

DC-6GHz Reflective SPDT

GaAs Monolithic Microwave IC in SMD leadless package

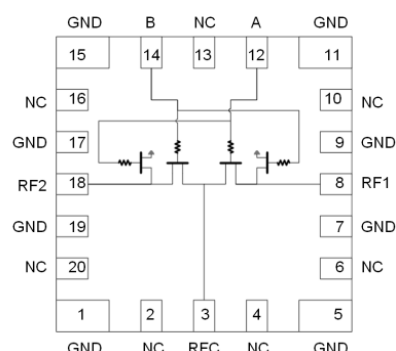
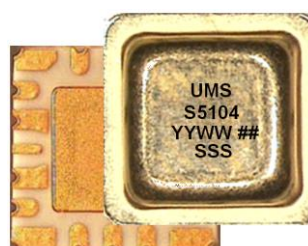
Description

The CHS5104-FAA is a monolithic FET based reflective switch housed in leadless surface mount hermetic metal ceramic 6x6mm² package.

It is designed for a wide range of applications, from space and military to commercial communication systems.

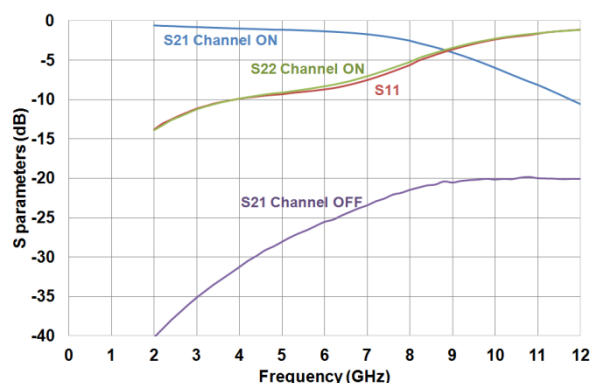
The circuit is manufactured with a pHEMT process, 0.25μm gate length.

It is supplied in RoHS compliant SMD package.



Main Features

- Broadband performance: DC-6GHz
- Low insertion loss:
 - 0.6dB @2GHz
 - 1.0dB @4GHz
 - 1.3dB @6GHz
- Isolation: 30dB @4GHz
- Input P1dB: 30dBm



Main Electrical Characteristics

Tamb.= +25°C Vh=0V/VL=-5V

Symbol	Parameter	Min	Typ	Max	Unit
Freq	Frequency range	DC		6	GHz
IL	On state insertion loss		1.3		dB
ISOL	Off state isolation		30		dB
RL	On state return loss		10		dB
IP1dB	Input Power @1dB gain compression		30		dBm

Electrical Characteristics ⁽¹⁾

T_{amb.} = +25°C, specifications are given for 50Ω source and load impedances.

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Freq	Frequency range		DC		6	GHz
IL	On state insertion loss ⁽¹⁾	DC - 2GHz DC - 4GHz DC - 6GHz		0.6 1.0 1.3		dB
ISOL	Off state isolation	DC - 2GHz DC - 4GHz DC - 6GHz		40 30 25		dB
RL	On state input and output return losses	DC - 2GHz DC - 4GHz DC - 6GHz		13 10 8		dB
VH	Control voltage high level			0	0.5	
VL	Control voltage low level		-8	-5		V
IP1dB	Input Power @1dB gain compression.	Freq. ≥0.5GHz VL=-5V/VH=0V VL=-8V/VH=0V		30 33		dBm
Ton / Toff	Switching time	50% control to 90% RF, and 50% control to 10% RF		10		ns
Ic	Current consumption on the control supply voltage	Freq. ≥0.5GHz Pin≤33dBm VH= 0V VL=-5V VL=-8V		150 50 300		μA

⁽¹⁾ These values are representative of onboard measurements as defined on the drawing in paragraph "Evaluation mother board". Reference planes of on-board measurements are defined in the paragraph S-parameters reference planes

⁽²⁾ Variation rate of insertion loss with temperature in the range -40°C to +125°C: -0.002dB/°C

SPDT truth table

PAD A	PAD B	Electrical path RFC to RF1	Electrical path RFC to RF2
VH	VL	ON	OFF
VL	VH	OFF	ON

Absolute Maximum Ratings ⁽¹⁾T_{amb.} = +25°C

Symbol	Parameter	Values	Unit
VH	High level control voltage	0.8	V
VL	Low level control voltage	-10	mA
P _{in}	Maximum peak input power overdrive	37	dBm
T _j	Maximum Junction temperature	175	°C

⁽¹⁾ Operation of this device above anyone of these parameters may cause permanent damage.

Temperature Range

T _a	Operating temperature range	-55 to +125	°C
T _{stg}	Storage temperature range	-55 to +150	°C

Device thermal performances

All the figures given in this section are obtained assuming that the FAA device is only cooled down by conduction through the package thermal pad (no convection mode considered).

The temperature is monitored at the package back-side interface (Tcase).

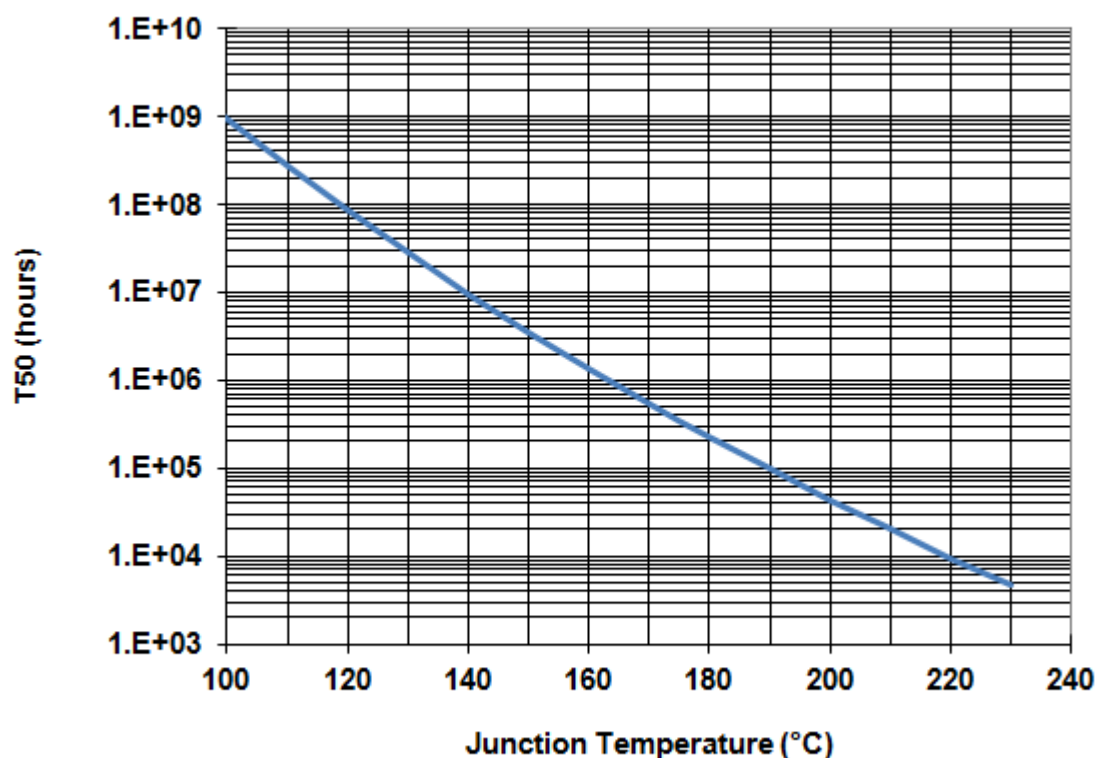
The system maximum temperature must be adjusted in order to guarantee that Tjunction remains below the maximum value specified in the Absolute Maximum Ratings table.

So, the system PCB must be designed to comply with this requirement.

Parameter	Biasing conditions	Tjunction (°C)	R _{TH} (°C/W)	T50 (hours)
R _{TH} ⁽¹⁾ Thermal Resistance (Junction to Case)	VH= 0V/VL=-5V Pdiss= 2.1W	175	43	3.4E+05

(1) Assuming 85°C Tcase

Note: when SPDT operates in linear mode Pdiss can be neglected and Tj=Tcase



Typical Package Sij parameters

Tamb.= +25°C, A=0V, B=-5V , on-state RFC-RF1 path

Freq (GHz)	S11 (dB)	PhS11 (°)	S21 (dB)	PhS21 (°)	S12 (dB)	PhS12 (°)	S22 (dB)	PhS22 (°)
2	-13.8	-141.2	-0.6	-61.7	-0.6	-61.4	-13.9	-158.5
2.5	-12.3	-154.6	-0.7	-76.5	-0.7	-76.6	-12.4	3.2
3	-11.1	-168.7	-0.8	-91.6	-0.8	-91.6	-11.2	166.5
3.5	-10.4	176.9	-0.9	-106.5	-0.9	-106.5	-10.4	150.2
4	-9.9	161.7	-1.0	-121.5	-1.0	-121.6	-9.9	134.6
4.5	-9.6	145.7	-1.1	-136.7	-1.1	-136.7	-9.4	119.9
5	-9.3	128.6	-1.1	-152.0	-1.1	-152.0	-9.1	106.1
5.5	-9.0	109.3	-1.2	-167.9	-1.2	-167.9	-8.7	93.4
6	-8.7	88.1	-1.3	175.9	-1.3	175.9	-8.3	81.4
6.5	-8.2	65.4	-1.5	159.3	-1.5	159.3	-7.8	70.0
7	-7.5	41.3	-1.7	142.2	-1.7	142.2	-7.0	58.7
7.5	-6.6	17.0	-2.0	124.7	-2.0	124.7	-6.2	46.7
8	-5.6	-6.5	-2.5	107.0	-2.5	106.9	-5.2	33.7
8.5	-4.5	-29.0	-3.2	89.4	-3.2	89.3	-4.2	20.3
9	-3.7	-49.3	-4.0	72.1	-4.0	72.2	-3.4	5.7
9.5	-2.9	-67.8	-4.9	55.6	-4.9	55.6	-2.8	-9.3
10	-2.4	-84.8	-6.0	39.7	-6.0	39.7	-2.3	-24.3
10.5	-2.0	-100.3	-7.1	25.1	-7.1	25.1	-1.9	-39.1
11	-1.7	-113.8	-8.1	11.1	-8.1	11.2	-1.6	-53.3
11.5	-1.3	-127.3	-9.3	-2.8	-9.3	-2.8	-1.3	-67.0
12	-1.1	-139.9	-10.6	-15.4	-10.6	-15.4	-1.1	-80.3
12.5	-1.1	-151.8	-11.8	-27.2	-11.8	-27.2	-1.0	-93.0
13	-1.0	-162.9	-13.1	-38.0	-13.1	-38.1	-0.9	-105.1
13.5	-0.9	-173.7	-14.3	-47.7	-14.3	-47.7	-0.9	-116.6
14	-0.9	175.8	-15.4	-56.9	-15.4	-56.9	-0.9	-127.0
14.5	-0.9	165.8	-16.6	-64.9	-16.5	-64.9	-0.8	-137.8
15	-0.9	155.6	-17.6	-72.8	-17.6	-72.8	-0.8	-148.0
15.5	-1.0	145.4	-18.5	-78.2	-18.5	-78.2	-0.9	-157.8
16	-1.0	135.4	-19.0	-84.7	-19.0	-84.7	-1.0	-167.1
16.5	-1.0	124.4	-19.7	-91.4	-19.7	-91.3	-1.0	-175.9
17	-1.0	114.1	-19.9	-99.7	-19.9	-99.7	-1.0	175.1
17.5	-1.0	102.5	-20.9	-107.5	-20.9	-107.5	-1.1	166.1
18	-1.0	90.5	-21.8	-113.6	-21.8	-113.6	-1.3	157.1
18.5	-1.1	78.2	-22.1	-117.6	-22.1	-117.6	-1.5	148.8
19	-1.2	65.0	-22.2	-121.2	-22.2	-121.2	-1.8	140.3
19.5	-1.3	52.2	-22.2	-128.3	-22.2	-128.3	-2.2	132.6
20	-1.3	38.1	-22.0	-135.3	-21.9	-135.3	-2.6	126.0

Typical Package Sij parameters

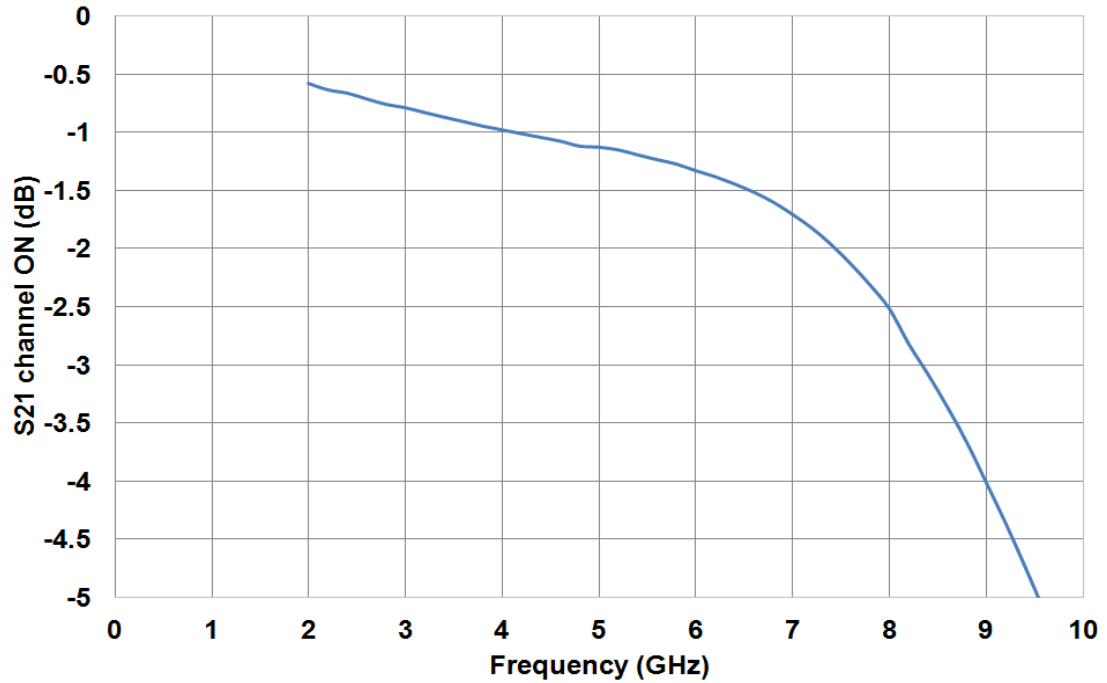
Tamb.= +25°C, A=-5V, B=0V , off-state RFC-RF1 path

Freq (GHz)	S11 (dB)	PhS11 (°)	S21 (dB)	PhS21 (°)	S12 (dB)	PhS12 (°)	S22 (dB)	PhS22 (°)
2	-11.9	-139.4	-40.2	68.3	-40.2	68.1	-0.7	129.5
2.5	-10.9	-156.1	-37.5	59.0	-37.5	58.8	-0.8	116.5
3	-10.4	-170.0	-35.2	49.0	-35.1	48.8	-0.8	104.0
3.5	-9.9	173.9	-33.1	37.8	-33.1	37.8	-0.8	91.2
4	-9.7	158.4	-31.3	26.0	-31.3	26.0	-0.8	78.5
4.5	-9.4	142.5	-29.5	13.3	-29.5	13.3	-0.8	65.8
5	-8.9	121.7	-28.1	-1.4	-28.1	-1.3	-0.8	53.0
5.5	-8.8	100.5	-26.7	-15.7	-26.7	-15.7	-0.8	40.3
6	-8.6	78.3	-25.5	-30.3	-25.5	-30.3	-0.8	27.7
6.5	-8.4	54.9	-24.5	-44.7	-24.5	-44.6	-0.8	15.3
7	-7.8	32.6	-23.4	-60.1	-23.4	-60.2	-0.8	2.9
7.5	-7.1	12.7	-22.3	-75.8	-22.3	-75.8	-0.8	-9.2
8	-6.1	-8.7	-21.4	-92.3	-21.4	-92.3	-0.8	-21.1
8.5	-5.0	-29.5	-20.8	-108.4	-20.8	-108.4	-0.8	-32.8
9	-4.0	-49.7	-20.5	-125.2	-20.5	-125.2	-0.8	-44.6
9.5	-3.3	-67.3	-20.2	-140.9	-20.2	-141.0	-0.8	-56.1
10	-2.6	-84.3	-20.1	-156.3	-20.1	-156.4	-0.9	-67.3
10.5	-2.1	-99.9	-20.0	-170.3	-20.0	-170.4	-0.9	-78.2
11	-1.7	-113.4	-20.0	173.3	-20.0	173.3	-0.8	-89.0
11.5	-1.3	-127.0	-20.1	160.1	-20.1	160.1	-0.9	-99.8
12	-1.1	-139.8	-20.1	147.4	-20.1	147.4	-0.9	-110.1
12.5	-1.0	-151.7	-20.0	134.0	-20.0	134.0	-0.9	-120.5
13	-1.0	-163.0	-19.9	123.0	-19.9	123.0	-1.0	-130.0
13.5	-0.9	-173.4	-19.6	109.2	-19.6	109.1	-0.9	-139.5
14	-0.9	176.0	-19.9	96.6	-19.9	96.6	-0.9	-148.4
14.5	-0.9	165.9	-19.8	84.6	-19.8	84.6	-0.9	-157.9
15	-0.9	155.6	-19.7	73.8	-19.7	73.8	-1.0	-167.2
15.5	-0.9	145.5	-19.6	61.2	-19.5	61.2	-1.1	-176.3
16	-0.9	135.5	-19.8	48.9	-19.8	48.9	-1.3	175.0
16.5	-1.0	124.4	-19.8	38.7	-19.8	38.7	-1.3	166.7
17	-1.0	114.1	-20.2	28.4	-20.2	28.4	-1.4	157.6
17.5	-1.0	102.6	-19.8	19.3	-19.8	19.3	-1.6	148.5
18	-1.0	90.6	-19.5	9.3	-19.4	9.3	-1.9	139.2
18.5	-1.1	78.2	-19.2	-2.6	-19.2	-2.5	-2.3	130.2
19	-1.2	65.0	-19.0	-16.3	-18.9	-16.4	-2.9	121.1
19.5	-1.2	52.2	-18.9	-30.0	-18.9	-30.0	-3.8	113.0
20	-1.3	38.1	-18.9	-45.0	-18.9	-45.0	-4.9	107.3

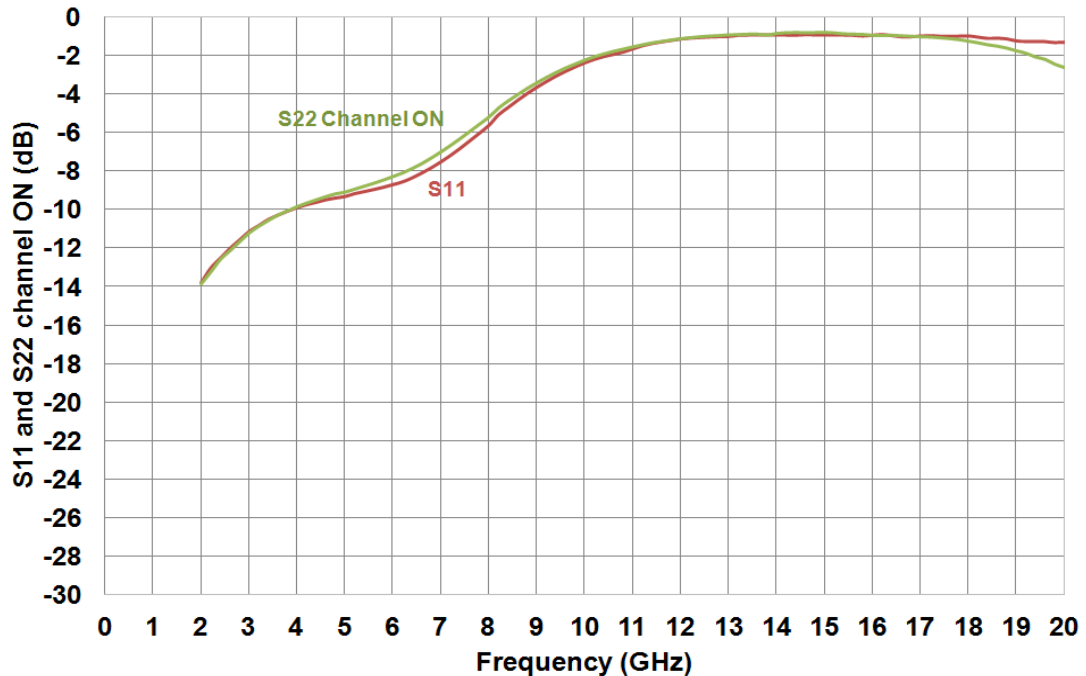
Typical Board Measurements

Tamb.= +25°C, VH=0V / VL=-5V

ON state RFC-RF1 path : S21 versus Frequency (A=0V, B=-5V)

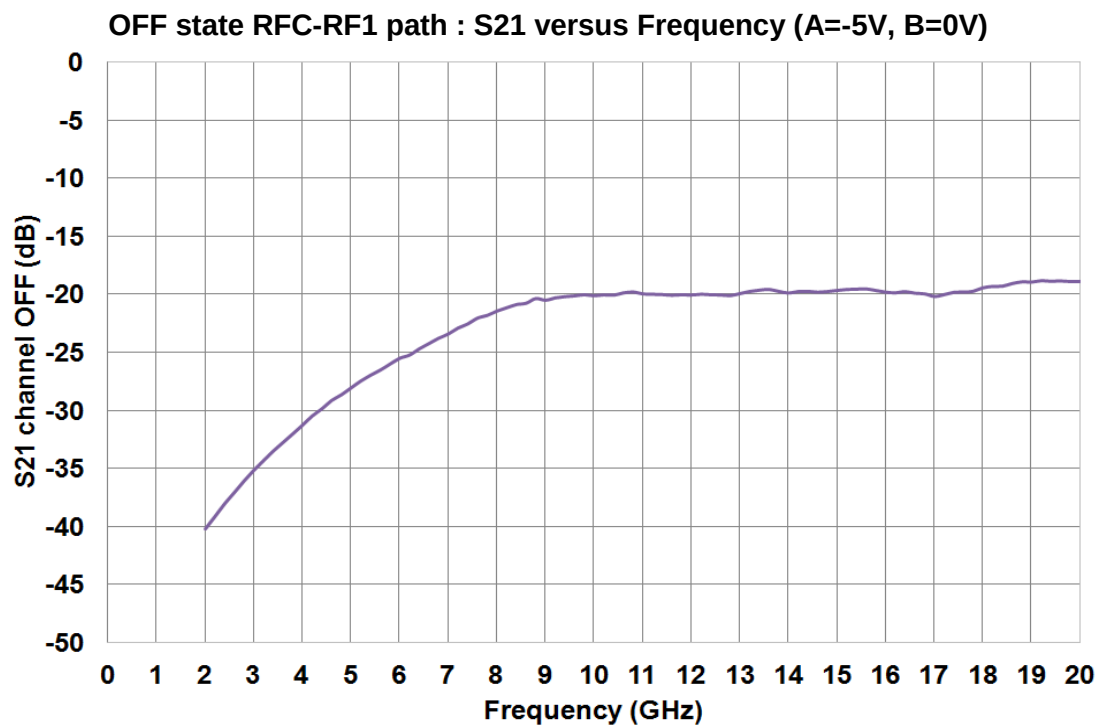


ON state RFC-RF1 path : S11 and S22 versus Frequency (A=0V, B=-5V)



Typical Board Measurements

Tamb.= +25°C, VH=0V / VL=-5V

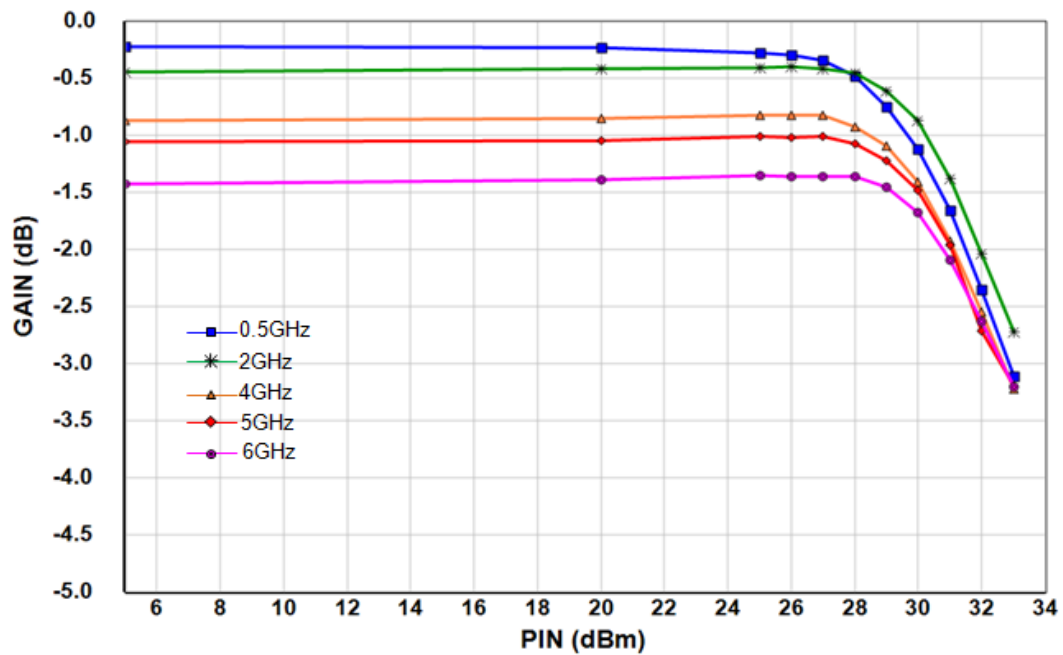


Typical Board Measurements

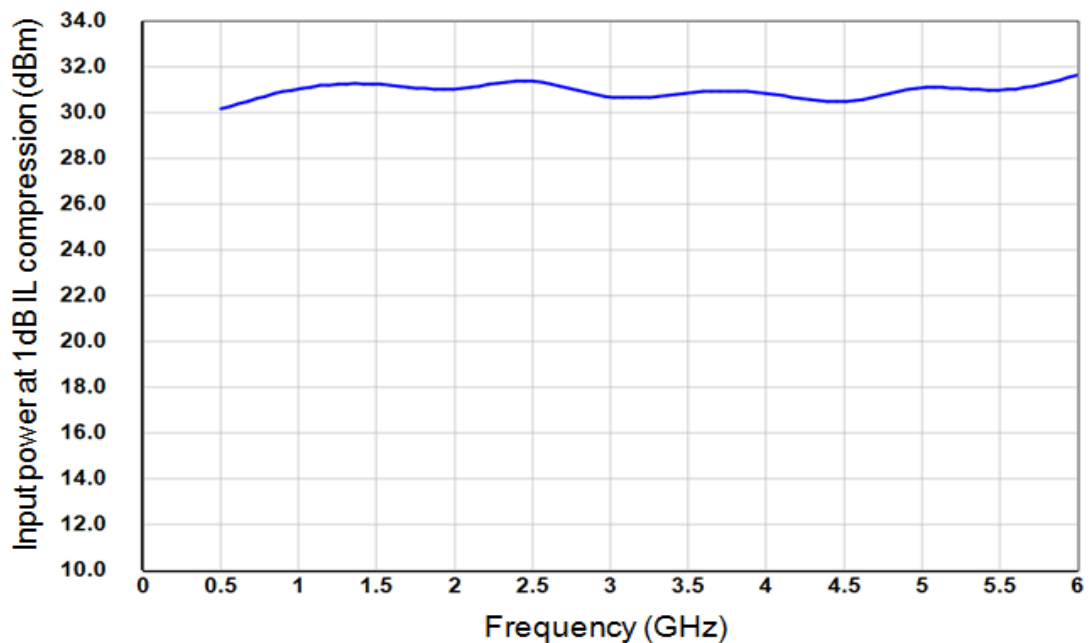
T_{amb.} = +25°C, V_H=0V / V_L=-5V

Note: board losses are corrected

Insertion Loss RFC-RF1 path versus input power
(A=0V/B=-5V)



Input power at 1dB Insertion Loss compression (RFC-RF1 path) versus frequency
(A=0V/B=-5V)

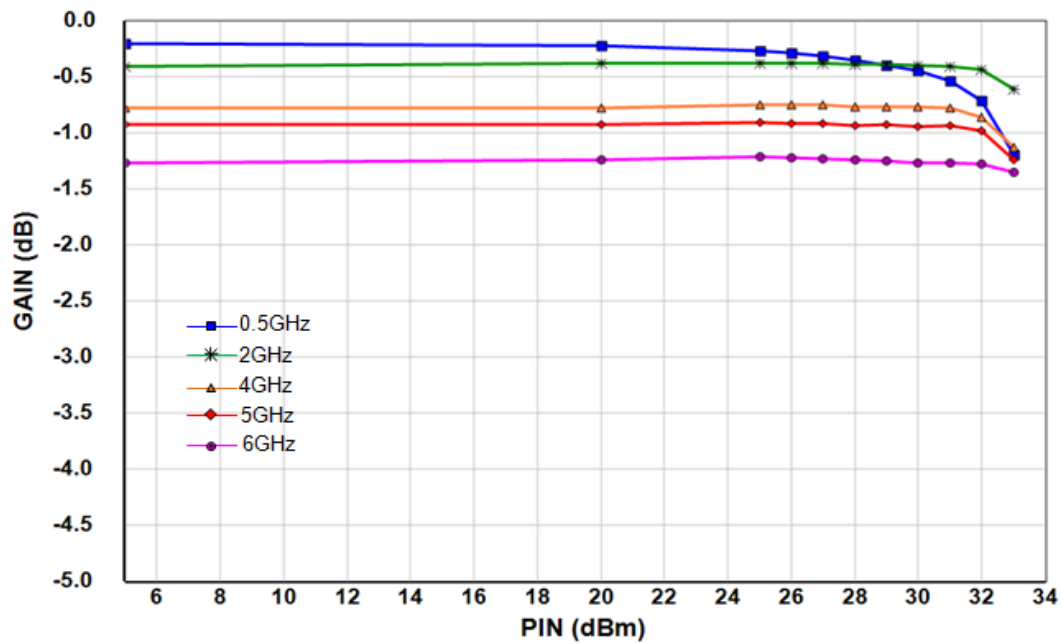


Typical Board Measurements

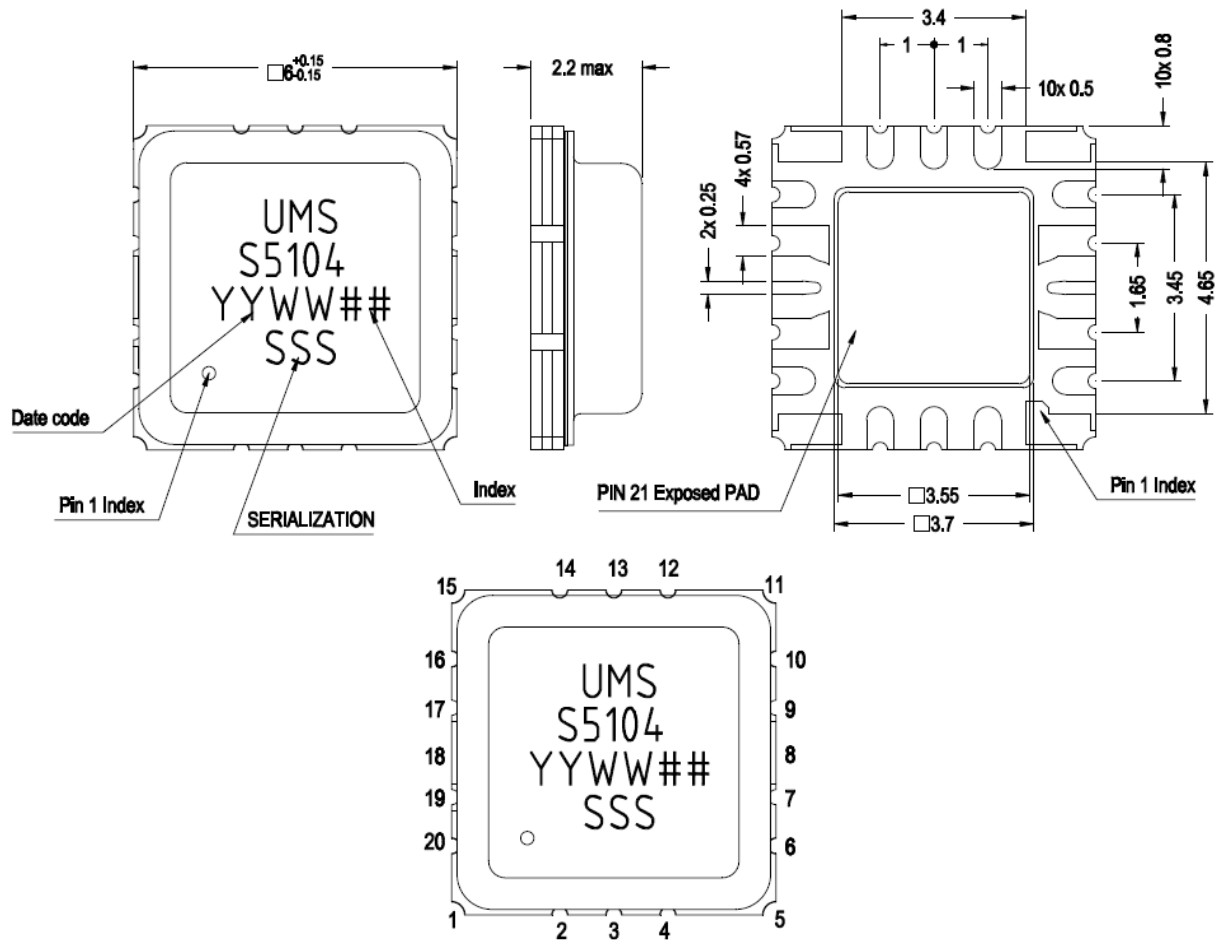
Tamb.= +25°C, VH=0V / VL=-8V

Note: board losses are corrected

Insertion Loss RFC-RF1 path versus input power
(A=0V/B=-8V)



Package outline



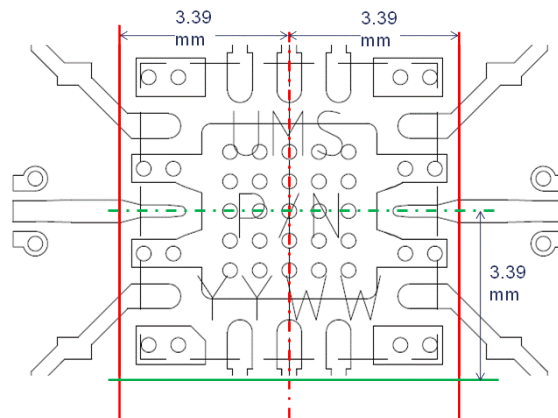
Units : mm	1- GND ⁽²⁾	8- RF1	15- GND ⁽²⁾
21- GND	2- NC	9- GND ⁽²⁾	16- NC
	3- RFC	10- A	17- GND ⁽²⁾
	4- NC	11- GND ⁽²⁾	18- NC
	5- GND ⁽²⁾	12- NC	19- RFC
	6- NC	13- GND	20- NC
	7- GND ⁽²⁾	14- RF1	

⁽¹⁾ The package outline drawing included to this data-sheet is given for indication. Refer to the application note AN0024 (<http://www.ums-gaas.com>) for exact package dimensions.

⁽²⁾ It is strongly recommended to ground all pins marked "GND" through the PCB board. Ensure that the PCB board is designed to provide the best possible ground to the package.

Definition of the Sij reference planes

The reference planes used for Sij measurements given above are symmetrical from the symmetrical axis of the package (see drawing beside). The input and outputs reference planes are located at 3.39mm offset (input wise or output wise respectively) from these axis. Then, the given Sij parameters incorporate the land pattern of the evaluation motherboard recommended in paragraph "Evaluation motherboard".

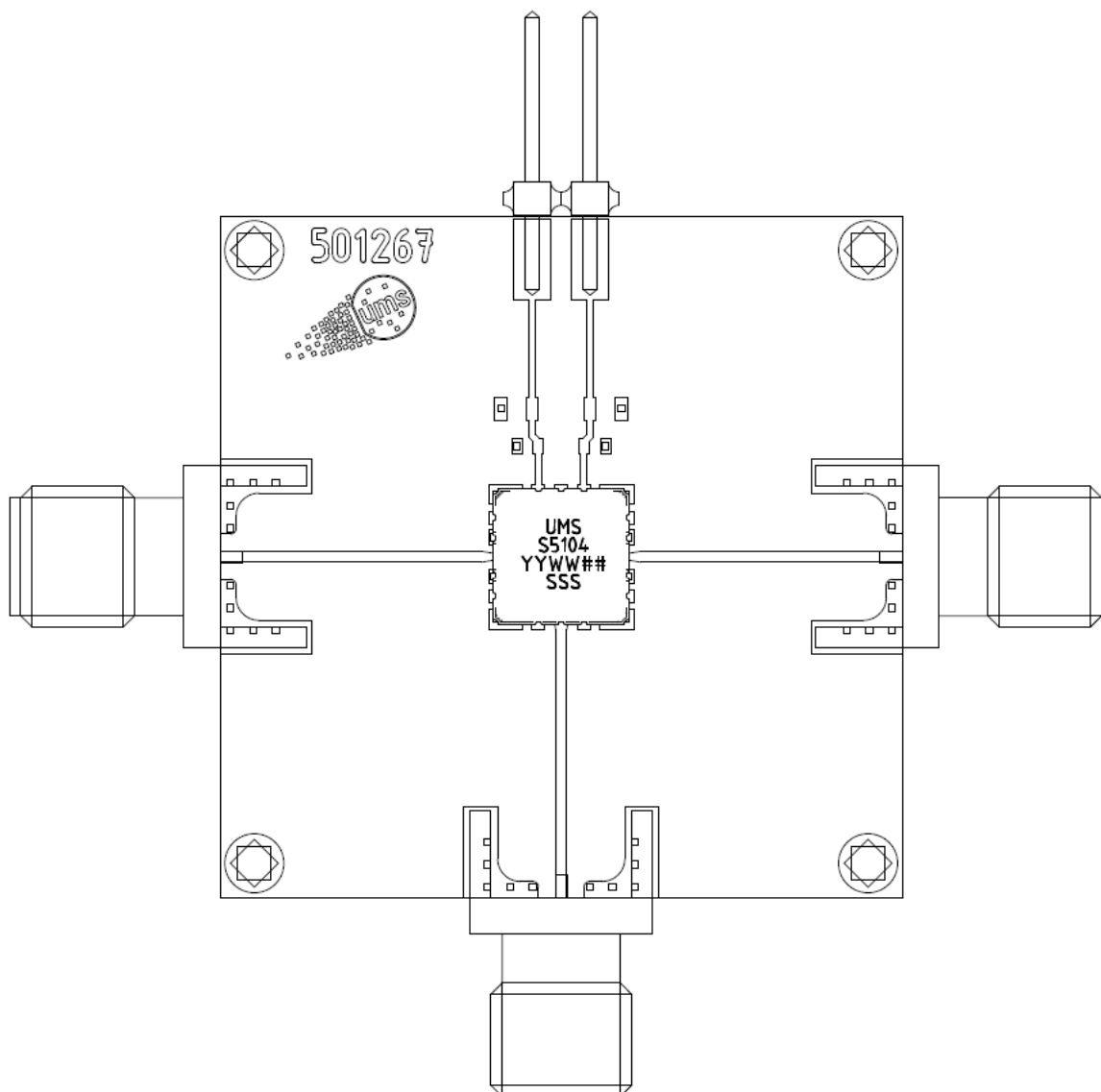


Package Information

Parameter	Value
Package body material	RoHS-compliant
Lead finish	Gold
Hermetic sealing (fine leak compliant Mil-Std-883 Method 1014.10 Condition A4, tracer gas He at 1atm)	1×10^{-8} ccHe/s/atm

Evaluation board description

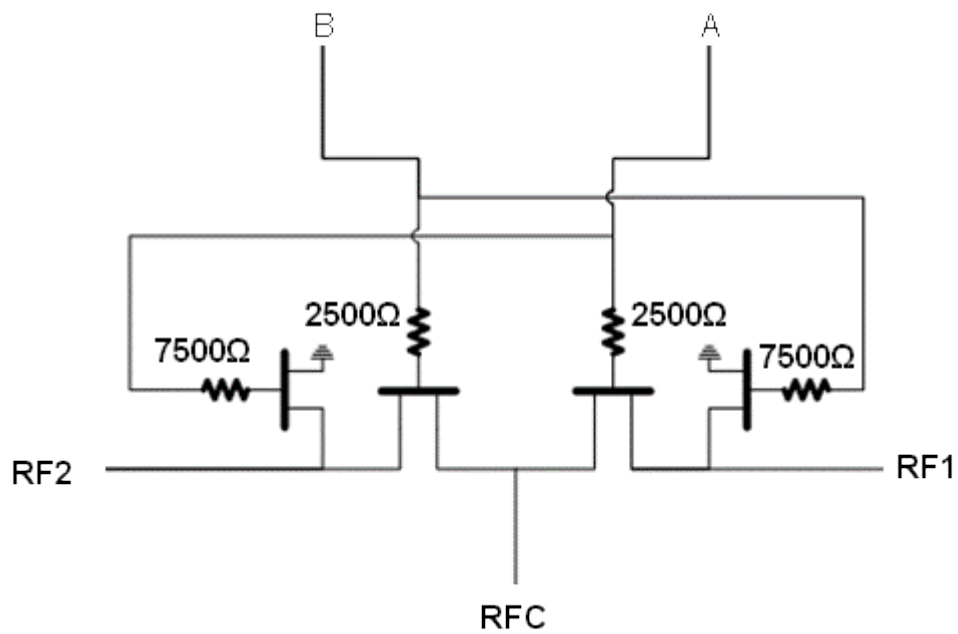
- Compatible with the proposed footprint.
- Based on typically Ro4003 / 8mils or equivalent.
- Using a micro-strip to coplanar transition to access the package.
- Recommended for the implementation of this product on a module board.



Recommendation on decoupling

Label	Type	Decoupling	Comment
A, B	Control voltage	Not required	SPDT switch pad control
RFC, RF1, RF2	RF access	External DC block must be used to ensure DC decoupling	The MMIC is DC coupled

DC Schematic



Notes

Recommended package footprint for FAA Package

Refer to the application note AN0024 available at <http://www.ums-gaas.com> for package footprint recommendations and exact package dimensions.

SMD mounting procedure for FAA Package

For the mounting process standard techniques involving solder paste and a suitable reflow process can be used. For further details, see application note AN0024 available at <http://www.ums-gaas.com>.

Recommended environmental management

UMS products are compliant with the regulation in particular with the directives RoHS N°2011/65 and REACH N°1907/2006. More environmental data are available in the application note AN0019 also available at <http://www.ums-gaas.com>.

Recommended ESD management

Refer to the application note AN0020 available at <http://www.ums-gaas.com> for ESD sensitivity and handling recommendations for the UMS package products.

Ordering Information

FAA package: CHS5104-FAA/XY
Waffle pack: XY = 24

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