



FORMIKE ELECTRONIC CO.,LTD

PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH014TG01-F01 Ver 1.0

【 ◆ 】 Preliminary Specification

【 】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWD	PD REVIEWD	PREPARED BY
Kam	/	Stephen	Roy

Prepared By :

FORMIKE ELECTRONIC CO.,LTD

Address :Room A818 New Energy Building, NanHai Road, NanShan District, ShenZhen, China. 518054

TEL:(86) 755 88306921,88306931 FAX:(86) 755 88304615

Http:// www.wandisplay.com

- This specification is subject to change without notice.Please contact FORMIKE or it's representative before designing your product based on this specification.



TABLE OF CONTENTS

CONTENTS	PAGE
Cover page	1
Table of Contents	2
Record of Revision	3
General Specifications	4
Input/Output Terminals	5
Absolute Maximum Ratings	6
Electrical Characteristics	7
Timing Chart	9
Power On/off Sequence	9
Optical Characteristics	20
Environmental & Reliability Tests	24
Mechanical Drawing	25
Packing Information	26
Precautions For Use of LCD Modules	27



Record of Revision

Rev	Issued Date	Description	Editor
1.0	2010-02-10	Preliminary Release	Stephen



1 General Specification

Feature		Description
Size		1.45inch
Display Mode		Normally White, Transmissive
Technology Type		a-Si, Clear Type(3H)
Resolution		128(RGB) x 128
Interface		CPU 8bits/SPI 4W/SPI 3W
Color Depth		65/262K
Pixel Pitch (mm)		0.203x0.203
Pixel Configuration		R.G.B. Vertical Stripe
Viewing Direction		6 o'clock
Gray Scale Inversion Direction		12 o'clock
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
Driver IC		ST7715R
Temperature	Operation	-20~+70°C
	Storage	-30~+80°C

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



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	°C	
Storage Temperature	T _{STG}	-30	80	°C	



4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25°C

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	--	$0.2 \times VCC$	V	D0~D7,VPP,WR/RS,IM2,/CS, RESET,RS/SCL,RD,SPIW4
	High Level	V_{IH}	$0.8 \times VCC$	--	VCC	V	
Output Signal Voltage	Low Level	V_{OL}	--	--	$0.2 \times VCC$	V	AVCL,AVDD
	High Level	V_{OH}	$0.8 \times VCC$	--	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°C

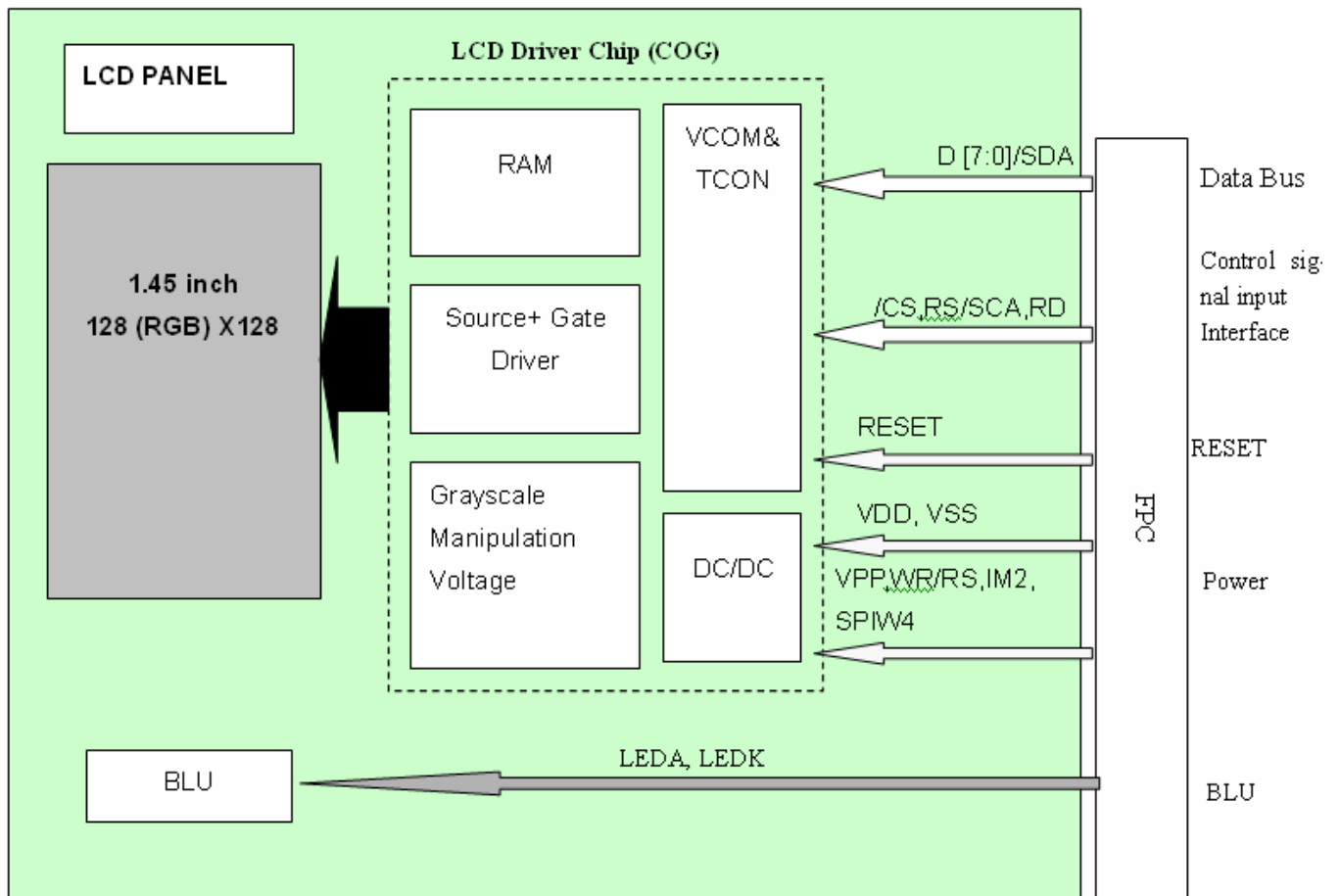
Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	20	25	mA	
Forward Voltage	V_F	--	3.2	--	V	1 LED
Power Consumption	W_{BL}	--	64	--	mW	

Note1: Figure below shows the connection of backlight LED.

Note 2: One LED: $I_F = 20 \text{ mA}$, $V_F = 3.2 \text{ V}$

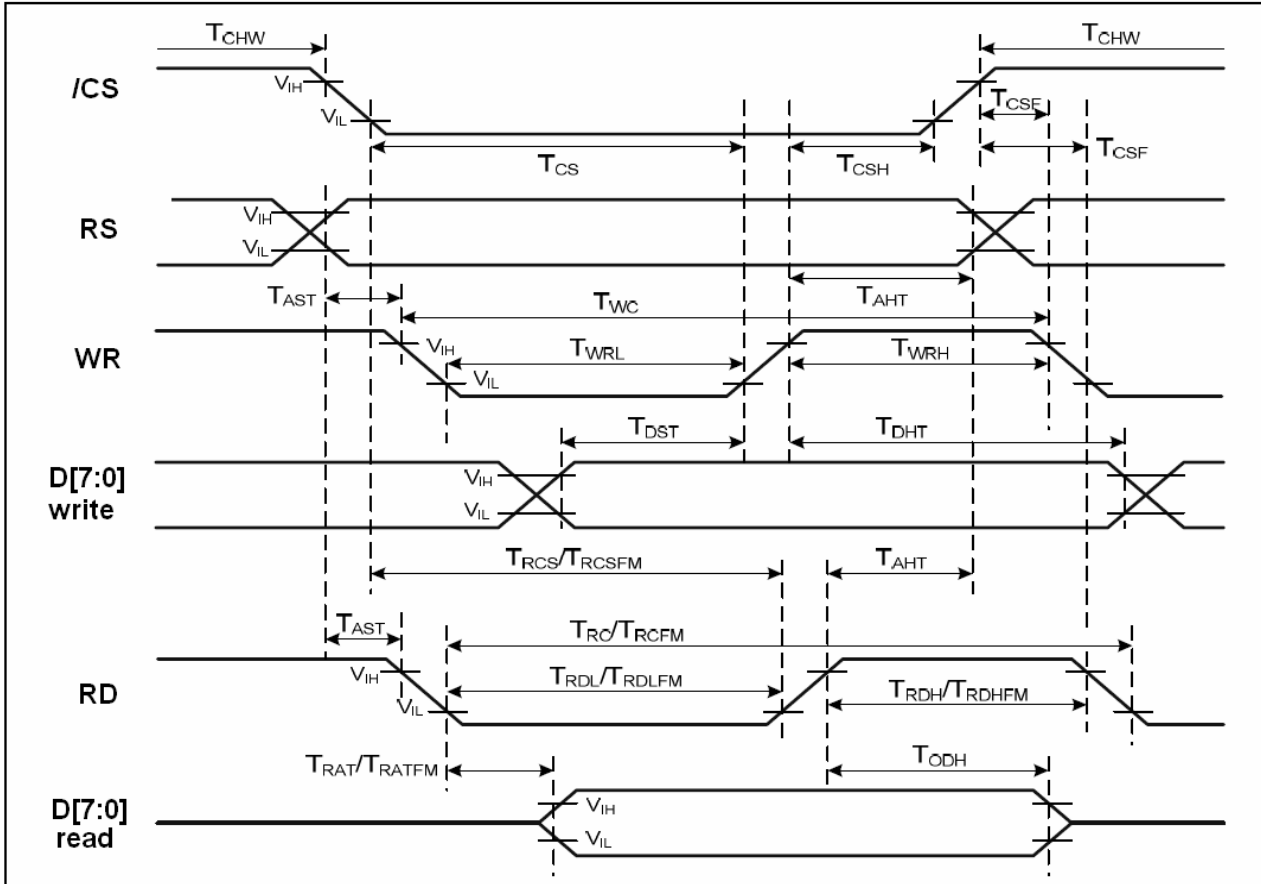
Note 3: The life of LED: 20,000 hours

4.3 Block Diagram

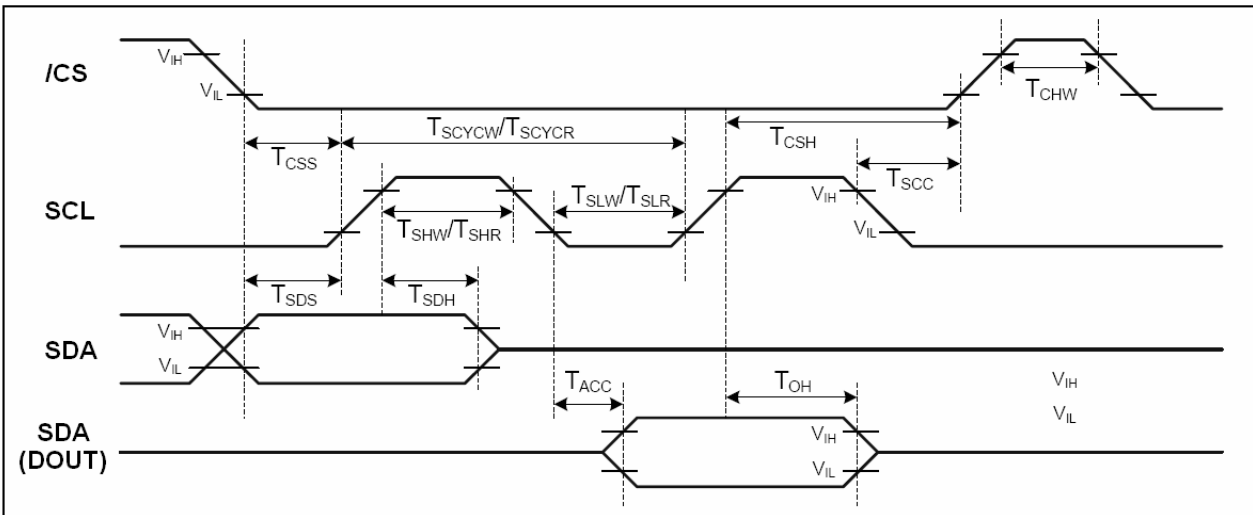


5 Timing Chart

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	

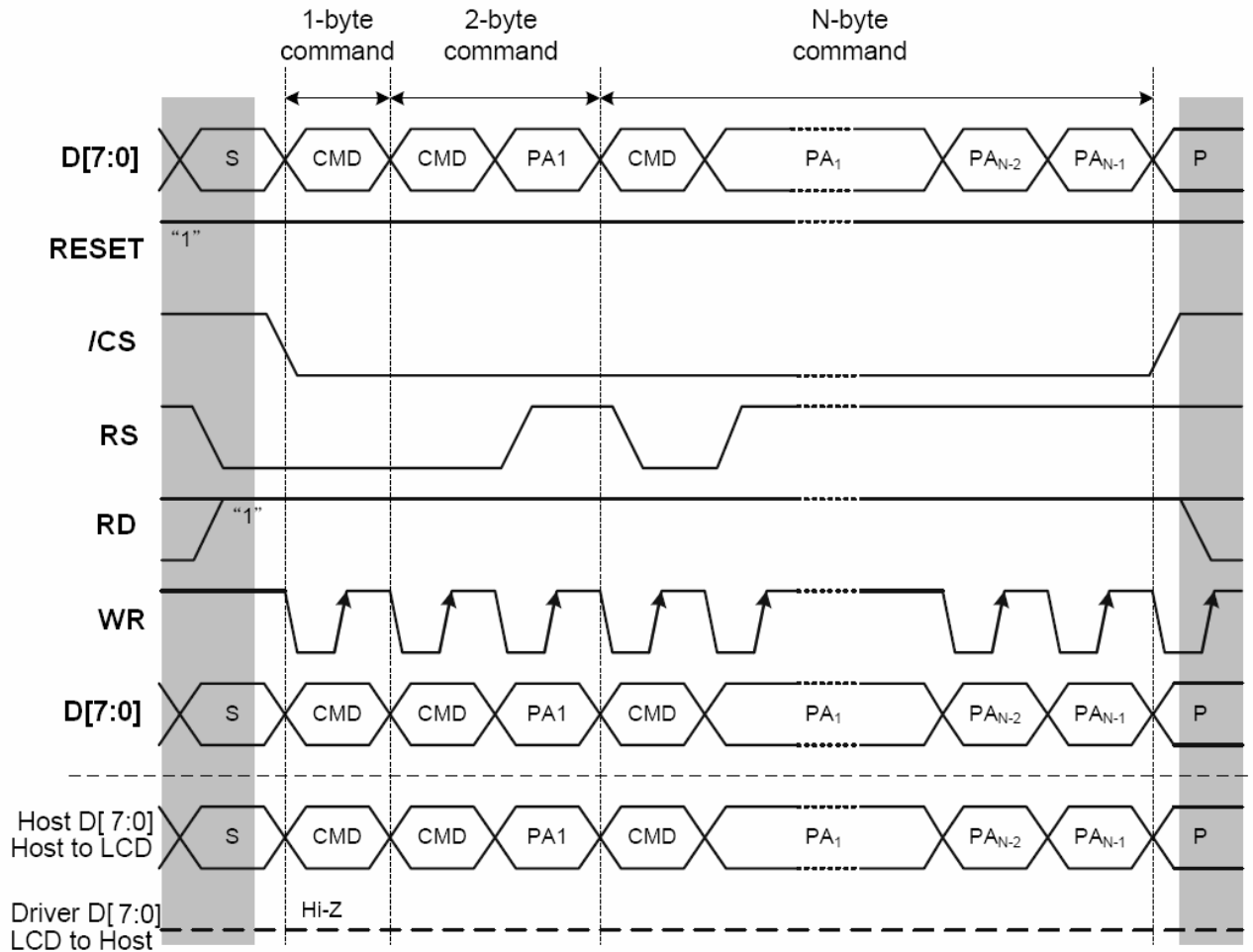
Parallel interface characteristics

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	
SDA (DIN) (DOUT)	TSLR	SCL "L" pulse width (Read)	60		ns	For maximum CL=30pF For minimum CL=8pF
	TSDS	Data setup time	10		ns	
	TSDH	Data hold time	10		ns	
	TACC	Access time	10	50	ns	
	TOH	Output disable time	15	50	ns	

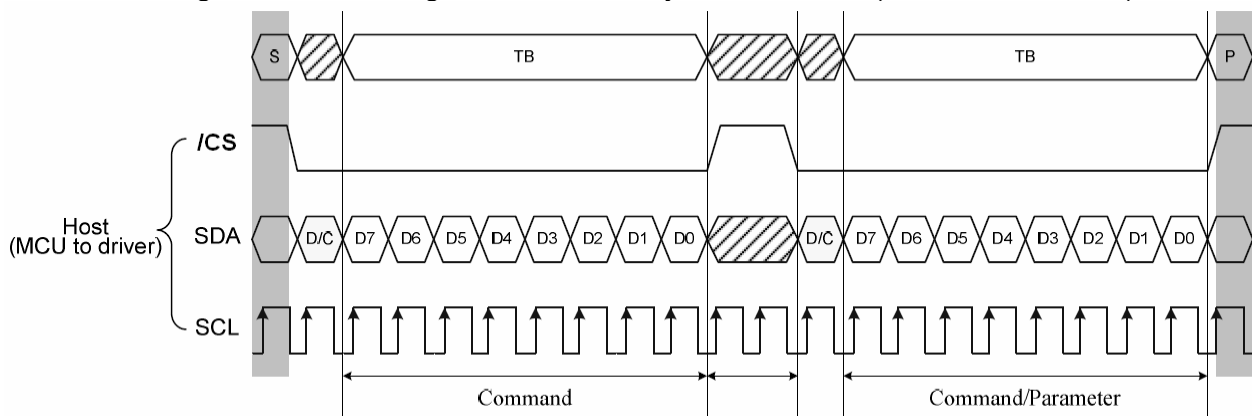
Serial Interface Characteristics

5.3 Register Write/Read Timing

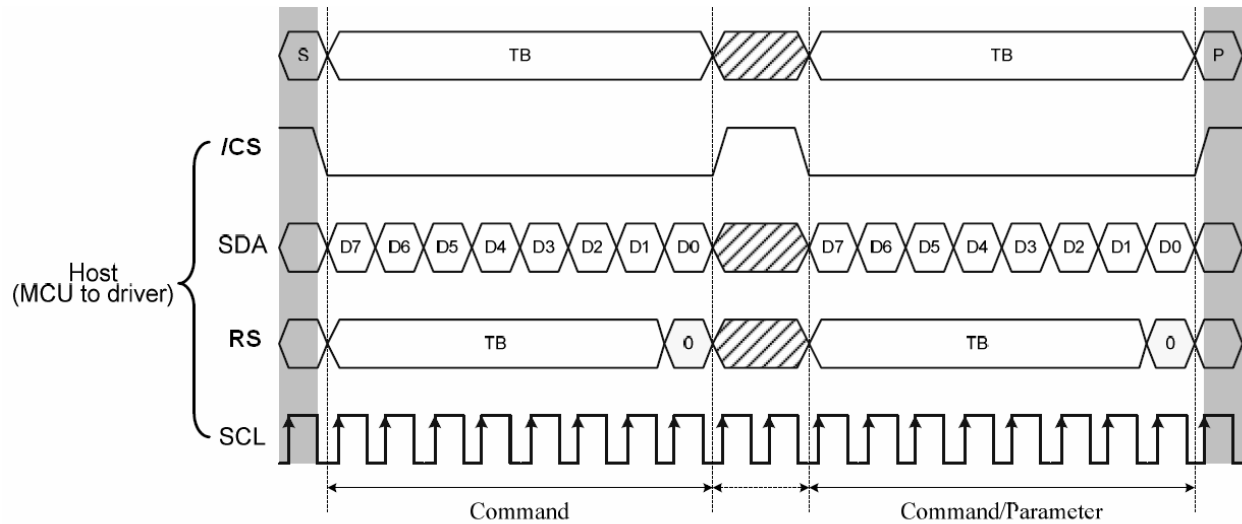
5.3.1 System Bus Interface Register Write Timing



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

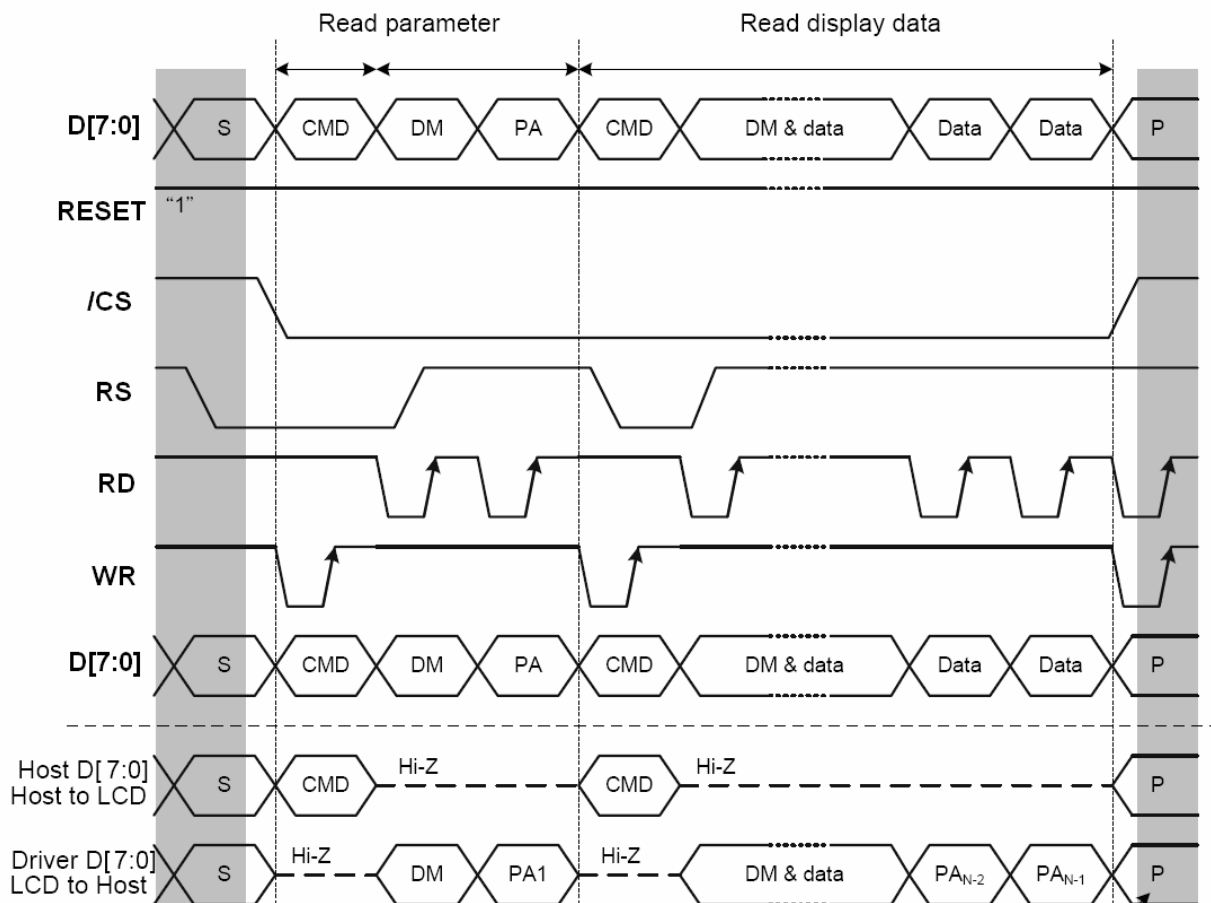


Serial Interface Protocol 3 wire Write Mode



Serial Interface Protocol 4 wire Write Mode

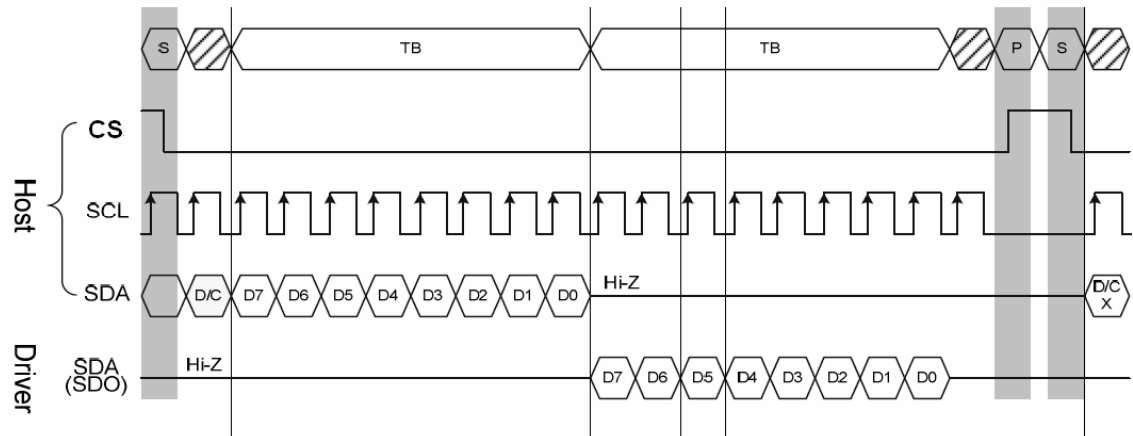
5.3.2 System Bus Interface Register Read Timing



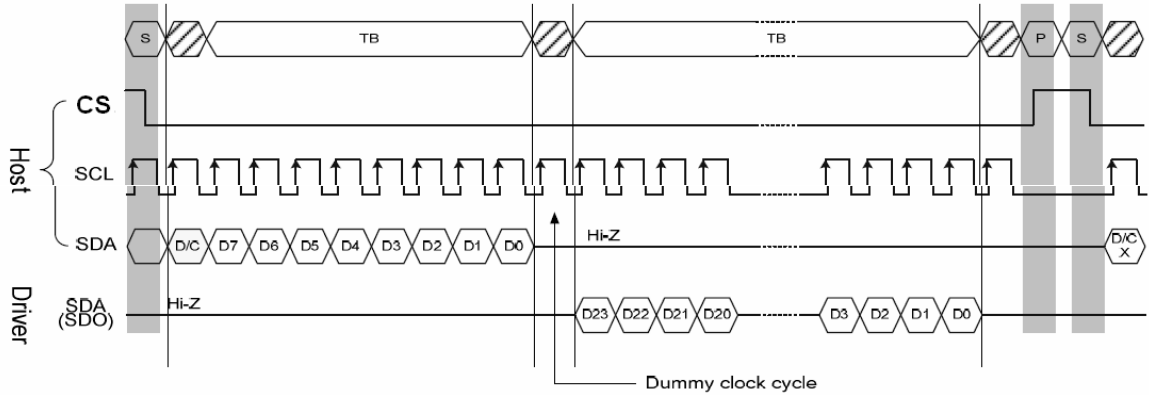
Register Read Timing in Parallel Bus System Interface (for I80 series MPU)



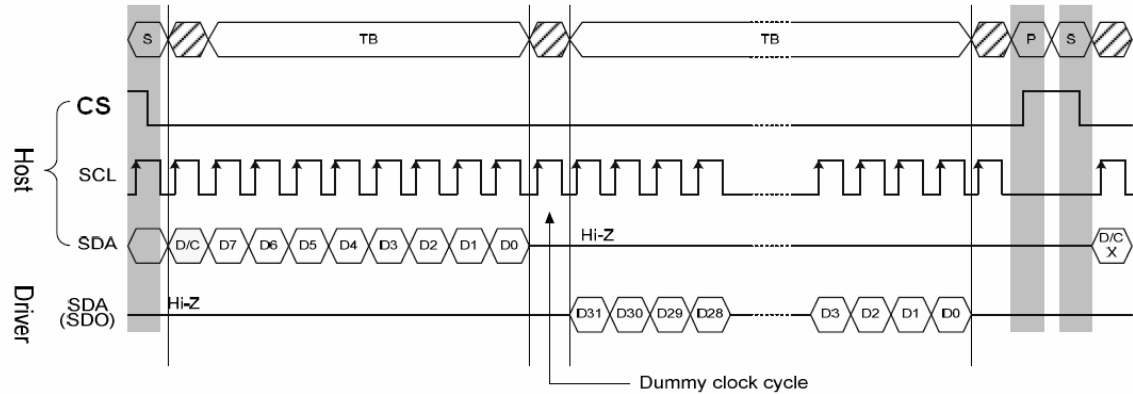
3-line serial protocol (for RDID1/RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh command: 8-bit read):



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



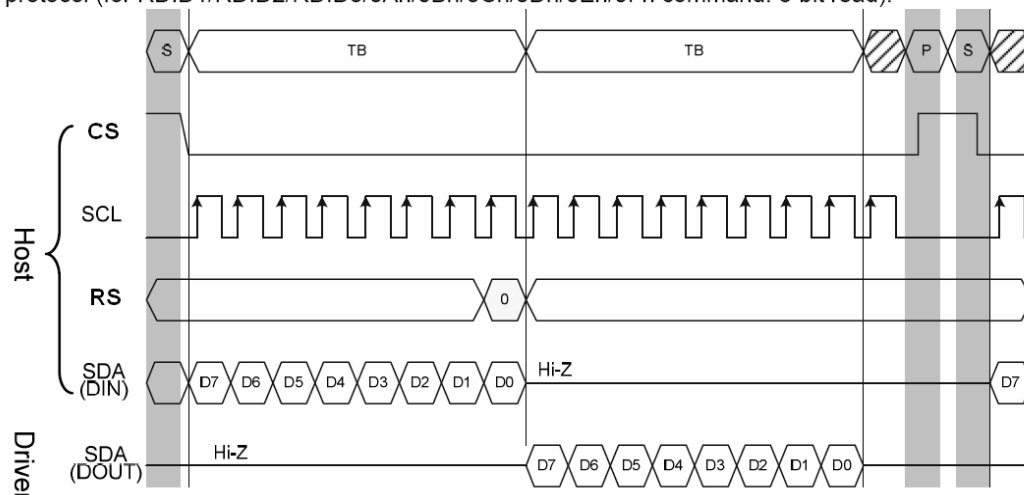
3-line Serial Protocol (for RDDST command: 32-bit read)



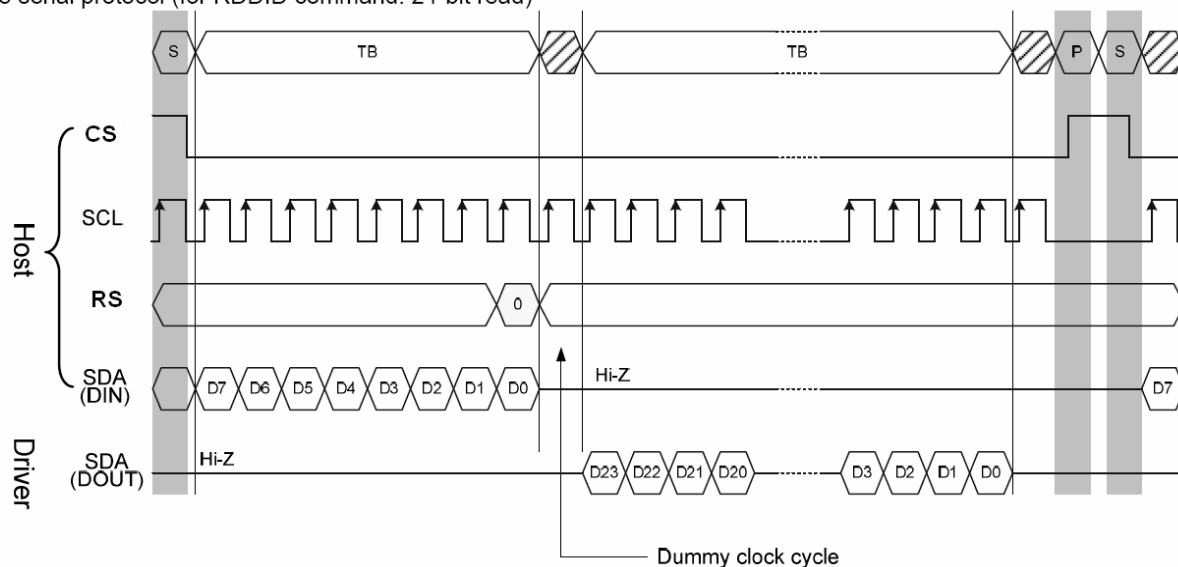
3 Wires Serial Interface Protocol, Read Mode



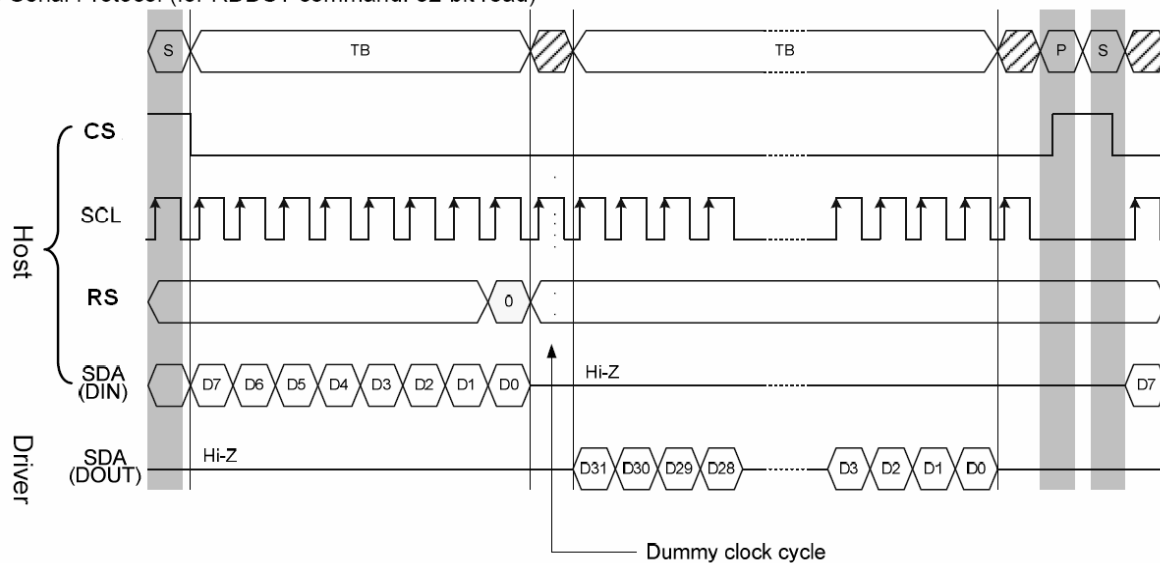
4-line serial protocol (for RDID1/RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh command: 8-bit read):



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



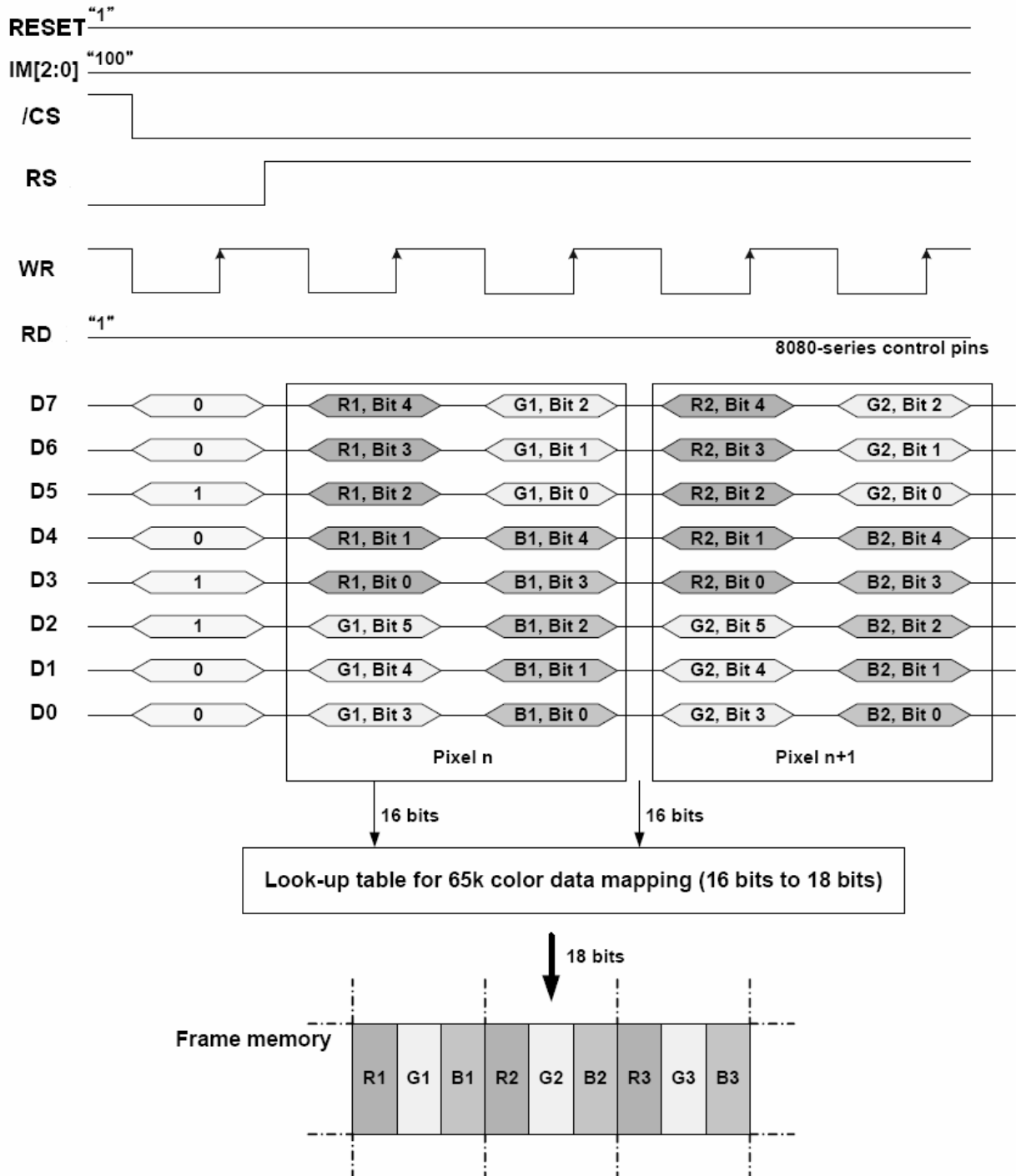
4-line Serial Protocol (for RDDST command: 32-bit read)



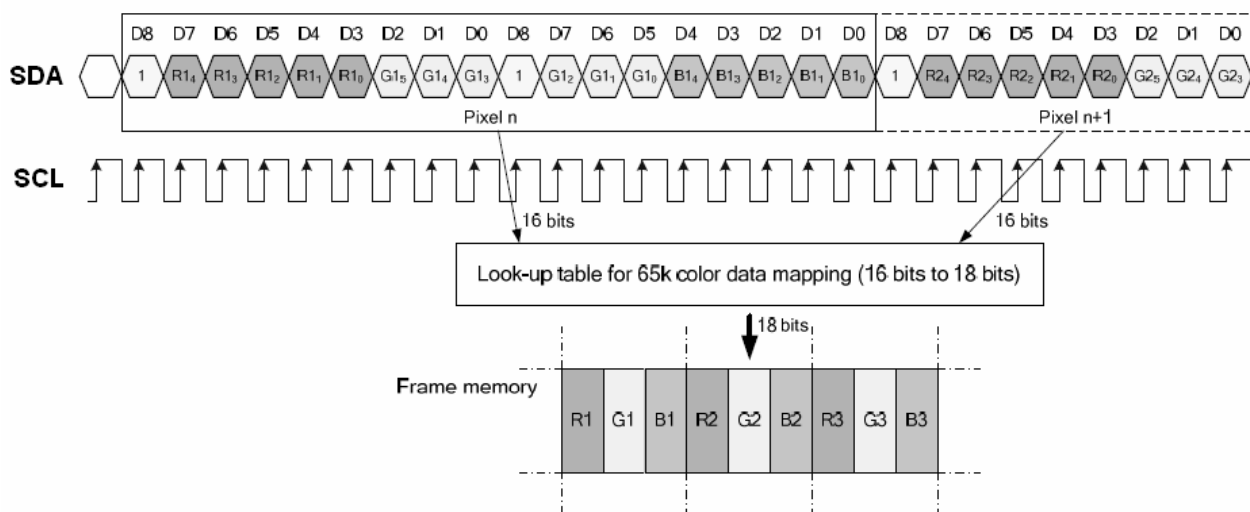
4Wire Serial Interface Protocol, Read Mode



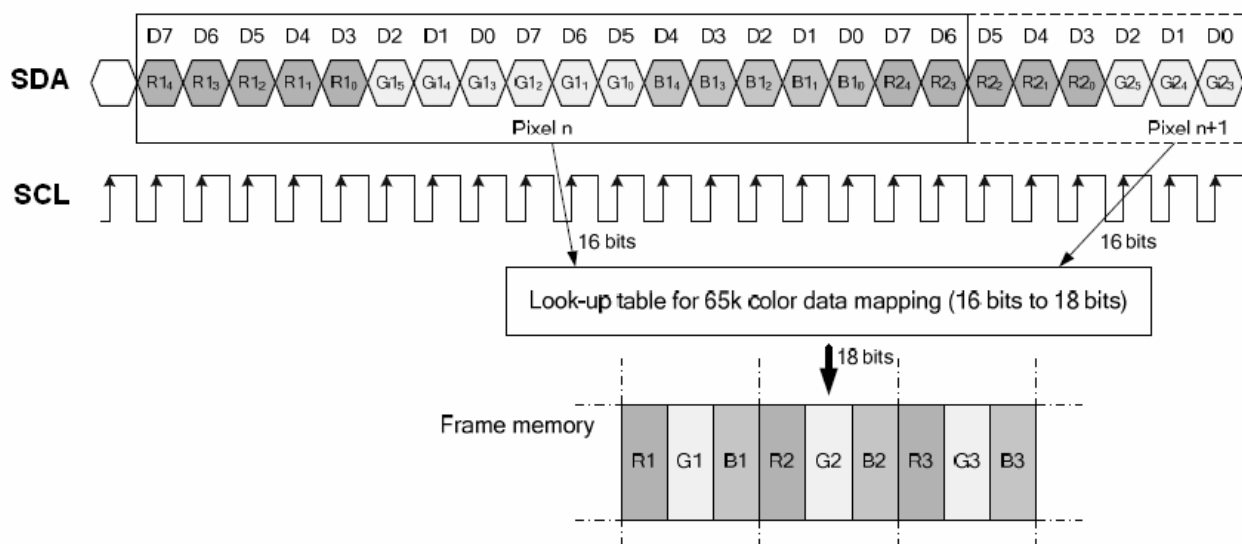
5.4 Data Color Coding



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

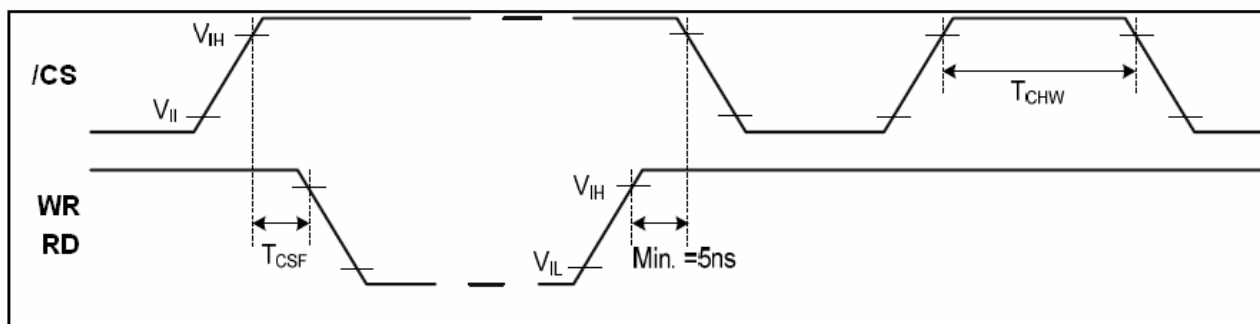
**RESET** "1"**IM2** IM2=IM1=IM0="0"**/CS**

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

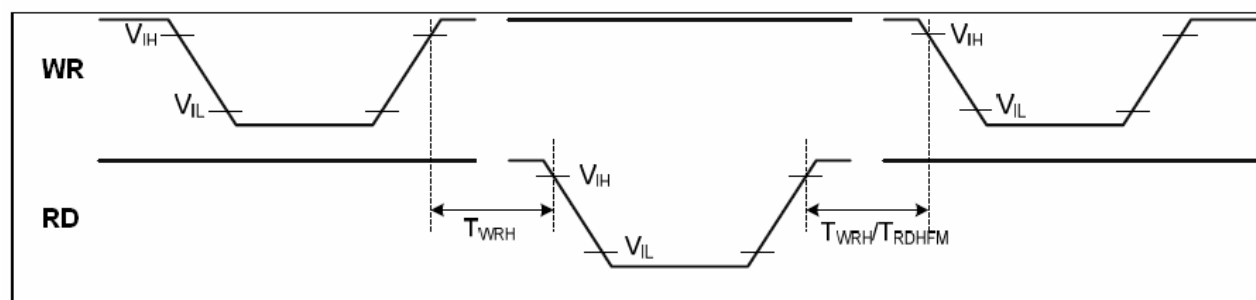
RESET "1"**IM2** "1", P68="0", IM2=IM1=IM0="0"**/CS****RS** "1"

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

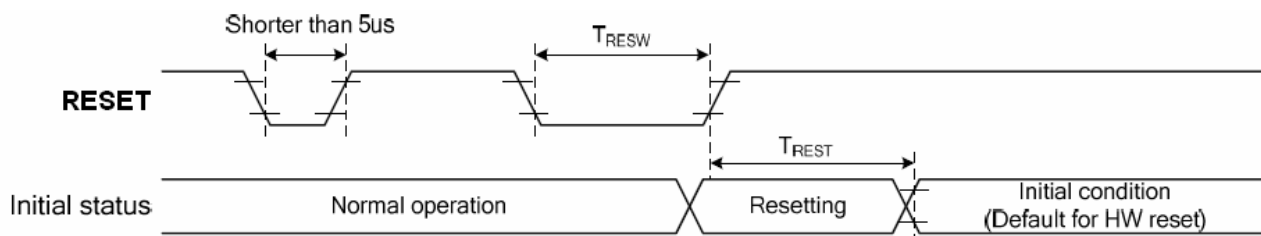


Chip selection timing



Write-to-read and read-to-write timing

5.6 Reset Timing



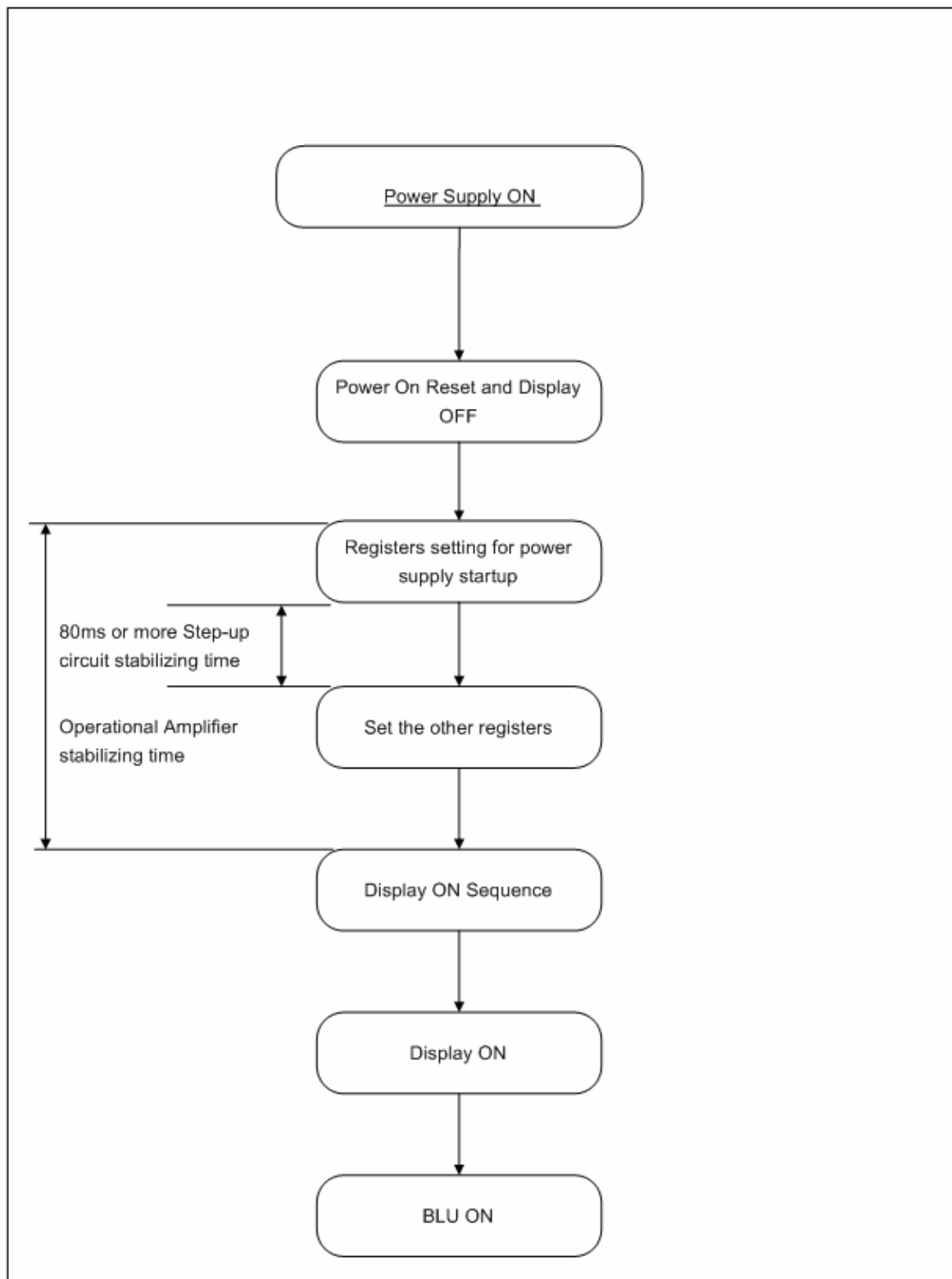
Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESET	tRESW	Reset pulse duration	10	-	us
	tREST	Reset cancel	-	5	ms
				120	ms

Reset Timing



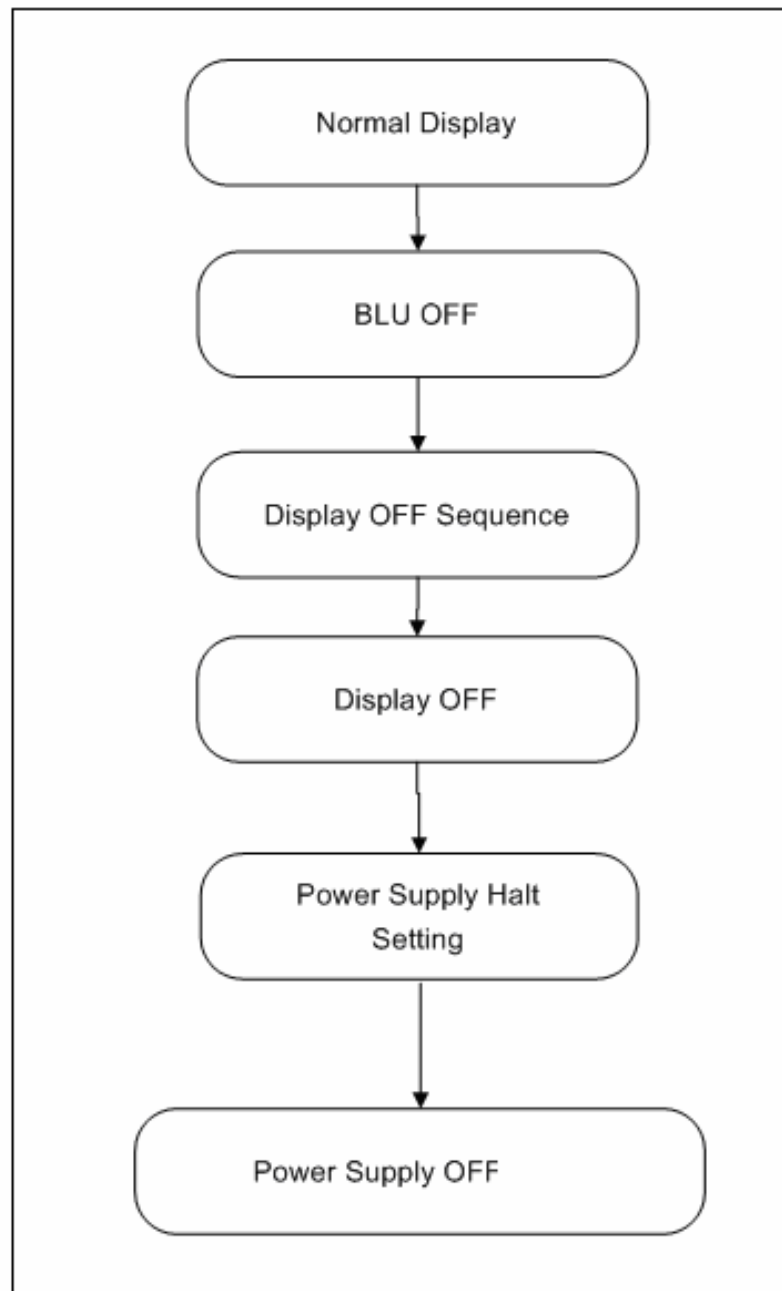
6 Power On/Off Sequence

6.1 Power on Sequence





6.2 Power Off Sequence





7 Optical Characteristics

Ta=25°C

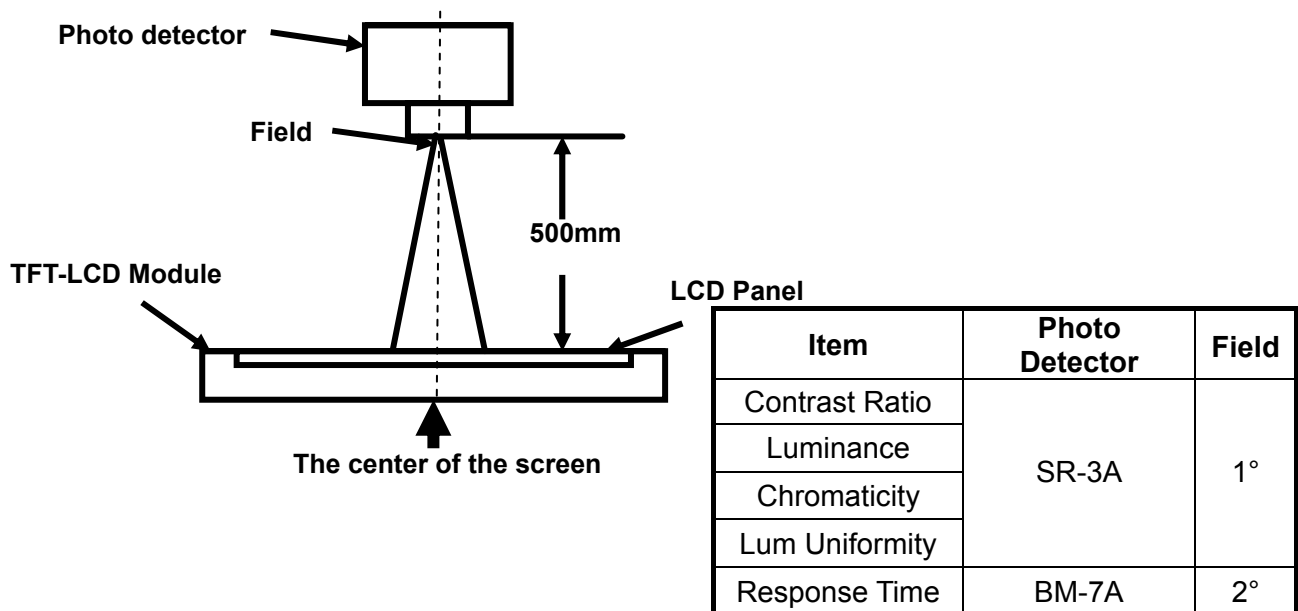
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥ 10	60	70	-	Degree	Note 2
		θB		50	60	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	θ=0°	300	350	-		Note1 Note3
Response Time		Ton	25℃	-	25	40	ms	Note1
		Toff						Note4
Chromaticity	White	x	Backlight is on	0.265	0.315	0.365		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		-	80	-	%	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°C.
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.



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).

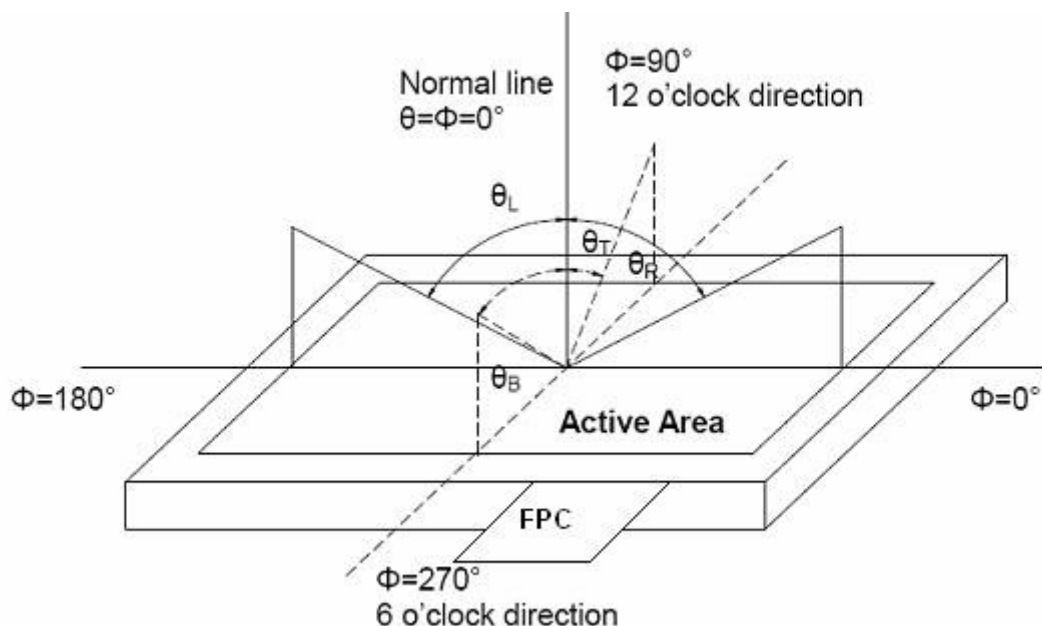


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

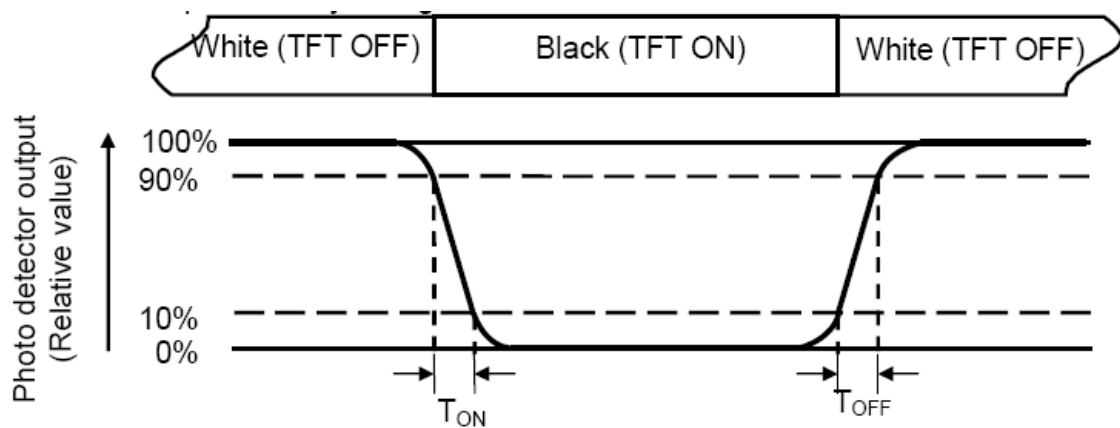
"White state ":The state is that the LCD should driven by Vwhite.

"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) = L_{min} / L_{max}

L-----Active area length W----- Active area width

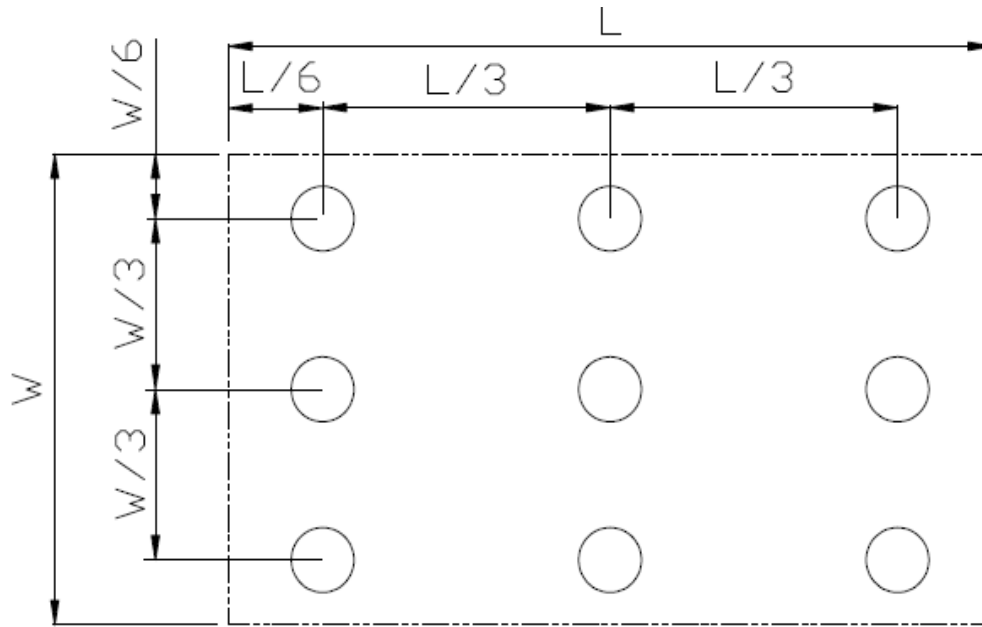


Fig. 2 Definition of uniformity

L_{max} : The measured maximum luminance of all measurement position.

L_{min} : 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

1 No: PIN NAME

1	GND
2	AVCL
3	GND
4	AVDD
5	VPP(OTP)
6	IOVCC
7	GND
8	WM/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/SL
22	RD
23	VCC
24	SPW4
25	GND
26	IOVCC
27	GND
28	IOVCC
29	GND
30	LEDA
31	LEDK
32	NC

32.36±0.15(outline)
29.30(LCD)
(16.18)
26.04(AA)
(3.16)
(1.53)
128bits x 728bits
View direction
of O'clock
38.00±0.15(outline)
32.60(LCD)
26.04(AA)
(1.69)
3.68±0.3
13.54±0.5
1.60±0.3
2.02±0.3
4.12±0.5
1.98±0.3
25.66
32
PO.7X31=21.70±0.10
W=0.35±0.05
8.10±0.06
32
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32

REMOTE TAPE

2.60±0.1(Exclude 0.5T)
3-φ0.50±0.1
1.00(MAX)
0.11±0.03
0.0678
0.2034
0.2034
R G B R
R G B R

Detail: A
Scale: 40:1

IM2	SPW4	Interface
1	0	MCU 8-bit Parallel
0	0	3-line SPI
0	1	4-line SPI

DOUBLE SIDE TAPE
T0.15MM
37.20±0.1
0.40±0.1
29.76±0.1
27.96±0.3
1.30±0.1
2.20±0.5
2-26.25±0.3
9.75±0.5
1.38±0.1
1.30±0.1
2-φ1.0
32
5.57
17.00±0.1
2.20±0.3
5.12±0.1
1
12.00

FORMIKE ELECTRONIC CO.,LTD

CONTROL DIMENTION: ()

REFERENCE DIMENTION: ()

APPROVED: Shu wei 2009.03.14

CHECKED: Yong qing ju 2009.03.14

DESIGNED: li qing wei 2009.03.14

MODEL NAME KWH014TG02-F01

PART NAME LCM

DRAWING NUMBER YGT1-00

MATERIAL NUMBER

3rd ANGLE

UNIT mm

SCALE 1:1

PAGE 1/1



10 Packing information

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity
1	module	KWH014TG01-F01	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 alcoholSolvents 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.