

LIQUID CRYSTAL DISPLAY MODULE

G325E01R300

Development Specification

APPROVAL

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Seiko Instruments Inc.

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Sales Sec. 1

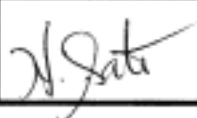

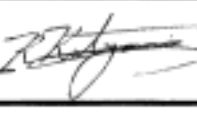



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1. GENERAL

1-1 Application

This specification applies to the liquid crystal display module designated G325E01R300 to be delivered Seiko Instruments Inc. to _____.

1-2 Deliberation Concerning Product Applications

The LCD module has been designed and manufactured specifically for use in _____.

In the event that _____ uses the product in anything other than _____, _____ shall immediately notify Seiko Instruments Inc. of such application and both companies shall discuss quality and quality assurance and other requirements in response to and for the LCD module.

Application 1:

Systems for controlling or ensuring the safety of transportation systems (automobiles, train, or airplanes).

Application 2:

Fire or burglar alarm systems which require a high degree of accuracy and reliability.

Application 3:

Other safety devices which require a high degree of accuracy and reliability.

Application 4:

Life - support systems or other medical equipment or devices.

1-3 Industrial Property

In the event that devices or equipment using the LCD module infringe on the industrial property rights of any third party, _____ shall be responsible for any and all matters excluding the structure and manufacturing method of the LCD module provided by Seiko Instruments Inc.

1-4 Specifications Modifications / Amendments and Consultation

This specification shall be established upon discussion between Seiko Instruments Inc. and _____. Problems arising from or with respect to matters not specified with in this document or modification / amendments to specifications requested by either _____ or Seiko Instruments Inc. shall be negotiated in good faith upon discussion by both parties.

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2. SCOPE

This specification covers the engineering requirements for the G325E01R300 liquid crystal display module developed by Seiko Instruments Inc. to _____.

2-1 General Spec.

- 320 x 240 dots matrix
- 1/240 duty, 1/12 bias
- FSTN : Black & White mode (RCF : 2 layer), Transflective type
- Positive type (Display data “H” = Display ON = Black, Display data “L” = Display OFF = White)
- Polarizer visual spec. : Normal (Glare)
- 4-bit parallel data input
- 9 o'clock viewing angle
- Power supply : VDD, Bias voltage (VLCD(V1), V2(GND), V3~V6)

2-2 Mechanical Characteristics

Item	Characteristic
Dot Configuration	320 x 240 dots
Dot Pitch	0.24 x 0.24 mm
Dot Spacing	0.015 x 0.015 mm
LCD Dimensions (Horizontal x Vertical x Thickness)	88.30 x 69.10 x 2.20 max. mm
Viewing Area (Horizontal x Vertical)	79.80 x 60.60 mm
Active Area (Horizontal x Vertical)	76.785 x 57.585 mm
Weight	24.5 g typ.

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2-3 Absolute Maximum Ratings

GND = 0V

Item	Symbol	Conditions	Standard		Unit
			Min.	Max.	
Power Supply Voltage	VDD	Ta = 25°C 50±10%RH	-0.3	+7.0	V
	VLCD-GND		-0.3	+42.0	V
Input Voltage	Vin		-0.3	VDD + 0.3	V
Operating temperature	Topr	< 65%RH	-10	+60	°C
Storage temperature	Tstg		-20	+70	°C
Storage humidity		< 48 hrs	20	85	%RH
		< 1000 hrs	20	65	%RH

2-4 Electrical Characteristics (The number with () is reference)

GND=0V, Ta=-10~60°C

Item		Symbol	Conditions	Standard			Unit
				Min.	Typ.	Max.	
Power supply voltage		VDD		2.75	3.0	5.25	V
		VLCD	VDD=3.0V Ta=25°C	(14.7)	(15.2)	(15.7)	V
Input Voltage	High	V _{IH}		0.8VDD	-	VDD	V
	Low	V _{IL}		0	-	0.2VDD	V
Current consumption*		IDD	Ta=25°C	-	(0.14)	(0.30)	mA
		ILCD		-	(0.69)	(1.40)	mA

*VDD = 3.0V, VLCD=(15.2)V,

Frequency of data shift clock : 3.0MHz, Frame Frequency : 70Hz

Display pattern : Checker pattern

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2-5 Optical Characteristics (The number with () is reference)

2-5-1 Optical Characteristics

1/240duty, 1/12duty, $f_{FLM}=70\text{Hz}$

Item	Symbol	Conditions	Temp.	Min.	Typ.	Max.	Unit
Contrast	C	$\theta = 0^\circ$ $\phi = 270^\circ$ $V_{opr} = (15.2)\text{V}$	25°C	(3.0)	(6.5)	-	
Viewing Angle	θ_1	C < 2 $\phi = 270^\circ$ $V_{opr} = (15.2)\text{V}$	25°C	-	-	(-40)	deg.
	θ_2			(40)	-	-	
	$\theta_2 - \theta_1$			(80)	-	-	
Response time	t_{on}	$\theta = 0^\circ$ $\phi = 270^\circ$ $V_{opr} = (15.2)\text{V}$	25°C	-	200	400	ms
	t_{off}			-	300	600	
	t_{on}	$\theta = 0^\circ$ $\phi = 270^\circ$ $V_{opr} = (16.5)\text{V}$	-10°C	-	2000	3000	
	t_{off}			-	3300	5000	

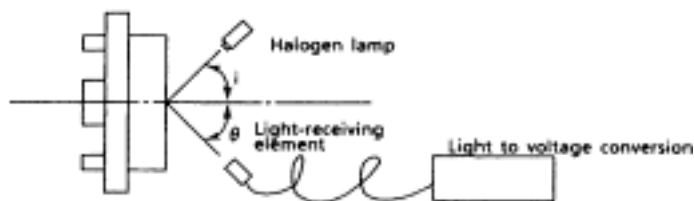
Measurement equipment: CANON illuminomer

2-5-2 Recommend operating voltage ($V_{opr}=V_{LCD-GND}$)

Temp. (°C)	-10	25	60
V_{opr} (V)	(16.5)	(15.2)	(13.7)

* Contrast measurement

Direct a halogen lamp at the display dot screen, receive the reflected light with a light-receiving element, convert the quantity of reflected light to voltage, and measure the contrast.



*Response time measurement

Use a transmissive panel to measure the response.

2.5.3 Recommend frame frequency

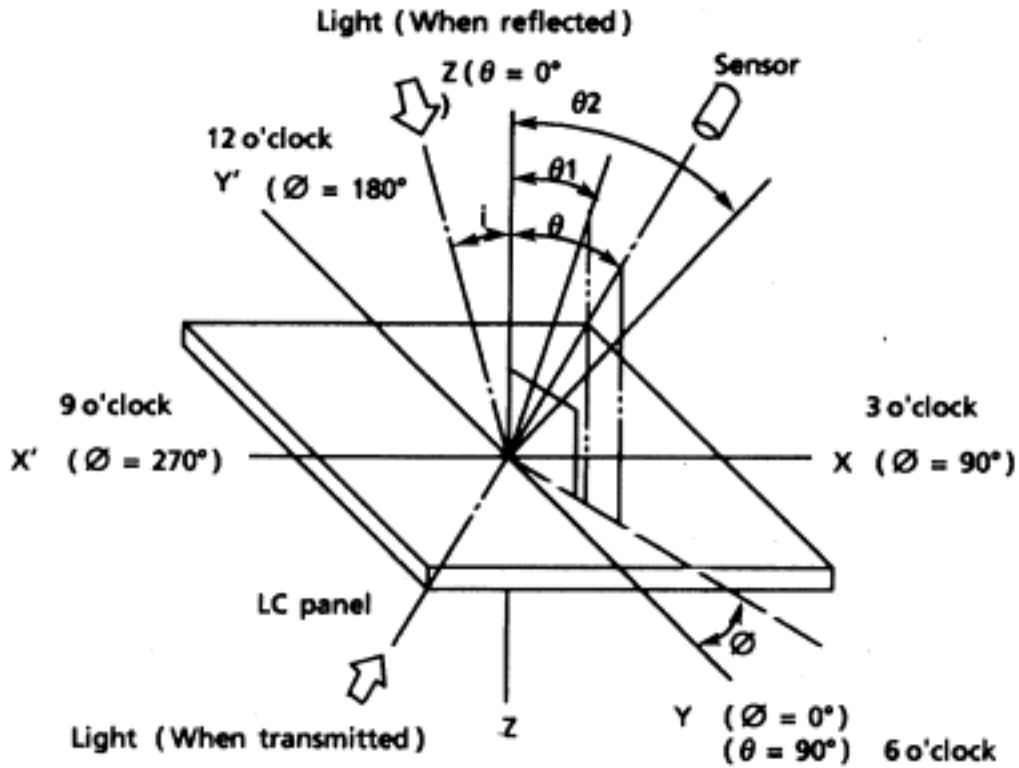
Set the frame frequency to the following value to prevent flicker.

Frame frequency (FLM frequency): $70\text{Hz} \pm 5\text{Hz}$

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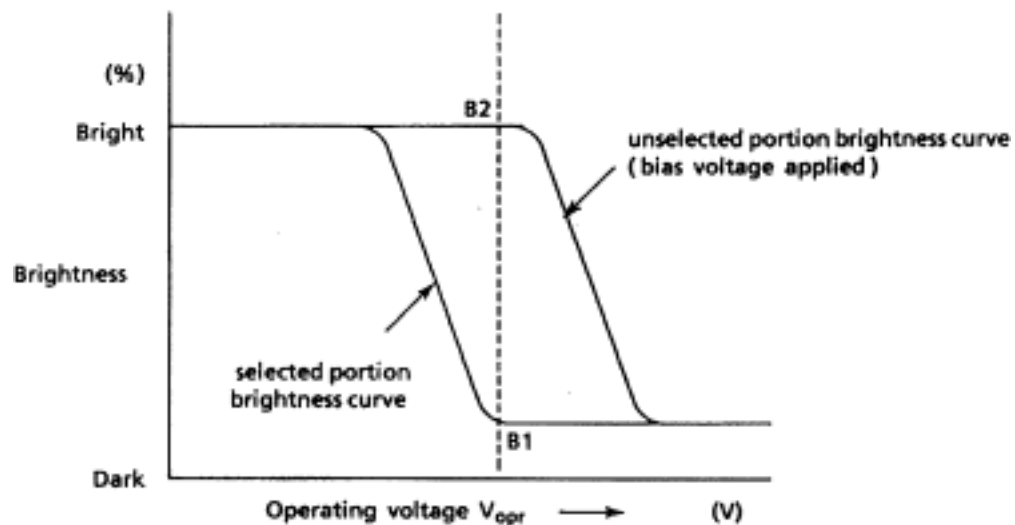
2-5-4 Definition of optical characteristics

- Definition of angles ϕ and θ



- Definition of contrast C

$$C = \frac{B1}{B2} = \frac{\text{Brightness of selected portion}}{\text{Brightness of unselected portion}}$$



Development Spec.

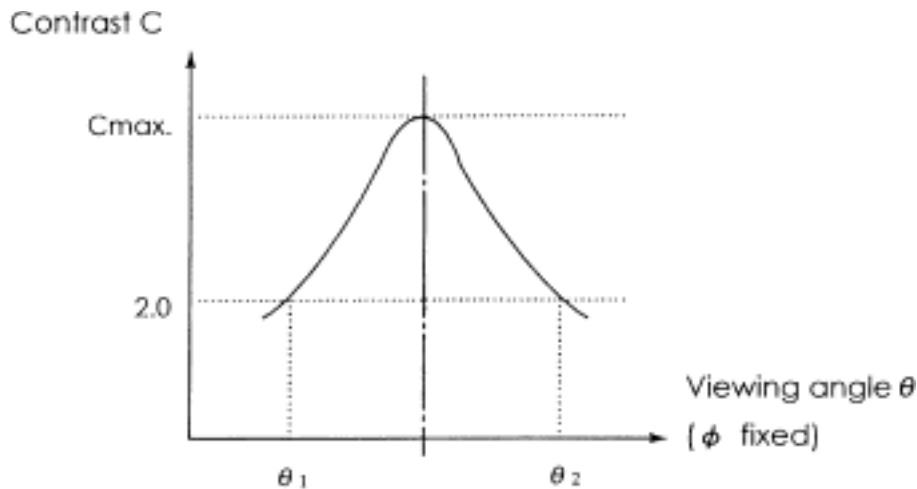
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Rev. : a

Product No. : G325E01R300

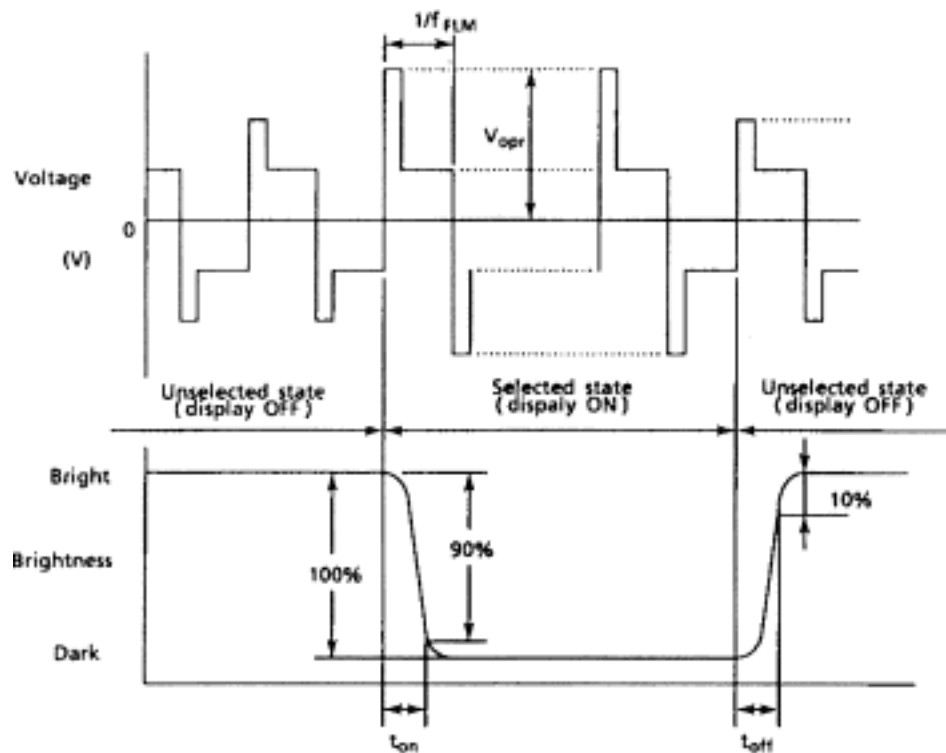
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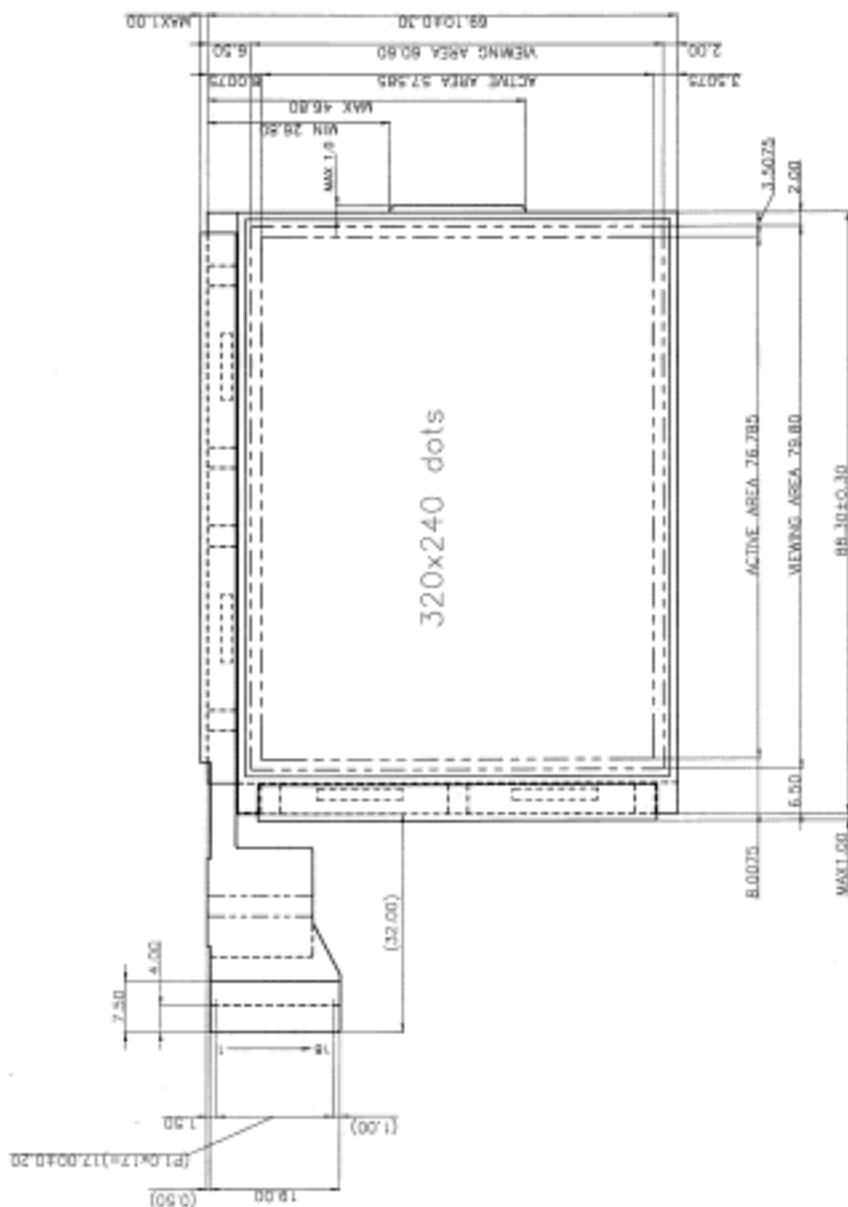
- Definition of viewing angle θ_1 and θ_2



Note : Optimum vision with the naked eye and viewing angle θ at C_{max} above are not always the same

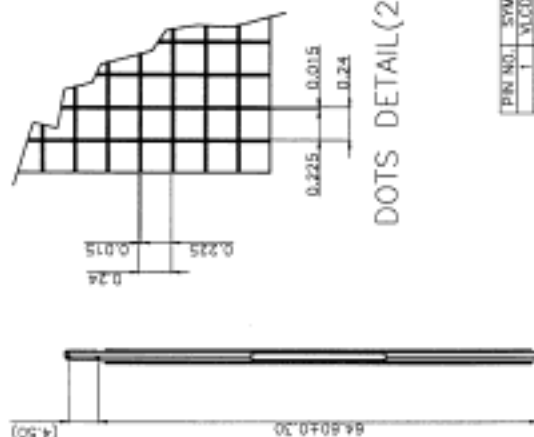
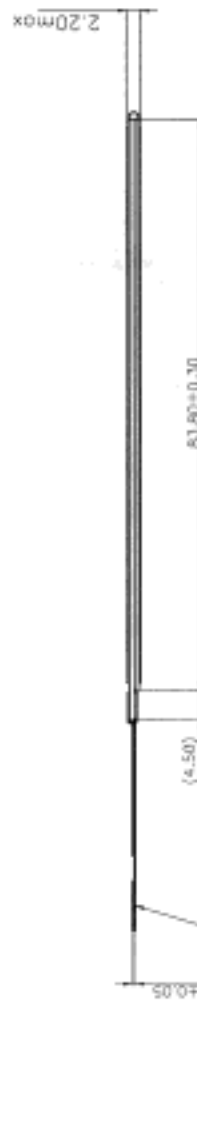
- Definition of response time

 V_{opr} : Operating voltage [V] t_{on} : Response time (rise) [ms] f_{FLM} : Frame frequency [Hz] t_{off} : Response time (fall) [ms]



320x240 dots

LCD Driver
HCD66110BP (for segment)
HCD66113BP (for common)

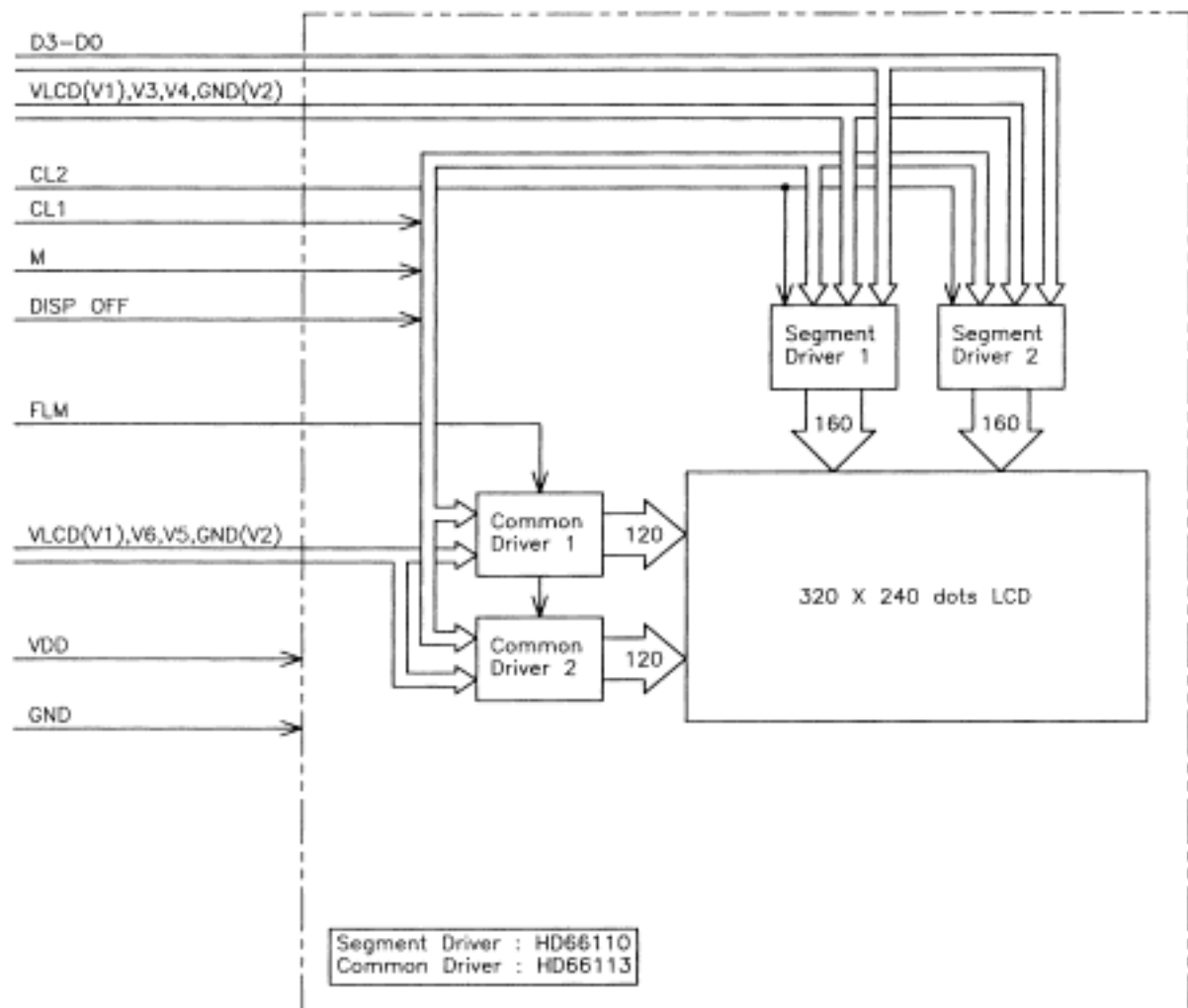




DOTS DETAIL(20/1)

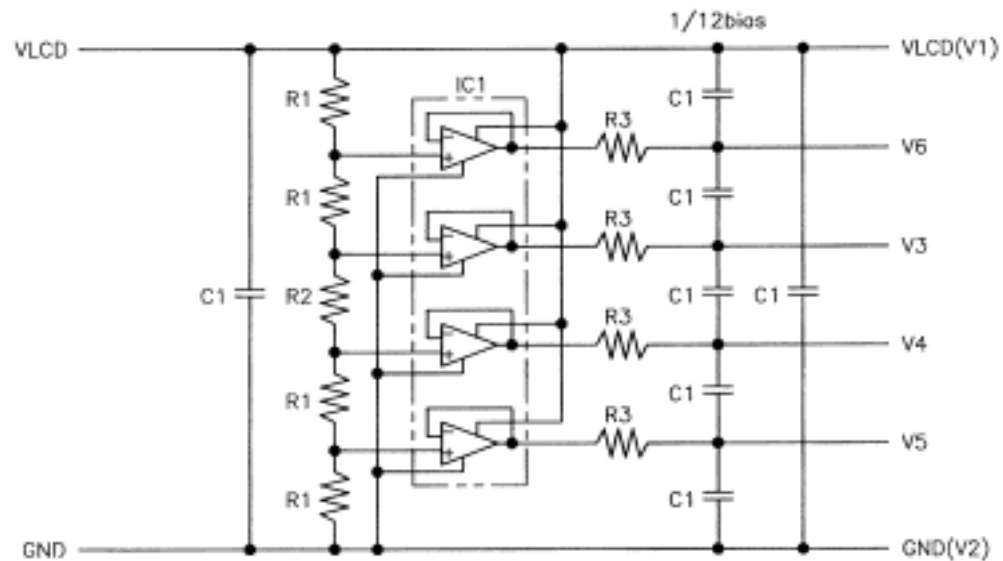
PIN NO.	SYMBOL
1	VCC(V1)
2	V8
3	V3
4	V4
5	V5
6	GND(V2)
7	GND
8	VDD
9	FLM
10	CL2
11	M
12	CL1
13	DEP OFF
14	GND
15	O3
16	O2
17	O1
18	DO



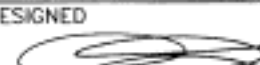
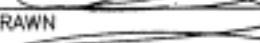
MATERIAL		TREATMENT		SHEET NUMBER	SIZE	WEIGHT	DATE	
(1)	2/1	Jordan	SEP, 1st, '98					
CAL.	G325E01R300							
TITLE	2-6 Dimension	NO.	1					
DRAWING	G.325E 1A	PAGE	R17					
NO.								
SII Microtechno Inc.								



PART NUMBER			TITLE 2-7 Circuit Block Diagram			
MODEL ORIGINAL NO.						
SCALE	UNIT	Q'TY	DRAWING NUMBER G325E01R300			
APPROVED						
LEADER		DESIGNED	DATE	SHEET NO.	REV.	PAGE
			19 Oct.'98		A	9/17
CHECKED		DRAWN	Seiko Instruments Inc.			
						



IC1:LP324M(National Semiconductor)
 R1:22(kOHM) \pm 0.5%, R2:180(kOHM) \pm 2%, R3:4.7(OHM) \pm 5%
 C1:2.2-4.7(uF)

PART NUMBER			TITLE 2-8 Bias Circuit Drawing			
MODEL ORIGINAL NO.						
SCALE	UNIT	Q'TY	DRAWING NUMBER G325E01R300			
APPROVED						
LEADER	DESIGNED 		DATE 19 Oct.'98	SHEET NO.	REV. A	PAGE 10/17
CHECKED	DRAWN 		Seiko Instruments Inc.			

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3. RELIABILITY

3-1 Reliability

Test Item	Test Conditions	Evaluation and Assessment
Operation at high temperature and humidity ^{*1}	40°C±2°C , 90%RH Drive module for 240 hours Measure after 2 hours left at normal temperature and humidity	No abnormalities in Function ^{*2} and appearance ^{*3}
Storage at low temperature ^{*1}	-20°C±3°C for 240 hours Measure after 2 hours left at normal temperature and humidity	No abnormalities in Function ^{*2} and appearance ^{*3}
Storage at high temperature ^{*1}	70°C±3°C for 240 hours Measure after 2 hours left at normal temperature and humidity	No abnormalities in Function ^{*2} and appearance ^{*3}
Temperature cycle ^{*1}	-20°C±2°C ⇔ 70°C±2°C Left for 1 hour at each temperature, Transition time 5 min., repeated 10 times	No abnormalities in Function ^{*2} and appearance ^{*3}
Vibration	10Hz ⇒ 55Hz ⇒ 10Hz Sweep for 1 min. Amplitude 1.5mm 2 hours each in the X,Y and Z directions	No abnormalities in Function ^{*2} and appearance ^{*3}

* 1 Inspection condition :

2 hours storage at room temperature after test

There should be no dewing during test and 2 hours storing

* 2 Dissipation current, contrast and display functions

* 3 Polarizing filter deterioration, other appearance defects

3-2 Liquid Crystal Panel Service Life

50,000 hours minimum at 25°C±10°C , 45%RH

3-3 Definition of Panel Service Life

- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Unusual operation occurs in component
- Unusual operation occurs on display appearance

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4. OPERATING INSTRUCTION

4-1 LCD Terminal Function

No.	Signal	Function
1	VLCD(V1)	Bias voltage (Liquid crystal drive voltage: (15.2)V typ.)
2	V6	Bias voltage
3	V3	Ditto
4	V4	Ditto
5	V5	Ditto
6	GND(V2)	Ditto (GND : 0V)
7	GND	0V
8	VDD	Power supply voltage: +3.0V typ.
9	FLM	Frame signal (sync. Of display)
10	CL2	Display data shift clock
11	M	LCD drive signal (AC signal)
12	CL1	Display data latch signal
13	DISP OFF	Display ON/OFF control signal ("H":Display ON, "L":Display OFF)
14	GND	0V
15	D3	Display data
16	D2	Ditto
17	D1	Ditto
18	D0	Ditto

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4-2 Timing Characteristics

Ta = -10~+60°C, VDD = 2.75~4.5V, GND=0V

Item	Symbol	Min.	Typ.	Max.	Unit
FLM cycle time	t _{CLM}	13.3	14.3	15.4	msec
CL1 cycle time	t _{CCL1}	400	-	-	nsec
CL1 "H" pulse width	t _{WCL1H}	30	-	-	nsec
CL1 "L" pulse width	t _{WCL1L}	370	-	-	nsec
FLM setup time	t _{FLMS}	100	-	-	nsec
FLM hold time	t _{FLMH}	30	-	-	nsec
Input signal rise time	t _{RCL1}	-	-	30	nsec
Input signal fall time	t _{FCL1}	-	-	30	nsec
CL2 period	t _{CCL2}	100	-	-	nsec
CL2 "H" pulse width	t _{WCL2H}	37	-	-	nsec
CL2 "L" pulse width	t _{WCL2L}	37	-	-	nsec
CL2 data setup time	t _{DS}	35	-	-	nsec
CL2 data hold time	t _{DH}	35	-	-	nsec
CL2 rise to CL1 rise time	t _{LD}	-	-	-	nsec
CL2 fall to CL1 fall time	t _{SL}	100	-	-	nsec
CL1 rise to CL2 rise time	t _{LS}	-	-	-	nsec
CL1 fall to CL2 fall time	t _{LH}	-	-	-	nsec

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Ta = -10~+60°C, VDD = 4.75~5.25V , GND=0V

Item	Symbol	Min.	Typ.	Max.	Unit
FLM cycle time	t _{CFLM}	13.3	14.3	15.4	msec
CL1 cycle time	t _{CCL1}	400	-	-	nsec
CL1 "H" pulse width	t _{WCL1H}	30	-	-	nsec
CL1 "L" pulse width	t _{WCL1L}	370	-	-	nsec
FLM setup time	t _{FLMS}	100	-	-	nsec
FLM hold time	t _{FLMH}	30	-	-	nsec
Input signal rise time	t _{RCCL1}	-	-	30	nsec
Input signal fall time	t _{FCCL1}	-	-	30	nsec
CL2 period	t _{CCL2}	100	-	-	nsec
CL2 "H" pulse width	t _{WCL2H}	37	-	-	nsec
CL2 "L" pulse width	t _{WCL2L}	37	-	-	nsec
CL2 data setup time	t _{DS}	10	-	-	nsec
CL2 data hold time	t _{DH}	10	-	-	nsec
CL2 rise to CL1 rise time	t _{LD}	-	-	-	nsec
CL2 fall to CL1 fall time	t _{SL}	100	-	-	nsec
CL1 rise to CL2 rise time	t _{LS}	-	-	-	nsec
CL1 fall to CL2 fall time	t _{LH}	-	-	-	nsec

Development Spec.

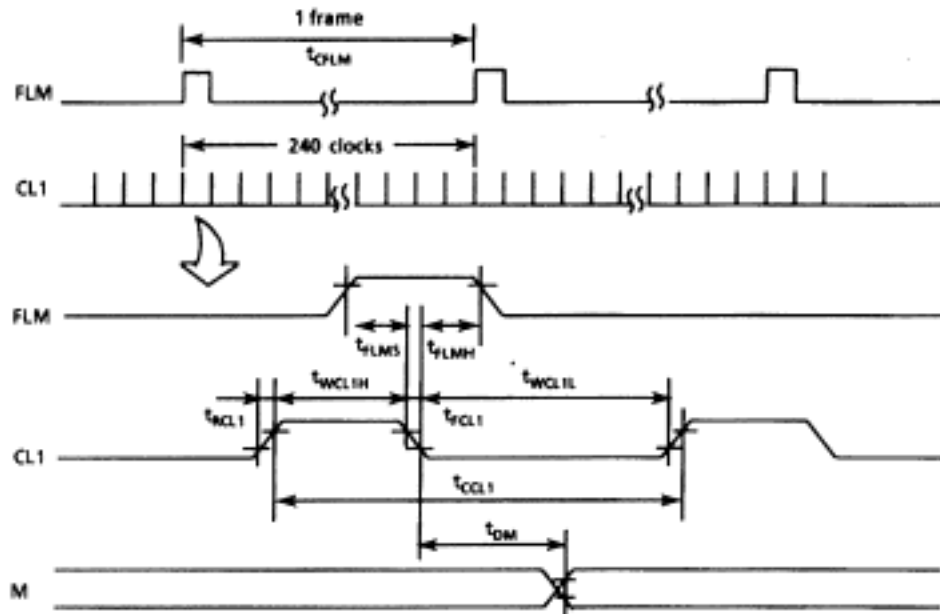
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Rev. : a

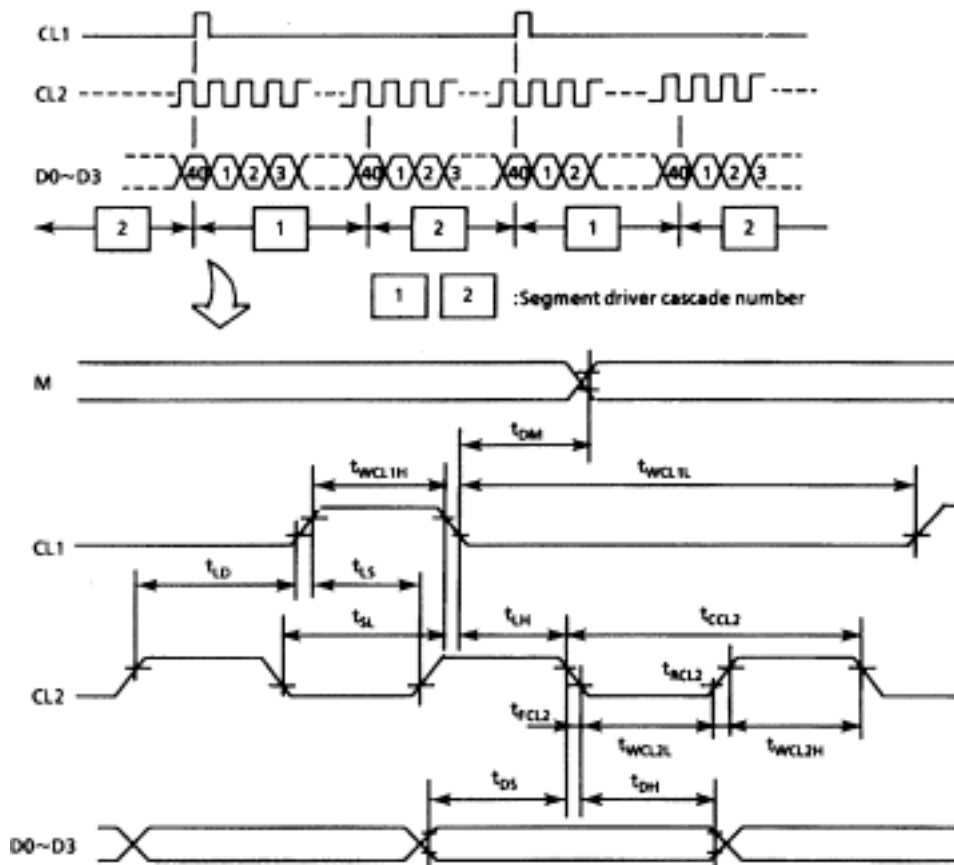
Product No. : G325E01R300

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Timing chart 1 : Timing of signal input into common driver

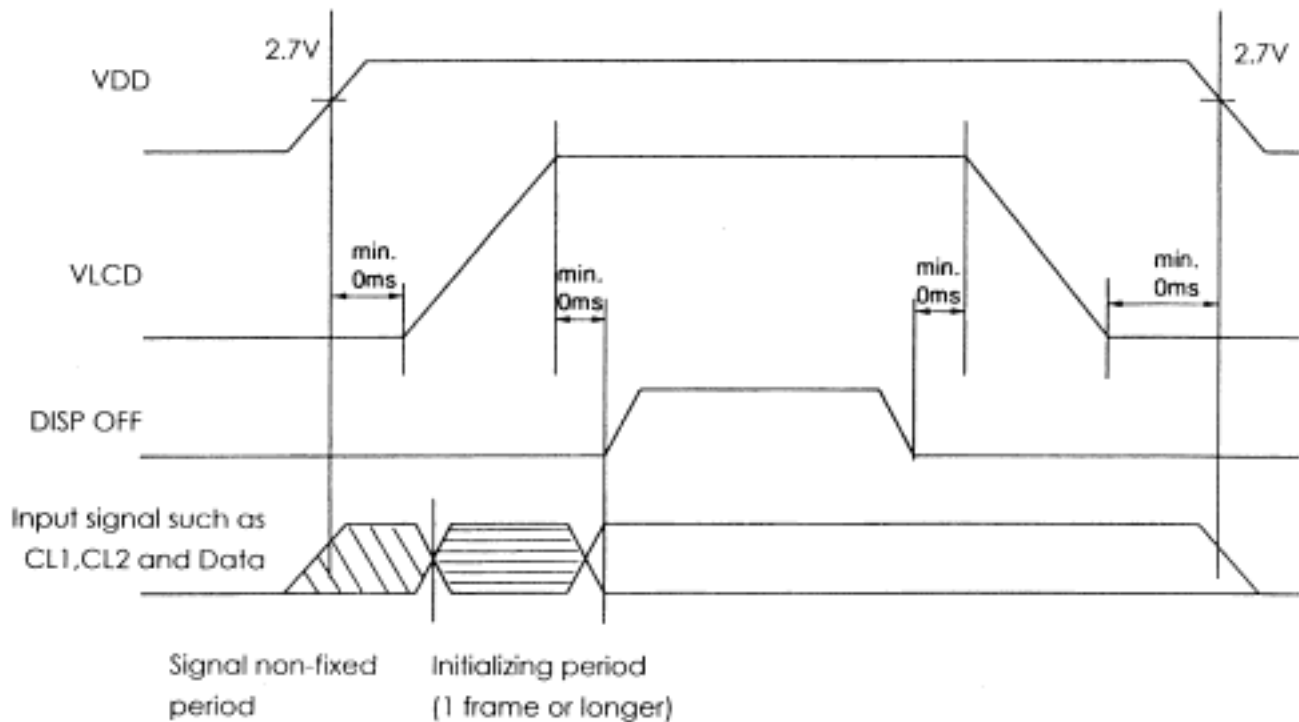


Timing chart 2 : Timing of signal input into segment driver



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4-3 Power ON/OFF and Signal Input Timing



At power on

- (1) Power on VDD. At this time, input 0 to the DISP OFF pin.
- (2) Display-off function forces the LCD driver to output a V2 level (lowest level).
- (3) Display-off function takes priority even if the input signal status becomes irregular immediately after VDD power-on
- (4) Input the specified signals to initialize registers of the LCD driver. Its period must be 1 frame or longer.
- (5) Set the DISP OFF level to 1 to cancel display-off function after steps (1) to (4). At this time, VLCD and each V pin input must be at the specified level.

At power off

Basically, the power-off procedure is the reverse of the power-on procedure.

- (1) Set the DISP OFF level to 0.
- (2) Lowest LCD driver power supply to 0V.
- (3) Lowest VDD and each input signals to 0V.

At this time, each V pin input must be at 0V. Display-off function stops when VDD falls to 0V, and therefore, the LCD driver may output a level other than V2 (lowest level). As a result, a display error may be caused at power-off or power-on.

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5. HANDLING PRECAUTIONS

5-1 Safety

The liquid crystal in the LCD is poisonous, DO NOT put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

5-2 Handling

- ① The LCD panel is plate glass. DO NOT subject the panel to mechanical shock or excessive force on its surface.
- ② The polarizer attached to the display is very easy to damage, handle it with careful attention.
- ③ To avoid contamination on the display surface, DO NOT touch the display surface with bare hands.
- ④ Provide a space so that the LCD panel does not come into contact with other components.
- ⑤ To protect the LCD panel from external pressure, put covering glass (acrylic board or similar board) keeping appropriate gap between them.
- ⑥ Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where dew condensation occurs.

5-3 Static Electricity

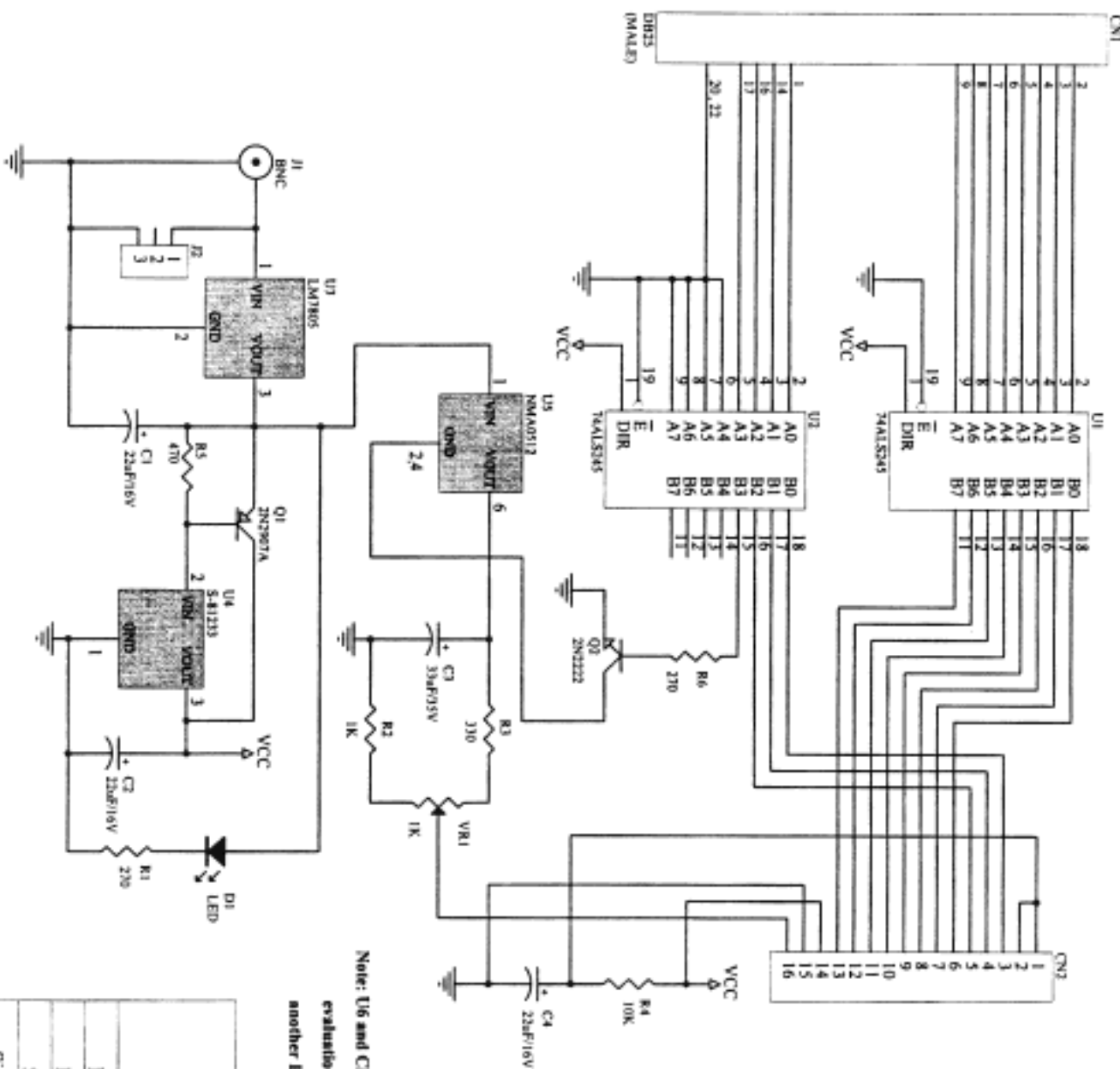
- ① Ground soldering iron tips, tools and testers when they operate.
- ② Ground your body when handling the products.
- ③ DO NOT apply voltage to the input terminal without applying power supply.
- ④ DO NOT apply voltage which exceeds the absolute maximum rating.
- ⑤ Store the products in an anti-electrostatic container.

5-4 Storage

- ① Store the module in a dark place where the temperature is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and the humidity below 65%RH.
- ② DO NOT store the module near organic solvents or corrosive gases.
- ③ DO NOT crush, shake, or jolt the module (including accessories).

5-5 Cleaning

- ① DO NOT wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- ② Wipe the module gently with a soft cloth soaked with a petroleum benzine.
- ③ DO NOT apply voltage which exceeds the absolute maximum rating.
- ④ Store the products in an anti-electrostatic container.



Note: U6 and CN3 are not used on G8 evaluation kit; they are used for another LCD display (C545002)

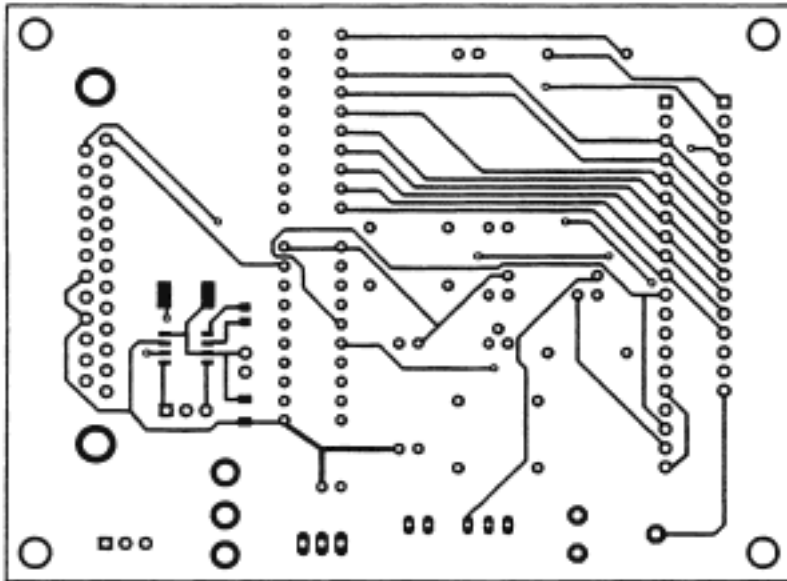


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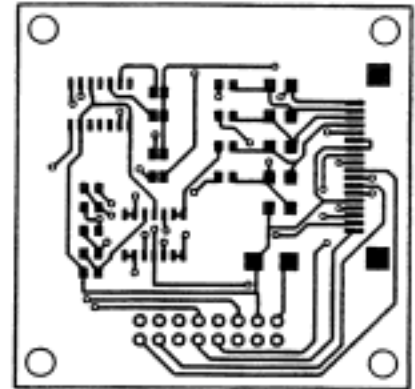
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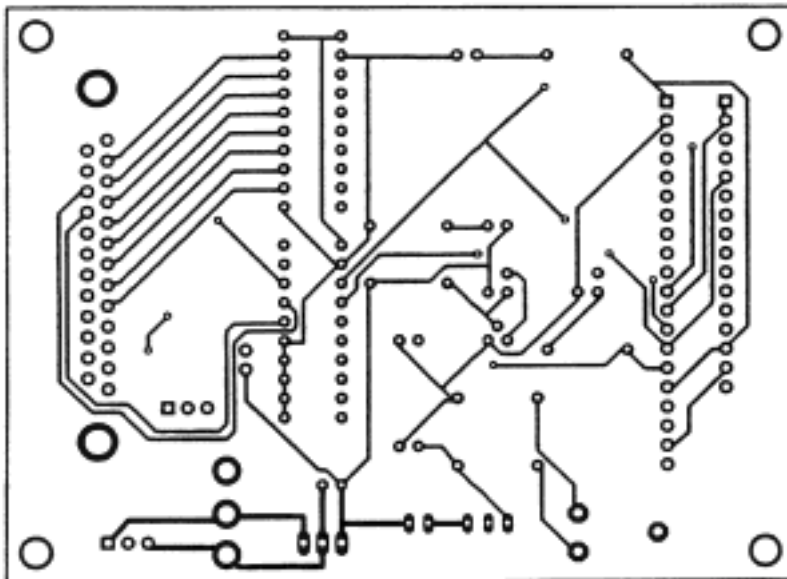
Size A Rev. A



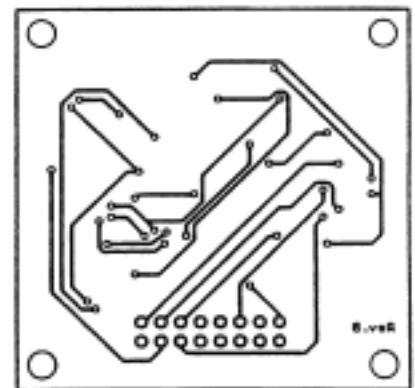
Link3 Component side



COG12 Component side



Link3 Solder side



COG12 Solder side