

PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data

| | | |
|----------------------|---|--|
| 1.1 Company |  | STMicroelectronics International N.V |
| 1.2 PCN No. | | AMS/20/12147 |
| 1.3 Title of PCN | | Introduction of a new Assembly and Test location (Subcontractor TSHT China) for products assembled in SOT23 5L package |
| 1.4 Product Category | | See product list |
| 1.5 Issue date | | 2020-05-27 |

2. PCN Team

| | |
|---------------------------|--------------------------|
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| 2.1.2 Phone | +1 8475853058 |
| 2.1.3 Email | heather.robertson@st.com |
| 2.2 Change responsibility | |
| 2.2.1 Product Manager | Marcello SAN BIAGIO |
| 2.1.2 Marketing Manager | Salvatore DI VINCENZO |
| 2.1.3 Quality Manager | Giuseppe LISI |

3. Change

| 3.1 Category | 3.2 Type of change | 3.3 Manufacturing Location |
|--------------|---|--|
| Transfer | Line transfer for a full process or process brick (process step, control plan, recipes) from one site to another site: Assembly site (SOP 2617) | Assembly and Test Plant : - Carsem (Malaysia) - TSHT (China) |

4. Description of change

| | Old | New |
|---|--|--|
| 4.1 Description | Assembly and Test Plant : - Carsem (Malaysia) | Assembly and Test Plant : - Carsem (Malaysia) - TSHT (China) |
| 4.2 Anticipated Impact on form,fit, function, quality, reliability or processability? | No impact | |

5. Reason / motivation for change

| | |
|----------------------|--|
| 5.1 Motivation | We released in 2017 the PCN 10331 and 10454 to announce the qualification of our subcontractor TSHT for the assembly of selected products in SOT23 5. This new PCN is just to enlarge the list of impacted products. |
| 5.2 Customer Benefit | CAPACITY INCREASE |

6. Marking of parts / traceability of change

| | |
|-----------------|-------------------------|
| 6.1 Description | New Finished good codes |
|-----------------|-------------------------|

7. Timing / schedule

| | |
|-------------------------------------|--------------|
| 7.1 Date of qualification results | 2020-04-30 |
| 7.2 Intended start of delivery | 2020-08-31 |
| 7.3 Qualification sample available? | Upon Request |

8. Qualification / Validation

| | | | |
|--|---|------------|------------|
| 8.1 Description | 12147 standard-Sot23 TSHT additional lines_.pdf | | |
| 8.2 Qualification report and qualification results | Available (see attachment) | Issue Date | 2020-05-27 |

9. Attachments (additional documentations)

12147 Public product.pdf

12147 standard-Sot23 TSHT additional lines_.pdf

10. Affected parts

| 10. 1 Current | | 10.2 New (if applicable) |
|--------------------------------|--------------------------------|---------------------------------|
| 10.1.1 Customer Part No | 10.1.2 Supplier Part No | 10.1.2 Supplier Part No |
| LD2985BM25R | LD2985BM25R | |
| LD2985BM28R | LD2985BM28R | |
| LD2985BM30R | LD2985BM30R | |
| | LD2985BM31R | |
| LD2985BM33R | LD2985BM33R | |
| LD2985BM50R | LD2985BM50R | |
| | LDK220M-R | |
| | LDK220M25R | |
| | LDK220M27R | |
| | LDK220M30R | |
| | LDK220M32R | |
| | LDK220M33R | |
| | LDK220M36R | |
| | LDK220M40R | |
| | LDK220M50R | |
| | LDK320AM-R | |
| | LDK320AM120R | |
| | LDK320AM15R | |
| | LDK320AM25R | |
| | LDK320AM30R | |
| | LDK320AM33R | |
| | LDK320AM36R | |
| | LDK320AM50R | |
| | LDK320M-R | |
| | LDK320M18R | |
| | LDK320M30R | |
| | LDK320M33R | |
| | LDK320M50R | |
| LK112M15TR | LK112M15TR | |
| LK112M18TR | LK112M18TR | |
| LK112M25TR | LK112M25TR | |
| LK112M33TR | LK112M33TR | |
| LK112M50TR | LK112M50TR | |
| LK112M60TR | LK112M60TR | |
| LK112M80TR | LK112M80TR | |
| LK112SM18TR | LK112SM18TR | |
| LK112SM33TR | LK112SM33TR | |
| LK112SM50TR | LK112SM50TR | |

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Public Products List

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PCN Title : Introduction of a new Assembly and Test location (Subcontractor TSHT China) for products assembled in SOT23 5L package

PCN Reference : AMS/20/12147

Subject : Public Products List

Dear Customer,

Please find below the Standard Public Products List impacted by the change.

| | | |
|-------------|--------------|-------------|
| LK112M80TR | LDK320M25R | LDK320AM15R |
| LK112M33TR | LDK220M-R | LDK320AM36R |
| LD2985BM25R | LK112M15TR | LDK320AM50R |
| LD2985BM18R | LK112M60TR | LDK320M-R |
| LK112M25TR | LD2985BM28R | LDK220M33R |
| LK112SM50TR | LD2985BM33R | LK112SM18TR |
| LDK220M30R | LDK220M40R | LDK320AM30R |
| LD2985BM30R | LD2985BM50R | LD2985BM31R |
| LDK220M36R | LDK320AM25R | LDK320M18R |
| LK112SM33TR | LDK320AM120R | LDK320M30R |
| LDK320AM-R | LK112M18TR | LDK320M33R |
| LDK220M25R | LDK220M27R | LK112M50TR |
| LDK220M32R | LDK320AM33R | LDK320M50R |
| LDK220M50R | | |



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**PRODUCT/PROCESS
CHANGE NOTIFICATION**

PCN AMS/20/12147

Analog, MEMS & Sensors (AMS)

**Introduction of a new Assembly and Test location
(TSHT China) for products assembled in SOT23 5L package**

WHAT:

Progressing on activities related to process modernization and quality improvement, ST is pleased to announce the introduction of TSHT/China as an added subcontractor for Assy and Test & Finishing activities for some products assembled in our SOT23 5L package. **We already released in July 2017 the PCN10331 and 10454 announcing this new plant.** This new PCN is just to enlarge the list of impacted products.

The list of test vehicles used for the validation is listed here below.

| Commercial Product | Current Finished Good | Current Assy & TnF Plant | Added Finished Good | Added Assy & TnF Plant |
|--------------------|-----------------------|--------------------------|---------------------|------------------------|
| LD2981CM33TR | LD2981CM33TR\$2V | Carsem | LD2981CM33TR\$1R | TSHT |
| LDK120M-R | LDK120M-R\$3V | Carsem | LDK120M-R\$1R | TSHT |

Dedicated engineering trials and test vehicles have been defined to validate the change.

WHY:

The purpose of the introduction of TSHT for both Assy and Test & Finishing activities for the here above listed commercial products is to further improve the rationalization of our manufacturing assets and provide a better support to our customers by enhancing the manufacturing process for higher volume production.

HOW:

- The qualification is based on Test vehicle representatives by using internal ST rule for changes.

WHEN:

The transfer set will be implemented in Q2/2020 in TSHT.

Marking and traceability:

Unless otherwise stated by customer's specific requirement, the traceability of the parts assembled with the new material set will be ensured by new internal sales type, date code and lot number.

The changes here reported will not affect the electrical, dimensional and thermal parameters keeping unchanged all the information reported on the relevant datasheets.

There is -as well- no change in the packing process or in the standard delivery quantities. Shipments may start earlier with the customer's written agreement.

Reliability Qualification plan

New Subcontractor

SOT23 in SC-Tianshui Huatian-China (TSHT)

TVs: LDK120 (UI69) & LD2981(KR33)

| General Information | | Locations | |
|-----------------------------------|---|------------------------|---|
| Product Lines | UI69 | Wafer fab | CTM8 |
| Product Description | 200 mA low quiescent current very low noise LDO | Assembly plant | <i>SC-Tianshui Huatian-China (TSHT)</i> |
| P/N | LDK120M-R\$4V | | |
| Product Group | AMG (Analog & MEMS Group) | | |
| Product division | General Purpose Analog & RF Division | Reliability Lab | <i>Catania Reliability LAB</i> |
| Package | POWER MANAGEMENT | | |
| Silicon Process technology | SOT23 5L - 1.0mil Pd-Cu | | |
| | BCD6S | | |

| General Information | | Locations | |
|-----------------------------------|--------------------------------------|------------------------|---|
| Product Lines | KR33 | Wafer fab | Singapore 6 |
| Product Description | Very Low Drop VREG @ 100mA 3.3 V | Assembly plant | <i>SC-Tianshui Huatian-China (TSHT)</i> |
| P/N | LD2981ABM33TR\$3V | | |
| Product Group | AMG (Analog & MEMS Group) | | |
| Product division | General Purpose Analog & RF Division | Reliability Lab | <i>Catania Reliability LAB</i> |
| Package | POWER MANAGEMENT | | |
| Silicon Process technology | SOT23 5L - 1.0mil Pd-Cu | | |
| | BI20II | | |

DOCUMENT INFORMATION

| Version | Date | Pages | Prepared by | Approved by | Comment |
|---------|----------|-------|-----------------|-----------------|--------------|
| 1.0 | Jun-2017 | 7 | Giuseppe Failla | Giovanni Presti | Final Report |

Note: This report is a summary of the reliability trials performed in good faith by STMicroelectronics in order to evaluate the potential reliability risks during the product life using a set of defined test methods.

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1 APPLICABLE AND REFERENCE DOCUMENTS

| Document reference | Short description |
|--------------------|---|
| JESD47 | Stress-Test-Driven Qualification of Integrated Circuits |

2 GLOSSARY

| | |
|------------|-----------------------|
| DUT | Device Under Test |
| PCB | Printed Circuit Board |
| SS | Sample Size |
| | |

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

To qualify the SOT23 in the subcontractor SC-Tianshui Huatian-China (TSHT)
In order to cover the FE/BE compatibility two TVs in different technologies have been chosen:

- TV1: LDK120M-R\$4V (UI69) diffused in BCD6S
- TV2: LD2981ABM33TR\$3V (KR33) diffused in BI20II.

BE Process

To be qualified

3 different Lots + 2 different BE CLs for each Test Vehicle are requested

3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception. It is stressed that reliability tests have shown that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests demonstrates the ruggedness of the products and safe operation, which is consequently expected during their lifetime

4 DEVICE CHARACTERISTICS

4.1 Device description

- ❖ The LDK120 low drop voltage regulator provides 200 mA of maximum current from an input supply voltage in the range of 1.9 V to 5.5 V, with a typical dropout voltage of 100 mV. It is stabilized with a ceramic capacitor on the output. The very low drop voltage, low quiescent current and low noise features make it suitable for low power battery powered applications. An enable logic control function puts the LDK120 in shutdown mode allowing a total current consumption lower than 1 μ A. The device also includes a short-circuit constant current limiting and thermal protection.
- ❖ The LD2981 is a 100 mA fixed-output voltage regulator. The low-drop voltage and the ultra low quiescent current make them suitable for low noise, low power applications and in battery powered systems. The quiescent current in sleep mode is less than 1 μ A when INHIBIT pin is pulled low. Shutdown logic control function is available on pin n° 3 (TTL compatible). This means that when the device is used as local regulator, it is possible to put a part of the board in standby, decreasing the total power consumption. The LD2981 is designed to work with low ESR ceramic capacitor. Typical applications are in cellular phone, palmtop/laptop computer, personal digital assistant (PDA), personal stereo, camcorder and camera.

4.2 Construction note

| | LDK120M-R\$4V (UI69) | LD2981ABM33TR\$3V (KR33) |
|-----------------------------------|----------------------------------|--------------------------------|
| Wafer/Die fab. information | | |
| Wafer fab manufacturing location | CT8 | AMK6 |
| Technology | BCD6S | BI20II |
| Die finishing back side | RAW SILICON | LAPPED SILICON |
| Die size | 782 x 736 um | 1470 x 990 um |
| Bond pad metallization layers | Ti/AlCu/TiNARC | AISi |
| Passivation type | TEOS/SiN/Polyimide | P-Vapox/Nitride/Polyimide(PIQ) |
| Assembly information | | |
| Assembly site | SC-Tianshui Huatian-China (TSHT) | |
| Package description | SOT 23 5L | |
| Molding compound | Epoxy | |
| Frame | SOT235 A194 (52X72) -16P | |
| Die attach process | GLUE | |
| Wires bonding materials/diameters | 1.0mil Pd Cu | |
| Lead finishing process | Pure Tin Plating Sn 100% | |

5 TESTS PLAN SUMMARY

5.1 Test plan and results summary

TV1: LDK120M-R\$4V (UI69)

| Test | PC | Std ref. | Conditions | Steps | SS | | | | |
|-----------------------------------|----|-----------------|---|-------|--------------------------------|-------|-------|----------|----------|
| | | | | | Lot 1 | Lot 2 | Lot 3 | Lot 1-CL | Lot 1-CL |
| Die Oriented Tests (*) | | | | | | | | | |
| HTOL | | JESD22 A-108 | T _j = 125°C, V = V _{bias} +7V | | 168 H | 0/77 | | | |
| | | | | | 500 H | 0/77 | | | |
| | | | | | 1000 H | 0/77 | | | |
| HTSL | | JESD22 A-103 | T _a = 150°C | | 168 H | 0/25 | 0/25 | 0/25 | 0/25 |
| | | | | | 500 H | 0/25 | 0/25 | 0/25 | 0/25 |
| | | | | | 1000 H | 0/25 | 0/25 | 0/25 | 0/25 |
| Package Oriented Tests (*) | | | | | | | | | |
| PC | | JESD22 A-113 | Drying 24 H @ 125°C Store 168 H @ T _a =85°C Rh=85% Oven Reflow @ Tpeak=260°C 3 times | | Final | pass | pass | pass | pass |
| | | | | | | | | | |
| AC | Y | JESD22 A-102 | Pa=2Atm / T _a =121°C | | 96 h | 0/25 | 0/25 | 0/25 | |
| TC | Y | JESD22 A-104 | T _a = -65°C to 150°C | | 100cy | 0/25 | 0/25 | 0/25 | 0/25 |
| | | | | | 200cy | 0/25 | 0/25 | 0/25 | 0/25 |
| | | | | | 500 cy | 0/25 | 0/25 | 0/25 | 0/25 |
| THB | Y | JESD22 A-101 | T _a = 85°C, RH = 85%, Bias +5,5V | | 168 H | 0/25 | 0/25 | 0/25 | |
| | | | | | 500 H | 0/25 | 0/25 | 0/25 | |
| | | | | | 1000 H | 0/25 | 0/25 | 0/25 | |
| Other Tests | | | | | | | | | |
| ESD | | JESD22-C101 | CDM | | 500V 750V corner pins | Pass | | | |
| | | | | | | | | | |
| CA | | | Construction Analysis | | | Pass | | | |

Note (*) All samples have been assembled on dedicated PCB in agreement with JEDEC020 spec.

TV2: LD2981ABM33TR\$3V (KR33)

| Test | PC | Std ref. | Conditions | Steps | SS | | | | |
|-------------------------------|----|-----------------|---|-------|--------------------------------|-------|-------|----------|----------|
| | | | | | Lot 4 | Lot 5 | Lot 6 | Lot 4-CL | Lot 4-CL |
| Die Oriented Tests | | | | | | | | | |
| HTOL | | JESD22 A-108 | T _j = 125°C, V = V _{bias} +20V | | 168 H | 0/77 | | | |
| | | | | | 500 H | 0/77 | | | |
| | | | | | 1000 H | 0/77 | | | |
| HTSL | | JESD22 A-103 | T _a = 150°C | | 168 H | 0/25 | 0/25 | 0/25 | 0/25 |
| | | | | | 500 H | 0/25 | 0/25 | 0/25 | 0/25 |
| | | | | | 1000 H | 0/25 | 0/25 | 0/25 | 0/25 |
| Package Oriented Tests | | | | | | | | | |
| PC | | JESD22 A-113 | Drying 24 H @ 125°C Store 168 H @ T _a =85°C Rh=85% Oven Reflow @ Tpeak=260°C 3 times | | Final | pass | pass | pass | pass |
| | | | | | | | | | |
| AC | Y | JESD22 A-102 | Pa=2Atm / T _a =121°C | | 96 h | 0/25 | 0/25 | 0/25 | |
| TC | Y | JESD22 A-104 | T _a = -65°C to 150°C | | 100cy | 0/25 | 0/25 | 0/25 | 0/25 |
| | | | | | 200cy | 0/25 | 0/25 | 0/25 | 0/25 |
| | | | | | 500 cy | 0/25 | 0/25 | 0/25 | 0/25 |
| THB | Y | JESD22 A-101 | T _a = 85°C, RH = 85%, Bias +16V | | 168 H | 0/25 | 0/25 | 0/25 | |
| | | | | | 500 H | 0/25 | 0/25 | 0/25 | |
| | | | | | 1000 H | 0/25 | 0/25 | 0/25 | |
| Other Tests | | | | | | | | | |
| ESD | | JESD22-C101 | CDM | | 500V 750V corner pins | Pass | | | |
| | | | | | | | | | |

Note:

6 ANNEXES

6.1 Tests Description

| Test name | Description | Purpose |
|--|--|---|
| Die Oriented | | |
| HTOL High Temperature Operating Life | The device is stressed in static or dynamic configuration, approaching the operative max. absolute ratings in terms of junction temperature and bias condition. | To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way. The typical failure modes are related to, silicon degradation, wire-bonds degradation, oxide faults. |
| HTB High Temperature Bias | | |
| HTRB High Temperature Reverse Bias | The device is stressed in static configuration, trying to satisfy as much as possible the following conditions: low power dissipation; max. supply voltage compatible with diffusion process and internal circuitry limitations; | To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way. |
| HTFB / HTGB High Temperature Forward (Gate) Bias | | To maximize the electrical field across either reverse-biased junctions or dielectric layers, in order to investigate the failure modes linked to mobile contamination, oxide ageing, layout sensitivity to surface effects. |
| HTSL High Temperature Storage Life | The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature. | To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding. |
| ELFR Early Life Failure Rate | The device is stressed in biased conditions at the max junction temperature. | To evaluate the defects inducing failure in early life. |
| Package Oriented | | |
| PC Preconditioning | The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption. | As stand-alone test: to investigate the moisture sensitivity level. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop corn" effect and delamination. |
| AC Auto Clave (Pressure Pot) | The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature. | To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity. |
| TC Temperature Cycling | The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere. | To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation. |

| Test name | Description | Purpose |
|--|---|---|
| TF / IOL Thermal Fatigue / Intermittent Operating Life | The device is submitted to cycled temperature excursions generated by power cycles (ON/OFF) at T ambient. | To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation. |
| THB Temperature Humidity Bias | The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambient temperature and relative humidity. | To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence. |
| Other | | |
| ESD Electro Static Discharge | The device is submitted to a high voltage peak on all his pins simulating ESD stress according to different simulation models. CBM: Charged Device Model HBM: Human Body Model MM: Machine Model | To classify the device according to his susceptibility to damage or degradation by exposure to electrostatic discharge. |
| LU Latch-Up | The device is submitted to a direct current forced/sunk into the input/output pins. Removing the direct current no change in the supply current must be observed. | To verify the presence of bulk parasitic effect inducing latch-up. |