# Reliability Evaluation Report

## MDG-MCD-RER 1911

### STM32F/STM32L/ STM8L (438-425-444-761)

### WBC to DAF for UQFN4x4 COL 28L & UQFN5x5 COL32L

### JSCC (PCN11503 )

| General Information | | Traceability | |
|---|---|---|---|
| Commercial Product | STM32F334K8U6<br>STM32L031G6U6<br>STM32F031G6U6<br>STM8L101G2U6 | Diffusion Plant | Rousset RS8F<br>TSMC FAB 3 - FAB11 |
| Product Line | 438X66, 425X66, 444X66, 761X19 | Assembly Plant | JSCC - CHINA |
| Die revision | X438XXXZ, X425XXXX, X444XXXA, 761XXXY | | |
| Product Description | STM32F, STM32L, STM8L | | |
| Package | UQFN5x5 COL 32L (Chip On Lead)<br>UQFN4x4 COL 28L (Chip On Lead) | Reliability Assessment | |
| Silicon Technology | CMOSF9S-CMOSF9GO2 RS8F, 0.18 TSMC | Pass | ☒ |
| Division | MDG-MCD | Fail | ☐ |

***Note:*** *this report is a summary of the reliability trials performed in good faith by STMicroelectronics in order to evaluate the electronic device conformance to its specific mission profile. This report and its contents shall not be disclosed to a third party without previous written agreement from STMicroelectronics or under the approval of the author (see below).*

| Version | Date | Author | Function |
|---|---|---|---|
| 1.0 | Nov 02nd 2020 | Bambang Redjeki SIE<br>Céline Navarro | MDG-Q&R<br>MDG-MCD-Q&R |

## APPROVED BY:

| Function | Location | Name | Date |
|---|---|---|---|
| Division Q&R Responsible | Rousset | Pascal NARCHE | Nov 02nd, 2020 |
| BE Quality Manager | Rousset | Gisele SEUBE | Nov 02nd, 2020 |

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# 1 RELIABILITY EVALUATION OVERVIEW

## 1.1 Objective

The aim of this report is to present results of the reliability evaluation performed on STM8L, STM32L, STM32F for UQFN4x4 COL and UQFN5x5 COL WBC (wafer back-side coating) to DAF (die attach film).

This Production Change Notification (PCN) concerns change of WBC to DAF for UQFN4x4 COL and UQFN5x5 COL at JSCC China.

Changes are described here below:

| | From: | To: |
|---|---|---|
| Assembly site | JSCC (China) | JSCC (China) |
| Die Attach material | WBC Epoxy Henkel 8006NS | DAF Hitachi HR-5104T-25 |

## 1.2 Reliability Strategy

4 Test vehicles for reliability trials are described here below:

| Product | Process or Package | Diffusion or Assembly plant |
|---|---|---|
| STM32F334K8U6 | 0.18EMBF/2P - QFN5X5 COL 32L x 0.5 | TSMC - JSCC |
| STM32L031G6U6 | CMOSF9S-5M - QFN4x4 COL 28L x 0.55 | RS8F - JSCC |
| STM32F031G6U6 | 0.18EMBF/2P - QFN4x4 COL 28L x 0.55 | TSMC - JSCC |
| STM8L101G2U6 | CMOSF9-G02 - QFN4x4 COL 28L x 0.55 | RS8F - JSCC |

Qualification is based on standard STMicroelectronics Corporate Procedures for Quality and Reliability, in full compliancy with the JESD-47 international standard.

## 1.3 Conclusion

All reliability tests have been completed with positive results. Neither functional nor parametric rejects were detected at final electrical testing.

According to good reliability tests results and reliability strategy, the qualification is granted for MCD devices with DAF in UQFN COL.

Refer to Section 3.0 for reliability test results.

# 2 TEST VEHICLE CHARACTERISTICS

## 2.1 Generalities

| Package line | Assembly Line Package | Device (RawLine Code) | Diffusion Process | Number of Lots |
|---|---|---|---|---|
| QFN | QFN 5X5x0.5 COL 32L | 81EL*438ESXZ | 0.18EMBF/2P | 1 |
| | QFN 4x4x0.55 COL 28L | 83MB*425ESXX | CMOSF9S-5M | 1 |
| | QFN 4x4x0.55 COL 28L | 85MB*444ESXA | 0.18EMBF/2P | 1 |
| | QFN 4x4x0.55 COL 28L | 80MB*761ESXY | CMOSF9-G02 | 1 |

## 2.2 Traceability

### 2.2.1 Wafer fab information

Table 1

| | Wafer fab information | | | |
|---|---|---|---|---|
| **Test vehicle** | **438** | **425** | **444** | **761** |
| Wafer fab name / location | TS3F TSMC | RS8F Rousset | TS3F TSMC | RS8F Rousset |
| Wafer diameter | 8 inches | | | |
| Wafer thickness | 381 +/- 25µm | 375 +/- 25µm | 381 +/- 25µm | 375 +/- 25µm |
| Silicon process technology | 0.18EMBF/2P | CMOSF9S-5M | 0.18EMBF/2P | CMOSF9-G02 |
| Number of masks | 33 | 37 | 33 | 39 |
| Die finishing front side (passivation) materials | HDPox 10kA+SRO 1.5kA+PESIN 6kA | USG + NitUV (HFP USG+UV Nitride) | HDPox 10kA+SRO 1.5kA+PESIN 6kA | USG + NitUV (HFP USG+UV Nitride) |
| Die finishing back side Materials | RAW SILICON - BACK GRINDING | | | |
| Die area (Stepping die size) | 3914x3760 µm | 2132x2528 µm | 2458x2360 µm | 1256x1788 µm |
| Die pad size | 65x70 µm | 53x108 µm | 65x70 µm | 65x108 µm |
| Sawing street width (X,Y) | 80 x 80 µm | | | |
| Metal levels/ Materials/ Thickness | Metal 1 Tin/AlCu/Tin 0.450 µm<br>Metal 2 Tin/AlCu/Tin 0.450 µm<br>Metal 3 Tin/AlCu/Tin 0.450 µm<br>Metal 4 Tin/AlCu/Tin 0.450 µm<br>Metal 5 Tin/AlCu/Tin 0.875 µm | Metal 1 TaN/Ta/Cu 0.280 µm<br>Metal 2 Ti/AlCu/TxTN 0.310 µm<br>Metal 3 Ti/AlCu/TxTN 0.310 µm<br>Metal 4 Ti/AlCu/TxTN 0.310 µm<br>Metal 5 Ti/AlCu/TxTN 1.200 µm | Metal 1 Tin/AlCu/Tin 0.450 µm<br>Metal 2 Tin/AlCu/Tin 0.450 µm<br>Metal 3 Tin/AlCu/Tin 0.450 µm<br>Metal 4 Tin/AlCu/Tin 0.450 µm<br>Metal 5 Tin/AlCu/Tin 0.875 µm | Metal 1 TaN/Ta/Cu 0.280 µm<br>Metal 2 TaN/Ta/Cu 0.350 µm<br>Metal 3 TaN/Ta/Cu 0.350 µm<br>Metal 4 TaN/Ta/Cu 0.350 µm<br>Metal 5 Ti/AlCu/TxTN 0.900 µm |

### 2.2.2 Assembly information

Table 2

| Assembly Information die 425, 444, 761 | |
|---|---|
| Assembly plant name / location | JSCC - China |
| Pitch (mm) | 0.5 |
| Die thickness after back-grinding | 150 +/- 25µm |
| Die sawing method | Step cut |
| **Bill of Material elements** | |
| Lead frame material/supplier/reference | QFNs-HD-COL28 4*4 C7NP30*0-572U-STW |
| Lead frame finishing (material) | e4 Precious metal (Ag, Au, NiPdAu) |
| Die attach material/type (glue/supplier) | DAF HITACHI HR-5104T-25 |
| Wire bonding material/diameter | GOLD WIRE 0.8 MILS |
| Molding compound material/supplier/reference | SUMITOMO EME G770HCD |
| Package Moisture Sensitivity Level (JEDEC J-STD020D) | 3 |
| **Assembly Information die 438** | |
| Assembly plant name / location | JSCC - China |
| Pitch (mm) | 0.5 |
| Die thickness after back-grinding | 150 +/- 25µm |
| Die sawing method | Step cut |
| **Bill of Material elements** | |
| Lead frame material/supplier/reference | UQFNS-(COL)4S 32L 5x5 C7 NP3 0x0-360U |
| Lead frame finishing (material) | e4 Precious metal (Ag, Au, NiPdAu) |
| Die attach material/type (glue/supplier) | DAF HITACHI HR-5104T-25 |
| Wire bonding material/diameter | GOLD WIRE 0.8 MILS |
| Molding compound material/supplier/reference | SUMITOMO EME G770HCD |
| Package Moisture Sensitivity Level (JEDEC J-STD020D) | 3 |

### 2.2.3 Reliability testing information

Table 3

| Reliability Testing Information | |
|---|---|
| Reliability laboratory name / location | JSCC (China) / ST Rousset (France) |

Note: ST is ISO 9001 certified. This induces certification of all internal and subcontractor labs.
ST certification document can be downloaded under the following link:
http://www.st.com/content/st_com/en/support/quality-and-reliability/certifications.html

## 3 TESTS RESULTS SUMMARY

### 3.1 Lot Information

Table 4

| Lot # | Diffusion Lot / Wafer ID | Die Revision (Cut) | Assy Lot / Trace Code | Raw Line | Package |
|---|---|---|---|---|---|
| 1 | CRP645 /#25 | Cut1.1 | 939300721 F0000 | 81EL*438ESXZ | QFN 5X5x0.5 COL 32L |
| 2 | VG92116117/#25 | Cut2.2 | VG9211611 E0000 | 83MB*425ESXX | QFN 4x4x0.55 COL 28L |
| 3 | 9U92704311 /#25) | Cut1.0 | 9U9270431 S0000 | 85MB*444ESXA | QFN 4x4x0.55 COL 28L |
| 4 | VG8451081Z /#23 | Cut 2.2 | VG8451082 0000 | 80MB*761ESXY | QFN 4x4x0.55 COL 28L |

## 3.2 Test plan and results summary

**Table 5 – ACCELERATED ENVIRONMENT STRESS TESTS**

| Test code | Stress method | Stress Conditions | Lots | S.S. | Total | Results/Lot Fail/S.S. | Comments: (N/A =Not Applicable) |
|---|---|---|---|---|---|---|---|
| ESD CDM | ANSI/ESD STM5.3.1 | 250V<br>500V<br>500V<br>500V | 4 | 3 | 12 | Lot1: 0/3 (die 438)<br>Lot2: 0/3 (die 425)<br>Lot3: 0/3 (die 444)<br>Lot4: 0/3 (die 761) | |
| PC | J-STD-020 | 24h bake@125°C,<br>MSL3 (192h@30C/60%RH)<br>3x Reflow simulation<br>Peak Reflow Temp= 260°C | 3<br>1 | 385<br>462 | 1617 | Lot1: 0/385<br>Lot2: 0/385<br>Lot3: 0/385<br>Lot4: 0/ 462 | *No delamination TSAM / CSAM after Pre-conditioning* |
| TC | JESD22-A104 | Ta=-65/150°C<br>Duration= 1000cyc<br><br>☒ After PC | 4 | 77 | 308 | Lot1: 0/77<br>Lot2: 0/77<br>Lot3: 0/77<br>Lot4: 0/77 | |
| UHAST | JESD22-A118 | Ta=130°C ,85% RH<br>Duration= 96hrs<br><br>☒ After PC | 4 | 77 | 308 | Lot1: 0/77<br>Lot2: 0/77<br>Lot3: 0/77<br>Lot4: 0/77 | |
| HTSL | JESD 22-A103 | Ta=150°C,<br>Duration= 1000hrs<br><br>☒ After PC | 4 | 77 | 308 | Lot1: 0/77<br>Lot2: 0/77<br>Lot3: 0/77<br>Lot4: 0/77 | |
| AC | JESD 22-A102 | 168h (121°C/100%RH), 2Atm<br><br>☒ After PC | 4 | 77 | 308 | Lot1: 0/77<br>Lot2: 0/77<br>Lot3: 0/77<br>Lot4: 0/77 | |
| bHAST | JESD 22-A110 | 264h (110°C/85%RH), 2Atm<br><br>☒ After PC | 1 | 77 | 77 | Lot 4: 0/77 | |

Note: Test method revision reference is the one active at the date of reliability trial execution

Table 7 - PACKAGE ASSEMBLY INTEGRITY TESTS

| Test code | Method | Tests Conditions | Lots | S.S. | Total | Results/Lot Fail/S.S. | Comments: (N/A =Not Applicable) |
|---|---|---|---|---|---|---|---|
| CA | Construction Analysis including<br>-Wire bond shear<br>-Wire bond pull | ST internal specifications | 4 | 50 | 150 | Lot1: 0/50<br>Lot2: 0/50<br>Lot3: 0/50<br>Lot4 :0/50 | CA-04-0120<br>CA-05-0120<br>CA-03-0120<br>CA-28-0720 |

# 4 APPLICABLE AND REFERENCE DOCUMENTS

| Reference | Short description |
|---|---|
| JESD47 | Stress-Test-Driven Qualification of Integrated Circuits |
| SOP2.4.4 | Record Management Procedure |
| SOP2.6.2 | Internal Change Management |
| SOP2.6.7 | Finished Good Maturity Management |
| SOP2.6.9 | Package & Process Maturity Management in BE |
| SOP2.6.11 | Program Management for Product Development |
| SOP2.6.17 | Management of Manufacturing Transfers |
| SOP2.6.19 | Front-End Technology Platform Development and Qualification |
| DMS 0061692 | Reliability Tests and Criteria for Product Qualification |
| ANSI/ESD STM5.3.1 | Electrostatic discharge (ESD) sensitivity testing charge device model (CDM) |
| JESD 22-A108 | Temperature, Bias and Operating Life |
| JESD 22-A103 | High Temperature Storage Life |
| J-STD-020 | Moisture/reflow sensitivity classification for non-hermetic solid state surface mount devices |
| JESD22-A113 | Preconditioning of non-hermetic surface mount devices prior to reliability testing |
| JESD22-A118 | Unbiased Highly Accelerated temperature & humidity Stress Test |
| JESD22-A104 | Temperature cycling |
| JESD22-A101 | Temperature Humidity Bake |
| JESD 22-A102 | Autoclave |
| JESD 22-A110 | Biased Highly Accelerated temperature & humidity Stress Test |

# 5 GLOSSARY

| Reference | Short description |
|---|---|
| PC | Preconditioning (solder simulation) |
| THB | Temperature Humidity Bias |
| TC | Temperature cycling |
| uHAST | Unbiased Highly Accelerated Stress Test |
| HTSL | High temperature storage life |
| AC | Autoclave |
| ESD CDM | Electrostatic discharge (charge device model) |
| CA | Construction Analysis |

# 6 REVISION HISTORY

| Revision | Author | Content description | Approval List | | | |
|---|---|---|---|---|---|---|
| | | | Function | Location | Name | Date |
| 1.0 | Céline Navarro / Bambang Redjeki SIE | Initial release | Division Q&R Responsible | RSST | Pascal NARCHE | November 2nd, 2020 |
| | | | Division Quality Manager | RSST | Gisele SEUBE | November 2nd, 2020 |