EXAMINED BY :	EMERGING DISPLAY	FILE NO . CAS-10356
		ISSUE : DEC.21,2004
APPROVED BY:	TECHNOLOGIES CORPORATION	TOTAL PAGE : 11
		VERSION : 6

CUSTOMER ACCEPTANCE SPECIFICATIONS

MODEL NO. :

13BB0(WHITE LED TYPES)

FOR MESSRS :

CUSTOMER'S APPROVAL

DATE :

BY :

RECORDS OF REVISION

DOC . FIRST ISSUE

APR.27,2004

DATE	REVISED PAGE NO.	SUMMARY
MAY.12,2004	3	4. ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLYVOLTAGE FOR LOGIC	VDD – VSS	—	3.15	3.3	3.45	V
RECOMMENDED LCD DRIVING VOLTAGE	VDD – V5	Ta =- 20 °C	(10.5)	(10.8)	(11.1)	V
	∅=10° θ=0°	Ta = 25 °C	(10.0)	(10.3)	(10.6)	
	DUTY=1/65	Ta = 70 °C	(9.2)	(9.5)	(9.8)	

↓

PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY VOLTAGE FOR LOGIC	VDD – VSS	—	(3.15)	3.3	(3.45)	V
RECOMMENDED LCD DRIVING VOLTAGE	V0 – VSS	Ta =- 20 °C	(10.5)	(10.8)	(11.1)	V
	∅=10° θ=0°	Ta = 25 °C	(10.0)	(10.3)	(10.6)	
	DUTY=1/64	Ta = 70 °C	(9.2)	(9.5)	(9.8)	

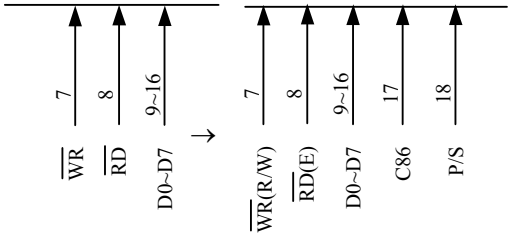
NOTE(1) : APPLIED TO TERMINALS RS,D0 ~ D7, $\overline{RD}$, $\overline{WR}$, $\overline{CSI}$, $\overline{RES}$.→

NOTE(1) : APPLIED TO TERMINALS RS,D0~D5,D6(SCL),D7(SI), $\overline{RD}$ (E), $\overline{WR}$ (R/W), $\overline{CSI}$, $\overline{RES}$,C86,P/S.

NOTE(2) : APPLIED TO TERMINALS D0 ~ D7 .→

NOTE(2) : APPLIED TO TERMINALS D0 ~ D5,D6(SCL),D7(SI) .

	5 , 6	6. OUTLINE DIMENSIONS REVISION NOTE
	7	7. BLOCK DIAGRAM



	9	9. INTERFACE SIGNALS

PIN NO	SYMBOL	FUNCTION
7	$\overline{WR}$	WRITE DATA CONTROL
8	$\overline{RD}$	READ DATA CONTROL
15	D6	DATA BUS
16	D7	

↓

PIN NO	SYMBOL	FUNCTION
7	$\overline{WR}$ (R/W)	8080 FAMILY INTERFACE ACTS AS THE ACTIVE-LOW WRITE STROBE. 6800 FAMILY INTERFACE ACTS AS THE READ/WRITE CONTROL SIGNAL.
8	$\overline{RD}$ (E)	8080 FAMILY INTERFACE ACTS AS THE ACTIVE-LOW READ STROBE. 6800 FAMILY INTERFACE ACTS AS THE ACTIVE-HIGH ENABLE CLOCK.
15	D6(SCL)	WHEN THE SERIAL INTERFACE IS SELECTED(P/S:L) D6:THE SERIAL CLOCK INPUT(SCL)D7:SERIAL DATA INPUT(SI) D0 TO D5 ARE SET TO HIGH IMPEDANCE
16	D7(SI)	

ADD PIN NO.17,18

MAY.26,2004	0-2	NUMBERING SYSTEM ADD STN+Blue : B
	5	6. OUTLINE DIMENSIONS CHANGE BACKLIGHT CONFIGURATION ADD NOTE : MARK △ MODIFY (NUMBER NOTE MODIFY VERSION)

RECORDS OF REVISION

DOC . FIRST ISSUE

APR.27,2004

DATE	REVISED PAGE NO.	SUMMARY
JUN.14,2004	2	3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN .	MAX .	UNIT	REMARK
POWER SUPPLY FOR LOGIC	VDD – VSS	- 0.3	+ 5	V	
POWER SUPPLY FOR LCD DRIVING	VDD – V5	- 0.3	+ 16.0	V	
INPUT VOLTAGE	VI	– 0.3	VDD + 0.3	V	

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PARAMETER	SYMBOL	MIN .	MAX .	UNIT	REMARK
POWER SUPPLY FOR LOGIC	VDD – VSS	0.3	+3.5	V	
POWER SUPPLY FOR LCD DRIVING	VO – VOUT	0.3	+18.0	V	

	3	4. ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY VOLTAGE FOR LOGIC	VDD – VSS	—	(3.15)	3.3	(3.45)	V
POWER SUPPLY CURRENT FOR LOGIC NOTE (3)	IDD	VDD – VSS =3.3V	—	(0.5)	(1.0)	mA

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PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY VOLTAGE FOR LOGIC	VDD – VSS	—	2.7	3.0	3.3	V
POWER SUPPLY CURRENT FOR LOGIC NOTE (3)	IDD	VDD – VSS =3.0V	—	(0.5)	(1.0)	mA

	10	10.1 POWER SUPPLY FOR LCM VDD (3.3V) → VDD(+3.0V)
NOV.23,2004	0-3	NUMBERING SYSTEM EW13BB0FLW→ES13BB0FLW
	2	3.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS.(AT Ta=25°C) LED POWER DISSIPATION : (0.4)MAX.→0.45MAX. LED FORWARD CURRENT : (80)MAX.→90MAX. LED REVERSE VOLTAGE : 8.0MAX.→10.0MAX.
	3	4. ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY CURRENT FOR LOGIC NOTE (3)	IDD	VDD – VSS =3.0V	—	(0.5)	(1.0)	mA
RECOMMENDED LCD DRIVING VOLTAGE	V0 – VSS	Ta =- 20 °C	(10.5)	(10.8)	(11.1)	V
	∅=10° θ=0°	Ta = 25 °C	(10.0)	(10.3)	(10.6)	
	DUTY=1/64	Ta = 70 °C	(9.2)	(9.5)	(9.8)	
LED FORWARD VOLTAGE	VF	IF = (60 mA)	—	5	—	V

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PARAMETER	SYMBOL	CONDITION	MIN .	TYP .	MAX .	UNIT
POWER SUPPLY CURRENT FOR LOGIC NOTE (3)	IDD	VDD – VSS =3.0V	—	0.5	1.5	mA
RECOMMENDED LCD DRIVING VOLTAGE	V0 – VSS	Ta =- 20 °C	10.2	10.7	11.2	V
	∅=10° θ=0°	Ta = 25 °C	9.8	10.3	10.8	
	DUTY=1/64	Ta = 70 °C	9.4	9.9	10.4	
LED FORWARD VOLTAGE	VF	IF = 60 mA	—	5	—	V

	4	5. OPTICAL CHARACTERISTICS

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 ° θ = 0°	—	(7)	—	—	1
	FSTN			—	(14)	—	—	1
BRIGHTNESS OF MODULE		L	IF=(60mA)	(4.5)	(7.5)	—	cd / m²	1 , 2
				(3)	(5)	—		1 , 3

↓

ITEM		SYMBOL	CONDITION	MIN .	TYP .	MAX.	UNIT	NOTE
VIEWING ANGLE	STN	∅2 – ∅ 1	K ≥ 2 . 0	—	50	—	deg.	1
	FSTN			—	30	—	deg.	1
CONTRAST RATIO	STN	K	∅ = 10 ° θ = 0°	5.1	5.8	—	—	1
	FSTN			4.1	4.7	—	—	1
BRIGHTNESS OF MODULE		L	IF=60mA	18	24	—	cd / m²	1 , 2
				12	16	—		1 , 3

DEC.21,2004	4	5. OPTICAL CHARACTERISTICS

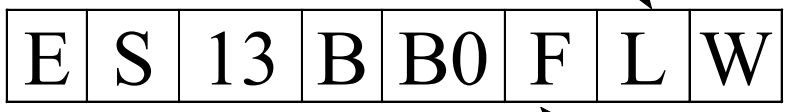
ITEM		MIN .	TYP .	MAX.
VIEWING ANGLE	STN	—	50	—
	FSTN	—	30	—
CONTRAST RATIO	STN	5.1	5.8	—
	FSTN	4.1	4.7	—
RESPONSE TIME		—	TBD	—
		—	TBD	—
		—	TBD	—
		—	TBD	—
		—	TBD	—
		—	TBD	—

→

ITEM		MIN .	TYP .	MAX.
VIEWING ANGLE	STN	20	—	—
	FSTN	30	—	—
CONTRAST RATIO	STN	3.5	4.5	—
	FSTN	4.1	4.7	—
RESPONSE TIME		—	2806	5612
		—	156	312
		—	77	154
		—	1956	3912
		—	129	258
		—	67	134

NUMBERING SYSTEM

Polarizer Mode	Backlight	Code value
Transflective	LED	L
Transmissive	LED	M



LCD type + LCD color	Code Value
STN + Yellow-Green	Y
STN + Gray	G
FSTN + White	F
FSTN + Black	N
STN + Blue	B

TABLE OF CONTENTS

1. GENERAL SPECIFICATIONS

1.1 APPLICATION NOTES FOR CONTROLLER/DRIVER
PLEASE REFER TO :

SITRONIX ST7565P

2. MECHANICAL SPECIFICATIONS

(1) NUMBER OF DOTS	----------	128W * 64H DOTS
(2) MODULE SIZE	----------	87.6W * 50.4H * 5.9D(max) mm
(3) EFFECTIVE AREA	----------	70W * 37H mm
(4) ACTIVE AREA	----------	65.265W * 32.625H mm
(5) DOT SIZE	----------	0.495W * 0.495H mm
(6) DOT PITCH	----------	0.51W * 0.51H mm
(7) LCD TYPE*		
(8) DRIVING METHOD	----------	1 / 64 DUTY MULTIPLEX DRIVE 1 / 9 BIAS
(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	0.3	+3.5	V	
POWER SUPPLY FOR LCD DRIVING	VO – VOUT	0.3	+ 18.0	V	
STATIC ELECTRICITY	—	—	200.00	V	NOTE (1)
LED POWER DISSIPATION	PD	—	0.45	W	
LED FORWARD CURRENT	IF	—	90	mA	
LED REVERSE VOLTAGE	VR	—	10	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	– 2 0 °C	7 0 °C	– 3 0 °C	8 0 °C	NOTE (2) , (3)
HUMIDITY	—	8 5 % RH	—	8 5 % RH	WITHOUT CONDENSATION
VIBRATION	—	2 . 4 5 m/S^2 (0 . 2 5 G)	—	1 1 . 7 6 m/S^2 (1 . 2 G)	10~100 Hz XYZ DIRECTIONS 1 Hr. EACH
SHOCK	—	2 9 . 4 m/S^2 (3 G)	—	4 9 0 m/S^2 (5 0 G)	10 m SECONDS XYZ DIRECTIONS 1 TIME EACH
CORROSIVE GAS	NOT ACCEPTABLE		NOT ACCEPTABLE		

NOTE (2) : Ta AT –30°C : 240HR MAX.
80°C : 240HR 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	—	2.7	3.0	3.3	V
INPUT VOLTAGE	VIH	H LEVEL	0.8VDD	—	VDD	V
NOTE (1)	VIL	L LEVEL	VSS	—	0.2VDD	V
OUTPUT VOLTAGE	VOH	IOH = - 0.5 mA	0.8VDD	—	VDD	V
NOTE (2)	VOL	IOH = 0.5 mA	VSS	—	0.2VDD	V
POWER SUPPLY CURRENT FOR LOGIC NOTE (3)	IDD	VDD – VSS =3.0V	—	0.5	1.5	mA
RECOMMENDED LCD DRIVING VOLTAGE	V0 – VSS ∅=10° θ=0° DUTY=1/64	Ta =- 20 °C	10.2	10.7	11.2	V
		Ta = 25 °C	9.8	10.3	10.8	
		Ta = 70 °C	9.4	9.9	10.4	
OSCILLATION FREQUENCY	fosc	1/64 DUTY	17	20	24	KHz
LED FORWARD VOLTAGE	VF	IF = 60 mA	—	5	—	V

NOTE (1) : APPLIED TO TERMINALS RS , D0 ~ D5,D6(SCL),D7(SI), $\overline{RD}$ (E), $\overline{WR}$ (R/W), $\overline{CSI}$, $\overline{RES}$,C86,P/S.
NOTE (2) : APPLIED TO TERMINALS D0 ~ D5 , D6(SCL) , D7(SI) .
NOTE (3) : THIS DISPLAY PATTERN IS ALL ON OR OFF.

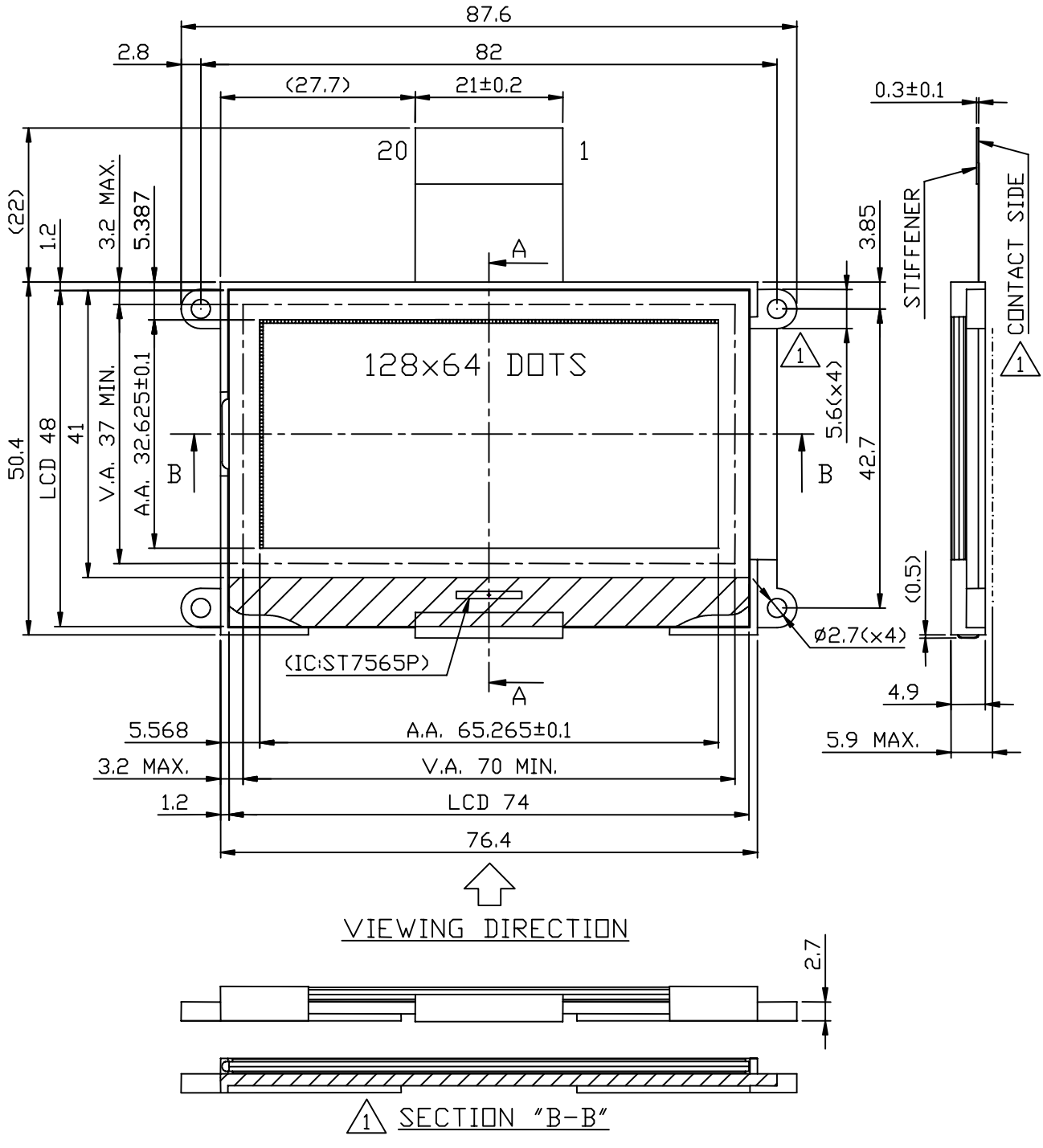
5. OPTICAL CHARACTERISTICS

Ta = 25 °C VDD = 5.0 V

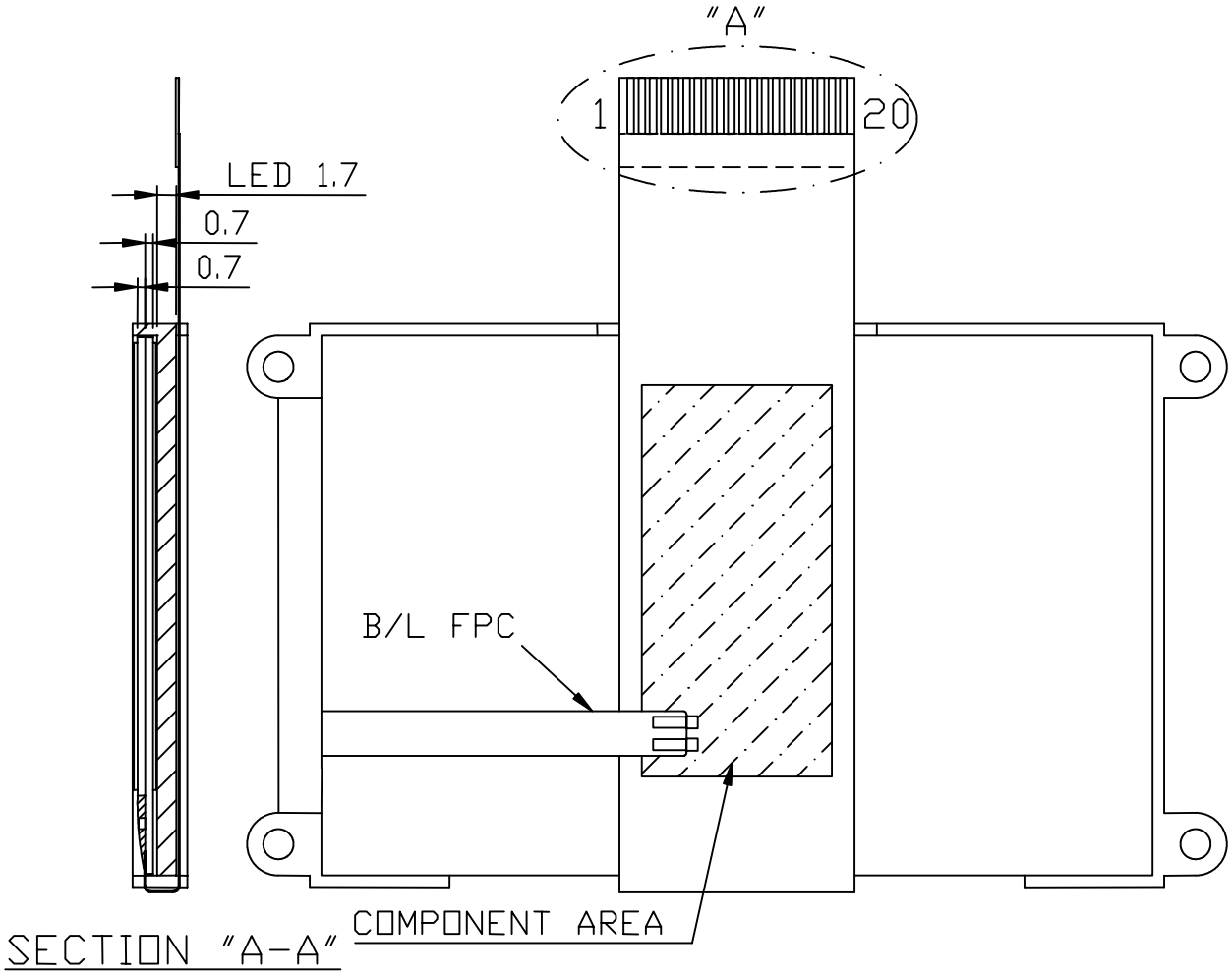
ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT	NOTE
VIEWING ANGLE	STN	∅2 – ∅1	K ≥ 2.0		20	—	—	deg.	1
	FSTN				30	—	—	deg.	1
CONTRAST RATIO	STN	K	∅ = 10° θ = 0°		3.5	4.5	—	—	1
	FSTN				4.1	4.7	—	—	1
RESPONSE TIME		tr (rise)	∅=10° θ = **	Ta = -20 °C	—	2806	5612	ms	1
				Ta = 25 °C	—	156	312		
				Ta = 70 °C	—	77	154		
		tf (fall)		Ta = -20 °C	—	1956	3912		
				Ta = 25 °C	—	129	258		
				Ta = 70 °C	—	67	134		
BRIGHTNESS OF MODULE		L	IF=60mA		18	24	—	cd / m^2	1 , 2
					12	16	—		1 , 3

NOTE (1) : PLEASE REFER TO :
CUSTOMER ACCEPTANCE STANDARD SPECIFICATIONS. (EU - 002A)
NOTE (2) : POLARIZER MODE : TRANSMISSIVE
NOTE (3) : POLARIZER MODE : TRANSFLECTIVE

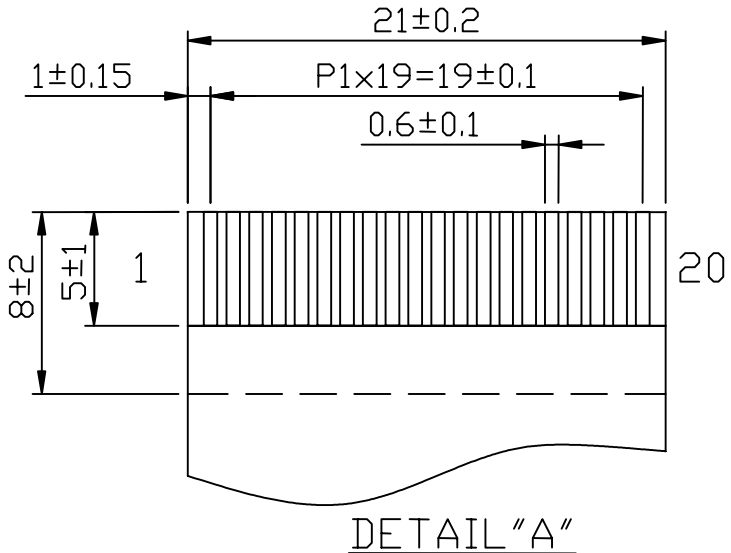
6 . OUTLINE DIMENSIONS



UNIT : mm
SCALE : NTS
NOT SPECIFIED TOLERANCE IS ± 0.5
NOTE : MARK ⚠ MODIFY (NUMBER NOTE MODIFY VERSION)

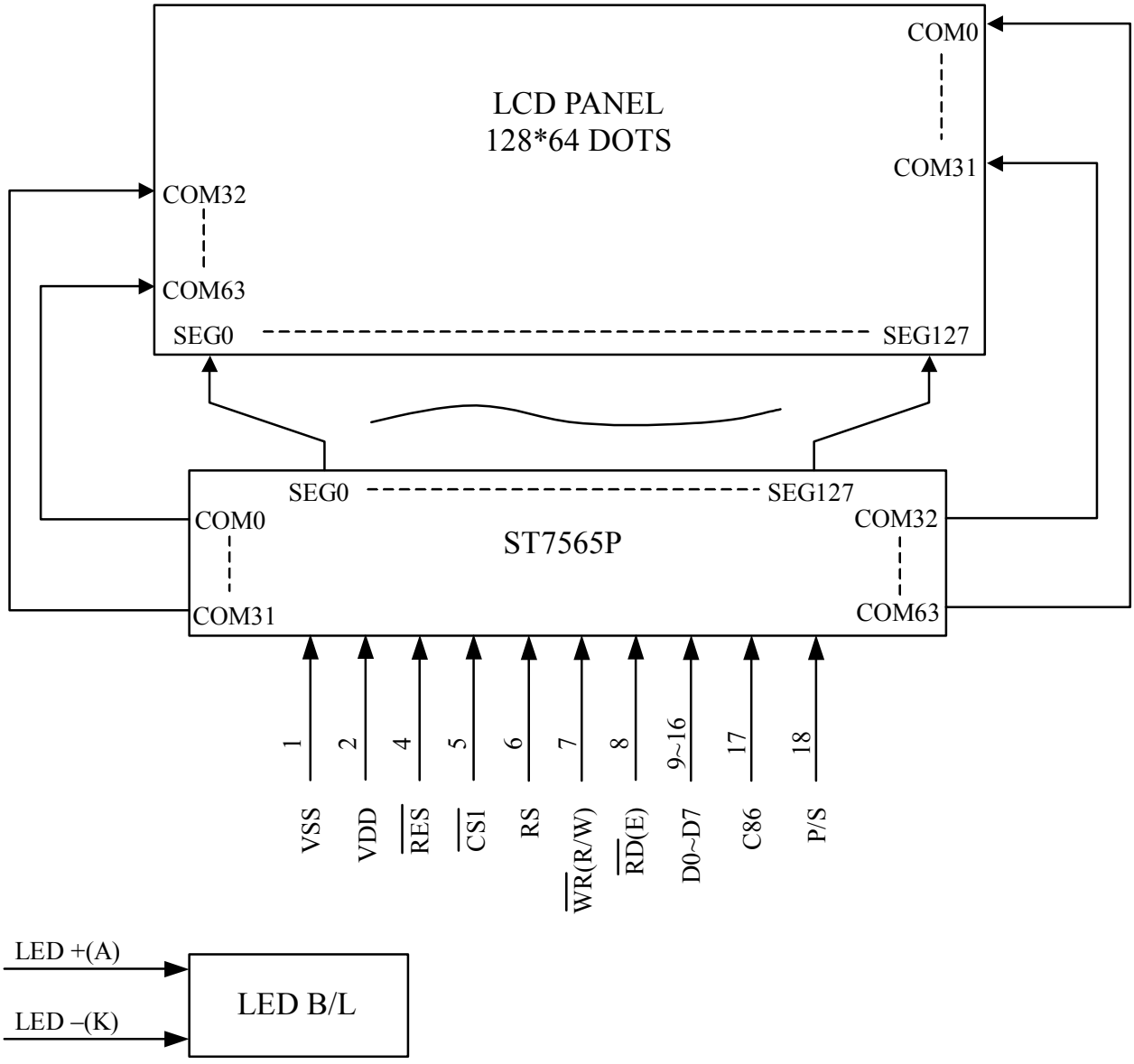


SECTION "A-A"

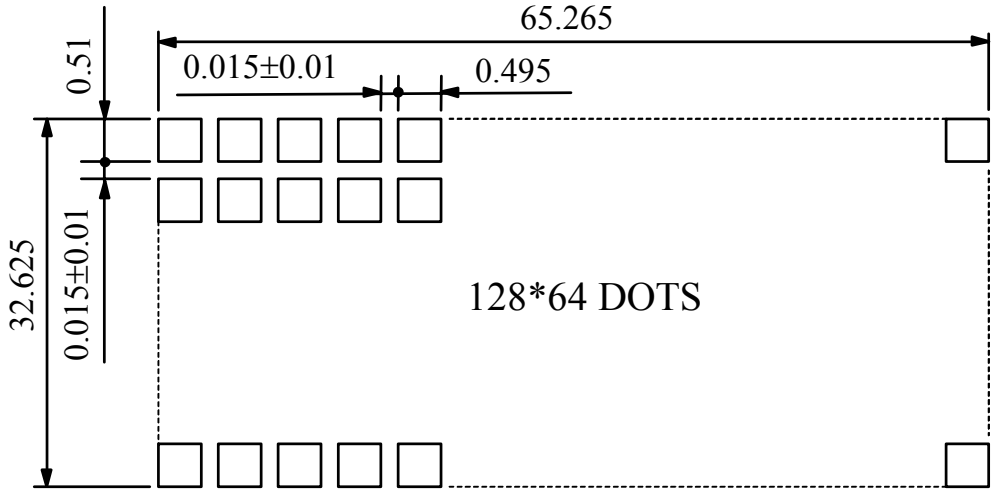


DETAIL"A"

7 . BLOCK DIAGRAM



8 . DETAIL DRAWING OF DOT MATRIX



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

9. INTERFACE SIGNALS

PIN NO	SYMBOL	FUNCTION
1	VSS	GROUND (0 V)
2	VDD	POWER SUPPLY FOR LOGIC CIRCUIT
3	NC	NO CONNECTION
4	$\overline{RES}$	RESET SIGNAL
5	$\overline{CS1}$	CHIP SELECTION
6	RS	DATA / COMMAND CONTROL SIGNAL RS = "H" : INDICATES THAT DO TO D7 ARE DISPLAY DATA RS = "L" : INDICATES THAT DO TO D7 ARE CONTROL DATA
7	$\overline{WR}$ (R/W)	8080 FAMILY INTERFACE ACTS AS THE ACTIVE-LOW WRITE STROBE. 6800 FAMILY INTERFACE ACTS AS THE READ/WRITE CONTROL SIGNAL.
8	$\overline{RD}$ (E)	8080 FAMILY INTERFACE ACTS AS THE ACTIVE-LOW READ STROBE. 6800 FAMILY INTERFACE ACTS AS THE ACTIVE-HIGH ENABLE CLOCK.
9	D0	DATA BUS
10	D1	
11	D2	
12	D3	
13	D4	
14	D5	
15	D6(SCL)	WHEN THE SERIAL INTERFACE IS SELECTED(P/S=L) D6:THE SERIAL CLOCK INPUT(SCL) D7:SERIAL DATA INPUT(SI) D0 TO D5 ARE SET TO HIGH IMPEDANCE
16	D7(SI)	
17	C86	C86="H"=6800 SERIES MPU INTERFACE C86="L"=8080 MPU INTERFACE
18	P/S	THIS IS THE PARALLEL DATA INPUT/SERIAL DATA INPUT SWITCH TERMINAL. P/S="H":PARALLEL DATA INPUT. P/S="L":SERIAL DATA INPUT. THE FOLLOWING APPLIES DEPENDING ON THE P/S STATUS:

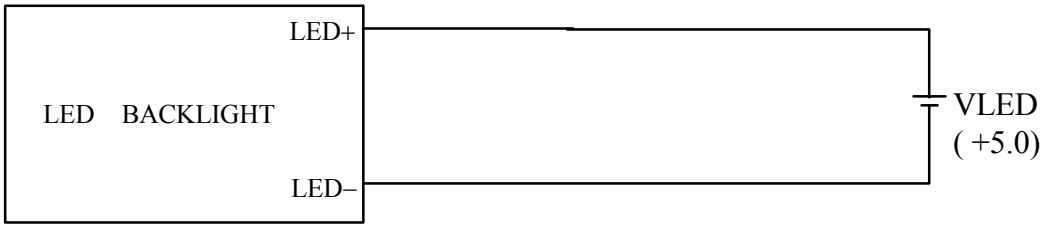
P/S	DATA/COMMAND	DATA	READ/WRITE	SERIAL CLOCK
"H"	RS	D0 TO D7	$\overline{RD}$, $\overline{WR}$	X
"L"	RS	SI(D7)	WRITE ONLY	SCL(D6)

		WHEN P/S ="L",D0 TO D5 FIXED "H". $\overline{RD}$ (E) AND $\overline{WR}$ (R/W) ARE FIXED TO EITHER "H" OR "L". WITH SERIAL DATA INPUT , IT IS IMPOSSIBLE READ DATA FROM RAM.
19	LED +	POWER SUPPLY FOR LED BACKLIGHT (ANODE)
20	LED–	POWER SUPPLY FOR LED BACKLIGHT (CATHODE)

10. POWER SUPPLY

10.1 POWER SUPPLY FOR LCM

10.2 POWER SUPPLY FOR LED BACKLIGHT



11. INSTRUCTION DESCRIPTION

(Note) *: disabled data

Command	Command Code										Function
	RS	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM
(7) Display data read	1	0	1	Read data								Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565P)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0 1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17) V_0 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the V_0 output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value						
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 1	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	Mode	Set the flashing mode
(20) Booster ratio set	0	1	0	1 0	1 0	1 0	1 0	1 0	0 0	0 step-up value	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) Power saver												Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command