



Approval

Customer :

DATE : Jun. 25. 2012

SAMSUNG TFT-LCD
MODEL : LT1220MT02-H

Any Modification of Specification is not allowed without SDC's Permission.

NOTE :

Customer's Approval	
SIGNATURE	DATE

APPROVED BY <i>Kang Sang Rae</i>	DATE Jun.25. 2012
PREPARED BY <i>ChangHee Hong</i>	DATE Jun.25. 2012

Application Engineering Group
Samsung Display Co . , LTD.

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*** Revision History**

Date	Rev. No	Page	Summary
Jun. 25. 2012	000	all	First issued

WWW.CANSDISPLAY.COM

General Description

Description

LT1220MT02 –H is a active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit. The resolution of a 22.0" is 1680 x 1050 and this model can display up to 16.7M colors with wide viewing angle of 80° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Transparent Display Monitor, Show window, Kiosk etc.

Features

- RoHS compliance (Pb-free)
- High Transmittance
- TN(Twisted Nematic) mode
- Wide viewing angle ($\pm 160^\circ$)
- High speed response
- WXGA (1680 x 1050 pixels) resolution (16:9)
- Low power consumption
- DE(Data Enable) mode
- Interface –HDMI

Recommend

- Do not use liquid cleaner at LCD surface
- Use cover glass at LCD

General Information

Items	Specification	Unit	Note
Module Size	493.7(H) x 371.0(V)	mm	$\pm 0.5\text{mm}$
	7.0(T1), 22.0(T2)		
Weight	1,300(Max.)	g	
Pixel Pitch	0.282(H) x 0.282(V)	mm	
Active Display Area	473.76(H) x 296.1(V)	mm	
Surface Treatment	Clear LR, Haze 2%		
Display Colors	8 bit – 16.7M	Color	
Number of Pixels	1680(H) x 1050(V)	pixel	
Pixel Arrangement	RGB vertical stripe		
Display Mode	Normally White		

1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	GND-0.5	5.5	V	(1)
Operating temperature	T _{OPR}	0	50	°C	(2)
Storage temperature	T _{STG}	-25	60	°C	
Glass surface temperature (Operation)	Center	T _{CENTER}	0	°C	(2),(5)
	T. Uniformity	ΔT	-	10	
Shock (non - operating)	S _{nop}	-	30	G	(3)
Vibration (non - operating)	V _{nop}	-	1.5	G	(4)

Note (1) Ta= 25 ± 2 °C

(2) Temperature and relative humidity range are shown in the figure below.

- a. 90 % RH Max. (Ta ≤ 40 °C)
- b. Relative Humidity is 90% or less. (Ta > 40°C)
- c. No condensation

- (3) 11ms, sine wave, one time for ±X, ±Y, ±Z axis
- (4) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

Performance Specification

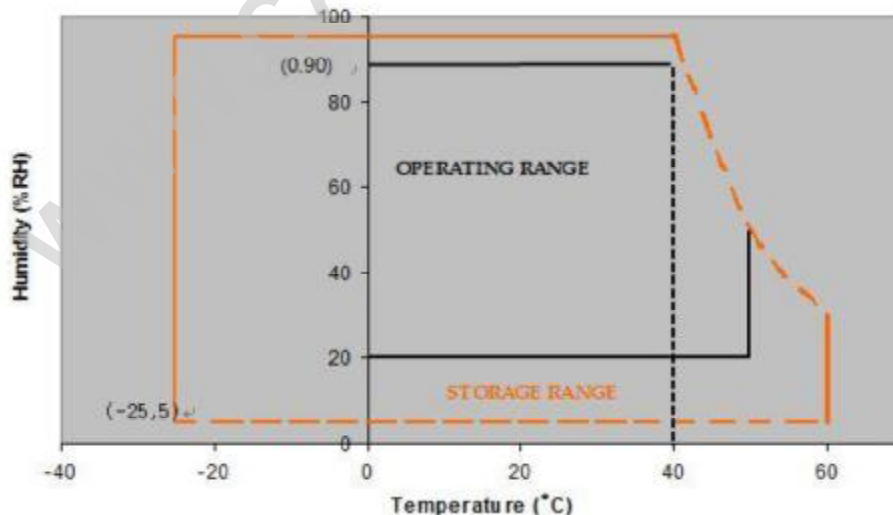
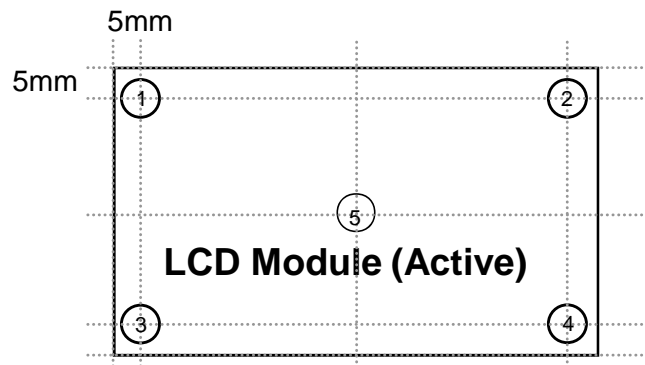


Fig. Temperature and Relative humidity range

(5) Definition of test point



ΔT should be less than $10\text{ }^{\circ}\text{C}$ ($\Delta T = |T_{\text{CENTER}} - T_{\text{CORNER}}|$)

T_{CENTER} : Temperature of the center of the glass surface (Test point 5)

T_{CORNER} : Temperature of each edge of the glass surface (Test point 1~4)

2. Application information for DID (Digital Information Display)

A long-term display like DID application may cause uneven display including image retention. To optimize module's lifetime and function, several operating usages are required.

1. Normal operating condition

- Temperature: $20 \pm 15\text{ }^{\circ}\text{C}$
- Humidity: $55 \pm 20\%$
- Display pattern: moving picture or regular switchover display

Note) Long-term static information image may cause uneven display.

2. Operating usages under abnormal operating condition. Note (1)

- a. Ambient condition
 - Well-ventilated place is recommended to set up DID system.
- b. Power off and screen saver
 - Periodical power-off or screen saver is needed after long-term static display. Note (2)

3. Operating usages to protect uneven display due to long-term static information display

- a. Suitable operating time for E-DID : under 20 hours a day.
- b. Periodical display contents change from static image to moving picture.
 - Liquid crystal refresh time is required.
- c. Periodical background color and character (image) color change
 - Use different colors for background and character (image), respectively.
 - Change colors periodically.
- d. Avoid combination of background and character with large different luminance.

Note (1) Abnormal condition means every operating condition except normal operating condition.

Note (2) Moving picture or black pattern is strongly recommended for screen saver.

4. Lifetime in this spec is guaranteed only when DID is used under right operating usages.

3. Optical Characteristics

The optical characteristics should be measured in a dark room or equivalent.
 Measuring equipment : TOPCON RD-80S,SPECTRORADIOMETER SR-3, Eldim EZ-Contrast)
 * Light Source : D65 Standard Light Source (notice(a))
 (Ta = 25 ± 2°C, VDD = 5V, fv = 60Hz, f_{DCLK} = 59.5MHz, I_L = 100% duty)

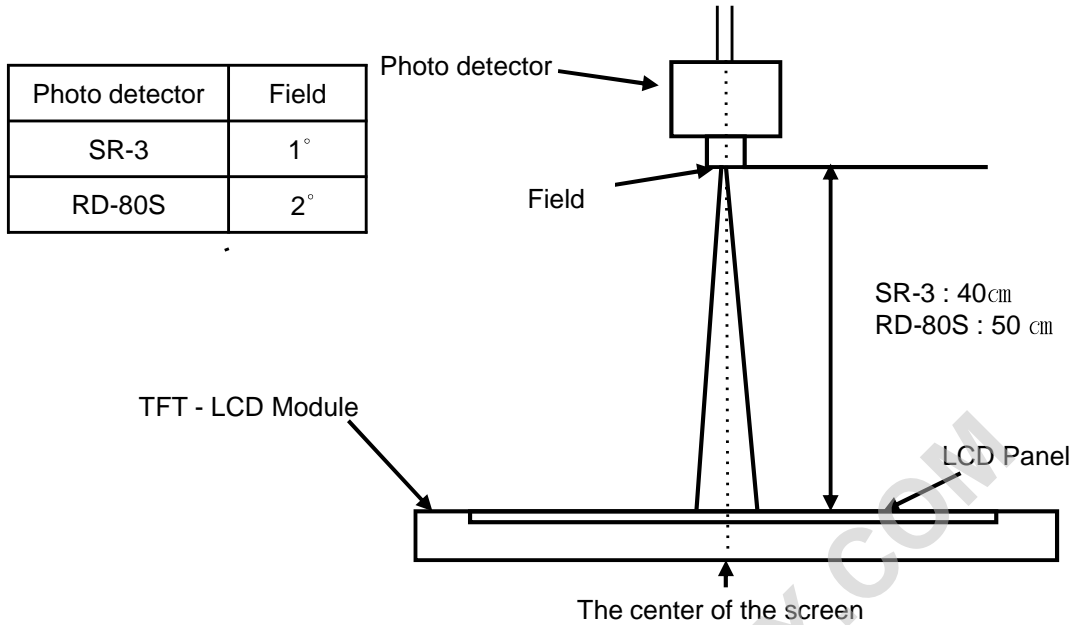
Item		Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R		Normal q _L ,R=0 q _U ,D=0 Viewing Angle	100	500	-		(3) SR-3
Response Time	On/Off	TR	0°C		-	45	55	msec	(5) RD-80S
		+T F	RT		-	5	8		
Transmittance		%			12	15			(4) CA-210
Color Gamut		-			-	5	-	%	-
Viewing Angle	Hor.	q _L		C/R≥10	70	80	-	Degree	(1),(6) SR-3
		q _R			70	80	-		
	Ver.	q _U			50	60	-		
		q _D			70	80	-		

Note (1) Test Equipment Setup

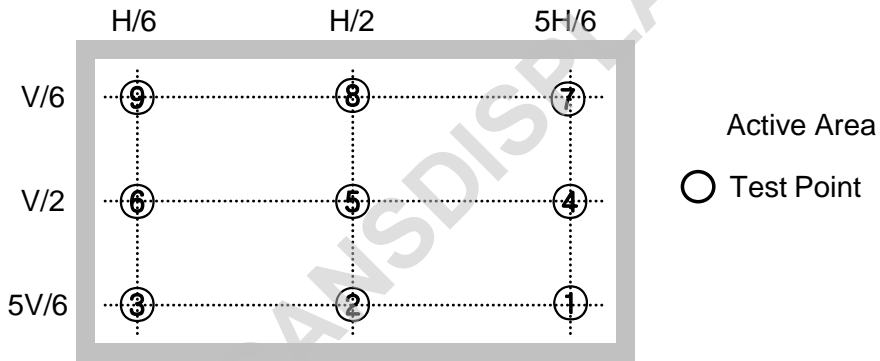
The measurement should be executed in a stable, windless and dark room for 40min and 60min after operating the panel at the given temperature for stabilization of the standard light. (SDC uses the standard luminance of the D65 media.)

Environment condition : Ta = 25 ± 2 °C

※ D65 media has the general light source.
 The temperature of color is 6487K. The coordinate of color is Wx = 0.313 / Wy = 0.329
 Luminance of this product is 7217cd / m²



Note (2) Definition of test point



Note (3) Definition of Contrast Ratio (C/R)

: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G_{max}}{G_{min}}$$

Gmax : Luminance with all pixels white

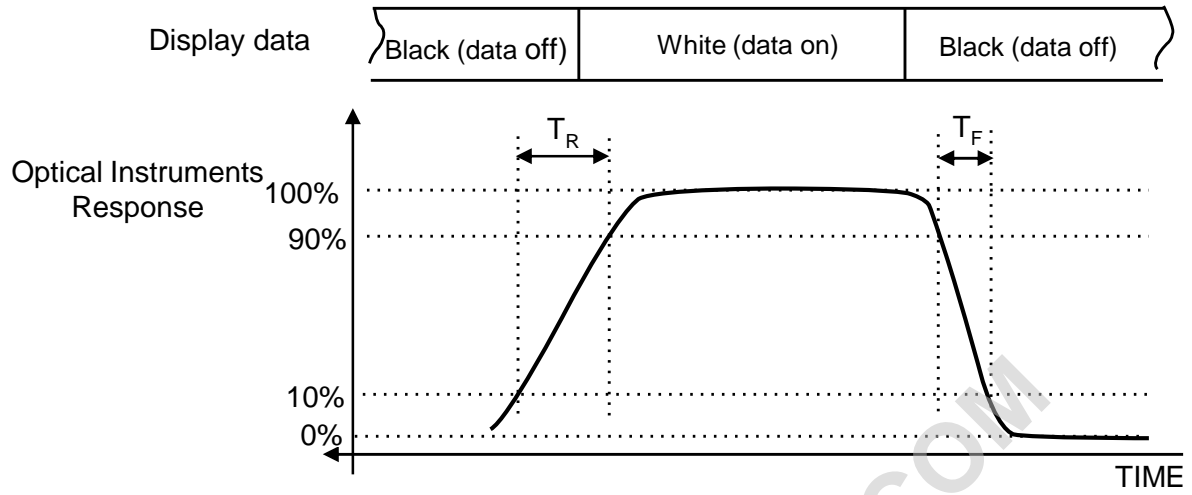
Gmin : Luminance with all pixels black

Note (4) Definition of Transmittance

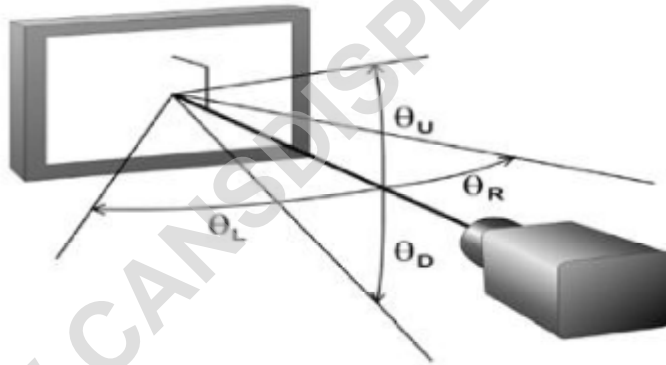
Measure Pattern : Fully white

$$\frac{\text{The intensity of radiation(Output)}}{\text{The intensity of radiation(Input)}} \times 100$$

Note (5) Definition of Response time : Average response time of all Gray to Gray except T_r , T_f



Note (6) Definition of Viewing Angle
: Viewing angle range ($C/R \geq 10$)



4. Electrical Characteristics

4.1 TFT LCD Module

The connector for display data & timing signal should be connected.

Ta = 25°C ± 2 °C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply	V _{DD}	4.5	5.0	5.5	V	(1)
Current of Power Supply	(a) Black	-	1700	2100	mA	(2),(3)
	(b) White	-	1400	1800	mA	
Interface Type	HDMI	HDMI 1.3				(4)
Rush Current	I _{RUSH}	-	-	4	A	(5)

Note (1) The ripple voltage should be controlled under 10% of V_{DD}.

(2) f_v = 60Hz, f_{DCLK} = 59.6 MHz, V_{DD} = 5.0V, DC Current.

(3) Power dissipation check pattern (LCD Module only)

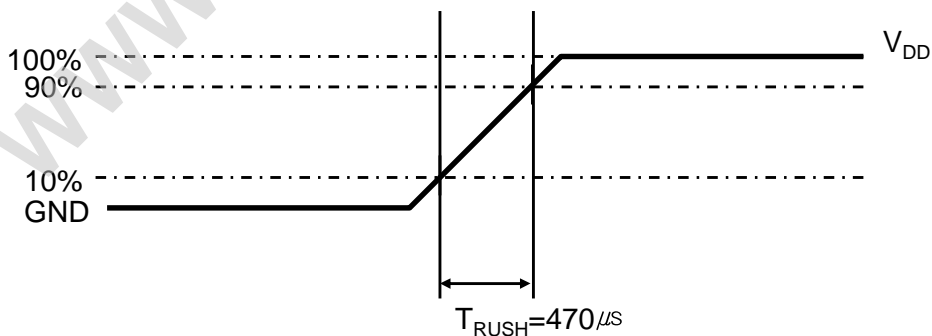
a) Black Pattern

b) White Pattern

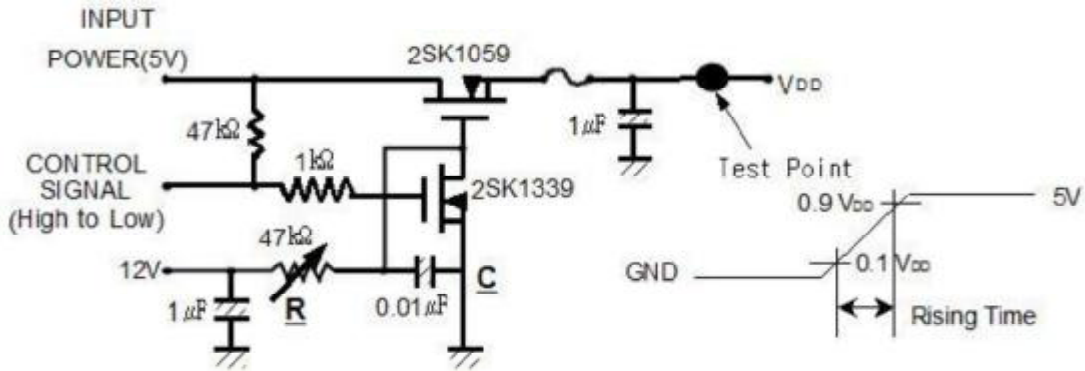


(4) HDMI Version – 1.3 (HDMI Specification - [Http://www.hdmi.org](http://www.hdmi.org))

(5) Measurement Conditions



Rush Current I_{RUSH} can be measured when T_{RUSH} is 470 μ s.

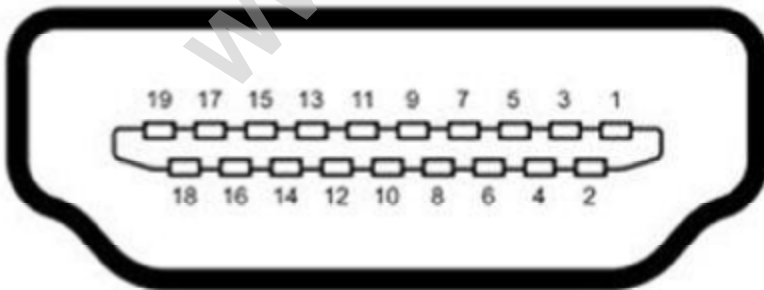


Control Signal : High(+5V) -->Low(Ground)
 All Signal lines to panel except for power 5V : Ground
 The rising time of supplied voltage is controlled to 470us by R and C value.

5. Input Terminal Pin Assignment

5.1 Input Signal & Power : HDMI & 5V DC

PIN No.	Description	PIN No.	Description
1	TMDS data 2+	11	TMDS clock shield
2	TMDS data 2 shield	12	TMDS clock -
3	TMDS data 2-	13	CEC
4	TMDS data 1+	14	No connection
5	TMDS data 1 shield	15	SCL
6	TMDS data 1-	16	SDA
7	TMDS data 0+	17	DDC/CEC Ground
8	TMDS data 0 shield	18	+5V Power
9	TMDS data 0-	19	Hot Plug Detect
10	TMDS clock +		



5V Adapter Specification	
Voltage of power	5V
Current of power	3A
Diameter	4π(External) 1.7π (Internal)



Fig. HDMI Pin(19P) Map and Adapter spec

5.2 HDMI Board Spec

5.2.1 General Feature

NO	Item	SPEC.	RMKS
1	Resolution	WSXGA+ (1680 X 1050)	
2	Control Key	Volume(-), Volume(+)	
3	LED Indicator	① ST-BY: Red ② ON: Green ③ Action : Blink	
4	Power Input	DC +5V	
5	Power consumption	0.25W(ST-BY), 4.5W(MAX Sound Output)	Board Only
6	Outline Dimension	100(H) X 47(V)mm	
7	Operating Temp.	0~50°C	
8	Accessory	Remote Controller	

1) Absolute Maximum ratings

NO	Item	Min.	Typ.	Max.	unit	RMKS	
1	Power Supply Voltage	4.5	5	5.5	V		
2	Current of Power Supply	St-by	-	45	55	mA	W/O LVDS Power
3		ON(Mute)	-	400	500	mA	
4		0.5W+0.5W	-	800	850	A	
6	V ripple				mV		

2) Electrical Characteristic

Item	SPEC.	Unit	RMKS
Power Supply Voltage	5.5	V	Ta=25°C
Storage temperature	-20~+60	°C	
Operation temperature	0~+55	°C	

5.2.2 In / Output Interface

(1) Power Input

[Connector] : GCD01-0082

[Mating Connector] :

Pin No	Function
3	DC5V(+)
other	DC5V(-)

(2) Volume Control switch Input (SW1, SW2)

[Tack Switch] : DJT1101NHA(DAEJIN Switch)

No	Function	
SW1	Volume +	Increase audio output level.
SW2	Volume -	Decrease audio output level.

(3) IR1: IR Input

Pin No	Function
1	Vcc
2	GND
3	IR in

(4) P5: SPEAKER Output

[Connector] : 12505WR-04A00(YEONHO)

[Mating Connector] : 12505HS-04000(YEONHO)

P5	
Pin No	Function
1	OUT1+
2	OUT2-
3	OUT2+
4	OUT1-

5.3 Resolution Support

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5.3.1 DVI Mode

No	Resolution	Dot Clock[MHz]	Frequency		Remark
			H[KHz]	V[Hz]	
1	600*600	43.200	50.000	50.000	600*600 50Hz
2	640*350	25.176	31.468	70.083	640*350 70Hz
3	640*400	21.003	24.826	55.415	720*400 55Hz
4	640*400	25.173	31.468	70.083	720*400 70Hz
5	640*480	25.048	31.465	59.937	480P 60Hz
6	640*480	25.173	31.468	59.941	480P 60Hz
7	640*480	25.175	31.469	59.941	480P 60Hz
8	640*480	25.200	31.500	60.000	480P 60Hz
9	640*480	30.239	35.000	66.666	640*480 67Hz
10	640*480	31.500	37.861	72.809	640*480 73Hz
11	640*480	31.500	37.500	75.000	640*480 75Hz
12	720*400	28.319	31.468	70.083	720*480 70Hz
13	720*400	28.321	31.468	70.085	720*480 70Hz
14	720*400	28.322	31.468	70.085	720*480 70Hz
15	720*400	28.350	31.500	70.152	720*480 70Hz
16	720*480	26.969	31.469	59.941	480P 60Hz
17	720*480	27.000	31.469	59.941	480P 60Hz
18	720*480	27.027	31.500	60.000	480P 60Hz
19	720*483	27.000	31.469	59.941	480P 60Hz
20	720*483	27.000	31.468	59.939	480P 60Hz
21	720*576	27.000	31.250	50.000	576P 50Hz
22	720*576	42.000	45.259	74.932	720*576 75Hz
23	800*600	35.929	35.156	56.950	800*600 56Hz
24	800*600	36.000	35.152	56.250	800*600 56Hz
25	800*600	39.923	37.879	60.317	800*600 60Hz
26	800*600	39.943	37.895	60.346	800*600 60Hz
27	800*600	40.000	37.879	60.317	800*600 60Hz
28	800*600	50.000	48.076	72.188	800*600 72Hz
29	800*600	49.500	46.875	75.000	800*600 75Hz
30	832*624	57.284	49.726	74.552	832*624 75Hz
31	1024*768	63.999	48.777	60.000	1024*768 60Hz
32	1024*768	65.000	48.363	60.004	1024*768 60Hz
33	1024*768	94.438	48.777	60.000	1024*768 60Hz
34	1024*768	75.000	56.476	70.069	1024*768 70Hz
35	1024*768	78.750	60.020	75.027	1024*768 75Hz
36	1024*768	80.000	60.241	74.927	1024*768 75Hz
37	1152*864	108.000	67.500	75.000	1152*864 75Hz
38	1152*870	99.998	68.680	75.060	1152*870 75Hz
39	1152*870	100.000	68.680	75.055	1152*870 75Hz
40	1152*900	94.500	61.846	66.000	1152*900 66Hz
41	1152*900	105.562	71.713	76.048	1152*900 76Hz
42	1280*720	74.250	37.500	50.000	720P 50Hz
43	1280*720	74.176	44.955	59.937	720P 60Hz
44	1280*720	74.176	44.955	59.940	720P 60Hz
45	1280*720	74.250	45.000	60.000	720P 60Hz
46	1280*768	79.499	47.776	59.870	1280*768 60Hz
47	1280*768	102.250	60.289	74.893	1280*768 75Hz
48	1280*768	102.875	60.090	74.926	1280*768 75Hz
49	1280*960	108.000	60.000	60.000	1280*960 60Hz
50	1280*1024	106.958	64.745	60.060	1280*1024 60Hz
51	1280*1024	108.000	63.979	60.029	1280*1024 60Hz
52	1280*1024	108.180	63.337	59.978	1280*1024 60Hz
53	1280*1024	128.943	74.620	70.000	1280*1024 70Hz
54	1280*1024	124.995	74.402	69.992	1280*1024 70Hz
55	1280*1024	132.752	76.824	72.000	1280*1024 72Hz
56	1280*1024	135.000	78.125	72.000	1280*1024 72Hz
57	1280*1024	134.998	79.972	75.024	1280*1024 75Hz
58	1280*1024	135.000	81.125	76.107	1280*1024 76Hz
59	1400*1050	122.796	65.317	59.979	1400*1050 60Hz
60	1400*1050	155.999	82.278	75.003	1400*1050 75Hz
61	1440*480	54.000	31.469	59.941	480P 60Hz
62	1440*480	54.054	31.500	60.000	480P 60Hz
63	1440*576	54.000	31.250	50.000	576P 50Hz
64	1440*900	106.500	55.935	59.888	1440*900 60Hz
65	1440*900	136.749	70.635	74.984	1440*900 75Hz
66	1440*1050	101.001	64.744	59.948	1440*1050 60Hz
67	1600*900	108.000	60.000	60.000	1600*900 60Hz
68	1600*1200	162.000	75.000	60.000	1600*1200 60Hz
69	1600*1200	175.500	81.250	65.000	1600*1200 65Hz
70	1680*1050	146.250	65.290	59.954	1680*1050 60Hz
71	1680*1050	185.682	82.306	74.892	1680*1050 75Hz
72	1980*1080	148.500	56.250	50.000	1080P 50Hz
73	1980*1080	148.350	67.432	59.940	1080P 60Hz
74	1980*1080	148.500	67.500	60.000	1080P 60Hz
75	1980*1080	172.999	67.158	59.962	1980*1080 60Hz
76	1980*1200	153.999	74.038	59.950	1980*1200 60Hz
77	1980*1200	193.249	74.556	59.884	1980*1200 60Hz

MODEL

LTI220MT02-H

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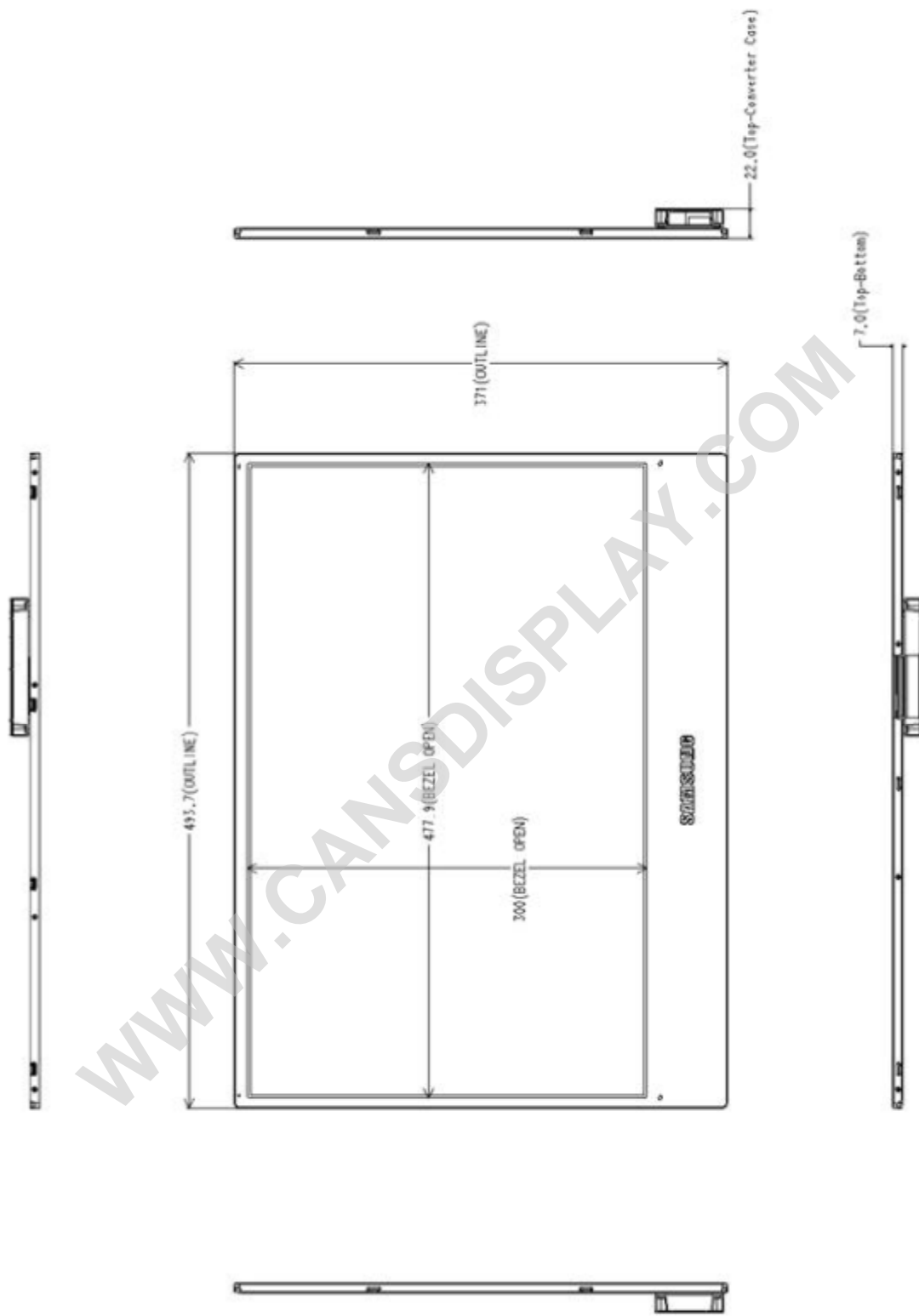
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5.3.2 HDMI mode

No	Resolution	Dot Clock[MHz]	Frequency		Remark
			H[KHz]	V[Hz]	
1	640*480(p)	25.175	31.469	59.941	480P 60Hz
2	720*480(p) 4:3	27.000	31.469	59.941	480P 60Hz
3	720*480(p) 16:9	27.000	31.469	59.941	480P 60Hz
4	1280*720(p)	74.250	45.000	60.000	720P 60Hz
5	1440*480(p) 4:3	54.001	31.469	59.941	480P 60Hz
6	1440*480(p) 16:9	54.001	31.469	59.941	480P 60Hz
7	720*576(p) 4:3	27.000	31.250	50.000	576P 50Hz
8	720*576(p) 16:9	27.000	31.250	50.000	576P 50Hz
9	1280*720(p)	74.250	37.500	50.000	720P 50Hz
10	1920*1080(p)	148.350	67.432	59.940	1080P 60Hz
11	1920*1080(p)	148.500	67.500	60.000	1080P 60Hz
22	1920*1080(p)	148.500	56.250	50.000	1080P 50Hz

7. Outline Dimension (Front View)



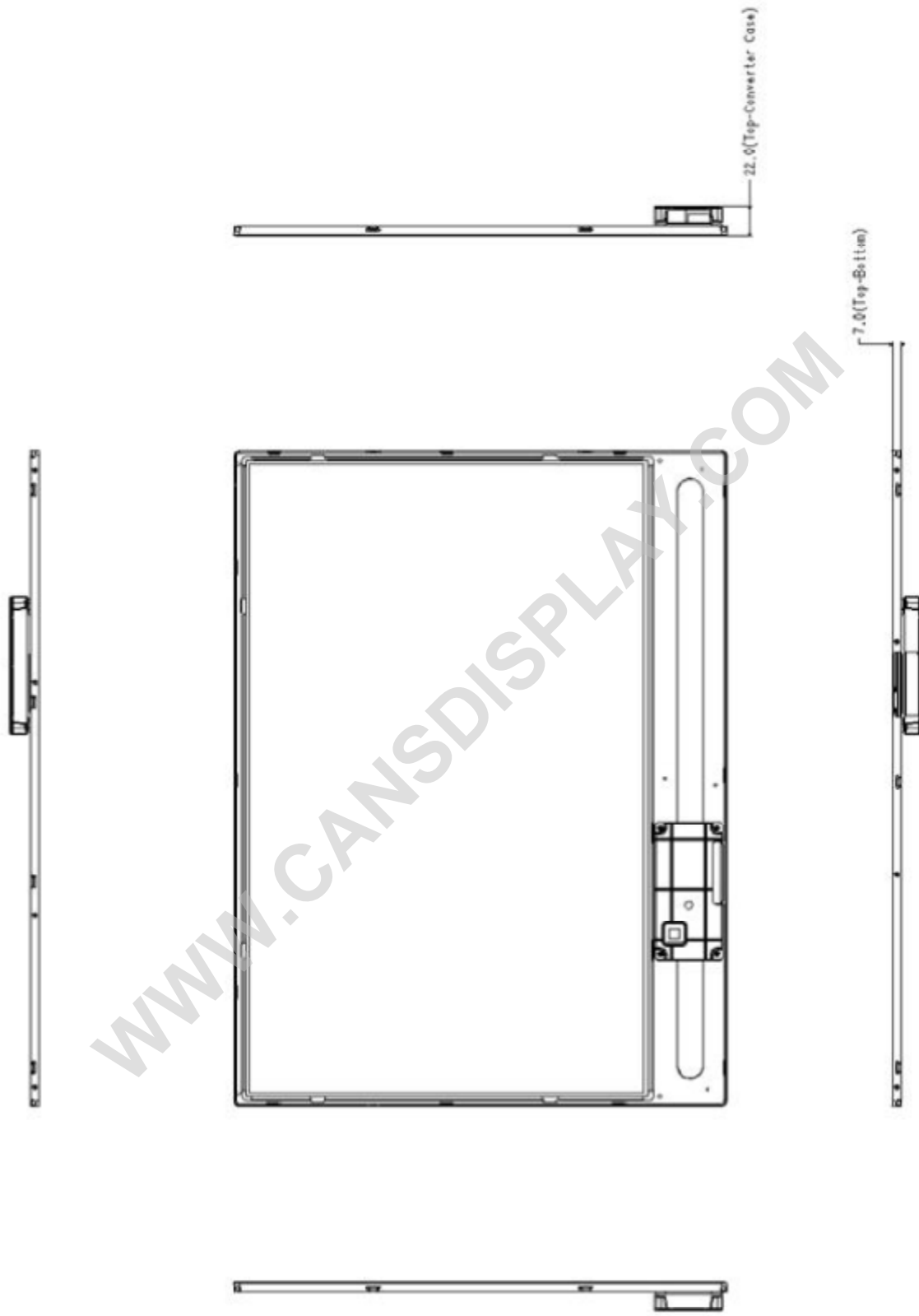
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7. Outline Dimension (Rear View)

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7. Reliability Test

Item	Test condition	Quantity
HTOL	50℃, 500hr determination	8EA
LTOL	0℃, 500hr determination	4EA
HTS	60℃, 500hr determination	4EA
LTS	-25℃, 500hr determination	4EA
THB	50℃ / 90%RH, 500hr determination	4EA
WHTS	60℃ / 75%RH, 250hr determination	4EA
T/S	-20 ~ 60℃, Dwell time : 30Min, 200cycle	4EA
TSS	-20 ~ 60℃, 110cycle	4EA
Image sticking	50℃, Mosaic pattern (9 X 10)	4EA
ESD (Operation)	Contact : ± 10kV, 150pF/330Ω, 210point, 1times/Point Non - Contact : ± 20kV, 150pF/330Ω, 210point, 1times/Point	3EA
Vibration	10 ~ 300Hz, 1.5G, 10minSR, 30min/± XYZ axis	3EA
Shock	1time/± XY axis, 30G, 11msec	3EA
Dust	6.6 ~ 8.6um, 5sec spray, 5min sedimentation / 10hr, Power 10min on, 10min off	2EA
Pallet Vibration → Pallet Drop	Pallet vibration : 1.05Grms, 5 ~ 200Hz, 1hr/stack side Pallet Drop : 20cm, bottom side 2 angles, 1side(Bottom)	1Pallet
Altitude	-40 ~ 50℃ 0~45,000ft, 1cycle(72.5hr)	4EA

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these should be no change which may affect practical display functions.

- * HTOL/ LTOL : High/Low Temperature Operating Life
- ** THB : Temperature Humidity Bias
- *** HTS/LTS : High/Low Temperature Storage
- **** WHTS : Wet High Temperature Storage

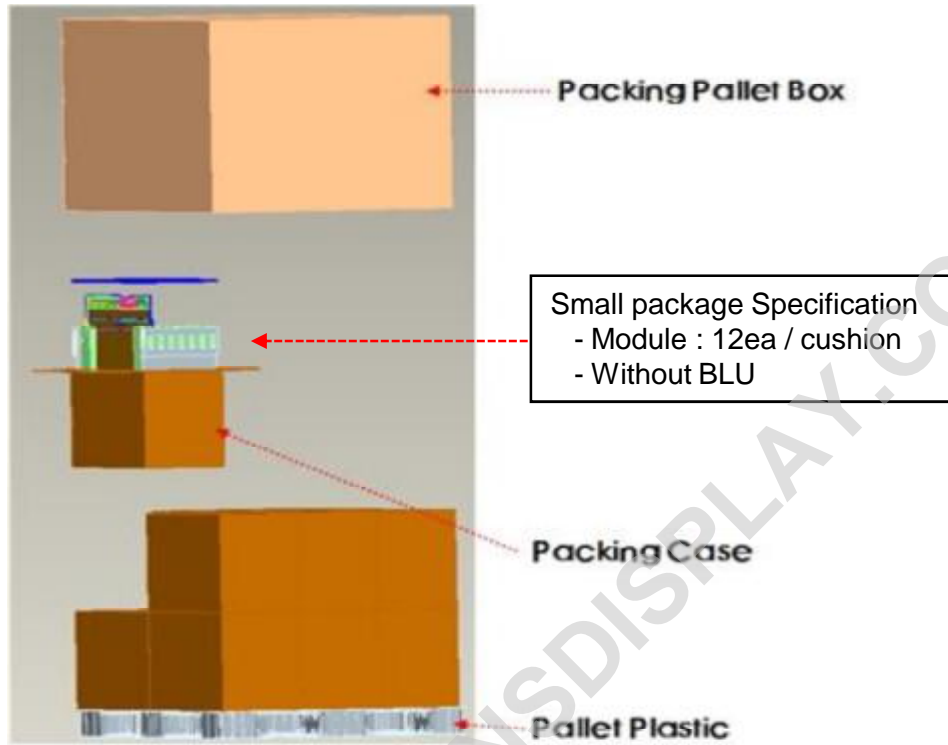
8. PACKING

8.1 CARTON (Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method



8.2 Packing Specification

Item	Specification	Remark
LCD Packing	144ea / (Packing-Pallet Box)	1. 1.3 Kg / LCD (144ea) 2. 4.5Kg / Packing-pallet box (1ea) 3. 3.5Kg / Packing Case (12ea) 4. 5.3Kg / Pallet Plastic (1ea) 5. Box Material : Paper 6. Packing Pallet Box Material : Paper
Total Pallet Weight	239.0kg	Pallet(5.3kg)+module(1.3* 144= 187.2kg) +Packing case (3.5*12= 42Kg)+Pallet box(4.5Kg)

8.3 Packing Storage condition

ITEM	Unit	Min.	Max.
Storage Temperature	(°C)	5	40
Storage Humidity	(%rH)	35	75
Storage life	12 months		
Storage Condition	<ul style="list-style-type: none"> - . Prohibit direct sunlight - . Ventilation in storehouse and Control changing temperature is within limits of environment - . Put it on pallet, don't put it on floor. and store them with removing from wall. - . Don't wet Out-BOX and avoid rain. - . Without condensation. - . Etc. Avoid harmful Condition. 		

8.4 Packing long-term Storage guide

Long –term Storage Process	More than 3months Storage or Low temp. Delivery/under 5 °C Storage, → On the 20 °C 50%rH Condition , More than 24hr release.
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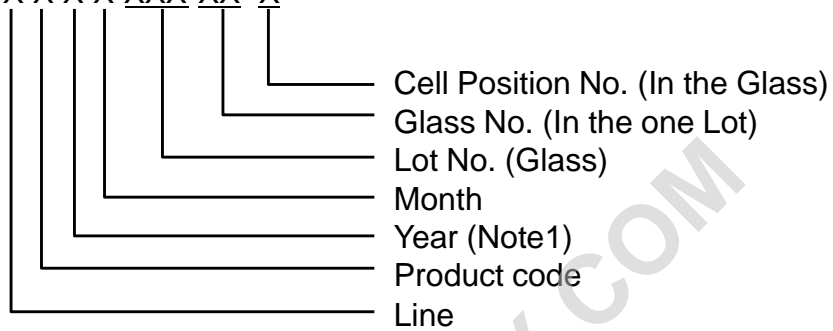
9. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

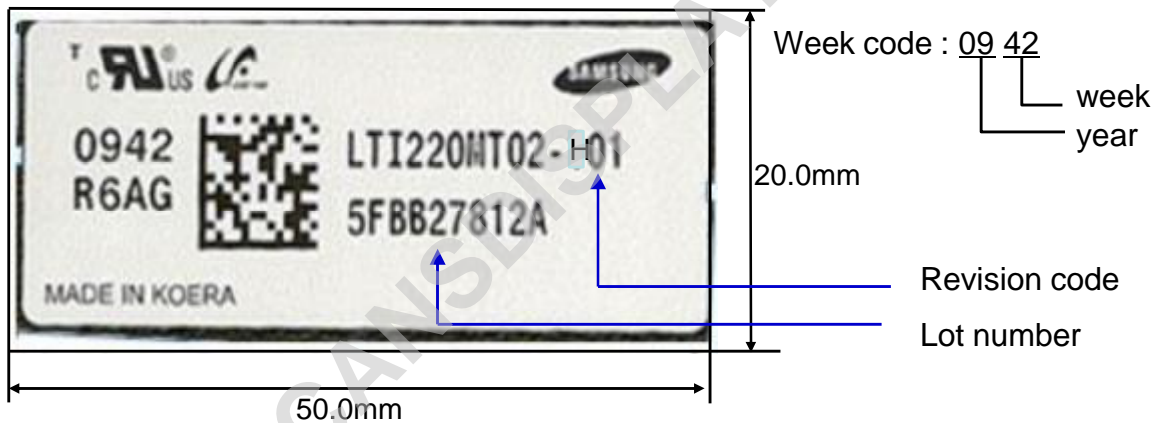
(1) Part number : LTI220MT02

(2) Revision: Three letters

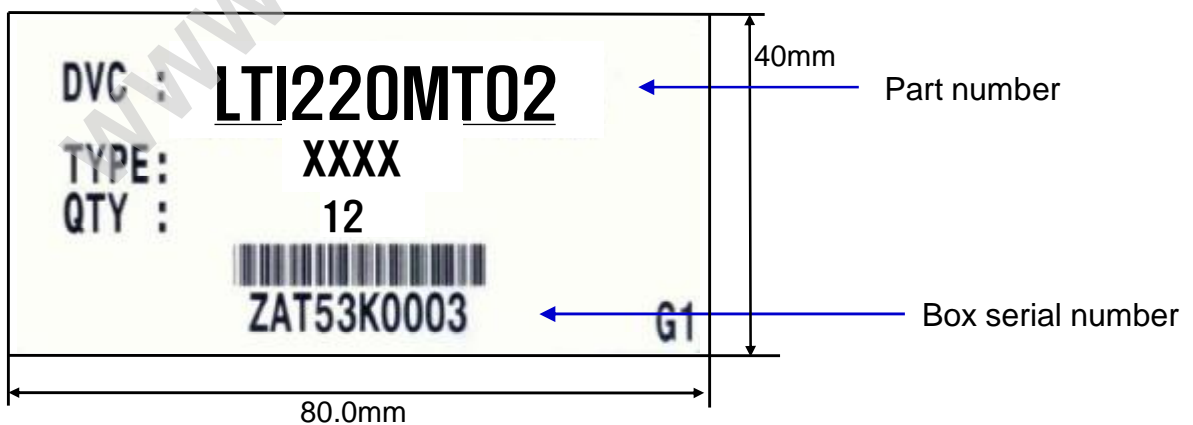
(3) Lot number : X X X X XXX XX X



(4) Nameplate Indication



(5) Packing box attach



(6) Others

1. After service part

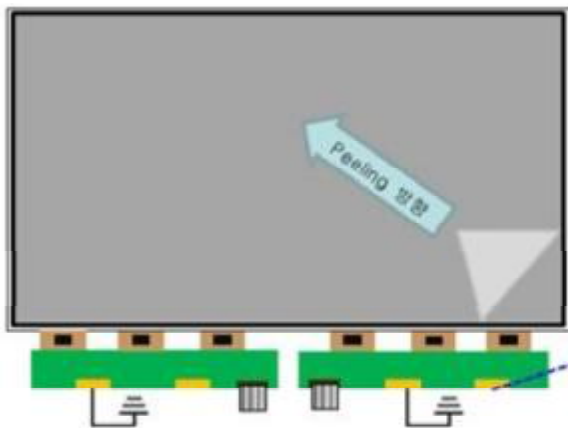
Lamps cannot be replaced because of the narrow bezel structure.

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10. General Precautions

10.1 Handling

- (a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light.
- (c) Note that polarizers are very fragile and could be easily damaged.
Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.
Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride.
It might permanent damage to the polarizer due to chemical reaction.
- (g) 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, legs or clothes, it must be washed away thoroughly with soap.
- (h) Protect the module from static, it may cause damage to the CMOS Gate Array IC.
- (i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not adjust the variable resistor which is located on the module.
- (l) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.



- a. Peel off slowly and constant speed
- b. Be sure to ground S-PBA while peeling of the protection film
- c. The protection film must not touch drivers and S-PBAs

GND SR-Open Pattern
 - Be sure to contact with ground while peeling of the protection film

10.2 Storage

- (a) Do not leave the Module in high temperature, and high humidity for a long time. It is highly recommended to store the Module with temperature from 0 to 35 °C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD Module in direct sunlight.
- (c) The Module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storing.

10.3 Operation

- (a) Do not connect or disconnect the Module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the "Power on/off sequence"
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers.
 Grounding and shielding methods may be important to minimize the interference.

10.4 Others

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. (the supply voltage variation, Input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the module may be damaged.
- (d) If the module displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.
- (e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

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