

# **Liquid Crystal Display Module With A Touch Panel**

## **Technical Data**

**Seiko Instruments Inc.**

## Introduction

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### Revision History

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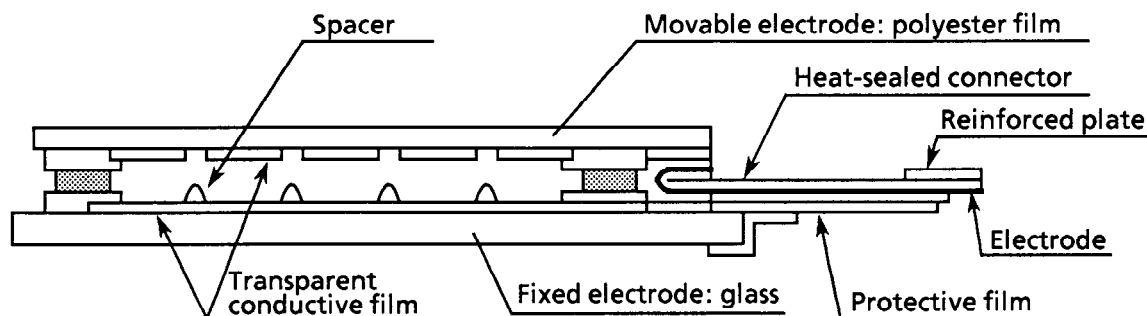
## 1. General Description

In the liquid crystal display (LCD) module with a touch panel, a transparent touch switch is mounted on the LCD display screen. The switching functions are displayed on the LCD display screen, from which you can select a desirable switch using your fingertip. Therefore, changing the display contents allows you to change the functions of the switch. This switch is a small size and multifunctional switch.

The applications cover office and factory automation equipment and instruments.

## 2. Touch Panel

### 2.1 Structure



### 2.2 Characteristics

#### (1) Temperature Range

Item	Symbol	Conditions	Standard	Unit
Op. temperature range	$T_{opr}$	Less than 85% RH, non condensing	0 to + 50	°C
Storage tem. range	$T_{stg}$	Less than 90% RH, non condensing	- 20 to + 60	°C

#### (2) Ratings

Item	Symbol	Conditions	Standard			Unit
			min.	typ.	max.	
Input Voltage	$V_{IN}$		-	-	5	V DC
Input Current	$I_{IN}$		-	-	1	mA

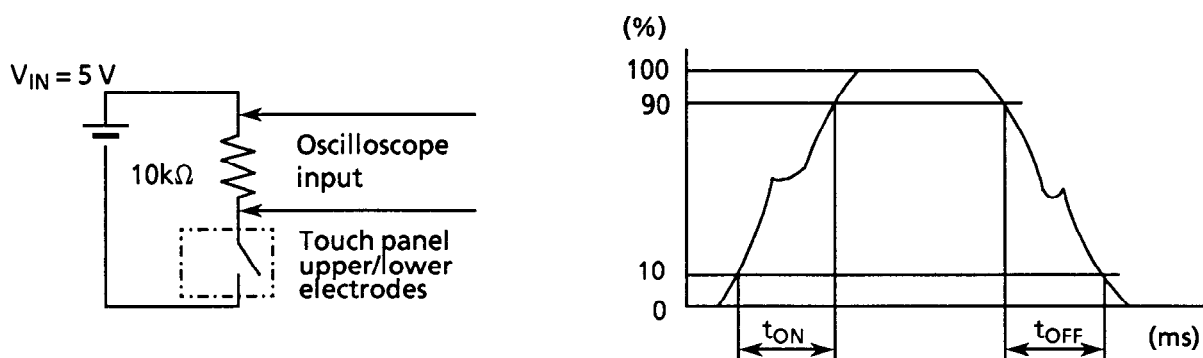
#### (3) Mechanical Characteristics

Item	Symbol	Test Method	Standard			Unit
			min.	typ.	max.	
Operation force	F	After being pressed using a silicon rubber bar of end radius 3 mm, diameter $\phi$ 6 mm, rubber hardness 60°, test the force obtained when the contact resistance stabilizes.	-	-	100	gf
Heat seal strength		Peel-off test at 90°	150	-	-	g/cm
Surface hardness		Pencil hardness test: JIS K5400	2H	-	-	-
Input method		-	Input only using fingertip. DO NOT INPUT USING FINGERNAIL.			-

(4) Electrical Characteristics

Item	Symbol	Conditions	Standard			Unit
			min.	typ.	max.	
Bounce Chattering <sup>1</sup>	$t_{ON}$		-	-	20	ms
	$t_{OFF}$		-	-	20	ms
Contact Resistance <sup>2</sup>	$R_p$		-	-	9	k $\Omega$
Insulation Resistance <sup>3</sup>	$R_r$		10	-	-	M $\Omega$

1 Configure the circuit as shown below. Press the center of the arbitrary key on the touch panel at 300 gf using a silicone rubber bar to activate the switch. Measure the bounce chattering when this switch is ON and OFF. The silicone rubber bar shall be end radius 3 mm, diameter  $\phi$ 6 mm, and rubber hardness 60°.



- Press the center of the arbitrary key on the touch panel at 300 gf using a silicone rubber bar to activate the switch. Measure the contact resistance between upper and lower terminals of the switch. The silicone rubber bar shall be end radius 3 mm, diameter  $\phi$ 6 mm, and rubber hardness 60°.
- Apply input voltage ( $V_{IN}$ ) 50 V between the switch terminals. Measure the insulation resistance between adjacent terminals and between upper and lower terminals of the switch.

(5) Key Operation Life

Item	Conditions	Criteria	Standard	Unit
Key Operation Life	$V_{IN} = 5\text{ V DC}$ $I_{IN} = 1\text{ mA}$ Pressure: $300 \pm 100\text{ gf}$ Test bar: A silicone rubber bar of end radius 3 mm, diameter $\phi$ 6 mm, and rubber hardness 60°	Conform to electrical characteristics standard (bounce chattering, contact resistance, insulation resistance).	More than 1,000,000	times

## 2.3 Chemical Resistance of Touch Panel Surface

### 2.3.1 General Chemicals

#### (1) Polyester Film on the Surface

Chemicals		Conditions and Result	
		Room tem. for 7days	At 70°C, for 7 days
Acid	Acetic acid	○	△
	10% Hydrochloric acid	○	△
	Conc. hydrochloric acid	△	×
	10% Nitric acid	○	△
	Concentrated nitric acid	×	×
	10% Sulfuric acid	○	△
	Concentrated sulfuric acid	×	×
Alkaline	10% Ammonia solution	△	×
	Conc. ammonia solution	×	×
	10% Caustic soda	×	×
Solvent	Benzene	○	○
	Toluene	○	○
	Acetone	○	○
	Ethanol	○	○
	Solvent naphtha	○	○
	Chloroform	○	△
	Methyl-ethyl-ketone	○	△
	Acetic acid ethyl	○	△

○: resistant, △: reduction in strength (approx. 10%), ×: no resistance

#### (2) Surface Coating Material (hard coating, non-glare coating)

chemicals		Conditions	Result
Acid	35% Hydrochloric acid	Moisten for 30 min.	○
Alkaline	28% Ammonia solution	Moisten for 12 hours	○
	5% Caustic soda	Moisten for 5 hours	○
Solvent	Toluene	Moisten for 12 hours	○
	Acetone	Moisten for 12 hours	○
	Methyl-ethyl-ketone	Moisten for 12 hours	○
	Chloroform	Moisten for 12 hours	○
	Acetic acid ethyl	Moisten for 12 hours	○
	Acetic acid butyl	Moisten for 12 hours	○
	Ethanol	Moisten for 12 hours	○

○: resistant, △: reduction in strength (approx.10%), ×: no resistance

### 2.3.2 Household Materials

#### (1) Polyester Film on the Surface

Materials	Conditions	Result
Vinegar	for 24 hours	No abnormality in external appearance
Salad oil	for 24 hours	No abnormality in external appearance
Soy sauce	for 24 hours	No abnormality in external appearance
Worcester sauce	for 24 hours	No abnormality in external appearance
Butter	for 24 hours	No abnormality in external appearance
Coffee	for 24 hours	No abnormality in external appearance

#### (2) Surface Coating Material (hard coating, non-glare coating)

Materials	Conditions	Results	
		Thickness	External Appearance
Hand cream	For 6 months	No change	No abnormality
Sweat (artificial)	For 6 months	No change	No abnormality
Fingerprint (artificial)	For 6 months	No change	No abnormality
Water	For 6 months	No change	No abnormality
Machine oil	For 6 months	No change	No abnormality

## 2.4 Handling Precautions

### (1) Storage

- Do not leave this product in water and organic solution or in an atmosphere of acid.

### (2) Handling

- Do not place any heavy weights on the touch panel.
- Do not apply excessive shock to this product and do not drop it.
- To remove stains from the surface of the product, wipe gently with a soft dry cloth or a soft cloth that has been dampened with a small amount of ethanol.
- Do not handle the heat seal connector (when handling the product).

### (3) Assembly

- Assemble so that the housing does not apply excessive stress to the touch panel.
- The heat seal part is easily disconnected. So, be sure not so as to apply excessive stress to the heat seal part.
- In order to equalize the external and internal pressures, the touch panel is provided with an air groove. If water or oil exists in the vicinity of the groove, such a solution may penetrate into the inside. Be sure that such a solution does not remain in the vicinity of the groove.

### (4) Operation

- Only fingertip input is allowable. Do not input using any hard object or sharp-edged tool.



### 3. Liquid Crystal Display Module With a Touch Panel: G321EV5B00X/G321EV5R00X

#### 3.1 General Description

- Transparent touch panel  
10 × 6 key matrix  
Non-glare
- Blue mode: G321EV5B00X
- Black & White mode: G321EV5R00X
- CFL backlight

#### 3.2 Mechanical Characteristics

Item	Standard	Unit
Dot format (H × V)	320 × 240	Dot
Dot size (H × V), typ.	0.27 × 0.27	mm
Dot pitch (H × V), typ.	0.30 × 0.30	mm
Module size (H typ. × V typ. × D max.)	150.0 × 97.0 × 16.0	mm
Viewing area (H × V), typ.	103.0 × 79.4	mm
Active display area (H × V), typ.	95.97 × 71.97	mm
Weight, typ.	240	g

#### 3.3 Optical Characteristics

##### (1) G321EV5B00X

1/240 duty, 1/13.1 bias,  $V_{opr} = V_{DD} - V_O$

Item	Symbol	Conditions	Temp.	min.	typ.	max.	Unit
Contrast	C	$\theta = 0^\circ$ $\phi = 0^\circ$ $V_{opr} = 21.2 \text{ V}$	25°C	2.0	3.0	-	-
Viewing angle	$\theta_1$	$C \geq 2.0^\circ$ $\phi = 0^\circ$ $V_{opr} = 21.2 \text{ V}$	25°C	-	-	- 15	degree
	$\theta_2$			20	-	-	
	$\theta_2 - \theta_1$			35	-	-	
Response time	$t_{on}$	$\theta = 0^\circ$ $\phi = 0^\circ$ $V_{opr} = 21.2 \text{ V}$	25°C	-	170	260	ms
	$t_{off}$			-	190	290	
	$t_{on}$	$\theta = 0^\circ$ $\phi = 0^\circ$ $V_{opr} = 22.8 \text{ V}$	0°C	-	1100	1700	
	$t_{off}$			-	500	750	

(2) G321EV5R00X

1/240 duty, 1/13.1 bias,  $V_{opr} = V_{DD} - V_O$

Item	Symbol	Conditions	Temp.	min.	typ.	max.	Unit
Contrast	C	$\theta = -10^\circ$ $\phi = 0^\circ$ $V_{opr} = 20.6 \text{ V}$	25°C	3.0	6.0	-	-
Viewing angle	$\theta_1$	$C \geq 2.0^\circ$ $\phi = 0^\circ$ $V_{opr} = 20.6 \text{ V}$	25°C	-	-	-15	degree
	$\theta_2$			30	-	-	
	$\theta_2 - \theta_1$			45	-	-	
Response time	$t_{on}$	$\theta = 0^\circ$ $\phi = 0^\circ$ $V_{opr} = 20.6 \text{ V}$	25°C	-	230	350	ms
	$t_{off}$			-	150	230	
	$t_{on}$	$\theta = 0^\circ$ $\phi = 0^\circ$ $V_{opr} = 22.4 \text{ V}$	0°C	-	1100	1700	
	$t_{off}$			-	500	750	

### 3.4 Maximum Absolute Rating, Electrical Characteristics, Recommended Operating Voltage ( $V_{opr}$ )

(1) G321EV5B00X

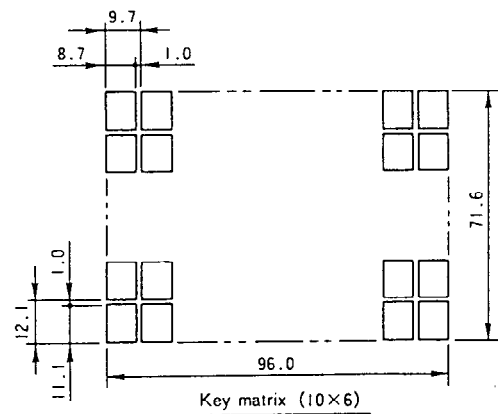
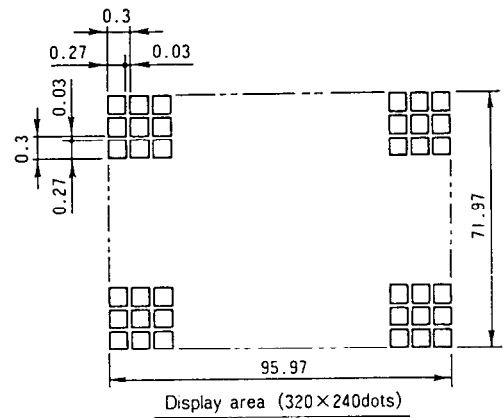
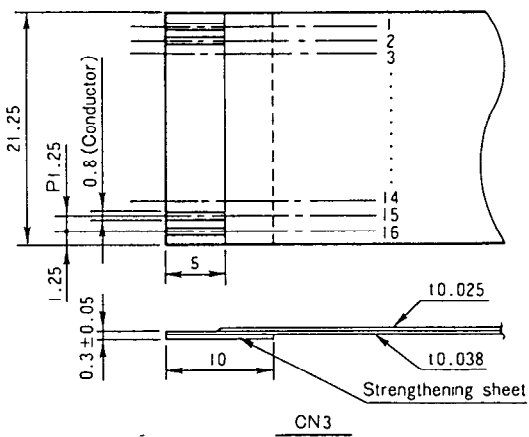
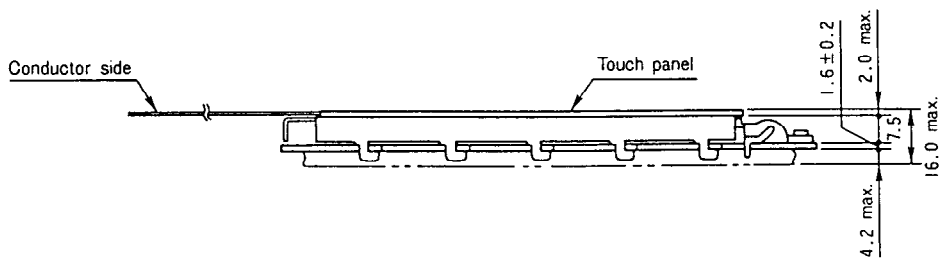
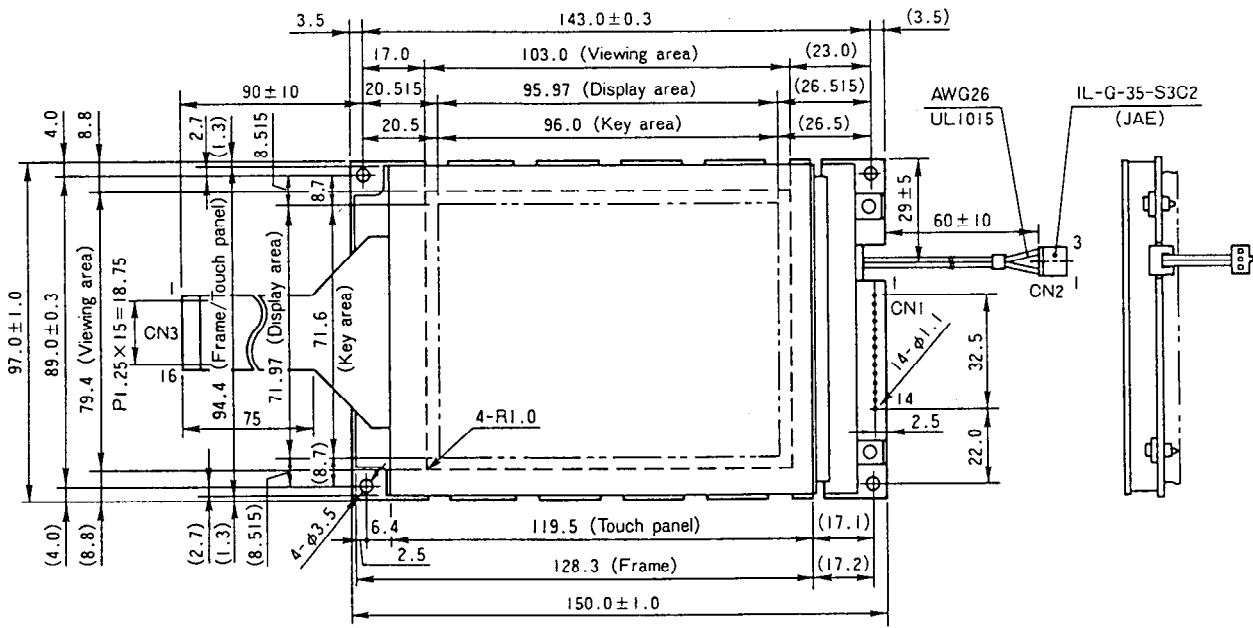
The maximum absolute rating, electrical characteristics and recommended operating voltage ( $V_{opr}$ ) are the same as those for the standard module G321EV5B000.

(2) G321EV5R00X

The maximum absolute rating, electrical characteristics and recommended operating voltage ( $V_{opr}$ ) are the same as those for the standard module G321EV5R000.

### 3.5 Outline Dimensions

General tolerance  $\pm 0.5$



### 3.6 Input and Output Terminals

#### (1) LCD

##### CN1

No.	Symbol	Function
1	FLM	1 frame timing signal
2	M	NC (or liquid crystal AC drive control signal)
3	CL1	1 common line timing signal
4	CL2	Display data shift clock
5	$\overline{\text{DISPOFF}}$	Display ON/OFF control <sup>1</sup>
6	D <sub>0</sub>	Display data input
7	D <sub>1</sub>	Display data input
8	D <sub>2</sub>	Display data input
9	D <sub>3</sub>	Display data input
10	V <sub>DD</sub>	Power supply voltage (1): + 5 V
11	V <sub>SS</sub>	GND: 0 V
12	V <sub>LC</sub>	Power supply voltage (2) : - 24 V
13	V <sub>O</sub>	Liquid crystal drive voltage adjustment terminal
14	F <sub>GND</sub>	Frame GND <sup>2</sup>

- 1 The display comes on at  $\overline{\text{DISPOFF}} = \text{"H,"}$  and goes out at  $\overline{\text{DISPOFF}} = \text{"L."}$
- 2 F<sub>GND</sub> is connected to the metallic frame of the module. So, use when grounding the frame.

#### (2) CFL Backlight

##### CN2

Connector for CFL: Socket IL-G-3S-S3C2 (JAE), Socket contact: IL-G-C2-SC-10000 (JAE)

Applicable connectors (directly connected to substrate): IP-G-3P-S3T2-E (straight type) (JAE)

IL-G-3P-S3L2-E (right-angle type) (JAE)

No.	Symbol	Color of wire	Function
1	V <sub>FL</sub>	black	GND <sup>1</sup> : 0 V
2	NC	—	unused
3	V <sub>FL1</sub>	red	CFL backlight drive signal

<sup>1</sup> is not connected to V<sub>SS</sub>(GND) of CN1.

(3) Touch Panel

No.	Symbol	Function
1	X6	SW6, SW16, SW26, SW36, SW46, SW56 output (input) line
2	X5	SW5, SW15, SW25, SW35, SW45, SW55 output (input) line
3	X4	SW4, SW14, SW24, SW34, SW44, SW54 output (input) line
4	X3	SW3, SW13, SW23, SW33, SW43, SW53 output (input) line
5	X2	SW2, SW12, SW22, SW32, SW42, SW52 output (input) line
6	Y6	SW1 to SW10 input (output) line
7	Y5	SW11 to SW20 input (output) line
8	Y4	SW21 to SW30 input (output) line
9	Y3	SW31 to SW40 input (output) line
10	Y2	SW41 to SW50 input (output) line
11	Y1	SW51 to SW60 input (output) line
12	X1	SW1, SW11, SW21, SW31, SW41, SW51 output (input) line
13	X7	SW7, SW17, SW27, SW37, SW47, SW57 output (input) line
14	X8	SW8, SW18, SW28, SW38, SW48, SW58 output (input) line
15	X9	SW9, SW19, SW29, SW39, SW49, SW59 output (input) line
16	X10	SW10, SW20, SW30, SW40, SW50, SW60 output (input) line

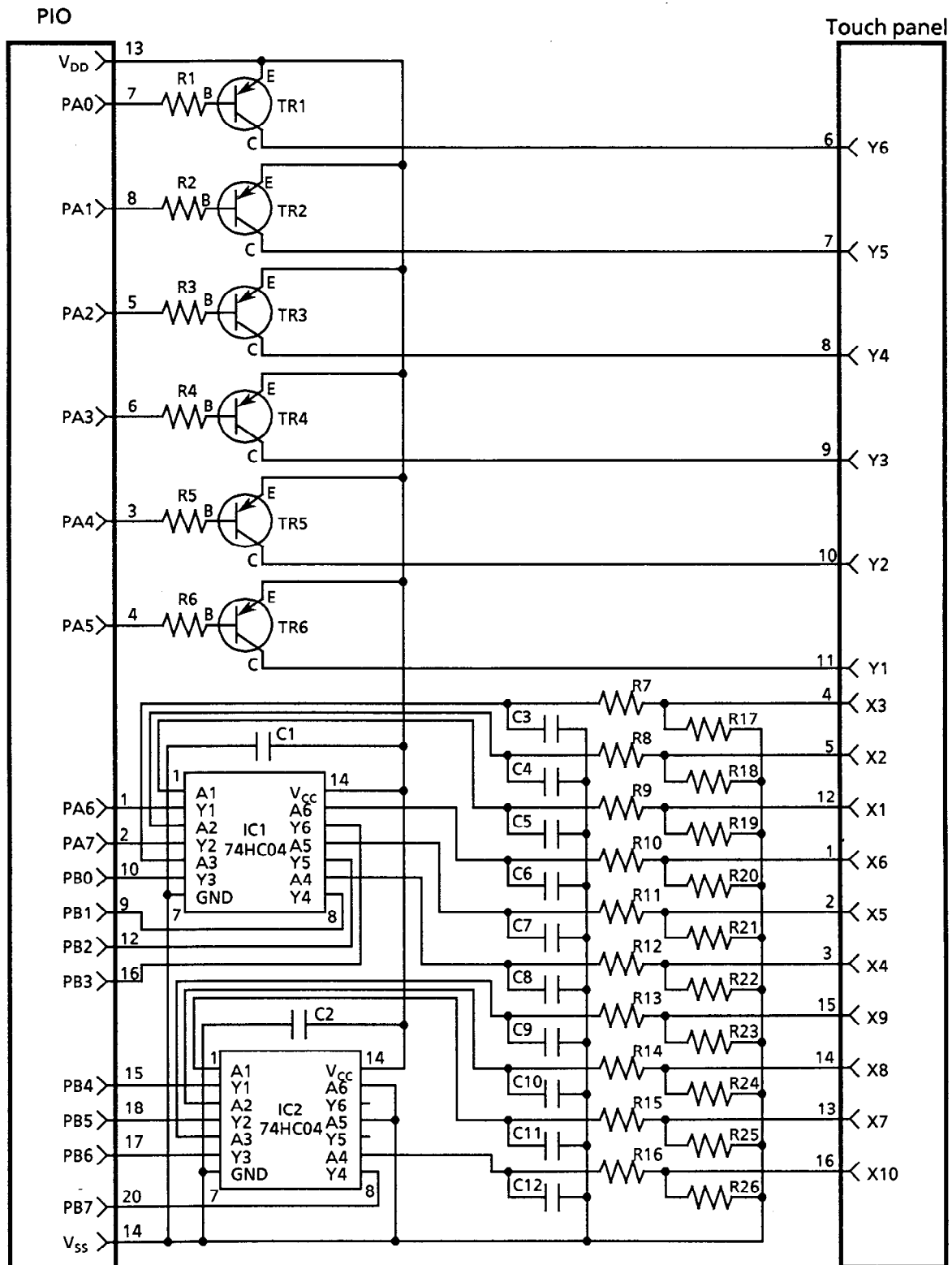
\* Key Matrix

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Y6	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
Y5	SW11	SW12	SW13	SW14	SW15	SW16	SW17	SW18	SW19	SW20
Y4	SW21	SW22	SW23	SW24	SW25	SW26	SW27	SW28	SW29	SW30
Y3	SW31	SW32	SW33	SW34	SW35	SW36	SW37	SW38	SW39	SW40
Y2	SW41	SW42	SW43	SW44	SW45	SW46	SW47	SW48	SW49	SW50
Y1	SW51	SW52	SW53	SW54	SW55	SW56	SW57	SW58	SW59	SW60

\*\* Mating Connector

- Straight type
  - IL-FPC-16S-S1T1 (JAE)
  - IL-404-16S-TW (JAE)
- Right angle type
  - IL-FPC-16S-S1L1 (JAE)
  - IL-404-16S-LW (JAE)

### 3.7 Interface Circuit Example



- (Example) TR1 to TR6: 2SA1015  
 R1 to R6: 3.3 k $\Omega$ : (1 to 10 k $\Omega$ )  
 R17 to R26: 330 k $\Omega$ : (100 to 500 k $\Omega$ )  
 C1, C2: 0.1  $\mu$ F  
 R7 to R16: 10 k $\Omega$ , C3 to C12: 0.1  $\mu$ F: ( $R_{(n+4)} \times C_n = 1\text{ms}$ ,  $n = 3$  to 12)

This circuit functions as follows:

Scan PA<sub>0</sub> to PA<sub>5</sub> in order to change the signal from "1" to "0" and output. These signals are converted through TR<sub>1</sub> to TR<sub>6</sub>, and "1" is output to terminal Y of the touch panel. Terminal X is pulled down by R<sub>17</sub> to R<sub>26</sub> to become "0."

Pressing the switch provided with the touch panel changes terminal X from "0" to "1" when the crossed terminal Y becomes "1" when scanning. Other X terminals remain "0." That is, if terminal X<sub>m</sub> becomes "1" at a time when terminal Y<sub>n</sub> becomes "1" when scanning, this means that the switch intercrossing electrode X<sub>m</sub> and electrode Y<sub>n</sub> is pressed. The signal of terminal X is reversed in circuits IC<sub>1</sub> and IC<sub>2</sub>, and is output to input terminals PA<sub>6</sub>, PA<sub>7</sub> and PB<sub>0</sub> to PB<sub>7</sub> of PIO.

For easy operation, it is advisable to display the area, functions, and explanation of the switch area using the LCD which is mounted under the touch panel.

Taking into consideration the bounce chattering standard, set the scanning speed to more than 20 msec.

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