



ASI-T-2201DA0EN/W

No	Item	Specification	Remark
1	Type	Transflective	--
2	Display Mode	Normally White	--
3	Pixel Element	a-Si TFT	--
4	Screen Size	2.2inch	--
5	Resolution	240(RGB) x320	--
6	Color Number	262K	--
7	Active Area	33.84(W) x 45.12(H) (mm)	--
8	Pixel Size	0.141 x 0.141 (μm)	--
9	Color Arrangement	RGB-stripe	--
10	Assembly Type	COG	--
11	Back Light	LED	--
12	Good Viewing Direction	6 o'clock	--
13	Gray Scale Inversion Direction	12 o'clock	--
14	Weight	TBD	--
15	Module Dimension	40.6 (W) x 56.6 (H) x 2.7 (D)	--
16	Panel Maker	TIANMA	--
17	TFT Driver IC	ILI9341	



RECORD OF REVISION

DATE	REV.	PAGE	SUMMARY
2023/11/27	2 (1)		Add QUALITY AND RELIABILITY , Please refer to 1
		P1-P20	Modify the Page number , Please refer to 1
		P19-P20	Add Quality and reliability , Please refer to 1

3. General specifications

3.1 General specifications

It is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses the amorphous silicon TFT as a switching devices. This model is composed of a Transflective type TFT-LCD Panel, a driver circuit and a back-light unit. The resolution of a 2.2" Main LCD contains 240 x 320 pixels, and can display up to 262K colors and is suitable for cell phone application.

3.2 Features

- High image quality a-Si TFT LCD module.
- 262K color number.
- RGB interface
 - a. 6-/16-/18-bit RGB interface

4. Mechanical data

No	Item	Specification	Remark
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5. Absolute maximum ratings

5.1 Electrical absolute maximum ratings

(1) TFT-LCD Panel Absolute Maximum Ratings

Ta=25°C GND=0V

Item	Symbol	Standard Value		Unit	Remark
		Min.	Max.		
Power voltage	VDD	-0.3	4.6	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) Back-Light Unit

Ta=25°C

Item	Symbol	Min.	Max.	Unit	Remark
Current	I _{LED}	--	25	mA	--

5.2 Environmental absolute maximum ratings

Item	Symbol	Min.	Max.	Unit	Remark
Operation temperature range	T _{op}	-20	70	°C	Ambient
Storage temperature range	T _{st}	-30	80	°C	Ambient

- (1) Corrosive gas environment is not acceptable.
- (2) TFT-LCD color will change slightly depending on environment temperature. This phenomenon is reversible.

6. Electrical characteristics

(1)TFT-LCD Module

Ta=25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply voltage	VDD	2.5	2.8	3.3	V	--
Logic Input voltage	V _{IH}	0.7VDD	--	VDD	V	--
	V _{IL}	0	--	0.3VDD	V	--
Logic Output voltage	V _{OH}	0.8VDD	--	VDD	V	--
	V _{OL}	0	--	0.2VDD	V	--

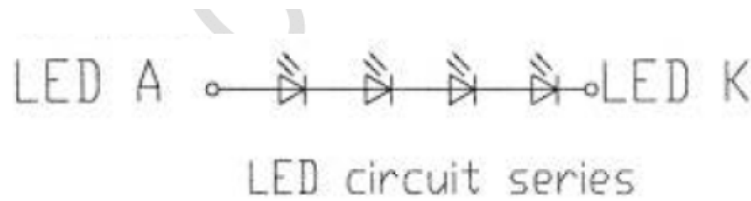
(2) Back-Light Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Voltage	V _{LED}	12	12.6	14.4	V	NOTE (1)
Current	I _{LED}	--	20	--25	mA	
Life Time	Lf	(20,000)	--	--	Hrs	NOTE (2)

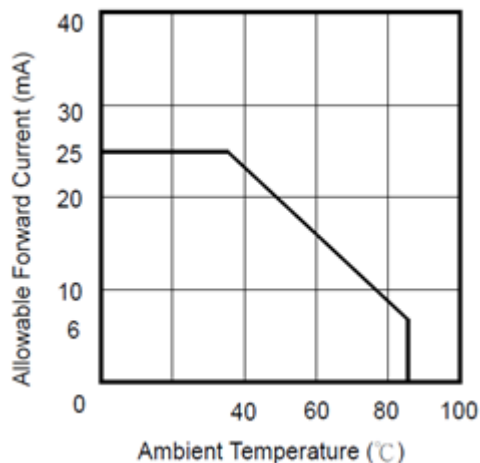
NOTE (1) : The LED is Parallel type.

NOTE (2) : The “LED life time” is defined as the module brightness decreases to 50% of original brightness that the ambient temperature is 25°C and I_{LED}=20mA. The LED lifetime could be decreased if operating I_{LED} is larger than 20mA.

NOTE (3) : Back-light circuit :



NOTE (4) : Current reduction rate of LED backlight is according to the graph indicated below :



7. Optical characteristics

7-1. Driving the backlight condition (Transmissive mode)

Ta=25°C, IB=20mA

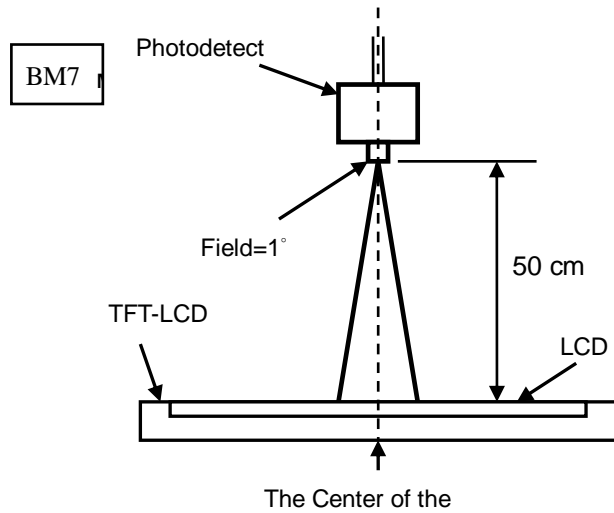
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness		B	θ=0° Normal viewing angle At the center of panel	80	90	--	cd/m ²	--
Contrast Ratio		C/R		100	120	--	--	--
Response Time		Tr + Tf		--	35	50	ms	--
Color chromatic	White	W _X		--	(0.273)	--	--	--
		W _Y	--	(0.296)	--			
Viewing Angle	Top	θ _T	C/R ≥ 10	38	48	--	Deg.	--
	Bottom	θ _B		35	45	--		
	Left	θ _L		30	40	--		
	Right	θ _R		40	45	--		
Uniformity		--	--	70	80	--	%	--
NTSC		--	--	45	50	--		

7-2. Not Driving the backlight condition (Reflective mode)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		C/R	θ=0°	7	10	--	--	--
Response Time		Tr + Tf	25°C	--	25	40	ms	--
Reflection ratio		--	--	4.8	5.5	--	%	--
Viewing Angle	Top	θ _T	C/R ≥ 2	60	70	--	Deg.	--
	Bottom	θ _B		60	70	--		
	Left	θ _L		60	70	--		
	Right	θ _R		60	70	--		
NTSC		--	--	5.5	7	--	%	--

Note 1: The brightness test equipment setup

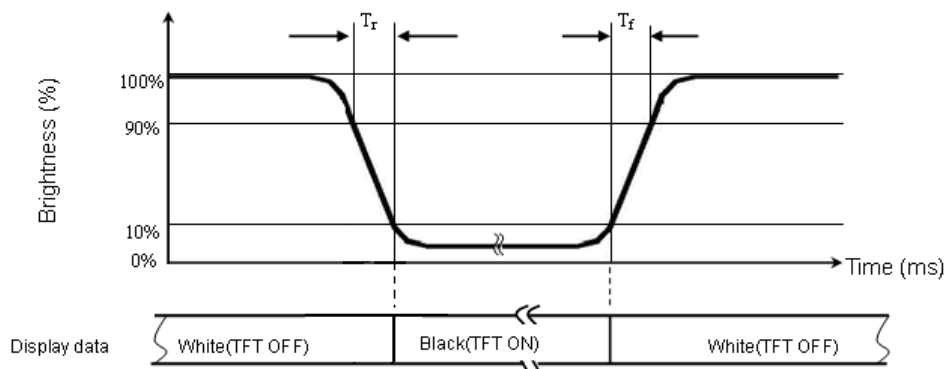
(As measuring "black" image, field=1°
Is the best testing condition.)



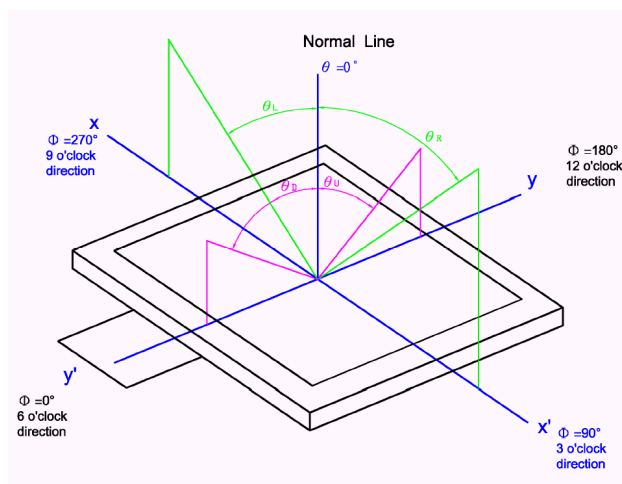
Note 2: Definition of contrast Ratio (C/R)

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

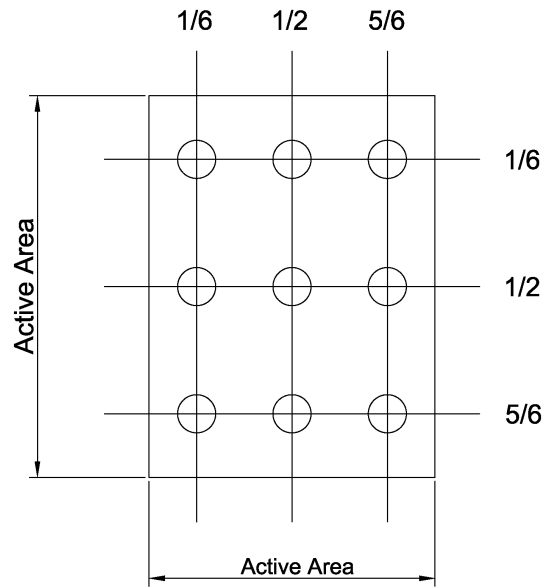
Note 3: Definition of response time



Note 4: Definition of viewing angle



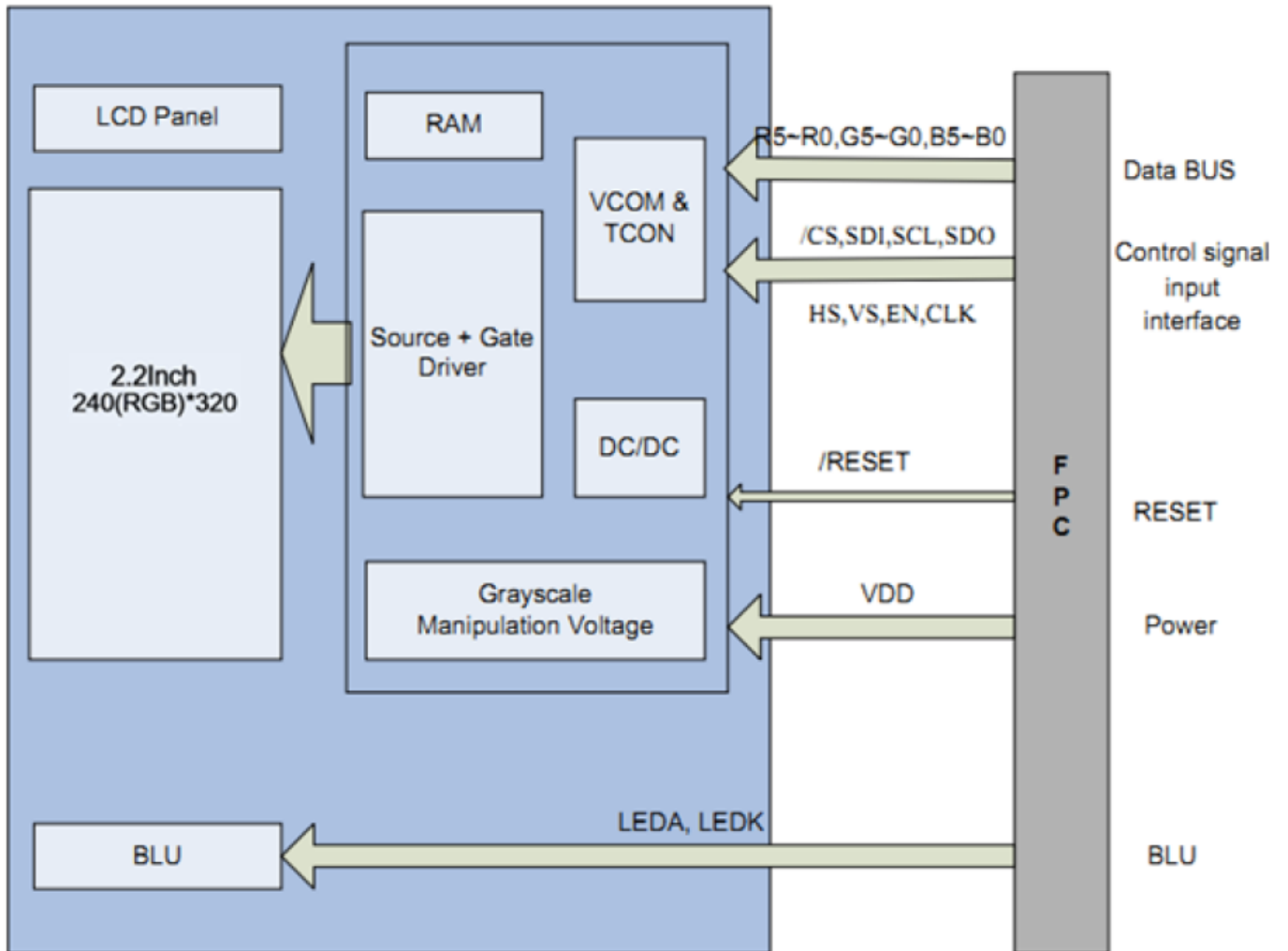
Note 5: Definition of uniformity (U_n)



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

9. Block diagram

9.1 TFT-LCD Module (Interface System Structure)



10. Input Terminal Pin Assignment

10.1 Input Signal & Power Supply

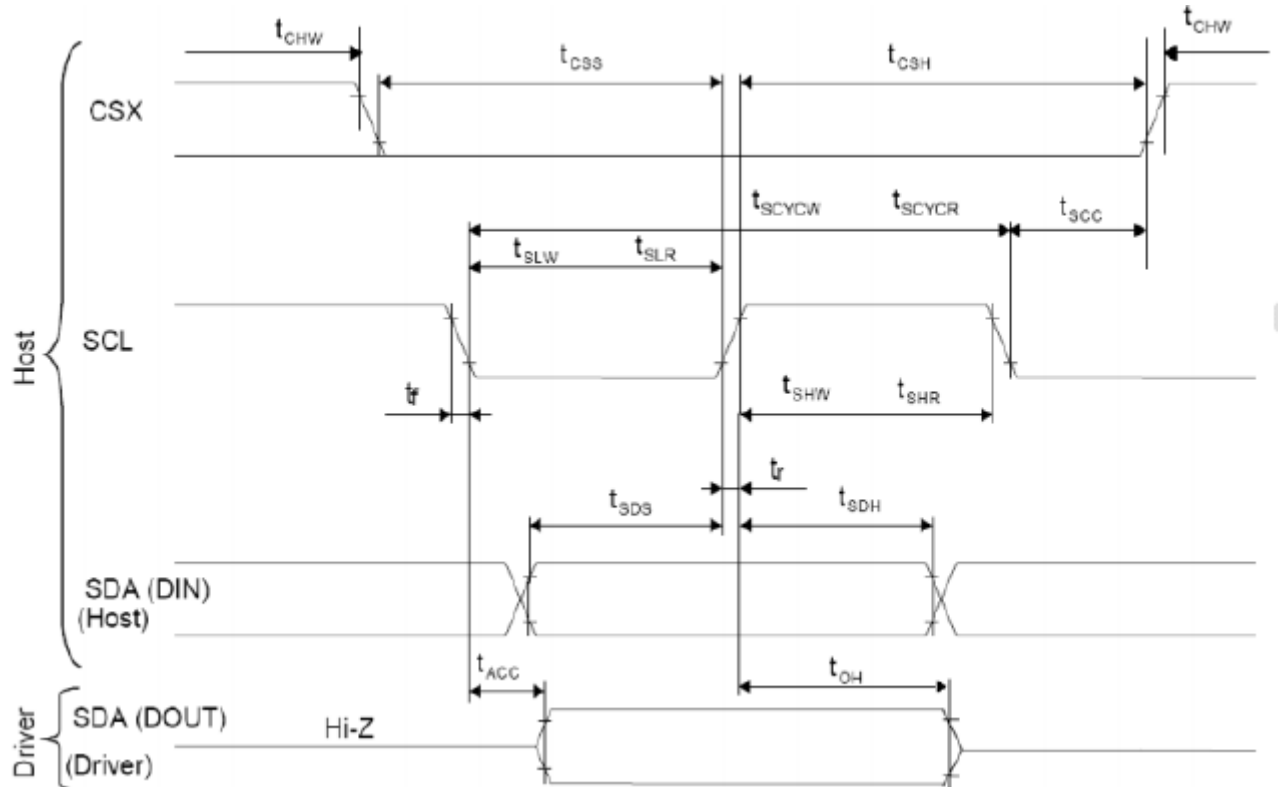
Pin no	Symbol	Description
1	VL1(LED+)	Power supply for LED(High voltage)
2	VL2(LED-)	Power supply for LED(Low voltage)
3	GND	Ground
4	VDD	Poewer supply of IC
5	GND	Ground
6	VSYNC	Vertical sync. signal
7	RESET	Reset Enable
8	GND	Ground
9	CS	SPI Chip select
10	SDO	SPI serial Data output
11	SDI	SPI serial Data input
12	GND	Ground
13	SCL	SPI serial interface clock
14	GND	Ground
15	B5	Blue data signal
16	B4	Blue data signal
17	B3	Blue data signal
18	B2	Blue data signal
19	B1	Blue data signal
20	B0	Blue data signal
21	ENABLE	Data Enable signal
22	HSYNC	Horizontal sync signal
23	GND	Ground
24	DCLK	Data sampling clock
25	GND	Ground
26	G5	Green data signal
27	G4	Green data signal
28	G3	Green data signal
29	G2	Green data signal
30	G1	Green data signal
31	G0	Green data signal
32	GND	Ground
33	R5	Red data signal



Pin no	Symbol	Description
34	R4	Red data signal
35	R3	Red data signal
36	R2	Red data signal
37	R1	Red data signal
38	R0	Red data signal
39	GND	Ground

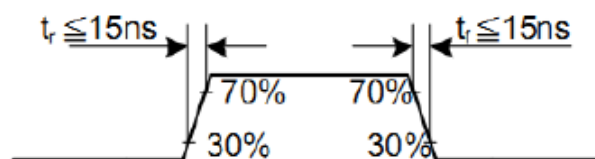
11. Interface Specifications

11.1 Parallel Interface Timing Characteristics (8080-series MCU)

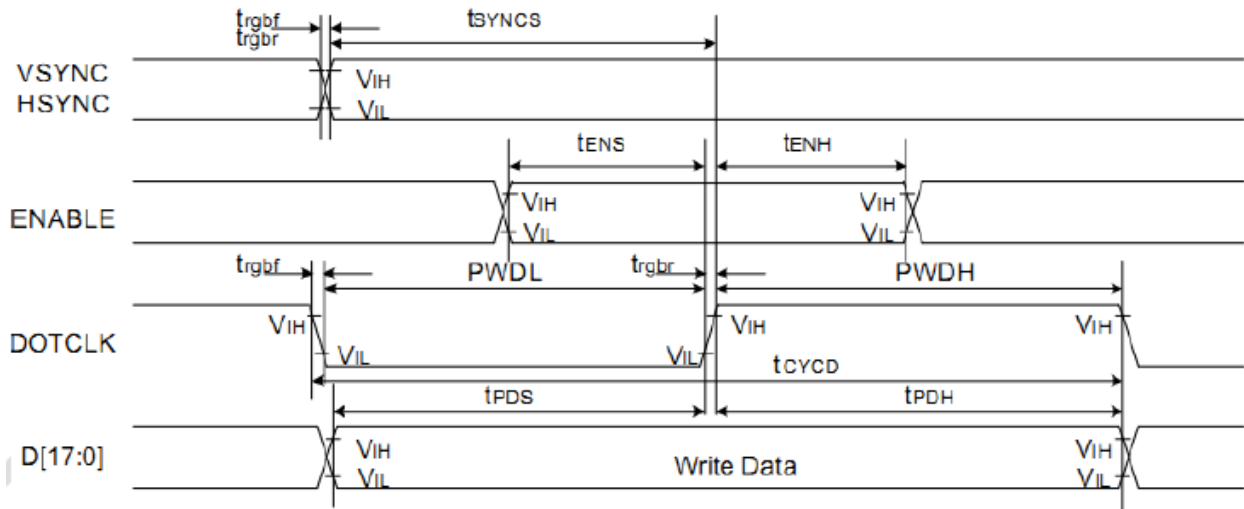


Signal	Symbol	Parameter	min	max	Unit	Description	
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns		
	tshw	SCL "H" Pulse Width (Write)	40	-	ns		
	tslw	SCL "L" Pulse Width (Write)	40	-	ns		
	tscycr	Serial Clock Cycle (Read)	150	-	ns		
	tshr	SCL "H" Pulse Width (Read)	60	-	ns		
	tslr	SCL "L" Pulse Width (Read)	60	-	ns		
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns		
	tsdh	Data hold time (Write)	30	-	ns		
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns		
	toh	Output disable time (Read)	10	50	ns		
CSX	tsc	SCL-CSX	20	-	ns		
	tchw	CSX "H" Pulse Width	40	-	ns		
	tcss	CSX-SCL Time		60	-	ns	
				65	-	ns	

Note: $T_a = 25^\circ\text{C}$, $V_{DD1} = 1.65\text{V to } 3.3\text{V}$, $V_{CI} = 2.5\text{V to } 3.3\text{V}$, $AGND = VSS = 0\text{V}$



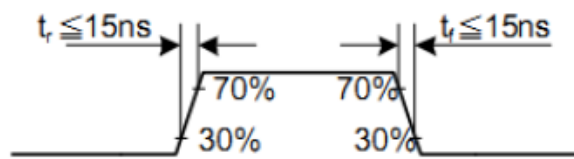
Parallel 18/16/6-bit RGB Interface Timing Characteristics



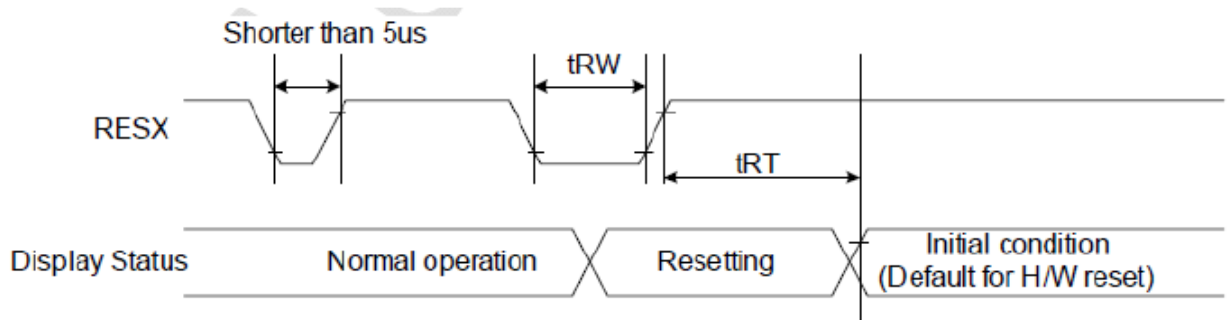
Parallel 18/16/6-bit RGB Interface Timing parameters

Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	$PWDH$	DOTCLK high-level period	15	-	ns	
	$PWDL$	DOTCLK low-level period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{trbr}, t_{trbf}	DOTCLK, HSYNC, VSYNC rise/fall time	-	15	ns	
VSYNC / HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	6-bit bus RGB interface mode
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t_{ENS}	DE setup time	15	-	ns	
	t_{ENH}	DE hold time	15	-	ns	
D[17:0]	t_{POS}	Data setup time	15	-	ns	
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	$PWDH$	DOTCLK high-level pulse period	15	-	ns	
	$PWDL$	DOTCLK low-level pulse period	15	-	ns	
	t_{CYCD}	DOTCLK cycle time	100	-	ns	
	t_{trbr}, t_{trbf}	DOTCLK, HSYNC, VSYNC rise/fall time	-	15	ns	

Note: $T_a = -30$ to 70 °C, $V_{DDI}=1.65V$ to $3.3V$, $V_{CI}=2.5V$ to $3.3V$, $AGND=VSS=0V$



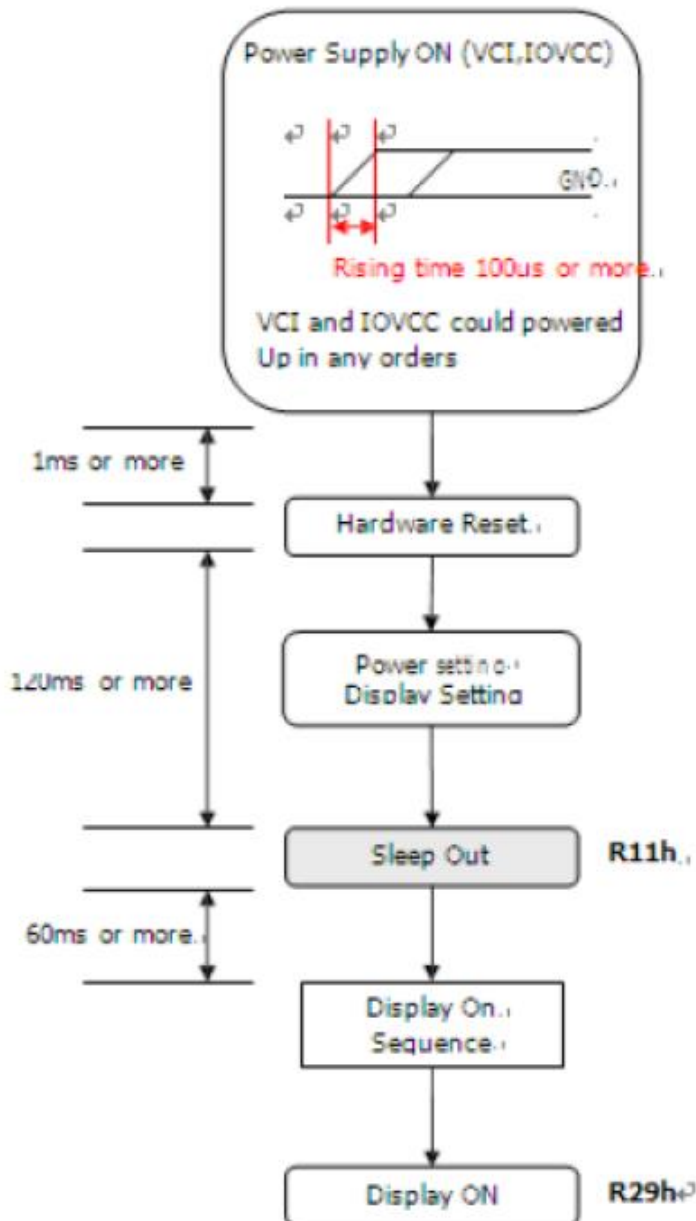
11.2 Reset Timinig



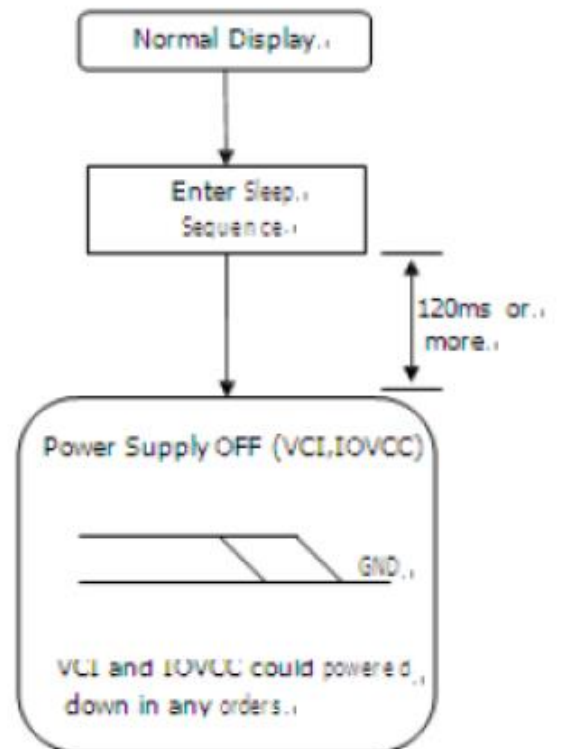
Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

Power on/off sequence

Power ON Sequence



Power Off Sequence



12. Reliability Test Items

No.	Test items	Conditions	Remark
1	High temperature storage	80°C 240H	--
2	Low temperature storage	-30°C 240H	--
3	High temperature operation	70°C, 240H	--
4	Low temperature operation	-20°C, 240H	--
5	High temperature & high humidity storage	40°C, 90% RH, 240H	--
6	Vibration test	Freq.:10 ~ 55~10 Hz, Amp.:1.5 mm 1H for each direction of X, Y, Z	Non-operation
7	Electrostatic discharge	C=150pF, R=330Ω, 5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; (Environment: 15°C ~ 35°C, 30% ~ 60%, 86Kpa ~ 106Kpa)	Non-operation
8	Thermal Shock	-30°C ,30 min /80°C ,30 min , 20 cycles	Static
<p>Criterion: There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.</p>			

13. General 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 polarizer 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.

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 dismantling the LCD modules, turn the power off.
- (b) Protect the LCD modules from electric shock.
- (c) The Driver IC control algorithms should always be 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.

13.4 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



14. Quality and reliability \triangle

14.1 Test condition

Test should be conducted under the following conditions:

- (a) Ambient temperature: $25 \pm 5^{\circ}\text{C}$
- (b) Humidity: $55 \pm 10\% \text{ RH}$

14.2 Sampling plan

Sampling method shall be in accordance with MIL-STD-105D, inspection level II, normal inspection, and single sampling plan tables for normal tightened and reduced inspection.

14.3 Acceptable quality level

A major defect is a defect that could result in failure or materially reduce that the usability of the unit of product for its intended purpose.

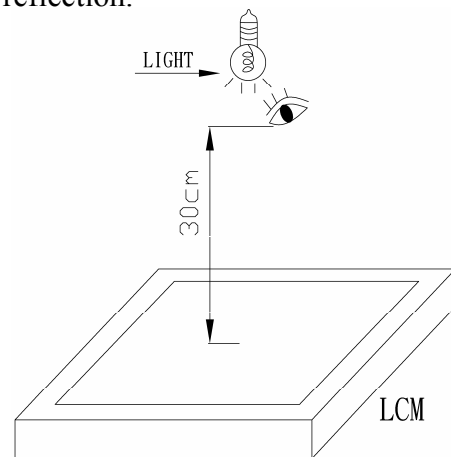
A minor defect is one that does not materially reduce the usability of the unit of product for its intended purpose or is a departure from established standards having no significant bearing on the effective use or operation of the unit.

14.4 Appearance

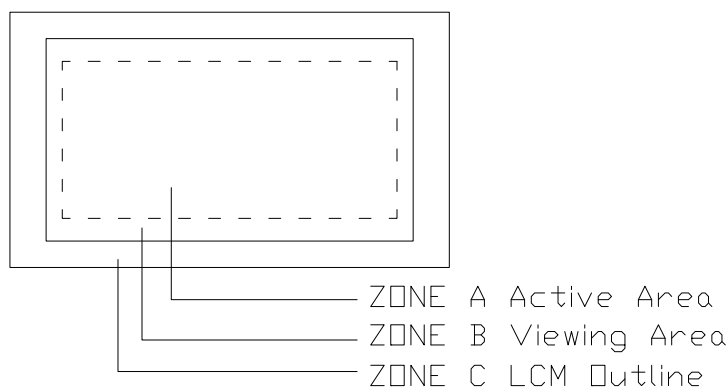
Appearance test is to be conducted by human eyes at approximately 30cm distance from LCD module under the single fluorescent light without reflection.

Condition:

- (a) Illumination:
 - Appearance inspection: $700 \pm 100 \text{ Lux}$
 - Functionality inspection: $100 \pm 50 \text{ Lux}$
- (b) Inspect determination: 30cm
- (c) Inspect direction: above the LCM
- (d) View angle: $\pm 45^{\circ}$



The inspection area of LCD panel shall be within the range of following limits.



14.5 Inspection quality criteria for TFT LCM

ITEM	DESCRIPTION OF DEFECTS	Zone	Acceptable level (%)						
DIMENSION	Refer to individual acceptance specification	A . C	2.5						
LINE DEFECT ON SURFACE (SCRATCHES, BLACK/ WHITE LINE)	(a) $W \leq 0.04\text{mm}$, disregard (b) $L \leq 5\text{mm} \ \& \ 0.04\text{mm} < W \leq 0.05\text{mm}$, $N \leq 3$, ACC (c) $W > 0.05\text{mm}$, Follow “ SPOT DEFECTON ON SURFACE ” (d) Distance between 2 lines $\geq 5\text{mm}$	A	2.5						
SPOT DEFECT ON SURFACE (BLACK/ WHITE SPOT)	Average diameter , D (a) $D \leq 0.15\text{mm}$, disregard (b) $0.15\text{mm} < D \leq 0.3\text{mm}$, $N \leq 3$, ACC (c) $D > 0.3\text{mm}$, REJ (d) Distance between 2 spots $\geq 5\text{mm}$	A	2.5						
DENSE TINY WHITE SPOT	Definition of Tiny bright spot : $D < 0.1\text{mm}$ Tiny white spots can be disregard More than 5 spots clustered within a 5mm diameter circle is not allowed ($N \leq 5$, $\emptyset \leq 5$)	A	2.5						
DENT / BUBBLE ON POLARIZER	(a) $D \leq 0.2\text{mm}$, disregard (b) $0.2\text{mm} < D \leq 0.4\text{mm}$, $N \leq 3$, ACC (c) $D > 0.4\text{mm}$, REJ	B	2.5						
DAMAGE ON LCD EDGESIDE	(a) Corner Fragment size $X \leq 3\text{mm}$, $Y \leq 3\text{mm}$, $Z \leq T$, ACC (b) Side Fragment size $X \leq 6\text{mm}$, $Y \leq 1\text{mm}$, $Z \leq T$, ACC (c) Gradual Crack is not allowed ※ T : Glass thickness	C	0.65						
BRIGHT/ DARK POINT	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Item</th> <th>Allow number in Area A</th> </tr> </thead> <tbody> <tr> <td>Bright point</td> <td>0</td> </tr> <tr> <td>Dark point</td> <td>≤ 3</td> </tr> </tbody> </table> ※ Point : A sub pixel 1R or 1G or 1B ※ The distance of bright or dark point $> 5\text{mm}$	Item	Allow number in Area A	Bright point	0	Dark point	≤ 3	A	2.5
Item	Allow number in Area A								
Bright point	0								
Dark point	≤ 3								
CHROMA MURA	Not allowed if it can be observed through ND Filter 2%.	A	2.5						
FPC DEFECT	(a) Broken , kink , indentation and scratch is not allowed (b) Dirt on surface can be disregard	C	2.5						
B/L (FRAME DEEFCT)	(a) Broken and oil pollution is not allowed (b) Scratch can be disregard (c) Protrusions and indentations that do not affect functionality can be disregard	C	2.5						

NOTE(1): ACC : Accept

NOTE(2): REJ : Reject