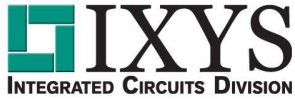


Reliability Report: Qualification/Reliability Data for 250-350 Volt Form-B Relay Products and Depletion Mode
MOSFET Products IXYS IC Division (Process P 7.1)
Qualification Report No.: 2013-011



Reliability Report

Qualification/Reliability Data for 250-350 Volt Form-B Relay Products and Depletion mode MOSFET Products IXYS IC Division (Process P7.1)

Report Number: 2013-011

Date: 9/12/13

Introduction:

This summarizes the Qualification/Reliability Life-test and Environmental data on LCB/LBB/PBB 110/127/150 series- Form-B Relay products and CPC37XX/CPC560X-Depletion Mode Vertical DMOS FETs that were collected during Qualification or as ongoing Monthly Reliability Monitor Program. Some data is represented by P7.1 discrete Form B MOSFET's from IXYS IC Division product CPC5602C and can be used for qualification by comparison for CPC1130N and CPC1150N. Also, Since CPC37XX/CPC560X product families and LBB110 use the same Depletion Mode Vertical DMOS FETs and share the same design and wafer fabrication processes, CPC5602 and LBB110 data presented here can be shared for CPC37XX/CPC560X Reliability lifetime calculation.

Qualification/Reliability Results:

The stress tests data and associated results for the LCB/LBB127/PBB 110, 127, 150 Form-B Relay products are summarized in Table 1.

Table 1: P7.1 – High Voltage Form-B Reliability Data

Product/ Package	Stress Test/ Conditions	Kits Number	Read-points/ (Reject/SS)	Comments
CPC5603C/ SOT-223	HTGB 125°C, Gate Bias -15V	F238	1000 hrs.	Qualification Data
			0/77	
CPC5603C/ SOT-223	HTGB 125°C, Gate Bias -15V	F338	1000 hrs.	Qualification Data
			0/77	
CPC5602C/ SOT-223	HTRB 125°C, 80% WVDC	K636	1000 hrs.	Reliability Monitor Data
			0/36	
CPC3703C/ SOT-89	HTRB 125°C, 80% WVDC	FE018	1000 hrs.	Qualification Data
			0/210	
CPC1117N/ 4-Pin SOP	HTRB 125°C, 80% WVDC	TE2534	1000 hrs.	Qualification Data
			0/105	
CPC5602C/ SOT-223	THB 85°C/85% RH, 1000 hrs.	Qual Lot#1	1000 hrs.	Qualification Data
			0/77	
CPC5602C/ SOT-223	THB 85°C/85% RH, 1000 hrs.	Qual Lot#2	1000 hrs.	Qualification Data
			0/77	

Reliability Report: Qualification/Reliability Data for 250-350 Volt Form-B Relay Products and Depletion Mode
MOSFET Products IXYS IC Division (Process P 7.1)
Qualification Report No.: 2013-011

Product/ Package	Stress Test/ Conditions	Kits Number	Read-points/ (Reject/SS)	Comments
CPC5602C/ SOT-223	THB 85°C/85% RH, 1000 hrs.	Qual Lot #3	1000 hrs. 0/77	Qualification Data
CPC5602C/ SOT-223	Thermal Shock,(T/S) 0 to 100°C, 10/10 dwell	K636	15 cycles 0/55	Reliability Monitor Data
CPC5602C/ SOT-223	Pre-Condition Bake, Soak @L1, Reflow 245C, 3X	M043031311	IR Reflow	Qualification Data
			0/231	
CPC5602C/ SOT-223	Pre-Condition Bake, Soak @L1, Reflow 260C, 3X	FE014	IR Reflow	Qualification Data
			0/231	
CPC5602C/ SOT-223	HTS Bake at 150C, 1000 hrs	FE014	1000 hrs	Qualification Data
			0/77	
CPC5602C/ SOT-223	Temp Cycle -65 to 150C, 1000 cycles	FE014	1000 cycles	Qualification Data
			0/77	
CPC5602C/ SOT-223	PCT 121C, 15 psig, 100% RH, 168 hrs	FE014	168 hrs	Qualification Data
			0/77	
CPC5602C/ SOT-223	Thermal Shock -55 to 125C, 500 cycles	M043031311	500 cycles	Qualification Data
			0/77	
CPC5602C/ SOT-223	Temp Cycle -65 to 150C, 1000 cycles	M043031311	1000 cycles	Qualification Data
			0/77	
CPC5602C/ SOT-223	Autoclave 121C, 100% RH, 2 atm	M043031311	2 atm	Qualification Data
			0/77	
CPC5602C/ SOT-223	HTS Bake at 150C, 1008 hrs	M043031311	1008 hrs	Qualification Data
			0/77	
CPC5602C/ SOT-223	ESD-HBM RC Network: 1.5 kΩ, 100 pF	FE030	Zap	Qualification Data
			0/12	

ESD Testing Results:

As part of this qualification, the product CPC5602C was subjected to Human Body Model (HBM) ESD Sensitivity Classification testing using a KeyTek Zapmaster system. The results are summarized in Table 2. All samples were electrically tested to data sheet limits before and after ESD stressing and they passed after +/- 1000V zapping.

Table2: Product CPC5602C ESD Characterization Results

ESD Model	Kit Number	Package	ESD Test Spec	RC Network	Highest Passed	Class
HBM	CPC5602C FE030	SOT-223	JESD22, A114-E	1.5kΩ, 100pF	1000V	1C

FIT (Failure in Time) Rate of P7.1 – High Voltage Form-B Relays:

The Table 3 below summarizes the number of devices tested and their test duration along with the associated failures from Qualification and Reliability Monitoring. Using the Reliability Monitoring stress data from HTRB, FIT rate was calculated based on the equivalent device hours at use condition of 40°C compared to 125°C test condition at 0.7eV of activation energy. For THB stress, FIT rate was calculated based on the 85°C/85% RH test condition, and 40°C/60% RH ambient use condition using the activation energy of 0.7eV. The FIT rates came out to be 23.39 FITs, 14.64 FITs and 35.05 FITs for HTGB, HTRB and THB respectively.

Table 3: P7.1 – High Voltage Form-B FIT Rate Calculation

Stress	Use Cond.	# of Devices Tested	# of Fails.	Hours Tested	AE (eV)	Eq. Dev. Hours	FITs @ 60% CL
HTGB	40°C	77	0	1000	0.7	39,332,519	23.39
HTGB	40°C	77	0	1000	0.7		
HTRB	40°C	36	0	1000	0.7	62,829,868	14.64
HTRB	40°C	210	0	1000	0.7		
THB	40°C/60%	77	0	1000	0.7	26,248,530	35.05
THB	40°C/60%	77	0	1000	0.7		
THB	40°C/60%	77	0	1000	0.7		