

Product Specification

Product Name: 60301

Product Code : B JL160160-030W-E002

Customer
Approved by Customer
Approved Date:

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REVISION RECORD

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1 Overview

60301 is a monochrome LCD display module with 160×160 dot matrix.

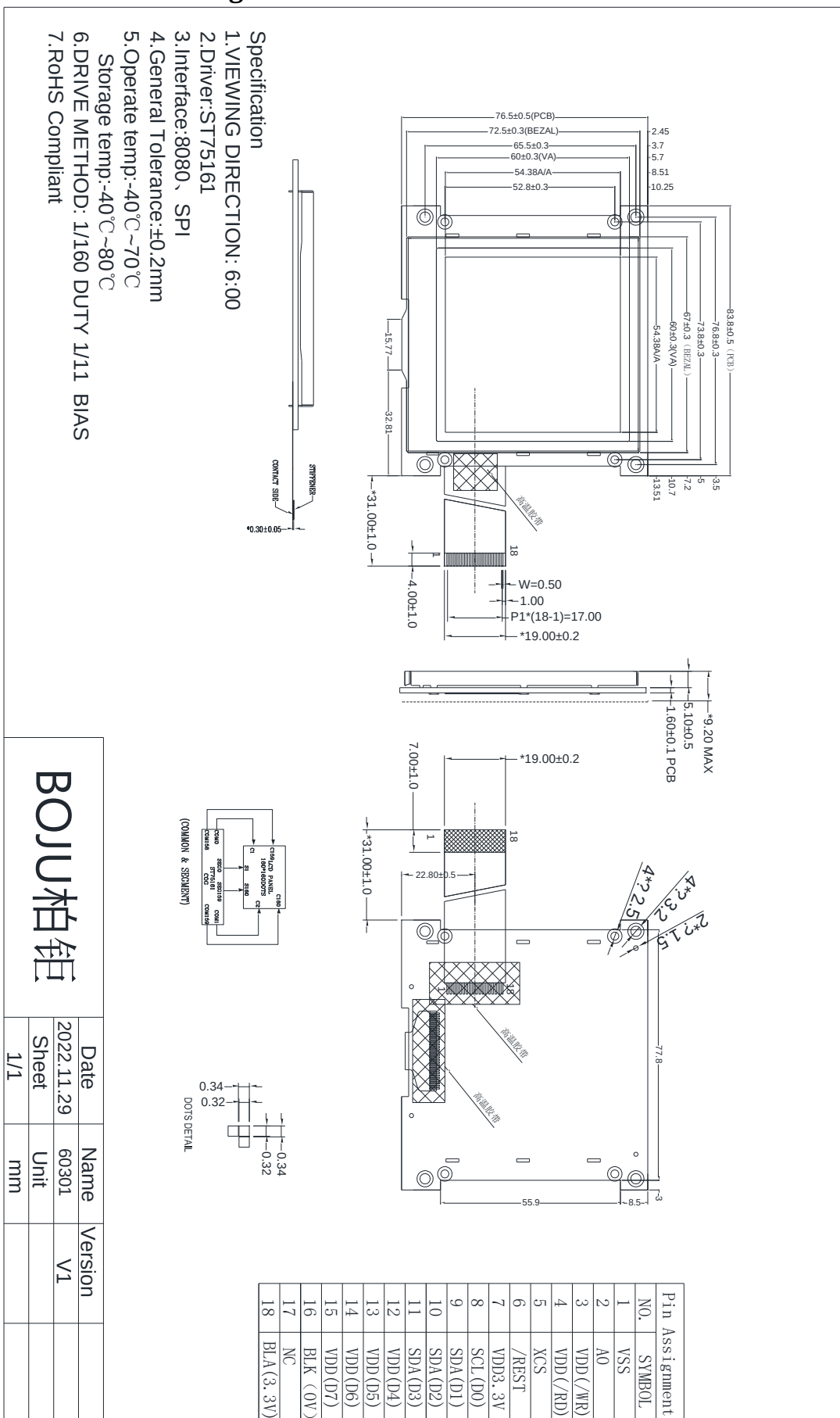
2 Features

- Dot Matrix:160×160
- Driver IC: ST75161
- Interface: 4- SPI
- Wide range of operating temperature: -40℃ to 80℃

3 Mechanical Data

NO.	ITEM	SPECIFICATION	UNIT
1	LCD type	FSTN POSITIVE	-
2	Viewing direction	6:00	O'Clock
3	Module size (H*W*T)	83.8*76.5*9.2(MAX)	mm
4	Active area (H*W)	54.38*54.38	mm
5	Driver IC	ST75161	-
6	Number of dots	160*160	-
7	Backlight type	8 LEDS	
8	Interface type	Serial interface	-
9	Operating temperature	-40 ~ 70	℃
10	Storage temperature	-40 ~ 80	℃

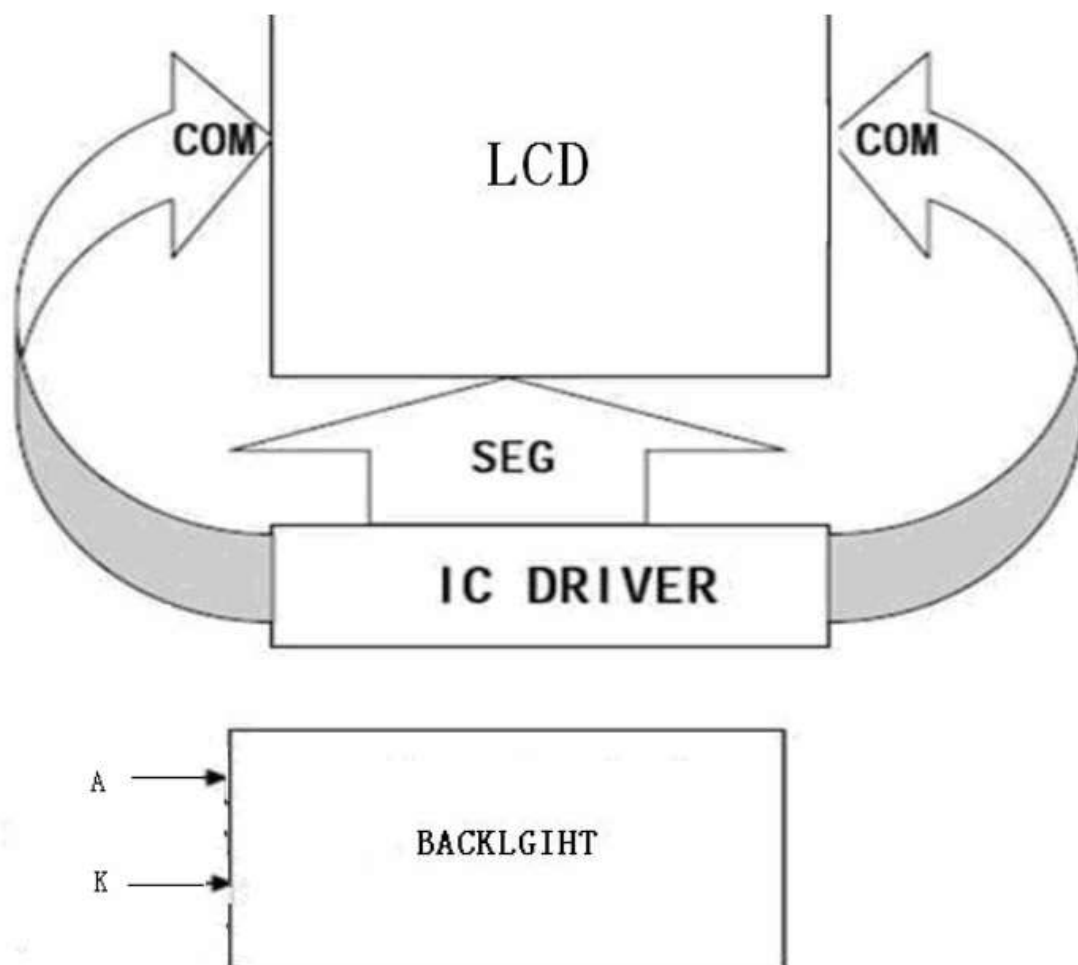
4 Mechanical Drawing



5 Module Interface

PIN NO.	PIN NAME	DESCRIPTION
1	VSS	This is a ground pin.
2	A0	Data/Command control pin. H: Data; L : Command.
3	VDD(WR)	Power supply,3.3V..
4	VDD(RD)	Power supply,3.3V..
5	CS#	Chip Select, active low.
6	RES #	This pin is reset signal input. When the pin is LOW, initialization of the chip is executed. Keep this pin HIGH during normal operation.
7	VDD	Power supply,3.3V.
8	SCL(D0)	Serial clock input
9	SDA(D1)	Serial data Input/Output
10	SDA(D2)	Serial data Input/Output
11	SDA(D3)	Serial data Input/Output
12	VDD(D4)	Power supply,3.3V.
13	VDD(D5)	Power supply,3.3V.
14	VDD(D6)	Power supply,3.3V.
15	VDD(D7)	Power supply,3.3V.
16	BLK(0V)	Backlight cathode
17	NC	Floating
18	BLA(3.3V)	Backlight anode

6 Function Block Diagram



7 Absolute Maximum Ratings

Parameter	SYMBOL	MIN	UNIT
Operating temperature	TOP	-40 to +70	°C
Storage Temperature	TST	-40 to +80	°C
Supply Voltage For Logic	VDD-VSS	-0.3~3.5	V
Supply Voltage For LCD	Vop	0~16.5	V

8 Electrical Characteristics

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage For Logic	VDD-VSS	—	3.0	3.3	3.5	V
Supply Voltage For LCD	Vop	Ta=25°C	14.5	15.5	16.5	V
Input High Volt.	VIH	—	0.5VDD	—	VDD	V
Input Low Volt.	VIL	—	VSS	—	0.2VDD	V
Output High Volt.	VOH	—	VDD -0.4	—	—	V
Output Low Volt.	VOL	—	—	—	VSS +0.4	V
Supply Current	IDD	VDD=3.3V	90.0	100.0	105.0	mA

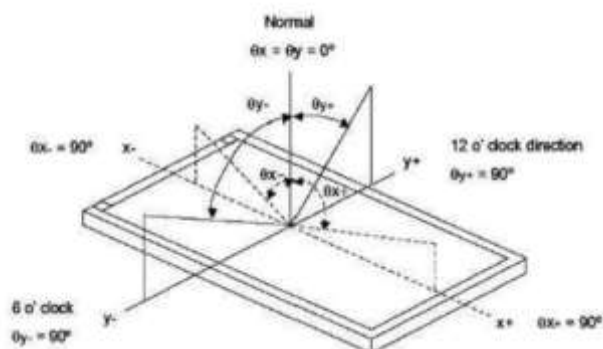
Backlight Characteristics

Item	Symbol	Min	Typ	Max	Unit	Condition
Supply Current	I	--	80	90	mA	5.0V
WHITE LED	V	--	--	--	V	80mA
Luminous	Lv	--	--	--	Cd/m2	80mA
Uniformity	--	70	--	--	%	80mA
Color	White					

9 Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ_L	$CR \geq 2$	0	—	25	$\psi = 180^\circ$
	θ_R	$CR \geq 2$	0	—	25	$\psi = 0^\circ$
	θ_T	$CR \geq 2$	0	—	15	$\psi = 90^\circ$
	θ_B	$CR \geq 2$	0	—	35	$\psi = 270^\circ$
Contrast Ratio	CR	—	—	6	8	—
Response Time	T rise	—	—	50	400	ms
	T fall	—	—	120	400	ms

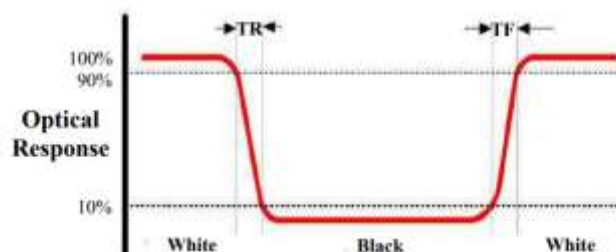
Note 1: Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

$$CR = \frac{\text{Luminance of white state}}{\text{Luminance of black state}}$$

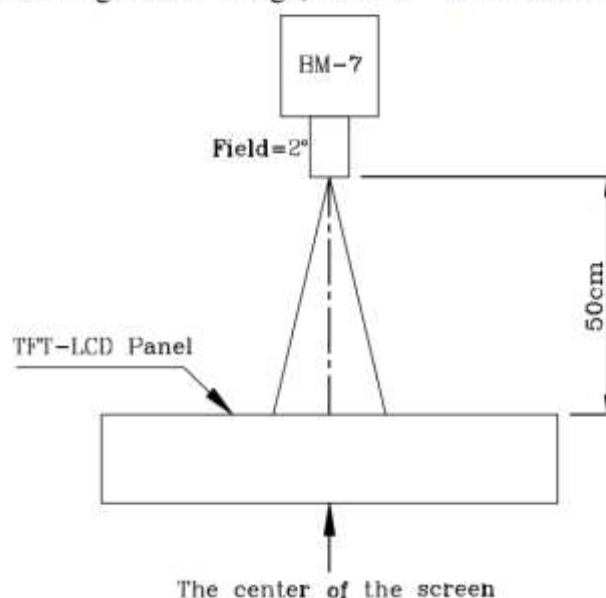
Note 3: Definition of Response Time(T_r , T_f)



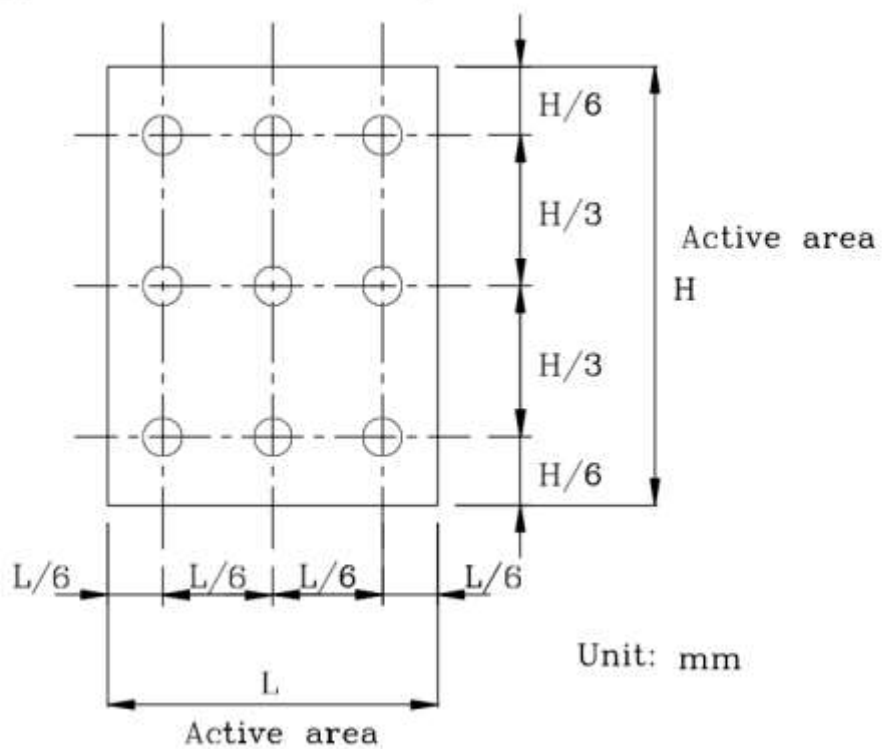
Note 4: Definition of Luminance

① The Brightness Test Equipment Setup

Field=2° (As measuring "black" image, field=2° is the best testing condition)

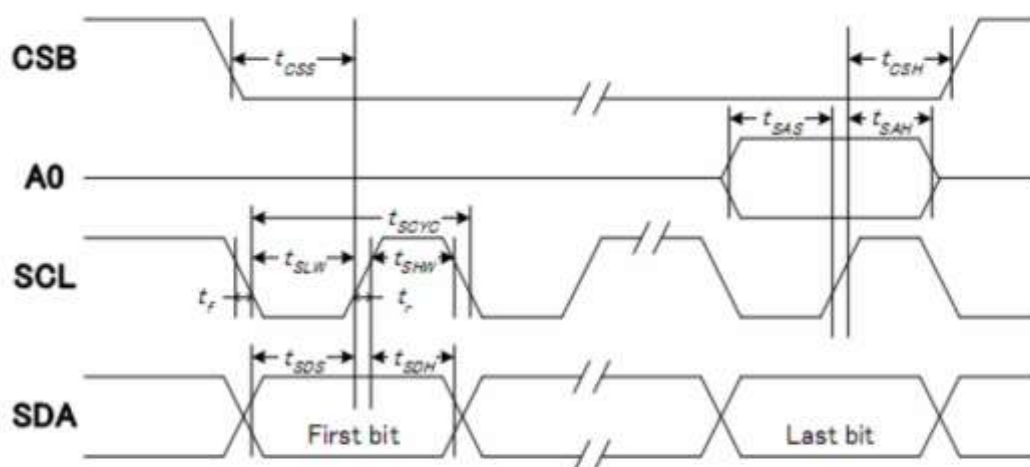


②The Brightness Test Point Setup



10 Timing Characteristics

System Bus Timing for 4-Line SPI MCU Interface



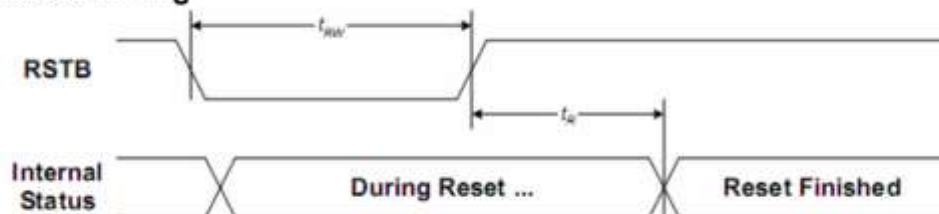
VDD1 = 1.8~3.3V, Ta = 25°C

Item	Signal	Symbol	Condition	Min.	Max.	Unit
Serial clock period	SCLK	tSCYC		80	—	ns
SCLK "H" pulse width		tSHW		30	—	
SCLK "L" pulse width		tSLW		30	—	
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		20	—	
CSB-SCLK time		tCSH		20	—	
CS "H" pulse width		tCHW		0	-	

Note:

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

Reset Timing



VDD1 = 1.8~3.3V, Ta = 25°C

Item	Symbol	Condition	Min.	Max.	Unit
Reset time	tR		—	1	ms
Reset "L" pulse width	tRW		1	—	ms

INSTRUCTION DESCRIPTION

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
1.Extension Command	0	0	0	0	1	1	EXT1	0	0	EXT0	Set extension instruction
Ext[1:0]=0,0 (Extension Command 1)											
2.Display ON/OFF	0	0	1	0	1	0	1	1	1	DSP	Set LCD display DSP=0: Display off DSP=1: Display on
3.Inverse Display	0	0	1	0	1	0	0	1	1	INV	Set inverse display INV=0: Normal display INV=1: Inverse display
4.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
5.Display Control	0	0	1	1	0	0	1	0	1	0	Set display control CLD : Set CL dividing ratio DT[7:0] : Set the number of duty LF[4:0] : Set N-line inversion counter FI : Set the inversion type of frame at the end of common scan cycle
	1	0	0	0	0	0	0	CLD	0	0	
	1	0	DT7	DT6	DT5	DT4	DT3	DT2	DT1	DT0	
	1	0	0	0	LF4	FI	LF3	LF2	LF1	LF0	
6.Power Save	0	0	1	0	0	1	0	1	0	SLP	Set power save mode SLP=0: Sleep out mode SLP=1: Sleep in mode
7.Set Page Address	0	0	0	1	1	1	0	1	0	1	Set page address Starting page address: 00h ≤ YS ≤ 27h Ending page address: YS ≤ YE ≤ 27h
	1	0	YS7	YS6	YS5	YS4	YS3	YS2	YS1	YS0	
	1	0	YE7	YE6	YE5	YE4	YE3	YE2	YE1	YE0	
8.Set Column Address	0	0	0	0	0	1	0	1	0	1	Set column address Starting column address: 00h ≤ XS ≤ 9Fh Ending column address: XS ≤ XE ≤ 9Fh
	1	0	XS7	XS6	XS5	XS4	XS3	XS2	XS1	XS0	
	1	0	XE7	XE6	XE5	XE4	XE3	XE2	XE1	XE0	
9.Data Scan Direction	0	0	1	0	1	1	1	1	0	0	Set normal/ inverse display of address and address scan direction
	1	0	0	0	0	0	0	MV	MX	0	
10.Write Data	0	0	0	1	0	1	1	1	0	0	Write data to DDRAM
	1	0	D7	D6	D5	D4	D3	D2	D1	D0	
11.Read Data	0	0	0	1	0	1	1	1	0	1	Read data from DDRAM (Only for parallel interface and I ² C)
	1	1	D7	D6	D5	D4	D3	D2	D1	D0	
12.Partial In	0	0	1	0	1	0	1	0	0	0	Set partial area Starting partial display address: 00h ≤ PTS ≤ 9Fh Ending partial display address: 00h ≤ PTE ≤ 9Fh
	1	0	PTS7	PTS6	PTS5	PTS4	PTS3	PTS2	PTS1	PTS0	
	1	0	PTE7	PTE6	PTE5	PTE4	PTE3	PTE2	PTE1	PTE0	

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
13. Partial Out	0	0	1	0	1	0	1	0	0	1	Exit the partial mode
14. Read/Modify/Write In	0	0	1	1	1	0	0	0	0	0	Enable read modify write
15. Read/Modify/Write Out	0	0	1	1	1	0	1	1	1	0	Disable read modify write
16. Scroll Area	0	0	1	0	1	0	1	0	1	0	Set scroll area TL[7:0] : Set top line address BL[7:0] : Set bottom line address NSL[7:0] : Number of specified line SCM[1:0] : Area scroll mode
	1	0	TL7	TL6	TL5	TL4	TL3	TL2	TL1	TL0	
	1	0	BL7	BL6	BL5	BL4	BL3	BL2	BL1	BL0	
	1	0	NSL7	NSL6	NSL5	NSL4	NSL3	NSL2	NSL1	NSL0	
17. Set Start Line	0	0	1	0	1	0	1	0	1	1	Set scroll start address 00h ≤ SL ≤ 9Fh
	1	0	SL7	SL6	SL5	SL4	SL3	SL2	SL1	SL0	
18. OSC ON	0	0	1	1	0	1	0	0	0	1	Turn on the internal oscillator
19. OSC OFF	0	0	1	1	0	1	0	0	1	0	Turn off the internal oscillator
20. Power Control	0	0	0	0	1	0	0	0	0	0	Power circuit operation VB=0: OFF, VB=1: ON VF=0: OFF, VF=1: ON VR=0: OFF, VR=1: ON
	1	0	0	0	0	0	VB	0	VF	VR	
21. Set Vop	0	0	1	0	0	0	0	0	0	1	Set Vop
	1	0	0	0	Vop5	Vop4	Vop3	Vop2	Vop1	Vop0	
	1	0	0	0	0	0	0	Vop8	Vop7	Vop6	
22. Vop Control	0	0	1	1	0	1	0	1	1	VOL	Control Vop VOL=0: Vop increase one step VOL=1: Vop decrease one step
23. Read Register Mode	0	0	0	1	1	1	1	1	0	REG	Set read register mode REG=0: read the register value of Vop[5:0] REG=1: read the register value of Vop[8:6]
24. Nop	0	0	0	0	1	0	0	1	0	1	No operation
25. Read Status (Parallel and I ² C)	0	1	D7	D6	D5	D4	D3	D2	D1	D0	Read status byte (Parallel and I ² C)
26. Read Status (4-Line and 3-Line SPI)	0	0	1	1	1	1	1	1	1	0	Read status byte (4-Line and 3-Line SPI)
	0	1	D7	D6	D5	D4	D3	D2	D1	D0	
27. Data Format Select	0	0	0	0	0	0	1	DO	0	0	DO=0: LSB on bottom (Default) DO=1: LSB on top
28. Display Mode	0	0	1	1	1	1	0	0	0	0	Set display mode DM=0: Mono(Default) DM=1: 4Gray Scale Mode
	1	0	0	0	0	1	0	0	0	DM	

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
29.Set ICON	0	0	0	1	1	1	0	1	1	ICON	Enable/Disable ICON RAM ICON=1 ; Enable ICON RAM ICON=0 ; Disable ICON RAM
Ext[1:0]=0,1 (Extension Command 2)											
30. Set Gray Level	0	0	0	0	1	0	0	0	0	0	Set gray scale level GL[4:0]: Set Light Gray Level GD[4:0]: Set Dark Gray Level
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	GL4	GL3	GL2	GL1	GL0	
	1	0	0	0	0	GL4	GL3	GL2	GL1	GL0	
	1	0	0	0	0	GL4	GL3	GL2	GL1	GL0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	GD4	GD3	GD2	GD1	GD0	
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	0	0	
31.Analog Circuit Set	0	0	0	0	1	1	0	0	1	0	Set analog circuit BE[1:0]: Booster efficiency set BS[2:0]: Set bias ratio
	1	0	0	0	0	0	0	0	0	0	
	1	0	0	0	0	0	0	0	BE1	BE0	
	1	0	0	0	0	0	0	BS2	BS1	BS0	
32.Booster Level	0	0	0	1	0	1	0	0	0	1	Set booster level BST=0 : X8 BST=1 : X10
	1	0	1	1	1	1	1	0	1	BST	
33. Driving Select	0	0	0	1	0	0	0	0	0	DS	Power type DS=0: Internal (Default) DS=1 :External
34.Auto Read Control	0	0	1	1	0	1	0	1	1	1	Set auto-read instruction XARD=0: Enable auto read XARD=1: Disable auto read
	1	0	1	0	0	XARD	1	1	1	1	
35.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	
36.OTP Control Out	0	0	1	1	1	0	0	0	0	1	OTP control out
37.OTP Write	0	0	1	1	1	0	0	0	1	0	OTP write
38.OTP Read	0	0	1	1	1	0	0	0	1	1	OTP read

INSTRUCTION	A0	R/W	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
39.OTP Selection Control	0	0	1	1	1	0	0	1	0	0	OTP selection control Ctrl=1: Disable OTP Selection Ctrl=0: Enable OTP Selection
	1	0	1	Ctrl	0	1	1	0	0	1	
40.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	
41.Frame Rate	0	0	1	1	1	1	0	0	0	0	Frame rate setting in different temperature range
	1	0	0	0	0	FRA4	FRA3	FRA2	FRA1	FRA0	
	1	0	0	0	0	FRB4	FRB3	FRB2	FRB1	FRB0	
	1	0	0	0	0	FRC4	FRC3	FRC2	FRC1	FRC0	
	1	0	0	0	0	FRD4	FRD3	FRD2	FRD1	FRD0	
42.Temperature Range	0	0	1	1	1	1	0	0	1	0	Temperature range setting
	1	0	0	TA6	TA5	TA4	TA3	TA2	TA1	TA0	
	1	0	0	TB6	TB5	TB4	TB3	TB2	TB1	TB0	
	1	0	0	TC6	TC5	TC4	TC3	TC2	TC1	TC0	
43.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	
Ext[1:0]=1,0(Extension Command 3)											
44.Read ID	0	0	0	1	1	1	1	1	1	RID	Read ID RID=1 ; Enable RID=0 ; Disable
Ext[1:0]=1,1(Extension Command 4)											
45.Enable OTP	0	0	1	1	0	1	0	1	1	0	Enable OTP EOTP =0 ; Disable (Default) EOTP =1 ; Enable
	1	0	0	0	0	EOTP	0	0	0	0	

11 Standard Specification for Reliability

11.1 Standard Specification for Reliability of LCD Module

No.	Item	Description
01	High temperature operation	The sample should be allowed to stand at 70℃ for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.
02	Low temperature operation	The sample should be allowed to stand at -20℃ for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours.
03	High temperature storage	The sample should be allowed to stand at 80℃ for 240 hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 2 hours.
04	Low temperature storage	The sample should be allowed to stand at -30℃ for 240 hours under no-load condition, then returning it to normal temperature condition, and allowing it stand for 2 hours.
05	Moisture storage	The sample should be allowed to stand at 60℃,90%RH MAX for 240 hours under no-load condition, then taking it out and drying it at normal temperature for 2 hours.
06	Thermal shock storage	The sample should be allowed to stand the following 10 cycles : -40℃ for 30 minutes → normal temperature for 5 minutes → +90℃ for 30 minutes → normal temperature for 5 minutes, as one cycle.
07	Packing vibration	Frequency range : 10Hz ~ 55Hz Amplitude of vibration : 1.5mm Sweep time: 12 min X,Y,Z 2 hours for each direction.
08	Packing drop test	According to ASTM-D-5327.
09	Electrical Static Discharge	Air: ±4KV 150pF/330Ω 5 times
		Contact: ±2KV 150pF/330Ω 5 time

*Sample size for each test item is 3~5pcs

11.2 Testing Conditions and Inspection Criteria

For the final test, the testing sample must be stored at room temperature for 24 hours. After the tests listed in Table 11.2, standard specifications for reliability will be executed in order to ensure stability.

No.	Item	Test Model	In section Criteria
01	Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
02	Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
03	Appearance	Visual inspection	Defect free.

12 Specification of Quality Assurance

This standard of Quality Assurance confirms to the quality of LCD module products supplied by BODJOY.

12.1 Quality Test

Before delivering, the supplier should conduct the following tests to confirm the quality of products.

Electrical-Optical Characteristics: According to the individual specification to test the product.

Appearance Characteristics: According to the individual specification to test the product.

Reliability Characteristics: According to the definition of reliability on the specification for testing products..

12.2 Delivery Test

Before delivering, the supplier should conduct the delivery test.

Test method: According to MIL-STD105E.General Inspection Level II take a single Time.

The defects classify of AQL as following:

Major defect: AQL = 0.65

Minor defect: AQL = 2.5

Total defects: AQL = 2.5

12.3 Non-conforming Analysis & Deal With Manners

12.3.1 Non-conforming Analysis

Purchaser should provide the data detail of non-conforming sample and the non-conforming.

After receiving the data detail from purchaser, the analysis of non-conforming should be finished within two weeks.

If the analysis can't be finished on time, supplier must notice purchaser 3 days in advance.

12.3.2 Disposition of non-conforming

If any product defect be found during assembling, supplier must change the good for every defect after confirmation.

Both supplier and customer should analyze the reason and discuss the disposition of non-conforming when the reason of nonconforming is notsure.

12.4 Agreement items

Both parties should negotiate together when the following problems happen.

There is any problem of standard of quality assurance, and both sides should agree that it must be modified.

There is any argument item which does not record in the standard of quality assurance. Any other special problem.

12.5 Standard of The Product Appearance Test

12.5.1 Manner of appearance test

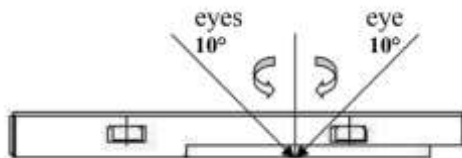
The test must be under 20W × 2 or 40W fluorescent light, and the distance of view

must be at 30 ± 5 cm.

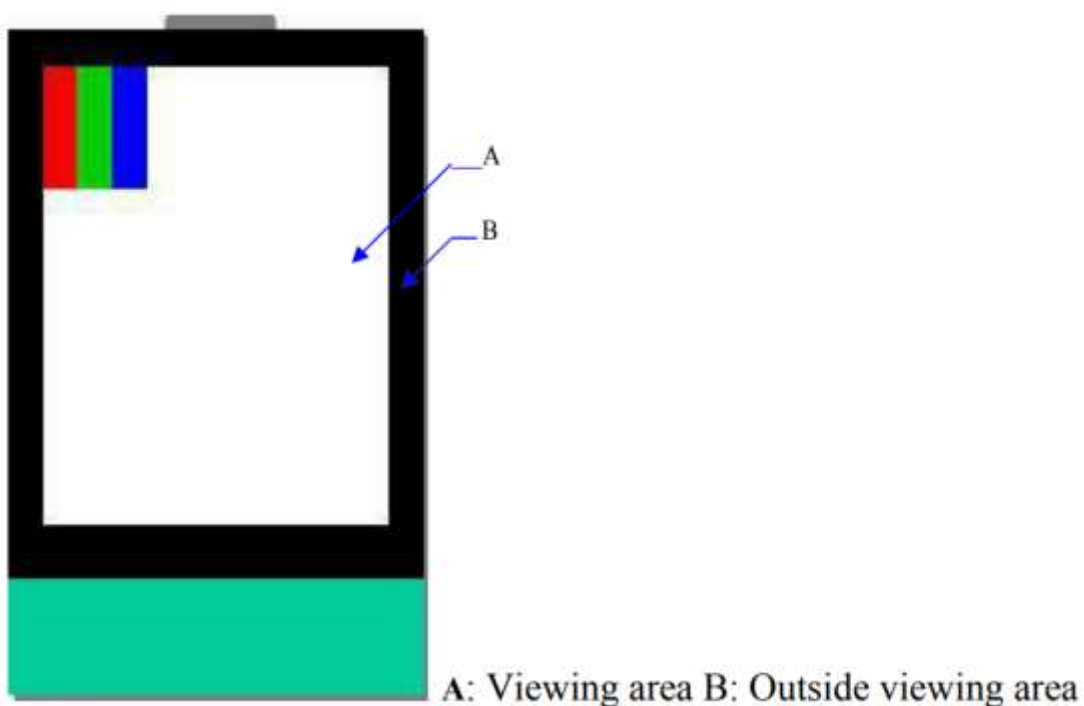
When test the model of transmissive product must add the reflective plate.

The test direction is base on around 10° of vertical line.

Temperature: $25 \pm 5^\circ\text{C}$ Humidity: $60 \pm 10\%\text{RH}$



Definition of area:



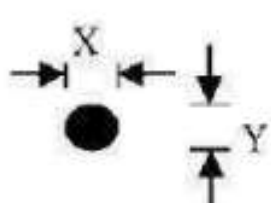
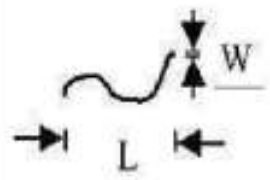
12.5.1 Basic principle

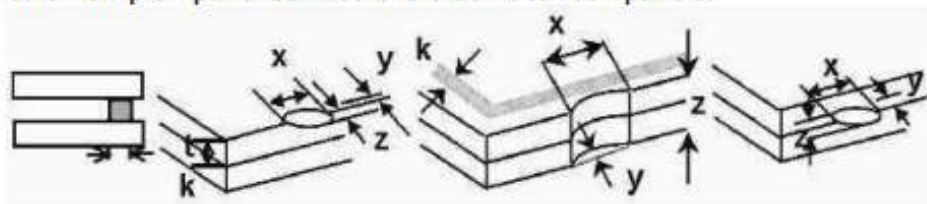
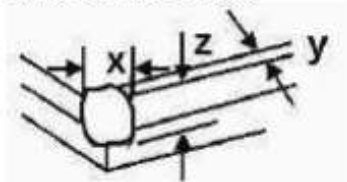
When the standard can not be described, AQL will be applied.

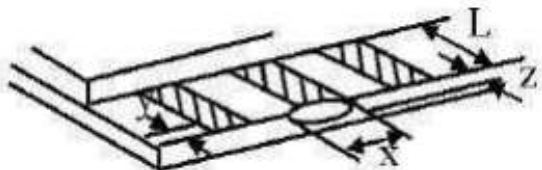
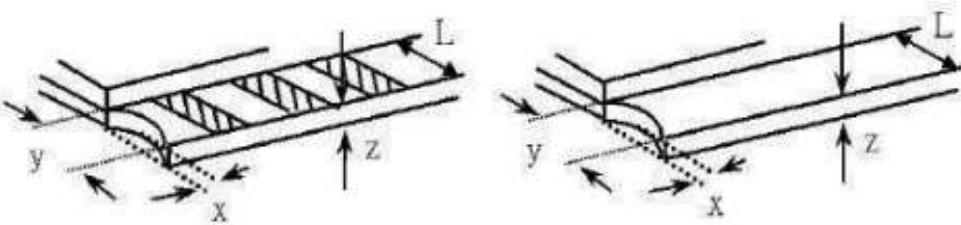
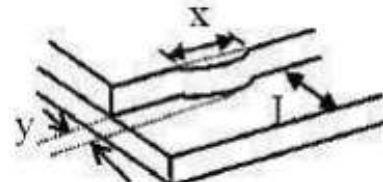
The sample of the lowest acceptable quality level must be negotiated by both supplier and customer when any dispute happened.

New item must be added on time when it is necessary.

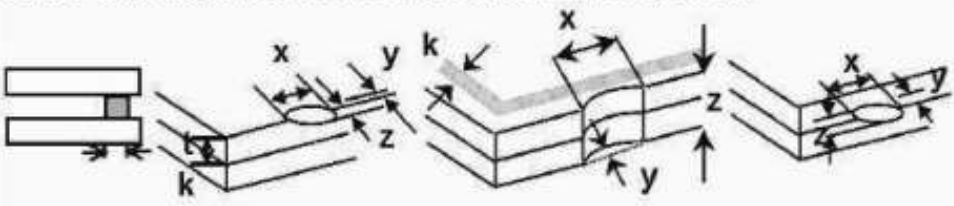
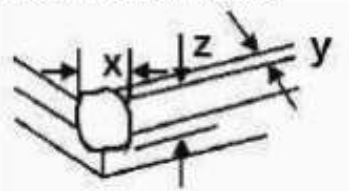
12.6 Inspection Specification

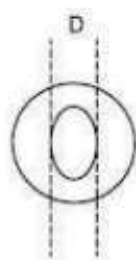
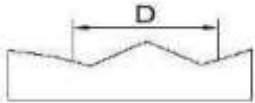
NO.	Item	Criterion	AQL																										
01	Electrical Testing	1.1 Missing vertical, horizontal segment, segment contrast defect. 1.2 Missing character, dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect. 1.7 Mixed product types. 1.8 Flicker	0.65																										
02	Black or White spots or Bright spots or Color spots on LCD (Display only)	2.1 White and black or color spots on display $\cong 0.25\text{mm}$, no more than Five spots. 2.2 Densely spaced: No more than three spots within 3mm.	2.5																										
03	LCD and Touch Panel black spots, white spots, contamination (non – display)	3.1 Round type: As following drawing $\Phi = (X+Y) / 2$ <table><thead><tr><th>Size(mm)</th><th>Acceptable Q'ty</th></tr></thead><tbody><tr><td>$\Phi \cong 0.10$</td><td>Accept no dense</td></tr><tr><td>$0.10 < \Phi \cong 0.20$</td><td>2</td></tr><tr><td>$0.20 < \Phi \cong 0.25$</td><td>2</td></tr><tr><td>$0.25 < \Phi \cong 0.30$</td><td>1</td></tr><tr><td>$0.30 < \Phi$</td><td>than two spots within 3mm.</td></tr></tbody></table> * Densely spaced: No more 3.2 Line type: (As following drawing) <table><thead><tr><th>Length(mm)</th><th>Width(mm)</th><th>Acceptable Q'ty</th></tr></thead><tbody><tr><td>---</td><td>$W \cong 0.02$</td><td>Accept no dense</td></tr><tr><td>$L \cong 3.0$</td><td>$0.02 < W \cong 0.05$</td><td rowspan="2">2</td></tr><tr><td>$L \cong 2.5$</td><td>$0.03 < W \cong 0.08$</td></tr><tr><td colspan="2">* Densely spaced: No more than two lines within 3mm.</td><td>Rejection</td></tr></tbody></table>	Size(mm)	Acceptable Q'ty	$\Phi \cong 0.10$	Accept no dense	$0.10 < \Phi \cong 0.20$	2	$0.20 < \Phi \cong 0.25$	2	$0.25 < \Phi \cong 0.30$	1	$0.30 < \Phi$	than two spots within 3mm.	Length(mm)	Width(mm)	Acceptable Q'ty	---	$W \cong 0.02$	Accept no dense	$L \cong 3.0$	$0.02 < W \cong 0.05$	2	$L \cong 2.5$	$0.03 < W \cong 0.08$	* Densely spaced: No more than two lines within 3mm.		Rejection	2.5
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* Densely spaced: No more than two lines within 3mm.		Rejection																											

NO.	Item	Criterion			AQL												
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction	Size Φ(mm)	Acceptable Q'ty	2.5												
			Φ ≦ 0.20	Accept no dense													
			0.20 < Φ ≦ 0.50	3													
			0.50 < Φ ≦ 1.00	2													
			1.00 < Φ	0													
			Total Q'ty	3													
05	Scratches	Follow NO.3 -2 Line Type.															
06	Chipped glass	Symbols: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length 6.1 General glass chip: 6.1.1 Chip on panel surface and crack between panels:			2.5												
																	
		<table><tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr><tr><td>$Z \leq 1/2t$</td><td>Not over viewing area</td><td>$x \leq 1/8a$</td></tr><tr><td>⊙ Unit: mm</td><td></td><td></td></tr><tr><td>$1/2t < z \leq 2t$</td><td>Not exceed 1/3k</td><td>$x \leq 1/8a$</td></tr></table> ⊖ If there are 2 or more chips, x is the total length of each chip				z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	⊙ Unit: mm			$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$
		z: Chip thickness	y: Chip width	x: Chip length													
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$															
⊙ Unit: mm																	
$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$															
6.1.2 Corner crack: 																	
<table><tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr><tr><td>$Z \leq 1/2t$</td><td>Not over viewing area</td><td>$x \leq 1/8a$</td></tr><tr><td>⊙ Unit: mm</td><td></td><td></td></tr><tr><td>$1/2t < z \leq 2t$</td><td>Not exceed 1/3k</td><td>$x \leq 1/8a$</td></tr></table> ⊖ If there are 2 or more chips, x is the total length of each chip			z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	⊙ Unit: mm			$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$			
z: Chip thickness	y: Chip width	x: Chip length															
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$															
⊙ Unit: mm																	
$1/2t < z \leq 2t$	Not exceed 1/3k	$x \leq 1/8a$															

NO.	Item	Criterion	AQL																
07	Glass crack	Symbols: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: LCD side length L: Electrode pad length 7.2 Protrusion over terminal: 7.2.1 Chip on electrode pad:  <table><tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr><tr><td>$y \leq 0.5\text{mm}$</td><td>$x \leq 1/8a$</td><td>$0 < z \leq t$</td></tr></table> 7.2.2 Non-conductive portion:  <table><tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr><tr><td>$y \leq 1/8a$</td><td>$x \leq 1/8a$</td><td>$0 < z \leq 1/3$</td></tr></table> ⊙ If there chipped area touches the ITO terminal, over 1/3 of the ITO must remain and be inspected according to electrode terminal specifications. ⊙ the product will be heat sealed by the customer, the alignment mark must not be damaged. 7.2.3 Substrate protuberance and internal crack  <table><tr><td>y: width</td><td>x: length</td></tr><tr><td>$y \leq 1/3L$</td><td>$X \leq a$</td></tr></table>	y: Chip width	x: Chip length	z: Chip thickness	$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$	y: Chip width	x: Chip length	z: Chip thickness	$y \leq 1/8a$	$x \leq 1/8a$	$0 < z \leq 1/3$	y: width	x: length	$y \leq 1/3L$	$X \leq a$	2.5
		y: Chip width	x: Chip length	z: Chip thickness															
		$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$															
		y: Chip width	x: Chip length	z: Chip thickness															
$y \leq 1/8a$	$x \leq 1/8a$	$0 < z \leq 1/3$																	
y: width	x: length																		
$y \leq 1/3L$	$X \leq a$																		

NO.	Item	Criterion	AQL
08	Cracked glass	The LCD with extensive crack is not acceptable.	2.5
09	Backlight elements	9.1 Illumination source flickers when lit. 9.2 Spots or scratches that appear when lit must be judged. Using LCD spot, lines and contamination standards. 9.3 Backlight doesn't light or color is wrong.	2.5 2.5 0.65
10	Bezel	Bezel must comply with product specifications.	2.5
11	PCB、COB	11.1 COB seal may not have pinholes larger than 0.2mm or contamination. 11.2 COB seal surface may not have pinholes through to the IC. 11.3 The height of the COB should not exceed the height indicated in the assembly diagram. 11.4 There may not be more than 2mm of sealant outside the seal area on PCB. And there should be no more than three places. 11.5 Parts on PCB must be the same as on the production characteristic chart, There should be no wrong parts, missing parts or excess parts. 11.6 The jumper on the PCB should conform to the product characteristic chart.	2.5 2.5 2.5 2.5 0.65 0.65
12	FPC	12.1 FPC terminal damage $\leq$ 1/2 FPC terminal width and can not affect the function , we judge accept. 12.2 FPC alignment hole damage $\leq$ 1/2 alignment area and can not affect the function , we judge accept.	2.5 2.5
13	Soldering	13.1 No cold solder joints, missing solder connections, oxidation or icicle. 13.2 No short circuits in components on PCB or FPC.	2.5 0.65

NO.	Item	Criterion	AQL												
14	Touch Panel Chipped glass	Symbols: x: Chip length y: Chip width z: Chip thickness k: Seal width t: Touch Panel Total thickness a: LCD side length L: Electrode pad length 14.1 General glass chip: 14.1.1 Chip on panel surface and crack between panels:  <table><tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr><tr><td>$Z \leq t$</td><td>$\leq 1/2 k$ and not over viewing area</td><td>$x \leq 1/8a$</td></tr></table> ⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip 14.1.2 Corner crack:  <table><tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr><tr><td>$z \leq t$</td><td>$\leq 1/2 k$ and not over viewing area</td><td>$x \leq 1/8a$</td></tr></table> ⊙ Unit: mm ⊙ If there are 2 or more chips, x is the total length of each chip	z: Chip thickness	y: Chip width	x: Chip length	$Z \leq t$	$\leq 1/2 k$ and not over viewing area	$x \leq 1/8a$	z: Chip thickness	y: Chip width	x: Chip length	$z \leq t$	$\leq 1/2 k$ and not over viewing area	$x \leq 1/8a$	2.5
z: Chip thickness	y: Chip width	x: Chip length													
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$z \leq t$	$\leq 1/2 k$ and not over viewing area	$x \leq 1/8a$													

NO.	Item	Criterion	AQL										
15	Touch Panel(Fish eye、dent and bubble on film)	<table><tr><th>SIZE(mm)</th><th>Acceptable Q'ty</th></tr><tr><td>$\Phi \leq 0.2$</td><td>Accept no dense</td></tr><tr><td>$0.2 < D \leq 0.4$</td><td>5</td></tr><tr><td>$0.4 < D \leq 0.5$</td><td>2</td></tr><tr><td>$0.5 < D$</td><td>0</td></tr></table> 	SIZE(mm)	Acceptable Q'ty	$\Phi \leq 0.2$	Accept no dense	$0.2 < D \leq 0.4$	5	$0.4 < D \leq 0.5$	2	$0.5 < D$	0	2.5
SIZE(mm)	Acceptable Q'ty												
$\Phi \leq 0.2$	Accept no dense												
$0.2 < D \leq 0.4$	5												
$0.4 < D \leq 0.5$	2												
$0.5 < D$	0												
16	Touch Panel Newton ring	Newton ring dimension $\leq 1/2$ touch panel area and not affect font and line distortion($\leq 2.5\%$) , it is acceptable.	2.5										
17	Touch Panel Linearity	Less than 2.5% is acceptable.	2.5										
18	LCD Ripple	Touch the touch panel , can not see the LCD ripple. Pen: R 1.0mm silicon rubber. Operation Force: 80g	2.5										
19	General appearance	19.1 Pin type must match type in specification sheet. 19.2 LCD pin loose or missing pins. 19.3 Product packaging must the same as specified on packaging specification sheet. 19.4 Product dimension and structure must conform to product specification sheet.	0.65 0.65 0.65 0.65										

13 General Precautions

13.1 Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

13.2 Handling

The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.

The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.

To avoid contamination on the display surface, do not touch the module surface with bare hands.

Keep a space so that the LCD panels do not touch other components.

Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.

Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.

Do not leave module in direct sunlight to avoid malfunction of the ICs.

13.3 Static Electricity

Be sure to ground module before turning on power or operating module.

Do not apply voltage which exceeds the absolute maximum rating value.

13.4 Storage

Store the module in a dark room where must keep at $25\pm 10^{\circ}\text{C}$ and 65%RH or less.

Do not store the module in surroundings containing organic solvent or corrosive gas.

Store the module in an anti-electrostatic container or bag.

13.5 Cleaning

Do not wipe the polarizer with dry cloth. It might cause scratch.

Only use a soft cloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

14 Packing Method

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