TFT LCD Approval Specification

MODEL NO.: M220Z1-P0A

- CONTENTS -

REVISION HISTORY ---------- 3

1. GENERAL DESCRIPTION ---------- 4
   1.1 OVERVIEW
   1.2 FEATURES
   1.3 APPLICATION
   1.4 GENERAL SPECIFICATIONS
   1.5 MECHANICAL SPECIFICATIONS

2. ABSOLUTE MAXIMUM RATINGS ---------- 6
   2.1 ABSOLUTE RATINGS OF ENVIRONMENT (BASED ON CMO MODULE M220Z1-L0A)
   2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)
   2.3 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)

3. ELECTRICAL CHARACTERISTICS ---------- 8
   3.1 TFT LCD OPEN CELL
   3.2 Vcc POWER DIP CONDITION

4. BLOCK DIAGRAM ---------- 9
   4.1 TFT LCD OPEN CELL

5. INPUT TERMINAL PIN ASSIGNMENT ---------- 11
   5.1 TFT LCD MODULE
   5.2 LVDS DATA MAPPING TABLE
   5.3 COLOR DATA INPUT ASSIGNMENT

6. INTERFACE TIMING ---------- 14
   6.1 INPUT SIGNAL TIMING SPECIFICATIONS
   6.2 POWER ON/OFF SEQUENCE

7. OPTICAL CHARACTERISTICS ---------- 17
   7.1 TEST CONDITIONS
   7.2 OPTICAL SPECIFICATIONS
   7.3 FLICKER ADJUSTMENT

8. PACKAGING ---------- 23
   8.1 PACKING SPECIFICATIONS
   8.2 PACKING METHOD

9. DEFINITION OF LABELS ---------- 25
   9.1 OPEN CELL LABEL
   9.2 CARTON LABEL

10. RELIABILITY TEST ---------- 26

11. PRECAUTIONS ---------- 27
   11.1 ASSEMBLY AND HANDLING PRECAUTIONS
   11.2 SAFETY PRECAUTIONS
   11.3 OTHER

12. MECHANICAL DRAWING ---------- 27

REVISION HISTORY

Version	Date	Section	Description
Ver. 2.0	May, 21 '09	-	M220Z1-P0A Approval Specifications was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The M220Z1-P0A is a 22-inch wide TFT LCD cell with driver ICs and a 30-pins-2ch-LVDS circuit board. The product supports 1680 x 1050 WSXGA+ (16:10 wide screen) mode and can display up to 16.7M colors. The backlight unit is not built in. The inverter module for the Backlight Unit is not built in.

1.2 FEATURES

- Super wide viewing angle
- High contrast ratio
- Fast response time
- High color saturation
- WSXGA+ (1680 x 1050 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- RoHS Compliance

1.3 APPLICATION

- TFT LCD Monitor
- TFT LCD TV
- Workstation & desktop monitor
- Display terminals for AV application

1.4 GENERAL SPECIFICATI0NS

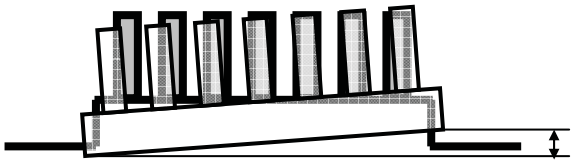
Item	Specification	Unit	Note
Diagonal Size	22.0	inch	
Active Area	473.76 (H) x 296.10 (V)	mm	(1)
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1680 x R.G.B. x 1050	pixel	-
Pixel Pitch	0.282 (H) x 0.282 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally White	-	-
Surface Treatment	Hard coating (3H), Anti-glare (Haze 25%)	-	-
Power Consumption	5	Watt	(2)

1.5 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Weight	-	-	615	g	-
I/F connector mounting position	The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.			-	(3)

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

(2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT (BASED ON CMO MODULE M220Z1-L03)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)

2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

High temperature or humidity may reduce the performance of panel. Please store LCD panel within the specified storage conditions.

Storage Condition: With packing.

Storage temperature range: 25±5 ºC.

Storage humidity range: 50±10%RH.

Shelf life: 30days

2.3 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)

Item	Symbol	Value		Unit	Note
		Min	Max		
Power Supply Voltage	V_{CC}	-0.3	+6.0	V	(1)
Logic Input Voltage	Vlogic	-0.3	3.6		

Note (1) Permanent damage might occur if the module is operated at conditions exceeding the maximum values.

3. ELECTRICAL CHARACTERISTICS

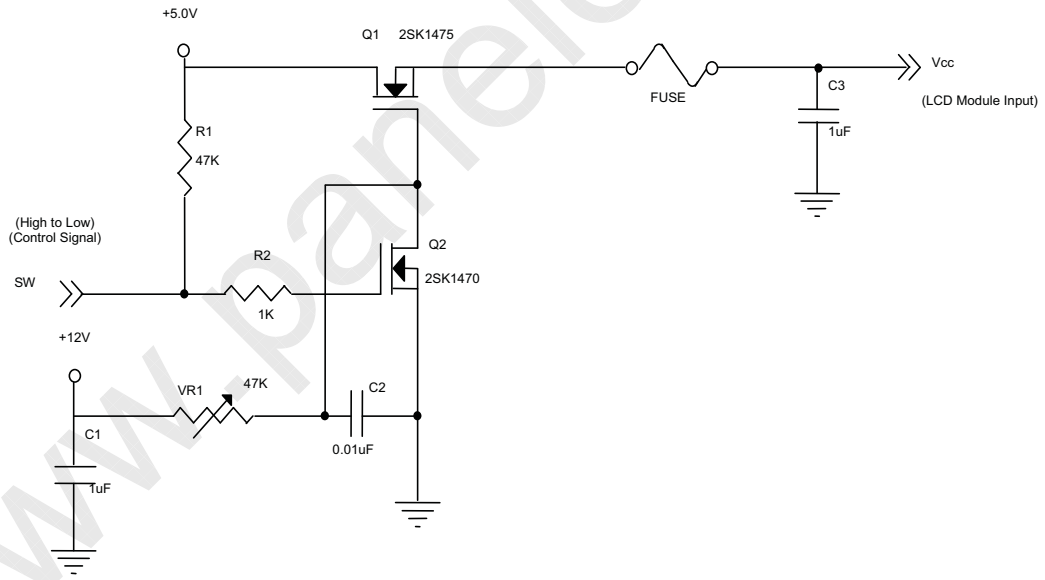
3.1 TFT LCD OPEN CELL

Ta = 25 ± 2 ºC

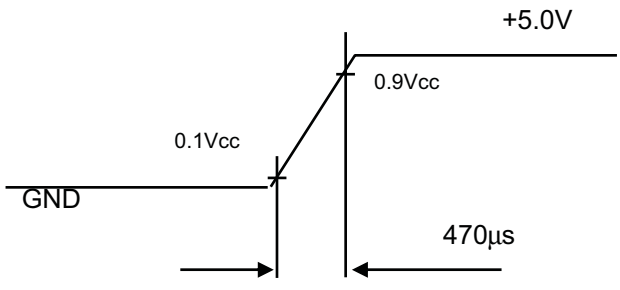
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	4.5	5.0	5.5	V	-
Ripple Voltage		V_{RP}	-	--	100	mV	-
Rush Current		I_{RUSH}	-	--	5	A	(2)
Power Supply Current	White	Icc	-	560	780	mA	(3)a
	Black		-	950	1330	mA	(3)b
	Vertical Stripe		-	920	1290	mA	(3)c
Power Consumption		P_{LCD}	-	4.75	6.7	Watt	(4)
LVDS differential input voltage		Vid	100	-	600	mV	-
LVDS common input voltage		Vic	1.0	1.2	1.4	V	-
Logic High Input Voltage		VIH	2.64	3.3	3.5	V	
Logic Low Input Voltage		VIL			0.66	V	

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:



Vcc rising time is 470µs



Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 ± 2 ºC, F_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

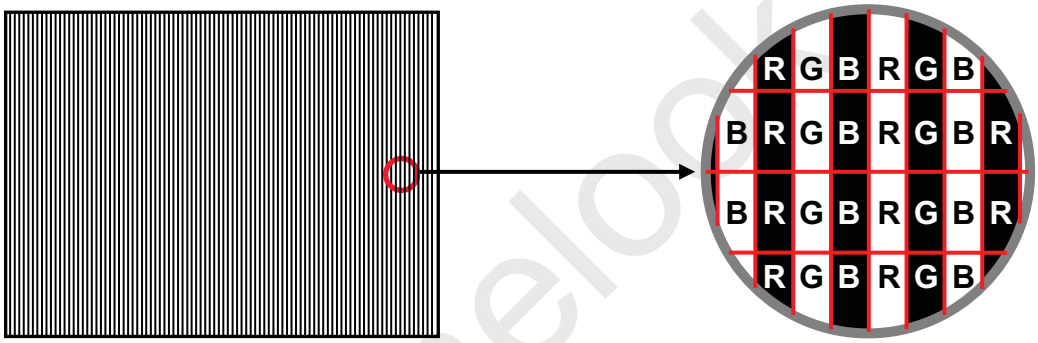
a. White Pattern

Active Area

b. Black Pattern

Active Area

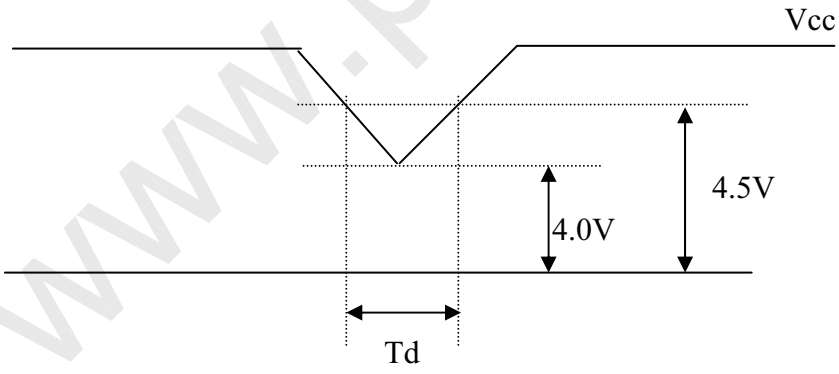
c. Vertical Stripe Pattern



Active Area

Note (4) The power consumption is specified at the pattern with the maximum current.

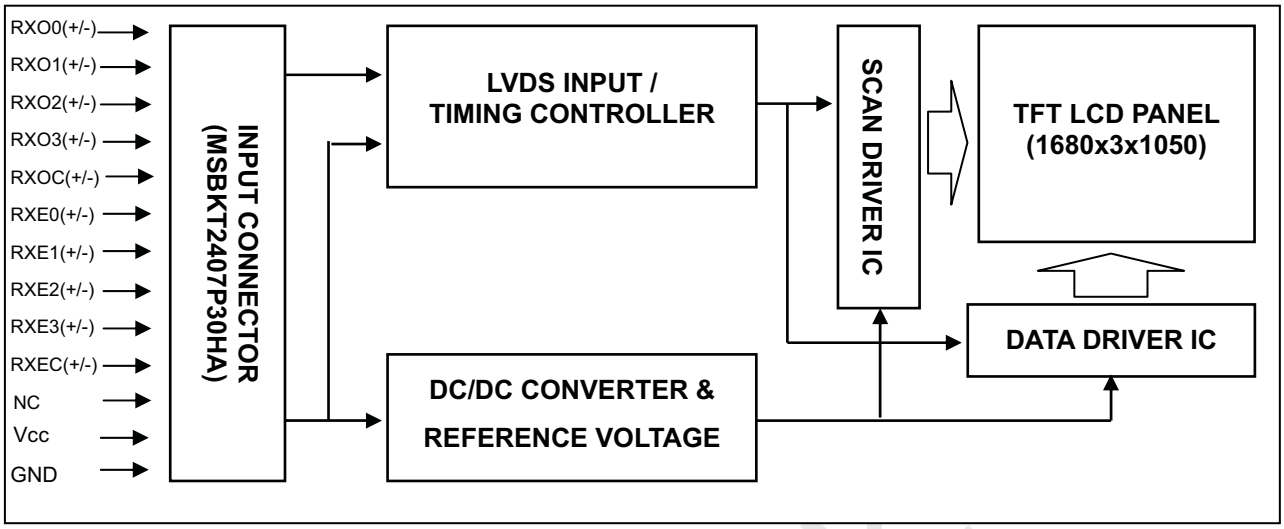
3.2 Vcc Power Dip Condition:



Dip condition: $4.0V \le Vcc \le 4.5V, Td \le 20ms$

4. BLOCK DIAGRAM

4.1 TFT LCD OPEN CELL



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Name	Description
1	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
2	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
3	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
4	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
5	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
6	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RXOC-	Negative LVDS differential clock input. (odd)
9	RXOC+	Positive LVDS differential clock input. (odd)
10	RXO3-	Negative LVDS differential data input. Channel O3(odd)
11	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)
23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	For LCD internal use only, Do not connect
26	NC	For LCD internal use only, Do not connect
27	NC	For LCD internal use only, Do not connect
28	Vcc	+5.0V power supply
29	Vcc	+5.0V power supply
30	Vcc	+5.0V power supply

Note (1) Connector Part No.: MSBKT2407P30HA or FI-XB30SSL-HF(JAE) or EQUIVALENT.

Note (2) The first pixel is odd.

Note (3) Input signal of even and odd clock should be the same timing.

5.2 LVDS DATA MAPPING TABLE

LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6
LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

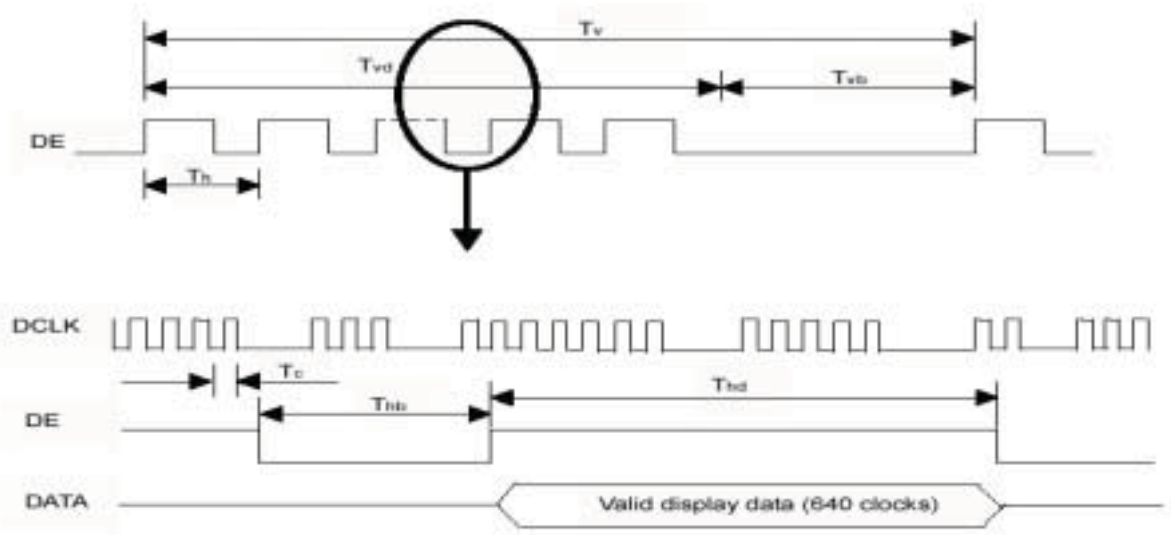
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

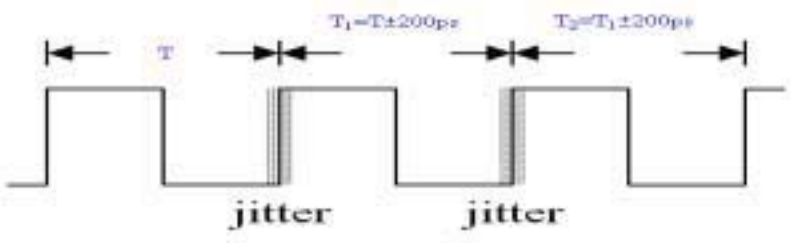
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	49	60	76	MHz	-
	Period	Tc	13	16.7	20	ns	
	Input cycle to cycle jitter	T_{rcl}	-	-	200	ps	(1)
	Spread spectrum modulation range	F_{clkin_mod}	F_{clkin}-2%	-	F_{clkin}+2%	MHz	(2)
	Spread spectrum modulation frequency	F_{SSM}	-	-	200	KHz	
	High Time	Tch	-	4/7	-	Tc	-
	Low Time	Tcl	-	3/7	-	Tc	-
LVDS Data	Setup Time	Tlvs	600	-	-	ps	(3)
	Hold Time	Tlvh	600	-	-	ps	
Vertical Active Display Term	Frame Rate	Fr	50	60	75	Hz	Tv=Tvd+Tvb
	Total	Tv	1077	1080	1090	Th	-
	Display	Tvd	1050	1050	1050	Th	-
	Blank	Tvb	Tv-Tvd	30	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	910	920	929	Tc	Th=Thd+Thb
	Display	Thd	840	840	840	Tc	-
	Blank	Thb	Th-Thd	80	Th-Thd	Tc	-

Note: Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

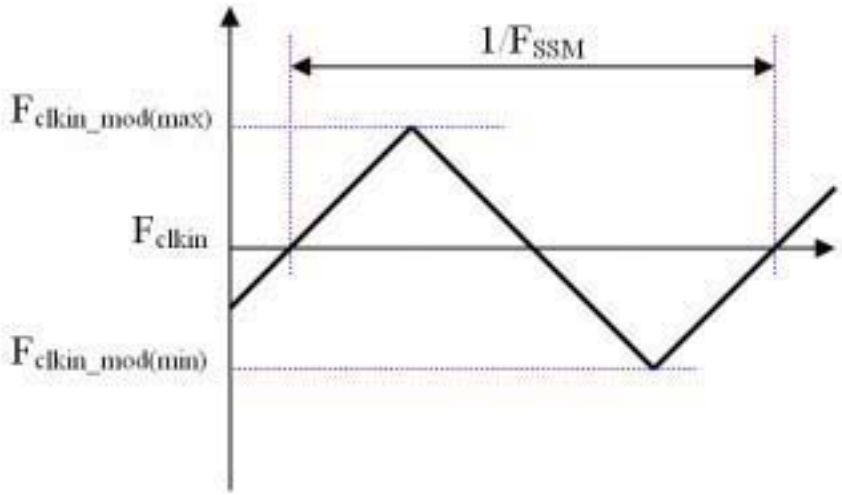
INPUT SIGNAL TIMING DIAGRAM



Note (1) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T_1 – TI

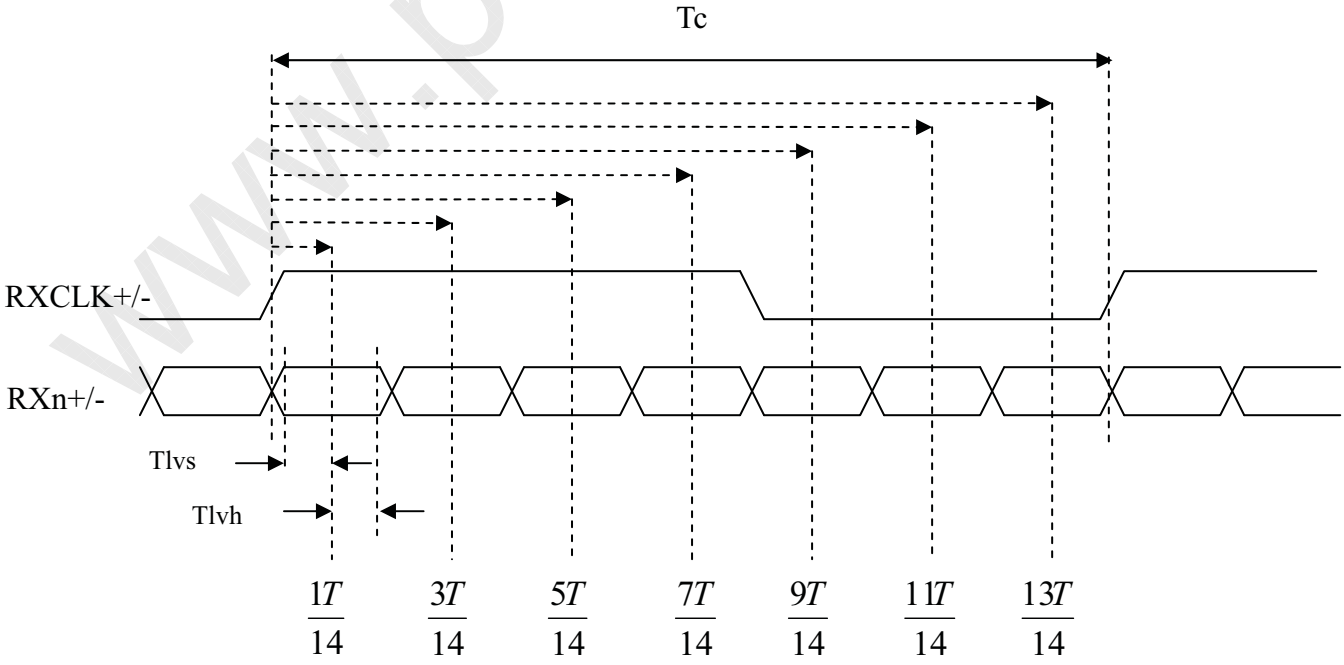


Note (2) The SSCG (Spread spectrum clock generator) is defined as below figures.



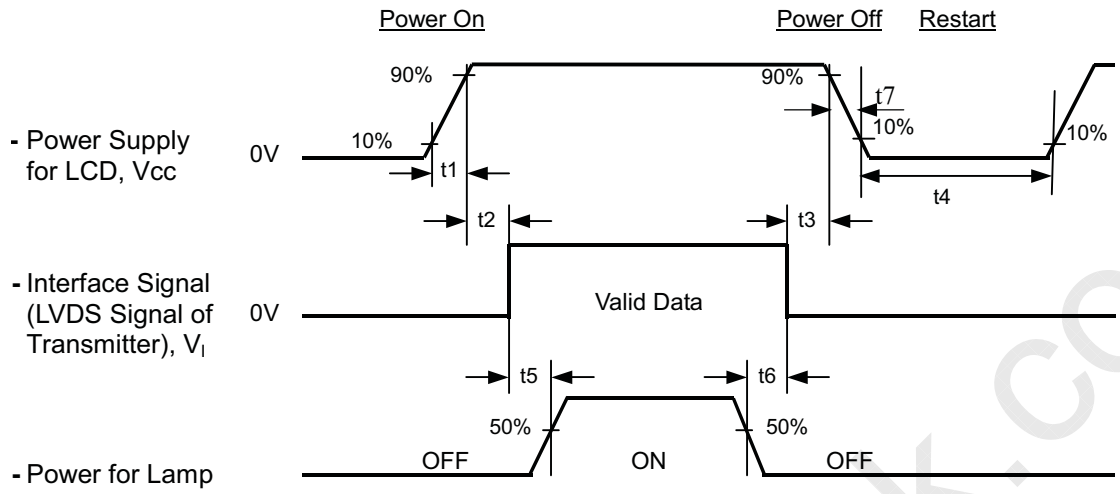
Note (3) The LVDS timing diagram and setup/hold time is defined and showing as the following figures.

LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	8.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	7.5 ±0.5	mA
Inverter Driving Frequency	F_L	55 ±5	KHz

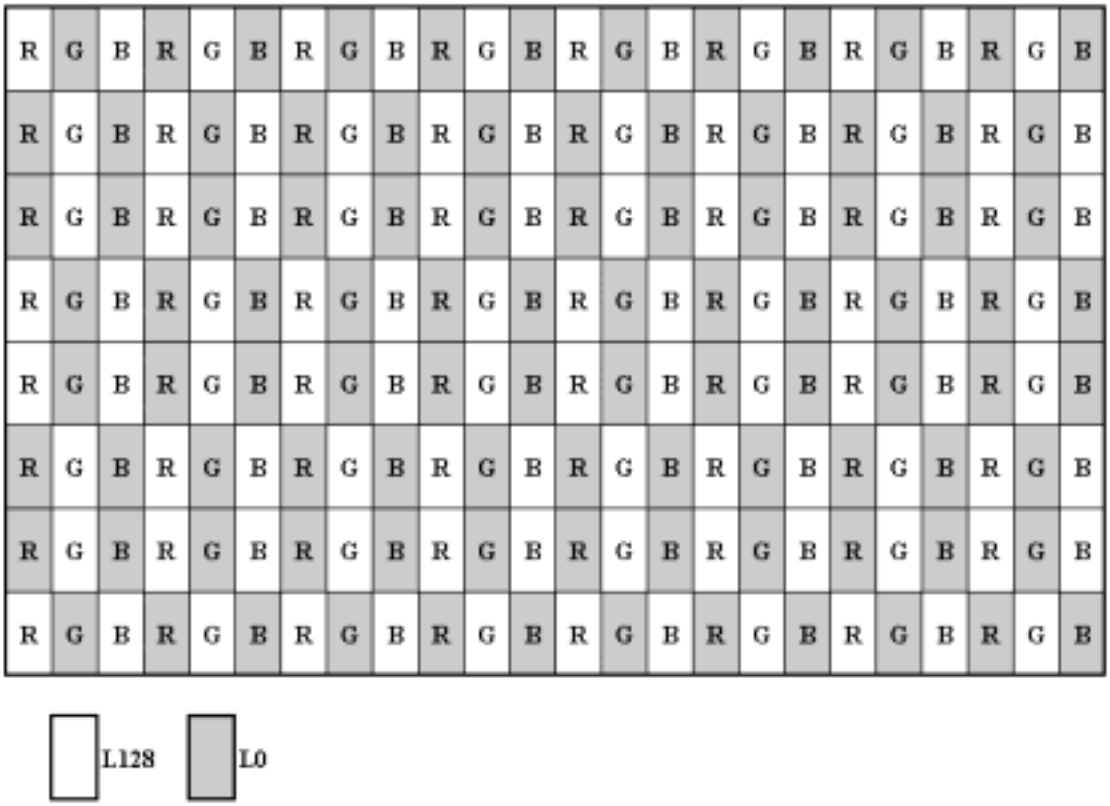
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown as below. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rcx	θ_x=0°, θ_Y =0° CS-1000T Standard light source "C"	Typ - 0.03	0.658	Typ + 0.03	-	(0),(6)
		Rcy			0.328		-	
	Green	Gcx			0.272		-	
		Gcy			0.600		-	
	Blue	Bcx			0.143		-	
		Bcy			0.093		-	
	White	Wcx			0.323		-	
		Wcy			0.365		-	
Center Transmittance		T%	θ_x=0°, θ_Y =0° CS-1000T, CMO BLU	5.9	6.5	-	%	(1), (5)
Contrast Ratio		CR		700	1000	-	-	(1), (3)
Response Time		T_R	θ_x=0°, θ_Y =0°	-	1.3	2.2	ms	(4)
		T_F		-	3.7	5.8	ms	
Transmittance uniformity		δT%	θ_x=0°, θ_Y =0° CS-1000T	-	1.33	-	-	(1), (7)
Viewing Angle	Horizontal	θ_x+	CR≥10 BM-5A	75	85	-	Deg.	(1), (2) (6)
		θ_x-		75	85	-		
	Vertical	θ_Y+		70	80	-		
		θ_Y-		70	80	-		

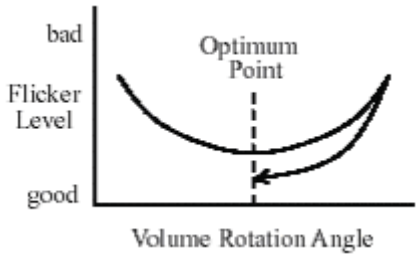
7.3 Flicker Adjustment

(1) Adjustment Pattern: 2H1V checker pattern as follows.



(2) Adjustment Method:

Flicker should be adjusted by turning the volume of Vcom. It is adjusted to the point with least flickering of the whole screen. After making it surely overrun at once, it should be adjusted to the optimum point.



(3) Connector pin 26 CTL Adjustment Method:

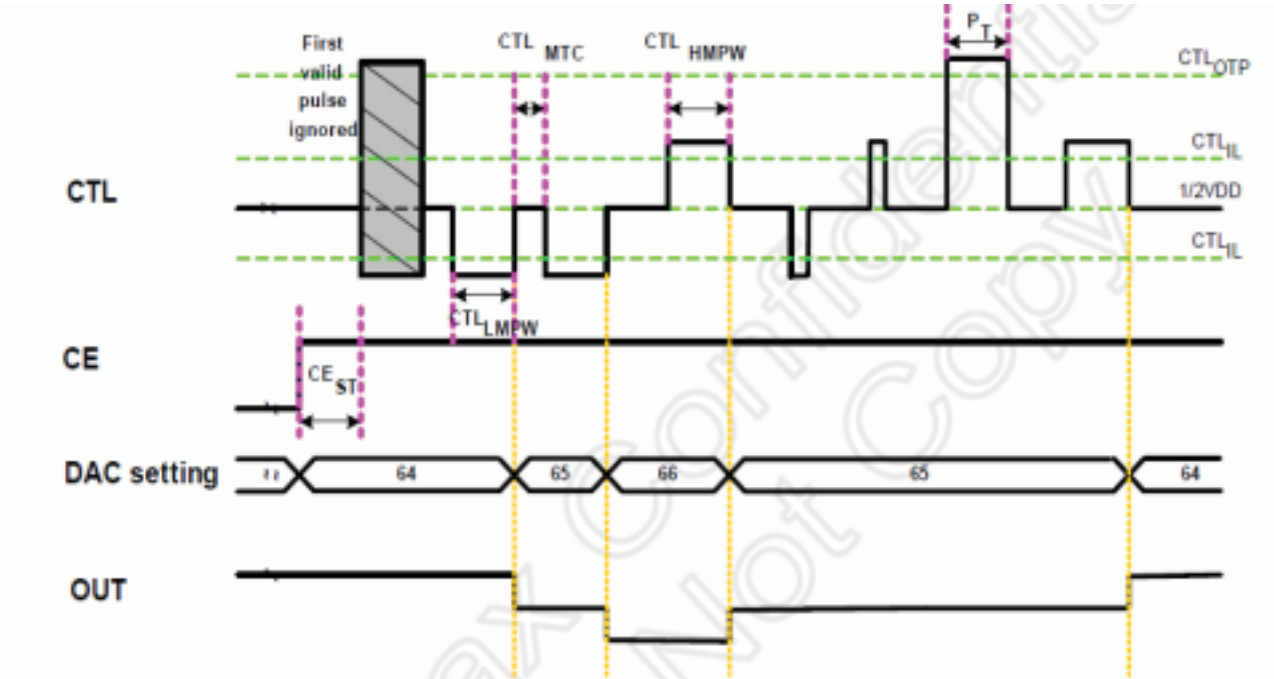


Figure 6. 2

CTL is a pin to control the digital Vcom IC. There are three voltage levels to control this IC.

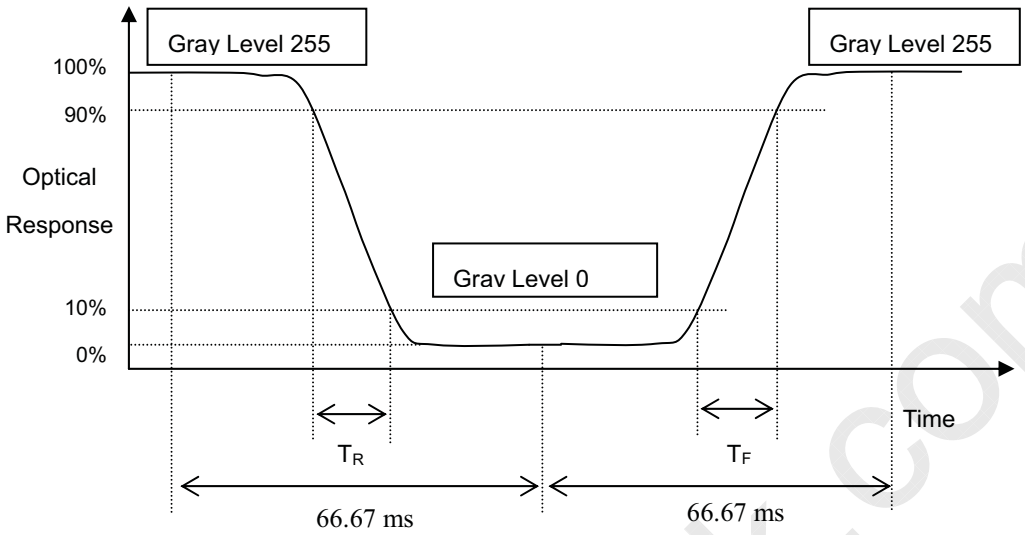
1. Give 0.8VDD~VDD (2.64~3.3V) voltage level can increase the counter value (+1) internal IC. So, Vcom value can be added. This voltage pulse must be greater than 300us.

2. Give 0~0.2VDD (0~0.66V) voltage level can decrease the counter value (-1) internal IC. So, Vcom value can be reduced .This voltage pulse must be greater than 300us.

3. Give 6.5~6.9V voltage level can write data into memory cells internal IC. So, Vcom value can be saved into the digital Vcom IC. This voltage pulse must be greater than 300us.

Note: the memory cells internal IC can be written only 30 times.

Note (4) Definition of Response Time (T_R, T_F):



Note (5) Definition of Transmittance (T%):

Module is without signal input.

$$\frac{\text{Luminance of LCD module } L(5)}{}$$

L (X) and L_{BLU}(X)is corresponding to the luminance of the point X at Figure in Note (7).

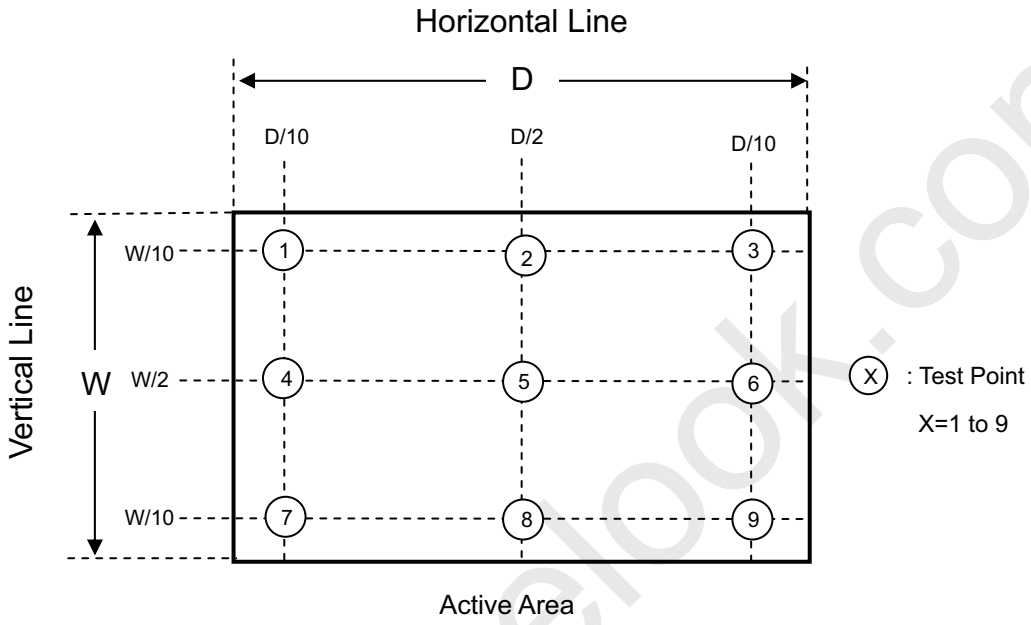
Note (6) Measurement Setup:

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 (7) Definition of Transmittance Variation (δT%):

Measure the transmittance at 9 points

$$\delta T\% = \frac{\text{Maximum [L (1), L (2),.....L (12), L (9)]}}{\text{Minimum [L (1), L (2),..... ....L (12), L (9)]}}$$



8. PACKAGING

8.1 PACKING SPECIFICATIONS

(1) 15 open cells / 1 Box

(2) Box dimensions: 625 (L) X 550 (W) X 385 (H) mm

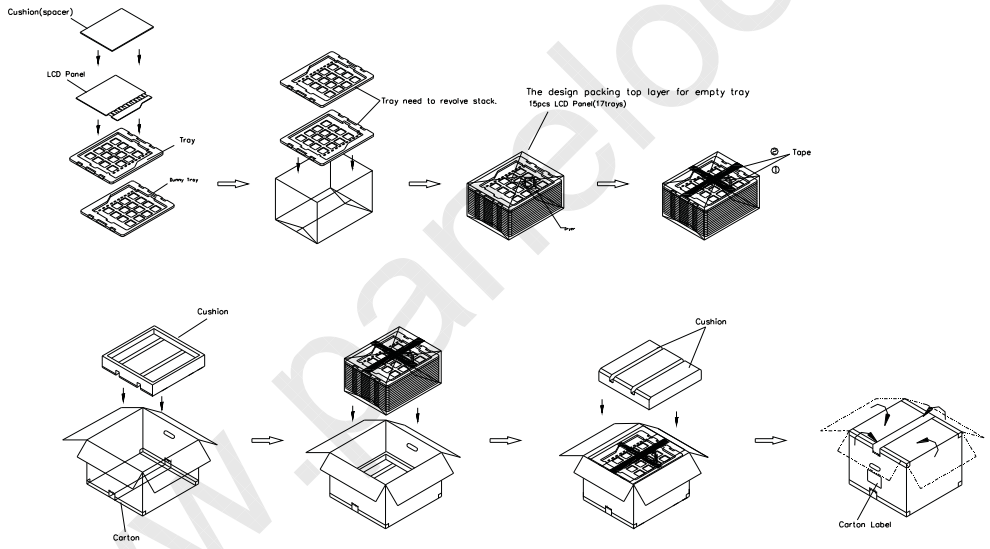
(3) Weight: approximately 17.6Kg (15 open cells per box)

8.2 PACKING METHOD

(1) Carton Packing should have no failure in the following reliability test items.

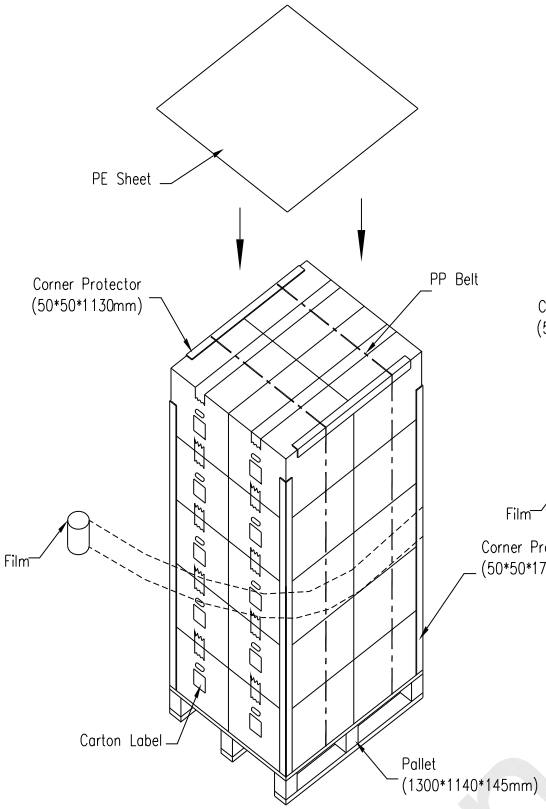
Test Item	Test Conditions	Note
Packing Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation

(2) Packing method.

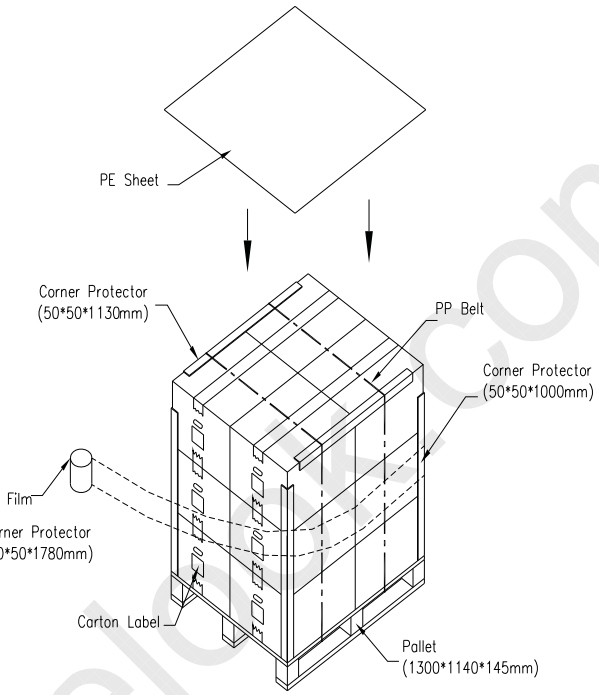


(1) 15 LCD Cells+PCB/1 box
(2) Carton dimensions : 650(L)x550(W)x385(H)mm
(3) Weight :approximately 17.6kg(15 Cells per Carton).

Sea and Land Transportation



Air Transportation



9. DEFINITION OF LABELS

9.1 CMO OPEN CELL LABEL

The barcode nameplate is pasted on each OPEN CELL as illustration for CMO internal control.

Barcode definition:

Serial ID: CM-22Z1A-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	CMO=CM
22Z1A	Model number	M220Z1-P0A=22Z1A
X	Revision code	C1:1 ,C2:2……
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M
X	Gate driver IC code	
XX	Cell location	Tainan, Taiwan=TN
L	Cell line #	1,2,~,9,A,B,~,Y,Z
XX	Module location	Tainan, Taiwan=TN
L	Module line #	1,2,~,9,A,B,~,Y,Z
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4… Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31= 1, 2, 3, ~, 9, A, B, C, ~, T, U, V
NNNN	Serial number	Manufacturing sequence of product

9.2 CARTON LABEL

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

(a) Model Name: M220Z1 –P0A

(b) Carton ID: CMO internal control

(c) Quantities: 15 pcs

10. RELIABILITY TEST

Environment test conditions are listed as following table.

Items	Required Condition	Note

11. PRECAUTIONS

11.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the product during assembly.

(2) To assemble backlight or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It is not permitted to have pressure or impulse on the module because the LCD panel will be damaged.

(4) Always follow the correct power sequence when the product is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

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

(6) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

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

(8) High temperature or humidity may reduce the performance of module. Please store this product within the specified storage conditions.

(9) When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly.

11.2 SAFETY PRECAUTIONS

(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.
If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(2) After the product's end of life, it is not harmful in case of normal operation and storage.

11.3 OTHER

(1) When fixed patterns are displayed for a long time, remnant image is likely to occur.

12. MECHANICAL DRAWING