PRELIMINARY

NEC LCD Technologies, Ltd.

TFT COLOR LCD MODULE

NL8060BH18-02

18cm (7.2 Type)
SVGA, 3D

PRELIMINARY DATA SHEET

DOD-PP-1222(5th edition)

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

INTRODUCTION

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

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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 NL8060BH18-02 is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array and a backlight.

The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.

Color (Red, Green, Blue) data signals from a host system (e.g. signal generator, etc.) are modulated into best form for active matrix system by a 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.

Each pixel of this LCD module has two sets of sub-pixels, one is for a right eye and the other for a left eye. When the data for both a right and a left eye are distributed to those sub-pixels, the image is perceived as 3D. If the same data are distributed, the image appears to be 2D. Therefore, to achieve 3D image, the horizontal video data is doubled compared with the conventional LCDs.

1.2 APPLICATION

- For industrial use

1.3 FEATURES

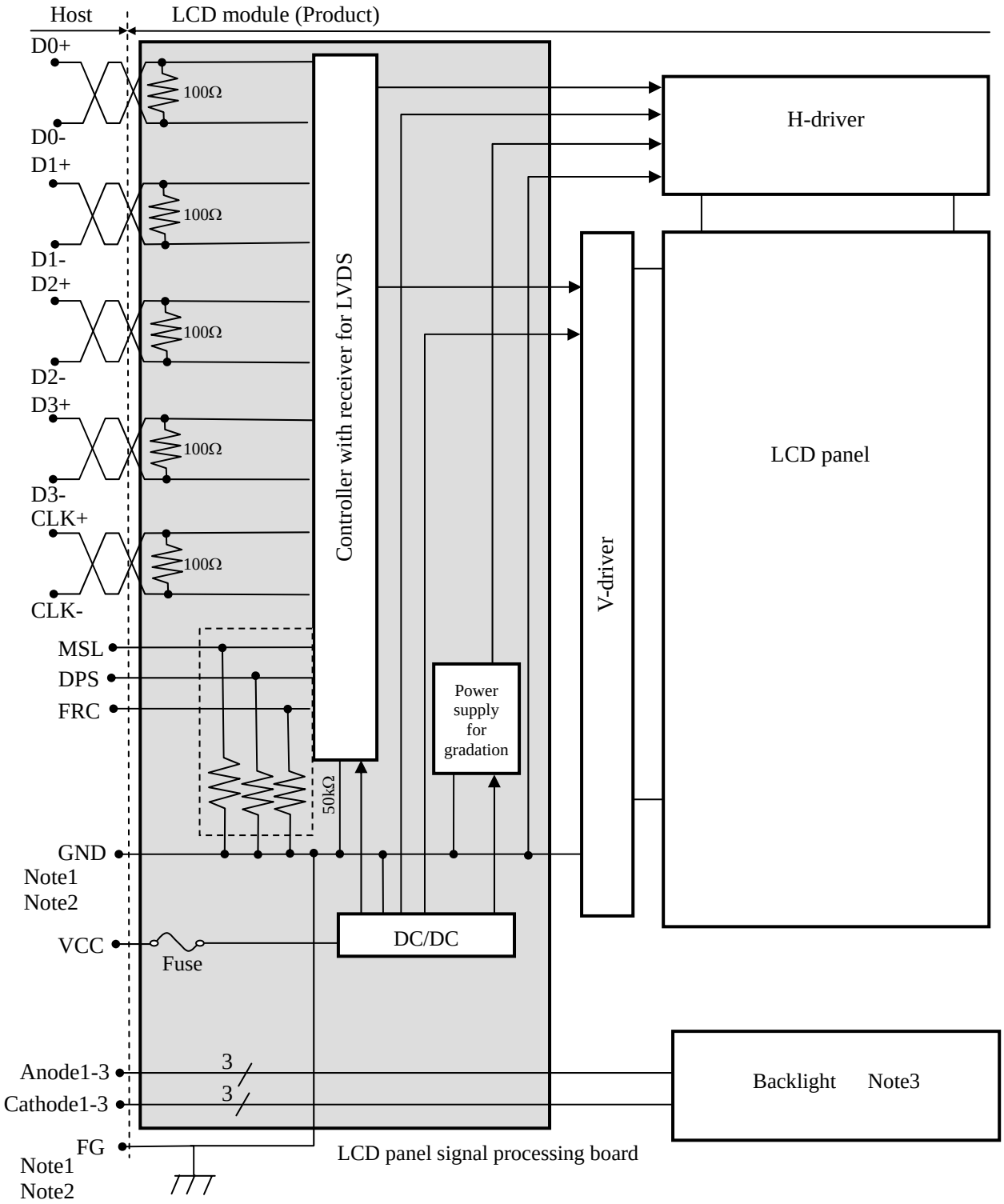
- The simultaneous 2D/3D displayability
- LVDS interface (1port)
- LED backlight type
- Replaceable lamp holder for backlight

2. GENERAL SPECIFICATIONS

Display area	146.4 (H) × 109.8 (V) mm
Diagonal size of display	18cm (7.2 inches)
Drive system	a-Si TFT active matrix
Display color	16,777,216 colors (At 8-bit input, FRC terminal= High) 262,144 colors (At 6-bit input, FRC terminal= Low or Open)
Pixel	800 (H) × 600 (V) pixels
Pixel arrangement	HDDP (Horizontally Double-Density Pixel) structure
Dot pitch	0.0915 (H) × 0.061 (V) mm
Pixel pitch	0.183 (H) × 0.183 (V) mm
Module size	164.3 (W) × 125.4 (H) × 6.0 (D) mm (typ.)
Weight	135 g (typ.)
Contrast ratio	600:1 (typ.)
Viewing angle	*At the contrast ratio ≥10:1* • Horizontal: Right side 80° (typ.), Left side 80° (typ.) • Vertical: Up side 80° (typ.), Down side 60° (typ.)
Designed viewing direction	*At DPS= Low or open: Normal scan* • Viewing direction without image reversal: up side (12 o'clock) • Viewing direction with contrast peak: down side (6 o'clock) • Viewing angle with optimum grayscale (γ≒2.2): normal axis (perpendicular)
Color gamut	*At LCD panel center* 68 % (typ.) [against NTSC color space]
Response time	*Ton+Toff (10%←→90%)* 18 ms (typ.)
Luminance	*At IL= 20mA/One circuit* 370 cd/m^2 (typ.)
Signal system	LVDS 1port (Receiver: THC63LVDF84B, THine Electronics Inc. or equivalent) [8bit/6bit digital signals for data of RGB colors, Dot clock (CLK), Data enable (DE)]
Power supply voltage	LCD panel signal processing board: 3.3V
Backlight	LED backlight type: Replaceable part • Lamp holder set: Type No. 72LHS02
Power consumption	*At IL=20mA/One circuit, Checkered flag pattern* 2.9 W (typ.)

Note1: The above table is a general specification at 2D mode.

3. BLOCK DIAGRAM

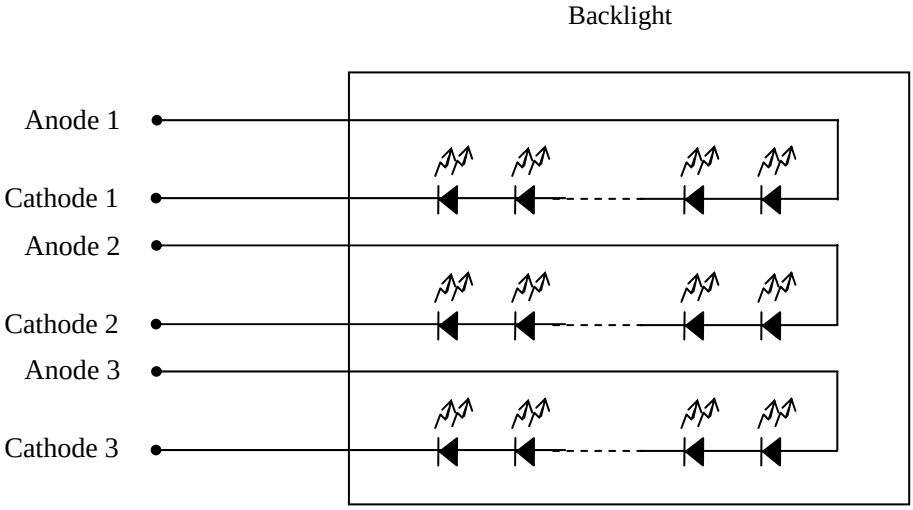


Note1: Relations between GND (Signal ground) and FG (Frame ground) in the LCD module are as follows.

GND - FG	Connected

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

Note3: Backlight in detail



4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification	Unit
Module size	164.3 ± 0.5 (W) × 125.4 ± 0.5 (H) × 6.0 ± 0.5 (D) Note1 (D):Excluding CN1	mm
Display area	146.4 (H) × 109.8 (V) Note1	mm
Weight	135 (typ.), 150 (max.)	g

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Note1: See "**8. OUTLINE DRAWINGS**".

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal processing board	VCC	-0.3 to +4.0	V	-
Input voltage for signals	Display signals Note1	VD	-0.3 to VCC+0.3	V	
	Function signal Note2	VF			
Backlight	Forward current	IL	22	mA	per one circuit
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°C <Ta≤ 50°C
			≤ 70	%	50°C <Ta≤ 55°C
Absolute humidity Note5		AH	≤ 73 Note6	g/m^3	Ta> 55°C

Note1: D0+/-, D1+/-, D2+/-, D3+/-, CLK+/-
Note2: DPS, FRC, 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= 55°C and RH= 70%

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	-	410 Note1	685 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, FRC and MSL signals	High	VFH	0.7VCC	-	VCC	V	CMOS level
	Low	VFL	0	-	0.3VCC	V	
Input current for DPS, FRC and MSL signals	High	IFH	-	-	300	μA	-
	Low	IFL	-300	-	-	μA	

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, Note2, Note3)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Forward current	IL	-	20	22	mA	-
Forward Voltage	VL	-	26.1	27.0	V	at IL= 20mA /One circuit

Note1: Please drive with constant current.
Note2: The above specifications are for one LED circuit of the backlight.
Note3: The Luminance uniformity may be changed depending on the current variation between 3 circuits. It is recommended that the current value difference between each circuit is less than 5%.

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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.

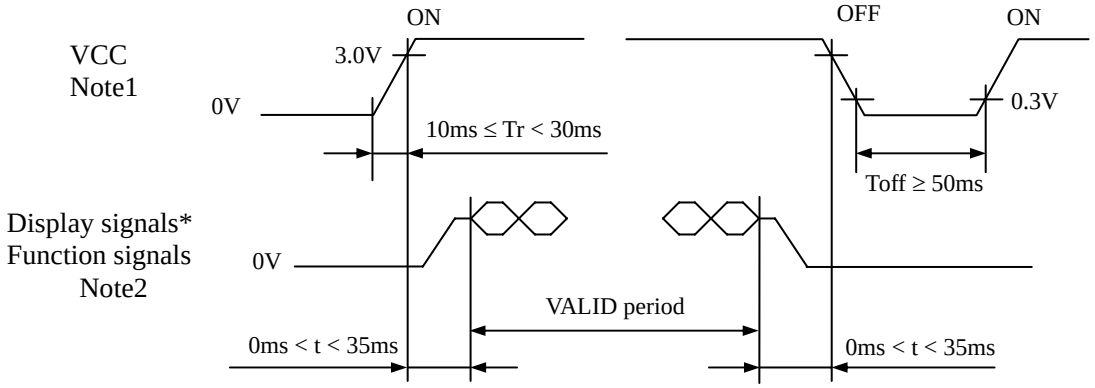
4.3.4 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	TF16SN1.60	KOA	1.6A 32V	3.2A	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.

4.4 POWER SUPPLY VOLTAGE SEQUENCE

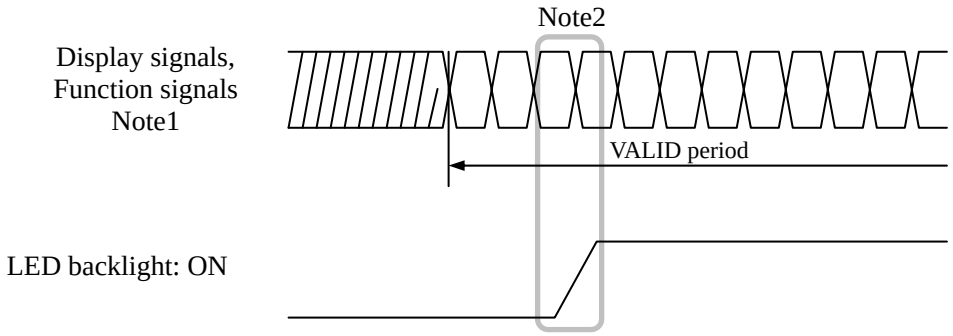
4.4.1 LCD panel signal processing board



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 signals (D0+/-, D1+/-, D2+/-, D3+/- and CLK+/-) and function signals (DPS, FRC and MSL) 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 Backlight lighting circuit



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): IMSA-9637S-40C-GF (IRISO ELECTRONICS CO.,LTD)

Pin No.	Symbol	Signal	Input data signal: 8bit		Input data signal: 6bit	Remarks
			MAP A	MAP B		
1	VCC	Power supply	Power supply			Note1
2	VCC					
3	VCC					
4	VCC					
5	VCC					
6	VCC					
7	VCC					
8	VCC					
9	GND	Ground	Ground			Note1
10	GND					
11	GND					
12	GND					
13	GND					
14	GND					
15	GND					
16	GND					
17	MSL	Selection of LVDS input map	Low or Open	High	Low or Open	Note4
18	GND	Ground	Ground			Note1
19	D0-	Pixel data	R2-R7,G2	R0-R5,G0		Note2
20	D0+					
21	GND	Ground	Ground			Note1
22	D1-	Pixel data	G3-G7,B2-B3	G1-G5,B0-B1		Note2
23	D1+					
24	GND	Ground	Ground			Note1
25	D2-	Pixel data	B4-B7,DE	B2-B5,DE		Note2
26	D2+					
27	GND	Ground	Ground			Note1
28	CLK-	Pixel clock	Pixel clock			Note2
29	CLK+					
30	GND	Ground	Ground			Note1
31	D3- or GND	Pixel data or Ground	R0-R1,G0-G1,B0-B1	R6-R7,G6-G7,B6-B7	Ground	Note1 Note2 Note3
32	D3+ or GND					
33	GND	Ground	Ground			Note1
34	FRC	Selection of the number of colors	High		Low or Open	Note3 Note4
35	DPS	Selection of scan direction	High : Reverse scan Low or Open : Normal scan			Note5
36	GND	Ground	Ground			Note1
37	GND					
38	GND					
39	GND					
40	GND					

Note1: All GND and VCC terminals should be used without any non-connected lines.
Note2: Adjust LVDS signal level minimize that the jitter and the skew.
Note3: See "**4.6 DISPLAY COLORS AND INPUT DATA SIGNALS**".
Note4: See "**4.5.4 Connection between receiver and transmitter for LVDS**".
Note5: See "**4.8 SCANNING DIRECTIONS**".

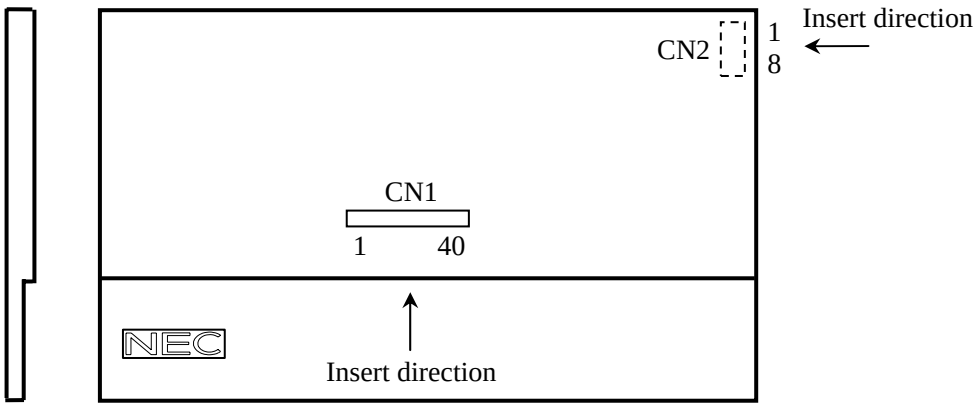
4.5.2 Backlight lamp

CN2 plug (LCD module side): SM08B-SRSS-TB (J.S.T. Mfg. Co., Ltd.)
Adaptable socket: SHR-08V-S, SHR-08V-S-B (J.S.T. Mfg. Co., Ltd.)

Pin No.	Symbol	Signal	Remarks
1	A1	Anode1	-
2	K1	Cathode1	-
3	A2	Anode2	-
4	K2	Cathode2	-
5	A3	Anode3	-
6	K3	Cathode3	-
7	A4	N.C.	Keep this pin Open.
8	K4	N.C.	Keep this pin Open.

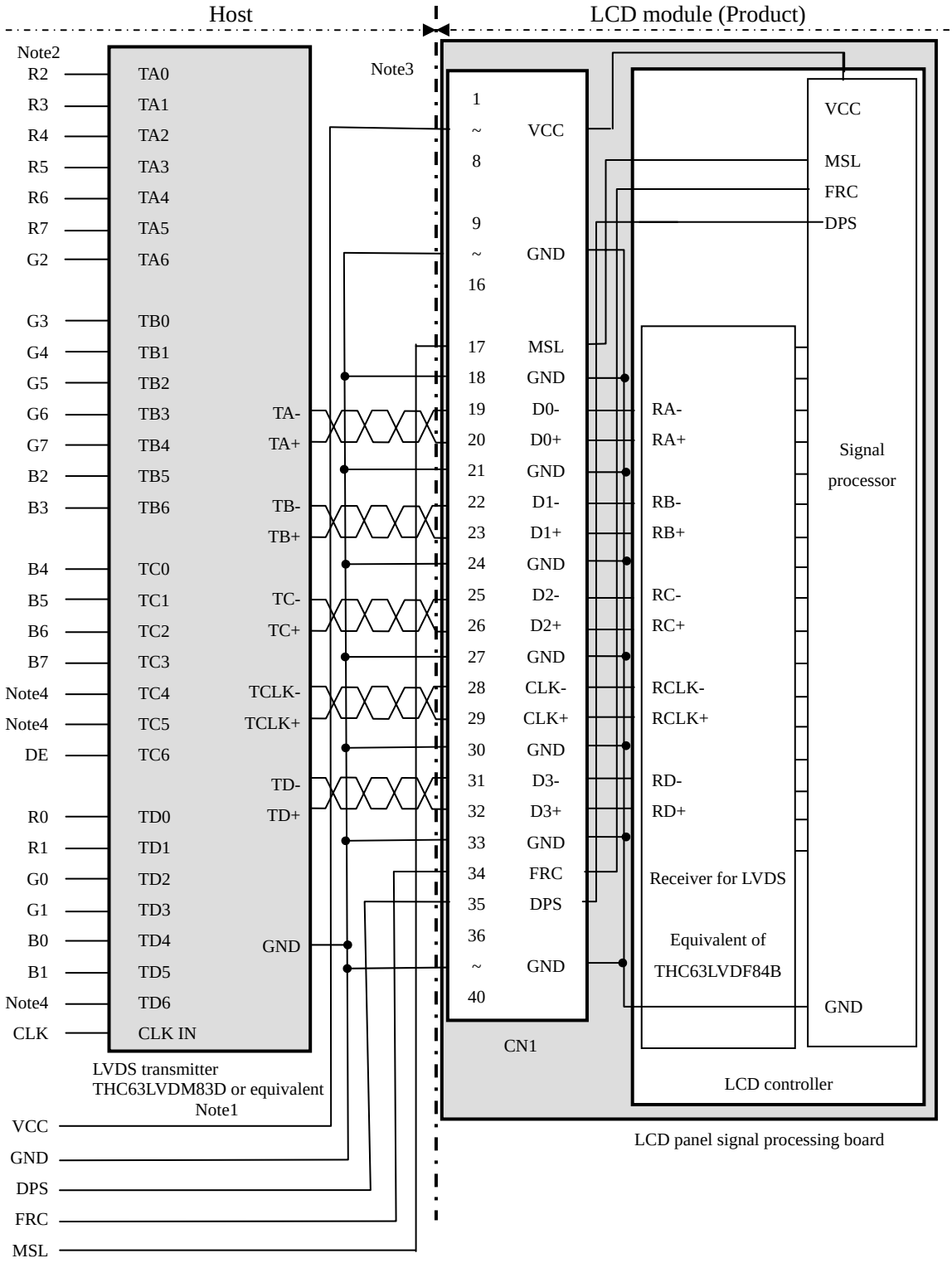
4.5.3 Positions of plug and socket

Rear side



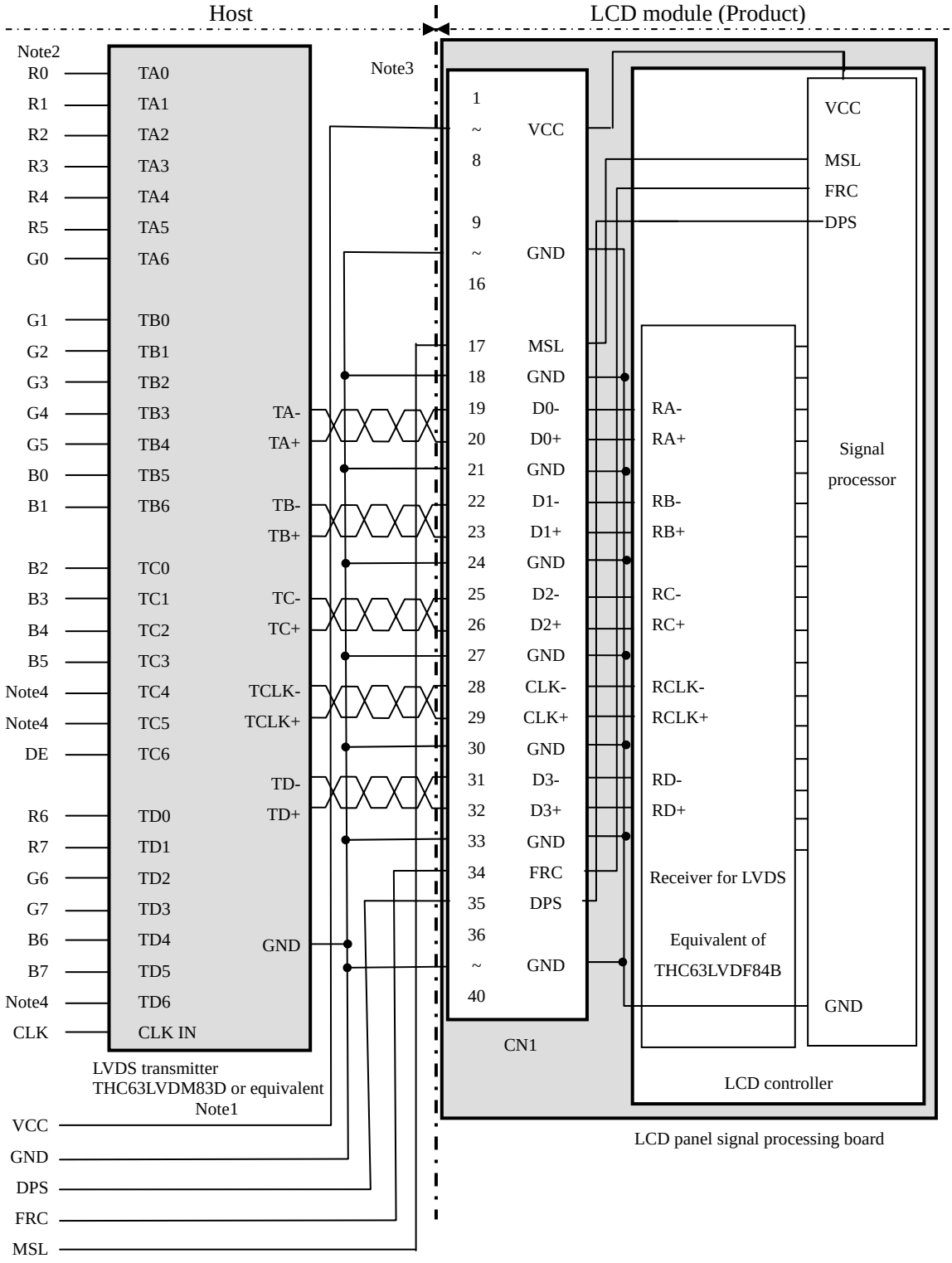
4.5.4 Connection between receiver and transmitter for LVDS

(1) Input data signal: 8bit, MAP A



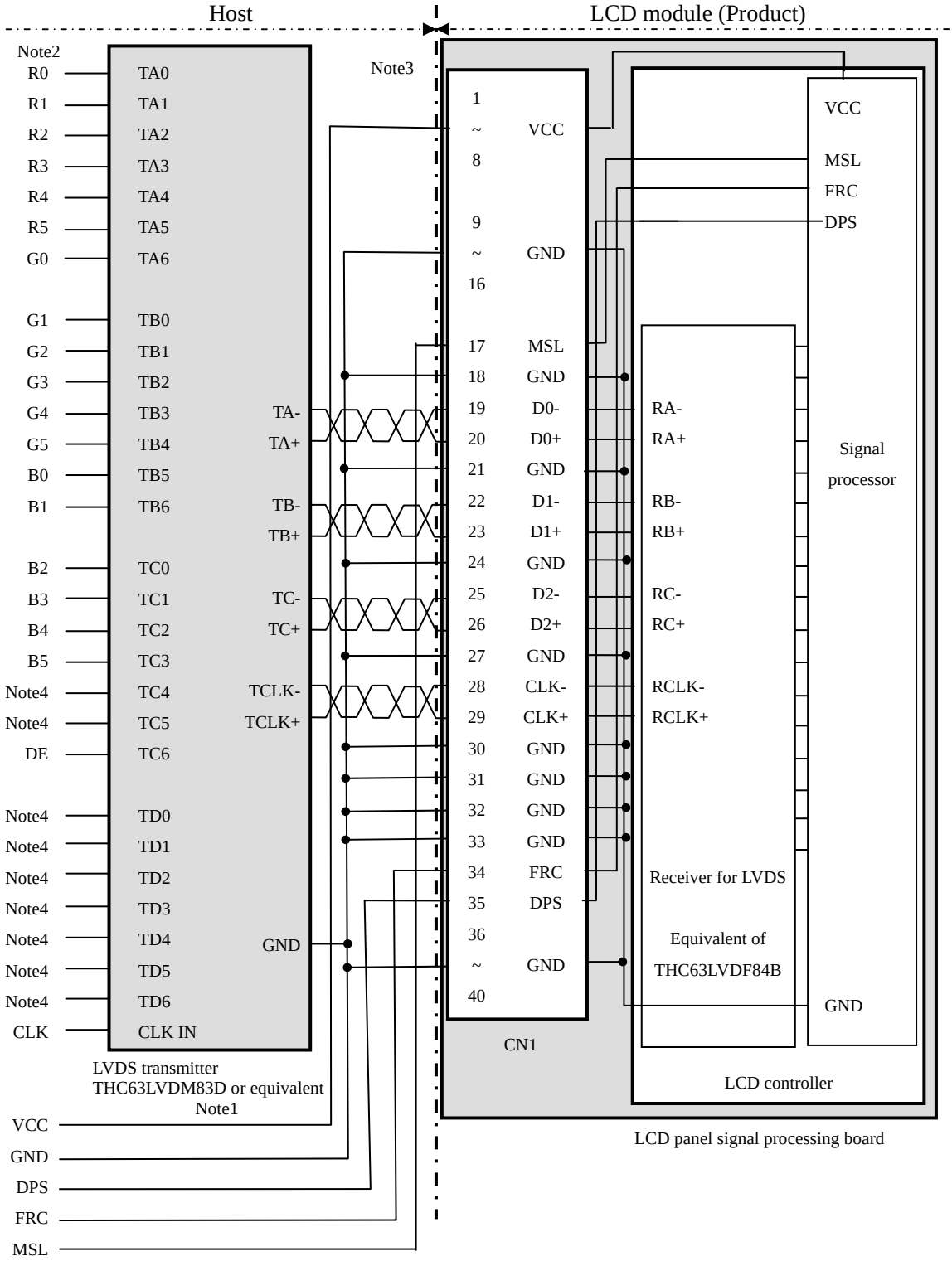
Note1: Recommended transmitter THC63LVDM83D (THine Electronics Inc.) or equivalent
Note2: LSB (Least Significant Bit) - R0, G0, B0 MSB (Most Significant Bit) - R7, G7, B7
Note3: Adjust LVDS signal level minimize that the jitter and the skew.
Note4: Input signals to TC4, TC5 and TD6 are not used inside the product, but do not keep TC4, TC5 and TD6 open to avoid noise problem.

(2) Input data signal: 8bit, MAP B



Note1: Recommended transmitter THC63LVDM83D (THine Electronics Inc.) or equivalent
Note2: LSB (Least Significant Bit) - R0, G0, B0 MSB (Most Significant Bit) - R7, G7, B7
Note3: Adjust LVDS signal level minimize that the jitter and the skew.
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.

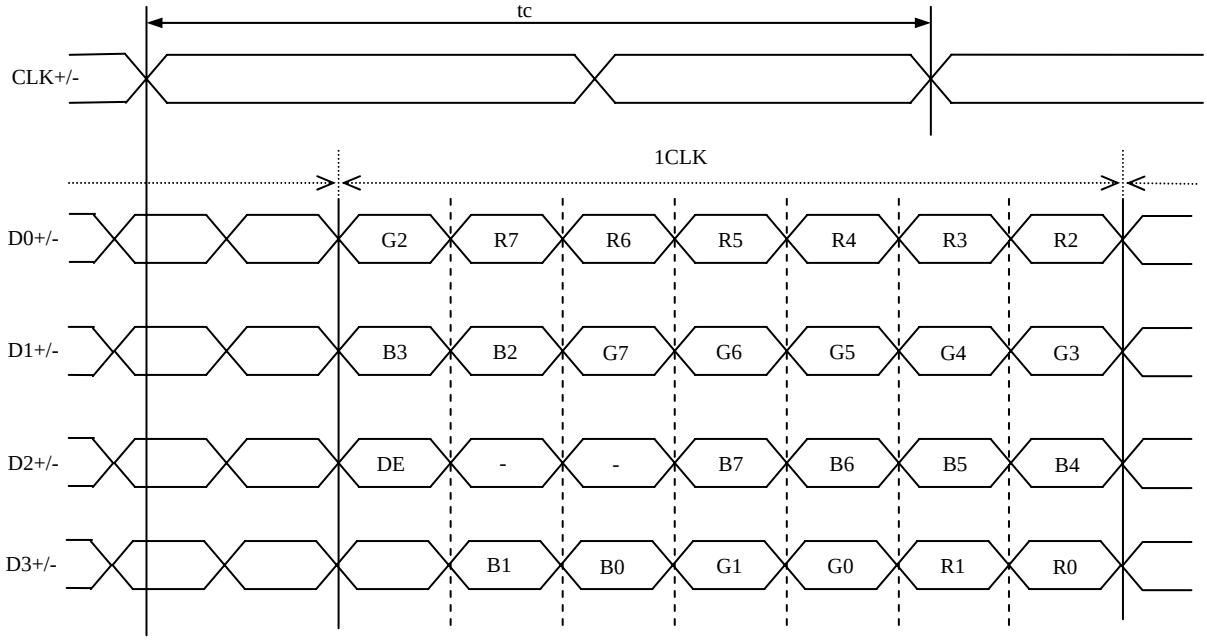
(3) Input data signal: 6bit



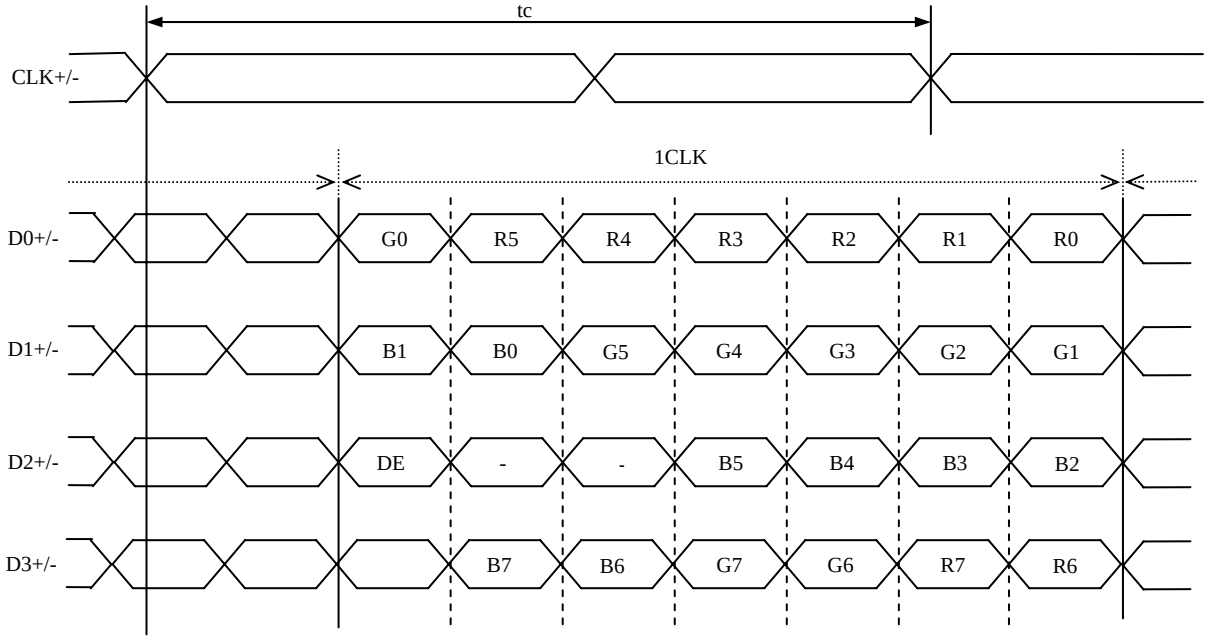
Note1: Recommended transmitter THC63LVDM83D (THine Electronics Inc.) or equivalent
Note2: LSB (Least Significant Bit) – R0, G0, B0 MSB (Most Significant Bit) – R5, G5, B5
Note3: Adjust LVDS signal level minimize that the jitter and the skew.
Note4: Input signals to TC4, TC5 and TD0-6 are not used inside the product, but do not keep TC4, TC5 and TD0-6 open to avoid noise problem.

4.5.5 Input data mapping

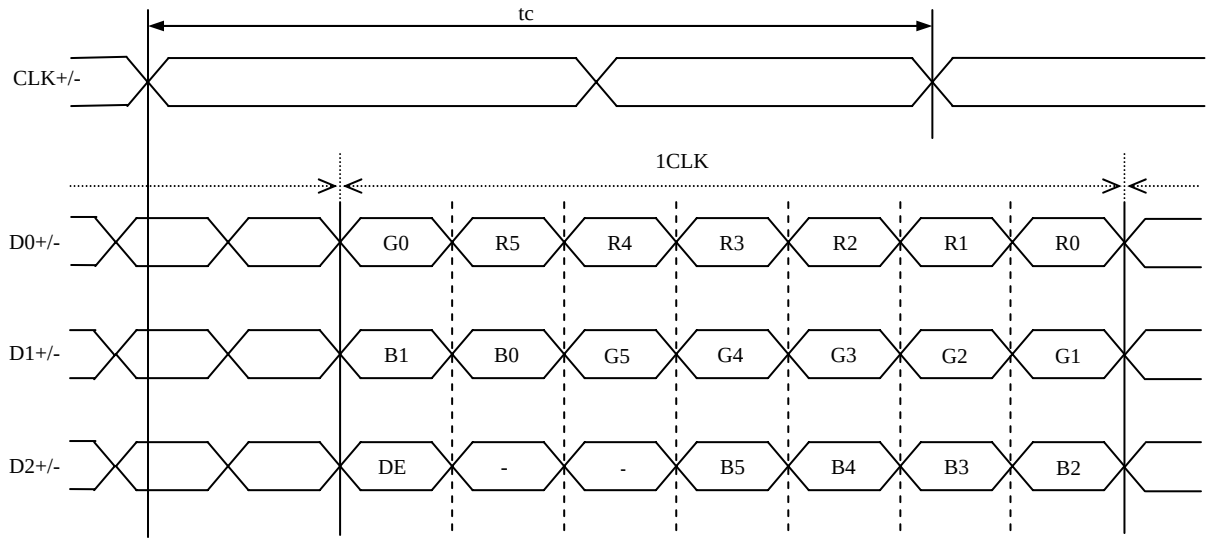
(1) Input data signal: 8bit, MAP A



(2) Input data signal: 8bit, MAP B



(3) Input data signal: 6bit



4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

4.6.1 Combinations between input data signals, FRC signal and MSL signal

This product can display in equivalent to 16,777,216 colors in 256 gray scales and 262,144 colors in 64 gray scales by combination between input data signals, FRC signal and MSL signal. See following table.

Combination	Input data signals	Input data mapping	CN1- Pin No.31 and 32	FRC terminal	MSL terminal	Display colors	Remarks
①	8 bit	Map A	D3+/-	High	Low or open	16,777,216	Note1
②	8 bit	Map B	D3+/-	High	High	16,777,216	Note1
③	6 bit	-	GND	Low or open	Low or open	262,144	Note2

Note1: See "**4.6.2 16,777,216 colors**".
Note2: See "**4.6.3 262,144 colors**".

4.6.2 16,777,216 colors

This product can display equivalent of 16,777,216 colors in 256 gray scales by combination ① and ②.(See "**4.6.1 Combinations between input data signals, FRC signal and MSL signal** ".)
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

4.6.3 262,144 colors

This product can display equivalent of 262,144 colors in 64 gray scales by combination ③.
(See "**4.6.1 Combinations between input data signals, FRC signal and MSL signal** ".)
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 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	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 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	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 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	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 "**4.8 SCANNING DIRECTIONS**".).

C (0, 0)

RR	LR
RG	LG
RB	LB

RR: Red (Red color for right eye) LR: Red (Red color for left eye)
RG: Green (Green color for right eye) LG: Green (Green color for left eye)
RB: Blue (Blue color for right eye) LB: Blue (Blue color for left eye)

C(0, 0)	C(1, 0)	• • •	C(X, 0)	• • •	C(798, 0)	C(799, 0)
C(0, 1)	C(1, 1)	• • •	C(X, 1)	• • •	C(798, 1)	C(799, 1)
•	•	•	•	•	•	•
•	•	• • •	•	• • •	•	• • •
•	•	•	•	•	•	•
C(0, Y)	C(1, Y)	• • •	C(X, Y)	• • •	C(798, Y)	C(799, Y)
•	•	•	•	•	•	•
•	•	• • •	•	• • •	•	•
•	•	•	•	•	•	•
C(0, 598)	C(1, 598)	• • •	C(X, 598)	• • •	C(798, 598)	C(799, 598)
C(0, 599)	C(1, 599)	• • •	C(X, 599)	• • •	C(798, 599)	C799 (,599)

The line image of input data for the above table is as follows.

D (0, 0)

RR	LR
RG	LG
RB	LB

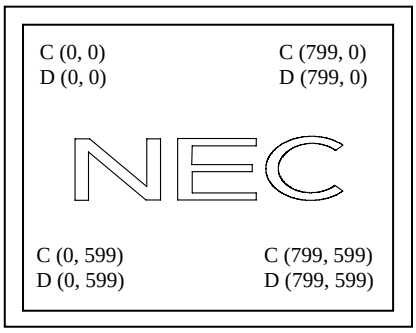
RR: Red (Red color for right eye) LR: Red (Red color for left eye)
RG: Green (Green color for right eye) LG: Green (Green color for left eye)
RB: Blue (Blue color for right eye) LB: Blue (Blue color for left eye)

L(0, 0)	•	L(X, 0)	•	L(799, 0)	R(0, 0)	•	R(X, 0)	•	R(799, 0)
L(0, 1)	•	L(X, 1)	•	L(799, 1)	R(0, 1)	•	R(X, 1)	•	R(799, 1)
•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•
L(0, Y)		L(X, Y)		L(799, Y)	R(0, Y)		R(X, Y)		R(799, Y)
•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•
L(0, 598)	•	L(X, 598)	•	L(799, 598)	R(0, 598)	•	R(X, 598)	•	R(799, 598)
L(0, 599)	•	L(X, 599)	•	L(799, 599)	R(0, 599)	•	R(X, 599)	•	R(799, 599)

Note1: At reverse scanning, the line of input data should be lined the same as the forward scanning.

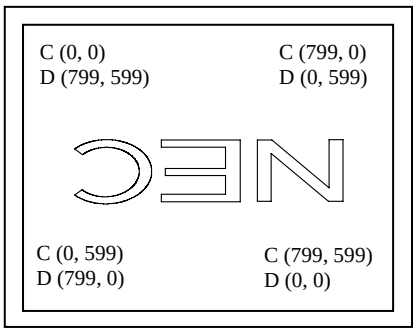
4.8 SCANNING DIRECTIONS

The following figures are seen from a front view.



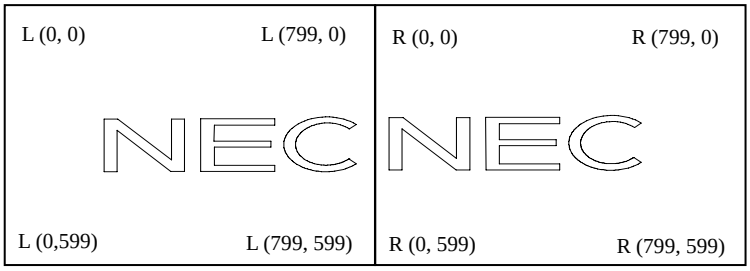
Note1

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



Note1

Figure 2. Reverse scan (DPS: High)



Note1

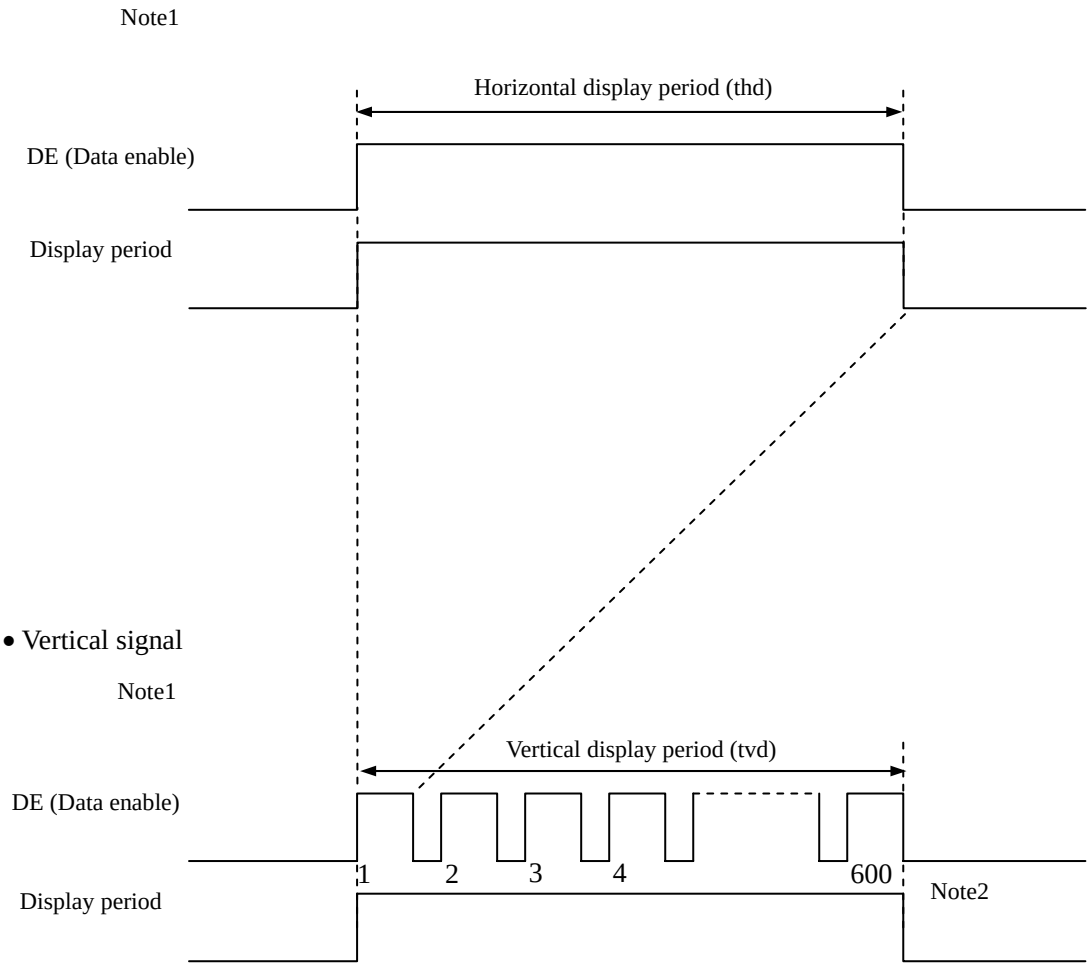
Figure 3. 3D signal image

Note1: Meanings of C (X, Y), D (X, Y), L (X, Y) and R (X, Y)
C (X, Y): The coordinates of the display position (See "**4.7 DISPLAY POSITIONS**".)
D (X, Y): The data number at display
L (X, Y): The data number of input signal for LCD panel signal processing board (the data for left eye)
R (X, Y): The data number of input signal for LCD panel signal processing board (the data for right eye)

4.9 INPUT SIGNAL TIMINGS

4.9.1 Outline of input signal timings

- 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.

4.9.2 Timing characteristics

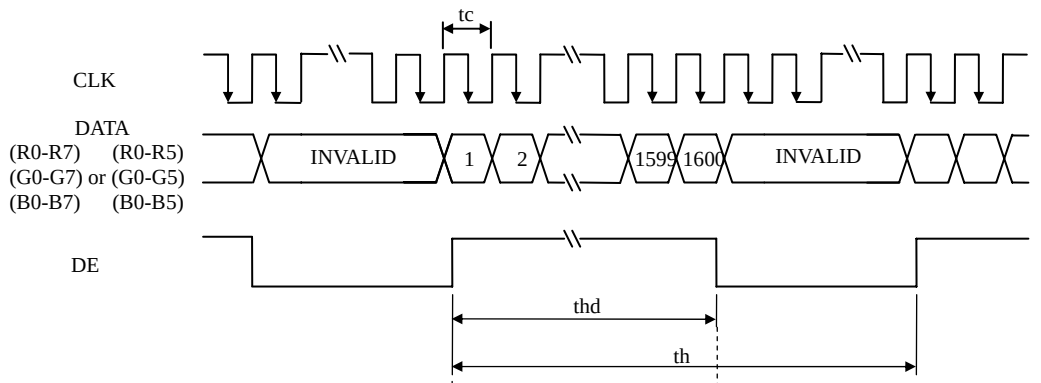
(Note1, Note2, Note3)

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	60.0	65.4	68.0	MHz	15.29 ns (typ.)
	Duty		-		-		-	-
	Rise time, Fall time		-				ns	
DATA	CLK-DATA	Setup time	-		-		ns	-
		Hold time	-				ns	
	Rise time, Fall time		-				ns	
DE	Horizontal	Cycle	th	26.0	27.4	30.0	µs	36.5 kHz (typ.)
				1,740	1,792	1,920	CLK	
		Display period	thd		1,600		CLK	-
	Vertical (One frame)	Cycle	tv	15.4	16.7	18.2	ms	60.26 Hz (typ.)
				605	608	615	H	
		Display period	tvd		600		H	-
	CLK-DE	Setup time	-		-		ns	-
		Hold time	-				ns	
	Rise time, Fall time		-				ns	

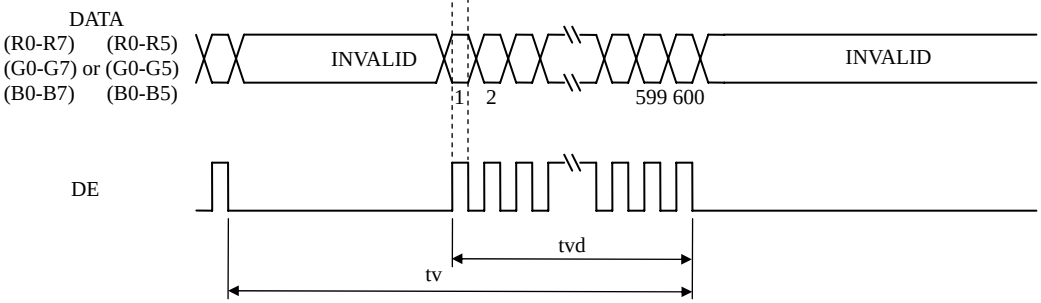
Note1: Definition of parameters is as follows.
tc = 1CLK, th = 1H
Note2: See the data sheet of LVDS transmitter.
Note3: Vertical cycle (tv) should be specified in integral multiple of Horizontal cycle (th).

4.9.3 Input signal timing chart

Horizontal timing



Vertical timing



4.10 OPTICS

4.10.1 Optical characteristics

(Note1, Note2)

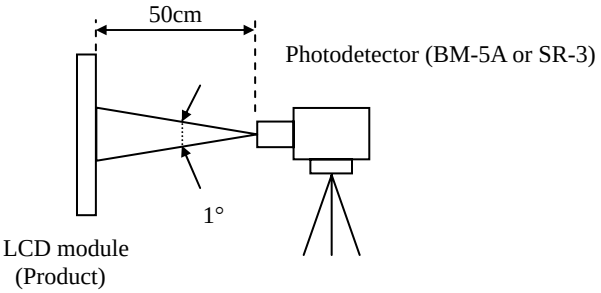
Parameter		Condition	Symbol	min.	typ.	max.	Unit	Measuring instrument	Remarks	
Luminance		White at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	L	280	370	-	cd/m^2	BM-5A	-	5
Contrast ratio		White/Black at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	CR	300	600	-	-	BM-5A	Note3	
Chromaticity	White	x coordinate	Wx	0.263	0.313	0.363	-	SR-3	Note4	
		y coordinate	Wy	0.279	0.329	0.379	-			
	Red	x coordinate	Rx	-	0.63	-	-			
		y coordinate	Ry	-	0.34	-	-			
	Green	x coordinate	Gx	-	0.32	-	-			5
		y coordinate	Gy	-	0.62	-	-			
	Blue	x coordinate	Bx	-	0.15	-	-			
		y coordinate	By	-	0.08	-	-			
Color gamut		θR= 0°, θL= 0°, θU= 0°, θD= 0° at center, against NTSC color space	C	63	68	-	%			5
Response time		White to Black	Ton	-	3	6	ms	BM-5A	Note5 Note6	
		Black to White	Toff	-	15	20	ms			
Viewing angle	Right	θU= 0°, θD= 0°, CR≥ 10	θR	70	80	-	°	EZ Contrast	Note7	
	Left	θU= 0°, θD= 0°, CR≥ 10	θL	70	80	-	°			
	Up	θR= 0°, θL= 0°, CR≥ 10	θU	70	80	-	°			
	Down	θR= 0°, θL= 0°, CR≥ 10	θD	50	60	-	°			

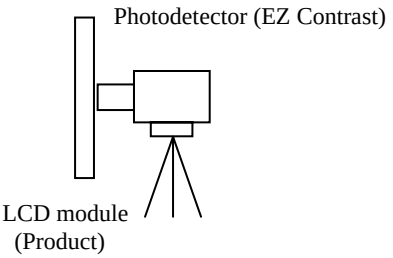
Note1: These are initial characteristics at 2D display.

Note2: Measurement conditions are as follows.

Ta= 25°C, VCC= 3.3V, IL= 20mA/One circuit, Horizontal cycle= 1/36.5kHz, Vertical cycle= 1/60.26Hz, DPS= Low or Open: Normal scan

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





5

Note3: See "**4.10.2 Definition of contrast ratio**".

Note4: These coordinates are found on CIE 1931 chromaticity diagram.

Note5: Product surface temperature: TopF= 30 °C 5

Note6: See "**4.10.3 Definition of response times**".

Note7: See "**4.10.4 Definition of viewing angles**".

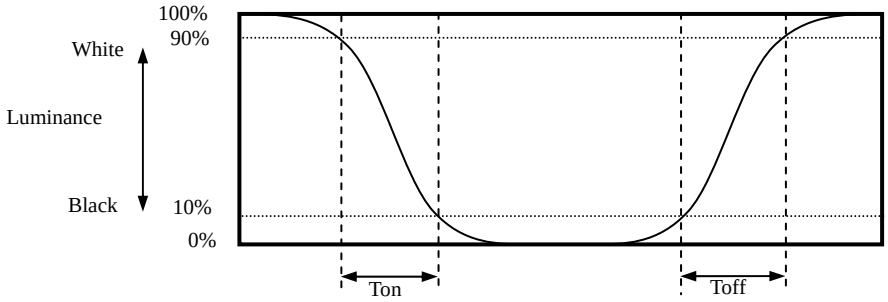
4.10.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

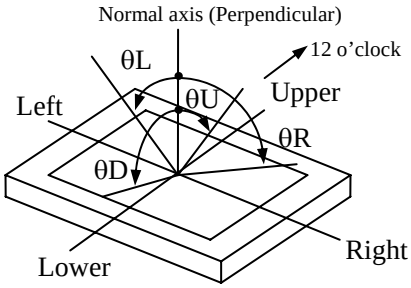
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

4.10.3 Definition of 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.).



4.10.4 Definition of viewing angles



5. ESTIMATED LUMINANCE LIFETIME

The luminance lifetime is the time from initial luminance to half-luminance.

This lifetime is the estimated value, and is not guarantee value.

Condition		Expected luminance lifetime Note1, Note2, Note3	Unit
LED elementary substance	25°C (Ambient temperature of the product) Continuous operation, IL=20mA/One circuit	30,000	h

Note1: Life time expectancy is mean time to half-luminance.
Note2: Expected luminance lifetime is not the value for LCD module but the value for LED elementary substance.
Note3: By ambient temperature, the lifetime changes particularly. Especially, in case the product works under high temperature environment, the lifetime becomes short.

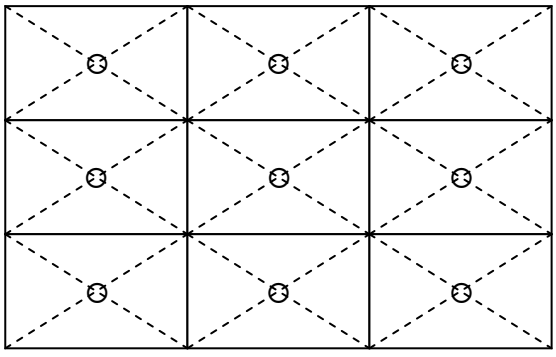
6. RELIABILITY TESTS

(Note1)

Test item	Condition	Judgment
High temperature and humidity (Operation)	① 60 ± 2°C, RH= 90%, 240hours ② Display data is black.	No display malfunctions
Heat cycle (Operation)	① 0 ± 3°C…1hour 55 ± 3°C…1hour ② 50cycles, 4hours/cycle ③ Display data is black.	
Thermal shock (Non operation)	① -20 ± 3°C…30minutes 60 ± 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, 19.6m/s^2 ② 1 minute/cycle ③ X, Y, Z directions ④ 60 times each directions	No display malfunctions No physical damages
Mechanical shock (Non operation)	① 539m/ s^2, 11ms ② ±X, ±Y, ±Z directions ③ 5 times each directions	

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.



7. PRECAUTIONS

7.1 MEANING OF CAUTION SIGNS

The following caution signs have very important meaning. **Be sure to read "7.2 CAUTIONS" and "7.3 ATTENTIONS", after understanding these contents!**

This sign has the meaning that customer will be injured by personnel or the product will sustain a damage, if customer has wrong operations.

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

7.2 CAUTIONS

* **Do not shock and press the LCD panel and the backlight! There is a danger of breaking, because they are made of glass. (Shock: Equal to or no greater than 539m/s^2 and equal to or no greater than 11ms, Pressure: Equal to or no greater than 19.6 N (ϕ16mm jig))**

7.3 ATTENTIONS

7.3.1 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 When the product is put on the table temporarily, display surface must be placed downward.
③ 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.
④ The torque for product mounting screws must never exceed 0.294N·m. Higher torque might result in distortion of the bezel.
⑤ The panel surface is very delicate so do not touch the surface and keep the surface clean from finger print and such. Take hold of sides of the product when handling the product.
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). Bends or twist described above and undue stress to any portion may cause display mura.
⑦ Do not push nor pull the interface connectors while the product is working.
⑧ When handling the product, use of an original protection sheet on the product surface is recommended for protection of product surface.
⑨ 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.
⑩ Please stop looking at the display once you feel eye fatigue.

7.3.2 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.

7.3.3 Characteristics

The following items are neither defects nor failures.

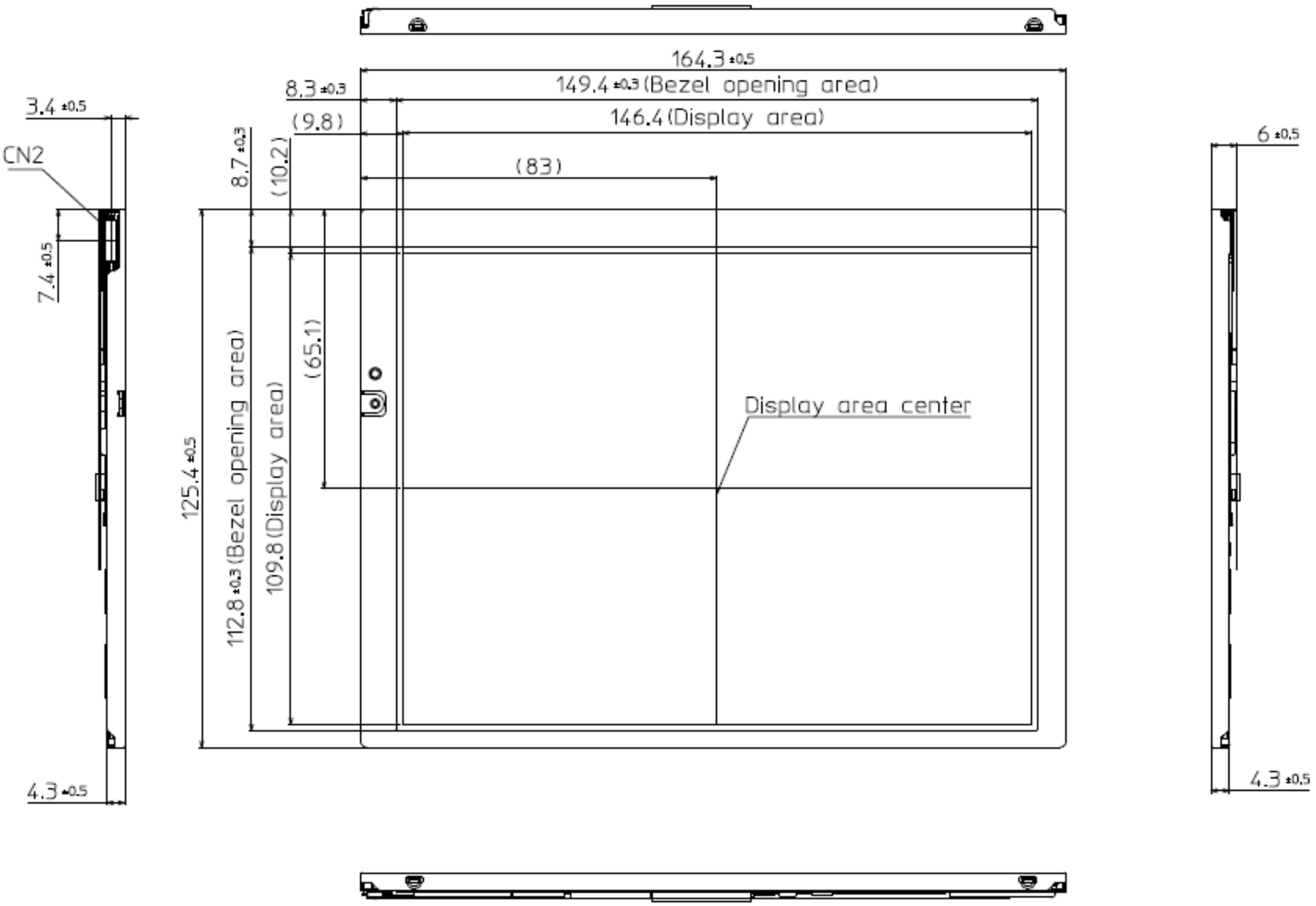
① Characteristics of the LCD (such as response time, luminance, color uniformity and so on) may be changed depending on ambient temperature. If the product is stored under condition of low temperature for a long time, it may cause display mura. In this case, the product should be operated after enough 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 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.
④ The display color may be changed depending on viewing angle because of the use of condenser sheet in the backlight.
⑤ Optical characteristics may be changed depending on input signal timings.
⑥ The 3D distance and angular vary depending on a personal sensitivity and/or room temperature.
⑦ The 3D distance and angular vary depending on high or low temperature.
⑧ Use of a clear protection plate which does not touch the LCD surface when the LCD installed with a set. And keep a gap between the plate and the LCD surface after installation.

7.3.4 Other

① All VCC and GND terminals should be used without any non-connected lines.
② Do not disassemble a product or adjust variable resistors.
③ See "REPLACEMENT MANUAL FOR LAMP HOLDER SET", when replacing backlight lamps.
④ Pay attention not to insert foreign materials inside of the product, when using tapping screws.
⑤ 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.

8. OUTLINE DRAWINGS

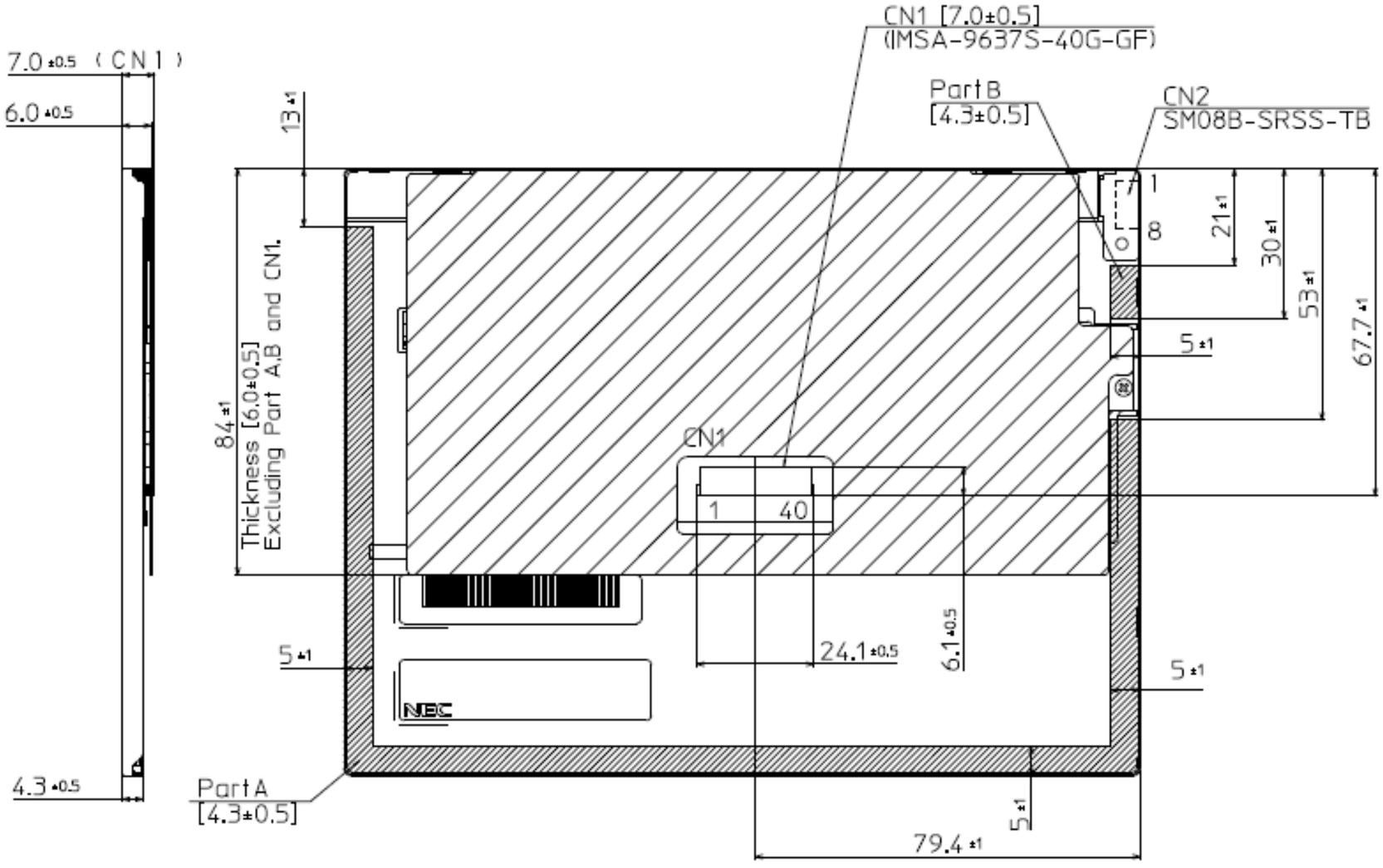
8.1 FRONT VIEW



Unit: mm

Note1: The values in parentheses are for reference.

8.2 REAR VIEW



Note1: When the LCD module is installed, support part A and B equally.

Unit: mm

REVISION HISTORY

The inside of latest specifications is revised to the clerical error and the major improvement of previous edition. Only a changed part such as functions, characteristic value and so on that may affect a design of customers, are described especially below.

Edition	Document number	Prepared date	Revision contents and signature
1st edition	DOD-PP-0903	Dec. 14, 2009	**Revision contents** New issue **Writer** *Approved by* T. OGAWA *Checked by* ——— *Prepared by* T. OGAWA
2nd edition	DOD-PP-1153	Jan. 27, 2011	**Revision contents** P5 General specifications • Module size (W): 163.3(W) mm (typ.) → 164.3(W) mm (typ.) • Weight: TBD g (typ.) → (135) g (typ.) • Contrast ratio: TBD (typ.) → 600:1 (typ.) • Viewing angle • Right/Left/Up side: TBD° (typ.) → 80° (typ.), Down side: TBD° (typ.) → 60° (typ.) • Color gamut: 40% (typ.) → (68) % (typ.) • Response time: (18) ms (typ.) → 18 ms (typ.) • Power consumption: (3.5) W (typ.) → 2.9 W (typ.) P6 Block diagram • GND-FG: Not connected → Connected P8 Mechanical specifications • Module size (W): 163.3± 0.5 (W) → 164.3± 0.5 (W) mm • Weight: TBD (typ.) → (135) (typ.) g P8 Absolute maximum ratings • Storage temperature : (-30) to (+80) → -20 to +60 °C • Operating temperature-Front/Rear: (-20) to +60 → 0 to +55 °C • Relative humidity: ≤ 55, 50°C <Ta≤ 60°C →≤ 70 %, 50°C <Ta≤ 55°C • Absolute humidity: ≤ 71, Ta> 60°C →≤ 73 g/m^3, Ta> 55°C • Note6: Ta= 60°C and RH= 55% →Ta= 55°C and RH= 70% P9 LCD panel signal processing board • Power supply current: (600) (typ.), (1,010) (max.) → 410 (typ.), 685 (max.) mA P10 Backlight lamp • Forward voltage: 24.0 (typ.) → 26.1 (typ.)V P10 Fuse (specified) P11 LCD panel signal processing board • VCC: 10μs → 10ms P12 LCD panel signal processing board • CN1 socket: DF19L-30P-1H → IMSA-9637S-40C-GF • Adaptable plug (elimination) • Table (revised), Note2 (revised) P13 Backlight lamp • CN2 plug: DF19L-14P-1H → SM08B-SRSS-TB • Adaptable socket: DF19G-14S-1C, DF19G-14S-1CF → SHR-08V-S • Table (revised) P13 Positions of plug and socket • Figure (revised) P14-16 Connection between receiver and transmitter for LVDS • Input data signal-8bit MAP A, 8bit MAP B, 6bit: Figure (revised), Note3 (revised) P18 Combinations between input data signals, FRC signal and MSL signal • CN1: Pin No.23 and 24 →Pin No.31 and 32

REVISION HISTORY

Edition	Document number	Prepared date	Revision contents and signature
2nd edition	DOD-PP-1153	Jan. 27, 2011	**Revision contents** P24 Timing characteristics • DE- Horizontal- Display period- Remarks: 36.5 kHz(typ.) → - - Vertical- Display period- Remarks: 60.26 Hz(typ.) → - P26 Optical characteristics • Luminance: TBD (min.) → (260) (min.) cd/m^2 • Contrast ratio: TBD (min., typ.) → 300 (min.), 600 (typ.) • Color gamut: TBD (min.), 40 (typ.) % → (63) (min.), (68) (typ.) % • Response time-Ton: (3) (typ.), TBD (max.) ms → 3 (typ.), 6 (max.) ms -Toff: (15) (typ.), TBD (max.) ms → 15 (typ.), 20 (max.) ms • Viewing angle- θR, θL, θU: TBD (min., typ.)° → 70 (min.), 80(typ.)° - θD: TBD (min., typ.) → 50 (min.), 60(typ.)° • Note2: Display mode: SVGA (elimination) P28 Estimated luminance lifetime • LED elementary substance : 10,000 → 30,000 h P29 Reliability tests • High temperature and humidity : 90% → 60% • Heat cycle: (-20) ± 3°C, 60 ± 3°C → 0 ± 3°C, 55 ± 3°C • Thermal shock: (-30) ± 3°C, (80) ± 3°C → -20 ± 3°C, 60 ± 3°C P30 Handling of the product • ⑤, ⑩ (addition) • ⑧ polarizer , Adhesive type protection --- characteristics of the polarizer. (elimination) P31 Characteristics • ⑦ (addition) P32-33 Outline drawings • Front view (revised) •163.3 ±0.5→ 164.3 ±0.5, (7.3)→ (8.3), (8.8)→ (9.8), (82)→ (83), CN2 (addition) • Rear view (The whole is revised) **Writer** *Approved by* T. OGAWA *Checked by* ——— *Prepared by* T. OGAWA
3rd edition	DOD-PP-1164	Feb. 8, 2011	**Revision contents** P8 Mechanical specifications • Module size: (D):Excluding CN1 (addition) P13 Backlight lamp • Adaptable socket: SHR-08V-S-B (addition) P26 Optical characteristics • Luminance: (260) (min.) → 300 (min.) cd/m^2 P32-33 Outline drawings • Front view, Rear view (revised) **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-1183	Mar. 4, 2011	**Revision contents** P5 General specifications • Module size (D): 5.8(D) mm (typ.) → 6.0(D) mm (typ.) • Weight: (135) g (typ.) → 140 g (typ.) • Backlight- replaceable part • Lamp holder set: TBD → 72LHS02 P6 Block diagram- Note2 (change of expression) P8 Mechanical specifications • Module size (D): 5.8 ± 0.5 (D) → 6.0 ± 0.5 (D) mm • Weight: (135) (typ.), TBD (max.) g → 140 (typ.), 155 (max.) g P8 Absolute maximum ratings • Forward current: TBD mA → 22 mA P10 Backlight lamp • Forward current: TBD (max.) mA→ 22 (max.) mA • Forward voltage: TBD (max.) V→ 27.0 (max.) V P14-16 Connection between receiver and transmitter for LVDS • 8bit, MAP A/B, 6bit- Figure, Note1: THC63LVDM83R → THC63LVDM83D • 6bit- Figure, Note4: TD0-TD6 (addition) P22 Scanning directions • Also the arrow shows the direction of scan. (elimination) • Figure1, 2: The arrow (elimination) P28 Estimated luminance lifetime • Note1 (addition) P30 Handling of the product- ⑤ (change of expression) P32-33 Outline drawings • Front view: 5.8 ± 0.5→ 6.0 ± 0.5 • Rear view: 5.8 ± 0.5→ 6.0 ± 0.5 (2 points), 6.7 ± 0.5→ 7.0 ± 0.5 (2 points) **Writer** *Approved by* T. OGAWA *Checked by* ——— *Prepared by* T. OGAWA
5th edition	DOD-PP-1222	May 24, 2011	**Revision contents** P5 General Specifications • Weight: 140 g (typ.) → 135 g (typ.) • Color gamut: (68) % (typ.) → 68 % (typ.) • Luminance: 400 cd/m^2 (typ.) → 370 cd/m^2 (typ.) P8 Mechanical specifications • Weight: 140 (typ.), 155 (max.) g → 135 (typ.), 150 (max.) g P10 Backlight lamp: Note2 (addition) P14-15 (1) Input data signal: 8bit, MAP A, (2) Input data signal: 8bit, MAP B • TD+ ←→ TD- (correction) P22 Scanning directions • Figure3: Reverse scan (DPS: High) → 3D signal image (correction) P26 Optical characteristics • Luminance: 300 (min.), 400 (typ.) cd/m^2 → 280 (min.), 370 (typ.) cd/m^2 • Chromaticity : Rx, Ry: TBD (typ.) → 0.63 (typ.), 0.34 (typ.) : Gx, Gy: TBD (typ.) → 0.32 (typ.), 0.62 (typ.) : Bx, By: TBD (typ.) → 0.15 (typ.), 0.08 (typ.) • Color gamut: (63) (min.), (68) (typ.) % → 63 (min.), 68 (typ.) % • Note2: Photodetector (BM-5A or SR-3): (2) ° → 1 ° • Note5: TopF: TBD °C → 30 °C

REVISION HISTORY

Edition	Document number	Prepared date	Revision contents and signature
5th edition	DOD-PP-1222	May 25, 2011	**Revision contents** P29 Reliability test- condition • High temperature and humidity: RH= 60% → RH= 90% • Vibration: 120 times → 60 times **Signature of writer** *Approved by* T. OGAWA *Checked by* *Prepared by* T. OGAWA