LCM Specification

☑Preliminary specification

☐Final Specification

Project No. 项目编号	TFT-H043A12SVILT4R40
Customer 客户名称	
Module No. 客户型号	
Product type 产品内容	TFT LCD Module 800 x 3RGB x 480 Dots 4.3"TFT LCD

Signature by customer:

客户确认签章：

☐Trial production   ☐Mass production

编　　制	电子审核	结构审核	批　　准
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Shenzhen Hot Display Technology Co.,Ltd

Document revision history :

DOCUMENT REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
0	2021-05-19	First Release.	YL.Liu	

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1. General Feature:

Item	Standard Value	Unit
Display Size	4.3"	--
Number of Pixels	800(H)x3(RGB)*480(V)	--
Active Area	95.04(H) *53.86(V)	mm
Outline Dimension	105.50(H) ×67.20(V)× 2.95(D)<TFT> 105.50(H) ×67.20(V)× 4.15(D)<TFT+RTP>	mm
Viewing Direction	FULL O'Clock	-
Interface	MCU 8/16,SPI 3L/4L,IIC	-
TFT Driver IC	ST7262+HOT7381	-
TFT Driver Condition	VCI=3.3V	V
Backlight	White LED	-
Touch Panel	Resistive Touch	-
CTP Driver IC	- - -	-
CTP Driver Condition	- - -	-
TFT Operation Temperature	-30~85	℃
TFT Storage Temperature	-30~85	℃

2.Outline Dimensions

*** Do not display the fixed pattern for a long time when using a normally black panel, as it may cause image sticking due to the LCM structure. If the screen is displayed in fixed mode, use a screen saver.It is recommended to display the fixed mode in less than 2 minutes or less.

Pin	SIGNAL	Pin	SIGNAL
1	LED_K	21	DB3
2	LED_K	22	DB4
3	LED_A	23	DB5
4	LED_A	24	DB6
5	GND	25	DB7
6	GND	26	DB8
7	VC1	27	DB9
8	VC1	28	DB10
9	PS2	29	DB11
10	PS1	30	DB12
11	PS0	31	DB13
12	RESX	32	DB14
13	CS	33	DB15
14	RD	34	INT
15	WR	35	NC
16	RS	36	GND
17	WAIT	37	RTP_XR
18	DB0	38	RTP_YD
19	DB1	39	RTP_XL
20	DB2	40	RTP_YU

Dwg Title: TFT-H043A12SVILT4R40
Scale 1:1
Ver: V0
Unit MM Tol. ±0.3 Drawn: Liu.YL Date: 2021-04-18

5,00<PI>

BL CIRCUIT DIAGRAM:
Vf=16.0V, If=40mA

LED-A○ LED-K○

4,15±0.3<RTP+TFT>
2,95±0.2<TFT>

H=2.0mm Max.
Contact Side PI Stiffener
0.30±0.05

0,30
4,13
4,40
5,23

XR

TFT 4.3"
DOTS: 80043RGB*480
Full View(80/80/80)

YU YD

XL

105,50±0.2<Outline>
104,90±0.2<RTP Outline>
97,24<BE Open>
96,70<RTP A/A>
95,040<TFT A/A>

0,50
P0,5*39=19,50
20,50±0.1

3,97
3,25
2,77
0,15

53,856<LCD A/A>
55.50<RTP A/A>
56,32<BE Open>
64,90±0.2<RTP Outline>
67,20±0.2<Outline>

19,14±0.5

96,58±0.5

*1.	LCD Display Type	TFT/Transmissive/Normally Black/16.7M Color
*2.	Viewing Direction	Full View(U80/D80/R80/L80)
*3.	Interface	MCU 8/16, SPI 3L/4L, IIC
*4.	Operating Voltage	VCI=3.3V (Typ)
*5.	Operating Temp	-30°C~85°C
*6.	Storage Temp	-30°C~85°C
*7.	Driver IC	ST7262+HOT7381
*8.	Backlight	WHITE Vf=16.0V If=40mA(Typ)
*9.	LCM Brightness	450 cd/m² (Typ)

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3. Pin Description

3.1 Pin Description

Pin NO.	Symbol	Description
1,2	LED_K	LED Cathode
3,4	LED_A	LED Anode(+16V/40mA)
5,6	GND	Ground
7,8	VCI	Analog Power(3.0 ~ 3.6 V,3.3V)
9-11	PS[2-0]	MCU interface settings.Please refer to Table 3-3 "MCU Wiring Diagram" description.
12	RESX	Reset input signal When RESX = 0 and maintain the length of 256 clock cycles, HOT7381 will generate a reset action.
13	CS	Chip select signal。If the MCU interface is set to the serial mode, this pin can be set to GPIB [0], internal pull-up resistor
14	RD	Read control signal 8080 in parallel mode, this pin is the signal RD #, RD # = 0, representative of the MCU HOT7381 Zhong gets or read data row is the status read cycle. In the 6800 parallel mode, this pin is the EN signal, EN = 1, which means that the MCU's control of HOT7381 is in the Enable cycle. If the MCU interface is set to the serial mode, this pin can be set to GPIB [0], internal pull-up resistor
15	WR	Write control signal In the 8080 parallel port mode, this pin is the WR# signal, WR# = 0, which represents the MCU writes commands to HOT7381 or data write cycles. In the 6800 parallel port mode, this pin is the RW# signal, RW# = 1, which means that the MCU is reading data or status reading cycle of HOT7381. RW# = 0, which means MCU writes commands or data write cycles to HOT7381 If the MCU interface is set to the serial mode, this pin can be set to GPIB [0], internal pull-up resistor
16	RS	Command or data selection signal RS = 0, which means that the MCU reads the status of the HOT7381 or commands the write cycle. RS = 1, which means that the MCU reads or writes data to the HOT7381 . If the MCU interface is set to the serial mode, this pin can be set to GPIB [0], internal pull-up resistor
17	WAIT	Waiting for output signal When the MCU performs read and write control on HOT7381, if HOT7381 is busy, it will change WAIT# to a low level to inform the MCU to enter the waiting period.
---Continued---		

Pin NO.	Symbol	Description
18-33	DB[0-15]	MCU data bus When the MCU connection interface is set to parallel mode, these data buses serve as the data transmission interface with the MCU. DB[15:8] can be set as a GPIO interface in 8-bit parallel mode. DB[7:0] are also shared pins. If set to serial port mode, these data buses will be used as serial port signals. Please refer to Table 3-2 "MCU serial port signal" description.
34	INT	Interrupt output signal When the set interrupt condition occurs, this pin becomes a low level, which is used to generate an interrupt output to inform the MCU.
35	NC	Open this pin.
36	GND	Ground
37	RTP_XR	Resistive TP function pin.If not used, let this pin open.
38	RTP_YD	Resistive TP function pin.If not used, let this pin open.
39	RTP_XL	Resistive TP function pin.If not used, let this pin open.
40	RTP_YU	Resistive TP function pin.If not used, let this pin open.
---END---		

3.2 MCU serial port signal

Pin	8080 I/F		6800 I/F		SPI 3L	SPI 4L	IIC
	8 Bit	16 Bit	8 Bit	16 Bit			
DB[15-8]	---	DB[15-8]	---	DB[15-8]	GPIOA[0:7]	GPIOA[0:7]	GPIOA[0:7]
DB7	DB7	DB7	DB7	DB7	SCLK	SCLK	SCLK
DB6	DB6	DB6	DB6	DB6	接地	SDI	I2C_SDA
DB5	DB5	DB5	DB5	DB5	SD	SDO	I2CA[5]
DB4	DB4	DB4	DB4	DB4	SCS	SCS	I2CA[4]
DB[3-0]	DB[3-0]	DB[3-0]	DB[3-0]	DB[3-0]	接地	接地	I2CA[3:0]
CS	CS	CS	CS	CS	GPIB[0]	GPIB[0]	GPIB[0]
RD	RD	RD	EN	EN	GPIB[1]	GPIB[1]	GPIB[1]
WR	WR	WR	RW	RW	GPIB[2]	GPIB[2]	GPIB[2]
RS	RS	RS	A0	A0	GPIB[3]	GPIB[3]	GPIB[3]
INT	INT	INT	INT	INT	INT	INT	INT
WAIT	WAIT	WAIT	WAIT	WAIT	---	---	---

NOTE1:When using the parallel port mode, the choice of 8-bit or 16-bit data transmission is determined by the bit0 Of the register REG[01h]. If bit0=0, it is set to 8bit data bus, if bit0=1, it is set to 16bit Data Bus.

NOTE2:GPIOA[7:0] are general-purpose I/Os. These pins are shared with DB[15:8]. GPIOA can be used only when the MCU is set to 8-bit parallel mode or serial port mode. The output mode of these pins can be set via registers.

NOTE3:The input signal of GPIB[3:0] shares pins with {RS, WR, RD, CS }. GPIB[3:0] only provides read function, and can be used only when MCU is set to serial port mode. The output mode of these pins can be set via registers.

3.3 **Wiring Diagram**
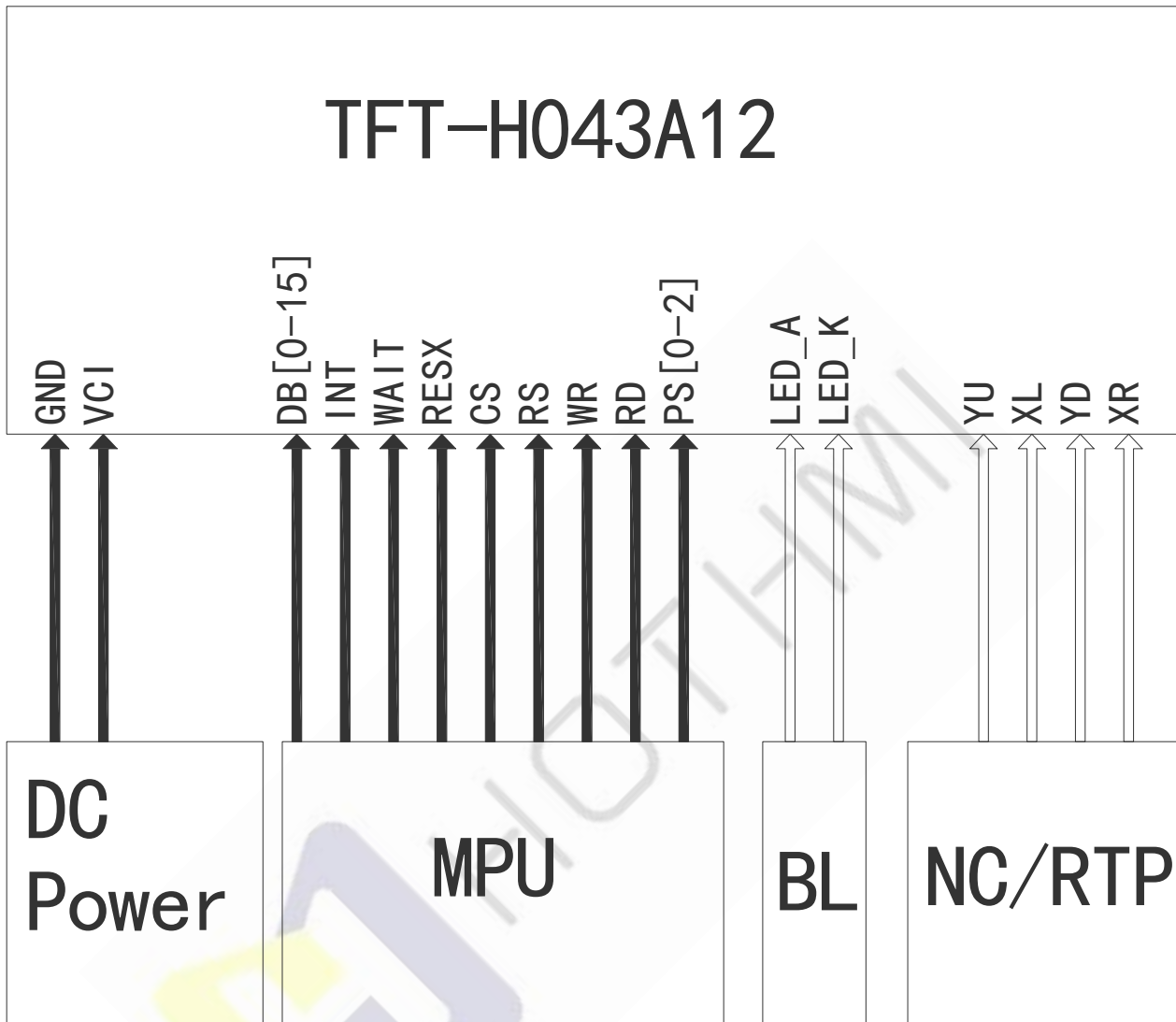
PS2	PS1	PS0	MCU Interface
0	0	X	8080 8/16 bit
0	1	X	6800 8/16 bit
1	0	0	SPI 3L
1	0	1	SPI 4L
1	1	X	IIC

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4. Electrical Characteristics

4-1 TFT LCD Module Operating Conditions

Item	Symbol	Condition	Min	Type	Max	Uint
Interface logic circuits	IOVCC	-	-	-	-	V
Analog Power supply	VCI	-	3.0	3.3	3.6	V
TFT Gate on voltage	VGH	-	-	13.0	-	V
TFT Gate off voltage	VGL	-	-	-10.5	-	V

4-2 LED back light specification (pera chip)

Item	Symbol	Condition	Min	Type	Max	Uint
Forward voltage	Vt	If=20mA	15.0	16.0	17.0	V
Forward current	Ipn	/1-chip	-	40	-	mA
Luminance(With LCD)	Lv	If=40mA	-	600	-	cd/㎡
Luminous color	White					

4-3 CTP Operating Conditions

Item	Symbol	Condition	Min	Type	Max	Uint
Power Supply Voltages	VDD	-	2.8	3.30	3.60	V
I/O Digital Voltage	IOVDD	-	2.8	3.30	3.60	V

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5. OPTICAL SPECIFICATION

5.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance 1lux and temperature = 25 2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0 . The center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement.

5.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	ΘL	CR>10	-	80	-	Deg.	Note 1
		ΘR		-	80	-	Deg.	
	Vertical	ΘU		-	80	-	Deg.	
		ΘD		-	80	-	Deg.	
Contrast ratio		CR	Θ = 0°	-	1200	-		Note2
Color Gamut		CG		45	50	-	%	
White Chromaticity		Wx		-	(0.311)	-		
		Wy		-	(0.338)	-		
Reproduction of color	Red	Rx	Θ = 0°	-	-	-		Note4 (Based on C Light)
		Ry		-	-	-		
	Green	Gx		-	-	-		
		Gy		-	-	-		
	Blue	Bx		-	-	-		
		By		-	-	-		
Response Time (Rising + Falling)		Tr＋Tf	Θ = 0° Ta= 25℃	-	30	-	ms	Note5
Transmittance(with Polarizer)		Tr		-	(4.6)	-	%	Note3

Note:

1.Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2.Contrast measurements shall be made at viewing angle of Θ = 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black)

state . (see FIGUR 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR= \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3.Transmittance is the Value without APF and without CG.

4.The color chromaticity coordinates specified in the above table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

5.The electro-optical response time measurements shall be made as FIGURE 2 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Tf.

Figure1 Measurement Set Up
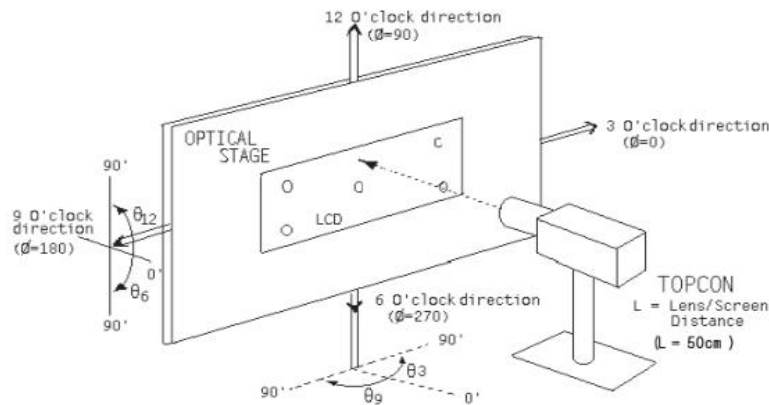
Figure2 Response Time Testing

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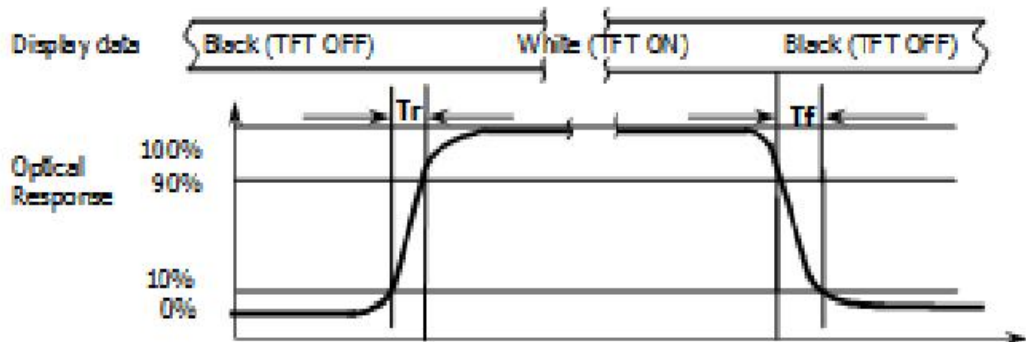
6.Timing Characteristics of Input Signals

6-1 Parallel Host Interface

6-1-1 8080 parallel interface:

8080 MCU

HOT7381

D[7:0]/[8:15] ⟷ DB[7:0]/[8:15]

ADDR[N:1] → Decoder → CS#
$\overline{IORQ}$

ADDR[0] → A0
$\overline{WR}$ → WR#
$\overline{RD}$ → RD#   PSM[2]
$\overline{WAIT}$ ← WAIT#   PSM[1]
$\overline{INTR}$ ← INT#   PSM[0]
$\overline{RES}$ → RST#

A0, CS#

T_{AS8} T_{CYC8} T_{AH8}

WR#, RD#

T_{CC8} T_{DH8}

T_{DS8}

DB[7:0]/[15:8]
(Write)

T_{ACC8} T_{OH8}

DB[7:0]/[15:8]
(Read)
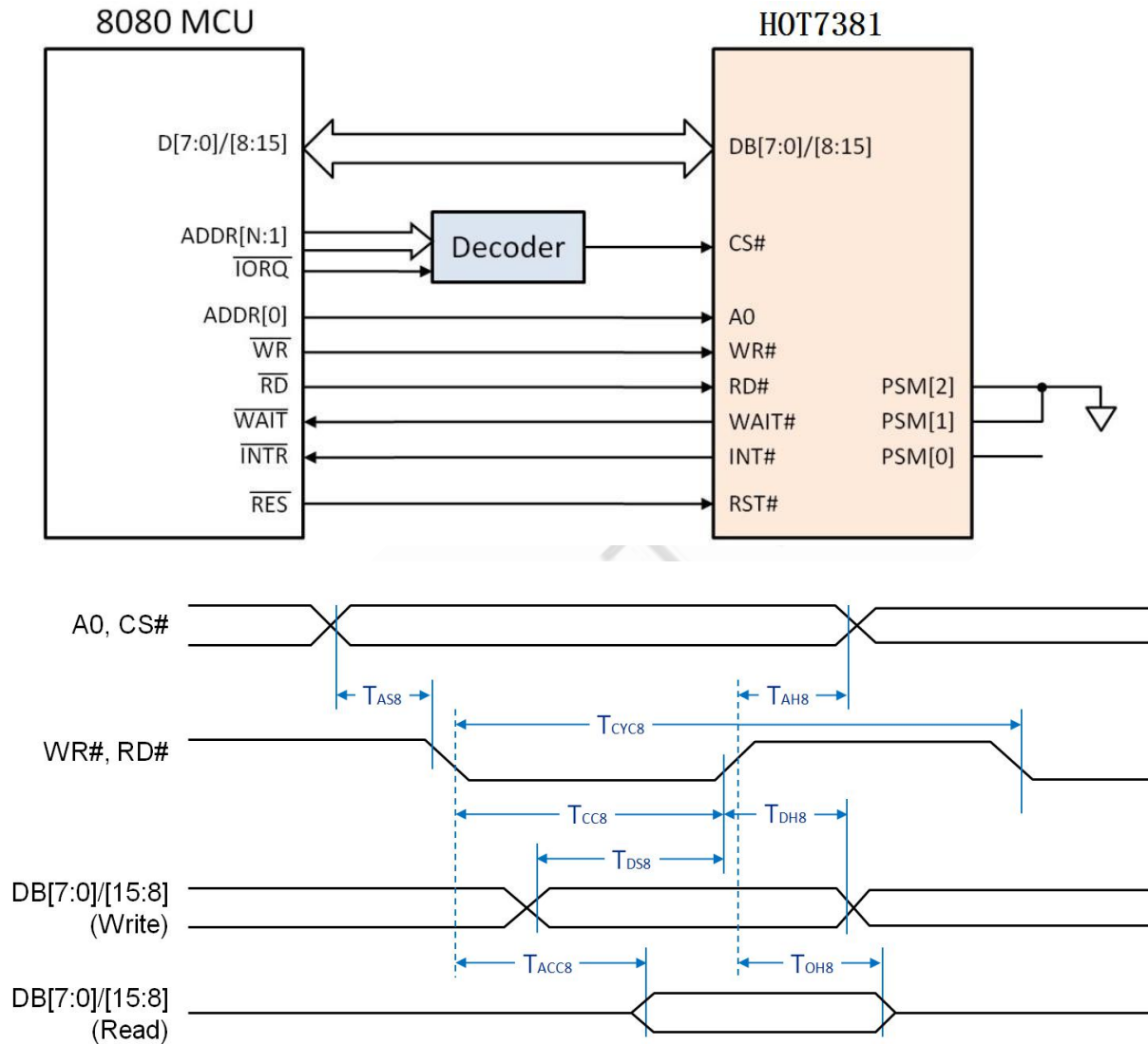
Symbol	Parameter	Rating		Unit	Note
		Min.	Max.		
T_{CYC8}	Cycle Time	50	--	ns	
T_{CC8}	Strobe Pulse Width	20	--	ns	
T_{AS8}	Address Setup Time	0	--	ns	
T_{AH8}	Address Hold Time	10	--	ns	tc is one system clock period:
T_{DS8}	Data Setup Time	20	--	ns	tc = 1/SYS_CLK
T_{DH8}	Data Hold Time	10	--	ns	
T_{ACC8}	Data Output Access Time	0	20	ns	
T_{OH8}	Data Output Hold Time	0	20	ns	

6-1-2 6800 parallel interface:
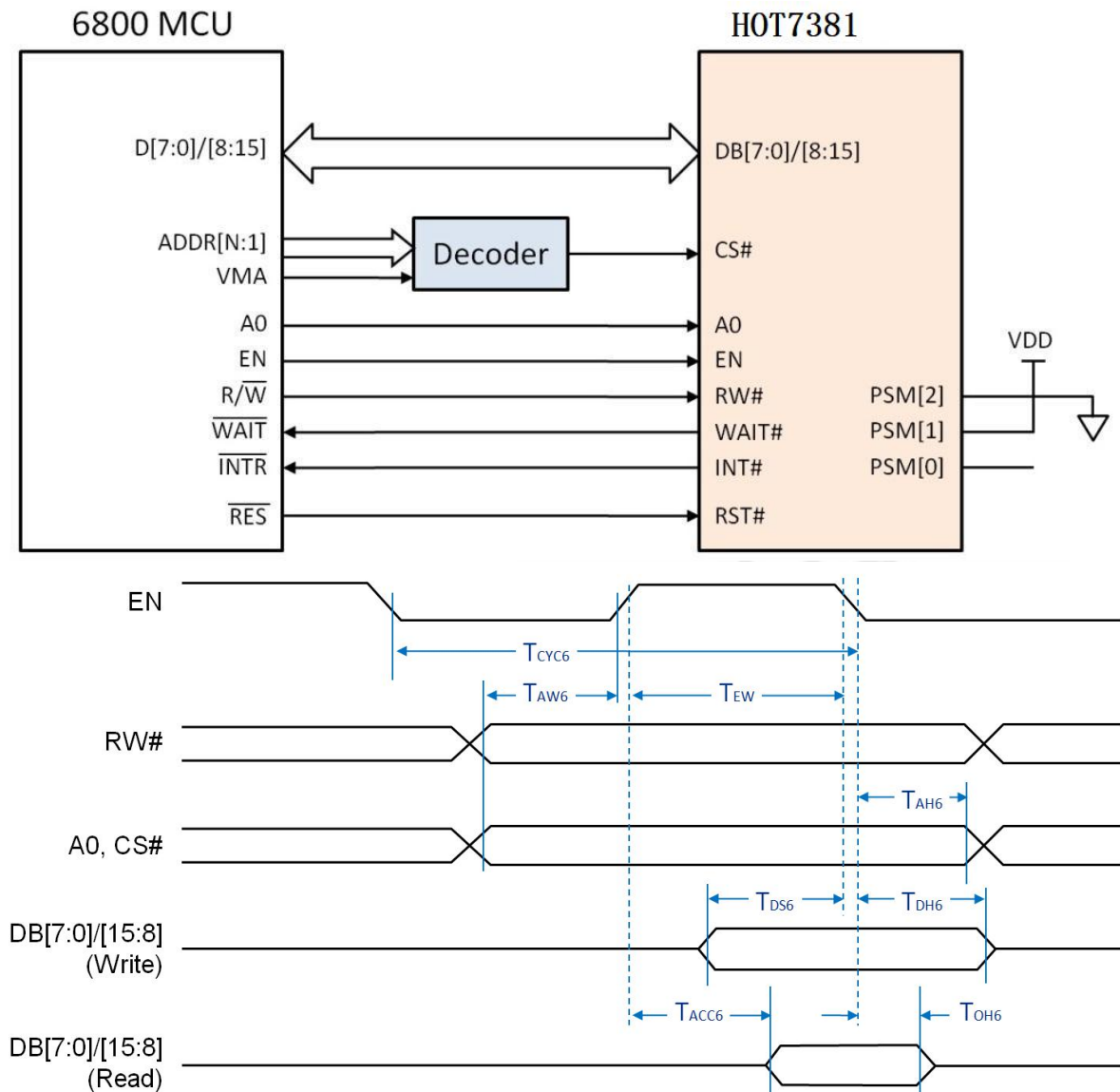
符 号	参 数	Rating		单位	说 明
		Min.	Max.		
T_{CYC6}	Cycle Time	50	--	ns	
T_{EW}	Strobe Pulse Width	20	--	ns	
T_{AW6}	Address Setup Time	0	--	ns	
T_{AH6}	Address Hold Time	10	--	ns	tc is one system clock
T_{DS6}	Data Setup Time	20	--	ns	period:
T_{DH6}	Data Hold Time	10	--	ns	tc = 1/SYS_CLK
T_{ACC6}	Data Output Access Time	0	20	ns	
T_{OH6}	Data Output Hold Time	0	20	ns	

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Host through the host interface to access HOT7381"s Registers and Display Memory. HOT381 has one Status Register and 256 Instruction Registers (i.e. .REG[00h] ~ REG[FF]). The access procedure are as following:

Register Write:

    1. Address Write: Write the Register"s Address. For example, 00h i.e. REG[00h], 01h i.e. REG[01h], 02h i.e. REG[02h] ……

    2. Data Write: Write Data to the Register

Register Read:

    1. Address Write: Write the Register"s Address

    2. Data Write: Read Data from the Register

Displays Memory (Display RAM) is where the TFT screen image data is stored,. Host through interface and write data into Display RAM. The procedure of access Display RAM is as following:

Display RAM Write:

    1. Set the Active Window Registers before writing any image data.

    2. Perform an register write to Graphic R/W Position Register 0, REG[5Fh]).

    3. Repeat step 2 until setup all the Active Window & Graphic R/W Position Coordinates.

    4. Perform an address write to point to Memory Data Port Register (REG[04h])

    5. Perform data writes to fill the window. Each write to the Memory Data Port will auto-increment the internal memory address.

6-2   3-Wire SPI Interface
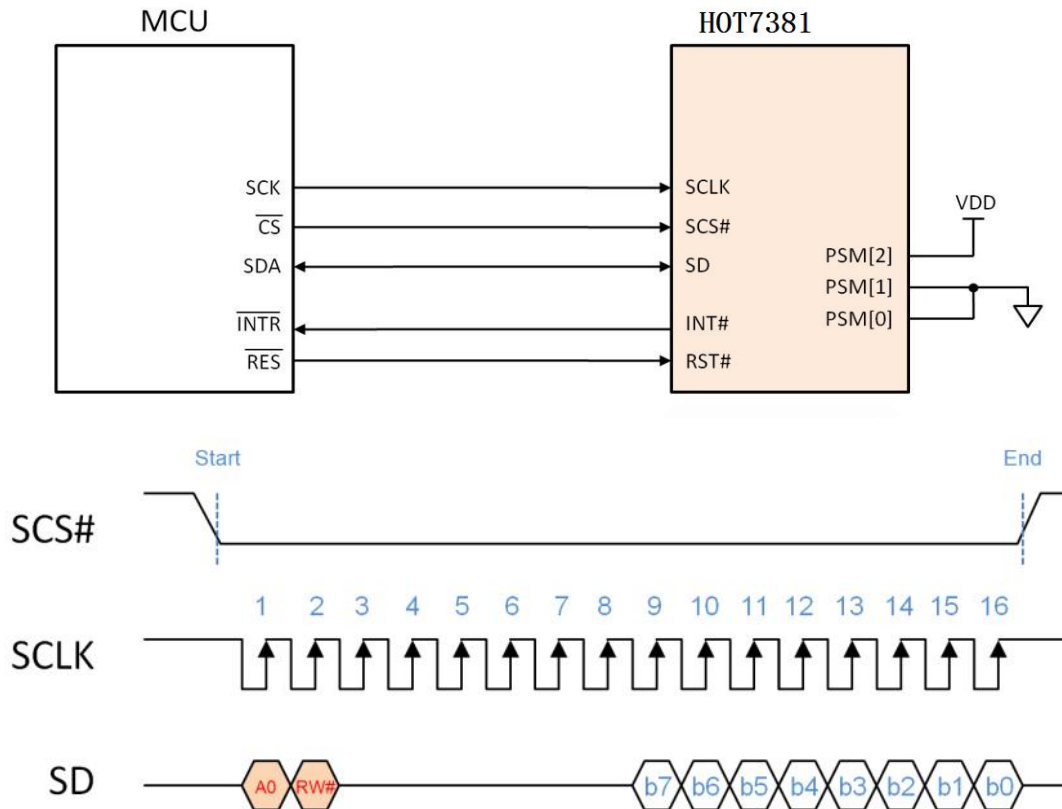
Status Register Read:

1. Host drive SCS#(Low) and SCLK(SPI Clock).

2. Host drive A0(Low), then drive RW#(High).

3. HOT381 will drive the Data of Status Register (b7 ~ b0) at 9 th ~ 16 th   Clock. Then Host will get the content of Status Register.

Write Register's Address:

1. Host drive SCS#(Low) and SCLK.

2. Host drive A0(Low), then drive RW#(Low).

3. Host drive the Register"s Address (b0 ~ b7) at 9 th ~ 16 th   Clock to HOT381.

Write Data to Register or Memory:

1. Host drive SCS#(Low) and SCLK.

2. Host drive A0(High), then drive RW#(Low).

3. Host drive the Data at 9 th ~ 16 th   Clock to HOT381. i.e. Data will be stored in Register or Memory.

Read Register's Data:

1. Host drive SCS#(Low) and SCLK.

2. Host drive A0(High), then drive RW#(High).

3. HOT381 will drive the Data of Register at 9 th ~ 16 th   Clock. Then Host will get the content of Register.

6-3　4-Wire SPI Interface
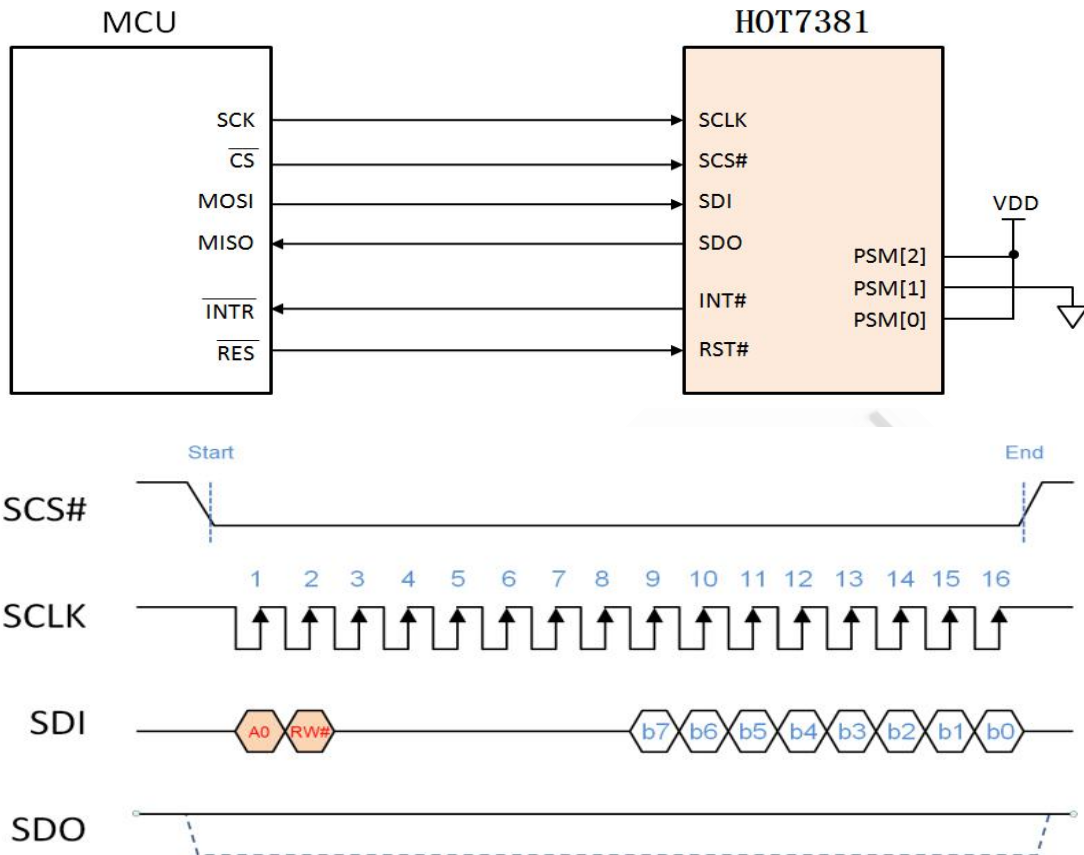
The above Timing diagram is the Write Cycle of 4-Wires SPI. When Host drive A0(Low) and RW#(Low), that"s means Host write Register's Address. When Host drive A0(High), then RW#(Low) that"s means Host write data to Register or Display RAM.

The following Timing diagram is the Read Cycle of 4-Wires SPI. When Host drive A0(Low) and RW#(High), that"s means Host want to read the data of Status Register. HOT381 will drive the Data of Status Register (b7 ~ b0) at 9 th ~ 16 th　Clock. Then Host will get the data of Status Register. When Host drive A0(High), then RW#(High) that"s means Host want to read the data of Command Register. HOT381 will drive the Data of Command Register (b7 ~ b0) at 9 th ~ 16 th Clock for Host. Of course, Host will get the content of Command Register.
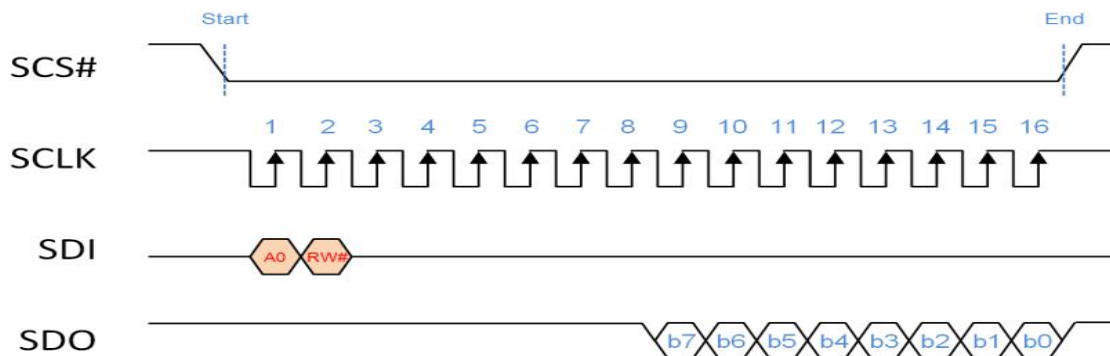
6-4 IIC Interface

The serial I2C interface is also almost same as 3-Wires SPI interface. But I2C interface only need 2 wires for data transfer. The following is the application circuit of I2C interface. Signals I2CA[5:0] are used to setup HOT381"s Device ID, and to avoid confuse with other"s I2C device. In this example circuit, I2CA[5:3] connect to VDD, and if all DIP Switch are "ON" state, then I2C Device ID is 111000b. i.e. 38h. Therefore if Host drive I2C timing with "111000b" Device ID, then HOT381 will communicate in the I2C cycle time with Host.
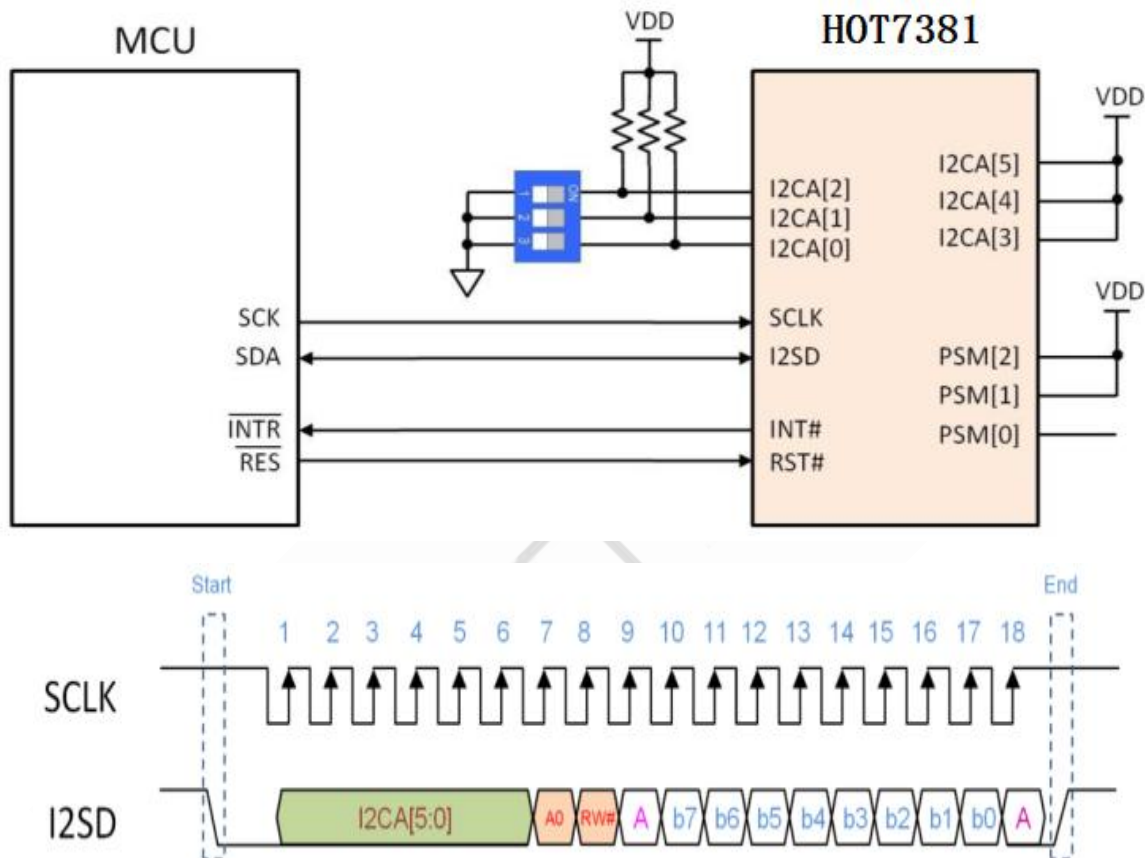
At first, Host has to know the Device ID of the I2C device. Then release the Device ID"s data in the five clocks of beginning. the Device ID data is 111000. The definition of A0 and RW# are same as SPI interface. When Host release A0(High) and RW#(Low), that means Host will write data(b7 ~ b0, at 10th ~ 17th Clock) to Command Register or Display RAM. If Host release A0(High) and RW#(High), that means Host want to read date from Command Register. HOT381 will release the content(b7 ~b0) of Command Register on 10th ~ 17th Clock. If Host release A0(Low) And RW#(High), that means Host want to read Status Data. HOT381 will release the Status Data(B7~ B0) on 10th ~ 17th Clock. Host will get the data of HOT381"s Status Register.

7. RELIABILITY TEST

7-1 Temperature and Humidity

TEST ITEMS	CONDITIONS	NOTE
High Temperature Storage	Ta=+85 o C, 240hrs	
Low Temperature Storage	Ta=-30 o C, 240hrs	
High Temperature Operation	Ta=+85 o C, 240hrs	
Low Temperature Operation	Ta=-30 o C, 240hrs	
High Temperature and High Humidity (Operating)	Ta=+60 o C, 90%RH, 240hrs	

Note: (1) All tests above are practiced at module type.

(2) There is no display function NG issue occurred, all the cosmetic specification is

judged before the reliability stress.
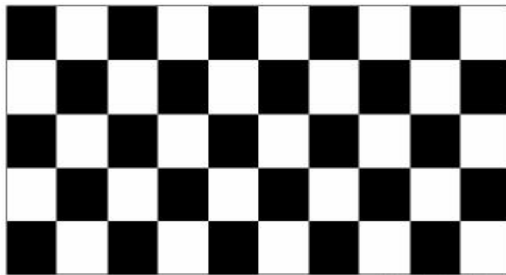
(a) Test Pattern (chess board Pattern)   (b) Gray Pattern

7-2 Shock and Vibration

ITEMS	CONDITIONS
Packing Shock (Non-Operation)	● Shock level:980m/s² ● Waveform:1/2 Sine wave,6msec ● ±X, ±Y ±Z,each axis 1 times
Packing Vibration (Non-Operation)	● Frequency range:8-33.3HZ ● Stoke:1.0mm ● Sweep: 10Hz-50Hz ● x,y,z 2 hours for each direction

7-3 Electrostatic Discharge

TEST ITEM	CONDITIONS
ESD (Non-operation)	150pF,330Ω，Contact±4KV,Air :±8KV.Note 1
	200pF,0Ω，±200V Contact test.Note 2

Note:Measure Point:

1.LCD glass and metal bezel

2.IF connector pins

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8.HANDDLING & CAUTIONS

8-1 Caution For Operation

♦Since the LCM is made of glass, do not apply strong mechanical impact or static load onto it.Handling with care since shock, vibration, and careless handling may seriously affect the product.If it falls from a high place or receives a strong shock, the glass maybe broken.

♦It is indispensable to drive the LCM within the specified voltage limit since the higher voltage than the limit causes LCM's life shorter. An electro-chemical reaction due to DC causes undesirable deterioration of the LCM so that the use of DC drive should avoid.

♦Do not connect or disconnect the LCM to or from the system when power is on.

♦Never use the LCM under abnormal conditions of high temperature and high humidity.

♦When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCM may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCM's surface which may affect the operation of the polarizer on the LCM.

♦Response time will be extremely delay at lower temperature than the operating temperature range and on the other hand LCM may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCM. The LCM will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

♦Do not display the fixed pattern for a long time when using a normally black panel, as it may cause image sticking due to the LCM structure. If the screen is displayed in fixed mode, use a screen saver.It is recommended to display the fixed mode in less than 2 minutes or less.

♦Do not disassemble and/or re-assemble LCM module

♦The LCD modules should be stored under the storage temperature range. the recommend condition is: Temperature : 0℃~ 40℃, Relatively humidity: ≤80%, and no more than 1 year.

7-2 Caution Against Static Charge

♦The LCM use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.

♦Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.

♦Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

♦In handling the LCM, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary

--END--

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