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Edition 2.0 2012-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Liquid crystal display devices –
Part 4: Liquid crystal display modules and cells – Essential ratings and characteristics

Dispositifs d'affichage à cristaux liquides –
Partie 4: Modules et cellules d'affichage à cristaux liquides – Valeurs limites et caractéristiques essentielles

IEC 61747-4:2012

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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LIQUID CRYSTAL DISPLAY DEVICES –

Part 4: Liquid crystal display modules and cells – Essential ratings and characteristics

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61747-4 has been prepared by IEC technical committee 110: Electronic display devices.

This second edition cancels and replaces the first edition published in 1998. This edition constitutes a technical revision.

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

– 2.1 and 3.1 of IEC 61747-4:1998 were deleted because these items are defined in IEC 61747-1;
– 2.7.6, in 2.7, Supplementary information, of IEC 61747-4:1998 was deleted because the scope of this standard is about passive matrix monochrome liquid crystal display modules;
– The item "Gray scale: digital or analog" in 2.3.1 of IEC 61747-4:1998 was changed to "Gray scale: number" because it is more accurate;

– Contrast mode: light symbol on dark background (“LOD” or “positive image”) or dark symbol on light background (“DOL” or “negative image”) was introduced in this part of IEC 61747 to replace the description in 2.3.1 and 3.3.1 of IEC 61747-4:1998.

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

CDV	Report on voting
110/349/CDV	110/393/RVC

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.

This International Standard is to be used in conjunction with IEC 61747-1:1998 and its Amendment 1 (2003).

A list of all the parts in the IEC 61747 series, published under the general title *Liquid crystal display devices*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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
- amended.

LIQUID CRYSTAL DISPLAY DEVICES –

Part 4: Liquid crystal display modules and cells – Essential ratings and characteristics

1 Scope

This part of IEC 61747 describes the essential ratings and characteristics of LCD cells and passive matrix monochrome liquid crystal display modules.

It does not apply to active matrix LCD cells nor to multicolour cells.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61747-1:1998, *Liquid crystal and solid-state display devices – Part 1: Generic specification*

3 Liquid crystal display modules

3.1 Principles and material used

Example: a TN display cell with electronic circuits and connector pins.

Where appropriate, a type of light source.

3.2 Modes of operation

3.2.1 Optical mode of operation

– illumination mode: for example reflective, transmissive, transflective
– gray scale: number
– contrast mode: light symbol on dark background (“LOD” or “positive image”) or dark symbol on light background (“DOL” or “negative image”)

3.2.2 Electrical mode of operation

– example: static mode or multiplex mode, etc.

3.3 Details of outline

3.3.1 Material, mechanical description

– examples: glass, plastic, metal, etc.
– construction: for example integrated backlight, bezel structure

3.3.2 Method of connection

– connector, flex cable or connection pins, etc.

3.3.3 Outline drawing and dimensions

– overall dimensions
– viewing area and display centre

3.3.4 Pinout table and/or connection diagram

– type of connectors

3.3.5 Preferred or designed viewing direction

3.4 Limiting values (absolute maximum rating system) over the operating temperature range, unless otherwise stated

3.4.1 Minimum and maximum operating temperature (T_{op})

3.4.2 Minimum and maximum storage temperature (T_{stg})

3.4.3 Minimum and maximum value of supply voltages for logic and LCD drive (V_{DD}-V_{SS}, V_{DD}-V_{EE}, V_{EE}-V_{SS}, V_O-V_{SS}, V_{DD}-V_O)

3.4.4 Minimum and maximum value of input signal voltage (V_{IN})

3.4.5 Where appropriate, maximum value of backlight voltage (V_{BL})

3.4.6 Where appropriate, maximum soldering temperature (T_{sld})

– maximum soldering time and minimum distance to module package should be specified

3.5 Electrical and optical characteristics

The following parameters should be specified in Table 1.

Table 1 – Electrical and optical characteristics of LCD modules

Reference	Characteristics	Condition at T_{op} = 25 °C unless otherwise specified	Symbol	Requirements	
3.5.1	Supply voltage for logic drive Supply voltage for LCD drive		V_{DD}-V_{SS} V_{DD}-V_{EE} V_{EE}-V_{SS} V_O-V_{SS} V_{DD}-V_O	Min.	Max.
3.5.2	Input signal voltages High level input signal voltage Low level input signal voltage		V_{IN} V_{IH} V_{IL}	Min.	Max.
3.5.3	Backlight voltages (where appropriate)		V_{BL}	Min.	Max.
3.5.4	Operating frequency (where appropriate) Frame frequency Oscillator frequency		f_{op} f_{FRM} f_{OSC}	Min.	Max.
3.5.5	Supply currents (without backlight)	Conditions chosen to achieve maximum supply current, e.g. operating supply voltage, display pattern, etc., as appropriate	I_{tot} I_{DD} and/or I_{EE}		Max.

Reference	Characteristics	Condition at T_{op} = 25 °C unless otherwise specified	Symbol	Requirements	
3.5.6	High level input signal current (where appropriate)		I_{IH}		Max.
3.5.7	Low level input signal current (where appropriate)		I_{IL}		Max.
3.5.8	Operating backlight current (where appropriate)		I_{BL}		Max.
3.5.9	Contrast ratio (diffused light and/or direct beam)	When the module has a backlight system, this system shall be used at a specified level during the contrast ratio measurements	CR_{diff} CR_{dir}	Min.	
3.5.10	Luminance (where appropriate)	Specified measuring method and conditions	L	Min.	
3.5.11	Viewing angle range	Specified definition of viewing direction and specified contrast ratio	θ_V and θ_H	Min.	Max.
3.5.12	Turn-on time	Specified temperature	t_{on}		Max.
3.5.13	Turn-off time	Specified temperature	t_{off}		Max.
3.5.14	Transmittance (regular and/or diffuse) (where appropriate)	Specified measuring method and conditions	τ_r and/or τ_d	Min.	
3.5.15	Reflectance (regular and/or diffuse) (where appropriate)	Specified measuring method and conditions	ρ_r and/or ρ_d	Min.	Max.

3.6 Supplementary information

(To be given only as far as necessary for the specification and use of the device.)

3.6.1 Angular dependence of contrast ratio

3.6.2 Switching times versus temperature

3.6.3 Timing characteristics and timing of logic voltages

3.6.4 Supply voltages sequence condition, where appropriate

3.6.5 Operating voltage range, if appropriate, as a function of temperature at specified contrast ratio

3.6.6 Handling and operating information

3.6.7 Precautions with respect to electrostatic discharges

3.6.8 Precautions of installation: mechanical and/or electrical

3.6.9 Safety information

3.6.10 Characterization of diffuse and specular reflectance and transmittance

4 Liquid crystal display cells (LCD cells)

4.1 Principle and material used

Example: twisted nematic cell

4.2 Modes of operation

4.2.1 Optical mode of operation

– illumination mode: for example reflective, transmissive, transflective
– contrast mode: light symbol on dark background (“LOD” or “positive image”) or dark symbol on light background (“DOL” or “negative image”)

4.2.2 Electrical mode of operation

Static mode or multiplex mode

4.3 Details of outline

4.3.1 Mechanical description

Example: glass or plastic

4.3.2 Method of connection

4.3.3 Outline drawing

Dimensions and display pattern

4.3.4 Pinout table and/or connection diagram

4.3.5 LCD cell reference axis for definition of viewing angle

4.3.6 Recommended viewing direction

4.4 Limiting values (absolute maximum rating system) over the operating temperature range, unless otherwise stated

4.4.1 Minimum and maximum storage temperatures (T_{stg})

4.4.2 Minimum and maximum operating temperatures (T_{op})

4.4.3 Maximum ambient humidity (RH)

4.4.4 Minimum and maximum atmospheric pressure outside

4.4.5 Maximum mechanical shock

4.4.6 Maximum vibration

4.4.7 Maximum acceleration

4.4.8 Maximum bending strength of the cell

4.4.9 Maximum torsional strength of the cell

4.4.10 Maximum r.m.s. value of applied driving voltage

4.4.11 Maximum peak-to-peak value of applied driving voltage

4.4.12 Maximum d.c. voltage component of the applied driving voltage

4.4.13 Maximum soldering temperature and time, where appropriate

4.5 Electrical and optical characteristics

The following parameters should be specified in Table 2:

– viewing direction and contrast condition;
– electrical mode of operation.

Table 2 – Electrical and optical characteristics of LCD cells

Reference	Characteristics	Condition at T_{op} = 25 °C unless otherwise stated	Symbols	Requirements	
4.5.1	Driving voltage			Min.	Max.
4.5.2	Driving frequency			Min.	Max.
4.5.3	Threshold voltage	At specified frequency	V_{th}	Min.	Max.
4.5.4	Saturation voltage	At specified frequency	V_{sat}	Min.	Max.
4.5.5	Total current: All picture elements activated at MPX. ratio = 1	At specified voltage and frequency			Max.
4.5.6	Total capacitance: All picture elements activated at MPX. ratio = 1	At specified voltage and frequency			Max.
4.5.7	Contrast ratio	At specified viewing direction. Diffuse light and/or direct beam	CR_{dir} and/or CR_{diff}	Min.	
4.5.8	Turn-on time		t_{on}		Max.
4.5.9	Turn-off time		t_{off}		Max.
4.5.10	Where appropriate, regular and/or diffuse transmittance		τ_r and/or τ_d	Min.	
4.5.11	Where appropriate, regular and/or diffuse reflectance		ρ_r and/or ρ_d	Min.	Max.

4.6 Supplementary information

(To be given only as far as necessary for the specification and use of the device.)

4.6.1 Angular dependence of contrast ratio

4.6.2 Switching times versus temperature

4.6.3 Operating range

– threshold voltage versus temperature;
– operating voltage range as a function of temperature at specified contrast ratio.