PREPARED BY:	DATE	



APPROVED BY: DATE

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DEVICE SPECIFICATION FOR

TFT-LCD module

MODEL No. LQ050T5DW70

CUSTOMER'S APPROVAL

DATE

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<u>BY</u> T.MAKII

PRESENTED

DEPARTMENT GENERAL MANAGER ENGINEERING DEPT. II LIQUID CRYSTAL DISPLAY DIVISION III LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION

RECORDS OF REVISION

MODEL No: LQ050T5DW70

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1. General

The product covered herein is an amorphous-silicon TFT (Thin Film Transistor) mono LCD (Liquid Crystal Display) module of active matrix type and with a panel aspect ratio of 15 : 9.

2. Features

- 5.0 " screen with a panel aspect ratio of 15:9, which makes the module suitable for use in wide-screen systems and produces a high resolution image that is composed of 96,000 pixels elements in a stripe arrangement.
- Graphics and texts can be displayed on a 400×240×RGB dots panel with (87424) colors by supplying 6 bit data signals.
- Wide viewing field angle technology is employed.
- · Active matrix drive system allowing high-contrast images to be produced
- Reduced reflection as a result of low reflection black matrix and an antiglare (AG) polarizer being adopted.
- COG packaging technology used for a thin, lightweight and compact module
- Realized a high quality picture of the natural color appearance by adopting Normally Black Mode which is superior to the color appearance.
- LED backlight

3. Module Components and Outline

The module comprises of a TFT LCD panel, drivers, PCB, an FPC, a front case, and a backlight. (backlight operating circuit is not included.)

4. Mechanical Specification

Table $4-1$			
Parameter	Specification	Units	Remarks
Screen size (Diagonal)	12.6 [5.0"]	cm	
Active Area	108.0 (W) x 64.8 (H)	mm	
Display Format	400 x 240 x RGB	Dots	
Dot Pitch	0.270 (W) x 0.090 (H)	mm	
Pixel Configuration	Stripe Configuration		
Display Mode	Normally Black		
Outline Dimension	124.0 (W) x 80.0(H) x 6.5 (D)	mm	[Note 4-1,2]
Mass	(120) MAX	g	[Note 4-1]

[Note 4-1] TYP values are given.

[Note 4-2] FPC (LCD/LED) ,PCB (Mounted parts) ,PCB Fixing Hook are not included.

5. Input terminal

5-1)TFT-LCD panel driving part

Table 5	-1		
Pin No.	Symbol	Description	Remarks
1	GND	Ground	
2	DCLK	Clock signal for system driver.	
3	GND	Ground	
4	BO	BLUE data signal(LSB)	
5	B1	BLUE data signal	
6	B2	BLUE data signal	
7	B3	BLUE data signal	
8	B4	BLUE data signal	
9	B5	BLUE data signal(MSB)	
10	GND	Ground	
11	G0	GREEN data signal(LSB)	
12	G1	GREEN data signal	
13	G2	GREEN data signal	
14	G3	GREEN data signal	
15	G4	GREEN data signal	
16	G5	GREEN data signal(MSB)	
17	GND	Ground	
18	R0	RED data signal(LSB)	
19	R1	RED data signal	
20	R2	RED data signal	
21	R3	RED data signal	
22	R4	RED data signal	
23	R5	RED data signal(MSB)	
24	GND	Ground	
25	SHUT	Control signal for Power supply.	*
26	GND	Ground	
27	HSY	Horizontal synchronous signal (Low active)	
28	VSY	Vertical synchronous signal (Low active)	
29	N.C.	to be used it as "OPEN"	
30	GND	Ground	
31	GND	Ground	
32	N.C.	to be used it as "OPEN"	
33	VCC	Power supply for LCD module	
34	VCC	Power supply for LCD module	
35	VCC	Power supply for LCD module	
36	VCC	Power supply for LCD module	
37	N.C.	This is open terminal	
38	GND	Ground	
39	GND	Ground	
40	GND	Ground	

*Please refer to Chapter, Power Supply sequence

(See Fig.1 : Outline Dimensions $\)$

5-2)LED backlight driving part

10010 0	-		
Pin No.	Symbol	Function	Remarks
1	A1	LED Anode side 1	
2	A2	LED Anode side 2	
3	N.C.	OPEN	
4	C1	LED Cathode side 1	
5	C2	LED Cathode side 2	
6	N.C.	OPEN	
7	Themistor(+)	(TBD)	
8	Themistor $(-)$	(TBD)	

Table 5-2

Ref.(Below) Circuit diagram in LED back light

(See Fig.1 : Outline Dimensions)



6. Absolute maximum ratings

Table 6

Table 6					GND = 0V
Item	Symbol	MIN.	MAX.	Unit	Remarks
Power supply Voltage	VCC	-0.3	4.0	V	
Input Signal Voltage	VID	-0.3	VCC+0.3	V	[Note 6-1]
Storage Temperature	Tstg	-40	+95	°C	[Note 6-2,3]
Operating Temperature	Topr1	-30	+85	°C	[Note 6-4]
(Panel temperature)					

[Note 6-1] R0~R5, G0~G5, B0~B5, DCLK, HSY, VSY, SHUT

[Note 6-2] This rating applies to all parts of the module and should not be exceeded.

[Note 6-3] Maximum wet-bulb temperature is 57°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

[Note 6-4] The operating temperature is a temperature at which the module is assured to operate. Display quality criteria such as contrast and response speed are evaluated when $Ta = +25^{\circ}C$.

7. Electrical Characteristics

7-1) TFT LCD panel driving section

Table 7-1					GN	D=0V	$Ta = +25^{\circ}C$
	Item	Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Power Supply	Voltage Range	VCC	(+3.1)	+3.3	+3.6	V	
voltage	Rise time	Trise	—	_	10	ms	[Note 7-3]
	Voltage Fall	VTH	(2.5)	_	—	V	[Note 7-3,4]
	Voltage drop time	Tvth	—		(10)	ms	[Note 7-3]
	Resupply voltage	Voff	0		(0.1Vcc)	V	[Note 7-4]
	Time of	Tpon	(100)	_	_	ms	[Note 7-4]
	re-power supply						
Input signal	Hi	V IHS	$0.7 \times VCC$		VCC	V	[Note 7-1]
voltage	Lo	V ILS	GND	_	$0.3 \times VCC$	V	
Input	Hi	IHS1	—	_	1.0	μ A	[Note 7-2]
current 1	Lo	ILS1	-1.0	_	—	μ A	
Input	Hi	IHS2	—	_	1.0	μ A	HSY/VSY
current 2	Lo	ILS2	-30	_	—	μ A	
Input	Hi	IHS3	—	_	30	μ A	SHUT
current 3	Lo	ILS3	-1.0	_	_	μΑ	

[Note 7-1] : DCLK、HSY、VSY、SHUT、R0~R5、G0~G5、B0~B5

[Note 7-2] : DCLK, R0~R5, G0~G5, B0~B5

[Note 7-3] : Please refer to Fig.7-1

[Note 7-4] : If VCC becomes lower than VTH, Power supply is to be put again. After getting VCC to GND level, the sequence of Power supply "ON" should be executed after 100 ms passed. (Please refer to Fig.7-2)

Fig.7-1 : Vcc Waveform



Fig.7-2 : Sequence of re-power supply



7-2)Backlight driving section

Table 7-2

Ta=+25℃

Item	Symbol	MIN.	TYP.	MAX.	Unit	Remarks
LED Voltage	Vf	17.0	18.5	21.0	V	6 LEDs, 1 line
						IF=60mA
LED Current	If	—	60	70	mA	
Power consumption	Wf	—	2.2	—	W	Vf imes If imes 2line
LED Voltage (-30°C)	Vf (-30)	—		22.0	V	Tp=-30°C,IF=60mA
LED Voltage (+85°C)	Vf (+85)	16.0	_	_	V	Tp=+85°C,IF=60mA

8. Input signal timing characteristics

Table 8

	Item	Symbol	MIN	TYP	MAX	Unit	Remarks
DCLK	Clock frequency	fCLK	(TBD)	6.67	(TBD)	MHz	1/(1/fV/tV/tH)
	Clock pulse high duty	fWCH	40	—	60	%	
	Clock pulse low duty	fWCL	40	—	60	%	
	Rise time	fCR	—	—	20	%	
	Fall time	fCF	—	—	20	%	
Data	Set up time	tDS	10	—	—	ns	Applied to R0-
	Hold Time	tDH	10	—	—	ns	R5/G0-G5/B0-B5
HSY signal	Cycle(time)	tH(t)	(TBD)	64.10	(TBD)	us	1/fV/tV
(HSY)	Cycle(Clock)	tH(clk)	(TBD)	430	(TBD)	clk	
	frequency	fH	(TBD)	15.51	(TBD)	kHz	1/tH
	Pulse Duration	tHPW	—	10	—	clk	
	Set up time	tHS	10	—	—	ns	
	Hold time	tHH	10	—	—	ns	
VSY Signal	Cycle	tV	(TBD)	260	(TBD)	line	
(VSY)	frequency	fV	—	59.66	—	Hz	
	Pulse Duration	tVPW	2	2	—	line	
Horizonta	al Display period	tHA	—	400	—	clk	
Horizonta	l display starting	tHBP	—	20	—	clk	
position (He	orizontal back porch)						
Horizontal front porch		tHFP	—	10		clk	
HSY-VSY phase difference		tHV	0	0	—	clk	
Vertical	display period	tVA	—	240	—	line	
Vertical disp	lay starting position	tVBP	—	6	—	line	
(Vertie	cal back porch)						
Vertic	al front porch	tVFP	_	14	_	line	

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Fig.8 Timing char

9.Power On/Off sequence Figure 9 : Power On/Off sequence



Table 9: Power On/Off sequence spec

Symbol	MIN	TYP	MAX	Unit
t1	10	—	—	ms
t2	0	—	—	ms
t3	10	—	—	frame
t4	0	_	_	ms
t5	9	_	_	frame

9-1. Power on sequence Below figure 9-1 / table 9
shows "Power On Sequence".
The input signal should be delayed "t1" and "t2" after Vcc turn on. Then, it starts to display at 7 vertical duration

later by counting the falling edge pulse of VSY.

Figure 9-1 : Power on sequence



Table 9-1 : Power On sequence spec

Item	Symbol	MIN	TYP	MAX	Unit
Vcc input signal time	t1	10		_	ms

Note : The "Shut signal" should be Hi during "Power on sequence" - No-mage in the Figure 9-1.

9-2. Power Off sequence

Below figure 9-2 shows "Power Off sequence". "Power Off sequence" will start by SHUT signal Lo-level from Hi level during normal operation. After the SHUT signal get Lo, it takes 6 vertical duration to no image.



Note : The "SHUT signal" should be Lo during "Power off sequence" - No-mage in the Figure 9-2. Note : During the power off sequence, please keep the input signal on.

10. Current Consumption

Table 10 showes the specification of current consumption.

Table	10
Lable	τU

Table 10						Ta	1 = 25 °C
Item	Symbol	Vcc Condition	Min	Тур	Max	Unit	Remarks
Vcc current	IVCC	VCC=+3.3V	_	(11)	(25)	mA	

* (Measurement condition) :

Display pattern / : Black Pattern, checkered pattern

Driving Condition :

fCLK=6.67MHz, fH=15.51kHz, fV=59.66Hz

definition)

fH : Horizontal Sync.(HSY) Frequency fH=1/tH(t)

fV : Vertical Sync.(VSY) Frequency fV=1/(tH(t)*tV)

11. Input Data Signals and Display Position on the screen



Display position of input data (H,V)

12. Input Signals	, Basic Display	Color and Gray	Scale of Each Color
-------------------	-----------------	----------------	---------------------

	<u> </u>	8	,		1 1	,			U											
	Colors &					Ι)ata s	signa	l		0	Low	level	volta	age	1:]	High	level	volta	ge
	Gray scale	Gray Scale	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
	Black	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	-	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Ξ	Green	_	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
asic	Cyan		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
colc	Red	I	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
r	Magenta	_	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	_	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	_	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	仓	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
hray	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scs	仓	\checkmark	\checkmark						\checkmark					\checkmark						
le of	Û	\checkmark				V												\mathbf{k}		
f red	Brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Û	GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS63	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G_1	仓	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
ay S	Darker	GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Scale	仓	\checkmark				k			\checkmark					\checkmark						
e of g	Û	\checkmark				١												\mathbf{k}		
ree	Brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
D	Û	GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	仓	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
ray	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Scal	仓	\checkmark				r			\downarrow						\checkmark					
e of	Û	\checkmark				١			\checkmark						\downarrow					
bleu	Brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
	Û	GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	Bleu	GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

13.Optical characteristics

Table 13								$Ta=25^{\circ}C$
Parameter		Symbol	Condition	Min	Тур	Max	Unit	Remarks
Viewing angle		θ 21, θ 22	$CR \ge 30$	35	50	—	°(degree)	[Note 13-1,2]
range		θ 11		28	40	—	°(degree)	
		$\theta \ 12$		24.5	35	—	°(degree)	
Contrast ra	tio	CRmax.	$\theta = 0^{\circ}$	250		—		[Note 13-2]
Response	Rise	τ r	$\theta = 0^{\circ}$	—	12	24	ms	[Note 13-3]
time	Fall	τ d		—	23	46	ms	
Luminance $\theta \ 0\phi 0$		Y	If=60mA	525	700	—	cd/m^2	[Note 13-4]
Luminance θ 40 φ 30		Y	If=60mA	270	360	—	cd/m^2	
Luminance θ 30 φ 30		Y	If=60mA	400	533	—	cd/m^2	
White		x	If=60mA	0.280	0.310	0.340		[Note 13-4,6]
Luminance		у		0.289	0.319	0.349		
LED Life time		_	continuation	10,000	_	_	hour	[Note 13-5]

*Measuring after 30minutes operation. The measurement of the optical character is measured by using the method of fig.13-1 and fig.13-2 under the condition which is equal to the darkroom or the darkroom.



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measurement method

[Note 13-1] Viewing angle range is defined as follows.

[Note 13-3] Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".

- [Note 13-5] LED life time is defined as the time when the brightness of the panel not to become less than 50% of the original value in the continuous operation under the condition of LED current I f=60mA.
- [Note 13-6] Color Chromaticity need to be simulated after the R/G/B requirement provided. The final typical value for W/R/G/B will be determined after sample evaluation.

14. Display quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

- 15. Mechanical characteristics
 - 15-1) External appearance
 - Appearance of the active area only is guaranteed. (See Fig.1: Outline dimensions)
 - 15-2) Main composition parts (See Fig.2 : Main composition parts)
- 16. Handling instructions
 - 16-1) Handling of LCD-FPC,LED-FPC
 - ① Please do not hang a LCD module or do not apply excessive power for LCD-FPC,LED-FPC.
 - ② Please do not fold the LCD-FPC or LED-FPC. Please follow Sharp's FPC handling recommendations for bending the LCD-FPC & LED-FPC and under all circumstances ensure the minimum bend radius guideline of (0.5) mm is observed.
 - (3) Whilst Sharp connects the FPC to the TFT LCD, TT is required to inspect the connection status before their assembly.

16-2) Mounting of module

①Please take care during the assembly process to ensure the to TFT-LCD module is not twisted or warped.

Don't reach the pressure of touch-switches of the set side to a module directly , because images may be disturbed

- ② Please power off the system before connecting the input/output connector.
- 16-3) Precautions in mounting

Polarizer which is made of soft material and susceptible to damage and must be handled carefully. Protective sheet covers the surface to protect it against scratches and dirties. It is recommended to keep a protective sheet (Including alternative protective sheet attached by the customer & agreed with Sharp in advance) during assembly and remove immediately before use by end customer, taking care of static electricity. Precautions in peeling off protective sheet.

A) Working environment

When the protective sheet is peeled off, static electricity may cause dust to stick to the polarizer surface.

To avoid this, the optimised environment is:

- a) Floor: Conductive treatment of $1M\Omega$ or more on the tile.
 - (conductive mat or conductive paint on the tile)
- b) Clean room free form dust and with an adhesive mat on the doorway.
- c) Humidity: 50% \sim 70% Temperature: 15°C \sim 27°C
- d) Workers shall wear conductive shoes, conductive work clothes, conductive gloves and an earth band.

B) Working procedures

a) Direct the air of discharging blower somewhat downward to ensure that module is in the flow of this air.

Please set the distance between module and discharging blower the most suitable distance of blower.

- b) Peel off protective sheet, pulling adhesive tape slowly to your side.
- (5 seconds or more peel off time is necessary when the discharging blower is not present)
- c) After peeling off the protective sheet, immediately pass the module to the next work process to prevent the module to get dust.
- d) Method of removing dust from polarizer
 - Blow off dust with N2 blower for which static electricity preventive measure has been taken.
 - · Since polarizer is vulnerable, wiping should be avoided if possible.

When removal of stain or grease is necessary, we recommend to use adhesive tape to softly remove them from the panel.

When metal part of the TFT-LCD module (shielding case) is soiled, wipe it with soft dry cloth. For stubborn dirties, wipe the part, breathing on it.

Wipe off water drop or finger grease immediately. Long contact with water may cause discoloration or spots on the polarizer.

TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Handle with care. Since CMOS LSI is used in this module, take care of static electricity and earth your body when handling.

16-4) Product design guidelines

Sharp recommends strict adherence to the following system product design guidelines.

- Protection of the LCD module against water & salt-water by a waterproof cover.
- Please take measures to ensure interference radiation from the module, does not interfere with surrounding appliances.
- Ensure exposed electrical components and contacts are electronically protected by implementing necessary insulation in the system by following good design practices for the system.

16-5) Others

- ① Do not expose the module to direct sunlight or intensive ultraviolet rays for several hours; liquid crystal is deteriorated by ultraviolet rays.
- ⁽²⁾ Store the module at a temperature near the room temperature. At lower than the rated storage temperature, liquid crystal solidifies, causing the panel to be damaged. At higher than the rated storage temperature, liquid crystal turns into isotropic liquid and may not recover.
- ③ If LCD panel breaks, there may be a possibility that the liquid crystal escapes from the panel. Since the liquid crystal is poisonous, do not put it into the eyes or mouth. When liquid crystal sticks to hands, feet or clothes, wash it out immediately with soap.
- ④ Reference information (Handling procedures) available from Sharp on request detail additional guidance and procedures for handling a display which should be followed.

17. Packing form

17-1) The packing form figure: See Fig.3.

- 17-2) Carton handling & storage:
 a)Piling number of cartons : MAX 9
 b)Conditions for storage
 Environment
 ①Temperature : 0~40°C
 ②Humidity : 60%RH or less (at 40°C)
 Avoid dew condensation at low temperature and high humidity.
 ③Atmosphere :Avoid harmful gases & liquids, such as acid or alkali which corrode
 - electronic components and/or wires, must not be detected.
 - ④ Period : about 3 months
 - (5) Opening of the package : In order to prevent the LCD module from breakdown by electrostatic charges, please control the room humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth strape etc.

$18. \ Others$

18-1)Indication of lot number

The lot number is shown on a label. Attached location is shown in Fig.1(Outline Dimensions). Indicated contents of the label

1	
	LQ050T5DG70
	10000001 *
	MADE IN CHINA

contents of lot No.

the 1st ~2nd figure	production year (ex. 2010 : 10)
the 3rd figure	production month 1,2,3,,9,X,Y,Z
the 4th \sim 9th figure	serial No. $000001 \sim$
the 10th figure	revision marks A,B,C

Note: Implementation of the above QR Code label is subject to commercial agreement between Continental & Sharp

18-2)About RoHS

This TFT-LCD module corresponds to the RoHS..

18-3)The country of origin of the TFT-LCD module. China

18-4)Describe the country of origin clearly on the carton. MADE IN CHINA

19. Reliability Test Conditions for TFT-LCD Module (TBD)

No.	Test item	Conditions
1	Low temperature storage test	Ta = -40°C, (24)hrs
2	High temperature storage	Ta = +90°C, (48)hrs
3	Service Life Test	Tp = +85°C, (2080)hrs On(8.5s)-Off (25s)cycle 900hrs.
4	High Temp, High Humidity Test	Ta = +80°C, 85%RH (185)hrs, 30sec-on/540sec-off cycle
5	Shock Resistance	50g, 2 x 3axes
6	Vibration	10 to 1000Hz, (2x24hrs) x 3axes
7	Thermal Shock	Ta = +80°C~-35°C ; (200)cycle
8	Short Vibration Test	Frequency range: 5 to 1000Hz ; 15mins x 3axes
9	Damp Heat Cyclic Test	10cycles x 24hrs
10	High Temp Operation	Tp = +85°C, (200)hrs
11	High Temp Operation	Tp = -30°C, (200)hrs
11	High Temp Storage	Ta = +95°C, (200)hrs
13	Low Temp Storage	Ta = -40°C, (200)hrs

Ta = Ambient temperature, Tp = Panel surface temperature

Reliability test requirements under discussion between Sharp & Continental

