PRODUCT/PROCESS CHANGE NOTIFICATION

PCN APM-DIS/10/4891
Notification Date 02/03/2010

APM - ASD & IPAD Division

AC Switches in TO-92 package

Conversion to ECOPACK(r)2 grade &

Qualification of Copper wire bonding

Table 1. Change Implementation Schedule

Forecasted implementation date for change	12-Feb-2010
Forecasted availabillity date of samples for customer	12-Feb-2010
Forecasted date for **STMicroelectronics** change Qualification Plan results availability	27-Jan-2010
Estimated date of changed product first shipment	07-May-2010

Table 2. Change Identification

Product Identification (Product Family/Commercial Product)	AC Switches in TO-92 package
Type of change	Package assembly process change
Reason for change	Conversion to ECOPACK(r)2
Description of the change	The ECOPACK(r) program is the cornerstone of our efforts for being leader in offering environmentally friendly packaging. Progressing in this program, ST is implementing technical solutions designed to progressively remove banned substances from manufacturing. To meet the so called "Halogen-Free" requirements of the market, ST is converting its AC Switches in TO-92 package to the ECOPACK(r)2 grade. The permanent evolution of our technology leads us to implement at the same time the copper wire bonding process instead of gold, for all AC Switches in TO-92.
Product Line(s) and/or Part Number(s)	See attached
Description of the Qualification Plan	See attached
Change Product Identification	Traceability insured by the internal date code and the Q.A. number
Manufacturing Location(s)	1]Sc - Ase Weihai - China

Table 3. List of Attachments

Customer Part numbers list	
Qualification Plan results	

- -

Customer Acknowledgement of Receipt	**PCN APM-DIS/10/4891**
Please sign and return to STMicroelectronics Sales Office	**Notification Date 02/03/2010**
☐ Qualification Plan Denied	Name:
☐ Qualification Plan Approved	Title:
	Company:
☐ Change Denied	Date:
☐ Change Approved	Signature:

Remark

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DOCUMENT APPROVAL

Name	Function
Paris, Eric	Division Marketing Manager
Duclos, Franck	Division Product Manager
Cazaubon, Guy	Division Q.A. Manager

PRODUCT/PROCESS
CHANGE NOTIFICATION

PCN APM-DIS/10/4891

APM - ASD & IPAD Division[1]

<u>AC Switches in TO-92 package:</u>

Conversion to ECOPACK®2 grade &

Qualification of Copper wire bonding

(1) APM: Analog, Power & MEMS Group - ASD: Application Specific Device - IPAD: Integrated Passive and Active Devices

WHY THIS CHANGE

The ECOPACK® program is the cornerstone of our efforts for being leader in offering **environmentally friendly packaging**. Progressing in this program, ST is implementing technical solutions designed to progressively remove banned substances from manufacturing.

To meet the so called **"Halogen-Free"** requirements of the market, ST is converting its **AC Switches** in **TO-92 package** to the **ECOPACK®2** grade.

The permanent evolution of our technology leads us to implement at the same time the **copper wire bonding process** instead of gold, for **all AC Switches in TO-92**.

The **involved product** series are listed below:

Package	Product Family	Involved Series or Product	ECOPACK®2 conversion	Copper wire bonding
TO-92	ACS devices	ACS102-6xx(-TR) ACS108-6xx(-TR)	All	All
	Ignitors	FLC21-135A		
	SCRs	P0102xA xxxx P0109DA xxxx P0111xA xxxx P0115DA xxxx P0118xA xxxx P0130AA xxxx		
		X00602MA xxxx X00619MA xxxx		
		X0202xA xxxx X0203xA xxxx X0205xA xxxx X0225xA xxxx X0227MA 5DL2		
		XL0840		
	Triacs	Z00607xA xxxx Z0103xA xxxx Z0107xA xxxx Z0109xA xxxx Z0110MA 1AA2 Z0125MA xxxx Z0127MA 2EL2 Z0140MA 2DL2		

Specific devices not expressly listed in the above table are included in the announced change.

WHAT IS THE CHANGE

The **ECOPACK®2** grade is defined as follows:

1. **RoHS compliance**, with possible exemptions,
2. **500 ppm** maximum of **Antimony** as oxide or organic compound in each organic assembly materials (glue, substrate, mold compounds, housing).
3. **900ppm** maximum of **[Bromine + Chlorine]**, this value referring to the maximum total content.

The implemented changes are summed up in the table below.

Material	Current	New
Molding compound	Cheil ST-7100DS	Samsung SG-8100GSA
Wire Bonding	Gold wire	Copper wire

There is **no impact** on the **electrical, dimensional** and **thermal parameters** of the products with respect to the product datasheet. This was verified in the qualification program. There is **no change** in the **packing modes** and the standard **delivery quantities** either.

HOW AND WHEN

Qualification and test results:

The **qualification program** mainly consists of **reliability tests** and **comparative electrical characterizations**.

The **reliability test report** is annexed to the present document.

Sampling:

Qualification samples of selected devices and test vehicles are available on request as indicated below.

Salestypes (including test vehicles)	Product Family	Samples availability
ACS108-6SA-TR	ACS devices	Week 06-2010
X0202MA 1AA2	SCR	
X0205MA 2BL2	SCR	
XL0840	SCR	
Z00607MA 1BA2	Triac	
Z0103MA 2AL2	Triac	
Z0107NA 5AL2	Triac	

Other samples are available on request for delivery within notice period if ordered within 30 days from notification.

Change implementation schedule:

Both changes will be **simultaneously implemented** in the manufacturing site of **China**.

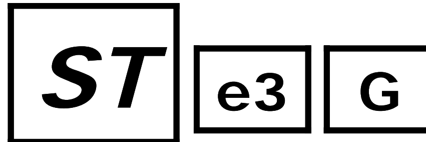
The **production change** and **first shipments** will be implemented according to our work in progress and materials availability as indicated in the schedule below:

Product Family	Production Change	1st Shipments
All	From Week 06 - 2010	From Week 18 - 2010

Following Jedec Standard No. 46-C, lack of acknowledgement of the PCN within **30 days** will constitute acceptance of the change. After acknowledgement, lack of additional response within the **90 days** from PCN notification period will constitute acceptance of the change. In any case, **first shipments** may start earlier with customer's **written agreement**.

Marking and traceability:

The **marking** of the modified components will be differentiated with an **additional letter "G" that will be printed to the right of the "e3"** symbol of the IPC-JEDEC J-STD 609 standard, as shown below.



The **traceability** for the modified products will be ensured by an **internal codification** and by the **Q.A. number**.

Conversion roadmap:

Deliveries of **current product versions** will continue while the conversion is brought to completion and as long as former product stocks last.

Annex: **Reliability Test Report** for qualification program.

Reliability Report

Cu wire and ECOPACK®2 grade for T0-92 package at ASE

General Information	
Product Line	*PL 58*
Product Description	*AC Switches*
P/N	*All AC Switches in TO-92*
Product Group	*IMS*
Product division	*APM*
Package	*TO-92*
Maturity level step	*30*

Locations	
Wafer fab	*ST TOURS (France)*
Assembly plant	*ASE* WEIHAI
Reliability Lab	*ST TOURS (France)*
Reliability assessment	*PASS*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Comment
1.0	12/15/09	15	Samuel Ducret	First issue

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

1 **APPLICABLE AND REFERENCE DOCUMENTS** **3**
2 **GLOSSARY** **3**
3 **RELIABILITY EVALUATION OVERVIEW** **4**
3.1 OBJECTIVES 4
3.2 CONCLUSION 4
4 **DEVICE CHARACTERISTICS** **5**
4.1 CONSTRUCTION NOTE 5
5 **TESTS RESULTS SUMMARY** **7**
5.1 TEST VEHICLE 7
5.2 TEST PLAN AND RESULTS SUMMARY 7
6 **ANNEXES** **8**
6.1 TESTS DESCRIPTION 8
6.2 DRIFT ANALYSIS : 8

1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
JESD47	Stress-Test-Driven Qualification of Integrated Circuits
FMEA	8176234

2 GLOSSARY

DUT	Device Under Test
PCB	Printed Circuit Board
SS	Sample Size
PC	Pre-conditionning
HTRB	High Temperature Reverse Bias
HTGB	High Temperature Gate Bias
TC	Temperature Cycling
PCT	Pressure Pot 2 bars
THB	Temperature Humidity Bias
TF	Thermal Fatigue/Intermittent Operational Life
OLT	Operational Life Test or Functional Test
ESD	ESD Characterization
DPA	Destructive Physical Analysis. Random sample of devices that have successfully completed THB and TC
	Physical Dimension
	Terminal Strength
	Resistance to solvents
	Constant Acceleration
	Vibration Variance Frequency
	Mechanical Shock
	Hermeticity
RSH	Resistance to solder Heat
	Solderability
	Thermal Resistance
	Wire Bond Strength
	Bond Shear
	Die Shear
	Unclamped Inductive Switching (Power MOS only)
	Dielectric Integrity (Power MOS only)
DT	Drop Test
	Screwing Test
	Dedicated Test

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The objective is to qualify the TO-92 package with Cu wire (instead of Au wire) and the ECOPACK®2 (“Halogen-free”) molding compound in ASE back end. This qualification has to be done for all the AC Switches in TO-92 package.

This change is covered by the PCN APM-DIS/09/4891.

The reliability test plan has been defined after FMEA following “stress test driven” method including die and package oriented test.
See reliability plan in the paragraph 5.2. This reliability plan includes ACS108-6SA/EC, XL0840/EC, Z0127MA2EL2/E$, X0202MA1BA2/EC and Z00607MA1BA2/EC tests-vehicles.

3.2 Conclusion

Reliability Plan requirements have been fulfilled without exception. According to positive reliability results from carefully chosen tests vehicle, the TO92 package with Cu wire in ASE back end presents good guarantee of robustness in terms of resistance to environmental stresses.

4 DEVICE CHARACTERISTICS

4.1 Construction note

	XL0840/EC
Wafer/Die fab. information	
Wafer fab manufacturing location	STM Tours (France)
Wafer Testing (EWS) information	
Electrical testing manufacturing location	STM Tours (France)
Assembly information	
Assembly site	ASE WEIHAI
Package description	TO-92
Wires bonding material	Copper
Lead finishing process	Lead Free
Molding compound	**ECOPACK®2** (“Halogen-free”) molding compound
Final testing information	
Testing location	ASE WEIHAI

	Z00607MA1BA2/EC
Wafer/Die fab. information	
Wafer fab manufacturing location	STM Tours (France)
Wafer Testing (EWS) information	
Electrical testing manufacturing location	STM Tours (France)
Assembly information	
Assembly site	ASE WEIHAI
Package description	TO-92
Wires bonding material	Copper
Lead finishing process	Lead Free
Molding compound	**ECOPACK®2** (“Halogen-free”) molding compound
Final testing information	
Testing location	ASE WEIHAI

	Z0127MA2EL2/EC
Wafer/Die fab. information	
Wafer fab manufacturing location	STM Tours (France)
Wafer Testing (EWS) information	
Electrical testing manufacturing location	STM Tours (France)
Assembly information	
Assembly site	ASE WEIHAI
Package description	TO-92
Wires bonding material	Copper
Lead finishing process	Lead Free
Molding compound	**ECOPACK®2** (“Halogen-free”) molding compound
Final testing information	
Testing location	ASE WEIHAI

	X0202MA1BA2/EC
Wafer/Die fab. information	
Wafer fab manufacturing location	STM Tours (France)
Wafer Testing (EWS) information	

Electrical testing manufacturing location	STM Tours (France)
Assembly information	
Assembly site	ASE WEIHAI
Package description	TO-92
Wires bonding material	Copper
Lead finishing process	Lead Free
Molding compound	**ECOPACK®2** (“Halogen-free”) molding compound
Final testing information	
Testing location	ASE WEIHAI

	ACS108-6SA/EC
Wafer/Die fab. information	
Wafer fab manufacturing location	STM Tours (France)
Wafer Testing (EWS) information	
Electrical testing manufacturing location	STM Tours (France)
Assembly information	
Assembly site	ASE WEIHAI
Package description	TO-92
Wires bonding material	Copper
Lead finishing process	Lead Free
Molding compound	**ECOPACK®2** (“Halogen-free”) molding compound
Final testing information	
Testing location	ASE WEIHAI

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Process/ Package	Part number
1	TO-92	ACS108-6SA/EC
2	TO-92	XL0840/EC
3	TO-92	Z0127MA2EL2/EC
4	TO-92	X0202MA1BA2/EC
5	TO-92	Z00607MA1BA2/EC

Detailed results in below chapter will refer to P/N and Lot #.

5.2 Test plan and results summary

Test	PC	Std ref.	Conditions	SS	Steps	Failure/SS					Note
						Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	
HTRB	N	JESD22A-108	Tj = 150°C, VAC bias = VRRM	308	168 H	0/77	n/a	0/77	0/77	0/77	
					500 H	0/77	n/a	0/77	0/77	0/77	
					1000 H	0/77	n/a	0/77	0/77	0/77	
THB	N	JESD22A-101	Ta = 85°C, RH = 85%, BIAS V=100V	100	168 H	0/25	0/25	0/25	0/25	n/a	
					500 H	0/25	0/25	0/25	0/25	n/a	
					1000 H	0/25	0/25	0/25	0/25	n/a	
uHAST	N	JESD22A-118	130°C 85%HR 2,3 Bar	75	96H	0/25	0/25	0/25	n/a	n/a	
TC	N	JESD22A-104	-65°C/+150°C	100	100 cycles	0/25	0/25	0/25	0/25	n/a	
					500 cycles	0/25	0/25	0/25	0/25	n/a	

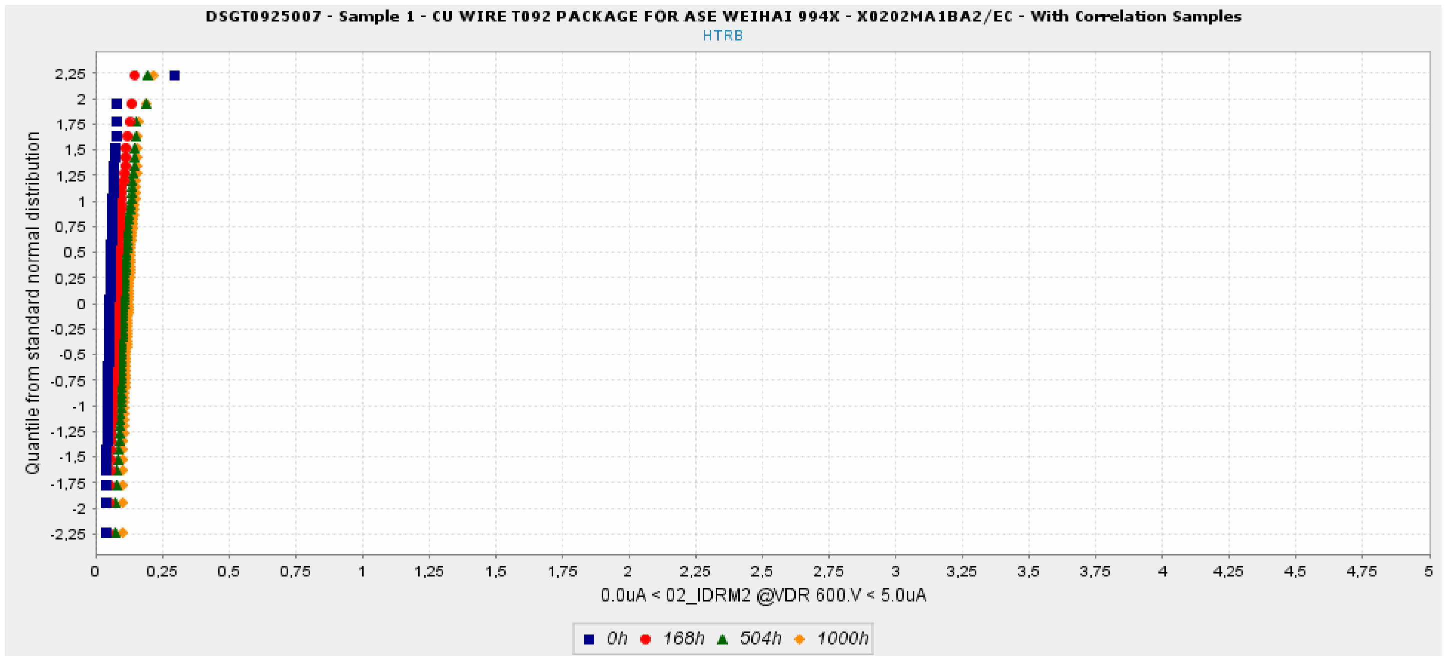
6 ANNEXES

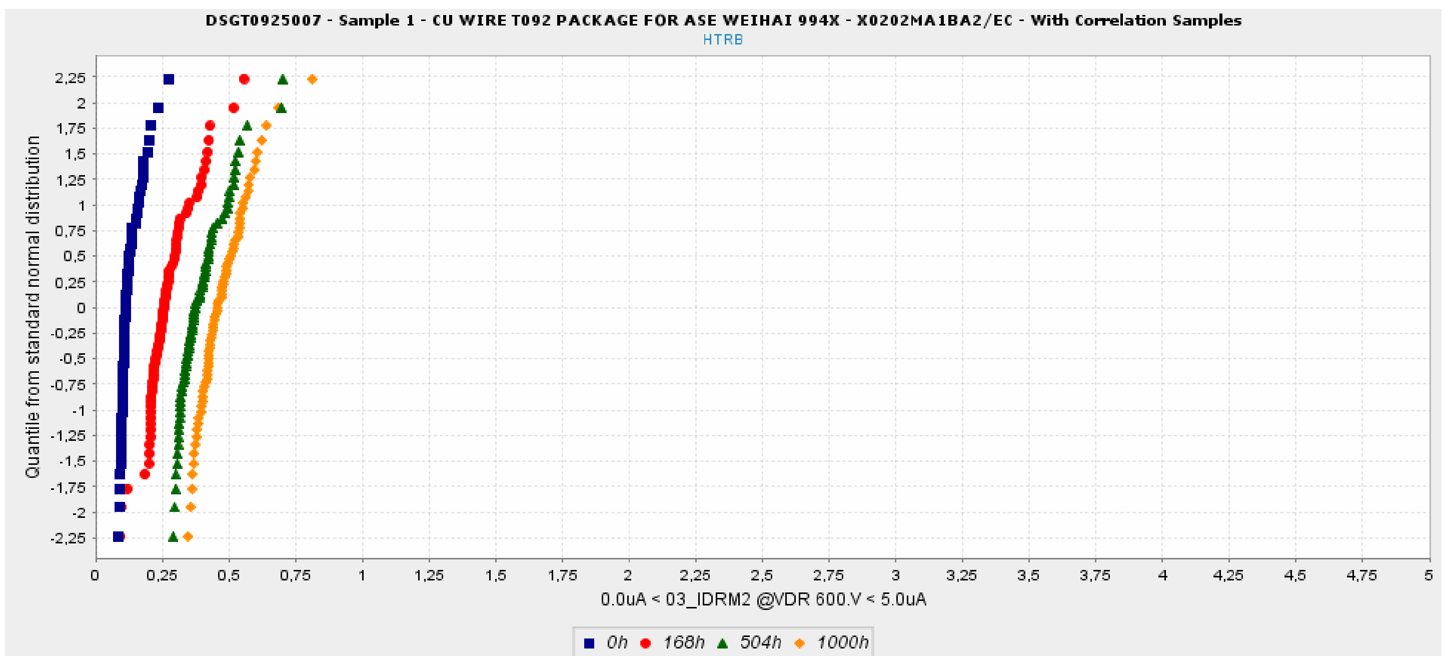
6.1 Tests Description

Test name	Description	Purpose
Die Oriented		
HTRB High Temperature Reverse Bias	The device is stressed in dynamic configuration (ac blocking voltage), trying to satisfy as much as possible the following conditions: low power dissipation; max. supply voltage compatible with diffusion process and internal circuitry limitations; MIL-STD-750: Method 1040, Condition A. Rated VRRM, 125°C, 1000 hours	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. 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.
Package Oriented		
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere. -65°C/+150°C; 2 cycles/hours; 500 cycles	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
THB Temperature Humidity Bias	The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambient temperature and relative humidity. 85°C / RH=85% ; 1000 hours	To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence.
U-HAST	130 °C/85% RH, 96 hours; without bias applied	The Highly-Accelerated Temperature and Humidity Stress Test is performed for the purpose of evaluating the reliability of non-hermetic packaged solid-state devices in humid environments. It employs severe conditions of temperature, humidity, and bias which accelerate the penetration of moisture through the external protective material (encapsulant or seal) or along the interface between the external protective material and the metallic conductors which pass through it.

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, idrrm, Vtm,


DSGT0925007 - Sample 1 - CU WIRE T092 PACKAGE FOR ASE WEIHAI 994X - X0202MA1BA2/EC - With Correlation Samples
HTRB
Quantile from standard normal distribution
2,25
2
1,75
1,5
1,25
1
0,75
0,5
0,25
0
-0,25
-0,5
-0,75
-1
-1,25
-1,5
-1,75
-2
-2,25
0
0,25
0,5
0,75
1
1,25
1,5
1,75
2
2,25
2,5
2,75
3
3,25
3,5
3,75
4
4,25
4,5
4,75
5
0.0uA < 02_IDRM2 @VDR 600.V < 5.0uA
0h
168h
504h
1000h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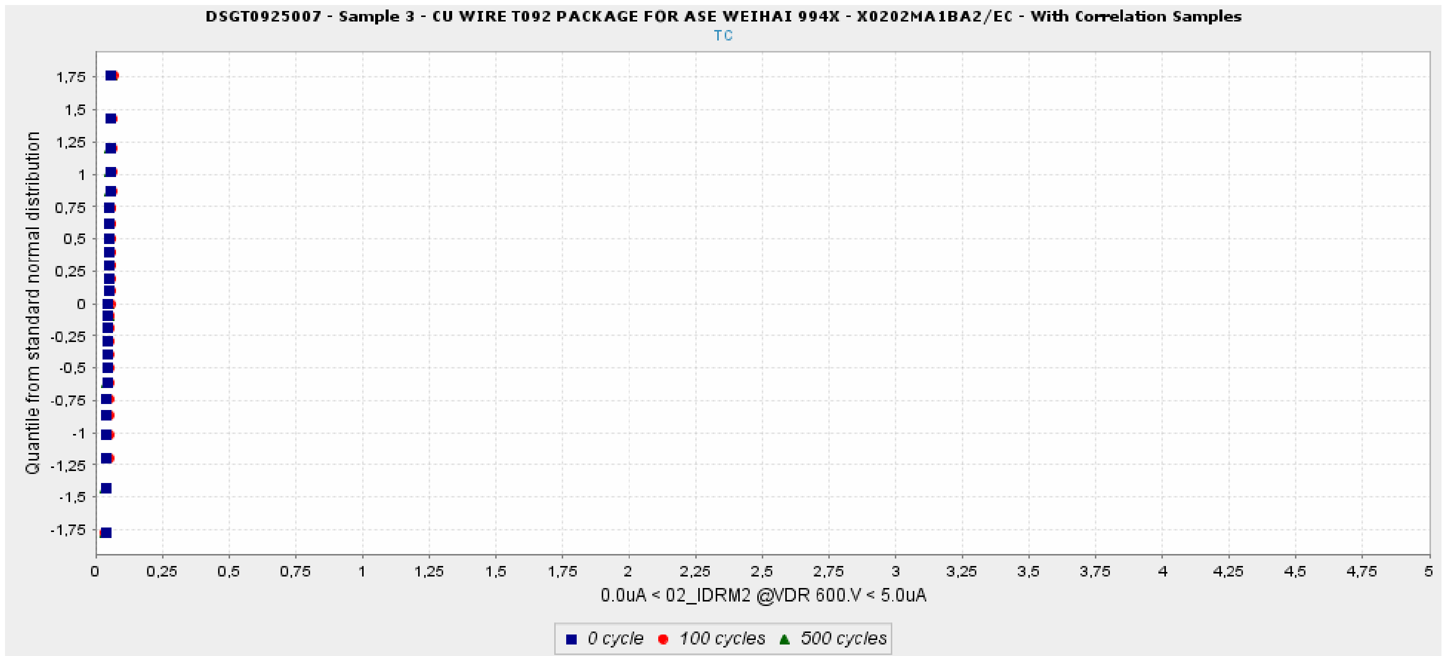
HTRB
Quantile from standard normal distribution
2,25
2
1,75
1,5
1,25
1
0,75
0,5
0,25
0
-0,25
-0,5
-0,75
-1
-1,25
-1,5
-1,75
-2
-2,25
0
0,25
0,5
0,75
1
1,25
1,5
1,75
2
2,25
2,5
2,75
3
3,25
3,5
3,75
4
4,25
4,5
4,75
5
0.0uA < 03_IDRM2 @VDR 600.V < 5.0uA
0h
168h
504h
1000h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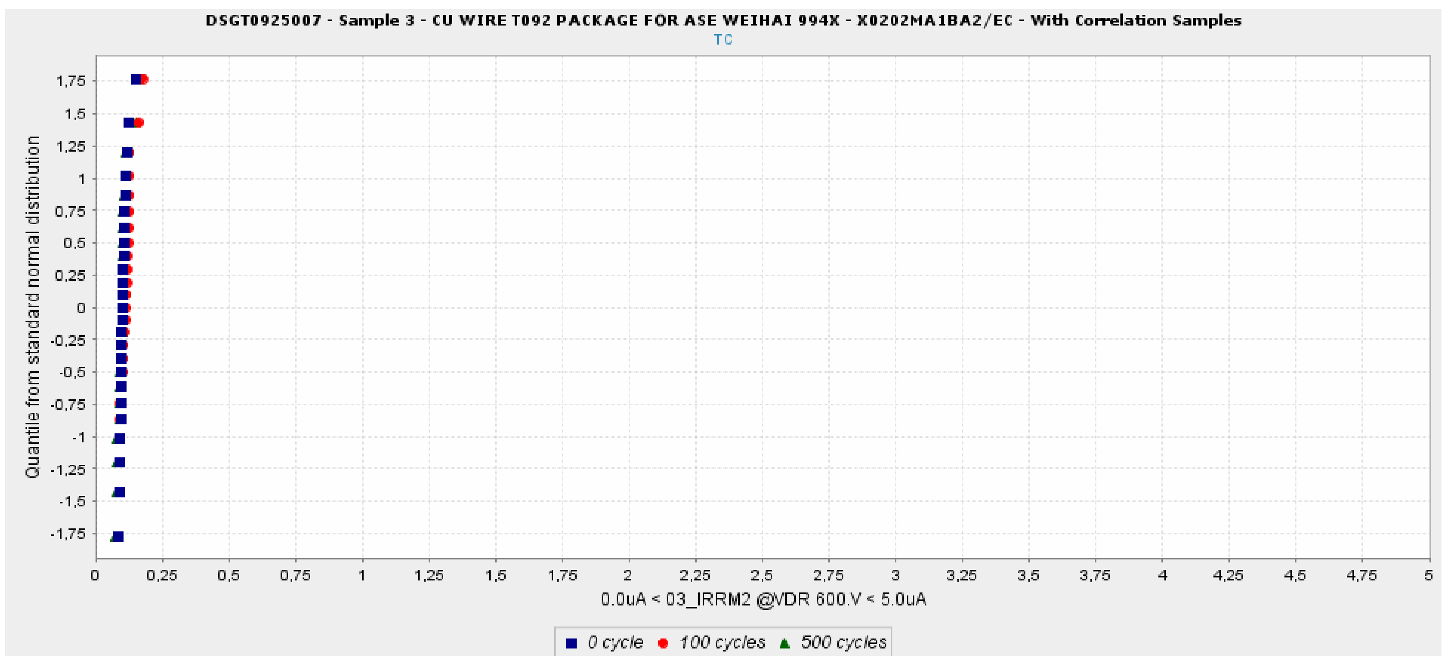
TC
Quantile from standard normal distribution
1,75
1,5
1,25
1
0,75
0,5
0,25
0
-0,25
-0,5
-0,75
-1
-1,25
-1,5
-1,75
0
0,25
0,5
0,75
1
1,25
1,5
1,75
2
2,25
2,5
2,75
3
3,25
3,5
3,75
4
4,25
4,5
4,75
5
0.0uA < 02_IDRM2 @VDR 600.V < 5.0uA
0 cycle
100 cycles
500 cycles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TC
Quantile from standard normal distribution
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1,5
1,25
1
0,75
0,5
0,25
0
-0,25
-0,5
-0,75
-1
-1,25
-1,5
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2,25
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2,75
3
3,25
3,5
3,75
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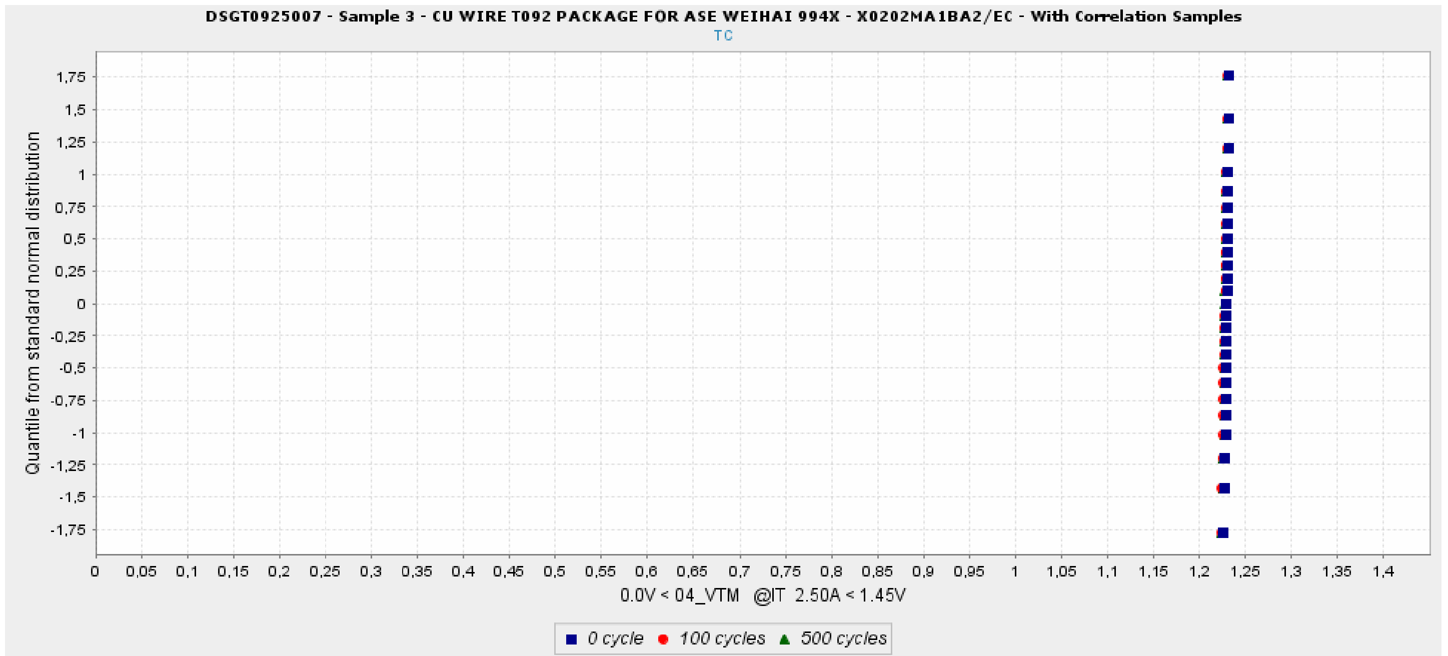
4,25
4,5
4,75
5
0.0uA < 03_IRRM2 @VDR 600.V < 5.0uA
0 cycle
100 cycles
500 cycles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TC
Quantile from standard normal distribution
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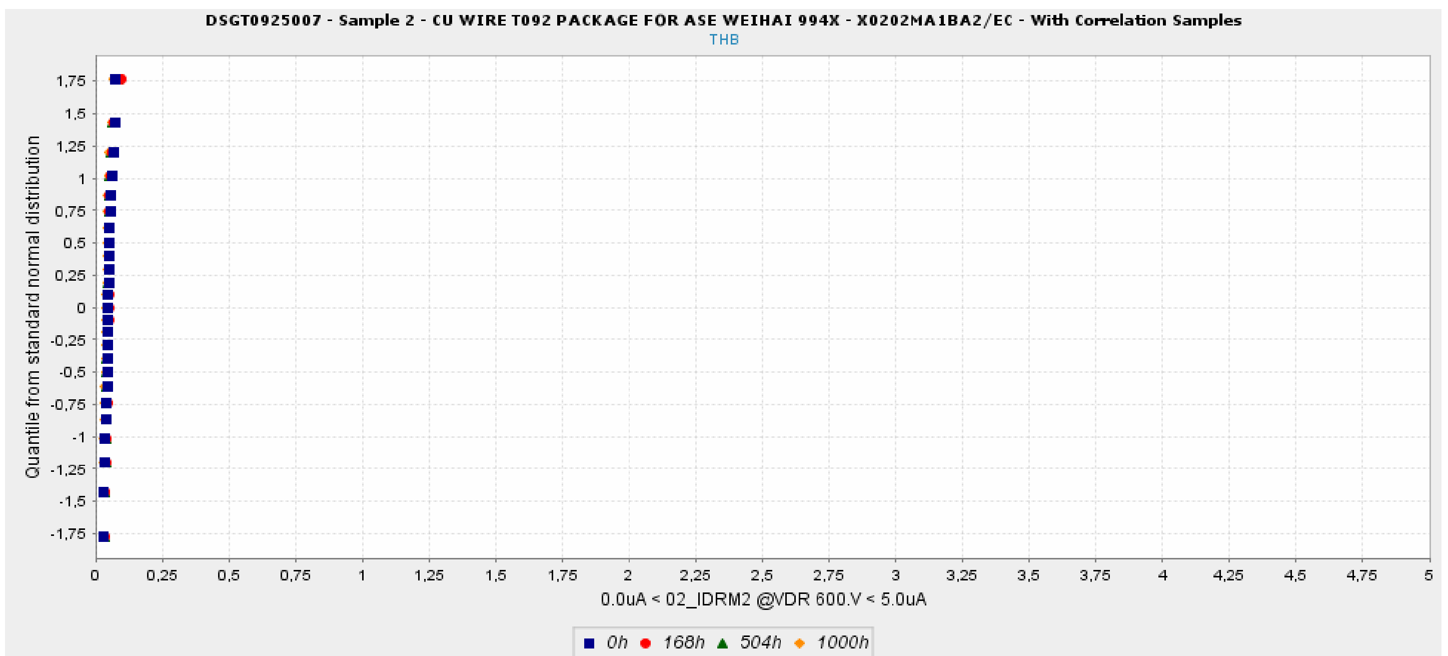
0 cycle
100 cycles
500 cycles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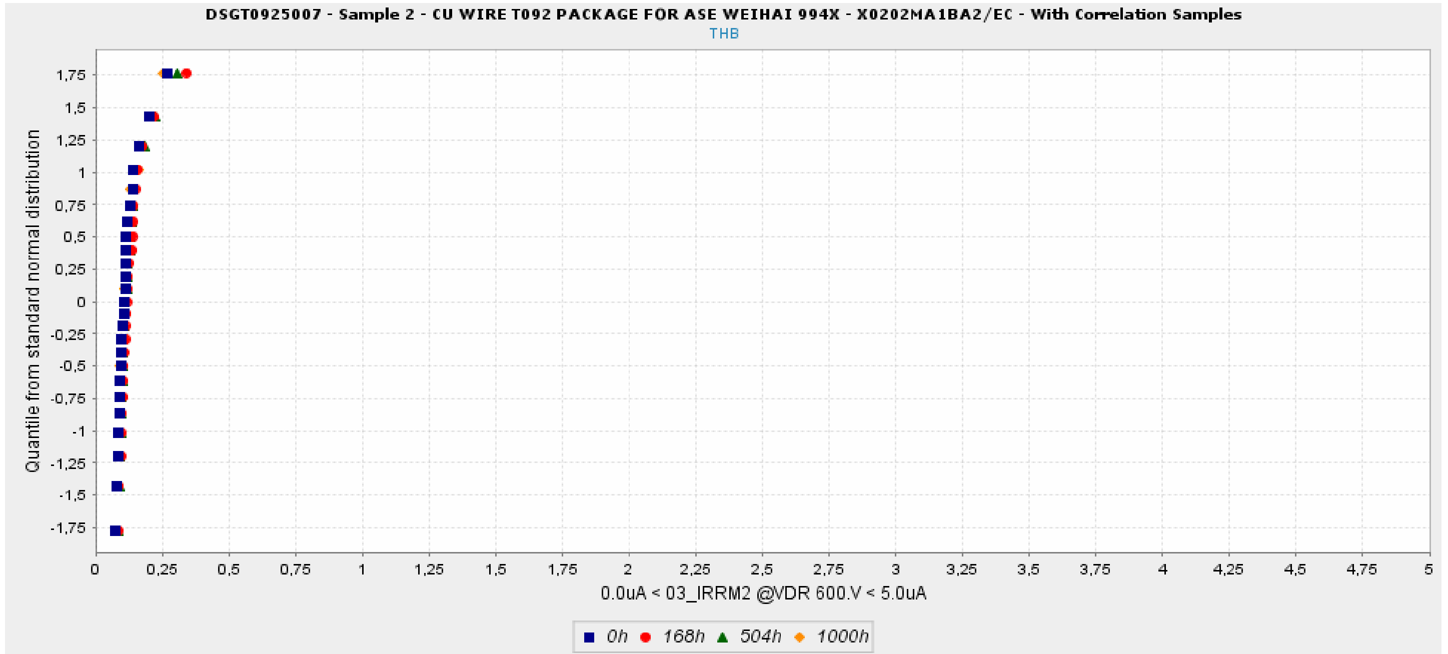
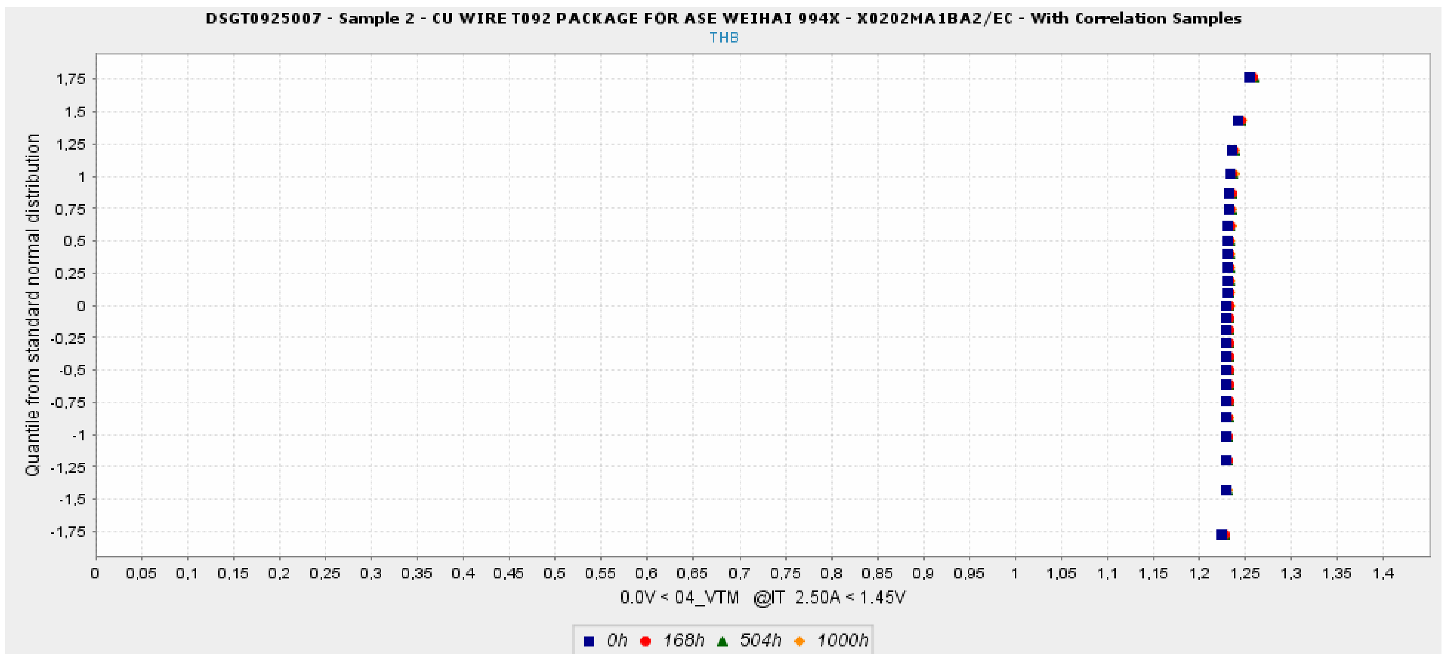
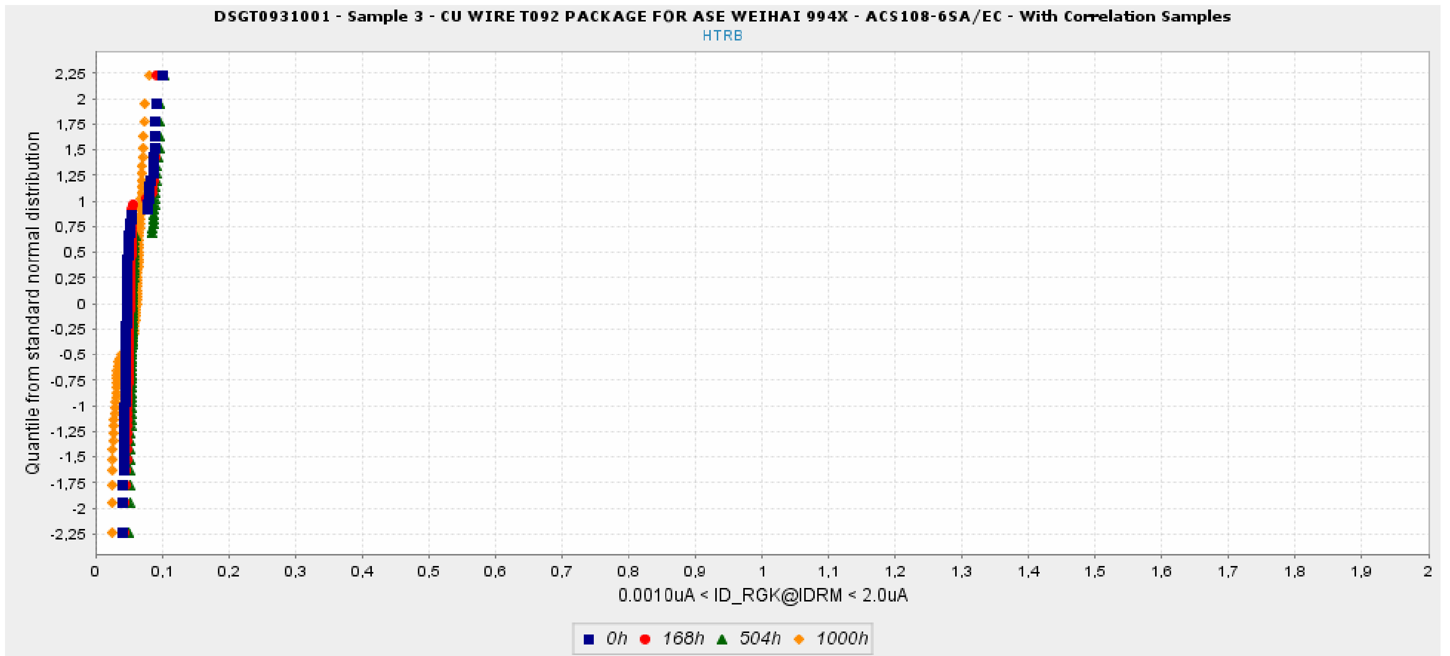
0h
168h
504h
1000h





ACS108-6SA/EC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1,75
1,5
1,25
1
0,75
0,5
0,25
0
-0,25
-0,5
-0,75
-1
-1,25
-1,5
-1,75
-2
-2,25
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0,1
0,2
0,3
0,4
0,5
0,6
0,7
0,8
0,9
1
1,1
1,2
1,3
1,4
1,5
1,6
1,7
1,8
1,9
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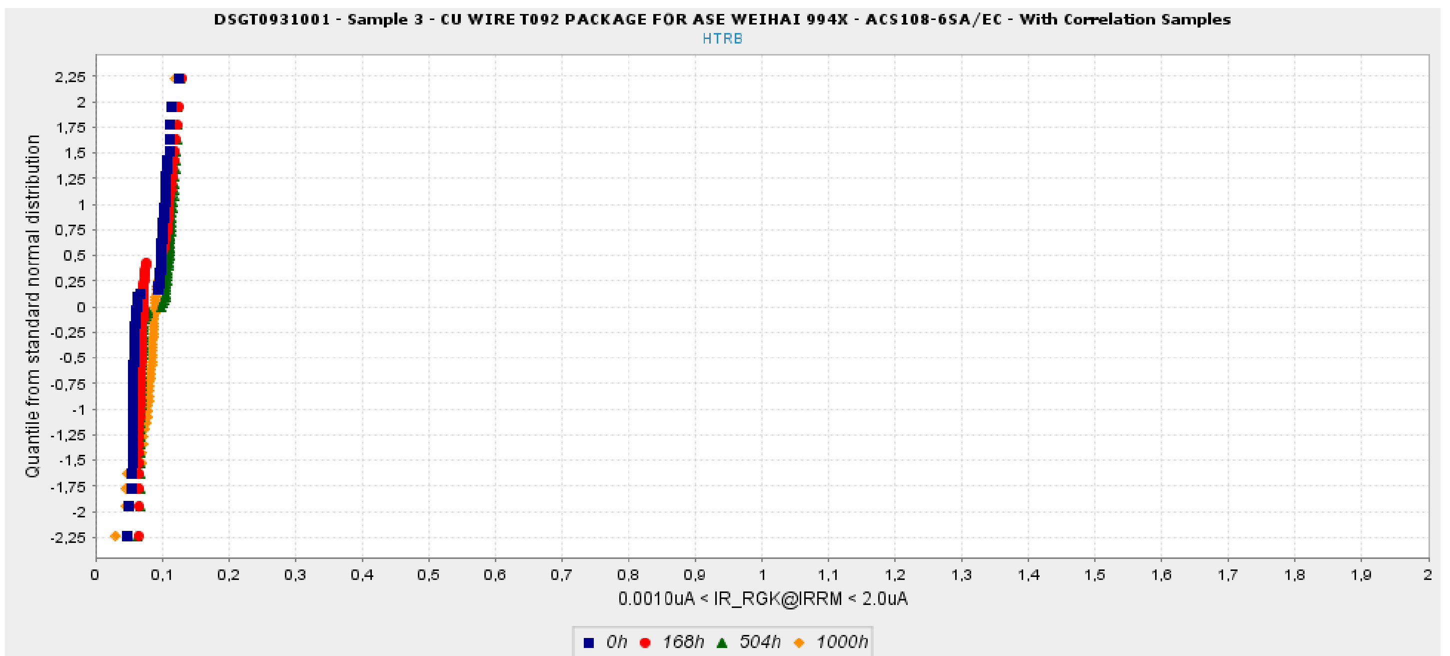
168h
504h
1000h


DSGT0931001 - Sample 3 - CU WIRE T092 PACKAGE FOR ASE WEIHAI 994X - ACS108-6SA/EC - With Correlation Samples
HTRB
Quantile from standard normal distribution
2,25
2
1,75
1,5
1,25
1
0,75
0,5
0,25
0
-0,25
-0,5
-0,75
-1
-1,25
-1,5
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-2
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0,5
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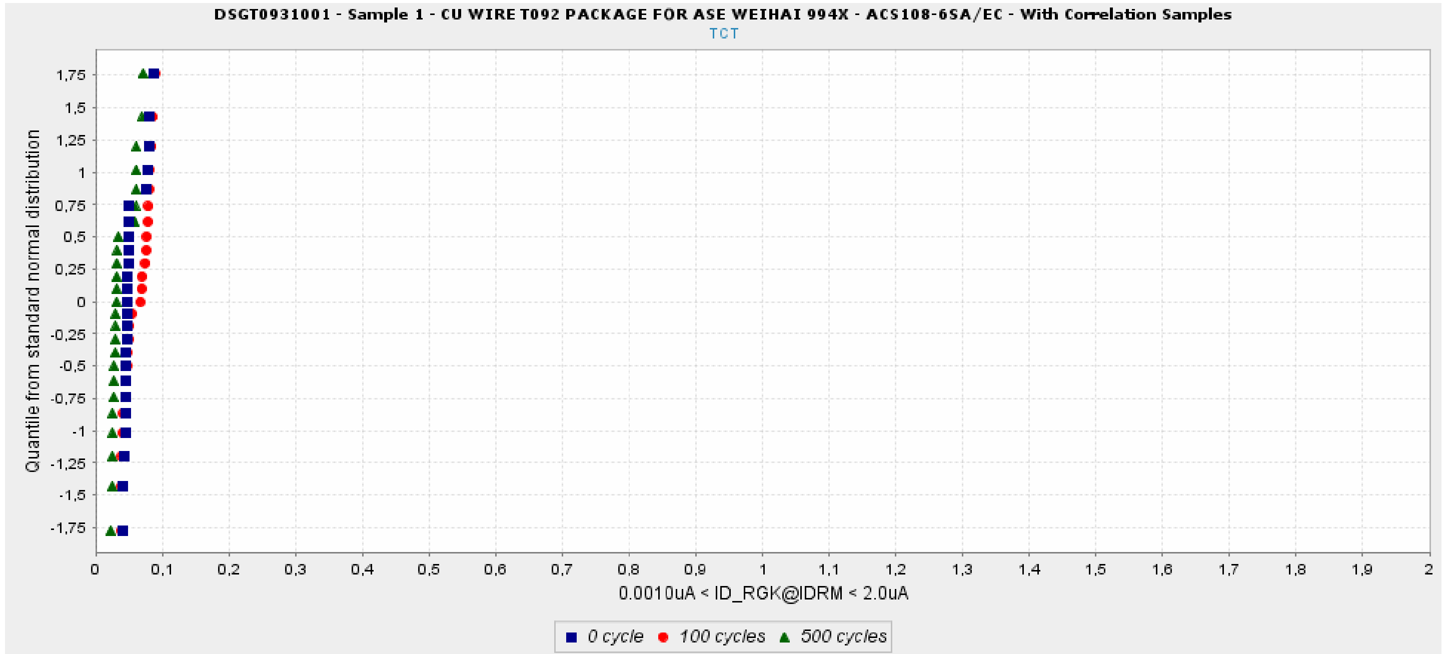
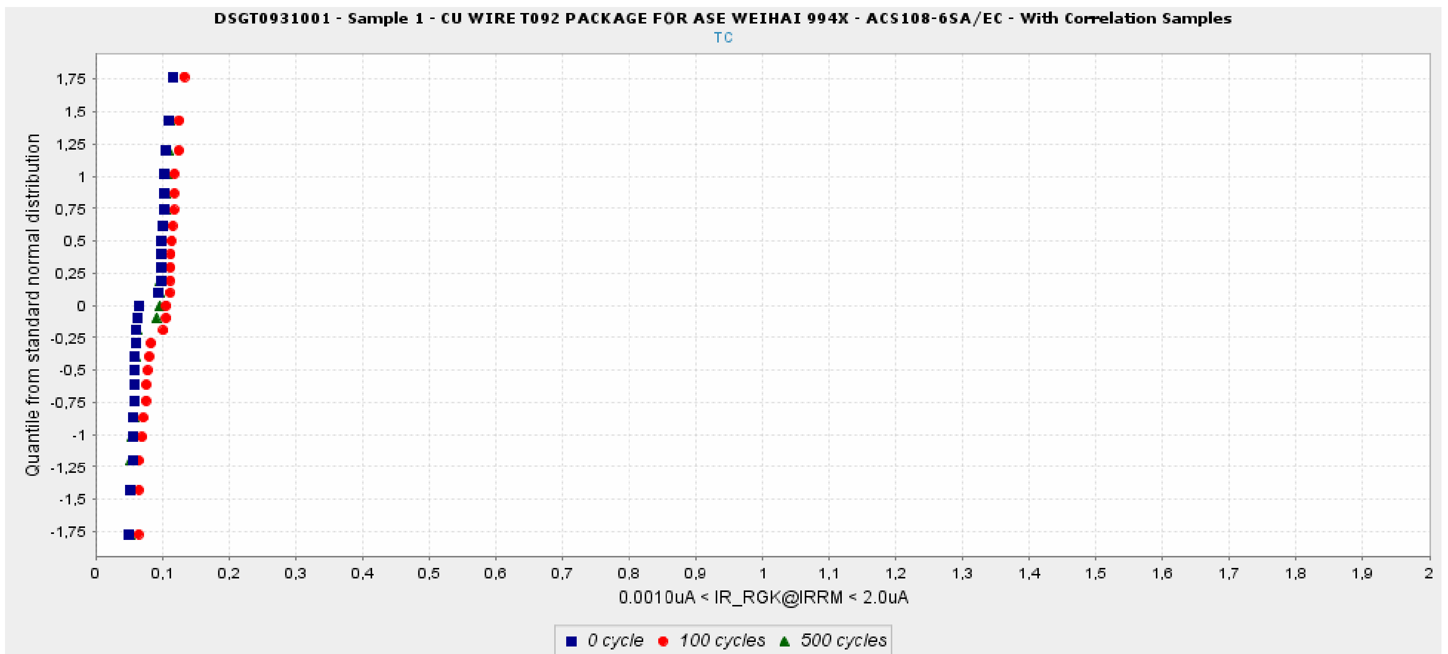
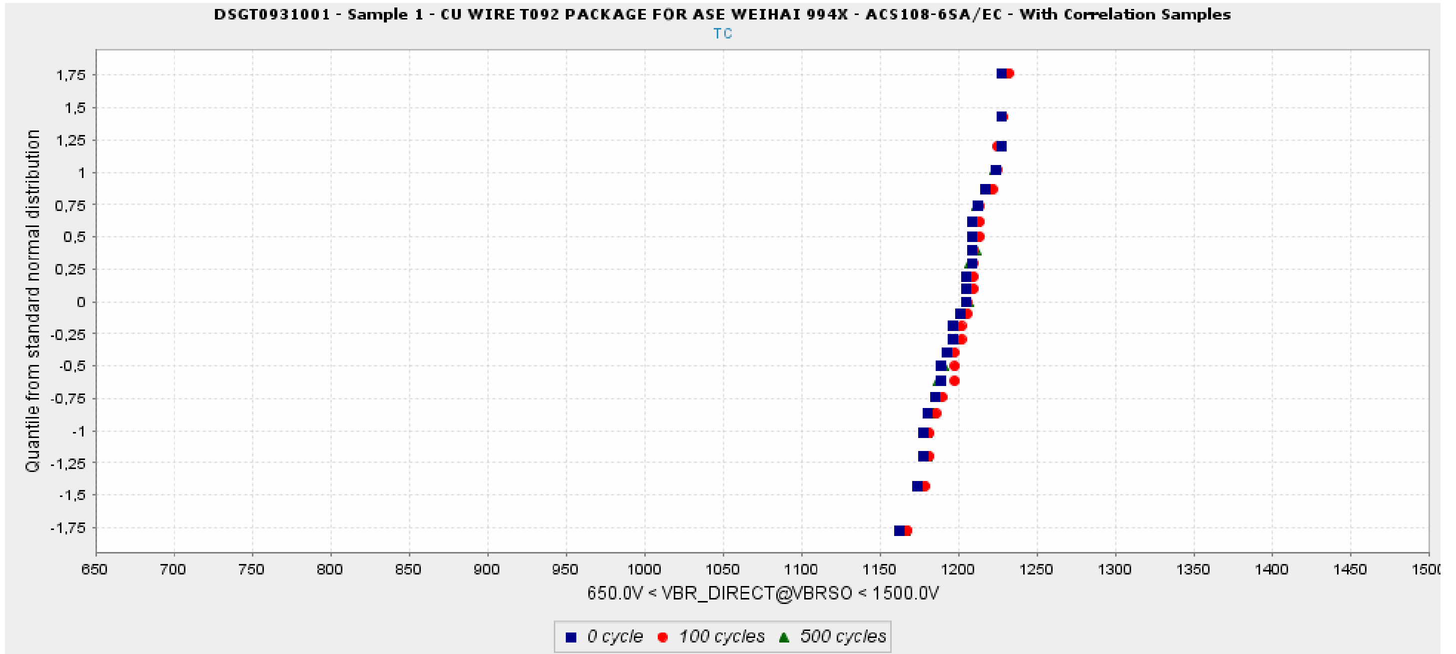
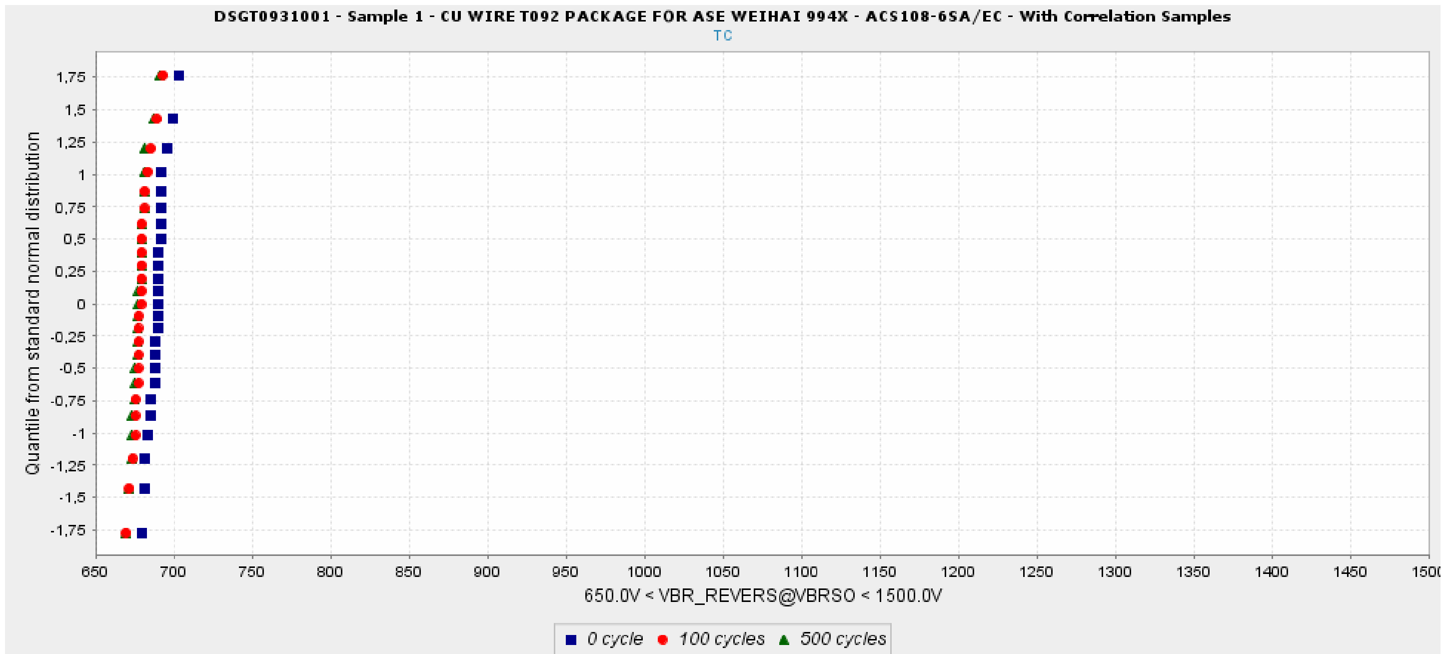
0,7
0,8
0,9
1
1,1
1,2
1,3
1,4
1,5
1,6
1,7
1,8
1,9
2
0.0010uA < IR_RGK@IRRM < 2.0uA
0h
168h
504h
1000h


DSGT0931001 - Sample 1 - CU WIRE T092 PACKAGE FOR ASE WEIHAI 994X - ACS108-6SA/EC - With Correlation Samples
TCT
Quantile from standard normal distribution
0.0010uA < ID_RGK@IDRM < 2.0uA
0 cycle
100 cycles
500 cycles


DSGT0931001 - Sample 1 - CU WIRE T092 PACKAGE FOR ASE WEIHAI 994X - ACS108-6SA/EC - With Correlation Samples
TC
Quantile from standard normal distribution
0.0010uA < IR_RGK@IRRM < 2.0uA
0 cycle
100 cycles
500 cycles


DSGT0931001 - Sample 1 - CU WIRE T092 PACKAGE FOR ASE WEIHAI 994X - ACS108-6SA/EC - With Correlation Samples
TC
Quantile from standard normal distribution
650.0V < VBR_DIRECT@VBRSO < 1500.0V
0 cycle
100 cycles
500 cycles


DSGT0931001 - Sample 1 - CU WIRE T092 PACKAGE FOR ASE WEIHAI 994X - ACS108-6SA/EC - With Correlation Samples
TC
Quantile from standard normal distribution
650.0V < VBR_REVERS@VBRSO < 1500.0V
0 cycle
100 cycles
500 cycles

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