MGA-683P8

Low Noise And High Linearity Active Bias Low Noise Amplifier

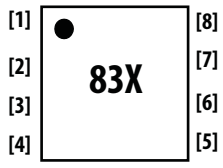
Data Sheet

Description

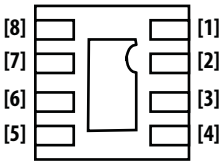
Avago Technologies' MGA-683P8 is an economical, easy-to-use GaAs MMIC Low Noise Amplifier (LNA). The LNA has low noise and high linearity achieved through the use of Avago Technologies' proprietary 0.25 µm GaAs Enhancement-mode pHEMT process. It is housed in a miniature 2.0 x 2.0 x 0.75 mm^3 8-pin Quad-Flat-Non-Lead (QFN) package. It is designed for optimum use from 450 MHz up to 2 GHz. The compact footprint and low profile coupled with low noise, high gain and high linearity make the MGA-683P8 an ideal choice as a low noise amplifier for cellular infrastructure for GSM and CDMA. For optimum performance at higher frequency from 1.5 GHz to 4 GHz, the MGA-684P8 is recommended. Both MGA-683P8 and MGA-684P8 share the same package and pinout.

Pin Configuration and Package Marking

2.0 x 2.0 x 0.75 mm^3 8-lead QFN



Top View



Bottom View

Pin 1 – Vbias
Pin 2 – RFinput
Pin 3 – Not Used
Pin 4 – Not Used

Pin 5 – Not Used
Pin 6 – Not Used
Pin 7 – RFoutput/Vdd
Pin 8 – Not Used
Centre tab - Ground

Note:
Package marking provides orientation and identification
"83" = Device Code
"X" = Month Code



Attention: Observe precautions for handling electrostatic sensitive devices.
ESD Machine Model = 90 V (Class A)
ESD Human Body Model = 500 V (Class 1B)
Refer to Avago Application Note A004R: Electrostatic Discharge, Damage and Control.

Features

- Low noise Figure
- High linearity performance
- GaAs E-pHEMT Technology[1]
- Low cost small package size: 2.0 x 2.0 x 0.75 mm^3
- Excellent uniformity in product specifications
- Tape-and-Reel packaging option available

Specifications

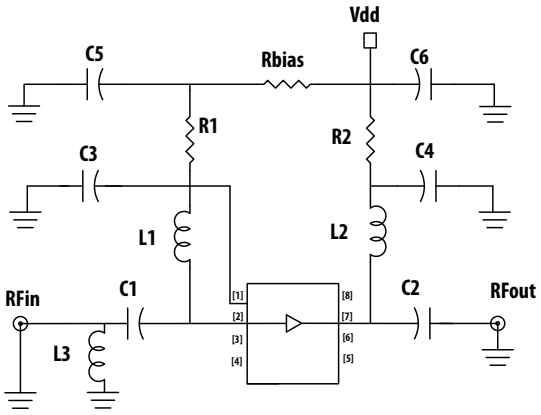
900 MHz; 5 V, 40 mA

- 17.8 dB Gain
- 0.56 dB Noise Figure
- More than 20 dB Input Return Loss
- 32.8 dBm Output IP3
- 21.5 dBm Output Power at 1dB gain compression

Applications

- Low noise amplifier for cellular infrastructure for GSM and CDMA.
- Other low noise application.
- Repeater, Metrocell/Picocell application.

Simplified Schematic



Note:
- The schematic is shown with the assumption that similar PCB is used for both MGA-683P8 and MGA-684P8.
- Detail of the components needed for this product is shown in Table 1.
- Enhancement mode technology employs positive gate voltage, thereby eliminating the need of negative gate voltage associated with conventional depletion mode devices.
- Good RF practice requires all unused pins to be earthed.

Absolute Maximum Rating [1] T_A=25° C

Symbol	Parameter	Units	Absolute Maximum
V_{dd}	Device Voltage, RF output to ground	V	5.5
Idd	Drain Current	mA	90
P_{max}	CW RF Input Power (V_{dd} = 5.0 V, I_d = 54 mA)	dBm	+20
P_{diss}	Total Power Dissipation [2]	W	0.495
T_j	Junction Temperature	°C	150
T_{stg}	Storage Temperature	°C	-65 to 150

Thermal Resistance

Thermal Resistance [3]
(V_{dd} = 5.0 V, I_{dd} = 40 mA)
θ_{jc} = 72°C/W

Notes:
1. Operation of this device in excess of any of these limits may cause permanent damage.
2. Thermal resistance measured using Infra-Red Measurement Technique.
3. Power dissipation with unit turned on. Board temperature T_B is 25° C. Derate at 13.89 mW/°C for T_B > 114° C.

Electrical Specifications [1, 4]

RF performance at T_A = 25° C, V_{dd} = 5 V, R_{bias} = 12 kOhm, 900 MHz, measured on demo board in Figure 5 with component list in Table 1 for 900 MHz matching.

Symbol	Parameter and Test Condition	Units	Min.	Typ.	Max.
I_{dd}	Drain Current	mA	25	40.3	53
Gain	Gain	dB	16.3	17.8	19.3
OIP3 [2]	Output Third Order Intercept Point	dBm	28.5	32.8	
NF [3]	Noise Figure	dB		0.56	0.8
OP1dB	Output Power at 1dB Gain Compression	dBm		21.5	
IRL	Input Return Loss, 50 Ω source	dB		24	
ORL	Output Return Loss, 50 Ω load	dB		13	
REV ISOL	Reverse Isolation	dB		21	

Notes:
1. Measurements at 900 MHz obtained using demo board described in Figure 1.
2. OIP3 test condition: F_{RF1} = 900 MHz, F_{RF2} = 901 MHz with input power of -10 dBm per tone.
3. For NF data, board losses of the input have not been de-embedded.
4. Use proper bias, heatsink and derating to ensure maximum channel temperature is not exceeded. See absolute maximum ratings and application note for more details.

Product Consistency Distribution Charts

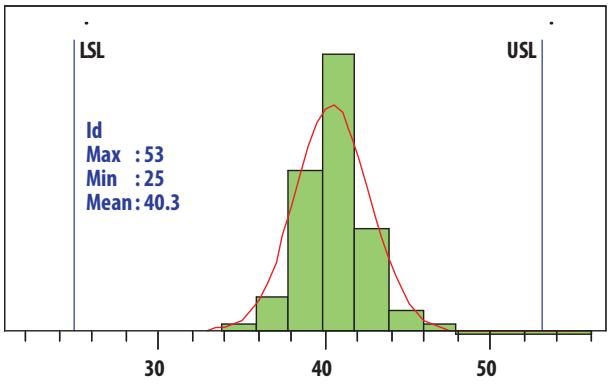


Figure 1. Idd @ 900 MHz, Mean = 40.3

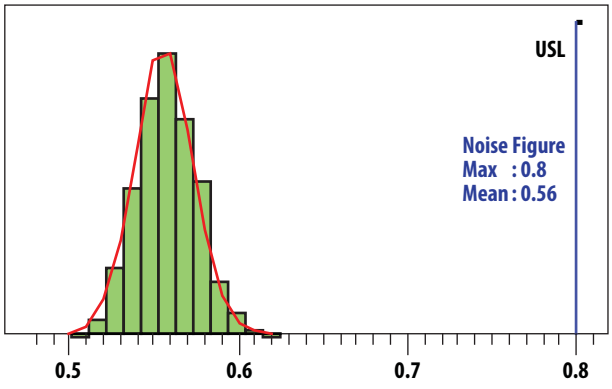


Figure 2. Noise Figure @ 900 MHz, Mean = 0.56

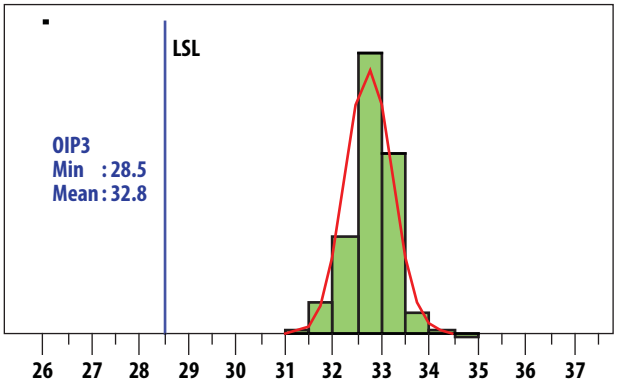


Figure 3. OIP3 @ 900 MHz, Mean = 32.8

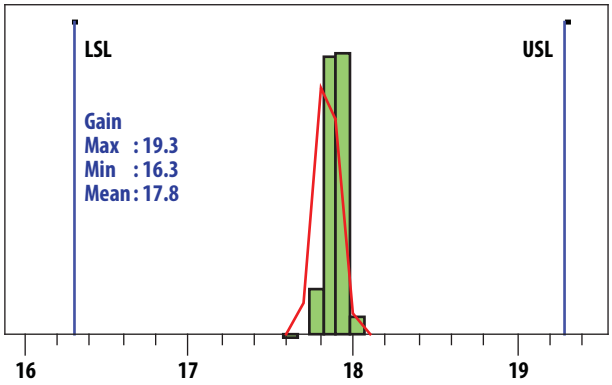


Figure 4. Gain @ 900 MHz, Mean = 17.8

Notes:
1. Distribution data samples are 500 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.

Demo Board Layout

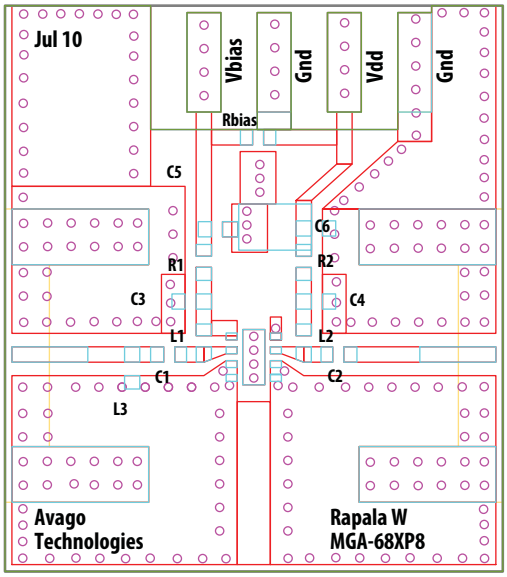


Figure 5. Demo Board Layout Diagram

Demo Board Schematic

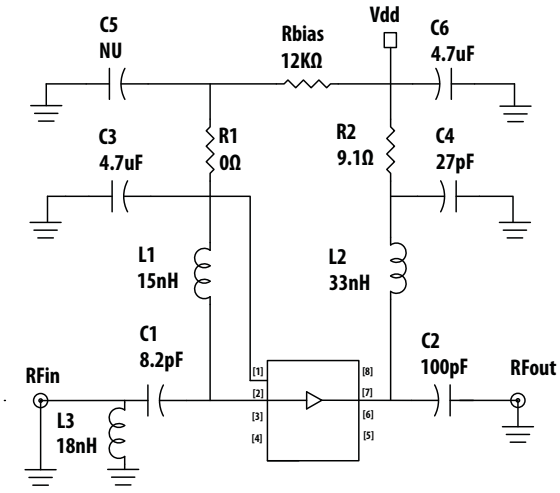


Figure 6. Demo Board Schematic Diagram

– Recommended PCB material is 10 mils Rogers RO4350.

– Suggested component values may vary according to layout and PCB material.

Notes:

- The schematic is shown with the assumption that similar PCB is used for both MGA-683P8 and MGA-68P8.
- Detail of the components needed for this product is shown in Table 1.

Table 1. Component list for 900 MHz matching

Part	Size	Value	Detail Part Number
C1	0402	8.2 pF	Murata GRM15
C2	0402	100 pF	Murata GRM15
L1	0402	15 nH	Toko LL1005
L2	0402	33 nH	Toko LL1005
L3	0402	18 nH	Toko LL1005
C4	0402	27 pF	Murata GRM15
C3, C6	0402	4.7 µF	Murata GRM15
Rbias	0402	12 KOhm	KOA RK73
R1	0402	0 Ohm	KOA RK73
R2	0402	9.1 Ohm	KOA RK73

Notes:
C2 is a blocking capacitor
L2 output match for OIP3
L1, C1 and L3 are used for IRL matching.
C3, C4 and C6 are bypass capacitors
C5 is not use for this product
R2 is stabilizing resistor
Rbias is the biasing resistor

MGA-683P8 Typical Performance in Demoboard

RF performance at T_A = 25° C, Vdd = 5 V, measured on demo board in Figure 5 with component list in Table1 for 900 MHz matching, unless otherwise stated.

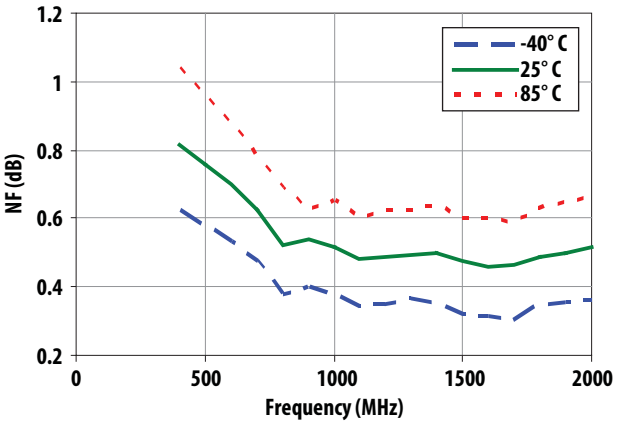


Figure 7. NF vs Frequency vs Temperature

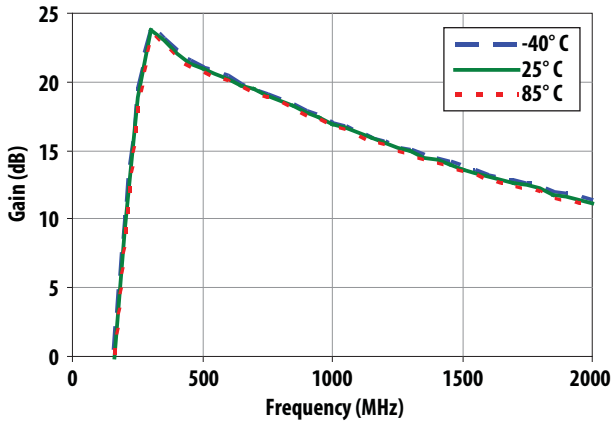


Figure 8. Gain vs Frequency vs Temperature

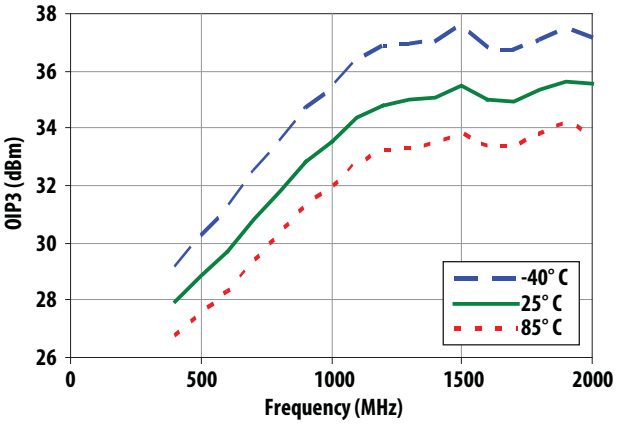


Figure 9. OIP3 vs Frequency vs Temperature

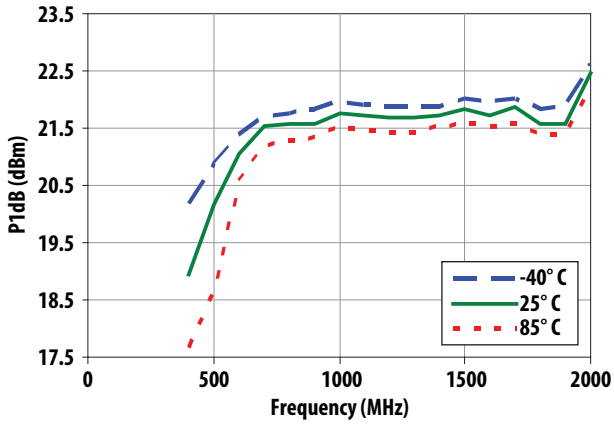


Figure 10. OP1dB vs Frequency vs Temperature

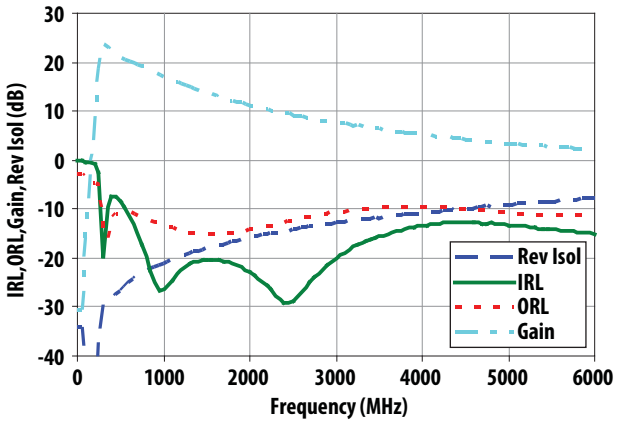


Figure 11. Input Return Loss, Output Return Loss, Gain, Reverse Isolation vs Frequency

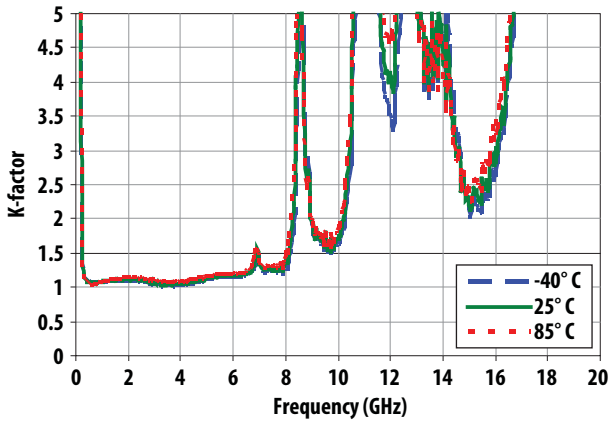


Figure 12. K-factor vs Frequency vs Temperature

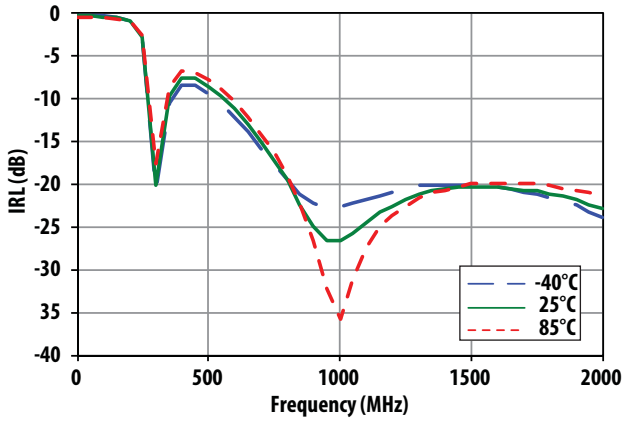


Figure 13. Input Return Loss vs Frequency vs Temperature

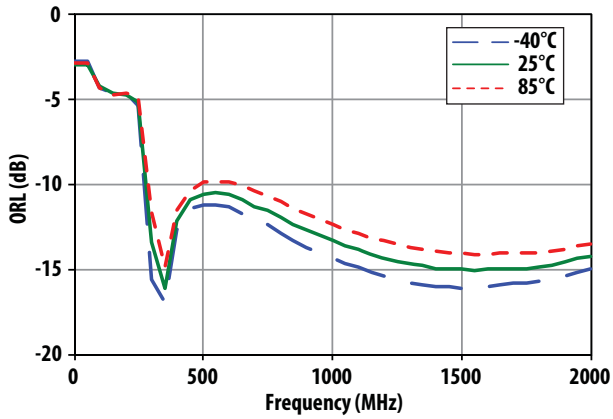


Figure 14. Output Return Loss vs Frequency vs Temperature

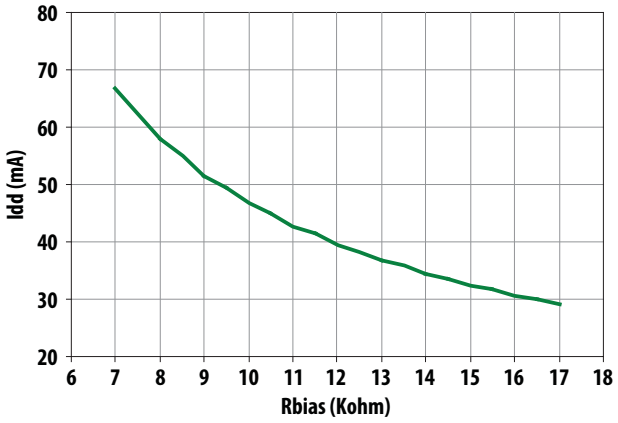


Figure 15. Idd vs Rbias

MGA-683P8 Typical Scattering Parameters, Vdd = 5 V

Freq GHz	S_{11}		S_{21}		S_{12}		S_{22}		
	Mag.	Ang.	dB	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
0.10	0.78	-39.85	28.64	27.04	149.39	0.02	61.61	0.33	-37.71
0.50	0.28	-91.85	21.88	12.41	109.78	0.05	57.18	0.09	-4.96
0.90	0.18	-116.24	17.98	7.92	90.98	0.08	59.30	0.14	-15.82
1.00	0.15	-125.00	17.18	7.22	87.35	0.09	59.00	0.14	-19.87
1.50	0.10	-142.26	14.00	5.01	71.80	0.12	55.32	0.20	-41.56
2.00	0.08	-158.00	11.67	3.83	58.64	0.16	49.50	0.20	-61.44
2.50	0.06	-177.30	9.81	3.09	46.91	0.19	42.91	0.21	-80.22
3.00	0.04	168.68	8.28	2.59	36.14	0.23	36.14	0.23	-95.46
4.00	0.00	-108.56	5.94	1.98	16.53	0.30	22.23	0.25	-119.00
5.00	0.03	-73.16	4.23	1.63	-1.82	0.36	7.81	0.25	-143.80
6.00	0.04	-151.00	2.90	1.40	-19.09	0.42	-6.77	0.25	-170.44
7.00	0.06	-158.00	1.80	1.23	-35.70	0.47	-21.90	0.26	166.00
8.00	0.12	-156.52	0.83	1.10	-51.10	0.52	-36.75	0.30	150.48
9.00	0.17	-162.00	0.01	1.00	-65.36	0.56	-51.21	0.34	138.44
10.00	0.20	-178.00	-0.60	0.93	-79.22	0.60	-66.02	0.35	124.40
11.00	0.21	155.00	-1.06	0.89	-93.53	0.64	-81.83	0.33	104.00
12.00	0.22	123.32	-1.55	0.84	-109.00	0.66	-98.70	0.34	78.63
13.00	0.26	103.28	-2.14	0.78	-123.00	0.66	-115.00	0.38	62.36
14.00	0.32	94.32	-2.66	0.74	-136.00	0.66	-130.00	0.42	59.90
15.00	0.39	84.02	-2.96	0.71	-147.00	0.67	-143.00	0.43	59.92
16.00	0.42	66.23	-3.10	0.70	-160.00	0.68	-158.00	0.40	49.93
17.00	0.43	44.22	-3.53	0.67	-175.88	0.66	-176.00	0.40	27.05
18.00	0.48	28.22	-4.50	0.60	169.00	0.60	167.00	0.48	10.42
19.00	0.57	16.40	-5.59	0.53	156.04	0.53	153.00	0.56	7.77
20.00	0.61	5.40	-6.14	0.49	145.00	0.50	140.00	0.60	6.82
20.0	0.62	5.97	-6.14	0.49	145.85	0.50	140.18	0.60	6.77

Typical Noise Parameters, Vdd=5V

Freq	Fmin	Γopt	Γopt	
GHz	dB	Mag.	Ang.	Rn/50
0.5	0.46	0.207	-35.1	0.054
0.7	0.379	0.185	-14.7	0.06
0.75	0.366	0.18	-10.2	0.055
0.8	0.356	0.175	-5	0.0494
0.9	0.343	0.164	-4.2	0.0432
1.7	0.5	0.079	88.9	0.0594
1.9	0.55	0.059	125.3	0.0466

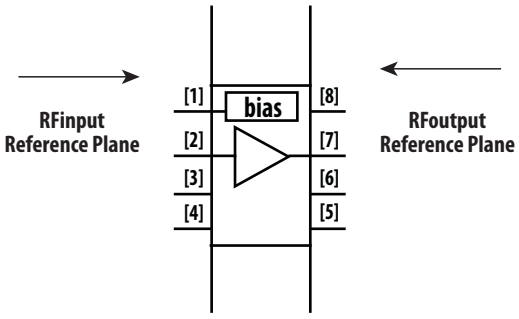
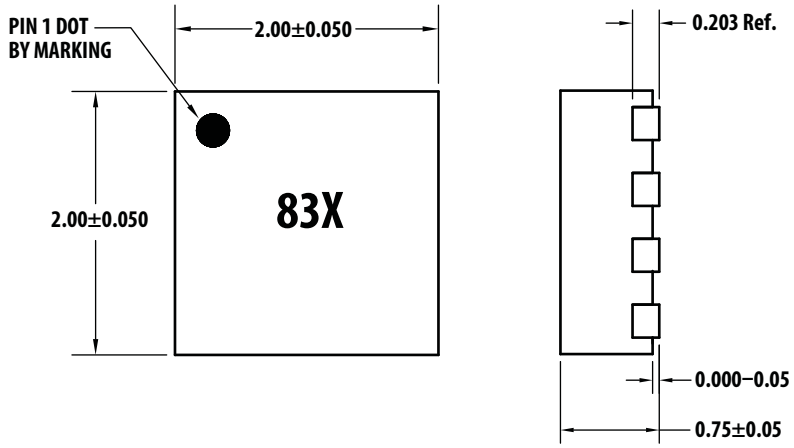
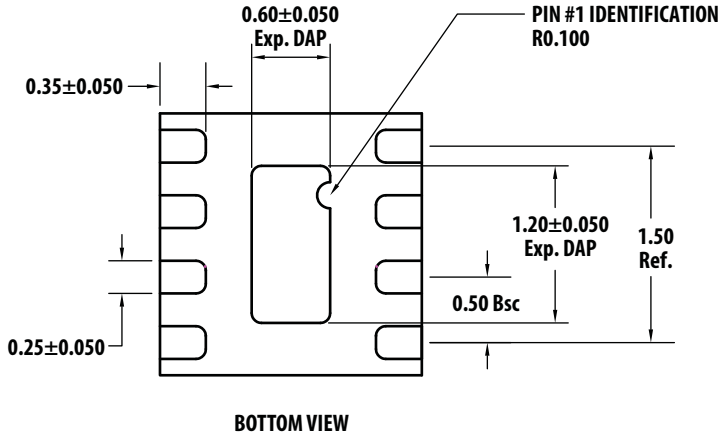


Figure 16.

Notes:
1. The Fmin values are based on noise figure measurements at 100 different impedances using Focus source pull test system. From these measurements a true Fmin is calculated.
2. Scattering and noise parameters are measured on coplanar waveguide made on 0.010 inch thick ROGER 4350. The input reference plane is at the end of the RFinput pin and the output reference plane is at the end of the RFoutput pin as shown in Figure 16.

SLP4X4 Package



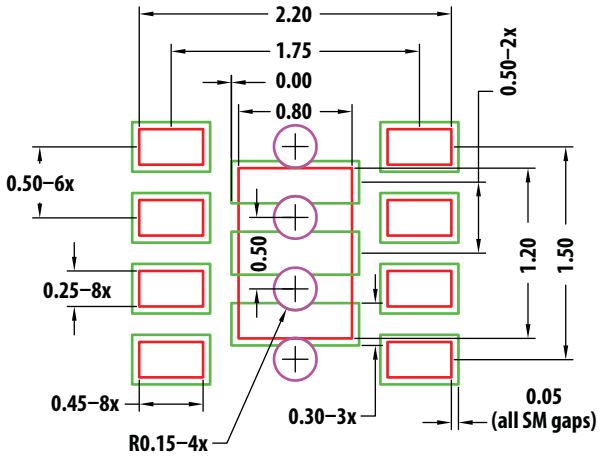


Notes:
1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating.
3. Dimensions are exclusive of mold ash and metal burr.

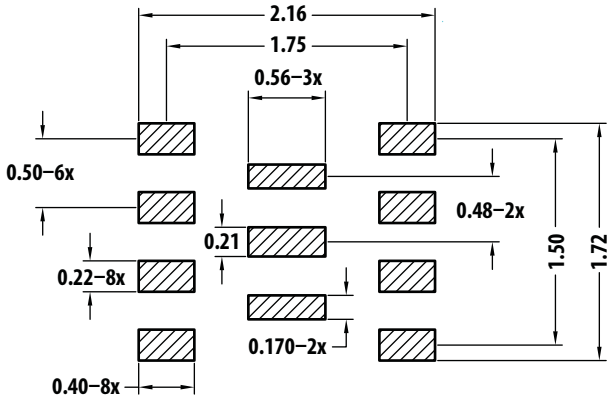
Part Number Ordering Information

Part Number	No. of Devices	Container
MGA-683P8-BLKG	100	Antistatic Bag
MGA-683P8-TR1G	3000	7 inch Reel

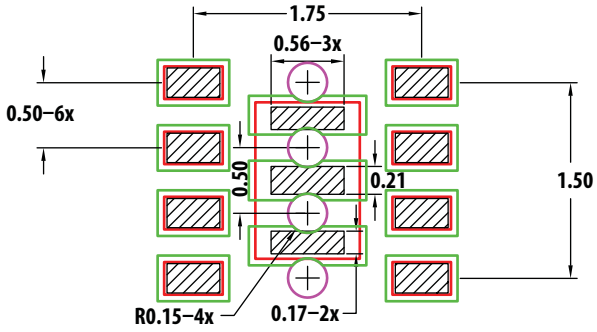
PCB Land Pattern and Stencil Design



PCB Land Pattern



Stencil Design

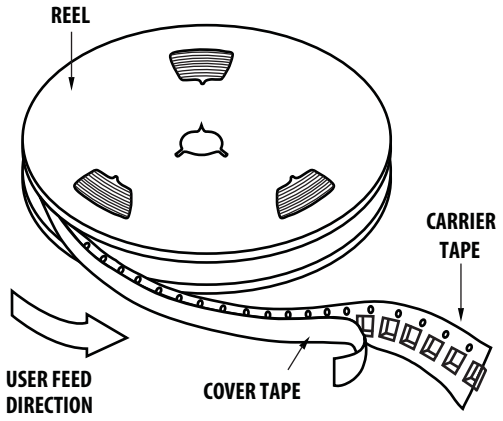


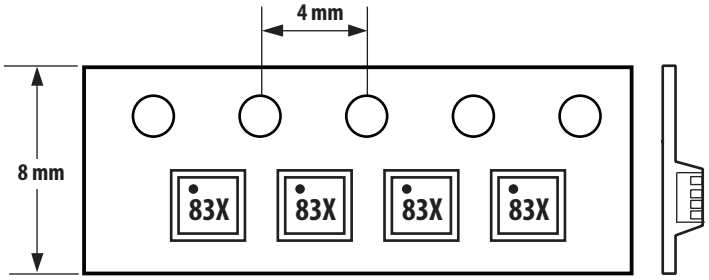
Combines PCB & Stencil Design



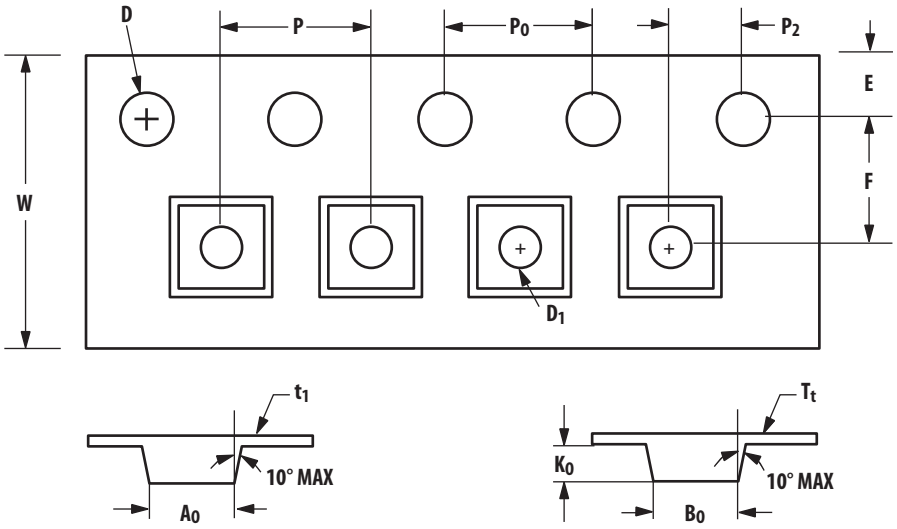
All Dimension are in millimeters

Device Orientation



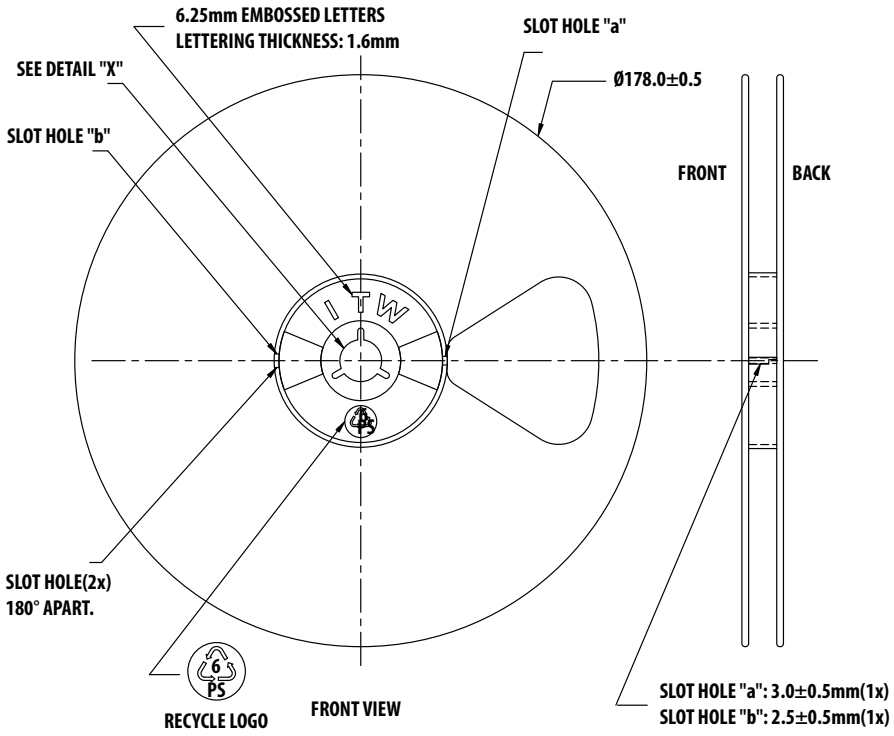


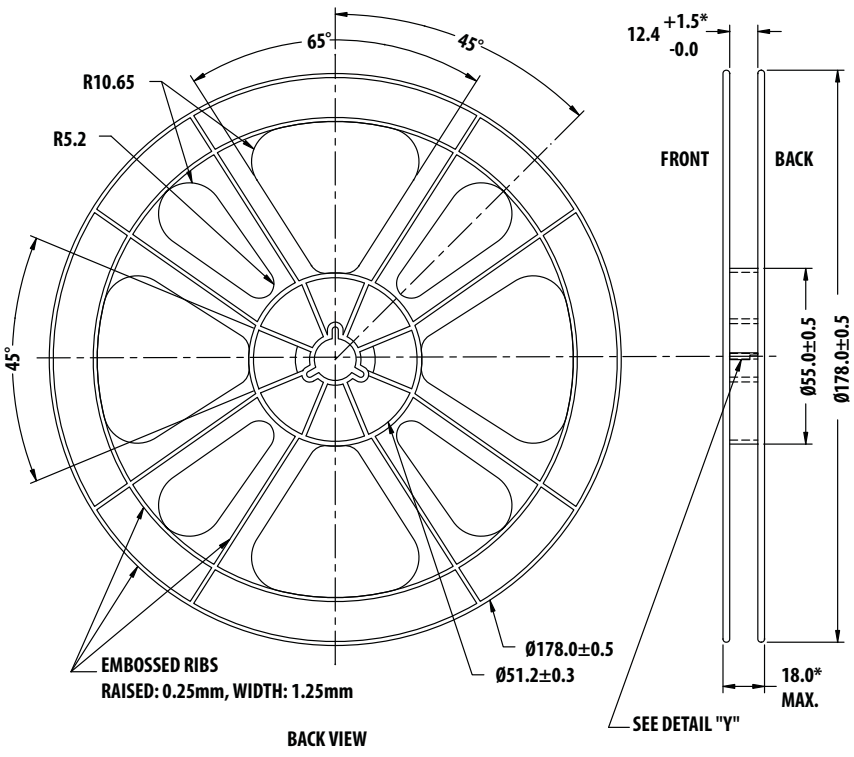
Tape Dimensions

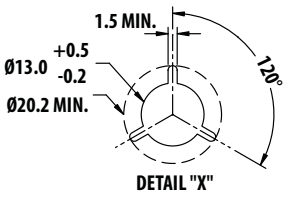


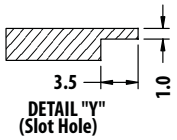
DESCRIPTION		SYMBOL	SIZE (mm)	SIZE (INCHES)
CAVITY	LENGTH	A_0	2.30 ± 0.05	0.091 ± 0.004
	WIDTH	B_0	2.30 ± 0.05	0.091 ± 0.004
	DEPTH	K_0	1.00 ± 0.05	0.039 ± 0.002
	PITCH	P	4.00 ± 0.10	0.157 ± 0.004
	BOTTOM HOLE DIAMETER	D_1	1.00 + 0.25	0.039 + 0.002
PERFORATION	DIAMETER	D	1.50 ± 0.10	0.060 ± 0.004
	PITCH	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	0.315 ± 0.012
			8.00 ± 0.10	0.315 ± 0.004
	THICKNESS	t_1	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









For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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