Reliability Report

Reliability Data for IXD_609 Series VIS Foundry Process CU05UMS12010

Report Title: Reliability Data for IXD_609 Series VIS Foundry Process CU05UMS12010

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Introduction:

This report summarizes the Reliability data of Clare's IXD_609 Series. The Reliability data presented here were collected during Clare's product qualification. The purpose of this qualification was to verify the Clare's Quality and Reliability requirements as outlined in Clare's internal specifications. The IXD_609 Series Gate Driver silicon is foundered at Vanguard International Semiconductor, Corp. (VIS) and assembled at Atec in the Philippines. The VIS process is CU05UMS12010.

Reliability Tests:

Table 1 below provides the qualification tests that were performed. The stress tests and sample size are chosen based on the Clare's specification P-04-25-WW, "Reliability, Risk Analysis and Qualification Procedure" and with the approval of the product development team and quality assurance.

Table 1: Product Family IXD_609 Series Reliability Tests

Stress Test	Applicable Specs	Stress Conditions	Product/ Package	Number of Lots	Sample Size (SS)	Total SS
HTOL	Mil-Std-883	125°C, 80%	IXDD609 SOIC – 8L EP	1	77	77
HTOL	Mil-Std-883	125°C, 80%	IXDD609PI 8 Pin DIP	1	90	90
Latch Up	JESD78	Trigger Pulse = 1us 5vpp, VCC = =18V	IXDD609 SOIC – 8L EP	1	2	2
HAST	JESD22, A110-C	130°C, 85% 18.8PSI, 96hrs	IXDD604SIA SOIC – 8L EP	2	76	152
Thermal Shock (T/S)	Mil-Std-883, M1011	0 to 100°C, 10/10 dwells, 15 cycles	IXDD604SIA SOIC – 8L EP	3	55	165
Temp Cycle (T/C)	Mil-Std-883, N1010, "B"	-55 to 125°C, 10/10 dwells, 300 cycles	IXDD604SIA SOIC – 8L EP	3	55	165
High Temp Storage	JESD22-A103C	125°C, 1000hrs	IXDD604SIA SOIC – 8L EP	3	50	150
MSL	J-STD-020D.1	IR Reflow, Level 1	IXDD604SIA SOIC – 8L EP	3	50	150
ESD HBM	JESD22, A114-E	1.5kΩ, 100pF	IXDD609 SOIC – 8L EP	3	25	75

Reliability Test Results:

The stress tests and associated results for the product family IXD_609 Series qualification are summarized in Table 2. The devices chosen for the qualification were from standard material manufactured through normal production test flow and electrically tested to datasheet limits prior to stressing. Then reliability stresses were conducted and electrically tested to datasheet limit at each interval and final readpoints.

Table 2: Product Family IXD_609 Series Reliability Test Results

Stress Test	Product/Kit Number	Readpoint / (Reject/ SS)	Comments
HTOL	IXDD609 S0027 Wafer 002	1000 hrs. 0/77	Qual Lot#1 Data
HTOL	IXDD609PI C00039 1023	1000 hrs. 0/90	Qual Lot#1 Data
Latch Up N-MOS	IXDD609 S0027 Wafer 002	VNN=10.8V INN=1mA Current Into Output=9Amp 0/2	Qual Lot#1 Data
Latch Up P-MOS	IXDD609 S0027 Wafer 002	VPP=10.6V IPP=1.1mA Current Into Output=9Amp 0/2	Qual Lot#1 Data
HAST	IXDD604SIA AV0001 0928 IXDD604 C00058 1023	96 hrs. 0/152	Qual Lot#1, #2 Data

Stress Test	**Product/Kit Number**	**Readpoint / (Reject/ SS)**	**Comments**
Thermal Shock	IXDD604SIA AV0001 0928	15 Cycles 0/55	Qual Lot#1 Data
Thermal Shock	IXDD604SIA AV0002 0929	15 Cycles 0/55	Qual Lot#2 Data
Thermal Shock	IXDD604SIA AV0005 0944	15 Cycles 0/55	Qual Lot#3 Data
Temp Cycle	IXDD604SIA AV0001 0928	300 Cycles 0/55	Qual Lot#1 Data
Temp Cycle	IXDD604SIA AV0002 0929	300 Cycles 0/55	Qual Lot#2 Data
Temp Cycle	IXDD604SIA AV0005 0944	300 Cycles 0/55	Qual Lot#3 Data
High Temp Storage	IXDD604SIA AV0001 0928	1000 hrs. 0/50	Qual Lot#1 Data
High Temp Storage	IXDD604SIA AV0002 0929	1000 hrs. 0/50	Qual Lot#2 Data
High Temp Storage	IXDD604SIA AV0005 0944	1000 hrs. 0/50	Qual Lot# 3 Data
MSL	IXDD604SIA AV0001 0928	IR Reflow Level 1 0/50	Qual Lot#1 Data
MSL	IXDD604SIA AV0002 0929	IR Reflow Level 1 0/50	Qual Lot#2 Data
MSL	IXDD604SIA AV0005 0944	IR Reflow Level 1 0/50	Qual Lot#3 Data

ESD Testing Results:

As part of this qualification, the product family IXD_609 Series was subjected to Human Body Model (HBM) ESD Sensitivity Classification testing using a KeyTek Zapmaster system. The results are summarized in Table 3. All samples were electrically tested to data sheet limits before and after ESD stressing and they passed after +/-3000V zapping.

Table3: Product Family IXD_609 Series ESD Characterization Results

ESD Model	Product/Kit Number	Package	ESD Test Spec	RC Network	Highest Passed	Class
HBM	IXDD609 C00038	SOIC – 8L EP	JESD22, A114-E	1.5kΩ, 100pF	3000V	2

FIT (Failure in Time) Rate on the Product Family IXD_609 Series:

Table 4 summarizes the number of devices used for the product family IXD_609 Series reliability stress with associated failures. Using the HTOL data, FITs were calculated based on the Acceleration Factor (AF) and equivalent device hours at 0.7eV of activation energy according to the Clare's procedure P-04-25-WW for 125°C test temperature and 40°C use temperatures. The calculated FITs from the reliability stress came out to be 21.57 for HTOL. Using the HAST data, FITs were calculated based on the Acceleration Factor (AF) and equivalent device hours at 0.7eV of activation energy according to Clare's procedure P-04-25-WW for 130°C test temperature and 40°C use temperatures. The calculated FITs from the reliability stress came out to be 44.03 for HAST.

Table 4: Product Family IXD_609 Series FIT Rate Summary

Qual#	Stress	Product/Kit Number	# of Devices	# of Fails	Hours Tested	Act. Energy	Acc. Factor	Equivalent Dev. Hours	FIT Rate @ 60% CL
1	HTOL	IXDD609 S0027 Wafer 002 IXDD609PI C00039 1023	167	0	1000	0.7	255.41	42,652,796	21.57
2	HAST	IXDD604SIA AV0001 0928 IXDD604SIA C00058 1023	152	0	96	0.7	1.4318E +03	20,892,615	44.03

Conclusion:

The qualification of the product family IXD_609 Series has been successfully completed for the production release. The reliability and process data for VIS CU05UMS12010 can be found at S:/REED/Projects/New Process Information/Vanguard.