WANXIN IMAGE
INCORPORATION

Product Specifications

3.5” TFT-LCD with Touch Panel Module
Model No. : WXCAT35-TG3#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-C35TG3-001

Contents

Records of Version

Version	Revise Date	Page	Content
1.0	2007-06-15	All	First version
1.1	2007-07-30	24	Add initial code
1.2	2007-08-01	9	Modify Viewing Angle

1 General Description

WXCAT35-TG3#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, and a 4-wires analog resistive type touch panel. 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
- 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.
- 4-wires analog resistive type touch panel.

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	2.5~3.6 V	
15	Interface	RGB 24-bit	
16	Surface Treatment	UV Cut/Anti Glare	

1.3.2 Touch Panel

No	Item	Specification	Remark
1	Type	4 Wires Analog Resistive Type	
2	Input Mode	Pen	
3	Surface Treatment	Clear Type	
4	Glass Thickness	0.7±0.1 (mm)	
5	Active Area	70.08 x 52.56 (mm)	
6	Viewing Area	71.38 x 54.16 (mm)	
7	Outline Dimension	76.6x63.6x1.15 (mm) （Including double-side tape）	
8	Activation Force	60~100(g)	Finger/Stylus Within" guaranteed active area", but not on the age and Dot-Spacer. Shape of pen end : Φ0.3mm~Φ0.5mm
9	Surface Hardness	≧3H	JIS-K5400

2 Absolute Maximum Ratings

2.1 Electrical Absolute Maximum Ratings

2.1.1 TFT-LCD Panel Absolute Maximum Ratings

Ta=25℃ GND=0V

Item	Symbol	Condition	Standard Value		Unit	Remark
			Min	Max		
Input power supply voltage	Vcc	GND=0V	-0.3	5.0	V	logic and analog

- 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℃

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

2.1.3 Touch Panel

Ta=25℃

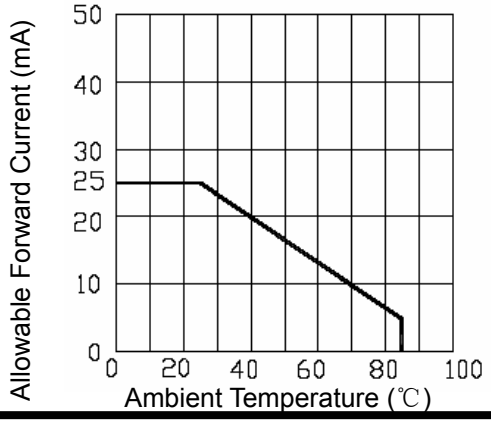
Item	Symbol	Min	Max	Unit	Remark
DC Voltage	V_{TP}	--	7	V	DC

2.2 Environment Absolute Maximum Ratings

2.2.1 TFT-LCD Module

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



2.2.2 Touch Panel

Item		Symbol	Min	Max	Unit	Remark
Operation	Temperature	Top	-10	50	℃	Ambient
	Humidity	RHop	-	90	%	-
Storage	Temperature	Tst	-20	70	℃	Ambient
	Humidity	RHst	-	90	%	-

3 Electrical Characteristics

3.1 TFT-LCD Module

Ta=25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply	Vcc	2.5	3.3	3.6	V	

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.

3.3 Touch Panel

Item	Direction	Value	Unit	Remark
Resistance between terminals	X (Film)	200 ~ 900	Ω	-
	Y (Glass)	200 ~ 900		
Linearity	X	≦1.5	%	-
	Y	≦1.5		
Chattering	--	≦10	ms	-
Insulation resistance	--	≧(25M)		DC (25V)

4 Optical Specification

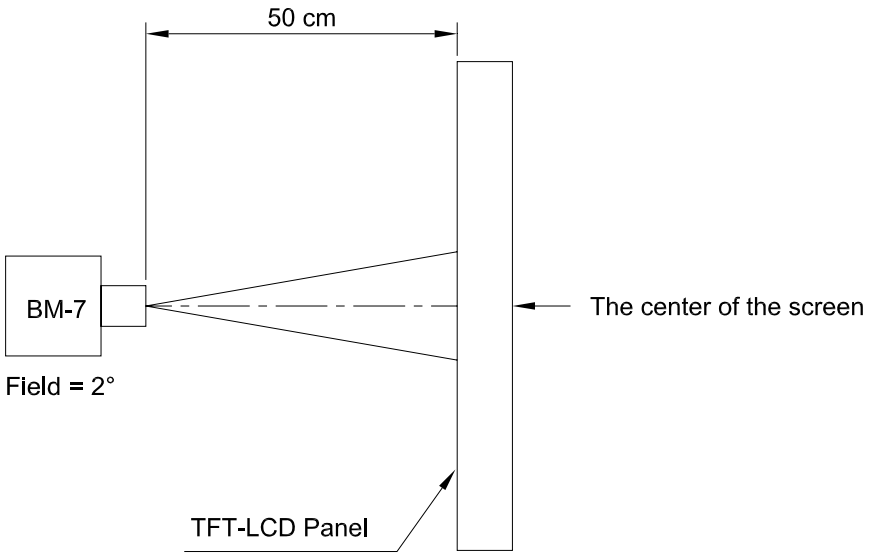
Ta=25℃,Vcc=3.3V, I_B=20 mA

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Brightness		B	θ=0° Normal viewing angle At the center of panel Backlight On Equipment: BM7 Field=2°	120	160	--	cd/m^2	Note 1 With TP
Contrast Ratio		CR		170	200	--	--	Note 2 Without TP
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≧10 Backlight On Equipment: BM7 Field=2°	--	50	--	Degrees	Note 4
	Bottom	θ_D		--	65	--		
	Left	θ_L		--	60	--		
	Right	θ_R		--	60	--		
Uniformity		Un	θ=0° Normal viewing angle Backlight On Equipment: BM7 Field=2°	70	80	--	%	Note 5

4.1 Touch Panel

Item	Specification	Remark
Light Transmission	>80%	ASTM D1003 Wavelength=550nm

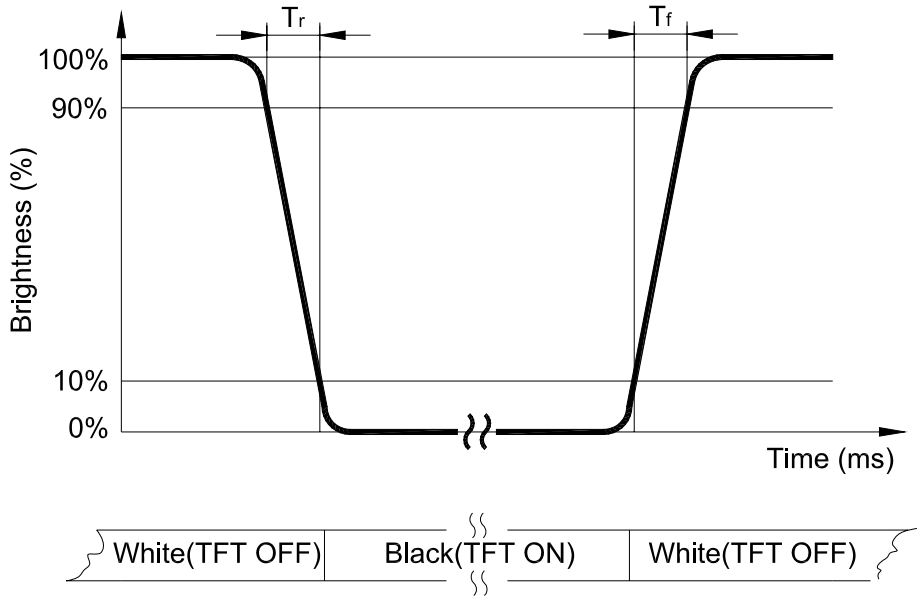
Note 1: The brightness test equipment setup
I_B=20mA, Field=2° (As measuring “black” image, field=2° is the best testing condition.)



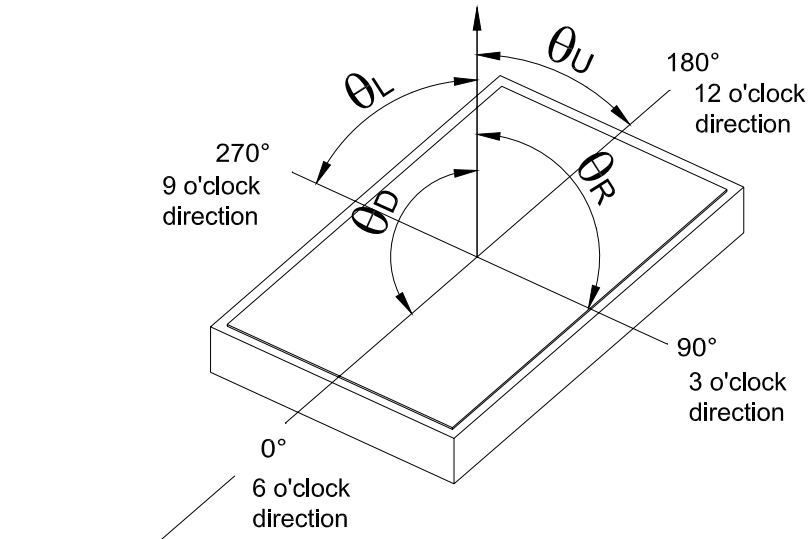
Note 2: Definition of contrast ratio (**C.R**)

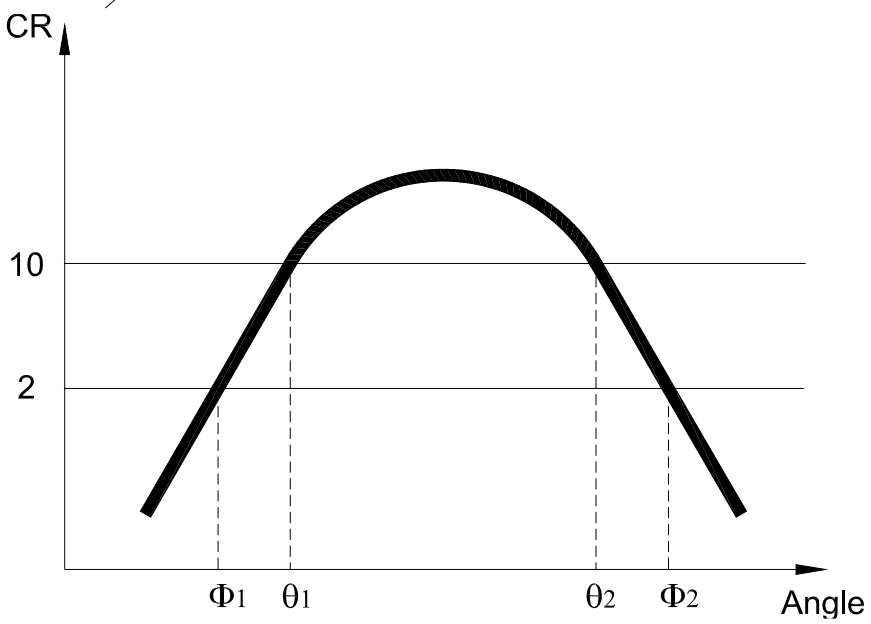
$$C.R = \frac{\text{Brightness When LCD is at “White” State}}{\text{Brightness When LCD is at “Black” State}}$$

Note 3: Definition of response time

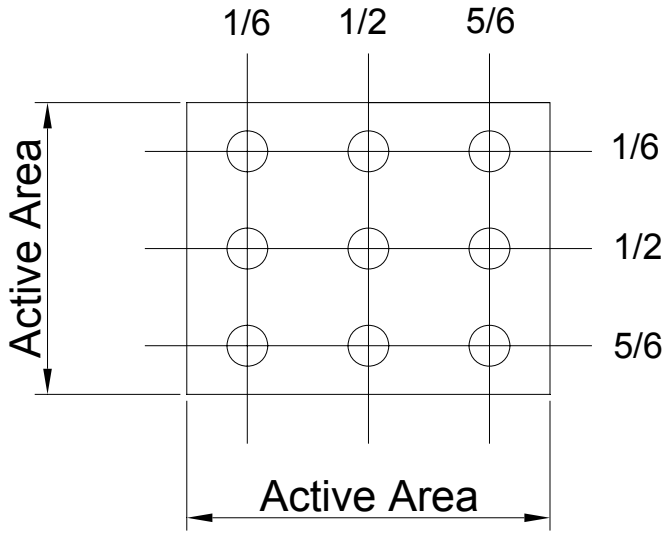


Note 4: Definition of viewing angle





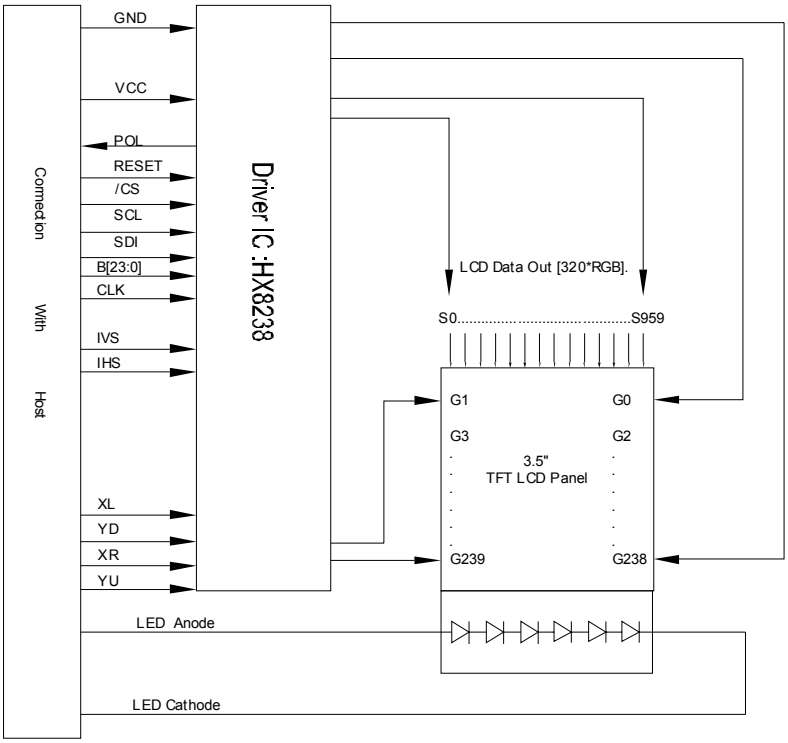
Note 5: Definition of uniformity (**Un**)



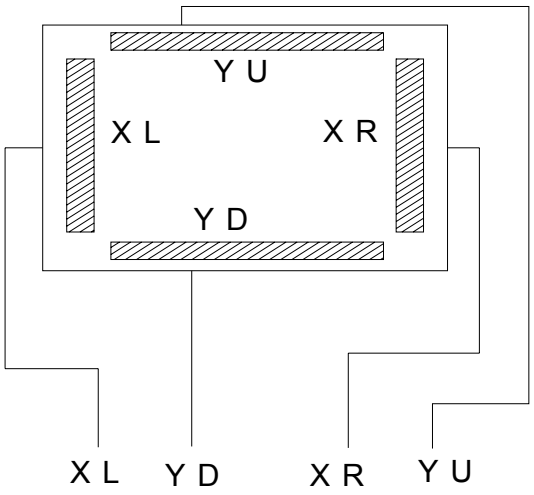
$$Un = \frac{Bmin}{Bmax} \times 100\%$$

5 Block Diagram

5.1 TFT-LCD Module



5.2 Touch Screen Panel



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	XR	Touch Panel Glass Terminal	Input	
7	YD	Touch Panel Film Terminal	Input	
8	XL	Touch Panel Glass Terminal	Input	
9	YU	Touch Panel Film Terminal	Input	
10	GND	Ground	Input	
11	NC	No Connection	--	
12	NC	No Connection	--	
13	POL	Vcom Generate Signal	Output	
14	/RESET	System Reset	Input	
15	/CS	Chip Select	Input	
16	SCL	Serial Port Clock	Input	
17	SDI	Serial Data Input	Input	
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	NC	No Connection	--	
46	NC	No Connection	--	
47	VCC	Vdigital	Input	
48	VCC	Vdigital	Input	
49	NC	No Connection	--	
50	NC	No Connection	--	
51	NC	No Connection	--	
52	NC	No Connection	--	
53	NC	No Connection	--	
54	NC	No Connection	--	
55	NC	No Connection	--	
56	NC	No Connection	--	
57	NC	No Connection	--	
58	DEN	Data Enabling Signal	Input	
59	GND	Ground	Input	
60	GND	Ground	Input	

7 DC Characteristics

Unless otherwise specified, Voltage Referenced to Vss, VDDIO=2.2V, Ta=25℃

Symbol	parameter	Test Condition	Min.	Typ.	Max.	Unit	Note
V_{DD}	System power supply ins of the logic block	Recommend Operating Voltage Possible Operating Voltage	1.8	--	2.5	V	--
V_{DDIO}	Power supply pin of IO pin	Recommend Operating Voltage Possible Operating Voltage	1.4	--	3.6	V	--
V_{ci}	Booster Reference Supply Voltage Range	Recommend Operating Voltage Possible Operating Voltage	2.5 or VDDIO	--	3.6	V	--
I_{sleep}	Sleep mode current	--	--	50	--	μA	--
L_{dp}	Operating mode current	100pF loading at Source output	--	4.0	6	mA	--
V_{CIM}	Negative V_{ci} Output Voltage	No panel loading	VCI	--	--	V	--
V_{CIX2}	V_{CIX2} primary booster efficiency	No panel loading,ITO for V_{CIX2}, V_{ci} and V_{Chs} =10Ohm	83	90	--	%	Note1
V_{GH}	Gate driver High Voltage Booster efficiency	No panel loading:4xbooster; ITO for C_{YP}, C_{YN}, V_{CIX2}, V_{ci} and V_{CHS} =10Ohm	84	89.5	--	%	Note 2
		No panel loading:5xbooster; ITO for C_{YP}, C_{YN}, V_{CIX2}, V_{ci} and V_{CHS} =10Ohm	80	88.5	--	%	
		No panel loading:6xbooster; ITO for C_{YP}, C_{YN}, V_{CIX2}, V_{ci} and V_{CHS} =10Ohm	72	80	--	%	
V_{GL}	Gate driver Low Output Voltage	--	V_{GH}	--	-5.1	V	--
V_{COMH}	VCOM High Output Voltage	--	--	--	5.54	V	--
V_{COML}	VCOM Low Output Voltage	--	--	--	V_{CIM} +0.5	mV	--
V_{COMA}	VCOM Amplitude	--	--	--	6	V	--
V_{LCD63}	V_{LCD63} Output Voltage	--	--	--	5.57	V	--
$\triangle V_{LCD63}$	Max、Source Voltage Variation	--	-2	--	2	%	--
V_{OH1}	Logic High Output Voltage	I out=-100μA	0.9* V_{DDIO}	--	V_{DD}	V	--
V_{VD}	Source Output Voltage Deviation	--	--	±20	--	mV	--

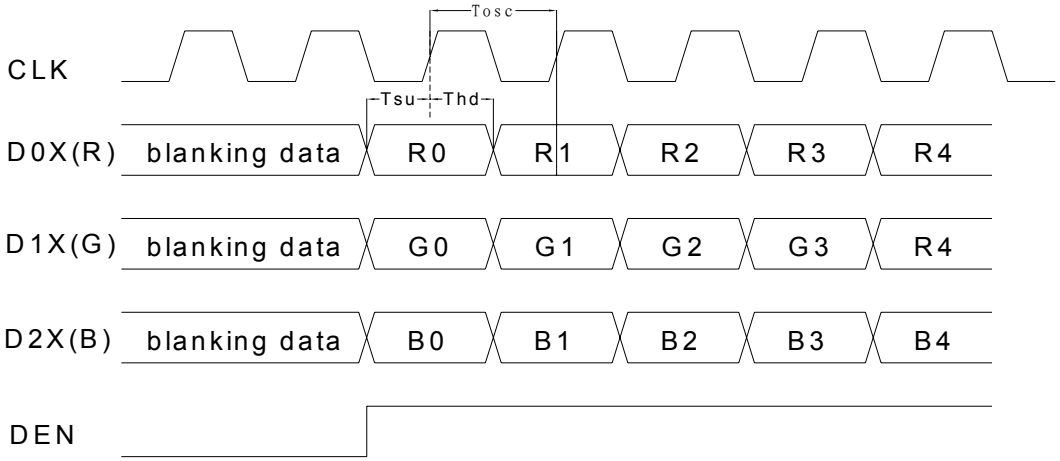
V_{OS}	Source Output Voltage Offset	--	--	--	±30	mV	--
V_{OL1}	Logic Low Output Voltage	I out=-100μA	0	--	0.1* V_{DDIO}	V	--
V_{IH1}	Logic High Input Voltage	--	0.8* V_{DDIO}	--	V_{DDIO}	V	--
V_{iL1}	Logic Low Input Voltage	--	0	--	0.2*V_{DDIO}	V	--
I_{OH}	Logic High Output Current Source	V OUT=VDD-0.4	50	--	--	μA	--
I_{OL}	Logic Low Output Current Drain	V OUT=0.4	--	--	-50	μA	--
I_{Oz}	Logic Output Tri-state Current Drain Source	--	-1	--	1	μA	--
$I_{IL/IH}$	Logic Input Current	--	-1	--	1	μA	--
C_{IN}	Logic pins Input Capacitance	--	--	5	7.5	pF	--
R_{SON}	Source drivers output resistance	--	--	1	--	KΩ	--
R_{GON}	Gate drivers output resistance	--	--	500	--	Ω	--
R_{CON}	VCOM output resistance	--	--	200	--	Ω	--

NOTE1: V_{CIX2} efficiency= V_{CIX2} /(2x V_{ci})x100%
NOTE1: V_{GH} efficiency= V_{GH} /(V_{ci} x n) x100%(when n=booster factor)

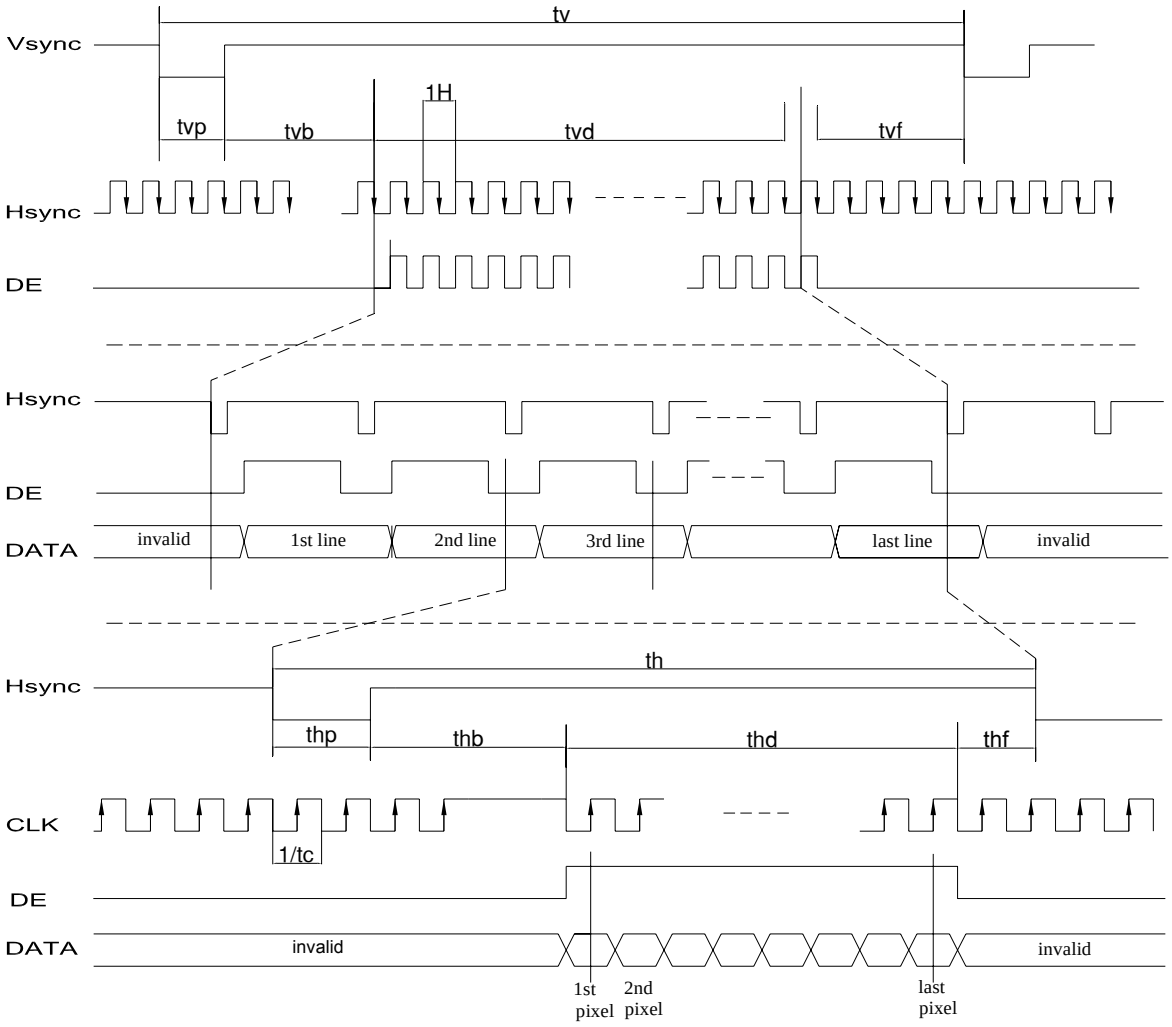
8 AC Characteristics

Signal	Item	Symbol	Min	Typ	Max	Unit
Dclk	Frequency	Dclk	-	6.4	-	MHZ
	Dclk-Period	Tosc	-	156	-	ns
Data	Setup Time	TSU	12	-	-	ns
	Hold Time	THD	12	-	-	ns
Hsync	Period	Th	-	408	-	DCLK
	Pulse Width	Thp	-	30	-	DCLK
	Back-Porch	Thb	-	38	-	DCLK
	Display Period	Thd	-	320	-	DCLK
	Front-Porch	Thf	-	20	-	DCLK
Vsync	Period	Tv	-	270	-	TH
	Pulse Width	Tvp	-	3	-	TH
	Back-Porch	Tvb	-	15	-	TH
	Display Period	Tvd	-	240	-	TH
	Front-Porch	Tvf	-	12	-	TH

Digital Parallel RGB



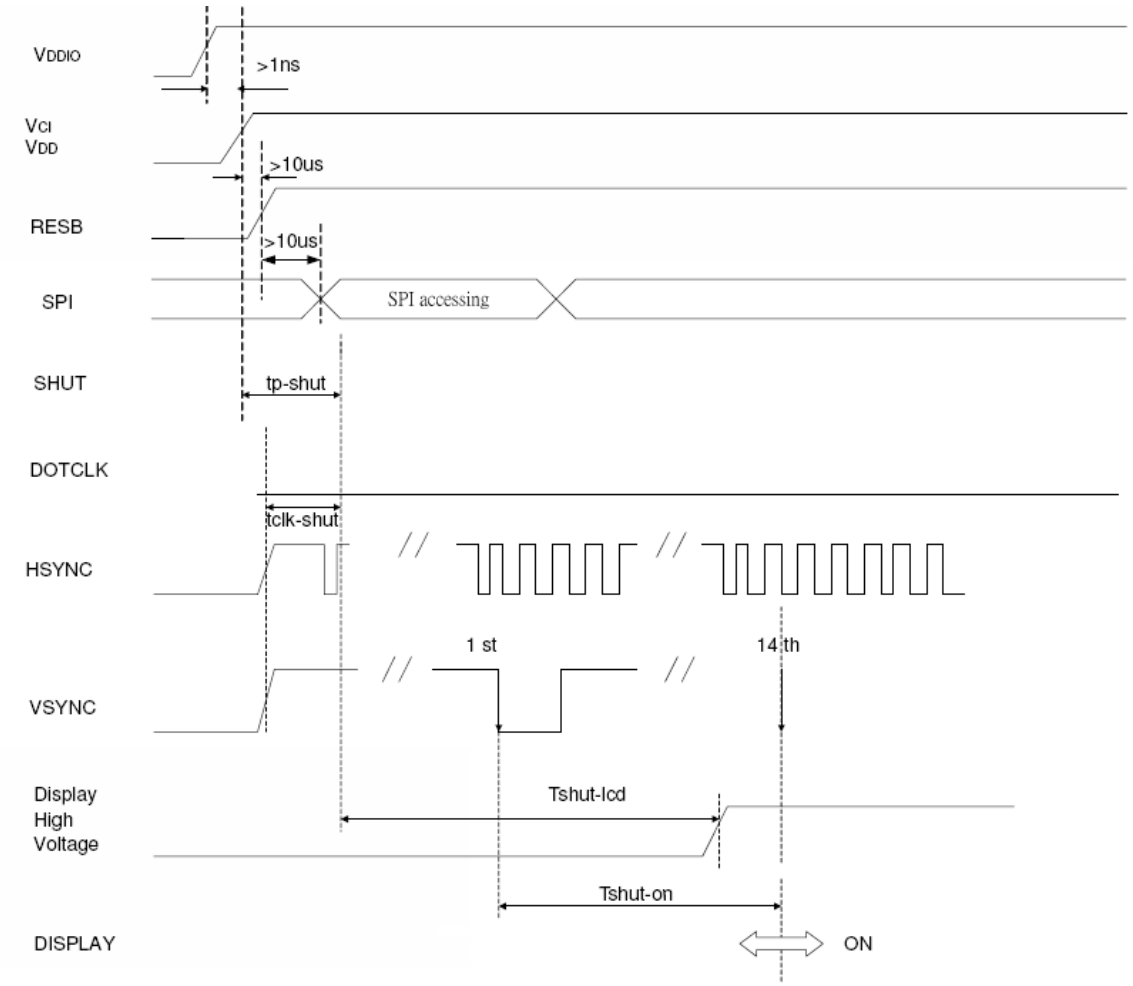
Input Timing



8.1 Power up sequence

Characteristics	Symbol	Min.	Typ.	Max.	Unit
VDD/VDDIO on to falling edge of SHUT	Tp-shut	1	--	--	us
DOTCLK	Tclk-shut	1	--	--	clk
Falling edge of SHUT to LCD power on	Tshut-lcd	--	--	128	ms
Falling edge of SHUT to display start -1 line:408clk -1frame:262line -DOTCLK=6.5MHz	Tshut-on	--	--	14	KHz
		--	166	232.4	ms

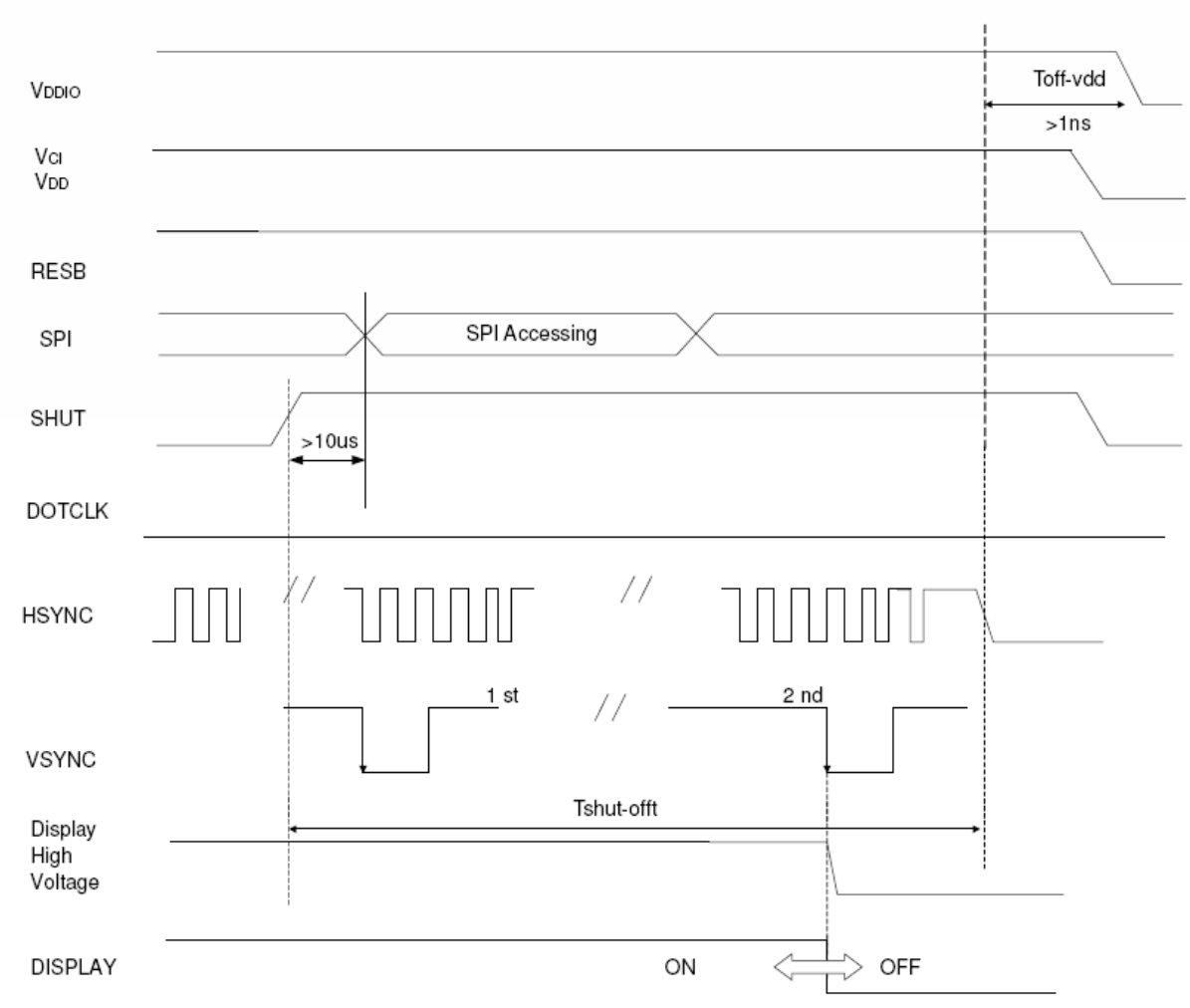
Note: It is necessary to input DOTCLK before the falling edge of SHUT
Display starts at 10th falling edge of VSTNC after the falling edge of SHUT.



8.2 Power down sequence

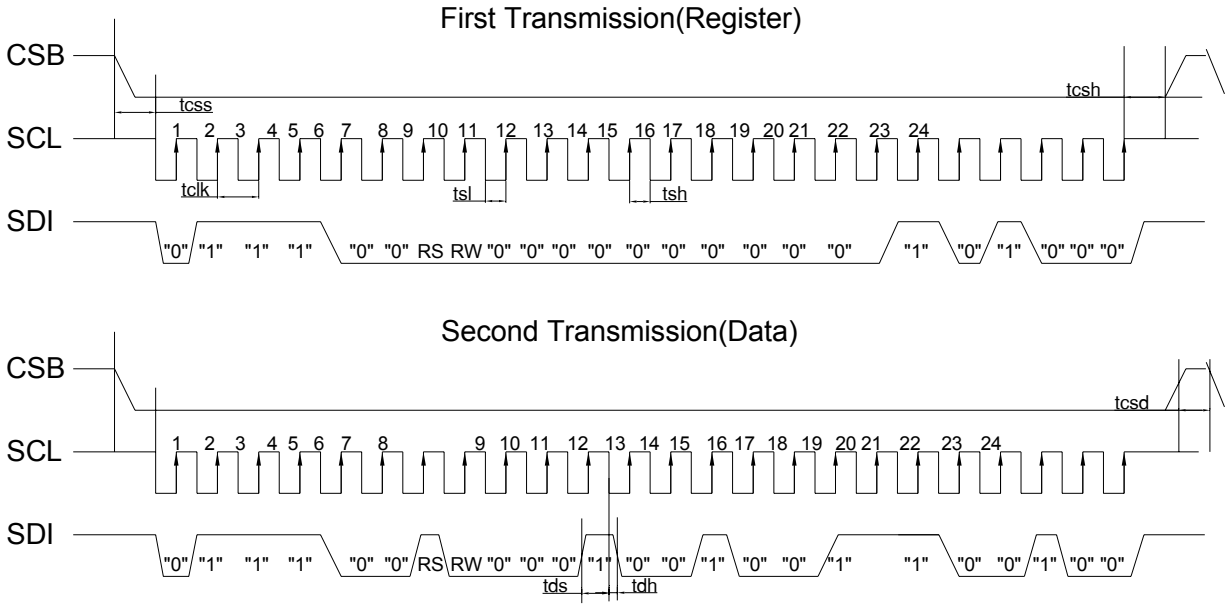
Characteristics	Symbol	Min.	Typ.	Max.	Unit
Rising edge of SHUT to display off -1 line:408 clk -1frame:262 line -DOTCLK=6.5MHz	Tshut-off	2	--	--	frame
		33.4	--	--	ms
Falling edge of SHUT to LCD power on	Toff-vdd	1	--	--	us

Note: DOTCLK must be maintained at lease 2 frames after the rising edge of SHUT.
Display become off at the 2nd falling edge of VSTNC after the falling edge of SHUT.
If RESET signal is necessary for power down, provide it after the 2-frames-cycle of the SHUT period.



8.3 SPI timing characteristics

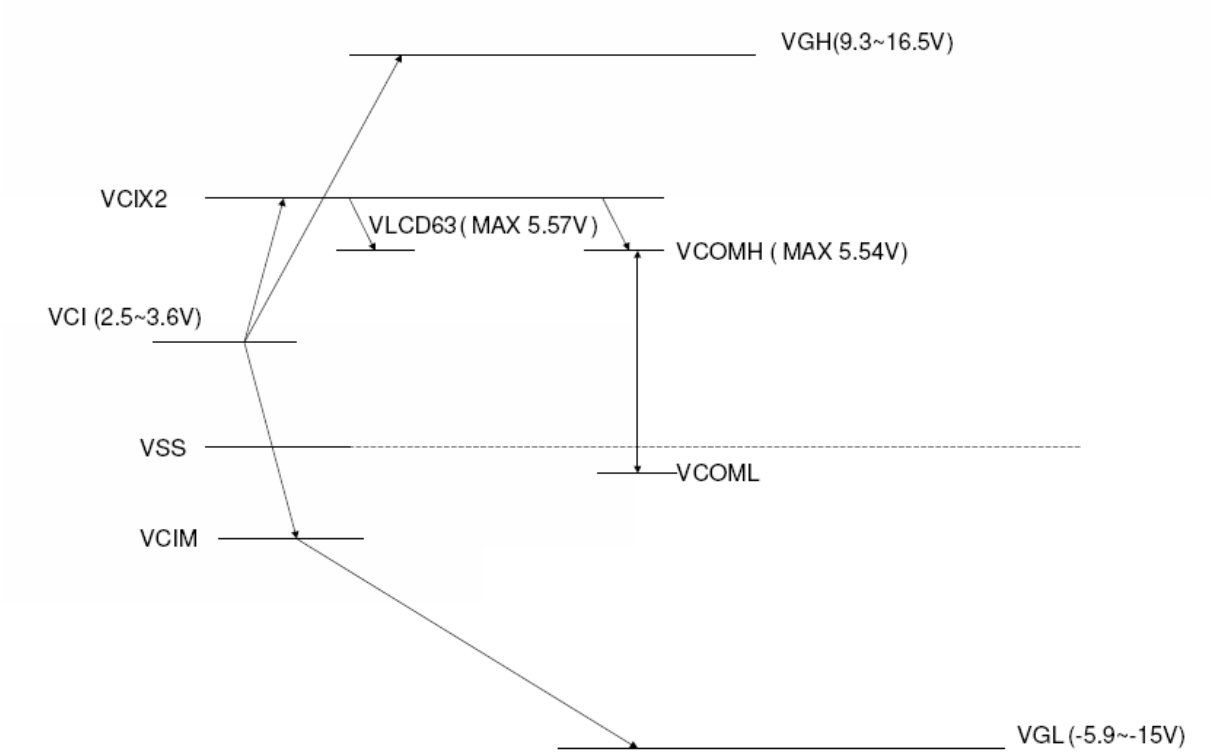
Characteristics	Symbol	Min	Typ	Max	Unit
Serial Clock Frequency	fclk	-	-	20	MHz
Serial Clock Cycle Time	tclk	50	-	-	ns
Clock Low Width	tsl	25	-	-	ns
Clock High Width	tsh	25	-	-	ns
Chip Select Setup Time	tcss	0	-	-	ns
Chip Select Hold Time	tcsh	10	-	-	ns
Chip Select High Delay Time	tcsd	20	-	-	ns
Data Setup Time	tds	5	-	-	ns
Data Hold Time	tdh	10	-	-	ns



Note:The example transmit "0x1264h" to register R28h.
SPID connected to VSS.

SPI interface timing diagram & transaction example

9 Output Voltage Relationship



Note: The above voltages level assumed 100% efficiency of the internal booster. There has no voltage drop due to resistance from ITO trace of panel.

10 Initial code

POWER

R0Dh=0x3229

R0Eh=0x3200

R1Eh=0x00D2

GAMMA

R30h=0x0500

R31h=0x0007

R32h=0x0000

R33h=0x0200

R34h=0x0405

R35h=0x0003

R36h=0x0707

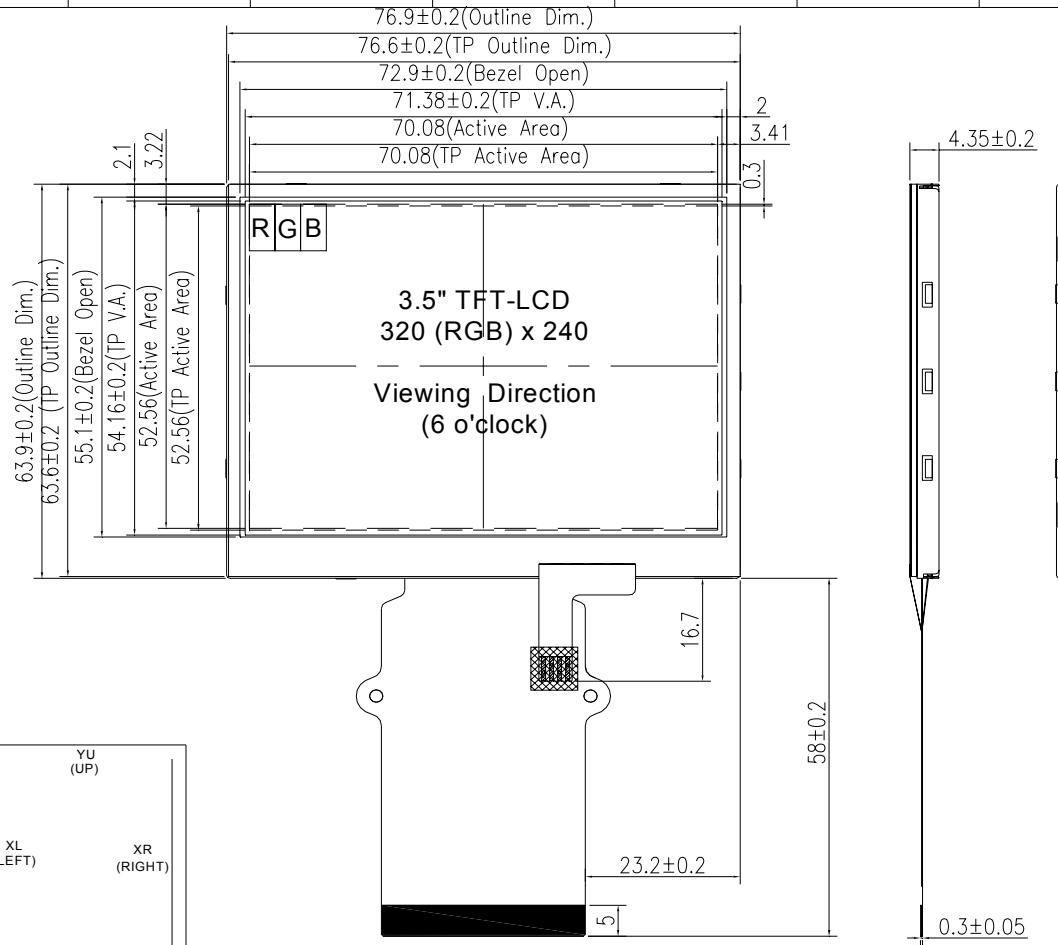
R37h=0x0100

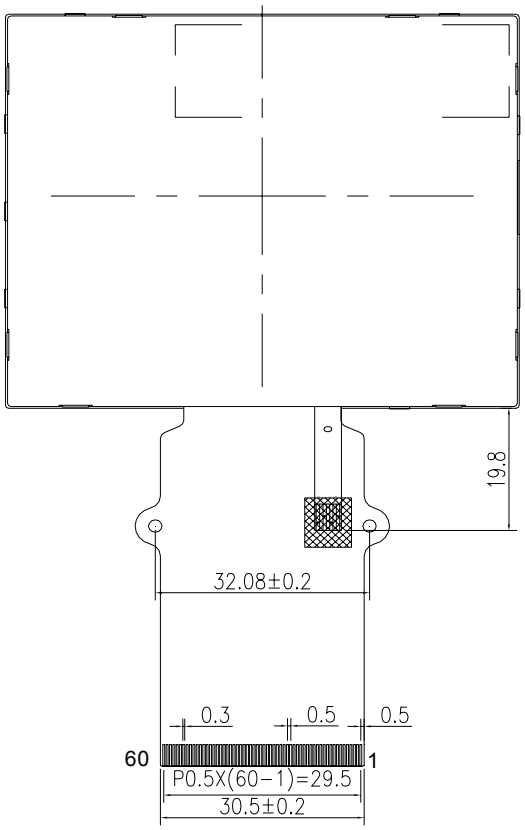
R3Ah=0x0403

R3Bh=0x0403

11 Outline Dimension

See next page.





1. 3.5" Transmissive, Normally-White TFT-LCD Module
2. Resolution: 320 (RGB) x 240
3. Driver IC: HX8238
4. Interface: Parallel RGB-24 bit+SPI
5. Backlight: 6LED in Serial @20mA
6. 4-wire analog resistive touch panel

TOUCH PANEL PIN ASSIGNMENT

1	XL	Glass Terminal
2	YD	Film Terminal
3	XR	Glass Terminal
4	YU	Film Terminal

Customer's Approval	
Customer	
Date	

FPC Pin Asignment

NO.	SIGNAL
1,2	LED_Cothode
3,4	LED_Anode
5	GND
6	XR
7	YD
8	XL
9	YU
10	GND
11	NC
12	NC
13	POL
14	/RESET
15	/CS
16	SCL
17	SDI
18	DATA0
19	DATA1
20	DATA2
21	DATA3
22	DATA4
23	DATA5
24	DATA6
25	DATA7
26	DATA8
27	DATA9
28	DATA10
29	DATA11
30	DATA12
31	DATA13
32	DATA14
33	DATA15
34	DATA16
35	DATA17
36	DATA18
37	DATA19
38	DATA20
39	DATA21
40	DATA22
41	DATA23
42	IHS
43	IVS
44	CLK
45	NC
46	NC
47	VCC
48	VCC
49	NC
50	NC
51	NC
52	NC
53	NC
54	NC
55	NC
56	NC
57	NC
58	DEN
59	GND
60	GND

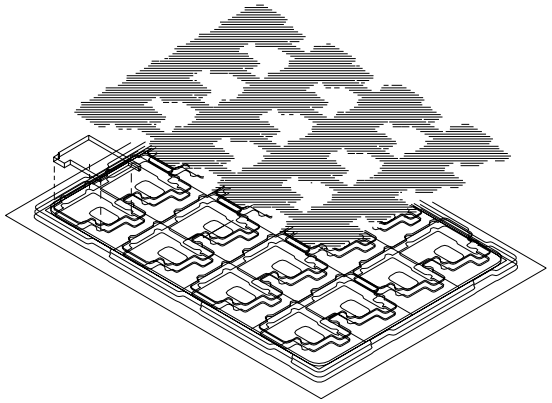
REV	Date	Description	General Tolarence	
			0 < X ≤ 4	± 0.1
			4 < X ≤ 16	± 0.15
			16 < X ≤ 64	± 0.2
			64 < X ≤ 256	± 0.25

Wanxin Image Inc.

Rev.	1.0	Scale	1/1	Sheet	1/1	Unit	mm	Date	2007-05-30
Design		Check		Approve		Model No.		WXCAT35-TG3#001	
Li xiu kai						Doc No.		WXCAT35-TG3#001	

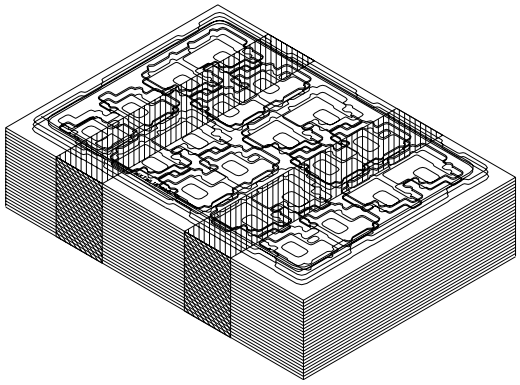
12 Package

1



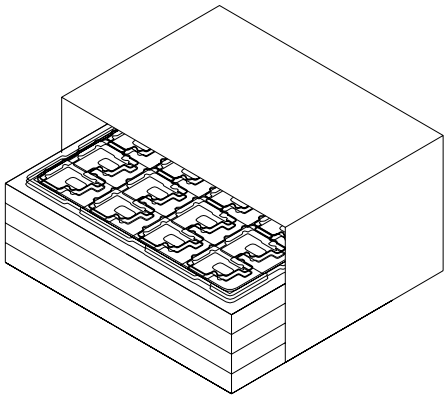
8 pcs per tray + 1 cover (EPE)

2



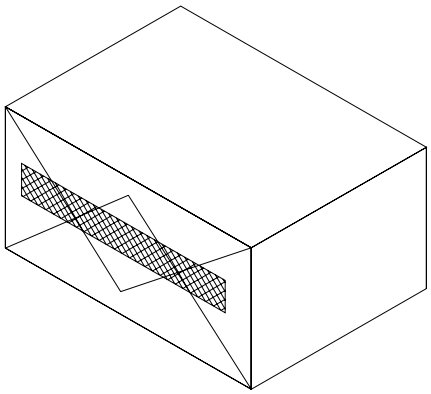
25 trays + 1 dummy tray = 200 pcs
Packing 14 trays with sealing tape

3



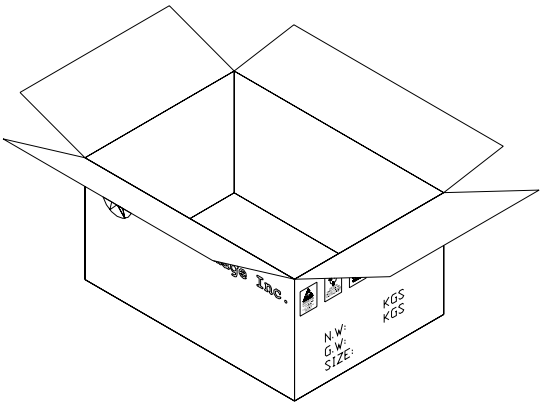
Putting trays into anti-electrostatic bag

4



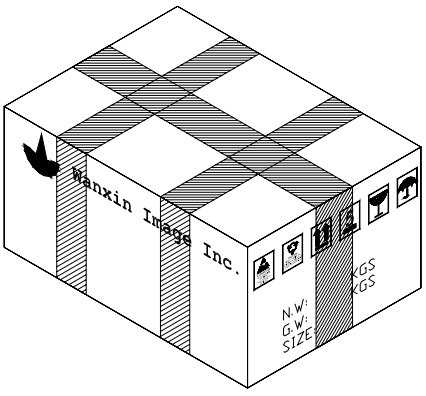
Packing bag

5



Putting bag into carton
Protected by 6 pieces of cushion EPE sheet

6



Packing carton with sealing tape
Carton outline size: 507×368×228 (mm)

13 Precautions

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

13.1 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. It might damage the touch panel surface permanently. 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.

(j) Do not lift the FPC of Touch Panel.

13.2 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.

13.3 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.

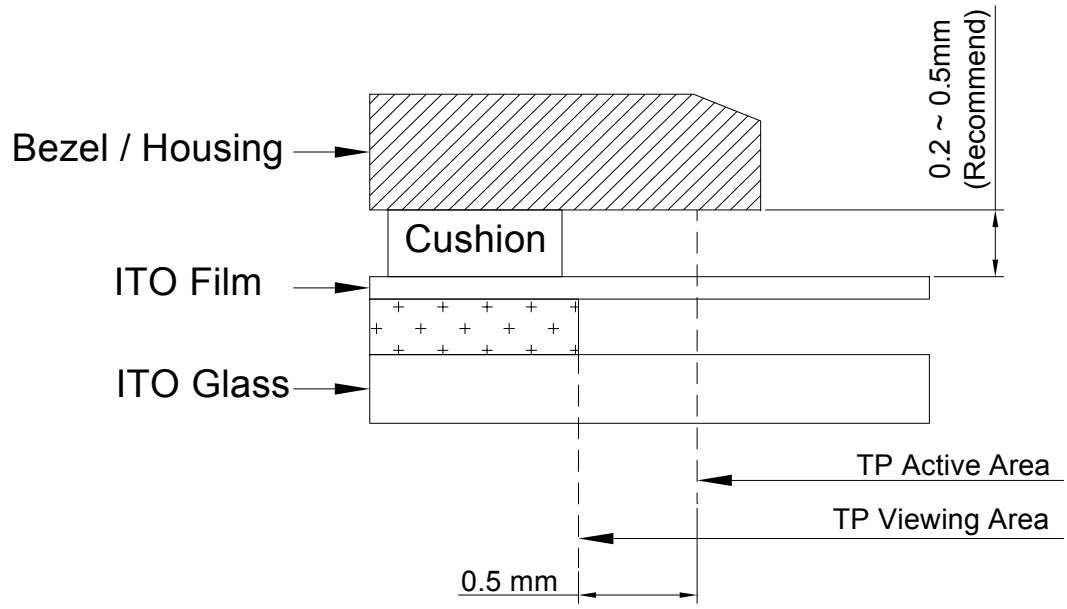
13.4 Touch Panel Mounting Notes

(a) If a cushion is used between bezel/housing and film must be choose as free as enough to absorb the expansion and contraction to avoid the distortion of film.

(b) The cushion must be placed out of the Viewing Area.

(c) Bezel/Housing edge must be posited between Key Area and Viewing Area. The edge enters the Key Area may cause unexpected input if the gap is too narrow or foreign particles like dusts exist between Bezel/Housing and ITO film.

(d) Mounting example:



The corner part has conductivity. Do not touch any metal part after mounting.

13.5 Others

(e) If the liquid crystal leaks from the panel, it should be kept away from the eyes or mouth.

(f) For the fragility of polarizer, it is recommended to attach a transparent protective plate over the display surface.

(g) It is recommended to peel off the protection film on the polarizer slowly so that the electrostatic charge can be minimized.