RoHS COMPLIANT

KYOCERA

KYOCERA Display Corporation

APPROVAL SHEET

承　　認　　書

Customer 客戶名稱	
Part No. 產品型號	TVL-55730GD035JU-LW-G-ABN
Product type 產品內容	Mode: Transmissive and Normally white type 3.5” a-Si color TFT LCD Module
RoHS 綠色產品	□ Non-compliance ■ Compliance
Remarks 備註欄	

■Preliminary Specification　暫行規格

□Final Specification　正式規格

Signature by Customer:
客戶確認簽章:

Issued by QA	Checked by QA	Checked by PM	Approved By	
			QA	BU

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Specification of LCD Module

Product No.: TVL-55730GD035JU-LW-G-ABN

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Issue date: 2012/06/11

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1. GENERAL DESCRIPTION

TVL-55730GD035JU-LW-G-ABN is a transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver IC, and FPC, backlight unit.

2. FEATURES

Display Mode	Transmissive Type
	a-Si color TFT LCD, Normally white type
Screen Size	3.5 inch
Display Format	Graphic 240*RGB*320 Stripe type
Color	262K/65K color
Interface	RGB IF(18/16 bit)
Viewing Direction	Higher Contrast ratio: 6 o'clock Less gray scale reversal: 12 O'clock

3. MECHANICAL SPECIFICATION

Item	Specifications	Unit
Dimensional outline	60.68 (W) x 82.04 (H) x 3.38 (T)	mm
Resolution	240X(R, G, B)×320	dot
Active area	53.28 (W) x71.04 (H)	mm
Pixel pitch	0.222 (W)×0.222(H)	mm

＊ Dimensional outline without FPC

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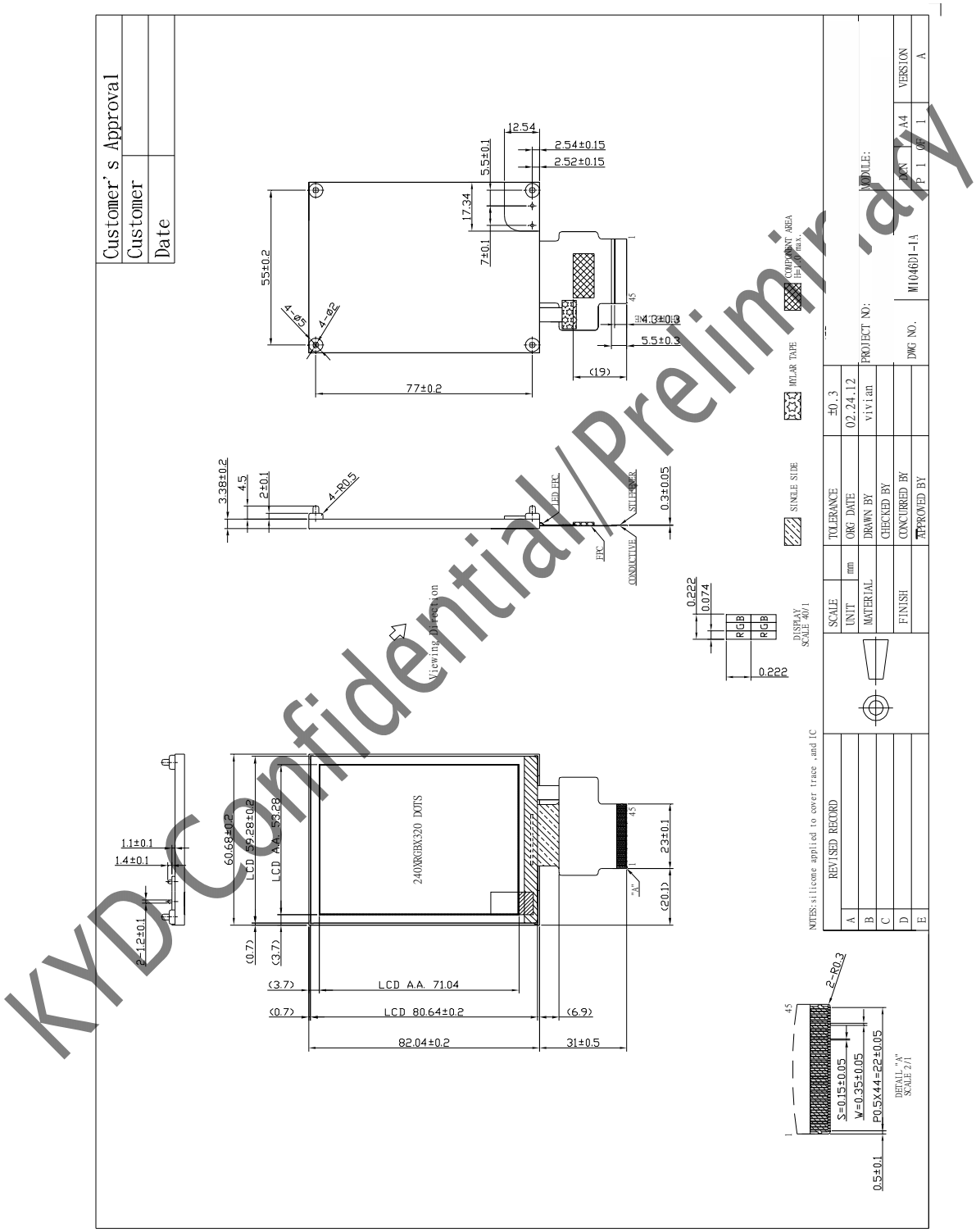
4. MECHANICAL DIMENSION



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5. MAXIMUM RATINGS (for IC)

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

Item	Symbol	Values		Unit	Condition
		Min.	Max.		
Power Supply for Logic	VCC	-0.3	4.6	V	
Storage Temperature	T_{ST}	-30	80	°C	
Operating Temperature (Ambient Temperature)	T_{OP}	-20	70	°C	
Humidity	-	-	90	%RH	Note1

Note1: $T_A \leqq 40$℃ Without dewing

6. ELECTRICAL CHARACTERISTIC

A. Typical operating conditions (GND=AV_{SS}=0V)

Item		Symbol	Values			Unit	Remark
			Min.	Typ.	Max.		
IC Power Voltage		VCC	3.0	3.3	3.6	V	
Input Voltage	H level	V_{IH}	$0.8V_{cc}$		V_{cc}	V	
	L level	V_{IL}	-0.3		$0.2V_{cc}$	V	
Consumption current of V_{DD}		I_{DD}	-	-	18	mA	

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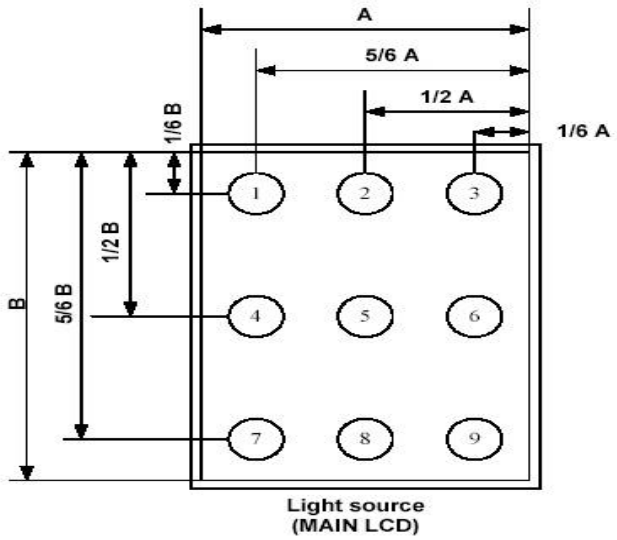
7. BACKLIGHT CHARACETRISTIC

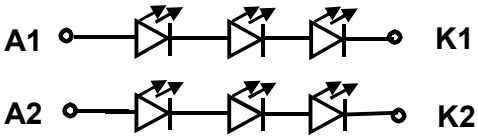
7.1. Characteristic

Item	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_f	I_f=40mA	8.4	-	10.5	V
Forward current	I_f	3 series* 2 sets		40mA		mA
POWER CONSUMPTION	P_{BL}	I_f=40mA	336	-	420	mW
Luminous color	White					
Chip connection	3 chip series* 2 sets					

Note 1 : Kyocera Display ensures all white LEDs that provide from our LED mfg has right to produce/sell and any legal issues happened relate to patent, Kyocera Display is willing take liability on it. Note 2 : We suggest constant current.

7.2. Lightguide Specification





a. Test Instrument: BM-7 (Distance =500mm; Field = 1°)

b. Light Source: LED * 6 3S*2 sets (White)
c. Conditions: VF(MAX) =10.5V ; IF(TYP)= 40 mA
d. Measure Brightness: 1 ~ 9
e. Uniformity = (Min. Brightness / Max. Brightness)*100%
f. Uniformity ≧ 80%

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8. MODULE FUNCTION DESCRIPTION

8.1. PIN Description

Pin NO.	Terminal	Functions
1	NC	NC
2	NC	NC
3	NC	NC
4	NC	NC
5	GND	GND
6	VCC	Internal logic power:
7	VCC	Internal logic power:
8	/CS	Chip select signal. Low: the is accessible High: the is not accessible Must connect to the GND or VCC level when not used. This pin has weak pull high/low resistors and can be modified to high / low by metal layer change for customer's request.
9	SCL	(A) In 80-system interface mode, a write strobe signal can be input via this pin and initializes a write operation when the signal is low. (B) In SPI mode, served as a synchronizing clock signal
10	SDI	Series Data is the input on the rising edge of the SCL signal in SPI mode. Must connect to the GND or VCC level when not in use. This pin has weak pull high/low resistors and can be modified to high / low by metal layer change for customer's request.
11	SDO	Series Data is the output on the rising edge of the SCL signal in SPI mode.
12	GND	GND
13	B0	DATA Bus Input.
14	B1	DATA Bus Input.
15	B2	DATA Bus Input.
16	B3	DATA Bus Input.
17	B4	DATA Bus Input.
18	B5	DATA Bus Input.

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19	GND	GND
Pin NO.	**Terminal**	**Functions**
20	G0	DATA Bus Input.
21	G1	DATA Bus Input.
22	G2	DATA Bus Input.
23	G3	DATA Bus Input.
24	G4	DATA Bus Input.
25	G5	DATA Bus Input.
26	GND	GND
27	R0	DATA Bus Input.
28	R1	DATA Bus Input.
29	R2	DATA Bus Input.
30	R3	DATA Bus Input.
31	R4	DATA Bus Input.
32	R5	DATA Bus Input.
33	GND	GND
34	DE	In external interface mode, polarity of DE signal is synchronized with valid graphic data input. Low: Valid data on DB17-DB0 High: Invalid data on DB17-DB0 Moreover, setting EPL bit can change the polarity of the DE signal. Must connect to the GND or VCC level when not in use. This pin has weak pull high/low resistors and can be modified to high / low by metal layer change for customer's request.
35	GND	GND
36	DOTCLK	In external interface mode, served as a dot clock signal. When DPL = "0": Input data on the rising edge of DOTCLK When DPL = "1": Input data on the falling edge of DOTCLK It is fixed to the VCC level when not in use.
37	GND	GND

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38	HSYNC	In external interface mode, served as a horizontal synchronized signal input Must connect to the VCC or GND level when not used. This pin has weak pull high/low resistors and can be modified to high / low by metal layer change for customer's request.
Pin NO.	**Terminal**	**Functions**
39	VSYNC	In external interface mode, served as a vertical synchronize signal input Must connect to the VCC or GND level when not in use. This pin has weak pull high/low resistors and can be modified to high / low by metal layer change for customer's request.
40	/RESET	RESET pin. This is an active low signal.
41	GND	GND
42	A1	B/L Power input PIN anode
43	A2	B/L Power input PIN anode
44	K1	B/L Power input PIN negative
45	K2	B/L Power input PIN negative

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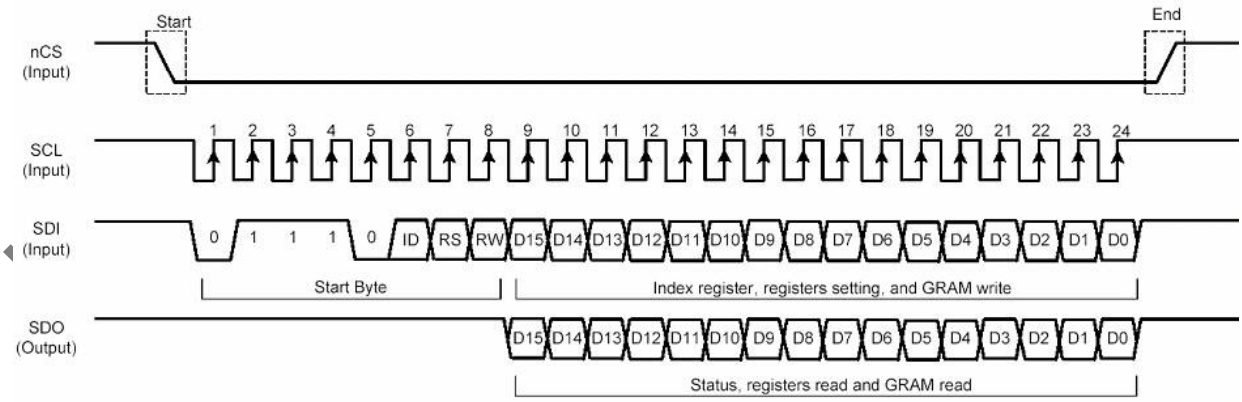
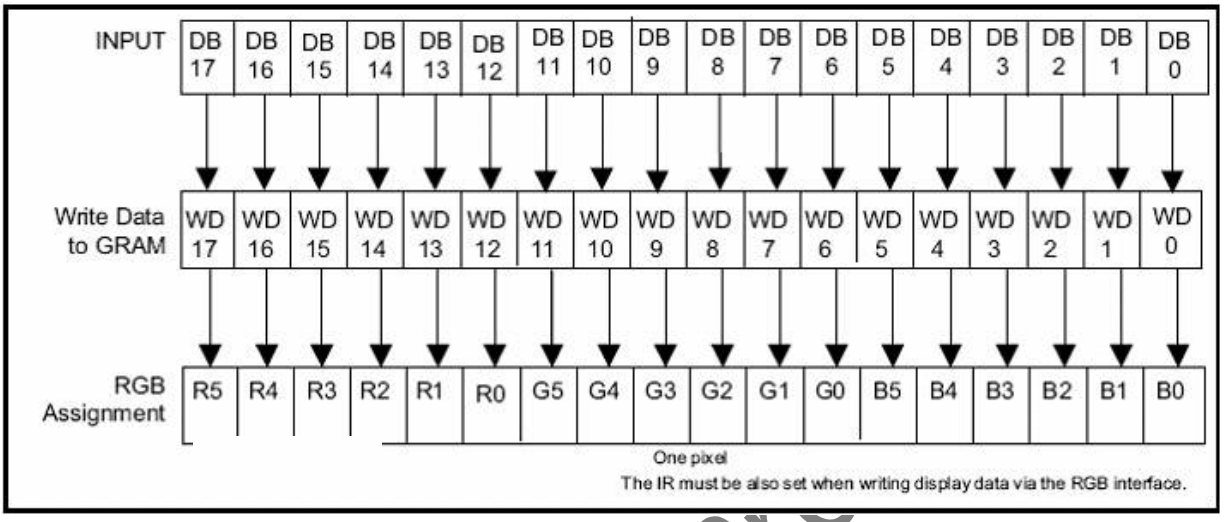
8.2. System interface

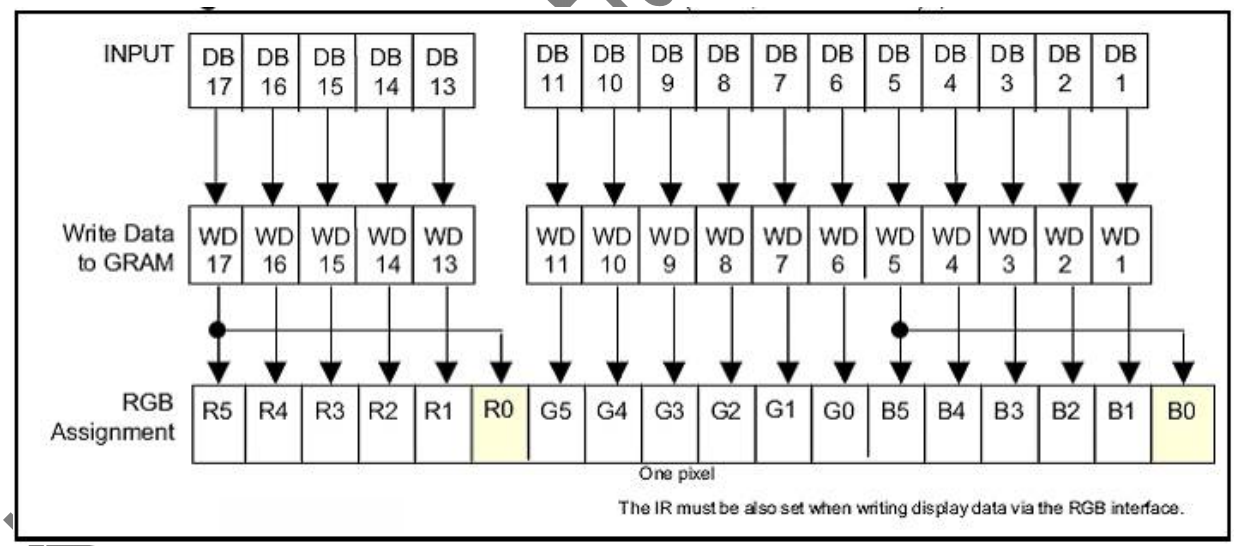
SPI



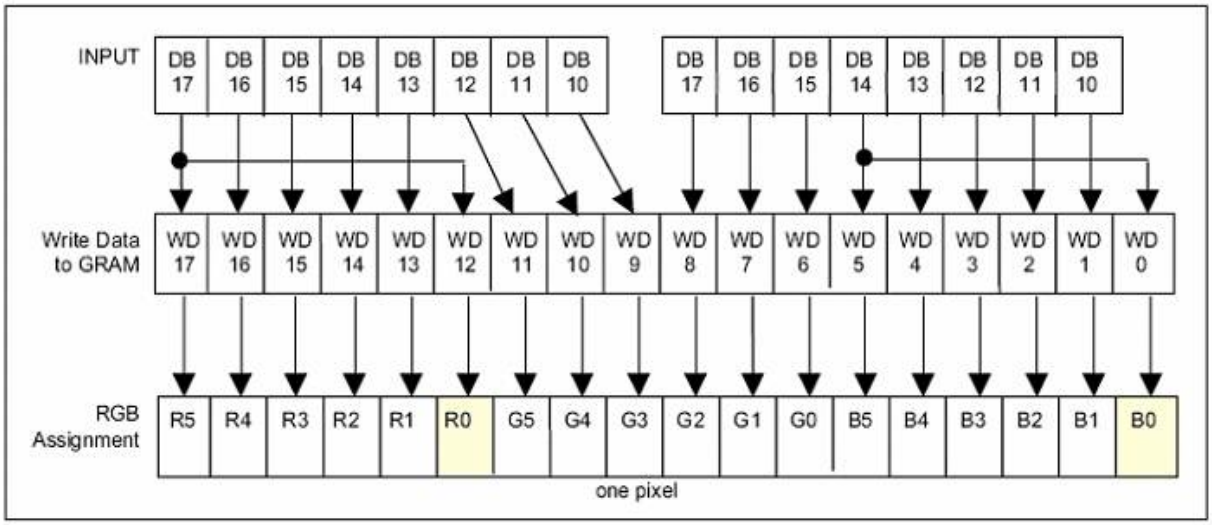
18-bit RGB interface



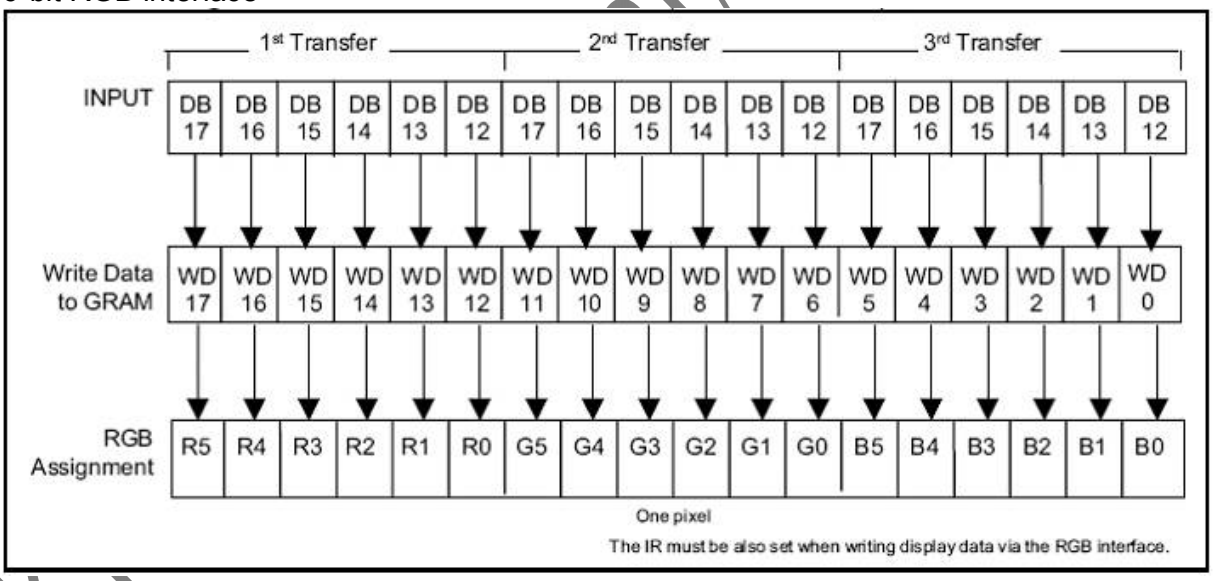
16-bit RGB interface



8-bit RGB interface



6-bit RGB interface



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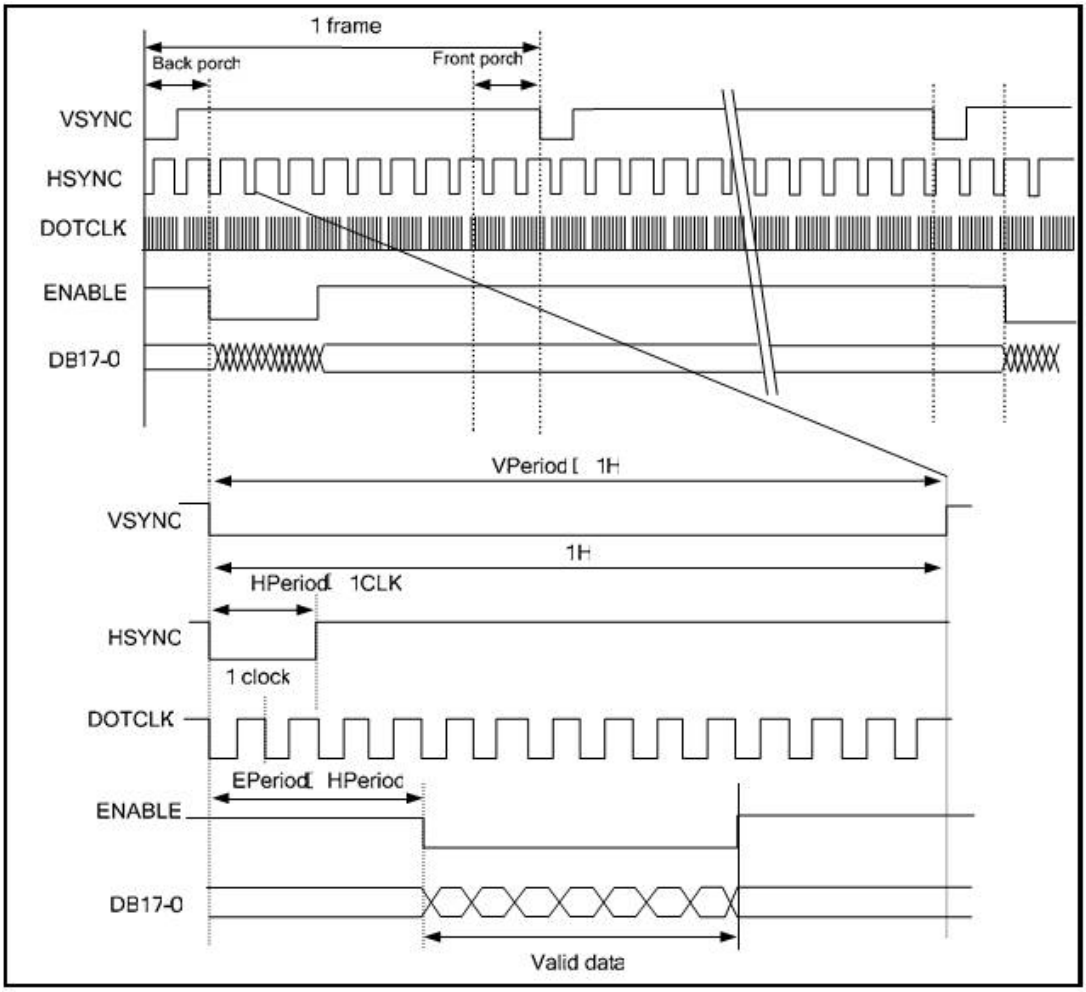
8.3. Timing Characteristics

8.3.1.1 18/16-bit interface Timing



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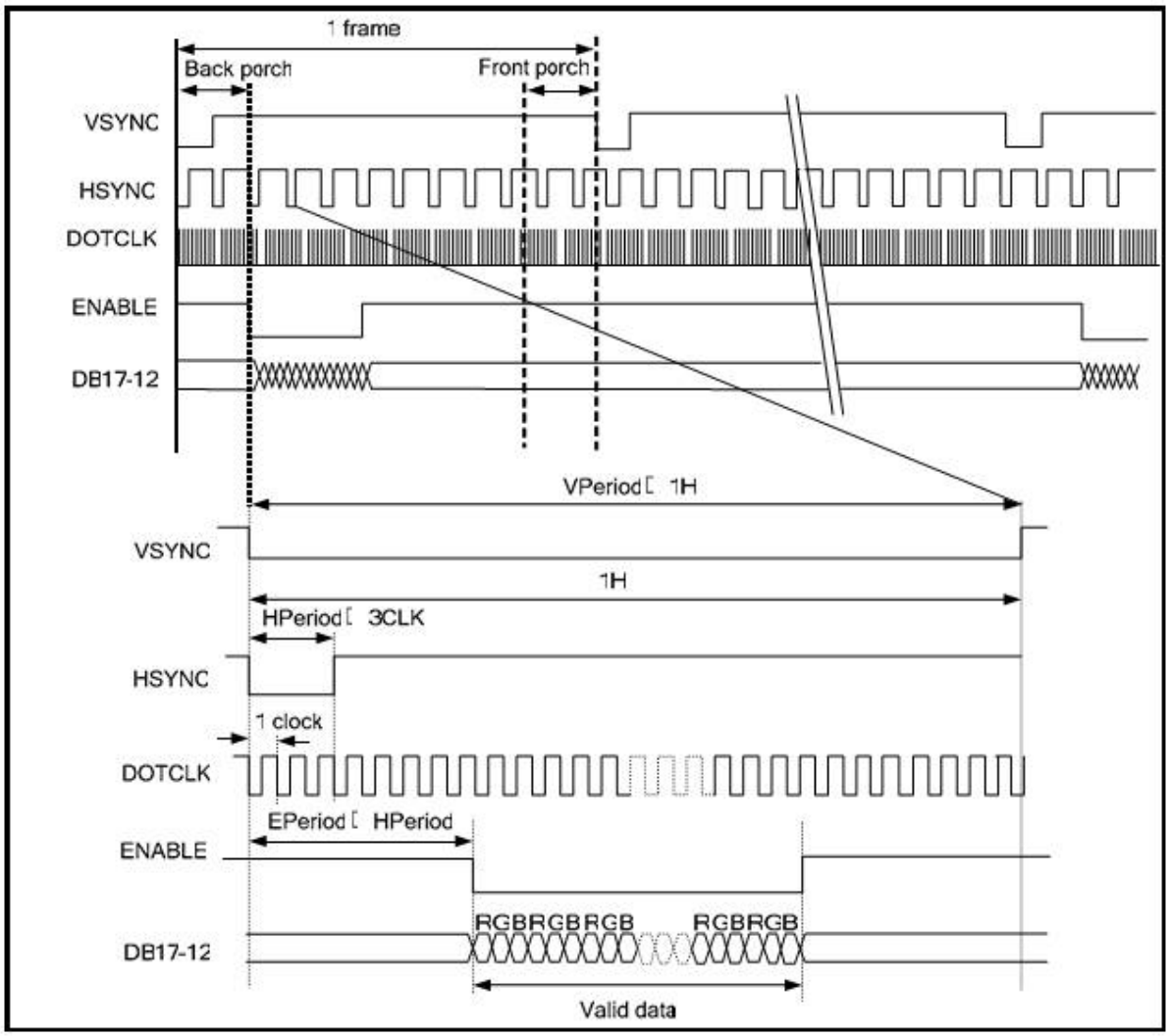
8.3.1.2 6-bit interface Timing



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8.3.2 Clock-synchronized Serial Interface Timing Characteristics

Normal Write Function (VCC=1.65~3.30V)

Item	Symbol		Unit	Min.	Typ.	Max.
Serial Time Clock Cycle	Write (received)	tSCYC	ns	100	-	20.000
	Read (transmitted)	tSCYC	ns	350	-	20.000
Serial Clock high-level width	Write (received)	tSCH	ns	40	-	-
	Read (transmitted)	tSCH	ns	150	-	-
Serial Clock low-level width	Write (received)	tSCL	ns	40	-	-
	Read (transmitted)	tSCL	ns	150	-	-
Serial clock rise/fall time		tSCr, tSCf	ns	-	-	20
Chip select setup time		tCSU	ns	20	-	-
Chip select hold time		tCH	ns	60	-	-
Serial input data setup time		tSISU	ns	30	-	-
Serial input data hold time		tSIH	ns	30	-	-
Serial output data delay time		tSOD	ns	-	-	130
Serial output data hold time		tSOH	ns	5	-	-

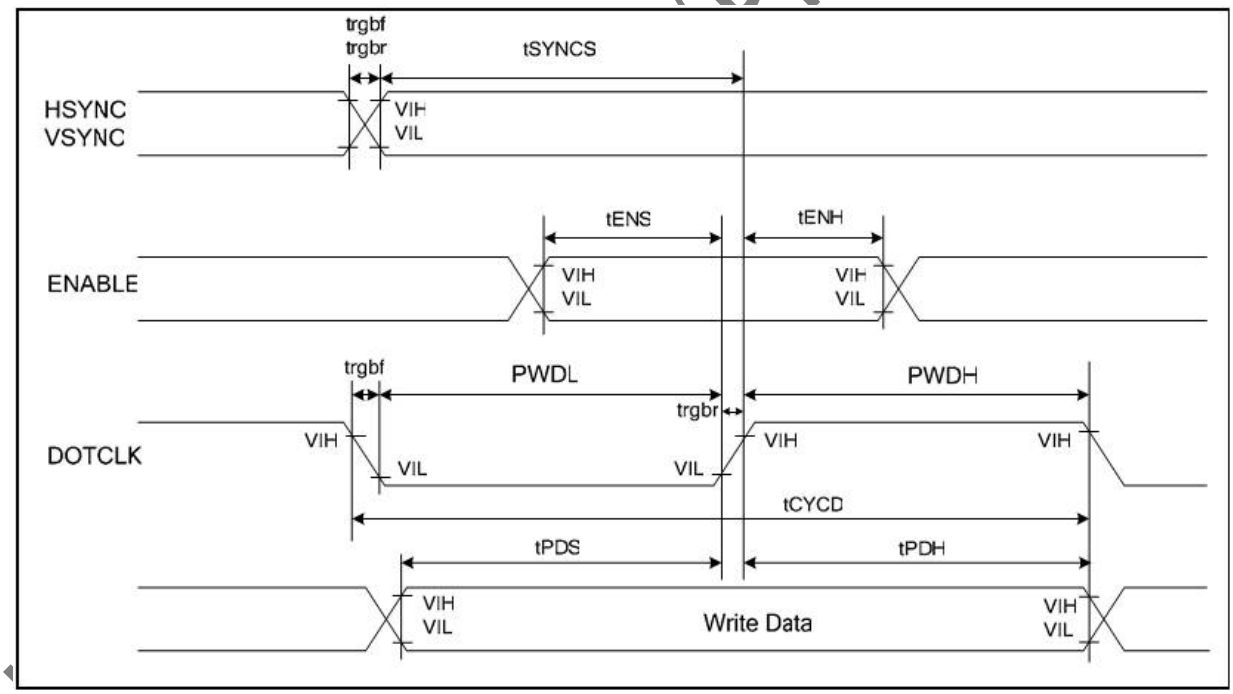
8.3.3 RGB Interface Timing Characteristics

18-/ 16- bit RGB interface VCC=1.65~3.30V

Item	Symbol	Unit	Min.	Typ.	Max.
VSYNC/HSYNC Setup time	tSYNCS	clock	0	-	1
ENABLE Setup time	tENS	ns	10	-	-
ENABLE Hold time	tENH	ns	20	-	-
DOTCLK low-level pulse width	PWDL	ns	40	-	-
DOTCLK high-level pulse width	PWDH	ns	40	-	-
DOTCLK cycle time	tCYCD	ns	100	-	-
Data setup time	tPDS	ns	10	-	-
Data hold time	tPDH	ns	40	-	-
DOTCLK, VSYNC and HSYNC rise/fall time	trgbr trgbf	ns	-	-	25

6-bit RGB interface,VCC=1.65~3.30V

Item	Symbol	Unit	Min.	Typ.	Max.
VSYNC/HSYNC setup time	tSYNCS	clock	0	-	1
ENABLE setup time	tENS	ns	10	-	-
ENABLE hold time	tENH	ns	25	-	-
DOTCLK low-level pulse width	PWDL	ns	25	-	-
DOTCLK high-level pulse width	PWDH	ns	25	-	-
DOTCLK cycle time	tCYCD	ns	60	-	-
Data setup-time	tPDS	ns	10	-	-
Data hold time	tPDH	ns	25	-	-
DOTCLK, VSYNC, and HSYNC rise/fall time	trgb ttrgbf	ns	-	-	25



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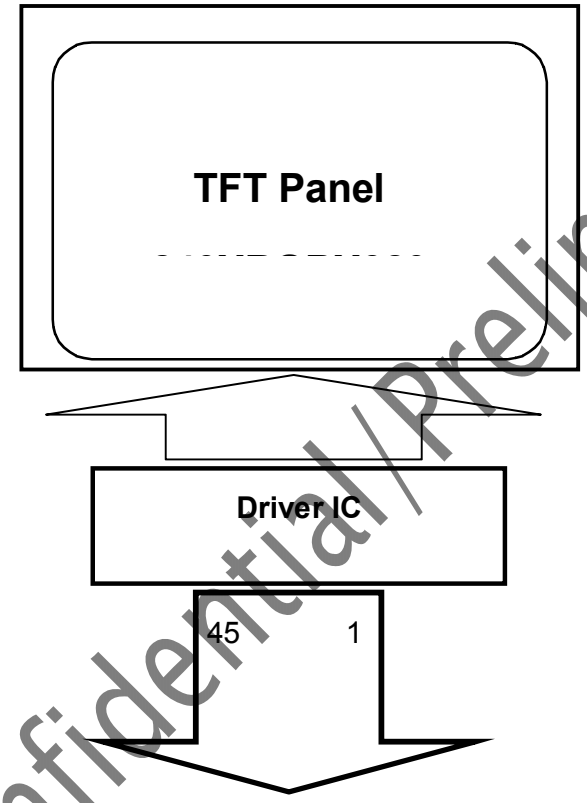
8.4. Block diagram of LCD

8.4.1. Block diagram



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9. ELECTRO-OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state with the methods shown in Note 1,Note2,Note3.

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Response time	$T_R + T_F$	Θ=0	-	30	45	ms	Note 4
Contrast ratio	CR	At optimized viewing angle	250	300	-	-	Note 5
Viewing Angle	6H	CR≧10	-	55	-	Degree	Note 6
	12H		-	65	-		
	9H		-	65	-		
	3H		-	65	-		
Brightness	L	Θ=0	200	250	-	-	Note 3
White	X	Θ=0	0.27	0.31	0.35		
	Y		0.26	0.30	0.34		
RED	X	Θ=0	0.55	0.59	0.63		
	Y		0.30	0.34	0.38		
GREEN	X	Θ=0	0.34	0.38	0.42		
	Y		0.53	0.57	0.61		
BLUE	X	Θ=0	0.11	0.15	0.19		
	Y		0.04	0.08	0.12		

Note1:Ambient temperature=25℃.

Note2:To be measured in the dark room.

Note3: Optical specifications are measured by Topcon BM-5A with a viewing angle of 1° at a distance of 50cm and normal direction.

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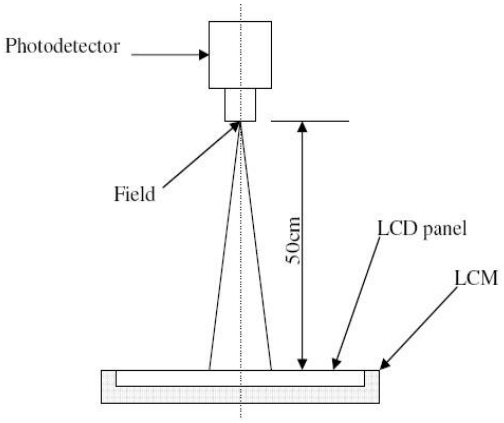
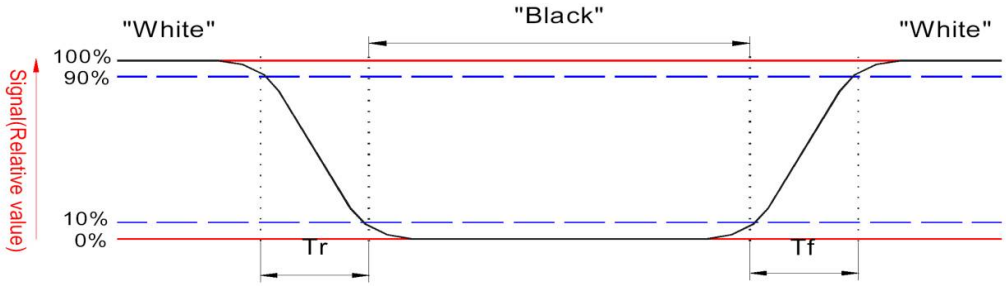


Note4:Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black”to”white”(falling time) and from “white”to”black” (rising time),respectively.

The response time is defined as the time interval between the 10％ and 90％ of amplitudes.Refer to figure as below.



Note5: Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness measured when LCD is at “white state”}}{\text{Brightness measured when LCD is at “black state”}}$$

Note6:Definition of viewing angle:

Refer to figure as below.

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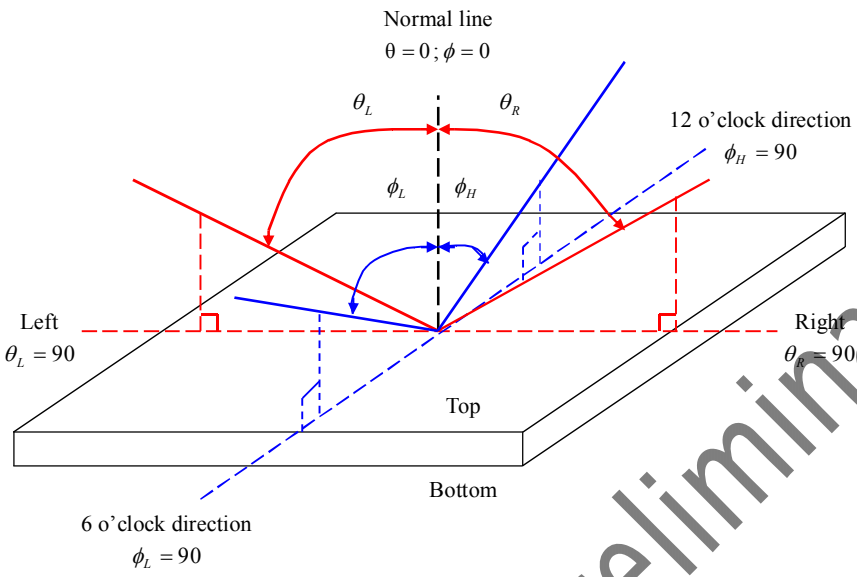

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10. RELIABILITY

10.1.MTTF

The LCD module shall be designed to meet a minimum MTTF value of 50,000 hours with normal condition. (25°C in the room without sunlight; not include life time of backlight).

10.2.Tests

NO.	ITEM	CONDITION	CRITERION
1	High Temperature Operating	70℃ 240 hrs	◦ No defect of Operational function in room temperature are allowable(23±5℃). ◦ Leakage current should be below double of initial value.
2	Low Temperature Operating	-20℃ 240 hrs	
3	High Temperature Non-Operating	80℃ 240 hrs	
4	Low Temperature Non-Operating	-30℃ 240 hrs	
5	High Temperature/ Humidity Non-Operating	50℃,90%RH 240 hrs	
6	Temperature Shock Non-Operating	-30℃ ←→ 80℃ (30min) (5min) (30min) 10 CYCLES	
7	Electro-static Discharge	HBM: ±2kv	

Note 1: Test after 24 hours in room temperature(23±5℃).
Note 2: The sampling above is individually for each reliability testing condition.
Note 3: The color fading of polarizing filter should not care.
Note 4: All of the reliability testing chamber above, is using D.I. water.(Min value: 1.0 MΩ-cm)
Note 5: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

10.3.Color performance

No.	ITEM	Criterion (initial)
1	Luminance	>50%
2	NTSC	>70%
3	Contrast Ratio	>50%

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11. INSPECTION CRITERIA

11.1.Inspection Conditions

11.1.1. Environmental conditions

The environmental conditions for inspection shall be as follows

Room temperature: 23±5°C

Humidity: 50±20%RH

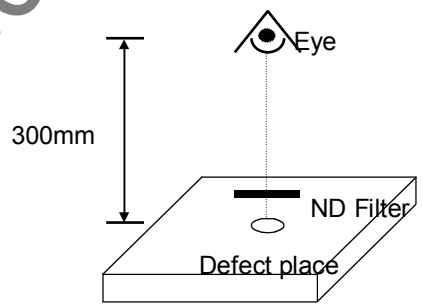
11.1.2. The external visual inspection

With a single 1000±200lux fluorescent lamp as the light source, the inspection was in the distance of 30cm or more from the LCD to the inspector's eyes.

11.2.Light Method

11.2.1. Environment lamp under 1000±200 lux, Viewing direction for inspection over 30 cm

11.2.2. The distance from eye to defect around 300mm, the distance from ND Filter to defect around 25~30mm



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11.3.Classification Of Defects

11.3.1. Major defect

A major defect refers to a defect that may substantially degrade usability for product applications.

11.3.2. Minor defect

A minor defect refers to a defect which is not considered to be able substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation.

Notes: If the LCD/LCM 's cosmetic and display performance do not specify in "inspection criterion", it should be based on these delivered samples.

11.4.Sampling & Acceptable Quality Level

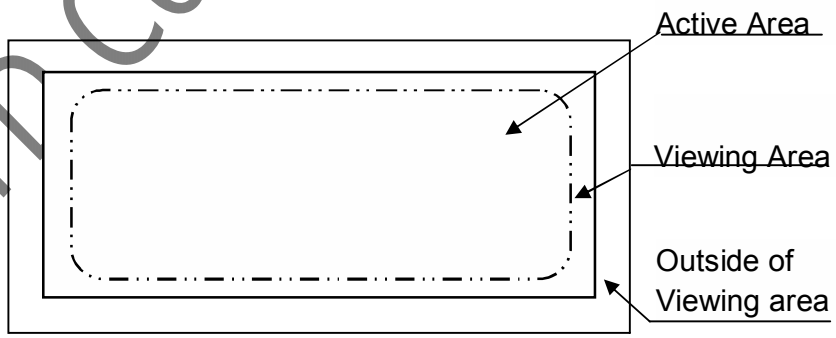
Level II, MIL-STD-105E

	Major	Minor
Cosmetic	1.0 %	1.5 %
Electrical-display	0.4%	0.65 %

11.5.Definition Of Inspection Area

V.A: Viewing Area

A.A: Active Area



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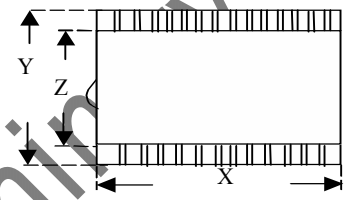
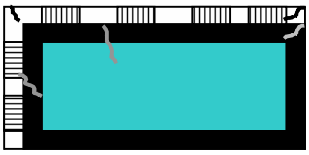
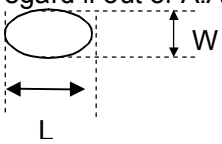
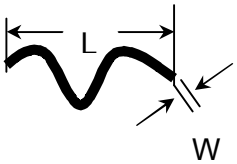
11.6.Items and Criteria

11.6.1. Visual inspection criterion in cosmetic

(1) Glass defect

No	Defect	Criteria	Remark
1	Dimension (Minor)	By engineering diagram	
2	Cracks (Major)	Extensive crack 【Reject】	

(2) LCM appearance defect with in A.A

No	Item	Criteria		Remark
1	Round type (Minor)	Defect Spec.	Permissible Q'ty	1:ψ=(L+W)/2, L: Length, W: Width 2: Disregard if out of A.A. 
		ψ≦0.15mm	Disregard	
		0.15mm<ψ≦0.20mm	3	
		0.20mm<ψ≦0.30mm	1	
		ψ > 0.30mm	0	
2	Line type (Minor)	Defect Spec.	Permissible Q'ty	1: L: Length, W: Width 2: Disregard if out of A.A. 
		W≦0.03mm	Disregard	
		L≦3.0mm and 0.03mm< W≦0.05mm	2	
		L≦3.0mm and 0.05mm<W≦0.10mm	1	
		L>3.0mm or W>0.10mm	0	

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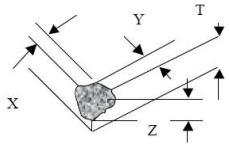
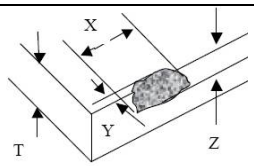
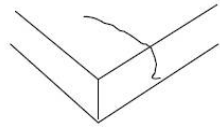
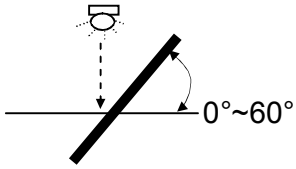
3	Corner chip (Minor)	X≦3.0mm, Y≦3.0mm,Z≦T 【Disregard】	
No	Item	Criteria	Remark
4	Edge chip (Minor)	X≦3.0mm, Y≦3.0mm,Z≦T 【Disregard】	
5	Crack (Major)	Not allowed	
6	Newton's ring (Minor)	Defect Spec. / Permissible Q'ty ψ≦7mm / Disregard ψ>7mm / 0	Under day light 

(3) FPC

No	Defect	Criteria	Remark
1	Copper peeling (Minor)	Copper peeling 【Reject】	

(4) Black tape

No	Defect	Criteria	Remark
1	Shift (Minor)	IC exposed 【Reject】	
2	No black tape (Minor)	No black tape 【Reject】	

(5) Silicon

No	Defect	Criteria	Remark
1	Amount of silicon (Minor)	ITO exposed 【Reject】	

(6) Power cord

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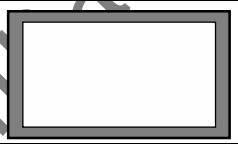
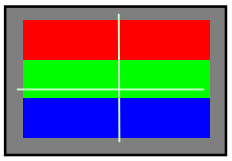
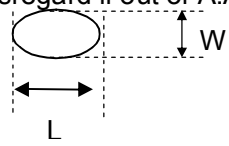
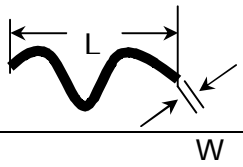
No	Defect	Criteria	Remark
1	Power cord (Minor)	Power core loose	

11.6.2. LCM electrical criterion

No	Defect	Criteria		Remark
1	No display (Major)	Not allowed		
2	Missing line (Major)	Not allowed		
3	Darker or lighter line (Major)	Not allowed		
4	Bright / Dark point (Minor)	Spec.	Permissible Qty	1:1sub-pixel: 1R or 1G or 1B 2:Point defect area≧1/2 sub pixel.
		Bright point	1	
		Dark point	2	
5	Round type (Minor)	Spec.	Permissible Qty	1.ψ=(L+W)/2, L: Length, W: Width 2. Disregard if out of A.A. 
		ψ≦0.20mm	Disregard	
		0.20mm<ψ≦0.35mm	3	
		ψ > 0.35mm	0	
6	Line type (Minor)	Spec.	Permissible Qty	1. L: Length, W: Width 2. Disregard if out of A.A. 
		W≦0.03mm	Disregard	
		L≦5.0mm and 0.03mm<W≦0.05mm	4	

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		L≦5.0mm and 0.05mm<W≦0.15mm	3	
		W>0.15mm or L>5.0mm	0	
8	Mura (Minor)	By 5% ND filter invisible		

11.6.3. Others

1. Issues that are not defined in this document shall be discussed and agreed with both parties. (Customer and supplier)
2. Unless otherwise agreed upon in writing, the criteria shall be applied to both parties. (Customer and supplier)

12. ILLUSTRATION OF LCD DATE CODE (TBA)

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13. RoHS COMPLIANT WARRANTY

RoHs Hazardous substances including:

- Cd< 100 ppm
- Pb< 1000 ppm
- Hg< 1000 ppm
- Cr +6 < 1000 ppm
- PBDE < 1000 ppm
- PBB < 1000 ppm

14. PRECAUTIONS FOR USE

14.1.Safety

(1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
(2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
(3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

14.2.Storage Conditions

(1) Store the panel or module in a dark place where the temperature is 23±5°C and the humidity is below 50±20%RH.
(2) Store in anti-static electricity container.
(3) Store in clean environment, free from dust, active gas, and solvent.
(4) Do not place the module near organics solvents or corrosive gases.
(5) Do not crush, shake, or jolt the module.
(6) Do not exposed to direct sun light of fluorescent lamps.

14.3.Installing LCD Module

Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate or touch panel to protect the polarizer and LC cell.

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14.4.Precautions For Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (Vo). Adjust Vo to show the best contrast.
(2) Driving the LCD in the voltage above the limit will shorten its lifetime.
(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
(4) When turning the power on, input each signal after the positive/negative voltage becomes stable.
(5) Do not apply mater or any liquid on product, which composed of LCM.

14.5.Handling Precautions

(1) Avoid static electricity that can damage the CMOS LSI; please wear the wrist strap when handling.
(2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
(3) Do not give external shock.
(4) Do not apply excessive force on the surface; it may cause display abnormal.
(5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
(6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
(7) Do not operate it above the absolute maximum rating.
(8) Do not remove the panel or frame from the module.
(9) Do not apply mater or any liquid on product, which composed of LCM.

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14.6. Guarantee

14.6.1. The period is within 12 months since the date of shipping out under normal using and storage conditions.

14.6.2. Any defect not caused by Kyocera Display is not guaranteed to the customer. The defect phenomenon should be agreed by both parties.

15. REVISION HISTORY

Version	Revise record	Date
A	New version	2012/03/02
B	Viewing Direction remark	2012/04/24

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