# PRODUCT / PROCESS CHANGE NOTIFICATION

| 1. PCN basic data | |
|---|---|
| 1.1 Company | STMicroelectronics International N.V |
| 1.2 PCN No. | POWER AND DISCRETE PRODUCTS/24/14700 |
| 1.3 Title of PCN | Transfer of Assembly and Test line for TVS products housed in SMA & SMB packages |
| 1.4 Product Category | SMAJxxx<br>SM6Txxx<br>SMBJxxx |
| 1.5 Issue date | 2024-04-15 |

| 2. PCN Team | |
|---|---|
| 2.1 Contact supplier | |
| 2.1.1 Name | PIKE EMMA |
| 2.1.2 Phone | +44 1628896111 |
| 2.1.3 Email | emma.pike@st.com |
| 2.2 Change responsibility | |
| 2.2.1 Product Manager | Stephane CHAMARD |
| 2.1.2 Marketing Manager | Philippe LEGER |
| 2.1.3 Quality Manager | Jean-Paul REBRASSE |

| 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: Wafer fabrication (SOP 2617) | Same subcontractor in China (same city) |

| 4. Description of change | | |
|---|---|---|
| | Old | New |
| 4.1 Description | Subcontractor A - Plant 1 in China | Subcontractor A - Plant 2 in China |
| 4.2 Anticipated Impact on form,fit, function, quality, reliability or processability? | No | |

| 5. Reason / motivation for change | |
|---|---|
| 5.1 Motivation | Due to plant rationalization at subcontractor level, STMicroelectronics started new plant qualification to support TVS products business continuity. |
| 5.2 Customer Benefit | SERVICE CONTINUITY |

| 6. Marking of parts / traceability of change | |
|---|---|
| 6.1 Description | New Finished Good/Type (ending by /HR) print on carton labels |

| 7. Timing / schedule | |
|---|---|
| 7.1 Date of qualification results | 2024-04-12 |
| 7.2 Intended start of delivery | 2024-07-19 |
| 7.3 Qualification sample available? | Upon Request |

| 8. Qualification / Validation | | | |
|---|---|---|---|
| 8.1 Description | 14700 24014QRP.pdf | | |
| 8.2 Qualification report and qualification results | Available (see attachment) | Issue Date | 2024-04-15 |

| 9. Attachments (additional documentations) |
|---|
| 14700 Public product.pdf<br>14700 PCN TVS plant transfer at subco.pdf<br>14700 24014QRP.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 |
| | SM6T15CA | |
| | SM6T18A | |
| | SM6T18CA | |
| | SM6T24CA | |
| | SM6T33A | |
| | SM6T33CA | |
| | SMAJ15CA-TR | |
| | SMAJ24A-TR | |
| | SMAJ43CA-TR | |
| | SMBJ15A-TR | |
| | SMBJ20CA-TR | |
| | SMBJ22A-TR | |
| | SMBJ28A-TR | |
| | SMBJ30A-TR | |
| | SMBJ30CA-TR | |
| | SMBJ33CA-TR | |
| | SMBJ48CA-TR | |
| | SMBJ18A-TR | |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

Subject to any contractual arrangement in force with you or to any industry standard implemented by us, STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

# Public Products List

Publict Products are off the shelf products. They are not dedicated to specific customers, they are available through ST Sales team, or Distributors, and visible on ST.com

***PCN Title :*** Transfer of Assembly and Test line for TVS products
housed in SMA & SMB packages
***PCN Reference :*** POWER AND DISCRETE PRODUCTS/24/14700

***Subject :*** Public Products List

Dear Customer,

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

| | | |
|---|---|---|
| SMBJ16A-TR | SMBJ13CA-TR | SMAJ26CA-TR |
| SMAJ28A-TR | SMAJ18A-TR | SM6T30A |
| SMBJ22A-TR | SM6T22CA | SMBJ26A-TR |
| SMAJ15CA-TR | SMBJ12CA-TR | SM6T33CA |
| SMBJ15A-TR | SMAJ24CA-TR | SM6T22A |
| SMAJ13CA-TR | SMAJ18CA-TR | SMAJ26A-TR |
| SMBJ26CA-TR | SMBJ24A-TR | SM6T24CA |
| SMAJ33CA-TR | SMBJ36CA-TR | SMAJ28CA-TR |
| SMBJ22CA-TR | SMBJ30A-TR | SM6T39A |
| SM6T36CA | SMAJ48CA-TR | SM6T56CA |
| SMBJ12A-TR | SMAJ58CA-TR | SMAJ24A-TR |
| SMBJ24CA-TR | SM6T24A | SMAJ13A-TR |
| SM6T15A | SMBJ70CA-TR | SM6T68CA |
| SM6T27CA | SMAJ33A-TR | SMBJ18CA-TR |
| SMAJ12A-TR | SMBJ40CA-TR | SMBJ20A-TR |
| SM6T36A | SMBJ30CA-TR | SM6T27A |
| SM6T18CA | SMBJ48CA-TR | SMBJ28CA-TR |
| SMAJ43CA-TR | SMBJ20CA-TR | SM6T39CA |
| SMBJ58CA-TR | SM6T18A | SMAJ20A-TR |
| SMAJ15A-TR | SMAJ12CA-TR | SMAJ70CA-TR |
| SMAJ30A-TR | SM6T33A | SMBJ33A-TR |
| SMBJ15CA-TR | SM6T15CA | SMBJ33CA-TR |
| SMAJ30CA-TR | SMAJ40CA-TR | SMBJ18A-TR |
| SM6T30CA | SMBJ28A-TR | |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

Subject to any contractual arrangement in force with you or to any industry standard implemented by us, STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

# Qualification Report
## *Plant transfer for TVS (SMA and SMB packages)*

| General Information | |
|---|---|
| **Product Line** | *Protection* |
| **Product Description** | *Industrial TVS products SMA and SMB packages* |
| **Product Perimeter** | SMAJxxx<br>SM6Txxx<br>SMBJxxx |
| **Product Group** | *APMS* |
| **Product Division** | *Discrete & Filter* |
| **Packages** | *SMA - SMB* |
| **Maturity level step** | *Qualified* |

| Locations | |
|---|---|
| **Wafer Fab** | *ST Tours (France)* |
| **Assembly Plant** | *Subcontractor (990C) - China* |
| **Reliability Lab** | *ST Tours (France)* |
| **Reliability Assessment** | *Compliant* |

### DOCUMENT INFORMATION

| Version | Date | Pages | Prepared by | Approved by | Comments |
|---|---|---|---|---|---|
| 1.0 | April 12, 2024 | 20 | A. KHEDIM | Timothée PINGAULT Digitally signed by Timothée PINGAULT Date: 2024.04.12 14:27:06 +02'00' | Document creation |

Note: This report is a summary of the qualification trials performed in good faith by STMicroelectronics in order to evaluate the potential risks during the product life using a set of defined test methods.
This report does not imply for STMicroelectronics expressly or implicitly any contractual obligations other than as set forth in STMicroelectronics general terms and conditions of Sale. This report and its contents shall not be disclosed to a third party without previous written agreement from STMicroelectronics.

## TABLE OF CONTENTS

# 1 APPLICABLE AND REFERENCE DOCUMENTS

| Document reference | Short description |
|---|---|
| **JESD 47** | Stress-Test-Driven Qualification of Integrated Circuits |
| **JESD 94** | Application specific qualification using knowledge based test methodology |
| **JESD 22** | Reliability test methods for packaged devices |
| **MIL-STD-750C** | Test method for semiconductor devices |

# 2 GLOSSARY

| | |
|---|---|
| **DBT** | Dead bug test |
| **DPA** | Destructive Physical Analysis |
| **GD** | Generic Data |
| **H3TRB** | High Humidity High Temperature Reverse Bias |
| **HTRB** | High Temperature Reverse Bias |
| **PD** | Physical Dimensions |
| **PV** | Parametric Verification |
| **RS** | Repetitive Surges |
| **RSH** | Resistance to solder heat |
| **SD** | Solderability |
| **SS** | Sample Size |
| **TC** | Temperature Cycling |
| **UHAST** | Unbiased Highly Accelerated Stress Test |

# 3 RELIABILITY EVALUATION OVERVIEW

## 3.1 Objectives

Due to plant rationalization at subcontractor level, STMicroelectronics has qualified a new plant to support TVS products business continuity.

The objective is to qualify the plant transfer (same subcontractor, no change in BOM, lead frame, plating, resin nor tools) of SMA and SMB lines.
The impacted products are the following:

- 400W & 600W TVS embedded in SMA package,
- 600W TVS embedded in SMB package.

| Commercial Product | Package | Comment (optional) |
|---|---|---|
| SMAJxxx<br>SM6Txxx<br>SMBJxxx | SMA<br>SMA<br>SMB | Industrial grade |

| Impacted products | | |
|---|---|---|
| SMAJ12A | SM6T15A | SMBJ12A |
| SMAJ12CA | SM6T15CA | SMBJ12CA |
| SMAJ13A | SM6T18A | SMBJ13CA |
| SMAJ13CA | SM6T18CA | SMBJ15A |
| SMAJ15A | SM6T22A | SMBJ15CA |
| SMAJ15CA | SM6T22CA | SMBJ16A |
| SMAJ18A | SM6T24A | SMBJ18A |
| SMAJ18CA | SM6T24CA | SMBJ18CA |
| SMAJ20A | SM6T27A | SMBJ20A |
| SMAJ24A | SM6T27CA | SMBJ20CA |
| SMAJ24CA | SM6T30A | SMBJ22ATR |
| SMAJ26A | SM6T30CA | SMBJ22CA |
| SMAJ26CA | SM6T33A | SMBJ24A |
| SMAJ28A | SM6T33CA | SMBJ24CA |
| SMAJ28CA | SM6T36A | SMBJ26A |
| SMAJ30A | SM6T36CA | SMBJ26CA |
| SMAJ30CA | SM6T39A | SMBJ28A |
| SMAJ33A | SM6T39CA | SMBJ28CA |
| SMAJ33CA | SM6T56CA | SMBJ30A |
| SMAJ40CA | SM6T68CA | SMBJ30CA |
| SMAJ43CA | | SMBJ33A |
| SMAJ48CA | | SMBJ33CA |
| SMAJ58CA | | SMBJ36CA |
| SMAJ70CA | | SMBJ40CA |
| | | SMBJ48CA |
| | | SMBJ58CA |
| | | SMBJ70CA |

The reliability test methodology used follows the JESD47: “Stress Test driven Qualification Methodology”.

The reliability tests ensuing are:

.

- TC to ensure the mechanical robustness of the products.
- HTRB to evaluate the risk of contamination from the resin and the assembly process versus the die layout sensitivity.
- H3TRB, UHAST to check the robustness to corrosion and the good package hermeticity.
- RSH, Solderability and DBT to check compatibility of package with customer assembly.
- Functional test: Repetitive IPP to verify robustness of device submitted to rated Ipp (as per data sheet)

For some tests, similarity methodology is used. See 5.1 “comments” for more details about similarities.

### 3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception. 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 robustness of the products and safe operation, which is consequently expected during their lifetime.

Based on these results, TVS in SMD packages are compliant with JESD47.

# 4 DEVICE CHARACTERISTICS

## 4.1 Device description

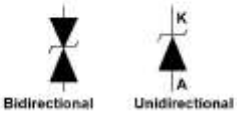
Example datasheet of TVS SMA package (SMAJ70CA)

life.augmented

**SMAJxxA, SMAJxxCA**

Datasheet

400 W TVS in SMA


**Product status links**

SMAJ5.0A, SMAJ5.0CA,
SMAJ6.0A, SMAJ6.0CA,
SMAJ6.5A, SMAJ6.5CA,
SMAJ8.5A, SMAJ8.5CA,
SMAJ10A, SMAJ10CA,
SMAJ12A, SMAJ12CA,
SMAJ13A, SMAJ13CA,
SMAJ15A, SMAJ15CA,
SMAJ18A, SMAJ18CA,
SMAJ20A, SMAJ20CA,
SMAJ24A, SMAJ24CA,
SMAJ26A, SMAJ26CA,
SMAJ28A, SMAJ28CA
SMAJ30A, SMAJ30CA,
SMAJ33A, SMAJ33CA
SMAJ40A, SMAJ40CA,
SMAJ43A, SMAJ43CA,
SMAJ48A, SMAJ48CA
SMAJ58A, SMAJ58CA,
SMAJ70A, SMAJ70CA,
SMAJ85A, SMAJ85CA,
SMAJ100A, SMAJ100CA,
SMAJ130A, SMAJ130CA,
SMAJ154A, SMAJ154CA,
SMAJ170A, SMAJ170A,
SMAJ188A, SMAJ188CA

### Features

- Peak pulse power:
  - 400 W (10/1000 µs)
  - 2.3 kW (8/20 µs)
- Stand-off voltage range from 5 V to 188 V
- Unidirectional and bidirectional types
- Low leakage current:
  - 0.2 µA at 25 °C
  - 1 µA at 85 °C
- Operating $T_J$ max: 150 °C
- JEDEC registered package outline

### Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026 solderable matte tin plated leads
- JESD-201 class 2 whisker test
- IPC7531 footprint
- JEDEC registered package outline
- IEC 61000-4-4 level 4:
  - 4 kV
- IEC 61000-4-2, C = 150 pF - R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)

### Description

The SMAJ series is designed to protect sensitive equipment against electrostatic discharges according to IEC 61000-4-2 and MIL STD 883, method 3015, and electrical overstress according to IEC 61000-4-4 and 5. This device is more generally used against surges below 600 W (10/1000 µs).

The Planar technology makes it compatible with high-end circuits where low leakage current and high junction temperature are required to provide long term reliability and stability. SMAJ devices are packaged in SMA (SMA footprint in accordance with IPC 7531 standard).

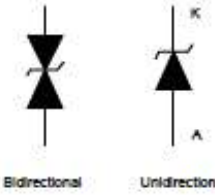
Example datasheet of TVS SMB package (SMBJ33A)

life.augmented

# SMBJ

Datasheet

## 600 W TVS in SMB


| Product status link | |
|---|---|
| SMBJ | SMBJ5.0A, SMBJ5.0CA, SMBJ6.0A, SMBJ6.0CA, SMBJ6.5A, SMBJ6.5CA, SMBJ8.5A, SMBJ8.5CA, SMBJ10A, SMBJ10CA, SMBJ12A, SMBJ12CA, SMBJ13A, SMBJ13CA, SMBJ15A, SMBJ15CA, SMBJ16A, SMBJ16CA, SMBJ18A, SMBJ18CA, SMBJ20A, SMBJ20CA, SMBJ22A, SMBJ22CA, SMBJ24A, SMBJ24CA, SMBJ26A, SMBJ26CA, SMBJ28A, SMBJ28CA, SMBJ30A, SMBJ30CA, SMBJ33A, SMBJ33CA, SMBJ36A, SMBJ36CA, SMBJ40A, SMBJ40CA, SMBJ43A, SMBJ43CA, SMBJ48A, SMBJ48CA, SMBJ58A, SMBJ58CA, SMBJ64A, SMBJ64CA, SMBJ70A, SMBJ70CA, SMBJ85A, SMBJ85CA, SMBJ100A, SMBJ100CA, SMBJ130A, SMBJ130CA, SMBJ154A, SMBJ154CA, SMBJ170A, SMBJ170CA, SMBJ188A, SMBJ188CA |

### Features

- Peak pulse power: 600 W (10/1000 µs) and 4 kW (8/20 µs)
- Stand-off voltage range from 5 V to 188 V
- Unidirectional and bidirectional types
- Low leakage current: 0.2 µA at 25 °C and 1 µA at 85 °C
- Operating $T_j$ max: 150 °C
- High power capability at $T_j$ max.: up to 515 W (10/1000 µs)
- Lead finishing: matte tin plating

### Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026 solderable matte tin plated leads
- JESD-201 class 2 whisker test
- IPC7531 footprint
- JEDEC registered package outline
- IEC 61000-4-4 level 4:
  - 4 kV
- IEC 61000-4-2, C = 150 pF - R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)

### Description

The SMBJ series are designed to protect sensitive equipment against electrostatic discharges according to IEC 61000-4-2 and MIL STD 883, method 3015, and electrical overstress according to IEC 61000-4-4 and 5. This device is more generally used against surges below 600 W (10/1000 µs).

The Planar technology makes it suitable for high-end equipment and SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time.

The SMBJ series are packaged in SMB.

## 4.2 Construction Note

| | 400W, 600W TVS package SMA qualification |
|---|---|
| **Wafer/Die fab. information** | |
| Wafer fab manufacturing location | ST Tours - France |
| Technology / Process family | Discrete Transil |
| **Wafer Testing (EWS) information** | |
| Electrical testing manufacturing location | ST Tours - France |
| **Assembly information** | |
| Assembly site | Subcontractor (990C) - China |
| Package description | SMA |
| Molding compound | ECOPACK®2 molding compound |
| Lead finishing material | Lead free (pure Tin) |
| **Final testing information** | |
| Testing location | Subcontractor (990C) - China |

| | 600W TVS SMB qualification |
|---|---|
| **Wafer/Die fab. information** | |
| Wafer fab manufacturing location | ST Tours - France |
| Technology / Process family | Discrete Transil |
| **Wafer Testing (EWS) information** | |
| Electrical testing manufacturing location | ST Tours - France |
| **Assembly information** | |
| Assembly site | Subcontractor (990C) - China |
| Package description | SMB |
| Molding compound | ECOPACK®2 molding compound |
| Lead finishing material | Lead free (pure Tin) |
| **Final testing information** | |
| Testing location | Subcontractor (990C) - China |

# 5 TESTS PLAN AND RESULTS SUMMARY

## 5.1 Test vehicles

| Lot # | Finish Good | Package | Comments |
|---|---|---|---|
| Lot 1 | SMAJ70CA | SMA | Qualification lot |
| Lot 2 | SMBJ33A | SMB | Qualification lot |
| Lot 3 | SMBJ33A | SMB | Qualification lot |
| Lot 4 | SMBJ70CA | SMB | Qualification lot |
| Lot 5 | SMBJ70CA | SMB | Qualification lot |
| Lot 6 | SMAJ33A | SMA | Qualification lot |
| Lot 7 | SMAJ70CA | SMA | Qualification lot |
| Lot 8 | SMBJ33A | SMB | Qualification lot |

Detailed results in the chapter below will refer to these references.

## 5.2 Test plan

| Stress | Abrv | Reference | Lot | SS | Comments | Test plan |
|---|---|---|---|---|---|---|
| Pre and Post-Stress Electrical Test | TEST | User specification or supplier's standard Specification | All qualification parts tested per the requirements of the appropriate device specification. | | | |
| Pre-conditioning | PC | J-STD-020 JESD22-A113 | All qualification parts tested per the requirements of the appropriate device specification. | | As per targeted MSL Not applicable for PTH and WLCSP without coating | |
| MSL research | MSL | J-STD-020 | | | Not applicable for PTH and WLCSP without coating | |
| External Visual | EV | JESD22B-101 | All qualification parts tested per the requirements of the appropriate device specification. | | Done during Assembly → Test & Finish inspection | |
| Parametric Verification | PV | User specification | | | | |
| High Temperature Reverse Bias | HTRB | MIL-STD-750-1 M1038 Method A (for diodes, rectifiers and Zeners) M1039 Method A (for transistors) | Lot 1<br>Lot 2<br>Lot 3<br>Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 45<br>45<br>45<br>45<br>45<br>45<br>45<br>45 | | X |
| AC blocking voltage | ACBV | MIL-STD-750-1 M1040 Test condition A | | | Required for Thyristor only. Alternative to HTRB | |
| High Temperature Forward Bias | HTFB | JESD22 A-108 | | | Not required, applicable only to LEDS Alternative to HTRB | |
| High Temperature Operating Life | HTOL | | | | Covered by HTRB or ACBV | |
| Steady State Operational | SSOP | MIL-STD-750-1 M1038 Test condition B | | | Required for Voltage Regulator (Zener) only. | |
| High Temperature Gate Bias | HTGB | JESD 22A-108 | | | Required for Power MOSFET – IGBT only. | |
| High Temperature Storage Life | HTSL | JESD22 A-103 | | | Covered by H3TRB | |
| Temperature Humidity Storage | THS | JESD22 A-118 | | | Covered by H3TRB | |
| Temperature Cycling | TC | JESD22A-104 | Lot 1<br>Lot 2<br>Lot 3<br>Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 30<br>30<br>30<br>30<br>30<br>25<br>25<br>25 | | X |
| Temperature Cycling Hot Test | TCHT | JESD22A-104 | | | Required for Power MOSFET – IGBT only. | |
| Temperature Cycling Delamination Test | TCDT | JESD22A-104 J-STD-035 | | | Required for Power MOSFET – IGBT only. Alternative to TCHT | |
| Wire Bond Integrity | WBI | MIL-STD-750 Method 2037 | | | For dissimilar metal bonding systems only | |
| Unbiased Highly Accelerated Stress Test | UHAST | JESD22A-118 or A101 | Lot 1<br>Lot 2<br>Lot 3 | 77<br>77<br>77 | | X |

| Stress | Abrv | Reference | Lot | SS | Comments | Test plan |
|---|---|---|---|---|---|---|
| | | | Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 77<br>77<br>25<br>25<br>25 | | |
| Autoclave | AC | JESD22A-102 | | | Alternative to UHAST | |
| Highly Accelerated Stress Test | HAST | JESD22A-110 | | | Covered by H3TRB (same failure mechanisms activation). | |
| High Humidity High Temperature Reverse Bias | H3TRB | JESD22A-101 | Lot 1<br>Lot 2<br>Lot 3<br>Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 25<br>25<br>25<br>25<br>25<br>25<br>25<br>25 | Alternative to HAST | X |
| High Temperature High Humidity Bias | HTHH B | JED22A-101 | | | Not required, LED only | |
| Intermittent Operational Life / Thermal Fatigue | IOL | MIL-STD-750 Method 1037 | | | For power devices. Not required for Transient Voltage Suppressor (TVS) parts | |
| Power and Temperature Cycle | PTC | JED22A-105 | | | For power devices. Not required for Transient Voltage Suppressor (TVS) parts<br>Perform PTC if $\Delta Tj>100°C$ cannot be achieved with IOL<br>Alternative to IOL | |
| ESD Characterization | ESD HBM | AEC Q101-001 and 005 | | | | |
| ESD Characterization | ESD CDM | AEC Q101-001 and 005 | | | | |
| Destructive Physical Analysis | DPA | AEC-Q101-004 Section 4 | | | After H3TRB and TC | X |
| Physical Dimension | PD | JESD22B-100 | | | | |
| Terminal Strength | TS | MIL-STD-750 Method 2036 | | | Required for leaded parts only | |
| Resistance to Solvents | RTS | JESD22B-107 | | | Not applicable for Laser Marking | |
| Constant Acceleration | CA | MIL-STD-750 Method 2006 | | | Required for hermetic packaged parts only. | |
| Vibration Variable Frequency | VVF | JESD22B-103 | | | Required for hermetic packaged parts only. | |
| Mechanical Shock | MS | JESD22 B-104 | | | Required for hermetic packaged parts only. | |
| Hermeticity | HER | JESD22A-109 | | | Required for hermetic packaged parts only. | |
| Resistance to Solder Heat | RSH | JESD22 A-111 (SMD) | Lot 1<br>Lot 4<br>Lot 6<br>Lot 7 | 30<br>30<br>30 | | X |
| Solderability | SD | J-STD-002<br>JESD22B102 | Lot 5 | 4*15 | | X |
| Dead Bug Test | DBT | ST Internal specification | Lot 1<br>Lot 4 | 2*30<br>2*30 | | X |
| Thermal Resistance | TR | JESD24-3, 24-4, 24-6 as appropriate | | | Required in case of process change.<br>Not applicable to protection device as no limit specified in the datasheet | |

| Stress | Abrv | Reference | Lot | SS | Comments | Test plan |
|---|---|---|---|---|---|---|
| Wire Bond Strength | WBS | MIL-STD-750 Method 2037 | | | Covered during workability trials | |
| Bond Shear | BS | AEC-Q101-003 | | | Covered during workability trials | |
| Die Shear | DS | MIL-STD-750 Method 2017 | | | Not Applicable to parts with solder paste die attach | |
| Unclamped Inductive Switching | UIS | AEC-Q101-004 section 2 | | | Required for Power MOS and internally clamped IGBTs only | |
| Dielectric Integrity | DI | AEC-Q101-004 section 3 | | | Required for Power MOSFET – IGBT only. | |
| Short Circuit Reliability Characterization | SCR | AEC-Q101-006 | | | Required for smart power parts only | |
| Whisker Growth Evaluation | WG | AEC-Q005 JESD201 | | | | |
| Early Life Failure Rate | ELFR | JESD74 | | | Recommended for new techno development in case of identified failure mechanism | |
| Functional Test (in rush, di/dt,…) | FT | Internal specification | | | | |
| Repetitive Surge | RS | Internal specification | Lot 1<br>Lot 2<br>Lot 3<br>Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 20<br>20<br>20<br>20<br>20<br>20<br>20<br>20 | Required for protection devices only. | X |

| | | | | | | |
|---|---|---|---|---|---|---|
| Low Temperature Storage | LTS | JESD-22 A119: 209 | | | AQG324 test for Modules | |
| Thermal shock test | TST | JESD22-A104 | | | AQG324 test for Modules | |
| Power Cycling (seconds) | PCsec | MIL-STD750-1 Method1037 | | | AQG324 test for Modules | |
| Power Cycling (minutes) | PCmin | MIL-STD750-1 Method1037 | | | AQG324 test for Modules | |
| Mechanical shock | MS | IEC 600068-2-27 | | | AQG324 test for Modules | |
| Vibration | V | IEC60068-2-6 | | | AQG324 test for Modules | |

## 5.3 Results summary

| Test | PC | Std ref. | Conditions | Total | Steps | Results / Lot Fail/s.s. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SMAJ70CA | SMBJ33A | SMBJ33A | SMBJ70CA | SMBJ70CA | SMAJ33A | SMAJ70CA | SMBJ33A |
| | | | | | | Lot 1 | Lot 2 | Lot 3 | Lot 4 | Lot 5 | Lot 6 | Lot 7 | Lot 8 |
| **Pre-and Post Electrical Test** | - | ST datasheet | IR, VBR, VF parameters according to product datasheet | 1530 | - | 0/1530 | | | | | | | |
| **External Visual** | - | JESD22B-101 | All qualification parts submitted for testing passed External & Visual inspection during manufacturing process | | | | | | | | | | |
| **Parametric Verification** | - | ST datasheet | Over part temperature range (note1) | Refer to paragraph 6.1 in Annexes | | | | | | | | | |
| HTRB | N | MIL-STD-750-1 M1038 Method A | Junction Temperature=150°C Temperature=150°C Tension=Vrm | 315 | 1000h | 0/45 | 0/45 | 0/45 | 0/45 | | 0/45 | 0/45 | 0/45 |
| TC | Y | JESD22-A104 | Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-65°C | 300 | 500cy | 0/45 | 0/45 | 0/45 | 0/45 | 0/45 | 0/25 | 0/25 | 0/25 |
| RSH | N | JESD22A-111 (SMD) / JESD22B-106 (PTH) | Temperature=260°C Time (on)=10s | 120 | Measure after dipping | 0/30 | | | 0/30 | | 0/30 | 0/30 | |
| H3TRB | Y | JESD22-A101 | Humidity (HR)=85% Temperature=85°C Tension= Vrm (max 100V) | 175 | 1000h | 0/25 | 0/25 | 0/25 | 0/25 | | 0/25 | 0/25 | 0/25 |
| UHAST | Y | JESD22 A-118 | Humidity (HR)=85% Pressure=2.3bar Temperature=130°C | 460 | 96h | 0/77 | 0/77 | 0/77 | 0/77 | 0/77 | 0/25 | 0/25 | 0/25 |
| Solderability | N | J-STD-002 (test B SMD) | Wet aging = 8h Metal (solder) = SnPb No data dream = 1 No elec Measurement=1 Temperature=220°C | 15 | Visual inspection | | | | | 0/15 | | | |

| Test | PC | Std ref. | Conditions | Total | Steps | Results / Lot Fail/s.s. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SMAJ70CA | SMBJ33A | SMBJ33A | SMBJ70CA | SMBJ70CA | SMAJ33A | SMAJ70CA | SMBJ33A |
| | | | | | | Lot 1 | Lot 2 | Lot 3 | Lot 4 | Lot 5 | Lot 6 | Lot 7 | Lot 8 |
| Solderability | N | J-STD-002 (test B SMD) | Dry aging = 16h<br>Metal (solder) = SnAgCu<br>No data dream = 1<br>No elec<br>Measurement=1<br>Temperature=245°C | 15 | Visual inspection | | | | | 0/15 | | | |
| Solderability | N | J-STD-002 (test B SMD) | Wet aging = 8h<br>Metal (solder) = SnAgCu<br>No data dream = 1<br>No elec<br>Measurement=1<br>Temperature=245°C | 15 | Visual inspection | | | | | 0/15 | | | |
| Solderability | N | J-STD-002 (test B SMD) | Dry aging = 16h<br>Metal (solder) = SnPb<br>No data dream = 1<br>No elec<br>Measurement=1<br>Temperature=220°C | 15 | Visual inspection | | | | | 0/15 | | | |
| DBT | N | DM00112629 | No Data Dream=1<br>No Elec Measurement=1<br>Reflow=1 | 60 | Visual inspection | 0/30 | | | 0/30 | | | | |
| DBT | N | DM00112629 | No Data Dream=1<br>No Elec Measurement=1<br>Reflow=1 | 60 | Visual inspection | 0/30 | | | 0/30 | | | | |
| **Functional test** | | | | | | | | | | | | | |
| Repetitive Surge | Y | ADCS0060282 | IPP=IPP datasheet<br>Pulse delay=0.01ms<br>Time between surge=60s | 160 | 50 surges | 0/20 | 0/20 | 0/20 | 0/20 | 0/20 | 0/20 | 0/20 | 0/20 |

Note 1: These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances.
Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers."

# 6 ANNEXES

## 6.1 Parametric Verification

### SMAJ33A

**Characterization SMAJ33A**

*Date : 05/04/2024*
*Ref : 23515A*
*Lab : ST Tours Characterization Lab*

| TEST | VBR | IRM | IRM | VCL 10/1000 µs | RD | VCL 8/20 µs | RD |
|---|---|---|---|---|---|---|---|
| EQUIPMENT | TESEC | TESEC | TESEC | TESEC | TEST CALCULES | TESEC | TESTS_CALCULES |
| Condition 1 | 25°C | 25°C | 85°C | 25°C | 25°C | 25°C | 25°C |
| Condition 2 | IR=1mA | VRM=33V | VRM=33V | IPP=7.5A | IF1=3.75A | IPP=33A | IF1=16.5A |
| Condition 3 | | | | | IF2=7.5A | | IF2=33A |
| Condition 4 | | | | | VR1= 1-VCL 10/1000 µs | | VR1= 1-VCL 8/20 µs |
| Condition 5 | | | | | VR2= 2-VCL 10/1000 µs | | VR2= 2-VCL 8/20 µs |
| Min. Datasheet | *36.7* | | | | | | |
| Typ. Datasheet | *38.6* | | | | | | |
| Max. Datasheet | | *0,2µA* | *1µA* | *53.3* | *1.70* | *69.7* | *0.884ohm* |
| Comments | Direct | Direct | Direct | Direct | Direct | Direct | Direct |
| UNIT | V | nA | nA | V | *Ohm* | V | *Ohm* |
| N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Min | 37.83 | 1.27 | 3.34 | 45.9 | 0.96 | 48.69 | 0.324 |
| Max | 39.13 | 10.23 | 47.13 | 48.3 | 1.2 | 52.71 | 0.379 |
| Avg. | 38.49 | 4.48 | 20.11 | 46.8 | 1.04 | 50.5 | 0.341 |

*(*)These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances.*
*Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers*

### SMBJ33A

**Characterization SMBJ33A**

*Date : 05/04/2024*
*Ref : 23534A*
*Lab : ST Tours Characterization Lab*

| TEST | VBR | IRM | IRM | VCL 10/1000 µs | RD | VCL 8/20 µs | RD |
|---|---|---|---|---|---|---|---|
| EQUIPMENT | TESEC | TESEC | TESEC | TESEC | TEST CALCULES | TESEC | TESTS_CALCULES |
| Condition 1 | 25°C | 25°C | 85°C | 25°C | 25°C | 25°C | 25°C |
| Condition 2 | IR=1mA | VRM=33V | VRM=33V | IPP=11.8A | IF1=5.9A | IPP=57A | IF1=28.5A |
| Condition 3 | | | | | IF2=11.8A | | IF2=57A |
| Condition 4 | | | | | VR1= 1-VCL 10/1000 µs | | VR1= 1-VCL 8/20 µs |
| Condition 5 | | | | | VR2= 2-VCL 10/1000 µs | | VR2= 2-VCL 8/20 µs |
| Min. Datasheet | *36.7* | | | | | | |
| Typ. Datasheet | *38.6* | | | | | | |
| Max. Datasheet | | *0,2µA* | *1µA* | *53.3* | *1.08* | *69.7* | *0.512ohm* |
| Comments | Direct | Direct | Direct | Direct | Direct | Direct | Direct |
| UNIT | V | nA | nA | V | *Ohm* | V | *Ohm* |
| N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Min | 38.41 | 1.975 | 6.975 | 46.2 | 0.576 | 51.32 | 0.191 |
| Max | 40 | 7.863 | 11.93 | 48.3 | 0.83 | 54.08 | 0.225 |
| Avg. | 38.99 | 2.719 | 9.62 | 46.96 | 0.663 | 52.49 | 0.212 |

*(*)These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances.*
*Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers*

SMBJ70CA

**Characterization SMBJ70CA**

*Date : 05/04/2024*
*Ref : 23516A*
*Lab : ST Tours Characterization Lab*

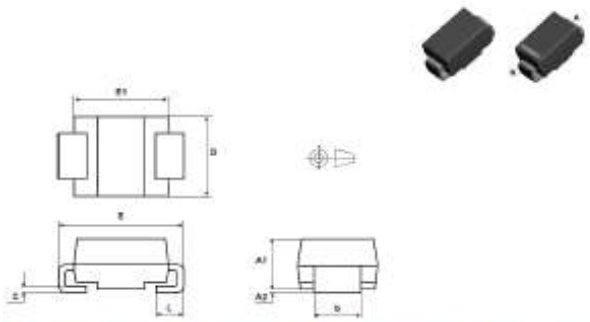
| TEST | VBR | VBR | IRM | IRM | IRM | IRM |
|---|---|---|---|---|---|---|
| EQUIPMENT | TESEC | TESEC | TESEC | TESEC | TESEC | TESEC |
| Condition 1 | 25°C | 25°C | 25°C | 25°C | 85°C | 85°C |
| Condition 2 | IR=1mA | IR=1mA | VRM=70V | VRM=70V | VRM=70V | VRM=70V |
| Condition 3 | | | | | | |
| Condition 4 | | | | | | |
| Condition 5 | | | | | | |
| Min. Datasheet | *77.8* | *77.8* | | | | |
| Typ. Datasheet | *81.9* | *81.9* | | | | |
| Max. Datasheet | | | *0,2µA* | *0,2µA* | *1µA* | *1µA* |
| Comments | Direct | Reverse | Direct | Reverse | Direct | Reverse |
| UNIT | V | V | nA | nA | nA | nA |
| N | 30 | 30 | 30 | 30 | 30 | 30 |
| Min | 79.98 | 80.12 | 1.074 | 0.952 | 4.42 | 2.393 |
| Max | 83.17 | 82.25 | 26.86 | 27.91 | 46.83 | 40.78 |
| Avg. | 81.37 | 81.15 | 6.687 | 9.846 | 19.109 | 20.215 |

| TEST | VCL 10/1000 µs | VCL 10/1000 µs | RD | RD | VCL 8/20 µs | VCL 8/20 µs | RD | RD |
|---|---|---|---|---|---|---|---|---|
| EQUIPMENT | TESEC | TESEC | TEST CALCULES | TEST CALCULES | TESEC | TESEC | TESTS_CALCULES | TESTS_CALCULES |
| Condition 1 | 25°C | 25°C | 25°C | 25°C | 25°C | 25°C | 25°C | 25°C |
| Condition 2 | IPP=5.5A | IPP=5.5A | IF1=2.75A | IF1=2.75A | IPP=27A | IPP=27A | IF1=13.5A | IF1=13.5A |
| Condition 3 | | | IF2=5.5A | IF2=5.5A | | | IF2=27A | IF2=27A |
| Condition 4 | | | VR1= 1-VCL 10/1000 µs | VR1= 1-VCL 10/1000 µs | | | VR1= 1-VCL 8/20 µs | VR1= 1-VCL 8/20 µs |
| Condition 5 | | | VR2= 2-VCL 10/1000 µs | VR2= 2-VCL 10/1000 µs | | | VR2= 2-VCL 8/20 µs | VR2= 2-VCL 8/20 µs |
| Min. Datasheet | | | | | | | | |
| Typ. Datasheet | | | | | | | | |
| Max. Datasheet | *113* | *113* | *4.91* | *4.91* | *146* | *146* | *2.2ohm* | *2.2ohm* |
| Comments | Direct | Reverse | Direct | Reverse | Direct | Reverse | Direct | Reverse |
| UNIT | V | V | *Ohm* | *Ohm* | V | V | *ohm* | *ohm* |
| N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Min | 95 | 94.9 | 2.109 | 2.472 | 98.08 | 98.08 | 0.611 | 0.603 |
| Max | 97.5 | 97.1 | 3.381 | 2.909 | 100.83 | 100.83 | 0.679 | 0.679 |
| Avg. | 96.04 | 95.9 | 2.766 | 2.71 | 99.48 | 99.48 | 0.642 | 0.6373 |

*(*)These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances.*
*Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers*

## 6.2 **Physical Dimensions**

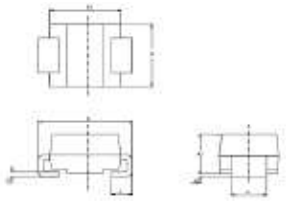
SMA package dimensions

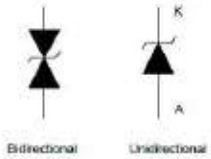


| Ref. | Millimeters | |
|---|---|---|
| | Min. | Max. |
| A1 | 1.90 | 2.45 |
| A2 | 0.05 | 0.20 |
| b | 1.25 | 1.65 |
| c | 0.15 | 0.40 |
| D | 2.25 | 2.90 |
| E | 4.80 | 5.35 |
| E1 | 3.95 | 4.60 |
| L | 0.75 | 1.50 |

| Spec | A1 | A2 | b | c | D | E | E1 | L |
|---|---|---|---|---|---|---|---|---|
| MIN: | 1.90 | 0.05 | 1.25 | 0.15 | 2.25 | 4.80 | 3.95 | 0.75 |
| MAX: | 2.45 | 0.20 | 1.65 | 0.40 | 2.90 | 5.35 | 4.60 | 1.50 |
| 1 | 2.134 | 0.142 | 1.549 | 0.280 | 2.818 | 5.069 | 4.380 | 1.066 |
| 2 | 2.107 | 0.150 | 1.536 | 0.250 | 2.825 | 5.065 | 4.379 | 1.055 |
| 3 | 2.138 | 0.133 | 1.539 | 0.268 | 2.800 | 5.080 | 4.383 | 1.040 |
| 4 | 2.129 | 0.113 | 1.551 | 0.277 | 2.806 | 5.128 | 4.371 | 1.037 |
| 5 | 2.124 | 0.124 | 1.537 | 0.271 | 2.810 | 5.115 | 4.364 | 1.051 |
| 6 | 2.093 | 0.137 | 1.528 | 0.261 | 2.817 | 5.062 | 4.371 | 1.055 |
| 7 | 2.116 | 0.144 | 1.551 | 0.275 | 2.802 | 5.117 | 4.375 | 1.039 |
| 8 | 2.087 | 0.104 | 1.539 | 0.266 | 2.810 | 5.131 | 4.379 | 1.023 |
| 9 | 2.132 | 0.118 | 1.543 | 0.273 | 2.804 | 5.080 | 4.382 | 1.041 |
| 10 | 2.132 | 0.122 | 1.541 | 0.280 | 2.814 | 5.133 | 4.375 | 1.021 |
| 11 | 2.137 | 0.142 | 1.535 | 0.271 | 2.801 | 5.088 | 4.379 | 1.021 |
| 12 | 2.089 | 0.132 | 1.528 | 0.261 | 2.806 | 5.109 | 4.371 | 1.016 |
| 13 | 2.146 | 0.137 | 1.533 | 0.267 | 2.820 | 5.123 | 4.380 | 1.072 |
| 14 | 2.136 | 0.112 | 1.544 | 0.270 | 2.818 | 5.096 | 4.366 | 1.045 |
| 15 | 2.115 | 0.132 | 1.533 | 0.271 | 2.813 | 5.092 | 4.368 | 1.042 |
| 16 | 2.107 | 0.119 | 1.532 | 0.276 | 2.837 | 5.097 | 4.382 | 1.039 |
| 17 | 2.125 | 0.130 | 1.541 | 0.269 | 2.819 | 5.104 | 4.375 | 1.020 |
| 18 | 2.132 | 0.134 | 1.532 | 0.265 | 2.803 | 5.112 | 4.376 | 1.045 |
| 19 | 2.139 | 0.142 | 1.528 | 0.268 | 2.827 | 5.113 | 4.379 | 1.029 |
| 20 | 2.121 | 0.118 | 1.529 | 0.263 | 2.804 | 5.127 | 4.383 | 1.016 |
| 21 | 2.130 | 0.140 | 1.543 | 0.271 | 2.823 | 5.127 | 4.368 | 1.040 |
| 22 | 2.146 | 0.136 | 1.555 | 0.273 | 2.814 | 5.079 | 4.362 | 1.020 |
| 23 | 2.114 | 0.130 | 1.536 | 0.263 | 2.799 | 5.102 | 4.376 | 1.036 |
| 24 | 2.126 | 0.140 | 1.549 | 0.272 | 2.820 | 5.133 | 4.380 | 1.037 |
| 25 | 2.133 | 0.137 | 1.537 | 0.272 | 2.820 | 5.088 | 4.375 | 1.052 |
| 26 | 2.099 | 0.116 | 1.530 | 0.268 | 2.809 | 5.177 | 4.389 | 1.030 |
| 27 | 2.089 | 0.107 | 1.524 | 0.256 | 2.820 | 5.075 | 4.383 | 1.063 |
| 28 | 2.108 | 0.111 | 1.547 | 0.274 | 2.825 | 5.079 | 4.376 | 1.074 |
| 29 | 2.100 | 0.105 | 1.531 | 0.274 | 2.814 | 5.110 | 4.370 | 1.058 |
| 30 | 2.140 | 0.134 | 1.540 | 0.268 | 2.816 | 5.110 | 4.385 | 1.042 |
| MIN | 2.087 | 0.104 | 1.524 | 0.250 | 2.799 | 5.062 | 4.362 | 1.016 |
| MAX | 2.146 | 0.150 | 1.555 | 0.280 | 2.837 | 5.177 | 4.389 | 1.074 |
| AVG | 2.121 | 0.128 | 1.538 | 0.269 | 2.814 | 5.104 | 4.376 | 1.041 |

SMB package dimensions






| Ref. | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.0748 | 0.0965 |
| A2 | 0.05 | 0.20 | 0.0020 | 0.0079 |
| b | 1.95 | 2.20 | 0.0768 | 0.0867 |
| c | 0.15 | 0.40 | 0.0059 | 0.0157 |
| D | 3.30 | 3.95 | 0.1299 | 0.1556 |
| E | 5.10 | 5.60 | 0.2008 | 0.2205 |
| E1 | 4.05 | 4.60 | 0.1594 | 0.1811 |
| L | 0.75 | 1.50 | 0.0295 | 0.0591 |

| Cote | A1 | A2 | b | c | D | E | E1 | L |
|---|---|---|---|---|---|---|---|---|
| 1 | 2.18 | 0.16 | 2.04 | 0.28 | 3.52 | 5.34 | 4.55 | 1.09 |
| 2 | 2.14 | 0.17 | 2.03 | 0.29 | 3.51 | 5.38 | 4.51 | 1.11 |
| 3 | 2.18 | 0.17 | 2.03 | 0.28 | 3.51 | 5.35 | 4.55 | 1.08 |
| 4 | 2.17 | 0.16 | 2.01 | 0.29 | 3.52 | 5.38 | 4.53 | 1.10 |
| 5 | 2.11 | 0.16 | 2.03 | 0.29 | 3.51 | 5.35 | 4.51 | 1.12 |
| 6 | 2.14 | 0.14 | 2.02 | 0.29 | 3.53 | 5.34 | 4.55 | 1.10 |
| 7 | 2.16 | 0.15 | 2.02 | 0.28 | 3.47 | 5.33 | 4.51 | 1.09 |
| 8 | 2.17 | 0.16 | 2.02 | 0.28 | 3.50 | 5.35 | 4.53 | 1.06 |
| 9 | 2.17 | 0.16 | 2.02 | 0.27 | 3.51 | 5.36 | 4.51 | 1.09 |
| 10 | 2.17 | 0.15 | 2.01 | 0.28 | 3.49 | 5.34 | 4.51 | 1.11 |
| 11 | 2.17 | 0.16 | 2.03 | 0.28 | 3.50 | 5.36 | 4.52 | 1.07 |
| 12 | 2.17 | 0.16 | 2.03 | 0.28 | 3.51 | 5.37 | 4.54 | 1.07 |
| 13 | 2.16 | 0.15 | 2.04 | 0.28 | 3.52 | 5.36 | 4.51 | 1.08 |
| 14 | 2.18 | 0.16 | 2.02 | 0.29 | 3.51 | 5.39 | 4.54 | 1.07 |
| 15 | 2.17 | 0.14 | 2.02 | 0.28 | 3.50 | 5.38 | 4.53 | 1.09 |
| 16 | 2.17 | 0.16 | 2.02 | 0.29 | 3.53 | 5.36 | 4.52 | 1.10 |
| 17 | 2.17 | 0.16 | 2.05 | 0.27 | 3.52 | 5.38 | 4.51 | 1.10 |
| 18 | 2.18 | 0.15 | 2.03 | 0.28 | 3.53 | 5.37 | 4.50 | 1.11 |
| 19 | 2.15 | 0.15 | 2.02 | 0.27 | 3.50 | 5.37 | 4.52 | 1.11 |
| 20 | 2.17 | 0.16 | 2.02 | 0.28 | 3.53 | 5.37 | 4.53 | 1.11 |
| 21 | 2.16 | 0.16 | 2.01 | 0.28 | 3.56 | 5.34 | 4.50 | 1.10 |
| 22 | 2.17 | 0.16 | 2.03 | 0.28 | 3.56 | 5.41 | 4.52 | 1.07 |
| 23 | 2.16 | 0.15 | 2.02 | 0.28 | 3.55 | 5.37 | 4.50 | 1.11 |
| 24 | 2.18 | 0.16 | 2.03 | 0.29 | 3.52 | 5.33 | 4.53 | 1.11 |
| 25 | 2.17 | 0.14 | 2.03 | 0.29 | 3.55 | 5.35 | 4.52 | 1.11 |
| 26 | 2.17 | 0.15 | 2.02 | 0.28 | 3.50 | 5.37 | 4.52 | 1.09 |
| 27 | 2.18 | 0.15 | 2.02 | 0.29 | 3.55 | 5.36 | 4.51 | 1.08 |
| 28 | 2.17 | 0.16 | 2.02 | 0.28 | 3.56 | 5.34 | 4.51 | 1.09 |
| 29 | 2.17 | 0.16 | 2.02 | 0.28 | 3.56 | 5.38 | 4.49 | 1.08 |
| 30 | 2.17 | 0.15 | 2.04 | 0.28 | 3.54 | 5.33 | 4.50 | 1.10 |
| **LSL** | 1.90 | 0.05 | 1.95 | 0.15 | 3.30 | 5.10 | 4.05 | 0.75 |
| **USL** | 2.45 | 0.20 | 2.20 | 0.40 | 3.95 | 5.60 | 4.60 | 1.50 |
| **MIN** | 2.11 | 0.14 | 2.01 | 0.27 | 3.47 | 5.33 | 4.49 | 1.06 |
| **MAX** | 2.18 | 0.17 | 2.05 | 0.29 | 3.56 | 5.41 | 4.55 | 1.12 |
| **AVG** | 2.17 | 0.16 | 2.02 | 0.28 | 3.52 | 5.36 | 4.52 | 1.09 |

## 6.3 Tests description

| Test name | Description | Purpose |
|---|---|---|
| **Die Oriented** | | |
| **HTRB**<br>High Temperature Reverse Bias | The device is stressed in static configuration, trying to satisfy as much as possible the following conditions:<br>- Low power dissipation<br>- Max. supply voltage compatible with diffusion process and internal circuitry limitations.<br><br>Forward: device is forward biased with a current fixed and adjusted to reach the targeted junction temperature | 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.<br>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.<br>To assess active area and contacts integrity |
| **Package Oriented** | | |
| **PC**<br>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.<br>As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance.<br>The typical failure modes are "pop-corn" effect and delamination. |
| **H3TRB**<br>High Humidity High Temperature Reverse 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. |
| **TC**<br>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. |
| **UHAST**<br>Unbiased Highly Accelerated Stress Test | 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. |
| **DPA**<br>Destructive Physical Analysis | Specific construction analysis on random parts that have successfully completed THB or TC. | To investigate on reliability stresses impact on delamination, corrosion and product construction integrity. |
| **RSH**<br>Resistance to Solder Heat | Package is dipped by the leads in a solder bath after initial wet ageing (for SMDs only). Assessment by electrical test + no external crack | To simulate wave soldering process and verify that package will not be thermally damaged during this step. |

| Test name | Description | Purpose |
|---|---|---|
| **DBT**<br>Dead Bug Test | To evaluate the wettability of the package leads. Good indicator to determine the bad solderability behavior | Components are glued up-side down on a substrate. Pins are wetted with a moderately activated flux. Then run once through the reflow oven with leadfree temperature profile. Visual inspection is performed with suitable tool. |
| **SD**<br>Solderability | The purpose of this test method is to provide a referee condition for the evaluation of the solderability of terminations (including leads up to 0.125 inch in diameter) that will be assembled using tin lead eutectic solder. | This evaluation is based on the ability of these terminations to be wetted and to produce a suitable fillet when coated by tin lead eutectic solder. These procedures will test whether the packaging materials and processes used during the manufacturing operations process produce a component that can be successfully soldered to the next level assembly using tin lead eutectic solder. A preconditioning test is included in this test method, which degrades the termination finish to provide a guard band against marginal finish. |
| **Functional Tests** | | |
| **RS**<br>Repetitive Surges | The device is submitted to a reverse current peak: Ipp, which depends of the current holding of the product. | To evaluate the holding of the component to a high electrical field. Short circuit or hot point is expected as failure mechanism. |

# *PCN*
# *Product/Process Change Notification*

## Transfer of Assembly and Test line for TVS products housed in SMA & SMB packages

| | | | |
|---|---|---|---|
| **Notification number:** | PDP/24/14700 | **Issue Date** | 12-Apr-2024 |
| **Issued by** | Sophie da Silva | | |
| **Product series affected by the change** | | SMAJxxx<br>SM6Txxx<br>SMBJxxx | |
| **Type of change** | | Transfer | |

**Description of the change**

The production of TVS products housed in SMA & SMB package currently located at subcontractor in China will be transferred to new plant location (same subcontractor and same city) in China.

**Reason for change**

Due to plant rationalization at subcontractor level, STMicroelectronics started new plant qualification to support TVS products business continuity.

| | |
|---|---|
| **Former versus changed product:** | The changed products do not present modified electrical, dimensional or thermal parameters, leaving unchanged the current information published in the product datasheet.<br><br>The Moisture Sensitivity Level of the part (according to the IPC/JEDEC JSTD-020D standard) remains unchanged.<br><br>The footprint recommended by ST remains the same.<br><br>There is no change in the packing modes and the standard delivery quantities either.<br><br>The products remain in full compliance with the ST ECOPACK®2 grade (so called “halogen-free”). |

**Disposition of former products**

Delivery of current products will be done until stock depletion.

**Marking and traceability**

Traceability of the change will be ensured by Finished Good/Type print on carton labels.

| Commercial part number/Order code | Former Finished Good/Type | New Finished Good/Type |
|---|---|---|
| SMBJ70CA-TR | SMBJ70CAH-TR/YS | Ending with /HR<br>SMBJ70CAH-TR/HR |

| | |
|---|---|
| **Qualification completion date** | 12-Apr-2024 |

**Forecasted sample availability**

| Product family | Sub-family | Commercial part Number | Availability date |
|---|---|---|---|
| PROTECTION | SMA | SMAJ33A-TR | Wk18-2024 |
| PROTECTION | SMB | SMBJ33A-TR | Wk18-2024 |
| PROTECTION | SMB | SMBJ70CA-TR | Wk18-2024 |

For sample(s) request, please inform FSE (Field Sales Engineer) in order to insert corresponding **Non-Standard Samples Order** (a single Commercial Product for each request) with **PCN reference** as additional information.

**Change implementation schedule**

| Sales-types | Estimated production start | Estimated first shipments |
|---|---|---|
| **Finished Good** | **W16-2024** | **W29-2024** |

| | |
|---|---|
| **Comments:** | With early PCN acceptance, shipments could be anticipated |

**Customer's feedback**

Please contact your local ST sales representative or quality contact for requests concerning this change notification.
Absence of acknowledgement of this PCN within 30 days of receipt will constitute acceptance of the change.
Absence of additional response within 90 days of receipt of this PCN will constitute acceptance of the change.

| | |
|---|---|
| **Qualification program and results** | 24014QRP Attached |

*(1) ADG: Automotive and Discrete Group*

| Impacted Commercial Products | | |
|---|---|---|
| **SMA package** | **SMB package** | |
| SMAJ12A-TR | SM6T15A | SMBJ15CA-TR |
| SMAJ12CA-TR | SM6T15CA | SMBJ16A-TR |
| SMAJ13A-TR | SM6T18A | SMBJ18A-TR |
| SMAJ13CA-TR | SM6T18CA | SMBJ18CA-TR |
| SMAJ15A-TR | SM6T22A | SMBJ20A-TR |
| SMAJ15CA-TR | SM6T22CA | SMBJ20CA-TR |
| SMAJ18A-TR | SM6T24A | SMBJ22A-TR |
| SMAJ18CA-TR | SM6T24CA | SMBJ22CA-TR |
| SMAJ20A-TR | SM6T27A | SMBJ24A-TR |
| SMAJ24A-TR | SM6T27CA | SMBJ24CA-TR |
| SMAJ24CA-TR | SM6T30A | SMBJ26A-TR |
| SMAJ26A-TR | SM6T30CA | SMBJ26CA-TR |
| SMAJ26CA-TR | SM6T33A | SMBJ28A-TR |
| SMAJ28A-TR | SM6T33CA | SMBJ28CA-TR |
| SMAJ28CA-TR | SM6T36A | SMBJ30A-TR |
| SMAJ30A-TR | SM6T36CA | SMBJ30CA-TR |
| SMAJ30CA-TR | SM6T39A | SMBJ33A-TR |
| SMAJ33A-TR | SM6T39CA | SMBJ33CA-TR |
| SMAJ33CA-TR | SM6T56CA | SMBJ36CA-TR |
| SMAJ40CA-TR | SM6T68CA | SMBJ40CA-TR |
| SMAJ43CA-TR | SMBJ12A-TR | SMBJ48CA-TR |
| SMAJ48CA-TR | SMBJ12CA-TR | SMBJ58CA-TR |
| SMAJ58CA-TR | SMBJ13CA-TR | SMBJ70CA-TR |
| SMAJ70CA-TR | SMBJ15A-TR | |

# Qualification Report
## *Plant transfer for TVS (SMA and SMB packages)*

| General Information | |
|---|---|
| **Product Line** | *Protection* |
| **Product Description** | *Industrial TVS products SMA and SMB packages* |
| **Product Perimeter** | SMAJxxx<br>SM6Txxx<br>SMBJxxx |
| **Product Group** | *APMS* |
| **Product Division** | *Discrete & Filter* |
| **Packages** | *SMA - SMB* |
| **Maturity level step** | *Qualified* |

| Locations | |
|---|---|
| **Wafer Fab** | *ST Tours (France)* |
| **Assembly Plant** | *Subcontractor (990C) - China* |
| **Reliability Lab** | *ST Tours (France)* |
| **Reliability Assessment** | *Compliant* |

### DOCUMENT INFORMATION

| Version | Date | Pages | Prepared by | Approved by | Comments |
|---|---|---|---|---|---|
| 1.0 | April 12, 2024 | 20 | A. KHEDIM | Timothée PINGAULT Digitally signed by Timothée PINGAULT Date: 2024.04.12 14:27:06 +02'00' | Document creation |

Note: This report is a summary of the qualification trials performed in good faith by STMicroelectronics in order to evaluate the potential risks during the product life using a set of defined test methods.
This report does not imply for STMicroelectronics expressly or implicitly any contractual obligations other than as set forth in STMicroelectronics general terms and conditions of Sale. This report and its contents shall not be disclosed to a third party without previous written agreement from STMicroelectronics.

## TABLE OF CONTENTS

# 1 APPLICABLE AND REFERENCE DOCUMENTS

| Document reference | Short description |
|---|---|
| **JESD 47** | Stress-Test-Driven Qualification of Integrated Circuits |
| **JESD 94** | Application specific qualification using knowledge based test methodology |
| **JESD 22** | Reliability test methods for packaged devices |
| **MIL-STD-750C** | Test method for semiconductor devices |

# 2 GLOSSARY

| | |
|---|---|
| **DBT** | Dead bug test |
| **DPA** | Destructive Physical Analysis |
| **GD** | Generic Data |
| **H3TRB** | High Humidity High Temperature Reverse Bias |
| **HTRB** | High Temperature Reverse Bias |
| **PD** | Physical Dimensions |
| **PV** | Parametric Verification |
| **RS** | Repetitive Surges |
| **RSH** | Resistance to solder heat |
| **SD** | Solderability |
| **SS** | Sample Size |
| **TC** | Temperature Cycling |
| **UHAST** | Unbiased Highly Accelerated Stress Test |

# 3 RELIABILITY EVALUATION OVERVIEW

## 3.1 Objectives

Due to plant rationalization at subcontractor level, STMicroelectronics has qualified a new plant to support TVS products business continuity.

The objective is to qualify the plant transfer (same subcontractor, no change in BOM, lead frame, plating, resin nor tools) of SMA and SMB lines.
The impacted products are the following:

- 400W & 600W TVS embedded in SMA package,
- 600W TVS embedded in SMB package.

| Commercial Product | Package | Comment (optional) |
|---|---|---|
| SMAJxxx<br>SM6Txxx<br>SMBJxxx | SMA<br>SMA<br>SMB | Industrial grade |

| Impacted products | | |
|---|---|---|
| SMAJ12A | SM6T15A | SMBJ12A |
| SMAJ12CA | SM6T15CA | SMBJ12CA |
| SMAJ13A | SM6T18A | SMBJ13CA |
| SMAJ13CA | SM6T18CA | SMBJ15A |
| SMAJ15A | SM6T22A | SMBJ15CA |
| SMAJ15CA | SM6T22CA | SMBJ16A |
| SMAJ18A | SM6T24A | SMBJ18A |
| SMAJ18CA | SM6T24CA | SMBJ18CA |
| SMAJ20A | SM6T27A | SMBJ20A |
| SMAJ24A | SM6T27CA | SMBJ20CA |
| SMAJ24CA | SM6T30A | SMBJ22ATR |
| SMAJ26A | SM6T30CA | SMBJ22CA |
| SMAJ26CA | SM6T33A | SMBJ24A |
| SMAJ28A | SM6T33CA | SMBJ24CA |
| SMAJ28CA | SM6T36A | SMBJ26A |
| SMAJ30A | SM6T36CA | SMBJ26CA |
| SMAJ30CA | SM6T39A | SMBJ28A |
| SMAJ33A | SM6T39CA | SMBJ28CA |
| SMAJ33CA | SM6T56CA | SMBJ30A |
| SMAJ40CA | SM6T68CA | SMBJ30CA |
| SMAJ43CA | | SMBJ33A |
| SMAJ48CA | | SMBJ33CA |
| SMAJ58CA | | SMBJ36CA |
| SMAJ70CA | | SMBJ40CA |
| | | SMBJ48CA |
| | | SMBJ58CA |
| | | SMBJ70CA |

The reliability test methodology used follows the JESD47: “Stress Test driven Qualification Methodology”.

The reliability tests ensuing are:

.

- TC to ensure the mechanical robustness of the products.
- HTRB to evaluate the risk of contamination from the resin and the assembly process versus the die layout sensitivity.
- H3TRB, UHAST to check the robustness to corrosion and the good package hermeticity.
- RSH, Solderability and DBT to check compatibility of package with customer assembly.
- Functional test: Repetitive IPP to verify robustness of device submitted to rated Ipp (as per data sheet)

For some tests, similarity methodology is used. See 5.1 “comments” for more details about similarities.

### 3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception. 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 robustness of the products and safe operation, which is consequently expected during their lifetime.

Based on these results, TVS in SMD packages are compliant with JESD47.

# 4 DEVICE CHARACTERISTICS

## 4.1 Device description

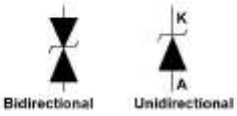
Example datasheet of TVS SMA package (SMAJ70CA)

life.augmented

**SMAJxxA, SMAJxxCA**

Datasheet

400 W TVS in SMA


**Product status links**

SMAJ5.0A, SMAJ5.0CA,
SMAJ6.0A, SMAJ6.0CA,
SMAJ6.5A, SMAJ6.5CA,
SMAJ8.5A, SMAJ8.5CA,
SMAJ10A, SMAJ10CA,
SMAJ12A, SMAJ12CA,
SMAJ13A, SMAJ13CA,
SMAJ15A, SMAJ15CA,
SMAJ18A, SMAJ18CA,
SMAJ20A, SMAJ20CA,
SMAJ24A, SMAJ24CA,
SMAJ26A, SMAJ26CA,
SMAJ28A, SMAJ28CA
SMAJ30A, SMAJ30CA,
SMAJ33A, SMAJ33CA
SMAJ40A, SMAJ40CA,
SMAJ43A, SMAJ43CA,
SMAJ48A, SMAJ48CA
SMAJ58A, SMAJ58CA,
SMAJ70A, SMAJ70CA,
SMAJ85A, SMAJ85CA,
SMAJ100A, SMAJ100CA,
SMAJ130A, SMAJ130CA,
SMAJ154A, SMAJ154CA,
SMAJ170A, SMAJ170A,
SMAJ188A, SMAJ188CA

### Features

- Peak pulse power:
  - 400 W (10/1000 µs)
  - 2.3 kW (8/20 µs)
- Stand-off voltage range from 5 V to 188 V
- Unidirectional and bidirectional types
- Low leakage current:
  - 0.2 µA at 25 °C
  - 1 µA at 85 °C
- Operating $T_J$ max: 150 °C
- JEDEC registered package outline

### Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026 solderable matte tin plated leads
- JESD-201 class 2 whisker test
- IPC7531 footprint
- JEDEC registered package outline
- IEC 61000-4-4 level 4:
  - 4 kV
- IEC 61000-4-2, C = 150 pF - R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)

### Description

The SMAJ series is designed to protect sensitive equipment against electrostatic discharges according to IEC 61000-4-2 and MIL STD 883, method 3015, and electrical overstress according to IEC 61000-4-4 and 5. This device is more generally used against surges below 600 W (10/1000 µs).

The Planar technology makes it compatible with high-end circuits where low leakage current and high junction temperature are required to provide long term reliability and stability. SMAJ devices are packaged in SMA (SMA footprint in accordance with IPC 7531 standard).

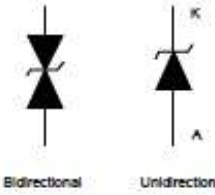
Example datasheet of TVS SMB package (SMBJ33A)

life.augmented

# SMBJ

Datasheet

## 600 W TVS in SMB


| Product status link | |
|---|---|
| SMBJ | SMBJ5.0A, SMBJ5.0CA, SMBJ6.0A, SMBJ6.0CA, SMBJ6.5A, SMBJ6.5CA, SMBJ8.5A, SMBJ8.5CA, SMBJ10A, SMBJ10CA, SMBJ12A, SMBJ12CA, SMBJ13A, SMBJ13CA, SMBJ15A, SMBJ15CA, SMBJ16A, SMBJ16CA, SMBJ18A, SMBJ18CA, SMBJ20A, SMBJ20CA, SMBJ22A, SMBJ22CA, SMBJ24A, SMBJ24CA, SMBJ26A, SMBJ26CA, SMBJ28A, SMBJ28CA, SMBJ30A, SMBJ30CA, SMBJ33A, SMBJ33CA, SMBJ36A, SMBJ36CA, SMBJ40A, SMBJ40CA, SMBJ43A, SMBJ43CA, SMBJ48A, SMBJ48CA, SMBJ58A, SMBJ58CA, SMBJ64A, SMBJ64CA, SMBJ70A, SMBJ70CA, SMBJ85A, SMBJ85CA, SMBJ100A, SMBJ100CA, SMBJ130A, SMBJ130CA, SMBJ154A, SMBJ154CA, SMBJ170A, SMBJ170CA, SMBJ188A, SMBJ188CA |

### Features

- Peak pulse power: 600 W (10/1000 µs) and 4 kW (8/20 µs)
- Stand-off voltage range from 5 V to 188 V
- Unidirectional and bidirectional types
- Low leakage current: 0.2 µA at 25 °C and 1 µA at 85 °C
- Operating $T_j$ max: 150 °C
- High power capability at $T_j$ max.: up to 515 W (10/1000 µs)
- Lead finishing: matte tin plating

### Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026 solderable matte tin plated leads
- JESD-201 class 2 whisker test
- IPC7531 footprint
- JEDEC registered package outline
- IEC 61000-4-4 level 4:
  - 4 kV
- IEC 61000-4-2, C = 150 pF - R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)

### Description

The SMBJ series are designed to protect sensitive equipment against electrostatic discharges according to IEC 61000-4-2 and MIL STD 883, method 3015, and electrical overstress according to IEC 61000-4-4 and 5. This device is more generally used against surges below 600 W (10/1000 µs).

The Planar technology makes it suitable for high-end equipment and SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time.

The SMBJ series are packaged in SMB.

## 4.2 Construction Note

| | 400W, 600W TVS package SMA qualification |
|---|---|
| **Wafer/Die fab. information** | |
| Wafer fab manufacturing location | ST Tours - France |
| Technology / Process family | Discrete Transil |
| **Wafer Testing (EWS) information** | |
| Electrical testing manufacturing location | ST Tours - France |
| **Assembly information** | |
| Assembly site | Subcontractor (990C) - China |
| Package description | SMA |
| Molding compound | ECOPACK®2 molding compound |
| Lead finishing material | Lead free (pure Tin) |
| **Final testing information** | |
| Testing location | Subcontractor (990C) - China |

| | 600W TVS SMB qualification |
|---|---|
| **Wafer/Die fab. information** | |
| Wafer fab manufacturing location | ST Tours - France |
| Technology / Process family | Discrete Transil |
| **Wafer Testing (EWS) information** | |
| Electrical testing manufacturing location | ST Tours - France |
| **Assembly information** | |
| Assembly site | Subcontractor (990C) - China |
| Package description | SMB |
| Molding compound | ECOPACK®2 molding compound |
| Lead finishing material | Lead free (pure Tin) |
| **Final testing information** | |
| Testing location | Subcontractor (990C) - China |

# 5 TESTS PLAN AND RESULTS SUMMARY

## 5.1 Test vehicles

| Lot # | Finish Good | Package | Comments |
|---|---|---|---|
| Lot 1 | SMAJ70CA | SMA | Qualification lot |
| Lot 2 | SMBJ33A | SMB | Qualification lot |
| Lot 3 | SMBJ33A | SMB | Qualification lot |
| Lot 4 | SMBJ70CA | SMB | Qualification lot |
| Lot 5 | SMBJ70CA | SMB | Qualification lot |
| Lot 6 | SMAJ33A | SMA | Qualification lot |
| Lot 7 | SMAJ70CA | SMA | Qualification lot |
| Lot 8 | SMBJ33A | SMB | Qualification lot |

Detailed results in the chapter below will refer to these references.

## 5.2 Test plan

| Stress | Abrv | Reference | Lot | SS | Comments | Test plan |
|---|---|---|---|---|---|---|
| Pre and Post-Stress Electrical Test | TEST | User specification or supplier's standard Specification | All qualification parts tested per the requirements of the appropriate device specification. | | | |
| Pre-conditioning | PC | J-STD-020 JESD22-A113 | All qualification parts tested per the requirements of the appropriate device specification. | | As per targeted MSL Not applicable for PTH and WLCSP without coating | |
| MSL research | MSL | J-STD-020 | | | Not applicable for PTH and WLCSP without coating | |
| External Visual | EV | JESD22B-101 | All qualification parts tested per the requirements of the appropriate device specification. | | Done during Assembly → Test & Finish inspection | |
| Parametric Verification | PV | User specification | | | | |
| High Temperature Reverse Bias | HTRB | MIL-STD-750-1 M1038 Method A (for diodes, rectifiers and Zeners) M1039 Method A (for transistors) | Lot 1<br>Lot 2<br>Lot 3<br>Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 45<br>45<br>45<br>45<br>45<br>45<br>45<br>45 | | X |
| AC blocking voltage | ACBV | MIL-STD-750-1 M1040 Test condition A | | | Required for Thyristor only. Alternative to HTRB | |
| High Temperature Forward Bias | HTFB | JESD22 A-108 | | | Not required, applicable only to LEDS Alternative to HTRB | |
| High Temperature Operating Life | HTOL | | | | Covered by HTRB or ACBV | |
| Steady State Operational | SSOP | MIL-STD-750-1 M1038 Test condition B | | | Required for Voltage Regulator (Zener) only. | |
| High Temperature Gate Bias | HTGB | JESD 22A-108 | | | Required for Power MOSFET – IGBT only. | |
| High Temperature Storage Life | HTSL | JESD22 A-103 | | | Covered by H3TRB | |
| Temperature Humidity Storage | THS | JESD22 A-118 | | | Covered by H3TRB | |
| Temperature Cycling | TC | JESD22A-104 | Lot 1<br>Lot 2<br>Lot 3<br>Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 30<br>30<br>30<br>30<br>30<br>25<br>25<br>25 | | X |
| Temperature Cycling Hot Test | TCHT | JESD22A-104 | | | Required for Power MOSFET – IGBT only. | |
| Temperature Cycling Delamination Test | TCDT | JESD22A-104 J-STD-035 | | | Required for Power MOSFET – IGBT only. Alternative to TCHT | |
| Wire Bond Integrity | WBI | MIL-STD-750 Method 2037 | | | For dissimilar metal bonding systems only | |
| Unbiased Highly Accelerated Stress Test | UHAST | JESD22A-118 or A101 | Lot 1<br>Lot 2<br>Lot 3 | 77<br>77<br>77 | | X |

| Stress | Abrv | Reference | Lot | SS | Comments | Test plan |
|---|---|---|---|---|---|---|
| | | | Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 77<br>77<br>25<br>25<br>25 | | |
| Autoclave | AC | JESD22A-102 | | | Alternative to UHAST | |
| Highly Accelerated Stress Test | HAST | JESD22A-110 | | | Covered by H3TRB (same failure mechanisms activation). | |
| High Humidity High Temperature Reverse Bias | H3TRB | JESD22A-101 | Lot 1<br>Lot 2<br>Lot 3<br>Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 25<br>25<br>25<br>25<br>25<br>25<br>25<br>25 | Alternative to HAST | X |
| High Temperature High Humidity Bias | HTHH B | JED22A-101 | | | Not required, LED only | |
| Intermittent Operational Life / Thermal Fatigue | IOL | MIL-STD-750 Method 1037 | | | For power devices. Not required for Transient Voltage Suppressor (TVS) parts | |
| Power and Temperature Cycle | PTC | JED22A-105 | | | For power devices. Not required for Transient Voltage Suppressor (TVS) parts<br>Perform PTC if $\Delta Tj>100°C$ cannot be achieved with IOL<br>Alternative to IOL | |
| ESD Characterization | ESD HBM | AEC Q101-001 and 005 | | | | |
| ESD Characterization | ESD CDM | AEC Q101-001 and 005 | | | | |
| Destructive Physical Analysis | DPA | AEC-Q101-004 Section 4 | | | After H3TRB and TC | X |
| Physical Dimension | PD | JESD22B-100 | | | | |
| Terminal Strength | TS | MIL-STD-750 Method 2036 | | | Required for leaded parts only | |
| Resistance to Solvents | RTS | JESD22B-107 | | | Not applicable for Laser Marking | |
| Constant Acceleration | CA | MIL-STD-750 Method 2006 | | | Required for hermetic packaged parts only. | |
| Vibration Variable Frequency | VVF | JESD22B-103 | | | Required for hermetic packaged parts only. | |
| Mechanical Shock | MS | JESD22 B-104 | | | Required for hermetic packaged parts only. | |
| Hermeticity | HER | JESD22A-109 | | | Required for hermetic packaged parts only. | |
| Resistance to Solder Heat | RSH | JESD22 A-111 (SMD) | Lot 1<br>Lot 4<br>Lot 6<br>Lot 7 | 30<br>30<br>30 | | X |
| Solderability | SD | J-STD-002<br>JESD22B102 | Lot 5 | 4*15 | | X |
| Dead Bug Test | DBT | ST Internal specification | Lot 1<br>Lot 4 | 2*30<br>2*30 | | X |
| Thermal Resistance | TR | JESD24-3, 24-4, 24-6 as appropriate | | | Required in case of process change.<br>Not applicable to protection device as no limit specified in the datasheet | |

| Stress | Abrv | Reference | Lot | SS | Comments | Test plan |
|---|---|---|---|---|---|---|
| Wire Bond Strength | WBS | MIL-STD-750 Method 2037 | | | Covered during workability trials | |
| Bond Shear | BS | AEC-Q101-003 | | | Covered during workability trials | |
| Die Shear | DS | MIL-STD-750 Method 2017 | | | Not Applicable to parts with solder paste die attach | |
| Unclamped Inductive Switching | UIS | AEC-Q101-004 section 2 | | | Required for Power MOS and internally clamped IGBTs only | |
| Dielectric Integrity | DI | AEC-Q101-004 section 3 | | | Required for Power MOSFET – IGBT only. | |
| Short Circuit Reliability Characterization | SCR | AEC-Q101-006 | | | Required for smart power parts only | |
| Whisker Growth Evaluation | WG | AEC-Q005 JESD201 | | | | |
| Early Life Failure Rate | ELFR | JESD74 | | | Recommended for new techno development in case of identified failure mechanism | |
| Functional Test (in rush, di/dt,…) | FT | Internal specification | | | | |
| Repetitive Surge | RS | Internal specification | Lot 1<br>Lot 2<br>Lot 3<br>Lot 4<br>Lot 5<br>Lot 6<br>Lot 7<br>Lot 8 | 20<br>20<br>20<br>20<br>20<br>20<br>20<br>20 | Required for protection devices only. | X |

| | | | | | | |
|---|---|---|---|---|---|---|
| Low Temperature Storage | LTS | JESD-22 A119: 209 | | | AQG324 test for Modules | |
| Thermal shock test | TST | JESD22-A104 | | | AQG324 test for Modules | |
| Power Cycling (seconds) | PCsec | MIL-STD750-1 Method1037 | | | AQG324 test for Modules | |
| Power Cycling (minutes) | PCmin | MIL-STD750-1 Method1037 | | | AQG324 test for Modules | |
| Mechanical shock | MS | IEC 600068-2-27 | | | AQG324 test for Modules | |
| Vibration | V | IEC60068-2-6 | | | AQG324 test for Modules | |

## 5.3 Results summary

| Test | PC | Std ref. | Conditions | Total | Steps | Results / Lot Fail/s.s. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SMAJ70CA | SMBJ33A | SMBJ33A | SMBJ70CA | SMBJ70CA | SMAJ33A | SMAJ70CA | SMBJ33A |
| | | | | | | Lot 1 | Lot 2 | Lot 3 | Lot 4 | Lot 5 | Lot 6 | Lot 7 | Lot 8 |
| **Pre-and Post Electrical Test** | - | ST datasheet | IR, VBR, VF parameters according to product datasheet | 1530 | - | 0/1530 | | | | | | | |
| **External Visual** | - | JESD22B-101 | All qualification parts submitted for testing passed External & Visual inspection during manufacturing process | | | | | | | | | | |
| **Parametric Verification** | - | ST datasheet | Over part temperature range (note1) | Refer to paragraph 6.1 in Annexes | | | | | | | | | |
| HTRB | N | MIL-STD-750-1 M1038 Method A | Junction Temperature=150°C Temperature=150°C Tension=Vrm | 315 | 1000h | 0/45 | 0/45 | 0/45 | 0/45 | | 0/45 | 0/45 | 0/45 |
| TC | Y | JESD22-A104 | Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-65°C | 300 | 500cy | 0/45 | 0/45 | 0/45 | 0/45 | 0/45 | 0/25 | 0/25 | 0/25 |
| RSH | N | JESD22A-111 (SMD) / JESD22B-106 (PTH) | Temperature=260°C Time (on)=10s | 120 | Measure after dipping | 0/30 | | | 0/30 | | 0/30 | 0/30 | |
| H3TRB | Y | JESD22-A101 | Humidity (HR)=85% Temperature=85°C Tension= Vrm (max 100V) | 175 | 1000h | 0/25 | 0/25 | 0/25 | 0/25 | | 0/25 | 0/25 | 0/25 |
| UHAST | Y | JESD22 A-118 | Humidity (HR)=85% Pressure=2.3bar Temperature=130°C | 460 | 96h | 0/77 | 0/77 | 0/77 | 0/77 | 0/77 | 0/25 | 0/25 | 0/25 |
| Solderability | N | J-STD-002 (test B SMD) | Wet aging = 8h Metal (solder) = SnPb No data dream = 1 No elec Measurement=1 Temperature=220°C | 15 | Visual inspection | | | | | 0/15 | | | |

| Test | PC | Std ref. | Conditions | Total | Steps | Results / Lot Fail/s.s. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SMAJ70CA | SMBJ33A | SMBJ33A | SMBJ70CA | SMBJ70CA | SMAJ33A | SMAJ70CA | SMBJ33A |
| | | | | | | Lot 1 | Lot 2 | Lot 3 | Lot 4 | Lot 5 | Lot 6 | Lot 7 | Lot 8 |
| Solderability | N | J-STD-002 (test B SMD) | Dry aging = 16h<br>Metal (solder) = SnAgCu<br>No data dream = 1<br>No elec<br>Measurement=1<br>Temperature=245°C | 15 | Visual inspection | | | | | 0/15 | | | |
| Solderability | N | J-STD-002 (test B SMD) | Wet aging = 8h<br>Metal (solder) = SnAgCu<br>No data dream = 1<br>No elec<br>Measurement=1<br>Temperature=245°C | 15 | Visual inspection | | | | | 0/15 | | | |
| Solderability | N | J-STD-002 (test B SMD) | Dry aging = 16h<br>Metal (solder) = SnPb<br>No data dream = 1<br>No elec<br>Measurement=1<br>Temperature=220°C | 15 | Visual inspection | | | | | 0/15 | | | |
| DBT | N | DM00112629 | No Data Dream=1<br>No Elec Measurement=1<br>Reflow=1 | 60 | Visual inspection | 0/30 | | | 0/30 | | | | |
| DBT | N | DM00112629 | No Data Dream=1<br>No Elec Measurement=1<br>Reflow=1 | 60 | Visual inspection | 0/30 | | | 0/30 | | | | |
| **Functional test** | | | | | | | | | | | | | |
| Repetitive Surge | Y | ADCS0060282 | IPP=IPP datasheet<br>Pulse delay=0.01ms<br>Time between surge=60s | 160 | 50 surges | 0/20 | 0/20 | 0/20 | 0/20 | 0/20 | 0/20 | 0/20 | 0/20 |

Note 1: These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances.
Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers."

# 6 ANNEXES

## 6.1 Parametric Verification

### SMAJ33A

**Characterization SMAJ33A**

*Date : 05/04/2024*
*Ref : 23515A*
*Lab : ST Tours Characterization Lab*

| TEST | VBR | IRM | IRM | VCL 10/1000 µs | RD | VCL 8/20 µs | RD |
|---|---|---|---|---|---|---|---|
| EQUIPMENT | TESEC | TESEC | TESEC | TESEC | TEST CALCULES | TESEC | TESTS_CALCULES |
| Condition 1 | 25°C | 25°C | 85°C | 25°C | 25°C | 25°C | 25°C |
| Condition 2 | IR=1mA | VRM=33V | VRM=33V | IPP=7.5A | IF1=3.75A | IPP=33A | IF1=16.5A |
| Condition 3 | | | | | IF2=7.5A | | IF2=33A |
| Condition 4 | | | | | VR1= 1-VCL 10/1000 µs | | VR1= 1-VCL 8/20 µs |
| Condition 5 | | | | | VR2= 2-VCL 10/1000 µs | | VR2= 2-VCL 8/20 µs |
| Min. Datasheet | *36.7* | | | | | | |
| Typ. Datasheet | *38.6* | | | | | | |
| Max. Datasheet | | *0,2µA* | *1µA* | *53.3* | *1.70* | *69.7* | *0.884ohm* |
| Comments | Direct | Direct | Direct | Direct | Direct | Direct | Direct |
| UNIT | V | nA | nA | V | *Ohm* | V | *Ohm* |
| N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Min | 37.83 | 1.27 | 3.34 | 45.9 | 0.96 | 48.69 | 0.324 |
| Max | 39.13 | 10.23 | 47.13 | 48.3 | 1.2 | 52.71 | 0.379 |
| Avg. | 38.49 | 4.48 | 20.11 | 46.8 | 1.04 | 50.5 | 0.341 |

*(*)These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances.*
*Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers*

### SMBJ33A

**Characterization SMBJ33A**

*Date : 05/04/2024*
*Ref : 23534A*
*Lab : ST Tours Characterization Lab*

| TEST | VBR | IRM | IRM | VCL 10/1000 µs | RD | VCL 8/20 µs | RD |
|---|---|---|---|---|---|---|---|
| EQUIPMENT | TESEC | TESEC | TESEC | TESEC | TEST CALCULES | TESEC | TESTS_CALCULES |
| Condition 1 | 25°C | 25°C | 85°C | 25°C | 25°C | 25°C | 25°C |
| Condition 2 | IR=1mA | VRM=33V | VRM=33V | IPP=11.8A | IF1=5.9A | IPP=57A | IF1=28.5A |
| Condition 3 | | | | | IF2=11.8A | | IF2=57A |
| Condition 4 | | | | | VR1= 1-VCL 10/1000 µs | | VR1= 1-VCL 8/20 µs |
| Condition 5 | | | | | VR2= 2-VCL 10/1000 µs | | VR2= 2-VCL 8/20 µs |
| Min. Datasheet | *36.7* | | | | | | |
| Typ. Datasheet | *38.6* | | | | | | |
| Max. Datasheet | | *0,2µA* | *1µA* | *53.3* | *1.08* | *69.7* | *0.512ohm* |
| Comments | Direct | Direct | Direct | Direct | Direct | Direct | Direct |
| UNIT | V | nA | nA | V | *Ohm* | V | *Ohm* |
| N | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Min | 38.41 | 1.975 | 6.975 | 46.2 | 0.576 | 51.32 | 0.191 |
| Max | 40 | 7.863 | 11.93 | 48.3 | 0.83 | 54.08 | 0.225 |
| Avg. | 38.99 | 2.719 | 9.62 | 46.96 | 0.663 | 52.49 | 0.212 |

*(*)These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances.*
*Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers*

SMBJ70CA

**Characterization SMBJ70CA**

*Date : 05/04/2024*
*Ref : 23516A*
*Lab : ST Tours Characterization Lab*

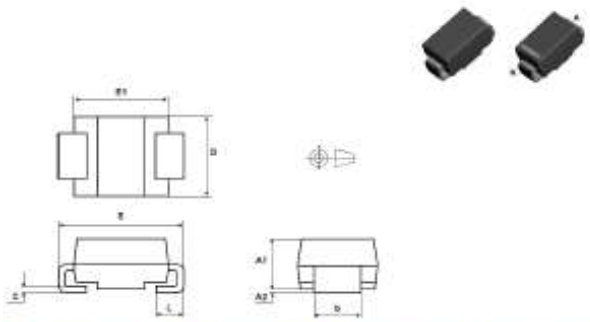
| TEST | VBR | VBR | IRM | IRM | IRM | IRM |
|---|---|---|---|---|---|---|
| EQUIPMENT | TESEC | TESEC | TESEC | TESEC | TESEC | TESEC |
| Condition 1 | 25°C | 25°C | 25°C | 25°C | 85°C | 85°C |
| Condition 2 | IR=1mA | IR=1mA | VRM=70V | VRM=70V | VRM=70V | VRM=70V |
| Condition 3 | | | | | | |
| Condition 4 | | | | | | |
| Condition 5 | | | | | | |
| Min. Datasheet | *77.8* | *77.8* | | | | |
| Typ. Datasheet | *81.9* | *81.9* | | | | |
| Max. Datasheet | | | *0,2µA* | *0,2µA* | *1µA* | *1µA* |
| Comments | Direct | Reverse | Direct | Reverse | Direct | Reverse |
| UNIT | V | V | nA | nA | nA | nA |
| N | 30 | 30 | 30 | 30 | 30 | 30 |
| Min | 79.98 | 80.12 | 1.074 | 0.952 | 4.42 | 2.393 |
| Max | 83.17 | 82.25 | 26.86 | 27.91 | 46.83 | 40.78 |
| Avg. | 81.37 | 81.15 | 6.687 | 9.846 | 19.109 | 20.215 |

| TEST | VCL 10/1000 µs | VCL 10/1000 µs | RD | RD | VCL 8/20 µs | VCL 8/20 µs | RD | RD |
|---|---|---|---|---|---|---|---|---|
| EQUIPMENT | TESEC | TESEC | TEST CALCULES | TEST CALCULES | TESEC | TESEC | TESTS_CALCULES | TESTS_CALCULES |
| Condition 1 | 25°C | 25°C | 25°C | 25°C | 25°C | 25°C | 25°C | 25°C |
| Condition 2 | IPP=5.5A | IPP=5.5A | IF1=2.75A | IF1=2.75A | IPP=27A | IPP=27A | IF1=13.5A | IF1=13.5A |
| Condition 3 | | | IF2=5.5A | IF2=5.5A | | | IF2=27A | IF2=27A |
| Condition 4 | | | VR1= 1-VCL 10/1000 µs | VR1= 1-VCL 10/1000 µs | | | VR1= 1-VCL 8/20 µs | VR1= 1-VCL 8/20 µs |
| Condition 5 | | | VR2= 2-VCL 10/1000 µs | VR2= 2-VCL 10/1000 µs | | | VR2= 2-VCL 8/20 µs | VR2= 2-VCL 8/20 µs |
| Min. Datasheet | | | | | | | | |
| Typ. Datasheet | | | | | | | | |
| Max. Datasheet | *113* | *113* | *4.91* | *4.91* | *146* | *146* | *2.2ohm* | *2.2ohm* |
| Comments | Direct | Reverse | Direct | Reverse | Direct | Reverse | Direct | Reverse |
| UNIT | V | V | *Ohm* | *Ohm* | V | V | *ohm* | *ohm* |
| N | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Min | 95 | 94.9 | 2.109 | 2.472 | 98.08 | 98.08 | 0.611 | 0.603 |
| Max | 97.5 | 97.1 | 3.381 | 2.909 | 100.83 | 100.83 | 0.679 | 0.679 |
| Avg. | 96.04 | 95.9 | 2.766 | 2.71 | 99.48 | 99.48 | 0.642 | 0.6373 |

*(*)These data are indicative values given as information only. Please note that the ST guarantee is the compliance of the products to the ST datasheet. Parameters distributions are not considered as a ST guarantee under any circumstances.*
*Please note that these electrical parameters are 100% tested at 25°C at Final stage of back-end manufacturing before deliveries to customers*

## 6.2 **Physical Dimensions**

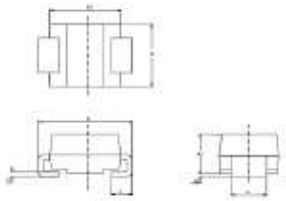
SMA package dimensions

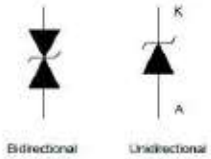


| Ref. | Millimeters | |
|---|---|---|
| | Min. | Max. |
| A1 | 1.90 | 2.45 |
| A2 | 0.05 | 0.20 |
| b | 1.25 | 1.65 |
| c | 0.15 | 0.40 |
| D | 2.25 | 2.90 |
| E | 4.80 | 5.35 |
| E1 | 3.95 | 4.60 |
| L | 0.75 | 1.50 |

| Spec | A1 | A2 | b | c | D | E | E1 | L |
|---|---|---|---|---|---|---|---|---|
| MIN: | 1.90 | 0.05 | 1.25 | 0.15 | 2.25 | 4.80 | 3.95 | 0.75 |
| MAX: | 2.45 | 0.20 | 1.65 | 0.40 | 2.90 | 5.35 | 4.60 | 1.50 |
| 1 | 2.134 | 0.142 | 1.549 | 0.280 | 2.818 | 5.069 | 4.380 | 1.066 |
| 2 | 2.107 | 0.150 | 1.536 | 0.250 | 2.825 | 5.065 | 4.379 | 1.055 |
| 3 | 2.138 | 0.133 | 1.539 | 0.268 | 2.800 | 5.080 | 4.383 | 1.040 |
| 4 | 2.129 | 0.113 | 1.551 | 0.277 | 2.806 | 5.128 | 4.371 | 1.037 |
| 5 | 2.124 | 0.124 | 1.537 | 0.271 | 2.810 | 5.115 | 4.364 | 1.051 |
| 6 | 2.093 | 0.137 | 1.528 | 0.261 | 2.817 | 5.062 | 4.371 | 1.055 |
| 7 | 2.116 | 0.144 | 1.551 | 0.275 | 2.802 | 5.117 | 4.375 | 1.039 |
| 8 | 2.087 | 0.104 | 1.539 | 0.266 | 2.810 | 5.131 | 4.379 | 1.023 |
| 9 | 2.132 | 0.118 | 1.543 | 0.273 | 2.804 | 5.080 | 4.382 | 1.041 |
| 10 | 2.132 | 0.122 | 1.541 | 0.280 | 2.814 | 5.133 | 4.375 | 1.021 |
| 11 | 2.137 | 0.142 | 1.535 | 0.271 | 2.801 | 5.088 | 4.379 | 1.021 |
| 12 | 2.089 | 0.132 | 1.528 | 0.261 | 2.806 | 5.109 | 4.371 | 1.016 |
| 13 | 2.146 | 0.137 | 1.533 | 0.267 | 2.820 | 5.123 | 4.380 | 1.072 |
| 14 | 2.136 | 0.112 | 1.544 | 0.270 | 2.818 | 5.096 | 4.366 | 1.045 |
| 15 | 2.115 | 0.132 | 1.533 | 0.271 | 2.813 | 5.092 | 4.368 | 1.042 |
| 16 | 2.107 | 0.119 | 1.532 | 0.276 | 2.837 | 5.097 | 4.382 | 1.039 |
| 17 | 2.125 | 0.130 | 1.541 | 0.269 | 2.819 | 5.104 | 4.375 | 1.020 |
| 18 | 2.132 | 0.134 | 1.532 | 0.265 | 2.803 | 5.112 | 4.376 | 1.045 |
| 19 | 2.139 | 0.142 | 1.528 | 0.268 | 2.827 | 5.113 | 4.379 | 1.029 |
| 20 | 2.121 | 0.118 | 1.529 | 0.263 | 2.804 | 5.127 | 4.383 | 1.016 |
| 21 | 2.130 | 0.140 | 1.543 | 0.271 | 2.823 | 5.127 | 4.368 | 1.040 |
| 22 | 2.146 | 0.136 | 1.555 | 0.273 | 2.814 | 5.079 | 4.362 | 1.020 |
| 23 | 2.114 | 0.130 | 1.536 | 0.263 | 2.799 | 5.102 | 4.376 | 1.036 |
| 24 | 2.126 | 0.140 | 1.549 | 0.272 | 2.820 | 5.133 | 4.380 | 1.037 |
| 25 | 2.133 | 0.137 | 1.537 | 0.272 | 2.820 | 5.088 | 4.375 | 1.052 |
| 26 | 2.099 | 0.116 | 1.530 | 0.268 | 2.809 | 5.177 | 4.389 | 1.030 |
| 27 | 2.089 | 0.107 | 1.524 | 0.256 | 2.820 | 5.075 | 4.383 | 1.063 |
| 28 | 2.108 | 0.111 | 1.547 | 0.274 | 2.825 | 5.079 | 4.376 | 1.074 |
| 29 | 2.100 | 0.105 | 1.531 | 0.274 | 2.814 | 5.110 | 4.370 | 1.058 |
| 30 | 2.140 | 0.134 | 1.540 | 0.268 | 2.816 | 5.110 | 4.385 | 1.042 |
| MIN | 2.087 | 0.104 | 1.524 | 0.250 | 2.799 | 5.062 | 4.362 | 1.016 |
| MAX | 2.146 | 0.150 | 1.555 | 0.280 | 2.837 | 5.177 | 4.389 | 1.074 |
| AVG | 2.121 | 0.128 | 1.538 | 0.269 | 2.814 | 5.104 | 4.376 | 1.041 |

SMB package dimensions






| Ref. | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.0748 | 0.0965 |
| A2 | 0.05 | 0.20 | 0.0020 | 0.0079 |
| b | 1.95 | 2.20 | 0.0768 | 0.0867 |
| c | 0.15 | 0.40 | 0.0059 | 0.0157 |
| D | 3.30 | 3.95 | 0.1299 | 0.1556 |
| E | 5.10 | 5.60 | 0.2008 | 0.2205 |
| E1 | 4.05 | 4.60 | 0.1594 | 0.1811 |
| L | 0.75 | 1.50 | 0.0295 | 0.0591 |

| Cote | A1 | A2 | b | c | D | E | E1 | L |
|---|---|---|---|---|---|---|---|---|
| 1 | 2.18 | 0.16 | 2.04 | 0.28 | 3.52 | 5.34 | 4.55 | 1.09 |
| 2 | 2.14 | 0.17 | 2.03 | 0.29 | 3.51 | 5.38 | 4.51 | 1.11 |
| 3 | 2.18 | 0.17 | 2.03 | 0.28 | 3.51 | 5.35 | 4.55 | 1.08 |
| 4 | 2.17 | 0.16 | 2.01 | 0.29 | 3.52 | 5.38 | 4.53 | 1.10 |
| 5 | 2.11 | 0.16 | 2.03 | 0.29 | 3.51 | 5.35 | 4.51 | 1.12 |
| 6 | 2.14 | 0.14 | 2.02 | 0.29 | 3.53 | 5.34 | 4.55 | 1.10 |
| 7 | 2.16 | 0.15 | 2.02 | 0.28 | 3.47 | 5.33 | 4.51 | 1.09 |
| 8 | 2.17 | 0.16 | 2.02 | 0.28 | 3.50 | 5.35 | 4.53 | 1.06 |
| 9 | 2.17 | 0.16 | 2.02 | 0.27 | 3.51 | 5.36 | 4.51 | 1.09 |
| 10 | 2.17 | 0.15 | 2.01 | 0.28 | 3.49 | 5.34 | 4.51 | 1.11 |
| 11 | 2.17 | 0.16 | 2.03 | 0.28 | 3.50 | 5.36 | 4.52 | 1.07 |
| 12 | 2.17 | 0.16 | 2.03 | 0.28 | 3.51 | 5.37 | 4.54 | 1.07 |
| 13 | 2.16 | 0.15 | 2.04 | 0.28 | 3.52 | 5.36 | 4.51 | 1.08 |
| 14 | 2.18 | 0.16 | 2.02 | 0.29 | 3.51 | 5.39 | 4.54 | 1.07 |
| 15 | 2.17 | 0.14 | 2.02 | 0.28 | 3.50 | 5.38 | 4.53 | 1.09 |
| 16 | 2.17 | 0.16 | 2.02 | 0.29 | 3.53 | 5.36 | 4.52 | 1.10 |
| 17 | 2.17 | 0.16 | 2.05 | 0.27 | 3.52 | 5.38 | 4.51 | 1.10 |
| 18 | 2.18 | 0.15 | 2.03 | 0.28 | 3.53 | 5.37 | 4.50 | 1.11 |
| 19 | 2.15 | 0.15 | 2.02 | 0.27 | 3.50 | 5.37 | 4.52 | 1.11 |
| 20 | 2.17 | 0.16 | 2.02 | 0.28 | 3.53 | 5.37 | 4.53 | 1.11 |
| 21 | 2.16 | 0.16 | 2.01 | 0.28 | 3.56 | 5.34 | 4.50 | 1.10 |
| 22 | 2.17 | 0.16 | 2.03 | 0.28 | 3.56 | 5.41 | 4.52 | 1.07 |
| 23 | 2.16 | 0.15 | 2.02 | 0.28 | 3.55 | 5.37 | 4.50 | 1.11 |
| 24 | 2.18 | 0.16 | 2.03 | 0.29 | 3.52 | 5.33 | 4.53 | 1.11 |
| 25 | 2.17 | 0.14 | 2.03 | 0.29 | 3.55 | 5.35 | 4.52 | 1.11 |
| 26 | 2.17 | 0.15 | 2.02 | 0.28 | 3.50 | 5.37 | 4.52 | 1.09 |
| 27 | 2.18 | 0.15 | 2.02 | 0.29 | 3.55 | 5.36 | 4.51 | 1.08 |
| 28 | 2.17 | 0.16 | 2.02 | 0.28 | 3.56 | 5.34 | 4.51 | 1.09 |
| 29 | 2.17 | 0.16 | 2.02 | 0.28 | 3.56 | 5.38 | 4.49 | 1.08 |
| 30 | 2.17 | 0.15 | 2.04 | 0.28 | 3.54 | 5.33 | 4.50 | 1.10 |
| **LSL** | 1.90 | 0.05 | 1.95 | 0.15 | 3.30 | 5.10 | 4.05 | 0.75 |
| **USL** | 2.45 | 0.20 | 2.20 | 0.40 | 3.95 | 5.60 | 4.60 | 1.50 |
| **MIN** | 2.11 | 0.14 | 2.01 | 0.27 | 3.47 | 5.33 | 4.49 | 1.06 |
| **MAX** | 2.18 | 0.17 | 2.05 | 0.29 | 3.56 | 5.41 | 4.55 | 1.12 |
| **AVG** | 2.17 | 0.16 | 2.02 | 0.28 | 3.52 | 5.36 | 4.52 | 1.09 |

## 6.3 Tests description

| Test name | Description | Purpose |
|---|---|---|
| **Die Oriented** | | |
| **HTRB**<br>High Temperature Reverse Bias | The device is stressed in static configuration, trying to satisfy as much as possible the following conditions:<br>- Low power dissipation<br>- Max. supply voltage compatible with diffusion process and internal circuitry limitations.<br><br>Forward: device is forward biased with a current fixed and adjusted to reach the targeted junction temperature | 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.<br>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.<br>To assess active area and contacts integrity |
| **Package Oriented** | | |
| **PC**<br>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.<br>As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance.<br>The typical failure modes are "pop-corn" effect and delamination. |
| **H3TRB**<br>High Humidity High Temperature Reverse 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. |
| **TC**<br>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. |
| **UHAST**<br>Unbiased Highly Accelerated Stress Test | 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. |
| **DPA**<br>Destructive Physical Analysis | Specific construction analysis on random parts that have successfully completed THB or TC. | To investigate on reliability stresses impact on delamination, corrosion and product construction integrity. |
| **RSH**<br>Resistance to Solder Heat | Package is dipped by the leads in a solder bath after initial wet ageing (for SMDs only). Assessment by electrical test + no external crack | To simulate wave soldering process and verify that package will not be thermally damaged during this step. |

| Test name | Description | Purpose |
|---|---|---|
| **DBT**<br>Dead Bug Test | To evaluate the wettability of the package leads. Good indicator to determine the bad solderability behavior | Components are glued up-side down on a substrate. Pins are wetted with a moderately activated flux. Then run once through the reflow oven with leadfree temperature profile. Visual inspection is performed with suitable tool. |
| **SD**<br>Solderability | The purpose of this test method is to provide a referee condition for the evaluation of the solderability of terminations (including leads up to 0.125 inch in diameter) that will be assembled using tin lead eutectic solder. | This evaluation is based on the ability of these terminations to be wetted and to produce a suitable fillet when coated by tin lead eutectic solder. These procedures will test whether the packaging materials and processes used during the manufacturing operations process produce a component that can be successfully soldered to the next level assembly using tin lead eutectic solder. A preconditioning test is included in this test method, which degrades the termination finish to provide a guard band against marginal finish. |
| **Functional Tests** | | |
| **RS**<br>Repetitive Surges | The device is submitted to a reverse current peak: Ipp, which depends of the current holding of the product. | To evaluate the holding of the component to a high electrical field. Short circuit or hot point is expected as failure mechanism. |