



HTG240160C-31W-42K07-V08

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Table of Content

1. Basic Specifications	-----	3
1.1 Display Specifications	-----	3
1.2 Mechanical Specifications	-----	3
1.3 Circuit Diagram	-----	3
1.4 Terminal Function	-----	4
1.5 Product Outline	-----	5
1.6 Schematic Diagram	-----	6
2. Absolute Maximum Ratings	-----	7
3. Electrical Characteristics	-----	7
3.1 DC Characteristics	-----	7
3.2 LED Backlight Circuit	-----	7
3.3 AC Characteristics	-----	8
3.4 Reset Timing	-----	10
4. Function specifications	-----	10
4.1 The Parallel Interface	-----	10
4.2 Basic Setting	-----	11
4.3 Resetting the LCD module	-----	11
4.4 Display Memory Map	-----	12
4.5 Display Commands	-----	14
4.6 Basic Operating Sequence	-----	16
5. Inspection Standards	-----	17
6. Handling Precautions	-----	18
6.1 Mounting method	-----	18
6.2 Cautions of LCD handling and cleaning	-----	18
6.3 Caution against static charge	-----	18
6.4 Packaging	-----	18
6.5 Caution for operation	-----	18
6.6 Storage	-----	18
6.7 Safety	-----	18
7 Packaging specifications	-----	19

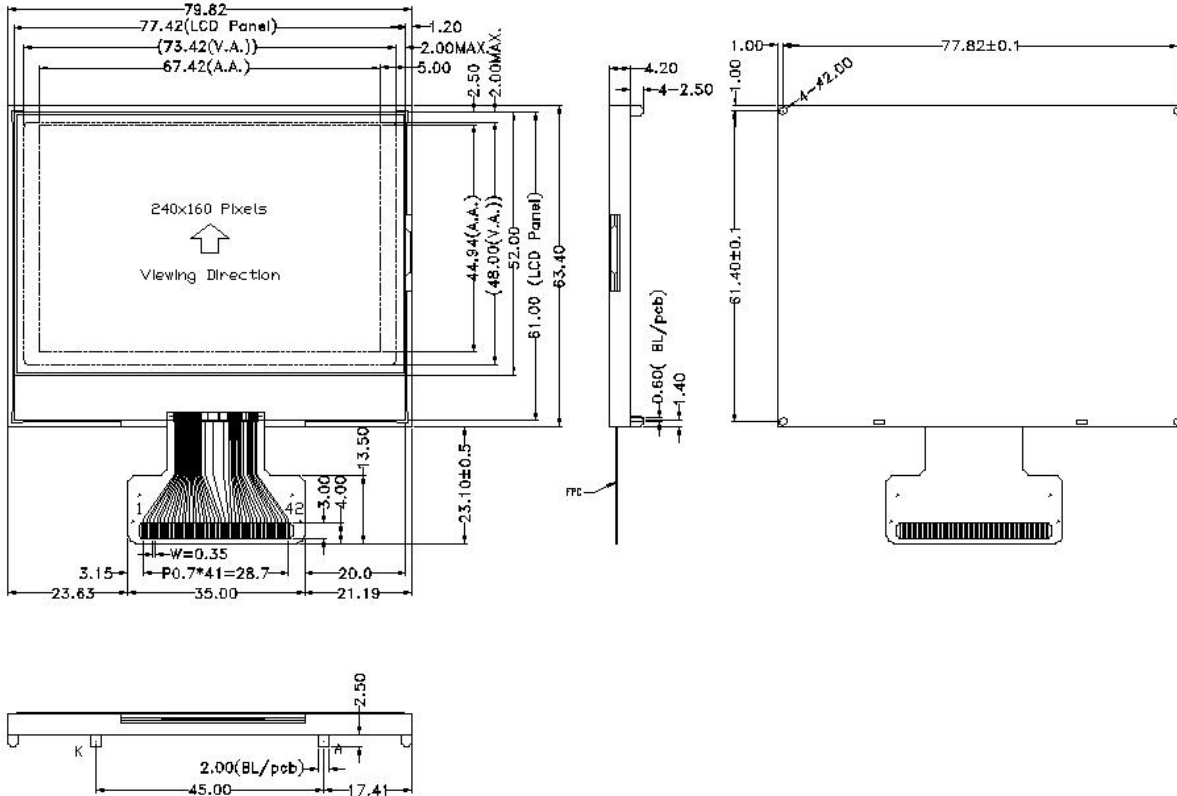
1. Basic Specifications

1.1 Display Specifications

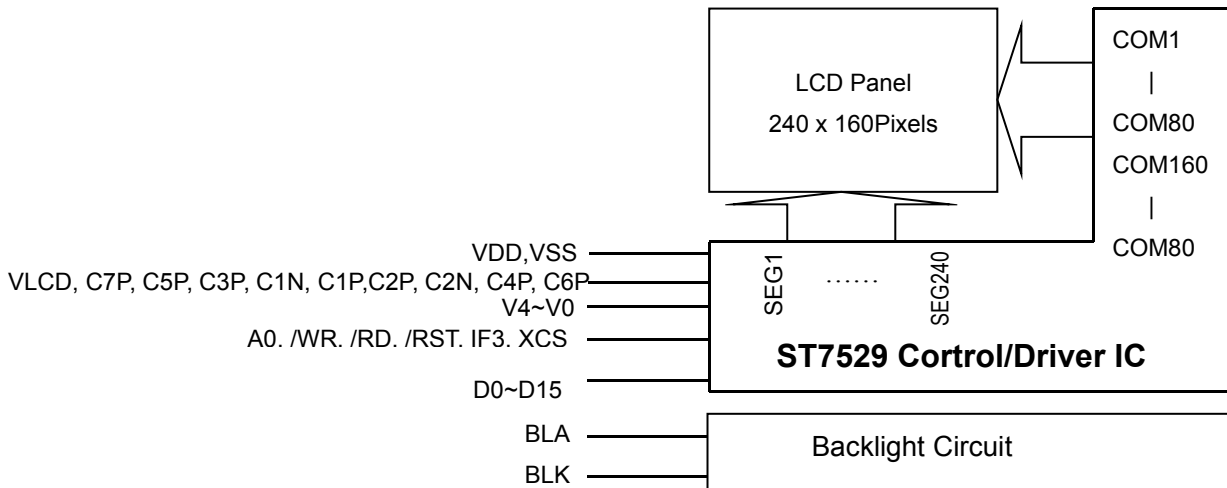
- 1>LCD Display Mode : FSTN, Positive, Transflective
- 2>Viewing Angle : 6H
- 3>Driving Method : 1/160 Duty, 1/12 Bias
- 4>Backlight : White LED

1.2 Mechanical Specifications

- 1>Outline Dimension : 79.82x 63.4x 4.2mm (See attached Outline Drawing for Details)



1.3 Circuit Diagram



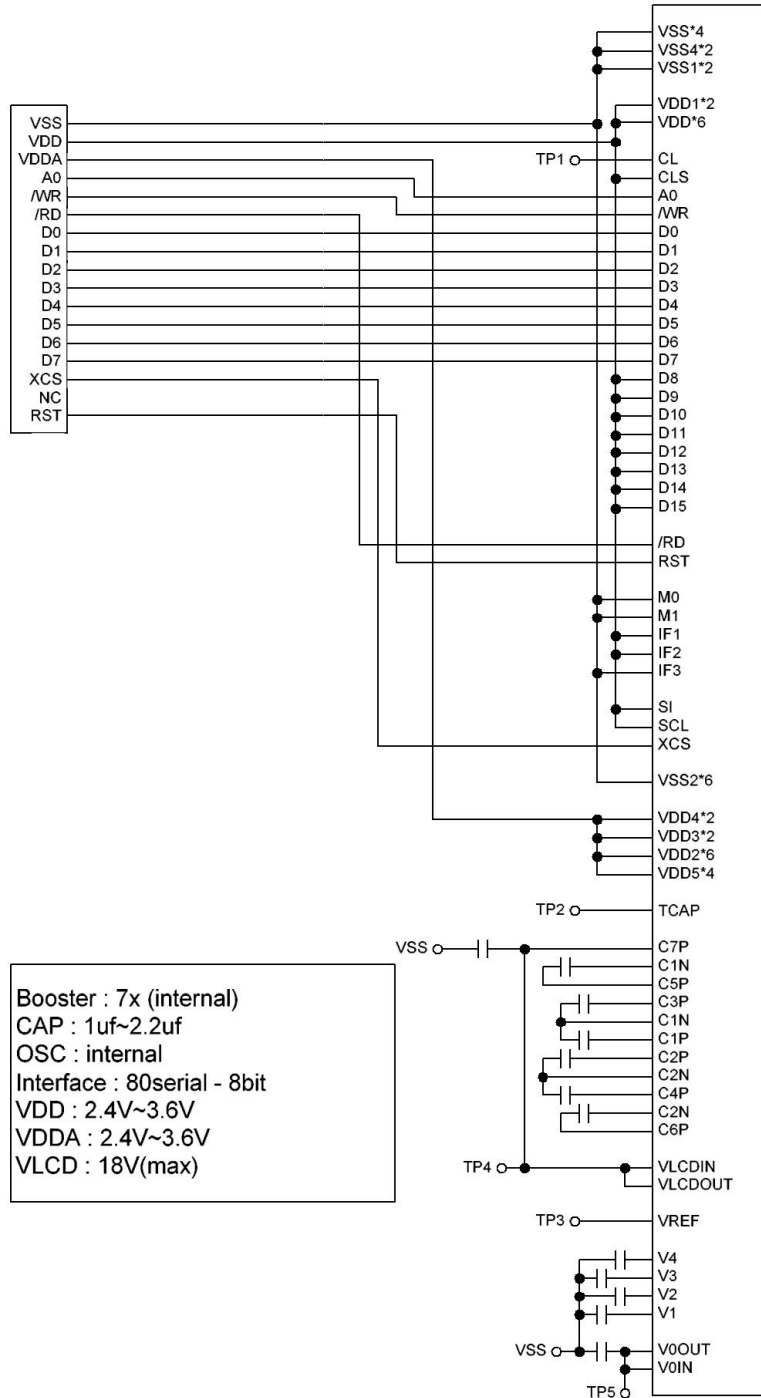
1.4 Terminal Function

Pin No.	Pin Name	Function
1	A0	Register select input pin
2	/WR	Write(/WR) Control Signal Input
3~18	D0~D15	They connect to the standard 8-bit or 16-bit MPU bus via the 8/16 –bit bi-directional bus. When the following interface is selected and the XCS pin is high, the following pins become high impedance, which should be fixed to VDD or VSS. 1. 8-bit parallel: D15-D8 are in the state of high impedance 2. Serial interface: D15-D0 are in the state of high impedance
19	/RD	Read (/RD) Control Signal Input.
20	/RST	Reset input pin
21	IF3	Parallel / Serial data input select input
		IF3
		H
		L
22	XCS	Chip select input pins
23	VDD	Power supply(3.3V)
24	VSS	Negative Power Supply,0V
25	VDD2	Power Supply For Logic Circuit 3.3V
26	C7P	Voltage Converter Circuits The Step-up Voltage Circuits the VLCDIN & VLCDOUT must be connected together.
27	C5P	
28	C3P	
29	C1N	
30	C1P	
31	C2P	
32	C2N	
33	C4P	
34	C6P	
35~36	VLCDIN-VLCD OUT	the VLCDIN & VLCDOUT must be connected together.
37~40	V4~V0	LCD driver supply voltages
41~42	V0OUT-VOIN	LCD driver supply voltages the V0IN & V0OUT must be connected together.

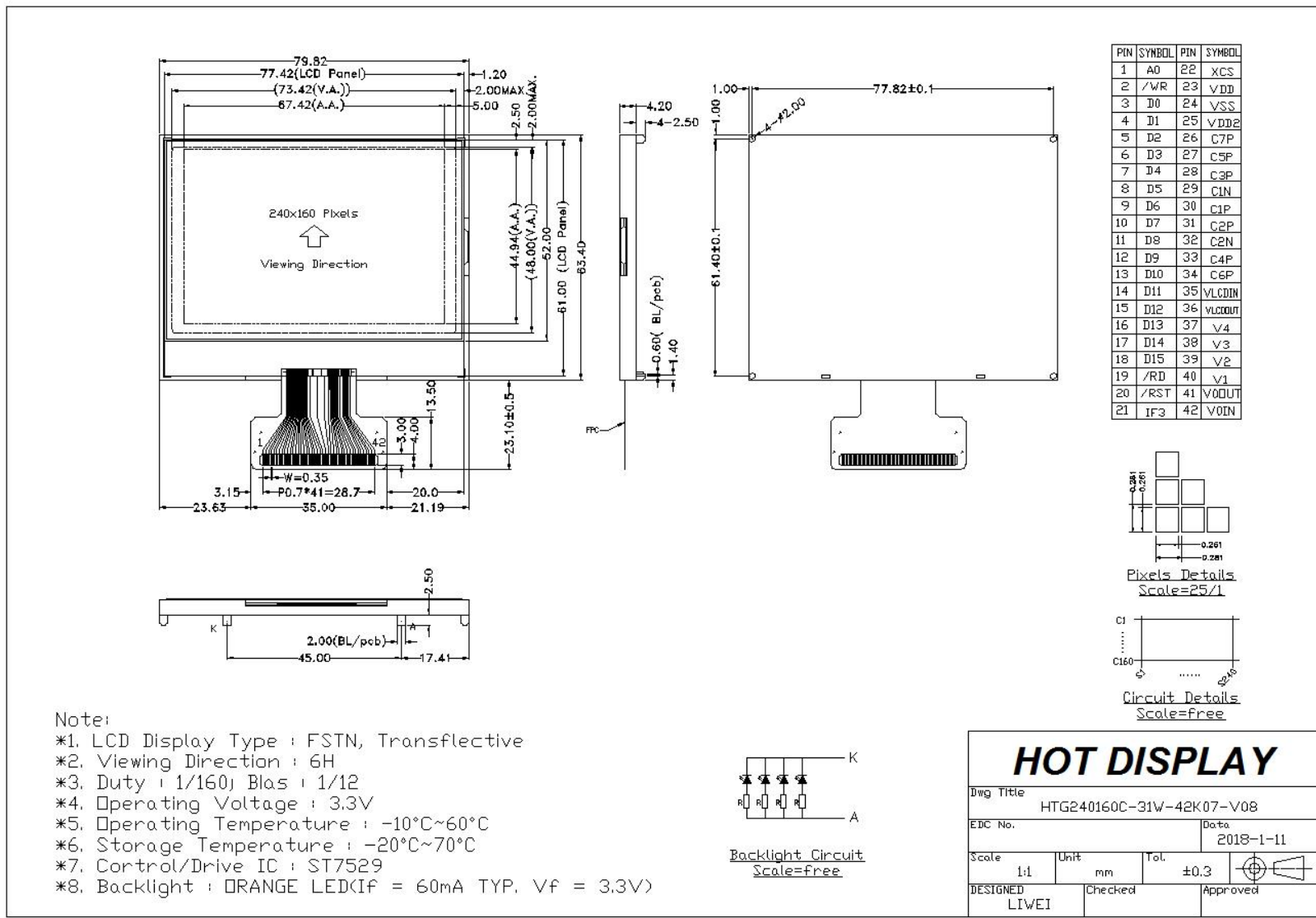
其他模式接线图请参考 IC 规格书

ST7529

ST7529 / 80serial - 8bit



1.5 Product Outline



URL:www.hotlcd.com

2. Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Supply Voltage	V _{DD}	V _{SS}	+3.3	V	V _{SS} = 0V
Input Voltage	V _{IN}	V _{SS}	V _{DD} +0.3	V	V _{SS} = 0V
Operating Temperature	T _{OP}	-10	+60	°C	No Condensation
Storage Temperature	T _{st}	-20	+70	°C	No Condensation

3. Electrical Characteristics

3.1 DC Characteristics

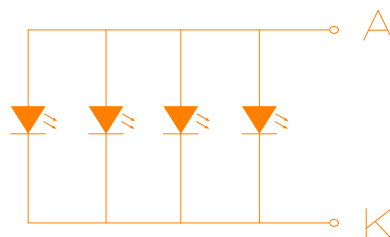
V_{SS} = 0V, T_{OP} = 25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Operating Voltage	V _{DD}	2.4	-	3.3	V	V _{DD}
High-level input voltage	V _{IH}	0.7 V _{DD}	-	V _{DD}	V	-
Low-level input voltage	V _{IL}	V _{SS}	-	0.3 V _{DD}	V	
High level Output Current	I _{OH}	0.5	-	-	mA	V _{DD} =2.7V, V _{OH} =2.2V
Low level Output Current	I _{OL}	-	-	-0.5	mA	V _{DD} =2.7V, V _{OL} =0.5V
Operation Current	I _{OP}	100	-	220	μA	V _{DD} =3.0V
Supply step-up output Voltage circuit	V _{LCDOUT}	-	-	18	V	Relative to V _{SS}
Voltage regulator circuit Operating voltage	V _{LCDIN}	-	-	18	V	Relative to V _{SS}

3.2 LED Backlight Circuit

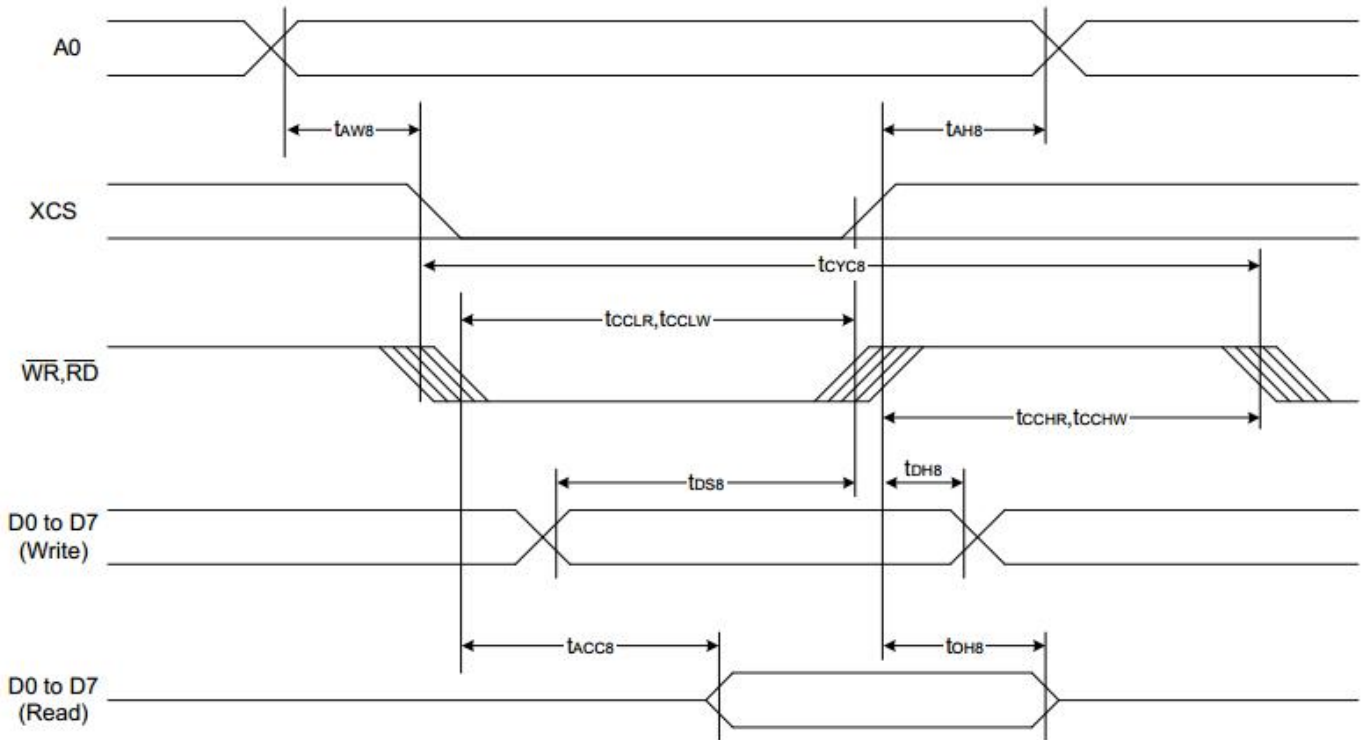
V_{SS} = 0V, T_{OP} = 25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	V _f BLA	-	3.1	-	V	V _{DD}
Forward Current	I _f BLA	-	60	65	mA	V _{DD}



3.3 AC Characteristics

3.3.1 8080 Mode System Bus Timing



(VDD = 3.3V , Ta = -30 to 85°C, Die)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8	-	20	-	ns
Address setup time		tAW8	-	20	-	
System cycle time		tCYC8	-	200	-	
Enable L pulse width (WRITE)	WR	tCCLW	-	100	-	
Enable H pulse width (WRITE)		tCCHW	-	100	-	
Enable L pulse width (READ)	RD	tCCLR	-	100	-	
Enable H pulse width (READ)		tCCHR	-	100	-	
WRITE Data setup time	D0 to D7	tDS8	-	150	-	
WRITE Address hold time		tDH8	-	20	-	
READ access time		tACC8	CL = 100 pF	-	40	
READ Output disable time		tOH8	CL = 100 pF	-	30	

Vss = 0V, Top = 25°C

(VDD = 2.7 V , Ta = -30 to 85°C,Die)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8	-	20	-	ns
Address setup time		tAW8	-	30	-	
System cycle time		tCYC8	-	250	-	
Enable L pulse width (WRITE)	WR	tCCLW	-	150	-	
Enable H pulse width (WRITE)		tCCHW	-	100	-	
Enable L pulse width (READ)	RD	tCCLR	-	150	-	
Enable H pulse width (READ)		tCCHR	-	100	-	
WRITE Data setup time	D0 to D7	tDS8	-	200	-	
WRITE Address hold time		tDH8	-	20	-	
READ access time		tACC8	CL = 100 pF	-	40	
READ Output disable time		tOH8	CL = 100 pF	-	30	

*1 The input signal rise time and fall time (tr, tf) is specified at 15 ns or less. When the system cycle time is extremely fast, (tr + tf) ≤ (tCYC8 – tCCLW – tCCHW) for (tr + tf) ≤ (tCYC8 – tCCLR – tCCHR) are specified.

*2 All timing is specified using 20% and 80% of VDD as the reference.

*3 tCCLW and tCCLR are specified as the overlap between XCS being "L" and WR and RD being at the "L" level.

3.4 Reset Timing

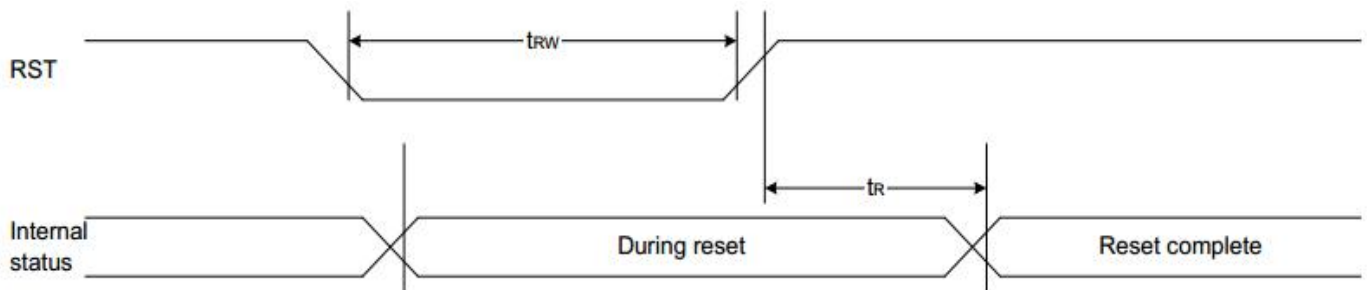


Fig 43.

(VDD = 3.3V , Ta = -30 to 85°C, Die)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR	-	-	-	1	us
Reset "L" pulse width	RST	tRW	-	1	-	-	us

(VDD = 2.7V , Ta = -30 to 85°C, Die)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR	-	-	-	1.5	us
Reset "L" pulse width	RST	tRW	-	1.5	-	-	us

4. Function specifications

4.1 The Parallel Interface

Shared	8080 Mode		Function
A0	/RD	/WR	
H	L	H	Reads the display data
H	H	L	Writes the display data
L	L	H	Status read
L	H	L	Write Command data

4.2 Basic Setting

To drive the LCD module correctly and provide normally display, please use the following setting

- 1> ADC = 0 (normal)
- 2> SHL select = 1(reverse)
- 3> LCD Bias Select = 1/9
- 4> Initial Display Line = 0
- 5> Entire Display ON/OFF = OFF(normal)
- 6> Reverse Display ON/OFF = OFF(normal)
- 7> Set Power Control Set:
Voltage follower = ON,voltage converter = ON,Voltage regulator = ON
- 8> Display ON/OFF =ON

4.3 Resetting the LCD module

The LCD module should be initialized bu using /RES terminal.

While turning on the VDD and VSS power supply, maintain /RES terminal at LOW level, After the Power supply stabilized, release the reset terminal(/RES = High)

4.4 Display Memory Map

4.4.1 Memory Map (3B3P, 8-bit mode)

		Column										
LCD read direction	CI = 0		0			1			84			
	CI = 1		84			83			0			
	Pixel		P0	P1	P2	P3	P4	P5		P252	P253	P254
	Data Line		D7' _{1,0}	D7' _{2,0}	D7' _{3,0}	D7' _{1,1}	D7' _{2,1}	D7' _{3,1}		D7' _{1,84}	D7' _{2,84}	D7' _{3,84}
			D6' _{1,0}	D6' _{2,0}	D6' _{3,0}	D6' _{1,1}	D6' _{2,1}	D6' _{3,1}		D6' _{1,84}	D6' _{2,84}	D6' _{3,84}
			D5' _{1,0}	D5' _{2,0}	D5' _{3,0}	D5' _{1,1}	D5' _{2,1}	D5' _{3,1}		D5' _{1,84}	D5' _{2,84}	D5' _{3,84}
			D4' _{1,0}	D4' _{2,0}	D4' _{3,0}	D4' _{1,1}	D4' _{2,1}	D4' _{3,1}		D4' _{1,84}	D4' _{2,84}	D4' _{3,84}
			D3' _{1,0}	D3' _{2,0}	D3' _{3,0}	D3' _{1,1}	D3' _{2,1}	D3' _{3,1}		D3' _{1,84}	D3' _{2,84}	D3' _{3,84}
Block	LI = 0	LI = 1										
0	0	159										
	1	158										
	2	157										
	3	156										
1	4	155										
	5	154										
	6	153										
	7	152										
2	8	151										
	9	150										
38	152	7										
	153	6										
	154	5										
	155	4										
39	156	3										
	157	2										
	158	1										
	159	0										
SEGout			0	1	2	3	4	5		252	253	254

4.4.2 Memory Map (3B3P, 16-bit mode)

		Column														
LCD read direction	CI = 0	0					1					84				
	CI = 1	84					83					0				
	Pixel	P0	P1	P2	P3	P4	P5		P252	P253	P254					
	Data Line	D15' _{1,0}	D7' _{1,0}	D15' _{2,0}	D15' _{1,1}	D7' _{1,1}	D15' _{2,1}		D15' _{1,84}	D7' _{1,84}	D15' _{2,84}					
		D14' _{1,0}	D6' _{1,0}	D14' _{2,0}	D14' _{1,1}	D6' _{1,1}	D14' _{2,1}		D14' _{1,84}	D6' _{1,84}	D14' _{2,84}					
		D13' _{1,0}	D5' _{1,0}	D13' _{2,0}	D13' _{1,1}	D5' _{1,1}	D13' _{2,1}		D13' _{1,84}	D5' _{1,84}	D13' _{2,84}					
		D12' _{1,0}	D4' _{1,0}	D12' _{2,0}	D12' _{1,1}	D4' _{1,1}	D12' _{2,1}		D12' _{1,84}	D4' _{1,84}	D12' _{2,84}					
		D11' _{1,0}	D3' _{1,0}	D11' _{2,0}	D11' _{1,1}	D3' _{1,1}	D11' _{2,1}		D11' _{1,84}	D3' _{1,84}	D11' _{2,84}					
Block	LI = 0	LI = 1														
0	0	159														
	1	158														
	2	157														
	3	156														
1	4	155														
	5	154														
	6	153														
	7	152														
2	8	151														
	9	150														
38	152	7														
	153	6														
	154	5														
	155	4														
39	156	3														
	157	2														
	158	1														
	159	0														
SEGout			0	1	2	3	4	5		252	253	254				

4.5 Display Commands

Ext=0 or Ext=1

Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
1	Ext In	0	1	0	0	0	1	1	0	0	0	0	Ext=0 Set	30	None
2	Ext Out	0	1	0	0	0	1	1	0	0	0	1	Ext=1 Set	31	None

Ext=0

Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
1	DISON	0	1	0	1	0	1	0	1	1	1	1	Display On	AF	None
2	DISOFF	0	1	0	1	0	1	0	1	1	1	0	Display Off	AE	None
3	DISNOR	0	1	0	1	0	1	0	0	1	1	0	Normal Display	A6	None
4	DISINV	0	1	0	1	0	1	0	0	1	1	1	Inverse Display	A7	None
5	COMSCN	0	1	0	1	0	1	1	1	0	1	1	COM Scan Direction	BB	1 byte
6	DISCTRL	0	1	0	1	1	0	0	1	0	1	0	Display Control	CA	3 bytes
7	SLPIN	0	1	0	1	0	0	1	0	1	0	1	Sleep In	95	None
8	SLPOUT	0	1	0	1	0	0	1	0	1	0	0	Sleep Out	94	None
9	LASET	0	1	0	0	1	1	1	0	1	0	1	Line Address Set	75	2 bytes
10	CASET	0	1	0	0	0	0	1	0	1	0	1	Column Address Set	15	2 bytes
11	DATSDR	0	1	0	1	0	1	1	1	1	0	0	Data Scan Direction	BC	3 bytes
12	RAMWR	0	1	0	0	1	0	1	1	1	0	0	Writing to Memory	5C	Data
13	RAMRD	0	1	0	0	1	0	1	1	1	0	1	Reading from Memory	5D	Data
14	PTLIN	0	1	0	1	0	1	0	1	0	0	0	Partial display in	A8	2 bytes
15	PTLOUT	0	1	0	1	0	1	0	1	0	0	1	Partial display out	A9	None
16	RMWIN	0	1	0	1	1	1	0	0	0	0	0	Read and Modify Write	E0	None
17	RMWOUT	0	1	0	1	1	1	0	1	1	1	0	RMW end	EE	None
18	ASCSET	0	1	0	1	0	1	0	1	0	1	0	Area Scroll Set	AA	4 bytes
19	SCSTART	0	1	0	1	0	1	0	1	0	1	1	Scroll Start Set	AB	1 byte
20	OSCON	0	1	0	1	1	0	1	0	0	0	1	Internal OSC on	D1	None
21	OSCOFF	0	1	0	1	1	0	1	0	0	1	0	Internal OSC off	D2	None
22	PWRCTRL	0	1	0	0	0	1	0	0	0	0	0	Power Control	20	1 byte
23	VOLCTRL	0	1	0	1	0	0	0	0	0	0	1	EC control	81	2 bytes
24	VOLUP	0	1	0	1	1	0	1	0	1	1	0	EC increase 1	D6	None
25	VOLDOWN	0	1	0	1	1	0	1	0	1	1	1	EC decrease 1	D7	None
26	RESERVED	0	1	0	1	0	0	0	0	0	1	0	Not Use	82	0

27	EPSRRD1	0	1	0	0	1	1	1	1	1	0	0	READ Register1	7C	None
28	EPSRRD2	0	1	0	0	1	1	1	1	1	0	1	READ Register2	7D	None
29	NOP	0	1	0	0	0	1	0	0	1	0	1	NOP Instruction	25	None
30	STREAD	0	0	1	Read Data							Status Read			
31	EPINT	0	1	0	0	0	0	0	0	1	1	1	Initial code(1)	07	1 byte

Ext=1

Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
1	Gray 1 Set	0	1	0	0	0	1	0	0	0	0	0	FRAME 1 Gray PWM Set	20	16 bytes
2	Gray 2 Set	0	1	0	0	0	1	0	0	0	0	1	FRAME 2 Gray PWM Set	21	16 bytes
3	ANASET	0	1	0	0	0	1	1	0	0	1	0	Analog Circuit Set	32	3 bytes
4	SWINT	0	1	0	0	0	1	1	0	1	0	0	Software Initial	34	None
5	EPCTIN	0	1	0	1	1	0	0	1	1	0	1	Control EEPROM	CD	1 byte
6	EPCOUT	0	1	0	1	1	0	0	1	1	0	0	Cancel EEPROM	CC	None
7	EPMWR	0	1	0	1	1	1	1	1	1	0	0	Write to EEPROM	FC	None
8	EPMRD	0	1	0	1	1	1	1	1	1	0	1	Read from EEPROM	FD	None

Note: The table above is for 8-bit interface. For the application of 16-bit interface, fill D15~8 with 0, and other bits are just the same with the table above.

4.6 Basic Operating Sequence

```

void intial(void)
{
    write_inst(0x81);           //EC control
    write_data(0x0E);         //vop[5:0]
    write_data(0x04);         //vop[8:6]
    delay(50);
    write_inst(0x30);         //EXT = 0
    write_inst(0x20);         //power control
    write_data(0x03);         //D0 = regulator
    write_inst(0x94);         //sleep out
    / D1 = follwer / D3 = booster
    //VB - VF VR : VB=OFF, VF=1, VR=1, 0x03
    write_inst(0xD1);         //OSC on
    外部电压电路

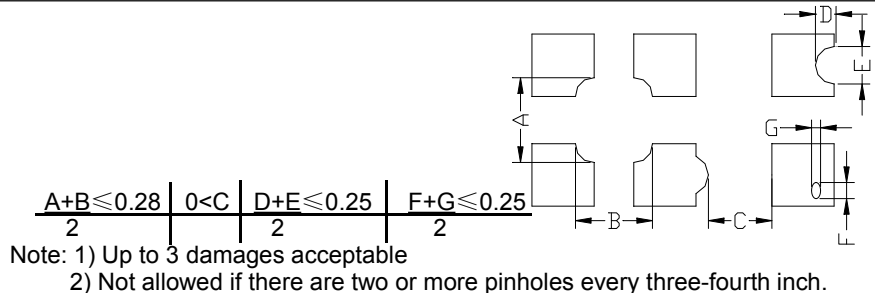
    write_inst(0xBB);         //com scan
    direc. = 0~65 / 160~66
    write_data(0x01);         //
    write_inst(0xA7);         //inverse
    write_inst(0xCA);         //display control
    write_data(0x04);         //CL dividing
    display
    ratio = 0
    write_inst(0xBC);         //data scan
    write_data(0x27);         //duty
    direc.
    write_data(0x00);         //c/l
    //N-Line Low
    com//line,ci,li:address scan direc.
    write_data(0x00);         //BGR
    write_data(0x02);         //gray scale
    3b3pd1 方式 1//

    write_inst(0x31);         //EXT = 1
    write_inst(0x32);         //analog
    write_data(0x07);         //OSC freq
    write_data(0x00);         //booster effic.
    write_inst(0xAF);         //display on
    write_data(0x02);         //bias

    write_inst(0x30);         //EXT = 0
    delay(50);
}

```


5. Inspection Standards

Item	Criterion for defects	Defect type
1) Display on inspection	(1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient	Major
2) Black / White spot	Size Φ (mm) $\Phi \leq 0.3$ Acceptable number $0.3 < \Phi \leq 0.45$ Ignore (note) $0.45 < \Phi \leq 0.6$ 3 $0.6 < \Phi$ 1 0	Minor
3) Black / White line	Length (mm) Width (mm) Acceptable number $L \leq 10$ $W \leq 0.03$ Ignore $5.0 \leq L \leq 10$ $0.03 < W \leq 0.04$ 3 $5.0 \leq L \leq 10$ $0.04 < W \leq 0.05$ 2 $1.0 \leq L \leq 10$ $0.05 < W \leq 0.06$ 2 $1.0 \leq L \leq 10$ $0.06 < W \leq 0.08$ 1 $L \leq 10$ $0.08 < W$ follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern	 <p>Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.</p>	Minor
5) Spot-like contrast irregularity	Size Φ (mm) Acceptable Number $\Phi \leq 0.7$ Ignore (note) $0.7 < \Phi \leq 1.0$ 3 $1.0 < \Phi \leq 1.5$ 1 $1.5 < \Phi$ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.	Minor
6) Bubbles in polarizer	Size Φ (mm) Acceptable Number $\Phi \leq 0.4$ Ignore (note) $0.4 < \Phi \leq 0.65$ 2 $0.65 < \Phi \leq 1.2$ 1 $1.2 < \Phi$ 0	Minor
7) Scratches and dent on the polarizer	Scratches and dent on the polarizer shall be in the accordance with "2) Black/white spot", and "3) Black/White line".	Minor
8) Stains on the surface of LCD panel	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	Minor
9) Rainbow color	No rainbow color is allowed in the optimum contrast on state within the active area.	Minor
10) Viewing area encroachment	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.	Minor
11) Bezel appearance	Rust and deep damages that are visible in the bezel are rejected.	Minor
12) Defect of land surface contact	Evident crevices that are visible are rejected.	Minor
13) Parts mounting	(1) Failure to mount parts (2) Parts not in the specifications are mounted (3) For example: Polarity is reversed, HSC or TCP falls off.	Minor
14) Part alignment	(1) LSI, IC lead width is more than 50% beyond pad outline. (2) More than 50% of LSI, IC leads is off the pad outline.	Minor
15) Conductive foreign matter (solder ball, solder hips)	(1) $0.45 < \Phi, N \geq 1$ (2) $0.3 < \Phi \leq 0.45, N \geq 1, \Phi$: Average diameter of solder ball (unit: mm) (3) $0.5 < L, N \geq 1, L$: Average length of solder chip (unit: mm)	Minor
16) Bezel flaw	Bezel claw missing or not bent	Minor
17) Indication on name plate (sampling indication label)	(1) Failure to stamp or label error, or not legible.(all acceptable if legible) (2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.	Minor

6. Handling Precautions

6.1 Mounting method

A panel of LCD module made by our company consists of two thin glass plates with polarizers that easily get damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

6.2 Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketene
- Aromatics

6.3 Caution against static charge

The LCD module uses C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to V_{dd} or V_{ss} . Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

6.4 Packaging

- Module employs LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

6.5 Caution for operation

It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.

- An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

6.6 Storage

In the case of storing for a long period of time, the following ways are recommended:

- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

6.7 Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.