IXYS
INTEGRATED CIRCUITS DIVISION

Reliability Report

Reliability Data for AC Relay/SCR Based with Optical Driver Circuit

Report Title: Reliability Data for AC Relay/SCR Based with Optical Driver Circuit

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Introduction:

This report summarizes the Reliability data of IXYS Integrated Circuits Division. The Reliability data presented here were collected during IXYS IC Division product qualification. The purpose of this qualification was to verify the IXYS IC Division Quality and Reliability requirements as outlined in IXYS IC Division internal specifications. The AC Relay/SCR Based with Optical Driver Circuit silicon is manufactured at IXYS Silicon FAB in Lampertheim, Germany and assembled at ATEC and PSI in the Philippines.

Reliability Tests:

Table 1 below provides the qualification tests that were performed. The stress tests and sample size are chosen based on the IXYS Integrated Circuits Division internal specification and with the approval of the product development team and quality assurance.

Table 1: Product AC Relay/SCR Based with Optical Driver Circuit Reliability Tests

Stress Test	Applicable Specs	Stress Conditions	Product/ Package	Number of Lots	Sample Size (SS)	Total SS
HTRB/ HTOL	Mil-Std-883	125°C, 80%	CPC1709J ISOPLUS-264 CPC1976Y Power SIP CPC1966Y Power SIP CPC1998J i4-PAC	4	25, 129, 78, 76, 76, 78, 77	539
Thermal Shock (T/S)	Mil-Std-883, M1011	0 to 100°C, 10/10 dwells, 15 cycles	CPC1976Y Power SIP CPC1966Y Power SIP CPC1998J i4-PAC	3	55	165
Temp Cycle (T/C)	Mil-Std-883, N1010, “B”	-55 to 125°C, 10/10 dwells, 300 cycles	CPC1976Y Power SIP CPC1966Y Power SIP CPC1998J i4-PAC	3	55	165
High Temp Storage	JESD22-A103C	125°C, 1000hrs	CPC1998J i4-PAC	1	50	50

Stress Test	Applicable Specs	Stress Conditions	Product/ Package	Number of Lots	Sample Size (SS)	Total SS
MSL	J-STD-020D.1	IR Reflow, Level 1	CPC1998J i4-PAC	1	25	25
ESD HBM	JESD22, A114-E	1.5kΩ, 100pF	CPC1998J i4-PAC	1	3	3

Reliability Test Results:

The stress tests and associated results for the product AC Relay/SCR Based with Optical Driver Circuit 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 AC Relay/SCR Based with Optical Driver Circuit Reliability Test Results

Stress Test	Product/Kit Number	Readpoint / (Reject/ SS)	Comments
HTRB	CPC1709J PE0009	1000 hrs 0/25	Qual Lot#1 Data
HTRB	CPC1998J PE0031	1000 hrs 0/77	Qual Lot#1 Data
HTRB	CPC1976Y T57324	1000 hrs 0/129	Qual Lot#1 Data
HTOL	CPC1976Y TE2960	1000 hrs 0/78	Qual Lot#1 Data
HTOL	CPC1976Y TE3050	1000 hrs 0/76	Qual Lot#2 Data
HTOL	CPC1976Y TE3061	1000 hrs 0/76	Qual Lot#3 Data
HTOL	CPC1966Y T53397	1000 hrs. 0/78	Qual Lot#1 Data

Stress Test	Product/Kit Number	Readpoint / (Reject/ SS)	Comments
Thermal Shock	CPC1998J PE0031	15 Cycles 0/55	Qual Lot#1 Data
Temp Cycle	CPC1998J PE0031	300 Cycles 0/55	Qual Lot#1 Data
Thermal Shock	CPC1976Y T57324	15 Cycles 0/55	Qual Lot#1 Data
Temp Cycle	CPC1976Y T57324	300 Cycles 0/55	Qual Lot#1 Data
Thermal Shock	CPC1966Y T53397	15 Cycles 0/55	Qual Lot#1 Data
Temp Cycle	CPC1966Y T53397	300 Cycles 0/55	Qual Lot#1 Data
High Temp Storage	CPC1998J PE0031	1000 hrs. 0/50	Qual Lot#1 Data
MSL	CPC1998J PE0031	IR Reflow Level 1 0/25	Qual Lot#1 Data

ESD Testing Results:

As part of this qualification, the product AC Relay/SCR Based with Optical Driver Circuit 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 +/-8000V testing.

Table3: Product AC Relay/SCR Based with Optical Driver Circuit ESD Characterization Results

ESD Model	Product/Kit Number	Package	ESD Test Spec	RC Network	Highest Passed	Class
HBM	CPC1998J PE0031	i4-PAC	JESD22, A114-E	1.5kΩ, 100pF	8000V	3B

FIT (Failure in Time) Rate on the Product AC Relay/SCR Based with Optical Driver Circuit :

Table 4 summarizes the number of devices used for the product AC Relay/SCR Based with Optical Driver Circuit reliability stress with associated failures. Using the HTRB data, FITs were calculated based on the Acceleration Factor (AF) and equivalent device hours at 0.7eV of activation energy for 125°C test temperature and 40°C use temperatures. The calculated FITs from the reliability stress came out to be 15.59/11.70 for HTRB/HTOL.

Table 4: Product AC Relay/SCR Based with Optical Driver Circuit 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	HTRB	CPC1709J PE0009 CPC1976Y T57324 CPC1998J PE0031	231	0	1000	0.7	255.41	58,998,778	15.59
1	HTOL	CPC1976Y TE2960 TE3050 TE3061 CPC1966Y T53397	308	0	1000	0.7	255.41	78,665,038	11.70

Conclusion:

The qualification of the product AC Relay/SCR Based with Optical Driver Circuit has been successfully completed for the production release.