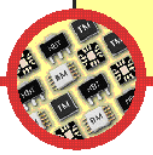
Ceramic Packaged GaN Power HEMT

DC-10 GHz

AM012WN-BI-R
AM012WN-BI-G-R

Feb 2015
Rev 0



DESCRIPTION

AMCOM's AM012WN-BI-R is a discrete GaN/SiC HEMT that has a total gate width of 1.25mm. It is in a ceramic BI package for operating up to 10 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 10 GHz
- Gain=17dB, P_{5dB}=37dBm, PAE=51%, ζ_{Drain}=55% @ 2.8 GHz
- 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 @ 2.8 GHz (CW)

(V_{ds} = 28V, I_{dq} = 188mA)

Parameters	MIN	TYP
P_{5dB}* (dBm)	36	37
PAE @ P_{5dB}	40%	51%
Drain eff @ P_{5B}	45%	55%
Small Signal Gain (dB)	15	17
Optimum load reflection coeff.	-	0.28∠137°

* 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}	500
Continuous Dissipation At Room Temp. (W)	P_t	20.7
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	625	1000	1425
Pinch-off Voltage V_p (V)	V_{ds}=10V, I_{ds} =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 ($^oC/W$)		-	8.46	-

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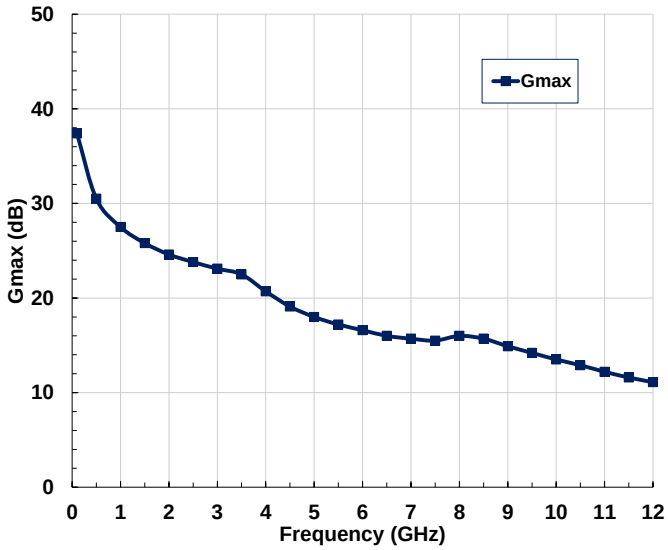
SMALL SIGNAL MEASUREMENTS

S-Parameters* @ V_{ds} = 28V, I_{dq} = 188mA

Freq(GHz)	MAG(S11)	ANG(S11)	MAG(S21)	ANG(S21)	MAG(S12)	ANG(S12)	MAG(S22)	ANG(S22)
0.1	0.996	-11.296	20.272	169.93	0.004	82.795	0.487	-9.018
0.5	0.941	-53.328	18.051	139.73	0.016	56.936	0.459	-40.56
1	0.858	-93.689	14.159	110.07	0.025	32.851	0.42	-70.408
1.5	0.802	-122.11	11.122	87.711	0.029	16.342	0.403	-90.859
2	0.767	-143.16	9.045	69.474	0.031	4.379	0.403	-105.65
2.5	0.741	-160.14	7.629	53.456	0.032	-4.777	0.411	-117.26
3	0.718	-175.03	6.643	38.606	0.032	-12.009	0.422	-127.06
3.5	0.695	170.87	5.944	24.295	0.033	-17.815	0.431	-135.79
4	0.668	156.65	5.444	10.08	0.034	-22.589	0.437	-143.89
4.5	0.638	141.45	5.085	-4.402	0.035	-26.79	0.439	-151.68
5	0.605	124.46	4.823	-19.473	0.038	-31.046	0.435	-159.45
5.5	0.571	104.84	4.625	-35.413	0.042	-36.123	0.424	-167.58
6	0.545	81.904	4.455	-52.46	0.048	-42.787	0.404	-176.59
6.5	0.538	55.745	4.28	-70.774	0.055	-51.613	0.372	172.65
7	0.562	27.981	4.068	-90.388	0.063	-62.842	0.324	158.71
7.5	0.618	1.041	3.793	-111.24	0.071	-76.449	0.253	138.37
8	0.698	-23.303	3.438	-133.13	0.077	-92.132	0.172	101.48
8.5	0.785	-44.662	3.001	-155.63	0.08	-109.37	0.159	31.785
9	0.863	-63.205	2.505	-178.05	0.08	-127.28	0.276	-20.012
9.5	0.921	-79.143	1.998	160.58	0.075	-144.81	0.432	-48.646
10	0.957	-92.607	1.536	141.14	0.068	-160.95	0.575	-68.997
10.5	0.977	-103.83	1.154	124.09	0.059	-175.17	0.69	-85.038
11	0.987	-113.19	0.859	109.45	0.051	172.64	0.774	-98.051
11.5	0.991	-121.05	0.641	96.976	0.044	162.28	0.834	-108.78
12	0.993	-127.78	0.482	86.317	0.037	153.45	0.876	-117.75

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

Maximum Available Gain (28V,188mA)



POWER MEASUREMENTS

OPTIMUM LOAD (28V/188mA)

Freq (GHz)	MAG(Γ_L)	ANG(Γ_L)
1	0.12	127
1.5	0.17	122
2	0.22	123
2.5	0.26	132
3	0.29	140
3.5	0.32	148
4	0.34	155
4.5	0.33	163
5	0.3	170
5.5	0.27	177
6	0.22	-175
6.5	0.16	-164
7	0.07	-147
7.5	0.03	2
8	0.15	33

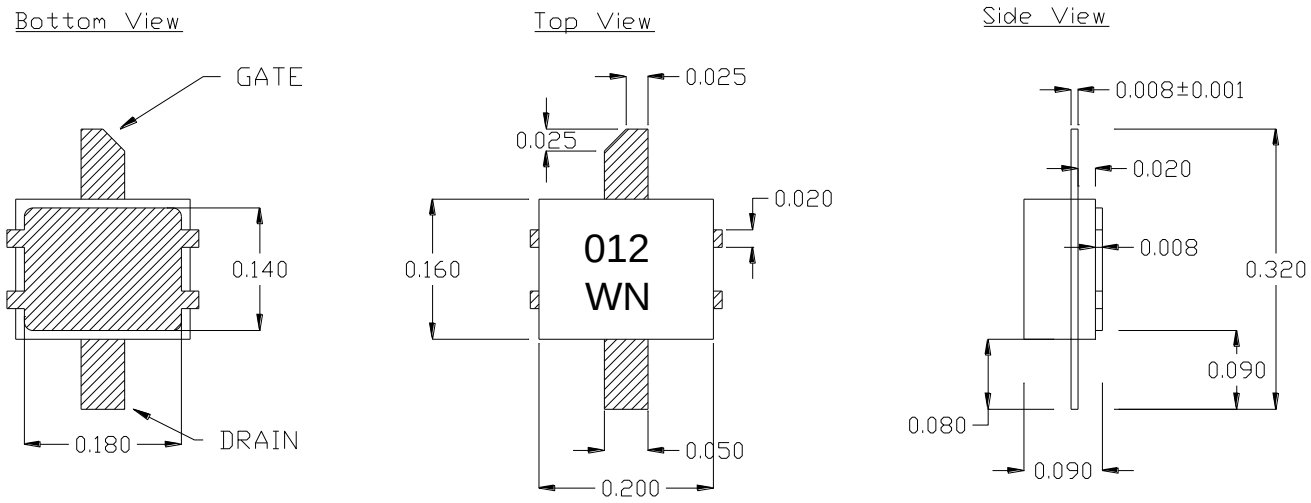
* Reference line is at the edge of the package.

Evaluation boards power measurements (CW)

(V_{ds} = 28V, I_{dq} = 188mA)

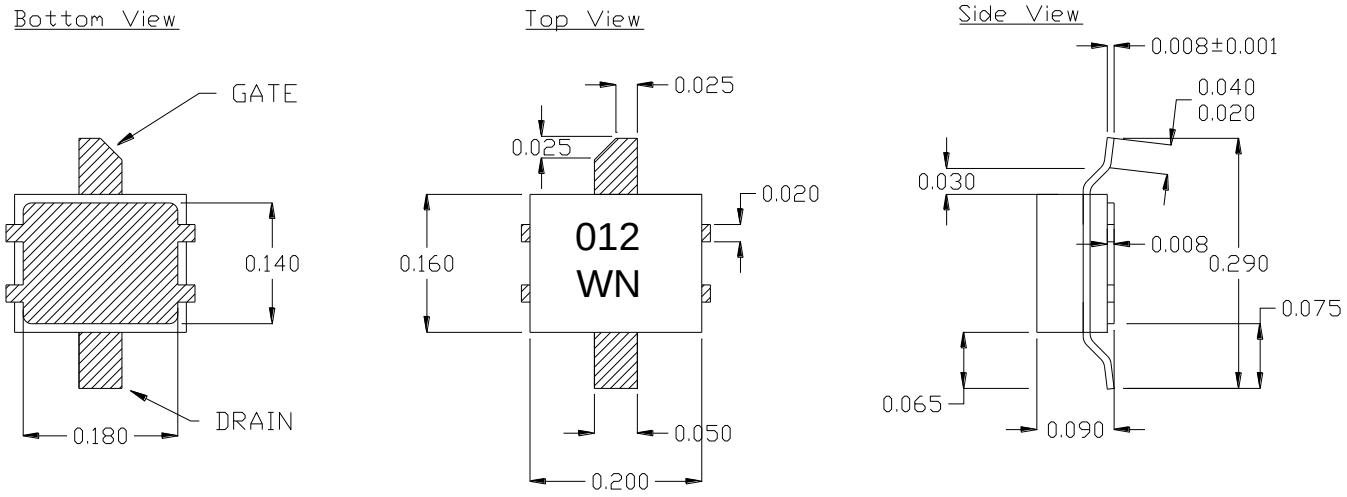
Parameters \ Frequency	1.3 GHz		2.8 GHz		5.2 GHz	
	MIN	TYP	MIN	TYP	MIN	TYP
P_{5dB} (dBm)	36.5	37.5	36	37	36	37
PAE @ P_{5dB}	45%	56%	40%	51%	40%	47%
Drain eff @ P_{5B}	48%	58%	45%	55%	43%	53%
Small Signal Gain (dB)	18	20	15	17	11.5	13.5
Input RL (dB)	-	15	-	13	-	15

PACKAGE OUTLINE



* All Dimensions are in inch

AM012WN-BI-R (Straight leads)



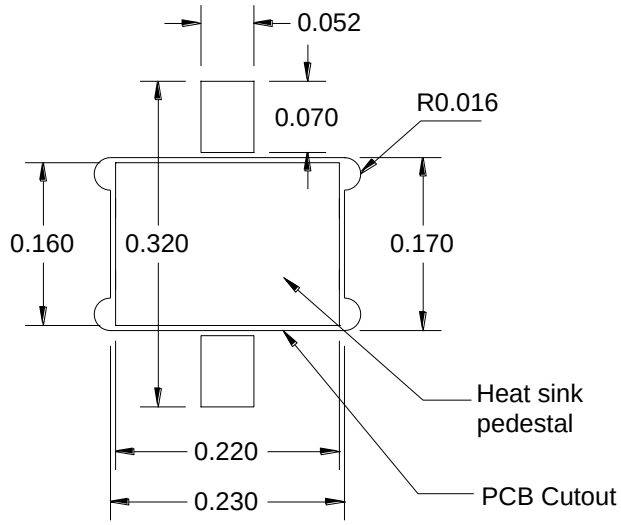
* All Dimensions are in inch

AM012WN-BI-G-R (Bent Leads)

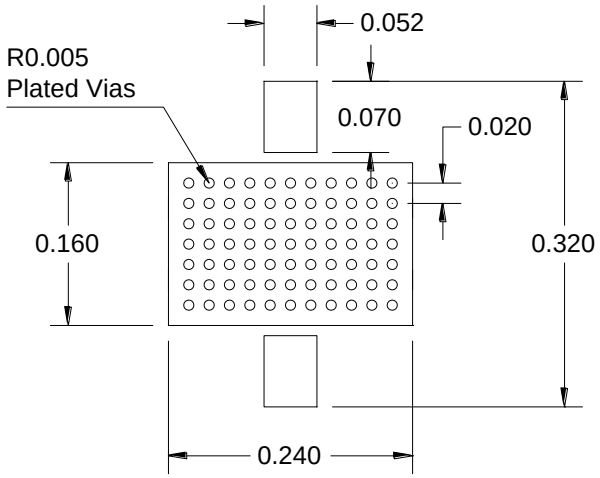
MOUNTING INSTRUCTIONS

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)



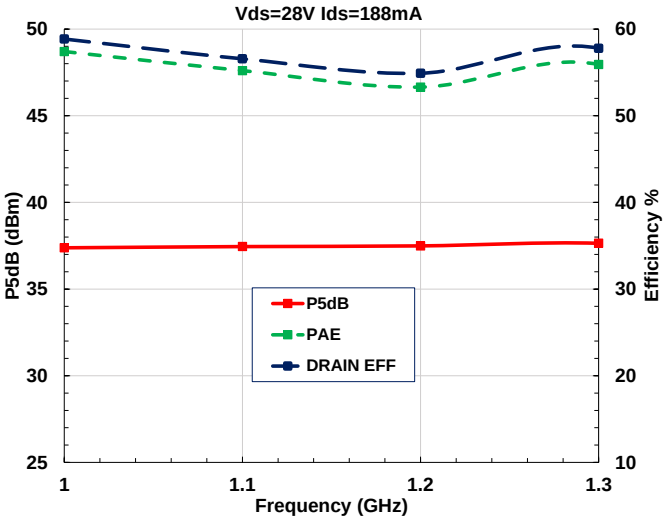
Option 2 for Bent Leads

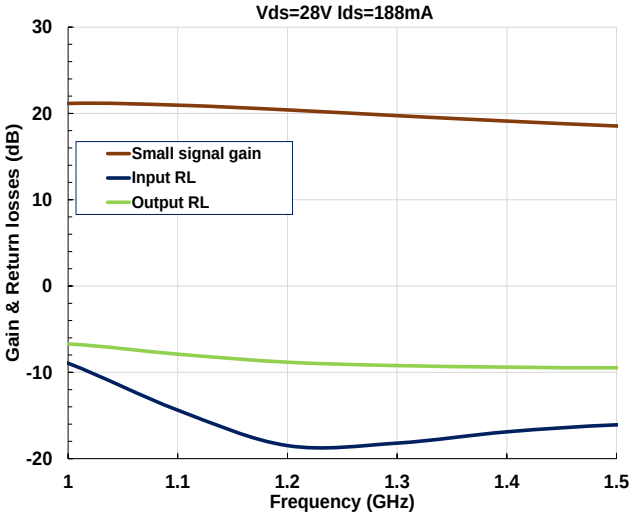


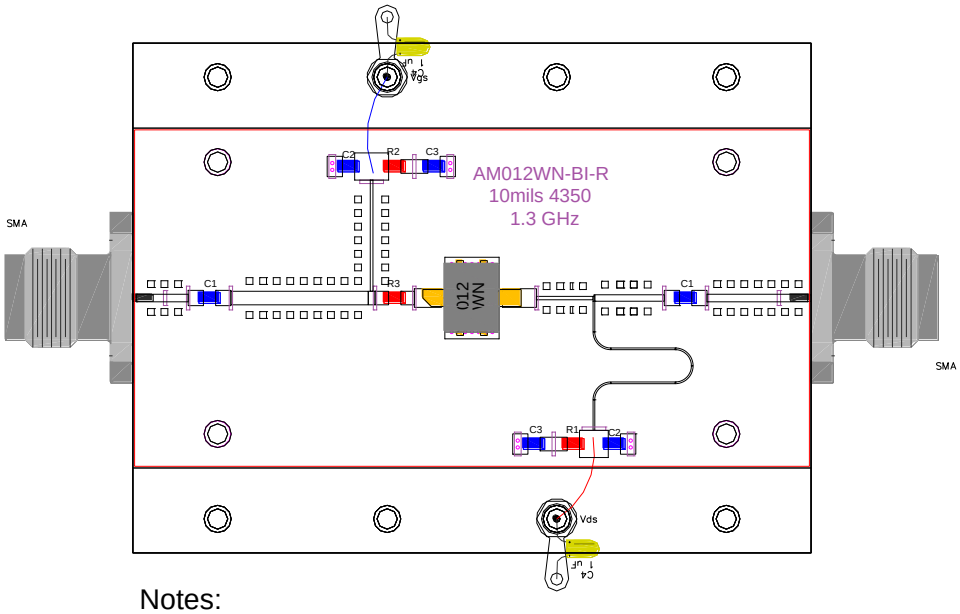
* All Dimensions are in inch

TEST CIRCUITS

1) 1 GHz to 1.3 GHz

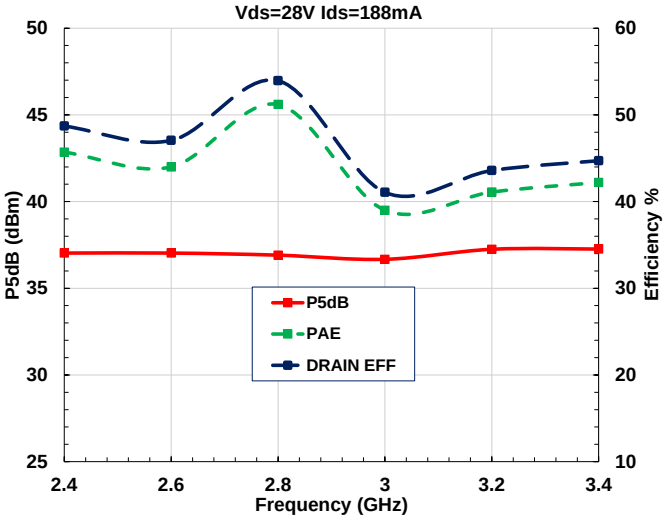


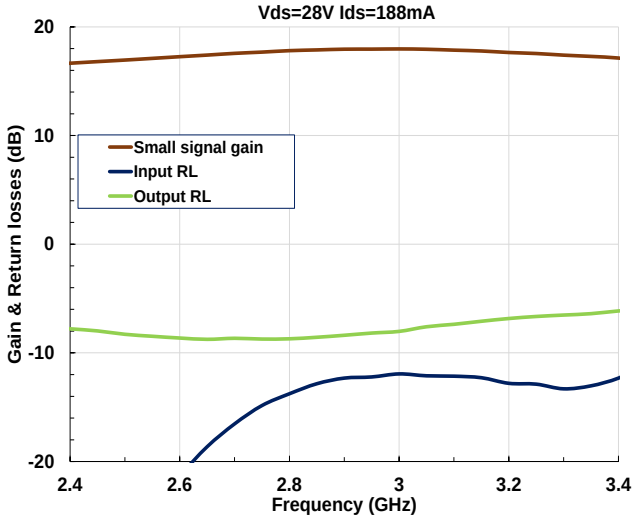


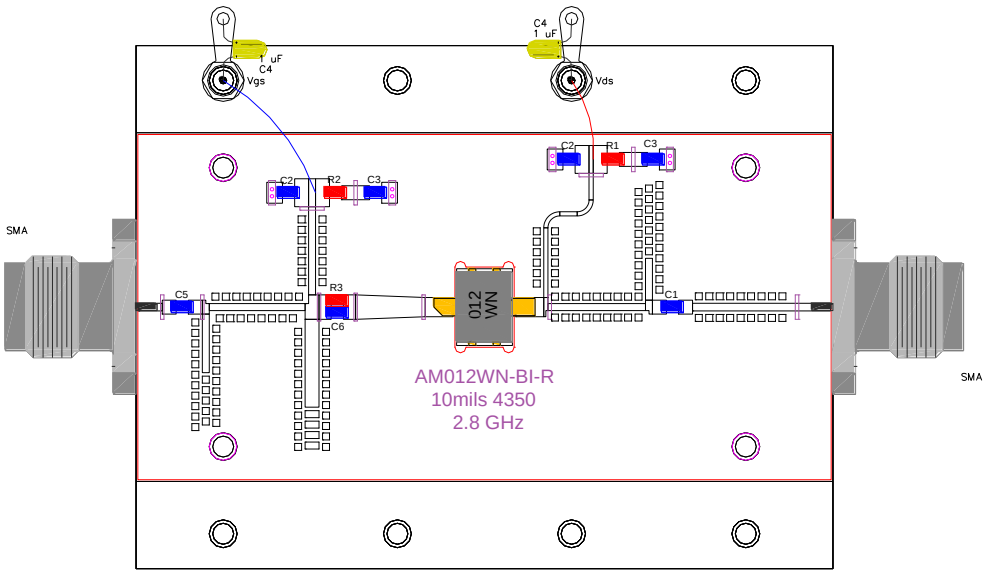


Notes:
1- 10mils Rogers 4350 Material (LoPro)
2- Ckt is for 1.25mm mask71 @ 1.3 GHz
3- C1=10pF, C2=20pF, C3=1000pF, C4=1uF
R1=5.1ohms, R2=51ohms, R3=18ohms
4- All SMT Caps & Resistors are 0603 size

2) 2.4 GHz to 3.4 GHz

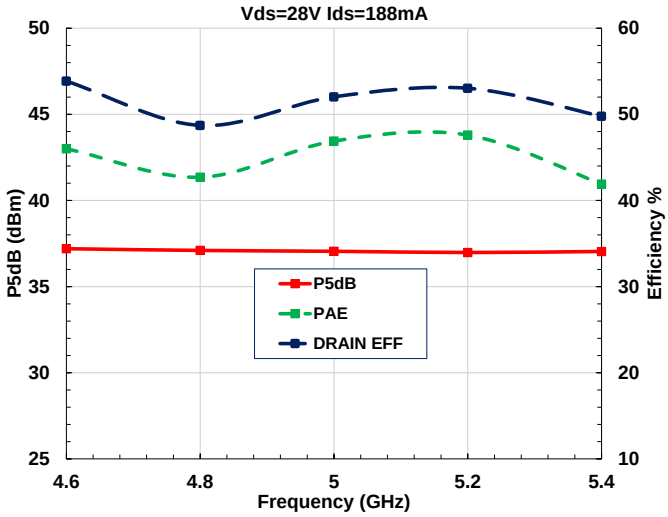


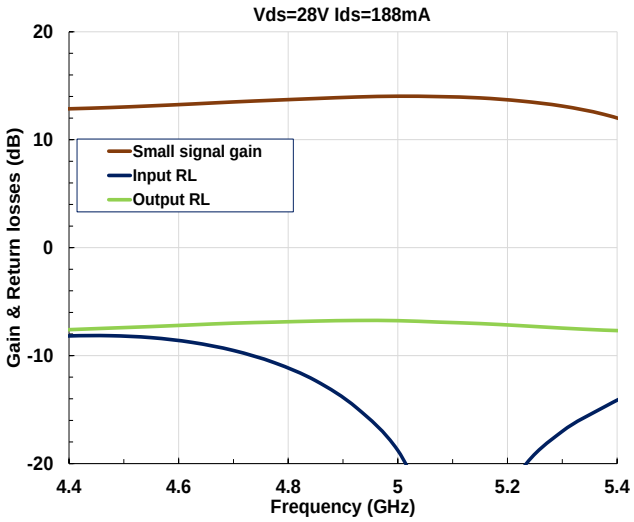


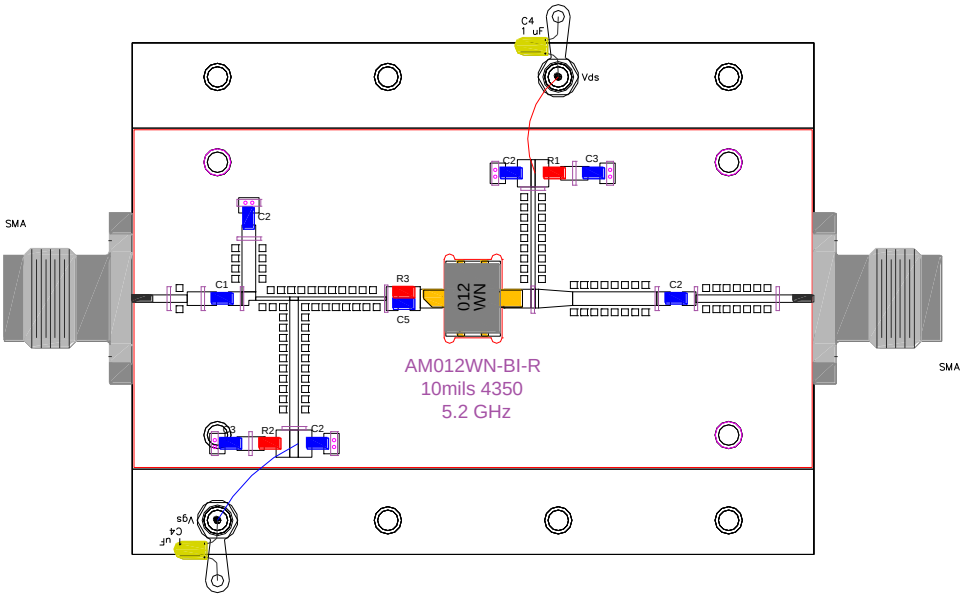


Notes:
1- 10mils Rogers 4350 Material (LoPro)
2- Ckt is for 1.25mm mask71 @ 2.8GHz
3- C1=10pF, C2=20pF, C3=1000pF, C4=1uF, C5=4.7pF, C6=2.4pF
R1=5.1ohms, R2=51ohms, R3=22ohms
4- All SMT Caps & Resistors are 0603 size

3) 4.6 GHz to 5.6 GHz







Notes:
1- 10mils Rogers 4350 Material (LoPro)
2- Ckt is for 1.25mm mask71 @ 5.2GHz
3- C1=1.2pF, C2=10pF, C3=1000pF, C4=1uF, C5=1pF
R1=5.1ohms, R2=51ohms, R3=43ohms
4- All SMT Caps & Resistors are 0603 size