



WANXIN IMAGE
I N C O R P O R A T I O N

Product Specifications

3.5" TFT-LCD Module Model No. : WXHAT35-MG3#001

PD Dept.	PD Dept.	PD Dept.
Prepared by	Checked by	Approved by
Sun Jin		Dr. Chyau

WANXIN IMAGE INC.

4F, No. 65, Kuang-Fu North Rd.,
Hsin-Chu Industrial Park, Ho-Kuo,
Hsin-Chu County, 303 Taiwan, R.O.C.
Tel : 886-3-5976977
Fax : 886-3-5974074

Doc No. : RP-P302-CD02-02
SP-H35MG3-001



Contents

1	General Description	4
1.1	Features	4
1.2	Application	4
1.3	General Specification	5
2	Absolute Maximum Ratings	6
2.1	Electrical Absolute Maximum Ratings	6
2.2	Environment Absolute Maximum Ratings	6
3	Electrical Characteristics	7
3.1	TFT-LCD Module	7
3.2	Back-Light Unit.....	7
4	Optical Specification	8
5	Block Diagram	12
5.1	TFT-LCD Module	12
6	Interface Specification	13
7	Gamma Correction	15
8	24 Bit RGB interface timing	16
8.1	Clock and Sync waveforms.....	16
8.2	IHS and horizontal control timing waveforms	16
8.3	SYNC mode	16
8.4	DE Mode	16
8.5	HIS and horizontal control timing waveforms	17
8.6	IHS and vertical shift clock timing waveforms	18
8.7	IHS and vertical control timing waveforms	18
9	SPI timing characteristics	19
9.1	Power On/Off Sequence	19
9.2	Power On Control	19
10	Outline Dimension	21
11	Package	23
12	Precautions.....	24
12.1	Handling.....	24
12.2	Storage	24
12.3	Operation	24
12.4	Others	25



Records of Version

Version	Revise Date	Page	Content
1.0	2007-05-21	All	First version



1 General Description

WXHAT35-MG3#001 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit a backlight unit. The panel size is 3.5 inch and the resolution is 320×240. The panel can display up to 16.7M colors and is suitable for portable device display application.

1.1 Features

- ◆ High image quality a-Si TFT LCD module.
- ◆ 16,777,216 color number.
- ◆ 24bit RGB Interface + Serial Peripheral Interface
- ◆ NTSC/PAL TV system mode auto detection.
- ◆ High contrast, high brightness.
- ◆ Light weight, slim design.
- ◆ Low power consumption.
- ◆ Line inversion mode with stripe type.
- ◆ DE (Data Enable, Dotclk) mode, SYNC (Vsync, Hsync, Dotclk) mode.

1.2 Application

- ◆ Display terminals for portable devices, such as
 - ✦ GPS (Global Positioning System),
 - ✦ DSC (Digital Still Camera),
 - ✦ PMP (Portable Multimedia Player),
 - ✦ Other devices which require high quality displays.



1.3 General Specification
1.3.1 TFT LCD Module

No	Item	Specification	Remark
1	Type	Transmissive	
2	Display Mode	Normally White	
3	Pixel Element	a-Si TFT	
4	Screen Size	3.5 inch (diagonal)	
5	Resolution	320(RGB)×240	
6	Color Number	16,777,216	
7	Active Area	70.08×52.56 (mm)	
8	Dot Pitch	73×219 (μm)	
9	Color Arrangement	RGB-stripe	
10	Assembly Type	COG	
11	Back Light	LED	
12	Viewing Direction	6 o'clock	
13	Module Dimension	76.9mm×63.9mm×4.35mm	
14	Power Supply	3.8~5.5 V	
15	Interface	SPI+RGB 24-bit	
16	Surface Treatment	UV Cut/Anti Glare	



2 Absolute Maximum Ratings

2.1 Electrical Absolute Maximum Ratings

2.1.1 TFT-LCD Panel Absolute Maximum Ratings

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital voltage (Source)	VCC	-0.3	7	V	-
Analog voltage (Source)	VDD	-0.3	7	V	
Power supply voltage (Gate)	VDD_G	-0.3	7	V	
Input voltage	Vin	-0.3	VCC+0.3	V	-
Gate On voltage	VGH	-0.3	32	V	-
Gate Off voltage	VGL	-22	0.3	V	-

- If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.

2.1.2 Back-Light Unit

Ta=25°C

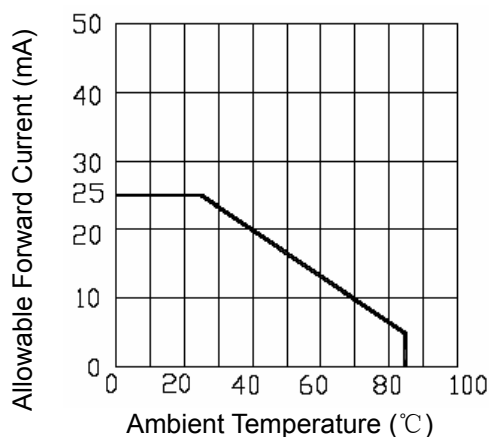
Item	Symbol	Min.	Max.	Unit	Remark
Forward current	I _B	--	25	mA	--

2.2 Environment Absolute Maximum Ratings

2.2.1 TFT-LCD Module

Item	Symbol	Min	Max	Unit	Remark
Operation temperature range	Top	-20	70	°C	Ambient
Storage temperature range	Tst	-30	80	°C	Ambient

- Corrosive gas environment is not acceptable.
- TFT-LCD color will change slightly depending on environment temperature. This phenomenon is reversible. Current reduction rate of LED backlight is according to the graph indicated below:





3 Electrical Characteristics

3.1 TFT-LCD Module

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Digital voltage (Source)	VCC	3	3.3	3.6	V
Analog voltage (Source)	VDD	3.8	5	5.5	V
Power supply voltage (Gate)	VDD_G	2.3	3.3	5.5	V
Power supply voltage (Gate)	VEE_G	-20	-	-5	V
Gate On voltage	VGH	7	-	VEE+40	V
Gate Off voltage	VGL	-20	-	-5	V
Operation frequency	FCPV	-	-	200	KHz

3.2 Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Current	I_B	--	20	25	mA	
Forward voltage	V_F	--	19.2	--	V	
Power Consumption	P_{BL}	--	384	--	mW	

- Six LEDs are in serial type.
- The luminous intensity of LED is strongly dependent on the driving current.



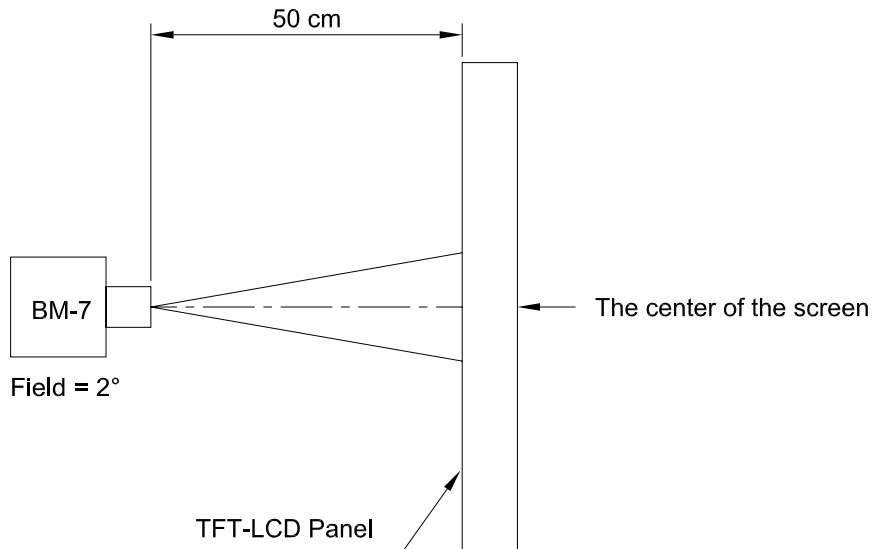
4 Optical Specification

$T_a=25^{\circ}\text{C}$, $V_{cc}=3.3\text{V}$ $V_{DD}=5.0\text{V}$, $I_B=20\text{ mA}$

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Brightness		B	$\theta=0^{\circ}$ Normal viewing angle At the center of panel Backlight On Equipment: BM7 Field= 2°	150	200	--	cd/m^2	Note 1
Contrast Ratio		CR		150	200	--	--	Note 2
Response Time		Rising : T_r		--	25	40	ms	Note 3
		Falling : T_f						
Color Chromaticity (CIE 1931)	White	X		0.237	0.287	0.337	--	
		Y		0.261	0.311	0.361		
	Red	X		0.572	0.622	0.672		
		Y		0.294	0.344	0.394		
	Green	X		0.237	0.287	0.327		
		Y		0.538	0.588	0.638		
	Blue	X		0.088	0.138	0.188		
		Y		0.028	0.078	0.128		
Viewing Angle	Top	θ_U	$CR \geq 10$ Backlight On Equipment: BM7 Field= 2°	--	65	--	Degrees	Note 4
	Bottom	θ_D		--	50	--		
	Left	θ_L		--	60	--		
	Right	θ_R		--	60	--		
Uniformity		Un	$\theta=0^{\circ}$ Normal viewing angle Backlight On Equipment: BM7 Field= 2°	70	80	--	%	Note 5



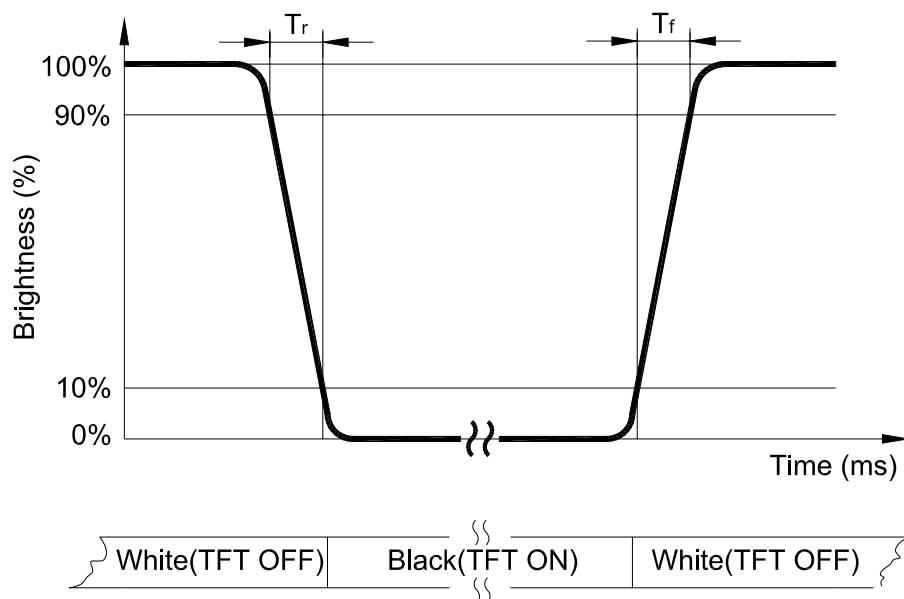
Note 1: The brightness test equipment setup
 $I_B=20\text{mA}$, Field= 2° (As measuring "black" image, field= 2° is the best testing condition.)



Note 2: Definition of contrast ratio (C.R)

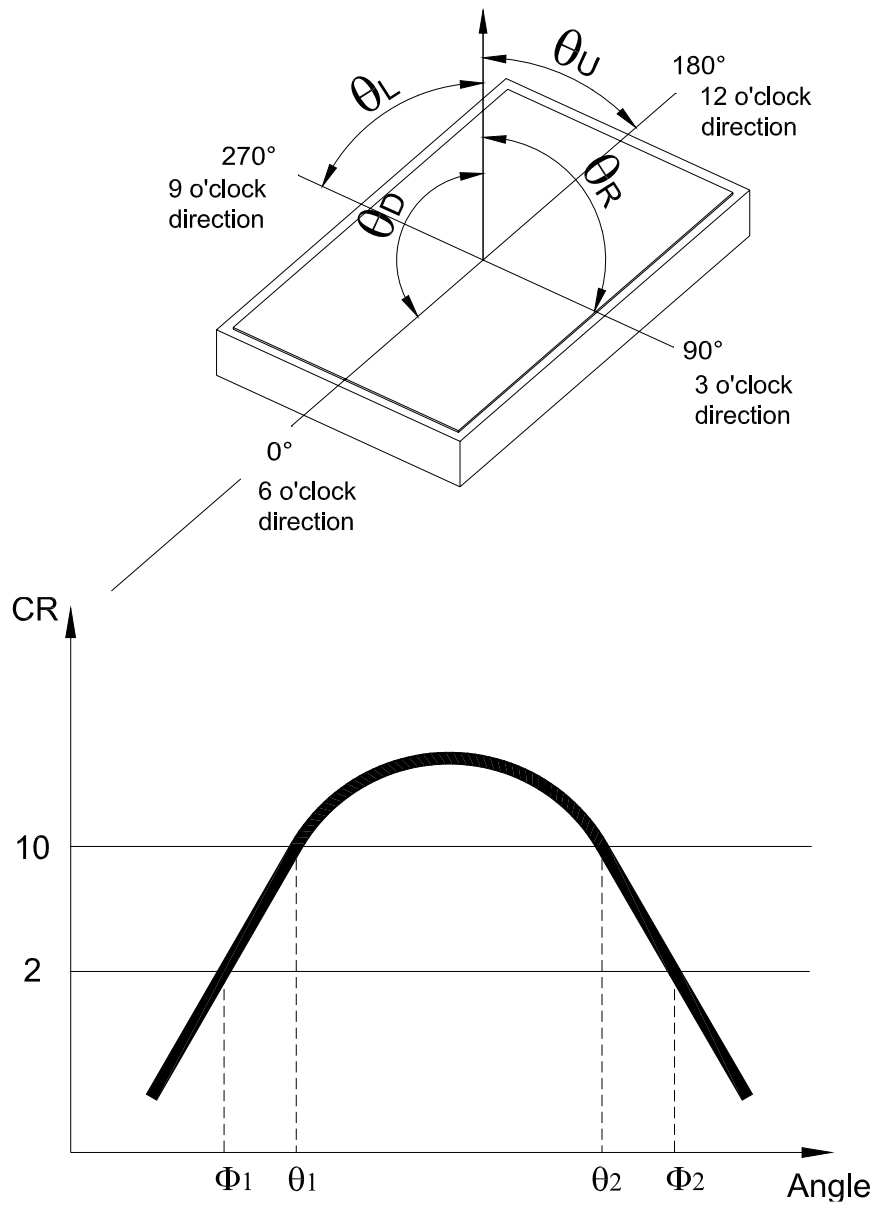
$$\text{C.R} = \frac{\text{Brightness When LCD is at "White" State}}{\text{Brightness When LCD is at "Black" State}}$$

Note 3: Definition of response time



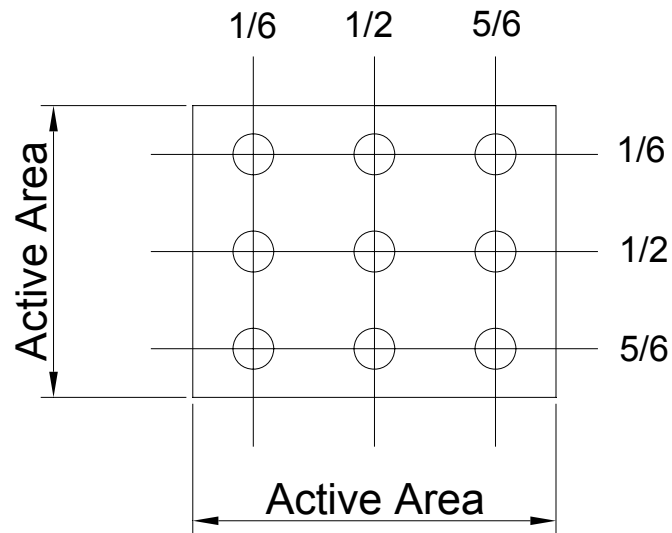


Note 4: Definition of viewing angle





Note 5: Definition of uniformity (U_n)

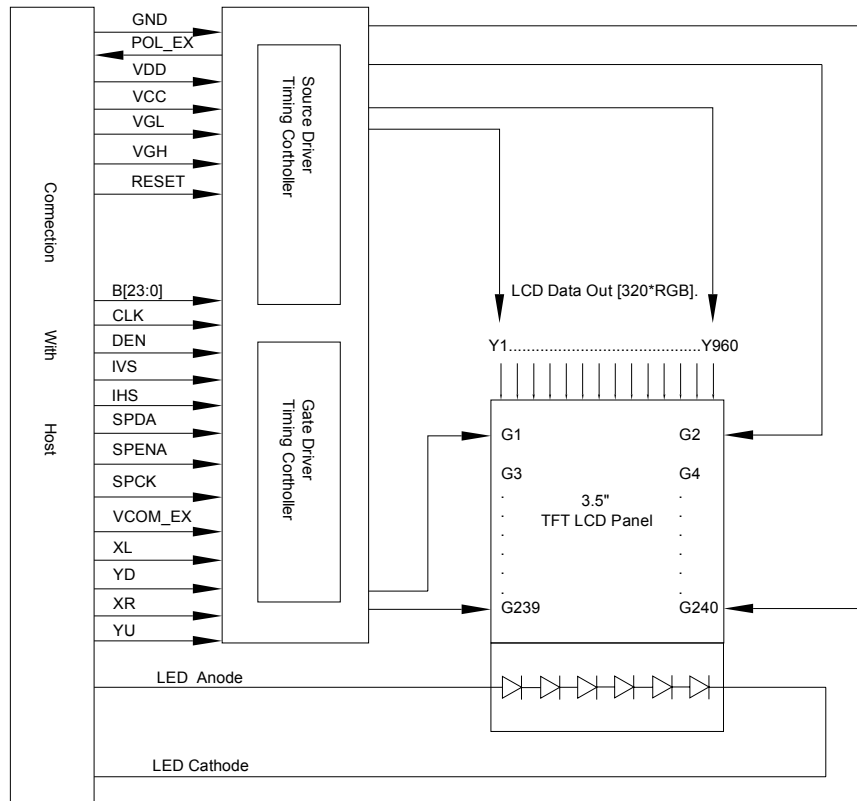


$$U_n = \frac{B_{min}}{B_{max}} \times 100\%$$



5 Block Diagram

5.1 TFT-LCD Module





6 Interface Specification

Pin No	Symbol	Description	Input/Output	Note
1	LED_Cathode	Backlight Cathode	Input	
2	LED_Cathode	Backlight Cathode	Input	
3	LED_Anode	Backlight Anode	Input	
4	LED_Anode	Backlight Anode	Input	
5	GND	Ground	Input	
6	NC	No Connection	--	
7	NC	No Connection	--	
8	NC	No Connection	--	
9	NC	No Connection	--	
10	GND	Ground	Input	
11	NC	No Connection	--	
12	NC	No Connection	--	
13	POL_EX	Vcom Generate Signal	Output	
14	/RESET	System Reset	Input	
15	SPENA	Serial Data Enable	Input	
16	SPCK	Serial Port Clock	Input	
17	SPDA	Serial Data Input/Output	Input/ Output	
18	D0	Blue Data (LSB)	Input	
19	D1	Blue Data	Input	
20	D2	Blue Data	Input	
21	D3	Blue Data	Input	
22	D4	Blue Data	Input	
23	D5	Blue Data	Input	
24	D6	Blue Data	Input	
25	D7	Blue Data (MSB)	Input	
26	D8	Green Data (LSB)	Input	
27	D9	Green Data	Input	
28	D10	Green Data	Input	
29	D11	Green Data	Input	
30	D12	Green Data	Input	
31	D13	Green Data	Input	
32	D14	Green Data	Input	
33	D15	Green Data (MSB)	Input	
34	D16	Red Data (LSB)	Input	



35	D17	Red Data	Input	
36	D18	Red Data	Input	
37	D19	Red Data	Input	
38	D20	Red Data	Input	
39	D21	Red Data	Input	
40	D22	Red Data	Input	
41	D23	Red Data (MSB)	Input	
42	IHS	Horizontal Synchronous Signal	Input	
43	IVS	Vertical Synchronous Signal	Input	
44	CLK	Data Clock	Input	
45	VDD	Vanalog	Input	
46	VDD	Vanalog	Input	
47	VCC	Vdigital	Input	
48	VCC	Vdigital	Input	
49	NC	No Connection	--	
50	VGL	Vgoff Voltage	Input	
51	VGL	Vgoff Voltage	Input	
52	NC	No Connection	--	
53	VGH	Vgon Voltage	Input	
54	NC	No Connection	--	
55	NC	No Connection	--	
56	VCOM_EX	Vcom	Input	
57	VCOM_EX	Vcom	Input	
58	DEN	Data Enabling Signal	Input	
59	GND	Ground	Input	
60	GND	Ground	Input	



7 Gamma Correction

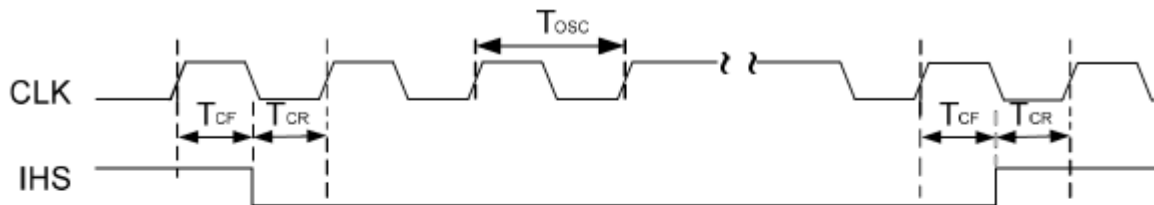
The 8 gamma correction reference voltages are generated internally. The default voltages are as below table based on VDD(5V) and VSS(0V). According to the different VDD and VSS, these 8 gamma correction reference voltages will be varied.

	V1	V2	V3	V4	V5	V6	V7	V8
Default voltage	4.45	3.435	2.854	2.540	2.301	2.090	1.818	0.55

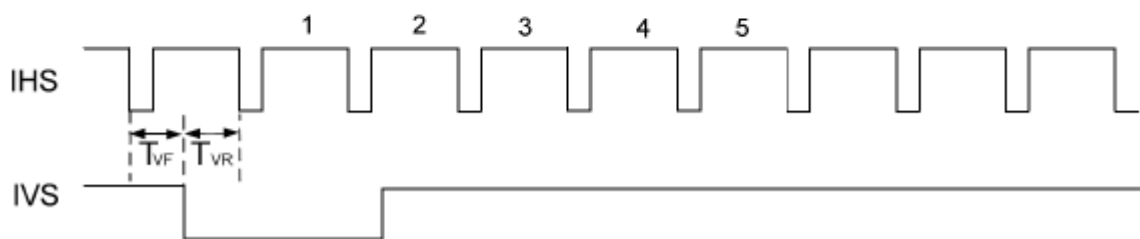


8 24 Bit RGB interface timing

8.1 Clock and Sync waveforms



CLK and IHS timing waveform



IHS and IVS timing waveforms

The instruction setting for the gate driver is executed by the serial interface. When the instruction for the gate driver / power-supply IC is set, the serial transfer must be executed to the gate driver immediately.

8.2 IHS and horizontal control timing waveforms

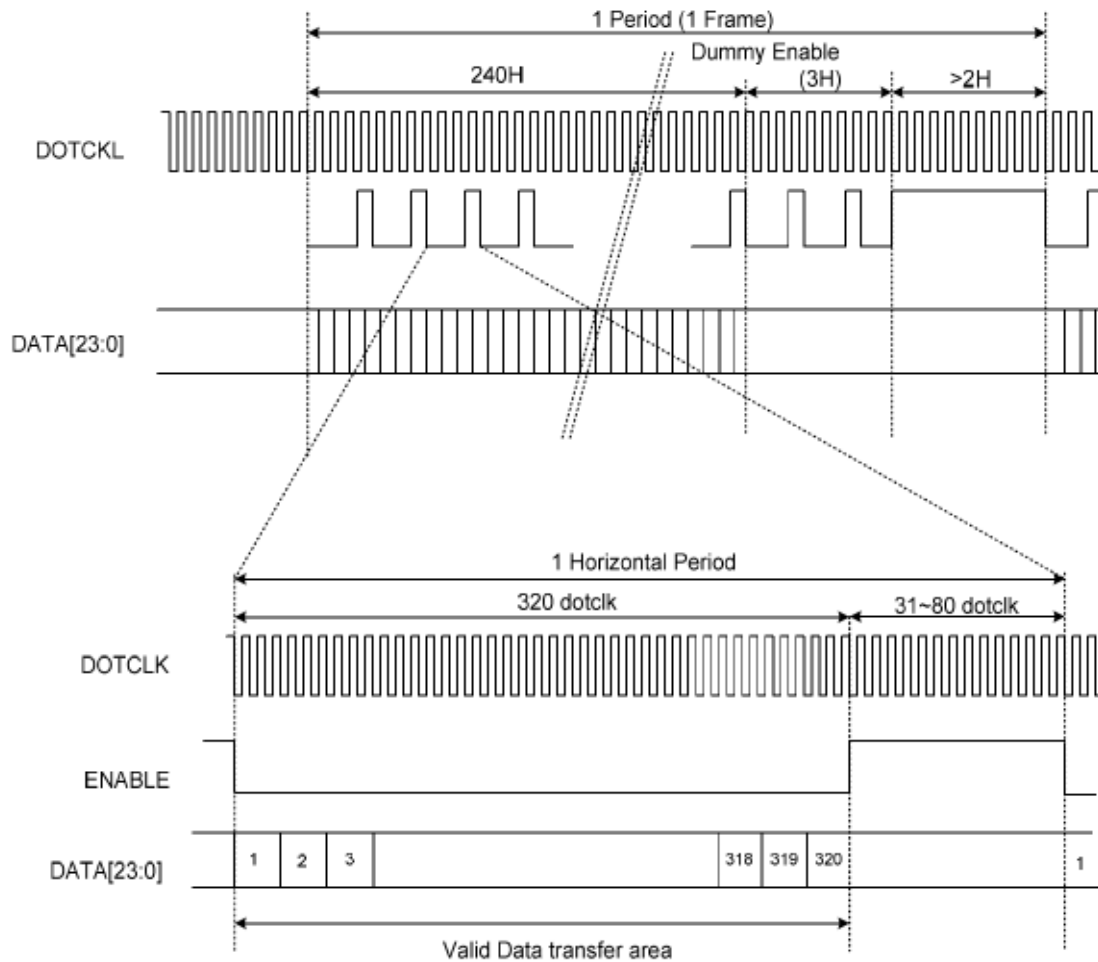
For digital RGB input data format, both SYNC mode and DE mode are supported. If DEN signal is fixed low, SYNC mode is used. Otherwise, DE mode is used.

8.3 SYNC mode

Parameter	Symbol	Min.	Type	Max.	Unit
HSYNC pulse width	THS	5	30	-	Tosc
M time	T4	-	4368	-	ns

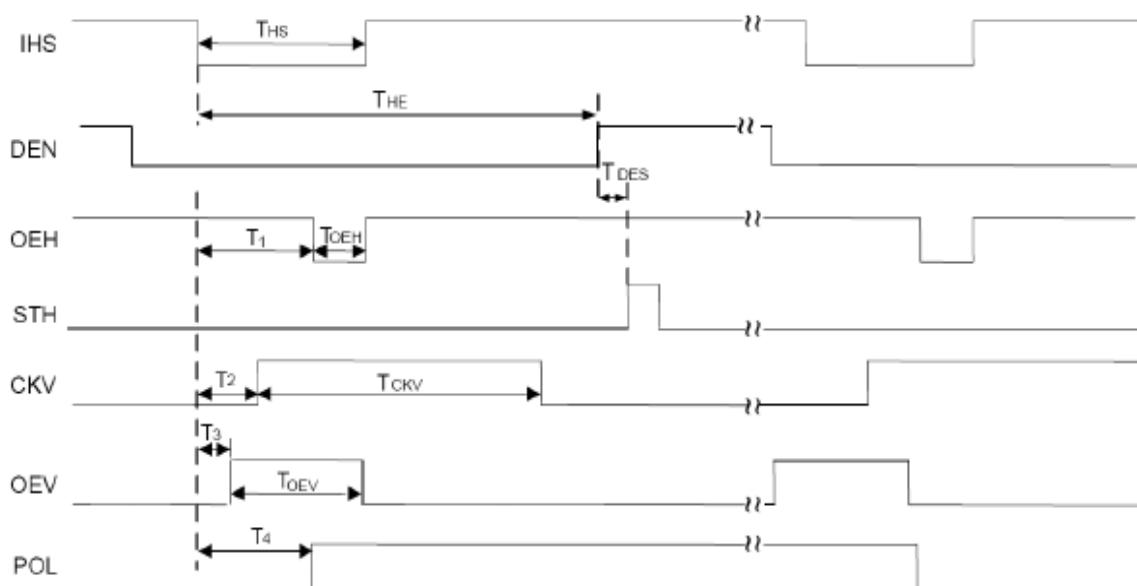
8.4 DE Mode

Parameter	Symbol	Min.	Type	Max.	Unit
HSYNC pulse width	THS	5	30	-	Tosc
ENABLE time	THE	36	68	88	Tosc
M time	T4	-	4368	-	ns



CLK, ENABLE and DATA timing waveforms

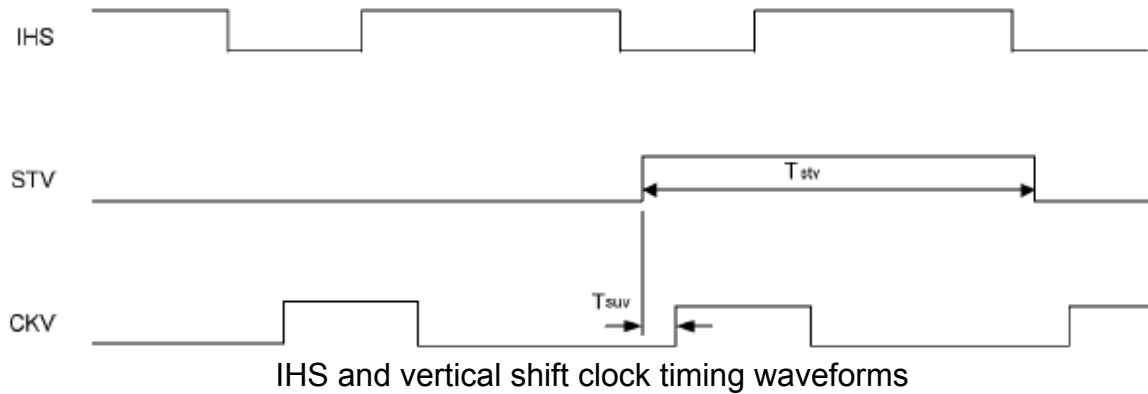
8.5 HIS and horizontal control timing waveforms



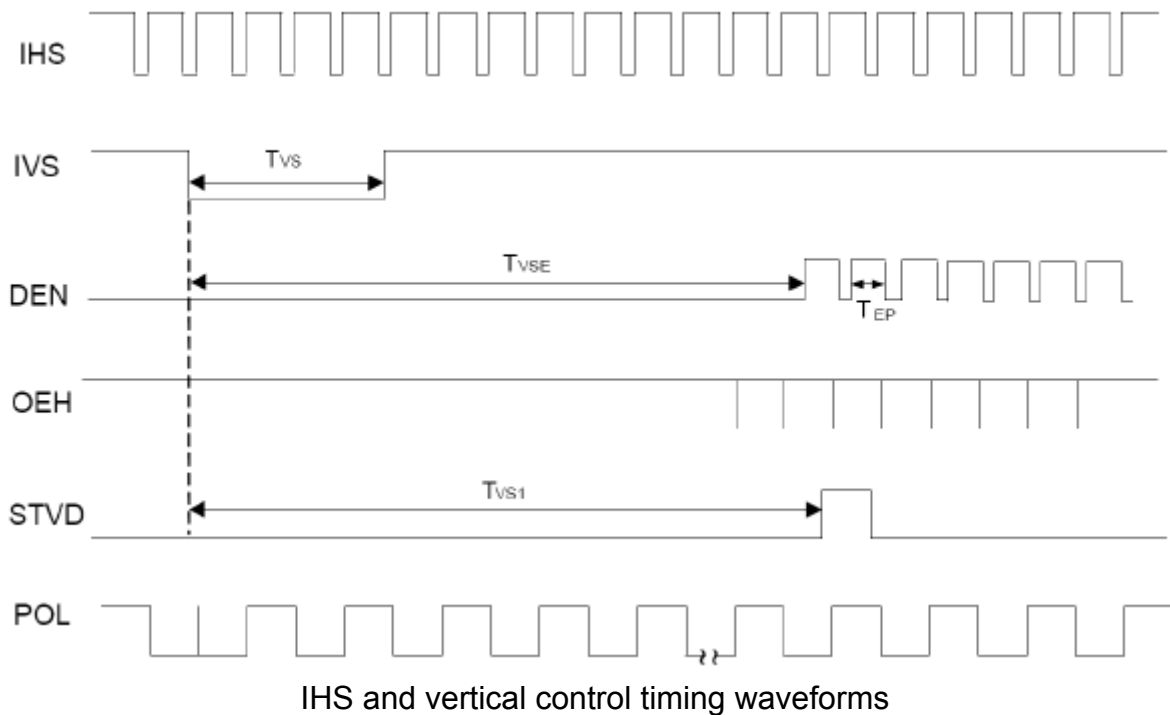
IHS and horizontal control timing waveforms



8.6 IHS and vertical shift clock timing waveforms



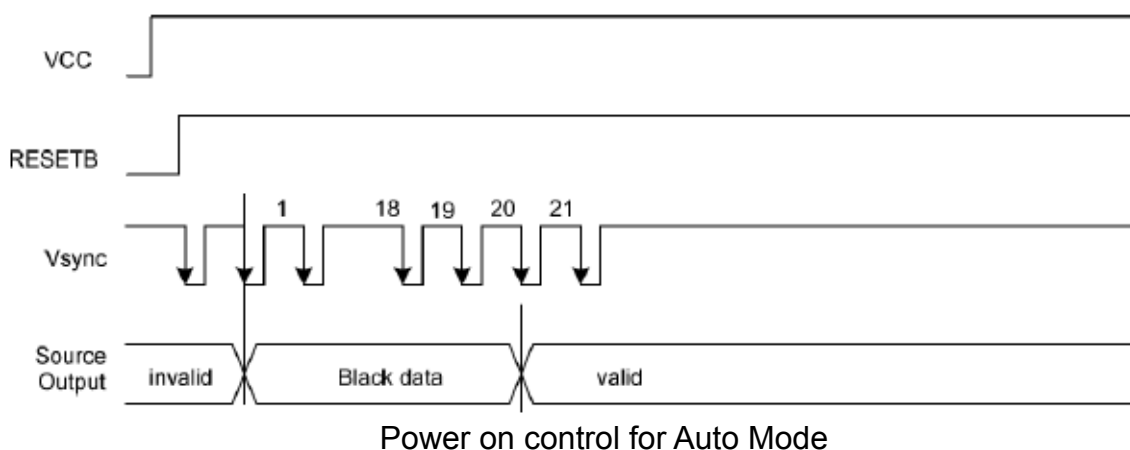
8.7 IHS and vertical control timing waveforms





9 SPI timing characteristics

Parameter	Symbol	Min.	Type	Max.	Unit
SCL period	TCK	60	-	-	ns
SCL high width	TCKH	30	-	-	ns
SCL low width	TCKL	30	-	-	ns
DATA setup time	TSU1	12	-	-	ns
DATA hold time	THD1	12	-	-	ns
CS to SCL setup time	TCS	20	-	-	ns
CS to SDI hold time	TCE	20	-	-	ns
CS high pulse width	TCD	50	-	-	ns
SDI output latency	TCR	-	1/2	-	Tck



9.1 Power On/Off Sequence

To prevent the device damage from latch up, the power ON/OFF sequence shown below must be followed.

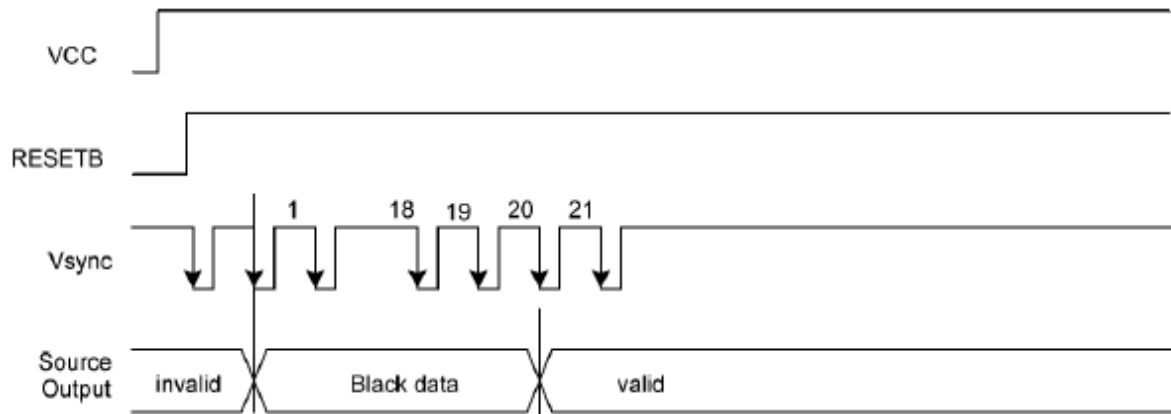
Power ON: VCC, GND → VDD, VSS → V1 to V8

Power OFF: V1 to V8 → VDD, VSS → VCC, GND

9.2 Power On Control

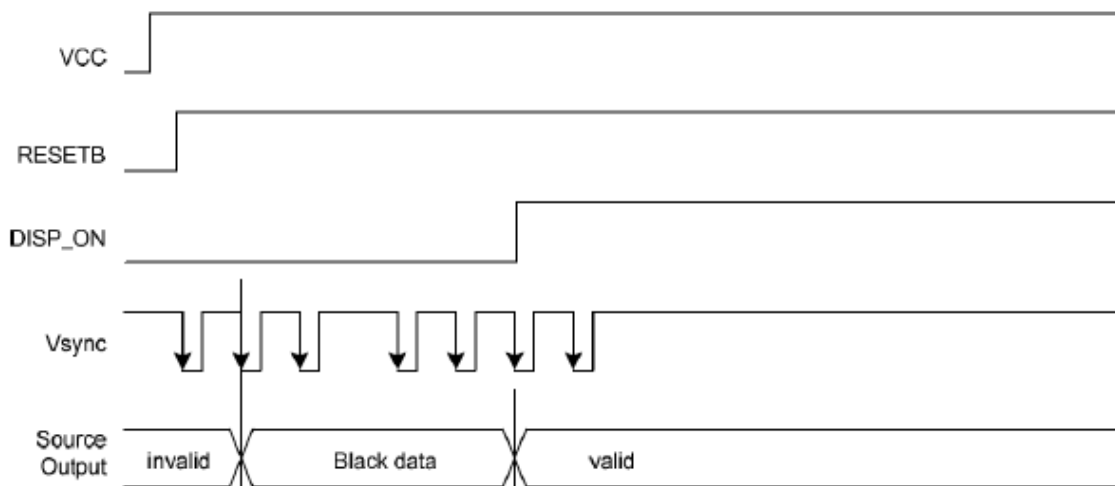
WXHAT35-MG3#001 has a power ON sequence control function. There are two kinds of the mode. One is Auto mode, and another is Manual Mode.

Auto Mode: When power is ON, black data is outputted for 20-frames (default value) first, from the falling edge of the following Vsync signal. It can be defined in Register R3 A_TIME1(bit5) and A_TIME0(bit4) when AUTO_DP(bit7) = "H"



Power on control for Auto Mode

Manual Mode: When power is ON, you should set the Register R3 AUTO_DP(bit7)= "L" to stay at the manual mode. Black data is outputted until the DISP_ON(bit 6) = H then display the normal image.

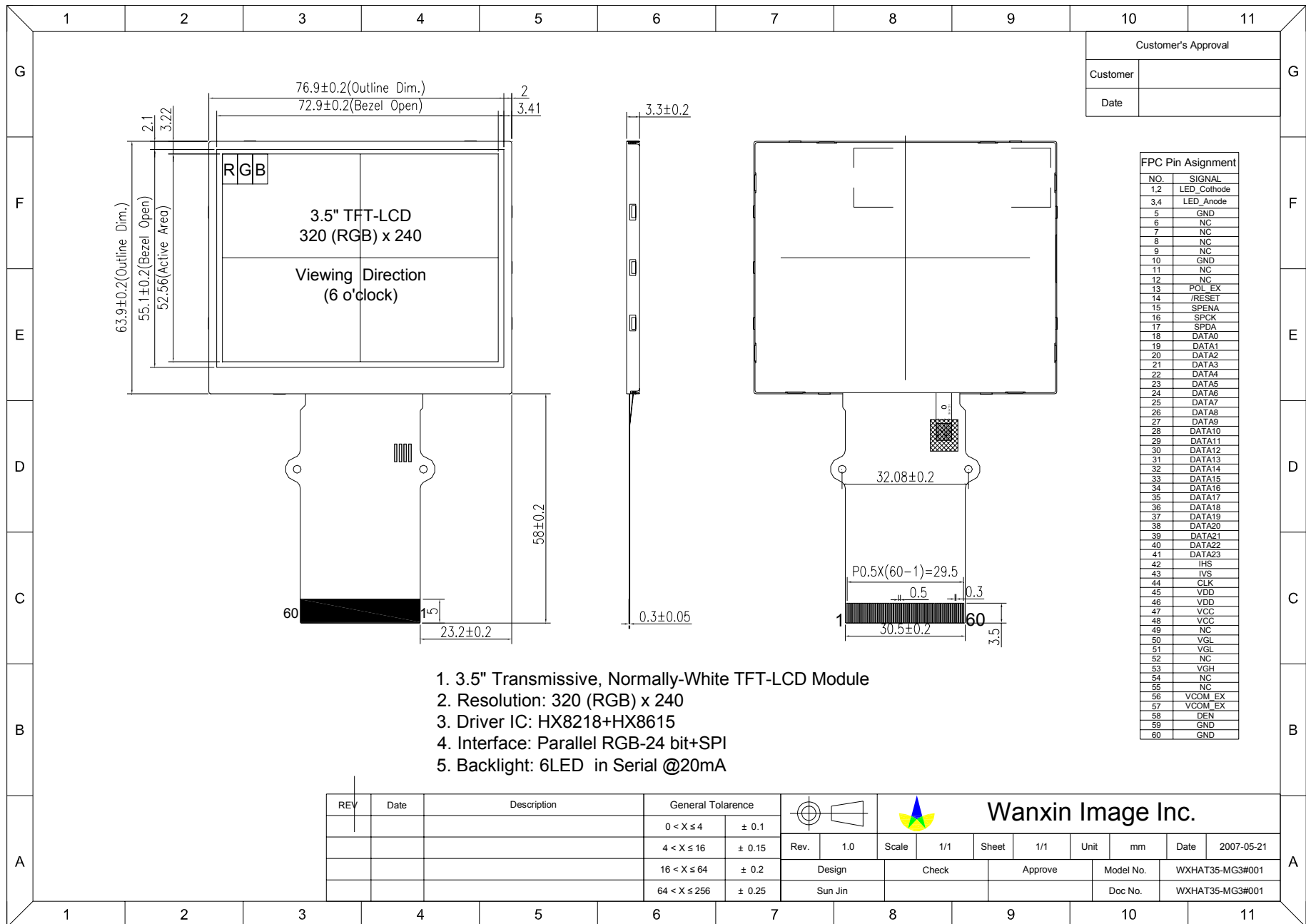


Power on control for Manual Mode



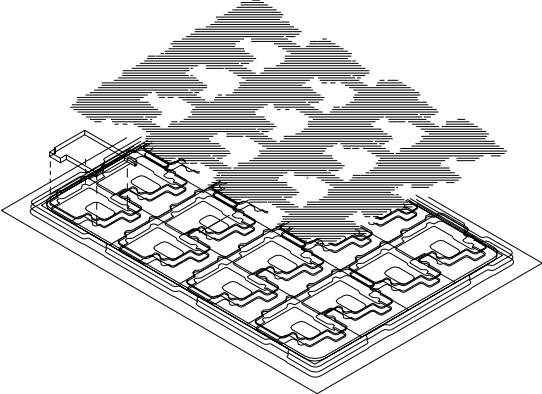
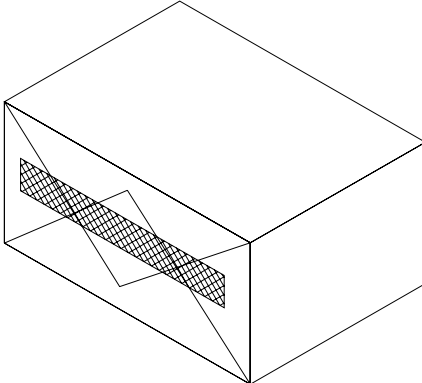
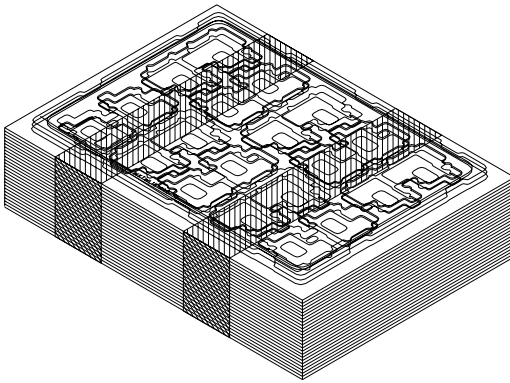
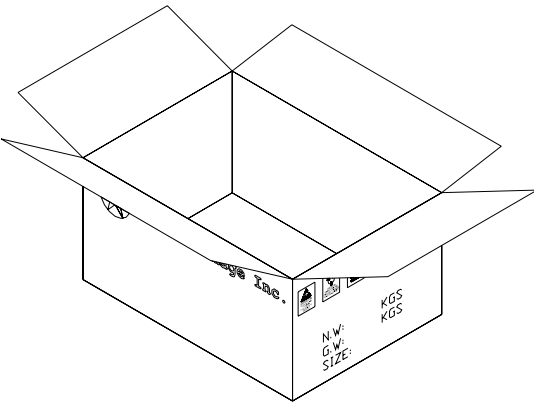
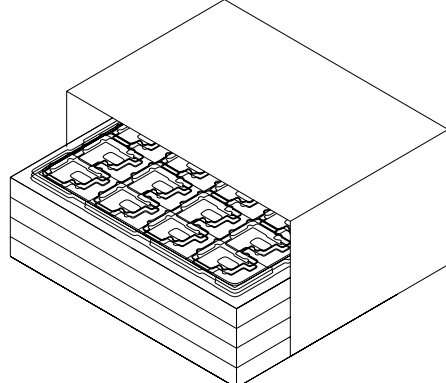
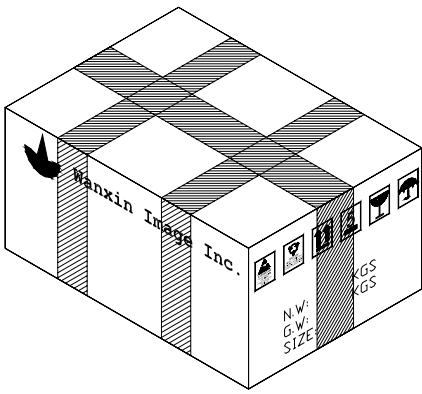
10 Outline Dimension

See next page.





11 Package

1  8 pcs per tray + 1 cover (EPE)	4  Packing bag
2  25 trays + 1 dummy tray = 200 pcs Packing 14 trays with sealing tape	5  Putting bag into carton Protected by 6 pieces of cushion EPE sheet
3  Putting trays into anti-electrostatic bag	6  Packing carton with sealing tape Carton outline size: 507×368×228 (mm)



12 Precautions

Please pay attentions to the followings as using the LCD module.

12.1 Handling

- (a) Do not apply strong mechanical stress like drop, shock or any force to LCD module. It may cause improper operation, even damage.
- (b) Because the polarizer is very fragile and easy to be damaged, do not hit, press or rub the display surface with hard materials.
- (c) Do not put heavy or hard material on the display surface, and do not stack LCD modules.
- (d) If the display surface is dirty, please wipe the surface softly with cotton swab or clean cloth.
- (e) Avoid using Ketone type materials (e.g. Acetone), Toluene, Ethyl acid or Methyl chloride to clean the display surface. The recommended solvents are water and Isopropyl alcohol.
- (f) Wipe off water droplets or oil immediately.
- (g) Protect the LCD module from ESD. It will damage the LSI and the electronic circuit.
- (h) Do not touch the output pins directly with bare hands.
- (i) Do not disassemble the LCD module.

12.2 Storage

- (a) Do not leave the LCD modules in high temperature, especially in high humidity for a long time.
- (b) Do not expose the LCD modules to sunlight directly.
- (c) The liquid crystal is deteriorated by ultraviolet. Do not leave it in strong ultraviolet ray for a long time.
- (d) Avoid condensation of water. It may cause improper operation.
- (e) Please stack only up to the number stated on carton box for storage and transportation. Excessive weight will cause deformation and damage of carton box.

12.3 Operation

- (a) When mounting or dismounting the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms stated in chapter 8 should always obeyed to avoid damaging the LSI and electronic circuit.



-
- (d) Be careful to avoid mixing up the polarity of power supply for backlight.
 - (e) Absolute maximum rating specified above has to be always kept in any case. Exceeding it may cause non-recoverable damage of electronic components or, nevertheless, burning.
 - (f) When a static image is displayed for a long time, remnant image is likely to occur.
 - (g) Be sure to avoid bending the FPC to an acute shape, it might break FPC.
 - (h) Most of the touch screens have air vent to equalize the inside air pressure to the outside one. The air vent must be open and liquid contact must be avoided as the liquid may be absorbed if the liquid is accumulated near the air vent.
 - (i) For the fragility of ITO film, it should avoid to use too tapering pen as the input material.

12.4 Others

- (a) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.
- (b) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.
- (c) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.



<The last page is left blank>