

Hunan Huayuan display technology CO.,LTD

GH12864-20

STN DOTS LCD MODULE

SPECIFICATION

Standard code	Department	Rev No.
		A/0
Checked by	Written by	Date

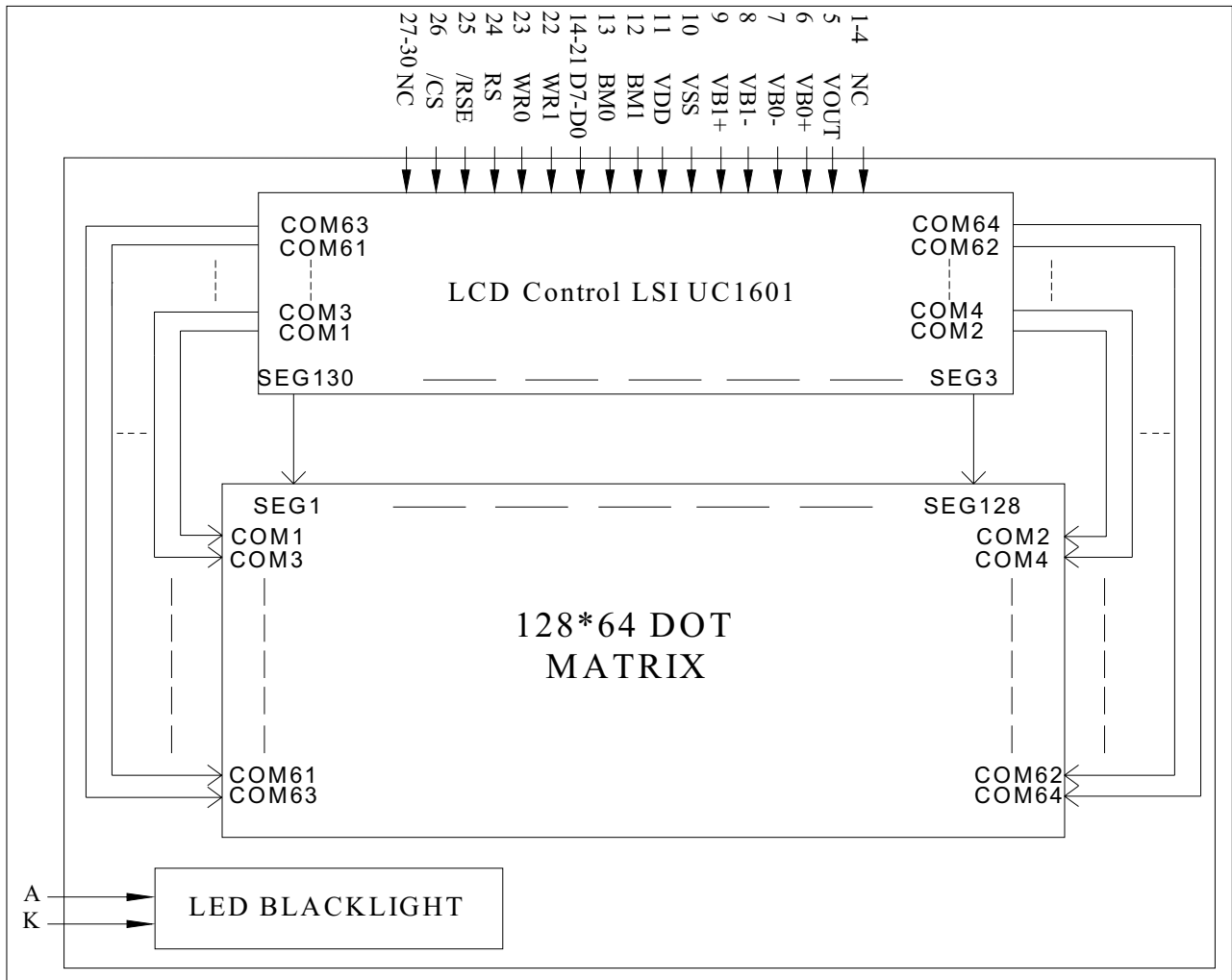
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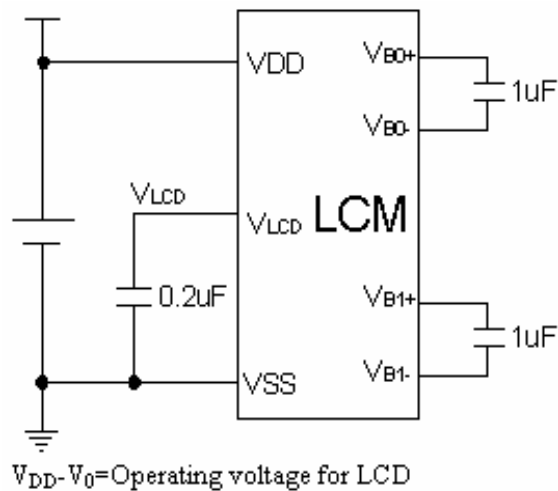
1.MECHANICAL SPECIFICATIONS

ITEM	Norminal dimensions
Lcd mode	128*64 Dots Graphic
Module dimension	56.6(W)*44.2(H:not include the FPC)*7.65MAX (T)
Viewing area	50.6(W) * 31.00(H)
Active area	46.562(W)*27.682 (H)
Dot pitch	0.364W) * 0.433(H)
Dot size	0.334 (W) * 0.403(H)
Duty/bias	1/65 duty, 1/9 bias
LCD	STN//Negative/Blue/Transmissive
Viewing direction	6 o'clock
Driver	UC1601

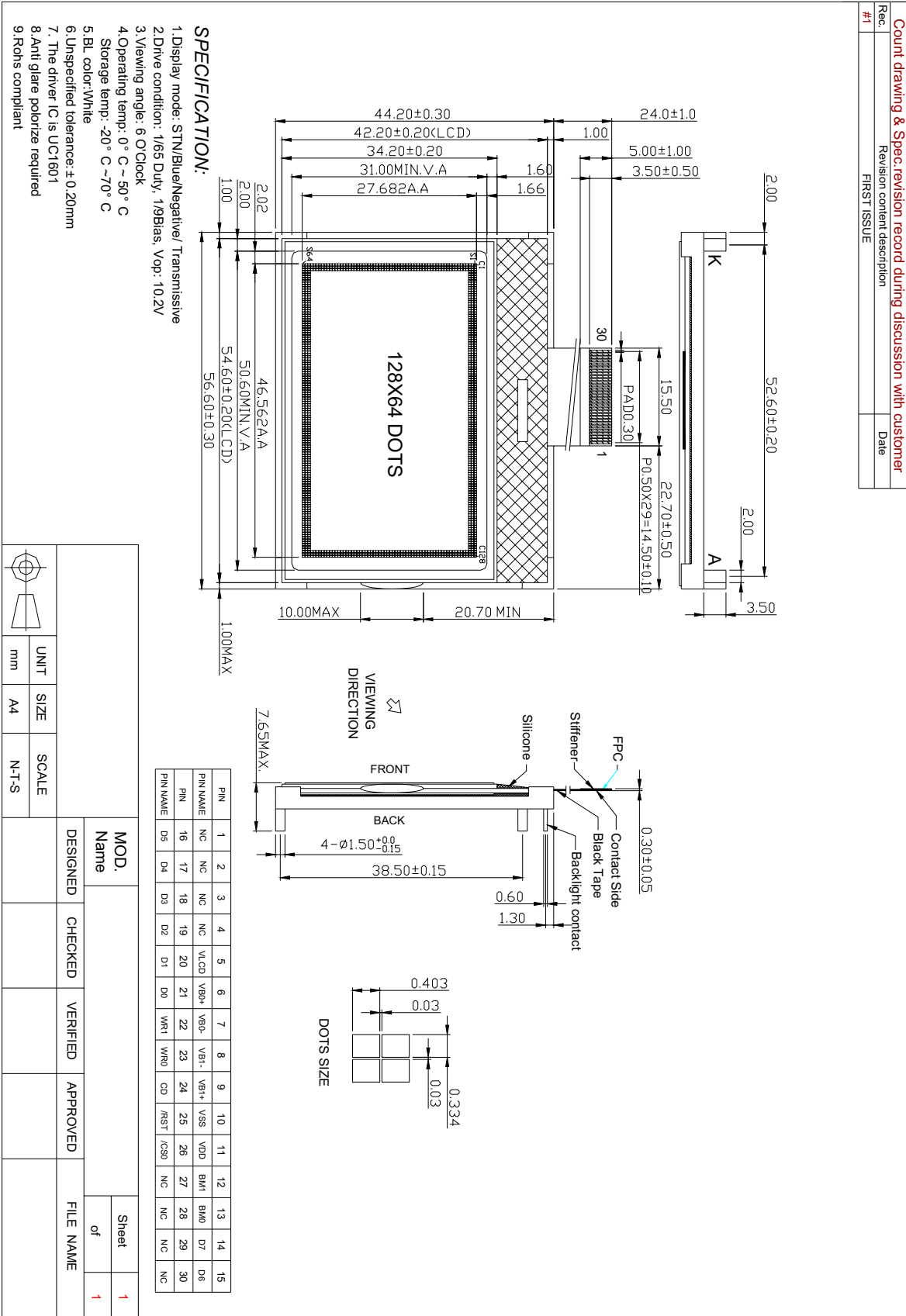
2. BLOCKDIAGRAM



3. POWER SUPPLY



4. Dimensional Outline



5. PIN DESCRIPTION

Pin no.	Symbol	Function
1	NC	NO Connection
2	NC	NO Connection
3	NC	NO Connection
4	NC	NO Connection
5	Vlcd	Power supply for LCD drive circuit
6	VB0+	LCD bias Voltages.
7	VB0-	LCD bias Voltages.
8	VB1-	LCD bias Voltages.
9	VB1+	LCD bias Voltages.
10	VSS	Ground
11	VDD	Power supply for Logic circuit and LCD
12	BM1	Host Interface set function
13	BM0	Host Interface set function
14	D7	Display data signal
15	D6	
16	D5	
17	D4	
18	D3/SDA	
19	D2	
20	D1	
21	D0/SCK	
22	WR1	Read/write enable signal
23	WR0	Read/write select signal
24	CD	Signal to select registers
25	RST	Reset signal
26	/CS	Chip select signal
27	NC	NO Connection
28	NC	NO Connection
29	NC	NO Connection
30	NC	NO Connection

6. MAXIMUM ABSOLUTE LIMIT (T=25°C)

Item	Symbol	Standard value	Unit
Power supply voltage for logic	V _{DD}	-0.3~+4.0	V
LCD driver voltage	V _{LCD}	-0.3~+12.0	V
Input voltage	V _I	V _{SS} -0.4~V _{DD} +0.3	V
Operating temperature	T _{opr}	0~+50	°C
Storage temperature	T _{stg}	-20~+70	°C

Note: Voltage greater than above may damage the module
All voltages are specified relative to V_{SS}=0V

7.ELECTRICAL CHARACTERISTICS.

7-1-1DC Characteristics ($V_{DD}=+3V$, $V_{SS}=0V$, $T_a=25^{\circ}C$)

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V_{DD}	2.7	3.0	3.3	V	-
Supply current	I_{DD}	-	-	1.5	mA	During display
Input current	I_0	-	0.9	-	mA	-
Output voltage	V_{OUT}	6		12	V	$V_{DD}=3V$
Input voltage	V_{IL}	VSS	-	0.2VDD	V	-
	V_{IH}	0.8VDD	-	V_{DD}	V	
Output voltage	V_{OL}	VSS	-	0.2VDD	V	$I_{OL}=2mA$
	V_{OH}	0.8VDD	-	VDD	V	$I_{OH}=200\mu A$
Input leakage current	I_{LKG}	-1	-	1	μA	$V_{IN}=0$ or V_{DD}
LCD driving voltage	V_{LCD}	10	10.2	10.4	V	-

7-1-2.Backlight Specifications Absolute maximum rating($T_a=25^{\circ}C$)

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward voltage	V_f	2.9	3.1	3.3	V	$I_f=30mA$
Reverse Current	I_r	-	-	15	μA	$V_r=5V$
Power Dissipation	P_d	-	-	100	mw	$I_f=30mA$
Chromaticity Coordinates	X	0.27	0.29	0.31	---	$I_f=30mA$
	Y	0.28	0.30	0.32	---	
Luminance	L_v	80	-	-	Cd/m^2	$I_f=30mA$
Luminance with the LCD	L_v	15	-	-	Cd/m^2	$I_f=30mA$
Color	White					

7-2 AC Characteristics

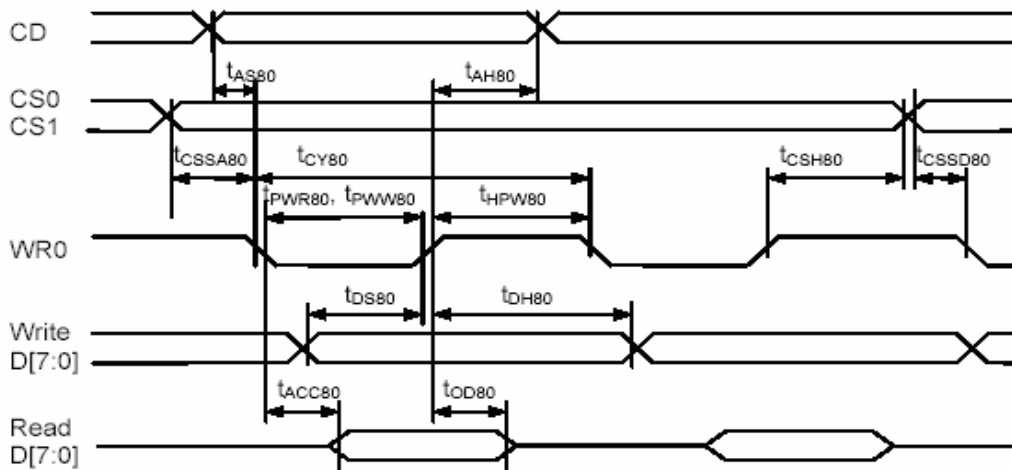


FIGURE 13: Parallel Bus Timing Characteristics (for 8080 MCU)

(2.5V ≤ V_{DD} < 3.3V, T_a = 25 °C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t _{AS80}	CD	Address setup time		0	–	nS
t _{AH80}		Address hold time		40	–	nS
t _{CY80}		System cycle time		135	–	nS
t _{PWR80}	WR1	Pulse width (read)		65	–	nS
t _{PWW80}	WR0	Pulse width (write)		65	–	nS
t _{HPW80}	WR0, WR1	High pulse width		65	–	nS
t _{DS80}	D0~D7	Data setup time		30	–	nS
t _{DH80}		Data hold time		20	–	nS
t _{ACC80}		Read access time	C _L = 100pF	–	50	nS
t _{OD80}		Output disable time		10	50	
t _{CSSA80}	CS1/CS0	Chip select setup time		10		nS
t _{CSSD80}				10		
t _{CSH80}				20		

(2.4V ≤ V_{DD} < 2.5V, T_a = 25 °C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t _{AS80}	CD	Address setup time		0	–	nS
t _{AH80}		Address hold time		60	–	nS
t _{CY80}		System cycle time		280	–	nS
t _{PWR80}	WR1	Pulse width (read)		95	–	nS
t _{PWW80}	WR0	Pulse width (write)		95	–	nS
t _{HPW80}	WR0, WR1	High pulse width		95	–	nS
t _{DS80}	D0~D7	Data setup time		30	–	nS
t _{DH80}		Data hold time		30	–	nS
t _{ACC80}		Read access time	C _L = 100pF	–	50	nS
t _{OD80}		Output disable time		10	50	
t _{CSSA80}	CS1/CS0	Chip select setup time		10		nS
t _{CSSD80}				10		
t _{CSH80}				20		

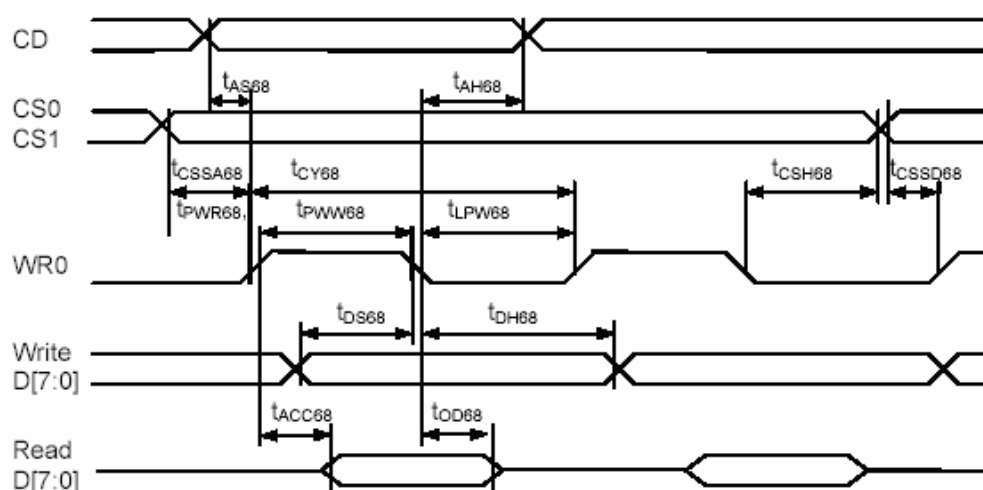


FIGURE 14: Parallel Bus Timing Characteristics (for 6800 MCU)

(2.5V \leq V_{DD} < 3.3V, T_a = 25 °C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t _{AS68} t _{AH68}	CD	Address setup time Address hold time		0 40	–	nS
t _{CY68}		System cycle time		135	–	nS
t _{PWR68}	WR1	Pulse width (read)		65	–	nS
t _{PWW68}		Pulse width (write)		65	–	nS
t _{LPW68}		Low pulse width		65	–	nS
t _{DS68} t _{DH68}	D0~D7	Data setup time Data hold time		30 15	–	nS
t _{ACC68} t _{OD68}		Read access time Output disable time	C _L = 100pF	– 10	50 50	nS
t _{CSSA68} t _{CSSD68} t _{CSH68}	CS1/CS0	Chip select setup time		10 10 20		nS

(2.4V \leq V_{DD} < 2.5V, T_a = 25 °C)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t _{AS68} t _{AH68}	CD	Address setup time Address hold time		0 60	–	nS
t _{CY68}		System cycle time		200	–	nS
t _{PWR68}	WR1	Pulse width (read)		95	–	nS
t _{PWW68}		Pulse width (write)		95	–	nS
t _{LPW68}		Low pulse width		95	–	nS
t _{DS68} t _{DH68}	D0~D7	Data setup time Data hold time		30 30	–	nS
t _{ACC68} t _{OD68}		Read access time Output disable time	C _L = 100pF	– 10	50 50	nS
t _{CSSA68} t _{CSSD68} t _{CSH68}	CS1/CS0	Chip select setup time		10 10 20		nS

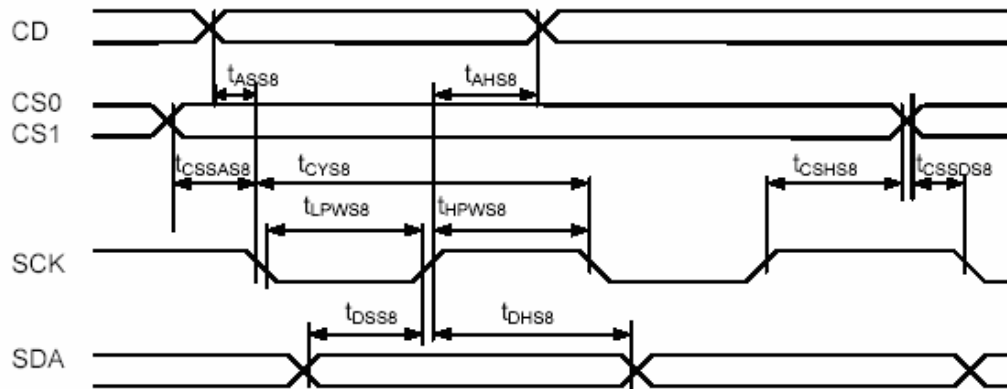


FIGURE 15: Serial Bus Timing Characteristics (for S8)

($2.5V \leq V_{DD} < 3.3V$, $T_a = 25^\circ C$)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{ASS8}	CD	Address setup time		0	–	nS
t_{AHS8}		Address hold time		40	–	nS
t_{CYS8}	SCK	System cycle time		135	–	nS
t_{LPWS8}		Low pulse width		65	–	nS
t_{HPWS8}		High pulse width		65	–	nS
t_{DSS8}	SDA	Data setup time		30	–	nS
t_{DHS8}		Data hold time		15	–	nS
t_{CSSAS8}	CS1/CS0	Chip select setup time		10		nS
t_{CSSDS8}				10		
t_{CSHS8}				20		

($2.4V \leq V_{DD} < 2.5V$, $T_a = 25^\circ C$)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{ASS8}	CD	Address setup time		0	–	nS
t_{AHS8}		Address hold time		60	–	nS
t_{CYS8}	SCK	System cycle time		200	–	nS
t_{LPWS8}		Low pulse width		95	–	nS
t_{HPWS8}		High pulse width		95	–	nS
t_{DSS8}	SDA	Data setup time		30	–	nS
t_{DHS8}		Data hold time		25	–	nS
t_{CSSAS8}	CS1/CS0	Chip select setup time		10		nS
t_{CSSDS8}				10		
t_{CSHS8}				20		

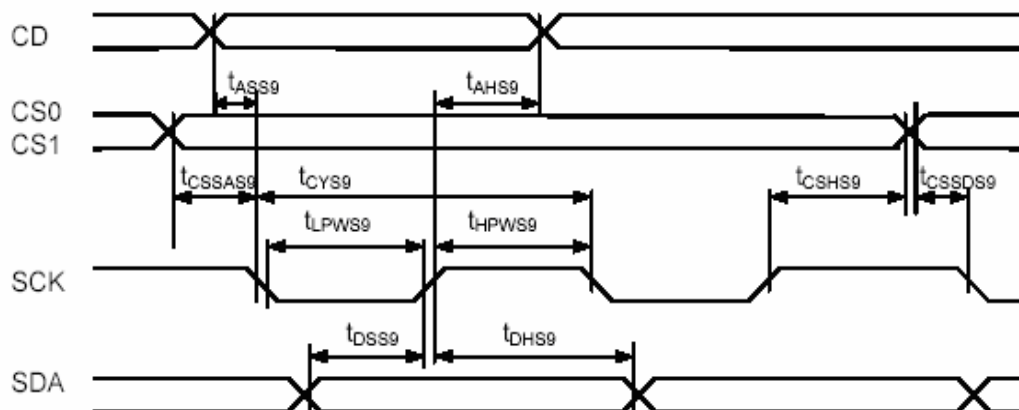


FIGURE 16: Serial Bus Timing Characteristics (for S9)

 $(2.5V \leq V_{DD} < 3.3V, T_a = 25^\circ C)$

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{ASS9}	CD	Address setup time		0	–	nS
t_{AHS9}		Address hold time		40	–	nS
t_{CYS9}	SCK	System cycle time		135	–	nS
t_{LPWS9}		Low pulse width		65	–	nS
t_{HPWS9}		High pulse width		65	–	nS
t_{DSS9}	SDA	Data setup time		30	–	nS
t_{DHS9}		Data hold time		15	–	nS
t_{CSSAS9}	CS1/CS0	Chip select setup time		10		nS
t_{CSSDS9}				10		
t_{CSHS9}				20		

 $(2.4V \leq V_{DD} < 2.5V, T_a = 25^\circ C)$

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{ASS9}	CD	Address setup time		0	–	nS
t_{AHS9}		Address hold time		60	–	nS
t_{CYS9}	SCK	System cycle time		200	–	nS
t_{LPWS9}		Low pulse width		95	–	nS
t_{HPWS9}		High pulse width		95	–	nS
t_{DSS9}	SDA	Data setup time		30	–	nS
t_{DHS9}		Data hold time		20	–	nS
t_{CSSAS9}	CS1/CS0	Chip select setup time		10		nS
t_{CSSDS9}				10		
t_{CSHS9}				20		

8. CONTROL AND DISPLAY COMMAND

The following is a list of host commands supported by UC1601

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	RS	WA	DE	-	-	N/A	
4	Set Column Address LSB	0	0	0	0	0	0	#	#	#	#	Set CA [3:0]	0
	Set Column Address MSB	0	0	0	0	0	1	#	#	#	#	Set CA [7:4]	0
5	Set Multiplexing Rate	0	0	0	0	1	0	0	0	#	#	Set MR [1:0]	11b: 65
6	Set Temp. Compensation	0	0	0	0	1	0	0	1	#	#	Set TC[1:0]	00b: -0.05%/°C
7	Set Panel Loading	0	0	0	0	1	0	1	0	0	#	Set PC[0]	0b: < 15nF
8	Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC[2:1]	11b
9	Set Adv. Program Control (double byte command)	0	0	0	0	1	1	0	0	0	R	Set APC[R][7:0], R = 0, or 1	N/A
10	Set Scroll Line	0	0	0	1	#	#	#	#	#	#	Set SL[5:0]	0
11	Set Page Address	0	0	1	0	1	1	#	#	#	#	Set PA[3:0]	0
12	Set V _{BIAS} Potentiometer (double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM[7:0]	COH
		0	0	#	#	#	#	#	#	#	#		
13	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC[2:0]	001b
14	Set Frame Rate	0	0	1	0	1	0	0	0	0	#	Set LC[3]	0b
15	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC[1]	0
16	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC[0]	0
17	Set Display Enable	0	0	1	0	1	0	1	1	1	#	Set DC[2]	0
18	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	0	Set LC[2:1]	0
19	System Reset	0	0	1	1	1	0	0	0	1	0	System Reset	N/A
20	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
21	Set Test Control (double byte command)	0	0	1	1	1	0	0	1	TT		For testing only. Do not use.	N/A
		0	0	#	#	#	#	#	#	#	#		
22	Set LCD Bias Ratio	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	11b: 9
23	Reset Cursor Update Mode	0	0	1	1	1	0	1	1	1	0	AC[3]=0, CA=CR	N/A
24	Set Cursor Update Mode	0	0	1	1	1	0	1	1	1	1	AC[3]=1, CR=CA	N/A

* Other than commands listed above, all other bit patterns result in NOP (No Operation).

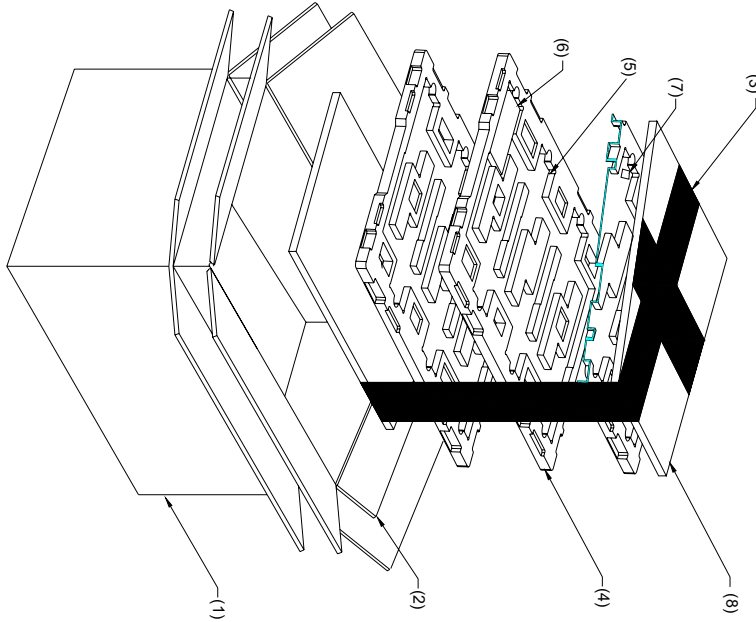
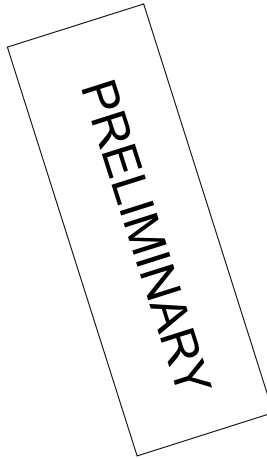
9.Package

NO.	ITEM	PART NO.	SPEC	UNIT	QTY PER	REMARK
1	CARTON	PK-CARTON-A	400*300*285	PCS	1	
2	SUB-CARTON	PK-SUB CARTON-A	375*270*260	PCS	1	
3	ADHESIVE TAP	BG-12864A-PSPK-B	1	m	1	+- SHAPE
4	PEARL PAD	BG-12864A-PP-B	360*255*17	PCS	19	ESD 10 ⁻⁶ -10 ⁻¹¹
5	MODULE	BG-12864A-SDBA-J-G-B	306.5*233.7*2.0	PCS	18	BE CAREFUL IN PUT
6	DRYER	56.6*69.2*7.65	56.6*69.2*7.65	PCS	360	
7	DRYER	19	19	PCS	8	
8	PAPER BOARD	PK-PB-A	360*255*6	PCS	2	

Specification:

One sub-carton contains 19 layers packings; 20modules in each PSPK tray of 18 layers, 8 packer of dryers is put on the upper top of 19 th PSPK tray. A stiff board is put on bottom and top side to stiffen the packings and it is adhered together with adhesive tape. The sub-carton are placed into the outside carton.

One carton can contain 18*20=360 modules.

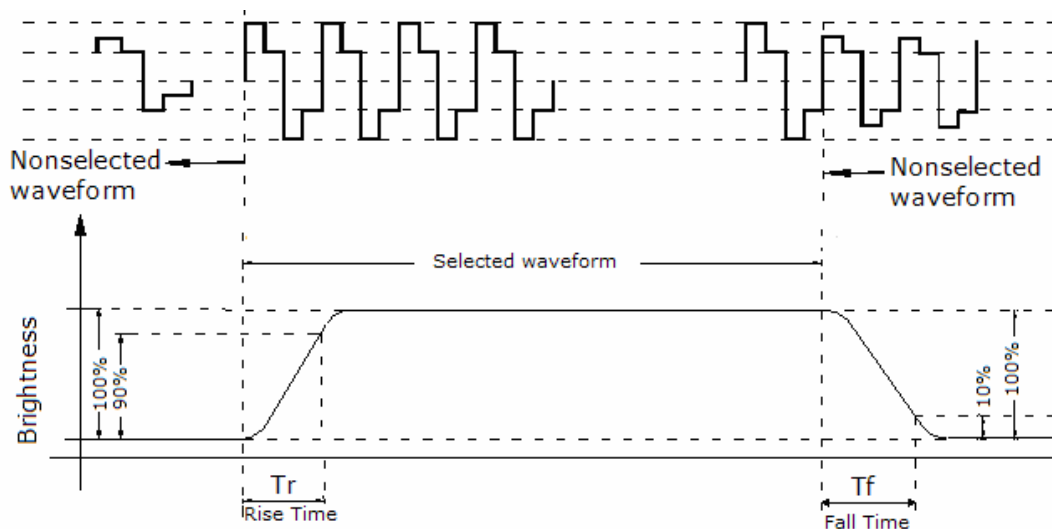


10. Quality Specifications

10-1. Electro-Optic Characteristics

NO	ITEM		Symbol	Temp°C	Rating			Unit	
					Min	Typ	Max		
1	Response	Rise time	Tr	25	N/A	138.8	300	Ms	
	time	Fall time	Tf						25
2	Operating Frequency		Ff	25		64			
3	Contrast Rate		Cr	25	2	5.0	-		-
4	Viewing Direction		6 O' CLOCK						
5	Viewing Angle Cr ≥ 2	12H φ = 90°	θ 1	25		30		Deg	
		6H φ = 270°	θ 2			38			
		3H φ = 0°	θ 3			47			
		9H φ = 180°	θ 4			46			
6	Current Consumption		Is	25		8.2	12	μ A	
7	Capacitance		C	25		3.5		nF	

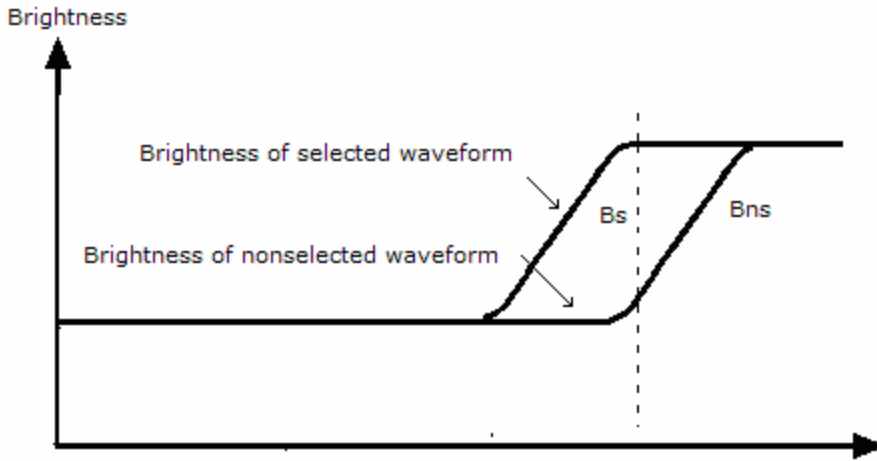
Response Time



Measuring Condition:

1. Driving waveform: 1/N Duty, 1/a Bias selected waveform.
2. Driving Frequency: Typical value in Individual specification.
3. Operating Voltage : LCD driving voltage getting maximum contrast rate.
4. Measuring Angle : See Individual Specification.
5. Measuring Temperature : See Individual Specification .

Contrast Ratio Definition



Negative Type

$$\text{Contrast Ratio(Cr)} = \frac{\text{Brightness of non-selected waveform(Bns)}}{\text{Brightness of selected waveform(Bs)}}$$

Viewing Angle

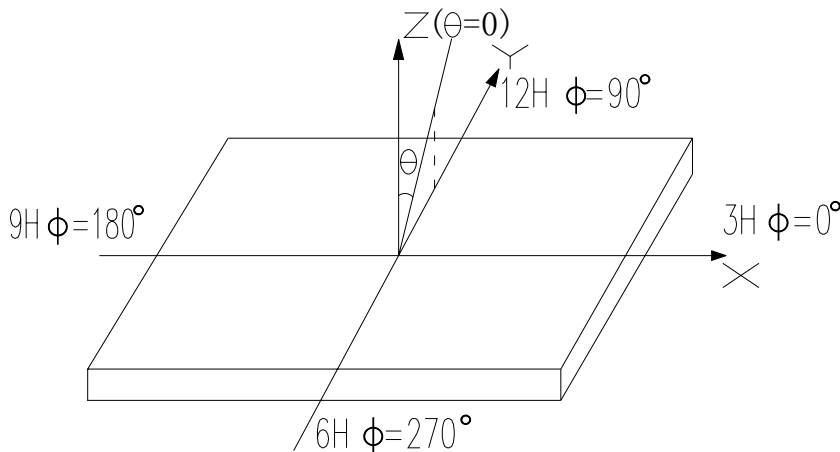
Viewing Angle

θ : Angle between Viewer Direction and Normal.

$$(-90^\circ \leq \theta \leq 90^\circ)$$

ϕ : Angle between Projection of Viewer Direction to X-Y plane and Y axis.

$$(0^\circ \leq \phi \leq 360^\circ)$$



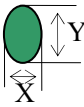
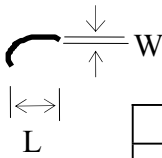
Measuring Condition

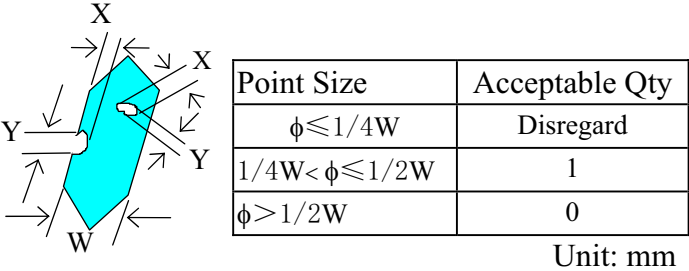
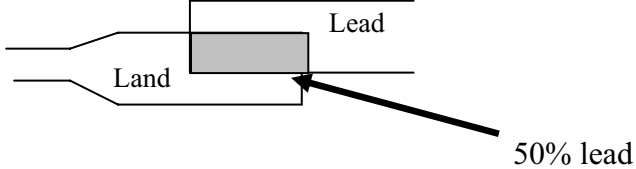
1. Driving Voltage: Same as Vlcd.
2. Driving Frequency: Same as Frame Frequency

10-2 Defect classification

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

Note on defect classification

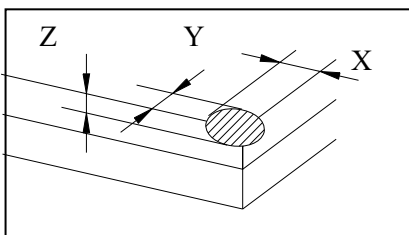
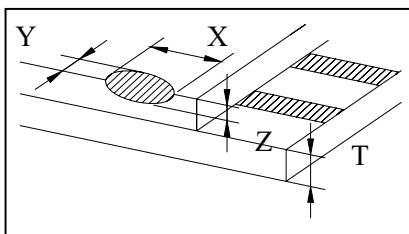
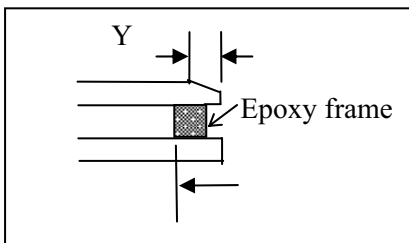
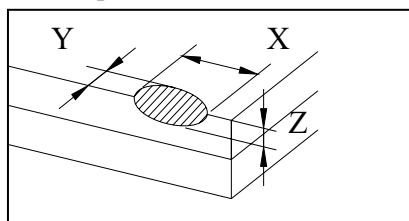
No.	Item	Criterion																				
1	Short or open circuit	Not allow																				
	LC leakage																					
	Flickering																					
	No display																					
	Wrong viewing direction																					
	Wrong Back-light																					
2	Contrast defect	Refer to approval sample																				
	Background color deviation																					
3	Point defect, Black spot, dust (incl. Polarizer) $\phi = (X+Y)/2$	 <table border="1" data-bbox="938 882 1375 1178"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <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> </tbody> </table> <p style="text-align: center;">Unit: mm</p>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.20$	3	$0.20 < \phi \leq 0.25$	2	$0.25 < \phi \leq 0.30$	1	$\phi > 0.30$	0								
Point Size	Acceptable Qty.																					
$\phi \leq 0.10$	Disregard																					
$0.10 < \phi \leq 0.20$	3																					
$0.20 < \phi \leq 0.25$	2																					
$0.25 < \phi \leq 0.30$	1																					
$\phi > 0.30$	0																					
4	Line defect	 <table border="1" data-bbox="798 1366 1347 1626"> <thead> <tr> <th colspan="2">Line</th> <th>Acceptable Qty.</th> </tr> <tr> <th>L</th> <th>W</th> <th></th> </tr> </thead> <tbody> <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> </tbody> </table> <p style="text-align: center;">Unit: mm</p>	Line		Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 < W$	Applied as point defect
Line		Acceptable Qty.																				
L	W																					
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$1.0 \geq L$	$0.1 > W$	1																				
---	$0.05 < W$	Applied as point defect																				
5	Rainbow	Not more than two color changes across the viewing area.																				

No.	Item	Criterion								
6	Segment pattern $W = \text{Segment width}$ $\phi = (X+Y)/2$	(1) Pin hole $\phi < 0.10\text{mm}$ is acceptable.  <table border="1" data-bbox="946 517 1406 694"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 1/4W$</td> <td>Disregard</td> </tr> <tr> <td>$1/4W < \phi \leq 1/2W$</td> <td>1</td> </tr> <tr> <td>$\phi > 1/2W$</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: right;">Unit: mm</p>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
7	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering								
8	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. 								
9	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.								
10	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.								

11

LCD

2.1.1 chip on the surface



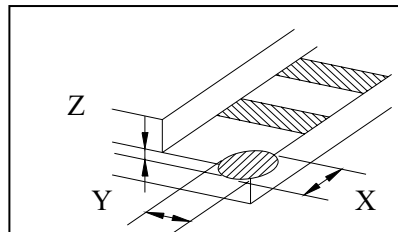
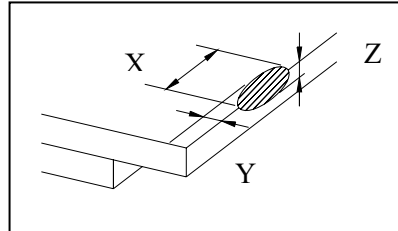
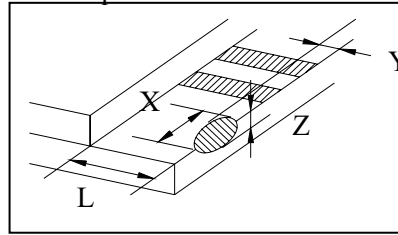
X	Y	Z
$>1/8A$	$\leq 0.3\text{mm}$	$\leq 1/2T$
$\leq 1/8A$	Not enter into epoxy frame	$\leq T$
	Not enter into the inner edge of epoxy	$\leq 1/2T$

A: LCD Length

11

LCD

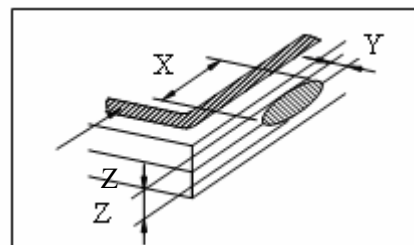
2.1.2 chip on the terminal



X	Y	Z
$>1/8A$	$\leq 0.3\text{mm}$	$\leq 1/2T$
$\leq 1/8A$	$\leq 1/2L$	$\leq T$
$\leq 1/8A$ 且 $\leq 1\text{mm}$	$\leq L$	$\leq T$
$\leq 1/8A$ 且 $\leq 2\text{mm}$	$\leq L$	$\leq 1/2T$

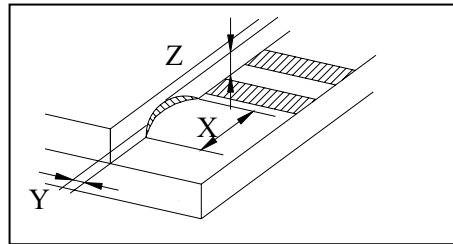
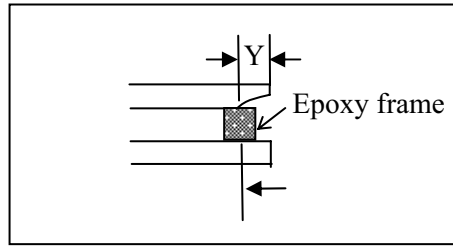
Note: the distance between crack and contact pad must be greater than the width of 1st contact pad
 A: LCD Length

2.1.3 chip out on between side



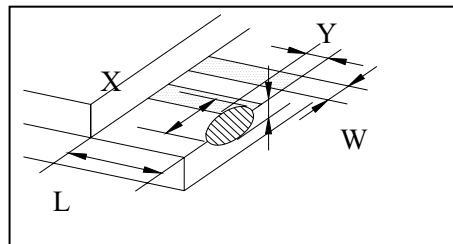
11

LCD



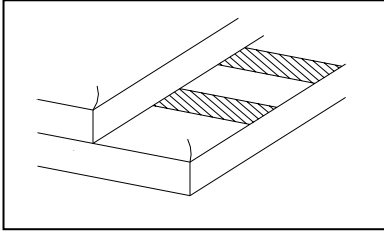
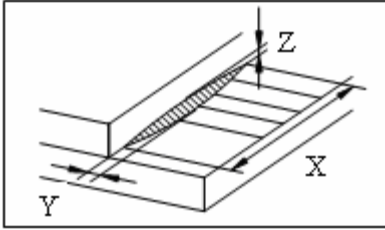
X	Y	Z
$\leq 1/8A$	Not enter into epoxy frame	$Z \leq 2T$
	Not enter into 1/2 epoxy frame	$Z \leq 1/2T$

2.1.4 including corner chip and side chip



X	Y	Z
$>1/8A$	$\leq 1/6L$	$\leq 1/2T$
$\leq 1/8A$	$\leq 1/3L$	
$\leq 1/4W$	$\leq 2/3L$	

A: LCD Length

11	LCD	<p>2.2 Chip out</p>  <p>1) Chip out is that crackles extend to inner edge . 2) Crackles round epoxy frame will be rejected. 3) Chip out on the terminal will be rejected: $Z=T$ length $>1\text{mm}$ or $Z<T$ length $>2\text{mm}$ 4) The chip out at ITO will be rejected.</p>							
		<p>2.3 Poor cutting</p>  <table border="1" data-bbox="678 1122 1158 1368"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>$>1/8$ A</td> <td>≤ 0.3</td> <td>$\leq 1/2T$</td> </tr> <tr> <td>\leq $1/8A$</td> <td>According to drawing</td> <td>$1/2T \leq Z \leq T$</td> </tr> </tbody> </table> <p>A: LCD Length</p> <p>Any one out of the specification will be rejected.</p>	X	Y	Z	$>1/8$ A	≤ 0.3	$\leq 1/2T$	\leq $1/8A$
X	Y	Z							
$>1/8$ A	≤ 0.3	$\leq 1/2T$							
\leq $1/8A$	According to drawing	$1/2T \leq Z \leq T$							

10-3. Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	70°C	240	No abnormalities in functions and appearance
High temp. Operating	50°C	240	
Low temp. Storage	-20°C	240	
Low temp. Operating	0°C	240	
Humidity	40°C/ 90%RH	240	
Temp. Cycle	-20°C ← 25°C → 70°C (1 hour ← 5 min → 1 hour)	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 ($20\pm 8^{\circ}\text{C}$), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

10-4. Precaution for using LCM

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 isopropyl alcohol, ethyl alcohol or trichloroethane, 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 make any modification on the PCB without consulting HY.
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: $300^{\circ}\text{C}\pm 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.
5. Use lead-free 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 v_{lcd} .
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.

Limited Warranty

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

1. The liability of HY is limited to 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 HY and the customer, HY will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with 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.