DENSITRON DISPLAYS

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

PRODUCT NUMBER	84-0168-000

INTERNAL APPROVALS		
Product Manager	Engineering	Document Control
Date:	Date:	Date:

Preliminary

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REVISION RECORD

Rev.	Date	Page	Par.	Comment	ECN no.
A	12/1/11	--	--	Preliminary DCA Release	E4553

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1 GENERAL SPECIFICATIONS

ITEM	DESCRIPTION	UNIT
Module Outline Dimensions	164.05 (H) x 100.86(V) x 2.35 (T) (Not including cable)	mm
Active Display Area	153.6(H) x 90.0 (V)	mm
Pixel Configuration Format / Resolution	1024 (H) x 600 (V)	pixels
LCD Type	Transmissive / Normally Black	--
Backlight Type	Bottom edge side, 1-LED lighting Bar type (20*LED array)	--
Weight	90 Max	gram
Interface	1 Channel LVDS Interface with 1 pixel /clock	--
Pixel Arrangement	Pixels RGB stripe arrangement	--
Pixel pitch	50(H)X150(V)xRGB	um
Display Color	16.7M(6bits+H-FRC)	--
RoHS Compliant	Yes	--
Surface Treatment	Hard coating, 3H, Low reflection (Front polarizer)	--

2 FEATURES

- The display module is an 7” diagonal WSVGA supported TFT-LCD and can display 16.7M colors (Hi FRC).

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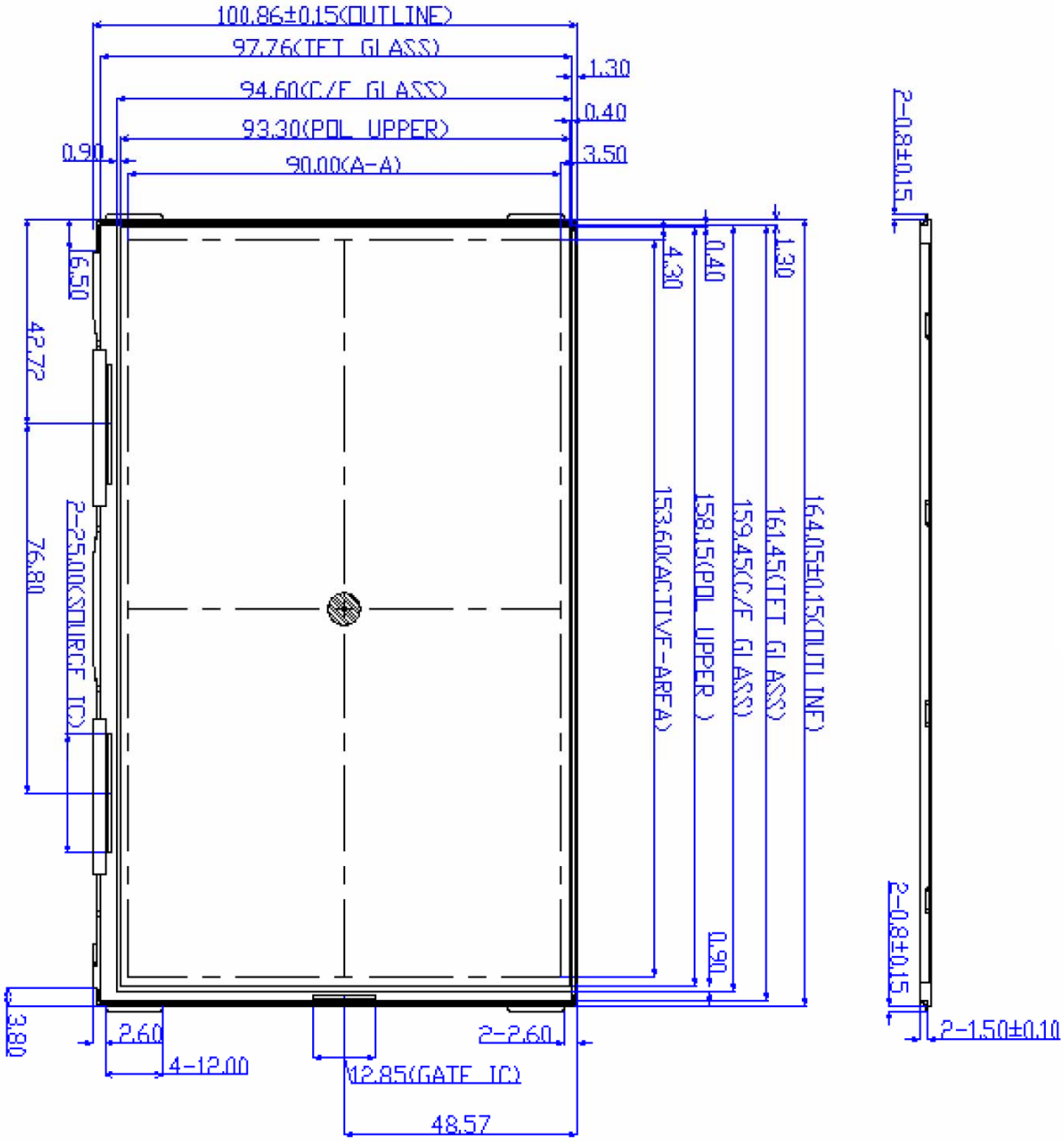
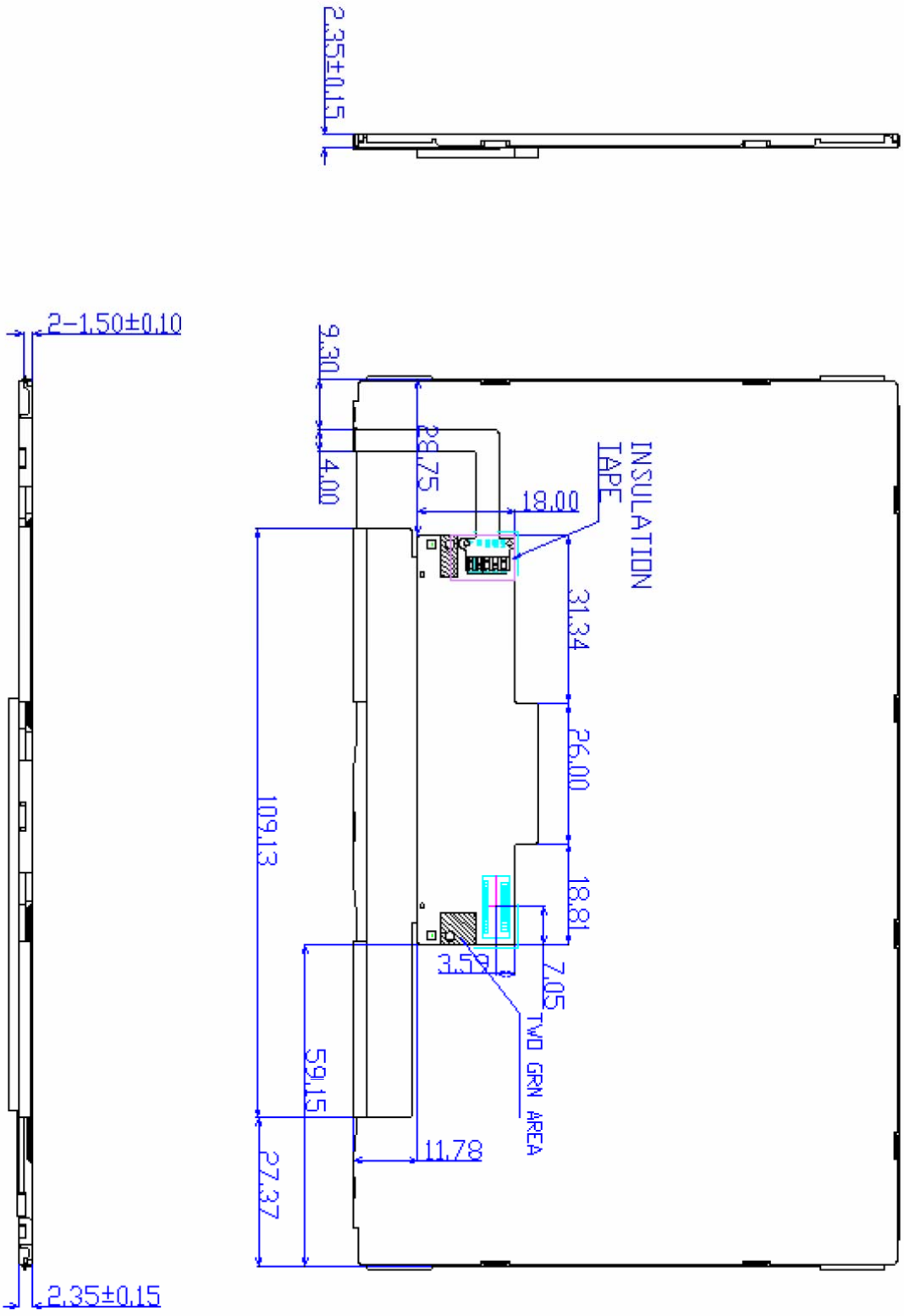
3 MECHANICAL DRAWING




2.35±0.15
2-1.50±0.10
9.30
28.75
4.00
18.00
INSULATION TAPE
31.34
26.00
109.13
18.81
3.5
7.05
TWO GRN AREA
59.15
11.78
27.37
2.35±0.15

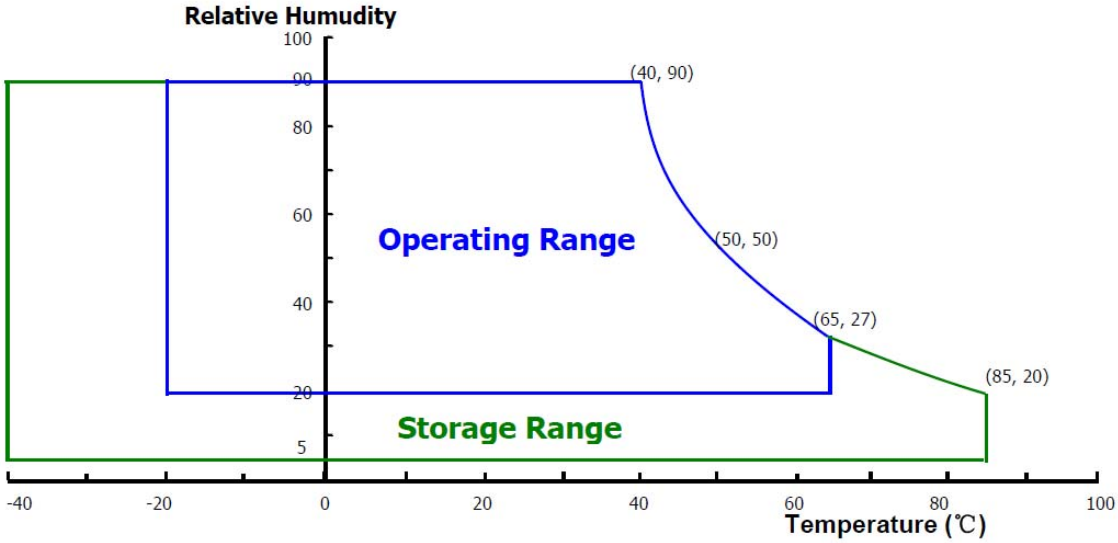
4 ABSOLUTE MAXIMUM RATINGS

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C,)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage (LCD module)	V_{DD}	-0.3	4	V	
Backlight Power supply voltage	HV_{DD}	-0.3	40	V	
Backlight LED Current	I_{LED}	-	30	mA	
Backlight LED Reverse Coltage	V_R	-	2	V	
Storage temperature	T_{STG}	-40	+85	°C	(1)
Operating temperature	T_{OPR}	-20	+65	°C	(1)

Note (1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39°C max. and no condensation of water.



5 ELECTRICAL CHARACTERISTICS

TFT-LCD Module

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Power supply input voltage	V_{DD}	3.2	3.7	4.2	V	
Power Supply Current	I_{DD}	-	220	-	mA	Note 1
Backlight Power Supply Voltage	H_{VDD}	3.2	3.7	4.2	V	
Backlight power supply current	I_{HVDD}	-	346	-	mA	
LED driver Efficiency	η	-	82	-	%	Note 2
Positive-Going Input Threshold Voltage	V_{IT+}	-	-	+100	mV	
Negative-going Input Threshold voltage	V_{IT-}	-100	-	-	mV	V_{COM} = 1.2V Typ
Differential input common mode voltage	V_{COM}	-	1.2	-	V	V_{IH}=100mV V_{IL}=100mV
Power Consumption	P_D	-	0.78	-	W	Note 1
	P_{BL}	-	1.25	-	W	Note 2
	P_{Total}	-	2.01	-	W	

Note1: The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for 3.7V at 25°C

a) Typ: Black Pattern

Note 2: Calculated value for reference (VLED X ILED)

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6 BACKLIGHT CHARACTERISTICS

The back-light system is an edge-lighting type with white LED (Light Emitting Diode)s.

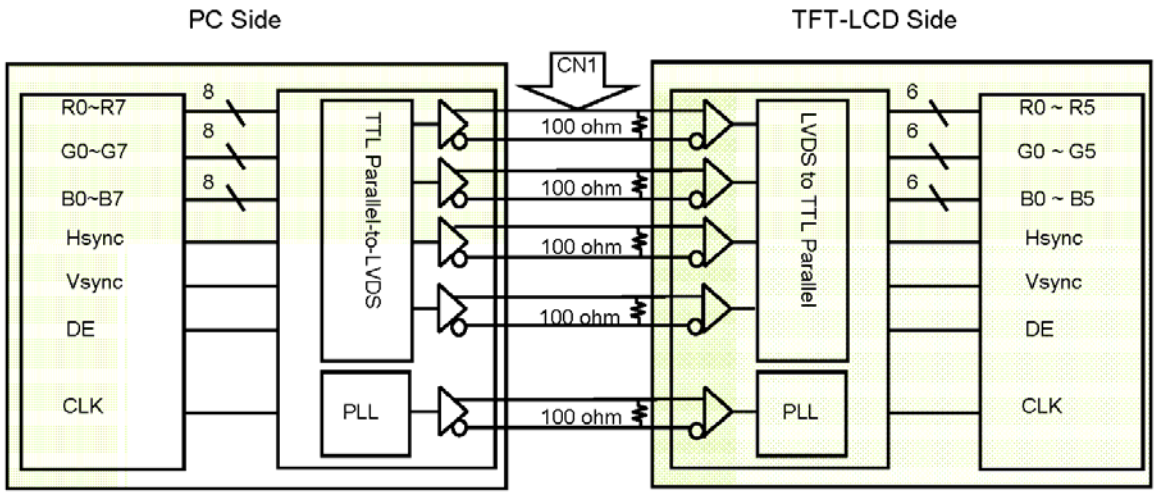
(Ta=25±2°C)

Item		Symbol	Value			Unit	Condition
			Min.	Typ.	Max.		
LED Forward Voltage		V_F	-	-	3.06	V	
LED Forward Current		I_F	-	-	16.7	mA	
LED Power Consumption		P_{LED}	-	-	1.025	W	Note 1
LED Life Time (25℃)		-	15,000	-	-	hr	IF= 20mA Note 2
Power supply for LED Driver		V_{LED}	3.2	3.7	4.2	V	
EN Control Level	Backlight ON	-	-	-	+100	mV	
	Backlight OFF	-	-100	-	-	mV	
PWM control Level	PWM High Level	-	-	2.8	-	V	
	PWM Low level	-	-	0	0.6	V	
PWM control Frequency		F_{PWM}	5	-	100	KHz	
Duty Ratio		-	90%	93%	-	%	

Note (1)Calculated Value for reference I_{LED} X V_{LED} = P_{LED}.

(2) The LED life-time defines as the estimated time to 50% degradation of initial luminous.

7 BLOCK DIAGRAM



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8 ELECTRO-OPTICAL CHARACTERISTICS

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θØ=0 (=θ3) as the 3 o'clock direction (the "right"), θØ=90 (= θ12) as the 12 o'clock direction ("upward"), θØ=180 (= θ9) as the 9 o'clock direction ("left") and θØ=270(= θ6) as the 6 o'clock direction ("bottom"). While scanning θand/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be 3.7 ± 0.5V at 25°C. Optimum viewing angle direction is 6 'clock.

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	-	80	-	Deg.	Note 1
		Θ_9		-	80	-	Deg.	
	Vertical	Θ_{12}		-	80	-	Deg.	
		Θ_6		-	80	-	Deg.	
Color Temperature				6000	7000	8000	K	
Color Gamut				46.7	51.7	-	%	
Luminance Contrast ratio		CR	Θ = 0°	700	900			Note 2
Luminance of White	9 Points	Y_w	Θ = 0°	320	400	-	cd/m²	Note 3
White Luminance uniformity	9 Points	ΔY9		80	90	-		Note 4
White Chromaticity		W_x	Θ = 0°	Typ. -0.02	0.303	Typ. +0.02		Note 5
		W_y			0.333			
Reproduction of color	Red	R_x	Θ = 0°	Typ. -0.03	0.600	Typ. +0.03		
		R_y			0.340			
	Green	G_x			0.315			
		G_y			0.565			
	Blue	B_x			0.145			
		B_y			0.125			
Response Time (Rising + Falling)		T_{RT}	Ta= 25° C Θ = 0°	-	30	-	ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as luminance values of 9 point average across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display. the LED current is setting at 20mA.

4. The White luminance uniformity on LCD surface is then expressed as : ΔY = Minimum Luminance of 9 points / Maximum Luminance of 9 points (see FIGURE 2).

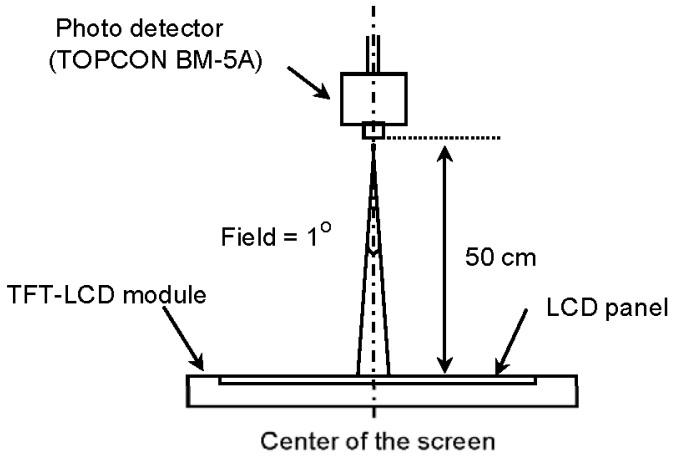
5. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark. (See FIGURE 4).

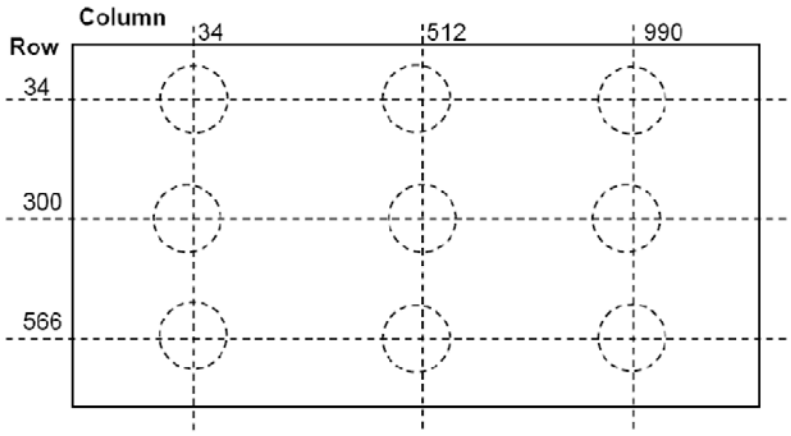
Optical measurements

Figure 1. Measurement Set Up



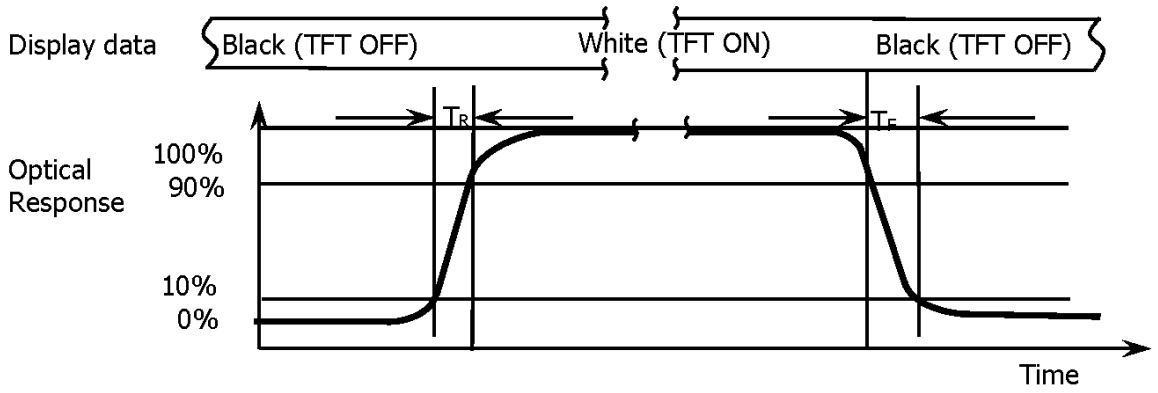
Optical characteristics measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



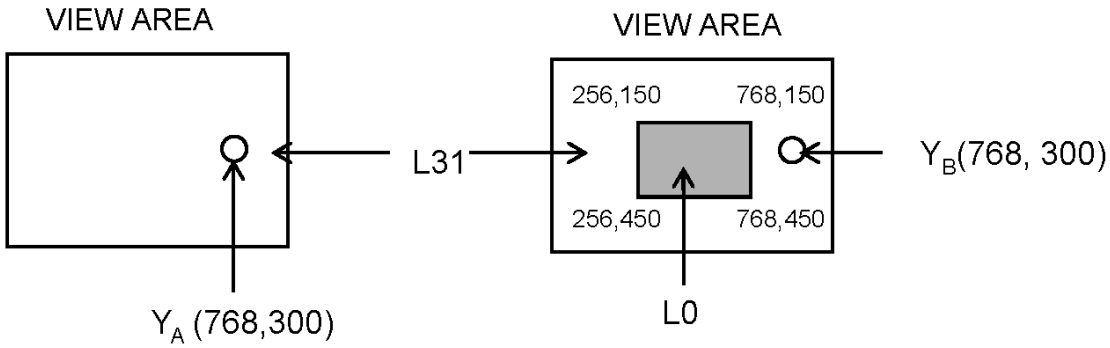
Center Luminance of white is defined as luminance values of center 9 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
The White luminance uniformity on LCD surface is then expressed as : ΔY9 = Minimum Luminance of five points / Maximum Luminance of nine points (see FIGURE 2).

Figure 3. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Td.

Figure 4. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where:

Y_A = Initial luminance of measured area (cd/m^2)
Y_B = Subsequent luminance of measured area (cd/m^2)

The location measured will be exactly the same in both patterns

Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark (Refer to FIGURE 4).

9 INPUT/OUTPUT TERMINALS PIN ASSIGNMENT

6.1 Pin Assignment

The electronics interface connector is FF12-31A-R11B.
The connector interface pin assignments are listed in Table 6.

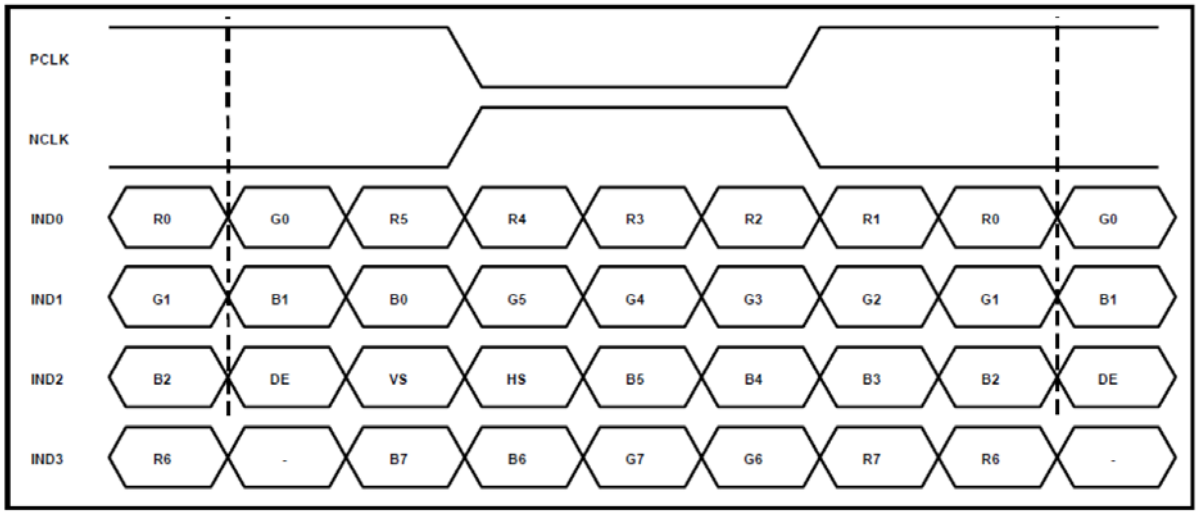
<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	VDDIN	Power supply VDDIN=3.7V (Typ.)
2	VDDIN	
3	VDDIN	
4	VDDIN	
5	VDDIN	
6	VDDIN	
7	VDDIN	
8	NC	Non Connection
9	NC	Non Connection
10	LDO_EN	LDO enable for driver IC
11	GND	GROUND
12	GND	GROUND
13	RIN0-	LVDS Negative data signal (-)
14	RIN0+	LVDS Positive data signal (+)
15	GND	GROUND
16	RIN1-	LVDS Negative data signal (-)
17	RIN1+	LVDS Positive data signal (+)
18	GND	GROUND
19	RIN2-	LVDS Negative data signal (-)
20	RIN2+	LVDS Positive data signal (+)
21	GND	GROUND
22	LVDS_CLK-	LVDS Negative CLK signal (-)
23	LVDS_CLK+	LVDS Positive CLK signal (+)
24	GND	GROUND
25	RIN3-	LVDS Negative data signal (-)
26	RIN3+	LVDS Positive data signal (+)
27	GND	GROUND
28	LED_EN	LED enable
29	GND	GROUND
30	DVDD	3.3V Power
31	GND	GROUND

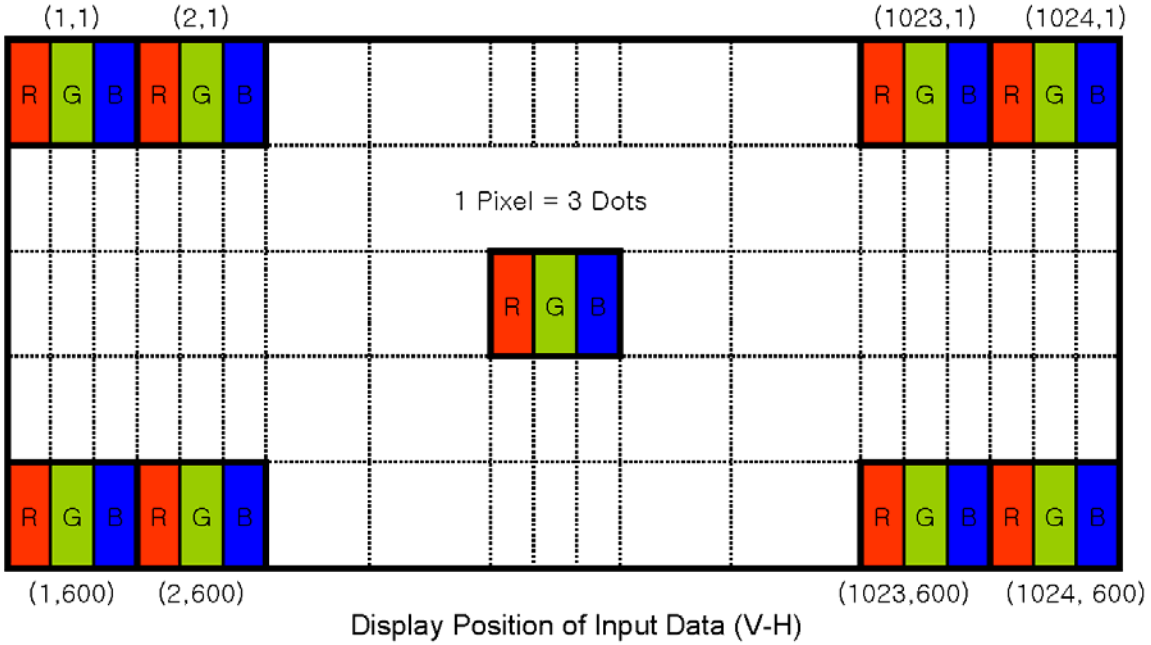
10 BASIC DISPLAY COLOR AND GRAY SCALE

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of White	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

11 LVDS INPUT SIGNAL



Data input Format



Display Position of Input Data (V-H)

12 SIGNAL TIMING SPECIFICATION

The Display is operated by DE only.

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	40.8	51.2	67.2	MHz
	High Time	Tch	40%	50%	60%	Tc
	Low Time	Tcl	60%	50%	40%	Tc
Frame Period		Tv	610	635	800	lines
			60	60	60	Hz
			16.6	16.6	16.6	ms
Vertical Display Period		Tvd	600	600	600	lines
One line Scanning Period		Th	1114	1344	1400	clocks
Horizontal Display Period		Thd	1024	1024	1024	clocks

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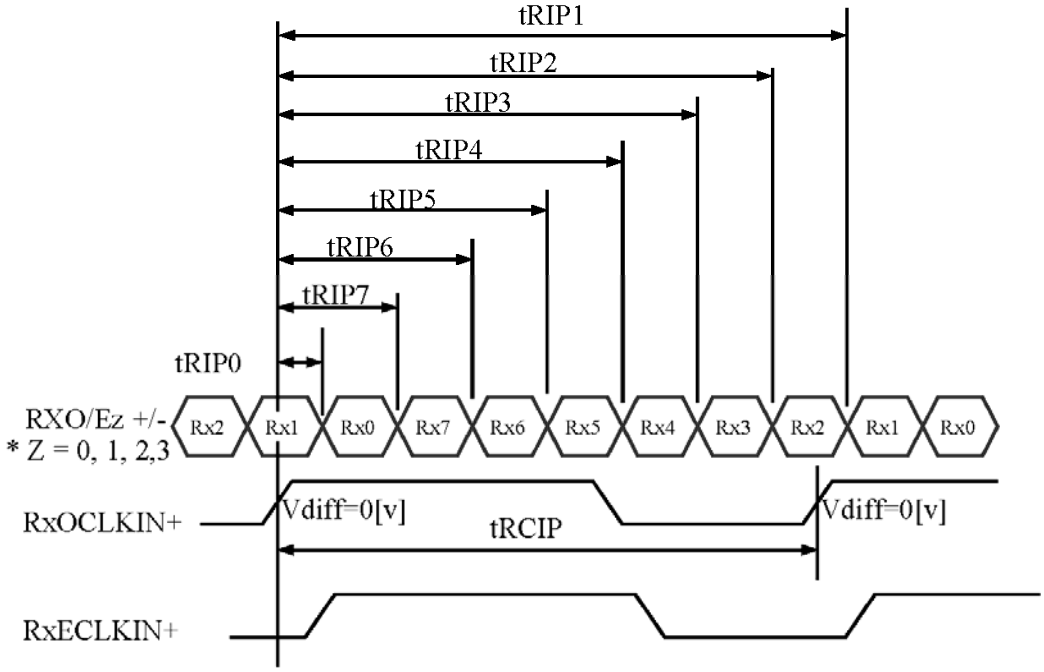
LVDS Rx Interface timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 8.

<Table 8. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	14.88	19.53	24.51	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRICP/7-0.4	tRICP/7	tRICP/7+0.4	nsec	
Input Data 2	tRIP7	2 ×tRICP/7-0.4	2 ×tRICP/7	2 ×tRICP/7+0.4	nsec	
Input Data 3	tRIP6	3 ×tRICP/7-0.4	3 ×tRICP/7	3 ×tRICP/7+0.4	nsec	
Input Data 4	tRIP5	4 ×tRICP/7-0.4	4 ×tRICP/7	4 ×tRICP/7+0.4	nsec	
Input Data 5	tRIP4	5 ×tRICP/7-0.4	5 ×tRICP/7	5 ×tRICP/7+0.4	nsec	
Input Data 6	tRIP3	6 ×tRICP/7-0.4	6 ×tRICP/7	6 ×tRICP/7+0.4	nsec	
Input Data 7	tRIP2	7 ×tRICP/7-0.4	7 ×tRICP/7	7 ×tRICP/7+0.4	nsec	



* Vdiff = (RXO/Ez+)-(RXO/Ez-),…. ,(RXO/ECLK+)-(RXO/ECLK-)

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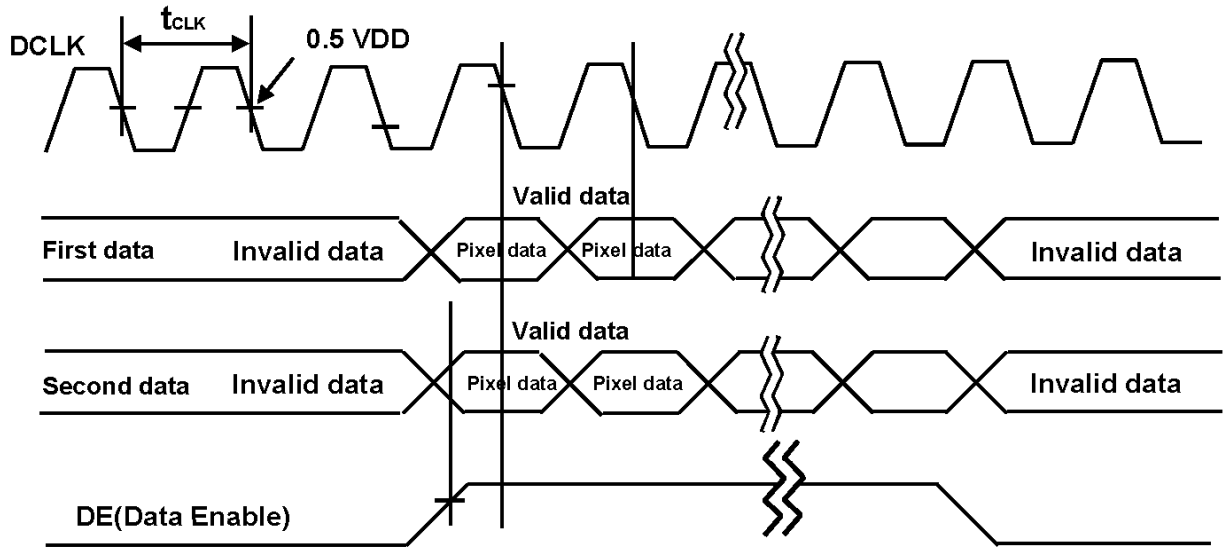
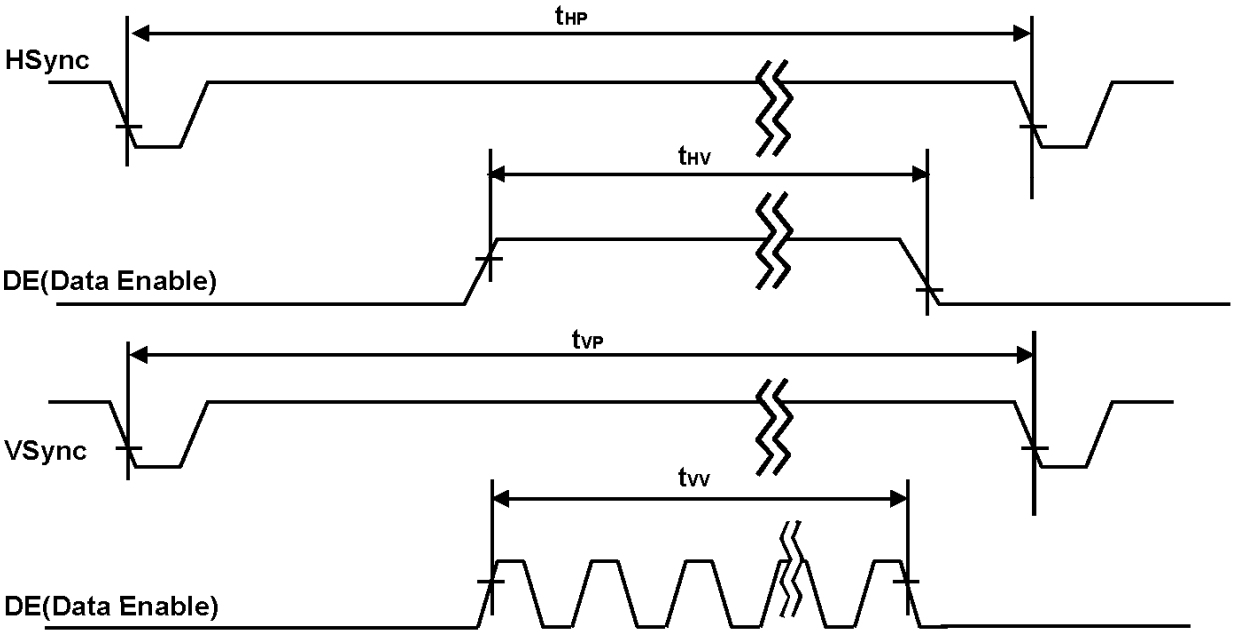
13 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL





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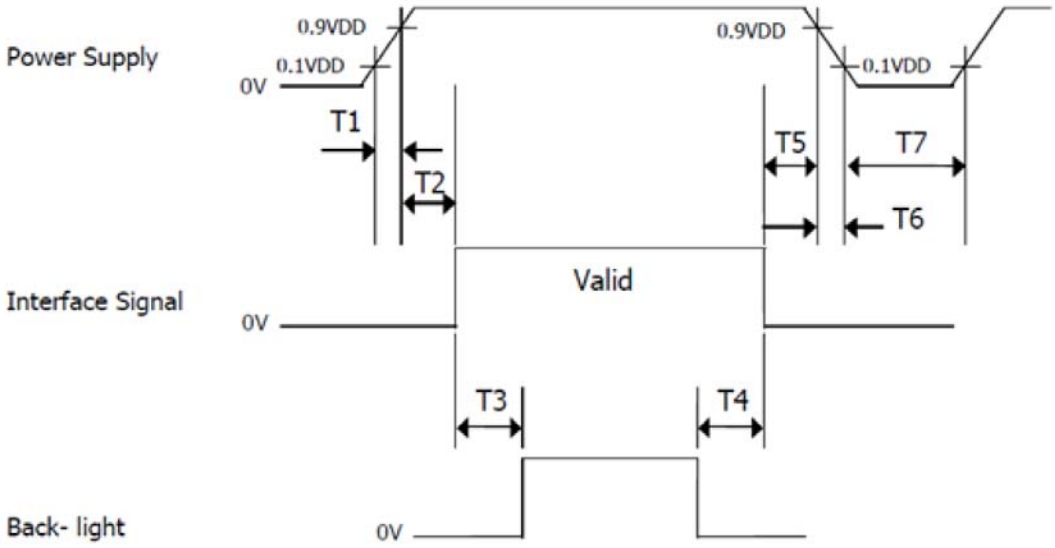
14 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0.5	-	50	ms
T6	0	-	10	ms
T7	500	-	-	ms

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

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15 CONNECTOR DESCRIPTION

Physical interface is described as for the connector on LCM.
These connectors are capable of accommodating the following signals and will be following components.

TFT LCD Module

Connector Name /Description	For Signal Connector
Manufacturer	DDK or Compatible
Type/ Part Number	FF12-31A-R11B or Compatible

LED connector

Pin No.	Symbol	For Signal Connector
1	VLEDP	LED Anode Power Supply
2	VLEDN1	LED Cathode Power Supply
3	VLEDN2	
4	VLEDN3	
5	VLEDN4	

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16 RELIABILITY TEST

No.	Test Item	Test Condition
1	High Temperature Storage	85 ± 2 ºC / 24 hours
2	Low Temperature Storage	-40 ± 2 ºC / 24 hours
3	High Temperature Operation	60 ± 2 ºC / 24 hours
4	Low Temperature Operation	-20 ± 2 ºC / 24 hours
5	Temperature Cycle	-40 ± 2 ºC ~ 85 ºC (2hr.) X 30 Cycles
6	Proof against Dampness	50 ± 5 ºC X 90% RH / 120 hours; Pure Water Used (Resistance > 10 MΩ)
7	Vibration Test	Frequency: 10 Hz ~ 55 Hz ~ 10 Hz Amplitude: 1.5 mm X,Y & Z directions for a total of 3 hours
8	Dropping Test	Dropped to the ground from 1 m height, one time and test ed on all sides of the carton when packed.
9	ESD Test	Voltage: ±8 kV; R: 330 Ω; C: 150 pF Air Discharged, 10 Times
Inspection after Test		The sample is tested for the following defects after 2 ~ 4 hours of storage at room temperature: 1. Air bubbles in the LCD 2. Leaking Seal 3. No Display 4. Missing Segments 5. Glass Cracks 6. Idd current is higher than twice the initial value

Remarks:

1. The test samples are applicable to only one test group.
2. Sample size for each test group is 5 ~ 10 pieces.
3. In case of a malfunction caused by ESD test, if it recovers to the normal state after resetting, it would be judged as a good part.
4. EL backlights can produce black spots/blemishes in humidity and temperature test due to natural chemical reactions and fluorescence. This is checked for.
5. Please use automatic switch menu (or roll menu) in test mode.

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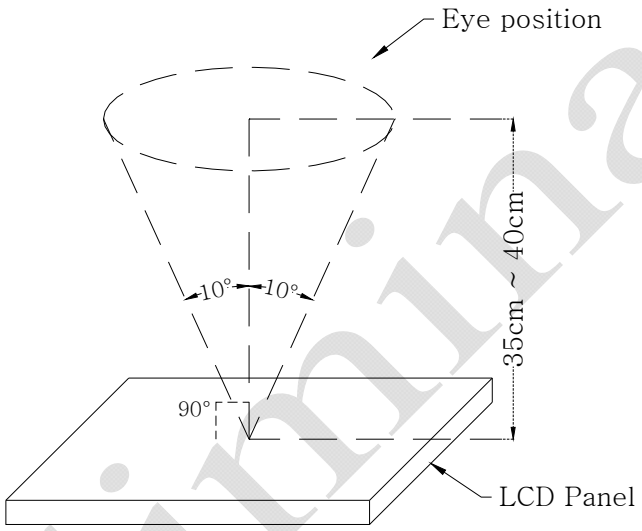
17 INCOMING INSPECTION STANDARDS

17.1 THE ENVIRONMENTAL CONDITION FOR INSPECTION

The environmental condition and visual inspection shall be conducted as below.
(1) Ambient temperature: 25 ± 5 ℃
(2) Humidity: 60 ± 5% RH
(3) Viewing distance: 35 ~ 40 cm approx.
(4) Viewing angle: Normal to the LCD panel as shown below
(5) Ambient Illumination: 300 ~ 500 Lux. for external appearance inspection.



17.2 CLASSIFICATION OF DEFECTS AND AQL

Class of defects	AQL	Definition
Major	1.0%	It is a defect that is likely to result in failure or to reduce materially the usability of the intended function.
Minor	1.5%	It is a defect that will not result in a functioning problem with deviation classified.

Note: Sampling plan according to GB / T2828.1-2003 / ISO 2859-1:1999 and ANSI/ASQC Z1.4-1993, Normal level 2.

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17.3 INSPECTION PARAMETERS

Item		Specification / Description				Note
Display	Function	No display				-
		Malfunction				-
Operating	Contrast ratio	Out of spec.				-
	Line defect	No obvious Vertical and Horizontal line defects for the bright, dark and colored.				-
	Point defect (red, green, blue, black, white)	Item	Acceptable number			1, 4, 5, 6
			A	B	Total	
		Bright dot	N ≤ 2	N ≤ 2	N ≤ 7	
		Black / dark dot	N ≤ 3	N ≤ 4		
		Total dots	N ≤ 4	N ≤ 5		
		Two adjacent dots	Not allowed			
		Three or more adjacent dots	Not allowed			
External Inspection (Non-operating)	Scratch on the Polarizer	L (mm)	W (mm)	Acceptable number		2
		L ≤ 2.5	W ≤ 0.1	4		
		L > 2.5	W > 0.1	0		
	Dent or bubble on the polarizer	Dimension (mm)		Acceptable number		3
		D ≤ 0.5		4		
		D ≤ 0.15		Disregard		
	Foreign material on the polarizer	Dimension (mm)		Acceptable number		3
		D ≤ 0.5		4		
		D ≤ 0.15		Disregard		

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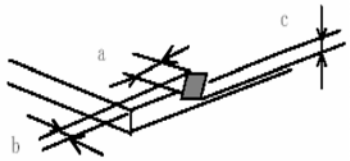
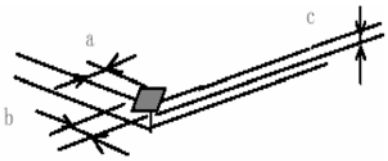
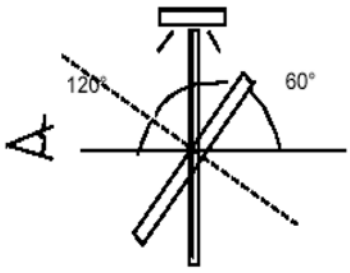
<table>
<tr><th colspan="2">Item</th><th colspan="3">Specification / Description</th><th>Note</th></tr>
<tr><td rowspan="13">Touch Panel
(If Present)</td><td rowspan="4">Scratch</td><td>L (mm)</td><td>W (mm)</td><td>Acceptable number</td><td rowspan="4">2</td></tr>
<tr><td rowspan="3">L ≤ 10</td><td>W < 0.05</td><td>Disregard</td></tr>
<tr><td>0.05 ≤ W < 0.1</td><td>N ≤ 4</td></tr>
<tr><td>W ≥ 0.1</td><td>0</td></tr>
<tr><td rowspan="3">Foreign materials
(Linear shape)</td><td rowspan="3">L ≤ 10</td><td>W < 0.05</td><td>Disregard</td><td rowspan="3">2</td></tr>
<tr><td>0.05 ≤ W < 0.1</td><td>N ≤ 3</td></tr>
<tr><td>W ≥ 0.1</td><td>0</td></tr>
<tr><td rowspan="4">Foreign materials
(Circular shape)</td><td colspan="2">Dimension (mm)</td><td>Acceptable number</td><td rowspan="4">3</td></tr>
<tr><td colspan="2">D ≤ 0.25</td><td>Disregard</td></tr>
<tr><td colspan="2">0.25 < D ≤ 0.5</td><td>N ≤ 6</td></tr>
<tr><td colspan="2">D > 0.5</td><td>0</td></tr>
<tr><td rowspan="2">Glass chips</td><td colspan="2">  </td><td>a ≤ 5mm
b ≤ 3mm
c ≤ t (t: Glass Thickness)</td><td rowspan="2">7</td></tr>
<tr><td colspan="2">  </td><td>a ≤ 3mm
b ≤ 3mm
c ≤ t (t: Glass thickness)</td></tr>
<tr><td>Newton’s rings</td><td colspan="2">(In case of doubtful situations only)
Observe at 60° from the product surface for a while under a Fluorescent lamp.
(3-Wavelength lamp)
  </td><td>If Average Diameter ≤ (1/3) Touch Panel Area,
Disregard.</td><td>7</td></tr>
</table>

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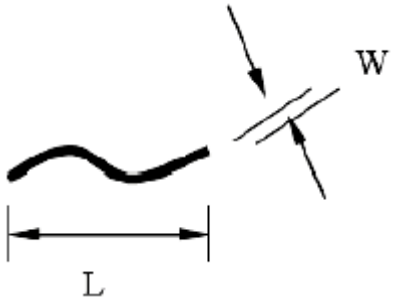
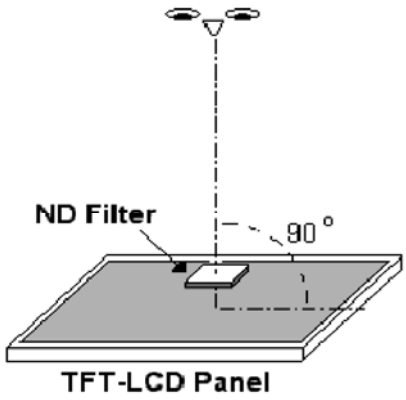
Note 1: The definition of dot defect: The dot defect was judged after repair and the size of a defective dot with size over 1/2 of one standard dot is regarded as one defective dot.

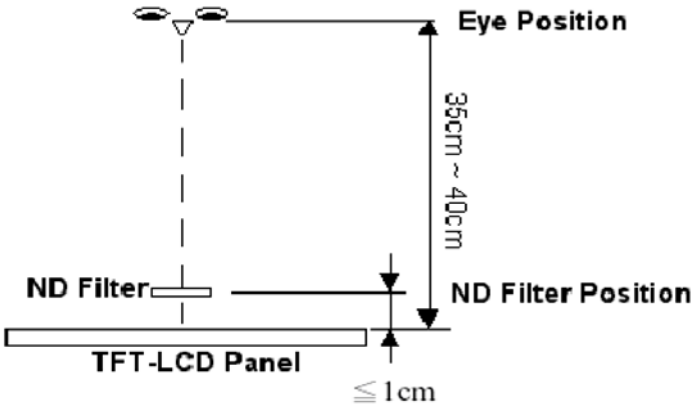
Note 2:



Note 3: Diameter - D = (a + b) / 2

Note 4: A bright dot is defined with 6% transmission ND filter as shown below:





Note 5: Adjacent Dots:

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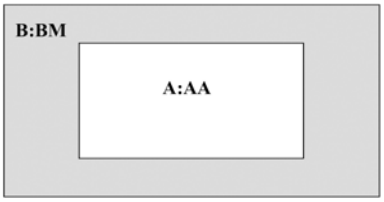
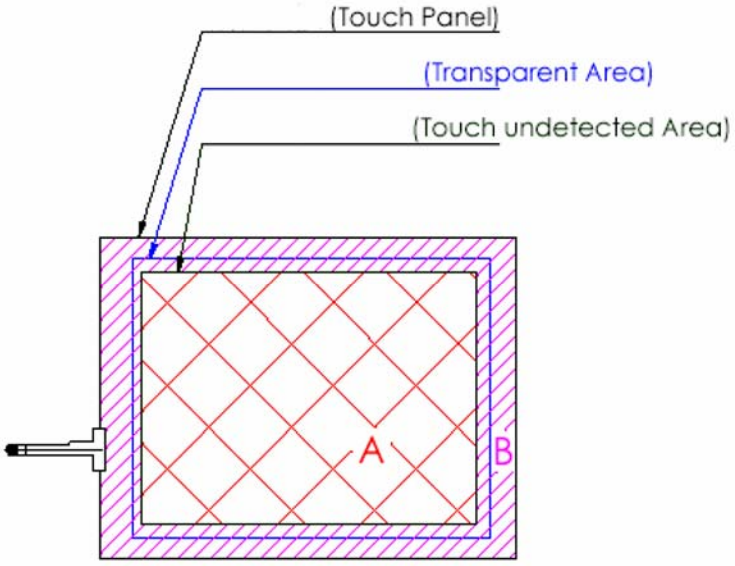
Note 6:

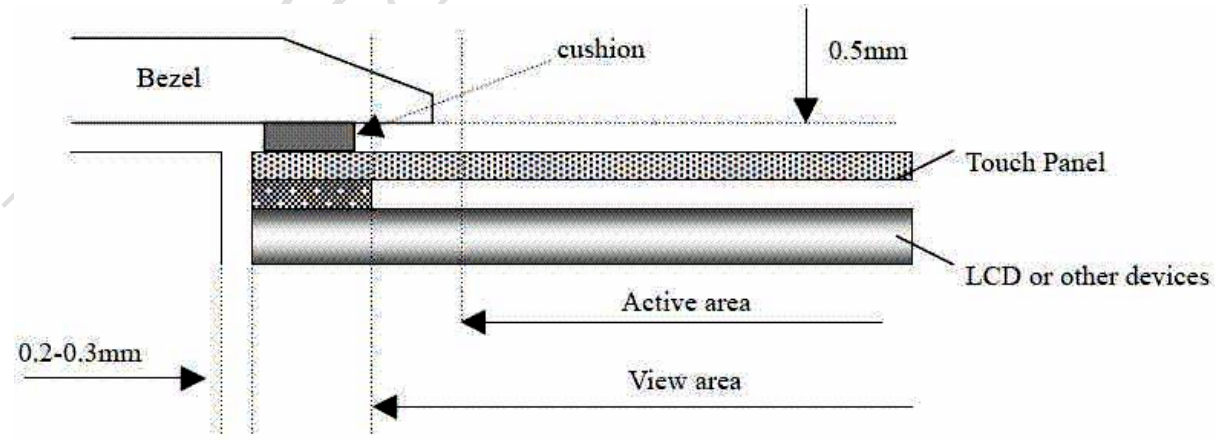


Note 7:



A: Area without any defect point effect on normal operation
B: Defects are not specified in this area

GENERAL INSTALLATION AND ASSEMBLY DIAGRAM:



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18 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 Trichlorotrifluoroethane. Do not wipe the display surface with dry or hard materials that will damage the polarizer 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 terminals 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 sunlight 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).

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