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		APPLICABLE DIVISION DEVELOPMENT DEPT.I DESIGN CENTER I LCD DESIGN DEVELOPMENT DISPLAY DEVICE BUSINESS GROUP WUXI SHARP ELECTRONIC COMPONENTS CO.,LTD.

DEVICE SPECIFICATION for
TFT LCD Module
(2160x2(R,G,GB,BR)x3840 dots)

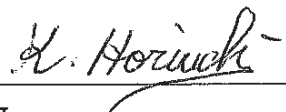
Model No.
LS055D1SX05(G)

CUSTOMER'S APPROVAL

DATE _____

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SPEC No.
LCY-W-16912

MODEL No.
LS055D1SX05(G)

PAGE
1

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- Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment (trunk lines), nuclear power control equipment and medical or other equipment for life support.
- SHARP assumes no responsibility for any damage resulting from the use of the device which does not comply with the instructions and the precautions specified in these specification sheets.
- Contact and consult with a SHARP sales representative for any questions about this device.

[For handling and system design]

- (1) Do not scratch the surface of the polarizer film as it is easily damaged.
- (2) If the cleaning of the surface of the LCD panel is necessary, wipe it swiftly with cotton or other soft cloth. Do not use organic solvent as it damages polarizer.
- (3) Water droplets on polarizer must be wiped off immediately as they may cause color changes, or other defects if remained for a long time.
- (4) Since this LCD panel is made of glass, dropping the module or banging it against hard objects may cause cracks or fragmentation.
- (5) Certain materials such as epoxy resin (amine's hardener) or silicone adhesive agent (de-alcohol or de-oxym) emits gas to which polarizer reacts (color change). Check carefully that gas from materials used in system housing or packaging do not hurt polarizer.
- (6) Liquid crystal material will freeze below specified storage temperature range and it will not get back to normal quality even after temperature comes back within specified temperature range. Liquid crystal material will become isotropic above specified temperature range and may not get back to normal quality. Keep the LCD module always within specified temperature range.
- (7) Do not expose LCD module to the direct sunlight or to strong ultraviolet light for long time.
- (8) If the LCD driver IC (COG) is exposed to light, normal operation may be impeded. It is necessary to design so that the light is shut off when the LCD module is mounted.
- (9) Do not disassemble the LCD module as it may cause permanent damage.

(10) As this LCD module contains components sensitive to electrostatic discharge, be sure to follow the instructions in below.

① Operators

Operators must wear anti-static wears to prevent electrostatic charge up to and discharge from human body.

② Equipment and containers

Process equipment such as conveyer, soldering iron, working bench and containers may possibly generate electrostatic charge up and discharge. Equipment must be grounded through 100Mohms resistance. Use ion blower.

③ Floor

Floor is an important part to leak static electricity which is generated from human body or equipment.

There is a possibility that the static electricity is charged to them without leakage in case of insulating floor, so the counter measure (electrostatic earth: $1 \times 10^8 \Omega$) should be made.

④ Humidity

Proper humidity of working room may reduce the risk of electrostatic charge up and discharge. Humidity should be kept over 50% all the time.

⑤ Transportation/storage

Storage materials must be anti-static to prevent causing electrostatic discharge.

⑥ Others

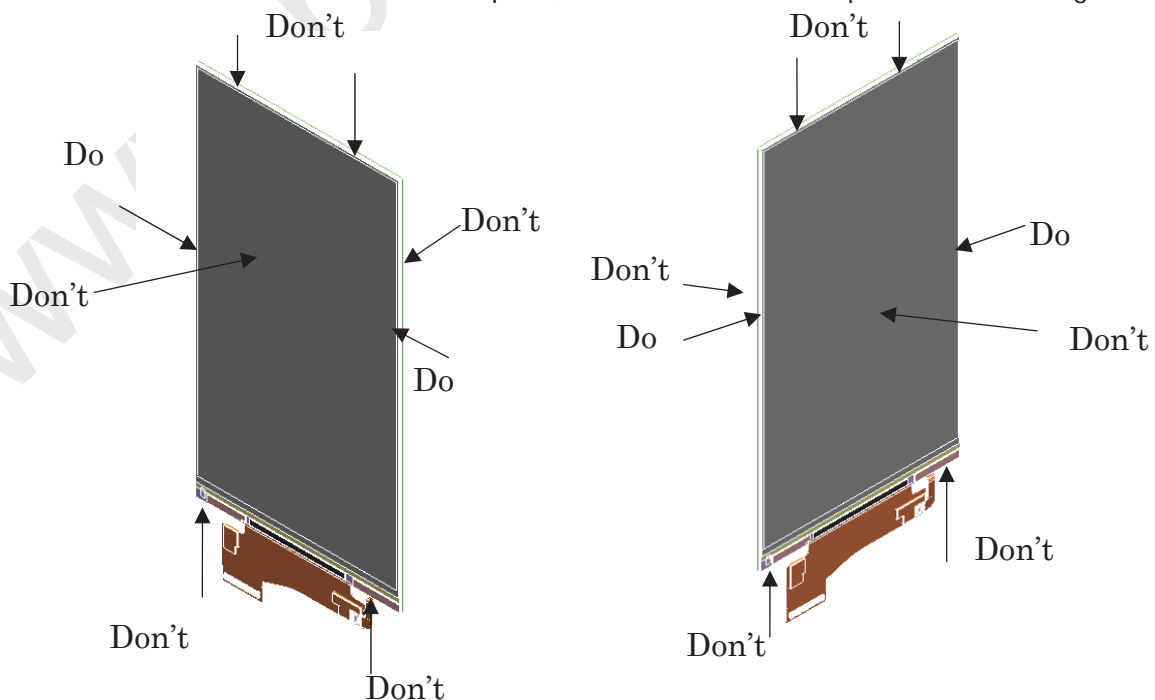
Protective film is attached on the surface of LCD panel to prevent scratches or other damages. When removing this protective film, remove it slowly under proper anti-ESD control such as ion blower.

(11) Hold LCD very carefully when placing LCD module into the system housing. Do not apply excessive stress or pressure to LCD module. Do not to use chloroprene rubber as it may affect on the reliability of the electrical interconnection.

(12) Do not hold or touch LCD panel to flex interconnection area as it may be damaged.

(13) As the binding material between LCD panel and flex connector mentioned in 12) contains an organic material, any type of organic solvents are not allowed to be used. Direct contact by fingers is also prohibited.

(14) When carrying the LCD module, place it on the tray to protect from mechanical damage. It is recommended to use the conductive trays to protect the CMOS components from electrostatic discharge. When holding the module, hold the Plastic Frame of LCD module so that the panel, COG and other electric parts are not damaged.



- (15) Do not touch the COG's patterning area. Otherwise the circuit may be damaged.
- (16) Do not touch LSI chips as it may cause a trouble in the inner lead connection.
- (17) Place a protective cover on the LCD module to protect the glass panel from mechanical damages.
- (18) LCD panel is susceptible to mechanical stress and even the slightest stress will cause a color change in background. So make sure the LCD panel is placed on flat plane without any continuous twisting, bending or pushing stress.
- (19) Protective film is placed onto the surface of LCD panel when it is shipped from factory. Make sure to peel it off before assembling the LCD module into the system. Be very careful not to damage LCD module by electrostatic discharge when peeling off this protective film. Ion blower and ground strap are recommended.
- (20) Make sure the mechanical design of the system in which the LCD module will be assembled matches specified viewing angle of this LCD module.
- (21) This LCD module does not contain nor use any ODS (1,1,1-Trichloroethane, CCL4) in all materials used, in all production processes.

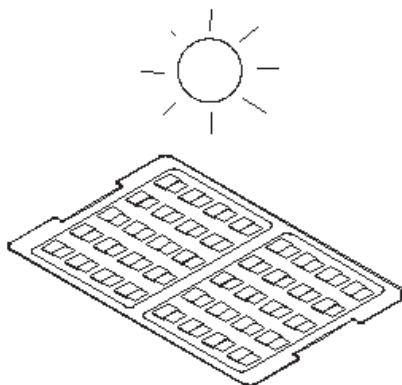
[For operating LCD module]

- (1) Do not operate or store the LCD module under outside of specified environmental conditions.
- (2) At the shipment, adjust the contrast of each LCD module with electric volume. LCD contrast may vary from panel to panel depending on variation of LCD power voltage from system.
- (3) As opt-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable.

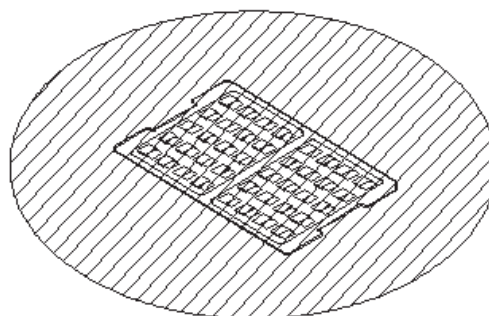
[Precautions for Storage]

- (1) Do not expose the LCD module to direct sunlight or strong ultraviolet light for long periods. Store in a dark place.
- (2) The liquid crystal material will solidify if stored below the rated storage temperature and will become an isotropic liquid if stored above the rated storage temperature, and may not retain its original properties. Only store the module at normal temperature and humidity (25±5°C,60±10%RH) in order to avoid exposing the front polarizer to chronic humidity.
- (3) Keeping Method
 - a. Don't keeping under the direct sunlight.
 - b. Keeping in the tray under the dark place.

DON'T



DO



- (1) Do not operate or store the LCD module under outside of specified environmental conditions.
- (2) Be sure to prevent light striking the chip surface.



SPEC No.
LCY-W-16912

MODEL No.
LS055D1SX05(G)

PAGE
4

[Other Notice]

- (1) Do not operate or store the LCD module under outside of specified environmental conditions.
- (2) As electrical impedance of power supply lines (VDDIO-GND) are low when LCD module is working, place the de-coupling capacitor nearby LCD module as close as possible.
- (3) Reset signal must be sent after power on to initialize LSI. LSI does not function properly until initialize it by reset signal.
- (4) Generally, at power on, in order not to apply DC charge directly to LCD panel, supply logic voltage first and initialize LSI logic function including polarity alternation. Then supply voltage for LCD bias. At power off, in order not to apply DC charge directly to LCD panel, execute Power OFF sequence and Discharge command.
- (5) Don't touch to FPC surface, exposed IC chip, electric parts and other parts, to any electric, metallic materials.
- (6) No bromide specific fire-retardant material is used in this module.
- (7) Do not display still picture on the display over 2 hours as this will damage the liquid crystal.

[Precautions for Discarding Liquid Crystal Modules]

COG: After removing the LSI from the liquid crystal panel, dispose of it in a similar way to circuit boards from electronic devices.

LCD panel: Dispose of as glass waste. This LCD module contains no harmful substances. The liquid crystal panel contains no dangerous or harmful substances. The liquid crystal panel only contains an extremely small amount of liquid crystal (approx.100mg) and therefore it will not leak even if the panel should break.

-Its median lethal dose (LD50) is greater than 2,000 mg/kg and a mutagenetic (Aims test: negative) material is employed.

FPC: Dispose of as similar way to circuit board from electric device.



SPEC No.
LCY-W-16912

MODEL No.
LS055D1SX05(G)

PAGE
5

1. Application

This data sheet is to introduce the specification of LS055D1SX05 active matrix 16,777,216 color LCD module. Main color LCD module is controlled by Driver IC (NT35950 with 1/3 RAM).

If any problem occurs concerning the items not stated in this specification, it must be solved sincerely by both parties after deliberation.

As to basic specification of driver IC and touch controller refer to the each specification and handbook.

2. Construction and Outline

Construction: LCD panel Driver (COG), and electric components, 18 White LED lumps, prism sheet, diffuser, light guide and reflector, plastic frame and PET Sheet to fix them mechanically.

Outline: See page 31

Connection: B to B connector (FB35-RC60-3A 60 pins)

There shall be no scratches, stains, chips, distortions and other external drawbacks that may affect the display function.

In order to realize thin module structure, double-sided adhesive tapes are used to fix LCD panels. As these tapes do not guarantee to permanently fix the panels, LCD panel may rise from the module when shipped from factory.

So please make sure to design the system to hold the edges of LCD panel by the soft material such as sponge when LCD module is assembled into the cabinet.

3. Mechanical Specification

Table 1

Parameter		Specifications	Unit
Outline dimensions (typ)		69.84 (W) x 128.76 (H) x1.24 (D)	mm
Main LCD Panel	Active area	68.04 (W) x 120.96 (H)	mm
	Display format	2160 (W)x 2(RG,GB,BR) x 3840(H)	-
	Dot pitch	0.01575(W) x 0.0315(H)	mm
	Base color *1	Normally Black	-
Mass		Approx 17.0	g

*1 Due to the characteristics of the LC material, the colors vary with environmental temperature.



SPEC No. LCY-W-16912	MODEL No. LS055D1SX05(G)	PAGE 6
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4. Absolute Maximum Ratings

(4-1) Electrical absolute maximum ratings

Table 2

Ta=25 °C

Parameter	Symbol	Min	Max	Unit	Remark
Supply Voltage	VDDI_LCD-GND	-0.3	+4.0	V	*1,2
	DVDD	+1.29	+1.4	V	*2,3
	VSP-GND	+4.5	+6.3	V	*1,2
	VSN-GND	-6.3	-4.5	V	*1,2

*1) VDDI=1.70to2.05V, VSP=4.5~6.3V, VSN=-4.5~-6.3V, DVSS=DVSS1=DVSS2=AVSS=VSSAM1=VSSAM2=0V, DVDD/DVDD1/DVDD2=Based on NVT setting, Ta=-30 to 70 °C (to +85 °C no damage).

* 2) When the measurements are performed with module, measurement points are like below.

* 3) DVDD=DVDD1=DVDD2=external DVDD input voltage when EXT_DVDD_EN="1".

(4-2) Environment Conditions

Table 3

Item	Top		Tstg		Remark
	MIN.	MAX.	MIN.	MAX.	
Ambient temperature	-20 °C	+60°C	-30 °C	+70°C	Note 2)
Humidity	Note 1)		Note 1)		No condensation

Note1) Ta ≤ 40 °C.....95 % RH Max

Note2) Ta > 40 °C.....Absolute humidity shall be less than Ta=40 °C /95 % RH.

As opt-electrical characteristics of LCD will be changed, dependent on the temperature, the confirmation of display quality and characteristics has to be done after temperature is set at 25 °C and it becomes stable.

Be sure not to exceed the rated voltage, otherwise a malfunction may occur.



SPEC No. LCY-W-16912	MODEL No. LS055D1SX05(G)	PAGE 7
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5. Electrical Specifications

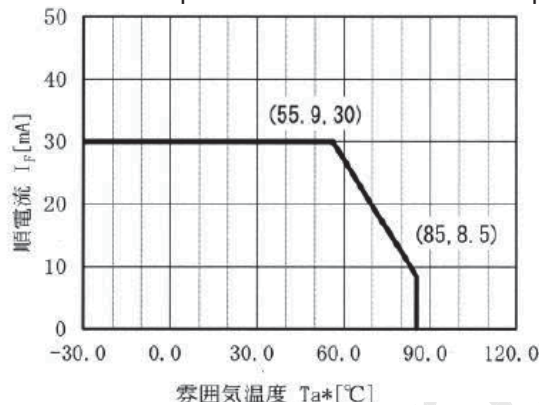
(5-1) Absolute Maximum Ratings (LCD Module)
T_{AMB}=+25C, Frm=60Hz

ITEM	Symbol	MIN.	MAX.	Unit
Supply voltage range VDDI	V _{VDDI}	-0.3	2.15	V
Supply voltage range DVDD	V _{DVDD}	-0.3	1.45	V
Storage temperature	T _{sta}	-30	+80	C
Supply voltage range VSP	V _{VSP}	-0.3	6.6	V
Supply voltage range VSN	V _{VSN}	-6.6	+0.3	V
Input voltage range	V _{IN}	-0.3	VDDI+0.3	V
Operating temperature #1	T _{OD}	-20	+60	C
LED Input electric current #2	I _{LED}	--	25	mA/pcs

Notes:

#1 Optical specs do not need to be met beyond the Operating Temperature range.

#2 Ambient temperature and the maximum input are fulfilling the following operating conditions.



#Figure 1

As shown in the derating data submitted separately, higher LED current causes lower LED characteristics vs driving period. Please supply the proper LED current in consideration of the VR glass inside temperature and the reported derating data.



SPEC No.
LCY-W-16912

MODEL No.
LS055D1SX05(G)

PAGE
8

(5-2)Normal Operating Range (LCD Module)

$T_{AMB}=+25C$, Frm=60Hz

ITEM	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range VDDI (*2)	V_{VDDI}	1.75	1.85	1.95	V
Supply voltage range DVDD (*2)	V_{DVDD}	1.34	1.36	1.38	V
Supply voltage range VSP (*2)	V_{VSP}	5.6	5.8	6.0	V
Supply voltage range VSN (*2)	V_{VSN}	-5.8	-5.6	-5.4	V
Output voltage range low @ $I_{out}=1mA$	V_{ol1}	GND	--	$0.2 \cdot V_{VDDI}$	V
Output voltage range high @ $I_{out}=1mA$	V_{oh1}	$0.8 \cdot V_{VDDI}$	--	V_{VDDI}	V
Input voltage range low(RESX)	V_{il1-R}	GND	--	$0.2 \cdot V_{VDDI}$	V
Input voltage range high(RESX)	V_{ih1-R}	$0.8 \cdot V_{VDDI}$	--	V_{VDDI}	V
Input voltage range low(Except RESX)	V_{il1}	GND	--	$0.3 \cdot V_{VDDI}$	V
Input voltage range high(Except RESX)	V_{ih1}	$0.7 \cdot V_{VDDI}$	--	V_{VDDI}	V
Input current	I_{inh1}	--	--	1	uA
	I_{iol1}	-1	--	--	uA
Max Load Current (2sub pix Checker)	P_{max}	--	696(*1)	839(*1)	mW
Deep Standby Mode	P_{LCD}	Not supported			
LED Current	I_{LED}	--	20	--	mA/pcs

(*1) Command mode(Still image), DVDD=1.36V, VDDI =1.85V, VSP=5.8V, VSN=-5.6V

(*2) Voltage shall be at the point of module input.

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