MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI10032A-G-1

Revision	1.0
Engineering	
Date	
Our Reference	

REVISION RECORD

Version	Page	Revision Items	Name	Date
1.0		First release		2008.12.14

TABLE OF CONTENTS

1 Description

The MI10032A-G-1, Graphics LCM unit consists of 100(segment) x 32(common) dots dot-matrix LCD panel, LCD driver, controller LSI on a single LCD. Incorporating display data RAM in the controller LSI, the unit can efficiently display the desired graphic under microprocessor control.

◆　Wide viewing direction.
◆　Wide Operating temperature.
◆　Requirements on environmental protection: RoHS.

2 Features

Item	Contents
LCD type	FSTN
	positive
LCD Duty	1/33
LCD Bias	1/6
Polarizer	transflective
LCD background color	white
Segment color	blue-black
Backlighting	--
Backlighting type	LED
Backlighting color	Yellow-green
Backlighting drive	--
View direction	6:00
Operating temperature	-20℃~60℃
Storage temperature	-30℃~70℃
Controller	ST7565R
Frame	--
Technology	COG
Power supply	VDD=3.0V
Data Transfer	Serial

Notes:
● Color tone can slightly change with temperature and driving voltage.
● Color tone will be changed by backlight.

3 Absolute maximum ratings (Without LED backlighting ,Ta=25℃)

Parameter	Symbol	Min	Max	Unit	Remark
Logic circuit supply voltage	V_{DD}	-0.3	+3.6	V	
LCD driving voltage	V_{LCD}	-0.3	+13.5	V	
Operating temperature range	Top	-20	+60	℃	No Condensation
Storage temperature range	Tst	-30	+70	℃	

Note :

- LCD operating voltage $V_{LCD}=V_0 - V_{SS.}$
- If the module is above these absolute maximum ratings. It may become permanently damaged.
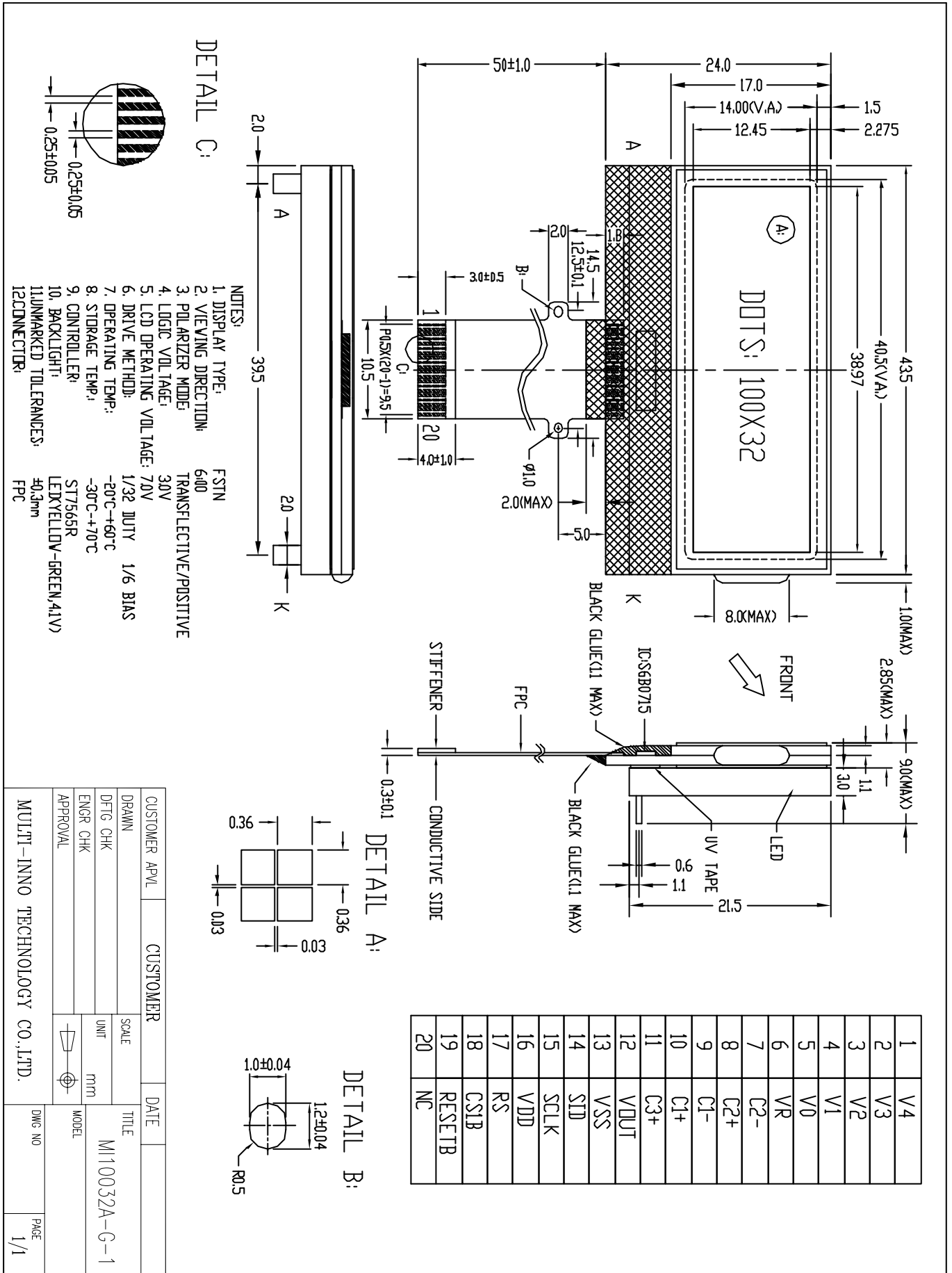- $V_{DD} > V_{SS}$ must be maintained.

4 Mechanical Characteristics

4.1 Mechanical features

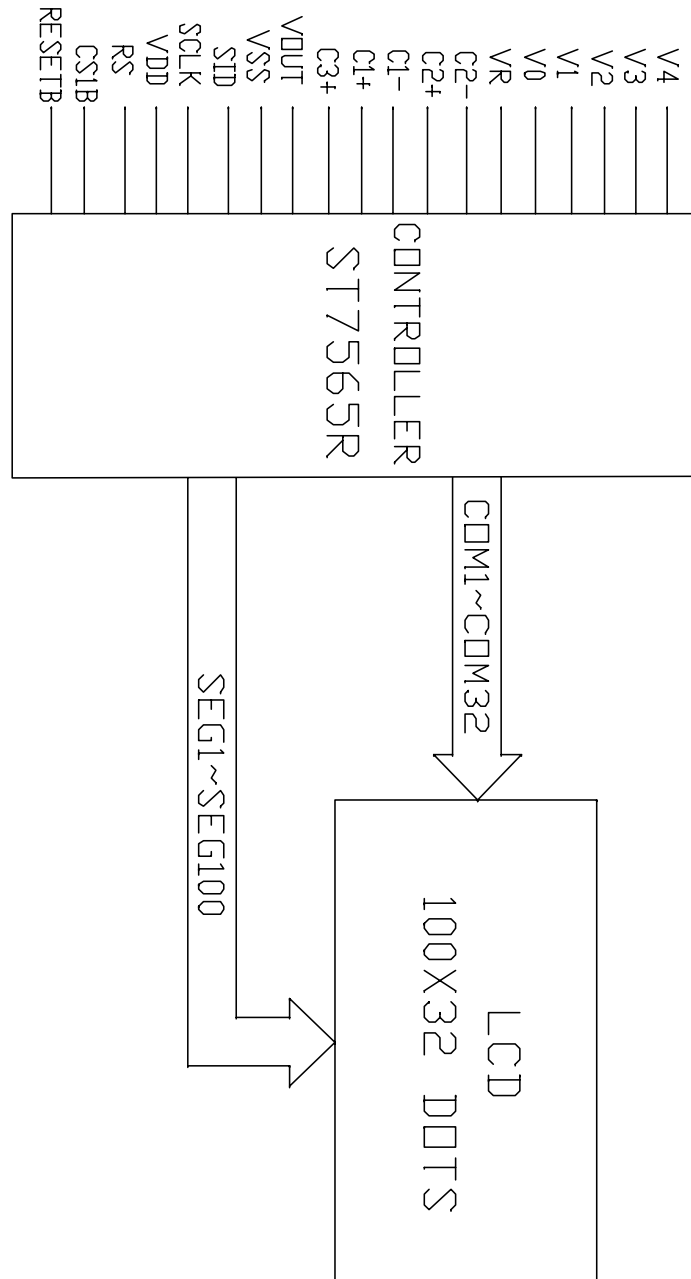| Parameter	Standard Value	Unit
Display type	Graphics module	--
Character size(W×H)	--	mm
Number of dots/characters (W×H)	100 x 32	--
View area (W×H)	40.5 x 14.0	mm
Active Area (W×H)	38.97 x 12.45	mm
Dot Size (W×H)	0.36 x 0.36	mm
Dot Pitch (W×H)	0.39 x 0.39	mm
Module size(W×H×D)	43.5 x 24.0 x 9.0(MAX) *	mm
Module total weight (approx)	TBD	g
Module outline dimensions	Refer to page 5-"Mechanical drawing"	--

Note: The dimension does not include the length of FPC
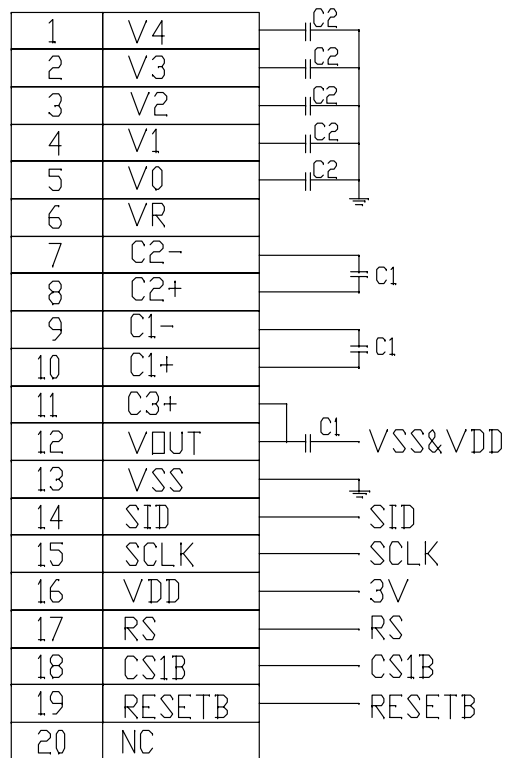
4.2 Mechanical drawing.

DETAIL C:

NOTES:
1. DISPLAY TYPE: FSTN
2. VIEWING DIRECTION: 6:00
3. POLARIZER MODE: TRANSFLECTIVE/POSITIVE
4. LOGIC VOLTAGE: 3.0V
5. LCD OPERATING VOLTAGE: 7.0V
6. DRIVE METHOD: 1/32 DUTY 1/6 BIAS
7. OPERATING TEMP.: -20°C-+60°C
8. STORAGE TEMP.: -30°C-+70°C
9. CONTROLLER: ST7565R
10. BACKLIGHT: LED(YELLOW-GREEN,4.1V)
11.UNMARKED TOLERANCES: ±0.3mm
12.CONNECTOR: FPC

DETAIL A:

DETAIL B:

CUSTOMER APVL | CUSTOMER
DRAWN
DFTG CHK
ENGR CHK
APPROVAL

MULTI-INNO TECHNOLOGY CO.,LTD.

SCALE | UNIT | DATE
mm

TITLE
MODEL
DWG NO

MI10032A-G-1

PAGE 1/1

1	V4
2	V3
3	V2
4	V1
5	V0
6	VR
7	C2-
8	C2+
9	C1-
10	C1+
11	C3+
12	VOUT
13	VSS
14	SID
15	SCLK
16	VDD
17	RS
18	CS1B
19	RESETB
20	NC

5 Circuit

5.1 Block Diagram

5.2 Recommend interface circuit

1	V4
2	V3
3	V2
4	V1
5	V0
6	VR
7	C2-
8	C2+
9	C1-
10	C1+
11	C3+
12	VOUT
13	VSS
14	SID
15	SCLK
16	VDD
17	RS
18	CS1B
19	RESETB
20	NC

Note:

Item	Set value	units
C1	1.0 to 4.7	uF
C2	0.1 to 4.7	uF

C1 and C2 are determined by the size of
the LCD being driven

6 Interface description .

Pin No.	Symbol	I/O	Description
1	V_4	--	Multi-level power supply for the liquid crystal drive.
2	V_3	--	Multi-level power supply for the liquid crystal drive.
3	V_2	--	Multi-level power supply for the liquid crystal drive.
4	V_1	--	Multi-level power supply for the liquid crystal drive.
5	V_0	--	Multi-level power supply for the liquid crystal drive.
6	VR	--	Output voltage regulator terminal.
7	C2-	--	DC/DC voltage converter.
8	C2+	--	DC/DC voltage converter.
9	C1-	--	DC/DC voltage converter.
10	C1+	--	DC/DC voltage converter.
11	C3+	--	DC/DC voltage converter.
12	V_{OUT}	--	DC/DC voltage converter.
13	V_{SS}	0V	Ground
14	SID	I/O	The serial data input
15	SCLK	I/O	The serial clock input
16	V_{DD}	3.0V	Power supply voltage for logic
17	RS	I/O	Determines whether the data bits are data or command.
18	CS1B	I/O	Chip Enable Signal (active at low)
19	RESETB	I/O	Reset Signal (Initialize at low)
20	NC	--	No connect.

7 Instruction Code & Timing characteristics

7.1 COMMAND

The module   MI10032A-G-1   include the controller-ST7565R. When indirect mode is selected for the system interface, use commands to set up the display. The table below lists the types of commands, including the code of each command. more details refer to ST7565R data sheet please.

| Command	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 / 1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit				0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 / 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 / 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 / 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 / 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565R)
(12) Read-modify-write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0 / 1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V_0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value						
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 / 1	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	Mode	Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
				0	0	0	0	0	0	step-up value		
(21) Power save	0	1	0									Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

Note: "*" means ignored data

7.2 Interface Timing characteristics

Note: Please refer to IC: ST7565R   data sheet for more details.

7.2.1 Clock timing

4-line SPI Interface
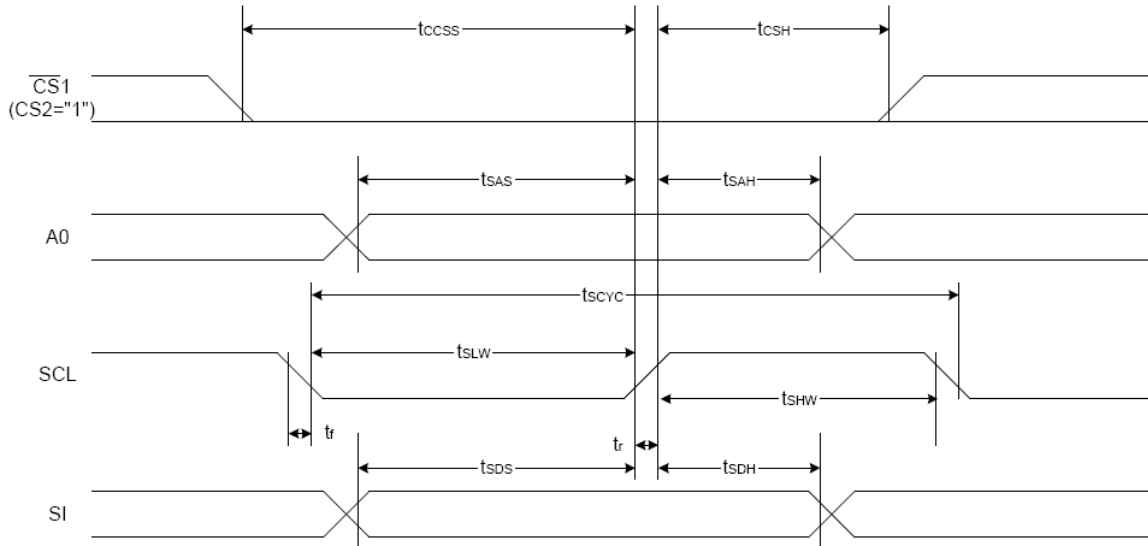
(V$_{DD}$ = 3.3V,Ta = −30 to 85°C)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
4-line SPI Clock Period	SCL	T$_{scyc}$		50	—	ns
SCL "H" pulse width		T$_{shw}$		25	—	
SCL "L" pulse width		T$_{SLW}$		25	—	
Address setup time	A0	T$_{SAS}$		20	—	
Address hold time		T$_{sah}$		10	—	
Data setup time	SI	T$_{sds}$		20	—	
Data hold time		T$_{SDH}$		10	—	
CS-SCL time	CS	T$_{css}$		20	—	
CS-SCL time		T$_{csh}$		40	—	

(V$_{DD}$ = 2.7V,Ta = −30 to 85°C)

Item	Signal	Symbol	Condition	Rating Min.	Rating Max.	Units
4-line SPI Clock Period	SCL	T$_{scyc}$		100	—	ns
SCL "H" pulse width		T$_{SHW}$		50	—	
SCL "L" pulse width		T$_{SLW}$		50	—	
Address setup time	A0	T$_{SAS}$		30	—	
Address hold time		T$_{SAH}$		20	—	
Data setup time	SI	T$_{SDS}$		30	—	
Data hold time		T$_{SDH}$		20	—	
CS-SCL time	CS	T$_{CSS}$		30	—	
CS-SCL time		T$_{CSH}$		60	—	

7.2.2 Reset timing
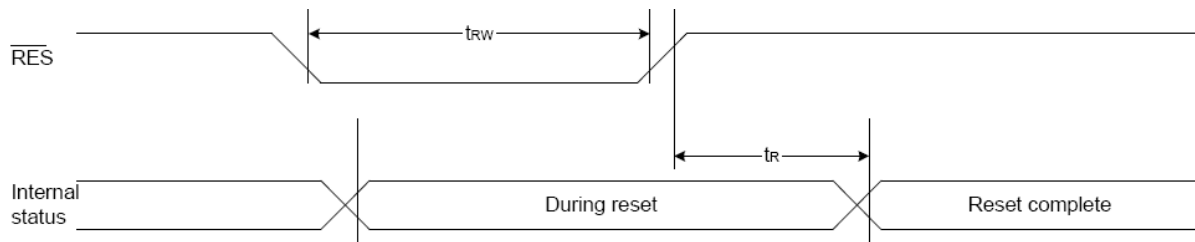
(V$_{DD}$ = 3.3V,Ta = −30 to 85°C)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t$_R$		—	—	1.0	us
Reset "L" pulse width	/RES	t$_{RW}$		1.0	—	—	us

(V$_{DD}$ = 2.7V,Ta = −30 to 85°C)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t$_R$		—	—	2.0	us
Reset "L" pulse width	/RES	t$_{RW}$		2.0	—	—	us

7.3 Initialization flow map

7.3.1 When the built-in power is being used immediately after turning on the power:


```
┌──────────────────────────────────┐
│      Power ON Flow: Start        │
└──────────────────────────────────┘
┌──────────────────────────────────┐
│      Turn ON the power           │
│   and keep /RES pin at "L"       │
└──────────────────────────────────┘
┌──────────────────────────────────┐
│    Wait for the power stabilized │
└──────────────────────────────────┘
┌──────────────────────────────────┐
│   Release reset state (/RES = "H")│
│  Wait for reset circuit finished (<1ms)│
└──────────────────────────────────┘
┌──────────────────────────────────┐
│   Initialized state (Default) ...*1│
└──────────────────────────────────┘
┌──────────────────────────────────┐
│  Function setup by command       │
│  (user setting)                  │
│  (11) LCD bias setting ...*2     │
│  (8) ADC selection ...*3         │
│  (15) Common output mode         │
│  selection ...*4                 │
└──────────────────────────────────┘
┌──────────────────────────────────┐
│  Function setup by command       │
│  (user setting)                  │
│  (17) Set internal V0 regulator resistor ratio│
│  for V0 voltage ...*5            │
│  (18) Electronic volume control ...*6│
└──────────────────────────────────┘
┌──────────────────────────────────┐
│  Function setup by command       │
│  (user setting)                  │
│  (16) Power control setting ...*7│
└──────────────────────────────────┘
┌──────────────────────────────────┐
│   Initialize DDRAM (Page 0~8)    │
└──────────────────────────────────┘
┌──────────────────────────────────┐
│     Initialization Finished      │
└──────────────────────────────────┘
```

Arrange to execute all these procedures from releasing the reset state to setting the power control within 5ms.
In case of other models, execute the procedures from turning on the power to setting the power control in 5ms.

* The target time of 5ms will result to vary depending on the panel characteristics and the capacitance of the smoothing capacitor. Therefore, we suggest you to conduct an operation check using the actual equipment.

Notes: Refer to respective sections or paragraphs listed below.
     *1: Description of functions; Resetting circuit
     *2: Command description; LCD bias setting
     *3: Command description; ADC selection
     *4: Command description; Common output state selection
     *5: Description of functions; Power circuit & Command description; Setting the built-in resistance radio for regulation of the V_0 voltage
     *6: Description of functions; Power circuit & Command description; Electronic volume control
     *7: Description of functions; Power circuit & Command description; Power control setting

7.3.2 When the built-in power is not being used immediately after turning on the power:

* The target time of 5ms will result to vary depending on the panel characteristics and the capacitance of the smoothing capacitor. Therefore, we suggest you to conduct an operation check using the actual equipment.

Notes: Refer to respective sections or paragraphs listed below.
*1: Description of functions; Resetting circuit
*2: Command description; LCD bias setting
*3: Command description; ADC selection
*4: Command description; Common output state selection
*5: Description of functions; Power circuit & Command description; Setting the built-in resistance radio for regulation of the V_0 voltage
*6: Description of functions; Power circuit & Command description; Electronic volume control
*7: Description of functions; Power circuit & Command description; Power control setting
*8: The power saver ON state can either be in sleep state or stand-by state.
    Command description; Power saver START (multiple commands)

8 Electrical characteristics

V_{SS}=0V,   Ta=25℃

Parameter		Symbol	Condition	MIN	TYP	MAX	UNIT
Logic circuit supply voltage		V_{DD}	--	2.8	3.0	3.2	V
Input voltage for logic circuit	"H"level	V_{IH}	V_{DD}=3.0V	0.8 V_{DD}	--	V_{DD}	
	"L"level	V_{IL}		V_{SS}	--	0.2 V_{DD}	
Output voltage for logic circuit	"H"level	V_{OH}		0.8 V_{DD}	--	V_{DD}	
	"L"level	V_{OL}		V_{SS}	--	0.2 V_{DD}	
Logic power supply current (Without backlighting)		I_{CC}		--	--	5.5	mA
Used driver IC		ST7565R of Sitronix					

9 Optical Characteristics
9.1 Optical Characteristics

Ta=25℃

Parameter		Symbol	Ratings			Unit	Measuring Temp.	Reference
			Min	Type	Max.			
Operating voltage		V_o	6.7	7.0	7.3	V	25℃	〔Note9-1〕
Frame frequency		f	--	64	--	Hz		〔Note9-2〕
Contrast ratio		Cr(θ=20°, Φ=90° or 270°)	3	--	--		25℃	〔Note9-3〕
Response time	Turn on	t_{on}			300	ms	25℃	〔Note9-4〕
	Turn off	t_{off}			300	ms	25℃	
Viewing angle (Cr≥2)	Up-down	θ1 (Φ=90° or	--	-20~30	--	deg	25℃	〔Note9-5〕
	Left-right	θ2 (Φ=0° or 180°)	--	-30~30	--	deg	25℃	

Note: All the value in this table is theoretics.

〔Note9-1〕 The maximum and minimum ratings don't mean the LCD works well in the whole range of Vo. Vo must be adjusted to optimize the viewing angle and contrast. Refer to definition of drive voltage, refer to 9.2.

〔Note9-2〕The frequency shouldn't be too low to avoid flicker. Refer to definition of drive voltage, refer to 9.2.

〔Note9-3〕 Refer to 9.2/9.3/9.4/9.5.

〔Note9-4〕 The selected state is dark and non-selected state is white(or bright) with positive type, reversely the selected state is white (or bright) and non-selected state is dark with negative type. Refer to 9.6 definition of response time.

〔Note9-5〕 Generally the viewing direction is 6:00 or12:00, sometimes 3:00 or 9:00. The range of left to right and up to down based on Cr=2 show the viewing angle. Viewing angle range isn't the range of defects inspection. Refer to 9.4.

9.2 Definition of drive voltage

(1) Definition of drive voltage and waveform
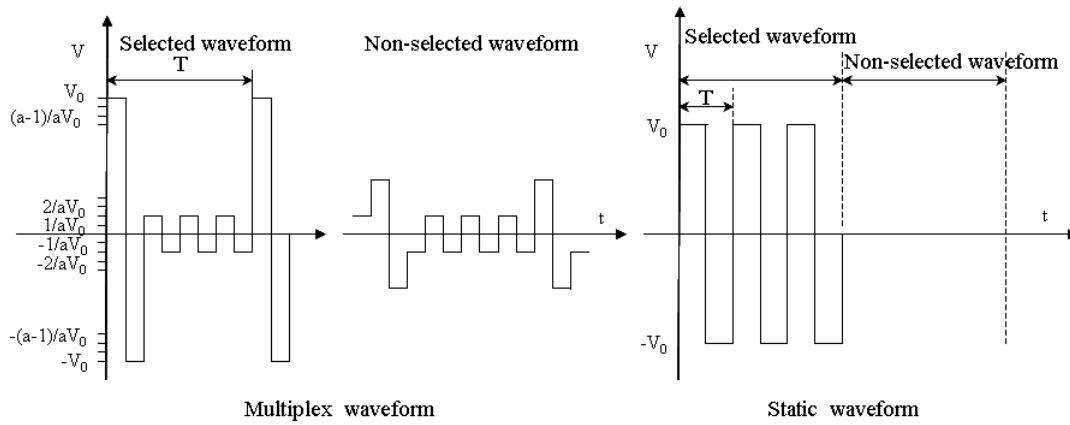
Fig.1 Definition of drive voltage and waveform

Operating voltage：V_o Frame frequency: f=1/T

Duty: 1/N   Bias: 1/a

(2) Operating voltage: V_o

Multi-inno can evaluate whether the LCD can be redesigned to obtain customer preferable performance if customer's LCD drive voltage isn't adjustable.

9.3 Optical characteristics measurement equipment and method

The setup and test method are showed in fig.2. Test methods are different according to different illumination mode.

Transmissive mode: light resource is placed at the back of LCD.

Reflective mode and transflective mode: light resource is placed at the front side of LCD.
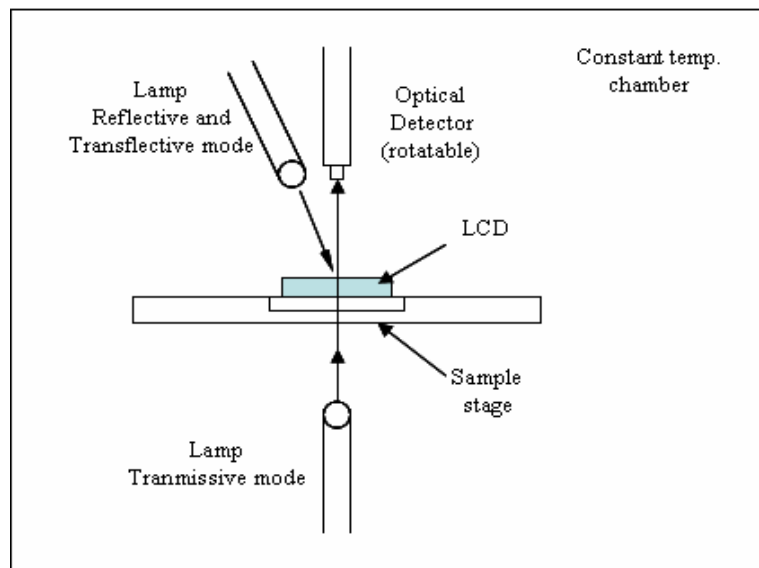
Fig.2 Optical characteristics measurement equipment

The chamber temperature, light resource and driving signal should be stable before testing. If test the characteristics under high or low temperature, the test system should be stable for more than 10 minutes before testing.

9.4 Definition of viewing direction

Refer to the graph below marked by θ and Φ
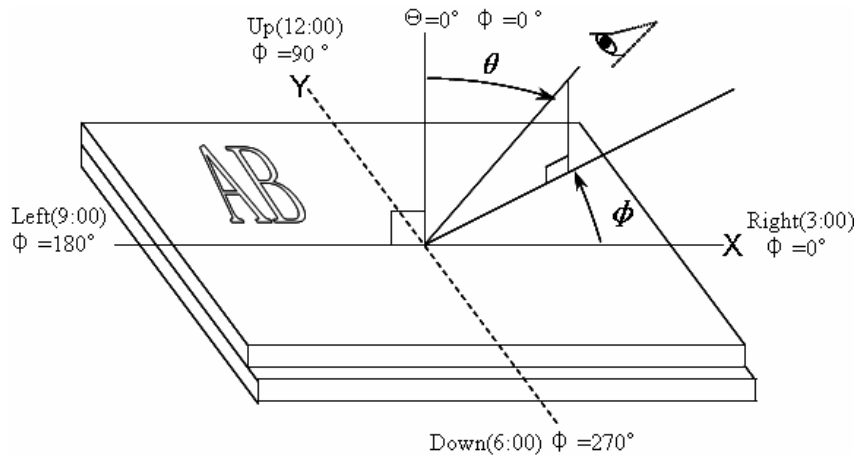
Fig.3 Definition of viewing direction

9.5 Definition of contrast ratio

Contrast ratio can be calculated by the formula (9-1) below for positive type. If the LCD is negative type, Cr (θ, Φ) is equal to luminance (θ, Φ, non-selected state) divided by luminance (θ, Φ, selected state). Note3-4 shows the relationship between selected state, non-selected state and bright state, dark state.

$$Cr(\theta,\phi) = \frac{L_2}{L_1} = \frac{Luminance(\theta,\phi)\,(Bright\ state)}{Luminance(\theta,\phi)\,(Dark\ state)} \quad\quad (9\text{-}1)$$
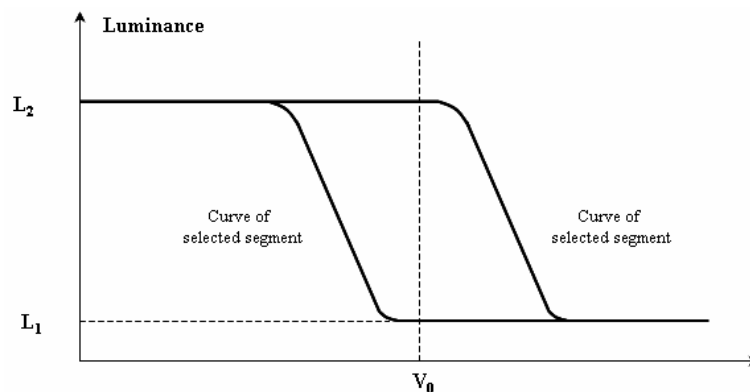
Fig.4 Electro-optical characteristic (EOC) graph (positive type)

9.6 Definition of response time

Turn on time (rise time):　$t_{on} = t_d + t_r$ (from non-selected state to selected state)
Turn off time (fall time):　$t_{off} = t_D + t_R$ (from selected state to non-selected state)
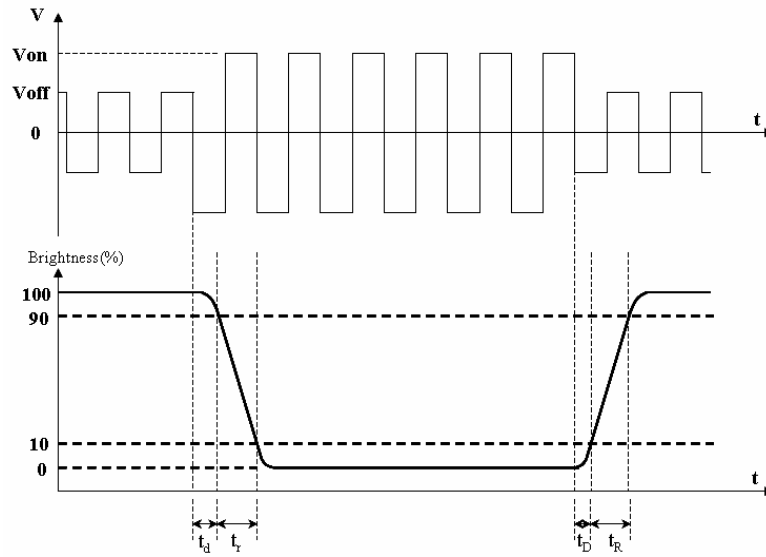
Fig.5 Definition of response time (positive type)

3.7 Definition of viewing angle
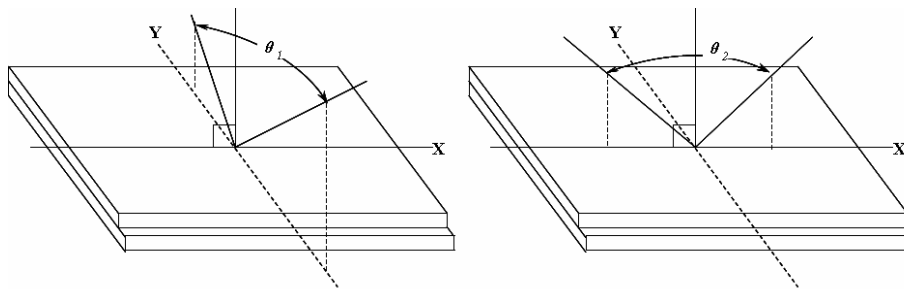
Fig 6 Definition of viewing angle

θ_1 ——range of viewing angle from up to down

θ_2 ——range of viewing angle from left to right.

10 Reliability

10.1 Content of Reliability Test   Ta=25℃

No	Test Item	Test condition	Criterion
1	High Temperature Storage	70℃±2℃ 120H Restore 2H at 25℃ Power off	After testing, cosmetic and electrical defects should not happen.
2	Low Temperature Storage	-30℃±2℃ 120H Restore 2H at 25℃ Power off	
3	High Temperature Operation	60℃±2℃ 120H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 120H Restore 4H at 25℃ Power on	
5	High Temperature & Humidity Operation	40℃±2℃ 90%RH 120H Power on	
6	Temperature Cycle	−30℃←→25℃←→80℃ 30min 5min 30min after 10cycle, Restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s^2, 120min	
8	Shock Test	Half-sine wave,300m/s^2,11ms	
9	Drop Test(package state)	800mm, concrete floor,1corner, 3edges, 6 sides each time	1.After testing, cosmetic and electrical defects should not happen. 2.the product should remain at initial place 3.Product uncovered or package broken is not permitted.

Notes:
1. Each test item applies for a test sample only once, The test sample can not be used again in any other test item.
2. The test sample is inspected after 2 hours or more storing at room temperature and room humidity after each test item is finished.
3. The criteria refer to 10.2.

10.2 Inspection of criteria

Remark NO.	Content
1	Functional test is OK. Missing Segment, shorts, unclear segment, nondisplay, display abnormally, liquid crystal leak are unallowable.
2	After testing, cosmetic defects should not happen, no low temperature bubbles, seal loose and fall, frame rainbow, ACF bubble growing are unallowable in the appearance test.
3	Total current consumption should not be over 10% of initial value.
4	After tests being executed, Contrast must be larger than 70% of its initial value prior to the tests.
5	No glass crack, chipped glass, end seal loose frame crack and so on.
6	No structure loose and fall.

11 Quality level

11.1 Classification of defects

Major defects (MA): A major defect refers to a defect that may substantially degrade usability for product applications, including all functional defects (such as no display, abnormal display, open or missing segment, short circuit, missing component), outline dimension beyond the drawing, progressive defects and those affecting reliability.

Minor defects (MI): A minor defect refers to a defect which is not considered to be able to substantially degrade the product application or a defect that deviates from existing standards almost unrelated to the effective use of the product or its operation, such as black spot, white spot, bright spot, pinhole, black line, white line, contrast variation, glass defect, polarizer defect, etc.

11.2 Definition of inspection range

For LCD defects, dividing two areas to make a judgment (according figure 1). 　A zone : Inside Viewing area 　B zone : Outside Viewing area 　X1(A.A~V.A): 2mm　　X2(A.A~V.A): 2mm 　Y1(A.A~V.A): 2mm　　Y2(A.A~V.A): 2mm	 Figure 1

11.3 Inspection items and general notes
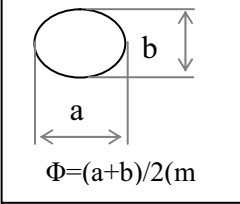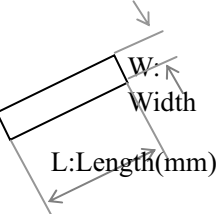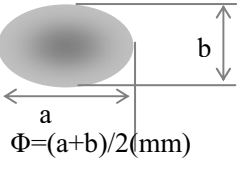
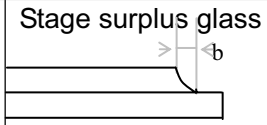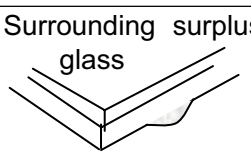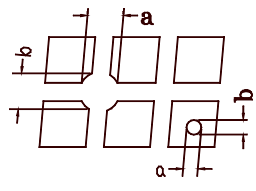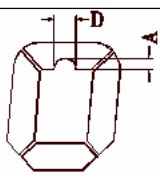|		
General notes	①Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and Multi-inno. ②Viewing area should be the area which Multi-inno guarantees. ③Limit sample should be prior to this Inspection standard. ④Viewing judgment should be under static pattern. ⑤Inspection conditions 　Inspection distance: 250 mm (from the sample)　　Temperature　　: 25±5 ºC 　Inspection angle　: 45 degrees in 12 o'clock direction (all defects in viewing area should be inspected from this direction)	
Inspection items	Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble	The color of a small area is different from the remainder. The phenomenon doesn't change with voltage
	Contrast variation	The color of a small area is different from the remainder. The phenomenon changes with voltage
	Polarizer defect	Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass
	Functional defect	no display, display abnormally, open or missing segment, short circuit, False viewing direction
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass
	Segment defect	Pin holes or cracks in segment, Transformation of segment
	PCB defect	Components assembly defect
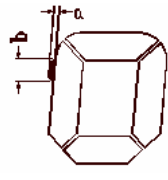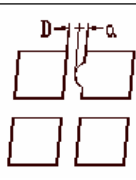
11.4 Outgoing Inspection level
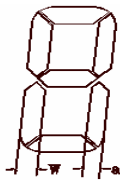
Outgoing Inspection standard	Inspection conditions	Inspection				
		Min.	Max.	Unit	IL	AQL
Major Defects	See 11.3 general notes	See　11.5			II	0.65
Minor Defects	See 11.3 general notes	See　11.5			**II**	1.5
Note：Sampling standard conforms to GB2828						
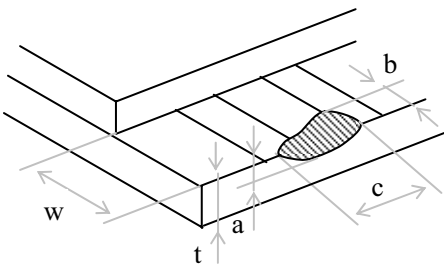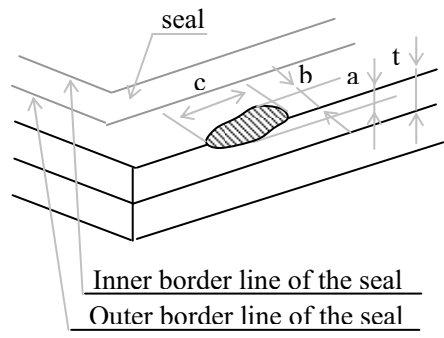
11.5 Inspection Items and Criteria
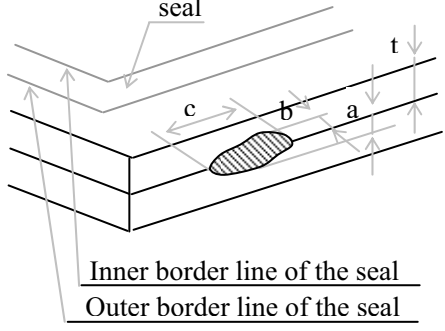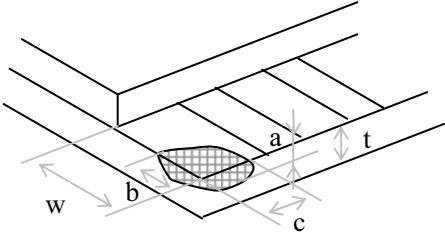
Inspection items			Judgment standard			
			Category		Acceptable number	
					A zone	B zone
1	Black spot,White spot, Bright Spot, Pinhole, Foreign Particle, Particle in or on glass, Scratch on glass	$\Phi=(a+b)/2(m$	A	$\Phi \leqq 0.10$	Neglected	Neglected
			B	$0.10<\Phi \leqq 0.20$	3	
			C	$0.20<\Phi$	0	
2	Black line, White line, Particle Between Polarizer and glass, Scratch on glass	W:Width L:Length(mm)	A	$W \leqq 0.02$	Neglected	Neglected
			B	$0.02<W \leqq 0.05$ $L \leqq 3.0$	3	
			C	$W>0.05$ or $L>3.0$	0	
3	Contrast variation	$\Phi=(a+b)/2(mm)$	A	$\Phi \leqq 0.2$	Neglected	Neglected
			B	$0.2<\Phi \leqq 0.3$	2	
			C	$0.3<\Phi \leqq 0.4$	1	
			D	$0.4<\Phi$	0	
			Total defective point(B,C)		3	
4	Bubble inside cell		any size		none	none
5	Polarizer defect (if Polarizer is used)	Scratch ,damage on polarizer, Particle on polarizer or between polarizer and glass.	Refer to item 1 and item 2.			
		Bubble, dent and convex	A	$\Phi \leqq 0.3$	Neglected	Neglected
			B	$0.3<\Phi \leqq 0.7$	2	

			C	0.7<Φ	0	
6	Surplus glass	Stage surplus glass	b≦0.3mm			
		Surrounding surplus glass	Should not influence outline dimension and assembling.			
7	Open segment or open common		Not permitted			
8	Short circuit		Not permitted			
9	False viewing direction		Not permitted			
10	Contrast ratio uneven		According to the limit specimen			
11	Crosstalk		According to the limit specimen			
12	Black /White spot(display)		Refer to item 1			
13	Black /White line(display)		Refer to item 2			
14	Pin holes and cracks in segment		not counted	Max.3 dots allowed		Max.3 dots allowed
			x<0.1mm	0.1mm≤x≤0.2mm		
			x=(a+b)/2			
			not counted	Max.2 dots allowed each segment		
			A<0.1mm	0.1mm≤A≤0.2mm D<0.25mm		
15	Transformation of segment		not counted	Max.1 defect allowed each segment		Max.3 defects allowed
			x<0.1mm	0.1mm≤x≤0.2mm		
			x=(a+b)/2			
			not counted	Max.1 defect allowed each segment		
			a<0.1mm	0.1mm≤a≤0.2mm D>0		

		$0.8W \leq a \leq 1.2W$ a=measured value of width W=nominal value of width	Max.2 defects allowed

		Inspection items		Judgment standard		
				Category(application: B zone)		Acceptable number
17	Glass defect crack	①The front of lead terminals	A	$a \leq t$, $b \leq 1/5W$, $c \leq 3mm$		Max.3 defects allowed
			B	Crack at two sides of lead terminals should not cover patterns and alignment mark		
		②Surrounding crack—non-contact side		b < Inner borderline of the seal		

seal

Inner border line of the seal
Outer border line of the seal

③ Surrounding crack— contact side
seal

Inner border line of the seal
Outer border line of the seal

b < Outer borderline of the seal

④Corner

A	$a \leqq t$, $b \leqq 3.0$, $c \leqq 3.0$
B	Glass crack should not cover patterns u and alignment mark and patterns.

Inspection items			Judgment standard
			Category(application: B zone)
18	PCB defect	Component soldering: No cold soldering、short、open circuit、burr、tin ball The flat encapsulation component position deviation must be less than 1/3 width of the pin (Pic.1); the sheet component deviation: Pin deviates from the pad and contact with the near components is not permitted（Pic.2）	
		lead defect: The lead lack must be less than 1/3 of its width; The lead burr must be less than 1/3 of the seam; Impurities connect with the near leads is not permitted	
		Connector soldering: Soldering tin is at contact position of the plug and socket is not permitted No foundation is scald Serious cave distortion on plug and socket contact pin is not permitted	
		Glue on root of the speaker receiver and motor lead: The insulative coat of the lead must join into the PCB; the protected glue must envelop to the insulative coat.	

12 Precautions for Use of LCD Modules

12.1 Handling Precautions

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

12.1.2 Liquid in LCD is hazardous substance, 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, thoroughly and promptly wash it off using soap and water.

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

12.1.4 Don't touch, push or rub the exposed polarizer covering the display surface of the LCD module with anything harder than an HB pencil lead, the polarizer is soft and easily scratched, handle it carefully.

12.1.5 Don't put or attach anything on the display area to avoid leaving any marks on.

12.1.6 If the display surface is contaminated or becomes dusty, breathe on the surface and gently wipe it with a soft dry cloth. do not scrub hard to avoid damage the surface. If still not completely clear, moisten cloth with one of the following solvents:

  — Isopropyl alcohol
  — Ethyl alcohol

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

  — Water
  — Ketone
  — Aromatic solvents

12.1.7 Do not attempt to disassemble the LCD Module.

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

12.1.9 Avoid using the same display pattern long time (continous ON segment).Software must be prepared so that the pattern will be changed

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

 a. Be sure to ground the body and electric appliances when handling the LCD Modules. It is preferable to use conductive mat on table and wear cotton clothes or conductive processed fibre. Synthetic fibre is not recommended.

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

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

 d. The LCD Module is coated with a film to protect the display surface. Be careful and slow when peeling off this protective film since static electricity may be generated. It is recommended to use ionic fan or machine when operating. It is recommended to remove the protection foil slowly (> 3 sec.).

 e. It is preferable to wear gloves etc, to avoid damaging the LCD. Please do not touch electrodes with bare hands or avoid any other contamination.

12.2 Storage precautions

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

12.2.2 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 :   5℃ ～ 40℃

                  Relatively humidity: ≤80%

12.2.3 The LCD modules should be stored in a clean environment or room, free from acid, alkali and harmful gas.

12.2.4 Store the module in anti-static electricity container and without any physical load.

12.3 Transportation precautions

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

12.4 Soldering

12.4.1 Use the high quality solders, only solder the I/O terminals.

12.4.2 No higher than 280℃ and time less than 3-4 second during soldering.

12.4.3 Rewiring: no more than 3 times.

12.4.4 when you remove connector or cable soldered to I/O terminals, please confirm that solder is fully melted. If you remove by force, electrodes at I/O terminals may be damaged (or stripped off). It is recommended to use solder suction machine.

13. LCD Module Part Numbering System

MI 10032 A G 1

① ② ③ ④ ⑤

NO.	Explanation
①	**MULTI-INNO module indicating**
②	**Module type: 100 columns X 32 rows, 5 DIGITS**
③	**Module series**
④	**LCD type**
	G | COG
⑤	**Version number**