NEC

TFT COLOR LCD MODULE

NL12876BC26-21

39cm (15.3 Type)
WXGA
LVDS interface (1port)

Data Sheet

（1st Edition）

All information in this document is subject to change without prior notice.

1st Engineering Department Color LCD Division Display Device Operations Unit NEC Electron Devices NEC Corporation		
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Checked		
Prepared		May 14, 2001

INTRODUCTION

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Anti-radioactive design is not implemented in this product.

CONTENTS

1. OUTLINE

NL12876BC26-21 is a TFT (thin film transistor) active matrix color liquid crystal display (LCD) comprising amorphous silicon TFT attached to each signal electrode, a driving circuit and a backlight.

This product has a 39cm (15.3 inches) display area by a diagonal, and contains 1280×768 pixels in it. Also it can display 16,194,277 colors.

2. FEATURES

- LVDS interface (adapted THC63LVD824,THine Electronics, Inc. as a receiver)
- High luminance
- Wide viewing angle (with Retardation Film)
- Low reflection
- High contrast ratio
- Wide color gamut
- Incorporated edge type backlight
- Replaceable lamp holders
- Approved by UL1950 Third Edition (File No. E170632) and CSA-C22.2 No. 950-95 (File No. E170632)

3. APPLICATION

Multimedia monitor

4. PRINCIPLE AND STRUCTURE

A color TFT (thin film transistor) LCD module is composed of a TFT liquid crystal panel structure, LSIs for driving the TFT array, and a backlight assembly. The TFT liquid crystal panel structure is injected liquid crystal material into the narrow gap between a TFT array glass substrate and a color filter glass substrate. Also, LCD module is connected the driver LSIs with a TFT liquid crystal panel structure, and then the backlight assembly is attached to the backside of the panel.

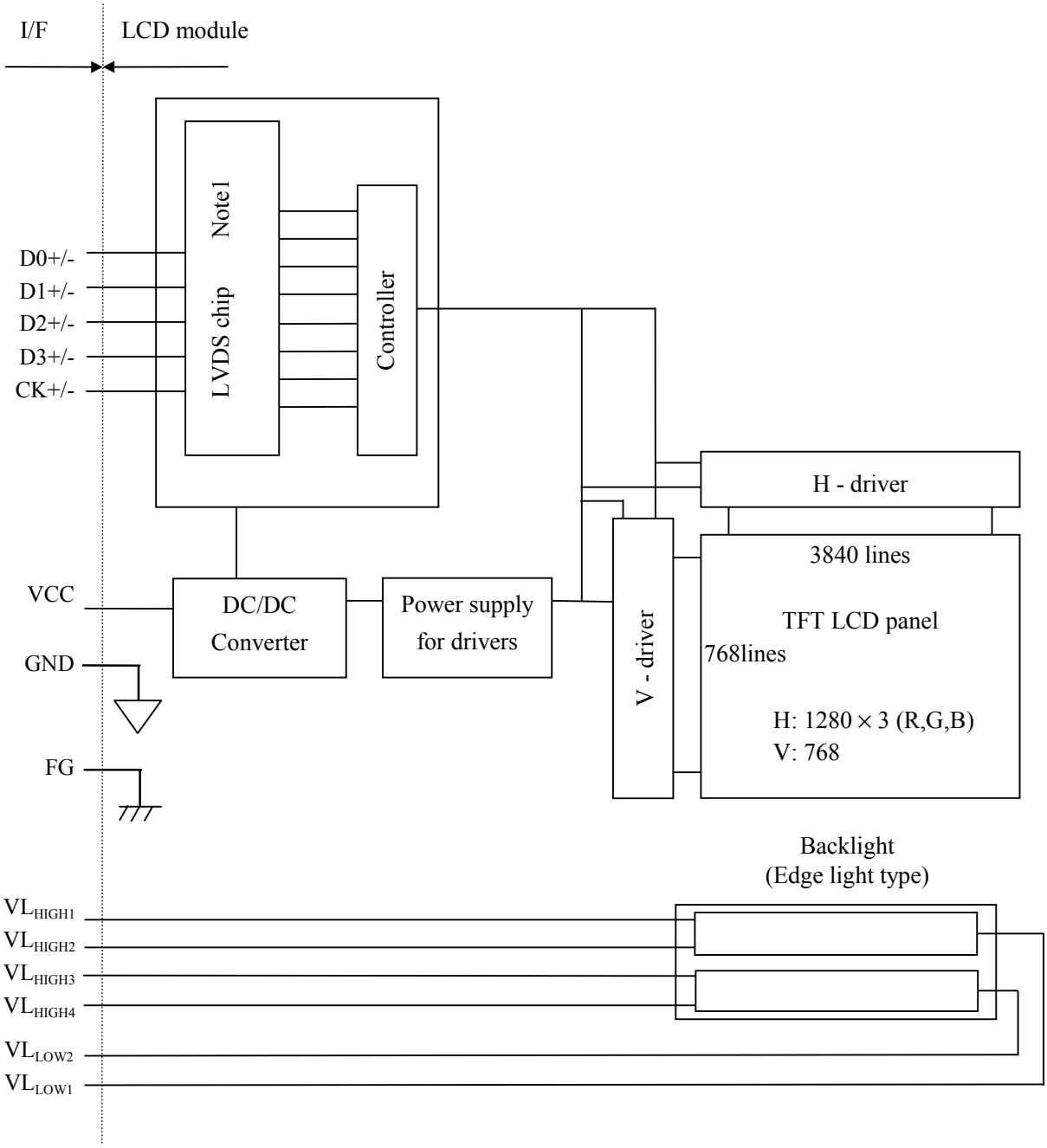
RGB (red, green, blue) data signals from a source system are modulated into a form suitable for active matrix addressing by the onboard signal processor and sent to the driver LSIs which in turn addresses the individual TFT cells.

Working as an electro-optical switch, each TFT cell regulates transmitted light from the backlight assembly when worked by the data source. Color images are created by regulating the amount of transmitted light through the array of red, green, and blue dots.

5. OUTLINE OF CHARACTERISTICS (at room temperature)

Display area	334.08 (H) × 200.448 (V) mm
Drive system	a-Si TFT active matrix
Display colors	16,194,277 colors
Number of pixels	1280 (H) × 768 (V)
Pixel arrangement	RGB vertical stripe
Pixel pitch	0.261 (H) × 0.261 (V) mm
Module size	369.0 (Typ., H) × 226.0 (Typ., V) × 20.0 (Max., D) mm
Weight	1450 g (Typ.)
Contrast ratio	300:1 (Typ., Viewing angle is θx =± 0 °, θy = ±0 °)
Viewing angle (To be out of 10:1 for the contrast ratio)	-Horizontal: 60 ° (Typ., left side, right side) -Vertical: 40 ° (Typ., up side), 60 ° (Typ., down side)
Designed viewing direction:	Optimum grayscale (γ=2.2): perpendicular
Polarizer pencil-hardness	3H (Min., at JIS K5400)
Color gamut	56 % (Typ., at center, To NTSC)
Response time	11ms (Typ.)
Luminance	500 cd/m^2 (Typ., at IL= 6mA / lamp)
Signal system	LVDS interface (Receiver: THC63LVD824, THine Electronics, Inc.) RGB 8-bit signals, Dot clock (CLK), and Data enable signal (DE).
Supply voltage	5 V (Logic, LCD driving)
Backlight	Edge light type: Four cold cathode fluorescent lamps in two holders, Inverter-less [Replaceable parts] -Lamp holder: 153LHS01
Power consumption	21.3W (Typ., Checkered flag pattern, at IL= 6mA / lamp)

6. BLOCK DIAGRAM



Note1: THC63LVD824 core (THine)

Note2: GND is signal ground for logic and LCD driving. GND is not connected to FG (Frame Ground) in the LCD module. These grounds should be connected to system ground in customer equipment.

7. GENERAL SPECIFICATIONS

Item	Specification	Unit
Module size	369.0±1.0 (H) × 226.0±1.0 (V) × 20.0(Max., D) Note1	mm
Display area	334.08 (H) × 200.448 (V) [Diagonal display size: 39cm (Type 15.3)]	mm
Number of pixels	1280 (H) × 768 (V)	pixel
Dot pitch	0.087 (H) × 0.261 (V)	mm
Pixel pitch	0.261 (H) × 0.261 (V)	mm
Pixel arrangement	RGB (Red, Green, Blue) vertical stripe	—
Display colors	16,194,277	color
Weight	1450 (Typ.), 1600 (Max.)	g

Note1: Exclude the bulge by wrinkles or bending of a transparency sheet

8. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Remarks
Supply voltage	VCC	-0.3 to +6.0	V	Ta = 25°C
Logic input voltage	Vi	-0.3 to VCC+0.3	V	Ta = 25°C
Lamp voltage	VL	2000	Vrms	Ta = 25°C
Storage temperature	Tst	-20 to +60	°C	—
Operating temperature	Top	0 to +50	°C	Module surface Note1
Relative humidity (RH) Note 2		≤ 95	%	Ta≤ 40°C
		≤ 85	%	40°C＜Ta≤ 50°C
Absolute humidity Note 2		≤78 Note3	g/m^3	Ta＞55°C

Note1: Measure at the surface of panel (including self-heat)

Note2: No condensation

Note3: Ta = 55°C, RH = 70%.

9. ELECTRICAL CHARACTERISTICS

(1) Logic, LCD driving (Ta＝25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	VCC	4.75	5.0	5.25	V	-
Ripple voltage	VRP	-	-	100	mV	for VCC
Differential input (H) Threshold voltage	VTH	-	-	+100	mV	VCM=1.2V Note1
Differential input (L) Threshold voltage	VTL	-100	-	-	mV	
Differential Input voltage	VI	0	-	2.4	V	-
Terminating resistor	RT	-	100	—	Ω	-
Supply current	ICC	-	250 Note2	800 Note3	mA	VCC= 5.0V

Note1: Common mode voltage in LVDS driver

Note2: Checkered flag pattern (in EIAJ ED-2522)

Note3: Theoretical maximum current pattern

(2) Backlight

(Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Lamp current	IL	3.0	6.0	6.5	mArms	for each lamp, IL=6.0mArms: 500cd/m^2, Note1
Lamp voltage	VL	—	700	—	Vrms	-
Lamp turn on voltage	VS	950	—	—	Vrms	Ta = 25°C, Note1
		1500	—	—	Vrms	Ta = 0°C, Note1
Oscillator frequency	Ft	50	—	60	kHz	Note2

Note1: When IL and/or VS are lower than Min. value, lamps will not turn on.

Note2: Recommended value of 'Ft'

1) 'Ft' should be within the specification.

and

2) Ft = 1/ 4th × (2n-1) th: Hsync period

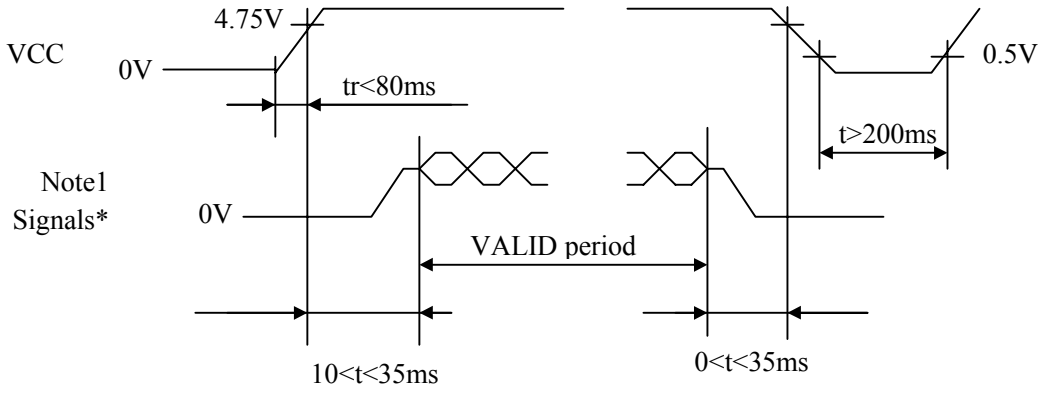
n: a natural number (1,2,3…)

If Ft is not the recommended value, Beat noise may display on the screen, because of interference between Ft frequency and Hsync frequency.

Note3: The lamp current should be measured by high-frequency current meter at the low voltage terminal. Two lamps contain in the one lamp holder, and both lamps are connected to one low voltage cable. Therefore, the lamp current at low voltage terminal is sum of two lamps (12mA Typ.)

Note4: The inverter power supply has a big influence on lighting-up characteristics and the lifetime of the lamp. When design the inverter power supply, evaluate it sufficiently.

10. SUPPLY VOLTAGE SEQUENCE



*Signals: DE, CLK, R0 to R7, G0 to G7, B0 to B7

Note1: The values of signals are at terminal of resistor 100Ω.

Note2: When VCC is not supplied, Logic signals (synchronous signals and control signals) should be "0" voltage (V). If these input voltages are higher than 0.3 V, the internal circuit will be damaged.

Note3: When turn on the LCD module, if VCC voltage has the chance of fall-down during the rising period up to 4.75V, the LCD module may not start to work because of the protection circuit.

Note4: Turn on/off the backlight during VCC and signals are supplied to LCD module. When turns on/off backlight during LCD module is not working, the display may momentarily become white.

Note5: When the VCC is not supplied to LCD module, please keep all signals low level or high impedance.

Note6.This product has the fuse shown below list.

	Type name	Producer	Rating
VCC	KMC20	DAITO	20V/2A

The power capacity should be more than 2 times of fuse ratings from safety point of view. If the power capacity of customer system is less than above request, check and evaluate it carefully.

11. INTERFACE PIN CONNECTIONS

(1) Interface connector for signals and power

CN1 socket

Part No.: FI-SEB20P-HF

Adaptable plug: FI-SE20M

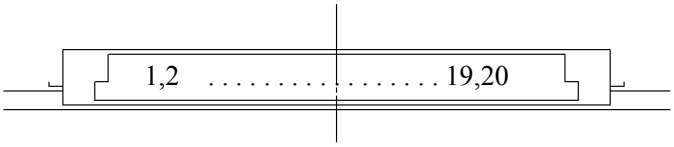
Supplier: Japan Aviation Electronics Industry Limited (JAE)

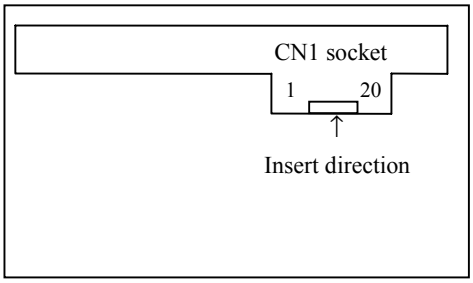
Pin No.	Symbol	Signal type	Function
1	VCC	+5.0V power supply	+5.0V±5%
2	VCC		
3	GND	Ground	Note1
4	GND		
5	D0-	Pixel data	LVDS differential signal
6	D0+		
7	GND	Ground	Note1
8	D1-	Pixel data	LVDS differential signal
9	D1+		
10	GND	Ground	Note1
11	D2-	Pixel data	LVDS differential signal
12	D2+		
13	GND	Ground	Note1
14	CK-	Pixel clock	LVDS differential signal CLK for pixel data f=81MHz (Typ.)
15	CK+		
16	GND	Ground	Note1
17	D3-	Pixel data	LVDS differential signal
18	D3+		
19	GND	Ground	Note1
20	GND		

Note1: GND is signal ground for logic and LCD driving. GND is not connected to FG (Frame Ground) in the LCD module and these grounds should be connected to system ground in customer equipment.

Note2: Use 100Ω twist pair wires for the cable.

CN1 socket: Figure from socket view





(2) Connector for backlight unit

CN201 plug

Part No.: BHR-04VS-1

Adaptable socket: SM03(7-D1)B-BHS-TB

Supplier: J.S.T. TRADING COMPANY, Ltd.

Pin No.	Symbol	Function
1	VL_{HIGH1}	Upper side lamp, High voltage terminal (The cable color is pink)
2	VL_{HIGH2}	Upper side lamp, High voltage terminal (The cable color is pink)
3	N.C.	Non-connection, Keep the terminal open.
4	VL_{LOW1}	Upper side lamp, Low voltage terminal (The cable color is gray)

CN202 plug

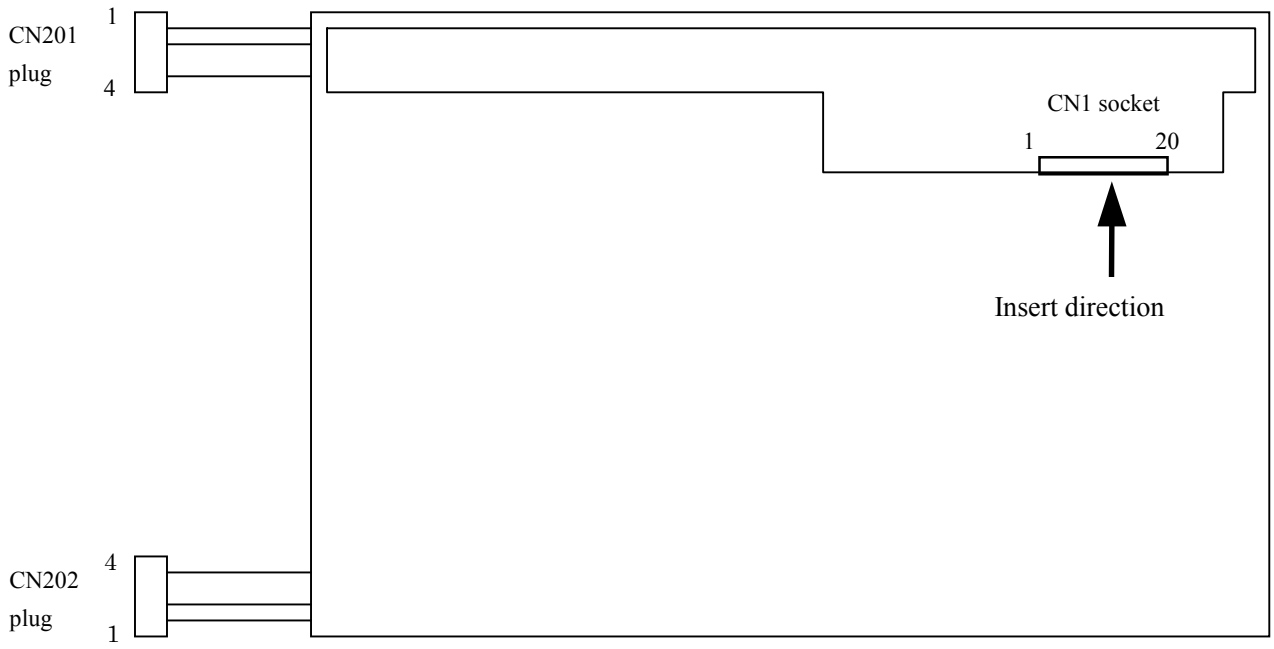
Part No.: BHR-04VS-1

Adaptable socket: SM03(7-D1)B-BHS-TB

Supplier: J.S.T. TRADING COMPANY, Ltd.

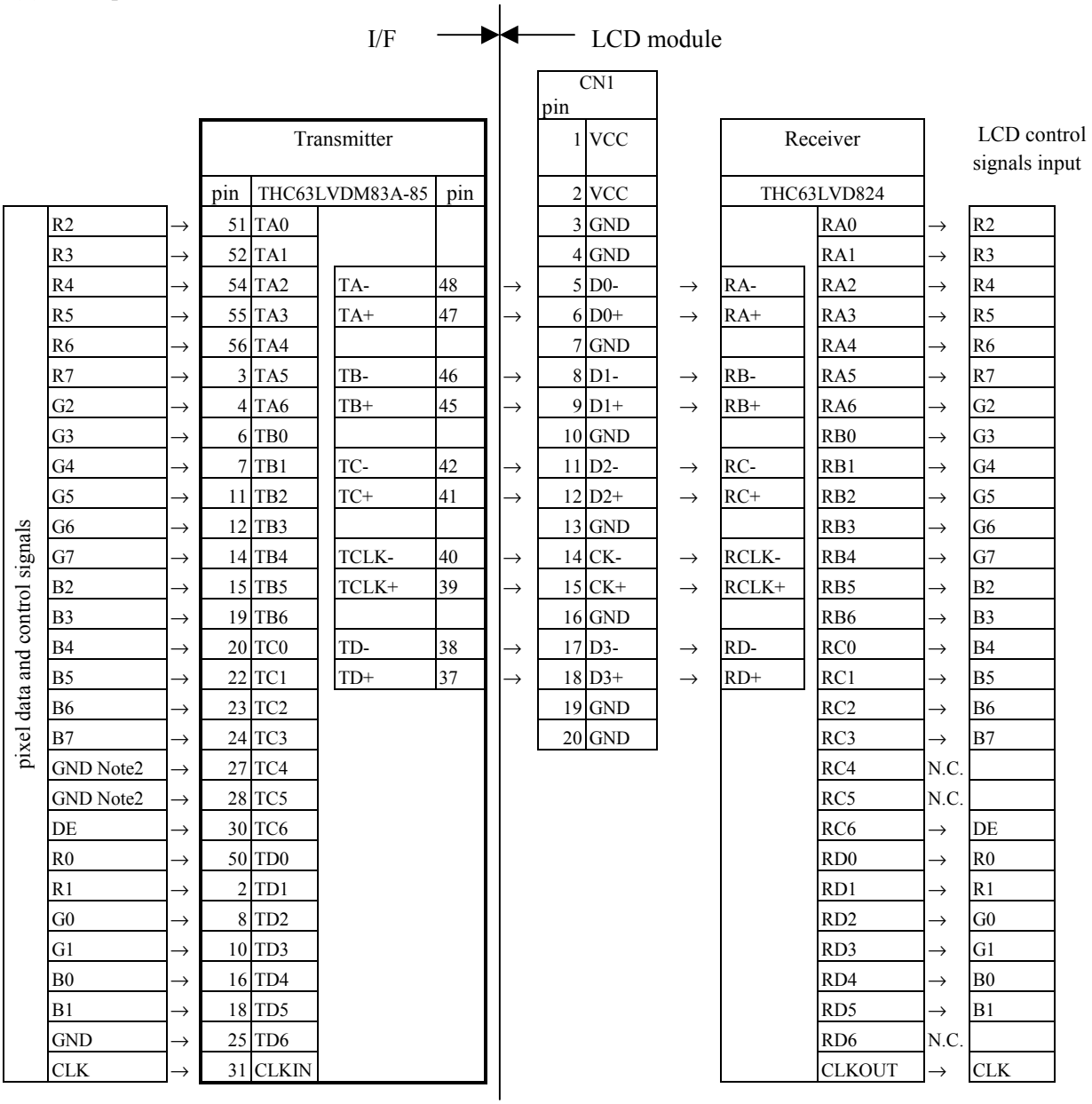
Pin No.	Symbol	Function
1	VL_{HIGH3}	Lower side lamp, High voltage terminal (The cable color is pink)
2	VL_{HIGH4}	Lower side lamp, High voltage terminal (The cable color is pink)
3	N.C.	Non-connection, Keep the terminal open.
4	VL_{LOW2}	Lower side lamp, Low voltage terminal (The cable color is gray)

Attention: VL_{HIGH} and VL_{LOW} must be connected correctly. If customer connects wrongly, customer will be hurt and the module will be broken.



12. HOW TO CONNECT with LVDS TRANSMITTER

(1) 8bit input

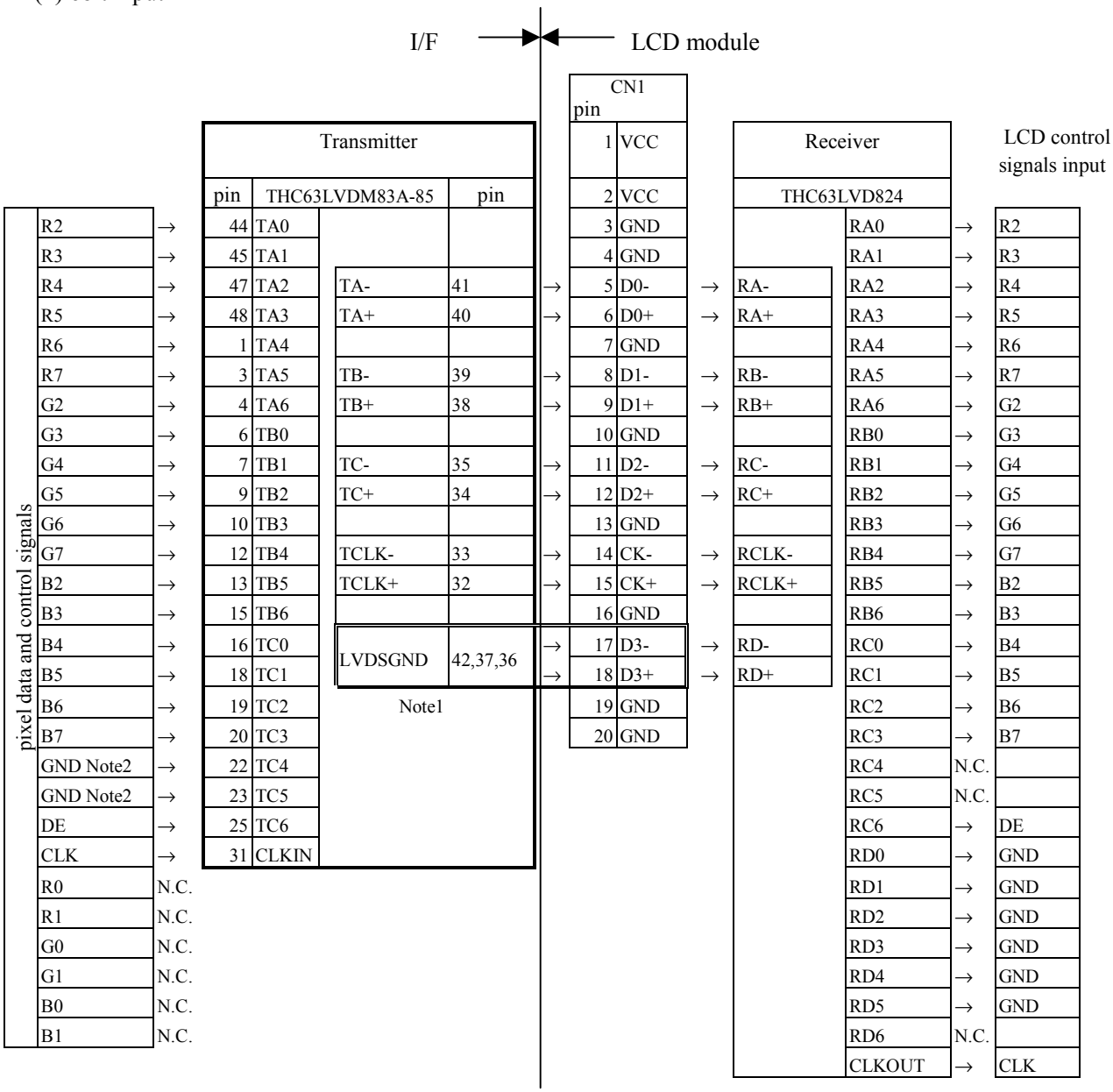


Note1: Use 100Ω twist pair wires for the Cable.

Note2: TC4 and TC5 of LVDS transmitter input signals are not used at LCD controler.

Note3: These signals should be kept the specification of **14.INPUT SIGNAL TIMINGS**.
Evaluate the clock jitter sufficiently, because the timing margins of LVDS signals are severe.

(2) 6bit input



Note1: Connect pin No.17(D3-) and 18(D3+) of CN1 to LVDSGND.

Note2: LVDS transmitter input signals TC4 and TC5 are not connected to LCD control signals input.

Note3: Use 100Ω twist pair wires for the Cable

Note4: These signals should be kept the specification of **14.INPUT SIGNAL TIMINGS**.
Evaluate the clock jitter sufficiently, because the timing margins of LVDS signals are severe.

13. DISPLAY COLORS vs. INPUT DATA SIGNALS

	Display colors	Data signal (0: Low level, 1: High level)																									
		R 7	R 6	R 5	R 4	R 3	R 2	R 1	R 0	G 7	G 6	G 5	G 4	G 3	G 2	G 1	G 0	B 7	B 6	B 5	B 4	B 3	B 2	B 1	B 0
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	0	1
																		1	1	1	1	1	1	1	0
																		1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	1																
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	1																
	Magenta	1	1	1	1	1	1	0	1									1	1	1	1	1	1	0	1
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
		1	1	1	1	1	1	1	1									1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1								
										1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
										1	1	1	1	1	1	1	1								
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
										1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1								
		1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
	White	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
		1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
		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 grayscale	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	1																
		1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	1	1	1																
Green grayscale	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	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1								
										1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
										1	1	1	1	1	1	1	1								
Blue grayscale	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	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
																		1	1	1	1	1	1	1	0
																		1	1	1	1	1	1	1	1

Note1: The combination of 8-bit signals (253 steps in grayscale) results in equivalent to 16,194,277 (253 ×253×253) colors.
The display data of (11111101), (11111110) and (11111111) become same grayscale.

14. INPUT SIGNAL TIMINGS

(1) Input signal specifications for LCD controller

Parameter			Symbol	Min.	Typ.	Max.	Unit	Remarks
CLK	Frequency		1/tc	78.0	81.0	84.0	MHz	LVDS driver input
				-	12.34	-	ns	
	Duty		tch/tc	Note2			-	-
	Period between rise and fall		tcrf				ns	
DATA	CLK-DATA	Setup timing	tds				ns	
		Hold timing	tdh				ns	
	Period between rise and fall		tdrf				ns	
DE	Horizontal	Cycle period	tehc Note3	-	20.840	-	µs	47.99kHz(Typ.)
				1408	1688	-	CLK	
		Display period	tehd	1280			CLK	-
	Vertical (One frame)	Cycle period	tevc	-	16.797	-	ms	59.54kHz(Typ.)
				771	806	-	H	
		Display period	tevd	768			H	-
	CLK-DE timing	Setup timing	tes	Note2			ns	
		Hold timing	teh				ns	
	Period between rise and fall		terf				ns	

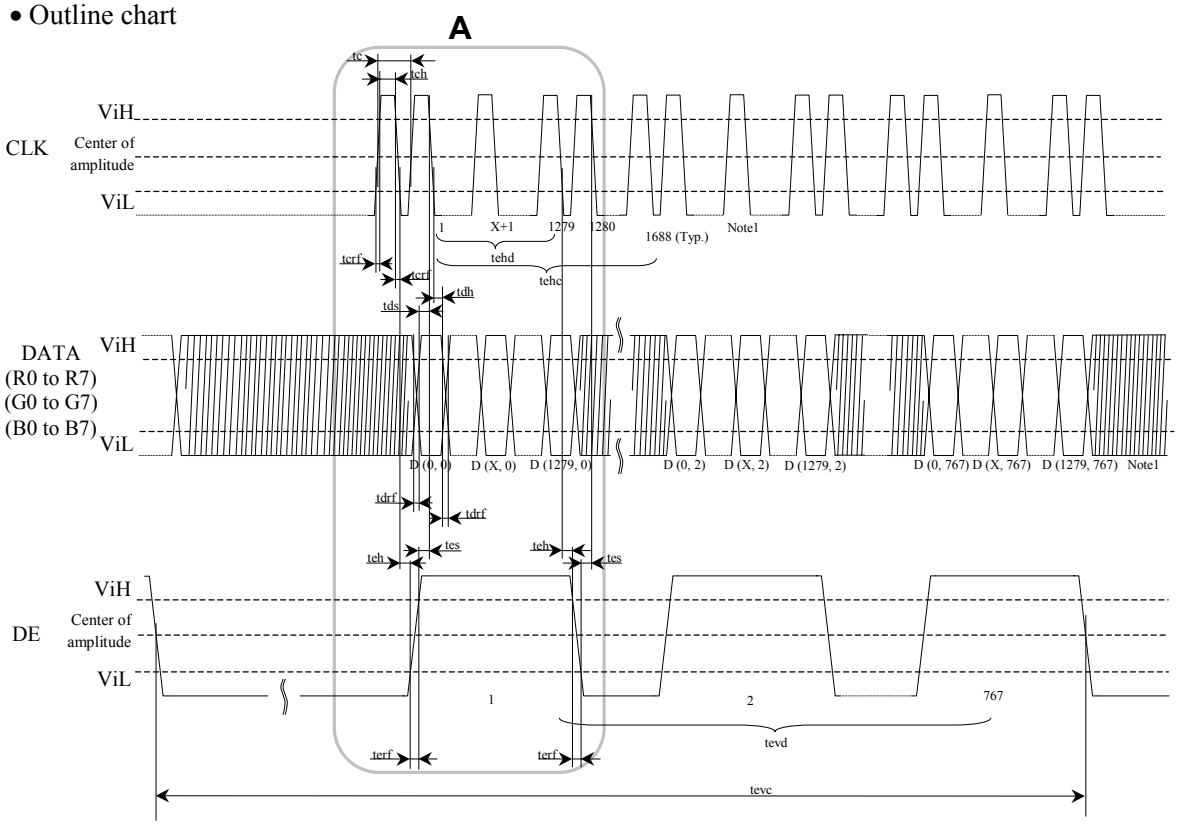
Note1: Definition of units is as follows.
tc = 1CLK, tehc = 1H

Note2: Timing specifications are defined by the input signals of LVDS transmitter. THC63LVDM83A-85 (THine) or equivalent products are recommended for LVDS transmitter.

Note3: During operation, fluctuation of horizontal cycle period "tehc" must not exceed ±1 CLK. Otherwise function errors will occur in LCD module.
e.g.: Acceptable fluctuation range is 1599-1601 CLK, when the horizontal cycle period "tehc" is 1600 CLK.

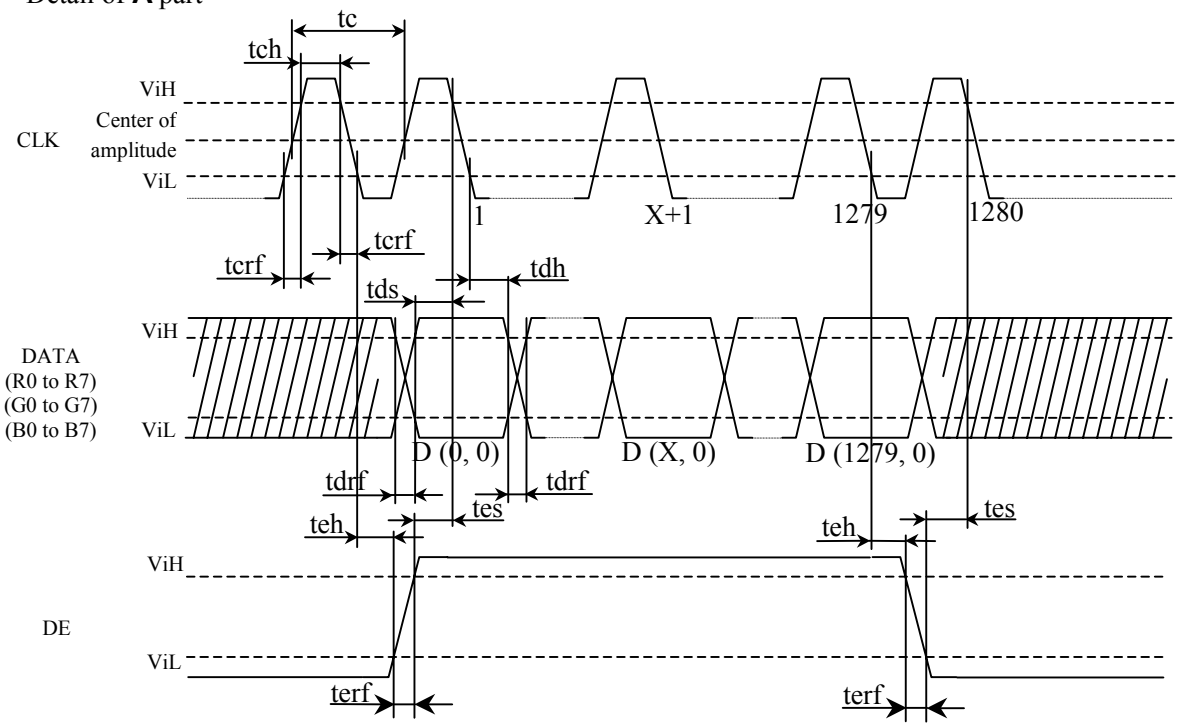
(2)Input signal timing chart

• Outline chart



Note1: X is data number from 1 to 767.

• Detail of **A** part



*ViH, ViL: Refer to LVDS transmitter specifications.

(3) Display position of input data

D(0,0)	D(1,0)	D(2,0)	→	D(1279,0)
D(0,1)	D(1,1)	D(2,1)	→	D(1279,1)
D(0,2)	D(1,2)	D(2,2)	→	D(1279,2)
↓	↓	↓	↘	↓
D(0,767)	D(1,767)	D(2,767)	→	D(1279,767)

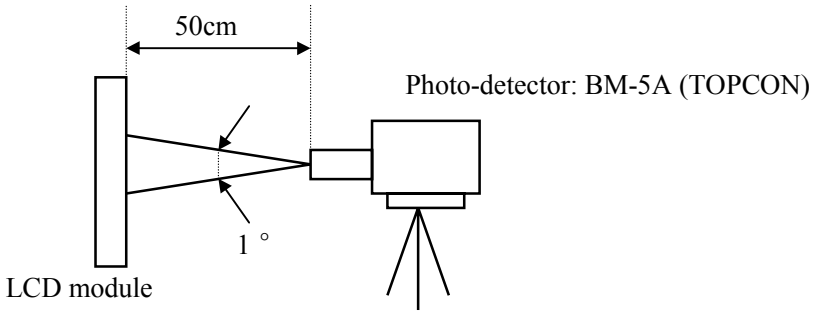
15. OPTICAL CHARACTERISTICS

(Ta = 25°C, Note1)

Parameter		Symbol	Condition		Min.	Typ.	Max.	Unit	Remarks
Contrast ratio		CR	Note4		200	300	-	-	Note3
			Best contrast angle at center		-	450	-	-	Note3
Luminance		Lumax	White, Note4		400	500	-	cd/m^2	Note2
Luminance uniformity		-	Max. / Min.		-	1.2	1.3	-	Note7
Color gamut		C	To NTSC		50	56	-	%	Note4
Chromaticity Coordinates		W	White (x, y)		-	0.309, 0.320	-	-	-
		R	Red (x, y)		-	0.632, 0.337	-	-	
		G	Green (x, y)		-	0.319, 0.553	-	-	
		B	Blue (x, y)		-	0.142, 0.090	-	-	
Viewing Angle Range (CR>10)	Horizontal	θx+	CR>10, θy = ±0°		50	60	-	deg.	Note5
		θx-			50	60	-	deg.	
	Vertical	θy+	CR>10, θx = ±0°		30	40	-	deg.	
		θy-			35	60	-	deg.	
Viewing Angle Range (CR>5)	Horizontal	θx+	CR>5, θy = ±0°		-	80	-	deg.	
		θx-			-	80	-	deg.	
	Vertical	θy+	CR>5, θx = ±0°		-	60	-	deg.	
		θy-			-	65	-	deg.	
Response time (Module surface temperature = 30°C)		Ton	White to black	100%→10%	-	12	20	ms	Note6
				90%→10%	-	11	-		
		Toff	Black to white	0%→90%	-	25	30		
				10%→90%	-	21	-		

Note1: VCC = 5V, IL= 6.0mArms

Note2: Optical characteristics at 60Hz are measured after 20minutes from working the product, in the dark room. All parameters are measured after luminance saturation.



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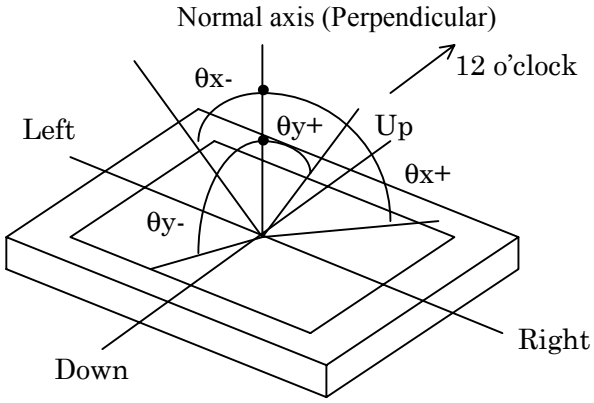
Note3: The contrast ratio is calculated by using the following formula.

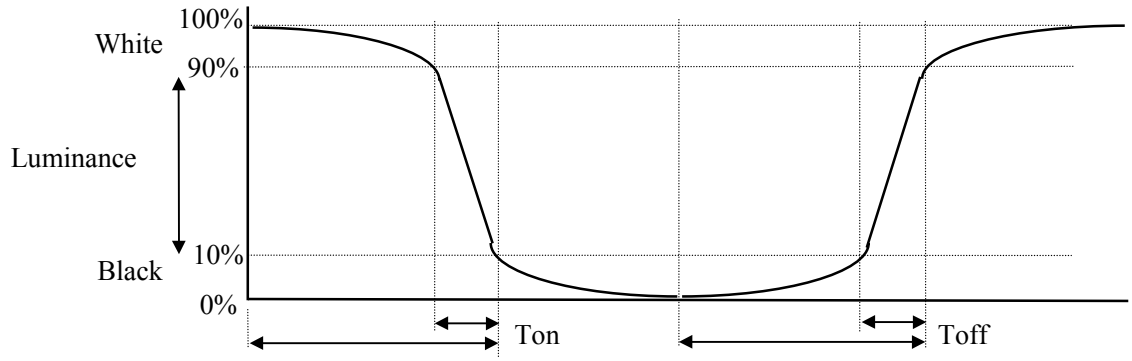
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance with all pixels in "white"}}{\text{Luminance with all pixels in "black"}}$$

Note4: Viewing angle is θx = ±0°, θy = ±0°, at center.

Note5: Definitions of viewing angle are as follows



Note6: Definitions of response time are as follows.
Response time is measured, the luminance changes "white" to "black" or "black" to "white" by Photo-detector's output level. Definition of response times are the period between 90% and 10% (that is Ton), and one between 10% and 90% (that is Toff), of the output level.



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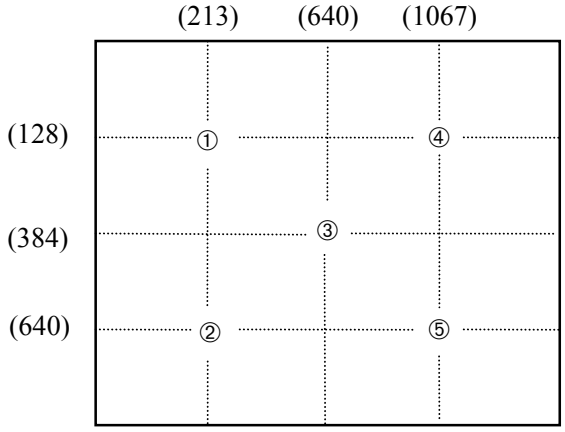
Note7: Luminance uniformity is calculated by using the following formula.

$$\text{Luminance uniformity} = \frac{\text{Maximum luminance}}{\text{Minimum luminance}}$$

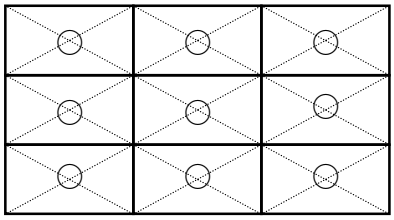
The luminance is measured at near the five points shown below.



16. RELIABILITY TEST

Test item	Test condition	Judgment
High temperature/humidity operation	50±2℃, RH= 85% 240 hours, Display data is black.	Note1
Heat cycle (operation)	① 0°C±3°C --- 1 hour 55°C±3°C --- 1 hour ② 50 cycles , 4 hours/cycle ③ Display data is black.	Note1
Thermal shock (non-operation)	① -20°C±3°C --- 30 minutes 60°C±3°C --- 30 minutes ② 100 cycles ③ Temperature transition time is less than 5 minutes.	Note1
Vibration (non-operation)	① 5-100Hz, 19.6m/s^2 1 minute/cycle, X,Y,Z direction ② 50 times each direction	Note1, 2
Mechanical shock (non-operation)	① 294m/s^2, 11ms X,Y,Z direction ② 3 times each direction	Note1, 2
ESD (operation)	150pF, 150Ω, ±10kV 9 places on a panel 10 times each place at one-second intervals	Note1,3
Dust (operation)	15 kinds of dust (JIS-Z 8901) Hourly 15 seconds stir, 8 times repeat	Note1

Note1: No display malfunctions
(Display functions are checked under the same condition as out-going inspection.)
Note2: No physical damages
Note3: Discharge points are shown in the figure.



17. PRECAUTIONS

17.1 MEANING OF CAUTION SIGNS

The following caution signs have very important meaning. **Be sure to understand following contents!**

⚠CAUTION	This sign has a meaning that customer will be injured by himself, or the product will sustain a damage, if customer makes a mistake in operations.
	This sign has a meaning that customer will get an electric shock, if customer makes a mistake in operations.
	This sign has a meaning that customer will be injured by himself, if customer makes a mistake in operations.

17.2 CAUTIONS

Do not touch HIGH VOLTAGE PART of the lamp cables while turn on. Customer will be in danger of an electric shock.

∗ Pay attention to handling for the working backlight. It may be over 35°C from ambient temperature.

∗ Do not shock and press the LCD panel and the backlight. There will be in danger of breaking, because there are made of glass. (Shock: To be not greater 294m/s^2 and to be not greater than 11ms, Pressure: To be not greater 19.6N)

17.3 ATTENTIONS

(1) Handling the product

① When customer pulls out products from carton box, take hold of both ends without touch the circuit board. If you touch it, products may be broken down and/or out of adjustment, because of stress to mounting parts.

② If customer places products temporarily, turn down the display side and place on a flat table.

③ Handle products with care and avoid electrostatic discharge (e.g. Decrease with earth band, ionic shower, etc.), because electrostatic may be damaged products (LCD modules).

④ The torque for mounting screws should never exceed 0.39N·m. Over torque may cause mechanical damage to the product.

⑤ Do not press or friction, because LCD panel surface is sensitive. If customers will clean the product surface, NEC Corporation or their supplier will recommend using the cloth with ethanolic liquid.

⑥ Do not push-pull the interface connectors while turn on, because wrong power sequence may break down the product.

⑦ Connection cables such as flexible cable, and so on, are danger of damage. Do not hook cables nor pull them.

(2) Environment

① Dewdrop atmosphere must be avoided.

② Do not operate and/or store in high temperature and/or high humidity atmosphere. If customer store the product, keep in antistatic pouch in room temperature, because of avoidance for dusts and sunlight.

③ Do not operate in high magnetic field. Circuit boards may be broken down by it.

④ Use an original protection sheet on product surface (polarizer). Adhesive type protection sheet should be avoided, because it may change color and/or properties of the polarizer.

(3) Specification for products

① Do not display the fixed pattern for a long time because it may cause image sticking. If the screen is displayed the fixed pattern, use a screen saver.

② The product may be changed of color by viewing angle.

③ Luminance may have change by voltage variation, even if power source applies recommended voltage to backlight inverter.

④ Optical characteristics may be changed by input signal timings.

(4) Installation of an inverter

① Insert an insulation sheet between the inverter and the chassis, when the inverter is installed on the chassis. If customer does not insert the insulation sheet, electric discharge may occur from the inverter to the module.

Recommended insulation sheet:

- Thickness of the insulation sheet: t 0.4mm
- Material: Polyethylene terephtalate (UL class : 94V-0)

(5) Other

① All GND and VCC terminals should be connected without a non-connected signal line.

② Do not disassemble a product and/or adjust volume.

③ If customer would like to replace backlight lamps, see 'REPLACEMENT MANUAL FOR BACKLIGHT'.

④ If customer uses screwnails, pay attention not to insert waste materials in inside of products.

⑤ When customer returns product for repair and so on, pack it with original shipping package because of avoidance of some damages during transportation.

⑥ Not only the product but also the equipment that used the product should be packed and transported as the product becomes vertical. Otherwise, there is the fear that a display dignity decreases by an impact or vibrations.

⑦ To avoid contact between the lamp cable and the chassis, insert an insulation sheet between the lamp cable and the chassis or use a cable clamp, when the lamp cable is assembled to the chassis. Otherwise, leak current may occur from the lamp cables to the chassis (frame ground (FG)), and the luminance may be decrease.

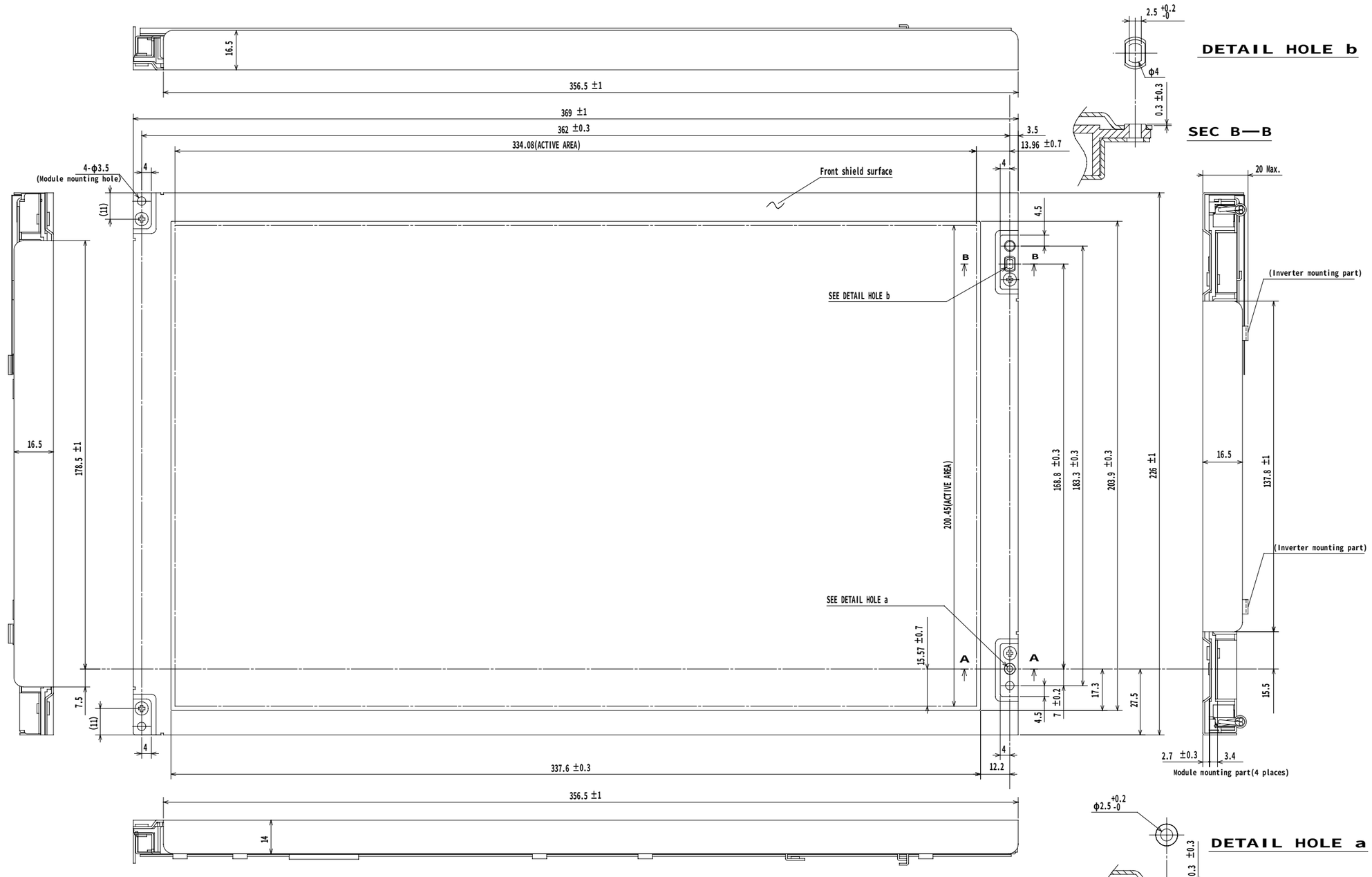
⑧ Fluctuation of lamp current, which is caused by lamp ambient temperature, luminance control, supply voltage and method of lamp cable installation, may invite malfunctions of the inverter protection circuit. When design the inverter protection circuit, evaluate the lamp current sufficiently.

General specifications for the LCD
The following items are neither defects nor failures.

- **Response time, luminance and color gamut may be changed by ambient temperature.**
- **The LCD may be seemed luminance uniformity, flicker, vertical seam and/or small spot by display patterns.**
- **Optical characteristics (e.g. luminance, display uniformity, etc.) gradually is going to change depending on operating time, and especially low temperature, because the LCD has cold cathode fluorescent lamps.**

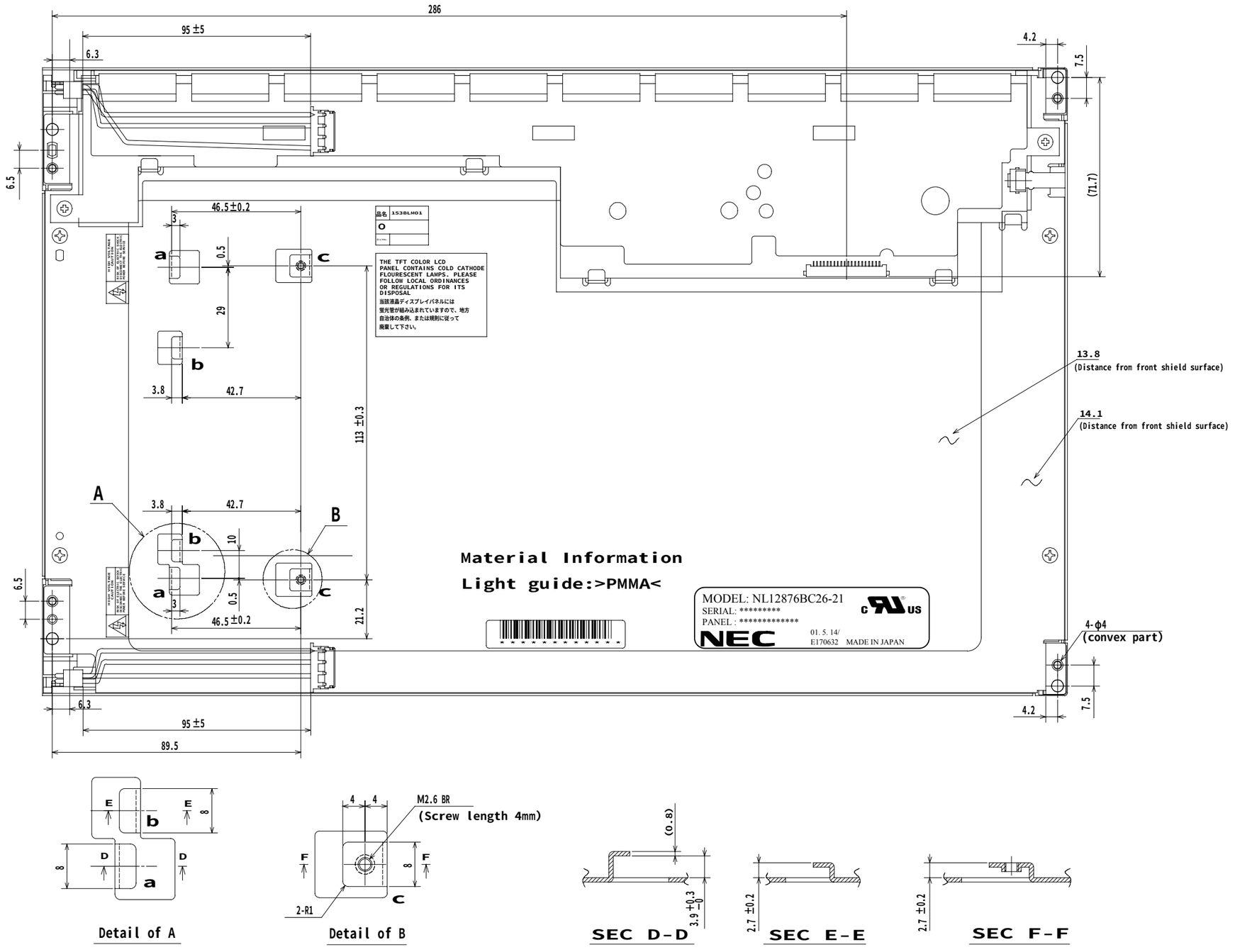
18. OUTLINE DRAWINGS (Unit: mm)

18.1. FRONT VIEW



Note1: The torque for mounting screws should never exceed 0.392N·m.
Note2: Tolerances of dimensions not shown are ±0.5mm.
Note3: The dimensions in parenthesis are reference only.

18.2 REAR VIEW



Note1: The torque for mounting screws should never exceed 0.392N·m.
Note2: Tolerances of dimensions not shown are ±0.5mm.

Rev.	Prepared date	Revision contents	
1	May 14, 2001	DOD-M-0362 Preliminary specifications → Data sheet The inside of this document is revised the clerical error and unclear expression in previous one. The important changes such as specifications, characteristics and functions are as follows. P4 Features: Add UL approval. P5 Polarizer pencil-hardness: 2H → 3H P5, P7 Weight: 1250g Typ., 1500g Max. →1450g Typ., 1600g Max. P7 Absolute humidity: Expression of rating is revised. P8 Backlight: Add Note3. P10 Connector for backlight unit: CN201 socket → CN201 plug CN202 socket → CN202 plug P12, P13 How to connect with LVDS TRANSMITTER is changed. P15, P16 Expression of input signal timings are revised. P17 Expression of optical characteristics is revised. P23, P24 Precautions: Add (4) ①, (5) ⑦,and (5)⑧. P25, P26 Outline drawings are revised.	*Approved by* *Checked by* *Prepared by* R. Kawashima