

Customer: _____

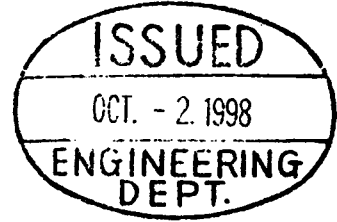
No. _____

Date: OCT., 2, 1998

Attention: _____

Your Ref. No: _____

Your Part No: _____



SPECIFICATIONS

ALPS: LCD MODULE

MODEL: LSUBL617XA

Spec. No: LSUBL617XA-1

Sample No: _____

RECEIPT STATUS
RECEIVED
By. Date _____
Signature _____
Name _____
Title _____

ALPS ELECTRIC CO., LTD

HEAD OFFICE
1-7, YUKIGAYA-OHITSUKA-CHO,
OHTA-KU, TOKYO 145 JAPAN

DSG'D S. Takita

APP'D S. Takita
ENG. DEPT. DIVISION

Sales

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						<i>Shimizu</i>	<i>Shimizu</i>	<i>Stokuta</i>
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1. General

1.1 Scope

This specifications is applied to LCD module. ALPS P/N:LSUBL617XA.

1.2 Outline

This device is possible to show graph and letter at will.

(Input signals results in to change Liquid Crystals.)

1.3 Recommended applications

Office Automation Equipment (EX: FAX), Factory Automation Equipment, Hand Writing Device (HWD)

2. Environmental status

Item	Status	Unite	Note
Operating temperature	0~50	℃	-
Storage temperature	-20~70	℃	-
Humidity	0~90	%RH	Note 1

Note 1) Pay attention to keep dewdrops.

3. Applicable documents and definition

3.1 Definition of words

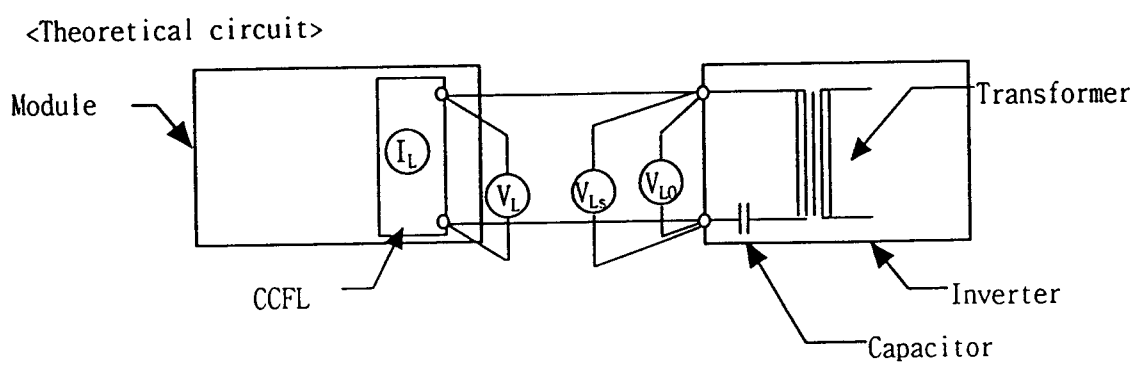
3.1.1 LCD module

Item	Definition
COMMON (COM)	Common electrode
SEGMENT (SEG)	Segment electrode
DF GENERATOR	Part of LCD circuit that generate a signal.
V_{LCD}	This voltage is directory supplied to LCD cell.
$1/bV_{LCD}$	Bias voltage for LCD driving.
DUTY	Number of timesharing.

3.1.2 Backlight

Item	Symbol	Definition
Open voltage	V_{LO}	Output voltage of inverter ※Non-LOAD
Startup voltage	V_{LS}	Supply voltage for CCFL Unit (When this voltage is applied to CCFL, Backlight radiate steady light.)
CCFL voltage	V_L	Supply voltage for CCFL
CCFL current	I_L	Supply current for CCFL

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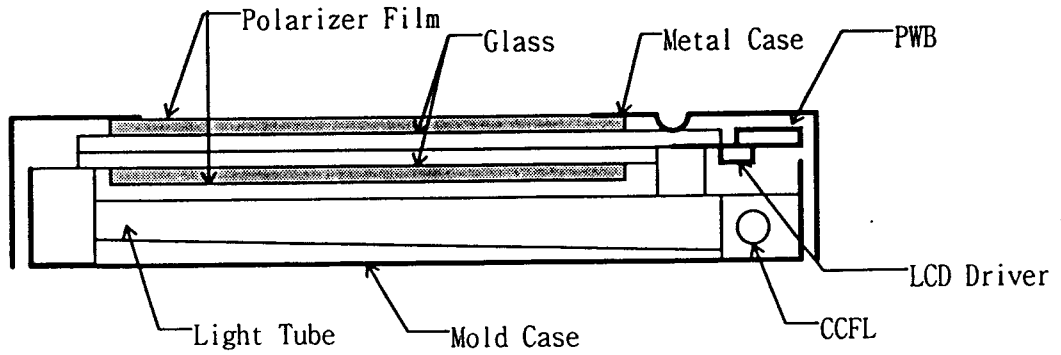
3.2 Definitions of abbreviations

Item	Definition
LCD	Liquid Crystal Display
RF STN	Retardation Film Super Twisted Nematic
CCFL	Cold Cathod Fluorescent Lamp

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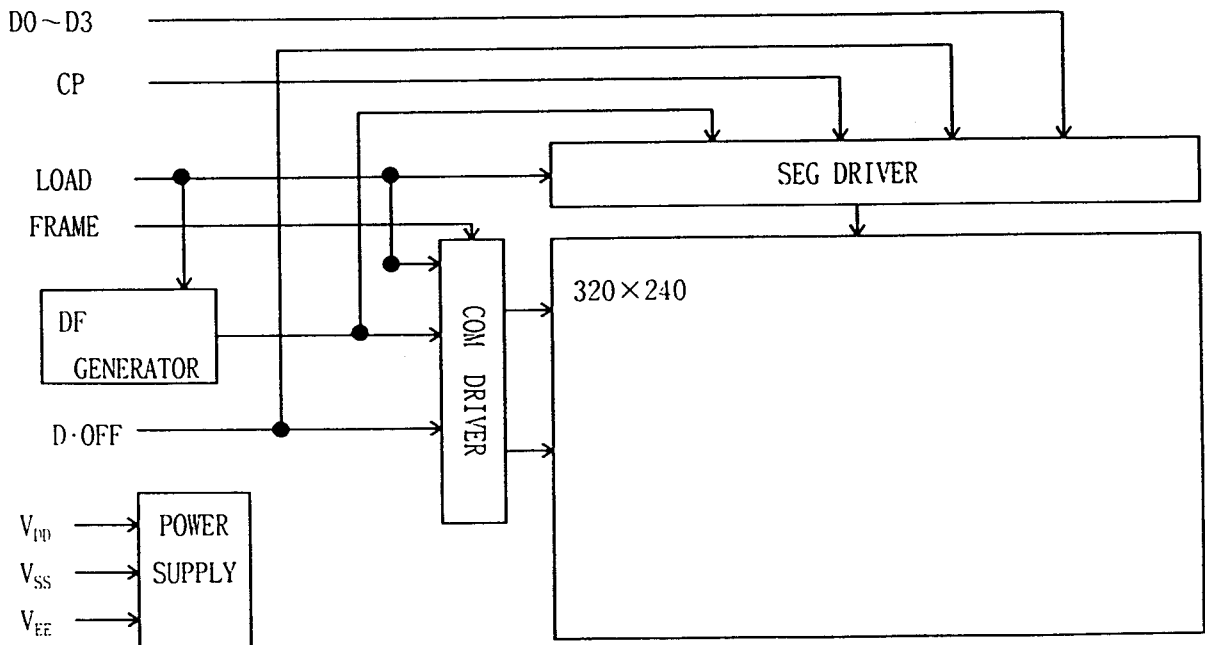
4. Principle of operation

4.1 Basic structure



Item	Specification	Unit
Display format	320×240	—
Dot pitch	0.36×0.36	mm
Dot size	0.33×0.33	mm
Display mode	RF STN, Transmissive	—
Background color	BLUE (negative type)	—
Backlight	CCFL	—
Duty	1/240	—

4.2 Block diagram



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4.3 Interface

4.3.1 LCD connector

CNI : HIROSE ELECTRIC CO., LTD. ;DF13-14P-1.25H Note 2

Pin No.	Symbol	Function	Notes
1	FRAME	Frame start signal(Data signal of the shift register of the Common driver)	H→L
2	N.C	—	—
3	LOAD	1)Latch pulse of shift register data 2)Shift clock for Common driver	H→L
4	CP	Clock pules for Segment shift register	H→L
5	D-OFF	H: Display on, L: Display off	—
6	D0	Input data signal	H : ON
7	D1		L : OFF
8	D2		Note 1
9	D3		
10	V _{DD}	Power supply for Logic(5 V)	—
11	V _{SS}	GND(0 V)	—
12	V _{EE}	Power supply for LCD(+)	—
13	V ₀	Power supply for contrast adjusting.	—
14	F.G	Frame GND	—

Note 1)In case of positive type : H(■),L(□)

In case of negative type : H(□),L(■)

Note 2)Recommended fitting connector : HIROSE ELECTRIC CO., LTD. ;DF13-14S-1.25C.

4.3.2 Backlight connector

FLCN : J.S.T MFG CO .. LTD ;BHR-03VS-1 Note 3

Pin No.	Symbol	Function	Notes
1	HOT	Voltage for CCFL(Backlight)	—
2	NC	—	—
3	NC	—	—
4	COLD	GND	—

Note 3)Recommended fitting connector : J.S.T MFG CO.,LTD ;SM02(8.0)B-BHS-1-TB

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5. Performance and characteristic

5.1 Absolute maximum ratings

5.1.1 LCD module

Item	Symbol	Condition	Min.	Max.	Unit	Notes
Supply voltage for Logic	$V_{DD}-V_{SS}$	—	-0.3	6.0	V	—
Supply voltage for LCD	$V_0(V_{FE})-V_{SS}$	—	0	30.0	V	—
Input voltage of signal	V_I	—	-0.3	$V_{DD}+0.3$	V	—

5.1.2 Backlight

Item	Symbol	Condition	Min.	Max.	Unit	Notes
Open voltage	V_S	$T_a=0\text{ }^\circ\text{C}$, $f_L=55\text{ kHz}$	860 Note 1	2000	Vrms	—
CCFL current	I_L	$T_a=25\text{ }^\circ\text{C}$, $f_L=55\text{ kHz}$	2.0	9.0	mArms	—

Note 1) Minimum voltage to CCFL at 0 °C.

5.2 Mechanical characteristics

Item	Specification	Unit
Dimension	Specified by the drawing	mm
Viewing area	Specified by the drawing	mm
Weight	Max. 165	g

5.3 Optical characteristics

5.3.1 LCD panel Measuring equipment: LCD-7000(OHTSUKA ELECTRONICS CO.,LTD.)

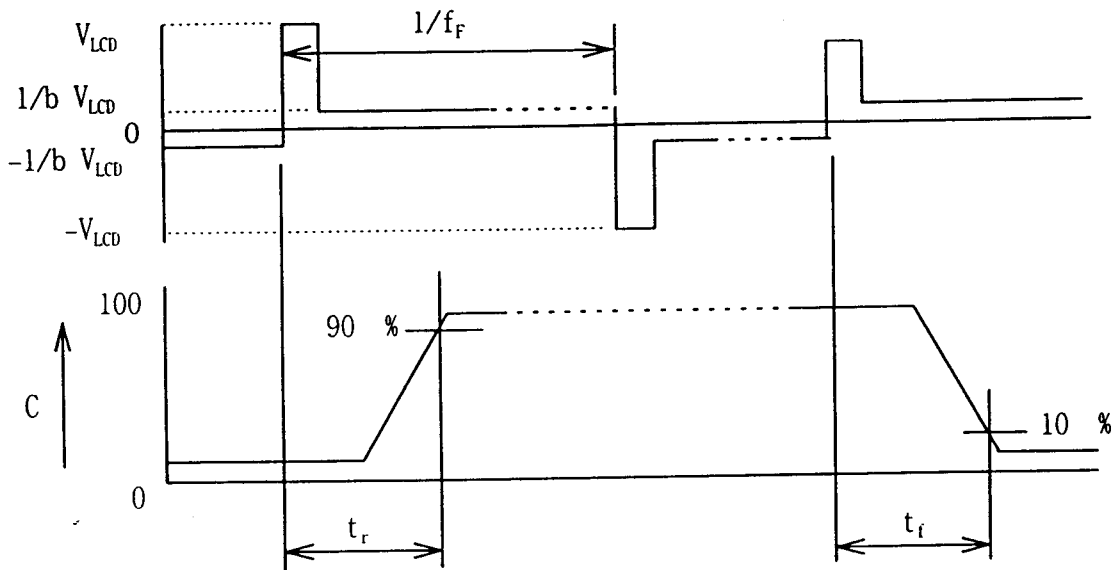
No.	Item	Symbol	Temp. (°C)	Min.	Typ.	Max.	Unit	Notes
1	Response time (Rise)	t_r	0	—	—	1100	ms	—
			25	—	370	450		
	Response time (Fall)	t_f	0	—	—	650	ms	Note 2
			25	—	180	250		
2	Viewing angle	Upper- θ_{UPPER}	25	15	—	—	deg	$K \geq 2$, Note 3
		Lower θ_{LOWER}	25	30	—	—		
	Left- Right	ϕ_{LEFT}	25	30	—	—	deg	$K \geq 2$, Note 3
		ϕ_{RIGHT}	25	30	—	—		
3	Contrast	K	25	3.5	4	—	Note 4	

5.3.2 LCD module Measuring equipment: BM-5A(TOPCON CORPORATION)

No.	Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Notes
1	Brightness	I	—	—	210	—	cd/m ²	Note 5

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Note 2) Definition of response time and measuring condition

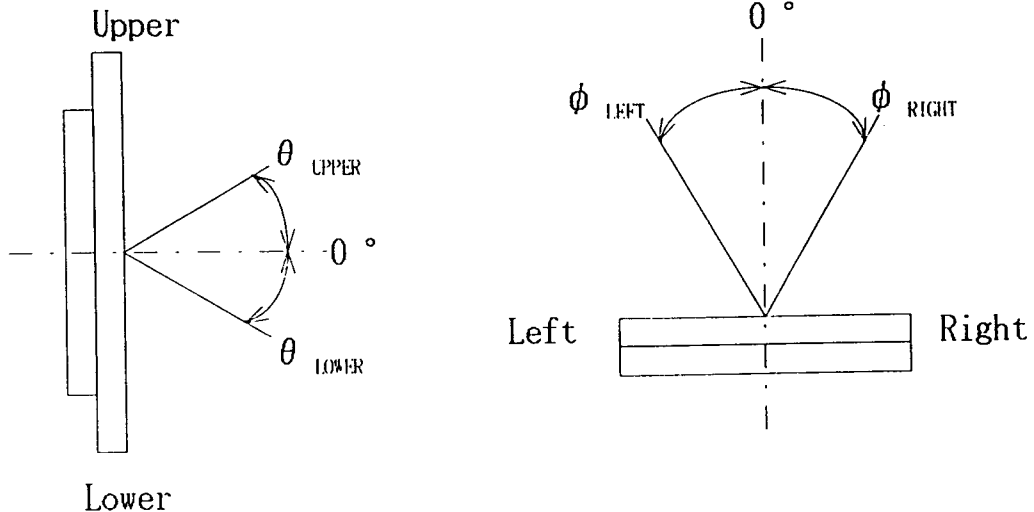


- Measurement condition
- | | |
|--------------------|---|
| 1) Temperature | : $T_a = 0, 25 \text{ }^\circ\text{C}$ |
| 2) Frame frequency | : $f_F = 70 \text{ Hz}$ |
| 3) Viewing angle | : $\theta = \phi = 0 \text{ }^\circ$ |
| 4) Supply voltage | : $V_{LCD} = (\text{Max. Contrast at } 0 \text{ }^\circ\text{C})$
: $V_{LCD} = (\text{Max. Contrast at } 25 \text{ }^\circ\text{C})$ |

※ In case of positive type: $C = \text{Blackness}$

※ In case of negative type: $C = \text{Brightness}$

Note 3) Definition of viewing angle



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Note 4) Definition of contrast ratio

$$\text{Contrast } K = \left(\frac{B_n}{B_s} \right)^N$$

Measurement condition

1) Temperature	: Ta=25 °C
2) Frame frequency	: f _F =70 Hz
3) Viewing angle	: θ = φ = 0 °
4) Supply voltage	: V _{LCD} (Max. Contrast)

※In case of positive type : N=1

※In case of negative type : N=-1

B_n: Reflectance value of non-selected condition (Voltage of Photometer)

B_s: Reflectance value of selected condition (Voltage of Photometer)

Note 5) Measurement condition of Brightness

1) Measuring Time	: 30 min. after CCFL on
2) Temperature	: Ta=25 °C
3) Humidity	: 30~80 %
4) CCFL current	: 5.0 mA _{rms}
5) Supply voltage	: V _{LCD} (Max. Contrast)
6) Measuring equipment	: TOPCON BM-5A

5.4 Electrical characteristics

5.4.1 LCD DC characteristics (V_{DD}=5.0 V±10 %, Ta=25 °C, Frame frequency f_F=70 Hz)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Notes
Input high level voltage	V _{IH}	—	0.8 V _{DD}	—	V _{DD}	V	—
Input high level voltage	V _{IL}	—	0	—	0.2 V _{DD}	V	—
Supply current	I _{DD}	V _{DD} =5.0 V, V ₀ =24.9 V	—	3.0	6.0	mA	Note 6
	I _{EE}	V _{DD} =5.0 V, V ₀ =24.9 V	—	4.5	9.0	mA	Note 6
Supply voltage for Logic	V _{DD}	—	4.5	5.0	5.5	V	—
Supply voltage for LCD	V _{EE}	—	22.3	24.9	27.4	V	Note 7

Note 6) Checker pattern while measuring I_{DD} and I_{EE}.

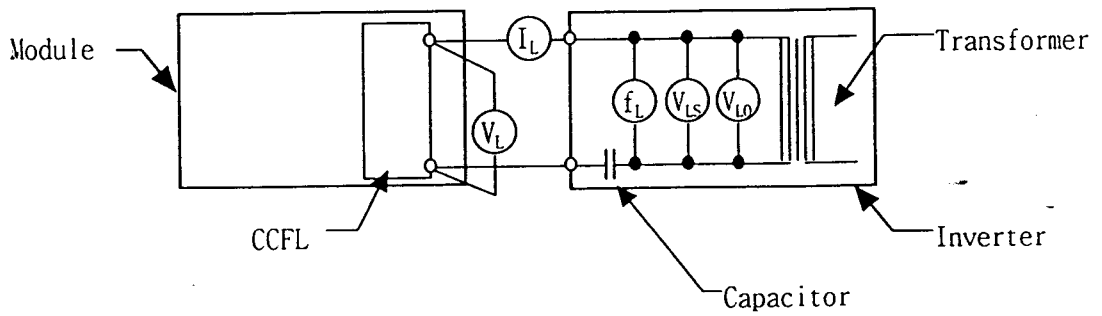
Note 7) "Supply Voltage for LCD" (V_{EE}) is changing by ambient temperature. To set up potentiometer value, evaluate V_{EE} in the range of operating temperature.

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5.4.2 Backlight DC characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Notes
Startup voltage	V_{LS}	0 °C	700	780	860	Vrms	—
		25 °C	470	520	570	Vrms	—
CCFL voltage	V_L	25 °C	310	345	380	Vrms	—
CCFL current	I_L	25 °C	4.5	5.0	5.5	mA rms	—
Operating frequency	f_L	25 °C	50	55	60	kHz	—
Power consumption	P	T=25 °C, f _l =55 kHz	1.4	1.73	2.09	Wrms	-

Test circuit)



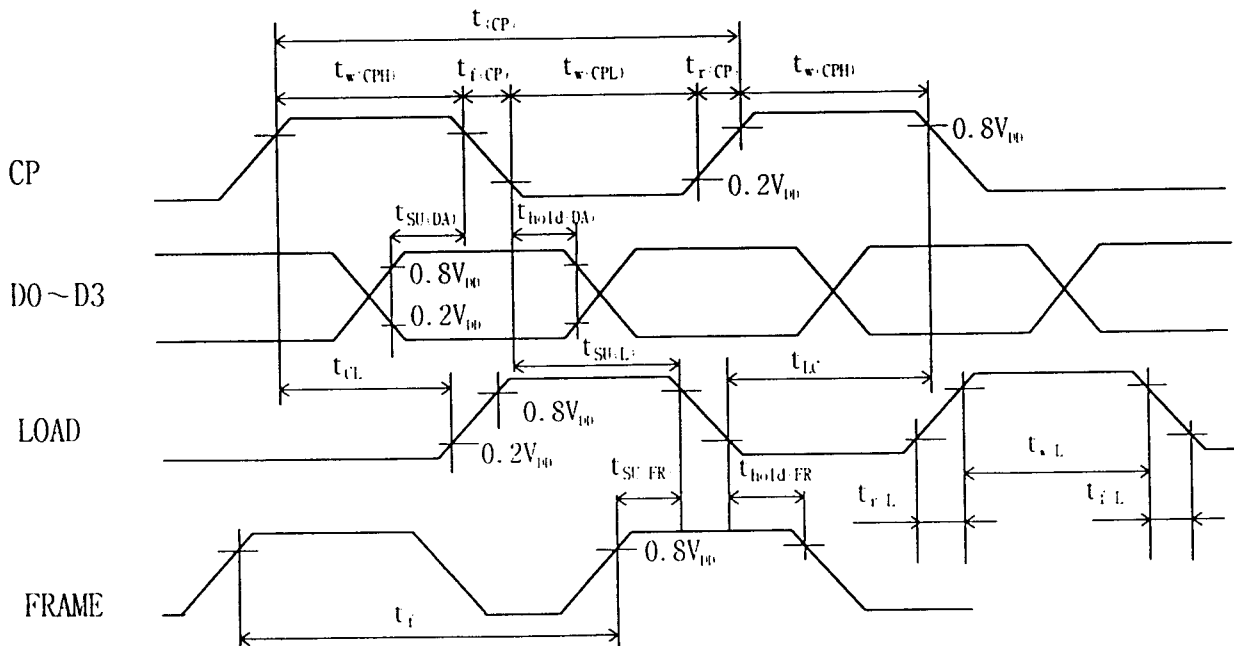
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5.4.3 AC characteristics

($V_{DD}=5V \pm 10\%$, $T_a=0 \sim 50^\circ C$)

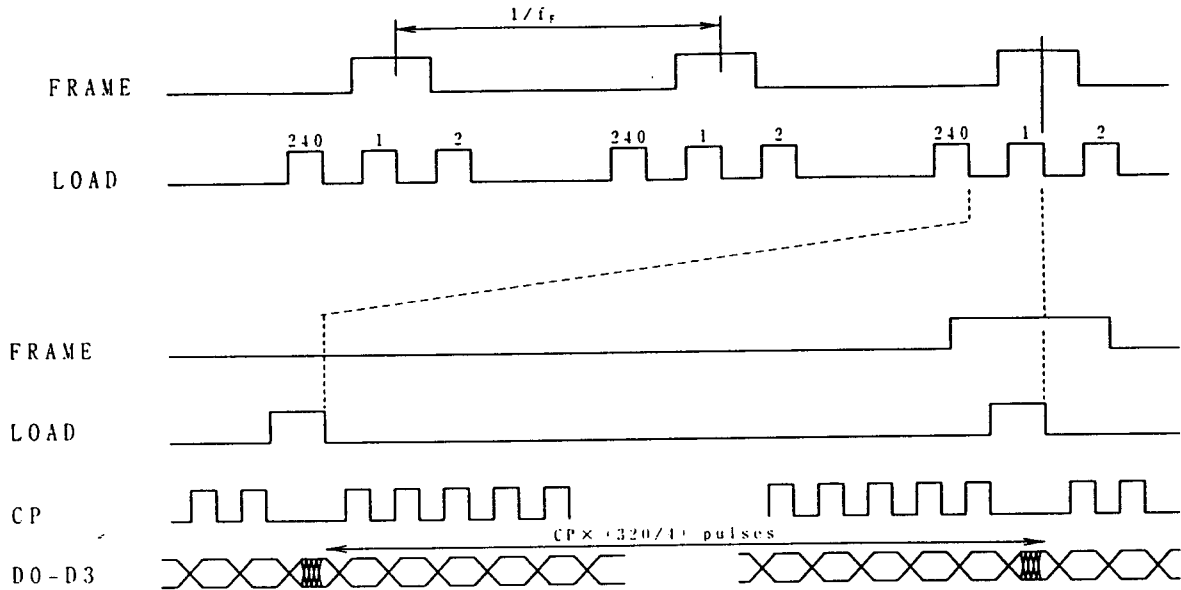
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Notes
CP cycle time	t_{CP}	—	125	—	—	ns	—
CP pulse width	$t_{w(CPL)}, t_{w(CPH)}$	—	50	—	—	ns	—
CP rise time	$t_{r(CP)}$	—	—	—	Note 8	ns	—
CP fall time	$t_{f(CP)}$	—	—	—	Note 8	ns	—
DATA setup time	$t_{su(DA)}$	—	50	—	—	ns	—
DATA hold time	$t_{hold(DA)}$	—	50	—	—	ns	—
LOAD→CP time	t_{LC}	—	40	—	—	ns	—
CP→LOAD time	t_{CL}	—	40	—	—	ns	—
LOAD pulse width	$t_{w(L)}$	—	45	—	—	ns	—
LOAD setup time	$t_{su(L)}$	—	50	—	—	ns	—
LOAD rise time	$t_{r(L)}$	—	—	—	Note 8	ns	—
LOAD fall time	$t_{f(L)}$	—	—	—	Note 8	ns	—
Setup time FRAME→LOAD	$t_{su(FR)}$	—	45	—	—	ns	—
Hold time FRAME→LOAD	$t_{hold(FR)}$	—	5	—	—	ns	—
FRAME cycle time	t_F	—	1/125	1/70	1/65	s	—

Note 8) $t_r, t_f \leq (t_{CP} - t_{w(CPL)} - t_{w(CPH)})/2$. And $t_r, t_f \leq 50$ ns.



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5.4.4 LCD timing chart

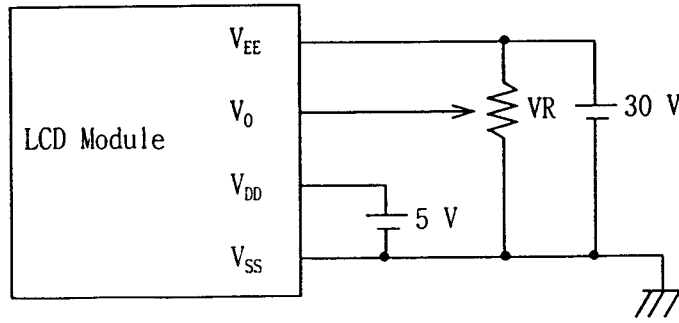


LCD data map (1 FRAME)

ノットNo.		SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	...	SEG318	SEG319	SEG320	
COM1	FRAME	LOAD1	UD3	UD2	UD1	UD0	UD3	UD2	UD1	...	UD2	UD1	UD0
			CP1			CP2			...	CP80			
COM2	FRAME	LOAD2	UD3	UD2	UD1	UD0	UD3	UD2	UD1	...	UD2	UD1	UD0
			CP1			CP2			...	CP80			
...	
COM240	FRAME	LOAD240	UD3	UD2	UD1	UD0	UD3	UD3	UD2	UD1	UD0
			CP1			CP80			

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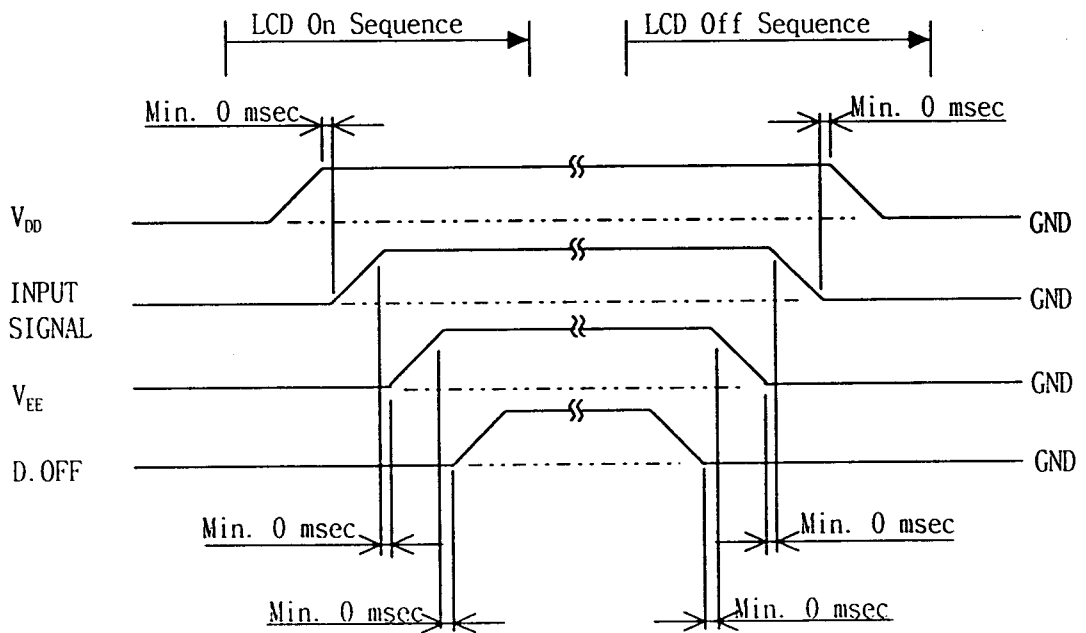
5.4.5 Example for power supply



VR:Typ. 10 kΩ

5.4.6 Precaution of power sequence

In order to prevent IC Latch-up and DC Voltage from working on LCD panel, turn on each power and signal in the order shown below.



5.5 Appearance defect

Specified by the Product Inspection Provision.

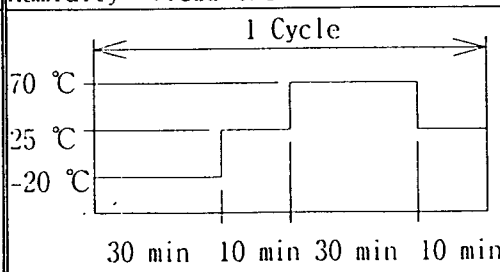
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6. Durability

No.	Test item	Test condition	Time	Notes
1	Vibration test	Frequency: 10~55 Hz Max. amplitude:1.52mm(0.06in) Sweeping:10-55-10 Hz 1 minute Direction:Normally 3 directions	2h each total 6h	Note1
2	Drop impact test	Impact :588 m/s ² (60 G) Impact time:6 ms Direction: Normally 3 directions	each direction 1 Time	Note1
3	Drop impact test(Packing)	Drop 0.7 m to strike a 30mm Lauan board in packing Direction: Normally 3 directions	each direction 1 Time	Note1

Note 1)This LCD module should be operated normally after finish the test.

7. Weather resistance

No.	Test item	Test condition	Time	Notes
1	High temperature operation test	Normal performance ,ON-state Temperature :50 °C Humidity :less then 30 %RH	120 h	Note1 Note3
2	Low temperature operation test	Normal performance ,ON-state Temperature :0 °C Humidity :less then 60 %RH	120 h	Note2 Note3
3	High temperature storage test	Normal performance ,OFF-state Temperature :70 °C Humidity :less then 30 %RH	120 h	Note1 Note3
4	Low temperature storage test	Normal performance ,OFF-state Temperature :-20 °C	120 h	Note2 Note3
5	High temperature and High humidity storage test	Normal performance ,OFF-state Temperature :40 °C Humidity :less then 95 %RH	120 h	Note1 Note3
6	Heat cycle test	 <p>70 °C 25 °C -20 °C</p> <p>30 min 10 min 30 min 10 min</p>	50 Cycle	Note1 Note3

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Note 1) After leaving the samples in the condition above, leave them at the room temperature for 30 minutes.

Note 2) After leaving the samples in the condition above, leave them in the dry and room temperature for 24 hours.

Note 3) This LCD module should be operated normally after finish the test.

8. Reliability

8.1 LCD

Life time : Expected life is more than 50,000 h under normal operating condition.

8.2 Backlight

Half Brightness Life: This life is more than 17,000 h.

Definition of Half Brightness : 50% of initial brightness

Condition

- 1) CCFL Current : 5 mA_{rms}
- 2) Temperature : 25 °C
- 3) Input wave : Sine wave

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9. Cautions

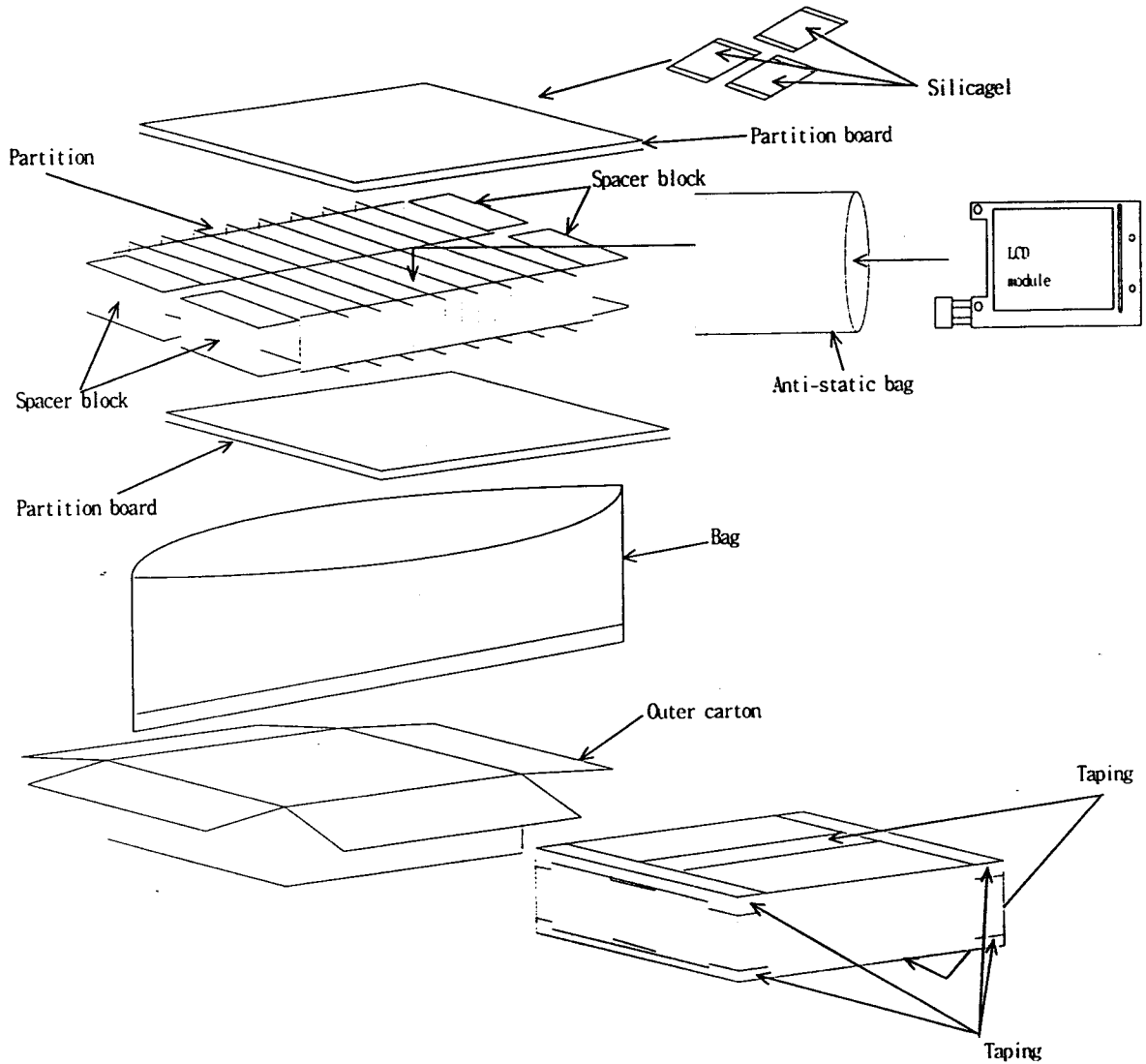
9.1 Operating

1. Use LCD module with following 3 cautions in mind to prevent trouble and failure.
 - (1) Attach LCD module to your equipment without bending and twisting stress.
 - (2) No dust.
 - (3) Keep On-Off sequence. (See 5.4.6 Precaution)
2. Keep temperature range (See 2.Environmental status) cause that using beyond temperature range is deteriorated contrast.
3. However LCD module is designed with EMI and EMC in mind, it is important that the equipment attached it have low EMI and EMC level.
4. Use LCD module with following 2 cautions in mind.
 - (1) Turn off while no using. (EX:Auto-Power-Off function)
 - (2) Mount screensaver.
5. Do not use LCD module out of the temperature range at maximum ratings. Out of the temperature range, it is possible that contrast is deteriorated defect appears, and characteristic of liquid crystal monocular is deteriorated.

9.2 Handling and Storing

1. LCD surface is easy to damage. Do not press, push and rub by something harder than pencil hardness "HB".
2. If LCD surface become dirty, wipe off it by soft cloth.
3. Be careful following 3 cautions to prevent corrosion and getting worse quality.
 - (1) Wipe off waterdrop(dewdrop) on LCD surface.
 - (2) No acetic acid, chlorine acid and hydrogen sulfide compound.
 - (3) When storing LCD module , shelter from the direct sunlight.
4. The LCD module contains a C-MOS LSI. To avoid damage to the LSI from static electricity generated while working, pay close attention to grounding. And do not touch connector terminals with bare hands.
5. Do not remake or disassemble the LCD module. That will cause trouble and failure.
6. Please handle with special care, in order to prevent the damage the glass part like LCD cell, or CCFL and/or the connection of electrical components like TCP. If glass(EX:LCD cell, CCFL) is broken, protect hands when you dispose of it.
7. Do not lick liquid crystal(fluid) that might leak from damaged LCD. If you touch liquid crystal(fluid), wash the exposed area immediately with soap and water.
8. Be careful for the handling with the high voltage for CCFL.
9. The mold case is made of PC(POLY CARBONATE). Do not use a solvent while handling to avoid trouble and failure.
10. If LCD module is stored for long time, keep it into ALPS packing box.

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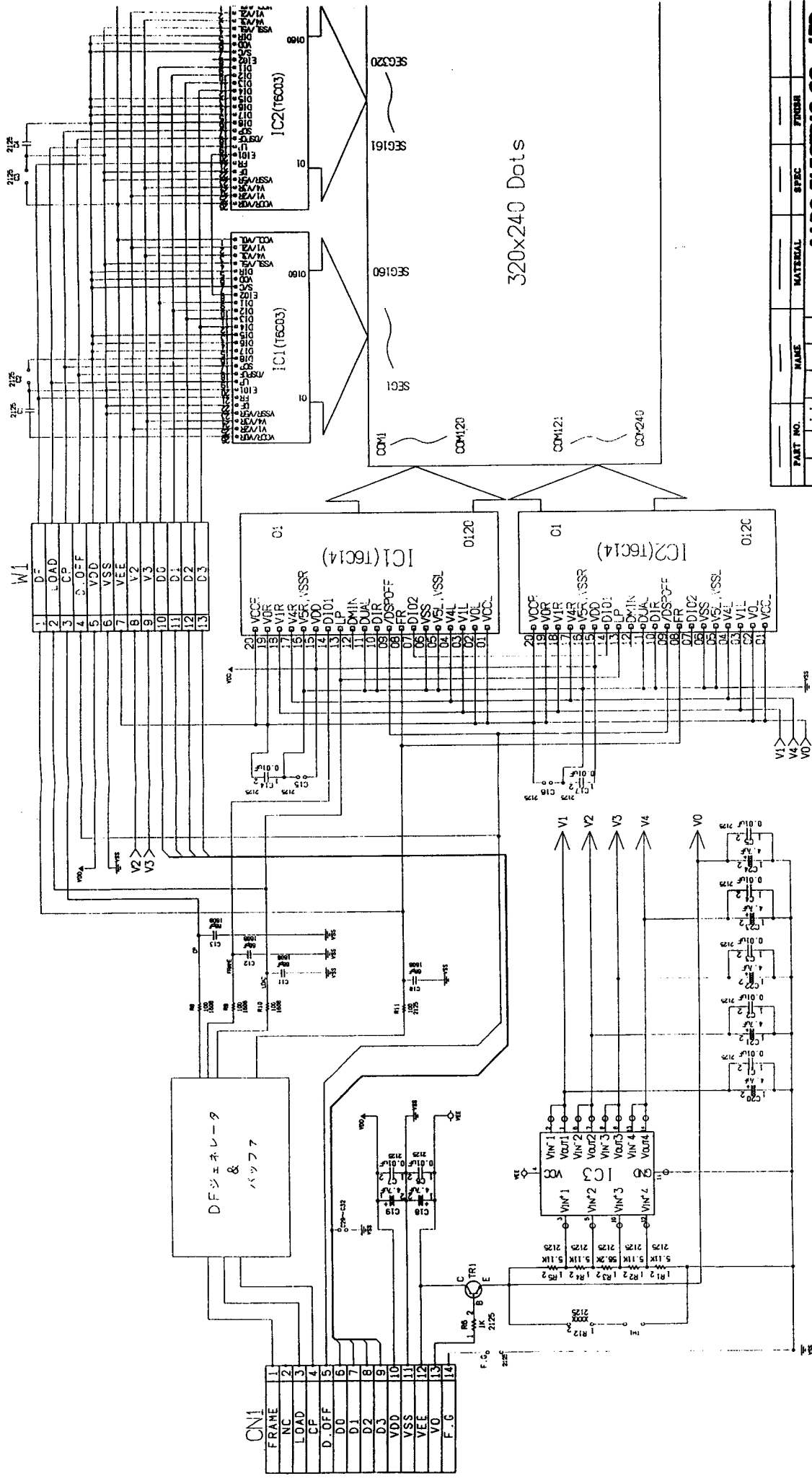


Item	Specification	Notes
Weight	About 7.500 g	—
Number of LCD module	40 PCs	—

Parts of name	Material	Thickness	Notes
Outer carton	ABFC170	t=8	—
Partition	BFC170	t=3	—
Partition board	AFC170	t=5	—
Spacer block	BFC170	t=3	—

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REFERENCE
SMALLER SCALE



PART NO.	NAME	MATERIAL	SPEC	FINISH

ALPS ELECTRIC CO., LTD.
LSUB1617XA
TITLE LCD 320x240 DOTS (REF)
L00 PALLETCIRCUIT DIAG
CHECKED 1980.12.10 S. Tokiwa
DESIGNED 1980.11.10 M. A. P. P.
PROCEDURE NO.