NEC

TFT COLOR LCD MODULE

NL10276BC20-07Y

26.3cm (10.4 Type)

XGA

PRELIMINARY DATA SHEET

DOD-M-1348 (2nd edition)

This DATA SHEET is updated document from PRELIMINARY DATA SHEET DOD-M-1289(1).

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

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INTRODUCTION

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The quality grade of this product is ***"Standard"*** unless otherwise specified in this document. If customers intend to use this product for applications other than those specified for ***"Standard"*** quality grade, they should contact NEC Corporation sales representative in advance.

CONTENTS

1. OUTLINE

1.1 STRUCTURE AND PRINCIPLE

NL10276BC20-07Y module 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. PC, signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, 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 APPLICATIONS

- Display terminal for control system
- Industrial PC

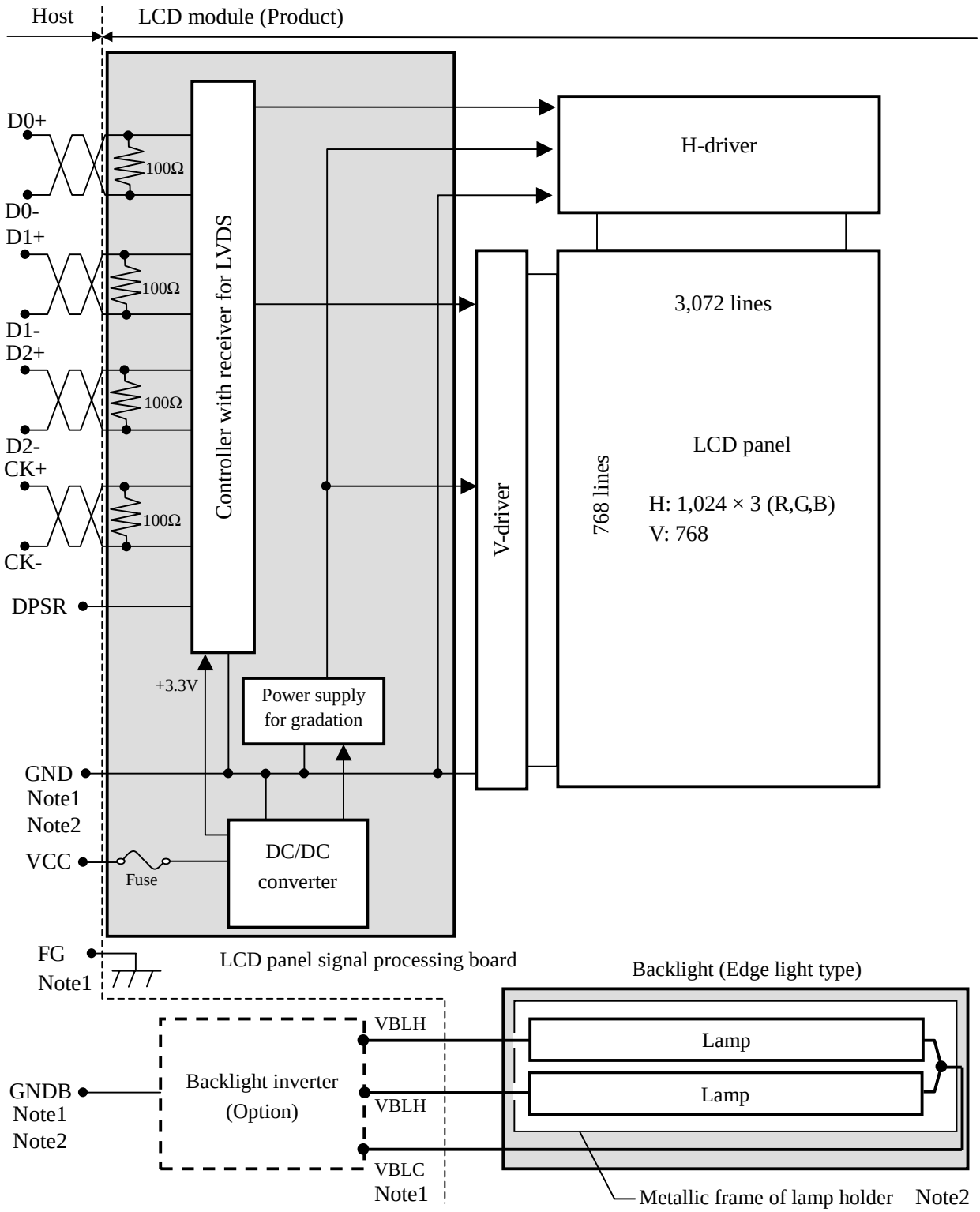
1.3 FEATURES

- High luminance
- Wide viewing angle
- Extensive temperature
- 6-bit digital RGB signals
- Single link LVDS interface
- Reversible-scan direction
- Edge light type
- Replaceable lamp for backlight (Inverter less)
- Suitable for setting in the portrait position (See “4.7 DISPLAY POSITIONS AND 4.8 SCANNING DIRECTIONS”.)

2. GENERAL SPECIFICATIONS

Display area	210.432 (W) × 157.824 (H) mm (typ.)	
Diagonal size of display	26.3 cm (10.4 inches)	
Drive system	a-Si TFT active matrix	
Display color	262,144 colors	
Pixel	1,024 (H) × 768 (V) pixels	
Pixel arrangement	RGB (Red dot, Green dot, Blue dot) vertical stripe	
Dot pitch	0.0685 (W) × 0.2055 (H) mm	
Pixel pitch	0.2055 (W) × 0.2055 (H) mm	
Module size	243.0 (W) × 185.1 (H) × 17.6 (D) mm (typ.)	2
Weight	530 g (typ.)	
Contrast ratio	300:1 (typ.)	2
Viewing angle	*At the contrast ratio 10:1* • Right side 50° (typ.), Left side 50° (typ.) • Up side 35° (typ.), Down side 75° (typ.)	2
Designed viewing direction	*At DPSR: normal scan* • Viewing direction without image reversal: up side (12 o'clock) • Viewing direction with contrast peak: down side 1° (6 o'clock) • Viewing angle with optimum grayscale (γ=2.2): normal axis	2
Polarizer surface	Antiglare	
Polarizer pencil-hardness	3H (min.) [by JIS K5400]	
Color gamut	*At LCD panel center* 40 % (typ.) [against NTSC color space]	2
Response time	*Ton (white 90%→ black 10%)* 15 ms (typ.)	2
Luminance	*At IBL= 5.0mArms / lamp* 300 cd/m^2 (typ.)	2
Signal system	Single link LVDS (Receiver: THC63LVDF64A, THine Electronics Inc.) [6-bit 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: 2 cold cathode fluorescent lamps (Replaceable parts • Lamp holder set: Type No. 104LHS35) (Recommended inverter (Option) • Inverter: Type No. 104PW191)	
Power consumption	*At IBL= 5.0mArms / lamp and checkered flag pattern* 6.2W (typ.)	

3. BLOCK DIAGRAM



Note1: Connections between GND (Signal ground), FG (Frame ground) and VBLC (Lamp low voltage terminal) in the LCD module

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

Note2: These grounds should be connected together in customer equipment.

4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification		Unit
Module size	243.0 ± 0.5 (W) × 185.1 ± 0.5 (H) × 17.6 (typ., D)	Note1	mm
Display area	210.432 (W) × 157.824 (H)	Note1	mm
Weight	530 (typ.), 550 (max.)		g

2

Note1: See "**11. OUTLINE DRAWINGS**".

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal board	VCC	-0.3 to +4.0	V	Ta = 25°C
	Lamp	VBLH	1,500	Vrms	
Input voltage for signals	Display signals Note1	VD	-0.3 to VCC+0.3	V	
	Function signals Note2	VF	-0.3 to VCC+0.3	V	
Storage temperature		Tst	-20 to +70	°C	-
Operating temperature	Front surface	TopF	0 to +60	°C	
	Rear surface	TopR	0 to +60	°C	
Relative humidity Note3		RH	≤ 95	%	Ta ≤ 40°C
			≤ 85	%	40 < Ta ≤ 50°C
			≤ 70	%	50 < Ta ≤ 55°C
			≤ 60	%	55 < Ta ≤ 60°C
Absolute humidity Note3		AH	≤ 78 Note4	g/m^3	Ta > 60°C

Note1: Display signals are D0+/-, D1+/-, D2+/- and CK+/-.
Note2: Function signal is DPSR.
Note3: No condensation
Note4: Ta = 60°C, RH = 60%

4.3 ELECTRICAL CHARACTERISTICS

4.3.1 Driving for 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	-	300 Note1	500 Note2	mA	VCC = 3.3V
Input voltage for LVDS receiver	Low	VDRL	0	-	0.8	V	-
	High	VDRH	2.0	-	2.4	V	
Differential input threshold voltage for LVDS receiver	Low	VTL	-100	-	-	mV	VCM=1.2V Note3
	High	VTH	-	-	+100	mV	
Input voltage for DPSR signal	Low	VFDL	0	-	0.8	V	-
	High	VFDH	2.0	-	VCC	V	

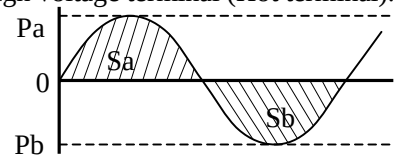
Note1: Checkered flag pattern (by EIAJ ED-2522)
Note2: Pattern for maximum current
Note3: Common mode voltage for LVDS receiver

4.3.2 Working for backlight lamp

Parameter	Symbol	Ta	min.	typ.	max.	Unit	Remarks
Lamp starting voltage	VS	0°C	1,100	-	-	Vrms	Note1
		25°C	850	-	-	Vrms	
Lamp voltage	VBLH	25°C	-	520	-	Vrms	Note1,Note2
Lamp current	IBL	25°C	2.0	5.0	5.5	mArms	Note2, Note3
Lamp oscillation frequency	FO	25°C	60	65	70	kHz	Note4

Note1: The power supply 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).

Note2: 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).



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

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

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

Note3: The lamp holder of this product contains two backlight lamps. The low voltage terminal of both lamps is connected to one contact point. Also above power supply current specification is one lamp duty. Therefore, this lamp holder becomes twice as many power supply current as above value on low voltage (Cold) line. The measurement for the power supply current value of one lamp should measure on high voltage (Hot) line to each lamp.

Note4: 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 synchronous cycle (See "4.9.3 Timing characteristics".)
n: Natural number (1, 2, 3 ·····)

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.

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

Note1: The permissible ripple voltage includes spike noise.

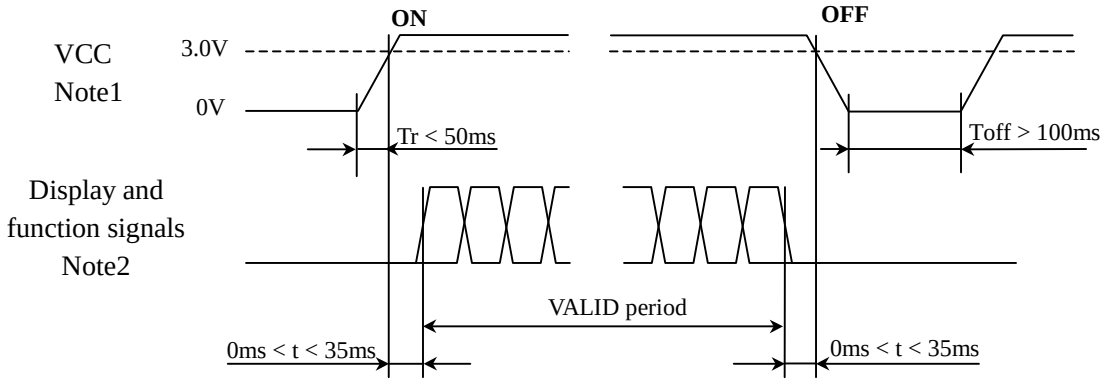
4.3.4 Fuse

Fusing line	Fuse		Rating	Fusing current Note1
	Type	Supplier		
VCC	TF16N2.00	KOA Corporation	2.0 A 47 V	4.0 A

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

4.4 POWER SUPPLY VOLTAGE SEQUENCE

4.4.1 Sequence for LCD panel signal processing board

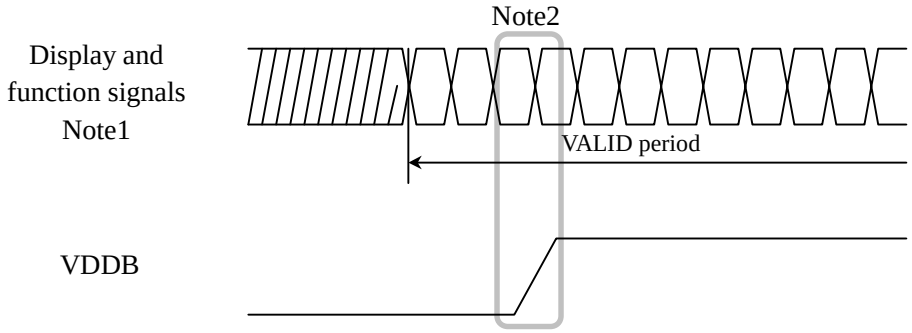


Note1: In terms of voltage variation (voltage drop) while VCC rising edge is below 3.0V, a protection circuit may work, and then this product may not work.

Note2: Display (D0+/-, D1+/-, D2+/- and CK+/-) with 100Ω (Characteristic impedance) and function (DPSR) signals must be Low or High-impedance, exclude the VALID period (See above sequence diagram), in order to avoid that internal circuits is damaged.

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. If customer stops the display and function signals, they should be cut VCC.

4.4.2 Sequence for backlight inverter (Option)



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

Note2: The backlight inverter voltage (VDDB) should be inputted 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 (Module side): FI-SE20P-HF (Japan Aviation Electronics Industry Limited)
Adaptable plug: FI-S20S (Japan Aviation Electronics Industry Limited)

Pin No.	Symbol	Function	Remarks
1	GND	Ground	-
2	GND		
3	DPSR	Select of scan direction	High: Reverse scan Low or Open: Normal scan Note1
4	NC	Non connection	-
5	GND	Ground	
6	CK+	Pixel clock	Note2
7	CK-		
8	GND	Ground	-
9	D2+	Pixel data	Note2
10	D2-		
11	GND	Ground	-
12	D1+	Pixel data	Note2
13	D1-		
14	GND	Ground	-
15	D0+	Pixel data	Note2
16	D0-		
17	GND	Ground	-
18	GND		
19	VCC	Power supply	
20	VCC		

Note1: See "4.8 SCANNING DIRECTIONS".

Note2: Twist pair wires with 100Ω (Characteristic impedance) should be connected between LCD panel signal processing board and LVDS transmitter.

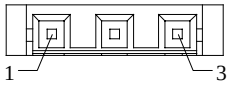
CN1: Figure of socket

4.5.2 Backlight lamp

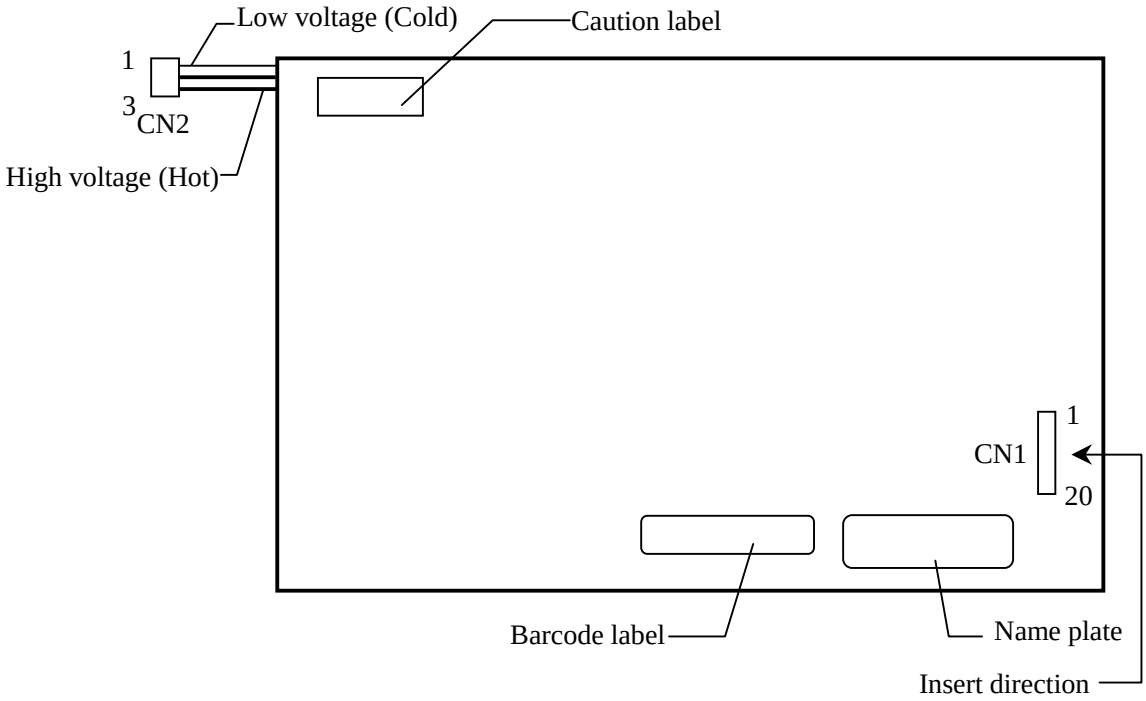
CN2 plug: BHR-03VS-1 (J.S.T Mfg. Co., Ltd.)
Adaptable socket: SM03 (4.0) B-BHS-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLC	Low voltage (Cold)	-
2	VBLH	High voltage (Hot)	
3	VBLH	High voltage (Hot)	

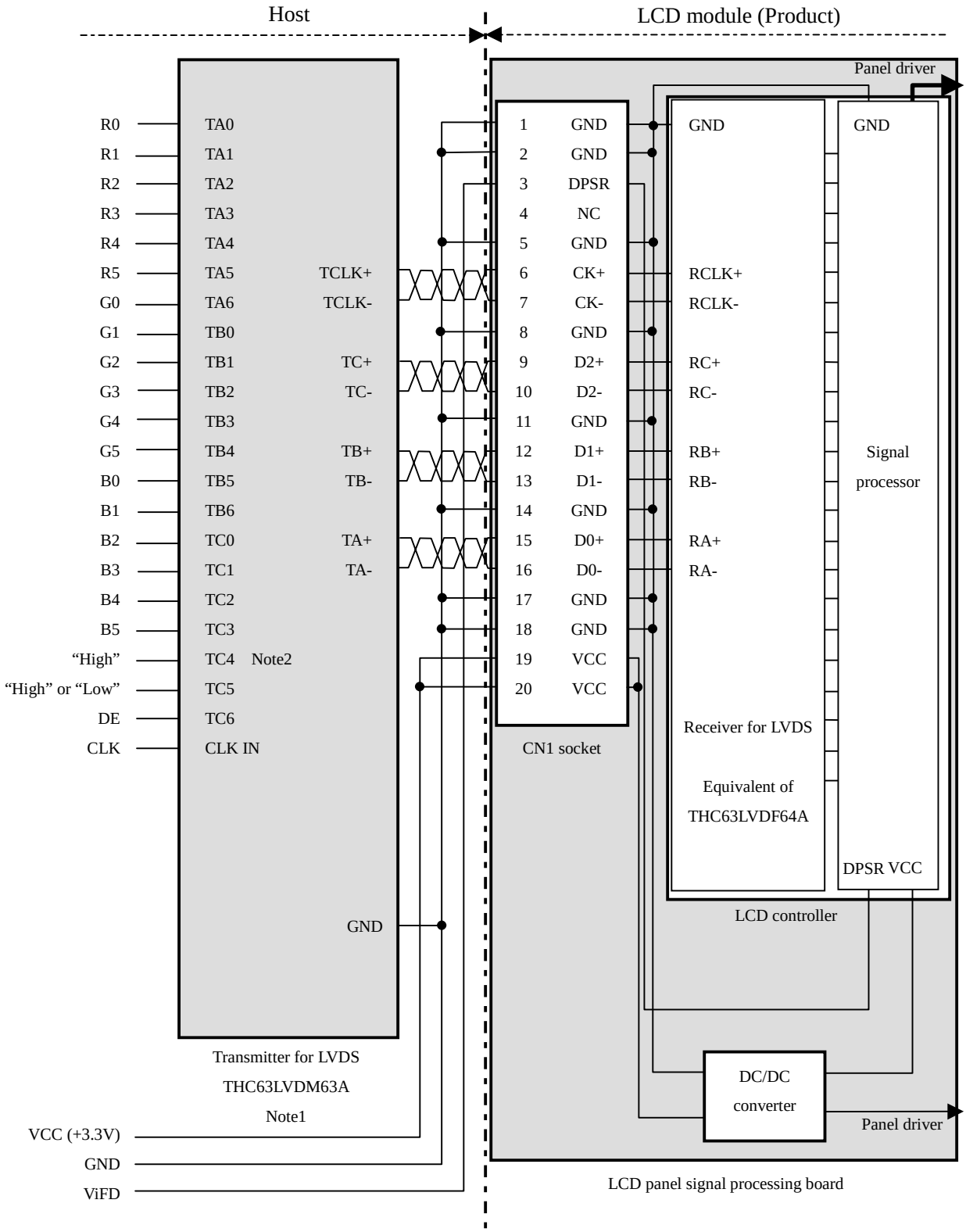
CN2: Figure of plug



4.5.3 Positions of a plug and a socket



4.5.4 Connection between receiver and transmitter for LVDS



Note1: Recommended transmitter

See the data sheet for THC63LVDM63A (THine Electronics Inc.).

Note2: TC4 must be fixed to "High".

4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

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

Display colors		Data signal (0: Low level, 1: High level)																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red 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	1	0	0	0	0	0	0	0	0	0	0	0	0
	dark	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑				:						:						:		
	↓				:						:						:		
	bright	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
		1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green 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	1	0	0	0	0	0	0
	dark	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	↑				:						:						:		
	↓				:						:						:		
	bright	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
		0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue 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	1
	dark	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	1	1	1	1	0	1
		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

4.7 DISPLAY POSITIONS

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

C(1023, 0)	C(1023, 1)	• • •	C(1023, Y)	• • •	C(1023,766)	C(1023,767)
C(1022, 0)	C(1022, 1)	• • •	C(1022, Y)	• • •	C(1022, 766)	C(1022,767)
• • •	• • •	• • •	• • •	• • •	• • •	• • •
C(X, 0)	C(X, 1)	• • •	C(X, Y)	• • •	C(X, 766)	C(X,767)
• • •	• • •	• • •	• • •	• • •	• • •	• • •
C(1, 0)	C(1, 1)	• • •	C(1, Y)	• • •	C(1, 766)	C(1, 767)
C(0, 0)	C(0, 1)	• • •	C(0, Y)	• • •	C(0, 766)	C(0, 767)

4.8 SCANNING DIRECTIONS

The following figures are seen from a front view. Also the arrow shows the direction of scan.

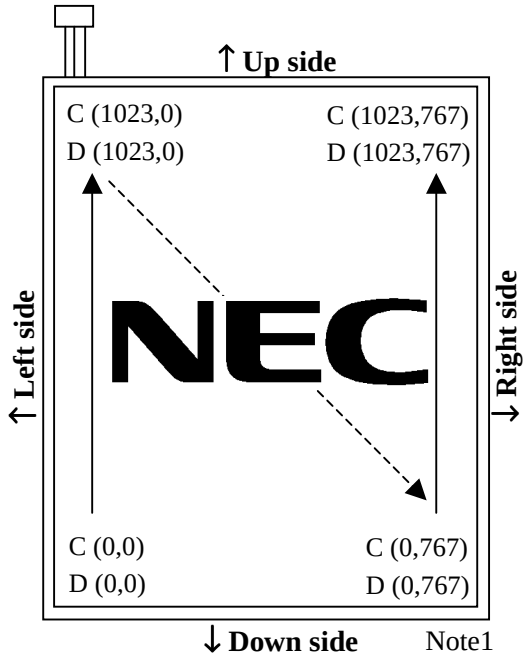


Figure 1. Normal scan (DPSR: Low or Open)

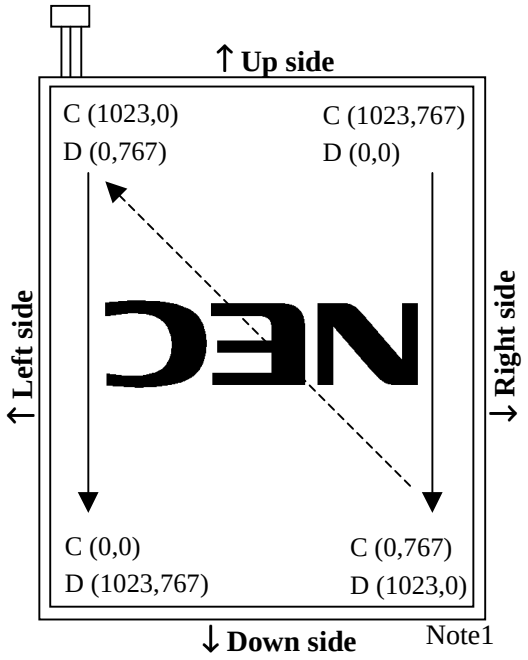


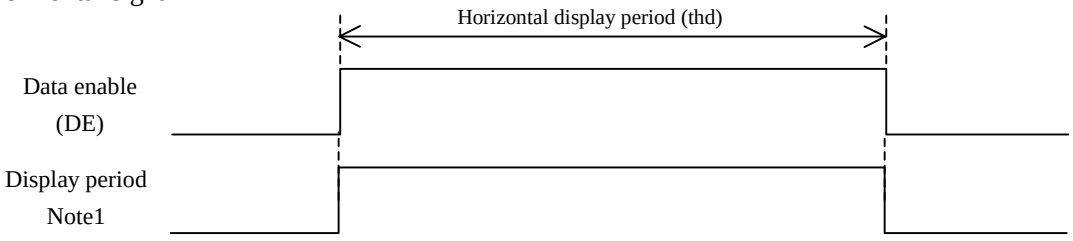
Figure 2. Reverse scan (DPSR: High)

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 signal processing board

4.9 INPUT SIGNAL TIMINGS FOR LCD PANEL SIGNAL PROCESSING BOARD

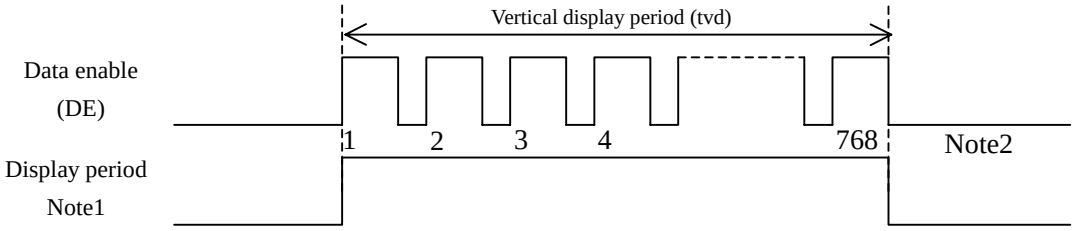
4.9.1 Outline of input signal timings

- Horizontal signal



Note1: This diagram indicates virtual signal for set up to timing.

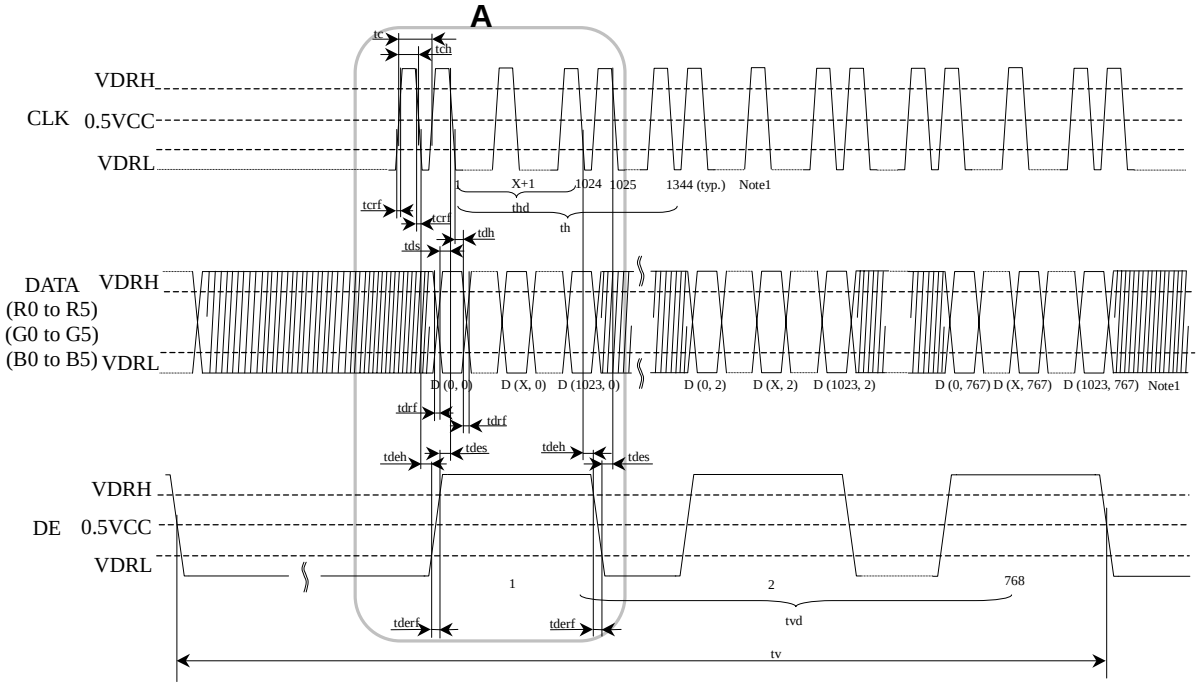
- Vertical signal



Note1: This diagram indicates virtual signal for set up to timing.
Note2: See "4.9.2 Input signal timing chart" for numeration of pulse.

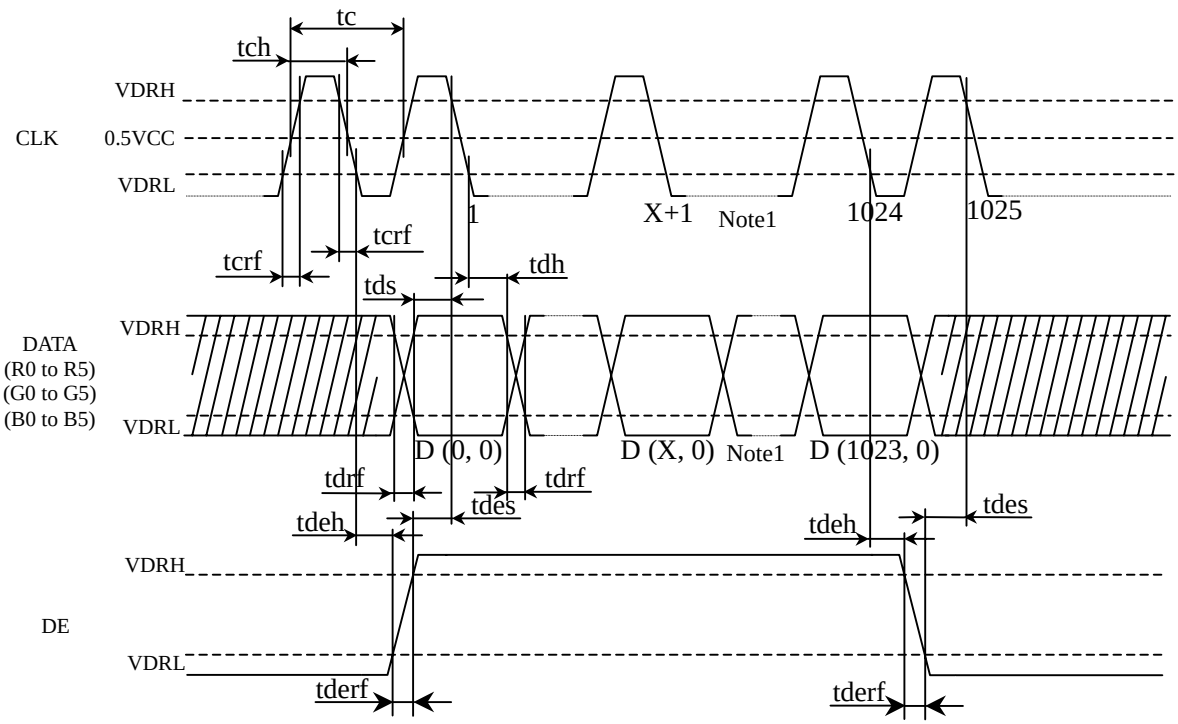
4.9.2 Detailed input signal timing chart for DE mode

- Outline chart



Note1: X is data number from 1 to 1022. See "4.8 SCANNING DIRECTIONS".

• Detail of **A** part



Note1: X is data number from 1 to 1022. See "4.8 SCANNING DIRECTIONS".

4.9.3 Timing characteristics

Parameter Note1			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency (LVDS receiver)		tcf	60.0	65.0	68.0	MHz	15.4 ns (typ.) Note1
	Duty		tcd	-	-	-	-	Note1, Note2
	Rise time, Fall time		tcrf	-	-	-	-	Note2
DATA	CLK-DATA	Setup time	tds	-	-	-	-	
		Hold time	tdh	-	-	-	-	
	Rise time, Fall time		tdrf	-	-	-	-	
DE	Horizontal	Cycle	th	19.67	20.676	22.4	μs	48.363kHz (typ.) Note1, Note3
				-	1,344	-	CLK	
		Display period	thd	1,024			CLK	60.0Hz (typ.) Note1
	Vertical (One frame)	Cycle	tv	13.3	16.666	18.5	ms	
				780	806	-	H	
		Display period	tvd	768			H	
	CLK-DE	Setup time	tdes	-	-	-	-	Note2
		Hold time	tdeh	-	-	-	-	
	Rise time, Fall time		tderf	-	-	-	-	

Note1: Definition of parameters is as follows.

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

Note2: See the data sheet of LVDS transmitter.

Note3: "th" must keep the fluctuation within ±1 CLK, because of avoidance of image sticking.

4.10 OPTICS

4.10.1 Optical characteristics

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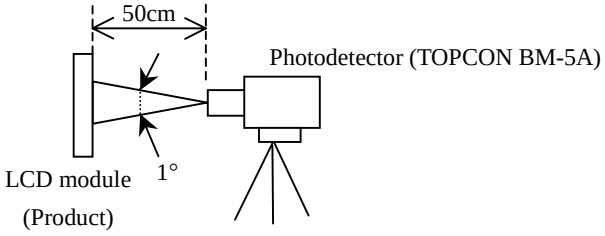
Parameter Note1	Condition	Symbol	min.	typ.	max.	Unit	Remarks
Luminance	White at center θR = 0°, θL = 0°, θU = 0°, θD = 0°	L	100	300	-	cd/m^2	Note2
Contrast ratio	White/Black at center θR = 0°, θL = 0°, θU = 0°, θD = 0°	CR	150	300	-	-	-
Luminance uniformity	-	LU	-	1.24	1.40	-	Note3

Reference data

Parameter Note1		Condition	Symbol	min.	typ.	max.	Unit	Remarks
Chromaticity	White	**x** coordinate	Wx	0.300	0.330	0.360	-	Note4
		y coordinate	Wy	0.326	0.356	0.386	-	
	Red	**x** coordinate	Rx	-	0.581	-	-	
		y coordinate	Ry	-	0.342	-	-	
	Green	**x** coordinate	Gx	-	0.331	-	-	
		y coordinate	Gy	-	0.539	-	-	
	Blue	**x** coordinate	Bx	-	0.156	-	-	
		y coordinate	By	-	0.165	-	-	
Color gamut		θR = 0°, θL = 0°, θU = 0°, θD = 0° at center, against NTSC color space	C	35	40	-	%	
Response time		White to black	Ton	-	15	30	ms	Note5 Note6
		Black to white	Toff	-	40	60	ms	
Viewing angle	Right	θU = 0°, θD = 0°, CR = 10	θR	40	50	-	°	Note7
	Left	θU = 0°, θD = 0°, CR = 10	θL	45	50	-	°	
	Up	θR = 0°, θL = 0°, CR = 10	θU	30	35	-	°	
	Down	θR = 0°, θL = 0°, CR = 10	θD	65	75	-	°	

Note1: Measurement conditions are as follows.
Ta = 25°C, VCC = 3.3V, IBL = 5.0mArms/lamp, Display mode: XGA, Horizontal cycle = 48.363kHz, Vertical cycle = 60.0Hz, DPSR = Low or Open: Normal scan

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



Note2: See "4.10.2 Definition of contrast ratio".
Note3: See "4.10.3 Definition of luminance uniformity".
Note4: These coordinates are found on CIE 1931 chromaticity diagram.
Note5: Product surface temperature: TopF = 25°C
Note6: See "4.10.4 Definition of response times".
Note7: See "4.10.5 Definition of viewing angles".

4.10.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

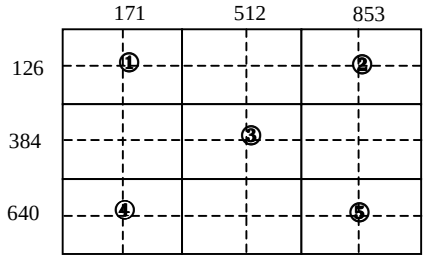
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

4.10.3 Definition of luminance uniformity

The luminance uniformity is calculated by using following formula.

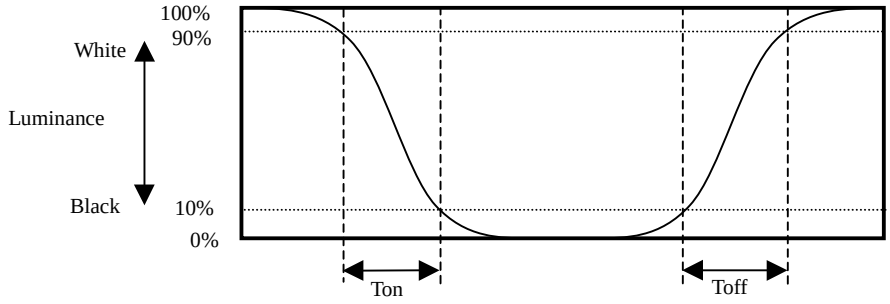
$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑤}}{\text{Minimum luminance from ① to ⑤}}$$

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



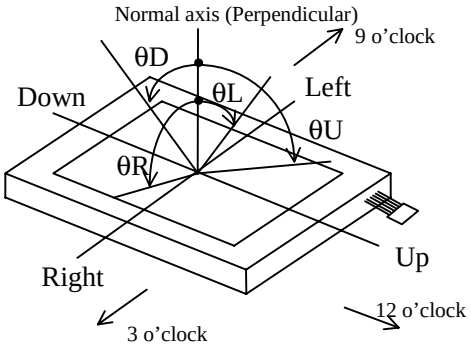
4.10.4 Definition of response times

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.).



4.10.5 Definition of viewing angles

2



5. PRECAUTIONS

5.1 MEANING OF CAUTION SIGNS

The following caution signs have very important meaning. **Be sure to read "5.2 CAUTIONS", after understanding this contents!**

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

5.2 CAUTIONS

- **Pay attention to burn injury for the working backlight! It may be over 35°C from ambient temperature.**
- **Do not shock and press the LCD panel and the backlight! 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 19.6N)**

5.3 ATTENTIONS

5.3.1 Handling of the product

① Take hold of both ends without touch the circuit board when customer pulls out products (LCD modules) from inner packing box. If customer touches it, products may be broken down or out of adjustment, because of stress to mounting parts.

② Do not hook cables nor pull connection cables such as flexible cable and so on, for fear of damage.

③ If customer puts down the product temporarily, the product puts on flat subsoil as a display side turns down.

④ Take the measures of electrostatic discharge such as earth band, ionic shower and so on, when customer deals with the product, because products may be damaged by electrostatic.

⑤ The torque for mounting screws must never exceed 0.29N·m. Higher torque values might result in distortion of the bezel.

⑥ 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) except mounting hole portion. 2

Bends or twist described above and undue stress to any portion except mounting hole portion may cause display un-uniformity.

⑦ Do not press or rub on the sensitive display surface. If customer clean on the panel surface, NEC Corporation recommends using the cloth with ethanolic liquid such as screen cleaner for LCD.

⑧ Do not push-pull the interface connectors while the product is working, because wrong power sequence may break down the product.

⑨ 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. This damage may cause a lamp breaking and abnormal operation of high voltage circuit. 2

5.3.2 Environment

① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in antistatic pouch in room temperature, because of avoidance for dusts and sunlight, if customer stores the product.
② In order to prevent dew condensation occurring by temperature difference, the product packing box must be opened after leave under the environment of an unpacking room temperature enough. Because a situation of dew condensation occurring is changed by the environmental temperature and humidity, evaluate the leaving time sufficiently. (Recommendation leaving time: 6 hour or more with packing state) 2
③ Do not operate in high magnetic field. Circuit boards may be broken down by it.
④ Use an original protection sheet on the product surface (polarizer). Adhesive type protection sheet should be avoided, because it may change color or properties of the polarizer.
⑤ This product is not designed as radiation hardened. 2

5.3.3 Characteristics

The following items are neither defects nor failures.

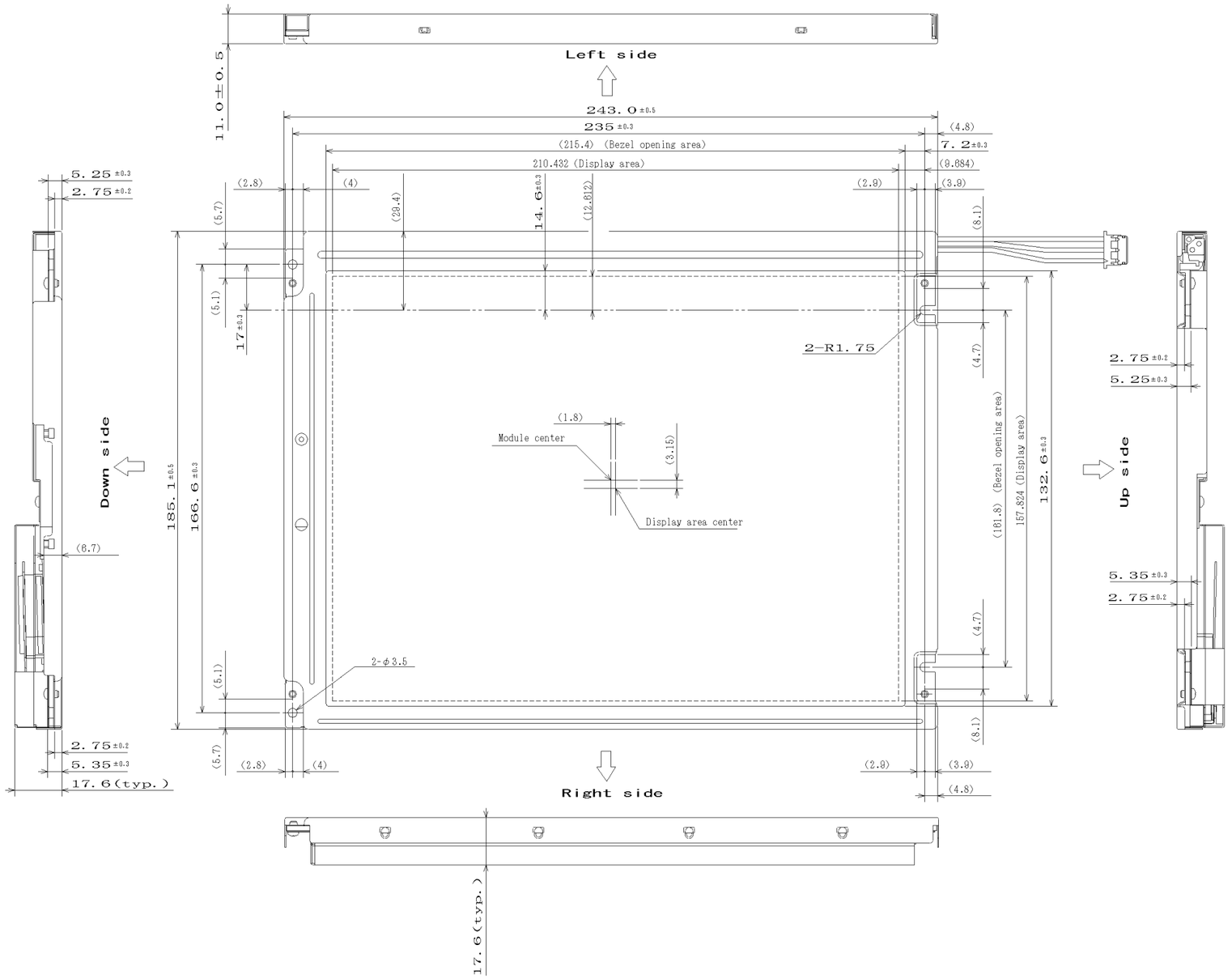
① Response time, luminance and color may be changed by ambient temperature.
② The LCD may be seemed luminance non-uniformity, flicker, vertical seam or small spot by display patterns.
③ Optical characteristics (e.g. luminance, display uniformity, etc.) gradually is going to change depending on operating 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 by viewing angle because of the use of condenser sheet in the backlight.
⑥ Optical characteristics may be changed by input signal timings.
⑦ The interference noise of input signal frequency for this product's signal processing board and luminance control frequency of customer's backlight inverter may appear on a display. Set up luminance control frequency of backlight inverter so that the interference noise does not appear.

5.3.4 Other

① All GND, backlight inverter ground (GNDB), VCC and backlight inverter power supply voltage (VDDB) terminals should be used without a non-connected line.
② Do not disassemble a product or adjust volume without permission of NEC Corporation.
③ See "REPLACEMENT MANUAL FOR LAMPHOLDER", if customer would like to replace backlight lamps.
④ Pay attention not to insert waste materials inside of products, if customer uses screwnails.
⑤ Pack the product with original shipping package, because of avoidance of some damages during transportation, when customer returns it to NEC Corporation for repair and so on.

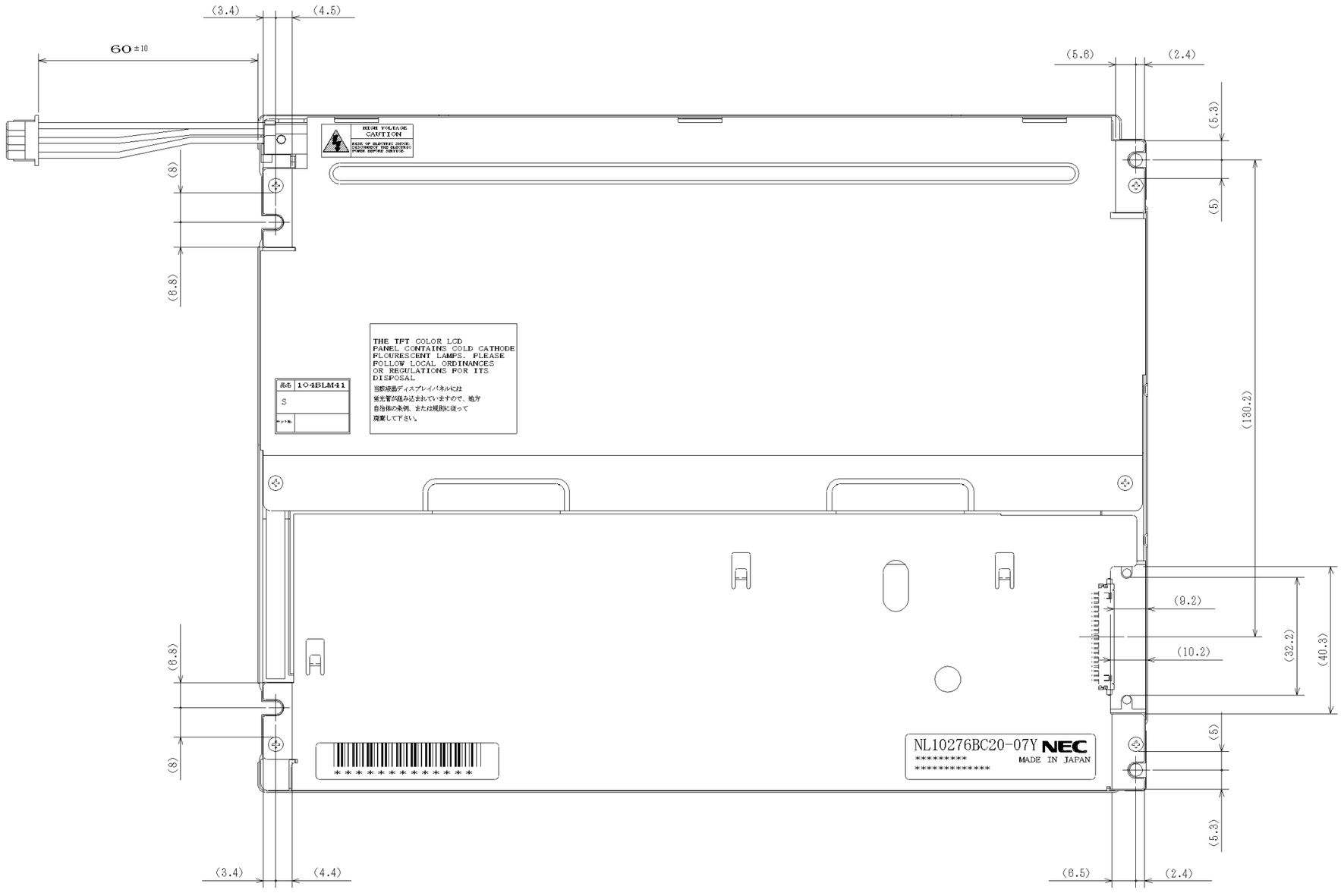
6. OUTLINE DRAWINGS

6.1 FRONT VIEW



Unit: mm

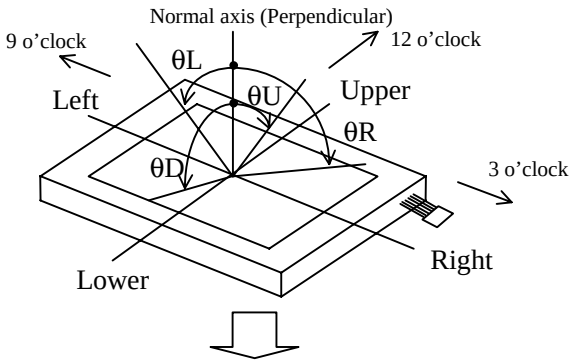
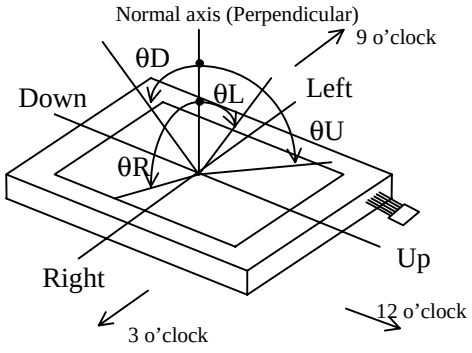
6.2 REAR VIEW



Unit: mm

REVISION HISTORY

The inside of latest specifications is revised to the clerical error, undecided mater (TBD, etc.) 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-M-1289	Dec. 20, 2002	New issue **Writer** *Approved by* T. ITO　*Checked by*　*Prepared by* R. KAWASHIMA
2nd edition	DOD-M-1348	Mar. 12, 2003	**Revision contents** P5, P18, P19 Optical characteristics are decided. P5, P18, P19 Definitions of viewing angles are revised.   P5 General specifications- Designed viewing direction: • Viewing direction without image reversal: right side (3 o'clock) → up side (12 o'clock) • Viewing direction with contrast peak: left side 5° to 10° (9 o'clock) → down side 1° (6 o'clock) P5, P7 Module size: 11.0± 0.5mm → 17.6 mm typ. (corrected) P15 Scanning directions: Figures are revised. P20 Precautions- Handling of the product: ⑥ and ⑨ are added. P21 Precautions- Environment: ② and ⑤ are added. **Signature of writer** *Approved by* TOSHIHIDE ITO　*Checked by* R. KAWASHIMA　*Prepared by* N. KANO