NEC

TFT COLOR LCD MODULE

Type: NL10276AC30-04E
38cm (15 Type), XGA

SPECIFICATIONS

(First Edition)

Preliminary

All information in this document is subject to change without prior notice.

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Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

CONTENTS

1. DESCRIPTION P.4
2. FEATURES P.4
3. APPLICATIONS P.4
4. STRUCTURE AND FUNCTIONS P.5
5. OUTLINE OF CHARACTERISTICS (at room temperature) P.6
6. BLOCK DIAGRAM P.6
7. GENERAL SPECIFICATIONS P.7
8. ABSOLUTE MAXIMUM RATINGS P.7
9. ELECTRICAL CHARACTERISTICS P.9
10. SUPPLY VOLTAGE SEQUENCE P.10
11. INTERFACE PIN CONNECTIONS P.12
12. METHOD OF CONNECTIONS FOR THC63LVDF63A P.13
13. DISPLAY COLORS vs INPUT DATA SIGNALS P.14
14. INPUT SIGNAL TIMINGS P.19
15. FOR LVDS RECEIVER P.20
16. OPTICAL CHARACTERISTICS P.23
17. RELIABILITY TEST P.23
18. EXPECTED VALUE OF THE LAMP P.24
19. GENERAL CAUTIONS P.26
20. OUTLINE DRAWINGS
    - 28.1 FRONT VIEW P.27
    - 28.2 REAR VIEW

1. DESCRIPTION

NL10276AC30-04E is a TFT (thin film transistor) active matrix color liquid crystal display (LCD) comprising amorphous silicon TFT attached to each signal electrode, a driving circuit and a backlight. NL10276AC30-04E has a built-in backlight with inverter.
The 38cm(15 Type) diagonal display area contains 1024 × 768 pixels and can display 262144 colors simultaneously.

2. FEATURES

- Wide viewing angle (with retardation film)
- LVDS interface (THC63LVDF64A, Thine Electronics, Inc.)
- High luminous (300cd/ m^2, typ.) and Low reflection
- Incorporated edge type backlight (Four lamps, Inverter) and Backlight tube replaceable
- Approved by UL1950 Third Edition and CSA-C22.2 No.950-95
- Variable luminance control

3. APPLICATIONS

- Engineering work station
- Desk-top type of PC

4. STRUCTURE AND FUNCTIONS

A color TFT (thin film transistor) LCD module is comprised of a TFT liquid crystal panel structure, LSIs for driving the TFT array, and a backlight assembly. Sandwiching liquid crystal material in the narrow gap between a TFT array glass substrate and a color filter glass substrate creates the TFT panel structure. After the driver LSIs are connected to the panel, the backlight assembly is attached to the backside of the panel.
RGB (red, green, blue) data signals from a source system is modulated into a form suitable for active matrix addressing by the onboard signal processor and sent to the driver LSIs which
in turn addresses the individual TFT cells.
Acting as an Electro-optical switch, each TFT cell regulates light transmission from the backlight assembly when activated by the data source. By regulating the amount of light passing through the array of red, green, and blue dots, color images are created with clarity.

5. OUTLINE OF CHARACTERISTICS (at room temperature)

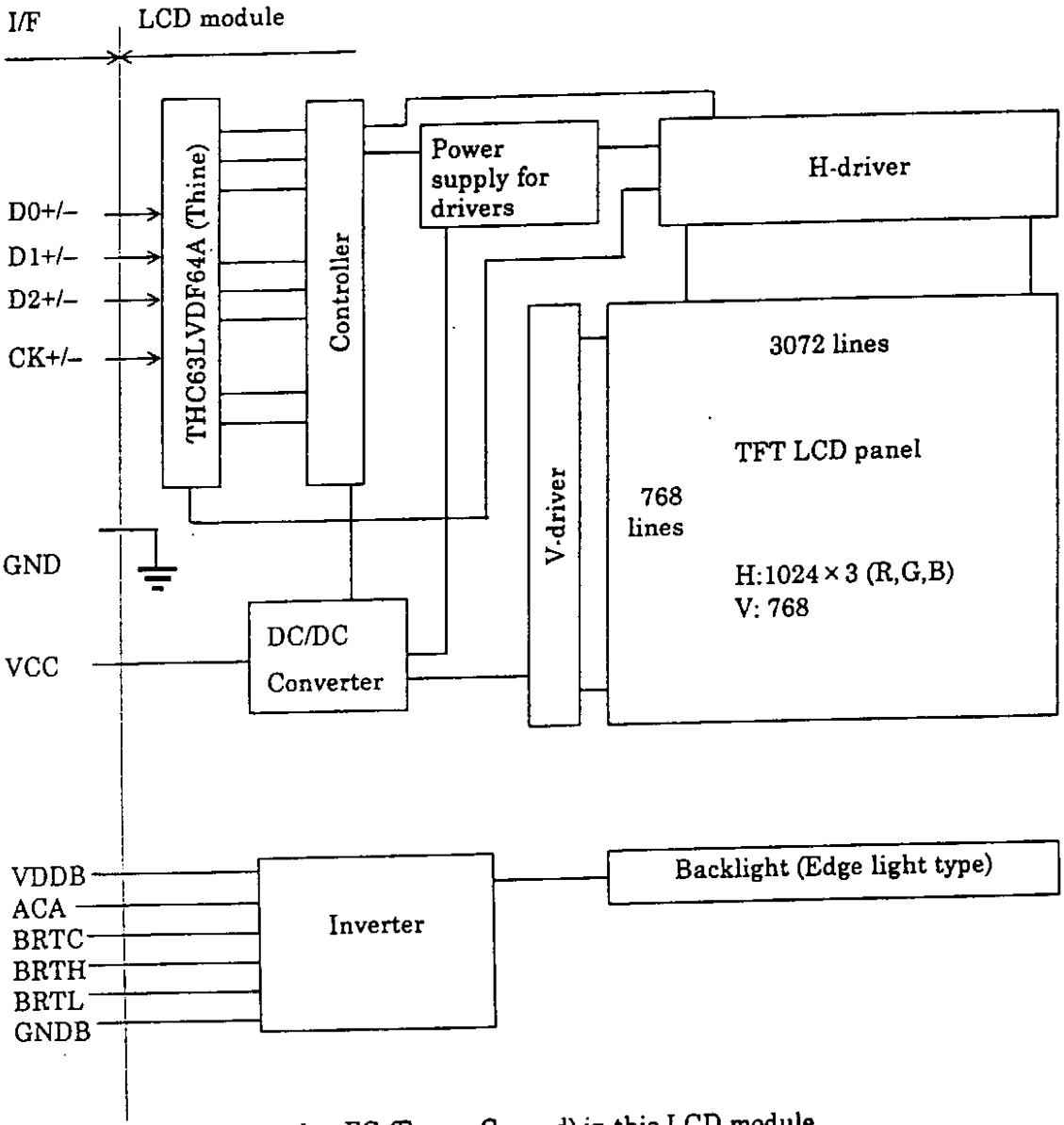
Display area	304.128(H) × 228.096(V)mm
Drive system	a-Si TFT active matrix
Display colors	262144 colors
Number of pixels	1024 × 768
Pixel arrangement	RGB vertical stripe
Pixel pitch	0.297(H) × 0.297(V)mm
Module size	350.0(H) × 265.0(V) × 21 max. (D) mm (inverter-less) 24 max. (D) mm (with the inverter)
Weight	1620g (typ.)
Contrast ratio	200:1 (typ.)

Viewing angle (more than the contrast ratio of 10:1)
- Horizontal: 55° (typ. , left side, right side)
- Vertical: 45° (typ. , up side, down side)

Designed viewing direction
- Wider viewing angle without image reversal: up side (12 o'clock)
- Best contrast ratio angle: down side 5° to 10°
- Optimum grayscale (γ =2.2): perpendicular

Polarizer Pencil-hardness	3H(min., at JIS K5400)
Color gamut	40%(typ. At center, To NTSC)
Response time	15ms(typ.), "white" to "black"
Luminance	300cd/m^2(typ.)
Signal system	RGB 6-bit signals, Synchronous signals(Hsync, Vsync), Dot clock (CLK) LVDS interface (THC63LVDF64A, Thine Electronics, Inc.)
Supply voltage	5V (Logic, LCD driving) , 12V (Backlight)
Backlight	Edge light type: Four cold cathode fluorescent lamps with inverter 【Replaceable parts】 · Lamp holder: type No.150LHS07 · Inverter: type No.150PW081
Power consumption	19W (typ.)

6. BLOCK DIAGRAM



Note 1: GND is connected to FG (Frame Ground) in this LCD module.

7. GENERAL SPECIFICATIONS

Items	Specifications	Unit
Module size	350.0±0.6 (H) × 265.0±0.6 (V) × 21 max. (D) mm (inverter-less) 24 max. (D) mm (with the inverter)	mm
Display area	304.128 (H) × 228.096 (V)	mm
Number of pixels	1024 (H) × 768 (V)	pixel
Dot pitch	0.099 (H) × 0.297 (V)	mm
Pixel pitch	0.297 (H) × 0.297 (V)	mm
Pixel arrangement	RGB (Red, Green, Blue) vertical stripe	—
Display colors	262,144 (RGB, 6bit)	color
Weight	1620(typ.), 1700(max.)	g

8. ABSOLUTE MAXIMUM RATINGS

Parameters	Symbols	Ratings	Unit	Remarks
Supply voltage	VCC	-0.3 to +6.0	V	Ta = 25℃
	VDDB	-0.3 to +14	V	
Logic input voltage	Vi	-0.3 to VCC+0.3	V	
Logic input voltage (backlight-logic signal)	ViBL1	-0.3 to +5.5	V	
Logic input voltage (backlight-BRTL signal)	ViBL2	-0.3 to +VCC	V	
Storage temperature	Tst	-20 to +60	℃	—
Operating temperature	Top	0 to +50	℃	Module surface
Humidity (No condensation)		≦ 95% relative humidity		Ta≦40℃
		≦ 85% relative humidity		40℃<Ta≦50℃
		Absolute humidity shall not exceed Ta=50℃,85% relative humidity level.		Ta>50℃

9. ELECTRICAL CHARACTERISTICS

(1) Logic/ LCD driving

Ta = 25℃

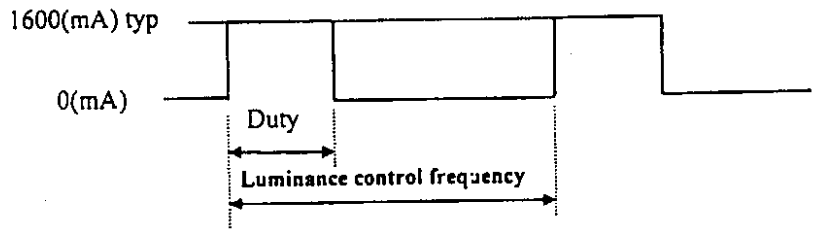
Parameters	Symbols	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	VCC	4.75	5.0	5.25	V	—
Ripple voltage	Vrp	—	—	100	mV	for VCC
LVDS signal input "L" voltage	ViL	-100	—	—	mV	VCM=1.2V VCM:Common mode voltage in LVDS driver
LVDS signal input "H" voltage	ViH	—	—	+100	mV	
Input voltage	Vi	0	—	2.4	V	—
Terminating resistor	Rt	—	100	—	Ω	—
Supply current	ICC	—	300 Note 1	600	mA	VCC=5.0V

Note 1: Checker flag pattern (in EIAJ ED-2522)

(2) Backlight

Ta = 25℃

Parameters	Symbols	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	VDDB	11.4	12.0	12.6	V	—
Logic input "L" voltage	ViL	0	—	0.8	V	for BRTC, ACA
Logic input "H" voltage	ViH	2.2	—	5.25	V	
Logic input "L" current	IiL	-1.0	—	—	mA	for BRTC, ACA, BRTL
Logic input "H" current	IiH	—	—	0.8	mA	
Supply current	IDDB	—	1430	1600	mA	VDDB=12.0V (at max. luminance)



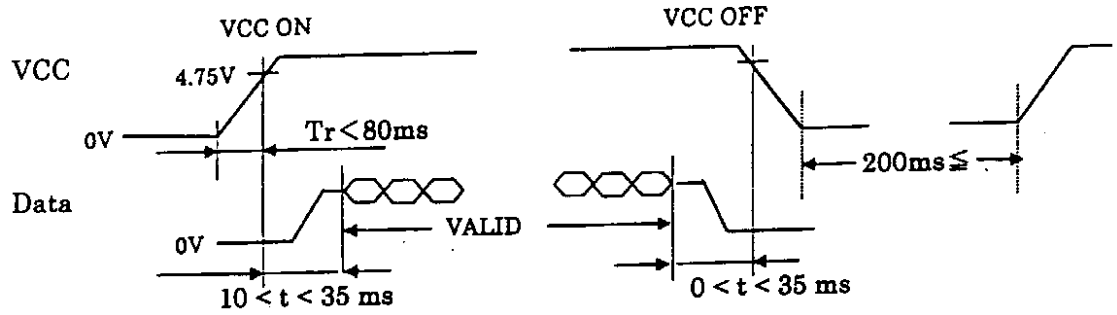
maximum luminance control : 100%
minimum luminance control : 20%
Luminance control frequency : 243 to 297 Hz 270Hz(typ.)

This LCD module uses fuse as follows.

Symbols	Type name	Producer	Rating
VCC	ICP-S1.2	Rohm	50V / 1.2A
VDDB	SF-024MFC2R0A	FUJITSU MEDIA DEVICES LIMITED	24V / 2A

Before the power is designed, the fuses should be considered. The power capacity should be used more than 1.5 times of fuse rating.
In case of small power capacity, the module should be evaluate enough.

10. SUPPLY VOLTAGE SEQUENCE



Data: pixel data and pixel clock

*1 Logic signals (synchronous signals and control signals) should be "0" voltage (V), when VCC is not input. If input voltage to signal lines is higher than 0.3 V, the internal circuit will be damaged.
*2 In VCC ON, if Vcc descends to less than 4.75V by the action of unstable, the module may not turn on.
*3 The supply voltage for input signals should be the same as VCC.
*4 Apply VDDB within the LCD operation period. When the backlight turns on before LCD operation or the LCD operation turns off before the backlight turns off, the display may momentarily become un-uniformity or white.
*5 12V for backlight should be started up within 80ms, otherwise, the protection circuit makes the backlight turn off.

11. INTERFACE PIN CONNECTIONS

(1) Interface connector for signal and power

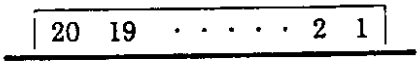
Part No. : FI-SE20P-HF
Adaptable socket : FI-SE20M
Supplier : Japan Aviation Electronics Industry Limited (JAE)

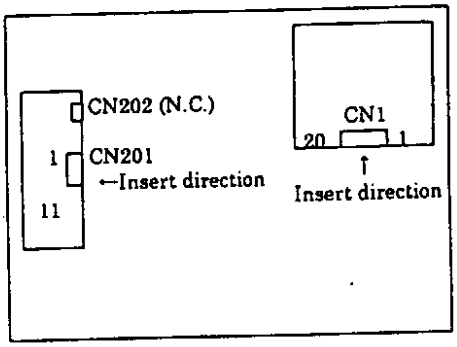
CN1

Pin No.	Symbols	Signal type	Function
1	GND	Ground	Note 1
2	GND		
3	NC	Non-connection	–
4	NC		
5	GND	Ground	Note 1
6	CK+	Pixel clock	CLK for pixel data f=65MHz (typ.) (LVDS level)
7	CK-		
8	GND	Ground	Note 1
9	D2+	Pixel data	LVDS differential data input
10	D2-		
11	GND	Ground	Note 1
12	D1+	Pixel data	LVDS differential data input
13	D1-		
14	GND	Ground	Note 1
15	D0+-	Pixel data	LVDS differential data input
16	D0-		
17	GND	Ground	Note 1
18	GND		
19	VCC	+5.0V power supply	Supply +5.0V±5%
20	VCC		

Note 1: GND is signal ground for logic and LCD driving. GND should be connected to system ground. GND is connected to FG (Frame Ground) in this LCD module.
Note 2: Connect all pins (except 3,4) to avoid noise issue. Use 100Ω twist pair wires for the Cable.

CN1: Figure from socket view





Note : CN202 should be opened.

(2) Connector for backlight unit

Part No. : IL-Z-11PL1-SMTY
Adaptable socket : IL-Z-11S-S125C3
Supplier : Japan Aviation Electronics Industry Limited (JAE)

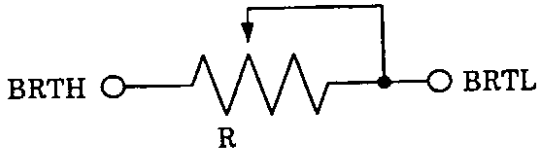
CN201

Pin No.	Symbols	Signal type	Function
1	VDDB	12V power supply	Supply +12V±5%
2	VDDB		
3	VDDB		
4	GNDB	Ground for backlight	Note 1
5	GNDB		
6	GNDB		
7	ACA	Luminance control signal	"H" or "Open" : luminance 100% "L" : luminance 67%
8	BRTC	Backlight ON/OFF control signal	"H" or "Open" : Backlight ON "L" : Backlight OFF
9	BRTH	Luminance control signal	Note 2
10	BRTL	Luminance control signal	
11	N.C.		

Note 1: Neither GND nor Flame is connected to GNDB. GNDB should be connected to Flame.

Note 2: There are two ways of controlling luminance.

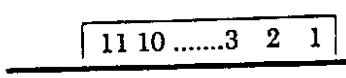
(1) A way of luminance control by a variable resistor.
The variable resistor for luminance control should be 10 kΩ type, and zero point of the resistor corresponds to the minimum of luminance.



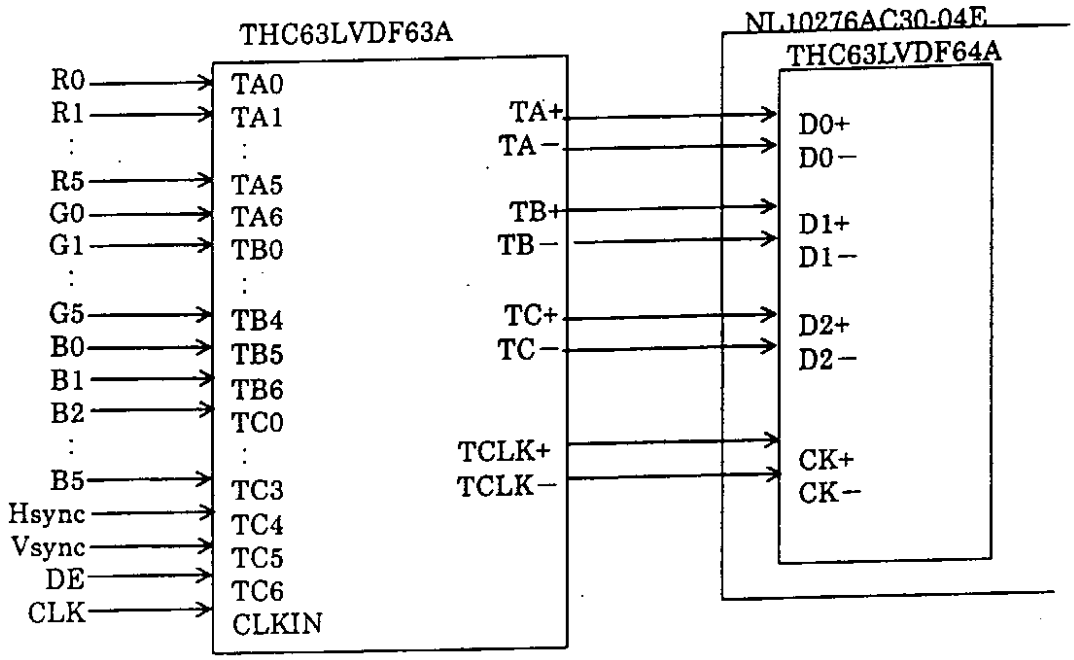
Mating variable resistor: 10kΩ±5%, B curve
Maximum luminance (100%) : R=10kΩ
Minimum luminance (20%) : R=0Ω

(2) A way of luminance control by voltage
BRTH should be fixed to 0V to control luminance by voltage. The range of input voltage between BRTL and GNDB is as follows.
Maximum luminance (100%, ACA=H): 1 V (typ.)
Minimum luminance (20%, ACA=H): 0 V

CN201: Figure from socket view



12. METHOD OF CONNECTION FOR THC63LVDF63A



Note 1: 100Ω twist pair
Note 2: These signals should be kept in the specified range of 14. INPUT SIGNAL TIMINGS.
Note 3: VCCi=3.3V (LCD internal voltage)

13. DISPLAY COLORS vs INPUT DATA SIGNALS

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 grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	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 grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	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 grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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

Note: Colors are developed in combination with 6-bit signals (64 steps in grayscale) of each primary red, green, and blue color. This process can result in up to 262,144 ($64 \times 64 \times 64$) colors.

14. INPUT SIGNAL TIMINGS

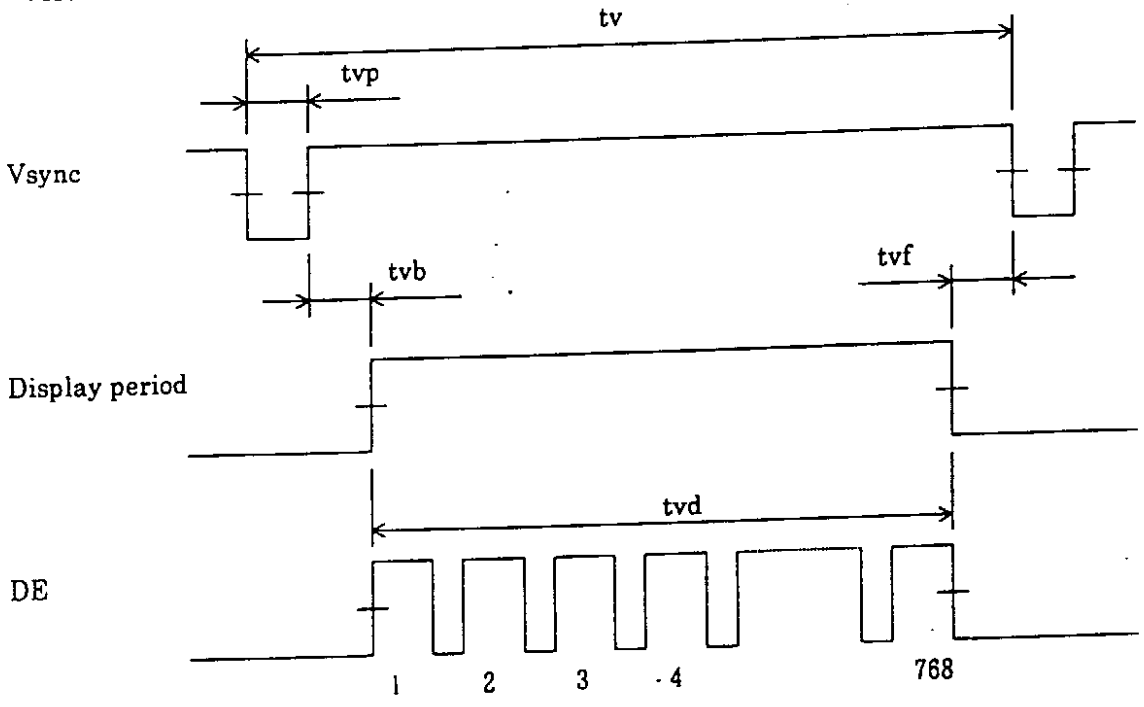
(1) Input signal specification for LCD controller

	Parameters	Symbols	Min.	Typ.	Max.	Unit	Remarks
CLK	Frequency	1/tc	60.0 —	65.0 15.385	68.0 —	MHz ns	15.385ns(typ.)
	Duty	tch/tc	0.4	0.5	0.6	—	note 1
	Rise, fall	tcrf	—	—	10	ns	note 1
Hsync	Period	th	— —	20.676 1344	— —	μs CLK	48.363kHz(typ.)
	Display period	thd	—	1024	—	CLK	—
	Front-porch	thf	0	—	—	CLK	—
	Pulse width	thp *	12	—	127	CLK	—
	Back-porch	thb *	2	—	—	CLK	—
	* thp + thb		15	—	160	CLK	—
	Hsync-CLK timing	ths	1	—	—	ns	note 1
	CLK-Hsync timing	thh	2	—	—	ns	note 1
	Rise, fall	thrf	—	—	10	ns	—
Vsync	Period	tv	— —	16.666 806	— —	ms H	60.004Hz(typ.)
	Display period	tvd	—	768	—	H	—
	Front-porch	tvf	1	—	—	H	—
	Pulse width	tvp *	1	3	36	H	—
	Back-porch	tvb *	1	—	36	H	—
	* tvp + tvb		3	—	38	H	—
	Vsync-Hsync timing	tvs	10	—	—	ns	note 1
	Hsync-Vsync timing	tvh	1	—	—	CLK	note 1
	Rise, fall	tvrf	—	—	10	ns	note 1
DATA	DATA-CLK (Set up)	tds	1	—	—	ns	note 1
	CLK-DATA (Hold)	tdh	2	—	—	ns	note 1
DE	DE-CLK timing	tes	1	—	—	ns	—
	CLK-DE timing	teh	2	—	—	ns	
	Rise, fall	terf	—	—	10	ns	

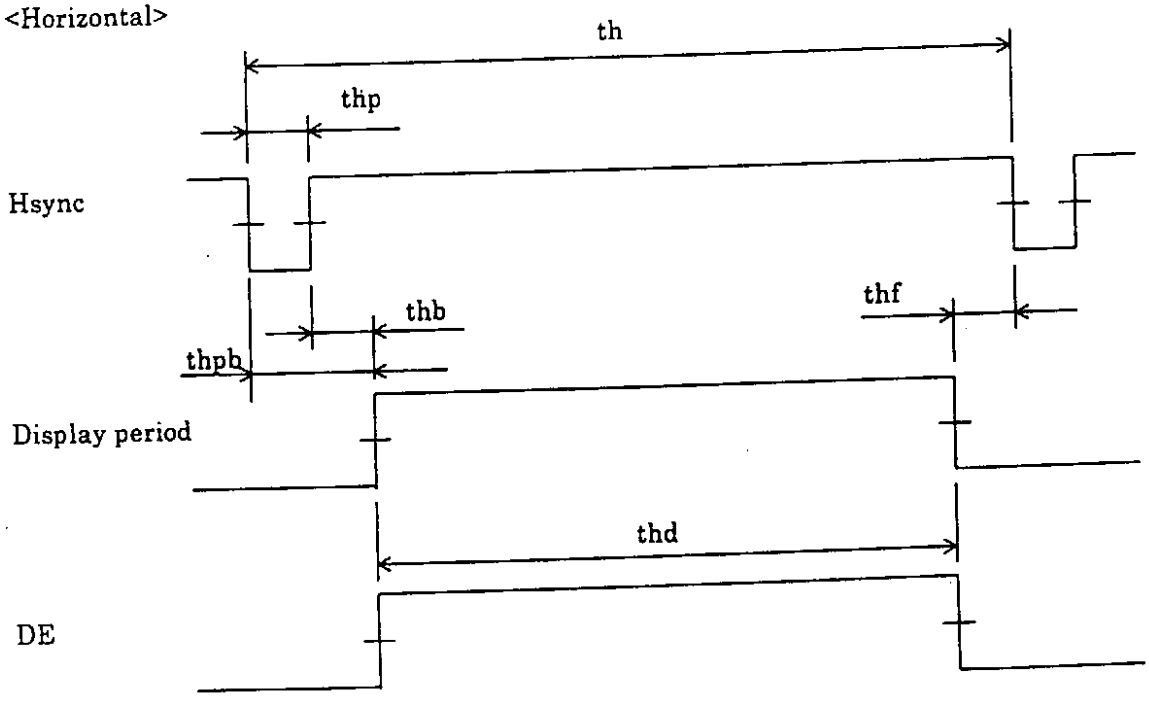
Note 1: These values are in the output of THC63LVDF64A.
(Refer to 12. METHOD OF CONNECTION FOR THC63LVDF63A)

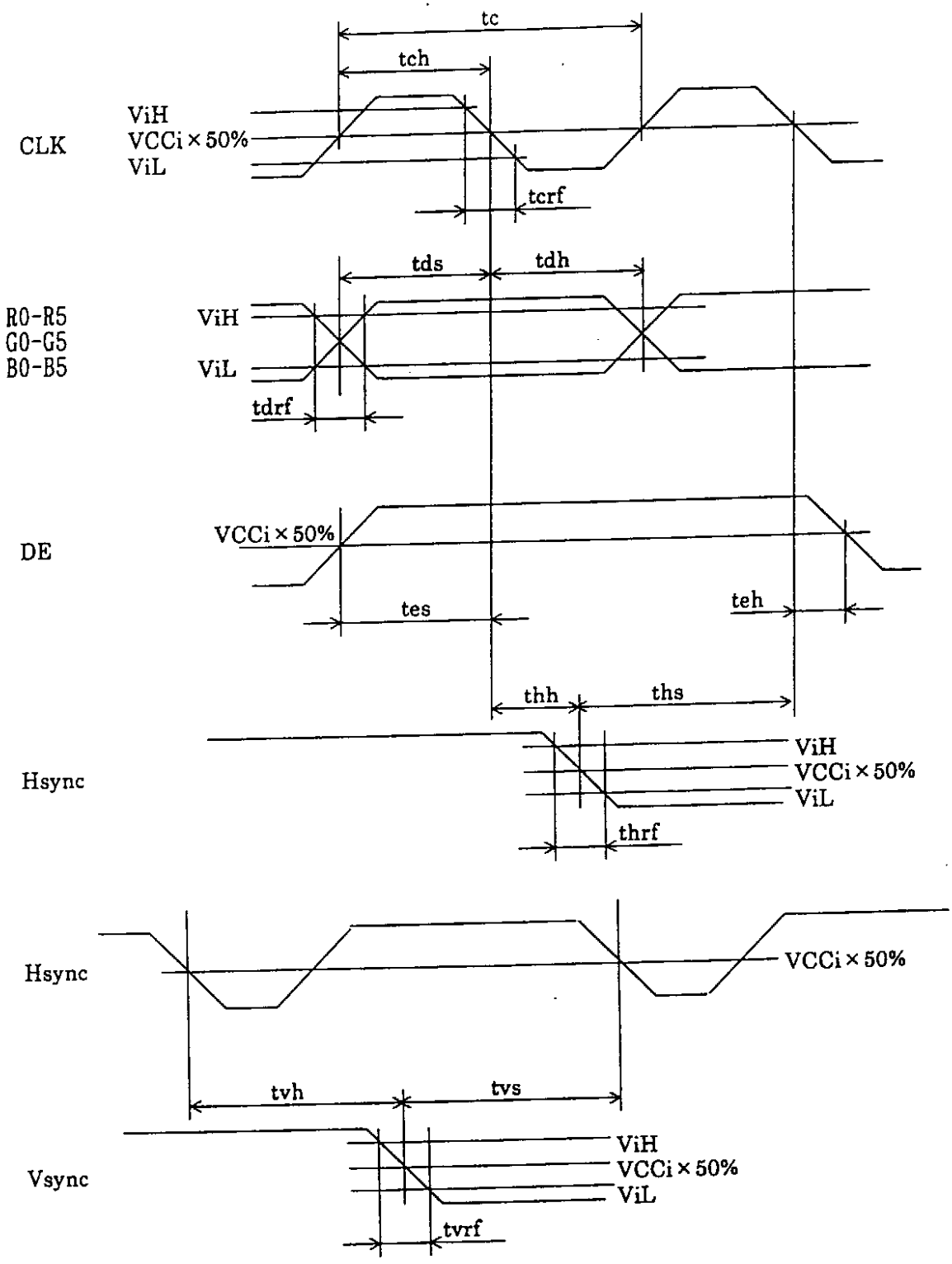
(2) Definition of input signal timing for LCD controller

<Vertical>



<Horizontal>

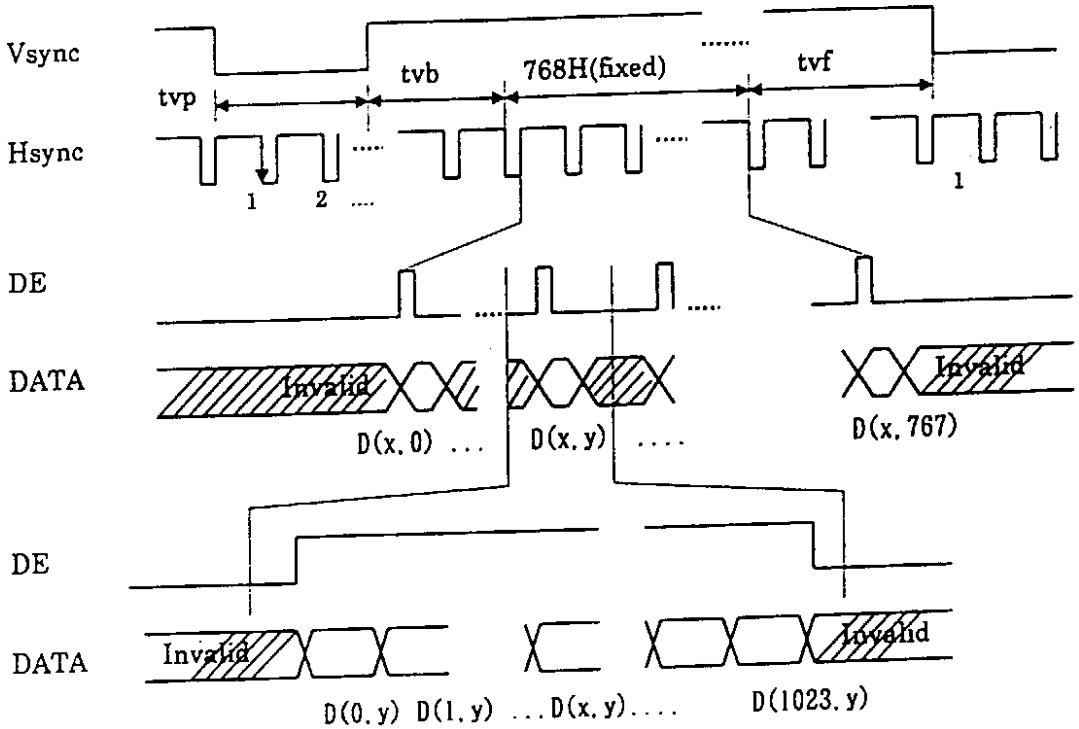


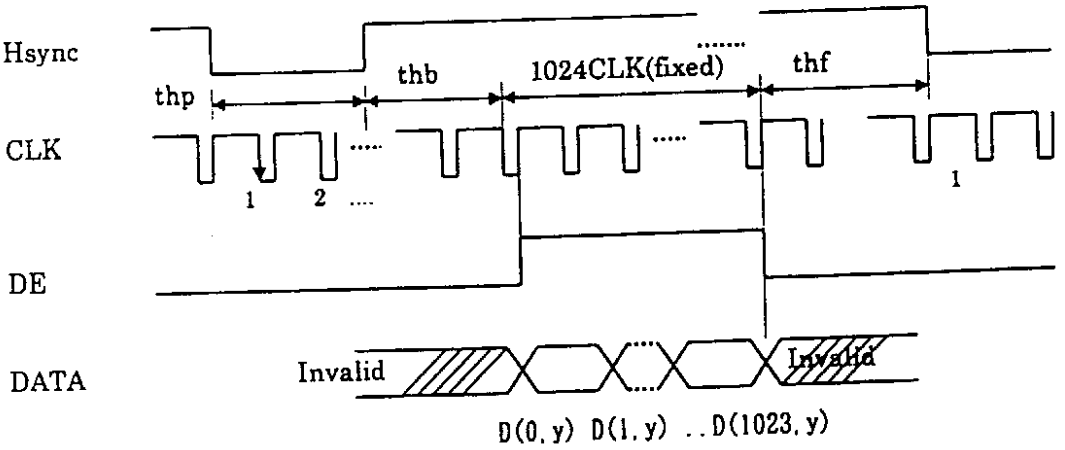


ViH = VCCi × 0.7(Min.)
ViL = VCCi × 0.3(Max.)

note 1: VCCi = 3.3V (LCD internal voltage)

(3) Input signal timing chart for LCD





note 1: These values are in the output of THC63LVDF64A.
(Refer to 12. METHOD OF CONNECTION FOR THC63LVDF63A).

(4) Display position of input data

D(0, 0)	D(0, 1)	D(0, 2)	··· ···	D(0, 1023)
D(1, 0)	D(1, 1)	D(1, 2)	··· ···	D(1, 1023)
D(2, 0)	D(2, 1)	D(2, 2)	··· ···	D(2, 1023)
⋮	⋮	⋮	⋮	⋮
D(767,0)	D(767,1)	D(767,2)	··· ···	D(767,1023)

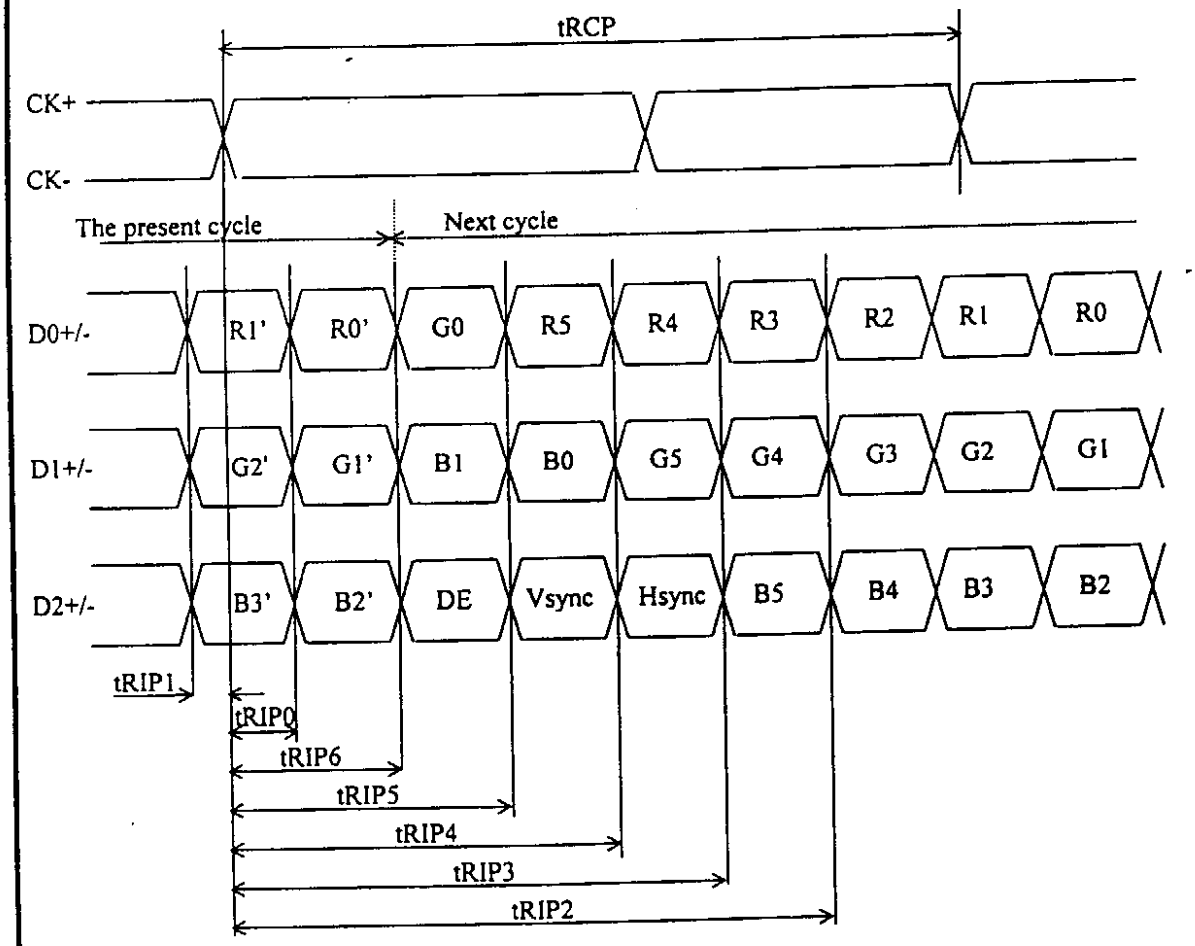
15. FOR LVDS RECEIVER

(1) Input signal specifications

Parameters	Symbols	min.	typ.	max.	Unit	Remarks
CLK Frequency	tRCP	14.71	T	16.66	ns	—
Bit0 position	tRIP1	-0.5	0	0.5	ns	T=15.38ns
Bit1 position	tRIP0	T/7-0.5	T/7	T/7+0.5	ns	T=15.38ns
Bit2 position	tRIP6	2T/7-0.5	2T/7	2T/7+0.5	ns	T=15.38ns
Bit3 position	tRIP5	3T/7-0.5	3T/7	3T/7+0.5	ns	T=15.38ns
Bit4 position	tRIP4	4T/7-0.5	4T/7	4T/7+0.5	ns	T=15.38ns
Bit5 position	tRIP3	5T/7-0.5	5T/7	5T/7+0.5	ns	T=15.38ns
Bit6 position	tRIP2	6T/7-0.5	6T/7	6T/7+0.5	ns	T=15.38ns
Phase Lock Loop Set	tRPLL	—	—	10	ms	—

Note 1: See the specifications of LVDS manufactures for detailed design.

(2) Input signal timing chart



16. OPTICAL CHARACTERISTICS

(Ta = 25· ℃, VCC=5V, VDDB=12V)

Parameters	Symbols	Conditions		Min.	Typ.	Max.	Unit	Remark
Contrast ratio	CR	θ x= ±0°, θ y= ±0°		80	200	—	—	Note 1
Luminance	Lvmax	"White"	ACA=H	220	300	—	cd/m²	Note 3 Note 5
Luminance uniformity	—	max. / min.		—	—	1.30	—	Note 6

Reference data

(Ta=25℃, VCC=5V, VDDB=12V)

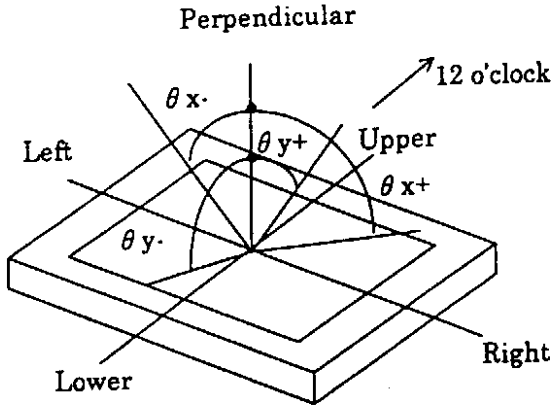
Parameters		Symbols	Conditions		Min.	Typ.	Max.	Unit	Remark
Best Contrast ratio		CR	θ x= ±0°, θ y= -5° to 10°		—	400	—	—	Note 1
Viewing Angle Range	Horizontal	θ x+	CR>10, θ y = ±0°		50	55	—	deg.	Note 2
		θ x-	CR>10, θ y = ±0°		50	55	—	deg.	
	Vertical	θ y+	CR>10, θ x = ±0°		35	45	—	deg.	
		θ y-	CR>10, θ x = ±0°		30	45	—	deg.	
	Horizontal	θ x+	CR>5, θ y = ±0°		—	80	—	deg.	Note 2
		θ x-	CR>5, θ y = ±0°		—	80	—	deg.	
	Vertical	θ y+	CR>5, θ x = ±0°		—	60	—	deg.	
		θ y-	CR>5, θ x = ±0°		30	65	—	deg.	
Color gamut		C	To NTSC		35	40	—	%	Note 3 Note 5
		W	White (x, y)		—	0.30, 0.31	—	—	
		R	Red (x, y)		—	0.58, 0.33	—	—	
		G	Green (x, y)		—	0.33, 0.52	—	—	
		B	Blue (x, y)		—	0.15, 0.11	—	—	
Response time		Ton	"White" to "Black"		—	15	40	ms	Note 4
		Toff	"Black" to "White"		—	30	50	ms	
Luminance control range		—	Maximum luminance: 100%	ACA=H	—	20－100	—	%	—
				ACA=L	—	40－100	—		
Luminance		Lvmax	"White"	ACA=L	147	200	—	cd/m²	Note 3 Note 5
Color temperature		—	"White"		—	7500	—	K	—

Note 1: The contrast ratio is calculated by using the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance with all pixels in "white"}}{\text{Luminance with all pixels in "black"}}$$

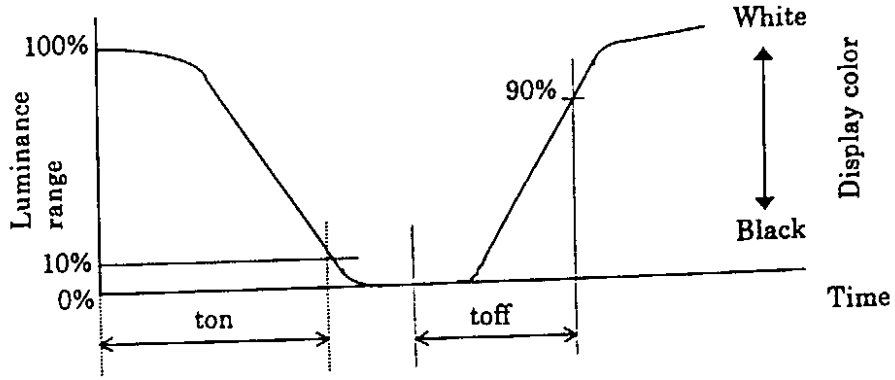
The luminance is measured in a darkroom.

Note 2: Definitions of viewing angle are as follows.

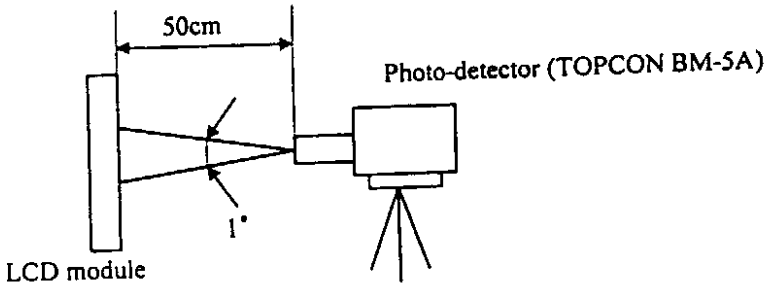


Note 3: Viewing angle is $\theta x = \pm 0^\circ$, $\theta y = \pm 0^\circ$. At center.

Note 4: Definition of response time is as follows.
Photo-detector output signal is measured when the luminance changes "white to black" or "black to white".



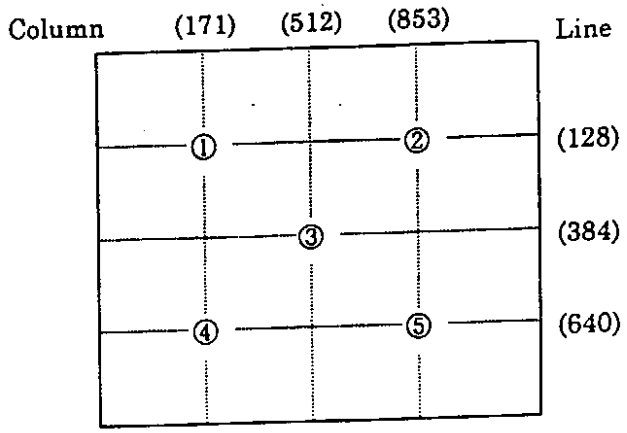
Note 5: The luminance is measured after 20 minutes from the module works, with all pixels in "white".



Note 6: The luminance uniformity is calculated by using following formula.

$$\text{Luminance uniformity} = \frac{\text{Maximum Luminance}}{\text{Minimum Luminance}}$$

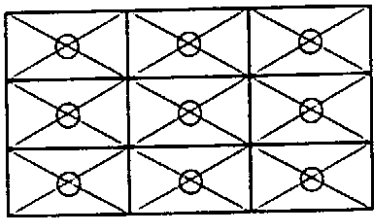
The luminance is measured at near the five points shown below.



17. RELIABILITY TEST

Test items	Test conditions	Judgment
High temperature/humidity operation	50±2℃, 85% relative humidity 240 hours, Display data is black.	*1
Heat cycle (operation)	① 0℃±3℃···1 hour 55℃±3℃···1 hour ② 50 cycles , 4 hours/cycle ③ Display data is black.	*1
Thermal shock (non-operation)	① -20℃±3℃···30 minutes 60℃±3℃···30 minutes ② 100 cycles ③ Temperature transition time is within 5 minutes.	*1
Vibration (non-operation)	① 5-100Hz, 2G 1 minute/cycle, X,Y,Z direction ② 50 times each direction	*1, *2
Mechanical shock (non-operation)	① 30G, 11ms X,Y,Z direction ② 3 times each direction	*1, *2
ESD (operation)	150pF, 150Ω, ±10KV 9 places on a panel *3 10 times each place at one-second intervals	*1
Dust (operation)	15 kinds of dust (JIS-Z 8901) Hourly 15 seconds stir, 8 times repeat	*1

*1: Display function is checked by the same condition as LCD module out-going inspection.
*2: Physical damage
*3: Discharge points are shown in the figure.



18. EXPECTED VALUE OF THE LAMP

	Backlight
Conditions	Luminance Maximum Room temp. (25±2℃) , Continuous operation
Expected value (MTTF)	25,000H
Criteria	Half value luminance (compared with initial value.)

Note 1: The lifetime is expected value (reference).
Note 2: This module consists of four lamps. Even though one of the lamps goes off, All the lamps may go off.

19. GENERAL CAUTION

Because next figures and sentences are very important, please understand these contents as follows.

⚠ CAUTION	This figure is a mark that you will get hurt and/or the module will have damages when you make a mistake to operate.

⚡	This figure is a mark that you will get electric shock when you make a mistake to operate.
✋	This figure is a mark that you will get hurt when you make a mistake to operate.

⚠ CAUTIONS

⚡	Do not touch an inverter –on which a caution label is stuck– while the LCD module is working, because of high voltage.

(1) Caution when taking out the module

a. Pick the pouch only, when taking out the module from the carrier box.

(2) Cautions for handling the module

a. As the electrostatic discharges may break the LCD module, handle the LCD module with care against electrostatic discharges.

b. ✋ As the LCD panel and backlight element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.

c. As the surface of polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.

d. Do not pull the interface connectors in or out while the LCD module is operating.

e. Put the module display side down on a flat horizontal plane.

f. Handle connectors and cables with care.

g. When the module is operating, do not lose CLK, HS, or Vsync signal. If any one or more of these signals is lost, the LCD panel would be damaged.

h. The torque for mounting screws should never exceed 0.392 N · m (4kgf · cm).

(3) Cautions for atmosphere

a. Dew drop atmosphere must be avoided.

b. Do not store and/or operate the LCD module in high temperature and/or high humidity atmosphere. Storage in an anti-static pouch and under the room temperature atmosphere is recommended.

c. This module uses cold cathode fluorescent lamps. Therefore, the life of lamps becomes short if the module is operated in the low temperature environment.

d. Do not operate the LCD module in high magnetic field.

(4) Cautions for the module characteristics

a. Do not apply any fixed patterns for a long time to the LCD module. It may cause image sticking. Use the screen savers if the display pattern is fixed for a long time.

b. This module has the retardation film, which may cause the variation of the color hue in the different viewing angles. The ununiformity may appear on the screen under the high temperature operation.

c. The noise from the inverter circuit may be observed in the luminance control mode. This is neither defects nor malfunctions.

(5) Other cautions

a. Do not disassemble and/or reassemble LCD module.

b. Do not readjust any variable resistors nor switches in the module.

c. When returning the module for repair or etc., pack the module properly to avoid any damages. We recommend using the original shipping packages.

d. In case that the scan converter is used to convert VGA signal to NTSC, it is recommended using the frame-memory type, not the line-memory.

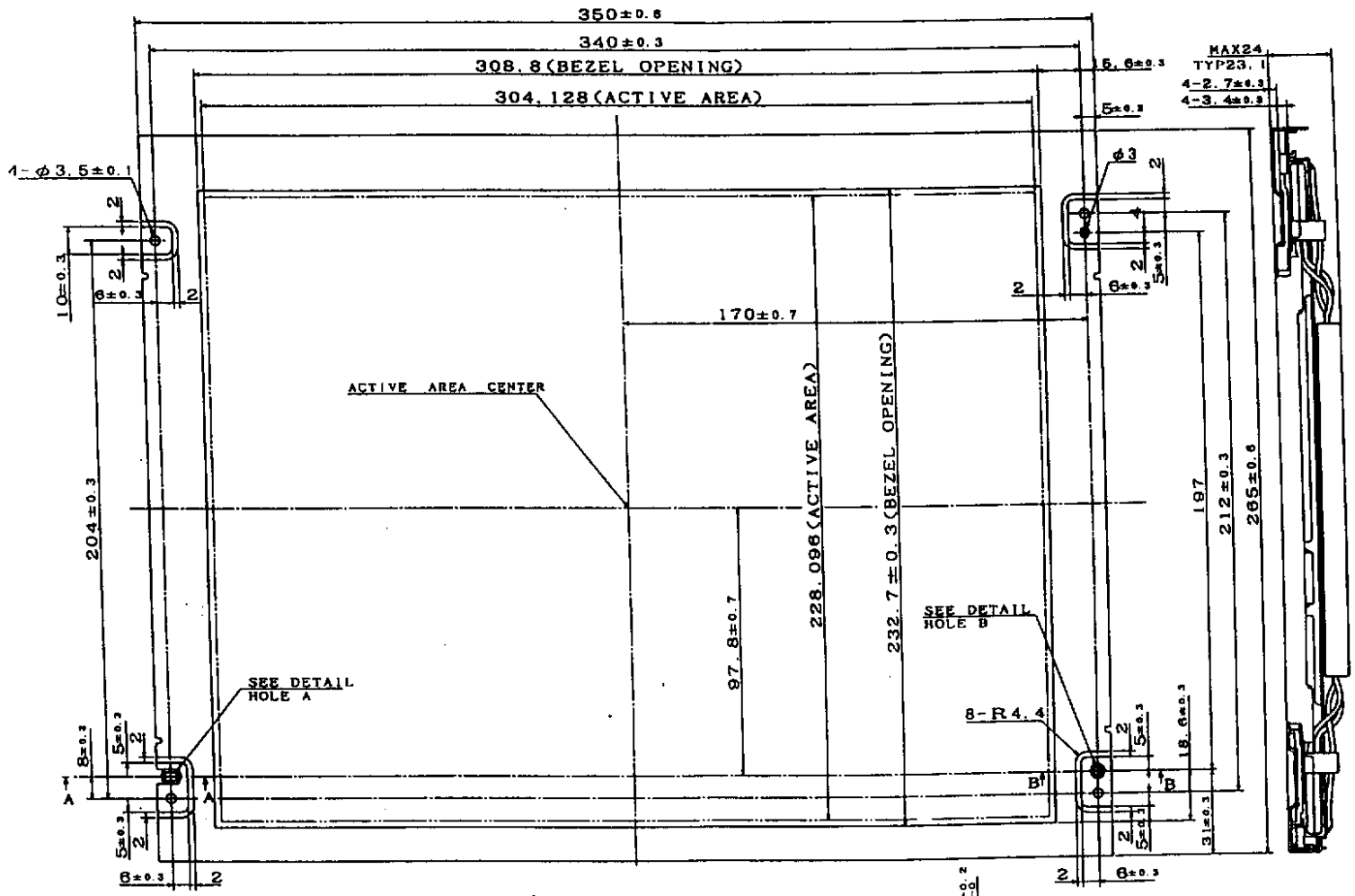
Liquid Crystal Display has the following specific characteristics. These are neither defects nor malfunctions.

The ambient temperature may affect the optical characteristics of this module.
This module has cold cathode tube for backlight. Optical characteristics, like luminance or uniformity, will be changed by the progress in time.

Uneven brightness and/or small spots may be observed depending on different display patterns.

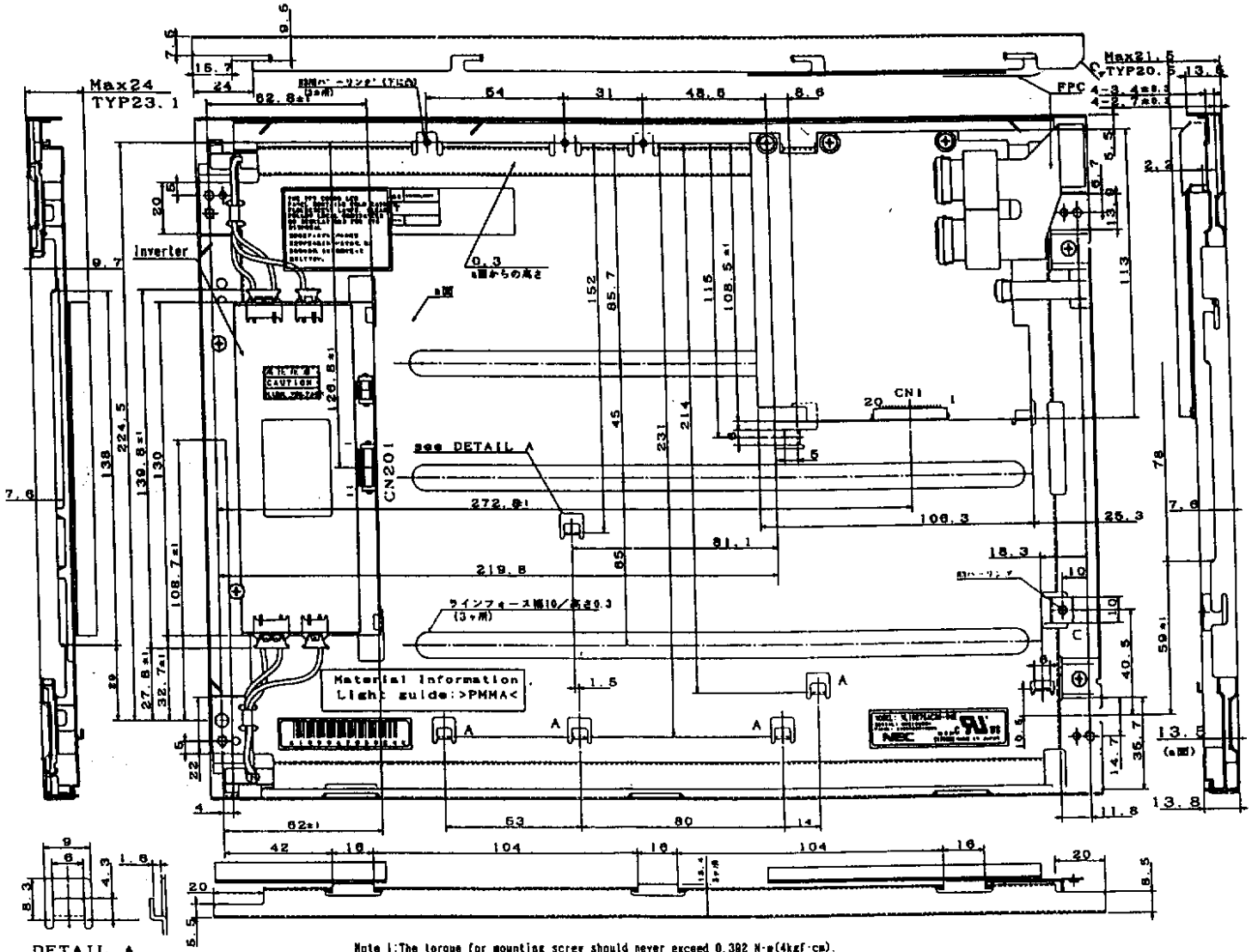
20. OUTLINE DRAWINGS

20.1 Front view (Unit: mm)



Note 1:The torque for mounting screw should never exceed 0.392N·m(4kgf·cm).
Note 2:Not shown tolerances of the dimensions are ±0.5mm.

20.2 Rear view



Note 1:The torque for mounting screw should never exceed 0.392 N-m(4kgf-cm).
Note 2:Not shown tolerances of the dimensions are ±0.5mm.

Revision History

Rev.	prepared date	Revision contents	Approved	Checked	Prepared	Issued date
1	June 25, 1999	DOD-H-7242	T. Ishi	T. Kuwagi	N. Kano	