IEC 61747-1-2

Edition 1.0 2014-08

INTERNATIONAL STANDARD

Liquid crystal display devices –
Part 1-2: Generic – Terminology and letter symbols

IEC 61747-1-2:2014-08(en)

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

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

IEC 61747-1-2

Edition 1.0 2014-08

INTERNATIONAL STANDARD

Liquid crystal display devices – Part 1-2: Generic – Terminology and letter symbols

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE T

ICS 31.120

ISBN 978-2-8322-1806-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

LIQUID CRYSTAL DISPLAY DEVICES –

Part 1-2: Generic – Terminology and letter symbols

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61747-1-2 has been prepared by IEC technical committee 110: Electronic display devices.

This first edition cancels and replaces the first edition of IEC 61747-1 published in 1998 and Amendment 1:2003. This edition constitutes a technical revision.

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

a) The former IEC 61747-1, *Generic specification* was divided into IEC 61747-1-1, *Liquid crystal display devices – Part 1-1: Generic – Generic specification* and IEC 61747-1-2, *Liquid crystal display devices – Part 1-2: Generic – Terminology and letter symbols*.
b) In this part of IEC 61747, new terms have been added and some of the terms and the definitions have been updated.

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

CDV	Report on voting
110/526/CDV	110/562/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.

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

NOTE The structure of IEC 61747 series and the changes in the numbering are shown in Annex D of IEC 61747-30-1:2012.

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.

A bilingual version of this publication may be issued at a later date.

LIQUID CRYSTAL DISPLAY DEVICES –

Part 1-2: Generic – Terminology and letter symbols

1 Scope

This part of IEC 61747 gives the preferred terms, their definitions and symbols for liquid crystal devices, with the object of using the same terminology when publications are prepared in different countries.

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 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

IEC 60617, *Graphical symbols for diagrams*

ISO 80000-1, *Quantities and units – Part 1: General*

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1 Physical concepts

3.1.1
alignment layer
thin layer deposited over the patterned electrodes that determines the direction of the director at the surface

Note 1 to entry: The alignment layer produces the desired ordering. Alignment such as homeotropic alignment or planar alignment is achieved by the co-operative ordering of the liquid crystal molecules locally affected by the surface forces. The alignment layer generates the pretilt angle.

3.1.2
anti-ferroelectric liquid crystal
AFLC
type of smectic liquid crystal having no macroscopic electric polarization at zero external field

Note 1 to entry: An anti-ferroelectric liquid crystal has a paraelectric state with layers of alternating polarity of permanent dipoles without an external electric field, and it transfers to a ferroelectric state of parallel alignment when an electric field is applied.

3.1.3
cell gap
thickness of the liquid crystal layer between the two support plates

3.1.4
cholesteric phase
liquid crystal phase that exhibits planar nematic ordering in which the directors form a helix that has its axis perpendicular to the plane

3.1.5
chiral pitch
helical pitch
periodic distance needed for directors to rotate by 360° in a helically structured liquid crystal

3.1.6
chiral nematic phase
liquid crystal phase that exhibits planar nematic ordering in which the directors form a helix that has its axis perpendicular to the plane

3.1.7
clearing point
phase transition temperature of a liquid crystal for transition toward the isotropic phase

3.1.8
dichroic liquid crystal
liquid crystal exhibiting dichroism, i.e. the property of anisotropic absorption of light

3.1.9
direct addressing
method of addressing by applying a signal to a terminal that corresponds to a single pixel

Note 1 to entry: Hence, all pixels can be addressed individually, in groups or simultaneously

3.1.10
director
axial unit vector describing the local axis of symmetry for the orientational distribution function of any chosen molecular axis of a liquid crystal

Note 1 to entry: The director co-ordinates define the local alignment of the liquid crystal.

3.1.11
disclination
localized alignment defect (appearing generally in the form of closed or open lines) forming the boundary between areas exhibiting different alignment states

3.1.12
discotic mesophase
liquid crystal phase of disc-like shaped molecules exhibiting a long range ordering with respect to the short molecular axis

3.1.13
domain
region having a well-defined boundary in which liquid crystal molecules have the same director orientation

3.1.14
dynamic scattering
electro-optical effect showing a light scattering caused by turbulent motion in a liquid crystal layer induced by an electro-hydrodynamic effect

3.1.15
electrically controlled birefringence
electro-optical effect caused by the birefringence of a liquid crystal layer which can be modulated (varied) by an electric field

Note 1 to entry: It is also called “tunable birefringence”.

3.1.16
electrode layer
electrically conductive layer, usually transparent, covering the support plates and patterned to establish the display and electric contact configuration

Note 1 to entry: The electrode layer may be made, for example, of indium tin oxide (ITO).

3.1.17
ferroelectric liquid crystal
liquid crystal phase exhibiting a spontaneous electric polarization

Note 1 to entry: The ferroelectric liquid crystal effect is commonly exhibited in chiral smectic liquid crystal.

3.1.18
film compensated super twisted nematic liquid crystal
FSTN
liquid crystal which changes the background colour of an STN-LCD to black-and-white, by adding a special layer of compensation film

3.1.19
guest-host effect
anisotropic optical absorption effect occurring in a dichroic liquid crystal layer containing a dissolved dye

3.1.20
highly twisted nematic liquid crystal cell
nematic liquid crystal which has a twisted angle structure of 90° to 180° between two substrates

3.1.21
homeotropic alignment
alignment state of a liquid crystal layer for which the director is at all points nominally perpendicular to a support plate surface

3.1.22
liquid crystal
material that exhibits a mesophase consisting of elongated (rod-like) or disc-like (discotic) molecules and that possesses at least one long range orientational ordering with respect to one molecular axis

3.1.23
mesophase
mesomorphic phase
ordered state of matter between the crystalline and isotropic liquid phases, exhibiting some of the properties of the neighbouring phases, for example in respect of fluidity and birefringence

3.1.24
nematic phase
liquid crystal phase in which the molecules possess a long-range orientational ordering of one molecular axis (uniaxial nematic liquid crystal) or two molecular axes (biaxial nematic liquid crystal)

3.1.25
phase transition
phenomenon in which liquid crystal changes from one phase to another

EXAMPLE From the smectic to the nematic phase, the solid to the smectic phase, or the nematic to the isotropic liquid phase

3.1.26
planar alignment
alignment state of a liquid crystal layer for which the director is everywhere nominally parallel to a support plate surface

Note 1 to entry: This alignment is also referred to as homogeneous alignment.

3.1.27
polymer dispersed liquid crystal
liquid crystal polymer composites within which there exists at least two different phases

3.1.28
pretilt angle
angle between the plane of a support plate and the adjacent liquid crystal director

3.1.29
rubbing axis
rubbing direction
direction or axis of rubbing of the alignment layer in order to align liquid crystal molecules

3.1.30
smectic phase
liquid crystalline phase characterized by at least one one-dimensional long range transitional ordering of the molecules and a long-range orientational ordering for one molecular axis

3.1.31
spacer
material (e.g. calibrated spheres or cylinders) incorporated into a liquid crystal cell to ensure a constant distance between the support plates

3.1.32
storage capacitor
capacitor, parallel to a liquid crystal element, holding a signal voltage applied to each pixel or subpixel in an active matrix display

3.1.33
storage effect
property of a picture element in which the visual information is retained after the activation has been removed

3.1.34
super twisted nematic liquid crystal
STN
nematic liquid crystal which possesses a twisted structure from 180° to 270° between the support plates

3.1.35
thermotropic liquid crystal
material whose liquid crystalline phase changes as the temperature changes in a certain range

3.1.36
thin film transistor liquid crystal display
TFT-LCD
active matrix liquid crystal display with thin film transistors, in which every pixel is controlled by one or more thin film transistor switches

3.1.37
twist angle
oriented angle between the projections of the respective surface directors at the support plates on to one of the support plates of a twisted nematic cell

3.1.38
twisted nematic liquid crystal
TN
nematic liquid crystal which possesses a twisted structure of around 90° between the support plates

3.1.39
twisted nematic structure
nematic liquid crystal state characterized by a twisted structure

3.1.40
voltage holding ratio
ratio of the holding voltage to the signal voltage initially applied at opposed electrodes in a liquid crystal cell

3.2 General terms

3.2.1
achromatic display
display that generates an image which is devoid of hue

3.2.2
active area
part of a display screen area delimited by picture elements

3.2.3
active matrix display
matrix-addressed display device in which each picture element has at least one switching element (e.g. diode or transistor)

3.2.4
addressing
selection of the pixels in space and/or time for activation or deactivation

3.2.5
alphanumeric display
display that is able to show a limited set of characters comprising at least letters and Arabic numerals

3.2.6
backlight
light source system that illuminates light uniformly onto a liquid crystal display cell from behind

3.2.7
black matrix
film-like structure that prevents unwanted light from passing between the dot electrodes in a matrix display

Note 1 to entry: A black matrix is normally formed with a metal or organic film patterned on the substrate.

3.2.8
built in driver
monolithic driver
IC driver built in the same substrate as the active elements of pixels in an active matrix LCD

3.2.9
chip on glass
joint of liquid crystal module that mounts the IC chip directly on to the glass substrate of a liquid crystal cell

3.2.10
chip on film
binding of the IC chip on the flexible printed circuit directly

3.2.11
colour filter
filter that selectively transmits light of a specific wavelength range in colour liquid crystal display devices

Note 1 to entry: Generally, three primary colour (red, green, blue) filters are fitted onto the substrate.

3.2.12
common electrode

3.2.12.1
common electrode
<segment display> electrode facing segment electrodes

3.2.12.2
common electrode
<passive matrix display> scanning electrode in a passive matrix display

3.2.12.3
common electrode
<active matrix display with thin film transistors> electrode pairing with pixel electrodes fitted with transistors

3.2.13
data electrode
signal electrode
electrode applied with the data signal voltage synchronized with the scanning signals in a multiplexed display

3.2.14
subpixel
dot
separately addressed internal structure in a pixel that extends the pixel function

Note 1 to entry: The term “dot” is often used by display engineers.

3.2.15
driver
device that transforms the address information into driving signals suitable for selecting a pixel.

Note 1 to entry: The same signals may also activate the pixel.

3.2.16
emissive display
display that contains its own source(s) of light.

Note 1 to entry: This light can be produced by the transducer itself or provided by one or more internal light source(s) modulated by the transducer.

3.2.17
frame frequency
number of image frames addressed per second

3.2.18
frame rate control
method for realizing grey-levels that makes use of the temporal integration of the human visual system

Note 1 to entry: Different optical levels in different frames will be averaged over time to provide the sensation of a certain grey-level.

3.2.19
front projection display
form of projection display whereby the display device and the observer are located on the same side of the screen on which the image is displayed

3.2.20
LCD controller
circuit that supplies necessary control signals to drivers or integrated circuits for an LCD

3.2.21
LCD driving voltage
LCD drive voltage
voltage that drives a liquid crystal display cell

SEE: Figure 1.

3.2.22
liquid crystal cell
flat structure consisting of a minimum of two support plates with liquid crystal contained in the space between them

Note 1 to entry: The support plates are usually separated by a distance of several micrometres.

3.2.23
liquid crystal display cell
liquid crystal cell that is used to modulate light to present information

3.2.24
liquid crystal display device
display device using an electro-optical effect of liquid crystal

Note 1 to entry: The term liquid crystal display device may be used as a general term for liquid crystal display cells and liquid crystal display modules.

3.2.25
liquid crystal display module
display unit combining a liquid crystal display cell with drive electronics

Note 1 to entry: Additional options are possible such as backlight, mounting brackets, etc.

3.2.26
logic voltage
logic driving voltage
voltage applied to operate the logic circuitry in an electronic display device

SEE: Figure 1.

3.2.27
matrix addressing
method of addressing in which a pixel is selected by applying signals to the terminals that correspond to its row and column

EXAMPLE A typical example is a panel with row and intersecting column electrodes in which one row is selected at a time.

Note 1 to entry: An individual pixel is addressed by selecting groups in space and time.

3.2.28
matrix display
display device consisting of regularly distributed pixels arranged in rows and columns

3.2.29
metal insulator metal
MIM
thin film diode that has the non-linear conductivity of an insulation film sandwiched between metal films

3.2.30
monochrome display
display using only one colour or black and white contrast

3.2.31
multicolour display
chromatic display that can utilize two or more (but a limited number of) colours

3.2.32
multiplex driving
method of temporal driving in which a first set of pixel groups is selected in a sequence once in a time frame and a second set of intersecting pixel groups is selected according to the pattern to be displayed

Note 1 to entry: A typical example is a cell with row electrodes and intersecting column electrodes in which one row is selected at a time.

3.2.33
normally black mode
normally black
mode in which the luminance of pixels in the OFF voltage state is less than that in the ON voltage state

3.2.34
normally white mode
normally white
mode in which the luminance of pixels in the OFF voltage state is greater than that in the ON voltage state

3.2.35
parent glass
mother glass
sheet glass used as raw material for the manufacturing of liquid crystal display panels and liquid crystal display modules

3.2.36
passive matrix display
matrix addressed display device in which each pixel is addressed directly by applied signals on the addressing and data lines

3.2.37
pixel
smallest element that is capable of generating full functionality of a display device

3.2.38
polarizer
optical component that enables transmission of a specific polarized light

3.2.39
projection display
display device which projects a display image onto a screen by an optical system

3.2.40
rear projection display
form of projection display whereby the display device and the observer are located on the opposite sides of the screen on which the image is displayed

3.2.41
reflective display
display device that modulates the reflected light from an external source

3.2.42
reflector

3.2.42.1
reflector
<reflective type LCD> optical component used to reflect incident light

3.2.42.2
reflector
<backlight system> optical component to enhance light intensity by reflection

3.2.43
retardation film
polymer optical-anisotropic film that possesses either a single or double optical axis

3.2.44
scanning electrode
electrode applied with a scanning signal voltage in a matrix display

3.2.45
segment
special purpose dedicated pixel

EXAMPLE A specific portion of an alphanumeric symbol, or a sign by itself.

3.2.46
segment display
display device showing only alphanumeric characters and/or fixed patterns made of segment electrodes which may be different in size and orientation

3.2.47
segment electrode

3.2.47.1
segment electrode
<segment display> electrode forming a part of alphanumeric characters and/or fixed patterns in a segment display

3.2.47.2
segment electrode
<passive matrix display> data or signal electrode

3.2.48
static driving
method of driving in which all pixels are addressed simultaneously and constantly

3.2.49
substrate
base material, generally flat and transparent, made of for example glass or plastic sheet, covered with several layers (electrode, sealing and surface alignment layers), forming the mechanical structure of a liquid crystal cell

3.2.50
support plate
plate, generally transparent, made of for example glass or plastic sheet, covered with several layers (electrodes, sealing and surface alignment layers), forming the mechanical structure of a liquid crystal cell

3.2.51
tape carrier package
TCP
IC package in which chips are mounted on a flexible printed wiring board

3.2.52
thin film diode
TFD
diode formed on the surface of a substrate as a thin film

3.2.53
thin film transistor
TFT
transistor formed on the surface of a substrate as a thin film

3.2.54
transflective display
display device that modulates light from an external source by reflection and from another source by transmission through a semitransmissive reflector

3.2.55
transflector
optical component used in a transflective type LCD to partially reflect and partially transmit incident light

3.2.56
transmissive display
display device that modulates light from an external source by transmission

3.2.57
transparent conductive layer
transparent electrode
layer or electrode that has both electric conductivity and transmittance of visible light

Note 1 to entry: A typical material for transparent electrodes is ITO (indium tin oxide).

3.2.58
visual inspection
method of checking, with the human eye, for display defects or the other characteristics

3.3 Terms related to specifications, ratings and characteristics, image quality, reliability test, measurement

3.3.1
after image
short time remnant of an image on the screen after the actual image is removed

3.3.2
aperture ratio
ratio of the pixel area available for light modulation to the total geometrical pixel area

3.3.3
bubble
visual defect that is caused by a cavity or gas in the liquid crystal material or paste of the polarizer or reflector

3.3.4
contrast
subjective assessment of the difference in appearance of two parts of a field of view seen simultaneously or successively

3.3.5
contrast ratio
CR
ratio between the higher, L_{H}, and lower, L_{L}, luminances that define the feature to be detected, measured by the contrast ratio CR, defined as:

$$CR = \frac{L_{\mathrm{H}}}{L_{\mathrm{L}}}$$

3.3.6
cross-talk
shadowing
unwanted luminance variation on a part of a display area produced by an image displayed on another part of the display

3.3.7
delay time
time interval from switching the display from the OFF state to the ON state or from the ON state to the OFF state until the instant at which the luminance changes by 10 % of the difference in the ON and OFF luminance levels

SEE: Figure 2.

3.3.8
designed viewing direction
viewing direction obtained by designing the visual characteristics of a liquid crystal display device to enable the easiest viewing according to the purpose of device use

3.3.9
diffused light method
method for illuminating the device under test during electro-optical measurements using diffused light

Note 1 to entry: The measuring spot on the display is uniformly illuminated from all directions. Such an illumination can be realized by integrating spheres, diffusing hemispheres, etc.

3.3.10
direct beam method
method for illuminating the device under test during electro-optical measurements using a direct beam

Note 1 to entry: The measuring spot on the display is illuminated by a directional light-beam.

3.3.11
duty ratio
reciprocal value of the number of pixel groups which are addressed in a multiplex addressing scheme

EXAMPLE The reciprocal of the number of rows for a row-at-a-time matrix addressing scheme.

3.3.12
electro-optic characteristic
variation of a photometric property (e.g. luminance or contrast) as a function of electric drive quantities (e.g. voltage or current)

3.3.13
fall time
time interval during which the luminance changes from 10 % to 90 % of the total possible luminance variation range for the normally white mode or from 90 % to 10 % for the normally black mode, after switching LCD driving voltage from the ON state to the OFF state

SEE: Figure 2.

3.3.14
grey scale
range of shades of gray without apparent colour

3.3.15
image sticking
long time remnant of an image on the screen after the actual static image is removed

3.3.16
LCD reliability
LCD mechanical reliability
estimated allowable stress which the LCDs can sustain for a specified period of time or as an estimated failure rate at a specified stress level

Note 1 to entry: Both approaches for quantifying the reliability of LCDs use the power law for slow crack growth and require a knowledge of the fatigue constant for the parent glass employed in the LCD displays.

3.3.17
LCD edge strength
uniaxial strength wherein edge flaws are subjected to tension during measurement

3.3.18
LCD surface strength
biaxial strength wherein surface flaws with different orientations are subjected to uniform tension during measurement

3.3.19
line defect
vertical/horizontal line defect
visual defect located along the same line

3.3.20
mura
non-uniformity
visual imperfection in luminance or chromaticity

3.3.21
optical saturation voltage
specific voltage necessary to vary the luminance from the initial luminance at 0 V to 90 % of the maximum possible variation range

3.3.22
optical threshold voltage
specific voltage necessary to vary the luminance from the initial luminance at 0 V to 10 % of the maximum possible variation range

3.3.23
pinhole
visible missing part of a pixel electrode, black matrix, etc.

3.3.24
point defect
any type of minute circle defect

Note 1 to entry: Point defects can be luminous dots, half luminous dots, dark dots, linked dots, pinholes, bubbles and foreign material inclusions.

3.3.25
preferred viewing direction
specific viewing direction of a liquid crystal display device in which the displayed image can be best perceived

3.3.26
production line
arrangement of process operations in production permitting sequential occurrence at various stages of production

EXAMPLE Examples of processes are as follows: a) electrode patterning process; b) alignment treatment process; c) assembly process; d) liquid crystal material filling process; e) finishing process; f) inspection process.

Note 1 to entry: Quality assessment procedures are not included in these stages.

3.3.27
production lot
devices of the same type, manufactured in the same production lines and passing through the same nominated process, normally within a period of one month

3.3.28
response time
generic term for “turn-on time” and “turn-off time”

SEE: Figure 2.

3.3.29
rise time
time interval during which the luminance changes from 90 % to 10 % of the total possible luminance variation range for the normally white mode or from 10 % to 90 % for the normally black mode, after switching the LCD driving voltage from the OFF state to the ON state

SEE: Figure 2.

3.3.30
scratch defect
defect caused by scratching the glass or polarizer surface

3.3.31
sealing layer
layer situated between the support plates and surrounding the liquid crystal to ensure the hermeticity and integrity of the liquid crystal cell

3.3.32
stain
stain shaped defect larger than a pixel and with an unclear boundary

3.3.33
turn-off time
time interval from switching the display from the ON state to the OFF state until the instant at which the luminance of a liquid crystal display reaches 90 % in the normally white mode or 10 % in the normally black mode

Note 1 to entry: 0 % is the minimum possible luminance and 100 % is the maximum. The turn-off time is the sum of the delay time and the fall times (see Figure 2).

3.3.34
turn-on time
time interval from switching the display from the OFF state to the ON state until the instant at which the luminance of a liquid crystal display reaches 10 % in the normally white mode or 90 % in the normally black mode

Note 1 to entry: 0 % is the minimum possible luminance and 100 % is the maximum. The turn-on time is the sum of the delay time and the rise times (see Figure 2).

3.3.35
viewing angle range
range of viewing angular direction over which the visual specification is satisfied

3.3.36
viewing area
active area plus any contiguous areas that display permanent visual information or a display background

3.3.37
viewing direction
direction or angle for viewing an electronic display device

Note 1 to entry: The viewing direction is defined by the inclination angle q or θ and the azimuth j or φ.

3.4 Extra components

3.4.1
diffuser
diffusing plate
optical component used to diffuse light in order to illuminate it onto the display device in a uniform manner

3.4.2
direct backlight
light source system in which light tubes are placed directly underneath a display screen and illumination is made uniform using optical components such as a reflector and diffusing plate

3.4.3
edge light
side light
light source system in which light source tubes are mounted on one or more sides of a display or a light-guide plate

3.4.4
light-guide plate
transparent media that is used generally in an edge-lit backlight unit for forming the requiredlight distribution spatially for transmissive displays or transflective displays

3.4.5
wide view compensation film
compensation film for widening the viewing-angle of a liquid crystal display

4 Units and symbols

Terminology shall, wherever possible, be either taken from Clause 3 or from IEC 60050.

Units, graphical and letter symbols shall, wherever possible, be taken from the following standards:

IEC 60027;

IEC 60617;

ISO 80000-1.

Any other units, symbols or terminology peculiar to one of the devices covered by this generic specification shall be taken from the relevant IEC or ISO standards or derived in accordance with the principles of the standards listed above.

It is recommended to use the letter symbols as listed in Table 1 below.

Table 1 – Letter symbols

No	Name of quantity	Symbol	Unit	Remarks
001	Horizontal pixel pitch	H_{pitch}	mm	
002	Vertical pixel pitch	V_{pitch}	mm	
003	Operating display luminance	L	cd/m^2	
004	Contrast ratio (diffused light)	CR_{diff}	–	
005	Contrast ratio (direct beam)	CR_{dir}	–	
006	Viewing angle range (horizontal)	θ_{H}	° (degree)	
007	Viewing angle range (vertical)	θ_{V}	° (degree)	

No	Name of quantity	Symbol	Unit	Remarks
008	Reflectance (regular)	ρ_r	%	
009	Reflectance (diffuse)	ρ_d	%	
010	Transmittance (regular)	τ_r	%	
011	Transmittance (diffuse)	τ_d	%	
012	Turn-on time	t_{on}	ms	Refer to Figure 2
013	Rise time	t_r	ms	Refer to Figure 2
014	Turn-off time	t_{off}	ms	Refer to Figure 2
015	Fall time	t_f	ms	Refer to Figure 2
016	Threshold voltage	V_{th}	V	
017	Saturation voltage	V_{sat}	V	
018	Oscillator frequency	f_{OSC}	Hz	
019	Frame frequency	f_{FRM}	Hz	
020	Operating frequency	f_{op}	Hz	
021	Supply voltage for logic drive	$V_{DD} - V_{SS}$	V	
022 023 024 025	Voltage for LCD drive	$V_{DD} - V_{EE}$ $V_{EE} - V_{SS}$ $V_O - V_{SS}$ $V_{DD} - V_O$	V	Refer to Figure 1
026 027	Supply current	I_{DD} I_{EE}	mA	Refer to Figure 1
028	Operating LCD voltage	V_{op}	V	
029	Backlight supply voltage	V_{BL}	V	
030	Backlight supply current	I_{BL}	mA	
031	Input signal voltage	V_{IN}	V	
032	High level input signal voltage	V_{INH}	V	
033	Low level input signal voltage	V_{INL}	V	
034	Total power consumption	P_{tot}	W	
035	Total current consumption	I_{tot}	mA	
036	Total parallel segment resistance	R_{tot}	Ω	
037	Total parallel segment capacitance	C_{tot}	F	
038	High level input signal current	I_{INH}	mA	
039	Low level input signal current	I_{INL}	mA	
040	Operating temperature	T_{op}	°C	
041	Storage temperature	T_{stg}	°C	
042	Soldering temperature	T_{sld}	°C	

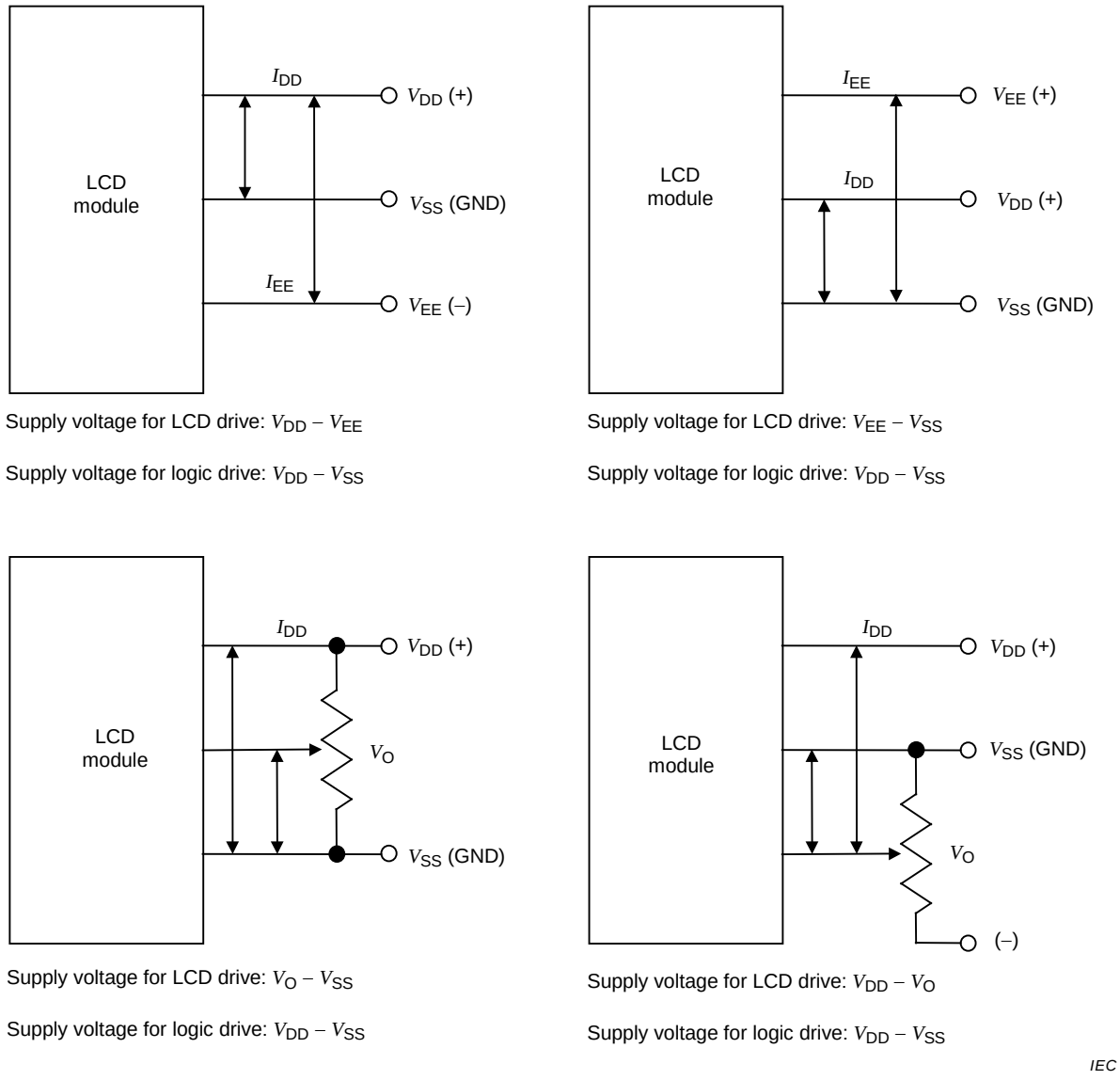
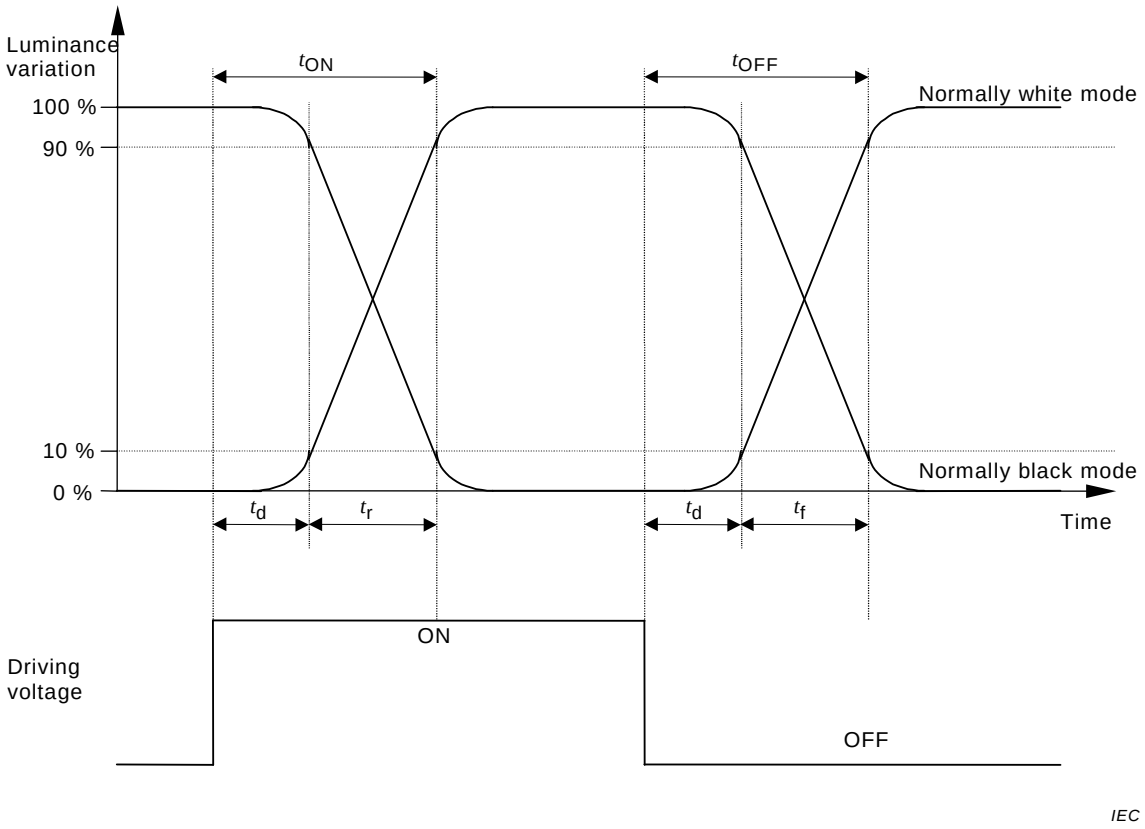


Figure 1 – Block diagram for explanation of supply voltages



Key

t_{ON} turn-on time

t_{OFF} turn-off time

t_d delay time

t_r rise time

t_f fall time

Figure 2 – Timing chart for explanation of response times

Bibliography

[1] ISO 9241-3:1992, *Ergonomic requirements for office work with visual display terminals* (VDTs) – *Part 3: Visual display requirements*

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

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