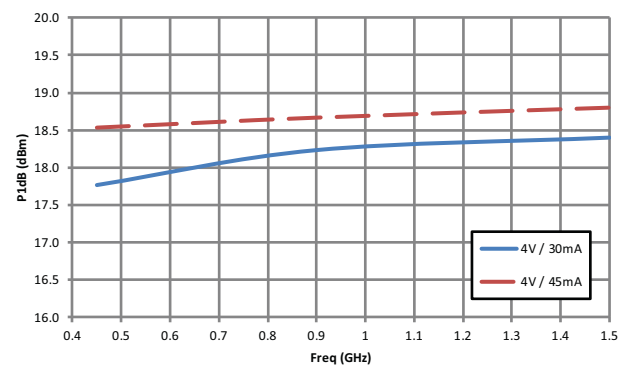


Figure 18 NF vs. Frequency at Vdd = 3V

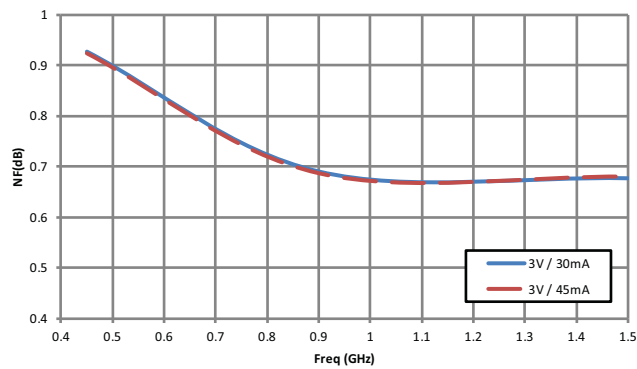


Figure 19 Gain vs. Frequency at Vdd = 3V

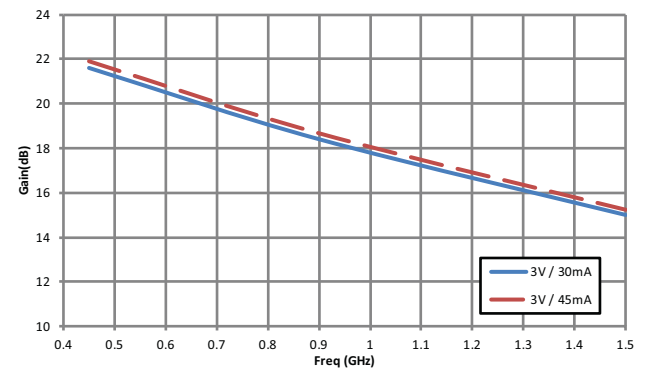


Figure 20 IRL vs. Frequency at Vdd = 3V

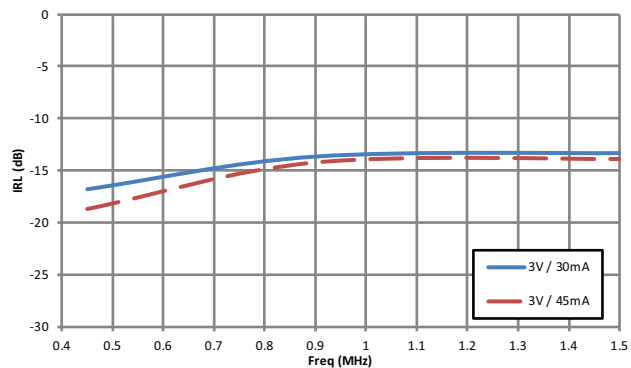
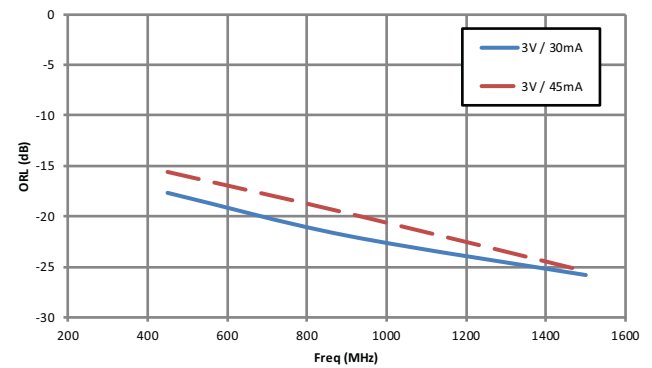


Figure 21 ORL vs. Frequency at Vdd = 3V



MGA-621P8 over Idd Performance Vdd = 4V

Figure 22 OIP3 vs. Frequency at Vdd = 4V

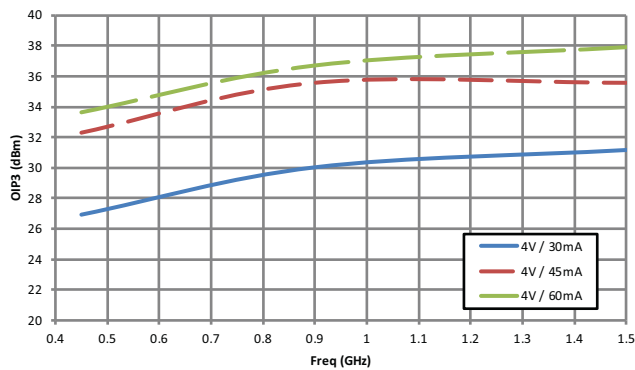


Figure 23 P1dB vs. Frequency at Vdd = 4V

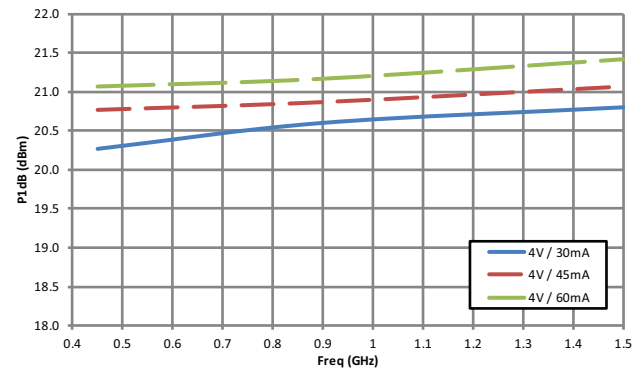


Figure 24 NF vs. Frequency at Vdd = 4V

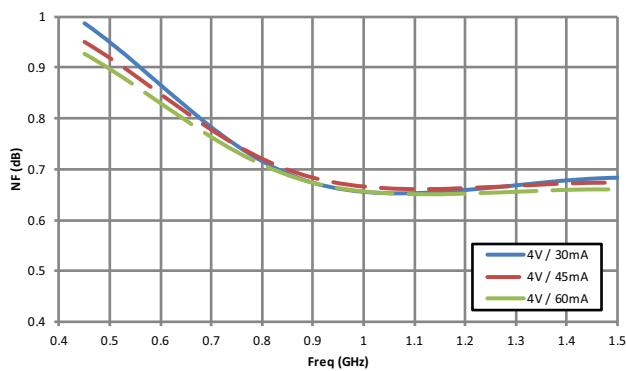


Figure 25 Gain vs. Frequency at Vdd = 4V

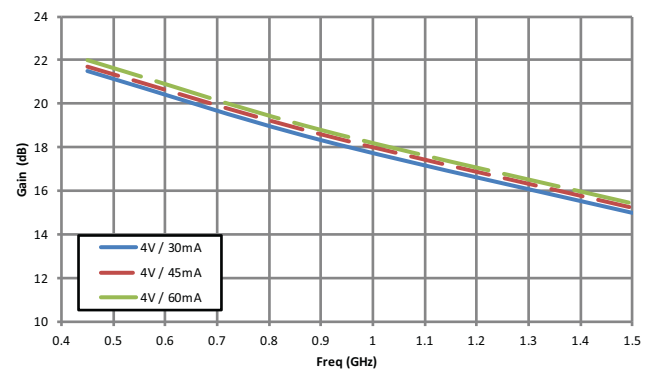


Figure 26 IRL vs. Frequency at Vdd = 4V

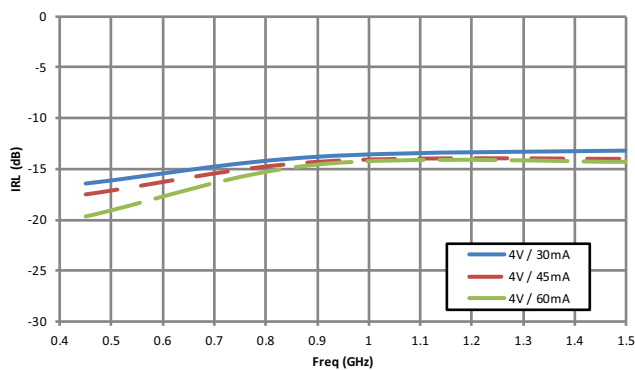
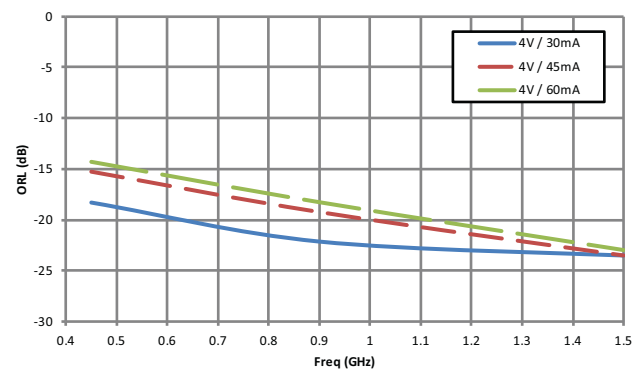


Figure 27 ORL vs. Frequency at Vdd = 4V



MGA-621P8 over Idd Performance Vdd = 5V

Figure 28 OIP3 vs. Frequency at Vdd = 5V

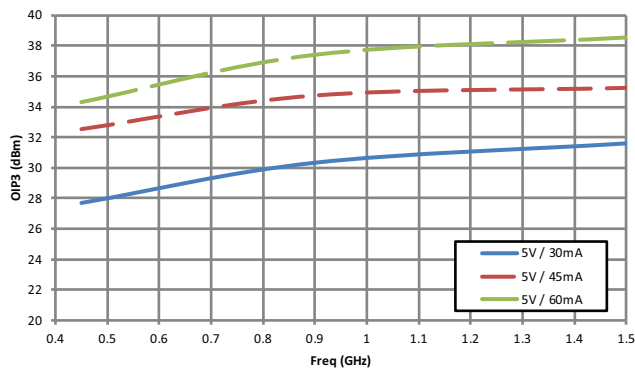


Figure 29 P1dB vs. Frequency at Vdd = 5V

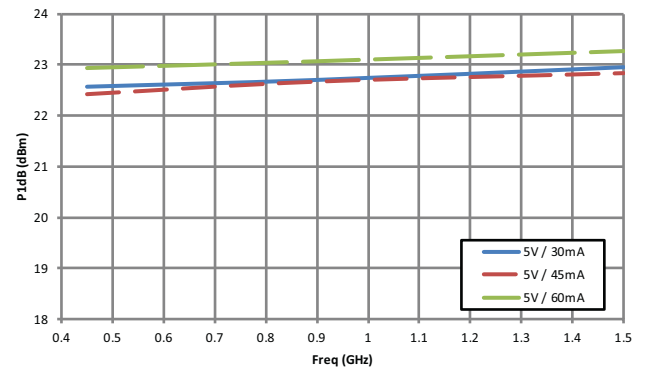


Figure 30 NF vs. Frequency at Vdd = 5V

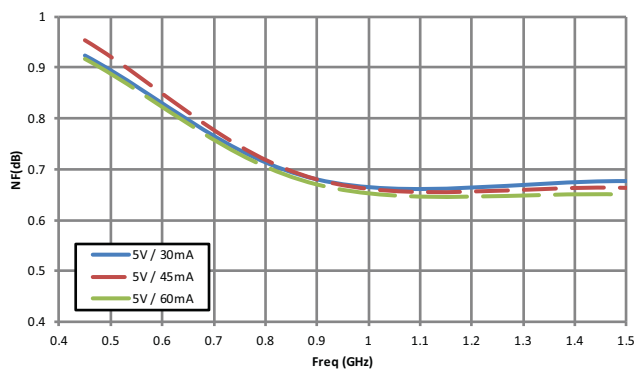


Figure 31 Gain vs. Frequency at Vdd = 5V

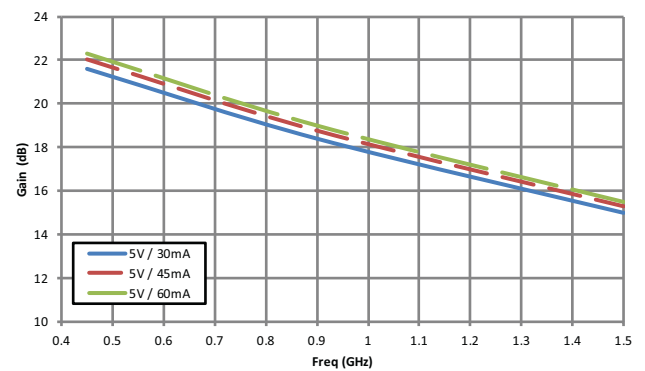


Figure 32 IRL vs. Frequency at Vdd = 5V

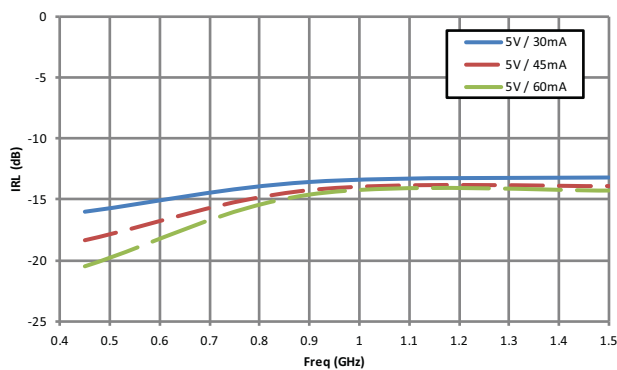
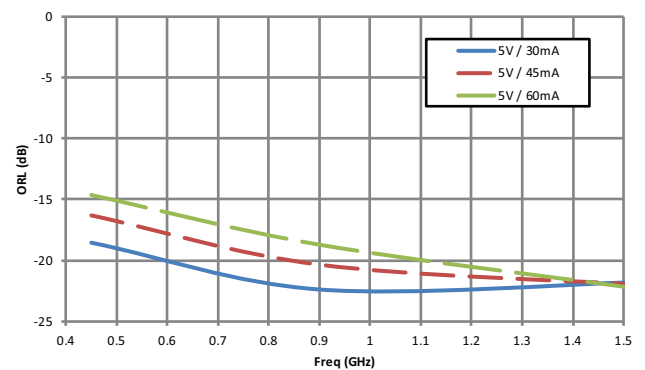


Figure 33 ORL vs. Frequency at Vdd = 5V

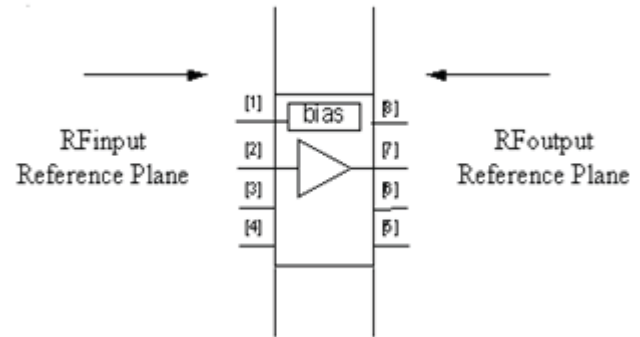


MGA-621P8 Typical Scattering Parameters, Vdd = 4V, Idd = 65 mA

freq GHz	S11		S21			S12		S22	
	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.1	0.30	-54.42	25.77	19.43	157.88	0.03	19.85	0.13	-147.21
0.2	0.23	-75.20	24.58	16.95	148.21	0.04	22.58	0.13	178.18
0.3	0.20	-90.13	23.63	15.19	140.01	0.04	26.09	0.13	152.37
0.4	0.19	-101.37	22.79	13.79	132.53	0.04	29.85	0.12	133.25
0.5	0.18	-110.56	21.99	12.58	125.66	0.05	34.17	0.11	118.14
0.6	0.18	-118.55	21.20	11.48	119.41	0.05	36.86	0.10	103.00
0.7	0.18	-125.27	20.44	10.52	113.82	0.05	39.57	0.09	88.54
0.8	0.18	-131.26	19.71	9.68	108.74	0.06	41.79	0.08	74.16
0.9	0.18	-136.18	19.02	8.93	104.10	0.06	43.41	0.07	60.99
1.0	0.19	-142.93	18.36	8.28	99.87	0.07	44.47	0.07	47.62
1.1	0.19	-147.17	17.72	7.69	95.94	0.07	45.39	0.07	36.37
1.2	0.19	-150.80	17.13	7.18	92.25	0.08	46.01	0.06	22.69
1.3	0.19	-154.37	16.56	6.73	88.81	0.08	46.12	0.06	10.09
1.4	0.19	-157.18	16.02	6.32	85.52	0.09	45.95	0.06	-3.29
1.5	0.19	-159.86	15.50	5.95	82.41	0.09	45.81	0.06	-14.70
2.0	0.18	-170.21	13.24	4.59	68.66	0.12	43.37	0.08	-54.98
3.0	0.15	-173.07	9.90	3.12	46.26	0.17	34.49	0.13	-82.88
4.0	0.13	-160.54	7.50	2.37	27.07	0.21	23.39	0.17	-92.71
5.0	0.15	-161.16	5.66	1.92	8.67	0.26	10.75	0.17	-115.74
6.0	0.16	-168.32	4.15	1.61	-9.33	0.30	-3.13	0.18	-148.55
7.0	0.18	-169.02	2.81	1.38	-26.77	0.34	-17.35	0.23	-171.42
8.0	0.22	-172.11	1.54	1.19	-44.09	0.37	-32.48	0.27	-179.22
9.0	0.28	-179.13	0.40	1.05	-56.93	0.39	-44.39	0.34	172.55
10.0	0.36	167.24	-0.65	0.93	-72.87	0.41	-59.89	0.32	165.25
11.0	0.40	150.74	-1.67	0.83	-88.88	0.43	-76.41	0.36	143.82
12.0	0.42	117.93	-3.74	0.65	-106.42	0.38	-95.94	0.45	119.98
13.0	0.48	75.82	-7.44	0.43	-106.46	0.26	-99.26	0.65	96.63
14.0	0.36	46.19	-6.28	0.49	-88.91	0.31	-76.27	0.74	78.06
15.0	0.12	54.36	-3.61	0.66	-103.00	0.49	-90.86	0.65	60.03
16.0	0.14	105.64	-2.80	0.72	-126.00	0.59	-116.07	0.55	29.26
17.0	0.16	99.88	-3.19	0.69	-147.98	0.60	-140.52	0.59	-2.26
18.0	0.20	87.16	-4.00	0.63	-165.87	0.58	-161.06	0.65	-14.54
19.0	0.40	52.83	-4.69	0.58	-171.24	0.55	-169.34	0.53	-10.12
20.0	0.60	41.84	-5.39	0.54	176.07	0.52	175.04	0.57	10.07

Typical Noise Parameters Vdd = 4V, Idd = 65 mA

Freq GHz	Fmin dB	Γ_{opt} Mag.	Γ_{opt} Ang	Rn/50
0.5	0.48	0.093	-178.1	0.098
0.6	0.48	0.098	178.6	0.093
0.7	0.48	0.104	175.6	0.087
0.8	0.48	0.109	172.8	0.082
0.9	0.48	0.115	170.2	0.077
1.0	0.48	0.120	167.9	0.073
1.1	0.48	0.125	165.8	0.068
1.2	0.48	0.131	163.9	0.065
1.3	0.49	0.136	162.3	0.061
1.4	0.49	0.141	160.9	0.057
1.5	0.49	0.147	159.8	0.054
1.6	0.50	0.152	158.9	0.052
1.7	0.50	0.157	158.2	0.049
1.8	0.51	0.162	157.7	0.047
1.9	0.51	0.167	157.5	0.045
2.0	0.52	0.173	157.6	0.043
2.1	0.53	0.178	157.8	0.042
2.2	0.54	0.183	158.3	0.041
2.3	0.54	0.188	159.1	0.040
2.4	0.55	0.193	160.0	0.040
2.5	0.56	0.198	161.3	0.039
2.6	0.57	0.203	162.7	0.039
2.7	0.58	0.208	164.4	0.040
2.8	0.59	0.213	166.3	0.040
2.9	0.61	0.218	168.5	0.041
3.0	0.62	0.223	170.8	0.043
3.1	0.63	0.228	173.5	0.044
3.2	0.64	0.233	176.3	0.046
3.3	0.66	0.238	179.4	0.048
3.4	0.67	0.243	-177.2	0.050
3.5	0.69	0.247	-173.7	0.053
3.6	0.70	0.252	-169.9	0.056
3.7	0.72	0.257	-165.8	0.059
3.8	0.74	0.262	-161.5	0.063
3.9	0.75	0.266	-157.0	0.067
4.0	0.77	0.271	-152.3	0.071

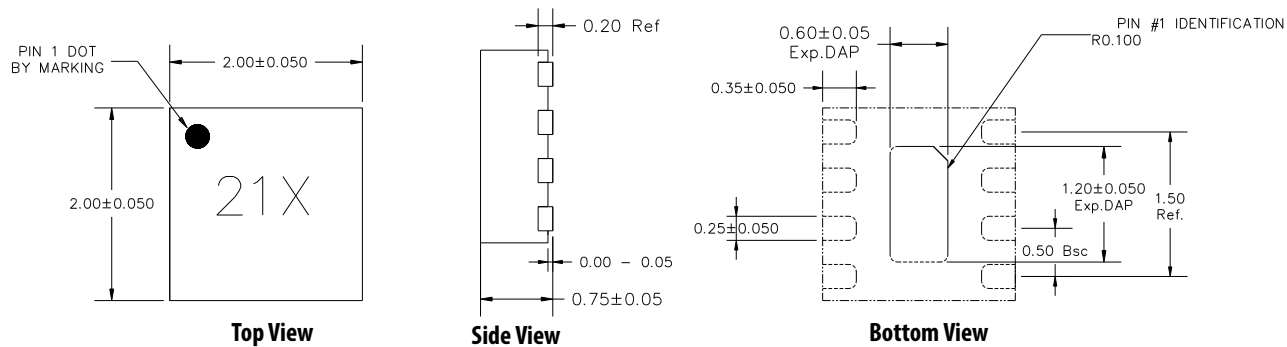


NOTE Sparameters at other biasing conditions can be found at Avago web site.

Part Numbering Ordering Information

Part Number	No. of Devices	Container
MGA-621P8-BLKG	100	Antistatic Bag
MGA-621P8-TR1G	3000	Container: 7 inch Reel

SLP2X2 Package



NOTE

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating.
3. Dimensions are exclusive of mold ash and metal burr.
4. 21 = Product code.
5. X = Month code.

Recommended PCB Land Pattern and Stencil Design

Figure 34 PCB Land Pattern

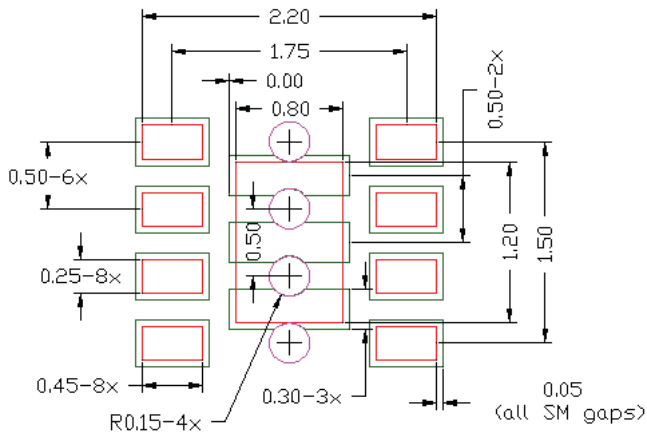


Figure 35 Stencil Design

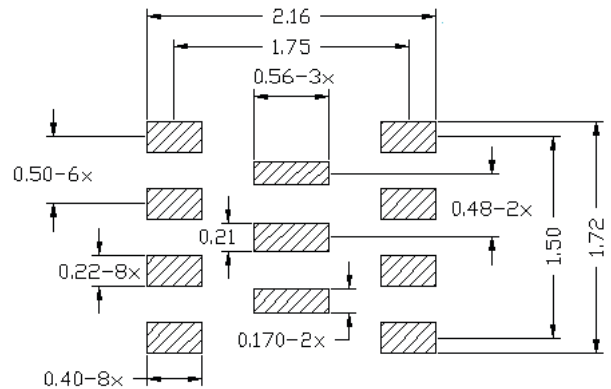
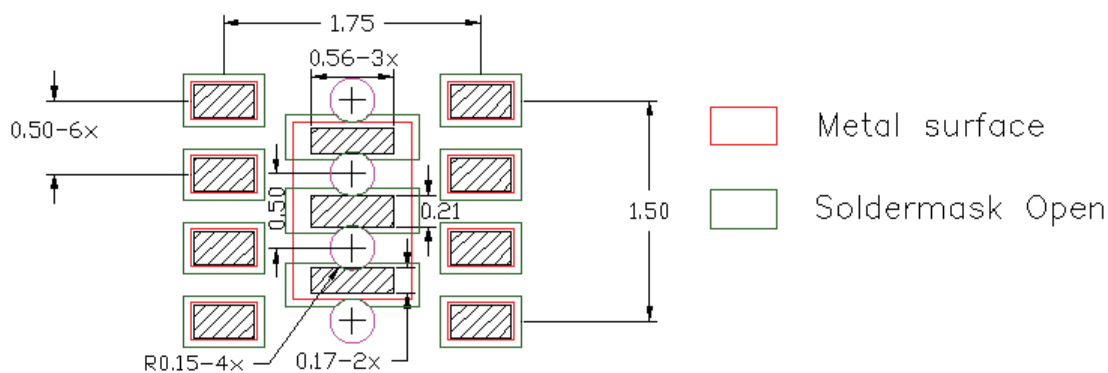


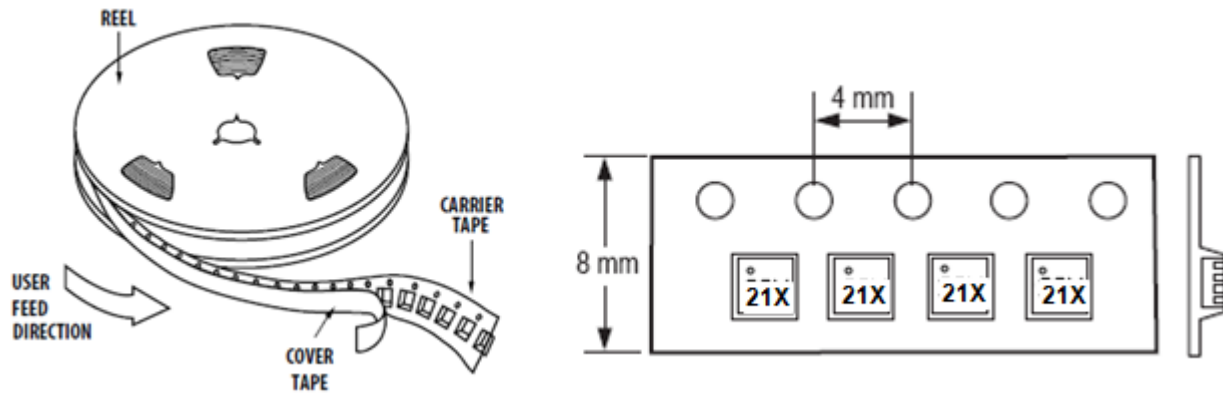
Figure 36 Combination of Land Pattern and Stencil Opening



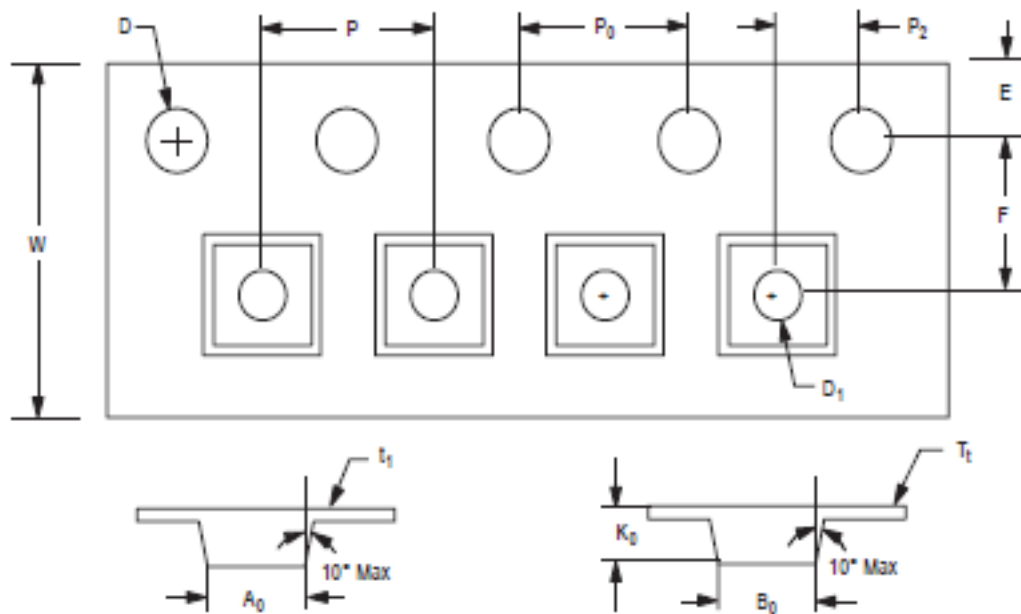
NOTE

1. Recommended land pattern and stencil opening.
2. Stencil thickness is 0.1 mm (4 mils).
3. All dimension are in mm unless otherwise specified.

Device Orientation

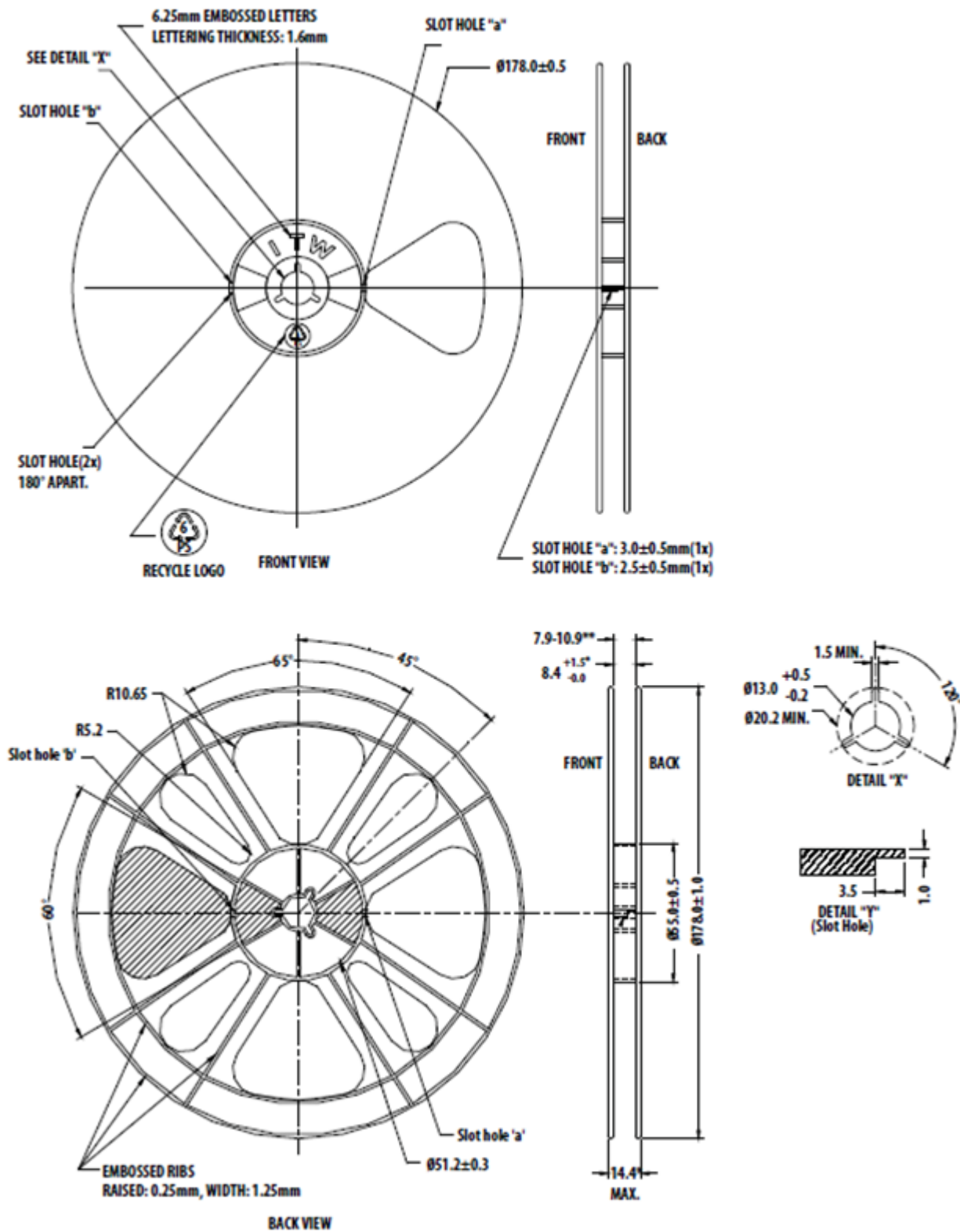


Tape Dimensions



Description		Symbol	Size (mm)	Size (inches)
Cavity	Length	A_0	2.30 ± 0.05	0.091 ± 0.004
	Width	B_0	2.30 ± 0.05	0.091 ± 0.004
	Depth	K_0	1.00 ± 0.05	0.039 ± 0.002
	Pitch	P	4.00 ± 0.10	0.157 ± 0.004
	Bottom Hole Diameter	D_1	$1.00 + 0.25$	$0.039 + 0.002$
Perforation	Diameter	D	1.50 ± 0.10	0.060 ± 0.004
	Pitch	P_0	4.00 ± 0.10	0.157 ± 0.004
	Position	E	1.75 ± 0.10	0.069 ± 0.004
Carrier Tape	Width	W	$8.00 + 0.30$ 8.00 ± 0.10	0.315 ± 0.012 0.315 ± 0.004
	Thickness	t_t	0.254 ± 0.02	0.010 ± 0.0008
Cover Tape	Width	C	5.4 ± 0.10	0.205 ± 0.004
	Tape Thickness	T_t	0.062 ± 0.001	0.0025 ± 0.0004
Distance	Cavity to Perforation (Width Direction)	F	3.50 ± 0.05	0.138 ± 0.002
	Cavity to Perforation (Length Direction)	P_2	2.00 ± 0.05	0.079 ± 0.002

Reel Dimensions – 7 Inch



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