APM - ASD & IPAD Division

SCRs and Triacs in TO-220AB and D2PAK packages

Qualification of a new supplier for leadframe
<table>
<thead>
<tr>
<th>Production process involved</th>
<th>SCRs and Triacs in TO-220AB and D²PAK packages</th>
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<tbody>
<tr>
<td>Production process details</td>
<td>Generic</td>
</tr>
<tr>
<td>Reason for change</td>
<td>secure the supply chain</td>
</tr>
<tr>
<td>Description</td>
<td>The present document announces the qualification of a new supplier for the leadframe used in our assembly plant in China for the production of our SCRs and Triacs in TO-220AB (non insulated type) and D²PAK packages assembled with clip bonding technology. The purpose of this qualification is to secure the supply chain.</td>
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<td>Forecasted date of implementation</td>
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<tr>
<td>Description of qualification program</td>
<td>See Attached Qualification Plan</td>
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<tr>
<td>Involved ST facilities</td>
<td>China plant</td>
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## DOCUMENT APPROVAL

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<tr>
<th>Name</th>
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<tr>
<td>Paris, Eric</td>
<td>Division Marketing Manager</td>
</tr>
<tr>
<td>Cazaubon, Guy</td>
<td>Division Q.A. Manager</td>
</tr>
<tr>
<td>Duclos, Franck</td>
<td>Process Owner</td>
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APM - ASD & IPAD Division

SCRs and Triacs in TO-220AB and D²PAK packages:

Qualification of a new supplier for leadframe

TO-220AB

D²PAK

Reason
The present document announces the qualification of a new supplier for the leadframe used in our assembly plant in China for the production of our SCRs and Triacs in TO-220AB (non insulated type) and D²PAK packages, assembled with clip bonding technology.

The purpose of this qualification is to secure the supply chain.

Products involved

<table>
<thead>
<tr>
<th>Package</th>
<th>Product sub-family</th>
<th>Standard Product Series</th>
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</thead>
<tbody>
<tr>
<td>D²PAK</td>
<td>SCRs</td>
<td>TNxxxH-6G(-RG)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TNxxx-xxxG(-GR)</td>
</tr>
<tr>
<td></td>
<td>Triacs</td>
<td>Txxx-xxxG(-TR)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TxxxH-6G(-TR)</td>
</tr>
<tr>
<td></td>
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<td>TxxxH-xxxG(-TR)</td>
</tr>
<tr>
<td>TO-220AB</td>
<td>SCRs</td>
<td>AVSxxxCB</td>
</tr>
<tr>
<td>(non insulated)</td>
<td></td>
<td>BTBxxx-xxxBRG / BWRG</td>
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<tr>
<td></td>
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<td>BTBxxx-xxxCRG / CWRG</td>
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<td>BTBxxx-xxxSRG / SWRG</td>
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<tr>
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<td></td>
<td>BTBxxx-xxxTRG / TWRG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Txxx-xxxT</td>
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<tr>
<td></td>
<td></td>
<td>TxxxH-6T</td>
</tr>
</tbody>
</table>

Customer specific SCRs and Triacs not expressly included in the above table but derived from above product series and housed in the D²PAK and non insulated TO-220AB packages with clip bonding technology are also benefiting of this part double sourcing.

Schedule

Deliveries of parts assembled with the new supplier leadframe will start from week 49-2010.

Following Jedecl Standard No. 46-C, lack of acknowledgement of this PIL within 30 days will constitute acceptance of the change. After acknowledgement, lack of additional response within the 90 day period from PIL notification will constitute acceptance of the change.

Effect of change

The alternative lead frame was designed as the replication of the leadframe currently sourced with a qualified material. Qualification was done with respect to ST’s current supply specification. There is no impact on the electrical, dimensional and thermal parameters of the products, neither on the MSL (moisture sensitivity level) of devices in D²PAK (MSL 1). The verification by visual, mechanical, electrical, and reliability testing was included in the qualification program.

Qualification

The reliability test report is annexed to the present document.
Reliability Evaluation Report
Qualification new frame supplier for TO-220AB and D²PAK Clip packages

<table>
<thead>
<tr>
<th>General Information</th>
<th>Locations</th>
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</tr>
<tr>
<td>PL 58</td>
<td>ST Tours (France)</td>
</tr>
<tr>
<td>Product Description</td>
<td>Assembly plant</td>
</tr>
<tr>
<td>SCRs and Triacs</td>
<td>ST Shenzhen (China)</td>
</tr>
<tr>
<td>All SCRs and Triacs in non isolated TO-220AB or D²PAK package</td>
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<tr>
<td>P/N</td>
<td>Reliability Lab</td>
</tr>
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<td>isolated TO-220AB or D²PAK package</td>
<td>ST Tours (France)</td>
</tr>
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<td>Product Group</td>
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<td>IMS</td>
<td></td>
</tr>
<tr>
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<tr>
<td>Package</td>
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</tr>
<tr>
<td>TO-220AB and D²PAK</td>
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<tr>
<td>Silicon Process technology</td>
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</tr>
<tr>
<td>Mesa Glass</td>
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</tr>
<tr>
<td>Maturity level step</td>
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DISTRIBUTION LIST

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<tbody>
<tr>
<td>Francis Lemaire</td>
<td>Product Engineer</td>
<td>Isabelle Dubois</td>
<td>PE&amp;D Technician</td>
</tr>
<tr>
<td>Samuel Ducret</td>
<td>Reliability Engineer</td>
<td>Stephane Forster</td>
<td>Reliability Engineer</td>
</tr>
<tr>
<td>Stephane Moreau</td>
<td>PE&amp;D Engineer</td>
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DOCUMENT INFORMATION

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<tr>
<td>1.0</td>
<td>09/06/10</td>
<td>17</td>
<td>Stéphane Forster</td>
<td>Guy Cazaubon</td>
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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. 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.
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1 APPLICABLE AND REFERENCE DOCUMENTS

<table>
<thead>
<tr>
<th>Document reference</th>
<th>Short description</th>
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<tbody>
<tr>
<td>AEC-Q101</td>
<td>Stress test qualification for automotive grade discrete semiconductors</td>
</tr>
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<td>JESD47</td>
<td>Stress-Test-Driven Qualification of Integrated Circuits</td>
</tr>
<tr>
<td>SOP 2614</td>
<td>Reliability requirements for product qualification</td>
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<td>0061692</td>
<td>Reliability tests and criteria for qualifications</td>
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</table>

2 GLOSSARY

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>DUT</td>
<td>Device Under Test</td>
</tr>
<tr>
<td>SS</td>
<td>Sample Size</td>
</tr>
<tr>
<td>PC</td>
<td>Pre-conditionning</td>
</tr>
<tr>
<td>THB</td>
<td>Temperature Humidity Bias</td>
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</table>
3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective of this report is to evaluate a new frame supplier for TO-220AB and D³PAK packages. Evaluation is done with 3 test vehicles: T835-600G-TR, T2535-600G-TR and BTB24-600BWRG.

The reliability test plan has been defined after FMEA following “stress test driven” method including package tests.

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 vehicles tests are:
- T835-600G-TR
- T2535-600G-TR
- BTB24-600BWRG

Package D²PAK for T835-600G-TR and T2535-600G-TR:

![D²PAK Diagram]

Package TO-220AB for BTB24-600BWRG:

![TO-220AB Diagram]

For more information see referenced Datasheet document.
4.2 Construction note

See referenced Product Baseline for detailed information.

<table>
<thead>
<tr>
<th>T835-600G-TR/7</th>
<th>Wafer/Die fab. information</th>
<th>Assembly information</th>
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<tbody>
<tr>
<td>Wafer fab manufacturing location</td>
<td>ST Tours</td>
<td>Technology</td>
<td>Mesa Glass</td>
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<td>Process family</td>
<td>58 Thyristor Triacs</td>
<td>Wafer Testing (EWS) information</td>
<td>Electrical testing manufacturing location</td>
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<tr>
<td>Assembly site</td>
<td>ST SHENZHEN (China)</td>
<td>Package description</td>
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<table>
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<th>Wafer/Die fab. information</th>
<th>Assembly information</th>
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<td>Wafer fab manufacturing location</td>
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<tr>
<td>Assembly site</td>
<td>ST SHENZHEN (China)</td>
<td>Package description</td>
<td>D²PAK</td>
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<tr>
<td>Testing location</td>
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<td>Wafer fab manufacturing location</td>
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5 TESTS RESULTS SUMMARY

5.1 Test vehicle

<table>
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<tr>
<th>Lot #</th>
<th>Process/ Package</th>
<th>Part Number</th>
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<tr>
<td>Lot 1</td>
<td>D²PAK</td>
<td>T835-600G-TR</td>
</tr>
<tr>
<td>Lot 2</td>
<td>D²PAK</td>
<td>T2535-600G-TR</td>
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<tr>
<td>Lot 3</td>
<td>TO-220AB</td>
<td>BTB24-600BWRG</td>
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Detailed results in below chapter will refer to P/N and Lot #.

5.2 Test plan and results summary

Moisture Sensitivity Level = MSL1

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<tr>
<th>Test</th>
<th>PC</th>
<th>Std ref.</th>
<th>Conditions</th>
<th>SS</th>
<th>Steps</th>
<th>Failure/SS</th>
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Package Oriented Tests

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<th>Conditions</th>
<th>SS</th>
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6 ANNEXES

6.1 Tests Description

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<tr>
<th>Test name</th>
<th>Description</th>
<th>Purpose</th>
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<tr>
<td>Package Oriented</td>
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<tr>
<td>PC Preconditioning</td>
<td>The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.</td>
<td>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 &quot;pop corn&quot; effect and delamination.</td>
</tr>
<tr>
<td>THB Temperature Humidity Bias</td>
<td>The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambient temperature and relative humidity.</td>
<td>To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence.</td>
</tr>
</tbody>
</table>
6.2 **Drift Analysis**

In addition to the table of results (refer to item 5), the following graphs provide a straightforward data analysis with a representation of the selected parameter population in the Henry's chart. Since the « y » axis represents the cumulative population of the different read-outs, statistical analysis is easy (median, range), while the overall stability and span during the stress test is immediately evident. No drift is observed on the main parameters Idrm, irm, Vtm, THB test on T2535

**Id evolution after 1000 hours of THB test**

**Ir evolution after 1000 hours of THB test**
Vtm+ evolution after 1000 hours of THB test

Vtm- evolution after 1000 hours of THB test
THB test on T835

Id evolution after 1000 hours of THB test

Ir evolution after 1000 hours of THB test
Vtm+ evolution after 1000 hours of THB test

Vtm- evolution after 1000 hours of THB test
THB test on BTB24

Id evolution after 1000 hours of THB test

Ir evolution after 1000 hours of THB test
Von+ evolution after 1000 hours of THB test

Von- evolution after 1000 hours of THB test
6.3 **Device identification - Marking**

**Triac series**

- **Insulation**
  - A = insulated
  - B = non insulated

- **Current**
  - 24 = 25 A in TO-220AB
  - 25 = 25 A in RD91
  - 26 = 25 A in TOP3

- **Voltage**
  - 600 = 600 V
  - 800 = 800 V

- **Sensitivity and type**
  - B = 50 mA Standard
  - BW = 50 mA Snubberless
  - CW = 35 mA Snubberless

- **Packing mode**
  - RG = Tube

**Triac series**

- **Current**
  - 25 = 25 A

- **Sensitivity**
  - 35 = 35 mA

- **Voltage**
  - 600 = 600 V
  - 800 = 800 V

- **Package**
  - G = D²PAK

- **Packing mode**
  - Blank = Tube
  - -TR = Tape and Reel
Triac series
Current
8 = 8A
Sensitivity
10 = 10 mA
35 = 35 mA
Voltage
600 = 600 V
800 = 800 V
Package
B = DPAK
H = IPAk
G = D^2PAK
R = I^2PAK
Packing mode
Blank = Tube
-TR = Tape and reel
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