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CUSTOMER ACCEPTANCE SPECIFICATIONS

MODEL NO. :

32F93(LED TYPES)

FOR MESSRS :

CUSTOMER'S APPROVAL

DATE :

BY :

EMERGING DISPLAY
TECHNOLOGIES CORPORATION

MODEL NO. 32F93(LED TYPES)	VERSION 1
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NUMBERING SYSTEM

Polarizer Mode	Backlight	Code value
Transflective	LED	L
Transmissive	LED	M

E W 3 2 F 9 3 F L W

LCD type + color	Code Value
FSTN + White	F
STN + Blue	B
FSTN + Black	N

Backlight	Code value
WHITE	W

1. GENERAL SPECIFICATIONS

1.1 GENERAL SPECIFICATIONS
PLEASE REFER TO :

CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS :

E U - 0 0 2 A

1.2 THIS INDIVIDUAL SPECIFICATIONS IS PRIOR TO GENERAL
SPECIFICATIONS .

1.3 TOUCH PANEL SPECIFICATIONS PLEASE REFER TO :
E U - 3 0 0

2. MECHANICAL SPECIFICATIONS

(1) NUMBER OF DOTS	-----	320W * 240H DOTS
(2) MODULE SIZE	-----	126.2W * 99.8H * 9.3 D (max.) mm
(3) EFFECTIVE AREA	-----	77.79W * 58.59H mm
(4) ACTIVE AREA	-----	76.79W * 57.59H mm
(5) DOT SIZE	-----	0.23W * 0.23H mm
(6) DOT PITCH	-----	0.24W * 0.24H mm
(7) LCD TYPE *		
(8) DRIVING METHOD	-----	1 / 240 DUTY MULTIPLEX DRIVE
(9) VIEWING DIRECTION	-----	6 O'CLOCK
(10) BACK LIGHT	-----	LED;COLOR : WHITE

* PLEASE REFER TO NUMBERING SYSTEM .

3. ABSOLUTE MAXIMUM RATINGS

3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS . (AT Ta = 25 °C)

PARAMETER	SYMBOL	MIN .	MAX .	UNIT	REMARK
POWER SUPPLY FOR LOGIC	VDD - VSS	0	7.0	V	
POWER SUPPLY FOR LCD DRIVING	VEE - VSS	0	2.7	V	
INPUT VOLTAGE	VI	VSS	VDD	V	
STATIC ELECTRICITY	—	—	100	V	NOTE (1)
POWER SUPPLY FOR LED	VLED - VLSS	—	5.0	V	

NOTE (1) : TEST METHOD AND CONDITIONS :
AFTER CHARGING UP 200 PF CAPACITOR BY STATED VOLTAGE ,
THE CAPACITOR IS CONNECTED WITH INTERFACE PINS OF THE
MODULE .

3.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS .

I T E M	OPERATING		STORAGE		REMARK
	MIN .	MAX .	MIN .	MAX .	
AMBIENT TEMPERATURE	-10 °C	50 °C	-20 °C	60 °C	NOTE (2), (3)
HUMIDITY	—	85 % RH	—	85 % RH	WITHOUT CONDENSATION
VIBRATION	—	2.45 m/S ² (0.25 G)	—	11.76 m/S ² (1.2 G)	10---100HZ XYZ DIRECTIONS 1 Hr.EACH
SHOCK	—	29.4 m/S ² (3 G)	—	490 m/S ² (50 G)	10 mSECONDS XYZ DIRECTIONS 1 TIME EACH
CORROSIVE GAS	NOT ACCEPTABLE		NOT ACCEPTABLE		

NOTE (2) : Ta AT -20°C : 48HR MAX .

60°C : 168HR MAX .

NOTE (3) : BACKGROUND COLOR CHANGES SLIGHTLY DEPENDING ON AMBIENT
TEMPERATURE THIS PHENOMENON IS REVERSIBLE .

4. ELECTRICAL CHARACTERISTICS

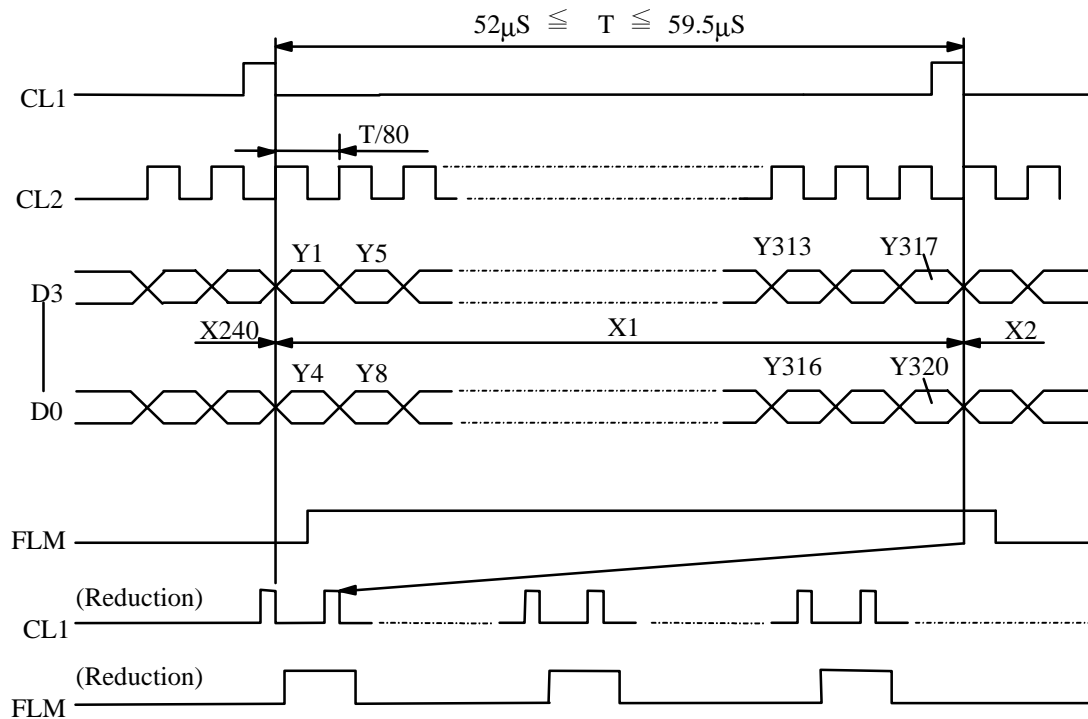
Ta = 25 °C

PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY VOLTAGE FOR LOGIC	VDD – VSS	—	2.5	—	5.0	V
INPUT VOLTAGE NOTE (1)	VIH	H LEVEL	0.8VDD	—	—	V
	VIL	L LEVEL	—	—	0.2VDD	V
POWER SUPPLY CURRENT FOR LOGIC NOTE (2)	IDD	VDD–VSS =5.0V VEE–VSS=21.0V	—	17	25	mA
CONTRAST ADJUST VOLTAGE	VEE – VSS ∅ = 10°, θ = 0° DUTY=1/240	Ta = -10 °C	23.3	24.3	25.3	V
		Ta = 25 °C	20.8	21.8	22.8	V
		Ta = 50 °C	17.3	18.3	19.3	V
CLOCK OSCILLATION FREQUENCY	fosc	—	—	8	—	MHZ
POWER SUPPLY FOR LED	VLED – VLSS	IF = 100 mA	—	5.0	—	V

NOTE (1) : APPLIED TO TERMINALS FLM , CL1, CL2, D0, D1, D2, D3.

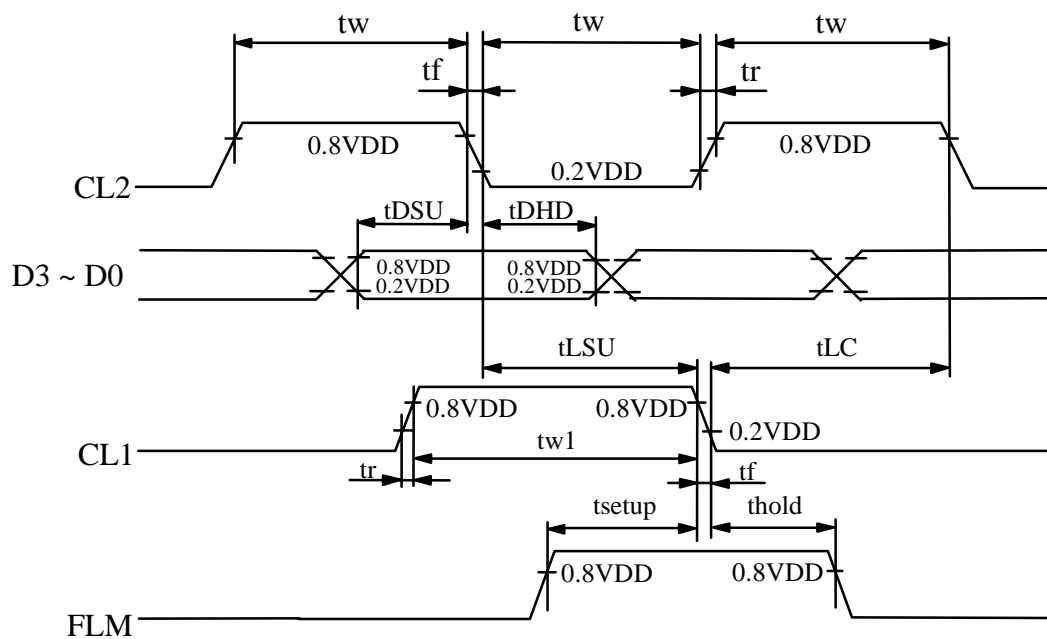
NOTE (2) : THIS DISPLAY PATTERN IS ALL ON OR OFF.

5. TIMING CHARACTERISTICS
5.1 INTERFACE TIMING



5.2 SWITCHING CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
CL1 PULSE WIDTH	tw1	30	—	—	ns
CL2 PULSE	tw	51	—	—	ns
RISE,FALL TIME	tr,tf	—	—	50	ns
DATA SETUP TIME	tDSU	30	—	—	ns
DATA HOLD TIME	tDHD	40	—	—	ns
CL1 SETUP TIME	tLSU	51	—	—	ns
CL1 TO CL2 TIME	tLC	51	—	—	ns
FLM SETUP TIME	tsetup	30	—	—	ns
FLM HOLD TIME	thold	50	—	—	ns



6. OPTICAL CHARACTERISTICS

Ta = 25 °C

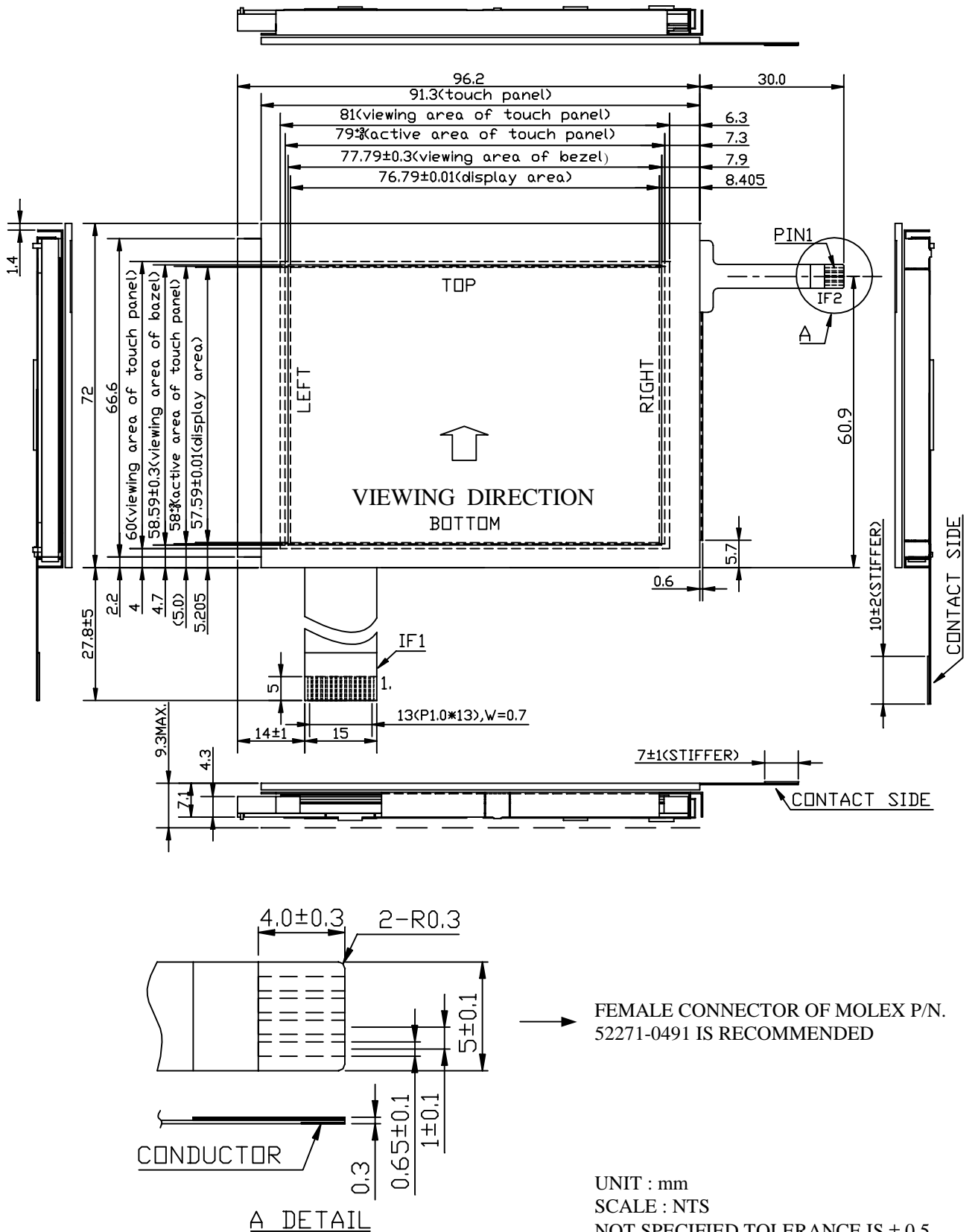
I T E M		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
VIEWING AREA	STN	$\varnothing 2 - \varnothing 1$	$K \geq 2.0$	—	40	—	deg.	1
	FSTN			50	—	—	deg.	1
CONTRAST RATIO	STN	K	$\varnothing = 10^\circ$	3	—	—	—	1
	FSTN			5	—	—	—	1
RESPONSE TIME		t r (rise)	$\varnothing = 10^\circ$ $\theta = 0^\circ$	—	(330)	—	msec	1
		t f (fall)	$\varnothing = 10^\circ$ $\theta = 0^\circ$	—	(330)	—	msec	1
THE BRIGHTNESS OF BACK-LIGHT		B	$\varnothing = 10^\circ$ $\theta = 0^\circ$	10	—	—	cd/m ²	1, 2
				13	—	—		1, 3

NOTE (1) : PLEASE REFER TO :
CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS. (EU - 002A)

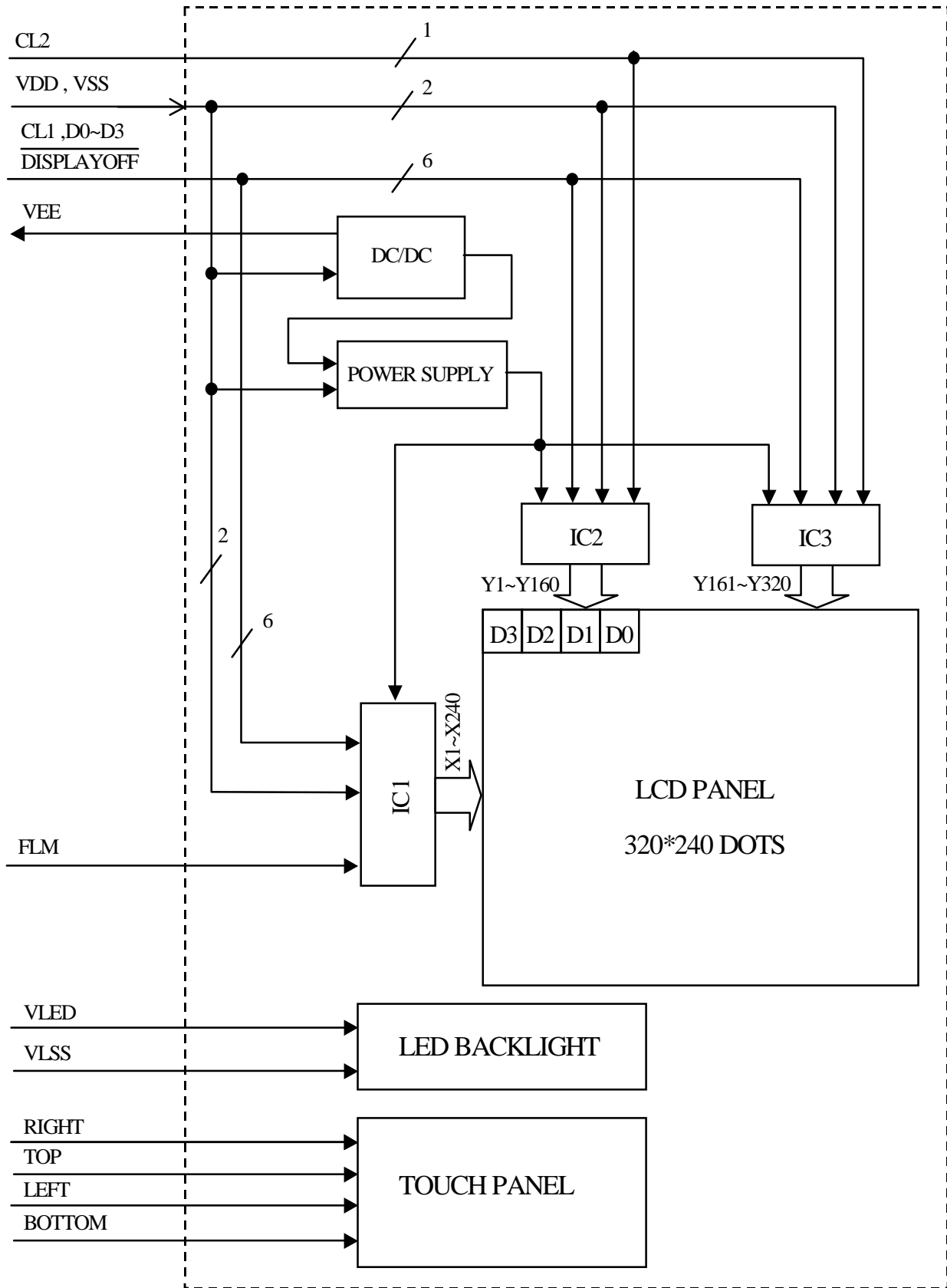
NOTE (2) : POLARIZER IS TRANSFLECTIVE TYPE .

NOTE (3) : POLARIZER IS TRANSMISSIVE TYPE .

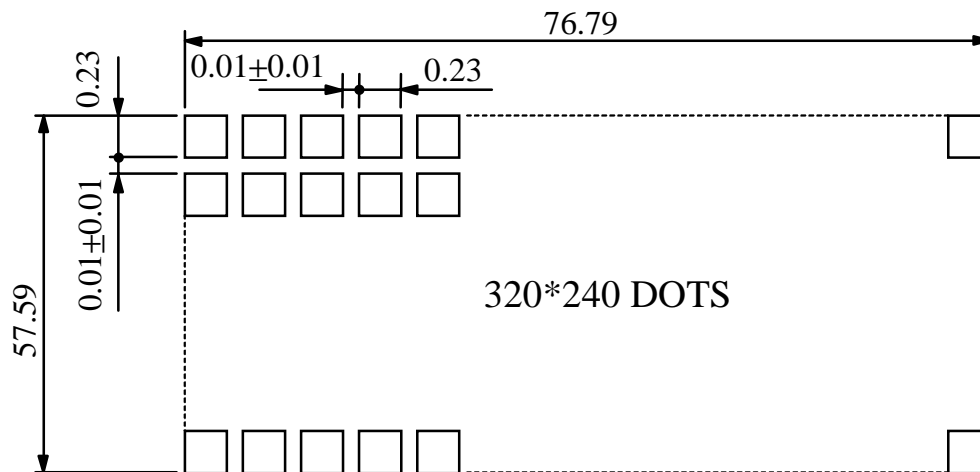
7. OUTLINE DIMENSION



8. BLOCK DIAGRAM



9. DETAIL DRAWING OF DOT MATRIX



UNIT : mm
SCALE : NTS
NOT SPECIFIED TOLERANCE IS ± 0.1

10. INTERFACE SIGNALS

IF1 :

PIN NO.	SYMBOL	FUNCTION
1	VDD	POWER SUPPLY FOR LOGIC CIRCUIT.
2	VSS	GROUND.
3	VEE	POWER SUPPLY FOR LCD DRIVING VOLTAGE
4	FLM	THE FLM SIGNAL INDICATING THE BEGINNING OF EACH DISPLAY CYCLE.
5	N.C	NO CONNECTION
6	CL1	DISPLAY DATA LATCH.
7	CL2	DISPLAY DATA SHIFT.
8	D0	DISPLAY DATA
9	D1	DISPLAY DATA
10	D2	DISPLAY DATA
11	D3	DISPLAY DATA
12	$\overline{\text{DISPLAYOFF}}$	CONTROLL LCD ON/OFF “ L “ : DISPLAY OFF , “ H “ DISPLAY ON
13	VLED	POWER SUPPLY FOR LED B.L
14	VLSS	POWER SUPPLY FOR LED B.L

IF2 : TOUCH PANEL INTERFACE

PIN NO.	SYMBOL	FUNCTION
1	LEFT	LEFT SIDE
2	TOP	TOP
3	RIGHT	RIGHT SIDE
4	BOTTOM	BOTTOM

1 1 . SPECIFICATIONS FOR TOUCH PANEL

1 1.1 INPUT METHOD AND ACTIVATION FORCE

Input Method	Average Activation Force
Stylus	> 30 grams
Finger	> 80 grams

1 1.2 TYPICAL OPTICAL CHARACTERISTICS

- 11.2.1 Visible Light Transmission: > 80 % @ 550nm
- 11.2.2 Haze: 5 % ± 2 % through hard coated PET only

1 1.3 ELECTRICAL SPECIFICATIONS

- 11.3.1 Operating Voltage: 5.5V or less
- 11.3.2 Contact current: 20mA (maximum)
- 11.3.3 Circuit close resistance : X : 400 ~ 900 Ω
Y : 200 ~ 600Ω
- 11.3.4 Circuit open resistance: > 20MΩ at 25VDC
- 11.3.5 Contact bounce: < 15ms
- 11.3.6 Linear Test : ± 1.5 % or Less

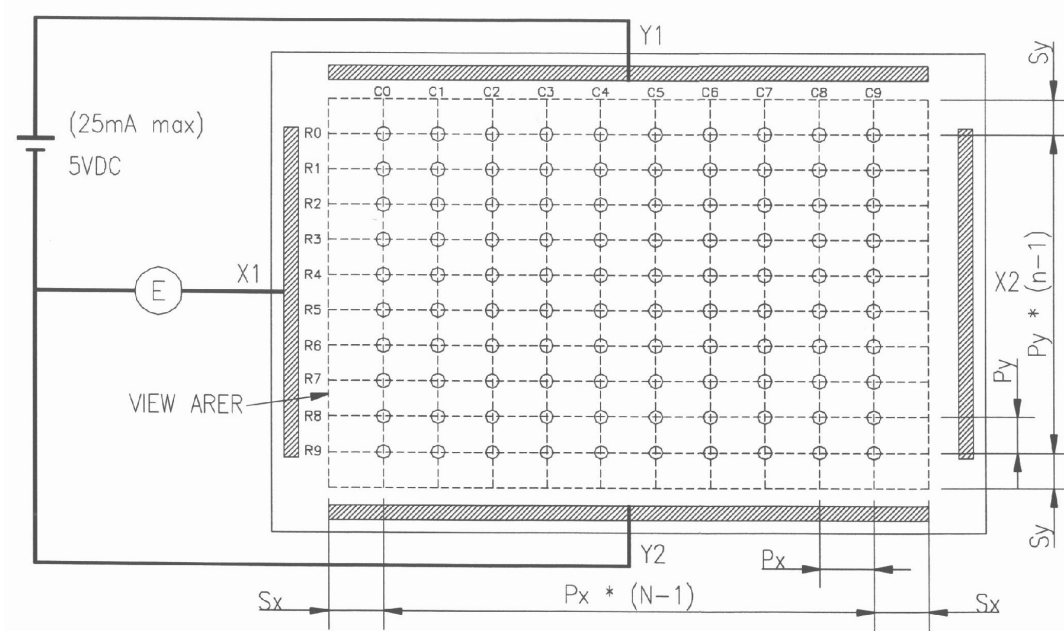
1 1.4 LINEARITY

11.4.1 Linear Test Specification

- Direction X: ± 1.5 % or less
- Direction Y: ± 1.5 % or less

11.4.2 Line Test Circuit for Y Coordinate

Add 5V between Y1 and Y2 touch the point C0R0 to C9R9 separately, and measure the voltage from X1 as the following drawing.



11.4.3 Calculate Linearity : For the First Row0

$$R0avg = (VC0 + VC1 + VC2 + \dots + VC9) \div 10$$

R0max = The maximum voltage in Row 0

R0min = The minimum voltage in Row 0

$$R0 \text{ linear1} = \left| \frac{R0 \text{ max} - R0 \text{ avg.}}{R0 \text{ avg.}} \right| * 100 \%$$

$$R0 \text{ linear2} = \left| \frac{R0 \text{ min} - R0 \text{ avg.}}{R0 \text{ avg.}} \right| * 100 \%$$

$$R0 \text{ linear} = \max (R0 \text{ linear1}, R0 \text{ linear2})$$

11.4.4 For X Coordinate Test

Add 5 voltage between X1 and X2 touch the point C0R0 to C9R9 separately and measure the voltage from Y1 as the above drawing

11.4.5 Calculate Linearity : For the First Column0

$$C0avg = (VR0 + VR1 + VR2 + \dots + VR9) \div 10$$

C0max = The maximum voltage in Column 0

C0min = The minimum voltage in Column 0

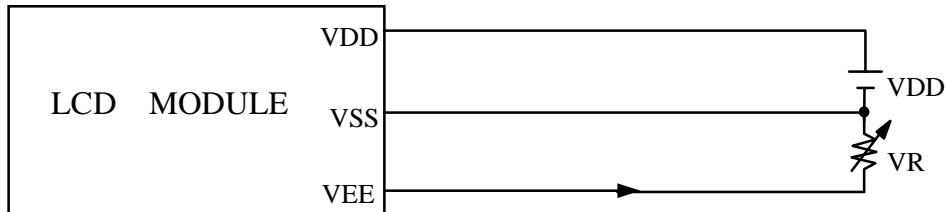
$$C0 \text{ linear1} = \left| \frac{C0 \text{ max} - C0 \text{ avg.}}{C0 \text{ avg.}} \right| * 100 \%$$

$$C0 \text{ linear2} = \left| \frac{C0 \text{ min} - C0 \text{ avg.}}{C0 \text{ avg.}} \right| * 100 \%$$

$$C0 \text{ linear} = \max (C0 \text{ linear1}, C0 \text{ linear2})$$

1 2 . POWER SUPPLY

1 2.1 POWER SUPPLY FOR LCM



RECOMMENDED : VR : 20K Ω

1 2 . 2 POWER SUPPLY FOR LED BACK - LIGHT

