MGA-30316
3.3 -3.9GHz
½ Watt High Linearity Amplifier

Data Sheet

Description

Avago Technologies' MGA-30316 is a high linearity ½ Watt PA with good OIP3 performance and exceptionally good PAE at p1dB gain compression point, achieved through the use of Avago Technologies' proprietary 0.25um GaAs Enhancement-mode pHEMT process.

The device required simple matching components to achieve wide bandwidth performance since it has a built in input prematch.

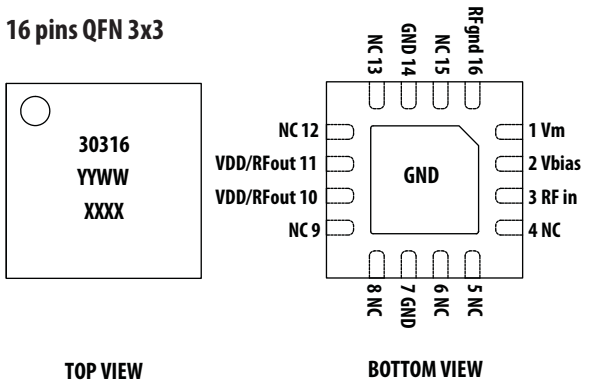
The adjustable temperature compensated internal bias circuit allowed the device to be operated at either class A or class AB operation

The MGA-30316 is housed inside a standard 16 pin QFN 3X3 package.

Applications

- Class A driver amplifier for WiMAX Base Stations.
- General purpose gain block.

Component Image



Notes:
Package marking provides orientation and identification
"30316" = Device Part Number
"YYWW" = Year and Work Week of manufacture
"XXXX" = Last 4 digit of Lot number

Features

- High linearity and P1dB
- Unconditionally Stable across load condition
- Built in adjustable temperature compensated internal bias circuitry
- With prematch - required simple matching
- GaAs E-pHEMT Technology [1]
- Standard QFN 3X3 package
- 5V supply
- Excellent uniformity in product specifications
- Tape-and-Reel packaging option available
- MSL-1 and Lead-free
- High MTTF for base station application

Specifications

3.5GHz; 5V, 198mA (typ)

- 12.8 dB Gain
- 44.4 dBm Output IP3
- 28.5 dBm Output Power at 1dB gain compression
- 51.3% PAE at P1dB
- 2.7 dB Noise Figure

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

Attention: Observe precautions for handling electrostatic sensitive devices.
ESD Machine Model = 70 V
ESD Human Body Model = 250 V
Refer to Avago Application Note A004R: Electrostatic Discharge, Damage and Control.

Absolute Maximum Rating [1] T_A=25°C

Symbol	Parameter	Units	Absolute Max.
$V_{dd,max}$	Device Voltage, RF output to ground	V	5.5
$I_{ds,max}$	Device Drain Current	mA	400
$V_{ctrl,max}$	Control Voltage	V	5.5
$P_{in,max}$	CW RF Input Power	dBm	22
P_{diss}	Total Power Dissipation [2]	W	2.2
$T_{j,max}$	Junction Temperature	°C	150
T_{STG}	Storage Temperature	°C	-65 to 150

Thermal Resistance [3] θ_{jc} = 37 °C/W
(Vdd=5, Ids=200mA, Tc=85°C)

Notes:
1. Operation of this device in excess of any of these limits may cause permanent damage.
2. This is limited by maximum Vdd and Ids. Derate 27mW/ °C for Tc > 68.6 °C.
3. Thermal resistance measured using Infra-Red measurement technique.

Electrical Specifications [4]

T_A = 25 °C, Vdd =5V, Vctrl =5V, RF performance at 3.5 GHz, measured on demo board (see Fig.7) unless otherwise specified.

Symbol	Parameter and Test Condition	Units	Min.	Typ.	Max.
Ids	Quiescent current	mA	155	198	250
Ictrl	Vctrl current	mA	-	7	-
Gain	Gain	dB	11	12.8	14
OIP3 [5]	Output Third Order Intercept Point	dBm	40	44.4	-
OP1dB	Output Power at 1dB Gain Compression	dBm	27	28.5	-
PAE	Power Added Efficiency	%	-	51.3	-
NF	Noise Figure	dB	-	2.7	-
S11	Input Return Loss, 50Ω source	dB	-	-10	-
S22	Output Return Loss, 50Ω load	dB	-	-8.5	-
S12	Reverse Isolation	dB	-	-27	-

Notes:
4. Measurements at 3.5GHz obtained using demo board described in Figure 6 and 7.
5. 3.5GHz OIP3 test condition: F_{RF1} - F_{RF2} = 10MHz with input power of -5dBm per tone measured at worse side band
6. Use proper bias, heat sink and de-rating to ensure maximum channel temperature is not exceeded. See absolute maximum ratings and application note (if applicable) for more details.

Product Consistency Distribution Charts [1, 2]

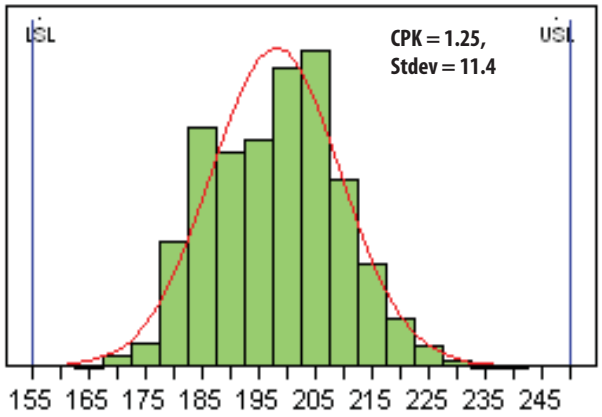


Figure 1. Ids at 3.5GHz; LSL=155mA, nominal =198mA, USL=250mA

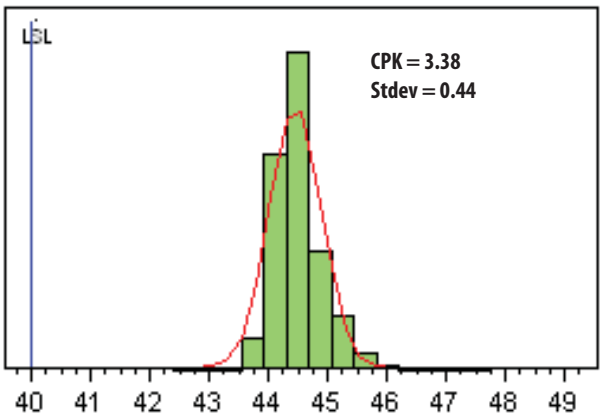


Figure 2. OIP3 at 3.5GHz; LSL=40dBm, nominal=44.4dBm

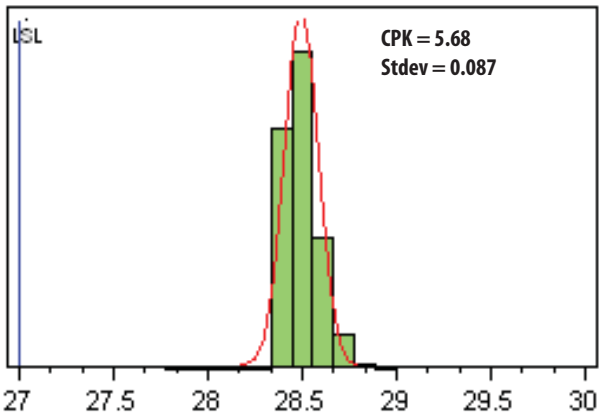


Figure 3. P1dB at 3.5GHz; LSL=27dBm, nominal =28.5dBm

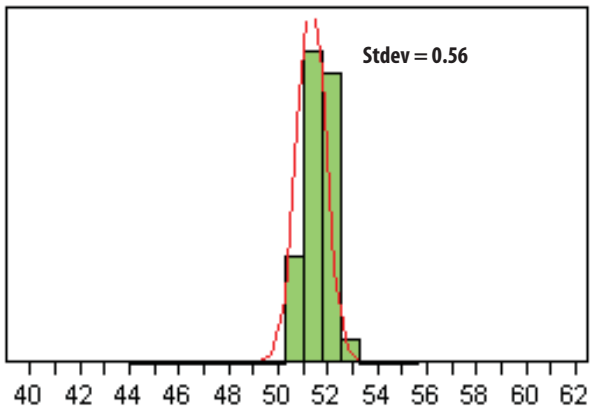


Figure 4. PAE@P1dB 3.5GHz; nominal=51.3%

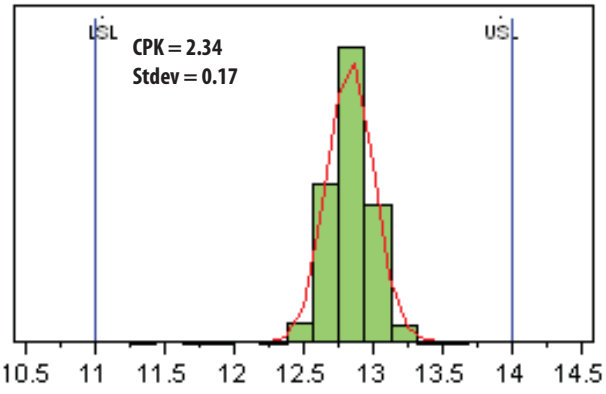


Figure 5. Gain at 3.5GHz; LSL=11dB, nominal =12.8dB, USL=14dB

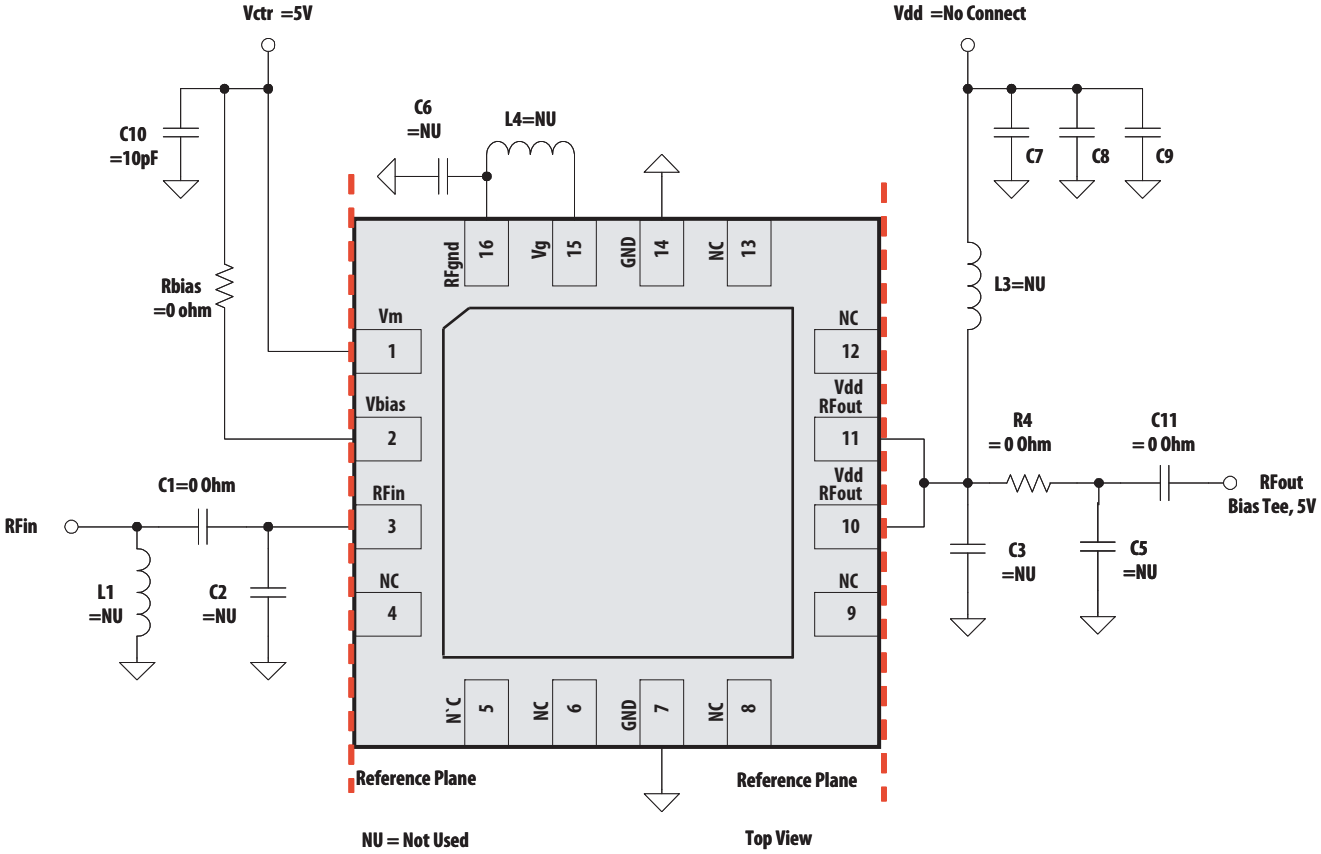
Notes:

1. Distribution data sample size is 500 samples taken from 3 different wafer lots and 3 different wafers. Future wafers allocated to this product may have nominal values anywhere between the upper and lower limits.
2. Measurements were made on a characterization test board, which represents a trade-off between optimal OIP3, gain, P1dB and PAE. Circuit trace losses have not been de-embedded from measurements above.

S-Parameter (Vdd=5V, Vctrl=5V, T=25°C, unmatched 50 ohm)

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
0.1	-6.82	-151.29	27.03	150.46	-47.73	71.5	-12.25	-128.58
0.2	-4.78	-159.01	25.15	138.28	-41.95	64.79	-8.27	-130.03
0.3	-4.18	-166.18	23.78	133.19	-39.08	55.33	-5.81	-135.8
0.4	-3.47	-169.93	22.65	123.43	-37.52	46.92	-4.38	-143.58
0.5	-2.93	-173.8	21.61	114.31	-36.49	38.95	-3.55	-150.15
0.6	-2.63	-177.69	20.68	107.63	-35.95	33.44	-3.15	-155.24
0.7	-2.41	178.2	19.59	101.05	-35.67	29.42	-3.05	-159.58
0.8	-2.23	174.29	18.64	95.04	-35.37	26.01	-2.97	-162.74
0.9	-2.15	170.69	17.86	90.54	-35.16	23.86	-2.97	-164.72
1	-2.15	167.04	17.01	86.49	-35.02	22.13	-3.08	-166.58
1.1	-2.11	163.4	16.34	82.19	-34.8	20.22	-3.11	-167.95
1.2	-2.13	159.95	15.76	78.67	-34.6	19.29	-3.2	-168.64
1.3	-2.2	156.03	15.16	75.31	-34.49	18.58	-3.34	-169.5
1.4	-2.23	152.09	14.67	71.57	-34.32	17.24	-3.42	-170.22
1.5	-2.47	147.67	14.12	68.05	-34.1	20.11	-3.61	-170.41
1.6	-2.49	144.86	13.79	65.62	-33.46	15.95	-3.69	-170.18
1.7	-2.6	140.23	13.35	62.35	-33.36	14.77	-3.81	-170.43
1.8	-2.77	135.94	13.05	59.69	-33.04	15.06	-3.93	-169.7
1.9	-2.99	131.36	12.76	57.06	-32.49	15.09	-4.03	-168.68
2	-3.21	127.11	12.63	54.39	-31.8	12.77	-3.97	-168.24
2.1	-3.39	122.76	12.59	50.88	-31.25	8.84	-3.86	-168.39
2.2	-3.61	117.96	12.48	47.2	-30.93	5.55	-3.88	-168.52
2.3	-3.8	112.9	12.38	43.05	-30.67	1.89	-3.95	-169.12
2.4	-4.05	107.72	12.31	38.81	-30.34	-1.84	-3.95	-169.52
2.5	-4.33	102.21	12.23	34.51	-30.09	-4.96	-4.03	-169.49
2.6	-4.65	96.41	12.13	30.05	-29.85	-8.75	-4.11	-169.94
2.7	-5.05	90.74	12.1	25.39	-29.57	-12.78	-4.11	-170.25
2.8	-5.54	84.58	12.05	20.47	-29.32	-16.64	-4.17	-170.13
2.9	-6.12	78.29	11.99	15.42	-29.08	-21.03	-4.25	-170.45
3	-6.9	71.89	11.96	10.03	-28.83	-25.96	-4.25	-170.58
3.1	-7.88	64.98	11.94	4.22	-28.58	-31.04	-4.24	-170.44
3.2	-9.23	57.3	11.9	-1.9	-28.45	-36.51	-4.26	-170.23
3.3	-11.19	49.31	11.87	-8.49	-28.27	-42.81	-4.18	-170.28
3.4	-14.22	39.62	11.8	-15.78	-28.12	-49.57	-4.05	-170.11
3.5	-19.94	23.89	11.64	-23.57	-28.13	-56.85	-3.92	-169.91
3.6	-30.95	-79.21	11.42	-31.82	-28.22	-64.96	-3.72	-170.28
3.7	-17.87	-146.45	11.09	-40.52	-28.41	-73.3	-3.45	-170.74
3.8	-12.15	-160.58	10.57	-49.43	-28.82	-81.96	-3.21	-171.49
3.9	-8.81	-171.12	9.93	-58.26	-29.39	-90.63	-2.96	-172.77
4	-6.56	179.84	9.17	-66.62	-30.07	-98.94	-2.73	-174.21
4.1	-4.98	172.2	8.22	-74.31	-30.96	-106.74	-2.59	-175.63
4.2	-3.84	165.23	7.21	-81.56	-31.96	-114.42	-2.48	-177.43
4.3	-3	159.18	6.2	-87.81	-32.99	-121.08	-2.36	-178.93
4.4	-2.39	154.5	5.09	-93.09	-34.14	-126.93	-2.33	-179.99
4.5	-1.96	150.27	3.98	-97.98	-35.29	-132.83	-2.3	178.66
4.6	-1.61	146.62	2.94	-102.25	-36.42	-138.03	-2.27	177.63
4.7	-1.35	144.08	1.88	-105.53	-37.68	-143.09	-2.27	177.01
4.8	-1.18	141.63	0.81	-108.81	-38.92	-148.09	-2.29	176.27
4.9	-1.02	139.62	-0.15	-111.55	-40.15	-153.01	-2.29	175.63
5	-0.89	138.34	-1.07	-113.65	-41.37	-157.93	-2.29	175.36
5.1	-0.85	137.14	-2.07	-115.8	-42.75	-163.22	-2.33	175.03
5.2	-0.79	135.92	-2.89	-117.73	-44.04	-169.68	-2.34	174.63
5.3	-0.73	135.3	-3.7	-119.18	-45.5	-176.84	-2.36	174.49
5.4	-0.75	134.69	-4.59	-120.78	-47.13	174.68	-2.41	174.31
5.5	-0.75	133.99	-5.33	-122.15	-49.38	167.69	-2.47	174.11
5.6	-0.75	133.62	-6	-123.2	-50.75	167.52	-2.48	174.1
5.7	-0.82	133.4	-6.76	-124.42	-51.1	157.54	-2.51	174.03
5.8	-0.89	133.12	-7.43	-125.61	-51.76	147.91	-2.53	173.71
5.9	-0.91	132.85	-8.01	-126.69	-51.77	135.29	-2.56	173.44
6	-1.03	132.62	-8.69	-127.93	-52.06	122.98	-2.61	173.08

S-Parameter Test circuit



Demo Board

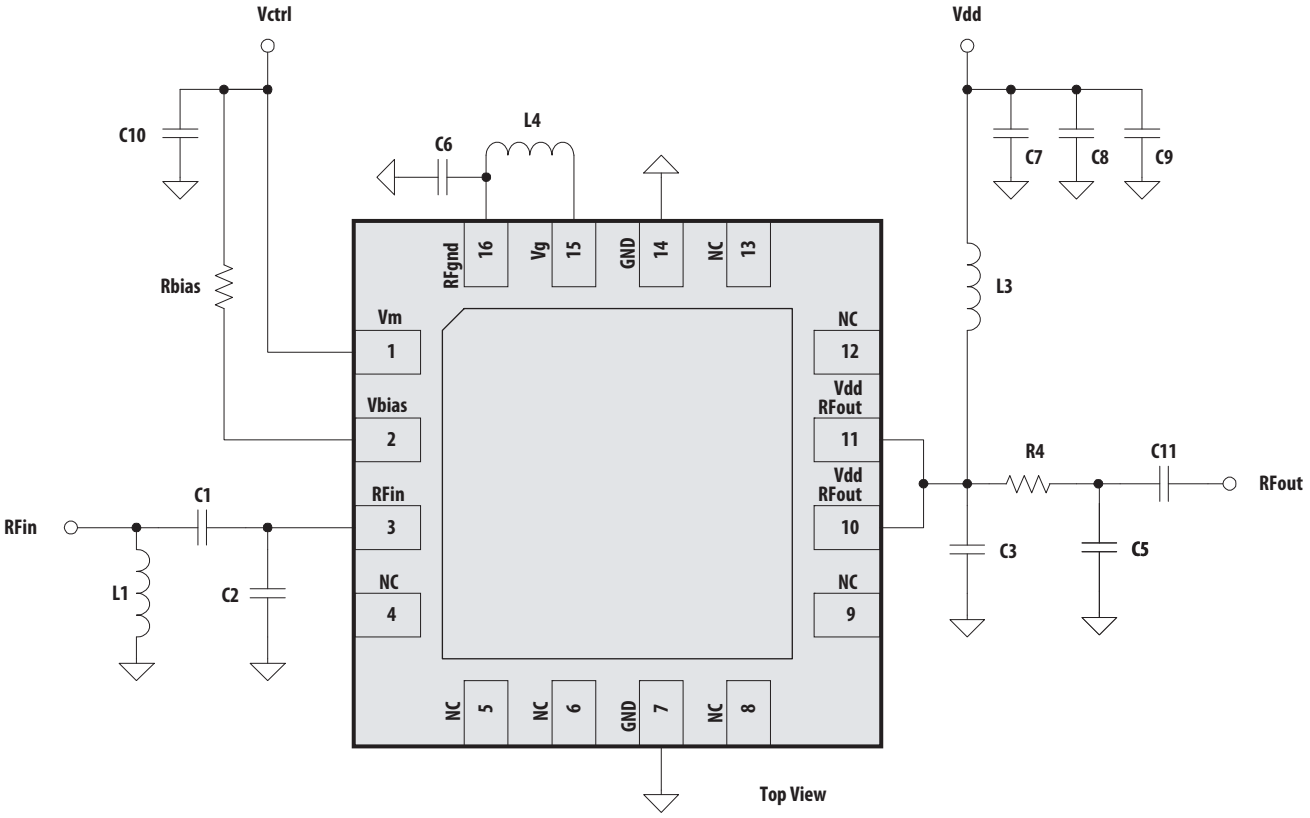


Figure 6. Demo board and application schematic

Demo Board Part List

Circuit Symbol	Size	Value	Part Number	Description
L1	0402	2.2nH	LLP1005-FH2N2C (Toko)	MLC Inductor
L3	0402	1.0nH	LLP1005-FH1N0B (Toko)	MLC Inductor
L4		NU		
C1	0402	1.0pF	GRM1555C1H1R0CZ01B (Murata)	Ceramic Chip Capacitor
C2	0402	NU		
C3	0402	1.3pF	GJM1555C1H1R3CB01E (Murata)	Ceramic Chip Capacitor
C5	0402	0.5pF	GJM1555C1HR50BB01 (Murata)	Ceramic Chip Capacitor
C6		NU		
C7	0402	0.1uF	GRM155R71C104KA88D (Murata)	Ceramic Chip Capacitor
C8	0402	10pF	GRM1555C1H100JZ01B (Murata)	Ceramic Chip Capacitor
C9	0805	2.2uF	GRM21BR61E225KA12L (Murata)	Ceramic Chip Capacitor
C10	0402	10pF	GRM1555C1H100JZ01B (Murata)	Ceramic Chip Capacitor
C11	0402	4.7pF	GRM1555C1H4R7CZ01B (Murata)	Ceramic Chip Capacitor
R4	0402	0 ohm	RK73Z1ETTP (KOA)	Chip Resistor

Note: Rbias is used to lower the quiescent current. Default is 0 ohm

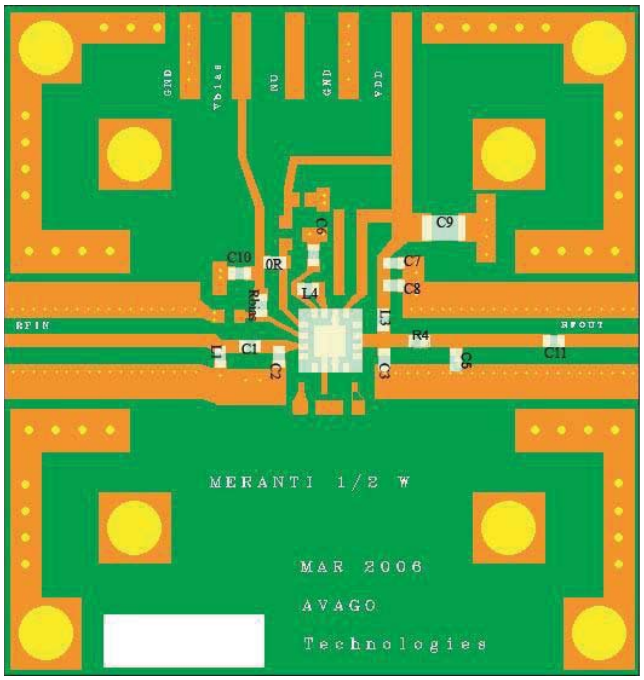


Figure 7. Demo board Layout

- Recommended PCB material is 10 mils Rogers RO4350, with FR4 backing for mechanical strength.
- Suggested component values may vary according to layout and PCB material.

MGA-30316 Typical Performance

T_A = +25 °C, Vdd = 5V, Vctrl = 5V, Input Signal = CW unless stated otherwise.

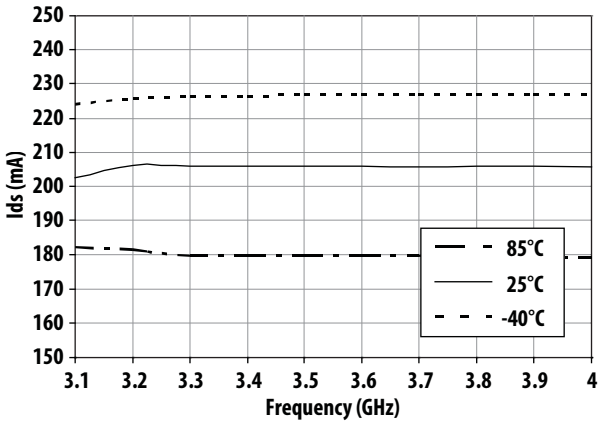


Figure 8. Over Temperature Ids vs Frequency

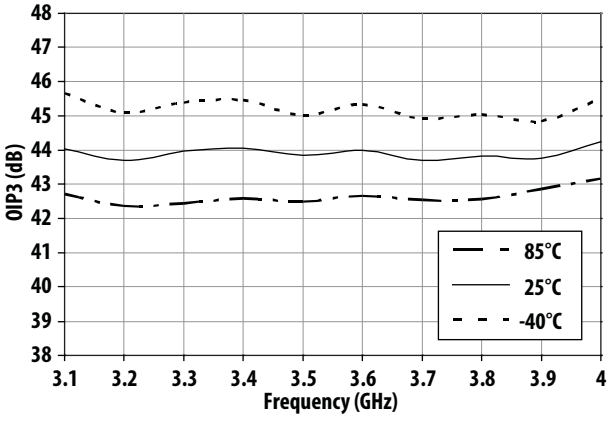


Figure 9. Over Temperature OIP3 vs Frequency

MGA-30316 Typical Performance

T_A = +25°C, Vdd = 5V, Vctrl = 5V, Input Signal = CW unless stated otherwise.

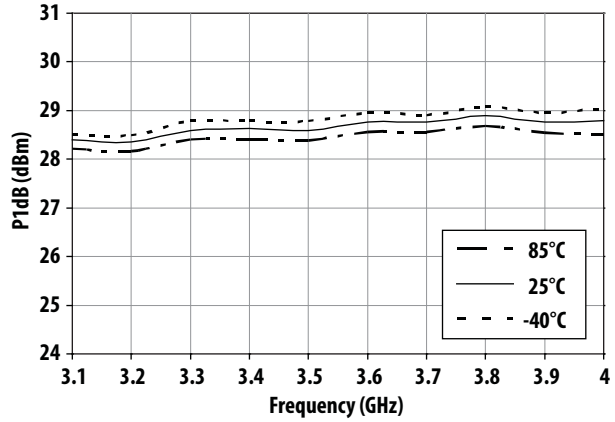


Figure 10. Over Temperature P1dB vs Frequency

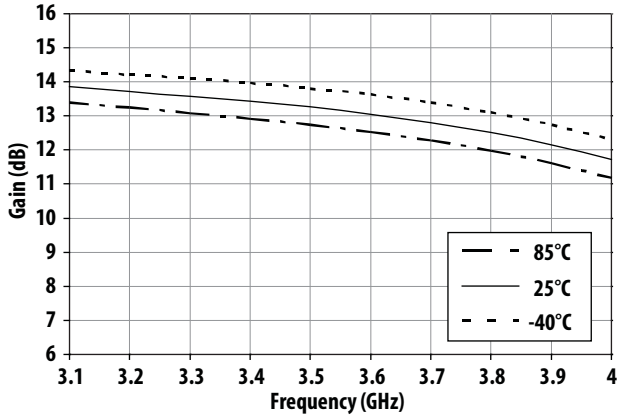


Figure 11. Over Temperature Gain vs Frequency

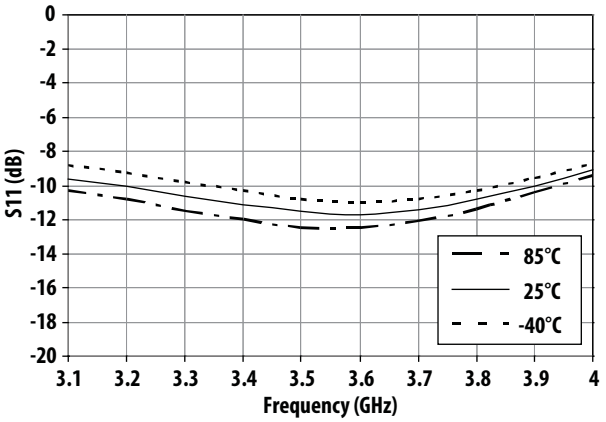


Figure 12. Over Temperature S11 vs Frequency

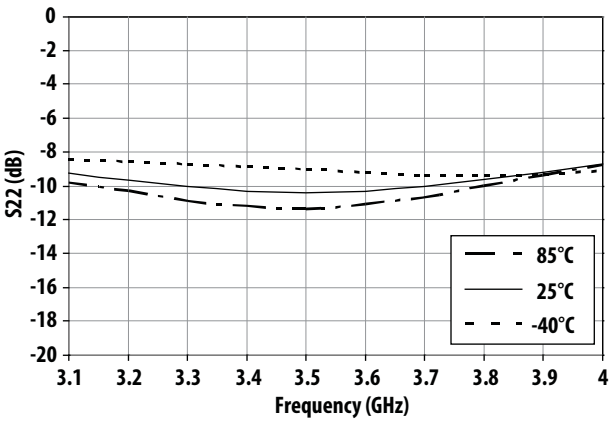


Figure 13. Over Temperature S22 vs Frequency

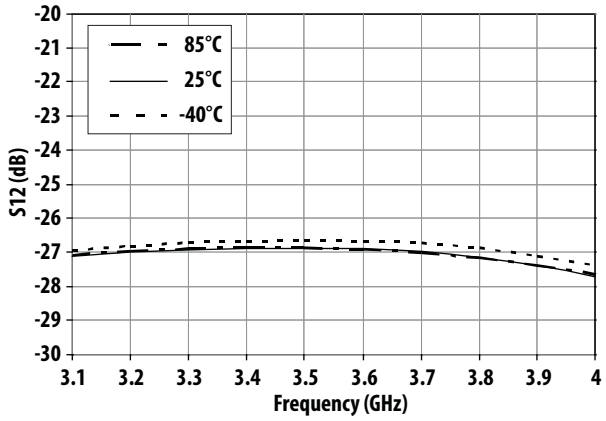


Figure 14. Over Temperature S12 vs Frequency

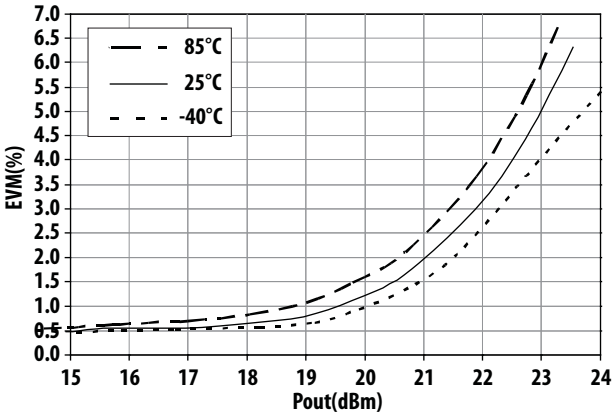
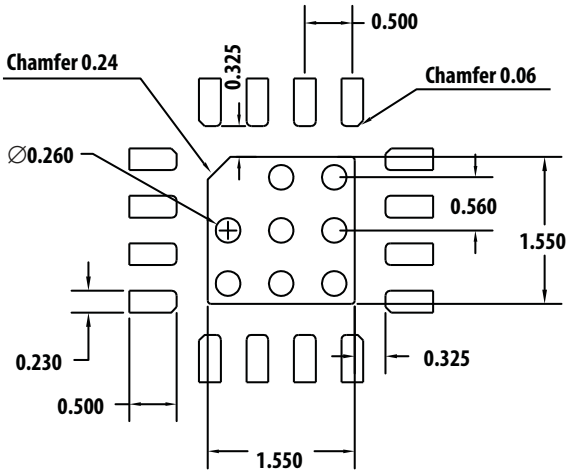
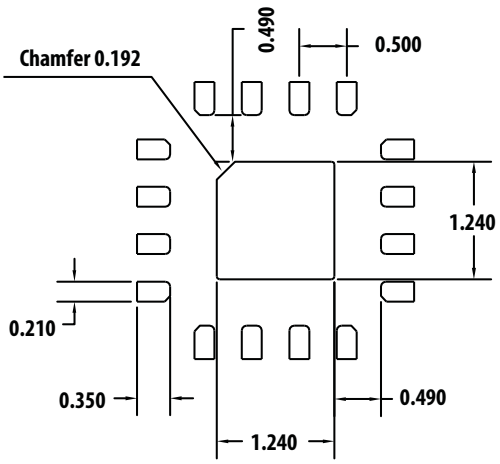


Figure 15. Over temperature EVM vs Pout at 3.5GHz

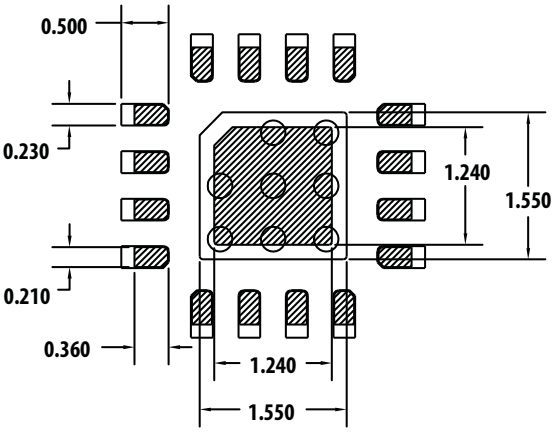
PCB Layout and Stencil Design



PCB Land Pattern (Top View)



Stencil Outline



Combined PCB & Stencil Layouts

Notes:
1. All dimensions are in milimeters.

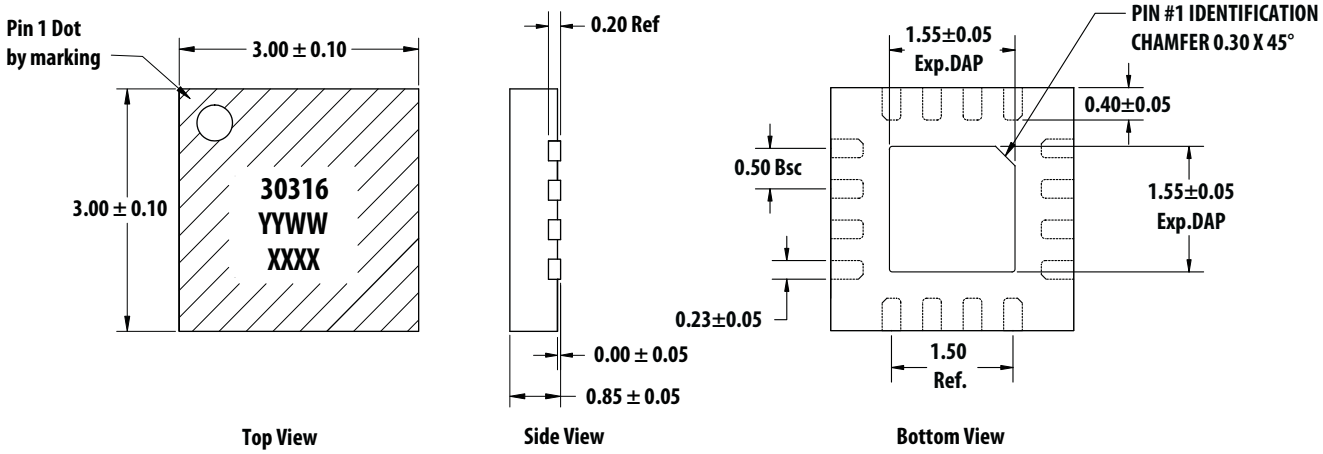
Part Number Ordering Information

Part Number	No. of Devices	Container
MGA-30316-TR1G	1000	7″ Reel
MGA-30316-TR2G	3000	13″ Reel
MGA-30316-BLKG	100	antistatic bag

Product Family

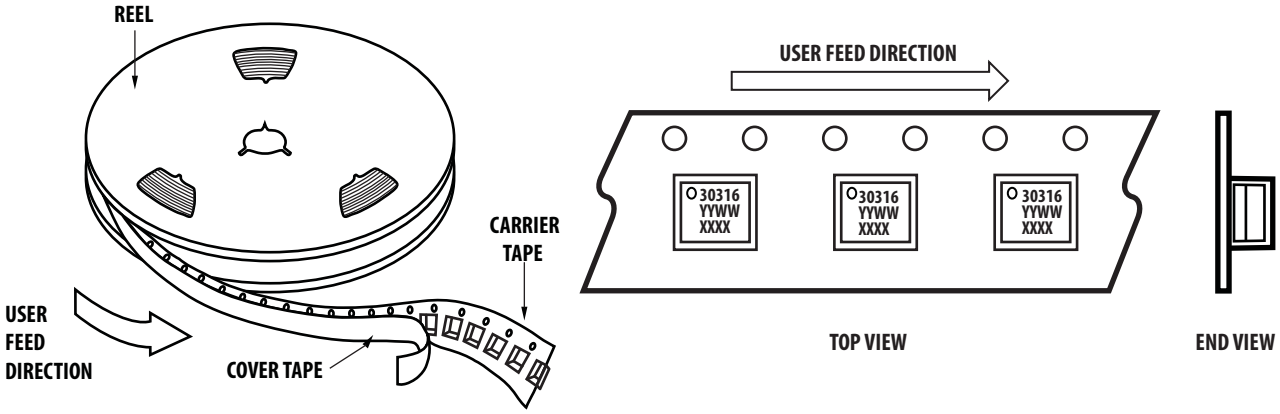
Output Power	Frequency Band		
	700MHz-1GHz	1.7- 2.7GHz	3.3-3.9GHz
0.5W	MGA-30116	MGA-30216	MGA-30316
1W	ALM-31122	ALM-31222	ALM-31322
2W	ALM-32120	ALM-32220	ALM-32320

Package Dimensions

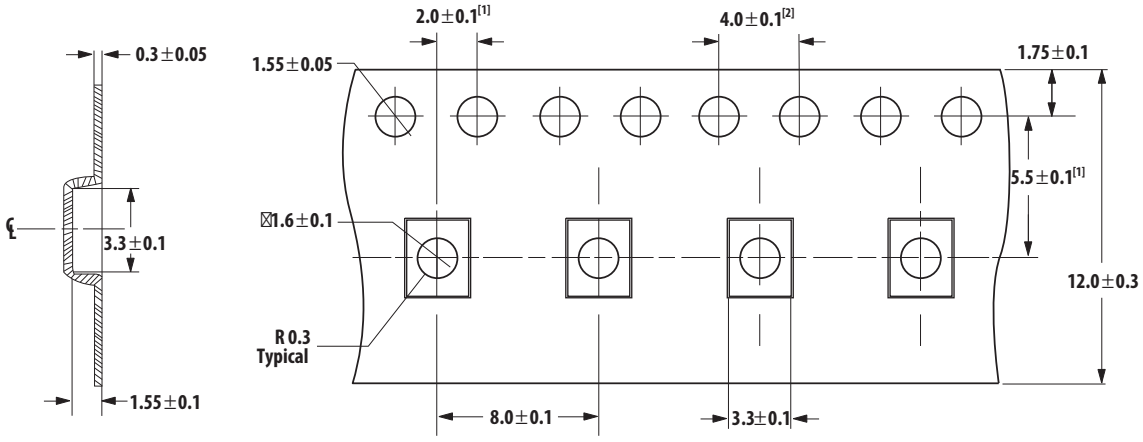


Notes:
1. All dimensions are in milimeters
2. Dimensions are inclusive of plating
3. Dimensions are exclusive of mold flash and metal burr

Device Orientation

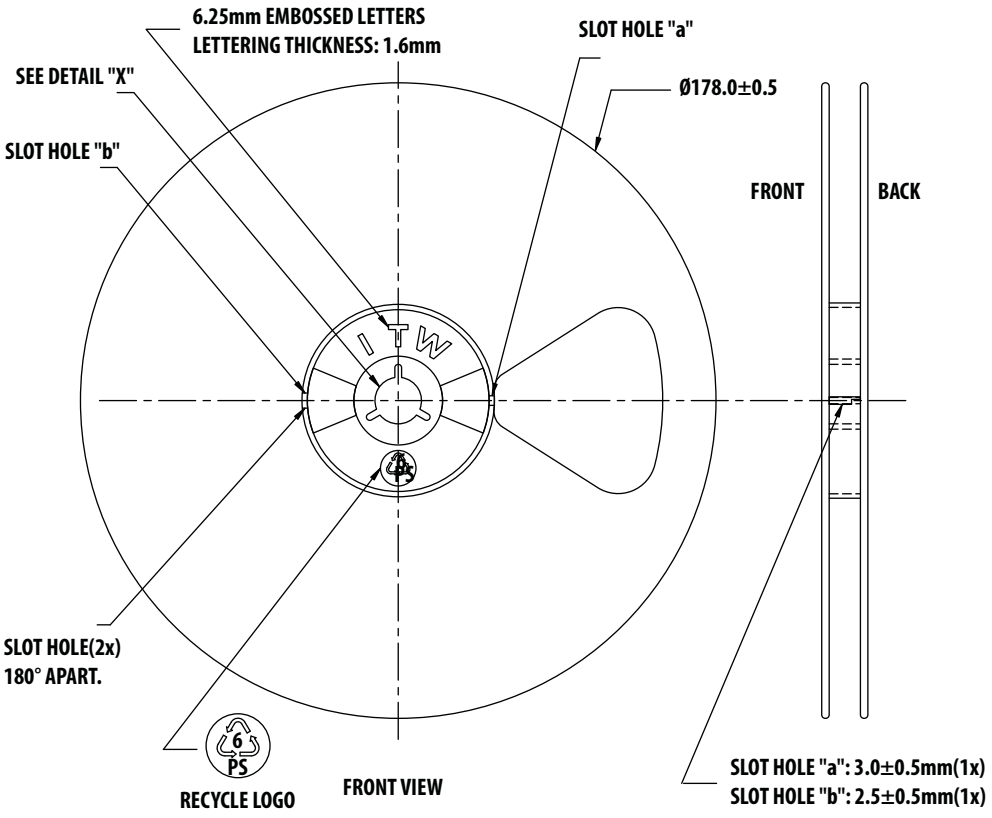


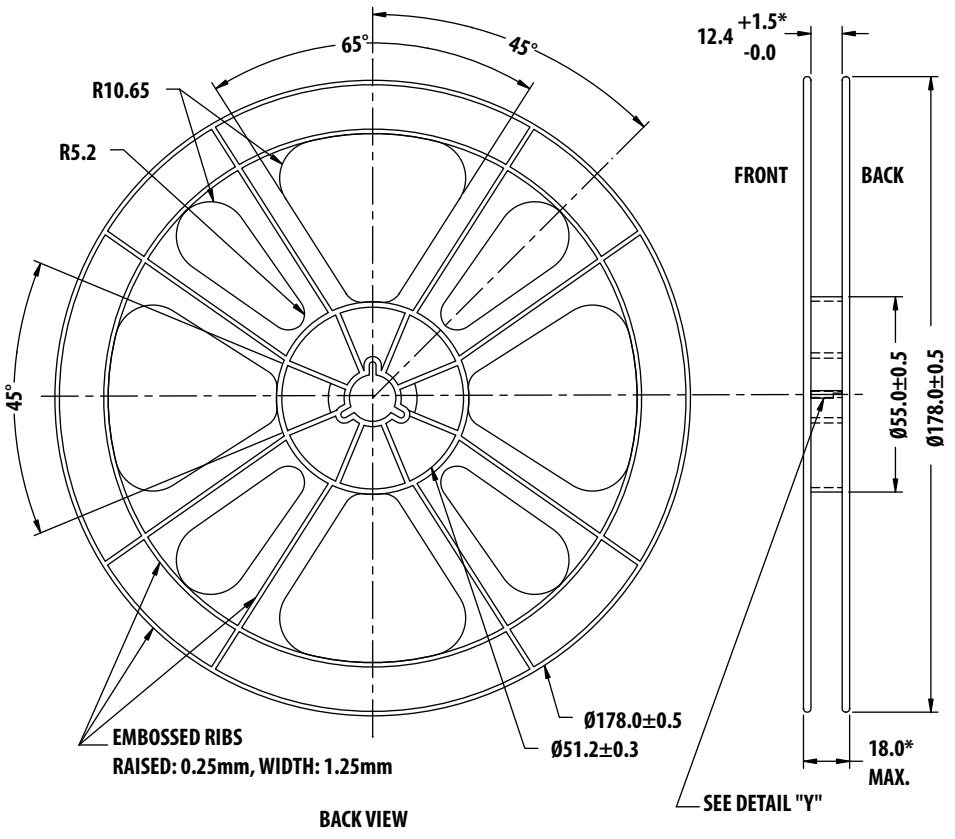
Tape Dimensions

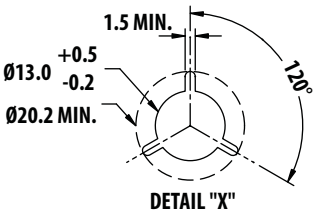


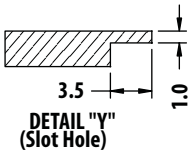
Notes:
1. Measured from centerline of sprocket hole to centerline of pocket
2. Cumulative tolerance of 10 sprocket holes is ±0.20
3. All dimensions in millimeter unless otherwise stated

Reel Dimension - 7 inch

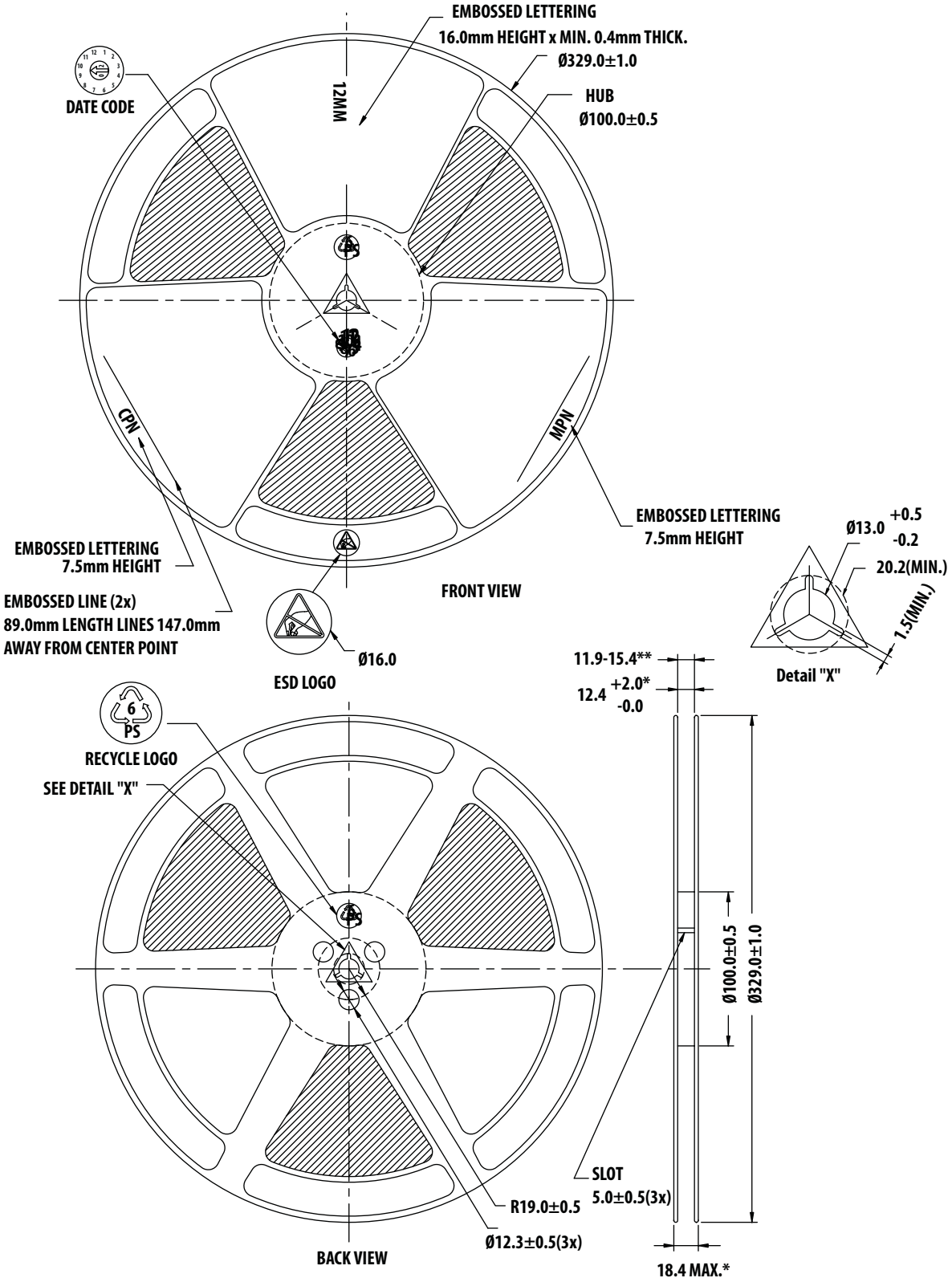








Reel Dimension - 13 inch



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

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