

PRELIMINARY

NEC NEC LCD Technologies, Ltd.

TFT COLOR LCD MODULE

NL128102BC29-01

48.0 cm (19.0 Type)

SXGA

LVDS interface (2port)

PRELIMINARY DATA SHEET 

DOD-PD-0104 (1st edition)

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

INTRODUCTION

No part of this document shall be copied in any form or by any means without the prior written consent of NEC LCD Technologies, Ltd. (hereinafter called "NEC").

NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a product described herein or any other liability arising from use of such application. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or of others.

While NEC has been making continuous effort to enhance the reliability of its products, the possibility of failures cannot be eliminated entirely. To minimize risks of damage to property or injury to person arising from a failure in an NEC product, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.

NEC products are classified into the following three quality grades:

"Standard", "Special", "Specific"

The *"Specific"* quality grade applies only to applications developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a product depend on its quality grade, as indicated below. Customers must check the quality grade of each application before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

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

Specific: Military systems, aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems (medical equipment, etc.) and any other equipment

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 sales representative in advance.

CONTENTS

INTRODUCTION	2
1. OUTLINE	4
1.1 STRUCTURE AND PRINCIPLE	4
1.2 APPLICATIONS	4
1.3 FEATURES	4
2. GENERAL SPECIFICATIONS	5
3. BLOCK DIAGRAM	6
4. DETAILED SPECIFICATIONS	7
4.1 MECHANICAL SPECIFICATIONS	7
4.2 ABSOLUTE MAXIMUM RATINGS	7
4.3 ELECTRICAL CHARACTERISTICS	8
4.3.1 Driving for LCD panel signal processing board	8
4.3.2 Working for backlight lamp.....	9
4.3.3 Power supply voltage ripple.....	10
4.3.4 Fuse	10
4.4 POWER SUPPLY VOLTAGE SEQUENCE.....	11
4.5 CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS	12
4.5.1 LCD panel signal processing board	12
4.5.2 Backlight lamp	13
4.5.3 Positions of plugs and a socket	14
4.6 SELECTION OF LVDS INPUT MAP.....	15
4.6.1 Mode A.....	15
4.6.2 Mode B.....	16
4.7 DISPLAY COLORS AND INPUT DATA SIGNALS	18
4.8 DISPLAY POSITION	19
4.9 INPUT SIGNAL TIMINGS FOR LCD PANEL SIGNAL PROCESSING BOARD	20
4.9.1 Outline of input signal timings.....	20
4.9.2 Timing characteristics	21
4.9.3 Input signal timing chart	22
4.10 OPTICS	23
4.10.1 Optical characteristics	23
4.10.2 Definition of contrast ratio	24
4.10.3 Definition of luminance uniformity.....	24
4.10.4 Definition of response times.....	24
4.10.5 Definition of viewing angles	24
5. RELIABILITY TESTS	25
6. PRECAUTIONS	26
6.1 MEANING OF CAUTION SIGNS	26
6.2 CAUTIONS	26
6.3 ATTENTIONS.....	26
6.3.1 Handling of the product.....	26
6.3.2 Environment	27
6.3.3 Characteristics	27
6.3.4 Other.....	27
7. OUTLINE DRAWINGS	28
7.1 FRONT VIEW	28
7.2 REAR VIEW	29
REVISION HISTORY	30

1. OUTLINE

1.1 STRUCTURE AND PRINCIPLE

NL128102BC29-01 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

- Monitor for PC

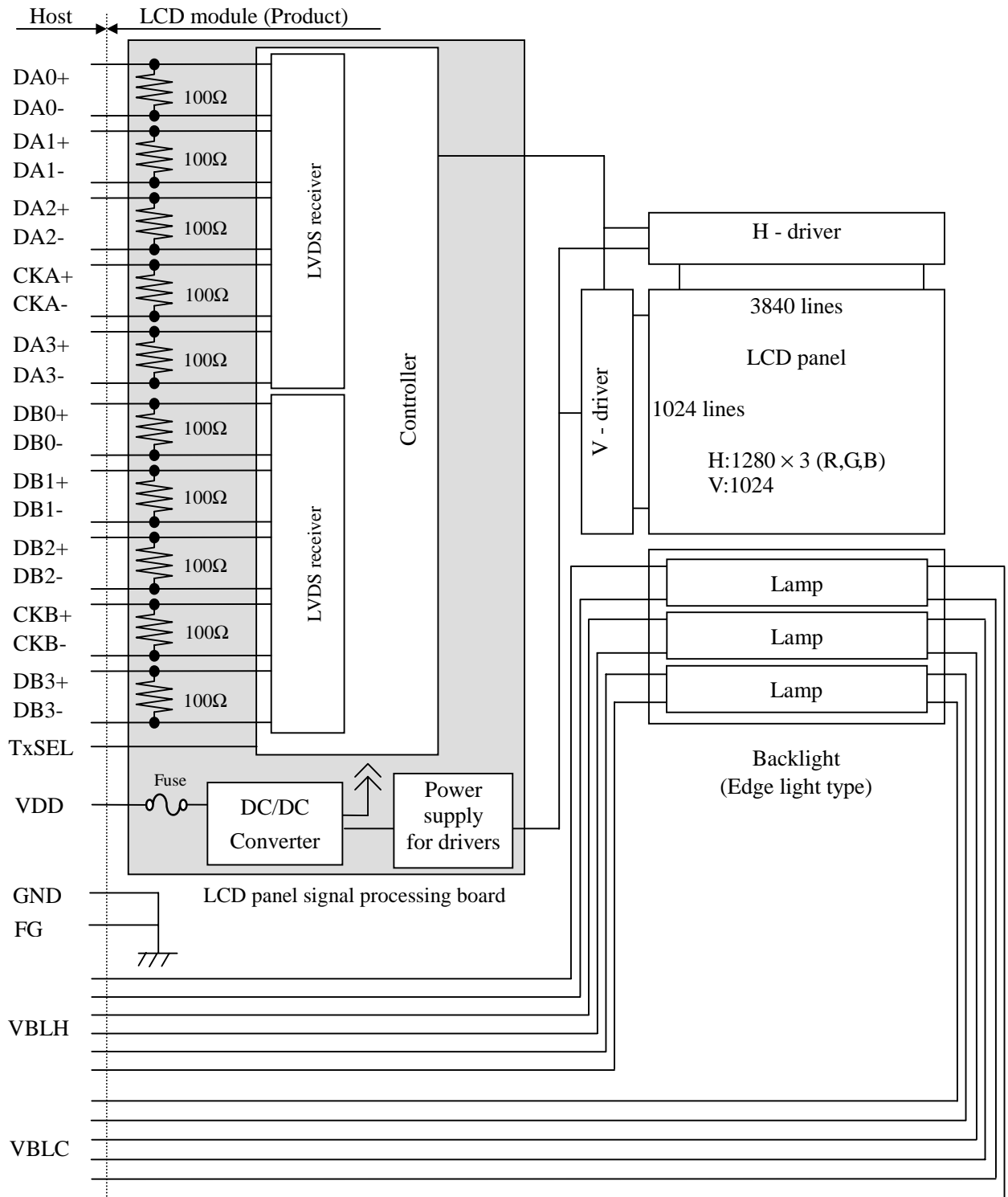
1.3 FEATURES

- Ultra-wide viewing angle
- Wide color gamut
- High contrast
- High resolution
- LVDS interface
- Selectable LVDS input map
- Edge light type (Inverter less)

2. GENERAL SPECIFICATIONS

Display area	376.32 (W) × 301.056 (H) mm (typ.)
Diagonal size of display	48.0 cm (19.0 inches)
Drive system	a-Si TFT active matrix
Display color	16,777,216 colors
Pixel	1,280 (H) × 1024 (V) pixels
Pixel arrangement	RGB (Red dot, Green dot, Blue dot) vertical stripe
Dot pitch	0.098 (W) × 0.294 (H) mm
Pixel pitch	0.294 (W) × 0.294 (H) mm
Module size	404.2 (W) × 330.0 (H) × 22.0 (D) mm (typ.)
Weight	3,100 g (typ.)
Contrast ratio	(450):1 (typ.)
Viewing angle	At the contrast ratio 10:1 <ul style="list-style-type: none"> • 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 ($\gamma=2.2$): normal axis
Polarizer surface	TBD
Polarizer pencil-hardness	TBD
Color gamut	At LCD panel center 72 % (typ.) [against NTSC color space]
Response time	Ton (black 10% → white 90%) + Toff (white 90% → black 10%) (25) ms (typ.)
Luminance	At IBL=(6.0)mArms / lamp (300) cd/m ² (typ.)
Signal system	LVDS 2 port 8bit digital signals for data of RGB colors, Dot clock (CLK), Data enable (DE)
Power supply voltage	LCD panel signal processing board: 5.0V
Backlight	Edge light type: 6 cold cathode fluorescent lamps (Inverter less)
Power consumption	At IBL=(6.0)mArms / lamp and checkered flag pattern (31.6) W (typ.) (Power dissipation of the inverter does not include.)

3. BLOCK DIAGRAM



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

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

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

PRELIMINARY

4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification	Unit
Module size	404.2 ± 0.5 (W) × 330.0 ± 0.5 (H) × 22.0 ± 0.3 (D) Note1	mm
Display area	376.32 (W) × 301.056 (H) Note1	mm
Weight	3,100 (typ.), 3,300 (max.)	g

Note1: See "7. OUTLINE DRAWINGS".

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal processing board	VDD	-0.3 to +6.0	V	Ta = 25°C
	Lamp voltage	VBLH	TBD	Vrms	
Input voltage for signals	Display signals Note1	VD	-0.3 to +2.8	V	Ta = 25°C VDD= 5.0V
	Function signal Note2	VF		V	
Storage temperature		Tst	-20 to +60	°C	-
Operating temperature	Front surface	TopF	0 to +55	°C	Note3
	Rear surface	TopR	0 to (+55)	°C	Note4
Relative humidity Note5		RH	≤ 95	%	Ta ≤ 40°C
			≤ 85	%	40 < Ta ≤ 50°C
			≤ 70	%	50 < Ta ≤ 55°C
Absolute humidity Note5		AH	≤ 73 Note6	g/m ³	Ta > 55°C
Operating altitude		-	≤ 4,850	m	0°C ≤ Ta ≤ 55°C
Storage altitude		-	≤ 13,600	m	-20°C ≤ Ta ≤ 60°C

Note1: Display signals are DA0+/-, DA1+/-, DA2+/-, DA3+/-, CKA+/-, DB0+/-, DB1+/-, DB2+/-, DB3+/-, CKB+/-

Note2: Function signal is TxSEL.

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: Ta = 55°C, RH = 70%

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	VDD	(4.5)	5.0	(5.5)	V	-	
Power supply current	IDD	-	(920) Note1	(1400) Note2	mA	at VDD = 5.0V	
Permissible ripple voltage	VRP	-	-	100	mVp-p	for VDD	
Differential input threshold voltage for LVDS receiver	High	VTH	-	-	+100	mV	at VCM=1.2V Note3
	Low	VTL	-100	-	-	mV	
Terminating resistor	RT	-	100	-	Ω	-	
Input voltage for function signal	High	VFH	1.7	-	-	V	TxSEL Note4
	Low	VFL	-	-	0.5	V	
Input current for function signal	IFL	-80	-	+10	μA		

Note1: Checkered flag pattern [by EIAJ ED-2522]

Note2: Pattern for maximum current

Note3: Common mode voltage for LVDS receiver

Note4: TxSEL is pulled-up in the product. (Pull-up resistor: 50kΩ)

4.3.2 Working for backlight lamp

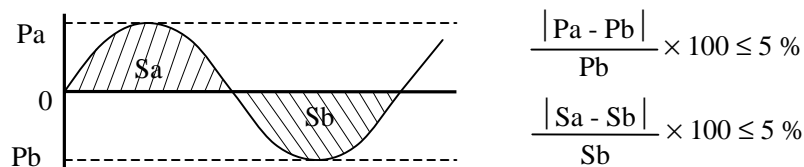
(Ta=25°C, Note1)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Lamp current	IBL	(3.0)	(6.0)	(7.0)	mArms	At IBL=(6.0)mArms: (300)cd/m ² Note3
Lamp voltage	VBLH	-	(750)	-	Vrms	Note2,Note3
Lamp starting voltage	VS	(1100)	-	-	Vrms	Ta = 25°C Note2, Note3
		(1430)	-	-	Vrms	Ta = 0°C Note2, Note3
Lamp oscillation frequency	FO	(40)	44	(50)	kHz	Note4

Note1: This product's backlight consists of 6 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).



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: 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.

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

th: Horizontal cycle (See "4.9.2 Timing characteristics".)

n: Natural number (1, 2, 3)

Note5: 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.

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 (Measure at input terminal of power supply)	Note1	Unit
VDD	5.0V	≤ 100		mVp-p

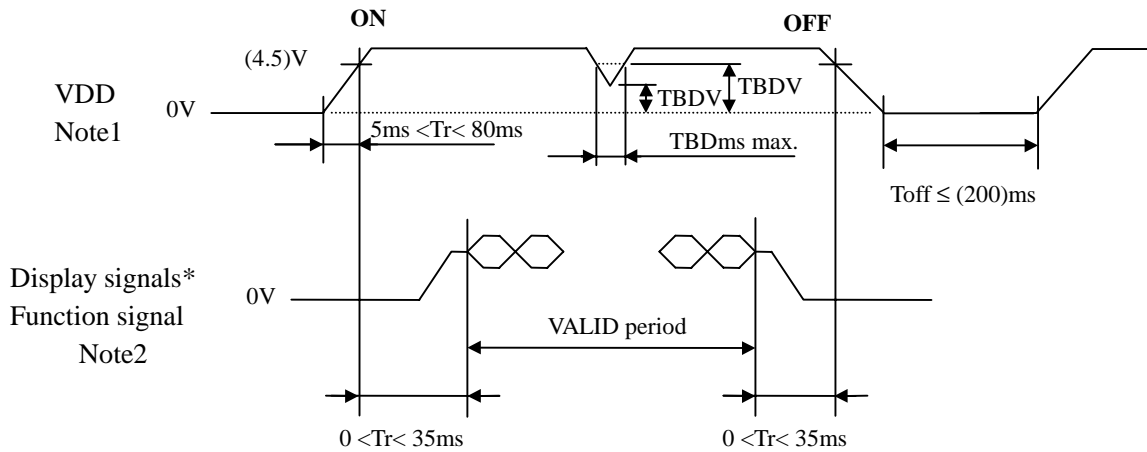
Note1: The permissible ripple voltage includes spike noise.

4.3.4 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VDD	TBD	TBD	TBD	TBD	Note1
			TBD		

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



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

Note1: In terms of voltage variation (voltage drop) while VDD rising edge is below (4.5)V, a protection circuit may work, and then this product may not work.

Note2: Display signals (DA0+/-, DA1+/-, DA2+/-, DA3+/-, CKA+/-, DB0+/-, DB1+/-, DB2+/-, DB3+/-, CKB+/-) and function signal (TxSEL) must be "0" voltage, exclude the VALID period (See above sequence diagram). If these signals are higher than 0.3V, the internal circuit 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 VDD.

Note3: VDD should be TBDV or more while VDD ON period.

Note4: The backlight power supply voltage 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 (LCD module side): FI-X30SL-HF (Japan Aviation Electronics Industry Limited (JAE))
 Adaptable plug: FI-X30C/ FI-30H/ FI-X30M (Japan Aviation Electronics Industry Limited (JAE))

Pin No.	Symbol	Signal	Remarks
1	DA0-	Odd pixel data 0	Note1
2	DA0+		
3	DA1-	Odd pixel data 1	Note1
4	DA1+		
5	DA2-	Odd pixel data 2	Note1
6	DA2+		
7	GND	Ground	-
8	CKA-	Odd pixel clock	Note1
9	CKA+		
10	DA3-	Odd pixel data 3	Note1
11	DA3+		
12	DB0-	Even pixel data 0	Note1
13	DB0+		
14	GND	Ground	-
15	DB1-	Even pixel data 1	Note1
16	DB1+		
17	GND	Ground	-
18	DB2-	Even pixel data 2	Note1
19	DB2+		
20	CKB-	Even pixel clock	Note1
21	CKB+		
22	DB3-	Even pixel data 3	Note1
23	DB3+		
24	GND	Ground	-
25	TxSEL	Selection of LVDS input map	High or Open: Mode A Low: Mode B Note2, Note3
26	RSVD	-	Keep this pin Open.
27	N.C.	-	Keep this pin Open.
28	VDD	Power supply	-
29			
30			

Note1: Twist pair wires with 100Ω (Characteristic impedance) should be connected between LCD panel signal processing board and LVDS transmitter.

Note2: TxSEL is pulled-up in the product. (Pull-up resistor: 50kΩ)

Note3: See "**4.6 SELECTION OF LVDS INPUT MAP**".

PRELIMINARY

4.5.2 Backlight lamp

Attention: VBLH and VBLC must be connected correctly. If customer connects wrongly, customer will be hurt and the module will be broken.

CN201 plug (LCD module side): BHSR-02VS-1 (J.S.T Mfg. Co., Ltd.)

Adaptable socket: SM02B-BHSS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage (Hot)	Cable color: Pink
2	VBLC	Low voltage (Cold)	Cable color: Gray

CN202 plug (LCD module side): BHSR-02VS-1 (J.S.T Mfg. Co., Ltd.)

Adaptable socket: SM02B-BHSS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage (Hot)	Cable color: White
2	VBLC	Low voltage (Cold)	Cable color: Gray

CN203 plug (LCD module side): BHSR-02VS-1 (J.S.T Mfg. Co., Ltd.)

Adaptable socket: SM02B-BHSS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage (Hot)	Cable color: Pink
2	VBLC	Low voltage (Cold)	Cable color: Gray

CN204 plug (LCD module side): BHSR-02VS-1 (J.S.T Mfg. Co., Ltd.)

Adaptable socket: SM02B-BHSS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage (Hot)	Cable color: Pink
2	VBLC	Low voltage (Cold)	Cable color: Gray

CN205 plug (LCD module side): BHSR-02VS-1 (J.S.T Mfg. Co., Ltd.)

Adaptable socket: SM02B-BHSS-1-TB (J.S.T Mfg. Co., Ltd.)

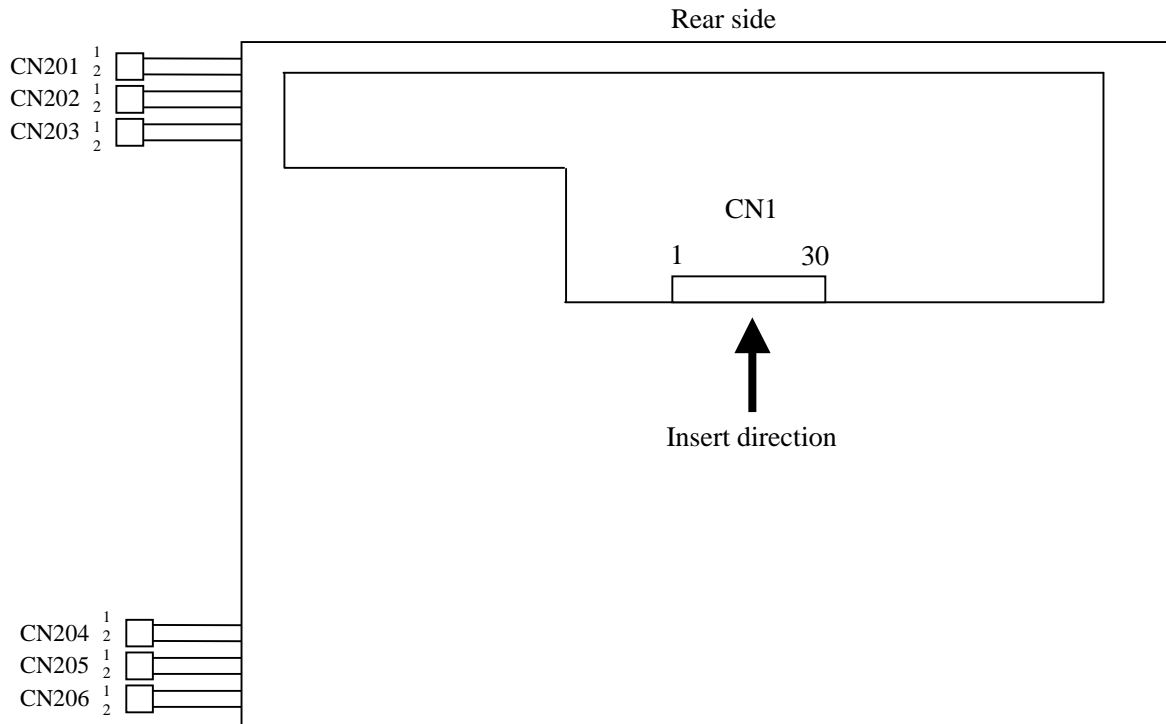
Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage (Hot)	Cable color: White
2	VBLC	Low voltage (Cold)	Cable color: Gray

CN206 plug (LCD module side): BHSR-02VS-1 (J.S.T Mfg. Co., Ltd.)

Adaptable socket: SM02B-BHSS-1-TB (J.S.T Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	VBLH	High voltage (Hot)	Cable color: Pink
2	VBLC	Low voltage (Cold)	Cable color: Gray

4.5.3 Positions of plugs and a socket



PRELIMINARY

4.6 SELECTION OF LVDS INPUT MAP

4.6.1 Mode A

Input data		Transmitter			CNI				
		Pin	DS90CF383, C385 or equivalent						
Odd pixel data and control signal	Note1	RA0	→ 51	TXIN0		Note2	Pin	Symbol	
		RA1	→ 52	TXIN1	TA1-	→	1	DA0-	
		RA2	→ 54	TXIN2	TA1+	→	2	DA0+	
		RA3	→ 55	TXIN3					
		RA4	→ 56	TXIN4	TB1-	→	3	DA1-	
		RA5	→ 3	TXIN6	TB1+	→	4	DA1+	
	Note1	GA0	→ 4	TXIN7					
		GA1	→ 6	TXIN8	TC1-	→	5	DA2-	
		GA2	→ 7	TXIN9	TC1+	→	6	DA2+	
		GA3	→ 11	TXIN12			7	GND	
		GA4	→ 12	TXIN13	TCLK1-	→	8	CKA-	
		GA5	→ 14	TXIN14	TCLK1+	→	9	CKA+	
	Note1	BA0	→ 15	TXIN15					
		BA1	→ 19	TXIN18	TD1-	→	10	DA3-	
		BA2	→ 20	TXIN19	TD1+	→	11	DA3+	
		BA3	→ 22	TXIN20					
		BA4	→ 23	TXIN21					
		BA5	→ 24	TXIN22					
	Note3	RSVD	→ 27	TXIN24					
	Note3	RSVD	→ 28	TXIN25					
		DE	→ 30	TXIN26					
		RA6	→ 50	TXIN27					
		RA7	→ 2	TXIN5					
		GA6	→ 8	TXIN10					
		GA7	→ 10	TXIN11					
		BA6	→ 16	TXIN16					
		BA7	→ 18	TXIN17					
	Note3	RSVD	→ 25	TXIN23					
		CLK	→ 31	CLKIN					
	Even pixel data	Note1	RB0	→ 51	TXIN0				
			RB1	→ 52	TXIN1	TA2-	→	12	DB0-
		RB2	→ 54	TXIN2	TA2+	→	13	DB0+	
		RB3	→ 55	TXIN3			14	GND	
		RB4	→ 56	TXIN4	TB2-	→	15	DB1-	
		RB5	→ 3	TXIN6	TB2+	→	16	DB1+	
Note1		GB0	→ 4	TXIN7			17	GND	
		GB1	→ 6	TXIN8	TC2-	→	18	DB2-	
		GB2	→ 7	TXIN9	TC2+	→	19	DB2+	
		GB3	→ 11	TXIN12					
		GB4	→ 12	TXIN13	TCLK2-	→	20	CKB-	
		GB5	→ 14	TXIN14	TCLK2+	→	21	CKB+	
Note1		BB0	→ 15	TXIN15					
		BB1	→ 19	TXIN18	TD2-	→	22	DB3-	
		BB2	→ 20	TXIN19	TD2+	→	23	DB3+	
		BB3	→ 22	TXIN20			24	GND	
		BB4	→ 23	TXIN21			25	TxSEL0	
		BB5	→ 24	TXIN22			26	TxSEL1	
Note3		RSVD	→ 27	TXIN24			27	GND	
Note3		RSVD	→ 28	TXIN25			28	VDD	
Note3		RSVD	→ 30	TXIN26			29	VDD	
		RB6	→ 50	TXIN27			30	VDD	
		RB7	→ 2	TXIN5					
		GB6	→ 8	TXIN10					
		GB7	→ 10	TXIN11					
		BB6	→ 16	TXIN16					
		BB7	→ 18	TXIN18					
Note3		RSVD	→ 25	TXIN23					
		CLK	→ 31	CLKIN					

PRELIMINARY

4.6.2 Mode B

Input data		Transmitter				CN1	
		Pin	THC63LVDF83A/R or equivalent	Pin	THC63LVD823 or equivalent		
Odd pixel data and control signal	Note1 RA2 →	51	TA0	53	R12		
	RA3 →	52	TA1	54	R13	TA1-	→ 1 DA0-
	RA4 →	54	TA2	57	R14	TA1+	→ 2 DA0+
	RA5 →	55	TA3	58	R15		
	RA6 →	56	TA4	59	R16	TB1-	→ 3 DA1-
	RA7 →	3	TA5	60	R17	TB1+	→ 4 DA1+
	Note1 GA2 →	4	TA6	63	G12		
	GA3 →	6	TB0	64	G13	TC1-	→ 5 DA2-
	GA4 →	7	TB1	65	G14	TC1+	→ 6 DA2+
	GA5 →	11	TB2	66	G15		7 GND
	GA6 →	12	TB3	67	G16	TCLK1-	→ 8 CKA-
	GA7 →	14	TB4	68	G17	TCLK1+	→ 9 CKA+
	Note1 BA2 →	15	TB5	73	B12		
	BA3 →	19	TB6	74	B13	TD1-	→ 10 DA3-
	BA4 →	20	TC0	75	B14	TD1+	→ 11 DA3+
	BA5 →	22	TC1	76	B15		
	BA6 →	23	TC2	77	B16		
	BA7 →	24	TC3	78	B17		
	Note3 RSVD →	27	TC4	7	RSVD		
	Note3 RSVD →	28	TC5	8	RSVD		
	DE →	30	TC6	9	DE		
	RA0 →	50	TD0	51	R10		
	RA1 →	2	TD1	52	R11		
	GA0 →	8	TD2	61	G10		
	GA1 →	10	TD3	62	G11		
BA0 →	16	TD4	69	B10			
BA1 →	18	TD5	70	B11			
Note3 RSVD →	25	TD6	-				
CLK →	31	CLKIN	10	CLK			
Even pixel data	Note1 RB2 →	51	TA0	81	R22		
	RB3 →	52	TA1	82	R23	TA2-	→ 12 DB0-
	RB4 →	54	TA2	83	R24	TA2+	→ 13 DB0+
	RB5 →	55	TA3	84	R25		14 GND
	RB6 →	56	TA4	85	R26	TB2-	→ 15 DB1-
	RB7 →	3	TA5	86	R27	TB2+	→ 16 DB1+
	Note1 GB2 →	4	TA6	91	G22		17 GND
	GB3 →	6	TB0	92	G23	TC2-	→ 18 DB2-
	GB4 →	7	TB1	93	G24	TC2+	→ 19 DB2+
	GB5 →	11	TB2	94	G25		
	GB6 →	12	TB3	95	G26	TCLK2-	→ 20 CKB-
	GB7 →	14	TB4	96	G27	TCLK2+	→ 21 CKB+
	Note1 BB2 →	15	TB5	99	B22		
	BB3 →	19	TB6	100	B23	TD2-	→ 22 DB3-
	BB4 →	20	TC0	1	B24	TD2+	→ 23 DB3+
	BB5 →	22	TC1	2	B25		24 GND
	BB6 →	23	TC2	5	B26		25 TxSEL0
	BB7 →	24	TC3	6	B27		26 TxSEL1
	Note3 RSVD →	27	TC4	-			27 GND
	Note3 RSVD →	28	TC5	-			28 VDD
	Note3 RSVD →	30	TC6	-			29 VDD
	RB0 →	50	TD0	79	R20		30 VDD
	RB1 →	2	TD1	80	R21		
	GB0 →	8	TD2	89	G20		
	GB1 →	10	TD3	90	G21		
BB0 →	16	TD4	97	B20			
BB1 →	18	TD5	98	B21			
Note3 RSVD →	25	TD6	-				
CLK →	31	CLKIN	-				

PRELIMINARY

Note1: LSB (Least Significant Bit) – RA0, GA0, BA0, RB0, GB0, BB0
MSB (Most Significant Bit) – RA7, GA7, BA7, RB7, GB7, BB7

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

Note3: Input signal RSVD is not used inside the product. It is recommended that these signals are set to Low.

PRELIMINARY

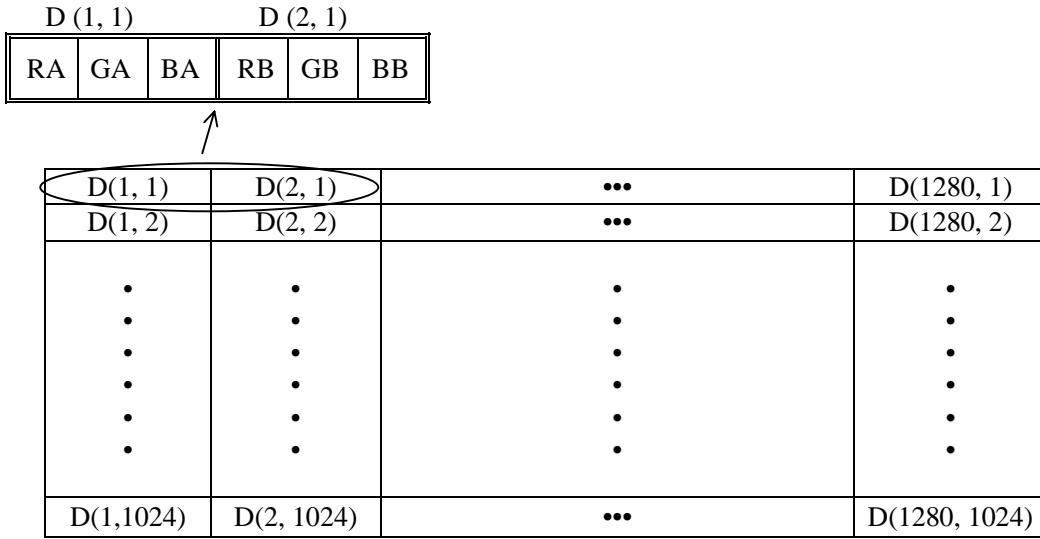
4.7 DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display in equivalent to 16,777,216 colors in 256 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)																							
		RA7 RA6 RA5 RA4 RA3 RA2 RA1 RA0								GA7 GA6 GA5 GA4 GA3 GA2 GA1 GA0								BA7 BA6 BA5 BA4 BA3 BA2 BA1 BA0							
		RB7 RB6 RB5 RB4 RB3 RB2 RB1 RB0								GB7 GB6 GB5 GB4 GB3 GB2 GB1 GB0								BB7 BB6 BB5 BB4 BB3 BB2 BB1 BB0							
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 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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	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 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	1	0	0	0	0	0	0	0	0
Green	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 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	1
Blue	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	

PRELIMINARY

4.8 DISPLAY POSITION

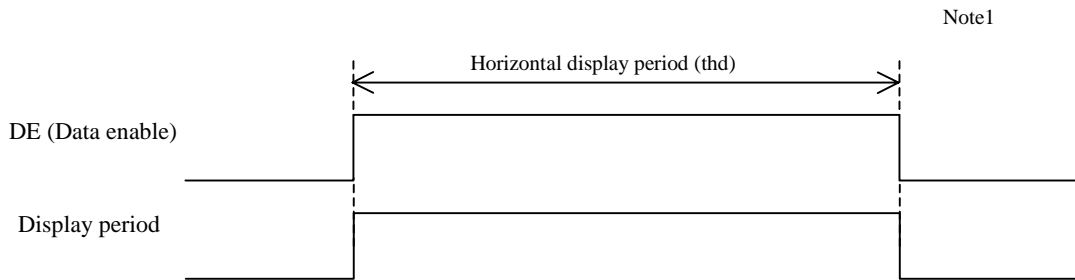


4.9 INPUT SIGNAL TIMINGS FOR LCD PANEL SIGNAL PROCESSING BOARD

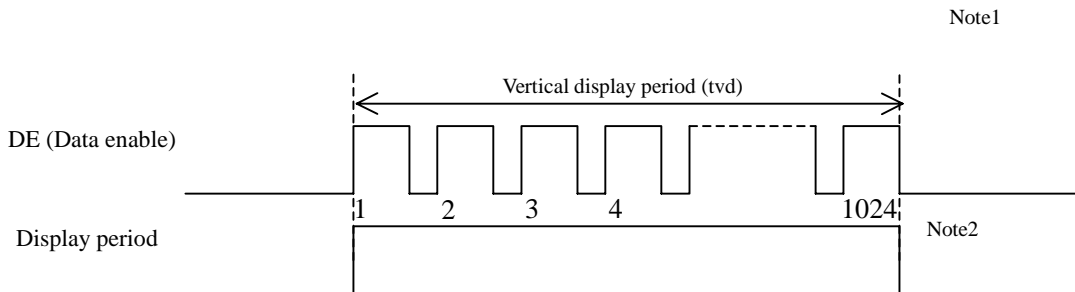
4.9.1 Outline of input signal timings

This diagram indicates virtual signal for set up to timing.

- Horizontal signal



- Vertical signal



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

Note2: See "**4.9.3 Input signal timing chart**" for numeration of pulse.

PRELIMINARY

4.9.2 Timing characteristics

Parameter		Symbol	min.	typ.	max.	Unit	Remarks	
CLK	Frequency	-	TBD	(54)	TBD	MHz	18.52 ns (typ.)	
	Duty	-	-			-	Note2	
	Rise time, Fall time	-				ns		
DATA	CLK-DATA	Setup time	-			ns	Note2	
		Hold time				ns		
	Rise time, Fall time	-				ns		
DE	Horizontal	Cycle	th	(12.3)	(15.63)	-	μs	64.0 kHz (typ.) Note1, Note2, Note3
		Display period	thd	(750)	(844)	TBD	CLK	
	Vertical (One frame)	Cycle	tv	(13.1)	16.6	(17.5)	ms	
		Display period	tvd	(1028)	(1066)	-	H	
	CLK-DE	Setup time	-	-			ns	Note2
		Hold time	-				ns	
Rise time, Fall time		-	ns					

Note1: Definition of parameters is as follows.

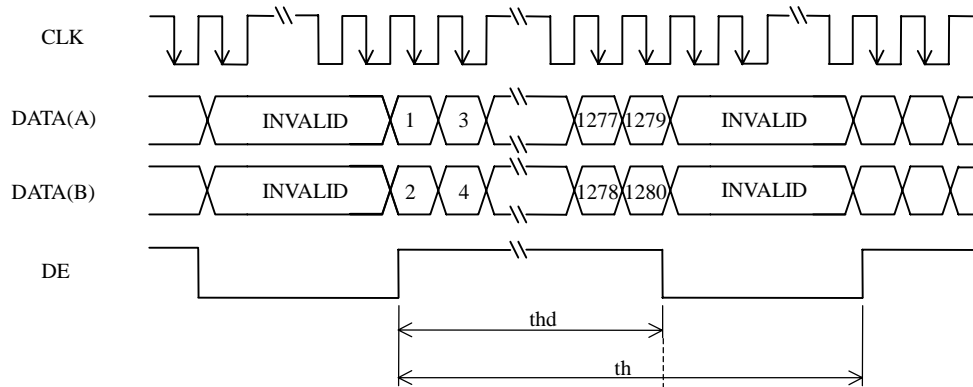
$$t_c = 1\text{CLK}, t_h = 1\text{H}$$

Note2: See the data sheet of LVDS transmitter.

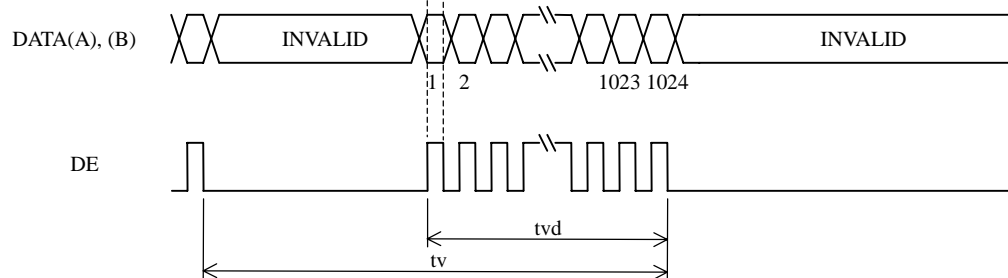
Note3: "th" must keep the fluctuation within ± 1 CLK, because of avoidance of image sticking.

4.9.3 Input signal timing chart

Horizontal timing



Vertical timing



Note1: DATA(A)= RA0-RA7, GA0-GA7, BA0-BA7
 DATA(B)= RB0-RB7, GB0-GB7, BB0-BB7

4.10 OPTICS

4.10.1 Optical characteristics

(Note1, Note2)

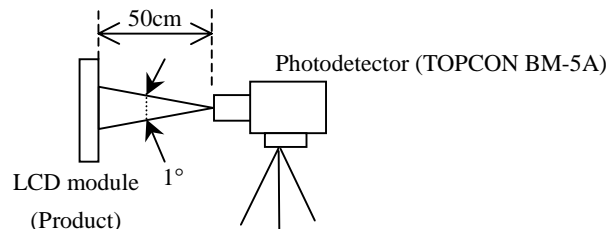
Parameter	Condition	Symbol	min.	typ.	max.	Unit	Remarks
Luminance	White at center $\theta R = 0^\circ, \theta L = 0^\circ, \theta U = 0^\circ, \theta D = 0^\circ$	L	TBD	(300)	-	cd/m ²	-
Contrast ratio	White/Black at center $\theta R = 0^\circ, \theta L = 0^\circ, \theta U = 0^\circ, \theta D = 0^\circ$	CR	TBD	(450)	-	-	Note3
Luminance uniformity	-	LU	-	TBD	1.3	-	Note4
Chromaticity	White	x coordinate	Wx	TBD	TBD	TBD	Note5
		y coordinate	Wy	TBD	TBD	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	$\theta R = 0^\circ, \theta L = 0^\circ, \theta U = 0^\circ, \theta D = 0^\circ$ at center, against NTSC color space	C	TBD	72	-	%	
Response time	Black to white	Ton	-	TBD	TBD	ms	Note6 Note7
	White to black	Toff	-	TBD	TBD	ms	
Viewing angle	Right	$\theta U = 0^\circ, \theta D = 0^\circ, CR = 10$	θR	70	85	-	Note8
	Left	$\theta U = 0^\circ, \theta D = 0^\circ, CR = 10$	θL	70	85	-	
	Up	$\theta R = 0^\circ, \theta L = 0^\circ, CR = 10$	θU	70	85	-	
	Down	$\theta R = 0^\circ, \theta L = 0^\circ, CR = 10$	θD	70	85	-	

Note1: These are initial characteristics.

Note1: Measurement conditions are as follows.

Ta= 25°C, VDD= 5.0V, IBL = (6.0)mArms/lamp, Display mode: SXGA, Horizontal cycle = 64.0kHz, Vertical cycle = 60.0Hz

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 = TBD°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.

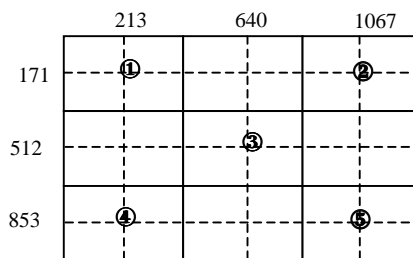
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

4.10.3 Definition of luminance uniformity

The luminance uniformity is calculated by using following formula.

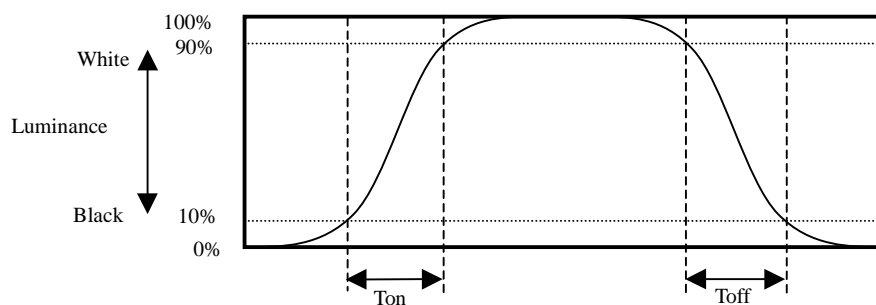
$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑤}}{\text{Minimum luminance from ① to ⑤}}$$

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

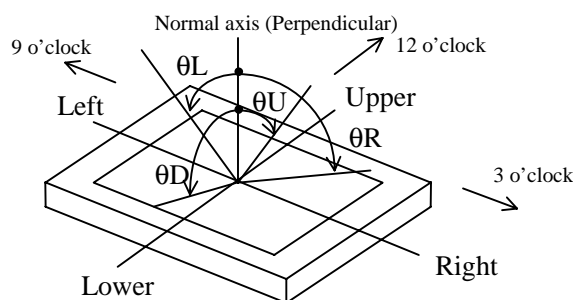


4.10.4 Definition of response times

Response time is measured, the luminance changes from " 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.).



4.10.5 Definition of viewing angles

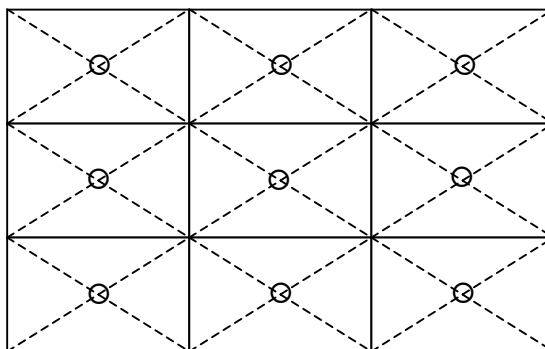


5. RELIABILITY TESTS

Test item	Condition	Judgment	Note1
High temperature and humidity (Operation)	① $60 \pm 2^{\circ}\text{C}$, RH = 60%, 240hours ② Display data is white.	No display malfunctions	
Heat cycle (Operation)	① $0 \pm 3^{\circ}\text{C}$...1hour $55 \pm 3^{\circ}\text{C}$...1hour ② 50cycles, 4hours/cycle ③ Display data is white.		
Thermal shock (Non operation)	① $-20 \pm 3^{\circ}\text{C}$...30minutes $60 \pm 3^{\circ}\text{C}$...30minutes ② 100cycles, 1hour/cycle ③ Temperature transition time is within 5 minutes.		
Vibration (Non operation)	① 5 to 100Hz, 11.76m/s^2 ② 1 minute/cycle ③ X, Y, Z direction ④ 10 times each directions	No display malfunctions No physical damages	
Mechanical shock (Non operation)	① 490m/s^2 , 11ms ② X, Y, Z direction ③ 3 times each directions		
ESD (Operation)	① 150pF, 150Ω , $\pm 10\text{kV}$ ② 9 places on a panel surface Note2 ③ 10 times each places at 1 sec interval	No display malfunctions	
Dust (Operation)	① Sample dust: No.15 (by JIS-Z8901) ② 15 seconds stir ③ 8 times repeat at 1 hour interval		
Low pressure	operation ① 53.3 kPa ② $0^{\circ}\text{C} \pm 3^{\circ}\text{C}$...24 hours ③ $55^{\circ}\text{C} \pm 3^{\circ}\text{C}$...24 hours		
	non-operation ① 15 kPa ② $-20^{\circ}\text{C} \pm 3^{\circ}\text{C}$...24 hours ③ $60^{\circ}\text{C} \pm 3^{\circ}\text{C}$...24 hours		

Note1: Display functions are checked under the same conditions as product inspection.




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 "10.2 CAUTIONS" and "10.3 ATTENTIONS", after understanding this 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. Customer will be in danger of an electric shock.**



*** Do not touch the working backlight. Customer will be in 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 490m/s² and to be not greater 11ms, Pressure: To be not greater 19.6 N)**

6.3 ATTENTIONS

6.3.1 Handling of the product

- ① Take hold of both ends without touch the circuit board cover 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 lamp 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 0.67N·m. Higher torque values might result in distortion of the bezel. And the screw length must be 4.0mm to 7.0mm.
- 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.
 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 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.

6.3.2 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)
- 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.
- ⑤ 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.

6.3.3 Characteristics

The following items are neither defects nor failures.

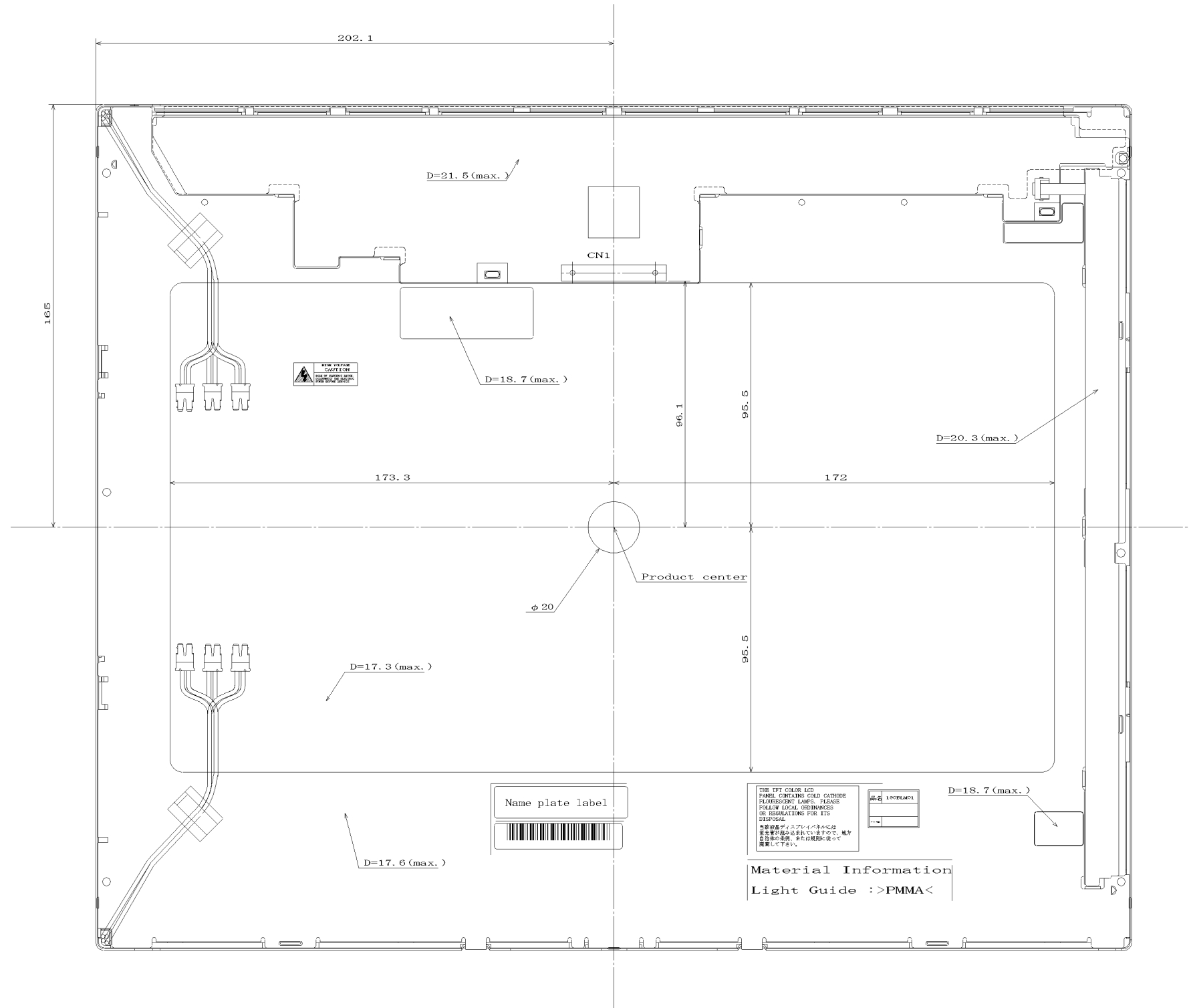
- ① Response time, luminance and color may be changed by ambient temperature.
- ② The LCD may be seemed luminance non-uniformity, flicker, vertical seam or small spot by display patterns.
- ③ Optical characteristics (e.g. luminance, display uniformity, etc.) gradually is going to change depending on 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.

6.3.4 Other

- ① All GND and VCC terminals should be used without a non-connected line.
- ② Do not disassemble a product or adjust volume without permission of NEC.
- ③ Pay attention not to insert waste materials inside of products, if customer uses screwdrivers.
- ④ Pack the product with original shipping package, because of avoidance of some damages during transportation, when customer returns it to NEC for repair and so on.

PRELIMINARY

7.2 REAR VIEW



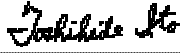
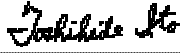
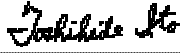
Note1: Not shown tolerances of the dimensions are TBD.

Unit: mm

PRELIMINARY

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	Prepared date	Revision contents and signature									
1st edition	July 2, 2003	<p data-bbox="395 553 608 582">Revision contents</p> <p data-bbox="419 611 539 640">New issue</p> <p data-bbox="443 712 643 741">Signature of writer</p> <table data-bbox="467 763 1305 891"><tr><td data-bbox="467 763 738 792"><i>Approved by</i></td><td data-bbox="770 763 1002 792"><i>Checked by</i></td><td data-bbox="1010 763 1305 792"><i>Prepared by</i></td></tr><tr><td data-bbox="467 801 738 853"></td><td data-bbox="770 801 1002 853">_____</td><td data-bbox="1010 801 1305 853"><i>R. Kawashima</i></td></tr><tr><td data-bbox="467 862 738 891">T. ITO</td><td data-bbox="770 862 1002 891">_____</td><td data-bbox="1010 862 1305 891">R. KAWASHIMA</td></tr></table>	<i>Approved by</i>	<i>Checked by</i>	<i>Prepared by</i>		_____	<i>R. Kawashima</i>	T. ITO	_____	R. KAWASHIMA
<i>Approved by</i>	<i>Checked by</i>	<i>Prepared by</i>									
	_____	<i>R. Kawashima</i>									
T. ITO	_____	R. KAWASHIMA									