宇华国际科技有限公司
YuHua INT,L Technology Co., LIMITED

TFT LCD Display Datasheet

REV 15

28th May 2016

SPECIFICATION
FOR
LCD MODULE

Customer : _____

Product Model: YH024CSQ4001 V.1

Sample code: _____

Designed by	Checked by	Approved by

Final Approval by Customer

☐ **LCM Machinery OK** Checked By _____ ☐ **LCM Display OK** Checked By _____	☐ **LCM OK** ☐ **NG，Problem survey:** Approved By _____

※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

Revision History

REVISION	DATE	COMMENT	REMARKS
1	04/03/2016	Initial Draft	Initial Draft Version
1.1	08/03/2016	Initial Release	Formatting Change
1.2	10/03/2016	Updated with CLB drawing/version	
1.3	10/05/2016	Updated with CLB drawing/version	
1.4	19/05/2016	Updated dimension tolerance	
1.5	28/05/2016	Updated the weight and brightness	

Table of Contents

1. General Specification

24320240 is a colour active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a colour TFT-LCD panel, driver IC, FPC and a back light unit and with/without a Resistive Touch Panel (RTP), and with/without a Cover Lens Bezel (CLB). The module display area contains 240 x 320 pixels. This product accords with RoHS environmental criterion.

ITEM		CONTENTS	UNIT
LCD Type		TFT / Transmissive / Normally white	
Size		2.4	Inch
Viewing Direction		6:00 (without image inversion)	O'Clock
Gray Scale Inversion Direction		12:00	O'Clock
LCD (W × H)		42.72 x 60.26	mm^3
Active Area (W × H)		36.72 × 48.96	mm^2
Dot Pitch (W × H)		0.153 × 0.153	mm^2
Number of Dots (Pixels)		240 (RGB) × 320	
Driver IC		ILI9341V	
Backlight Type		4 LEDs	
Surface Luminance	24320240	228 (typical)	cd/m^2
	24320240-CLB	221 (typical)	
	24320240-RTP	182 (typical)	
Interface Type		MCU-8/16bit	
Color Depth		16.7M	
Pixel Arrangement		RGB Vertical Stripe	
Surface Treatment		AG	
Input Voltage		2.8 (typical)	V
With/Without TP (Touch Panel)		24320240 - Without TP 24320240-CLB – Without TP, with CLB 24320240-RTP – With Resistive Touch	
Weight	24320240	11.0	g
	24320240-CLB	19.8	
	24320240-RTP	16.2	

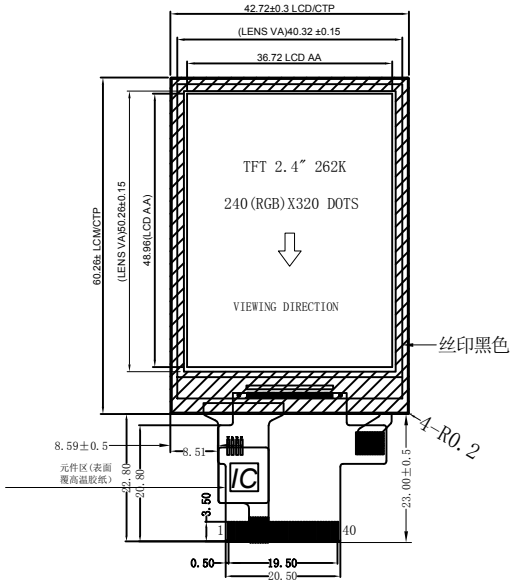
Note 1: RoHS compliant
Note 2: LCD weight tolerance: ± 5%.

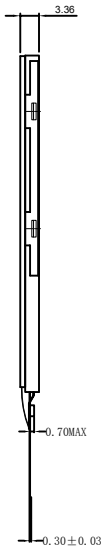
Part Number Details:

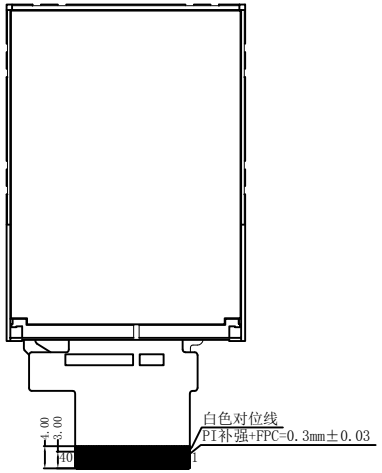
LCD	TFT Systems LCD Display
24320240	2.4 inch, 240 x 320 Resolution
RTP	Resistive Touch
CLB	Cover Lens Bezel

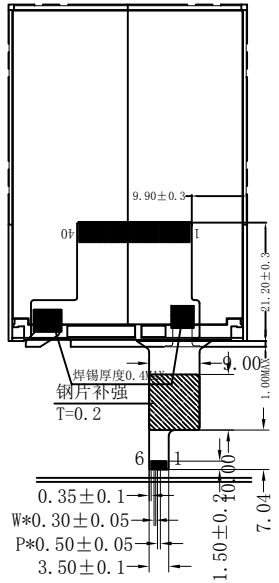
YuHua INT,L Technology Co., LIMITED

REV	DESCRIPTION	DATE
1.0	First release	



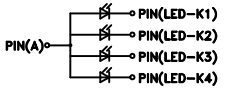






PIN	NAME
1	GND
2	GND
3	IM0
4	FMARK
5	YD
6	XL
7	RESET
8	RS
9	CS
10	RD
11	WR
12	VCC
13	NC
14	GND
15	DB15
16	DB14
17	DB13
18	DB12
19	DB11
20	DB10
21	DB9
22	DB8
23	DB7
24	DB6
25	DB0
26	DB1
27	DB2
28	DB3
29	DB4
30	DB5
31	YU
32	XR
33	LEDA
34	LEDK1
35	LEDK2
36	LEDK3
37	LEDK4
38	NC
39	NC
40	GND

LED CIRCUIT DIAGRAM:



IM0=0:16bit,DB0-DB15
IM0=1:8bit,DB8-DB15

NOTES:

1. DISPLAY TYPE: MAIN LCD a-si 65/262K 2.4″ TFT
2. OPERATING TEMP.: -20° C~70° C
3. STORAGE TEMP.: -30° C~80° C
4. LCD DRIVER:ILI9341V
5. BACKLIGHT:4 CHIP-WHITE LED
6. UNMARKED TOLERANCE: ±0.2
7. 符合ROHS要求
8. 建议机壳V.A开窗比LCD的A.A单边大0.5

pin num	dif
pin 1	VDD
pin 2	SCL
pin 3	SDA
pin 4	INT
pin 5	RST
pin 6	GND

REVISION RECORD	DATE
1	
2	
3	
4	
5	
6	

YU HUA INT'LTECHNOLOGY CO., LTD

TITLE:		P/N :	
FILE NAME : YH024CSQ4001		Ver. : 1.0	SCALE : N.T.S.
DRAWN BY		DATE	UNIT : mm
CHECKED BY		DATE	PRO.(3):
APPROVED BY		DATE	SHEET : 1/1

5. Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage for LCD Logic	VDD/VCC	-0.3	4.6	V
Supply Voltage for TP Logic	VDD/VCC-VSS	-	-	V
Input Voltage for Logic	VIN	VSS-0.5	VDD	V
LED forward voltage (each LED)	IF	-	25	mA
Operating Temperature	T_{OP}	-20	70	°C
Storage Temperature	T_{ST}	-30	80	°C
Humidity	RH	-	90% (Max 60°C)	RH

6. Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Power Voltage	VDD/DCC	2.6	2.8	3.3	V
Input Current	IVDD	-	-	-	mA
Input Voltage 'H' Level	V_{IH}	0.7 VDD	-	VDD	V
Input Voltage 'L' Level	V_{IL}	0	-	0.3 VDD	V

7. Electro-Optical Characteristics

ITEM		SYM	CONDITION	MIN	TYP	MAX	UNIT	REMARK
Response Time		Tr+Tf	θ=0	-	30	-	ms	Figure 1 (4)
Contrast Ratio		Cr	°	-	250	-	-	Figure 2 (1)
Luminance Uniformity		δ WHITE	Ø=0	75	80	-	%	Figure 2 (3)
Surface Luminance		Lv	4DLCD-24320240	205	228	-	cd/m2	Figure 2 (2)
			4DLCD-24320240-RTP	164	182			
			4DLCD-24320240-CLB	199	221			
Viewing Angle Range		θ	Ø = 90°	-	35	-	deg	Figure 3 (6)
			Ø = 270°	-	55	-	deg	
			Ø = 0°	-	55	-	deg	
			Ø = 180°	-	55	-	deg	
CIE (x,y) Cromacity	Red	x	θ=0° Ø=0° Ta=25	0.574	0.624	0.674		Figure 2 (5)
		y		0.318	0.368	0.418		
	Green	x		0.3	0.35	0.4		
		y		0.5	0.55	0.6		
	Blue	x		0.093	0.143	0.193		
		y		0.069	0.119	0.169		
	White	x		0.26	0.31	0.36		
		y		0.283	0.333	0.383		

8. Backlight Characteristics

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Voltage for LED backlight	V_l	-	3.2	3.4	V
Current for LED backlight	I_l	-	80	100	mA
LED Life Time	-	30000	-	-	Hrs

Note: The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C.

Note 1: Contrast Ratio(CR) is defined mathematically as below, for more information see Figure 1.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

Note 2: Surface luminance is the LCD surface from the surface with all pixels displaying white.
For more information, see Figure 2.

Lv = Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)

Note 3: The uniformity in surface luminance δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information, see Figure 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

Note 4: Response time is the time required for the display to transition from white to black (Rise Time, Tr) and from black to white (Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers ConoScope series.

Note 5: CIE (x, y) chromaticity, the x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

Note 6: Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information, see Figure3.

Note 7: For viewing angle and response time testing, the testing data is based on Autronic-Melchers ConoScope series. Instruments for Contrast Ratio, Surface Luminance, Luminance Uniformity, CIE the test data is based on TOPCONs BM-5 photo detector.

Figure 1. The definition of response time

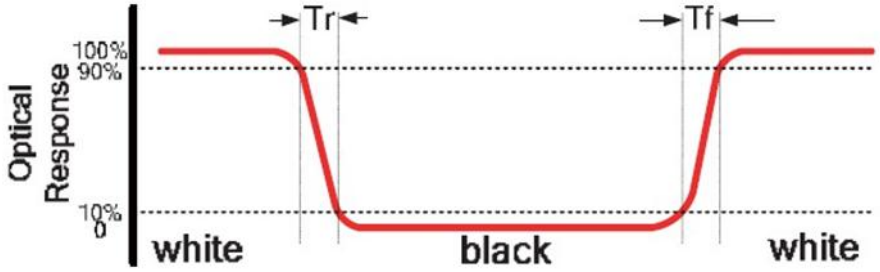


Figure 2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity

A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=5mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

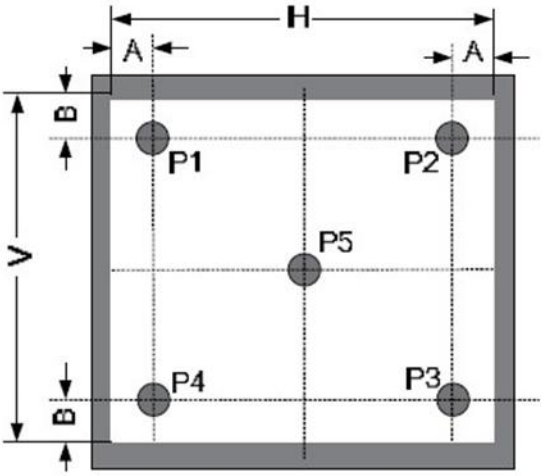
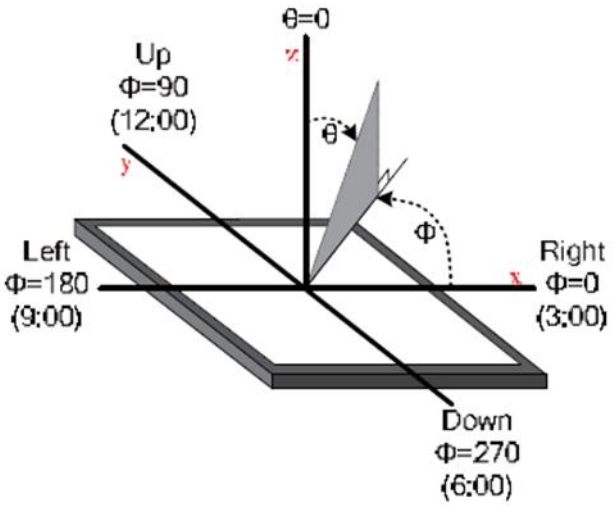


Figure 3. The definition of viewing angle



9. Interface Descriptions

9.1. LCD Interface

PIN NO.	SYMBOL	DESCRIPTION	REMARK
1	GND	Ground	
2	GND	Ground	
3	IM0	8/16bit selection pin	Note 1
4	FMARK	Tearing effect output signal	
5	YD/NC	The touch panel Y bottom pin	
6	XL/NC	The touch panel X left pin	
7	RESET	Reset input signal	
8	RS	Data/Command selection pin	
9	CS	Chip select input pin	
10	RD	Read signal	
11	WR	Write signal	
12	VCC	Power supply	
13	NC	No Connect	
14	GND	Ground	
15	DB15	Databus DB15	
16	DB14	Databus DB14	
17	DB13	Databus DB13	
18	DB12	Databus DB12	
19	DB11	Databus DB11	
20	DB10	Databus DB10	
21	DB9	Databus DB9	
22	DB8	Databus DB8	
23	DB7	Databus DB7	
24	DB6	Databus DB6	
25	DB0	Databus DB0	
26	DB1	Databus DB1	
27	DB2	Databus DB2	
28	DB3	Databus DB3	
29	DB4	Databus DB4	
30	DB5	Databus DB5	
31	YU/NC	The touch panel Y up pin	
32	XR/NC	The touch panel X right pin	
33	LEDA	Anode of LED Backlight	
34	LEDK1	Cathode1 of LED Backlight	
35	LEDK2	Cathode2 of LED Backlight	
36	LEDK3	Cathode3 of LED Backlight	
37	LEDK4	Cathode4 of LED Backlight	
38	NC	No Connect	
39	NC	No Connect	
40	GND	Ground	

Note 1: IM0(8/16) (pin 3)

IM0(8/16)	Interface	Remark
0	MCU 16bit	Databus:DB0~DB15
1	MCU 8bit	Databus:DB8~DB15

CTP Interface

pin num	dif
pin 1	VDD
pin 2	SCL
pin 3	SDA
pin 4	INT
pin 5	RST
pin 6	GND

10. Initialisation Code

```
//*********Hardware reset*********//
LCD_RESET=1;
Delayms(15);
LCD_RESET=0;
Delayms(120);
LCD_RESET=1;
Delayms(120);

//********Start Initial Sequence*******//
write_reg(0xCF);
write_dat(0x00);
write_dat(0xC1);
write_dat(0x30);

write_reg(0xED);
write_dat(0x64);
write_dat(0x03);
write_dat(0X12)
write_dat(0X81)

write_reg(0xE8);
write_dat(0x85);
write_dat(0x10);
write_dat(0x7A);

write_reg(0xCB);
write_dat(0x39);
write_dat(0x2C);
write_dat(0x00);
write_dat(0x34);
write_dat(0x02);

write_reg(0xF7);
write_dat(0x20);

write_reg(0xEA);
write_dat(0x00);
write_dat(0x00);

write_reg(0xC0); //Power control
write_dat(0x21); //VRH[5:0]

write_reg(0xC1); //Power control
write_dat(0x13); //SAP[2:0]; BT[3:0]

write_reg(0xC5); //VCM control
write_dat(0x32);
write_dat(0x3C);

write_reg(0xC7); //VCM control2
write_dat(0X9C);
write_reg(0x36); // Memory Access Control
write_dat(0x08);
write_reg(0x3A);
write_dat(0x55);
write_reg(0xB1);
write_dat(0x00);
write_dat(0x16);
```

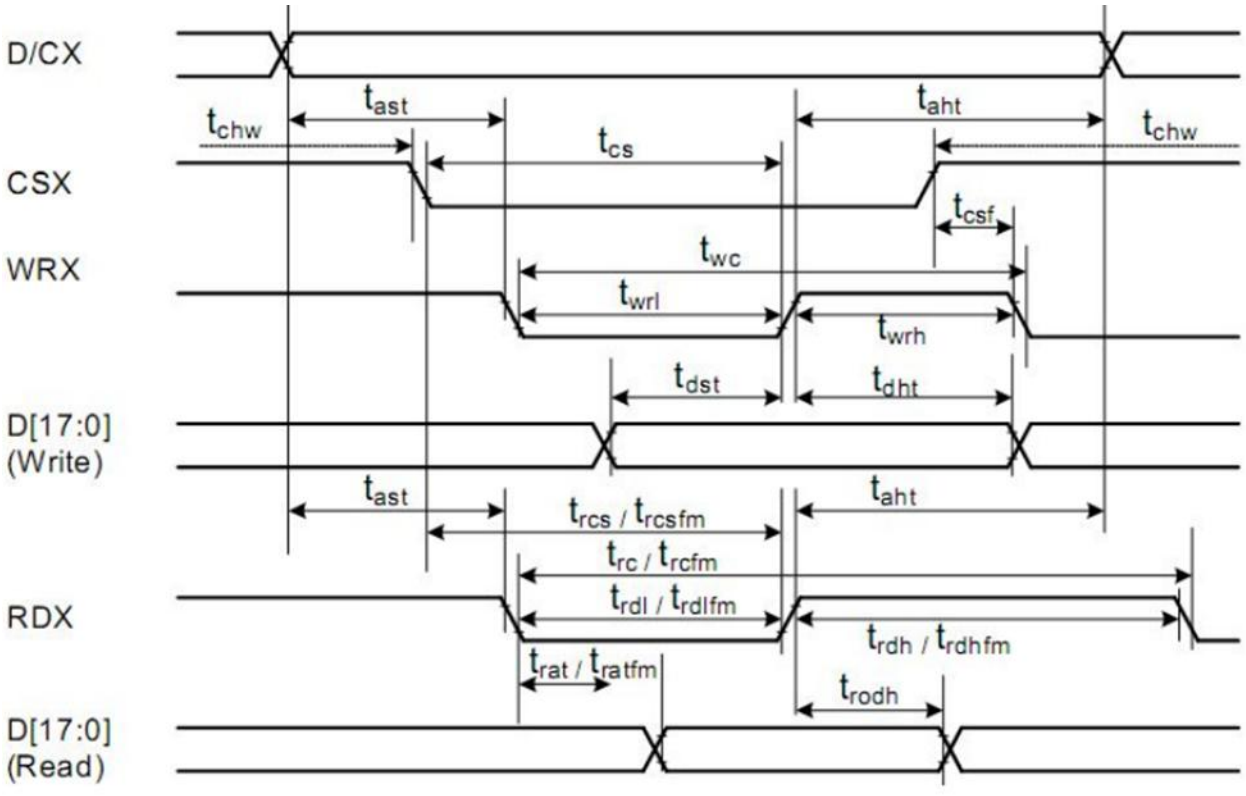
```
write_reg(0xB6); // Display Function Control
write_dat(0x0A);
write_dat(0xA2);

write_reg(0xF6);
write_dat(0x01);
write_dat(0x30);

write_reg(0xF2); // 3Gamma Function Disable
write_dat(0x00);

write_reg(0x26); //Gamma curve selected
write_dat(0x01);

write_reg(0xE0); //Set Gamma
write_dat(0x0F);
write_dat(0x1E);
write_dat(0x1B);
write_dat(0x0B);
write_dat(0x0E);
write_dat(0x08);
write_dat(0x47);
write_dat(0XB7);
write_dat(0x37);
write_dat(0x0B);
write_dat(0x14);
write_dat(0x05);
write_dat(0x0C);
write_dat(0x07);
write_dat(0x00);

write_reg(0XE1); //Set Gamma
write_dat(0x00);
write_dat(0x21);
write_dat(0x24);
write_dat(0x04);
write_dat(0x11);
write_dat(0x07);
write_dat(0x38);
write_dat(0x48);
write_dat(0x48);
write_dat(0x04);
write_dat(0x0B);
write_dat(0x0A);
write_dat(0x33);
write_dat(0x38);
write_dat(0x0F);

write_reg(0x11); //Exit Sleep
Delayms(120);
write_reg(0x29); //Display on
```

11. LCD Timing Details

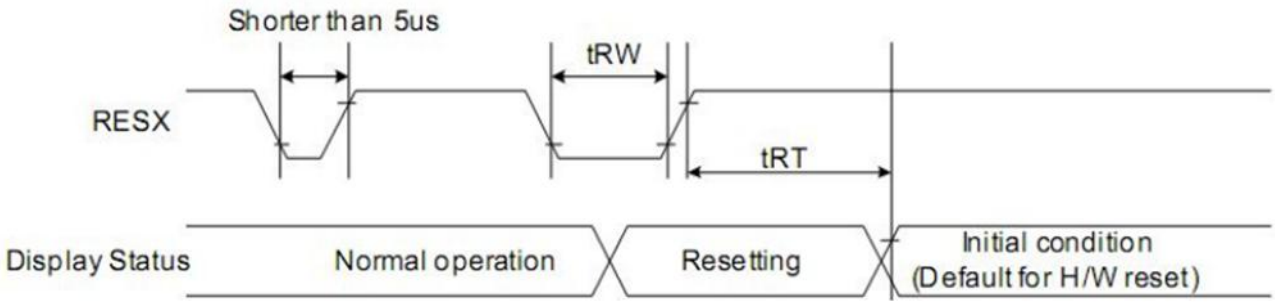
11.1. Timing Chart

SIGNAL	SYMBOL	PARAMETER	MIN	MAX	UNIT	DESCRIPTION
DCX	tast	Address setup time	0	-	ns	-
	taht	Address hold time (Write/Read)	0	-	ns	-
CSX	tchw	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time	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)	10	-	ns	
WRX	twc	Write cycle	66	-	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	
	trdhfm	Read Control Pulse H duration (FM)	90	-	ns	
	trdlfm	Read Control Pulse L duration (FM)	355	-	ns	
RDX(ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control Pulse H duration	90	-	ns	
	trdl	Read Control Pulse L duration	45	-	ns	
D[17:0]	tdst	Write data setup time	10	-	ns	
	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	

Timing parameter (VDD=3.3V, GND=0V, Ta=25˚C)



11.2. Reset Timing

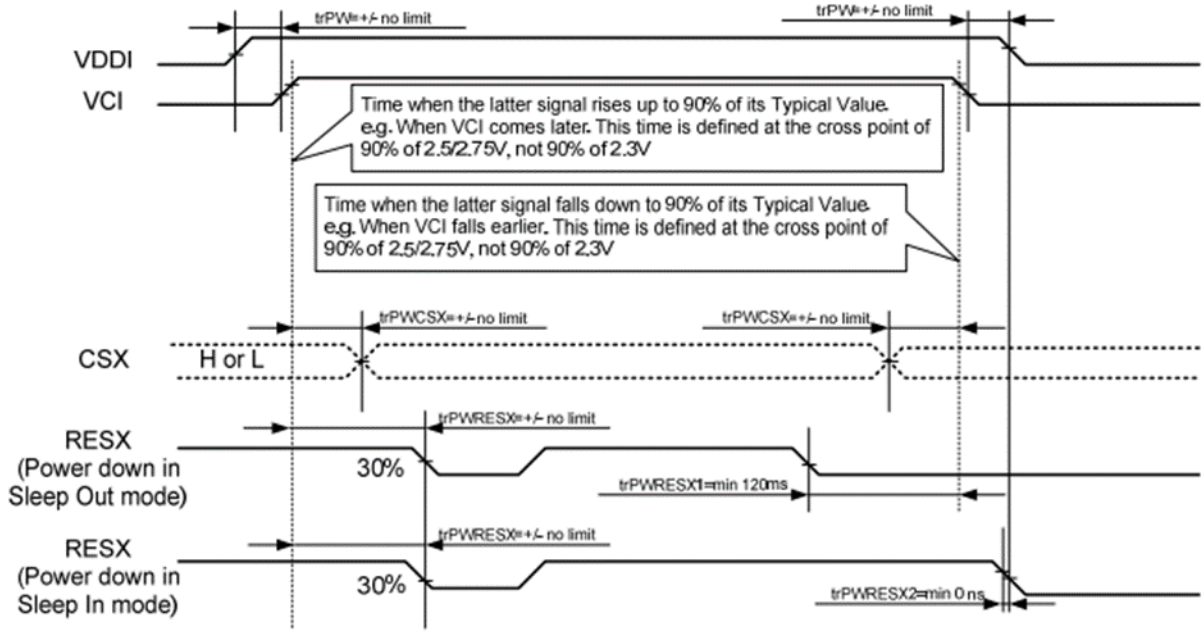


SIGNAL	SYMBOL	PARAMETER	MIN	MAX	UNIT
RESET	tRW	Reset low pulse width	10	-	us
	tRT	Reset complete time	-	5 (note1)	ms
			-	120 (note2)	ms

Note 1: When reset applied during SLPIN mode
Note 2: When reset applied during SLPOUT mode.

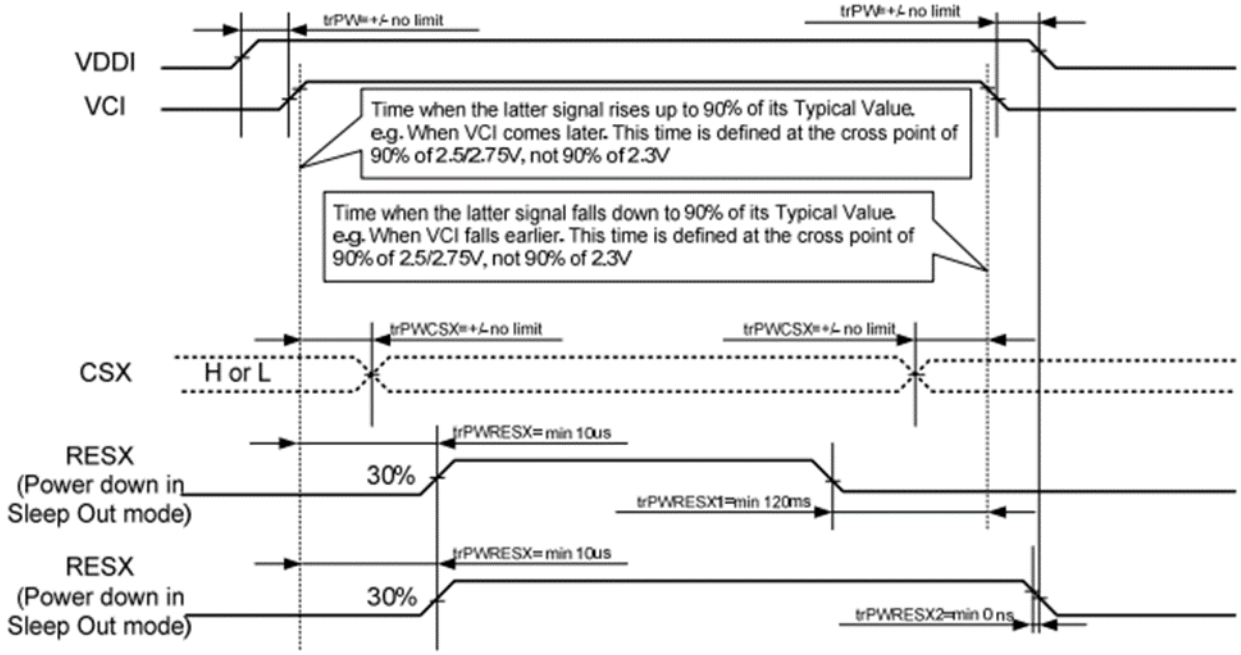
11.3. Power On Sequence

11.3.1. Case 1 - RES line is held High or Unstable by Host at Power ON



trPWRESX1 is applied to RESX falling in the Sleep Out Mode
trPWRESX2 is applied to RESX falling in the Sleep In Mode

11.3.2. Case 2 - RES line is held Low by Host at Power ON



trPWRESX1 is applied to RESX falling in the Sleep Out Mode
trPWRESX2 is applied to RESX falling in the Sleep In Mode

11.4. Power-off Sequence - Uncontrolled Power Off

Uncontrolled power off is a situation where power is removed unexpectedly, e.g. a battery powering a device is disconnected without using the controlled power off sequence. There will not be any damage to the display module, nor will the display module cause any damage to the host. During an uncontrolled power off event, ILI9341V will force the display to blank its content and there will not be any further abnormal visible effects on the display after 1 second of the power being removed. The display will remain blank until the Power On Sequence occurs.

12. Reliability Test

No.	SYMBOL	TEST CONDITION	REMARK
1	High Temperature Storage	80℃±2℃ 96H Restore 2H at 25℃ Power off	After test cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-30℃±2℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃ 96H Power on	
4	Low Temperature Operation	-20℃±2℃ 96H Power on	
5	High Temperature & Humidity Operation	60℃±2℃ 90%RH 96H Power on	
6	Temperature Cycle	-20℃←→25℃←→70℃ 30min 5min 30min After 10 cycles, restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s^2, 120min	
8	Shock Test	Half-sinewave, 300m/s^2, 11ms	

13. Legal Information