PRELIMINARY

NEC LCD Technologies, Ltd.

TFT COLOR LCD MODULE

NL12876BC26-25

4

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

PRELIMINARY DATA SHEET

DOD-PP-0167 (4th edition)

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INTRODUCTION

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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 NL12876BC26-25 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. 4

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 signal processing circuit, 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

- For industrial use

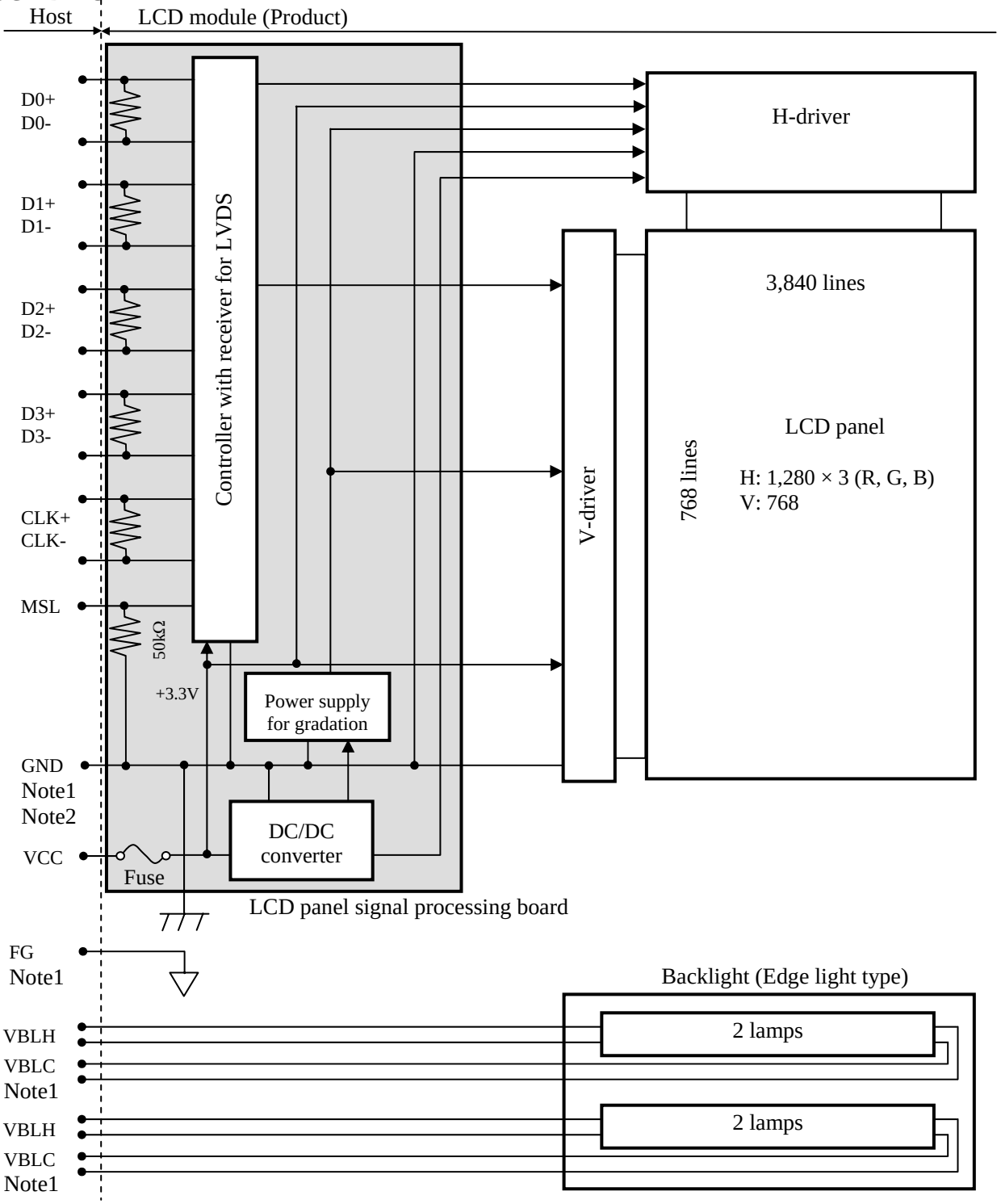
1.3 FEATURES

- High luminance
- High contrast
- Ultra Wide viewing angle
- Wide temperature range
- LVDS interface
- Edge light type (without inverter)

2. GENERAL SPECIFICATIONS

Display area	334.08 (H) × 200.45 (V) mm	
Diagonal size of display	39cm (15.3 inches)	
Drive system	a-Si TFT active matrix	
Display color	16,777,216 colors (At 8-bit input + FRC)	4
Pixel	1280 (H) × 768 (V) pixels	
Pixel arrangement	RGB (Red dot, Green dot, Blue dot) vertical stripe	
Dot pitch	0.087 (H) × 0.261 (V) mm	
Pixel pitch	0.261 (H) × 0.261 (V) mm	
Module size	358.0 mm (W) (typ.) × 226.0 mm (H) (typ.) × 16.8 (D) mm (max.) (excluding projection)	4
Weight	TBD g (typ.)	
Contrast ratio	TBD (typ.)	
Viewing angle	*At the contrast ratio ≥10:1* • Horizontal: Right side 85° (typ.), Left side 85° (typ.) • Vertical: Up side 85° (typ.), Down side 85° (typ.)	
Designed viewing direction	• Viewing angle with optimum grayscale (γ=2.2): normal axis (perpendicular)	
Polarizer surface	Antiglare	
Polarizer pencil-hardness	3H (min.) [by JIS K5400]	
Color gamut	*At LCD panel center* (40)% (typ.) [against NTSC color space]	
Response time	*Ton+Toff (10%←→ 90%)* 25ms (typ.)	
Luminance	*At IBL= 6.0 mArms / lamp* (400)cd/m^2 (typ.)	4
Signal system	LVDS 1port (Receiver: THC63LVDF84B, THine Electronics Inc. or equivalent) [8bit digital signals for data of RGB colors, Dot clock (CLK), Data enable (DE)]	
Power supply voltage	LCD panel signal processing board: 3.3V	
Backlight	Edge light type: 4 cold cathode fluorescent lamps (without inverter)	
Power consumption	*At IBL=6.0mArms / lamp, Checkered flag pattern* TBD W (typ., Power dissipation of the inverter is not included.)	4

3. BLOCK DIAGRAM



Note1: Relations between GND (Signal ground), FG (Frame ground) and VBLC (Lamp low voltage terminal) in the LCD module are as follows.

GND - FG	TBD
GND - VBLC	Not connected
FG - VBLC	Not connected

Note2: GND, FG and GNDB must be connected to customer equipment's ground, and it is recommended that these grounds are connected together in customer equipment.

4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification	Unit
Module size	358.0 ± 0.5 (W) × 226.0 ± 0.5 (H) × 16.8 max. (D) (excluding projection) Note1	mm
Display area	334.08 (H) × 200.45 (V) Note1	mm
Weight	TBD (typ.), TBD (max.)	g

4

Note1: See "**7. OUTLINE DRAWINGS**".

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal processing board	VCC	-0.3 to +3.6	V	-
	Lamp voltage	VBLH	TBD	Vrms	
Input voltage for signals	Display signals Note1	VD	-0.3 to +3.6 and < VCC+0.3	V	
	Function signal Note2	VF			
Storage temperature		Tst	-20 to +80	°C	-
Operating temperature	Front surface	TopF	-10 to +70	°C	Note3
	Rear surface	TopR	-10 to +70	°C	Note4
Relative humidity Note5		RH	≤ 95	%	Ta ≤ 40°C
			≤ 85	%	40°C <Ta≤ 50°C
			≤ 55	%	50°C <Ta≤ 60°C
			≤ 36	%	60°C <Ta≤ 70°C
Absolute humidity Note5		AH	≤ 70 Note6	g/m^3	Ta> 70°C

Note1: D0+/-, D1+/-, D2+/-, D3+/-, CLK+/-
Note2: MSL
Note3: Measured at center of LCD panel surface (including self-heat)
Note4: Measured at center of LCD module's rear shield surface (including self-heat)
Note5: No condensation
Note6: Water amount at Ta= 70°C and RH= 36%

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4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD panel signal processing board

(Ta= 25°C)

Parameter		Symbol	min.	typ.	max.	Unit	Remarks
Power supply voltage		VCC	3.0	3.3	3.6	V	-
Power supply current		ICC	-	(600) Note1	(900) Note2	mA	at VCC= 3.3V
Permissible ripple voltage		VRP	-	-	100	mVp-p	for VCC
Differential input threshold voltage	High	VTH	-	-	+100	mV	at VCM= 1.2V Note3
	Low	VTL	-100	-	-	mV	
Terminating resistance		RT	-	100	-	Ω	-
Input voltage for DPS and MSL signals	High	VFH	0.7VCC	-	VCC	V	CMOS level
	Low	VFL	0	-	0.3VCC	V	
Input current for DPS and MSL signal	High	IFH	-	-	160	μA	-
	Low	IFL	-160	-	-	μA	

4

4

Note1: Checkered flag pattern [by EIAJ ED-2522]
Note2: Pattern for maximum current
Note3: Common mode voltage for LVDS receiver

4.3.2 Backlight lamp

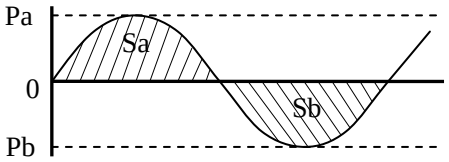
(Ta= 25°C, Note1)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Lamp current	IBL	3.0	6.0	6.5	mArms	at IBL= TBD mArms: L= (400)cd/m^2 Note3, Note4
Lamp voltage	VBLH	-	(670)	-	Vrms	Note2, Note3
Lamp starting voltage	VS	(1,100)	-	-	Vrms	Ta= 25°C Note2, Note3, Note5
		(1,600)	-	-	Vrms	Ta= -20°C Note2, Note3, Note5
Lamp oscillation frequency	FO	(38)	(43)	(48)	kHz	Note6

Note1: This product consists of 4 backlight lamps, and these specifications are for each lamp.

Note2: The lamp voltage cycle between lamps should be kept on a same phase. "VS" and "VBLH" are the voltage value between low voltage side (Cold) and high voltage side (Hot).

Note3: The asymmetric ratio of working waveform for lamps (Power supply voltage peak ratio, power supply current peak ratio and waveform space ratio) should be less than 5 % (See the following figure.). If the waveform is asymmetric, DC (Direct current) element apply into the lamp. In this case, a lamp lifetime may be shortened, because a distribution of a lamp enclosure substance inclines toward one side between low voltage terminal (Cold terminal) and high voltage terminal (Hot terminal). When designing the inverter, evaluate asymmetric of lamp working waveform sufficiently.



$$\frac{|Pa - Pb|}{Pb} \times 100 \leq 5\%$$

$$\frac{|Sa - Sb|}{Sb} \times 100 \leq 5\%$$

Pa: Supply voltage/current peak for positive, Pb: Supply voltage/current peak for negative
Sa: Waveform space for positive part, Sb: Waveform space for negative part.

Note4: This product consists of 2 lamps. The lamp current should be measured by high-frequency current meter at the low voltage terminal.

Note5: The inverter should be designed so that the lamp starting voltage can be maintained for more than 1 second. Otherwise the lamp may not be turned on.

Note6: In case "FO" is not the recommended value, beat noise may display on the screen, because of interference between "FO" and "1/th". Recommended value of "FO" is as following.

$$FO = \frac{1}{4} \times \frac{1}{th} \times (2n\text{-}1)$$

th: Horizontal cycle (See "**4.8.2 Timing characteristics**".)
n : Natural number (1, 2, 3 ·····)

Note7: Method of lamp cable installation may invite fluctuation of lamp current and voltage or asymmetric of lamp working waveform. When designing method of lamp cable installation, evaluate the fluctuation of lamp current, voltage and working waveform sufficiently.

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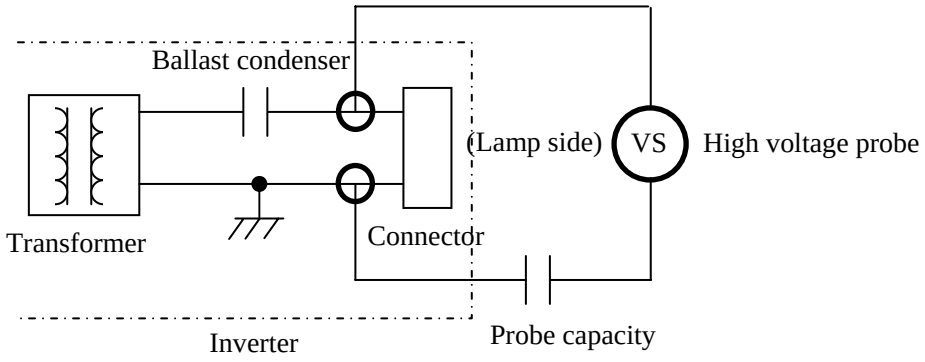
Note8: In case of Inverter with Ballast condenser, "VS" is the voltage lebel between Ballast condenser and Connector (Refer to the below “Example of measurement”). "VS" should be designed to be more than minimum "VS". Otherwise the lamp may not be turned on because the lamp starting voltage is less than minimum "VS".

Example of measurement
Probe capacity: 3pF (Tektronix, inc.: P6015A)



4.3.3 Power supply voltage ripple

This product works, even if the ripple voltage levels are beyond the permissible values as following the table, but there might be noise on the display image.

Power supply voltage		Ripple voltage Note1 (Measure at input terminal of power supply)	Unit
VCC	3.3V	≤ 100	mVp-p

Note1: The permissible ripple voltage includes spike noise.

4.3.4 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	(TF16SN3.15)	(KOA)	(3.15A) (32V)	(6.3A)	Note1

Note1: The power supply capacity should be more than the fusing current. If it is less than the fusing current, the fuse may not blow in a short time, and then nasty smell, smoke and so on may occur.

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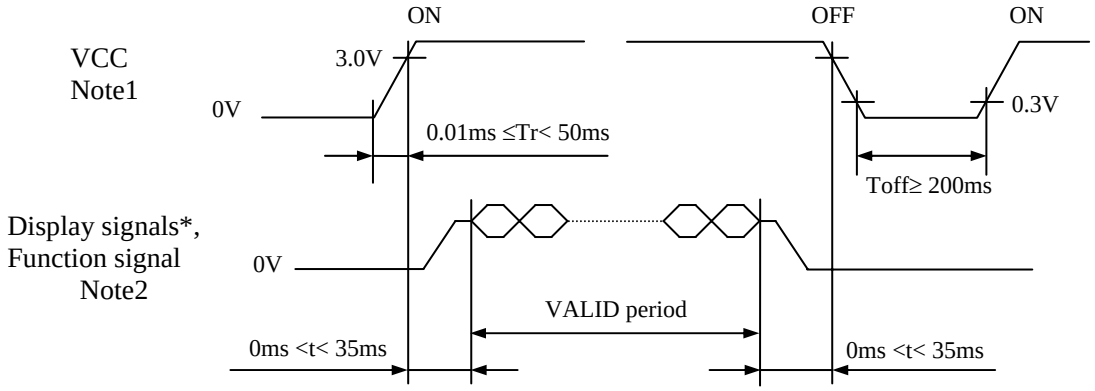
4.4 POWER SUPPLY VOLTAGE SEQUENCE

4.4.1 LCD panel signal processing board



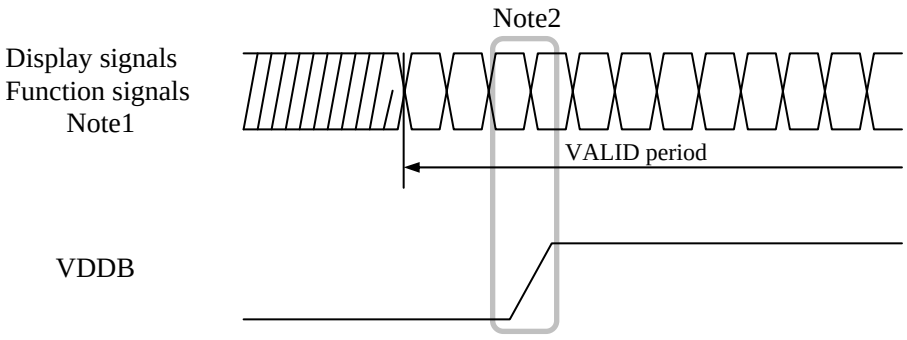
4
4
4

* These signals should be measured at the terminal of 100Ω resistance.

Note1: In terms of voltage variation (voltage drop) while VCC rising edge is below 3.0V, a protection circuit may work, and then this product may not work.

Note2: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CLK+/-) and function signal (MSL) must be Low or High-impedance, exclude the VALID period (See above sequence diagram), in order to avoid that internal circuits is damaged. 4
If some of display and function signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. VCC should be cut when the display and function signals are stopped.

4.4.2 Inverter (Option)



Note1: These are the display and function signals for LCD panel signal processing board.

Note2: The backlight should be turned on within the valid period of display and function signals, in order to avoid unstable data display.

4.5 CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS

4.5.1 LCD panel signal processing board

CN1 socket (LCD module side): DF14H-20P-1.25H (Hirose Electric Co., Ltd. (HRS)) 4
Adaptable plug: DF14-20S-1.25C (Hirose Electric Co., Ltd. (HRS))

Pin No.	Symbol	Signal	Remarks
1	VCC	Power supply	Note3
2	VCC		
3	GND	Ground	Note3
4	GND		
5	D0-	Pixel data	Note2
6	D0+		
7	GND	Ground	Note3
8	D1-	Pixel data	Note2
9	D1+		
10	GND	Ground	Note3
11	D2-	Pixel data	Note2
12	D2+		
13	GND	Ground	Note3
14	CLK-	Pixel clock	Note2
15	CLK+		
16	GND	Ground	Note3
17	D3-	Pixel data	Note2
18	D3+		
19	GND	Ground	Note3
20	MSL	Selection of LVDS Input data map	High: LVDS input map A Low or Open: LVDS input map B Note1,Note4

Note1: See "**4.6 DISPLAY COLORS AND INPUT DATA SIGNALS**".
Note2: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.
Note3: All GND and VCC terminals should be used without any non-connected lines.
Note4: See "**4.5.4 Connection between receiver and transmitter for LVDS**".

4.5.2 Backlight lamp

Attention: VBLH and VBLC must be connected correctly. Wrong connections will cause electric shock and also break down of the product.

CN201 plug (LCD module side): BHR-03VS-1 (J.S.T Mfg. Co., Ltd.)
Adaptable socket: SM02(8.0)B-BHS-1-TB(LF)(SN), SM02(8.0)B-BHS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage terminal (Hot)	Cable color: Pink
2	N.C.	-	Keep this pin Open.
3	VBLC	Low voltage terminal (Cold)	Cable color: White

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CN202 plug (LCD module side): BHR-03VS-1 (J.S.T Mfg. Co., Ltd.)
Adaptable socket: SM02(8.0)B-BHS-1-TB(LF)(SN), SM02(8.0)B-BHS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage terminal (Hot)	Cable color: Blue
2	N.C.	-	Keep this pin Open.
3	VBLC	Low voltage terminal (Cold)	Cable color: White

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CN203 plug (LCD module side): BHR-03VS-1 (J.S.T Mfg. Co., Ltd.)
Adaptable socket: SM02(8.0)B-BHS-1-TB(LF)(SN), SM02(8.0)B-BHS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage terminal (Hot)	Cable color: Pink
2	N.C.	-	Keep this pin Open.
3	VBLC	Low voltage terminal (Cold)	Cable color: White

4

CN204 plug (LCD module side): BHR-03VS-1 (J.S.T Mfg. Co., Ltd.)
Adaptable socket: SM02(8.0)B-BHS-1-TB(LF)(SN), SM02(8.0)B-BHS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage terminal (Hot)	Cable color: Blue
2	N.C.	-	Keep this pin Open.
3	VBLC	Low voltage terminal (Cold)	Cable color: White

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4.5.3 Positions of plug and socket

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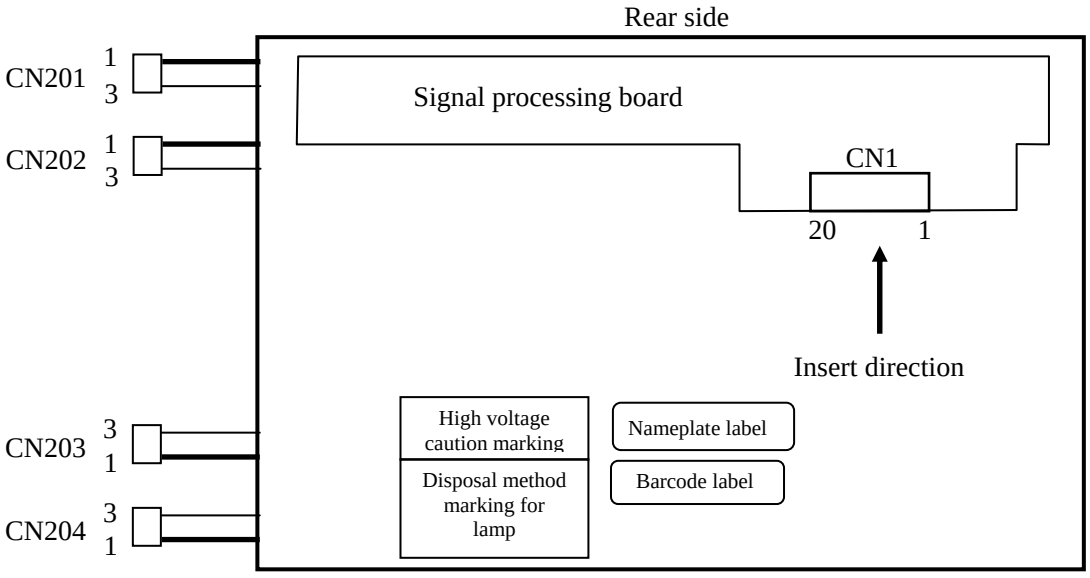
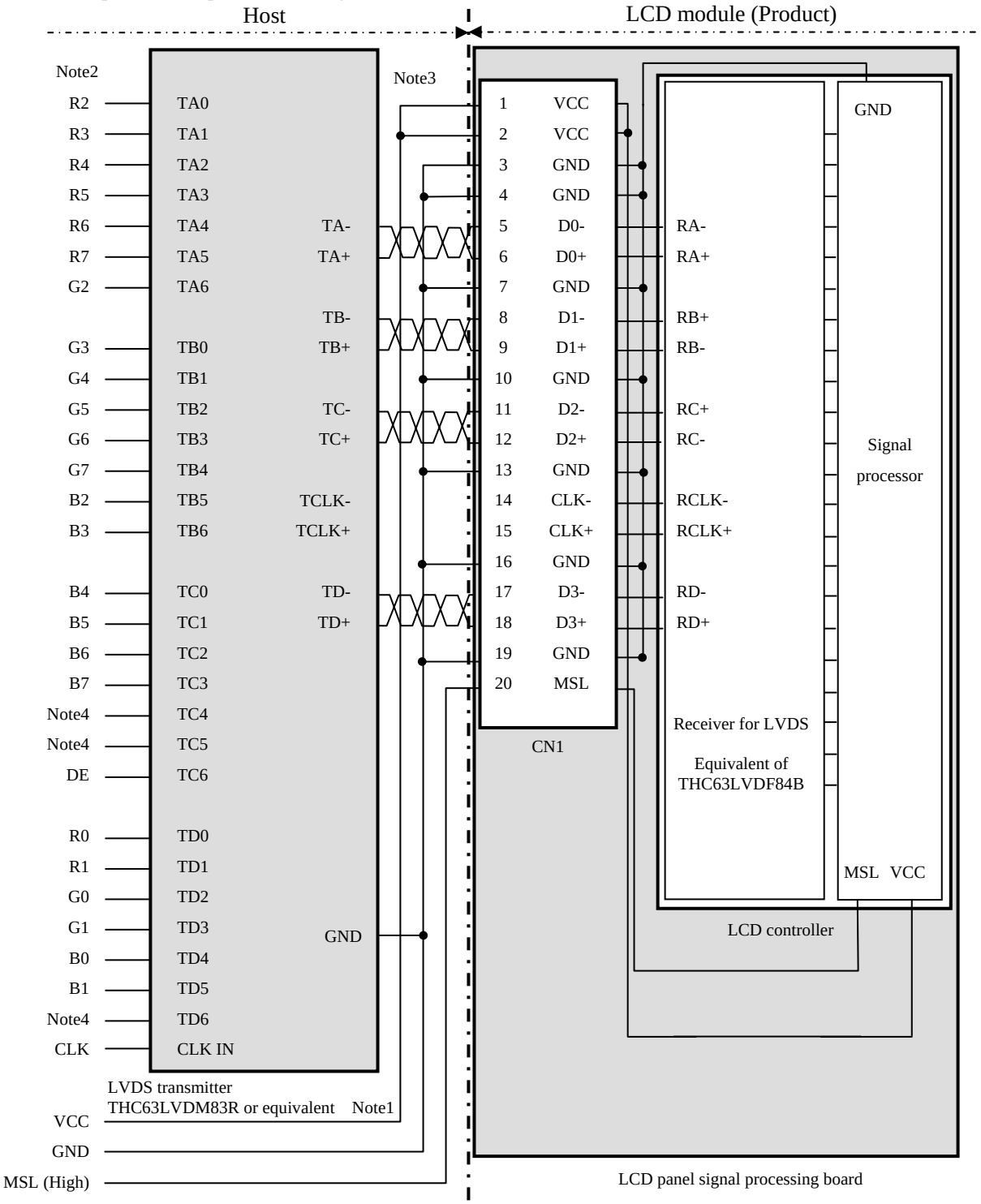


4.5.4 Connection between receiver and transmitter for LVDS

(1) LVDS Input data map A (MSL: High)



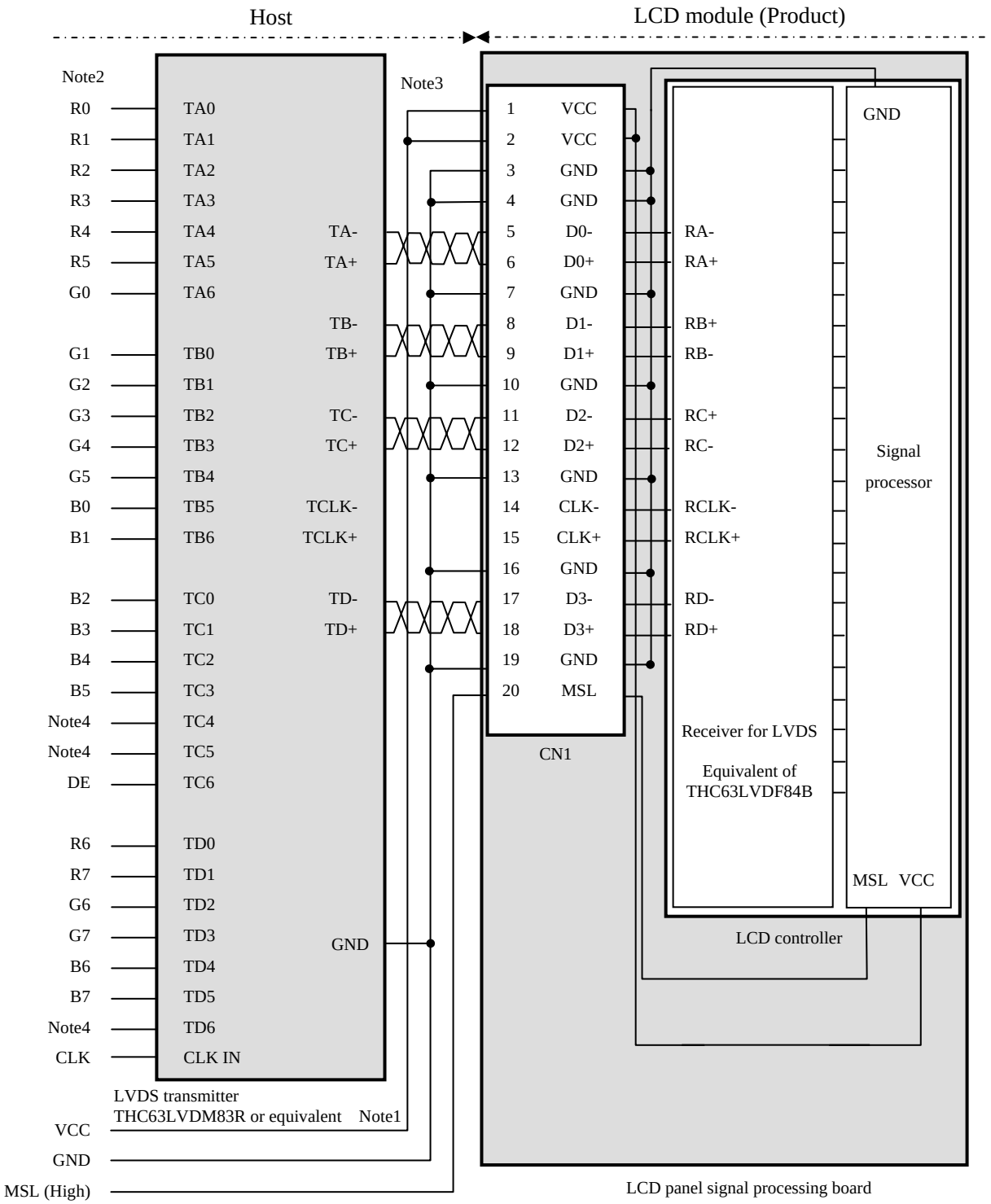
Note1: Recommended transmitter THC63LVDM83R (THine Electronics Inc.) or equivalent

Note2: LSB (Least Significant Bit) - R0, G0, B0 MSB (Most Significant Bit) - R7, G7, B7

Note3: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

Note4: Input signals to TC4, TC5 and TD6 are not used inside the product, but do not keep TC4, TC5 and TD6 open to avoid noise problem.

(2) LVDS Input data map B (MSL: Low or Open)



Note1: Recommended transmitter THC63LVDM83R (THine Electronics Inc.) or equivalent

Note2: LSB (Least Significant Bit) – R0, G0, B0 MSB (Most Significant Bit) – R7, G7, B7

Note3: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.

Note4: Input signals to TC4, TC5 and TD6 are not used inside the product, but do not keep TC4, TC5 and TD6 open to avoid noise problem.

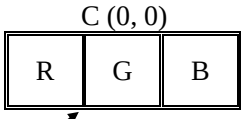
4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display equivalent of 16,777,216 colors in 256 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)																							
		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.



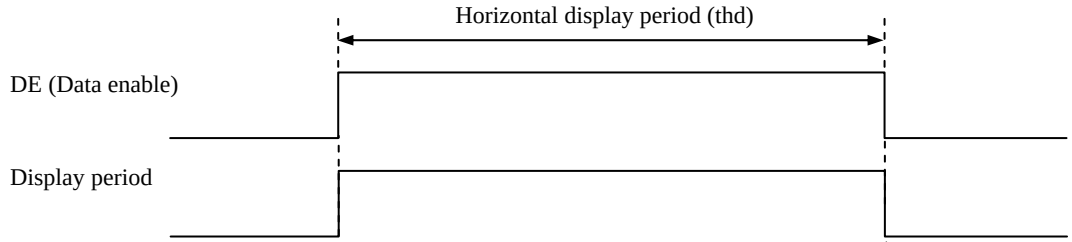
C(0, 0)	C(1, 0)	• • •	C(X, 0)	• • •	C(1278, 0)	C((1279, 0)
C(0, 1)	C(1, 1)	• • •	C(X, 1)	• • •	C((1278, 1)	C((1279, 1)
• • •	• • •	• • •	• • •	• • •	• • •	• • •
C(0, Y)	C(1, Y)	• • •	C(X, Y)	• • •	C((1278, Y)	C((1279, Y)
• • •	• • •	• • •	• • •	• • •	• • •	• • •
C(0, 766)	C(1, 766)	• • •	C(X, 766)	• • •	C((1278, 766)	C((1279, 766)
C(0, 767)	C(1, 767)	• • •	C(X, 767)	• • •	C((1278, 767)	C((1279, 767)

4.8 INPUT SIGNAL TIMINGS

4.8.1 Outline of input signal timings

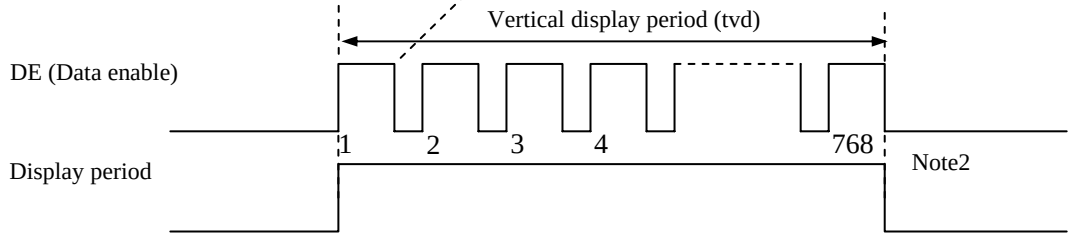
- Horizontal signal

Note1



- Vertical signal

Note1



Note1: This diagram indicates virtual signal for set up to timing.
Note2: See "**4.8.3 Input signal timing chart**" for numeration of pulse.

4.8.2 Timing characteristics

(Note1, Note2, Note3)

Parameter			Symbol	min.	typ.	max.	Unit	Remarks	
CLK	Frequency		1/tc	(70)	79.5	TBD	MHz	12.579ns (typ.)	4
	Duty		-	-			-	-	
	Rise time, Fall time		-				ns		
DATA	CLK-DATA	Setup time	-	-			ns	-	
		Hold time	-				ns		
	Rise time, Fall time		-				ns		
DE	Horizontal	Cycle	th	TBD	20.93	TBD	µs	47.776kHz (typ.)	4
				-	1664	-	CLK		
		Display period	thd	1280			CLK	-	
	Vertical (One frame)	Cycle	tv	TBD	16.70	TBD	ms	60.0Hz (typ.)	4
				-	798	-	H		
		Display period	tvd	768			H		
	CLK-DE	Setup time	-	-			ns	-	
		Hold time	-				ns		
	Rise time, Fall time		-				ns		

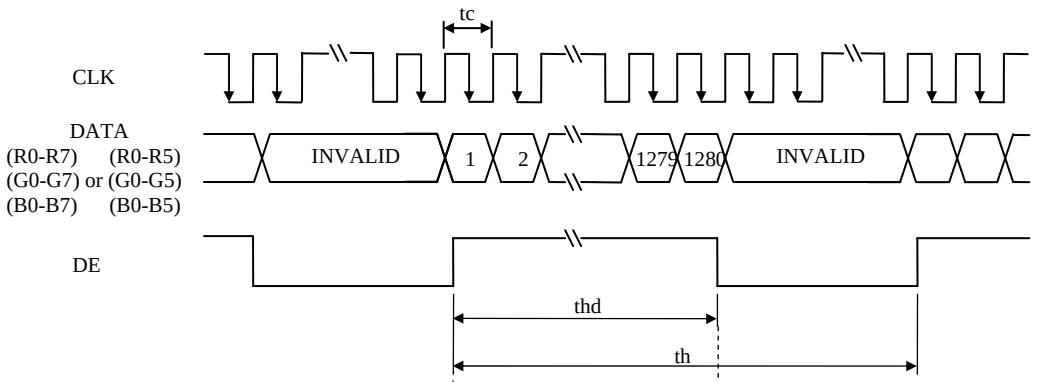
Note1: Definition of parameters is as follows.
tc= 1CLK, th= 1H

Note2: See the data sheet of LVDS transmitter.

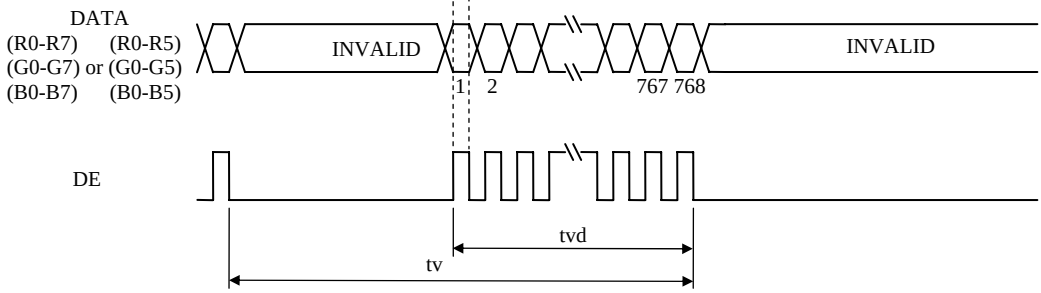
Note3: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

4.8.3 Input signal timing chart

Horizontal timing



Vertical timing



4.9 OPTICS

4.9.1 Optical characteristics

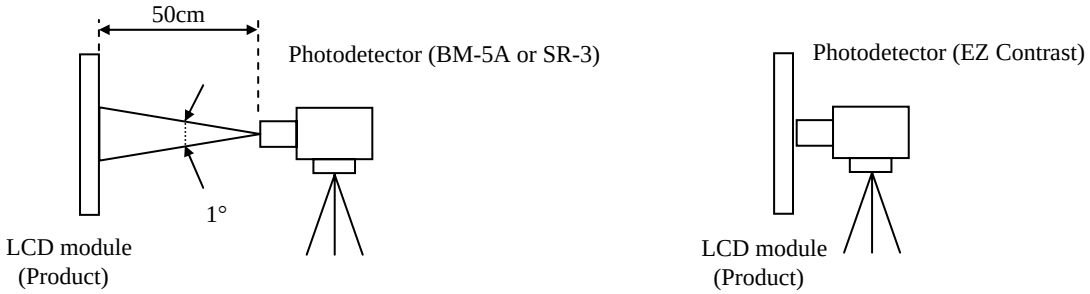
(Note1, Note2)

Parameter		Condition	Symbol	min.	typ.	max.	Unit	Measuring instrument	Remarks
Luminance		White at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	L	TBD	(400)	-	cd/m^2	BM-5A	-
Contrast ratio		White/Black at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	CR	TBD	TBD	-	-	BM-5A	Note3
Luminance uniformity		White θR= 0°, θL= 0°, θU= 0°, θD= 0°	LU	-	TBD	TBD	-	BM-5A	Note4
Chromaticity	White	**x** coordinate	Wx	TBD	0.313	TBD	-	SR-3	Note5
		y coordinate	Wy	TBD	0.329	TBD	-		
	Red	**x** coordinate	Rx	-	TBD	-	-		
		y coordinate	Ry	-	TBD	-	-		
	Green	**x** coordinate	Gx	-	TBD	-	-		
		y coordinate	Gy	-	TBD	-	-		
	Blue	**x** coordinate	Bx	-	TBD	-	-		
		y coordinate	By	-	TBD	-	-		
Color gamut		θR= 0°, θL= 0°, θU= 0°, θD= 0° at center, against NTSC color space	C	TBD	(40)	-	%		
Response time		White to Black	Ton	-	TBD	TBD	ms	BM-5A	Note6 Note7
		Black to White	Toff	-	TBD	TBD	ms		
Viewing angle	Right	θU= 0°, θD= 0°, CR≥ 10	θR	TBD	85	-	°	EZ Contrast	Note8
	Left	θU= 0°, θD= 0°, CR≥ 10	θL	TBD	85	-	°		
	Up	θR= 0°, θL= 0°, CR≥ 10	θU	TBD	85	-	°		
	Down	θR= 0°, θL= 0°, CR≥ 10	θD	TBD	85	-	°		

Note1: These are initial characteristics.

Note2: Measurement conditions are as follows.
Ta= 25°C, VCC= 3.3V, IBL= 6.0mArms/lamp, Display mode: WXGA,
Horizontal cycle= 1/47.776kHz, Vertical cycle= 1/60.0Hz

Optical characteristics are measured at luminance saturation after 20minutes from working the product, in the dark room. Also measurement methods are as follows.



Note3: See "**4.9.2 Definition of contrast ratio**".
Note4: See "**4.9.3 Definition of luminance uniformity**".
Note5: These coordinates are found on CIE 1931 chromaticity diagram.
Note6: Product surface temperature: TopF= TBD°C
Note7: See "**4.9.4 Definition of response times**".
Note8: See "**4.9.5 Definition of viewing angles**".

4.9.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

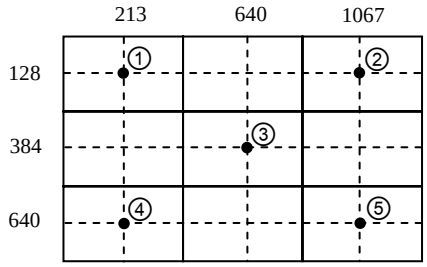
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

4.9.3 Definition of luminance uniformity

The luminance uniformity is calculated by using following formula.

$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑤}}{\text{Minimum luminance from ① to ⑤}}$$

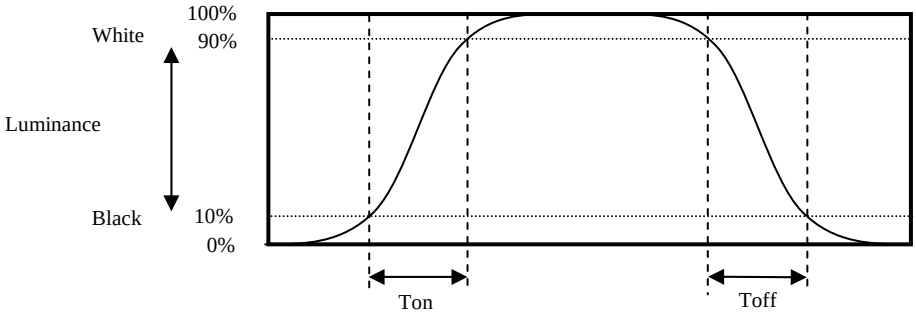
The luminance is measured at near the 5 points shown below.



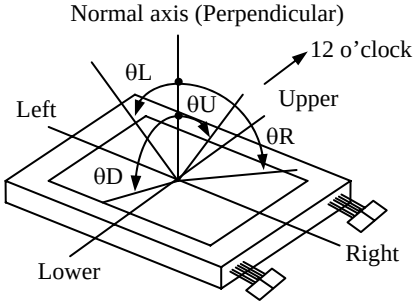
4.9.4 Definition of response times

4

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



4.9.5 Definition of viewing angles



5. RELIABILITY TESTS

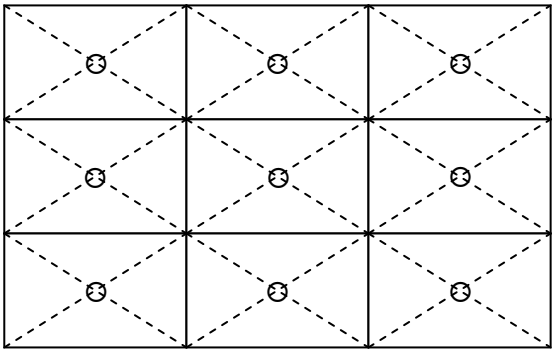
(Note1)

Test item	Condition	Judgement
High temperature and humidity (Operation)	① 60 ± 2°C, RH= 90%, 240hours ② Display data is black.	No display malfunctions
High temperature (Operation)	① 70 ± 3°C, 240hours ② Display data is black.	
Heat cycle (Operation)	① -10 ± 3°C…1hour 70 ± 3°C…1hour ② 50cycles, 4 hours/cycle ③ Display data is black.	
Thermal shock (Non operation)	① -20 ± 3°C…30minutes 80 ± 3°C…30minutes ② 100cycles, 1hour/cycle ③ Temperature transition time is within 5 minutes.	
ESD (Operation)	① 150pF, 150Ω, ±10kV ② 9 places on a panel surface Note2 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 (Non operation)	① 5 to 100Hz, 11.756m/s^2 ② 1 minute/cycle ③ X, Y, Z direction ④ 50 times each directions	No display malfunctions No physical damages
Mechanical shock (Non operation)	① 294m/ s^2, 11ms ② ±X, ±Y, ±Z direction ③ 3 times each directions	

4

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

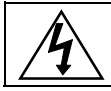
Note2: See the following figure for discharge points.



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 539m/s^2 and to be not greater 11ms, Pressure: To be not greater 19.6 N (ϕ16mm jig))**

6.3 ATTENTIONS 

6.3.1 Handling of the product

① Take hold of both ends without touching the circuit board when the product (LCD module) is picked up from inner packing box to avoid broken down or misadjustment, because of stress to mounting parts on the circuit board.
② Do not hook nor pull cables such as lamp cable, and so on, 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 using mounting holes without undue stress such as bends or twist (See outline drawings). And do not add undue stress to any portion (such as bezel flat area). Bends or twist described above and undue stress to any portion may cause display mura.
⑥ Do not press or rub on the sensitive product surface. When cleaning the product surface, use of the cloth with ethanolic liquid such as screen cleaner for LCD is recommended.
⑦ Do not push nor pull the interface connectors while the product is working.
⑧ Do not bend or unbend the lamp cable at the near part of the lamp holding rubber, to avoid the damage for high voltage side of the lamp.

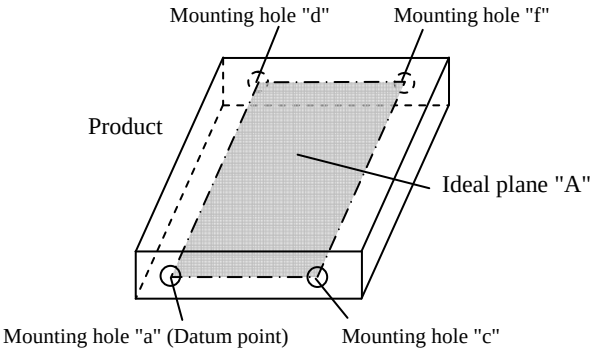
⑨ Properly connect the plug (backlight side) to adaptable socket (inverter side) without incomplete connection. After connecting, be careful not to hook the lamp cables because incomplete connection may occur by hooking the lamp cables. This incomplete connection may cause abnormal operation of high voltage circuit. 4

⑩ If the lamp cable is attached on the metal part of the product directly, high frequency leak current to the metal part may occur, then the brightness may decrease or the lamp may not be turned on.

⑪ When handling the product, use of an original protection sheet on the product surface (polarizer) is recommended for protection of product surface. Adhesive type protection sheet may change color or characteristics of the polarizer.

⑫ Usually liquid crystals don't leak through the breakage of glasses because of the surface tension of thin layer and the construction of LCD panel. But, if you contact with liquid crystal for the worst, please wash it out with soap. 4

⑬ The product must be installed using mounting holes without undue stress such as bends or twist (See outline drawings). And do not add undue stress to any portion (such as bezel flat area).Bends or twist described above and undue stress to any portion may cause display mura. 4
Recommended installing method: Ideal plane "A" is defined by one mounting hole (datum point) and other mounting holes. The ideal plane "A" should be the same plane within ±0.3 mm.



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 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. Circuit boards 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 Characteristics of the LCD (such as response time, luminance, color uniformity and so on) may be changed depending on ambient temperature. If the product is stored under condition of low temperature for a long time, it may cause display mura. In this case, the product should be operated after enough time being left under condition of operating temperature.
② Display mura, flicker, vertical seam or small spot may be observed depending on display patterns.
③ 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.
④ Do not display the fixed pattern for a long time because it may cause image sticking. Use a screen saver, if the fixed pattern is displayed on the screen.
⑤ The display color may be changed depending on viewing angle because of the use of condenser sheet in the backlight.
⑥ Optical characteristics may be changed depending on input signal timings.
⑦ The interference noise between input signal frequency for this product's signal processing board and luminance control frequency of the inverter may appear on a display. Set up luminance control frequency of the inverter so that the interference noise does not appear.
⑧ After the product is stored under condition of low temperature or dark place for a long time, the cold cathode fluorescent lamp may not be turned on under the same condition because of the general characteristic of cold cathode fluorescent lamp. In addition, when Luminance control ratio is low in pulse width modulation method inverter, the lamp may not be turned on. In this case, power should be supplied again. 4

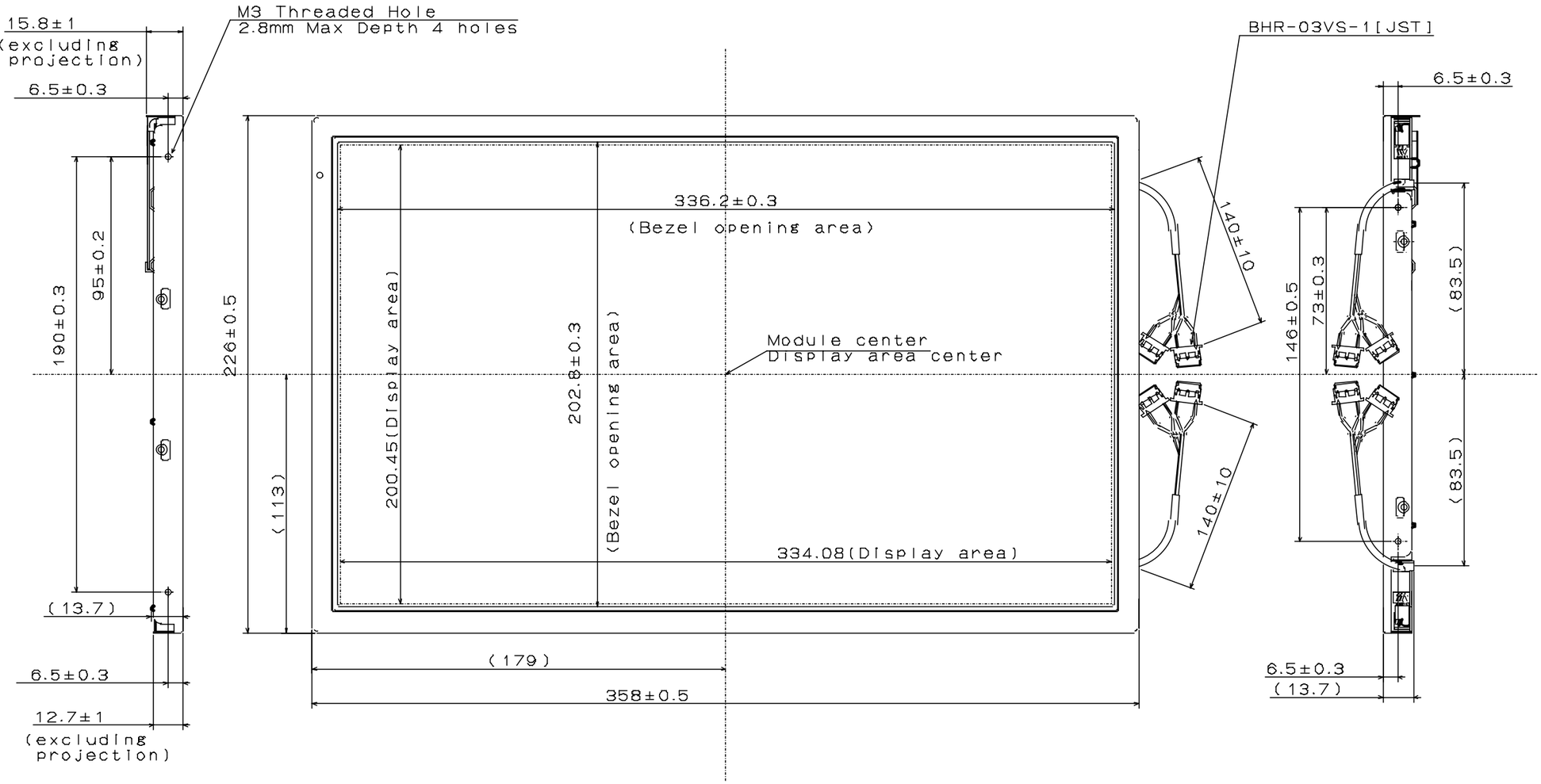
6.3.4 Other

① All GND and VCC terminals should be used without any non-connected lines.
② Do not disassemble a product or adjust variable resistors.
③ Pay attention not to insert foreign materials inside of the product, when using tapping screws.
④ Pack the product with original shipping package, in order to avoid any damages during transportation, when returning the product to NEC for repair and so on.

7. OUTLINE DRAWINGS

4

7.1 FRONT VIEW

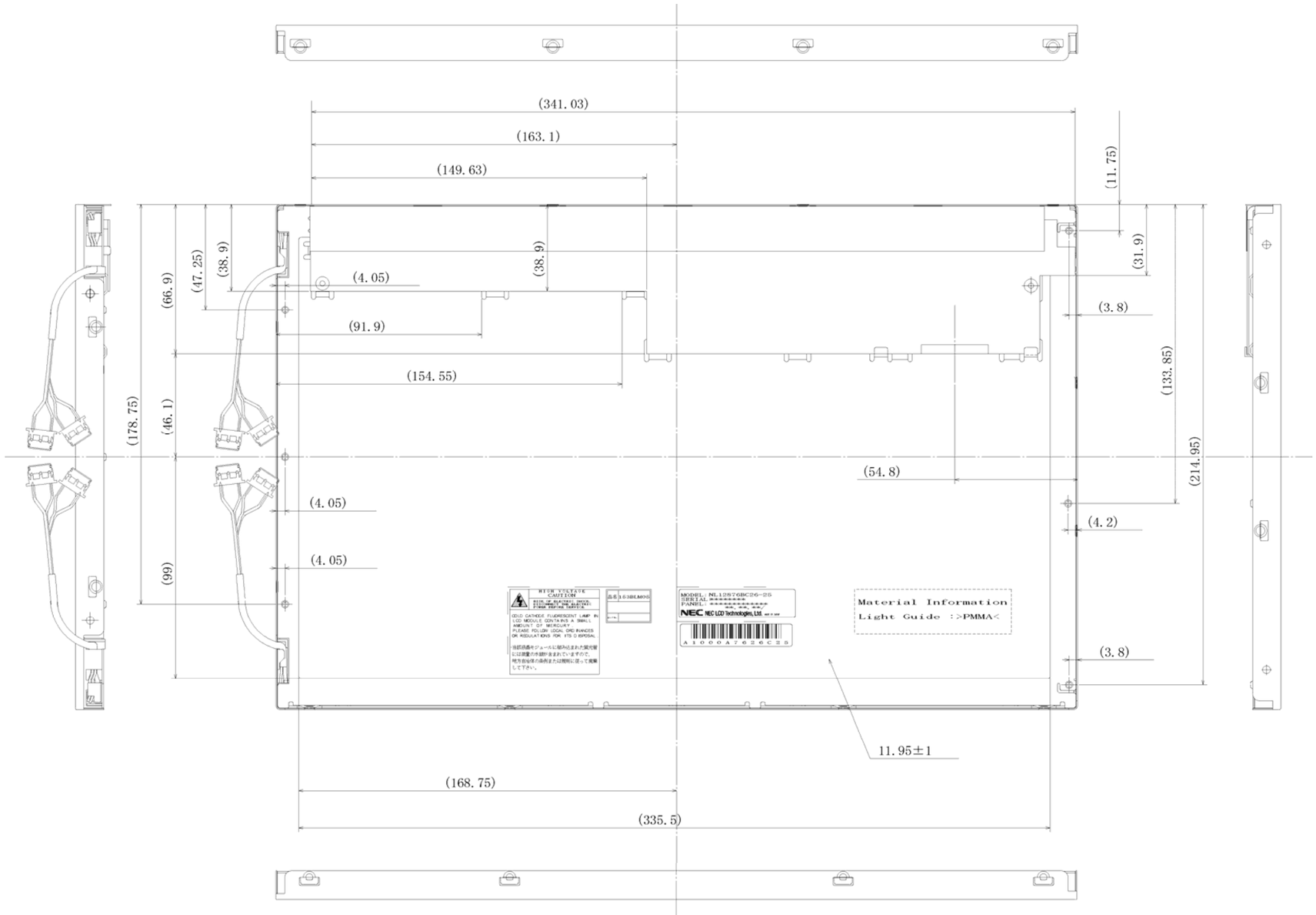


Note1: The values in parentheses are for reference.
Note2: The torque for product mounting screws must never exceed TBD N·m.

Unit: mm

7.2 REAR VIEW

4



Unit: mm

Note1: The values in parentheses are for reference.
Note2: The torque for product mounting screws must never exceed TBD N·m.

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-0063	Nov. 1, 2006	**Revision contents** New issue **Writer** *Approved by* T. OGAWA *Checked by* *Prepared by* T. OGAWA
2nd edition	DOD-PP-0091	Nov.10, 2006	**Revision contents** P26 Outline drawings • Summary outline drawing is changed. **writer** *Approved by* T. OGAWA *Checked by* *Prepared by* M. TANAKA
3rd edition	DOD-PP-0114	Dec.01, 2006	**Revision contents** P5 GENERAL SPECIFICATIONS • Display area :334.08(H) × 200.448(V)mm → 334.08(H) × 200.45(V)mm P7 MECHANICAL SPECIFICATIONS • Display area : 304.128(H) × 228.096(V)mm → 334.08(H) × 200.45(V)mm P8 LCD panel signal processing board • Power supply current : TBD mA (typ. , max.)→ (600) mA (typ.), (900) mA (max.) P9 Backlight lamp • Lamp current : TBD mArms (min. , typ. , max.) → 3.0 mArms (min.), 6.0 mArms (typ.), 6.5 mArms (max.) • Lamp voltage : TBD Vrms (typ.)→ (670) Vrms (typ.) • Lamp starting voltage : TBD Vrms (min.)→ (1,100) Vrms (min.) (Ta= 25°C) TBD Vrms (min.)→ (1,600) Vrms (min.) (Ta= -20°C) • Lamp oscillation frequency : TBD kHz (min. , typ. , max.) → (38) kHz (min.), (43) kHz (typ.), (48) kHz (max.) P13 Backlight lamp • CN plug (LCD module side), Adaptable socket : (addition) P19 Timing characteristics • CLK- Frequency : TBD MHz (min.), 81.0 MHz (typ.)→(70) MHz (min.),79.5 MHz (typ.) • DE- Horizontal- Cycle : 20.84 μs (typ.) , 1688 CLK (typ.) → 20.93 μs (typ.) , 1664 CLK (typ.) • DE- Vertical- Cycle : 16.79 ms (typ.) , 806 H (typ.) → 16.70 ms (typ.) , 798 H (typ.) P26, P27 OUTLINE DRAWINGS • FRONT VIEW and REAR VIEW is changed. **Signature of writer** *Approved by* T. OGAWA *Checked by* *Prepared by* T. OGAWA

REVISION HISTORY

Edition	Document number	Prepared date	Revision contents and signature
4th edition	DOD-PP-0167	Feb. 6, 2007	**Revision contents** P1, P4 Outline-Structure and Principle • NL12876BC26-XX → NL12876BC26-25 P5 General specifications • Display color: 6-bit → 8-bit • Module size: 17.0 (D) mm (max.) (excluding protuberance) → 16.8 (D) mm (max.) (excluding projection) • Luminance, Power consumption: At IBL= TBD mArms / lamp→ 6.0 mArms / lamp P6 Block diagram:50kΩ (addition) P7 Detailed specifications • Mechanical- specifications-Module size: 17.0 max (D) → 16.8 max (D) (excluding projection) • Absolute maximum ratings-Note2: FRC→ MSL (correction) P8 Electrical characteristics-LCD panel signal processing board • Input voltage for DPS and MSL signals: VFH: TBD (min.)→0.7VCC (min.), VFL: TBD (max.)→ 0.3VCC (max.) • Input current for DPS and MSL signals: IFH: TBD (max.)→ 160 (max.), IFL: TBD (min.)→ -160 (min.) P10 Backlight lamp • Note8 (addition) P11 Fuse: TBD → (TF16SN3.15) P12 Power supply voltage sequence-LCD panel processing board • TBD ≤Tr< TBD→ 0.01ms ≤Tr< 50ms • Toff≥ TBD→ Toff≥ 200ms • TBD <t< TBD→ 0ms <t< 35ms • Note2: FRC→ MSL (correction) P13 Connections and functions for interface pins-LCD panel signal processing board • CN1 socket (LCD module side) and Adaptable plug (correction) P14 Backlight lamp: CN2→ CN201,CN202,CN203,CN204 P15 Positions of plug and socket: drawings (addition) P16-P17 Connection between receiver and transmitter for LVDS • LVDS Input data map A and B-19pin: DPS→ GND (correction) • Note4: TD6 (addition) P17 Connection between receiver and transmitter for LVDS • Recommended transmitter terminal marking (correction) • Note2-MSB (Most Significant Bit): R5, G5, B5→ R7, G7, B7 (correction) P21 Timing characteristics-Remarks • CLK: 12.579 ns (typ.), DE-Horizontal: 47.776 kHz (typ.), DE-Vertical: 60.0 kHz (typ.) (addition) P23 Optics- Optical characteristics • Chromaticity-Wx,Wy (typ.): TBD (typ.) → 0.313, 0.329 (typ.) (correction) • Note2: Measurement conditions (addition) P24 Optics- definition of response times (correction) P25 Reliability test- Vibration and Mechanical shock: Test condition (addition) P27-P28 Precautions-Attentions • Handling of the product: ⑨, ⑫ and ⑬ (addition) • Characteristics: ⑧ (addition) P29-30 Outline drawings: (change) **Signature of writer** *Approved by* T. OGAWA *Checked by* *Prepared by* T. OGAWA