To : _____

SPECIFICATIONS	
Product Name	**LPM012M134B**

 Approval Signature

Accepted by : _____

Date : _____

Japan Display Inc.

Proposed by : _____

JDG01-E-01E

		Issued No.	JDG010000603
		Revision	03
Revision History		Product Name	LPM012M134B
		Customer Part No.	

Date/Rev.	Contents of change			Reasons	Remarks
Nov.10.2016 Rev.01	-	-	New Release	-	LPM012M134B(01)
Feb. 8, 2017 Rev.02	C	P.6, 9, 23, 24	Revised	Correction of mistake	LPM012M134B(02)
Oct.6,2017 Rev.03	C	P.1, 16, 18, 23, 25	Revised	Revised	LPM012M134B(03)

(C): Changed　　(A): Appended　　(D): Deleted　　(F): Filled in

CONTENTS

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1.   BASIC SPECIFICATIONS

LPM012M134B is a 1.199 inch reflective active matrix liquid crystal display (LCD) module.

The Active area of the LCD module is round in shape and it has 240(H) x 240(V) pixels.

A pixel has 2-bit static random-access memory (SRAM) to store the image data for each sub-pixel and

it is capable of displaying 64 colors.

This display is a reflective LCD therefore the specifications are defined in reflective mode only unless otherwise specified in this specification sheet.

1.1 STRUCTURES

No.	FACTOR	SPECIFICATIONS	UNIT
1	LCD structure	LTPS (Memory in Pixel type)	-
2	Outward *(1)	33.256(W) x 34.656(H) x 0.844(D) (*1-1)	mm
3	Weight	Approx. 1.7	g
4	Screen size	30.456 (1.199inch) diameter	mm
5	Resolution	240(H) x 240(V)	dot
6	Dot pitch (Horizontal x Vertical)	0.0423(H) x 0.1269(V)	mm
7	Dot layout	RGB stripe	-
8	Liquid crystal mode	ECB normally black (Reflective type)	-
9	Polarizer	Hard Coat type (*Pencil Hardness : 2H)	-

Note)

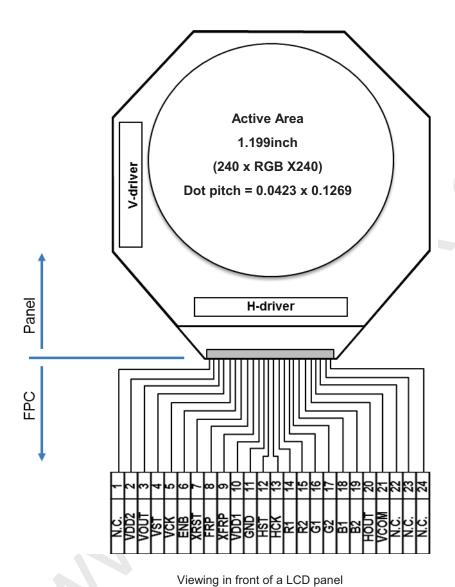(*1-1) Excluding FPC and part of protruding. See attached drawing for details.

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1.2 BLOCK DIAGRAM

The block diagram of a panel is shown below.

1.2.1 Pin layout Internal circuit

Active Area

1.199inch

(240 x RGB X240)

Dot pitch = 0.0423 x 0.1269

V-driver

Panel

FPC

H-driver

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
N.C.	VDD2	VOUT	VST	VCK	ENB	XRST	FRP	XFRP	VDD1	GND	HST	HCK	R1	R2	G1	G2	B1	B2	HOUT	VCOM	N.C.	N.C.	N.C.

Viewing in front of a LCD panel

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1.3 INPUT / OUTPUT TERMINAL NAME AND FUNCTIONS

P: Power supply　　I: Input　　O: Output　　NC: Not connected

PIN	SYMBOL	TYPE	DESCRIPTION	REMARK
1	N.C.	NC	Not connected to the LCD	(*1-2)
2	VDD2	P	Power supply for the vertical driver and pixel memory	
3	VOUT	O	Output from the end of the vertical shift register	(*1-3)
4	VST	I	Start signal for the vertical driver	
5	VCK	I	Shift clock for the vertical driver	
6	ENB	I	Write enable signal for the pixel memory	
7	XRST	I	Reset signal for the horizontal and vertical driver	
8	FRP	I	Liquid crystal driving signal ("Off" pixel)	
9	XFRP	I	Liquid crystal driving signal ("On" pixel)	
10	VDD1	P	Power supply for the horizontal driver and pixel memory	
11	GND	P	GND for the LCD	
12	HST	I	Start signal for the horizontal driver	
13	HCK	I	Shift clock for the horizontal driver	
14	R1	I	Red image data (odd pixels)	
15	R2	I	Red image data (even pixels)	
16	G1	I	Green image data (odd pixels)	
17	G2	I	Green image data (even pixels)	
18	B1	I	Blue image data (odd pixels)	
19	B2	I	Blue image data (even pixels)	
20	HOUT	O	Output from the end of the horizontal shift register	(*1-3)
21	VCOM	I	Common electrode driving signal	
22	N.C.	NC	Not connected to the LCD	(*1-2)
23	N.C.	NC	Not connected to the LCD	(*1-2)
24	N.C.	NC	Not connected to the LCD	(*1-2)

Note)

(*1-2) It is recommended to connect to GND.

(*1-3) Do not connect any signal or power wire to these terminals.

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2. ABSOLUTE MAXIMUM RATINGS

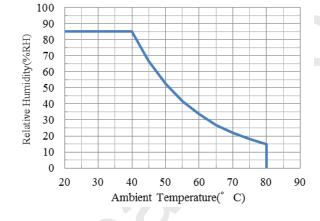| PARAMETER	RATINGS	UNIT	REMARKS
Power supply voltage	6.3	V	
VCOM, FRP and XFRP signal voltage	0 to 6.3	V	
Input control signal voltage	0 to 6.3	V	(*2-1)
Operating temperature range (LCD panel surface)	-20 to +70	℃	(*2-2)
Storage temperature range	-30 to +80	℃	(*2-2)

Note)

(*2-1) HST, HCK, XRST, VST, VCK, ENB, R1, G1, B1, R2, G2, B2

(*2-2): Maximum humidity is defined as follows:

Ta≦40℃ : 85%RH Max.

Ta > 40℃ Absolute humidity must be lower than the humidity of 85%RH at 40℃

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3. ELECTRICAL CHARACTERRISTICS

3.1 POWER SUPPLY VOLTAGE

PARAMETER	SYMBOL	Min.	Typ.	Max.	UNIT	REMARK
Power supply voltage1	VDD1	3.1	3.2	3.3	V	
Power supply voltage2	VDD2	4.4	4.5	4.6	V	
Ground for LCD	GND		0		V	

3.2 INPUT SIGNAL VOLTAGE
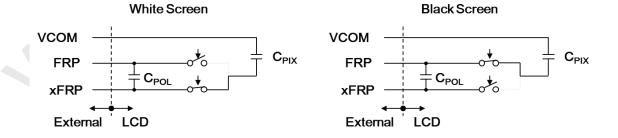
PARAMETER		Min.	Typ.	Max.	UNIT	REMARK
Input control signal	High	VDD1 - 0.1	VDD1	VDD1	V	(3-1*)
	Low	GND	GND	GND + 0.1	V	
VCOM, FRP, XFRP	High	VDD1 - 0.1	VDD1	VDD1	V	
	Low	GND	GND	GND + 0.1	V	

Note)

(*3-1) HST, HCK, XRST, VST, VCK, ENB, R1, G1, B1, R2, G2, B2

3.3 INPUT TERMINAL CAPACITANCE

PARAMETER	SYMBOL	Min.	Typ.	Max.	UNIT	REMARK
Input control signal	C_{IN}	-	10	14	pF	
VCOM	C_{PIX}	-	30	42	nF	
FRP	$C_{Pix} + C_{POL}$	-	35	49	nF	
XFRP	$C_{Pix} + C_{POL}$	-	35	49	nF	

White Screen   Black Screen

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3.4 POWER CONSUMPTION

STATIC IMAGE

Driving Condition: VDD1=3.2V, VDD2=4.5V, Ta=25℃, White screen, Without Backlight

PARAMETER	SYMBOL	Min.	Typ.	Max.	UNIT
VDD1 current consumption	IVDD1	-	24	70	uA
VDD2 current consumption	IVDD2	-	2	30	uA
Total power consumption	PWR	-	0.086	0.359	mW

STATIC IMAGE (Refresh rate: 1Hz)

Driving Condition: VDD1=3.2V, VDD2=4.5V, Ta=25℃, White screen, Without Backlight

PARAMETER	SYMBOL	Min.	Typ.	Max.	UNIT
VDD1 current consumption	IVDD1	-	24	70	uA
VDD2 current consumption	IVDD2	-	2	30	uA
Total power consumption	PWR	-	0.086	0.359	mW

MOVING IMAGE (Refresh rate: 25Hz)

Driving Condition: VDD1=3.2V, VDD2=4.5V, Ta=25℃, White screen, Without Backlight

PARAMETER	SYMBOL	Min.	Typ.	Max.	UNIT
VDD1 current consumption	IVDD1	-	58	130	uA
VDD2 current consumption	IVDD2	-	3	30	uA
Total power consumption	PWR	-	0.199	0.551	mW

Driving Condition: VDD1=3.2V, VDD2=4.5V, Ta=25℃, Cyan & Green Stripes, Without Backlight

PARAMETER	SYMBOL	Min.	Typ.	Max.	UNIT
VDD1 current consumption	IVDD1	-	269	560	uA
VDD2 current consumption	IVDD2	-	3	30	uA
Total power consumption	PWR	-	0.874	1.927	mW

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3.5 AC CHARACTERISTICS

Driving Condition: VDD1=3.2V, VDD2=4.5V, Ta=25℃

PARAMETER	SYMBOL	Min.	Typ.	Max.	UNIT	REMARK
Vertical Pixel Number	-	-	240	-	Pixels	
Vertical Frequency	Fv	-	25.06	25.44	Hz	
Vertical Period	Tv	39.31	39.90	-	msec	
Vertical Clock Number	Nv	-	488	-	Clocks	
Vertical Blanking Number	Nvbl	-	8	-	Clocks	
Horizontal Pixel Number	-	-	240	-	Pixels	
Horizontal period	Th	80.52	81.74	82.96	us	
Horizontal Clock Number	Nh	-	122	-	Clocks	
Horizontal Blanking Number	Hbl	-	2	-	Clocks	
HST rising time	trHST	-	-	50	nsec	
HST falling time	tfHST	-	-	50	nsec	
HST data set-up time	tsHST	0.33	0.33	0.34	usec	
HST data hold time	thHST	0.33	0.34	0.34	usec	
HST delay time	tdHST	0.66	0.67	0.68	usec	
HCK rising time	trHCK	-	-	50	nsec	
HCK falling time	tfHCK	-	-	50	nsec	
HCK High width	tcHCKH	0.66	0.67	0.68	usec	
HCK Low width	tcHCKL	0.66	0.67	0.68	usec	
DATA rising time	trDT	-	-	50	nsec	
DATA falling time	tfDT	-	-	50	nsec	
DATA set-up time	tsDT	0.33	0.33	0.34	usec	
DATA hold time	thDT	0.33	0.34	0.34	usec	
VST rising time	trVST	-	-	50	nsec	
VST falling time	tfVST	-	-	50	nsec	
VST set-up time	tsVST	39.60	40.20	40.80	usec	
VST hold time	thVST	40.92	41.54	42.16	usec	
VCK rising time	trVCK	-	-	50	nsec	
VCK falling time	tfVCK	-	-	50	nsec	
VCK High width	twVCKH	80.52	81.74	82.96	usec	
		1.00	-	-	usec	(*3-2)
VCK Low width	twVCKL	80.52	81.74	82.96	usec	
		1.00	-	-	usec	(*3-2)
VCK set-up time	tsVCK	21.12	21.44	21.76	usec	
VCK hold time	thVCK	18.48	18.76	19.04	usec	
ENB rising time	trEN	-	-	50	nsec	
ENB falling time	tfEN	-	-	50	nsec	
ENB High width	twEN	40.92	41.54	42.16	usec	
XRST rising time	trXRST	-	-	50	nsec	
XRST falling time	tfXRST	-	-	50	nsec	
XRST Low width	twXRST	161.04	163.48	165.92	usec	
XRST set-up time	tsXRST	21.12	21.44	21.76	usec	
VCOM cycle time	tcVCOM	15.68	16.5	17.33	msec	
VCOM rising time	trVCOM	-	-	100	usec	
VCOM falling time	tfVCOM	-	-	100	usec	

Note)

(*3-2) Partial Update Mode (non-updated area)

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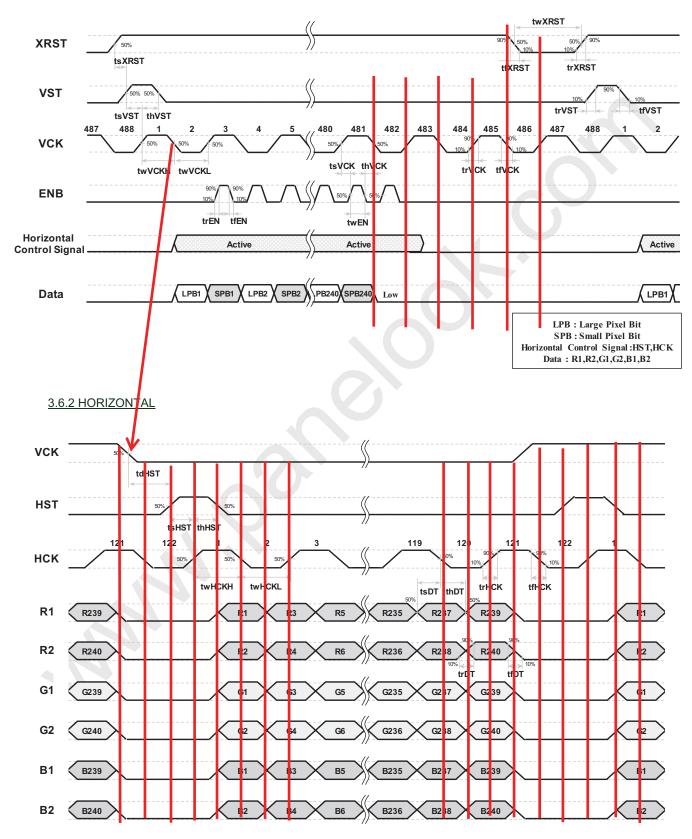
3.6 TIMING DIAGRAM (UPDATE MODE)

3.6.1 VERTICAL

LPB : Large Pixel Bit
SPB : Small Pixel Bit
Horizontal Control Signal :HST,HCK
Data : R1,R2,G1,G2,B1,B2
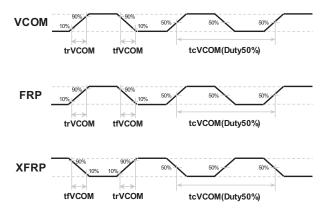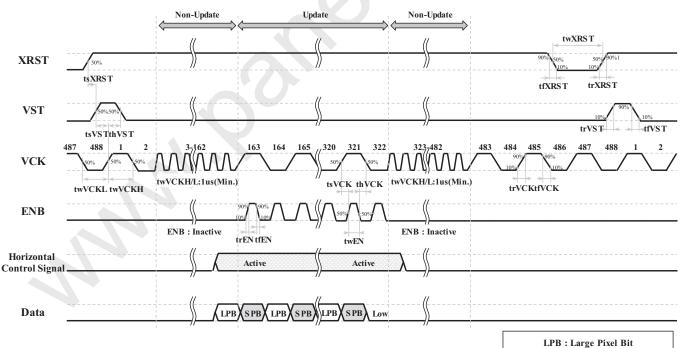
3.6.2 HORIZONTAL

3.6.3 VCOM,FRP,XFRP

FRP is the same signal as VCOM, and XFRP is the inverse signal of VCOM and FRP.

3.7 TIMING DIAGRAM (PARTIAL-UPDATE MODE)

When 81-160 lines of the image is updated.

| LPB : Large Pixel Bit |
| SPB : Small Pixel Bit |
| Horizontal Control Signal :HST,HCK |
| Data : R1,R2,G1,G2,B1,B2 |

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3.8 RECOMMENDED SEQUENCE
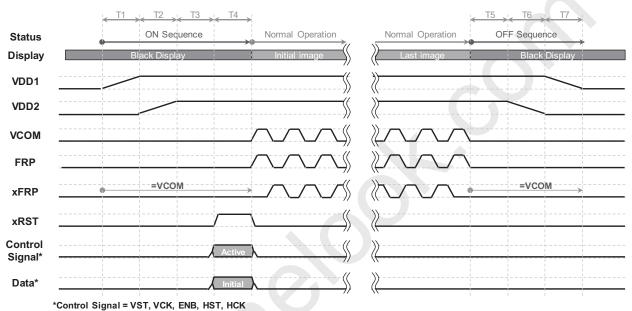
3.8.1 ON/OFF SEQUENCE

[On Sequence]
　　1) VDD1 Rise Time　T1 : Depends on IC
　　2) VDD2 Rise Time　T2 : Depends on IC
　　3) Internal Circuit Reset Time　T3 : twXRST or more
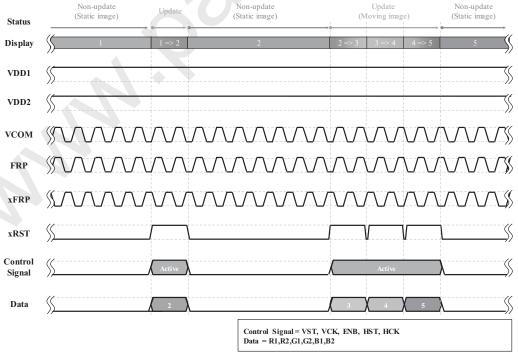　　4) Pixel Memory Initialize Time　T4 : 1Frame

[OFF Sequence]
　　1) Pixel electrode discharge time　T5 : twXRST or more
　　2) VDD2 fall time　T6 : Depends on IC
　　3) VDD1 fall time　T7 : Depends on IC

*Control Signal = VST, VCK, ENB, HST, HCK
*Data = R1,R2,G1,G2,B1,B2

3.8.2 MODE CHANGE SEQUENCE

Control Signal = VST, VCK, ENB, HST, HCK
Data = R1,R2,G1,G2,B1,B2
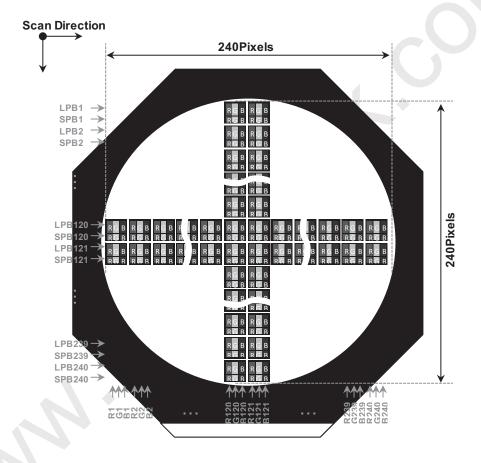
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4. PIXEL LAYOUT

The LCD has 6-bit-per-pixel (bpp) memory, and it is capable of displaying 64 colors.

Every RGB sub pixel has 2-bit Memory: Large pixel bit (LPB) of 2/3 area and Small pixel bit (SPB) of 1/3 area.

There are 4 conditions of the pixel memory, which are follows:

1) When LPB and SPB are both high.   100% brightness

2) When LPB is high, SPB is low.   67% brightness

3) When LPB is low, SPB is high.   33% brightness

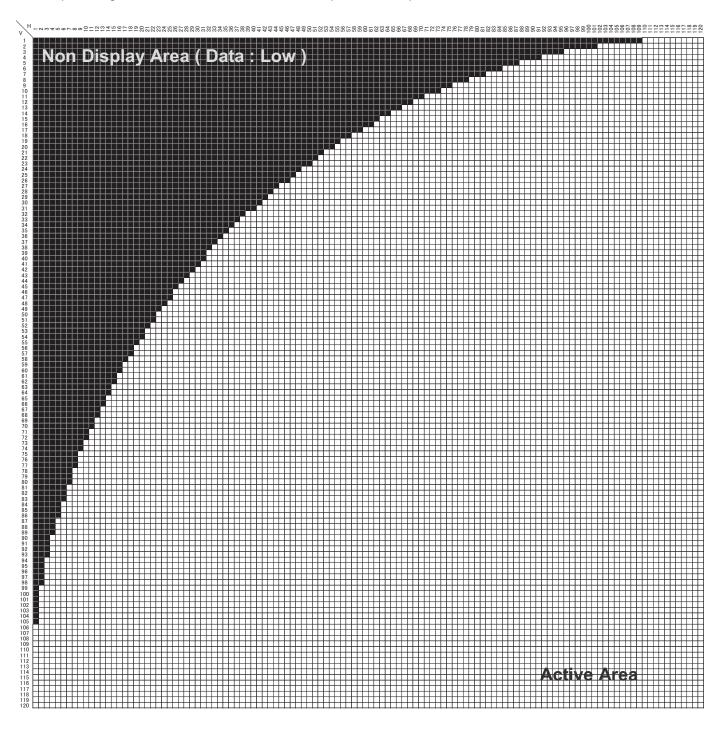4) When LPB and SPB are both Low.   0% brightness

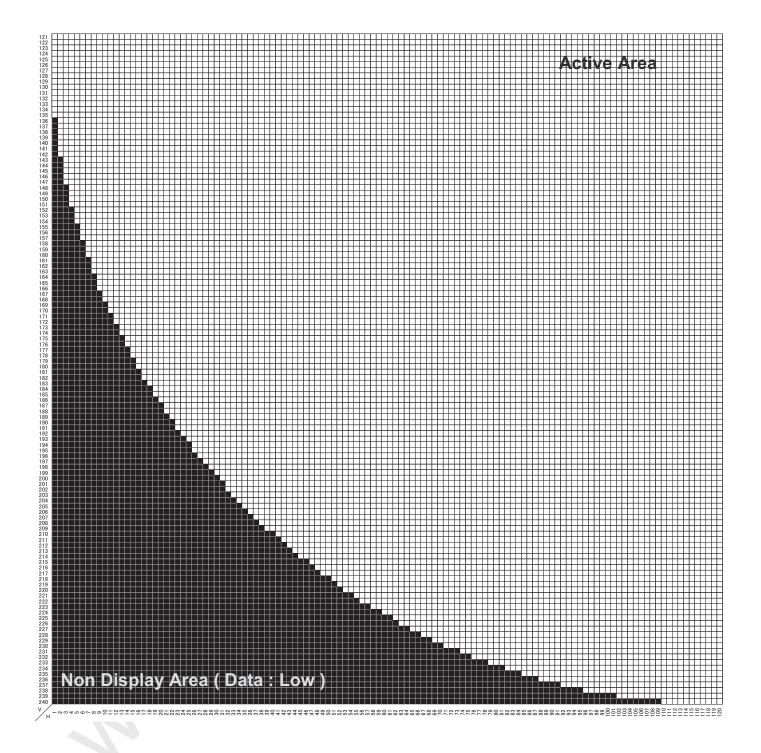4.1 PIXEL CONFIGURATION

4.2 PIXEL ADDRESS MAP

The Active area of this LCD is round in shape.

Thus input square image (240x240 pixels) is cropped to fit active area.

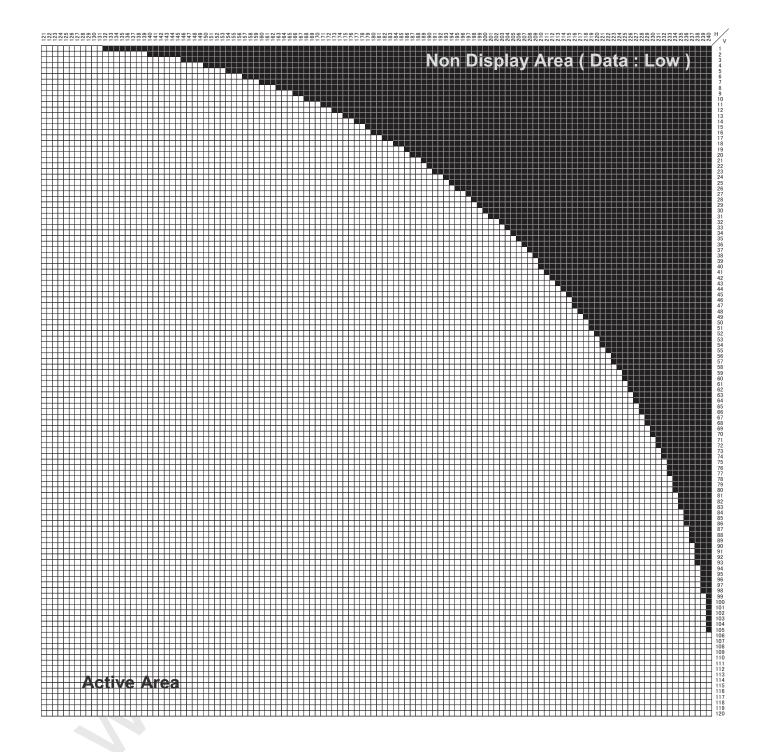Keep RGB signal Low out of the active area to reduce power consumption.
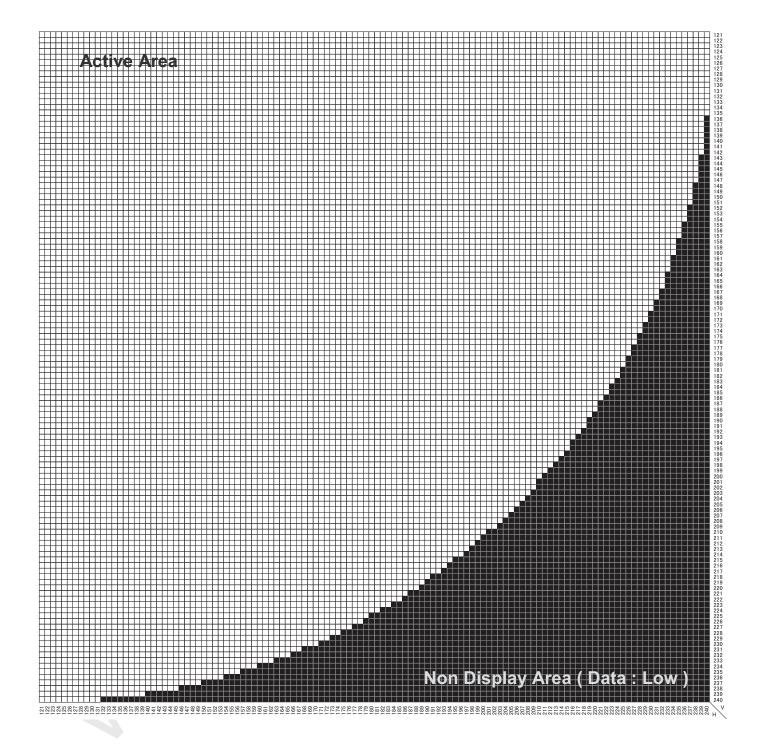
Non Display Area (Data : Low)

Active Area

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Active Area

Non Display Area (Data : Low)

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Non Display Area (Data : Low)

Active Area

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5. OPTICAL SPECIFICATION

5.1 OPTICAL CHARACTERISTICS
5.1.1 REFLECTIVE MODE

Driving Condition: VDD1=3.2V, VDD2=4.5V, VCOM frequency = 60Hz±10%

Item	Symbol	Temp. (°C)	Rating Min.	Rating Typ.	Rating Max.	Unit	Definition (Measurement setup)	Remark
Contrast	CR	25	10	20	-	-	1	
Response	Tr	25	-	3	6	ms	2	Black ➔ White
	Td		-	6	10			White ➔ Black
Color coordinates	Rx	25	(0.460)	0.505	(0.550)	-	3	*Reference value
	Ry		(0.295)	0.315	(0.335)			
	Gx		(0.280)	0.300	(0.320)			
	Gy		(0.405)	0.445	(0.485)			
	Bx		(0.145)	0.170	(0.195)			
	By		(0.135)	0.175	(0.215)			
	Wx		(0.295)	0.315	(0.335)			
	Wy		(0.310)	0.335	(0.360)			
NTSC ratio	-	25	16	23	-	%	4	
Reflectance	-	25	18	23	-	%	Basic measurement condition & Measurement system	
Viewing Angle (CR>2)	θL	25	45	60	-	°	5	Horizontal
	θR		50	65	-			
	θT		50	65	-			Vertical
	θB		45	60	-			

5.1.2 TRANSMISSIVE MODE

Driving Condition: VDD1=3.2V, VDD2=4.5V, VCOM frequency = 60Hz±10%

Item	Symbol	Temp. (°C)	Rating Min.	Rating Typ.	Rating Max.	Unit	definition (Measurement setup)	Remark
Transmittance	T	25	(0.2)	0.3	-	%	6	

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5.2 DEFINITION AND CONDITION OF OPTICAL CHARACTERISTICS
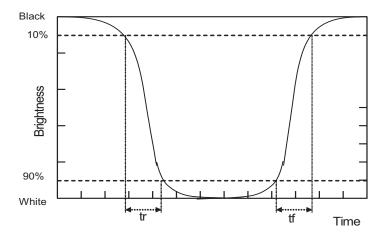
5.2.1 DEFINITIONS OF OPTICAL CHARACTERISTICS

Definition 1

This is a ratio between the screen surface reflectance of the white raster and the black raster

$$\text{Contrast ratio (CR)} = \frac{\text{Reflection intensity on all pixels White}}{\text{Reflection intensity on all pixels Black}}$$

Definition 2

The response time is defined as the following figure and shall be measured by matching the input signal for "Black" and "White".

・Normally Black mode

tr：Response time from Black to White
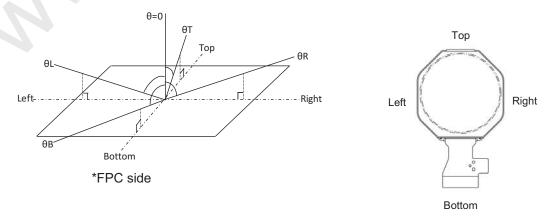
tf：Response time from White to Black

Definition 3

This is the x-y coordinate of Red, Green, Blue and White colors specified on the CIE1931 chromaticity diagram.   (* It is not a guaranteed value)

Definition 4

This is an area of a triangle shaped by R, G and B coordinates on the CIE1931 chromaticity diagram.

Definition 5

This is a maximum angle θ from the normal direction that keeps having the contrast more than 2.

*FPC side

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Definition 6

Transmittance is defined by the result of measuring backlight provided by Japan Display Inc.

- Measurement method of optical characteristics -
< Basic measurement conditions >
a) Driving voltage
        VDD1 = 3.2V, VDD2 = 4.5V

b) Measurement temperature
                25℃ unless otherwise specified

c) Measurement point
            Center of the Active area (one point) unless otherwise specified
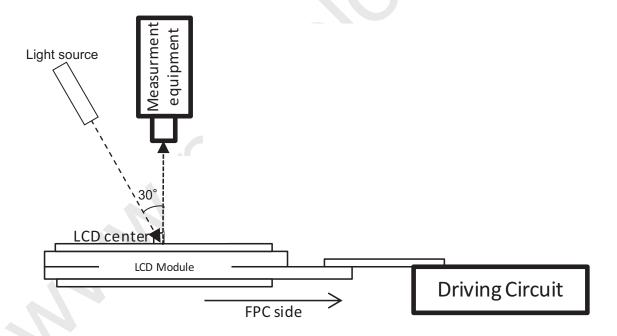
d) Measurement equipment
            LCD5200 or equivalent

f) Light source
        Parallel light source
            ・Light source input direction: form TOP side (30°)
            ・Light source receive direction: at LCD center (0°)

< Measurement system>

  LCD5200 or equivalent

Light source

Measurment equipment

30°

LCD center

LCD Module

Driving Circuit

FPC side

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6. INSPECTION

6.1 QUALITY STANDARD

6.1.1 Lot

Lot means the unit includes all products delivered to your company at one time.

6.1.2 INSPECTION CONDITION

(1) Ambient Conditions
   Temperature   : 25 ℃ (±5℃)
   Humidity   : 60% (±20%)
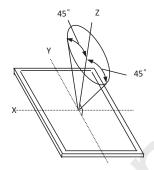   Ambient Luminance   : 1000 – 2000 lux
   Supply Voltage   : VDD1=3.2(V) / VDD2=4.5(V)
(2) Viewing Distance
   The distance between the LCD and the inspector's eyes should be 30cm (±10cm).
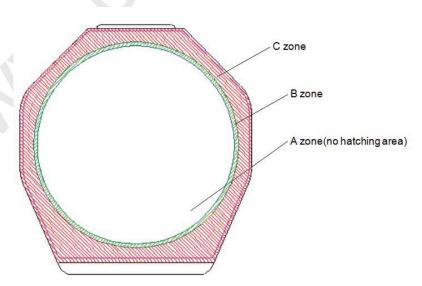(3) Viewing Angle
   Viewing angle shall be ±45 degrees from the vertical direction as shown below.

6.1.3 ZONE DEFINITION
   A zone   : Active area
   B zone   : Viewing area
   C zone   : No active and Border area including assemble parts.

*For detail dimensions refer to outline drawing.

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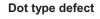| Product Number: LPM012M134B	Revision Number: 03	Page: 20/30

6.1.4 TREATMENT OF OTHER PROBLEMS

If any troubles should occur concerns our products that have been assembled at your company's manufacturing processes, both companies shall jointly investigate and resolve the causes.
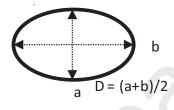
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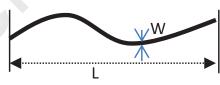
6.2 DISPLAY APPEARANCE STANDARDS

Item		Zone	Criteria		Remark
Name	Cause		Size(mm)	N.	
Dot type defect	B/W spot (Dent in glass or Upper polarizer, Particle, Swell) Bright/Dark dot defect	A	D≦0.15	Ignore	Keep two defect distance more than 5mm
			0.15＜D≦0.25	2	
			0.25＜D	0	
		B	D≦0.25	Ignore	
			0.25＜D≦0.3	3	
			0.3＜D	0	
		C	Ignore		
Line type defect	Scratch on polarizer or Foreign material between Upper polarizer and glass	A	W≦0.03	Ignore	Keep two defect distance more than 5mm
			0.03＜W≦0.08 , L≦2	2	
			0.08＜D or 2＜L	0	
		B	W≦0.10 , L≦3	3	
			0.10＜W or 3＜L	0	
		C	Ignore		
Air bubble	Air bubble	A	D2≦0.25	2	
			D1≦0.20	2	
			0.5＜D1+D2	0	
		B	Ignore		
		C	Ignore		

Dot type defect

Line type defect

$$D = (a+b)/2$$
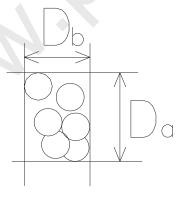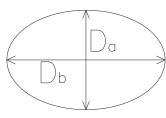
Aggregate of small air bubbles

Big air bubble

*When there is an agreement limit samples, Item is judged according to the limit sample.

Total defect quantity: A zone (N≦3) each inspection(lighting / appearance) , B zone (N≦5)

*Other items are to be decided by agreement between both parties.

*Aggregate of small air bubbles: The longer one is defined as D1 among Da and Db.

*Big air bubble: The longer one is defined as D2 among Da and Db.

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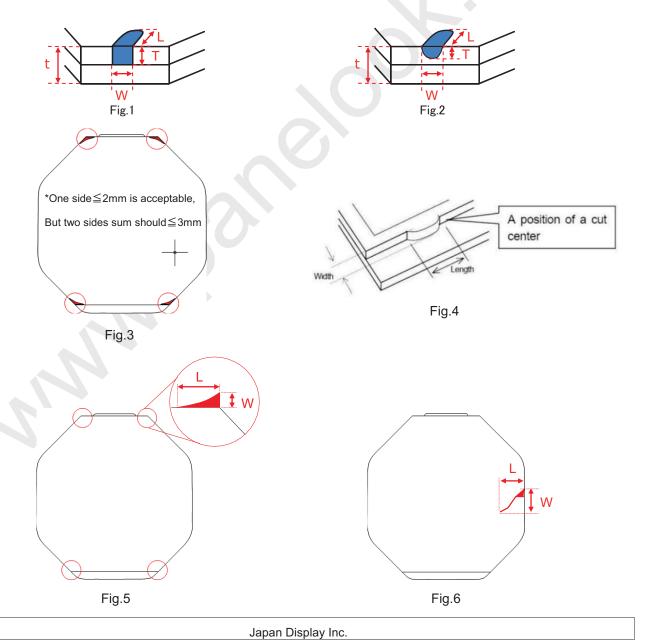
6.3 EXTERNAL APPEARANCE STANDARDS

Item	Criteria		Remarks
	Size(mm)	Number	
Chipping	(A) W≦3 , L≦0.2 , T=1/2t	Ignore	Fig 1
	(B) W≦3 , L≦0.6 , T<1/2t	Ignore	Fig 2
	Except (A) & (B)	0	
Chipping on the corner	Refer to the Fig.3		Fig 3
Projection	W≦0.3 , L≦5.0	Ignore	Fig 4
	0.3<W or 5.0<L	0	
Corner burr	W≦0.5 , L≦5.0	Ignore	Fig 5
	0.5<W or 5.0<L	0	
Crack *(1)	W≦3.0 , L≦0.5	Ignore	V-shaped chipping included , Fig6
	3.0<W or 0.5<L	0	

Note)   *(1)"Crack" means the one which would progress further.

Fig.1

Fig.2

*One side≦2mm is acceptable,

But two sides sum should≦3mm

Fig.3

Fig.4

Fig.5

Fig.6

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7. RELIABILITY SPECIFICATION

7.1 CONDITIONS OF RELIABILITY AND MECHANICAL TEST

No.	TEST ITEM	CONDITION		REMARK
1	High Temperature Storage	Ta=80℃	240h	
2	Low Temperature Storage	Ta=-30℃	240h	
3	High Temperature & High Humidity Storage	Ta=60℃／90%RH （No condensation）	240h	
4	High Temperature & High Humidity Operation	Ta=40℃／90%RH （No condensation）	240h	
5	High Temperature Operation	Ta=70℃	240h	
6	Low Temperature Operation	Ta=-20℃	240h	
7	Thermal shock (non-operating)	Ta=-20℃ to 70℃ （30min each）	50cycles	
8	ESD	HBM IEC 61340-3-1, ESD STM5.1 V =±1.0kV (Contact) R = 1.5kΩ, C = 100pF	1 time each terminal	
9	Packing Vibration	Random Vibration 5～500Hz	101min Direction Z	(*7-1)
10	Packing Drop	Height 60cm,1 corner 3 edges,6 surfaces	1 time Each direction	(*7-1)

Note)

(*7-1) Tests are conducted package.

Above test evaluate for development. It is not guaranteed value for lot acceptance.

If a nonconformance is found, both parties will have a discussion to solve it.

7.2 CRITERIA FOR JUDGEMENT

After the above tests, return samples to the normal temperature and moisture environment in the thermostat chamber room over 30 minutes not to condense. Inspect samples kept for more than 1 hour after pulling them out of the thermostat chamber room.

(1) There shall be no abnormality in the functions (Ex. No display, abnormal display, line defects).

(2) There shall be no serious degradation.(Ex. Brightness uniformity, reversible changes, optical changes due to back light or polarizer are ignored.)

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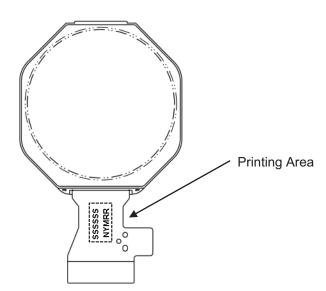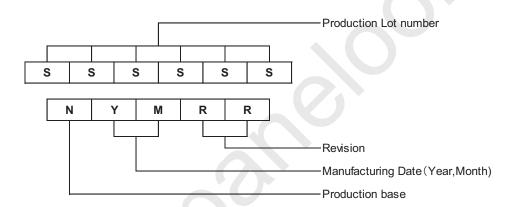
8.   DESIGNATION OF LOT MARK

8.1 LOT MARK

Lot mark is printed on the FPC of the LCD module.

Printing Area

Production Lot number

| S | S | S | S | S | S |

| N | Y | M | R | R |

Revision

Manufacturing Date（Year,Month）

Production base

Year	Figure in lot mark
2017	7
2018	8
2019	9
2020	0
2021	1
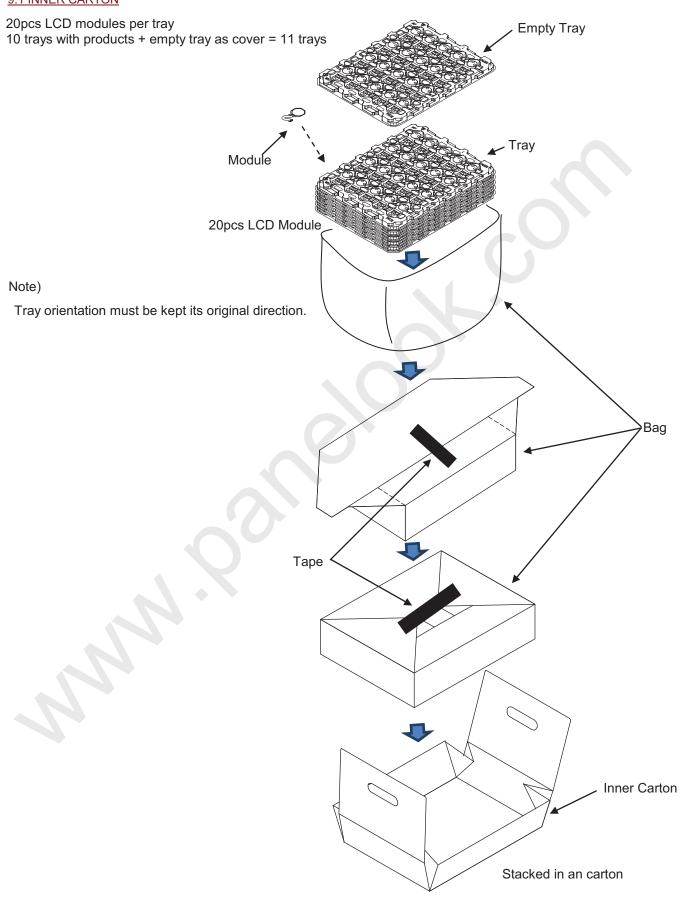
Month	Figure in lot mark	Month	Figure in lot mark
Jan.	A	July	G
Feb.	B	Aug.	H
Mar.	C	Sep.	I
Apr.	D	Oct.	J
May	E	Nov.	K
June	F	Dec.	L

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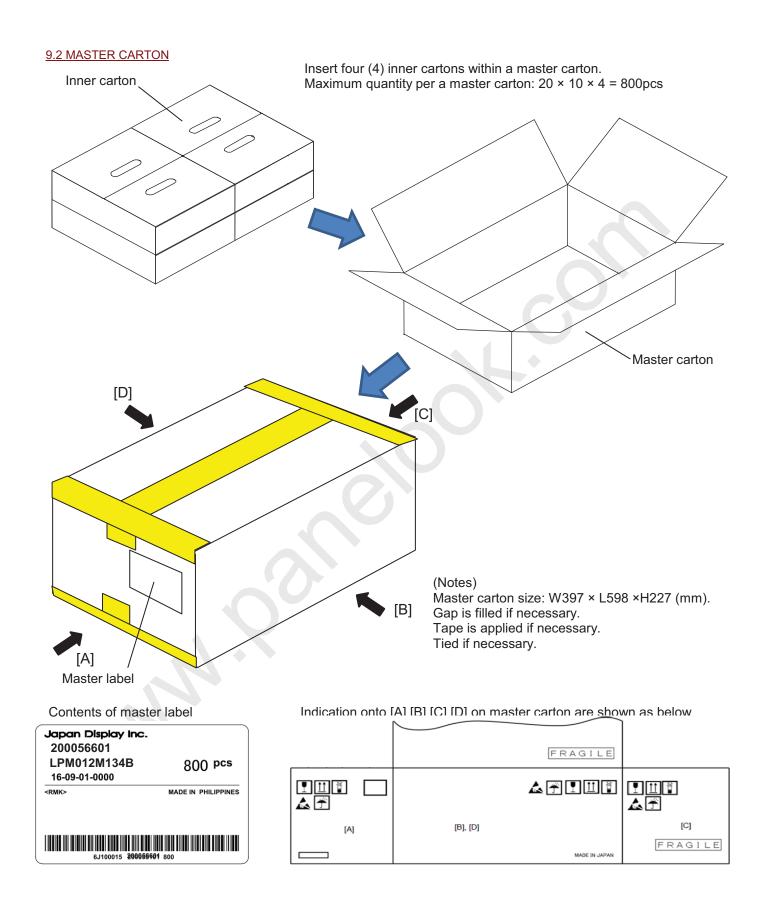
9. PACKING SPECIFICATIONS

9.1 INNER CARTON

20pcs LCD modules per tray
10 trays with products + empty tray as cover = 11 trays

Empty Tray

Module

Tray

20pcs LCD Module

Note)

   Tray orientation must be kept its original direction.

Bag

Tape

Inner Carton

Stacked in an carton

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9.2 MASTER CARTON

Inner carton

Insert four (4) inner cartons within a master carton.
Maximum quantity per a master carton: 20 × 10 × 4 = 800pcs

Master carton

[D]

[C]

[B]

[A]

Master label

(Notes)
Master carton size: W397 × L598 ×H227 (mm).
Gap is filled if necessary.
Tape is applied if necessary.
Tied if necessary.

Contents of master label

Indication onto [A] [B] [C] [D] on master carton are shown as below

Japan Display Inc.
200056601
LPM012M134B   800 pcs
16-09-01-0000

<RMK>   MADE IN PHILIPPINES

6J100015 200056601 800

FRAGILE

[A]

[B], [D]

[C]

MADE IN JAPAN

FRAGILE

Japan Display Inc.

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10.   LCD MODULE USAGE AND PRECAUTIONS

10.1 HANDLING

(1) The display panel is made of glass. Do not subject it to mechanical shock such as dropping it from a high position, etc.

(2) If the display panel is damaged and internal liquid crystal substance leaks out, be sure not to inhale or consume it. If the internal liquid crystal substance comes into contact with skin or clothing, promptly wash it off using soap and running water.

(3) Do not apply excessive force on the surface, perimeter or adjoining areas of LCD module since this may cause display panel color tone to vary.

(4) The polarizer covering the display panel surface of the LCD module is soft and can be easily scratched or dented. Handle this polarizer carefully.

(5) If the surface polarizer becomes contaminated, use the following recommended or equivalent adhesive tape for contaminants removal.

• Scotch-brand mending tape (No. 810)

(6) Do not breathe on the display surface or use Ethyl Alcohol solvent for contaminant removal as polarizer discoloration may occur. Furthermore, solvent other than mentioned above may also damage the polarizer. Especially, do not use the followings.

• Water

• Ketones

• Aromatic solvents

(7) When mounting the LCD Module, be sure that it is free from twisting, warping, or distortion. Any stress can have great influence to the display quality. Also, in cases where outer case or frame is included, be sure to secure sufficient stiffness on the outer case or frame for a robust design.

(8) Do not apply pressure at or around the FPC bonding area and the surrounding area.

(9) Do not attempt to disassemble or rework the LCD module.

(10) To prevent destruction of the elements by static electricity, be careful to maintain an optimum working environment.

• Be sure to ground your body before handling the LCD module.

• Make sure that solder guns and all other tools required for assembly have been grounded.

• To reduce occurrence of static electricity, avoid using this product in dry environments.

• A protective film has been attached to the surface of the LCD panel. When peeling off the protective film, be careful to prevent electrostatic discharges.

(11) To minimize performance degradation of the LCD module caused by destructive forces such as static electricity, etc., avoid direct contact to the following sections when handling the LCD module.

• terminal electrodes of connector

• wiring pattern on FPC

(12) LCD Panel surface is protected by a protective film layer. This protective film must be removed before final product installation. After removal of protective film layer, some adhesive residues maybe left on the LCD panel, especially after long storage period, please refer to section 5) listed above for proper contaminant removal procedure.

(13) Take precaution to minimize corrosion of electrodes. Corrosion of electrodes is accelerated by moisture, condensation or a current flow in a high-humidity environment.

(14) Do not apply excessive pressure to the FPC part. Force type such as twist, warp, etc., may damage FCP patterning traces.

(15) Do not use sharp, pointy or rigid tools when handing LCD panels. These objects can scratch or nick the glass panel which can cause it to crack.

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(16) Do not touch or handle the LCD module directly with bare hands. Residue of dirt, oil or water may have the possibility to cause corrosion. Be sure to wear finger sacks or gloves when handling LCD modules. When holding an LCD panel module, carefully hold the panel by the edges of the glass plate.
(17) Avoid using LCD module under condensation or high humidity environment because polarizer etc. maybe damaged in these conditions.
(18) Trays are used to package LCD modules for shipment. If LCD modules scratch the tray during shipment, material of the scratched tray may be left on LCD modules. In such case, clean up LCD modules after removal from trays.
(19) When installing LCD module, don't apply excess stress of bending or stretching to the input cable
(20) Keep NC terminal open electrically.
(21) After storage under high humidity or condensation environment, keep LCD module under room temperature more than 30 minutes before operation.
(22) Take precautions to handling LCD module because the glass plate has very keen edges.

10.2 DESIGN OF APPLICATION

(1) The absolute maximum ratings represent the rated values which LCD module cannot exceed. When LCD modules are used beyond this rated value, the operating characteristics may be adversely affected.
(2) To prevent the occurrence of erroneous operation caused by noise, special attention on satisfying VIL, VIH specified values is required. This includes taking the precautionary measures of using short cables for signal transferring.
(3) An inherent characteristic of liquid crystal display is its temperature dependency. Be sure to use the LCD modules within the specified operating temperature range, as recognition of the display becomes difficult when the LCD module is used outside its range. Also, keep in mind that the voltage levels necessary for clear display images will vary according to temperature.
(4) It is recommended that power supply lines (VDD1, VDD2) to include current surge protection. (Fuse etc. recommend value: 0.5A)
  (5) Note the peripheral devices can cause mutual noise interference with LCD modules. Especially, input devices such as Touch Panel, etc., may output operational level by radiation noise even when these devices are not in operation. Actual performance confirmation and verification under actual usage environment by actual final product is highly recommended.
(6) To avoid EMI, preventive measures should be implemented in the final product.
(7) Display abnormality may occur with sudden removal of power supply such as device battery. Sudden removal of power supply shall be avoided at all time. LCD module quality cannot be guaranteed under such condition.
(8) Ensure sufficient light shading measures during design phase and when assemble the LCD module.
(9) Ensure sufficient light shading measures in the inspection process.
(10) Similar to general electronic components, ESD may cause LCD IC to malfunction. ESD preventive measures should be considered around the LCD module.
(11) While display data may be kept, data can be easily changed by external noise. Noise shall be minimized at device or system level.
(12) As unexpected noise may occur, periodic refresh operation such as resend the command and display data is highly recommended as part of the software routine.
(13) When logic circuit power is off, do not apply any signals to the input terminals.
(14) Do not use other components such as FPC or other features to fix the LCD module position, as pressure/tension may produce undesired result such as FPC trace crack.

10.3 DISPLAY CHARACTERISTICS

(1) Because the optimum LCD driving voltage depends on the ambient temperature, display may slightly flicker at the environment of high temperature.
(2) One of the special characteristics of liquid crystal is that it freezes when stored at the temperature below the storage temperature range. Such freezing may cause orientation defects or bubbles (black or white) to appear in the LCD panel. Bubbles may also occur if the panel receives an impact in a low-temperature environment.
(3) If the LCD module is left operating for a long time with the same display showing, the displayed pattern may leave traces on the screen or the contrast may become inconsistent.

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10.4 KEEPING THE PRODUCTS

(1) When keeping LCD modules, avoid the following condition or environment.
• Exposure to direct sunlight or fluorescent lamps lightings.
• High-temperature/high-humidity or very low-temperature (below 0°C) environments.
• Exposure to water droplets, condensation, etc.
Furthermore, keep LCD modules in anti-static bags to prevent static electricity charge ups. Whenever possible, LCD modules should be stored in the same conditions in which they were shipped from Japan Display Inc.
(2) Take precaution to minimize corrosion of electrodes. Corrosion of electrodes is accelerated by moisture, condensation or a current flow in a high-humidity environment.
(3) Recommended keeping conditions.
• Keeping environment : +15℃ to 35℃, less than 65%RH
• Duration: up to 2 months after shipping date
(4) The shipping carton must not be stacked up over 1.5m in height.

10.5 DISPOSAL

(1) When disposing LCD modules, consult company specialized in industrial waste treatment which is permitted by the government or local authority.   When incineration is the method of LCD module disposal, law of environmental hygienic must be obeyed.

10.6 OTHERS

(1) This product is designed to be used in ordinary electronic devices. Do not use this product in other applications, especially in devices that may cause direct bodily damage to end users (such as aerospace equipment, traffic control equipment, medical equipment, life-support system equipment, or safety equipment).
(2) Japan Display Inc. shall not be responsible for defects that occur in this product or in equipment connected to this product if the product is used in an environment that exceeds the ranges specified in this document, or in an environment not described in this document.

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Rear
(Side B)

Soldering PAD

(Connector Insertion Part)

0.3±0.3

1.45±0.3

0.844±0.13 (LCD Panel)
(0.4)(LCD Panel)
(0.119)(Rear Polarizer)
(0.325)(Front Polarizer)

0.3±0.03
(Connector Insertion Part)

Note 1) Cosmetic imperfection will be allowed outside the Viewing Area.
2) Viewing Direction is the angle to get best reflective performance.

Ver.01

Front
(Side A)

Viewing
Direction

34.656
(33.556)
(25.028)
(9.54)

0.35max.

Stiffener(PI)

33.256
Ø31.256
Ø30.456
(23.716)
10max.

1.4±0.15
(9.54)
(11.628)
0.3±0.3
2×2-(R5)
2-(R2.5)

LCD FPC

(9.628)

3±0.15
1.45±0.3

(16.6)

(23.628)
(16.63)

Pin1
Pin24
2-R0.2

4±0.5(Stiffener)
2.5±0.3
0.2

0.5±0.03
0.5±0.07
0.3±0.03
(24-1)x0.5=11.5±0.03
12.5±0.05

C(5:1)
(FH34SRJ-24S-0.5SH(50)/FH19SC-24S-0.5SH(Hirose))

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CONFIDENTIAL