

PREPARED BY: <u>Sekido Satoshi</u> DATE: <u>Jan. 20. 2011</u>	<div style="text-align: center;">  </div> MOBILE LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION <b>SPECIFICATION</b>	SPEC No. LCY-10063A
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DEVICE SPECIFICATION FOR

**TFT - LCD module**

MODEL No. LQ042T5DZ11

CUSTOMER'S APPROVAL

DATE \_\_\_\_\_

BY \_\_\_\_\_

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## RECORDS OF REVISION

MODEL No : LQ042T5DZ11

[illegible]

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## 1. General

This TFT-LCD module is a color active matrix LCD (Liquid Crystal Display) module of transmissive type incorporating amorphous silicon TFT (Thin Film Transistor). General specification of the module is shown in the Table 3-1.

It is composed of a color TFT-LCD panel, driver ICs, control-PWB, FPC(between color TFT-LCD panel and control-PWB), frame, shielding front case, shielding back case and backlight unit.

## 2. Features

- Utilizes a panel with a 16:9 aspect ratio, which makes the module suitable for use in wide-screen systems.
- The 4.2 screen produces a high resolution image that is composed of 130,560 pixels elements in a stripe arrangement.
- Graphics and texts can be displayed on a 480 x 272 x RGB dots panel with 262,144 colors by supplying 18 bits (6 bits×RGB) data signal.
- Wide viewing field angle technology is employed.
- By adopting an active matrix drive, a picture with high contrast is realized.
- By COG method, realized a slim, lightweight, and compact module.
- Reduced reflection as a result of low reflection black matrix and an antiglare (AG) and anti-reflection (AR) polarizer being adopted. The reflectance on the surface of polarizer is 1.5% typical.
- Realized a high quality picture of the natural color appearance by adopting Normally Black Mode which is superior to the color appearance.
- An inverted video display in the vertical and horizontal directions is possible.
- The backlight is excellent of brightness rising characteristics at low temperature in consideration of automotive application.
- Column inversion driving scheme is used for triple gate scan.

## 3. Mechanical specifications (Dot Composition)

General Specification of the Module Table 3-1

Parameter	Specifications	Units	Remarks
Display format	130,560	pixels	
	480(W)×272(H)×RGB	dots	
Active area	92.88 (W) × 52.632 (H)	mm	
Screen size (Diagonal)	10.68[4.20"]	cm	
Dot pitch	0.1935 (W) × 0.0645 (H)	mm	
Pixel configuration	R,G,B Stripe configuration		
Outline dimension	102.5 (W)×69.0 (H)×12.0 (D)	mm	[Note 3-1]
Mass	120 (Typ.)	g	

[Note 3-1]

Excluding protrusions. Typical values are given.

For detailed measurements and tolerances, please refer to Fig. 1.



**4. Input terminal and its function**

4-1 TFT-LCD panel driving part

Connector used : FH41-50S-0.5SH(05)  
(HRS)

Table 4-1

Pin No.	Symbol	Description	Remarks
1	TEST	Continuity to Pin 50	
2	GND	GND	
3	N.C.	OPEN	
4	B+	Power Supply Voltage for Backlight	
5	B+	Power Supply Voltage for Backlight	
6	N.C.	OPEN	
7	GND	GND	
8	GND	GND	
9	BL_PWM	Input Signal for Backlight Dimming	
10	N.C.	OPEN	
11	THM1	Thermistor	[Note4-5]
12	THM2	Thermistor	[Note4-5]
13	VRV	Turning the Direction of Vertical Scanning	[Note4-4]
14	HRV	Turning the Direction of Horizontal Scanning	[Note4-3]
15	GND	Logic GND	
16	N.C.	OPEN	
17	VCC	Power Supply Voltage	
18	VCC	Power Supply Voltage	
19	N.C.	OPEN	
20	GND	GND	
21	R5	Red Data Signal(MSB)	
22	R4	Red Data Signal	
23	R3	Red Data Signal	
24	R2	Red Data Signal	
25	R1	Red Data Signal	
26	R0	Red Data Signal(LSB)	
27	GND	GND	
28	G5	Green Data Signal(MSB)	
29	G4	Green Data Signal	
30	G3	Green Data Signal	
31	G2	Green Data Signal	
32	G1	Green Data Signal	
33	G0	Green Data Signal(LSB)	
34	GND	GND	
35	B5	Blue Data Signal(MSB)	
36	B4	Blue Data Signal	
37	B3	Blue Data Signal	
38	B2	Blue Data Signal	
39	B1	Blue Data Signal	
40	B0	Blue Data Signal(LSB)	
41	GND	GND	
42	PON	Reset Signal	
43	GND	GND	
44	NCLK	Clock Signal for Sampling Each Data Signal	
45	GND	GND	

Pin No.	Symbol	Description	Remarks
46	VD	Vertical Sync	[Note4-1]
47	DEN	Horizontal Data Enable	[Note4-2]
48	HD	Horizontal Sync	[Note4-1]
49	GND	GND	
50	TEST	Continuity to Pin 1	

[Note4-1]

Hsync	Negative polarity
Vsync	Negative polarity

[Note4-2] The horizontal display starting position is settled in accordance with a rising timing of DEN signal. (Refer to Fig.2)

In case DEN is fixed to "Low", the horizontal display starting position is determined as described in Fig.2.(Don't keep DataEn "High" during operation.)

[Note4-3]

HRV="Hi" : Regular video  
 HRV="Lo" : Horizontally inverted video

[Note4-4]

VRV="Hi" : Regular video  
 VRV="Lo" : Vertically inverted video

[Note4-5]

Thermistor parts number : (NSM2103F344F3 (OHIZUMI))

## 5. Absolute maximum ratings

Table 5-1

GND=0V

Parameter	Symbol	MIN	MAX	Unit	Note
Input voltage	VB+	-0.3	23		21V~23V MAX 1s
+3.3V power supply	Vcc	-0.3	+4.0	V	
Input signal voltage 1	Vi1	-0.3	Vcc+0.3	V	[Note 5-1]
Input signal voltage 2	Vi2	-0.3	"VB+" +0.3	V	[Note 5-2]
Storage temperature	T stg	-40	95	°C	[Note 5-3.4]
Operating temperature (panel surface)	T opr1	-30	85	°C	[Note 5-3,4,5,6]
Operating temperature (Ambient temperature)	T opr2	-40	85	°C	[Note 5-6]

[Note 5-1] HD , DEN , VD , NCLK , B0~B5 , G0~G5 , R0~R5 , HRV , VRV , PON

[Note 5-2] BL\_PWM

[Note 5-3] This rating applies to all parts of the module and should not be exceeded.

The specified temperature provides the maximum value within 5mm around the module.

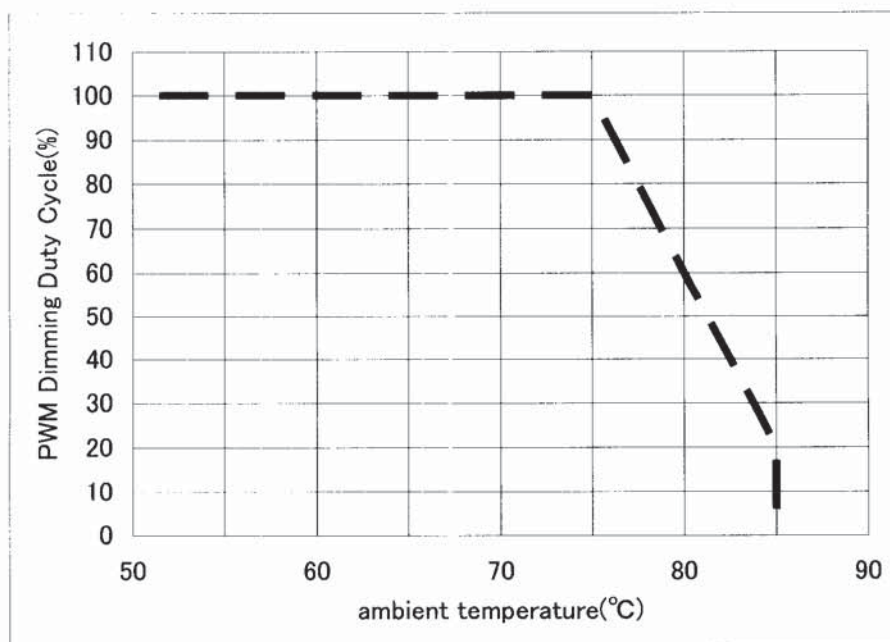
[Note 5-4] Maximum wet-bulb temperature is to be less than 58°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

[Note 5-5] The operating temperature only guarantees operation of the circuit. Specifications (contrast ratio, response time and other factors related to display quality) are determining at ambient temperature (Ta=25°C) .

[Note 5-6] Ambient temperature when the backlight is lit. (by PWM).

PWM dimming shall operate at  $T_a \geq 75^\circ\text{C}$ . (See attach figure)(Do not allow thermistor value to fall below 1.3k $\Omega$ )

Countermeasures for heat generation from LCD module are required at customer's system.

The display reduce performance level between  $-40^\circ\text{C} \leq T_a \leq -30^\circ\text{C}$  and  $+75^\circ\text{C} \leq T_a \leq +85^\circ\text{C}$ .

[Note 5-7] The above graph is reference data as LCD module alone



## 6. Electrical characteristics

### 6-1 TFT-LCD panel driving section

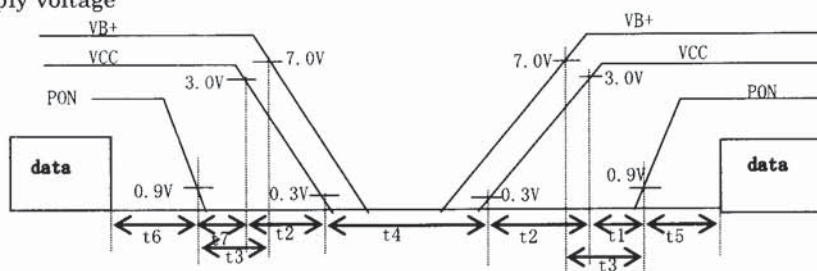
Table 6-1

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
VB+	Supply voltage	VB+	7.0	13.5	18.0	V	[Note 6-1]
	Current dissipation	IB+	—	150	400	mA	MAX:VB+=7.0V
Input Low voltage		V <sub>IBL</sub>	GND	—	0.4	V	“BL_PWM” terminal
Input High voltage		V <sub>IBH</sub>	2.1	—	5.5	V	
VCC	Supply voltage	V <sub>CC</sub>	+3.0	+3.3	+3.6	V	[Note 6-1]
	Current dissipation	I <sub>CC</sub>	—	10	60	mA	[Note 6-2]
Permissive input ripple		V <sub>RF</sub>	—	—	100	mV <sub>pp</sub>	
Input Low voltage		V <sub>IL</sub>	GND	—	0.3V <sub>CC</sub>	V	[Note 6-3]
Input High voltage		V <sub>IH</sub>	0.7V <sub>CC</sub>	—	V <sub>CC</sub>	V	
Input current 1 (Low)		I <sub>IL1</sub>	—	—	-2.0	μA	V <sub>IN</sub> =0V [Note 6-4]
Input current 1 (High)		I <sub>IH1</sub>	—	—	2.0	μA	
Input current 2 (Low)		I <sub>IL2</sub>	—	—	-400	μA	V <sub>IN</sub> =0V [Note 6-5]
Input current 2 (High)		I <sub>IH2</sub>	—	—	2.0	μA	
Input current 3 (Low)		I <sub>IL3</sub>	—	—	-3.0	μA	V <sub>IN</sub> =0V PON terminal
Input current 3 (High)		I <sub>IH3</sub>	—	—	3.0	μA	
Input current 4 (Low)		I <sub>IL5</sub>	—	—	1.0	μA	V <sub>IB</sub> =0V or 5.5V “BL_PWM” terminal
Input current 4 (High)		I <sub>IH5</sub>	—	—	600	μA	

[Note 6-1]

On-off conditions for supply voltage

- $0 < t_1$   
 $0 < t_2 \leq 10\text{ms}$   
 $0 < t_3$   
 $t_4 \geq 1\text{s}$   
 $0 < t_5 \leq 10\text{ms}$   
 $t_6 \leq 10\text{ms}$   
 $0 \leq t_7$



\*When PON signal turns off, display pattern may be un-controlled for an instance.

\*data = HD, DEN, VD, NCLK, B0~B5, G0~G5, R0~R5, HRV, VRV, BL\_PWM

[Note 6-2]

Typical current situation: White (GS63) pattern

Timing: Typical

VCC= +3.3 V

[Note 6-3]

HD, DEN, VD, NCLK, B0~B5, G0~G5, R0~R5, HRV, VRV, PON

[Note 6-4]

NCLK, B0~B5, G0~G5, R0~R5, HD, VD, DEN

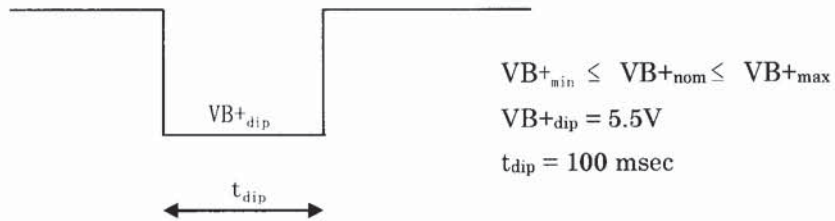
[Note 6-5]

HRV, VRV



[Note 6-6]

VB+Dip



\* VB+ can accept +5.5V for 100msec. Backlight will not Blinking.

\*\* IB+(max) is 0.51A when +5.5V is applied to VB+.

[Note 6-7]

VB+ voltage jumped value dV/dt

$$dVB^+/dt < 0.64 \text{ V/us}$$

## 7. Timing Characteristics of input signals

### 7-1) Timing characteristics

Table 7-1

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
Clock [NCLK]	Frequency	fCLK	8.58	9.70	10.99	MHz	
	Hi_Time	tWCH	20	—	—	ns	
	Lo_Time	tWCL	20	—	—	ns	
Data [I* 0-5]	Setup time	tDS	10	—	—	ns	
	Hold time	tDH	10	—	—	ns	
Horizontal sync.signal [HD]	Cycle	tH(t)	54.5	64.1	65.5	μs	
		tH(clk)	598	622	646	ck	
	Pulse width	tHPW	5	—	TH-5	ck	
Vertical sync.	Cycle	tV	305	312	344	line	
Signal [VD]	Pulse width	tVPW	2	—	TV-2	line	
Frame rate		fV	50	50	60	Hz	
Horizontal display period		tHA	480			ck	Only 480 ck
HD_NCLK phase difference		tHC	A-8	A	A+8	ns	A=1 / 2fCLK
HD_VD phase difference		tVH	-10	—	+10	ck	
Vertical front porch		tVFP	2	—	—	line	
Vertical back porch		tVBP	31			line	Only 31 line
Vertical display period		tVA	272			line	Only 272 line
Enable signal [HENAB]	Setup time	tES	10	—	—	ns	[Note 7-1]
	Hold time	tEH	10	—	—	ns	
	Pulse width	tEP	480			ck	[Note 7-1] Only 480 line
Horizontal front porch		tHFP	2	—	—	ck	
Horizontal back porch		tHBP	116			ck	[Note 7-2] Only 116 ck
			20	—	164	ck	[Note 7-3]
PWM Dimming Frequency		fpwm	150	—	250	Hz	BL_PWM [Note 7-4]
PWM Dimming Duty Cycle			1.0	—	100	%	

[Note 7-1] Enable signal must be input into Vertical invalid data period as well as Vertical display period.

[Note 7-2] This spec is applied for DEN Low fix mode.

[Note 7-3] This spec is applied for DEN active mode.

[Note 7-4] PWM Dimming Minimum OFF Pulse-Wide is 400ns. (at LCD module connector)

[Note 7-5] This LCD module used SC441A as the LED driver.





## 8. Input Signals, Basic Display Color and Gray Scale of Each Color

Table 8-1

Colors & Gray scale		Data signal																		
		0 :Low level voltage										1 :High level voltage								
		Gray Scale	R0	R1	R2	R3	R4	R5	G0	G1	G2	G3	G4	G5	B0	B1	B2	B3	B4	B5
Basic color	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
	Green	—	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	—	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	—	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	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
Gray Scale of red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Brighter	GS61	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
		GS62	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
		GS63	1	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
Gray Scale of green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
		GS2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Brighter	GS61	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0
		GS62	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
		GS63	0	0	0	0	0	0	1	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
Gray Scale of bleu	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
		GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	Brighter	GS61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
		GS62	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
		GS63	0	0	0	0	0	0	0	0	0	0	0	0	1	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 by 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.

## 9. Optical characteristics

Table 9-1

Ta=25℃ , Vcc=+3.3V , VB+=13.5V , BL\_PWM=100% ,Initial Value

Parameter	Symbol	Condition	Min	Typ.	Max	Unit	Remarks
Viewing Angle Range	$\theta$ 21, $\theta$ 22	CR=>10	70	85	—	° (degree)	[Note9-1,4]
	$\theta$ 11, $\theta$ 12		70	85	—	° (degree)	
Contrast ratio	C R max	$\theta = 0^\circ$	1100	2000	—		[Note9-2]
Response time	Rise		—	15	35	ms	[Note9-3]
	Fall		—	5	15	ms	
Color Chromaticity	x (white)		0.255	0.290	0.330		[Note9-6]  NTSC ratio is TYP (64%).
	y (white)		0.280	0.320	0.360		
	x (red)		0.592	0.622	0.652		
	y (red)		0.318	0.348	0.378		
	x (green)		0.290	0.320	0.350		
	y (green)		0.585	0.615	0.645		
	x (blue)		0.120	0.150	0.180		
	y (blue)		0.060	0.090	0.120		
Luminance	Y		375	500	—	cd/m <sup>2</sup>	
Off-Axis Half Brightness	$\theta$ 21, $\theta$ 22		35	45	—	° (degree)	[Note9-1]
	$\theta$ 11, $\theta$ 12		20	30	—	° (degree)	
uniformity	u		—	85	—	%	[Note9-5]
LED lifetime	+25℃	—	continuation	10,000	—	hour	[Note9-4]

※Measured after 30 minutes operation. The optical characteristic is measured by using the method of fig.5 and fig.6 under the condition of the darkroom or equivalent to it.

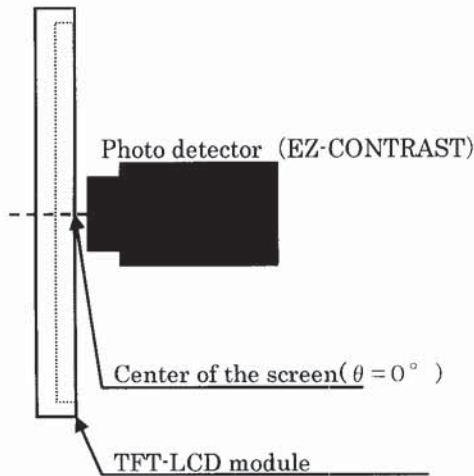


Fig. 5 The way of measuring  
Off-Axis Half Brightness/  
Viewing angle range/  
Response time

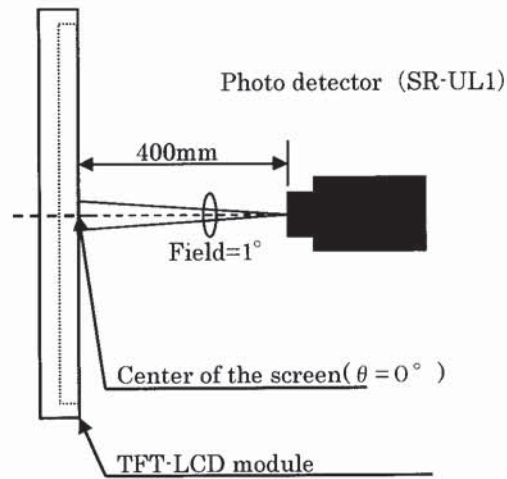
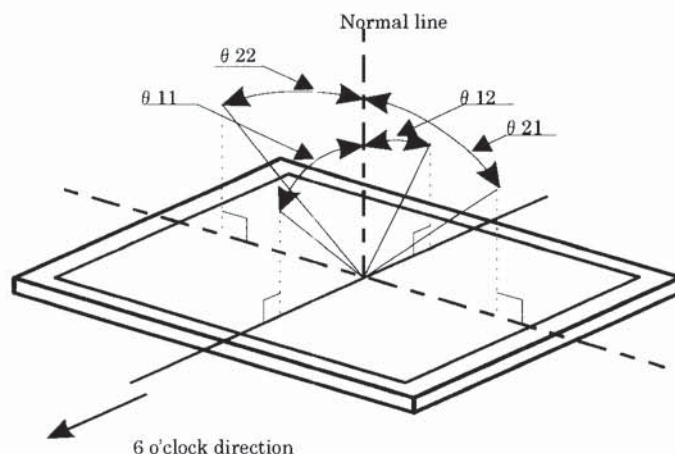


Fig. 6 The way of measuring  
Contrast/ Luminance/ Chromaticity

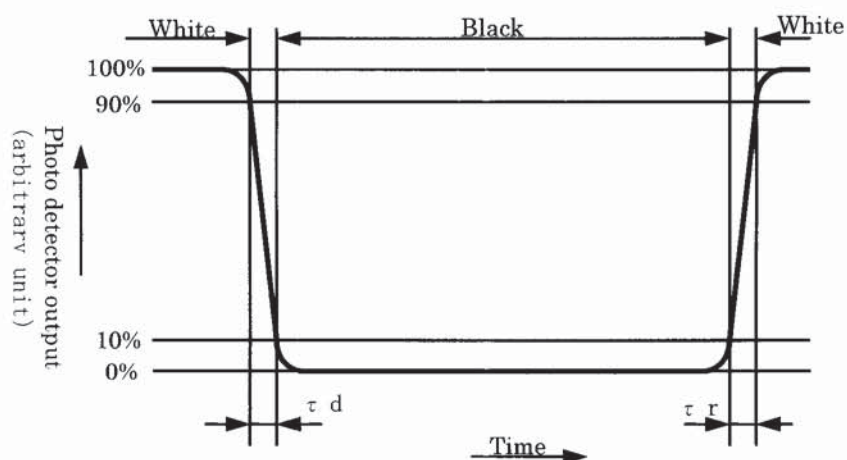
[Note 9-1] Viewing Angle Range and Off-Axis Half Brightness are defined as follows.



[Note 9-2] Contrast ratio of transmission is defined as follows:

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output with LCD being "white"}}{\text{Photo detector output with LCD being "black"}}$$

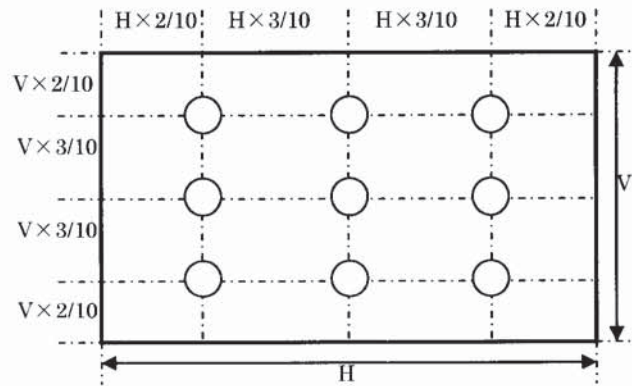
[Note 9-3] Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".



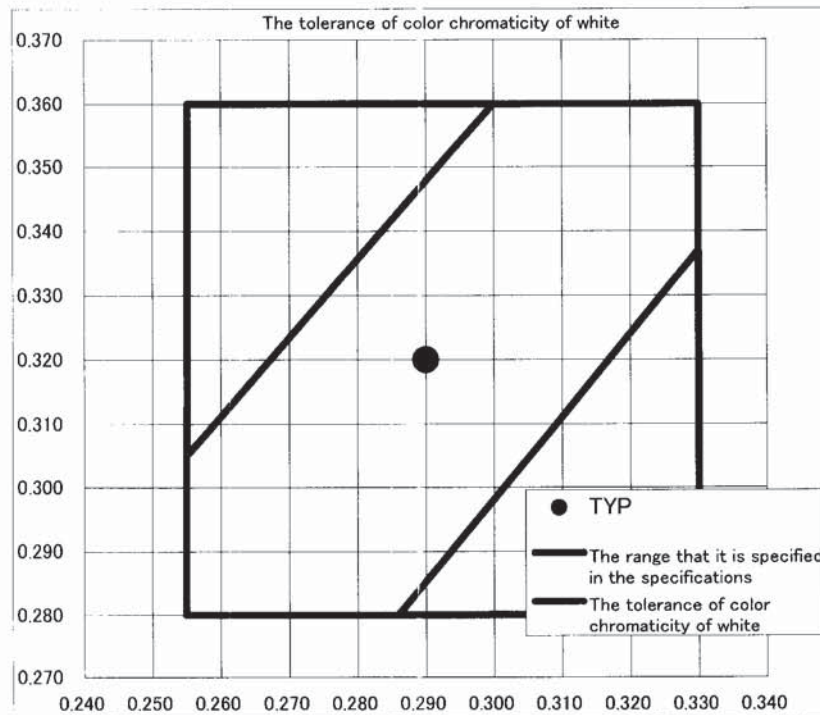
[Note 9-4] LED life time is defined as the time when the brightness of the panel is not become less than 50% of the original value in the continuous operation under the condition of PWM dimming 100%~1% ( $T_a=25^\circ\text{C}$ ).



[Note 9-5]  $u=Y_{\min}/Y_{\max}$ : (9 points luminance)



[Note 9-6] The tolerance of color chromaticity of white is shown as follows



**10. Display quality**

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

IIS No. LDIE-042TFO02 *MW. 2 7/15/2011*

**11. Mechanical characteristics****11-1 External appearance**

No extreme defect exists. (See Fig. 1)

**11-2 Panel toughness**

The panel shall not be broken when 19N is pressed on the center of the panel by a smooth sphere having 15 mm diameter.

Caution: In spite of very soft toughness, if, in the long-term, add pressure on the active area, it is possible to occur the functional damage.

**12. Handling instructions****12-1 Mounting of module**

The TFT-LCD module is designed to be mounted on equipment using the mounting tabs in the four corners of the module at the rear side.

On mounting the module, as the 2.5 tapping screw (fastening torque is TYP 0.4N·m) is recommended, be sure to fix the module on the same plane, taking care not to wrap or twist the module.

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

Power off the module, when you connect the input/output connector.

Please ensure that the LCD metal case is grounded in the system design.

**12-2 Precautions in mounting**

①Polarizer which is made of soft material and susceptible to flaw must be handled carefully.

Protection sheet is applied on the surface to protect it against scratches and dirties.

It is recommended to remove the protection sheet immediately before the use, taking care of static electricity.

The protection seat removed from the module doesn't assure quality.

②Precautions in removing the protection sheet

**A) Working environment**

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

To avoid this, the following working environment is desirable.

a) Floor: Conductive treatment of 1MΩ or more on the tile

(conductive mat or conductive paint on the tile)

b) Clean room free from dust and with an adhesive mat on the doorway

c) Advisable humidity: 50%~70%      Advisable temperature: 15°C~27°C

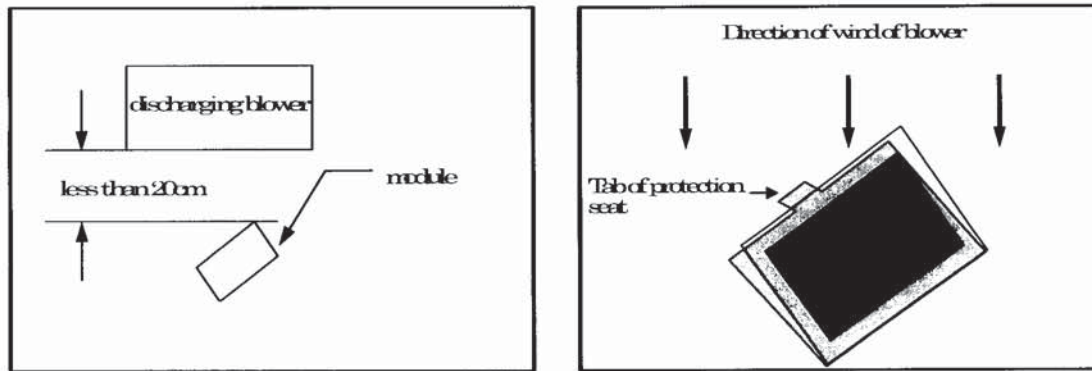
d) Workers shall wear conductive shoes, conductive work clothes, conductive gloves and an earth band.

**B) Working procedures**

a) Direct the wind of discharging blower somewhat downward to ensure that module is blown sufficiently. Keep the distance between module and discharging blower within 20 cm.

b) Remove the protection sheet, pulling the tab of protection seat slowly to your side.

c) On removing the protection sheet, 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.  
But when the panel has stain or grease, to use adhesive tape is recommended to remove them softly from the panel.

When metal part of the TFT-LCD module (shielding lid and rear 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. 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.

### 12-3 Caution of product design

The LCD module shall be protected against water or salt-water by the waterproof cover.  
Take measures against the interferential radiation from module, not to interfere surrounding appliances.

### 12-4 Others

1. Liquid crystal is sensitive to ultraviolet rays.  
Do not expose the module to direct sunlight for a long time.
2. Storage of the module under temperatures lower than the specified range may solidify liquid crystal in the module, resulting in damage to the panel. Storage of the module under temperatures exceeding the specified range may cause an irreversible change of liquid crystal to the isotropic phase.
3. When the LCD is broken, take care not to mouth liquid crystal. When liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.
4. Remove any water droplets or dirt on the polarizer without delay.  
Failure to do so may cause degradation.
5. Observe all other precautionary requirements in handling general electronic components.
6. When it keeps pushing a part of the touch panel for a long time, it causes the generation of Newton rings.
7. The LCD has been calibrated prior to shipment, do not change any of the adjustable values within the LCD module.



**13. Packing form**

13-1) The packing form figure: See Fig.4

13-2)

a) Piling number of cartons : MAX 9

b) Conditions for storage

Environment

① Temperature : 0~40°C

② Humidity : 60%RH or less (at 40°C)

No dew condensation at low temperature and high humidity.

③ Atmosphere : Harmful gas, such as acid or alkali which bites electronic components and/or wires, must not be detected.

④ Period : about 3 months

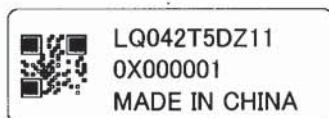
⑤ Opening of the package : In order to prevent the LCD module from breakdown by electrostatic charges, please control the room humidity over 50%RH and open the package taking sufficient countermeasures against electrostatic charges, such as earth, etc.

**14. Others**

14-1) Indication of lot number

① Attached location of the label : See Fig.1 (Outline Dimensions).

② Indicated contents of the label



← model number

← lot number

contents of lot No.

the 1st figure ··· production year (ex. 2009: 9)

the 2nd figure ··· production month 1,2,3,·····,9,X,Y,Z

the 3rd~8th figure ··· serial No. 000001~

the 9th figure ··· revision marks A,B,C··

14-2) Pb-free Environmental burden status

This TFT-LCD module is chromium hexavalent-free and Pb-free.

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