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.： TST035QVGS-43

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	2018-07-03	Initial Release	

3.0 General specification

Panel size: 3.5 inch

Display format: Graphics 240 (w) x 320 (h) dots

Dot pitch: 0.222 (w) x 0.222 (h) mm

Active area: 53.28 (w) x 71.04 (h) mm

General dimensions: 64.16 (w) x 83.39 (h) x 3.8 (t) mm

Pixel arrangement: W-stripe

Display mode: AIFF / Transmissive / Normal Black

Driving method: TFT active matrix

Viewing direction: All Direction

LCD controller / driver: ST7512

Interface: MPU 8-bit Parallel

4.0 Absolute maximum rating (at Vss = 0V, ambient temperature = 25°C)

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Supply Voltage	VCC	0.3	5.8	V
3.	Storage Humidity	HD	20	90	%RH
4.	Operating Temperature	T_{op}	-30°C to +80°C		°C
5.	Storage Temperature	T_{st}	-35°C to +85°C		°C

5.0 DC Characteristics

NO	ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
1.	Supply Voltage	VCC	2.7	3.3	5.5	V	-
2.	Input High Voltage	V_{IH}	0.7VCC	-	VCC	V	-
3.	Input Low Voltage	V_{IL}	GND	-	0.3VCC	V	-
4.	Output High Voltage	V_{OH}	0.8VCC	-	VCC	V	I_{OUT}=-1mA
5.	Output Low Voltage	V_{OL}	GND	-	0.2VCC	V	I_{OUT}=1mA
6.	I/O Leak Current	ILI	-0.1	-	0.1	uA	-

5.1 Backlight Options

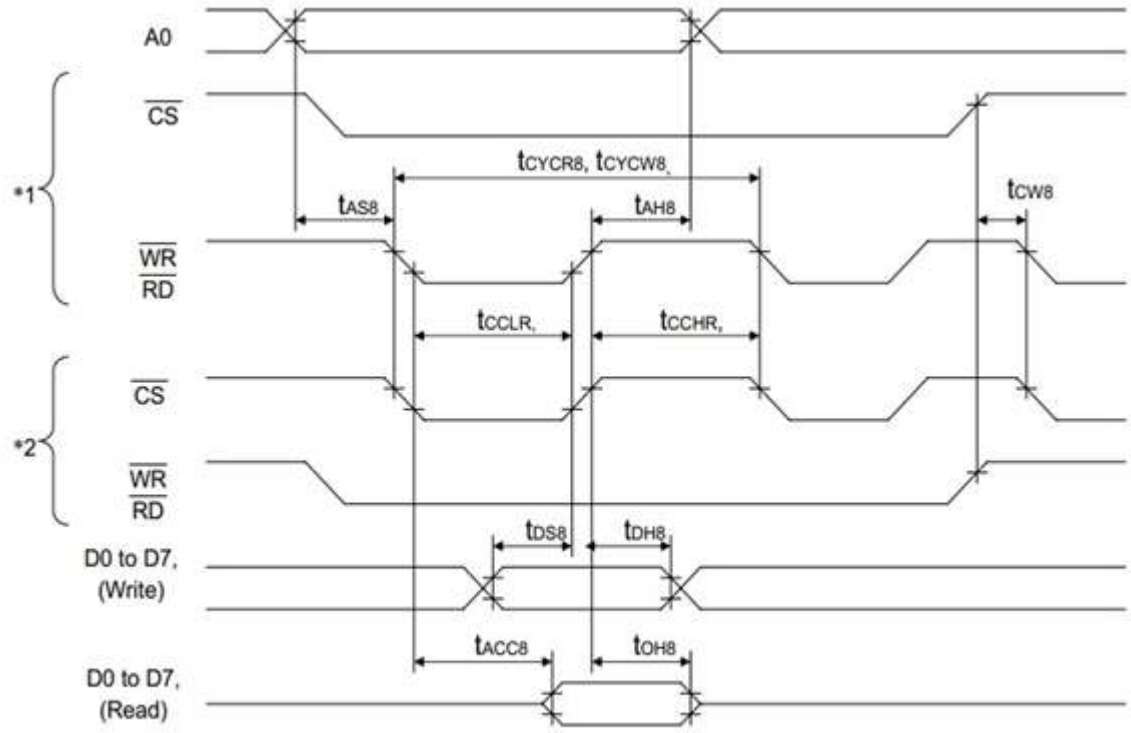
NO	COLOR	FORWARD VOLTAGE (V)			FORWARD CURRENT (mA)			TYPICAL BRIGHTNESS (cd/m2) *
		Min	Typ.	Max	Min	Typ.	Max	
1.	White	-	3.3	-	-	105	140	900

*Note:

1. Brightness measured at lcd surface.
2. Lifetime of backlight estimated as 20000 hours.
3. Definition of Lifetime: Luminance < 50% of initial Luminance
   (Test condition: Ta = 25^{0}C, Constant current supply (typical Value))

6.0 Timing Characteristics

6.1 The timing chart of parallel Interface



*1 If $\overline{CS}$ = LOW and if accessed by $\overline{WR}$ or $\overline{RD}$ signal

*2 If $\overline{WR}$ = $\overline{RD}$ = LOW and if accessed by $\overline{CS}$ signal

V_{SS}=0V, V_{DDI}=2.7 to 5.5V, V_{DD}=1.65 to 1.95V, V_{DD2}=2.7 to 5.5V T_a=-40 to 110°C

Parameter		Symbol	Condition	Min.	Max.	Unit
A0 setup time	Write	t_{ASW3}	—	10	—	ns
	Read	t_{ASR3}	—	10	—	
A0 hold time	Write	t_{AHW3}	—	10	—	
	Read	t_{AHR3}	—	10	—	
Write system cycle time		t_{CYCW3}	—	300	—	
$\overline{WR}$ LOW level pulse width		t_{CCLW3}	—	150	—	
$\overline{WR}$ HIGH level pulse width		t_{CCHW3}	—	100	—	
Read system cycle time		t_{CYCR3}	—	500	—	
$\overline{RD}$ LOW level pulse width		t_{CCLR3}	—	200	—	
$\overline{RD}$ HIGH level pulse width		t_{CCHR3}	—	250	—	
$\overline{CS}$-$\overline{WR}$ time		t_{CWW3}	—	30	—	
$\overline{CS}$-$\overline{RD}$ time		t_{CWR3}	—	30	—	
Data setup time		t_{DS3}	—	20	—	
Data hold time		t_{DH3}	—	20	—	
$\overline{RD}$ access time		t_{ACC3}	CL=50pF	—	250	
Output disable time		t_{OH3}		10	150	

*3 : All timing are specified based on the 20% and 80% of V_{DDI}

*4 : The rise and fall times (t_r and t_f) of the input signal are specified for less than 10ns.

6.2 Reset Timing

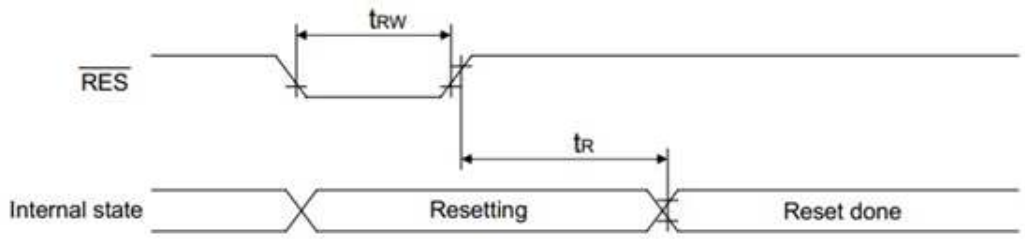


Fig.47 Resetting

V_{SS}=0V, V_{DDI} = 2.7 to 5.5V, V_{DD}=1.65 to 1.95V, V_{DD2}=2.7 to 5.5V, T_a=-40 to 110°C

Parameter	Symbol	Condition	Min.	Max.	Unit
Reset time	t_R	—	—	1	μs
Reset LOW level pulse width	t_{RW}	—	20	—	

*1 All timings are specified based on the 20% and 80% of V_{DDI}.
*2 All timings are specified based on the 20% and 80% of V_{DDI}.
*3 We recommend to hold the $\overline{RES}$ pin to LOW during power-on conditions.
*4 Applied when resetting while the power supply is stabilized.

7.0 Electro-Optical Characteristics

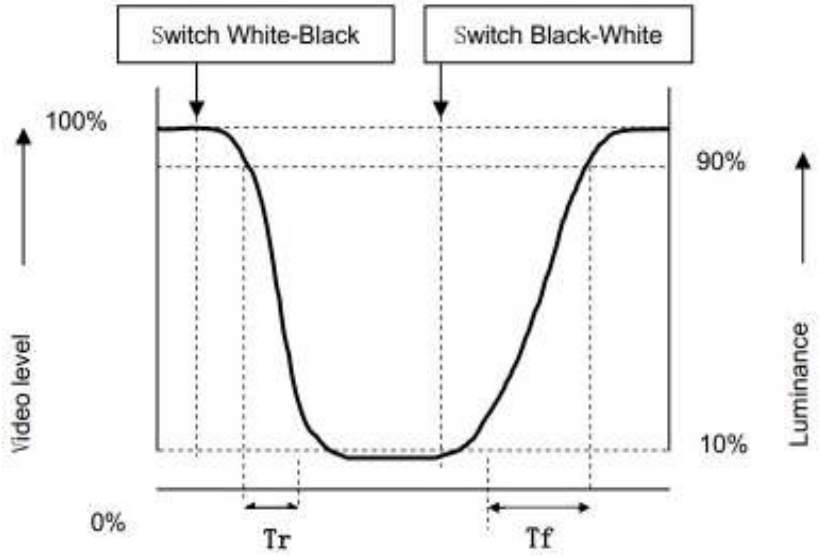
7.1 Parameters and specifications

Item	Symbol	Specifications			Unit	Note
		Min.	Typ.	Max.		
Transmittance(with POL)	T%		10		%	
Contrast ratio*	Cr (Θ=0°)	-	800	-		*[1]Here the data are design value. [2]Chromaticity measuring machine: CFT-01. **Reference Only**
Response time (25℃)*	$T_{r+}T_f$	-	35	50	ms	
Viewing angle (Cr≥ 10)*	Θ21	-	80	-	deg	
	Θ22	-	80	-		
	Θ12	-	80	-		
	Θ11	-	80	-		

7.2 Definitions and measuring methods

a. Response Time (Tr, Tf)

The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.

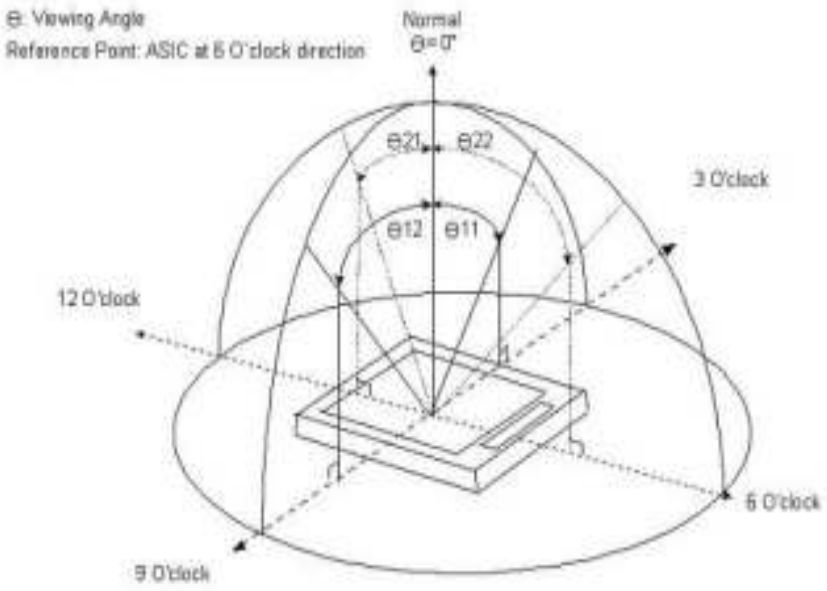


b. Contrast ratio (Cr)

The contrast ratio (Cr), measured on a module, is the ratio between the luminance (L_w) in a full white area (R=G=B=1) and the luminance (L_d) in a dark area (R=G=B=0):

$$Cr = \frac{L\_w}{L\_d}$$

c. Viewing angle diagram



d. Definition of color gamut

Measuring machine:CFT-01. NTSC'S Primaries:
R(x,y,Y)、G(x,y,Y)、B(x,y,Y).

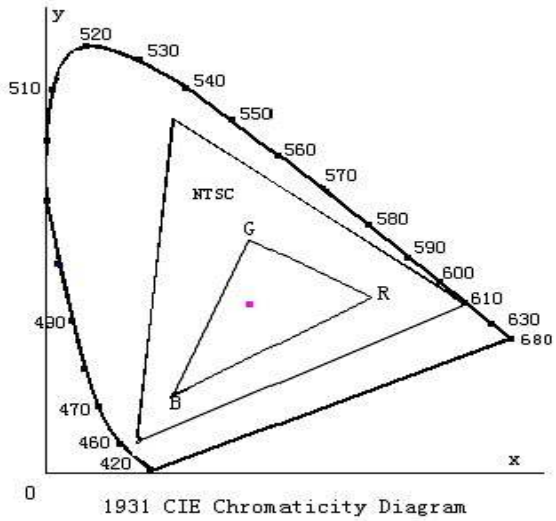


Fig. 1931 CIE Chromaticity Diagram

Colour gamut: $S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$

8.0 Interface

8.1	***Display Driver***	ST7511 or equivalent	
8.2	**Pin No**	**Symbol**	**Description**
	1	GND	Ground
	2	VCC	Power Supply
	3	XCS	Chip Select Pin
	4	GND	Ground
	5	XWR	Write Pin
	6	XRD	Read Pin
	7	GND	Ground
	8	A0	Data or Command identification Pin
	9	D0	Data Bus
	10	D1	Data Bus
	11	D2	Data Bus
	12	D3	Data Bus
	13	BL-	Backlight Ground
	14	D4	Data Bus
	15	D5	Data Bus
	16	D6	Data Bus
	17	D7	Data Bus
	18	XRES	Reset Pin and Low Active
	19	TE	Vertical Synchronization signal output Pin
	20	BL+	Backlight Supply

9.0 Reliability Test Condition

Item		Test Condition
Operating	High Temperature	70degC, 240 hrs
	Low Temperature	-20degC,240 hrs
Storage	High Temperature	80degC, 240hrs and recovery for 2hrs
	Low Temperature	-30degC, 240hrs and recovery for 2hrs
	High Temperature and High Humidity	50degC, 90%RH, 240hrs and recovery for 2 hrs
Thermal	Cycle	RT → -30degC → Rt → 80degC → RT 0min 30min 5min 30min 5min 50 cycles (Power off)
	Shock	RT → -30degV → 80degC 0min 30min 30min 50 cycles (Power off)

Rt means Room Temperature

REMARK:
1, The Test samples should be applied to only one test item.
2, Sample side for each test item is 5pcs.
3, For Damp Proof Test, Pure water (Resistance＞10MΩ) should be used.
4, In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5, EL evaluation should be accepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
6, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

10.0 Quality Standards

10.1 Dot Defects (Operation)

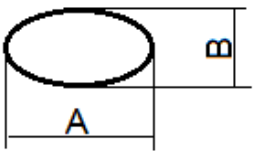
Item	Size((mm))	Acceptable number	Remark
Bright dots (red / green / blue)	D≤0.1	Neglected	MI
	0.1＜D≤0.2	max, 2	MI
	0.2＜D	0	MI
Black dots	-	max, 2	Not adjoining black dots
	-	0	adjacent black dots

10.2 Major Defects

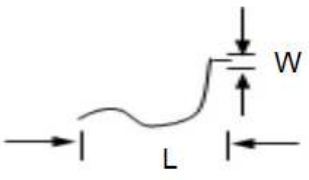
Item	Acceptable number	Remark
Function defect	not allowed	
Abnormal operation including distinct RGB line defects and white line defect	not allowed	
RGB timing	not allowed	
Wrong color	not allowed	
Less brightness	not allowed	
No backlight	not allowed	
Broken glass	not allowed	

10.3 Minor Defects (Visual)

Item	Size(mm)	Acceptable number	Remark
Black spots or white spots	D＜0.1,	Neglected	（Note1）
	0.1＜ D ≤0.2	max, 2	
	0.2＜ D,	max, 0	
Black lines, white lines	W ≤0.03	Neglected	（Note2）
	0.03＜ W ≤0.05 L ≤ 2,	max, 2	
	0.05＜ W	max, 0	



D = (A+B)/2



L : LENGTH
W : WIDTH

11.0 Precaution for using LCM.

1. Liquid Crystal Display (LCD)

LCD is made up of glass, organic sealant, organic fluid and polymer based polarizers. The following precautions should be taken when handling.

a) Keep the temperature within the range of use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel off or bubble.
b) Do not contact the exposed polarizer with anything harder than HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzene.
c) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or colour fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
d) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
e) Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules.

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modification. The following should be noted.

a) Do not tamper in any way with the tabs on the metal frame.
b) Do not modify the PCB by drilling extra holes, changing its outline, moving its component or modifying its pattern.
c) Do not touch the elastomer connector, especially at conductor area.
d) 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.
e) Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2 Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

a) The operator should be grounded whenever he/she comes into contact with the module. Never 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.
b) The modules should be kept in antistatic bags or other antistatic containers.
c) Only properly grounded soldering irons should be used.
d) If an electric screwdriver is used, it should be well grounded and shielded from spark commutator.
e) The normal static prevention measures should be observed for work clothes and working benches, the latter conductive (rubber) mat is recommended.
f) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

2.3 Operation

a) Viewing angle varies with the change of liquid crystal driving voltage (VLCD). VLCD has to be adjusted to show the best contrast.
b) It is a necessary condition to drive LCD's within the specified voltage limit since at the higher voltage limit this can result in shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
c) Response times will be delayed at lower temperature than the operating temperature range and on the other hand, at higher temperature LCD's show darker color in them. However those phenomena do not mean a malfunction or out of order with the LCD's which will recover in the specified operating temperature.
d) 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.

e) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.
f) Input logic voltage before apply analog high voltage such as LCD driving voltage when power on. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.
g) It is advisable to keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

2.4 Soldering

a) Solder only to the I/O terminals.
b) Use only soldering irons with proper grounding and no leakage.
c) Soldering temperature: 280 °C
d) Soldering time: 3 to 4 sec
e) Use eutectic solder with resin flux fill.
f) If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

2.5 Storage

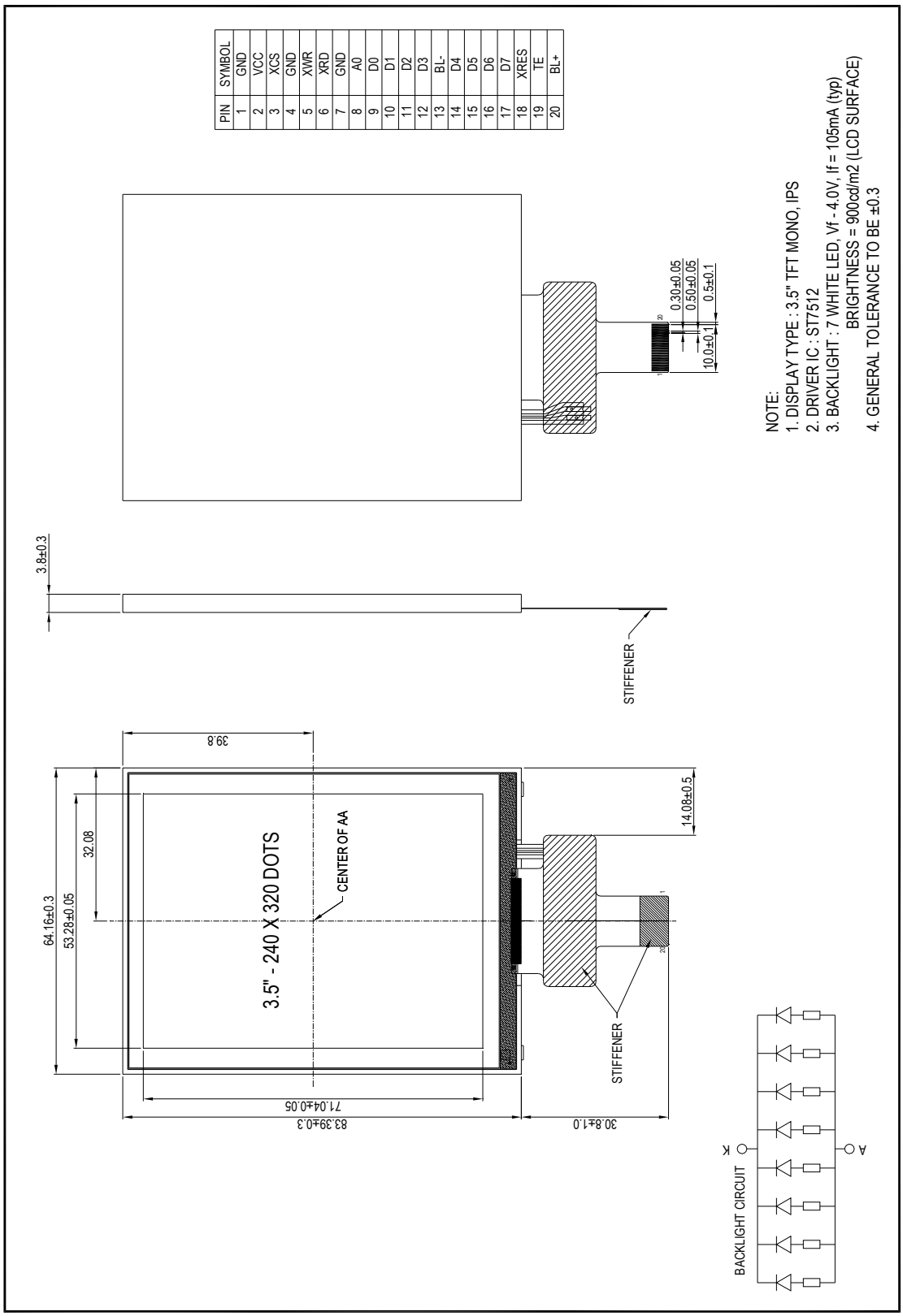
If any fluid leaks out of the damage glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all time.

4. Return LCM under Warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:

i. Broken LCD glass
ii. PCB eyelet's damaged or modified
iii. PCB conductors damaged
iv. Circuit modified in any way, including addition of components.
v. PCB tampered with by grinding, engraving or painting varnish.
vi. Soldering to, or modifying the bezel in any manner.

Module repairs will be invoiced to customer upon mutual agreement. Modules must be returned with sufficient description of failure or defects. Any connectors or cable installed by customer must be removed completely without damaging the PCB eyelet's, conductors and terminals


PIN SYMBOL
1 GND
2 VCC
3 XCS
4 GND
5 XWR
6 XRD
7 GND
8 A0
9 D0
10 D1
11 D2
12 D3
13 BL-
14 D4
15 D5
16 D6
17 D7
18 XRES
19 TE
20 BL+
0.30±0.05
0.50±0.05
0.5±0.1
10.0±0.1
3.8±0.3
STIFFENER
NOTE:
1. DISPLAY TYPE : 3.5" TFT MONO, IPS
2. DRIVER IC : ST7512
3. BACKLIGHT : 7 WHITE LED, Vf - 4.0V, If = 105mA (typ)
BRIGHTNESS = 900cd/m2 (LCD SURFACE)
4. GENERAL TOLERANCE TO BE ±0.3
39.8
32.08
64.16±0.3
53.28±0.05
3.5" - 240 X 320 DOTS
CENTER OF AA
14.08±0.5
71.04±0.05
83.39±0.3
30.8±1.0
STIFFENER
BACKLIGHT CIRCUIT
K
A