EXAMINED BY :	EMERGING DISPLAY	FILE NO . CAS-10285
		ISSUE : MAR.22,2004
APPROVED BY:	TECHNOLOGIES CORPORATION	TOTAL PAGE : 10
		VERSION : 4

CUSTOMER ACCEPTANCE SPECIFICATIONS

MODEL NO. :

32F90(LED TYPES)

FOR MESSRS :

_____

CUSTOMER'S APPROVAL

DATE :

_____

BY :

_____

RECORDS OF REVISION

DOC . FIRST ISSUE

MAY.24,2002

OCT.22,2003 — REVISED PAGE NO. 3

4. ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY CURRENT FOR LOGIC NOTE (2)	IDD	VDD–VSS =5.0V VEE–VSS=21.5V	—	0.3	—	mA
POWER SUPPLY CURRENT FOR LCD DRIVE NOTE (2)	IEE	VDD–VSS =5.0V VEE–VSS=21.5V	—	2.5	—	mA

↓

PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY CURRENT FOR LOGIC NOTE (2)	IDD	VDD–VSS =5.0V VEE–VSS=21.5V	—	0.3	0.52	mA
POWER SUPPLY CURRENT FOR LCD DRIVE NOTE (2)	IEE	VDD–VSS =5.0V VEE–VSS=21.5V	—	2.5	3.0	mA

REVISED PAGE NO. 6

6. OPTICAL CHARACTERISTICS

I T E M		SYMBOL	CONDITION	MIN .	TYP .	MAX.	UNIT	NOTE
VIEWING AREA	STN	∅ 2 - ∅ 1	K ≥ 2 . 0	—	40	—	d e g .	1
	FSTN			50	—	—	d e g .	1
RESPONSE TIME		t r (rise)	∅ = 1 0 ° θ = **	—	300	550	msec	1
		t f (fall)	∅ = 1 0 ° θ = **	—	300	550	msec	1
THE BRIGHTNESS OF BACK–LIGHT		B	VLED-VLSS=5.0V	10	—	—	cd/m²	1 , 2
				13	—	—		1 , 3

↓

I T E M		SYMBOL	CONDITION		MIN .	TYP .	MAX.	UNIT	NOTE
VIEWING ANGLE	STN	∅ 2 - ∅ 1	K ≥ 2 . 0		—	40	—	d e g .	1
	FSTN				50	—	—	d e g .	1
RESPONSE TIME		t r (rise)	∅ = 1 0 ° θ = **	Ta=-20°C	—	7200	14400	ms	1
				Ta=25°C	—	300	600		
				Ta=70°C	—	120	240		
		t f (fall)	∅ = 1 0 ° θ = **	Ta=-20°C	—	4900	9600		
				Ta=25°C	—	160	320		
				Ta=70°C	—	75	150		
THE BRIGHTNESS OF MODULE		L	VLED-VLSS=5.0V		8	10	—	cd/m²	1 , 2
					12	15	—		1 , 3

MAR.11,2004 — REVISED PAGE NO. 1

2. MECHANICAL SPECIFICATIONS

(2)MODULE SIZE ---- 93.8W*66.6H*6.5(max.)mm →

(2)MODULE SIZE ---- 93.8W*66.6H*7.0(max.)mm

REVISED PAGE NO. 3

4. ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY CURRENT FOR LOGIC NOTE (2)	IDD	VDD–VSS =5.0V VEE–VSS=21.5V	—	0.3	0.52	mA
POWER SUPPLY CURRENT FOR LCD DRIVE NOTE (2)	IEE	VDD–VSS =5.0V VEE–VSS=21.5V	—	2.5	3.0	mA
CONTRAST ADJUST VOLTAGE	VEE – VSS ∅ = 10° , θ =** DUTY=1/240	Ta = -20 °C	23	24	25	V
		Ta = 25 °C	20.5	21.5	22.5	V
		Ta = 70 °C	17	18	19	V

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PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY CURRENT FOR LOGIC NOTE (2)	IDD	VDD–VSS =5.0V VEE–VSS=21.7V	—	0.3	0.6	mA
POWER SUPPLY CURRENT FOR LCD DRIVE NOTE (2)	IEE	VDD–VSS =5.0V VEE–VSS=21.7V	—	2.5	5.0	mA
CONTRAST ADJUST VOLTAGE	VEE – VSS ∅ = 10° , θ =** DUTY=1/240	Ta = -20 °C NOTE (4)	21.2	22.2	23.2	V
		Ta = 25 °C NOTE (3)	20.7	21.7	22.7	V
		Ta = 70 °C NOTE (3)	19.3	20.3	21.3	V

ADD NOTE(3) , NOTE(4)

RECORDS OF REVISION

DOC . FIRST ISSUE

MAY.24,2002

DATE	REVISED PAGE NO.	SUMMARY
MAR.11,2004	6	6. OPTICAL CHARACTERISTICS

I T E M		SYMBOL	CONDITION		MIN .	TYP .	MAX.	UNIT	NOTE
CONTRAST RATIO	STN	K	∅ = 1 0 °		3	—	—	—	1
	FSTN				5	—	—	—	1
RESPONSE TIME		t r (rise)	∅ = 1 0 ° θ = **	Ta=-20°C	—	7200	14400	ms	1
				Ta=25°C	—	300	600		
				Ta=70°C	—	120	240		
		t f (fall)	∅ = 1 0 ° θ = **	Ta=-20°C	—	4900	9600		
				Ta=25°C	—	160	320		
				Ta=70°C	—	75	150		
THE BRIGHTNESS OF MODULE		L	VLED-VLSS=5.0V		8	10	—	cd/m²	1 , 2
					12	15	—		1 , 3

↓

I T E M		SYMBOL	CONDITION		MIN .	TYP .	MAX.	UNIT	NOTE
CONTRAST RATIO	STN	K	∅ = 1 0 °		1.5	3.0	—	—	1
	FSTN				3.0	5.5	—	—	1
RESPONSE TIME		t r (rise)	∅ = 1 0 ° θ = **	Ta=-20°C	—	4500	9000	ms	1
				Ta=25°C	—	300	600		
				Ta=70°C	—	70	140		
		t f (fall)	∅ = 1 0 ° θ = **	Ta=-20°C	—	3000	6000		
				Ta=25°C	—	190	380		
				Ta=70°C	—	90	180		
THE BRIGHTNESS OF MODULE		L	VLED-VLSS=5.0V		8	10	—	cd/m²	1 , 2
					12	15	—		1 , 3
THE UNIFORMITY OF MODULE		—			—	—	30	%	4

ADD NOTE(4)

	7	7. OUTLINE DIMENSIONS THICKNESS 6.5MAX.→7.0MAX.
	10	11.1 POWER SUPPLY FOR LCM 21.5V → 21.7V
MAR.22,2004	1	2. MECHANICAL SPECIFICATIONS (2)MODULE SIZE ------- 93.8W*66.6H*7.0(max.)mm → (2)MODULE SIZE ------- 96.3W*66.6H*7.0(max.)mm (NOT INCLUDED FFC LENGTH)
	10	ADD 11.3 TIMING OF POWER SUPPLY AND INTERFACE SIGNAL

NUMBERING SYSTEM

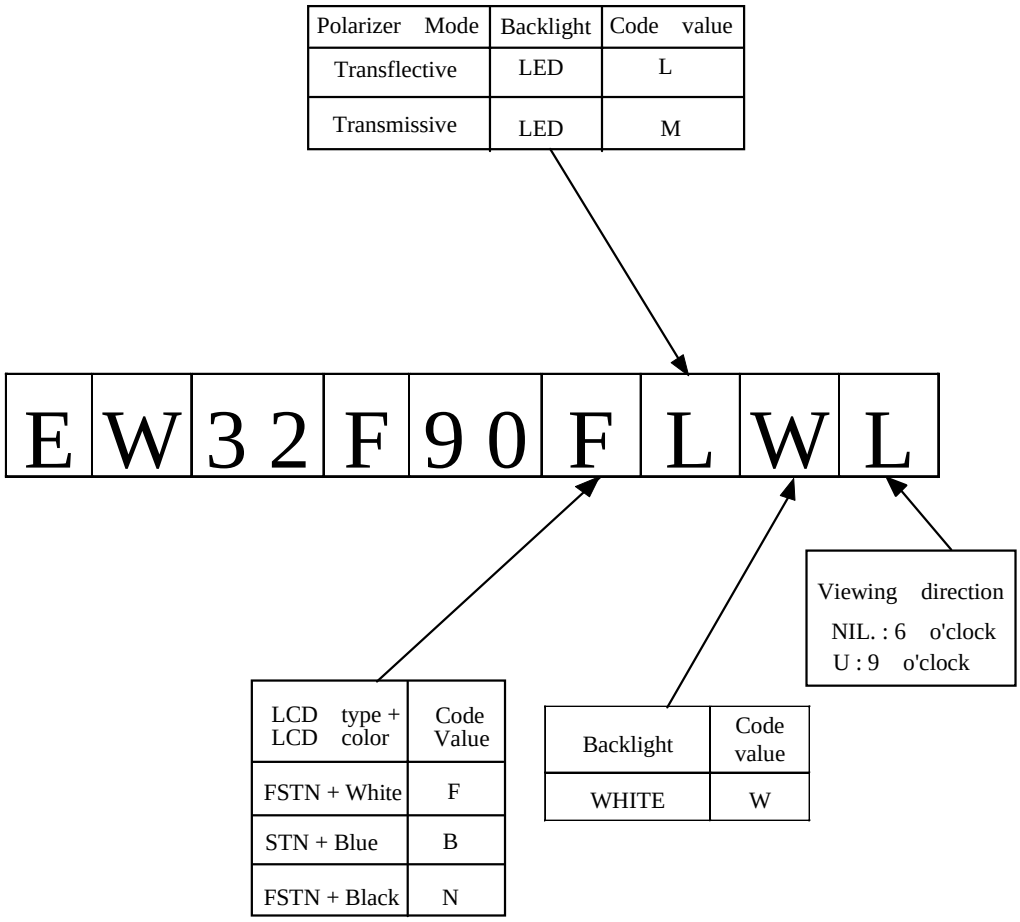


TABLE OF CONTENTS

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 .

2. MECHANICAL SPECIFICATIONS

(1)	NUMBER OF DOTS	320W * 240H DOTS
(2)	MODULE SIZE	96.3W * 66.6H * 7.0 (max.) mm (NOT INCLUDED FFC LENGTH)
(3)	VIEWING AREA	78.8W * 59.6H 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 *	
(10)	BACK LIGHT	LED ; COLOR : WHITE

* PLEASE REFER TO NUMBERING SYSTM .

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	27	V	
INPUT VOLTAGE	VIN	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.

ITEM	OPERATING		STORAGE		REMARK
	MIN.	MAX.	MIN.	MAX.	
AMBIENT TEMPERATURE	-20 °C	70 °C	-20 °C	70 °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.
70°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	—	5.5	V
POWER SUPPLY VOLTAGE FOR LCD DRIVE	VEE – VSS	—	+15	—	+27	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=21.7V	—	0.3	0.6	mA
POWER SUPPLY CURRENT FOR LCD DRIVE NOTE (2)	IEE	VDD–VSS =5.0V VEE–VSS=21.7V	—	2.5	5.0	mA
CONTRAST ADJUST VOLTAGE	VEE – VSS ∅ = 10° , θ =** DUTY=1/240	Ta = -20 °C NOTE (4)	21.2	22.2	23.2	V
		Ta = 25 °C NOTE (3)	20.7	21.7	22.7	V
		Ta = 70 °C NOTE (3)	19.3	20.3	21.3	V
CLOCK OSCILLATION FREQUENCY	fFLM	—	70	75	80	Hz
POWER SUPPLY FOR LED	VLED – VLSS	IF = 100 mA	—	5.0	—	V

**θ = 0° WHEN VIEWING DIRECTION IS 6 O'CLOCK

θ =270° WHEN VIEWING DIRECTION IS 9 O'CLOCK

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

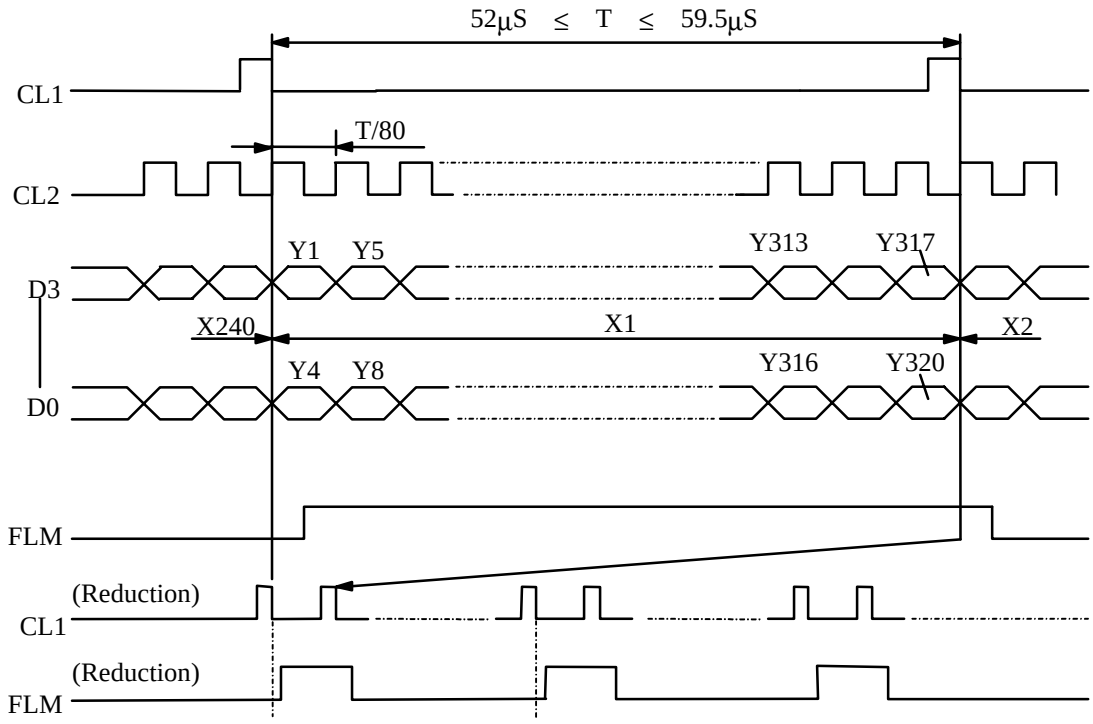
NOTE (2) : THIS DISPLAY PATTERN IS ALL ON OR OFF.

NOTE (3) : THIS DISPLAY PATTERN IS ALL "Q".

NOTE (4) : THIS DISPLAY PATTERN IS ALL "BAR" (ONLY Ta=-20°C)

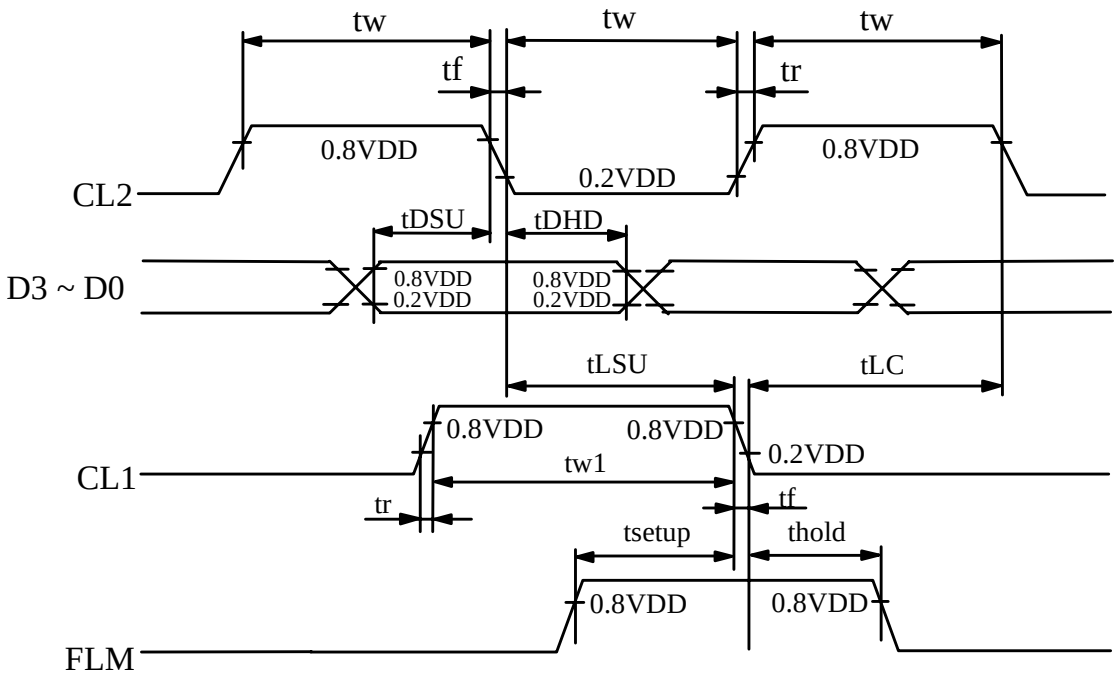
5. TIMING CHARACTERISTICS

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

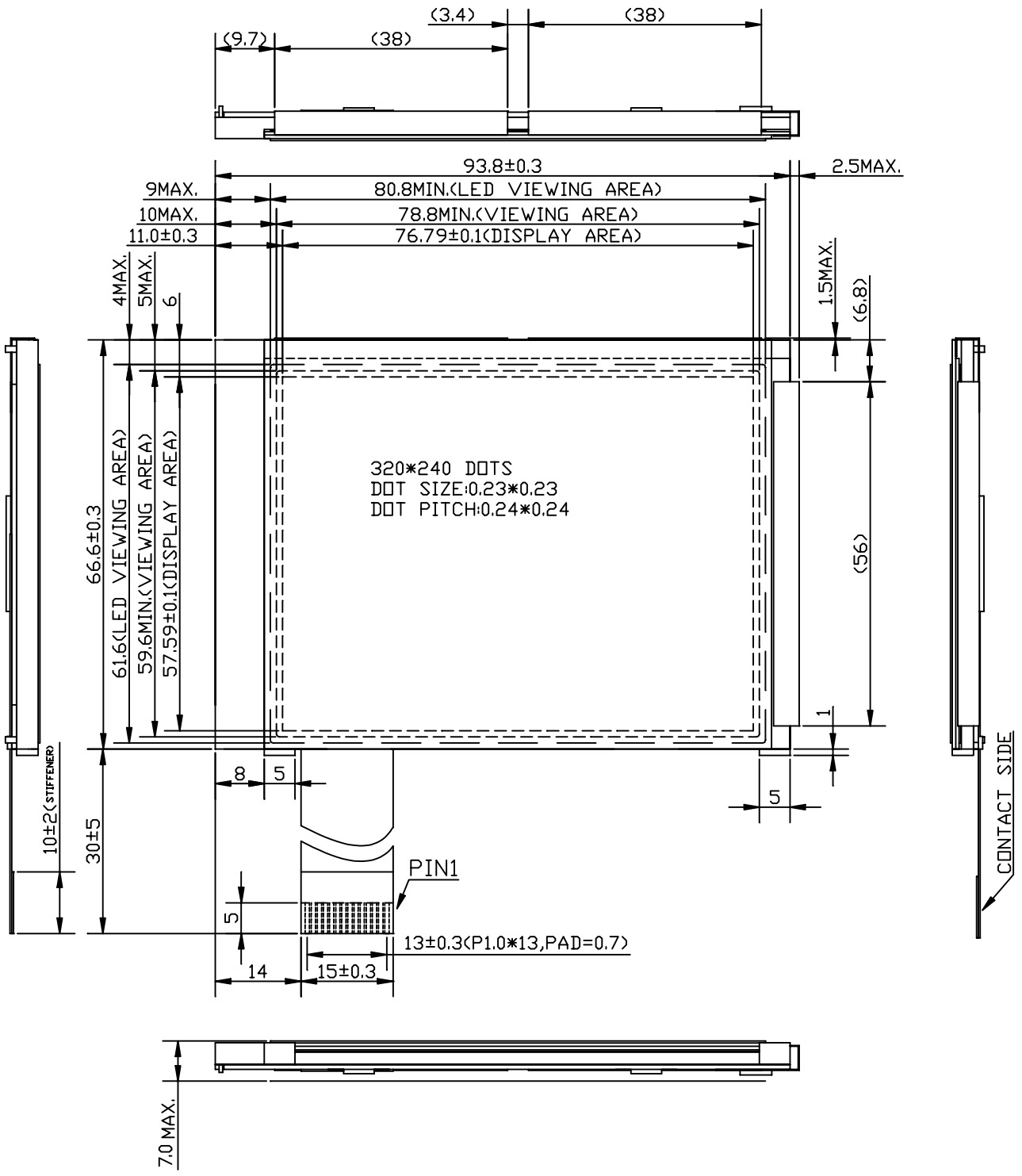
Ta = 25 °C

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT	NOTE
VIEWING ANGLE	STN	∅2 - ∅1	K ≥ 2.0		—	40	—	deg.	1
	FSTN				50	—	—	deg.	1
CONTRAST RATIO	STN	K	∅ = 10°		1.5	3.0	—	—	1
	FSTN				3.0	5.5	—	—	1
RESPONSE TIME		tr (rise)	∅ = 10° θ = **	Ta=-20°C	—	4500	9000	ms	1
				Ta=25°C	—	300	600		
				Ta=70°C	—	70	140		
		tf (fall)	∅ = 10° θ = **	Ta=-20°C	—	3000	6000		
				Ta=25°C	—	190	380		
				Ta=70°C	—	90	180		
THE BRIGHTNESS OF MODULE		L	VLED-VLSS=5.0V		8	10	—	cd/m^2	1 , 2
					12	15	—		1 , 3
THE UNIFORMITY OF MODULE		—			—	—	30	%	4

**θ = 0° WHEN VIEWING DIRECTION IS 6 O'CLOCK
θ =270° WHEN VIEWING DIRECTION IS 9 O'CLOCK

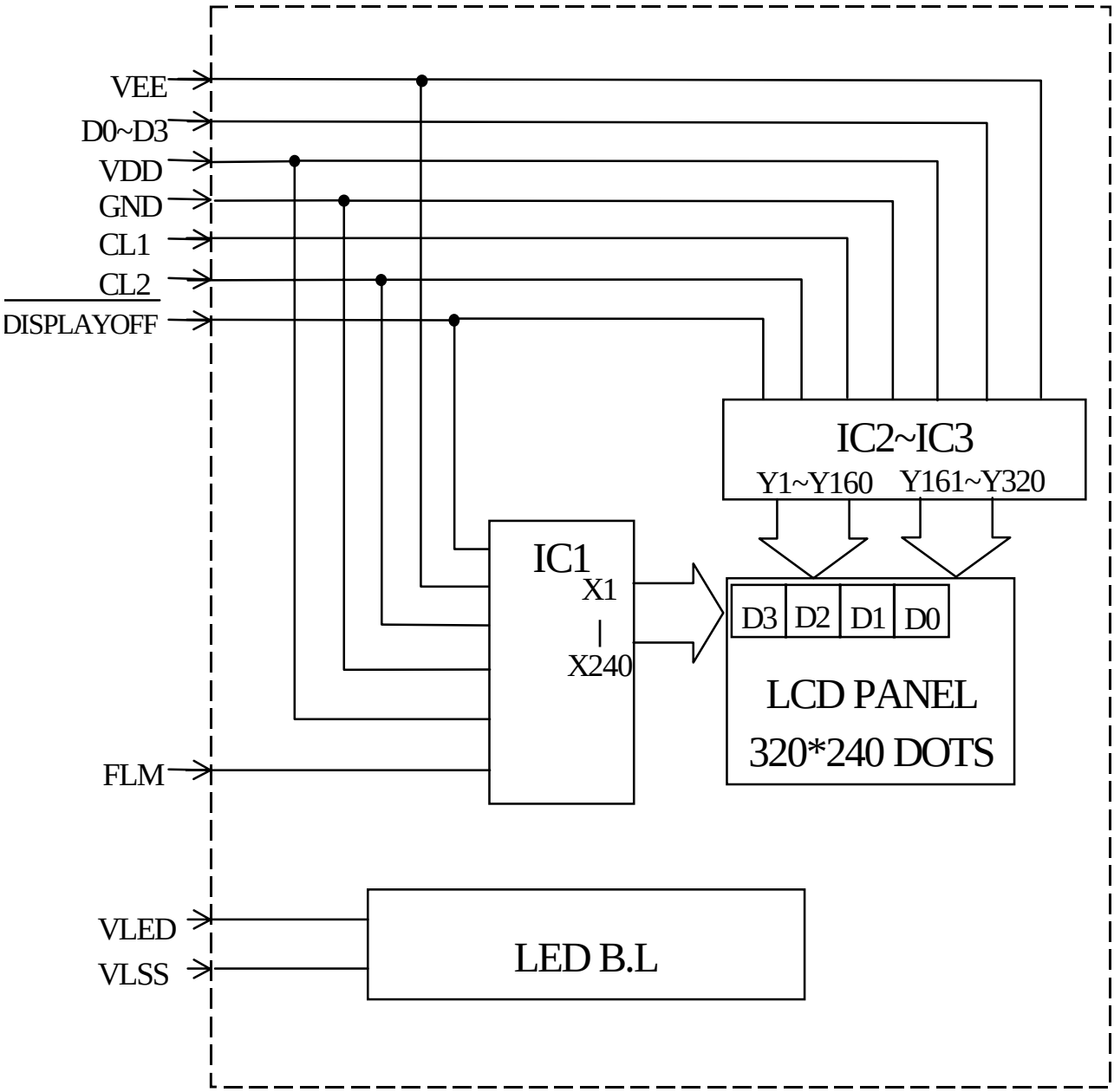
NOTE (1) : PLEASE REFER TO :
CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS. (EU – 002A)
NOTE (2) : POLARIZER IS TRANSFLECTIVE TYPE.
NOTE (3) : POLARIZER IS TRANSMISSIVE TYPE.
NOTE (4) : BRIGHTNESS AT GLASS SURFACE (DISPLAY ALL "OFF")

7 . OUTLINE DIMENSIONS

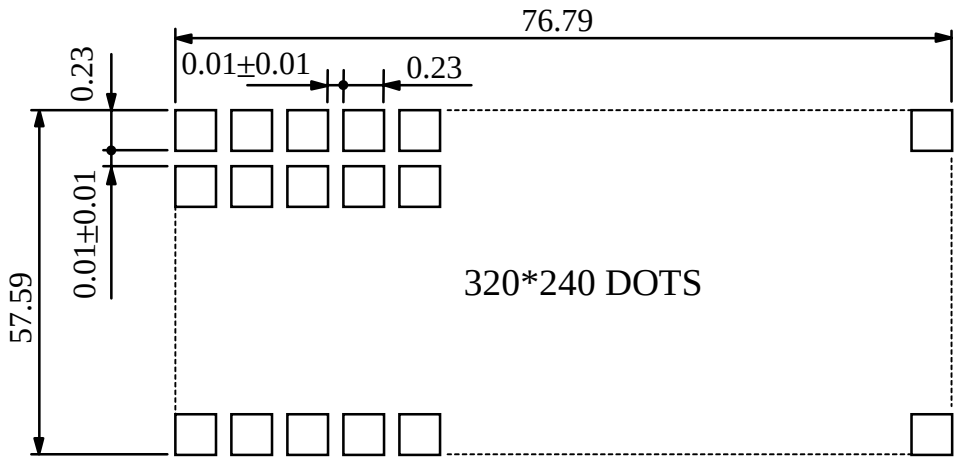


UNIT : mm
SCALE : NTS
NOT SPECIFIED TOLERANCE IS ± 0.5

8. BLOCK DIAGRAM



9. DETAIL DRAWING OF DOT MATRIX



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

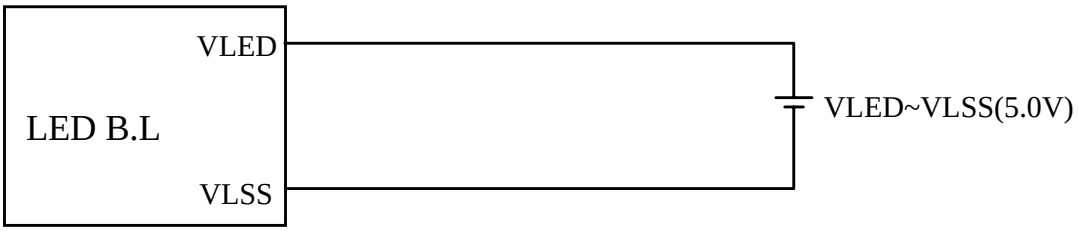
10. INTERFACE SIGNALS

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

11. POWER SUPPLY

11.1 POWER SUPPLY FOR LCM

11.2 POWER SUPPLY FOR LED BACK - LIGHT



11.3 TIMING OF POWER SUPPLY AND INTERFACE SIGNAL