



深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAYTECH. CO, TD.

TFT-LCD Module Specification

Module NO.: TST035HVSI-41P

Version: V1.0

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

For Customer' s Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

Version No.	Date	Content	Remark
V1.0	2018-6-23	Initial Release	

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1 General Characteristics

ITEM	Specification	Unit
LCD Type	a-Si TFT, Transmissive, Normally white, TN	-
LCD Size	3.5	inch
Resolution (W x H)	320 x (RGB) x 480	pixel
LCM (W x H x D)	54.48(H) x 84.71(V) x 3.5(D)	mm
Active Area (W x H)	48.96 (W) x 73.44 (H)	mm
Dot Pitch (W x H)	0.153 x 0.153	mm
Viewing Direction	6 o'clock	-
Gray Scale Inversion Direction	12 o'clock	-
Color Depth	65K/262K	-
Pixel Arrangement	RGB-stripe	-
Backlight Type	6 LEDs, 120mA 3.2V	-
Surface Luminance	Typ 250	cd/m ²
Surface Treatment	Anti-Glare	-
Driver IC	ILI9488	-
Interface Type	MCU / RGB	-
Input Voltage	2.8	V
With/Without TP	With RTP	-
Weight	TBD	g

Note 1: RoHS compliant

Note 2: LCM weight tolerance: ± 5%.

3 Interface description

PIN NO.	Symbol	Description
1	XR	The touch panel X Right pin
2	YD	The touch panel Y Down pin
3	XL	The touch panel X Left pin
4	YU	The touch panel Y Up pin
5-7	IM0-IM2	Select Interface mode
8	RESET	Chip reset pin(Low Active),
9	VS	Frame synchronizing signal for RGB interface operation
10	HS	Line synchronizing signal for RGB interface operation
11	DCLK	Dot clock signal for RGB interface operation
12	DE	Data enable signal for RGB interface operation
13-30	DB17-DB0	Data bus
31	DIN/SDA	Serial in/out signal
32	RDX	Serves as a read signal
33	WR/SCL	MCU interface: WRX pin,serves as a write signal SPI interface:SCL pin as Serial Clock when operates in the serial interface
34	D/CX	Data/Command selection pin Low:Command High:Parameter
35	CSX	Chip select input signal
36	VDD	Power supply
37	GND	System Ground. (0V)
38	LEDK	Backlight Cathode input pin.
39	LEDA	Backlight anode input pin.

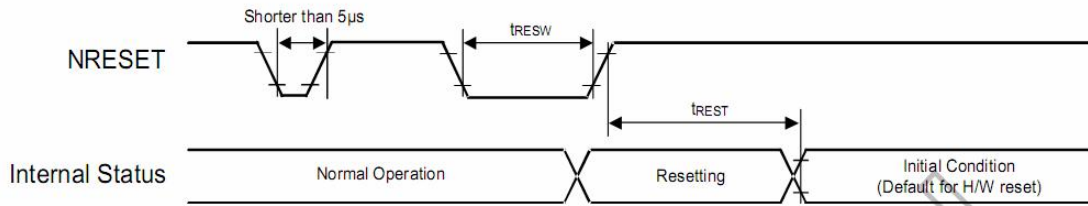
Table: Interface select

IM2	IM1	IM0	Interface	Data pin
0	1	0	MCU16-bit	DB[15:0],WR,RD,DCX,CS
0	1	1	MCU8-bit	DB[7:0], WR,RD,DCX,CS
1	0	1	3SPI+RGB	DB[15:0],SDA, SCL,CS
1	1	1	4SPI+RGB	DB[15:0],SDA, SCL, DCX, CS

Note: “0”connect to GND; “1”connect to IOVCC.

4 LCM Interface Timing

4.1 Reset Timing

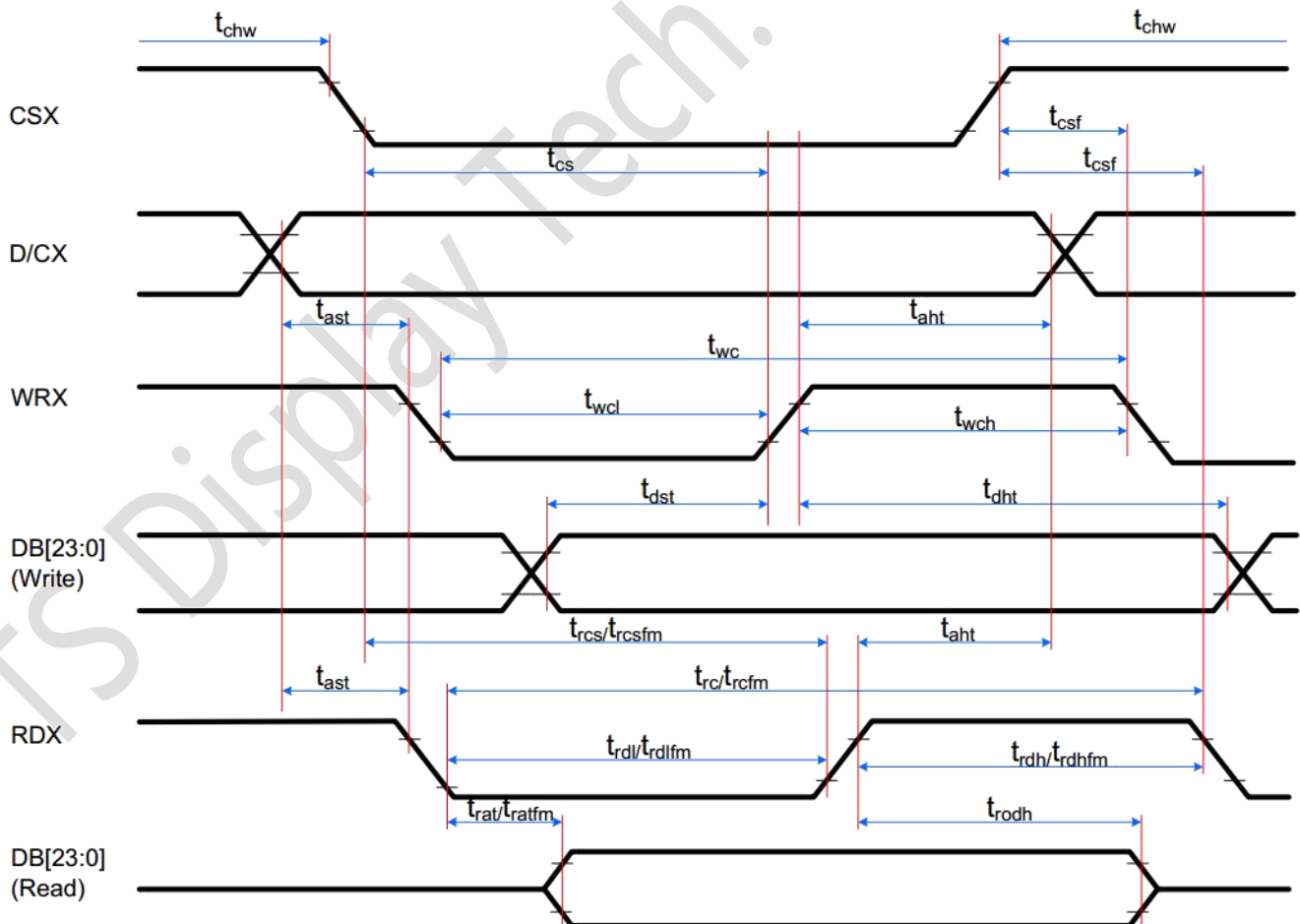


Signal	Symbol	Parameter	Min	Max	Unit
NRESET	t_{RESW}	Reset low pulse width	10	-	us
	t_{REST}	Reset complete time	5 (note 1)	-	ms
			120(note 2)	-	ms

Note: (1) When reset applied during SLPIN mode;

(2) When reset applied during SLPOUT mode.

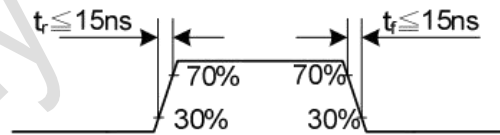
4.2 MCU Read/Write Timing



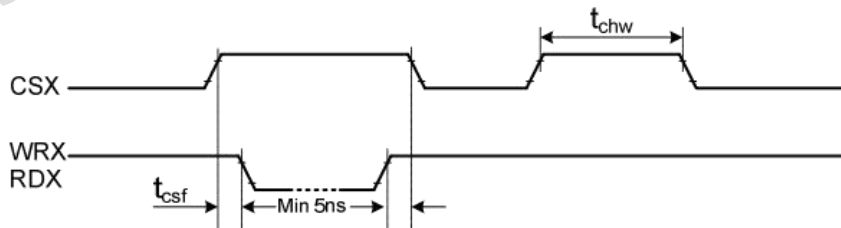
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	-
	that	Address hold time (Write/Read)	0	-	ns	-
CSX	tchw	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time (Write)	15	-	ns	-
	trcs	Chip Select setup time (Read ID)	45	-	ns	-
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	-
	tcsf	Chip Select Wait time (Write/Read)	0	-	ns	-
WRX	twc	Write cycle	40	-	ns	-
	twrh	Write Control pulse H duration	15	-	ns	-
	twrl	Write Control pulse L duration	15	-	ns	-
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	When read from Frame Memory
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	When read ID data
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
DB [23:0], DB [17:0], DB [15:0], DB [8:0], DB [7:0]	tdst	Write data setup time	10	-	ns	For maximum, CL=30pF For minimum, CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

Notes:

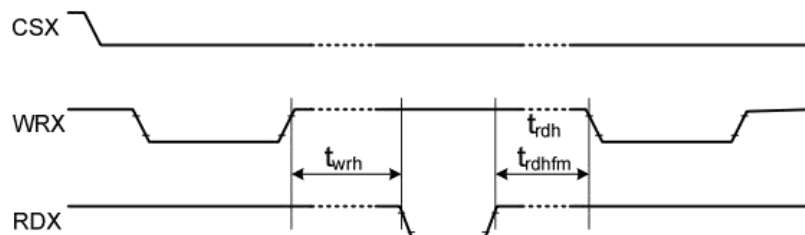
1. Ta = -30 to 70 °C, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V
2. Logic high and low levels are specified as 30% and 70% of IOVCC for input signals.
3. Input signal rising time and falling time:



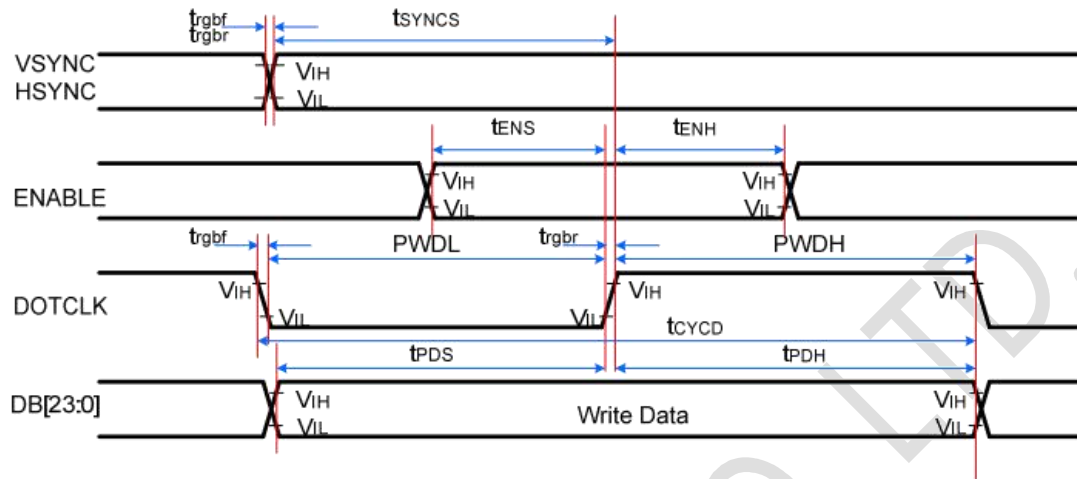
4. The CSX timing:



5. The Write to Read or the Read to Write timing:

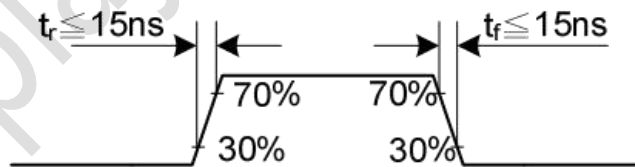


4.3 RGB Timing Characteristics

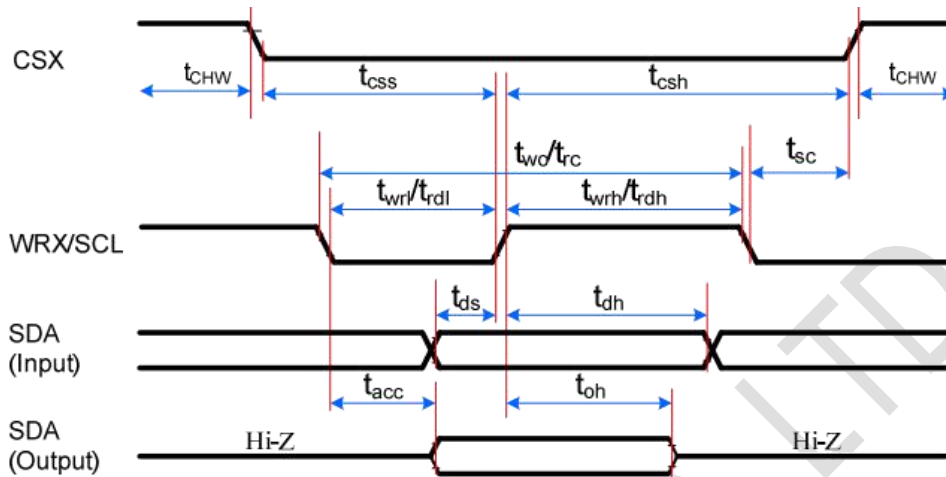


Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	16-/18-/24-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
DB [23:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	20	-	ns	
	PWDL	DOTCLK low-level period	20	-	ns	
	t_{CYCD}	DOTCLK cycle time	50	-	ns	
	t_{rgr}, t_{rgbr}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Note: $T_a = -30$ to 70 °C, $IOVCC = 1.65V$ to $3.3V$, $VCI = 2.5V$ to $3.3V$, $AGND = DGND = 0V$

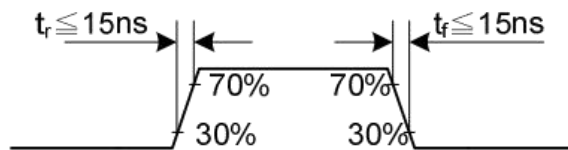


4.4 3-SPI Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
CSX	t _{sc}	SCL-CSX	15	-	ns	
	t _{chw}	CSX H Pulse Width	40	-	ns	
	t _{css}	Chip select time (Write)	60	-	ns	
	t _{csh}	Chip select hold time (Read)	65	-	ns	
SCL	t _{wc}	Serial Clock Cycle (Write)	66	-	ns	
	t _{wrh}	SCL H Pulse Width (Write)	15	-	ns	
	t _{wrl}	SCL L Pulse Width (Write)	15	-	ns	
	t _{rc}	Serial Clock Cycle (Read)	150	-	ns	
	t _{rdh}	SCL H Pulse Width (Read)	60	-	ns	
	t _{rdl}	SCL L Pulse Width (Read)	60	-	ns	
SDA (Input)	t _{ds}	Data setup time (Write)	10	-	ns	
	t _{dh}	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	t _{acc}	Access time (Read)	10	50	ns	For maximum CL=30pF
	t _{oh}	Output disable time (Read)	15	50	ns	For minimum CL=8pF

Note: Ta = -30 to 70 °C, IOVCC = 1.65V to 3.6V, VCI = 2.5V to 3.6V, AGND = DGND = 0V, T = 10+/-0.5ns



5 Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage (Analog)	VCC~GND	-0.3	3.3	V
Logic signal voltage(I/O)	IOVCC~GND	-0.3	3.3	V
Operating Temperature	TOP	-20	70	° C
Storage Temperature	TST	-30	80	° C
Humidity	RH	-	90%(Max 60° C)	RH

6 Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Analog operating voltage	VCC	2.5	2.8	3.3	V
Logic operating voltage	IOVCC	1.65	1.8	3.3	V
Input Current	IDD	-	TBD	-	mA
Input Voltage ' H ' level	VIH	0.7IOVCC	-	IOVCC	V
Input Voltage ' L ' level	VIL	-0.3	-	0.3IOVCC	
Output Voltage ' H ' level	VOH	0.8IOVCC	-	IOVCC	
Output Voltage ' L ' level	VOL	0	-	0.2IOVCC	

7 Backlight Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V _f	-	3.2	-	V
Current for LED backlight	I _f	-	120	-	mA
Power consumption	W _{bl}	-	384	-	mW
Uniformity	Avg	80	-	-	%
LED Life Time	-	30000	40000	-	Hrs

Note:

- 1.The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60%RH ±5 %.
2. The life time of LED will be reduced if LED is driven by high current, high ambient temperature and humidity conditions.
3. Typical operating life time is an estimated data.
4. Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded .Functional operation should be restricted to the conditions described under normal operating conditions.

8 LCD Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min	Typ	Max		
Response time (By Quick)	Tr+Tf	$\theta = 0^\circ$	-	20	40	ms	Note 5
Contrast ratio	CR	$\theta = 0^\circ$	-	500	-		Note 2,6
Viewing angle	Top	$CR \geq 10$	-	35	-	Deg.	Note 2,6,7
	Bottom	$CR \geq 10$	-	50	-		
	Left	$CR \geq 10$	-	60	-		
	Right	$CR \geq 10$	-	60	-		
Color chromaticity (CF only with ITO, light source is C light, CIE 1931)	Wx	$\theta = 0^\circ$	0.292	0.307	0.322		Note 3
	Wy		0.312	0.327	0.342		
	Rx		0.609	0.624	0.639		
	Ry		0.316	0.331	0.346		
	Gx		0.281	0.296	0.311		
	Gy		0.562	0.577	0.592		
	Bx		0.128	0.143	0.158		
By	0.094	0.109	0.124				
NTSC			57%	60%	-		Note 3
Cross talk	Ct		-	-	2%		Note 9
Transmittance	Trans		-	5.5%	-		Note 4

Note 1: Ambient temperature = 25°C.

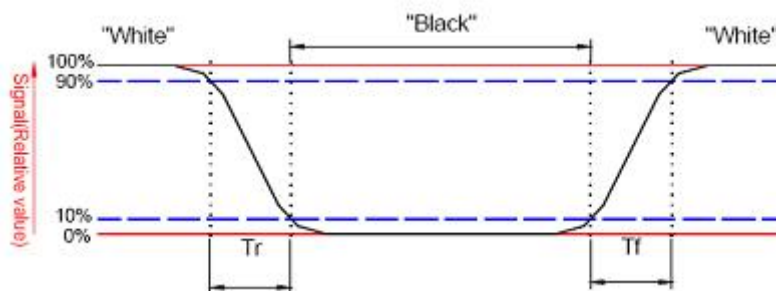
Note 2: To be measured with a viewing cone of 2° by Topcon luminance meter BM-5A.

Note 3: To be measured with Otsuta chromaticity meter LCF-2100M, CF only measure under C light simulation.

Note 4: CTC shipping status is cell without polarizer. Transmittance of Specification is cell with polarizer.
The tolerance of Transmittance is ±10%.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to “White” (falling time) and from “White” to “Black” (rising time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

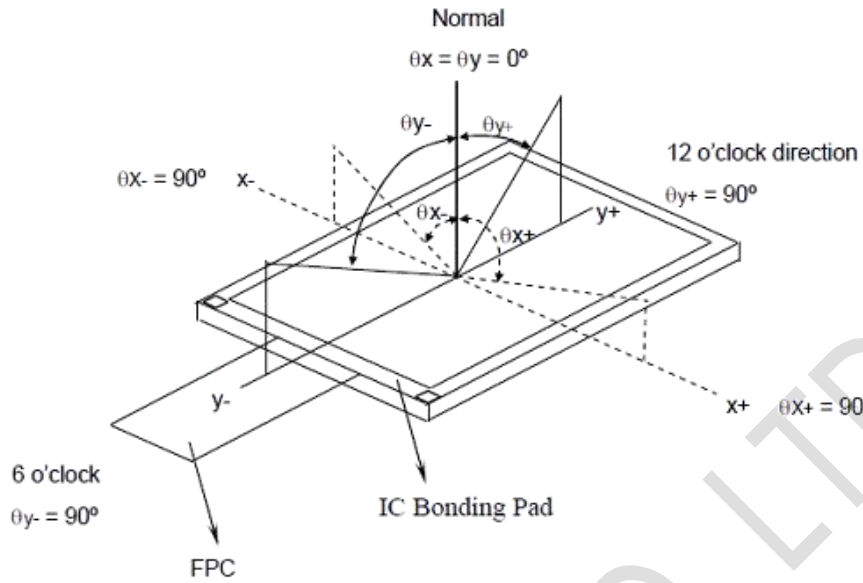


Note 6: Definition of contrast ratio:

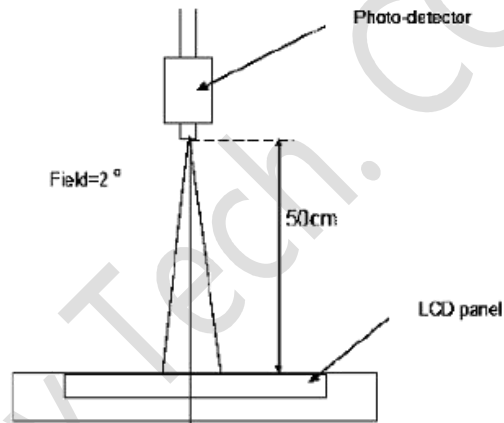
Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

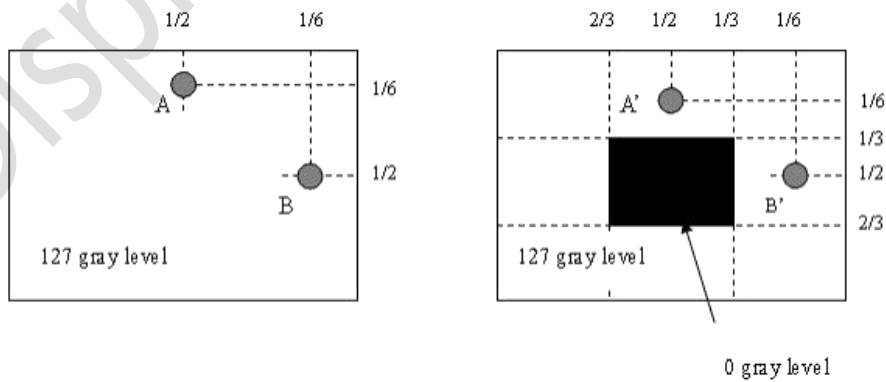
Note 7: Definition of viewing angle



Note 8: Optical characteristic measurement setup.



Note 9:



$|LA - LA'| / LA \times 100\% = 2\% \text{ max.}$, LA and LA' are brightness at location A and A'.

$|LB - LB'| / LB \times 100\% = 2\% \text{ max.}$, LB and LB' are brightness at location B and B'.

9 Touch Panel specifications

ITEM	VALUE			UNIT	REMARK
	Min	Typ	Max		
Linearity	-	-	1.5	%	Analog X and Y directions
Terminal Resistance	350	-	1050	Ω	x
	100	-	500		y
Insulation Resistance	20	-	-	M Ω	DC 25V
Voltage	-	5	-	V	DC
Transparency	78	-	-	%	-
Operation Force	70	-	120	g	-
Endurance	1,000,000	-	-	Touches	100g Operation Force
	-	-	30,000	Slides	
Surface Hardness	3	-	-	H	-

10 RELIABILITY TEST

NO.	TEST ITEM	TEST CONDITION	INSPECTION AFTER TEST
1	High Temperature Storage	80±2°C/96 hours	Inspection after 2~4 hours storage at room temperature and humidity. The condensation is not accepted. The sample shall be free from defects: 1. Air bubble in the LCD 2. Seal leak 3. Non-display 4. Missing segments 5. Glass crack
2	Low Temperature Storage	-30±2°C/96 hours	
3	High Temperature Operating	70±2°C/96 hours	
4	Low Temperature Operating	-20±2°C/96 hours	
5	Temperature Cycle	-30±2°C ~ 25~ 80± 2°C × 10 cycles (30 min.) (5min.) (30min.)	
6	Damp Proof Test	60°C ±5°C × 90%RH/96 hours	
7	Vibration Test	Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~150 Hz~10Hz 2 hours For each direction of X, Y, Z	
8	Shock Test	Half-sine, wave, 300m/s	
9	Packing Drop Test	Height: 80 cm 1 corner, concrete floor	
10	Electrostatic Discharge Test	C=150pF, R=330 Ω Air: ±8KV 150pF/330 Ω 30 times Contact: ±4KV,20 times	

11 Suggestions for using LCD modules

11.1 Handling of LCM

1. The LCD screen is made of glass. Don't give excessive external shock, or drop from a high place.
2. If the LCD screen is damaged and the liquid crystal leaks out, do not lick and swallow. When the liquid is attach to your hand, skin, cloth etc, wash it off by using soap and water thoroughly and immediately.
3. Don't apply excessive force on the surface of the LCM.
4. If the surface is contaminated, clean it with soft cloth. If the LCM is severely contaminated, use Isopropyl alcohol/Ethyl alcohol to clean. Other solvents may damage the polarizer. The following solvents is especially prohibited: water , ketone Aromatic solvents etc.
5. Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
6. Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
7. Don't disassemble the LCM.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD modules.
 - Tools required for assembling, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
9. Do not alter, modify or change the the shape of the tab on the metal frame.
10. Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
11. Do not damage or modify the pattern writing on the printed circuit board.
12. Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector
13. Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
14. Do not drop, bend or twist LCM.

11.2 Storage

1. Store in an ambient temperature of 5 to 45 C, and in a relative humidity of 40% to 60%. Don't expose to sunlight or fluorescent light.
2. Storage in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.

