MONOLITHIC MICROWAVE INTEGRATED CIRCUIT (MMIC)
InGaP HBT HB20M PROCESS FROM UMS,

VOLTAGE CONTROLLED OSCILLATOR 2.75-3GHZ
(CHV1203-98S)

ESCC Detail Specification No. 9012/003

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1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for the Microwave Monolithic Integrated Circuit (MMIC), in die form, S-band voltage controlled oscillator (VCO) referenced CHV1203-98S. The VCO, based on the InGaP HBT HB20M process from UMS, covers the frequency range from 2.75 GHz to 3 GHz. This document is based on, and should be read in conjunction with ESCC Generic Specification No. 9010, the requirements of which are supplemented herein.

1.2 TYPE VARIANTS

MMIC Variants of the basic type components specified herein, which are also covered by this specification, are given in Table 1(a).

1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the component specified herein, are scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The power dissipation de-rating curve is shown in Figure Figure 1.

1.5 PHYSICAL DIMENSIONS

The physical dimensions of the die and mechanical drawing specified herein are shown in Figure 2.

1.6 FUNCTIONAL DIAGRAM

The functional diagram, showing pad identification of the component specified herein, is shown in Figure 3.

1.7 HANDLING PRECAUTIONS

These devices are susceptible to damage by electrostatic discharge. Therefore suitable precautions shall be employed for protection during all phases of manufacture test, packaging, shipping and handling.

These chips are categorized as Class 0 with a Minimum Critical Path Failure Voltage of 50V for this Variant.

2 APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

(a) ESCC Generic Specification No. 9010 for Monolithic Microwave Integrated Circuits (MMICs)
(b) MIL STD 883 Test Methods and Procedures for Microelectronics
(c) ESCC20600 Preservation, Packaging and Despatch of ESCC Components
(d) ESCC21300 Terms Definition, Abbreviations, Symbols and Units
(e) ESCC23800 Electrostatic Discharge Sensitivity Test method

3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply. In addition, the following abbreviations are used:

- RTH (J-C) =Thermal Resistance, Junction to Case.
- VC=Supply voltage.
- IC=Supply current
- VT=Tuning voltage.

TABLE 1(a) – TYPE VARIANTS

(1) Variant	(2) Type	(3) Case	(4) Figure	(5) PAD Metallisation and thickness of Top Layer	(6) Backside Finish (Metallisation and Thickness)
01	CHV1203-98S	CHIP	2	Au, 3.3µm	Au, 4.5µm

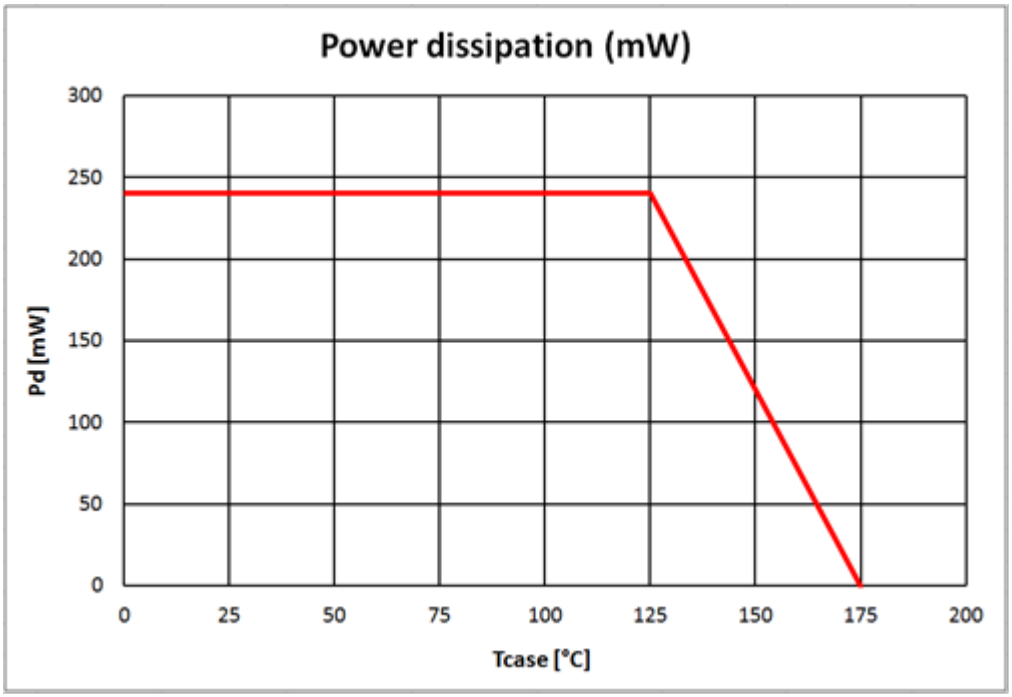
TABLE 1(b) - MAXIMUM RATINGS (1)

No.	Characteristics	Symbol	Maximum Ratings	Unit	Remarks
1	Tuning Voltage	VT	15	V	
2	Supply Voltage	VC	4	V	
3	Supply Current	IC	100	mA	Total current of the circuit
4	Junction Temperature	Tj	175	ºC	
5	Operating Temperature Range	Ta	-55 to +125	ºC	With respect to max Tj=175ºC
6	Storage Temperature Range	Tstg	-55 to +175	ºC	
7	Soldering Temperature	Ts01	300	ºC	AuSn 80/20 (see AN001 UMS application note
8	Thermal Resistance (2)	Rth	44	ºC/W	Rth (J-C) @125 ºC
10	Dissipated Power	Pdiss	240	mW	Continuous Pdiss (T= 125 ºC) (derate 4.8 mW/ ºC above 125 ºC)

NOTES:

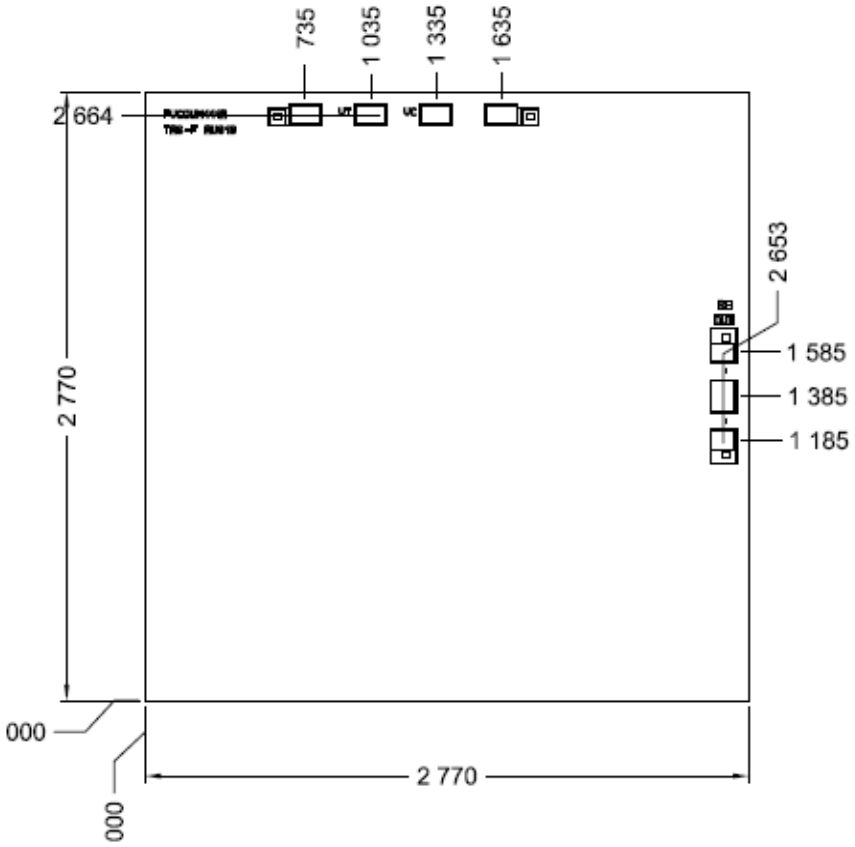
1. Operation of this device above anyone of these parameters may cause permanent damage.
2. For bare die mounted in appropriate package. Not a true maximum rating – for information only.

FIGURE 1– PARAMETER DERATING INFORMATION



Power dissipation de-rating curve.

FIGURE 2– PHYSICAL DIMENSIONS

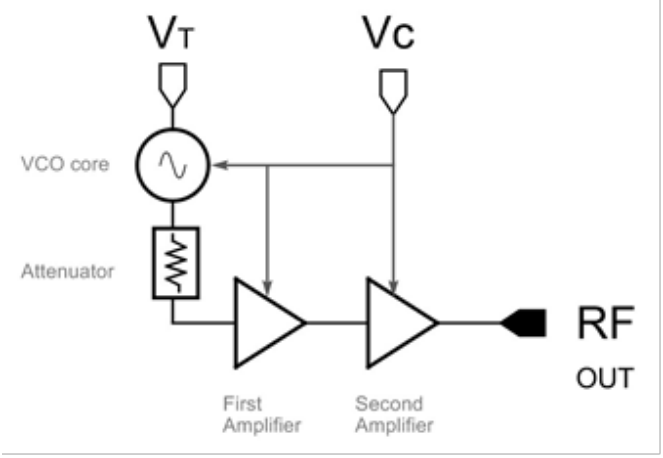


NOTES

All dimensions are in micrometers
Chip size = 2770 x 2770 ±35µm
Chip thickness = 100µm ±10µm
RF pad = 110 x 200µm²
DC pads= 100 x 100µm²
Chip width and length are given with a tolerance of ±35µm

Pin name	Description
VT	Tune Voltage
VC	Supply Voltage
RF	Output RF

FIGURE 3 – FUNCTIONAL DIAGRAM



4 REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the bare MMIC die specified herein shall be as stated in this specification and ESCC Generic Specification No. 9010 for Monolithic Microwave Integrated Circuits (MMIC).

The test requirement for the MMIC lot validation shall be performed on mounted MMIC samples submitted to Burn-in and electrical measurements CHART III(b) and Lot Acceptance tests level 2 CHART V.

Deviations from the Generic Specification applicable to this specification only, are listed in Para. 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirements and do not affect the MMIC chip reliability, are listed in the appendices attached to this specification.

4.2 DEVIATIONS FROM GENERIC SPECIFICATION

4.2.1 Deviations from Production Control – Wafer Lot Acceptance

(a) Total Dose Radiation Testing: not required

4.2.2 Deviations from Production Control – Wafer Screening (Chart II(a)

(a) Para. 9.5.2.1: applicable on 5 bare dies assembled on appropriate substrate

4.2.3 Deviations from Production control – Wafer Acceptance Testing (Chart III(a))

(a) Para. 9.7.1 and 9.7.2 only applicable

4.2.4 Deviations from Final Production Tests (chart II(b))

(a) Chart II (b) shall not be performed.

4.2.5 Deviations from Burn-in and Electrical Measurements (chart III(b))

(a) Para. 9.15: shall not be performed
(b) Para. 9.16: shall apply as per condition MIL-STD-883, Test Method 1015, Test condition 'B'. Duration shall be 240 hrs, 125°C ambient.
(c) Para.9.5.2.2: shall not be performed.

4.2.6 Deviations from Qualification Tests (Chart IV)

Chart IV shall not be performed.

4.2.7 Deviations from Lot Acceptance Tests (Chart V)

Chart V Level 2 – Endurance Subgroup plus electrical Subgroup shall apply.

Environmental/Mechanical Subgroups shall not be performed.

Deviations from the applicable Chart V level 2 to this specification are listed herein.

(a) Level 3: Electrical measurements at room and high and low temperatures (-25°C/+80°C) on 3 samples per qualification lot shall be performed. Components Assembly and Capability Tests shall not be performed.
(b) Level 3 Special testing Para. 9.27 shall not be performed.
(c) Level 2 Endurance Subgroup shall be performed on 10 samples. The operating life test duration shall be 1,000 hours minimum at 125°C ambient or equivalent as per table 1 of MIL- STD-883 Test method 1005.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension check

The dimensions of the components specified herein shall be checked. They shall conform to those shown in Figure 2.

4.3.2 Weight

The maximum weight of the components specified herein is negligible.

4.3.3 Terminal Strength

(a) Shall not be performed.

4.3.4 Bond Strength

The requirements for bond strength are specified in Section 9 of ESCC Generic Specification No. 9010. The test conditions shall be as described in MIL STD 883, method 2011, cond. D.

(a) Condition: 'D'.
(b) Bond Strengths: 20 wires (5 dies, 4 wires per die, No defect allowed).

4.3.5 Die Shear

The requirements for die shear are specified in Section 9 of ESCC Generic Specification No. 9010. The test conditions shall be as described in MIL STD 883, method 2019.

(a) Minimum acceptable on die shear strengths: 2.5kg (on 5 parts, No defect allowed).

4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the components specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

Bond Pad Metallization and Back-side metallization is Au

4.5 MARKING

4.5.1 General

The marking of components delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and the following paragraphs. When the component is too small to accommodate all of the marking as specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

The information to be marked and the order of precedence shall be as follows:

(a) The ESCC Component Number.
(b) Manufacturer name or Symbol
(c) Manufacturer Part Number
(d) Traceability as defined in ESCC : Lot, Wafer, Date code

The primary package shall bear an “ESD Sensitive” label.

4.5.2 ESCC Component Number

Each component shall bear the ESCC Component Number which shall be constituted and marked as follows: Pad Identification

- Detail specification Number: 9012003
- Type Variant (see Table 1(a))01
- Testing Level (B or C, as applicable) B

4.5.3 Pad Identification

Pad identification shall be as shown in Figure 2 of this specification.

4.5.4 Traceability Information

Each component shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification No. 21700.

4.5.5 Packaging

An appropriate Gel-Pak of glass filled black conductive polycarbonate with appropriate retention level shall be used for delivery, so that for storage and shipment the parts are adequately safe-guarded against mechanical or electrical injury during transportation to the ordered and:

- Protected against deterioration due to humidity
- Primary HS-shield metalized bag, partly filled with dry nitrogen and sealed
- Secondary DRY-SHIELD metalized humidity proof bag with desiccant and humidity indicator, partly filled with dry nitrogen and sealed

- Suitable for storage in their primary package for a period of several months,
- Easily identified after each stage of packaging

Furthermore the top side of the Gel-Pak shall be clearly identified. Appropriate Gel-Pak is VR76 CC 02 XL.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature
The parameters to be measured at room temperature are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at T_{amb} = + 25±3 °C.

4.6.2 Electrical Measurements at High and Low Temperatures
The parameters to be measured at high and low temperatures are scheduled in Table 3. Unless otherwise specified, the measurements shall be performed at + 80°C and -25°C.

4.6.3 Circuits for Electrical Measurements
Circuits for use in performing electrical measurements listed in Table 2 and Table 3 of this specification are shown in Figure 4.

4.7 BURN-IN TESTS
Burn-in shall be done in accordance with Chart III(b) of ESCC Generic Specification N° 9010.

4.7.1 Parameter Drift Values
The parameter and drift values applicable to Burn-In are specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at Tamb = + 25 ±3 °C. The parameter drift values applicable to the scheduled parameters shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified for a given parameter in Table 2 shall not be exceeded.

4.7.2 Conditions for Burn-in
The requirements for Burn-In are specified in Section 9 of ESCC Generic Specification No. 9010. The conditions for Burn-In shall be as specified in Table 5 of this specification.

4.7.3 Electrical Circuit for Burn-in
The circuit for use in performing the Burn-In test is shown in Figure 5 of this specification.

4.8 ENDURANCE TESTS (CHART V OF ESCC GENERIC SPECIFICATION NO. 9010)

4.8.1 Electrical Measurements at intermediate Points and on Completion of Endurance Tests
The parameters to be measured at intermediate points and on completion of endurance testing are scheduled in Table 2 of this specification. Unless otherwise stated, the measurements shall be performed at Ta = + 25 ± 3 °C.

4.8.2 Conditions for Operating Life Test (Part of Endurance Testing)
The requirements for operating life testing are specified in Section 9 of ESCC Generic Specification No. 9010. The conditions for operating life testing are specified in Table 5 of this specification.

4.8.3 Electrical Circuit for Operating Life Test

The circuit for use in performing the operating life test shall be the same as shown in Figure 5 of this specification for burn-in.

4.9 TOTAL DOSE IRRADIATION TESTING

Not applicable.

4.10 SPECIAL TESTING

Not applicable.

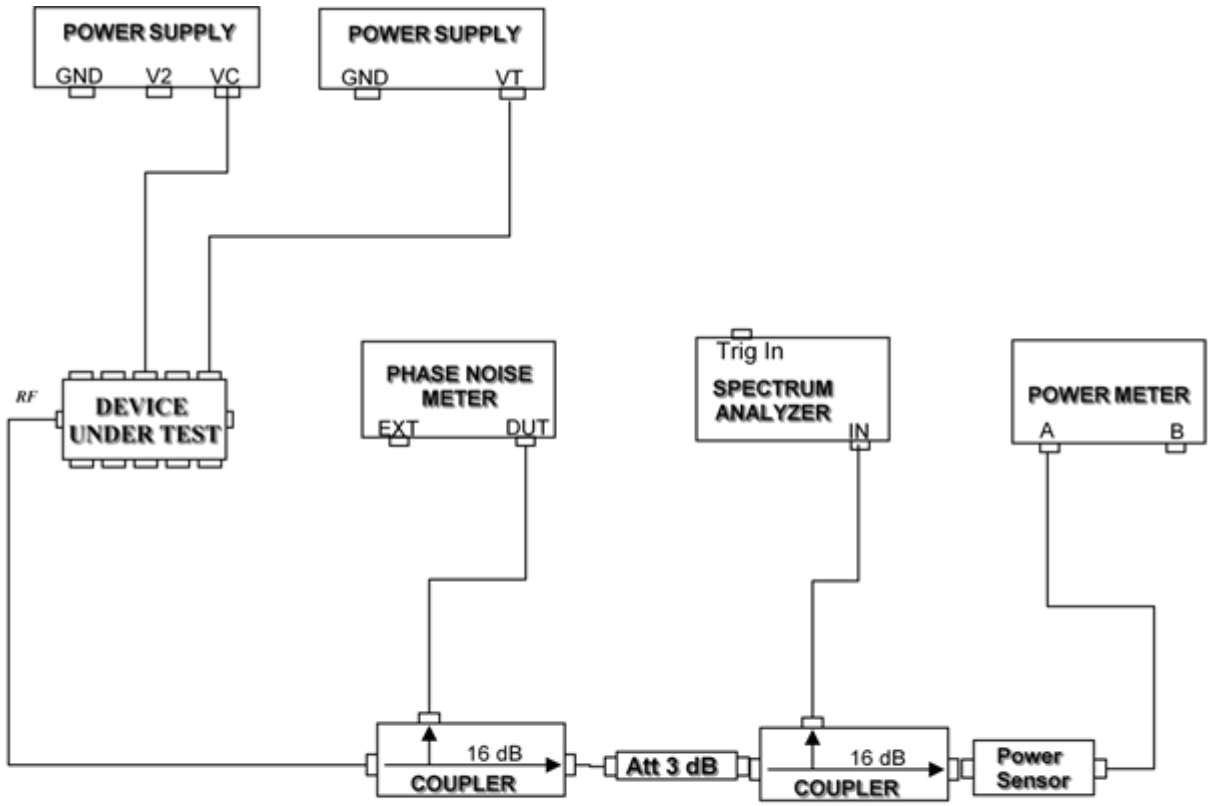
TABLE 2– ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE OF BARE DIE – DC & RF PARAMETERS

No.	Characteristics	Symbol	Limits			Unit
			Min.	Typ.	Max.	
1	Frequency Range	Freq.	2.75		3	GHz
2	Output Power	Pout	6	8		dBm
3	Output Power Variation vs VTune			0.8		dB
4	Phase Noise @10KHz			-85		dBc/Hz
5	Phase Noise @100KHz			-108		dBc/Hz
6	Tuning Sensitivity		40		110	MHz/V
7	Tune Voltage	vt	0		10	V
8	Supply Voltage	Vc		3		V
9	Supply Current	Ic		50		mA
10	Tune Port Leakage Current	It			1	µA
11	Output Return Loss		10			dB
12	F0/2 harmonic suppression			-43		dBc
13	3F0/2 harmonic suppression			-35		dBc
14	2F0 harmonic suppression			-35		dBc

TABLE 3– ELECTRICAL MEASUREMENTS AT LOW AND HIGH TEMPERATURE OF BARE DIE – DC & RF PARAMETERS

No.	Characteristics	Symbol	Limits			Unit
			Min.	Typ.	Max.	
1	Frequency Range	Freq.	2.75		3	GHz
2	Output Power	Pout	6	8		dBm
3	Output Power Variation vs VTune			1.2		dB
4	Phase Noise @10KHz			-85		dBc/Hz
5	Phase Noise @100KHz			-108		dBc/Hz
6	Tuning Sensitivity		40		110	MHz/V
7	Tune Voltage	vt	0		10	V
8	Supply Voltage	Vc		3		V
9	Supply Current	Ic		50		mA
10	Tune Port Leakage Current	It			1	µA
15	Frequency Drift Rate			0.3		MHz/°C

FIGURE 4 – TEST CONFIGURATION FOR ELECTRICAL MEASUREMENTS (DUT IN JIG)



Power and Phase noise measurement setup

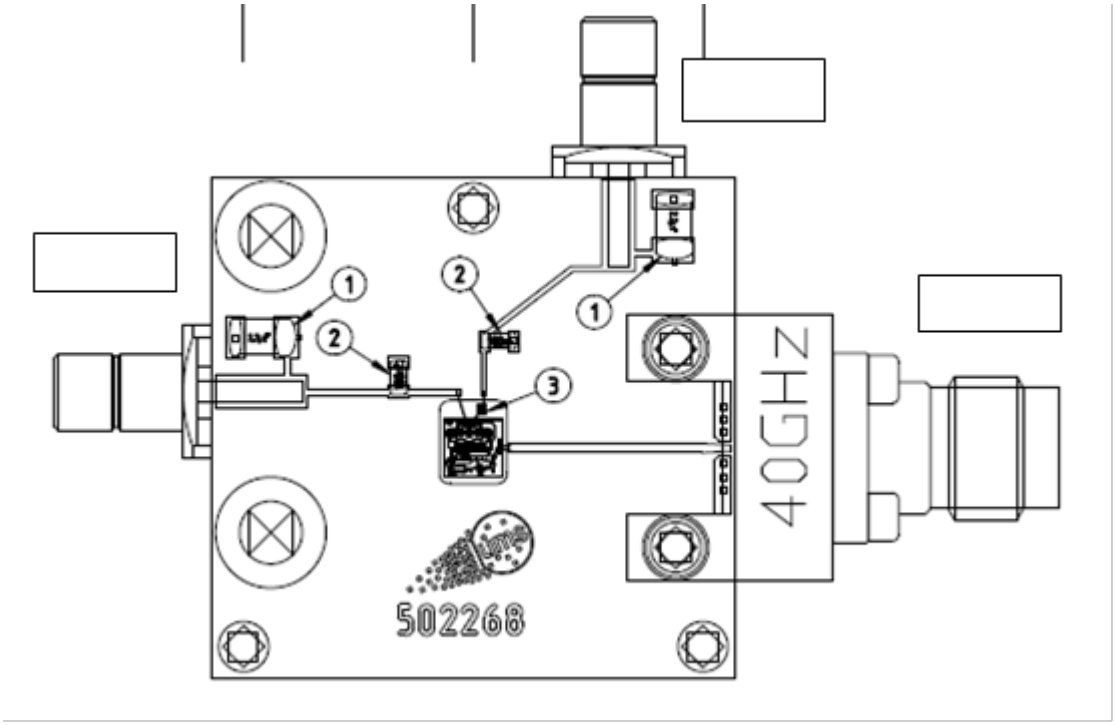
TABLE 4– PARAMETER DRIFT VALUES

No.	CHARACTERISTICS	SYMBOL	SPEC. AND/OR TEST METHOD	TEST CONDITIONS	LIMITS	UNIT
2	Output Power	Pout	As per Table 2	As per Table 2	+/-1	dB
8	Supply current	Ic	As per Table 2	As per Table 2	+/-20	%

TABLE 5– CONDITIONS FOR BURN-IN AND OPERATING LIFE TESTS

No.	CHARACTERISTICS	SYMBOL	VALUE	UNIT
1	Ambient Temperature	T_{amb}	+125	°C
2	Junction Temperature	Tj	+133	°C
3	Supply Current	Ic	62	mA
4	Supply biasing	Vc	3	V
5	Duration for Burn In		240	H
6	Duration for Life Test		1000	H

FIGURE 5 – ELECTRICAL CIRCUIT FOR BURN-IN AND LIFE TEST



N°1	Capacitor 2.2µF
N°2	Capacitor 100nF
N°3	Capacitor 120pF

APPENDIX A

AGREED DEVIATIONS FOR UMS TECHNOLOGIES (D)

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS
Visual inspection MIL STD 883, method 2010	SQ_10S_Visual inspection Specification for GaAs MMIC Level A (internal UMS specification for Visual inspection; based on Method 2010 condition A)
Recommended conditions for die attach and wire bonding	UMS application note : AN0001 User guide for bare dies GaAs MMIC storage, pick & place, die attach and wire bonding