MGA-622P8

1.5 GHz–4.0 GHz Low Noise Amplifier

Data Sheet

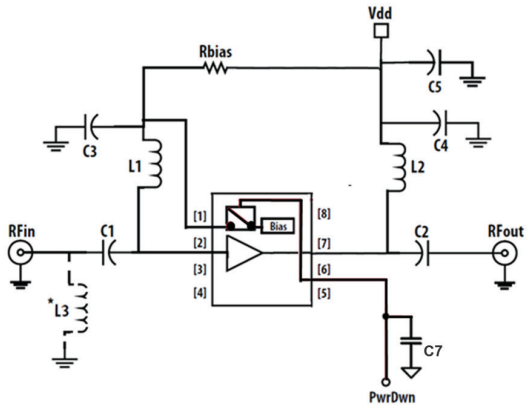
Description

Avago Technologies' MGA-622P8 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 0.25um GaAs Enhancement-mode pHEMT process.

It is housed in the miniature 2.0 mm × 2.0 mm × 0.75 mm 8-pin Dual-Flat-Non-Lead (DFN) package. The device is designed for optimum use from 1.5 GHz up to 4.0 GHz. For optimum performance at lower frequency from 450 MHz to 1.5 GHz, MGA-621P8 are 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 × 2.0 mm × 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

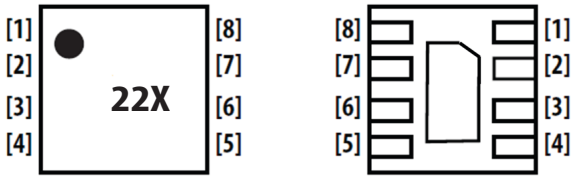
Typical performance at 1.9 GHz; 4V, 60 mA

- 18.5 dB Gain
- 0.56 dB Noise Figure
- 35 dBm Output IP3

Applications

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

Pin Configuration and Package Marking



Pin1 - Vbias
Pin2 - RFinput
Pin3 - Not Used
Pin4 - Not Used
Pin5 - PwrDwn
Pin6 - Not Used
Pin7 - RFoutput/Vdd
Pin8 - Not Used
Center tab - Ground

NOTE Package marking provides orientation and identification

- "22" = Device code
- "X" = Month code

Absolute Maximum Rating (see Note) T_A= 25°C

Symbol	Parameter	Units	Absolute Maximum
Vdd	Device Voltage, RF output to ground	V	5.5
Vbias	Drain Current	mA	90
$P_{in,max}$	CW RF Input Power (Vdd=4V, Id=60mA)	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 21.8mW/°C for TB>139°C.

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

Thermal Resistance

Thermal Resistance[a]
(Vdd = 4.0V, Idd =60mA),
Θ_{jc} = 45°C/W

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

Electrical Specifications

RF performance at T_A = 25°C, Z_0 = 50 Ω, Vdd = 4V, measured on demo board in Figure 6 with component list in Table 1 for 1.9 GHz.

Symbol	Parameter and Test Condition	Frequency (GHz)	Unit	Min	Typ	Max
Vdd	Device operating voltage		V	—	4.0	—
Idd	Device current		mA	50	61	75
Gain	Gain	1.9	dB	17.5	18.6	20.0
NF	Noise Figure	1.9	dB	—	0.56	0.9
OIP3[a]	Output Third order intercept point	1.9	dBm	32.0	35.0	—
OP1dB	Output Power at 1dB Gain Compression	1.9	dBm	—	20.4	—
IRL	Input Return Loss, 50 Ω source	1.9	dB	—	20.0	—
ORL	Output Return Loss, 50 Ω load	1.9	dB	—	12.0	—

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

NOTE

1. Measurements at 1.9 GHz obtained using demo board described in Figure 6.
2. For NF data, board losses of the input have not been de-embedded.

Truth Table

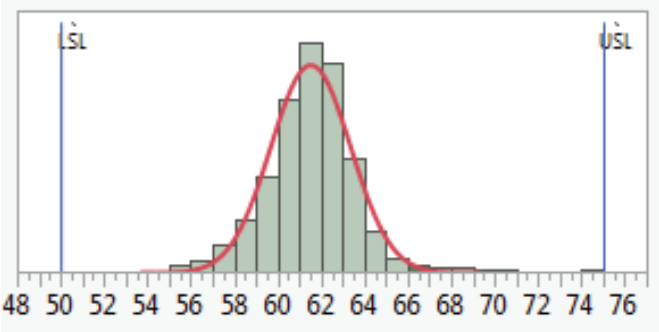
	VpwrDwn(V)
LNA Mode	0 or open
Power Down Mode	3.3

Product Consistency Distribution Charts (see Notes 1 and 2)

NOTE

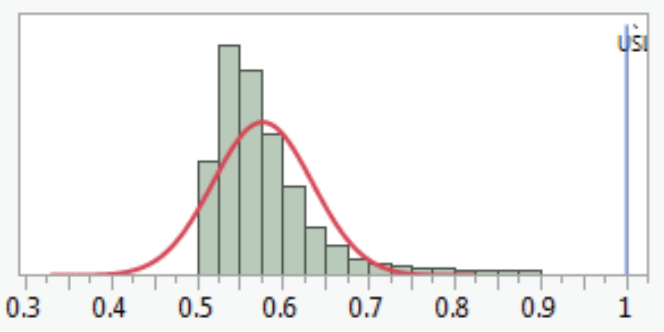
1. Distribution data samples are 3000 samples taken from 3 different wafers. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.
2. Circuit Losses have not been de-embedded from the actual measurements.

Figure 1 Idd @ 1.9 GHz, 4V, Mean=61 mA



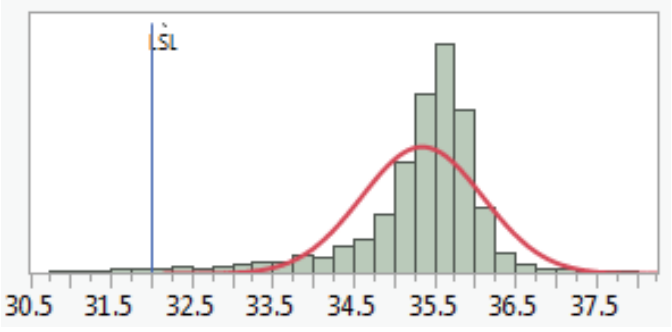
Idd, Max = 75, Min = 50

Figure 2 NF @ 1.9 GHz, 4V, Mean=0.56 dB



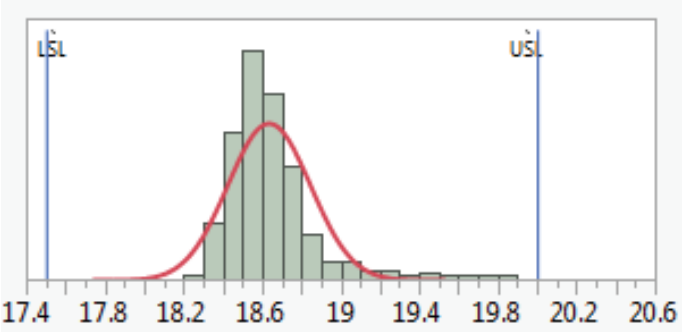
NF, Max = 0.9

Figure 3 OIP3 @ 1.9 GHz, 4V, Mean=35.5 dBm



OIP3, Min = 32.0

Figure 4 Gain @ 1.9 GHz, 4V, Mean=18.6 dB



Gain, Max = 20.0, Min = 17.5

Figure 5 Demo Board Layout Diagram

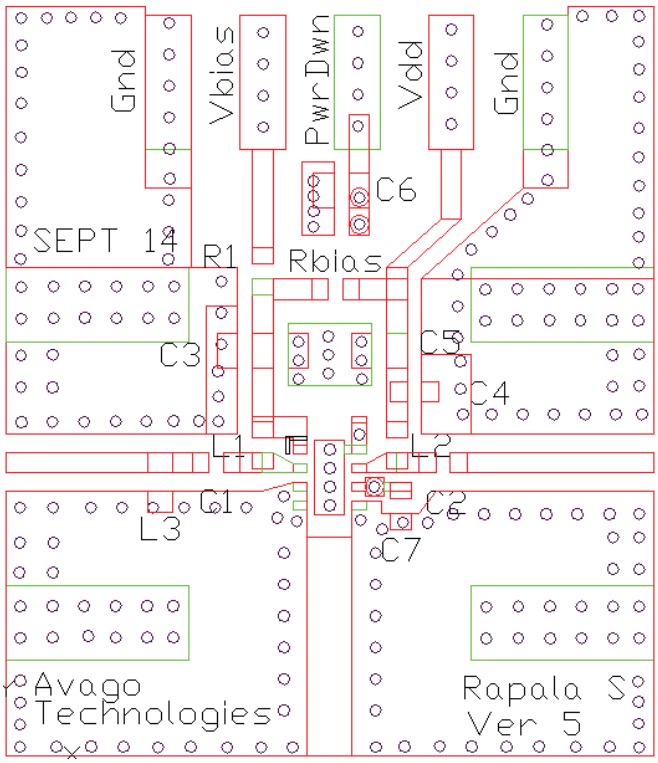
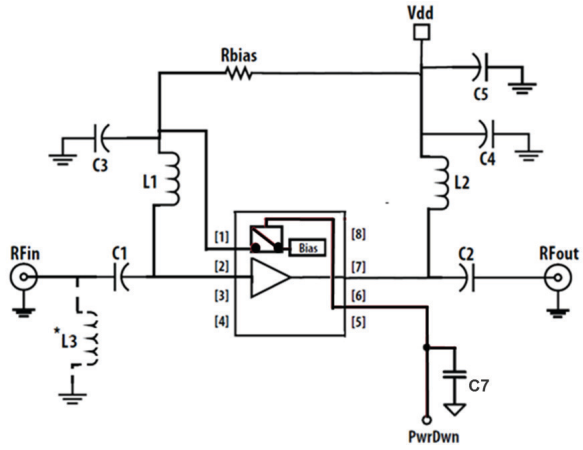


Figure 6 Demo Board Schematic Diagram



NOTE Details of the components needed for this product are shown in Table 1.

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

Table 1 Component List for 1.5 GHz to 2.7 GHz Matching (Refer to the Application Note for Other Application Frequencies)

Part	Size	Value	Detail Part Number
C1, C2, C4	0402	100 pF (Murata)	GRM1555C1H101JA01D
C3, C5	0603	4.7 µF (Murata)	GRM188R60J475KE19D
C6	0402	Not used	
C7	0402	10 pF	GRM1555C1H100JA01D
L1	0402	5.6 nH (Murata)	LQP15MN5N6G00
L2	0402	6.8 nH (Murata)	LQP15MN6N8G00
L3	0402	Not used	
Rbias	0402	2.49 kΩ (Kamaya)	RMC1/16SK2491FTH

NOTE C1, C2 are DC Blocking capacitors; L1 connect DC bias from Pin1 to Pin2, L2 is RF choke and output match; C3, C4, C5, C7 are bypass capacitors; L3 is optional for S11 improvement.

MGA-622P8 Typical Performance Vdd=4V, Idd=61mA

RF performance at T_A = 25°C, Vdd = 4V, Rbias=2.49 kΩ, measured on demo board in Figure 6 with component list in Table 1 for 1900 MHz matching, unless otherwise stated.

Figure 7 NF vs Frequency vs Temperature

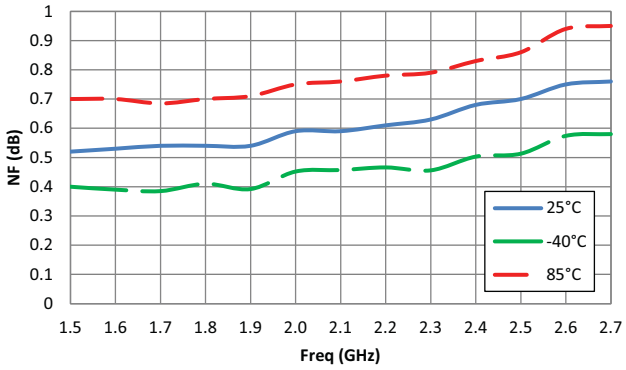


Figure 8 Gain vs Frequency vs Temperature

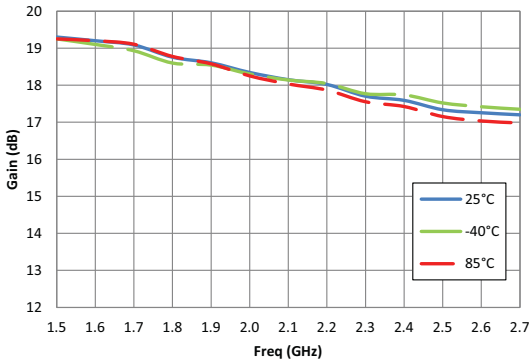


Figure 9 OIP3 vs Frequency vs Temperature

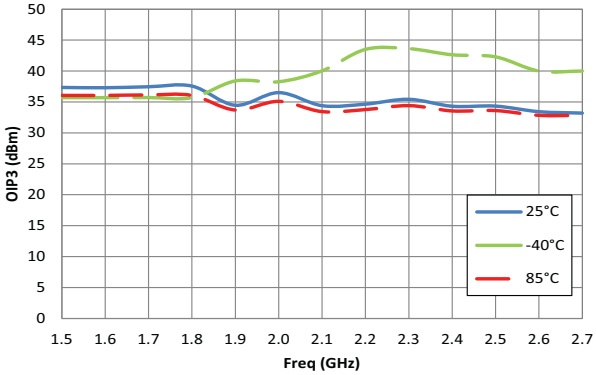


Figure 10 OP1dB vs Frequency vs Temperature

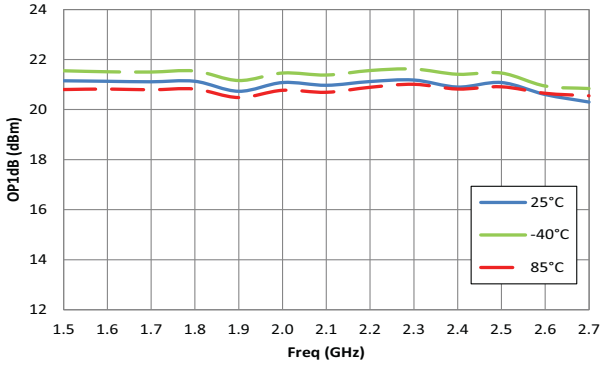


Figure 11 S-Parameter Performance

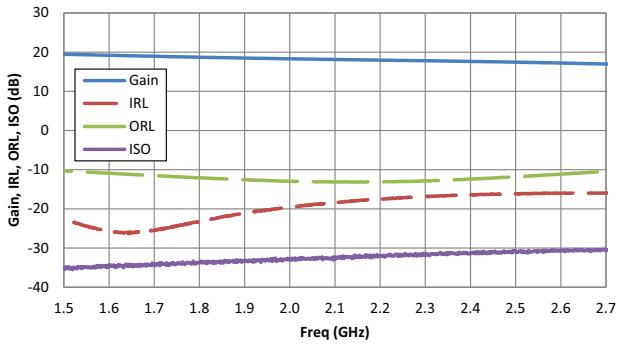


Figure 12 K-factor vs Frequency vs Temperature

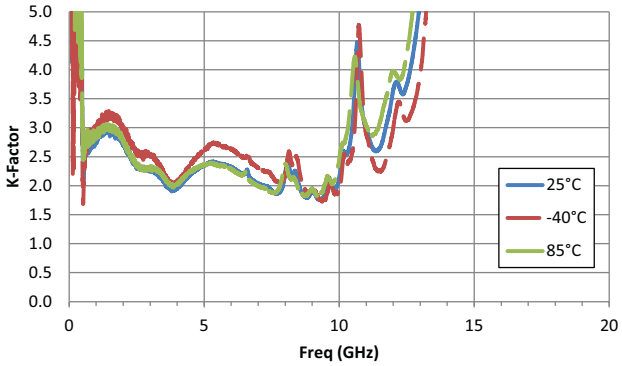
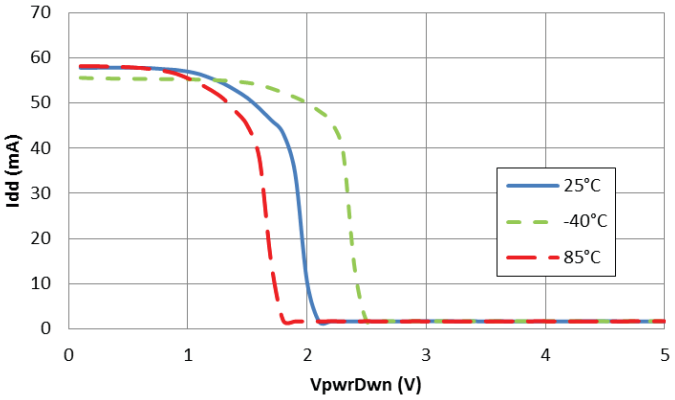


Figure 13 Idd vs PwrDwn



NOTE The component list in Table 1 remains unchanged except for Rbias is adjusted for different Idd. This note applies to Figure 14.

Figure 14 Schematic for Idd Adjustment (see Note)

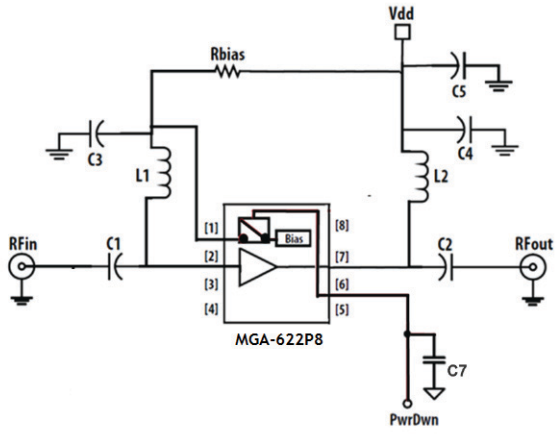
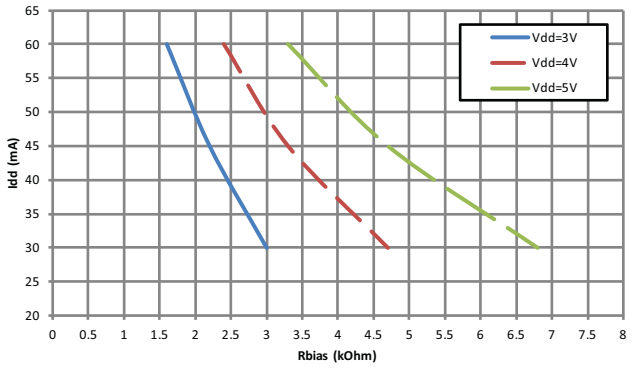


Figure 15 Idd vs. Rbias at Vdd



MGA622P8 over Idd Performance Vdd=3V

Figure 16 OIP3 vs. Frequency at Vdd = 3V

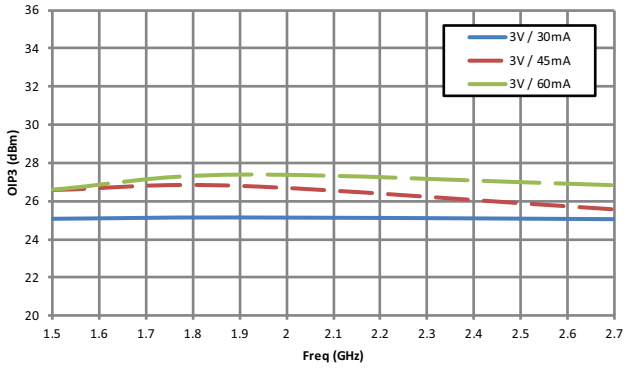


Figure 17 P1dB vs. Frequency at Vdd = 3V

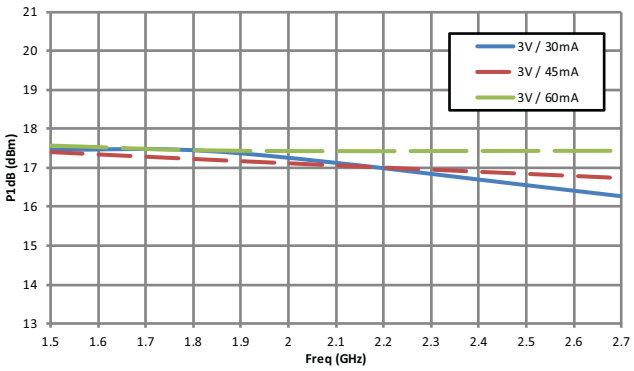


Figure 18 NF vs. Frequency at Vdd = 3V

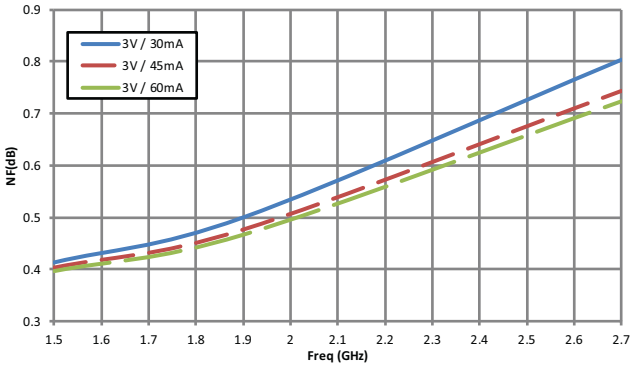


Figure 19 Gain vs. Frequency at Vdd = 3V

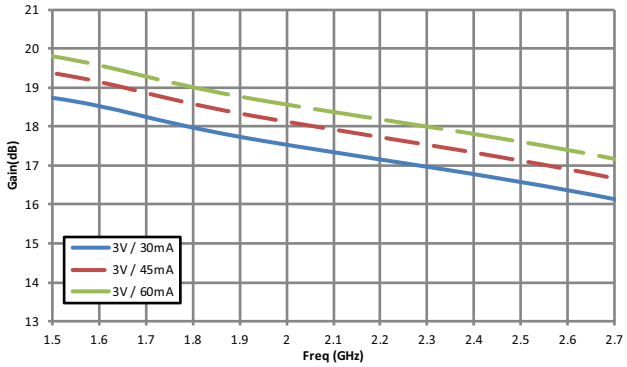


Figure 20 IRL vs. Frequency at Vdd = 3V

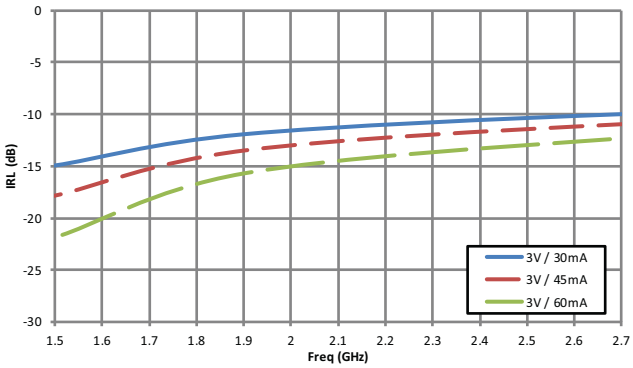
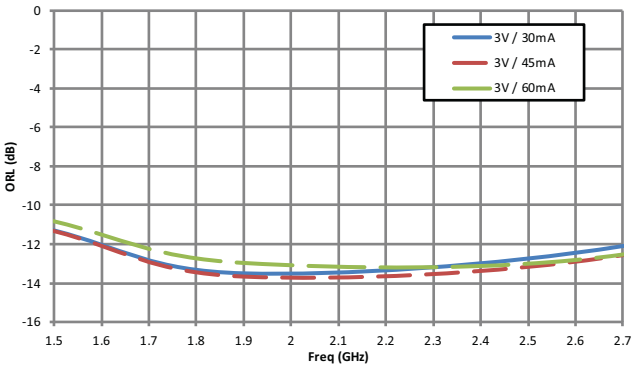


Figure 21 ORL vs. Frequency at Vdd = 3V



MGA622P8 over Idd Performance Vdd=4V

Figure 22 OIP3 vs. Frequency at Vdd = 4V

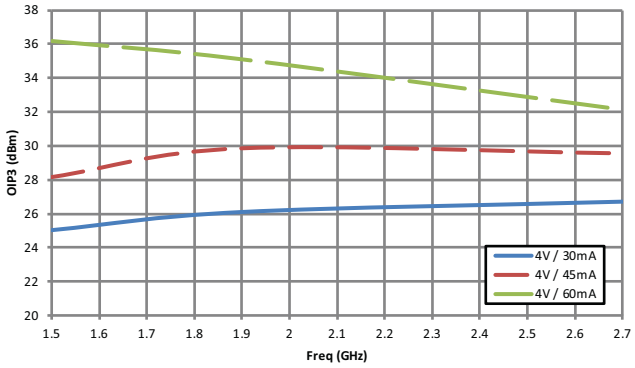


Figure 23 P1dB vs. Frequency at Vdd = 4V

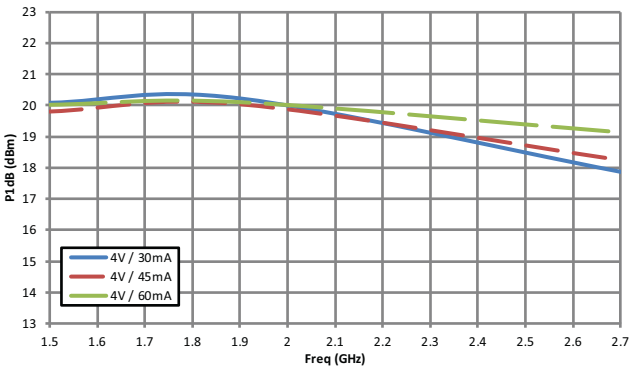


Figure 24 NF vs Frequency at Vdd = 4V

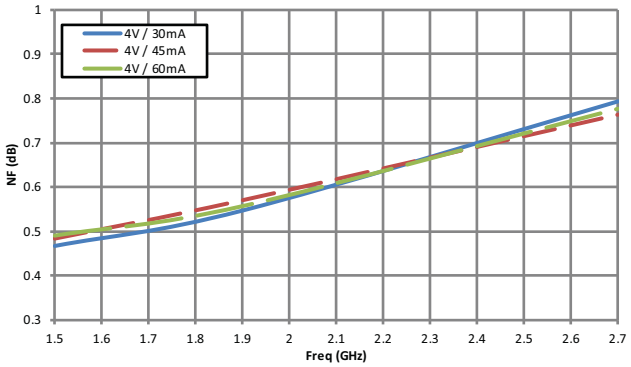


Figure 25 Gain vs. Frequency at Vdd = 4V

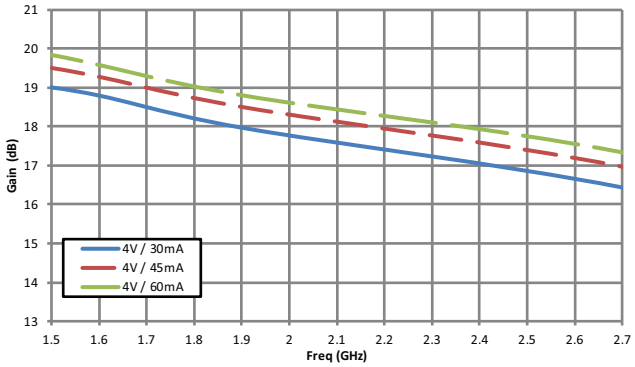


Figure 26 IRL vs. Frequency at Vdd = 4V

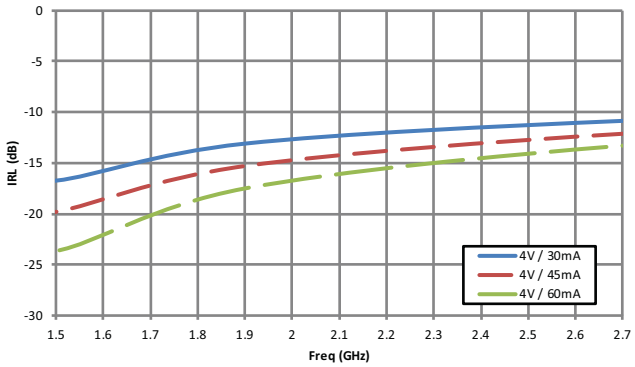
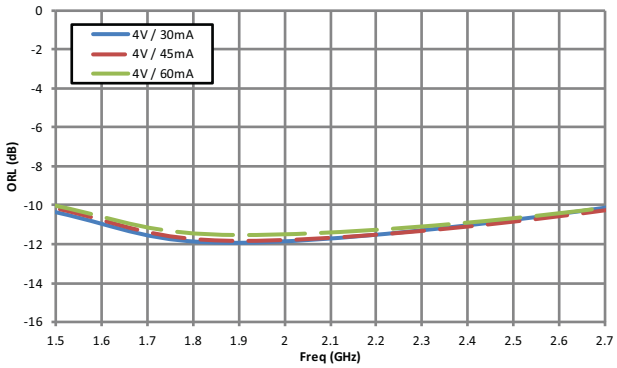


Figure 27 ORL vs. Frequency at Vdd = 4V



MGA622P8 over Idd Performance Vdd=5V

Figure 28 OIP3 vs. Frequency at Vdd = 5V

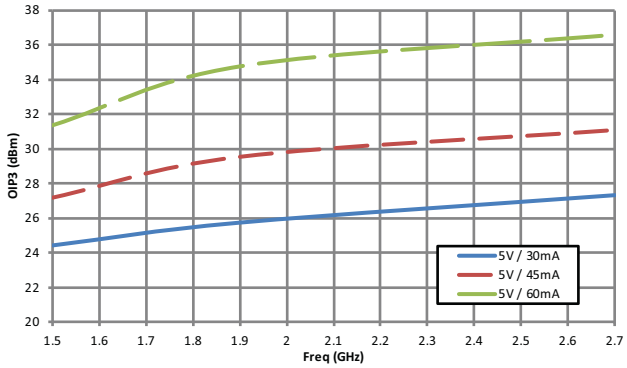


Figure 29 P1dB vs. Frequency at Vdd = 5V

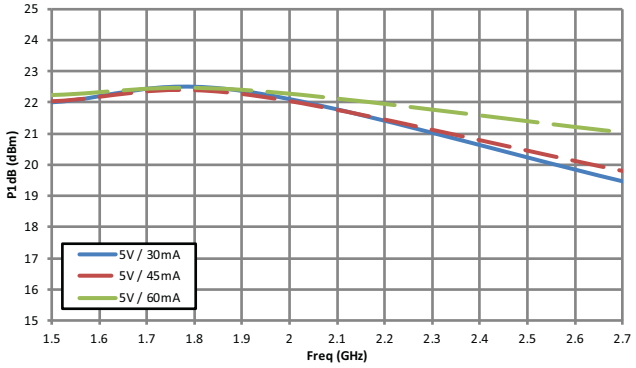


Figure 30 NF vs. Frequency at Vdd = 5V

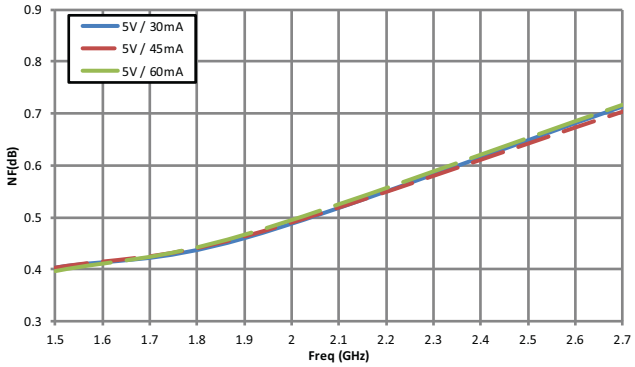


Figure 31 Gain vs. Frequency at Vdd = 5V

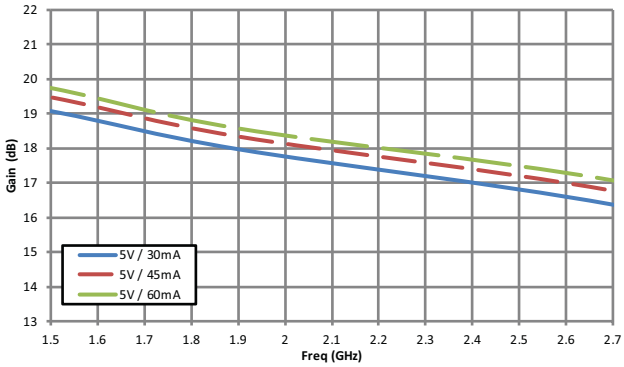


Figure 32 IRL vs. Frequeny at Vdd = 5V

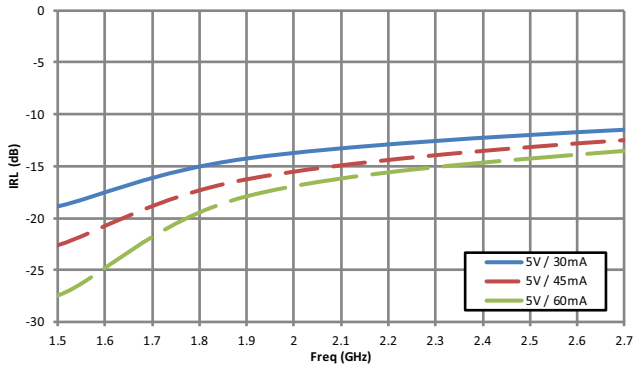
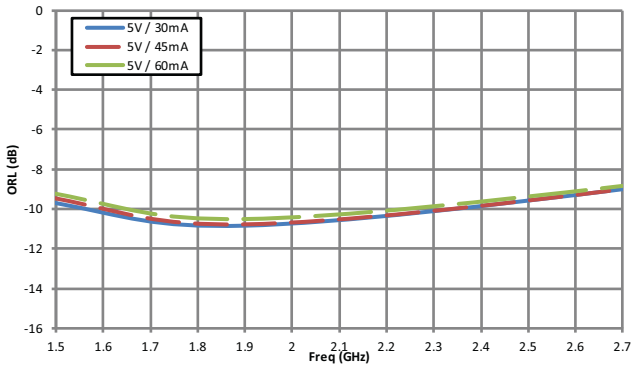
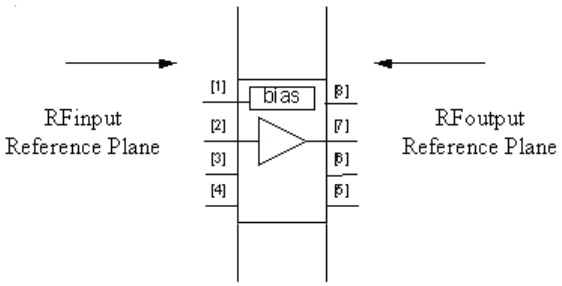


Figure 33 ORL vs. Frequency at Vdd = 5V



MGA-622P8 Typical Scattering Parameters, Vdd=4V, Idd = 60mA

freq GHz	S11			S21		S12		S22	
	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.1	0.92	–19.09	28.59	26.88	159.43	0.01	63.04	0.25	–49.05
0.5	0.58	–54.78	25.15	18.09	131.00	0.02	32.63	0.05	–29.93
0.9	0.45	–73.72	22.67	13.59	111.34	0.02	33.10	0.09	–2.17
1.0	0.42	–78.29	22.12	12.76	107.37	0.02	34.57	0.10	–2.02
1.5	0.36	–95.85	19.87	9.85	90.73	0.02	41.57	0.14	–12.93
1.9	0.33	–107.65	18.64	8.55	79.34	0.02	46.33	0.20	–24.22
2.0	0.32	–110.51	18.39	8.31	76.48	0.02	47.10	0.22	–27.67
2.5	0.30	–121.80	17.36	7.38	60.54	0.03	46.04	0.34	–50.59
3.0	0.30	–127.40	16.03	6.33	43.33	0.03	44.33	0.45	–75.87
3.5	0.32	–131.33	14.51	5.32	27.69	0.04	49.49	0.52	–96.86
4.0	0.33	–137.76	12.62	4.28	14.06	0.04	50.32	0.53	–118.20
5.0	0.36	–149.41	9.66	3.04	–4.44	0.06	43.83	0.49	–145.93
6.0	0.37	–163.96	7.82	2.46	–23.37	0.07	37.13	0.50	–169.08
7.0	0.39	178.30	6.16	2.03	–43.39	0.09	28.45	0.55	168.32
8.0	0.42	163.42	4.45	1.67	–63.80	0.10	17.87	0.58	148.95
9.0	0.44	151.81	2.41	1.32	–76.54	0.11	11.05	0.66	145.14
10.0	0.46	145.00	1.19	1.15	–93.30	0.14	1.73	0.63	130.57
11.0	0.47	133.75	0.15	1.02	–111.27	0.16	–10.09	0.66	108.88
12.0	0.47	113.66	–1.67	0.82	–131.37	0.18	–25.87	0.72	82.87
13.0	0.51	95.25	–4.09	0.62	–145.61	0.19	–37.55	0.79	71.60
14.0	0.55	84.81	–6.40	0.48	–154.04	0.19	–45.03	0.81	71.76
15.0	0.56	75.24	–8.02	0.40	–164.07	0.22	–56.19	0.78	63.35
16.0	0.58	63.43	–9.78	0.32	–178.12	0.24	–74.18	0.74	35.54
17.0	0.59	51.62	–12.36	0.24	170.30	0.24	–93.15	0.79	6.22
18.0	0.57	36.50	–14.67	0.18	168.78	0.23	–107.16	0.83	–5.11
19.0	0.59	20.05	–15.91	0.16	–178.72	0.23	–107.31	0.70	1.75
20.0	0.66	13.44	–16.21	0.15	–173.85	0.24	–115.65	0.80	12.78



NOTE S parameters at other biasing conditions can be found at the Avago website.

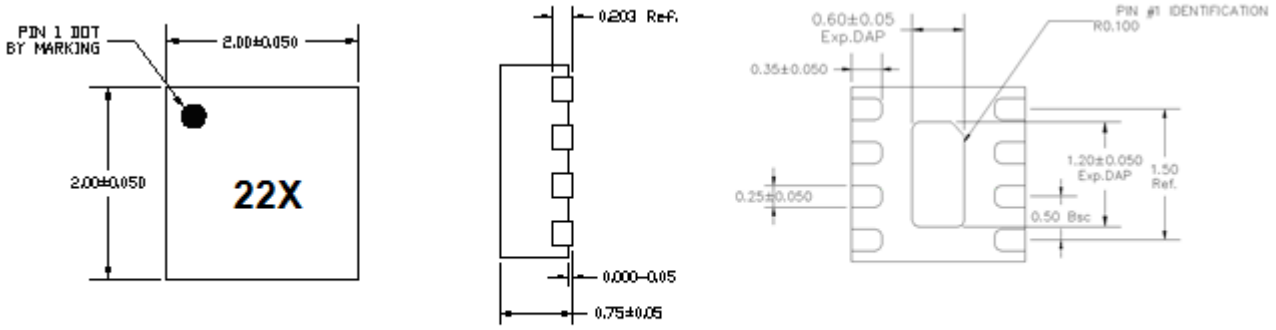
Typical Noise Parameters, Vdd=4V, Idd = 60mA

Freq GHz	Fmin	Γopt	Γopt	$R_{n/50}$
	dB	Mag.	Ang	
0.5	0.30	0.313	9.4	0.093
0.6	0.30	0.310	16.5	0.087
0.7	0.31	0.308	23.4	0.082
0.8	0.32	0.305	30.2	0.077
0.9	0.32	0.303	36.8	0.072
1.0	0.33	0.301	43.4	0.068
1.1	0.34	0.299	49.8	0.064
1.2	0.35	0.298	56.1	0.060
1.3	0.36	0.296	62.2	0.056
1.4	0.37	0.295	68.2	0.053
1.5	0.38	0.294	74.1	0.049
1.6	0.39	0.292	79.9	0.046
1.7	0.40	0.292	85.5	0.044
1.8	0.41	0.291	91.0	0.041
1.9	0.43	0.290	96.4	0.039
2.0	0.44	0.290	101.7	0.037
2.1	0.45	0.290	106.8	0.036
2.2	0.47	0.290	111.8	0.034
2.3	0.49	0.290	116.6	0.033
2.4	0.50	0.290	121.3	0.032
2.5	0.52	0.291	125.9	0.031
2.6	0.54	0.291	130.4	0.031
2.7	0.56	0.292	134.8	0.031
2.8	0.58	0.293	139.0	0.031
2.9	0.60	0.294	143.0	0.031
3.0	0.62	0.295	147.0	0.032
3.1	0.64	0.297	150.8	0.033
3.2	0.66	0.298	154.5	0.034
3.3	0.68	0.300	158.1	0.035
3.4	0.71	0.302	161.5	0.036
3.5	0.73	0.304	164.8	0.038
3.6	0.76	0.306	168.0	0.040
3.7	0.78	0.309	171.0	0.043
3.8	0.81	0.311	174.0	0.045
3.9	0.83	0.314	176.7	0.048
4.0	0.86	0.317	179.4	0.051

Part Number Ordering Information

Part Number	No. of Devices	Container
MGA-622P8-BLKG	100	Antistatic Bag
MGA-622P8-TR1G	3000	Container: 7 inch Reel

SLP2X2 Package



Top View Side View Bottom View

NOTE

1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating.
3. Dimensions are exclusive of mold ash and metal burr.

Recommended PCB Land Pattern and Stencil Design

Figure 34 PCB Land Patttern

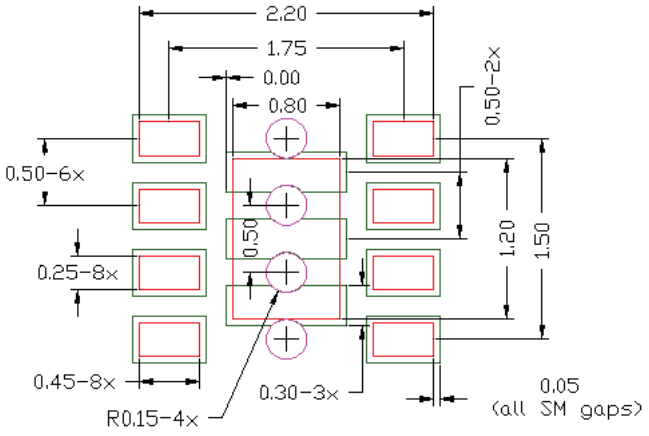


Figure 35 Stencil Design

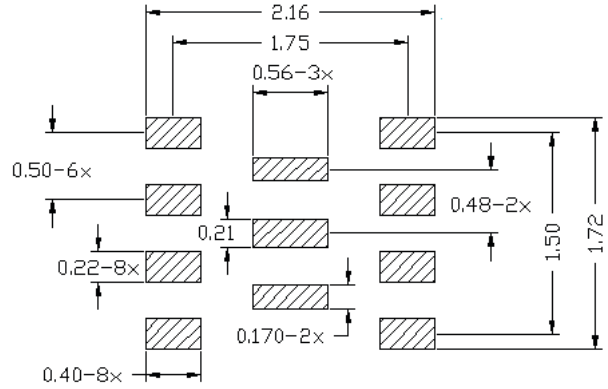
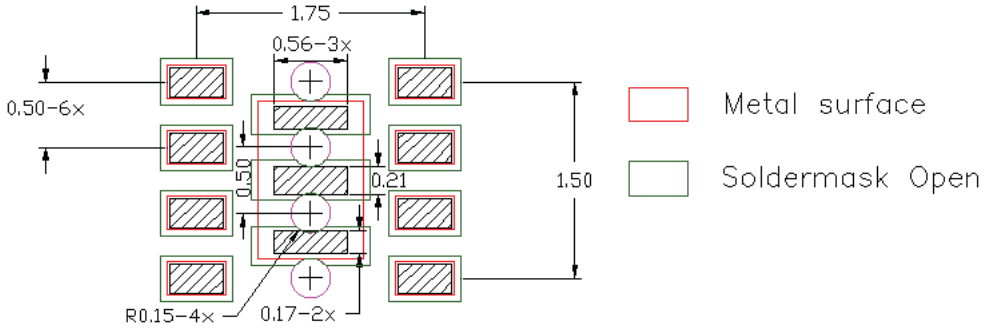


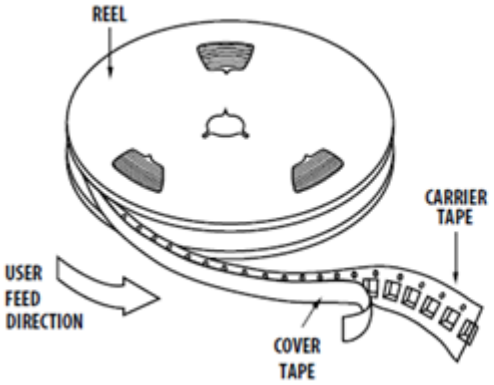
Figure 36 Combination of Land Pattern and Stencil Opening

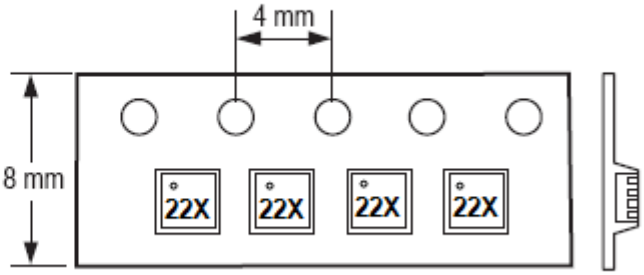


NOTE

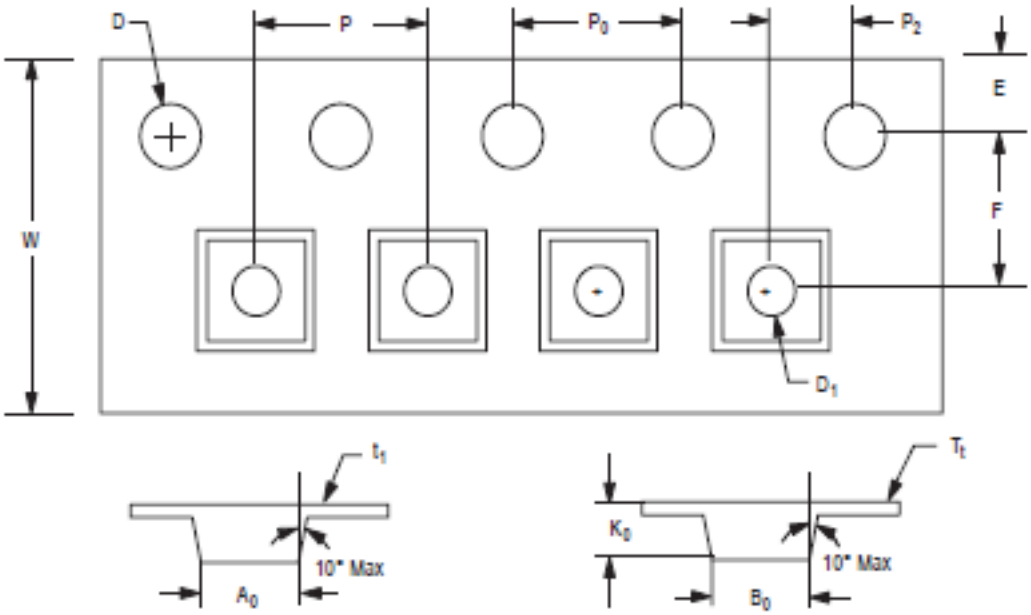
1. Recommended land pattern and stencil opening
2. Stencil thickness is 0.1 mm (4 mils)
3. All dimensions are in mm unless otherwise specified.

Device Orientation



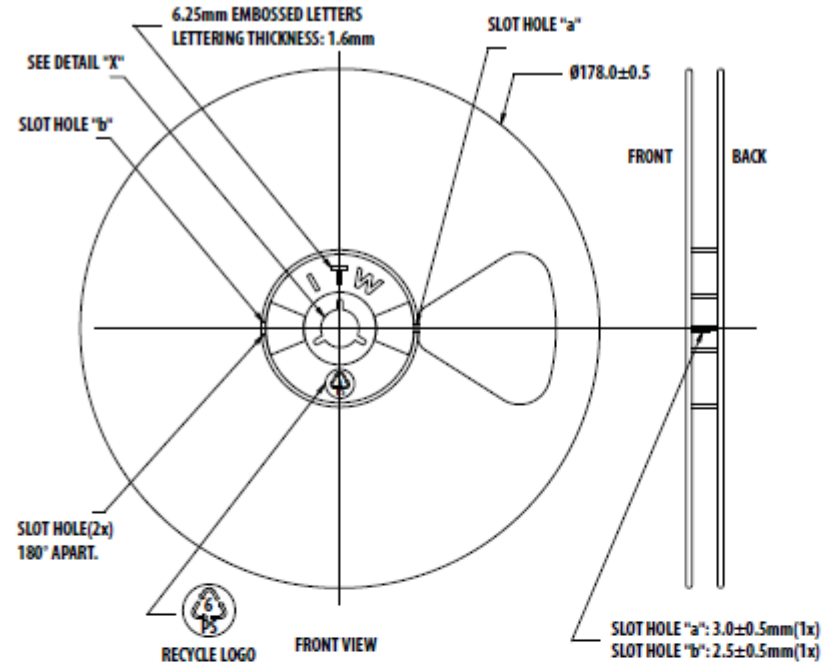


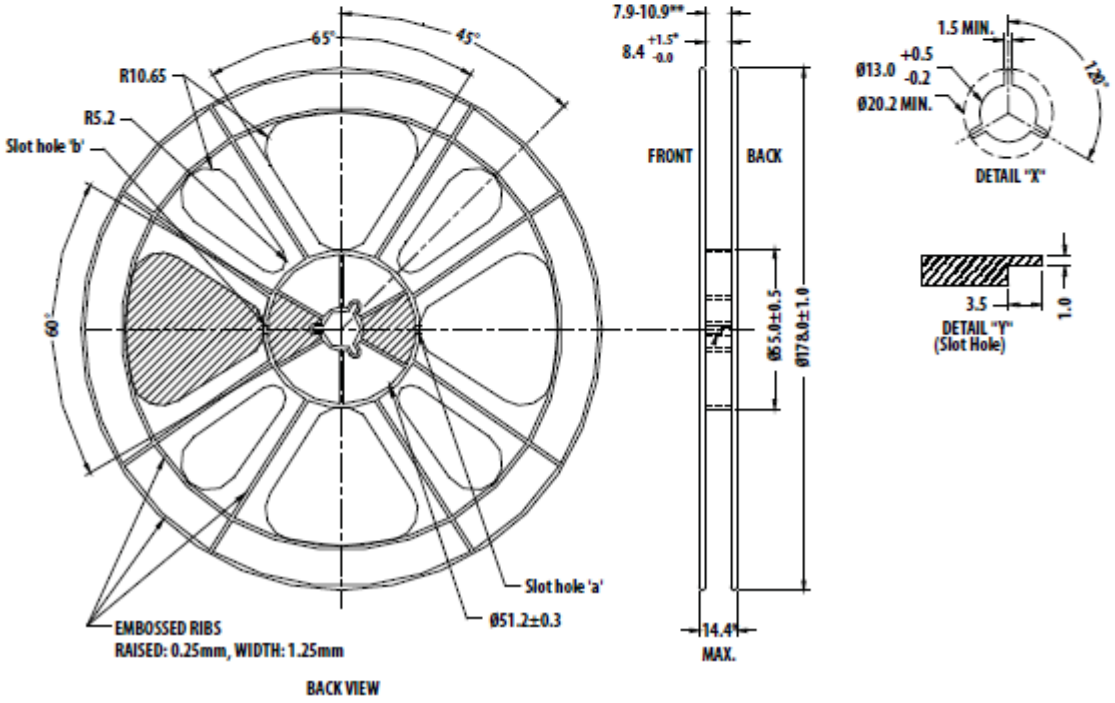
Tape Dimensions



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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www.avagotech.com

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