DISPLAY Elektronik GmbH

DATA SHEET

3,5” TFT MODULE

DEM 320240G TMH-PW-N

Product Specification **Version: 3.2.0**

06.09.2007

REVISION HISTORY:				
Revision	Date	Description	Written By	Approved By
1.0	09-May-2007	New Release.	XH	MH
2.0	21-May-2007	1) Add "Number of colors" and "Weight" in the Item 1.0. 2) Modify "Outline Drawing". 3) Modify "LOT NUMBERING SYSTEM"	XH	MH
3.0	24-Jul-2007	1) Update the module drawing in <3.0 OUTLINE DRAWING> 2) Add the forward current in <8.0 BACKLIGHT SPECIFICATION> 3) Update the "Quantity /each box", "Outer carton box size", "quantity/inner box, quantity/outer box", "weight" and the schematics in <15.0 PACKAGING STANDARD>	XH	MH
3.2.0	06.09.2007	Changed IC and Design (One-Chip-Solution)	XH	MH

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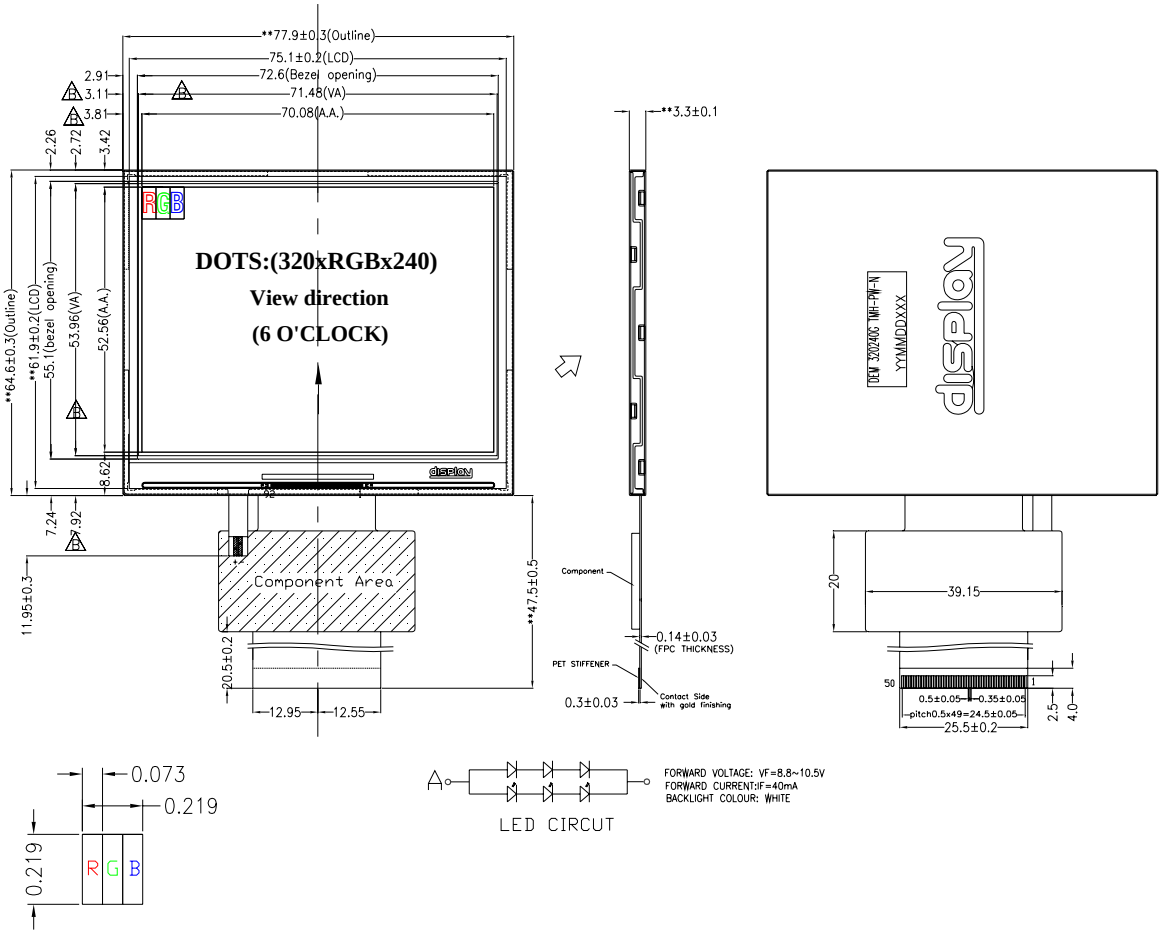
1.0 GENERAL SPECIFICATION

Item		Contents	Unit
Display technology		3.5"A- Si TFT Active-Matrix Transmissive	-
Module outer dimension		77.90 × 64.60 × 3.30	mm
Pixel Size		0.073 × 0.219	mm
Dot Pitch	D_{PH}	0.073	mm
	D_{PV}	0.219	mm
Effective display area		70.08 × 52.56	mm
Number of dots		320xRGB × 240	dots
Viewing direction		6	O'clock
Color-filter-array		RGB Stripe	-
Backlight		LED white backlight (Patented LED)	-
Driver IC		HX8238-A (HIMAX)	-
Interface type		Digital 8-bit serial/24-bit parallel RGB, CCIR601/656	-
Number Of Colors		16.7 Million	-
Operating temperature		-20°C to + 70°C	°C
Storage temperature		-30°C to + 80°C	°C
Weight		~ 33	g
Other Features		● Support N-line inversion. ● Support Contrast/Brightness control ● Source and gate scan direction control. ● On-chip voltage generator. ● On-chip DC-DC converter up to 6x / -6x. ● Programmable gamma correction curve. ● Non-Volatile Memory (OTP) for VCOM calibration ● Programmable common electrode voltage amplitude and level for Cs on common structure only ● PWM function to generate power for backlight control	

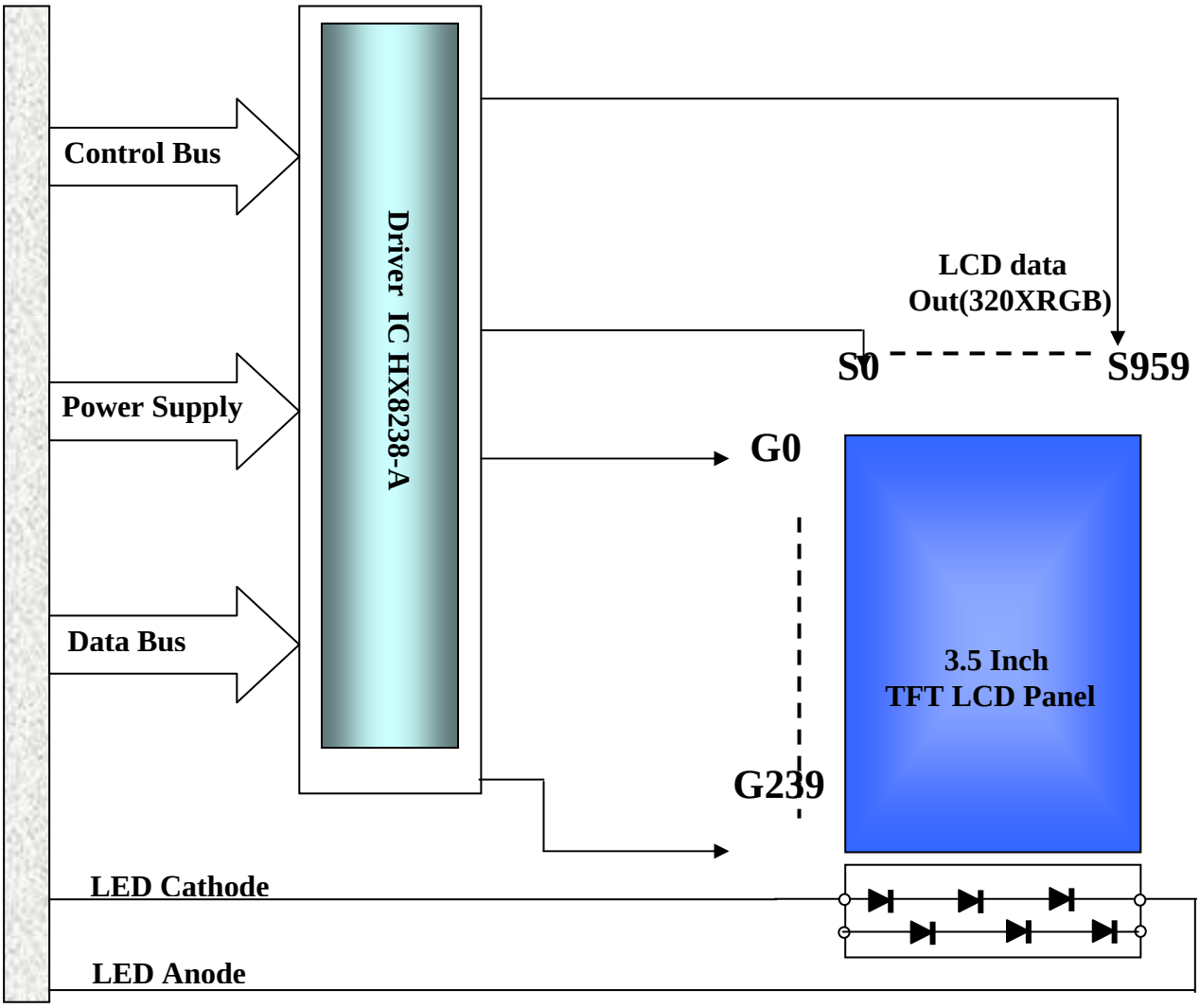
2.0 OUTLINE DRAWING



3.0 INTERFACE PIN DESCRIPTION

Pin NO.	Symbol	Function
1	A	Anode of backlight power supply (DC 10V)
2	A	Anode of backlight power supply (DC 10V)
3	K	Cathode of backlight power supply.
4	K	Cathode of backlight power supply.
5	VSS	ground
6	VSS	ground
7	QXH	Data sequence control pin
8	POL	Polarity signal to monitor VCOM signal
9	SDO	Data output pin in serial mode.
10	RESB	System reset pin
11	CSB	Chip select pin of serial interface.
12	SCK	Clock pin of serial interface.
13	SDI	Clock pin of serial interface.
14~21	B0~B7	Digital data input.(Blue)
22~29	G0~G7	Digital data input.(Green)
30~37	R0~R7	Digital data input.(Red)
38	DEN	Display enable pin from controller
39	HSYNC	Line synchronization signal.
40	VSYNC	Frame synchronization signal.
41	DOTCLK	Dot-clock signal and oscillator source.
42	SHUT	Display shut down pin to put the driver into sleep mode.
43	TB	Input pin to select the Gate driver scan direction.
44	REV	Input pin to select the display reversion.
45	RL	Input pin to select the Source driver data shift direction.
46	CM	Input pin to select 262k-color or 8-color display mode.
47	BGR	Input pin to select the color mapping.
48	VDDIO	Voltage input pin for I/O logic.
49	VCI	Booster input voltage pin.
50	VDD	Voltage input pin for internal logic.

4.0 BLOCK DIAGRAM



5.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Min	Max	Unit
Power voltage	VDDIO	VSS=0	-0.3	4	V
	VDD	VSS=0	-0.3	2.7	V
	VIC	VSS=0	VSS-0.3	5	V

6.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Min	Typ.	Max	Unit	Remarks
Power voltage	VDD	1.8	-	2.5	V	
	VDDIO	1.4	-	3.6	V	
	VIC	2.5 or VDDIO	-	3.6	V	
Gate on voltage	VGH	9.3	15	16.5	V	
Gate off voltage	VGL	-15	-10	-5.1	V	
Input high voltage	VIH	0.8*VDDIO	-	VDDIO	V	
Input low voltage	VIL	VSS	-	0.2*VDDIO	V	
Output high voltage	VOH	0.9*VDDIO	-	VDD	V	IOH=100uA
Output low voltage	VOL	VSS	-	0.1*VDDIO	V	IOL=100uA
VCOM High Output Voltage	V_{COMH}	2.5	3.6	4.5		
VCOM Low Output Voltage	V_{COML}	-3	-2.4	0		

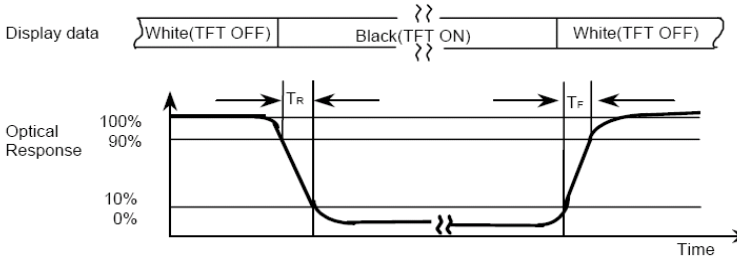
7.0 BACKLIGHT SPECIFICATIONS

Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Forward voltage	Vf	8.8	10	10.5	V	If = 40 mA
Absolute maximum Forward Current	If_m	35	-	50	mA	-
Reverse Voltage	Vr	10.5	-	15	V	
Reverse current	Ir	-	-	200	mA	Vr = 15V
Chromaticity coordinates	X	0.26	-	0.32	-	
	Y	0.26	-	0.32	-	
Luminance (BLU only)	Lv	2800	3000	-	cd/m^2	If = 40 mA
Uniformity	Δ	80	85	-	%	Min/max*100%
Remark	LED PATENTED					
Half-Brightness Life Time	50000 Hours					

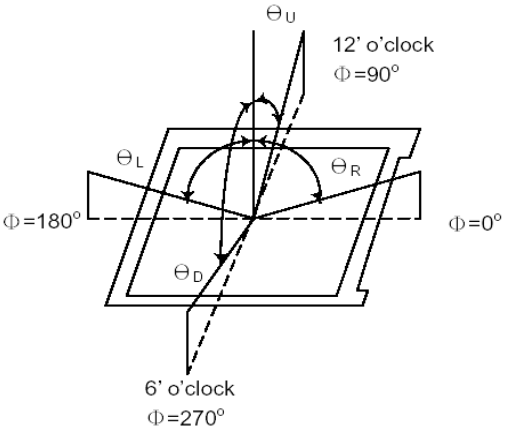
8.0 OPTICAL CHARACTERISTICS (Ta=25°C)

No	Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
1	Response Time		Tr	$\theta = \phi = 0^o$	-	15	20	ms	(1)
			T_f		-	35	50		
2	Contrast Ratio		CR	$\theta = \phi = 0^o$	150	250	-	-	(2)
3	Viewing Angle (CR ≥ 10)		Right	$\phi = 0^o$	-	45	-	Deg	(3)
			Left	$\phi = 180^o$	-	45	-	Deg	
			Upper	$\phi = 90^o$	-	15	-	Deg	
			Lower	$\phi = 270^o$	-	35	-	Deg	
4	Luminance of White (Center point of LCM)		L		200	220	-	Cd/m^2	(5)
5	Color Chromaticity (CIE1931)	Red	Rx	$\theta = \phi = 0^o$	0.610	0.640	0.670	-	(4) **"Simulation Data Reference Only"**
			Ry		0.314	0.344	0.374	-	
		Green	Gx		0.268	0.298	0.328	-	
			Gy		0.553	0.583	0.613	-	
		Blue	Bx		0.102	0.132	0.162	-	
			By		0.107	0.137	0.167	-	
		White	Wx		0.282	0.312	0.342	-	
			Wy		0.319	0.349	0.379	-	
6	Opt.Viewing Direction		6 O'clock						-

Note (1): Definition of Response Time



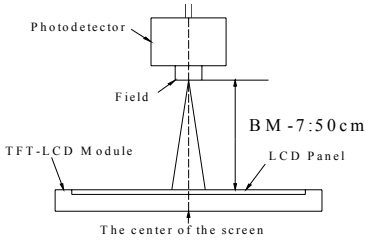
Note (3): Definition of Viewing



Note (2): Definition of Contrast Ratio
CR = Brightness at all pixels "White" / Brightness at all pixels "Black"

Note (4): Measured at center point vertically with backlight on.

Note(5):After stabilizing and leaving the panel alone at a given temperature for 30 min ,the measurement should be executed .Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the back-light. This should be measured in the center of screen.
Environment condition: Ta=25±2°C Back-Light On condition



9.0 Interface Timing

Please refer to HX8238-A datasheet for more details.

10.0 STANDARD SPECIFICATION FOR RELIABILITY

10.1 Standard specification of Reliability Test

No	Test Item	Content of Test	Test Condition	Applicable Standard
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	80+/-3 °C 240 hrs	------
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-30+/-3 °C 240 hrs	------
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70+/-3 °C 240 hrs	------
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	-20+/-3 °C 240 hrs	------
5	High temperature / Humidity operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40 °C, 90 %RH 120 hrs	MIL-202E-103B JIS-C5023
6	Temperature cycle	Endurance test applying the low and high temperature cycle. -20°C 30min. ⇌ 25°C 5min. ⇌ 70°C 30min. 1 cycle	-20°C / 70°C 10 cycles	------
Mechanical Test				
7	Drop Test	Endurance test applying the drop during transportation.	Packed, 100cm free fall (6 sides, 1 corner, 3edges)	----

Remarks:

1) For operation test, above specification is applicable when test pattern is changing during entire operation test.
2) Inspections after reliability tests are performed when the display temperature resumes back to room temperature.
3) It is a normal characteristic that some display abnormality can be seen during reliability test. If the display abnormality can resume back to normal condition at room temperature within 24hours, there is no permanent destruction over the display. The display still possesses its functionality after reliability tests.

10.2 Failure Judgment Criteria

After the reliability tests above, test sample shall be let return to room temperature and humidity for at least 4 hours before final tests are carried out.

Criterion Item	Failure Judgment Criteria
Electrical characteristic	Electrical short and open.
Mechanical characteristic	Out of mechanical specification
Optical characteristic	Out of the Appearance Standard

11.0 QUALITY ASSURANCE

11.0 Acceptable Quality Level (AQL)

Each lot should satisfy the quality level defined as follows:

a) Inspection method: MIL-STD-105E Level II normal one time sampling

b) AQL level

Category	AQL	Definition
Major	0.25%	Functional defective as product
Minor	1.00%	Satisfy all functions as product but not satisfy cosmetic standard

11.1 Conditions of Inspection

The inspection should be performed under following conditions:

a) Under 2 pieces of 40W white fluorescent lamps located 1m height from the LCD module.

b) 30cm view distance vertically from the LCD panel.

c) Under normal temperature 20~25°C and normal humidity 60±15%RH.

d) LCD voltage at stated in the specification and within ±0.5V of the typical value at 25°C.

11.2 Cosmetic Screening Criteria

<table>
<tr><th>No</th><th>Defect</th><th>Judgment Criteria</th><th>Category</th></tr>
<tr><td>1</td><td>Spots/Dust
/Bubble
(Round type)</td><td><table><tr><td>Size, d (mm)</td><td>Acceptable quantity in active area</td></tr><tr><td>d ≤ 0.15</td><td>Disregard</td></tr><tr><td>0.15 < d ≤ 0.20</td><td>2</td></tr><tr><td>0.2 ≤ d ≤ 0.30</td><td>1</td></tr><tr><td>d > 0.3</td><td>0</td></tr></table></td><td>Minor</td></tr>
<tr><td>2</td><td>Dust
/Bubble
/Scratches
(Line type)</td><td><table><tr><td>Width, W (mm)</td><td>Length, L (mm)</td><td>Acceptable quantity in active area</td></tr><tr><td>W≤ 0.01</td><td>Disregard</td><td>Disregard</td></tr><tr><td>W≤ 0.03</td><td>L≤ 3.0</td><td>2</td></tr><tr><td>W≤ 0.05</td><td>L≤ 3.0</td><td>1</td></tr><tr><td>W> 0.05</td><td>Disregard</td><td>0</td></tr></table></td><td>Minor</td></tr>
<tr><td>3</td><td>Background color & Rainbow</td><td>Not to be noticeable.</td><td>Minor</td></tr>
<tr><td>4</td><td>Allowable density</td><td>Above defects should be separated more than 5mm each other.</td><td>Minor</td></tr>
<tr><td>6</td><td>Coloration</td><td>Not to be noticeable coloration in the viewing area of the LCD panels.
Back-lit type should be judged with back-lit on state only.</td><td>Minor</td></tr>
<tr><td>7</td><td>Rainbow</td><td>Not to be noticeable.</td><td>Minor</td></tr>
<tr><td>8</td><td>Dot size</td><td>To be 95% ~ 105% of the dot size (Typ.) in drawing.
Partial defects of each dot (ex. pin-hole) should be treated as ‘spot’.</td><td>Minor</td></tr>
</table>

Note: d = (long length + short length) / 2

12.0 PRECAUTIONS FOR USING LCD MODULE

Handing Precautions

- The display panel is made of glass and polarizer. Do not subject it to mechanical shock by dropping or impact which may cause chipping especially on the edges.
- Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with Isopropyl alcohol or ethyl alcohol. Avoid using solvents like acetone (ketene), water, toluene, ethanol to clean the polarizer surface.
- Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion.
- Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- NC terminal should be open. Do not connect anything.
- If the logic circuit power is off, do not apply the input signals.
- Avoid contacting oil and fats.
- Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
- Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.
- For LCD module with FPC, please handle the FPC carefully and do not stress the FPC excessively which will damage the circuitry or components on the FPC.

Electro-Static Discharge Control

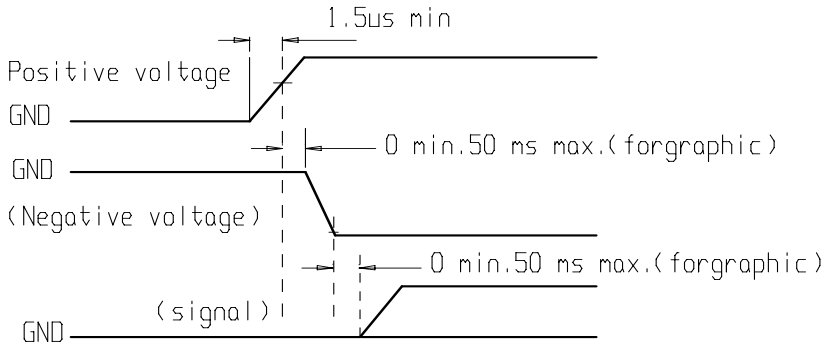
- Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.
- Be sure to ground the body when handling the LCD modules. Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity, be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.
- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.

Precaution for soldering to the LCM

- Observe the following when soldering lead wire, connector cable and etc. to the LCD module.
- Soldering iron temperature: 300 ~ 350°C.
  Soldering time: 3 sec.
  Solder: eutectic solder.
  Above is a recommended approach. Due to different solder composition and processing method, it is recommended that customer need to study and fine tuning their soldering process parameters accordingly.
- If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

Precautions for Operation

- Viewing angle varies with the change of liquid crystal driving voltage (V_O). Adjust V_O to show the best contrast.
- Driving the LCD in the voltage above the limit shortens its lifetime.
- Response time is greatly delayed at temperature below the operating temperature range. However, it will recover when it returns to the specified temperature range.
- If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- When turning the power on, input each signal after the positive/negative voltage becomes stable.



Storage

- When storing LCDs as spares for some years, the following precautions are necessary.
- Store them in a sealed polyethylene bag. If properly sealed, there is no need for desiccant.
- Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
- Environmental conditions:
  -- Do not leave them for more than 168hrs. at 60°C.
  -- Should not be left for more than 48hrs. at -20°C.

Safety

- It is recommended to crush damaged or unnecessary LCD into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

13.0 LOT NUMBERING SYSTEM

13.1 Definition of Lot Number

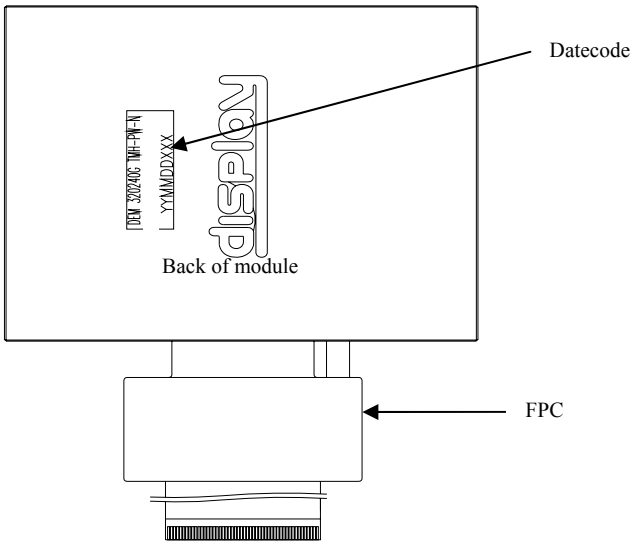
One lot means the delivery date and times to customer at one time.

YYMMDD XXX
(1) (2)

(1) Manufacturing date (COG bonding) (YY: Year, MM: Month, DD: Day)

(2) Serial number starts from A01, A02…..,A99, B01, B02….

13.2 Location of lot number



Remarks:
This datecode is meant for traceability purpose and will not affect functionality of the display module. Thus, there is no special control on the font type and font size of the datecode as long as it is visible and readable.

14.0 RoHS COMPLIANT PRODUCT

Standard of specific chemical substance

1.	Cadmium and Cadmium Compounds	Less than 100ppm
2.	Hexavalent Chromium Compounds	Less than 1000ppm
3.	Lead and Lead Compounds	Less than 1000ppm
4.	Mercury and Mercury Compounds	Less than 1000ppm
5.	Polybrominated Biphenyls (PBBs)	Less than 1000ppm
6.	Polybrominated Diphenyl ethers (PBDEs)	Less than 1000ppm

15.0 LIMITED WARRANTY

Please inspect the LCD modules within one month after your receipt. Unless agreed between DISPLAY and customer, DISPLAY will replace or repair any of its LCD modules, which are found to be functionally defective when inspected in accordance with DISPLAY LCD/LCM acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to DISPLAY within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DISPLAY limited to repair and/or replacement on the terms set forth above. DISPLAY will not be responsible for any subsequent or consequential events.