5.2.4 United Monolithic Semiconductors, France : GaN HEMT

5.2.4.1 *Contact Information*

Address	ESCC Chief Inspector
United Monolithic Semiconductors Batiment Charmille Mosaic parc Courtaboeuf 10 avenue du Quebec 91140 Villebon sur Yvette	Mr B. LAMBERT +33 6 45 74 51 75 +33 1 69 86 32 88 Benoit.Lambert@ums-rf.com

5.2.4.2 *Qualification*

Current Qualification Certificate No.	In QML since:	Type Designation
388	Mar 2024	Transistors, Microwave, GaN HEMT Unmatched in Metal Ceramic Package CHKxxxx-SYx Product Family

5.2.4.3 *List of Qualified Components*

Variant number	Detail Specification	Generic part number	Component type	Package
01	5614/009	CHK8101-SYC	15W @ 1.7GHz	Ceramic-Metal, Flanged,Type C
02	5614/009	CHK8201-SYA	50W @ 1.7GHz	Ceramic-Metal, Flanged,Type A
03	5614/009	CHKA012bSYA	130W @ 1.7GHz	Ceramic-Metal, Flanged,Type A

5.2.4.4 *Technology Flow Abstract*

CHKxxxx-SYx Product Family is based on the UMS GH50-20 GaN power bar technology. Power bars are assembled using AuSn eutectic soldering in a highly dissipated ceramic-metal Flanged packaged. To assure RF stability of each component type, an RF absorber is used in the package cavity. All manufacturing and test production is performed in accordance to the ESCC/5010.

	CAPABILITY APPROVAL DOMAIN	
	RIC1 (Product: CHK8101-SYC)	RIC3 (Product: CHKA012bSYA)
GaN DIE PROCESS		
Die overview		
Manufacturer	UMS – Ulm – Germany	
Power bar dies technology	UMS 4GH50-20	
Gate pitches	70µm	
Unitary gate finger width	250µm &	400µm
Finger gates per block	8	
Number of blocks	2 , 4, 8	
Max operating Freq. (GHz)	6 GHz	
PACKAGE TECHNOLOGY		
Package overview (without Lid)		
Package manufacturer	Kyocera – Gamo – Japan	
UMS Package reference	SYC	SYA
UMS SAP Material N°	47003170	47002520
Sealing	Seam-welding process	

Lead	2	4
Base plate length (mm)	17.5	20
Base plate width (mm)	6.7	
Lid for Package: Manufacturer	Hi-REL Group	
UMS Drawing Document N°	61504640	61503116 last version
RF Absorber : Manufacturer	DEMGY	
UMS Material N°	47003186	47003186

ASSEMBLY TECHNOLOGY	
Assembly subcontractor	RHe Microsystems GmbH – Radeberg – Germany
Preform characteristics	Material: Eutectic Au80Sn20 (Liquidis:278°C),
Sealing process	Hermetical seam sealed
Assembly screening (100%)	Stabilization bake - 24h @ 150°C / MIL-STD-750 method 1032 Temp. Cycling - 20 cycles -55/+150°C / MIL-STD-750 method 1051 PIND test - MIL-STD-750 method 2052 X-ray - Wire bonding inspection / MIL-STD-883 2009.12 Leak test - MIL-STD-883-1014.15 Cond A2

ELECTRICAL SCREENING FLOW	
Manufacturer	UMS – Villebon – France
Burn In 1 Electrical Stabilization (100%)	10hrs - Tamb=+125°C; VD=+50V; VG=-7V 10hrs - Tj=200°C; VD=+50V; VG=cst (RIC1:ID=256mA / RIC3:ID=1.25A)
Burn-In 2 (100%)	240hrs - Tj=200°C; VD=+50V; VG=cst (RIC1:ID=256mA / RIC3:ID=1.25A) RF characterization / Acceptance criteria based on specification and on parameter drift (before/after burn-in) / Pulsed or CW

FINAL PRODUCT		
Product overview		
Typical RF-power @1.3GHz (Vds=50V, Idq=25mA/mm)	>15W	>100W
Product reference	**CHK8101-SYC**	**CHKA012bSYA**

Radiation characteristics

Displacement Damage (DD) tests show no influence of proton irradiation on the electrical performance up to a tested fluence of 10^{12} p/cm2.

Total Ionizing Dose (TID) tests show no influence of Co60 irradiation up to a final tested dose of 274 krad (in GaN).

Single Event Burn-out (SEB) levels for gate and drain RF voltage excursions for transistors operating in class AB, such as described in next table.

Characteristics	Symbols	Safe Operating Area	Units	Remarks
Drain-Source Voltage RF-Excursion	V_{DS_peak}	≤ 125	V	Xe ions (LET-Si = 62.5keV/µm) Fluence = 1.E+07 ions/cm2
Gate-Source Voltage RF-Excursion	V_{GS_peak}	≥ -6	V	
Drain-Source Voltage RF-Excursion	V_{DS_peak}	≤ 125	V	Rh ions (LET-Si = 46.1keV/µm) Fluence = 1.E+07 ions/cm2
Gate-Source Voltage RF-Excursion	V_{GS_peak}	≥ -9	V	

In vacuum environment characteristics

Corona/Multipaction free operation test campaign was performed. No failure occurred up-to the maximum levels that it was possible to evaluate and which are provided in table here after.

Characteristics	Symbols	Safe Operating Area	Units	Remarks
Drain-Source Voltage RF-Excursion	V_{DS_peak}	≤ 133	V	Multipaction Phenomena See Note 1
Drain-Source Voltage RF-Excursion	V_{DS_peak}	≤ 138	V	Corona Phenomena See Note 2

NOTES:

1) Multipaction test conditions: Pressure < 1.5 10^{-5} mbar, frequency = 1.25GHz, Test board temperature from -30°C to 70°C
2) Corona test conditions: Pressure from 900mbar to <1.5 10^{-5} mbar, frequency = 1.25GHz, Test board temperature from -30°C to 70°C

5.2.4.5 Manufacturing sites

WAFER FABRICATION:
UMS Gmbh Wilhelm Runge Strasse 11 D-089081 Ulm Germany

DIE ASSEMBLY:
RHe Microsystems Gmbh Heidestrass 70 01454 Radeberg Germany

CONTROL AND TEST:
UMS SAS 10 avenue du Quebec 91140 Villebon sur Yvette France