ADVANCED LOGISTICS DEVELOPMENTS

Quality Solutions for Quality People

RELIABILITY PREDICTION FOR

CX480D5, D2D40, DRA3P48E4, H12WD4850 Products

ALD Document Number: Revision: 0-00-00G

Issue Date: May 05, 2013

Prepared by ALD for CRYDOM, Inc.
Contact Person: Bryan Bixby

	NAME	SIGNATURE	DATE
Prepared	D. George Papiashvili		02/05/2013
Checked	Alex Vainshtein		02/05/2013
Last Revised	D. George Papiashvili		10/05/2013
Approved			
Approved			

52 Menachem Begin Str., Tel Aviv, 67137 ISRAEL
Phone: (972) 3-791-3200 Fax: (972) 3-791-3210 Web: www.aldservice.com

CONTENTS

1. GENERAL

1.1. Introduction

This document represents the reliability prediction of CX480D5, D2D40, DRA3P48E4 and H12WD4850 Products, manufactured by CRYDOM. The reliability prediction was performed using A.L.D. Ltd. software - RAM Commander, version 8.2 SP2.

1.2. Abbreviations and Definitions

MTBF	-	Mean Time Between Failures	Qty	-	Quantity
λ	-	Failures per 10^9 hours	FR	-	Failure Rate
FIT	-	Failure In Time (where Time = 10^9 hours)	RefDes	-	Reference Designator
G_B	-	Ground, Benign	IAW	-	In Accordance With

2. RELIABILITY AND AVAILABILITY PREDICTION SUMMARY

2.1. Reliability prediction Summary

The results of reliability prediction for CX480D5, D2D40, DRA3P48E4 and H12WD4850 Products are presented in Table 1

Prediction Method: Telcordia Technologies Special Report SR-332, Issue 3		
Environmental Condition	**GB**	
Ambient Temperature	**25°C**	
Product ID	**λ [FIT]**	**MTBF [Hours]**
CX480D5	53.91	18,547,862
D2D40	29.20	34,247,164
DRA3P48E4	199.85	5,003,703
H12WD4850	60.85	16,433,050

Table 1 MTBF calculation summary results for CRYDOM Products

3. ANALYSIS CONSIDERATIONS

3.1. Reliability Prediction Method

The reliability prediction was performed IAW the Telcordia Technologies Special Report SR-332, Issue 3 (see ref. 5).

The method of prediction: Part Stress Analysis. For detailed information on electrical stresses please refer the general assumptions section in Paragraph 3.3

3.2. Environment & Temperature

The reliability prediction was performed for Environmental Factors presented in Table 2

Environmental Condition	Ambient Temperature
GB	25°C

Table 2 - Environment and Ambient Temperature

The temperature rise of 10 °C above the ambient temperature was taken for the internal components.

3.3. General Assumptions

- Failure rates of components are constant during equipment life period.
- The failures of different components are considered statistically independent.
- The assembly reliability model is a series one failure in any component causes an assembly failure.
- Only hardware failures were taken into consideration in the reliability prediction.
- The nominal levels of electrical stress for the components are taken IAW following values: 20% for film resistors, 20% for ceramic capacitors, 50% for tantalum and electrolytic capacitors and 50% for all other active components. (Excluding components, the reliability data of which was acquired by the direct request to manufacturer or has been provided by CRYDOM).
- For Manufacturer's Reliability Data, an extrapolation between different temperature conditions to 35°C is performed according to following document: System Reliability Toolkit (RiAC , D.A.C.S., 2006 , page 462 Table 6.4.1.4-3)
- For semiconductors with non-published by their manufacturer reliability data, the Failure Rate was taken into account using alternate reference
- For TRIAC-type semiconductors with unknown reliability parameters, the failure rate estimate was made according to similarity principle, by comparing their electrical and packaging characteristics with equivalent products available in the global market, and with the available data on reliability.

3.4. MTBF Calculation Model

The formula for module/card MTBF calculation is:

$$\lambda = \sum_{i=1}^{n} \lambda_i \qquad MTBF = \frac{1}{\lambda}$$

Where:

λ_i = failure rate of i'th item
n = number of items

4. APPENDICES CONTENTS

4.1. Appendix A - TEMPERATURE CURVES

This Appendix describes the effect of the temperature rise on the equipment failure rate.

5. REFERENCES

- Telcordia Technologies Special Report SR-332, Issue 3 (2011)
- System Reliability Toolkit (R.A.C., 1996)
- Component lists of CX480D5, D2D40, DRA3P48E4 and H12WD4850 Products (CRYDOM, 2013).
- Reliability data obtained from component manufacturers.
- ON-Semiconductor reliability database.

APPENDIX A

TEMPERATURE CURVES

MTBF vs Ambient Temperature

$T_{AMBIENT}$ (°C)	MTBF (Hours)			
	CX480D5	D2D40	DRA3P48E4	H12WD4850
25.	18547862.2	34247164.4	5003703.0	16433050.4
30.	16776020.7	29342868.4	4428371.1	14805389.8
35.	15003694.9	25049418.6	3870171.3	13141560.6
40.	13403114.3	21395130.2	3374964.0	11641553.4
45.	11995910.1	18304612.3	2945631.4	10332294.7
50.	10722783.8	15671847.3	2565927.0	9152658.8
55.	9608711.4	13444779.5	2238701.5	8130104.2
60.	8600614.2	11545504.7	1950236.3	7210376.6
65.	7650043.2	9911514.0	1689538.7	6346486.4