PRELIMINARY

NEC LCD Technologies, Ltd.

TFT COLOR LCD MODULE

NL4827HC19-05A

11cm (4.3 Type)
WQVGA

PRELIMINARY DATA SHEET

DOD-PP-0397 (2nd edition)

RoHS Compliant 2002/95/EC

This PRELIMINARY DATA SHEET is updated document from DOD-PP-0360(1).

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

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: 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

1. OUTLINE

1.1 STRUCTURE AND PRINCIPLE

Color LCD module NL4827HC19-05A 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

- Personal navigation device

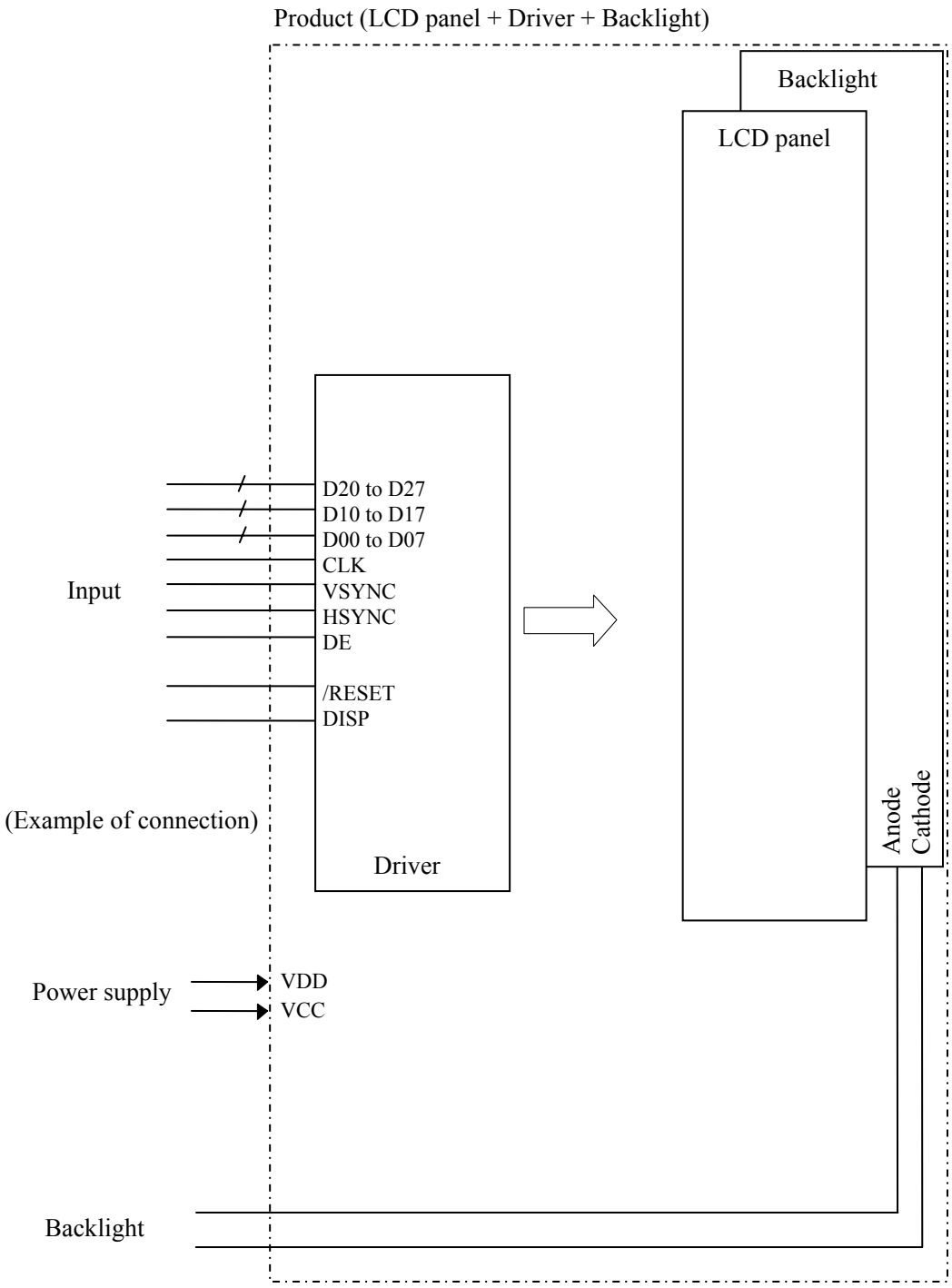
1.3 FEATURES

- Transmissive type
- Backlight 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) × 3.8 (D) mm (typ.)	2
Weight	51 (typ.)	2
Polarizer surface	Clear	
Polarizer pencil-hardness	3H (min.) [by JIS K5400]	
Designed viewing direction	Viewing direction without image reversal: down side (6 o'clock)	
Luminance	*At IL= 20mA* 600cd/m^2 (typ.)	2
Contrast ratio	*At IL= 20mA* 500:1 (typ.)	
Color gamut	*At LCD panel center* 60% (typ.) [against NTSC color space]	
Response time	*Ton+Toff (10%←→ 90%)* 33ms (typ.)	2
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: 3.0V (typ., for Logic) VDD: 5.0V (typ., for LCD driver)	2
Power consumption	LCD panel + Driver: (125) mW (typ.) Backlight: (512) mW (typ., at IL= 20mA)	2

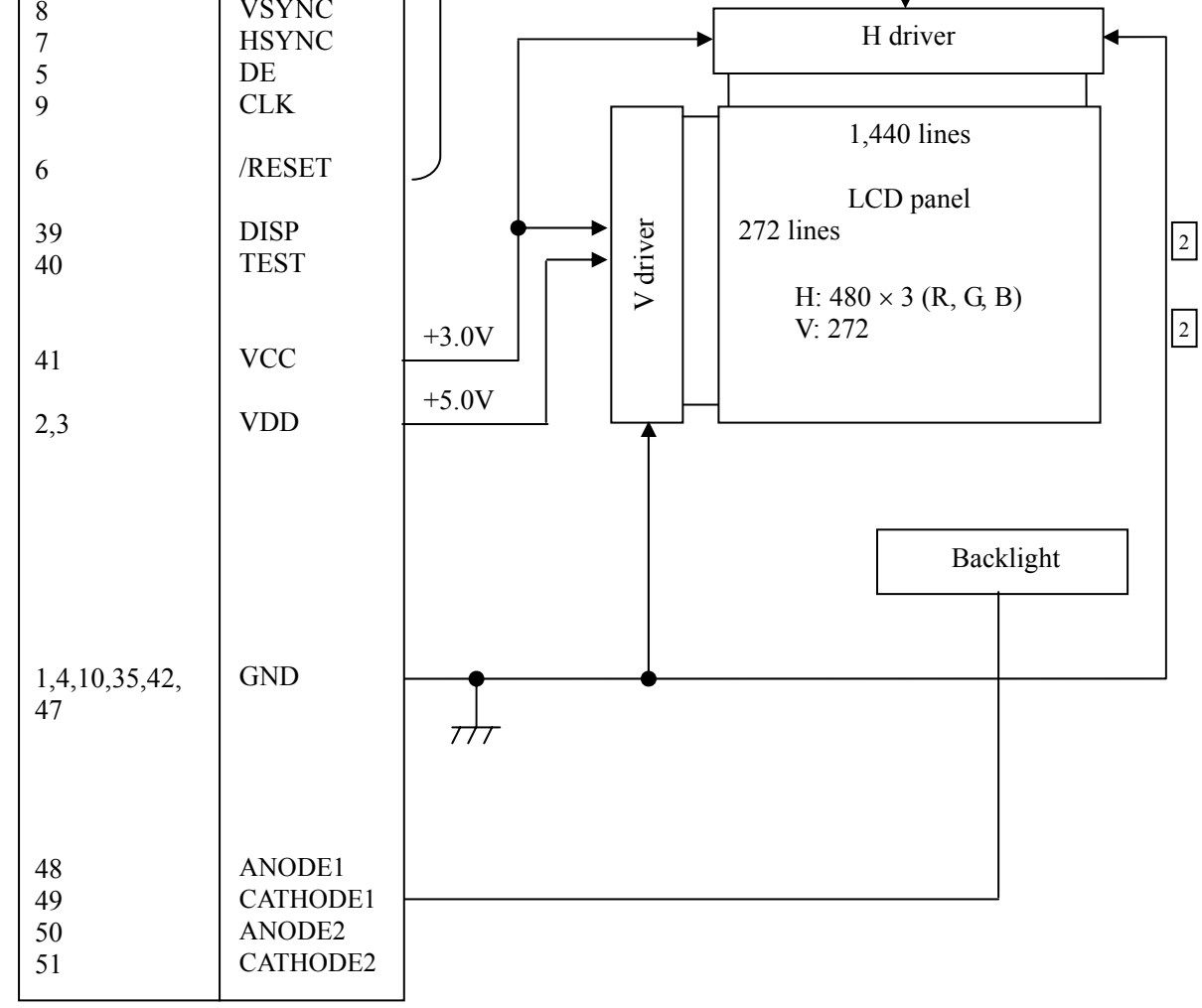
3. BLOCK DIAGRAM



2

FPC I/F

Pin No.	Symbol
11 to 18	D00 to D07
19 to 26	D10 to D17
27 to 34	D20 to D27
8	VSYNC
7	HSYNC
5	DE
9	CLK
6	/RESET
39	DISP
40	TEST
41	VCC
2,3	VDD
1,4,10,35,42, 47	GND
48	ANODE1
49	CATHODE1
50	ANODE2
51	CATHODE2



4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

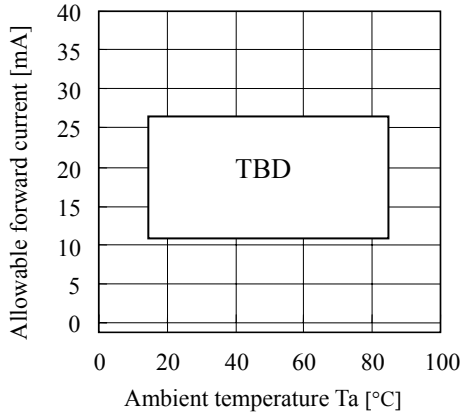
Parameter	Specification		Unit	
Module size	105.5 ± 0.3 (W) × 67.2 ± 0.3 (H) × 3.8 ± 0.3 (D) Note1	Note2	mm	2
Display area	95.04 (H) × 53.856 (V)	Note2	mm	
Weight	51 (typ.), 53 (max.)		g	2

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	≤ 20	V	Ta= 25°C, These values are applied for both Anode1 and 2.	2
	Power dissipation	PD	≤ 492	mW		2
	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 Note3		RH	≤ 95	%	Ta≤ 40°C	
			≤ 85		40°C <Ta≤ 50°C	
			≤ 55		50°C <Ta≤ 60°C	
			≤ 36		60°C <Ta≤ 70°C	2
Absolute humidity Note3		AH	≤ 70 Note4	g/m^3	Ta> 70°C	2
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% 2

4.3 ELECTRICAL CHARACTERISTICS

(1) Logic/ LCD driving

(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks	
Logic supply voltage	VCC	2.3	3.0	3.6	V	-	2
LCD driver supply voltage	VDD	4.8	5.0	5.2	V	-	2
Logic input high voltage	VIH	0.7VCC	-	VCC	V	Logic signal	2
Logic input low voltage	VIL	0	-	0.2VCC	V		
VCC supply current	ICC	-	(4.0)	TBD	mA	at VCC= 3.0V, VDD=5.0V Note1	2
VDD supply current	IDD	-	(22.5)	TBD	mA	at VCC= 3.0V, VDD=5.0V Note1	2

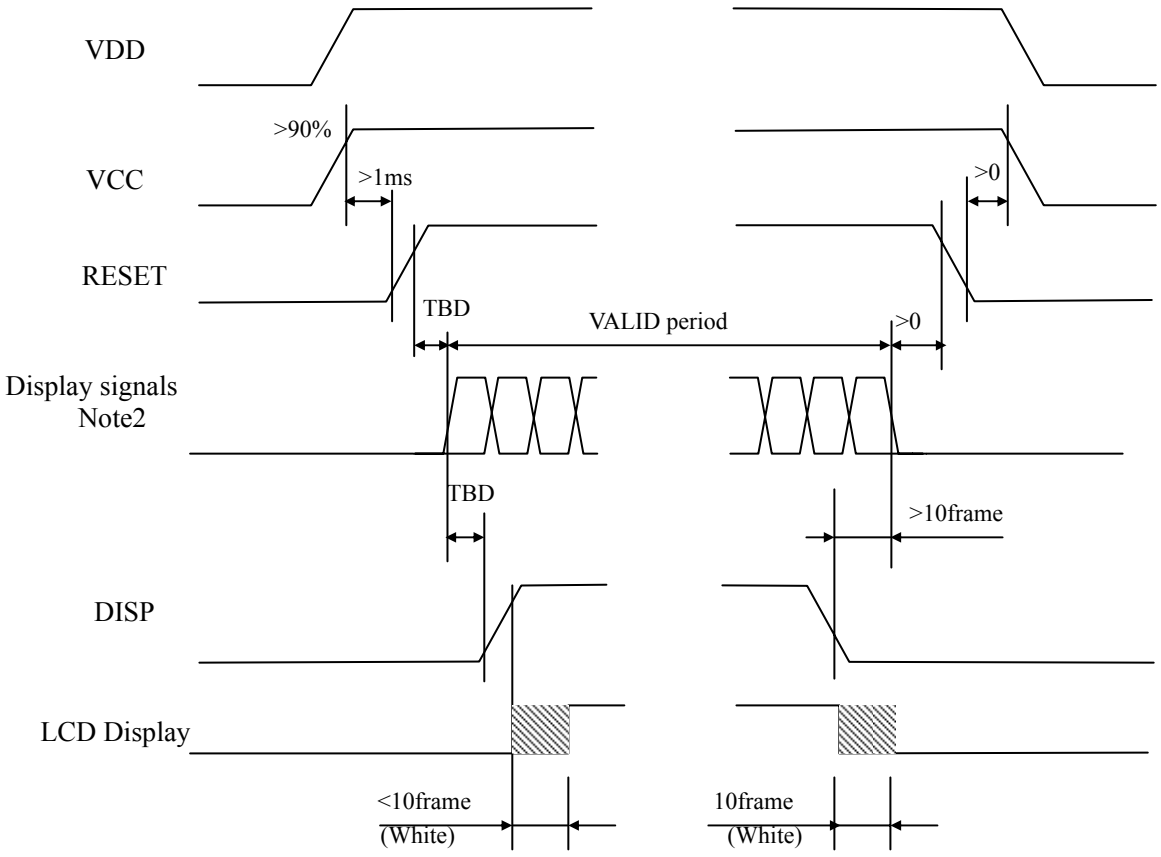
Note1: PPHCK=, (10.87)MHz, HSYNC= (20.7)kHz, VSYNC= (75)Hz 2
Checkered flag pattern (by EIAJ ED-2522)

(2) Backlight

(Ta= 25°C)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks	
Forward Current	IL1, 2	-	(20)	TBD	mA	-	
Forward Voltage	VL1, 2	-	(12.8)	14	V	at IL= 20mA	2

4.4 POWER SUPPLY VOLTAGE SEQUENCE



2

Note1: Supply voltage sequence must be followed above sequence diagram. 2
Note2: Display signals (CLK, HSYNC, VSYNC, DE, R0 to R7, G0 to G7, B0 to B7) must be Low or High-impedance, exclude the VALID period (See above sequence diagram), in order to avoid that internal circuits is damaged. 2
Note3: 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))

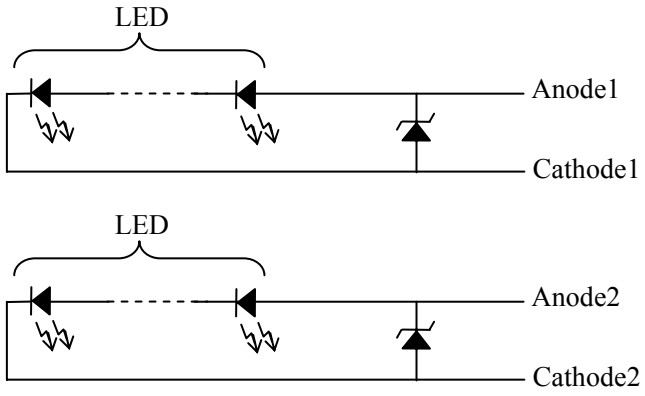
Pin No.	Symbols	Functions	Pin No.	Symbols	Functions
1	GND	Ground Note1	27	D20	Red data (LSB)
2	VDD	Power supply	28	D21	Red data
3	VDD		29	D22	Red data
4	GND	Ground Note1	30	D23	Red data
5	DE	Data enable signal	31	D24	Red data
6	/RESET	Reset	32	D25	Red data
7	HSYNC	Horizontal synchronous signal	33	D26	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	DISP	Display ON/OFF
14	D03	Blue data	40	TEST	Keep this pin H. 2
15	D04	Blue data	41	VCC	Power supply (Logic)
16	D05	Blue data	42	GND	Ground Note1
17	D06	Blue data	43	N. C.	Keep this pin Open.
18	D07	Blue data (MSB)	44	N. C.	Keep this pin Open.
19	D10	Green data (LSB)	45	N. C.	Keep this pin Open.
20	D11	Green data	46	N. C.	Keep this pin Open.
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.
DISP	Display ON/ OFF mode control. Internally pulled high. When DISP is L, input data is invalid and display OFF (white).
ANODE, CATHODE	Refer to the below "**Circuits of backlight**".

2



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Circuits of backlight

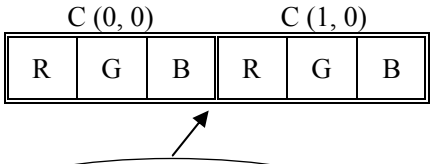
4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	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
		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	dark	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑					:								:								:			
	↓					:								:								:			
	bright	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
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	↑					:								:								:			
	↓					:								:								:			
	bright	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
	Green	0	0	0	0	0	0	0	0	1	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
		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	0	0	0	0	0	0	1	0
	↑					:								:								:			
	↓					:								:								:			
	bright	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
	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

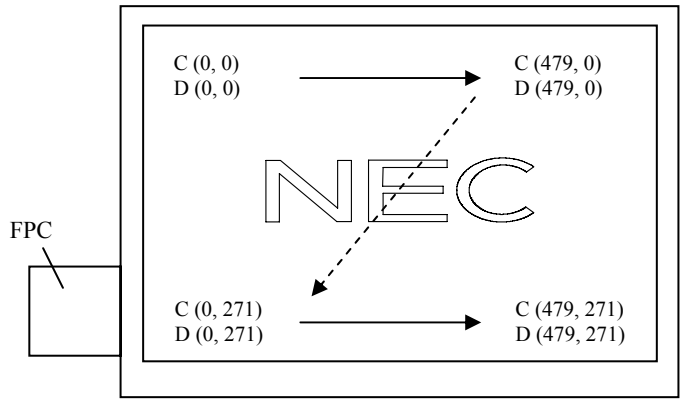
The following table is the coordinates per pixel (See figure of "**4.8 SCANNING DIRECTIONS**".).



C(0, 0)	C(1, 0)	•••	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

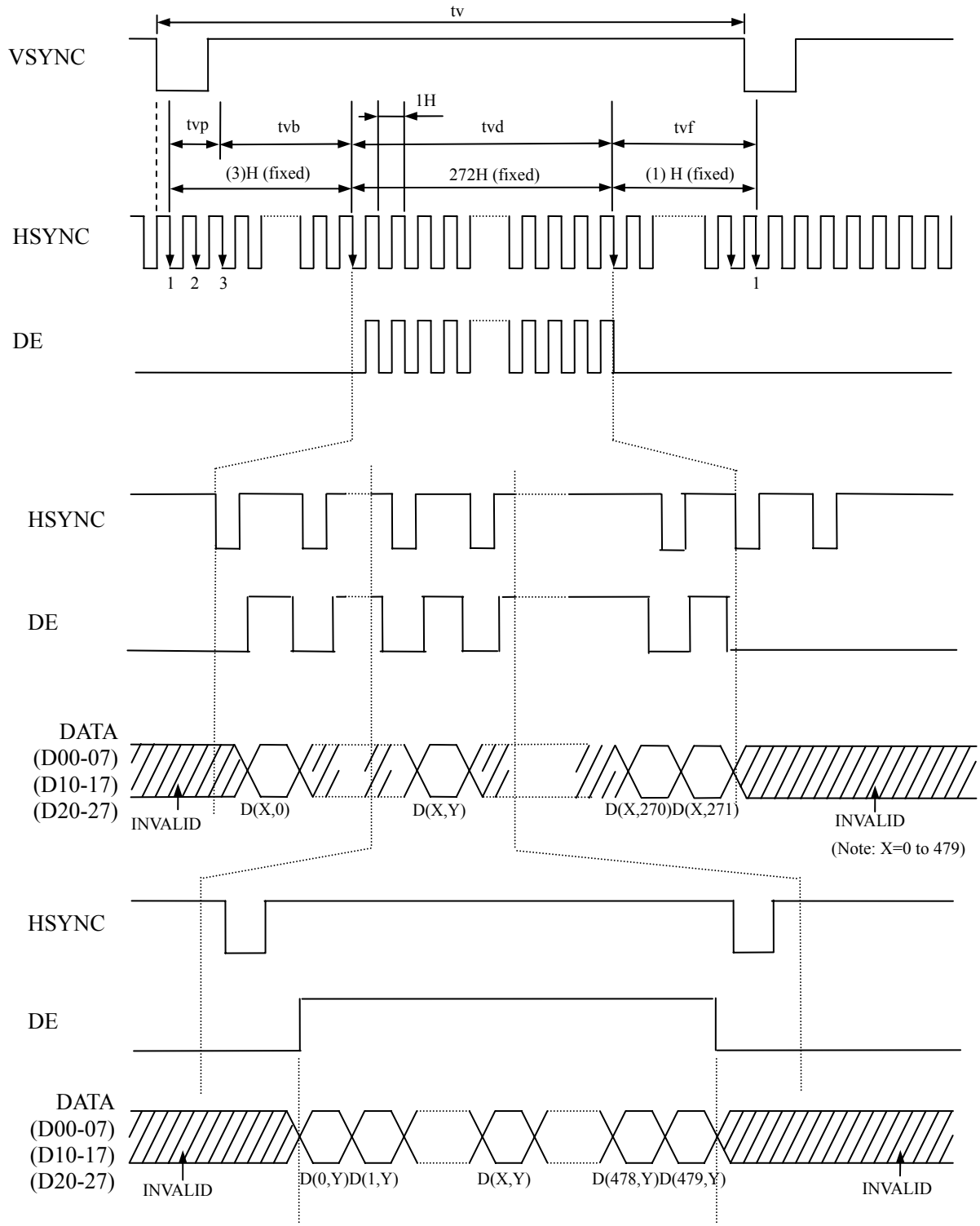
RGB interface (Ta= 25°C, VCC= 3.0V, VDD=5.0V) 2

(1) Timing characteristics

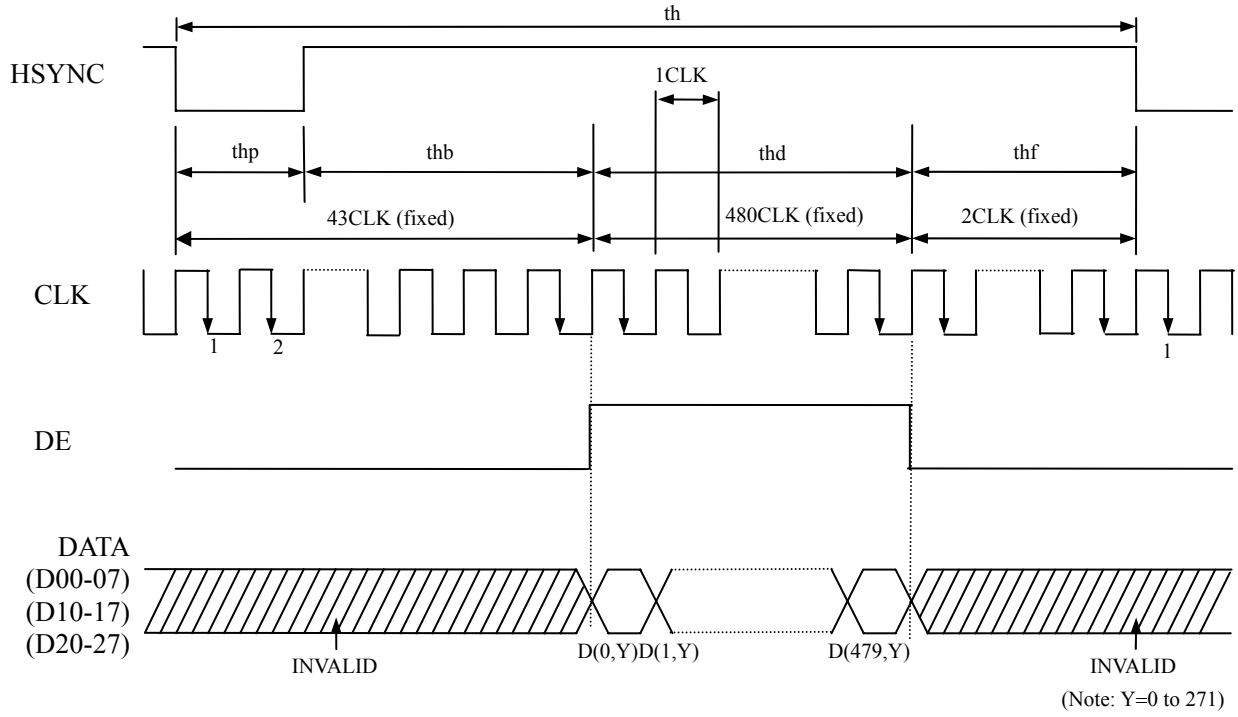
Parameter			Symbol	min.	typ.	max.	Unit	Remarks	
CLK	Frequency		1/tc	(8.69)	(10.87)	TBD	MHz	-	2
	Duty		tcd	0.4	0.5	0.6	-	-	
	Rise time, Fall time		tcrf	-	-	(2)	ns		2
DATA (D00-05) (D10-15) (D20-25)	CLK-DATA	Setup time	tds	15	-	-	ns	-	
		Hold time	tdh	15	-	-	ns		
	Rise time, Fall time		tdrf	-	-	(2)	ns		2
DE	CLK-DE	Setup time	tdes	15	-	-	ns	-	
		Hold time	tdeh	15	-	-	ns		
	Rise time, Fall time		tderf	-	-	(2)	ns		2
HSYNC	Cycle		th	TBD	(48.3)	(60.4)	µs	(20.7)kHz (typ.)	2
				(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		
	Rise time, Fall time		thrf	-	-	(2)	ns		2
VSYNC	Cycle		tv	TBD	(13.33)	(16.67)	ms	(75)Hz (typ.)	2
				(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	Setup time	tvhs	15	-	-	ns		2
		Hold time	tvhh	15	-	-	ns		
	Rise time, Fall time		tvrf	-	-	(2)	ns		2
DISP	DISP-VSYNC	Setup time	tdiss	15	-	-	ns	-	2
		Hold time	tdish	15	-	-	ns		
	Rise time, Fall time		tdisrf	-	-	(2)	ns		

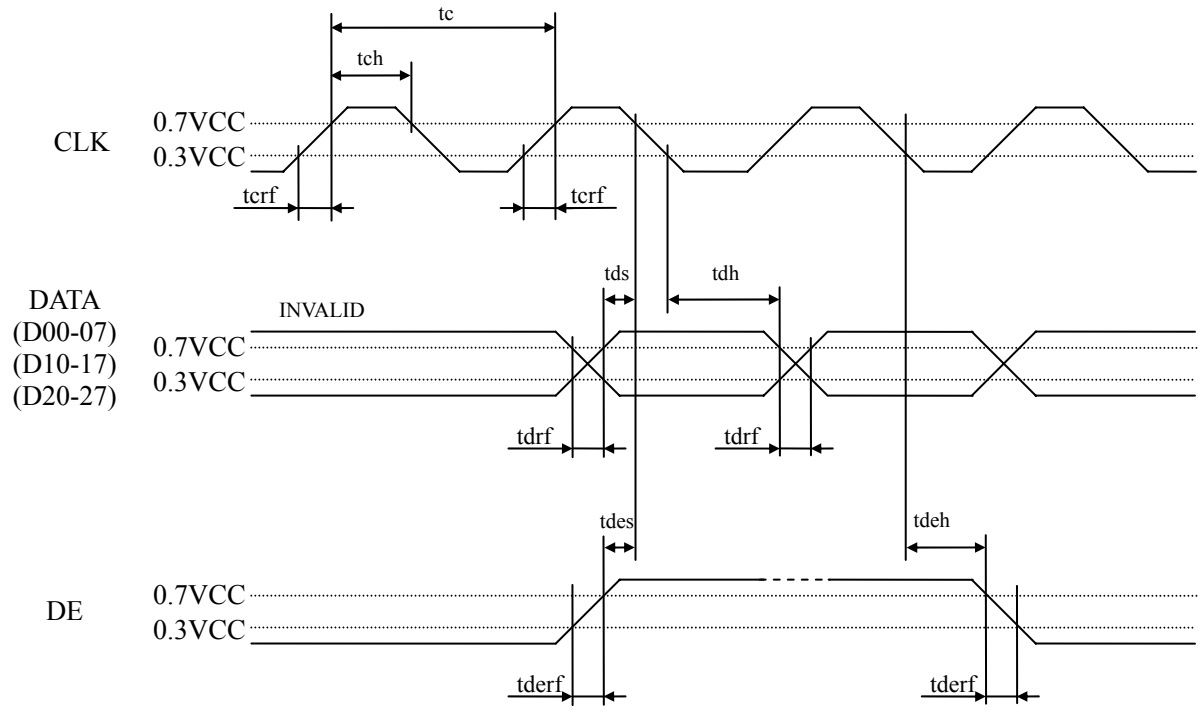
Note1: Definition of parameters is as follows.
tc= 1CLK, tcd= tch/tc, th= 1H
Note2: All parameters should be kept within the specified range.

(2) Input signal timing chart



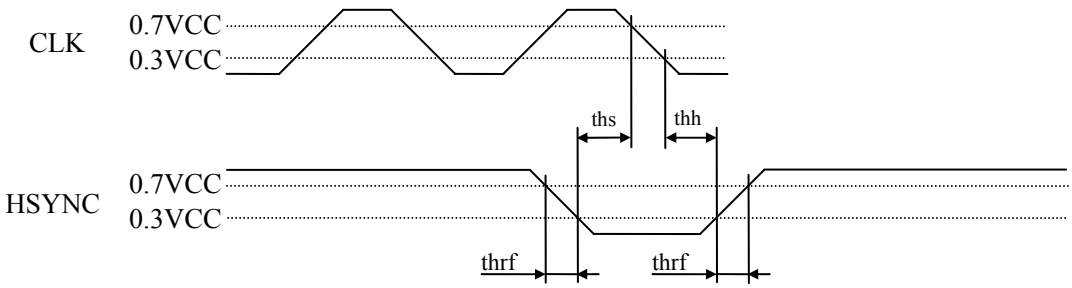
Note1: Unless otherwise specified, the input level is defined to be VIH= 0.7VCC, VIL= 0.3VCC. 2

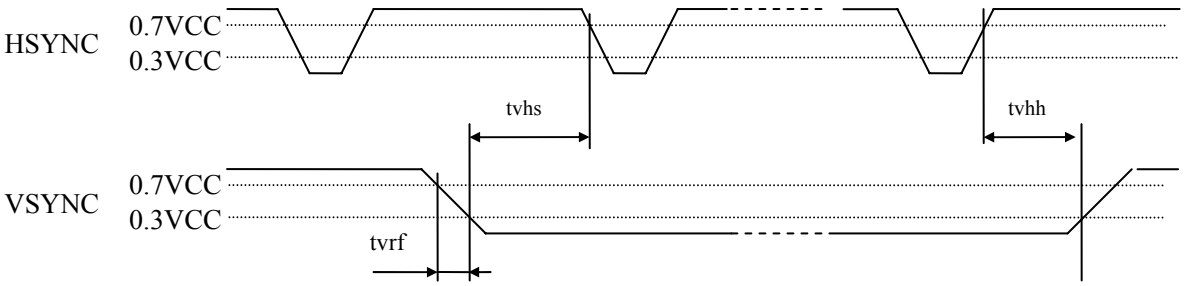

th
HSYNC
1CLK
thp
thb
thd
thf
43CLK (fixed)
480CLK (fixed)
2CLK (fixed)
CLK
1
2
1
DE
DATA
(D00-07)
(D10-17)
(D20-27)
INVALID
D(0,Y)D(1,Y)
D(479,Y)
INVALID
(Note: Y=0 to 271)


tc
tch
CLK
0.7VCC
0.3VCC
tcrf
tcrf
tds
tdh
DATA
(D00-07)
(D10-17)
(D20-27)
INVALID
0.7VCC
0.3VCC
tdrf
tdrf
tdes
tdeh
DE
0.7VCC
0.3VCC
tderf
tderf

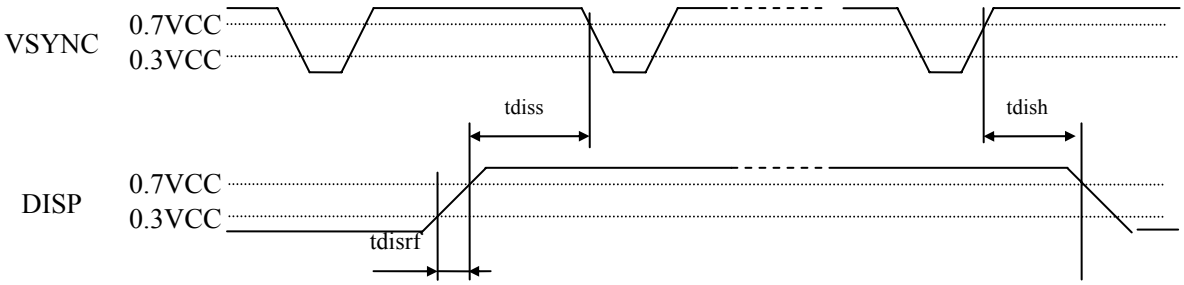
2

2





2



2

Note1: Unless otherwise specified, the input level is defined to be VIH= 0.7VCC, VIL= 0.3VCC.

2

4.10 OPTICAL CHARACTERISTICS

(Note1, Note2)

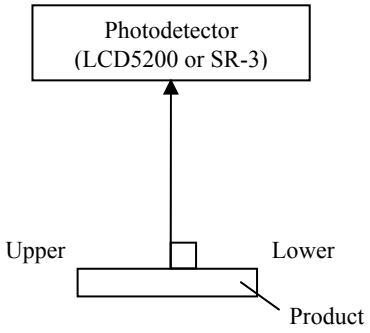
Parameter	Condition	Symbol	min.	typ.	max.	Unit	Remarks	
Luminance	White at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	L	TBD	600	-	cd/m^2	-	2
Contrast ratio	White/Black at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	CR	300	500	-	-	Note3	
Luminance uniformity	White θR= 0°, θL= 0°, θU= 0°, θD= 0° Maximum luminance: 100%	LU	70	80	-	%	Note4	2

Reference data

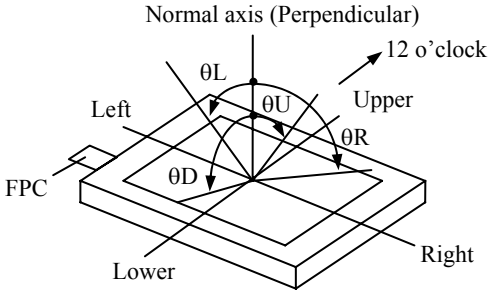
(Note1, Note2)

Parameter		Condition		Symbol	min.	typ.	max.	Unit	Remarks	
Chromaticity coordinates		White		Wx	-	TBD	-	-	Note5	
				Wy	-	TBD	-	-		
Color gamut		θR= 0°, θL= 0°, θU= 0°, θD= 0° at center, against NTSC color space		C	50	60	-	%		
Response time		White to black	90%→ 10%	Ton	-	8	-	ms	Note6 Note7	2
		Black to white	10%→ 90%	Toff	-	25	-			
Viewing angle	Right	θU= 0°, θD= 0°, CR≥ 10		θR	-	60	-	°	-	
	Left	θU= 0°, θD= 0°, CR≥ 10		θL	-	60	-	°		2
	Up	θR= 0°, θL= 0°, CR≥ 10		θU	-	60	-	°		
	Down	θR= 0°, θL= 0°, CR≥ 10		θD	-	40	-	°		

Note1: Measurement conditions are as follows.
Ta= 25°C, VCC= 3.0V, VDD= 5.0V, IL= 20mA, with touch panel 2



Note2: Definition of viewing angles



Note3: Definition of contrast ratio

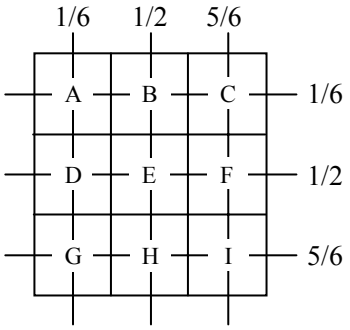
The contrast ratio is calculated by using the following formula.

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

Note4: Definition of luminance uniformity

Luminance uniformity is calculated by using the following formula.

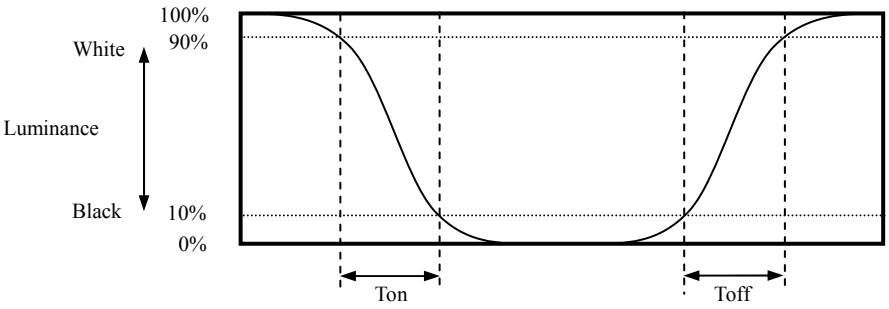
$$\text{Luminance uniformity (LU)} = \frac{\text{Minimum luminance from A to I}}{\text{Maximum luminance from A to I}} \times 100$$



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

(Note1)

Test item	Condition	Judgment
High temperature and humidity (Operation)	① 60 ± 2°C, RH= 90%, 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 53.3kPa 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 (2G) ② 30 minutes/cycle ③ X, Y, Z direction ④ 1 times each directions	No display malfunctions No physical damages
Mechanical shock (Non operation)	① 3,920m/s^2 , 2.5ms ② ±X, ±Y, ±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/s^2 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. (Polarizer 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

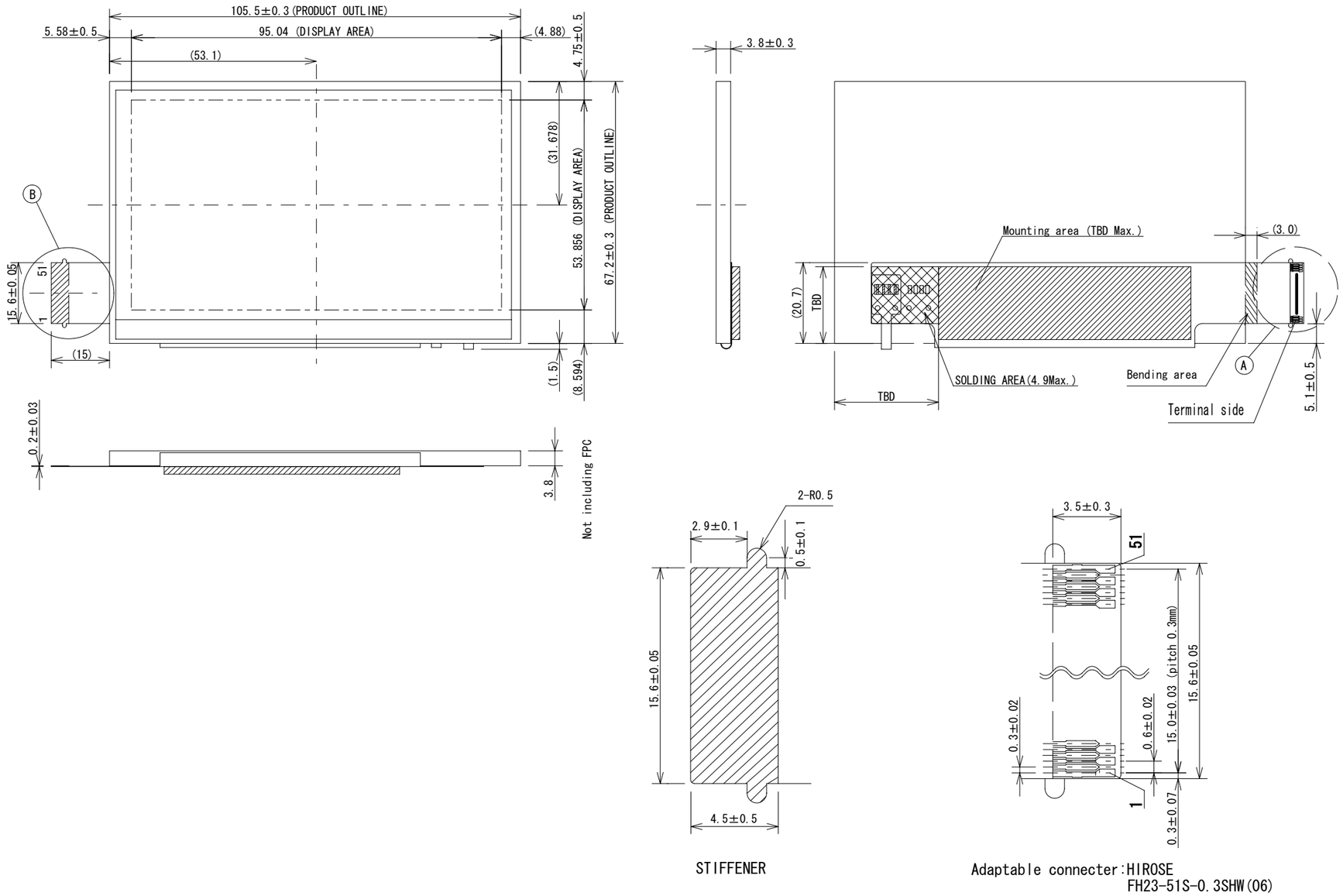
The following items are neither defects nor failures.

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.

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	DISP
15	D04	40	TEST
16	D05	41	VCC
17	D06	42	GND
18	D07	43	N. C.
19	D10	44	N. C.
20	D11	45	N. C.
21	D12	46	N. C.
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

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-0360	Sep. 3, 2007	**Revision contents** New issue **Writer** *Approved by* T. OGAWA *Checked by* *Prepared by* E. KATAYAMA
2nd edition	DOD-PP-0397	Oct. 15, 2007	**Revision contents** P5 General specifications • Module size: 105.5 (H) × 67.2 (V) × TBD (D)mm (typ.) → 105.5 (H) × 67.2 (V) × 3.8 (D)mm (typ.) • Weight: TBD → 51 g (typ.) • Luminace: 550cd/m^2 (typ.) → 600cd/m^2 (typ.) • Response time: 25ms (typ.) → 33ms (typ.) • Supply voltage-VCC: 2.5V → 3.0V (typ.) • Power consumption • LCD panel + Driver: TBD (typ.) → (125)mW (typ.) • Backlight: TBD (typ.) → (512)mW (typ.) P6-7 Block diagram • DISP (addition) • Pin No.39,40 (addition) • VCC: +2.5V → +3.0V P8 Mechanical specifications • Module size: 105.5 ± 0.3 (W) × 67.2 ± 0.3 (H) × TBD ± 0.3 (D)mm (typ.) → 105.5 ± 0.3 (W) × 67.2 ± 0.3 (H) × 3.8 ± 0.3 (D)mm (typ.) • Weight: TBD → 51g (typ.), 53g (max.) P8 Absolute maximum ratings • Backlight: VR: ≤25 → ≤20 (V), PD: ≤615 →≤492 (mW) • Relative humidity: ≤36 (%) (addition) • Absolute humidity Remarks: Ta > 60°C → Ta > 70°C • Note4: Ta= 60°C and RH= 55% →Ta= 70°C and RH= 36% P9 Logic/ LCD driving • VCC: TBD (min.), 2.5 (typ.), TBD (max.) →2.3 (min.) 3.0 (typ.), 3.6 (max.) (V) • VDD: TBD (min.),TBD (max.) →4.8 (min.), 5.2 (max.) (V) • VIH: 0.8VCC →0.7VCC (V), VIL: 0.2VCC →0.3VCC (V) • ICC: TBD (typ.) → (4.0) (typ.) (mA), Remarks: VCC: 2.5V → 3.0V • IDD: TBD (typ.) → (22.5) (typ.) (mA), Remarks: VCC: 2.5V → 3.0V • Note1: T PPHCK= 8.69MHz, HSYNC= 16.56kHz, VSYNC= 60Hz → PPHCK= (10.87)MHz, HSYNC= (20.7)kHz, VSYNC= (75)Hz P9 Backlight • Forward voltage: (16.0) (typ.), TBD (max.) → 12.8 (typ.), 14 (max.) (V) P9-10 Power supply voltage sequence • Diagam (revision) • Note1 (change), Note2 (addition) P10 Interface pin connections • Pin No.39: RSVD →DISP, Pin No.40: N.C. →TEST P11 Description of terminals • DISP (addition) • Circuits of backlight (revision) P14 Input signal timing • VCC= 2.5V → VCC= 3.0V

REVISION HISTORY

Edition	Document number	Prepared date	Revision contents and signature
2nd edition	DOD-PP-0397	Oct. 15, 2007	**Revision contents** P14 Timing characteristics • CLK-frequency: TBD (min.), 8.69 (typ.) → (8.69) (min.), (10.87) (typ.) (MHz) Rise time, Fall time: TBD (max.) → (2) (max.) (ns) • DATA-Rise time, Fall time: TBD (max.) → (2) (max.) (ns) • DE-Rise time, Fall time: TBD (max.) → (2) (max.) (ns) • HSYNK-cycle: 60.4 (typ.), TBD (max.) → (48.3) (typ.), (60.4) (max.) (μs) Remarks: 16.56 kHz → (20.7) kHz Rise time, Fall time: TBD (max.) → (2) (max.) (ns) • VSYNK-cycle: 16.59 (typ.), TBD (max.) → (13.33) (typ.), (16.67) (max.) (ms) Remarks: 60 Hz → (75) Hz Rise time, Fall time: TBD (max.) → (2) (max.) (ns) • VSYNC-HSYNC timing → VSYNC-HSYNC: Setup time, Hold time (revision) • DISP (addition) P15-17 Input signal timing chart • VIH: 0.8VCC →0.7VCC (V), VIL: 0.2VCC →0.3VCC (V) • HSYNC-VSYNC (revision) • VSYNC-DISP (addition) P18 Optical characteristics • Luminace: 550cd/m^2 (typ.) → 600cd/m^2 (typ.) • Luminace uniformity: 60 (min.) → 70 (min.) (%) • Response time: Ton: TBD (typ.) → 8 (typ.)(ms), Toff: TBD (typ.) → 25 (typ.)(ms) • Viewing angle: θR, θL: 50 (typ.) → 60 (typ.) (°),θU: 70 (typ.) → 60 (typ.) (°) • Note1: VCC= 2.5V → VCC= 3.0V P23 Outline drawings is revised. **Signature of writer** *Approved by* T. OGAWA; *Checked by* ———; *Prepared by* T. OGAWA