LCD Module Product Specification

□ : APPROVAL FOR SPECIFICATION

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For Customer : _____ : APPROVAL FOR SAMPLE

Module No. : <u>TST500MTWH-03</u>

For Customer's Acceptance :

Approved by	Comment
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:

Team Source Display



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1. Introduction

1.1 Scope of application

This specification applies to the Negative type TFT transmissive dot matrix LCD module ,This LCD module should be designed for mobile phone use.

LCD specification: Dots 800xRGBx480.

As to basic specification of the driver IC, refer to the IC (HX8664B+HX8264D)

specification and datasheet.

1.2 Structure:

Double display structure: TFT Module + FPC +BL FULL 16.7M Color 5.0inch TFT LCD size for main LCD; One bare chip with gold bump (COG) TECH; 24BIT RGB interface;

1.3 TFT features:

Structure: TFT PANNEL+IC+FPC+BL; Transmissive Type LCD 800 dot-source and 480 dot-gate outputs; White LED back light; 24BIT RGB interface;

1.4 Applications:

Mobile phone PSP PDA GPS Etc...



2. General specification

ITEM	Standard value	UNIT
LCD Type	TFT Transmissive	
Driver element	a-Si TFT Active matrix	
Number of Dots	800* (RGB) *480	Dots
Pixel Arrangement	RGB Vertical Stripe	
Active Area	108 *64.8	mm
Viewing Direction	12 0' clock	
Driver IC	HX8664B+HX8264D	
Module Size(W*H*T)	120. 76x75. 85x3. 1	mm
Approx. Weight	TBD	g
Back Light	White LED	
System interface	24 Bit RGB interface	
Backlight power consumption	730mW	
Panel power consumption	~350mW	

3. Mechanical drawing



4. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit		
Supply voltage for logic	V_{dd}	-0.3	4.0	V		
Input voltage for logic	V _{IN}	-0.5	V _{dd} +0.3	V		
Supply current (One LED)	I_{LED}		60	mA		
Operating temperature	T _{OP}	-20	+70	_ C		
Storage temperature	T _{ST}	-30	+80	□ C		
5. ELECTRICAL CHARACTERISTICS						
5.1 Typical Operation Conditions						

5. ELECTRICAL CHARACTERISTICS

Item	Symbol	Min	Тур	Max	Unit	Applicable terminal
Supply voltage	V_{dd}	3.0	3.3	3.6	V	V_{DD}
Input voltage	VIL	-0.3	-	0.2 V _{dd}	V	
	V _{IH}	$0.8 \ V_{dd}$	-	V _{dd}	V	
Input leakage current	I _{LKG}	-	-	-	μΑ	

5.2 Backlight Driving Conditions

Itam	Symbol		Values	Unit	Domort	
item	Symbol	Min.	Тур.	Max.	Unit	Kemark
Voltage for LED backlight	VL	(17.4)	(18.3)	(19.6)	V	Note 1
Current for LED backlight	IL	(30)	(40)	(50)	mA	
LED life time	-	20,000	-	-	Hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and $I_L = 40 \text{mA}.$

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at Ta=25°C and I_L =40mA. The LED lifetime could be decreased if operating I_L is lager than 50mA.

5.3. Timing Characteristics

5.3.1. AC Electrical Characteristics

Itom	Symphol		Values		Unit	Domort
ltem	Symbol	Min.	Тур.	Max.	Unit	Kelliark
HS setup time	Thst	8	-	-	ns	
HS hold time	Thhd	8	-	-	ns	
VS setup time	Tvst	8	-	S	ns	
VS hold time	Tvhd	8	-		ns	
Data setup time	Tdsu	8			ns	
Data hold time	Tdhd	8	-	-	ns	
DE setup time	Tesu	8	-	-	ns	
DE hold time	Tehd	8	-	-	ns	
DV _{DD} Power On Slew rate	Tpor	-	-	20	ms	From 0 to 90% DV _{DD}
RESET pulse width	TRst	10	-	-	ms	
DCLK cycle time	Tcoh	20	-	-	ns	
DCLK pulse duty	Tcwh	40	50	60	%	



5.3.2. Data Input Format



Figure 3. 2 Vertical input timing diagram.

5.3.3. Timing

ltem	Same hal		Values	I Incid	Dements	
	Symbol	Min.	Тур.	Max.	Unit	Kemark
Horizontal Display Area	thd	-	800	-	DCLK	
DCLK Frequency	fclk		30	50	MHz	
One Horizontal Line	th	889	928	1143	DCLK	
HS pulse width	thpw	1	48-	255	DCLK	
HS Blanking	thb		88		DCLK	
HS Front Porch	thfp	1	40	255	DCLK	

Itom	Symbol		Values	Unit	Domork	
item	Symbol	Min.	Тур.	Max.	Unit	Kelliark
Vertical Display Area	tvd		480	-	TH	
VS period time	tv	513	525	767	TH	
VS pulse width	tvpw	3	3	255	TH	
VS Blanking	tvb		32		TH	
VS Front Porch	tvfp	1	13	255	TH	

6. OPTICAL CHARACTERISTICS

				SPEC	SPECIFICATIONS			
ITEM	1	OL	S	MIN	TYP.	MA X	T	NOTE
Brightness		В		550	600	650	Cd/m ²	
Contrast Rat	tio	CR		-	500			
Response Ti	me	Tr+Tf			20		ms	
	Red	Xr	Viewing	0.540	0.590	0.640		
		Yr	viewing	0.300	0.350	0.400		All left side
CIE	Gree	Xg	normai	0.298	0.348	0.398		data are
Celor	n	Yg	angle	0.520	0.570	0.620		based on
coordinate	Blue	Хв		0.095	0.145	0.195		TIANMA's
coordinate		Υв		0.060	0.110	0.160		product
	White	Xw		0.270	0.320	0.370		reference
		Yw		0.310	0.360	0.410		only
	Hor.	θ_{X^+}		60	70			
Viewing		θ_{X-}	Center	60	70		Dog	
Angle	Ver.	$ heta_{_{Y+}}$	CR>=10	40	50		Deg.	
		$ heta_{Y-}$		60	70			
Uniformity	Un			75	80		%	





Note 2: Definition of contrast ratio CR:

 $CR = \frac{Brightness of non-selected dots (white)}{Brightness of selected dots (black)}$

Note 3: Definition of response time (TR, TF)



: The brightness test equipment setup

20mA Field=2° (As measuring "black" image, field=2° is the best testing condition)



Pin No	Symbol	Function
1	VLED-	BACK LIGHT POWER GROUND
2	VLED+	BACK LIGHT POWER SUPPLY
3	GND	POWER GROUND
4	VDD	POWER SUPPLY
5-12	R0-R7	RED DATA
13-20	G0-G7	GREEN DATA
21-28	B0-B7	BLUE DATA
29	GND	POWER GROUND
30	CLKIN	In external interface mode, served as a dot clock signal.
31	STBYB	standby mode control pin
32	HSD	In external interface mode, served as a horizontal synchronized signal input
33	VSD	In external interface mode, served as a vertical synchronize signal input
34	DEN	In external interface mode, polarity of ENABLE signal is synchronized with valid graphic data input.
35	NC	NC
36	GND	POWER GROUND
37	XR(NC)	
38	YD(NC)	
39	XL(NC)	
40	YU(NC)	

7. Interface Pin Function

NOTE:For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If ENB signal is fixed low. SYNC mode is used. Otherwise, DEN+SYNC is used

8. BLOCK DIAGRAM



9. <u>Standard Specification for Reliability</u>

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

9-1. Standard Specifications for Reliability of LCD Module

		Contact: ± 2 KV 150pF/330 Ω 5 time	
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*Sample size for each test item is 3~5pcs

9 - 2. Testing Conditions and Inspection Criteria

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in Table 12.2, Standard specifications for Reliability have been executed in order to ensure stability.

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

9-3. MTBF

MTBF	Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature $(25\pm5^{\circ}C)$, normal humidity (50±10% RH), and in area not exposed to direct sun light.
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10. Specification of Quality Assurance:

10-1. Purpose

- This standard for Quality Assurance should affirm the quality of LCD module products to supply to purchaser byTSLCD (Supplier).
- 10-2. Standard for Quality Test

a. Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

b. Electro-Optical Characteristics:

According to the individual specification to test the product.

c. Test of Appearance Characteristics:

According to the individual specification to test the product.

d. Test of Reliability Characteristics:

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

e. Delivery Test:

Before delivering, the supplier should take the delivery test.

(i) Test method: According to MIL-STD105E.General Inspection Level II take a single time.

(ii) The defects classify of AQL as following:

- Major defect: AQL = 0.65
- Minor defect: AQL = 2.5
- Total defects: AQL = 2.5

10-3. Non- conforming Analysis & Deal With Manners

- a. Non- conforming Analysis:
- (i) Purchaser should supply the detail data of non- conforming sample and the non- conforming.
- (ii) After accepting the detail data from purchaser, the analysis of non- conforming should be finished in two weeks.
 - (iii) If supplier can not finish analysis on time, must announce purchaser before 3 days.
 - b. Disposition of non- conforming:
 - (i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.
 - (ii) Both supplier and customer should analyze the reason and discuss the disposition of non- conforming when the reason of nonconforming is not sure.

10-4. Agreement items

- Both sides should discuss together when the following problems happen.
- a. There is any problem of standard of quality assurance, and both sides should think that must be modified.
- b. There is any argument item which does not record in the standard of quality assurance.
- c. Any other special problem.

- 10-5. Standard of The Product Appearance Test
 - a. Manner of appearance test:
 - (i) The test must be under $20W \times 2$ or 40W fluorescent light, and the distance of view must be at $30\pm5cm$.
 - (ii) When test the model of transmissive product must add the reflective plate.
 - (iii)The test direction is base on around 10° of vertical line.
 - (iiii)Temperature: 25±5°C Humidity: 60±10%RH



(iv) Definition of area:



- B. Area: Out of viewing area. (Outside viewing area)
- b. Basic principle:
- (i) It will accord to the AQL when the standard can not be described.
- (ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.
- (iii) Must add new item on time when it is necessary.

c. Standard of inspection: (Unit: mm)

NO	Item	Criterion		
01	Electrical Testing	 1.1 Missing vertical, horizontal segment, segment contrast defect. 1.2 Missing character, dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect. 1.7 Mixed product types. 1.8 Flicker 		
02	Black or White spots or Bright spots or Color spots on LCD (Display only)	2.1 White and black or color spots on display ≤ 0.25 mm, no more than Five spots.2.2 Densely spaced: No more than three spots within 3mm.		
	LCD and Touch Panel black spots.	3.1 Round type: As following drawing $\Phi = (X+Y) / 2$	2.5	
03	white spots, contamination (non – display)	3.2 Line type: (As following drawing) 3.2 Line type: (As following drawing) $\begin{array}{c} & & \\ \hline \hline & & \\ \hline \hline & & \\ \hline & & \\ \hline \hline & & \\ \hline & & \\ \hline \hline & & \\ \hline & & \\ \hline & & \\ \hline \hline & & \\ \hline \hline & & \\ \hline & & \\ \hline \hline \hline & & \\ \hline \hline \hline & & \\ \hline \hline \hline \hline$	2.5	

10-6. Inspection specification

NO	Item	Cri	terion		AQL
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction	Size $\Phi(mm)$ $\Phi \leq 0.20$ $0.20 < \Phi \leq 0.50$ $0.50 < \Phi \leq 1.00$ $1.00 < \Phi$ Total Q'ty	Acceptable Q'ty Accept no dense 3 2 0 3	2.5
05	Scratches	Follow NO.3 -2 Line Type.			
06	Chipped glass	Symbols: x: Chip length y: Chip width z: Chip k: Seal width t: Glass thickness a: LCI L: Electrode pad length 6.1 General glass chip: 6.1.1 Chip on panel surface and crack between $\begin{array}{c c} \hline & & & & & & & & & & & & & & & & & & $	thickness D side length een panels: $\begin{array}{c c} x : Chip len \\ \hline x \le 1/\\ \hline x \ge 1/\\ \hline x = 1/\\ \hline x \ge 1/\\ \hline x = 1/\\ \hline x = 1/\\ \hline x$	gth 8a 8a © Unit:	2.5



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

NO	Item		Criterion			AQL
		Symbols: x: Chip length y: Chip k: Seal width t: Touc L: Electrode pad length 14.1 General glass chip: 14.1.1 Chip on panel sur	o width z: Chip thickness ch Panel Total thickness a: L face and crack between panel	CD side length ls:		
					14	
		z: Chip thickness	y: Chip width	x: Chip length		
14	Touch Panel Chipped glass	Z≦t	$\leq 1/2$ k and not over viewing area	x≤1/8a	⊙ Unit: mm ⊙ If	2.5
		there are 2 or more chips	x is the total length of each	chip	∪ n	
			,	r		
		14.1.2 Corner crack:	ĘV			
		z: Chip thickness	y: Chip width	x: Chip length		
		z≦t	$\leq 1/2$ k and not over viewing area	$x \leq 1/8a$	⊙ Unit: mm ⊙ If	
		there are 2 or more chips	, x is the total length of each	chip	U II	

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