NEC

TFT COLOR LCD MODULE

Type: NL10276AC28-05D
36cm (14.1 Type), XGA
LVDS interface (1 port)

SPECIFICATIONS

(First Edition)

PRELIMINARY

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

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

CONTENTS

1. DESCRIPTION

NL10276AC28-05D 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. NL10276AC28-05D has a built-in backlight with an inverter.
The 36 cm(14.1 Type) diagonal display area contains 1024×768 pixels and can display 262144 colors simultaneously.

2. FEATURES

- High luminance and Low reflection
- LVDS interface (equivalent to THC63LVDF64A,Thine Electronics, Inc.)
- Incorporated edge type backlight (Two lamps, Inverter) and Backlight tube replaceable

3. APPLICATIONS

- Engineering work stations, Desk-top type of PCs
- Display terminals for control system
- Monitors

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)

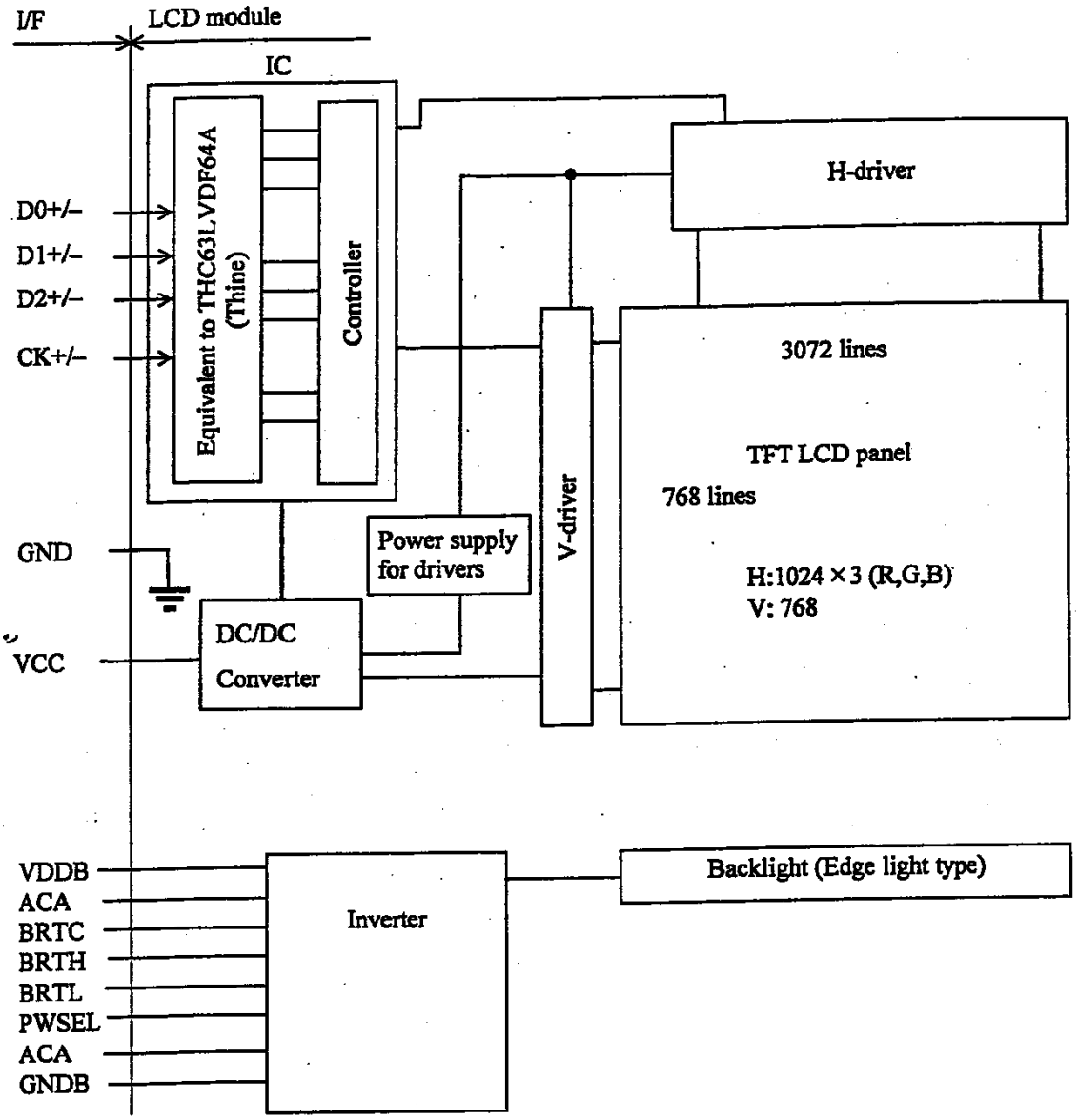
Display area	285.696 (H) × 214.272 (V)mm
Drive system	a-Si TFT active matrix
Display colors	262144 colors
Number of pixels	1024 × 768
Pixel arrangement	RGB vertical stripe
Pixel pitch	0.279 (H) × 0.279 (V)mm
Module size	330.0 (H) × 255.0 (V) × 20.0 typ. (D) mm
Weight	1220 g (typ.)
Contrast ratio	150:1 (typ.)

Viewing angle (more than the contrast ratio of 10:1)
- Horizontal: 50 ° (typ. , left side, right side)
- Vertical: 20 ° (typ. , up side), 35 ° (typ. , down side)

Designed viewing direction
- Optimum grayscale (γ =2.2): perpendicular

Polarizer Pencil-hardness	3 H (min., at JIS K5400)
Color gamut	40 % (typ. At center, To NTSC)
Response time	11 mS (typ.), "white" to "black"
Luminance	200 cd/m^2 (typ.)
Signal system	RGB 6-bit signals, Synchronous signals(Hsync, Vsync), Dot clock (CLK) LVDS interface (THC63LVDF64A, Thine Electronics, Inc.)
Supply voltage	5 V, 12 V (Logic, LCD driving, Backlight)
Backlight	Edge light type: Two cold cathode fluorescent lamps with inverter 【Replaceable parts】 • Lamp holder: type No.141LHS08 • Inverter: type No.141PW111
Power consumption	10.0 W (typ.)

6. OUTLINE OF CHARACTERISTICS (at room temperature)



Note 1: Neither GND nor GNDB is connected to frame.

7. GENERAL SPECIFICATIONS

Items	Specifications	Unit
Module size	330.0±0.5 (H) × 255.0±0.5 (V) × 20.5(max.)(D)	mm
Display area	285.696 (H) × 214.272 (V)	mm
Number of pixels	1024 (H) × 768 (V)	pixel
Dot pitch	0.093 (H) × 0.279 (V)	mm
Pixel pitch	0.279 (H) × 0.279 (V)	mm
Pixel arrangement	RGB (Red, Green, Blue) vertical stripe	—
Display colors	262,144	color
Weight	1220 (typ.), 1300 (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 +1.5	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
Differential input "L" Threshold voltage	ViL	-100	—	—	mV	VCM=1.2V VCM: Common mode voltage in LVDS driver
Differential input "H Threshold voltage	ViH	—	—	+100	mV	
Differential Input voltage	Vi	0.25	0.35	0.45	V	RT=100Ω
Common mode voltage	VCM	1.125	1.25	1.375	V	RT=100Ω
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)

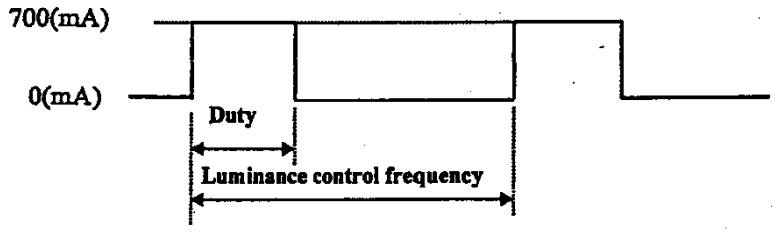
(2) Backlight

Ta = 25℃

Parameters	Symbols	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	VDDB	11.4	12.0	12.6	V	——
Logic input "L" voltage1	VIL1	0	—	0.6	V	for BRTP
Logic input "H" voltage1	VIH1	4.5	—	5.25	V	
Logic input "L" voltage2	VIL2	0	—	0.8	V	for BRTC, ACA, BRTL PWSEL
Logic input "H" voltage2	VIH2	2.2	—	5.25	V	
Logic input "L" current1	IIL1	-1.0	—	—	mA	for BRTP
Logic input "H" current1	IIH1	—	—	1.0	mA	
Logic input "L" current2	IIL2	-1.0	—	—	mA	for BRTC, ACA, BRTL PWSEL
Logic input "H" current2	IIH2	—	—	0.8	mA	
Supply current	IDDB	—	700	900	mA	VDDB=12.0V (at max. luminance)

(3) Inverter current wave

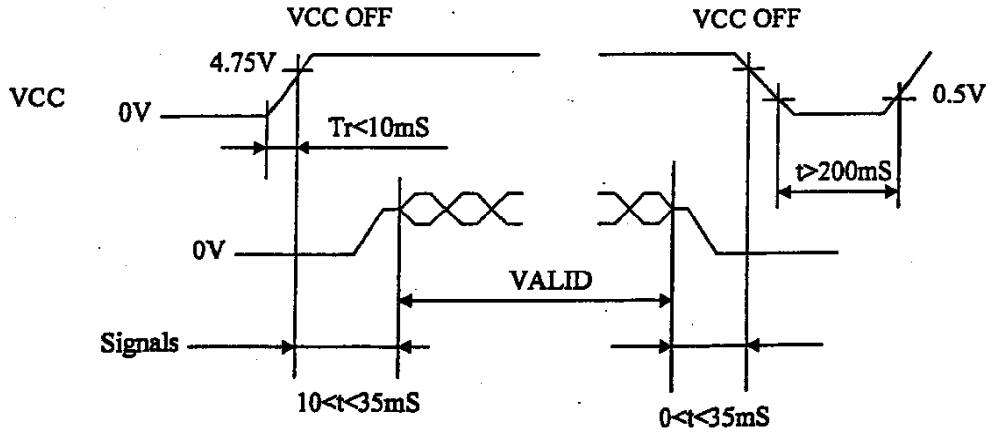
Inverter current wave is as follows.



maximun lumunanca control : 100%
minimun luminance control : 30%
Luminance control frequency ≒ Input Vsync frequency × K
Input Vsync frequency ≦ 75Hz : K=4.6
〃 > 75Hz : K=3.6

Please set up like above diagram.

10. SUPPLY VOLTAGE SEQUENCE



*1 Logic signals (synchronous signals and control signals) must 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 The supply voltage for input signals should be the same as VCC.

*3 Apply VDDB within the LCD operation period. (More than 4Vsync after the VCC are input.) When the backlight turns on before LCD operation or the LCD operation turns off before the backlight turns off, the display may momentarily become white.
However, 12V for backlight should be started up within 80ms, otherwise, the protection circuit makes the backlight turn off.

*4 When the power is off, please keep whole signals low level or high impedance.

11. INTERFACE PIN CONNECTIONS

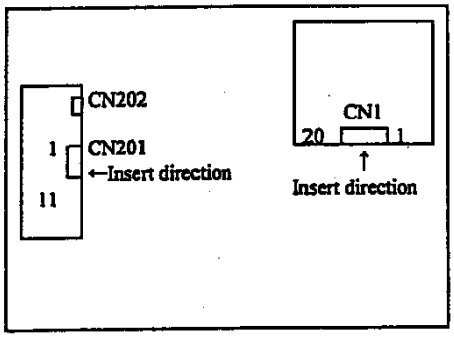
(1) Interface connector for signal and power

CN1
Part No. : FI-SE20P-HF
Adaptable socket : FI-SE20M
Supplier : Japan Aviation Electronics Industry Limited (JAE)

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: Signal ground for logic and LCD driving. GND should be connected to system ground. Neither GND nor GNDB is connected to the frame.
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



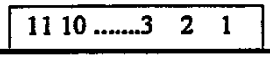
Note: Choice CN201 or CN202 and use one.

(2) Connector for backlight unit

CN201
Part No. : IL-Z-11PL1-SMTY
Adaptable socket : IL-Z-11S-S125C3
Supplier : Japan Aviation Electronics Industry Limited (JAE)

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" : Normal luminance "L" : Low luminance (1/2 of normal luminance)
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.	Non-connection	—

CN201: Figure from socket view

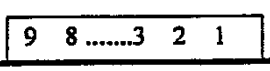


CN202
Part No. : IL-Z-9PL1-SMTY
Adaptable socket : IL-Z-9S-S125C3
Supplier : Japan Aviation Electronics Industry Limited (JAE)

Pin No.	Symbols	Signal type	Function
1	GNDB	Ground for backlight	Note 1
2	GNDB		
3	ACA	Luminance control signal	"H" or "Open" : Normal luminance "L" : Low luminance (1/2 of normal luminance)
4	BRTC	Backlight ON/OFF control signal	"H" or "Open" : Backlight ON "L" : Backlight OFF
5	BRTH	Luminance control signal	Note 2
6	BRTL	Luminance control signal	
7	BRTP	PWM luminance control signal	Note 3
8	GNDB	Ground for backlight	Note 1
9	PWSEL		Note 2

Note 1: GNDB is not connected to GND or the frame.

CN202: Figure from socket view



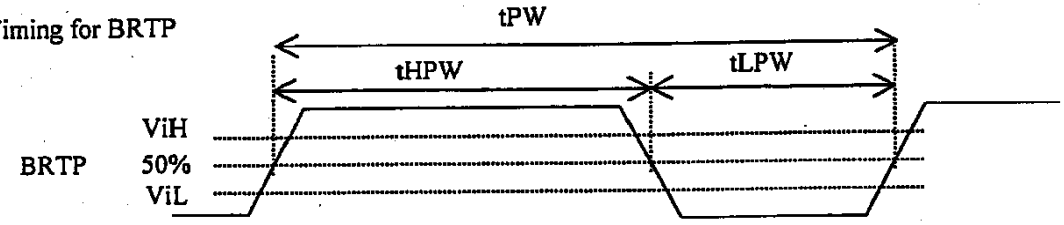
Note 2: Luminance control

Form	PWM	Voltage	Variable resister
How to adjust	PWSEL="L"	PWSEL="H" or "Open" and BRTP="OPEN"	
	See OUTSIDE CONTROL LUMINANCE	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%) : 1V (typ.) Minimum luminance (30%) : 0V	The variable resistor for luminance control should be 10 kΩ type, and zero point of the resistor corresponds to the minimum of luminance.  Maximum luminance(100%): R=10 KΩ Minimum luminance (30%) : R= 0 Ω Mating variable resistor: 10 KΩ ±5%, B curve, 1/10W

《OUTSIDE CONTROL FOR LUMINANCE》

Outside control is valid, when PWSEL="L" and input signal for BRTP. Luminance can be controlled by the duty value of input signal for BRTP.
Duty=100%: luminance is maximum.
Duty=20%: luminance is minimum.

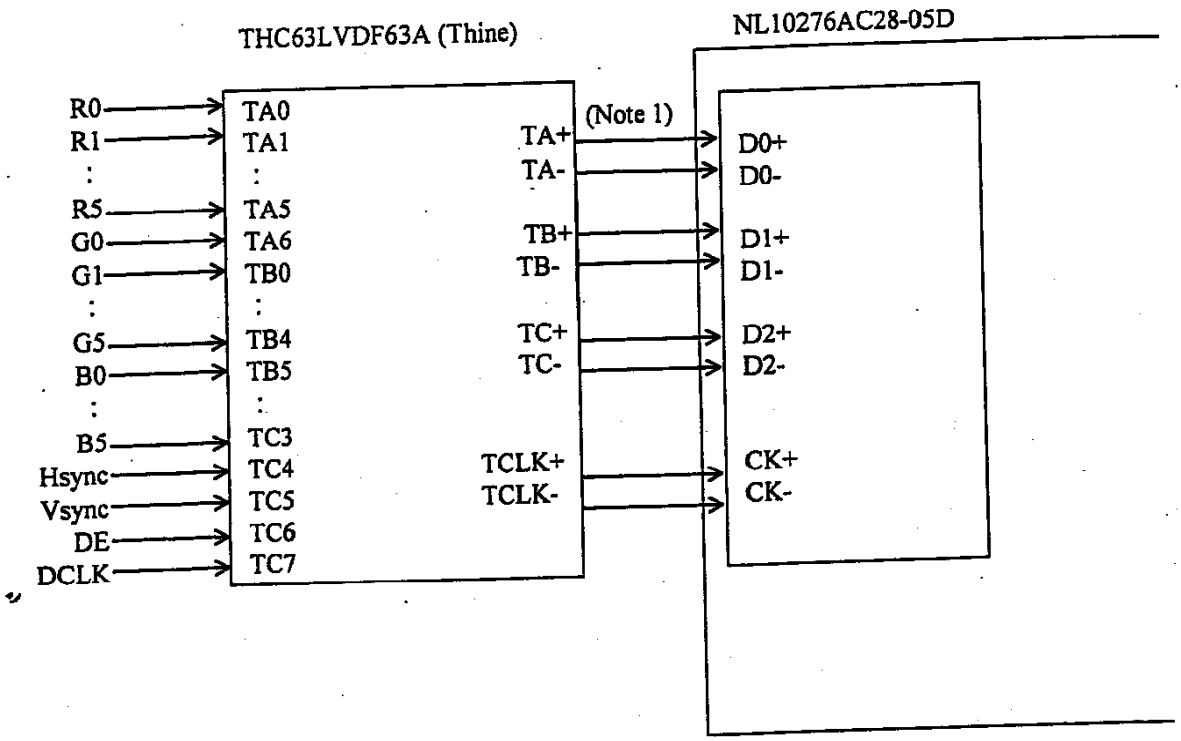
Timing for BRTP



Parameters	Symbols	Min.	Typ.	Max.	Unit	Remarks
Frequency	1/tPW	185	–	340	Hz	–
Pulse-width	tHPW/tPW	20	–	100	%	at max. luminance (100%)
Input voltage	ViL	–	–	0.6	V	–
	ViH	4.5	–	–	V	–

Regarding set up for frequency, refer to the below method.
Set up frequency = Vsync frequency × (n+0.25) or (n+0.75)
Adopt the frequency evaluating the display quality, because the display will be disturbed depend on frequency.

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 (64×64×64) colors.

14. INPUT SIGNAL TIMINGS

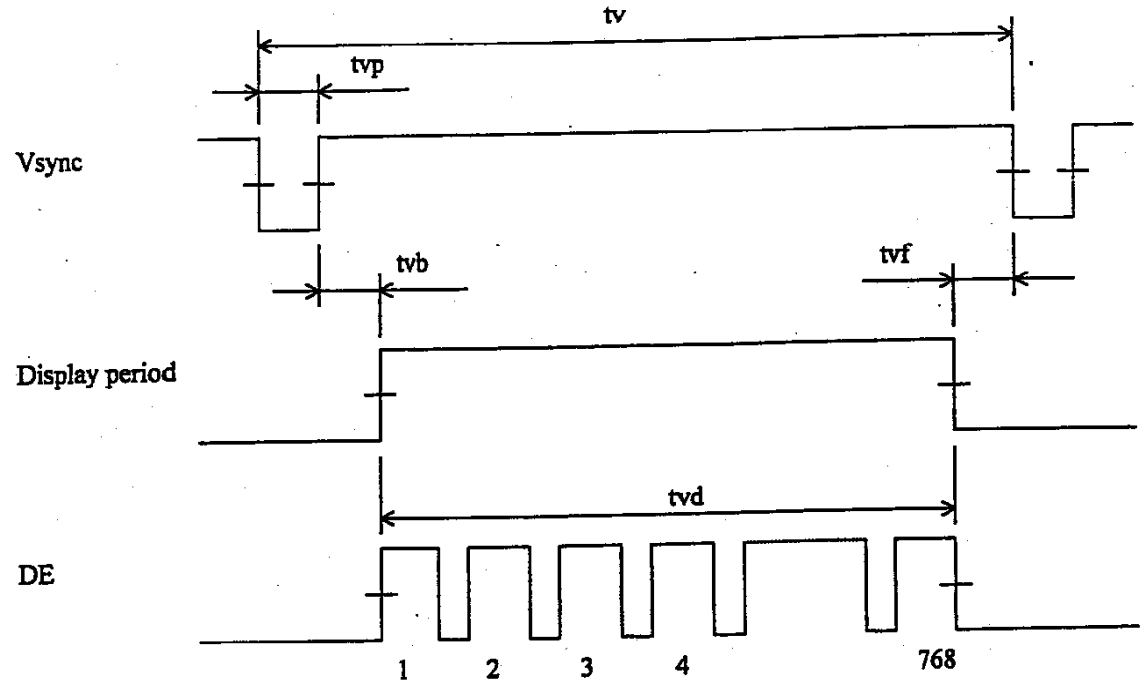
(1) Input signal specification for LCD controller

	Parameters	Symbols	Min.	Typ.	Max.	Unit	Remarks
CLK	Frequency	1/tc	60.0	65.0	68.0	MHz	15.385ns(typ.)
Hsync	Period	th	—	15.385	—	ms	48.363kHz(typ.)
			1110	1344	1780	CLK	
	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	—
Vsync	Period	tv	—	16.666	—	ms	60.004Hz(typ.)
			780	806	—	H	
	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

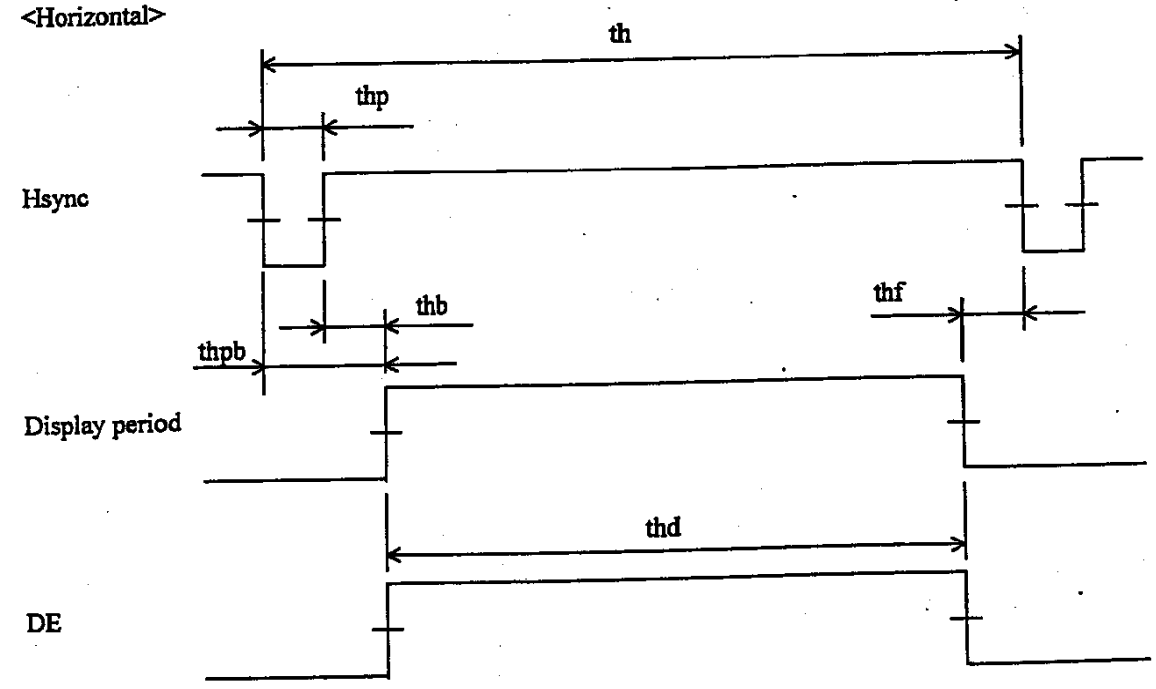
Note 1: These values are in the output of THC63LVDF64A.
(Refer to **12. METHOD OF CONNECTION FOR THC63LVDF63A)**

(2) Definition of input signal timing for LCD controller

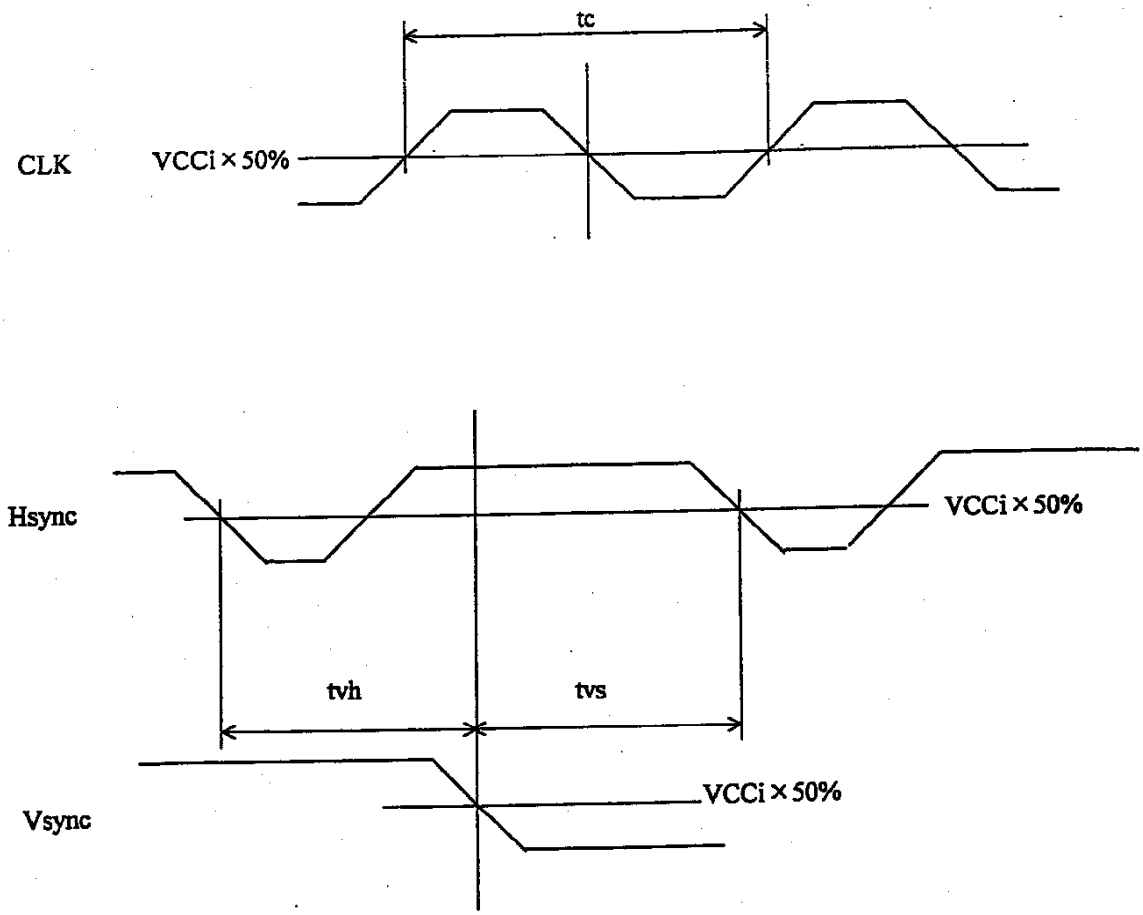
<Vertical>



<Horizontal>

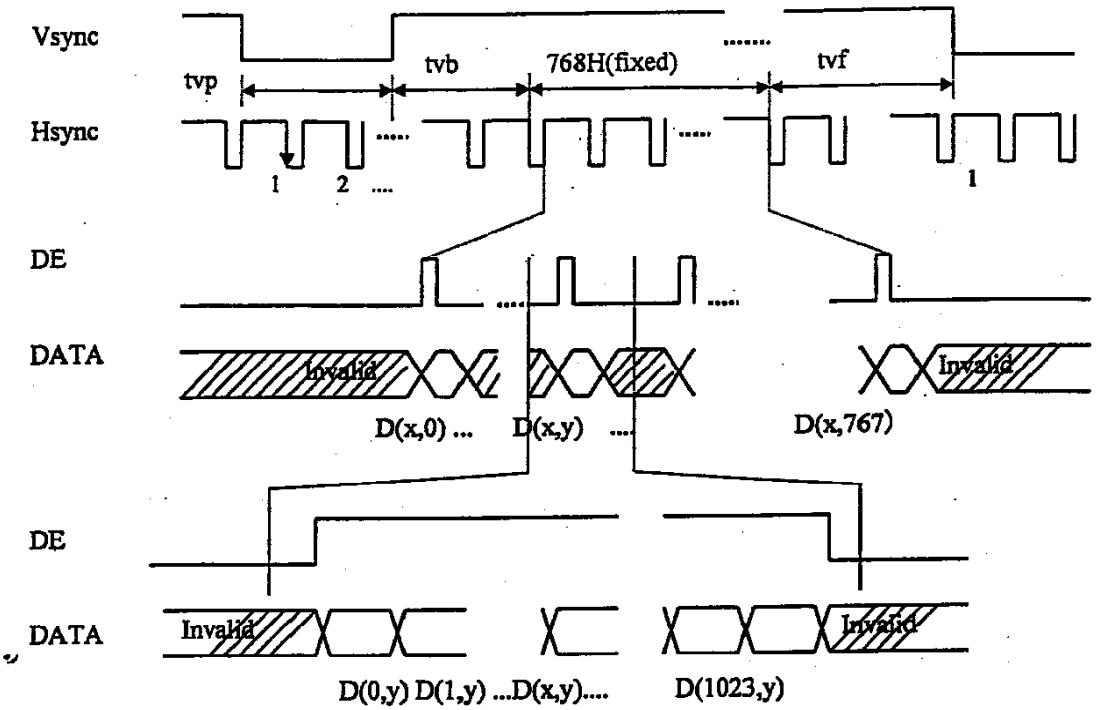


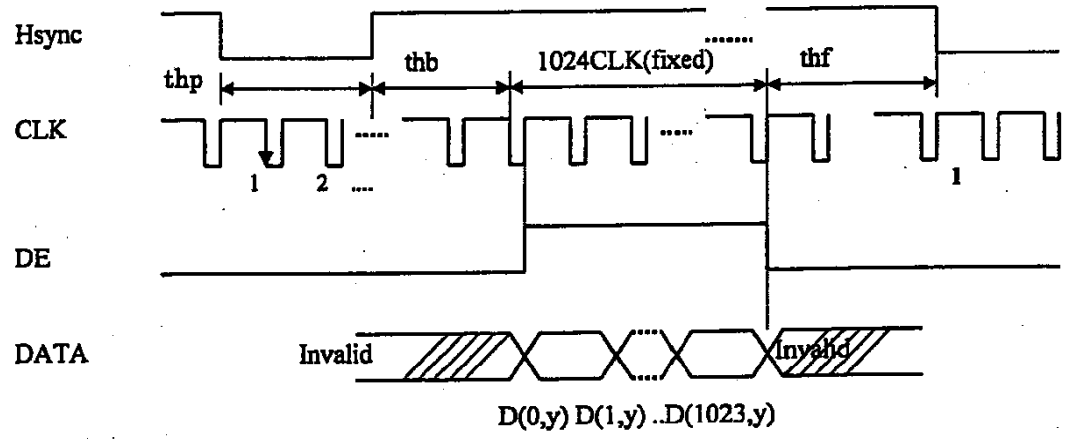
Note 1: "Display period" do not exist as signals.
Note 2: These values are in the output of THC63LVDF64A.
(Refer to 12. **METHOD OF CONNECTION FOR THC63LVDF63A**)



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

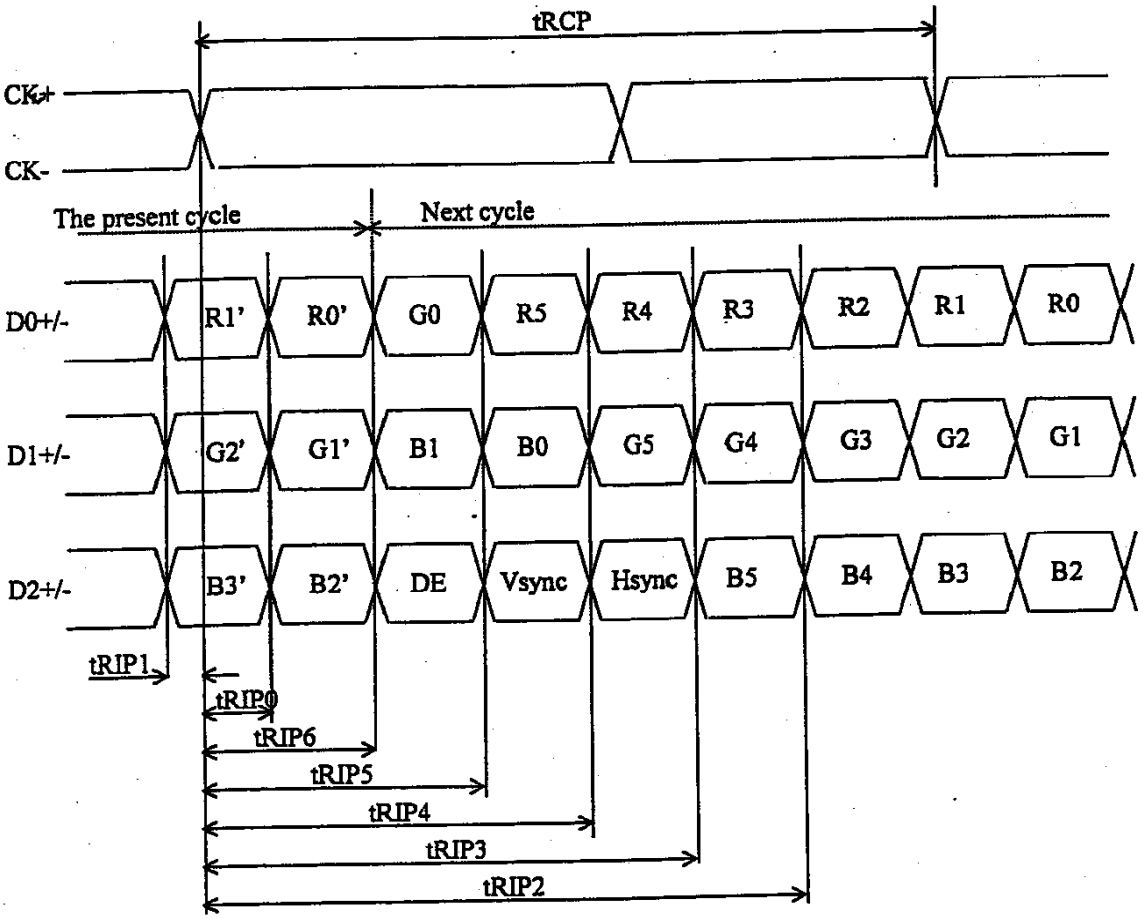
D(0, 0)	D(1, 0)	•••	D(X, 0)	•••	D(1023, 0)
D(1, 0)	D(1, 1)	•••	D(X, 1)	•••	D(1023, 1)
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
D(0, Y)	D(1, Y)	•••	D(X, Y)	•••	D(1023, Y)
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•
D(0,767)	D(1,767)	•••	D(X,767)	•••	D(1023,767)

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

(2) Input signal timing chart



16. OPTICAL CHARACTERISTICS

(Ta = 25 ℃, VCC=5V, VDDB=12V)

Parameters	Symbols	Conditions	Min.	Typ.	Max.	Unit	Remarks
Contrast ratio	CR	θ x= ±0°, θ y= ±0°	80	150	—	—	Note 1
Luminance	Lumax	"White"	150	200	—	cd/m^2	Note 5
Luminance uniformity	—	max. / min.	—	—	1.30	—	Note 6

Reference data

(Ta=25℃, VCC=5V, VDDB=12V)

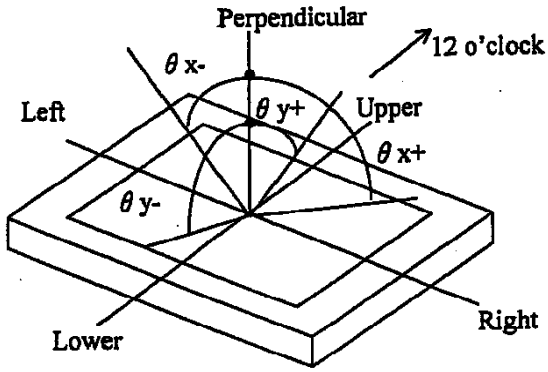
Parameters		Symbols	Conditions	Min.	Typ.	Max.	Unit	Remarks
Contrast ratio		CRP	Best contrast angle θ x= ±0°, θ y= -5°	—	300	—	—	Note 1
Color gamut		C	To NTSC	35	40	—	%	Note 3
Chromaticity Coordinates		W	White (x, y)	—	(0.30, 0.31)	—	—	—
		R	Red (x, y)	—	(0.57, 0.33)	—	—	
		G	Green (x, y)	—	(0.32, 0.51)	—	—	
		B	Blue (x, y)	—	(0.15, 0.11)	—	—	
Viewing Angle Range	Horizontal	θ x+	CR>10, θ y = ±0° (CR>5)	40	50 (60)	—	deg.	Note 2
		θ x-		40	50 (60)	—	deg.	
	Vertical	θ y+	CR>10, θ x = ±0° (CR>5)	15	20 (60)	—	deg.	
		θ y-		25	35 (60)	—	deg.	
Response time		Ton	"White" to "Black"	—	11	25	ms	Note 4
		Toff	"Black" to "White"	—	40	80	ms	

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

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

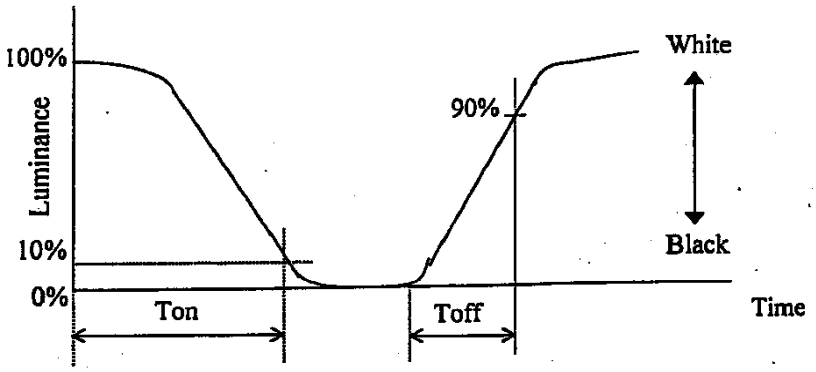
The luminance is measured in a darkroom.

Note 2: Definitions of viewing angle are as follows.

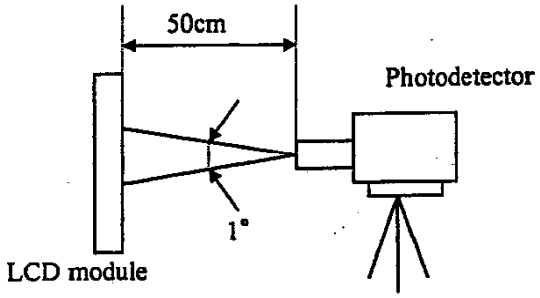


Note 3: Viewing angle is $\theta x = \pm 0^\circ$, $\theta y = \pm 0^\circ$. At center.

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".



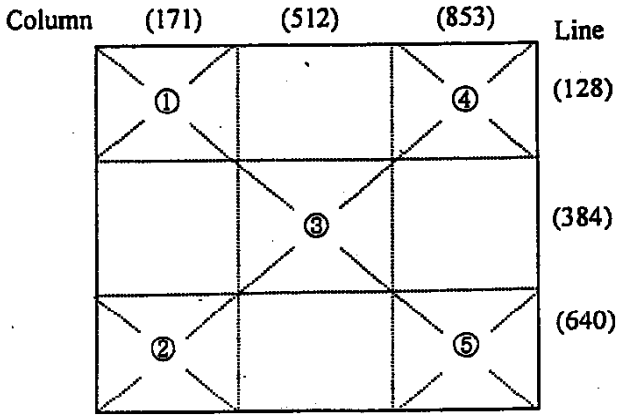
Note 5: The luminance is measured after 20 minutes from the module works, with all pixels in "white".



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

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

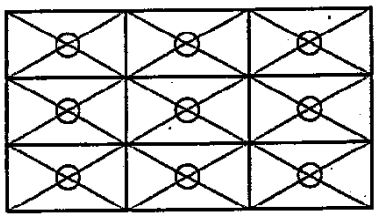
The luminance is measured at near the five points shown below.



17. RELIABILITY TEST

Test items	Test condition	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 LIFE-TIME OF THE LAMP

	Backlight
Condition	Luminance Maximum Room temp. (25±2℃) , Continuous operation
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 two lamps.

19. GENERAL CAITIONS

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

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

⚡	This figure is a mark that you will get an 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 stuvked—while the LCD module is working, because of dangerous high voltage.

(1) A caution when taking out the module

① Pick the pouch only, when taking out the module from the carrier box.

(2) Cautions for handling the module

① As the electrostatic discharges may break the LCD module, handle the LCD module with care against electrostatic discharges. Peel protection sheet out from the LCD panel surface as slowly as possible.

② ✋ As the LCD panel and backlight element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.

③ As the surface of polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.

④ Do not pull the interface connectors in or out while the LCD module is operating.

⑤ Put the module display side down on a flat horizontal plane.

⑥ Handle connectors and cables with care.

⑦ When the module is operating, do not lose CLK, Hsync, or Vsync signal. If any one or more of these signals is lost, the LCD panel would be damaged.

⑧ The torque for mounting screws should never exceed 0.39 N·m (4 Kgf·cm).

(3) Cautions for the atmosphere

① Dew drop atmosphere must be avoided.

② Do not store and/or operate the LCD module in a high temperature and/or high humidity atmosphere. Storage in an Electro-conductive polymer-packing pouch and under relatively low temperature atmosphere is recommended.

③ This module uses cold cathode fluorescent lamps. Therefore, the lifetime of lamp becomes short conspicuously at low temperature.

④ Do not operate the LCD module in high magnetic field.

(4) Cautions for the module characteristics

① Do not apply any fixed patterns data signals to the LCD module at product aging. Applying fixed pattern for a long time may cause image sticking. Use screen savers if the display pattern is fixed more than 30 minutes.

② The noise form the inverter circuit may observed in the luminance control mode. This is not defects nor malfunctions.

(5) Other cautions

① Do not disassemble and/or reassemble LCD module.

② Do not readjust variable resistors nor switches etc.

③ When returning the module for repair or etc., pack the module not to be broken. We recommend to the original shipping packages.
We recommend the original shipping packages.

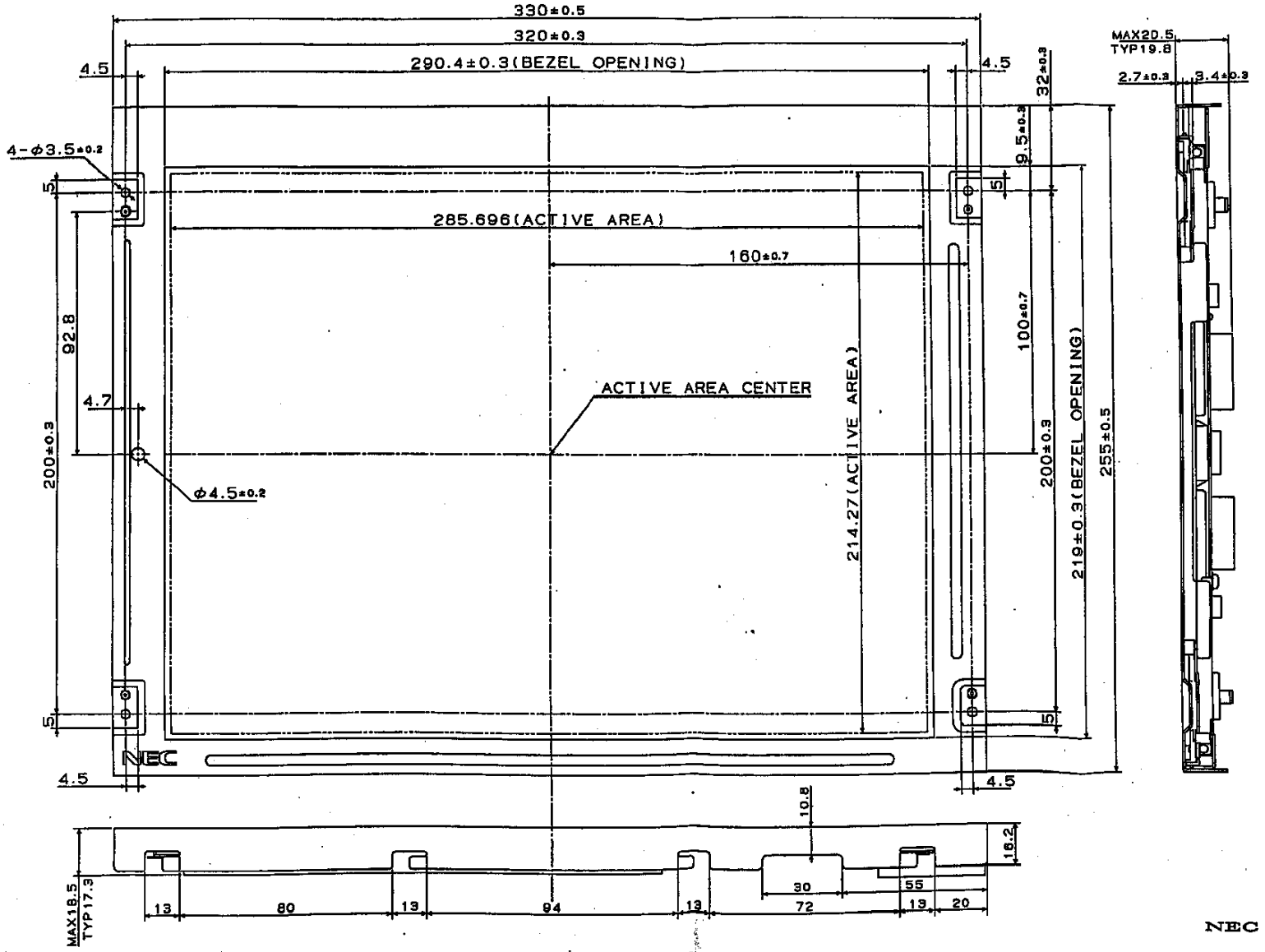
Liquid Crystal Display has the following specific characteristics. These are not defects nor malfunctions.

The ambient temperature may affect the display condition of the LCD module.
The LCD module has cold cathode tube for backlight. Optical characteristics, like luminance or uniformity, will be change change by the progress in time.

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

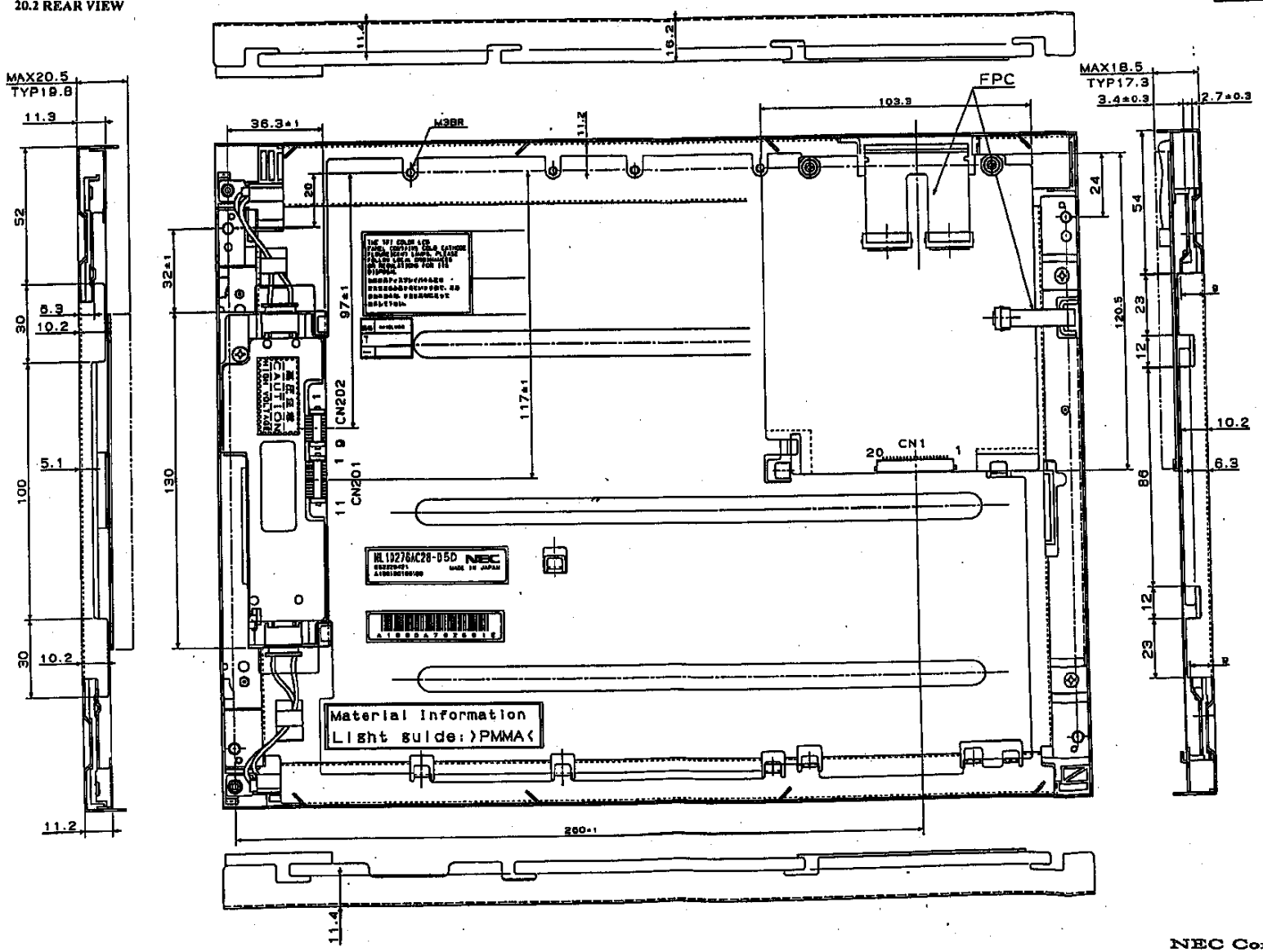
20. OUTLINE DRAWINGS (Unit in mm)

20.1 FRONT VIEW



※ The torque for mounting screw should never exceed 0.392 N·m (4 kgf·cm).
※ Not shown tolerance of the dimensions are ±0.5 mm.

20.2 REAR VIEW



Revision History

Rev.	prepared date	Revision contents	Approved	Checked	Prepared	Issued date
1	April 20, 1999	DOD-H-7151	D.A.John	T.Kusanagi	Y.Okuda	—