



## ASI-T-350RA3RSN/D

Item	Contents	Unit
Size	3.5	inch
Resolution	480(RGB) x 640	/
Interface	RGB 18 bit +SPI	/
Color Depth	262K	/
Technology type	a-si TFT	/
Pixel pitch	0.111 x 0.111	mm
Pixel Configuration	R.G.B. Vertical Stripe	
Outline Dimension (W x H x D)	64.0 x 85.0 x 3.0	mm
Active Area	53.28 x 71.04	mm
Display Mode	Transmissive, Normally white	/
Viewing Direction	9 o'clock	/
Backlight Type	LED	/
Driver IC	HX8363A	/



ASI-T-350RA3RSN/D

### Record of Revision

Date	Revision No.	Summary
2016-03-16	1.0	Rev 1.0 was issued



## ASI-T-350RA3RSN/D

### 1. Scope

This data sheet is to introduce the specification of ASI-T-350RA3RSN/D active matrix 262k color TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC and a backlight unit. The 3.5" display area contains 480 (RGB) x 640 pixels.

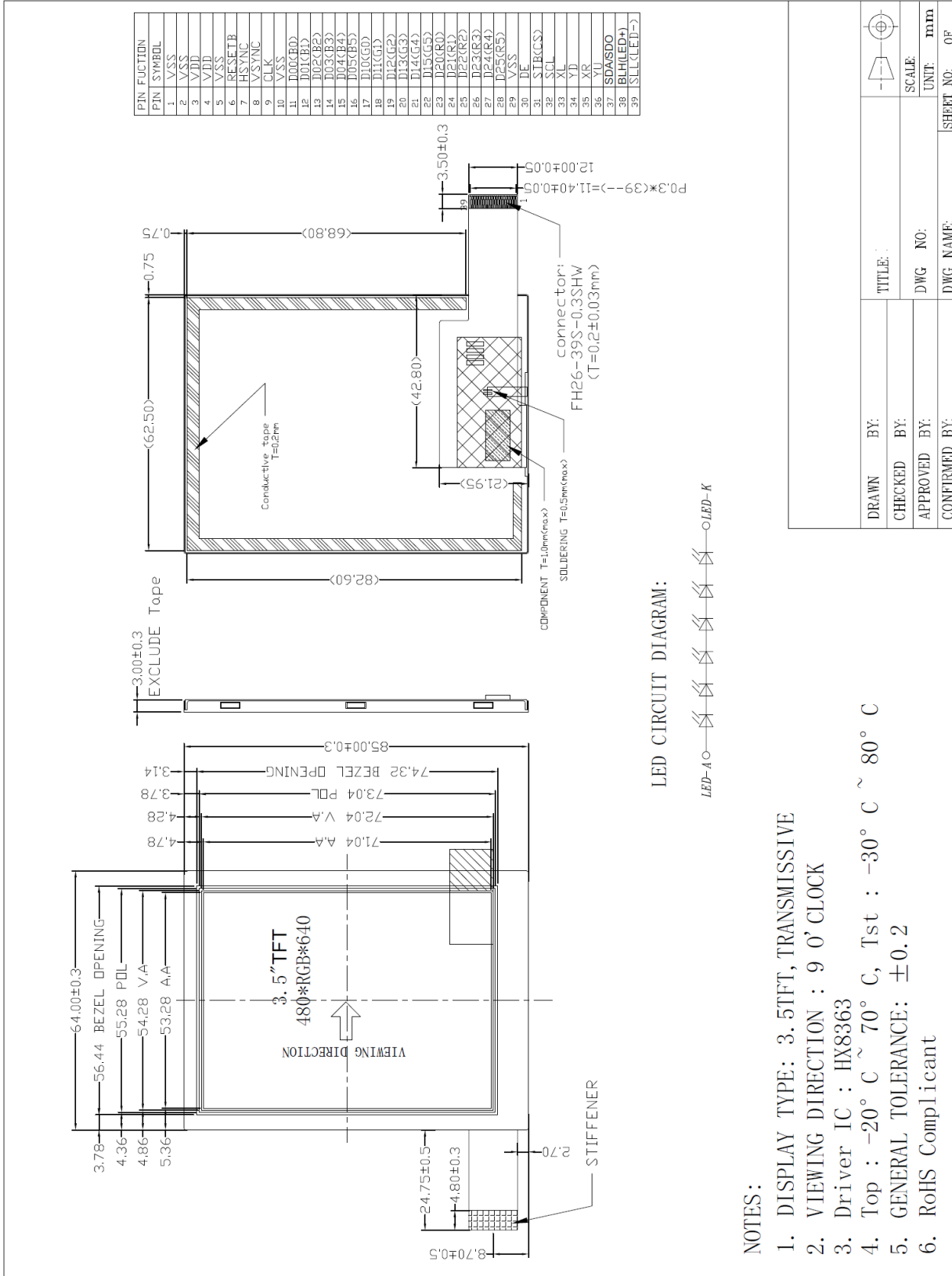
### 2. Application

Digital equipments which need color display outdoor, mobile navigator/video systems.

### 3. General Information

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### 4. Outline Drawing





5. Interface signals

No	Symbol	I/O	Description	Remarks
1	VSS	P	Ground	
2	VSS	P	Ground	
3	VDD	P	Power supply (+3.3V)	
4	VDD	P	Power supply (+3.3V)	
5	VSS	P	Ground	
6	RESETB	I	Reset pin to Initial the IC when RESET="L", reset enable	
7	HSYNC	I	Horizontal sync signal	
8	VSYNC	I	Vertical sync signal	
9	CLK	I	Clock for input data	
10	VSS	P	Ground	
11	D00(B0)	I/O	6bits Blue Data	
12	D01(B1)	I/O	6bits Blue Data	
13	D02(B2)	I/O	6bits Blue Data	
14	D03(B3)	I/O	6bits Blue Data	
15	D04(B4)	I/O	6bits Blue Data	
16	D05(B5)	I/O	6bits Blue Data	
17	D10(G0)	I/O	6bits Green Data	
18	D11(G1)	I/O	6bits Green Data	
19	D12(G2)	I/O	6bits Green Data	
20	D13(G3)	I/O	6bits Green Data	
21	D14(G4)	I/O	6bits Green Data	
22	D15(G5)	I/O	6bits Green Data	
23	D20(R0)	I/O	6bits Red Data	
24	D21(R1)	I/O	6bits Red Data	
25	D22(R2)	I/O	6bits Red Data	
26	D23(R3)	I/O	6bits Red Data	
27	D24(R4)	I/O	6bits Red Data	
28	D25(R5)	I/O	6bits Red Data	
29	VSS	P	Ground	
30	DE(ENAB)	I	Data Enable for RGB interface operation	
31	STB(CS)	I	Chip select	
32	SCL	I	Serial clock signal	
33	XL	I	NC	
34	YD	I	NC	
35	XR	I	NC	
36	YU	I	NC	
37	SDA/SDO	I/O	Serial Data signal	
38	BLH(LED+)	P	LED light anode (+19.2V)	
39	SLL(LED-)	P	LED light cathode	

Note: I/O definition: I-----Input, O---Output, P----Power/Ground



6. Absolute maximum Ratings

6.1. Electrical Absolute max. ratings

Parameter	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VDD	-0.3	4.6	V	
Input signal voltage	Vin	GND	VDD	V	

6.2. Environment Conditions

Item	Symbol	MIN	MAX	Unit	Remark
Operating Temperature	TOPR	-20	70	°C	
Storage Temperature	TSTG	-30	80	°C	

6.3. LED Backlight Absolute max. ratings

Item	Symbol	MIN	MAX	Unit	Remark
Back Light Forward Current	I <sub>LED</sub>	--	30	mA	For each LED

## 7. Electrical Specifications

### 7.1 Electrical characteristics

GND=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage	VDD	3.0	3.3	3.3	V	
Input Signal Voltage	Low Level	VIL	GND	--	0.3*VDD	V
	High Level	VIH	0.7*VDD	--	VDD	V
Output Signal Voltage	Low Level	VOL	GND	--	0.2*VDD	V
	High Level	VOH	0.8*VDD	--	VDD	V

### 7.2 LED Backlight

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	IF	--	20	30	mA	
Forward Voltage	VF	18	19.2	21.6	V	
Power Consumption	WBL	--	384	--	mW	
LED life time	--	-	25000	--	Hr	

Note1: The LED driving condition is defined for each LED channel.

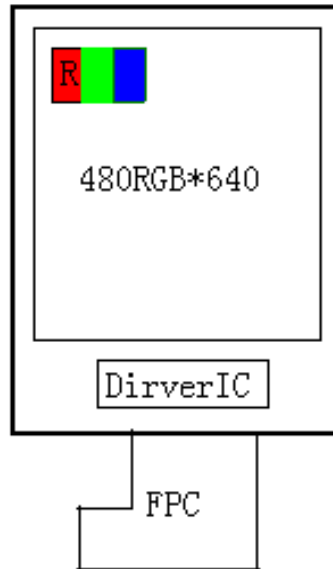
Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: Optical performance should be evaluated at Ta=25°C only If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

Note4: The LED driving condition is defined for each LED module.



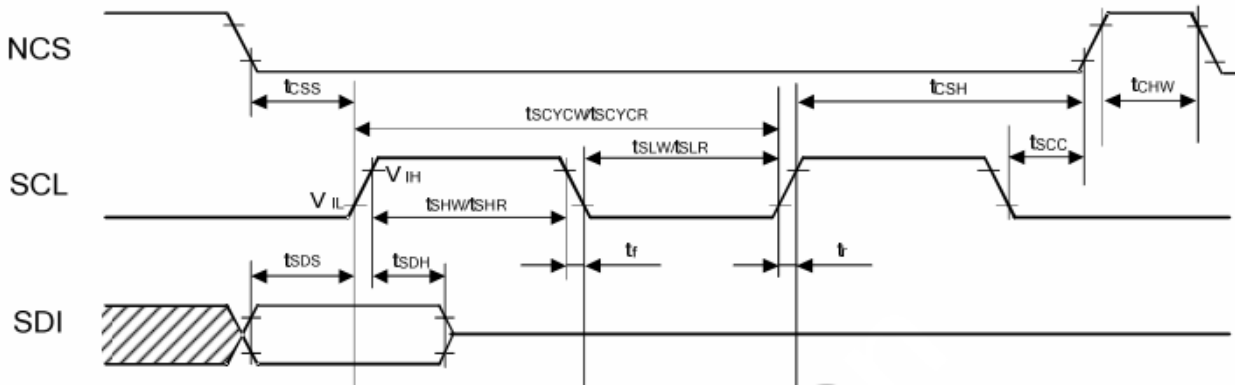
7.3 Schematic of LCD module system





## 8. Command/AC Timing

### 8.1 Serial Interface Characteristics(3-Pin serial)

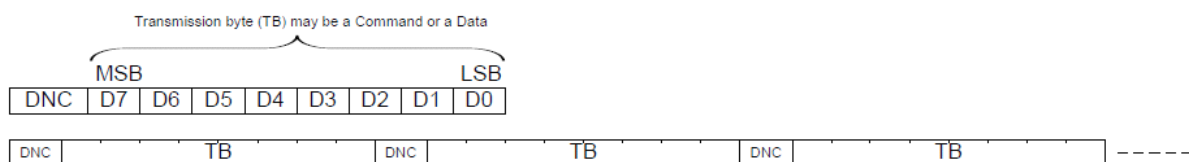


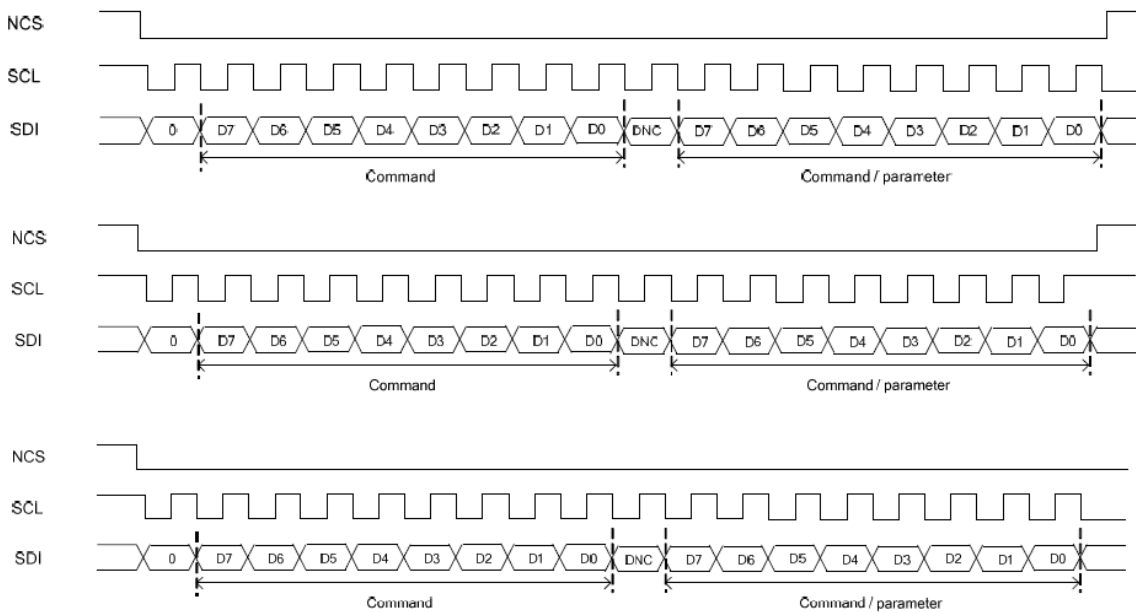
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Serial clock cycle (Write)	tSCYCW		80	-	-	
SCL "H" pulse width (Write)	tSHW	SCL	30	-	-	ns
SCL "L" pulse width (Write)	tSLW	SCL	30	-	-	ns
Data setup time (Write)	tSDS	SDI	10	-	-	ns
Data hold time (Write)	tSDH	SDI	10	-	-	ns
Serial clock cycle (Read)	tSCYCR		150	-	-	
SCL "H" pulse width (Read)	tSHR	SCL	60	-	-	ns
SCL "L" pulse width (Read)	tSLR	SCL	60	-	-	ns
SCL to Chip select	tSCC	NCS	30	-	-	ns
NCS "H" pulse width	tCHW	NCS	60	-	-	ns
NCS-SCL time (write)	tCSS	NCS	30	-	-	ns
NCS-SCL time (write)	tCSH	NCS	30	-	-	ns
NCS-SCL time (Read)	tCSS	NCS	60	-	-	ns
NCS-SCL time (Read)	tCSH	NCS	65	-	-	ns

### 8.2 Serial Data Transfer Interface

The 3-Pin serial data packet contains a control bit DNC and a transmission byte. If DNC is low, the transmission byte is command byte. If DNC is high, the transmission byte is stored to command register. The MSB is transmitted first. The serial interface is initialized when NCS is high. In this state, SCL clock pulse or SDI/SDO data have no effect. A falling edge on NCS enables the serial interface and indicates the start of data transmission.

#### 3 wire Serial Data Stream Format

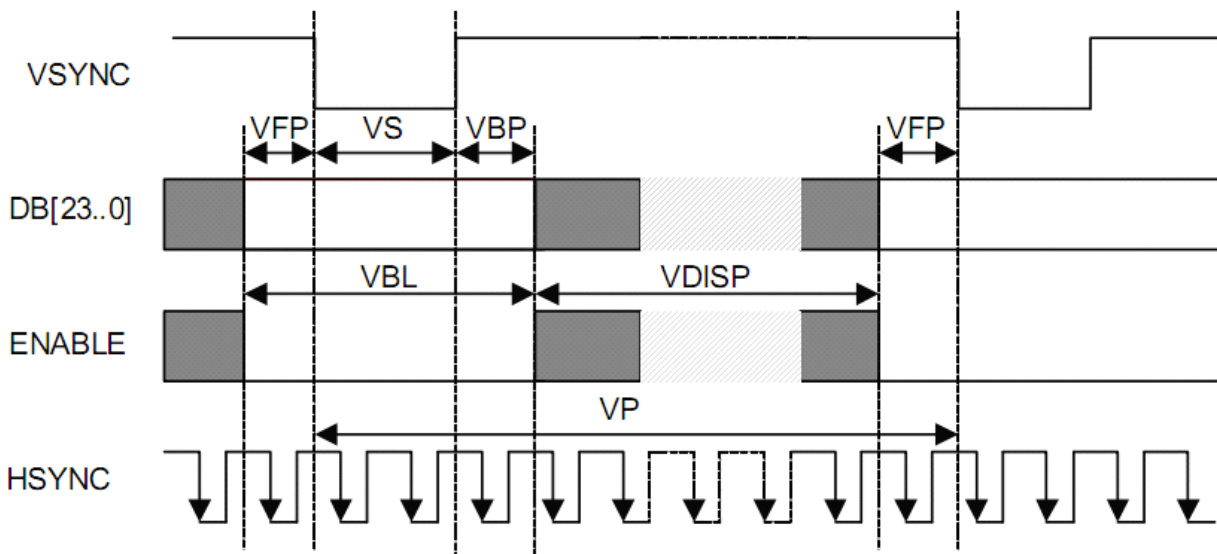




Serial Interface protocol 3 wire serial interface (write mode)

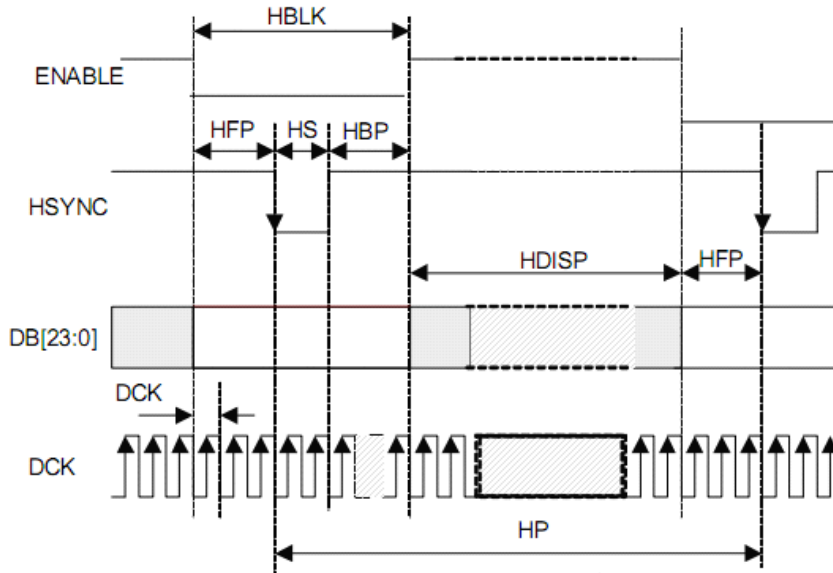
### 8.3 RGB Interface Characteristics

#### 8.3.1 Vertical timing for RGB I/F



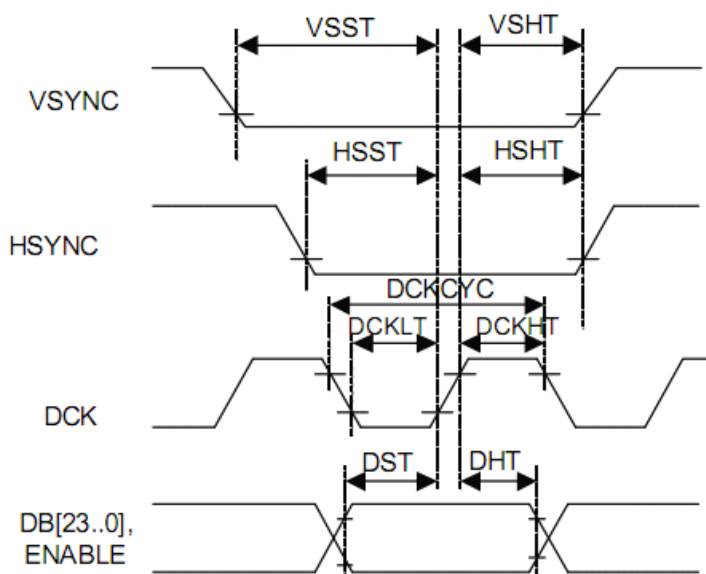
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
VS cycle	VP	-	646	649	652	Line
VS low pulse width	VS	-	2	3	4	Line
Vertical back porch	VBP	-	2	3	4	Line
Vertical front porch	VFP	-	2	3	4	Line
Vertical data start point	-	VS+VBP	4	6	8	Line
Vertical blanking period	VBLK	VS+VBP+VFP	6	9	12	Line
Vertical active area	-	VDISP	-	640	-	Line
Vertical Refresh rate	VRR	-	50	60	70	Hz

8.3.2 Horizontal timing for RGB I/F



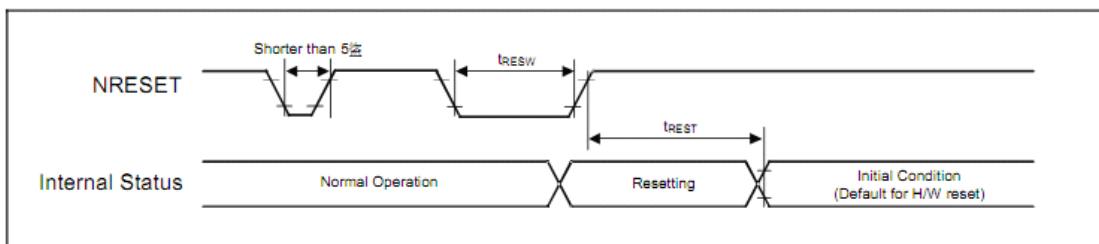
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
HS cycle	HP	-	504	520	568	DCK
HS low pulse width	HS	-	5	10	78	DCK
Horizontal back porch	HBP	-	5	10	78	DCK
Horizontal front porch	HFP	-	5	20	78	DCK
Horizontal data start point	-	HS+HBP	19	20	83	DCK
			700	-	-	ns
Horizontal blanking period	HBLK	HS+HBP+HFP	24	40	88	DCK
Horizontal active area	HDISP	-	-	480	-	DCK
Pixel clock frequency When RGB I/F is running	DCK	VRR = Min. 50Hz - Max. 70Hz	16.3	22.2	25.8	MHZ
			38.7	45.0	61.3	ns

8.3.3 General Timings for RGB I/F



Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical sync. Setup time	VSST	-	5	-	-	ns
Vertical sync. Hold time	VSHT	-	5	-	-	ns
Horizontal sync. Setup time	HSST	-	5	-	-	ns
Horizontal sync. Hold time	HSHT	-	5	-	-	ns
Pixel clock low time	DCKLT	-	5	-	-	ns
Pixel clock high time	DCKHT	-	5	-	-	ns
Data setup time DB[23:0]	DST	-	5	-	-	ns
Data Hold time DB[23:0]	DHT	-	5	-	-	ns

### 8.4 Reset Input Timing



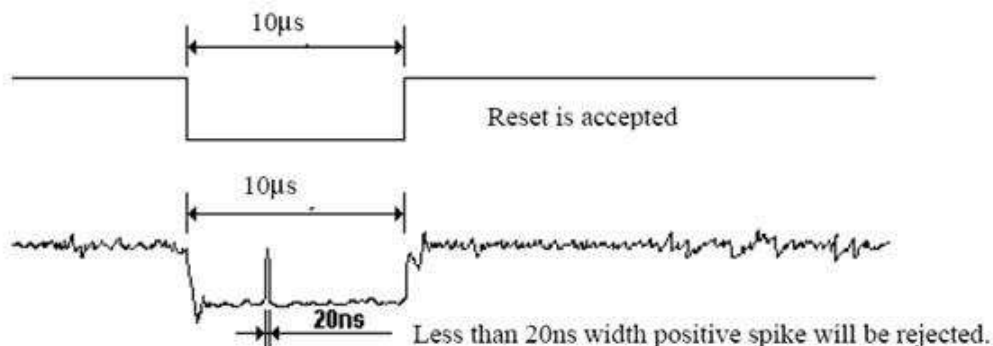
Symbol	Parameter	Related Pins	Min.	Typ.	Max.	Note	Unit
tRESW	Reset low pulse width <sup>(1)</sup>	NRESET	10	-	-	-	µs
tREST	Reset complete time	-	-	-	5	When reset is applied during Sleep In mode	ms
		-	-	-	120	When reset is applied during Sleep Out mode	ms

Note :

(1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the table below:

NRESET Pulse	Action
Shorter than 5µs	Reset Rejected
Longer than 10µs	Reset
Between 5µs and 10µs	Reset Start

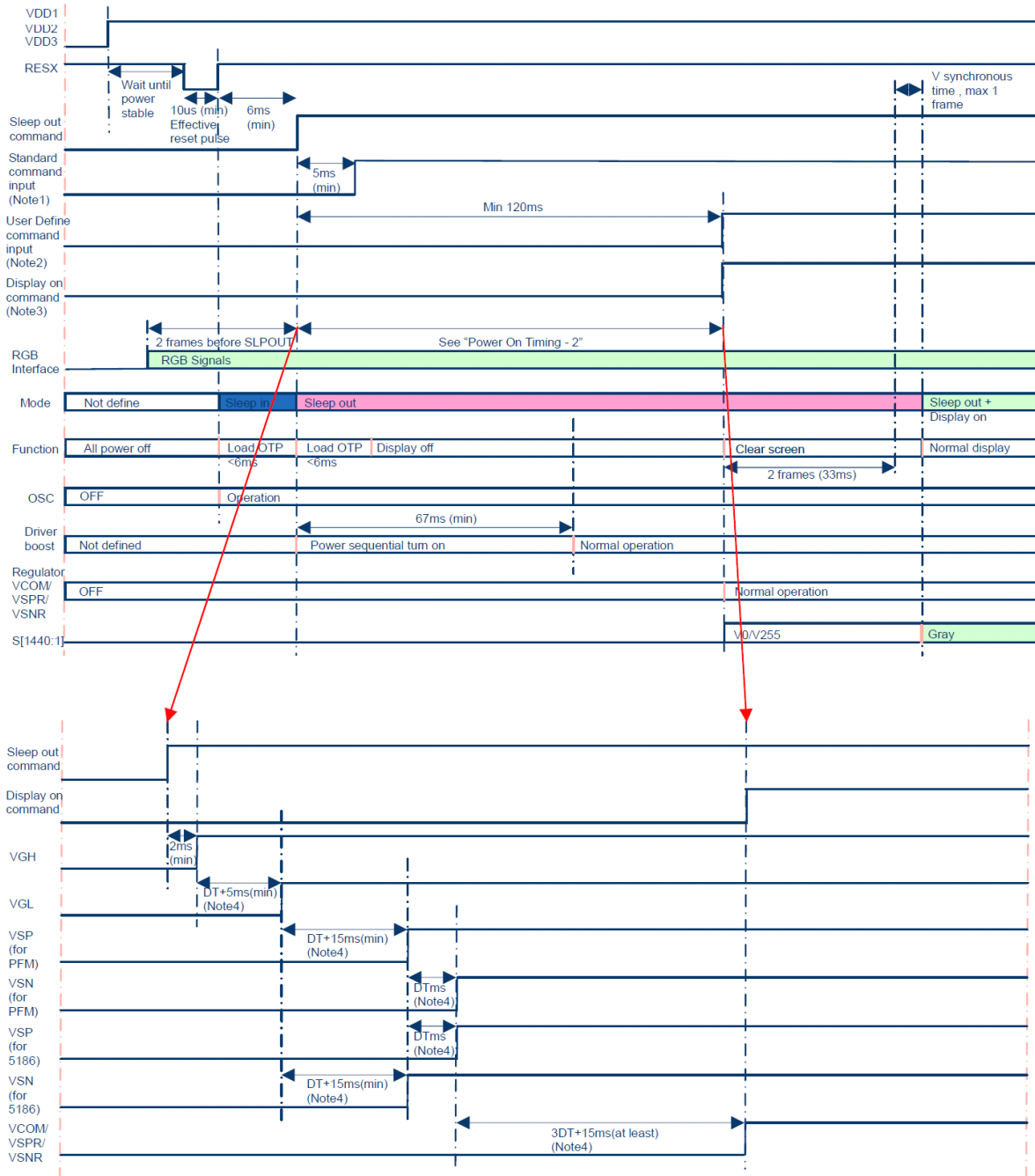
(2) Spike Rejection also applies during a valid reset pulse as shown below:



(3) It is necessary to wait 5msec after releasing NRESET before sending commands. Also Sleep Out command cannot be sent for 120msec.

## 8.5 Power ON/OFF Timing

### 8.5.1 Power ON Timing



**Note1:** “Standard” command except “01h” & “10h” command must wait 5ms after “Sleep out” command then can be sent. “01h” & “10h” command must wait 100ms after “Sleep out” command then can be sent.

**Note2:** “User Define” command must wait 100ms after “Sleep out” command then can be sent. “B9h” command must be sent first then other command can be sent after “B9h” command.

**Note3:** “Display on” command must send after “User Define” command or at the same time.

**Note4:**

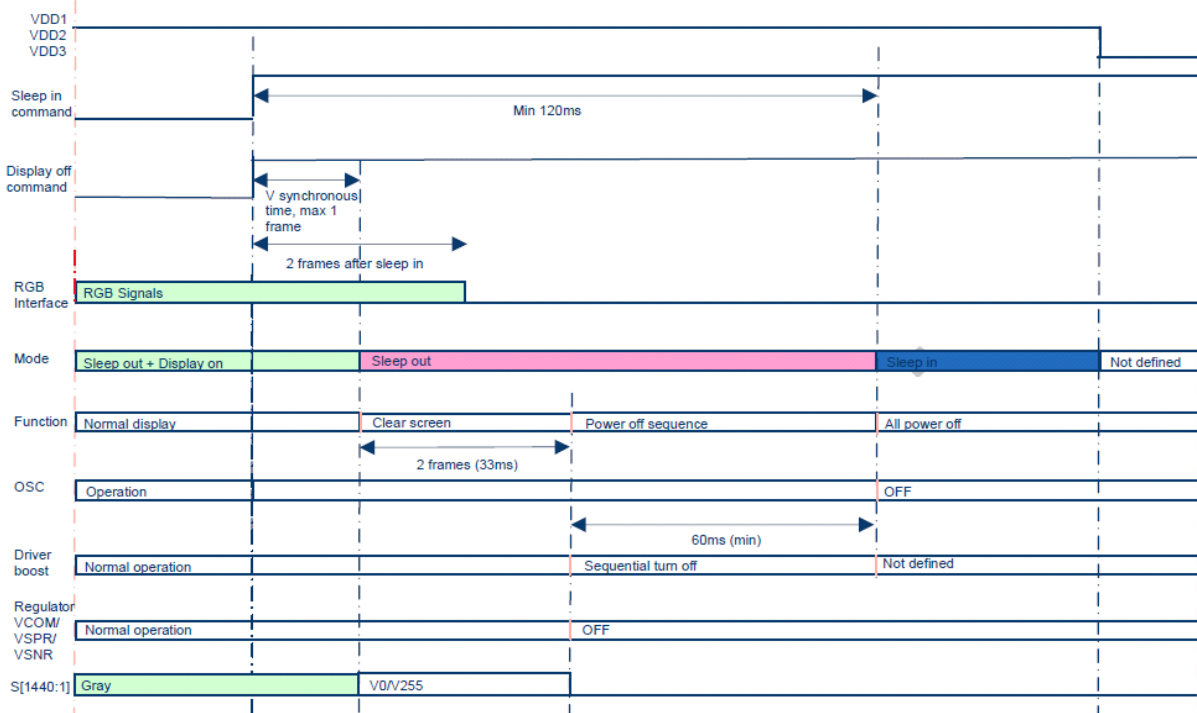
DT[1:0]: Delay time of power on and power off sequence.		
DT1	DT0	Delay time of power on and power off sequence on
0	0	5ms
0	1	10ms
1	0	15ms
1	1	20ms

Default DT=5ms



# ASI-T-350RA3RSN/D

## 8.5.2 Power off Timing



9. Optical Specification

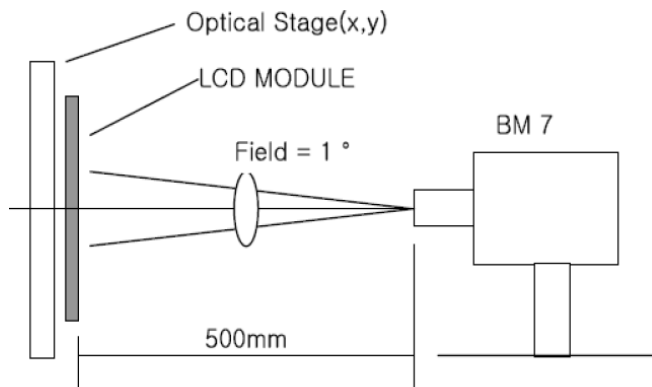
Ta=25°C

Item	Symbol	Condition	Min	Typ.	Max.	Unit	Remark
Contrast Ratio	CR	$\theta=0^\circ$	400	500	-		Note1 Note3
Response Time	Ton/ Toff	25°C	-	25	35	ms	Note1 Note4
View Angles	$\theta T$	$CR \geq 10$	60	70	-	Degree	Note 2
	$\theta B$		60	70	-		
	$\theta L$		50	60	-		
	$\theta R$		60	70	-		
Chromaticity	White	Brightness is on	x	0.251	0.301	0.351	Note5,
			y	0.271	0.321	0.371	
	Red		x	0.539	0.589	0.639	
			y	0.277	0.327	0.377	
	Green		x	0.298	0.348	0.398	
			y	0.546	0.596	0.646	
	Blue		x	0.106	0.156	0.206	
			y	0.056	0.106	0.156	
Luminance	L		280	350	-	cd/m <sup>2</sup>	Note6
NTSC	-			50		%	Note5
Uniformity	U		70	75	-	%	Note1 Note7

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

LED back-light: ON, Environment brightness < 150 lx

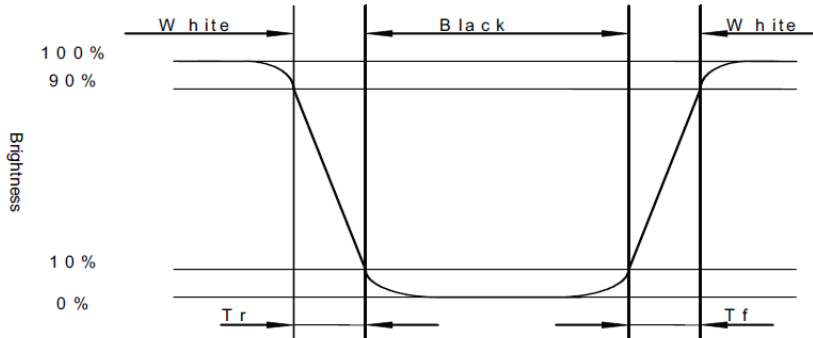


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

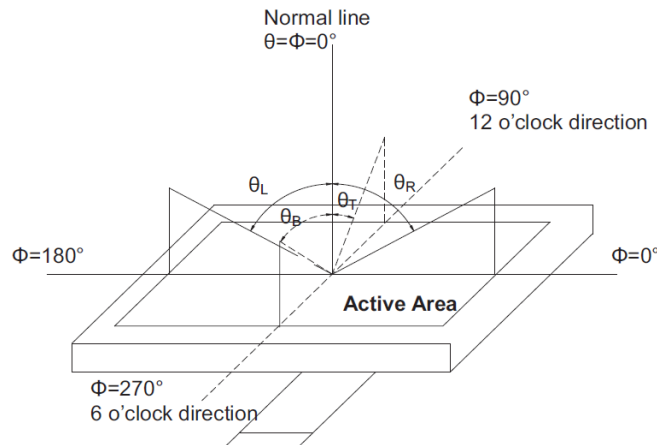
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise Time,  $T_r$ ) and from white to black(Decay Time,  $T_f$ ).



Note 4: Viewing angle range is defined as follow:

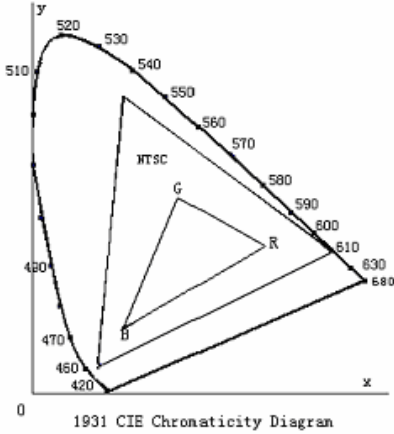
Viewing angle is measured at the center point of the LCD.





Note 5: Color chromaticity is defined as follow: (CIE1931)

Color coordinates measured at center point of LCD.



$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$

Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Uniformity}(U) = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

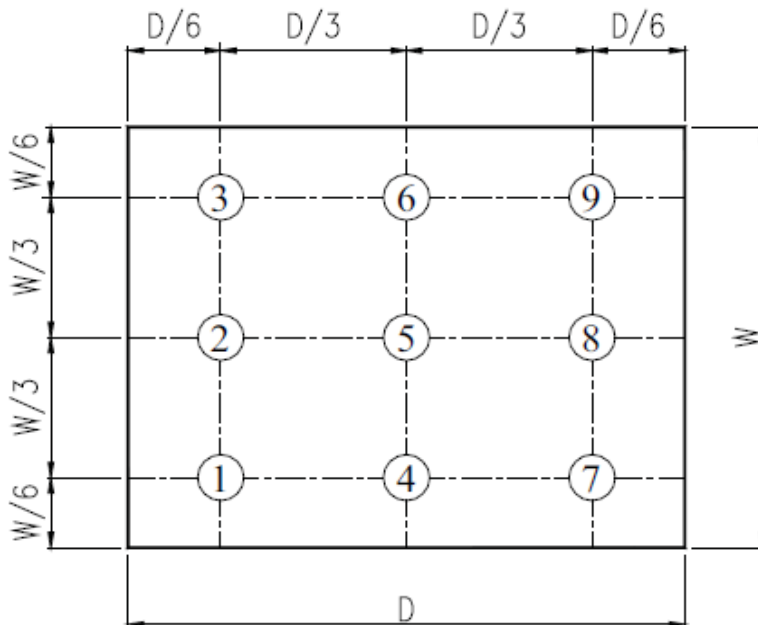


Fig. 2 Definition of uniformity



10. Environmental / Reliability Tests

No	Test Item	Condition	Judgment criteria
1	High Temp Operation	Ts=+70°C, 120hrs	Per table in below
2	Low Temp Operation	Ta=-20°C, 120hrs	Per table in below
3	High Temp Storage	Ta=+80°C, 120hrs	Per table in below
4	Low Temp Storage	Ta=-30°C, 120hrs	Per table in below
5	High Temp & High Humidity Storage	Ta=+40°C, 90% RH 120 hours	Per table in below (polarizer discoloration is excluded)
6	Thermal Shock (Non-operation)	-30°C 30 min~+70°C 30 min, Change time:5min, 10 Cycles	Per table in below
7	ESD (Operation)	C=150pF, R=330Ω · 5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times;	Per table in below
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z.	Per table in below
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	Per table in below
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	Per table in below

INSPECTION	CRITERION(after test)
Appearance	No Crack on the FPC, on the LCD Panel
Alignment of LCD Panel	No Bubbles in the LCD Panel No other Defects of Alignment in Active area
Electrical current	Within device specifications
Function / Display	No Broken Circuit, No Short Circuit or No Black line No Other Defects of Display

## 11. Precautions for Use of LCD Modules

### 11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

### 11.2 Handling

- A. The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
- B. Do not handle the product by holding the flexible pattern portion in order to assure the reliability
- C. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
- D. Provide a space so that the panel does not come into contact with other components.
- E. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
- F. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
- G. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.
- H. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

### 11.3 Static Electricity

- A. Ground soldering iron tips, tools and testers when they are in operation.
- B. Ground your body when handling the products.
- C. Power on the LCD module before applying the voltage to the input terminals.
- D. Do not apply voltage which exceeds the absolute maximum rating.
- E. Store the products in an anti-electrostatic bag or container.

### 11.4 Storage

- A. Store the products in a dark place at  $+25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
- B. Storage in a clean environment, free from dust, active gas, and solvent.

### 11.5 Cleaning

- A. Do not wipe the touch panel with dry cloth, as it may cause scratch.
- B. Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

### 11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.

