LCD MODULE SPECIFICATION
FOR CUSTOMER'S APPROVAL

Product Model : WYM240128K7G

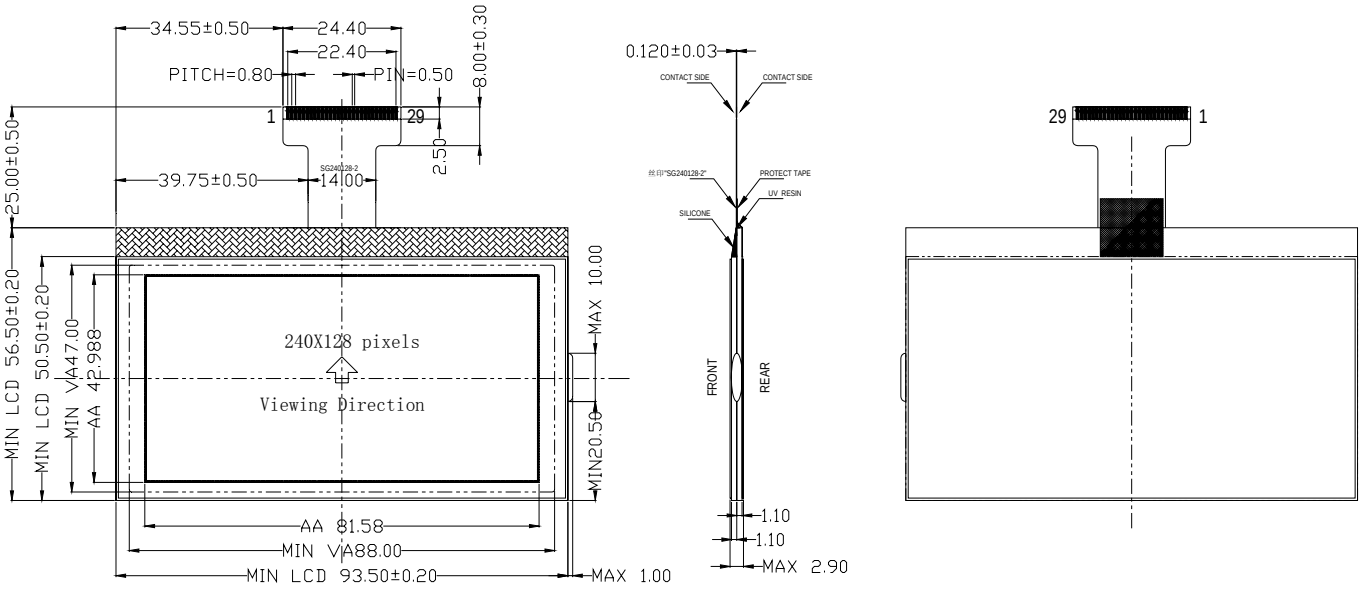
VERSION:1.0

OPTIONAL SPECIFICATION		
LCD	☐Normal Temperature（0～50℃） ■Wide Temperature（-20～+70℃） ☐Super Wide Temperature（-30～+80℃）	
	☐Yellow&Green ☐Blue ☐Gray ■Black & White	
Backlight	LED Backlight	☐White light ☐Green light ☐Yellow&Green light ☐Blue light
DC to DC Circuit	■Build-in ☐Not Build-in	
Controller	■Build-in ☐Not Build-in	

Version	Revision Date	Contents	Editor
1.0	2017-2-22	New Release	SMX

1. PHYSICAL DATA

Item	Contents	Unit
LCD type	FSTN	---
LCD duty	1/128	---
LCD bias	1/12	---
Viewing direction	6	o'clock
Module size (W×H×T)	93.5 ×56.5×2.9	mm
Number of dots(W×H)	240 × 128	dots
Dot Size(W×H))	0.32×0.316	mm
Dot Pitch(W×H))	0.34×0.336	mm



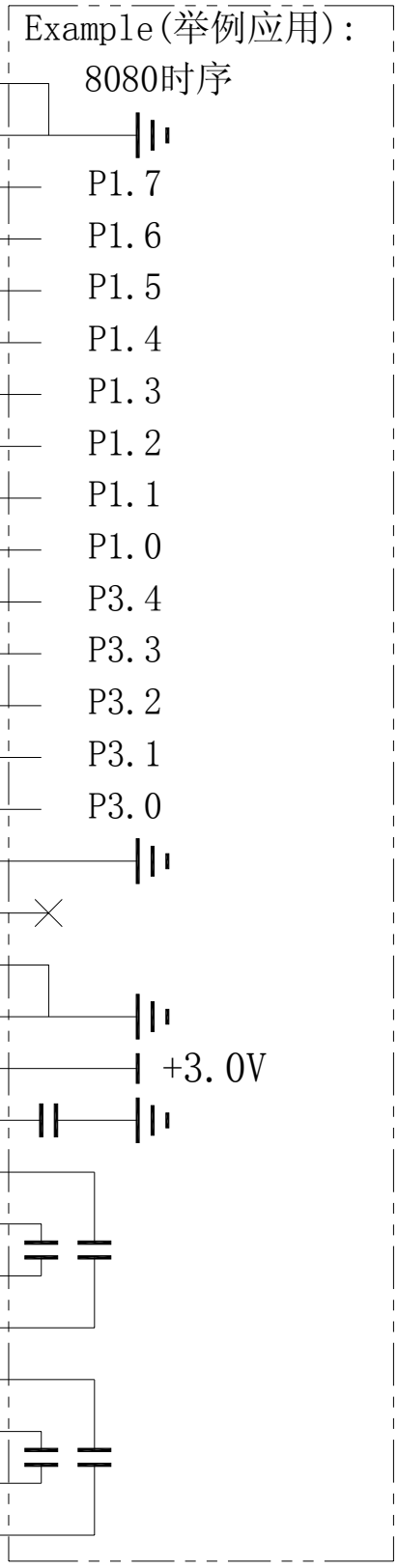
ITEM	PARAMETERS	ITEM	PARAMETERS
OPERATING VOLTAGE	3.0V	OPERATING TEMP	-20°C ～ 70°C
OPERATING CURRENT	2.0MA(MAX)	STORAGE TEMP	-30°C ～ 80°C
LCD DRIVE VOLTAGE	14.0V	BACKLIGHT	---
DISPLAY MODE	FSTN, TRANSFLECTIVE,POSITIVE	ROHS STANDARD	YES ■ NO □
LCD DRIVE METHOD	DUTY：1/128; BIAS：1/12	CONNECTOR TYPE	FPC
LCD DRIVE IC	UC1611sGAA	OTHER	--
VIEW DIRECTION	6:00 O'CLOCK		

2. Pin define

PIN NO.	Symbol	Level	Description
1	D15	I/O	Bi-directional bus for parallel host interface
2	D13	I/O	Bi-directional bus for parallel host interface
3-10	D7-D0	I/O	Bi-directional bus for parallel host interface
11	RES	I	Reset signal
12	CS0	I	Chip Selection
13	CD	I	Control data OR Display data
14	WR0	I	Controls the read/write operation of the host interface
15	WR1	I	Controls the read/write operation of the host interface
16	BM0	I	Bus Mode
17	TST4	I/HV	supply one of the high voltage required for MTP
18	ID0	I	Production control.
19	VSS	P	POWER Ground
20	VDD	P	POWER supply(+3.3V)
21	VLCD	P	High voltage LCD Power Supply.
22	VA0-	P	LCD Bias Voltages
23	VA1 -	P	LCD Bias Voltages
24	VA1+	P	LCD Bias Voltages
25	VA0+	P	LCD Bias Voltages
26	VB0 -	P	LCD Bias Voltages
27	VB1 -	P	LCD Bias Voltages
28	VB1+	P	LCD Bias Voltages
29	VB0+	P	LCD Bias Voltages

Key:
I = Input，O=OUTPUT，
IO = Bi - directional (input/output)
P = Power pin

PIN ASSIGNMENT:	
1	D15
2	D13
3	D7
4	D6
5	D5
6	D4
7	D3
8	D2
9	D1
10	D0
11	RST
12	CS0
13	CD
14	WR0
15	WR1
16	BM0
17	TST4
18	ID0
19	VSS
20	VDD
21	VLCD
22	VA0-
23	VA1-
24	VA1+
25	VA0+
26	VB0-
27	VB1-
28	VB1+
29	VB0+



3. ABSOLUTE MAXIMUM RATINGS

(1)Electrical Absolute Ratings

In accordance with IEC134, note 1, 2 and 3.

Symbol	Parameter	Min.	Max.	Unit
V_{DD}	Logic Supply voltage	-0.3	+4.0	V
V_{DD2}	LCD Generator Supply voltage	-0.3	+4.0	V
V_{DD3}	Analog Circuit Supply voltage	-0.3	+4.0	V
$V_{DD2/3}$-V_{DD}	Voltage difference between V_{DD} and $V_{DD2/3}$	--	2.0	V
V_{LCD}	LCD Generated voltage (-30°C ~ +80°C)	-0.3	+19.8	V
V_{IN}	Digital input voltage	-0.4	V_{DD} + 0.5	V
T_{OPR}	Operating temperature range	-30	+85	°C
T_{STR}	Storage temperature	-55	+125	°C

Note:

1. V_{DD} is based on V_{SS} = 0V
2. Stress above values listed may cause permanent damages to the device.

4. ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{DD}	Supply for digital circuit		1.65	1.8~3.3	3.6	V
$V_{DD2/3}$	Supply for bias & pump		2.7	2.8~3.3	3.6	V
V_{LCD}	Charge pump output	$V_{DD2/3} \geq$ 2.7V, 25°C		15.5	17.5	V
V_D	LCD data voltage	$V_{DD2/3} \geq$ 2.7V, 25°C			1.69	V
V_{IL}	Input logic LOW				0.2V_{DD}	V
V_{IH}	Input logic HIGH		0.8V_{DD}			V
V_{OL}	Output logic LOW				0.2V_{DD}	V
V_{OH}	Output logic HIGH		0.8V_{DD}			V
I_{IL}	Input leakage current				1.5	µA
C_{IN}	Input capacitance			5	10	pF
C_{OUT}	Output capacitance			5	10	pF
$R_{O(SEG)}$	SEG output impedance	V_{LCD} = 17V		1.35	2.5	k Ω
$R_{O(COM)}$	COM output impedance	V_{LCD} = 17V		1.35	2.5	k Ω
f_{LINE}	Average Line rate	LC[5:4] = 10b	-10%	28	+10%	kHz

POWER CONSUMPTION

V_{DD} = 2.7 V, V_{LCD} = 17.01 V, Mux Rate = 160, C_B = 5 µF, All HV outputs are open circuit.

Bias Ratio = 11, Line Rate = 10 b, Bus mode = 6800, Temperature = 25 °C,

PM = 234, Panel Loading (PC[1:0]) = 11 b, C_L = 500 nF, MTP= 00 H,

Display Pattern	Conditions	Typical	Maximum	Unit
All-OFF	Bus = idle	1656	2484	µA
2-pixel checker	Bus = idle	2031	3046	µA
--	Bus = idle (standby current)	--	5	µA

AC Characteristics

AC CHARACTERISTICS

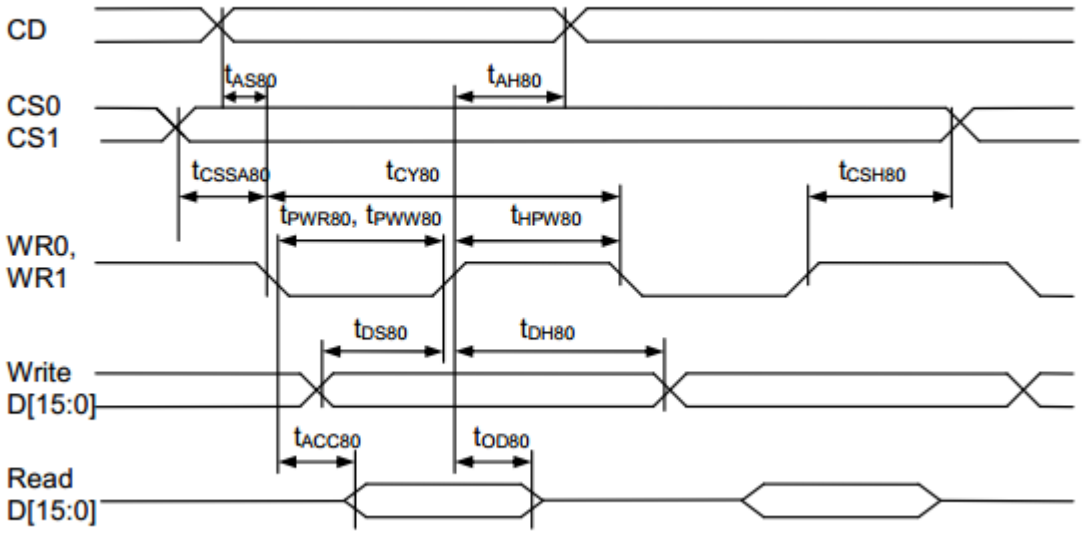


FIGURE 16: Parallel Bus Timing Characteristics (for 8080 MCU)

Symbol	Signal	Description		Condition	Min.	Max.	Unit
(2.5V ≤ V_{DD} < 3.6V, Ta= –30 to +85°C)					(Read / Write)		
t_{AS80} t_{AH80}	CD	Address setup time Address hold time			0 0	–	nS
t_{SSA80} t_{CSH80}	CS1/CS0	Chip select setup time			0 0	–	nS
t_{CY80}	WR1, WR0	System cycle time	16-bit bus 8-bit bus		440 / 360 180 / 160	–	nS
t_{PWR80} / t_{PWW80}		Low Pulse width	16-bit bus 8-bit bus		205 / 165 75 / 65		
t_{HPW80}		High pulse width	16-bit bus 8-bit bus		205 / 165 75 / 65		
t_{DS80} t_{DH80}	D15~D0 (Write)	Data setup time Data hold time			/ 30 / 0	–	nS
t_{ACC80} t_{OD80}	D15~D0 (Read)	Read access time Output disable time		C_L = 100pF	– / 30 /	60 –	nS
(1.65V ≤ V_{DD} < 2.5V, Ta= –30 to +85°C)					(Read / Write)		
t_{AS80} t_{AH80}	CD	Address setup time Address hold time			0 0	–	nS
t_{SSA80} t_{CSH80}	CS1/CS0	Chip select setup time			0 0	–	nS
t_{CY80}	WR1, WR0	System cycle time	16-bit bus 8-bit bus		830 / 630 330 / 290	–	nS
t_{PWR80} / t_{PWW80}		Low Pulse width	16-bit bus 8-bit bus		400 / 300 150 / 130		
t_{HPW80}		High pulse width	16-bit bus 8-bit bus		400 / 300 150 / 130		
t_{DS80} t_{DH80}	D15~D0 (Write)	Data setup time Data hold time			/ 60 / 0	–	nS
t_{ACC80} t_{OD80}	D15~D0 (Read)	Read access time Output disable time		C_L = 100pF	– / 50 /	120 –	nS

Note: The rising time and the falling time are stipulated to be equal to or less than 15nS each.

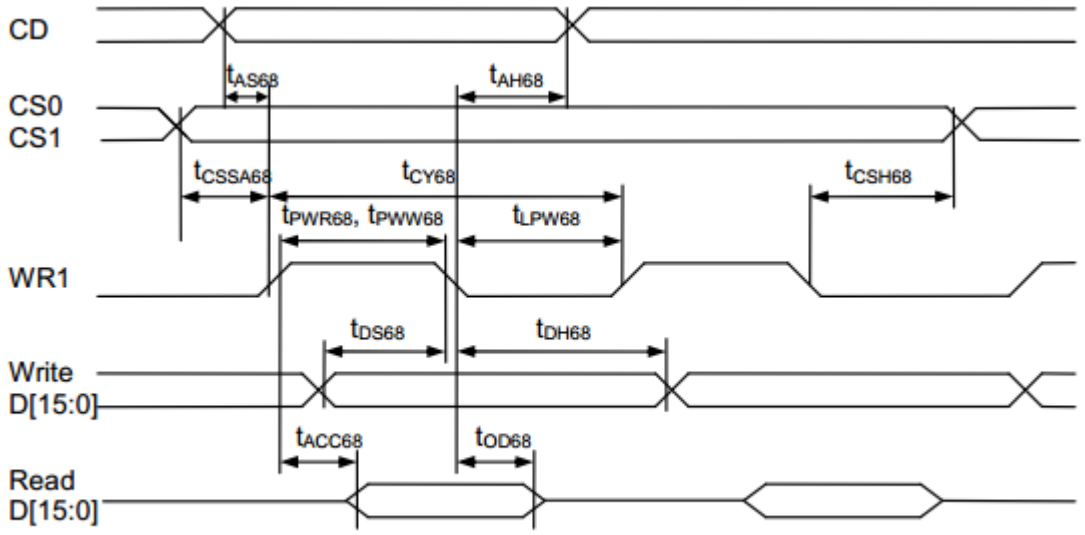


FIGURE 17: Parallel Bus Timing Characteristics (for 6800 MCU)

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(2.5V ≤ V_{DD} < 3.6V, Ta= –30 to +85°C)				(Read / Write)		
t_{AS68} t_{AH68}	CD	Address setup time Address hold time		0 0	–	nS
t_{CSSA68} t_{CSH68}	CS1/CS0	Chip select setup time		0 0		nS
t_{CY68}	WR1, WR0	System cycle time 16-bit bus 8-bit bus		440 / 360 180 / 160	–	nS
t_{PWR68} / t_{PWW68}		Low Pulse width 16-bit bus 8-bit bus		205 / 165 75 / 65		
t_{LPW68}		High Pulse width 16-bit bus 8-bit bus		205 / 165 75 / 65		
t_{DS68} t_{DH68}	D15~D0 (Write)	Data setup time Data hold time		/ 30 / 0	–	nS
t_{ACC68} t_{OD68}	D15~D0 (Read)	Read access time Output disable time	C_L = 100pF	– / 30 /	60 –	nS
(1.65V ≤ V_{DD} < 2.5V, Ta= –30 to +85°C)				(Read / Write)		
t_{AS68} t_{AH68}	CD	Address setup time Address hold time		0 0	–	nS
t_{CSSA68} t_{CSH68}	CS1/CS0	Chip select setup time		0 0		nS
t_{CY68}	WR1, WR0	System cycle time 16-bit bus 8-bit bus		830 / 630 330 / 290	–	nS
t_{PWR68} / t_{PWW68}		High Pulse width 16-bit bus 8-bit bus		400 / 300 150 / 130		
t_{LPW68}		Low pulse width 16-bit bus 8-bit bus		400 / 300 150 / 130		
t_{DS68} t_{DH68}	D15~D0 (Write)	Data setup time Data hold time		/ 60 / 0	–	nS
t_{ACC68} t_{OD68}	D15~D0 (Read)	Read access time Output disable time	C_L = 100pF	– / 50 /	120 –	nS

Note: The rising time and the falling time are stipulated to be equal to or less than 15nS each.

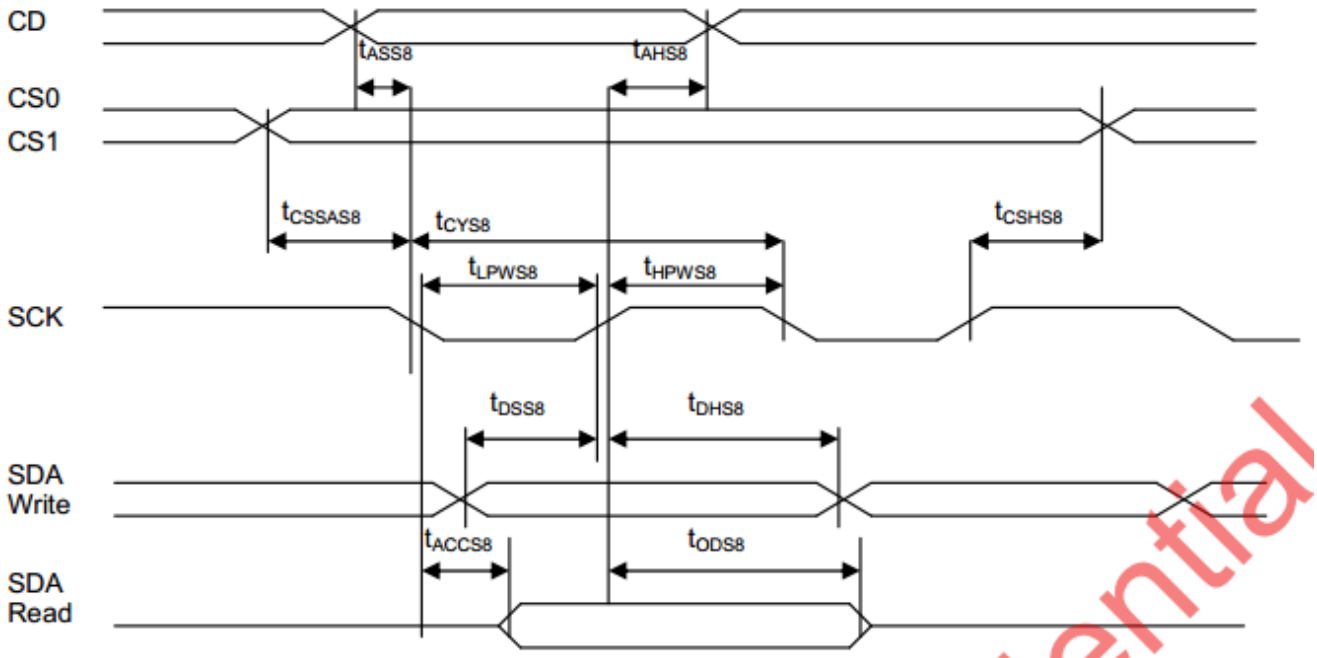


FIGURE 18: Serial Bus Timing Characteristics (for S8)

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(2.5V ≤ V_{DD} < 3.6V, Ta= –30 to +85°C)				(Read / Write)		
t_{ASS8} t_{AHS8}	CD	Address setup time Address hold time		0 0	–	nS
t_{CSSAS8} t_{CSHS8}	CS1/CS0	Chip select setup time		0 / 0 0 / 0	–	nS
t_{CYS8} t_{LPWS8} t_{HPWS8}	SCK	System cycle time Low pulse width High pulse width		150 / 66 60 / 18 60 / 18	–	nS
t_{DSS8} t_{DHS8}	SDA (Write)	Data setup time Data hold time		15 0	–	nS
t_{ACCS8} t_{ODS8}	SDA (Read)	Read access time Output disable time		– 15	50 –	nS
(1.65V ≤ V_{DD} < 2.5V, Ta= –30 to +85°C)				(Read / Write)		
t_{ASS8} t_{AHS8}	CD	Address setup time Address hold time		0 0	–	nS
t_{CSSAS8} t_{CSHS8}	CS1/CS0	Chip select setup time		0 / 0 0 / 0	–	nS
t_{CYS8} t_{LPWS8} t_{HPWS8}	SCK	System cycle time Low pulse width High pulse width		270 / 90 120 / 30 120 / 30	–	nS
t_{DSS8} t_{DHS8}	SDA (Write)	Data setup time Data hold time		/ 30 / 5	–	nS
t_{ACCS8} t_{ODS8}	SDA (Read)	Read access time Output disable time		– / 30 /	90 –	nS

Note: The rising time and the falling time are stipulated to be equal to or less than 15nS each.

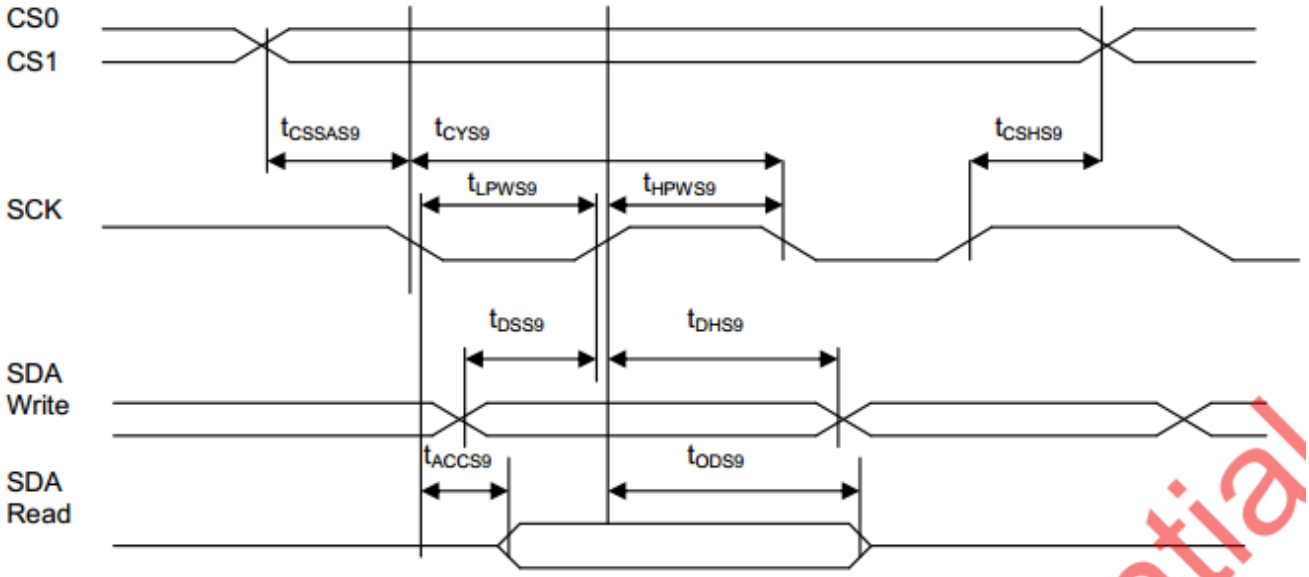


FIGURE 19: Serial Bus Timing Characteristics (for S9)

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(2.5V ≤ V_{DD} < 3.6V, Ta= –30 to +85°C)				(Read / Write)		
t_{CSSAS9} t_{CSHS9}	CS1/CS0	Chip select setup time		0 / 0 0 / 0	–	nS
t_{CYS9} t_{LPWS9} t_{HPWS9}	SCK	System cycle time Low pulse width High pulse width		150 / 66 60 / 18 60 / 18	– – –	nS
t_{DSS9} t_{DHS9}	SDA (Write)	Data setup time Data hold time		/ 15 / 0	–	nS
t_{ACCS9} t_{ODS9}	SDA (Read)	Read access time Output disable time		– / 15 /	50 –	nS
(1.65V ≤ V_{DD} < 2.5V, Ta= –30 to +85°C)				(Read / Write)		
t_{CSSAS9} t_{CSHS9}	CS1/CS0	Chip select setup time		0 / 0 0 / 0	–	nS
t_{CYS9} t_{LPWS9} t_{HPWS9}	SCK	System cycle time Low pulse width High pulse width		270 / 90 120 / 30 120 / 30	– – –	nS
t_{DSS9} t_{DHS9}	SDA (Write)	Data setup time Data hold time		/ 30 / 5	–	nS
t_{ACCS9} t_{ODS9}	SDA (Read)	Read access time Output disable time		– / 30 /	90 –	nS

Note: The rising time and the falling time are stipulated to be equal to or less than 15 nS each.

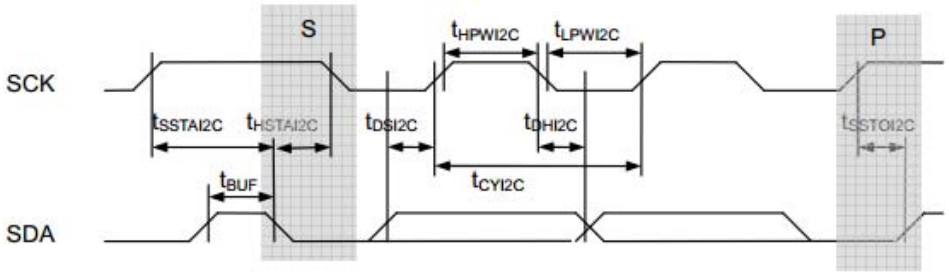


FIGURE 20: Serial bus timing characteristics (for I^2C)

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(2.5V ≤ V_{DD} < 3.6V, Ta= –30 to +85°C)				(Read / Write)		
t_{CYI2C} t_{LPWI2C} t_{HPWI2C}	SCK	SCK cycle time Low pulse width High pulse width	tr+tf ≤ 100nS	610 / 306 290 / 138 290 / 138	–	nS
t_{DSI2C} t_{DHI2C} $t_{SSTAI2C}$ $t_{HSTAI2C}$ $t_{SSTOI2C}$	SCK	Data setup time Data hold time START Setup time START Hold time STOP setup time		33 11 28 50 28	–	nS
t_{BUF}	SDA	Bus Free time between STOP and START condition		165	–	nS
(1.65V ≤ V_{DD} < 2.5V, Ta= –30 to +85°C)				(Read / Write)		
t_{CYI2C} t_{LPWI2C} t_{HPWI2C}	SCK	SCK cycle time Low pulse width High pulse width	tr+tf ≤ 100nS	780 / 260 375 / 115 375 / 115	–	nS
t_{DSI2C} t_{DHI2C} $t_{SSTAI2C}$ $t_{HSTAI2C}$ $t_{SSTOI2C}$	SCK	Data setup time Data hold time START Setup time START Hold time STOP setup time		60 11 28 60 28	–	nS
t_{BUF}	SDA	Bus Free time between STOP and START condition		220	–	nS

Note: The rising time and the falling time are stipulated to be equal to or less than 15nS each.

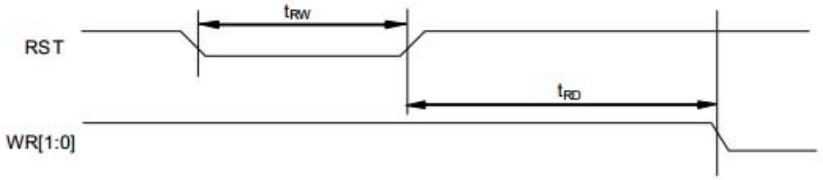
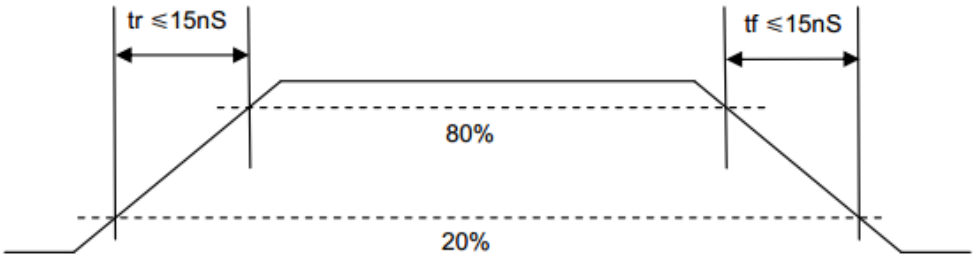


FIGURE 21: Reset Characteristics

Symbol	Signal	Description	Condition	Min.	Max.	Unit
(1.65V ≤ V_{DD} < 3.6V, Ta= –30 to +85°C)						
t_{RW}	RST	Reset low pulse width		3	–	µS
t_{RD}	RST, WR	Reset to WR pulse delay		10	–	mS

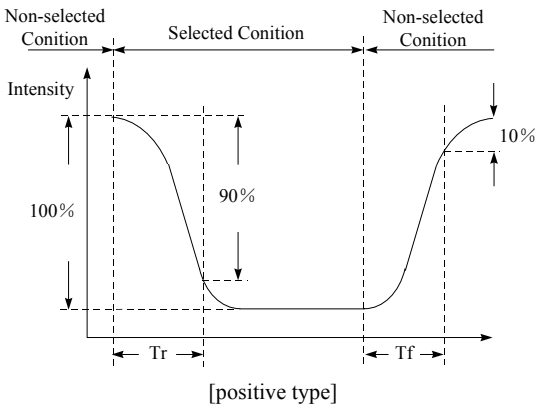
Note:
For each mode, the signal's rising time (tr) and falling time (tf) are stipulated to be equal to or less than 15nS each.



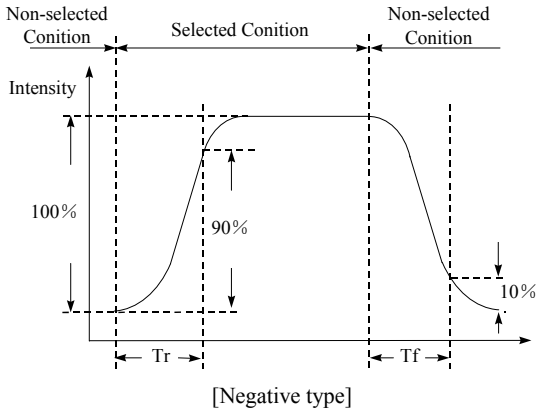
5. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	note
Viewing angle range	θ_f (12 o'clock)	When Cr≧2	35	---	---	Degree	Note 2 Note 3 Note 4
	θ_b (6 o'clock)		55	---	---		
	θ_l (9 o'clock)		55	---	---		
	θ_r (3 o'clock)		55	---	---		
Rise Time	T_r	V_0-V_{SS}=9.5V Ta=25℃		112		mS	Note 1
Fall Time	T_f			250			
Contrast	Cr		---	5. 4	---		

[Note 1] Definition of Response Time (Tr, Tf)



[positive type]

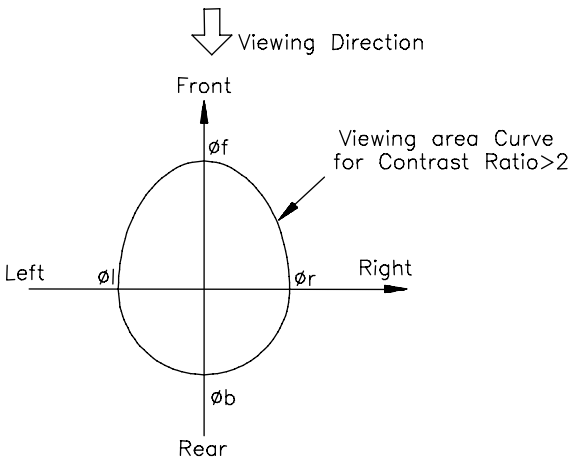


[Negative type]

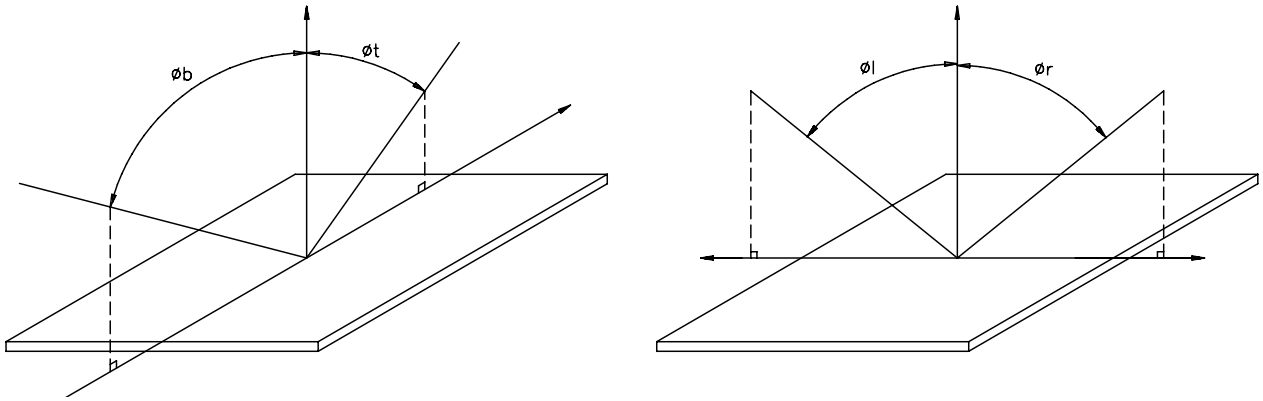
Conditions:

Operating Voltage : Vop
Frame Frequency : 64 Hz
Viewing Angle(θ , φ): 0° , 0°
Driving Wave form : 1/N duty, 1/a bias

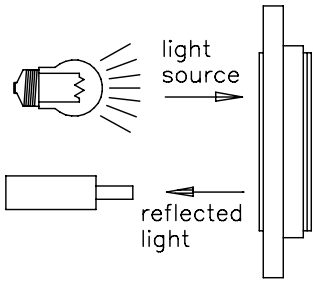
[Note 2] Definition of Viewing Direction



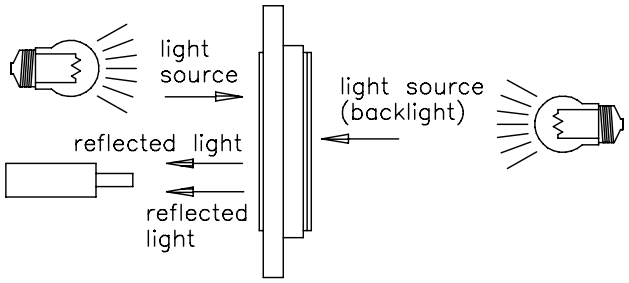
[Note 3] Definition of viewing angle



[Note 4] Description of Measuring Equipment



Reflective type



Transflective type

6. OPERATING PRINCIPLES & METHODS

The following list of host commands is supported by UC1611s

C/D: 0: Control 1: Data W/R: 0: Write cycle 1: Read cycle D7-D0: # Effective Data bits – Don't Care

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
1.	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A
2.	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A
3.	Get Status (triple-byte command)	0	1	Ver	MX	MY	WA	DE	WS	MD	MS	Get Status	N/A
				ID[1:0]		PMO[5:0]							
				Product Code				0	0	0	EF		
4.	Set Column Addr. LSB	0	0	0	0	0	0	#	#	#	#	Set CA[3:0]	0
	Set Column Addr. MSB	0	0	0	0	0	1	#	#	#	#	Set CA[7:4]	0
5.	Temp. Compensation.	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	00b: -0.05%/°C
6.	Set Panel Loading	0	0	0	0	1	0	1	0	#	#	Set PC [1:0]	11b: 33~55 nF
7.	Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC [3:2]	11b
8.	Set Adv. Program Control (double-byte command)	0	0	0	0	1	1	0	0	R	R	Set R, R = 0~3	N/A
				#	#	#	#	#	#	#	#	Set APC[R][7:0]	
9.	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0
	Set Scroll Line MSB			0	1	0	1	#	#	#	#	Set SL[7:4]	0
10.	Set Page Address LSB	0	0	0	1	1	0	#	#	#	#	Set PA[3:0]	0
	Set Page Address MSB			0	1	1	1	0	#	#	#	Set PA[6:4]	0
11.	Set Potentiometer (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	PM=EAH
		0	0	#	#	#	#	#	#	#	#		
12.	Set Isolation Clock Front (triple-byte command)	0	0	1	0	0	0	0	0	1	0	Set ISOF[3:0]	1H
				0	0	0	1	0	0	1	1		
				-	-	-	-	#	#	#	#		
13.	Set Isolation Clock Back (triple-byte command)	0	0	1	0	0	0	0	0	1	0	Set ISOB[3:0]	0H
				0	0	0	1	0	1	0	0		
				-	-	-	-	#	#	#	#		
14.	Set Partial Display Control	0	0	1	0	0	0	0	1	#	#	Set LC[9:8]	00b: Disable
15.	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b
16.	Set Fixed Lines	0	0	1	0	0	1	#	#	#	#	Set FL[3:0]	0
17.	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[5:4]	10b:28klps
18.	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0
19.	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0
20.	Set Display Enable	0	0	1	0	1	0	1	#	#	#	Set DC[4:2]	110b
21.	Set LCD Mapping Control (double-byte command)	0	0	1	1	0	0	0	0	0	0	Set LC[3:0]	0
		0	0	0	0	0	0	#	#	#	#		
22.	Set N-line Inversion (double-byte command)	0	0	1	1	0	0	1	0	0	0	Set NIV[6:0]	00H
		0	0	-	#	#	#	#	#	#	#		
23.	Set Display Pattern	0	0	1	1	0	1	0	#	#	#	Set DC[7:5]	000b
24.	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
25.	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
26.	Set test control (double-byte command)	0	0	1	1	1	0	0	1	TT		For testing only. Do not use.	N/A
		0	0	#	#	#	#	#	#	#	#		
27.	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	10b: 11
28.	Set COM End	0	0	1	1	1	1	0	0	0	1	Set CEN[7:0]	159
		0	0	#	#	#	#	#	#	#	#		
29.	Set Partial Display Start	0	0	1	1	1	1	0	0	1	0	Set DST[7:0]	0
		0	0	#	#	#	#	#	#	#	#		
30.	Set Partial Display End	0	0	1	1	1	1	0	0	1	1	Set DEN[7:0]	159
		0	0	#	#	#	#	#	#	#	#		

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action		Default
31.	Set Window Program Starting Column Address	0	0	1	1	1	1	0	1	0	0	Note (2)	Set WPC0[7:0]	0
				#	#	#	#	#	#	#	#			
32.	Set Window Program Starting Page Address	0	0	1	1	1	1	0	1	0	1		Set WPP0[6:0]	0
				-	#	#	#	#	#	#	#			
33.	Set Window Program Ending Column Address	0	0	1	1	1	1	0	1	1	0		Set WPC1[7:0]	255 (=FFh)
				#	#	#	#	#	#	#	#			
34.	Set Window Program Ending Page Address	0	0	1	1	1	1	0	1	1	1		Set WPP1[6:0]	79 (=4Fh)
				-	#	#	#	#	#	#	#			
35.	Set Window Program Mode	0	0	1	1	1	1	1	0	0	#	Set AC[3]		0:Inside
36.	Set MTP Operation Control	0	0	1	0	1	1	1	0	0	0	Set MTPC[5:0]		10H
				-	-	#	#	#	#	#	#			
37.	Set MTP Write Mask	0	0	1	0	1	1	1	0	0	1	Set MTPM[5:0]		0
				-	-	#	#	#	#	#	#			
38.	Set V_{MTP1} Potentiometer	0	0	1	1	1	1	0	1	0	0	Note (2)	Set MTP1	N/A
				#	#	#	#	#	#	#	#			
39.	Set V_{MTP2} Potentiometer	0	0	1	1	1	1	0	1	0	1		Set MTP2	N/A
				#	#	#	#	#	#	#	#			
40.	Set MTP Write Timer	0	0	1	1	1	1	0	1	1	0		Set MTP3	N/A
				#	#	#	#	#	#	#	#			
41.	Set MTP Read Timer	0	0	1	1	1	1	0	1	1	1		Set MTP4	N/A
				#	#	#	#	#	#	#	#			
SERIAL READ COMMAND (ENABLE IN S8 OR S9 BUS MODES ONLY)														
42.	Get Status (quadri-byte command)	0	0	1	1	1	1	1	1	1	0	Get Status till Chip Disabled		N/A
		-	1	Ver	MX	MY	WA	DE	WS	MD	MS			
				ID[1:0]		PMO[5:0]								
				Product Code[3:0]				0	0	0	EF			

Notes:

(1) All bit patterns other than commands listed above may result in undefined behavior.

(2) Commands (38)~(41) are shared with commands (31)~(34), and have exactly the same code.
When MTPC[3]=0, commands (37)~(41) are interpreted as Window Programming commands.
When MTPC[3]=1, they are MTP Control commands.

(3) MTPM and PM are actually the same register. Only one of the commands (36) is valid at any time, and it is determined by MTPC[3].

(4) After MTP-ERASE or MTP-PROGRAM operation, please always perform the following steps,
a) Disconnect TST4 power source.
b) Do a full V_{DD} ON-OFF cycle (make sure V_{DD} drops below 50mV).
before resuming normal operation.

7. RELIABILITY

No.	Test Item	Content of Test	Test Condition	Applicable Standard
Environmental Test				
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	80 °C 200 hrs	------
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-30 °C 200 hrs	------
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70 °C 200 hrs	------
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	-20 °C 200 hrs	------
5	High temperature / Humidity storage	Endurance test applying the high temperature and high humidity storage for a long time.	70 °C , 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
6	High temperature / Humidity operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	50 °C , 90 %RH 96 hrs	MIL-202E-103B JIS-C5023
7	Temperature cycle	Endurance test applying the low and high temperature cycle. -10°C 30min ⇌ 25°C 5min. ⇌ 60°C 30min ⟷ 1 cycle	-10°C / 60°C 10 cycles	------
Mechanical Test				
8	Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz → 1.5mmp-p 22~500Hz → 1.5G Total 0.5hrs	MIL-202E-201A JIS-C5025 JIS-C7022-A-10
9	Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G half sign wave 11 msedc 3 times of each direction	MIL-202E-213B
10	Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115 mbar 40 hrs	MIL-202E-105C
Others				
11	Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V , RS=1.5 kΩ CS=100 pF 10 time	MIL-883B-3015.1

Inspection after test: Inspection after 2～4 hours storage at room temperature ,the sample shall be free from defects:

1. Air bubble in the LCD.
2. Sealleak
3. Non-display.
4. Missing segments.
5. Glass crack.
6. Current Idd is twice higher than initial value.

8. QUALITY GUARANTEE

No	Item	Criteria
1	inclusions (black spot, white spot, dust)	(1)round type diameter mm(a*) no of defect* a≦0.20 neglect 0.20＜a≦0.35 5max 0.35＜a none (2)linear type **length mm(l) width mm(W) no. of defect** na W≦0.03 neglect l≦3 0.03＜W≦0.08 6 3＜l 0.08＜W none
2	scratch	1.scratch on protective film is permitted. 2.scratch on polarizer shall be as follow: (1)round type diameter mm(a*) no of defect a≦0.15 neglect 0.15＜a≦0.20 2 max 0.20＜a none (2)linear type be judged bye 1.-(2) linear type
3	dent	diameter ＜ 1.5mm
4	bubble	not exceeding 0.5mm average diameter is acceptable between glass and polarizing film
5	pin hole	(a+b)/2 ≦ 0.15mm maximum number: ignored 0.15＜(a+b)/2≦0.20mm maximum number:10
6	dot width	design width ±15%
7	dot defect	(a+b)/2≦0.20mm maximum number: ignored 0.20＜(a+b)/2≦0.30mm maximum number:5 x=width
8	contrast irregularity(spot)	diameter spec no of defect a≦0.50mm neglect 0.50＜a≦0.75 5 0.75＜a≦1.00 3 1.00＜a none
9	color tone and uniformity	obvious uneven color is not permitted

9. USING LCD MODULES

9-1. Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

(1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

(2) Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).

(3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(8) Do not put or attach anything on the display area to avoid leaving marks on.

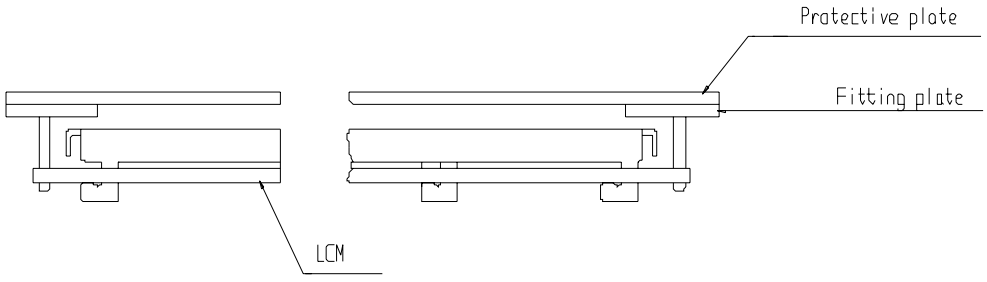
(9) Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).

(10) As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

9-2.Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

9-3. Precaution for Handing LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

(1) Do not alter, modify or change the shape of the tab on the metal frame.

(2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(3) Do not damage or modify the pattern writing on the printed circuit board.

(4) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

(5) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(6) Do not drop, bend or twist LCM.

LCM is easy to be damaged. Please note below and be careful for handling.

Correct handling:

As above picture, please handle with anti-static gloves around LCM edges.

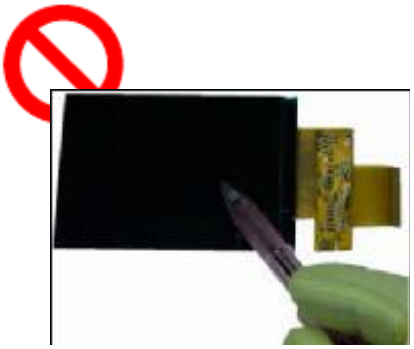
Incorrect handling:

Please don’t touch IC directly.

Please don’t stack LCM.

Please don’t hold the surface of panel.

Please don’t stretch interface of output, such as FPC cable.



Please don't hold the surface of IC. Please don't operate with sharp stick such as pens。

9-4.Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

(1) Make certain that you are grounded when handing LCM.

(2) Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.

(3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.

(4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

(5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

(6) To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

9-5. Precaution for soldering to the LCM

(1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.

- Soldering iron temperature : 280°C ± 10°C.
- Soldering time : 3-4 sec.
- Solder : eutectic solder.

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage dur to flux spatters.

(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and

time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

(3) When remove the electoluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

9-6.Precautions for Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (VO). Adjust VO to show the best contrast.

(2) Driving the LCD in the voltage above the limit shortens its life.

(3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.

(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used under the relative condition of 40°C , 50% RH.

(6) When turning the power on, input each signal after the positive/negative voltage becomes stable.

9-7. Storage

When storing LCDs as spares for some years, the following precaution are necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped.)

(4) Environmental conditions :

- Do not leave them for more than 168hrs. at 60°C.
- Should not be left for more than 48hrs. at -20°C.

9-8. Safety

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leakes out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

9-9.Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet's damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet's, conductors and terminals.