20-30GHz Medium Power Amplifier

GaAs Monolithic Microwave IC in SMD package

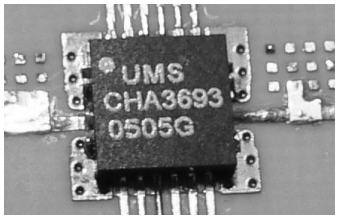
Description

The CHA3693-QDG is a high gain broadband four stage monolithic medium power amplifier. It is designed for a wide range of applications from military to commercial communication systems.

The circuit is manufactured with a PM-HEMT process: 0.15µm gate length.

It is supppplied in RoHS compliant SMD package.

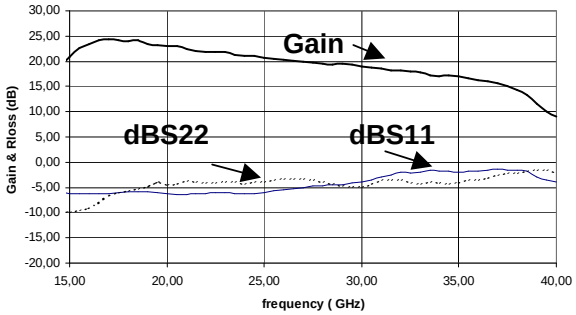
CHA3693-QDG on a Board



Main Features

- Broadband performance 20-30GHz
- 20dBm output power
- 20dB gain
- 330mA Low DC power consumption
- 28dBm 3rd order intercept point
- Output power level detector
- 24L-QFN4x4 SMD package

Typical measurements
Gain & Rloss (dB)



Main Characteristics

Tamb = +25℃, Vd= +3,5V Id=330mA

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating Frequency range	20		30	GHz
G	Smal signal Gain	18	20		dB
IP3	3rd order intercept point (Pin/tone=-10dBm)	26.5	27.5		dBm
Id	Bias current		330	400	mA

ESD Protections: Electrostatic discharge sensitive device observe handling precautions!

United Monolithic Semiconductors S.A.S.
Route Départementale 128 - BP46 - 91401 Orsay Cedex France
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

Electrical Characteristics*

Tamb = +25°C, Vd= +3,5V Id=330mA

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	**20**		**25**	GHz
G	Gain	20	21		dB
ΔG	Gain flatness		±1.5	±2	dB
Is	Reverse isolation		50		dB
S11	Input return loss		-7	-5	dB
S22	Output return loss		-4	-3	dB
IP3	3rd order intercept point (Pin/tone=-10dBm)	26.5	27.5		dBm
P1dB	Output power at 1dB gain compression	17	18		dBm
NF	Noise Figure		8	10	dB
Vd	Drain bias voltage (Lead D & D1)		3.5		V
Id	Drain bias current (small signal)		330	400	mA

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	**25**		**30**	GHz
G	Gain	18	20		dB
ΔG	Gain flatness		±1.5	±2	dB
Is	Reverse isolation		45		dB
S11	Input return loss		-5	-3	dB
S22	Output return loss		-4	-3	dB
IP3	3rd order intercept point (Pin/tone=-10dBm)	26.5	27.5		dBm
P1dB	Output power at 1dB gain compression	17	18		dBm
NF	Noise Figure		8	10	dB
Vd	Drain bias voltage (Lead D & D1)		3.5		V
Id	Drain bias current		330	400	mA

*These values are representative of onboard measurements as defined on the drawing 95541 (see below).
Performances can be optimized thanks to external matching (refer to the “Sub-band enhancement” section below).

Route Départementale 128, BP46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

Absolute Maximum Ratings (1)

Tamb = +25°C

Symbol	Parameter (1)	Values	Unit
Vd	Drain bias voltage	4	V
Ids	Drain bias current_small signal	470	mA
Vgs	Gate bias voltage	-2 to +0.4	V
Vds	Drain Gate voltage (vds-Vgs)	+5	V
Pin	Maximum continous input power Maximum peak input power overdrive	+4 +15	dBm
Tj	Junction temperature (2)	175	°C
Ta	Operating temperature range	-40 to +85	°C
Tstg	Storage temperature range	-55 to +125	°C

(1) Operation of this device above anyone of these paramaters may cause permanent damage.
(2) Thermal Resistance channel to ground paddle= 82.4 °C/W for Tamb. = +85°C (Vd= 3.5V, Id=330mA)

Route Départementale 128, BP46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

Typical Package Sij parameters

Tamb = +25°C, Vd= +3.5V Id=330mA (vg ≈-0.3V)

F(GHz)	S11 dB	S11 /°	S12 dB	S12 /°	S21 dB	S21 /°	S22 dB	S22 /°
2	-8,83	-88,13	-69,83	-126,88	-40,54	8,83	-0,11	-36,92
4	-8,83	-0,68	-73,27	68,20	-40,72	-39,81	-0,28	-73,87
6	-8,64	91,54	-64,31	37,06	-34,09	-107,22	-0,34	-111,83
8	-7,72	-157,53	-55,69	6,81	-30,27	-166,33	-0,40	-156,81
10	-7,30	-68,95	-68,59	20,62	-22,09	-142,85	-1,42	147,70
12	-6,49	37,98	-63,63	-32,07	2,12	127,18	-4,84	82,30
14	-5,95	143,74	-73,37	100,59	15,68	-16,16	-9,02	46,38
16	-5,95	-106,60	-52,40	93,68	22,74	-163,39	-8,61	19,87
18	-5,99	3,79	-62,93	-178,84	23,87	61,71	-5,02	-25,84
20	-6,36	108,06	-55,89	59,05	22,93	-47,72	-4,18	-66,46
21	-6,74	166,91	-46,87	45,01	22,66	-99,88	-3,86	-87,22
22	-6,27	-139,16	-51,98	46,66	21,92	-145,39	-3,97	-103,46
23	-6,16	-80,70	-48,96	16,37	21,92	169,12	-3,79	-116,84
24	-6,34	-23,12	-46,99	7,56	21,31	124,36	-4,24	-132,57
25	-6,40	36,28	-48,16	13,94	20,87	81,78	-4,09	-141,94
26	-5,93	96,58	-43,73	-4,41	20,66	37,50	-3,49	-154,57
27	-5,36	153,39	-42,94	-26,86	20,13	-2,95	-3,24	-168,83
28	-4,98	-148,47	-44,76	-35,38	19,78	-45,91	-3,76	177,81
29	-4,86	-86,47	-41,29	-37,25	19,78	-86,23	-4,50	167,74
30	-4,36	-27,89	-41,52	-61,53	19,32	-129,26	-4,80	163,72
31	-3,36	32,62	-38,66	-77,90	18,76	-173,86	-4,09	156,85
32	-2,64	92,69	-41,19	-158,77	18,17	149,82	-3,28	145,38
33	-2,24	145,64	-47,12	164,10	18,29	101,76	-4,01	136,30
34	-1,89	-155,52	-47,97	121,51	17,46	62,12	-4,02	125,27
35	-2,14	-101,63	-46,70	-44,11	16,98	16,48	-4,72	127,84
36	-2,36	-44,96	-42,01	-104,03	16,39	-29,52	-3,21	120,85
37	-2,03	14,77	-42,49	-123,02	15,72	-77,36	-2,78	113,07
38	-2,62	69,17	-40,73	-160,86	14,25	-128,68	-2,22	103,43
39	-4,20	121,07	-46,80	-168,39	11,71	179,68	-1,61	89,83
40	-5,39	-164,92	-50,85	-73,02	9,73	131,26	-2,18	72,52

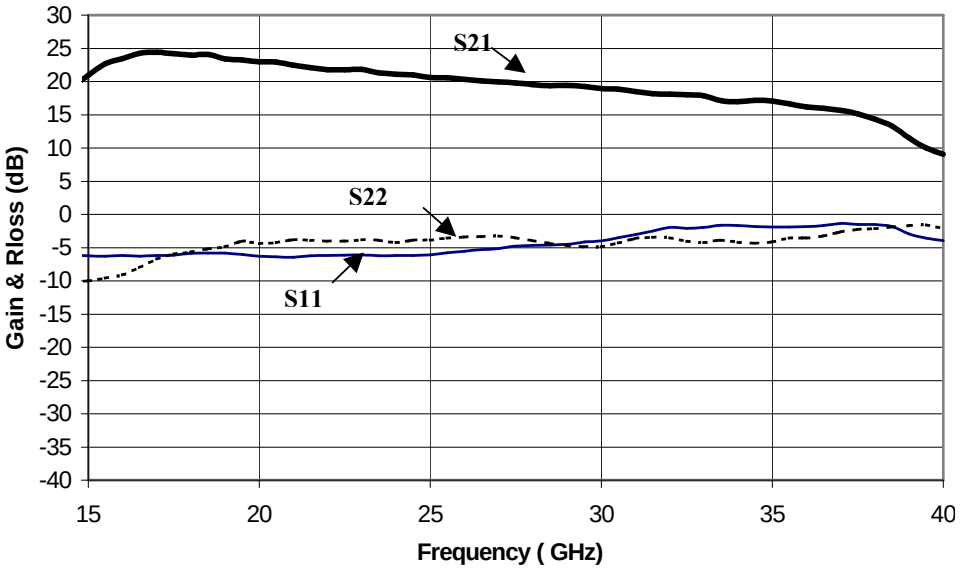
Refer to the “definition of the Sij reference planes” section below.

Route Départementale 128, BP46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

Typical PCB Measured Performance

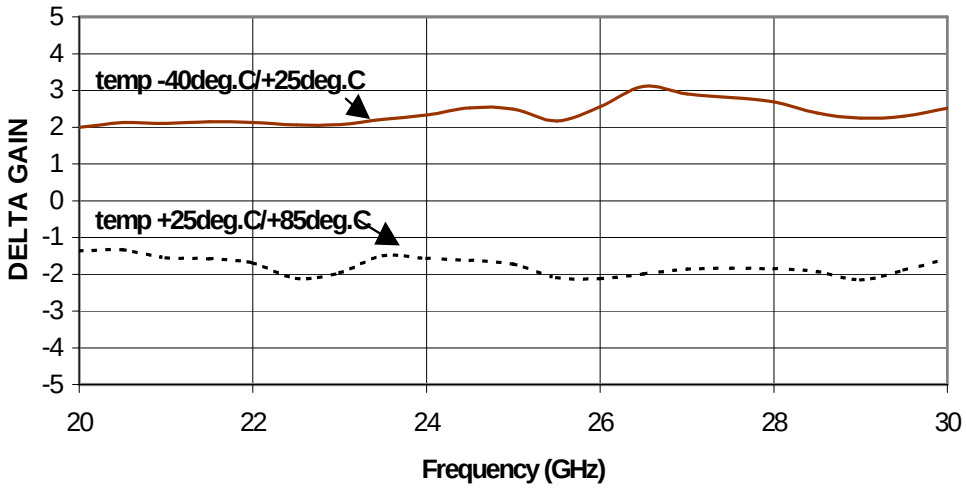
Tamb = +25°C, Vd= +3.5V Id=330mA

Sij parameters



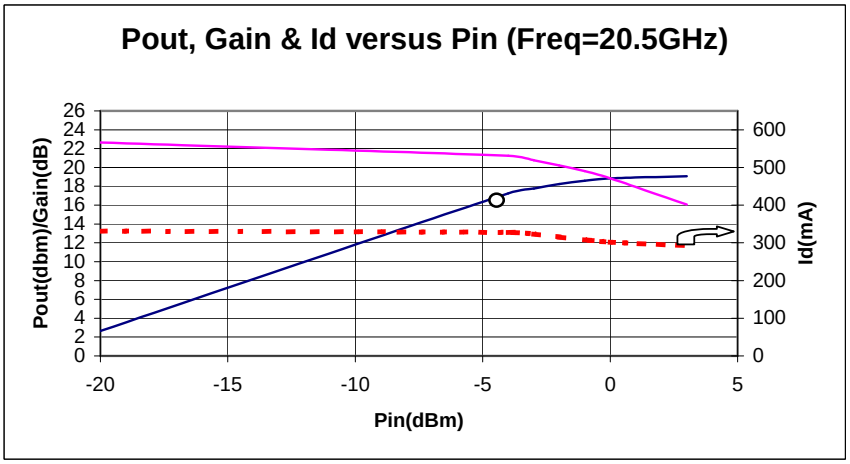
Gain and Rlosses in the package access planes, using the proposed land pattern & board 95541.

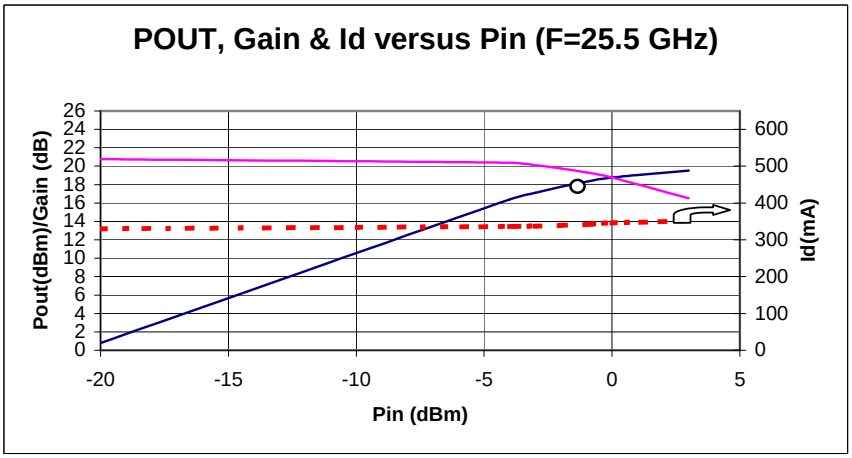
S21 Variation in Temperature

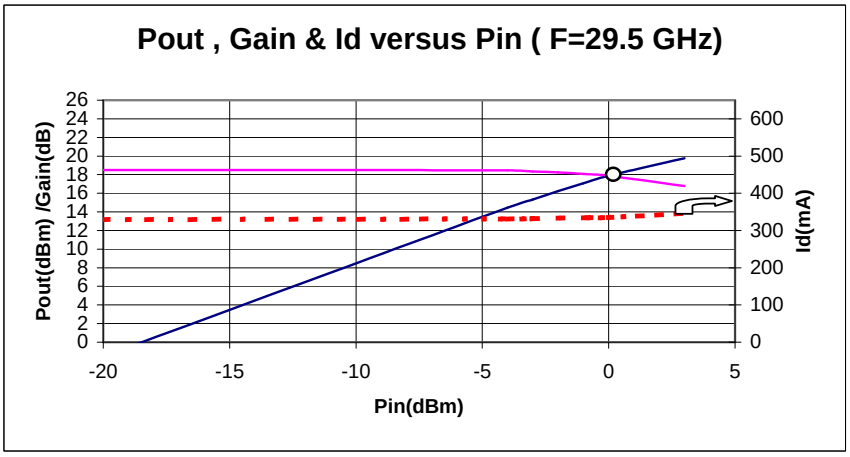


Route Départementale 128, BP46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

CW Power Measurements

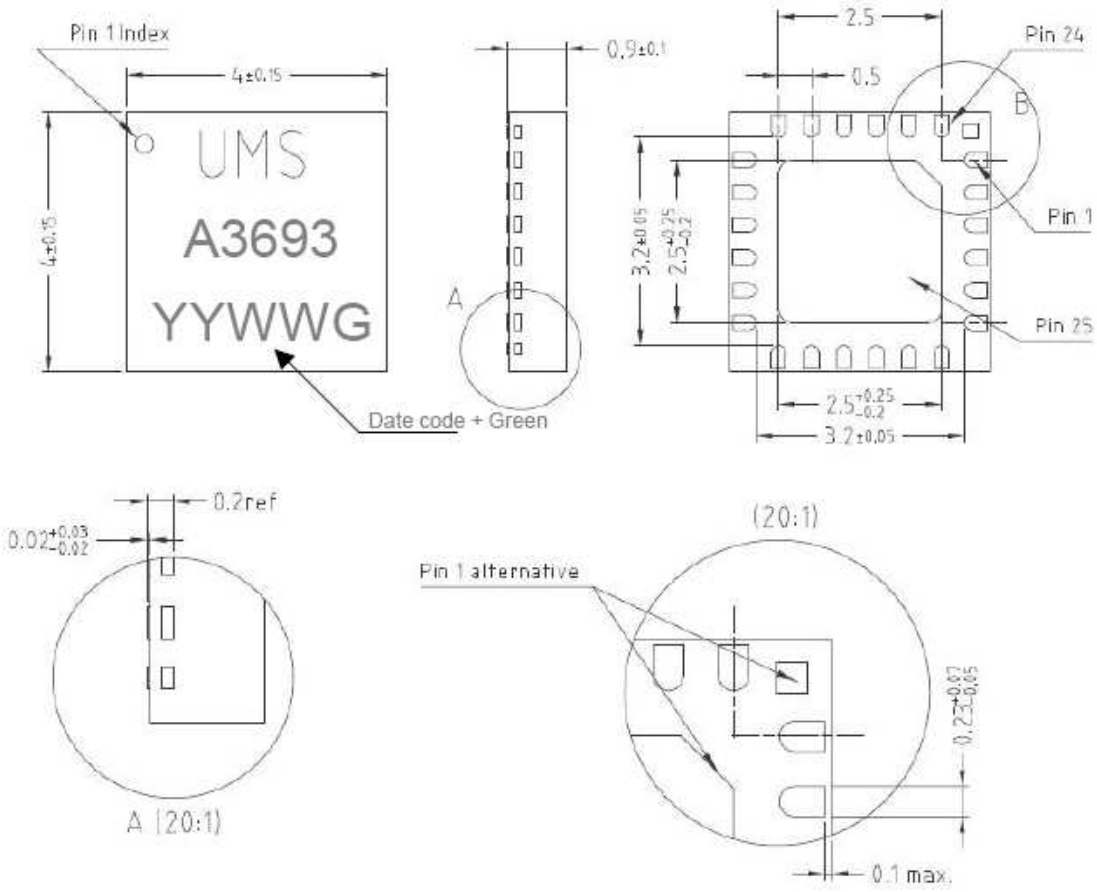






Route Départementale 128, BP46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

Package outline:



Units : mm
From the standard : JEDEC MO-220
Matt tin, Lead free (Green)

1- Nc	11- DR *	21- Nc
2- Gnd	12- Nc	22- Gnd
3- Gnd	13- Gnd	23- D1 **
4- RF IN	14- Gnd	24- Nc
5- Gnd	15- RF OUT	25- Gnd
6- Gnd	16- Gnd	
7- G1	17- Gnd	
8- G2	18- Nc	
9- G3	19- Nc	
10- G4	20- D **	

***** DR pad is provided for monitoring the output power. This access, when connected to an external resistor of 10kOhm (typical value) provides a DC voltage, which follows the output power level.

** D1pad corresponds to the 1st stage drain, D pad corresponds to the 2nd, 3rd, and 4st stage drains

Route Départementale 128, BP46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

The RF ports are DC blocked on chip. The DC connections do not include any decoupling capacitor in package, therefore it is mandatory to provide a good external DC decoupling on the PC board, as close as possible to the package.

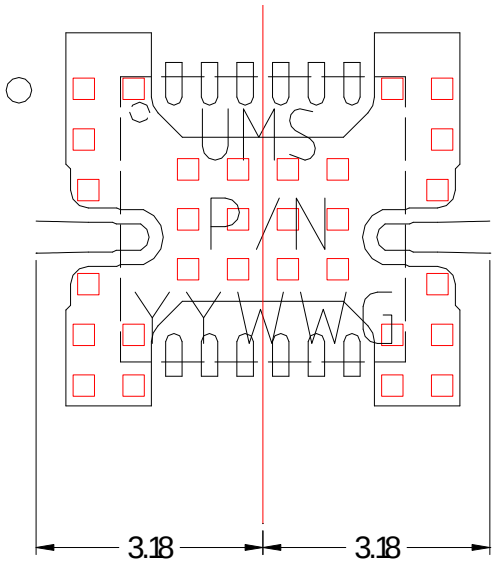
SMD mounting procedure

The SMD leadless package has been designed for high volume surface mount PCB assembly process. The dimensions and footprint required for the PCB (motherboard) are given in the drawings above.

For the mounting process standard techniques involving solder paste and a suitable reflow process can be used. For further details, see application note AN0017.

Definition of the Sij reference planes

The reference planes are defined from the footprint of the recommended characterization board 95541 shown below.
The reference is the symmetrical axis of the package. The input and output reference planes are located at 3.18mm offset (input wise and output wise respec.) from this axis. Then, the given Sij incorporates this land pattern.

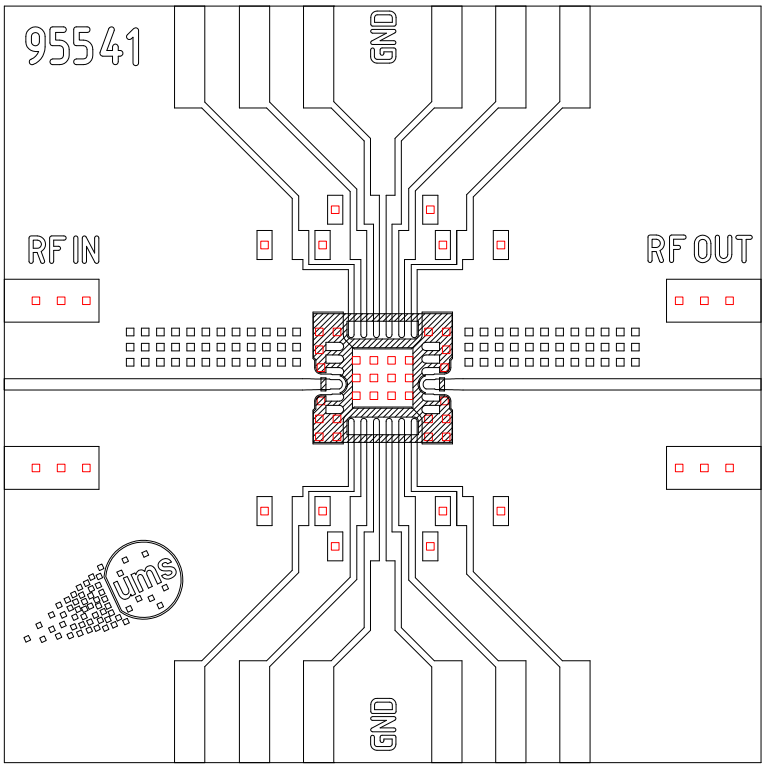


Unit : mm

Route Départementale 128, BP46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

Proposed Assembly board “95541” for the 24L-QFN4x4 products characterization.

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



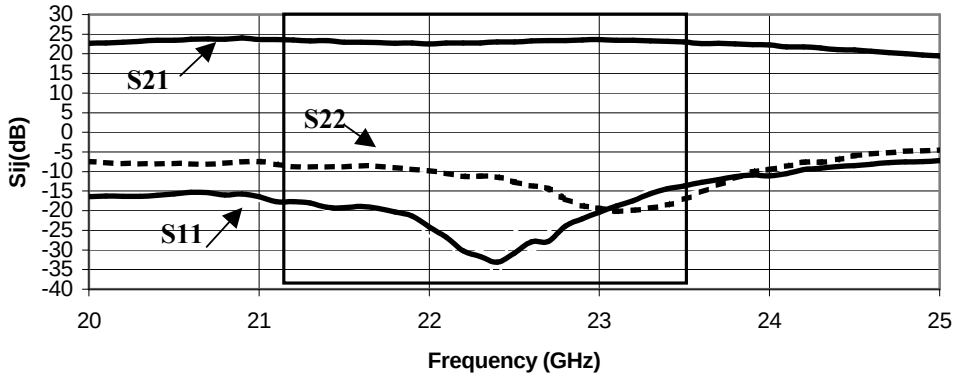
Route Départementale 128, B.P.46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09

Sub-band enhancement

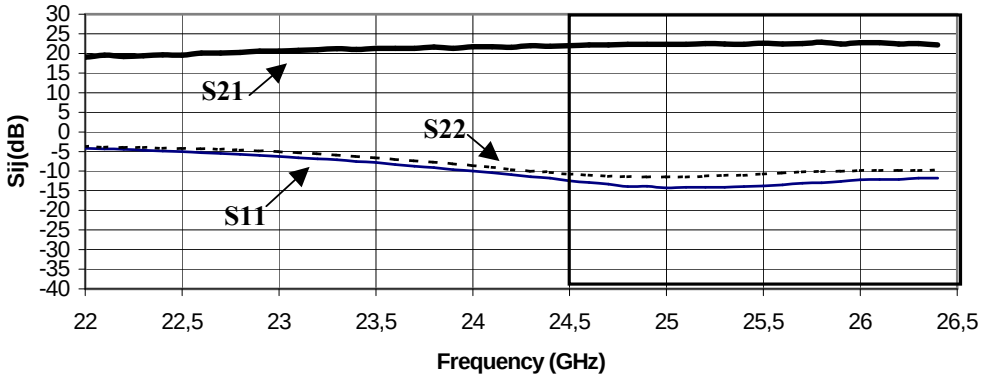
Based on the Sij matrix given previously, the performances of this product can be enhanced in sub-bands using external matching components such as very simple combination of micro-strip stubs.
For some sub-bands, matching networks have been implemented and some typical results are shown below.

The following graphs show S parameters obtained thanks to external matching networks.

Typical S parameters with matching networks for the 21.2-23.6 GHz band



Typical S parameters with matching networks for the 24.5-26.5 GHz band



Ordering Information

QFN 4x4 RoHS compliant package: CHA3693-QDG/XY
Stick: XY = 20 Tape & reel: XY = 21

Route Départementale 128, BP46 - 91401 ORSAY Cedex - FRANCE
Tel.: +33 (0) 1 69 33 03 08 - Fax: +33 (0) 1 69 33 03 09