PRELIMINARY

NEC LCD Technologies, Ltd.

TFT COLOR LCD MODULE

NL10260BC19-01D

22.6cm (8.9 Type)
WSVGA
LVDS interface (1port)

PRELIMINARY DATA SHEET

DOD-PP-0535 (5th edition)

This PRELIMINARY DATA SHEET is updated document from DOD-PP-0462(4).

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 products are classified into three quality grades: **"Standard"**, **"Special"**, and **"Specific"** of the highest grade of a quality assurance program at the choice of a customer. Each quality grade is designed for applications described below. Any customer who intends to use a product for application other than that of Standard quality grade is required to contact an NEC sales representative in advance.

The **Standard** quality grade applies to the products developed, designed and manufactured in accordance with the NEC standard quality assurance program, which are designed for such application as any failure or malfunction of the products (sets) or parts/components incorporated therein a customer uses are, directly or indirectly, free of any damage to death, human bodily injury or other property, like general electronic devices.

Examples: Computers, office automation equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment, industrial robots, etc.

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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.

The **Specific** quality grade applies to the products developed, designed and manufactured in accordance with the standards or quality assurance program designated by a customer who requires an extremely higher level of reliability and quality for such products.

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 NL10260BC19-01D 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 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 APPLICATION

- For industrial use

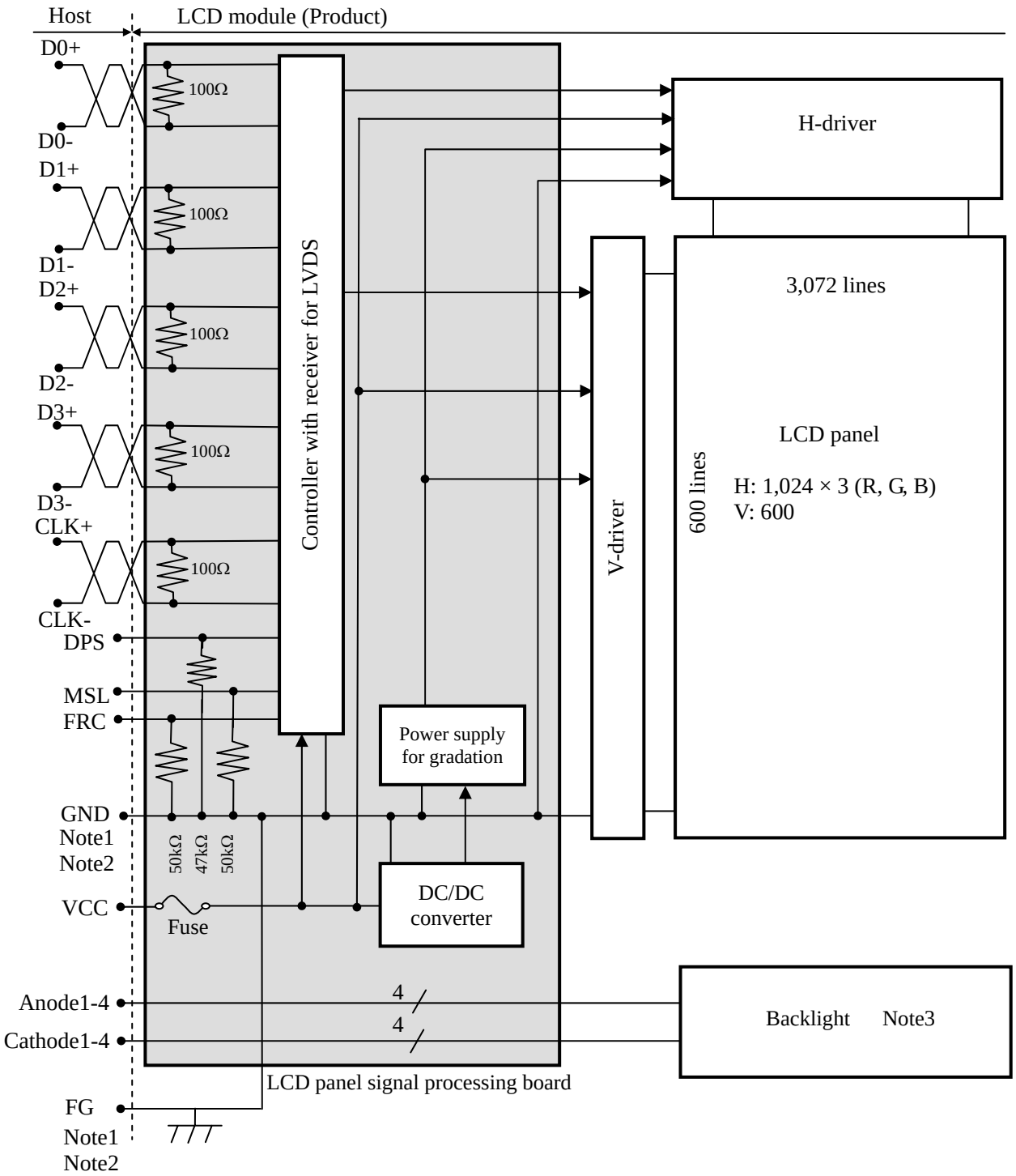
1.3 FEATURES

- Ultra-wide viewing angle (Adoption of Ultra-Advanced Super Fine TFT (UA-SFT))
- LVDS interface
- Selectable 8bit or 6bit digital signals for data of RGB
- LED backlight type
- Replaceable LED holder for backlight

2. GENERAL SPECIFICATIONS

Display area	195.072 (H) × 113.4 (V) mm	
Diagonal size of display	22.6cm (8.9 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	1,024 (H) × 600 (V) pixels	
Pixel arrangement	RGB (Red dot, Green dot, Blue dot) vertical stripe	
Dot pitch	0.0635 (H) × 0.189 (V) mm	
Pixel pitch	0.1905 (H) × 0.189 (V) mm	
Module size	214.0 (W) × 129.0 (H) × 5.7 (D) mm (typ.)	
Weight	(175) g (typ.)	
Contrast ratio	(500:1) (typ.)	
Viewing angle	*At the contrast ratio ≥10:1* • Horizontal: Right side 88° (typ.), Left side 88° (typ.) • Vertical: Up side 88° (typ.), Down side 88° (typ.)	5
Designed viewing direction	Viewing angle with optimum grayscale (γ=2.2): normal axis (perpendicular)	
Polarizer surface	Antiglare	
Polarizer pencil-hardness	3H (min.) [by JIS K5400]	
Color gamut	*At LCD panel center* 60 % (typ.) [against NTSC color space]	5
Response time	*Ton+Toff (10%←→90%)* (25) ms (typ.)	
Luminance	*At IL=15mA* 300 cd/m^2 (typ.)	5
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 • LED holder set: Type No. TBD)	
Power consumption	*At IL=15mA, Checkered flag pattern* (3.0) W (typ.)	5

3. BLOCK DIAGRAM

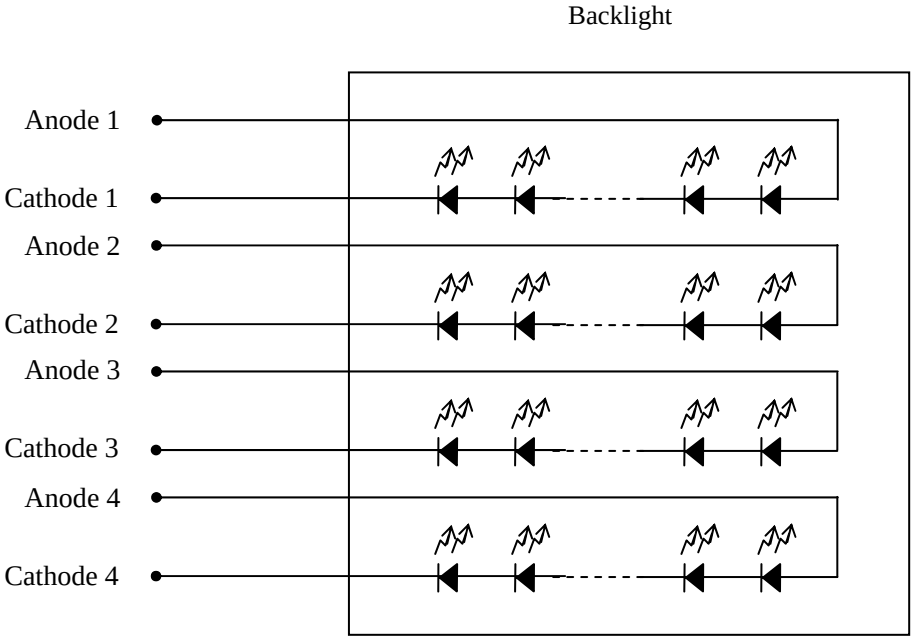


Note1: Relations between GND (Signal ground) and FG (Frame ground) in the LCD module are as follows.

GND - FG	Connected

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

Note3: Backlight in detail



4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification		Unit
Module size	214.0 ± 0.5 (W) × 129.0 ± 0.5 (H) × 5.7 ± 0.5 (D)	Note1	mm
Display area	195.072 (H) × 113.4 (V)	Note1	mm
Weight	(175) (typ.),TBD(max.)		g

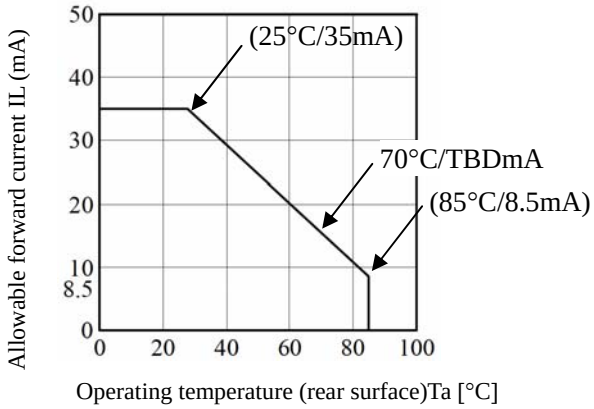
Note1: See "**7. OUTLINE DRAWINGS**".

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal processing board	VCC	-0.3 to +4.0	V	-
Input voltage for signals	Display signals Note1	VD	-0.3 to VCC+0.3	V	
	Function signals Note2	VF			
Backlight	Reverse voltage	VR	50	V	per one circuit
	Power dissipation	PD	1.23	W	
	Forward current	IL	Note3	mA	
Storage temperature		Tst	-30 to +80	°C	-
Operating temperature	Front surface	TopF	-20 to +70	°C	Note4
	Rear surface	TopR	-20 to +70	°C	Note5
Relative humidity Note6		RH	≤ 95	%	Ta ≤ 40°C
			≤ 85	%	40°C <Ta≤ 50°C
			≤ 55	%	50°C <Ta≤ 60°C
			≤ 36	%	60°C <Ta≤ 70°C
Absolute humidity Note6		AH	≤ 70 Note7	g/m^3	Ta> 70°C

Note1: Display signals are D0+/-, D1+/-, D2+/- and CLK+/-.
Note2: Function signals are DPS, FRC and MSL.

Note3: Forward current



Note4: Measured at center of LCD panel surface (including self-heat)
Note5: Measured at center of LCD module's rear shield surface (including self-heat)
Note6: No condensation
Note7: Water amount at Ta = 70°C and RH = 36%

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	-	(440) Note1	TBD Note2	mA	at VCC = 3.3V
Permissible ripple voltage		VRP	-	-	100	mVp-p	for VCC
Differential input threshold voltage for LVDS receiver	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 FRC and MSL signal	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

(Ta=25°C, Note1, Note2)

Parameter	Symbol	min.	typ.	max.	Unit	Remarks
Forward current	IL	-	15	35	mA	Note3
Forward voltage	VL	-	28.35	31.5	V	at IL=15mA

Note1: Please drive with constant current .
Note2: The Luminance uniformity may be changed depending on the current variation between 4 circuits. It is recommended that the current value difference between each circuit is less than 5%.
Note3: See "**4.2 ABSOLUTE MAXIMUM RATINGS Note4**".

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.

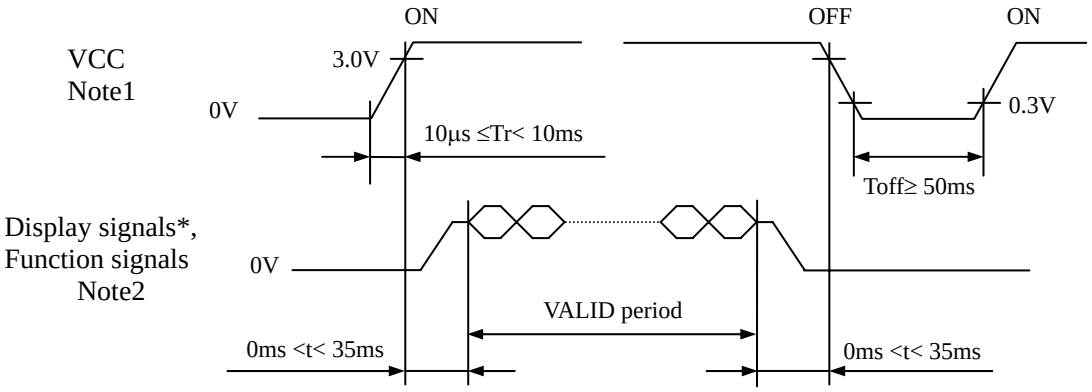
4.3.4 Fuse

Parameter	Fuse		Rating	Fusing current	Remarks
	Type	Supplier			
VCC	(FCC16202AB)	KAMAYA ELECTRIC CO., LTD.	(2.0A) 32V	(4.0A)	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

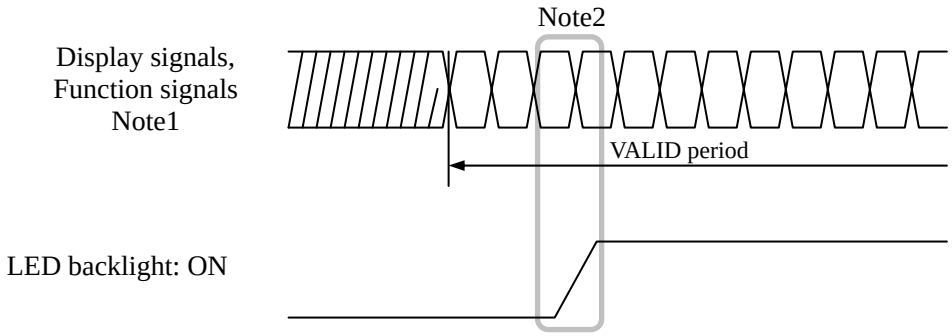


* These signals should be measured at the terminal of 100Ω resistance.

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

Note2: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CLK+/-) and function 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

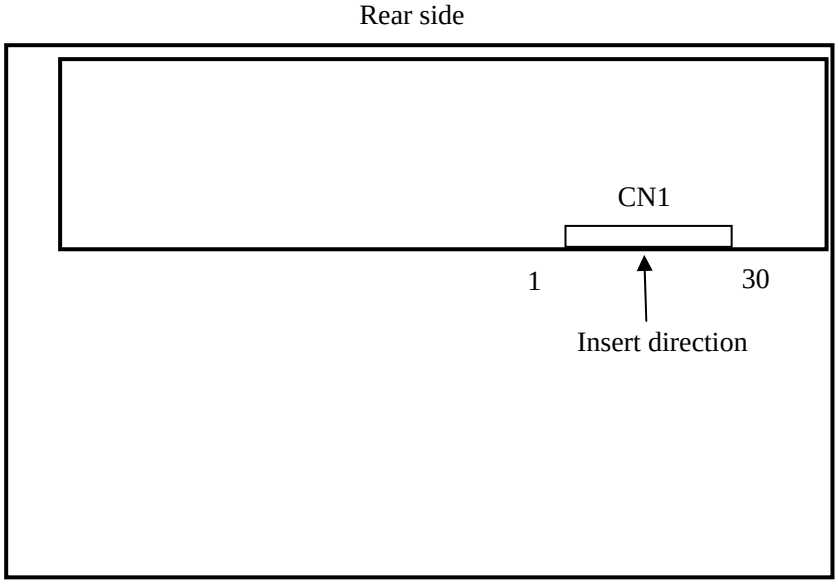
4.5.1 LCD panel signal processing board

CN1 socket (LCD module side): DF19L-30P-1H (Hirose Electric Co., Ltd. (HRS))
Adaptable plug: DF19G-30S-1C, DF19G-30S-1F (Hirose Electric Co., Ltd. (HRS))

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	GND	Ground	Ground			Note1
4	D0-	Pixel data	R2-R7,G2	R0-R5,G0		Note2
5	D0+					
6	GND	Ground	Ground			Note1
7	D1-	Pixel data	G3-G7,B2-B3	G1-G5,B0-B1		Note2
8	D1+					
9	GND	Ground	Ground			Note1
10	D2-	Pixel data	B4-B7,DE	B2-B5,DE		Note2
11	D2+					
12	GND	Ground	Ground			Note1
13	CLK-	Pixel clock	Pixel clock			Note2
14	CLK+					
15	GND	Ground	Ground			Note1
16	D3- or GND	Pixel data or Ground	R0-R1,G0-G1,B0-B1	R6-R7,G6-G7,B6-B7	Ground	Note1, Note2, Note3
17	D3+ or GND	Pixel data or Ground				
18	FRC	Selection of the number of colors	High		Low or Open	Note3 Note4
19	DPS	Selection of scan direction	High : Reverse scan Low or Open : Normal scan			Note5
20	MSL	Selection of LVDS input map	Low or Open	High	Low or Open	Note4
21	K4	Cathode	Cathode 4			
22	K3	Cathode	Cathode 3			
23	K2	Cathode	Cathode 2			-
24	K1	Cathode	Cathode 1			-
25	N.C.	N.C.	Keep this pin Open.			-
26	N.C.					
27	A4	Anode	Anode 4			-
28	A3	Anode	Anode 3			-
29	A2	Anode	Anode 2			-
30	A1	Anode	Anode 1			-

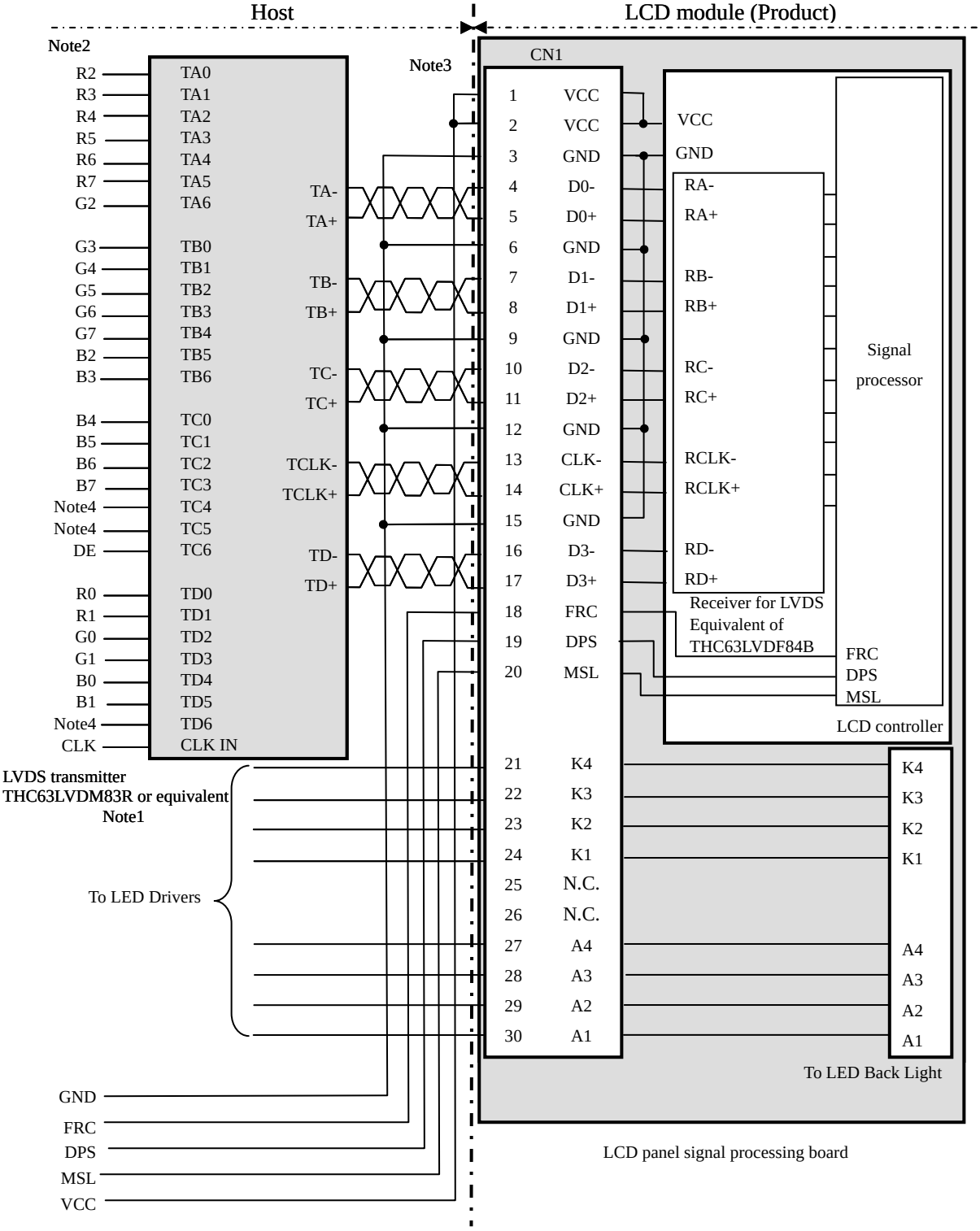
Note1: All GND and VCC terminals should be used without any non-connected lines.
Note2: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.
Note3: See "**4.6 DISPLAY COLORS AND INPUT DATA SIGNALS**".
Note4: See "**4.5.4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

4.5.2 Positions of plug and socket



4.5.3 Connection between receiver and transmitter for LVDS

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



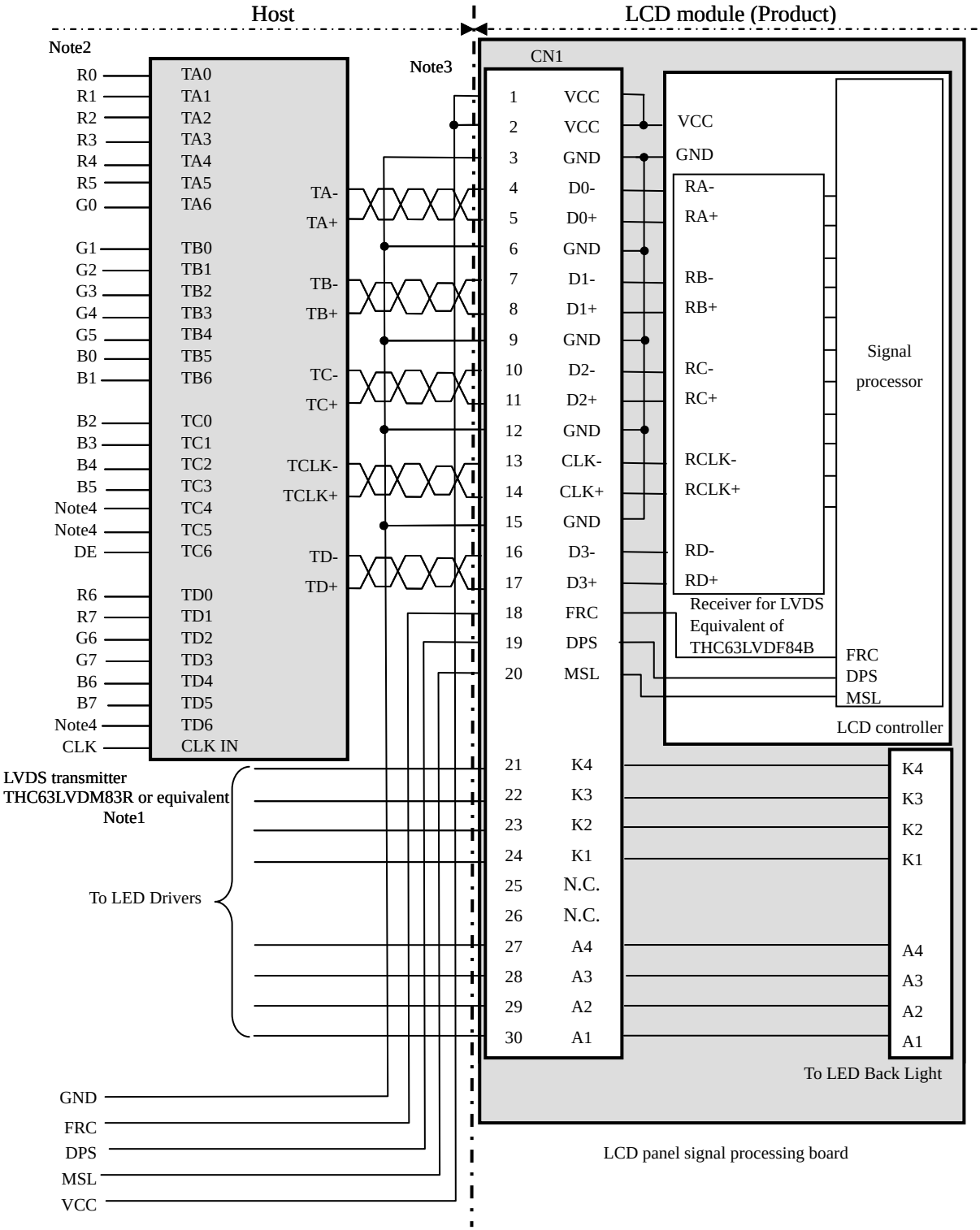
Note1: Recommended transmitter THC63LVDM83R (THine Electronics Inc.) or equivalent

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

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

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

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



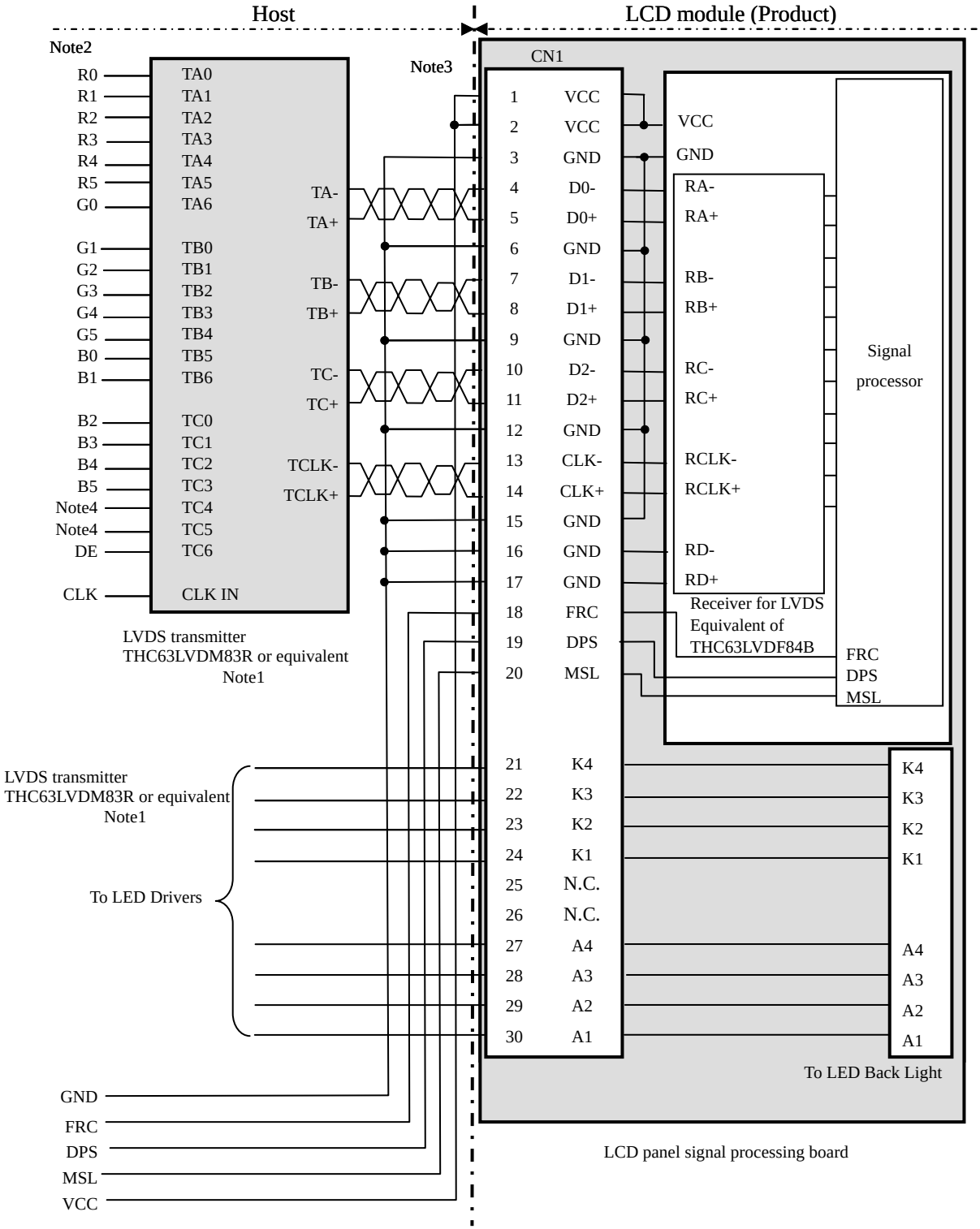
Note1: Recommended transmitter THC63LVDM83R (THine Electronics Inc.) or equivalent

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

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

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

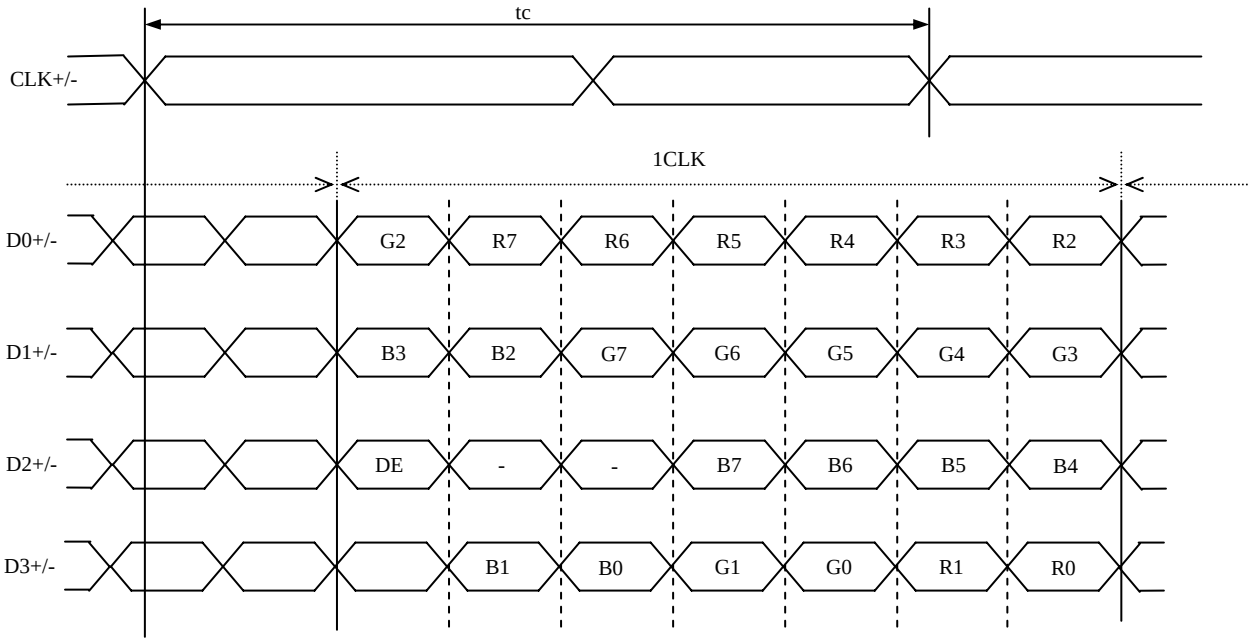
(3) Input data signal: 6bit



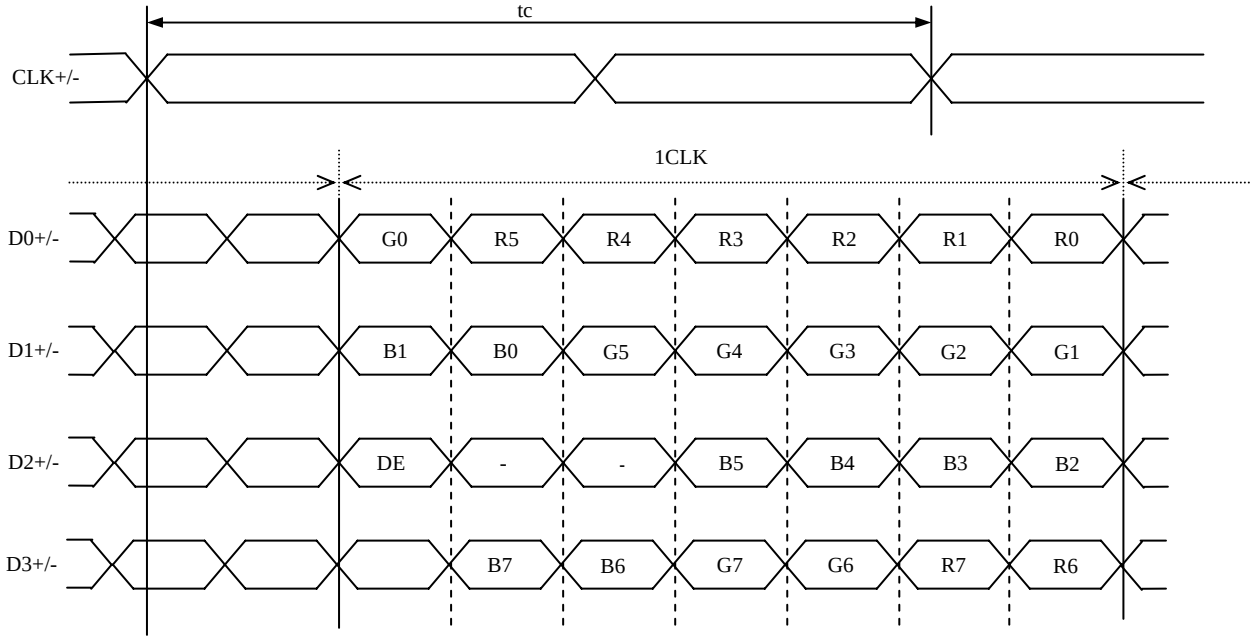
Note1: Recommended transmitter THC63LVDM63R (THine Electronics Inc.) or equivalent
Note2: LSB (Least Significant Bit) – R0, G0, B0 MSB (Most Significant Bit) – R5, G5, B5
Note3: Twist pair wires with 100Ω (Characteristic impedance) should be used between LCD panel signal processing board and LVDS transmitter.
Note4: Input signals to TC4 and TC5 are not used inside the product, but do not keep TC4 and TC5 open to avoid noise problem.

4.5.4 Input data mapping

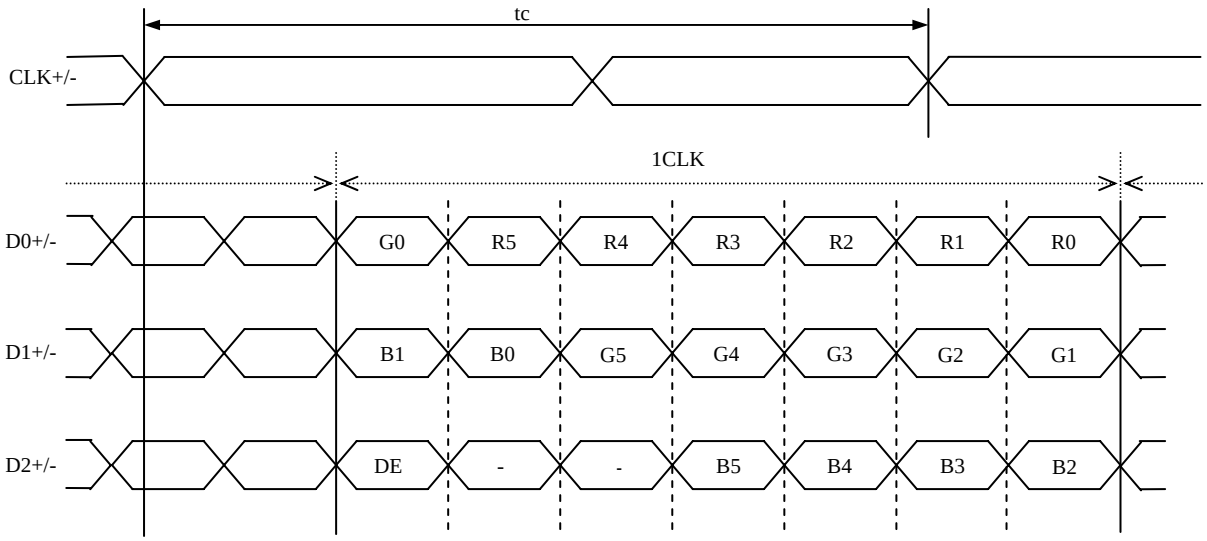
(1) Input data signal: 8bit, MAP A



(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.13 and 14	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 and FRC 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 and FRC 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**".).

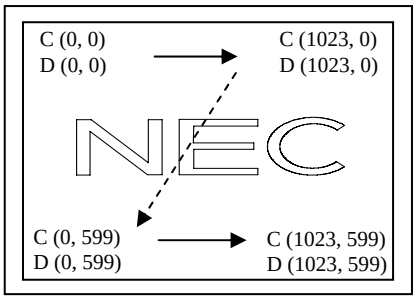
C (0, 0)

R	G	B

C(0, 0)	C(1, 0)	• • •	C(X, 0)	• • •	C(1022, 0)	C(1023, 0)
C(0, 1)	C(1, 1)	• • •	C(X, 1)	• • •	C(1022, 1)	C(1023, 1)
• • •	• • •	• • •	• • •	• • •	• • •	• • •
C(0, Y)	C(1, Y)	• • •	C(X, Y)	• • •	C(1022, Y)	C(1023, Y)
• • •	• • •	• • •	• • •	• • •	• • •	• • •
C(0, 598)	C(1, 598)	• • •	C(X, 598)	• • •	C(1022, 598)	C(1023, 598)
C(0, 599)	C(1, 599)	• • •	C(X, 599)	• • •	C(1022, 599)	C(1023, 599)

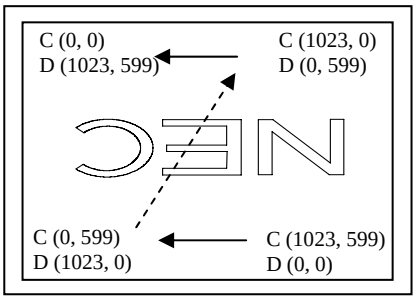
4.8 SCANNING DIRECTIONS

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



Note1

Figure1. Normal Scan (DPS: Low or Open)



Note1

Figure2. Reverse Scan (DPS: High)

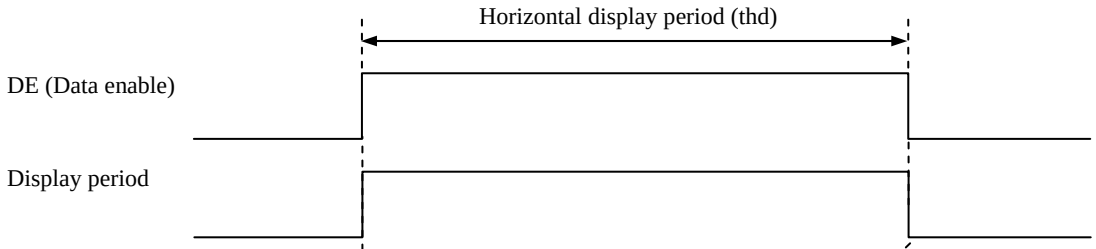
Note1: Meaning of C (X, Y) and D (X, Y)
C (X, Y): The coordinates of the display position (See "**4.7 DISPLAY POSITIONS**".)
D (X, Y): The data number of input signal for LCD panel signal processing board

4.9 INPUT SIGNAL TIMINGS

4.9.1 Outline of input signal timings

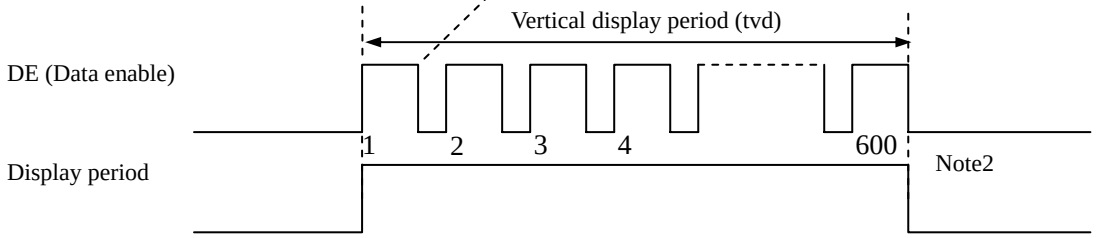
- Horizontal signal

Note1



- Vertical signal

Note1



Note1: This diagram indicates virtual signal for set up to timing.
Note2: See "**4.9.3 Input signal timing chart**" for numeration of pulse.

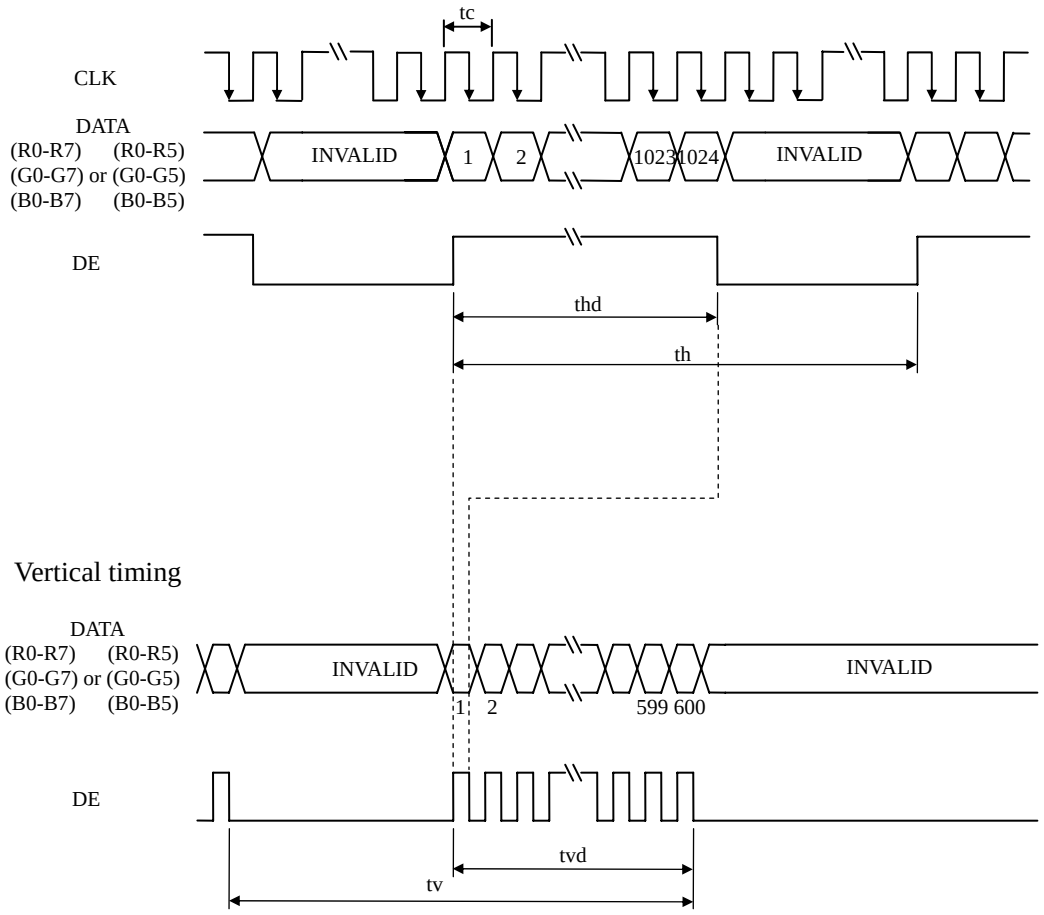
4.9.2 Timing characteristics

(Note1, Note2, Note3)

Parameter			Symbol	min.	typ.	max.	Unit	Remarks
CLK	Frequency		1/tc	48.0	50.4	52.6	MHz	19.841ns (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	25.10	26.667	28.0	µs	37.5kHz (typ.)
				1320	1,344	-	CLK	
		Display period	thd	1,024			CLK	
	Vertical (One frame)	Cycle	tv	15.3	16.667	17.5	ms	60.0Hz (typ.)
				610	625	-	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



4.10 OPTICS

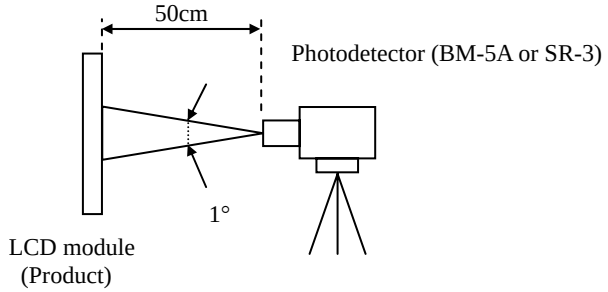
4.10.1 Optical characteristics

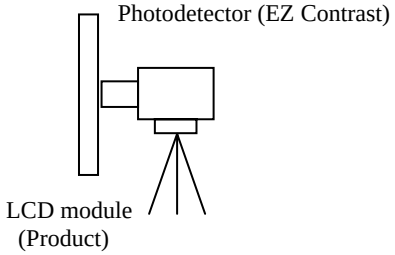
(Note1, Note2)

Parameter		Condition	Symbol	min.	typ.	max.	Unit	Measuring instrument	Remarks	
Luminance		White at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	L	TBD	300	-	cd/m^2	BM-5A	-	5
Contrast ratio		White/Black at center θR= 0°, θL= 0°, θU= 0°, θD= 0°	CR	TBD	(500)	-	-	BM-5A	Note3	
Luminance uniformity		White θR= 0°, θL= 0°, θU= 0°, θD= 0°	LU	-	1.25	1.4	-	BM-5A	Note4	
Chromaticity	White	**x** coordinate	Wx	0.263	0.313	0.363	-	SR-3	Note5	
		y coordinate	Wy	0.279	0.329	0.379	-			
	Red	**x** coordinate	Rx	-	TBD	-	-			
		y coordinate	Ry	-	TBD	-	-			
	Green	**x** coordinate	Gx	-	TBD	-	-			
		y coordinate	Gy	-	TBD	-	-			
	Blue	**x** coordinate	Bx	-	TBD	-	-			
		y coordinate	By	-	TBD	-	-			
Color gamut		θR= 0°, θL= 0°, θU= 0°, θD= 0° at center, against NTSC color space	C	TBD	60	-	%			5
Response time		Black to White	Ton	-	10	TBD	ms	BM-5A	Note6 Note7	
		White to Black	Toff	-	15	TBD	ms			
Viewing angle	Right	θU= 0°, θD= 0°, CR≥ 10	θR	70	88	-	°	EZ Contrast	Note8	
	Left	θU= 0°, θD= 0°, CR≥ 10	θL	70	88	-	°			5
	Up	θR= 0°, θL= 0°, CR≥ 10	θU	70	88	-	°			
	Down	θR= 0°, θL= 0°, CR≥ 10	θD	70	88	-	°			

Note1: These are initial characteristics.
Note2: Measurement conditions are as follows.
Ta= 25°C, VCC= 3.3V, IL= 15mA, Display mode: WSVGA,
Horizontal cycle= 1/37.5kHz, Vertical cycle= 1/60.0Hz

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





Note3: See "**4.10.2 Definition of contrast ratio**".
Note4: See "**4.10.3 Definition of luminance uniformity**".
Note5: These coordinates are found on CIE 1931 chromaticity diagram.
Note6: Product surface temperature: TopF = TBD°C
Note7: See "**4.10.4 Definition of response times**".
Note8: 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.

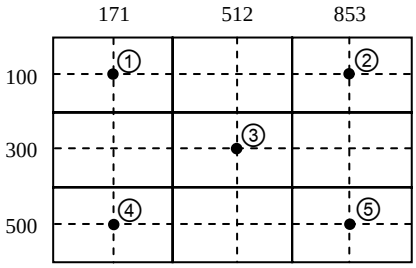
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

4.10.3 Definition of luminance uniformity

The luminance uniformity is calculated by using following formula.

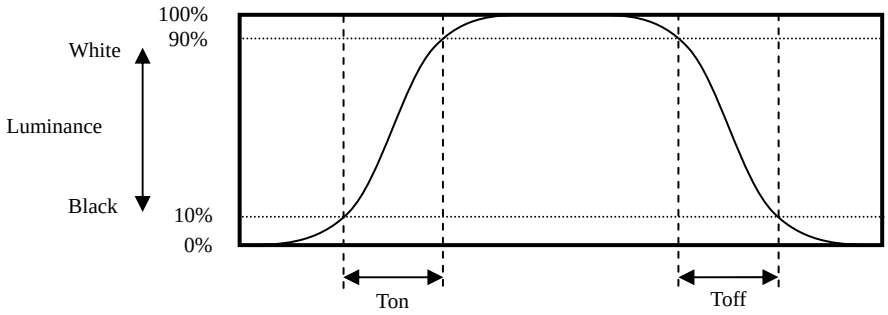
$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑤}}{\text{Minimum luminance from ① to ⑤}}$$

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

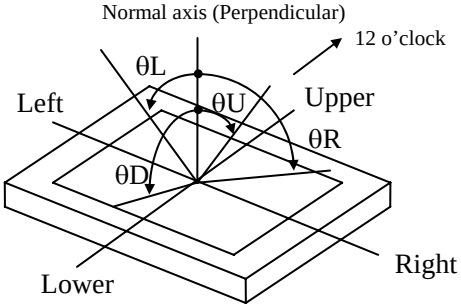


4.10.4 Definition of response times

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

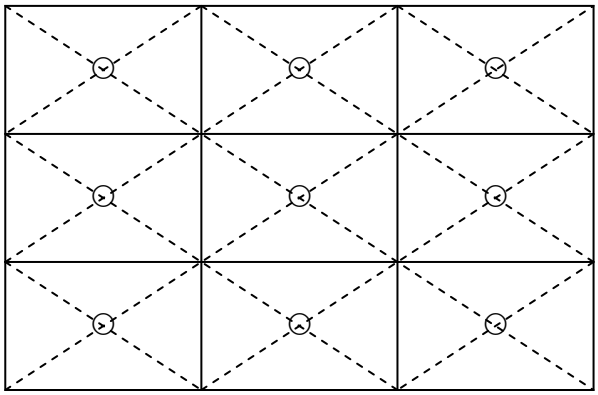


5. RELIABILITY TESTS

Test item	Condition	Judgment
High temperature and humidity (Operation)	① 60 ± 2°C, RH= 90%, 240hours ② Display data is black.	No display malfunctions Note1
High temperature (Operation)	① 70 ± 3°C, 240hours ② Display data is black.	
Heat cycle (Operation)	① -20 ± 3°C…1hour 70 ± 3°C…1hour ② 50cycles, 4 hours/cycle ③ Display data is black.	
Thermal shock (Non operation)	① -30 ± 3°C…30minutes 80 ± 3°C…30minutes ② 100cycles, 1hour/cycle ③ Temperature transition time is within 5 minutes.	
ESD (Operation)	① 150pF, 150Ω, ±10kV ② 9 places on a panel surface Note2 ③ 10 times each places at 1 sec interval	
Dust (Operation)	① Sample dust: No. 15 (by JIS-Z8901)) ② 15 seconds stir ③ 8 times repeat at 1 hour interval	
Vibration (Non operation)	① 5 to 100Hz, 19.6m/s^2 ② 1 minute/cycle ③ X, Y, Z directions ④ 120 times each directions	No display malfunctions No physical damages Note1
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.



6. PRECAUTIONS

6.1 MEANING OF CAUTION SIGNS

The following caution signs have very important meaning. **Be sure to read "6.2 CAUTIONS" and "6.3 ATTENTIONS", after understanding these contents!**

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

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

6.2 CAUTIONS

- **Do not touch the working backlight. There is a danger of burn injury.**
- **Do not shock and press the LCD panel and the backlight! There is a danger of breaking, because they are made of glass. (Shock: To be not greater 539m/s^2 and to be not greater 11ms, Pressure: To be not greater 19.6 N (ϕ16mm jig))**

6.3 ATTENTIONS

6.3.1 Handling of the product

① Take hold of both ends without touching the circuit board when the product (LCD module) is picked up from inner packing box to avoid broken down or misadjustment, because of stress to mounting parts on the circuit board.
② Do not hook nor pull cables such as cable, and so on, in order to avoid any damage.
③ When the product is put on the table temporarily, display surface must be placed downward.
④ When handling the product, take the measures of electrostatic discharge with such as earth band, ionic shower and so on, because the product may be damaged by electrostatic.
⑤ The product must be installed using mounting holes without undue stress such as bends or twist (See outline drawings). And do not add undue stress to any portion (such as bezel flat area). Bends or twist described above and undue stress to any portion may cause display mura.
⑥ Do not press or rub on the sensitive product surface. When cleaning the product surface, use of the cloth with ethanolic liquid such as screen cleaner for LCD is recommended.
⑦ Do not push nor pull the interface connectors while the product is working.
⑧ When handling the product, use of an original protection sheet on the product surface (polarizer) is recommended for protection of product surface. Adhesive type protection sheet may change color or characteristics of the polarizer.
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.

6.3.2 Environment

① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in packing box with antistatic pouch in room temperature to avoid dusts and sunlight, when storing the product.
② In order to prevent dew condensation occurring by temperature difference, the product packing box should be opened after enough time being left under the environment of an unpacking room. Evaluate the leaving time sufficiently because a situation of dew condensation occurring is changed by the environmental temperature and humidity. (Recommended leaving time: 6 hours or more with packing state)
③ Do not operate in high magnetic field. Circuit boards may be broken down by it.
④ This product is not designed as radiation hardened.

6.3.3 Characteristics

The following items are neither defects nor failures.

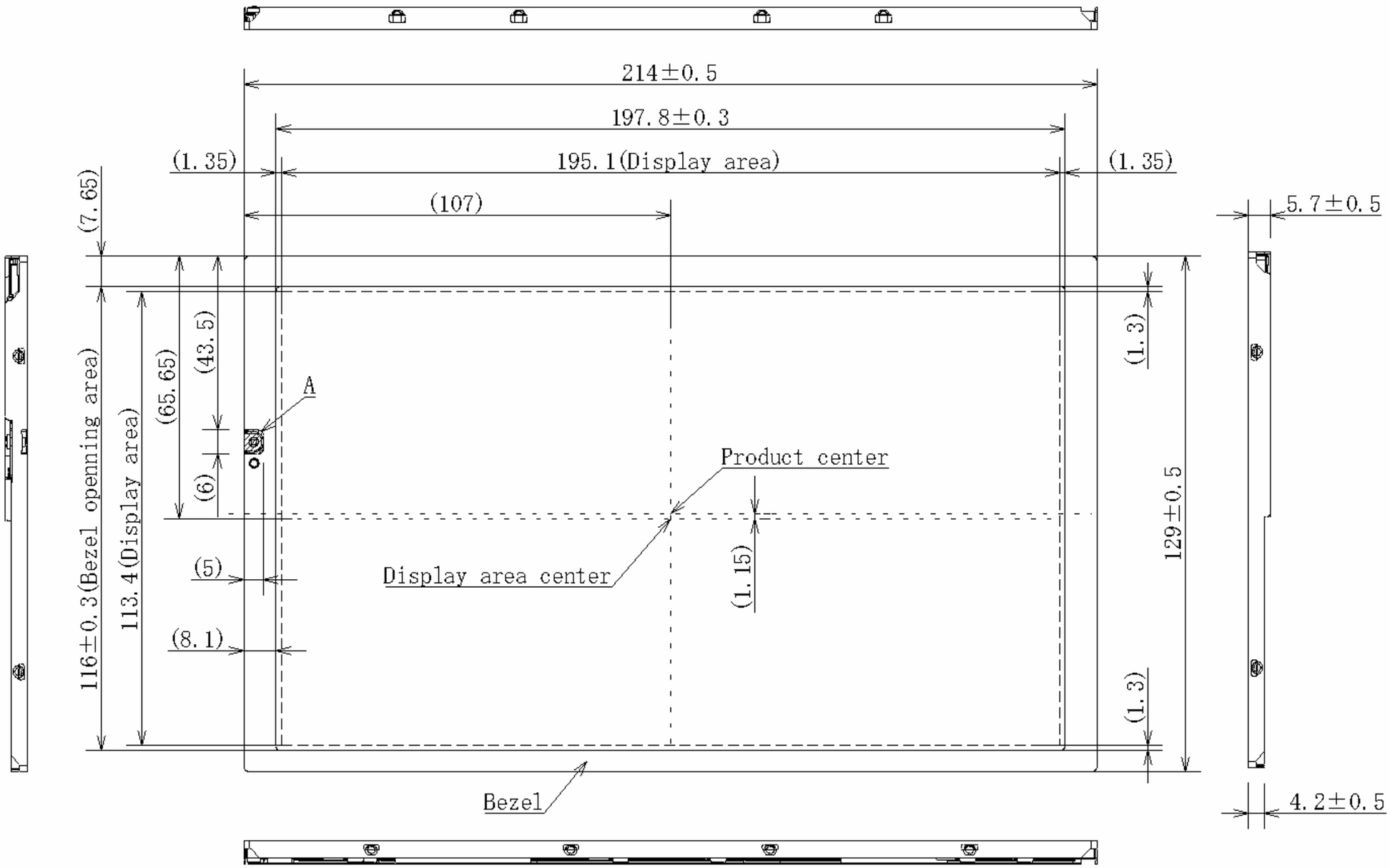
① Characteristics of the LCD (such as response time, luminance, color uniformity and so on) may be changed depending on ambient temperature. If the product is stored under condition of low temperature for a long time, it may cause display mura. In this case, the product should be operated after enough time being left under condition of operating temperature.
② Display mura, flicker, vertical seam or small spot may be observed depending on display patterns.
③ 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.

6.3.4 Other

① All GND and VCC terminals should be used without any non-connected lines.
② Do not disassemble a product or adjust variable resistors.
③ See "REPLACEMENT MANUAL FOR LED HOLDER SET", when replacing LED backlight.
④ Pack the product with original shipping package, in order to avoid any damages during transportation, when returning the product to NEC for repair and so on.

7. OUTLINE DRAWINGS

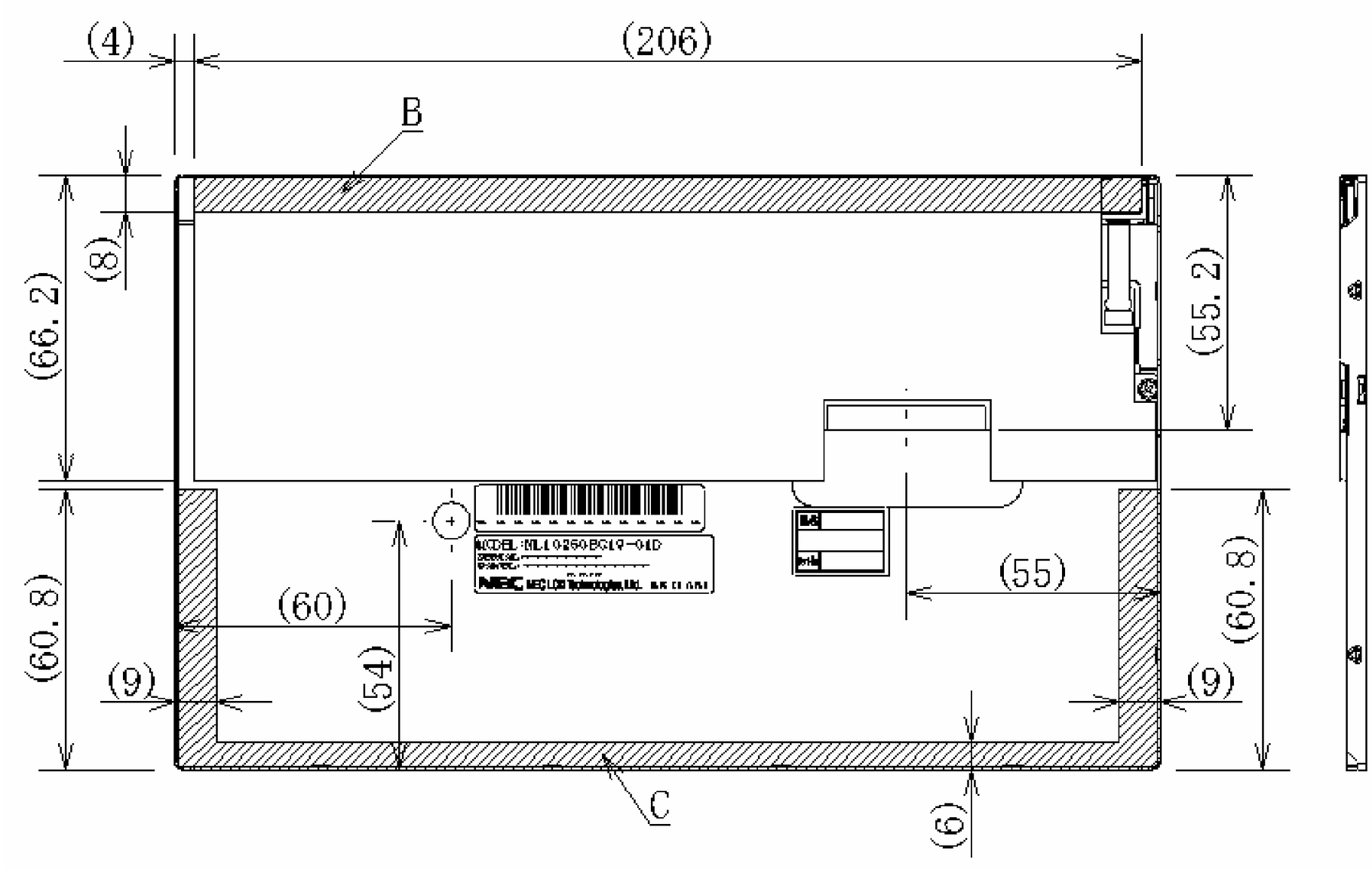
7.1 FRONT VIEW



Note1: The values in parentheses are for reference.
Note2: When installing the product to customer equipment, please press Bezel (including outline, excluding A) equally.

Unit: mm

7.2 REAR VIEW



Note1: The values in parentheses are for reference.
Note2: When installing the product to customer equipment, please press "**B**" and "**C**" (including outline, excluding A) 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-MDA -0086	Nov. 2, 2007	**Revision contents** New issue **Writer** *Approved by* T. Yano *Checked by* *Prepared by* Y. Takeishi
2nd edition	DOD-MDA -0094	Nov. 16, 2007	**Revision contents** P1, P4 Outline: NL10260BC19-XX → NL10260BC19-01 P4 Features • Wide viewing angle → Ultra-wide viewing angle P5 General specification • Pixel arrangement: BGR → RGB • Response time: (20) ms(typ.) → (25)ms(typ.) P8-9 Absolute maximum ratings • Pulse forward current (elimination) • Note4 (elimination) P12 LCD panel signal processing board (revision) P13 Positions of plugs and a socket • Pin-No.: 30-1 → 1-30 P14-16 Connection between receiver and transmitter for LVDS (revision) P21 Display positions: BGR → RGB P25 Optical characteristics • Contrast ratio: (850)(typ.) → (500)(typ.) • Response time - Toff: 10 (typ.) ms → 15 (typ.) ms **Writer** *Approved by* T. Yano *Checked by* *Prepared by* Y. Takeishi
3rd edition	DOD-PP-0420	Dec. 14, 2007	**Revision contents** P5 General specifications • Weight: (185)g (typ.) → 175g (typ.) • Power consumption: (3.6)W (typ.) → 3.4W (typ.) P8 Mechanical specifications • Weight: (185)g (typ.) → 175g (typ.) P9 Absolute maximum ratings- Note3 • Ambient temperature Ta [°C] → Operating temperature(rear surface) Ta [°C] P9 Electrical Characteristics - LCD panel signal processing board • Power supply current (ICC): (500)(typ.) mA → (440) (typ.) mA P12 LCD panel signal processing board • Pin No.21, 22: GND → N.C. P14-16 Connection between receiver and transmitter for LVDS • Pin No.21, 22: GND → N.C. P25 Optical characteristics - Condition • Response time (Ton): White to Black →Black to White • Response time (Toff): Black to White → White to Black P26 Definition of response times (correction) P29 Precautions - Attentions • Other: ④ (elimination) P30 Outline drawings-Font view (revision) P31 Outline drawings-Rear view (revision)

REVISION HISTORY

Edition	Document number	Prepared date	Revision contents and signature
3rd edition	DOD-PP-0420	Dec. 14, 2007	**Revision contents** **Writer** *Approved by* T. OGAWA *Checked by* ——— *Prepared by* T. OGAWA
4th edition	DOD-PP-0462	Feb. 14, 2008	**Revision contents** P1, P4 Outline, P31 Rear view: NL10260BC19-01 → NL10260BC19-01D P5 General specification • Polarizer surface: Clear → Antiglare P6 Block diagram P8 Absolute maximum ratings - Note2 P9 Electrical charasteristics - LCD panel signal processing board – Input voltage P11 Power supply voltage sequence - LCD panel signal processing board – Note2 • DPS (addition) P6 Block diagram • 0Ω (elimination) P12 Connections and functions for interface pins – CN1 socket • No.19 : GND → DPS P14-16 Connection between receiver and transmitter for LVDS • No.19 : GND → DPS • No.21, 22 : connection diagram (elimination) P21 Display positions • C (X, Y) : 1222 → 1022, 1223 → 1023 (correction) P21 Scanning direction • Figure1 : Normal Scan (DPS: Low or Open) (revision) • Figure2 : Reverse Scan (DPS: High) (addition) **Writer** *Approved by* T. OGAWA *Checked by* ——— *Prepared by* T. OGAWA
5th edition	DOD-PP-0535	Apr. 22, 2008	**Revision contents** P5 General specification • Luminance: 280cd/m^2 (typ.) → 300cd/m^2 (typ.) • Power consumption: (3.4)W (typ.) → (3.0)W (typ.) P10 Backlight • Forward Voltage: 31.5 (typ.), 35.0 (max.) (V) → 28.35 (typ.), 31.5 (max.) (V) P12 Connections and functions for interface pins – CN1 socket P14-16 Connection between receiver and transmitter for LVDS • No.21 : N.C. → K4, No.22 : N.C. → K3, No.23 : A4 → K2, No.24 : K4 → K1 • No.25: A3 → N.C., No.26 : K3 → N.C., No.27 : A2 → A4, No.28 : K2 → A3 • No.29 : A1 → A2, No.30 : K1 → A1 P23 Timing characteristics • DE- Horizontal - Display period: 1,280 → 1,024 (CLK) (correction) P25 Optical characteristics • Luminance: 280 (typ.) → 300 (typ.) (cd/m^2) P5 General specification, P25 Optical characteristics • Color gamut: (60) (typ.) → 60 (typ.) (%) • Viewing angle (θR, θL, θU, θD) (°): 85 (typ.) → 88 (typ.) **Signature of writer** *Approved by* T. OGAWA *Checked by* ——— *Prepared by* A. KUMANO