DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LQ060B3DW02

These parts have corresponded with the RoHS directive.

☐ CUSTOMER'S APPROVAL
BY _____

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RECORDS OF REVISION

LQ060B3DW02

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LD-27402A	2015/4/6	A		-	

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1．Application

This spec sheet applies to the color TFT-LCD module LQ060B3DW02.

2．Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT （Thin Film Transistor).
Graphics and texts can be displayed on a 768×128×RGB dots panel with 262144 colors
by supplying 18bit data signal (6bit×RGB), four timing signals ,DC supply voltages
for TFT-LCD panel driving and supply voltage for backlight.

LED drive circuit for backlight is not built in this module.

3．Mechanical Specifications

Parameter	technical literatures	Unit	Remarks
Display size	15 5.98inch Diagonal	cm	
Active area	149.76 H)×24.96 V)	mm	
Pixel format	768 H)×128 V) (1pixel＝R＋G＋B dot)	pixel	
Pixel pitch	0.195 H)×0.195 V)	mm	
Pixel configuration	R,G,B horizontal stripe		
Display mode	Normally black		
Unit outline dimensions	173.8 W)×42.1 H)×7.6(D)	mm	【Note3-1】
Mass	76	g	
Surface treatment	Anti-glare and hard-coating 3H		

【Note3-1】Protrusions such as Guide pins ,FPC components and FPC I/F part are not included.

Outline dimensions are shown in Fig.1.

4．Input Terminals

4-1．TFT-LCD panel driving

CN1　Corresponding connectors　　FH28D-40S-0.5H　(HIROSE)　　Note4-1

Pin	Symbol	Function	Polarity	Remark
1	STYPE	-		Note4-2
2	WPB	-		Note4-2
3	SDI	-		Note4-2
4	SDO	-		Note4-2
5	SDI_S	-		Note4-2
6	SCK	-		Note4-2
7	CSB	-		Note4-2
8	SPIVCC	-		Note4-2
9	DEN	Display Enable		Note4-3
10	GND	GND		
11	DOTCLK	Dot-clock signal		
12	GND	GND		
13	Hsync	Horizontal synchronous signal	Negative	
14	Vsync	Vertical synchronous signal	Negative	
15	GND	GND		
16	R0	RED data signal (LSB)		
17	R1	RED data signal		
18	R2	RED data signal		
19	R3	RED data signal		
20	R4	RED data signal		
21	R5	RED data signal (MSB)		
22	GND	GND		
23	G0	GREEN data signal (LSB)		
24	G1	GREEN data signal		
25	G2	GREEN data signal		
26	G3	GREEN data signal		
27	G4	GREEN data signal		
28	G5	GREEN data signal (MSB)		
29	GND	GND		
30	B0	BLUE data signal (LSB)		
31	B1	BLUE data signal		
32	B2	BLUE data signal		
33	B3	BLUE data signal		
34	B4	BLUE data signal		
35	B5	BLUE data signal (MSB)		
36	GND	GND		
37	Vcc	+3.3V Power Supply		
38	Vcc	+3.3V Power Supply		
39	LED_C	LED Cathode		
40	LED_A	LED Anode		

Note4-1　Please do not use it besides corresponding connector.
Note4-2　Please do not use everything from 1pin to 8pin.
Note4-3　Please use it with GND when you do not input DEN signal.

5．**Absolute Maximum Ratings**

Parameter	Symbol	Condition	Ratings		Unit	Remarks
			Min.	Max.		
Supply voltage	Vcc	Ta=25℃	0	+4.0	V	
Input voltage	VI	Ta=25℃	-0.3	+3.6	V	Note5-1
LED forward voltage	ILED	Ta=25℃	-	80	mA	Note5-2
LED reverse voltage	VLED_R	Ta=25℃	-	14.4	V	
Storage temperature	Tstg	―	-30	+85		Note5-3
Operating temperature	Tope	―	-30	+85		Note5-4

Note5-1　　(DEN), DOTCLK Hsync, Vsync, R0　R5, G0　G5, B0　B5

Note5-2　　LED_A to LED_C

Note5-3　　Humidity　95%RH Max.(Ta　40　)　Note static electricity.

Maximum wet-bulb temperature at 39　or less. (Ta　40　)　No condensation.

There is a possibility of causing deterioration in the irregularity and others of the screen and the display

fineness though the liquid crystal module doesn't arrive at destruction when using it at　60　+85　.

Note5-4　　In the operating temperature item, the low temperature side is the ambient temperature regulations.

The high temperature side is the panel surface (Active Area) temperature regulations.
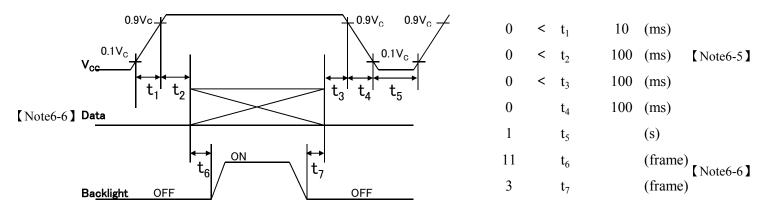
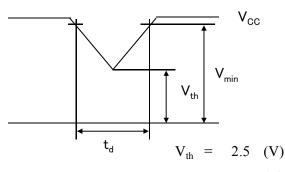# 6．Electrical Characteristics

6-1．TFT-LCD panel driving

$T_a = +25°C$

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Supply voltage	Vcc	-	+3.0	+3.3	+3.6	V	Note6-1 Note6-2
Current dissipation	Icc	Vcc=+3.3V	-	45.0	70.0	mA	Note6-3
Logic input voltage	V_{IL}		0		0.3Vcc	V	Note6-3
	V_{IH}		0.7Vcc		Vcc	V	
Logic input leak current	I_{OL}	VI=0V	-1		1	μA	Note6-3
	I_{OH}	VI=+3.3V	-1		1	μA	

Note6-1   On-off conditions for supply voltage.

0	t_1	10 (ms)
0	t_2	100 (ms)
0	t_3	100 (ms)
0	t_4	100 (ms)
1	t_5	(s)
11	t_6	(frame)
3	t_7	(frame)

Note6-5 applies to t_1–t_5. Note6-6 applies to t_6, t_7.

Note6-6   Data / Backlight timing diagram.

Note6-2   Vcc-dip conditions

· At Vth < V_{CC} ≦ Vmin

t_d ≦ 10 (ms)

LCD becomes to a normal display, after Vcc returns to Vmin in the above-mentioned.

· At V_{CC} < V_{th}

Vcc-dip conditions should also follow the On-off conditions for supply voltage

$V_{th} = 2.5$ (V)
$V_{min} = 3.0$ (V)

Note6-3   Typical cuurent situation : 16-gray-bar pattern

Vcc=+3.3V   fck = MHz   Ta=25

GS0 GS4 GS8   GS56 GS60

Note6-4   (DEN), DOTCLK Hsync, Vsync, R0 R5, G0 G5, B0 B5

Note6-5   Every signal is CMOS input, Hi-Z is prohibited when Vcc is on level
Input (DEN), DOTCLK, Hsync, Vsync, and R0 R5, G0 G5, B0 B5
after becomes regular amplitude and frequency.

Note6-6   It is recommended to consider some timing defference between CMOS input and Backlight input as shown above.
If the Backlight lights on before LCD starting, or if the Backlight is kept on after LCD stopping, the screen may look
an abnomal image may be displayed. This is caused by variation in output signal from timing generator at CMOS input

6-2．**Backlight Driving**

The backlight system is top-view type with white-LED.

The characteristics of LED are shown in the following table.

Ta＝+25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED Voltage	V_L	-	+12.8	+14.4	V	I_L=60mA
LED Current Range	I_L	-	60	80	mA	
Number of Circuit channel		-	1	-		Note6-7
LED Power Consumption	W_L	-	0.77	-	W	Note6-8
LED Life time	L_L	-	50,000	-	h	Note6-9

Note6-7   The LED backlight is composed of 1 string which 4 LEDs are connected with the series.
The below figure shows the circuit chart.

```
LED-A  o───────▶|──────▶|─────▶|─────▶|────┐
                                            │
LED-C  o────────────────────────────────────┘
```

Note6-8   Calculated value for reference   ($I_L \times V_L \times 1$ channel)

Note6-9   LED life time is defined as the time when Brightness becomes 50% of the original value.
Under the condition of Ta=25   and IL=60mA, and continuous lighting.
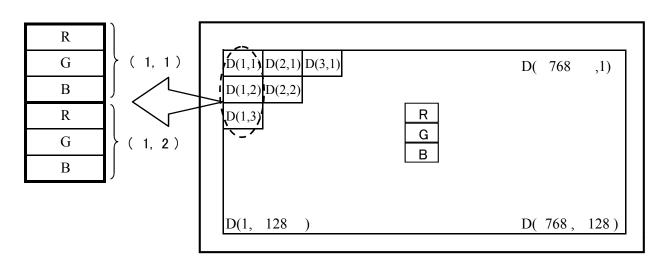
7. Timing characteristics of input signals

7-1. Timing characteristics

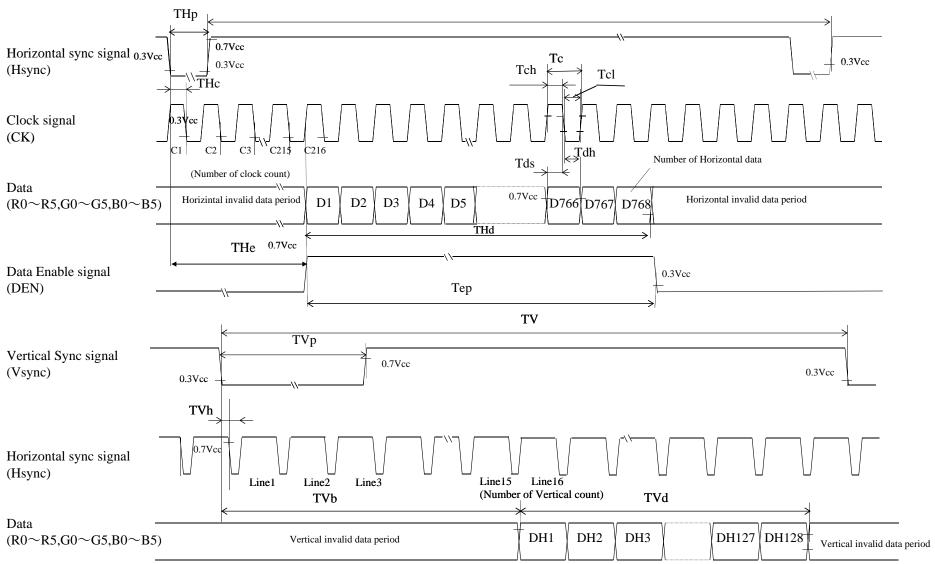| Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
DOTCLK	Frequency	1/Tc(=fck)	9.5	10	10.5	MHz	
	"High" time	Tch	16	-	-	ns	
	"Low" time	Tcl	16	-	-	ns	
Data	Setup time	Tds	8	-	-	ns	
	Hold time	Tdh	8	-	-	ns	
Hsync	Period	TH	-	105.6	-	μs	
			1002	1056	1108	clock	
	Pulse width	THp	5	-	-	clock	
	Back porch + THp	THb	-	215(fixed)	-	clock	
Vsync	Period	TV	153	158	163	line	Note7-1
	Pulse width	TVp	5	-	-	line	
	Back porch	TVb	-	15(fixed)	-	line	
DEN	Pulse width	Tep	768	768	768	clock	
Phase difference between Hsync and DEN		THe	100	-	215	clock	Note7-2
Phase difference between Hsync and DOTCLK		THc	5	-	-	ns	
Phase difference between Hsync and Vsync		TVh	0	-	50	clock	
Horizontal displayed period		THd	768	768	768	clock	
Vertical displayed period		TVd	128	128	128	line	

Note7-1 In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.

Note7-2 In HV mode, this LCD module takes the first data into 216th ck in the horizontal period.

However, in DEN mode, DEN becomes effective by priority.

7-2. Input Data Signals and Display Position on the screen

7-3. Input signal waveforms

THp

Horizontal sync signal 0.3Vcc
(Hsync)
0.7Vcc
0.3Vcc
THc
0.3Vcc

Tc
Tch
Tcl
0.3Vcc

Clock signal
(CK)
0.3Vcc

C1 C2 C3 C215 C216
(Number of clock count)

Tdh
Tds
Number of Horizontal data

Data
(R0～R5,G0～G5,B0～B5)
Horizintal invalid data period D1 D2 D3 D4 D5 0.7Vcc D766 D767 D768 Horizontal invalid data period

THd

THe 0.7Vcc

Data Enable signal
(DEN)
0.3Vcc
Tep

TV

Vertical Sync signal
(Vsync)
TVp
0.7Vcc
0.3Vcc
0.3Vcc

TVh

Horizontal sync signal
(Hsync)
0.7Vcc

Line1 Line2 Line3 Line15 Line16
(Number of Vertical count)
TVb TVd

Data
(R0～R5,G0～G5,B0～B5)
Vertical invalid data period DH1 DH2 DH3 DH127 DH128 Vertical invalid data period

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

8-1. 6 bit input

Colors & Gray scale		GrayScale	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
	↑	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	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
	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
	↑	GS1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Darker	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
	Green	GS63	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	Darker	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
	Blue	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.

9．Optical Characteristics

Ta=+25℃, Vcc=＋3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ3,θ9	CR＞10	70	80	-	Deg.	【Note9-1】【Note9-3】【Note9-6】
	Vertical	θ6,θ12		70	80	-	Deg.	
Contrast ratio		CR	optimized angle	500	700	-		【Note9-2】【Note9-4】【Note9-6】
Response Time		τr+τd		-	15	-	ms	【Note9-2】【Note9-5】【Note9-6】
Chromaticity of White		Wx	θ=0°	0.263	0.313	0.363		【Note9-2】【Note9-6】
		Wy		0.279	0.329	0.379		
Luminance of white		Y_{L1}		190	240	-	cd/m^2	【Note9-2】【Note9-6】I_L=60mA

※The measurement shall be executed 30 minutes after lighting at rating.(condition：I_L＝60mA)

 The optical characteristics shall be measured in a dark room or equivalent state with the method shown
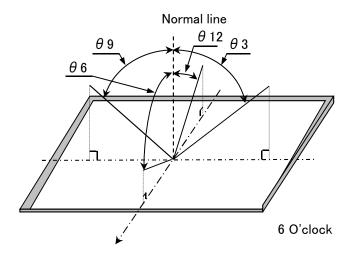
in Fig.2 below.

【Note9-1】Measuring method of Viewing angle

【Note9-2】Measuring method of contrast, luminance, response time, and Chromaticity.

Photodetector:(EZ-CONTRAST)

Panel center(θ=0°)

TFT-LCD module

Photodetector
：Response time(BM-5A)
：Contrast/Luminance/Chromaticity(SR-3)

400mm

Field=1°

Panel center(θ=0°)

TFT-LCD module

Fig.2 Optical characteristics measurement method
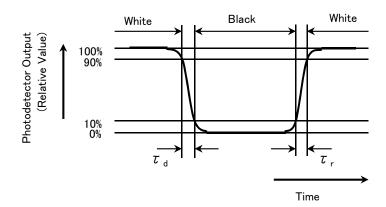
【Note9-3】Definitions of viewing angle range:

【Note9-4】Definition of contrast ratio:

The contrast ratio is defined as the following.　　Contrast（CR）＝ $\dfrac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$

【Note9-5】Definition of response time:

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

【Note9-6】This shall be measured at center of the screen.

10. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the FPC.

b) Please insert FPC in the connector carefully so that the tension should not hang.

c) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

d) Since the front polarizer is easily damaged, pay attention not to scratch it.
Blow away dust on the polarizer with antistatic N_2 blow. It is undesirable to wipe off because a polarizer is sensitive.
It is recommended to peel off softly using the adhesive tape when soil or finger oil is stuck to the polarizer.
When unavoidable, wipe off carefully with a cloth for wiping lenses.

e) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

f) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

g) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

h) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth
when handling.Observe all other precautionary requirements in handling components.

i) Since there is a circuit FPC in the module back, stress is not added at the time of a design assembly.
Please make it like. If stress is added, there is a possibility that circuit parts may be damaged.

j) LCD-FPC has electronic devices on its own. Please make sure electric insulation between that portion
(the devices and soldering) and the user's set.

k) The polarizer surface on the panel is treated with Anti-Glare for low reflection. In case of attaching protective
board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.

l) Do not expose the LCD panel to direct sunlight. Lightproof shade etc. should be attached when LCD panel is
used under such environment. The panel characteristic might be deteriorated and the display fineness decrease
when strong light is irradiated to the liquid crystal panel.

m) When handling LCD modules and assembling them into cabinets, that long-terms storage in the
environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent,
adhesive, resin, etc. which generate these gasses, causes corrosion and discoloration of the modules.
Therefore, please avoid these use.
Epoxy resin (amine series curing agent), silicone adhesive material (dealcoholization series and oxime series),
tray forming agent (azo compound) etc, in the cabinet or the packing materials may induce abnormal display with
polarizer film deterioration regardless of contact or noncontact to polarizer film.
Be sure to confirm the component of them.

n) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible
if it gets inside your eye or mouth by mistake.

o) Notice:Never dismantle the module , because it will cause failure. Moreover, please do not peel off the tapes other than
the creped paper tape (yellow tape) of a protection film pasted to the product.

p) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
(Please use a screen saver etc., in order to avoid an afterimage.)

q) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue,etc.
Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.

r) The LED used for this product is very sensitive to the temperature. Luminance decreases rapidly when it issued
for a long time under the environment of the high temperature. Please consult our company when it is used
under the environment like the above mentioned.

s) Don't give any stress to the joint part of FPC and LCD panel , please avoid the bend to panel side.

t) Because metal parts are used on this model, it has the potential of rust formation

11．Packing form

a) Piling number of cartons ： MAX．9

b) Package quantity in one carton： 64pcs

c) Carton size(TYP)： 584mm(W) × 349mm(D)×195mm(H)

d) Total mass of one carton filled with full modules(64pcs) ： 8kg

e) Packing form fig： fig.3

12．Reliability test items

No.	Test item	Conditions	Remark
1	High temperature storage test	Ambient temperature +85℃ 240H	【Note12-1】
2	Low temperature storage test	Ambient temperature -30℃ 240H	【Note12-1】
3	High temperature & high humidity operation test	Ambient temperature 40℃、Humidity 95% RH 240H （No condensation.）	【Note12-1】
4	High temperature operation test	Panel surface (Active Area) +85℃ 240H	【Note12-1】
5	Low temperature operation test	Ambient temperature -30℃ 240H	【Note12-1】

6	Vibration test	＜Sin wave＞
		  Frequency ：10～57Hz／Vibration width (one side) ：0.076mm
		             ：57～500Hz／Gravity ：9.8m/s2
		  Sweep time ：11minutes
		  Test period ：3H（X，Y，Z direction 1H）
			【Note12-1】

7	Shock test	Max. gravity ：490m/s2 Pulse width ：11ms Direction ：±X,±Y,±Z Test period ：1time／1direction	【Note12-1】

【Note12-1】 Under the display quality test conditions with normal operation state, these shall be no change

which may affect practical display function. (normal operation state：Temperature:15～35℃,
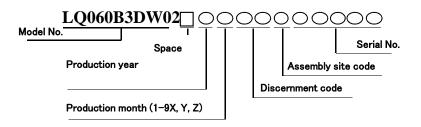
Humidity:45～75%, Atmospheric pressure:86～106kpa)
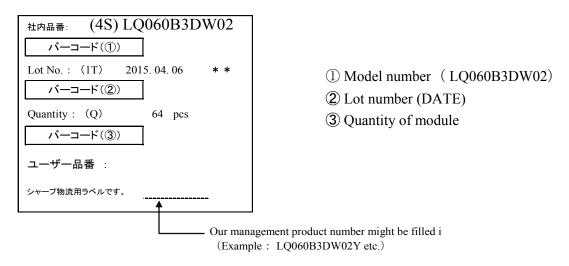
13. Others

13-1. Lot No Label:

A）Module serial label

The label that displays Model No. （LQ060B3DW02）・Lot No. is stuck on the back of the module.

Lot No display method（Figure and alphabet）

LQ060B3DW02□○○○○○○○○○○

Model No.

Space

Serial No.

Production year

Assembly site code

Discernment code

Production month (1-9X, Y, Z)

B）Packing box Label:

The label that displays ①Model number （LQ060B3DW02）②Lot number ③Quantity of module is stuck

on the packing box. Moreover, the display of bar code also applies to this.

社内品番:　(4S) LQ060B3DW02

バーコード(①)

Lot No. : (1T)　　2015. 04. 06　　＊＊

バーコード(②)

Quantity : (Q)　　　　64　pcs

バーコード(③)

ユーザー品番 :

シャープ物流用ラベルです。

① Model number （LQ060B3DW02）

② Lot number (DATE)

③ Quantity of module

Our management product number might be filled i

（Example : LQ060B3DW02Y etc.）

A right picture is written to the packing box of module for the RoHS restriction.

※R.C.（RoHS Compliance）means these parts have corresponded with the RoHS directive.

This module corresponds from the first sample to RoHS Directive.

R.C.

13-3. The ozone-depleting substances is not used.

13-4. If any problem occurs in relation to the description of this spec sheet, it shall be resolved

through discussion with spirit of cooperation.

14．Storage conditions

Environmental condition range of storage temperature and humidity

Temperature　　　　　0 to 40 degrees Celsius

【Note】Please refer below as a mean value of the environmental conditions.

Summer time temperature 20 to 35 degrees Celsius humidity , 85% and below

Winter time temperature 5 to 15 degrees Celsius humidity , 85% and below

Please maintain within 240 hours of accumulated length of storage time, with conditions of 40 degrees Celsius and room humidity of 95%.

Direct sunshine

Please keep it in the state of wrapping or the darkroom so that direct sunshine should not strike directly into the product.

Atmosphere

Please do not keep it in the place with the danger of the generation of the causticity gas and the volatile solvent.

Asking for be dewy prevention

・Please do not put directly on the floor, and keep the wrapping box on the palette or the stand to avoid the be dewy. Moreover, please arrange it in a constant direction correctly to improve ventilation under the palette.

・Please separate from the wall in the storage warehouse and keep it.

・Please note that ventilation is improved and consider the installation such as ventilators in the warehouse.

・Please manage so that there is no rapid temperature change more than natural environment.

Keeping period

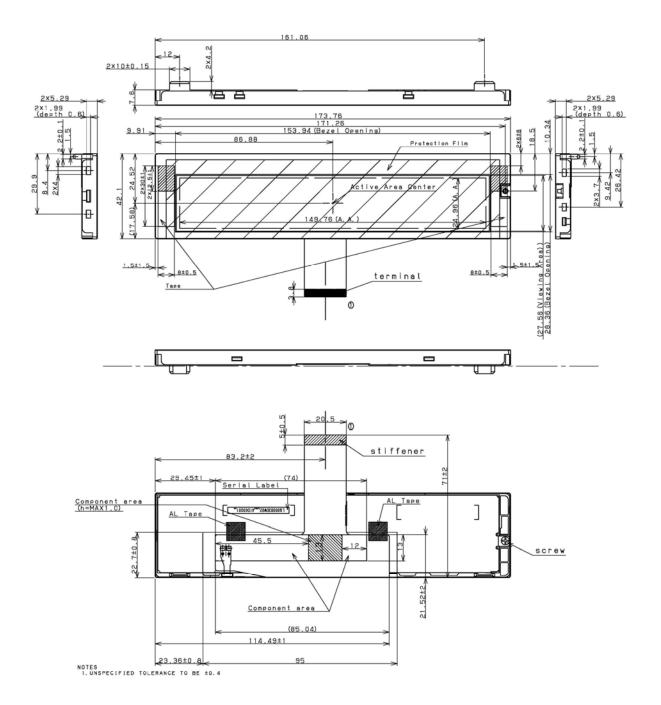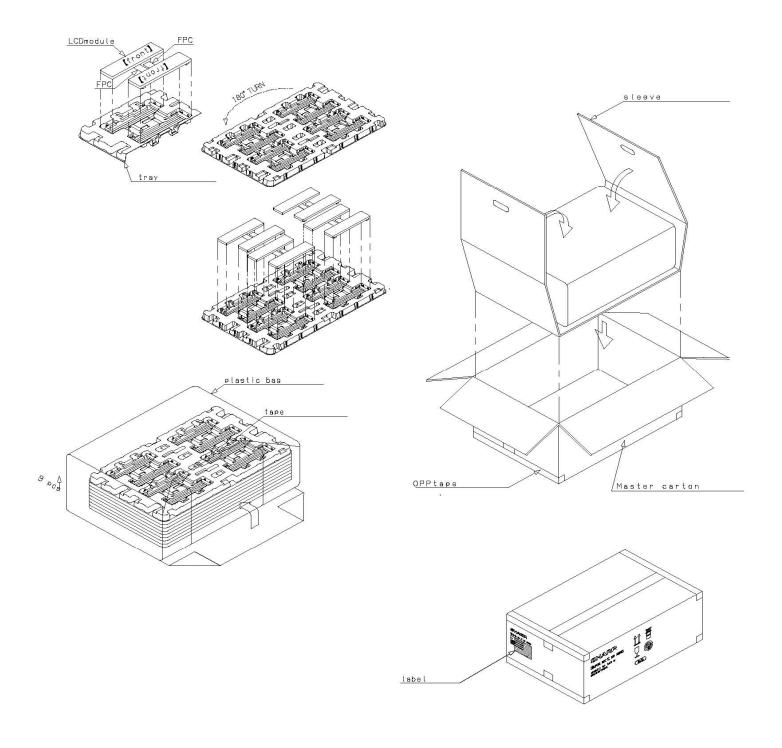Please make it to keeping within one year under the above-mentioned keeping condition.

Fig. 1 Outline Dimention

Fig3 : Packing form figure