

# TFT-DISPLAY DATASHEET

STARTEK  
Model:KDO24QVFMA020

## BRIEF SPEC.:

Main Feature  
Portrait Type  
Wide Operation Temperature  
Wide Viewing Angle

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Active Screen Area	36.72 x 48.96 (mm)
Diagonal   Format	2,4"   3:4
Resolution	240 X 320
Colors	65K /262K
Backlight	LED
Brightness	450 cd/m <sup>2</sup>
LED Life Time	
Interface	RGB
Viewing Angle	80/80 L/R 80/80
Touchscreen	no
Power Supply	3.3V (Typ.)
Module Outline	42.92 x 60.26 x 2,5(mm)
Operation Temperature	-20 ... +70 °C
Storage Temperature	-30... + 80 °C



**SPECIFICATION  
FOR  
LCD Module  
KD024QVFMA020**

<b>MODULE:</b>	<b>KD024QVFMA020</b>
<b>CUSTOMER:</b>	

<b>REV</b>	<b>DESCRIPTION</b>	<b>DATE</b>
<b>1.0</b>	<b>FIRST ISSUE</b>	<b>2016.01.08</b>

<b>STARTEK</b>	<b>INITIAL</b>	<b>DATE</b>
<b>PREPARED BY</b>		
<b>CHECKED BY</b>		
<b>APPROVED BY</b>		

<b>CUSTOMER</b>	<b>INITIAL</b>	<b>DATE</b>
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<b>Part. No</b>	<b>KD024QVFMA020</b>	<b>REV</b>	<b>V1.0</b>	<b>Page 1 of 27</b>
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常备库存  
Standing Stock

长期供货  
Long Time supply

支持小量  
NO MOQ

品种齐全  
In Full Range



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## General Description

### \* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 2.4'TFT-LCD contains 240x320 pixels, and can display up to 262K colors.

### \* Features

- Low Input Voltage: 3.3V(TYP)
- Display Colors of TFT LCD: 65K/262Kcolors
- Interface: 8/9/16/18Bit MCU Interface  
3/4SPI+16/18Bit RGB Interface  
3-line/4-line Serial Interface

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	36.72(H)*48.96(V) (2.4inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65/262K	colors	-
Number of pixels	240(RGB)*320	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.153(H)*0.153(V)	mm	-
Viewing angle	ALL	o'clock	-
Controller IC	ST7789V	-	-
Display mode	Transmissive/ Normally Black	-	-
Operating temperature	-20~+70	°C	-
Storage temperature	-30~+80	°C	-

### \* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		42.92		mm	-
	Vertical(V)		60.26		mm	-
	Depth(D)		2.5		mm	-
Weight			TBD		g	-

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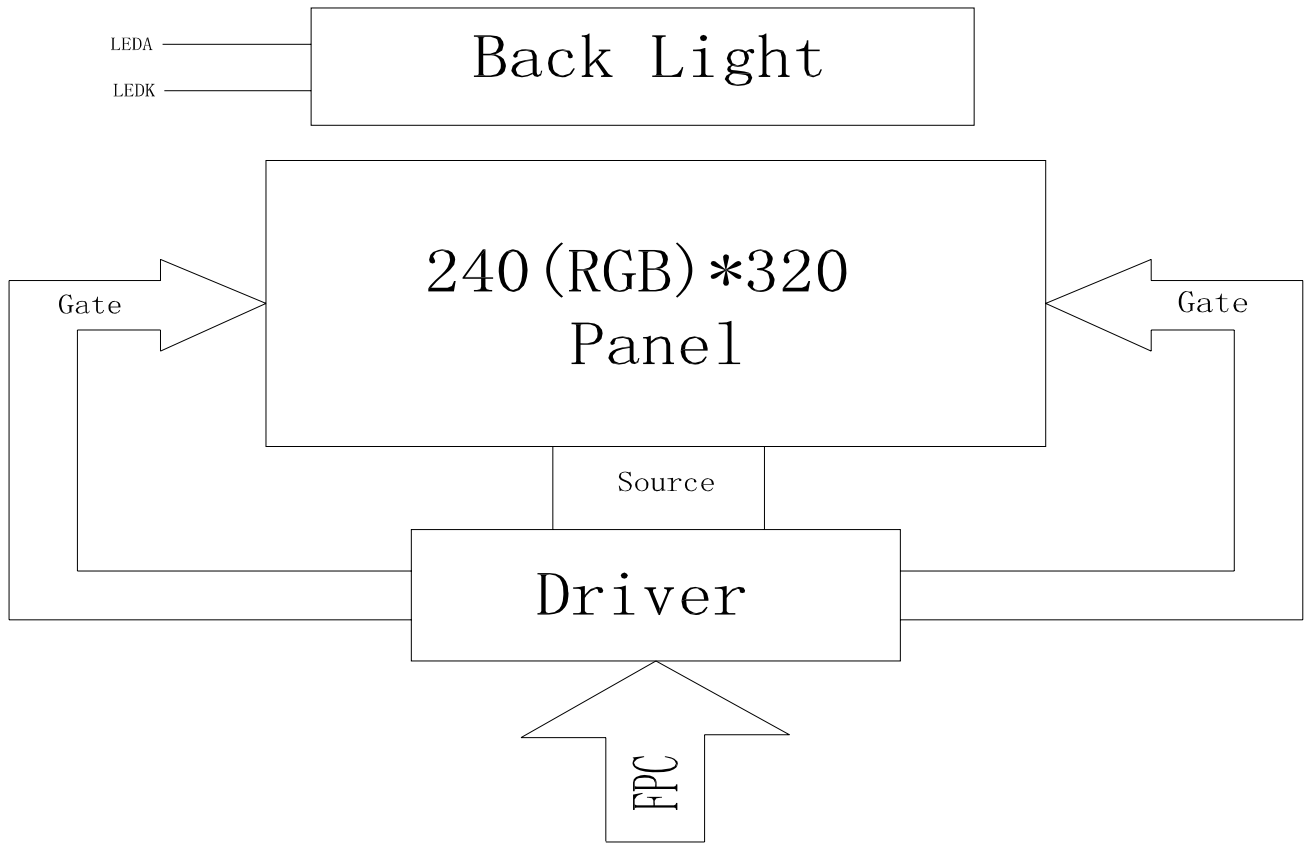
常备库存  
Standing Stock

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Long Time supply

支持少量  
NO MOQ

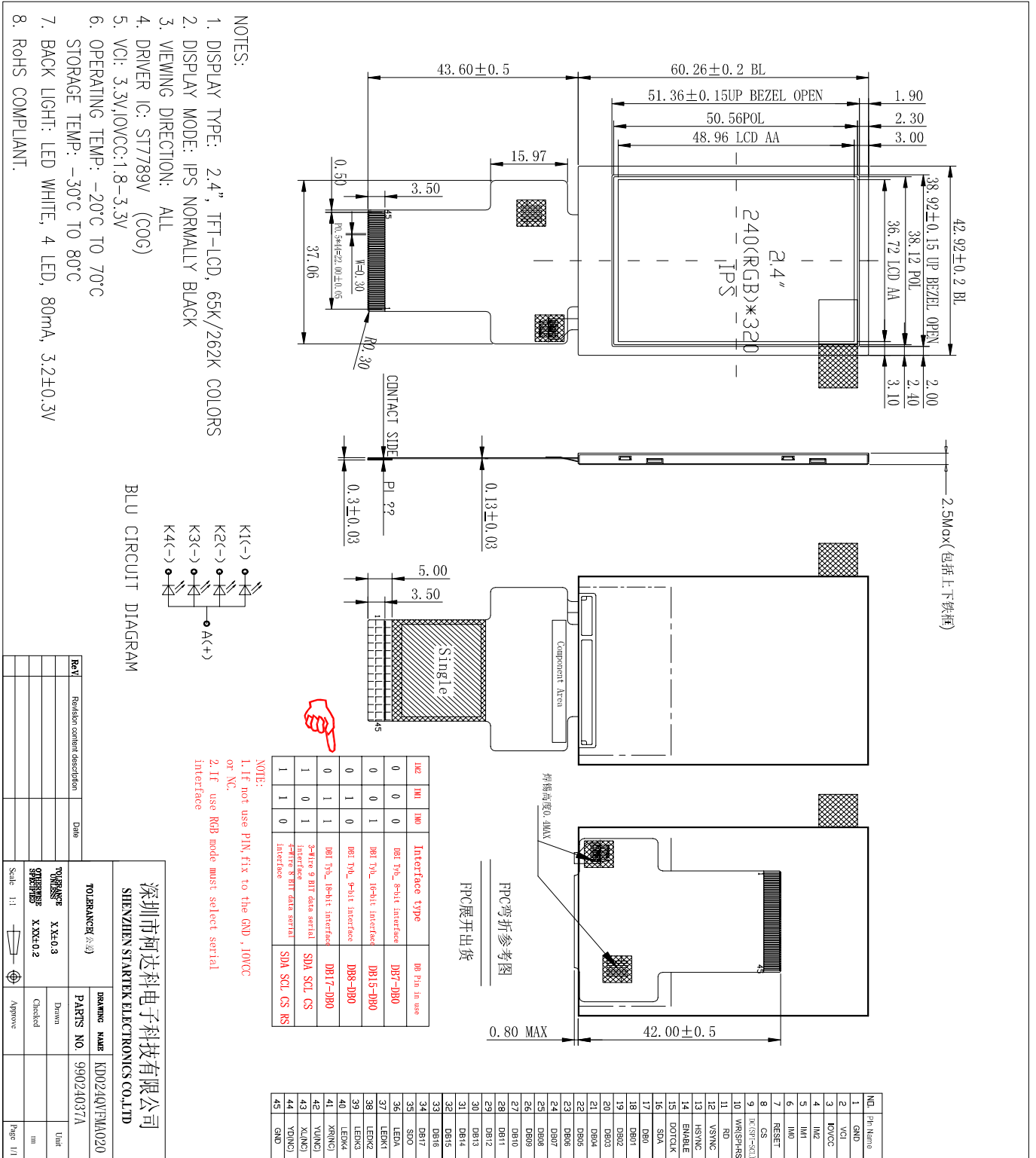
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### 1. Block Diagram



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2. Outline dimension



### 3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	VCI	Supply voltage(3.3V).	P
3	IOVCC	Supply voltage(1.8-3.3V).	P
4	IM2	MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface. Fix this pin at VCI and GND.	I
5	IM1		I
6	IM0		I
7	RESET	This signal will reset the device and must be applied to properly initialize the chip.	I
8	CS	Chip select input pin ("Low" enable). fix this pin at VCI or GND when not in use.	I
9	DC(SPI-SCL)	-Display data/command selection pin in parallel interface. -This pin is used to be serial interface clock. DC='1': display data or parameter. DC='0': command data. -If not used, please fix this pin at VDDI or DGND.	I
10	WR(SPI-RS)	-Write enable in MCU parallel interface. - Display data/command selection pin in 4-line serial interface. - Second Data lane in 2 data lane serial interface. -If not used, please fix this pin at VDDI or DGND.	I
11	RD	Serves as a read signal and MCU read data at the rising edge. fix this pin at VCI or GND when not in use.	I
12	VSYNC	Frame synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
13	HSYNC	Line synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
14	ENABLE	Data enable signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
15	DOTCLK	Dot clock signal for RGB interface operation. Fix this pin at VCI or GND when not in use.	I
16	SDA	Serial input signal.	I

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		The data is latched on the rising edge of the SCL signal. fix this pin at VCI or GND when not in use.	
17-34	DB0-DB17	18-bit parallel bi-directional data bus for MCU system and RGB interface mode . Fix to GND level when not in use	I/O
35	SDO	SPI interface output pin. -The data is output on the falling edge of the SCL signal. -If not used, let this pin open.	O
36	LEDA	Anode pin of backlight	P
37	LEDK1	Cathode pin OF backlight	P
38	LEDK2	Cathode pin OF backlight	P
39	LEDK3	Cathode pin OF backlight	P
40	LEDK4	Cathode pin OF backlight	P
41	XR	Touch panel Right Glass Terminal	A/D
42	YD	Touch panel Bottom Film Terminal	A/D
43	XL	Touch panel LIFT Glass Terminal	A/D
44	YU	Touch panel Top Film Terminal	A/D
45	GND	Ground.	P

## 4. LCD Optical Characteristics

### 4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T (%)	Normal viewing angle	—	4.65	—	%	Measuring with Polarizer , Reference Only
Transmittance (without Polarizer)		T (%)		—	14.6	—	%	
Contrast		CR		640	800	—	—	(1)(2)
Response time	Rising	T <sub>R</sub>		—	16	21	msec	(1)(3)
	Falling	T <sub>F</sub>		—	19	24		
Color gamut		(%)		—	70	—	%	C-light
Color chromaticity (CIE1931)	White	W <sub>x</sub>		0.290	0.310	0.330	—	(1)(4) CF glass
		W <sub>y</sub>		0.316	0.336	0.356		
	Red	R <sub>x</sub>		0.627	0.647	0.667	—	
		R <sub>y</sub>		0.297	0.317	0.337	—	
	Green	G <sub>x</sub>	0.255	0.275	0.295	—		
		G <sub>y</sub>	0.562	0.582	0.602			
	Blue	B <sub>x</sub>	0.120	0.140	0.160	—		
		B <sub>y</sub>	0.068	0.088	0.108			
Viewing angle	Hor.	Θ <sub>L</sub>	CR>10	—	80	—	—	(1)(4) Measuring with Polarizer , Reference Only
		Θ <sub>R</sub>		—	80	—		
	Ver.	Θ <sub>U</sub>		—	80	—		
		Θ <sub>D</sub>		—	80	—		
Optima View Direction		Free						(5)

### 4.2 Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : 25±2°C
- 15min. warm-up time.

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Standing Stock

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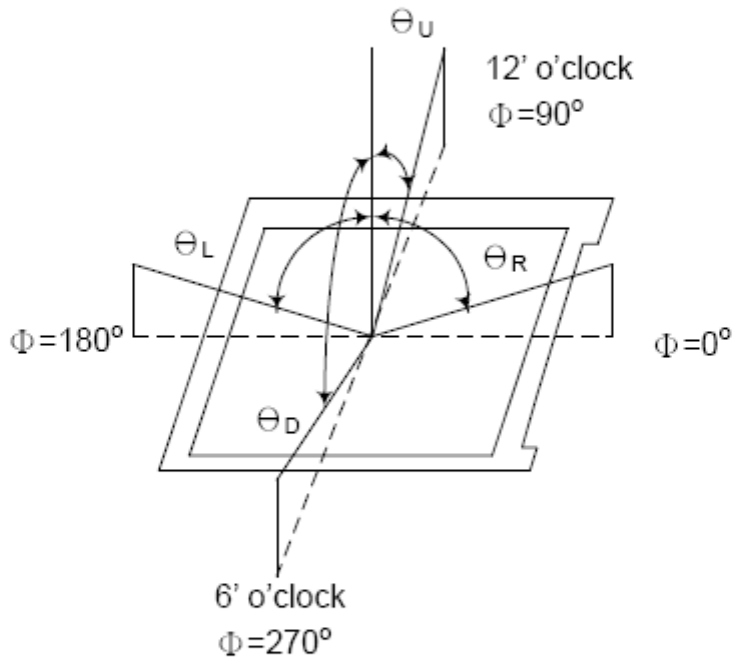
支持小量  
NO MOQ

品种齐全  
In Full Range

### 4.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

Note (1) Definition of Viewing Angle:

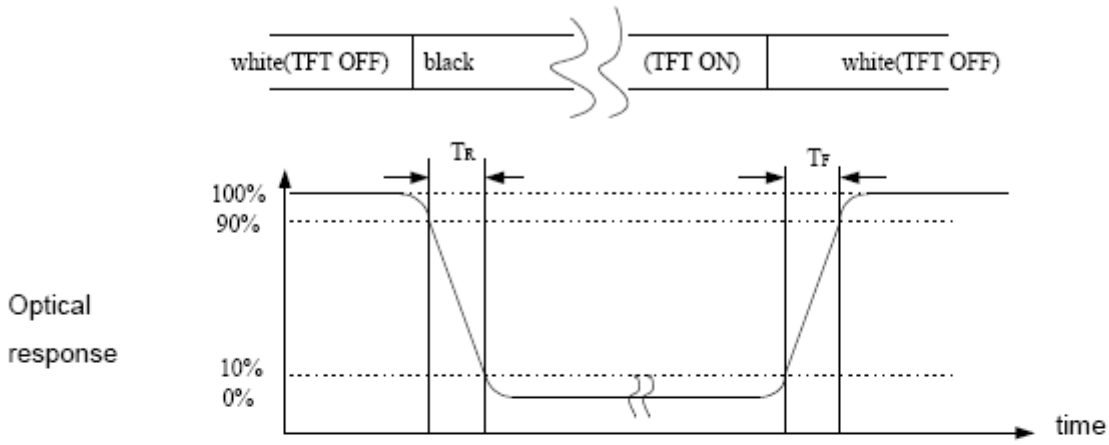


Note (2) Definition of Contrast Ratio (CR) :  
measured at the center point of panel

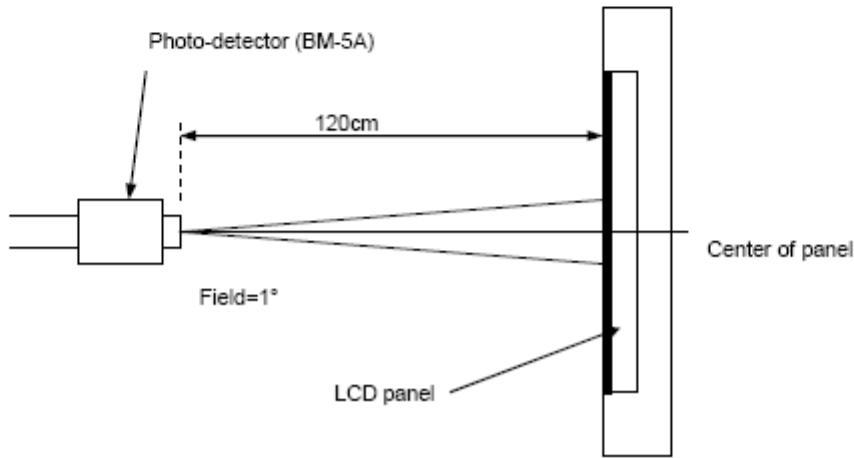
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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Note (3) Definition of Response Time : Sum of  $T_R$  and  $T_F$



Note (4) Definition of optical measurement setup



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## 5. Electrical Characteristics

### 5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VDD	-0.3	4.6	V
Digital interface supply Voltage	VDDIO	-0.3	4.6	V
Operating temperature	T <sub>OP</sub>	-20	+70	°C
Storage temperature	T <sub>ST</sub>	-30	+80	°C

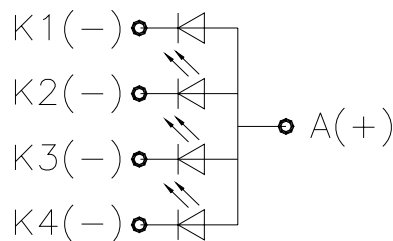
### 5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	2.4	3.3	4.2	V	
Digital interface supply Voltage	VDDIO	1.65	3.3	4.2	V	
Normal mode Current consumption	IDD	--	8	--	mA	
Level input voltage	V <sub>IH</sub>	0.7V <sub>DDIO</sub>		V <sub>DDIO</sub>	V	
	V <sub>IL</sub>	GND		0.3V <sub>DDIO</sub>	V	
Level output voltage	V <sub>OH</sub>	0.8V <sub>DDIO</sub>		V <sub>DDIO</sub>	V	
	V <sub>OL</sub>	GND		0.2V <sub>DDIO</sub>	V	

### 5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 4chips White LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I <sub>F</sub>	60	80	--	mA	
Forward Voltage	V <sub>F</sub>	--	3.2	--	V	
LCM Luminance	L <sub>V</sub>	450	--	--	cd/m <sup>2</sup>	IF=80MA
Uniformity	AV <sub>g</sub>	80	--	--	%	



BLU CIRCUIT DIAGRAM

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常备库存  
Standing Stock

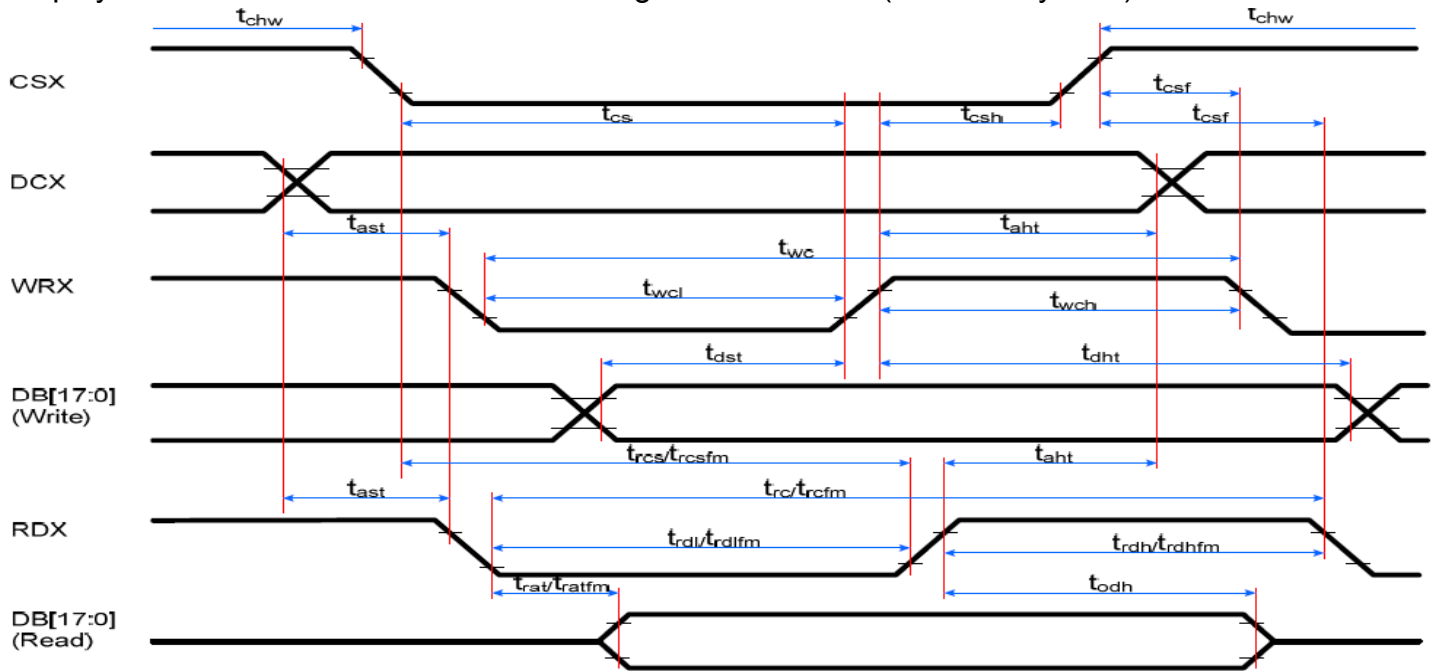
长期供货  
Long Time supply

支持小量  
NO MOQ

品种齐全  
In Full Range

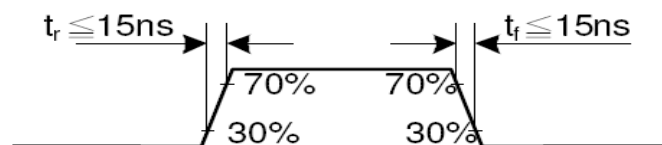
## 6. AC Characteristic

### 6.1. Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080- I system)



Signal	Symbol	Parameter	min	max	Unit	Description
DCX	t <sub>ast</sub>	Address setup time	0	-	ns	
	t <sub>ah</sub>	Address hold time (Write/Read)	10	-	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	
D[17:0], D[15:0], D[8:0], D[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:  $T_a = -30$  to  $70$  °C,  $IOVCC=1.65V$  to  $2.8V$ ,  $VCI=2.6V$  to  $3.3V$ ,  $GND=0V$



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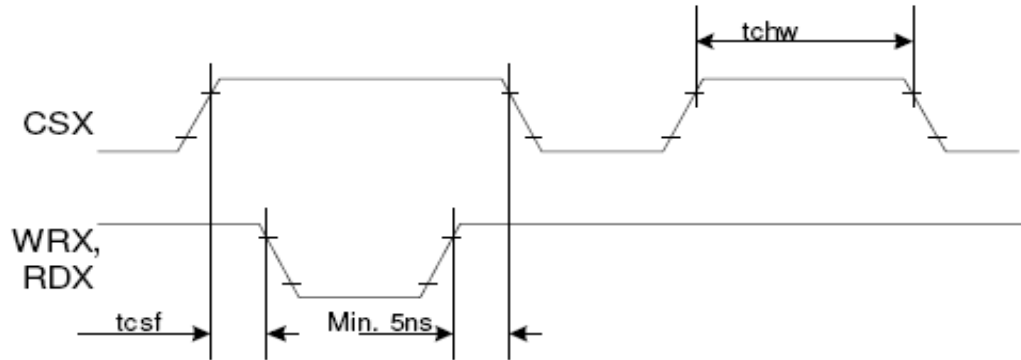
常备库存  
Standing Stock

长期供货  
Long Time supply

支持小量  
NO MOQ

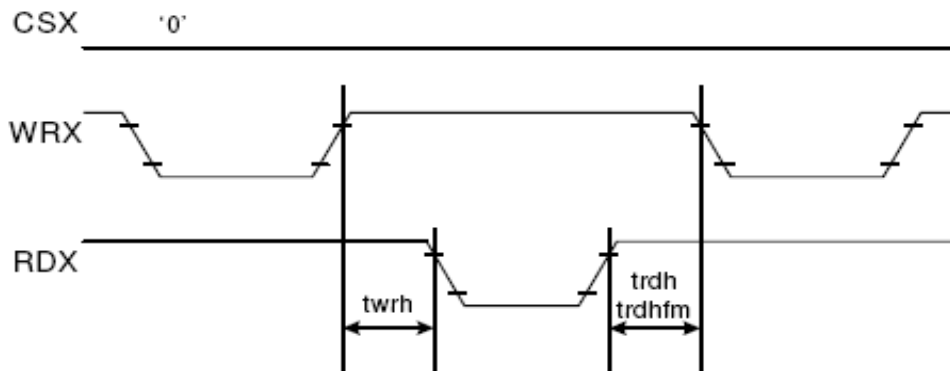
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CSX timings :



Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

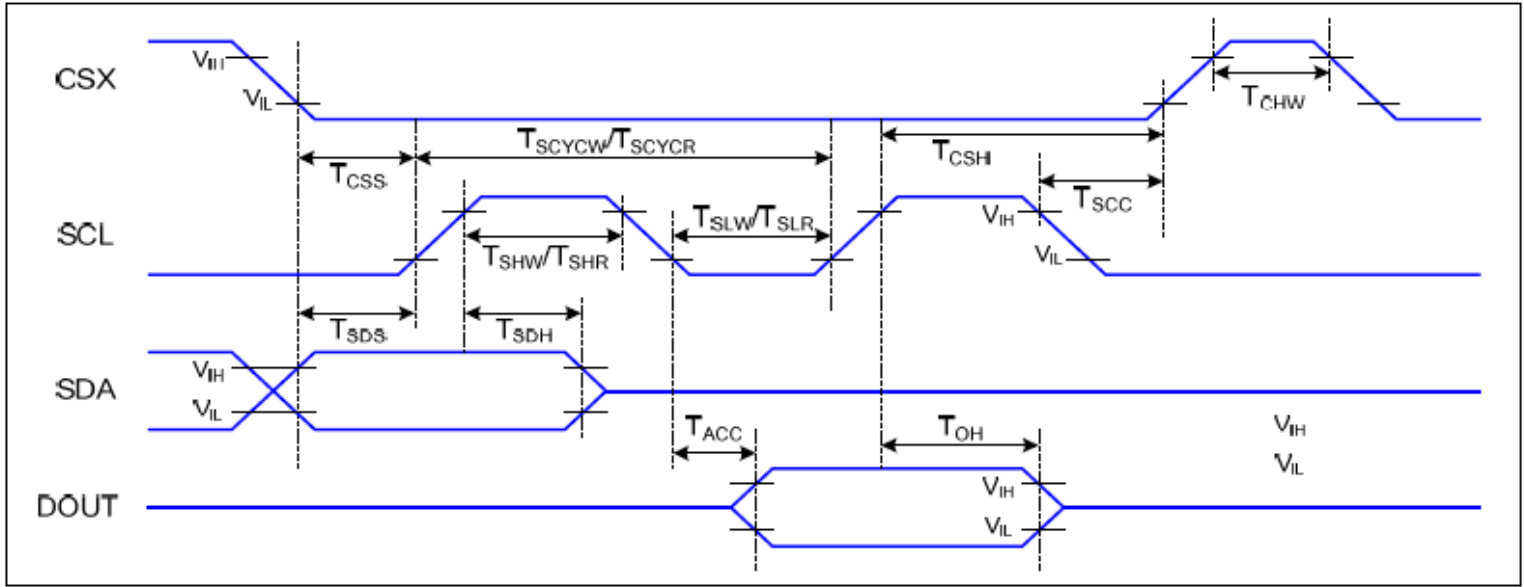
Write to read or read to write timings:



Note: Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

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

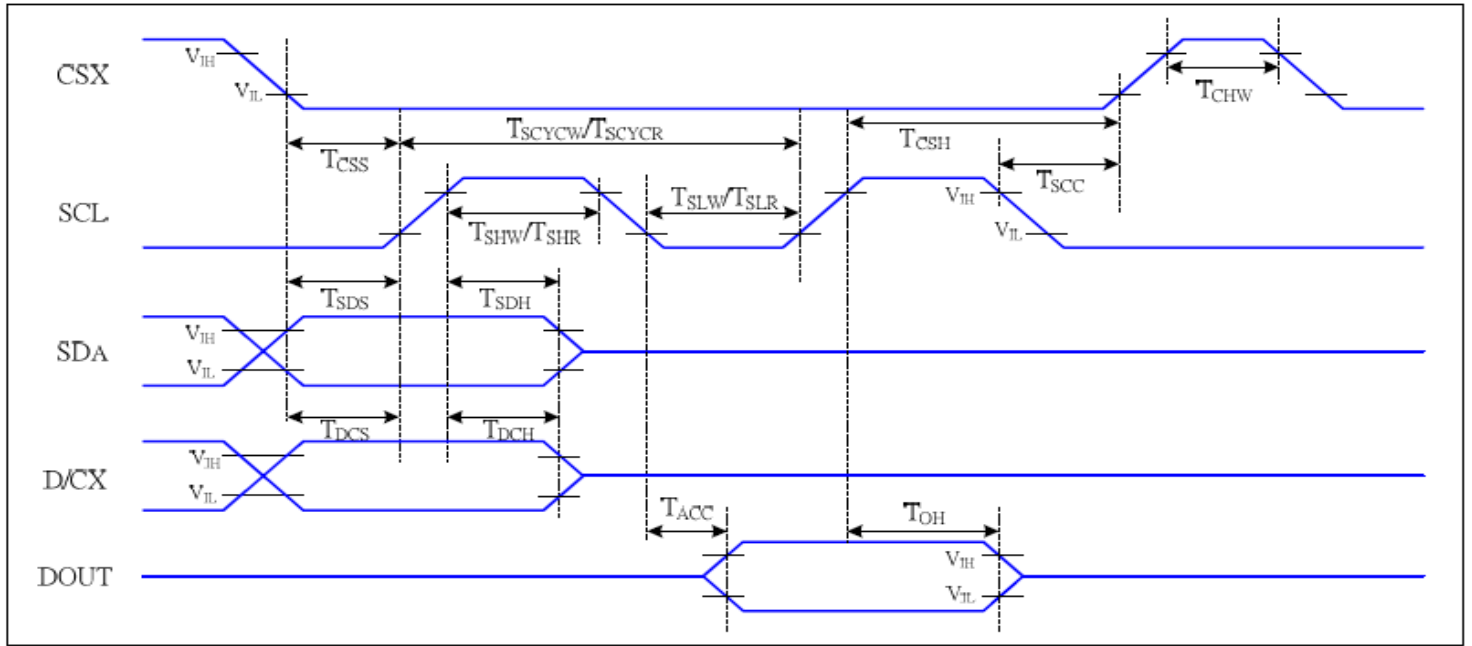


VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, T<sub>a</sub>=-30 to 70 °C

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T <sub>CSS</sub>	Chip select setup time (write)	15		ns	
	T <sub>CSH</sub>	Chip select hold time (write)	15		ns	
	T <sub>CSS</sub>	Chip select setup time (read)	60		ns	
	T <sub>SCC</sub>	Chip select hold time (read)	65		ns	
	T <sub>CHW</sub>	Chip select "H" pulse width	40		ns	
SCL	T <sub>SCYCW</sub>	Serial clock cycle (Write)	66		ns	
	T <sub>SHW</sub>	SCL "H" pulse width (Write)	15		ns	
	T <sub>SLW</sub>	SCL "L" pulse width (Write)	15		ns	
	T <sub>SCYCR</sub>	Serial clock cycle (Read)	150		ns	
	T <sub>SHR</sub>	SCL "H" pulse width (Read)	60		ns	
	T <sub>SLR</sub>	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T <sub>SDS</sub>	Data setup time	10		ns	
	T <sub>SDH</sub>	Data hold time	10		ns	
DOUT	T <sub>ACC</sub>	Access time	10	50	ns	For maximum CL=30pF
	T <sub>OH</sub>	Output disable time	15	50	ns	For minimum CL=8pF



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

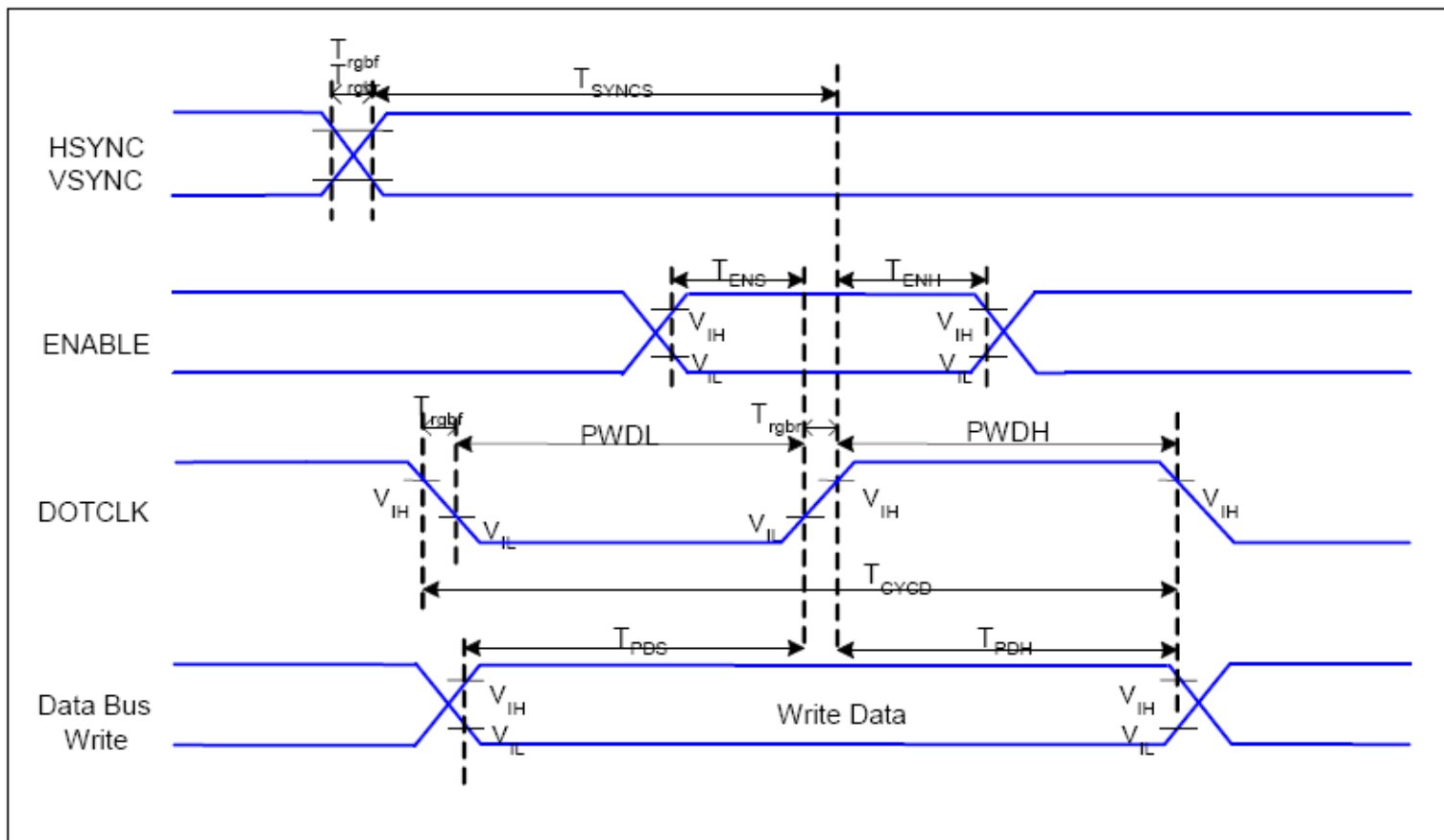


VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 °C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	$T_{CSS}$	Chip select setup time (write)	15		ns	
	$T_{CSH}$	Chip select hold time (write)	15		ns	
	$T_{CSS}$	Chip select setup time (read)	60		ns	
	$T_{SCC}$	Chip select hold time (read)	65		ns	
	$T_{CHW}$	Chip select "H" pulse width	40		ns	
SCL	$T_{SCYCW}$	Serial clock cycle (Write)	66		ns	-write command & data ram
	$T_{SHW}$	SCL "H" pulse width (Write)	15		ns	
	$T_{SLW}$	SCL "L" pulse width (Write)	15		ns	
	$T_{SCYCR}$	Serial clock cycle (Read)	150		ns	-read command & data ram
	$T_{SHR}$	SCL "H" pulse width (Read)	60		ns	
	$T_{SLR}$	SCL "L" pulse width (Read)	60		ns	
D/CX	$T_{DCS}$	D/CX setup time	10		ns	
	$T_{DCH}$	D/CX hold time	10		ns	
SDA (DIN)	$T_{SDS}$	Data setup time	10		ns	
	$T_{SDH}$	Data hold time	10		ns	
DOUT	$T_{ACC}$	Access time	10	50	ns	For maximum CL=30pF
	$T_{OH}$	Output disable time	15	50	ns	For minimum CL=8pF



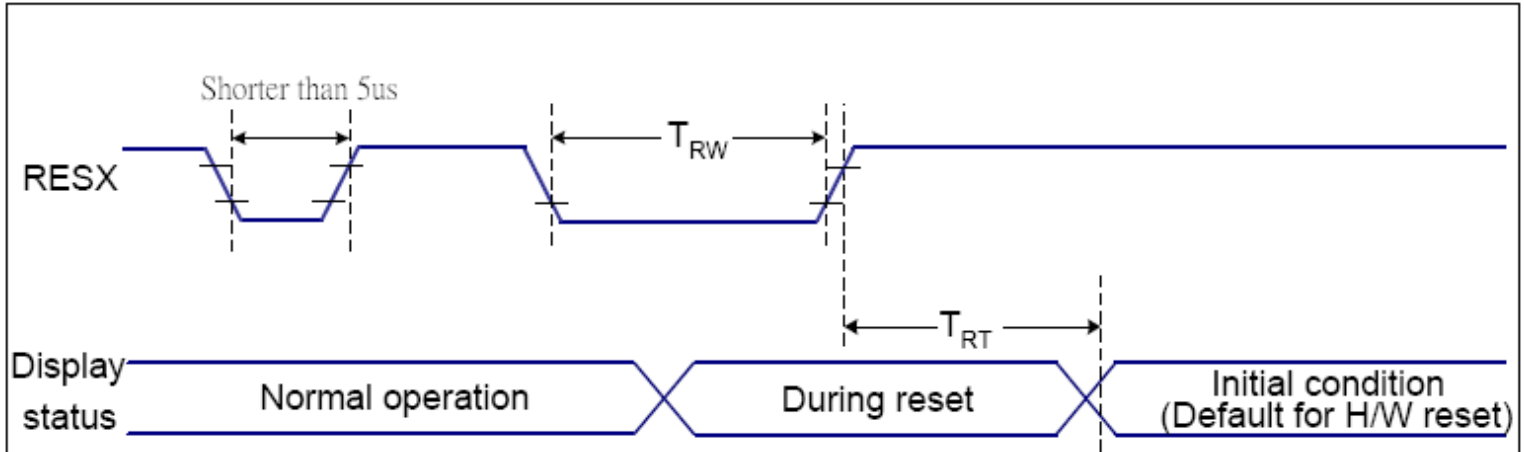
6.4 Parallel RGB Interface Timing Characteristics



VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 ~ 70 °C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	$T_{SYNCS}$	VSYNC, HSYNC Setup Time	30	-	ns	
ENABLE	$T_{ENS}$	Enable Setup Time	25	-	ns	
	$T_{ENH}$	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	$T_{CYCD}$	DOTCLK Cycle Time	120	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	20	ns	
DB	$T_{PDS}$	PD Data Setup Time	50	-	ns	
	$T_{PDH}$	PD Data Hold Time	50	-	ns	

## 6.5 Reset Timing Characteristics



$V_{DD1}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=-30 \sim 70 \text{ } ^\circ\text{C}$

Related Pins	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	

### Notes:

- The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time ( $t_{RT}$ ) within 5 ms after a rising edge of RESX.
- 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 9us	Reset
Between 5us and 9us	Reset starts

- 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.

- Spike Rejection also applies during a valid reset pulse as shown below:

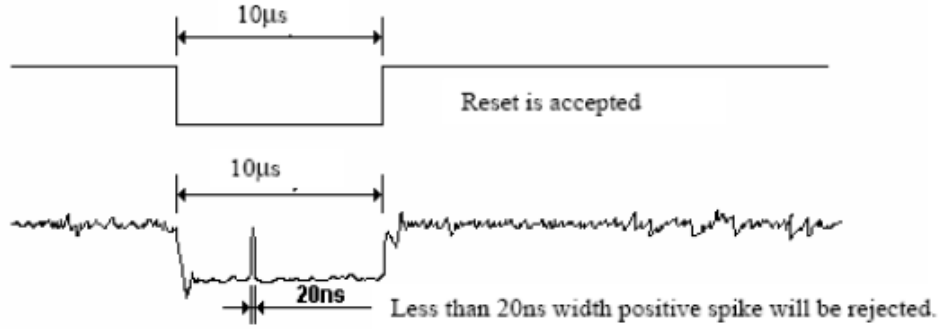
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常备库存  
Standing Stock

长期供货  
Long Time supply

支持少量  
NO MOQ

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- 5. When Reset applied during Sleep In Mode.
- 6. When Reset applied during Sleep Out Mode.
- 7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

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## 7. LCD Module Out-Going Quality Level

### 7.1 VISUAL & FUNCTION INSPECTION STANDARD

#### 7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

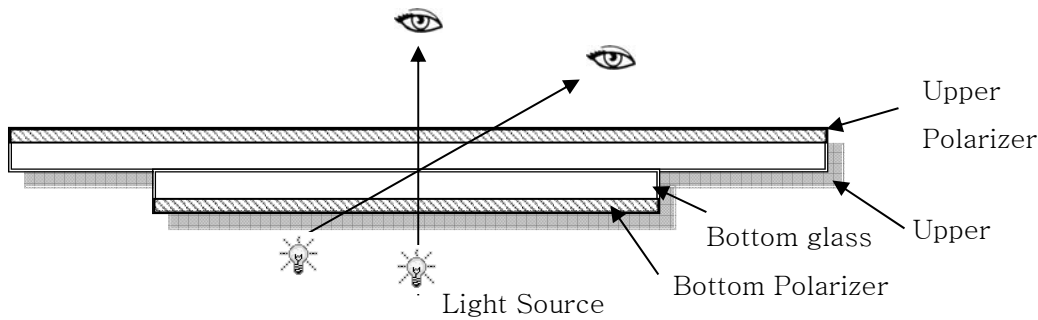
Temperature :  $25\pm 5^{\circ}\text{C}$

Humidity :  $65\%\pm 10\%RH$

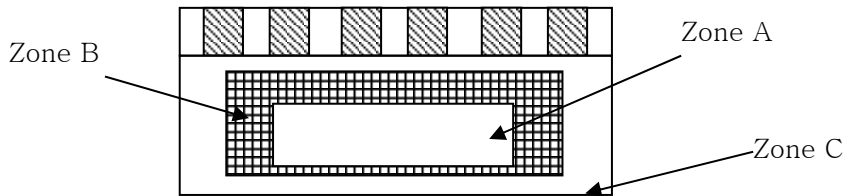
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



#### 7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.

#### 7.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II

AQL:

Major defect	Minor defect
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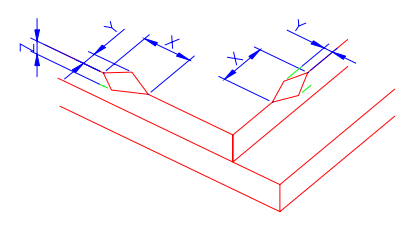
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	常备库存 Standing Stock	长期供货 Long Time supply	支持少量 NO MOQ	品种齐全 In Full Range

0.65	1.5
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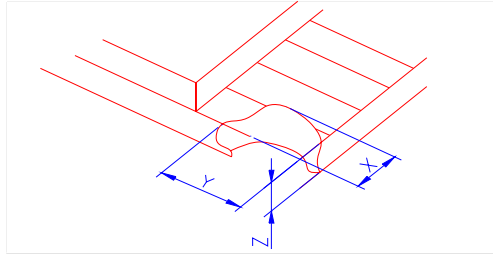
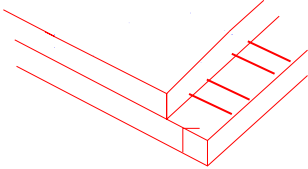
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

### 7.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken	(1) The edge of LCD broken	 <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">X</td> <td style="text-align: center;">Y</td> <td style="text-align: center;">Z</td> </tr> <tr> <td style="text-align: center;">≤3.0mm</td> <td style="text-align: center;">&lt;Inner border line of the seal</td> <td style="text-align: center;">≤T</td> </tr> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
X	Y	Z						
≤3.0mm	<Inner border line of the seal	≤T						
NOTE: X: Length Y: Width								



Z: Height L: Length of ITO, T: Height of LCD	(2)LCD corner broken	 <table border="1" data-bbox="917 548 1329 649"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </table>	X	Y	Z	≤3.0mm	≤L	≤T
	X	Y	Z					
≤3.0mm	≤L	≤T						
(3) LCD crack	 <p>Crack Not allowed</p>							

Number	Items	Criteria (mm)
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常备库存  
Standing Stock

长期供货  
Long Time supply

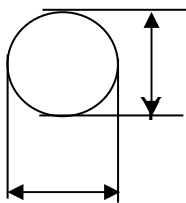
支持小量  
NO MOQ

品种齐全  
In Full Range



2.0

Spot defect



X

$$\Phi = (X+Y)/2$$

① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.10$	Ignore		
$0.10 < \Phi \leq 0.15$	3( distance $\geq 10\text{mm}$ )		
$0.15 < \Phi \leq 0.2$	1		
$0.2 < \Phi$	0		

② Dim spot (LCD/TP/Polarizer dim dot, light leakage, dark spot)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.1$	Ignore		
$0.1 < \Phi \leq 0.2$	2( distance $\geq 10\text{mm}$ )		
$0.2 < \Phi \leq 0.3$	1		
$\Phi > 0.3$	0		

③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.5$	2( distance $\geq 10\text{mm}$ )		
$\Phi > 0.5$	0		

Line defect  
(LCD/TP  
/Polarizer  
black/white  
line, scratch,  
stain)

Width(mm)	Length(mm)	Acceptable Qty		
		A	B	C
$\Phi \leq 0.03$	Ignore	Ignore		Ignore
$0.03 < W \leq 0.05$	$L \leq 3.0$	$N \leq 2$		
$0.05 < W \leq 0.08$	$L \leq 2.0$	$N \leq 2$		
$0.08 < W$	Define as spot defect			

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Standing Stock


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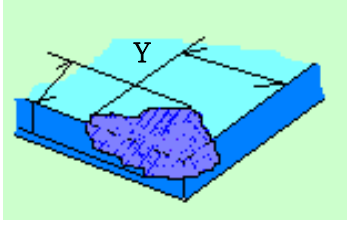
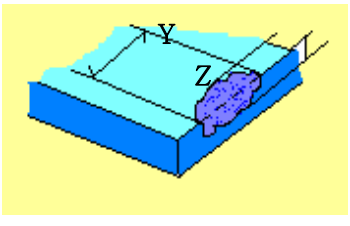
支持小量  
NO MOQ

品种齐全  
In Full Range



4.0	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.
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5.0	TP Related	TP bubble/ accidented spot	<table border="1"> <thead> <tr> <th rowspan="2">Size <math>\Phi</math>(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.1</math></td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.1 &lt; \Phi \leq 0.2</math></td> <td colspan="3">2 (distance <math>\geq 10</math>mm)</td> </tr> <tr> <td><math>0.2 &lt; \Phi \leq 0.3</math></td> <td colspan="3">1</td> </tr> <tr> <td><math>0.3 &lt; \Phi</math></td> <td colspan="3">0</td> </tr> </tbody> </table>	Size $\Phi$ (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore			$0.1 < \Phi \leq 0.2$	2 (distance $\geq 10$ mm)			$0.2 < \Phi \leq 0.3$	1			$0.3 < \Phi$	0			
		Size $\Phi$ (mm)	Acceptable Qty																								
			A	B	C																						
$\Phi \leq 0.1$	Ignore																										
$0.1 < \Phi \leq 0.2$	2 (distance $\geq 10$ mm)																										
$0.2 < \Phi \leq 0.3$	1																										
$0.3 < \Phi$	0																										
Assembly deflection	beyond the edge of backlight $\leq 0.15$ mm																										
Newton Ring	<p>Newton Ring area <math>&gt; 1/3</math> TP area NG</p> <p>Newton Ring area <math>\leq 1/3</math> TP area OK</p>																										

		TP corner broken	<table border="1"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td><math>X \leq 3.0\text{mm}</math></td> <td><math>Y \leq 3.0\text{mm}</math></td> <td><math>Z &lt; \text{LCD thickness}</math></td> </tr> </table>	X	Y	Z	$X \leq 3.0\text{mm}$	$Y \leq 3.0\text{mm}$	$Z < \text{LCD thickness}$	
		X	Y	Z						
$X \leq 3.0\text{mm}$	$Y \leq 3.0\text{mm}$	$Z < \text{LCD thickness}$								
X : length Y : width Z : height	* Circuitry broken is not allowed.									
		TP edge broken	<table border="1"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td><math>X \leq 6.0\text{mm}</math></td> <td><math>Y \leq 2.0\text{mm}</math></td> <td><math>Z &lt; \text{LCD thickness}</math></td> </tr> </table>	X	Y	Z	$X \leq 6.0\text{mm}$	$Y \leq 2.0\text{mm}$	$Z < \text{LCD thickness}$	
		X	Y	Z						
$X \leq 6.0\text{mm}$	$Y \leq 2.0\text{mm}$	$Z < \text{LCD thickness}$								
X : length Y : width Z : height	* Circuitry broken is not allowed.									

Criteria ( functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

## 8. Reliability Test Result

### 8.1 Condition

Item	Condition	Sample Size	Test Result	Note
Low Temperature	-20°C, 96HR	3ea	pass	-

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常备库存  
Standing Stock

长期供货  
Long Time supply

支持少量  
NO MOQ

品种齐全  
In Full Range

Operating Life test				
Thermal Humidity Operating Life test	70°C, 90%RH, 96HR	3ea	pass	-
Temperature Cycle ON/OFF test	-20°C ↔ 70°C, ON/OFF, 20CYC	3ea	pass	(1)
High Temperature Storage test	80°C, 96HR	3ea	pass	-
Low Temperature Storage test	- 30°C, 96HR	3ea	pass	-
Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours	3ea	pass	
Box Drop Test	1 Corner 3 Edges 6 faces, 66cm(MEDIUM BOX)	1box	pass	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

## 9. Cautions and Handling Precautions

### 9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to

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常备库存  
Standing Stock

长期供货  
Long Time supply

支持小量  
NO MOQ

品种齐全  
In Full Range

the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

## 9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

## 10.Packing

---TBD---

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	常备库存 Standing Stock	长期供货 Long Time supply	支持小量 NO MOQ	品种齐全 In Full Range