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	DET043QQNTCMI-1W	SPEC ONLY	1

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

CUSTOMER	Standard
CUSTOMER PART NUMBER	
PRODUCT NUMBER	DET043QQNTCMI-1W

Product Mgr	Design Eng
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Date: 13-May-13	Date: 13-May-13

Approval for Specification only

Approval for Specification and Sample

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3. Module Numbering System

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
D	E	T	0	4	3	Q	Q	N	T	C	M	I	-	1	W

1	D	
2	E	DENSITRON Standard TFT
3	T	
4~6	0	TFT Size:
	4	035=3.5", 043=4.3", 057=5.7", 070=7", 101=10.1"
	3	
7~8	Q	TFT Resolution:
	Q	QQ: 480X272 (WQVGA), VG: 640X480 (VGA) WV: 800X480 (WVGA), WS: 1024X600 (WSVGA)
9	N	TFT Brightness: N: Normal Brightness, H: High Brightness
10	T	TFT Interface System: T: TTL, L: LVDS
11~13	C	Touch Type: NT: Non-Touch, CS: Capacitive Single Touch,
	M	CM: Capacitive Multi Touch, RS: Resistive Single Touch, RM: Resistive Multi Touch
	I	Touch Interface: 0: No interface, U: USB I/F, I: I2C I/F, S: SPI I/F
14	-	
15~16	1	Revision
	W	A: Standard, W: Wide Viewing Angle

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4. Application

This specification is applied to the 4.3 inch supported TFT-LCD module With projected capacitive touch (PCT) and can display true 16.7M colors (8 bit/ color).The module is designed for PMP, GPS application and other electronic products which require flat panel display of digital signal interface. The model is composed of a TFT LCD panel, a driver circuit and a back-light system and used as the input devices for general electric appliances via both finger and Capacitive stylus pen.

5. Features

- WQVGA (480×272 pixels) resolution.
- 24 bit parallel RGB.
- Ultra Wide View Polarizer
- Projected Capacitive Touch
 - I²C Interface
 - Multi Touch (Ten points)

6. General Specifications

Item	Specifications	Unit
Screen Size	4.3 (Diagonal)	inch
Display Format	480RGB(H)×272(V)	dot
Active Area	95.04(H)×53.856(V)	mm
PIXEL Pitch	0.198(H)×0.198(V)	mm
Pixel Configuration	RGB Vertical Stripe	-
Display Mode	TN Type Transmissive Mode(Micro Reflective) Normally White	-
Surface Treatment	Clear(7H)	-
Viewing Direction	6 O'clock (The Gray Inversion will appear at this direction)	-
Outline Dimension	105.5(W)×67.2(H)×4.65(D)	mm
Weight	(65)	g
RoHS Compliance	DENSITRON certifies this product to be in compliance with European Union Directive 2002/95/EC on the restriction of certain hazardous substances in electrical and electronic equipment.	-

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7. Absolute Maximum Ratings

7.1 Absolute Ratings of Environment

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-30	+80	°C	(1)(2)
Operating Ambient Temperature	T _{OP}	-20	+70	°C	(1)(2)

Note1: Background color changes slightly depending on ambient temperature.

This phenomenon is reversible.

Note2: Please refer to item of RELIABILITY.

7.2 Electrical Absolute Ratings

7.2.1 TFT-LCD Module

(Ta=25±2°C, VSS=0V)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Digital Power Supply Voltage	DVDD	-0.3	4.0	V	-

7.2.2 Backlight Unit

(Ta=25±2°C)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Current of Backlight Unit	I _B	-	25	mA	(1)
Reverse Voltage	V _R	-	50	V	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.

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8. Electrical Characteristics

8.1 TFT-LCD Module

(Ta=25±2°C)

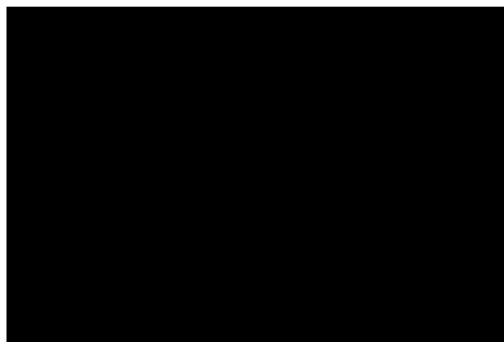
Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Digital Power Supply Voltage	DVDD	3.0	3.3	3.6	V	-
Input High Threshold Voltage	VIH	0.7DVDD	-	DVDD	V	-
Input Low Threshold Voltage	VIL	0	-	0.3 DVDD	V	-
VSYNC Frequency	F _V	-	59.94	-	Hz	-
HSYNC Frequency	F _H	-	17.14	-	KHz	-
Pixel Clock	PCLK	-	9.0	15.0	MHz	-

(VSS = 0V)

Parameter	SYMBOL	Condition	Min.	Typ.	Max.	Unit	Remarks
Digital Current	IDVDD	DVDD=3.3V	-	22.8	31.92	mA	(1)
Total Power Consumption	PC	-	-	75.24	105.34	mW	(1)

Note (1) The specified power consumption is under the conditions at DVDD = 3.3V, FV=60Hz, DCLK=9.0 MHz, whereas a power dissipation check Pattern below is displayed.

Black Pattern / 0 Gray



Active Area

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8.2 Backlight Unit

(Ta=25±2°C)

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Voltage	VL	-	(33)	-	V	(1)
Current of Backlight Unit	I _B	-	20	-	mA	(1)
Power Consumption	P _{BL}	-	(660)	-	mW	(1)
LED life time	-	20000	30000	-	Hr	(2)

Note (1) The driving design of backlight unit is dependent on serial consideration of 10 LEDs.

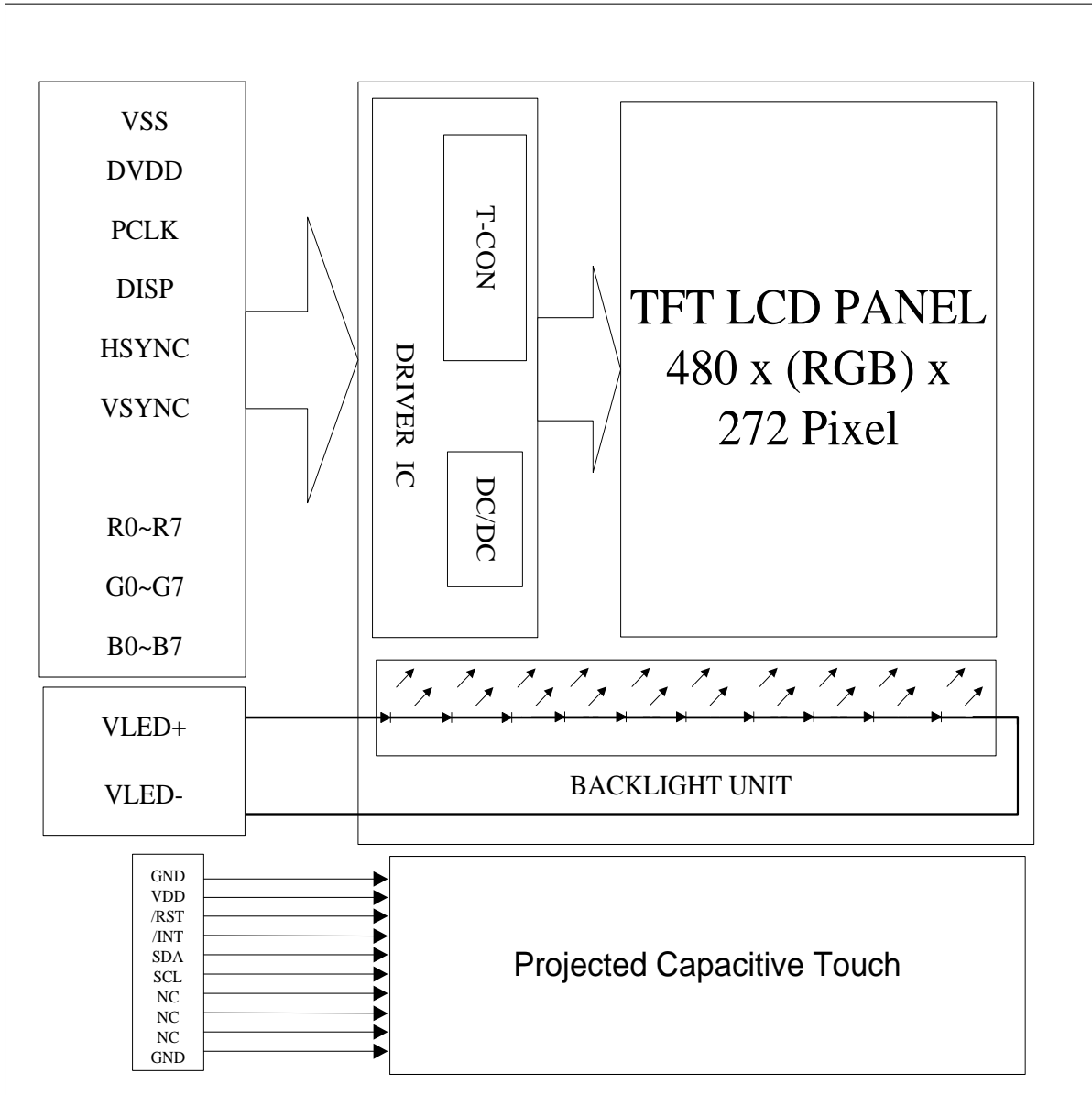
(2) The LED life time is defined as the module brightness decrease to 50%, original brightness at Ta=25°C , I_B =20mA.

8.3 Projected Capacitive Touch

Item	Value			Unit	Note
	Min.	Typ.	Max.		
Operating Voltage	3.0	3.3	3.6	V	-
Power Supply Current	-	10.0	14.0	mA	(1)
Power Consumption	-	33.3	46.2	mW	@3.3V
Interface	I ² C				-
Function	Multi Touch				-

Note (1) This test condition is touched with 10 points.

9. Block Diagram
TFT-LCD Module with Backlight Unit



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10. Input / Output Terminals Pin Assignment

10.1 TFT-LCD Module

(Reference Connector :

Hirose Electric CO., LTD. Product No.: FH12A-40S-0.5SH(55) Top contact type)

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	VSS	Ground	21	B0	Blue data(LSB)
2	VSS	Ground	22	B1	Blue data
3	DVDD	POWER SUPPLY(+3.3V)	23	B2	Blue data
4	DVDD	POWER SUPPLY(+3.3V)	24	B3	Blue data
5	R0	Red data(LSB)	25	B4	Blue data
6	R1	Red data	26	B5	Blue data
7	R2	Red data	27	B6	Blue data
8	R3	Red data	28	B7	Blue data(MSB)
9	R4	Red data	29	VSS	Ground
10	R5	Red data	30	PCLK	Pixel clock
11	R6	Red data	31	DISP	Display ON/OFF Signal
12	R7	Red data(MSB)	32	HSYNC	Horizontal Sync input with negative polarity
13	G0	Green data(LSB)	33	VSYNC	Vertical Sync input with negative polarity
14	G1	Green data	34	NC	NC
15	G2	Green data	35	NC	NC
16	G3	Green data	36	NC	NC
17	G4	Green data	37	NC	NC
18	G5	Green data	38	NC	NC
19	G6	Green data	39	NC	NC
20	G7	Green data(MSB)	40	NC	NC

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10.2 Backlight

(Reference Connector :

Kyocera Elco Corporation Product No. : 6298 Bottom contact type)

Terminal No.	Signal	Functions
1	VLED-	LED Power Source Input terminal (Cathode side)
2	NC	No Connection
3	NC	No Connection
4	VLED+	LED Power Source Input terminal (Anode side)

10.3 Projected Capacitive Touch

Connector: CVILUX CF25101D0R0-05

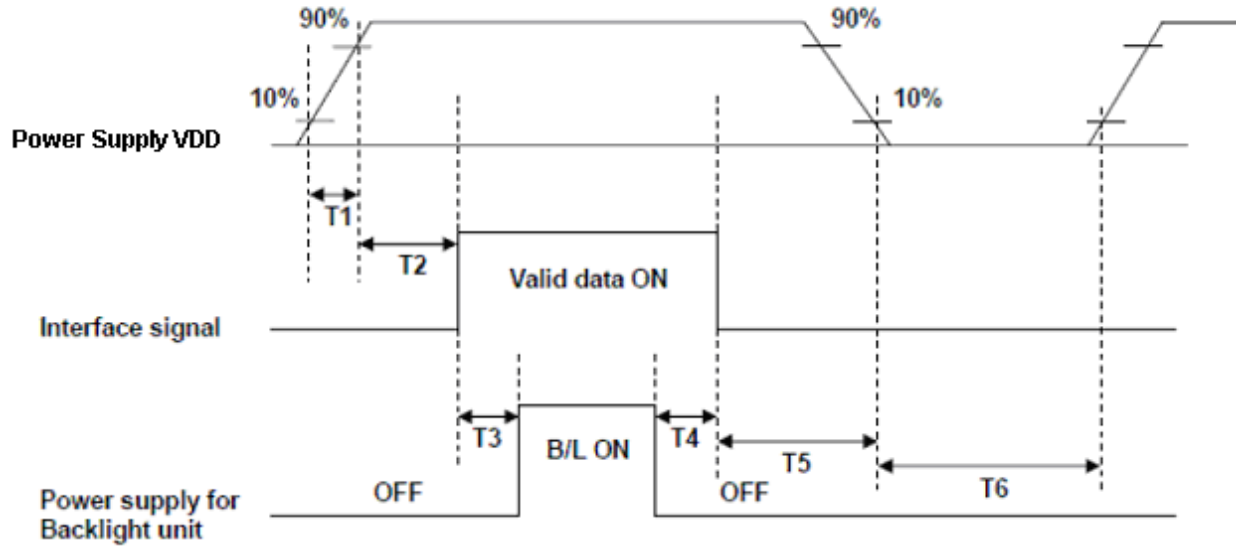
Pin No.	Symbol	I/O	Description
1	GND	I	System ground.
2	VDD	I	+3.3V power supply.
3	/RST	I	External reset signal, active low.
4	/INT	O	Interrupt signal, active low, asserted to request Host start a new transaction.
5	SDA	I/O	I ² C data signal.
6	SCL	I	I ² C clock signal.
7	NC	-	Not Connection
8	NC	-	Not Connection
9	NC	-	Not Connection
10	GND	I	System ground.

10.4 Color Data Input Assignment

The brightness of each primary color(red, green and blue) is based on the 8 bit gray scale data input for the color. The higher the binary input, the brighter the color. The table provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		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	
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	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	
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	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	
	White	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	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(1)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0		
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:		
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0		
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0		
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		

10.5 Power ON/OFF Sequence



POWER SEQUENCE TABLE

Parameter	Value			Units
	Min.	Typ	Max.	
T1	0.5	-	10	ms
T2	2	-	-	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	2	-	-	ms
T6	1000	-	-	ms

11. Interface Timing

11.1 Timing Requirement 1

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock cycle	$f_{CLK}^{(1)}$	-	9	15	MHz
Hsync cycle	$1/th$	-	17.14	-	KHz
Vsync cycle	$1/tv$	-	59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th	525	525	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp ⁽²⁾	2	41	41	CLK
Horizontal back porch	thb ⁽²⁾	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285	286	399	H ⁽¹⁾
Vertical display period	tvd	272	272	272	H ⁽¹⁾
Vertical front porch	tvf	1	2	227	H ⁽¹⁾
Vertical pulse width	tvp ⁽²⁾	1	10	11	H ⁽¹⁾
Vertical back porch	tvb ⁽²⁾	1	2	11	H ⁽¹⁾

Note: (1) Unit: CLK=1/ f_{CLK} , H= th,

(2) It is necessary to keep $tvp+tvb=12$ and $thp+thb=43$ in sync mode. DE mode is unnecessary to keep it.

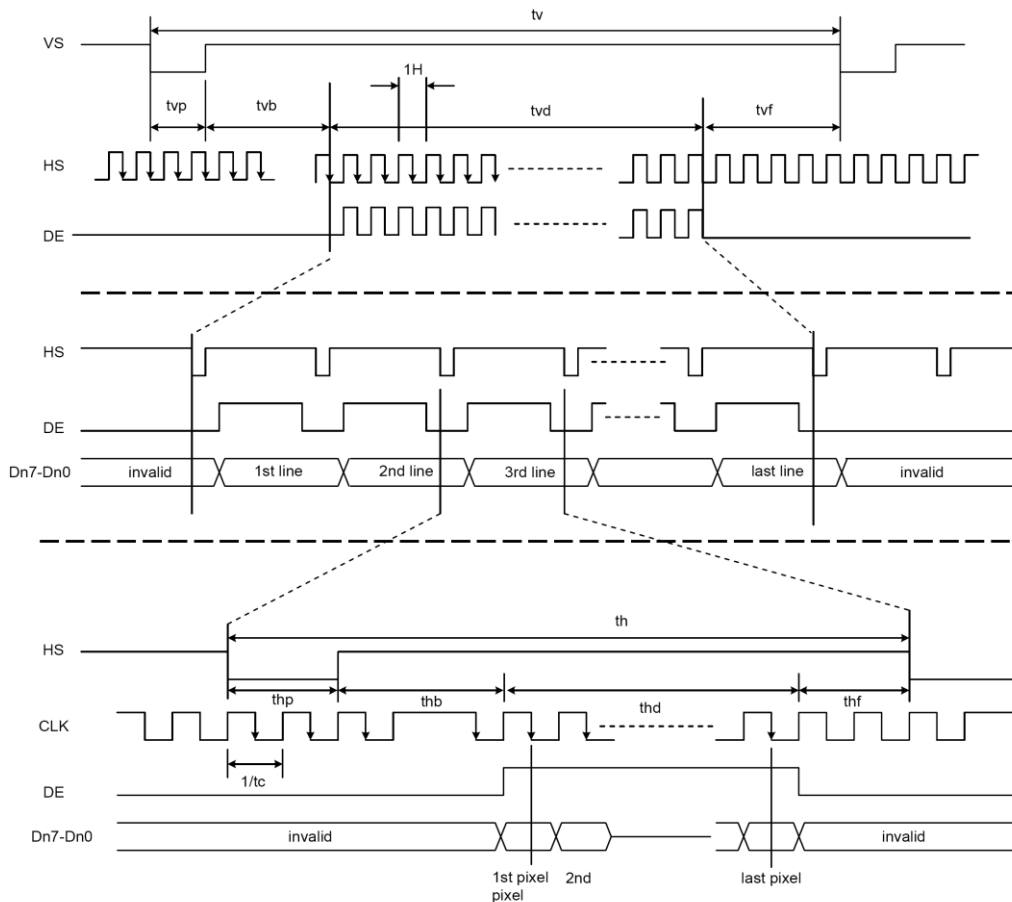


Figure 11.1 Input timing

11.2 Timing Requirement 2

(TA =25°C, DVDD=3.0V to 3.6V, VSS= 0V, tr (1)=tf (1)=2ns)

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
DISP setup time	t_{diss}	10	-	-	ns
DISP hold time	t_{dish}	10	-	-	ns
Clock period	PW_{CLK}^{*1}	66.7	-	-	ns
Clock pulse high period	PWH^{*1}	26.7	-	-	ns
Clock pulse low period	PWL^{*1}	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	ns
Hsync hold time	t_{hh}	10	-	-	ns
Data setup time	t_{ds}	10	-	-	ns
Data hold time	t_{dh}	10	-	-	ns
Vsync setup time	t_{vhs}	10	-	-	ns
Vsync hold time	t_{vhh}	10	-	-	ns

Note:

1. For parallel interface, maximum clock frequency is 15MHz.
2. tr, tf is defined 10% to 90% of signal amplitude.

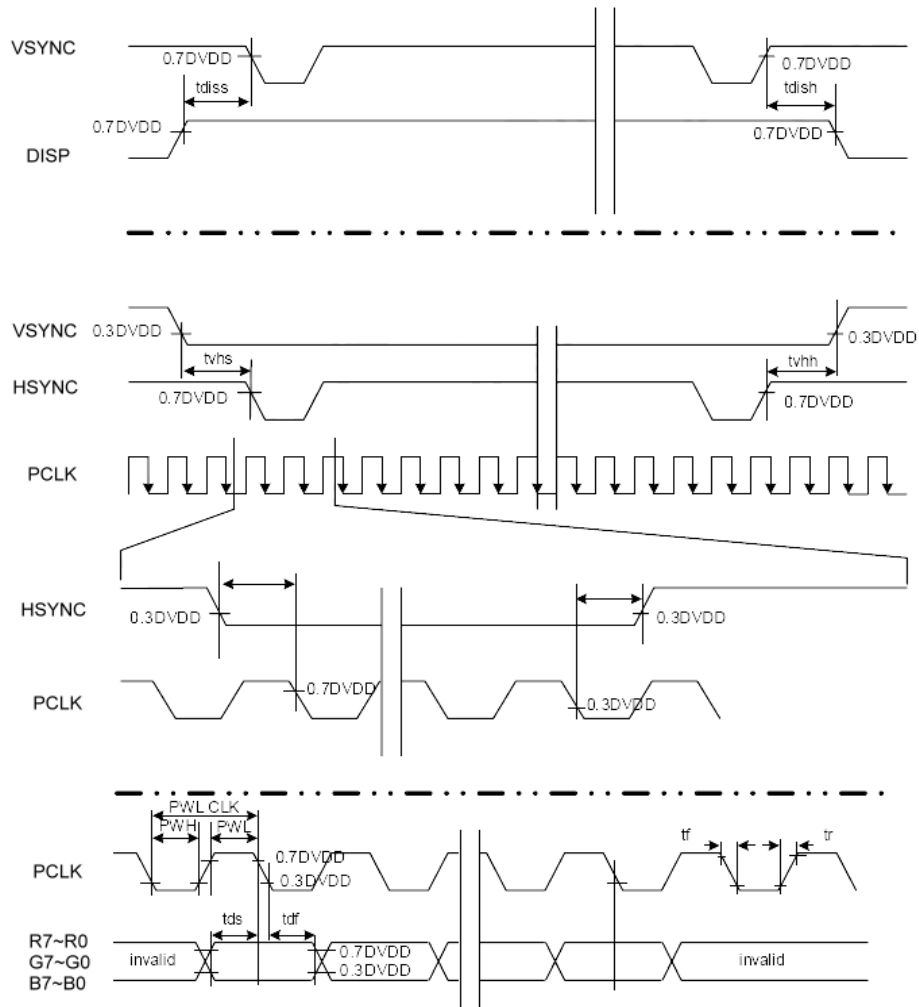
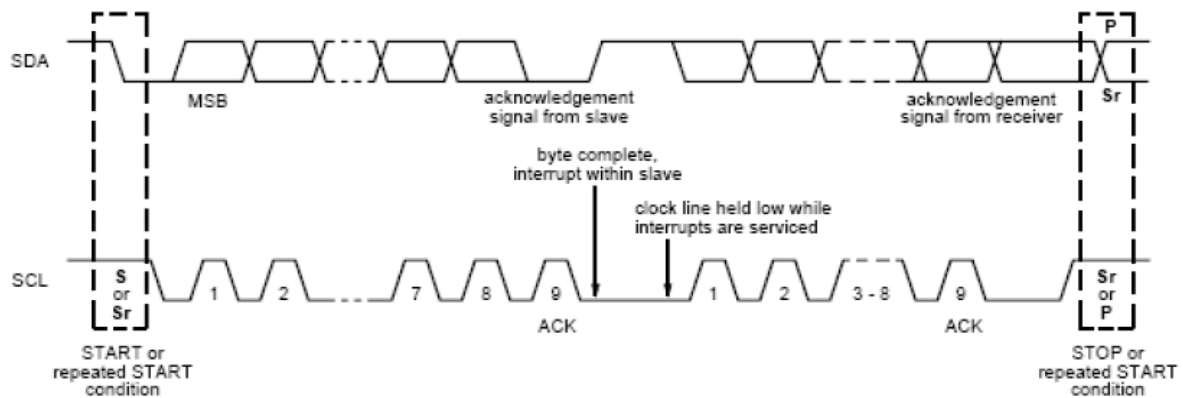


Figure 11.2 Input setup timing

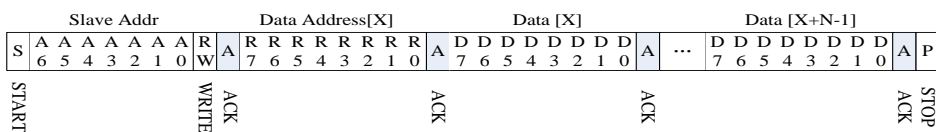
11.3 Timing Requirement of Projected Capacitive Touch

11.3.1 I2C Data Transfer Format

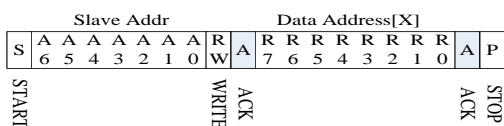


Mnemonics	Description
S	I ² C Start or I ² C Restart
A[6:0]	Slave Address = 7'b0111000
W	1'b0: Write
R	1'b1: Read
C	ACK
P	STOP: the indicate the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

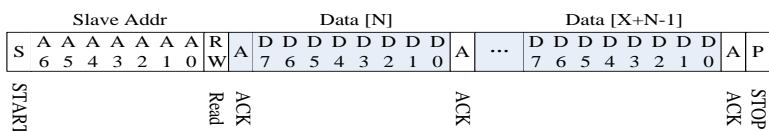
Write N bytes to I2C slave



Set Data Address



Read X bytes from I²C Slave



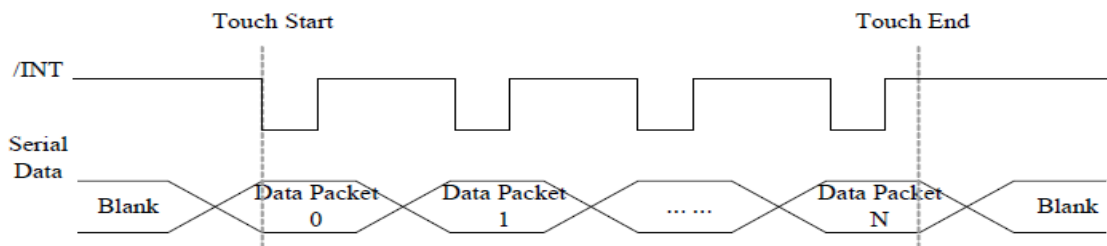
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11.3.2 I2C Timing Characteristics

(Ta=25±2°C)

Parameter	Min	Max	Unit
SCL frequency	-	400	kHz
Bus free time between a STOP and START condition	4.7	-	μs
Hold time (repeated) START condition	4.0	-	μs
Data setup time	250	-	ns
Setup time for a repeated START condition	4.7	-	μs
Setup time for STOP condition	4.0	-	μs

11.3.3 Interrupt Trigger Mode



11.3.4 I2C Operating Mode Register Map

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Host Access
Op,00h	DEVICE_MODE		Device Mode[2:0]							RW
Op,01h	Reserved									R
Op,02h	TD_STATUS					Number of touch points[3:0]				R
Op,03h	TOUCH1_YH	1 st Event Flag				1 st Touch Y Position[11:8]				R
Op,04h	TOUCH1_YL	1 st Touch Y Position[7:0]								R
Op,05h	TOUCH1_XH	1 st Touch ID[3:0]					1 st Touch X Position[11:8]			R
Op,06h	TOUCH1_XL	1 st Touch X Position[7:0]								R
Op,07h	Reserved									R
Op,08h	Reserved									R
Op,09h	TOUCH2_YH	2 nd Event Flag				2 nd Touch Y Position[11:8]				R
Op,0Ah	TOUCH2_YL	2 nd touch Y Position[7:0]								R

Op,0Bh	TOUCH2_XH	2 nd Touch ID[3:0]		2 nd Touch X Position[11:8]	R
Op,0Ch	TOUCH2_XL	2 nd Touch X Position[7:0]			R
Op,0Dh	Reserved				R
Op,0Eh	Reserved				R
Op,0Fh	TOUCH3_YH	3 rd Event Flag		3 rd Touch Y Position[11:8]	R
Op,10h	TOUCH3_YL	3 rd Touch Y Position[7:0]			R
Op,11h	TOUCH3_XH	3 rd Touch ID[3:0]		3 rd Touch X Position[11:8]	R
Op,12h	TOUCH3_XL	3 rd Touch X Position[7:0]			R
Op,13h	Reserved				R
Op,14h	Reserved				R
Op,15h	TOUCH4_YH	4 th Event Flag		4 th Touch Y Position[11:8]	R
Op,16h	TOUCH4_YL	4 th Touch Y Position[7:0]			R
Op,17h	TOUCH4_XH	4 th Touch ID[3:0]		4 th Touch X Position[11:8]	R
Op,18h	TOUCH4_XL	4 th Touch X Position[7:0]			R
Op,19h	Reserved				R
Op,1Ah	Reserved				R
Op,1Bh	TOUCH5_YH	5 th Event Flag		5 th Touch Y Position[11:8]	R
Op,1Ch	TOUCH5_YL	5 th Touch Y Position[7:0]			R
Op,1Dh	TOUCH5_XH	5 th Touch ID[3:0]		5 th Touch X Position[11:8]	R
Op,1Eh	TOUCH5_XL	5 th Touch X Position[7:0]			R
Op,1Fh	Reserved				R
Op,20h	Reserved				R
Op,21h	TOUCH6_YH	6 th Event Flag		6 th Touch Y Position[11:8]	R
Op,22h	TOUCH6_YL	6 th Touch Y Position[7:0]			R
Op,23h	TOUCH6_XH	6 th Touch ID[3:0]		6 th Touch X Position[11:8]	R
Op,24h	TOUCH6_XL	6 th Touch X Position[7:0]			R
Op,25h	Reserved				R
Op,26h	Reserved				R

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Op,27h	TOUCH7_YH	7 th Event Flag		7 th Touch Y Position[11:8]	R
Op,28h	TOUCH7_YL	7 th Touch Y Position[7:0]			R
Op,29h	TOUCH7_XH	7 th Touch ID[3:0]		7 th Touch X Position[11:8]	R
Op,2Ah	TOUCH7_XL	7 th Touch X Position[7:0]			R
Op,2Bh	Reserved				R
Op,2Ch	Reserved				R
Op,2Dh	TOUCH8_YH	8 th Event Flag		8 th Touch Y Position[11:8]	R
Op,2Eh	TOUCH8_YL	8 th Touch Y Position[7:0]			R
Op,2Fh	TOUCH8_XH	8 th Touch ID[3:0]		8 th Touch X Position[11:8]	R
Op,30h	TOUCH8_XL	8 th Touch X Position[7:0]			R
Op,31h	Reserved				R
Op,32h	Reserved				R
Op,33h	TOUCH9_YH	9 th Event Flag		9 th Touch Y Position[11:8]	R
Op,34h	TOUCH9_YL	9 th Touch Y Position[7:0]			R
Op,35h	TOUCH9_XH	9 th Touch ID[3:0]		9 th Touch X Position[11:8]	R
Op,36h	TOUCH9_XL	9 th Touch X Position[7:0]			R
Op,37h	Reserved				R
Op,38h	Reserved				R
Op,39h	TOUCH10_YH	10 th Event Flag		10 th Touch Y Position[11:8]	R
Op,3Ah	TOUCH10_YL	10 th Touch Y Position[7:0]			R
Op,3Bh	TOUCH10_XH	10 th Touch ID[3:0]		10 th Touch X Position[11:8]	R
Op,3Ch	TOUCH10_XL	10 th Touch X Position[7:0]			R
Op,3Dh	Reserved				R
Op,3Eh	Reserved				R

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11.3.5 DEVICE_MODE

This register is the device mode register, configure it to determine the current mode of the chip.

Address	Bit Address	Register Name	Description
Op,00h	6:4	Device Mode [2:0]	000b Normal operating Mode 001b System Information Mode (Reserved) 100b Test Mode – read raw data (Reserved)

11.3.6 TD_STATUS

This register is the Touch Data status register.

Address	Bit Address	Register Name	Description
Op,02h	3:0	Number of touch points[3:0]	How many points detected. 1-10 is valid.

11.3.7 TOUCHn_YH (n:1-10)

This register describes MSB of the Y coordinate of the nth touch point and the corresponding event flag.

Address	Bit Address	Register Name	Description
Op,03h ~ Op,39h	7:6	Event Flag	00b: Put Down 01b: Put Up 10b: Contact 11b: No event
	5:4		Reserved
	3:0	Touch Y Position [11:8]	MSB of Touch Y Position in pixels

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11.3.8 TOUCHn_YL (n:1-10)

This register describes LSB of the Y coordinate of the nth touch point.

Address	Bit Address	Register Name	Description
Op,04h ~ Op,3Ah	7:0	Touch Y Position [7:0]	LSB of the Touch Y Position in pixels

11.3.9 TOUCHn_XH (n:1-10)

This register describes MSB of the X coordinate of the nth touch point and corresponding touch ID.

Address	Bit Address	Register Name	Description
Op,05h ~ Op,3Bh	7:4 3:0	Touch ID[3:0] Touch X Position [11:8]	Touch ID of Touch Point MSB of Touch X Position in pixels

11.3.10 TOUCHn_XL (n:1-10)

This register describes LSB of the X coordinate of the nth touch point.

Address	Bit Address	Register Name	Description
Op,06h ~ Op,3Ch	7:0	Touch X Position [7:0]	LSB of The Touch X Position in pixels

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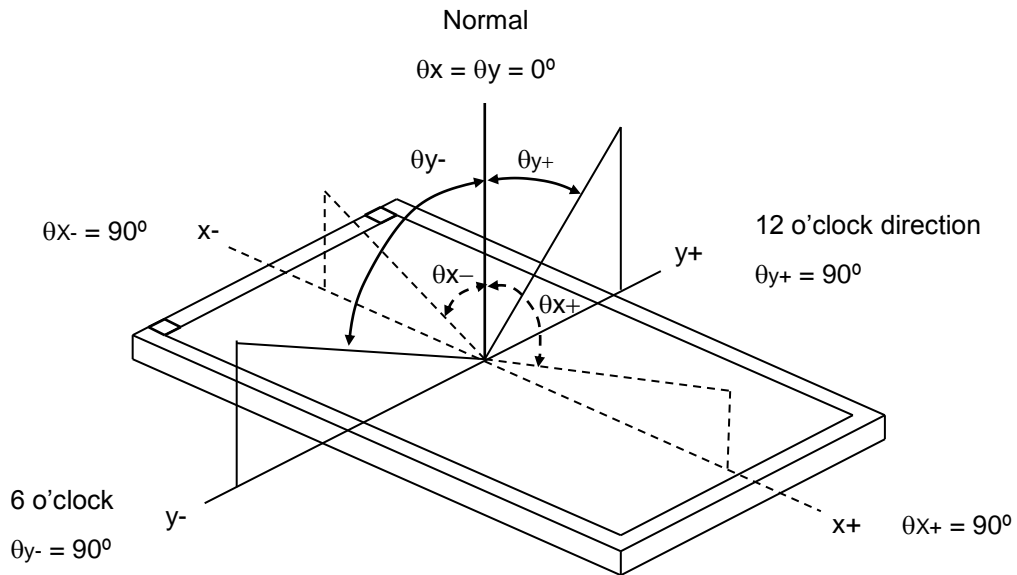
12. Optical Characteristics

The optical characteristics should be measured in a dark environment (≤ 1 lux) or equivalent state with the methods shown in Note (5).

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	300	(450)	-	-	(2),(5)
Response Time		$T_{R+} T_F$		-	20	-	ms	(3)
Luminance(Center)		LC		390	(430)	-	cd/m ²	(4),(5)
Brightness uniformity		B _{UNI}		70	(75)	-	%	(5),(6)
Color Chromaticity	Red	R _x		0.570	0.620	0.670	-	(1),(5)
		R _y		0.290	0.340	0.390	-	
	Green	G _x		0.290	0.340	0.390	-	
		G _y		0.510	0.560	0.610	-	
	Blue	B _x		0.090	0.140	0.190	-	
		B _y		0.050	0.100	0.150	-	
	White	W _x	0.260	0.310	0.360	-		
		W _y	0.270	0.320	0.370	-		
Viewing Angle	Horizontal	θ_{x+}	CR \geq 10	60	(80)	-	deg.	
		θ_{x-}		60	(80)	-		
	Vertical	θ_{Y+}		60	(80)	-		
		θ_{Y-}		60	(80)	-		

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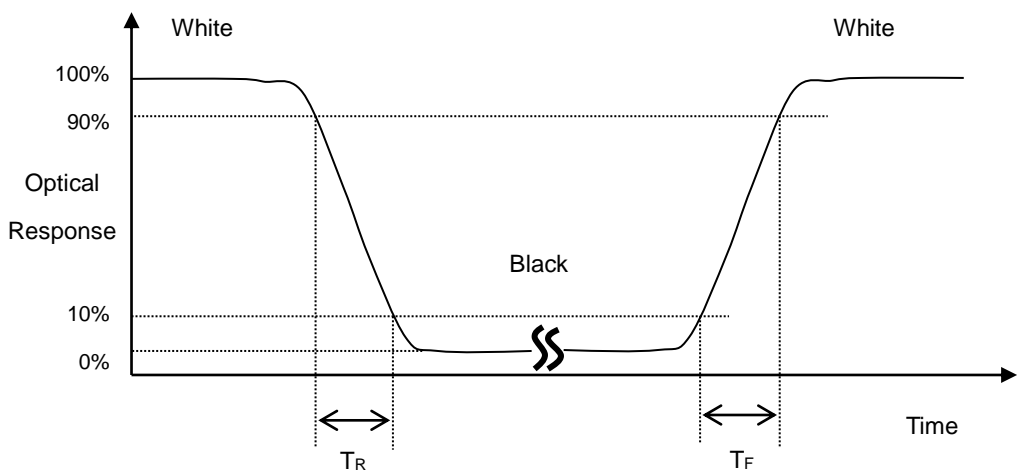
Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

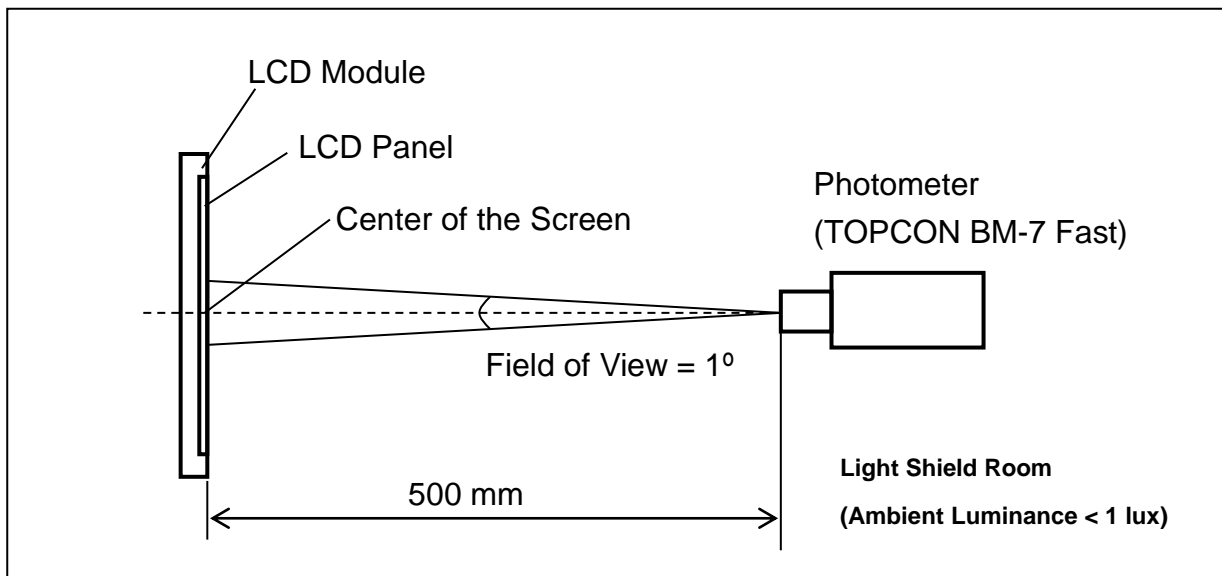
Note (3) Definition of Response Time (T_R , T_F):



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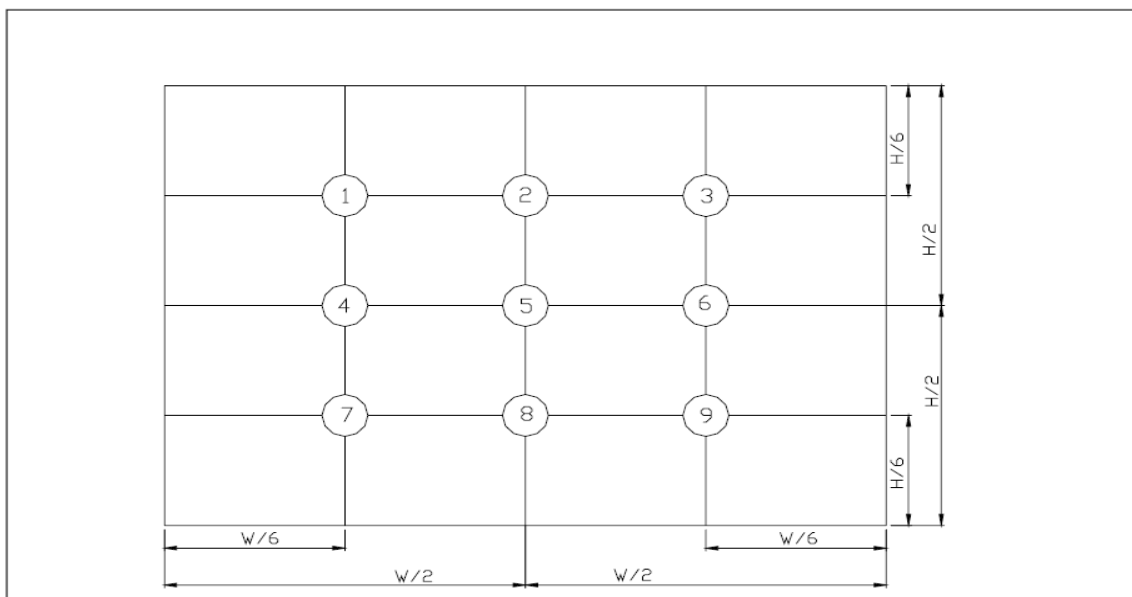
Note (4) Measurement Set-Up:

The LCD module should be stabilized at a given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



Note (5) Definition of brightness uniformity

$$\text{Brightness uniformity} = (\text{Min Luminance of 9 points}) / (\text{Max Luminance of 9 points}) \times 100\%$$



(單位 : mm)

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13. Reliability Test

No.	Test Items	Test Condition	Remark
1	High Temperature Storage Test	T _a = 80°C 240 hours	(1),(3),(4)
2	Low Temperature Storage Test	T _a = -30°C 240 hours	(1),(3),(4)
3	High Temperature Operation Test	T _s = 70°C 240 hours	(2),(3),(4)
4	Low Temperature Operation Test	T _a = -20°C 240 hours	(1),(3),(4)
5	High Temperature and High Humidity Operation Test	T _a =60°C 90%RH 240 hours	(3), (4)
6	Electro Static Discharge Test (non-operating)	-Panel Surface/Top Case : 150pF, 330Ω Air : ±15kV, Contact: ±8kV	(3)
7	Mechanical Shock Test (non-operating)	Half sine wave, 100G, 6ms 3 times shock of each six surfaces	(3)
8	Vibration Test (non-operating)	Sine wave:10 ~ 55 ~ 10Hz amplitude:1.5mm 3 axis, 2 hours/axis	(3)
9	Thermal Shock Test (non-operating)	-20°C (30min) ~ 70°C (30min) ,10 cycles	(3) , (4)
10	Drop Test(with Carton)	Height : 80cm 1 corner, 3 edges, 6 surfaces	(3)

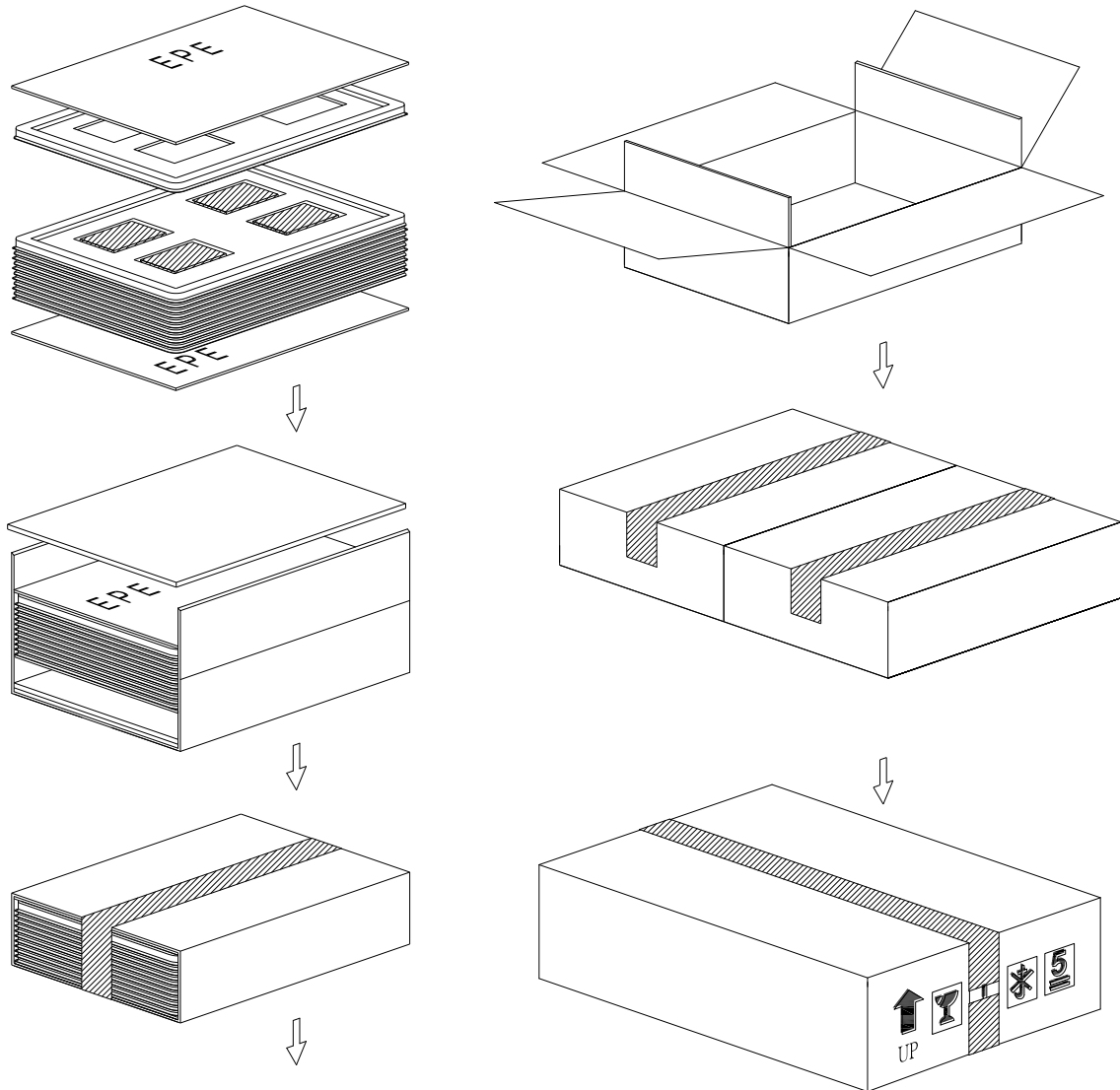
Note 1 : T_a is the ambient temperature of samples.

Note 2 : T_s is the temperature of panel' s surface.

Note 3 : In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don' t guarantee all of the cosmetic specification.

Note 4 : Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

14. Packaging



PARTS LIST					
	ITEM	SIZE(LxWxH) unit:mm	MATERIAL	Q.T.Y	NOTE
1	TRAY	372.0x262.0x16.6		26	
2	EPE(J46)	372.0x262.0x5.0	EPE	4	
3	CARD BOARD(P01)	816.0x375.0x3.5	CARTON	2	
4	CARD BOARD(P02)	945.0x275.0x3.5	CARTON	2	
5	CARD BOARD(P03)	375.0x265.0x3.5	CARTON	4	
6	INTERNAL BOX(S01)	400.0x290.0x150.0	CARTON	2	
7	EXTERNAL BOX(L28)	600.0x420.0x180.0		1	
8	PRODUCT	105.5x67.2x4.65		96	

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15. Precautions

15.1 Assembly and Handling Precautions

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It's recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) Don't apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD module in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow.

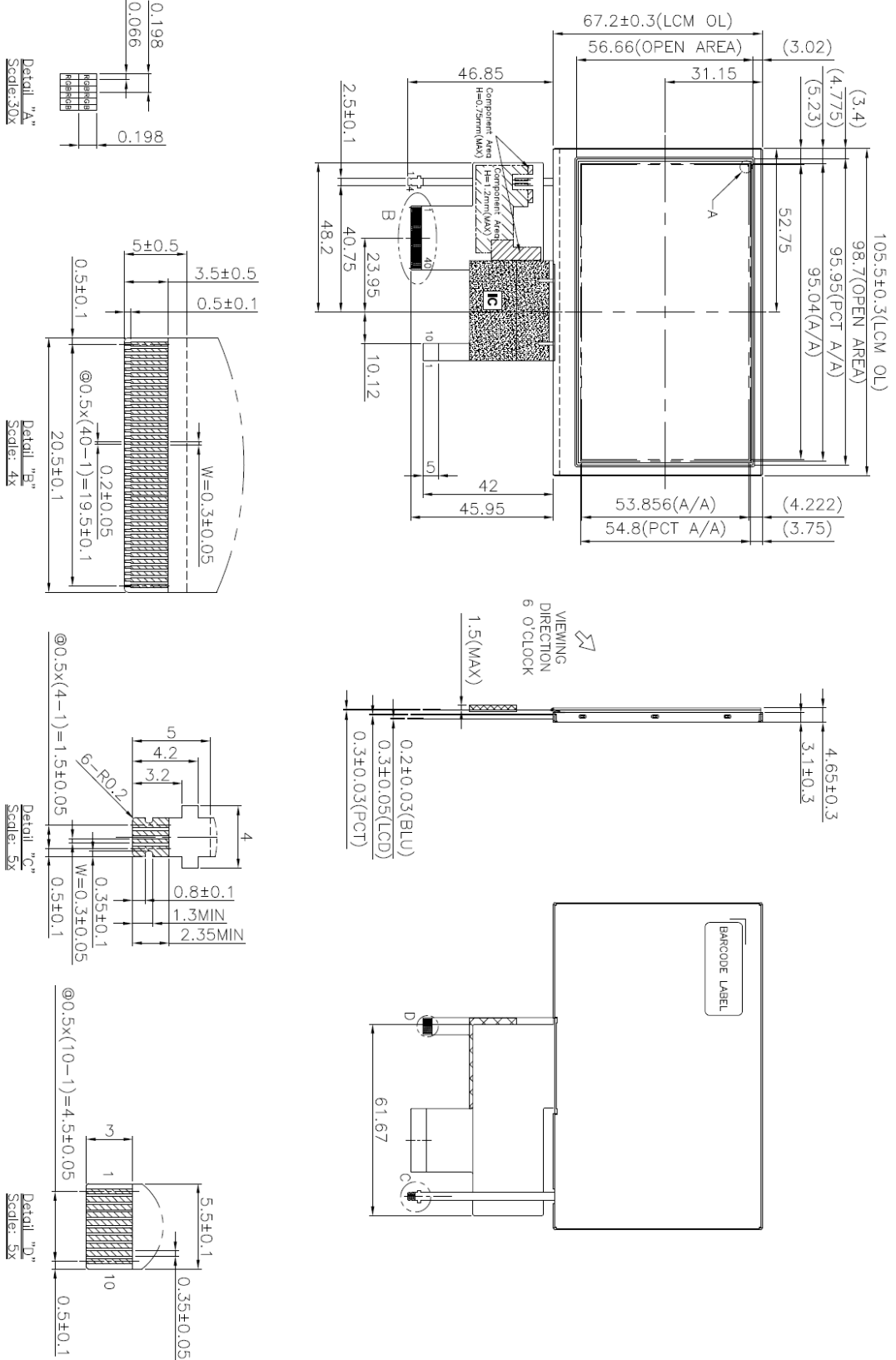
15.2 Safety Precautions

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

15.3 Terms of Warrant

- (1) Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- (2) Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.

16.Outline Drawing



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17. Incoming Inspection Standards

17.1 The environmental condition of inspection

The environmental condition and visual inspection shall be conducted as below.

- (1) Ambient temperature $25 \pm 5^{\circ}\text{C}$
- (2) Humidity: $60 \pm 5\%$ RH
- (3) Viewing distance is approximately 35 ~ 40 cm
- (4) Viewing angle is normal to the LCD panel as Fig _1(10°)
- (5) Ambient Illumination: 300 ~ 500 Lux for external appearance inspection

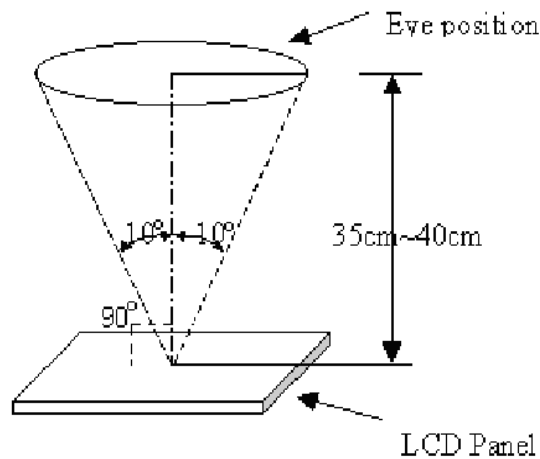


Fig _ 1

17.2 The defects classify of AQL as following:

- (1) Test method :According to [ANSI/ASQC Z 1.4](#) .General Inspection Level II take a single time
- (2) The defects classify of AQL as following:

Class of defects	AQL	Definition
Major	0.65%	It is 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 functioning problem with deviation classified.

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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 defect in bright , dark and colored.			-	
	Point Defect (red,green,blue,dark, white)	Item	Acceptable number			Note: 1、4、5、6
			A	B	Total	
		BRIGHT DOT	$N \leq 2$	$N \leq 2$	$N \leq 7$	
		DARK DOT	$N \leq 3$	$N \leq 4$		
		TOTAL DOT	$N \leq 4$	$N \leq 5$		
TWO ADJACENT DOT	NOT ALLOWED					
THREE OR MORE ADJACENT DOT	NOT ALLOWED					
External Inspection (non-operating)	Scratch on the polarizer	L(mm)	W(mm)	Acceptable number	Note:2	
		$L \leq 2.5$	$W \leq 0.1$	4		
		$L > 2.5$	$W > 0.1$	0		
	Dent or bubble on the polarizer	Dimension(mm)		Acceptable number	Note:3	
		$D \leq 0.5$		4		
		$D \leq 0.15$		Disregard		
	Line Criteria or Dot Criteria on the polarizer	Inactive dot		Acceptable number	Note:2、3	
		$D < 0.2\text{mm}$		Disregard		
		$0.2 \leq D \leq 0.5$ $L \leq 1.8\text{mm}, W \leq 0.1\text{mm}$		Line & dot number $N \leq 6$		

Incoming Inspection Touch Panel

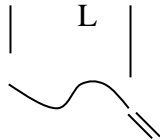
Circular Defects
Linear Defects
Scratch
Air Bubble
Crack

(1) Circular Defects

$$\phi = (L+W)/2$$

Diameter(mm)	Spec
$\phi \leq 0.2$	No quantity limit
$0.2 < \phi < 0.4$	Max 5defect
$0.4 \leq \phi$	Reject

(2) Linear Defects



Length	Width	Acceptable
$6.0 \geq L$	$0.06 \geq W$	Accept
$L \geq 6.0$	$W \geq 0.06$	Reject

(3) Scratch

Length	Width	Acceptable
$12.0 \geq L$	$0.06 \geq W$	Accept
$L \geq 12.0$	$W \geq 0.06$	Reject

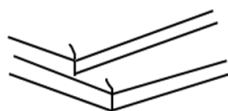
The Min distance of defects must be above 5.0mm.

(4) Air Bubble

Diameter(mm)	Spec
$\phi \leq 0.2$	No quantity limit
$0.2 < \phi \leq 0.6$	Max 5 defect

The Min distance of defects must be above 5.0mm.

(5)Crack **Reject**

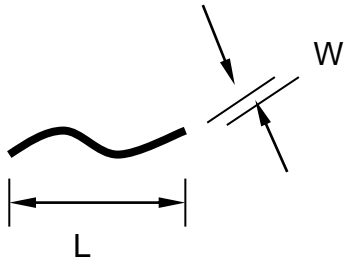


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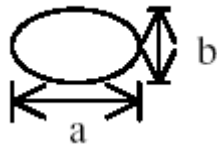
Note1. The definition of dot defect :

The dot defect was judged after repair and the size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

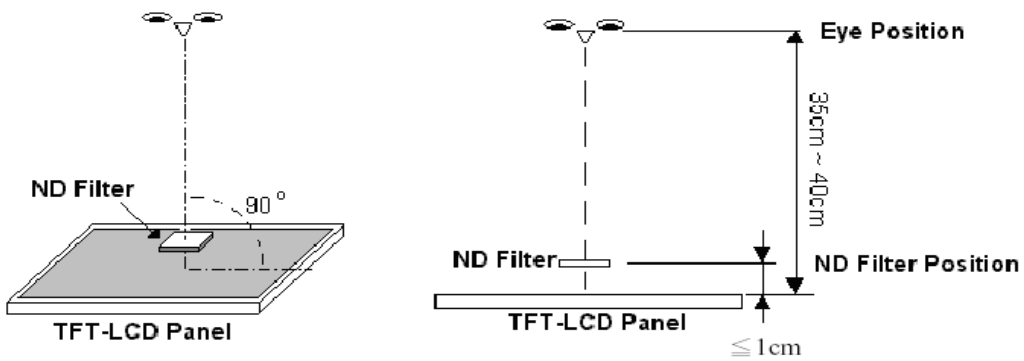
Note2.



Note3. D : Diameter $D=(a+b)/2$



Note4. Bright dot is defined through 6% transmission ND Filter as following.

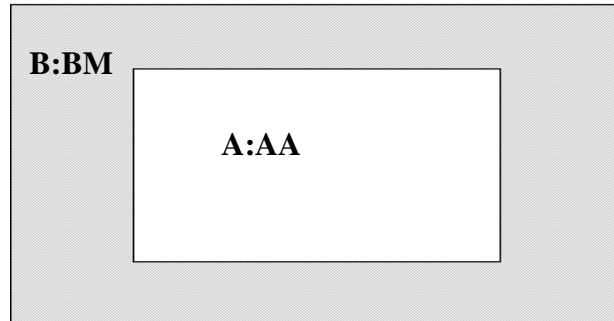


Note5. ADJACENT DOT



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Note6.



17.4 Handling of LCM

- (1) Don't give external shock.
- (2) Don't apply excessive force on the surface.
- (3) Liquid in LCD is hazardous substance. Must not lick and swallow. when the liquid is attach to your hand, skin, cloth etc. Wash it out thoroughly and immediately.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't disassemble the LCM.

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