LIQUID CRYSTAL DISPLAY MODULE

Product Specification

CUSTOMER	**Standard**
CUSTOMER PART NUMBER	
PRODUCT NUMBER	**DBC-48027243-1A0**

Product Mgr	Design Eng
Bruno Recaldini	**Luo Luo**
Date: 15-Feb-12	Date: 15-Feb-12

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REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECN no.
1.0	10.02.2010			First Issue	
1.1	15-Feb-12	7	2.3	Added Serial Label / Print	

1 MAIN FEATURES

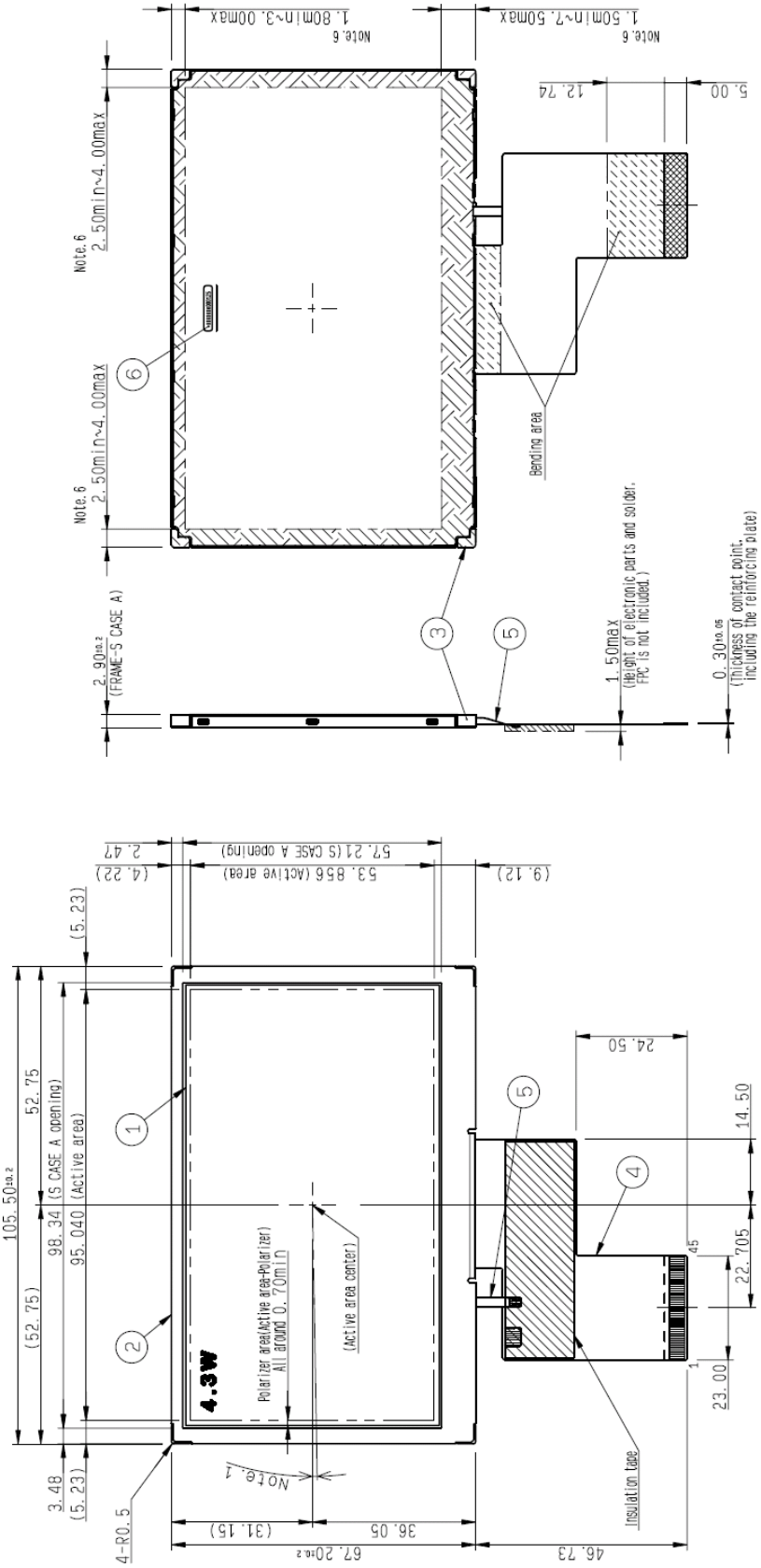
ITEM	CONTENTS
Screen Size	4.3” Diagonal
Display Format	480 x RGB x 272 Dots
N° of Colour	16,7m
Overall Dimensions	105.5 mm (H) x 67.20 mm (V) x 2.90 mm (D)
Active Area	95.040 mm (H) x 53.856 mm (V)
LCD Type	TFT
Mode	Sunlight Readable
Interface	8-bit RGB, parallel input
Backlight Type	LED
Operating Temperature	-20°C ~ +70°C
Storage Temperature	-30°C ~ +80°C
RoHS compliant	Yes

2 MECHANICAL SPECIFICATION

2.1 MECHANICAL CHARACTERISTICS

ITEM	CHARACTERISTIC	UNIT
Display Format	480 x RGB x 272	Dots
Overall Dimensions	105.5 (H) x 67.20 (V) x 2.90 (D)	mm
Bezel Opening Area	98.34 (H) x 57.21 (V)	mm
Active Area	95.040 (H) x 53.856 (V)	mm
Dot Pitch	66.0 (H) x RGB x 198.0 (V)	µm
Weight	40.0	g

2.2 MECHANICAL DRAWING



Note 2 S label is affixed the area shown in the drawing.
The thickness of the S label will be added to that of S case's surface.
Note 3 Recommended FPC connectors
For LCD: HIROSE/FH12A-45S-0. 5SH(55) (Top contact)
FPC pin assignment differs from a position of Datum Pin of recommended FPC connector.
Please notice the difference when designing your circuit with much care.
Note 4 Protective film is affixed on front surface on the screen.
Location tolerance of the protective film shall be ± 1.5 mm to the polarizer.
Note 5 Exercise care not to apply any forces to the cable holder of the S CASE A.
Note 6 In case TFT-LCD monitor is fixed to the case of your product, it is recommended that monitor is fixed in to "hatched" area.

2.3 SERIAL LABEL / PRINT

The label / print indicates the least significant digit of manufacture year (1digit), manufacture month with below alphabet (1letter), model code (4 or 5 characters), serial number (6 digits).

* Label / Print Contents

*	*	****(*)	******
a	b	c	d

where:

a The least significant digit of manufacturing year

b Manufacturing Month:
Jan-A, Feb-B, Mar-C, Apr-D, May-E, Jun-F, Jul-G, Aug-H, Sep-I, Oct-J, Nov-K, Dec-L

c Model code
43BGC →Made in Japan
43BHC →Made in Malaysia
43BJC →Made in China

d Serial number, like “000125”

Examples:

Made in Japan
2D43BGC000125
means "manufactured in April 2012, model 43BGC, serial number 000125"

Made in Malaysia
2D43BHC000125
means "manufactured in April 2012, model 43BHC, serial number 000125"

Made in China
2D43BJC000125
means "manufactured in April 2012, model 43BJC, serial number 000125"

3 ELECTRICAL SPECIFICATION

3.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Min	Max	Unit	Applicable terminal
Supply Voltage	VDD	Ta= 25°C	-0.3	5.0	V	VDD
Input Voltage for Logic	VI		-0.3	VDD+0.3	V	CLK, VSYNC, HSYNC, DE, D[27:20], D[17:10], D[07:00], STBYB

3.2 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit	Applicable terminal
Supply Voltage	VDD	VDD	3.0	3.3	3.6	V	VDD
Input Voltage for Logic	VI	VDD= 3.0~3.6V	0	--	VDD	V	CLK, VSYNC, HSYNC, DE, D[27:20], D[17:10], D[07:00], STBYB
Input Voltage for Logic	VIH	VDD= 3.0~3.6V	0.7xVDD	--	VDD	V	CLK, VSYNC, HSYNC, DE, D[27:20], D[17:10], D[07:00], STBYB
	VIL		0	--	0.3xVDD	V	
Pull Down Resister Value	Rpd		--	200	--	kΩ	DE, D[27:20], D[17:10], D[07:00]
Pull Up Resister Value	Rpu		--	200	--	kΩ	VSYNC, HSYNC, STBYB
Current Consumption	IDD		fCLK= 9MHz Colour bar display	17	34	mA	VDD
Standby Current	IDDs		Other Input with constant voltage	100	200	µA	

3.3 INTERFACE PIN ASSIGNMENT

3.3.1 LCM PIN ASSIGNMENT

Pin No.	Symbol	Function
1	VSS	GND
2	VSS	GND
3	VDD	Power supply
4	VDD	Power supply
5	D00	Display data (R) 00h: Black D00:LSB D07:MSB Driver has internal gamma conversion
6	D01	
7	D02	
8	D03	
9	D04	
10	D05	
11	D06	
12	D07	
13	D10	Display data (G) 00h: Black D10:LSB D17:MSB Driver has internal gamma conversion
14	D11	
15	D12	
16	D13	
17	D14	
18	D15	
19	D16	
20	D17	
21	D20	Display data (B) 00h: Black D20:LSB D27:MSB Driver has internal gamma conversion
22	D21	
23	D22	
24	D23	
25	D24	
26	D25	
27	D26	
28	D27	
29	VSS	GND
30	DCLK	Clock signal. Latching data at the falling edge
31	STBYB	Standby signal input. (Hi: Normal operation, Lo: Standby operation)
32	HSYNC	Horizontal sync signal input (Low active)
33	VSYNC	Vertical sync signal input (Low active)
34	DE	Input data effective signal (It is effective for the period of “Hi”)
35	NC	OPEN
36	VSS	GND
37	NC	OPEN
38	NC	OPEN
39	NC	OPEN
40	NC	OPEN

41	VSS	GND
42	BLL	Backlight drive (cathode side)
43	BLH	Backlight drive (anode side)
44	NC	OPEN
45	NC	OPEN

Recommended connector: HIROSE ELECTRIC FH12 series [FH12A-45S-0.5SH(55)]

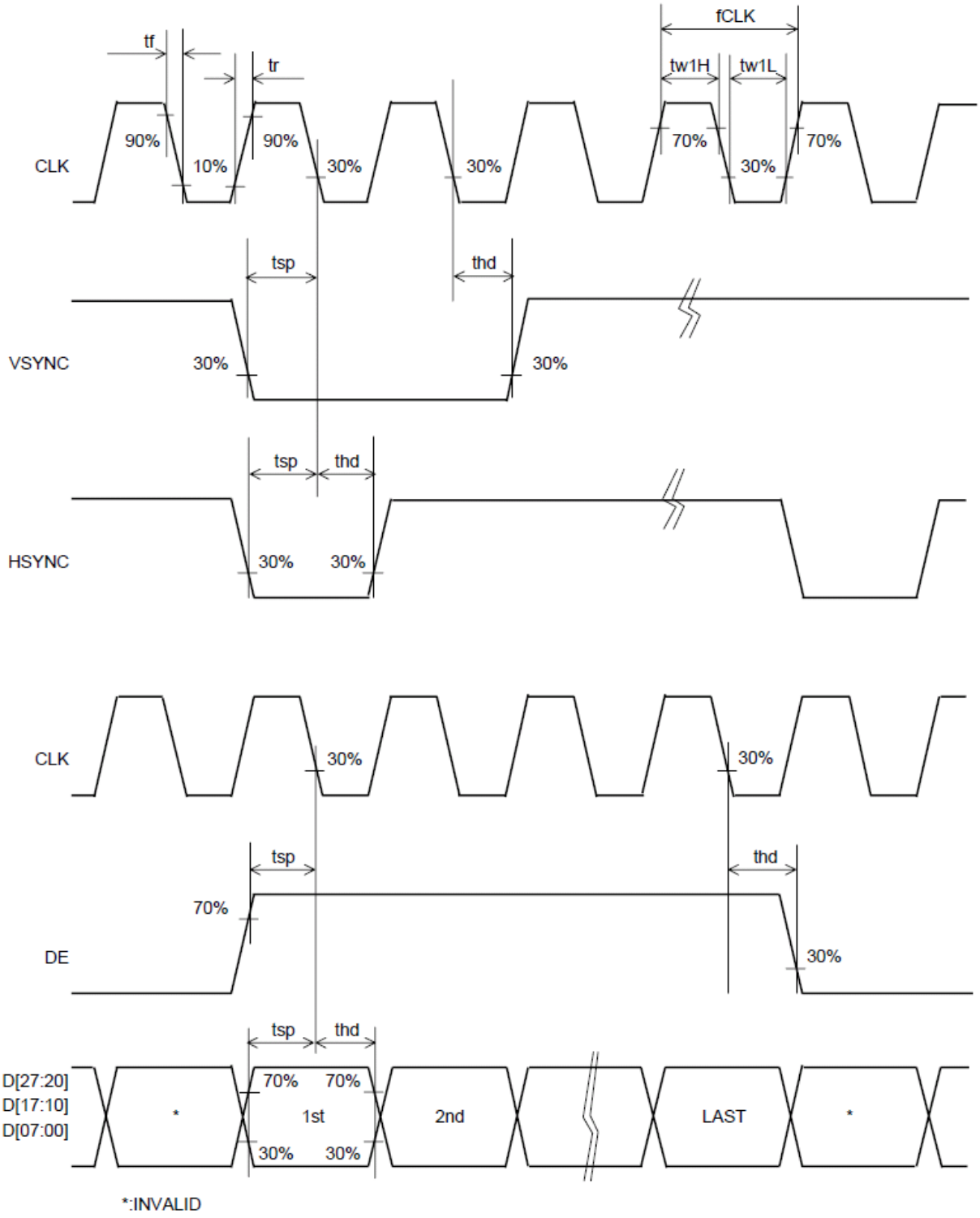
3.4 TIMING CHARACTERISTICS

3.4.1 AC Timing Characteristics

(Unless otherwise noted, Ta=25˚C, VDD=3.3V, VSS=0V)

Item	Symbol	Condition	Rating			Unit	Applicable terminal
			MIN	TYP	MAX		
CLK frequency	fCLK		5.0	9.0	12.0	MHz	CLK
CLK rising time	tr	10%-90%	--	--	9	ns	
CLK falling time	tf	90%-10%	--	--	9	ns	
CLK Low period	tw1L	0.3xVDD or less	0.4/fCLK	--	0.6/fCLK	ns	
CLK High period	tw1H	0.7xVDD or more	0.4/fCLK	--	0.6/fCLK	ns	
Setup time	tsp		12.0	--	--	ns	CLK, VSYNC, HSYNC, DE, D[27:20], D[17:10], D[07:00]
Hold time	thd		12.0	--	--	ns	

3.4.2 AC Timing Diagrams

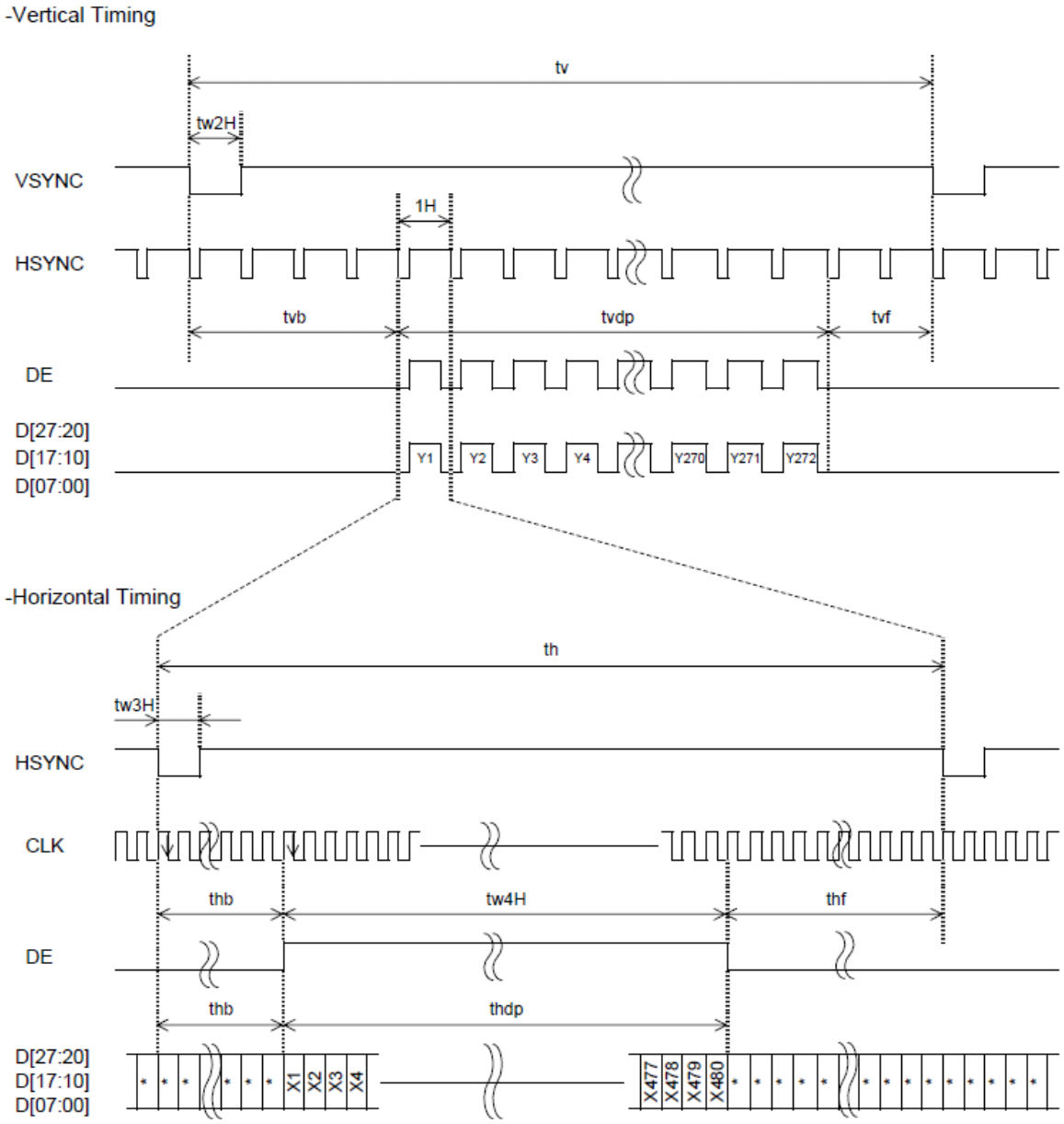


3.4.3 Input Timing Characteristics

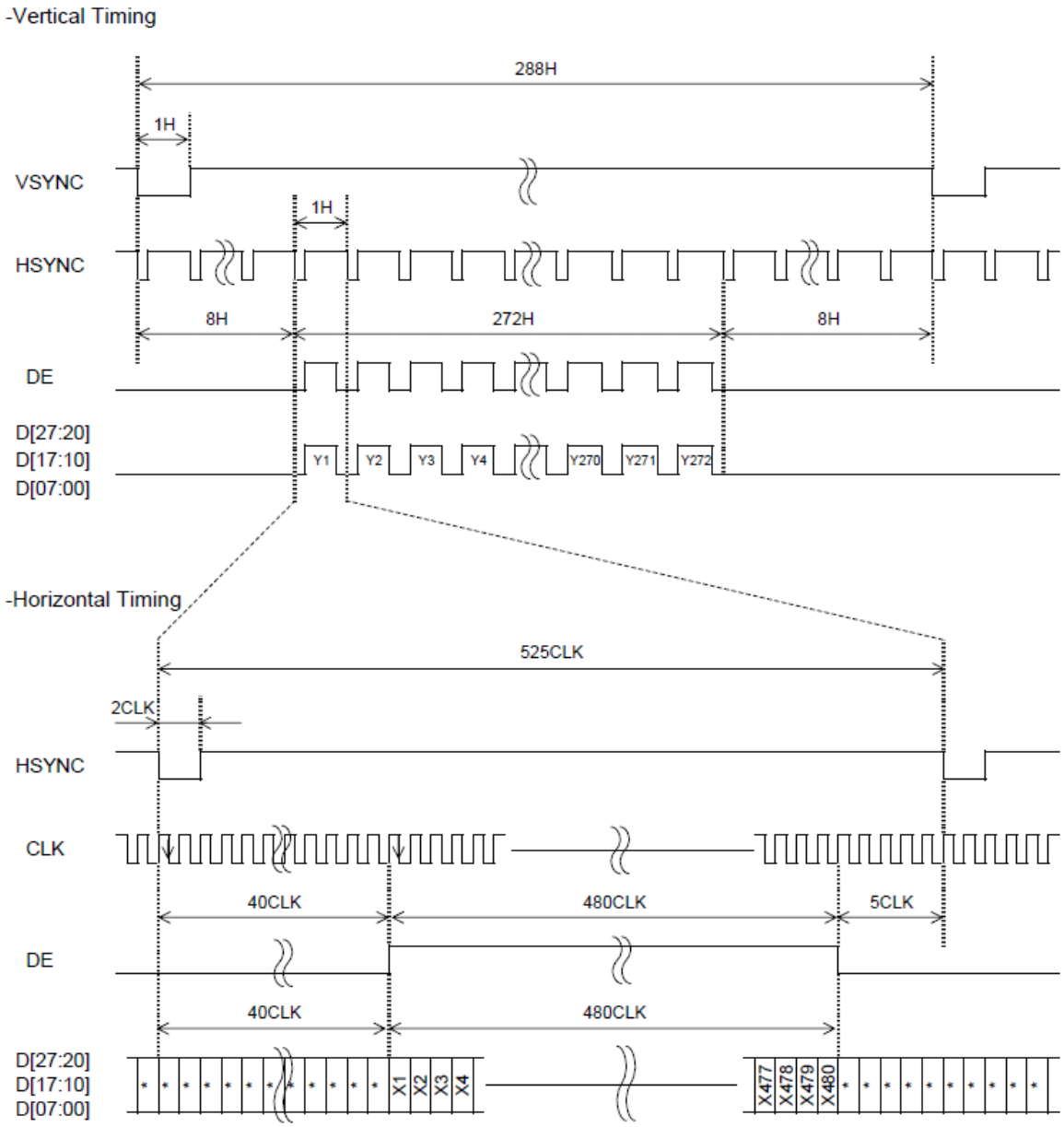
Unless otherwise noted, Ta=25°C, VDD=3.3V, VSS=0V

Item	Symbol	Rating			Unit	Applicable terminal
		MIN	TYP	MAX		
VSYNC frequency Note	fVSYNC	54	60	66	Hz	VSYNC
VSYNC signal cycle time	tv	277	288	400	H	VSYNC, HSYNC
VSYNC pulse width	tw2H	1	--	--	H	
Vertical back porch	tvb	3	8	31	H	
Vertical front porch	tvf	2	8	93	H	
Vertical display period	tvdp	--	272	--	H	VSYNC, HSYNC, DE, D[27:20], D[17:10], D[07:00]
HSYNC frequency	fHSYNC	15.38	16.67	18.18	KHz	HSYNC
HSYNC signal cycle time	th	520	525	800	CLK	HSYNC, CLK
HSYNC pulse width	tw3H	1	--	--	CLK	
Horizontal back porch	thb	36	40	255	CLK	HSYNC, DE, CLK
Horizontal front porch	thf	4	5	65	CLK	
Horizontal display period	thdp	--	480	--	CLK	DE, D[27:20], D[17:10], D[07:00], CLK
DE pulse width	tw4H	--	480	--	CLK	DE, CLK

3.4.4 Driving Timing Chart

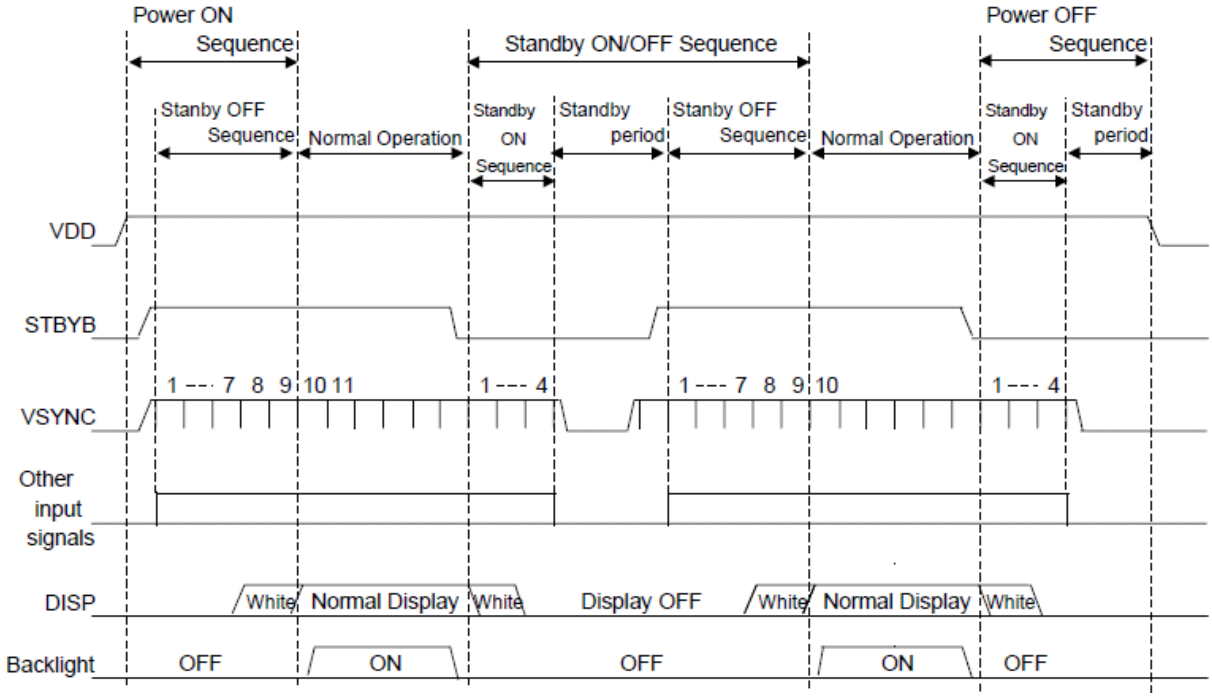


3.4.5 Example of Driving Timing Chart (fCLK= 9.0 MHz)



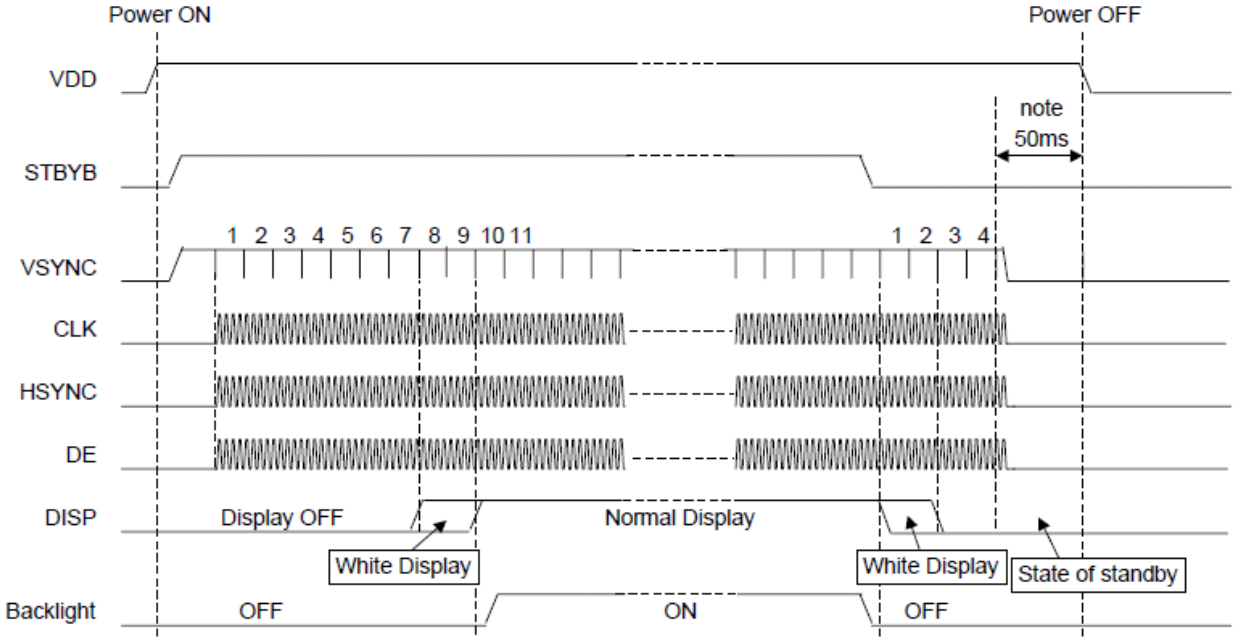
3.4.6 POWER SEQUENCE

The outline of “Power ON/OFF Sequence” and “Standby ON/OFF Sequence” is shown below.



3.4.7 Power ON/OFF Sequence

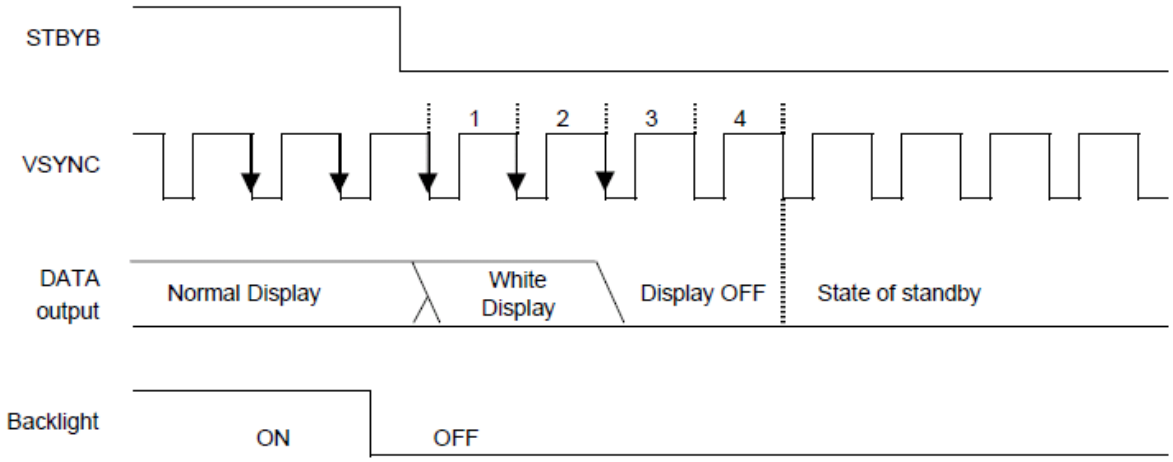
The sequence of the Power ON/OFF and the signal input must defend the following conditions.



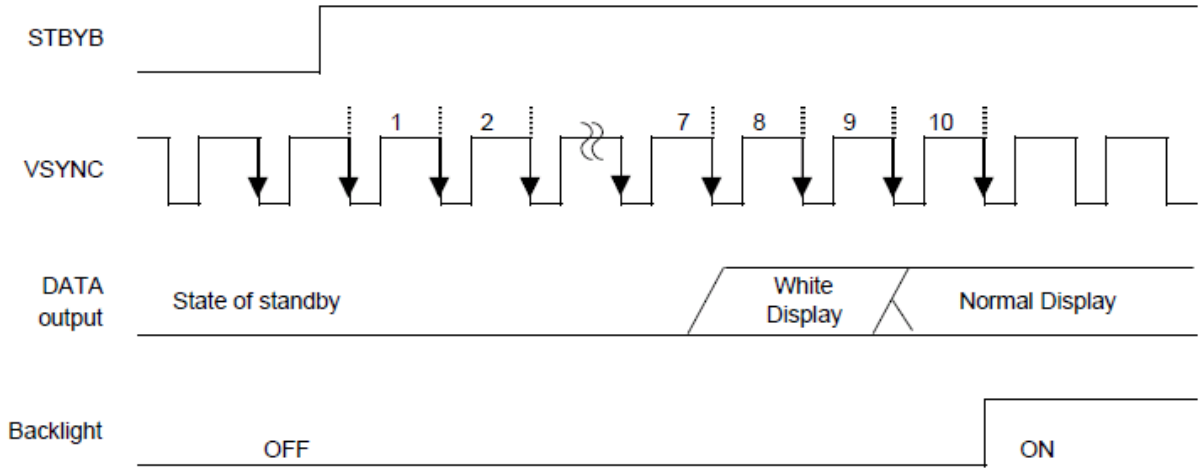
Note: For Power OFF, please turn off VDD since 50msec after the standby state shifts.
When CLK and the VSYNC signal are stopped or the power supply is turned off to a regulated frame or less, the afterimage might remain.

3.4.8 Standby ON/OFF Sequence

The following time will be needed by the shift in the state of the standby from the standby setting according to the STBYB signal. Meanwhile, VSYNC signal and the CLK signal should keep being supplied.



Similarly, the time of nine frames will be needed by the time a usual display is begun from the standby release by the STBYB signal. Please begin outputting in the 8th frame on the Display Data.



4 OPTICAL SPECIFICATION

4.1 OPTICAL CHARACTERISTICS

Ta = 25 °C

Item		Symbol	Condition	MIN	TYP	MAX	Unit	Note No.	Note
Response Time	Rise Time.	TON	VLCD=0.5V→4.8V	-	-	40	ms	1	*
	Fall Time	TOFF	VLCD=4.8V→0.5V	-	-	60	ms		
Contrast Ratio	Backlight ON	CR	VLCD= 0.5V/4.8V	240	400	-		2	
	Backlight OFF			-	7.5	-			
Viewing Angle	Left	θL	VLCD= 0.5V/4.8V	80	-	-	deg	3	*
	Right	θR		80	-	-	deg		
	Up	φU		80	-	-	deg		
	Down	φD		80	-	-	deg		
V-T Threshold Voltage		V		1.2	1.5	1.8	V	4	*
		V		1.7	2.0	2.3	V		
		V		2.2	2.5	2.8	V		
White V-T Curve		-	-	White V-T Curve					Reference
White Chromaticity		x	VLCD= 0.5V	White Chromaticity Range				5	
		y							
Burn-in				No noticeable burn-in image should be observed after 2 hours of window pattern display.				6	
Center Brightness			VLCD= 0.5V	315	450		cd/m²	7	
Brightness Distribution			VLCD= 0.5V	70			%	8	

* <Measured in the form of LCD module.

<Measurement Condition>

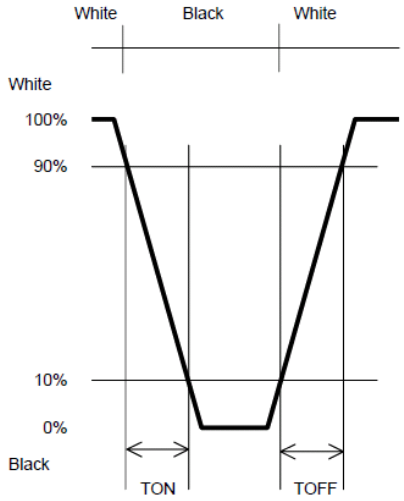
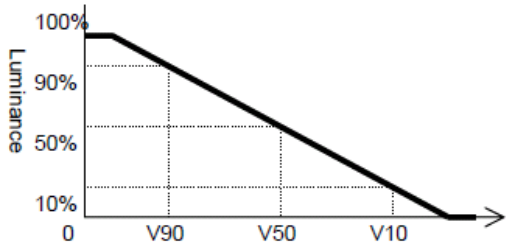
Measuring instruments: CS1000 (KONICA MINOLTA), LCD7000 OTSUKA ELECTRONICS), EZcontrast160D (ELDIM)

Driving condition: VDD= 3.3V, VSS= 0V
Optimized VCOMDC
VLCD= | Vsigpp±Vcompp | /2

Backlight: IL=10mA

Measured temperature: Ta=25°C

4.1.1 Test Method

Note	Item	Test method	Measuring instrument	Remark
1	Response time	Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.  	LCD7000	Black display VLCD=4.8V White display VLCD=0.5V TON Rise Time TOFF Fall Time
2	Contrast ratio	Measure maximum luminance Y1 (VLCD=0.5V) and minimum luminance Y2 (VLCD=4.8V) at the center of the screen by displaying raster or window pattern. Then calculate the ratio between these two values. Contrast ratio = Y1/Y2 Diameter of measuring point: 8mmφ	CS1000 LCD7000	Backlight ON Backlight OFF
3	Viewing angle Horizontal θ Vertical φ	Move the luminance meter from right to left and up and down and determinate the angles where contrast ratio is 10	EZcontrast160D	
4	V-T Threshold Value	Change VLCD by 0.1V step and plot the points where the luminance is 90% as V90, 50% as V50 and 10% as V10 of maximum luminance.  	LCD7000	
5	White chromaticity	Measure chromaticity coordinates x and y of CIE1931 colorimetric system at VLCD=0.5V Color matching faction: 2° view	CS1000	
6	Burn-in	Visually check burn-in image on the screen after 2 hours of “window display” (VLCD=0.5V/4.8V).		At optimized VCOMDC
7	Center brigtness	Measure the brightness at the center of the screen	CS1000	
8	Brightness distribution	(Brightness distribution)= 100 x B/A % A: max. brightness of the 9 points B: min. brightness of the 9 points	CS1000	

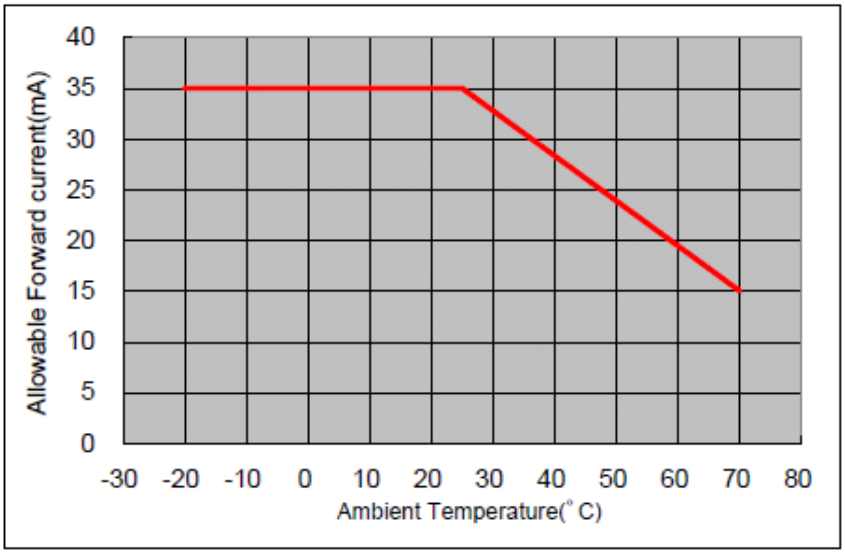
5 BACKLIGHT SPECIFICATION

5.1 LED DRIVING CONDITIONS

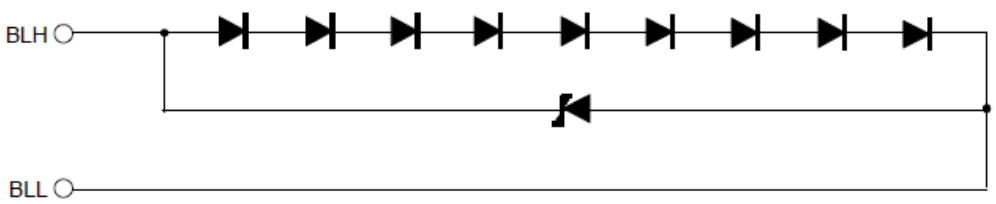
Item	Symbol	Condition	Rating			Unit	Applicable Terminal
			Min	Typ	Max		
Forward Current	IL25	Ta= 25°C	--	10.0	35.0	mA	BLH-BLL
	IL70	Ta= 70°C	--	--	15.0	mA	
Forward Voltage	VL	Ta= 25°C, IL= 10.0 mA	--	27.0	29.7	V	
Estimated Life of LED	LL	Ta= 25°C, IL= 10.0 mA Note	--	(20,000)	--	hr	

Note:

- The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.
- This figure is given as a reference purpose only, and not a guarantee.
- This figure is estimated for an LED operating alone.
  As the performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.



5.2 LED CIRCUIT



6 QUALITY ASSURANCE SPECIFICATION

6.1 DEFECTIVE DISPLAY AND SCREEN QUALITY

Test Condition:	Observed TFT-LCD monitor from front during operation with the following conditions
Driving Signal	Raster Patter (RGB in monochrome, white, black)
Signal condition	VLCD:0.5V, 2.2V, 4.8V (3 steps)
Observation distance	30 cm
Illuminance	200 to 350 lx
Backlight	IL=10mA

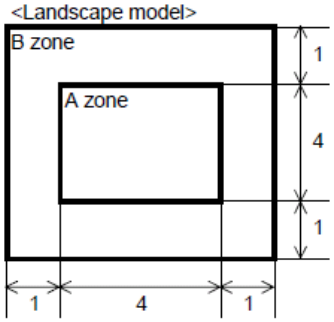
Defect item		Defect content		Criteria
Display Quality	Line defect	Black, white or color line, 3 or more neighboring defective dots		Not exists
	Dot defect	Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot) High bright dot: Visible through 2% ND filter at VLCD=4.8V Low bright dot: Visible through 5% ND filter at VLCD=4.8V Dark dot: Appear dark through white display at VLCD=2.2V		Refer to table 1
Screen Quality	Dirt	Point-like uneven brightness (white stain, black stain etc)		Invisible through 1% ND filter
	Foreign particle	Point-like	0.25mm<φ	N=0
			0.20<φ≦0.25mm	N≦2
			φ≦0.20mm	Ignored
		Liner	3.0mm<length and 0.08mm<width	N=0
			length≦3.0mm or width≦0.08mm	Ignored
	Others			Use boundary sample for judgment when necessary

φ(mm): Average diameter = (major axis + minor axis)/2
Permissible number: N

Table 1

Area	High bright dot	Low bright dot	Dark dot	Total	Criteria
A	0	2	2	3	Permissible distance between same color bright dots (includes neighboring dots): 3 mm or more Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more
B	2	4	4	6	
Total	2	4	4	7	

<Landscape model>



Division of A and B areas
B area: Active area
Dimensional ratio between A and B areas: 1: 4: 1 (Refer to the left figure)

6.2 SCREEN AND OTHER APPEARANCE

Testing conditions

Observation distance	30cm
Illuminance	1200～2000 lx

Item		Criteria	Remark
Polarizer	Flaw Stain Bubble Dust Dent	Ignore invisible defect when the backlight is on.	Applicable area: Active area only (Refer to the section 3.2 "Outward form")
S-case		No functional defect occurs	
FPC cable		No functional defect occurs	

6.3 DEALING WITH CUSTOMER COMPLAINTS

6.3.1 Non-conforming analysis

Purchaser should supply Densitron with detailed data of non-conforming sample. After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.
If the analysis cannot be completed on time, Densitron must inform the purchaser.

6.3.2 Handling of non-conforming displays

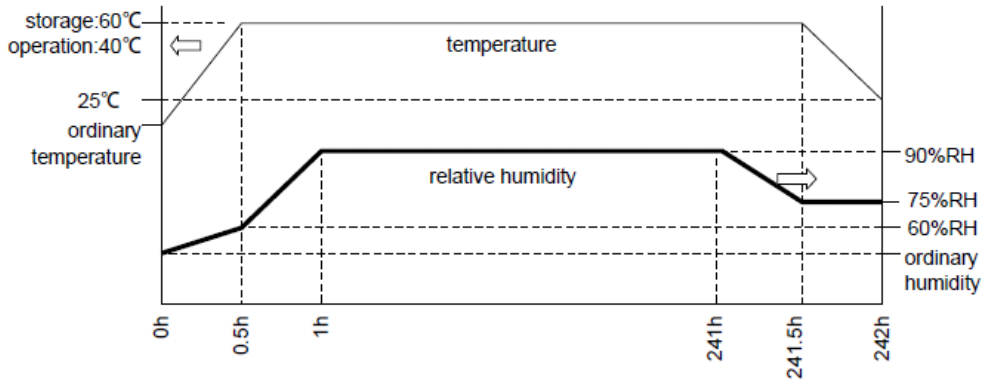
If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.
Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.
Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.

7 RELIABILITY SPECIFICATION

7.1 RELIABILITY TESTS

Test Item		Test Condition	Number of failures/ number of examinations
Durability Test	High Temperature Storage	Ta= 80°C 240h	0/3
	Low Temperature Storage	Ta= -30°C 240h	0/3
	High Temperature & High Humidity Storage	Ta= 60°C, RH=90% 240h	0/3
	High Temperature Operation	Tp= 70°C 240h	0/3
	Low Temperature Operation	Tp=- 20°C 240h	0/3
	High Temperature & Humidity Operation	Tp= 40°C RH= 90% 240h	0/3
	Thermal Shock Storage	-30°C←→80°C (30min/ 30min) 100cycles	0/3
Mechanical Environmental Test	Electrostatic Discharge Test (non operation)	Confirms to EIAJ ED-4701/300 C=200pF, R=0Ω, V=±200V Each 3 times of discharge on and power supply and other terminals.	0/3
	Surface Discharge Test (non operation)	C= 250pF R= 100Ω V=±12kV Each 5 times of discharge in both polarities on the center of screen with the case grounded.	0/3
	FPC Tension Test	Pull the FPC with the force of 3N for 10 sec. in the direction – 90-degree to its original direction.	0/3
	FPC Bend Test	Pull the FPC with the force of 3N for 10sec. in the direction -180-degree to its original direction. Reciprocate it 3 times	0/3
	Vibration Test	Total amplitude 1.5 mm, f=10 ~ 55Hz, X,Y,Z directions for each 2 hours	0/3
	Impact Test	Use original jig and make an impact with peak acceleration of 1000m/s² for 6 msec with half sine-curve at 3 times to each X,Y,Z directions with JIS 60068-2-27-1995.	0/3
Packing Test	Packing Vibration-Proof Test	Acceleration of 19,6 m/s² with frequency of 10→55→10Hz, X, Y, Z direction for each 30 minutes	0/1 Packing
	Packing Drop Test	Drop from 75 cm high. 1 time to each 6 surfaces, 3 edges, 1 corner	0/1 Packing

Note: Ta=ambient temperature Tp=Panel temperature



8 HANDLING PRECAUTIONS

Safety
If the LCD panel breaks, be careful not to get the liquid crystal fluid in your mouth or in your eyes.
If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Mounting and Design
Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.
When assembling with a zebra connector, clean the surface of the pads with alcohol and keep the surrounding air very clean.
Design the system so that no input signal is given unless the power supply voltage is applied.

Caution during LCD cleaning
Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotriflorothane.
Do not wipe the display surface with dry or hard materials that will damage the polariser surface.
Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

Caution against static charge
As the display uses C-MOS LSI drivers, connect any unused input terminal to VDD or VSS.
Do not input any signals before power is turned on. Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

Packaging
Displays use LCD elements, and must be treated as such. Avoid strong shock and drop from a height.
To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

Caution during operation
It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life. Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation. Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged. If the display area is pushed on hard during operation, some graphics will be abnormally displayed but returns to a normal condition after turning off the display once. Even a small amount of condensation on the contact pads (terminals) can cause an electro-chemical reaction which causes missing rows and columns. Give careful attention to avoid condensation.

Storage
Store the display in a dark place where the temperature is 25°C ± 10°C and the humidity below 50%RH.Store the display in a clean environment, free from dust, organic solvents and corrosive gases.
Do not crash, shake or jolt the display (including accessories).