

TFT COLOR LCD MODULE

NL4827HC19-XXB

**11cm (4.3 Type)
WQVGA**

PRELIMINARY DATA SHEET 
DOD-PP-0313 (1st edition)

**All information is subject to change without notice.
Please confirm the sales representative before
starting to design your system.**

INTRODUCTION

The Copyright to this document belongs to NEC LCD Technologies, Ltd. (hereinafter called "NEC"). No part of this document will be used, reproduced or copied without prior written consent of NEC.

NEC does and will not assume any liability for infringement of patents, copyrights or other intellectual property rights of any third party arising out of or in connection with application of the products described herein except for that directly attributable to mechanisms and workmanship thereof. No license, express or implied, is granted under any patent, copyright or other intellectual property right of NEC.

Some electronic parts/components would fail or malfunction at a certain rate. In spite of every effort to enhance reliability of products by NEC, the possibility of failures and malfunction might not be avoided entirely. To prevent the risks of damage to death, human bodily injury or other property arising out thereof or in connection therewith, each customer is required to take sufficient measures in its safety designs and plans including, but not limited to, redundant system, fire-containment and anti-failure.

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.

The **Standard** quality grade applies to the products developed, designed and manufactured in accordance with the NEC standard quality assurance program, which are designed for such application as any failure or malfunction of the products (sets) or parts/components incorporated therein a customer uses are, directly or indirectly, free of any damage to death, human bodily injury or other property, like general electronic devices.

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.

The **Special** quality grade applies to the products developed, designed and manufactured in accordance with an NEC quality assurance program stricter than the standard one, which are designed for such application as any failure or malfunction of the products (sets) or parts/components incorporated therein a customer uses might directly cause any damage to death, human bodily injury or other property, or such application under more severe condition than that defined in the Standard quality grade without such direct damage.

Examples: Control systems for transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, medical equipment not specifically designed for life support, safety equipment, etc.

The **Specific** quality grade applies to the products developed, designed and manufactured in accordance with the standards or quality assurance program designated by a customer who requires an extremely higher level of reliability and quality for such products.

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.

CONTENTS

INTRODUCTION	2
1. OUTLINE.....	4
1.1 STRUCTURE AND PRINCIPLE	4
1.2 APPLICATION.....	4
1.3 FEATURES	4
2. GENERAL SPECIFICATIONS	5
3. BLOCK DIAGRAM	6
4. DETAILED SPECIFICATIONS	8
4.1 MECHANICAL SPECIFICATIONS.....	8
4.2 ABSOLUTE MAXIMUM RATINGS	8
4.3 ELECTRICAL CHARACTERISTICS.....	9
4.4 POWER SUPPLY VOLTAGE SEQUENCE	10
4.5 INTERFACE PIN CONNECTIONS	11
4.6 DISPLAY COLORS AND INPUT DATA SIGNALS	13
4.7 DISPLAY POSITIONS.....	14
4.8 SCANNING DIRECTIONS	14
4.9 INPUT SIGNAL TIMINGS.....	15
RGB interface (Ta= 25°C, VCC= 2.5V, VDD=5.0V).....	15
4.10 OPTICAL CHARACTERISTICS	19
5. RELIABILITY TESTS	21
6. PRECAUTIONS	22
6.1 MEANING OF CAUTION SIGNS	22
6.2 CAUTIONS	22
6.3 ATTENTIONS	22
6.3.1 Handling of the product.....	22
6.3.2 Environment	23
6.3.3 Characteristics	23
6.3.4 Other	23
7. OUTLINE DRAWINGS	24
8. RECOMMENDATION DESIGN OF FRONT BEZEL	25
REVISION HISTORY	26

1. OUTLINE

1.1 STRUCTURE AND PRINCIPLE

Color LCD module NL4827HC19-XXB 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

- Personal navigation device

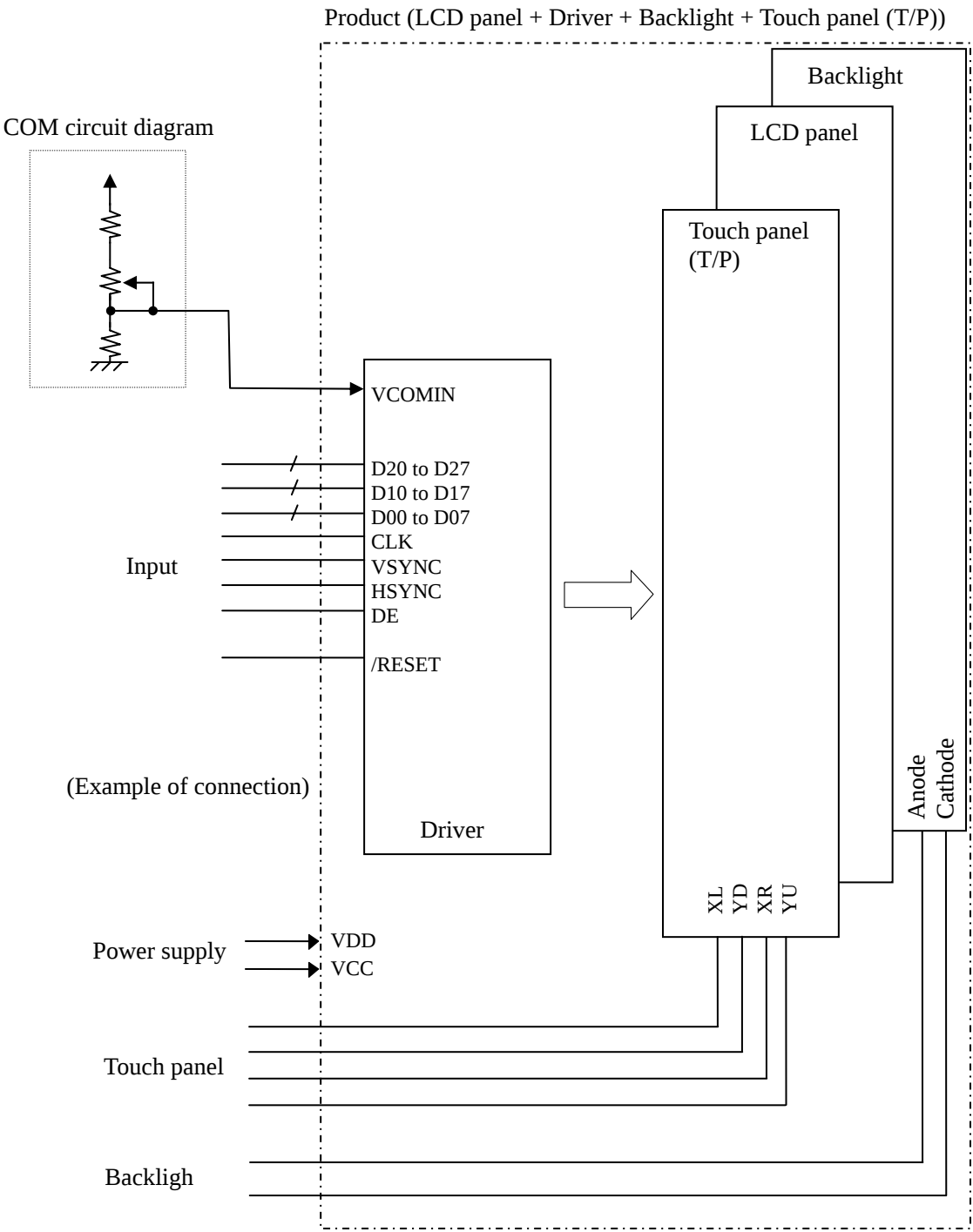
1.3 FEATURES

- Transmissive type
- Backlight and touch panel attached
- High luminance
- High contrast
- Including LCD controller and power supply
- 8-bit digital RGB signals

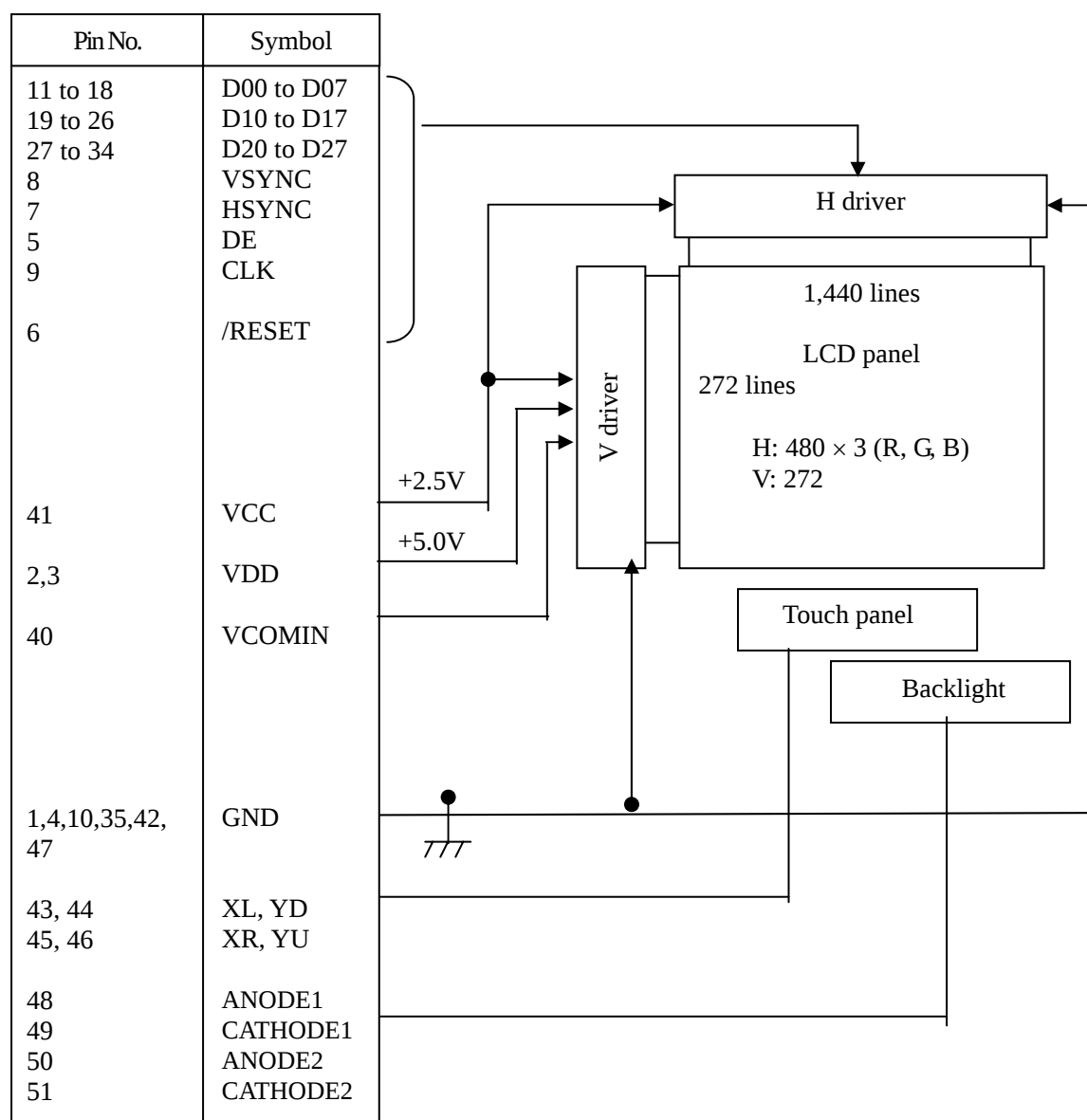
2. GENERAL SPECIFICATIONS

Display area	95.04 (H) × 53.856 (V) mm
Diagonal size of display	11cm (4.3 inches)
Drive system	a-Si TFT active matrix
Display color	16,777,216 colors
Pixel	480 (H) × 272 (V) pixels
Pixel arrangement	RGB (Red dot, Green dot, Blue dot) vertical stripe
Dot pitch	0.066 (H) × 0.198 (V) mm
Pixel pitch	0.198 (H) × 0.198 (V) mm
Module size	105.5 (H) × 67.2 (V) × T.B.D. (D) mm (typ.)
Weight	TBD (typ.)
Touch panel surface	Antiglare
Touch panel pencil-hardness	3H (min.) [by JIS K5400]
Designed viewing direction	Viewing direction without image reversal: down side (6 o'clock)
Luminance	At IL = 20mA, with Touch panel 450cd/m ² (typ.)
Contrast ratio	At IL = 20mA, with Touch panel 500:1 (typ.)
Color gamut	At LCD panel center 60% (typ.) [against NTSC color space]
Response time	Ton + Toff (10% ← → 90%) 25ms (typ.)
Signal system	8-bit digital signals for data of RGB colors, Dot clock (CLK), DE, Horizontal synchronous signal (HSYNC), Vertical synchronous signal (VSYNC), Reset signal (/RESET)
Supply voltage	VCC: 2.5V (typ., for Logic) VDD: 5.0V (typ., for LCD driver)
Power consumption	LCD panel + Driver: TBD (typ.) Backlight: TBD (typ., at IL = 20mA)

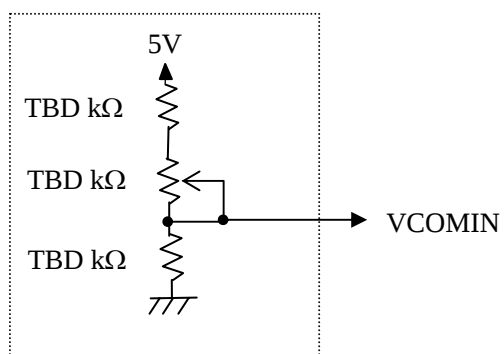
3. BLOCK DIAGRAM



FPC I/F



Reference design of COM circuit



4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification	Unit
Module size	105.5 ± 0.3 (W) $\times$ 67.2 ± 0.3 (H) $\times$ T.B.D. ± 0.3 (D) Note1	mm
Display area	95.04 (H) $\times$ 53.856 (V) Note2	mm
Weight	TBD.	g

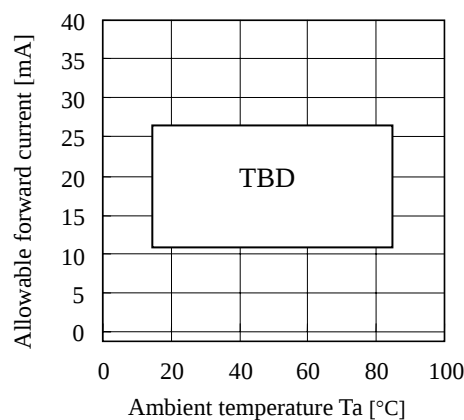
Note1: Excluding FPC

Note2: See "7. OUTLINE DRAWINGS".

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Remarks
Supply voltage	VCC	-0.3 to +6.0	V	Ta= 25°C
	VDD	-0.3 to +6.0		
Logic input voltage	VI	-0.3 to VCC+0.3	V	Logic signals
Backlight	Reverse voltage	VR	≤ 25	Ta= 25°C, These values are applied for both Anode1 and 2.
	Power dissipation	PD	≤ 615	
	Forward current	IL	Note1	-
	Pulse forward current	IFP	100	Pulse width ≤ 10ms, Duty ≤ 1/10
Storage temperature	Tst	(-30 to +80)	°C	-
Operating temperature	Top	-20 to +70		Product surface Note2
Relative humidity Note3	RH	≤ 95	%	Ta ≤ 40°C
		≤ 85		40°C < Ta ≤ 50°C
		≤ 55		50°C < Ta ≤ 60°C
Absolute humidity Note3	AH	≤ 70 Note4	g/m ³	Ta > 60°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= 60°C and RH= 55%

4.3 ELECTRICAL CHARACTERISTICS

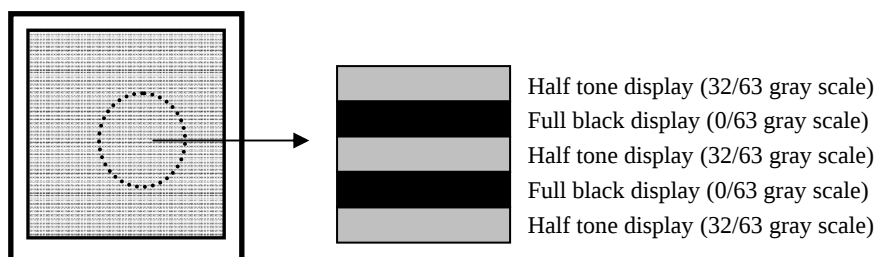
(1) Logic/ LCD driving

(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Logic supply voltage	VCC	TBD	2.5	TBD	V	-
LCD driver supply voltage	VDD	TBD	5.0	TBD	V	-
Logic input high voltage	VIH	0.8VCC	-	VCC	V	Logic signal
Logic input low voltage	VIL	0	-	0.2VCC	V	
COM/C voltage	COM/C	-	TBD	-	V	at VCC= 2.5V, VDD=5.0V Note1
VCC supply current	ICC	-	TBD	TBD	mA	at VCC= 2.5V, VDD=5.0V Note2
VDD supply current	IDD	-	TBD	TBD	mA	at VCC= 2.5V, VDD=5.0V Note2

Note1: The optimum value for COM/C is in the range of TBDV to TBD V.

Recommended adjustment display for COM/C



Note2: PPHCK= 8.69MHz, HSYNC= 16.56kHz, VSYNC= 60Hz,
Checkered flag pattern (by EIAJ ED-2522)

(2) Backlight

(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Forward Current	IL1, 2	-	(20)	TBD	mA	-
Forward Voltage	VL1, 2	-	(16.0)	TBD	V	at IL= 20mA

(3) Touch panel

(Ta= 25°C)

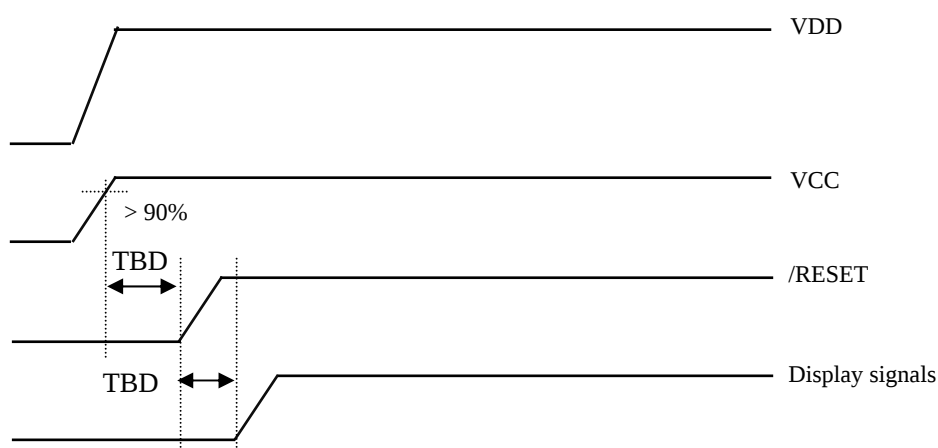
Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Touch panel input voltage	Vtp	-	-	5.5	V	-
Resistor between terminals(XL-XR)	Rx	(370)	-	(990)	Ω	-
Resistor between terminals(YU-YD)	Ry	(160)	-	(520)	Ω	-
Line linearity (X direction)	Xlin	-	-	1.5	%	Note1
Line linearity (Y direction)	Ylin	-	-	1.5	%	Note1
Insulation resistance	Rins	20	-	-	M Ω	at DC 25V
Static capacitance	Ctp	-	-	100	nF	-
Chattering	Chat	-	-	10	ms	Note1
Operation starting force	Ost	-	-	1.177 120	N gf	Note1, Note2
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), 300mm/s, 35mm, 0.5mm inside of Response area.

Note1: Input methods are a Finger or R0.8mm Polyacetal Stylus Pen. Input area is Display area.

Note2: Test condition

Resistance between X and Y axis must be 2k Ω or less, and the test voltage is 5V DC.

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 the signals recover, the LCD module may not be operated correctly. In this case, reset the sequence again.

4.5 INTERFACE PIN CONNECTIONS

CN1 (FPC)

Adaptable socket: (FH23-51S-0.3SHW(06)) (Hirose Electric Co., Ltd.(HRS))

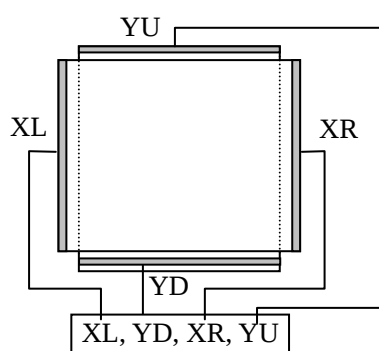
Pin No.	Symbols	Functions	Pin No.	Symbols	Functions
1	GND	Ground Note1	27	D20	Red data (LSB)
2	VDD	Power supply	28	D21	Red data
3	VDD		29	D22	Red data
4	GND	Ground Note1	30	D23	Red data
5	DE	Data enable signal	31	D24	Red data
6	/RESET	Reset	32	D25	Red data
7	HSYNC	Horizontal synchronous signal	33	D26	Red data
8	VSYNC	Vertical synchronous signal	34	D27	Red data (MSB)
9	CLK	Dot clock	35	GND	Ground Note1
10	GND	Ground Note1	36	RSVD	Keep this pin Open.
11	D00	Blue data (LSB)	37	RSVD	Keep this pin Open.
12	D01	Blue data	38	RSVD	Keep this pin Open.
13	D02	Blue data	39	RSVD	Keep this pin Open.
14	D03	Blue data	40	VCOMIN	COM high voltage input
15	D04	Blue data	41	VCC	Power supply (Logic)
16	D05	Blue data	42	GND	Ground Note1
17	D06	Blue data	43	XL	Horizontal terminal (Left side)
18	D07	Blue data (MSB)	44	YD	Vertical terminal (Down side)
19	D10	Green data (LSB)	45	XR	Horizontal terminal (Right side)
20	D11	Green data	46	YU	Vertical terminal (Up side)
21	D12	Green data	47	GND	Ground Note1
22	D13	Green data	48	ANODE1	LED1 voltage (Anode)
23	D14	Green data	49	CATHODE1	LED1 voltage (Cathode)
24	D15	Green data	50	ANODE2	LED2 voltage (Anode)
25	D16	Green data	51	CATHODE2	LED2 voltage (Cathode)
26	D17	Green data (MSB)			

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

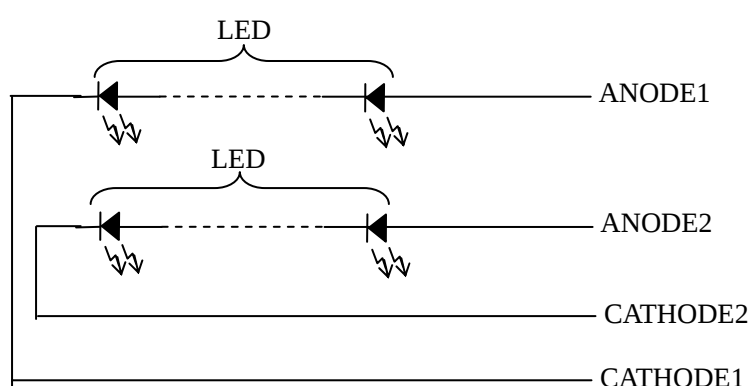
Note2: Do not fold the FPC. When the FPC is folded, pattern disconnection may be caused. In case of bending FPC, the minimum curvature (R) must be more than 1.0 mm.

Description of terminals

Terminals	Description
/RESET	When /RESET is L, an internal reset is performed. The reset operation is executed at the /RESET signal level. Be sure to perform reset via this pin at power application.
VCOMIN	This pin is the Common high voltage. The voltage needs to be adjusted. The details are explained the above. See "3 BLOCK DIAGRAM - Reference design of COM circuit".
YU,XR,YD,XL	Refer to the below "Circuits of touch panel".
ANODE, CATHODE	Refer to the below "Circuits of backlight".



Circuits of touch panel



Circuits of backlight

4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display equivalent of 16,777,216 colors in 256 gray scales by combination.
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)																							
		R7 R6 R5 R4 R3 R2 R1 R0	G7 G6 G5 G4 G3 G2 G1 G0	B7 B6 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	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	0	1	1	1	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	1	1	1	1	0	0	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	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	0
	dark ↑ ↓ bright	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	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	1	1	1	1	1	1	1	1	0	0	0	0	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
	dark ↑ ↓ bright	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	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Green	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	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
	dark ↑ ↓ bright	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	0	0	0	0	0	1	1	1	1	1	0	1	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0
Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	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)

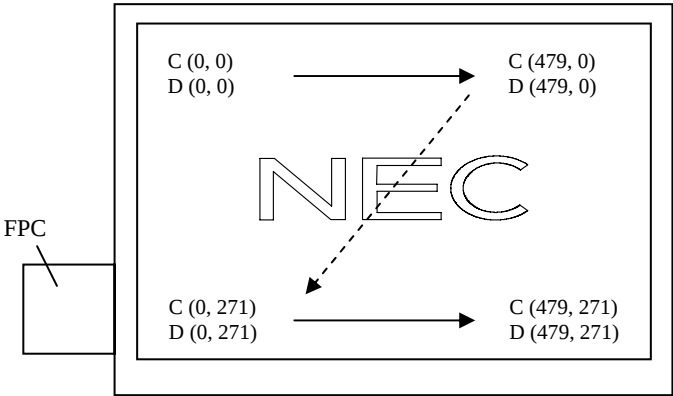
C (1, 0)

R	G	B	R	G	B
---	---	---	---	---	---

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, 270)	C(1, 270)	...	C(X, 270)	...	C(478, 270)	C(479, 270)
C(0, 271)	C(1, 271)	...	C(X, 271)	...	C(478, 271)	C(479, 271)

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

RGB interface (Ta= 25°C, VCC= 2.5V, VDD=5.0V)

(1) Timing characteristics

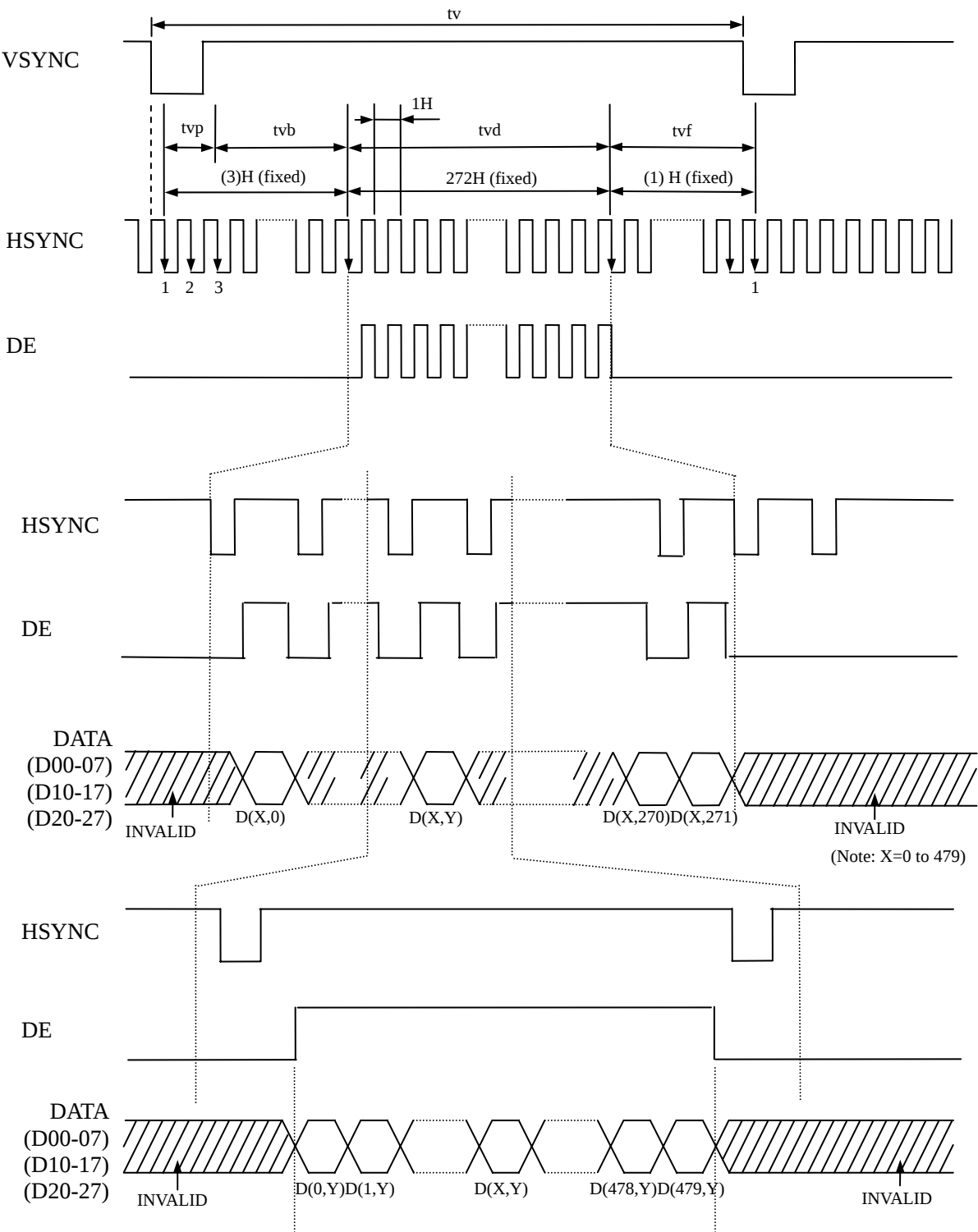
Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	TBD	8.69	TBD	MHz	-
	Duty		tcd	0.4	0.5	0.6	-	-
	Rise time, Fall time		tcrf	-	-	TBD	ns	
DATA (D00-05) (D10-15) (D20-25)	CLK-DATA	Setup time	tds	15	-	-	ns	-
		Hold time	tdh	15	-	-	ns	
	Rise time, Fall time		tdrf	-	-	TBD	ns	
DE	CLK-DE	Setup time	tdes	15	-	-	ns	-
		Hold time	tdeh	15	-	-	ns	
	Rise time, Fall time		tderf	-	-	TBD	ns	
HSYNC	Cycle		th	TBD	60.4	TBD	μs	16.56kHz (typ.)
				(525)			CLK	-
	Display period		thd	480			CLK	
	Front-porch		thf	(2)			CLK	
	Pulse width		thp	(2)	(41)	-	CLK	
	Back-porch		thb	(2)			CLK	
	CLK-HSYNC	Setup time	ths	15	-	-	ns	
		Hold time	thh	15	-	-	ns	
VSYNC	Cycle		tv	TBD	16.59	TBD	ms	60Hz (typ.)
				(276)			H	-
	Display period		tvd	272			H	
	Front-porch		tvf	(1)			H	
	Pulse width		tvp	(1)	(2)	-	H	
	Back-porch		tvb	(1)			H	
	VSYNC-HSYNC timing		tvh	15	-	-	ns	
	Rise time, Fall time		tvrh	-	-	TBD	ns	

Note1: Definition of parameters is as follows.

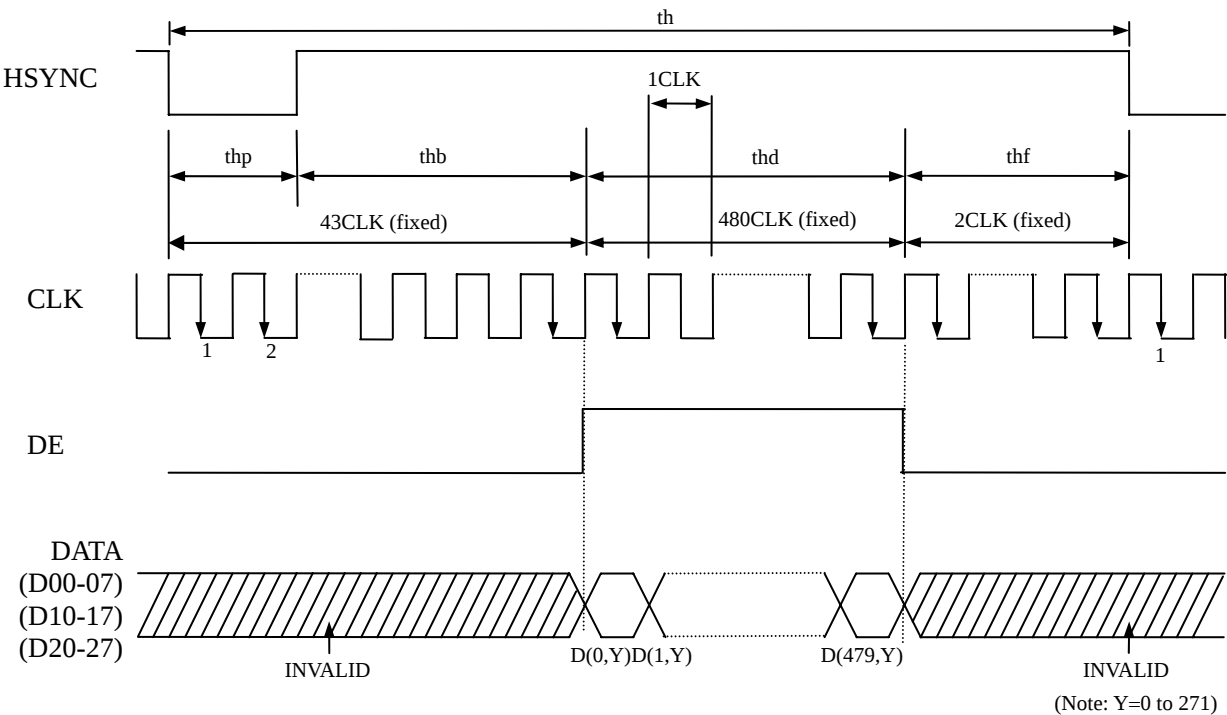
tc= 1CLK, tcd= tch/tc, th= 1H

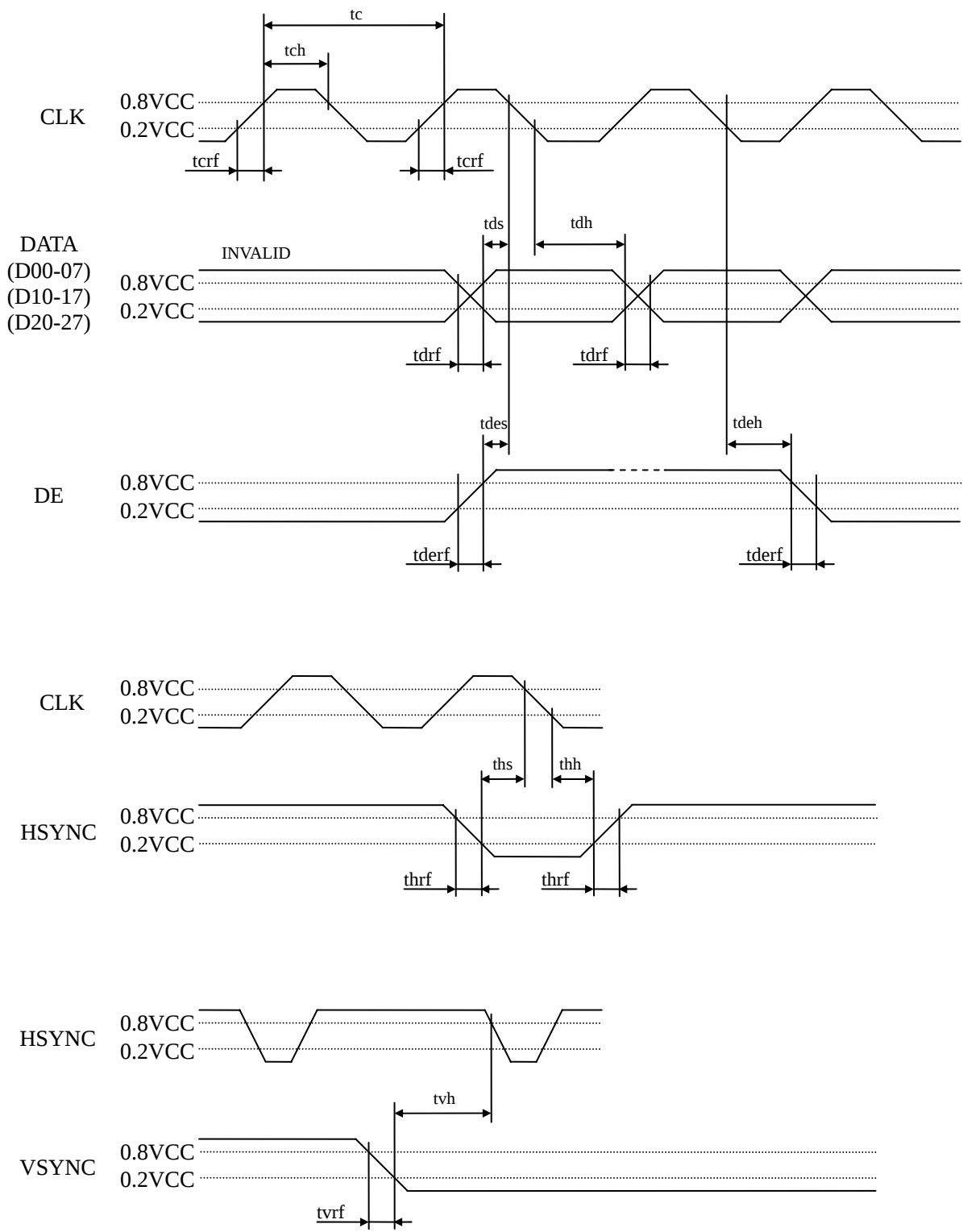
Note2: All parameters should be kept within the specified range.

(2) Input signal timing chart



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





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	280	450	-	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	300	500	-	-	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	80	-	%	Note4

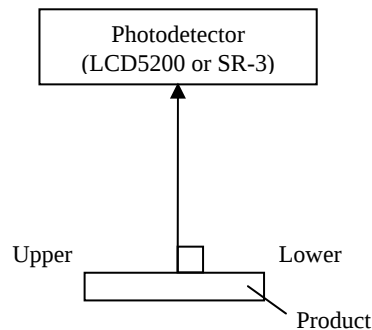
Reference data

(Note1, Note2)

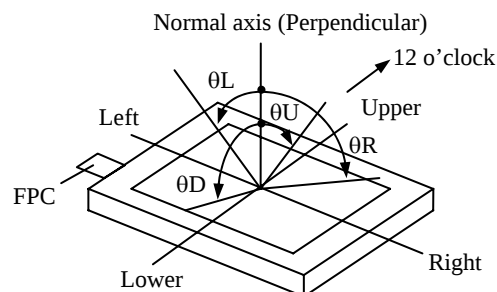
Parameter	Condition	Symbol	min.	typ.	max.	Unit	Remarks
Chromaticity coordinates	White	Wx	-	TBD	-	-	Note5
		Wy	-	TBD	-	-	
Color gamut	$\theta R = 0^\circ, \theta L = 0^\circ, \theta U = 0^\circ, \theta D = 0^\circ$ at center, against NTSC color space	C	50	60	-	%	
Response time	White to black	Ton	-	TBD	-	ms	Note6 Note7
	Black to white	Toff	-	TBD	-		
Viewing angle	Right	$\theta U = 0^\circ, \theta D = 0^\circ, CR \geq 10$	θR	50	-	°	-
	Left	$\theta U = 0^\circ, \theta D = 0^\circ, CR \geq 10$	θL	50	-	°	
	Up	$\theta R = 0^\circ, \theta L = 0^\circ, CR \geq 10$	θU	70	-	°	
	Down	$\theta R = 0^\circ, \theta L = 0^\circ, CR \geq 10$	θD	40	-	°	

Note1: Measurement conditions are as follows.

Ta= 25°C, VCC= 2.5V, VDD= 5.0V, IL= 20mA, with touch panel



Note2: Definition of viewing angles



Note3: Definition of contrast ratio

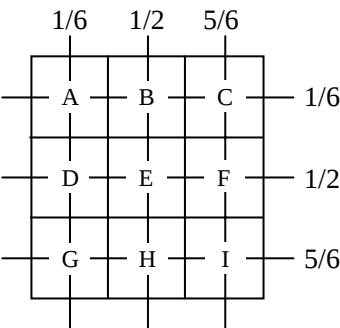
The contrast ratio is calculated by using the following formula.

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.

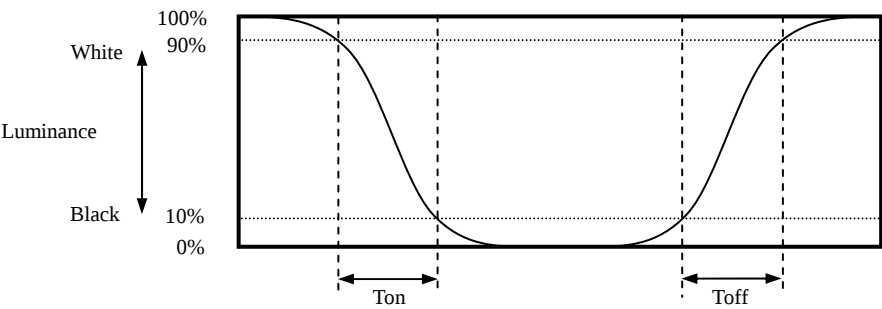
Luminance uniformity (LU) = $\frac{\text{Minimum luminance from A to I}}{\text{Maximum luminance from A to I}} \times 100$



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

(Note1)

Test item	Condition	Judgment
High temperature and humidity (Operation)	① $60 \pm 2^{\circ}\text{C}$, RH= 90%, 240 hours ② Display data is black.	No display malfunctions
Heat cycle (Operation)	① $-20 \pm 3^{\circ}\text{C}$...1 hour $70 \pm 3^{\circ}\text{C}$...1 hour ② 50 cycles, 4 hours/cycle ③ Display data is black.	
Thermal shock (Non operation)	① $(-30) \pm 3^{\circ}\text{C}$...30 minutes $(80) \pm 3^{\circ}\text{C}$...30 minutes ② 100 cycles, 1 hour/cycle ③ Temperature transition time is within 5 minutes.	
Low pressure (Non operation)	① 15kPa ② $(-30) \pm 3^{\circ}\text{C}$...24 hours ③ $(80) \pm 3^{\circ}\text{C}$...24 hours	
Low pressure (Operation)	① 53.3kPa ② $-20 \pm 3^{\circ}\text{C}$...24 hours ③ $70 \pm 3^{\circ}\text{C}$...24 hours	
ESD (Operation)	① 150pF, 150Ω, $\pm 10\text{kV}$ 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	No display malfunctions No physical damages
Vibration (Operation)	① 30 to 100Hz, 19.6m/s^2 (2G) ② 30 minutes/cycle ③ X, Y, Z direction ④ 1 times each directions	
Mechanical shock (Non operation)	① $3,920\text{m/s}^2$, 2.5ms ② $\pm X, \pm Y, \pm Z$ direction ③ 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

- 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 stress such as bends or twist. Bends, twist or any 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 touch panel with hard materials, because it is easily scratched. (Touch panel pencil-hardness: 3H)
- ⑦ When cleaning the T/P surface, wipe it with a soft dry cloth.
- ⑧ Do not push nor 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 If the product is subjected to direct sunlight for a long time, touch panel transmission may be degraded.

6.3.2 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 for dusts and sunlight, when storing the product.
- ② 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)
- ③ Do not operate in high magnetic field. Circuits may be broken down by it.
- ④ This product is not designed as radiation hardened.

6.3.3 Characteristics

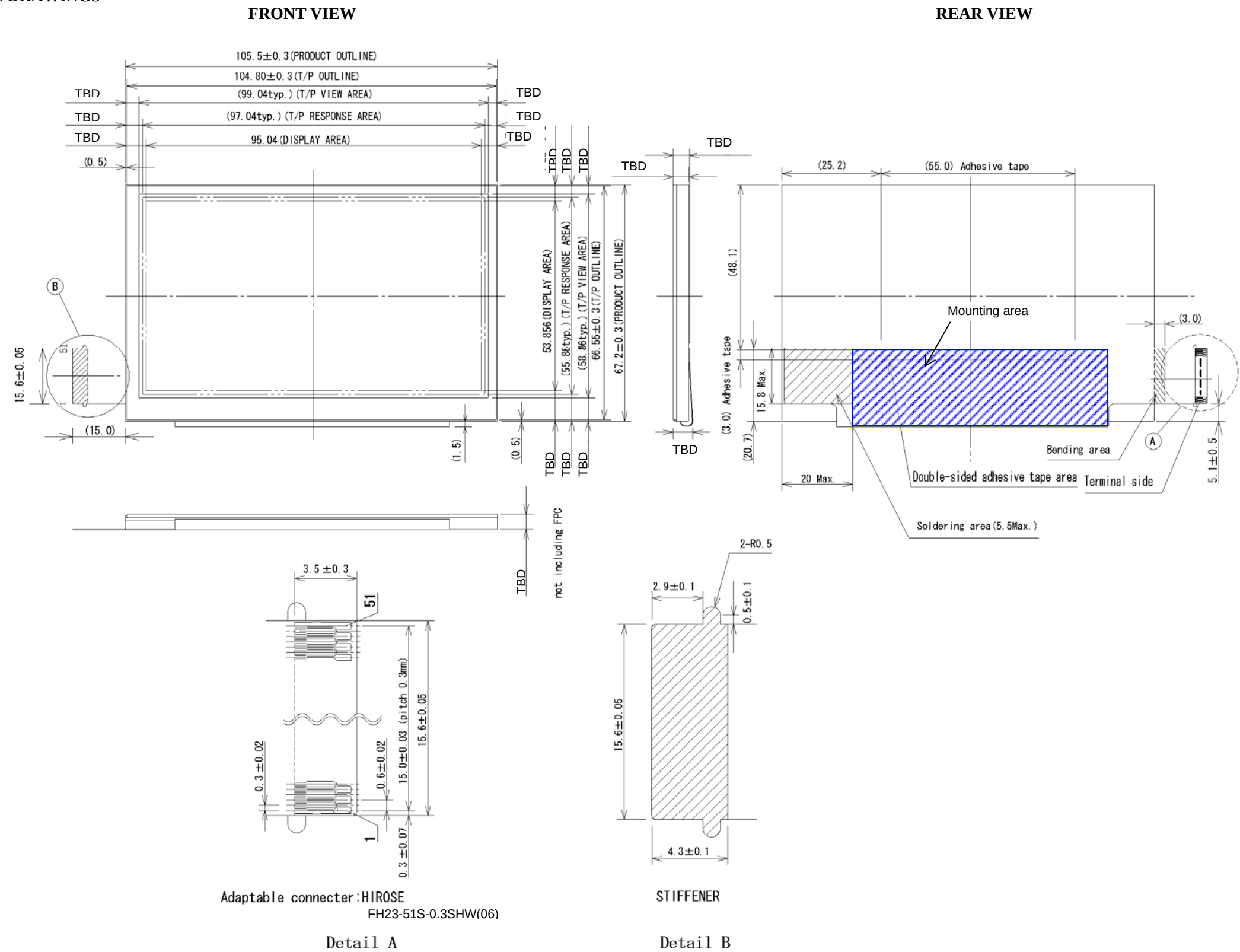
The following items are neither defects nor failures.

- ① Response time, luminance and color may be changed by ambient temperature.
- ② Display mura, flicker, vertical seam or small spot 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.
- ⑤ 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

- ① All GND terminals should be used without any non-connected lines.
- ② Do not disassemble the product.
- ③ Pack the product with original shipping package, in order to avoid any damages during transportation, when returning the product to NEC.

7. OUTLINE DRAWINGS

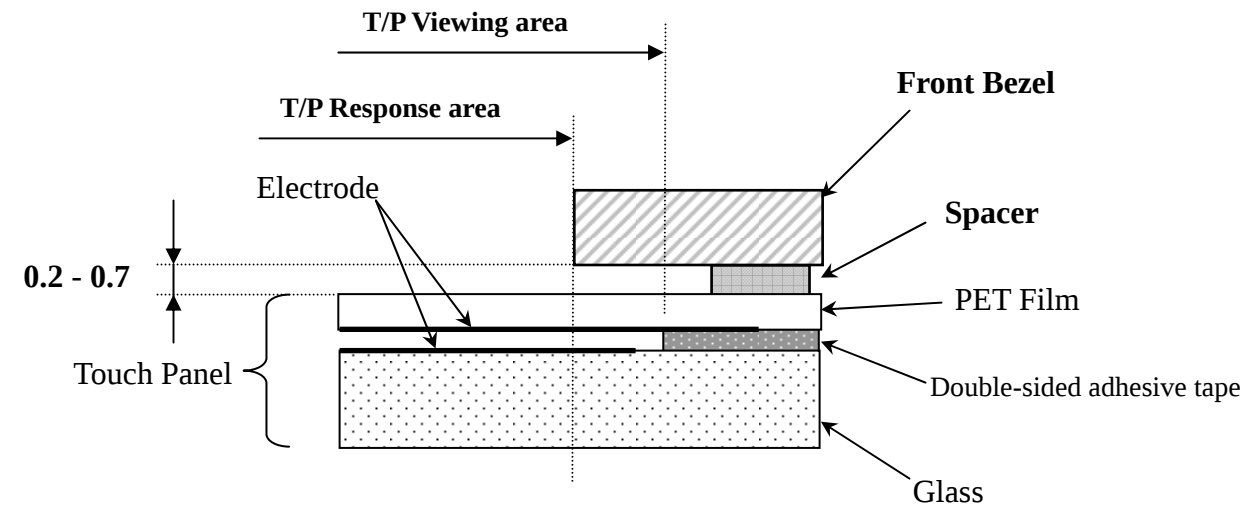


Pin No.	Symbol	Pin No.	Symbol
1	GND	26	D17
2	VDD	27	D20
3	VDD	28	D21
4	GND	29	D22
5	DE	30	D23
6	/RESET	31	D24
7	HSYNC	32	D25
8	VSYNC	33	D26
9	CLK	34	D27
10	GND	35	GND
11	D00	36	RSVD
12	D01	37	RSVD
13	D02	38	RSVD
14	D03	39	RSVD
15	D04	40	VCOMIN
16	D05	41	VCC
17	D06	42	GND
18	D07	43	XL
19	D10	44	YD
20	D11	45	XR
21	D12	46	YU
22	D13	47	GND
23	D14	48	ANODE1
24	D15	49	CATHODE1
25	D16	50	ANODE2
		51	CATHODE2

Note1: The values in parentheses are for reference.
Note2: When installing the product to the customer equipment, do not apply any stress to rear side of the product, FPC, Soldering Area and Mounting Area.
If not, it may cause display mura 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 Mounting Area of the FPC.

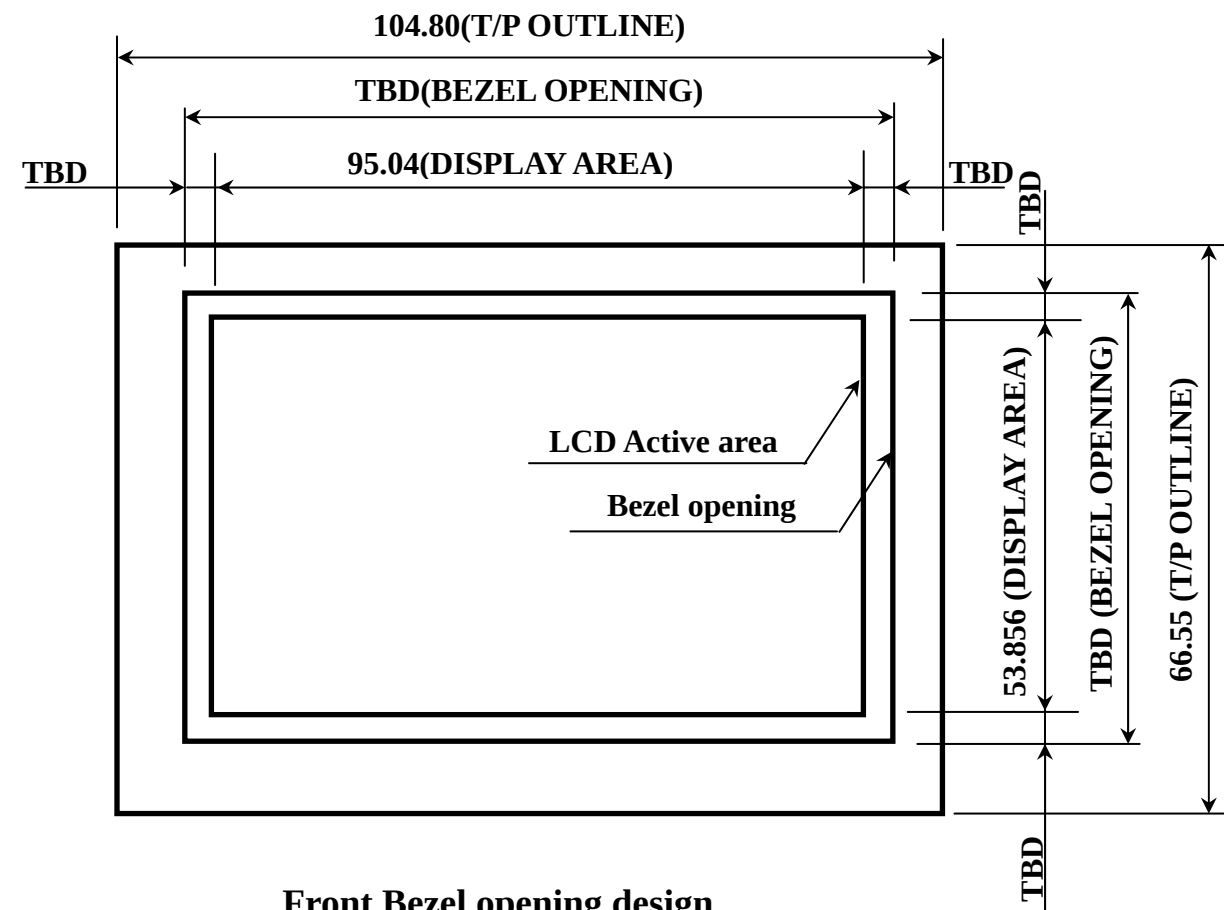
Unit: mm

8. RECOMMENDATION DESIGN OF FRONT BEZEL

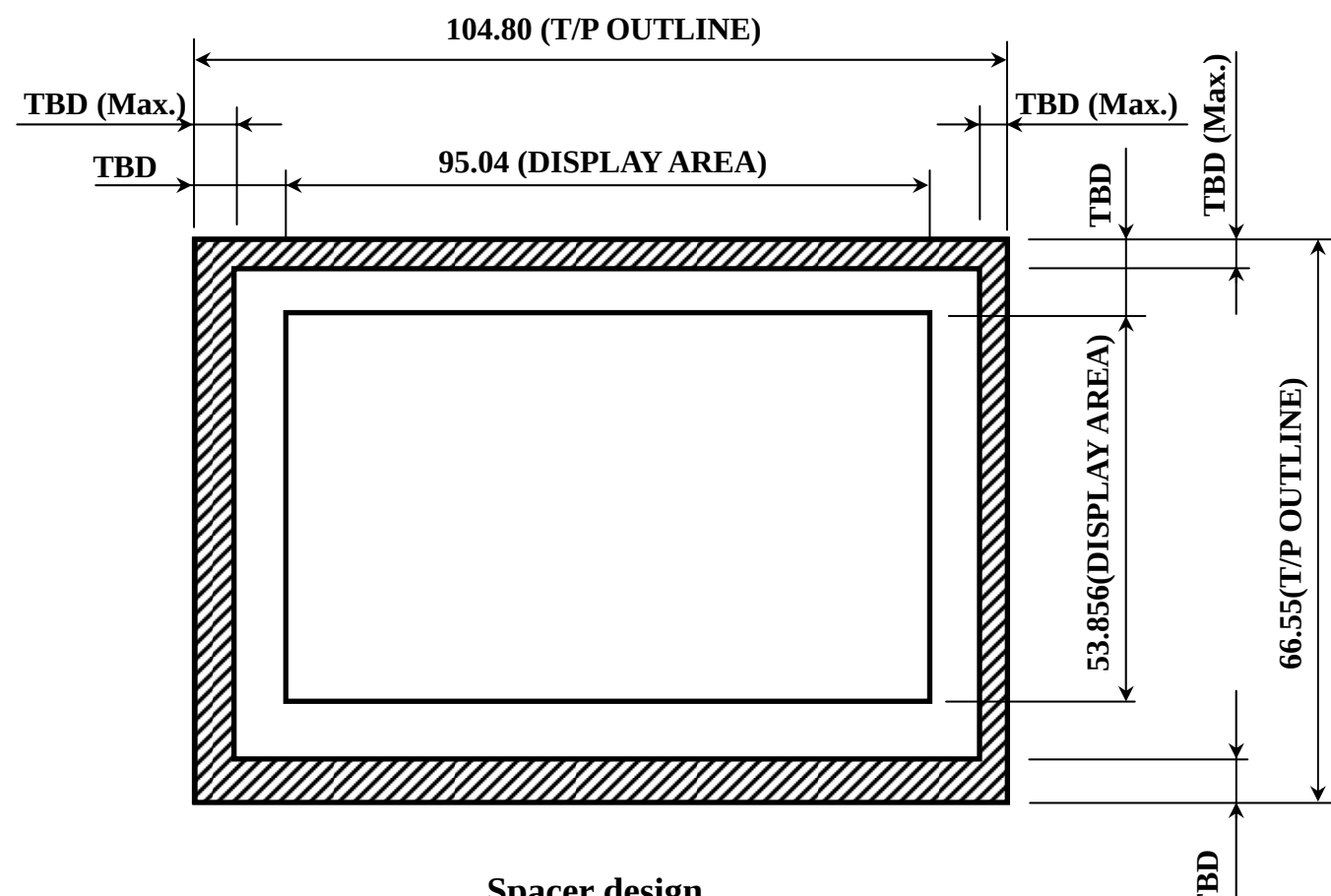


Design guidance for a front bezel and a spacer

1. Front Bezel opening design
 - a. Please place a 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 an 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”.



Front Bezel opening design



Spacer design

Unit: mm

REVISION HISTORY

The inside of latest specifications is revised to the clerical error and the major improvement of previous edition. Only a changed part such as functions, characteristic value and so on that may affect a design of customers, are described especially below.

Edition	Document number	Prepared date	Revision contents and signature
1st edition	DOD-PP-	July. 13, 2007	Revision contents New issue Signature of writer Approved by <i>T. Ogawa</i> T. OGAWA Checked by Prepared by <i>T. Ogawa</i> T. OGAWA