MODEL NO. :　　TM014EDH05

ISSUED DATE:　　2011-01-27

VERSION　　：　　Ver 2.0

□**Preliminary Specification**
■**Final Product Specification**

Customer :

Approved by	Notes

SHANGHAI TIANMA Confirmed :

Prepared by	Checked by	Approved by
张振英 2011-01-27		程梅 2011-01-27

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2009-10-10	Preliminary Release	Enhao Li
1.1	2009-12-31	Add LED life in Page 7	Enhao Li
2.0	2011-01-27	Final Specification Release	Zhenying Zhang

1   General Specifications

Feature		Spec
Display Spec	Size	1.45 inch
	Resolution	128(RGB) x 128
	Interface	CPU 8bits/SPI 4W/SPI 3W
	Color Depth	65/262k
	Technology Type	a-Si
	Pixel Pitch (mm)	0.203x 0.203
	Pixel Configuration	R.G.B Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear Type (3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	32.36x38.00x2.60
	Active Area(mm)	26.035x26.035
	With /Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	1 LED
Electronic	Driver IC	ST7715R

Note 1:Viewing direction for best image quality is different from TFT definition, there is a 180 degree shift.

Note 2 : Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance: $\pm$ 5%

2   Input/Output Terminals

2.1   TFT LCD Panel

No	Symbol	I/O	Description	Remark
1	GND	P	Ground	
2	AVCL	O	A power supply pin for generating GVCL. Connect a capacitor for stabilization.	
3	GND	P	Ground	
4	AVDD	O	Power input pin for analog circuits， Connect a capacitor for stabilization.	
5	VPP(OTP)	I	When writing NVM, it needs external power supply voltage (7.5V).If not uses, please NC.	
6	IOVCC	P	Logic Supply Voltage	
7	GND	P	Ground	
8	WR/RS	I	-Write enable in MCU parallel interface. -In 4-line SPI, this pin is used as D/CX (data/ command selection). -If not used, please fix this pin at VDDI or DGND level.	
9	D0/SDA	I	-used as MCU parallel interface data bus. -D0 is the serial input/output signal in serial interface mode.	
10	IM2	I	MCU Parallel interface bus and Serial interface select IM2='1', Parallel interface IM2='0', Serial interface	
11	D2	I	Used as MCU parallel interface data bus. In serial interface, are not used and should be fixed at VDDI or DGND level.	
12	D4	I		
13	D6	I		
14	/CS	I	Chip select signal, Low enable.	
15	RESET	I	Reset signal	
16	D7	I	Used as MCU parallel interface data bus. In serial interface, are not used and should be fixed at VDDI or DGND level.	
17	D5	I		
18	D3	I		
19	D1	I		
20	GND	P	Ground	
21	RS/SCL	I	Display data/command selection pin in MCU interface. In serial interface, this is used as SCL. -If not used, please fix this pin at VDDI or DGND level.	

22	RD	I	Read signal	
23	VCC	P	Analog Supply Voltage	
24	SPIW4	I	SPI4W='0', 3-line SPI enable. SPI4W='1', 4-line SPI enable. If not used, please fix this pin at DGND level.	
25	GND	P	Ground	
26	IOVCC	P	Logic Supply Voltage	
27	GND	P	Ground	
28	IOVCC	P	Logic Supply Voltage	
29	GND	P	Ground	
30	LEDA	P	Back light anode	
31	LEDK	P	Back light cathode	
32	NC	-	NC	

Note2-1: I/O definition：

　　　　I-----Input　　　　O---Output　　　　P----Power/ Ground　　　NC--- Not Connected

3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

Ta = 25°C

Item	Symbol	Min	Max	Unit	Remark
Logic Supply Voltage	IOVCC	1.65	3.7	V	
Analog Supply Voltage	VCC	2.3	4.6	V	
Input Signal Voltage	D0~D7,VPP,WR/RS,IM2,/CS,RESET, RS/SCL,RD,SPIW4	-0.3	VDD +0.3	V	
Back Light Forward Current	I_{LED}	--	25	mA	
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

4   Electrical Characteristics

4.1   Driving TFT LCD Panel

<div align="right">GND=0V, Ta=25℃</div>

Item		Symbol	Min	Typ	Max	Unit	Remark
Logic Supply Voltage		IOVCC	1.65	1.8/2.8	3.7	V	
Analog Supply Voltage		VCC	2.3	2.8	4.6	V	
Input Signal Voltage	Low Level	V_{IL}	0	--	0.2xVCC	V	D0~D7,VPP,WR/RS,IM2,/CS, RESET,RS/SCL,RD,SPIW4
	High Level	V_{IH}	0.8xVCC	--	VCC	V	
Output Signal Voltage	Low Level	V_{OL}	--	--	0.2xVCC	V	AVCL,AVDD
	High Level	V_{OH}	0.8xVCC	--	VCC	V	
(Panel+ LSI) Power Consumption	Black Mode (60Hz)	--	--	TBD	--	mW	
	Sleeping Mode	--	--	TBD	--	uW	

Note: We will provide the power consumption after we test the samples.

4.2   Driving Backlight   Ta=25℃

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	20	25	mA	
Forward Voltage	V_F	--	3.2	--	V	1 LED
Power Consumption	W_{BL}	--	64	--	mW	
Operating Life Time	--	10000	(20000)	--	Hrs	

Note1:   Figure below shows the connection of backlight LED.

A ⊶ ▶| ⊶ K

Note 2: One LED: I_F =20 mA, V_F =3.2V
Note 3: IF is defined for one channel LED.
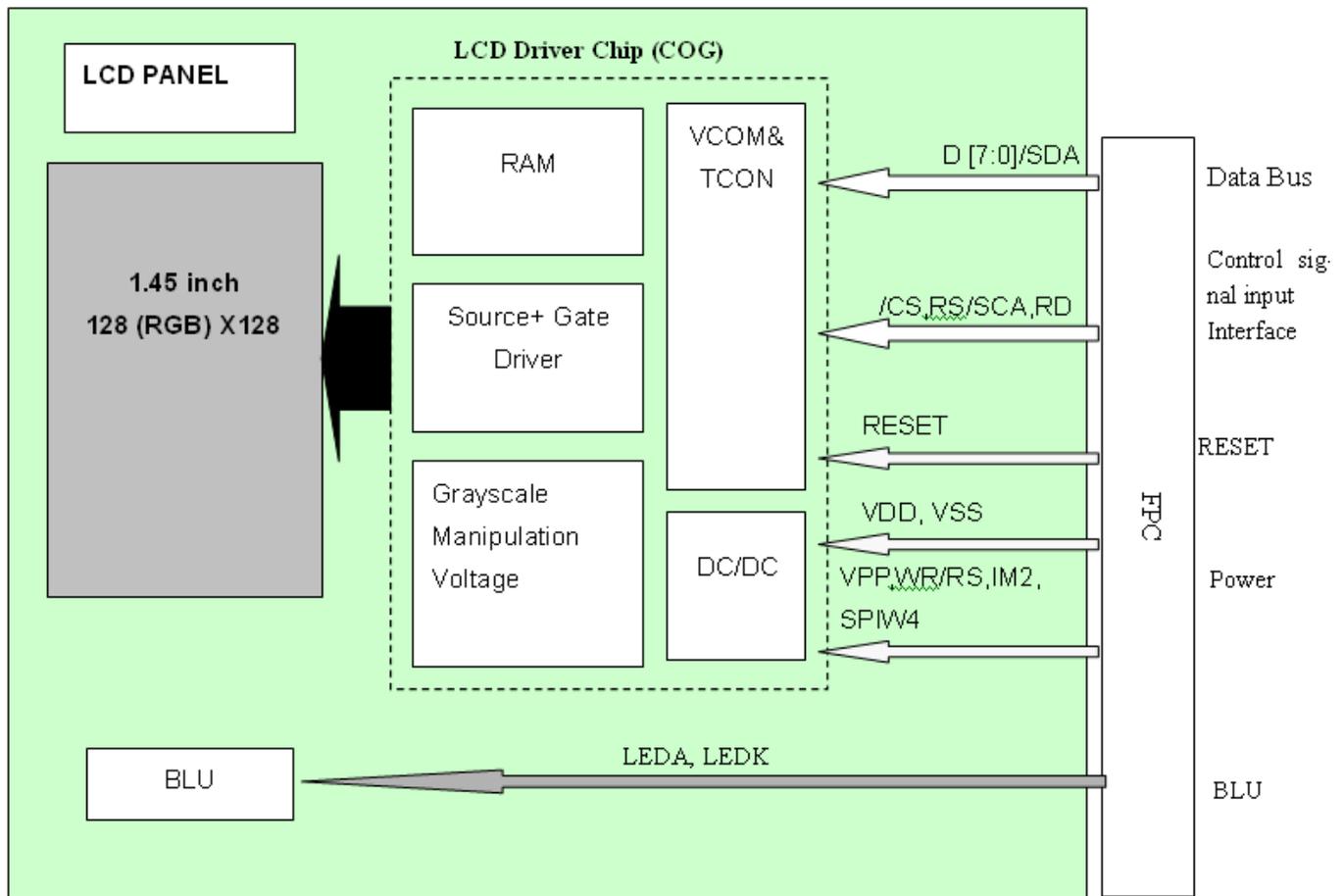   Optical performance should be evaluated at Ta=25℃ only.
    If LED is driven by high current, high ambient temperature & humidity condition, the life
    time of LED will be reduced.
    Operating life means brightness goes down to 50% initial brightness. Typical operating life
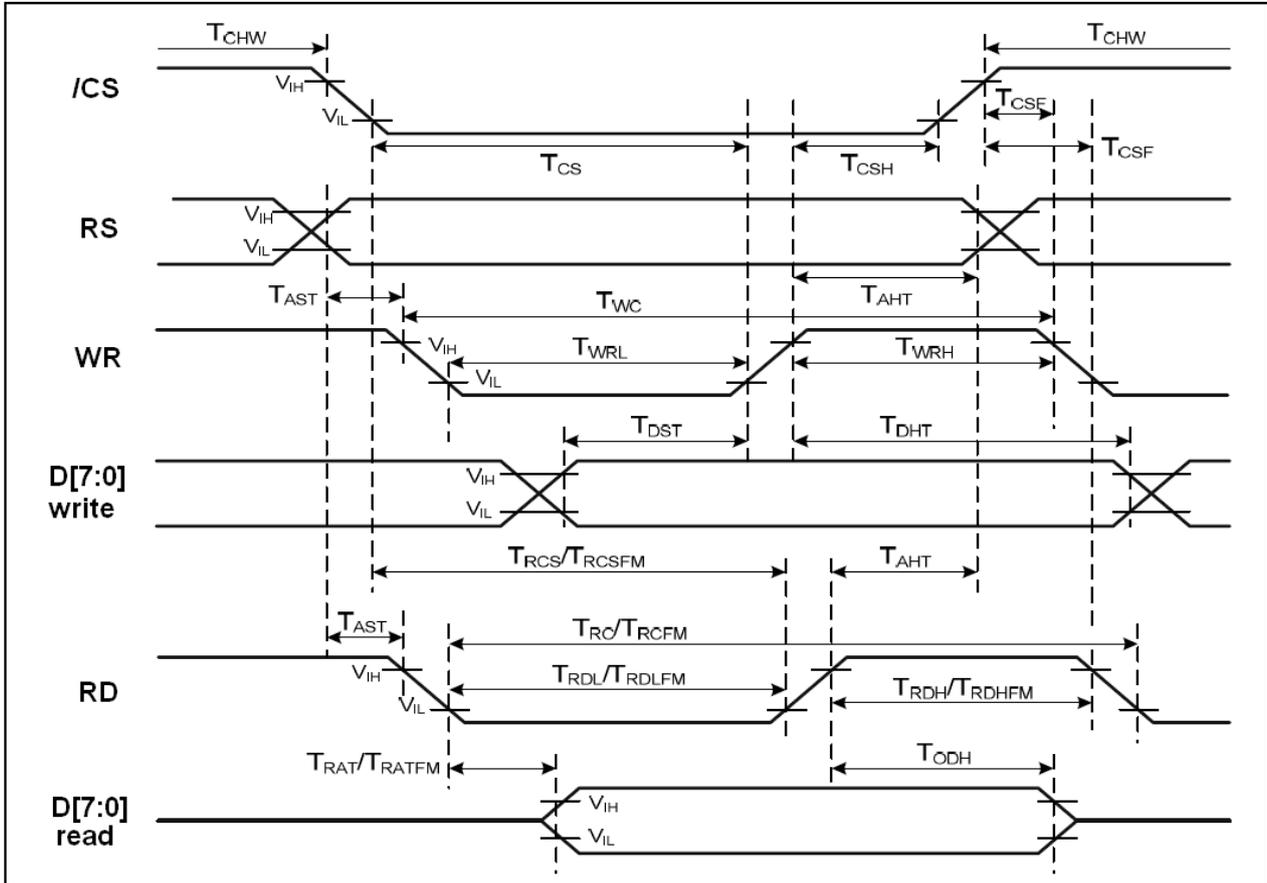time is estimated data.

4.3   Block Diagram
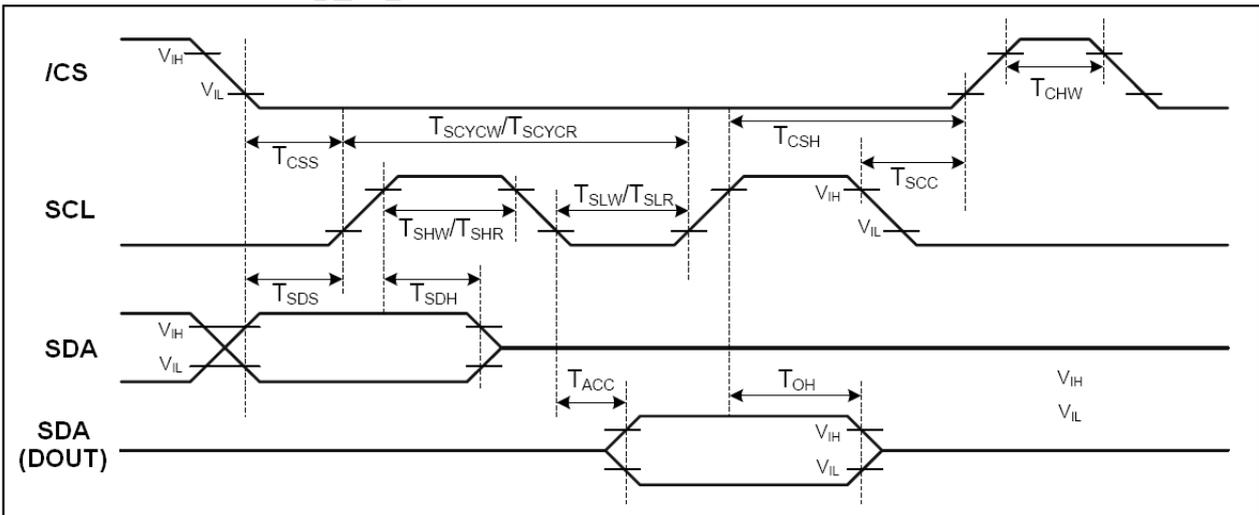
5 Timing Chart

5.1 Interface Characteristics

Parallel interface characteristics

Serial Interface Characteristics

5.2 Timing Parameter

Signal	Symbol	Parameter	Min	Max	Unit	Description
RS	TAST	Address setup time	10		ns	-
	TAHT	Address hold time (Write/Read)	10		ns	
/CS	TCHW	Chip select "H" pulse width	0		ns	-
	TCS	Chip select setup time (Write)	15		ns	
	TRCS	Chip select setup time (Read ID)	45		ns	
	TRCSFM	Chip select setup time (Read FM)	355		ns	
	TCSF	Chip select wait time (Write/Read)	10		ns	
	TCSH	Chip select hold time	10		ns	
WR	TWC	Write cycle	66		ns	
	TWRH	Control pulse "H" duration	15		ns	
	TWRL	Control pulse "L" duration	15		ns	
RD (ID)	TRC	Read cycle (ID)	160		ns	When read ID data
	TRDH	Control pulse "H" duration (ID)	90		ns	
	TRDL	Control pulse "L" duration (ID)	45		ns	
RD (FM)	TRCFM	Read cycle (FM)	450		ns	When read from frame memory
	TRDHFM	Control pulse "H" duration (FM)	90		ns	
	TRDLFM	Control pulse "L" duration (FM)	355		ns	
D[7:0]	TDST	Data setup time	10		ns	For CL=30pF
	TDHT	Data hold time	10		ns	
	TRAT	Read access time (ID)		40	ns	
	TRATFM	Read access time (FM)		340	ns	
	TODH	Output disable time	20	80	ns	

Parallel interface characteristics

| Signal	Symbol	Parameter	Min	Max	Unit	Description
/CS	TCSS	Chip select setup time (write)	15		ns	
	TCSH	Chip select hold time (write)	15		ns	
	TCSS	Chip select setup time (read)	60		ns	
	TSCC	Chip select hold time (read)	65		ns	
	TCHW	Chip select "H" pulse width	40		ns	
SCL	TSCYCW	Serial clock cycle (Write)	66		ns	
	TSHW	SCL "H" pulse width (Write)	15		ns	
	TSLW	SCL "L" pulse width (Write)	15		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 (DIN) (DOUT)	TSDS	Data setup time	10		ns	For maximum CL=30pF For minimum CL=8pF
	TSDH	Data hold time	10		ns	
	TACC	Access time	10	50	ns	
	TOH	Output disable time	15	50	ns	

Serial Interface Characteristics

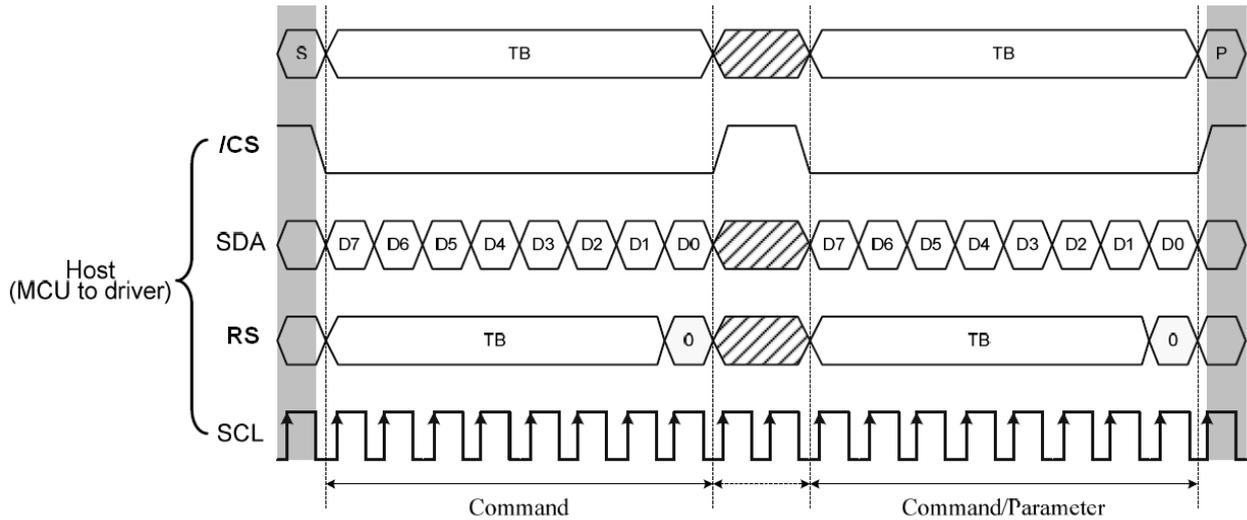# 5.3 Register Write/Read Timing

5.3.1 System Bus Interface Register Write Timing
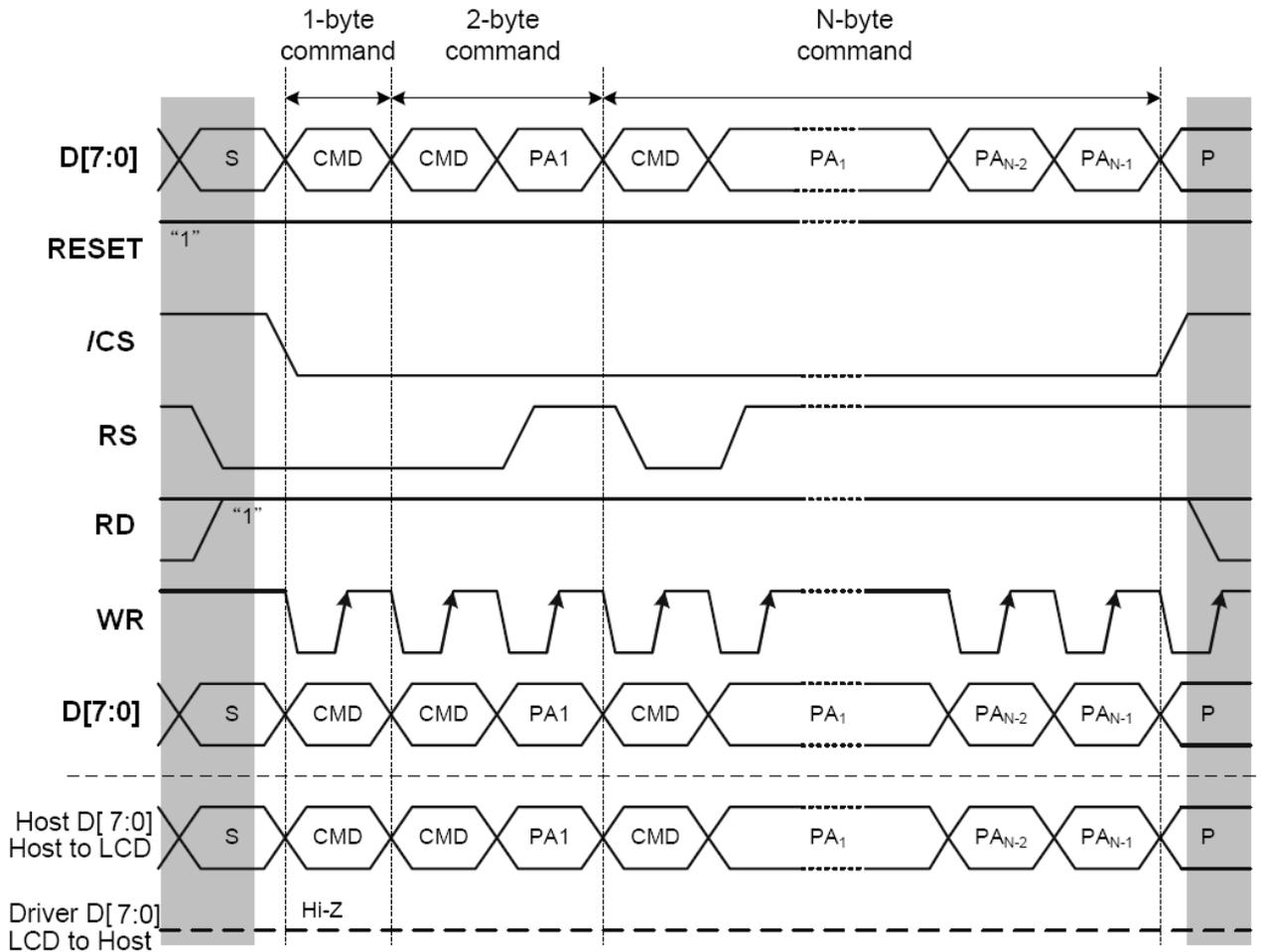
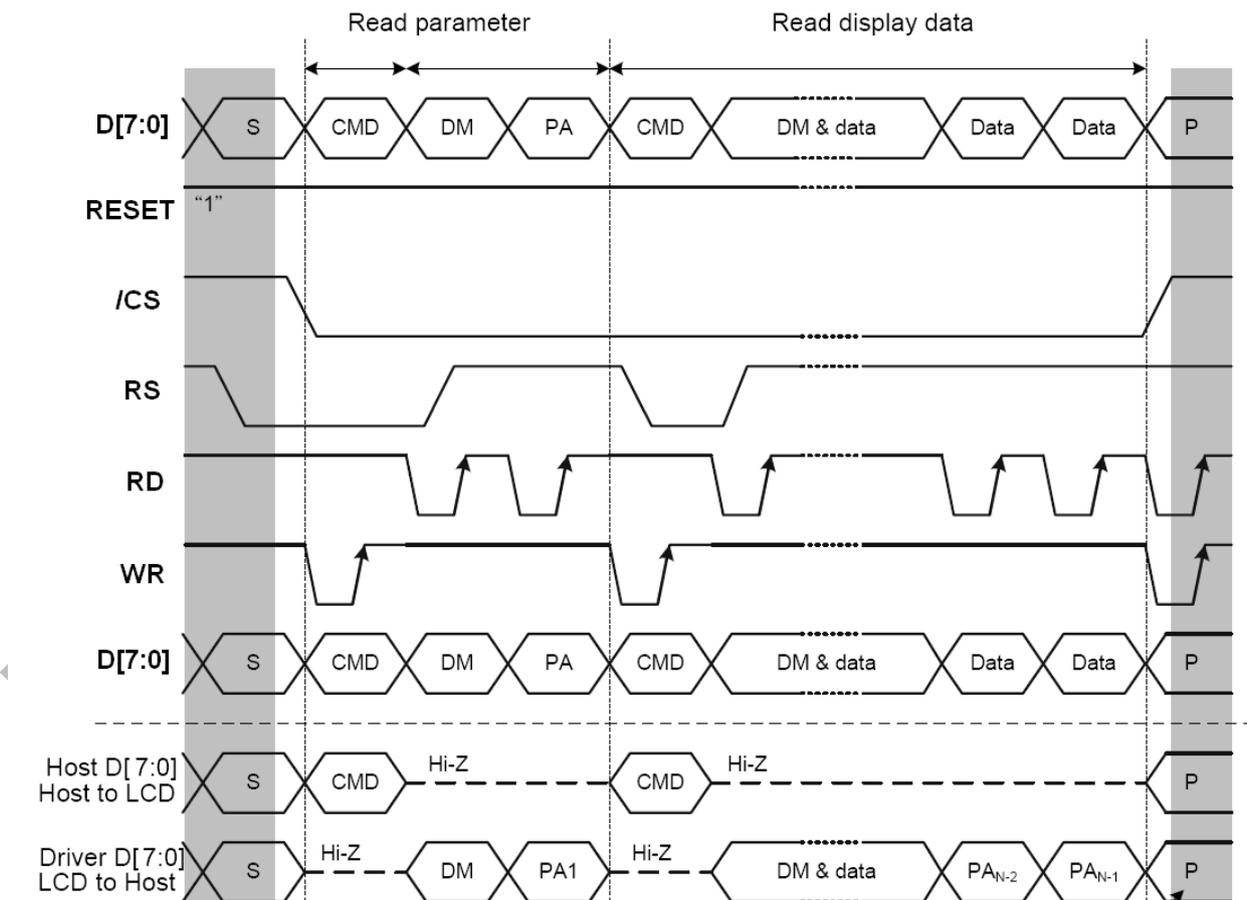Register Write Timing in Parallel Bus System Interface (for I80 series MPU)
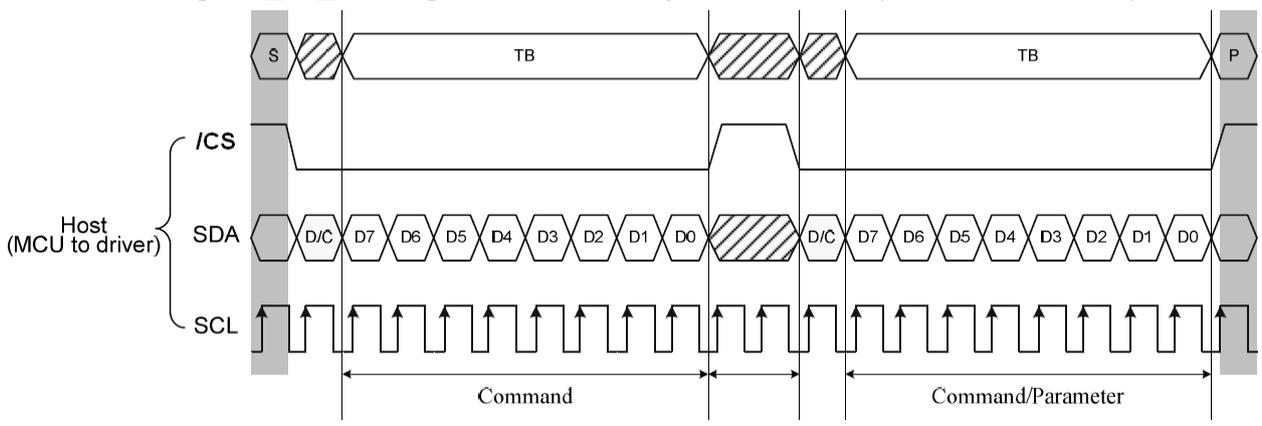
Serial Interface Protocol 3 wire Write Mode
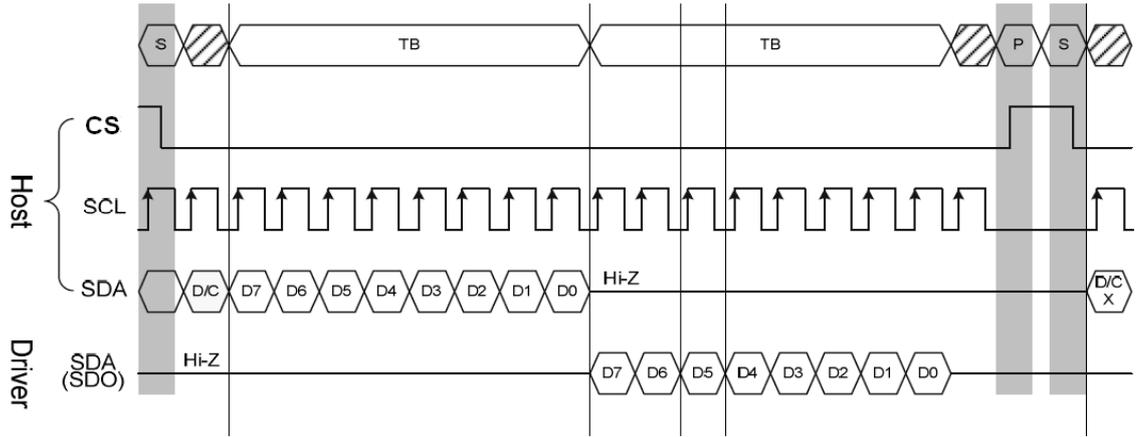
Serial Interface Protocol 4 wire Write Mode
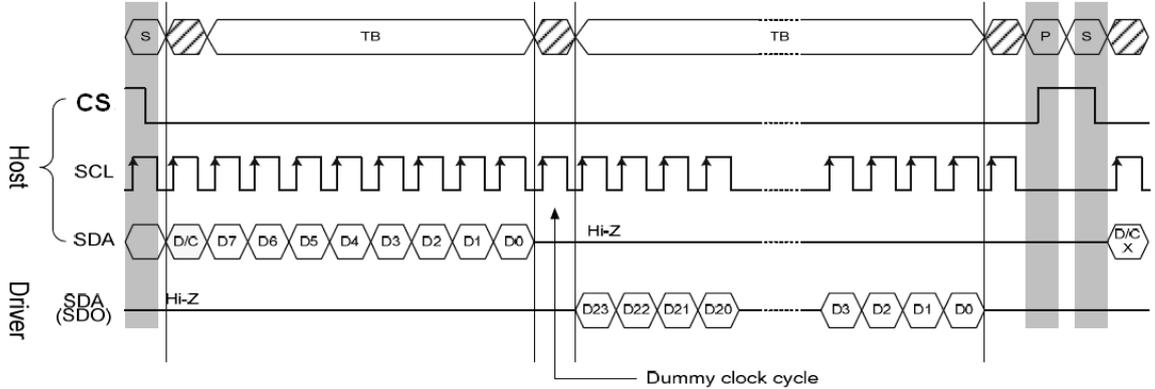
5.3.2 System Bus Interface Register Read Timing

Register Read Timing in Parallel Bus System Interface (for I80 series MPU)

3-line serial protocol (for RDID1/RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh command: 8-bit read):

3-line serial protocol (for RDDID command: 24-bit read)

3-line Serial Protocol (for RDDST command: 32-bit read)
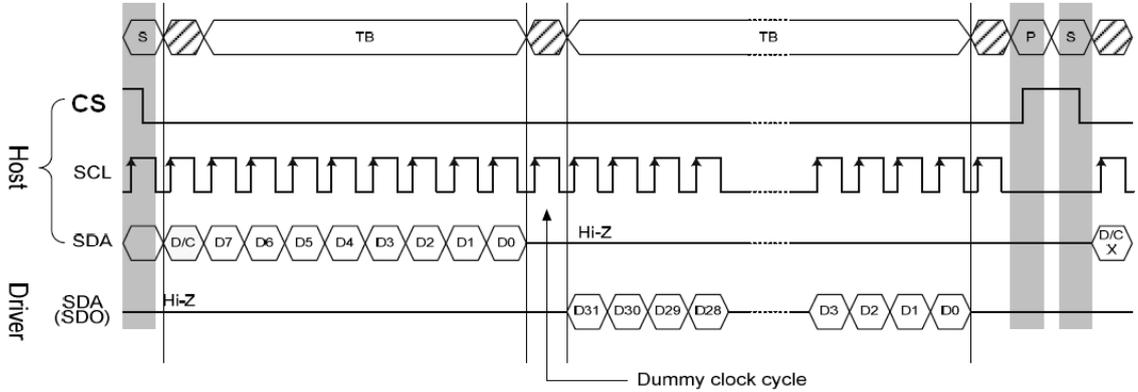

3 Wires Serial Interface Protocol, Read Mode

4-line serial protocol (for RDID1/RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh command: 8-bit read):

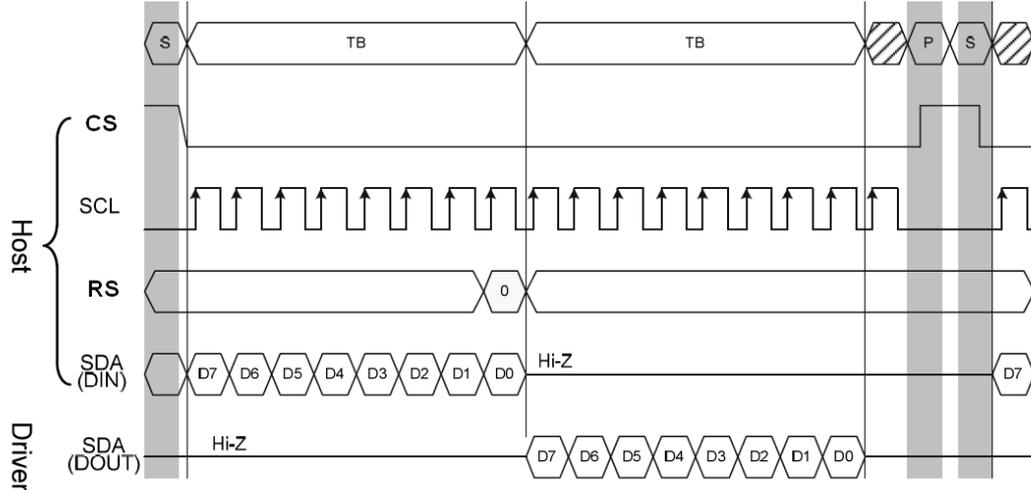4-line serial protocol (for RDDID command: 24-bit read)

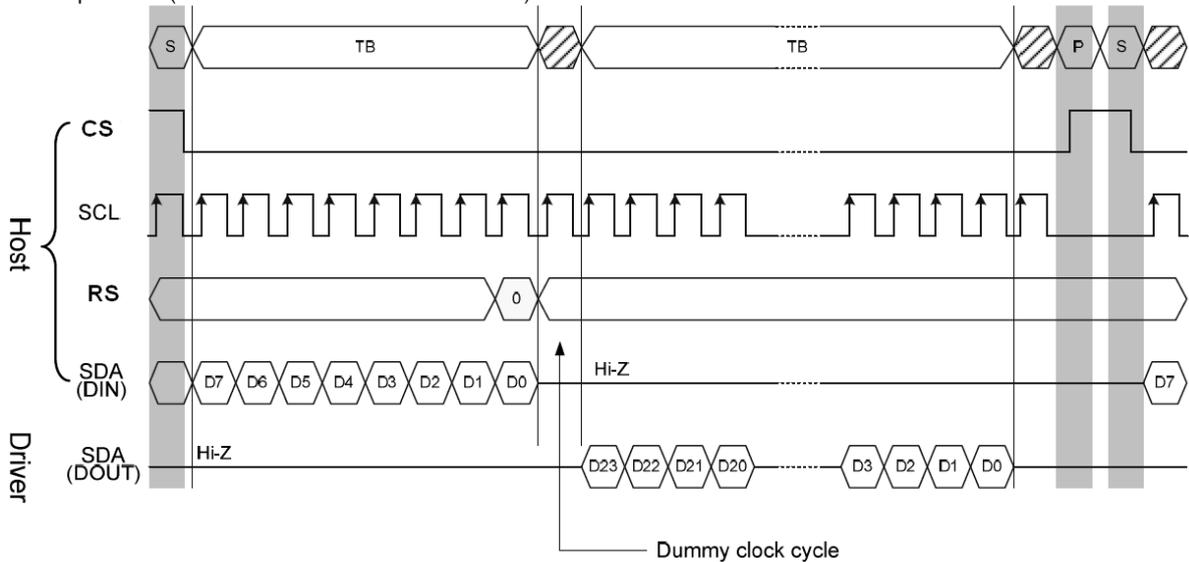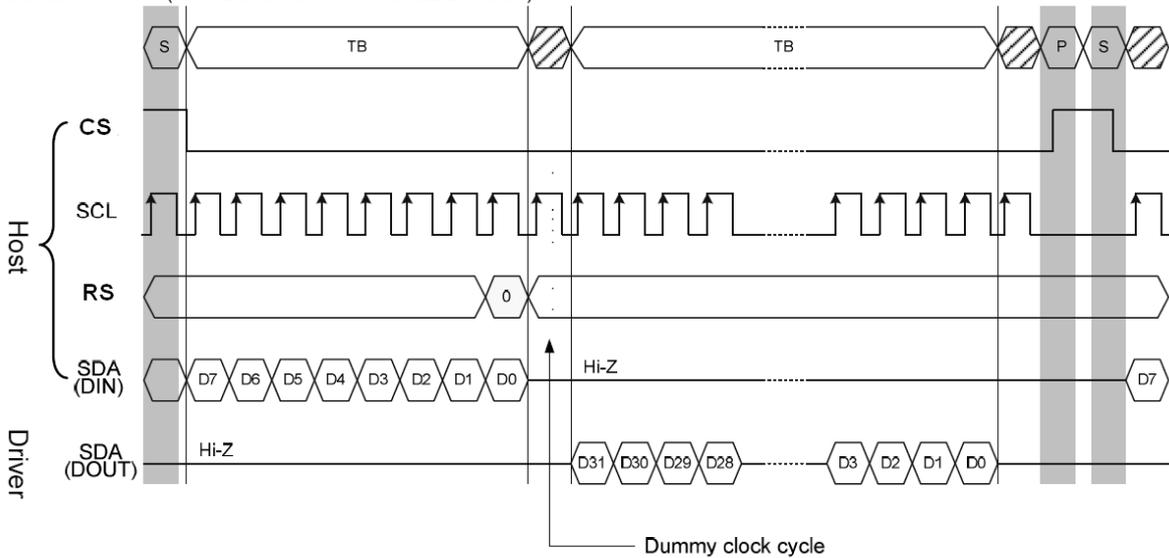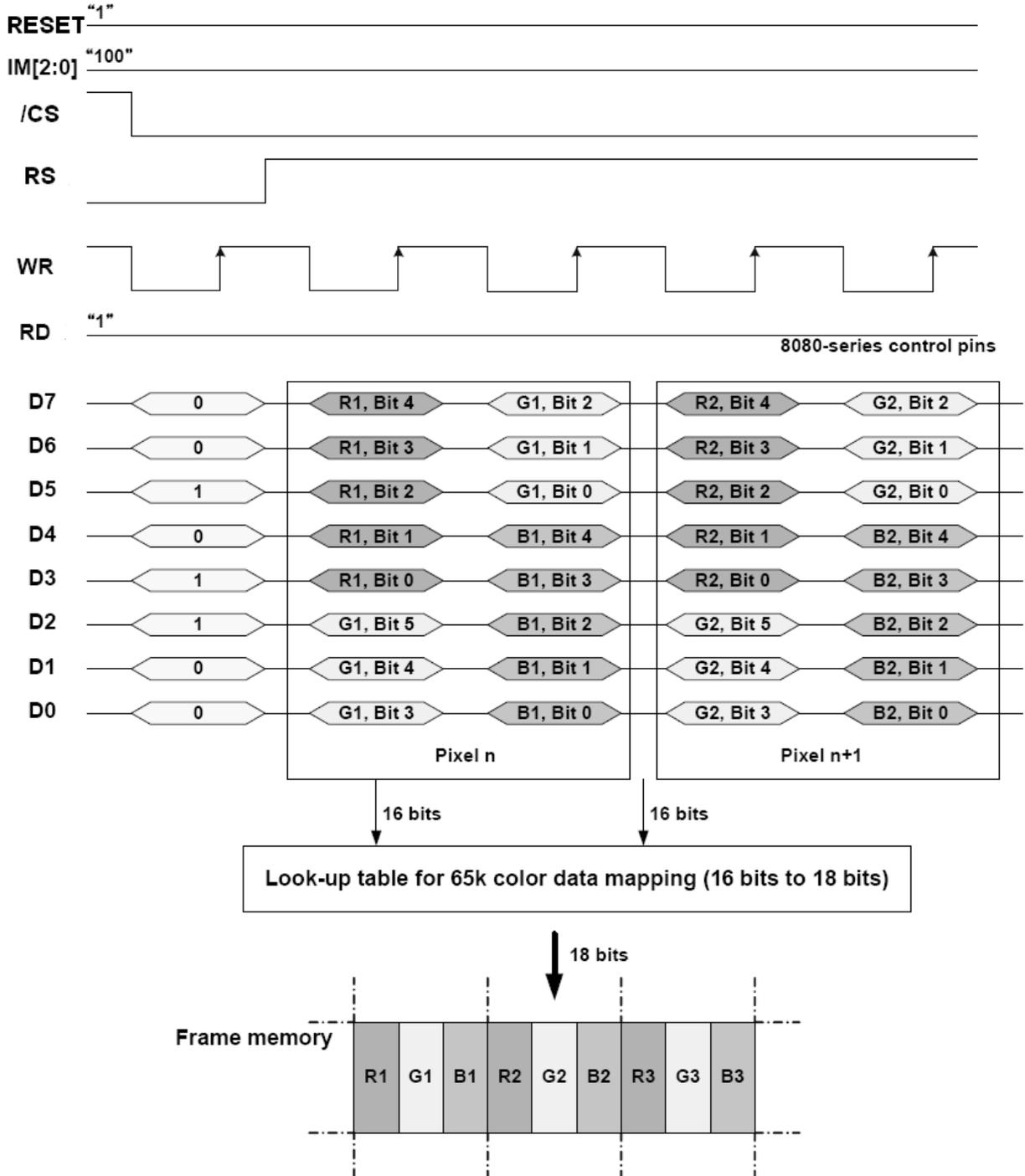4-line Serial Protocol (for RDDST command: 32-bit read)

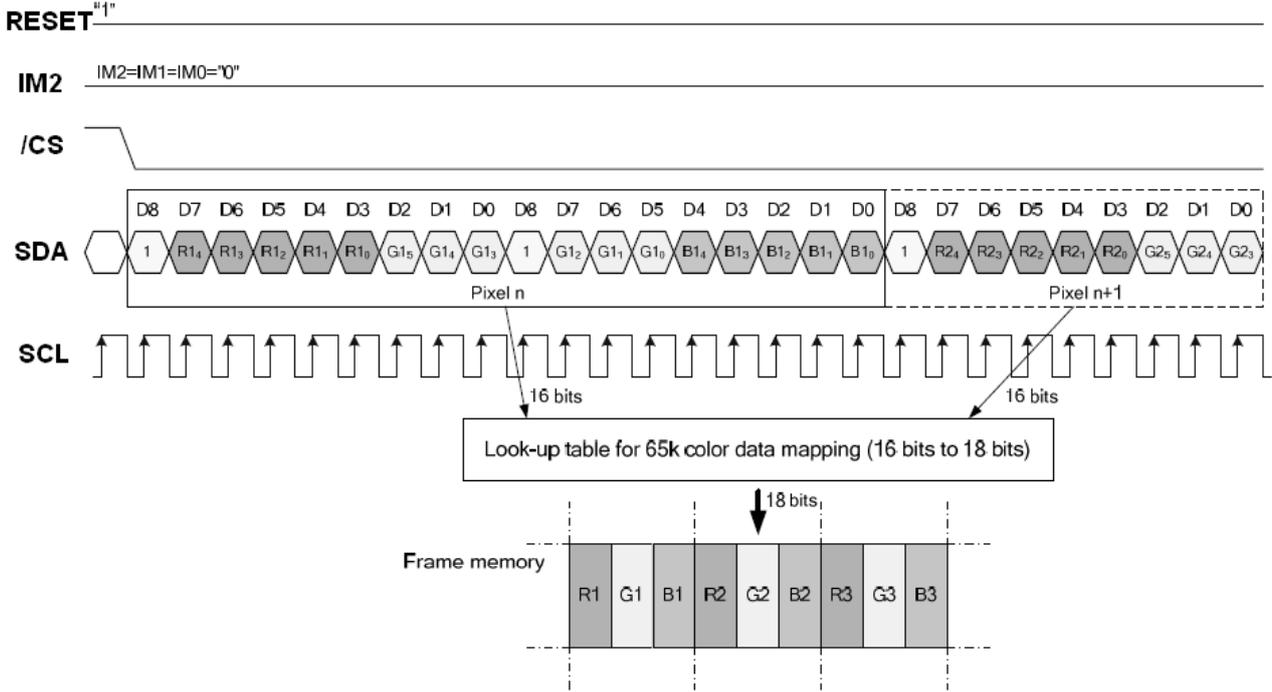4Wire Serial Interface Protocol, Read Mode

5.4 Data Color Coding

8-bit data bus for 16-bit/pixel (RGB 5-6-5-bit input), 65K-Colors

RESET "1"

IM2 IM2=IM1=IM0="0"

/CS

SDA

| D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

1 $R1_4$ $R1_3$ $R1_2$ $R1_1$ $R1_0$ $G1_5$ $G1_4$ $G1_3$ 1 $G1_2$ $G1_1$ $G1_0$ $B1_4$ $B1_3$ $B1_2$ $B1_1$ $B1_0$ 1 $R2_4$ $R2_3$ $R2_2$ $R2_1$ $R2_0$ $G2_5$ $G2_4$ $G2_3$

Pixel n Pixel n+1

SCL

16 bits 16 bits

Look-up table for 65k color data mapping (16 bits to 18 bits)

18 bits

Frame memory | R1 | G1 | B1 | R2 | G2 | B2 | R3 | G3 | B3 |

3-line serial Interface：Write data for 16-bit/pixel (RGB 5-6-5-bit input), 65K-Colors

RESET "1"

IM2 "1", P68="0", IM2=IM1=IM0="0"

/CS

RS "1"

SDA

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

$R1_4$ $R1_3$ $R1_2$ $R1_1$ $R1_0$ $G1_5$ $G1_4$ $G1_3$ $G1_2$ $G1_1$ $G1_0$ $B1_4$ $B1_3$ $B1_2$ $B1_1$ $B1_0$ $R2_4$ $R2_3$ $R2_2$ $R2_1$ $R2_0$ $G2_5$ $G2_4$ $G2_3$

Pixel n Pixel n+1

SCL

16 bits 16 bits

Look-up table for 65k color data mapping (16 bits to 18 bits)

18 bits

Frame memory | R1 | G1 | B1 | R2 | G2 | B2 | R3 | G3 | B3 |

4-line serial Interface：Write data for 16-bit/pixel (RGB 5-6-5-bit input), 65K-Colors

5.5 Chip selection &Write/Read Timing
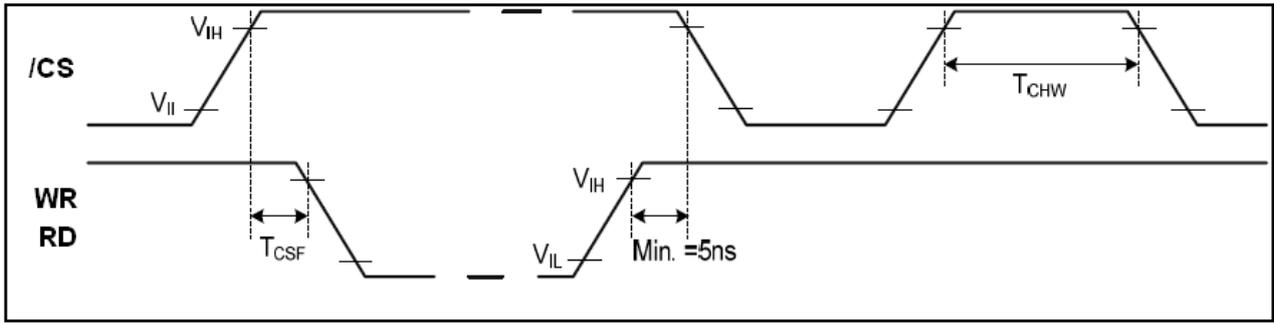
Chip selection timing
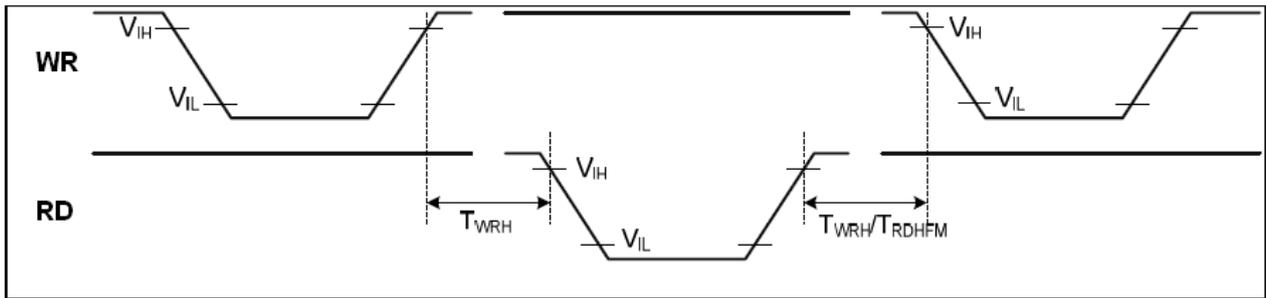
Write-to-read and read-to-write timing

5.6 Reset Timing
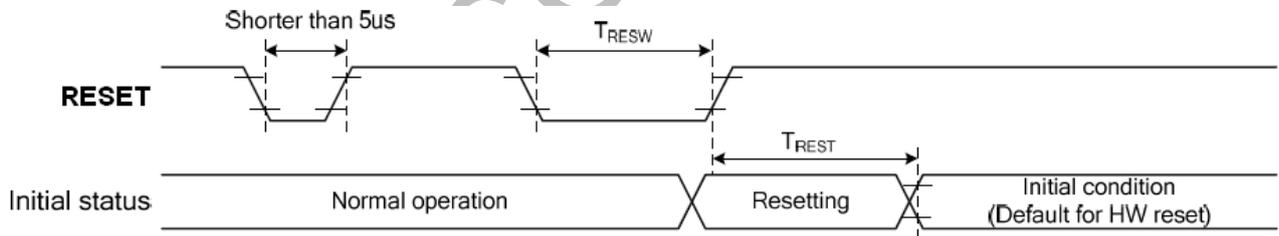
Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESET	tRESW	Reset pulse duration	10	-	us
	tREST	Reset cancel	-	5	ms
				120	ms

Reset Timing

6   Power On/Off Sequence

6.1 Power on Sequence

6.2 Power Off Sequence

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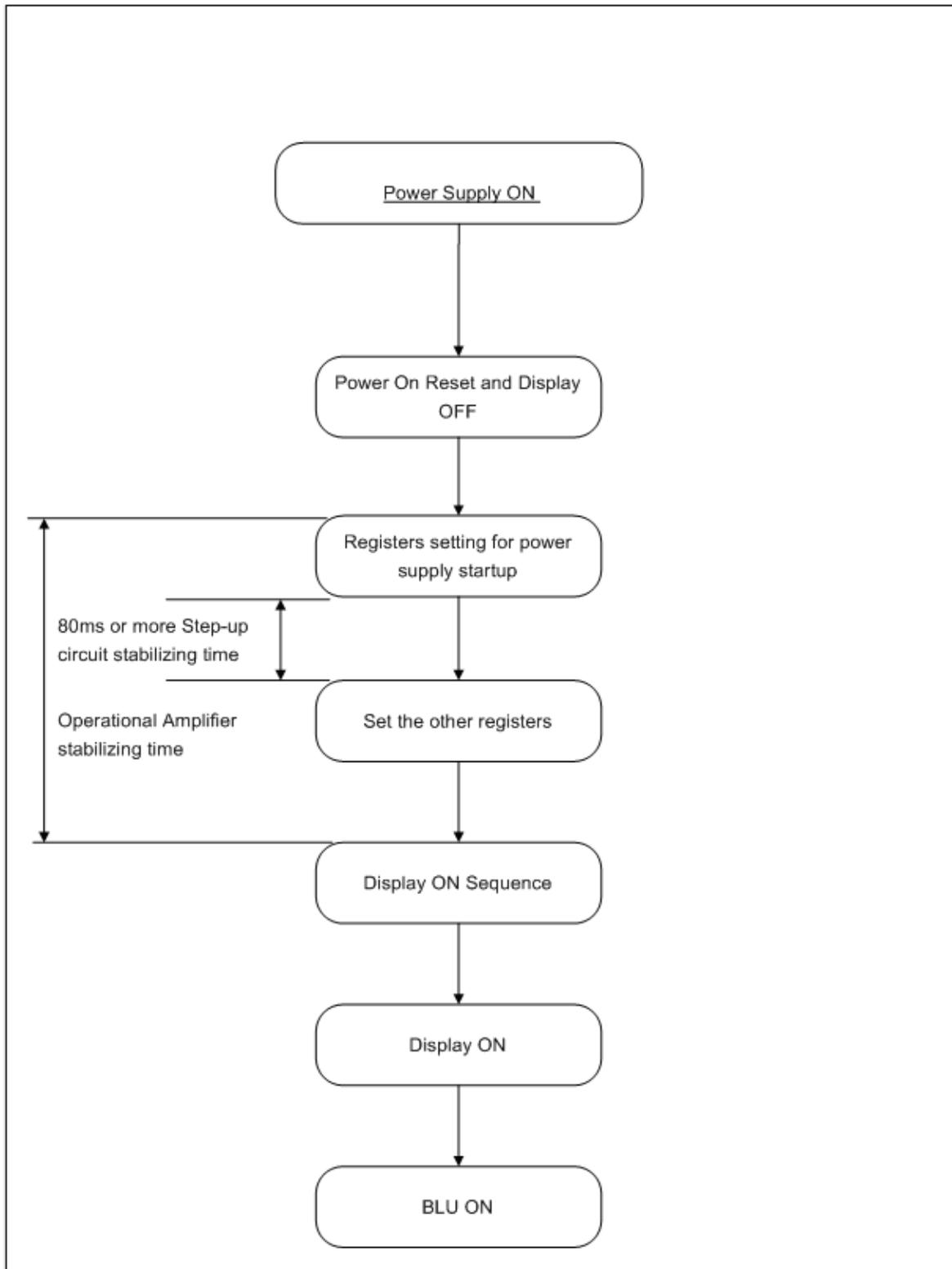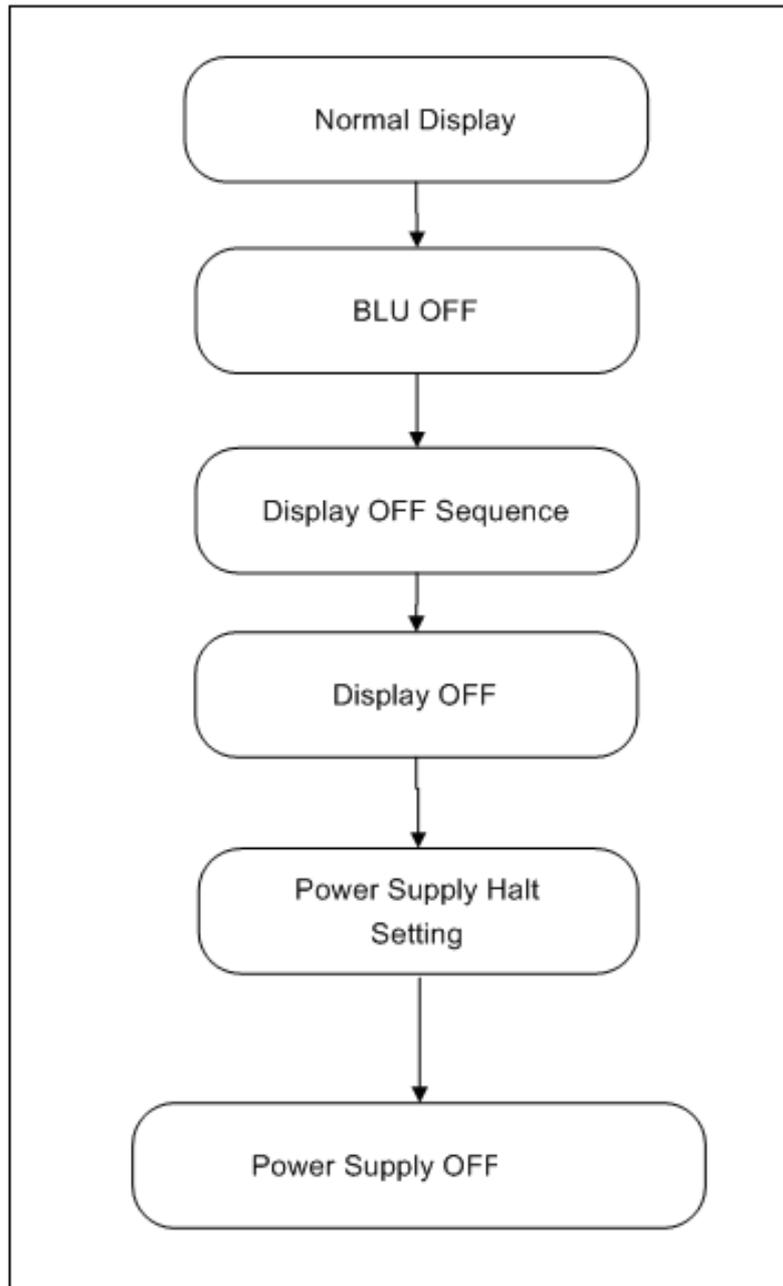
7   Optical Characteristics

Ta=25℃

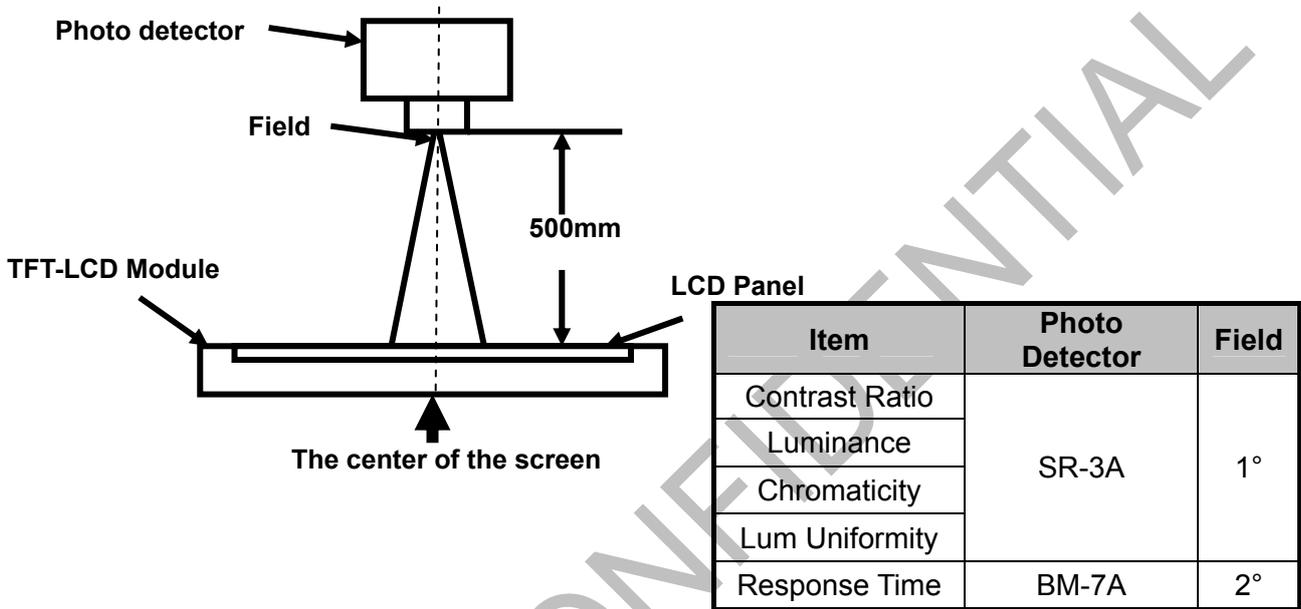| Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	60	70	-	Degree	Note 2
		θB		50	60	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	300	350	-		Note1 Note3
Response Time		Ton	25℃	-	25	40	ms	Note1 Note4
		Toff						
Chromaticity	White	x	Backlight is on	0.265	0.315	0.365		Note5, Note1
		y		0.277	0.327	0.377		
	Red	x		0.534	0.584	0.634		
		y		0.297	0.347	0.397		
	Green	x		0.290	0.340	0.390		
		y		0.510	0.560	0.610		
	Blue	x		0.115	0.165	0.215		
		y		0.035	0.095	0.135		
Uniformity		U		-	75	-	%	Note1 Note6
NTSC				-	50	-	%	Note 5
Luminance		L		120	140	-	cd/m^2	Note1 Note7

Test Conditions:

1. V_F=3.2V, I_F=20mA, the ambient temperature is 25℃.

2.   The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.

Photo detector

Field

500mm

TFT-LCD Module

LCD Panel

The center of the screen

Item	Photo Detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。

Normal line
$\theta=\Phi=0°$

$\Phi=90°$
12 o'clock direction

θ_L

θ_T θ_R

$\Phi=180°$

θ_B

Active Area

$\Phi=0°$

FPC

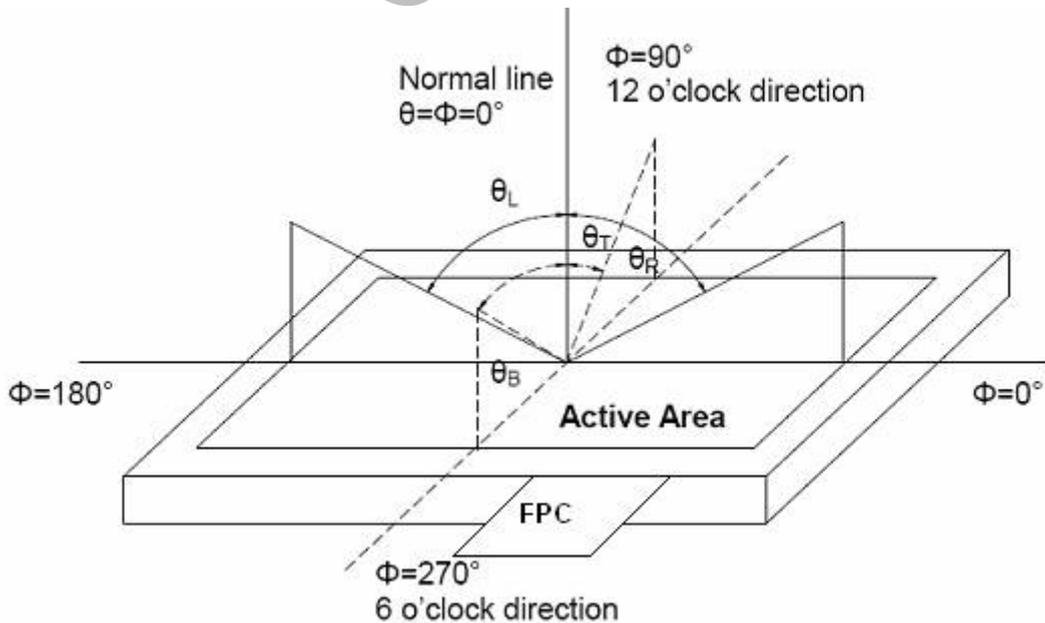$\Phi=270°$
6 o'clock direction

Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

"White state ":The state is that the LCD should driven by Vwhite.

"Black state": The state is that the LCD should driven by Vblack.

Vwhite: To be determined   Vblack: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.
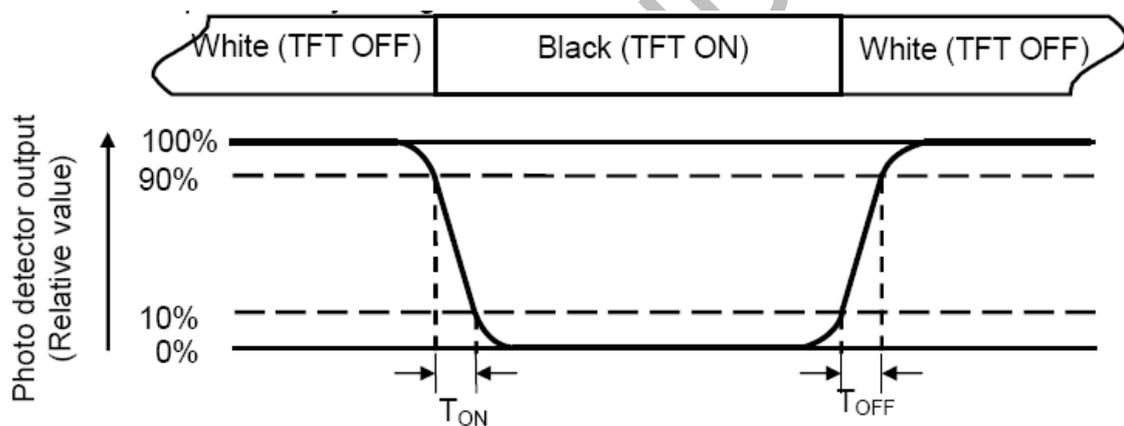
Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

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

Luminance Uniformity(U) = Lmin/ Lmax

L-------Active area length W----- Active area width
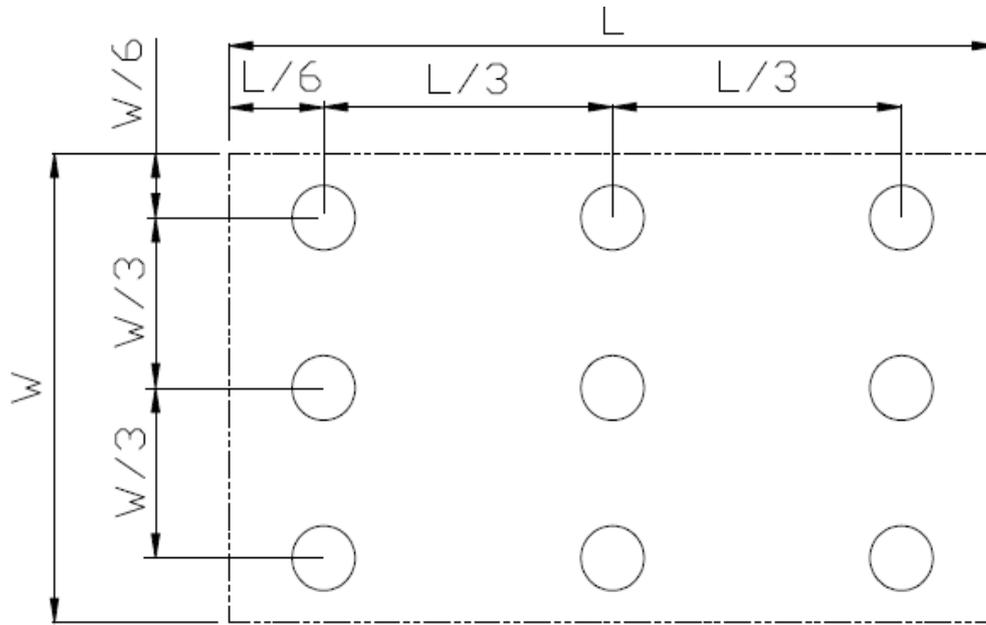
Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.
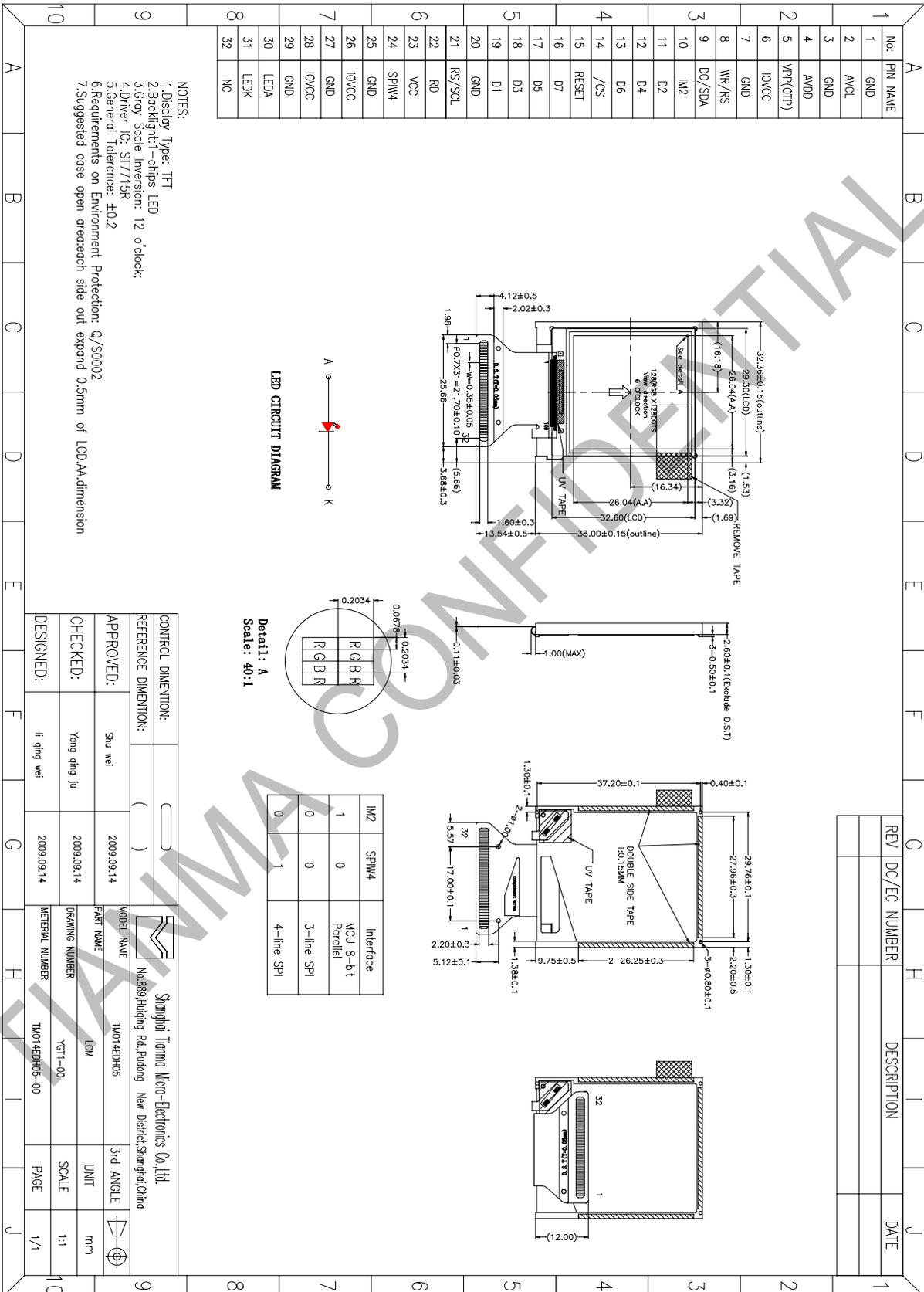
8 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70℃, 48hrs	Note1 IEC60068-2-2,GB2423.2—89
2	Low Temperature Operation	Ta=-20℃, 48hrs	IEC60068-2-1 GB2423.1—89
3	High Temperature Storage	Ta=+80℃, 48hrs	IEC60068-2-2, GB2423.2—89
4	Low Temperature Storage	Ta=-30℃, 48hrs	IEC60068-2-1 GB2423.1—89
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 48 hours	Note2 IEC60068-2-3, GB/T2423.3—2006
6	Thermal Shock (Non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min, 10 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22—87
7	Electro Static Discharge (Operation)	C=150pF, R=330Ω，5points/panel Air:±4KV, 5times; Contact:±2KV, 5 times; （Environment: 15℃～35℃, 30%～60%, 86Kpa～106Kpa）	IEC61000-4-2 GB/T17626.2—1998
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition)	IEC60068-2-6 GB/T2423.10—1995
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	IEC60068-2-27 GB/T2423.5—1995
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8—1995

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.
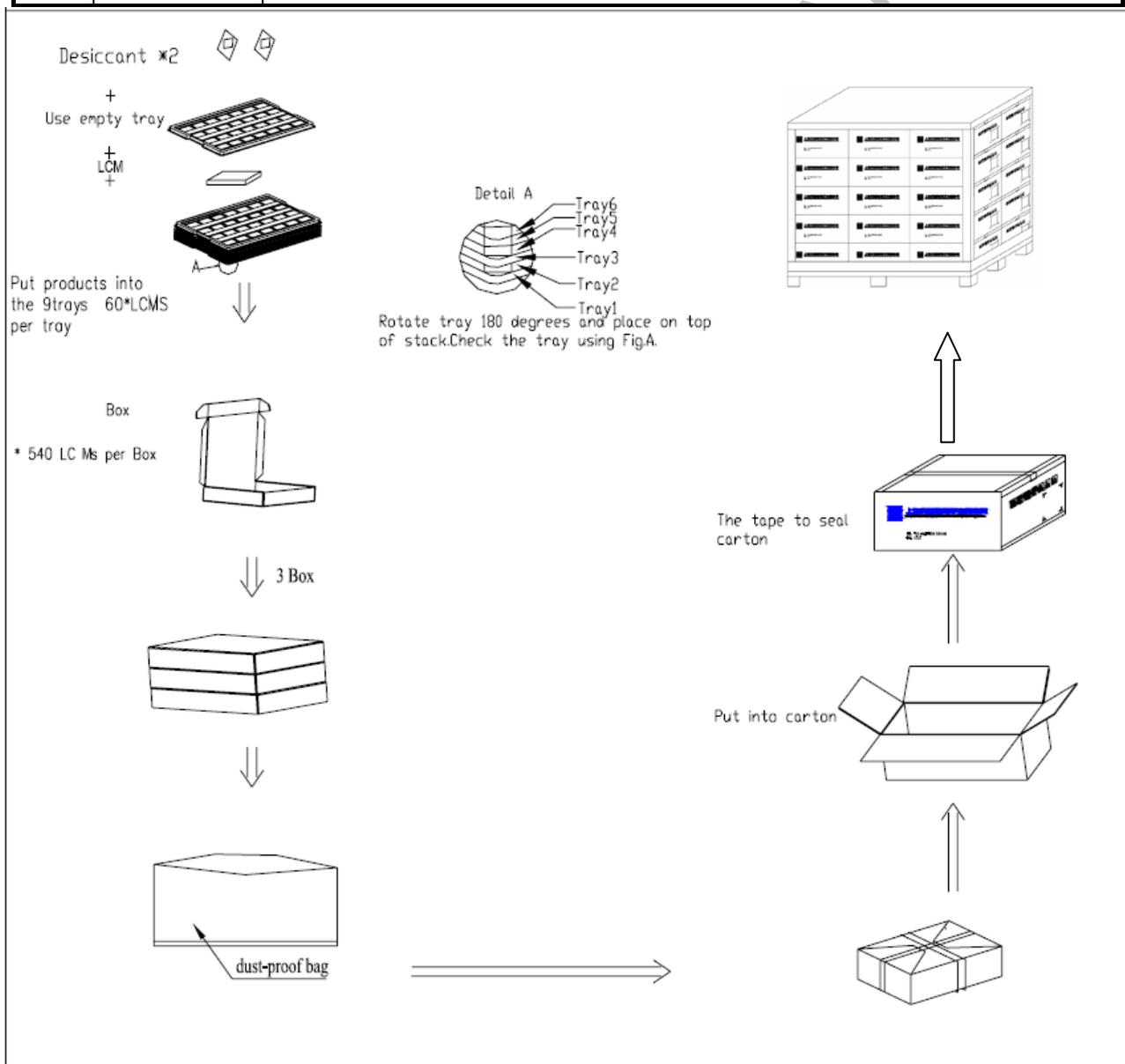
9 Mechanical Drawing

No:	PIN NAME
1	GND
2	AVCL
3	GND
4	AVDD
5	VPP(OTP)
6	IOVCC
7	GND
8	WR/RS
9	DO/SDA
10	IM2
11	D2
12	D4
13	D6
14	/CS
15	RESET
16	D7
17	D5
18	D3
19	D1
20	GND
21	RS/SCL
22	RD
23	VCC
24	SPIW4
25	GND
26	IOVCC
27	GND
28	IOVCC
29	GND
30	LEDA
31	LEDK
32	NC

NOTES:
1.Display Type: TFT
2.Backlight:1—chips LED
3.Gray Scale Inversion: 12 o'clock;
4.Driver IC: ST7715R
5.General Tolerance: ±0.2
6.Requirements on Environment Protection: Q/S0002
7.Suggested case open area:each side out expand 0.5mm of LCD,AA dimension

LED CIRCUIT DIAGRAM

Detail: A
Scale: 40:1

IM2	SPIW4	Interface
1	0	MCU 8—bit Parallel
0	0	3—line SPI
0	1	4—line SPI

CONTROL DIMENTION:			
REFERENCE DIMENTION:	( )	2009.09.14	
APPROVED:	Shu wei	2009.09.14	
CHECKED:	Yang qing ju	2009.09.14	
DESIGNED:	li qing wei	2009.09.14	

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MODEL NAME	TM014EDH05		3rd ANGLE
PART NAME	LCM	UNIT	mm
DRAWING NUMBER	YG71-00	SCALE	1:1
MATERIAL NUMBER	TM014EDH05-00	PAGE	1/1

REV	DC/EC NUMBER	DESCRIPTION	DATE

10 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity
1	LCM module	TM014EDH05	33.36×38.00×2.6	TBD	1620
2	Tray	PET（Transmit）	315×247×10.3	TBD	30
3	Anti-static bag	PE	700×545	0.021	1
4	BOX	CORRUGATED PAPER	520×345×74	0.227	3
5	Desiccant	Desiccant	45×50	0.0035	6
6	Carton	CORRUGATED PAPER	544×365×250	1.01	1
7	Total weight	TBD			

11 Precautions for Use of LCD Modules

11.1 Handling Precautions

11.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

11.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

11.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

11.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

11.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

－ Isopropyl alcohol、

－ Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

－ Water

－ Ketone

－ Aromatic solvents

11.1.6 Do not attempt to disassemble the LCD Module.

11.1.7 If the logic circuit power is off, do not apply the input signals.

11.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

11.1.8.1 Be sure to ground the body when handling the LCD Modules.

11.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

11.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

11.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

11.2 Storage precautions

11.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

11.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃   Relatively humidity: ≤80%

11.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

11.3 Transportation Precautions:

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.