PRODUCT SPECIFICATION

MONO LCD MODULE
MODEL: G2612A0FTW3G-B0 Ver:1.0

< ◇> Preliminary Specification

< ◆> Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED BY

Revision Status

Version	Revise Date	Page	Content	Modified By
Ver. 1.0	2013-5-29		First Issued	

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1. FEATURES

The features of LCD are as follows

* Display mode :FSTN, Transmissive,Positive
* Drive IC : ST7586S
* Interface Input Data : 8-bit parallel (6800 or 8080), 4-Line & 3-Line Interface
* Driving Method : 1/128Duty, 1/12 Bias
* Viewing Direction : 6 O'clock
* Backlight : LED/ White
* Sample NO. : G2612A0FTW3G-B0_01/20130527

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	72.30(W) x 53.80(H) x 3.8(T)	mm
Number of Dots	268 x 128	Dots
View Display Area	63.30(W)MIN x 30.76(H)MIN	mm
Activity Display Area	59.22(W)x28.28(H)	mm
Dot Size	0.209(W) x 0.209(H)	mm
Dot Pitch	0.221(W) x 0.221(H)	mm

3. ELECTRICAL SPECIFICATIONS

3-1 ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	$V_{DD} – V_{SS}$	1.7		3.6	V
Supply Voltage For LCD Drive	$V_{op}= V_{LCD} – V_{SS}$	-		18	V
Input Voltage	Vin	$0.7V_{DD}$		V_{DD}	V
Operating Temp.	Top	-30	-	+80	°C
Storage Temp.	Tst	-30	-	+80	°C

*****. NOTE: The response time will be extremely slow when the operating temperature is around -10℃, and the back ground will become darker at high temperature operating.

3-2 -1 ELECTRICAL CHARACTERISTICS

Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic supply Voltage		V_{DD} - V_{SS}	V_{DD}=3.3V ± 5 % Ta = 25 °C	2.8	3.3	3.3	V
LCD Drive		V_{OP}=V_{LCD}–V_{SS}		13.2	13.5	13.8	V
Input Voltage	"H" Level	V_{IH}		0.7V_{DD}	-	-	V
	"L" Level	V_{IL}		-	-	0.3 V_{DD}	V
Frame Frequency		f_{FLM}		-	77	-	Hz
Current Consumption		I_{DD}		-	0.96	-	mA
LCD Lifetime		-		-	100000	-	Hrs

3-2-2 VOP Program Setting Table

VOP (0xC0)	0x00ED	0x00EE	0x00F1	0x00F3	0x00F6	0x00F8	0x00FA	0x00FD	0x00FF	0x00102	0x00105
VLCD	13.0V	13.1V	13.2V	13.3V	13.4V	13.5V	13.6V	13.7V	13.8V	13.9V	14.0V

3-3 BACKLIGHT

3-3-1. Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Current	IF	Ta = 25 °C	-	60	80	mA
Reverse Voltage	VR		-	-	5.0	V
Power Dissipation	PD		-	-	264	mW
LED Lifetime	-		-	20000	-	Hrs

3-3-2. Electrical-optical Characteristics

Item	Symbol	Condition	Min.		Typ.		Max.		Unit
Forward Voltage	VF	If=60mA Ta = 25 °C	3.0		3.3		3.3		V
Average Luminous Intensity	Iv		300		400		-		cd/m^2
Color Coordinates	-		X	Y	X	Y	X	Y	
			0.25	0.25	0.28	0.28	0.31	0.31	

The brightness is measured without LCD panel

3-3-3 The main material of Backlight

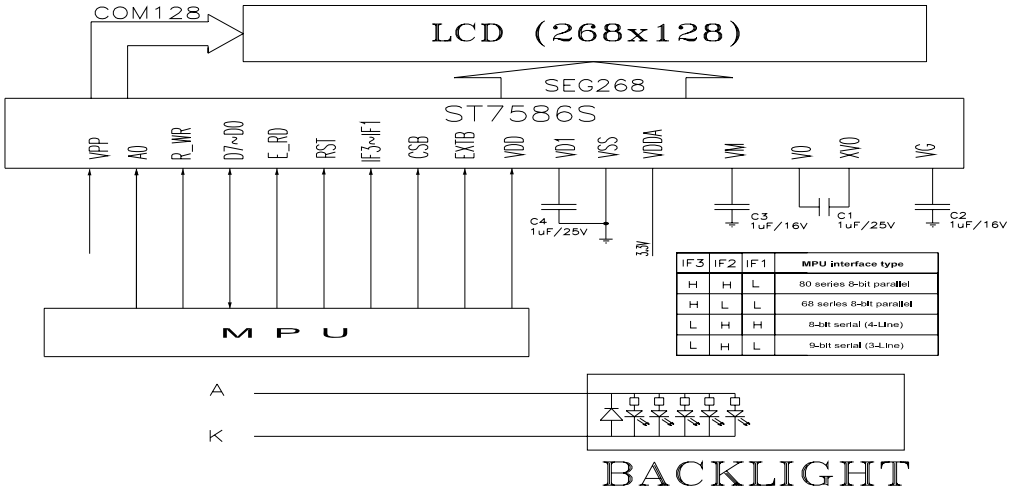
Frame is made of PC,and Light Guide Plate is PMMC.

4. TERMINAL FUNCTIONS AND BLOCK DIAGRAM

4-1. INTERFACE PIN FUNCTION DESCRIPTION

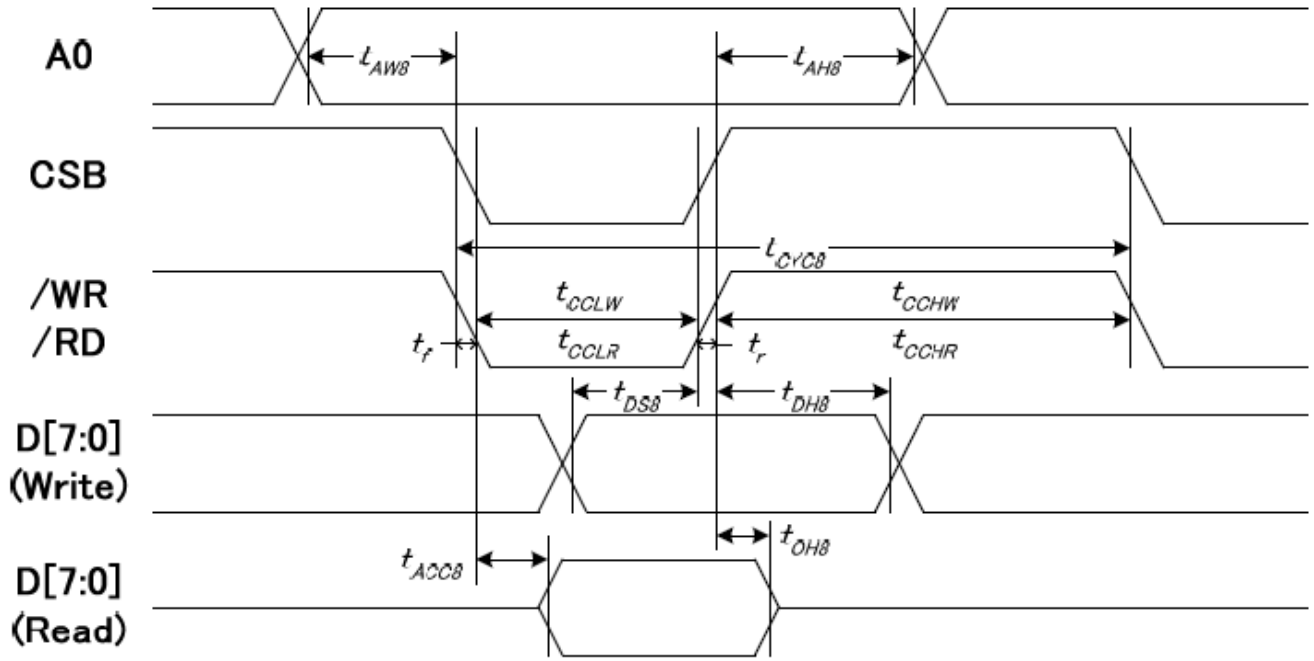
PIN NO.	SYMBOL	FUNCIONS
1	GND	Anti-shielding.
2	VG	VG is the power of SEG-drivers.
3	XV0	Negative operating voltage of COM-drivers.
4	V0	Positive operating voltage of COM-drivers.
5	VM	VM is the non-select voltage level of COM-drivers.
6	VDDA	Be separated in ITO and connected together by FPC or PCB.
7	VSS	Ground (0V).
8	VD1	Digital power source selection.
9	VDD	Supply voltage for logical circuit(3.3V).
10	EXTB	EXTB="L": Enable the extension operation mode.
11	CSB	Chip select input pin.
12~14	IF3~IF1	These pins select interface operation mode.
15	RST	Reset input pin.
16	E_RD	Read / Write execution control pin.
17~24	D7~D0	The bi-directional data bus of the MPU interface.
25	R_WR	Read / Write execution control pin.
26	A0	The function of the pin is different in parallel and serial interface.
27	VPP	The programming power supply of the built-in OTP.
28	GND	Anti-shielding.
29	K	Back light -.
30	A	Back light +(3.3V).

4-2. BLOCK DIAGRAM



5. TIMING CHARACTERISTICS

System Bus Timing for 8080 MCU Interface

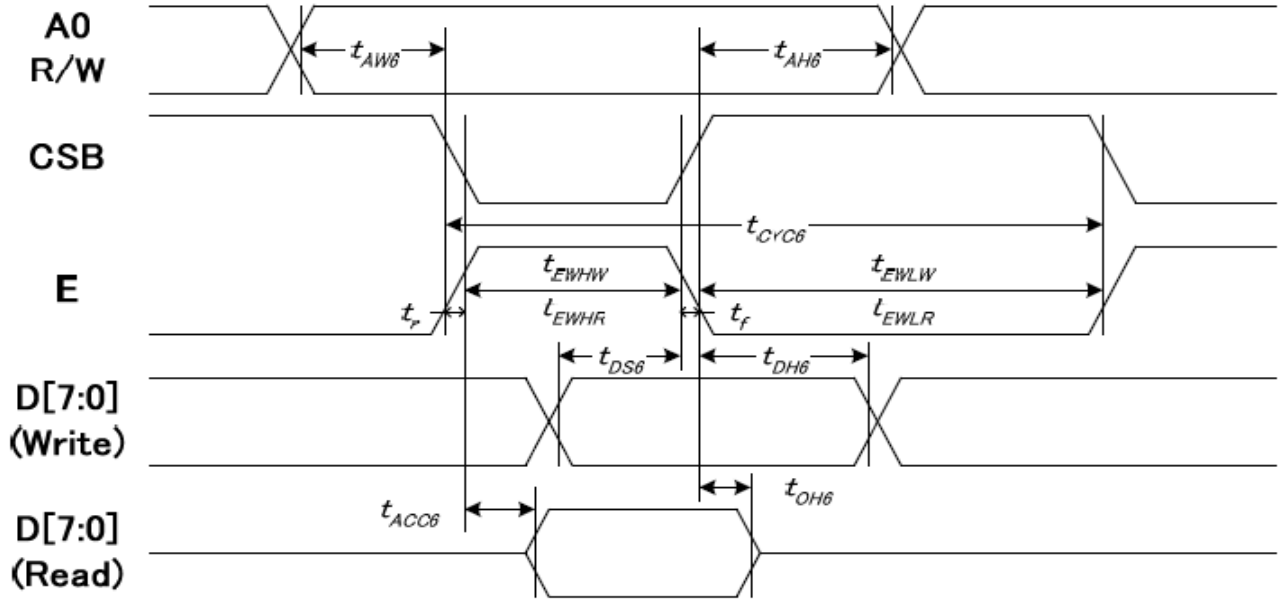


Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW8		0	—	ns
Address hold time		tAH8		0	—	
System cycle time (WRITE)	/WR	tCYC8		240	—	
/WR L pulse width (WRITE)		tCCLW		100	—	
/WR H pulse width (WRITE)		tCCHW		100	—	
System cycle time (READ)	RD	tCYC8		500	—	
/RD L pulse width (READ)		tCCLR		220		
/RD H pulse width (READ)		tCCHR		220		
WRITE Data setup time	D[7:0]	tDS8		20	—	
WRITE Data hold time		tDH8		20	—	
READ access time		tACC8	CL = 30 pF	—	100	
READ Output disable time		tOH8	CL = 30 pF	10	110	

Note:

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 VDD1 as the reference.
3. tCCLW and tCCLR are specified as the overlap between CSB being "L" and WR and RD being at the "L" level.

System Bus Timing for 6800 MCU Interface

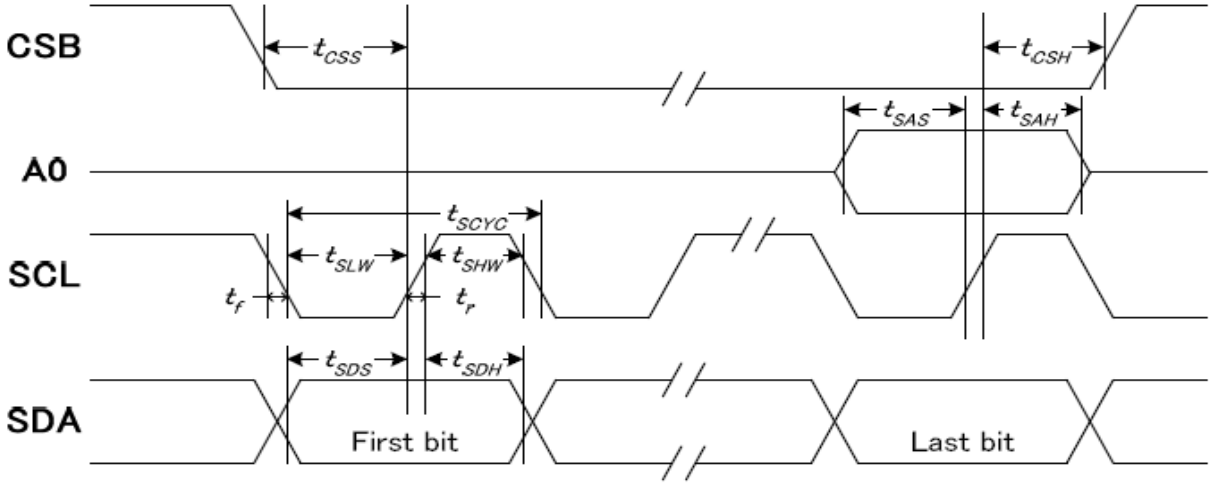


Item	Signal	Symbol	Condition	Min.	Max.	Unit
Address setup time	A0	tAW6		0	—	ns
Address hold time		tAH6		0	—	
System cycle time (WRITE)	E	tCYC6		240	—	
Enable L pulse width (WRITE)		tEWLW		100	—	
Enable H pulse width (WRITE)		tEWHW		100	—	
System cycle time (READ)		tCYC6		500		
Enable L pulse width (READ)		tEWLR		220	—	
Enable H pulse width (READ)		tEWHR		220		
Write data setup time	D[7:0]	tDS6		20	—	
Write data hold time		tDH6		20	—	
Read data access time		tACC6	CL = 16 pF	—	100	
Read data output disable time		tOH6	CL = 16 pF	10	110	

Note:

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) ≦ (tCYC6 – tEWLW – tEWHW) for (tr + tf) ≦ (tCYC6 – tEWLR – tEWHR) are specified.
2. All timing is specified using 20% and 80% of VDD1 as the reference.
3. tEWLW and tEWLR are specified as the overlap between CSB being "L" and E.

System Bus Timing for 4-Line SPI MCU Interface

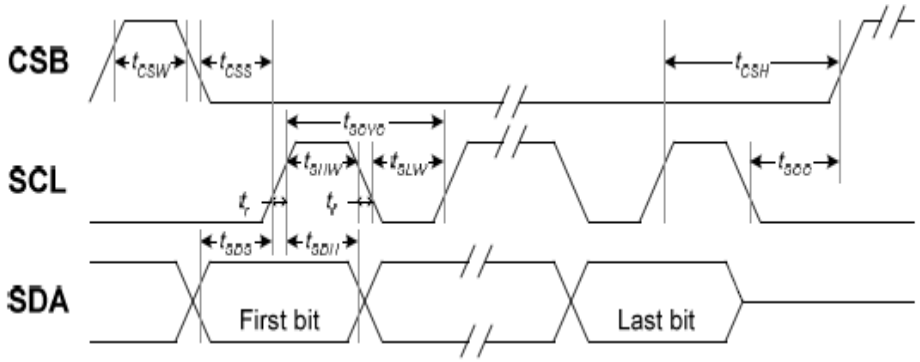


Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		200	—	ns
SCLK "H" pulse width		tSHW		140	—	
SCLK "L" pulse width		tSLW		60	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		20	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		20	—	
CSB-SCLK time	CSB	tCSS		30	—	
CSB-SCLK time		tCSH		30	—	

Note:

1. The input signal rise and fall time (tr, tf) are specified at 15 ns or less.
2. All timing is specified using 20% and 80% of VDD1 as the standard.

System Bus Timing for 3-Line SPI MCU Interface

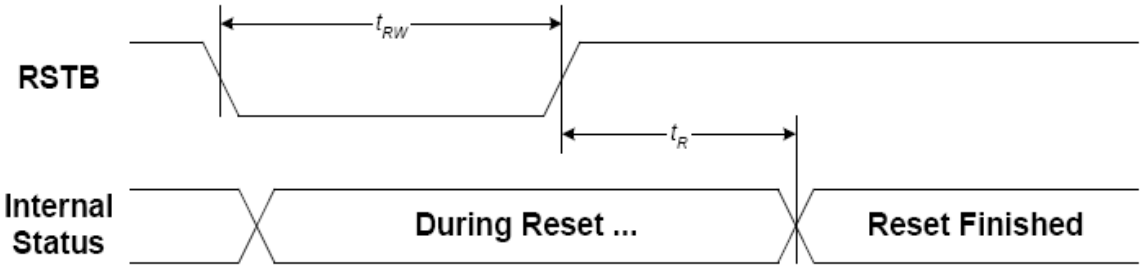


Item	Signal	Symbol	Condition	Rating		Unit
				Min.	Max.	
Serial Clock Period	SCLK	tSCYC		200	—	ns
SCL "H" pulse width		tSHW		140	—	
SCL "L" pulse width		tSLW		60	—	
Data setup time	SDA	tSDS		20	—	
Data hold time		tSDH		20	—	
CS-SCL time	CSB	tCSS		30	—	
		tCSH		30	—	
CS "H" pulse width		tCHW		0	—	

Note:

1. The input signal rise and fall time (tr, tf) are specified at 15 ns or less.
2. All timing is specified using 30% and 70% of VDD1 as the standard.

Reset Timing



VDD1 = 1.8V, Ta = 25°C

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		120	—	ms
Reset "L" pulse width	tRW		10	—	us

6. INSTRUCTION SET

6.1 INSTRUCTION Table

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
NOP	0	0	0	0	0	0	0	0	0	0	No operation
RESET	0	0	0	0	0	0	0	0	0	1	Software reset
Power Save	0	0	0	0	0	1	0	0	0	SLP	Set power save mode SLP=0: Sleep in mode SLP=1: Sleep out mode
Partial Mode	0	0	0	0	0	1	0	0	1	PTL	Set partial mode PTL=0: Partial mode on PTL=1: Partial mode off
Inverse Display	0	0	0	0	1	0	0	0	0	INV	Set inverse display mode INV=0: Normal display INV=1: Inverse display
All Pixel ON/OFF	0	0	0	0	1	0	0	0	1	AP	Set all pixel on mode AP=0: All pixel off mode AP=1: All pixel on mode
Display ON/OFF	0	0	0	0	1	0	1	0	0	DSP	Set LCD display DSP=0: Display off DSP=1: Display on
Set Column Address	0	0	0	0	1	0	1	0	1	0	Set column address Starting column address: 00h≦XS≦7Fh Ending column address: XS≦XE≦7Fh
	1	0	XS15	XS14	XS13	XS12	XS11	XS10	XS9	XS8	
	1	0	XS7	XS6	XS5	XS4	XS3	XS2	XS1	XS0	
	1	0	XE15	XE14	XE13	XE12	XE11	XE10	XE9	XE8	
	1	0	XE7	XE6	XE5	XE4	XE3	XE2	XE1	XE0	
Set Row Address	0	0	0	0	1	0	1	0	1	1	Set row address Starting row address: 00h≦YS≦9Fh Ending row address: YS≦YE≦9FH
	1	0	YS15	YS14	YS13	YS12	YS11	YS10	YS9	YS8	
	1	0	YS7	YS6	YS5	YS4	YS3	YS2	YS1	YS0	
	1	0	YE15	YE14	YE13	YE12	YE11	YE10	YE9	YE8	
	1	0	YE7	YE6	YE5	YE4	YE3	YE2	YE1	YE0	
Write Display Data	0	0	0	0	1	0	1	1	0	0	Write display data to DDRAM
	1	0	D7	D6	D5	D4	D3	D2	D1	D0	
Read Display Data	0	0	0	0	1	0	1	1	1	0	Read display data from DDRAM
	1	1	D7	D6	D5	D4	D3	D2	D1	D0	
Partial Display Area	0	0	0	0	1	1	0	0	0	0	Set partial area Partial display address start: 00h≦PTS≦9Fh Partial display address end: 00h≦PTE≦9Fh Display Area: 64≦Duty≦160
	1	0	PTS15	PTS14	PTS13	PTS12	PTS11	PTS10	PTS9	PTS8	
	1	0	PTS7	PTS6	PTS5	PTS4	PTS3	PTS2	PTS1	PTS0	
	1	0	PTE15	PTE14	PTE13	PTE12	PTE11	PTE10	PTE9	PTE8	
	1	0	PTE7	PTE6	PTE5	PTE4	PTE3	PTE2	PTE1	PTE0	
Scroll Area	0	0	0	0	1	1	0	0	1	1	Set scroll area Top Area: TA=00h~A0h Scrolling Area: SA=00h~A0h Bottom Area: BA=00h~A0h TA+SA+BA=160
	1	0	TA7	TA6	TA5	TA4	TA3	TA2	TA1	TA0	
	1	0	SA7	SA6	SA5	SA4	SA3	SA2	SA1	SA0	
	1	0	BA7	BA6	BA5	BA4	BA3	BA2	BA1	BA0	
Display Control	0	0	0	0	1	1	0	1	1	0	Set scan direction of COM and SEG MY=0: COM0→COM159 MY=1: COM159→COOM0 MX=0: SEG0→SEG383 MX=1: SEG383→SEG0
	1	0	MY	MX	0	0	0	0	0	0	
Start Line	0	0	0	0	1	1	0	1	1	1	Set display start line S=00h~9Fh
	1	0	S7	S6	S5	S4	S3	S2	S1	S0	

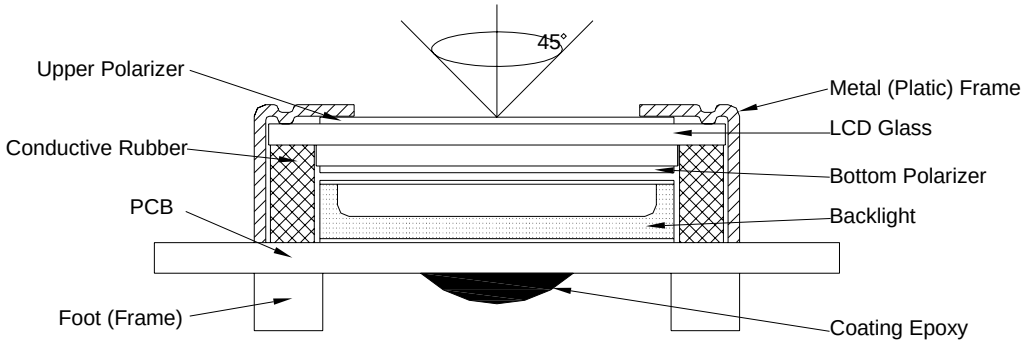
INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
Display Mode	0	0	0	0	1	1	1	0	0	M	Set display mode M=0: Gray mode M=1: Monochrome mode
Enable DDRAM Interface	0	0	0	0	1	1	1	0	1	0	Enable DDRAM interface
	1	0	0	0	0	0	0	0	1	0	
Display Duty	0	0	1	0	1	1	0	0	0	0	Set display duty DT=03h~9Fh
	1	0	DT7	DT6	DT5	DT4	DT3	DT2	DT1	DT0	
First Output COM	0	0	1	0	1	1	0	0	0	1	Set first output COM FC=00h~9Fh
	1	0	FC7	FC6	FC5	FC4	FC3	FC2	FC1	FC0	
FOSC Divider	0	0	1	0	1	1	0	0	1	1	Set FOSC dividing ratio
	1	0	0	0	0	0	0	0	FOD1	FOD0	
Partial Display	0	0	1	0	1	1	0	1	0	0	Set partial display mode
	1	0	1	0	1	0	0	0	0	0	
N-Line Inversion	0	0	1	0	1	1	0	1	0	1	Set N-Line inversion
	1	0	M	0	0	NL4	NL3	NL2	NL1	NL0	
Read Modify Write	0	0	1	0	1	1	1	0	0	RMW	Read modify write control RMW=0: Enable read modify write RMW=1: Disable read modify write
Set Vop	0	0	1	1	0	0	0	0	0	0	Set Vop
	1	0	Vop7	Vop6	Vop5	Vop4	Vop3	Vop2	Vop1	Vop0	
	1	0	-	-	-	-	-	-	-	Vop8	
Vop Increase	0	0	1	1	0	0	0	0	0	1	Vop increase one step
Vop Decrease	0	0	1	1	0	0	0	0	1	0	Vop decrease one step
BIAS System	0	0	1	1	0	0	0	0	1	1	Set BIAS system
	1	0	-	-	-	-	-	BS2	BS1	BS0	
Booster Level	0	0	1	1	0	0	0	1	0	0	Set booster level
	1	0	-	-	-	-	-	BST2	BST1	BST0	
Vop Offset	0	0	1	1	0	0	0	1	1	1	Set Vop offset
	1	0	0	VOF6	VOF5	VOF4	VOF3	VOF2	VOF1	VOF0	
Analog Control	0	0	1	1	0	1	0	0	0	0	Enable analog circuit
	1	0	0	0	0	1	1	1	0	1	
Auto Read Control	0	0	1	1	0	1	0	1	1	1	Auto read control XARD=0: Enable auto read XARD=1: Disable auto read
	1	0	1	0	0	XARD	1	1	1	1	
OTP WR/RD Control	0	0	1	1	1	0	0	0	0	0	OTP WR/RD control WR/RD=0: Enable OTP read WR/RD=1: Enable OTP write
	1	0	0	0	WR /RD	0	0	0	0	0	
OTP Control Out	0	0	1	1	1	0	0	0	0	1	OTP control out
OTP Write	0	0	1	1	1	0	0	0	1	0	OTP programming procedure
OTP Read	0	0	1	1	1	0	0	0	1	1	OTP up-load procedure
OTP Selection Control	0	0	1	1	1	0	0	1	0	0	OTP selection control Ctrl=0: Disable OTP Ctrl=1: Enable OTP
	1	0	0	Ctrl	0	1	1	0	0	1	
OTP Programming Setting	0	0	1	1	1	0	0	1	0	1	OTP programming setting
	1	0	0	0	0	0	1	1	1	1	

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
Frame Rate (Gray Scale Mode)	0	0	1	1	1	1	0	0	0	0	Frame rate setting in different temperature range (Gray scale mode)
	1	0	-	-	-	FRA4	FRA3	FRA2	FRA1	FRA0	
	1	0	-	-	-	FRB4	FRB3	FRB2	FRB1	FRB0	
	1	0	-	-	-	FRC4	FRC3	FRC2	FRC1	FRC0	
	1	0	-	-	-	FRD4	FRD3	FRD2	FRD1	FRD0	
Frame Rate (Monochrome Mode)	0	0	1	1	1	1	0	0	0	1	Frame rate setting in different temperature range (Monochrome mode)
	1	0	-	-	-	FRA4	FRA3	FRA2	FRA1	FRA0	
	1	0	-	-	-	FRB4	FRB3	FRB2	FRB1	FRB0	
	1	0	-	-	-	FRC4	FRC3	FRC2	FRC1	FRC0	
	1	0	-	-	-	FRD4	FRD3	FRD2	FRD1	FRD0	
Temperature Range	0	0	1	1	1	1	0	0	1	0	Temperature range setting
	1	0	-	TA6	TA5	TA4	TA3	TA2	TA1	TA0	
	1	0	-	TB6	TB5	TB4	TB3	TB2	TB1	TB0	
	1	0	-	TC6	TC5	TC4	TC3	TC2	TC1	TC0	
Temperature Gradient Compensation	0	0	1	1	1	1	0	1	0	0	Set temperature gradient compensation coefficient
	1	0	MT13	MT12	MT11	MT10	MT03	MT02	MT01	MT00	
	1	0	MT33	MT32	MT31	MT30	MT23	MT22	MT21	MT20	
	1	0	MT53	MT52	MT51	MT50	MT43	MT42	MT41	MT40	
	1	0	MT73	MT72	MT71	MT70	MT63	MT62	MT61	MT60	
	1	0	MT93	MT92	MT91	MT90	MT83	MT82	MT81	MT80	
	1	0	MTB3	MTB2	MTB1	MTB0	MTA3	MTA2	MTA1	MTA0	
	1	0	MTD3	MTD2	MTD1	MTD0	MTC3	MTC2	MTC1	MTC0	
	1	0	MTF3	MTF2	MTF1	MTF0	MTE3	MTE2	MTE1	MTE0	

7. QUALITY SPECIFICATIONS

7-1. LCM Appearance and Electric inspection Condition

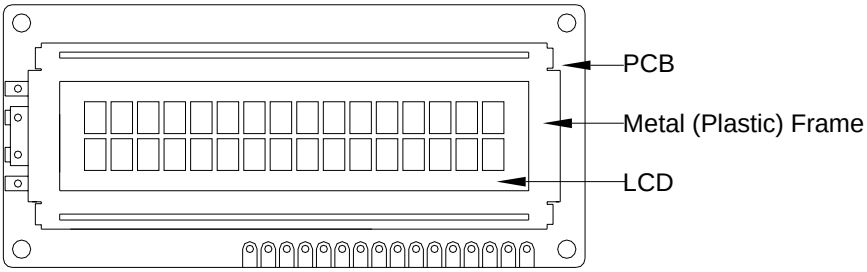
1. Inspection will be done by placing LCM 30cm away from inspector's eyeballs under normal illumination.



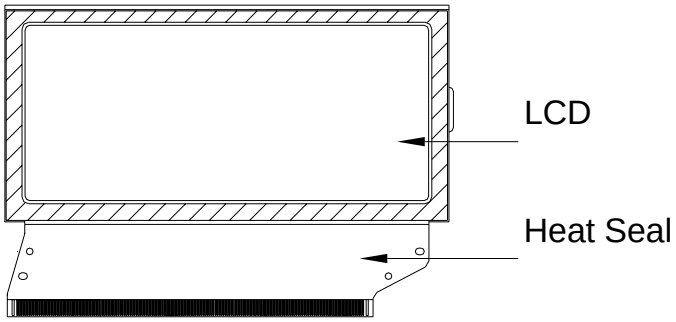
2. View Angle: with in 45˚around perpendicular line.

7-2. Definition

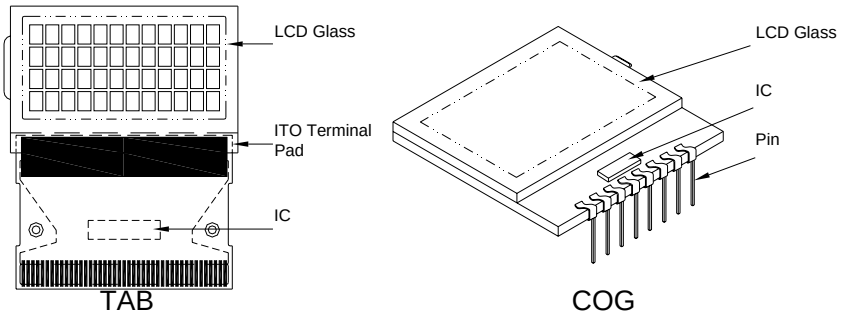
1. COB



2. Heat Seal



3. TAB and COG



7-3. Sampling Plan and Acceptance

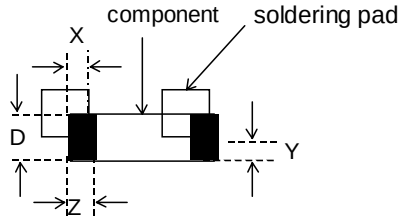
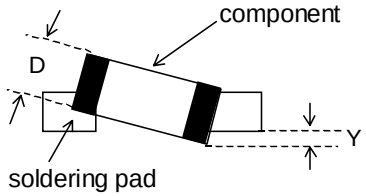
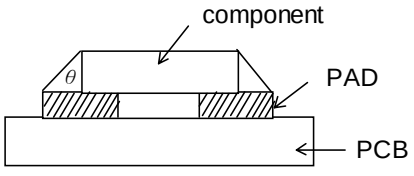
1. Sampling Plan
   MIL - STD - 105E (‖) ordinary single inspection is used.
2. Acceptance
   Major defect: AQL = 0.65%
   Minor defect: AQL = 1.5%

7-4. Criteria

1. COB

Defect	Inspection Item	Inspection Standards	
Major	PCB copper flakes peeling off	Any copper flake in viewing Area should be greater than 1.0mm^2	Reject
Major	Height of coating epoxy	Exceed the dimension of drawing	Reject
Major	Void or hole of coating epoxy	Expose bonding wire or IC	Reject
Major	PCB cutting defect	Exceed the dimension of drawing	Reject

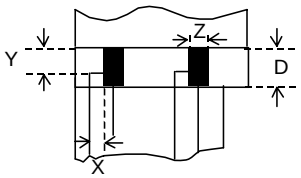
2. SMT

Defect	Inspection Item	Inspection Standards	
Minor	Component marking not readable		Reject
Minor	Component height	Exceed the dimension Of drawing	Reject
Major	Component solder defect (missing , extra, wrong component or wrong orientation		Reject
Minor	Component position shift 	X < 3/4Z Y > 1/3D	Reject Reject
Minor	Component tilt 	Y > 1/3D	Reject
Minor	Insufficient solder 	$\theta \leq 20^\circ$	Reject

3. Metal (Plastic) Frame

Defect	Inspection Item	Inspection Standards		
Major	Crack / breakage	Anywhere		Reject
Minor	Frame Scratch	W	L	Acceptable of Scratch
		w<0.1mm	Any	Ignore
		0.1≤w<0.2mm	L≤5.0mm	2
		0.2≤w<0.3mm	L≤3.0mm	1
		w≥0.3mm	Any	0
		Note : 1. Above criteria applicable to scratch lines with distance greater than 5mm. 2. Scratch on the back side of frame (not visible) can be ignored .		
Minor	Frame Dent , Prick $\Phi = \frac{L+W}{2}$			Acceptable of Dents / Pricks
		$\Phi \leq 1.0$mm		2
		$1.0 < \Phi \leq 1.5$mm		1
		$1.5\text{mm} < \Phi$		0
		Note : 1. Above criteria applicable to any two dents / pricks with distance greater than 5mm 2. Dent / prick on the back side of frame (not visible) can be ignored		
Minor	Frame Deformation	Exceed the dimension of drawing		
Minor	Metal Frame Oxidation	Any rust		

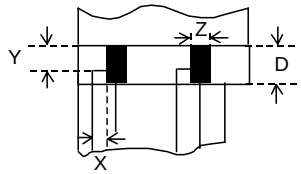
4. Flexible Film Connector (FFC)

Defect	Inspection Item	Inspection Standards	
Minor	Tilted soldering	Within the angle +5°	Acceptable
Minor	Uneven solder joint /bump		Reject
Minor	Hole $\Phi = \frac{L+W}{2}$	Expose the conductive line	Reject
		Φ > 1.0mm	Reject
Minor	Position shift 	Y > 1/3D	Reject
		X > 1/2Z	Reject

5. Screw

Defect	Inspection Item	Inspection Standards	
Major	Screw missing/loosen		Reject
Minor	Screw oxidation	Any rust	Reject
Minor	Screw deformation	Difficult to accept screw driver	Reject

6. Heat-seal 、TCP 、FPC

Defect	Inspection Item	Inspection Standards	
Major	Scratch expose conductive layer		Reject
Minor	HS Hole $\Phi = \frac{L+W}{2}$	Φ> 0.5mm	Reject
Major	Adhesion strength	Less than the specification	Reject
Minor	Position shift 	Y > 1/3D	Reject
		X > 1/2Z	Reject
Major	Conductive line break		Reject

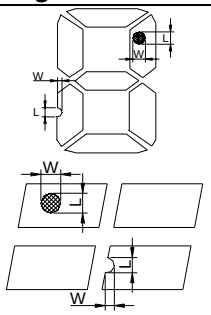
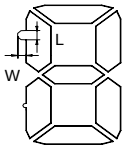
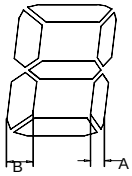
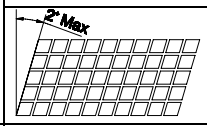
7. LED Backing Protective Film and Others

Defect	Inspection Item	Inspection Standards	
Minor	LED dirty, prick	Acceptable number of units	
		$\Phi \leq$0.10mm	Ignore
		0.10< $\Phi \leq$0.15mm	2
		0.15< $\Phi \leq$0.2mm	1
		Φ>0.2mm	0
		The distance between any two spots should be $\geq$5mm Any spot/dot/void outside of viewing area is acceptable	
Minor	Protective film tilt	Not fully cover LCD	Reject
Major	COG coating	Not fully cover ITO circuit	Reject

8. Electric Inspection

Defect	Inspection Item	Inspection Standards	
Major	Short		Reject
Major	Open		Reject

9. Inspection Specification of LCD

Defect	Inspect Item		Inspection Standards				
Minor	Linear Defect	∗ Glass Scratch ∗ Polarizer Scratch ∗ Fiber and Linear material	W	W≤0.03		0.03<W≤0.05	W>0.05
			L	L<5		L<3	Any
			ACC. NO.	1		1	Reject
			Note	L is the length and W is the width of the defect			
Minor	**Black Spot and Polarizer Pricked**	∗ Foreign material between glass and polarizer or glass and glass ∗ Polarizer hole or protuberance by external force	Φ	Φ≤0.1	0.1<Φ≤0.15	0.15<Φ≤0.2	Φ>0.2
			ACC. NO.	3EA / 100mm^2	2	1	0
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	White Spot and Bubble in polarizer	∗ Unobvious transparent foreign material between glass and glass or glass and polarizer ∗ Air protuberance between polarizer and glass	Φ	Φ≤0.3	0.3<Φ≤0.5	0.5<Φ	
			ACC. NO.	3EA / 100mm^2	1	0	
			Note	Φ is the average diameter of the defect. Distance between two defects > 10mm.			
Minor	Segment Defect		Φ	Φ≤0.10	0.10<Φ≤0.20	0.20<Φ≤0.25	Φ>0.25
			ACC. NO.	3EA / 100mm^2	2	1	0
			Note	W is more than 1/2 segment width			Reject
				$\Phi = \frac{L + W}{2}$ Distance between two defect is 10mm			
Minor	Protuberant Segment	 Φ = (L + W) / 2	Φ	Φ≤0.10	0.10<Φ≤0.20	0.20<Φ≤0.25	Φ>0.25
			W	Glue	W≤1/2 Seg W≤0.2	W≤1/2 Seg W≤0.2	Ignore
			ACC. NO.	3EA / 100mm^2	2	1	0
Minor	Assembly Mis-alignment		1. Segment				
			B	B≤0.4mm	0.4<B≤1.0mm	B>1.0mm	
			B-A	B-A<1/2B	B-A<0.2	B-A<0.25	
			Judge	Acceptable	Acceptable	Acceptable	
			2. Dot Matrix				
			Deformation>2°				Reject
Minor	Stain on LCD Panel Surface		Accept when stains can be wiped lightly with a soft cloth or a similar one. Otherwise, judged according to the above items: “Black spot” and “White Spot”				

8. RELIABILITY

NO.	Item	Condition	Criterion
1	High Temperature Operating	80℃, 96Hrs	No defect in cosmetic and operational function allowable. Total current Consumption should be below double of initial value.
2	Low Temperature Operating	-30℃, 96Hrs	
3	High Humidity	40℃, 90%RH, 96Hrs	
4	High Temperature Storage	80℃, 96Hrs	
5	Low Temperature Storage	-30℃, 96Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2g 2 Hrs per direction(X,Y,Z)	
7	Thermal Shock	-30℃ to25℃ to80℃ (60Min) (5Min) (60Min) 16Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 4kV and –1 ~ –4kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.
		Air Discharge Voltage: +1 ~ 6kV and –1 ~ -6kV	

Note: 1) Above conditions are suitable for our company standard products.
2) For restrict products, the test conditions listed as above must be revised.

9. HANDLING PRECAUTION

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizes which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

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

- Isopropyl alcohol
- Ethyl alcohol
- Tricolors triflers thane

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

Do not use the following solvent:

- Water- Ketenes- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

- Modules use 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.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.However those phenomena do not mean malfunction or out of order with LCD's. Which will come back in the specified operating temperature range.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is required.

(6) Storage

In the case of storing for a long period of time (for instance.) For years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

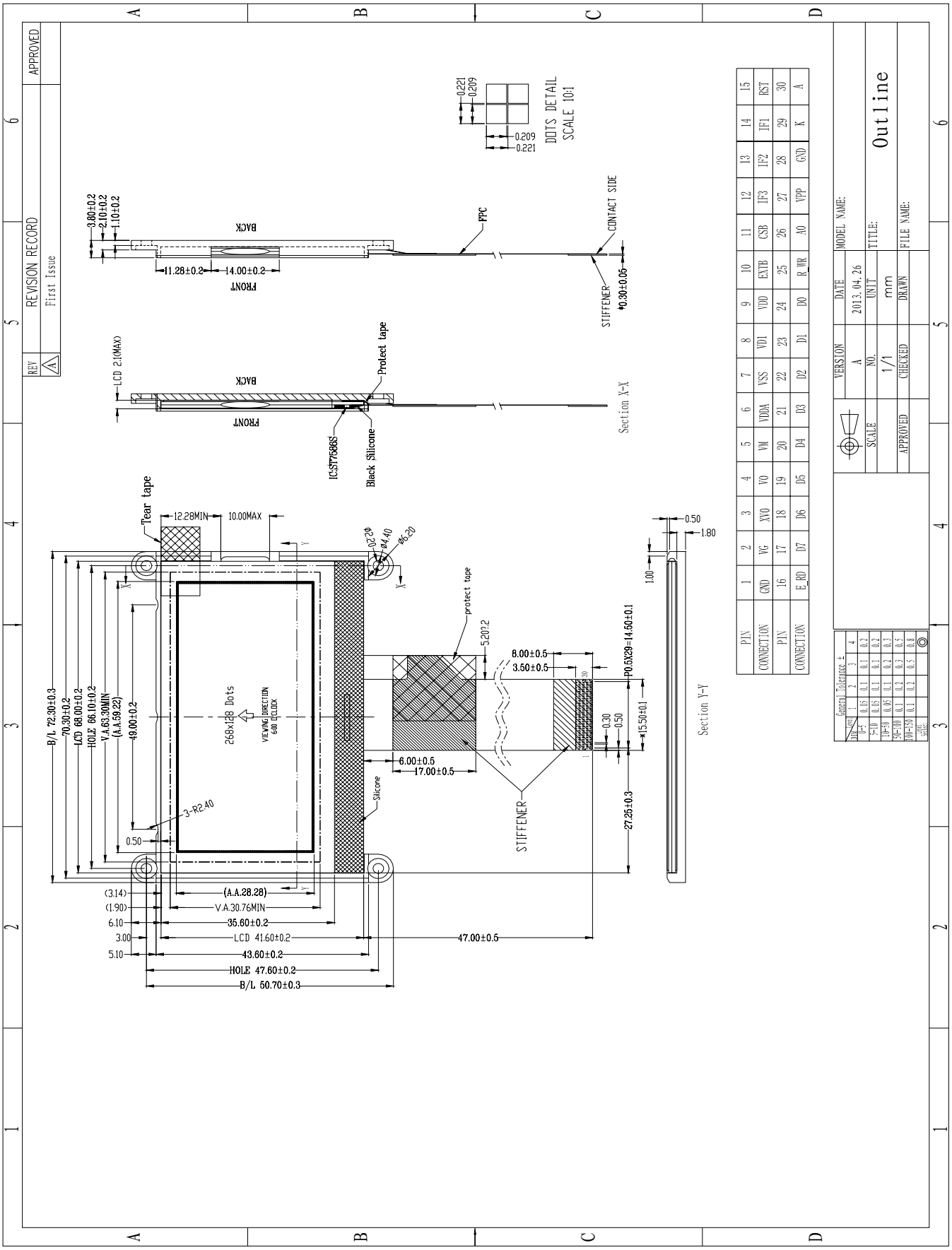
(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol.

Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

10. OUTLINE DIMENSION



P1N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CONNECTION	GND	VG	XVO	VO	VM	VDDA	VSS	VD1	VDD	EXTB	CSB	IF3	IF2	IF1	RST
P1N	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CONNECTION	E_RD	D7	D6	D5	D4	D3	D2	D1	D0	R_WR	A0	VPP	GND	K	A

General Tolerance ±				
DIM / Limit	1	2	3	4
0~3	0.05	0.1	0.1	0.2
3~10	0.05	0.1	0.1	0.2
10~30	0.06	0.1	0.2	0.3
30~100	0.1	0.2	0.3	0.5
100~150	0.1	0.2	0.5	0.8