

NEC NEC LCD Technologies, Ltd.

TFT COLOR LCD MODULE

NL4864HC13-01A

10.7cm (4.2 Type)

VGA

SPECIFICATIONS

(1st edition)

INTRODUCTION

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The products are classified into three quality grades: "**Standard**", "**Special**", and "**Specific**" of the highest grade of a quality assurance program at the choice of a customer. Each quality grade is designed for applications described below. Any customer who intends to use a product for application other than that of Standard quality grade is required to contact an NEC sales representative in advance.

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Examples: Computers, office automation equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment, industrial robots, etc.

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Examples: Military systems, aircraft control equipment, aerospace equipment, nuclear reactor control systems, medical equipment/devices/systems for life support, etc.

The quality grade of this product is the "**Standard**" unless otherwise specified in this document.

1. OUTLINE

1.1 STRUCTURE AND PRINCIPLE

Color LCD module NL4864HC13-01A is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array and a backlight.

The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.

Color (Red, Green, Blue) data signals from a host system (e.g. signal generator, etc.) are modulated into best form for active matrix system by a controller, and sent to the driver LSIs which drive the individual TFT arrays.

The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots.

1.2 APPLICATION

- Portable navigation device
- Handy terminals

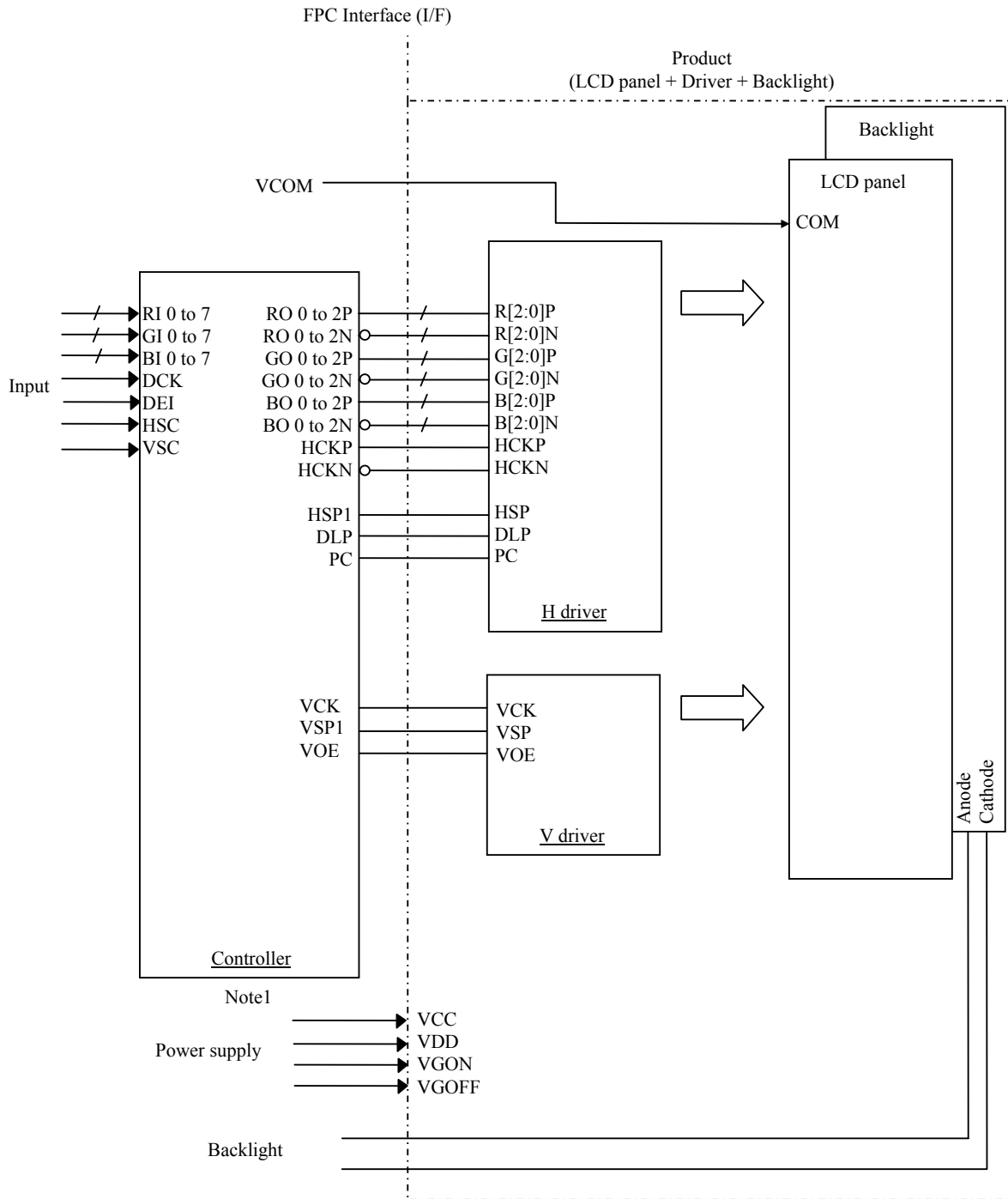
1.3 FEATURES

- Adoption of SR-NLT (Super-Reflective Natural Light TFT) (Transflective type)
- LED Backlight attached
- High luminance
- High contrast
- 6-bit RGB signals (RSDS Interface)
- Compliance with the European RoHS directive (2002/95/EC)

2. GENERAL SPECIFICATIONS

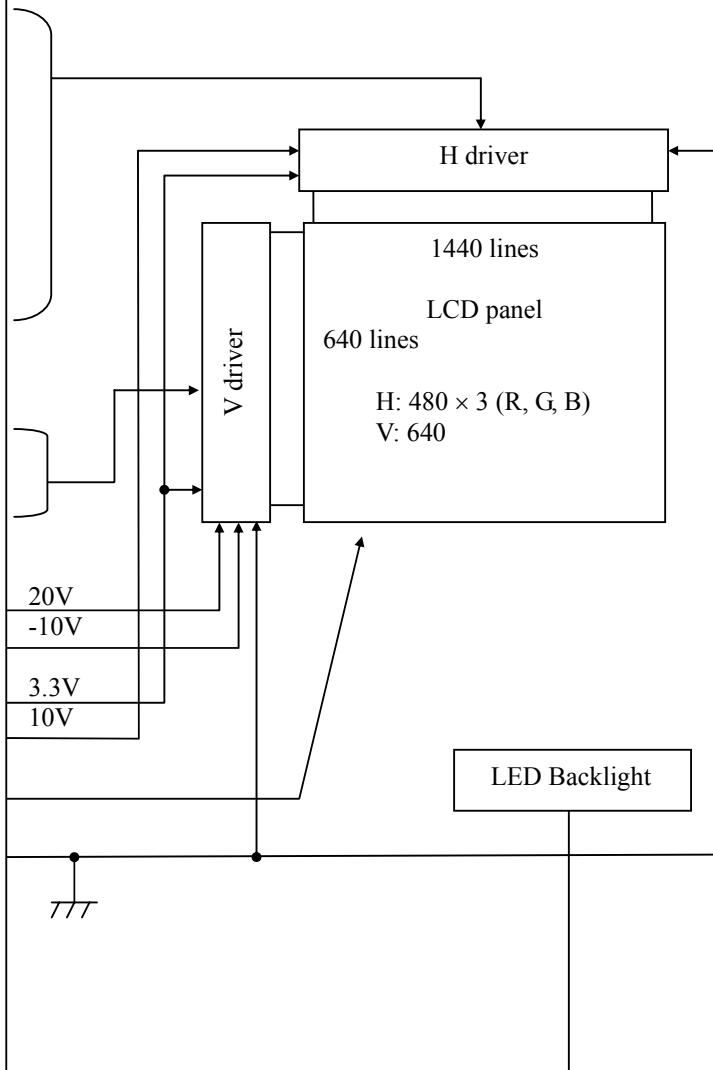
Display area	64.08 (H) × 85.44 (V) mm
Diagonal size of display	10.7cm (4.2 inches)
Drive system	a-Si TFT active matrix
Display color	262,144 colors
Pixel	480 (H) × 640 (V) pixels
Pixel arrangement	RGB (Red dot, Green dot, Blue dot) vertical stripe
Dot pitch	0.0445 (H) × 0.1335 (V) mm
Pixel pitch	0.1335 (H) × 0.1335 (V) mm
Module size	76.5 (W) × 99.7 (H) × 3.8 (D) mm (typ.)
Weight	59g (typ.)
Polarizer panel surface	Clear
Polarizer pencil-hardness	3H (min.) [by JIS K5400]
Designed viewing direction	<ul style="list-style-type: none"> • Viewing direction without image reversal: Lower side (6 o'clock) • Viewing direction with contrast peak: Up side (12 o'clock)
Luminance	At $IL = 14mA$ 280cd/m ² (typ.)
Reflection ratio	14% (typ.)
Contrast ratio	At transmissive mode 200:1 (typ., $IL = 14mA$)
	At reflective mode 15:1 (typ.)
Response time	$T_{on} + T_{off}$ (10% ← → 90%) 30 ms (typ., at transmissive mode) 19 ms (typ., at reflective mode)
Signal system	RSDS Interface
Supply voltage	VCC: 3.3V (typ.) VDD: 10 V(typ.) VGON: 20 V(typ.) VGOFF: -10 V(typ.)
Power consumption	LCD panel + Driver: 150 mW (typ.) Backlight: 333mW (typ., at $IL = 14mA$)

3. BLOCK DIAGRAM



FPC I/F

PinNo.	Symbol
13,15,17	R0P to R2P
12,14,16	R0N to R2N
20,22,24	G0P to G2P
19,21,23	G0N to G2N
27,29,31	B0P to B2P
26,28,30	B0N to B2N
10	HCKP
9	HCKN
8	HSP
33	DLP
34	PC
40	VCK
41	VSP
39	VOE
42	VGON
44	VGOFF
6	VCC
35,36	VDD
3,4	VCOM
1,2,5,7,11, 18,25,32, 37,38,43, 45,46,49, 50	GND
47	ANODE
48	CATHODE



4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification	Unit
Module size	76.5 ± 0.3 (W) \times 99.7 ± 0.3 (H) \times 3.8 ± 0.3 (D) Note1	mm
Display area	64.08 (H) \times 85.44 (V)	mm
Weight	59 (typ.), 61 (max.)	g

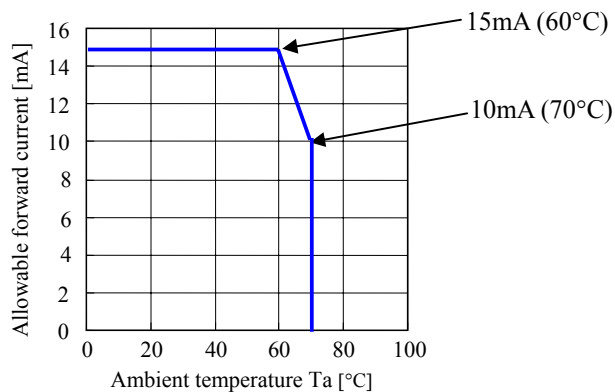
Note1: Excluding FPC mounted components.

Note2: See "12. OUTLINE DRAWINGS".

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Remarks	
Supply voltage	VCC	-0.3 to +5	V	Ta= 25°C	
	VDD	-0.3 to +13.5	V		
	VGON	-0.3 to +42.0	V		
	VGOFF	VGON - 42 to +0.3	V		
Logic input voltage	VI	-0.3 to VCC + 0.3	V	Logic signals	
Backlight	Reverse voltage	VR	≤ 40	Ta= 25°C	
	Power dissipation	PD	≤ 952		mW
	Forward current	IL	Note1	mA	-
	Pulse forward current	IFP	100	mA	Pulse width ≤ 10ms, Duty ≤ 1/10
Storage temperature	Tst	-30 to +80	°C	-	
Operating temperature	Top	-20 to +70		Product surface Note2	
Relative humidity	RH	≤ 95	%	Ta ≤ 40°C	
		≤ 85		40°C < Ta ≤ 50°C	
		≤ 55		50°C < Ta ≤ 60°C	
		≤ 36		60°C < Ta ≤ 70°C	
Absolute humidity	AH	≤ 70 Note4	g/m ³	Ta > 70°C	
Storage altitude		≤ 13,600	m	-30°C ≤ Ta ≤ 80°C	
Operating altitude		≤ 4,850	m	-20°C ≤ Ta ≤ 70°C	

Note1: Allowable forward current



Note2: Measured at display area

Note3: No condensation

Note4: Water amount at Ta= 70°C and RH= 36%

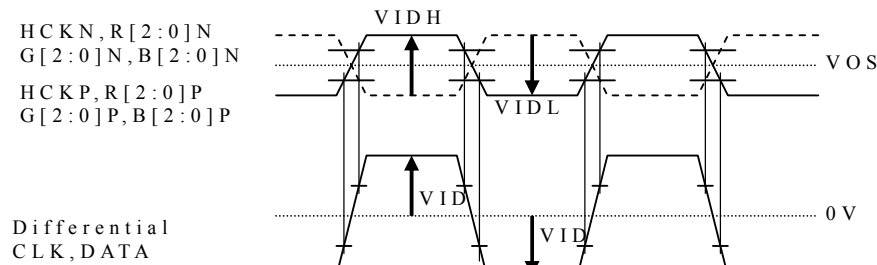
4.3 ELECTRICAL CHARACTERISTICS

(1) Logic/ LCD driving

(Ta= 25°C)

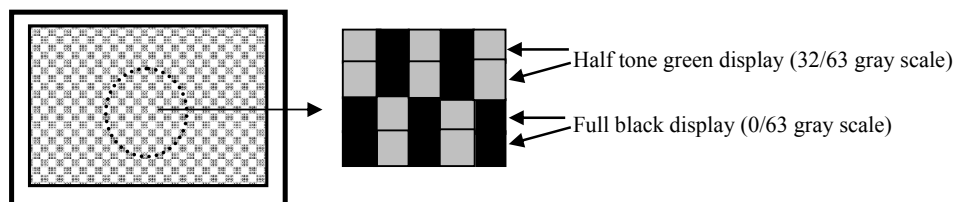
Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Logic supply voltage	VCC	2.7	3.3	3.6	V	-
H driver supply voltage	VDD	9.5	10	10.5	V	-
V driver(+) supply voltage	VGON	19	20	21	V	-
V driver(-) supply voltage	VGOFF	-11	-10	-9.0	V	-
RSDS input high voltage	VIDH	100	200	-	mV	at VCC= 3.3V R[2:0]P, G[2:0]P, B[2:0]P R[2:0]N, G[2:0]N, B[2:0]N HCKP, HCKN
RSDS input low voltage	VIDL	-	-200	-100	mV	
RSDS reference voltage	VOS	GND+0.1	1.2	VCC-1.2	V	Note1
Logic input high voltage	VIH	0.7VCC	-	VCC	V	HSP, DLP, PC, VSP, VCK, VOE
Logic input low voltage	VIL	0	-	0.3VCC	V	
COM voltage	VCOM	-	2.9	-	V	at VCC= 3.3V VDD= 10V Note2
VCC supply current	ICC	-	4.5	8	mA	at VCC= 3.3V Note3 Excluding the controller
VDD supply current	IDD	-	13	24	mA	at VDD= 10V Note3
VGON supply current	IGON	-	0.15	0.2	mA	at VGON= 20V Note3
VGOFF supply current	IGOFF	-0.2	-0.15	-	mA	at VGOFF= -10V Note3

Note1:



Note2: The optimum value for VCOM is in the range of 1.9 V to 3.9 V. The optimum VCOM is different every product.

Recommended adjustment display for VCOM



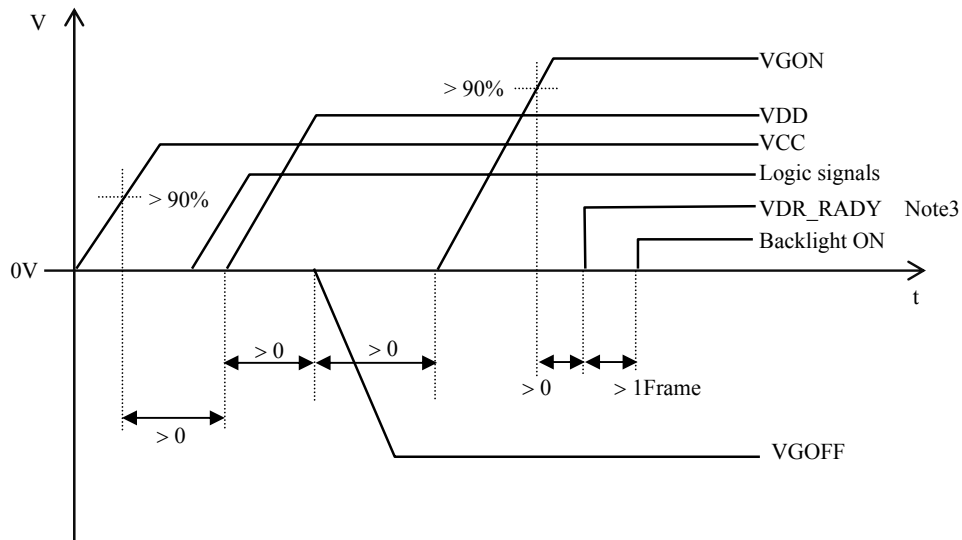
Note3: HCK= 19.6 MHz, DLP= 38.88 kHz, VSP= 60 Hz,
Checked flag pattern (by EIAJ ED-2522)

(2) Backlight

(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Forward Current	IL	-	14	15	mA	-
Forward Voltage	VL	-	23.8	26.2	V	at IL= 14mA

4.4 POWER SUPPLY VOLTAGE SEQUENCE



Note1: Supply voltage sequence must be followed above sequence diagram. To shut down, follow above sequence inversely.

Note2: All signals should not be interrupted during the operation. Even if signals are recovered, the LCD module may not be operated correctly. In this case, reset the sequence again.

Note3: The "VDR_RADY" signal of the controller should be "H" after Vgon.

4.5 INTERFACE PIN CONNECTIONS

Connector I/F plug: AA03-P050VA2 (Japan Aviation Electronics Industry Limited (JAE))
 Adaptable socket: AA03-S050VA1 (Japan Aviation Electronics Industry Limited (JAE))

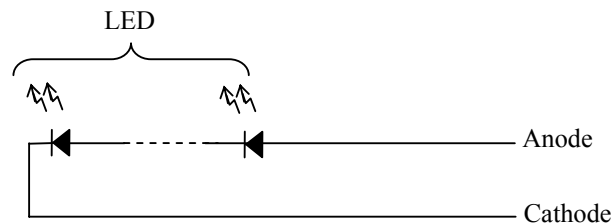
Pin No.	Symbols	Functions	Pin No.	Symbols	Functions
1	GND	Ground Note1	26	B0N	Blue data
2	GND	Ground Note1	27	B0P	Blue data
3	VCOM	Signal for common electrode	28	B1N	Blue data
4	VCOM	Signal for common electrode	29	B1P	Blue data
5	GND	Ground Note1	30	B2N	Blue data
6	VCC	Power supply	31	B2P	Blue data
7	GND	Ground Note1	32	GND	Ground Note1
8	HSP	H driver start pulse	33	DLP	H driver latch pulse
9	HCKN	H driver shift clock	34	PC	Polarity inversion signal
10	HCKP	H driver shift clock	35	VDD	Power supply
11	GND	Ground Note1	36	VDD	Power supply
12	R0N	Red data	37	GND	Ground Note1
13	R0P	Red data	38	GND	Ground Note1
14	R1N	Red data	39	VOE	V driver output enable
15	R1P	Red data	40	VCK	V driver shift clock
16	R2N	Red data	41	VSP	V driver start pulse
17	R2P	Red data	42	VGON	Power supply
18	GND	Ground Note1	43	GND	Ground Note1
19	G0N	Green data	44	VGOFF	Power supply
20	G0P	Green data	45	GND	Ground Note1
21	G1N	Green data	46	GND	Ground Note1
22	G1P	Green data	47	ANODE	LED voltage (Anode)
23	G2N	Green data	48	CATHODE	LED voltage (Cathode)
24	G2P	Green data	49	GND	Ground Note1
25	GND	Ground Note1	50	GND	Ground Note1

Note1: All GND terminals should be used without any non-connected lines.

Note2: Do not fold the FPC. When folding the FPC, pattern disconnection may occur. In case of bending FPC, the minimum curvature (R) must be more than 1.0 mm.

Description of terminals

Terminals	Description
VCOM	Common electrode voltage.
PC	This pin inverts the output polarity. The polarity inversion signal data is captured at the rising edge of DLP. The gamma-resistor is switched in accordance with the positive/negative polarity.
DLP	A timing signal that latches the contents of the data register. The contents of the data register are latched and transferred to the D/A converter on the rising edge of DLP. Then analog voltage corresponding to the display data is output on the falling edge of DLP.
HCKP/N	This pin is the shift clock input of the column shift register.
HSP	Fetching of display data starts when H is read at the falling edge of HCK.
VCK	This pin is the shift clock input of the gate shift register. The start pulse is captured at the rising edge of clock and output the pulse at the falling edge.
VOE	This pin controls the output of the gate drivers. Output can be controlled regardless of VSP and VCK.
VSP	This pin synchronizes with the frame and the gate driver.
ANODE CATHODE	Refer to the below “Circuits of backlight”.



Circuits of backlight

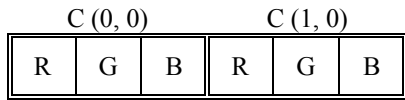
4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display 262,144 colors in with 64 gray scales.
 Also the relation between display colors and input data signals is as follows.

Display colors		Data signal (0: Low level, 1: High level)																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	dark	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑				⋮														
	↓				⋮														
bright	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
Red	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Green gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	↑				⋮														
	↓				⋮														
bright	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0	
Green	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	
Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Blue gray scale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	↑				⋮														
	↓				⋮														
bright	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	
Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	
Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

4.7 DISPLAY POSITIONS

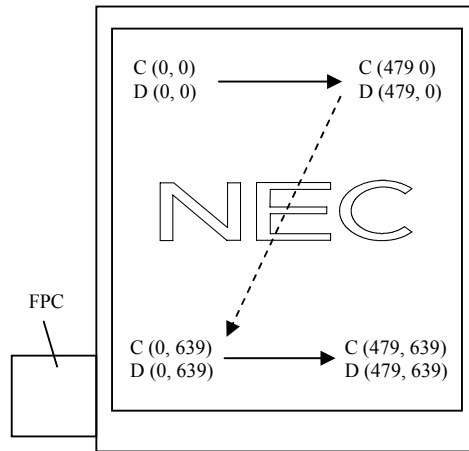
The following table is the coordinates per pixel (See figure of "4.8 SCANNING DIRECTIONS".).



C(0, 0)	C(1, 0)	...	C(X, 0)	...	C(478, 0)	C(479, 0)
C(0, 1)	C(1, 1)	...	C(X, 1)	...	C(478, 1)	C(479, 1)
•	•	•	•	•	•	•
•	•	•••	•	•••	•	•••
•	•	•	•	•	•	•
C(0, Y)	C(1, Y)	...	C(X, Y)	...	C(478, Y)	C(479, Y)
•	•	•	•	•	•	•
•	•	•••	•	•••	•	•
•	•	•	•	•	•	•
C(0, 638)	C(1, 638)	...	C(X, 638)	...	C(478, 638)	C(479, 638)
C(0, 639)	C(1, 639)	...	C(X, 639)	...	C(478, 639)	C(479, 639)

4.8 SCANNING DIRECTIONS

The following figures are seen from a front view. Also the arrow shows the direction of scan.



Note1: Meaning of C (X, Y) and D (X, Y)

C (X, Y): The coordinates of the display position (See "4.7 DISPLAY POSITIONS".)

D (X, Y): The data number of input signal for LCD panel

4.9 INPUT SIGNAL TIMINGS

4.9.1 Input signal specifications for the LCD controller (Ta= 25°C, VCC= 3.3V)

(1) Timing characteristics (DE mode)

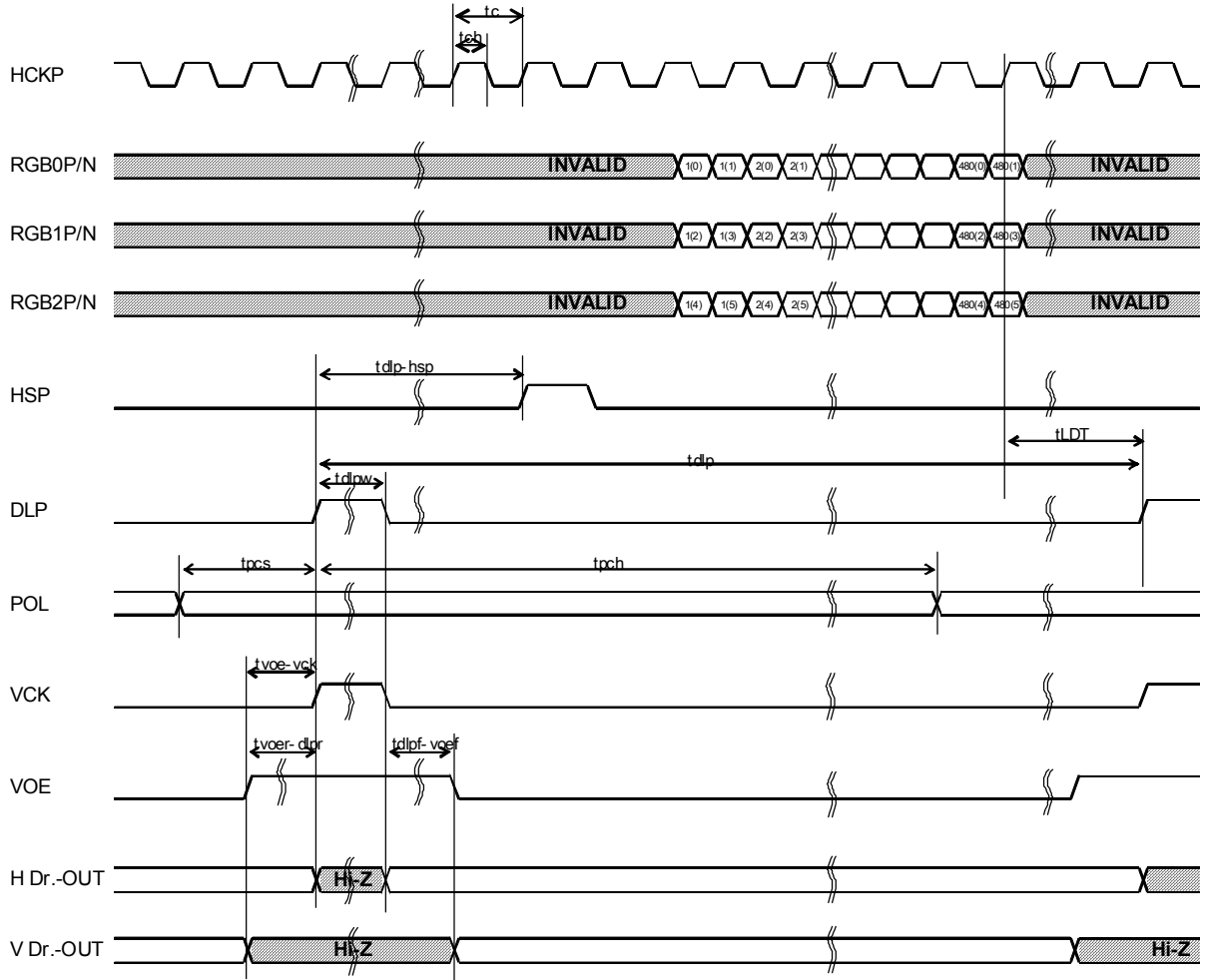
Parameter		Symbol	min.	typ.	max.	Unit	Remarks	
HCLKP/N	Frequency	1/tc	18.0	19.6	21.3	MHz	51ns (typ.)	
	Duty	tcd	0.4	0.5	0.6	-	-	
DATA (R[0:2]P/N) (G[0:2]P/N) (B[0:2]P/N)	DATA-HCKP/N	Setup time	tds	3	-	-	ns	-
		Hold time	tdh	0	-	-	ns	-
HSP	HSP-HCKP/N	Setup time	thsp	2	-	-	ns	-
		Hold time	thsp	3	-	-	ns	-
DLP	Cycle	tdlp	23.77	25.71	28.0	μs	38.88Hz (typ.)	
			490	504	-	CLK	-	
	Last data timing	tLDT	1	4	-	CLK	-	
	Pulse width	tdlpw	2	10	-	CLK	-	
	DLP to HSP time	tdlp-hsp	6	8	-	CLK	-	
PC	PC- DLP	Setup time	tpcs	9	-	-	ns	-
		Hold time	tpch	9	-	-	ns	-
VCK	Cycle	tvck	23.77	25.71	28.0	μs	38.88kHz (typ.)	
			490	504	-	CLK	-	
	VOE to VCK time	tvoe-vck	0	1.73	-	μs	-	
VSP	Cycle	tvsp	15.41	16.67	18.14	ms	60Hz (typ.)	
			647	648	-	H	-	
	VSP-VCK	Setup time	tvsp	1.5	-	-	μs	-
		Hold time	tvsp	1.5	-	-	μs	-
VOE	VOE↑ to DLP↑ time	tvoer-dlpr	1.6	1.73	-	μs	-	
	DLP↓ to VOE↓ time	tdlpf-voef	1.8	1.99	-	μs	-	

Note1: Definition of parameters is as follows.

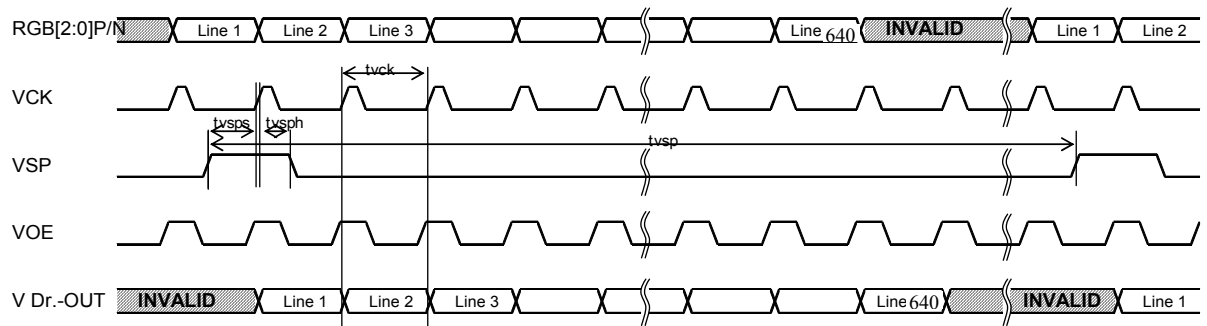
tc= 1CLK, tcd= tch/tc, th= 1H

Note2: All parameters should be kept within the specified range.

(2) Horizontal timing chart

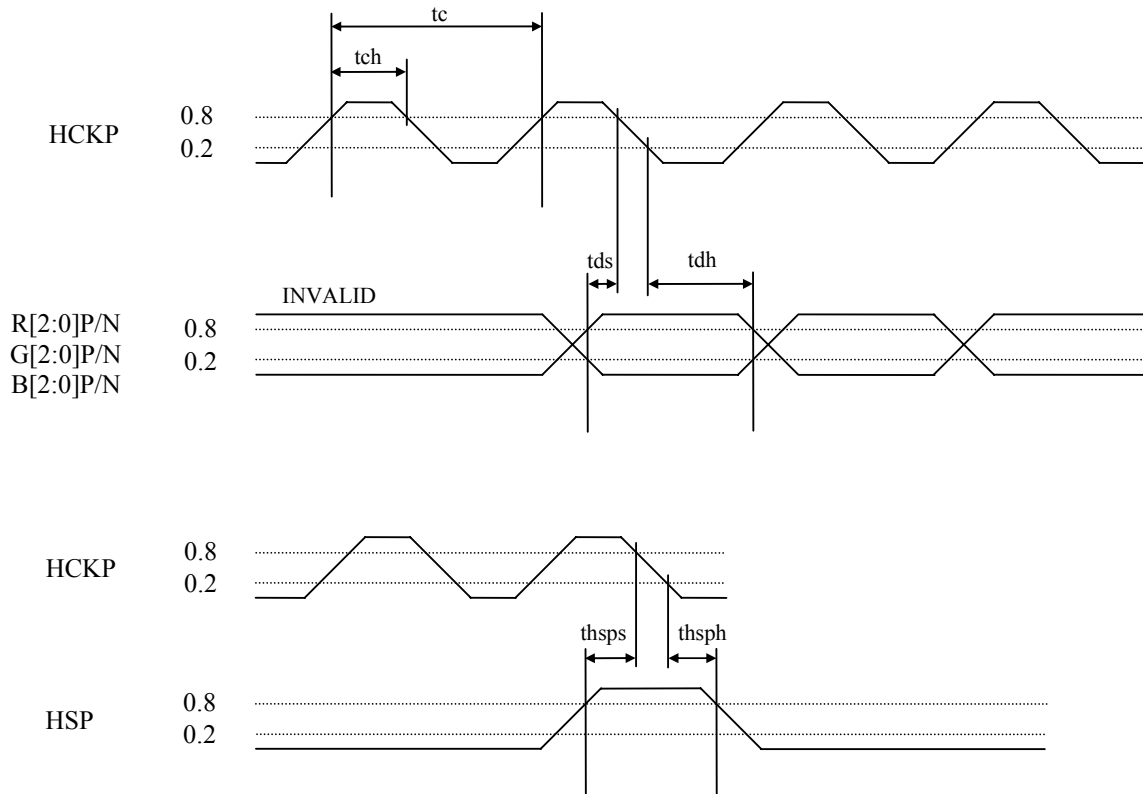
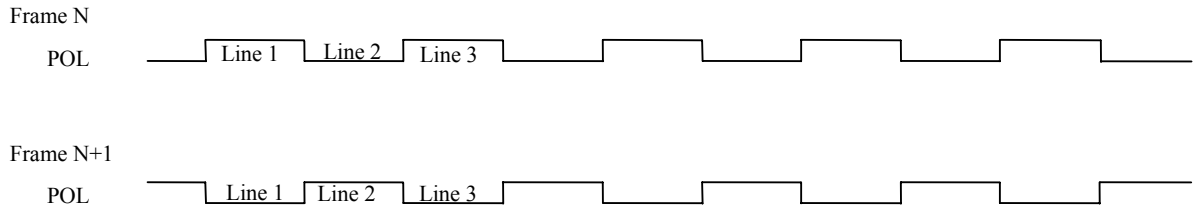


(3) Vertical timing chart



Note1: Unless otherwise specified, the input level is defined to be $V_{IH} = 0.8V_{CC}$, $V_{IL} = 0.2V_{CC}$

(4) Polarity of signal "POL"



Note1: Unless otherwise specified, the input level is defined to be $V_{IH}=0.8V_{CC}$, $V_{IL}=0.2V_{CC}$.

4.10 OPTICAL CHARACTERISTICS

<Backlight turning OFF>

(Note1, Note3, Note4)

Parameter	Condition	Symbol	min.	typ.	max.	Unit	Remarks
Reflection ratio	White, at center	RE	5	14	-	%	Note6
Contrast ratio	White/Black, at center	CR	7	15	-	-	Note7

Reference data

(Note1, Note3, Note4)

Parameter	Condition	Symbol	min.	typ.	max.	Unit	Remarks
Chromaticity coordinates	White	Wx	-	0.30	-	-	Note8
		Wy	-	0.33	-	-	
Color gamut	at center, against NTSC color space	C	-	5	-	%	
Response time	White to black	90%→10%	Ton	-	7	14	ms Note9 Note10
	Black to white	10%→90%	Toff	-	12	24	

<Backlight turning ON>

(Note2, Note3, Note5)

Parameter	Condition	Symbol	min.	typ.	max.	Unit	Remarks
Luminance	White at center $\theta R=0^\circ, \theta L=0^\circ, \theta U=0^\circ, \theta D=0^\circ$	L	190	280	-	cd/m ²	-
Contrast ratio	White/Black at center $\theta R=0^\circ, \theta L=0^\circ, \theta U=0^\circ, \theta D=0^\circ$	CR	150	200	-	-	Note7
Luminance uniformity	White $\theta R=0^\circ, \theta L=0^\circ, \theta U=0^\circ, \theta D=0^\circ$ Maximum luminance: 100%	LU	70	80	-	%	Note11

Reference data

(Note2, Note3, Note5)

Parameter	Condition	Symbol	min.	typ.	max.	Unit	Remarks
Chromaticity coordinates	White	Wx	0.27	0.32	0.37	-	Note8
		Wy	0.29	0.34	0.39	-	
Color gamut	$\theta R=0^\circ, \theta L=0^\circ, \theta U=0^\circ, \theta D=0^\circ$ at center, against NTSC color space	C	30	40	-	%	
Response time	White to black	90%→10%	Ton	-	7	14	ms Note9 Note10
	Black to white	10%→90%	Toff	-	23	46	
Viewing angle	Right	$\theta U=0^\circ, \theta D=0^\circ, CR \geq 5$	θR	-	30	-	° -
	Left	$\theta U=0^\circ, \theta D=0^\circ, CR \geq 5$	θL	-	30	-	
	Up	$\theta R=0^\circ, \theta L=0^\circ, CR \geq 5$	θU	-	30	-	
	Down	$\theta R=0^\circ, \theta L=0^\circ, CR \geq 5$	θD	-	35	-	

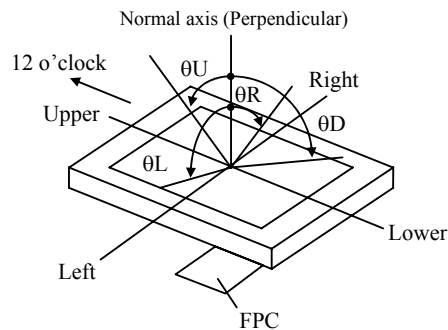
Note1: Measurement conditions are as follows.

$$T_a = 25^{\circ}\text{C}, V_{CC} = 3.3\text{V}, V_{DD} = 10\text{V}, V_{GON} = 20\text{V}, V_{GOFF} = -10\text{V}$$

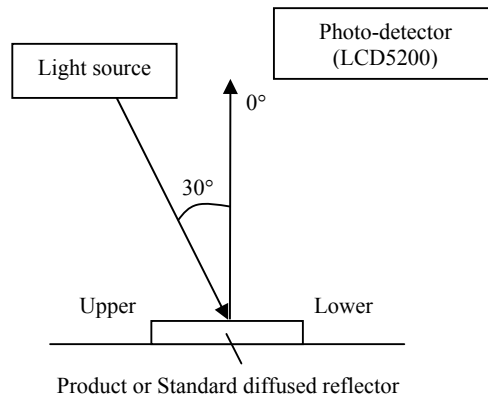
Note2: Measurement conditions are as follows.

$$T_a = 25^{\circ}\text{C}, V_{CC} = 3.3\text{V}, V_{DD} = 10\text{V}, V_{GON} = 20\text{V}, V_{GOFF} = -10\text{V}, I_L = 14\text{mA}$$

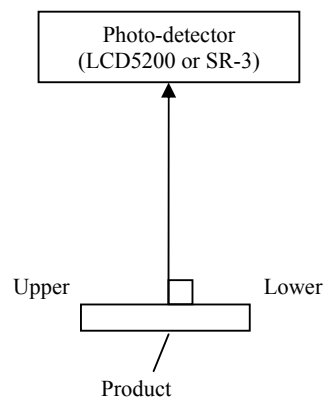
Note3: Definition of viewing angles



Note4: In reflective mode (Backlight turning OFF), Reflection ratio, Contrast ratio, Chromaticity coordinates and Color gamut are measured as follows.



Note5: In transmissive mode (Backlight turning ON), Luminance, Contrast ratio, Chromaticity coordinates and Color gamut are measured as follows.



Note6: Definitions of reflection ratio

The reflection ratio is calculated by using the following formula.

$$\text{Reflection (RE)} = \frac{\text{Luminance of reflected light at white screen}}{\text{Luminance of standard diffused reflector}} \times 100$$

Note7: Definition of contrast ratio

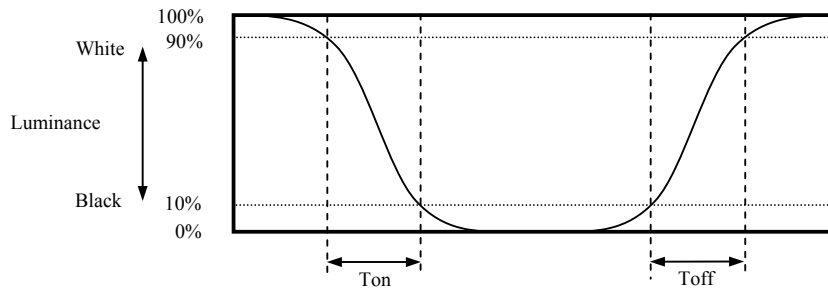
The contrast ratio is calculated by using the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

Note8: The White chromaticity coordinates are deviated by the LED deviation in addition to color filter deviation.

Note9: Definition of response times

Response time is measured at the time when the luminance changes from "white" to "black", or "black" to "white" on the same screen point, by photo-detector. Ton is the time when the luminance changes from 90% down to 10%. Also Toff is the time when the luminance changes from 10% up to 90% (See the following diagram.).

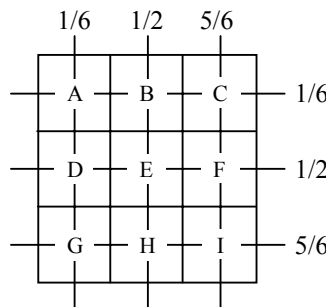


Note10: Product surface temperature: Top= 25°C

Note11: Definition of luminance uniformity

Luminance uniformity is calculated by using the following formula.

$$\text{Luminance uniformity (LU)} = \frac{\text{Minimum luminance from A to I}}{\text{Maximum luminance from A to I}} \times 100$$



5 ESTIMATED LUMINANCE LIFETIME

The luminance lifetime is the time from initial luminance to half-luminance.

This lifetime is the estimated value, and is not guarantee value.

Condition		Estimated luminance lifetime (Life time expectancy) Note1, Note2, Note3	Unit
LED elementary substance	25°C (Ambient temperature of LED) Continuous operation, IL= 14mA	33,000	h

Note1: Life time expectancy is mean time to half-luminance.

Note2: Estimated luminance lifetime is not the value for an LCD module but the value for LED elementary substance.

Note3: By ambient temperature, the lifetime changes particularly. Especially, in case the product works under high temperature environment, the lifetime becomes short.

6 RELIABILITY TESTS

Test item	Condition	Judgment	Note1
High temperature and humidity (Operation)	① 55 ± 2°C, RH = 85%, 240 hours ② Display data is black.	No display malfunctions	
Heat cycle (Operation)	① -20 ± 3°C...1 hour 70 ± 3°C...1 hour ② 50 cycles, 4 hours/cycle ③ Display data is black.		
Thermal shock (Non operation)	① -30 ± 3°C...30 minutes 80 ± 3°C...30 minutes ② 100 cycles, 1 hour/cycle ③ Temperature transition time is within 5 minutes.		
Low pressure (Non operation)	① 15kPa ② -30 ± 3°C...24 hours ③ 80 ± 3°C...24 hours		
Low pressure (Operation)	① 53.3 kPa ② -20 ± 3°C...24 hours ③ 70 ± 3°C...24 hours		
ESD (Operation)	① 150pF, 150Ω, ±10kV ② 3 places on a panel surface ③ 10 times each places at 1 sec interval		
Dust (Operation)	① Sample dust: No. 15 (by JIS-Z8901) ② 15 seconds stir ③ 8 times repeat at 1 hour interval		
Vibration (Operation)	① 30 to 100Hz, 19.6m/s ² ② 30 minutes/cycle ③ X, Y, Z directions ④ 1 times each directions		
Mechanical shock (Non operation)	① 3,920m/ s ² , 2.5ms ② ±X, ±Y, ±Z directions ③ 1 times each directions		

Note1: Display and appearance are checked under environmental conditions equivalent to the inspection conditions of defect specifications.

7. PRECAUTIONS

7.1 MEANING OF CAUTION SIGNS

The following caution signs have very important meaning. **Be sure to read "7.2 CAUTIONS" and "7.3 ATTENTIONS"!**



This sign has the meaning that a customer will be injured or the product will sustain damage if the customer practices wrong operations.



This sign has the meaning that a customer will be injured, if the customer practices wrong operations.

7.2 CAUTIONS



*** Do not shock and press the LCD panel and the backlight! There is a danger of breaking, because they are made of glass. (Shock: Equal to or no greater than $3,920\text{m/s}^2$ and equal to or no greater than 2.5ms)**

7.3 ATTENTIONS



7.3.1 Handling of the product

- ① Take hold of both ends without touching the FPC when the product (LCD module) is picked up from the tray.
- ② Do not hook nor pull the FPC in order to avoid any damage.
- ③ When the product is put on the table temporarily, display surface must be placed downward.
- ④ When handling the product, take the measures of electrostatic discharge with such as earth band, ionic shower and so on, because the product may be damaged by electrostatic.
- ⑤ The product must be installed and/or handled without any local stress such as bends or twist. Bends, twist or any local stress to any portion may cause display failures. And also do not put heavy or hard materials on the product.
- ⑥ Do not hit or rub the surface of panel with hard materials, because it is easily scratched. (Polarizer pencil-hardness: 3H)
- ⑦ When cleaning the product surface, wipe it with a soft dry cloth.
- ⑧ Do not push or pull the FPC while the product is working.
- ⑨ Do not fold the FPC. When the FPC is folded, pattern disconnection may be caused. In case of bending FPC, the minimum curvature (R) must be more than 1.0 mm.
- ⑩ When installing the product, do not contact a conductor such as a metal to the FPC excluding the terminal area. There is a risk of short circuit which is caused by breakage of insulation layer of the FPC.
- ⑪ When installing the product, apply the waterproof design to avoid going of water into the product.
- ⑫ Usually liquid crystals don't leak through the breakage of glasses because of the surface tension of thin layer and the construction of LCD panel. But, if you contact with liquid crystal by any chance, please wash it away with soap and water.

7.3.2 Environment

- ① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in packing box with antistatic pouch in room temperature to avoid dusts and sunlight, when storing the product.
- ② In order to prevent dew condensation occurred by temperature difference, the product packing box must be opened after enough time being left under the environment of an unpacking room. Evaluate the storage time sufficiently because dew condensation is affected by the environmental temperature and humidity. (Recommended leaving time: 6 hours or more with the original packing state after a customer receives the package)
- ③ Do not operate in high magnetic field. If not, circuit boards may be broken.
- ④ This product is not designed as radiation hardened.

7.3.3 Characteristics

The following items are neither defects nor failures.

- ① Response time, luminance and color may be changed by ambient temperature.
- ② Display mura, flickering, vertical stream or tiny spots may be observed depending on display patterns.
- ③ Do not display the fixed pattern for a long time because it may cause image sticking.
- ④ Optical characteristics may be changed depending on input signal timings.

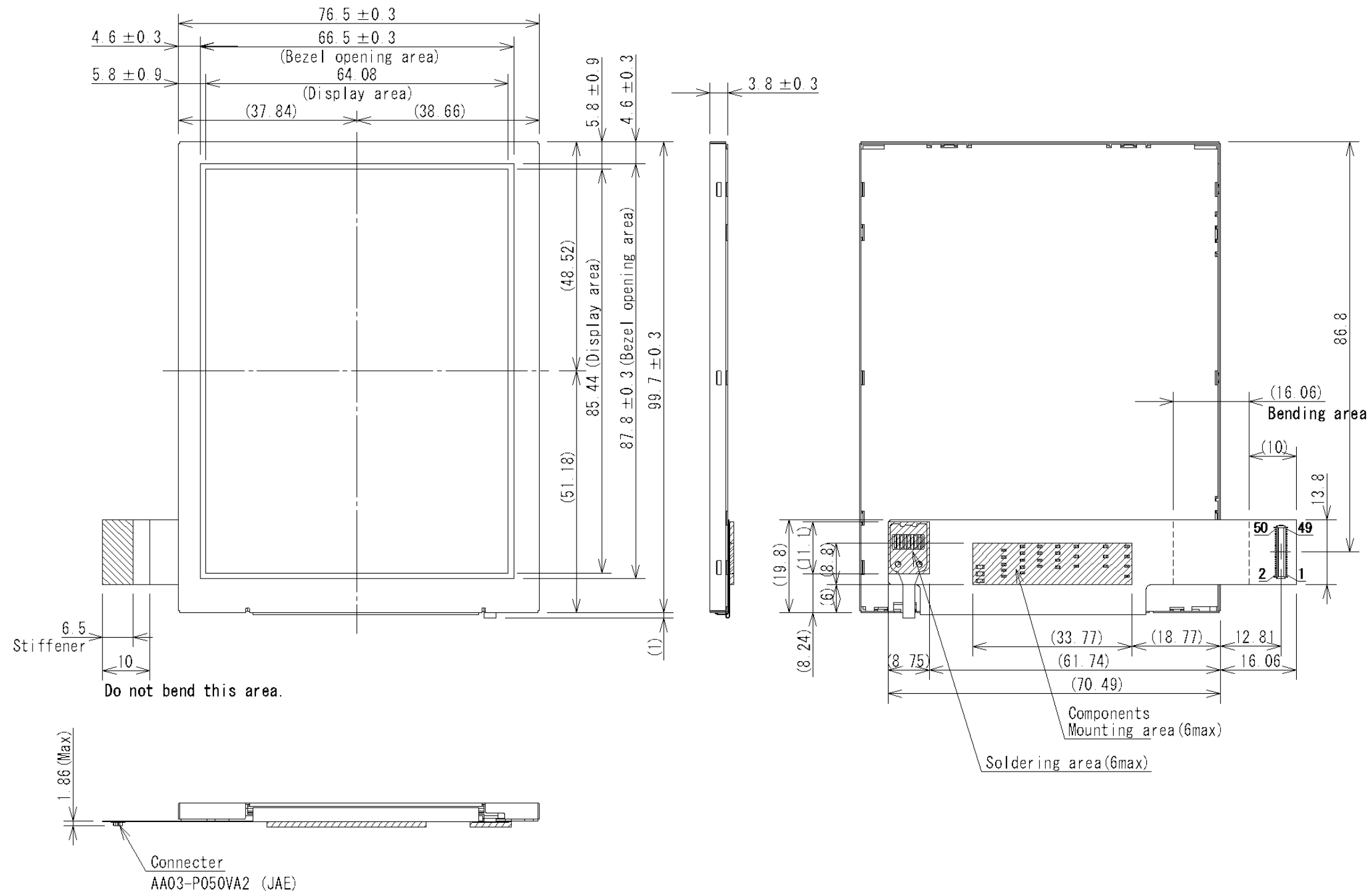
7.3.4 Others

- ① All GND terminals should be used without any non-connected lines.
- ② Do not disassemble the product.
- ③ Pack the product with the original shipping package, in order to avoid any damages during transportation, when returning the product to NEC for repairing and so on. .
- ④ When installing the product to customer equipment, do not apply any local stress to the rear side of the product, FPC, Soldering Area and Mounting Area. If not, it may cause display un-uniformity or break down of the product.
- ⑤ The information of China RoHS directive six hazardous substances or elements in this product is as follows.

China RoHS directive six hazardous substances or elements					
Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr VI)	Polybrominated Biphenyls (PBB)	Polybrominated Biphenyl Ethers (PBDE)
○	○	○	○	○	○

Note1: ○: This indicates that the poisonous or harmful material in all the homogeneous materials for this part is equal or below the limitation level of SJ/T11363-2006 standard regulation.

7. OUTLINE DRAWINGS



Pin No.	Symbols	Pin No.	Symbols
1	GND	26	B0N
2	GND	27	B0P
3	VCOM	28	B1N
4	VCOM	29	B1P
5	GND	30	B2N
6	VCC	31	B2P
7	GND	32	GND
8	HSP	33	DLP
9	HCKN	34	PC
10	HCKP	35	VDD
11	GND	36	VDD
12	R0N	37	GND
13	R0P	38	GND
14	R1N	39	VOE
15	R1P	40	VCK
16	R2N	41	VSP
17	R2P	42	VGON
18	GND	43	GND
19	G0N	44	VGOFF
20	G0P	45	GND
21	G1N	46	GND
22	G1P	47	ANODE
23	G2N	48	CATHODE
24	G2P	49	GND
25	GND	50	GND

- Note1: The values in parentheses are for reference.
 Note2: When installing the product to customer equipment, do not apply undue stress to the rear side of the product, FPC, Soldering Area and Components Mounting Area.
 If not, it may cause display un-uniformity or break down of the product.
 Note3: While the product is working, do not contact a conductor such as a metal to the Soldering Area and Components Mounting Area of the FPC.

Unit: mm