



**US Micro Products**  
*Electronic Products for the OEM*

# TFT-LCD PRODUCT SPECIFICATION

<b>PART NUMBER:</b>	<b>USMP-TT024Q-01K</b>
<b>DESCRIPTION:</b>	2.4" Active Matrix TFT-LCD, 240 x 320 RGB, 262K Full Colors

ISSUE DATE	APPROVED BY (Customer Use Only)	CHECKED BY	PREPARED BY
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Note : For detailed information please refer to IC data sheet : ILITEK – ILI9341

# 1. SPECIFICATIONS

## 1.1 Features

### Main LCD Panel

Item	Standard Value
Display Type	240 * (R、G、B) * 320 Dots
LCD Type	a-Si TFT, Normally Black VA, Transmissive
Screen size(inch)	2.4 (Diagonal)
Color configuration	R.G.B. vertical stripe
Backlight	White LED
Interface	8 /9/16/18 Bit Interface for i80 system and serial /RGB interface
Driver IC	ILI9341
ROHS	THIS PRODUCT CONFORMS TO THE ROHS OF USMP Detailed information please to refer website : <a href="http://www.usmicroproducts.com">http://www.usmicroproducts.com</a>

## 1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	41.87 (W) * 59.35 (L) * 2.6 (H)max	mm

### LCD Panel

Item	Standard Value	Unit
Viewing Area	38.5 (W) * 50.96(L)	mm
Active Area	36.72(W) * 48.96(L)	mm

Note : For detailed information please refer to LCM drawing

### 1.3 Absolute Maximum Ratings

#### Module

Item	Symbol	Condition	Min.	Max.	Unit
System Power Supply Voltage	VDD	-	-0.3	4.6	V
	VGH-VGL	GND	0	+32	
Logic Input Voltage	V <sub>IN</sub>	-	-0.3	VDD+0.3	V
Operating Temperature	TOP	-	-20	70	°C
Storage Temperature	TST	-	-30	80	°C

### 1.4 DC Electrical Characteristics

#### Module

GND = 0V, Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power Supply Voltage	VDD	-	-	2.8	-	V
Input High Voltage	V <sub>IH</sub>	-	0.7*VDD	-	VDD	V
Input Low Voltage	V <sub>IL</sub>	-	GND	-	0.3*VDD	V
Output High Voltage	V <sub>OH</sub>	IOH=-0.1mA	0.8*VDD	-	VDD	V
Output Low Voltage	V <sub>OL</sub>	IOL=0.1mA	GND	-	0.2*VDD	V
Supply Current	IDD	VDD = 2.8V Pattern= Full display *1	-	(10)	(15)	mA

Note 1: Maximum current display

## 1.5 Optical Characteristics

### TFT LCD panel

VDD= 2.8 V, Ta=25°C

Item		Symbol	Condition	Min.	Typ.	Max.	unit	
Response time	Rise	Tr+Tf	Ta = 25°C θX, θY = 0°	-	(35)	-	ms	Note2
	Fall							
Viewing angle	Top	θY+	CR ≥ 10	-	(80)	-	Deg.	Note4
	Bottom	θY-						
	Left	θX-						
	Right	θX+						
Contrast ratio		CR	Ta = 25°C θX , θY = 0°	-	(500)	-	-	Note3
Color of CIE Coordinate (With B/L & T/P)	White	X	Ta = 25°C θX , θY = 0°	(0.286)	(0.306)	(0.326)	-	Note1
		Y		(0.298)	(0.318)	(0.338)		
	Red	X		(0.637)	(0.657)	(0.677)		
		Y		(0.306)	(0.326)	(0.346)		
	Green	X		(0.249)	(0.269)	(0.289)		
		Y		(0.569)	(0.589)	(0.609)		
	Blue	X		(0.129)	(0.149)	(0.169)		
		Y		(0.060)	(0.080)	(0.100)		
Average Brightness Pattern=white display (With B/L )		IV	IF=TBD mA	(180)	(200)	-	cd/m <sup>2</sup>	Note1
Uniformity (With B/L )		△B	IF=TBD mA	80	-	-	%	Note1

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Note1:

\*1 :  $\Delta B = B(\min) / B(\max) * 100\%$

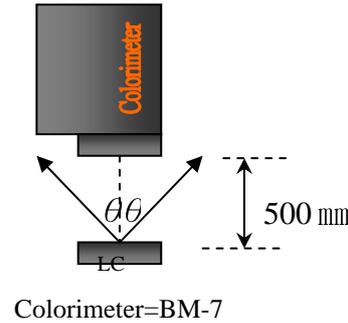
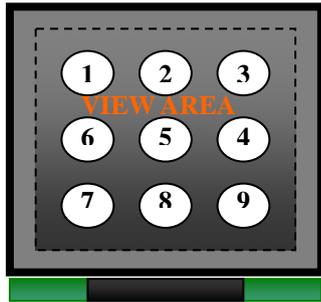
\*2 : Measurement Condition for Optical Characteristics:

a : Environment:  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  /  $60 \pm 20\% \text{R.H}$  , no wind , dark room below 10 Lux at typical lamp current and typical operating frequency.

b : Measurement Distance:  $500 \pm 50$  mm , ( $\theta = 0^{\circ}$ )

c : Equipment: TOPCON BM-7 fast , (field 1°) , after 10 minutes operation.

d : The uncertainty of the C.I.E coordinate measurement  $\pm 0.01$  , Average Brightness  $\pm 4\%$



Colorimeter=BM-7

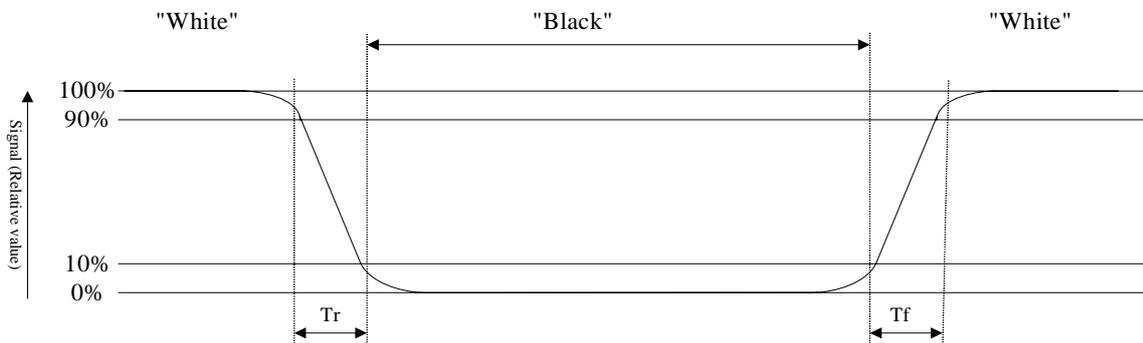
To be measured at the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7, after 10 minutes operation (module)

Note2: Definition of response time:

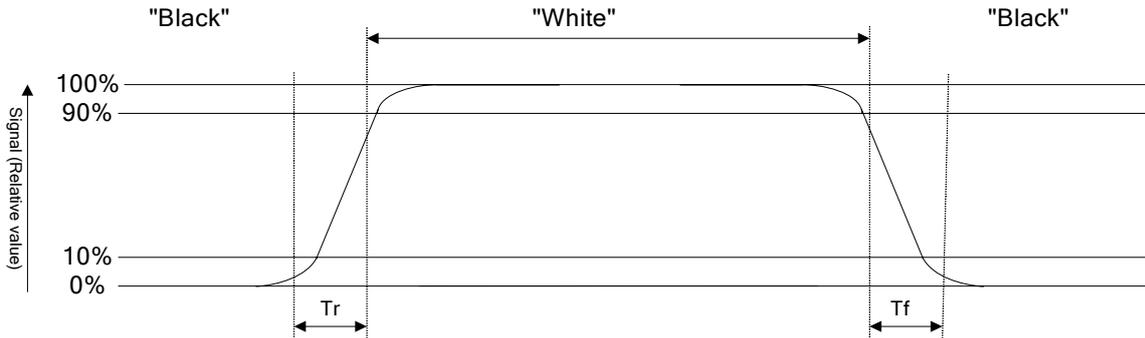
The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of Amplitudes.

Refer to figure as below:

Normally White



Normally Black



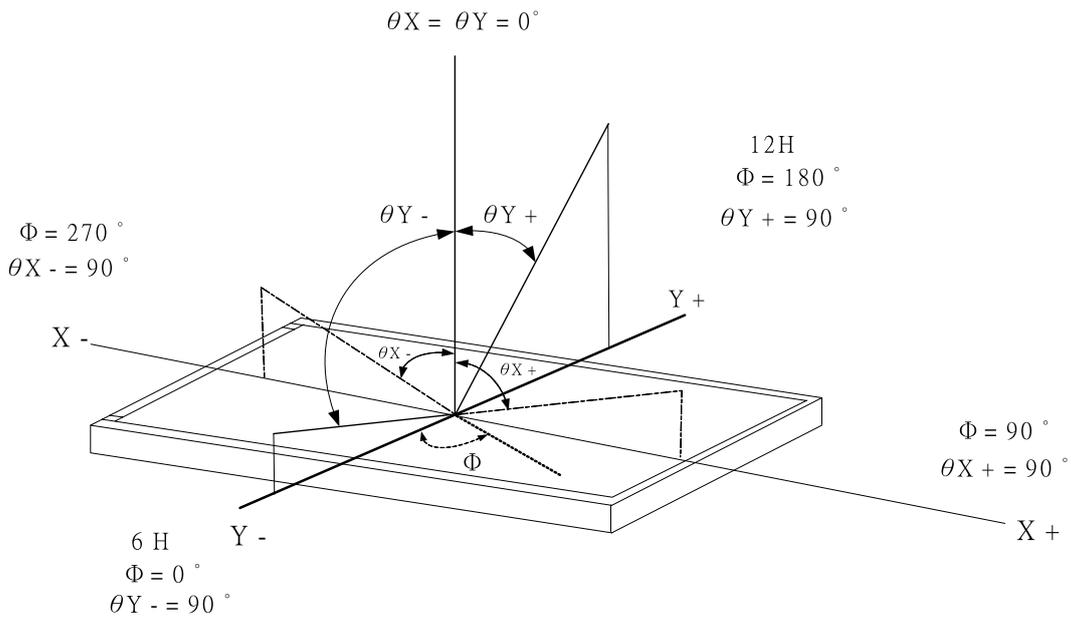
Note3: Definition of contrast ratio:

Contrast ratio is calculated with the following formula

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note4: Definition of viewing angle:

Refer to figure as below:



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## 1.6 Backlight & LED Characteristics

LCD Module with LED Backlight

### Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward Current	IF	Ta =25°C	-	TBD	mA
Reverse Voltage	VR	Ta =25°C	-	TBD	V

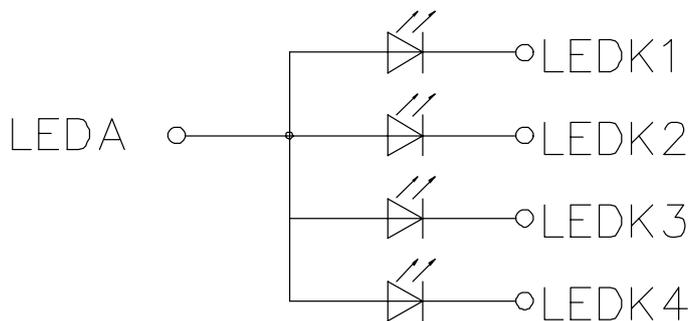
### Electrical / Optical Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	VF	IF= TBD mA	(2.9)	(3.2)	(3.5)	V
Average Brightness (without LCD )	IV		(5000)	-	-	cd/m <sup>2</sup>
Color of CIE Coordinate*1 (Without LCD )	X		(0.25)	(0.275)	(0.3)	*2
	Y		(0.25)	(0.275)	(0.3)	
Color	White					

\*1 : This value will be changed while mass production.

\*2 :  $\Delta B = B(\min) / B(\max) * 100\%$

B/L Internal Circuit Diagram



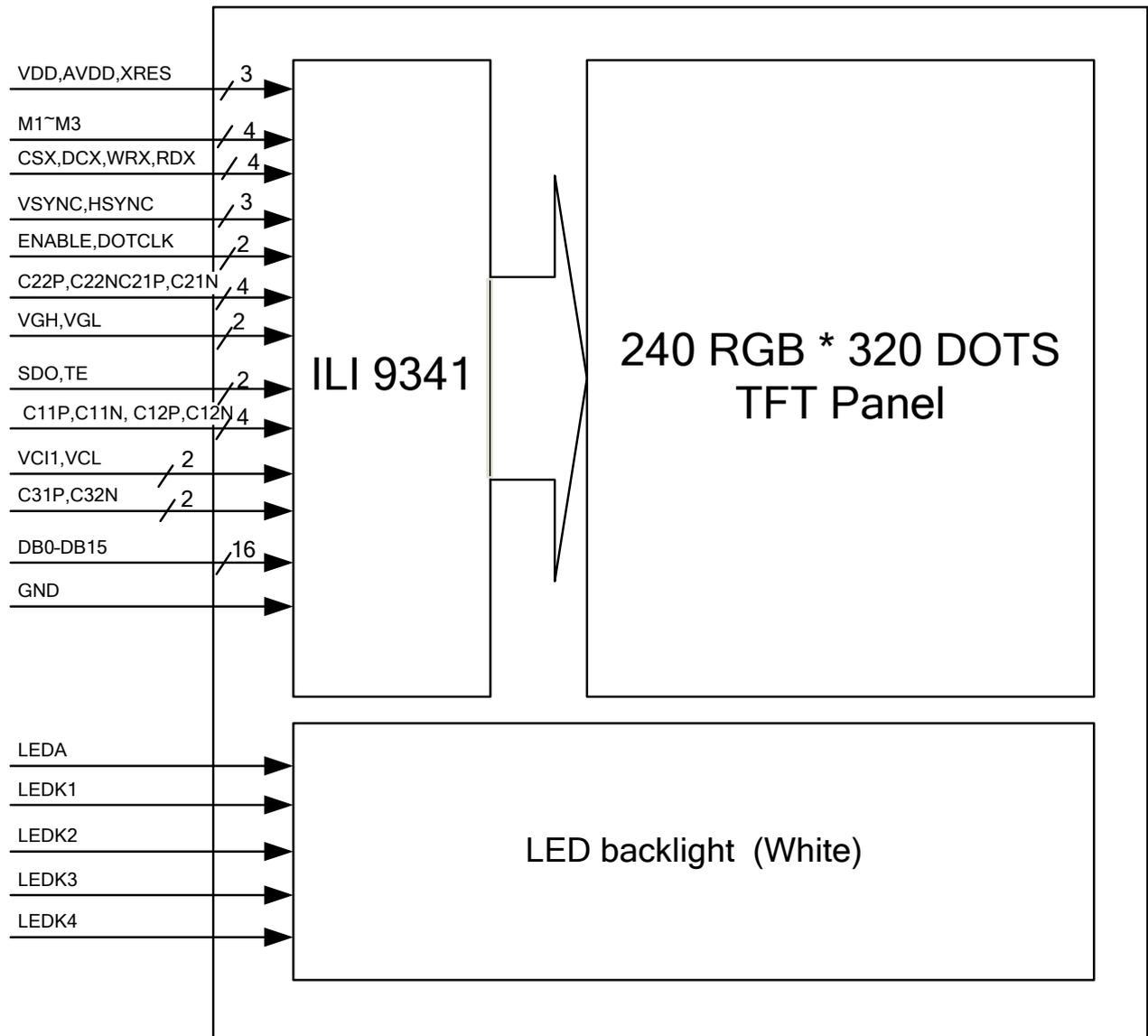
## 2. MODULE STRUCTURE

### 2.1 Counter Drawing

#### 2.1.1 LCM Mechanical Diagram

\* See Appendix

#### 2.1.2 Block Diagram



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## 2.2 Interface Pin Description

Pin No.	Symbol	Function
1	GND	System Ground.(0V)
2	GND	System Ground.(0V)
3	LEDK4	Power supply for LED Backlight Cathode input.
4	LEDK3	Power supply for LED Backlight Cathode input.
5	LEDK2	Power supply for LED Backlight Cathode input.
6	LEDK1	Power supply for LED Backlight Cathode input.
7	LEDA	Power supply for LED Backlight Anode input.
8	C22P	Place a 1uF/25V capacitor between C22P and C22N.
9	C22N	Place a 1uF/25V capacitor between C22N and C22P.
10	C21P	Place a 1uF/10V capacitor between C21P and C21N.
11	C21N	Place a 1uF/10V capacitor between C21N and C21P.
12	VGH	VGH pad. Place a 1uF/25V capacitor to GND.
13	VGL	VGL pad. Place a 1uF/25V capacitor to GND.
14	AVDD	AVDD pad. Place a 1uF/10V capacitor to GND.
15	C12P	Place a 1uF/10V capacitor between C12P and C12N.
16	C12N	Place a 1uF/10V capacitor between C12N and C12P.
17	C11P	Place a 1uF/10V capacitor between C11P and C11N.
18	C11N	Place a 1uF/10V capacitor between C11N and C11P.
19	GND	System Ground.(0V)
20	GND	System Ground.(0V)
21	GND	System Ground.(0V)
22	IM3	MPU Parallel interface bus and serial interface select
23	IM2	If use RGB Interface must select serial interface. * : Fix this pin at VDDI or VSS.

Pin No.	Symbol	Function
24	IM1	MPU Parallel interface bus and serial interface select
25	IM0	If use RGB Interface must select serial interface. * : Fix this pin at VDDI or VSS.
26	RESX	This signal will reset the device and must be applied to properly initialize the chip. Signal is active low.
27	CSX	Chip select input pin ("Low" enable).
28	D/CX (SCL)	This pin is used to select "Data or Command" in the parallel interface or 4-wire 8-bit serial data interface. When DCX = '1', data is selected. When DCX = '0', command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface. If not used, this pin should be connected to VDDI or VSS.
29	WRX (D/CX)	- 8080- I /8080- II system (WRX): Serves as a write signal and writes data at the rising edge. - 4-line system (D/CX): Serves as command or parameter select. Fix to VDDI level when not in use.
30	RDX	8080- I /8080- II system (RDX): Serves as a read signal and MCU read data at the rising edge. Fix to VDDI level when not in use.
31	VSYN	Frame synchronizing signal for RGB interface operation. Fix to VDDI or VSS level when not in use.
32	HSYN	Line synchronizing signal for RGB interface operation. Fix to VDDI or VSS level when not in use
33	ENABLE	Data enable signal for RGB interface operation. Fix to VDDI or VSS level when not in use
34	DOTCLK	Dot clock signal for RGB interface operation. Fix to VDDI or VSS level when not in use
35	SDA	The data is applied on the rising edge of the SCL signal. If not used, fix this pin at VDDI or VSS.
36	DB0	Bi-directional data bus.
37	DB1	Bi-directional data bus.
38	DB2	Bi-directional data bus.
39	DB3	Bi-directional data bus.

Pin No.	Symbol	Function
40	DB4	Bi-directional data bus.
41	DB5	Bi-directional data bus.
42	DB6	Bi-directional data bus.
43	DB7	Bi-directional data bus.
44	DB8	Bi-directional data bus.
45	DB9	Bi-directional data bus.
46	DB10	Bi-directional data bus.
47	DB11	Bi-directional data bus.
48	DB12	Bi-directional data bus.
49	DB13	Bi-directional data bus.
50	DB14	Bi-directional data bus.
51	DB15	Bi-directional data bus.
52	DB16	Bi-directional data bus.
53	DB17	Bi-directional data bus.
54	TE	Tearing effect output pin to synchronize MPU to frame writing, activated by S/W command. When this pin is not activated, this pin is low. If not used, open this pin.
55	VDD	Power supply.(2.8V) .
56	VDD	Power supply.(2.8V) .
57	VDD	Power supply.(2.8V) .
58	VCI1	VCI1 pad. Place a 1uF/10V capacitor to GND.
59	VCL	VCL pad. Place a 1uF/10V capacitor to GND.
60	GND	System Ground.(0V)
61	GND	System Ground.(0V)

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IM3	IM2	IM1	IM0	Interface	Register/Content	GRAM
0	1	0	1	3-wire 9-bit data serial I	SDA: In/OUT	
0	1	1	0	4-wire 8-bit data serial I	SDA: In/OUT	
1	1	0	1	3-wire 9-bit data serial II	SDA: In / SDO: Out	
1	1	1	0	4-wire 8-bit data serial II	SDA: In / SDO: Out	
0	0	0	0	8080 MCU 8-bit Parallel I	D[7:0]	D[7:0]
0	0	0	1	8080 MCU 16-bit Parallel I	D[7:0]	D[15:0]
0	0	1	0	8080 MCU 9-bit Parallel I	D[7:0]	D[8:0]
0	0	1	1	8080 MCU 18-bit Parallel I	D[7:0]	D[17:0]
1	0	0	0	8080 MCU 16-bit Parallel II	D[8:1]	D[17:10] D[8:1]
1	0	0	1	8080 MCU 8-bit Parallel II	D[17:10]	D[17:10]
1	0	1	0	8080 MCU 18-bit Parallel II	D[8:11]	D[17:0]
1	0	1	1	8080 MCU 9-bit Parallel II	D[17:10]	D[17:9]

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**2.2.1 Application Notes:**

TBD

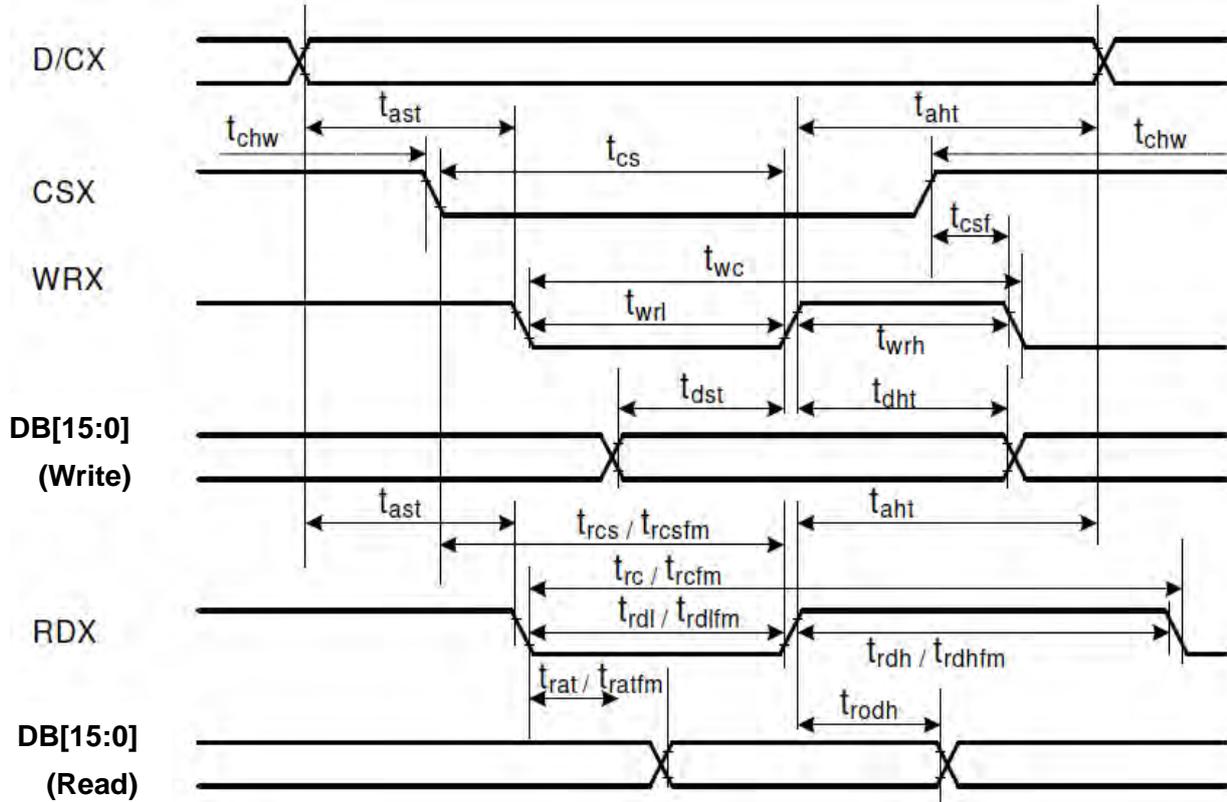
**2.2.2 Refer Initial code:**

TBD

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## 2.3 Timing Characteristics

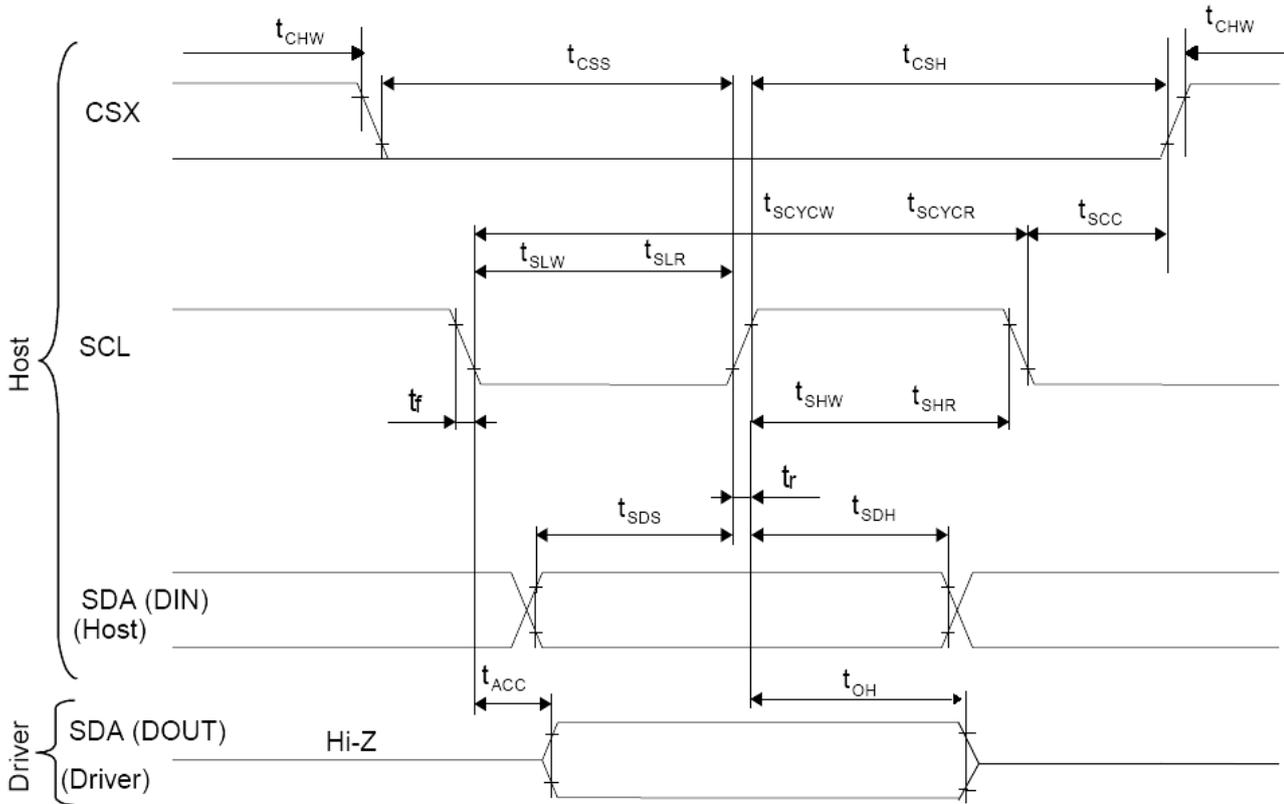
### Display Parallel 8080 system 16/8-bit Interface Timing Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
DCX	t <sub>ast</sub>	Address setup time	0	-	ns	
	t <sub>aht</sub>	Address hold time (Write/Read)	0	-	ns	
CSX	t <sub>chw</sub>	CSX "H" pulse width	0	-	ns	
	t <sub>cs</sub>	Chip Select setup time (Write)	15	-	ns	
	t <sub>rcs</sub>	Chip Select setup time (Read ID)	45	-	ns	
	t <sub>rcsfm</sub>	Chip Select setup time (Read FM)	355	-	ns	
	t <sub>csf</sub>	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	t <sub>wc</sub>	Write cycle	66	-	ns	
	t <sub>wrh</sub>	Write Control pulse H duration	15	-	ns	
	t <sub>wrl</sub>	Write Control pulse L duration	15	-	ns	
RDX (FM)	t <sub>rcfm</sub>	Read Cycle (FM)	450	-	ns	
	t <sub>rdhfm</sub>	Read Control H duration (FM)	90	-	ns	
	t <sub>rdlfm</sub>	Read Control L duration (FM)	355	-	ns	
RDX (ID)	t <sub>rc</sub>	Read cycle (ID)	160	-	ns	
	t <sub>rdh</sub>	Read Control pulse H duration	90	-	ns	
	t <sub>rdl</sub>	Read Control pulse L duration	45	-	ns	
DB[15:0] DB[7:0]	t <sub>dst</sub>	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	t <sub>dht</sub>	Write data hold time	10	-	ns	
	t <sub>rat</sub>	Read access time	-	40	ns	
	t <sub>ratfm</sub>	Read access time	-	340	ns	
	t <sub>rod</sub>	Read output disable time	20	80	ns	

Note: Ta = -30 to 70 °C, VCC=1.65V to 3.3V, VCI=2.5V to 3.3V, GND=0V

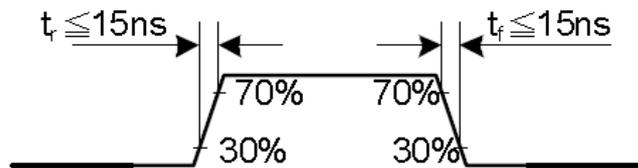
**Display Serial Interface Timing Characteristics (3-line SPI system)**



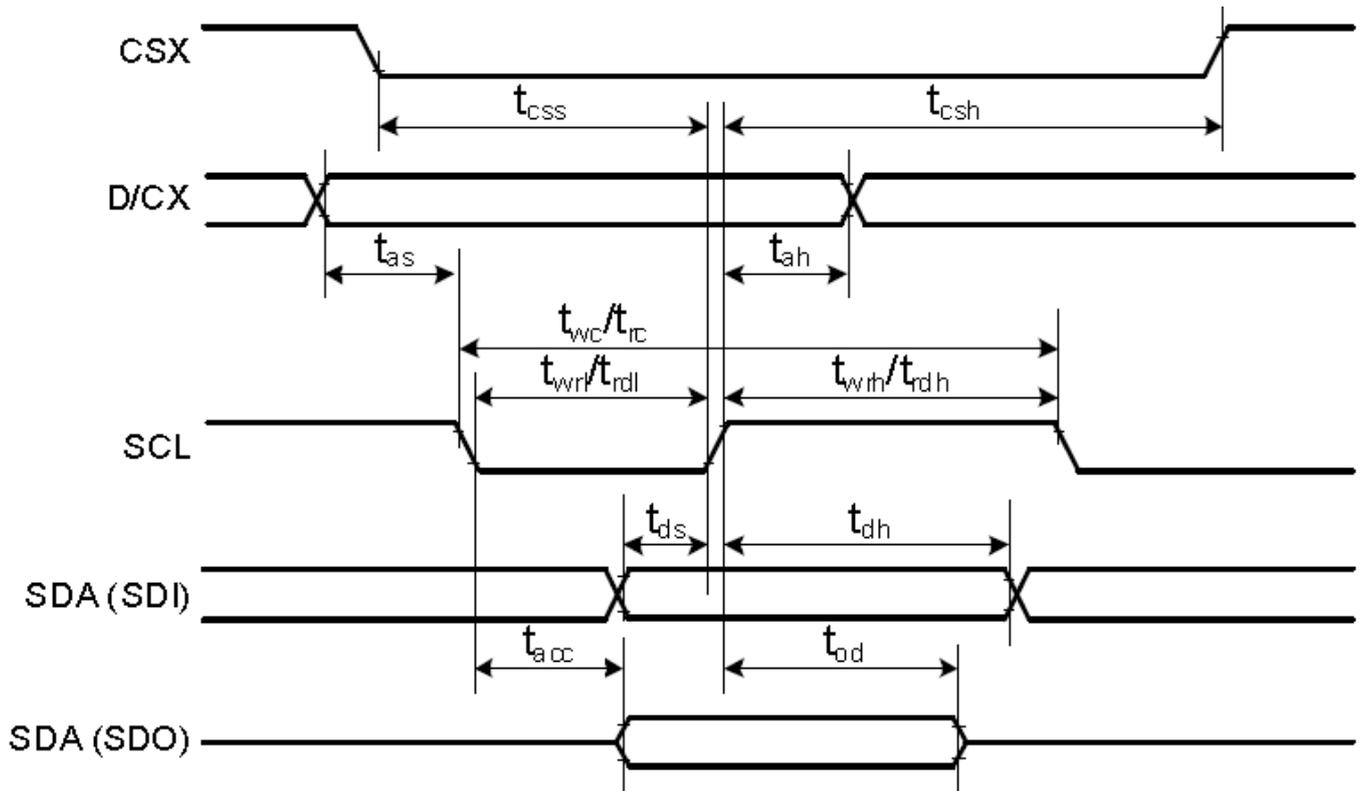
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Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (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	
	tch	CSX "H" Pulse Width	40	-	ns	
	tcss	CSX-SCL Time	60	-	ns	
			65	-	ns	

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

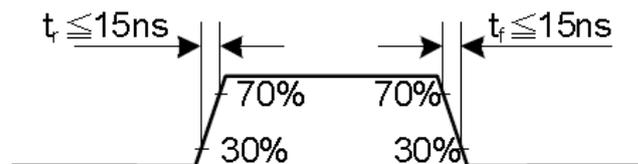


**Display Serial Interface Timing Characteristics (4-line SPI system)**

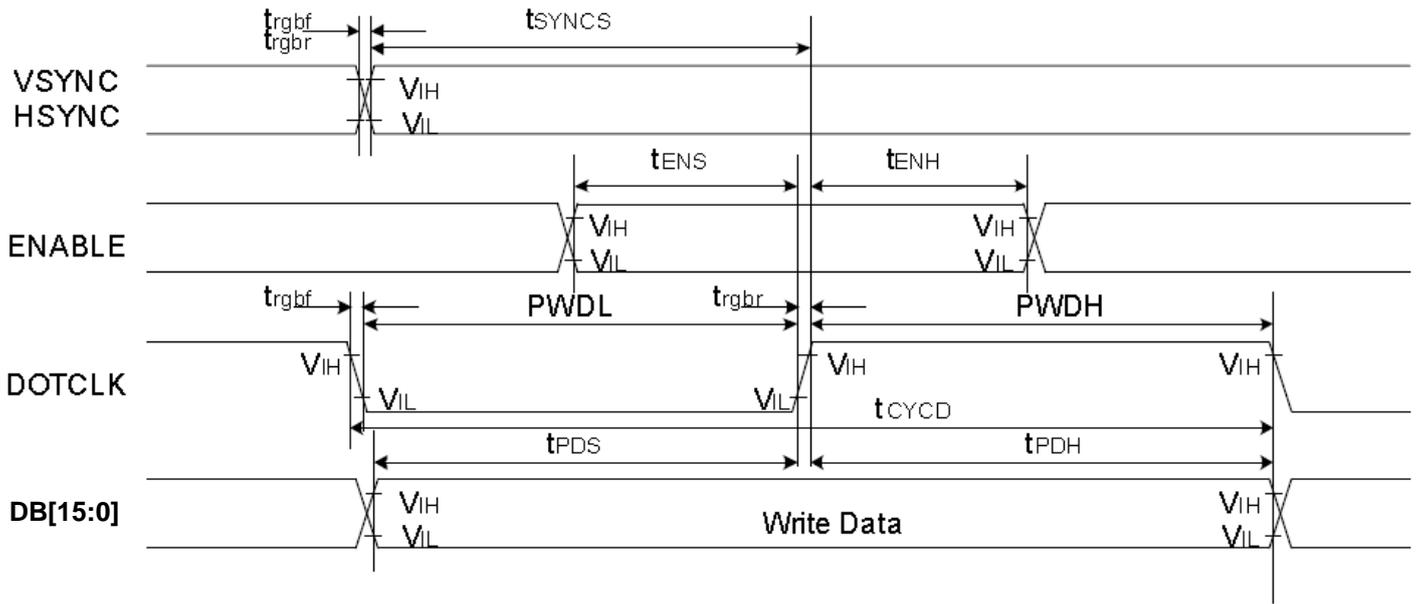


Signal	Symbol	Parameter	min	max	Unit	Description
CSX	$t_{css}$	Chip select time (Write)	40	-	ns	
	$t_{csh}$	Chip select hold time (Read)	40	-	ns	
SCL	$t_{wc}$	Serial clock cycle (Write)	100	-	ns	
	$t_{wrh}$	SCL "H" pulse width (Write)	40	-	ns	
	$t_{wrl}$	SCL "L" pulse width (Write)	40	-	ns	
	$t_{rc}$	Serial clock cycle (Read)	150	-	ns	
	$t_{rdh}$	SCL "H" pulse width (Read)	60	-	ns	
	$t_{rdl}$	SCL "L" pulse width (Read)	60	-	ns	
D/CX	$t_{as}$	D/CX setup time	10	-		
	$t_{ah}$	D/CX hold time (Write / Read)	10	-		
SDA / SDI (Input)	$t_{ds}$	Data setup time (Write)	30	-	ns	
	$t_{dh}$	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	$t_{acc}$	Access time (Read)	10	-	ns	For maximum CL=30pF
	$t_{od}$	Output disable time (Read)	10	50	ns	For minimum CL=8pF

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

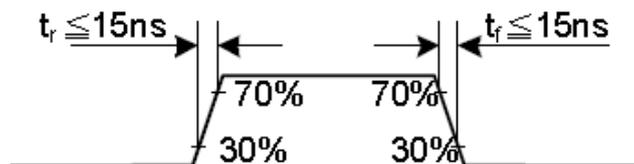


**Parallel 16-bit RGB Interface Timing Characteristics**



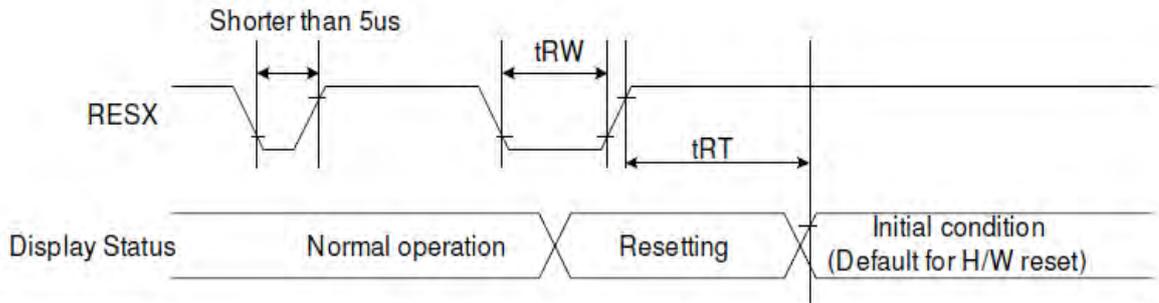
Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	$t_{sYNCS}$	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	$t_{sYNCH}$	VSYNC/HSYNC hold time	15	-	ns	
DE	$t_{ENs}$	DE setup time	15	-	ns	
	$t_{ENH}$	DE hold time	15	-	ns	
DB[15:0]	$t_{PDS}$	Data setup time	15	-	ns	
	$t_{PDH}$	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	
	$t_{rgbr}, t_{rgbf}$	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	
DB[15:0]	$t_{PDS}$	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	
	$t_{rgbr}, t_{rgbf}$	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  $3.3V$ ,  $AGND=VSS=0V$



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## Reset Timing



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

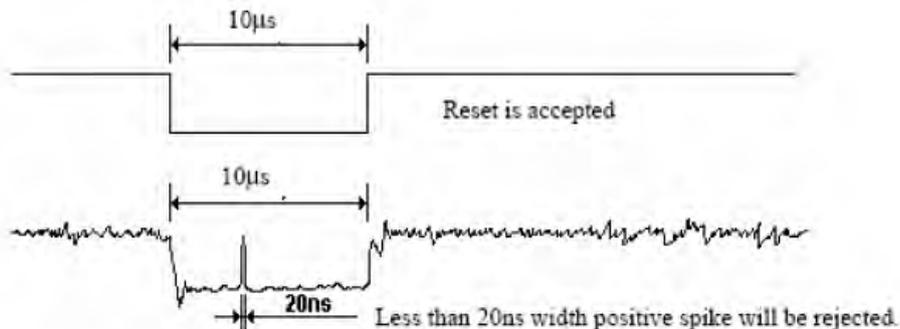
*Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.*

*Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -*

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

*Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In -mode.) And then return to Default condition for Hardware Reset.*

*Note 4: Spike Rejection also applies during a valid reset pulse as shown below:*



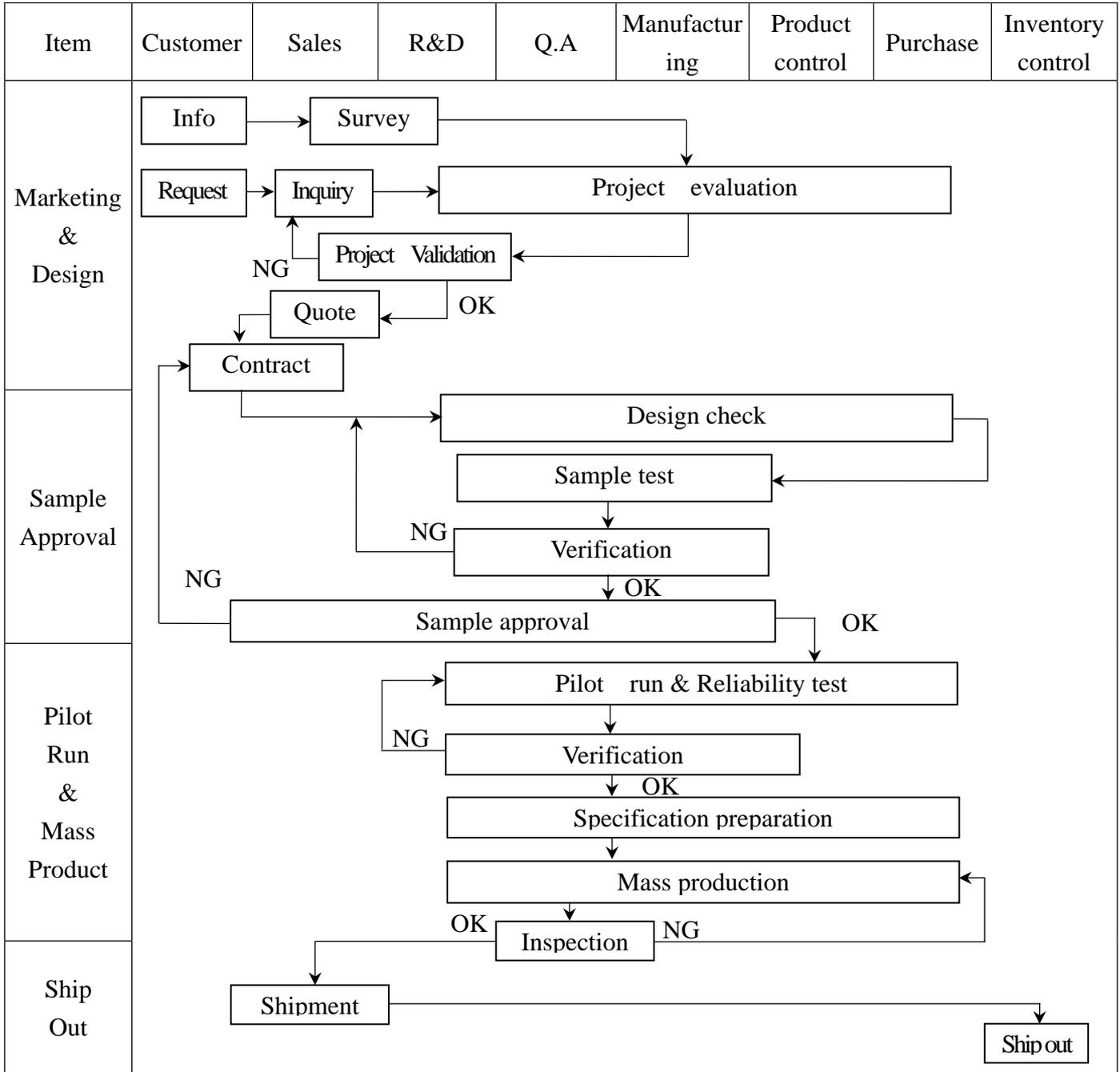
*Note 5: When Reset applied during Sleep In Mode.*

*Note 6: When Reset applied during Sleep Out Mode.*

*Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.*

### 3. QUALITY ASSURANCE SYSTEM

#### 3.1 Quality Assurance Flow Chart



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Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Sales Service	<pre> graph TD     Info[Info] --&gt; Claim[Claim]     Claim --&gt; Failure[Failure analysis]     Failure --&gt; Report[Analysis report]     Failure --&gt; Action[Corrective action]     Action --&gt; Tracking[Tracking]             </pre>							
Q.A Activity	1. ISO 9001 Maintenance Activities 3. Equipment calibration 5. Standardization Management				2. Process improvement proposal 4. Education And Training Activities			

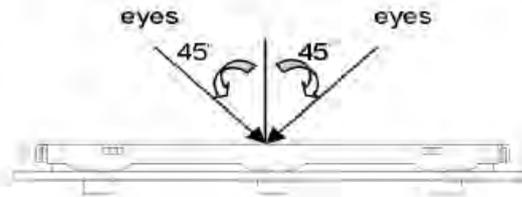
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### 3.2. Inspection Specification

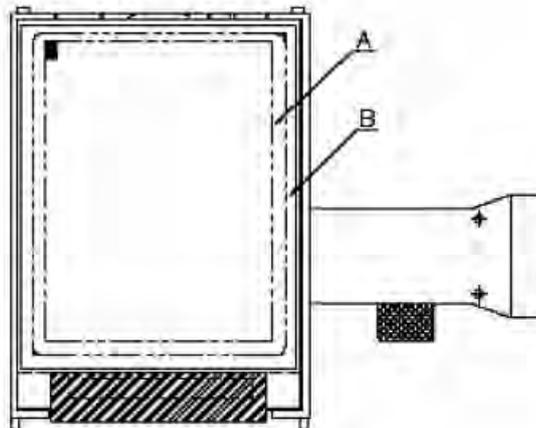
- ◆ **Scope** : The document shall be applied to TFT-LCD Module for less than 3.5" (Ver.B01).
- ◆ **Inspection Standard** : MIL-STD-105E Table Normal Inspection Single Sampling Level II.
- ◆ **Equipment** : Gauge , MIL-STD , Powertip Tester , Sample
- ◆ **Defect Level** : Major Defect AQL : 0.4 ; Minor Defect AQL : 1.5
- ◆ **OUT Going Defect Level** : Sampling.
- ◆ **Standard of the product appearance test** :

**a. Manner of appearance test :**

- (1). The test best be under 20W×2 fluorescent light , and distance of view must be at 30 cm.
- (2). The test direction is base on about around 45° of vertical line.



**(3). Definition of area.**



**A area : viewing area**

**B area : Outside of viewing area**

**(4). Standard of inspection : (Unit : mm)**

**◆ Specification For TFT-LCD Module Less Than 3.5" :**

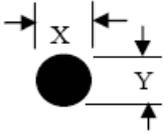
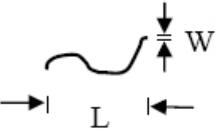
(Ver.B01)

NO	Item	Criterion	Level												
01	Product condition	1. 1 The part number is inconsistent with work order of production.	Major												
		1. 2 Mixed product types.	Major												
		1. 3 Assembled in inverse direction.	Major												
02	Quantity	2. 1 The quantity is inconsistent with work order of production.	Major												
03	Outline dimension	3. 1 Product dimension and structure must conform to structure diagram.	Major												
04	Electrical Testing	4. 1 Missing line character and icon.	Major												
		4. 2 No function or no display.	Major												
		4. 3 Display malfunction.	Major												
		4. 4 LCD viewing angle defect.	Major												
		4. 5 Current consumption exceeds product specifications.	Major												
05	<b>Dot defect</b>  (Bright dot 、 Dark dot)  On -display	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Item</th> <th>Acceptance (Q'ty)</th> </tr> </thead> <tbody> <tr> <td rowspan="4" style="text-align: center; vertical-align: middle;">Dot Defect</td> <td style="text-align: center;">Bright Dot</td> <td style="text-align: center;"><math>\leq 2</math></td> </tr> <tr> <td style="text-align: center;">Dark Dot</td> <td style="text-align: center;"><math>\leq 3</math></td> </tr> <tr> <td style="text-align: center;">Joint Dot</td> <td style="text-align: center;"><math>\leq 2</math></td> </tr> <tr> <td style="text-align: center;">Total</td> <td style="text-align: center;"><math>\leq 3</math></td> </tr> </tbody> </table> <p>5. 1 Inspection pattern : full white , full black , Red , Green and blue screens.</p> <p>5. 2 It is defined as dot defect if defect area <math>&gt; 1/2</math> dot.</p> <p>5. 3 The distance between two dot defect <math>\geq 5</math> mm.</p>	Item		Acceptance (Q'ty)	Dot Defect	Bright Dot	$\leq 2$	Dark Dot	$\leq 3$	Joint Dot	$\leq 2$	Total	$\leq 3$	Minor
Item		Acceptance (Q'ty)													
Dot Defect	Bright Dot	$\leq 2$													
	Dark Dot	$\leq 3$													
	Joint Dot	$\leq 2$													
	Total	$\leq 3$													

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◆ Specification For TFT-LCD Module Less Than 3.5" :

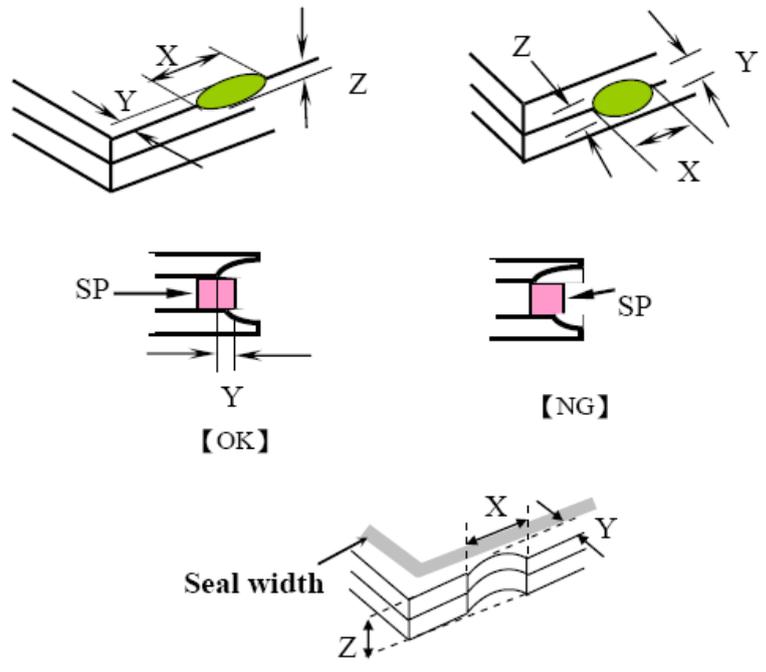
(Ver.B01)

NO	Item	Criterion	Level																																												
06	<p>Black or white dot、scratch、contamination</p> <p>Round type</p>  <p><math>\Phi = (x + y) / 2</math></p> <p>Line type</p> 	<p>6.1 Round type ( Non-display or display ) :</p> <table border="1"> <thead> <tr> <th rowspan="2">Dimension (diameter : <math>\Phi</math>)</th> <th colspan="2">Acceptance (Q'ty)</th> </tr> <tr> <th>A area</th> <th>B area</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.15</math></td> <td colspan="2">Ignore</td> </tr> <tr> <td><math>0.15 &lt; \Phi \leq 0.20</math></td> <td colspan="2">2</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.30</math></td> <td colspan="2">2</td> </tr> <tr> <td><math>\Phi &gt; 0.30</math></td> <td colspan="2">0</td> </tr> <tr> <td><b>Total</b></td> <td colspan="2">3</td> </tr> </tbody> </table> <p>6.2 Line type( Non-display or display ) :</p> <table border="1"> <thead> <tr> <th colspan="2">Dimension</th> <th colspan="2">Acceptance (Q'ty)</th> </tr> <tr> <th>Length (L)</th> <th>Width (W)</th> <th>A area</th> <th>B area</th> </tr> </thead> <tbody> <tr> <td>---</td> <td><math>W \leq 0.03</math></td> <td colspan="2">Ignore</td> </tr> <tr> <td><math>L \leq 5.0</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td colspan="2">3</td> </tr> <tr> <td>---</td> <td><math>W &gt; 0.05</math></td> <td colspan="2">As round type</td> </tr> <tr> <td colspan="2"><b>Total</b></td> <td colspan="2">3</td> </tr> </tbody> </table>	Dimension (diameter : $\Phi$ )	Acceptance (Q'ty)		A area	B area	$\Phi \leq 0.15$	Ignore		$0.15 < \Phi \leq 0.20$	2		$0.20 < \Phi \leq 0.30$	2		$\Phi > 0.30$	0		<b>Total</b>	3		Dimension		Acceptance (Q'ty)		Length (L)	Width (W)	A area	B area	---	$W \leq 0.03$	Ignore		$L \leq 5.0$	$0.03 < W \leq 0.05$	3		---	$W > 0.05$	As round type		<b>Total</b>		3		Minor
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07	Polarizer Bubble	<table border="1"> <thead> <tr> <th rowspan="2">Dimension (diameter : <math>\Phi</math>)</th> <th colspan="2">Acceptance (Q'ty)</th> </tr> <tr> <th>A area</th> <th>B area</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.20</math></td> <td colspan="2">Ignore</td> </tr> <tr> <td><math>0.20 &lt; \Phi \leq 0.50</math></td> <td colspan="2">3</td> </tr> <tr> <td><math>\Phi &gt; 0.50</math></td> <td colspan="2">0</td> </tr> <tr> <td><b>Total</b></td> <td colspan="2">3</td> </tr> </tbody> </table>	Dimension (diameter : $\Phi$ )	Acceptance (Q'ty)		A area	B area	$\Phi \leq 0.20$	Ignore		$0.20 < \Phi \leq 0.50$	3		$\Phi > 0.50$	0		<b>Total</b>	3		Minor																											
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◆ Specification For TFT-LCD Module Less Than 3.5" :

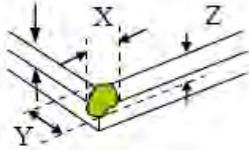
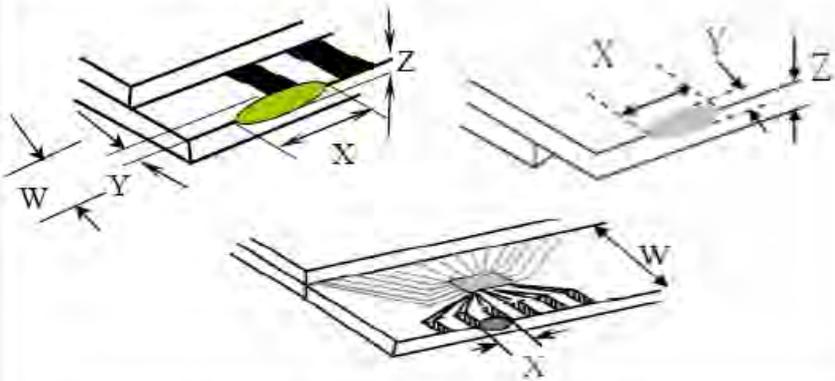
(Ver.B01)

NO	Item	Criterion	Level									
08	The crack of glass	<p><b>Symbols :</b></p> <p><b>X :</b> The length of crack  <b>Y :</b> The width of crack.  <b>Z :</b> The thickness of crack  <b>W :</b> terminal length  <b>t :</b> The thickness of glass  <b>a :</b> LCD side length</p> <hr/> <p>8.1 General glass chip :</p> <p>8.1.1 Chip on panel surface and crack between panels:</p>  <table border="1" data-bbox="550 1444 1348 1736"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq a</math></td> <td>Crack can't enter viewing area</td> <td><math>\leq 1/2 t</math></td> </tr> <tr> <td><math>\leq a</math></td> <td>Crack can't exceed the half of SP width.</td> <td><math>1/2 t &lt; Z \leq 2 t</math></td> </tr> </tbody> </table>	X	Y	Z	$\leq a$	Crack can't enter viewing area	$\leq 1/2 t$	$\leq a$	Crack can't exceed the half of SP width.	$1/2 t < Z \leq 2 t$	Minor
X	Y	Z										
$\leq a$	Crack can't enter viewing area	$\leq 1/2 t$										
$\leq a$	Crack can't exceed the half of SP width.	$1/2 t < Z \leq 2 t$										

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◆ Specification For TFT-LCD Module Less Than 3.5" :

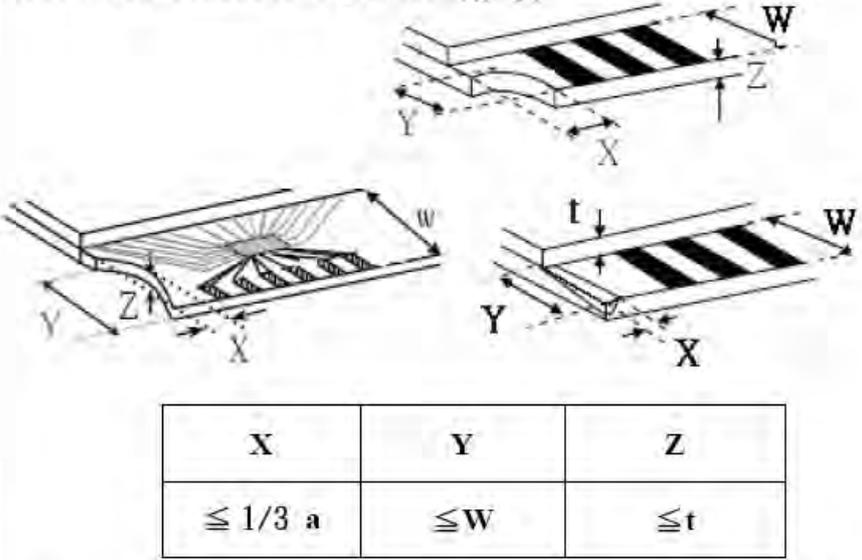
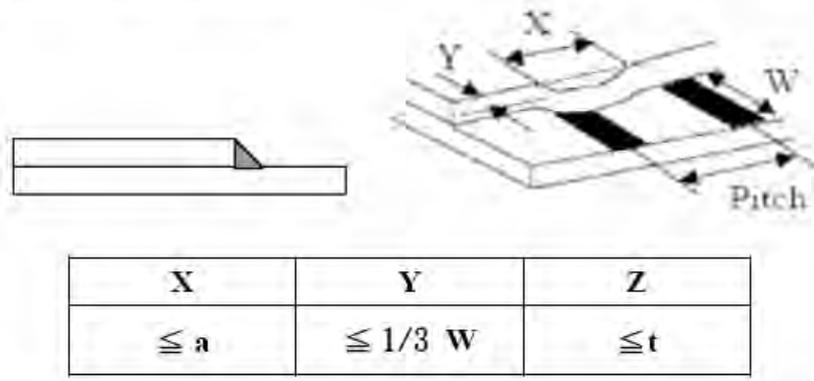
(Ver.B01)

NO	Item	Criterion	Level									
08	The crack of glass	<p>Symbols :</p> <p>X : The length of crack                      Y : The width of crack.                      Z : The thickness of crack                  W : terminal length                      t : The thickness of glass                  a : LCD side length</p> <hr/> <p>8.1.2 Corner crack :</p>  <table border="1" data-bbox="531 772 1337 1064"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td><math>\leq 1/5 a</math></td> <td>Crack can't enter viewing area</td> <td><math>Z \leq 1/2 t</math></td> </tr> <tr> <td><math>\leq 1/5 a</math></td> <td>Crack can't exceed the half of SP width.</td> <td><math>1/2 t &lt; Z \leq 2 t</math></td> </tr> </tbody> </table>	X	Y	Z	$\leq 1/5 a$	Crack can't enter viewing area	$Z \leq 1/2 t$	$\leq 1/5 a$	Crack can't exceed the half of SP width.	$1/2 t < Z \leq 2 t$	Minor
		X	Y	Z								
$\leq 1/5 a$	Crack can't enter viewing area	$Z \leq 1/2 t$										
$\leq 1/5 a$	Crack can't exceed the half of SP width.	$1/2 t < Z \leq 2 t$										
<p>8.2 Protrusion over terminal :</p> <p>8.2.1 Chip on electrode pad :</p>  <table border="1" data-bbox="568 1657 1345 1832"> <thead> <tr> <th></th> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>Front</td> <td><math>\leq a</math></td> <td><math>\leq 1/2 W</math></td> <td><math>\leq t</math></td> </tr> <tr> <td>Back</td> <td><math>\leq a</math></td> <td><math>\leq W</math></td> <td><math>\leq 1/2 t</math></td> </tr> </tbody> </table>		X	Y	Z	Front	$\leq a$	$\leq 1/2 W$	$\leq t$	Back	$\leq a$	$\leq W$	$\leq 1/2 t$
	X	Y	Z									
Front	$\leq a$	$\leq 1/2 W$	$\leq t$									
Back	$\leq a$	$\leq W$	$\leq 1/2 t$									

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◆ Specification For TFT-LCD Module Less Than 3.5" :

(Ver.B01)

NO	Item	Criterion	Level
08	The crack of glass	<p>Symbols :</p> <p>X : The length of crack                      Y : The width of crack.  Z : The thickness of crack                  W : terminal length  t : The thickness of glass                  a : LCD side length</p> <p>8.2.2 Non-conductive portion :</p>  <p>8.2.3 Glass remain :</p> 	Minor

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**◆Specification For TFT-LCD Module Less Than 3.5" :**

(Ver.B01)

NO	Item	Criterion	Level
09	Backlight elements	9. 1 Backlight can't work normally.	Major
		9. 2 Backlight doesn't light or color is wrong.	Major
		9. 3 Illumination source flickers when lit.	Major
10	General appearance	10. 1 Pin type 、 quantity 、 dimension must match type in structure diagram.	Major
		10. 2 No short circuits in components on PCB or FPC .	Major
		10. 3 Parts on PCB or FPC must be the same as on the production characteristic chart .There should be no wrong parts , missing parts or excess parts.	Major
		10. 4 Product packaging must the same as specified on packaging specification sheet.	Minor
		10. 5 The folding and peeled off in polarizer are not acceptable.	Minor
		10. 6 The PCB or FPC between B/L assembled distance(PCB or FPC ) is $\leq 1.5$ mm.	Minor

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## 4. RELIABILITY TEST

### 4.1 Reliability Test Condition

(Ver.B01)

NO.	TEST ITEM	TEST CONDITION											
1	High Temperature Storage Test	Keep in <b>+80 ±2°C</b> 96 hrs Surrounding temperature, then storage at normal condition 4hrs.											
2	Low Temperature Storage Test	Keep in <b>-30 ±2°C</b> 96 hrs Surrounding temperature, then storage at normal condition 4hrs.											
3	High Temperature / High Humidity Storage Test	Keep in <b>+60°C / 90% R.H</b> duration for 96 hrs Surrounding temperature, then storage at normal condition 4hrs. (Excluding the polarizer)											
4	ESD Test	Air Discharge: Apply <b>2 KV</b> with <b>5 times</b> Discharge for each polarity +/-	Contact Discharge: Apply <b>250V</b> with <b>5 times</b> discharge for each polarity +/-										
		1. Temperature ambience: <b>15°C ~ 35°C</b> 2. Humidity relative: <b>30% ~ 60%</b> 3. Energy Storage Capacitance(Cs+Cd): <b>150pF±10%</b> 4. Discharge Resistance(Rd): <b>330Ω±10%</b> 5. Discharge, mode of operation: Single Discharge (time between successive discharges at least 1 s) (Tolerance if the output voltage indication: <b>±5%</b> )											
5	Temperature Cycling Storage Test	<p style="text-align: center;"> <b>-30°C → +25°C → +80°C → +25°C</b>                      (30mins) (5mins) (30mins) (5mins)    <b>10 Cycle</b> </p> Surrounding temperature, then storage at normal condition 4hrs.											
6	Vibration Test (Packaged)	1. Sine wave <b>10~55 Hz</b> frequency (1 min) 2. The amplitude of vibration : <b>1.5 mm</b> 3. Each direction (X、Y、Z) duration for <b>2 Hrs</b>											
7	Drop Test (Packaged)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Packing Weight (Kg)</th> <th>Drop Height (cm)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0 ~ 45.4</td> <td style="text-align: center;">122</td> </tr> <tr> <td style="text-align: center;">45.4 ~ 90.8</td> <td style="text-align: center;">76</td> </tr> <tr> <td style="text-align: center;">90.8 ~ 454</td> <td style="text-align: center;">61</td> </tr> <tr> <td style="text-align: center;">Over 454</td> <td style="text-align: center;">46</td> </tr> </tbody> </table> <p style="text-align: center;">Drop direction : ※ 1 corner / 3 edges / 6 sides each 1times</p>		Packing Weight (Kg)	Drop Height (cm)	0 ~ 45.4	122	45.4 ~ 90.8	76	90.8 ~ 454	61	Over 454	46
Packing Weight (Kg)	Drop Height (cm)												
0 ~ 45.4	122												
45.4 ~ 90.8	76												
90.8 ~ 454	61												
Over 454	46												

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## 5. PRECAUTION RELATING PRODUCT HANDLING

### 5.1 SAFETY

- 5.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.
- 5.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

### 5.2 HANDLING

- 5.2.1 Avoid any strong mechanical shock which can break the glass.
- 5.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.
- 5.2.3 Do not remove the panel or frame from the module.
- 5.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully ,do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)
- 5.2.5 Do not wipe the polarizing plate with a dry cloth , as it may easily scratch the surface of plate.
- 5.2.6 Do not touch the display area with bare hands , this will stain the display area.
- 5.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.
- 5.2.8 To control temperature and time of soldering is  $320\pm 10^{\circ}\text{C}$  and 3-5 sec.
- 5.2.9 To avoid liquid (include organic solvent) stained on LCM .

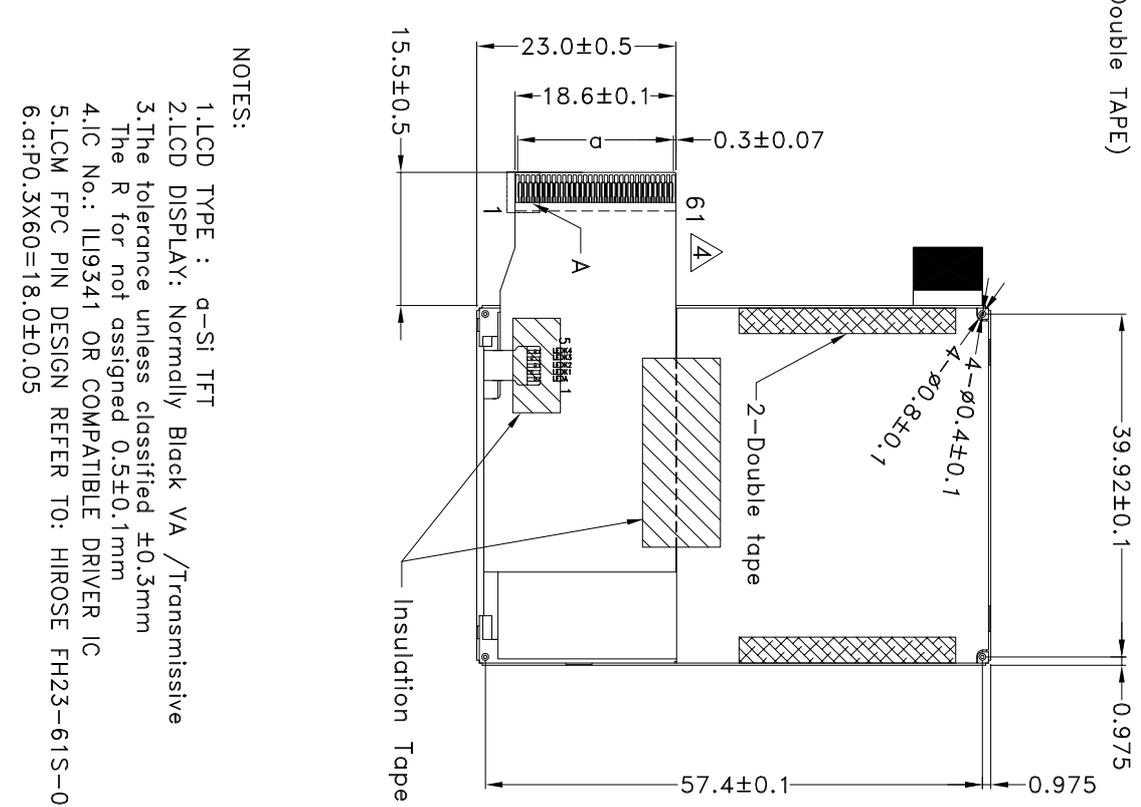
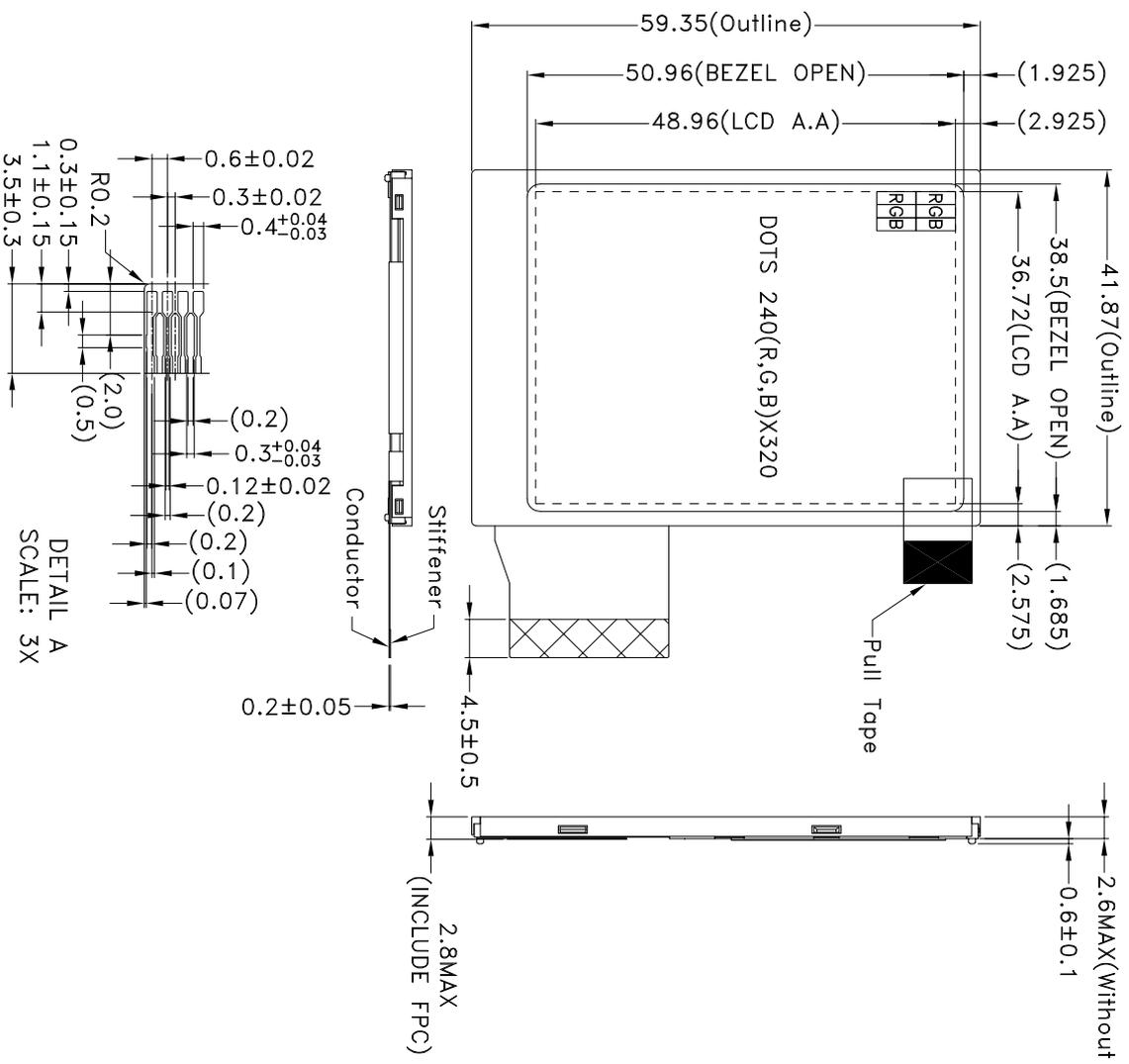
### 5.3 STORAGE

- 5.3.1 Store the panel or module in a dark place where the temperature is  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and the humidity is below 65% RH.
- 5.3.2 Do not place the module near organics solvents or corrosive gases.
- 5.3.3 Do not crush , shake , or jolt the module.

### 5.4 TERMS OF WARRANTY

- 5.4.1 Applicable warrant period  
The period is within Twenty-four months since the date of shipping out under normal using and storage conditions.
- 5.4.2 Unaccepted responsibility  
This product has been manufactured to your company's specification as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment , we cannot take responsibility if the product is used in nuclear power control equipment , aerospace equipment , fire and security systems or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.

A B C D E F G H



- NOTES:
- 1.LCD TYPE : a-Si TFT
  - 2.LCD DISPLAY: Normally Black VA /Transmissive
  - 3.The tolerance unless classified  $\pm 0.3\text{mm}$   
The R for not assigned  $0.5\pm 0.1\text{mm}$
  - 4.IC No.: ILI9341 OR COMPATIBLE DRIVER IC
  - 5.LCM FPC PIN DESIGN REFER TO: HIROSE FH23-61S-0.35HW
  - 6.d:P0.3X60=18.0±0.05

DETAIL A  
SCALE: 3X

007			
006			
005			
004	Modify FPC PIN NO.	Sunny	2012/12/18
003	Modify FPC & C/N	Sunny	2012/11/16
002	Modify FPC	Sunny	2012/11/01
001	NEW DRAWING	Sunny	2012/10/24
REV	REVISION	REVISER	DATE

PART NO: **USMP-TT024Q-01K**

DRAWING NAME: **LMD-USMP-TT024Q-01K**

TITLE: **LCD MODULE DRAWING**



6207 Bee Caves Rd, Ste. 330, Austin, TX 78746 USA  
Tel: (800) 741-7755, sales@usmicroproducts.com  
www.usmicroproducts.com

Design	Sunny Chen	Surface	(3)	Precision Level	-
Check	Tina Chen	Unit	MM	Material	-
Approve	Linda Lee	Scale	FIT	Thickness	-
		Page	1/1	Quantity	-



## Displays

US Micro Products is an industrial distributor specializing in engineered display solutions. We dedicate ourselves to providing the best in displays for the medical, industrial, gaming, automotive, aerospace, military and consumer markets.

**OLEDs**



**TFT Display**



**Open Frame Monitors**



**Passive LCDs**



**Multitouch**



**Touch Screen**



As our customer, you receive expert knowledge, support and service. Our technical sales staff and experienced design engineers provide answers to your questions and engineered solutions to meet your display needs.

## Peripheral Devices

Our full line of peripheral devices includes keyboards, trackballs and printers. These rugged industrial products are designed to meet the rigorous demands of your equipment and are available in a variety of standard and custom options.

**Keyboards**



**Trackballs**



**Aerospace Trackballs**



**Printers**

