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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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CONTENTS

FOREWORD.....	9
INTRODUCTION.....	11
1 Scope.....	12
2 Normative references	12
3 Terms, definitions and symbols	13
3.1 Terms and definitions.....	13
3.2 Symbols.....	16
4 Context and conditions	18
4.1 Failure modes and mechanisms.....	18
4.2 Thermal modelling	19
4.3 Operating Mission profile considerations.....	19
4.3.1 General	19
4.3.2 Operating and non-operating conditions	19
4.3.3 Dormancy.....	20
4.3.4 Storage conditions	20
4.4 Environmental conditions	20
4.5 Components choice	22
4.6 Reliability growth during the deployment phase of new equipment	23
4.7 How to use this document.....	24
5 Generic reference conditions and stress models.....	25
5.1 Recommended generic reference conditions.....	25
5.2 Generic stress models	26
5.2.1 General	26
5.2.2 Stress factor for voltage dependence, π_U	27
5.2.3 Stress factor for current dependence, π_I	27
5.2.4 Stress factor for temperature dependence, π_T	27
5.2.5 Environmental application factor, π_E	29
5.2.6 Dependence on switching rate, π_S	30
5.2.7 Dependence on electrical stress, π_{ES}	30
5.2.8 Other factors of influence	30
6 Integrated semiconductor circuits	30
6.1 Specific reference conditions	30
6.2 Specific stress factors models	33
6.2.1 Models General	33
6.2.2 Voltage dependence, factor π_U	33
6.2.3 Temperature dependence, factor π_T	33
7 Discrete semiconductors	36
7.1 Specific reference conditions	36
7.2 Specific stress factors models	37
7.2.1 General	37
7.2.2 Voltage dependence for transistors, factor π_U	38
7.2.3 Temperature dependence, factor π_T	38
8 Optoelectronic components	40

8.1	Specific reference conditions	40
8.2	Specific stress factors models.....	42
8.2.1	General	42
8.2.2	Voltage dependence, factor π_U	42
8.2.3	Current dependence, factor π_I	42
8.2.4	Temperature dependence, factor π_T	43
9	Capacitors	45
9.1	Specific reference conditions	45
9.2	Specific stress factors models.....	45
9.2.1	Models General	45
9.2.2	Voltage dependence, factor π_U	45
9.2.3	Temperature dependence, factor π_T	47
10	Resistors and resistor networks	48
10.1	Specific reference conditions	48
10.2	Specific stress factors models.....	49
10.2.1	Models General	49
10.2.2	Temperature dependence, factor π_T	49
11	Inductors, transformers and coils	50
11.1	Reference conditions	50
11.2	Specific stress factors models.....	50
11.2.1	Models General	50
11.2.2	Temperature dependence, factor π_T	50
12	Microwave devices	51
12.1	Specific reference conditions	51
12.2	Specific stress factors models.....	52
13	Other passive components	52
13.1	Specific reference conditions	52
13.2	Specific stress factors models.....	52
14	Electrical connections	52
14.1	Specific reference conditions	52
14.2	Specific stress factors models.....	53
15	Connectors and sockets	53
15.1	Reference conditions	53
15.2	Specific stress factors models.....	53
16	Relays	53
16.1	Reference conditions	53
16.2	Specific stress factors models.....	54
16.2.1	Models General	54
16.2.2	Dependence on switching rate, factor π_S	54
16.2.3	Dependence on electrical stress, factor π_{ES}	55
16.2.4	Temperature dependence, factor π_T	56
17	Switches and push-buttons	56
17.1	Specific reference conditions	56
17.2	Specific stress factors models.....	57
17.2.1	Models General	57

17.2.2	Dependence on electrical stress, factor π_{ES}	57
18	Signal and pilot lamps	58
18.1	Specific reference conditions	58
18.2	Specific stress factors models	58
18.2.1	Models General	58
18.2.2	Voltage dependence, factor π_U	59
19	Printed circuit boards (PCB)	59
20	Hybrid circuits	59
Annex A (normative) Failure modes of components		60
Annex B (informative) Thermal model for semiconductors		63
B.1	Thermal model	63
B.2	Junction temperature calculation	64
B.3	Thermal resistance evaluation	65
B.4	Power dissipation of an integrated circuit P	66
Annex C (informative) Failure rate prediction		69
C.1	General	69
C.2	Failure rate prediction for assemblies	69
C.2.1	General	69
C.2.2	Assumptions and limitations	70
C.2.3	Process for failure rate prediction	70
C.2.4	Prediction models	71
C.2.5	Consideration of operating profiles	75
C.2.5	Other methods of reliability prediction	75
C.2.6	Validity considerations of reliability models and predictions	76
C.3	Component considerations	76
C.3.1	Component model	76
C.3.2	Components classification	76
C.4	General consideration about failure rate	77
C.4.1	General	77
C.4.2	General behaviour of the failure rate of components	77
C.4.3	Expected values of failure rate	78
C.4.4	Sources of variation in failure rates	79
Annex D (informative) Considerations on mission profile		80
D.1	General	80
D.2	Dormancy	80
D.3	Mission profile	81
D.4	Example of mission profile	82
Annex E (informative) Useful life models		83
E.1	General	83
E.2	Power transistors	83
E.3	Optocouplers	83
E.3.1	Useful life L	83
E.3.2	Factor L_0	84
E.3.3	Factor κ_0	84
E.3.4	Factor κ_1	85
E.3.5	Factor κ_2	85
E.3.6	Factor κ_3	85

E.4	LED and LED modules	86
E.4.1	Useful life L	86
E.4.2	Factor L_0	86
E.4.3	Factor κ_0	87
E.4.4	Factor κ_1	87
E.4.5	Factor κ_2	88
E.4.6	Factor κ_3	88
E.5	Aluminium, non-solid electrolyte capacitors	88
E.6	Relays	89
E.7	Switches and keyboards	89
E.8	Connectors	89
Annex F (informative)	Physics of failure	90
F.1	General	90
F.2	Failure mechanisms of integrated circuits	91
Annex G (informative)	Considerations for the design of a data base on failure rates	92
G.1	General	92
G.2	Data collection acquisition – collection process	92
G.3	Which data to collect and how to collect it	92
G.4	Calculation and decision making	93
G.5	Data descriptions	93
G.6	Identification of components	94
G.6.1	General	94
G.6.2	Component identification	94
G.6.3	Component technology	94
G.7	Specification of components	94
G.7.1	General	94
G.7.2	Electrical specification of components	94
G.7.3	Environmental specification of components	95
G.8	Field related issues data	95
G.8.1	General	95
G.8.2	Actual field conditions	95
G.8.3	Data on field failures	95
G.9	Test related issues data	96
G.9.1	General	96
G.9.2	Actual test conditions	96
G.9.3	Data on test failures	96
G.10	Failure rate database attributes	97
Annex H (informative)	Potential sources of failure rate data and methods of selection	99
H.1	General	99
H.2	Data source selection	99
H.3	User data	100
H.4	Manufacturer's data	100
H.5	Handbook reliability data	101
H.5.1	General	101
H.5.2	Using handbook data with this document	101
H.5.3	List of available handbooks	102
Annex I (informative)	Overview of component classification	105
I.1	General	105

I.2	The IEC 61360 system.....	105
I.3	Other systems.....	113
I.3.1	General.....	113
I.3.2	NATO stock numbers.....	113
I.3.3	UNSPSC codes.....	113
I.3.4	STEP/EXPRESS.....	113
I.3.5	IECQ.....	113
I.3.6	ECALS.....	114
I.3.7	ISO 13584.....	114
I.3.8	MIL specifications.....	114
Annex J	(informative) Presentation of component reliability data.....	115
J.1	General.....	115
J.2	Identification of components.....	115
J.2.1	General.....	115
J.2.2	Component identification.....	116
J.2.3	Component technology.....	116
J.3	Specification of components.....	116
J.3.1	General.....	116
J.3.2	Electrical specification of components.....	116
J.3.3	Environmental specification of components.....	116
J.4	Test related issues data.....	116
J.4.1	General.....	116
J.4.2	Actual test conditions.....	117
J.5	Data on test failures.....	117
Annex K	(informative) Examples.....	119
K.1	Integrated circuit.....	119
K.2	Transistor.....	119
K.3	Capacitor.....	119
K.4	Relay.....	120
Bibliography	121
Figure 1	– Comparison of the temperature dependence of π_T for CMOS IC.....	25
Figure 2	– Selection of stress regions in accordance with current and voltage-operating conditions.....	55
Figure 3	– Selection of stress regions in accordance with current and voltage-operating conditions.....	57
Figure B.1	– Stress profile.....	64
Figure B.1	– Temperatures inside equipment.....	64
Figure B.2	– Averaging failure rates.....	65
Figure B.2	– Thermal resistance model.....	65
Figure D.1	– Mission profile.....	82
Table 1	– Basic environments.....	21
Table 2	– Values of environmental parameters for basic environments.....	22
Table 3	– Recommended reference conditions for environmental and mechanical stresses.....	26
Table 4	– Environmental application factor, π_E	29

Table 5 – Memory	31
Table 6 – Microprocessors and peripherals, microcontrollers and signal processors	31
Table 7 – Digital logic families and bus interfaces, bus driver and receiver circuits	31
Table 8 – Analog ICs	32
Table 9 – Application-specific ICs (ASICs)	32
Table 10 – Constants for voltage dependence	33
Table 11 – Factor π_U for digital CMOS-family ICs	33
Table 12 – Factor π_U for bipolar analog ICs	33
Table 13 – Constants for temperature dependence	33
Table 14 – Factor π_T for ICs (without EPROM; FLASH-EPROM; OTPROM; EEPROM; EAROM)	35
Table 15 – Factor π_T for EPROM; FLASH-EPROM; OTPROM; EEPROM; EAROM	35
Table 16 – Transistors common, low frequency	36
Table 17 – Transistors, microwave, (e.g. RF > 800 MHz)	36
Table 18 – Diodes	37
Table 19 – Power semiconductors	37
Table 20 – Constants for voltage dependence of transistors	38
Table 21 – Factor π_U for transistors	38
Table 22 – Constants for temperature dependence of discrete semiconductors	38
Table 23 – Factor π_T for transistors, reference and microwave diodes	39
Table 24 – Factor π_T for diodes (without reference and microwave diodes) and power semiconductors	39
Table 25 – Optoelectronic semiconductor signal receivers	40
Table 26 – LEDs, IREDS, laser diodes and transmitter components	40
Table 27 – Optocouplers and light barriers	41
Table 28 – Passive optical components	41
Table 29 – Transceiver, transponder and optical sub-equipment	41
Table 30 – Constants for voltage dependence of phototransistors	42
Table 31 – Factor π_U for phototransistors	42
Table 32 – Constants for current dependence of LEDs and IREDS	43
Table 33 – Factor π_I for LEDs and IREDS	43
Table 34 – Constants for temperature dependence of optoelectronic components	43
Table 35 – Factor π_T for optical components	44
Table 36 – Capacitors	45
Table 37 – Constants for voltage dependence of capacitors	46
Table 38 – Factor π_U for capacitors	46
Table 39 – Constants for temperature dependence of capacitors	47
Table 40 – Factor π_T for capacitors	48
Table 41 – Resistors and resistor networks	49
Table 42 – Constants for temperature dependence of resistors	49
Table 43 – Factor π_T for resistors	50

Table 44 – Inductors, transformers and coils.....	50
Table 45 – Constants for temperature dependence of inductors, transformers and coils	50
Table 46 – Factor π_T for inductors, transformers and coils	51
Table 47 – Microwave devices	51
Table 48 – Other passive components	52
Table 49 – Electrical connections.....	53
Table 50 – Connectors and sockets	53
Table 51 – Relays.....	54
Table 52 – Factor π_{ES} for low current relays.....	55
Table 53 – Factor π_{ES} for general purpose relays.....	55
Table 54 – Factor π_{ES} for automotive relays.....	56
Table 55 – Constants for temperature dependence of relays.....	56
Table 56 – Factor π_T for relays	56
Table 57 – Switches and push-buttons.....	57
Table 58 – Factor π_{ES} for switches and push-buttons for low electrical stress	58
Table 59 – Factor π_{ES} for switches and push-buttons for higher electrical stress.....	58
Table 60 – Signal and pilot lamps.....	58
Table 61 – Factor π_U for signal and pilot lamps.....	59
Table A.1 – Failure modes: ICs (digital)	60
Table A.2 – Failure modes: transistors, diodes, optocouplers.....	61
Table A.3 – Failure modes: LEDs.....	61
Table A.4 – Failure modes: laser diodes and modules	61
Table A.5 – Failure modes: photodiodes and receiver modules.....	61
Table A.6 – Failure modes: capacitors	62
Table A.7 – Failure modes: Resistors, inductive devices, relays	62
Table B.1 – Thermal resistance as a function of package type, pin number and airflow factor	66
Table B.2 – Typical values of v are K	66
Table B.3 – Values of P_{DC} and P_f	67
Table E.1 – Useful life limitations for switches and keyboards.....	89
Table F.1 – Failure mechanism for Integrated circuits.....	91
Table G.1 – Reliability prediction database attributes.....	98
Table H.1 – Result of calculation for transistors common, low frequency.....	102
Table H.2 – Sources of reliability data (in alphabetical order).....	102
Table I.1 – Classification tree (IEC 61360-4).....	106

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRIC COMPONENTS –
RELIABILITY –
REFERENCE CONDITIONS FOR FAILURE RATES
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International Standard IEC 61709 has been prepared by IEC technical committee 56: Dependability.

This third edition cancels and replaces the second edition, published in 2011. This edition constitutes a technical revision. This third edition is a merger of IEC 61709:2011 and IEC TR 62380:2004.

This edition includes the following significant technical changes with respect to the previous edition:

- a) addition of 4.5 Components choice, 4.6 Reliability growth during the deployment phase of new equipment, 4.7 How to use this document, and of Clause 19 Printed circuit boards (PCB) and Clause 20 Hybrid circuits with respect to IEC TR 62380;
- b) addition of failure modes of components in Annex A;
- c) modification of Annex B, Thermal model for semiconductors, adopted and revised from IEC TR 62380;
- d) modification of Annex D, Considerations on mission profile;
- e) modification of Annex E, Useful life models, adopted and revised from IEC TR 62380;
- f) revision of Annex F (former B.2.6.4), Physics of failure;
- g) addition of Annex G (former Annex C), Considerations for the design of a data base on failure rates, complemented with parts of IEC 60319;
- h) addition of Annex H, Potential sources of failure rate data and methods of selection;
- i) addition of Annex J, Presentation of component reliability data, based on IEC 60319.

The text of this standard is based on the following documents:

FDIS	Report on voting
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Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
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The contents of the corrigendum of October 2019 have been included in this copy.

INTRODUCTION

This document is intended for the reliability prediction of **electric** components as used in equipment and is aimed at organizations that have their own data and describes how to state and use that data in order to perform reliability predictions.

It can also be used to allow an organization to set up a failure rate database and describes the reference conditions for which field failure rates should be stated. The reference conditions adopted in this document are typical of the majority of applications of components in equipment however when components operate under other conditions the users may consider stating these conditions as their reference conditions.

Using the presented stress models allows extrapolation of failure rates **from reference conditions** to other operating conditions which in turn permits the prediction of failure rates at assembly level. This allows estimation of the effect of design changes or changes in the environmental conditions on component reliability. Reliability prediction is most useful in the early design phase of ~~electrical~~ equipment. It can be used, for example, to identify potential reliability problems, the planning of logistic support strategies and the evaluation of designs.

The stress models contained herein are generic and are as simple as possible while still being comparable with more complex equations contained in other models. **The predictions generated using this document have a wide range of prediction accuracy.**

This document does not contain failure rates, but it describes how they can be stated and used. This approach allows a user to select the most relevant and up to date failure rates for the prediction from a source that they select. This document also contains information on how to select the data that can be used in the presented models.

The failure rates considered in this document are assumed to be constant, either for an unlimited period of operation (general case) or for limited periods. The limitation of life is called useful life and applies only for some few component families, reaching the wear-out failure period (during which the failure rate is increasing) within the normal period of use. It is hence assumed that during useful life, the failure rate can be considered constant for any practical use.

For the purposes of this document the term **electric component** includes the commonly used terms “**electronic component**”, “**electrical component**” and “**electro-mechanical component**”.

ELECTRIC COMPONENTS – RELIABILITY – REFERENCE CONDITIONS FOR FAILURE RATES AND STRESS MODELS FOR CONVERSION

1 Scope

This document gives guidance on ~~how the use of~~ failure rate data ~~can be employed~~ for reliability prediction of electric components ~~used~~ in equipment.

The method presented in this document uses the concept of reference conditions which are ~~numerical~~ the typical values of stresses that are observed by components in the majority of applications.

Reference conditions are useful since they ~~are the basis of the calculation of failure rate under any conditions by the application of stress models that take into account the actual operating~~ provide a known standard basis from which failure rates can be modified to account for differences in environment from the environments taken as reference conditions. Each user can use the reference conditions defined in this document or use their own. When failure rates stated at reference conditions are used it allows realistic reliability predictions to be made in the early design phase.

The stress models described herein are generic and can be used as a basis for conversion of failure rate data ~~given~~ at these reference conditions to actual operating conditions when needed and this simplifies the prediction approach. Conversion of failure rate data is only ~~permissible~~ possible within the specified functional limits of the components.

This document also gives guidance on how a database of component failure data can be constructed to provide failure rates that can be used with the included stress models. Reference conditions for failure rate data are specified, so that data from different sources can be compared on a uniform basis. If failure rate data are given in accordance with this document then ~~no~~ additional information on the specified conditions ~~is required~~ can be dispensed with.

This document does not provide base failure rates for components – rather it provides models that allow failure rates obtained by other means to be converted from one operating condition to another operating condition.

The prediction methodology described in this document assumes that the parts are being used within its useful life. The methods in this document have a general application but are specifically applied to a selection of component types as defined in Clauses 6 to 20 and I.2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

~~IEC 60050-191, International electrotechnical vocabulary – Part 191: Dependability and quality of service~~

IEC 60050-192:2015, International electrotechnical vocabulary – Part 192: Dependability