

TFT COLOR LCD MODULE

NL2432HC17-05B

**6.8cm (2.7 Type)
QVGA**

DATA SHEET 
DOD-PP-0226 (2nd edition)



**This DATA SHEET is updated document from
DOD-PP-0220(1).**

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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.

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1. OUTLINE

1.1 STRUCTURE AND PRINCIPLE

Color LCD module NL2432HC17-05B 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, touch panel (T/P) 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

- Smart Phone
- PPC Phone

1.3 FEATURES

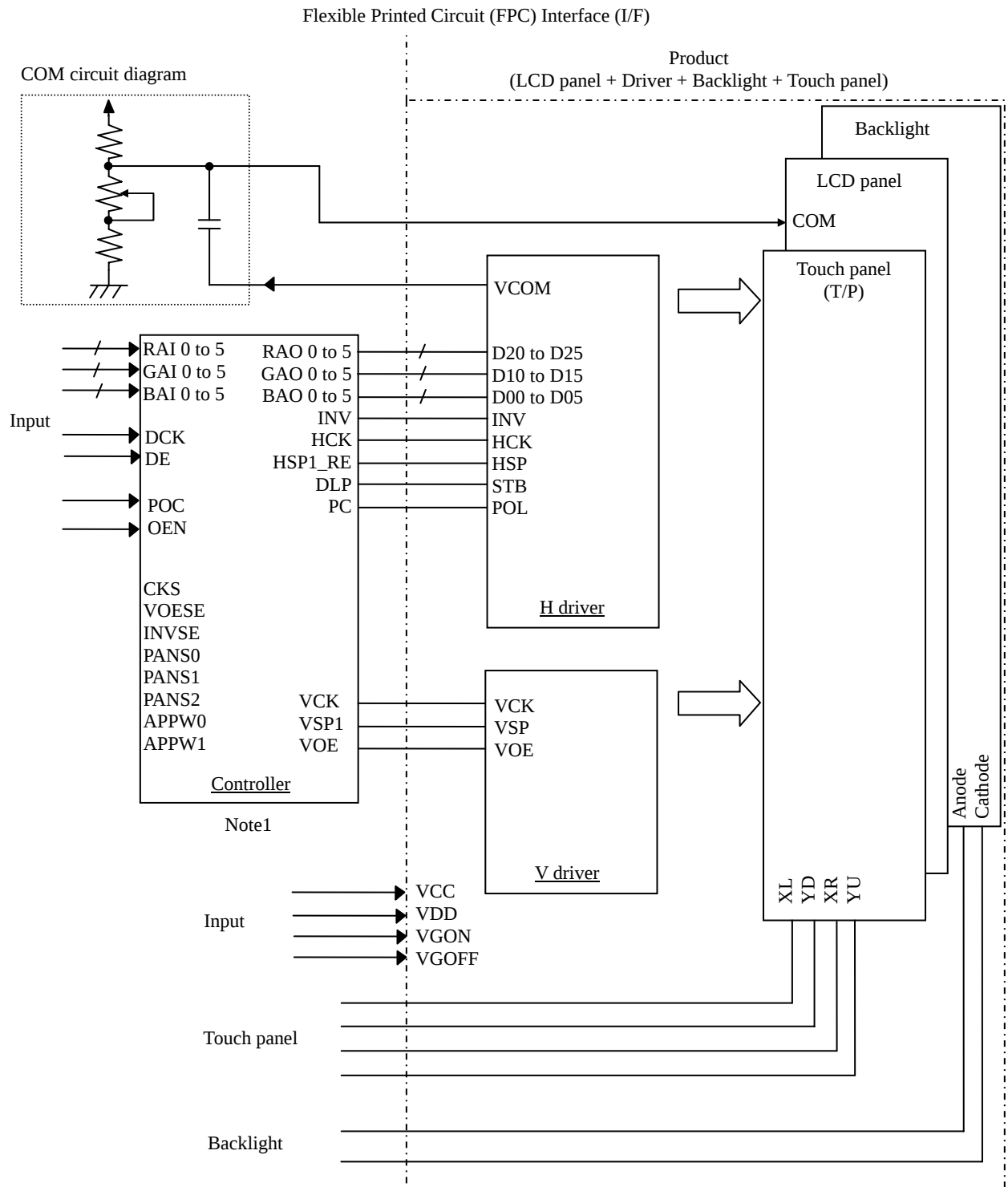
- Transmissive type
- Backlight and touch panel attached
- Recommended LCD controller: Part No. S1L50282B37N000 (NEC corp.)
- High luminance
- High contrast
- 6-bit digital RGB signals
- LCM is equipped with spacer in order to maintain the appropriate gap between the panel and the touch panel.

2. GENERAL SPECIFICATIONS

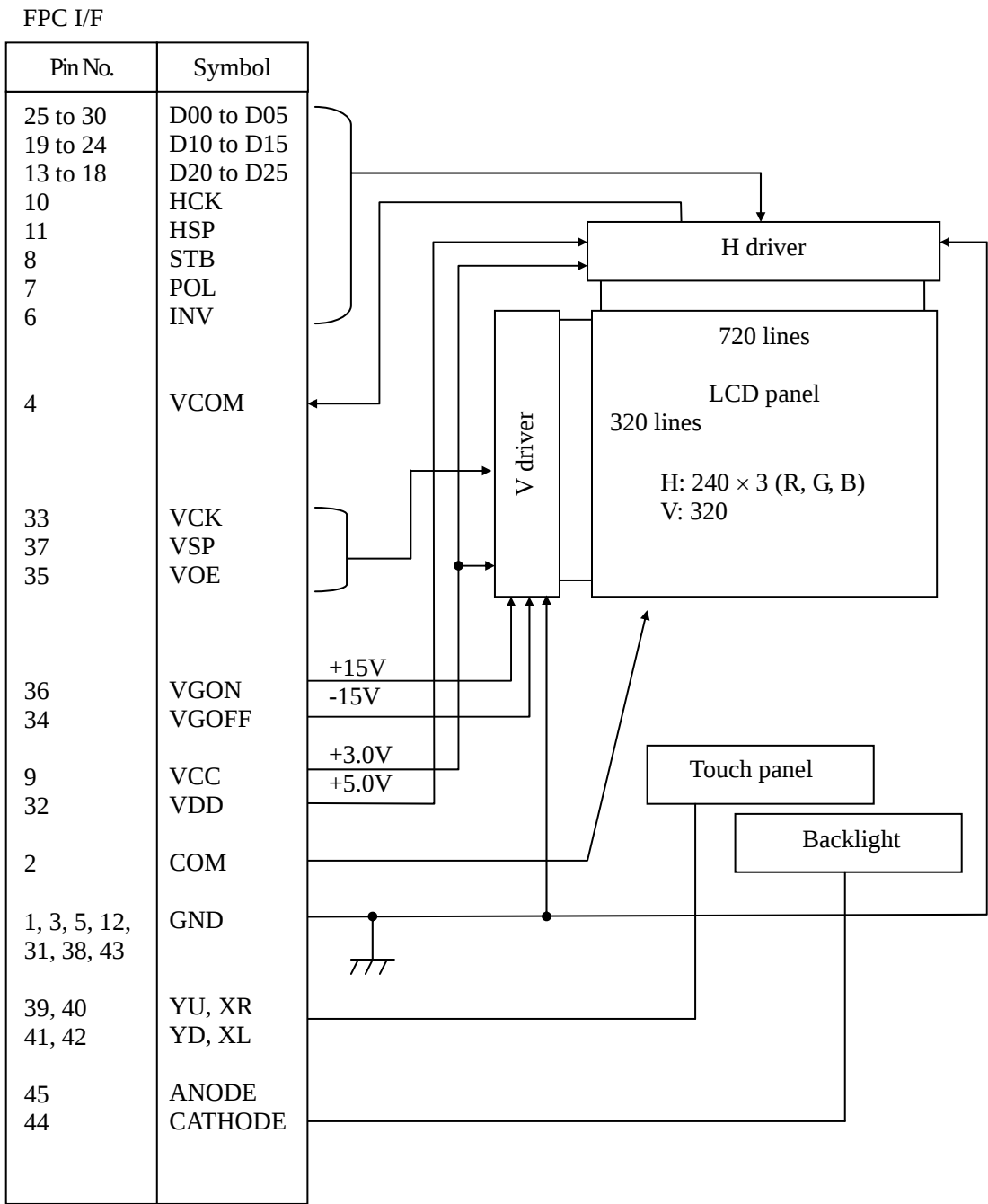
Display area	41.04 (H) × 54.72 (V) mm
Diagonal size of display	6.8cm (2.7 inches)
Drive system	a-Si TFT active matrix
Display color	262,144 colors
Pixel	240 (H) × 320 (V) pixels
Pixel arrangement	RGB (Red dot, Green dot, Blue dot) vertical stripe
Dot pitch	0.057 (H) × 0.171 (V) mm
Pixel pitch	0.171 (H) × 0.171 (V) mm
Module size	50.54 (H) × 68.62 (V) × 4.12 (D) mm (typ.)
Weight	28g (typ.)
Touch panel surface	Clear
Touch panel pencil-hardness	3H (min.) [by JIS K5400]
Designed viewing direction	- Viewing direction without image reversal: down side (6 o'clock) - Viewing direction with contrast peak: up side (12 o'clock)
Luminance	At IL = 18mA, With Touch panel 350cd/m ² (typ.)
Contrast ratio	At IL = 18mA, With Touch panel 400:1 (typ.)
Response time	Ton + Toff (10% ← → 90%) 23ms (typ.)
Signal system	Controller input signals (6-bit RGB data, DCK, DE, POC, OEN) Note1
Supply voltage	VCC: 3.0V (typ., for Logic) VDD: 5.0V (typ., for LCD Horizontal driver) VGON: +15.0 V (typ., for LCD Vertical driver) VGOFF: -15.0 V (typ., for LCD Vertical driver)
Power consumption	LCD panel + Driver: 20mW (typ.) Backlight: 230mW (typ., at IL=18mA)

Note1: Refer to the controller (Part No.: S1L50282B37N000) specifications.

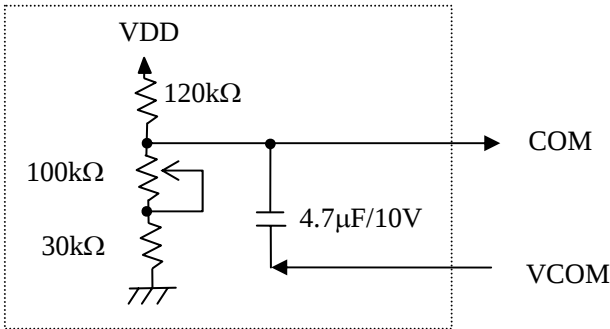
3. BLOCK DIAGRAM



Note1: Refer to the controller (part no.: S1L50282B37N000) specifications for input timings.



Reference design of COM circuit



4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification	Unit
Module size	50.54 ± 0.2 (W) $\times$ 68.62 ± 0.2 (H) $\times$ 4.12 ± 0.2 (D) Note1	mm
Display area	41.04 (H) $\times$ 54.72 (V) Note2	mm
Weight	28 (typ.), 30 (max.)	g

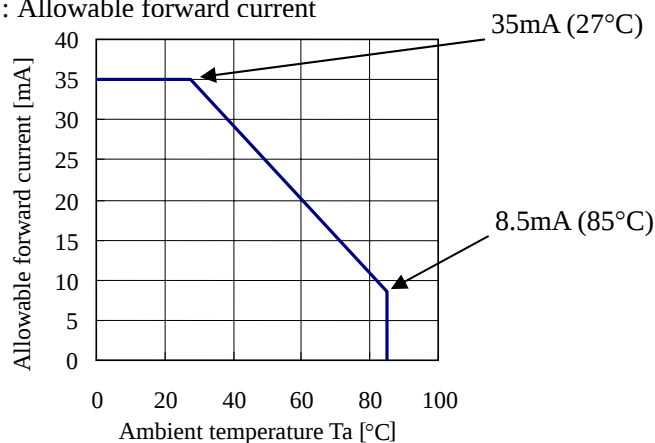
Note1: Excluding FPC

Note2: See "7. OUTLINE DRAWINGS".

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Remarks
Supply voltage	VCC	-0.3 to +4.0	V	Ta= 25°C
	VDD	-0.3 to +6.0		
	VGON	-0.3 to +44.0		
	VGOFF	VGON -44.0 to +0.3		
Logic input voltage	VI	-0.3 to VCC+0.3	V	Logic signals
Backlight	Reverse voltage	VR	V	Ta= 25°C
	Power dissipation	PD	mW	
	Forward current	IL	mA	-
	Pulse forward current	IFP	mA	Pulse width $\leq$ 10ms, Duty $\leq$ 1/10
Storage temperature	Tst	-30 to +70	°C	-
Operating temperature	Top	-20 to +60		Product surface Note2
Relative humidity Note3	RH	$\leq$ 95	%	Ta $\leq$ 40°C
		$\leq$ 85		40°C < Ta $\leq$ 50°C
		$\leq$ 55		50°C < Ta $\leq$ 60°C
Absolute humidity Note3	AH	$\leq$ 70 Note4	g/m ³	Ta>50°C
Storage altitude		$\leq$ 13,600	m	-30°C $\leq$ Ta $\leq$ 70°C
Operating altitude		$\leq$ 4,850	m	-20°C $\leq$ Ta $\leq$ 60°C

Note1: Allowable forward current



Note2: Measured at display area

Note3: No condensation

Note4: Water amount at Ta= 50°C and RH= 85%

4.3 ELECTRICAL CHARACTERISTICS

(1) Logic/ LCD driving

(Ta= 25°C)

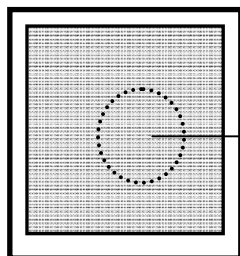
Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Logic supply voltage	VCC	2.6	3.0	3.6	V	-
H driver supply voltage	VDD	4.0	5.0	5.5	V	-
V driver(+) supply voltage	VGON	14.0	15.0	16.0	V	-
V driver(-) supply voltage	VGOFF	-16.0	-15.0	-14.0	V	-
Logic input high voltage	VIH	0.8VCC	-	VCC	V	Logic signal
Logic input low voltage	VIL	0	-	0.2VCC	V	
COM voltage input level	COM	VDD-0.3	VDD	-	Vp-p	-
COM center voltage	COM/C	-	1.8	-	V	at VDD=5.0V Note1
VCC supply current	ICC	-	0.4	1.0	mA	at VCC= 3.0V Note1 Excluding the controller
VDD supply current	IDD	-	3.5	6.5	mA	at VDD= 5.0V Note1
VGON supply current	IGON	-	0.04	0.1	mA	at VGON=15.0V Note1
VGOFF supply current	IGOFF	-	-0.04	-0.1	mA	at VGOFF= -15.0V Note1

Note1: PPHCK= 5.6MHz, PPSTB= 19.44kHz, PPVCK= 19.44kHz, PPVSP= 60Hz,

Checked flag pattern (by EIAJ ED-2522)

Note2: The optimal value for COM/C is in the range of 1.3V to 2.3V.

Recommended adjustment display for COM/C



Half tone display (32/63 gray scale)
Full black display (0/63 gray scale)
Half tone display (32/63 gray scale)
Full black display (0/63 gray scale)
Half tone display (32/63 gray scale)

(2) Backlight

(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Forward Current	IL	-	18	20	mA	-
Forward Voltage	VL	-	12.8	14	V	at IL= 18mA

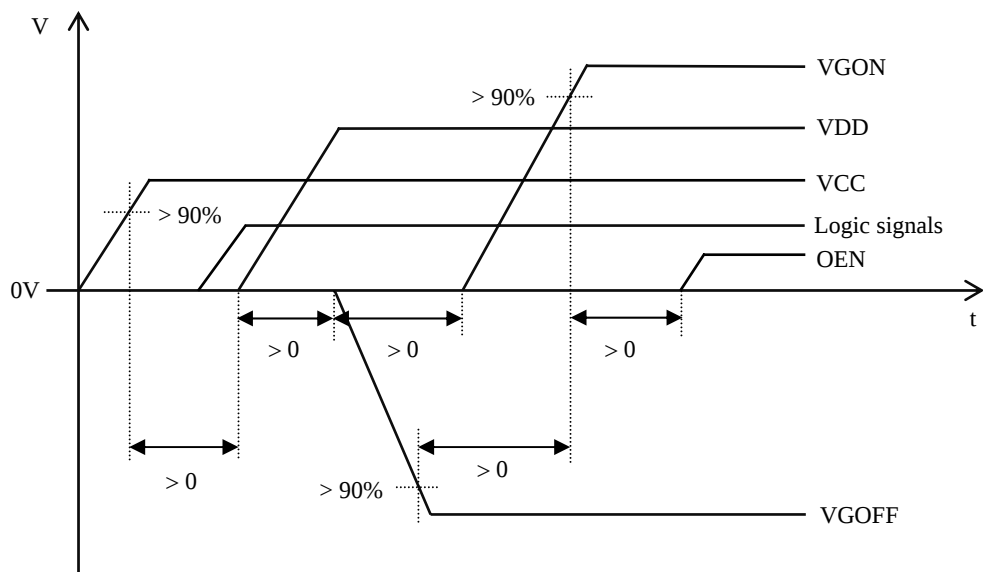
(3) Touch panel

(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Touch panel input voltage	Vtp	-	-	5.5	V	-
Resistor between terminals(XL-XR)	Rx	190	-	490	Ω	-
Resistor between terminals(YU-YD)	Ry	140	-	530	Ω	-
Line linearity (X direction)	Xlin	-	-	1.5	%	Note1
Line linearity (Y direction)	Ylin	-	-	1.5	%	Note1
Insulation resistance	Rins	20	-	-	MΩ	at DC 25 V
Capacitance	Ctp	-	-	100	nF	-
Chattering	Chat	-	-	10	ms	Note1
Operation starting force	Ost	-	-	0.784	N	Note1
				80	gf	
Surface hardness	Hs	3	-	-	H	Pencil hardness [by JIS K5400]
Point hitting life	Lhp	1,000,000	-	-	times	Polyacetal stylus pen: R0.8mm Load: 2.45N(250gf)
	Lhr	1,000,000	-	-	times	Silicon rubber: R8mm, Hardness 60° Load: 2.94N(300gf)
Line writing life	Lwl	50,000	-	-	times	Polyacetal stylus pen: R0.8mm Load: 2.45N(250gf) 35mm

Note1: Input method is Finger or Polyacetal stylus pen (R0.8mm).

4.4 POWER SUPPLY VOLTAGE SEQUENCE



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

Note2: The “OEN” signal of the controller must be “H” after VGON.

Note3: 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.

4.5 INTERFACE PIN CONNECTIONS

CN1 (FPC)

Adaptable socket: FH23-45S-0.3SHW(05) (Hirose Electric Co., Ltd.(HRS))

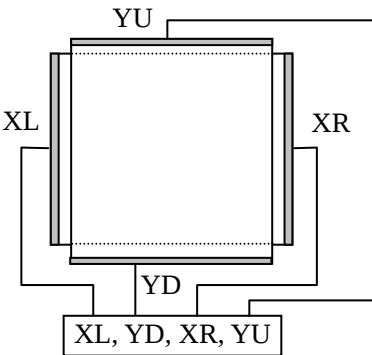
Pin No.	Symbols	Functions	Pin No.	Symbols	Functions
1	GND	Ground Note1	25	D00	Blue data (LSB)
2	COM	Signal for common electrode	26	D01	Blue data
3	GND	Ground Note1	27	D02	Blue data
4	VCOM	Driver output signal	28	D03	Blue data
5	GND	Ground Note1	29	D04	Blue data
6	INV	Data inversion signal	30	D05	Blue data (MSB)
7	POL	Polarity inversion signal	31	GND	Ground Note1
8	STB	H driver latch signal	32	VDD	H driver supply voltage
9	VCC	Logic supply voltage	33	VCK	V driver shift clock
10	HCK	H driver shift clock	34	VG OFF	V driver OFF voltage
11	HSP	H driver start pulse	35	VOE	V driver output enable ("L" output)
12	GND	Ground Note1	36	VG ON	V driver ON voltage
13	D20	Red data (LSB)	37	VSP	V driver start pulse
14	D21	Red data	38	GND	Ground Note1
15	D22	Red data	39	YU	T/P Vertical terminal (Up side)
16	D23	Red data	40	XR	T/P Horizontal terminal (Right side)
17	D24	Red data	41	YD	T/P Vertical terminal (Down side)
18	D25	Red data (MSB)	42	XL	T/P Horizontal terminal (Left side)
19	D10	Green data (LSB)	43	GND	Ground Note1
20	D11	Green data	44	CATHODE	LED voltage (Cathode)
21	D12	Green data	45	ANODE	LED voltage (Anode)
22	D13	Green data			
23	D14	Green data			
24	D15	Green data (MSB)			

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

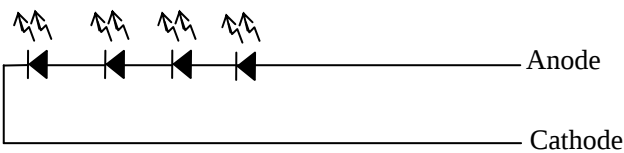
Note2: Do not fold the FPC. When folding the FPC, pattern disconnection may occur. In case of bending FPC, the minimum curvature (R) must be more than 1.0 mm.

Description of terminals

Terminal	Description
COM	This is the Common voltage. The voltage needs to be adjusted. See "3 BLOCK DIAGRAM - Reference design of COM circuit".
VCOM	This pin inverts the input signal from the POL pin and outputs it following conversion to the VDD potential at the rising edge of STB.
INV	This pin inverts the input data signal. Input data in synchronization with the shift clock. INV = L: Normal, INV = H: Data inversion
POL	This pin inverts the output polarity. The polarity inversion signal data is captured at the rising edge of STB. The gamma-resistor is switched in accordance with the positive/negative polarity. POL = H: Positive polarity POL = L: Negative polarity
STB	A timing signal that latches the contents of the data register. When a H level is read at the rising edge of HCK, the contents of the data register are latched and transferred to the D/A converter, and analog voltage corresponding to the display data is output. Also, because the internal operation via HCK continues even after the STB latch, do not stop HCK. The contents of the shift register are cleared at the rising edge of STB.
HCK	This pin is the shift clock input of the column shift register. Display data is captured into the data register at the rising edge.
HSP	Fetching of display data starts when H is read at the rising 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.
YU, XR, YD, XL	Refer to the below "Circuits of touch panel".
ANODE, CATHODE	Refer to the below "Circuits of back light".



Circuits of touch panel



Circuits of backlight

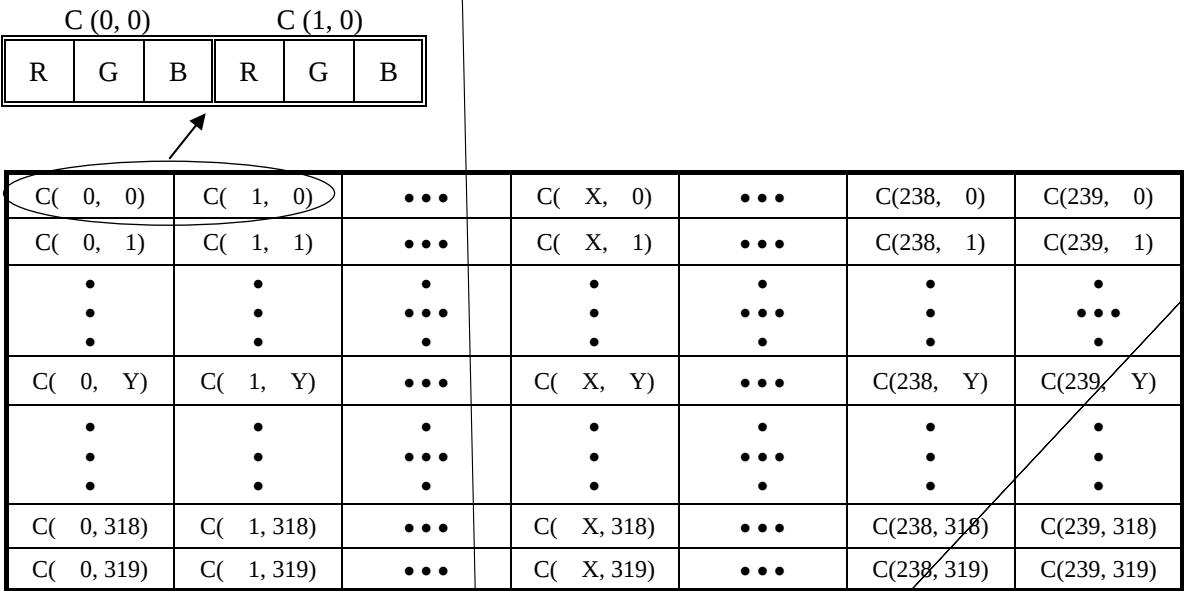
4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display in equivalent to 262,144 colors in 64 gray scales. Also the relation between display colors and input data signals is as the following table.

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
	dark ↑ ↓	0	0	0	0	0	1	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	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	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
	dark ↑ ↓	0	0	0	0	0	0	0	0	0	0	1	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
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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	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
	dark ↑ ↓	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	0	0	0	1	0	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	1

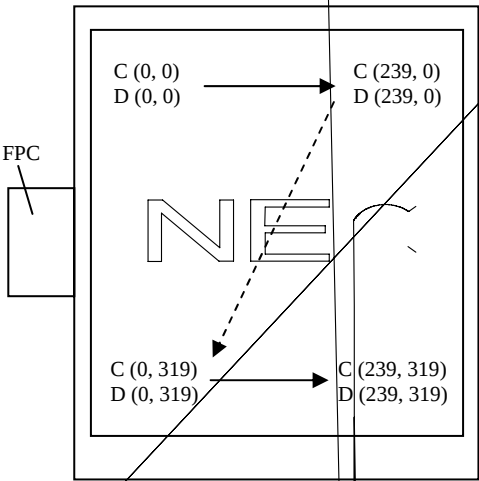
4.7 DISPLAY POSITIONS

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



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

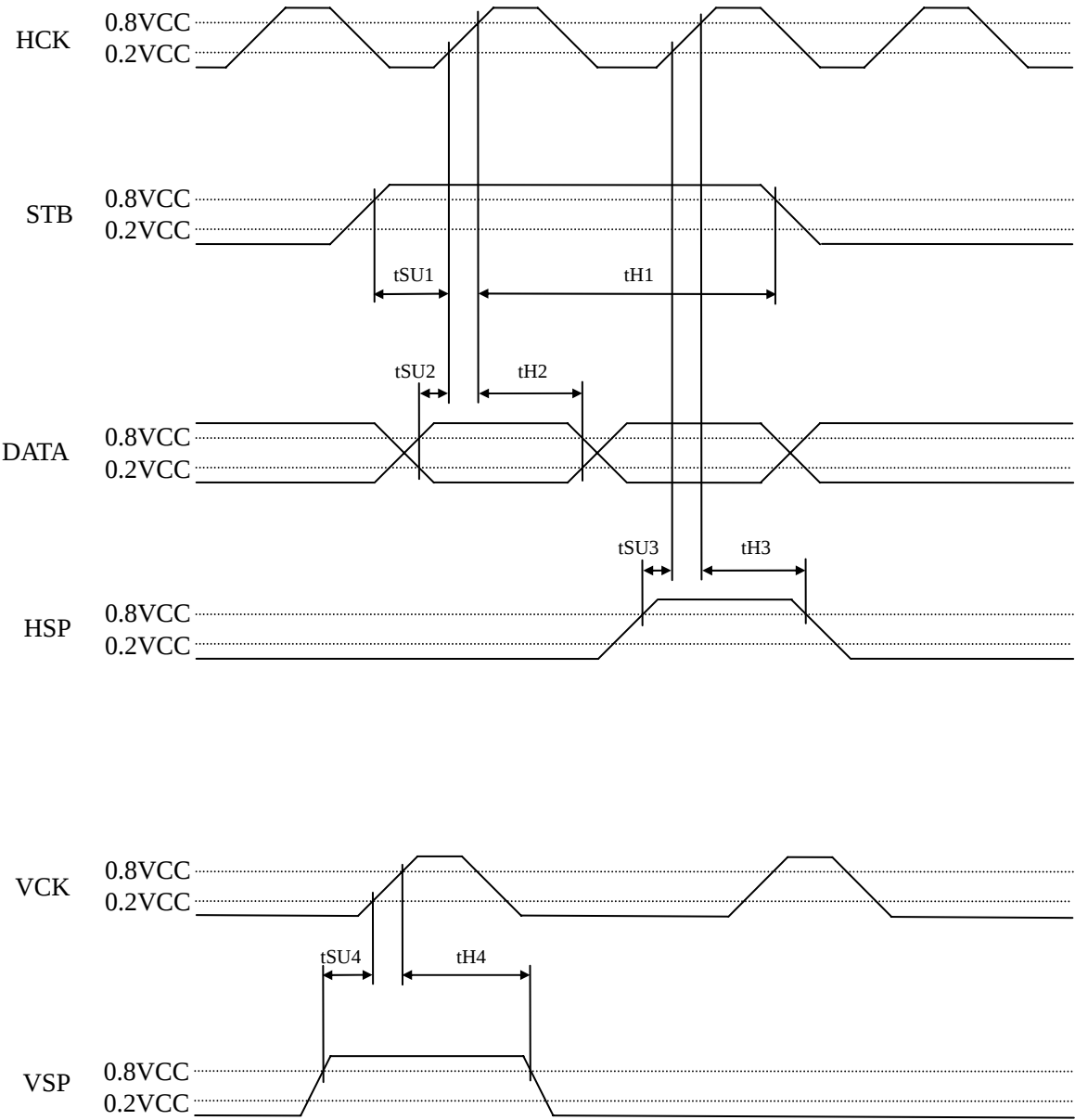
4.9 INPUT SIGNAL TIMINGS

Input signal specifications for the LCD controller (Ta= 25°C, VCC= 3.0V, VDD= 5.0V)

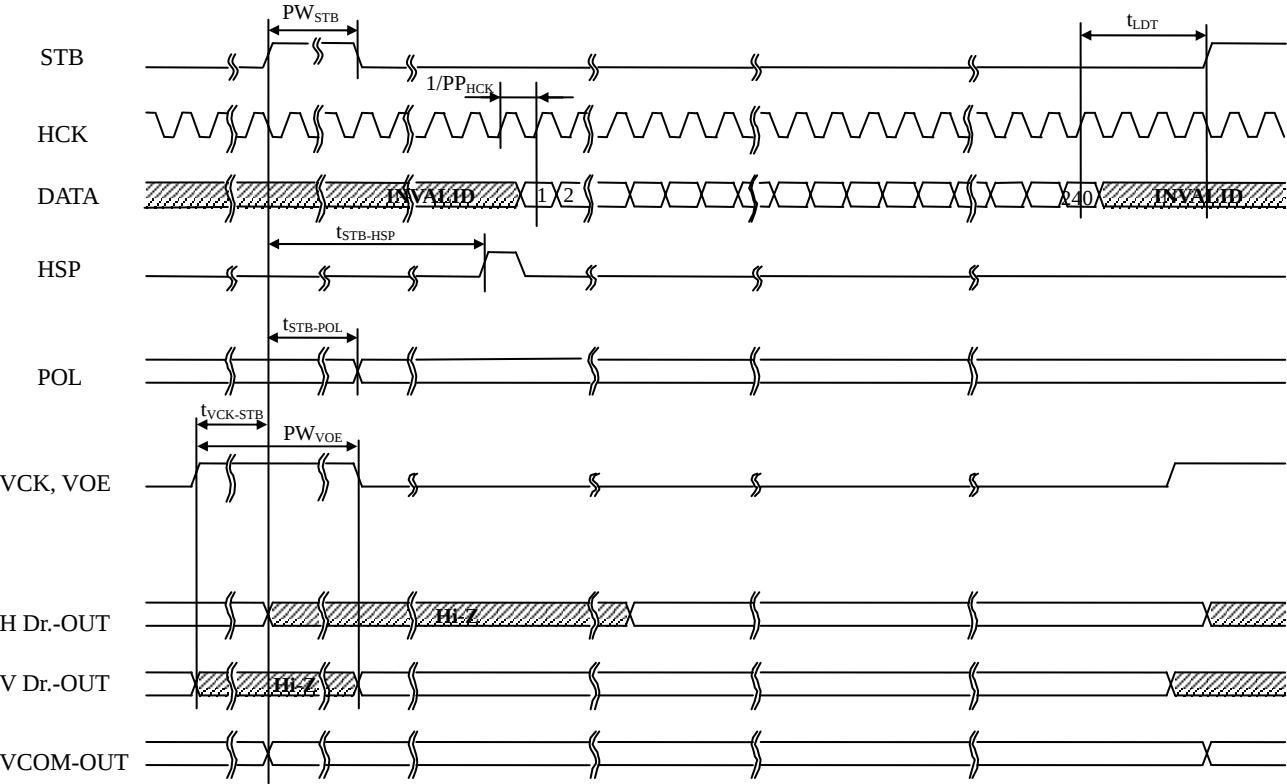
(1) Timing characteristics

Parameter	Symbol	min.	typ.	max.	Unit
HCK frequency	PPHCK	5.4	5.6	7.2	MHz
HCK High period	PWHCK(H)	35	-	-	ns
HCK Low period	PWHCK(L)	35	-	-	ns
Last data timing	tLDT	2	-	-	CLK
HCK-STB time	tHCK-STB	35	-	-	ns
STB frequency	PPSTB	16.5	19.44	20.0	kHz
STB pulse width	PWSTB	550	-	-	ns
STB-HSP time	tSTB-HSP	4	-	-	CLK
STB-POL time	tSTB-POL	40	-	-	ns
VCK-STB time	tVCK-STB	1	3	-	μs
VSP frequency	PPVSP	50	60	65	Hz
VCK frequency	PPVCK	16.5	19.44	20.0	kHz
STB setup time	tSU1	35	-	-	ns
STB hold time	tH1	35	-	-	ns
DATA setup time	tSU2	35	-	-	ns
DATA hold time	tH2	35	-	-	ns
HSP setup time	tSU3	35	-	-	ns
HSP hold time	tH3	35	-	-	ns
VSP setup time	tSU4	150	-	-	ns
VSP hold time	tH4	300	-	-	ns

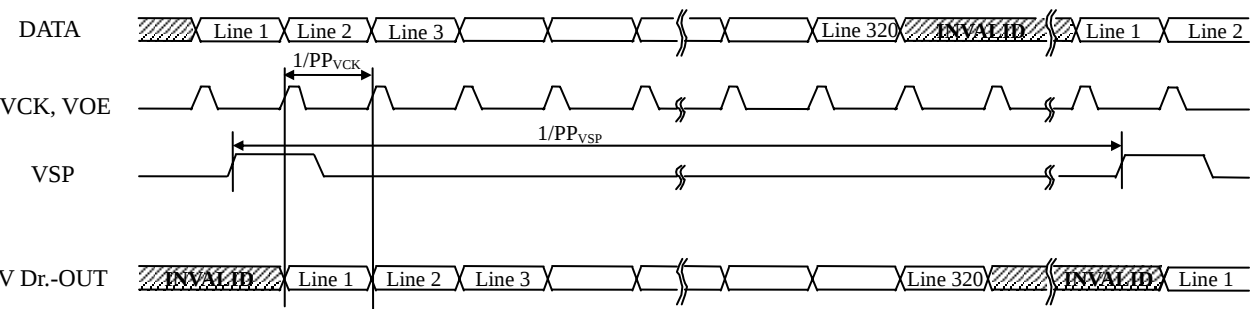
Note1: All parameters should be kept within the specified range.



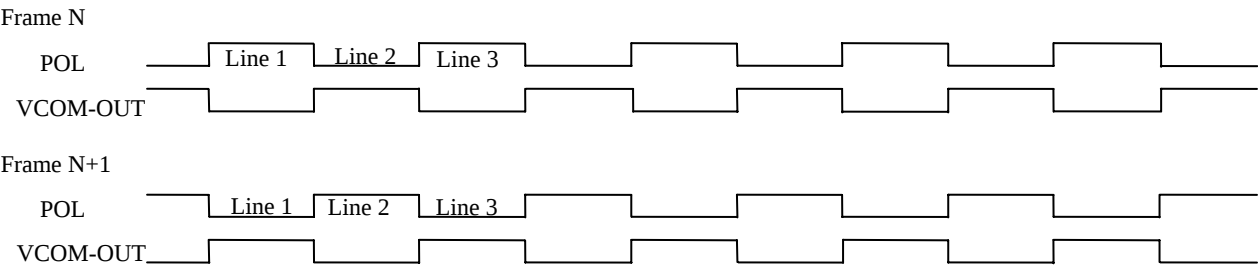
(2) Horizontal timing chart



(3) Vertical timing chart



(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

(Note1, Note2)

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	250	350	-	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	250	400	-	-	Note3
Luminance uniformity	White $\theta R = 0^\circ, \theta L = 0^\circ, \theta U = 0^\circ, \theta D = 0^\circ$ Maximum luminance: 100%	LU	60	70	-	%	Note4

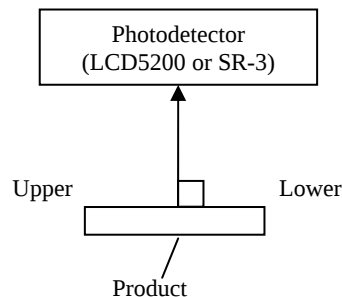
Reference data

(Note1, Note2)

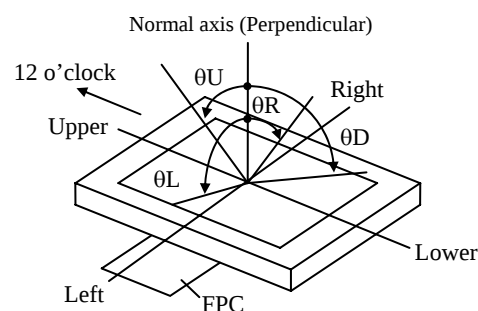
Parameter	Condition	Symbol	min.	typ.	max.	Unit	Remarks
Chromaticity coordinates	White	Wx	0.27	0.32	0.37	-	Note5
		Wy	0.29	0.34	0.39	-	
	Red	Rx	0.57	0.62	0.67	-	
		Ry	0.31	0.36	0.41	-	
	Green	Gx	0.30	0.35	0.40	-	
		Gy	0.49	0.54	0.59	-	
	Blue	Bx	0.09	0.14	0.19	-	
		By	0.09	0.14	0.19	-	
Color gamut	$\theta R = 0^\circ, \theta L = 0^\circ, \theta U = 0^\circ, \theta D = 0^\circ$ at center, against NTSC color space	C	40	45	-	%	
Response time	White to black	Ton	-	8	16	ms	Note6 Note7
	Black to white	Toff	-	15	30		
Viewing angle	Right	$\theta U = 0^\circ, \theta D = 0^\circ, CR \geq 5$	θR	-	50	-	-
	Left	$\theta U = 0^\circ, \theta D = 0^\circ, CR \geq 5$	θL	-	50	-	
	Up	$\theta R = 0^\circ, \theta L = 0^\circ, CR \geq 5$	θU	-	60	-	
	Down	$\theta R = 0^\circ, \theta L = 0^\circ, CR \geq 5$	θD	-	30	-	

Note1: Measurement conditions are as follows.

Ta= 25°C, VCC= 3.0V, VDD= 5.0V, IL= 18mA, with touch panel



Note2: Definition of viewing angles



Note3: Definition of contrast ratio

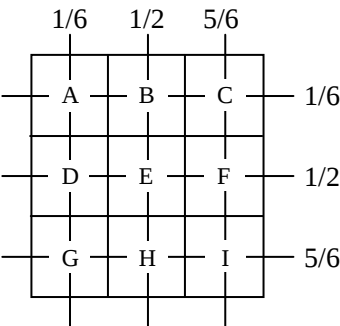
The contrast ratio is calculated by using the following formula.

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

Note4: Definition of luminance uniformity

Luminance uniformity is calculated by using the following formula.

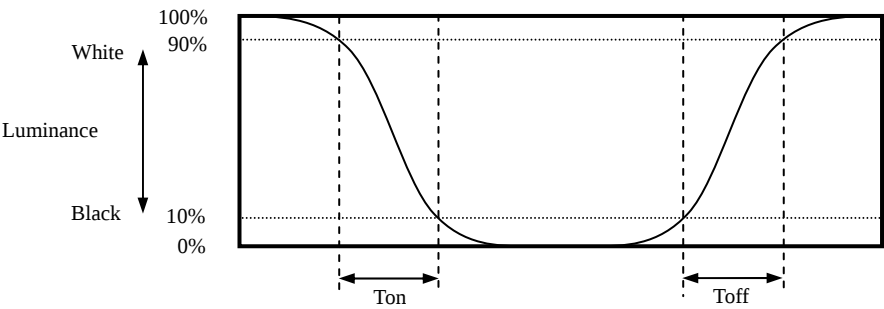
$$\text{Luminance uniformity (LU)} = \frac{\text{Minimum luminance from A to I}}{\text{Maximum luminance from A to I}} \times 100$$



Note5: The White chromaticity coordinates are deviated by the LED deviation in addition to color filter deviation.

Note6: Definition of response times

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



Note7: Product surface temperature: Top= 25°C

5. RELIABILITY TESTS

Test item	Condition	Judgment Note1
High temperature and humidity (Operation)	55 ± 2°C, RH = 85%, 240 hours Display data is black.	No display malfunctions
Heat cycle (Operation)	-20 ± 3°C...1 hour 60 ± 3°C...1 hour 50 cycles, 4 hours/cycle Display data is black.	
Thermal shock (Non operation)	-30 ± 3°C...30 minutes 70 ± 3°C...30 minutes 100 cycles, 1 hour/cycle Temperature transition time is within 5 minutes.	
Low pressure (Non operation)	15kPa -30 ± 3°C...24 hours 70 ± 3°C...24 hours	
Low pressure (Operation)	53.3kPa -20 ± 3°C...24 hours 60 ± 3°C...24 hours	
ESD (Operation)	150pF, 150Ω, ±10kV 3 places on a panel surface 10 times each places at 1 sec interval	
Dust (Operation)	Sample dust: No. 15 (by JIS-Z8901) 15 seconds stir 8 times repeat at 1 hour interval	
Vibration (Operation)	30 to 100Hz, 19.6m/s ² 30 minute/cycle X, Y, Z direction 1 times each directions	No display malfunctions No physical damages
Mechanical shock (Non operation)	3,920m/ s ² , 2.5ms ±X, ±Y, ±Z direction 1 times each directions	

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

6. PRECAUTIONS

6.1 MEANING OF CAUTION SIGNS

The following caution signs have very important meaning. **Be sure to read "6.2 CAUTIONS" and "6.3 ATTENTIONS", after understanding these contents!**



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



This sign has the meaning that customer will get an electrical shock, if customer has wrong operations.



This sign has the meaning that customer will be injured by himself, if customer has wrong operations.

6.2 CAUTIONS



*** Do not touch the working backlight. There is a danger of an electric shock.**



*** Do not touch the working backlight. There is a danger of burn injury.**
*** Do not shock and press the LCD panel and the backlight! There is a danger of breaking, because they are made of glass. (Shock: To be not greater 3,920m/s² and to be not greater 2.5ms)**

6.3 ATTENTIONS



6.3.1 Handling of the product

Take hold of both ends without touching the FPC when the product (LCD module) is picked up from the tray.

Do not hook nor pull the FPC in order to avoid any damage.

When the product is put on the table temporarily, display surface must be placed downward.

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.

The product must be installed and/or handled without undue stress such as bends or twist. Bends, twist or undue stress to any portion may cause display failures. And also do not put heavy or hard materials on the product.

Do not hit or rub the surface of touch panel with hard materials, because it is easily scratched. (Touch panel pencil-hardness: 3H)

When cleaning the T/P surface, wipe it with a soft dry cloth.

Do not push nor pull the FPC while the product is working.

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.

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.

When installing the product, apply the waterproof design to avoid going of water into the product.

6.3.2 Environment

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 for dusts and sunlight, when storing the product.

In order to prevent dew condensation occurring by temperature difference, the product packing box should be opened after enough time being left under the environment of an unpacking room. Evaluate the leaving time sufficiently because a situation of dew condensation occurring is changed by the environmental temperature and humidity. (Recommended leaving time: 6 hours or more with packing state)

Do not operate in high magnetic field. Circuits may be broken down by it.

This product is not designed as radiation hardened.

6.3.3 Characteristics

The following items are neither defects nor failures.

Response time, luminance and color may be changed by ambient temperature.

Display mura, flicker, vertical seam or small spot may be observed depending on display patterns.

Do not display the fixed pattern for a long time because it may cause image sticking.

Optical characteristics may be changed depending on input signal timings.

Touch panel film has polarizing characteristic. And the polarizer characteristics differ among products. Therefore, when seeing the displays through the other polarizing material (for example polarizing sunglasses), some displays can not be seen and some displays look different color darker because of polarizer characteristic mismatching between touch panel film and the other polarizing material.



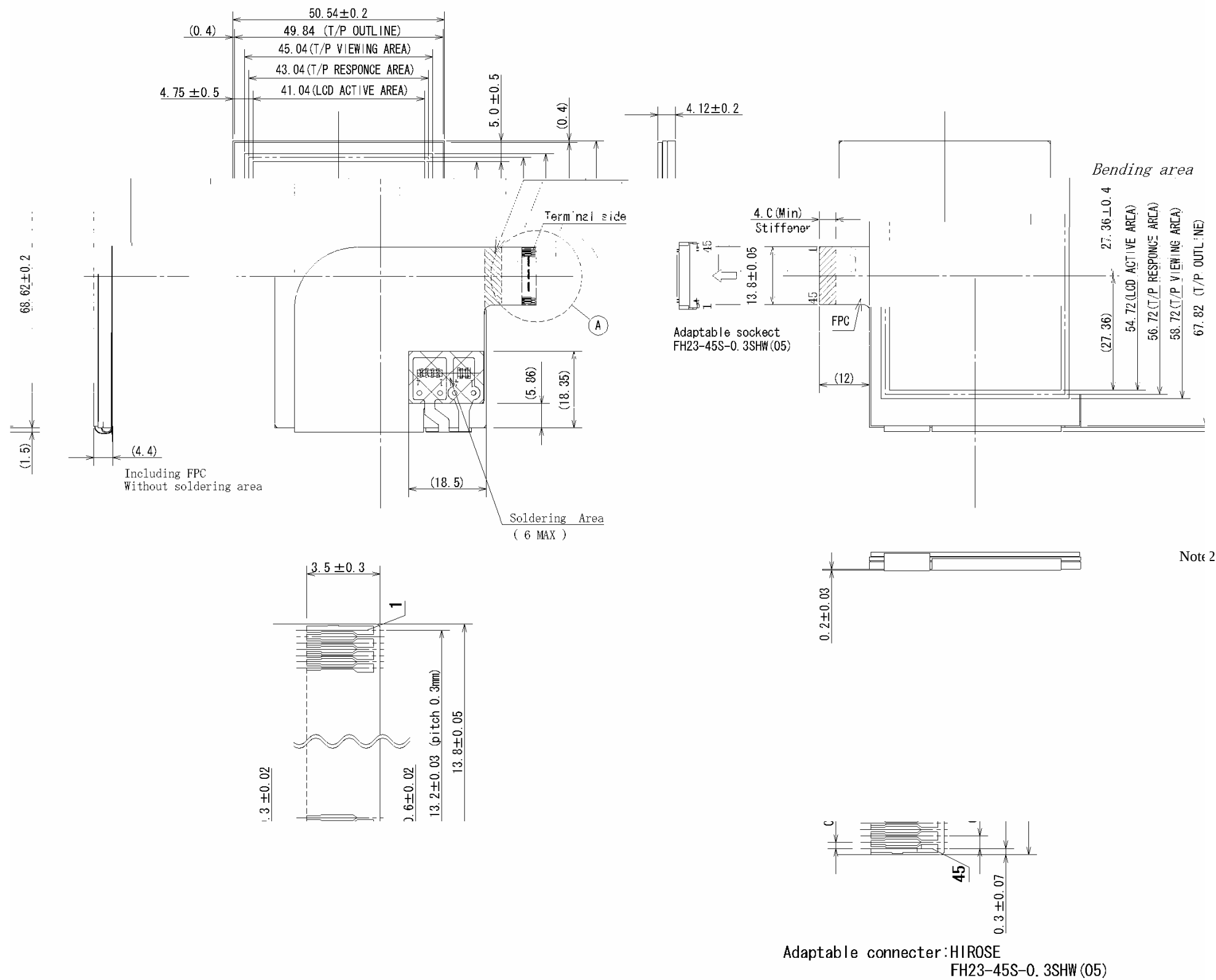
6.3.4 Other

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

Do not disassemble the product.

Pack the product with original shipping package, in order to avoid any damages during transportation, when returning the product to NEC.

7. OUTLINE DRAWINGS

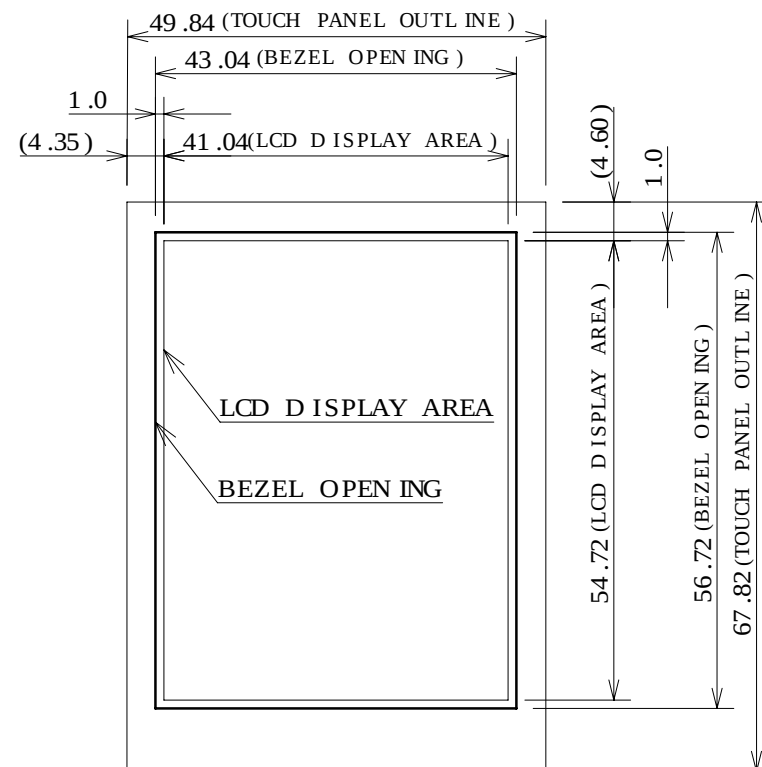
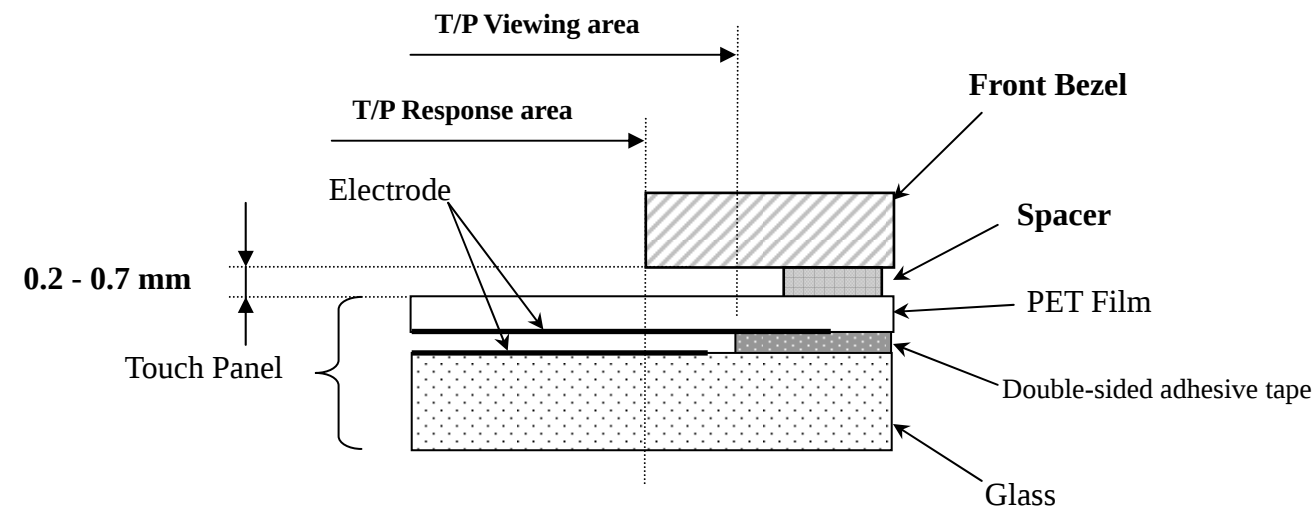


Pin No.	Symbols	Pin No.	Symbols
1	GND	25	D00
2	COM	26	D01
3	GND	27	D02
4	VCOM	28	D03
5	GND	29	D04
6	INV	30	D05
7	POL	31	GND
8	STB	32	VDD
9	VCC	33	VCK
10	HCK	34	VGOFF
11	HSP	35	VOE
12	GND	36	VGON
13	D20	37	VSP
14	D21	38	GND
15	D22	39	YU
16	D23	40	XR
17	D24	41	YD
18	D25	42	XL
19	D10	43	GND
20	D11	44	CATHODE
21	D12	45	ANODE
22	D13		
23	D14		
24	D15		

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

Unit: mm

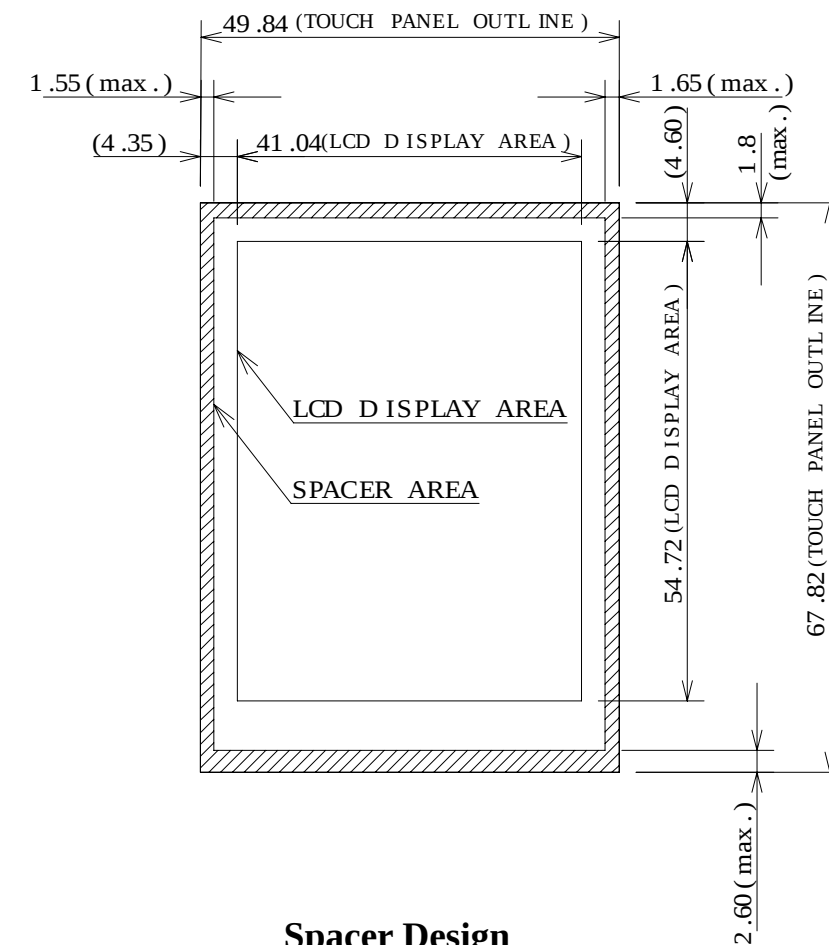
8. RECOMMENDATION DESIGN OF FRONT BEZEL



Front Bezel Opening Design

Design guidance for the front bezel and the spacer

1. Front Bezel opening design
 - a. Please place the front bezel opening to maintain the operation by a stylus pen inside the T/P response area.
 - b. Any pressures in the area between T/P response area and T/P viewing area are prohibited. Please use the appropriate material as the front bezel.
2. Spacer design
 - a. Please put a spacer, a cushion, on the front bezel. Do not use a double-sided adhesive tape because it adheres on the touch panel surface.
 - b. Please position the spacer over the Spacer area to avoid a "short".



Spacer Design

Unit: mm