Wincom Tech CO., LTD.

The LCD(M) Specialist

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PART NO. : WG14432A V0.0
-SFYLYNC06

FOR MESSRS. : _____

CONTENTS

ACCEPTED BY: _____ PROPOSED BY: _____

RECORD OF REVISION

DATE	PAGE	SUMMARY
2014-03-28	--	NEW SPEC

3. General specifications

3.1 General specifications

PLEASE REFER TO:

"CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS (MS-10-10000)".

3.2 Quality Assurance and Warranty

PLEASE REFER TO:

"QUALITY ASSURANCE MANUL (MS-10-10001)".

3.3 This individual specification is prior to general specifications

4. Mechanical data

- Display format: 144 x 32DOTS
- LCD type: STN Positive , Transflecive
- Backlight color : Yellow/Green , LED
- Viewing angle : 6:00
- Data transfer: 8Bit Parallel
- LCD controller: ST7920 or Equivalence
- Module size: 84 x 44 x 13.5mm
- View area : 65 x 16 mm
- Dot size : 0.39 x 0.39 mm
- Dot pitch : 0.42 x 0.42mm
- Driving method : 1/32duty, 1/6 bias

5. Absolute maximum ratings

5.1 Electrical absolute maximum ratings

I T E M	SYMBOL	MIN.	MAX.	UNIT	COMMENT
POWER SUPPLY FOR LOGIC	V_{DD}-V_{SS}	-0.3	5	V	---------
INPUT VOLTAGE	V_I	V_{SS}	$V_{DD+0.3}$	V	---------
STATIC ELECTRICITY	---------	------	-----	V	-----
POWER SUPPLY FOR BACKLIGHT	V_S	0	4.3	V_{rms}	---------
	f_{FL}	------	------	KHz	---------
STARTING VOLTAGE FOR BACKLIGHT	------	------	------	V_{rms}	Ta = 25℃
	------	------		V_{rms}	Ta = 25℃
POWER SUPPLY FOR LCD	V_{DD}-V_{EE}	------	5.8	V	---------

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5.2 Environmental absolute maximum ratings

I T E M	OPERATING		STORAGE		COMMENT
	MIN.	MAX.	MIN.	MAX.	
AMBIENT TEMPERATURE	-20℃	70℃	-30℃	80℃	------
HUMIDITY	NOTE (2)		NOTE (2)		NO CONDENSATION
VIBRATION NOTE (3)	------	0.5G	------	2G	10~300Hz XYZ DIRECTIONS 1 Hr EACH
SHOCK NOTE (3)	------	3G	------	5G	10 msec XYZ DIRECTIONS 1 TIME EACH
CORROSIVE GAS	NOT ACCEPTABLE		NOT ACCEPTABLE		------

NOTE (2): Ta ≦ 70℃: 75% RH MAX.

Ta ＞ 70℃: ABSOLUTE HUMIDITY MUST BE LOWER THAN THE HUMIDITY OF 75% RH AT 70℃.

NOTE (3): 1G = 9.8 m/s^2

6. Electrical characteristics

Ta = 25℃ V_{DD} = 5.0V

I T E M	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Power supply voltage for circuit	V_{DD}-V_{SS}	------	4.75	5.0	5.25	V
Power supply voltage for LCD driver	V_{DD}-V_0	------	5.6	5.8	6.0	V
Data input voltage	V_{IH}	H LEVEL	2.4	------	V_{DD}	V
	V_{IL}	L LEVEL	-0.3	------	0.4	V
LCD display duty ratio	DUTY	------	------	1/32	------	------
LED BACKLIGHT	I_{fp}	I mseo plus 10% Dutg cyele		--		mA
		Operating voltage	4.0	4.1	4.2	V
		Forward current		100		mA
LED Lifetime	------	V_{FL}= 3.1Vrms f_{FL}= --KHz	------	100,000	------	Hr

7. Optical characteristics

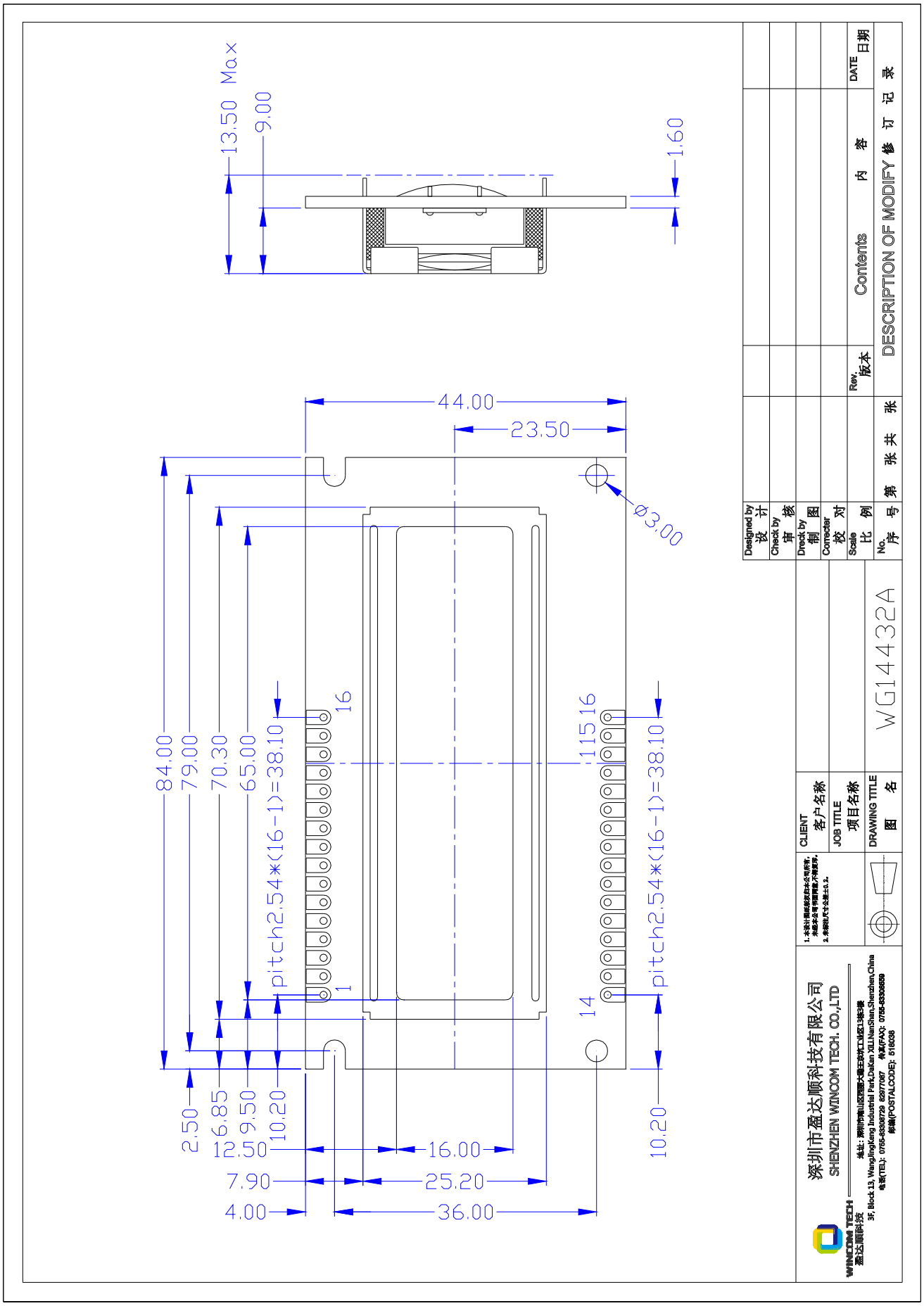
Ta = 25℃ V_{DD}-V_O = 4.8V

I T E M	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Viewing angle	Φ2-Φ1	K ≧ 2.0	-35	----	20	deg.	1
Contrast ratio	K	Φ = 10^0 θ = 0^0	4.0	----	-------	-------	1
Response time (at 25℃)	tr (rise)	Φ = 10^0 θ = 0^0	-------	-----	200	ms	1
	tf (fall)	Φ = 10^0 θ = 0^0	-------	-----	200	ms	1
The brightness of backlighting source	B	DOTS ALL ON VFL= 4.1Vrms fFL= KHZ	375	500	---	cd/m^2	2

NOTE (1): SEE CUSTOMER ACCEPTANCE STANDARD SPECIFICATION FOR DEFINITION OF OPTICAL CHARACTERISTICS

NOTE (2): UNDER NORMAL TEMPERATURE AND HUMIDITY IN A DARK ROOM

8. Outline dimension

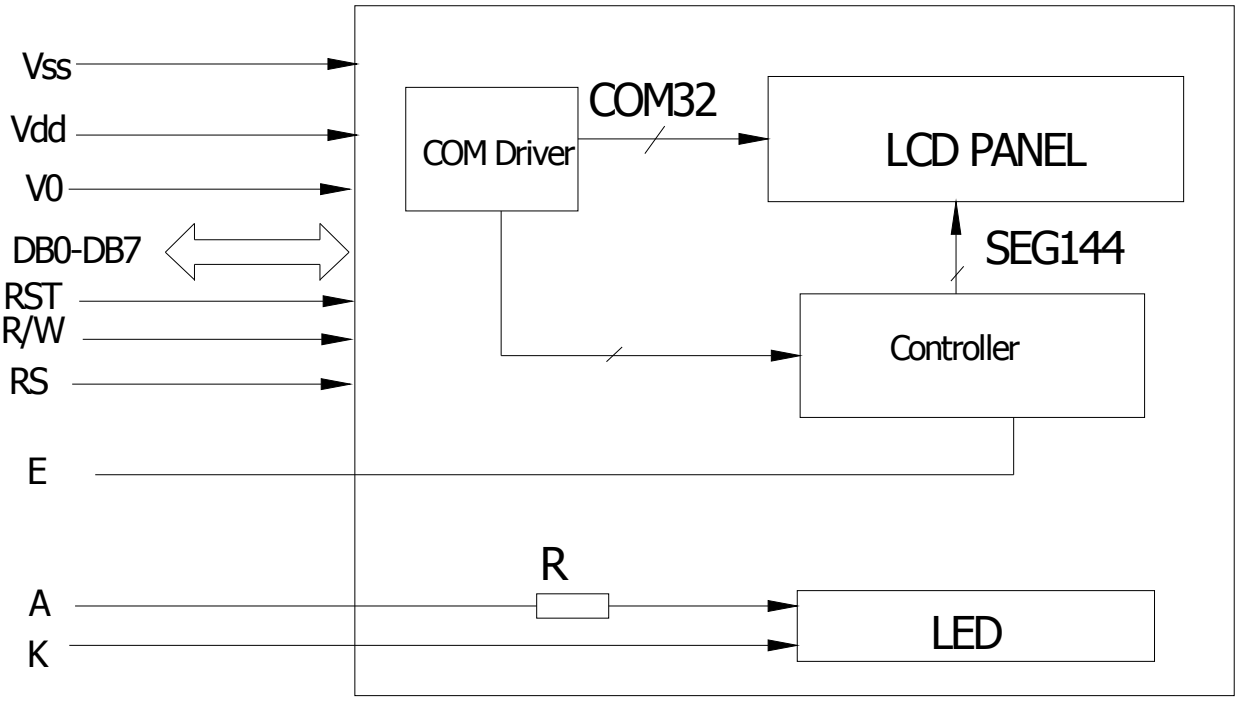


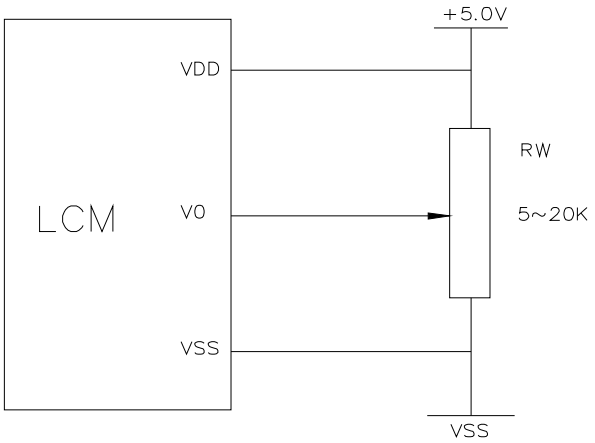
8.1 Interface

Pin Assignment

PIN NO.	Symbol	Level	Function
1	Vss	0V	Ground
2	VDD	+5V	LCM supply voltage
3	V0	--	Contrast Adjust
4	RS	H/L	H : Data Input L : Instruction Code Input
5	RW	H/L	H : Data Read(LCD to MPU) L : Data Write(MPU to LCM)
6	E	H/L	Enable signal
7~14	DB0~DB7	H/L	Data bus
15	A	(+5.0V)	Power supply for BL LED(+)
16	K	(-)	Power supply for BL LED(-)

9. Block diagram

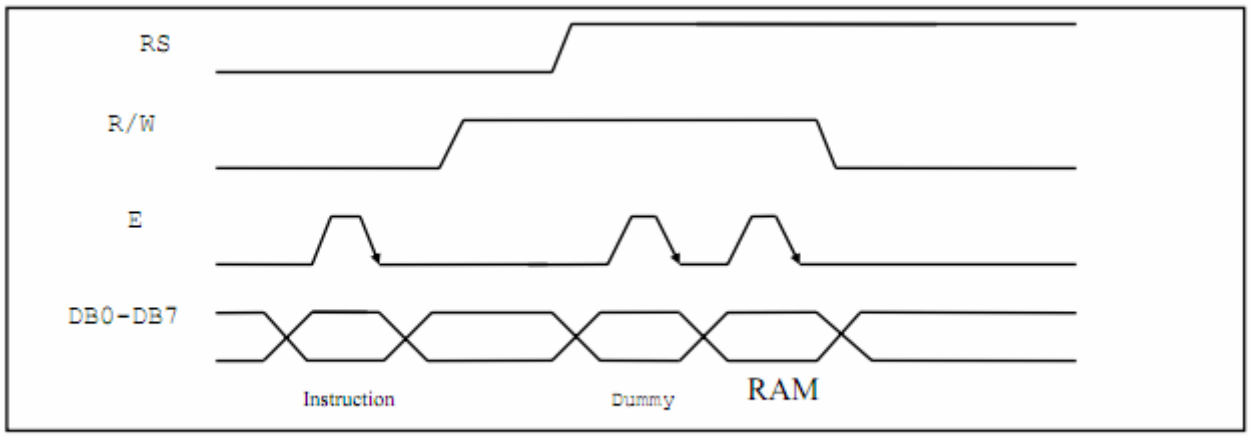




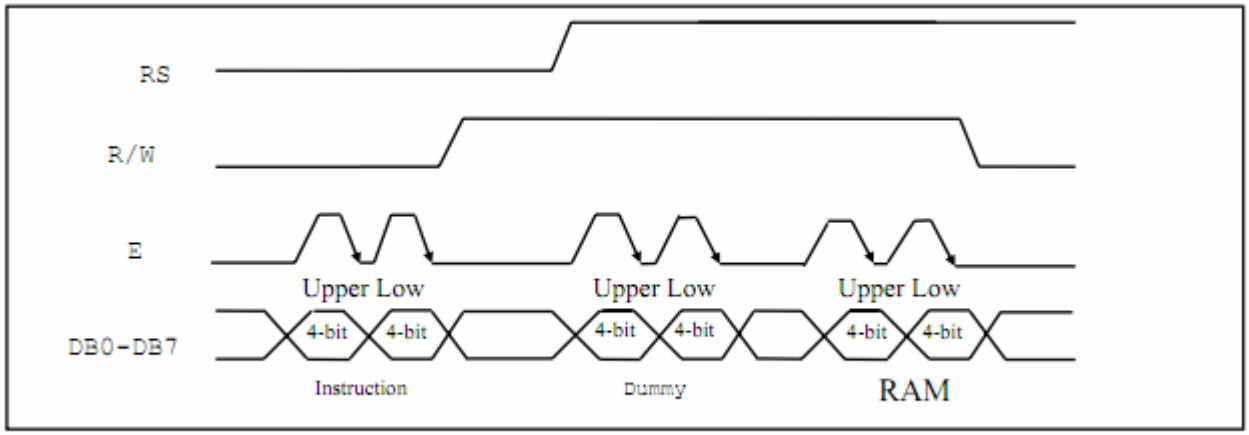
10. Parallel interface :

ST7920 is in parallel mode by pulling up PSB pin. And can select 8 bit or 4-bit bus interface by function set instruction DL control bit. MPU can control (RS , RW , E , and DB0..DB7) pins to complete the data transmission.

In 4-bit transfer mode, every 8 bits data or instruction is separated into 2 parts. Higher 4 bits (DB7~DB4) data will transfer. First and placed into data pins (DB7~DB4). Lower 4 bits (DB3~DB0) data will transfer second and placed into data pins (DB7~DB4). (DB3~DB0) data pins are not used.



Timing Diagram of 8-bit Parallel Bus Mode Data Transfer



Timing Diagram of 4-bit Parallel Bus Mode Data Transfer

11. Serial interface :

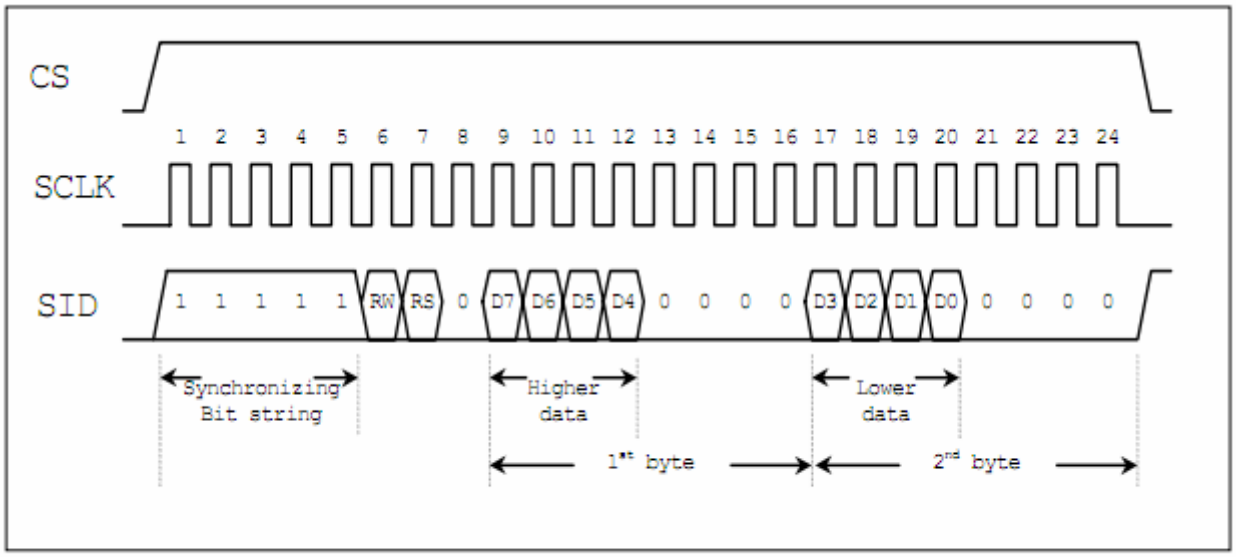
ST7920 is in serial interface mode when pull down PSB pin. Two pins (SCLK and SID) are used to complete the data transfer. Only write data is available.

When connecting several ST7920, chip select (CS) must be used. Only when (CS) is high the serial clock (SCLK) can be accepted. On the other hand, when chip select (CS) is low ST7920 serial counter and data will be reset. Transmission will be terminated and data will be cleared. Serial transfer counter is set to the first bit. For a minimal system with only one ST7920 and one MPU, only SCLK and SID pins are necessary. CS pin should pull to high.

ST7920's serial clock (SCLK) is asynchronous to the internal clock and is gene rated by MPU. When multiple instruction/data is transferred instruction execution time must be considered. Must wait for the previous instruction to finish before sending the next. ST7920 has no internal instruction buffer area.

When starting a transmission a start byte is required. It consists of 5 consecutive "1" (sync character). Serial transfer counter will be reset and synchronized. Following 2 bits for read/write (RW) and egister/data select (RS). Last 4 bits is filled by "0".

After receiving the sync character and RW and RS bits, every 8 bits instruction/data will be separated into 2 groups. Higher 4 bits (DB7~DB4) will be placed in first section followed by 4 "0". And lower 4 bits (DB3~DB0) will be placed in second section followed by 4 "0".



Timing Diagram of Serial Mode Data Transfer

12. Instruction Code

Instruction set 1: (RE=0: basic instruction)

Ins	code										Description	Exec time (540KHZ)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
CLEAR	0	0	0	0	0	0	0	0	0	1	Fill DDRAM with "20H", and set DDRAM address counter （AC）to "00H"	1.6 ms
HOME	0	0	0	0	0	0	0	0	1	X	Set DDRAM address counter（AC）to "00H", and put cursor to origin ；the content of DDRAM are not changed	72us
ENTRY MODE	0	0	0	0	0	0	0	1	I/D	S	Set cursor position and display shift when doing write or read operation	72us
DISPLAY ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1: display ON C=1: cursor ON B=1: blink ON	72 us
CURSOR DISPLAY CONTROL	0	0	0	0	0	1	S/C	R/L	X	X	Cursor position and display shift control ：the content of DDRAM are not changed	72 us
FUNCTION SET	0	0	0	0	1	DL	X	0 RE	X	X	DL=1 8-BIT interface DL=0 4-BIT interface **RE=1: extended instruction** **RE=0: basic instruction**	72 us
SET CGRAM ADDR.	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address to address counter（AC） **Make sure that in extended instruction SR=0 (scroll or RAM address select)**	72 us
SET DDRAM ADDR.	0	0	1	0 AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address to address counter（AC） AC6 is fixed to 0	72 us
READ BUSY FLAG（BF）& ADDR.	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read busy flag（BF）for completion of internal operation, also Read out the value of address counter（AC）	0 us
WRITE RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data to internal RAM (DDRAM/CGRAM/IRAM/GDRAM)	72 us
READ RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/IRAM/GDRAM)	72 us

Instruction set 2: (RE=1: extended instruction)

Inst.	code										description	Exec. time (540KHZ)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
STAND BY	0	0	0	0	0	0	0	0	0	1	Enter stand by mode, any other instruction can terminate (Com1..32 halted, only Com33 ICON can display)	72 us
SCROLL or RAM ADDR. SELECT	0	0	0	0	0	0	0	0	1	SR	SR=1: enable vertical scroll position SR=0: enable IRAM address **(extended instruction)** SR=0: enable CGRAM address**(basic instruction)**	72 us
REVERSE	0	0	0	0	0	0	0	1	R1	R0	Select 1 out of 4 line (in DDRAM) and decide whether to reverse the display by toggling this instruction **R1,R0 initial value is 00**	72 us
EXTENDED FUNCTION SET	0	0	0	0	1	DL	X	1 RE	G	0	DL=1 8-BIT interface DL=0 4-BIT interface **RE=1: extended instruction set** **RE=0: basic instruction set** G=1 :graphic display ON G=0 :graphic display OFF	72 us
SET IRAM or SCROLL ADDR	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	SR=1: AC5~AC0 the address of vertical scroll SR=0: AC3~AC0 the address of ICON RAM	72 us
SET GRAPHIC RAM ADDR.	0	0	1	0 AC6	0 AC5	0 AC4	AC3 AC3	AC2 AC2	AC1 AC1	AC0 AC0	Set GDRAM address to address counter (AC) First set vertical address and the horizontal address by consecutive writing Vertical address range AC6...AC0 Horizontal address range AC3…AC0	72 us

13. Specification of quality assurance

AQL inspection standard

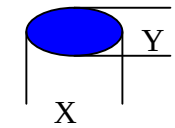
Sampling method: MIL-STD-105E, Level II, single sampling

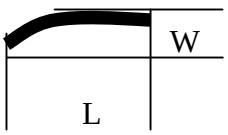
Defect classification **(Note: * is not including)**

Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	**2**	
		Back-light	**1,8**	
	Non-display	Flat cable or pin reverse	**10**	
		Wrong or missing component	**11**	
Minor	Display state	Background color deviation	**2**	**1.0**
		Black spot and dust	**3**	
		Line defect, Scratch	**4**	
		Rainbow	**5**	
		Chip	**6**	
		Pin hole	**7**	
	Polarizer	Protruded	**12**	
		Bubble and foreign material	**3**	
	Soldering	Poor connection	**9**	
	Wire	Poor connection	**10**	
	TAB	Position, Bonding strength	**13**	

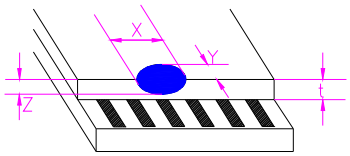
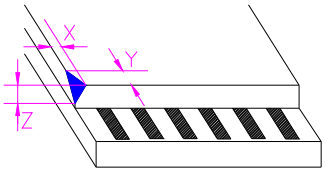
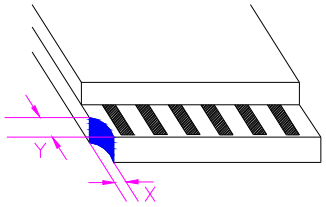
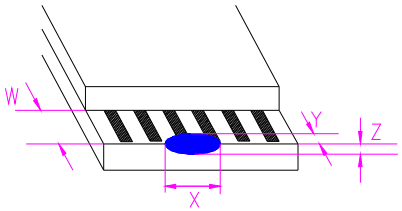
Note on defect classification

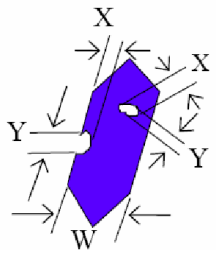
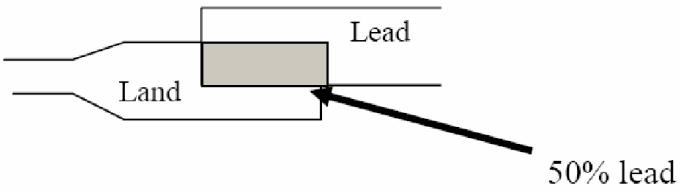
<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</td></tr>
<tr><td>2</td><td>Contrast defect
Background color deviation</td><td>Refer to approval sample</td></tr>
<tr><td>3</td><td>Point defect, Black spot, dust (including Polarizer)

ϕ = (X+Y)/2</td><td>


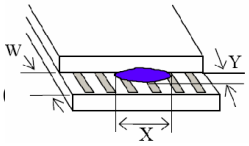
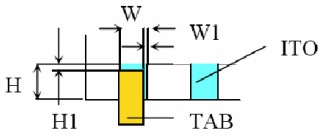
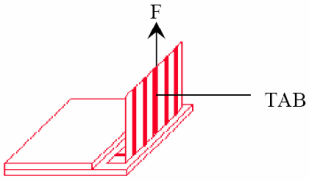
<table>
<tr><th>Point Size</th><th>Acceptable Qty.</th></tr>
<tr><td>ϕ <0.10</td><td>Disregard</td></tr>
<tr><td>0.10< ϕ ≤ 0.20</td><td>3</td></tr>
<tr><td>0.20< ϕ ≤ 0.25</td><td>2</td></tr>
<tr><td>0.25< ϕ ≤ 0.30</td><td>1</td></tr>
<tr><td>ϕ >0.30</td><td>0</td></tr>
</table>
Unit:mm
</td></tr>
<tr><td>4</td><td>Line defect, Scratch</td><td>


<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>0.015≥W</td><td>Disregard</td></tr>
<tr><td>3.0≥L</td><td>0.03≥W</td><td rowspan="2">2</td></tr>
<tr><td>2.0≥L</td><td>.05≥W</td></tr>
<tr><td>1.0≥L</td><td>0.1＞W</td><td>1</td></tr>
<tr><td>---</td><td>0.05＜W</td><td>Applied as point defect</td></tr>
</table>
</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.</td></tr>
</table>

NO.	Item	Criterion
6	Chip Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness W: Terminal Width	 Acceptable criterion X: ⩽2 | Y: 0.5mm | Z: ⩽t/2  Acceptable criterion X: ⩽2 | Y: 0.5mm | Z: ⩽t  Acceptable criterion X: ⩽3 | Y: ⩽2 | Z: ⩽t shall not reach to ITO  Acceptable criterion X: Disregard | Y: ⩽0.2 | Z: ⩽t

No.	Item	Criterion
7	Segment pattern W = Segment width ϕ = (X+Y)/2	(1) Pin hole ϕ < 0.10mm is acceptable.  Unit: mm
8	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering
9	Soldering	(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land. 
10	Wire	(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.
11*	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.

Point Size	Acceptable Qty
$\phi \leq 1/4W$	Disregard
$1/4W < \phi \leq 1/2W$	1
$\phi > 1/2W$	0

NO.	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable Y ≤ 0.4
13	TAB	1. Position  W1≤1/3W H1≤1/3H 2 TAB bonding strength test  P (=F/TAB bonding width) ≥650gf/cm , (speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.