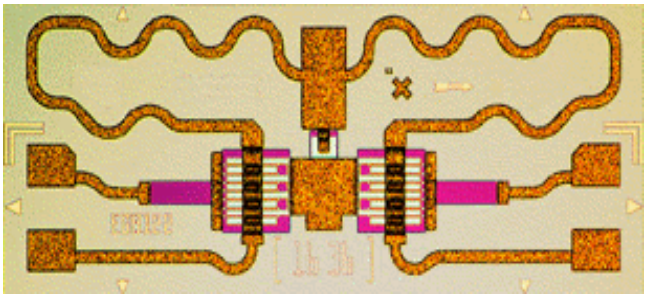
TriQuint SEMICONDUCTOR

Product Data Sheet
October 9, 2001

SPDT FET Switch

TGS8122-SCC



Key Features and Performance

- 8 to 11 GHz Frequency Range
- 0.9 dB Typical Insertion Loss
- 40 dB Typical Isolation at 9 GHz
- 1.5:1 Typical Input SWR at Midband
- 1.4:1 Typical Output SWR at Midband
- Less Than 2 ns Rise/Fall Time
- 1.7517 x 0.7739 x 0.152 mm (0.069 x 0.0305 x 0.006 in.)

Description

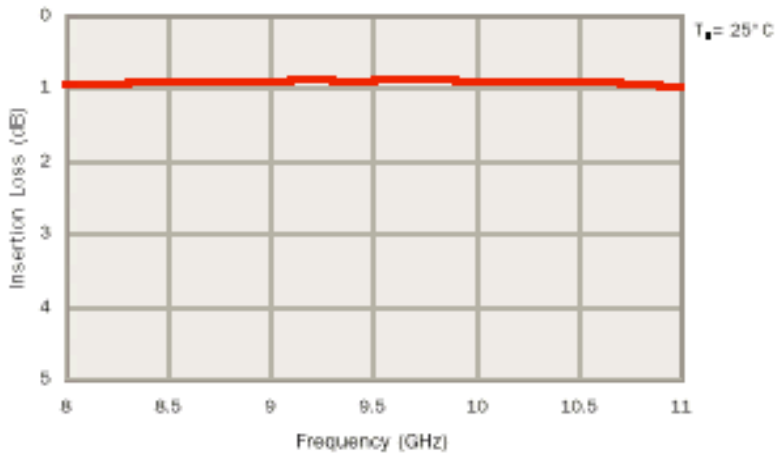
The TriQuint TGS8122-SCC is a monolithic single-pole, double-throw (SPDT) GaAs FET switch designed for 8 to 11 GHz. This device has low insertion loss, low leakage current of less than 50 uA with control voltages of -7 V and 0 V, and rise and fall times are less than 2 ns. Ground is provided to the circuitry through vias to the backside metallization.

This switch is ideal for use in high-speed switching radar and communication systems.

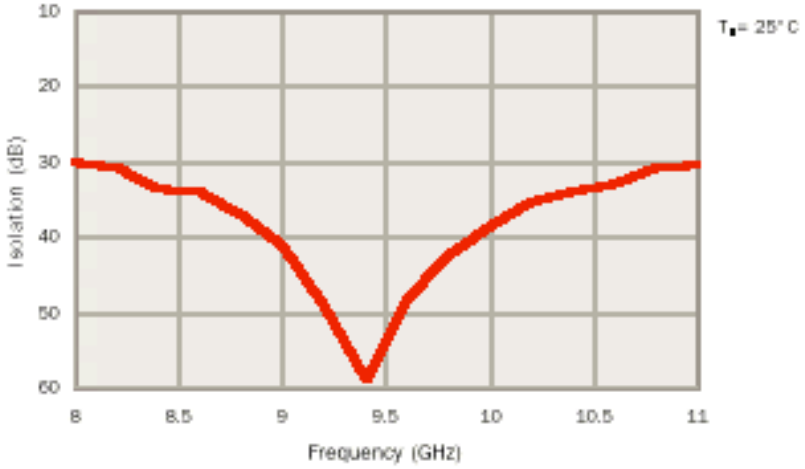
Bond pad and backside metallization is gold plated for compatibility with eutectic alloy attachment methods as well as the thermocompression and thermosonic wire-bonding processes.

The TGS8122-SCC is supplied in chip form and is readily assembled using automated equipment.

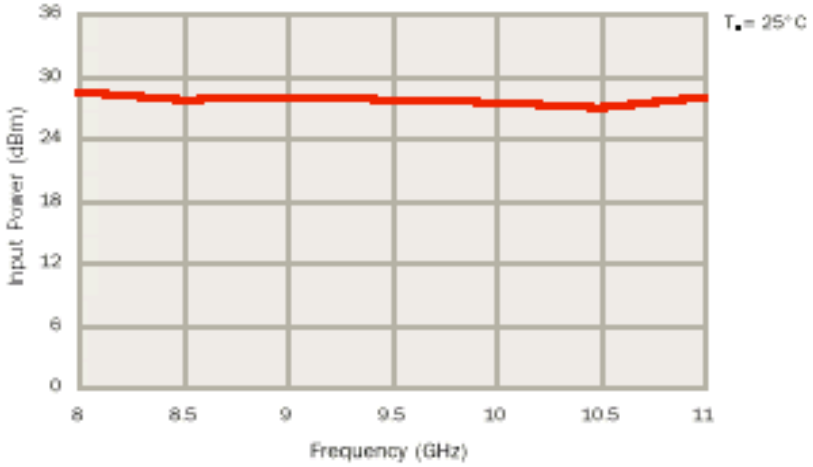
TYPICAL INSERTION LOSS



TYPICAL ISOLATION



TYPICAL INPUT POWER
P_{1dB}



TYPICAL RETURN LOSS

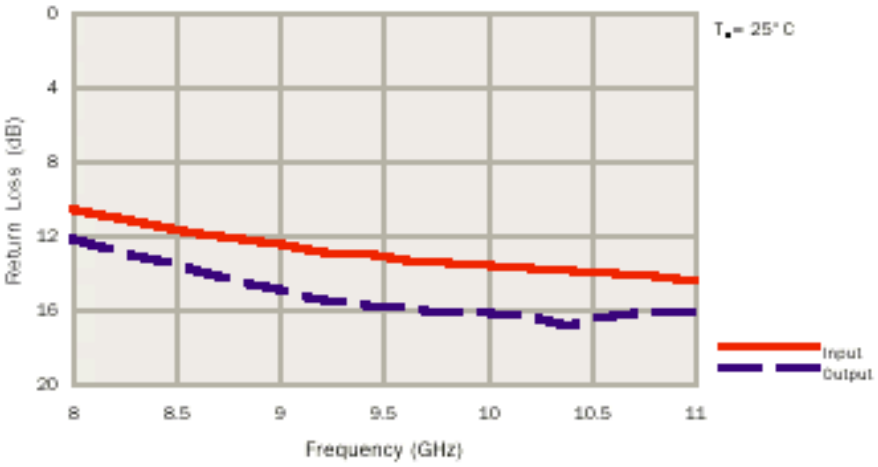


TABLE I
MAXIMUM RATINGS

SYMBOL	PARAMETER	VALUE
P_{IN} *	INPUT CONTINUOUS WAVE POWER	3 W
$V_{CTRL1,2}$	CONTROL VOLTAGE RANGE	-10V to 0V
T_{CH} **	OPERATING CHANNEL TEMPERATURE	150 ^{0}C
T_M	MOUNTING TEMPERATURE (30 SECONDS)	320 ^{0}C
T_{STG}	STORAGE TEMPERATURE	-65 to 150 ^{0}C

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

Stresses beyond those listed under “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 Specifications” is not implied. Exposure to maximum rated conditions for extended periods may affect device reliability.

* DC blocks are not provided at RF ports.

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

TABLE II
DC PROBE TESTS (100%)
(T_A = 25 °C ± 5 °C)

NOTES	SYMBOL	TEST CONDITIONS	LIMITS		UNITS
		3/	MIN	MAX	
	I_{DSS}	1/	378	702	mA
	G_m	1/	216	360	mS
2/	$\|V_P\|$	1/	2.0	3.6	V
2/	$\|V_{BVGD}\|$	1/	8	30	V
2/	$\|V_{BVGS}\|$	1/	8	30	V

1/ FET 1 and 2 are probed simultaneously with a total gate width of 1800 µm.

2/ V_P, V_{BVGD}, and V_{BVGS} are negative.

3/ Measurement conditions shall be subject to change at manufacturer's discretion with appropriate notification to the buyer.

TABLE III
RF WAFER CHARACTERIZATION TEST
(T_A = 25°C ± 5°C)

NOTE	TEST	MEASUREMENT CONDITIONS 2/	VALUE			UNITS
			MIN	TYP	MAX	
1/	SMALL-SIGNAL INSERTION LOSS (N)	F = 8 – 11 GHz		0.9	1.25	dB
1/	SMALL-SIGNAL ISOLATION (F)	F = 8 GHz F = 9 GHz F = 10 GHz F = 11 GHz F = 8 – 9 GHz F = 9 – 11 GHz	 30 24	30 40 42 31 	 	DB
1/	POWER OUTPUT AT 1 dB GAIN COMPRESSION (N)	F = 8 – 11 GHz	22.5	27.5		dBm
	INPUT STANDING WAVE RATIO	F = 8 – 11 GHz		1.5:1		
	OUTPUT STANDING WAVE RATIO	F = 8 – 11 GHz		1.4:1		
1/	INPUT RETURN LOSS MAGNITUDE (N)	F = 8 – 11 GHz	10			dB
1/	OUTPUT RETURN LOSS MAGNITUDE (N)	F = 8 – 11 GHz	10			dB
	RISE TIME, DETECTED OUTPUT VOLTAGE LEVEL	P_{IN} = 8 dBm @ 10GHz.		<2		nS
	FALL TIME, DETECTED OUTPUT VOLTAGE LEVEL	P_{IN} = 8 dBm @ 10GHz.		<2		nS

1/ "N" represents "ON" state (low loss state). "F" represents "OFF" state (isolated state).

2/ See Table IV.

TABLE IV
SWITCH BIAS CONDITIONS

CONTROL VOLTAGE		$RF_{common} - RF_{output1}$		$RF_{common} - RF_{output2}$	
V_{CTRL1}	V_{CTRL2}	RF PATH	STATE	RF PATH	STATE
-7 V	0 V	LOW LOSS	N	ISOLATED	F
0 V	-7 V	ISOLATED	F	LOW LOSS	N

TABLE V
AUTOPROBE FET PARAMETER MEASUREMENT CONDITONS

FET Parameters	Test Conditions
I_{DSS} : Maximum drain current (I_{DS}) with gate voltage (V_{GS}) at zero volts.	V_{GS} = 0.0 V, drain voltage (V_{DS}) is swept from 0.5 V up to a maximum of 3.5 V in search of the maximum value of I_{DS}; voltage for I_{DSS} is recorded as VDSP.
G_m : Transconductance; $\frac{(I_{DSS} - IDS1)}{VG1}$	For all material types, V_{DS} is swept between 0.5 V and VDSP in search of the maximum value of I_{ds}. This maximum I_{DS} is recorded as IDS1. For Intermediate and Power material, IDS1 is measured at V_{GS} = VG1 = -0.5 V. For Low Noise, HFET and pHEMT material, V_{GS} = VG1 = -0.25 V. For LNBECOLC, use V_{GS} = VG1 = -0.10 V.
V_P : Pinch-Off Voltage; V_{GS} for I_{DS} = 0.5 mA/mm of gate width.	V_{DS} fixed at 2.0 V, V_{GS} is swept to bring I_{DS} to 0.5 mA/mm.
V_{BVGD} : Breakdown Voltage, Gate-to-Drain; gate-to-drain breakdown current (I_{BD}) = 1.0 mA/mm of gate width.	Drain fixed at ground, source not connected (floating), 1.0 mA/mm forced into gate, gate-to-drain voltage (V_{GD}) measured is V_{BVGD} and recorded as BVGD; this cannot be measured if there are other DC connections between gate-drain, gate-source or drain-source.
V_{BVGS} : Breakdown Voltage, Gate-to-Source; gate-to-source breakdown current (I_{BS}) = 1.0 mA/mm of gate width.	Source fixed at ground, drain not connected (floating), 1.0 mA/mm forced into gate, gate-to-source voltage (V_{GS}) measured is V_{BVGS} and recorded as BVGS; this cannot be measured if there are other DC connections between gate-drain, gate-source or drain-source.

TYPICAL S-PARAMETERS

Insertion Path

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		Insertion Loss
(GHz)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	(dB)
7.0	0.30	106	0.88	- 73	0.876	- 73	0.25	- 53	1.2
7.1	0.29	106	0.88	- 75	0.880	- 75	0.24	- 57	1.1
7.2	0.28	106	0.88	- 77	0.882	- 77	0.23	- 61	1.1
7.3	0.27	106	0.88	- 79	0.885	- 79	0.22	- 66	1.1
7.4	0.27	106	0.89	- 81	0.886	- 81	0.22	- 71	1.0
7.5	0.26	107	0.89	- 83	0.887	- 83	0.21	- 76	1.0
7.6	0.26	108	0.89	- 85	0.888	- 85	0.20	- 81	1.0
7.7	0.25	108	0.89	- 87	0.890	- 87	0.20	- 86	1.0
7.8	0.25	109	0.90	- 89	0.891	- 89	0.19	- 91	1.0
7.9	0.24	110	0.90	- 91	0.893	- 91	0.19	- 96	0.9
8.0	0.24	110	0.90	- 93	0.894	- 93	0.18	- 101	1.0
8.1	0.23	112	0.90	- 95	0.896	- 95	0.18	- 106	0.9
8.2	0.23	112	0.90	- 97	0.897	- 97	0.17	- 112	0.9
8.3	0.23	113	0.90	- 99	0.897	- 99	0.17	- 118	0.9
8.4	0.22	114	0.90	- 101	0.898	- 101	0.17	- 123	0.9
8.5	0.22	115	0.90	- 103	0.899	- 103	0.16	- 129	0.9
8.6	0.22	117	0.90	- 105	0.899	- 105	0.16	- 135	0.9
8.7	0.22	117	0.90	- 107	0.899	- 107	0.16	- 140	0.9
8.8	0.21	118	0.90	- 109	0.902	- 108	0.16	- 145	0.9
8.9	0.21	119	0.90	- 111	0.902	- 110	0.16	- 151	0.9
9.0	0.21	120	0.90	- 112	0.903	- 112	0.16	- 156	0.9
9.1	0.21	121	0.90	- 114	0.903	- 114	0.16	- 162	0.9
9.2	0.21	122	0.90	- 116	0.903	- 116	0.15	- 167	0.9
9.3	0.20	123	0.90	- 118	0.904	- 118	0.15	- 172	0.9
9.4	0.20	123	0.90	- 120	0.904	- 120	0.15	- 177	0.9
9.5	0.20	124	0.90	- 122	0.904	- 122	0.15	179	0.9
9.6	0.20	124	0.90	- 124	0.904	- 124	0.15	174	0.9
9.7	0.20	125	0.90	- 126	0.904	- 126	0.16	170	0.9
9.8	0.20	125	0.90	- 128	0.904	- 128	0.16	165	0.9
9.9	0.19	125	0.90	- 130	0.904	- 130	0.16	160	0.9
10.0	0.19	126	0.90	- 132	0.902	- 132	0.16	156	0.9
10.1	0.19	127	0.90	- 134	0.902	- 134	0.15	152	0.9
10.2	0.19	128	0.90	- 136	0.901	- 136	0.15	148	0.9
10.3	0.18	128	0.90	- 138	0.902	- 138	0.15	144	0.9
10.4	0.18	128	0.90	- 140	0.901	- 140	0.15	141	0.9
10.5	0.18	129	0.90	- 142	0.899	- 142	0.15	137	0.9
10.6	0.17	130	0.90	- 144	0.898	- 144	0.15	133	0.9
10.7	0.17	132	0.90	- 147	0.898	- 146	0.15	129	0.9
10.8	0.17	133	0.90	- 149	0.895	- 148	0.15	125	1.0
10.9	0.17	134	0.90	- 151	0.896	- 151	0.14	120	1.0
11.0	0.16	135	0.89	- 153	0.895	- 153	0.14	115	1.0
11.1	0.16	137	0.89	- 155	0.893	- 155	0.14	110	1.0
11.2	0.16	140	0.89	- 157	0.892	- 157	0.13	105	1.0
11.3	0.15	142	0.89	- 159	0.891	- 159	0.13	100	1.0
11.4	0.15	146	0.89	- 161	0.887	- 161	0.12	94	1.0
11.5	0.15	149	0.88	- 163	0.885	- 163	0.12	89	1.1
11.6	0.16	152	0.88	- 165	0.883	- 165	0.11	83	1.1
11.7	0.16	154	0.88	- 167	0.882	- 167	0.11	77	1.1
11.8	0.17	156	0.88	- 169	0.881	- 169	0.10	69	1.1
11.9	0.17	157	0.88	- 171	0.878	- 171	0.09	62	1.1
12.0	0.17	158	0.88	- 173	0.878	- 173	0.09	55	1.1

T_A = 25°C

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

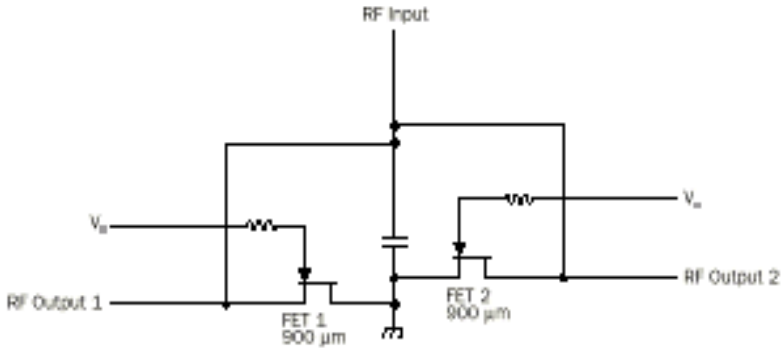
Isolation Path

Frequency	S_{11}		S_{21}		S_{12}		S_{22}		Isolation
(GHz)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	MAG	ANG(°)	(dB)
7.0	0.17	85	0.053	-84	0.055	-85	0.89	122	25.5
7.1	0.16	86	0.053	-87	0.052	-87	0.90	121	25.5
7.2	0.14	88	0.049	-89	0.050	-88	0.89	120	26.2
7.3	0.13	92	0.050	-88	0.049	-91	0.90	120	26.0
7.4	0.11	96	0.045	-95	0.046	-93	0.90	119	26.9
7.5	0.10	103	0.045	-96	0.044	-96	0.90	118	26.9
7.6	0.09	112	0.041	-101	0.042	-97	0.90	118	27.7
7.7	0.09	122	0.036	-100	0.040	-100	0.90	117	28.9
7.8	0.09	133	0.037	-100	0.038	-103	0.90	116	28.6
7.9	0.09	141	0.039	-106	0.035	-104	0.90	115	28.2
8.0	0.10	151	0.032	-100	0.032	-108	0.90	114	29.9
8.1	0.10	158	0.030	-107	0.030	-109	0.90	114	30.5
8.2	0.12	163	0.029	-114	0.028	-110	0.90	113	30.8
8.3	0.13	167	0.025	-116	0.025	-114	0.90	112	32.0
8.4	0.14	169	0.021	-114	0.023	-117	0.90	111	33.6
8.5	0.15	171	0.019	-120	0.020	-117	0.90	111	34.4
8.6	0.17	173	0.020	-114	0.017	-120	0.90	110	34.0
8.7	0.19	173	0.015	-114	0.015	-120	0.90	109	36.5
8.8	0.20	173	0.014	-116	0.012	-122	0.90	108	37.1
8.9	0.21	173	0.012	-122	0.011	-126	0.90	108	38.4
9.0	0.23	172	0.009	-115	0.008	-127	0.90	107	40.9
9.1	0.24	171	0.006	-121	0.007	-117	0.90	106	44.4
9.2	0.25	170	0.004	-74	0.004	-112	0.89	105	49.0
9.3	0.27	169	0.004	-117	0.002	-93	0.90	105	48.0
9.4	0.28	168	0.001	23	0.001	-65	0.90	104	58.9
9.5	0.29	166	0.002	10	0.002	18	0.90	103	54.0
9.6	0.30	165	0.004	1	0.004	13	0.89	103	48.5
9.7	0.31	164	0.004	14	0.007	22	0.90	102	48.0
9.8	0.32	162	0.008	21	0.009	28	0.90	101	42.4
9.9	0.33	160	0.013	28	0.010	26	0.89	100	37.7
10.0	0.33	159	0.012	22	0.013	23	0.89	100	38.4
10.1	0.34	157	0.016	27	0.015	21	0.90	99	35.9
10.2	0.35	155	0.017	19	0.017	18	0.90	98	35.4
10.3	0.35	153	0.020	16	0.018	17	0.90	98	34.0
10.4	0.36	152	0.020	12	0.020	16	0.89	97	34.0
10.5	0.36	151	0.020	10	0.021	13	0.90	96	34.0
10.6	0.37	149	0.023	9	0.024	11	0.89	95	32.8
10.7	0.37	147	0.025	9	0.025	8	0.88	95	32.0
10.8	0.38	145	0.028	6	0.027	7	0.89	95	30.9
10.9	0.38	144	0.031	6	0.030	5	0.89	94	30.2
11.0	0.38	142	0.030	2	0.031	2	0.89	93	30.5
11.1	0.38	140	0.033	-1	0.033	-1	0.89	92	29.6
11.2	0.38	138	0.036	-5	0.035	-5	0.89	91	28.9
11.3	0.38	136	0.036	-4	0.037	-7	0.89	91	28.9
11.4	0.38	134	0.039	-13	0.038	-9	0.89	90	28.2
11.5	0.37	132	0.042	-12	0.041	-12	0.88	90	27.5
11.6	0.37	130	0.043	-13	0.042	-15	0.88	89	27.3
11.7	0.37	128	0.043	-16	0.044	-19	0.88	88	27.3
11.8	0.36	125	0.045	-23	0.046	-23	0.88	87	26.9
11.9	0.35	122	0.049	-27	0.048	-27	0.88	87	26.2
12.0	0.34	119	0.049	-31	0.048	-31	0.87	86	26.2

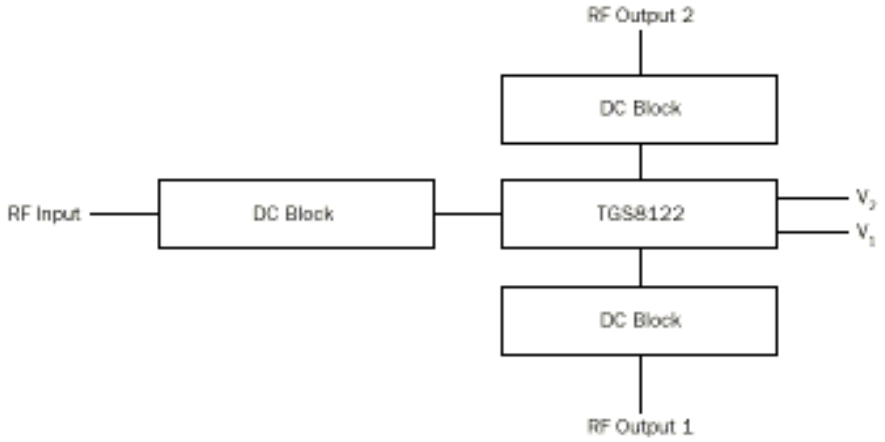
T_A = 25°C

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.

EQUIVALENT SCHEMATIC



RECOMMENDED ASSEMBLY DIAGRAM

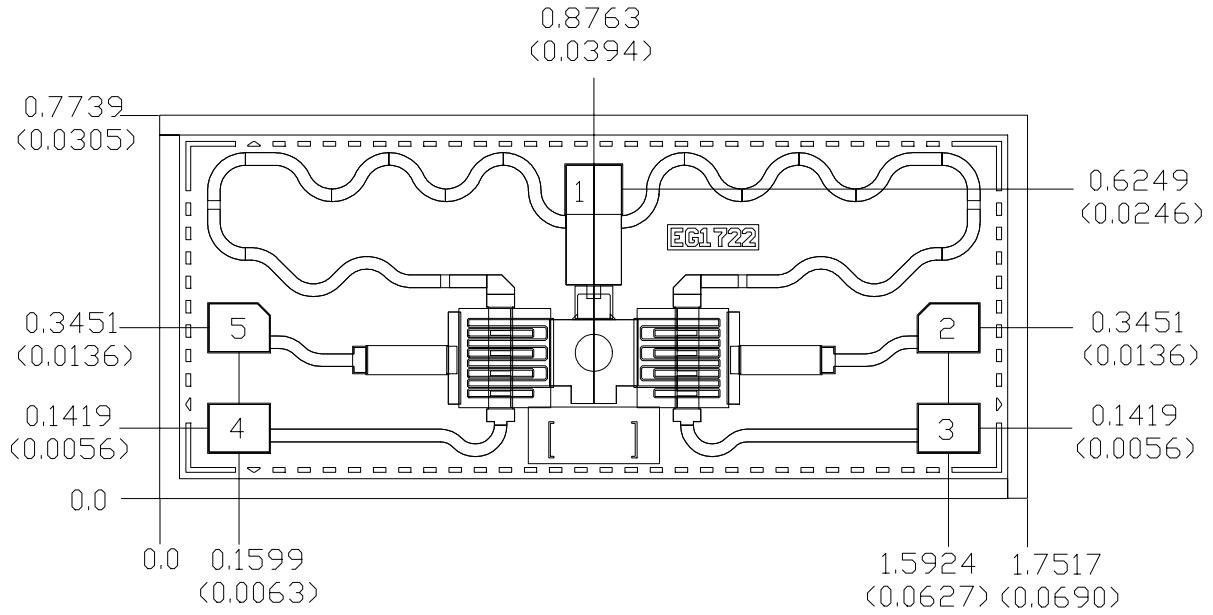


RF connections: bond using two 1-mil diameter, 20- to 25-mil-length gold wires at the RF Input and three 1-mil diameter, 20- to 25-mil-length gold wires at the RF Output port for optimum RF performance.

Low-loss path is RF Input to RF Output 1 for V_1 = - 7 V and V_2 = 0. Low-loss path is RF Input to RF Output 2 for V_1 = 0 and V_2 = - 7 V.

DC blocks are not provided at RF ports.

GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.



Units: millimeters (inches)
Thickness: 0.1524 (0.006) (reference only)
Chip edge to bond pad dimensions are shown to center of bond pad
Chip size tolerance: +/- 0.0508 (0.002)

Bond Pad #1 (RF Input)	0.1016 x 0.1168 (0.0040 x 0.0046)
Bond Pad #2 (Vctrl 2)	0.1016 x 0.1270 (0.0040 x 0.0050)
Bond Pad #3 (RF Output2)	0.1016 x 0.1270 (0.0040 x 0.0050)
Bond Pad #4 (RF Output1)	0.1016 x 0.1270 (0.0040 x 0.0050)
Bond Pad #5 (Vctrl 1)	0.1016 x 0.1270 (0.0040 x 0.0050)

Mechanical Drawing

GaAs MMIC devices are susceptible to damage from Electrostatic Discharge. Proper precautions should be observed during handling, assembly and test.