SHARP

TECHNICAL LITERATURE

MODEL NO. LM6Q40

DOC. NO. LC98556

DATE JUN.12.1998

** The technical literature is subject to be changed without notice **

SHARP COPRATION

PRESENTED
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SHARP CORPRATION

RECORDS OF REVISION

SPEC No.	MODEL No.
LC98556	LM6Q35

DOC.FIRST ISSUE
JUN. 12, 1998

IDENT.DATA No.

DATA	SPEC REVISED No.	REVISED No.	REF. PAGE	SUMMARY	CHECK & APPROVAL

○Contents

1.Application

This data sheet is to introduce the specification of LM6Q40,negative Matrix type Color LCD module.

2.Outline

FIFO and frame rate modulation circuits are built-in, therefore, 4,096 colors with 16 gray scales for each color(R/G/B) and high response time are possible with the input of C.sync. and Analog signal(R/G/B). DC/DC converter circuits and DC/AC inverter circuits for backlight are built-in..

3.Features

3-1)Supply voltage	;DC +12V
3-2)Interface	;NTSC interface
3-3)Input signal	;Analog RGB signal (0.7Vp-p) Composite-sync (CMOS level)
3-4)Driving method	;Negative matrix type
3-5)Display format	;960 dots * 240 dots (RGB stripes)
3-6)Backlight	;CCFT backlight (DC/AC inverter built-in)
3-7)Contrast adjust voltage	;Temperature compensation circuit built-in.

4.Construction:

320×RGB×240 dots color display module consisting of an LCD panel, PWB(printed wiring board) with electric components mounted onto, TCP(tape carrier package) to connect the LCD panel and PWB electrically, and plastic chassis with CCFT back light and bezel to fix them mechanically. Signal ground(Vss) is connected with the metal bezel.

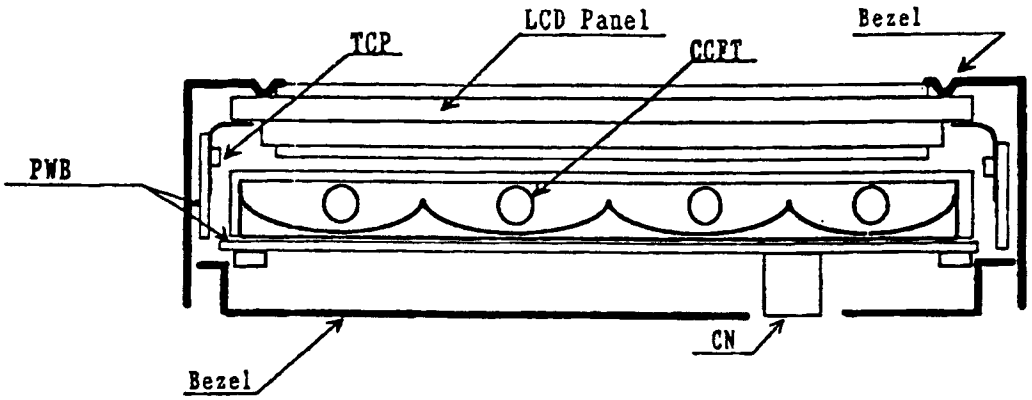


Fig.1 Module construction

Outline :See Outline dimension

Connection :See Fig. 9 and Table 6

Application inspection standard

The LCD module shall meet the following inspection standard : T.B.D.

5.Mechanical Specification

Table 1

Parameter	Specifications	Unit
Outline dimensions	146±0.5(W)×106.6±0.5(H)×34.8MAX(D)	mm
Viewing area	114.0(W)×86.0(H)	mm
Active area	111.335(W)×83.495(H)	mm
Display format	320×RGB(W)×240(H)	mm
Dot size	0.091(W)×RGB×0.323(H)	mm
Dot spacing	0.025	mm
Base color	Normally black *	-
Weight	approximate 370	g

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

6.Absolute Maximum Ratings

6-1.Electrical absolute maximum ratings

Table 2 Ta=25 ℃

Parameter	Symbol	MIN.	MAX.	Unit	Remark
Supply voltage	V_{CC}	0	13.2	V	
Input voltage (R,G,B)	V_{IN}	-0.3	4.5	V_{P-P}	75 Ω
Input voltage (C-SYNC)	V_{IN}	-0.3	7.0	V	

6-2.Environment Conditions

Ambient temperature ,Humidity conditions

Table 3

Item	Topr		Tstg		Remark
	MIN.	MAX.	MIN.	MAX.	
Ambient temperature	0 ℃	+50 ℃	-25 ℃	+65℃	Note 1)
Humidity	Note 2)				No condensation

Note 1) Care should be taken so that the LCD module may not be subjected to the temperature out of this specification.

Note 2) Ta≦40 ℃.....95 % RH Max.

Ta>40 ℃.....Absolute humidity shall be less than Ta=40 ℃/95 % RH.

Vibration conditions

Table 4 (Ta = 25 ℃, Not operate)

Frequency	10 Hz~57 Hz	57 Hz~500 Hz
Vibration level	-	9.8 m/s^2
Vibration width	0.075 mm	-
Interval	10 Hz~500 Hz~10 Hz/11.0 min	

2 hours for each direction of X/Y/Z (6 hours as total)

Shock conditions (Ta = 25 ℃, Not operate)

Acceleration : 490 m/s^2

Pulse width : 11 ms

3 times for each directions of ±X/±Y/±Z

7.Electrical Specifications

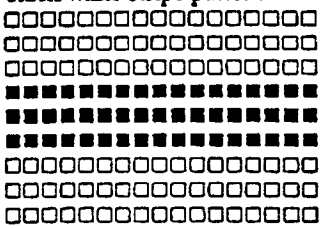
7-1.Electrical characteristics

Table 5 (Ta = 25 ℃)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	-		11.4	12.0	12.6	V
Input singal voltage (R,G,B)	$V_{IN}1$	-		-	0.7	-	Vp-p
Input signal voltage (C-SYNC)	$V_{IH}2$	"H" level		4.0	-	5.0	V
		"L" level		0	-	1.0	V
Supply current	I_{CC}	display pattern Note 1)	1*	-	580	640	mA
			2*	-	550	610	
Power consumption	Pd	display pattern Note 1)	1*	-	7.0	7.7	W
			2*	-	6.6	7.3	

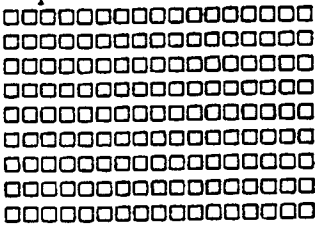
Note 1) Display pattern 1*

black/white stripe pattern



Display pattern 2*

All pixels "WHITE"



7-2 Interface signals

○ LCD

Table 6 CN1 (LCD)

Pin No	Symbol	I/O	Description
1	VSS	in	ground
2	VCC	in	Supply voltage (+12V)
3	R	in	Analog RED signal
4	B	in	Analog BLUE signal
5	MODE2	in	"L" level
6	VSS	in	ground
7	VCC	in	Supply voltage (+12V)
8	G	in	Analog GREEN signal
9	C-SYNC	in	Composite Sync
10	MODE2	in	Sampling Clock "H" 410 times per line "L" 398 times per line

Used connector ;IL-W-10P-SD (JAE)

Correspondable connector ;IL-W-10S-SD (JAE)

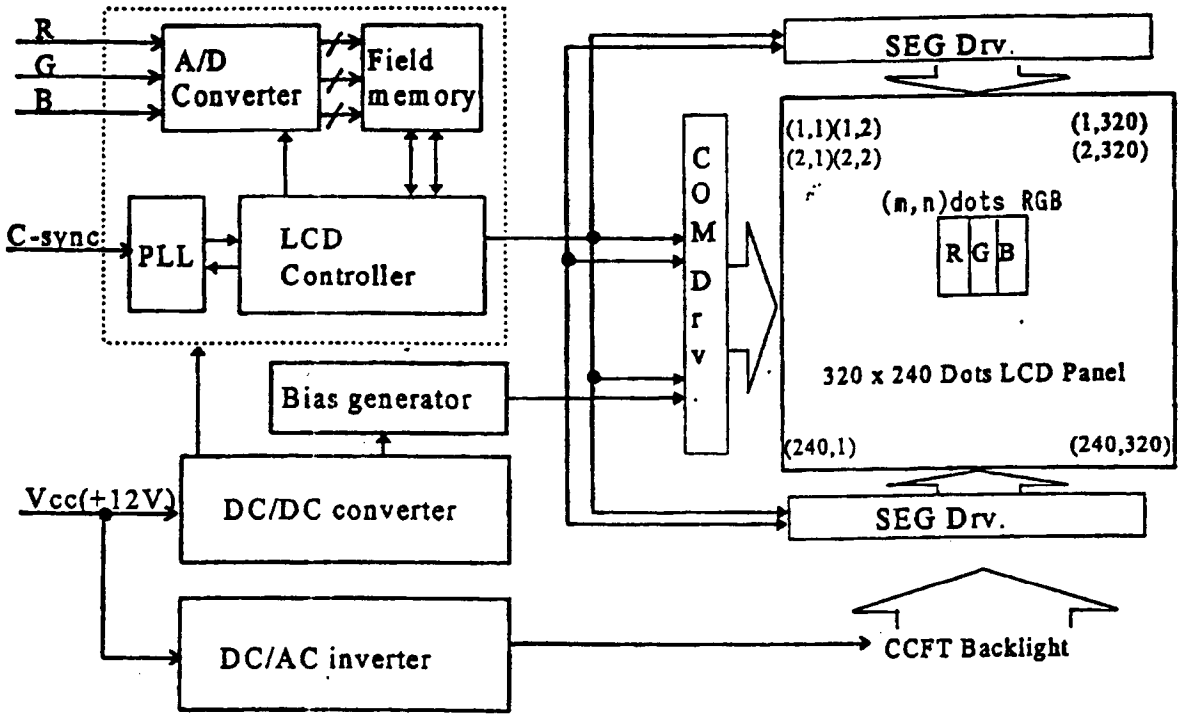


Fig.2 Circuit block diagram

8. Optical Characteristics

Table 9

Ta = 25 ℃, V_{cc} = 12.0 V

Parameter		Symbol	Condition			MIN.	TYP.	MAX.	Unit	Remark
Viewing angle range		θ_x	Co>5.0	θ_y=0 °	$\theta_x \geqq 0$ °	35	-	-	°	Note1)
					$\theta_x < 0$ °	-	-	-35	°	
		θ_y		θ_x=0 °	$\theta_y \geqq 0$ °	25	-	-	°	
					$\theta_y < 0$°	-	-	-15	°	
Contrast ratio		Co	$\theta_x = \theta_y = 0$ °		25 ℃	15	30		-	Note2)
					45 ℃	20	40			
Response time	Rise	τ r	$\theta_x = \theta_y = 0$ °			-	50	100	ms	Note3)
	Decay	τ d				-	30	60	ms	
Brightness		B	$\theta_x = \theta_y = 0$ °			150	200		cd/m^2	Note4)
Module chromaticity	white	x	$\theta_x = \theta_y = 0$ °			-	0.31	-	-	
		y	$\theta_x = \theta_y = 0$ °			-	0.38	-	-	

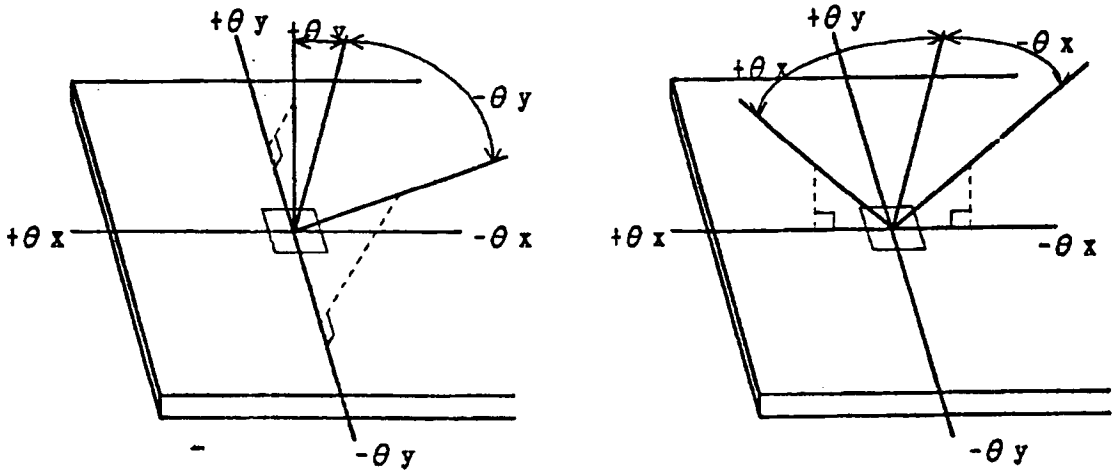


Fig.3 Definition of Viewing Angle

Note 1) The viewing angle range is defined as shown Fig.3.

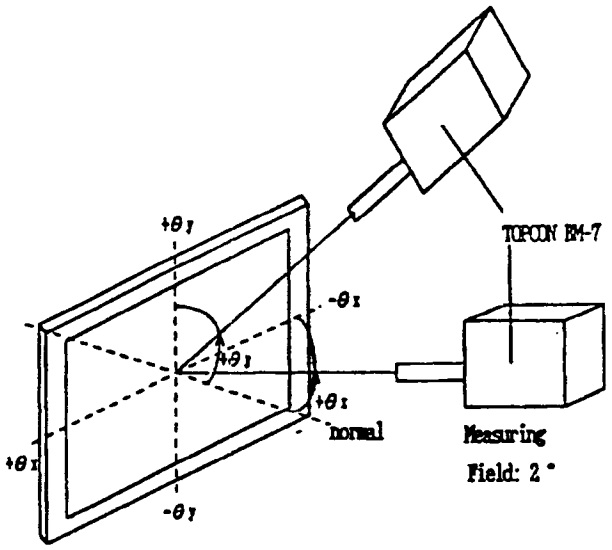
Note 2) Contrast ratio is defined as follows:

$$Co = \frac{\text{Luminance(brightness) all pixes "White" at Vmax}}{\text{Luminance(brightness) all pixes "dark " at Vmax}}$$

Vmax is defined in Fig.5.

Note 3) The response characteristics of photo-detector output are measured as shown in Fig.9, assuming that input signals are applied so as to select and deselect the dot to be measured, in the optical characteristics test method shown in Fig.6

Note4) Brightness is defined as average luminance (brightness) of measuring points (①~⑤) at Vco max. All pixels of LCD is "white"



Measuring Spot Size : ϕ 10 mm

θ x : Angle from "normal" to viewing surface rotated about the horizontal axis.

θ y : Angle from "normal" to viewing surface rotated about the vertical axis.

Fig.4 Optical Characteristics Test Method I

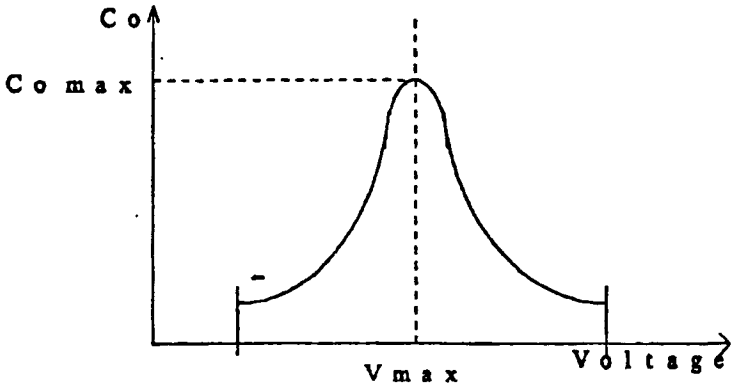
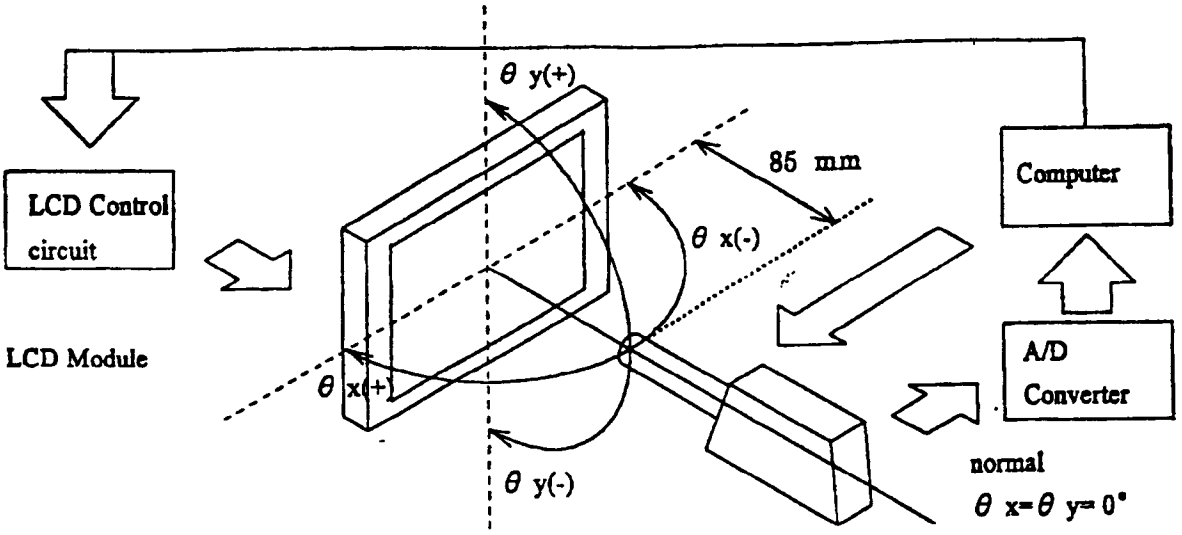


Fig.5 Definition of Vmax

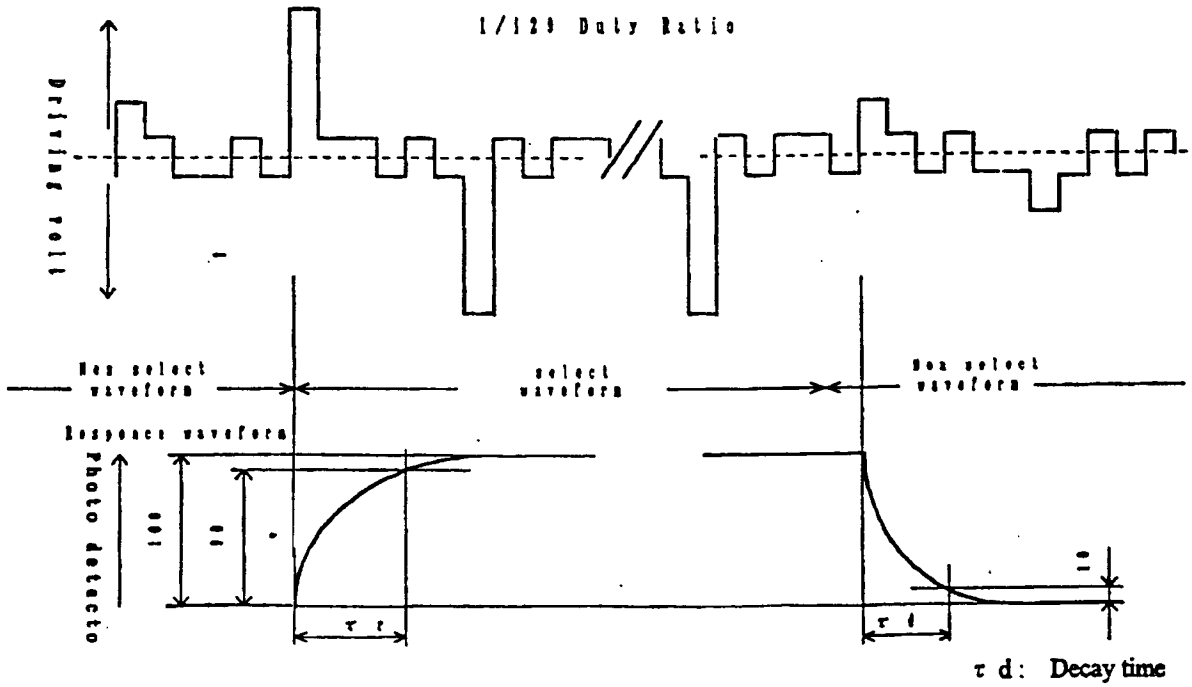


(Response Measurement)
Ta = 25 ℃
In dark room

TOPCON BM7 + quartz fiber
(Measuring spot size : ϕ 10 mm, Measuring Field : 2 °)

Fig. 6 Optical Characteristics Test Method II

τ r: Rise time



τ d: Decay time

Fig.7 Definition of Response time

9.Characteristics of Backlight

The ratings are given on condition that the following conditions are satisfied.

9-1) Measurement equipment : BM-7 (TOPCON Corporation)

9-2)Measurement conditions

1. Measurement circuit voltage : Vcc = 12.0 V
2. LCD: All pixels WHITE, RGB data White 1/tFRM = 60 Hz
3. Ambient temperature : 25 ℃

Measurement shall be executed 30 minutes after turning on.

9-3) Operating life

The operating life time is 10 000 hours or more at 25 ±1℃

The operating life time is defined as having ended when the illuminance or quantity of light has decreased to 60 % of the initials value.

*Average life time of CCFT will be decreased when LCD is operating at lower temperature.

9-4)Rating are defined as the average brightness inside the viewing area specified in Fig.11.

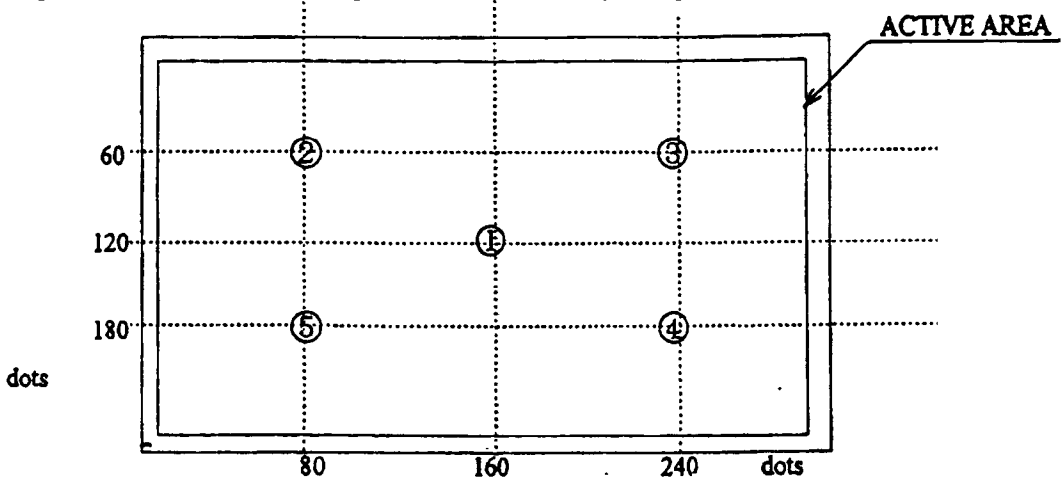


Fig.8 Measuring points (1-5)

10. Precautions

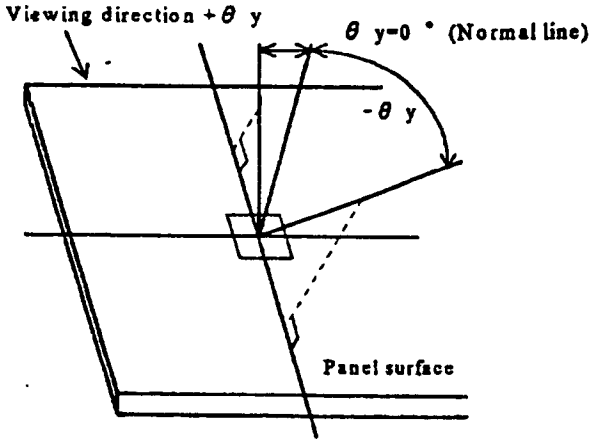
1) Industrial(Mechanical) design of the product in which this LCD module will be incorporated must be made so that the viewing angle characteristics of the LCD may be optimized.

This module's viewing angle is illustrated in Fig.1.

θ y MIN. < viewing angle < θ y MAX.

(For the specific values of θ y MIN., and θ y MAX., refer to the table)

Please consider the optimum viewing conditions according to the purpose when installing the module.



2) This module should be installed using mounting holes of metal bezel.

When installing the module, pay attention and handle carefully not to allow any undue stress such as twist or bend.

3) Since the front polarizer is easily damaged. Please pay attention not to scratch on its face.

It is recommended to use a transparent acrylic resin board or other type of protective panel on the surface of the LCD module to protect the polarizer, LCD panel, etc..

4) If the surface of the LCD panel is required to be cleaned, wipe it swiftly with cotton or other soft cloth. If it is not still clear completely, blow on and wipe it.

5) Water droplets, etc. must be wiped off immediately since they may cause color changes, staining, etc., if it remained for a long time.

6) Since LCD is made of glass substrate, dropping the module or banging it against hard objects may cause cracking or fragmentation.

7) Since CMOS LSIs are equipped in this module, following countermeasures must be taken to avoid electrostatics charge.

1. Operator

Electrostatic shielding clothes shall be had because it is feared that the static electricity is electrified to human body in case that operator have a insulating garment.

2. Equipment

There is a possibility that the static electricity is charged to equipment which have a function of peeling or mechanism of friction(EX: Conveyer, soldering iron, working table), so the countermeasure(electrostatic earth: 1×10^8 Ω) should be made.

3. Floor

Floor is a 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 countermeasure(electrostatic earth: 1×10^8 Ω) should be made.

4. Humidity

Humidity of working room may lower electrostatics generating material's resistance and have something to prevent electrifying. So, humidity should be kept over 50% because humidity less than 50 % may increase material's electrostatic earth resistance and it become easy to electrify.

5. Transportation/storage

The measure should be made for storage materials because there is a possibility that the static electricity, which electrify to human body or storage materials like container by friction or peeling, cause the dielectric charge.

6. Others

The laminator is attached on the surface of LCD module to prevent from scratches, fouling and dust. It should be peeled off unhurriedly with using static eliminator.

And also, static eliminator should be installed to prevent LCD module from electrifying at assembling line.

8) Don't use any materials which emit gas from epoxy resin(amines' hardener) and silicon adhesive agent(dealcohol or deoxym) to prevent change polorizer color owing to gas.

9) Since leakage current, which may be caused by routing of CCFT cables, etc., may affect the brightness of display, the inverter has to be designed taking the leakage current into consideration. Thorough evaluation of the LCD module/inverter built into its host equipment shall be conducted, therefore, to ensure the specified brightness.

10) Avoid to expose the module to the direct sun-light, strong ultraviolet light, etc. for a long time.

11) If stored at temperatures under specified storage temperature, the LC may freeze and be deteriorated. If storage temperature exceed the specified rating, the molecular orientation of the LC may change to that of a liquid, and they may not revert to their original state. Therefore, the module should be always stored at normal room temperature.

12) Disassembling the LCD module can cause permanent damage and should be strictly avoided.

13). Procedure insert mating connector

When the mating connector is inserted, it should be parallel to the used connector of LCD module and it should be inserted horizontally.

When the mating connector is attempted to be fixed to LCD connector, it should be inserted properly in order not to create a gap.

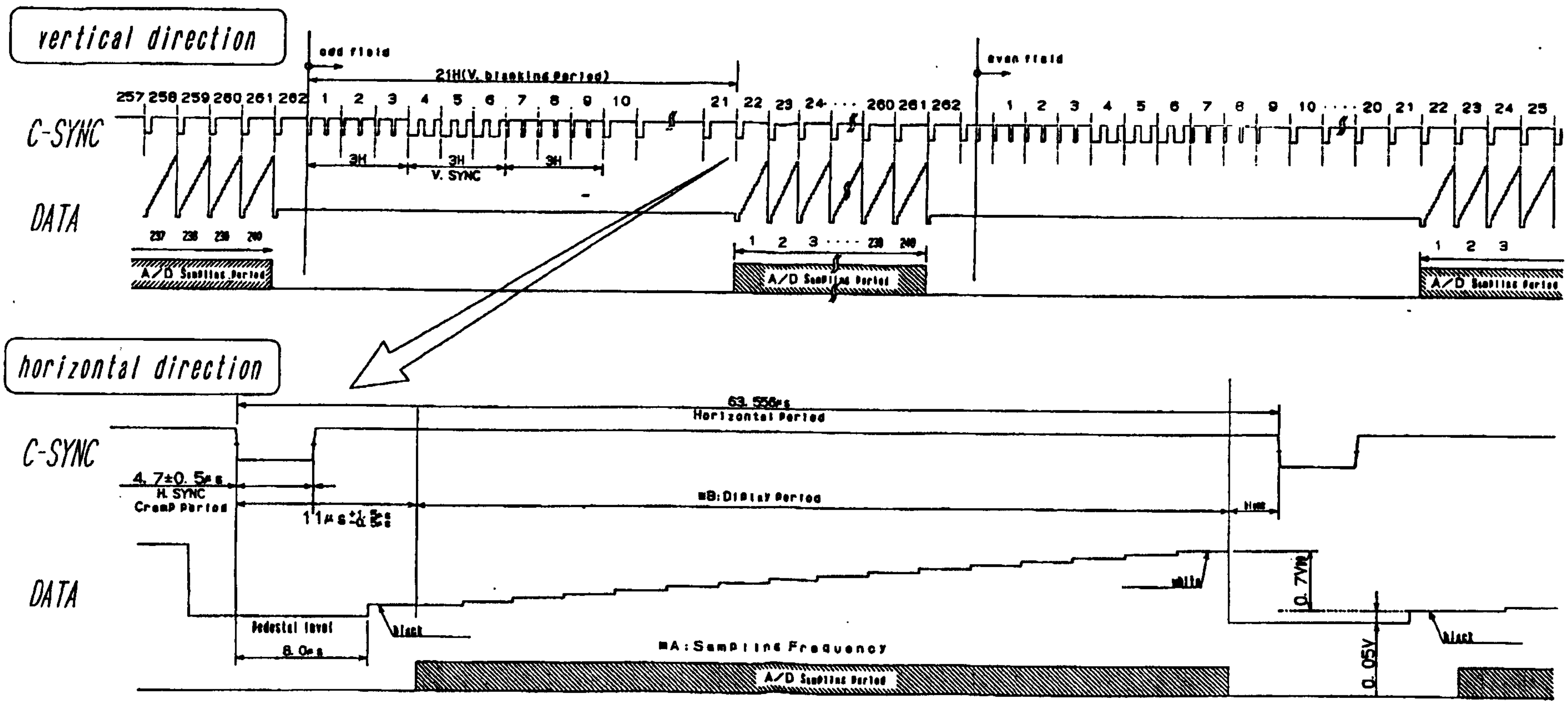
Please insert the connector as both edge is placed to the connect position of LCD connector.

14)It is a characteristic of LCD to maintain the displaying pattern when the pattern is a applied for long time. (Image retention)

To prevent image retention, please do not apply the fixed pattern for along time by pre-installing such programs at your side.

15) This phenomena (image retention) is not deterioration of LCD. It if happens, you can remove it by applying different patterns.

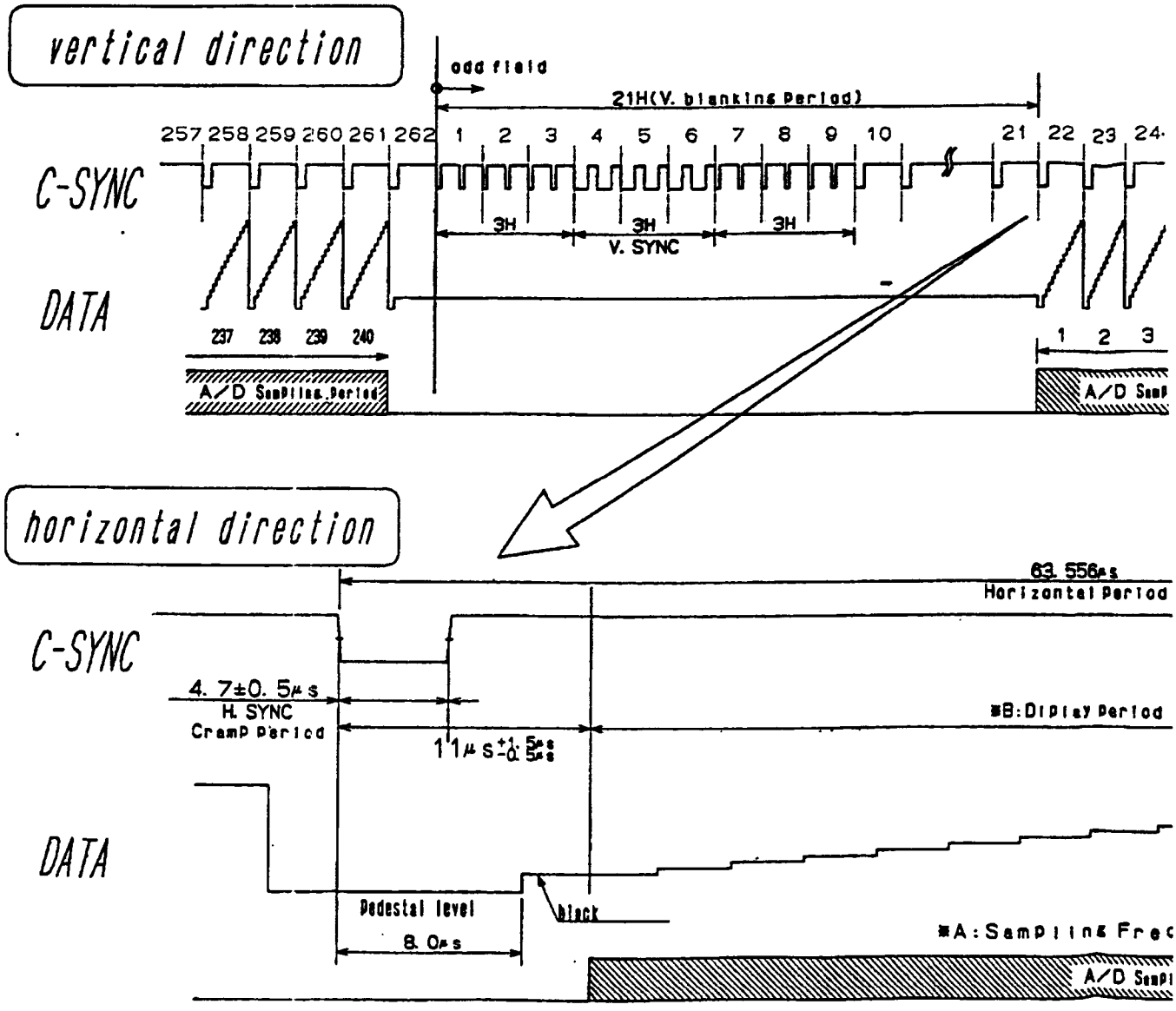
NTSC input sinal waveforms



※MODE1	H	L
A: Sampling frequency	6. 45MHz	6. 26MHz
B: Display Period	49. 6μs	51. 1μs

NAME	NTSC input signal and Display Period
DATE	1998 · 6 · 12
	SHARP CORPORATION
	シャープ株式会社 デューティ液晶(事本)
	MOBILE LCD DEVELOPMENT P.T

NTSC input sinal waveforms



* MODE1	H	L
A: Sampling frequency	6.45MHz	6.26MHz
B: Disply Period	49.6μs	51.1μs

出図 ISSUE

設計通報 DRAWING INFO. 連絡書 INFORMATION

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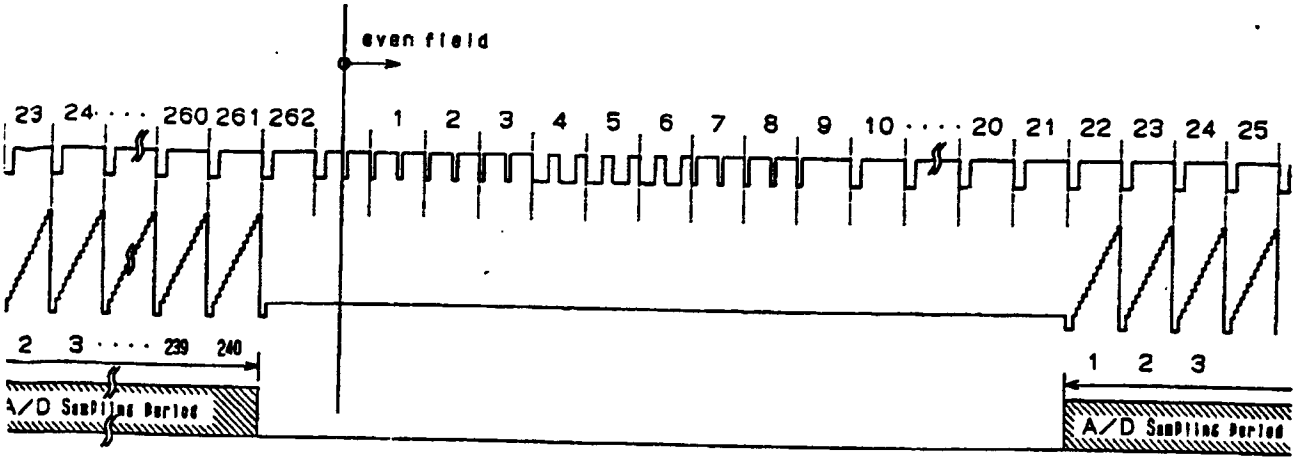
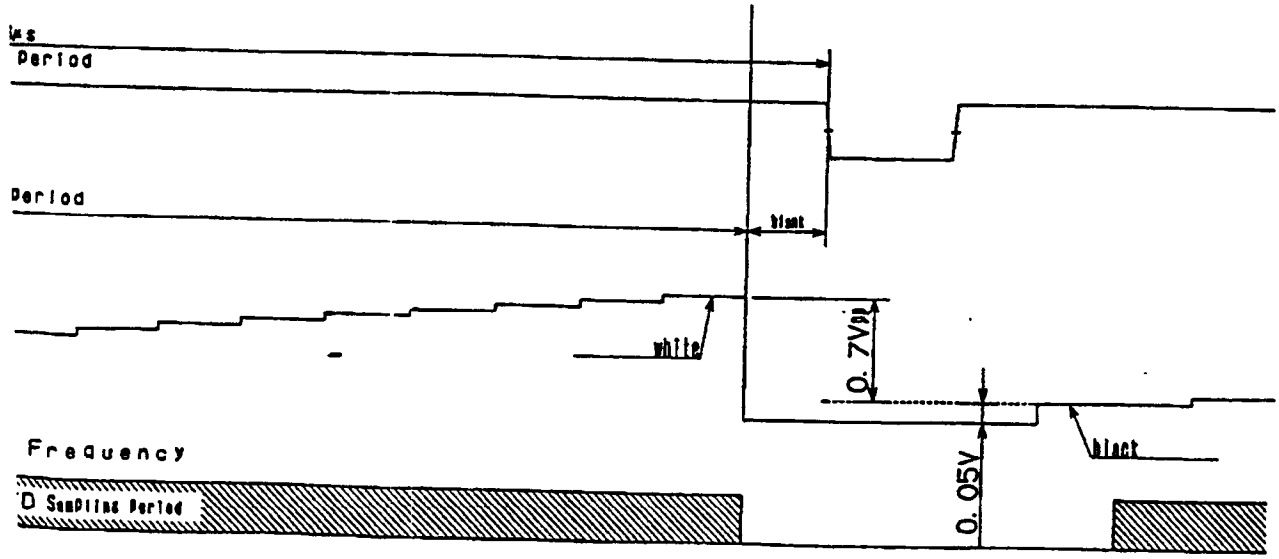
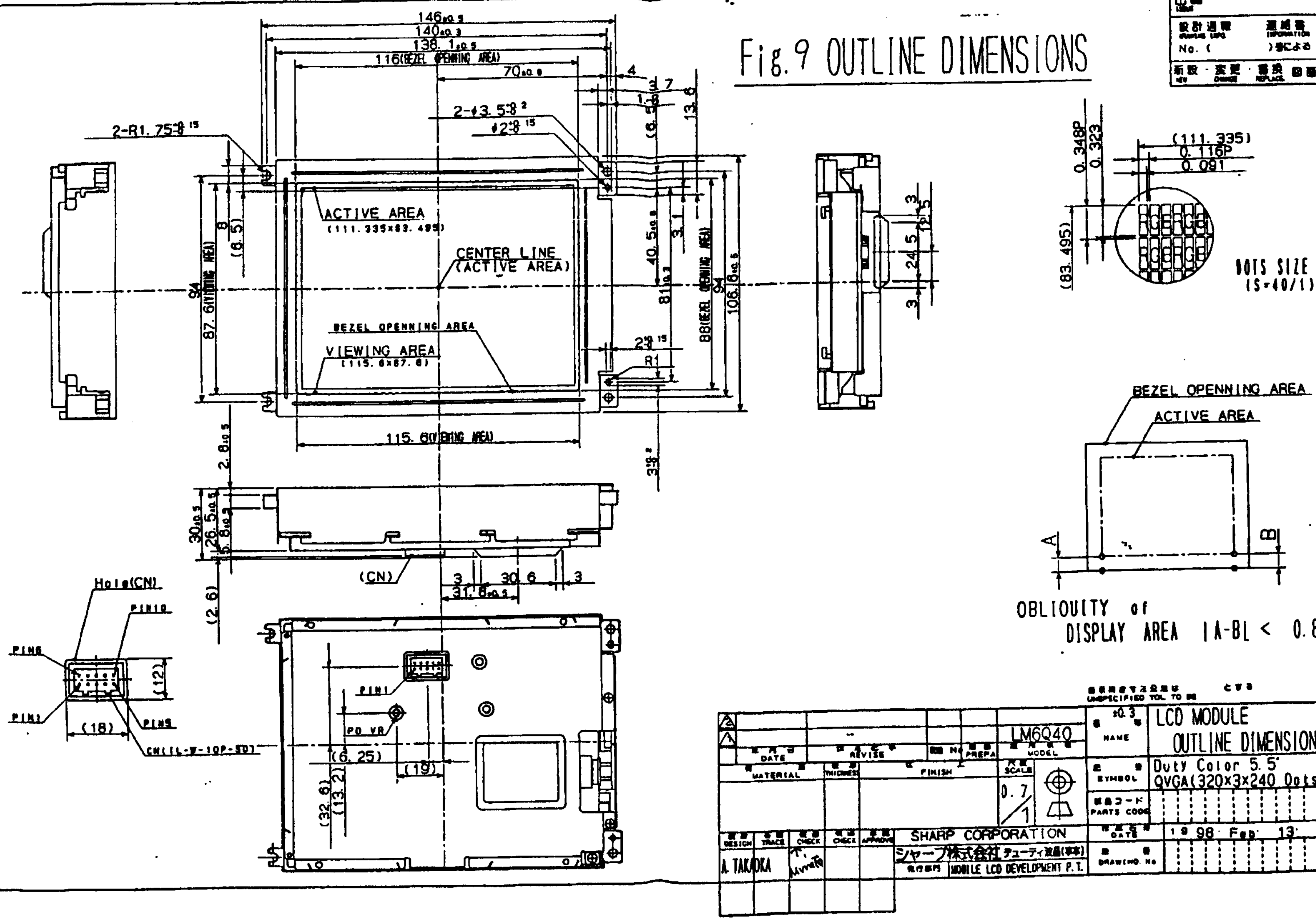




2								名称 NAME	NTSC InPut signal and DisPlY Period.
1									
年月日 DATE		改定記事 RIVISE		製造No	担当 PREPA	適用機種 MODEL			
設計 DESIGN	製図 TRACE	検図 CHECK	検図 CHECK	承認 APPROVE	SHARP CORPORATION			作成日付 DATE	1998 · 6 · 12 ·
					シャープ株式会社 デューティ液晶(事本)				
					発行部門	MOBILE LCD DEVELOPMENT P.T		図番 DRAWING No.	

Fig.9 OUTLINE DIMENSIONS



DATE	REVISE	PREPA	MODEL: LM6Q40	NAME	LCD MODULE OUTLINE DIMENSIONS
MATERIAL	THICKNESS	FINISH	SCALE: 0.7/1	SYMBOL	Duty Color 5.5" QVGA(320×3×240 Dots)
				PARTS CODE	
DESIGN: A. TAKAOKA			SHARP CORPORATION	DATE	1998 Feb 13
			MOBILE LCD DEVELOPMENT P.T.	DRAWING No	

UNSPECIFIED TOL. TO BE ±0.3

Analog RGB Interface, QVGA, CSTN, High Speed, High Contrast, LM6Q40