

WINCOM TECH Co., Ltd.

Product Specification

MB-TFT-35-S4-S

CUSTOMER	
CUSTOMER PART NO.	
APPROVED BY	
DATE	

.. Approved For Specifications

n Approved For Specifications & Sample

APPROVED BY	CHECKED BY	ORGANIZED BY

1 Feature

This single-display module is suitable for cell phone application. The Main-LCD adopts one backlight with High brightness 6-lamps white LED.

- (1) Construction: 3.5" a-Si color TFT-LCD, White LED Backlight, and FPC.
- (2) Main LCD: 2.1 Amorphous-TFT 3.5-inch display, transmissive, normally white type, and 6 o'clock.
 - 2.2 320(RGB) X240 dots Matrix.
 - 2.3 Narrow-contact ledge technique.
 - 2.4 Main LCD Driver IC: HX8218C01 x 1 and HX8615A x 1.
 - 2.5 Real 16.7M colors display.
- (3) Low cross talk by frame rate modulation.
- (4) Direct data display with display RAM.
- (5) Partial display function: You can save power by limiting the display space.
- (6) RGB interface.
- (7) Abundant command functions:
 - Area scroll function
 - Display direction switching function
 - Power saving function
- (8) Video signal interface: Parallel RGB.

Electric volume control function: you are able to program the temperature compensation function

2 Mechanical specifications

Dimensions and weight

Item		Specifications	Unit
External shape dimensions		76.9(W) x 63.9 (H) x 3.16(D)	mm
Main LCD	Pixel size	0.073 (W) x 0.219(H)	mm
	Active area	70.08 (W) x 52.56 (H)	mm

3 Absolute max Ratings and environment

3-1 Absolute max Ratings (Ta=25 °C, GND=0V)

Item	Symbol	Min.	Max.	Unit	Remarks
Power supply voltage	VDD	-0.3	+7.0	V	
Power supply voltage	VCC	-0.3	+7.0	V	
Input voltage	VIN	-0.3	VDD+0.3	V	

3-2 Environment

Item	Specifications	Remarks
Storage temperature	Max. +80 °C Min. -30 °C	Note 1: Non-condensing
Operating temperature	Max. +70 °C Min. -20 °C	Note 1: Non-condensing

1 : Ta ≤ +40 °C Max.85%RH

Ta > +40 °C The max. Humidity should not exceed the humidity with 40 °C 85%RH.

4 Electrical specifications

4-1 Electrical characteristics of LCM (IOV_{CC}=3.0V, Ta=25 °C)

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Power supply	VCC		+3	+3.3	+3.6	V
S-IC High-level input voltage	V _{IHC}		0.7 IOV _{CC}		IOV _{CC}	V
S-IC Low-level input voltage	V _{ILC}		0		0.3 IOV _{CC}	V
G-IC High-level input voltage	V _{IHC}		0.7 IOV _{CC}		IOV _{CC}	V
G-IC Low-level input voltage	V _{ILC}		0		0.3 IOV _{CC}	V
Consumption current of LED	V _{LED-ON}	I _F =20 mA	-	20.4	21.6	V

4-2 LED back light specification

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Forward voltage	V_f	$I_f=20\text{mA}$	-	20.4	21.6	V
Forward current	I_f	6-chip series	-	20	-	mA
Power Consumption	P_{BL}	$I_f=20\text{mA}$	-	408	-	mW
Uniformity (with L/G)	-	$I_f=20\text{mA}$	80%*1	-	-	
Bare LED Luminous intensity	V_f I_f	20.4 V 20mA	3200	-	-	cd/m2
Luminous color	White					
Chip connection	6-chip series connection					

5 Optical characteristics

Main LCD

5.1 Optical characteristics

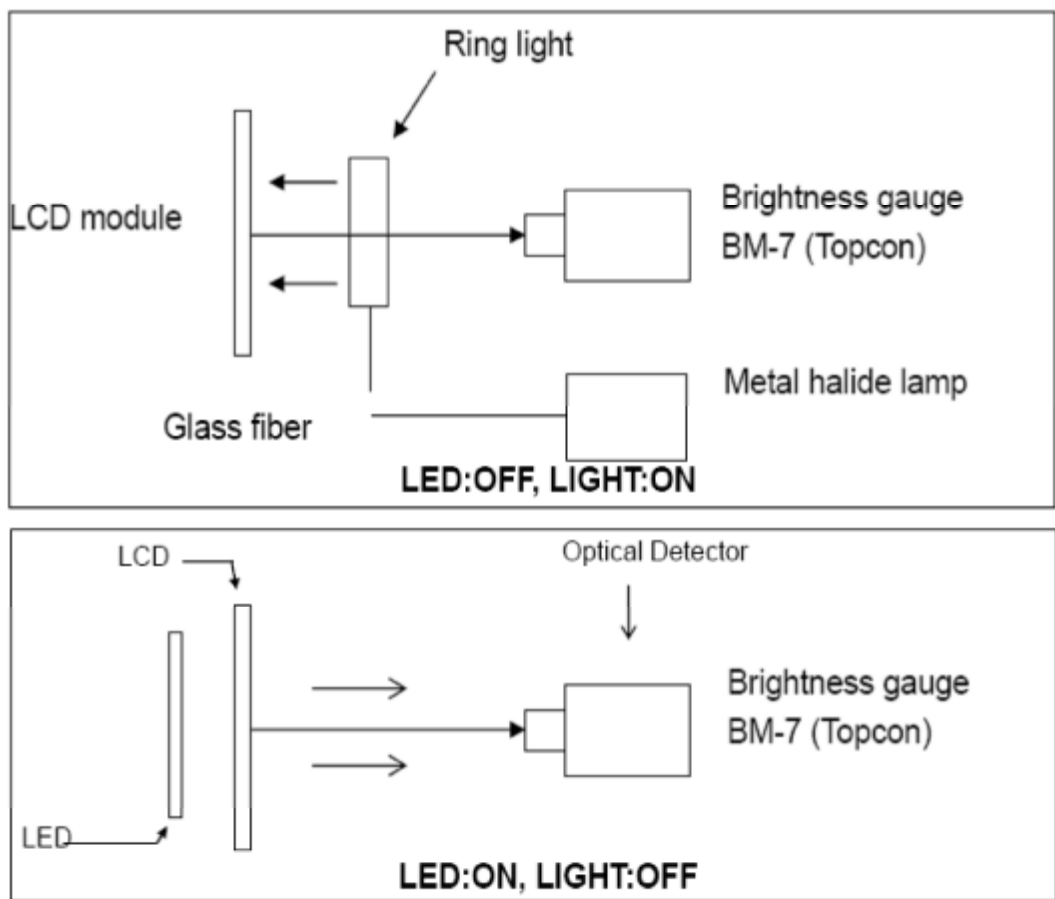
LED backlight transmissive module:

Item	Symbol	Temp.	Min.	Std.	Max.	Unit	Conditions	
Response time	$T_r + T_f$	25 °C	-	25	-	ms	(Note 2)	
Contrast ratio	CR	25 °C	240	300	-	-	$\theta = 0^\circ, \varphi = 0^\circ$ (Note 4)	
Visual angle	Vertical	θ	25 °C	90	100	-	Degree	CR \geq 10 (Note 3)
	Horizontal	φ	25 °C	110	120	-		
Visual angle direction priority				6:00			(Note 5)	
Brightness				250		Cd/m2	$V_{LED}=20.4\text{V}, 20\text{mA}$ Full White pattern	

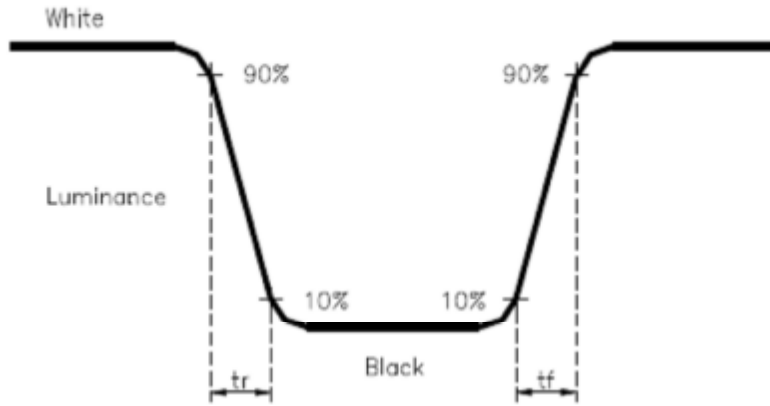
5.2 CIE (x, y) chromaticity (Ta = 25°C)

Item	Symbol	Transmissive			Conditions
		Min.	Typ.	Max	
Red	X	0.588	0.608	0.628	0.628
	Y	0.306	0.316	0.326	0.326
Green	X	0.292	0.312	0.332	0.315
	Y	0.295	0.305	0.315	0.576
Blue	X	0.125	0.135	0.145	0.145
	Y	0.122	0.137	0.152	0.152
White	X	0.285	0.305	0.325	0.325
	Y	0.314	0.334	0.354	0.354

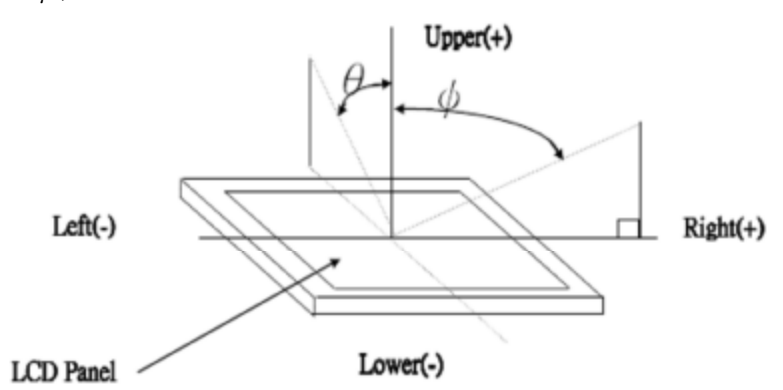
NOTE 1: Optical characteristic measurement system



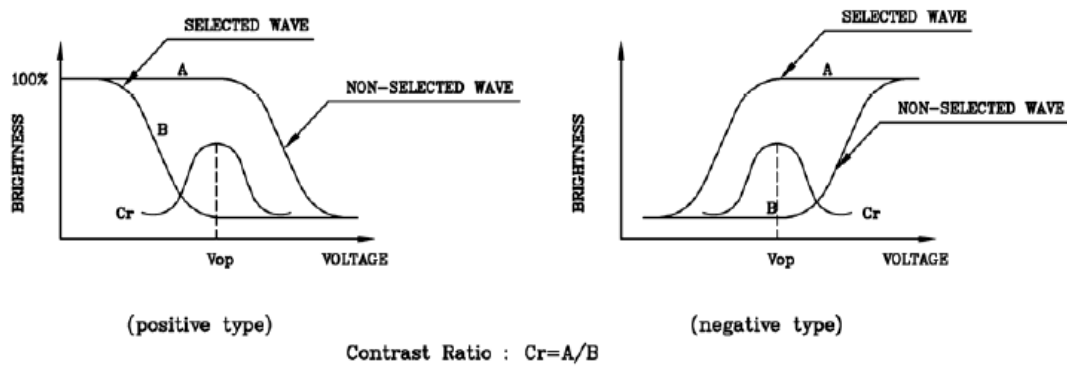
NOTE 2: Response time definition



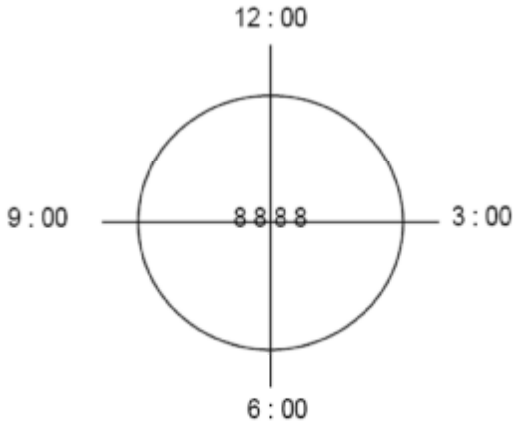
NOTE 3: φ , θ definition



NOTE 4: Contrast definition



NOTE 5: Visual angle direction priority



6 Block Diagram

Block diagram (Main LCD)

Display format: A-Si TFT transmissive, Normally white type, 6 o'clock.

Display composition: 240 x RGB x 320 dots

LCD Driver: HX8218C01/HX8615A

Back light: White LED x 6 ($I_{LED} = 20mA$)

6.1 Whole chip block diagram

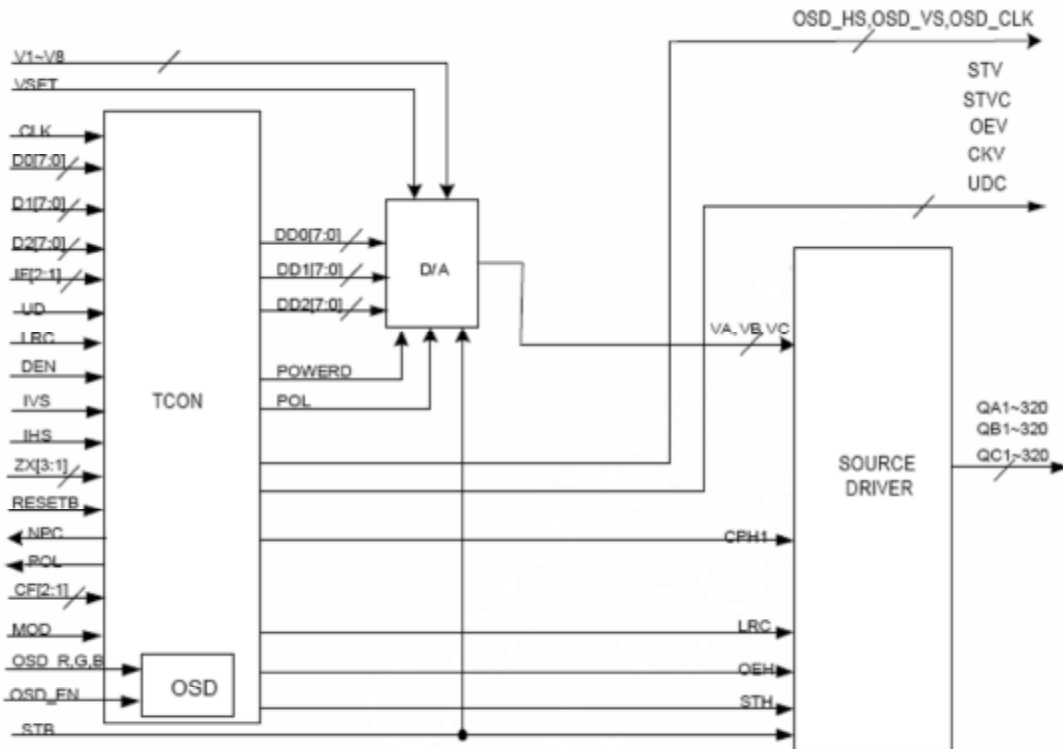


Fig 6.1 Whole chip block diagram

6.2 Timing controller block diagram

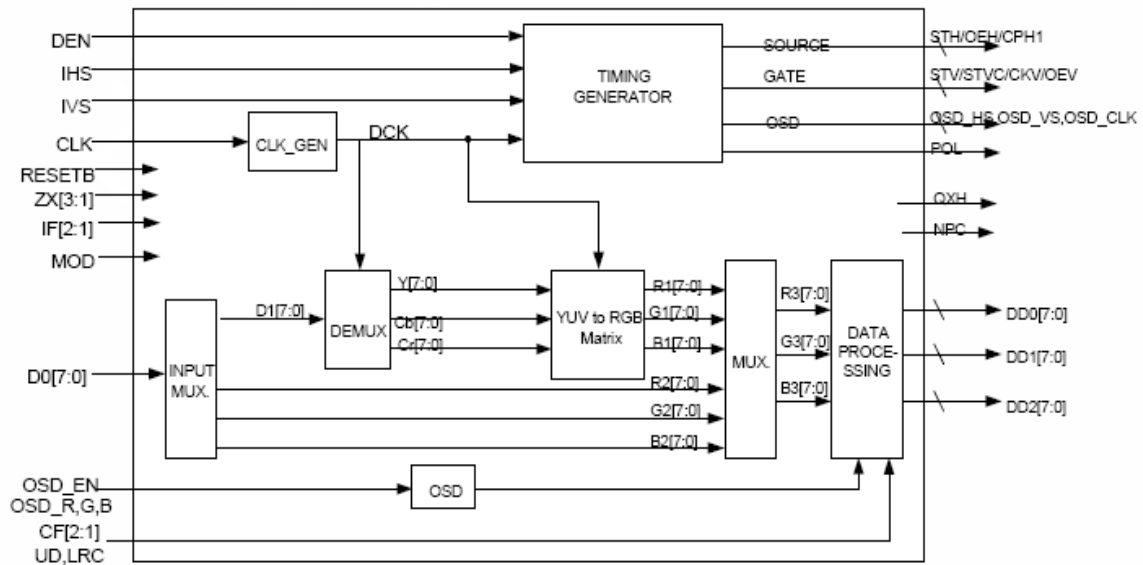


Fig 6.2 Timing controller block diagram

6.3 Source driver block diagram

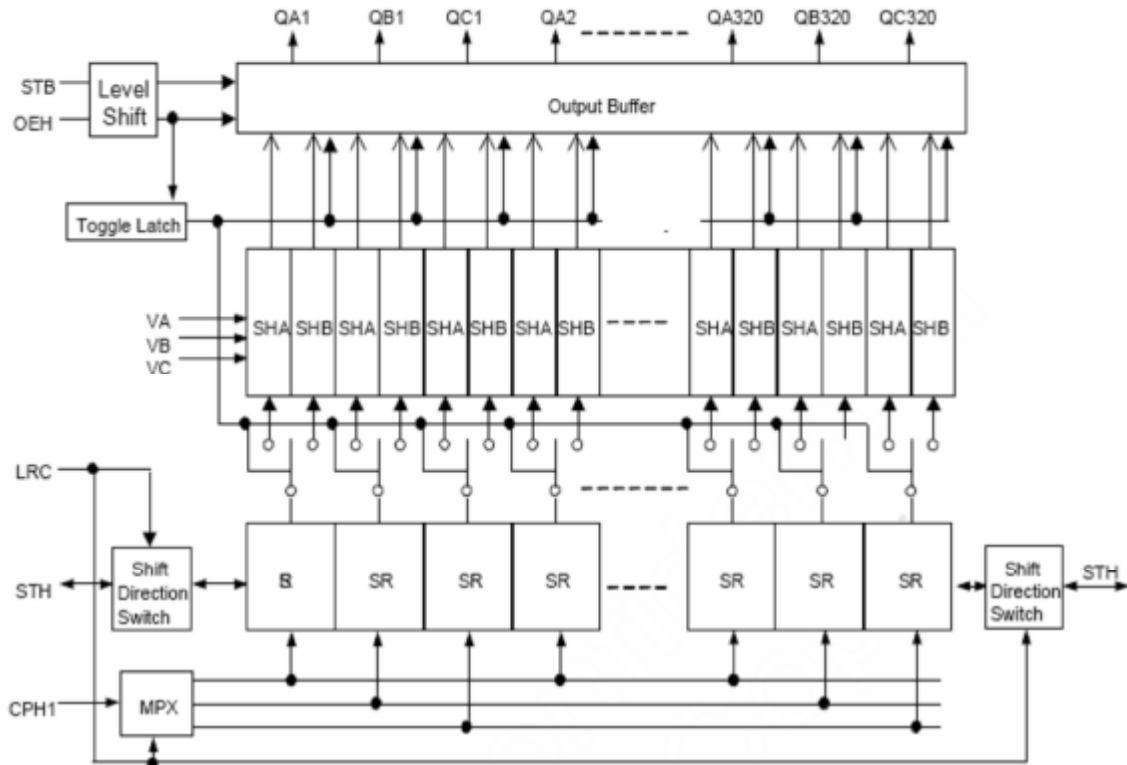


Fig 6.3 Source driver block diagram

7 Interface specifications

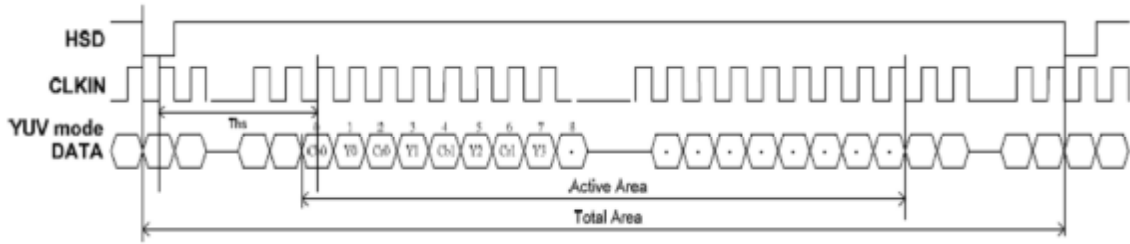
Pin No.	Terminal	Functions
1	LED-K1	LED Anode
2	LED-K2	LED Anode
3	LED-A1	LED Cathode
4	LED-A2	LED Cathode
5	NC	
6	NC	
7	M	The signal to generate Vcom
8	RESET	Reset
9	CS	Chip Select
10	SCL	Serial Clock
11	SDI	Serial Data
12~19	B0~B7	Blue Data
20~27	G0~G7	Green Data
28~35	R0~R7	Red Data
36	HSYNC	Horizontal Sync input
37	VSYNC	Vertical Sync input
38	DCLK	Data Clock
39,40	VDD	Analog Power
41,42	VCC	Digital Power
43	C4	Stable Capacitor connection
44,45	VGL	Gate OFF Power
46	NC	
47	VGH	Gate ON Power
48	NC	
49	NC	
50,51	V _{COM}	V _{COM} power
52	ENB	Data Enable Control
53,54	GND	Ground

8 Waveform

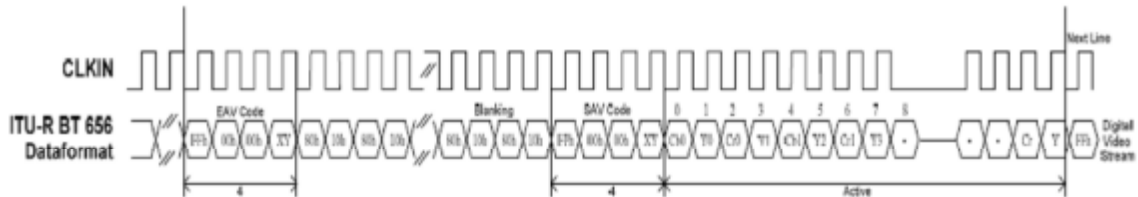
8.1 Timing Controller Timing Chart

Clock and Data waveforms

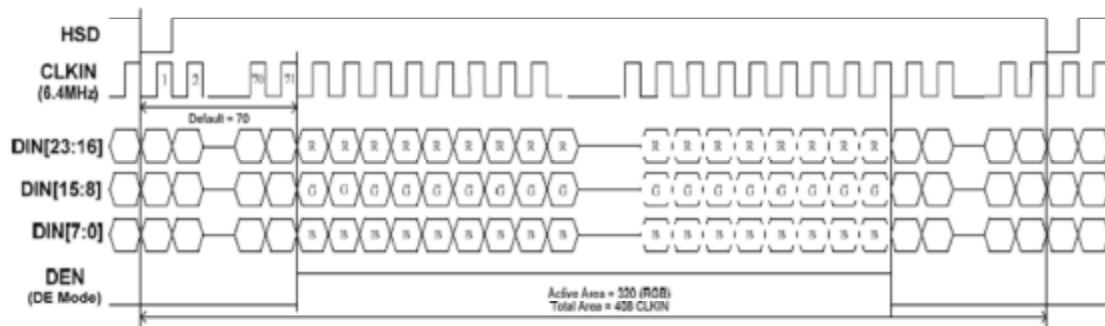
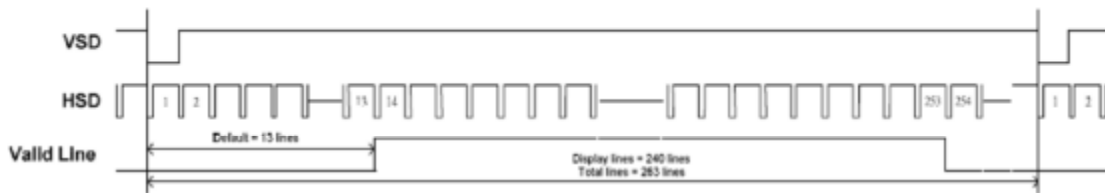
ITU-R BT601



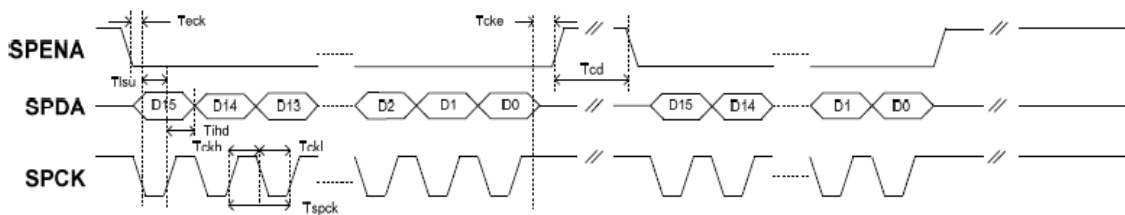
ITU-R BT656



24 bit RGB mode for 960x240



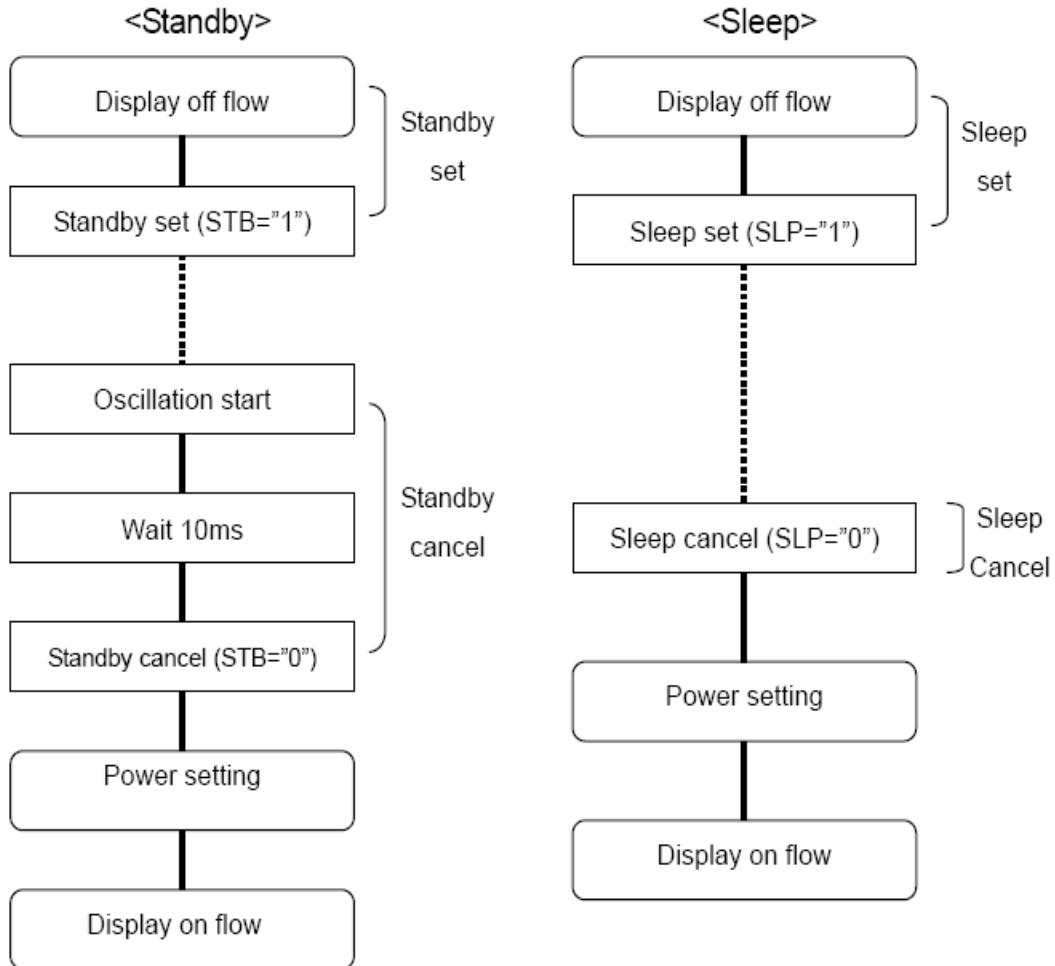
3-Wire Timing Diagram



Reset Function

The HX8216C01/HX8615A is internally initialized by RESET input. During the reset period, no instruction or GRAM data access from MPU can be accepted. The reset input must be held for at least 1ms. Do not access the

GRAM or initially set the instruction until the R-C oscillation frequency is stable after power has been supplied (10ms).



9 QUALITIES AND RELIABILITY

9.1 TEST CONDITIONS

Tests should be conducted under the following conditions:

Ambient temperature: $25 \pm 5^{\circ}\text{C}$

Humidity: $60 \pm 25\% \text{ RH}$.

9.2 SAMPLING PLAN

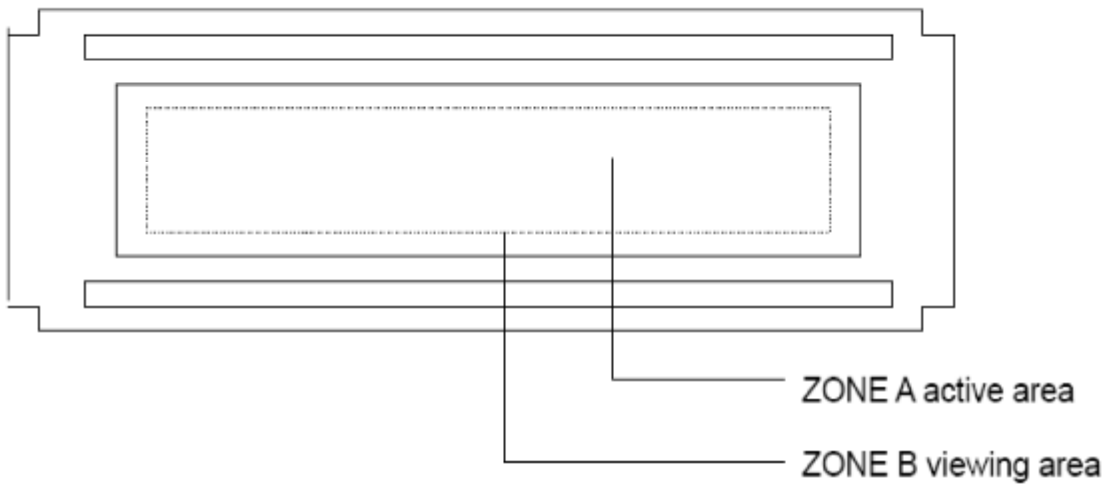
Sampling method shall be in accordance with MIL-STD-105E, level II, normal single sampling plan.

9.3 ACCEPTABLE QUALITY LEVEL

A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

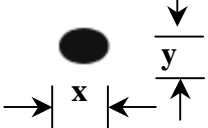
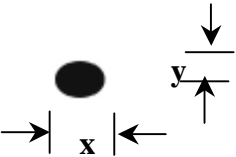
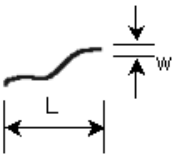
9.4 APPEARANCE

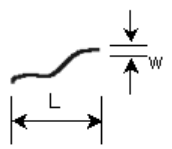
An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under fluorescent light. The inspection area of LCD panel shall be within the range of following limits.

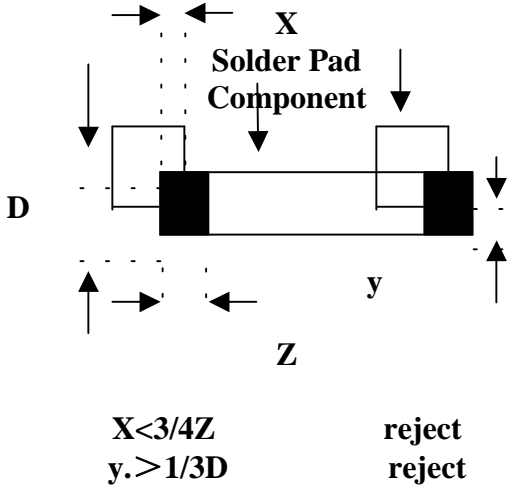


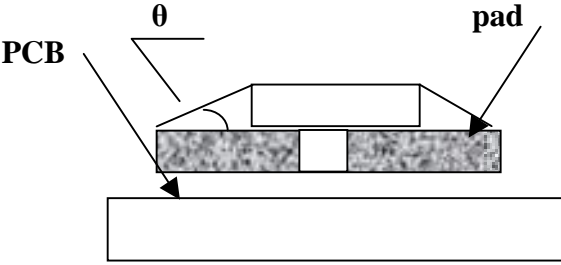
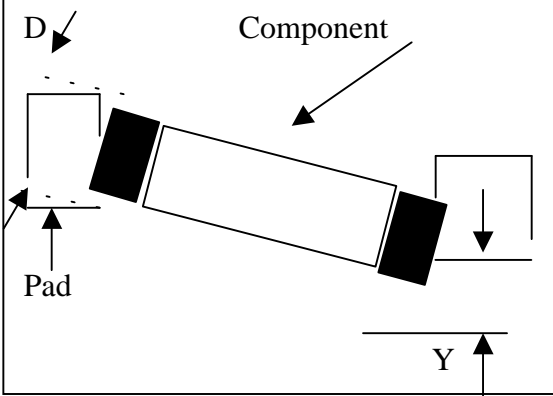
9.5 INSPECTION QUALITY CRITERIA

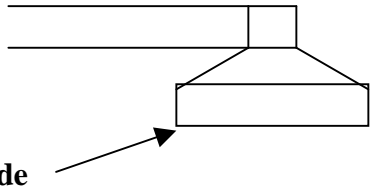
No	Item	Criterion	
01	Outline Dimension	In accord with drawing	
02	Position-finding Dimension Assemble Dimension	In accord with drawing	

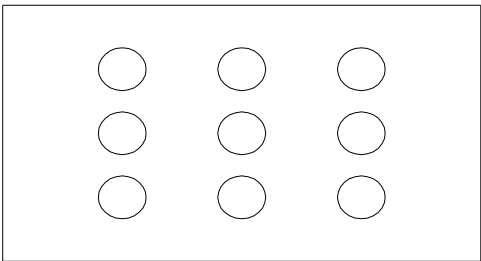
03	LCD black spots, white spots (Round type)	<p>Round type: non display 3.1 Small area LCD Unit: mm</p>  <table border="1" data-bbox="846 268 1365 577"> <thead> <tr> <th>Dimension</th> <th>Qualified Quantity</th> </tr> </thead> <tbody> <tr> <td>$D \leq 0.1$</td> <td>Ignore</td> </tr> <tr> <td>$0.1 < D \leq 0.15$</td> <td>2</td> </tr> <tr> <td>$D > 0.15$</td> <td>0</td> </tr> </tbody> </table>	Dimension	Qualified Quantity	$D \leq 0.1$	Ignore	$0.1 < D \leq 0.15$	2	$D > 0.15$	0									
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$D \leq 0.1$	Ignore																		
$0.1 < D \leq 0.15$	2																		
$D > 0.15$	0																		
<p>3.2 Large area LCD</p>  <table border="1" data-bbox="841 758 1365 1142"> <thead> <tr> <th>Dimension</th> <th>Qualified Quantity</th> </tr> </thead> <tbody> <tr> <td>$D \leq 0.1$</td> <td>Ignore</td> </tr> <tr> <td>$0.1 < D \leq 0.15$</td> <td>2</td> </tr> <tr> <td>$0.15 < D \leq 0.20$</td> <td>1</td> </tr> <tr> <td>$D > 0.20$</td> <td>0</td> </tr> </tbody> </table> <p>C-STN: if $D > 0.1$, unqualified</p>	Dimension	Qualified Quantity	$D \leq 0.1$	Ignore	$0.1 < D \leq 0.15$	2	$0.15 < D \leq 0.20$	1	$D > 0.20$	0									
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$0.1 < D \leq 0.15$	2																		
$0.15 < D \leq 0.20$	1																		
$D > 0.20$	0																		
04	LCD black spots, white spots (Line Style)	<p>4.1 Small area LCD Unit : mm</p>  <table border="1" data-bbox="740 1367 1365 1833"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Qualified Quantity</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>≤ 0.015</td> <td>Ignore</td> </tr> <tr> <td>≤ 1.0</td> <td rowspan="2">$0.015 < W \leq 0.025$</td> <td>2</td> </tr> <tr> <td>≤ 2.0</td> <td>1</td> </tr> <tr> <td>≤ 1.0</td> <td>$0.025 < W \leq 0.05$</td> <td>1</td> </tr> <tr> <td>-</td> <td>$D > 0.05$</td> <td>According to circle</td> </tr> </tbody> </table>	Length	Width	Qualified Quantity	-	≤ 0.015	Ignore	≤ 1.0	$0.015 < W \leq 0.025$	2	≤ 2.0	1	≤ 1.0	$0.025 < W \leq 0.05$	1	-	$D > 0.05$	According to circle
Length	Width	Qualified Quantity																	
-	≤ 0.015	Ignore																	
≤ 1.0	$0.015 < W \leq 0.025$	2																	
≤ 2.0		1																	
≤ 1.0	$0.025 < W \leq 0.05$	1																	
-	$D > 0.05$	According to circle																	

		<p>4.2 Large area LCD</p>  <p>CSTN: If $W \geq$</p>	<table border="1"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Qualified Quantity</th> </tr> </thead> <tbody> <tr> <td>-</td> <td>≤ 0.015</td> <td>Ignore</td> </tr> <tr> <td>≤ 2.0</td> <td>$0.015 < W \leq 0.025$</td> <td>2</td> </tr> <tr> <td>≤ 1.0</td> <td>$0.025 < W \leq 0.05$</td> <td>1</td> </tr> <tr> <td>-</td> <td>$D > 0.05$</td> <td>According to circle</td> </tr> </tbody> </table>	Length	Width	Qualified Quantity	-	≤ 0.015	Ignore	≤ 2.0	$0.015 < W \leq 0.025$	2	≤ 1.0	$0.025 < W \leq 0.05$	1	-	$D > 0.05$	According to circle	
Length	Width	Qualified Quantity																	
-	≤ 0.015	Ignore																	
≤ 2.0	$0.015 < W \leq 0.025$	2																	
≤ 1.0	$0.025 < W \leq 0.05$	1																	
-	$D > 0.05$	According to circle																	
				0.015, unqualified Ignore beyond viewing area															
05	LCD Scratch 、 Threadlike Fiber	Same to NO.3 circle Sightline and surface of LCD is vertical Same to NO.3 line style																	
06	POL	It is not admissible that POL is beyond the edge of glass, else, unqualified. It is essential that POL be over the 50 percent of width of frame, else, unqualified. According to the drawing in case of special definition.																	
07	IC/FPC Bonding	Scratch	Reject																
		Intensity Of Adhesion	If lower than specification, reject																
		Gold Fold Twist	Reject																
07	IC/FPC Bonding	Silicon	According to outline, no gold outside, seal can not be higher than LCD																
		FPC Gold Sever	Reject																
08	SMT	Lack of Component、 Polarity Inverse	If exist, reject																

		Leak Solder、 Virtual Solder	If exist, reject	
		Short Circuit In Solder Point	If exist, reject	
		Tin Ball	If exist, reject	
		Tin Acumination	If visual, reject	
		Height Solder Point	If higher 0.5mm than component. Reject	
		Height of component	Either side higher 0.5mm than component, Reject	
		Component Shift	 <p style="text-align: center;"> $X < 3/4Z$ reject $y > 1/3D$ reject </p>	

<p>08</p>	<p>SMT</p>	<p>Few Tin</p>	 <p>If $\theta \leq 20^\circ$ reject</p>	
		<p>Component Deflection</p>	 <p>If $Y > 1/3 D$ reject</p>	
		<p>Component Carcass Sideways</p>	<p>If exist with visual inspection, reject</p>	
		<p>Lot Tin</p>	<p>A: Tin accrete the solder side completely, hollowly, Ok B: Tin accrete the solder side completely, full circle arc, ok C: Jointing include whole solder side, height of tin > 50 percents of height of component, reject</p>	
		<p>Few Tin</p>	<p>A: Tin accrete the solder side completely, hollowly, Ok B: height of tin > 1/3 of solder side of component, ok C: height of tin \leq 1/3 of solder side of component, reject</p>	

		Normal	 <p>Jointing side</p>														
08	SMT	Short circuit 、 Open circuit		For bid													
09	Light	Quality of CSTN Display	<p>1、 Rolling strake with visual inspection, forbid</p> <p>2、 Difference of color in viewing area with visual inspection (full white、 red、 green、 blue), forbid</p> <p>3、 Display change with visual inspection, forbid</p>														
		<table border="1"> <thead> <tr> <th></th> <th>X</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>White</td> <td>±0.05</td> <td>±0.05</td> </tr> <tr> <td>Red</td> <td>±0.05</td> <td>±0.05</td> </tr> <tr> <td>Green</td> <td>±0.05</td> <td>±0.05</td> </tr> <tr> <td>Blue</td> <td>±0.05</td> <td>±0.05</td> </tr> </tbody> </table> <p>According to the specification or sample customer have approved</p>		X	y	White	±0.05	±0.05	Red	±0.05	±0.05	Green	±0.05	±0.05	Blue	±0.05	±0.05
	X	y															
White	±0.05	±0.05															
Red	±0.05	±0.05															
Green	±0.05	±0.05															
Blue	±0.05	±0.05															
10	Color Of CIE Coordinate	In accord with product specification	<p>Drive condition is according to specification</p> <p>Measure location is in Follow Picture</p> <p>3、 Adjust brightness instrument torero, burrow against the surface of LCD, press “measure”, record when the display is steady. (YOKOGAWA-3298)</p>														

11	Brightness	According to specification	 <p style="text-align: center;">Measure location</p>	
			According to product specification Measure instrument (DMS-501)	
12	CR (Max)	According to specification	According to product specification Measure instrument (DMS-501)	
13	Response Time	According to specification	According to product specification Measure instrument (DMS-501)	
14	Viewing angle	Compare with the sample customer supply	Compare with the sample customer supply when assemble	
15	Vibration 、 Ring	According to the use of product (main FPC of foldaway cell phone ≥ 6 thousand)	Measure instrument Bend angle: 150° Fix FPC in the casement when customer supply	
16	Frequency Of FPC Bend			

9.7 RELIABILITY

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C, t=96 hrs	
Low Temperature Operation	-20±3°C, t=96 hrs	1,2
High Temperature Storage	80±3°C, t=96 hrs	1,2
Low Temperature Storage	-30±3°C, t=96 hrs	1,2
Humidity Test	40°C, Humidity 90%, 96 hrs	1,2
Thermal Shock Test	-30°C ~ 25°C ~ 80°C 30 min. 5 min. 30 min. (1 cycle) Total 5 cycle	1,2
Vibration Test (Packing)	Sweep frequency : 10~55~10 Hz/1min Amplitude: 0.75mm Test direction: X.Y.Z/3 axis Duration: 30min/each axis	2
Static Electricity	150pF 330 ohm ±8kV, 10times air discharge	

Note 1: Condensation of water is not permitted on the module.

Note 2: The module should be inspected after 1-hour storage in normal conditions (15-35°C, 45-65%RH).

Definitions of life end point:

- I Current drain should be smaller than the specific value.
- I Function of the module should be maintained.
- I Appearance and display quality should not have degraded noticeably.
- I Contrast ratio should be greater than 50% of the initial value.

10 USE PRECAUTIONS

10.1 Handling precautions

- 1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
- 2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
- 3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.

4) If the LCD element breaks and any LC stuff leak, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

10.2 Installing precautions

- 1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
- 2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
- 3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
- 4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

10.3 Storage precautions

- 1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.
- 2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
- 3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

10.4 Operating precautions

- 1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.
- 2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal

standard. But this is not a failure; this will be restored if it is within the normal standard.

3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC drive voltage.

4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.

5) Make certain that each signal noise level is within the standard (L level: 0.2V_{dd} or less and H level: 0.8V_{dd} or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.

6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.

7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.

8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk occurs when the regularized display is maintained. Also, the LC drive voltage affects crosstalk. Design the contents of the display, considering crosstalk.

10.5 Other

1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.

2) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.

