Ceramic Packaged GaN Power HEMT

DC-12 GHz

AM005WN-BI-R
AM005WN-BI-G-R

Feb 2015
Rev 0

DESCRIPTION

AMCOM's AM005WN-BI-R is a discrete GaN/SiC HEMT that has a total gate width of 0.5mm. It is in a ceramic package for operating up to 12 GHz. The BI series uses a specially designed ceramic package with bent (BI-G) or straight (BI) leads in a drop-in mounting style. The flange at the bottom of the package serves simultaneously as DC ground, RF ground, and thermal path. This part is RoHS compliant.

FEATURES

- High Frequency Operation up to 12 GHz
- Gain=15dB, P_{5dB}=33.5dBm, PAE=51%, ζ_{Drain} =56% @ 3GHz
- Surface Mountable
- Bottom ground for Effective Heat Removal

APPLICATIONS

- High dynamic receiver
- Cellular Radio Base Stations
- Wideband and narrowband amplifiers
- Radar
- Test Instrumentation
- Military
- Jammers

RF PERFORMANCE @ 3 GHz (CW)

(V_{ds} = 28V, I_{dq} = 75mA)

Parameters	MIN	TYP
P_{5dB}* (dBm)	32.5	33.5
PAE @ P_{5dB}	40%	51%
Drain eff @ P_{5B}	45%	56%
Small Signal Gain (dB)	13	15
Optimum load reflection coeff.	-	0.51∠80°

* Power typically remains the same as frequency changes.

ABSOLUTE MAXIMUM RATING

Parameters	Symbol	Rating
Drain-Source Voltage (V)	V_{ds}	40
Gate-Source Voltage (V)	V_{gs}	-6
Drain Current (mA)	I_{ds}	200
Continuous Dissipation At Room Temp. (W)	P_t	8.3
Operating Temp. (^oC)	T_A	-55 to +85
Max. Channel Temp. (^oC)	T_{ch}	+200

DC PARAMETERS

Parameters	Conditions	MIN	TYP	MAX
Saturation Current I_{dss} (mA)	V_{ds}=10V, V_{gs} =0V	250	400	570
Pinch-off Voltage V_p (V)	V_{ds}=10V, Ids=2.5% I_{dss}	-3.9	-2.9	-1.9
Drain to Gate Breakdown Voltage BV_{gd} (V)	I_{dg} = 1 mA/mm	90	120	-
Thermal Resistance ($^oC/W$)		-	21.14	-

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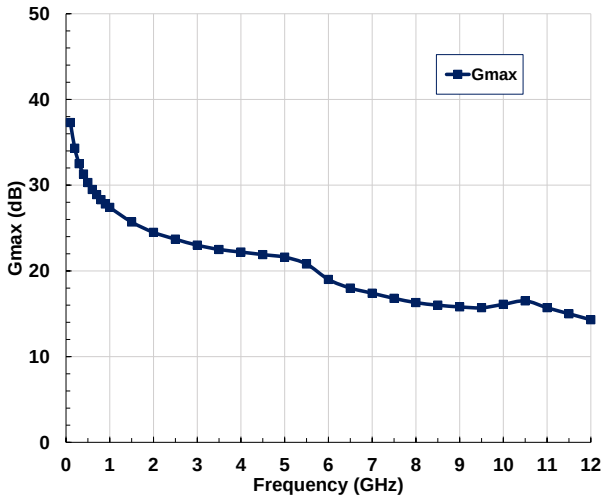
SMALL SIGNAL MEASUREMENTS

S-Parameters* @ V_{ds} = 28V, I_{dq} = 75mA

Freq(GHz)	MAG(S11)	ANG(S11)	MAG(S21)	ANG(S21)	MAG(S12)	ANG(S12)	MAG(S22)	ANG(S22)
0.1	0.999	-5.485	9.733	174.31	0.002	85.863	0.766	-3.876
0.5	0.987	-27.095	9.477	155.83	0.009	69.864	0.76	-18.552
1	0.958	-52.349	8.807	133.95	0.016	51.125	0.747	-35.936
1.5	0.922	-74.752	7.964	114.08	0.022	34.499	0.733	-51.616
2	0.887	-94.192	7.128	96.251	0.025	20.074	0.725	-65.532
2.5	0.855	-111.08	6.391	80.163	0.027	7.607	0.721	-77.883
3	0.825	-126	5.779	65.403	0.029	-3.22	0.722	-88.914
3.5	0.796	-139.54	5.291	51.608	0.03	-12.685	0.725	-98.85
4	0.766	-152.23	4.912	38.439	0.03	-21.009	0.729	-107.87
4.5	0.73	-164.58	4.629	25.577	0.03	-28.353	0.733	-116.14
5	0.688	-177.11	4.428	12.74	0.03	-34.836	0.737	-123.77
5.5	0.636	169.62	4.293	-0.359	0.031	-40.574	0.739	-130.89
6	0.57	154.83	4.211	-14.011	0.031	-45.7	0.739	-137.61
6.5	0.489	137.31	4.162	-28.481	0.032	-50.449	0.737	-144.04
7	0.396	114.84	4.122	-43.967	0.034	-55.204	0.733	-150.32
7.5	0.306	82.846	4.06	-60.531	0.037	-60.482	0.725	-156.62
8	0.265	37.007	3.947	-78.021	0.04	-66.794	0.711	-163.11
8.5	0.314	-9.288	3.77	-96.087	0.044	-74.43	0.688	-169.93
9	0.42	-41.664	3.537	-114.32	0.048	-83.387	0.651	-177.18
9.5	0.536	-63.95	3.273	-132.48	0.052	-93.563	0.596	175.09
10	0.642	-80.665	3.001	-150.64	0.057	-104.96	0.516	167
10.5	0.735	-94.034	2.73	-169.08	0.061	-117.72	0.404	159.27
11	0.816	-105.35	2.452	171.81	0.065	-132.03	0.257	155.67
11.5	0.885	-115.45	2.148	151.95	0.066	-147.83	0.113	-173.65
12	0.939	-124.77	1.811	131.84	0.065	-164.49	0.206	-109.18

* S2P file downloadable from the web: http://www.amcomusa.com/products/rftrans.html

Maximum Available Gain (28V,75mA)



POWER MEASUREMENTS

OPTIMUM LOAD (28V/75mA)*

Freq (GHz)	MAG(Γ_L)	ANG(Γ_L)
1	0.41	29
1.5	0.43	42
2	0.46	54
2.5	0.48	68
3	0.51	80
3.5	0.54	91
4	0.56	100
4.5	0.57	109
5	0.58	118
5.5	0.59	126
6	0.6	133
6.5	0.6	139
7	0.6	146
7.5	0.59	152
8	0.58	157

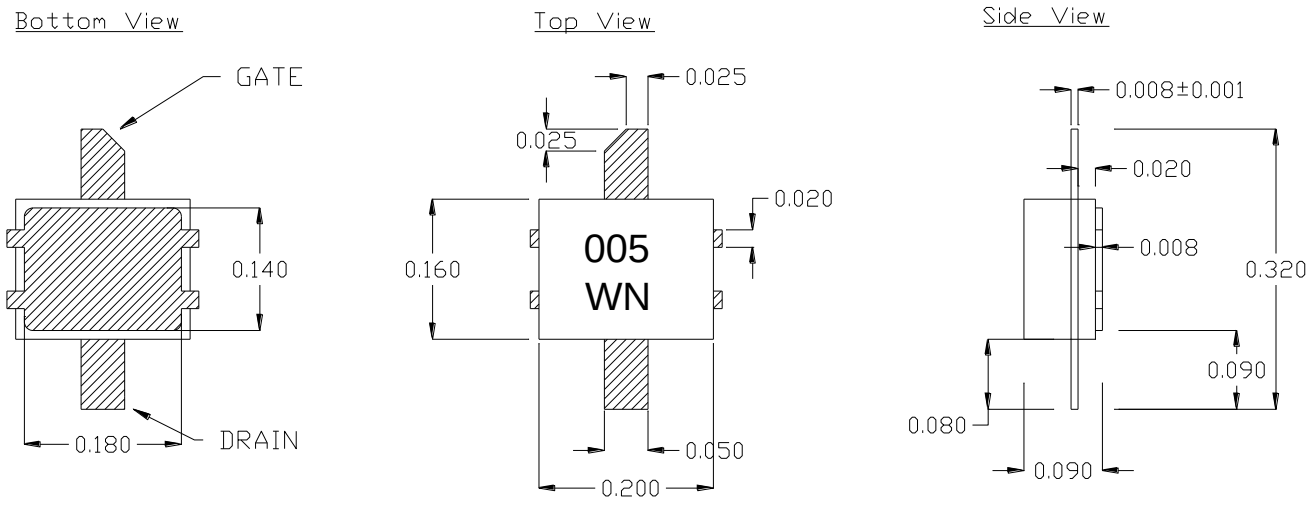
* Reference line is at the edge of the package.

Evaluation boards power measurements (CW)

(V_{ds} = 28V, I_{dq} = 75mA)

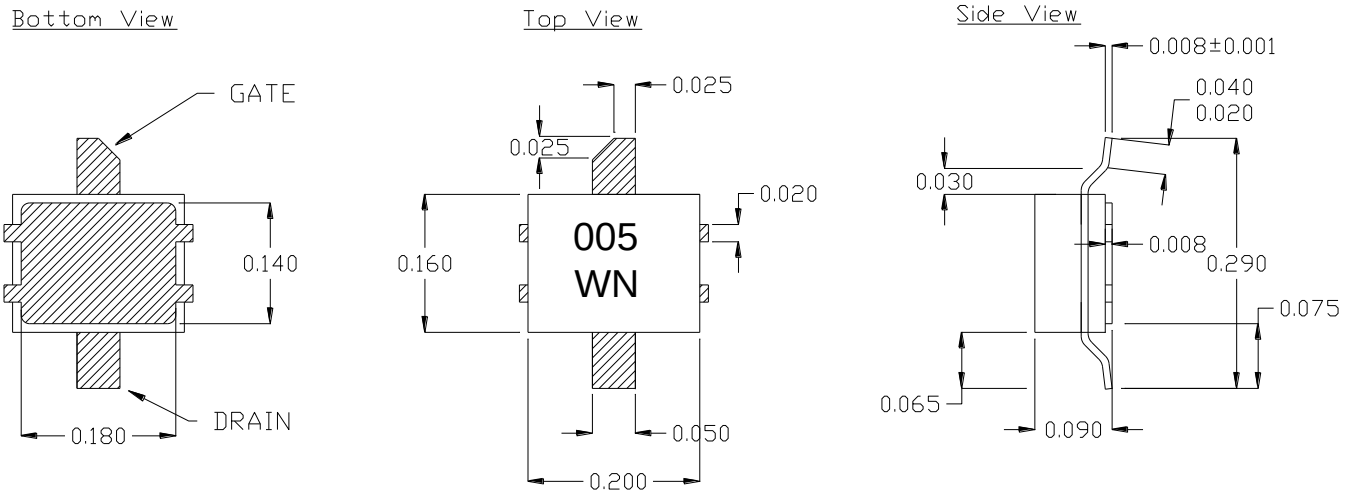
Parameters \ Frequency	1.7 GHz		3 GHz		5.7 GHz	
	MIN	TYP	MIN	TYP	MIN	TYP
P_{5dB} (dBm)	32.5	33.5	32.5	33.5	-	33.5
PAE @ P_{5dB}	45%	55%	40%	51%	-	44%
Drain eff @ P_{5B}	50%	60%	45%	56%	-	48%
Small Signal Gain (dB)	13.5	15.5	13	15	13	15
Input RL (dB)	-	12	-	10	-	10

PACKAGE OUTLINE



* All Dimensions are in inch

AM005WN-BI-R (Straight leads)



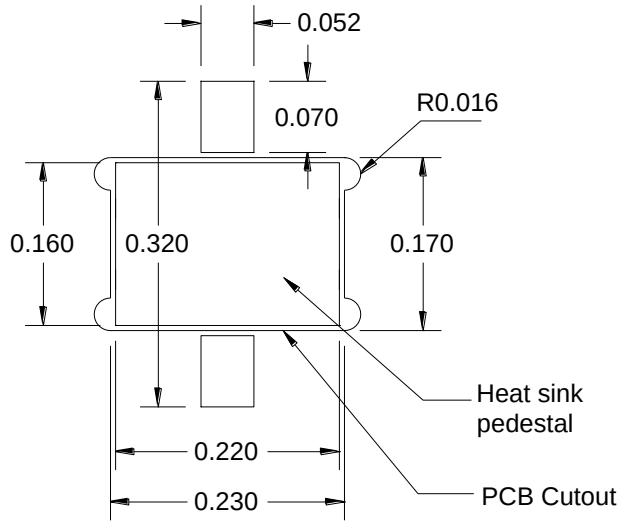
* All Dimensions are in inch

AM005WN-BI-G-R (Bent Leads)

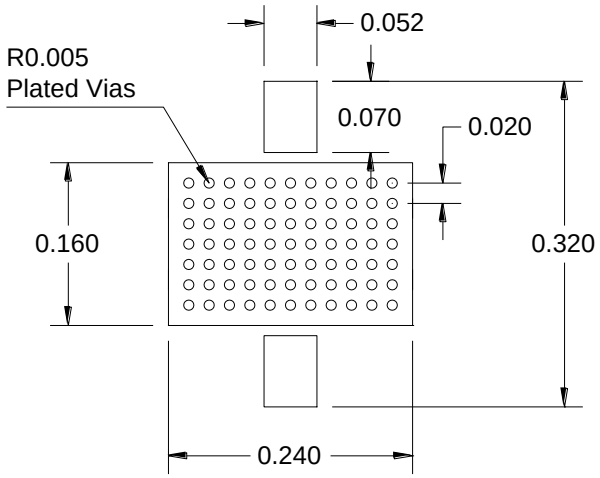
MOUNTING INSTRUCTIONS

The device may dissipate several watts of power. It is important to provide a good heat sink to dissipate the heat. There are two options of mounting the amplifier, as shown. The most effective way is to mount the amplifier to a heat sink pedestal (Option 1). We strongly recommend this way for high power device. The other option, which is mounted directly on PCB, is to add sufficient number of plated through via holes to the PCB. The base of the device is soldered to the PCB (Option 2). The via hole wall should be plated by at least 1 oz thick (1.5 mil) of high thermal conductivity copper to conduct the heat from the top of PCB to the bottom of PCB. Also fill the via holes with solder to help conducting the heat.

Option 1 for Straight Leads (Recommended)



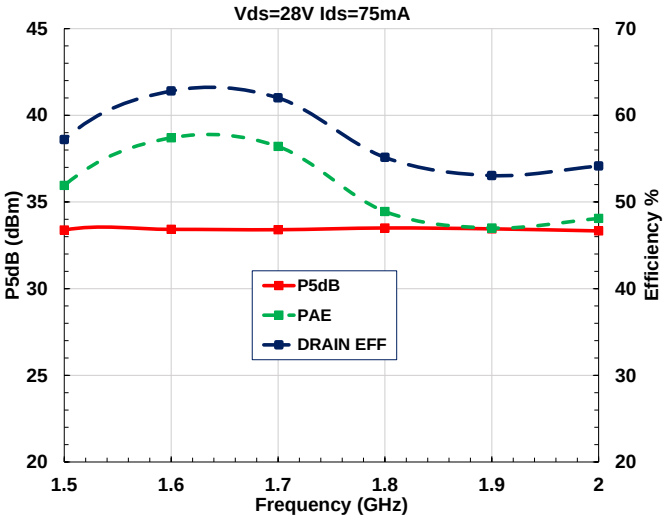
Option 2 for Bent Leads

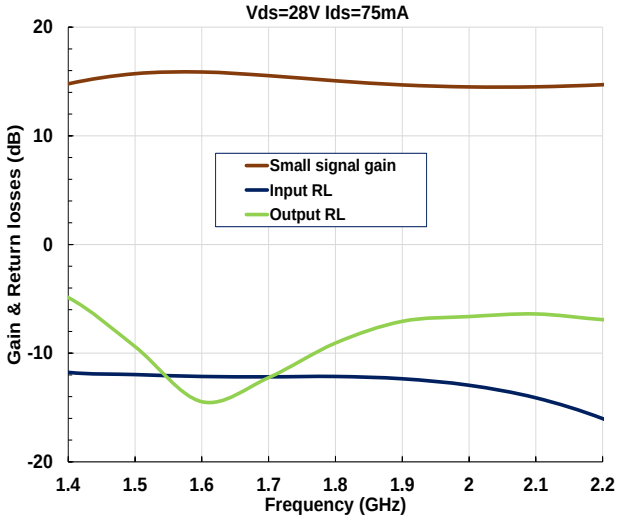


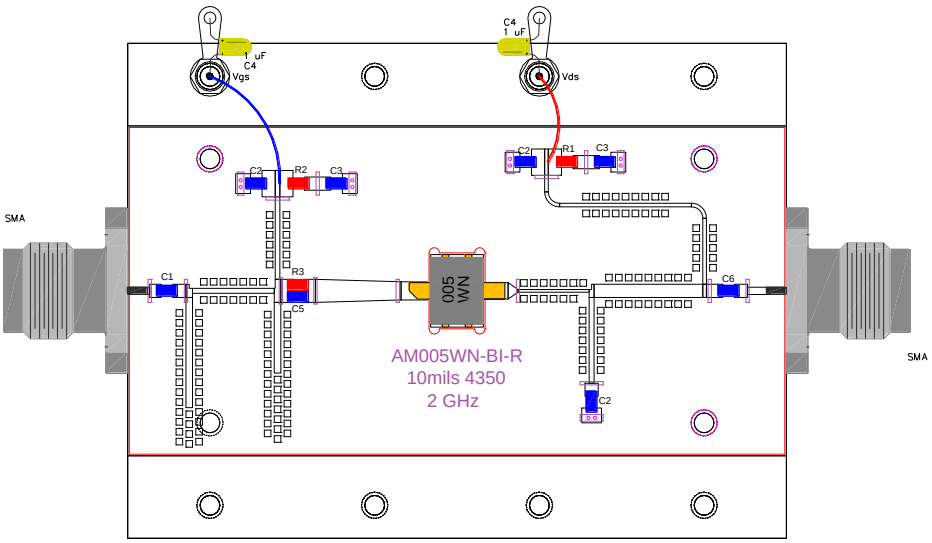
* All Dimensions are in inch

TEST CIRCUITS

1) 1.5 GHz to 2 GHz (CW)

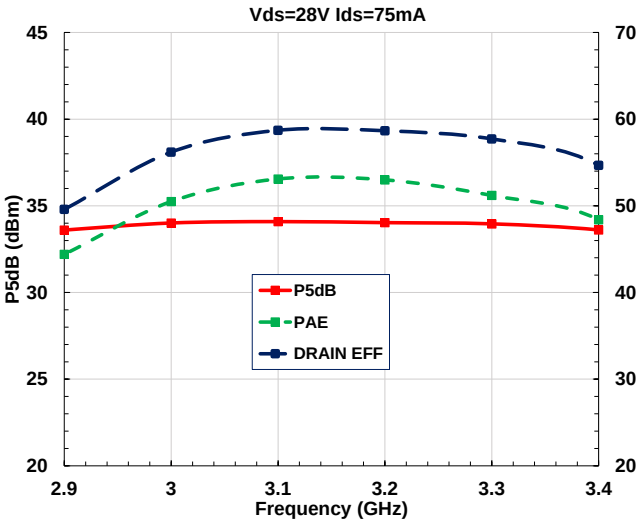


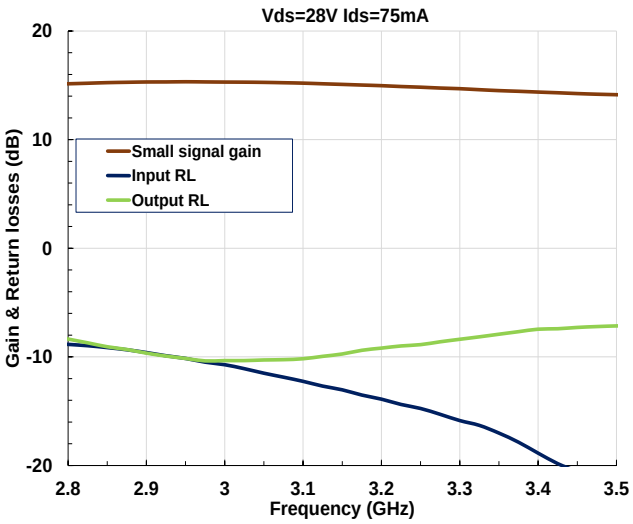


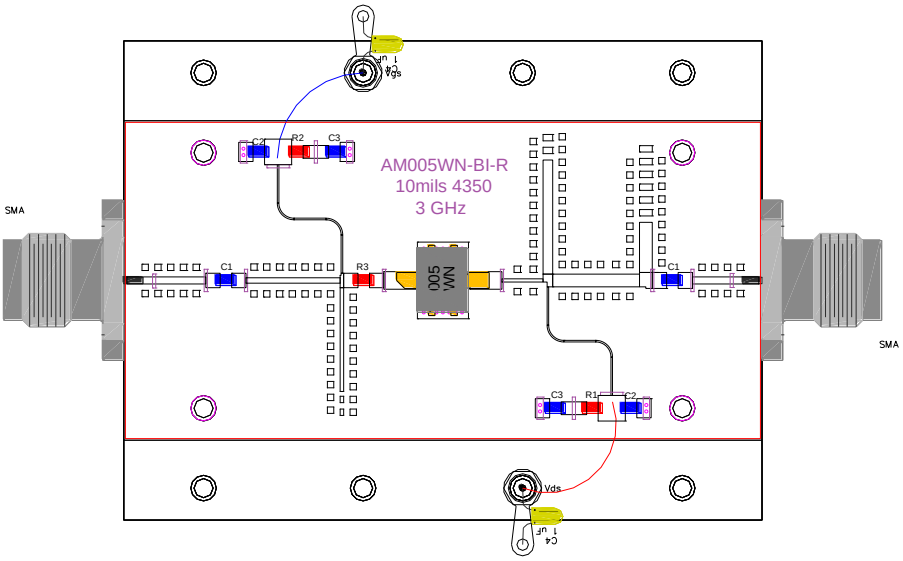


Notes:
1- 10mils Rogers 4350 Material (LoPro)
2- Ckt is for 0.5mm mask71 @ 2GHz
3- C1=10pF, C2=20pF, C3=1000pF, C4=1uF, C5=3.9pF, C6=6.8pF
R1=5.1ohms, R2=51ohms, R3=15ohms
4- All SMT Caps & Resistors are 0603 size

2) 2.9 GHz to 3.4 GHz (CW)

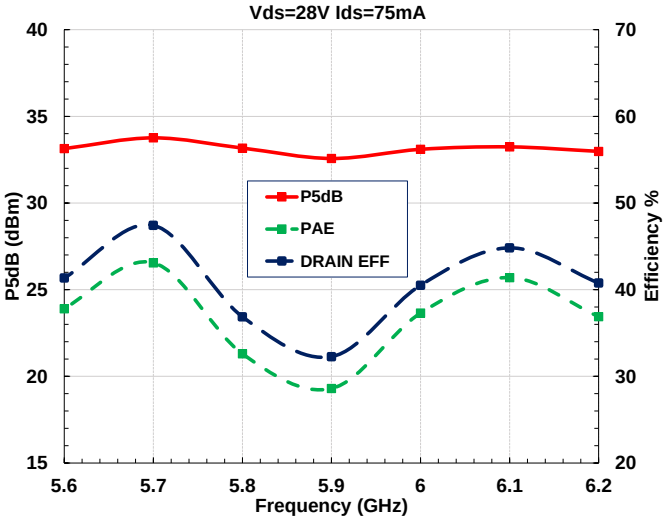


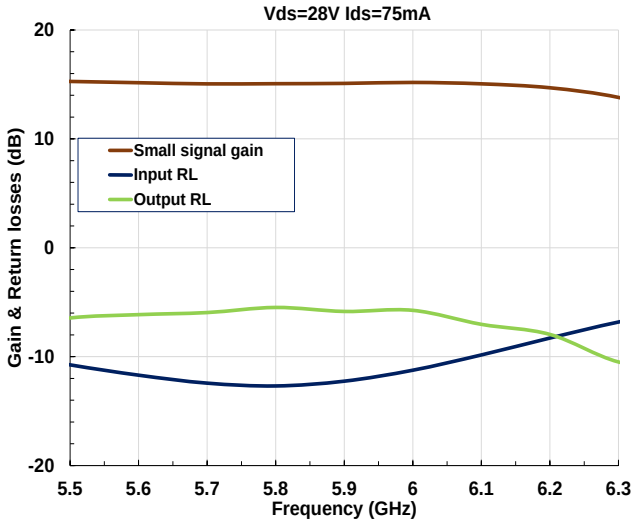


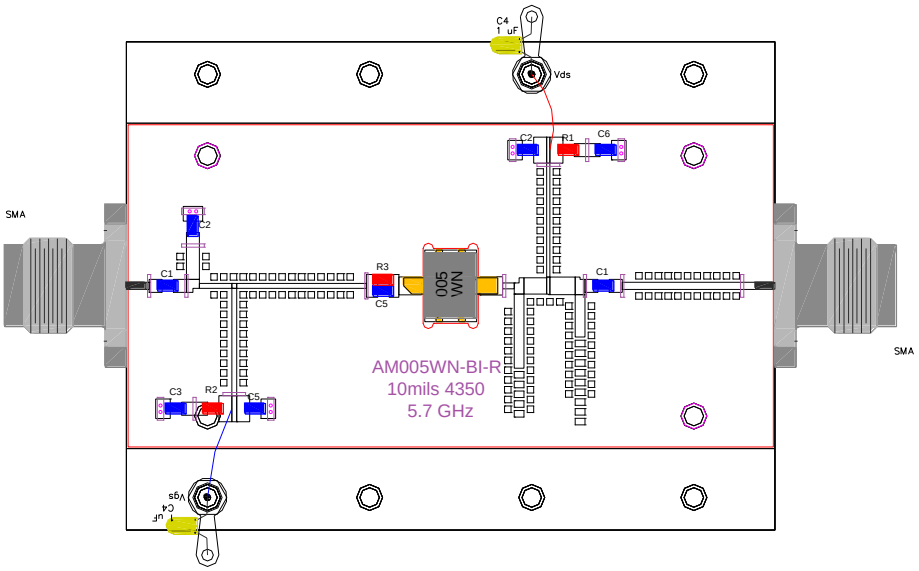


Notes:
1- 10mils Rogers 4350 Material (LoPro)
2- Ckt is for 0.5mm mask71 @ 3GHz
3- C1=10pF, C2=20pF, C3=1000pF, C4=1uF
R1=5.1ohms, R2=51ohms, R3=15ohms
4- All SMT Caps & Resistors are 0603 size

3) 5.6 GHz to 6.2 GHz (CW)







Notes:

1- 10mils Rogers 4350 Material (LoPro)
2- Ckt is for 0.5mm mask71 @ 5.7GHz
3- C1=12pF, C2=20pF, C3=1000pF, C4=1uF, C5=1pF, C6=2.2pF
R1=5.1ohms, R2=51ohms, R3=43ohms
4- All SMT Caps & Resistors are 0603 size