


**PRODUCT / PROCESS CHANGE NOTIFICATION**

**1. PCN basic data**

<b>1.1 Company</b>		STMicroelectronics International N.V
<b>1.2 PCN No.</b>	IPD/15/9447	
<b>1.3 Title of PCN</b>	Darlington Arrays ULN2003D1013TR and ULQ2003D1013TR SO16 Qualification in AMKOR Manila (Philippine) subcontractor.	
<b>1.4 Product Category</b>	Linear Voltage regulators	
<b>1.5 Issue date</b>	2015-10-14	

**2. PCN Team**

<b>2.1 Contact supplier</b>	
<b>2.1.1 Name</b>	SETTLES JEFF
<b>2.1.2 Phone</b>	+44 1628896222
<b>2.1.3 Email</b>	jeff.settles@st.com
<b>2.2 Change responsibility</b>	
<b>2.2.1 Product Manager</b>	Lorenzo NASO
<b>2.1.2 Marketing Manager</b>	Antonio RIVIERA
<b>2.1.3 Quality Manager</b>	Paolo MORETTI

**3. Change**

<b>3.1 Category</b>	<b>3.2 Type of change</b>	<b>3.3 Manufacturing Location</b>
Transfer of a full process or process brick (process step, control plan, recipes) from one site to another site	Product : even if test or process transfer is qualified	AMKOR Manila (Philippine)

**4. Description of change**

	<b>Old</b>	<b>New</b>
<b>4.1 Description</b>	Shenzhen (China), Bouskoura (Morocco) and ASE (Shanghai)	AMKOR Manila (Philippine)
<b>4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?</b>	No impact in terms of electrical performances, Quality and Reliability	

**5. Reason / motivation for change**

<b>5.1 Motivation</b>	Progressing on the activities related to quality improvement and along the plan of rationalizing the manufacturing processes, ST is glad to announce the qualification of SO16 in the AMKOR Manila subcontractor (Philippine).
<b>5.2 Customer Benefit</b>	CAPACITY INCREASE

**6. Marking of parts / traceability of change**

<b>6.1 Description</b>	The traceability of the parts assembled in the new subcontractor will be ensured by different internal codification and QA number.
------------------------	--

**7. Timing / schedule**

<b>7.1 Date of qualification results</b>	2015-10-07
<b>7.2 Intended start of delivery</b>	2016-01-07
<b>7.3 Qualification sample available?</b>	Upon Request

**8. Qualification / Validation**

<b>8.1 Description</b>	REL 6088-171-W-2015-ULQ2003D1013TR- L203- SO16 Amkor.pdf		
<b>8.2 Qualification report and qualification results</b>	Available (see attachment)	<b>Issue Date</b>	2015-10-14

**9. Attachments (additional documentations)**

9447PpPrdtLst.pdf  
REL 6088-171-W-2015-ULQ2003D1013TR- L203- SO16 Amkor.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
	ULN2003D1013TR	
	ULQ2003D1013TR	

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND / OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE ( AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION ), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners

©2014 STMicroelectronics - All rights reserved.

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan -  
Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)

## Reliability Report

### Qualification of a New Subcontractor for SO16 Package

**Package: SO16 - Amkor**  
**T.V: ULQ2003D1013TR**

#### General Information

<b>Product Line</b>	L203
<b>Product Description</b>	Multidarlington Array
<b>P/N</b>	ULQ2003D1013TR
<b>Product Group</b>	IPD
<b>Product division</b>	IND.& POWER CONV Voltage Regulator & Vre
<b>Packages</b>	SO16
<b>Silicon Process technology</b>	Bipolar

#### Locations

<b>Wafer fab</b>	<i>Ang Mo kio</i>
<b>Assembly plant</b>	AMKOR
<b>Reliability Lab</b>	<i>Catania Reliability LAB</i>
<b>Reliability assessment</b>	<i>Pass</i>

### DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comment
1.0	August 2015	6	Angelo Basile	Giovanni Presti	Final Report

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

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

<b>1</b>	<b>APPLICABLE AND REFERENCE DOCUMENTS .....</b>	<b>3</b>
<b>2</b>	<b>GLOSSARY .....</b>	<b>3</b>
<b>3</b>	<b>RELIABILITY EVALUATION OVERVIEW.....</b>	<b>3</b>
3.1	OBJECTIVES .....	3
3.2	CONCLUSION .....	3
<b>4</b>	<b>DEVICE CHARACTERISTICS.....</b>	<b>4</b>
4.1	DEVICE DESCRIPTION.....	4
4.2	CONSTRUCTION NOTE .....	4
<b>5</b>	<b>TESTS RESULTS SUMMARY.....</b>	<b>5</b>
5.1	TEST VEHICLE.....	5
5.2	TEST PLAN AND RESULTS SUMMARY .....	5
<b>6</b>	<b>ANNEXES .....</b>	<b>6</b>
6.1	TESTS DESCRIPTION.....	6

## **1 APPLICABLE AND REFERENCE DOCUMENTS**

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

## **2 GLOSSARY**

DUT	Device Under Test
SS	Sample Size
STD	Standard

## **3 RELIABILITY EVALUATION OVERVIEW**

### **3.1 Objectives**

SO16 Qualification in AMKOR subcontractor  
T.V.:Darlington Arrays ULQ2003D1013TR

### **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 ULQ2001A, ULQ2002A, ULQ2003 and ULQ2004A are high voltage, high current Darlington arrays each containing seven open collector Darlington pairs with common emitters. Each channel is rated at 500 mA and can withstand peak currents of 600 mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout

### 4.2 Construction note

P/N	ULQ2003D1013TR
<b>Wafer/Die fab. information</b>	
Wafer fab manufacturing location	Ang Mo Kio SINGAPORE
Technology	BiP > 6um
Die finishing back side	CHROMIUM/NICKEL/GOLD
Die size	2280, 1200 micron
Passivation type	SiN (nitride)
<b>Wafer Testing (EWS) information</b>	
Electrical testing manufacturing location	Ang Mo Kio EWS
Tester	ASL1000
Test program	CL203CB6_0300.zip
<b>Assembly information</b>	
Assembly site	AMKOR ATP1
Package description	SO 16
Molding compound	Epoxy
Die attach material	Glue
Wires bonding materials/diameters	Cu - 1.0mil
<b>Final testing information</b>	
Testing location	AMKOR ATP3
Tester	ASL 1000
Test program	L203_STE_FA 02.prg /l203 STS QAprg_

## 5 TESTS RESULTS SUMMARY

### 5.1 Test vehicle

Lot #	Trace Code	Package	Line	Comment
1 Lot	MBQ7*L203DA6	SO16L	L20303	STD
2 lot				STD
3 lot				STD
4 lot				Corner lot HH
5 lot				Corner lot LL

### 5.2 Test plan and results summary

P/N: ULQ2003D1013TR

Test	PC	Std ref.	Conditions	SS	Steps h=hours cy=cycles	Failure/SS					Note
						1 Lot	2 Lot	3 Lot	Lot HH	Lot LL	
<b>Die Oriented Tests</b>											
HTOL	N	JESD22 A-108	Ta =125°C Vbias+50V		168h	0/77	0/77	0/77			
					500h	0/77	0/77	0/77			
					1000h	0/77	0/77	0/77			
HTSL	N	JESD22 A-103	Ta = 150°C		168h	0/45	0/45	0/45	0/45	0/45	
					500h	0/45	0/45	0/45	0/45	0/45	
					1000h	0/45	0/45	0/45	0/45	0/45	
HTSL	N	JESD22 A-103	Ta = 175°C		168h	0/45	0/45	0/45			Engineering evaluation
					500h	0/45	0/45	0/45			
					1000h	0/45	0/45	0/45			
<b>Package Oriented Tests</b>											
PC	Y	JESD22 A-113	Drying 24 H @ 125°C Store 168 H @ Ta=85°C Rh=85% Oven Reflow @ Tpeak=260°C 3 times		Final	Pass	Pass	Pass	Pass	Pass	
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C		168h	0/77	0/77	0/77			
THB	Y	JESD22 A-101	Ta = 85°C, Rh=85% Vbias +35V		168h	0/77	0/77	0/77			
					500h	0/77	0/77	0/77			
					1000h	0/77	0/77	0/77			
TC	Y	JESD22 A-104	Ta = -65°C to 150°C		100cy	0/77	0/77	0/77	0/77	0/77	
					300cy	0/77	0/77	0/77	0/77	0/77	
					500cy	0/77	0/77	0/77	0/77	0/77	



## 6 ANNEXES

### 6.1 Tests Description

Test name	Description	Purpose
<b>Die Oriented</b>		
<b>HTOL</b> High Temperature Operative Life	The device is stressed in static or dynamic configuration, approaching the operative max. absolute ratings in terms of junction temperature and bias condition.	To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way. The typical failure modes are related to, silicon degradation, wire-bonds degradation, oxide faults.
<b>HTSL</b> High Temperature Storage Life	The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature.	To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding.
<b>Package Oriented</b>		
<b>PC</b> Preconditioning	The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.	As stand-alone test: to investigate the moisture sensitivity level. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop corn" effect and delamination.
<b>AC</b> Auto Clave (Pressure Pot)	The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature.	To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity.
<b>TC</b> 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.
<b>THB</b> Temperature Humidity Bias	The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambient temperature and relative humidity.	To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence.



## Public Products List

**PCN Title** : Darlington Arrays ULN2003D1013TR and ULQ2003D1013TR

SO16 Qualification in AMKOR Manila (Philippine) subcontractor.

**PCN Reference** : IPD/15/9447

**PCN Created on** : 07-Oct-2015

**Subject** : Public Products List

Dear Customer,

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

ULN2003D1013TR	ULQ2003D1013TR	
----------------	----------------	--



**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND / OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE ( AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION ), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners

©2014 STMicroelectronics - All rights reserved.

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan -  
Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)