NEC

TFT COLOR LCD MODULE

NL6448CC33-30W

26.4cm (10.4 Type)
VGA

DATA SHEET

(3rd edition)

All information is subject to change without notice.

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INTRODUCTION

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

Anti-radioactive design is not implemented in this product.

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1. OUTLINE

1.1 STRUCTURE AND PRINCIPLE

NL6448CC33-30W 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 unit.

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

- Industrial PC
- Display terminal for control system

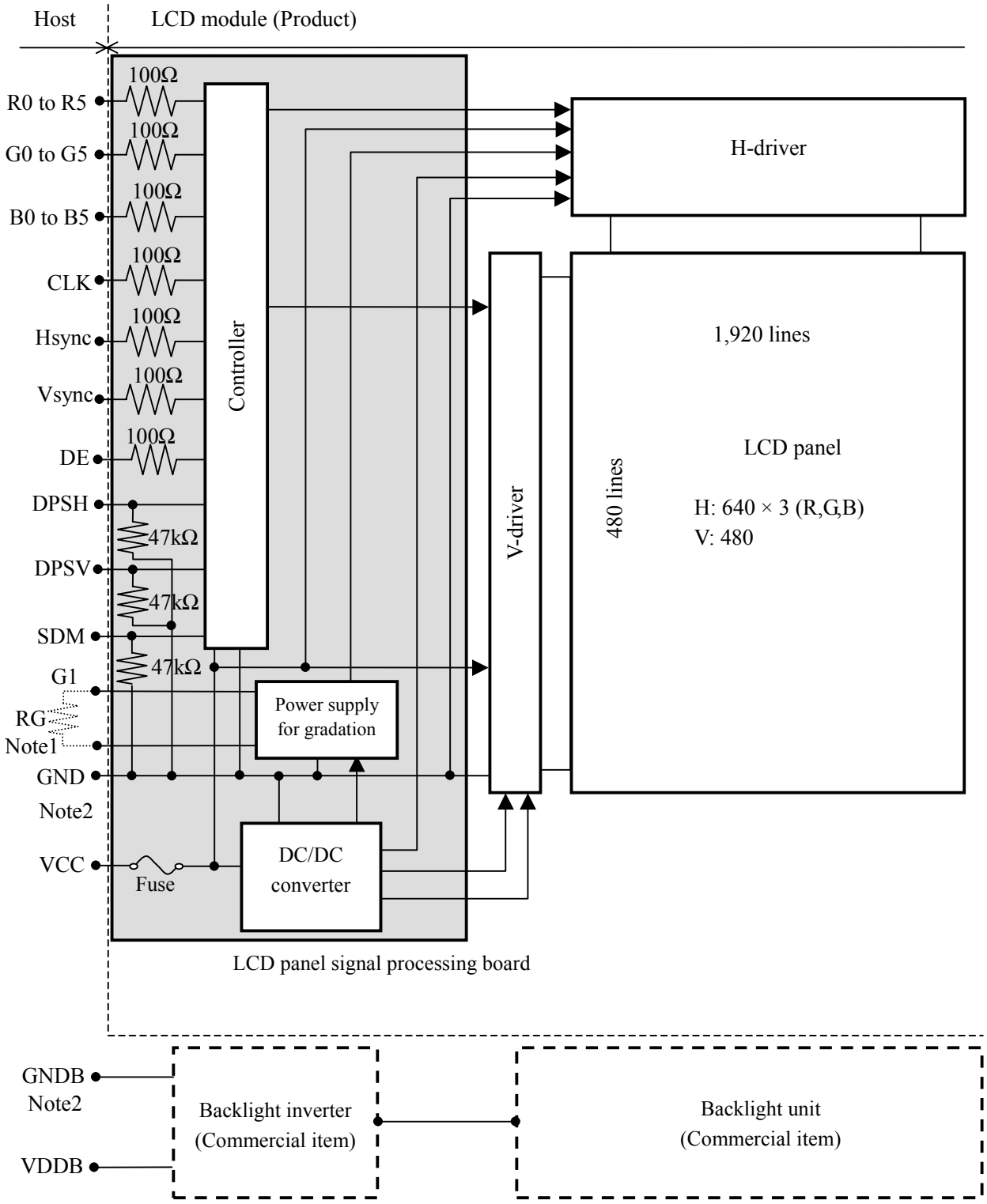
1.3 FEATURES

- Wide viewing angle
- 6-bit digital RGB signals
- Reversible-scan direction
- Gamma correction
- Backlight unit less

2. GENERAL SPECIFICATIONS

Display area	211.2 (W) × 158.4 (H) mm (typ.)
Diagonal size of display	26.4 cm (10.4 inches)
Drive system	a-Si TFT active matrix
Display color	262,144 colors
Pixel	640 (H) × 480 (V) pixels
Pixel arrangement	RGB (Red dot, Green dot, Blue dot) vertical stripe
Dot pitch	0.1100 (W) × 0.3300 (H) mm
Pixel pitch	0.3300 (W) × 0.3300 (H) mm
Module size	264.0 (W) × 187.8 (H) × 8.8 (D) mm (typ.)
Weight	300 g (typ.)
Contrast ratio	150:1 (typ.)
Viewing angle	*At the contrast ratio 10:1* • Horizontal: Left side 55° (typ.), Right side 55° (typ.) • Vertical: Up side 30° (typ.), Down side 50° (typ.)
Designed viewing direction	*At DPSH: normal scan and DPSV: normal scan* • Viewing direction without image reversal: up side (12 o'clock) • Viewing direction with contrast peak: down side 5° to 10° (6 o'clock) • Viewing angle with optimum grayscale (γ=2.2): normal axis
Polarizer surface	Non matt treatment
Polarizer pencil-hardness	2H (min.) [by JIS K5400]
Color gamut	*At use of backlight unit (1,500 cd/m^2, Wx: 0.320, Wy: 0.325)* 42 % (typ.) [against NTSC color space]
Response time	15 ms (typ.)
Transmittance	*At use of backlight unit (1,500 cd/m^2, Wx: 0.320, Wy: 0.325)* 6.0 % (typ.)
Signal system	6-bit digital signals for data of RGB colors, Dot clock (CLK), Data enable (DE), Horizontal synchronous signal (Hsync), Vertical synchronous signal (Vsync)
Power supply voltage	LCD panel signal processing board: 3.3V or 5.0V
Power consumption	*At checkered flag pattern* 1.0 W (typ.)

3. BLOCK DIAGRAM



Note1: Attach RG (Resistance) between G1 and G2. Do not use an "Open" condition!
Note2: GND and GNDB (Backlight inverter ground) should be connected together in customer equipment.

4. DETAILED SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Parameter	Specification	Unit
Module size	264.0 ± 0.5 (W) × 187.8 ± 0.5 (H) × 8.8 ± 0.5 (D) Note1	mm
Display area	211.2 ± 0.5 (W) × 158.4 ± 0.5 (H) Note1	mm
Weight	300 (typ.), 330 (max.)	g

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

4.2 ABSOLUTE MAXIMUM RATINGS

Parameter			Symbol	Rating	Unit	Remarks
Power supply voltage	LCD panel signal board		VCC	-0.3 to +6.5	V	Ta = 25°C
Input voltage for signals	Display signals Note1		VD	-0.3 to VCC+0.3	V	
	Function signals Note2		VF	-0.3 to VCC+0.3	V	
Gamma correction resistance			RG	3,000	Ω	-
Absolute light resistance illuminance			LRIL	20,000	lx	Front view side
Absolute light resistance intensity			LRIN	20,000	cd/m^2	Rear view side
Storage temperature			Tst	-30 to +85	°C	-
Operating temperature	Front surface	Character recognition	TopF1	-10 to +70	°C	
		Nondestructive for circuit system	TopF2	-25 to +85	°C	
	Rear surface	Character recognition	TopR1	-10 to +70	°C	
		Nondestructive for circuit system	TopR2	-25 to +85	°C	
Relative humidity Note3			RH	≤ 95	%	Ta ≤ 40°C
				≤ 85	%	40 < Ta ≤ 50°C
				≤ 70	%	50 < Ta ≤ 55°C
				≤ 60	%	55 < Ta ≤ 60°C
				≤ 50	%	60 < Ta ≤ 65°C
				≤ 42	%	65 < Ta ≤ 70°C
Absolute humidity Note3			AH	≤ 78 Note4	g/m^3	Ta > 70°C

Note1: Display signals are CLK, Hsync, Vsync, DE and DATA (R0 to R5, G0 to G5, B0 to B5).

Note2: Function signals are DPSH, DPSV and SDM.

Note3: No condensation

Note4: Ta = 70°C, RH = 42%

4.3 ELECTRICAL CHARACTERISTICS

4.3.1 Driving for LCD panel signal processing board

(Ta = 25°C)

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remarks
Power supply voltage		VCC	3.0	3.3	3.6	V	for 3V system
			4.7	5.0	5.3	V	for 5V system
Power supply current		ICC	-	280 Note1	400	mA	VCC = 3.3V Note2
			-	200 Note1	280	mA	VCC = 5.0V Note2
Logic input voltage for display signals	Low	VDLL	0	-	0.3Vcc	V	CMOS level
	High	VDLH	0.7Vcc	-	Vcc	V	
Input voltage for DPSH and DPSV signals	Low	VFDL	0	-	0.3Vcc	V	
	High	VFDH	0.7Vcc	-	Vcc	V	
Input voltage for SDM signal	Low	VFDL	0	-	0.3Vcc	V	
	High	VFDH	0.7Vcc	-	Vcc	V	

Note1: Checkered flag pattern [by EIAJ ED-2522]
Note2: RG = 820Ω (See "4.5.1 Terminal on LCD panel signal processing board".)

4.3.2 Power supply voltage ripple

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

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

Note1: The permissible ripple voltage includes spike noise.

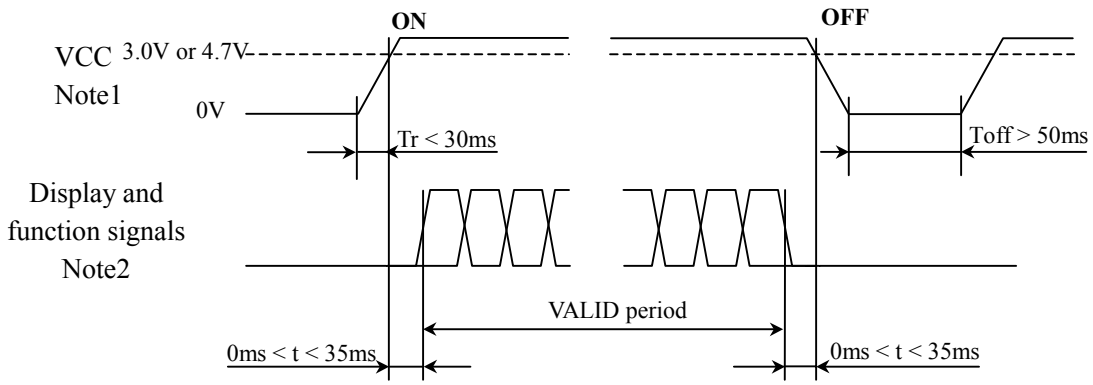
4.3.3 Fuse

Fusing line	Fuse		Rating	Fusing current Note1
	Type	Supplier		
VCC	TF20N1.25TE	KOA Corporation	1.25 A 32 V	2.5 A

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

4.4 POWER SUPPLY VOLTAGE SEQUENCE

4.4.1 Sequence for LCD panel signal processing board

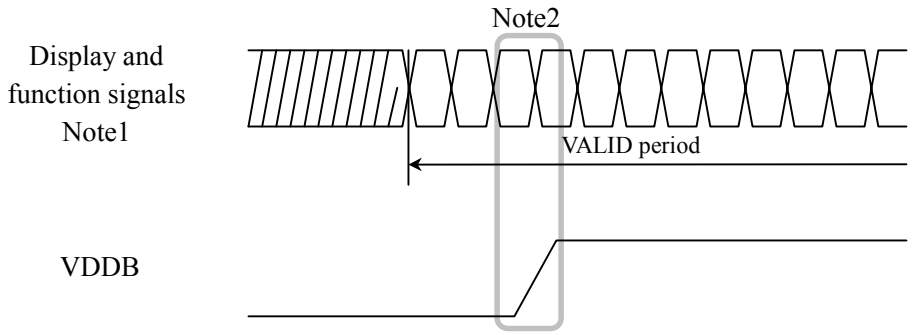


Note1: In terms of voltage variation (voltage drop) while VCC rising edge is below 3.0V in "VCC = 3.3V" or 4.7V in "VCC = 5.0V", a protection circuit may work, and then this product may not work.

Note2: Display (CLK, Hsync, Vsync, DE, R0 to R5, G0 to G5, B0 to B5) and function (DPSH, DPSV, SDM) signals must be Low or High-impedance, exclude the VALID period (See above sequence diagram), in order to avoid that internal circuits is damaged.

If some of display and function signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If customer stops the display and function signals, they should be cut VCC.

4.4.2 Sequence for backlight inverter (Commercial item)



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

Note2: The backlight inverter voltage (VDDB) should be inputted within the valid period of display and function signals, in order to avoid unstable data display.

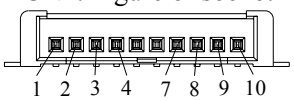
4.5 CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS

4.5.1 Terminal on LCD panel signal processing board

CN1 socket (LCD module side): IL-Z-10PL1-SMTY (Japan Aviation Electronics Industry Limited)
Adaptable plug: IL-Z-10S-S125C3 (Japan Aviation Electronics Industry Limited)

Pin No.	Symbol	Signal	Remarks
1	GND	Ground	-
2	CLK	Dot clock	
3	Hsync	Horizontal synchronous	
4	Vsync	Vertical synchronous	
5	GND	Ground	
6	R0	Red data (LSB)	Least significant bit
7	R1	Red data	-
8	R2	Red data	
9	R3	Red data	
10	R4	Red data	

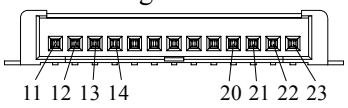
CN1: Figure of socket



CN2 socket (LCD module side): IL-Z-13PL1-SMTY (Japan Aviation Electronics Industry Limited)
Adaptable plug: IL-Z-13S-S125C3 (Japan Aviation Electronics Industry Limited)

Pin No.	Symbol	Signal	Remarks
11	R5	Red data (MSB)	Most significant bit
12	GND	Ground	-
13	G0	Green data (LSB)	Least significant bit
14	G1	Green data	-
15	G2	Green data	
16	G3	Green data	
17	G4	Green data	
18	G5	Green data (MSB)	Most significant bit
19	GND	Ground	-
20	B0	Blue data (LSB)	Least significant bit
21	B1	Blue data	-
22	B2	Blue data	
23	B3	Blue data	

CN2: Figure of socket

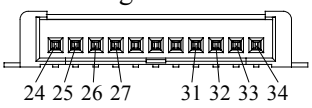


CN3 socket (LCD module side): IL-Z-11PL1-SMTY (Japan Aviation Electronics Industry Limited)
Adaptable plug: IL-Z-11S-S125C3 (Japan Aviation Electronics Industry Limited)

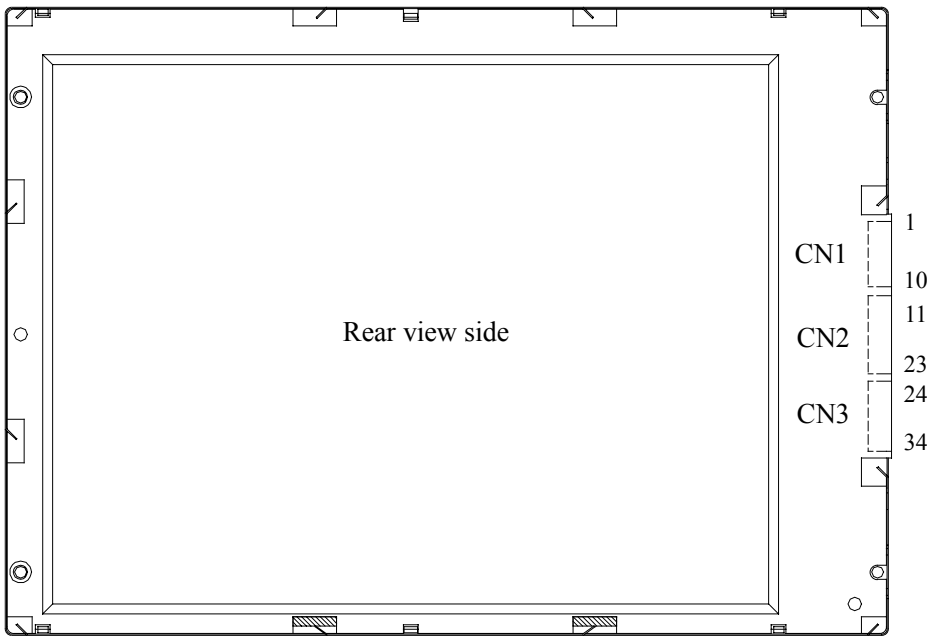
Pin No.	Symbol	Signal	Remarks
24	B4	Blue data	-
25	B5	Blue data (MSB)	Most significant bit
26	GND	Ground	-
27	DE	Data enable	
28	VCC	Power supply	
29	VCC	Power supply	
30	SDM	Select of display mode	DE mode: Low or Open, Fixed mode: High
31	DPSH	Select of scan direction (Horizontal)	Normal scan: Low or Open, Reverse scan: High Note1
32	DPSV	Select of scan direction (Vertical)	
33	G1	Gamma correction	Recommended variable resistance: 2.2kΩ ± 5% Do not use "Open" condition!
34	G2	Gamma correction	

Note1: See "4.8 SCANNING DIRECTIONS".

CN3: Figure of socket



4.5.2 Positions of sockets



4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

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

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

4.7 DISPLAY POSITIONS

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

C(0, 0)	C(1, 0)	•••	C(X, 0)	•••	C(638, 0)	C(639, 0)
C(0, 1)	C(1, 1)	•••	C(X, 1)	•••	C(638, 1)	C(639, 1)
⋮	⋮	⋮	⋮	⋮	⋮	⋮
C(0, Y)	C(1, Y)	•••	C(X, Y)	•••	C(638, Y)	C(639, Y)
⋮	⋮	⋮	⋮	⋮	⋮	⋮
C(0,478)	C(1,478)	•••	C(X,478)	•••	C(638,478)	C(639,478)
C(0,479)	C(1,479)	•••	C(X,479)	•••	C(638,479)	C(639,479)

4.8 SCANNING DIRECTIONS

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

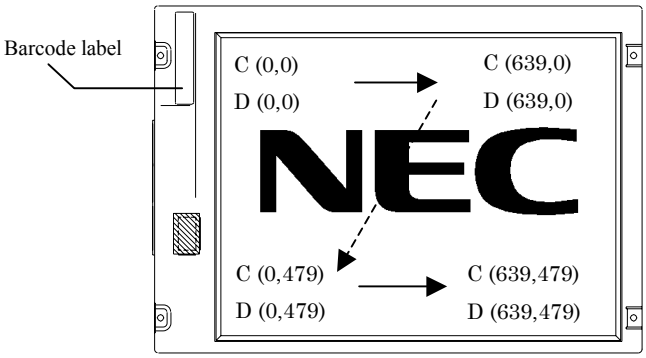


Figure 1. DPSH: Normal scan, DPSV: Normal scan

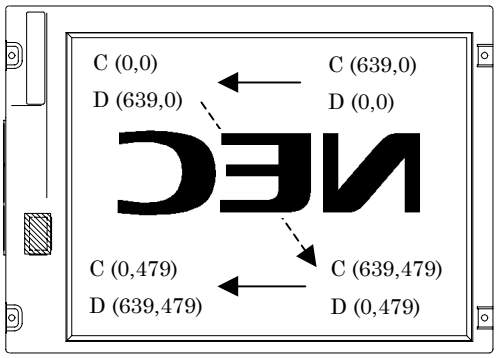


Figure 2. DPSH: Reverse scan, DPSV: Normal scan

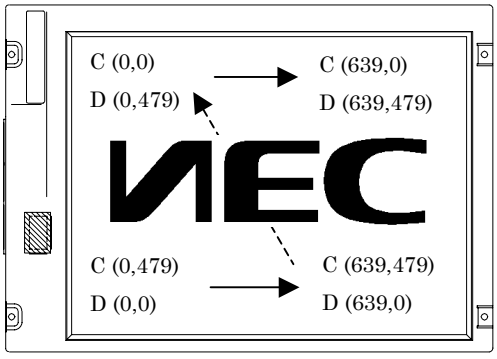


Figure 3. DPSH: Normal scan, DPSV: Reverse scan

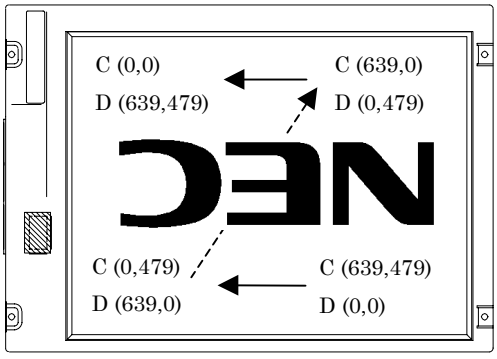


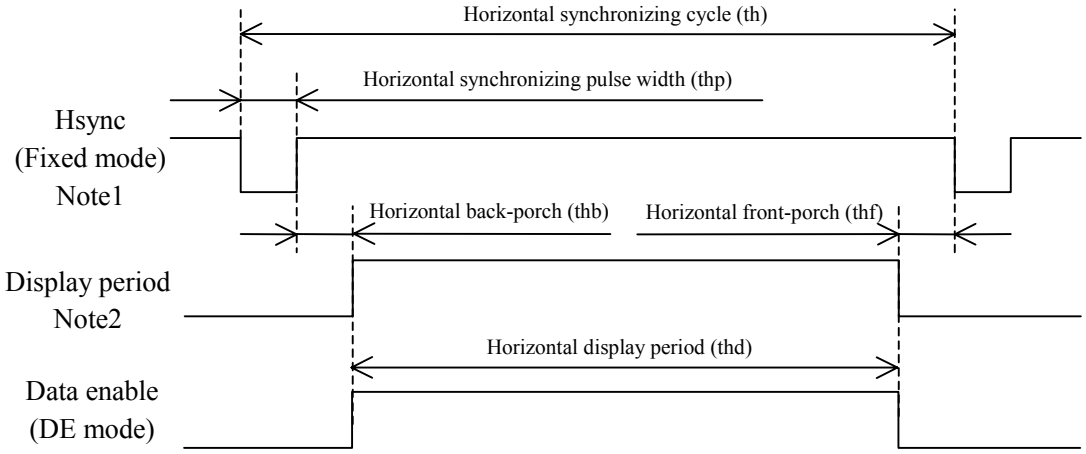
Figure 4. DPSH: Reverse scan, DPSV: Reverse scan

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
Note2: Normal scan: Low or Open, Reverse scan: High

4.9 INPUT SIGNAL TIMINGS FOR LCD PANEL SIGNAL PROCESSING BOARD

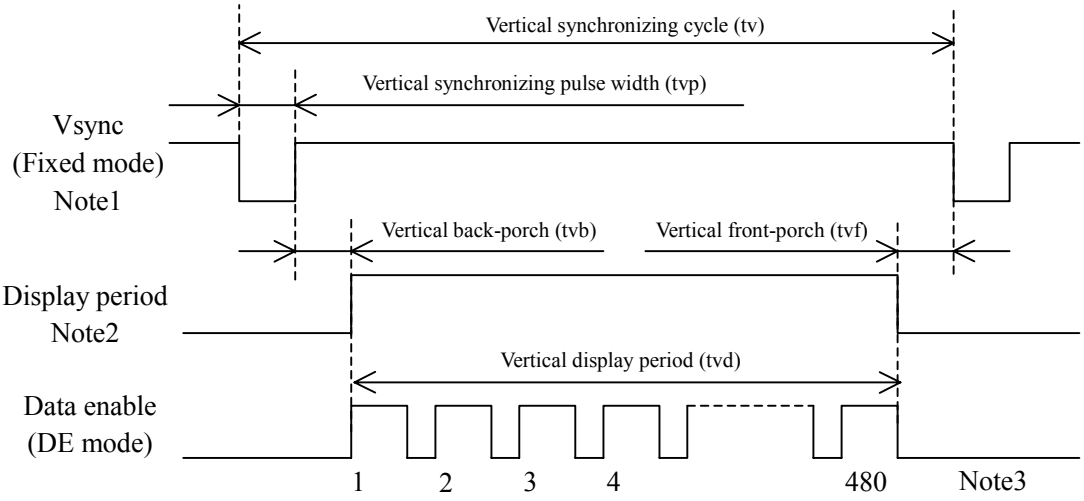
4.9.1 Outline of input signal timings

- Horizontal signal



Note1: Fixed mode cannot be used while working of DE mode.
Note2: This diagram indicates virtual signal for set up to timing.

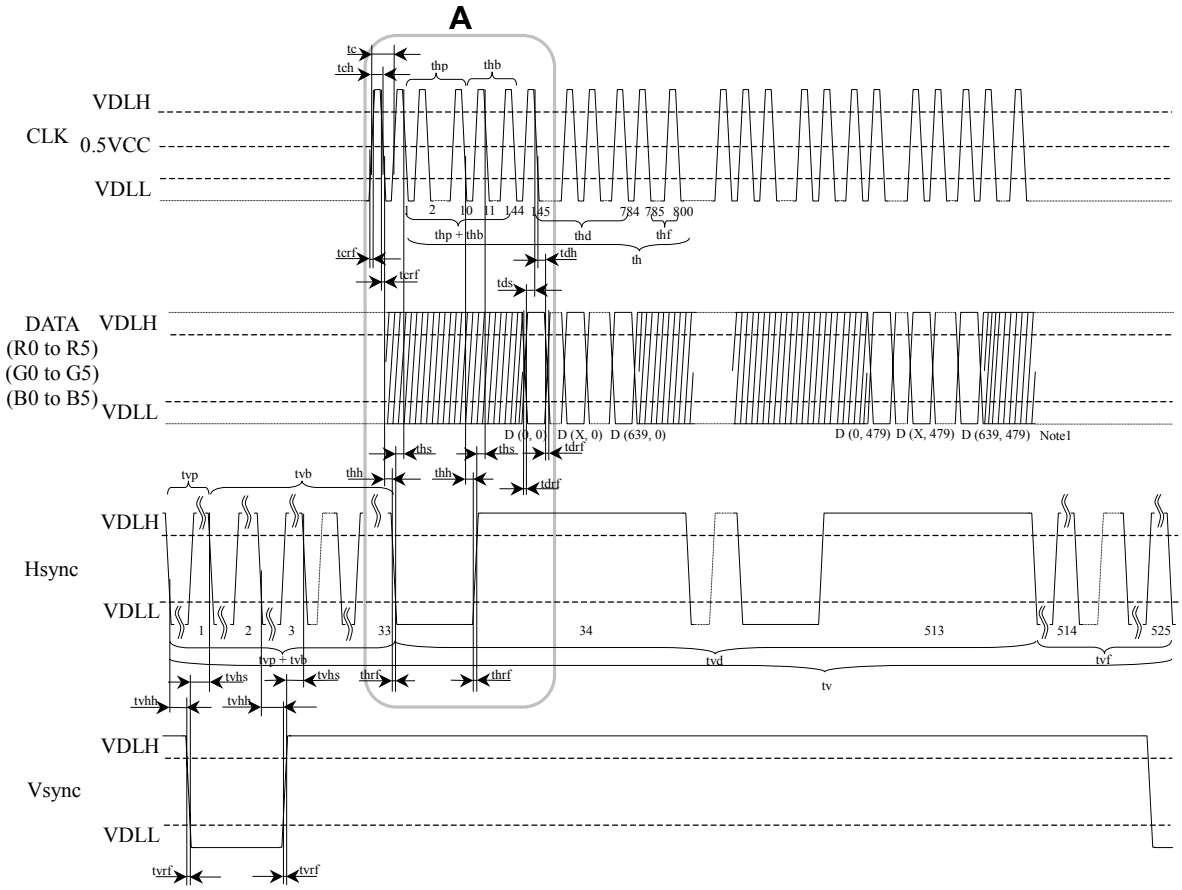
- Vertical signal



Note1: Fixed mode cannot be used while working of DE mode.
Note2: This diagram indicates virtual signal for set up to timing.
Note3: See "4.9.2 Detailed input signal timing chart for fixed mode" and "4.9.3 Detailed input signal timing chart for DE mode" for numeration of pulse.

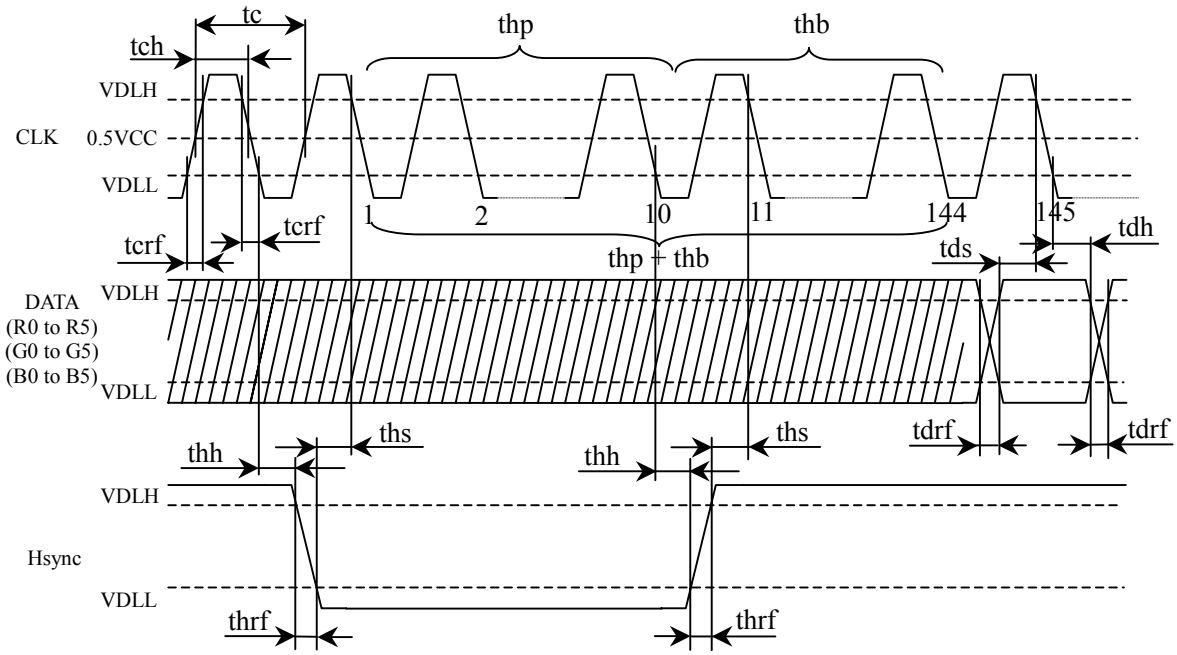
4.9.2 Detailed input signal timing chart for fixed mode

- Outline chart



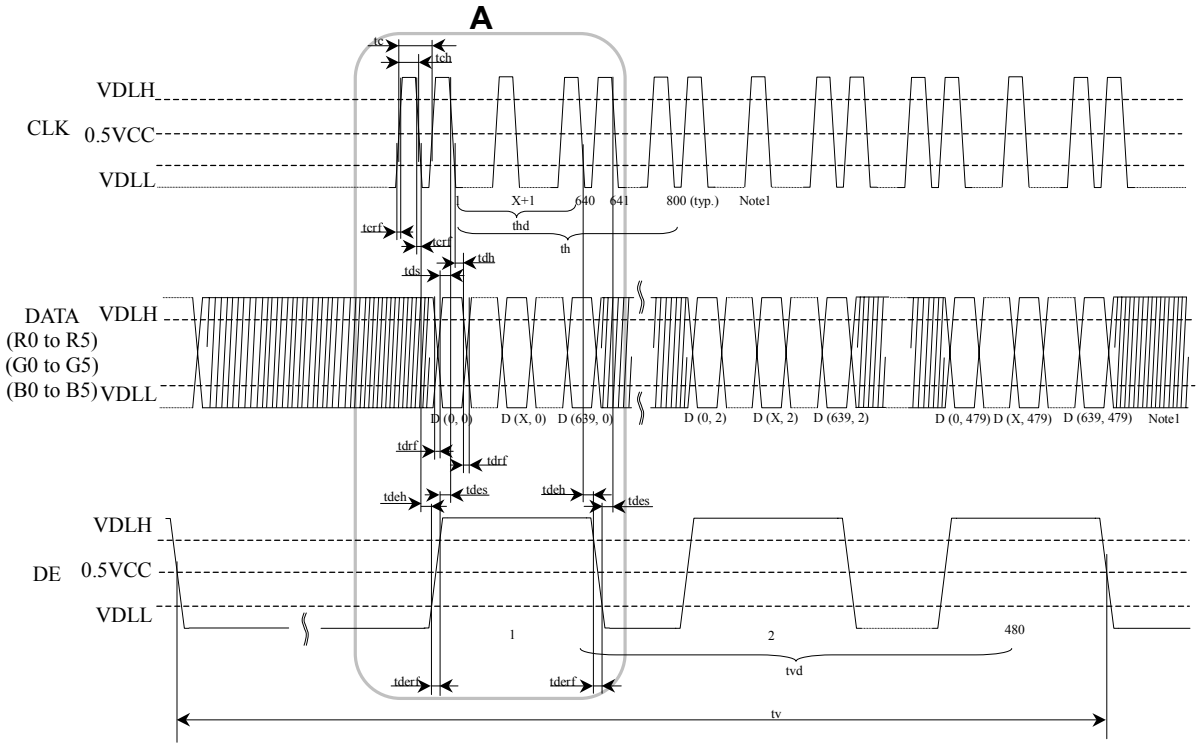
Note1: X is data number from 1 to 638. See "4.8 SCANNING DIRECTIONS".

- Detail of **A** part



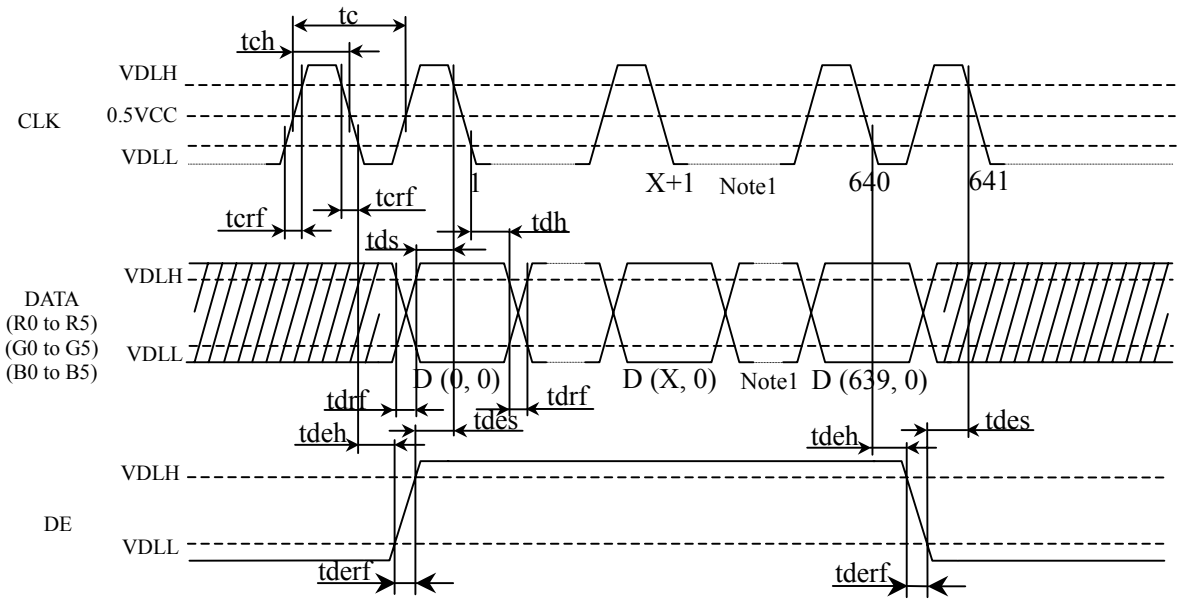
4.9.3 Detailed input signal timing chart for DE mode

• Outline chart



Note1: X is data number from 1 to 638. See "4.8 SCANNING DIRECTIONS".

• Detail of **A** part



Note1: X is data number from 1 to 638. See "4.8 SCANNING DIRECTIONS".

4.9.4 Timing characteristics

- Common to fixed mode and DE mode

Parameter			Symbol	Min.	Typ.	Max.	Unit	Remarks
CLK	Frequency		tcf	21.0	25.2	29.0	MHz	39.7 ns (typ.) Note1
	Duty		tcd	0.4	-	0.6	-	Note1
	Rise time, Fall time		tcrf	-	-	10	ns	-
DATA	CLK-DATA	Setup time	tds	8	-	-	ns	
		Hold time	tdh	12	-	-	ns	
	Rise time, Fall time		tdrf	-	-	10	ns	

Note1: Definition of parameters is as follows.

tcf = 1/tc, tcd = tch/tc = tch×tcd

- Fixed mode

Parameter			Symbol	Min.	Typ.	Max.	Unit	Remarks
Hsync	Cycle		th	30.0	31.8	33.6	μs	31.4 kHz (typ.)
				800			CLK	Note1
	Display period		thd	640			CLK	
	Front-porch		thf	16			CLK	
	Pulse width		thp	10	96	-	CLK	
	Back-porch		thb	-	48	134	CLK	
	Total of pulse width and back-porch		thp + thb	144			CLK	Note1, Note2
	CLK- Hsync	Setup time	ths	8	-	-	ns	-
		Hold time	thh	12	-	-	ns	
	Rise time, Fall time		thrf	-	-	10	ns	
Vsync	Cycle		tv	16.1	16.7	17.2	ms	59.9 Hz (typ.)
				525			H	Note1
	Display period		tvd	480			H	
	Front-porch		tvf	12			H	
	Pulse width		tvp	1	-	2	H	
	Back-porch		tvb	31	-	32	H	
	Total of pulse width and back-porch		tvp + tvb	33			H	Note1, Note2
	Vsync-Hsync	Setup time	tvhs	30	-	-	ns	Note1
		Hold time	tvhh	1	-	-	CLK	-
	Rise time, Fall time		tvrf	-	-	10	ns	

Note1: Definition of parameters is as follows.

tc = 1CLK, th = 1H

Note2: Keep tvp + tvb and thp + thb within the table. If it is out of specification, display position will be shifted to right/left side or up/down.

- DE mode

Parameter			Symbol	Min.	Typ.	Max.	Unit	Remarks
DE	Horizontal	Cycle	th	-	800	-	CLK	Note1
		Display period	thd	640			CLK	
	Vertical (One frame)	Cycle	tv	-	525	-	H	
		Display period	tvd	480			H	
	CLK-DE	Setup time	tdes	8	-	-	ns	-
		Hold time	tdeh	12	-	-	ns	
	Rise time, Fall time		tderf	-	-	10	ns	

Note1: Definition of parameters is as follows.

tc = 1CLK, th = 1H

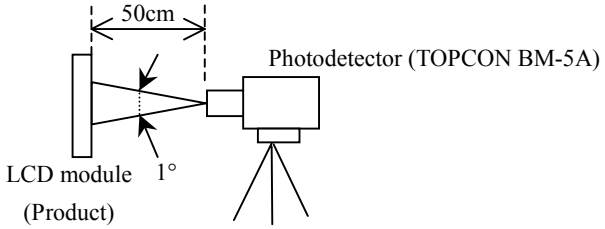
4.10 OPTICS

4.10.1 Optical characteristics

Parameter Note1		Condition	Symbol	Min.	Typ.	Max.	Unit	Remarks
Contrast ratio		White/Black at center θR = 0°, θL = 0°, θU = 0°, θD = 0°	CR	80	150	-	-	Note2
Transmittance		White at center θR = 0°, θL = 0°, θU = 0°, θD = 0°	T	5.5	6.0	-	%	-
Transmittance uniformity		-	TU	-	-	1.4	-	Note3
Chromaticity	White	**x** coordinate	Wx	-	0.321	-	-	Note4
		y coordinate	Wy	-	0.352	-	-	
	Red	**x** coordinate	Rx	-	0.590	-	-	
		y coordinate	Ry	-	0.356	-	-	
	Green	**x** coordinate	Gx	-	0.327	-	-	
		y coordinate	Gy	-	0.547	-	-	
	Blue	**x** coordinate	Bx	-	0.164	-	-	
		y coordinate	By	-	0.160	-	-	
Color gamut		θR = 0°, θL = 0°, θU = 0°, θD = 0° at center, against NTSC color space	C	40	42	-	%	
Response time		White to black	Ton	-	15	30	ms	Note5 Note6
		Black to white	Toff	-	55	70	ms	
Viewing angle	Right	θU = 0°, θD = 0°, CR = 10	θR	-	55	-	°	Note7
	Left	θU = 0°, θD = 0°, CR = 10	θL	-	55	-	°	
	Up	θR = 0°, θL = 0°, CR = 10	θU	-	30	-	°	
	Down	θR = 0°, θL = 0°, CR = 10	θD	-	50	-	°	
Gamma level		RG = 0Ω	γ_0	-	0.5	-	-	Note8
		RG = 2kΩ	γ_2	-	4.6	-	-	

Note1: Measurement conditions are as follows. However, RG of gamma level is option.
Ta = 25°C, VCC = 5.0V, DPSH = Low, DPSV: Low, RG = 820Ω,
Backlight (Color temperature: 6,000K, Luminance: 1,500cd/m^2, Wx: 0.320, Wy: 0.325)

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 transmittance uniformity".
Note4: These coordinates are found on CIE 1931 chromaticity diagram.
Note5: Product surface temperature: TopF = 25°C
Note6: See "4.10.4 Definition of response times".
Note7: See "4.10.5 Definition of viewing angles".
Note8: See "4.10.6 Gamma curves".

4.10.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

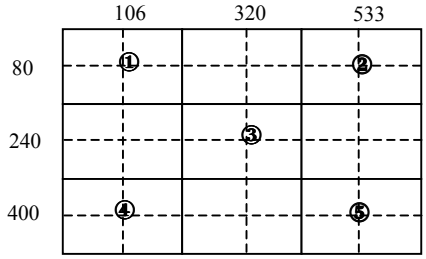
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

4.10.3 Definition of transmittance uniformity

The transmittance uniformity is calculated by using following formula.

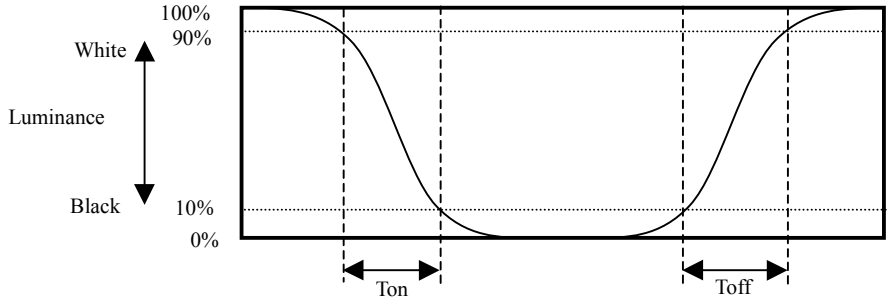
$$\text{Transmittance uniformity (TU)} = \frac{\text{Maximum transmittance from ① to ⑤}}{\text{Minimum transmittance from ① to ⑤}}$$

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

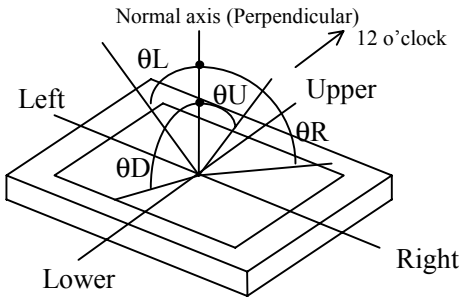


4.10.4 Definition of response times

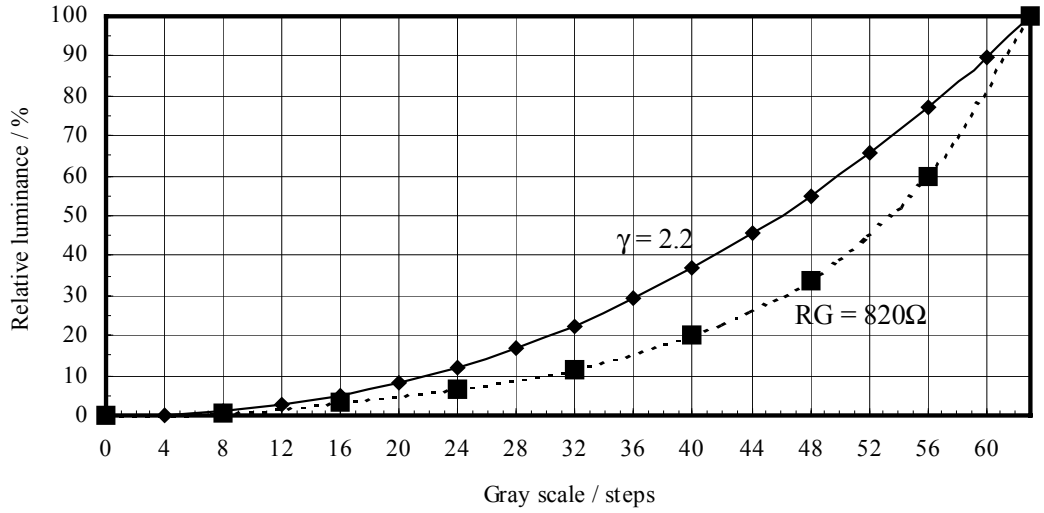
Response time is measured, the luminance changes from "white" to "black", or "black" to "white" on the same screen point, by photo-detector. Ton is the time it takes the luminance change from 90% down to 10%. Also Toff is the time it takes the luminance change from 10% up to 90% (See the following diagram.).



4.10.5 Definition of viewing angles



4.10.6 Gamma curves



4.10.7 Photoabsorbed axis of polarizer

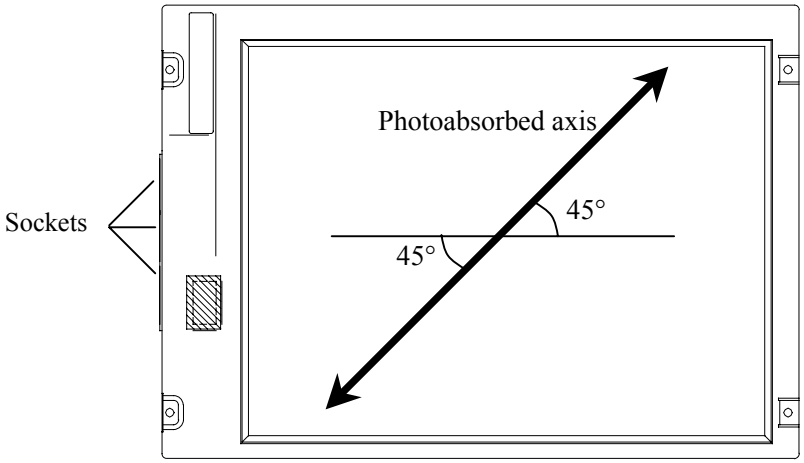


Figure 1. Front view

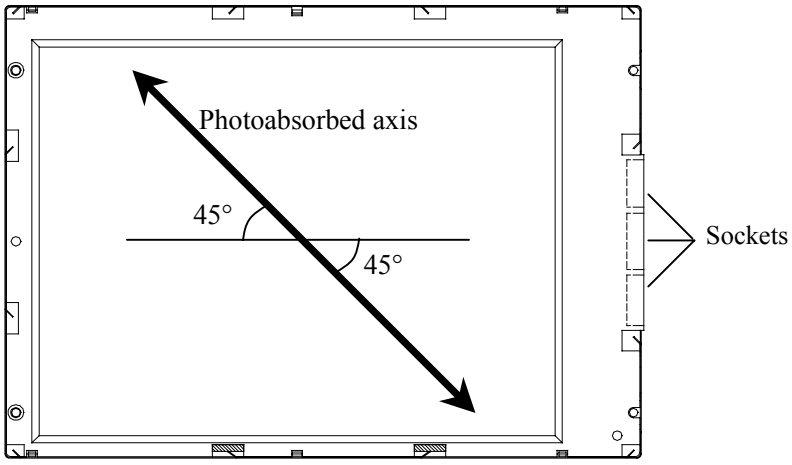


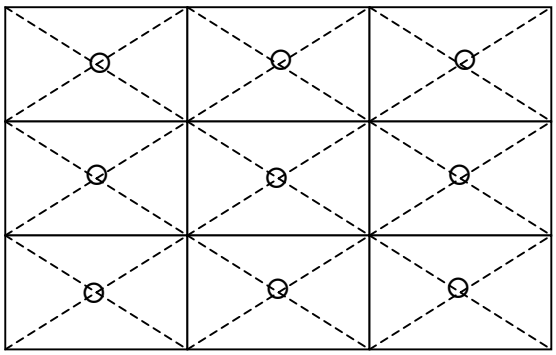
Figure 2. Rear view

5. RELIABILITY TESTS

Test item	Condition	Judgement
High temperature and humidity (Operation)	① 65 ± 2°C, RH = 85%, 240hours ② Display data is black.	No display malfunctions Note1
High temperature (Operation)	① 85 ± 3°C, 240hours ② Display data is black.	
Heat cycle (Operation)	① -25 ± 3°C…1hour 85 ± 3°C…1hour ② 50cycles, 5hours/cycle ③ Display data is black.	
Thermal shock (Non operation)	① -30 ± 3°C…30minutes 85 ± 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	
Vibration (Non operation)	① 5 to 100Hz, 19.6m/s^2 ② 1 minute/cycle ③ X, Y, Z direction ④ 120 times each directions	No display malfunctions Note1 No physical damages
Mechanical shock (Non operation)	① 490m/ s^2, 11ms ② ±X, ±Y, ±Z direction ③ 5 times each directions	

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 "6.2 CAUTIONS", after understanding this contents!**

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

6.2 CAUTIONS

Do not shock and press the LCD panel! Danger of breaking, because they are made of glass. (Shock: To be not greater 490m/s^2 and to be not greater 11ms, Pressure: To be not greater 19.6N)

6.3 ATTENTIONS

6.3.1 Handling of the product

① Take hold of both ends without touch the circuit board when customer pulls out products (LCD modules) from inner packing box. If customer touches it, products may be broken down or out of adjustment, because of stress to mounting parts.
② Do not put on too much stress for the interface connectors on the circuit board.
③ Do not hook cables nor pull connection cables such as flexible cable and so on, for fear of damage.
④ If customer puts down the product temporarily, the product puts on flat subsoil as a display side turns down.
⑤ 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.
⑥ The torque for mounting screws must never exceed 0.29N·m. Higher torque values might result in distortion of the bezel.
⑦ Do not press or rub on the sensitive display surface. If customer clean on the panel surface, NEC Corporation recommends using the cloth with ethanolic liquid such as screen cleaner for LCD.
⑧ Do not push-pull the interface connectors while the product is working, because wrong power sequence may break down the product.

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 Do not operate in high magnetic field. Circuit boards may be broken down by it.
③ 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.

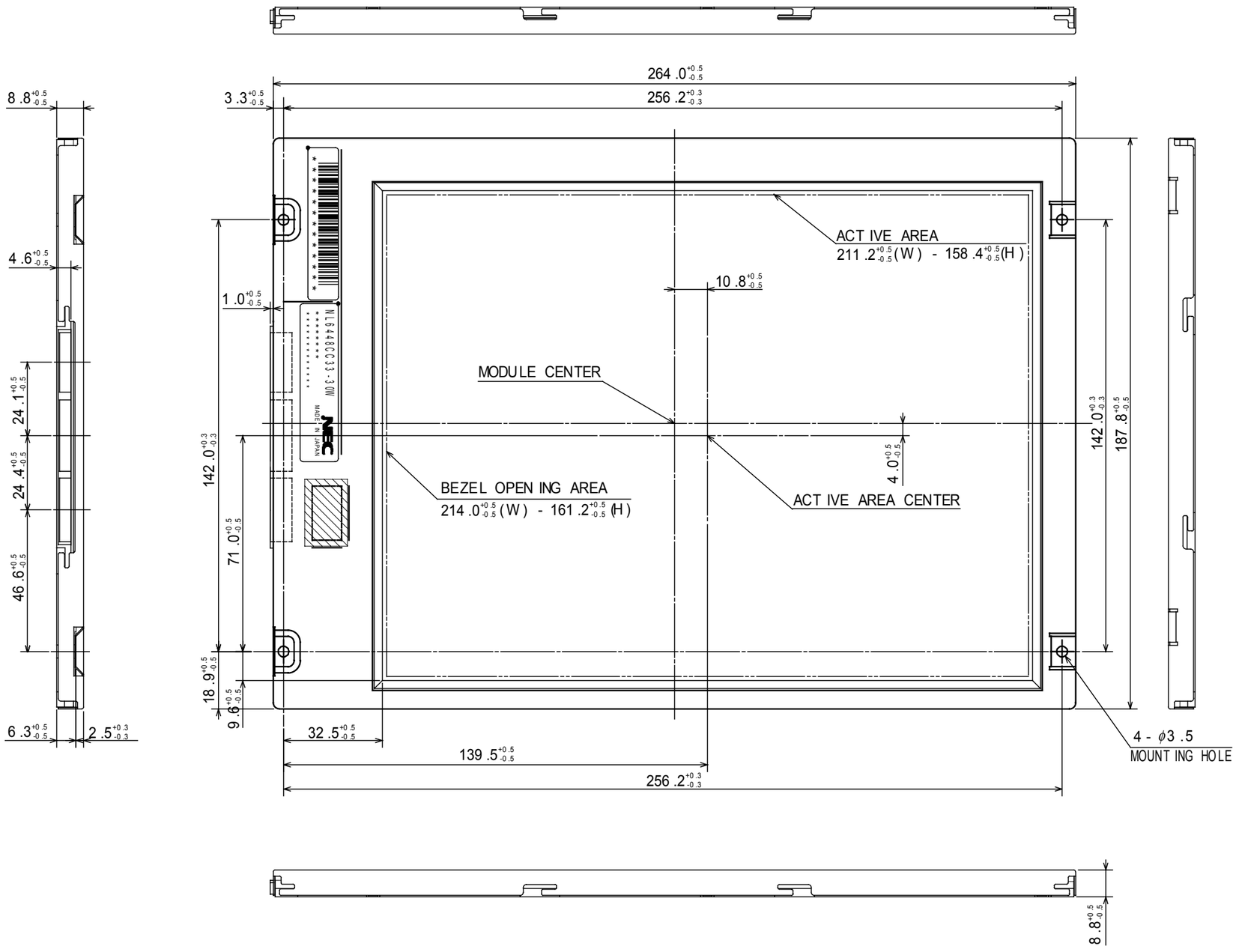
① Response time, luminance and color may be changed by ambient temperature.
② The LCD may be seemed luminance non-uniformity, flicker, vertical seam or small spot by display patterns.
③ Do not display the fixed pattern for a long time because it may cause image sticking. Use a screen saver, if the fixed pattern is displayed on the screen.
④ Optical characteristics may be changed by input signal timings.
⑤ 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, backlight inverter ground (GNDB), VCC and backlight inverter power supply voltage (VDDB) terminals should be used without a non-connected line.
② Do not disassemble a product or adjust volume without permission of NEC Corporation.
③ Pay attention not to insert waste materials inside of products, if customer uses screwnails.

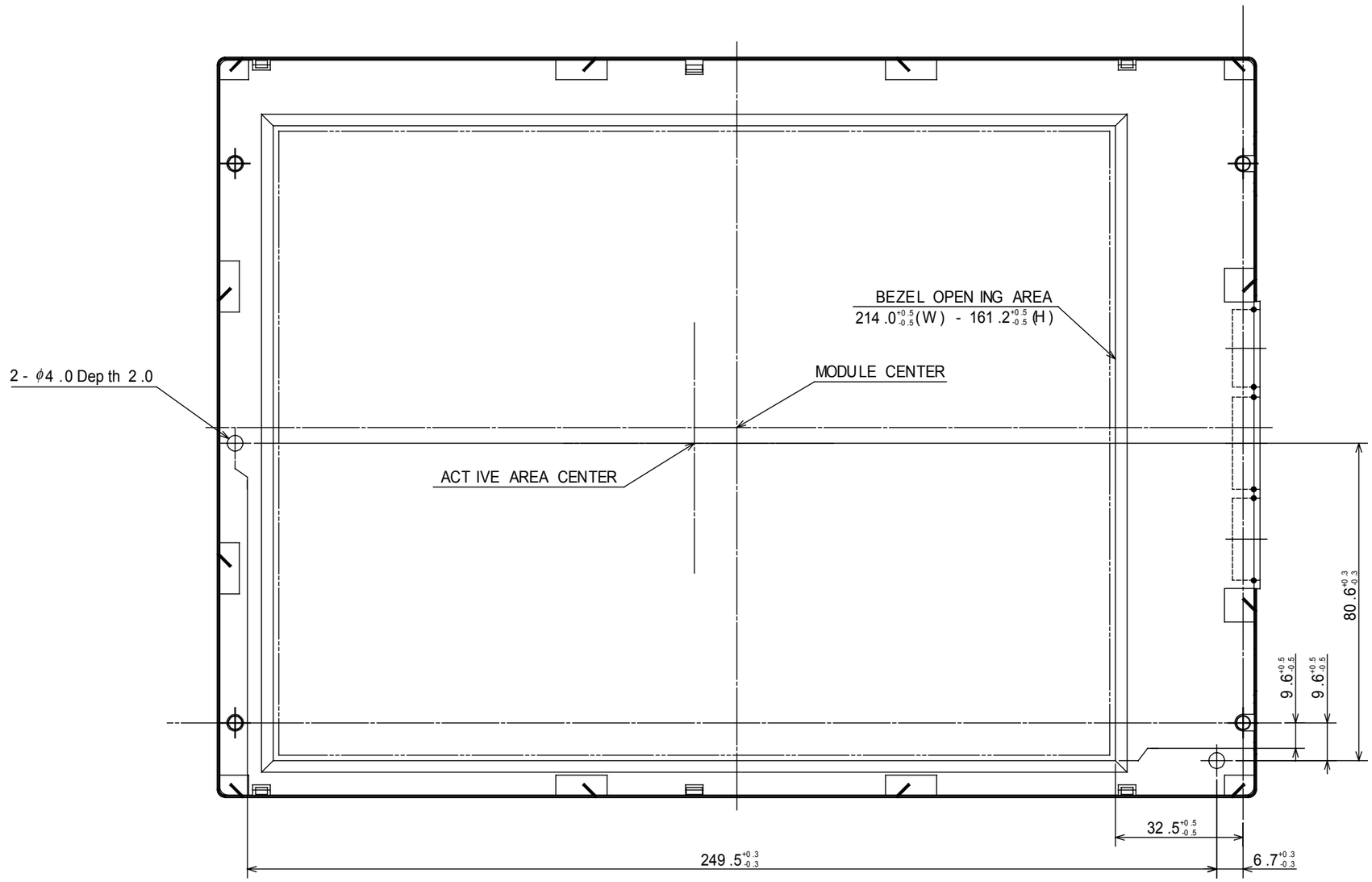
7. OUTLINE DRAWINGS

7.1 FRONT VIEW



Unit: mm

7.2 REAR VIEW



Unit: mm