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RELIABILITY PREDICTION REPORT

FOR THE

Oyster2 Cellular

Prepared by

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Introduction and Summary

This document presents Digital Matter' Reliability Prediction Report performed on the Oyster2 Cellular. It was analysed for Mean Time Between Failure (MTBF) in accordance with Telcordia, done on the ReliaSoft Lambda Predict software. Stress levels in accordance with typical operating conditions were used. Please see Appendix A for MTBF values as well as stresses for each component in the assembly.

The Oyster2 Cellular was found to have a Mean Time Between Failure (MTBF) of 2 128 320 hours of operation. This statement is fully supported by the reliability mathematical model presented in Reliability Analysis section, the below Failure Rate Data Summary and the detailed reliability parts count failure rate data tables presented in the Appendix A of this report.

Prediction method:	Telcordia
Environment:	GM - Ground Mobile, TA=45°C, TJ=65°C
Failure Rate (t=INF):	469.854203 FITs
MTBF:	2 128 320 (Hours)

Table 1: Reliability Analysis Summary

Scope

The report reflects the Oyster2 Cellular reliability design analysis performed from project inception through the issue date of this document. This report is limited to electronic parts.

Objectives

Throughout this report Digital Matter seeks to provide a prediction of the Oyster2 Cellular MTBF, to evaluate its current and potential reliability, to provide information in order to assist in directing and planning for reliability and related program efforts and to identify design features which are critical to reliability.

Reliability Analysis

Reliability Analysis Methodology

The prediction method used was Telcordia

Failure Rate (λ) = 10^9 hours (FITS)

MTBF = $1/\lambda$

$$\lambda_{SSi} = \lambda_{Gi} \pi_{Qi} \pi_{Si} \pi_{Ti}$$

Where λ_{Gi} : Generic steady-state failure rate for device i

π_{Qi} : Quality Factor for device i

π_{Si} : Stress factor for device i

π_{Ti} : Temperature factor for device i

Quality Factors

Digital Matters' use of commercial parts throughout the Oyster2 Cellular is reflected in the quality factors, presented in Appendix A.

Environmental Conditions

Every parts' generic failure rate includes the effects of environment factors. The appropriate environment factor for the Oyster2 Cellular is Ground Mobile (GM). For GM the semiconductor junction temperature, $T_J = 65^\circ\text{C}$, and the other parts ambient temperature, $T_A = 45^\circ\text{C}$.

MTBF Over Temperature

Below figure represents the MTBF over a temperature range from 30°C to 100°C

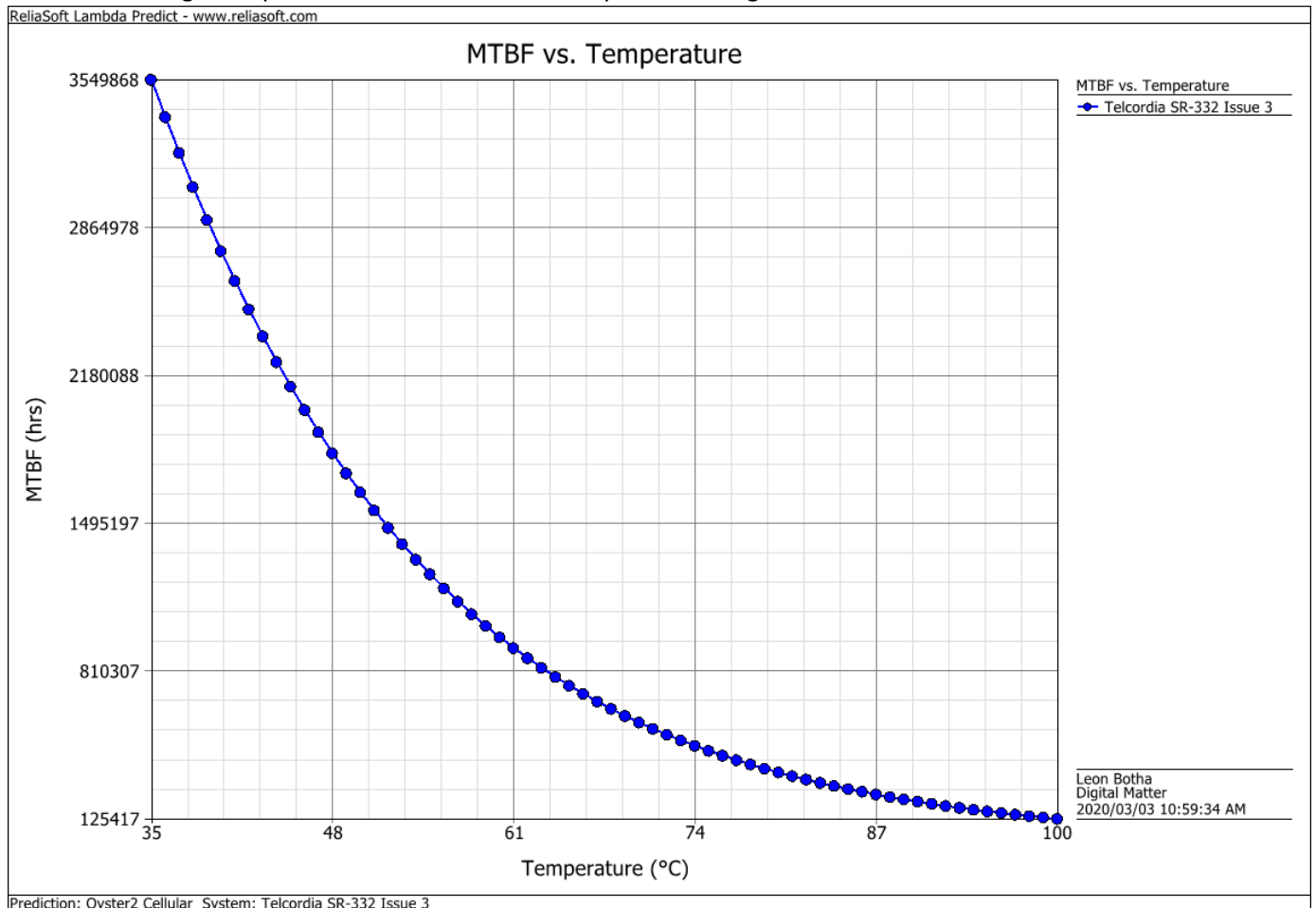


Figure 1: MTBF vs Temperature

Appendix A

Part Number	Category	Reference Designator	MTBF (hrs)	Contribution	Quantity	Current Stress	Power Stress	Voltage Stress	Quality
GRM1555C1H220GA01D	Capacitor	C1, C8, C17, C30, C36	3.477789E+09	0.000612	5	0.5		0.09	Level I
GRM31CD80J107ME39L	Capacitor	C2, C22	6.724121E+08	0.003165	2	0.5		0.714286	Level I
GRM155R71H104KE14J	Capacitor	C3, C4, C7, C12, C13, C14, C21, C28, C31, C35, C37, C40, C43, C50, C54, C55, C56, C57, C62	9.152077E+08	0.002326	19	0.5		0.09	Level I
293D106X0016A2TE3	Capacitor	C5	3.071357E+10	0.000069	1	0.5		0	Level I
GRM31CE70J476ME15L	Capacitor	C6	1.344824E+09	0.001583	1	0.5		0.714286	Level I
GCM188R71E105KA64D	Capacitor	C9	1.107660E+10	0.000192	1	0.5		0.2	Level I
GRM1555C1H471GA01D	Capacitor	C10	1.738895E+10	0.000122	1	0.5		0.09	Level I
GCM155R71H333KE02D	Capacitor	C11	1.738895E+10	0.000122	1	0.5		0.09	Level I
CC0603MRX5R5BB226	Capacitor	C15, C16	1.468246E+09	0.00145	2	0.5		0.52381	Level I
GCM188R71E105KA64D	Capacitor	C20, C27, C42	3.692200E+09	0.000576	3	0.5		0.2	Level I
GCM21BR71H105KA03K	Capacitor	C23	1.738895E+10	0.000122	1	0.5		0.09	Level I
GCM1555C1H101JA16D	Capacitor	C24	1.738895E+10	0.000122	1	0.5		0.09	Level I
GCM1555C1H330JA16D	Capacitor	C25, C39, C58, C59, C60	3.477789E+09	0.000612	5	0.5		0.09	Level I
C2012JB1E226M125AC	Capacitor	C26, C29, C38, C41, C61, C63	3.039401E+08	0.007002	6	0.5		0.64	Level I
C3216JB0J107M160AB	Capacitor	C32	9.712867E+08	0.002191	1	0.5		0.793651	Level I
GRM1555C1H5R6CA01J	Capacitor	C33	2.279257E+10	0.000093	1	0.5		0.024	Level I
GCM188L81H104KA57D	Capacitor	C34	1.669042E+10	0.000128	1	0.5		0.1	Level I
T520B227M006ATE045	Capacitor	C44, C45, C46	2.915226E+08	0.007301	3	0.5		0.603175	Level I
GCM155R71H103KA55J	Capacitor	C47, C64	9.208137E+09	0.000231	2	0.5		0.076	Level I
GJM1555C1H150JB01D	Capacitor	C48	2.514942E+10	0.000085	1	0.5		0	Level I
GCM1555C1H560JA16D	Capacitor	C49	1.841627E+10	0.000116	1	0.5		0.076	Level I
GJM1555C1H1R8CB01D	Capacitor	C51	2.514942E+10	0.000085	1	0.5		0	Level I
GJM1555C1HR50BB01D	Capacitor	C53	1.669042E+10	0.000128	1	0.5		0.1	Level I
GRM155R71H223KA12J	Capacitor	C65	1.841627E+10	0.000116	1	0.5		0.076	Level I
PESD5V0U1BB,115	Diode	D1, D2, D3, D4	7.236469E+08	0.002941	4	0.01	0.5	0.9	Level I
151031SS04000	Opto-Electronic	DS1	8.866975E+08	0.0024	1		0.5		Level I

BLM18PG181SN1	Inductor	FB1	3.054325E+09	0.000697	1		0.8	Level I	
LQG15HN6N8J02	Inductor	L1	3.054325E+09	0.000697	1		0.8	Level I	
LQG15HS27NJ02	Inductor	L2	3.054325E+09	0.000697	1		0.8	Level I	
SRN5040-4R7M	Inductor	L3	1.272635E+09	0.001672	1		0.8	Level I	
LQG15HN3N9C02D	Inductor	L4	2.776659E+09	0.000767	1		0.8	Level I	
LQG15HN15NJ02D	Inductor	L5	2.776659E+09	0.000767	1		0.8	Level I	
LQG15HN18NJ02D	Inductor	L6	2.776659E+09	0.000767	1		0.8	Level I	
DMP32D4SW-7	Transistor	Q1	8.523941E+07	0.024969	1	0.5	0.5	Level I	
MMBT2222AWT	Transistor	Q2	4.249617E+08	0.005008	1	0.5	0.5	Level I	
RC0402FR-0710RL	Resistor, Fixed		1 6.421823E+09	0.000331	1	0.1	0.5	Level I	
RC0402FR-0710KL	Resistor, Fixed	R2, R3, R7, R13, R15, R21, R23, R24		8.027279E+08	0.002651	8	0.1	0.5	Level I
RC0402FR-071K5L	Resistor, Fixed	R4, R6		3.210912E+09	0.000663	2	0.1	0.5	Level I
RC0402FR-07150RL	Resistor, Fixed		5 6.421823E+09	0.000331	1	0.1	0.5	Level I	
RC0603FR-0710RL	Resistor, Fixed		8 6.421823E+09	0.000331	1	0.1	0.5	Level I	
RC0402FR-072K2L	Resistor, Fixed	R9, R10		3.210912E+09	0.000663	2	0.1	0.5	Level I
RC0402FR-07100KL	Resistor, Fixed	R11, R18, R31		2.140608E+09	0.000994	3	0.1	0.5	Level I
RC0402FR-071KL	Resistor, Fixed		12 6.421823E+09	0.000331	1	0.1	0.5	Level I	
RC0402FR-07100RL	Resistor, Fixed		14 6.421823E+09	0.000331	1	0.1	0.5	Level I	
RC0402FR-07270KL	Resistor, Fixed	R16, R17, R26, R30		1.605456E+09	0.001326	4	0.1	0.5	Level I
RC0402FR-0747KL	Resistor, Fixed		19 6.421823E+09	0.000331	1	0.1	0.5	Level I	
PE0805FRF7W0R047L	Resistor, Fixed		20 4.347939E+09	0.00049	1	0.4	0.5	Level I	
RC0402FR-071ML	Resistor, Fixed		22 6.421823E+09	0.000331	1	0.1	0.5	Level I	
RC0402FR-0739KL	Resistor, Fixed		25 6.421823E+09	0.000331	1	0.1	0.5	Level I	
RC0402FR-07200KL	Resistor, Fixed		27 6.421823E+09	0.000331	1	0.1	0.5	Level I	
RC0402FR-070RL	Resistor, Fixed	R28, R29		3.210912E+09	0.000663	2	0.1	0.5	Level I
MMA8451QR1	IC, Microprocessor	U1		3.620079E+07	0.058792	1	0.5	Level I	
TPS78833DBVT	IC, Analog/Linear	U2		6.420082E+07	0.033151	1	0.5	Level I	
MAX2659ELT+T	IC, Analog/Linear	U3		8.038112E+07	0.026478	1	0.5	Level I	
EVA-M8Q	IC, Microprocessor	U4		3.620079E+07	0.058792	1	0.5	Level I	
EFM32TG11B120F128GQ48	IC, Microcontroller	U5		8.144640E+06	0.261315	1		Level I	
FPF1038UCX	Transistor	U6		8.523941E+07	0.024969	1	0.5	0.5	Level I

SST26VF032B-104I/MF	IC, ROM/PROM/EPROM	U7	1.185425E+07	0.179541	1		0.5		Level I
MCP1703T-3302E/MB	IC, Analog/Linear	U8	6.420082E+07	0.033151	1		0.5		Level I
MP4432GL	IC, Analog/Linear	U9	6.420082E+07	0.033151	1		0.5		Level I
STC3100IST	IC, Microprocessor	U10	3.620079E+07	0.058792	1		0.5		Level I
NLSX5014MUT	IC, Digital	U11	1.889992E+08	0.011261	1		0.5		Level I
SARA-G350-02S-01	Hybrid Block	U12	3.891051E+07	0.054698	1				0
DTC143ZUA	Transistor	U13	4.249617E+08	0.005008	1		0.5	0.5	Level I
TPS22917DBVR	Transistor	U14	8.523941E+07	0.024969	1		0.5	0.5	Level I
ABS06-32.768kHz-7-1-T	Miscellaneous	XTAL1, XTAL2	3.829909E+07	0.055571	2	0.5			Level I

The technical documentation relevant to the above report will be held at:

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