LUMMAX ELECTRONICS CO., LIMITED

SPECIFICATION

MODULE NO.: HEM128128-06B2

Rev: 01

Date: **2015-05-11**

APPROVED	CHECKED	PREPARED

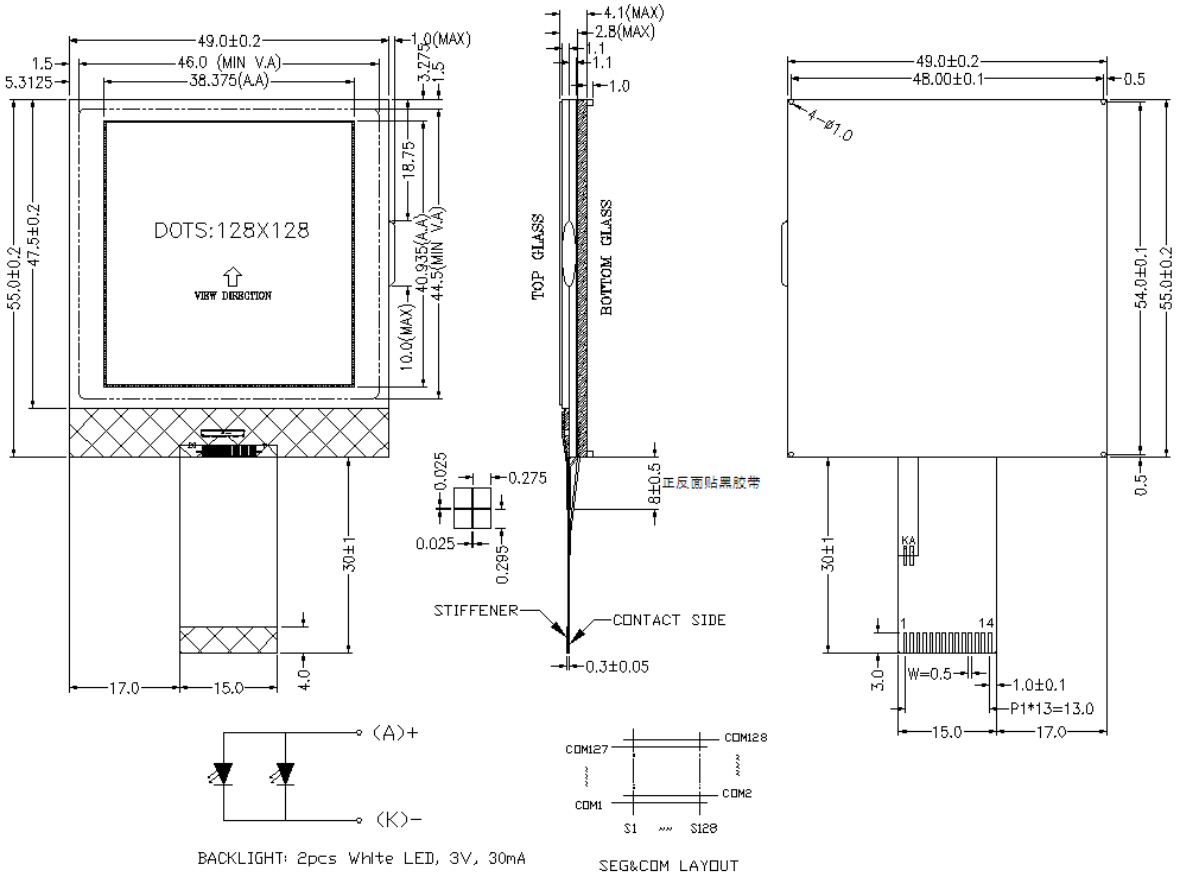
Customer Approval:	☐ Accept ☐ Reject Comment: Approved by:

History of Version

Date	Ver	Description	PREPARED	Checked
2015/05/11	01	New sample	WPY	XQC

CONTENTS

1. DIMENSIONAL OUTLINE



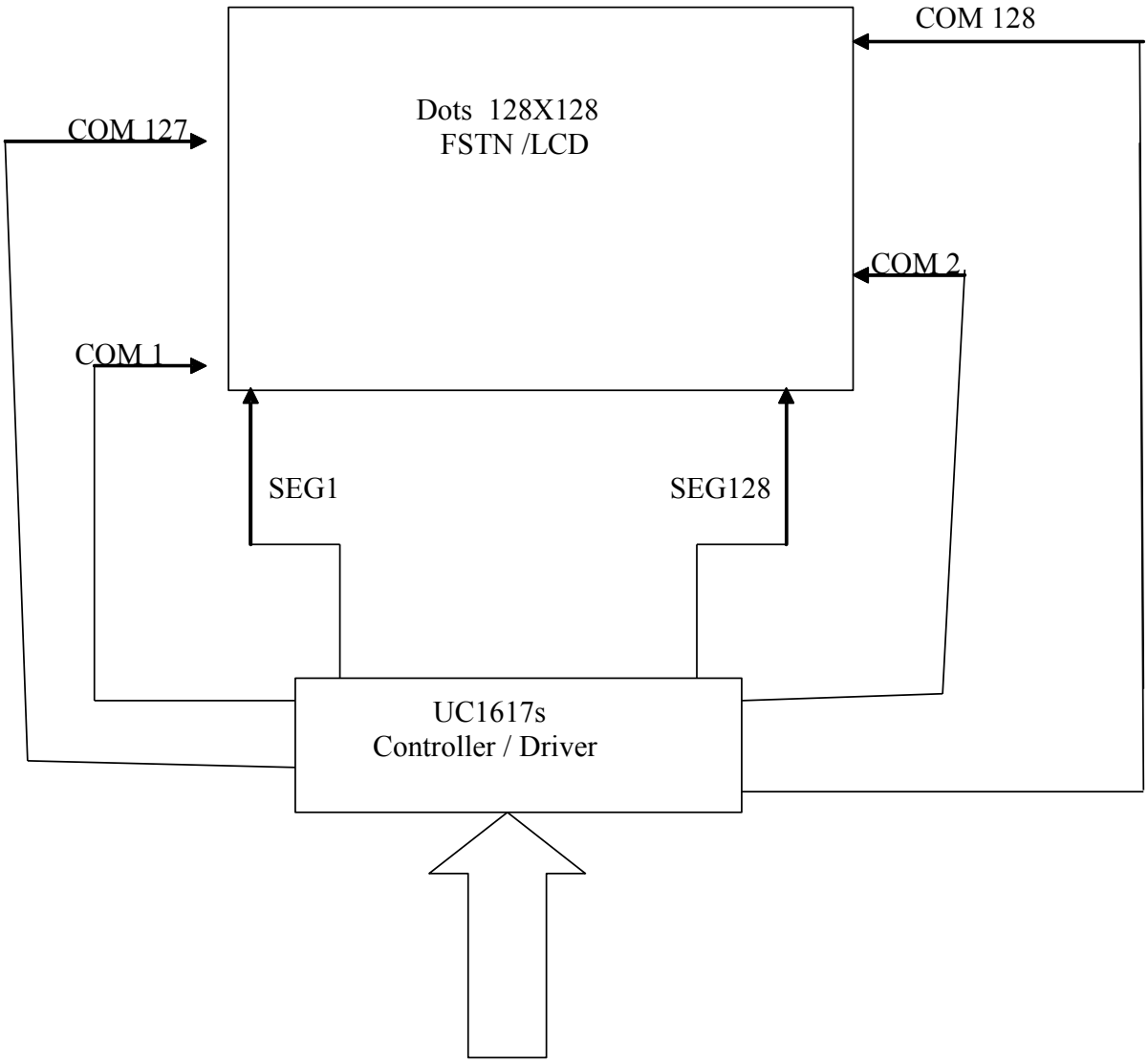
2.FUNCTIONS & FEATURES

2-1. Format	: 128X128 Dots
2-2. LCD mode	: FSTN, Positive, Transmissive Mode
2-3. Viewing direction	: 6 o'clock
2-4. Driving scheme	: 1/128 Duty cycle, 1/12 Bias
2-5. Low power operation	: Power supply voltage range (V_{DD}): 3.3V
2-6. VLCD adjustable for best contrast	: LCD driving voltage (V_{OP}): 13.0V
2-7. Operating temperature	: 0℃~50℃
2-8. Storage temperature	: -10℃~60℃

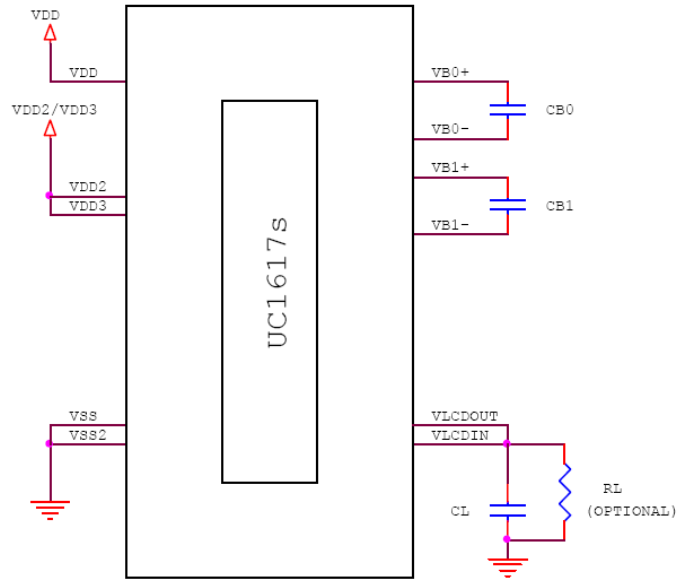
3.MECHANICAL SPECIFICATIONS

3-1. Module size	: 49mm(L)*55mm(W)*4.1mm(H)
3-2. Viewing area	: 46mm(L)*44.5mm(W)
3-3. Dot pitch	: 0.3mm(L)*0.32mm(W)
3-4. Dot size	: 0275mm(L)*0.295mm(W)

4.BLOCK DIAGRAM



5.POWER SUPPLY



Note

- Sample component values: (The illustrated circuit and component values are for reference only. Please optimize for specific requirements of each application.)
  C_B: 150 ~ 250x LCD load capacitance or 2.2μF (5V), whichever is higher.
  C_L: 330 nF (25V) is appropriate for most applications.
  R_L: 3.3M Ω ~10M Ω to act as a draining circuit when V_{DD} is shut down abruptly.

6. PIN DESCRIPTION

Pin no.	Symbol	Function
1	BLK	Backlight Ground
2	BLA	Backlight Power +3.0V
3	SCK	Serial clock input
4	SDA	Serial data input
5	/RES	Reset input pin. When RES is "L", initialization is executed.
6	/ CS0	This is the chip select signal.
7	CD	Select register data when CD= "H", and instruction when CD= "L"
8	VSS	Ground
9	VDD	Supply voltage for logic circuit +3.3V
10	VB0+	LCD Bias Voltages.
11	VB1+	
12	VB1-	
13	VB0-	
14	VLCD	Main LCD Power Supply.

7.MAXIMUM ABSOUTE LIMIT (T=25°C)

Item	Symbol	Standard value	Unit
Power supply voltage for logic	V_{DD}	-0.3~+4.0	V
Driver supply voltage for LCD	V_{LCD}	-0.3~19.8	V
Input voltage	V_{IN}	-0.3~V_{DD}+0.5	V
Operating temperature	Topr	0~+50	°C
Storage temperature	Tstg	-10~+60	°C

Note: Voltage greater than above may damage the module

8.ELECTRICAL CHARACTERISTICS

8-1 DC Characteristics

Item	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Test condition**
Operating voltage	V_{DD}, $V_{DD2/3}$	2.6	-	3.465	V	-
Voltage regulator operation voltage	V_{lcd}	-	14	15	V	$V_{DD2/3}$≥2.6V，25℃
Dynamic current consumption	I_{DD}	-	462	693	μA	V_{DD}=2.7V, V_{lcd}=14.0V, 1/11Bias, 2-pixel checker, Ta=25°C
Standby mode	I_{DD}	-	-	50	μA	V_{DD}=3.3V ,Ta=85°C
High-level-Input voltage	V_{IH}	0.8V_{DD}	-	V_{DD}	V	A0, D0~D7, WR,CS1 , RES,
Low-level Input voltage	V_{IL}	0	-	0.2V_{DD}	V	
High-level output voltage	V_{OH}	0.8V_{DD}	-	V_{DD}	V	I_{OH}=-0.5mA
low-level output voltage	V_{OL}	0	-	0.2V_{DD}	V	I_{OL}=0.5mA
Input leakage current	I_{IKG}	-	-	1.5	μA	V_{IN}=V_{SS} or V_{DD}(A0, WR,CS1)
LCD driving voltage	V_{LCD}	12.7	13.0	13.3	V	-

8-2 AC Characteristics

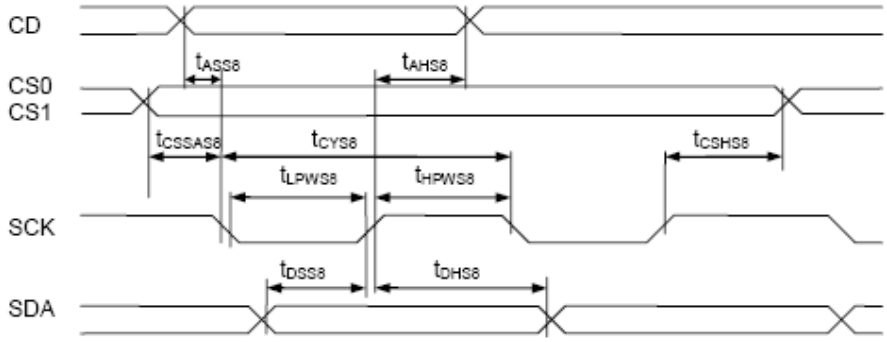


FIGURE 16: Serial Bus Timing Characteristics (for S8)

(2.5V ≤ V_{DD} < 3.465V, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
Write :						
t_{ASS8}	CD	Address setup time		0	–	nS
t_{AHS8}		Address hold time		0	–	nS
t_{CYS8}	SCK	System cycle time		35	–	nS
t_{LPWS8}		Low pulse width		17	–	nS
t_{HPWS8}		High pulse width		17	–	nS
t_{DSS8} t_{DHS8}	SDA	Data setup time Data hold time		15 5	–	nS
t_{CSSAS8} t_{CSHS8}	CS1/CS0	Chip select setup time Chip select hold time		5 5		nS
Read:						
t_{CYS8}	SCK	System cycle time		110	–	nS
t_{LPWS8}		Low pulse width		55	–	nS
t_{HPWS8}		High pulse width		55	–	nS
t_{ACCS8} t_{ODS8}		Read access time Output disable time	C_L = 100pF	– N/A	50 N/A	nS
t_{CSSAS8} t_{CSHS8}	CS1/CS0	Chip select setup time Chip select hold time		5 5		nS

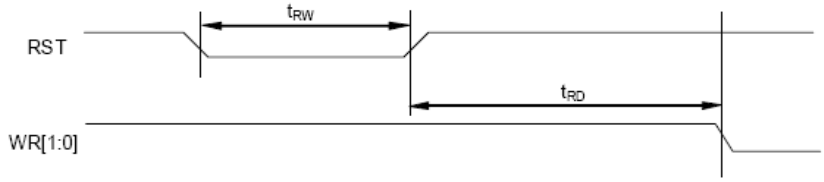


FIGURE 19: Reset Characteristics

(1.65V ≤ V_{DD} < 3.465V, Ta= –30 to +85°C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{RW}	RST	Reset low pulse width		3	–	µS
t_{RD}	RST, WR	Reset to WR pulse delay		10	–	mS

9.CONTROL AND DISPLAY COMMAND

The following is a list of host commands supported by UC1617s

C/D: 0: Control, 1: Data
W/R: 0: Write Cycle, 1: Read Cycle

\# Useful Data bits
– Don't Care

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action	Default
1.	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A
2.	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A
3.	Get Status	0	1	-	MX	MY	WA	DE	WS	MD	MS	Get {Status, Ver, PMO, Prod_Code, PID}	N/A
				Ver		PMO[5:0]							
				Prod_Code				0	PID	0	0		
4.	Set Page_C Address	0	0	0	0	0	#	#	#	#	#	Set CA[4:0]	00H
5.	Set Temp. Compensation	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	00b
6.	Set Panel Loading	0	0	0	0	1	0	1	0	#	#	Set PC[1:0]	10b
7.	Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC[3:2]	11b
8.	Set Adv. Program Control	0	0	0	0	1	1	0	0	R	R	Set APC[R][7:0], R = 0, 1 or 2	N/A
	(double-byte command)	0	0	#	#	#	#	#	#	#	#		
9.	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL[3:0]	0H
	Set Scroll Line MSB	0	0	0	1	0	1	-	#	#	#	Set SL[6:4]	0H
10.	Set Row Address LSB	0	0	0	1	1	0	#	#	#	#	Set RA[3:0]	0H
	Set Row Address MSB	0	0	0	1	1	1	-	#	#	#	Set RA[6:4]	0H
11.	Set V_{BIAS} Potentiometer	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	4EH
	(double-byte command)	0	0	#	#	#	#	#	#	#	#		
12.	Set Partial Display Control	0	0	1	0	0	0	0	1	#	#	Set LC[10:9]	00b: Disable
13.	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b
14.	Set Fixed Lines	0	0	1	0	0	1	0	0	0	0	Set {FLT, FLB}	00H
				#	#	#	#	#	#	#	#		
15.	Set Line Rate	0	0	1	0	1	0	0	0	#	#	Set LC[4:3]	00b
16.	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0b
17.	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0b
18.	Set Display Enable	0	0	1	0	1	0	1	1	#	#	Set DC[3:2]	10b
19.	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	#	Set LC[2:0]	000b
20.	Set N-Line Inversion	0	0	1	1	0	0	1	0	0	0	Set NIV[3:0]	6H
				-	-	-	-	#	#	#	#		
21.	Set LCD Gray Shade 1	0	0	1	1	0	1	0	0	#	#	Set LC[6:5]	01b
22.	Set LCD Gray Shade 2	0	0	1	1	0	1	0	1	#	#	Set LC[8:7]	10b
23.	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
24.	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
25.	Set Test Control	0	0	1	1	1	0	0	1	TT		For testing only. Do not use.	N/A
	(double-byte command)	0	0	#	#	#	#	#	#	#	#		
26.	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	11b: 11
27.	Set COM End	0	0	1	1	1	1	0	0	0	1	Set CEN[6:0]	127
		0	0	-	#	#	#	#	#	#	#		
28.	Set Partial Display Start	0	0	1	1	1	1	0	0	1	0	Set DST[6:0]	0
		0	0	-	#	#	#	#	#	#	#		
29.	Set Partial Display End	0	0	1	1	1	1	0	0	1	1	Set DEN[6:0]	127
		0	0	-	#	#	#	#	#	#	#		

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Action		Default
30.	Set Window Program Starting Page_C Address	0 0	0 0	1 -	1 -	1 -	1 #	0 #	1 #	0 #	0 #	Shared with MTP commands	Set WPC0	0
31.	Set Window Programming Starting Row Address	0 0	0 0	1 -	1 #	1 #	1 #	0 #	1 #	0 #	1 #		Set WPP0	0
32.	Set Window Programming Ending Page_C Address	0 0	0 0	1 -	1 -	1 -	1 #	0 #	1 #	1 #	0 #		Set WPC1	31
33.	Set Window Programming Ending Row Address	0 0	0 0	1 -	1 #	1 #	1 #	0 #	1 #	1 #	1 #		Set WPP1	127
34.	Enable window program	0	0	1	1	1	1	1	0	0	#	Set AC[3]		0: Disable
35.	Set MTP Operation control	0 0	0 0	1 -	0 -	1 #	1 #	1 #	0 #	0 #	0 #	Set MTPC[5:0]		10H
36.	Set MTP Write Mask	0 0	0 0	1 -	0 -	1 #	1 #	1 #	0 #	0 #	1 #	Set MTPM[5:0]		0
37.	Set V_{MTP1} Potentiometer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	0 #	0 #	Shared with Window Program commands	Set MTP1	N/A
38.	Set V_{MTP2} Potentiometer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	0 #	1 #		Set MTP2	
39.	Set MTP Write Timer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	1 #	0 #		Set MTP3	
40.	Set MTP Read Timer	0 0	0 0	1 #	1 #	1 #	1 #	0 #	1 #	1 #	1 #		Set MTP4	
SERIAL READ COMMAND (ENABLED ONLY IN S8/S9 MODE)														
41.	Get Status	0	0	1	1	1	1	1	1	1	0	Get status until chip disabled		N/A
		0	1	-	MX	MY	WA	DE	WS	MD	MS			
		0	1	Ver		PMO[5:0]								
		0	1	Prod_Code				0	PID	0	0			

Notes:

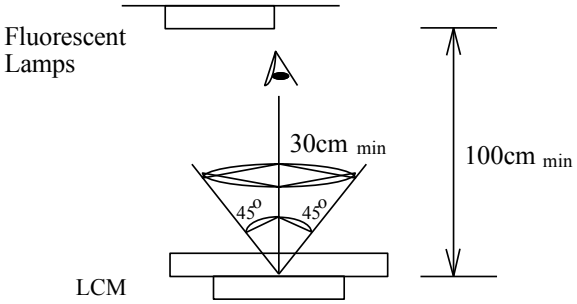
- Any bit patterns other than the commands listed above may result in undefined behavior.
- The interpretation of commands (36)~(40) depends on register MTPC[3].
- Commands (37)~(40) are shared with commands (30)~(33) and have exactly the same code. When MTPC[3]=0, commands (37)~(40) are interpreted as `Window Programming` commands. When MTPC[3]=1, they are the `MTP Control` commands.
- MTPM and PM are actually the same register. Only one of the commands (36 or 11) is valid at any time, and it is determined by MTPC[3].
- After MTP-ERASE or MTP-PROGRAM operation, before resuming normal operation, please always
  a) Remove TST4 power source,
  b) Do a full V_{DD} ON-OFF-ON cycle.

10.QUALITY SPECIFICATIONS

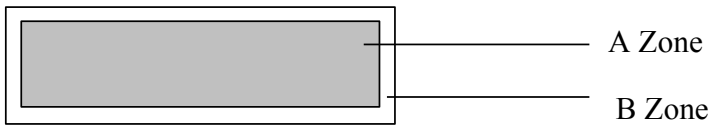
10.1 Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: Active display area (minimum viewing area).
B Zone: Non-active display area (outside viewing area).

10.2 Specification of quality assurance

AQL inspection standard

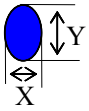
Sampling method: MIL-STD-105E, Level II, single sampling

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

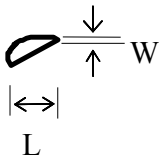
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background 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

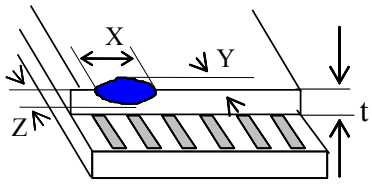
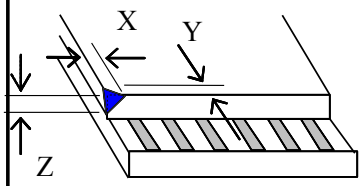
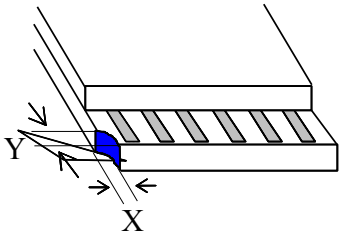
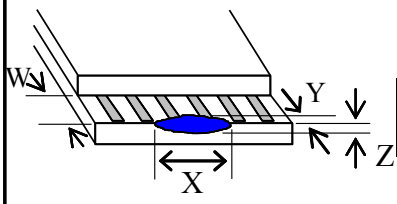
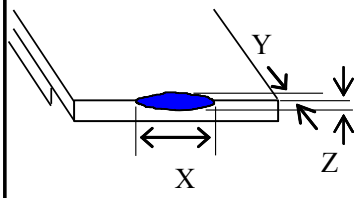
<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light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

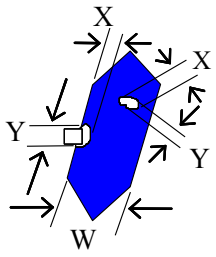
$\phi = (X+Y)/2$</td><td> 

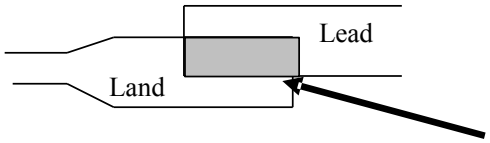
<table>
<tr><th>Point
Size</th><th>Acceptable Qty.</th></tr>
<tr><td>$\phi \leq 0.10$</td><td>Disregard</td></tr>
<tr><td>$0.10 < \phi \leq 0.20$</td><td>3</td></tr>
<tr><td>$0.20 < \phi \leq 0.25$</td><td>2</td></tr>
<tr><td>$0.25 < \phi \leq 0.30$</td><td>1</td></tr>
<tr><td>$\phi > 0.30$</td><td>0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

Scratch</td><td> 

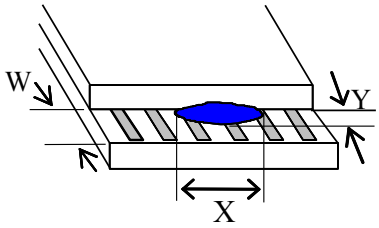
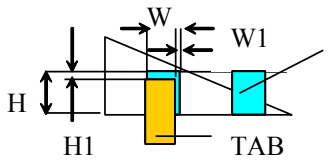
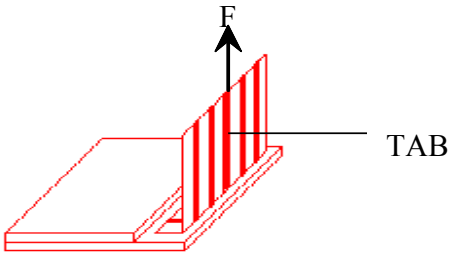
<table>
<tr><th colspan="2">Line</th><th rowspan="2">Acceptable Qty.</th></tr>
<tr><th>L</th><th>W</th></tr>
<tr><td>---</td><td>$0.015 \geq W$</td><td>Disregard</td></tr>
<tr><td>$3.0 \geq L$</td><td>$0.03 \geq W$</td><td rowspan="2">2</td></tr>
<tr><td>$2.0 \geq L$</td><td>$0.05 \geq W$</td></tr>
<tr><td>$1.0 \geq L$</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>
Unit: mm</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  Acceptable criterion X: ≤5; Y: ≤2; Z: ≤t/3

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>7</td><td>Segment
pattern
W = Segment width
ϕ = (X+Y)/2</td><td>(1) Pin hole
ϕ < 0.10mm is acceptable.
 

<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>ϕ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4W< ϕ≤1/2W</td><td>1</td></tr>
<tr><td>ϕ> 1/2W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>8</td><td>Back-light</td><td>(1) The color of backlight should correspond its specification.
(2) Not allow flickering</td></tr>
<tr><td>9</td><td>Soldering</td><td>(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.
 

50% lead</td></tr>
<tr><td>10</td><td>Wire</td><td>(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.</td></tr>
<tr><td>11*</td><td>PCB</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: 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.

10.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	60°C	48	No abnormalities in functions and appearance
High temp. Operating	50°C	48	
Low temp. Storage	-10°C	48	
Low temp. Operating	0°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	0°C ¬ 25°C →50°C (30 min ¬ 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

10.4 Precaution for using LCD/lCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoproply alcohol, ethyl alcohol or trichlorotriflorothane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not made any modification on the PCB without consulting HES.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.

4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: 280°C±10°C
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

HES LCDs and modules are not consumer products, but may be incorporated by HES's customers into consumer products or components thereof, HES does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of HES is limited to repair or replacement on the terms set forth below. HES will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between HES and the customer, HES will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with HES general LCD inspection standard . (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.