TRIQUINT SEMICONDUCTOR, INC.

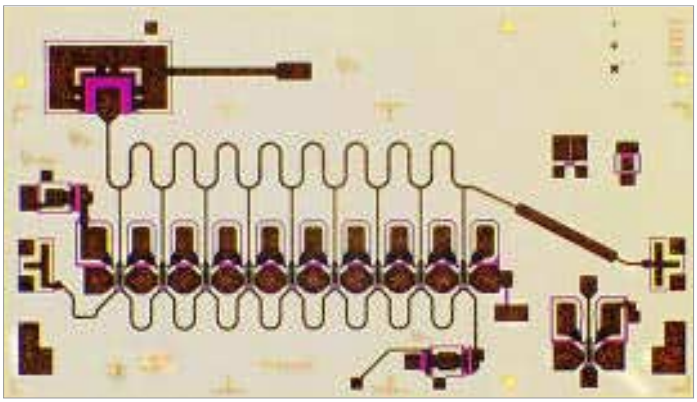
TQS

TGA8310-SCC

Low-Noise Amplifier **8310**

- **2 to 20-GHz Frequency Range**
- **3.5-dB Noise Figure Midband**
- **1.4:1 Typical Input/Output SWR**
- **17.5-dBm Output Power at 1-dB Gain Compression**
- **9-dB Typical Gain**
- **4,115 x 2,362 x 0,102 mm (0.162 x 0.093 x 0.004 in.)**

PHOTO ENLARGEMENT



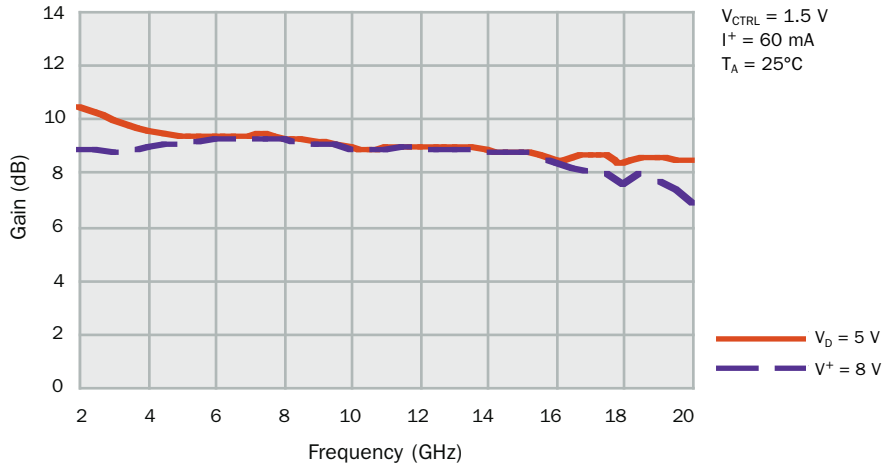
DESCRIPTION

The TriQuint TGA8310-SCC is a monolithic low-noise distributed amplifier, which operates from 2 to 20-GHz. Noise figure is typically 4-dB. Nine 122-µm gatewidth FETs typically provide 17.5-dBm of output power at 1-dB gain compression and 9-dB typical small signal gain. Typical input return loss is 17-dB from 2 to 20-GHz. Typical output return loss is 20-dB. Ground is provided to the circuitry through vias to the backside metallization.

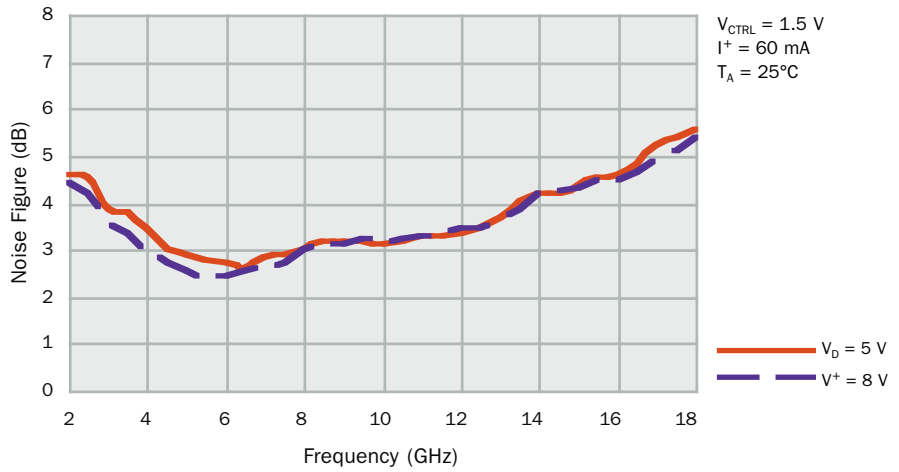
The TGA8310-SCC low-noise distributed amplifier is suitable for a variety of wide-band electronic warfare systems such as radar warning receivers, electronic counter-measures, decoys, jammers, and phased array systems.

Bond pad and backside metallization is gold plated for compatibility with eutectic alloy attachment methods as well as the thermocompression and thermosonic wire-bonding processes. The TGA8310-SCC is supplied in chip form and is readily assembled using automated equipment.

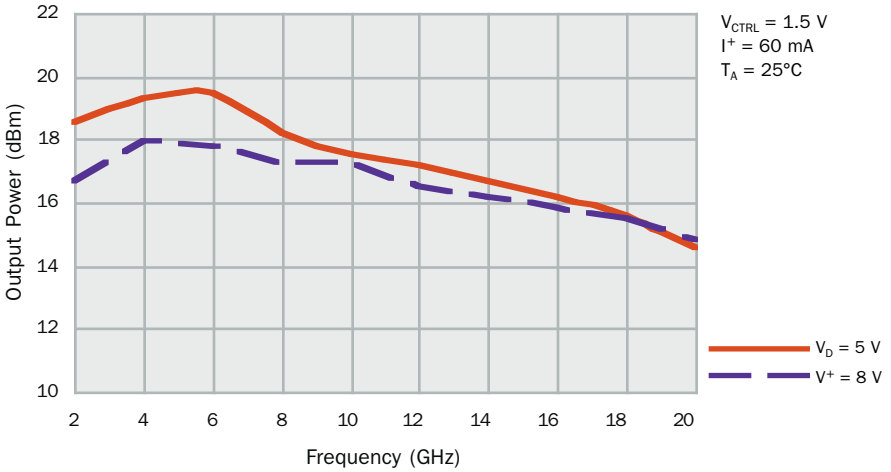
TYPICAL SMALL-SIGNAL POWER GAIN



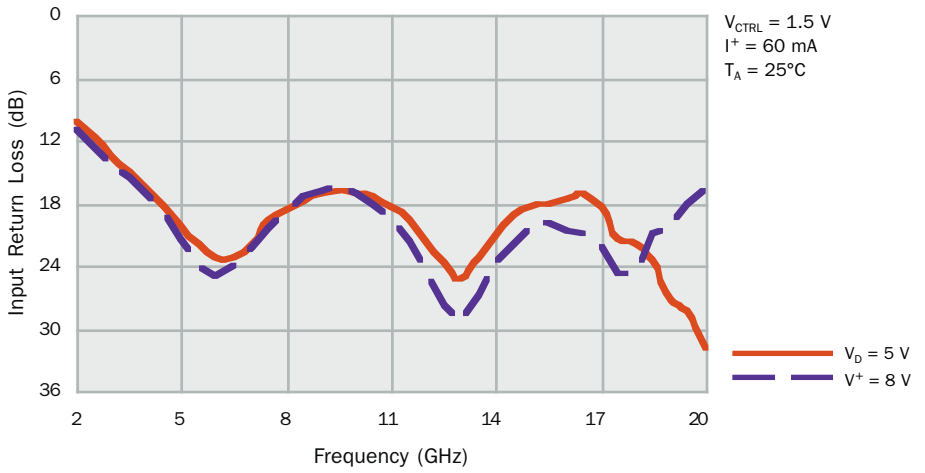
TYPICAL NOISE FIGURE



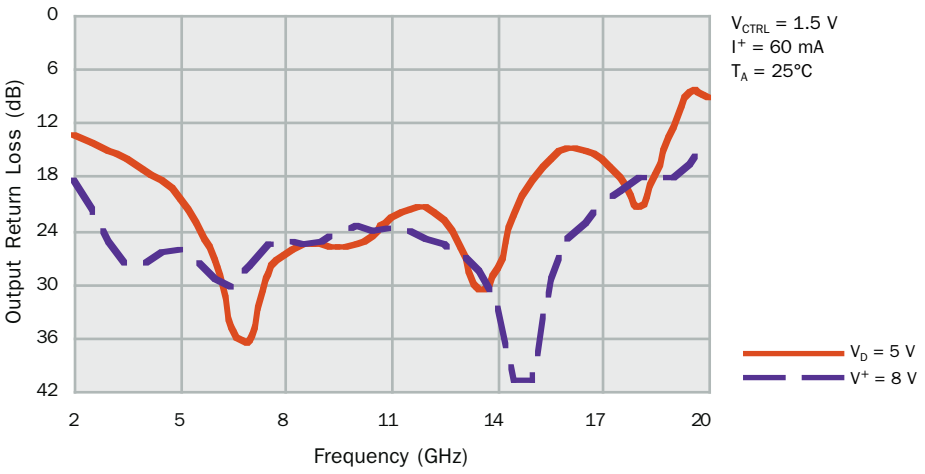
TYPICAL OUTPUT POWER
P_{1dB}



TYPICAL
INPUT RETURN LOSS



TYPICAL
OUTPUT RETURN LOSS



ABSOLUTE MAXIMUM RATINGS

Drain supply voltage, V_D	9 V
Positive supply voltage, V^+	12 V
Positive supply voltage range with respect to negative supply voltage, $V^+ - V_{G1}$	0 V to 13 V
Positive supply voltage range with respect to gain control voltage, $V_{CTRL} - V^+$	0 V to -13 V
Negative supply voltage range, V_{G1}	-5 V to 0 V
Gain control voltage range, V_{CTRL}	-5 V to 4 V
Drain supply current, I_D	I_{DSS}
Positive supply current, I^+	188 mA
Power dissipation, P_D, at (or below) 25 C base-plate temperature*	2.6 W
Input continuous wave power, P_{IN}	23 dBm
Operating channel temperature, T_{CH}**	150 C
Mounting temperature (30 sec), T_M	320 C
Storage temperature range, T_{STG}	-65 to 150 C

Ratings over operating channel temperature range, T_{CH} (unless otherwise noted)

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "RF Characteristics" is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

* For operation above 25 C base-plate temperature, derate linearly at the rate of 5.5 mW/ C.

**Operating channel temperature directly affects the device MTTF . For maximum life, it is recommended that channel temperature be maintained at the lowest possible level.

TYPICAL S-PARAMETERS

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		GAIN
(GHz)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	(dB)
2.0	0.31	-154	3.32	119	0.009	61	0.22	-19	10.4
2.5	0.26	-175	3.23	96	0.010	32	0.19	-62	10.2
3.0	0.21	169	3.13	75	0.011	14	0.17	-98	9.9
3.5	0.18	155	3.06	54	0.012	-6	0.16	-132	9.7
4.0	0.15	145	3.00	35	0.013	-23	0.14	-162	9.6
4.5	0.12	137	2.97	16	0.014	-42	0.12	169	9.4
5.0	0.10	134	2.93	-3	0.014	-59	0.10	143	9.3
5.5	0.08	135	2.93	-22	0.016	-76	0.07	116	9.3
6.0	0.07	143	2.92	-41	0.018	-96	0.04	87	9.3
6.5	0.07	153	2.93	-60	0.019	-115	0.02	44	9.3
7.0	0.08	162	2.94	-79	0.021	-133	0.02	-92	9.4
7.5	0.10	162	2.95	-99	0.022	-153	0.04	-143	9.4
8.0	0.12	157	2.91	-118	0.024	-170	0.05	-170	9.3
8.5	0.13	152	2.90	-138	0.025	173	0.05	164	9.2
9.0	0.14	145	2.85	-157	0.027	156	0.05	133	9.1
9.5	0.14	137	2.83	-176	0.028	140	0.05	95	9.1
10.0	0.14	127	2.80	165	0.029	123	0.05	52	8.9
10.5	0.14	116	2.77	146	0.029	109	0.06	17	8.8
11.0	0.12	109	2.80	127	0.032	89	0.07	-25	8.9
11.5	0.11	100	2.80	107	0.032	73	0.08	-54	9.0
12.0	0.08	99	2.80	88	0.033	56	0.08	-82	8.9
12.5	0.07	107	2.80	68	0.035	37	0.07	-109	8.9
13.0	0.06	128	2.79	48	0.035	18	0.05	-141	8.9
13.5	0.07	147	2.79	28	0.037	0	0.03	153	8.9
14.0	0.09	150	2.77	8	0.038	-21	0.04	53	8.8
14.5	0.11	144	2.74	-13	0.039	-41	0.08	13	8.7
15.0	0.12	130	2.73	-33	0.041	-58	0.12	-14	8.7
15.5	0.12	121	2.70	-54	0.044	-76	0.16	-42	8.6
16.0	0.13	112	2.65	-74	0.046	-96	0.18	-70	8.5
16.5	0.14	99	2.66	-94	0.049	-115	0.18	-99	8.5
17.0	0.12	87	2.70	-115	0.052	-134	0.16	-131	8.6
17.5	0.09	81	2.71	-138	0.056	-155	0.13	-166	8.7
18.0	0.08	95	2.61	-159	0.053	-175	0.08	145	8.3
18.5	0.07	79	2.68	-180	0.056	168	0.13	57	8.6
19.0	0.04	88	2.67	156	0.058	142	0.24	-25	8.5
19.5	0.04	92	2.65	133	0.054	119	0.37	-87	8.5
20.0	0.03	86	2.64	110	0.051	102	0.34	-149	8.4

T_A = 25°C, V_D = 5 V, V_{CTRL} = 1.5 V, I^+ = 60 mA

Reference planes for S-parameter data include bond wires as specified in the "Recommended Assembly Diagram." The S-parameters are also available on floppy disk and the world wide web.

TYPICAL S-PARAMETERS

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		GAIN
(GHz)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	(dB)
2.0	0.28	-155	2.76	108	0.007	37	0.12	-133	8.8
2.5	0.23	-178	2.75	90	0.008	19	0.08	-152	8.8
3.0	0.20	165	2.74	72	0.010	4	0.05	180	8.8
3.5	0.17	151	2.77	53	0.011	-12	0.04	134	8.8
4.0	0.14	140	2.79	35	0.012	-28	0.04	86	8.9
4.5	0.11	133	2.83	16	0.013	-45	0.05	55	9.0
5.0	0.08	132	2.84	-3	0.015	-63	0.05	32	9.1
5.5	0.06	138	2.87	-22	0.016	-80	0.04	8	9.2
6.0	0.06	154	2.88	-41	0.018	-99	0.03	-28	9.2
6.5	0.06	166	2.90	-60	0.019	-117	0.03	-82	9.2
7.0	0.08	165	2.88	-79	0.021	-136	0.04	-128	9.2
7.5	0.09	165	2.91	-98	0.022	-152	0.05	-157	9.3
8.0	0.12	160	2.88	-118	0.024	-171	0.06	173	9.2
8.5	0.13	154	2.87	-137	0.026	172	0.05	143	9.2
9.0	0.15	148	2.84	-157	0.027	156	0.05	111	9.1
9.5	0.15	141	2.81	-176	0.028	140	0.06	79	9.0
10.0	0.14	131	2.78	165	0.029	124	0.07	52	8.9
10.5	0.13	122	2.76	146	0.030	104	0.06	27	8.8
11.0	0.11	112	2.78	128	0.031	91	0.07	1	8.9
11.5	0.08	105	2.79	108	0.032	73	0.06	-29	8.9
12.0	0.06	105	2.76	88	0.032	55	0.06	-58	8.8
12.5	0.04	115	2.77	69	0.033	38	0.05	-85	8.9
13.0	0.03	147	2.76	49	0.034	20	0.05	-113	8.8
13.5	0.05	163	2.76	29	0.035	1	0.04	-147	8.8
14.0	0.06	161	2.75	8	0.037	-19	0.02	-173	8.8
14.5	0.08	150	2.74	-12	0.039	-39	0.01	163	8.7
15.0	0.10	133	2.72	-33	0.040	-59	0.01	-17	8.7
15.5	0.10	116	2.71	-54	0.042	-78	0.03	-37	8.7
16.0	0.09	103	2.60	-76	0.043	-96	0.06	-60	8.3
16.5	0.09	90	2.54	-96	0.046	-112	0.07	-76	8.1
17.0	0.08	65	2.52	-117	0.048	-131	0.09	-91	8.0
17.5	0.06	45	2.49	-139	0.050	-151	0.11	-112	7.9
18.0	0.06	81	2.39	-158	0.047	-170	0.13	-129	7.6
18.5	0.09	63	2.50	-179	0.051	177	0.12	-138	8.0
19.0	0.10	72	2.45	158	0.054	155	0.12	-135	7.8
19.5	0.13	85	2.34	133	0.053	132	0.15	-120	7.4
20.0	0.15	96	2.20	110	0.053	112	0.21	-118	6.8

T_A = 25°C, V^+ = 8 V, V_{CTRL} = 1.5 V, I^+ = 60 mA

Reference planes for S-parameter data include bond wires as specified in the " Recommended Assembly Diagram." -

RF CHARACTERISTICS

	PARAMETER	TEST CONDITIONS		TYP	UNIT
G_P	Small-signal power gain	f = 2 to 20 GHz	V_D = 5 V	9.0	dB
			V^+ = 8 V	8.5	
		f = 2 GHz	V_D = 5 V	4.6	
			V^+ = 8 V	4.4	
		f = 6 GHz	V_D = 5 V	2.7	
NF	Noise figure		V^+ = 8 V	2.5	dB
		f = 10 GHz	V_D = 5 V	3.1	
			V^+ = 8 V	3.2	
		f = 18 GHz	V_D = 5 V	5.6	
			V^+ = 8 V	5.4	
SWR(in)	Input standing wave ratio	f = 2 to 20 GHz	V_D = 5 V	1.4:1	–
			V^+ = 8 V	1.4:1	
SWR(out)	Output standing wave ratio	f = 2 to 20 GHz	V_D = 5 V	1.4:1	–
			V^+ = 8 V	1.4:1	
P_{1dB}	Output power at 1-dB gain compression	f = 2 to 20 GHz	V_D = 5 V	17.5	dBm
			V^+ = 8 V	16.5	
IP_3	Output third–order intercept point	f = 2 GHz	V_D = 5 V	29.5	dBm
		f = 6 GHz		27.0	
		f = 9 GHz		27.5	
		f = 12 GHz		26.5	
		f = 18 GHz		27.0	
	Output second–order intercept point	f_o = 2 GHz	V_D = 5 V	32.5	dBm
		f_o = 4 GHz		29.5	
		f_o = 6 GHz		29.0	
		f_o = 9 GHz		28.0	
	Output third harmonic at 1–dB gain compression	f_o = 2 GHz	V_D = 5 V	-29.0	dBc*
		f_o = 4 GHz		-24.5	
		f_o = 6 GHz		-19.5	
	Output second harmonic at 1–dB gain compression	f_o = 2 GHz	V_D = 5 V	-18.0	dBc*
		f_o = 4 GHz		-15.0	
		f_o = 6 GHz		-13.5	
		f_o = 9 GHz		-15.5	

V_D = 5 V, V_{CTRL} = 1.5 V, I^+ = 60 mA, T_A = 25°C

* Unit dBc applies to decibels with respect to the carrier or fundamental frequency f_o.

DC CHARACTERISTICS

	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
I_{DSS}	Zero–gate–voltage drain current at saturation	V_{DS} = 0.5 V to 3.5 V, V_{GS} = 0	97	292	mA

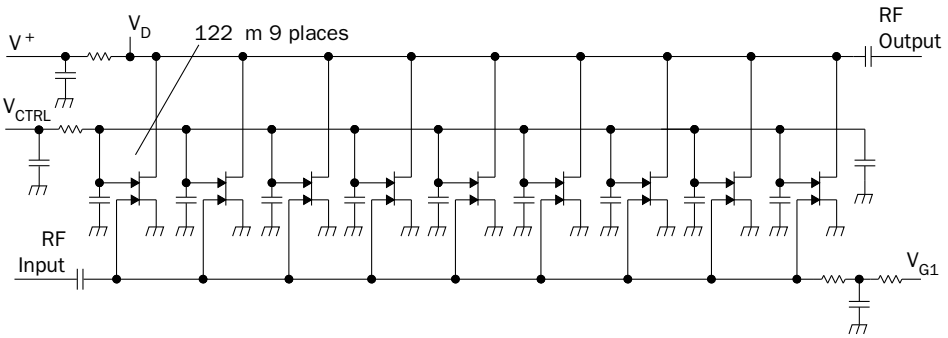
T_A = 25°C

V_{DS} for I_{DSS} is the drain voltage between 0.5 V and 3.5 V at which drain current is highest at dc autoprobe.

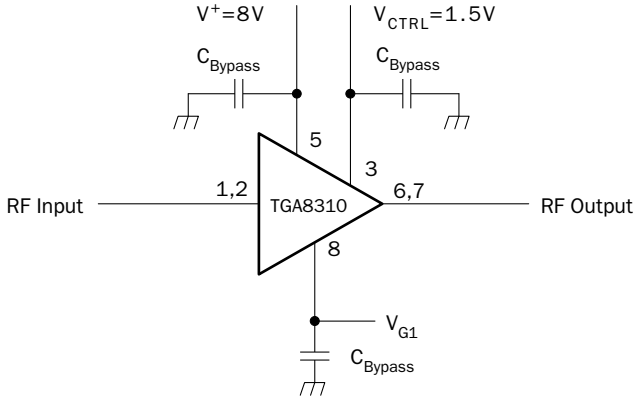
THERMAL INFORMATION

	PARAMETER	TEST CONDITIONS		NOM	UNIT
R_{JC}	Thermal resistance (channel to backside)	V_{CTRL} = 1.5 V,	V^+ = 8 V	12	°C/W
		I^+ = 60 mA	V_D = 5 V	20	

EQUIVALENT SCHEMATIC

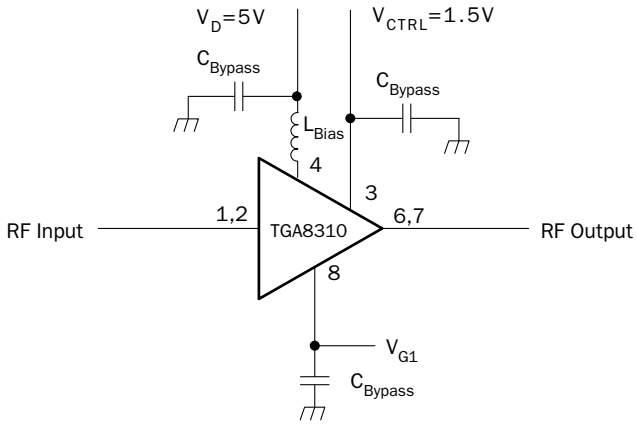


TYPICAL BIAS NETWORK



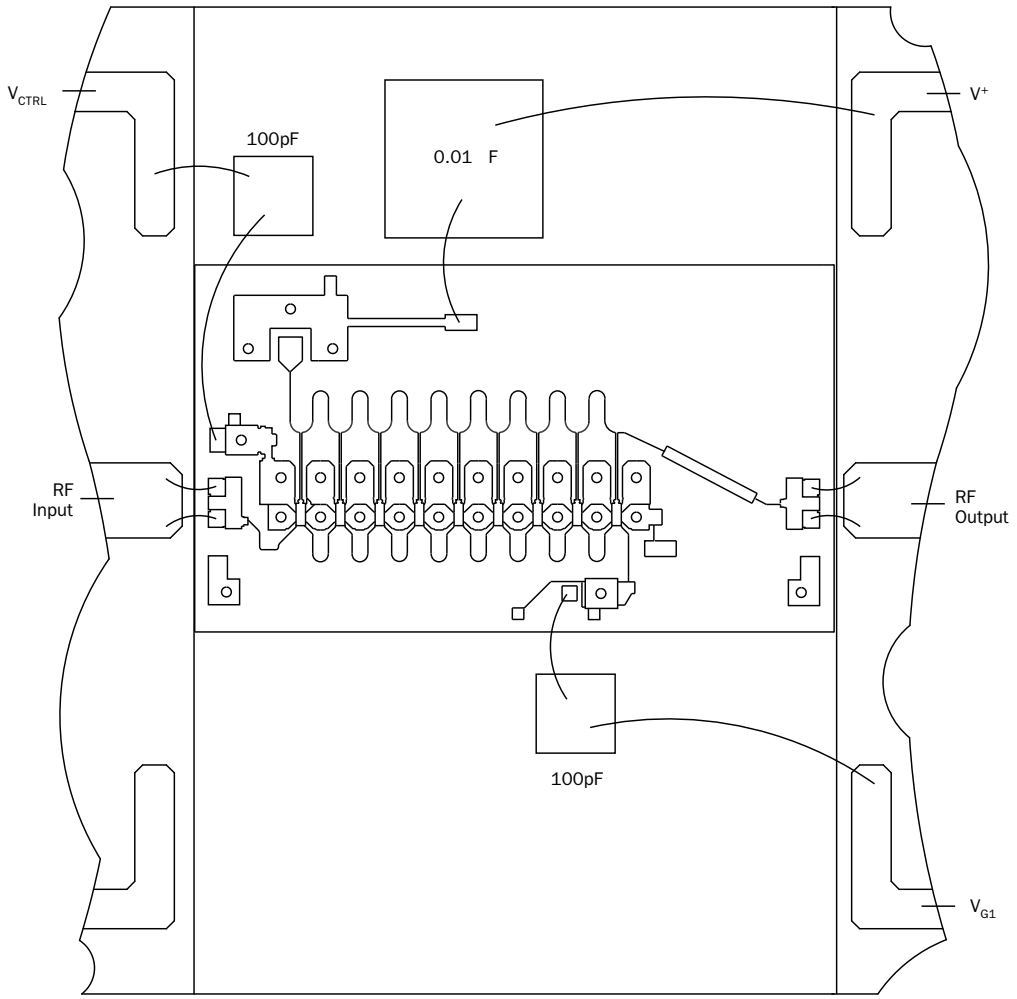
(V^+ = 8 V)

TYPICAL BIAS NETWORK



(V_D = 5 V)

RECOMMENDED ASSEMBLY DIAGRAM
8 Volt Bias

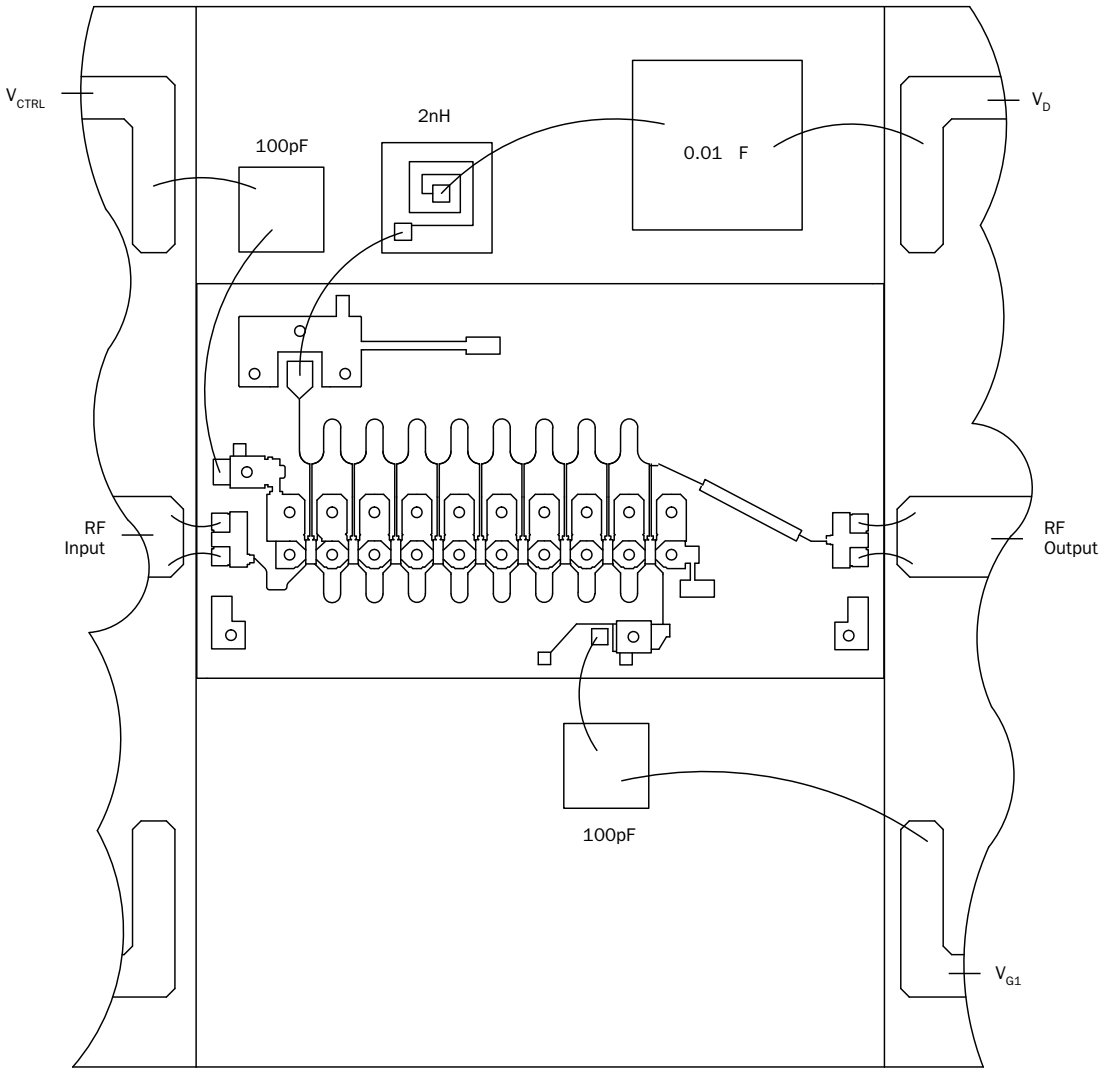


(V^+ = 8 V)

RF connections: Bond using two 1-mil diameter, 20 to 25-mil length gold bond wires at both RF Input and RF Output for optimum RF performance.

Close placement of external components is essential to stability.

RECOMMENDED ASSEMBLY DIAGRAM
5 Volt Bias



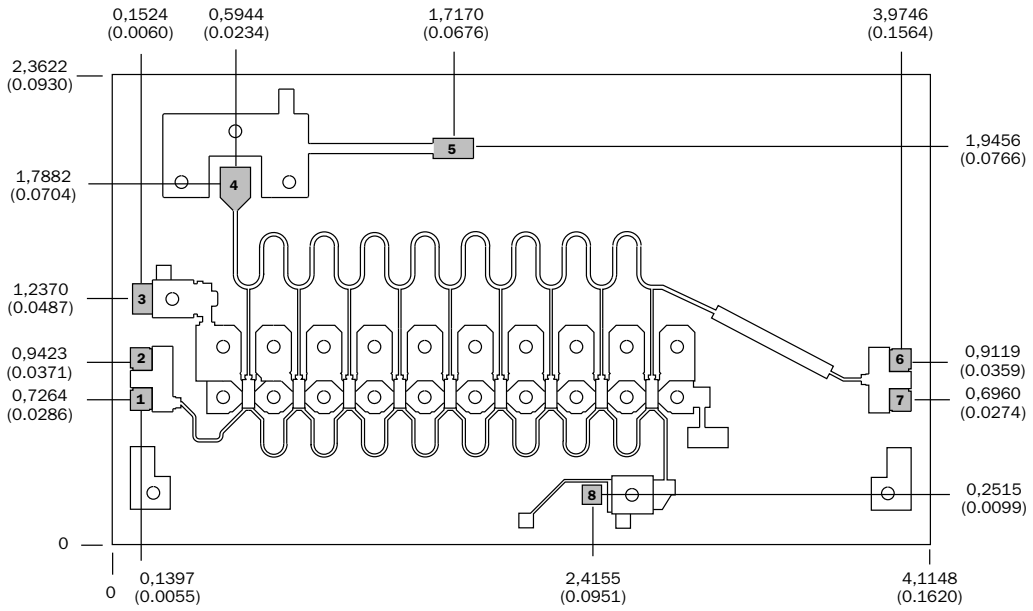
(V_D = 5 V)

The 2-nH thin-film network coil is TI part number 3022039-1.

RF connections: Bond using two 1-mil diameter, 20 to 25-mil length gold bond wires at both RF Input and RF Output for optimum RF performance.

Close placement of external components is essential to stability.

MECHANICAL DRAWING



Units: millimeters (inches)
Thickness: 0,1016 (0.004) (reference only)
Chip edge to bond pad dimensions are shown to center of bond pad.
Chip size ±0,0508 (0.002)

Bond pad #1 (RF Input):	0,0940 x 0,0991 (0.0037 x 0.0039)
Bond pad #2 (RF Input):	0,0940 x 0,0991 (0.0037 x 0.0039)
Bond pad #3 (V_{CTRL}):	0,1016 x 0,1524 (0.0040 x 0.0060)
Bond pad #4 (V_D):	0,1321 x 0,2108 (0.0052 x 0.0083)
Bond pad #5 (V^+):	0,2032 x 0,1016 (0.0080 x 0.0040)
Bond pad #6 (RF Output):	0,0940 x 0,0991 (0.0037 x 0.0039)
Bond pad #7 (RF Output):	0,0940 x 0,0991 (0.0037 x 0.0039)
Bond pad #8 (V_{G1}):	0,0965 x 0,0965 (0.0038 x 0.0038)