



深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, LTD.

TFT-LCD Module Specification

Module NO.: TST035FP-01B

Version: V1.0

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

For Customer' s Acceptance:	
Approved by	Comment

Team Source Display:		
Presented by	Reviewed by	Organized by

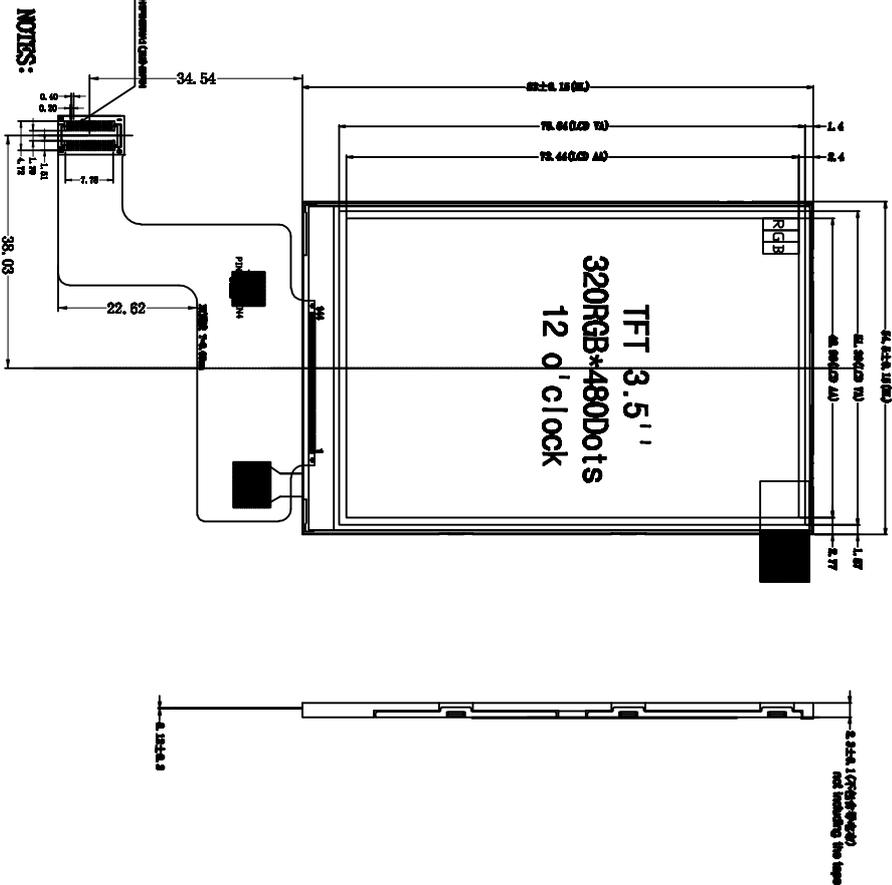
Version No.	Date	Content	Remark
V1.0	2017-7-10	Initial Release	

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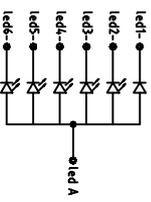
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1. General Features & Mechanical Specifications.

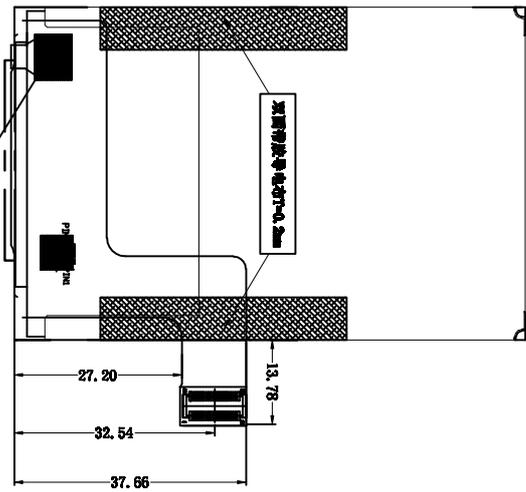
Item	Contents	Unit
LCD Type	a-Si TFT-color transmissive LCD	-
Display Format	RGB Stripe	-
Display color	262K color	-
Input Data	16/8-bits I80 system interface	-
Viewing Direction	12O'clock	-
Backlight	White(6x LED)	-
Driver IC	ILI9488	
Resolution	320(RGB)x480	-
Dimensional outline	54.50(W)x83.00(H) x 2.3 (T)	mm
Active area	48.96(W) x 73.44(H)	mm
Pixel Pitch	0.153(W)x 0.153(V)	mm
Diagonal length	3.47 "	inch
Operating Temp.	-20°C ~ + 70°C	°C
Storage Temp.	-30°C ~+ 80°C	°C



- NOTES:
1. DISPLAY TYPE: MAIN LCD 3.5" SEN(M88)+480 TFT
 2. OPERATING TEMP: -20° C~70° C; STORAGE TEMP: -30° C~80° C
 3. MAIN LCD DRIVER IC:
 4. OPTIMUM VIEWING ANGLE: 12:00
 5. BACKLIGHT: CHIP WHITE LED (120mA)
 6. LUMINANCE=250cd/cm² (typ), Chromaticity (x=0.31 | λ0.03, y=0.31 | λ0.03)
 7. Contrast ratio: 350/1, NTSC: 72%
 8. GENERAL TOLERANCE: ±0.2
 9. MARK "*" IS THE IMPORTANT DIMENSION
 10. CONNECTOR:
 11. ROHS COMPLIANT



CIRCUIT DIAGRAM



1	GND
2	XR
3	XL
4	GND
5	LEDK1
6	LEDK3
7	LENS
8	CS
9	RS
10	RESET
11	D0
12	D2
13	D4
14	D6
15	D8
16	D10
17	D12
18	D14
19	NC
20	NC
21	LEDA
22	LEDK6
23	D15
24	D13
25	D11
26	D9
27	D7
28	D5
29	D3
30	I/I
31	R0
32	VR
33	INVCC
34	VDD
35	LEDK4
36	LEDK2
37	EMARK
38	YU
39	YD
40	GND

深圳市一众显示科技有限公司

SHENZHEN TEAM SOURCE DISPLAY CO.,LTD.

UNIT:mm Drawn By Checked By Approved By

MODULE NO. TST035FP-01A

VER V0

Ver	Revised descriptions	Date
V0	First issue	2013-06-29

3. Absolute Mixmum Ratings(Ta=25°C)

Characteristics	Symbol	Min	Max	Unit	Remarks
Power supple voltage(1)	VCC	-0.3	4.6	V	(1),(2)
Power supply voltage(1)	VCI-GND	-0.3	+4.6	V	(1),(2)
Power supply voltage(1)	VGH-GND	-0.3	+18.5	V	(1)
Power supple voltage(1)	GND-VGL	-0.3	+18.5	V	(1)
Power supply voltage(1)	DDVDH	-0.3	+6.0	V	(1)

Note:

- (1) If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.
- (2) $V_{cc} \geq GND$ must be maintained.
- (3) $DDVDH \geq GND$ must be maintained.

3.1 Environmental absolute maximum ratings

ITEM	SPECIFICATION	REMARKS
Operating Temp.	-20 ~ 70 °C	Note(1)
Storage Temp.	-30 ~ 80 °C	Note (1) , (2)

Note:

- (1) 90% RH Max
- (2) In case of below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

4. ELECTRICAL CHARACTERISTICS

4.1 DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}		2.6	2.8	3.0	V
Input voltage	H level (VIH)		0.8VCC	--	V_{CC}	V
	L level (VIL)		-0.3	--	$0.2V_{cc}$	V
Supply current	I_{cc}	Without LED $V_{CC}=2.8V$	--	5	--	mA

4.2 DC characteristics of the LED back-light

$T_a = 25^{\circ}C$

Item	Symbol	Min.	Typ.	Max.	Unit
LED module Forward voltage	V_{LED}	2.9	3.1	3.3	V
LED module current	I_{LED}	--	90	--	mA
Luminance	L_v	4500	--	--	Cd/m ²

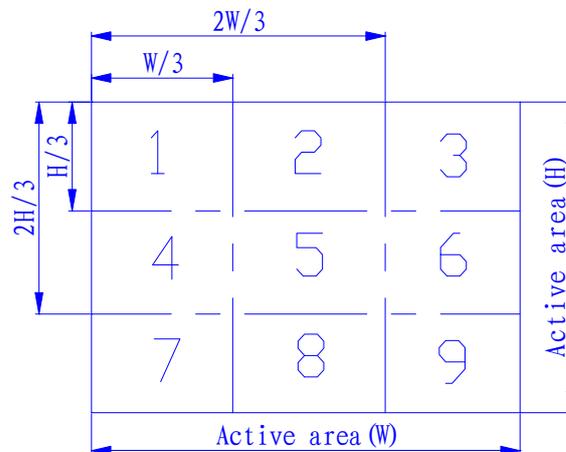
Note: 6 LEDS in parallel of B/L module.

1 Test condition is:

- a:Center point on active area
- b:Best Contrast

2 Uniform measure condition:

- a:Measure 9 point,Measure location is show below:
- b:Uniform=(Min brightness/Max.brightness)x100%
- c:Best Contrast.



5 INTERFACE PIN CONNECTION

NO.	Symbol	Description
1	GND	Ground
2	XR	Touch Panel Right PIN(X+)
3	XL	Touch Panel Left PIN(X-)
4	GND	Ground
5	LEDK1	Cathode input for Backlight
6	LEDK3	Cathode input for Backlight
7	LEDK5	Cathode input for Backlight
8	CS	Chip select signal.
9	RS	Data and command Pin
10	RESET	LCM reset pin
11	D0	Data bus pin
12	D2	Data bus pin
13	D4	Data bus pin
14	D6	Data bus pin
15	D8	Data bus pin
16	D10	Data bus pin
17	D12	Data bus pin
18	D14	Data bus pin
19-20	NC	NC
21	LEDA	A node input for Backlight
22	LEDK6	Cathode input for Backlight
23	D15	Data bus pin
24	D13	Data bus pin
25	D11	Data bus pin
26	D9	Data bus pin
27	D7	Data bus pin
28	D5	Data bus pin
29	D3	Data bus pin
30	D1	Data bus pin
31	RD	Read data signal pin
32	WR	Write data signal pin
33	IOVCC(1.8V)	Power Supply (1.8V)
34	VCI(2.8V)	Power Supply (2.8V)
35	LEDK4	Cathode input for Backlight

36	LEDK2	Cathode input for Backlight
37	FMARK	Tearing effect output pin
38	YU	Touch Panel UP PIN(Y+)
39	YD	Touch Panel Down PIN(Y-)
40	GND	Ground

说明:

FPC在R1上打电阻元件，为16位8080系统并行接口, (DB15-DB0)

FPC在R2上打电阻元件，为8位8080系统并行接口, (DB7-DB0)

6 ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Conditions	Specifications			Unit	Note	
			Min.	Typ.	Max.			
Transmittance	T%	Viewing normal angle $\theta_x = \theta_y = 0^\circ$		5.5		%	All left side data are based on CMO's following condition - 1. LC Mode: TN 2. Light Source : CMO LED BLU 3. Film : Linear Polarizer+WV (Nitro NPF-TEG1424DU) 4. Machine : DMS 803	
Contrast Ratio	CR			500	-	-		
Response Time	T_{on}		-	5		ms		
	T_{off}	-	15		ms			
Viewing Angle	Hor.	θ_{x+}	-	70	-	deg		
		θ_{x-}	-	70	-			
	Ver.	θ_{y+}	-	60	-			
		θ_{y-}	-	40	-			
Chromaticity	Red	X_R	0.611	0.641	0.671	-		Under C light Simulation CG : NTSC 60%
		Y_R	0.290	0.320	0.350	-		
	Green	X_G	0.270	0.300	0.330	-		
		Y_G	0.536	0.566	0.596	-		
	Blue	X_B	0.104	0.134	0.164	-		
		Y_B	0.098	0.128	0.158	-		
	White	X_W	0.267	0.297	0.327	-		
		Y_W	0.301	0.331	0.361	-		

*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

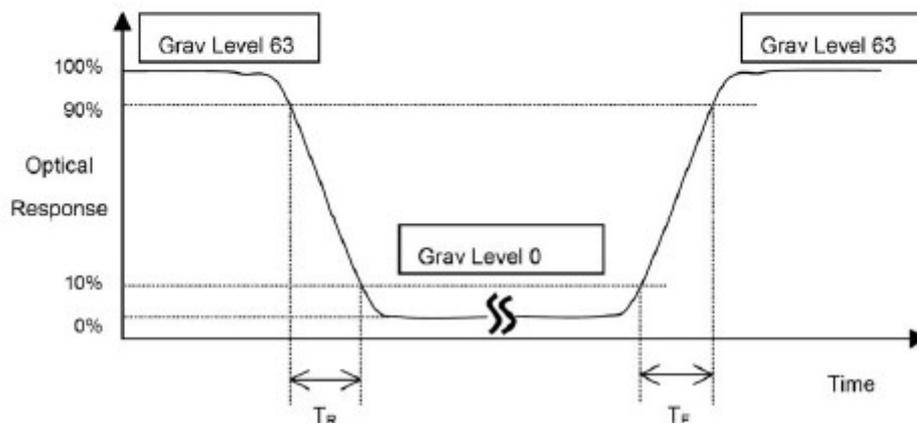
L63: Luminance of gray level 63

L0: Luminance of gray level 0

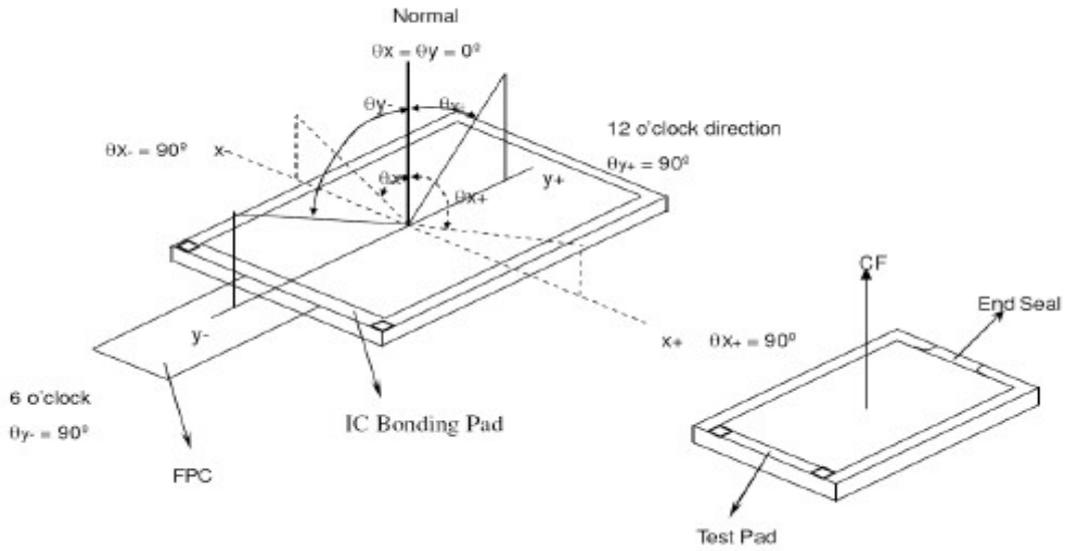
$$CR = CR(10)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

*Note (2) Definition of Response Time (TR, TF):



*Note(3) Definition of Viewing Angle



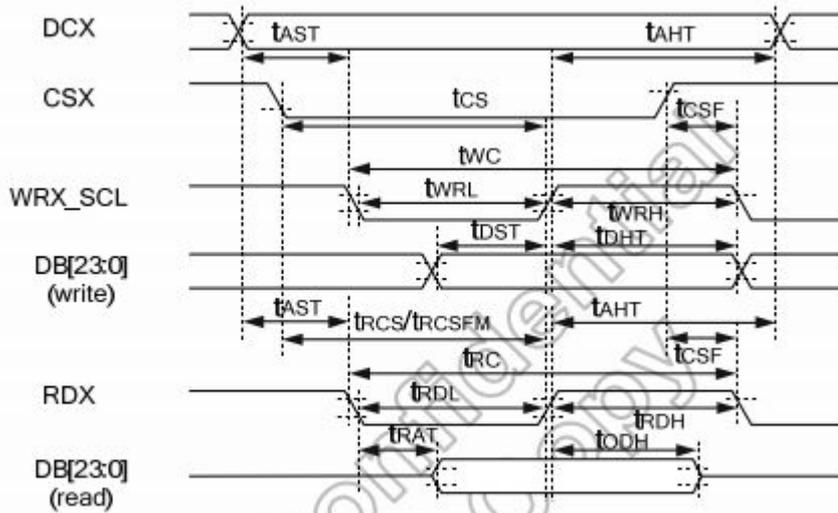


Figure 8.1: DBI Type B interface characteristics

(VSSA=0V, VDD1=1.8V, VDD3=2.8V, T_a=25°C)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
DCX	tAST	Address setup time	0	-	ns	-
	tAHT	Address hold time (Write/Read)	10	-	ns	-
CSX	tCS	Chip select setup time (Write)	10	-	ns	-
	tRCS	Chip select setup time (Read register)	45	-	ns	-
	tRCSFM	Chip select setup time (GRAM)	355	-	ns	-
	tCSF	Chip select wait time (Write/Read)	10	-	ns	-
WRX_SCL	tWC	Write cycle (write register)	50	-	ns	-
	tWC	Write cycle (write GRAM@SLPOUT)	47	-	ns	-
	tWC	Write cycle (write GRAM@SLPIN)	100	-	ns	-
	tWRH	Control pulse "H" duration	15	-	ns	-
	tWRL	Control pulse "L" duration	15	-	ns	-
RDX	tRC	Read cycle (read register)	160	-	ns	-
	tRC	Read cycle (GRAM)	450	-	ns	-
	tRDH	Control pulse "H" duration	90	-	ns	-
	tRDL	Control pulse "L" duration(read register)	35	-	ns	-
DB[23:0]	tRDL	Control pulse "L" duration(GRAM)	345	-	ns	-
	tDST	Data setup time	10	-	ns	-
	tDHT	Data hold time	10	-	ns	-
	tRAT	Read access time(read register)	-	40	ns	For maximum C _L =30pF
	tRAT	Read access time(GRAM)	-	340	ns	For minimum C _L =8pF
	tODH	Output disable time	20	80	ns	-

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of VDD1 for Input signals.

Table 8.2: DBI Type B interface characteristics

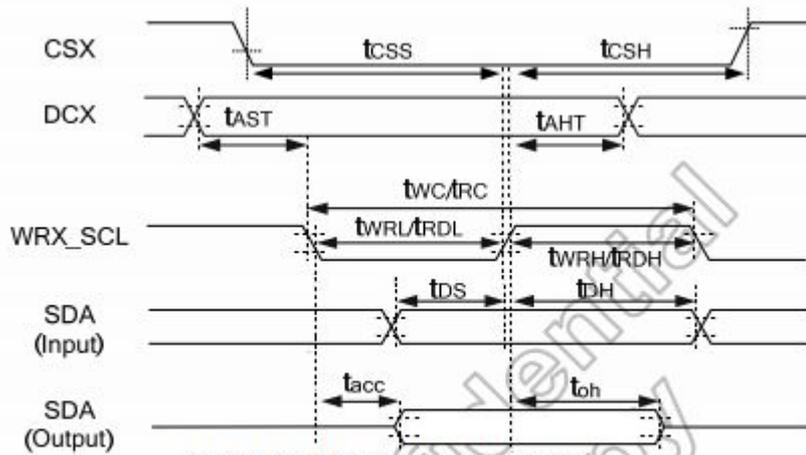


Figure 8.2: DBI Type C interface characteristics

(VSSA=0V, IOVCC=1.8V, VCI=2.8V, T_A = 25°C)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
CSX	t_{CSS}	Chip select setup time (Write)	15	-	ns	-
	t_{CSS}	Chip select setup time (Read)	60	-		
	t_{CST}	Chip select hold time (Write)	15	-		
	t_{CST}	Chip select hold time (Read)	65	-		
DCX	t_{AST}	Address setup time	0	-	ns	-
	t_{AHT}	Address hold time (Write/Read)	10	-		
WRX_SCL (Write)	t_{WC}	Write cycle	66	-	ns	-
	t_{WRH}	Control pulse "H" duration	15	-		
	t_{WRL}	Control pulse "L" duration	15	-		
WRX_SCL (Read)	t_{RC}	Read cycle	150	-	ns	-
	t_{RDH}	Control pulse "H" duration	60	-		
	t_{RDL}	Control pulse "L" duration	60	-		
SDA (Input)	t_{DS}	Data setup time	10	-	ns	For maximum C _L =30pF For minimum C _L =8pF
	t_{DH}	Data hold time	10	-		
SDA (Output)	t_{acc}	Read access time	10	50	ns	
	t_{oh}	Output disable time	15	50		

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of IOVCC for Input signals.

Table 8.3: DBI Type C interface characteristics

7 STANDARD SPECIFICATION FOR RELIABILITY

7.1 Standard specification of Reliability Test

No	Test Item	Content of Test	Test Condition	Applicable Standard
1	High temperature storage	Endurance test applying the high storage temperature for a long time.	70+/-3 °C 240 hrs	-----
2	Low temperature storage	Endurance test applying the low storage temperature for a long time.	-20+/-3 °C 240 hrs	-----
3	High temperature operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	60+/-3 °C 240 hrs	-----
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time.	-10+/-3 °C 240 hrs	-----
5	High temperature / Humidity operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40 °C , 90 %RH 120 hrs	-----
6	Temperature cycle	Endurance test applying the low and high temperature cycle. $\begin{array}{ccccc} -1^{\circ}\text{C} & \rightleftharpoons & 25^{\circ}\text{C} & \rightleftharpoons & 6^{\circ}\text{C} \\ \leftarrow 30\text{min.} & & 5\text{min.} & & \rightarrow 30\text{min.} \\ & & \text{1 cycle} & & \end{array}$	-----	
Mechanical Test				
7	Drop Test	Endurance test applying the drop during transportation.	Packed, 100cm free fall (6 sides, 1 corner, 3edges)	----

7.2 Failure Judgment Criteria

After the reliability tests above, test sample shall be let return to room temperature and humidity for at least 4 hours before final tests are carried out.

Criterion Item	Failure Judgment Criteria
Electrical characteristic	Electrical short and open.
Mechanical characteristic	Out of mechanical specification
Optical characteristic	Out of the Appearance Standard

8 QUALITY ASSURANCE

8.1 Acceptable Quality Level (AQL)

Each lot should satisfy the quality level defined as follows:

- a) Inspection method: MIL-STD-105E Level II normal one time sampling
- b) AQL level

Category	AQL	Definition
Major	0.25%	Functional defective as product
Minor	1.00%	Satisfy all functions as product but not satisfy cosmetic standard

8.2 Cosmetic Screening Criteria

No	Defect	Judgment Criteria	Category	
1	Spots/Dust /Bubble (Round type)	Size, d (mm)	Acceptable quantity in active area	
		$d \leq 0.15$	Disregard	
		$0.15 < d \leq 0.20$	3	
		$d > 0.20$	0	
2	Spots/Dust /Bubble /Scratches (Line type)	Width, W (mm)	Length, L (mm)	Acceptable quantity in active area
		$W \leq 0.02$	Disregard	Disregard
		$W \leq 0.03$	$L \leq 1.0$	Disregard
		$W \leq 0.05$	$L \leq 2.0$	3
		$W > 0.05$	Disregard	0
3	Background color & Rainbow	Not to be noticeable.	Minor	
4	Allowable density	Above defects should be separated more than 30mm each other.	Minor	
6	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-lit type should be judged with back-lit on state only.	Minor	
7	Rainbow	Not to be noticeable.	Minor	
8	Dot size	To be 95% ~ 105% of the dot size (Typ.) in drawing. Partial defects of each dot (ex. pin-hole) should be treated as 'spot'. (See <i>Cosmetic Screening Criteria (Operating) No.1</i>)	Minor	

Note: $d = (\text{long length} + \text{short length}) / 2$

9 PRECAUTIONS FOR USING LCD MODULE

9.1 Handling Precautions

- 9.1.1 The display panel is made of glass and polarizer. Do not subject it to mechanical shock by dropping or impact which may cause chipping especially on the edges.
- 9.1.2 Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 9.1.3 If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with Isopropyl alcohol or ethyl alcohol. Avoid using solvents like acetone (ketene), water, toluene, ethanol to clean the polarizer surface.
- 9.1.4 Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
- 9.1.5 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 9.1.6 Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion.
- 9.1.7 Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- 9.1.8 NC terminal should be open. Do not connect anything.
- 9.1.9 If the logic circuit power is off, do not apply the input signals.
- 9.1.10 Avoid contacting oil and fats.
- 9.1.11 Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming in contact with room temperature air.
- 9.1.12 Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

9.2 Electro-Static Discharge Control

- 9.2.1 Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.
- 9.2.2 Be sure to ground the body when handling the LCD modules. Tools required for assembling, such as soldering irons, must be properly grounded.
- 9.2.3 To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity, be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.
- 9.2.4 The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- 9.2.5 When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.

9.3 Precaution for soldering to the LCM

- 9.3.1 Observe the following when soldering lead wire, connector cable and etc. to the LCD module.

9.4 Soldering iron temperature: $300 \pm 10^{\circ}\text{C}$.

- 9.4.1 Soldering time: 3 sec.
- 9.4.2 Solder: eutectic solder.
- 9.4.3 If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

9.5 Precautions for Operation

- 9.5.1 Viewing angle varies with the change of liquid crystal driving voltage (V_O). Adjust V_O to show the best contrast.
- 9.5.2 Driving the LCD in the voltage above the limit shortens its lifetime.
- 9.5.3 Response time is greatly delayed at temperature below the operating temperature range. However, it will recover when it returns to the specified temperature range.
- 9.5.4 If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- 9.5.5 When turning the power on, input each signal after the positive/negative voltage becomes stable.

9.6 Storage

- 9.6.1 When storing LCDs as spares for some years, the following precautions are necessary.
- 9.6.2 Store them in a sealed polyethylene bag. If properly sealed, there is no need for desiccant.
- 9.6.3 Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C .
- 9.6.4 Environmental conditions:
- 9.6.5 Do not leave them for more than 168hrs. at 60°C .
- 9.6.6 Should not be left for more than 48hrs. at -20°C .

9.7 Safety

- 9.7.1 It is recommended to crush damaged or unnecessary LCD into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- 9.7.2 If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

10.Limited Warranty

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

1. The liability of TSD is limited to repair or replacement on the terms set forth below. TSD 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 TSD and the customer, TSD will only Replace or repair any its LCD which is found defective electrically or visually when Inspected in accordance with TSD LCD acceptance standards for a period of three Months from the date of shipment. Confirmation of such date shall be based on freight Document.
2. No warranty can be granted if any of the precautions stated in lcd modules above have Been disregarded. Broken glass, scratches on polarizers, mechanical damages as well as Defects that are caused by accelerated environmental tests are excluded from warranty.
3. In returning the LCD modules, they must be properly packaged and there should be detailed Description of the failures or defects.

11. Important Notice

The information presented in this specification has been carefully checked and is believed to be Accurate, however, no responsibility is assumed for inaccuracies, TSD reserves the right to Make changes to nay specifications without further notice for performance, reliability, production Technique and other considerations, TSD does not assume any liability arising out of the Application or use of products herein. Please see Limited Warranty in the previous section. TEAM SOURCE DISPLAY reserves the right to change this specification.

Packing

PARAMETER	Specification	Unit
Outside box	390(L) x 350(W) x 480(H)	mm
Inside pearl wool box	330(L)x185(W)x110(H)	mm
Product quantity of Inside box	64	pcs
Total product quantity	64*8=512	pcs
Total weight	12.5 ± 0.5	Kg

