

TFT COLOR LCD MODULES
NL128102AC20-05

**33 cm (13 type), 1280×1024 pixels,
4096 colors, incorporated backlight (edge-light type)**

DESCRIPTION

NL128102AC20-05 is a TFT (thin film transistor) active matrix color LCD (Liquid Crystal Display) comprising amorphous silicon TFTs attached to each signal electrode, a driving circuit, and a backlight.

The 33 cm diagonal display area contains 1280 × 1024 pixels and can display 4096 colors simultaneously with an ultra-high resolution.

FEATURES

- Large display size (33 cm diagonal)
- Large number of pixels (1280 × 1024)
- Ultra-fine pixel pitch
- High contrast ratio
- High speed response
- Digital RGB interface
- Incorporated edge-light type backlight

APPLICATIONS

- Engineering workstation (EWS), Personal computer (PC), Word processor
- Display terminals for control system
- New media
- Control board for NC machine
- Monitor for process controller



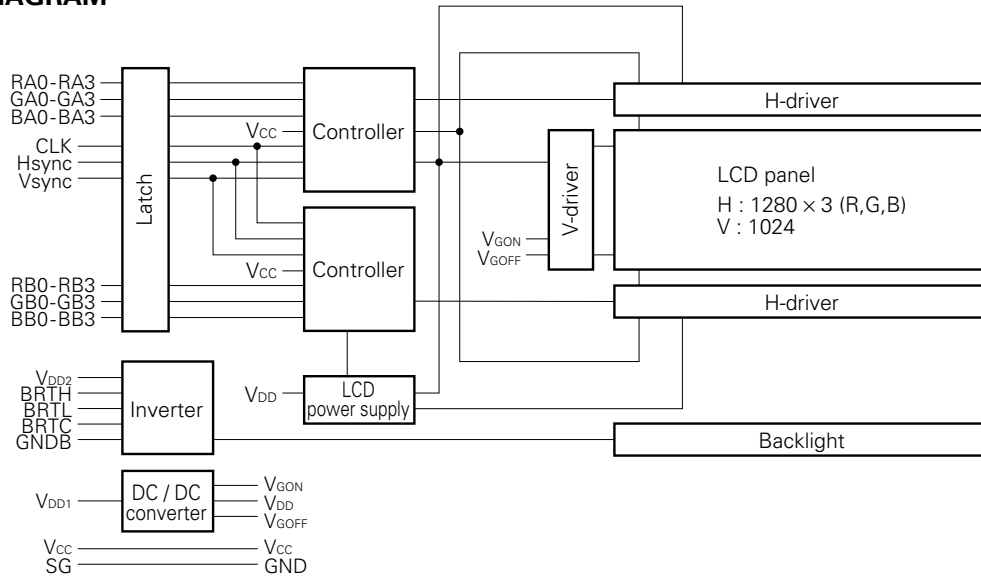
STRUCTURE AND FUNCTIONS

A TFT color LCD module comprises a TFT LCD panel, LSIs for driving liquid crystal and the backlight. A TFT LCD panel is composed of a TFT array glass substrate superimposed on a color filter glass substrate with liquid crystal filled in the narrow gap between two substrates. The backlight apparatus is located on the backside of the LCD panel.

RGB (Red, Green, Blue) data signals are sent to LCD panel drivers after modulation into suitable forms for active matrix addressing through the controller.

Each of the liquid crystal cells acts as an electro-optical switch that controls the light transmission from backlight by a signal applied to a signal electrode through the TFT switch.

BLOCK DIAGRAM



OUTLINE OF CHARACTERISTICS (at room temperature)

Display area	257.3(H) × 205.8(V) mm
Drive system	a-Si TFT active matrix
Display colors	4096 colors
Number of pixels	1280 × 1024 pixels
Pixel arrangement	RGB vertical stripe
Pixel pitch	0.201(H) × 0.201(V) mm
Module size	310.0(H) × 255.5(V) × 37.0(D) mm
Weight	2.0 kg (TYP.)
Contrast ratio	100 : 1 (TYP.)
Viewing angle (within the contrast ratio of 10 : 1)	Horizontal : 45° (TYP. Left side, Right side) Vertical : 20° (TYP. Up side), 20° (TYP. Down side)
Designed viewing direction	Upper direction (wider viewing angle without image reversal)
Color gamut	40 % (MIN., center, to NTSC)
Response time	50 msec. (MAX.)
Luminance	80 cd / m ² (TYP.)
Signal system	4 bit digital signals × 3 (RGB) × 2 (2 pixels / CLK), Synchronous signals (Hsync, Vsync)
Supply voltages	24 V, 12 V, 5 V
Backlight	Fluorescent lamps (cold cathode type) with inverter
Power consumption	22 W (TYP.)

GENERAL SPECIFICATIONS

Item	Specification	Unit
Module size	310.0±1(H) × 255.5±1(V) × 37.0 MAX.(D)	mm
Display area	257.3(H) × 205.8(V) (diagonal size 33 cm)	mm
Number of pixels	1280(H) × 1024(V)	pixel
Dot pitch	0.067(H) × 0.201(V)	mm
Pixel pitch	0.201(H) × 0.201(V)	mm
Pixel arrangement	RGB(Red, Green, Blue) vertical stripe	—
Display colors	4096	color
Weight	2.1 (MAX.)	kg

An inverter is incorporated with the module. (A luminance control variable resistor is extra)

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Remarks
Supply voltage	V _{DD1}	-0.3 to +28	V	Ta = 25°C
	V _{DD2}	-0.3 to +13	V	
	V _{CC}	-0.3 to +7	V	
Logic input	V _I	-0.3 to V _{CC} +0.3	V	—
Storage temp.	T _{ST}	-20 to 60	°C	—
Operating temp.	T _{OP}	0 to 50	°C	Module surface*
Humidity		95	%RH	Ta = 40°C
		85	%RH	Ta = 50°C
	Absolute humidity shall not exceed Ta = 50°C, 85 % relative humidity level.			Ta > 50°C

* display area center

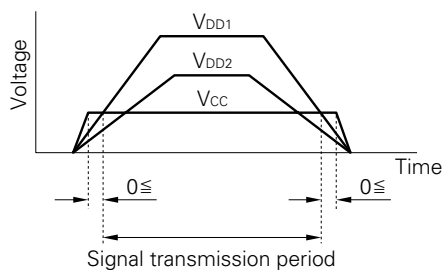
ELECTRICAL CHARACTERISTICS

(1) Logic, LCD driving

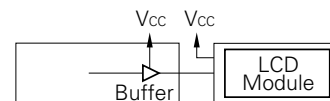
Ta = 25°C

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Supply voltage	V _{DD1}	22.8	24.0	25.2	V	—
	V _{DD2}	11.4	12.0	12.6	V	—
	V _{CC}	4.75	5.0	5.25	V	—
Logic input "L"	V _{IL}	0	—	0.8	V	TTL level
Logic input "H"	V _{IH}	2.0	—	V _{CC}	V	TTL level
Supply current	I _{DD1}	—	130	170	mA	LC driving V _{DD1} = 24.0 V
	I _{DD2}	—	1.2	1.5	A	Backlight V _{DD2} = 12.0 V
	I _{CC}	—	0.8	1.2	A	Logic V _{CC} = 5.0 V

SUPPLY VOLTAGE SEQUENCE



*1 The supply voltage of external driver for input signals should be the same as V_{CC}.



*2 Apply V_{DD2} 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 white.

*3 In the case of V_{DD2} being normally on, the backlight must be controlled by BRTC.
The BRTC signal supply sequence should be the same as that for above mentioned V_{DD2} in the notice *2

INTERFACE PIN CONNECTION

(1) Interface signals, power supply

CN1 Connector : 10268-52D2 (3 M)

View from controller PCB surface

NO.	Symbol	NO.	Symbol	NO.	Symbol	NO.	Symbol
117	CLK	217	SG	317	SG	417	Vsync
116	Hsync	216	SG	316	SG	416	BB3
115	BB2	215	SG	315	SG	415	BB1
114	BB0	214	SG	314	SG	414	BA3
113	BA2	213	SG	313	SG	413	BA1
112	BA0	212	SG	312	SG	412	GB3
111	GB2	211	SG	311	SG	411	GB1
110	GB0	210	SG	310	SG	410	GA3
109	GA2	209	SG	309	SG	409	GA1
108	GA0	208	SG	308	SG	408	RB3
107	RB2	207	SG	307	SG	407	RB1
106	RB0	206	SG	306	SG	406	RA3
105	RA2	205	SG	305	SG	405	RA1
104	RA0	204	SG	304	SG	404	BRTC
103	BRTH	203	GNDB	303	BRTL	403	+12 V
102	+12 V	202	GNDB	302	GNDB	402	+12 V
101	+5 V	201	+5 V	301	+5 V	401	+24 V

View from cable insert direction

01	CLK	SG	35
02	SG	Vsync	36
03	Hsync	SG	37
04	SG	BB3	38
05	BB2	SG	39
06	SG	BB1	40
07	BB0	SG	41
08	SG	BA3	42
09	BA2	SG	43
10	SG	BA1	44
11	BA0	SG	45
12	SG	GB3	46
13	GB2	SG	47
14	SG	GB1	48
15	GB0	SG	49
16	SG	GA3	50
17	GA2	SG	51
18	SG	GA1	52
19	GA0	SG	53
20	SG	RB3	54
21	RB2	SG	55
22	SG	RB1	56
23	RB0	SG	57
24	SG	RA3	58
25	RA2	SG	59
26	SG	RA1	60
27	RA0	SG	61
28	SG	BRTC	62
29	BRTH	BRTL	63
30	GNDB	+12 V	64
31	+12 V	GNDB	65
32	GNDB	+12 V	66
33	+5 V	+5 V	67
34	+5 V	+24 V	68

Symbol	Level	Function	Frequency
RA(0 to 3), RB(0 to 3)	TTL	Data (RED)	-
GA(0 to 3), GB(0 to 3)	TTL	Data (GREEN)	-
BA(0 to 3), BB(0 to 3)	TTL	Data (BLUE)	-
Hsync	TTL	HSYNC	64.60 kHz
Vsync	TTL	VSYNC	59.929 Hz
CLK	TTL	Dot clock	53.75 MHz
SG	-	Signal ground	-
BG	-	Backlight ground	-
BRTH	-	Luminance control	-
BRTL	-	Luminance control	-
BRTC	TTL	Backlight ON/OFF	-

(2) Backlight control, power supply

CN2 Connector : S16B-PHDSS (JST)

NO.	Symbol	Function	NO.	Symbol	Function
08	BRTC	Backlight ON/OFF	16	SG	Signal ground
07	BRTH	Luminance control	15	BRTL	Luminance control
06	SG	Signal ground	14	SG	Signal ground
05	V _{DD1}	24 V	13	V _{DD1}	24 V
04	GNDB	Backlight ground	12	GNDB	Backlight ground
03	V _{DD2}	12 V	11	V _{DD2}	12 V
02	SG	Signal ground	10	SG	Signal ground
01	V _{CC}	5 V	09	V _{CC}	5 V

- 1) BRTC : L = backlight OFF, H = backlight ON
OPEN = backlight ON
- 2) The variable resistor (1 kΩ B-type) for luminance control should be connected between BRTH and BRTL.
The minimum luminance corresponds to 0 Ω.
- 3) Connector pins having the same symbol (name) in connectors (CN1 and CN2) are through connected. Either is available.

DISPLAY COLORS vs. INPUT DATA SIGNALS

Display		Data signals (0 : Low level, 1 : High level)											
		RA3	RA2	RA1	RA0	GA3	GA2	GA1	GA0	BA3	BA2	BA1	BA0
		RB3	RB2	RB1	RB0	GB3	GB2	GB1	GB0	BB3	BB2	BB1	BB0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	1	1	1	1
	Red	1	1	1	1	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	0	0	0	0	1	1	1	1
	Green	0	0	0	0	1	1	1	1	0	0	0	0
	Cyan	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	0	0	0	0
	White	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
	Dark	0	0	0	1	0	0	0	0	0	0	0	0
	↑												
	↓												
	Bright	1	1	0	1	0	0	0	0	0	0	0	0
Green grayscale	Black	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
	↑												
	↓												
	Bright	0	0	0	0	1	1	0	1	0	0	0	0
Blue grayscale	Black	0	0	0	0	0	0	0	0	0	0	0	0
	Dark	0	0	0	0	0	0	0	0	0	0	1	0
	↑												
	↓												
	Bright	0	0	0	0	0	0	0	0	1	1	0	1
Blue grayscale	Dark	0	0	0	0	0	0	0	0	1	1	1	0
	Bright	0	0	0	0	0	0	0	0	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	1	1	1	1

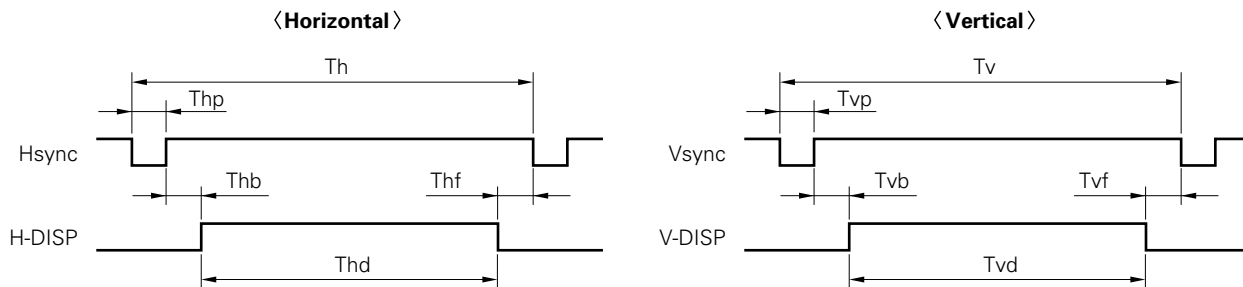
Note : Colors are developed in combination with 4 bit signal (16 steps in grayscale) of each primary red, green, and blue color.

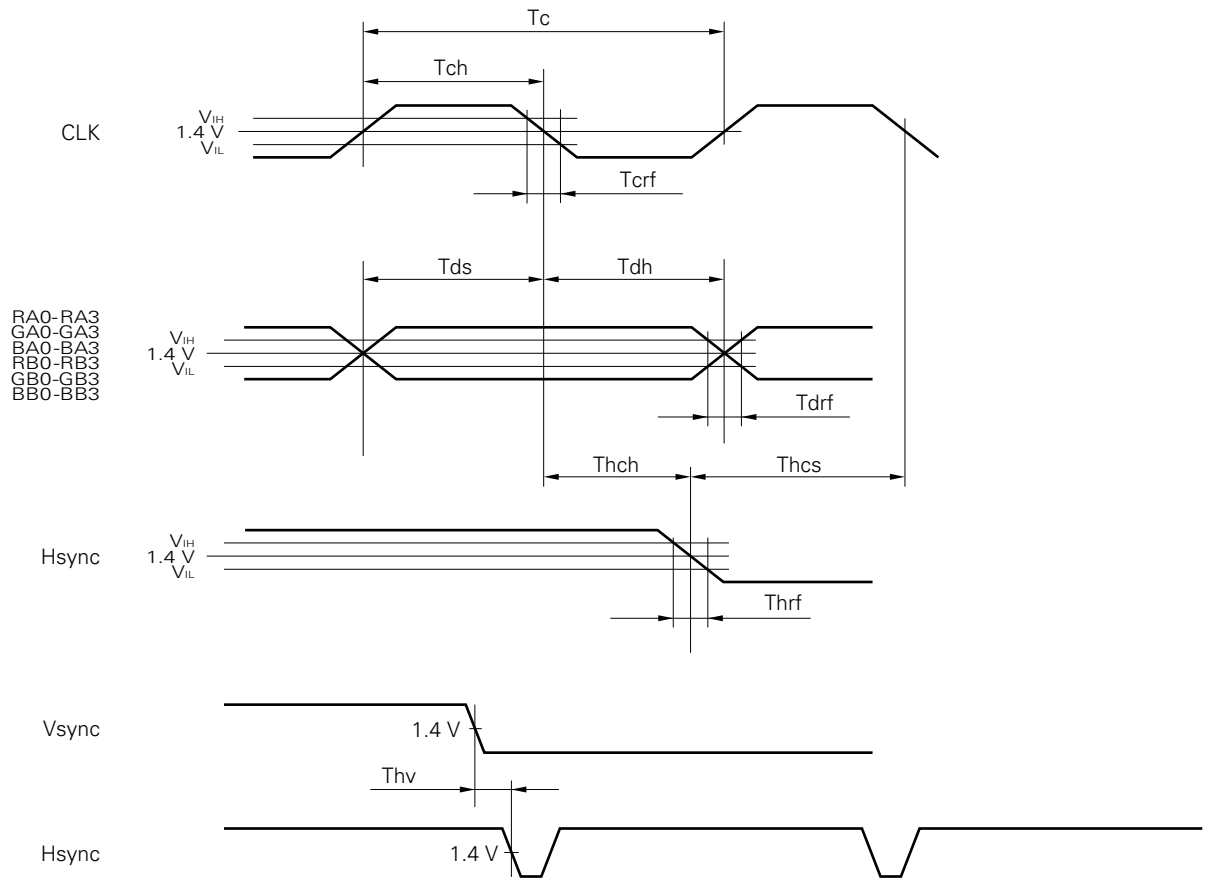
This process can result in up to 4096 (16 × 16 × 16) colors.

Input signal specifications

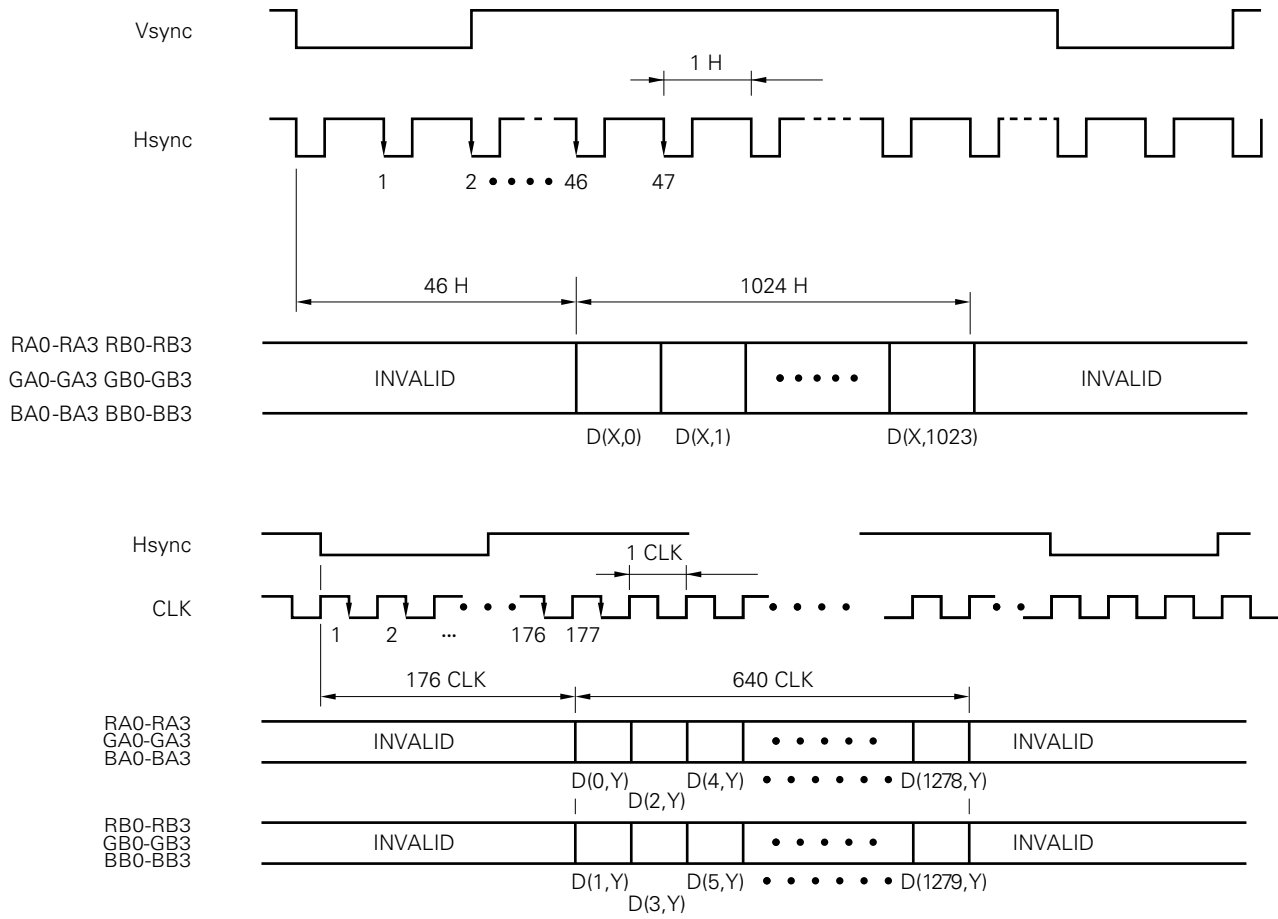
Items		Symbol	Time	Frequency	Note
CLK	Frequency	1 / Tc	18.60 ns	53.75 MHz	-
	Duty	Tch / Tc	0.4 to 0.6	-	-
	Rise, Fall	Tcrf	2.0 ns (MAX.)	-	-
Hsync	Period	Th	15.479 μ s	64.60 kHz	832 dots
	Display period	Thd	11.907 μ s	-	640 dots
	Front porch	Thf	0.298 μ s	-	16 dots
	Pulse width	Thp	1.786 μ s	-	96 dots
	Back porch	Thb	1.488 μ s	-	80 dots
	Clock-Hsync. timing 1	Thch	7.5 ns(MIN.)	-	-
	Clock-Hsync. timing 2	Thcs	2.0 ns(MIN.)	-	-
	V-H-skew	Thv	1.0 μ s(MIN.)	-	-
	Rise, Fall	Thrf	2.5 ns(MAX.)	-	-
Vsync	Period	Tv	16.686 ms	59.929 kHz	1078 H
	Display period	Tvd	15.850 ms	-	1024 H
	Front porch	Tvf	0.124 ms	-	8 H
	Pulse width	Tvp	0.062 ms	-	4 H
	Back porch	Tvb	0.650 ms	-	42 H
RA0-RA3 RB0-RB3 GA0-GA3 GB0-GB3 BA0-BA3 BB0-BB3	Set up	Tds	2.0 ns(MIN.)	-	-
	Hold	Tdh	7.5 ns(MIN.)	-	-
	Rise, Fall	Tdrf	2.5 ns(MAX.)	-	-

Definition of input signal timing





Input signal timing chart



Display position of input data

D(0,0)	D(1,0)	D(2,0)	-----	D(1279,0)
D(0,1)	D(1,1)			
D(0,2)				
⋮				
D(0,1023)	D(1,1023)	D(2,1023)	-----	D(1279,1023)

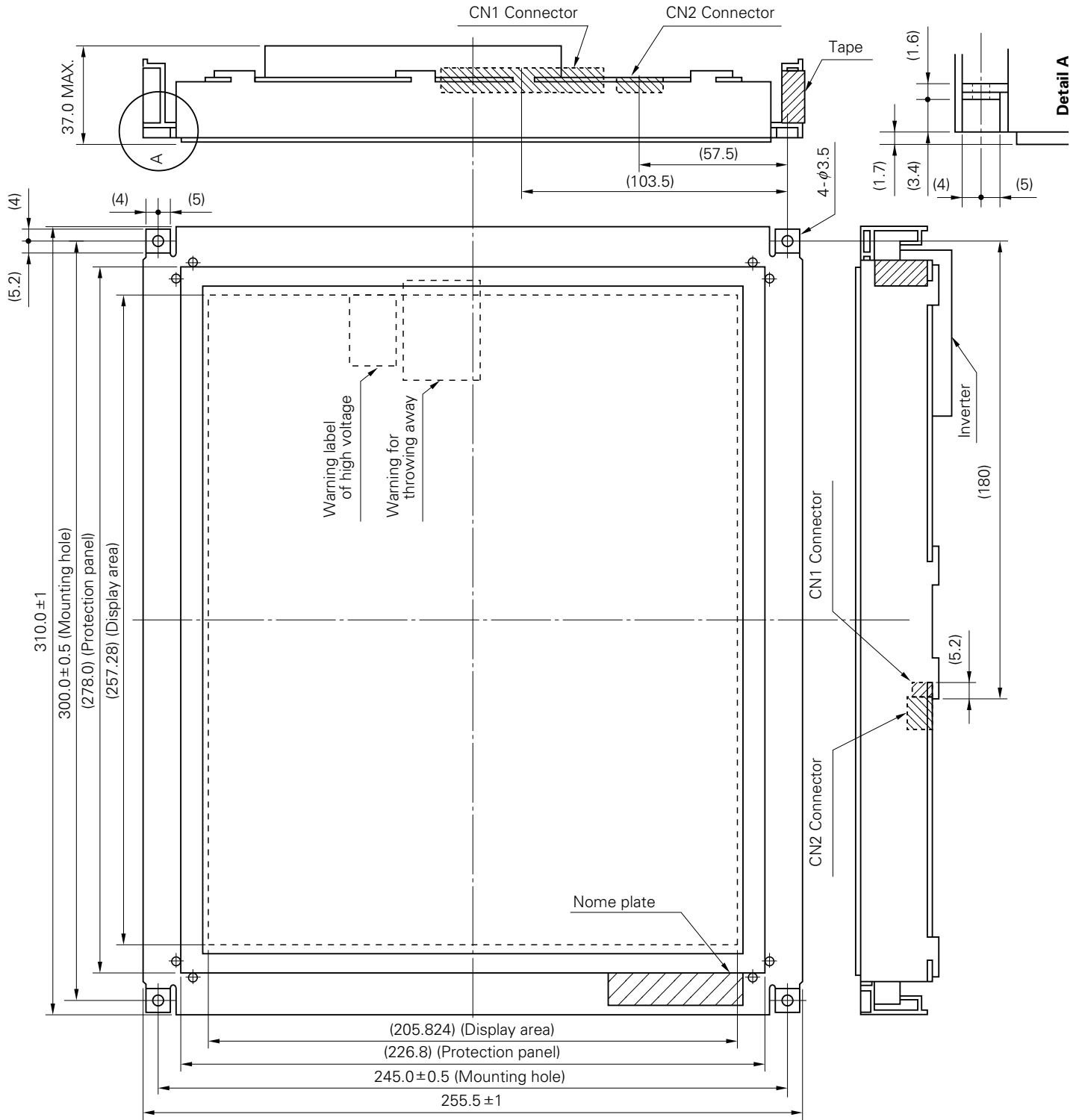
GENERAL CAUTION**WARNING**

Do not touch an inverter -- on which is stuck a caution label -- while the LCD module is under the operation, because of dangerous high voltage.

- (1) Caution when taking out the module
 - ① Pick the pouch only, when taking out module from a shipping package.
- (2) Cautions for handling the module
 - ① As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
 - ② As the LCD panel and back-light element are made of fragile glass material, impulse and pressure to the LCD module should be avoided.
 - ③ As the surface of protection panel 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.
- (3) Cautions for the operation
 - ① When the module is operating, do not lose CLK, Hsync or Vsync signals. If any one of these signals is lost, the LCD panel would be damaged.
 - ② Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (4) Cautions for the atmosphere
 - ① Dew drop atmosphere should be avoided.
 - ② Do not store and / or operate the LCD module in a high temperature and / or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.
- (5) Cautions for the module characteristics
 - ① Do not apply fixed pattern data signal to the LCD module at product aging. Applying fixed pattern for a long time may cause image sticking.
- (6) Other cautions
 - ① Do not disassemble and / or re-assemble LCD module.
 - ② Do not re-adjust variable resistor or switch etc.
 - ③ When returning the module for repair or etc., please pack the module not to be broken. We recommend to use the original shipping packages.
 - ④ When fixing I / F cable to the module tablet, the screw length must be less than 4 mm, too long screw may cause a luminance inequality.

Liquid Crystal Display has the following specific characteristics. These are not defects or malfunctions. The display condition of LCD module may be affected by the ambient temperature. The LCD module uses cold cathode tubes for backlighting. Optical characteristics, like luminance or uniformity, will change during life time. Uneven brightness and/or small spots may be noticed depending display patterns.

OUTLINE DRAWING (Unit in mm)



The value in parenthesis is for reference

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