



**Winstar Display Co., LTD**

**華凌光電股份有限公司**

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## SPECIFICATION

**CUSTOMER :** \_\_\_\_\_

**MODULE NO.:** **WF35GTIHCDO#**

<b>APPROVED BY:</b> ( FOR CUSTOMER USE ONLY )	<b>PCB VERSION:</b>	<b>DATA:</b>
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SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

VERSION	DATE	REVISED PAGE NO.	SUMMARY
0	2012.09.18		First issue



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MODLE NO :

**RECORDS OF REVISION**

DOC. FIRST ISSUE

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# 1. Module Classification Information

W F 35 G T I H C D 0 #

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

①	Brand: WINSTAR DISPLAY CORPORATION	
②	Display Type: H→Character Type, G→Graphic Type F→TFT Type	
③	Size: 3.5inch	
④	Model serials no.	
⑤	Backlight Type:	F→CCFL, White T→LED, White
⑥	LCD Polarize Type/ Temperature range/ Gray Scale Inversion Direction	C→Transmissive, N. T, 6:00 F→Transmissive, N. T, 12:00 O→Transmissive, N. T, 3:00 R→Transmissive, N. T, 9:00 I →Transmissive, W. T, 6:00 L→Transmissive, W. T, 12:00 U→Transmissive, W. T, 3:00 X→Transmissive, W. T, 9:00
⑦	Module type:	A : TFT LCD B : TFT+ FR+CONTROL BOARD C : TFT + FR+ A/D BOARD D : TFT + FR+A/D BOARD + CONTROL BOARD I : TFT+FR+D/V BOARD H: TFT+D/V BOARD
⑧	Resolution	A : 128 * 160 Dots B : 320 * 234 Dots C : 320 * 240 Dots D : 480 * 234 Dots
⑨	Interface type	D : Digital Input A : Analog Input
⑩	Reversion:	
⑪	Special code:	# : Fit in with the ROHS Directions and regulations

# General Specifications

Feature		Spec
Display Spec.	Size	3.5 inch
	Resolution	320(RGB) x 240
Mechanical Characteristics	LCM (W x H x D) (mm)	78.2 X 65.0X4.26
	Active Area(mm)	70.08 X 52.56
View Direction	12 o'clock	
Gray Scale Inversion Direction	6 o'clock	

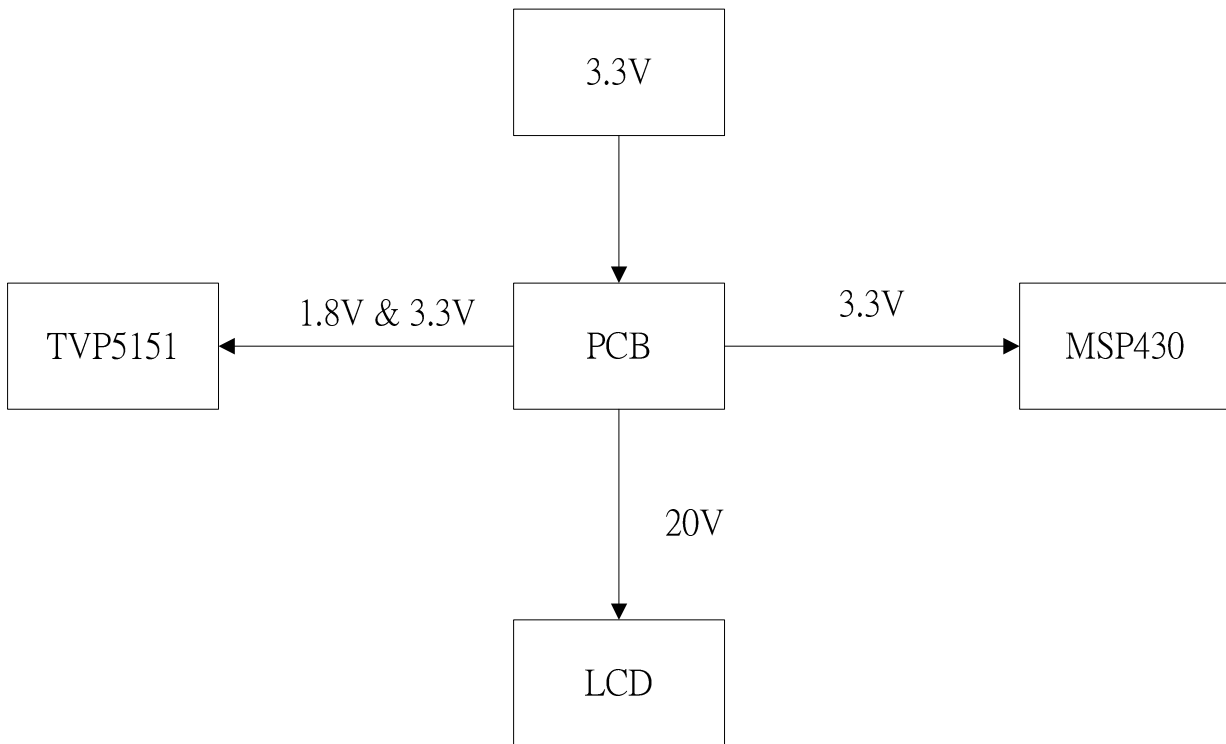
- Supports ITU-R BT.601 Standard Sampling, ex: DVD-player or Camera's AV Signal.
- Two Composite Inputs AV Signal, you can use GP10 pin to option Channel1 or Channel2.
- Support Backlight ON/OFF control, you can use BLE pin to option Backlight ON/OFF.
- Supply Voltage 3.3V.

## 2 Electrical Specifications

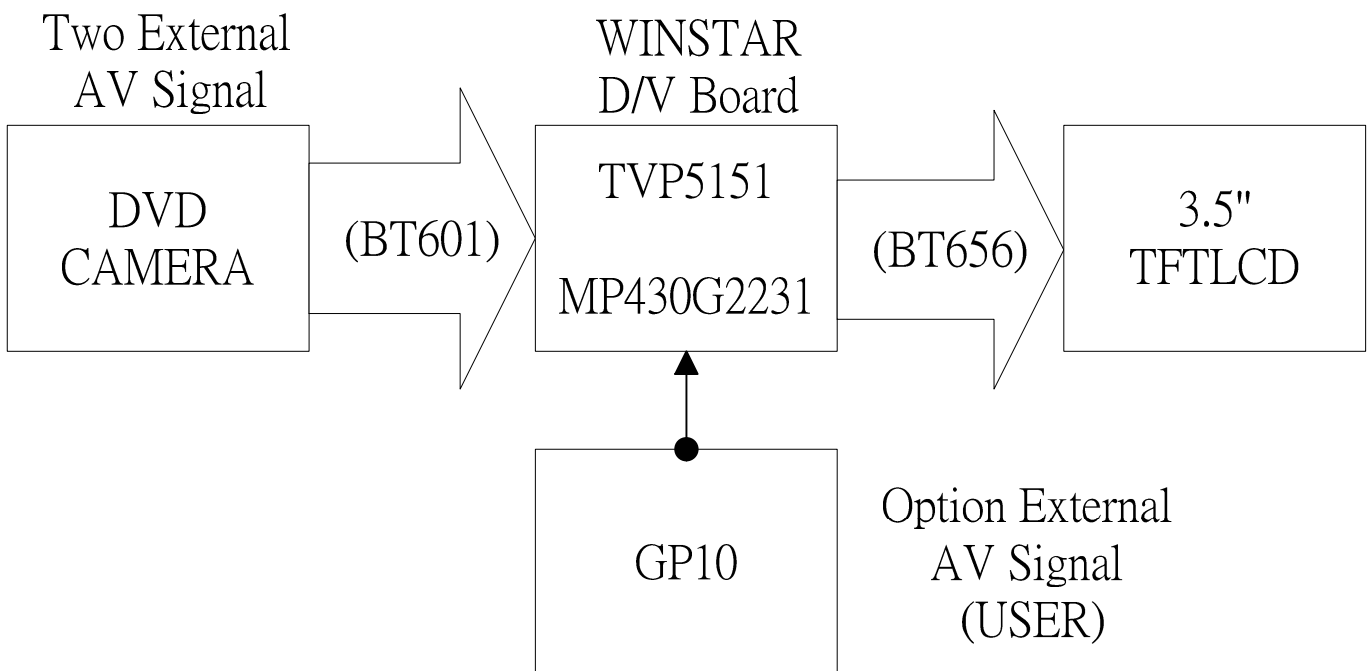
### 2.1 Recommended Operating Conditions

		MIN	NOM	MAX	UNIT
VCC	Digital supply voltage	3.0	3.3	3.6	V
ICC	Digital supply current		250		mA
BLE	Digital supply voltage	3.0	3.3	3.6	V
GP10	Analog PLL supply voltage	3.0	3.3	3.6	V

## 2.2 Supply Voltage Block Diagram



## 2.3 Signal Block Diagram



## 2.4 Clocks, Video Data, Sync Timing

PARAMETER		TEST CONDITIONS(1)	MIN	TYP	MAX	UNIT
Duty cycle, PCLK/SCLK			47	50	53	%
t1	PCLK high time	$\geq 90\%$		18.5		ns
t2	PCLK low time	$\leq 10\%$		18.5		ns
t3	PCLK fall time	90% to 10%			5	ns
t4	PCLK rise time	10% to 90%			5	ns
t5	Propagation delay time		3		8	ns

(1) Measured with 22- $\Omega$  series termination resistors and 10-pF load.

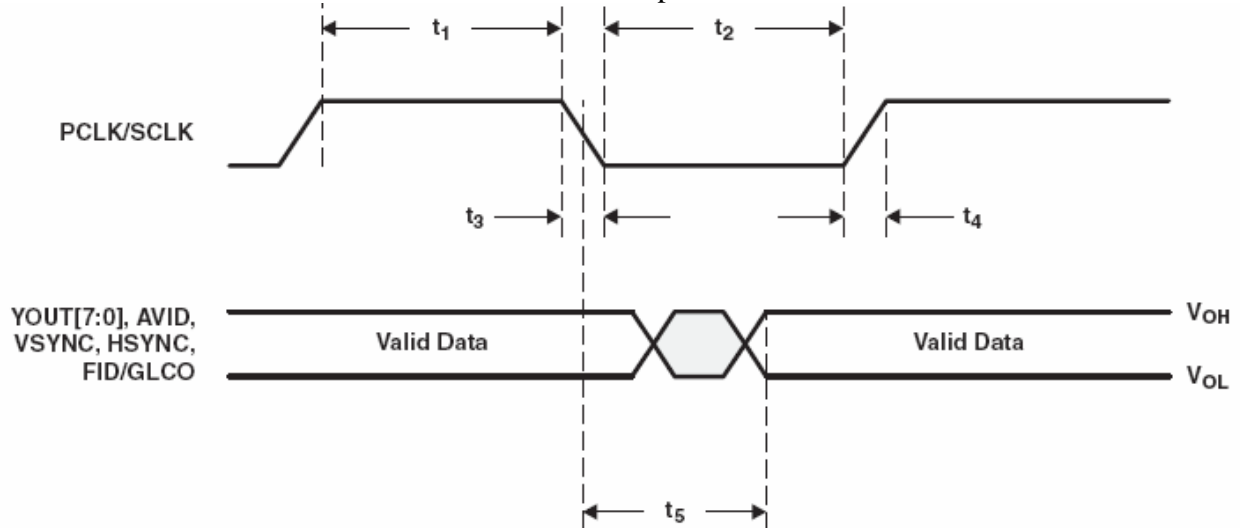


Figure 2-1 Clocks, Video Data, and Sync Timing

## 2.5 I2C Host Interface Timing

NO.	PARAMETER	MIN	TYP	MAX	UNIT
t1	Bus free time between STOP and START	1.3			$\mu\text{s}$
t2	Data Hold time	0		0.9	$\mu\text{s}$
t3	Data Setup time	100			ns
t4	Setup time for a (repeated) START condition	0.6			$\mu\text{s}$
t5	Setup time for a STOP condition	0.6			ns
t6	Hold time (repeated) START condition	0.6			$\mu\text{s}$
t7	Rise time SDA and SCL signal			250	ns
t8	Fall time SDA and SCL signal			250	ns
Cb	Capacitive load for each bus line			400	pF
fI2C	I2C clock frequency			400	kHz

(1) Specified by design

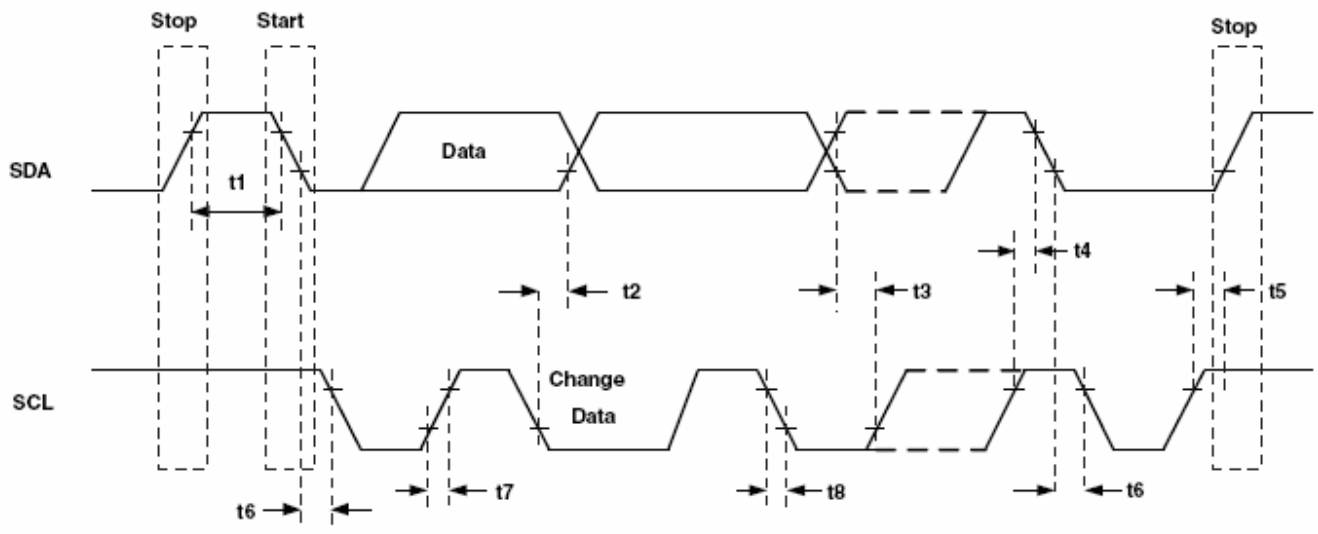


Figure 2-2 I<sup>2</sup>C Host Interface Timing

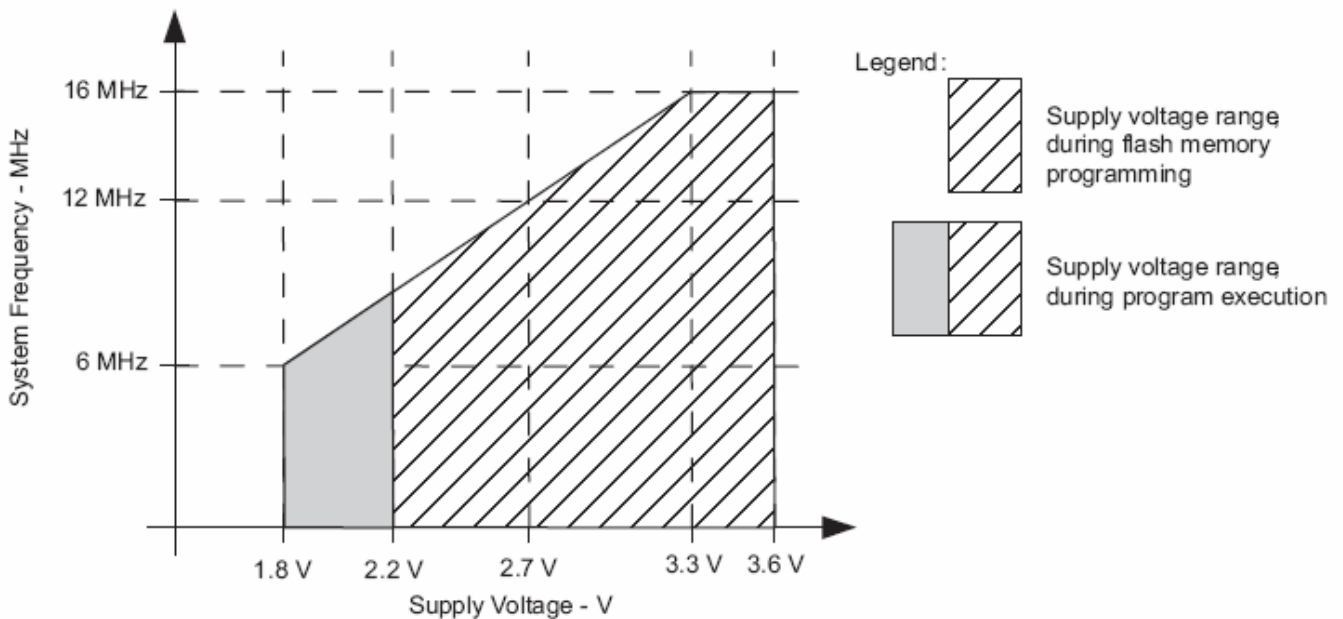


### 3. Recommended Operating Conditions

			MIN	NOM	MAX	UNIT
VCC	Supply voltage	During program execution	3.0	3.3	3.6	V
VSS	Supply voltage			0		V
TA	Operating free-air temperature	I version	-20		70	°C
fSYSTEM	Processor frequency (maximum MCLK frequency)(1) (2)	VCC = 1.8 V, Duty cycle = 50% ± 10%	dc		4.15	MHz
		VCC = 2.7 V, Duty cycle = 50% ± 10%	dc		12	
		VCC = 3.3 V, Duty cycle = 50% ± 10%	dc		16	

(1) The MSP430 CPU is clocked directly with MCLK. Both the high and low phase of MCLK must not exceed the pulse width of the specified maximum frequency.

(2) Modules might have a different maximum input clock specification. See the specification of the respective module in this data sheet.



Note: Minimum processor frequency is defined by system clock. Flash program or erase operations require a minimum VCC of 2.2 V.

Figure 3.1 Safe Operating Area

# 4. Reliability Test

## WIDE TEMPERATURE RELIABILITY TEST

N O.	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	80°C	240 Hrs		Appearance without defect	
2	Low Temp. Storage	-30°C	240 Hrs		Appearance without defect	
3	High Temp. & High Humi. Storage	60 °C 90%RH	240 Hrs		Appearance without defect	
4	High Temp. Operating Display	70°C	240 Hrs		Appearance without defect	
5	Low Temp. Operating Display	-20°C	240 Hrs		Appearance without defect	
6	Thermal Shock	-20 °C , 30min. → 70°C , 30min. ↑ (1cycle) ↓			Appearance without defect	10 cycles

# 5. Interface

CON1

Pin No.	Symbol	Description
1	VCC	Digital supply voltage 3.3V.
2	DGND	Digital GND.
3	BLE	Back Light control pin, High enable, Low disable.
4	GP10	AV signal option pin. High=Channel1, Low=Channel2.

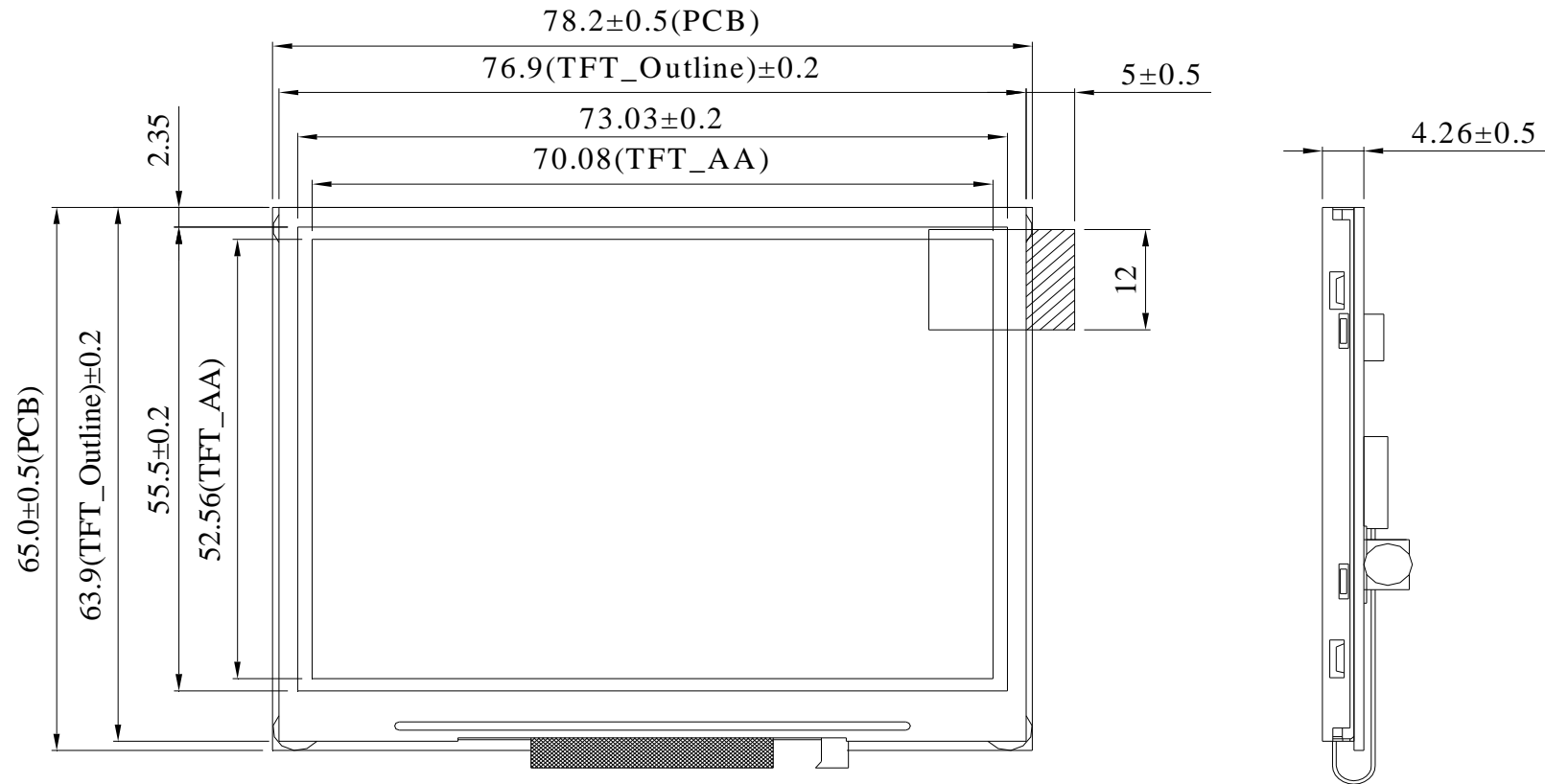
CH1

Pin No.	Symbol	Description
1	Channel1	External AV Signal 1.
2	Channel2	External AV Signal 2.

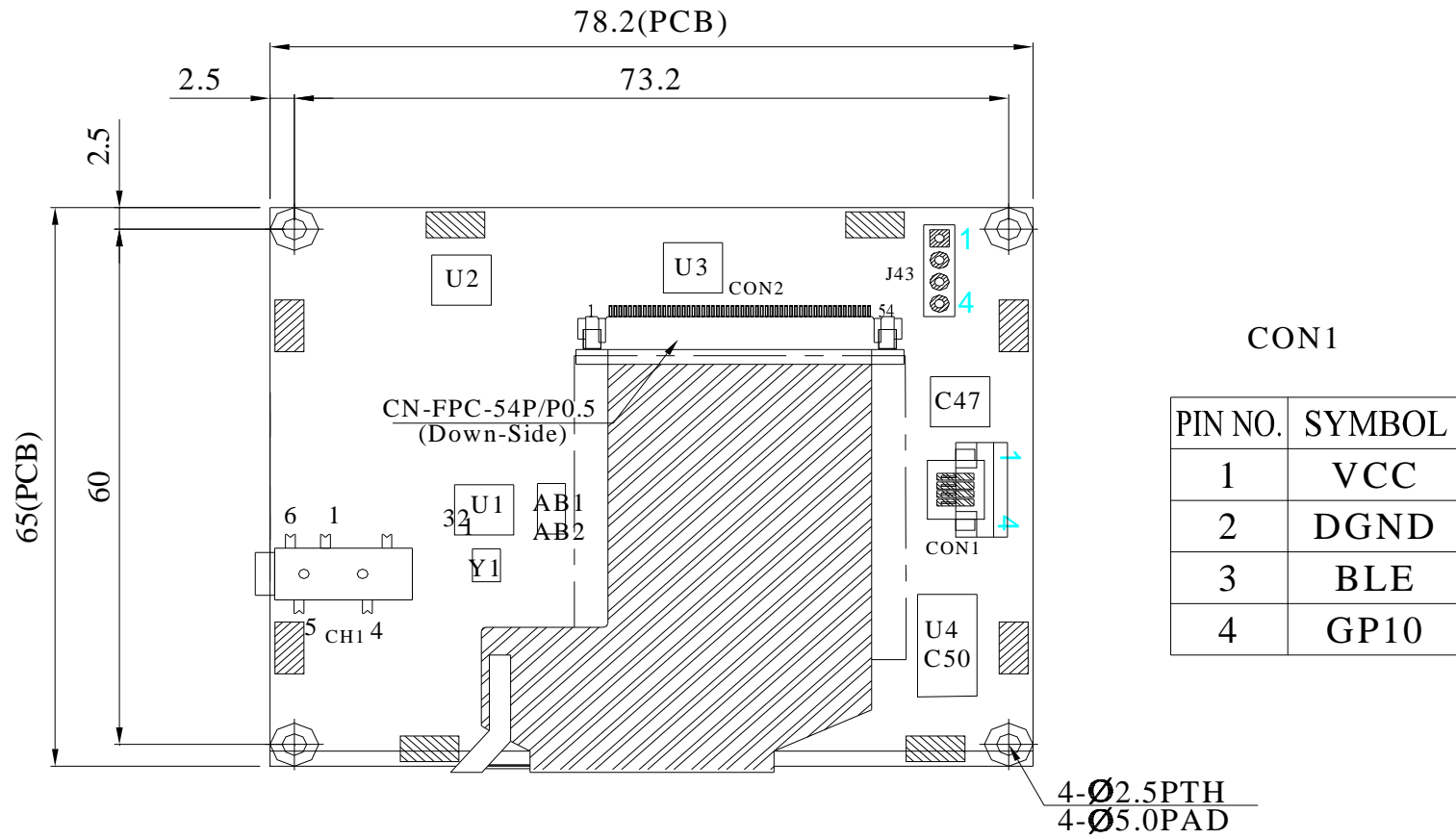
Data Types Supported by VDP

NAME	DESCRIPTION
WST SECAM	Teletext, SECAM
WST PAL B	Teletext, PAL, System B
WST PAL C	Teletext, PAL, System C
WST, NTSC B	Teletext, NTSC, System B
NABTS, NTSC C	Teletext, NTSC, System C
NABTS, NTSC D	Teletext, NTSC, System D (Japan)
CC, PAL	Closed caption PAL
CC, NTSC	Closed caption NTSC
WSS/CGMS-A	Wide-screen signaling/Copy Generation Management System-Analog, PAL
WSS/CGMS-A	Wide-screen signaling/Copy Generation Management System-Analog, NTSC
VITC, PAL	Vertical interval timecode, PAL
VITC, NTSC	Vertical interval timecode, NTSC
VPS, PAL	Video program system, PAL
Gemstar 2x Custom 1	Electronic program guide
Reserved	Reserved
Active Video	Active video/full field

# 6. Mechanical Drawing



The non-specified tolerance of dimension is  $\pm 0.3$ mm.



The non-specified tolerance of dimension is  $\pm 0.3\text{mm}$ .

# Inspection Provision

## 1.Purpose

The WINSTAR inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of WINSTAR LCD produces.

## 2.Applicable Scope

The WINSTAR inspection provision is applicable to the arrangement in regard to outgoing inspection and quality assurance after outgoing.

## 3.Technical Terms

### 3-1 WINSTAR Technical Terms



## 4.Outgoing Inspection

### 4-1 Inspection Method

MIL-STD-105E Level II Regular inspection

### 4-2 Inspection Standard

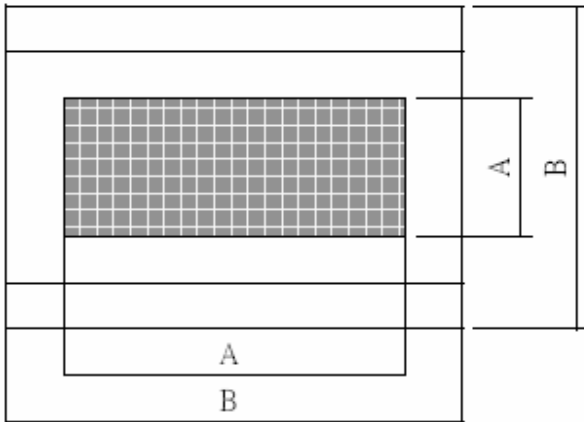
	Item	AQL(%)	Remarks
Major Defect	Dots	0.4	Faults which substantially lower the practicality and the initial purpose difficult to achieve
	Solder appearance		
	Cracks		

	Dimensions	External from Dimensions	0.4	
Minor Defect	Inside the glass	Black spots	0.65	Faults which appear to pose almost no obstacle to the practicality, effective use, and operation
	Polarizing plate	Scratches, foreign Matter, air bubbles, and peeling		
	Dots	Pinhole, deformation		
	Color tone	Color unevenness		
	Solder appearance	Cold solder Solder projections		

#### 4-3 Inspection Provisions

##### \*Viewing Area Definition

Fig. 1



A : Zone Viewing Area

B : Zone Glass Plate Outline

\*Inspection place to be 500 to 1000 lux illuminance uniformly without glaring.  
The distance between luminous source(daylight fluorescent lamp and cool white fluorescent lamp)  
and sample to be 30 cm to 50 cm.

\*Test and measurement are performed under the following conditions, unless otherwise specified.

Temperature  $20 \pm 15^{\circ}\text{C}$

Humidity  $65 \pm 20\% \text{R.H.}$

Pressure 860~1060hPa(mmbar)

In case of doubtful judgment, it is performed under the following conditions.

Temperature  $20 \pm 2^{\circ}\text{C}$

Humidity  $65 \pm 5\% \text{R.H.}$

Pressure 860~1060hPa(mmbar)

## 5. Specification for quality check

### 5-1-1 Electrical characteristics :

NO.	Item	Criterion
1	Non operational	Fail
2	Miss operating	Fail
3	Contrast irregular	Fail
4	Response time	Within Specified value

### 5-1-2 Components soldering :

Should be no defective soldering such as shorting, loose terminal cold solder, peeling of printed circuit board pattern, improper mounting position, etc.

### 5-2 Inspection Standard for TFT panel

#### 5-2-1 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 : 25~75% RH

(3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.

(4) Visual inspection on the operation condition for cosmetic shall be conducted at the distance 30cm or more between the LCD panels and eyes of inspector. The viewing angle shall be 90 degree to the front surface of display panel.

(5) Ambient Illumination : 300~500 Lux for external appearance inspection.

(6) Ambient Illumination : 100~200 Lux for light on inspection.

#### 5-2-2 Inspection Criteria

(1) Definition of dot defect induced from the panel inside

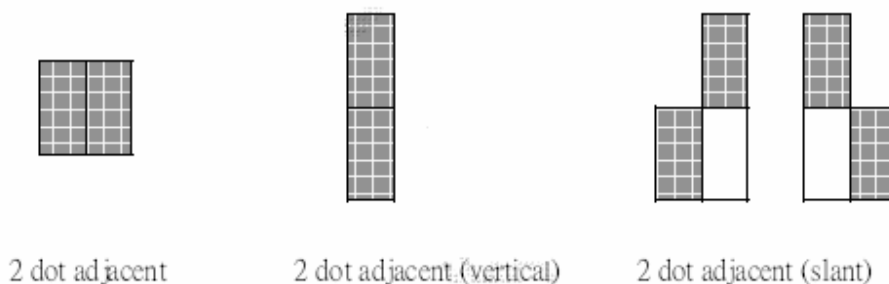
a) The definition of dot : The size of a defective dot over 1/2 of whole dot is regarded as one defective dot

b) Bright dot : Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

c) Dark dot : Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

d) 2 dot adjacent = 1 pair = 2 dots

Picture :





(2) Display Inspection

NO.	Item		Acceptable Count	
1	Dot defect	Bright Dot	Random	$N \leq 2$
			2 dots adjacent	$N \leq 0$
		Dark Dot	Random	$N \leq 3$
			2 dots adjacent	$N \leq 1$
	Total bright and dark dot		$N \leq 4$	
Functional failure (V-line/ H-line/Cross line etc.)			Not allowable	
Mura		It's OK if mura is slight visible through 6% ND filter. (Judged by limit sample if it is necessary)		
2	Newton ring (touch panel)	Orbicular of interference fringes is not allowed in the optimum contrast within the active area under viewing angle.		

(3) Appearance inspection

NO.	Item	Standards
1	Panel Crack	Not allow. It is shown in Fig.1.
2	Broken CF Non -lead Side of TFT	The broken in the area of $W > 2\text{mm}$ is ignored, L is ignored. It is shown in Fig.2.
3	Broken Lead Side of TFT	FPC lead, electrical line or alignment mark can't be damaged. It is shown in Fig.3.
4	Broken Corner of TFT at Lead Side	FPC lead. electrical line or alignment mark can't be damaged. It is shown in Fig.4.
5	Burr of TFT / CF Edge	The distance of burr from the edge of TFT / CF, $W \leq 0.3\text{mm}$ . It is shown in Fig.5.
6	Foreign Black / White/Bright Spot	(1) $0.15 < D \leq 0.5 \text{ mm}$ , $N \leq 4$ ; (2) $D \leq 0.15\text{mm}$ , Ignore. It is shown in Fig.6.
7	Foreign Black / White/Bright Line	(1) $0.05 < W \leq 0.1 \text{ mm}$ , $0.3 < L \leq 2 \text{ mm}$ , $N \leq 4$ .
		(2) $W \leq 0.05\text{mm}$ and $L \leq 0.3\text{mm}$ Ignore.
		It is shown in Fig.7.
8	Color irregular	Not remarkable color irregular.

Fig 1.

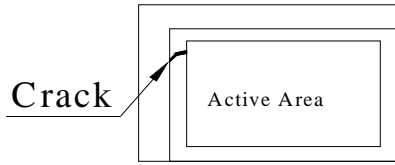


Fig 2.

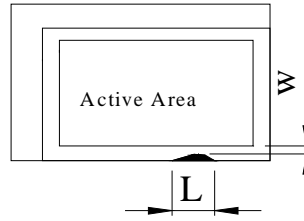


Fig 3.

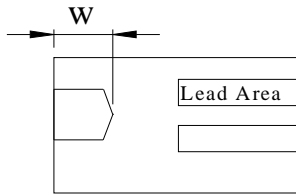


Fig 4.

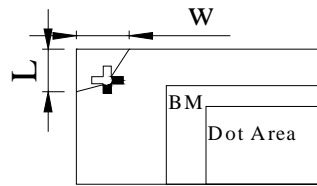


Fig 5.

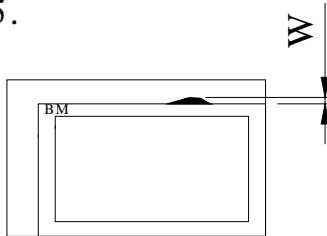
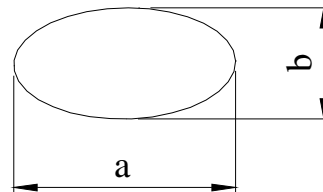


Fig 6.



$$D=(a+b)/2$$

Fig 7.

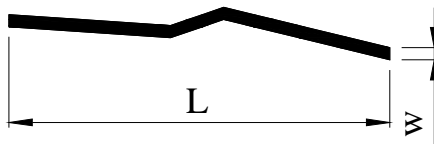
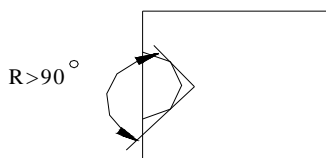


Fig8.



Notes

1.W:Widh

2.Lengh

3.D:Average Diameter

4.N:Count

5.All the anhle of the broken must be larger than 90°.It is shown in Fig.8.(R>90°)

NOTICE:

- SAFETY

1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING

1. Avoid static electricity which can damage the CMOS LSI.
2. Do not remove the panel or frame from the module.
3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
5. Do not use ketonics solvent & Aromatic solvent. Use a soft cloth soaked with a cleaning naphtha solvent.

- STORAGE

1. Store the panel or module in a dark place where the temperature is  $25\pm 5^{\circ}\text{C}$  and the humidity is below 65% RH.
2. Do not place the module near organics solvents or corrosive gases.
3. Do not crush, shake, or jolt the module.

- 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.

## 7. Quality Assurance

No.	Test Items	Test Condition	REMARK
1	High Temperature Storage Test	Ta=80°C Dry 240h	
2	Low Temperature Storage Test	Ta=-30°C Dry 240h	
3	High Temperature Operation Test	Ta=70°C Dry 240h	
4	Low Temperature Operation Test	Ta=-20°C Dry 240h	
5	High Temperature and High Humidity Operation Test	Ta=60°C 90%RH 240h	
6	Electro Static Discharge Test	Panel surface / top case. Contact / Air: ±6KV / ±8KV 150pF, 330Ω	Non-operating Note1
7	Shock Test (non-operating)	Shock level : 100G Waveform : half sinusoidal wave Shock Time :6ms Number of shocks :3 Times for each ±X, ±Y,±Z direction.	
8	Vibration Test (non-operating)	Frequency range : 10 Hz ~550 Hz Stoke : 1.3 mm Sweep : 1.5G, 33.3~400Hz Vibration : Sinusoidal Wave, 1Hrsfor X,YZ direction.	
9	Thermal Shock Test	-20 °C(0.5h) ~ 70°C(0.5h) / 100 cycles	

Note1: You need to connect copper wire between steel screw hole and earth.

# 8. Optical Characteristic

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Response time	Tr	$\theta=0^\circ, \phi=0^\circ$	-	10		ms	Note 3,5	
	Tf		-	15		ms		
Contrast ratio	CR	At optimized viewing angle	300	400	-	-	Note 4,5	
Color Chromaticity	White	$\theta=0^\circ, \phi=0^\circ$	Wx	0.26	0.31	0.36		Note 2,6,7
			Wy	0.28	0.33	0.38		
Viewing angle	Hor.	$\Theta_R$	50	60		Deg.	Note 1	
		$\Theta_L$	50	60				
	Ver.	$\Phi_T$	40	50				
		$\Phi_B$	45	55				
Brightness	-	-	200	300	-	cd/m <sup>2</sup>	Center of display	

Ta=25°C, IL=20mA

Note 1: Definition of viewing angle range

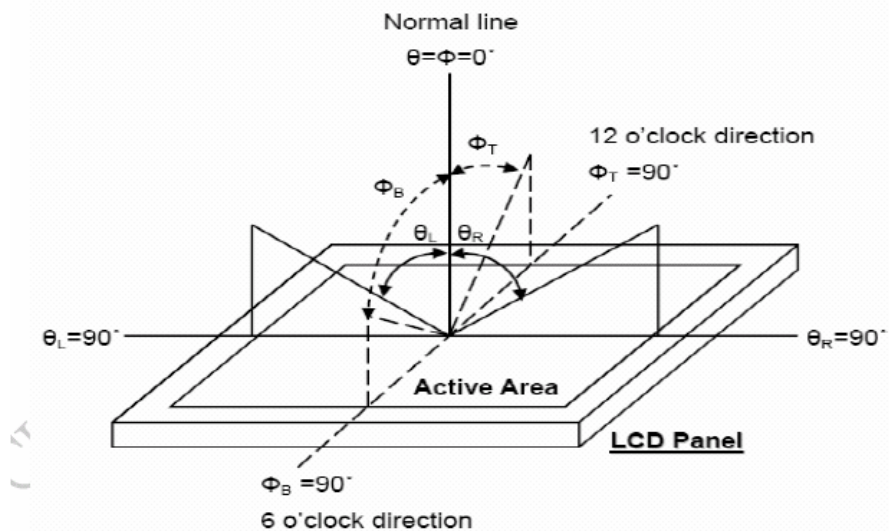


Fig. 1 Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

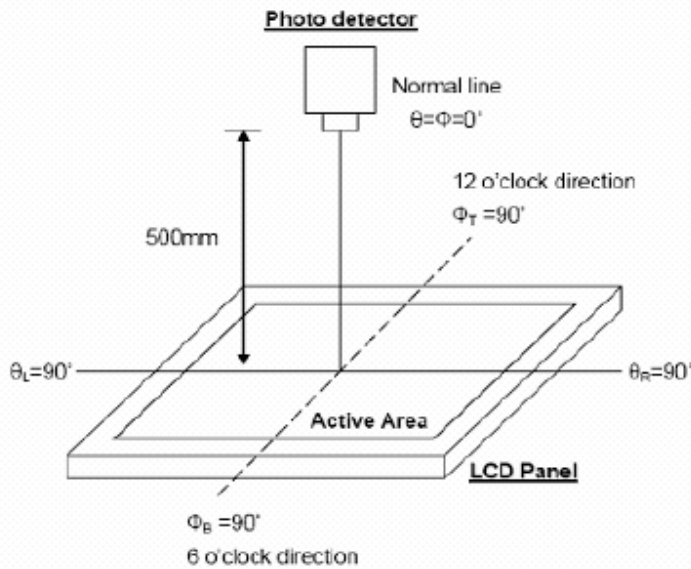
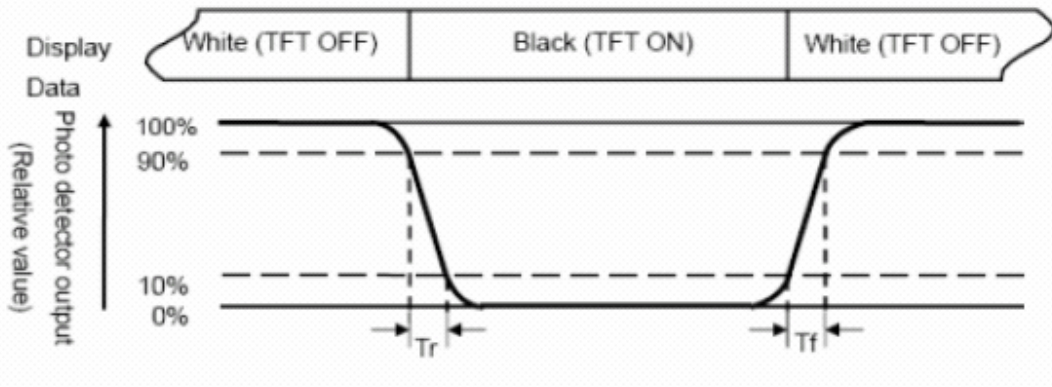


Fig. 2 Optical measurement system setup

Note 3: Definition of Response time:

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time,  $T_r$ , is the time between photo detector output intensity changed from 90% to 10%. And fall time,  $T_f$ , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

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

Note 5: White  $V_i = V_{i50} \pm 1.5V$

Black  $V_i = V_{i50} \pm 2.0V$

“±” means that the analog input signal swings in phase with VCOM signal.

“±” means that the analog input signal swings out of phase with VCOM signal.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 6: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

$$\text{Note 8 : Uniformity (U)} = \frac{\text{Brightness (min)}}{\text{Brightness (max)}} \times 100\%$$