SHARP

LQ070T3GR01

Color TFT LCD Module

(Model Number: LQ070T3GR01)

Specifications

Spec No.: LCY-00056A

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	LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION **SPECIFICATION**	APPLICABLE GROUP LIQUID CRYSTAL DISPLAY GROUP

DEVICE SPECIFICATION FOR

TFT - LCD module

MODEL No. LQ070T3GR01

CUSTOMER'S APPROVA

DATE

BY

PRESENTED

BY

S. YASUDA
Department General manager
Development Engineering Dept. 2
TFT Division. 1
TFT LIQUID CRYSTAL DISPLAY GROUP
SHARP CORPORATION

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2000.02.15		-	-	1st Issue
2000.11.01	A	7	IL＝4.5mArms → IL＝6.5mArms	Correction

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(1) Summary

This module utilizes amorphous silicon thin film transistors and a 16:9 aspect ratio. A 7.0 active matrix liquid crystal display allows full color to be displayed.
An outline of the module is given in Table 1.

(2) Features

・Utilizes a panel with a 16:9 aspect ratio, which makes the module suitable for use in wide-screen systems.
・The 7.0 screen produces a high resolution image that is composed of 112,320 pixel elements in a stripe arrangement.
・Wide viewing field angle technology is employed. (The most suitable viewing angle is in the 6 o'clock direction.)
・By adopting an active matrix drive, a picture with high contrast is realized.
・Reflection due to external light is minimized through the use of a low reflection, black matrix and an antiglare low reflection (AGLR) plate.
・A thin, light and compact module is accomplished through the use of COG mounting technology.
・By adopting a high aperture panel, high transmittance color filter and high transmission polarizing plates, transmittance ratio is realized.

(3) Structure and External Shape

External measurements for the module are given in Fig. 1, and the structure of the module is shown in Fig. 2.
The module is composed of the TFT-LCD panel, drivers, frame, backlight, sealed front case, and sealed back case.

(4)Mechanical specifications

table 1

Parameter	Specifications	Units	Remarks
Display format	336,960	pixels	
	1440(W)×234(H)	dots	
Active area	154.1（W）×87.0（H）	mm	
Screen size (Diagonal)	17.7 [7.0”]	cm	
Dot pitch	0.107（W）×0.372（H）	mm	
Pixel configuration	R,G,B Stripe configuration		
Outline dimension	166.0(W)×102.0(H)×7.6(D)	mm	【Note1-1】
Mass	205 (max)	g	

【Note1-1】 Typical values are given. For detailed measurements and tolerances, please refer to Fig. 1.

(5)Input / Output terminal　5-1)TFT-LCD panel driving part

table 2　　(Ｈｉ＝VSH、Ｌｏ＝ＧＮＤ)

Pin No.	Symbol	i/o	Description	Remarks
1	ＶＧＨ	i	Power supply for gate driver(High level).	
2	ＯＰＥＮ	－	Open	
3	ＯＰＥＮ	－	Open	
4	MODE２	i	Control signal for gate driver.	【Note 2-1】
5	MODE１	i	Control signal for gate driver.	【Note 2-1】
6	ＶＲＶ	i	Switching signal of scanning direction for gate driver.	【Note 2-2】
7	ＳＰＳ	i	Start signal for gate driver.	
8	ＣＬＳ	i	Clock signal for gate driver.	
9	ＶＣＣ	i	Power supply for logic circuit in gate driver.(High level)	
10	ＯＰＥＮ	－	Open	
11	ＯＰＥＮ	－	Open	
12	ＶＳＳ	i	Power supply for logic circuit in gate driver (Low level).	
13	ＯＰＥＮ	－	Open	
14	ＯＰＥＮ	－	Open	
15	ＶＧＬ	i	Power supply for gate driver (Low level)	
16	ＣＯＭ	i	Common electrode driving signal.	
17	ＧＮＤ	i	Ground	
18	ＣＬＤ	i	Clock signal for source driver.	
19	ＳＰＩＯ	i/o	Start signal for source driver.	
20	ＣＴＲ	i	Control signal for source driver.	【Note 2-3】
21	ＰＳ	i	Power save signal.	【Note 2-4】
22	ＨＲＶ	i	Switching signal of scanning direction for source driver.	【Note 2-2】
23	ＳＰＯＩ	o/i	Start signal for source driver.	
24	ＧＮＤ	i	Ground	
25	ＶＢ	i	Color video signal (Blue)	
26	ＶＧ	i	Color video signal (Green)	
27	ＶＲ	i	Color video signal (Red)	
28	ＧＮＤ	i	Ground	
29	ＶＳＨ	i	Power supply for source driver (High level)	
30	ＶＳＨ	i	Power supply for source driver (High level)	
31	ＶＳＨ	i	Power supply for source driver (High level)	
32	ＶＳＨ	i	Power supply for source driver (High level)	

【Note 2-1】　Refer to 7-7)

【Note 2-2】　Refer to 7-4)

【Note 2-3】　Refer to 7-5)

【Note 2.4】　Please usually use this terminal in high voltage.

5-2) Backlight fluorescent tube driving part

terminal	Ｎｏ.	Symbol	i/o	Function	Remarks
ＣＮ１	1	ＶＬ１	i	Input terminal （high voltage side)	
	2	ＶＬ２	i	Input terminal （low voltage side)	【Note3-1】

【Note3-1】　Connect the low voltage side of the DC/AC inverter used to drive the fluorescent tube to GND of the inverter circuit.

(6)Absolute maximum ratings

table 3　　ＧＮＤ＝０Ｖ

Parameter			Symbol	ＭＩＮ	ＭＡＸ	Unit	Note
Positive power supply voltage			ＶＳＨ	-0.3	+6.0	V	Ｔａ＝２５℃
Power supply for gate driver	TFT driving circuit	High level	ＶＧＨ	-0.3	+33.0	V	〃
		Low level	ＶＧＬ	VGH-33.0	VGH+0.3	V	〃
	Logic circuit	High level	ＶＣＣ	VSS-0.3	VSS+7.0	V	〃
		Low level	ＶＳＳ	VGH-33.0	VGH+0.3	V	〃
			VSS－VGL	+0.3	+35	V	〃
Analog input signals　[terminal 4-1]			ＶＩＡ	-0.3	VSH+0.3	V	〃
Digital input signals　[terminal 4-2]			ＶＩＤ	-0.3	VSH+0.3	V	〃
Common electrode driving signal			ＶＣＤＣ	-4	+6	V	〃
Storage temperature			Tstg.	-25	70	℃	【Note 4-1,2】
Operating temperature　(panel surface)			Topr1	0	70	℃	【Note 4-1,2,3】
Operating temperature （ Ambient temperature ）			Topr2	0	55	℃	【Note 4-4】

[terminal 4-1]ＶＲ，ＶＧ，ＶＢ

[terminal 4-2]ＣＬＤ，ＳＰＩＯ，ＳＰＯＩ，ＣＴＲ，ＨＲＶ，ＶＲＶ，ＭＯＤＥ２，ＭＯＤＥ１，ＳＰＳ，ＣＬＳ

【Note 4-1】　This rating applies to all parts of the module and should not be exceeded.

【Note 4-2】　Maximum wet-bulb temperature is 58℃.　Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

【Note 4-3】　The operating temperature only guarantees operation of the circuit. For contrast, speed response, and other factors related to display quality, determine operating temperature using the formula Ta=＋25℃

【Note 4-4】　Ambient temperature when the backlight is lit (reference value).

(7)Electrical characteristics

7-1)Recommended operating conditions

A)TFT-LCD panel driving section

table 4　　ＧＮＤ＝０Ｖ，Ｔａ＝２５℃

Parameter				Symbol	ＭＩＮ	ＴＹＰ	ＭＡＸ	Unit	Remarks
Power supply for source driver				VSH	+4.8	+5.0	+5.5	V	【Note5-1】
Power supply for gate driver	TFT driving circuit	High level		VGH	+12.5	+13.0	+13.5	V	
		Low level	AC	VGLAC	±0.5	±3.9	±5.0	Vp-p	
			DC	VGLDC	-9.5	-10.0	-10.5	V	
	Logic circuit	High level		VCC	VSS+VSH −0.1	VSS＋VSH	VSS+VSH +0.2	V	
		Low level		VSS	−18.0	−17.0	−16.0	V	
Analog input signal ［Terminal２－１］		AC component		VIAC	∓2.0	−	±2.0	V	【Note5-2】
		DC component		VIDC	VSM-0.1	VSM	VSM+0.1	V	【Note5-3】
Digital input signal ［Terminal２－２］		High level		VIDSH	VSH-1.0	−	VSH	V	
		Low level		VIDSL	0	−	1.0	V	
Digital input current ［Terminal２－２］		High level		IIDSH	−	−	60.0	μA	VIDSH=VSH
		Low level		IIDSL	−	−	60.0	μA	VIDSL=0V
							2.4	mA	Only HRV
Digital input voltage ［Terminal２－３］		High level		VIDGH	VSH-1.0	−	VSH	V	
		Low level		VIDGL	0	−	1.0	V	
Digital input current ［Terminal２－3］		High level		IIDGH	−	−	3.0	μA	VIDGH=VSH
		Low level		IIDGL	−	−	3.0	μA	VIDGL=0V
Common electrode driving signal		AC component		VCAC	±0.5	±3.9	±5.0	Vp-p	
		DC component		VCDC	+0.5	+2.0	+3.5	V	【Note 5-1,5-4】

Cautionary Matter: When applying or disconnecting power, please be sure that such action is simultaneously carried out for all power supplies. In addition, apply input signals only after power has been turned on.

ON … VSH→VSS→VCC→VGL→VGH　　OFF … VGH→VGL→VCC→VSS→VSH

[terminal 2-1]ＶＲ，ＶＧ，ＶＢ

[terminal 2-2]ＣＬＤ，ＳＰＩＯ，ＳＰＯＩ，ＣＴＲ，ＨＲＶ

[terminal 2-3]ＭＯＤＥ２，ＭＯＤＥ１，ＶＲＶ，ＳＰＳ，ＣＬＳ

【Note5-1】 Any change in voltage after adjusting VCDC should be less than 0.1 V.

【Note5-2】 Positive and negative amplitudes should be equal. When the AC input voltage is －／＋, FRPV and T are in phase. When the AC input voltage is ＋／－, FRPV and T are 180° out of phase. The MIN value produces a white display, and the MAX value produces a black display.

【Note5-3】 VSM=VSH/2.
Any change in voltage after adjusting VCDC should be less than 0.1 V.

【Note5-4】 To obtain the maximum value of contrast, each module must be adjusted to an optimum voltage.

B)Backlight driving section

table 5

Parameter	Symbol	ＭＩＮ	ＴＹＰ	ＭＡＸ	Unit	Remarks
lamp voltage	ＶＬ７	325	375	425	Vrms	ＩＬ＝6.5mArms
lamp current	ＩＬ	3.0	6.5	7.0	mArms	ordinary state
lamp frequency	ｆＬ	45	−	100	kHz	
kick-off voltage	ＶＳ	−	−	850	Vrms	Ta=+25℃
		−	−	1000	Vrms	Ta=0℃

(Inverter：ＨＩＵ－２８８　Harison Electric co. Ltd.)

7-2)Electrical characteristics

table 6　V_{SH}=5.0V,V_{GH}=13.0V,V_{CC}=-10.9V,V_{SS}=-16.0V,V_{GLDC}=-10.0V,V_{GLAC}=±3.9V,GND=0V,Ta=25℃

Parameter		Symbol	MIN	TYP	MAX	Unit	Remarks
SOURCE	Operating Clock frequency	f_{CLD}	-	-	5.0	MHz	CLD
	High level clock width	t_{WHC}	80.0	-	-	ns	
	Low level clock width	t_{WLC}	80.0	-	-	ns	
	Clock rise time	tr_D	-	-	20.0	ns	
	Clock fall time	tf_D	-	-	20.0	ns	
	Data set up time	t_{SUD}	30.0	-	-	ns	SPIO,SPOI
	Data hold time	t_{HD}	30.0	-	-	ns	
	High level pulse width	t_{WHD1}	0.4			μs	
	Pulse rise time	tr_P			20	ns	
	Pulse fall time	tf_P			20	ns	
GATE	Operating Clock frequency	f_{CLS}	-	-	16.5	kHz	CLS
	Minimum clock pulse with	t_{WHS}	0.5	-	-	μs	
	Clock rise time	tr_{CL}	-	-	100.0	ns	
	Clock fall time	tf_{CL}	-	-	100.0	ns	
	Data set up time	t_{SUS}	100.0	-	-	ns	CLS
	Data hold time	t_{HS}	300.0	-	-	ns	SPS
	Mode set up time	t_{SUM}	300.0	-	-	ns	CLS、MODE2
	Pulse rise time	tr_S	-	-	100	ns	SPS
	Pulse fall time	tf_S	-	-	100	ns	

7-3)Input signal timing chart

Refer FIG.4

7-4)Signal for reverse scanning

table 7

Mode	HRV	VRV
Normal mode	Hi	Lo
Right/Left reverse mode	Lo	Lo
Up/Down reverse mode	Hi	Hi
Right/Left & Up/Down reverse mode	Lo	Hi

caution)　Lo=GND　,　Hi=VSH

7-5)CRT terminal

This is control signal of switching sample holder circuit. Please set the high or low level synchronizing with SPD signal during the period each horizontal line.

※　High level = VSH, Low level = GND

7-6) Current dissipations

table8　　Ta＝25℃

Parameter		Symbol	Conditions	MIN	TYP	MAX	Unit
Current for source driver	Hi	I_{SH}	V_{SH}=+5.0V	-	45	60	mA
Current for gate driver	Hi	I_{GH}	V_{GH}=+13.0V	-	0.1	1.0	mA
	Lo	I_{GL}	V_{GLDC}=-10.0V	-	0.1	1.0	mA
	Logic	I_{CC}	V_{CC}=-10.9V	-	0.02	1.0	mA
		I_{SS}	V_{SS}=-16.0V	-	0.2	1.0	mA
Lamp power consumption		WL	Normal driving	-	2.4	-	W

Condition : CLS=15.73kHz, the SPS=60Hz, the SPD=15.73kHz and the CLD=3.99MHz
In case of using exclusive control-IC (LZ9GJ24) and inputting standard NTSC signal.

7-7)Signal for control of gate driver［ＭＯＤＥ１、ＭＯＤＥ２］

table 9

MODE 1	MODE 2	Outputting mode
Ｈｉ	Ｈｉ	Normal mode（1 line writing）
Ｌｏ	Ｈｉ	2 line same time writing mode
Ｈｉ	Ｌｏ	Out of use
Ｌｏ	Ｌｏ	No outputting

Note) Lo=GND , Hi=VSH

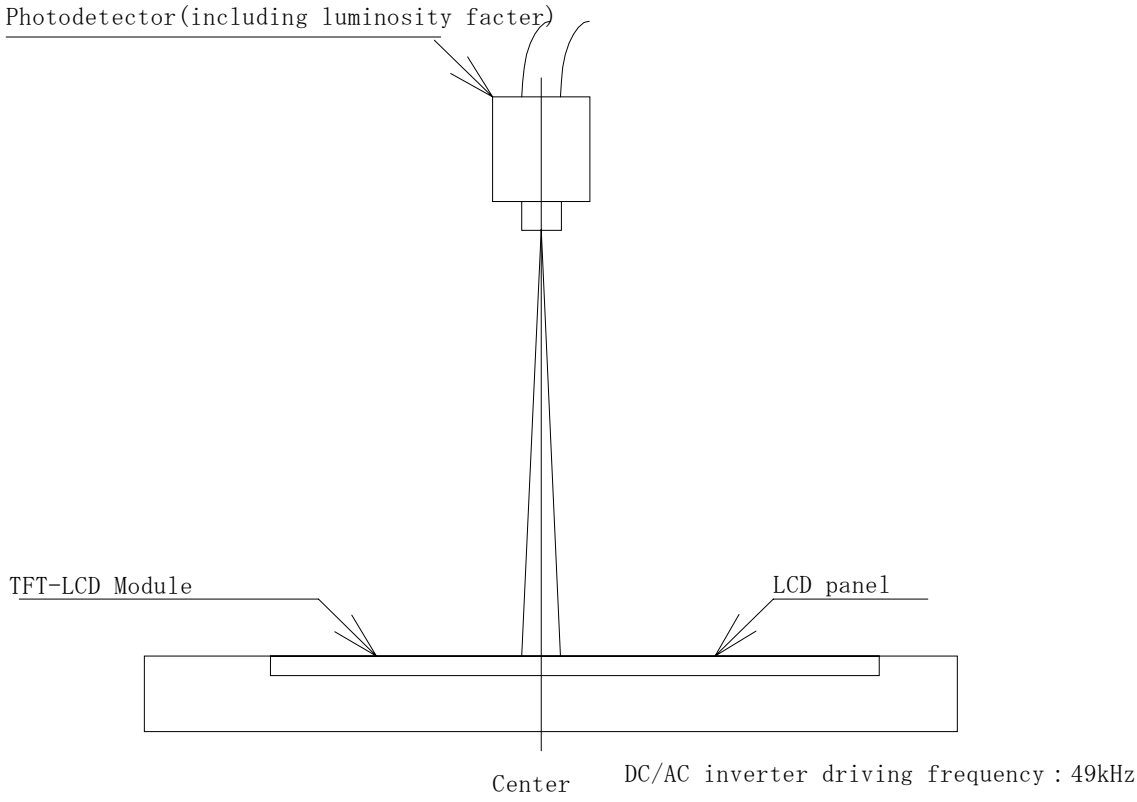
(8)Optical characteristics

Table 10 Ta=25℃

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remarks
Viewing angle range		△θ11	CR≧5	60	65	-	°(degree)	【Note 6-1,2,3】
		△θ12		35	40	-	°(degree)	
		△θ2		60	65	-	°(degree)	
Contrast ratio		Crmax	Optimal	60	-	-		【Note 6-2,3】
Response time	Rise	τr	θ＝0°	-	30	60	ms	【Note 6-2,4】
	Fall	τd		-	50	100	ms	
Luminance		Y	IL=6.5mArms	300	400	-	cd/m²	【Note 6-5】
White chromaticity		x	IL=6.5mArms	0.263	0.313	0.363		【Note 6-5】
		y	IL=6.5mArms	0.279	0.329	0.379		
lamp life time	+25℃	-	Continuation	10,000	-	-	hour	【Note 6-6】
	0℃	-	intermission	2,000	-	-	time	【Note 6-7】

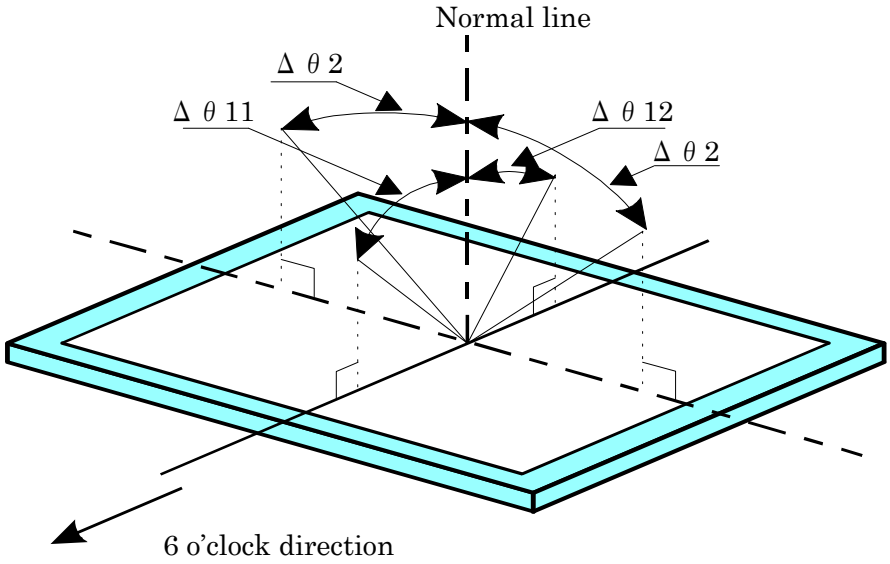
DC/AC inverter for external connection shown in following.
Harison Co.: HIU－288
Please refer to 【Note6-5】 for luminance.

※measuring after 30minutes.



mesuring method for optical characteristics

【Note 6-1】 Viewing angle range is defined as follows.



definition for viewing angle

【Note 6-2】 Applied voltage condition:

(1) VCDC is adjusted so as to attain maximum contrast ratio.

(2) Input ±1.90V at VIAC.

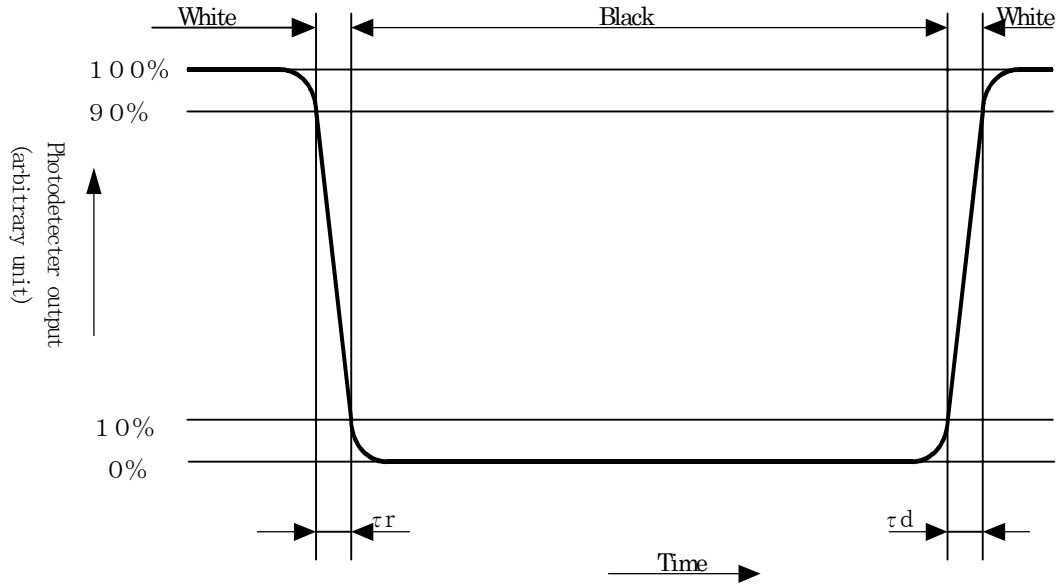
When VI50= transmission is 50% at Voltage-Transmission curve,

Black level：Vi50±2.5V, White level :Vi50 ∓ 1.5V

【Note 6-3】 Contrast ratio is defined as follows:

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

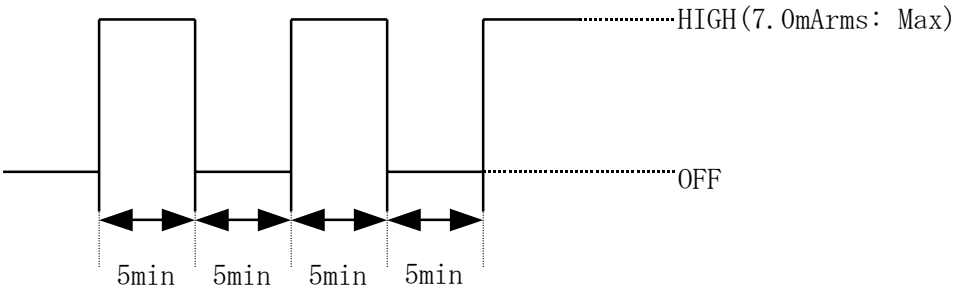
【Note 6-4】 Response time is obtained by measuring the transition time of photodetector output, when input signals are applied so as to make the area "black" to and from "white".



【Note 6-5】 Measured on the center area of the panel at a viewing cone 1° by TOPCON luminance meter BM-7.(After 30 minutes operation)
DC/AC inverter driving frequency:70kHz
(Including a rise in luminance because of rising frequency.)

【Note 6-6】 Lamp life time is defined as the time when either or occurs in the continuous operation under the condition of lamp current IL=3.0~6.5mArms(7.0mArms: Max) and PWM dimming 100%~5% (Ta=25℃)
Brightness not to become under 50% of the original value.

【Note 6-7】 The intermittent cycles is defined as a time when brightness not to become under 50% of the original value under the condition of following cycle.
Ambient temperature: 0℃



(9)Mechanical characteristics

9-1) External appearance

Do not exist extreme defects. (See Fig. 1)

9-2) 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.

9-3) I/O connector performance

A)Input/output connectors for the operation of LCD module

1)Applicable FPC : FCI:SFV32R-1ST

2)FPC flexibility : I. Slit on the film cover lay

If it had been tested bending under radius 0.6 mmR and bending angle 90 degrees condition, the FPC should not be cut at 30 times in or less.

II. Slit on the film cover lay coat part of one side printing

If it had been tested bending under radius nothingness and bending angle 180degrees, the FPC should not be cut.

(It should be bend by hand and only at once).

B)I/O connector of backlight driving circuit 【JST】

Symbol	Used Connector	Corresponding connector
CN1	BHR-02VS-1	SM02B-BHSS-1-TB (assembled on PWB)

(10) Display quality

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

(11) Handling instructions

11-1) Mounting of module

The TFT-LCD module is sure to fix the module on the same plane, taking care not to warp 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.

Please power off the module when you connect the input/output connector.

Please connect the metallic shielding cases of the module and the ground pattern of the inverter circuit surely. If that connection is not perfect, there may be a possibility that the following problems happen.

a). The noise from the backlight unit will increase.

b). The output from inverter circuit will be unstable. Then, there may be a possibility that some problems happen.

c). In some cases, a part of module will heat.

11-2) Precautions in mounting

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

Protective film (Laminator) is applied on the surface to protect it against scratches and dirts.

It is recommended to peel off the laminator immediately before the use, taking care of static electricity.

Precautions in peeling off the laminator.

A) Working environment

When the laminator is peeled 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 form dust and with an adhensive mat on the doorway

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

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

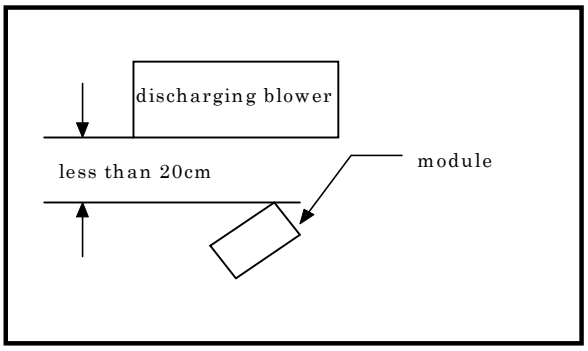
B) Working procedures

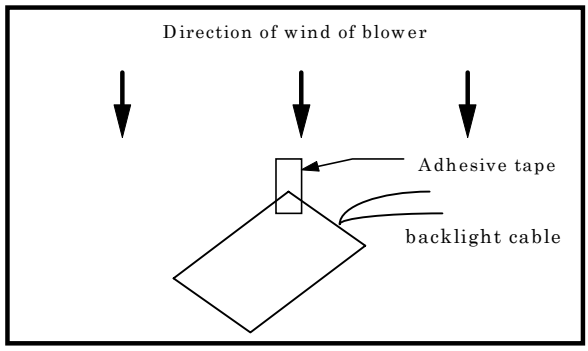
a) Direct the wind of discharging blower somewhat downward to ensure that module is blown sufficiently. Keep the distance between module and discharging blower within 20 cm.

b) Attach adhensive tape to the laminator part near discharging blower so as to protect polarizer against flaw.

c) Peel off laminator, pulling adhesive tape slowly to your side taking 5 or more second.

d) On peeling off the laminator, pass the module to the next work process to prevent the module to get dust.





e) Method of removing dust from polarizer

- Blow off dust with N2 blower for which static electricity preventive measure has been taken.
  Ionized air gun (Hugle Electronics Co.) is recommended.
- Since polarizer is vulnerable, wiping should be avoided.
  But when the panel has stain or grease, we recommend to use adhesive tape to softly remove them 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 dirts, wipe the part, breathing on it.
Wipe off water drops 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.

11-3) Precautions in adjusting module

Adjusting volumes on the rear face of the module have been set optimally before shipment. Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described here may not be satisfied.

11-4) Caution of product design

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

11-5) Others

① Do not expose the module to direct sunlight or intensive ultraviolet rays for many 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 The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.
④ If LCD panel breaks, there may be a possibility that the liquid crystal escapes from the panel. Since the liquid crystal is injurious, do not put it into the eyes or mouth. When liquid crystal sticks to hands, feet or clothes, wash it out immediately with soap.
⑤ Observe all other precautionary requirements in handling general electronic components.
⑥ Please adjust the voltage of common electrode as material of attachment by 1 module.

(12) Shipping form

12－1)Packing form (Refer Fig.5)

12－2） Carton keeping conditions

①The cartons can be piled up maximum 10 layers.

②Environments

Temperature : ０～４０℃

Humidity : ６０％RH or less (at ４０℃)
No dew condensation at low temperature and high humidity.

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

Periods : About 3 months

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

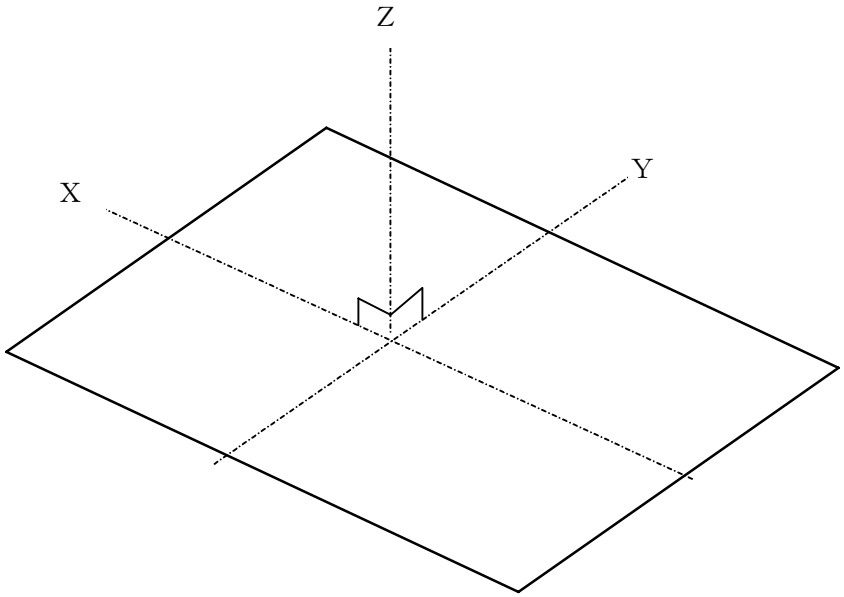
(13) Reliability test

table 13

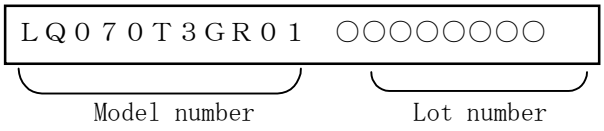
Remark) Temperature condition is based on operating temperature conditions No. (6) – table5-1.

No.	Test items	Test condition
1	High temperature strong test	Ta = +75℃ 240h
2	Low temperature strong test	Ta = -25℃ 240h
3	High temperature and high humidity operation test	Ta = +40℃, 90%RH 240h
4	Hi temperature operating test	Tp = +70℃ 240h
5	Low temperature operating test	Ta = 0℃ 240h
6	Electro static discharge test	±200V・200pF （0Ω） 1 time for each terminals
7	Shock test	980m/s2・6ms, ±X ; ±Y ; ±Z 3 times for each direction (JIS C0041, A-7 Condition C)
8	Vibration test	Frequency range :10～55Hz Stroke : 1.5mm Cycle : 1 minutes Each direction(X,Y, Z) 2 hours 【caution】(JIS C0040, A-10 condition A)
9	Heat shook test	-25℃ ～ +70℃ / 5 cycles (0.5h) (0.5h)

【Note】Ta = Ambient temperature, Tp = Panel temperature
【Check items】In the standard condition, there shall be no practical problems that may affect the display function.
【It is the goal specification with a mass production article, and there also is an item which you are not satisfied of this condition in a prototype level.】
【caution】X, Y, Z direction are shown as follow



(14) Indication of lot number label
①Attached location of the label : See Fig. 1
②Indicated contents of the label



Contents of lot number : 1st ·· Production year 2000⇒0
: 2nd ·· Production month 1,2,3,…9,X,Y,Z
: 3rd～7th ··Serial numbers 00001～
: 8th ·· Revision symbols A,B,C…

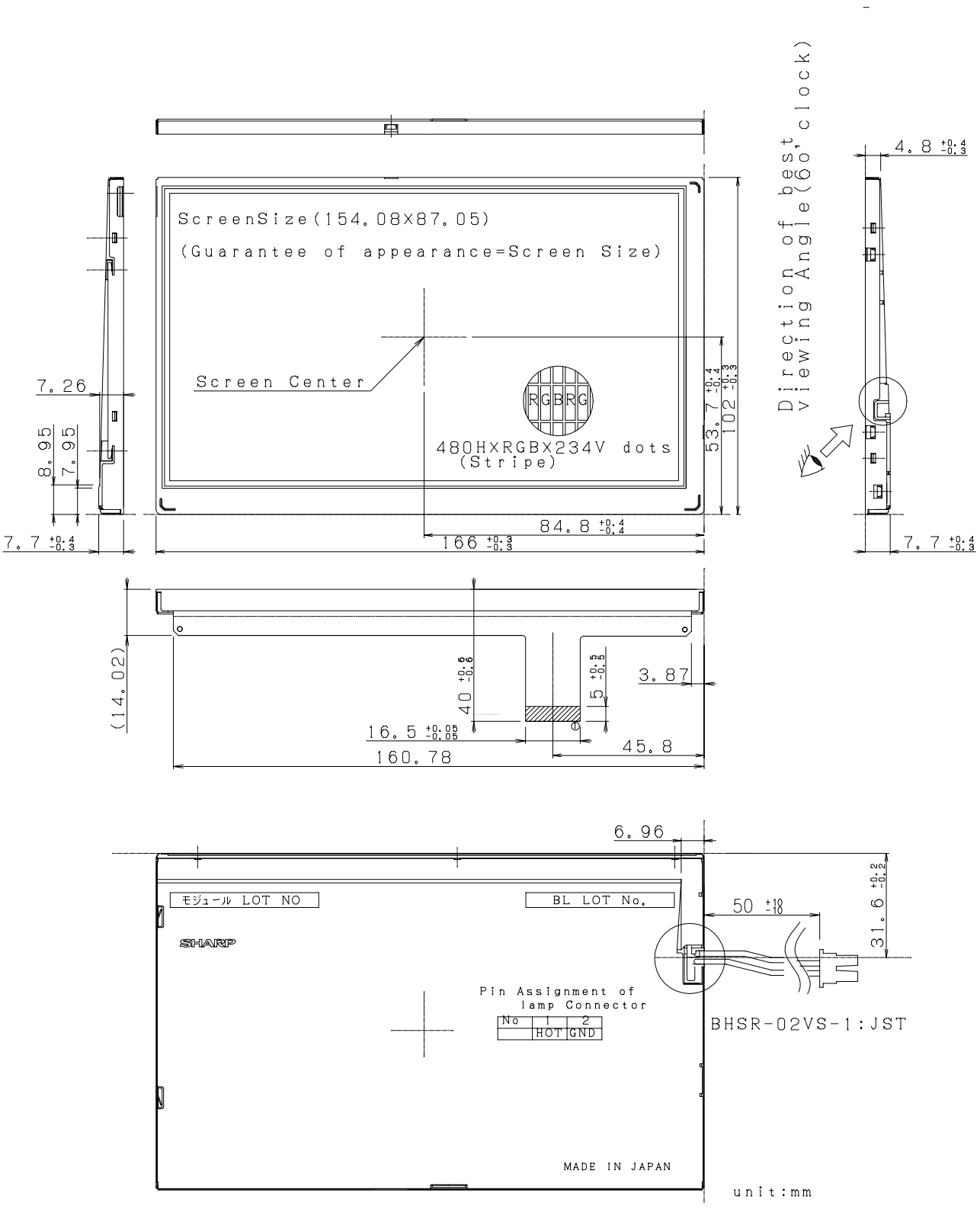


Fig1.　Out line Dimension for 7”TFT

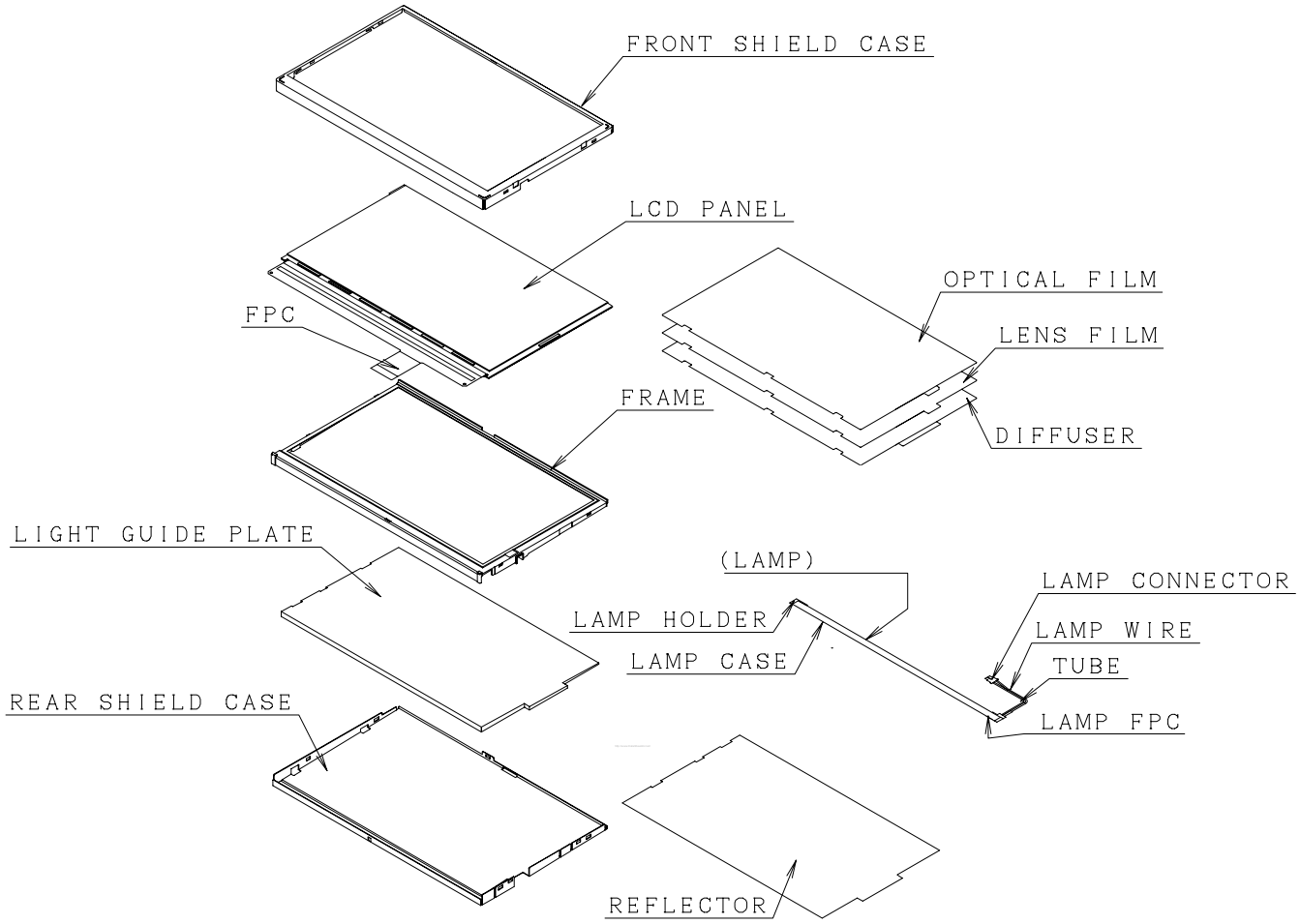


Fig. 2 Structure of the TFT-LCD module

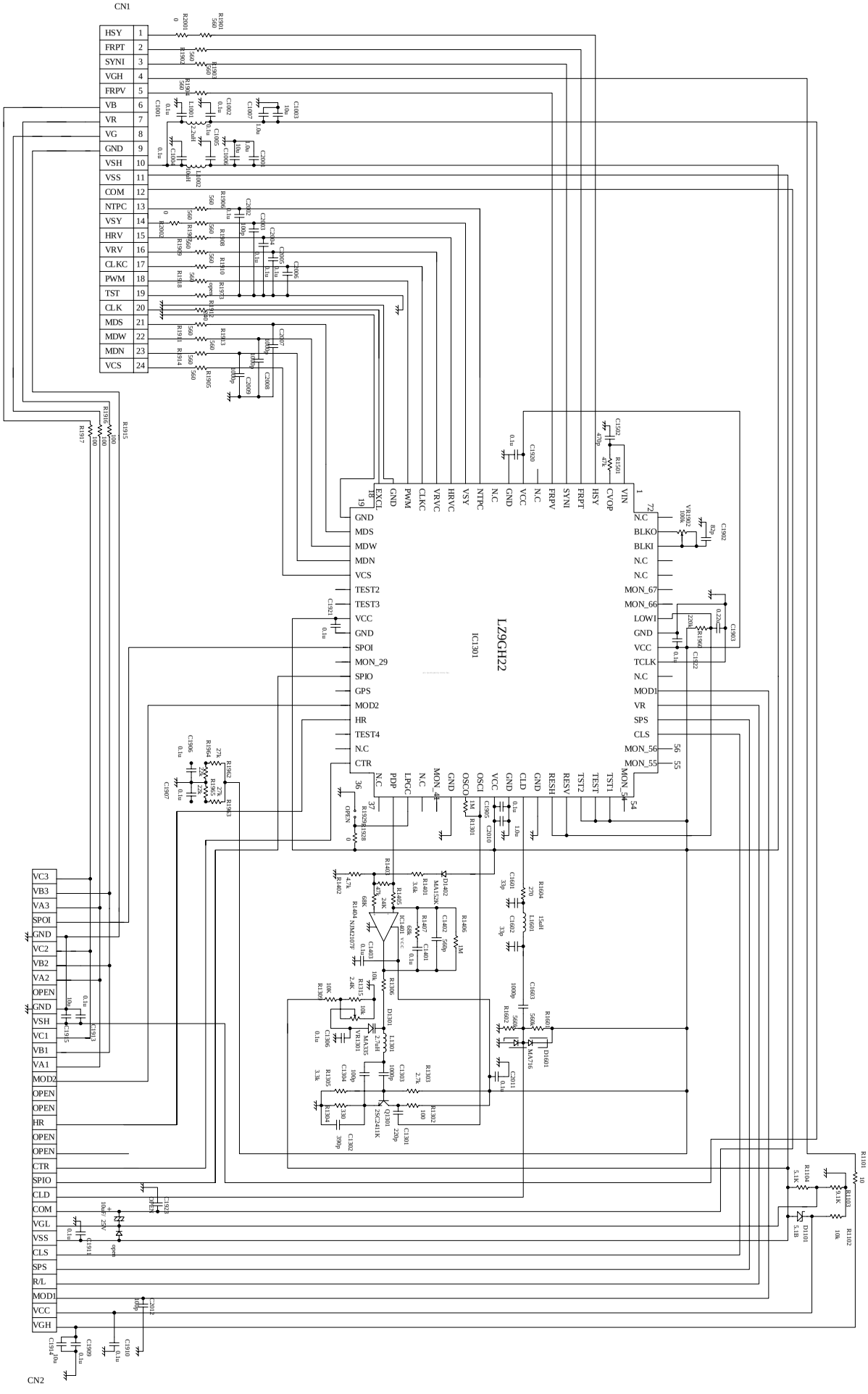


Fig.3 Reference drive circuit

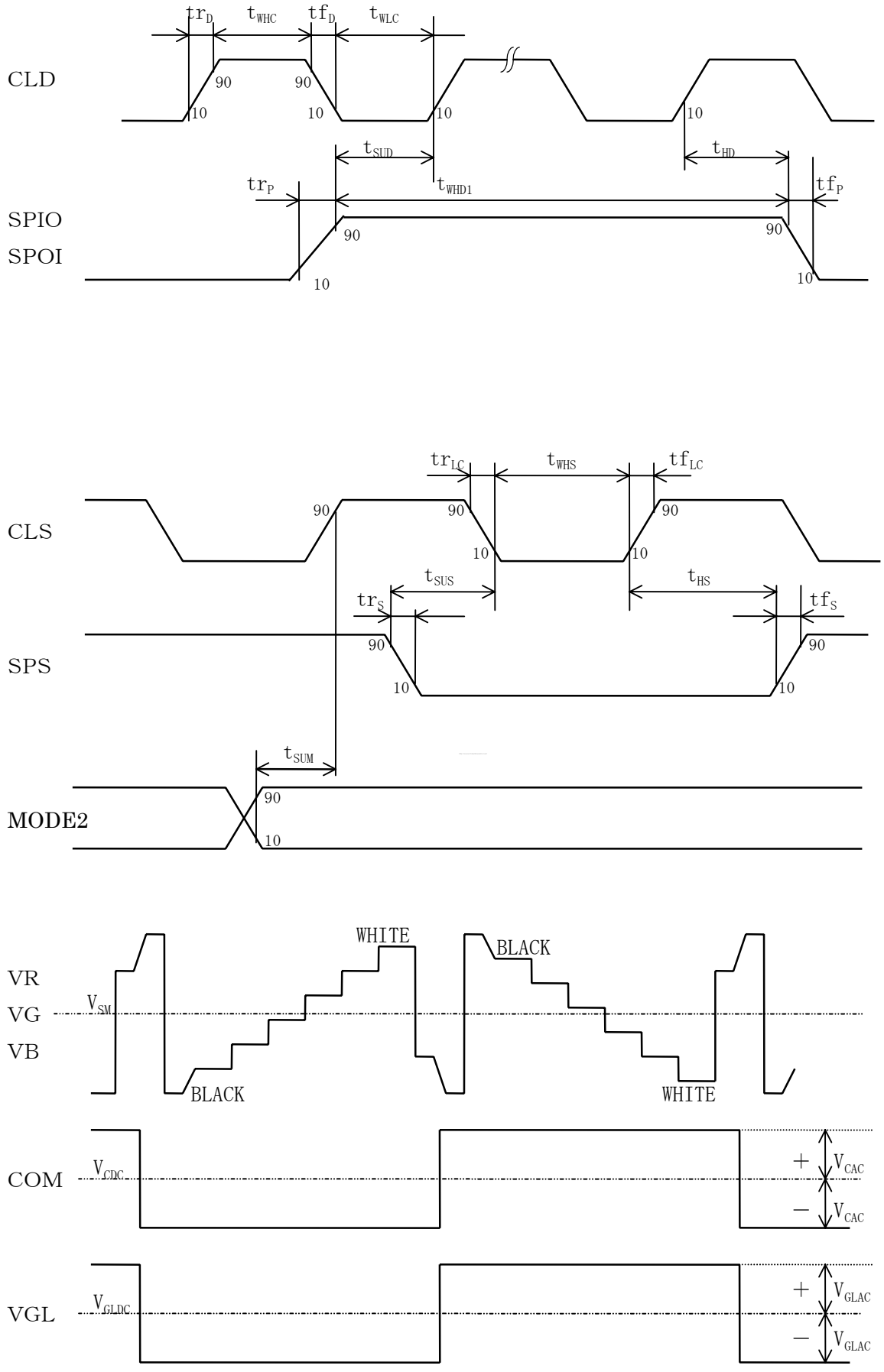


Fig.4 Input signal timing chart

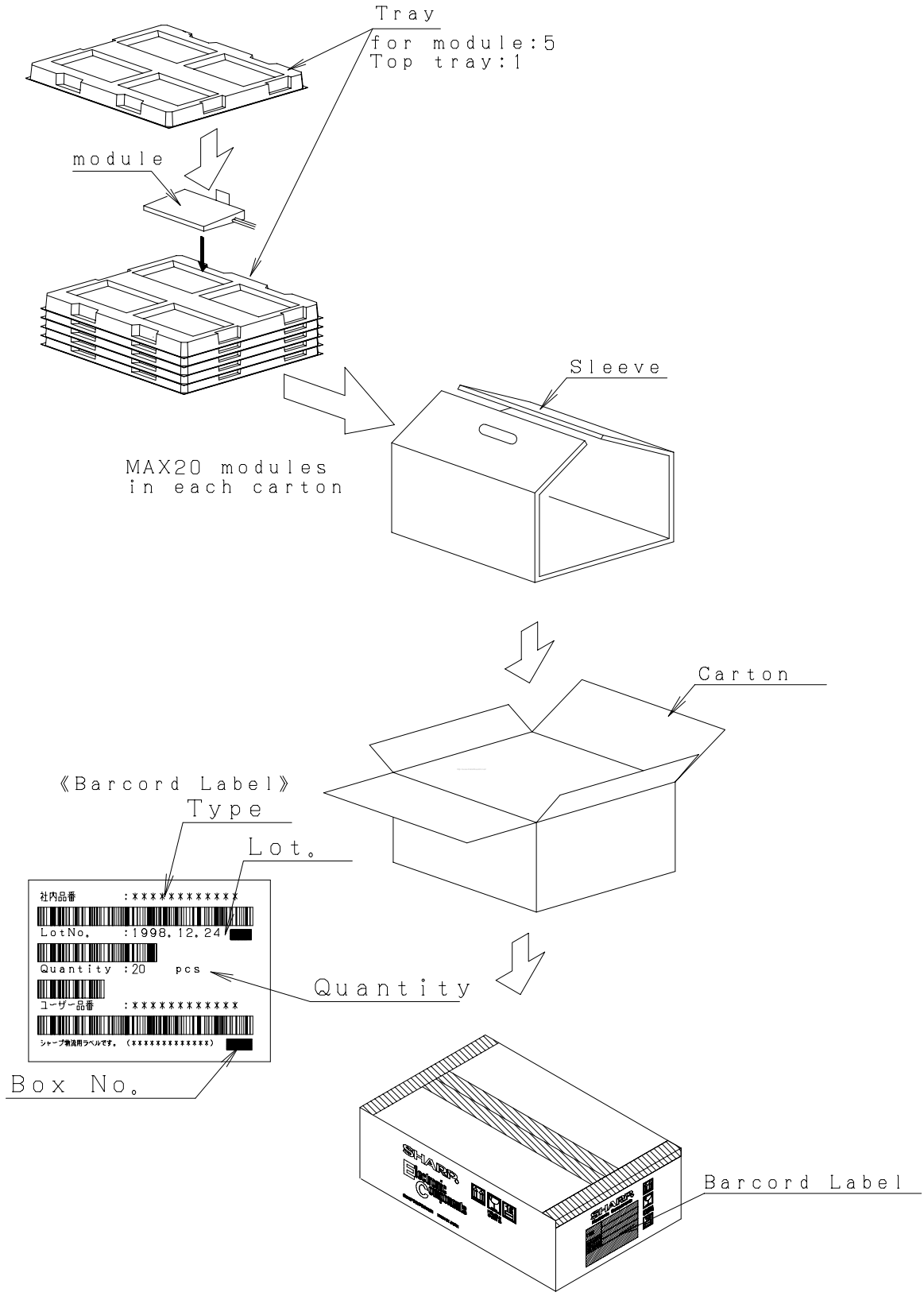


Fig.5 Package form

（Appendix）

Adjusting method of optimum common electrode DC bias voltage

To obtain optimum DC bias voltage of common electrode driving signal (VCDC), photoelectric devices are very effective, and the accuracy is with 0.1V. (In visual examination method, the accuracy is about 0.5V because of the difference among individuals.)

To gain optimum common electrode DC bias, there is the method that uses photoelectric devices.

Measurement of flicker

DC bias voltage is adjusted so as to minimize NTSC：60Hz(30Hz) / PAL：50Hz(25Hz) flicker.

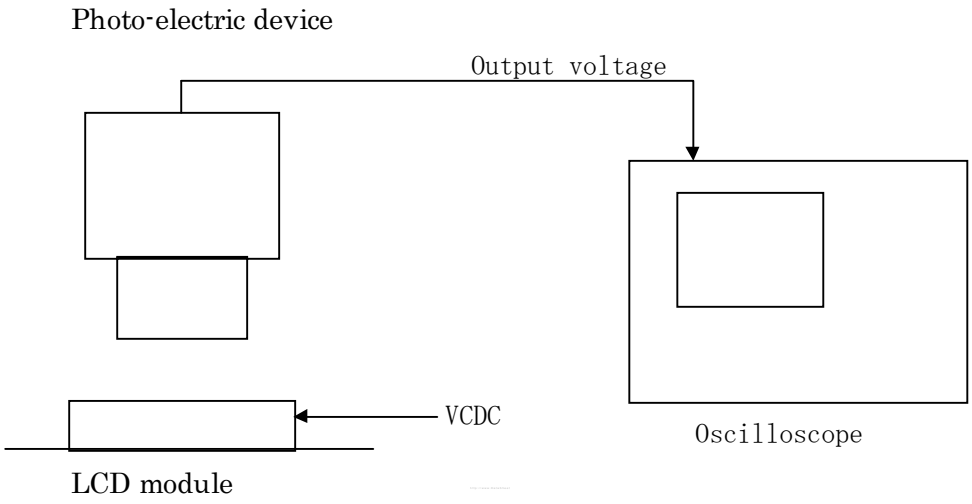


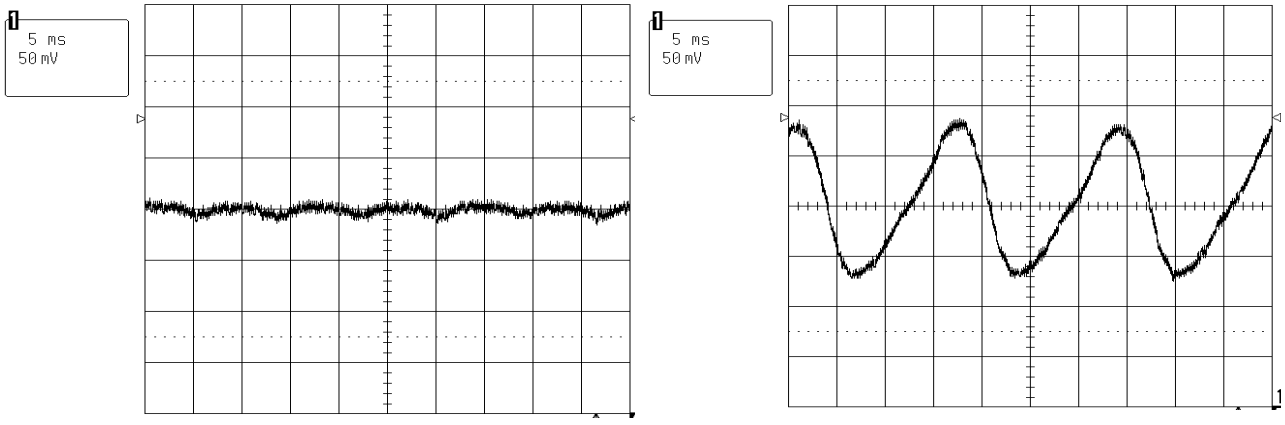
Fig. A　Measurement system

《Measurement of flicker》

Photoelectric output voltage is measured by an oscilloscope at a system show in Fig. A.

DC bias voltage must be adjusted so as to minimize the NTSC：60Hz (30Hz) / PAL：50Hz

(25Hz) flicker with DC bias voltage changing slowly. (Fig.B)



DC bias：Optimum　　DC bias：Optimum + 1

Fig. B　Waveforms of flicker

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SHARP®

NORTH AMERICA

SHARP Microelectronics of the Americas
5700 NW Pacific Rim Blvd.
Camas, WA 98607, U.S.A.
Phone: (1) 360-834-2500
Fax: (1) 360-834-8903
Fast Info: (1) 800-833-9437
www.sharpsma.com

EUROPE

SHARP Microelectronics Europe
Division of Sharp Electronics (Europe) GmbH
Sonninstrasse 3
20097 Hamburg, Germany
Phone: (49) 40-2376-2286
Fax: (49) 40-2376-2232
www.sharpsme.com

JAPAN

SHARP Corporation
Electronic Components & Devices
22-22 Nagaike-cho, Abeno-Ku
Osaka 545-8522, Japan
Phone: (81) 6-6621-1221
Fax: (81) 6117-725300/6117-725301
www.sharp-world.com

TAIWAN

SHARP Electronic Components
(Taiwan) Corporation
8F-A, No. 16, Sec. 4, Nanking E. Rd.
Taipei, Taiwan, Republic of China
Phone: (886) 2-2577-7341
Fax: (886) 2-2577-7326/2-2577-7328

SINGAPORE

SHARP Electronics (Singapore) PTE., Ltd.
438A, Alexandra Road, #05-01/02
Alexandra Technopark,
Singapore 119967
Phone: (65) 271-3566
Fax: (65) 271-3855

KOREA

SHARP Electronic Components
(Korea) Corporation
RM 501 Geosung B/D, 541
Dohwa-dong, Mapo-ku
Seoul 121-701, Korea
Phone: (82) 2-711-5813 ~ 8
Fax: (82) 2-711-5819

CHINA

SHARP Microelectronics of China
(Shanghai) Co., Ltd.
28 Xin Jin Qiao Road King Tower 16F
Pudong Shanghai, 201206 P.R. China
Phone: (86) 21-5854-7710/21-5834-6056
Fax: (86) 21-5854-4340/21-5834-6057
Head Office:
No. 360, Bashen Road,
Xin Development Bldg. 22
Waigaoqiao Free Trade Zone Shanghai
200131 P.R. China
Email: smc@china.global.sharp.co.jp

HONG KONG

SHARP-ROXY (Hong Kong) Ltd.
3rd Business Division,
17/F, Admiralty Centre, Tower 1
18 Harcourt Road, Hong Kong
Phone: (852) 28229311
Fax: (852) 28660779
www.sharp.com.hk
Shenzhen Representative Office:
Room 13B1, Tower C,
Electronics Science & Technology Building
Shen Nan Zhong Road
Shenzhen, P.R. China
Phone: (86) 755-3273731
Fax: (86) 755-3273735