

Quality by Design for Electronics

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Werner Fleischhammer



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The terms 'he' and 'his' are not indicative of a specific gender and should be taken throughout to refer to both men and women.

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Contents

Preface	ix
1. Introduction	1
2. Integrated quality assurance	9
2.1 Quality culture	9
2.2 Quality assurance in the initial phase	11
2.3 Quality assurance in the project phase	12
2.4 Quality assurance during the design phase	15
2.5 Quality assurance in the prototype and early production phase	16
2.6 Quality assurance in the production phase	17
2.7 The way to lower cost	17
3. Joint evaluation of all components	21
3.1 Evaluation, an important aspect of quality assurance	21
3.2 Evaluation survey and information system	27
4. Functional and electrical evaluation of digital ICs	35
4.1 Logic function	38
4.2 Static characteristics	39
4.2.1 <i>Input/output characteristics</i>	40
4.2.2 <i>Transfer characteristics</i>	45
4.2.3 <i>Supply current characteristics</i>	48
4.2.4 <i>Special static characteristics</i>	49
4.3 Dynamic characteristics	52
4.3.1 <i>General considerations</i>	52
4.3.2 <i>Test set-up</i>	53
4.3.3 <i>Delay parameters</i>	53
4.3.4 <i>Transition time (rise and fall time)</i>	58
4.3.5 <i>Logic spikes and noise may increase delay</i>	60
4.4 Evaluation by automatic test systems	62
4.4.1 <i>The benefits of automated testing</i>	62
4.4.2 <i>Cost comparison</i>	66
4.5 Special electrical parameters	68
4.5.1 <i>Dynamic noise immunity</i>	68
4.5.2 <i>Threshold time</i>	70
4.5.3 <i>Dynamic power supply current and supply spikes</i>	72

4.5.4	<i>Ground bounce and bus contention</i>	73
4.5.5	<i>Capacitance of inputs and outputs</i>	75
4.5.6	<i>Asynchronous behaviour</i>	78
4.6	Evaluation of standard LSI and VLSI circuits	86
4.7	Electrical evaluation of asics	92
4.7.1	<i>Different categories of asics</i>	92
4.7.2	<i>Full custom asics</i>	92
4.7.3	<i>Semicustom asics: gate arrays and standard cells</i>	93
4.7.4	<i>User programmable asics</i>	111
4.8	Electrical evaluation of memories	114
4.9	Evaluation of ECL circuits	115
4.9.1	<i>Status of ECL technology</i>	115
4.9.2	<i>Evaluation tests on ECL circuits</i>	116
4.10	Evaluation of passive components, discrete semiconductors and analogue ICs	116
4.11	Subcontractors (OEM)	118
4.12	Final remarks on electrical evaluation	119
5.	Reliability and environmental requirements	121
5.1	Reliability evaluation	121
5.2	Reliability tests	123
5.3	ESD sensitivity	124
5.3.1	<i>Physical basis</i>	124
5.3.2	<i>Measurement methods</i>	125
5.3.3	<i>Results</i>	127
5.4	Latch-up effect	130
5.5	Soft errors	131
5.6	Preconditioning (burn-in)	135
5.7	Wear-out	140
5.8	Technological evaluation	141
5.9	Mechanical characteristics	141
5.10	Customer audits at vendor's site	145
5.11	Cost and benefits of evaluation	145
5.11.1	<i>How to calculate the benefits of evaluation</i>	145
5.11.2	<i>Some real problems as examples</i>	151
6.	Quality assurance in the production phase	153
6.1	General considerations	153
6.2	Quality management	154
6.2.1	<i>Failure management system</i>	154
6.2.2	<i>Manufacturing process control</i>	157
6.2.3	<i>Quality actions</i>	159

6.2.4	<i>Test strategy</i>	160
6.3	Traceability	162
6.4	Incoming inspection	165
6.4.1	<i>Management of incoming inspection tests</i>	165
6.4.2	<i>How to choose the right testing hardware</i>	166
6.4.3	<i>How to procure test software</i>	175
6.4.4	<i>To what extent do components have to be tested?</i>	177
6.5	Board test strategy	179
6.5.1	<i>Procedure for choosing the optimal test strategy</i>	179
6.5.2	<i>Execution of board tests</i>	187
6.5.3	<i>Design for testability</i>	191
6.5.4	<i>Future trends</i>	191
6.6	Module test	193
6.7	Final or end test	194
6.7.1	<i>Test procedure</i>	194
6.7.2	<i>Detect board failures at board test, not at final test</i>	199
6.7.3	<i>Optimal scheduling of subtests</i>	201
6.7.4	<i>Test handler</i>	202
6.7.5	<i>Use of an expert system</i>	203
6.7.6	<i>Achieved cost reduction</i>	205
6.8	Service and maintenance	205
6.9	Failure analysis	209
6.9.1	<i>Failure documentation</i>	209
6.9.2	<i>Execution</i>	209
6.9.3	<i>Process of analysis</i>	211
6.9.4	<i>Interpretation of results</i>	213
6.10	Correlation with the vendor to reduce failure rate	216
6.11	Failure prevention	219
6.11.1	<i>Statistical process control (SPC)</i>	220
6.11.2	<i>Preconditioning (run-in)</i>	224
6.11.3	<i>ESD prevention</i>	224
6.11.4	<i>Use of human resources</i>	227
6.11.5	<i>Permanent control and calibration of test equipment</i>	229
6.12	Process changes	233
6.12.1	<i>Procedures for introducing process changes</i>	232
6.12.2	<i>Process qualification and release</i>	233
6.12.3	<i>Failure mode and effect analysis (FMEA)</i>	234
6.13	Achieved cost reduction	236

7. Design for quality, the key to good quality at low cost	241
8. Specifications and standards as a basis for co-operation	247
8.1 Purpose and procedure of specifying	247
8.2 General quality specification	247
8.3 Family specification	248
8.4 Part specification	248
8.5 Purchase contract	249
8.6 Agreement on the quality assurance (ship-to-stock contract)	249
8.7 ISO 9000 certification	249
Appendices	
A: Propagation of signals and crosstalk on interconnection lines	253
B: Evaluation test program	265
C: Calculation of failure rate λ	267
D: Reliability questionnaire	269
E: Check-list for comparing ATE testers	279
F: Principles of test software generation for ICs of high complexity	285
G: Shielding effectiveness of a cable connection	293
H: Agreement on quality assurance between purchaser and supplier	297
I: General quality specification	301
Glossary	313
Further reading	319
Index	325

Preface

This book concentrates on the quality of electronic products. Electronics in general, including semiconductor technology and software, has become the key technology for wide areas of industrial production. In nearly all expanding branches of industry electronics, especially digital electronics, is involved. And the spread of electronic technology has not yet come to an end. This rapid development, coupled with growing competition and the shorter innovation cycle, have caused economic problems which tend to have adverse effects on quality.

Therefore, good quality at low cost is a very attractive goal in industry today. The demand for better quality continues along with a demand for more studies in quality assurance. At the same time, many companies are experiencing a drop in profits just when better quality of their products is essential in order to survive against the competition.

There have been many proposals in the past to improve quality without increase in cost, or to reduce cost for quality assurance without loss of quality. This book tries to summarize the practical content of many of these proposals and to give some advice, above all to the designer and manufacturer of electronic devices. It mainly addresses practically minded engineers and managers. It is probably of less interest to pure scientists. The book covers all aspects of quality assurance of components used in electronic devices. Integrated circuits (ICs) are considered to be the most important components because the degree of integration is still rising. Therefore, the main focus is the application of these circuits in electronic devices. This book may be of some value to the designer of ICs as well, but no detailed theory of failure modes is given. The goal is to present methods on how to best use the benefits of quality assurance to improve product quality without increasing product cost. This book will show that it is profitable to involve quality engineers in the whole design process, starting with quality studies in parallel with first design steps and ending with periodical quality reviews together with the vendors. Likewise, open co-operation with the vendors in all stages of design will reduce the cost of quality assurance considerably.

The impetus to write this book came from many discussions which the author had with several manufacturers of electronic devices, mainly computers, and with many vendors of electronic components

from various countries. The main topics of these conversations involved finding a way of achieving an optimal compromise between quality and cost, and a way of balancing the partly conflicting interests of customer and vendor of components. The experiences, good and bad, which the author gained during this task are laid down in this book. However, it should be mentioned that, in this book, the problems are viewed from the eyes of a user more than from the eyes of a vendor of components. In this way, it may be a useful complement to the literature on the subject where quality problems are mostly seen from the viewpoint of the manufacturer of components. Aspects of software quality are not included in this book.

The author thanks everyone, vendors and users of ICs who assisted him in writing this book for all their fruitful discussions and valuable advice. Special thanks are due to Dr N. Lieske, director of quality assurance, for his input on joint qualification, preconditioning and ESD prevention and to Mr M. Kuchler, director of quality control, Siemens Nixdorf AG., Augsburg, Member of ZVEI ('Association of Information and Communication Technology') for his contribution to CAM, as well as to Mr F. Gelzer and Mr G. Gelfort for their help in preparing chip photos.

Last but not least I have to express my personal thanks to Mr Charles Gardiner and to Mr Philip Walters for their kind linguistic corrections, and to Jenny Lawson and her crew at First Class for editing this book.

Werner Fleischhammer
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