PREPARED BY:	DATE	SHARP	SPEC No.EP-99072
K Kamei	NOV 8 1999		FILE No.
CHECKED BY:	DATE	ELECTRONIC COMPONENTS GROUP SHARP CORPORATION	ISSUE
			PAGE
APPROVED BY:	DATE	SPECIFICATION	REPRESENTATIVE DIVISION ■ELECTRONIC CONPORNENT DIV. □OPTICAL DEVICE DIV. □PHOTO VOLTAICS DIV.
H Mohri	NOV 8 1999		

DEVICE SPECIFICATION FOR
COF (Chip On FPC) Unit

MODEL. DU3L1AF032A

User No.

□CUSTOMER'S ACCEPTANCE

DATE

BY

PRESENTED

BY T Yatsui NOV 9 1999

SHARP

MODEL No.
DU3L1AF032A

DOC.FIRST ISSUE

IDENT.DATA No.

RECORDS OF REVISION

DATE	REF.PAGE PARAGRAPH DRAWING No.	REVISED No.	SUMMARY	CHECK & APPROVAL

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SPECIFICATION OF DOT MATRIX LCD UNIT

1. General

1.1 Scope of Application

This specification applies to the positive type STN transflective dot matrix LCD unit which is supplied by Sharp Corporation.
[LCD specification: Bias 1/11, duty 1/104]
As to the basic specification of driver IC refer to the IC(NJRC NJU6678) specification and handbook.

1.2 Revision of Specification

If any trouble not prescribed in this specification occurs, the decision must be made after deliberation by both parties with sincerity. If revision of this specification is required, notice must be given to the partner without delay, and the specification must be revised after deliberation by both parties.
As to background color, color unevenness and luminance unevenness, decision must be made when necessary after deliberation by both parties.

2. Cares When Using

2.1 Cares When Mounting

(1) Since the LCD unit is easily damaged, due care must be taken when it is handled.
(2) When the LCD panel surface was contaminated, wipe it with absorbent cotton or soft cloth. If contaminant remains persistently, breathe on the panel, and then wipe.
(3) If drop of water remains for a long time, color change or staining is caused. It must be wiped off soon.
(4) The LCD panel (glass) is fragile. It must be handled with due care so that it is not dropped or hit against hard thing.
(5) The CMOS LSI used in the LCD unit is extremely sensitive to electrostatic charge. Provide the human body earth, electrostatic mat and destaticizing blower.
Handle it in the process where static electricity is 100V or below.
(6) The connection between LCD and COF may cause connection failure. Utmost care must be taken when it is handled.
(7) The organic materials are used for the LCD unit. Organic solvent may cause trouble. Take care so that any organic solvent does not contact.
(8) When carrying the LCD unit, use the tray so as to protect it (especially connection) from shock.
Use the conductive tray having insulation resistance about 10^6 to 10^9 ohm so as to prevent electrostatic damage to CMOS LSI.
(9) It is recommended to apply the rubber pressing holding structure for the connection between LCD and COF.
Recommended rubber: Silicone rubber SS-20 made by Shin-Etsu Polymer Co., Ltd.
(10) Light may cause malfunction of the driver IC. It must be designed so that light can be shielded when it is mounted.
(11) The front surface of LCD is protected with a protective film. Peel it when it is used.

2.2 Cares When Connecting Electrically

(1) So as to reduce impedance of power supply (VDD-GND), provide a condenser as close to the input terminal as possible.
(2) Since the specific operation is not performed inside, be sure to reset after the power is turned on.
(3) Since DC voltage is not applied to the LCD, turn on the logic system power (when power is turned on), and after initialization and liquid crystal output AC setting turn on power to the liquid crystal.
In case of power shut-off stop liquid crystal output AC after power to the liquid crystal is turned off.

2.3 Unit Mounting Angle

This unit has visual angle characteristics. It must be located in the position ensuring the easier watching in the real use state.

2.4 Unit Installation

(1) The unit is designed so that it is installed by users.
Take care so that warping and torsion stress does not affect the LCD.
Care must be taken so that excessive bending stress does not affect within environment 2.0 mm around the driver IC, tip resistors and condensers.
Stretching, compressing and bending stress must not be put to the driver IC and its enclosed part of the LCD unit, so user's cabinet and PWB should be designed not to contact with the IC of the unit.
(2) The LCD surface is protected with the protective film. Peel it when it is used. To prevent damage and contamination, provide the protective panel such as transparent acryl plate.

2.5 Others

(1) Avoid long-time influence of direct sunlight and intensive ultraviolet rays.
(2) In the environment where the operating temperature or humidity is higher or lower than the specified temperature or humidity do not use the LCD unit. At temperature lower than the rated storage temperature the liquid crystal is solidified, causing breakage of LCD panel. At temperature higher than the rated storage temperature the liquid crystal becomes isotropic liquid which cannot resume the initial state. Hence, the unit must be stored at a temperature as close to room temperature as possible.
(3) Display quality of LCD should be evaluated at the condition of optimum contrast.
(4) Generally,the LCD contrast changes depending on temperature. Temperature compensation circuit should be prepared by customer side in order for this COF unit to get the optimum contrast within the range of specified operating temperature.
(5) The dispersion (accuracy) of LCD power voltage may affect the LCD display contrast. It is necessary to provide the contrast adjusting function (electronic control, etc.).
(6) If the unit is used in any conditions not conforming to the specification, the warranty is invalid.
(7) The specification contains copyrighted information. Due care must be taken. The content of this specification must not be duplicated without preliminary permission.
(8) Examples of application described in the specification are intended to explain the typical applications of the product but not for guarantee of enforcement of industrial property or other properties or assent to licenses.
In the case when any problem relating to the industrial property of third party arises due to use of the Sharp's product, Sharp is not liable for this problem excepting problems which relate directly to the construction of Sharp's product or its production method.
(9) This product is made so that it is used for the general electronic equipment and is intended to be used for the following uses.
OA equipment, AV equipment, home-use electric appliances, communication equipment (terminals), etc.
(10) In the case when the product is used for the following uses which need high reliability, it is necessary to take proper means to maintain the reliability and safety of the equipment.
Electronic computers, machine tools, measuring instruments, traffic signal mechanisms, gas leak detecting and shut-off devices, antidisaster and anticrime devices, various safety devices
Control of transporting machines (airplanes, trains, cars) and units relating to safety, etc.

(11) In no case attempt to use this product for the following uses where extremely high reliability is required. Space equipment, communication equipment (main lines), atomic power controllers, medical equipment (for life-support systems), etc.

(12) This product does not use any ODS (specific chloro-fluoro carbon, specific halon, 1-1-1 trichloroethane, carbon tetrachloride) in all the production processes from raw materials to finished products. The product does not contain it.

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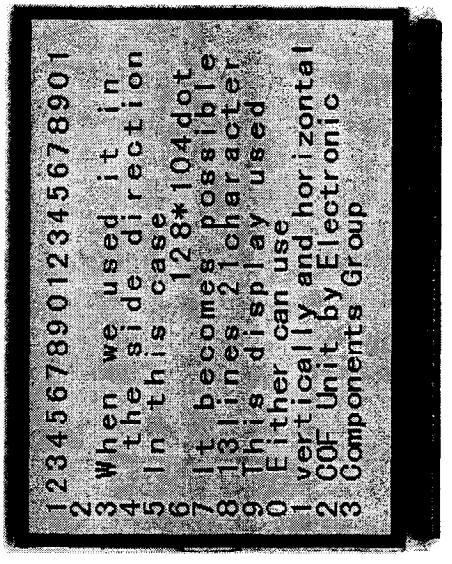
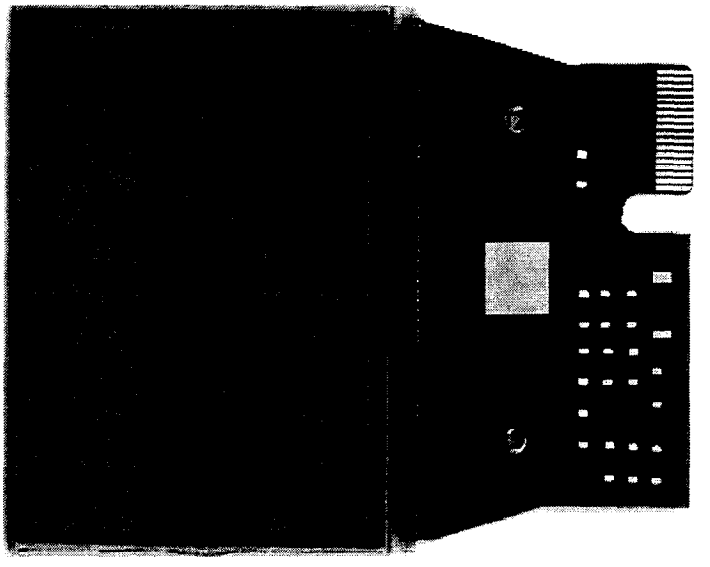
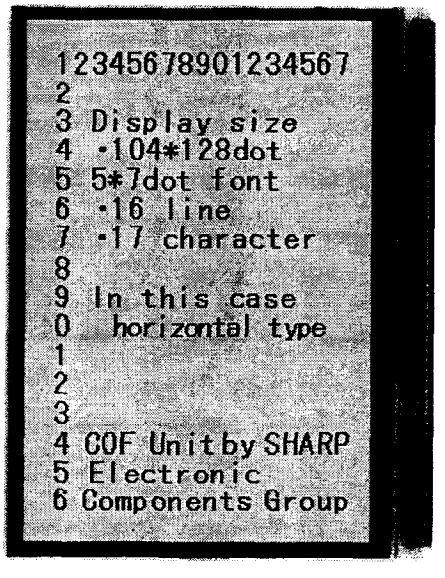
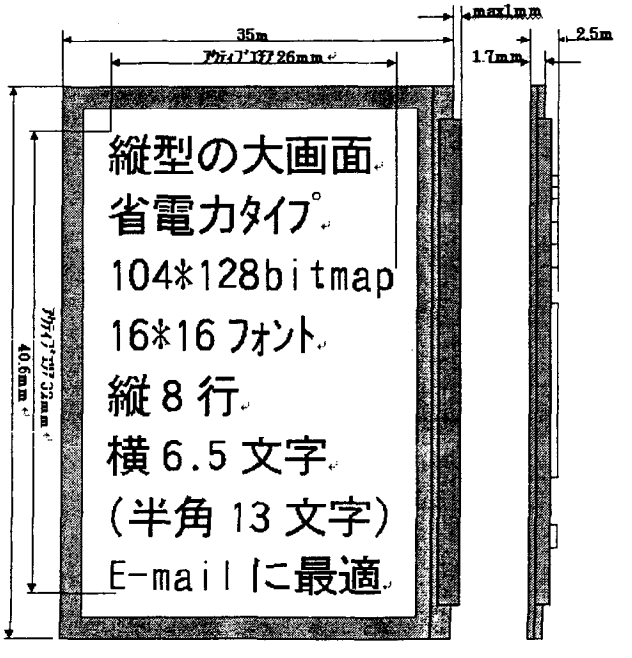
3. Construction and External Shape

Construction	:	LCD + COF(include Peripheral circuit)
External shape	:	Refer to LCD unit dimensional drawing
Connection	:	0.5mm Pitch terminal of ZIF type connector
Note	:	Silicon is applied at the area of LCD connection in order to prevent the display uneven in the humidity. (ITO exposed surface)









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4. Mechanical Specification

Item		Specification	Unit
External dimension of unit		Refer to the external dimension drawing.	mm
Effective display range		Refer to the external dimension drawing.	mm
Display size		104x128 DOTS	-
Dot size		0.235x0.235	mm
Dot Pitch		0.25x0.25	mm
Character color		Black	-
LCD	Type	FSTN, transflective, positive type	-
	Duty	1/104	
	Bias	1/11	
Weight		5.2	g

5. Absolute Maximum Rating

5.1 Electric Absolute Maximum Rating

SYMBOL	PARAMETER	MIN	MAX	UNIT
VDD	supply voltage range	-0.3	+5.0	V
V5	supply voltage range	VDD-17	VDD+0.3	V
V1,2,3,4	supply voltage range	-0.3	VDD+0.3	V

5.2 Environmental Condition

Item	Storage Temperature		Operating Temperature		Remarks
	Min	Max	Min	Max	
Ambient temperature	-30°C	+80°C	-20°C	+60°C	
Ambient humidity	Note 1		Note 1		Condensation not allowed

Note 1 Ta ≤ 40°C 90%RH max
Ta > 40°C Absolute humidity must be lower than 90%RH at Ta = 40°C. (excepting polarizer).

* Temperature of LCD unit must not be out of the specified temperature range.
* The LCD contrast is varied according to environmental temperature. Temperature compensation circuit should be prepared by customer side in order for this COF unit to get the optimum contrast within the range of specified operating temperature.

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6. Electric Specification

6.1 Electric Properties (Tentative)

Unless otherwise specified, VSS = 0V, VDD = 3V ±10%, Ta = -20 to 60°C

Item		Symbol	Conditions	Min	TYP	Max	Unit	Applied Terminal
Power voltage	Recommended operation	VDD		2.7	3.0	3.3	V	
High level input voltage		VIHC1		0.8 VDD	-	VDD	V	
Low level input voltage		VILC1		VSS		0.2 VDD	V	
Current consumption		IDD1	During power save mode		90		µA	
Current consumption		IDD2	Display VLCD=12v		220		µA	

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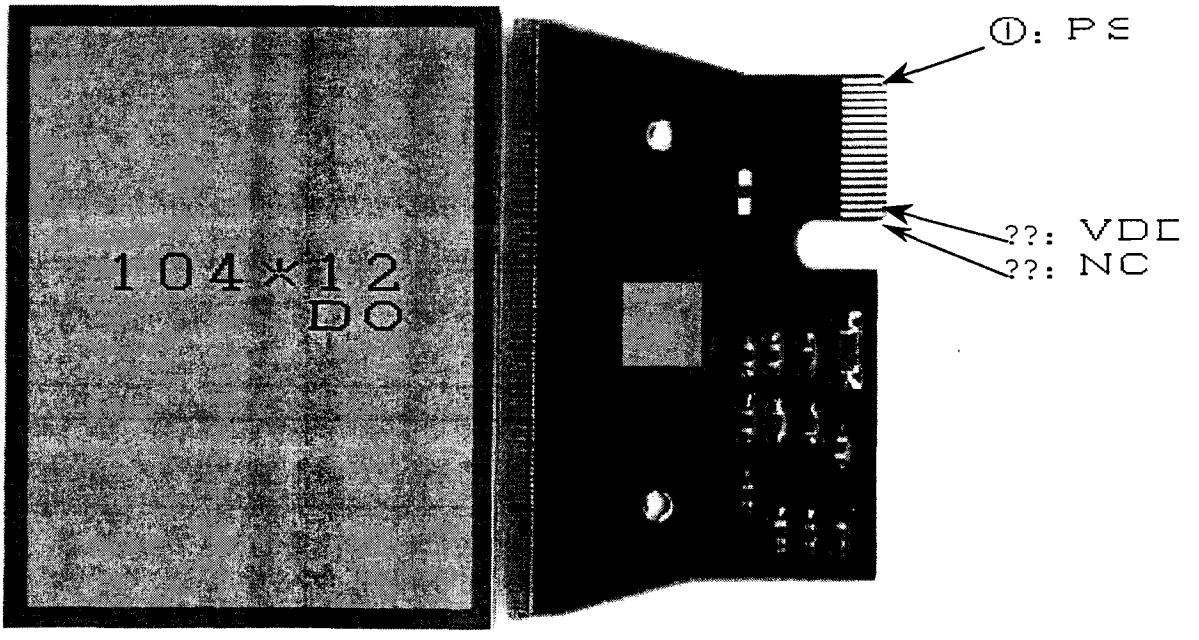
7. Interface Symbols(COF connection)

Terminal No.	Terminal name	I/O	Explanation
1	P/S	i	Serial or parallel interface selection terminal
2	M86	i	Used to select MPU interface type.
3	RESB	i	Resetting operation terminal.
4	CSB	i	Chip selection signal.
5	A0	i	Connect to the address bus MPU
6	WRB	i	<In case of 80 type MPU> Connect to the 80 type MPU WR signal. Active "L" The data on the data bus input syncronizing the rise edge of this signal. <In case of 68 type MPU> The read/write control signal of 68 type MPU input terminal.
7	RDB	i	<In case of 80 type MPU> RD signal of 80 type MPU input terminal. Active "L" During this signal is "L" ,D0~D7 terminals are output. <In case of 68 type MPU> Enable signal of 68 type MPU input terminal .Active "H"
8	D0	i/o	8bit parallel data
9	D1	i/o	8bit parallel data
10	D2	i/o	8bit parallel data
11	D3	i/o	8bit parallel data
12	D4	i/o	8bit parallel data
13	D5	i/o	8bit parallel data
14	D6(SCL)	i/o	Serial data clock signal input terminal. 8bit parallel data
15	D7(SI)	i/o	serial data input terminal. 8bit parallel data
16	VSS	↑power ↓	To be connected to 0V power source
17	VDD	GND	To be connected to +3V power source
18	NC	-	



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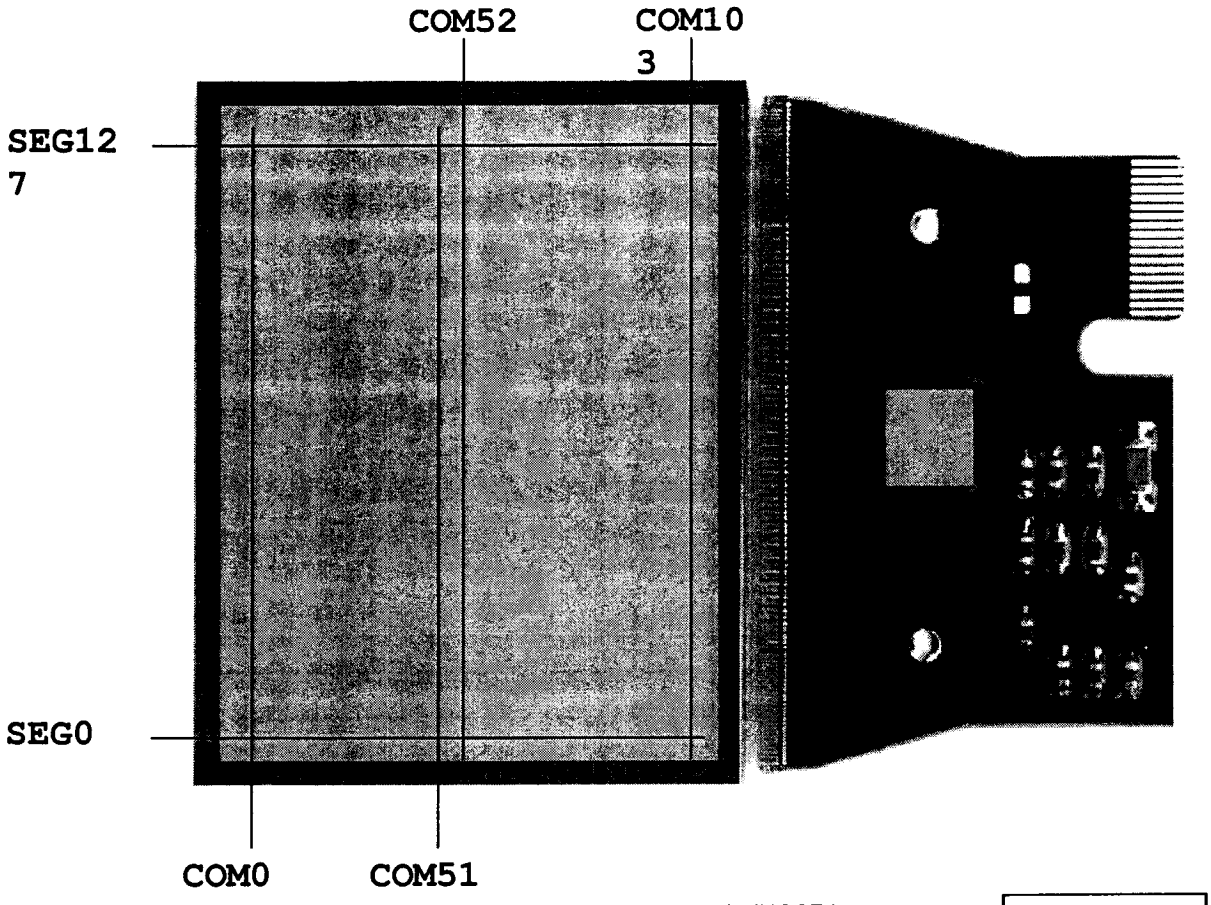
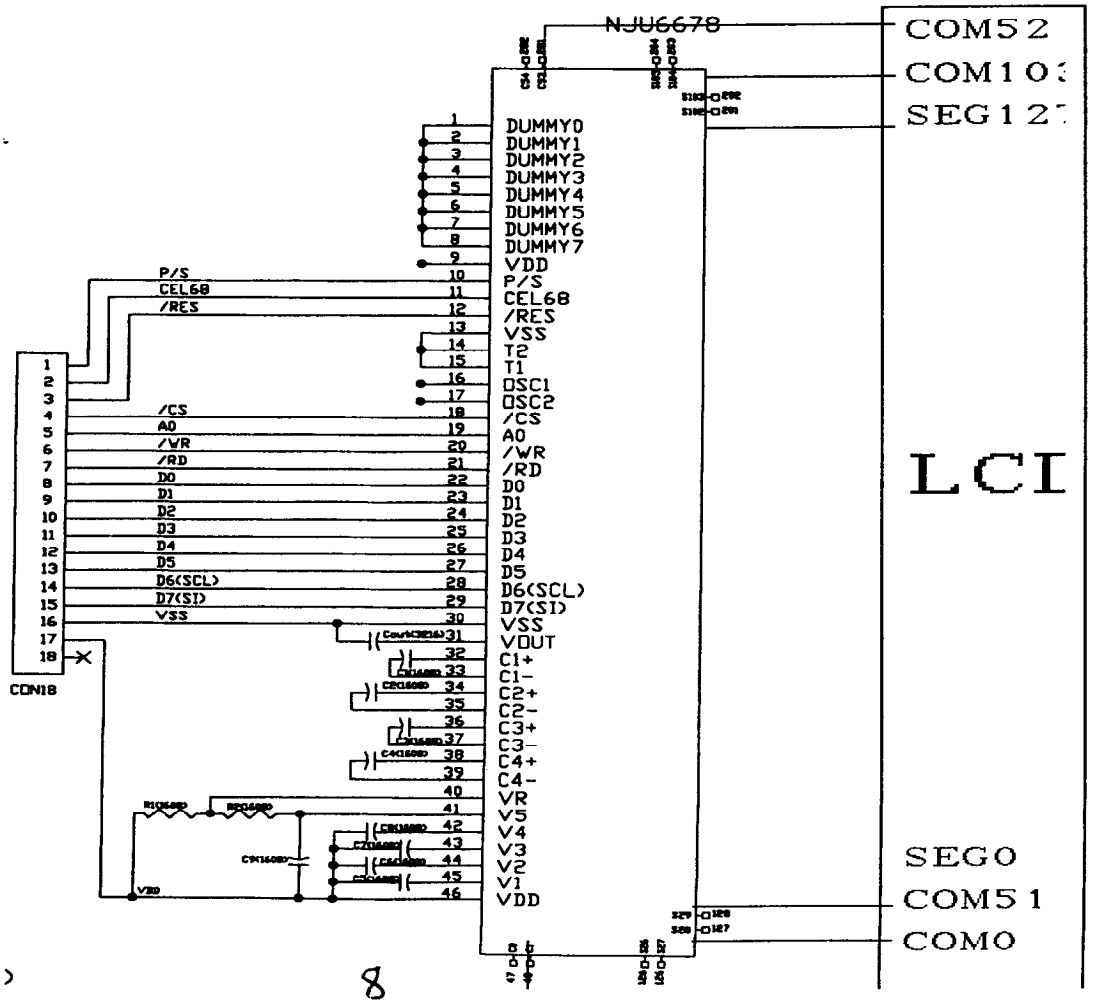
8. LCD Connection Diagram





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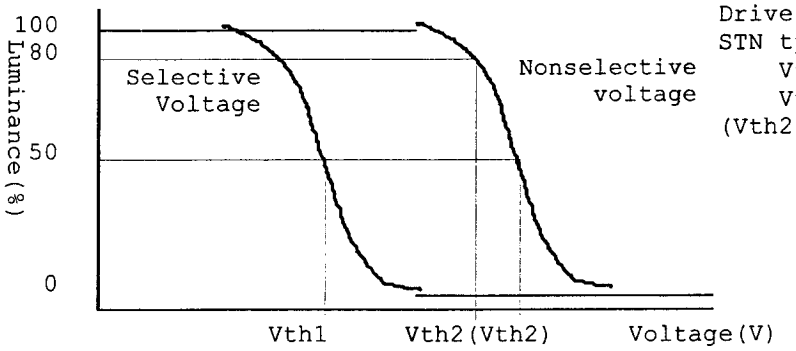
9. Electro optical Properties

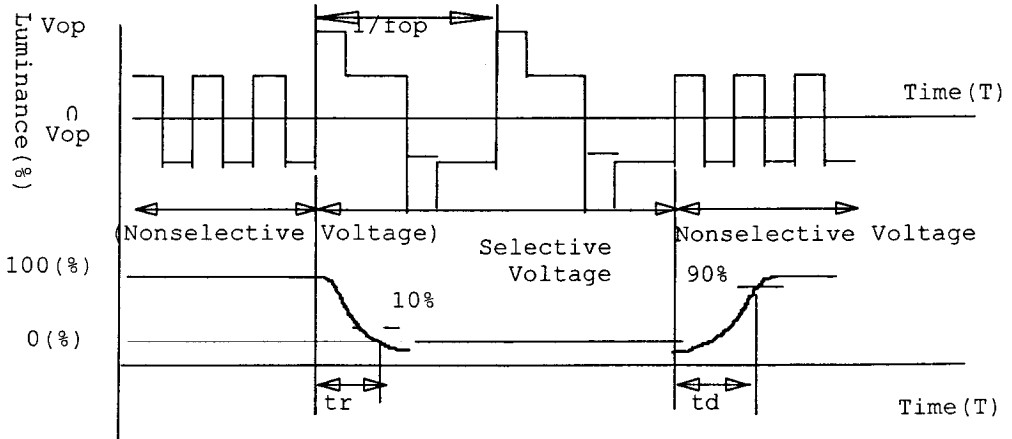
Item	Symbol	Temp. -C	type Standard Values Min	Standard value	Max	Unit	Conditions
Vth voltage	Vth	-20		12.5		V	Note 1
		+25		11.8			
		+60		10.8			
Frame frequency	fop	+25	-	(70)	-	Hz	Note 2
Response time	tr	-20	-	3300	6600	msec	Vop = Recommended voltage
	td		-	5300	10000		Note 2
	tr	+25	-	185	370		
	td		-	190	380		
Range of visual Angle	θ1	+25	-	50	-	DEG	Vop = 12.5V
	θ2	+25	-	130	-		Note 3
	f1	+25	-	30	-		
	f2	+25	-	30	-		
Contrast ratio	Cr	+25	4	7	-	-	Note 3 θ = 90- f = 0-

Note 1 Definition of Vth



Drive frequency:f=70Hz
STN type dot matrix display
Vth1 ?=0°f=0-
Vth2 ?=0°f=0-
(Vth2)is for dot matrix display

Note 2 Definition of frame frequency and response speed



Measurement conditions:
The visual angle is determined in the conditions shown in Note 1 above. Vop, Duty and Bias are determined in the conditions equivalent to drive conditions.

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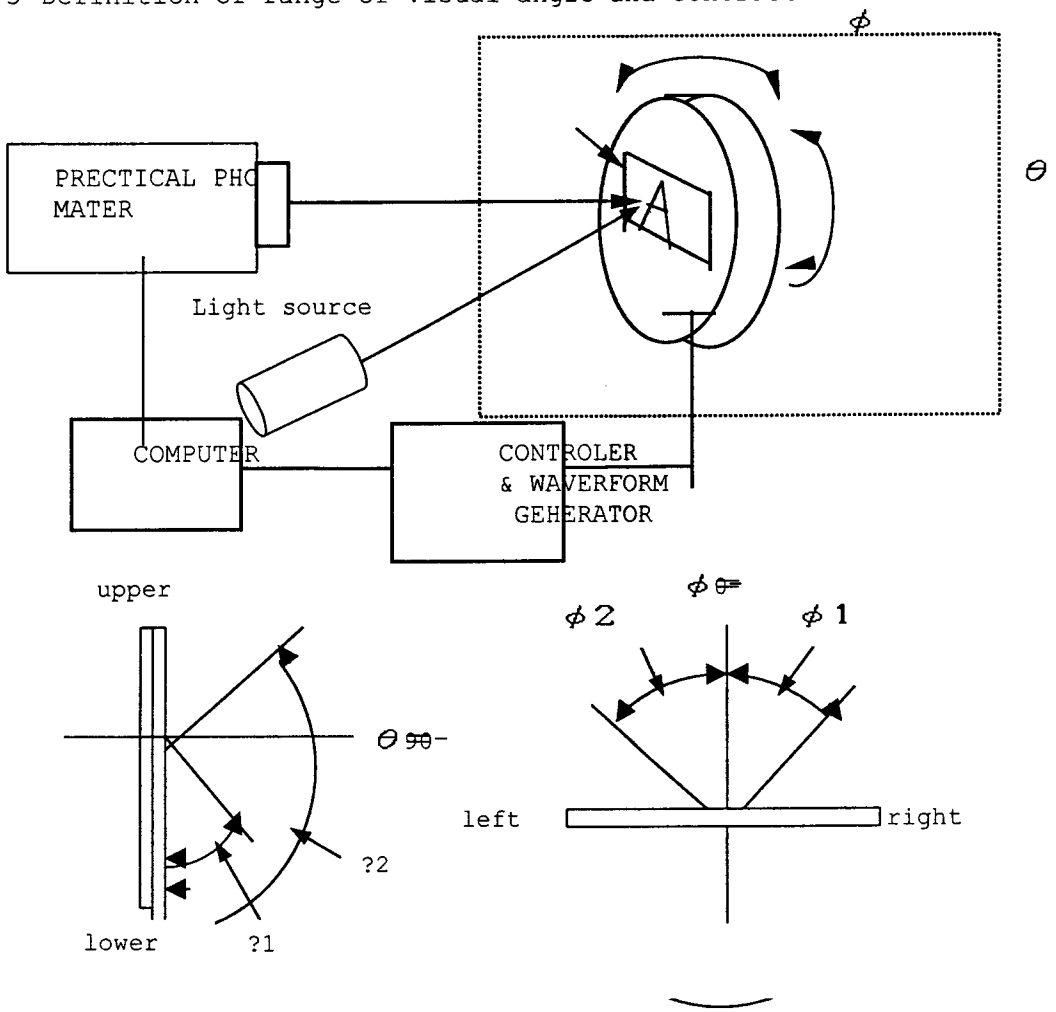
Note 3 Definition of range of visual angle and contrast ratio



The ratio of photomultiplier output A (when the selective voltage is applied to SEG) to photomultiplier output B (when nonselective voltage is applied) is referred to as contrast ratio at best visual angle ?1-.

Contrast ratio = (B/A)n Positive type: n = 1
Negative type: n = -1

Range of visual angle

Dot matrix display: Cr ? 2.0 (the range shown above)

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10. Reliability

Item	Conditions	Criteria	Remarks
1) Low temperature holding	-20-C, 240 hrs.	Performance and outward appearance must be satisfactory when 2 hours elapse after taking-out.	1)-5) Note 1
2) High temperature holding	60-C, 240 hrs.		
3) High humidity holding	40-C, 90%RH, 240 hrs.		
4) Temperature cycle	-20-C (30 min),25-C(5 min), 60-C (30 min) : 10cycle		
5) Bending characteristics	Bendable in condition of R = 0.38 mm (at a distance 2.0 mm or more from LSI) However, only FPC ink cover lay covered part (except the circuit pattern's exposed part and chip CRs' mounted part)		
6) Vibration characteristics	Packing state 5 Hz - 50 Hz - 5 Hz Up and down 30 min, to the left and right 15 min, forward and backward 15 min Acceleration 9.8 m/s^2		6),7) Note 2
7) Impact test	Drop the packaged product from height of 70 cm down to the hard wooden board laid on concrete. 1 angle, 3 edges, 6 surfaces, 10 times in all		

Note 1: The reliability check must be performed for each LCD unit (in shipping state).

Note 2: The reliability check must be performed in shipping-packaged state.

11. Other Electro-mechanical Conditions

Item		Conditions
FPC	Insulation resistance	Interpattern insulation resistance must be 100 Mohm or more. (DC100V)
	Electric strength	Interpattern electric strength must be AC500V (1 min or more.)
COF	Bending strength	Bendable in condition of R = 0.38 mm (At a distance of 2.0 mm or more from mounted LSI chip end) Only FPC ink cover lay covered part (except the circuit pattern's exposed part and chip C Rs' mounted part)

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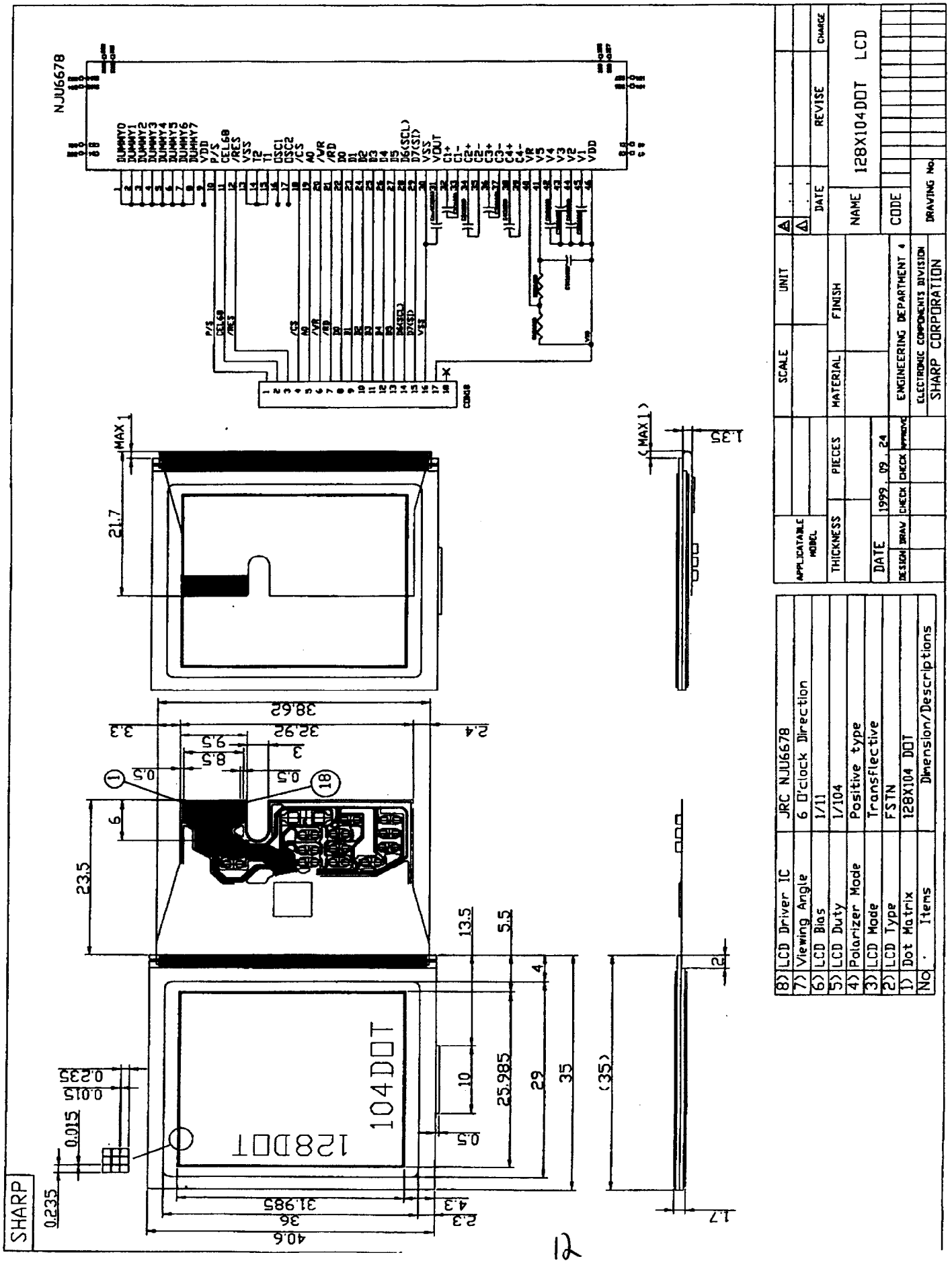
12. Dimensional Drawing



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13. Outgoing quality level

1 Purpose
This inspection standard applies to the Outgoing Inspection of COF-LCD unit , assurance by the Dept.
of Product Quality Assurance, Electronic Components Division.

2 Range of Applied tests
The inspection standard will be applied for Appearances, Display condition, Electric characteristics.

3.Inspection Method
ISO-2859, 1989, level II regular inspection and extract inspection to be applied.

4. Unit of Inspection
To test per one lot. To specify quality per warehouse regarded as one lot.

5. Pass or Failure Judgement
5.1 The lot to be judged as "Pass" when it meets all categories of inspection.
5.2 The lot to be judged as "Failure" when it has fault more than one.
5.3 Appearances Lot Judgement
Pass : In case a number of quantity of fault is equal to or below the number of quantity (AC)
which has been judged as Pass, to be defined as good.
Failure : In case a number of quantity of fault is equal or exceed the number of quantity (Re)
failures, the "lot" defined to be rejected.

5.4 AQL

	AQL
Major defect	1.0%
Minor defect	2.5%

5.5 Standard for Unit Judgement

Test items	Standard for Judgement
Appearance check Conductive and Display check	To be followed by another standard(PS) ditto

5.6 Testing Conditions
Temperature needs to be maintained at room temperature (20 ~30?),and room humidity
40 ~80%RH level.

①Conductive and Display appearance check
The designated conductive checker should be used under condition of a 20W (one-bulb) daylight
Fluorescent lamp (600-900 LX), 50 cm height from the object.
Test should be done by visual 30 cm distance from the eyes.

②Other Appearance check
The conditions should be used under condition of a 20W(one-bulb) daylight fluorescent lamp
(600-900LX), 50cm height from the object.

6. Process for Failure lot
The whole lot must be returned immediately to production line for re-inspection.
After re-work of failure lot must have extract inspection described article # 3

7. Others

7.1 The items and conditions not listed in this standard must follow the products specifications.
7.2 Any doubts or inconveniences have been occurred, there must have discussed and found countermeasure.

Appearance check (Except LCD)				
No.	Test Items	Justification for Defect	Defect Classification	
			Major	Minor
1-1	Parts Mounting	Misassemble, opposite direction and parts missing	○	
1-2	Cracking	Deep and critical cracking	○	
1-3	Chip Resin Finish	Incomplete resin finish Clacking in the resin from edge of the resin to the tin-plate area. Peeling the resin in a distance of1mm from edge of the resin.	○	○ ○
1-4	FPC damage	Broken and damaged heavily, not usable condition	○	
1-5	FPC Copper plated scratch	Scratched and broken	○	
1-6	FPC	Wire short, snapping or possible coming off Pin-hole and bubble appearing in Cover-Ray Foreign substance	○ ○ ○	
1-7	FPC tin gilding (input terminal)	Foreign substances adhering or spotted might become reliability problem	○	
1-8	Heated seal	Coming-off !	○	
1-9	Soldering	In complete soldering affects to the performance Soldering ball of diameter bigger than 0.3mm Abnormal soldering which causes to touch neighbor patterns/parts	○ ○	○

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Conductive and Display check				
No.	Test Items	Justification for Defect	Defect Classification	
			Major	Minor
2-1	Display conductive testing	Not correct display pattern is show when test pattern is in-put by checker a)All dots are lighting or not lighting due to open or short b)Every line, alternate lighting and not lighting pattern due to leakage Missing vertical lines Missing horizontal lines	○	
2-2	Glass damage			
	Corner of terminal	Length of missing must below 6mm max		○
	Terminal parts	The depth exceeds a half of terminal length A damage which depth is between 1/2 ~1/3 of terminal length and extends over 4 terminals.		○
	Other part	The depth exceeds a half of terminal width Even the depth is not exceeding above width of seal less than 0.4mm		○
	Glass edge damage			
	Terminal	The depth is the same as a terminal part of glass damaging standard		○
	Others	The depth exceeds 2.5mm and the thickness exceeds two third. (When a thickness of glass two third for application exceed a glass damaging standard)		○
2-3	Segment			
	White dots & lines	Dot's shape Average diameter exceeds 0.30mm More than two of things that average diameter doesn't exceed 0.3mm (It doesn't matter under 0.2mm in average diameter) Line's shape More than two of things that the width exceeds 0.06mm and the length exceeds 2.0mm More than two of things that the width doesn't exceed 0.06mm and the length exceeds 5.0mm (It doesn't matter under 0.03mm wide)		○ ○
	Characters form	Not meets patterns in the specification except it's considered not hindrance in appearance and function wise		○
	Blue & white dots	At the most optimum contrast, to be appeared the following blue & white points in the display area,. Average diameter exceeds 1.3mm Equal to or more than three of things 0.9mm ~ 1.3mm in average diameter		○

	Black & white lines	At the most optimum contrast, to be appeared the black and white line in the display area		○
2-4	Cell display area			
	Black dots, Foreign Substance and denting	Average diameter exceeds 0.30mm Equal to or more than two things 0.25mm ~0.30mm in average diameter Equal to more three things that average diameter doesn't exceed 25mm (It doesn't matter under 0.2mm in average diameter)		○
	Black line & scratch	Equal to more than two of things that the width exceeds 0.06mm and the length exceeds 2.0mm Equal to or more than two of things that the width doesn't exceed 0.06mmand the length exceeds 5.0mm (It doesn't matter under 0.03 mm wide)		○
2-5	Polarizing plate Bubble & crease	Average diameters exceeds 1.2mm Average diameter: 0.7mm ~1.2mm equal to or more than 2.(two) Diameter exceeds width 1.2mm, length 6.0mm Diameter width below 1.2mm, length 0mm equal to or more than 2.(two) (It doesn't matter under 0.4mm)		○
	Stains、dust	Stains can't be removed using soft cloth (except dust at inner gasket)		○
2-6	Position of fixing a reflector / a polarizer	Dislocation in effective display		○
2-7	Consumption current	Do not meet standard in the specifications	○	
2-8	External Dimension	Dimensions do not meet standard in the specifications	○	
2-9	Uneven color	Color should be even (Compare with the worst limited sample)		○

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14. Packing