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**TITLE : HTT40WQ1-M03****Product Specification****Rev. B****BOE HYDIS TECHNOLOGY**

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<b>REVISION HISTORY</b>				
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
0		Initial Release	06.04.25.	Y.J. Yoon
A		▷ Changed Power Consumption unit and Frame Rate at page 7 -White (min) : 11.1(13.1)mA → 57(61)mW (typ) : 12.1(13.1)mA → 60(66)mW (max): 12.1(13.1)mA → 65(70)mW -Black (min) : 15.0(16.8)mA → 72(81)mW (typ) : 15.6(17.4)mA → 78(87)mW (max): 15.9(17.8)mA → 83(93)mW - Frame Rate : 75(60)Hz → 60(75)Hz ▷ Changed Viewing Angle at page 18 - R/L/U/D : 68.5/68.5/58.5/52.5 → 65/65/50/55 ▷ Changed from Product Serial No to Label Code NO (Inner Box, Outer Box) at page 23	06.05.09	Y.J. Yoon
B	E0607-F011	▷ Added Min & Max for reproduction of color ▷ Added Min for Contrast Rate ▷ Change Luminance from 180 to 200 at page 18 ▷ Change Packing Box No. from 180 to 150 at page 24 ▷ Added Product Label at page 23 ▷ Added Protect film drawing at page 29	06.07.19	Y.J. Yoon
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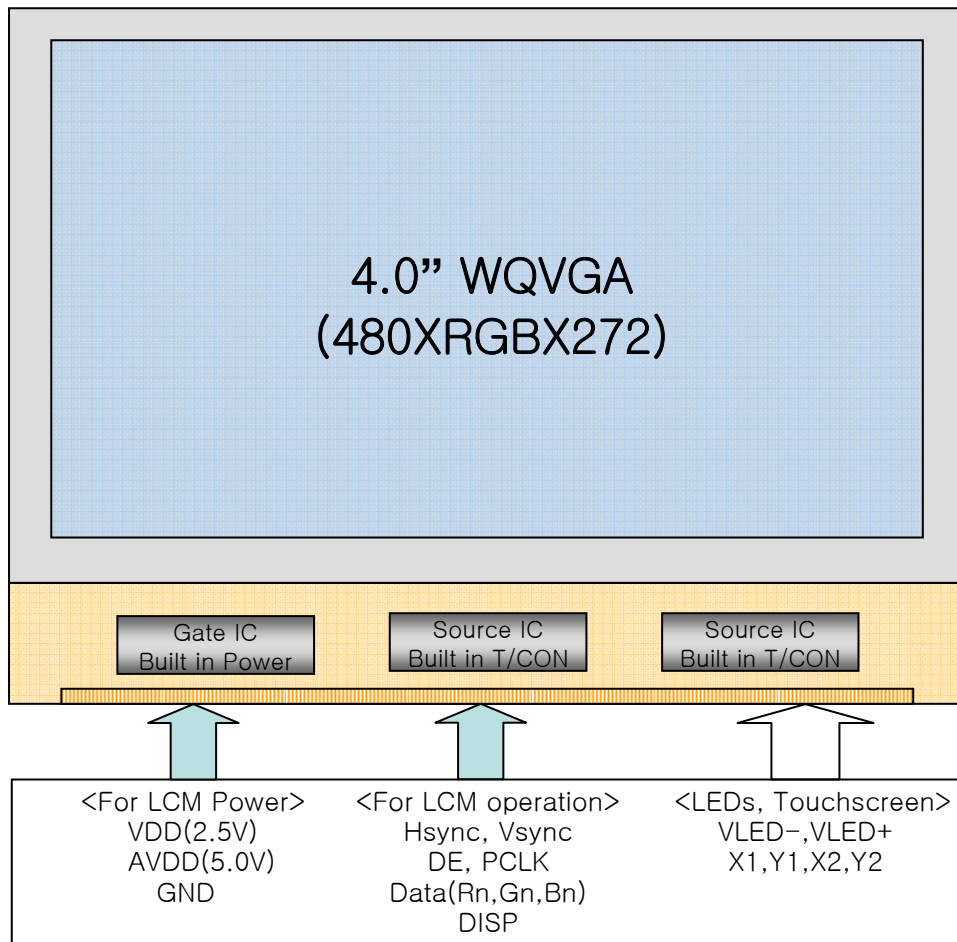
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## 1.0 GENERAL DESCRIPTION

### 1.1 Introduction

HTT40WQ1-M03 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 4.0 inch diagonally measured active area with WQVGA resolutions (480 horizontal by 272 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16,777,216 colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



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### 1.2 Feature

- RGB Interface with 1 pixel / clock, DE(Data Enable)& Sync mode.
- TN(Twisted Nematic) mode, Line inversion mode with stripe type.
- Low power consumption
- 8-bit color depth, display 16,777,216 colors
- Incorporated edge type back-light (6 LEDs)
- High luminance and contrast ratio, low reflection
- RoHS Compliant

### 1.3 Application


- Display terminals for AV & Portable application products.
- Display terminals for PMP (Portable Multimedia Player).
- Display terminals for P-CNS (Portable Car Navigation System).

### 1.4 General Specification

The followings are general specification at the model HTT40WQ1-M03.

Parameter	Specification	Unit	Remarks
Active area	87.84(H) × 49.776(V)	mm	
Number of pixels	480(H) × RGB × 272(V)	pixels	
Pixel pitch	0.183(H) × 0.183(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16,777,216	colors	
Display mode	Normally White		
Viewing direction	6	o'clock	
Dimensional outline	98.3 × 62.6 × 4.3 (Typ)	mm	
Weight	57 (Typ)	gram	
Back-light	Bottom edge side, 6-LEDs type		

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## 2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings >

[VSS=GND=0V]

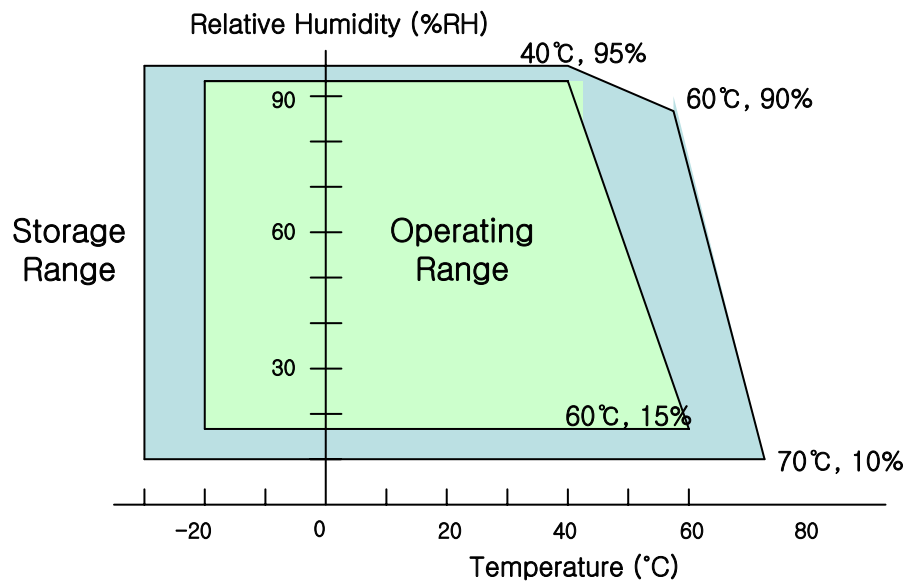
Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	AVDD	VSS-0.3	7.0	V	Ta = 25 °C
Logic Supply Voltage	DVDD	VSS-0.3	6.0	V	
Back-light LED Current	I <sub>BL</sub>	-	25	mA	
Operating Temperature	T <sub>OP</sub>	-20	60	°C	Note 1
Storage Temperature	T <sub>ST</sub>	-30	70	°C	Note 1

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.

2. In case of below 0 °C, the response time of LC becomes slower and the color be darker than normal one.



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### 3.0 ELECTRICAL SPECIFICATION

< Table 3. LCD Module Electrical Specification >

[Ta =25±2 °C]

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
Analog Power Supply Input	AVDD	4.8	5.0	5.2	V	
Logic Power Supply Input	DVDD	2.3	2.5	2.7	V	
Power Consumption	White	57(61)	60(66)	65(81)	mW	Note 1
	Black	72(81)	78(87)	83(93)	mW	
Vsync Frequency	f <sub>V</sub>	55	60	75	Hz	
Hsync Frequency	f <sub>H</sub>	15.5	17.14	21.37	KHz	
Main Clock Frequency	fclk	8.4	9.0	12.3	MHz	
LED forward Voltage	V <sub>f</sub>	-	3.5	4.0		
Back-light LED Current	I <sub>BL</sub>	-	20	25	mA	Note 2

Note :

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

The current draw and power consumption specified is for AVDD=5.0V, DVDD=2.5V

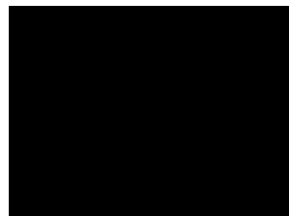
Frame rate=60(75)Hz and Clock frequency = 9.0(11.5)Mhz

Test Pattern of power supply current.

a) White Pattern



b) Black Pattern



2. Six LEDs serial type

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## 4.0 INTERFACE CONNECTION.

### 4.1 Module Input Signal & Power

- Connector Type : 0.5mm pitch, 50pin, Bottom contact.

Kyocera elco 6240 series, Hirose FH12 series or Equivalent

Pin No	Symbol	Function	Pin No	Symbol	Function
1	GND	GROUND	26	B5	BLUE DATA (B0: LSB, B7: MSB)
2	GND		27	B6	
3	VDD	POWER SUPPLY (2.5V)	28	B7	
4	VDD		29	GND	GROUND
5	R0	RED DATA (R0: LSB, R7: MSB)	30	PCLK	PIXEL CLOCK
6	R1		31	DISP	DISPLAY ON/OFF
7	R2		32	HSYNC	Horizontal sync signal
8	R3		33	VSYNC	Vertical sync signal
9	R4		34	DE	Data enable
10	R5		35	AVDD	POWER SUPPLY (5.0V)
11	R6		36	AVDD	
12	R7		37	GND	GROUND
13	G0	GREEN DATA (G0: LSB, G7: MSB)	38	GND	GROUND
14	G1		39	X1	X-Right for touch screen
15	G2		40	Y1	Y-Bottom for touch screen
16	G3		41	X2	X-Left for touch screen
17	G4		42	Y2	Y-top for touch screen
18	G5		43	GND	GROUND
19	G6		44	GND	
20	G7		45	GND	
21	B0	BLUE DATA (B0: LSB, B7: MSB)	46	VLED-	LED voltage for cathode
22	B1		47	VLED+	LED voltage for anode
23	B2		48	GND	GROUND
24	B3		49	GND	
25	B4		50	GND	

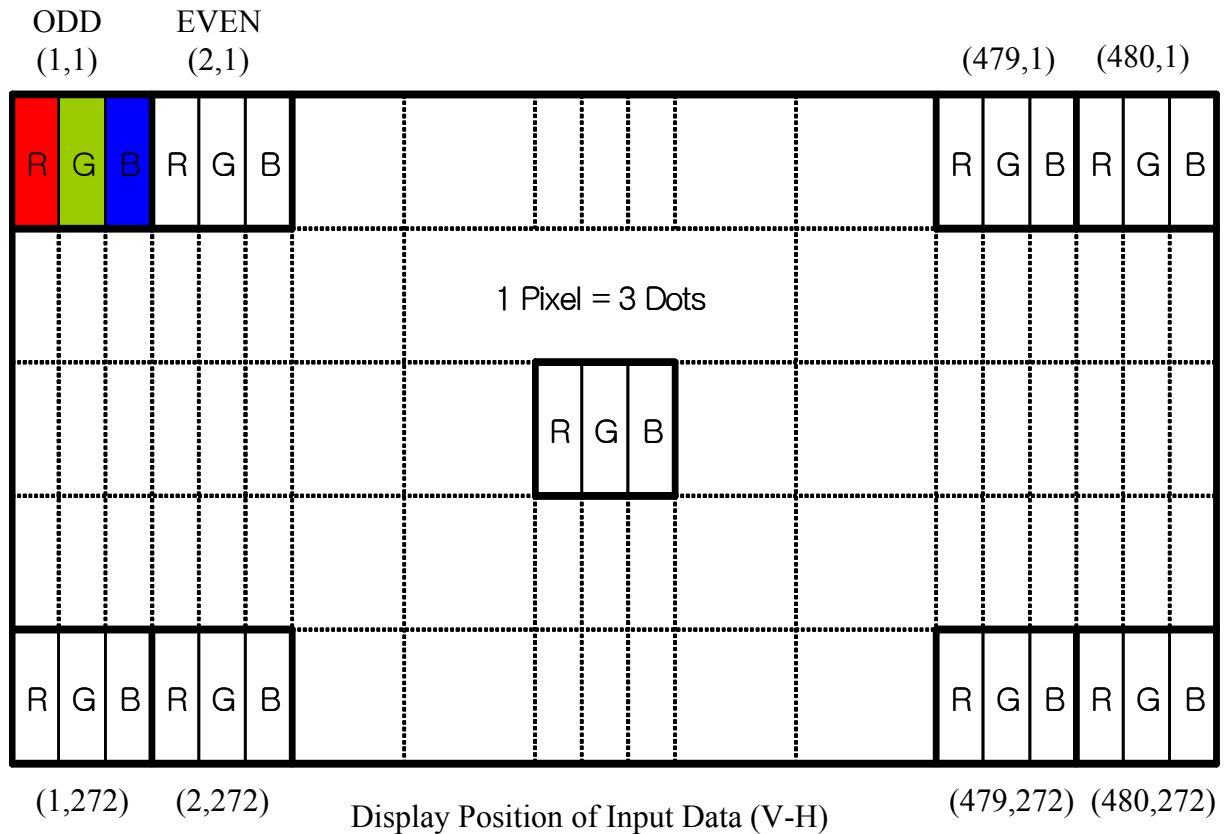
Note: If you use only Sync mode, please fix DE to GND

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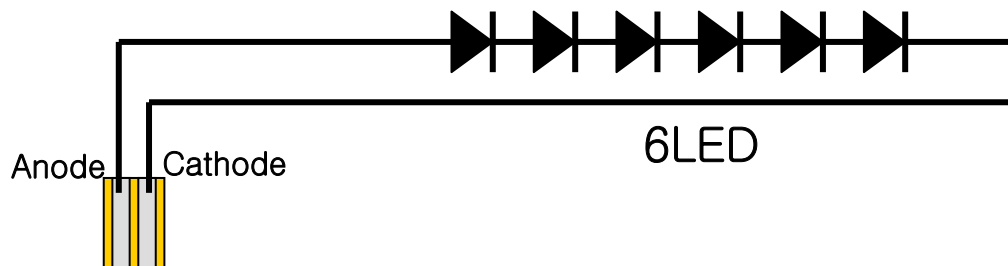
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**4.2 Data Input Format**



**4.3 Back-Light Unit : 2 pin FPC solder type**

Pin No	Symbol	Function
1	Anode for LED	LED Anode
2	Cathode for LED	LED Cathode



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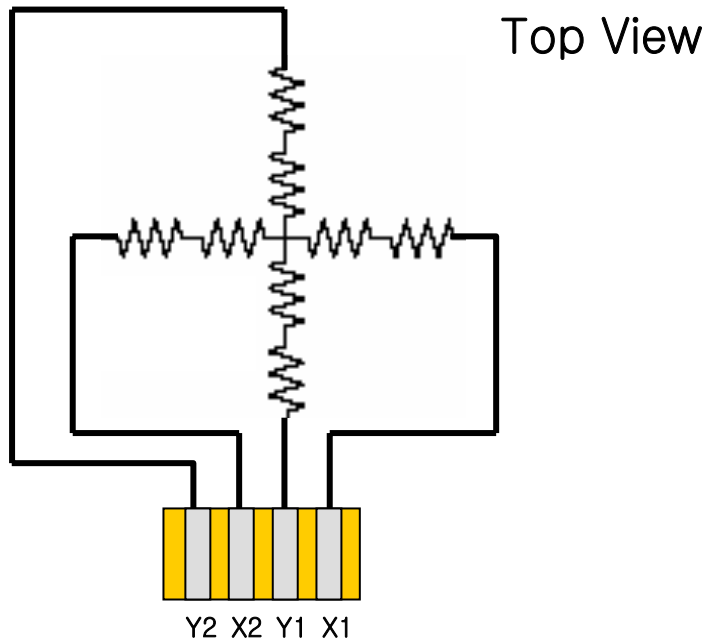
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**4.4 Touch Screen Panel : 4 pin FPC solder type**

Pin No	Symbol	I/O	Function
1	X1	Right	Right electrode – differential analog
2	Y1	Bottom	Bottom electrode – differential analog
3	X2	Left	Left electrode – differential analog
4	Y2	Top	Top electrode – differential analog



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**4.5 Input Signals, Basic Display Colors & Gray Scale Of Colors**

- Input signal : 0 = Low level voltage, 1 = High level voltage

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
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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
	Cyan	0	0	0	0	0	0	0	0	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
	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	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	1	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	
	△																							
	▽																							
	Brighter	1	1	1	1	1	1	0	1	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	
	Red	1	1	1	1	1	1	1	1	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	1	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	
	△																							
	▽																							
	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	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
	Green	0	0	0	0	0	0	0	0	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	1	
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	△																							
	▽																							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	
	△																							
	▽																							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	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	

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## 5.0 SIGNAL TIMING SPECIFICATION

### 5.1 Timing Parameters

< Table 8. Timing Table >

ITEM		Symbol	Min	Typ	Max	Unit	Note
CLK	Period	$t_{CLK}$	135	111	81.3	ns	
	Frequency	-	8.4	9.0	12.3	MHz	
Hsync	Frequency	$f_H$	15.5	17.14	21.37	KHz	
Vsync	Frequency	$f_V$	55	60	75	Hz	
Horizontal Signal	Cycle	$t_h$	-	525	-	CLK	Note.1
	Active display	$t_{hd}$	-	480	-	CLK	
	Front porch	$t_{hf}$	2	-	-	CLK	
	Pulse width	$t_{hp}$	2	41	-	CLK	
	Back porch	$t_{hb}$	2	-	-	CLK	
Vertical Signal	Cycle	$t_v$	-	286	-	H	Note.2
	Active display	$t_{vd}$	-	272	-	H	
	Front porch	$t_{vf}$	1	2	-	H	
	Pulse width	$t_{vp}$	1	10	-	H	
	Back porch	$t_{vb}$	1	2	-	H	

Note 1:

1) Horizontal cycle: Active display + Front porch + Pulse width + Back porch

thd: 480CLK, thf: 2CLK, thp: 41CLK, thb: 2CLK

th 525CLK: 480 + 2 + 41 + 2CLK

2) thf + thp + thb > 44CLK

Note 2:

1) Vertical cycle: Active display + Front porch + Pulse width + Back porch

tvd: 272H, tvf: 2H, tvp: 10H, tvb: 2H

tv 286H: 272 + 2 + 10 + 2H

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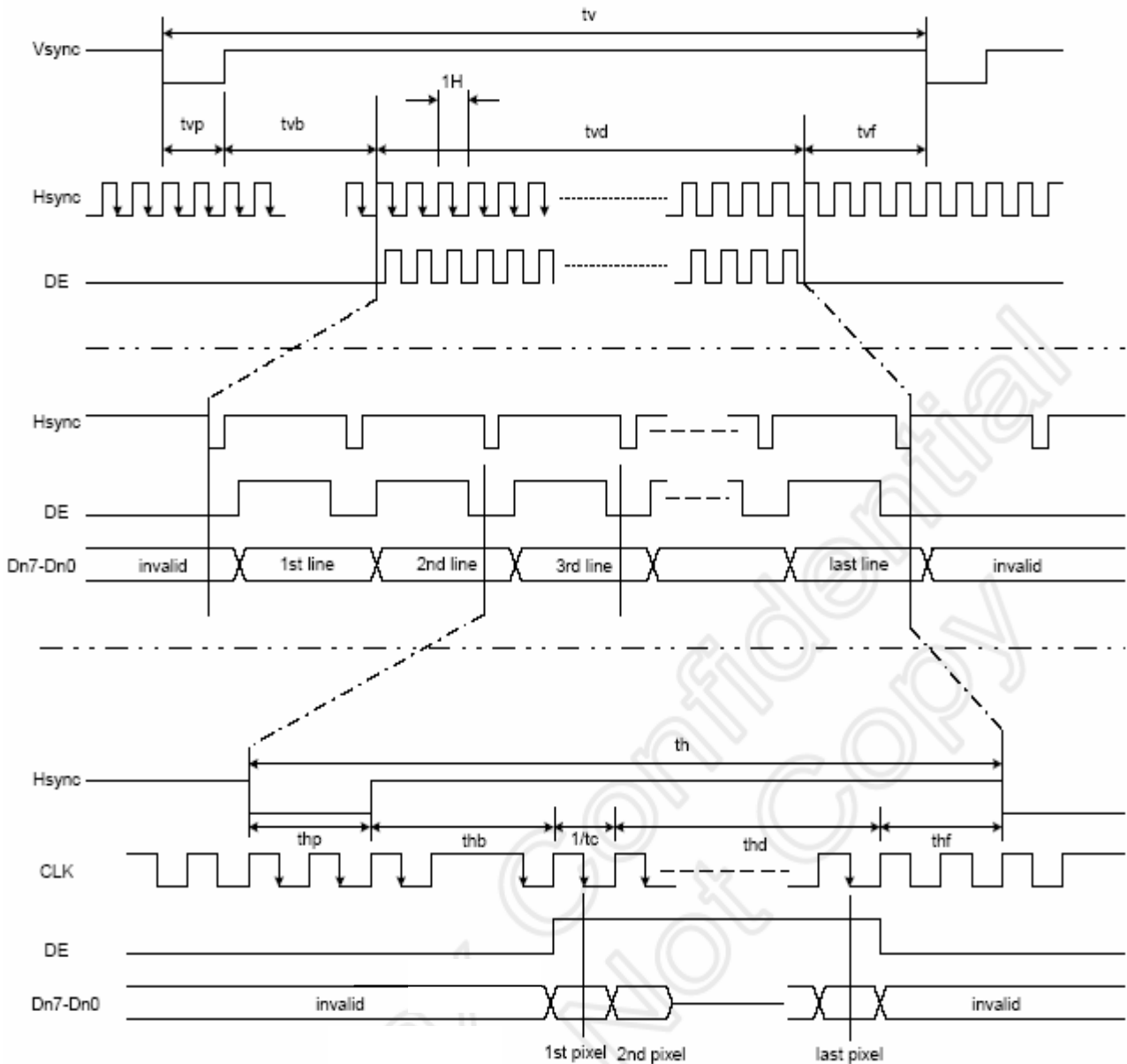
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(Ta = 25°C, DVDD=2.25V to 2.75V, GND=0V, tr=tf=2ns)

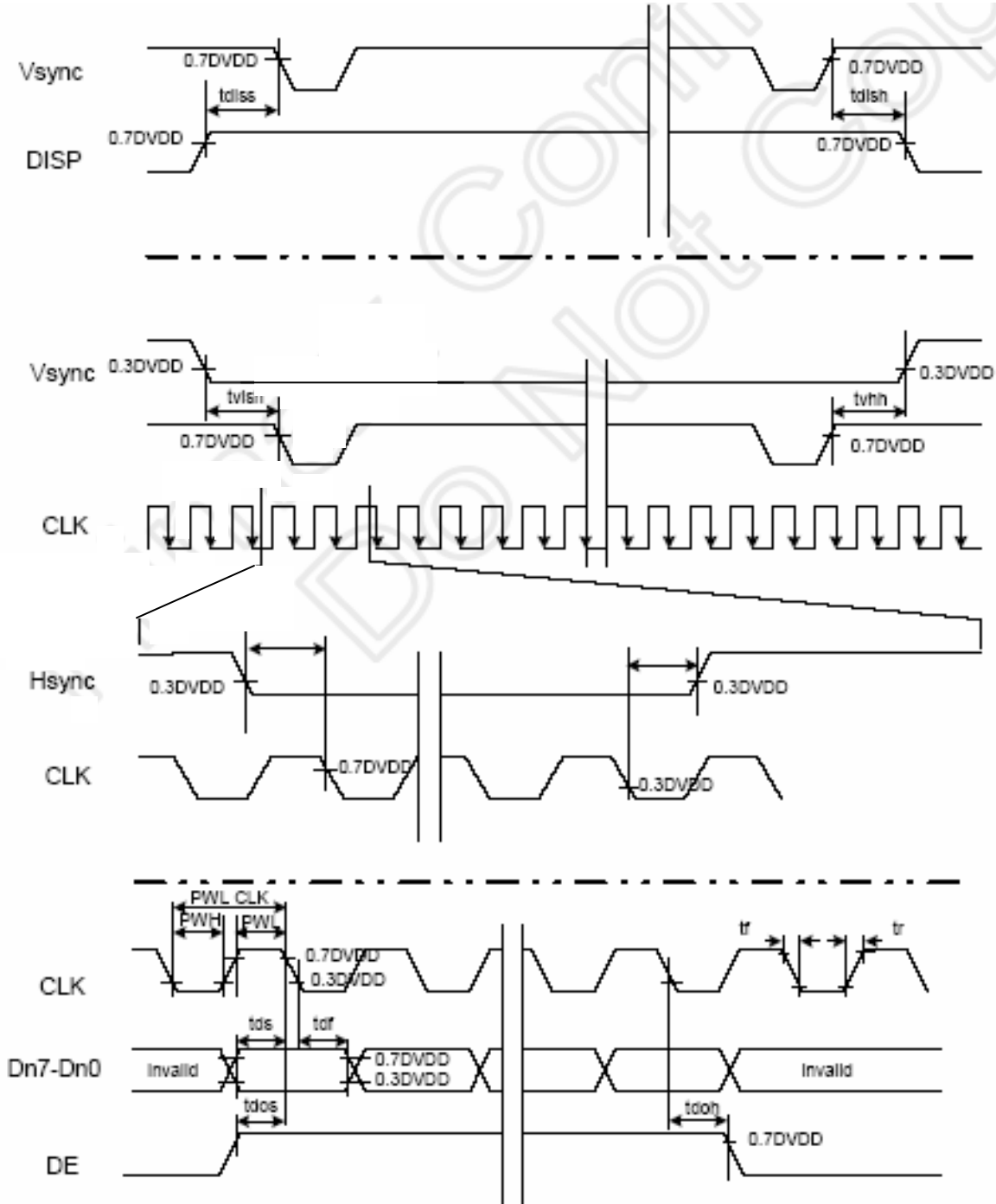
ITEM		Symbol	Min	Typ	Max	Unit	Note
DISP	Setup time	tdiss	10	-	-	ns	
	Hold time	tdish	10	-	-	ns	
CLK	Period	PW CLK	66.7	-	-	ns	Note.1
	Pulse high period	PWH	26.7	-	-	ns	
	Pulse low period	PWL	26.7	-	-	ns	
Hsync	Setup time	ths	10	-	-	ns	
	Hold time	thh	10	-	-	ns	
Vsync	Setup time	tvhs	10	-	-	ns	
	Hold time	tvhh	10	-	-	ns	
DE	Setup time	tdes	10	-	-	ns	
	Hold time	tdeh	10	-	-	ns	
Data (Rn,Gn,Bn)	Setup time	tds	10	-	-	ns	
	Hold time	tdh	10	-	-	ns	

Note 1:

- 1) Maximum clock frequency must be 15Mhz.
- 2) tr, tf is defined 10% to 90% of signal amplitude.

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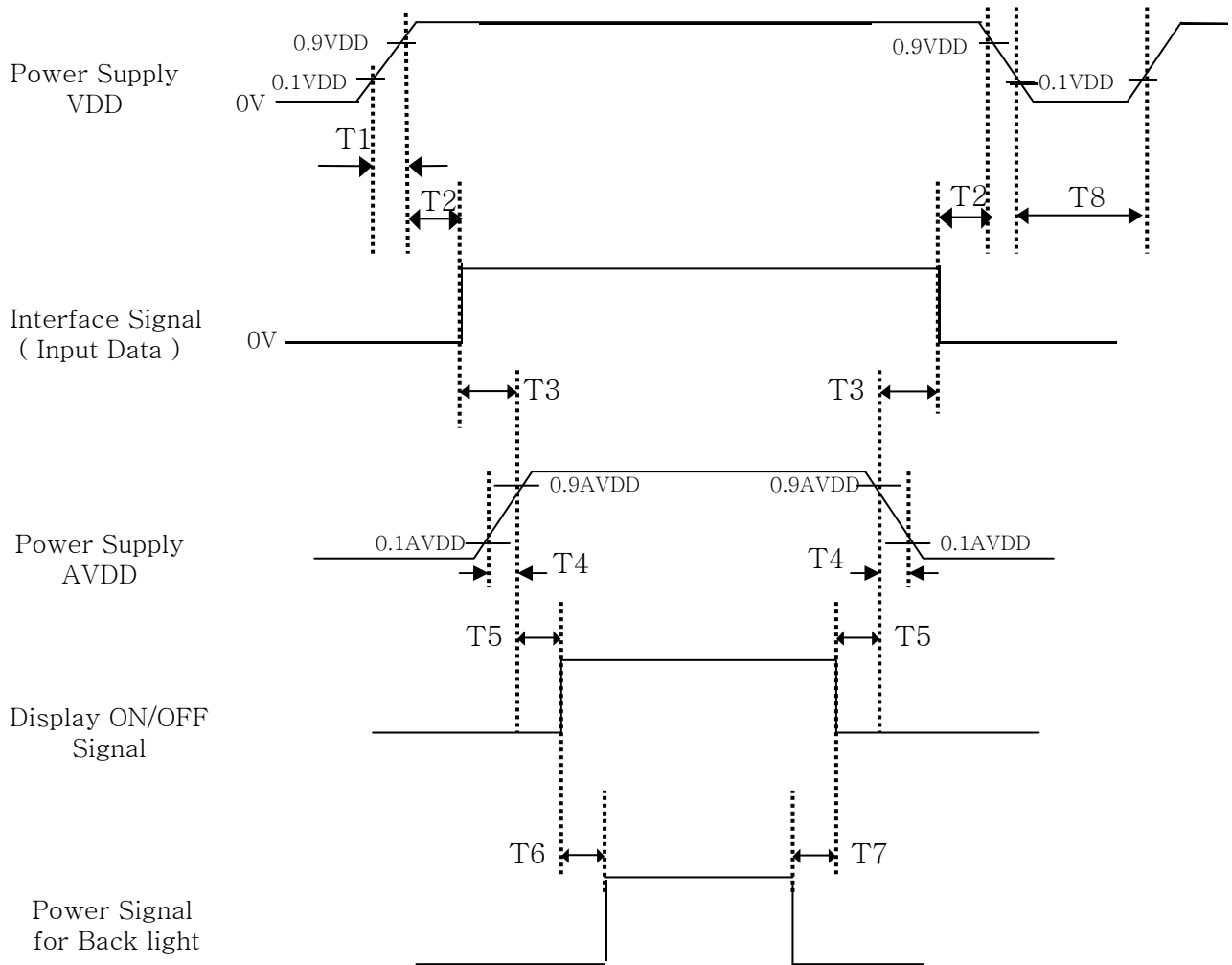
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**5.2 Power Sequence**

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



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Parameter	Values			Units
	Min	Typ	Max	
T1	0	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	0	-	10	ms
T5	7	-	50	ms
T6	160	-	-	ms
T7	160	-	-	ms
T8	1	-	-	sec

## 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.
3. Back Light must be turn on after display on signal .

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## 6.0 OPTICAL SPECIFICATION

The test of Optical specification shall be measured in a dark room (ambient luminance  $\leq 1$  lux and temperature =  $25 \pm 2$  °C) 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  $\Theta$  and  $\Phi$  equal to  $0^\circ$ . We refer to  $\Theta_{\theta=0}$  ( $=\Theta_3$ ) as the 3 o'clock direction (the "right"),  $\Theta_{\theta=90}$  ( $=\Theta_{12}$ ) as the 12 o'clock direction ("upward"),  $\Theta_{\theta=180}$  ( $=\Theta_9$ ) as the 9 o'clock direction ("left") and  $\Theta_{\theta=270}$  ( $=\Theta_6$ ) as the 6 o'clock direction ("bottom"). While scanning  $\Theta$  and/or  $\Phi$ , the center of the measuring spot on the Display surface shall stay fixed.

[VDD = 2.5V, AVDD=5.0V, Frame rate = 75(60)Hz, Pclk=11.5(9.0)Mhz, I<sub>BL</sub>=20mA Ta =  $25 \pm 2$  °C]

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle	Horizontal	$\Theta_3$	CR > 10	60	65	-	Deg.	Note 1
		$\Theta_9$		60	65	-	Deg.	
	Vertical	$\Theta_{12}$		45	50	-	Deg.	
		$\Theta_6$		50	55	-	Deg.	
Contrast ratio		CR		350	450	-		Note 2
Luminance of White		$Y_w$		180	200	-	cd/m <sup>2</sup>	Note 3
Reproduction of color	White	$W_x$	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	0.252	0.302	0.352		Note 4
		$W_y$		0.289	0.339	0.389		
	Red	$R_x$		0.549	0.599	0.649		
		$R_y$		0.283	0.333	0.383		
	Green	$G_x$		0.289	0.339	0.389		
		$G_y$		0.521	0.571	0.621		
	Blue	$B_x$		0.102	0.152	0.202		
		$B_y$		0.085	0.135	0.185		
Response Time( $T_r + T_d$ )					30		ms	Note 5

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**Note :**

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing 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.
2. Contrast measurements shall be made at viewing angle of  $\theta = 0^\circ$  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 shown in Appendix) 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 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.
4. The color chromaticity coordinates specified in Table 4. 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.
5. The electro-optical response time measurements shall be made as FIGURE 3 shown in Appendix by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Td, and 90% to 10% is Tr.

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## 7.0 MECHANICAL CHARACTERISTICS

### 7.1 Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model HTT40WQ1-M03. Other parameters are shown in Table 5.

<Table 5. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	98.3 × 62.6 × 4.3	mm
Weight	57	gram
Active area	87.84(H) × 49.776(V)	mm
Pixel pitch	0.183(H) × 0.183(V)	mm
Number of pixels	480(H) × 272(V) (1 pixel = R + G + B dots)	pixels
Back-light	Edge side 6-LEDs type	

### 7.2 Mounting

See FIGURE 5. (shown in Appendix)


### 7.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an anti-glare coating to minimize reflection and a coating to reduce scratching.

### 7.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350 [lux.]

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## 7.5 Touch screen panel specification.

### 7.5.1. Electrical Characteristics

Item	Min	Typ	Max	Unit	Remark
Linearity	-1.5	-	1.5	%	Analog X And Y Direction
Terminal Resistance	200	-	900	$\Omega$	X
	200	-	900	$\Omega$	Y
Insulation Resistance	10	-	-	M $\Omega$	DC 25V
Voltage	-	-	7	V	DC
Chattering	-	-	10	Ms	100K $\Omega$ Pull-up
Transparency	-	85	-	%	JIK_K7105,ASTM D1003,@550nm

Caution(1) : Do not Operate in with a thing except a poly-acetal (tip R0.8nm or less) or a finger, especially those with hard or sharp tips such as a ball point or a mechanical pencil.

### 7.5.2. Mechanical & Reliability Characteristics

Item	Min	Typ	Max	Unit	Remark
Activation Force	-	-	80	g	Note (1)
Durability (surface scratching)	Write 100,000	-	-	characters	Note (2)
Durability (surface pitting)	1,000,000	-	900	touches	Note (3)
Surface hardness	3	-	-	H	JIS K5400,ASTM D3363

NOTE (1) Stylus pen Input R0.8mm poly-acetal pen or Finger

(2) Measurement for Surface area

- Scratch 100,000 time straight line the Film with a stylus change every 20,000 times
- Force : 250gf
- Speed : 60mm/sec
- Stylus : R0.8 poly-acetal tip

(3) Pit 1,000,000 times on the Film With a R8.0 Silicon rubber

- Force : 250gf
- Speed : 2 Times/sec

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## 8.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 6. Reliability Test Parameters >

No	Test Items	Conditions
1	High Temperature Storage Test	Ta = 70°C, 240 hrs
2	Low Temperature Storage Test	Ta = -30°C, 240 hrs
3	High Temperature Operation Test	Ta = 60°C, 240 hrs
4	Low Temperature Operation Test	Ta = -20°C, 240 hrs
5	High Temp. and High Humidity Storage	T = 60°C, 90%RH for 240hr (But no condensation dew)
6	High Temperature & High Humidity Operation Test	Ta = 50°C, 90%RH, 240 hrs
7	Thermal Shock Test	Ta = -25°C ↔ 70°C , 100 cycle
8	Altitude Test	40000ft (25°C) 24H
9	ON/OFF Test	10sec/10sec, Manual 1000 cycle
10	PCT	2 atm, 120 °C, 100%, 24H, Contact
11	Electrostatic Discharge Test (Non-Operating)	150pF,330Ω, ±6KV(Contact), ±8KV(Air)

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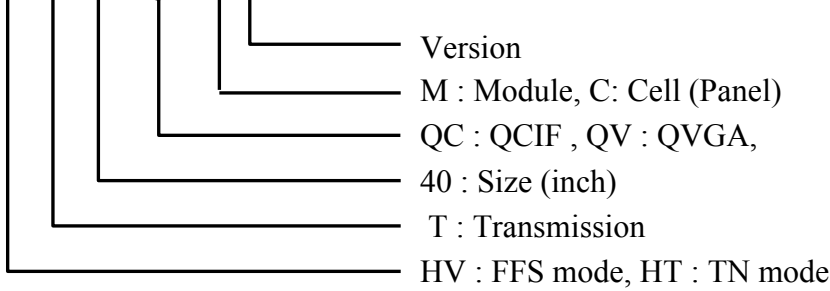
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**9.0 PRODUCT LABEL**

**9.1 Model name**

\* Model name

\* HT T 40 WQ1-M 03



**9.2 Serial Label (S Label)**

1) Content of Characters

\*\* \* \* \*\* \* \*\* \*\*\*\*\* \*  
 a b c d e f g h

	Meaning	ID
a	Product	Product Unique ID
b	Grade	T, Q
c	Production Site	H (BOE), R (Raygen), E (e-litecom), U(UDIA), S(ISES), B(BHL), I (Innertech)
d	Year	00~99
e	Month	1~9, X, Y, Z
f	Day	01~31
g	FG-code	Product code's last 4 digit
h	Working Group	A (A Team), B (B Team), C (C Team), D (D Team)


\* Example of S Label

JJTI065071100A

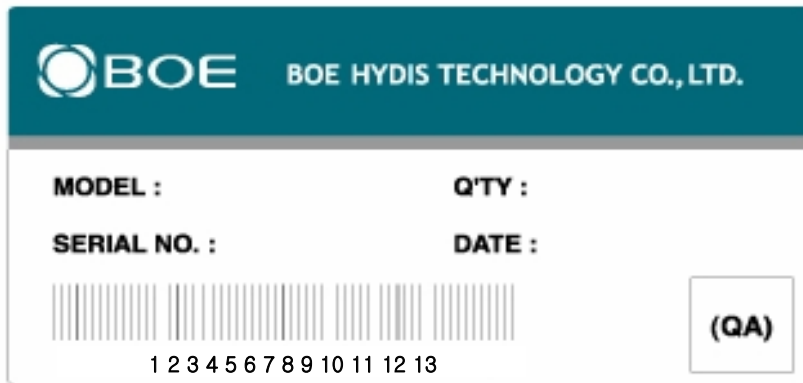
2) S Label Marking Location

Rear Bezel Area

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**9.3 Label Code NO (Inner Box, Outer Box)**

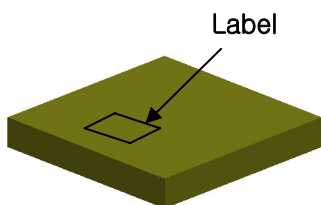


Size : 110 X 56

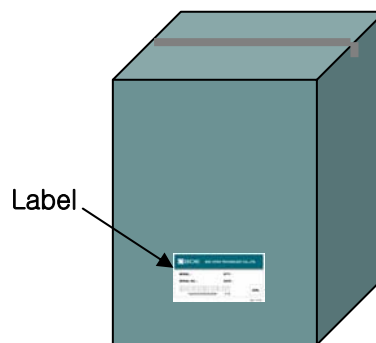
**\*Bar-Code No**

- 1~2 : Kinds
- 3 : Level
- 4 : Line
- 5 ~ 6 : Year
- 7 : Month
- 8 : Revision
- 9 ~ 13 : Serial No.

**\* Sticking Point**



Inner Box



Outer Box

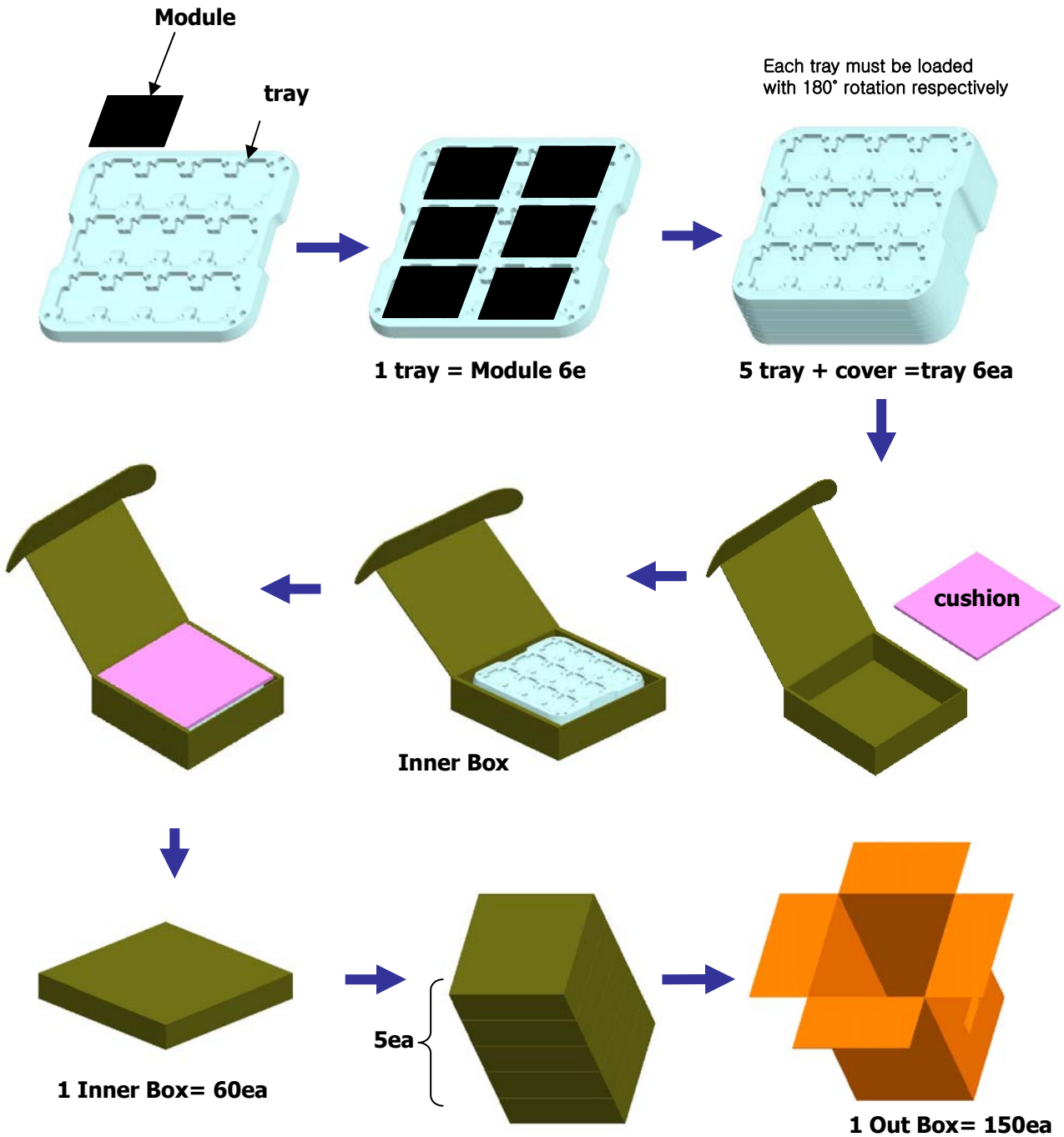
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### 10.0 PACKING INFORMATION

BOE provides the standard shipping container for customers, unless customer specifies their packing information. The standard packing method and Barcode information are shown in below.



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## 11.0 HANDLING & CAUTIONS

- (1) Cautions when taking out the module
  - Pick the pouch only, when taking out module from a shipping package.
- (2) Cautions for handling the module
  - As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
  - As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
  - As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
  - Do not pull the interface connector in or out while the LCD module is operating.
  - Put the module display side down on a flat horizontal plane.
  - Handle connectors and cables with care.
- (3) Cautions for the operation
  - When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
  - Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (4) Cautions for the atmosphere
  - Dew drop atmosphere should be avoided.
  - Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.
- (5) Cautions for the module characteristics
  - Do not apply fixed pattern data signal to the LCD module at product aging.
  - Applying fixed pattern for a long time may cause image sticking.
- (6) Other cautions
  - Do not disassemble and/or re-assemble LCD module.
  - Do not re-adjust variable resistor or switch etc.
  - When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

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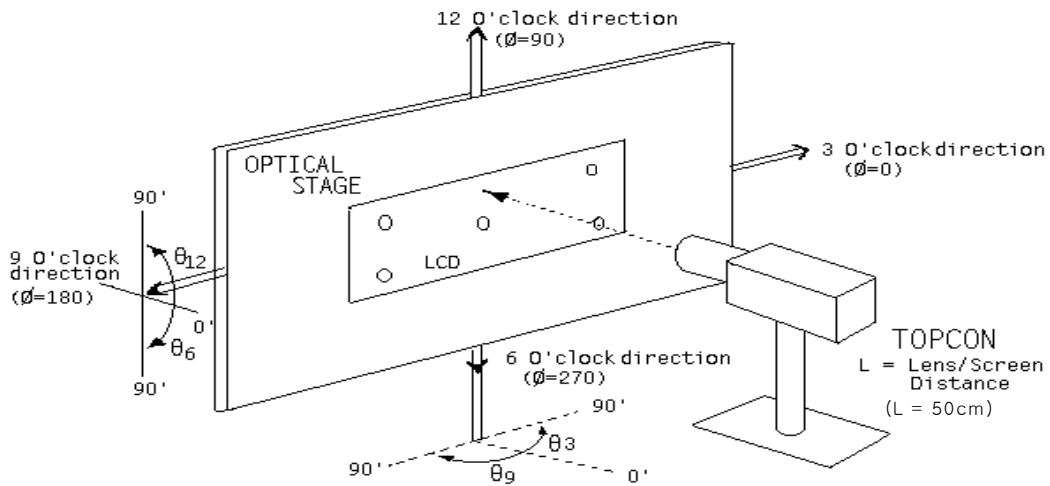
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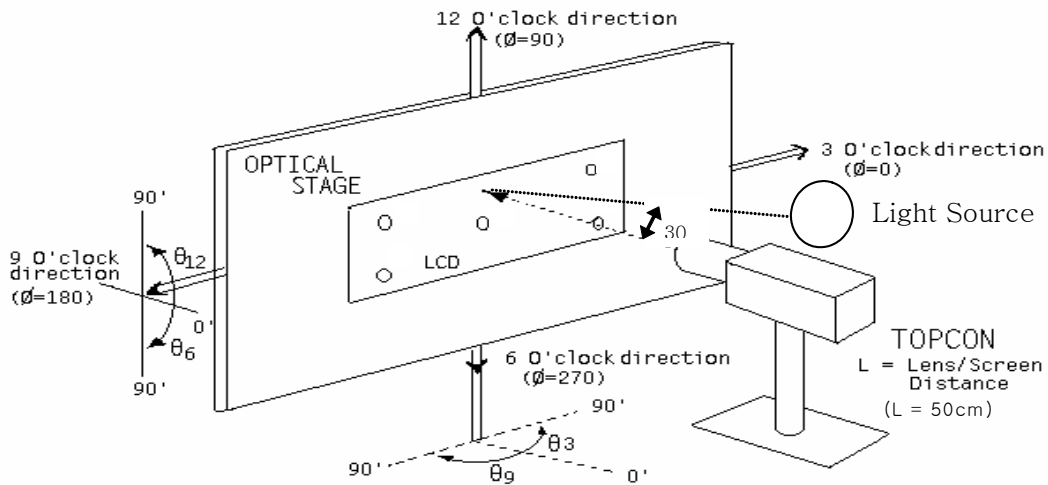
**12.0 APPENDIX**

**Figure 1. Measurement Set Up**

**- Back-Light On condition**



**- Back-Light OFF condition**



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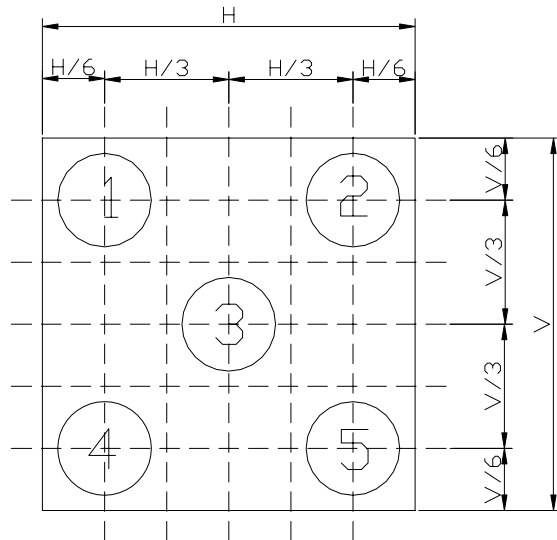
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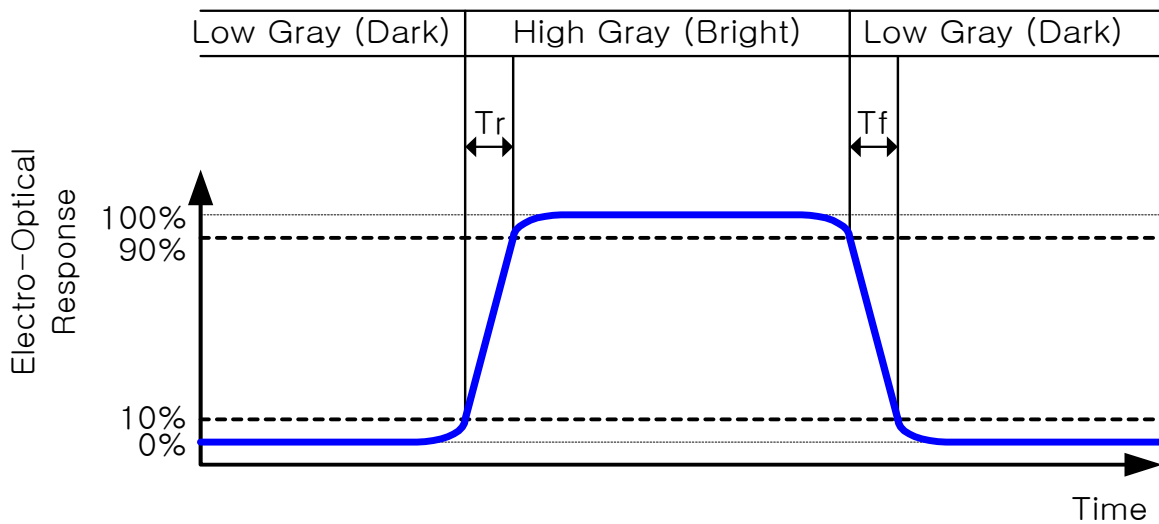
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**Figure 2. Average Luminance Measurement Locations**



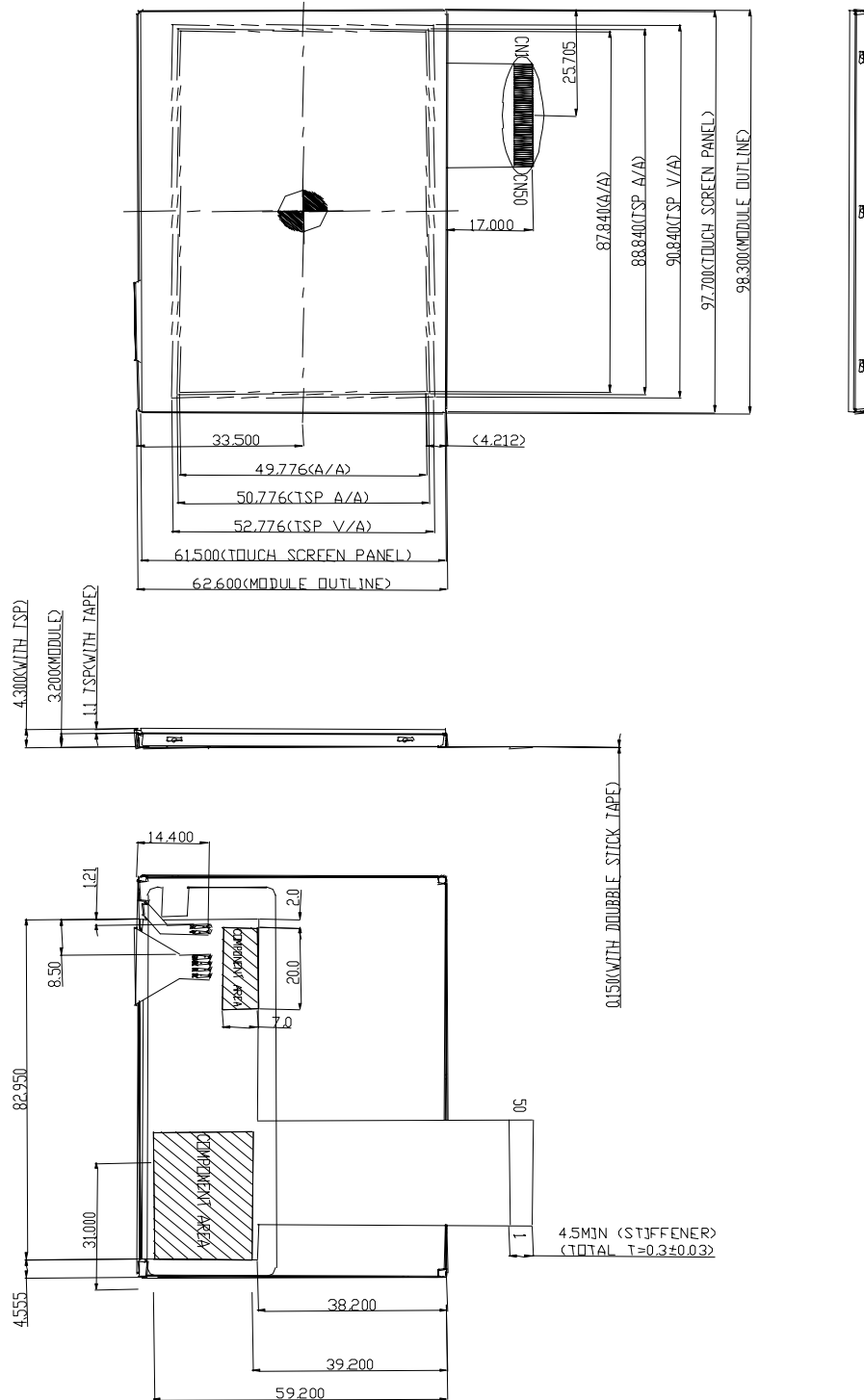
**Figure 3. Response Time Testing**



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**Figure 5. TFT-LCD Module Outline Dimensions**



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