Doc. Number:

☐ Tentative Specification
■ Preliminary Specification
☐ Approval Specification

MODEL NO.: N070ICE
SUFFIX: GB1

Customer:

APPROVED BY **SIGNATURE**

Name / Title _____ _____

Note :
Only for reference

Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By

CONTENTS

REVISION HISTORY

Version	Date	Page	Description
0.0	Oct, 29, 2012	All	Spec Ver.0.0 was first issued.
1.0	Jan, 02, 2013	All	Spec Ver.1.0 was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N070ICE-GB1 is a 7" (7" diagonal) TFT Liquid Crystal Display module with LED Backlight unit and **36 pins MIPI DSI** interface. This module supports 800 x 1280 WXGA mode.

1.2 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Screen Size	7" diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	800 x R.G.B. x 1280	pixel	-
Pixel Pitch	0.11775 (H) x 0.11775 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16,777,216 (8bit color depth)	color	-
Transmissive Mode	Normally black	-	-
Surface Treatment	Hard coating (3H), Glare	-	-
Luminance, White	300	Cd/m2	
Power Consumption	**Total 492 W (Max.), BL 1.13 W (Max.)**		(1)

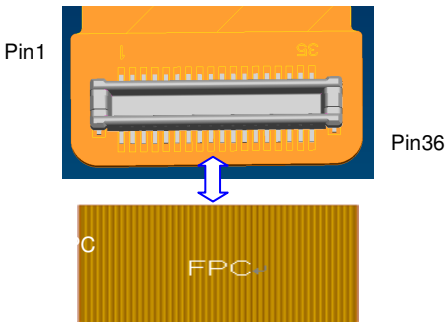
Note (1) The specified power consumption (with converter efficiency) is under the conditions at **VDD = 3.3 V, VCC = 1.8V, fv = 60 Hz, Brightness = 300nits, I_{F_LED} = 19mA** and Ta = 25 ± 2 ºC, whereas Mosaic pattern is displayed.

2. MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	105.42	105.62	105.82	mm	(1)
	Vertical (V)	163.07	163.27	163.47	mm	
	Thickness (T)			2.4 (w/o PCBA) 3.95 (w/ PCBA)	mm	
Bezel Area (CF Polarizer)	Horizontal	97.15	97.35	97.55	mm	
	Vertical	153.62	153.82	154.02	mm	
Active Area	Horizontal		94.2		mm	
	Vertical		150.72		mm	
Weight		-	-	90	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2.1 CONNECTOR TYPE



Please refer Appendix Outline Drawing for detail design.

Connector Part No.: **Panasonic AXT636124**

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

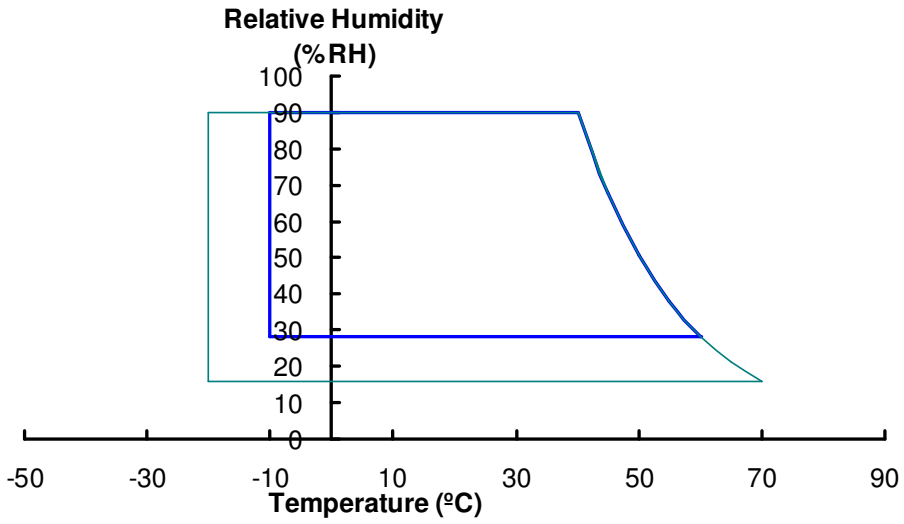
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+70	ºC	(1)
Operating Ambient Temperature	T_{OP}	-10	+60	ºC	(1), (2)
Anode for Light bar	Anode	(-2.4)	(32)	V	(1)
Cathode for Light bar	Cathode	(-2.4)	(32)	V	(1)

Note (1) (a) 90 %RH Max. (Ta <= 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel surface should be -10 ºC min. and 70 ºC max.



3.2 ELECTRICAL ABSOLUTE RATINGS

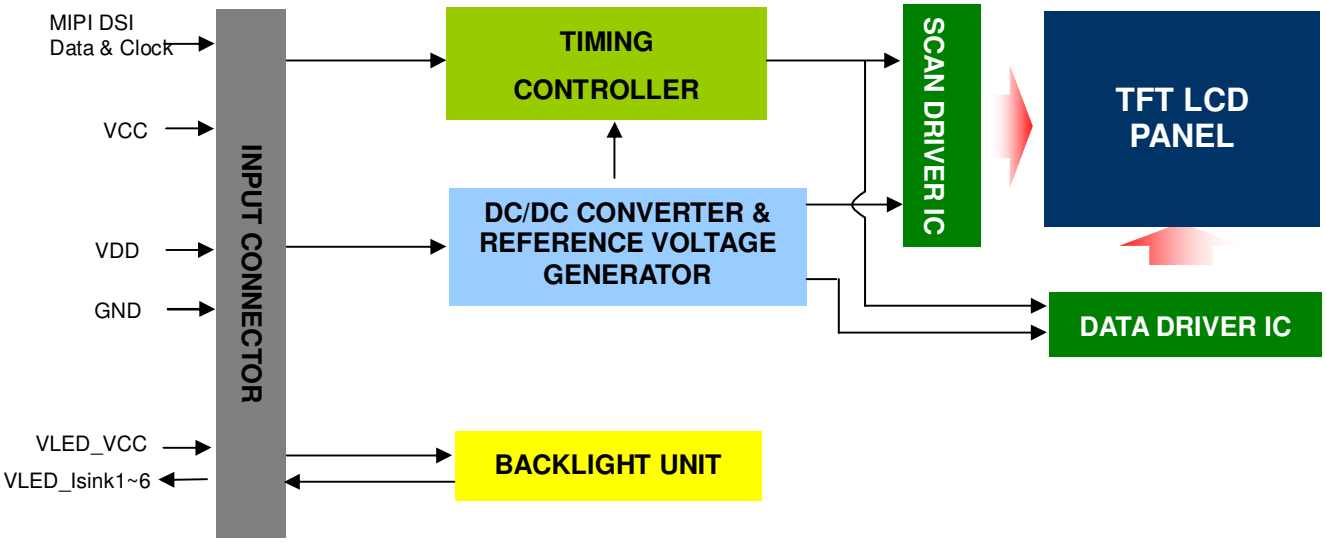
3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	**VDD**	**-0.3**	**+5.0**	**V**	(1)
	VCC	**-0.3**	**+2.0**	**V**	(1)

Note (1) Stresses beyond those listed in above “ELECTRICAL ABSOLUTE RATINGS” may cause permanent damage to the device. Normal operation should be restricted to the conditions described in “ELECTRICAL CHARACTERISTICS”.

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



4.2. INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin No	Symbol	I/O	Function	Remark
1	GND	P	Grounding for digital circuit	
2	VDD (3.3V)	P	Power supply for digital circuit	
3	D0N	I	MIPI lane0 negative	
4	VDD (3.3V)	P	Power supply for digital circuit	
5	D0P	I	MIPI lane0 positive	
6	VDD (3.3V)	P	Power supply for digital circuit	
7	GND	P	Grounding for digital circuit	
8	GND	P	Grounding for digital circuit	
9	D1N	I	MIPI lane1 negative	
10	VCC (1.8V)	P	VCC LDO output for internal digital circuit use	
11	D1P	I	MIPI lane1 positive	
12	VCC (1.8V)	P	VCC LDO output for internal digital circuit use	
13	GND	P	Grounding for digital circuit	
14	GND	P	Grounding for digital circuit	
15	CLKN	I	MIPI CLK input negative	
16	ANODE	P	Power for LED BL anode	
17	CLKP	I	MIPI CLK input positive	
18	ANODE	P	Power for LED BL anode	
19	GND	P	Grounding for digital circuit	
20	NC	I	BIST pattern	Note2
21	D2N	I	MIPI lane2 negative	
22	CATHODE1	P	LED string 1 cathode	
23	D2P	I	MIPI lane2 positive	
24	CATHODE2	P	LED string 2 cathode	
25	GND	P	Grounding for digital circuit	
26	CATHODE3	P	LED string 3 cathode	

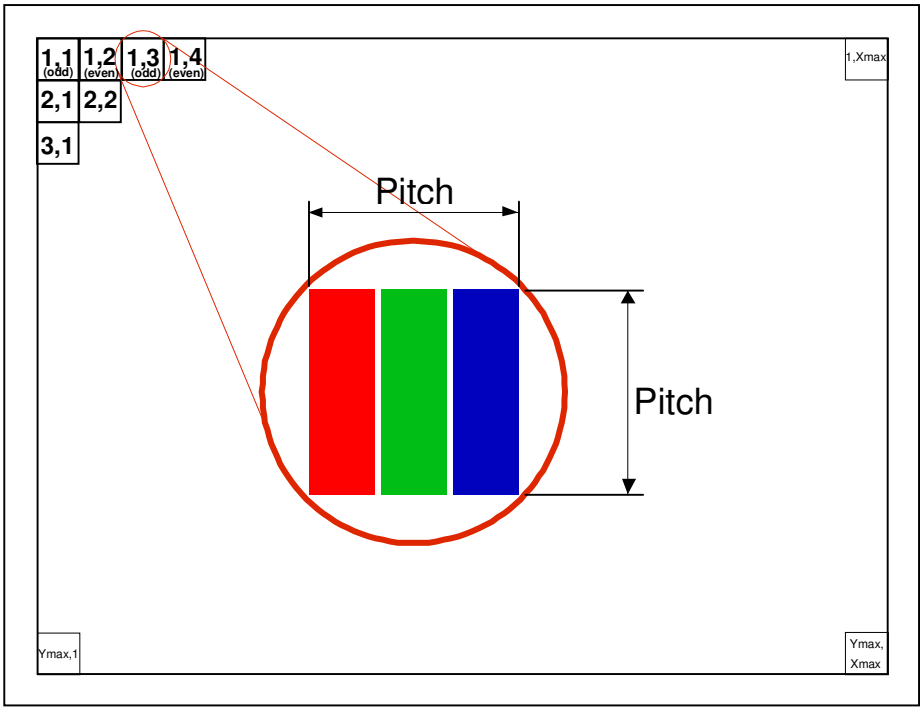
27	D3N	I	MIPI lane3 negative	
28	CATHODE4	P	LED string 4 cathode	
29	D3P	I	MIPI lane3 positive	
30	CATHODE5	P	LED string 5 cathode	
31	GND	P	Grounding for digital circuit	
32	CATHODE6	P	LED string 6 cathode	
33	LED_EN	I	LEDON / LEDPWM signal on/off control.	
34	GND		Grounding for digital circuit	
35	LED_PWN	O	PWM type control signal for brightness of the LED backlight.	
36	LED_ON	O	It is a LED driver control signal which is used for turning on/off the LED backlight.	

Note (1) The first pixel is odd as shown in the following figure.

Note (2) Normal operation/BIST pattern selection. (Pull UP/ down : R< 10KΩ)

BIST_EN=L, BIST(Clock input is not needed)

BIST_EN=H, Normal operation.



4.3 ELECTRICAL CHARACTERISTICS

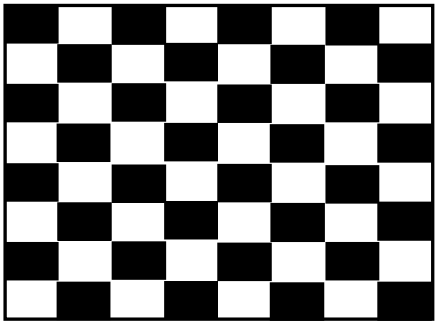
4.3.1 LCD ELETRONICS SPECIFICATION

Item		Symbol	Values			Unit	Remark
			Min.	Typ.	Max.		
Power supply voltage		VDD	3.0	3.3	3.6	V	
		VCC	1.7	1.8	1.9	V	
MIPI supply voltage		Ivcc_IF	1.7	1.8	1.9	V	
VCC High level input voltage		V_{IH2}	0.7 VCC	-	VCC	V	For I/O circuit
VCC Low level input voltage		V_{IL2}	0	-	0.3 VCC	V	
Power Supply Current	White	I_{DD}		**132**		mA	
		I_{Core_VDD}		**35**		mA	

Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) The specified power supply current is under the conditions at VDD = 3.3 V, VCC = 1.8 V, Ta = 25 ± 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. Mosaic Pattern



Active Area

b. White Pattern

Active Area

4.3.2 LED CONVERTER SPECIFICATION

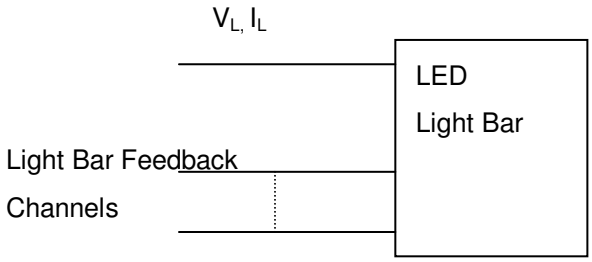
N/A

4.3.3 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V_L	8.4	9	9.9	V	(1)(2)(Duty100%)
LED Light Bar Power Supply Current	I_L	-	114	-	mA	
Power Consumption	P_L	-	1.03	1.13	W	(3)
LED Life Time	L_{BL}	12000	-	-	Hrs	(4)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below :

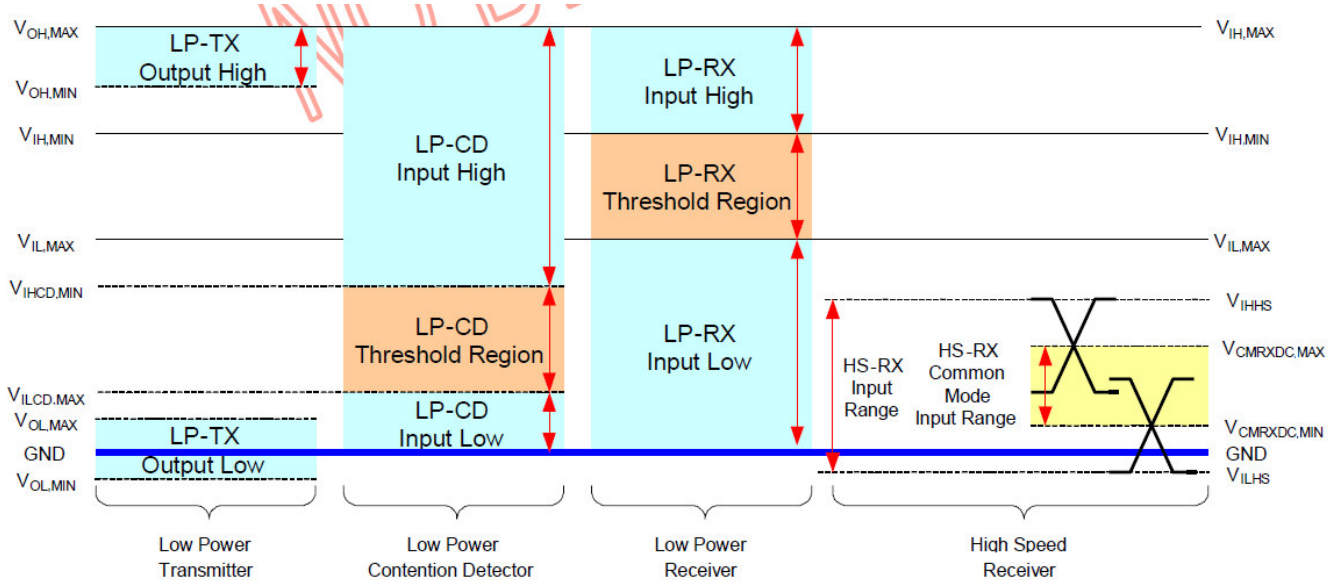


Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$ (Without LED converter transfer efficiency)

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 °C and I_L = 20 mA(Per EA) until the brightness becomes ≦ 50% of its original value.

4.4 MIPI DSI INPUT SIGNAL TIMING SPECIFICATIONS



MIPI DC Diagram

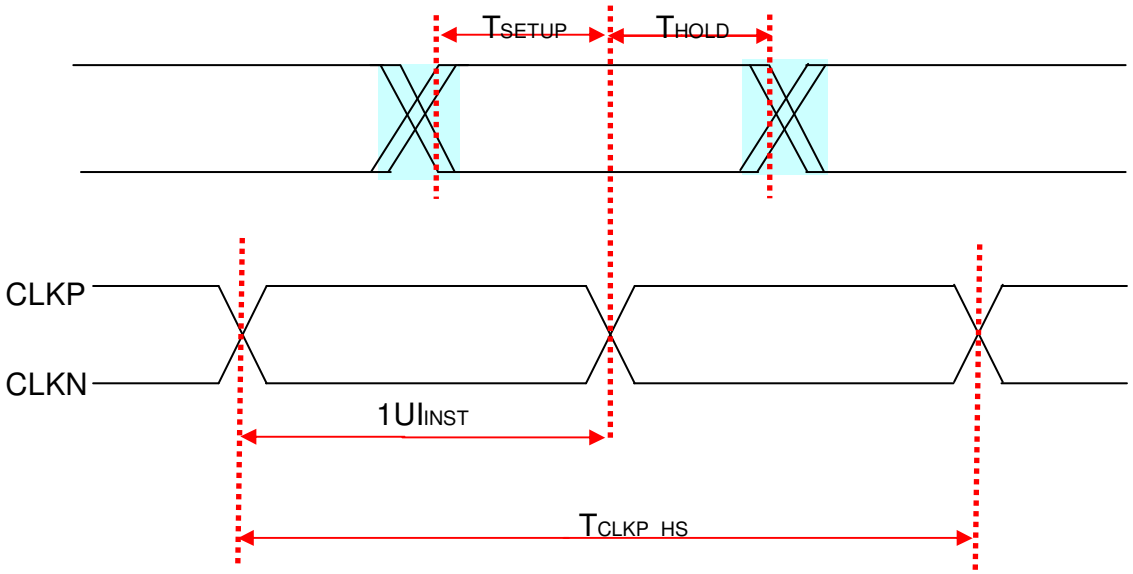
4.4.1 DC Electrical Characteristic

Parameter	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
MIPI Characteristics for High Speed Receiver						
Single-endedl input low voltage	V_{ILHS}	-40	-	-	mV	
Single-endedl input high voltage	V_{IHHS}	-	-	460	mV	
Common-mode voltage	V_{CMRXDC}	155	200	330	mV	
Differential input impedance	Z_{ID}	85	100	115	ohm	
HS transmit differential voltage(V_{OD} = V_{DP} - V_{DN})	$\|V_{OD}\|$	85	200	250	mV	
MIPI Characteristics for Low Power Mode						
Pad signal voltage range	V_I	-50	-	1350	mV	
Ground shift	V_{GNDSH}	-50	-	50	mV	
Logic 0 input threshold	V_{IL}	0	-	500	mV	
Logic 1 input threshold	V_{IH}	1000	-	1350	mV	

4.4.2 AC Electrical Characteristics

HS Transmission

Parameter	Symbol	Min	Typ	Max	Units	Notes
UI instantaneous	UI_{INST}	2	-	5.56	ns	1,2
Data to Clock Skew [measured at tansmitter]	$T_{SKEW[TX]}$	-0.1	-	0.1	ns	3
Data to Clock Setup Time [measured at receiver]	$T_{SETUP[RX]}$	0.55	-	-	ns	4
Data to Clock Hold Time [measured at reciever]	$T_{HOLD[RX]}$	0.55	-	-	ns	4
20% - 80% rise time and fall time	t_R / t_F	150	-	-	ps	
		-	-	0.3	UI_{INST}	



Data to Clock Timing Definitions

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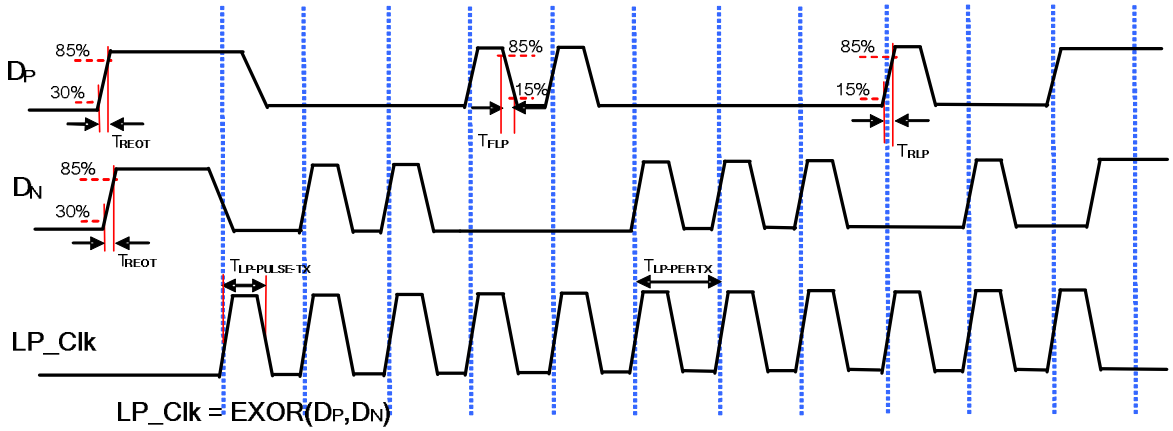
4.4.3 LP Transmission

Parameter	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
15%-85% rise time and fall time	T_{RLP} / T_{FLP}	-	-	35	ns	
30%-85% rise time(from HS to LP)	T_{REOT}	-	-	35	ns	
Pulse width of the LP exclusive-OR clock	$t_{LP-PULSE-TX}$	50	65	-	ns	
Period of the LP exclusive-OR clock	$t_{LP-PRE-TX}$	100	130	-	ns	



4.5 MIPI interface (Mobile Industry Processing Interface)

The Display Serial Interface standard defines protocols between a host processor and peripheral devices that adhere to MIPI Alliance standards for mobile device interfaces. The DSI standard builds on existing standards by adopting pixel formats and command set defined in MIPI Alliance standards.

DSI-compliant peripherals support either of two basic modes of operation: Command Mode and Video Mode.

Note: The product only supports Video Mode operation.

Video Mode refers to operation in which transfers from the host processor to the peripheral take the form of a real-time pixel stream. In normal operation, the display module relies on the host processor to provide image data at sufficient bandwidth to avoid flicker or other visible artifacts in the displayed image. Video information should only be transmitted using High Speed Mode. To reduce complexity and cost, systems that only operate in Video Mode may use a unidirectional data path.

4.5.1 MIPI Lane Configuration

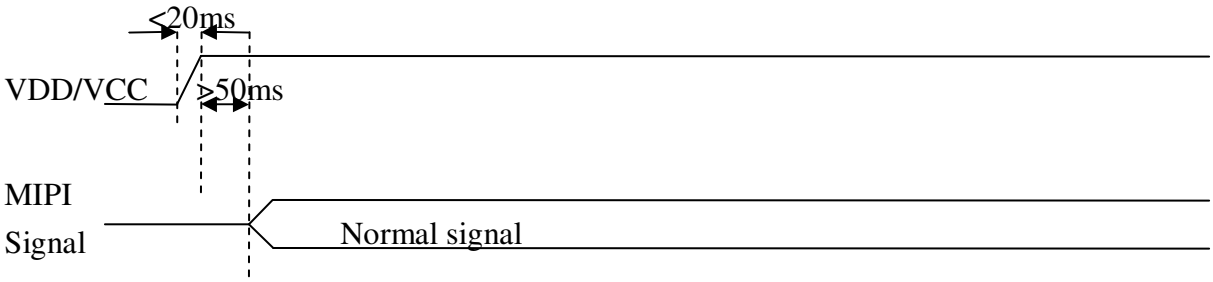
	MCU (Master) Display Module (Slave)
Clock Lane+/-	Unidirectional Lane ■ Clock Only ■ Escape Mode(ULPS Only)
Data Lane0+/-	Bi-directional Lane ■ Forward High-Speed ■ Bi-directional Escape Mode ■ Bi-directional LPDT
Data Lane1+/-	Unidirectional ■ Forward High speed
Data Lane2+/-	Unidirectional ■ Forward High speed
Data Lane3+/-	Unidirectional ■ Forward High speed

The connection between host device and display module is as reference.

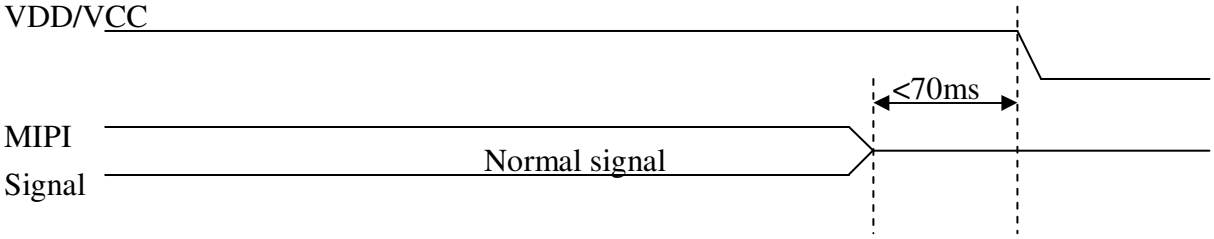
4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram.

a. Power on:



b. Power off:



5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

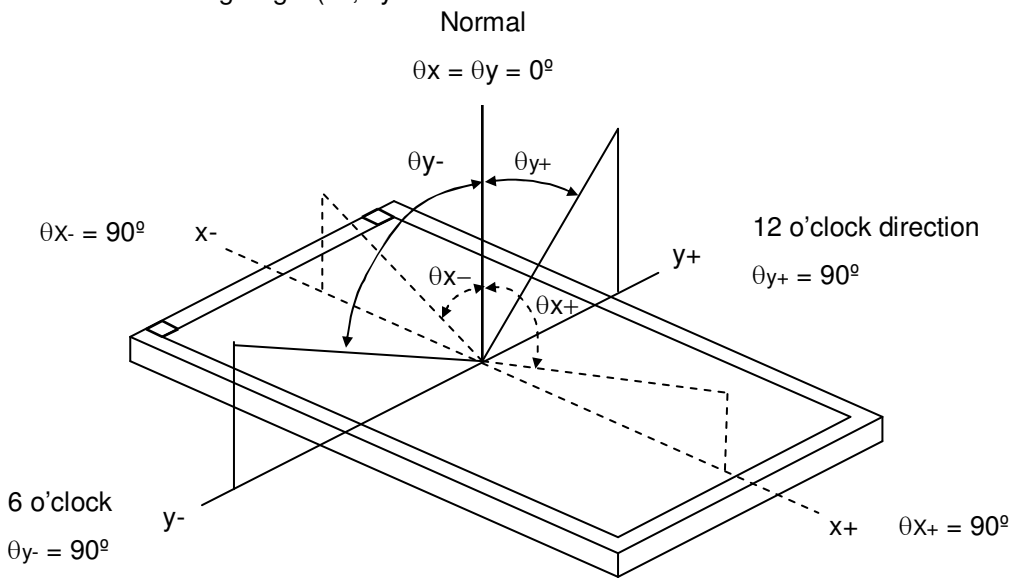
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I_L	114	mA

The measurement methods of optical characteristics are shown in Section 5.2. The following items should be measured under the test conditions described in Section 5.1 and stable environment shown in Note (5).

5.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Normal Angle	700	1000	-	-	(2), (5) ,(7)
Response Time		T_R		-	14	17	ms	(3) ,(7)
		T_F		-	11	14	ms	
CP Luminance of White		L_{CP}		250	300	-	cd/m^2	(4), (6) ,(7)
Color Chromaticity	Red	Rx		Typ – 0.03	TBD	Typ + 0.03	-	(1) ,(7)
		Ry			TBD		-	
	Green	Gx			TBD		-	
		Gy			TBD		-	
	Blue	Bx			TBD		-	
		By			TBD		-	
	White	Wx			0.31		-	
		Wy			0.347		-	
Viewing Angle	Horizontal	θ_x+	CR≥10	85	89		Deg.	(1),(5) , (7)
		θ_x-		85	89	-		
	Vertical	θ_Y+		85	89	-		
		θ_Y-		85	89	-		
White Variation of 9 Points		δW_{9p}	θ_x=0°, θ_Y =0°	70	-	-	%	(5),(6) , (7)

Note (1) Definition of Viewing Angle (θx, θy)



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

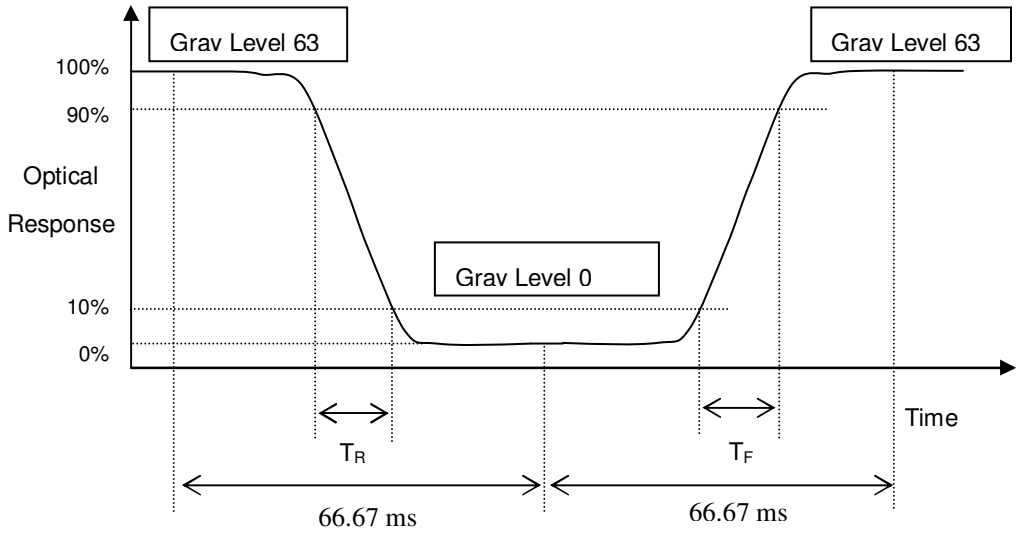
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



Note (4) Definition of Center Point Luminance of White (L_{CP}):

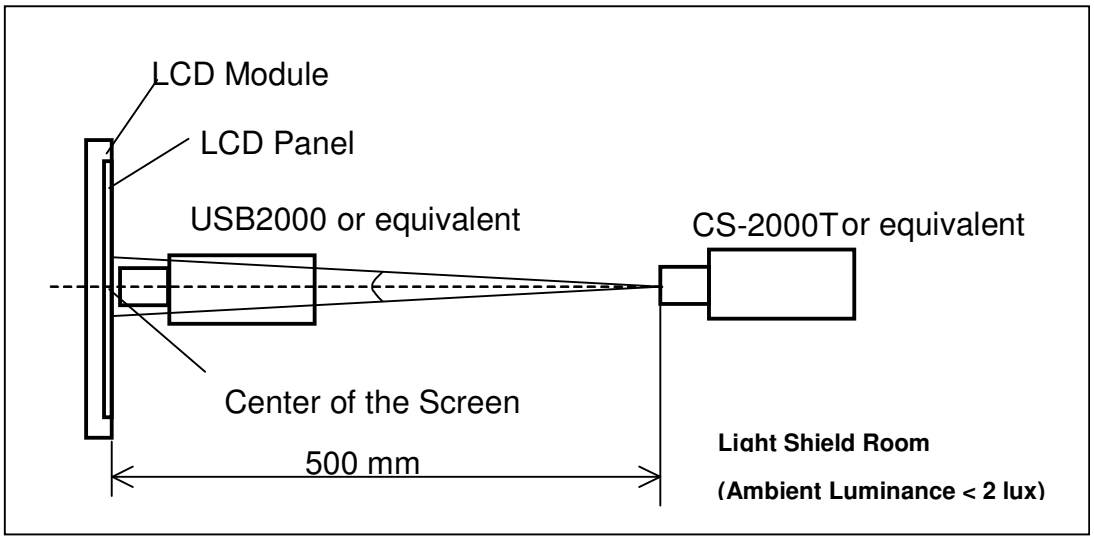
Measure the luminance of gray level 63 at center point

L_{CP} = L(5)

L (x) is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

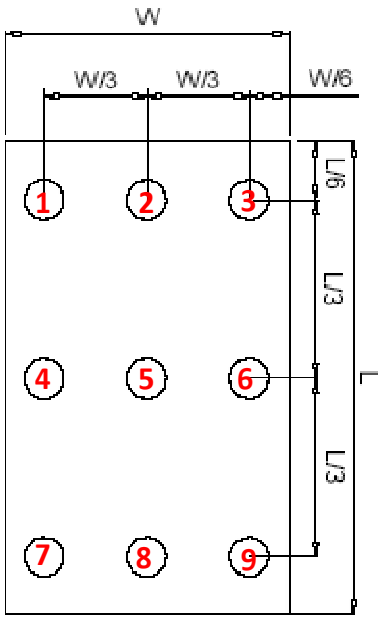
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 9 points

δW_{9p} = {Minimum [L (1) ~ L (9)] / Maximum [L (1) ~ L (9)]}*100%



Ⓧ : Test Point

X=1 to 9

Active area

Note (7) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.

6. RELIABILITY TEST ITEM

Test Item	Test Condition	Note
High Temperature Storage Test	70ºC, 240 hours	(1) (2)
Low Temperature Storage Test	-20ºC, 240 hours	
Thermal Shock Storage Test	-20ºC, 0.5hour←→70℃, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	60ºC, 240 hours	
Low Temperature Operation Test	-10ºC, 240 hours	
High Temperature & High Humidity Operation Test	60ºC, RH 90%, 240hours	
ESD Test (Operation)	150pF, 330Ω, 1sec/cycle Condition 1 : Contact Discharge, ±8KV Condition 2 : Air Discharge, ±15KV	(1)
Shock (Non-Operating)	220G, 2ms, half sine wave,1 time for each direction of ±X,±Y,±Z	(1)(3)
Vibration (Non-Operating)	1.5G / 10-500 Hz, Sine wave, 30 min/cycle, 1cycle for each X, Y, Z	(1)(3)

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

7. PACKING

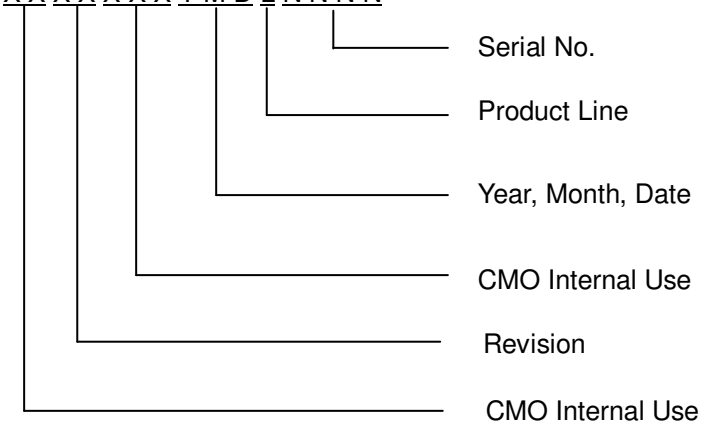
7.1 MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: N070ICE – GB1

(b) Revision: Rev. XX, for example: C1, C2 …etc.

(c) Serial ID: X X X X X X Y M D L N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 0~9, for 2010~2019

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

7.2 CARTON

(1)Box Dimensions : 435(L)*350(W)*275(H)
(2)60 Modules/Carton

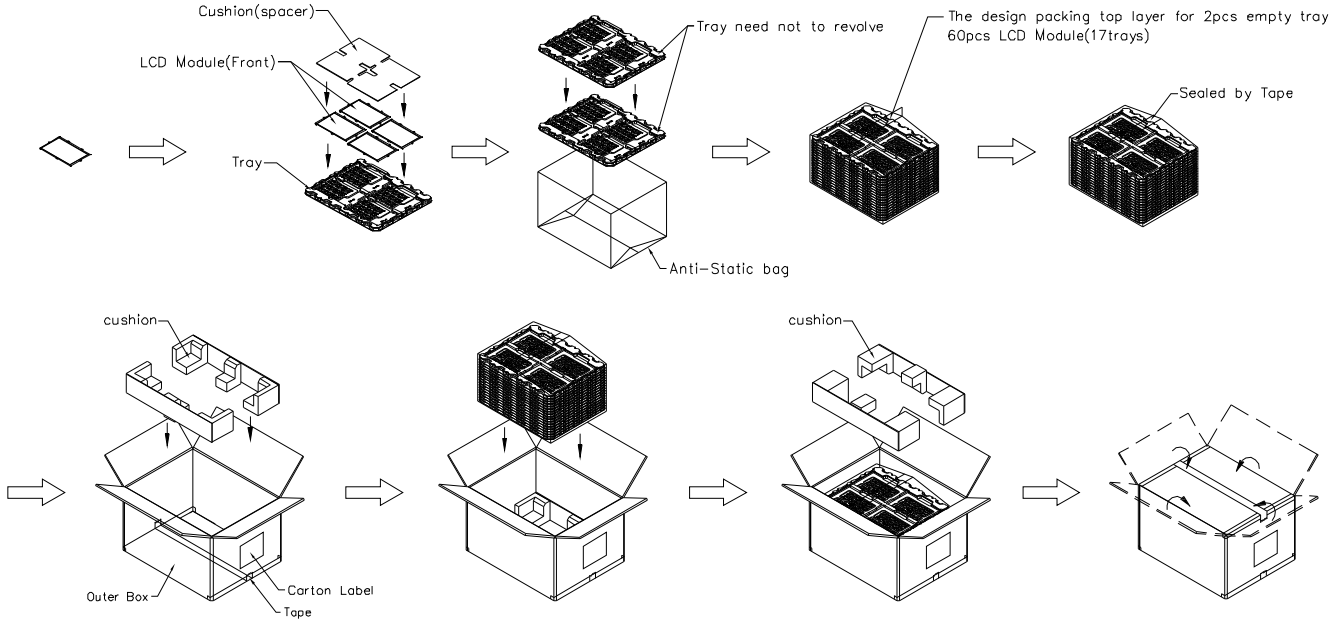


Figure. 7-2 Packing

7.3 PALLET

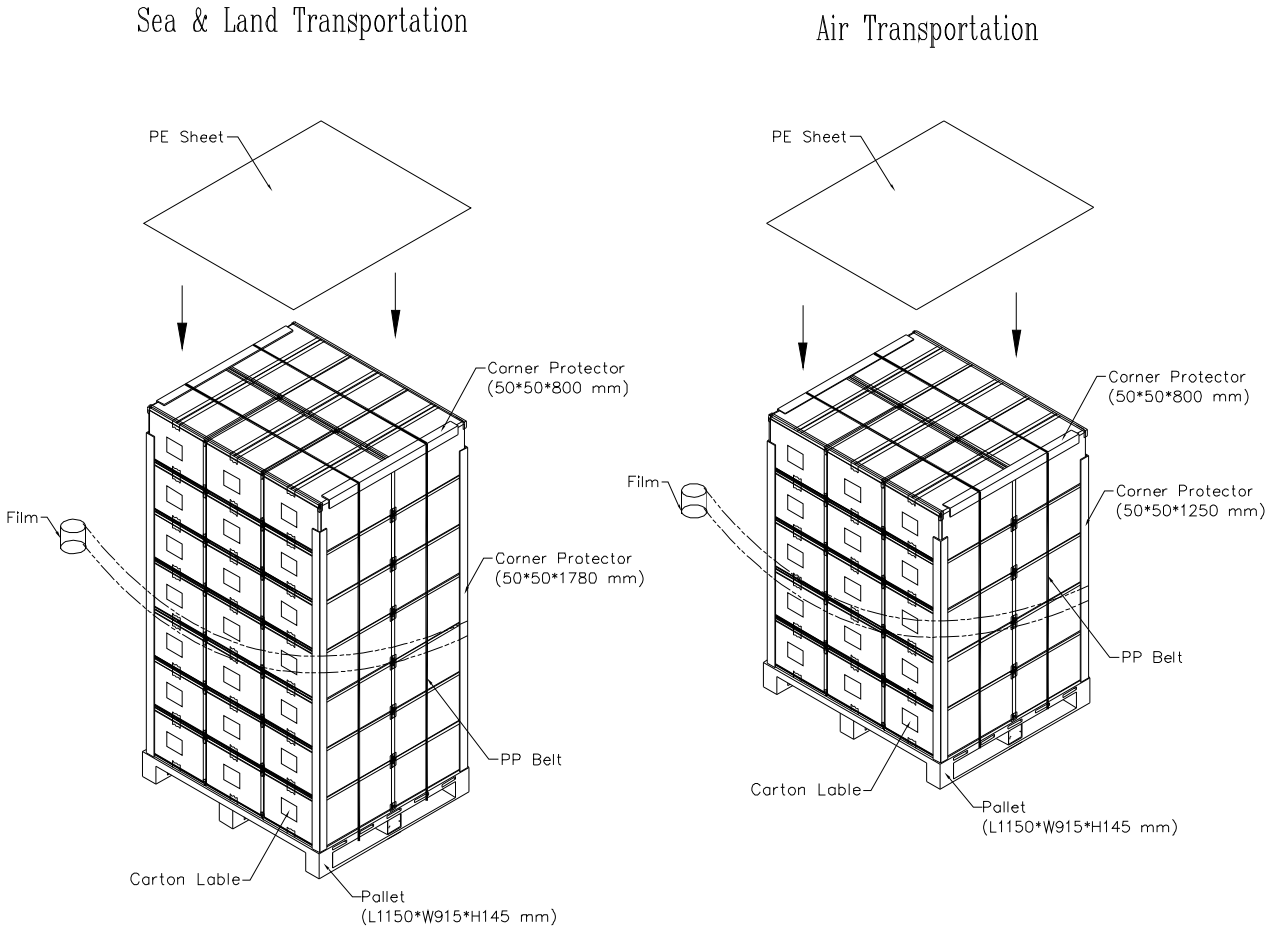


Figure. 7-3 Packing

8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the LED wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of LED will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

Appendix. EDID DATA STRUCTURE

N/A

Appendix. OUTLINE DRAWING