FORDATA
FOR DATA DISPLAY

classic mono LCDs

SPECIFICATION
GRAPHIC TYPE
DOT MATRIX LCD MODULE

| UV | F | HC | 👁 | RoHS | O₃ | 70℃ -20℃ | 💡 |

ITEM NUMBER: FDCG12864B-FLYYBW-51BN
ESTABLISHED DATE: 2010.11
DATASHEET VERSION: 2008 VERSION

ISSUED BY: 魏燕东 **CHECKED BY:** 庄智良 **APPROVED BY:** 庄智良

FORDATA ELECTRONIC CO.,LTD
PROFESSIONAL LCD SUPPLIER FROM CHINA

| STANDARD DOC. | DATASHEET STATEMENT |

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6. Icons explanation

FORDATA FOR DATA DISPLAY — FORDATA's 2006 version logo. FORDATA is an integrated manufacturer of flat panel display (FPD). FORDATA supplies TN, HTN, STN, FSTN monochrome LCD panel; COB, COG, TAB LCD module; and all kinds of LED backlight.

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FAST RESPONSE TIME
This icon on the cover indicates the product is with high response speed; Otherwise not.

PROTECTION CIRCUIT
This icon on the cover indicates the product is with protection circuit; Otherwise not.

HIGH CONTRAST
This icon on the cover indicates the product is with high contrast; Otherwise not.

LONG LIFE VERSION
This icon on the cover indicates the product is long life version (over 9K hours guaranteed); Otherwise not.

WIDE VIEWING SCOPE
This icon on the cover indicates the product is with wide viewing scope; Otherwise not.

Anti UV VERSION
This icon on the cover indicates the product is against UV line. Otherwise not.

RoHS COMPLIANCE
This icon on the cover indicates the product meets ROHS requirements; Otherwise not.

OPERATION TEMPERATURE RANGE
This icon on the cover indicates the operating temperature range (X-Y).

3TIMEs 100% QC EXAMINATION
This icon on the cover indicates the product has passed FORDATA's thrice 100% QC. Otherwise not.

TWICE SELECTION OF LED MATERIALS
This icon on the cover indicates the LED had passed FORDATA's twice strict selection which promises the product's identical color and brightness; Otherwise not.

VIcm = 3.0V
This icon on the cover indicates the product can work at 3.0V exactly; otherwise not.

N SERIES TECHNOLOGY (2008 developed)
FORDATA adopts new structure, new craft, new technology and new materials inside both LCD module and LCD panel to improve the "RainBow"

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STANDARD DOC.	REVISION RECORD	PAGE	1/17

NO.	DATE	DESCRIPTION	ITEM	PAGE	APPROVED
1	2010.11	INITIAL ISSUED	ALL	ALL	

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FORDATA ELECTRONIC CO.,LTD PROFESSIONAL LCD SUPPLIER FROM CHINA	STANDARD DOC.	CODE SYSTEM STANDARD COB	PAGE	2/17

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FD	C	C	08	01	A	F	L	Y	Y	B	W	5	2	L	E

No.	REMARKS	DESCRIPTION
1	COMPANY ABBRAVIATED	FD = FORDATA
2	IC packing	C = Chip On Board G = Chip On Glass T = TAB
3	LCM type	C = Character G = Graphic
4	Chyaracter	08, 10, 12, 16, 20, 24, 40, = Character number Per line
	Graphic	80, 100, 120, 122, 128, 160 ... ... = Row Dots Quantity
5	Character	01, 02, 04, = Character Lines
	Graphic	32, 64, 80, 128, 160 ... ... =Column Dots Quantity
6	Serial Number	A~Z
7	Polarizer type	R = Positive Reflective F = Positive Transflective M = Positive Transmissive N = Negative Transmissive E = Negative, Transflective B = Negative, Dual optical compensation (for FSTN type only)
8	Backlight type	N = No Backlight L = Array Type LED Backlight S = Edge Type LED Backlight E = EL backlight without Invertor F = EL backlight with Invertor C = CCFL backlight without Invertor T = CCFL backlight with Invertor
9	Backlight color	N = No Backlight Y = Yellow-Green W = White R = Red A = Amber C = Blue-Green B = Blue G = Green
10	LCD panel type	T = TN H = HTN Y = Yellow-Green STN G = Gray STN B = Blue STN F = FSTN
11	Viewing angle	B = Bottom 6:00 T = Top 12:00 R = Right 3:00 L = Left 9:00
12	Operation temperature range	S = 0°C ~ 50°C (Single Supply Voltage) D = 0°C ~ 50°C (Dual Supply Voltage) W = -20°C ~ 70°C (Single Supply Voltage) H = -20°C ~ 70°C (Dual Supply Voltage) T = -30°C ~ 80°C (Single Supply Voltage) E = -30°C ~ 80°C (Dual Supply Voltage)
13	Driving Voltage	1 : Vlcm = 3.0V, No / EL / CCFL Backlight or Vlcm = 3.0V, Vled = LED voltage, (Via AK) 2 : Vlcm = 3.6V, Vled = 5.0V (Not via AK) 3 : Vlcm = 3.6V, Vled = LED voltage, (Not via AK) 4 : Vlcm = 5.0V, Vled = LED voltage, (Not via AK) 5 : Vlcm = 5.0V, Vled = 5.0V (Not via AK) 6 : Vlcm = 5.0V, No / EL / CCFL Backlight or Vlcm = 5.0V, Vled = LED voltage, (Via AK) 7 : Vlcm = 3.6V, No / EL / CCFL Backlight or Vlcm = 3.6V, Vled = LED voltage, (Via AK) 8 : Vlcm = 3.0V, Vled = 5.0V 9 : Vlcm = 3.0V, Vled = LED voltage, (Not via AK)
14	Backlight Connect Method	0 = PIN1 LED-, PIN2 LED+ 1 = PIN15(17/19) LED+, PIN16(18/20) LED- 2 = PIN15(17/19) LED-, PIN16(18/20) LED+ 3 = PIN15(17/19) LED+, PIN16(18/20) NC 4 = PIN15(17/19) NC, PIN16(18/20) LED+ 5 = PINA LED+, PINK LED- 6 = No / EL / CCFL Backlight
15	IC Manufacturer	X = SAMSUNG L = SUNPLUS S = SITRONIX T = TOSHIBA E = EPSON H = HOLTEK Q = ASLIC N = CIMTEK P = PRINCETON
16	Font Set	R = English - Russia E = English - Japanese U = English - Europe H = English - Hebrew K = English - Europe N = NO FONT SET

BOOKBINDING AREA

FORDATA ELECTRONIC CO.,LTD PROFESSIONAL LCD SUPPLIER FROM CHINA	PRODUCT SPEC.	MODE NO. FDCG12864B-FLYYBW-51BN	PAGE	4/17

1. GENERAL SPECIFICATIONS

ITEM	NOMINAL DIMENSIONS / AVAILABLE OPTIONS
DISPLAY FORMAT	128 X 64 DOT MATRIX
LCD PANEL OPTIONS	STN (Yellow-green color)
POLARIZER OPTIONS	Positive, Transflective
BACKLIGHT OPTIONS	Array type LED backlight (Yellow-green color)
VIEWING ANGLE OPTIONS	6:00 (Bottom)
TEMPERATURE RANGE OPTIONS	Wide temperature range (-20°C ~ 70°C)
CONTROLLER IC	NT7107C+NT7108C
NEGATIVE IC	Built in
DISPLAY DUTY	1/64
DRIVING BIAS	1/9

2. MECHANICAL SPECIFICATIONS

OVERALL SIZE	LED backlight version :		93.0 x 70.0 x max 13.0		mm
VIEWING AREA	72.0W x 40.0H	mm	HOLE-HOLE	88.0W x 64.0H	mm
DOT SIZE	0.48W x 0.48H	mm	DOT PITCH	0.04W x 0.04H	mm
WEIGHT (EL BKL)	60.0	g	WEIGHT (LED BKL)	83.0	g

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT
POWER SUPPLY (LOGIC)	Vdd	25°C	-0.3	7.0	V
POWER SUPPLY (LCD)	V0	25°C	Vdd -19.0	Vdd +0.3	V
INPUT VOLTAGE	Vin	25°C	-0.3	Vdd +0.3	V
OPERATING TEMPERATURE	Vopr	——	-20	70	$^\circ$C
STORAGE TEMPERATURE	Vstg	——	-30	80	$^\circ$C

4. ELECTRONICAL CHARACTERISTIC*

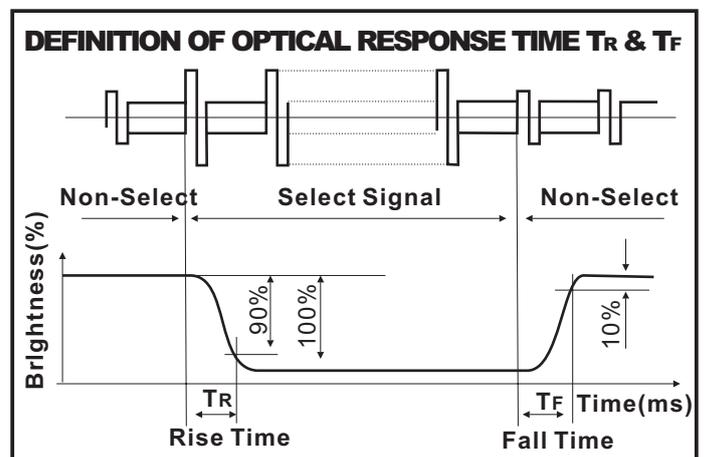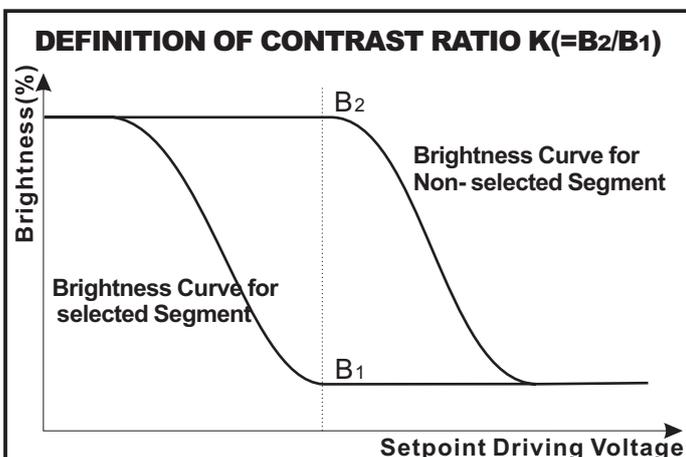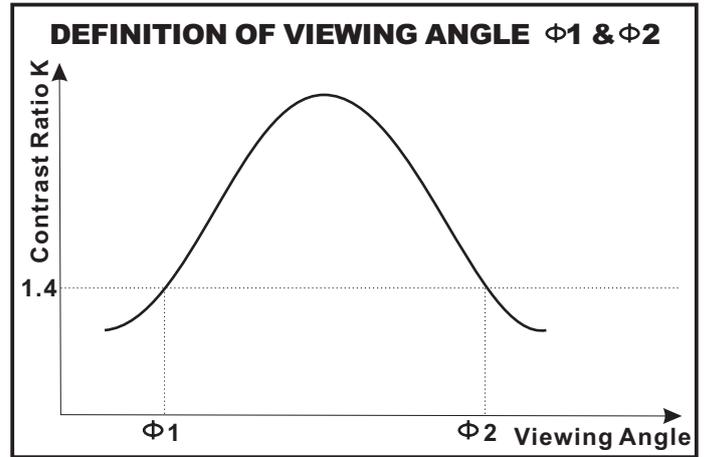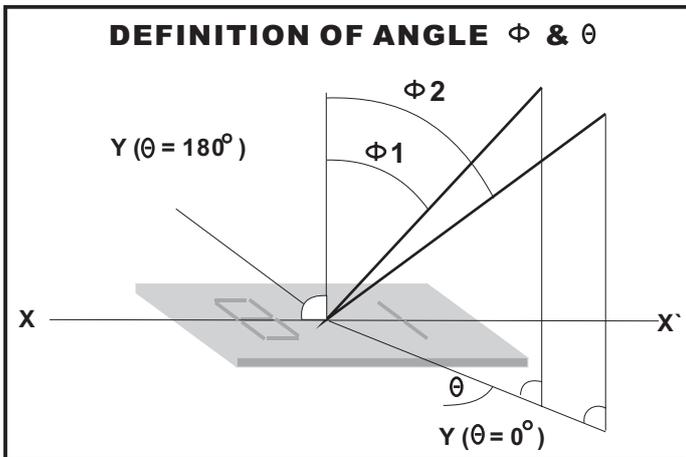| ITEM	SYMBOL	CONDITION	STANDARD			UNIT
			MIN	TYP	MAX	
Input voltage	Vdd	+5V	2.7	5.0	5.5	V
Supply current	Idd	Vdd=5V	——	2.1	——	mA
Recommended LCD driving voltage for normal temp. Version module	Vdd - V0	-20°C	8.40	——	9.00	V
		0°C	8.20	——	8.80	
		25°C	8.10	8.40	8.70	
		50°C	8.00	——	8.60	
		70°C	7.85	——	8.45	
LED forward voltage	Vf	25°C	3.8	——	4.4	V
LED forward current	If	25°C	——	330	——	mA
LED reverse Current	Ir	25°C	——	——	330	μA
LED Peak wave length	λp	25°C If = 330mA	568	——	575	nm
LED illuminance (Without LCD)	Lv	25°C If = 330mA	180	——	220	cd/m^2
LED life time	——	25°C If = 330mA	9K**	——	——	Hours

* The above data are for reference only.

** The warranty period of FORDATA LCD module is 1YEAR counted from the date shown on the label of products.

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5. OPTICAL CHARACTERISTIC

FOR TN TYPE LCD MODULE (T$_A$=25 ^{O}C, Vdd=5.0V ± 0.25V)

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
VIEWING ANGLE	$\Phi 2 - \Phi 1$	K=4	30	———	———	deg
	θ		25			
CONTRAST RATIO	K	———	———	2	———	———
RESPONSE TIME(RISE)	T$_R$	———	———	120	150	ms
RESPONSE TIME(FALL)	T$_F$	———	———	120	150	ms

FOR STN TYPE LCD MODULE (T$_A$=25 ^{O}C, Vdd=5.0V ± 0.25V)

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
VIEWING ANGLE	$\Phi 2 - \Phi 1$	K=4	40	———	———	deg
	θ		60			
CONTRAST RATIO	K	———	———	6	———	———
RESPONSE TIME(RISE)	T$_R$	———	———	150	250	ms
RESPONSE TIME(FALL)	T$_F$	———	———	150	250	ms

DEFINITION OF ANGLE Φ & θ

$\Phi 2$
$\Phi 1$
Y ($\theta = 180^o$)
X
X`
θ
Y ($\theta = 0^o$)

DEFINITION OF VIEWING ANGLE $\Phi 1$ & $\Phi 2$

Contrast Ratio K
1.4
$\Phi 1$
$\Phi 2$ Viewing Angle

DEFINITION OF CONTRAST RATIO K(=B$_2$/B$_1$)

Brightness(%)
B$_2$
Brightness Curve for Non- selected Segment
Brightness Curve for selected Segment
B$_1$
Setpoint Driving Voltage

DEFINITION OF OPTICAL RESPONSE TIME T$_R$ & T$_F$

Non-Select
Select Signal
Non-Select
Brightness(%)
90%
100%
10%
T$_R$
Rise Time
T$_F$ Time(ms)
Fall Time

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6. DC CHARACTERISTIC

(Unless otherwise stated, VDD= +5V ± 10%, VSS=0V, Ta=25℃)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
High Level Input Voltage	VIH1	---	0.7VDD	---	VDD	V
	VIH2	---	0.7VDD	---	VDD	V
Low Level Input Voltage	VIL1	---	0	---	0.3VDD	V
	VIL2	---	0	---	0.8	V
High Level Output Voltage	VOH	IOH = - 200μA	2.4	---	---	V
Low Level Output Voltage	VOL	IOL = 1.6 mA	---	---	0.4	V
Input Leakage Current	ILKG	VIN = VDD to VSS	-1.0	---	1.0	μA
Three-State (OFF) Input Current	ITSL	VIN = VDD to VSS	-5.0	---	5.0	μA
Operating Current	IDD1	During Display	---	---	100	μA
	IDD2	During Access, Access Cycle = 1MHz	---	---	500	μA

7. AC CHARACTERISTIC

Characteristic	Symbol	Min	Typ	Max	Unit
E Cycle	t_C	1000	—	—	ns
E High Level Width	t_{WH}	450	—	—	ns
E Low Level Width	t_{WL}	450	—	—	ns
E Rise Time	t_R	—	—	25	ns
E Fall Time	t_F	—	—	25	ns
Address Setup Time	t_{ASU}	140	—	—	ns
Address Hold Time	t_{AH}	10	—	—	ns
Data Setup Time	t_{DSU}	200	—	—	ns
Data Delay Time	t_D	—	—	320	ns
Data Hold Time (Write)	t_{DHW}	10	—	—	ns
Data Hold Time (Read)	t_{DHR}	20	—	—	ns

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7.1 WRITE MODE TIMING DIAGRAM
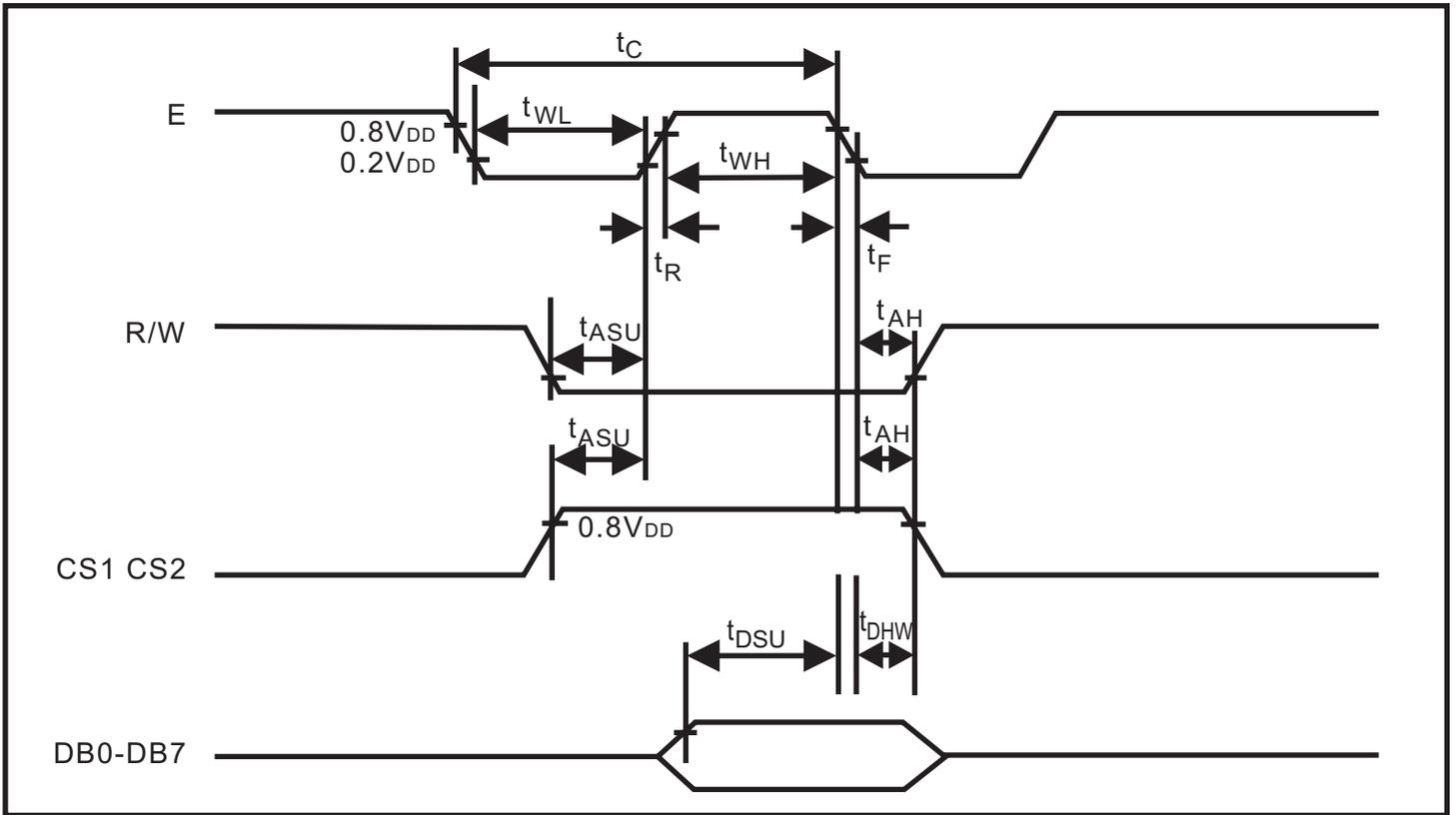
7.2 READ MODE TIMING DIAGRAM

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8.EXTERNAL DIMENSIONS

128 X 64 DOTS

2.54

1

Ø1.00 20PL

P2.54 X 19

66.52

72±0.2 (V.A.)

80.0±0.2

88.0±0.2 (H.H.)

93.0±0.5 (O.S.)

20

0.48

0.04

0.04

0.48

33.24

40.0 (V.A.)

52.0±0.2

64.0±0.2 (H.H.)

70.0±0.5 (O.S.)

14.0

9.0

Ø2.5 4PL

1.6

T1

T2
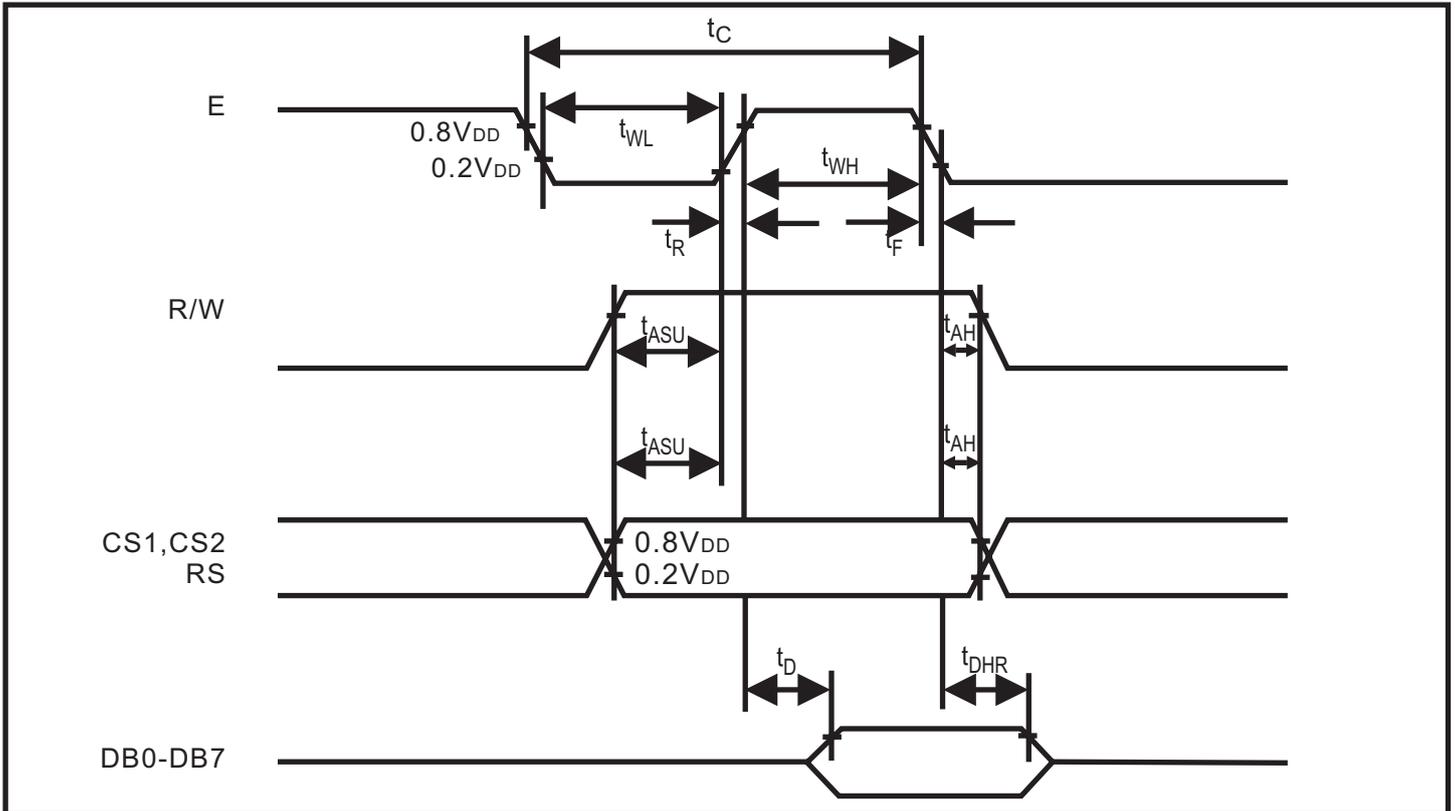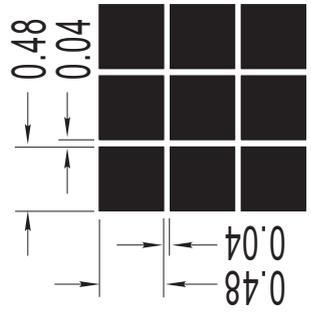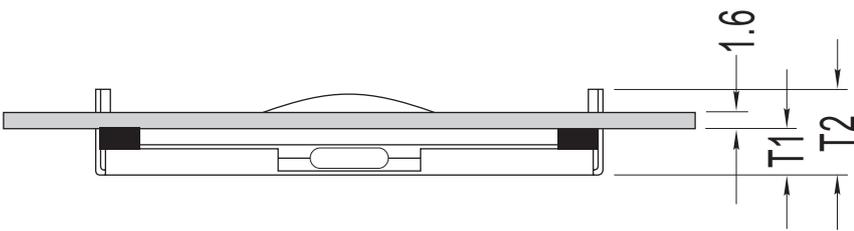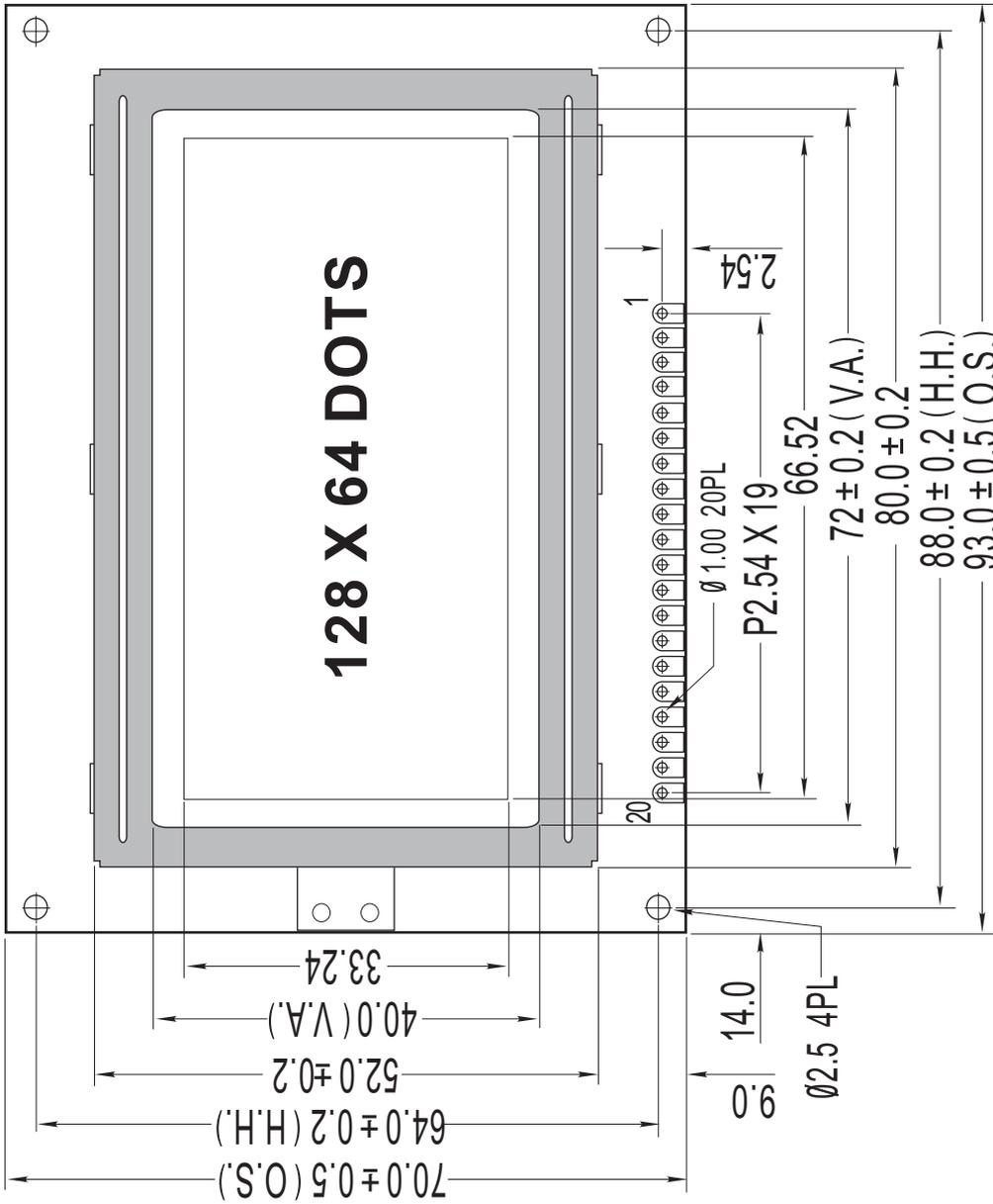
ITEM	T1	T2	UNIT
LED backlight	8.7	13.0	mm
EL or without backlight	4.6	9.0	mm

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9. PIN ASSIGNMENT

PIN NO.	SYMBOL	FUNCTION		REMARK
1	Vss	Power Supply	0V	
2	Vdd		+5V	
3	V0	Contrast Adjust		
4	RS	Rigister Select signal		
5	R/W	Read / Write		
6	E	Chip Enable signal		
7	DB0	Data Bit 0		
8	DB1	Data Bit 1		
9	DB2	Data Bit 2		
10	DB3	Data Bit 3		
11	DB4	Data Bit 4		
12	DB5	Data Bit 5		
13	DB6	Data Bit 6		
14	DB7	Data Bit 7		
15	CS1	When CS1=H,CS2=L, select U1		
16	CS2	When CS1=L,CS2=H, select U2		
17	RSTB	Reset signal		
18	Vee	Negative voltage output		
19	LED+	Anode of LED Unit		5.0V
20	LED-	Cathode of LED Unit		0V

10. BLOCK DIAGRAM

11. POWER SUPPLY

SINGLE SUPPLY TYPES

RPOT: 10K-20K

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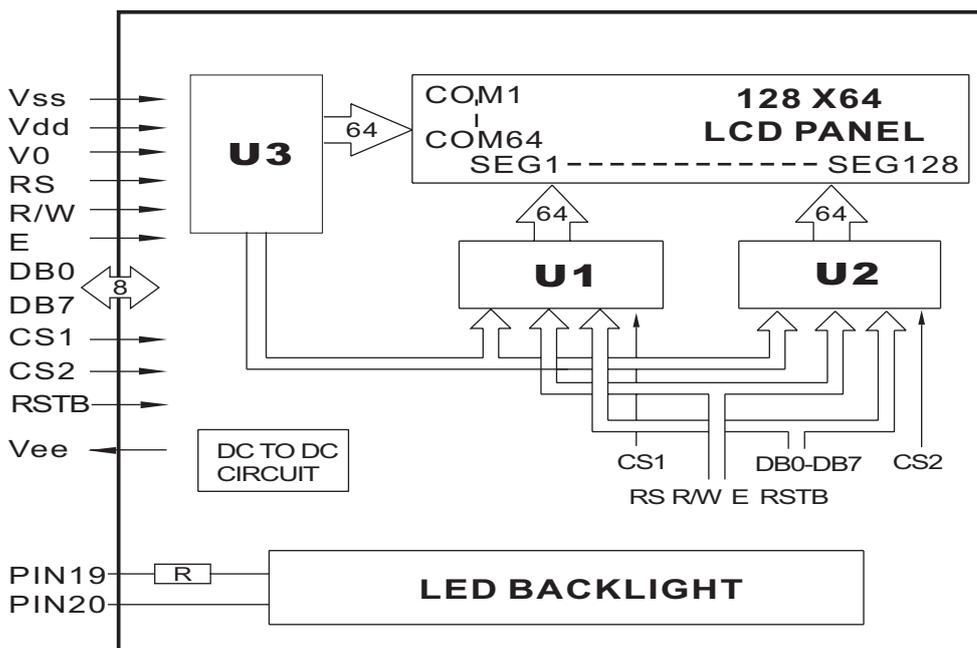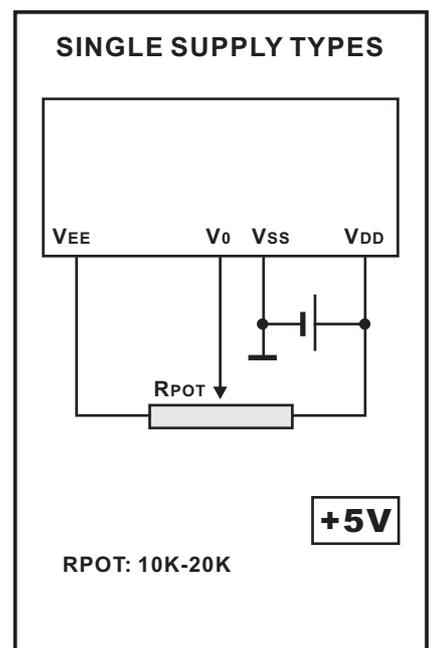
12. FUNCTIONAL DESCRIPTION

12.1 RESET

The system can be initialized by setting the RSTB to LOW when turning the power ON or by instruction from the MPU. When the RSTB is set to LOW, the following condition occurs:
1. The Display is turned OFF.
2. The Display Start Line register is set to 0 (Z-Address 0).

No instructions except the status read can be executed when the RSTB is LOW. This means that in order to execute other instructions, the RSTB must be cleared by setting DB4 to 0 and the DB7 set to 0 by status read instruction.

The table below shows the power supply initial conditions.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Reset Time	tRS	1.0	-	-	uS
Rise Time	tR	-	-	200	nS

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FORDATA ELECTRONIC CO.,LTD PROFESSIONAL LCD SUPPLIER FROM CHINA				
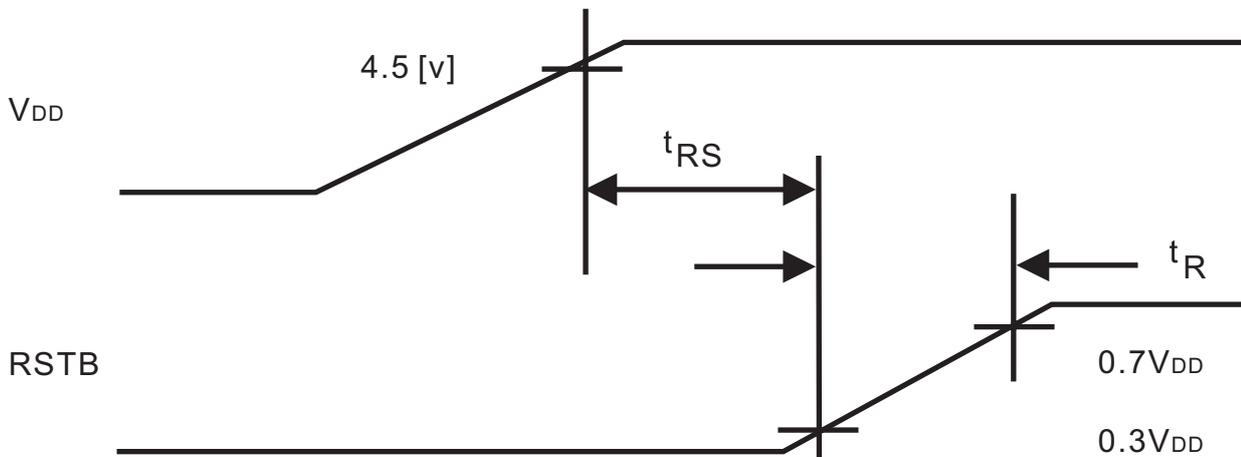
12.3 RELATION BETWEEN DISPLAY PATTERN AND DRIVERS
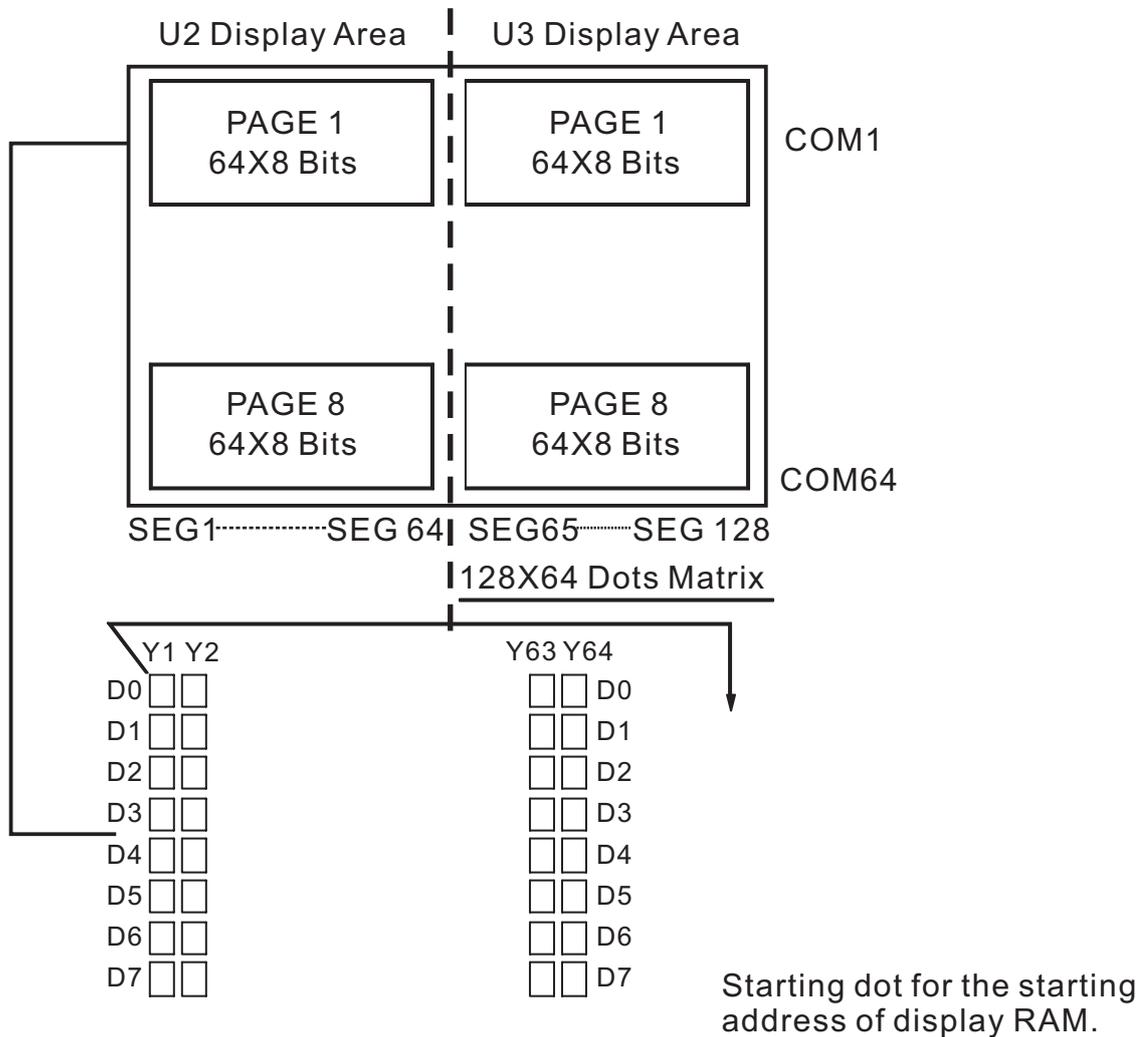
Each segment driver has 8 pages RAM, and each page has 64x8 bits RAM.
D0~D7 are 8 bits transmitted data, where D0 is LSB and D7 is MSB.

12.4 DISPLAY DATA RAM

The Display Data RAM is used to store the display data for the liquid crystal display. Write data 1 is indicates an ON State of the LCDs dot matrix while the OFF State is written as 0. ADC Signal can control the Display Data RAM and the segment output. Please refer to the table below.

ADC *	Display Data
H	Y-Address 0:S1 to Y-Address 63:S64

12.2 BUSY FLAG

The busy flag (DB7) is used to determine whether Nt7108 is operating or not. When the busy flag is HIGH, internal operation is taking place. When the busy flag is LOW, Nt7108 can accept data or instructions. The busy check diagram is shown below.
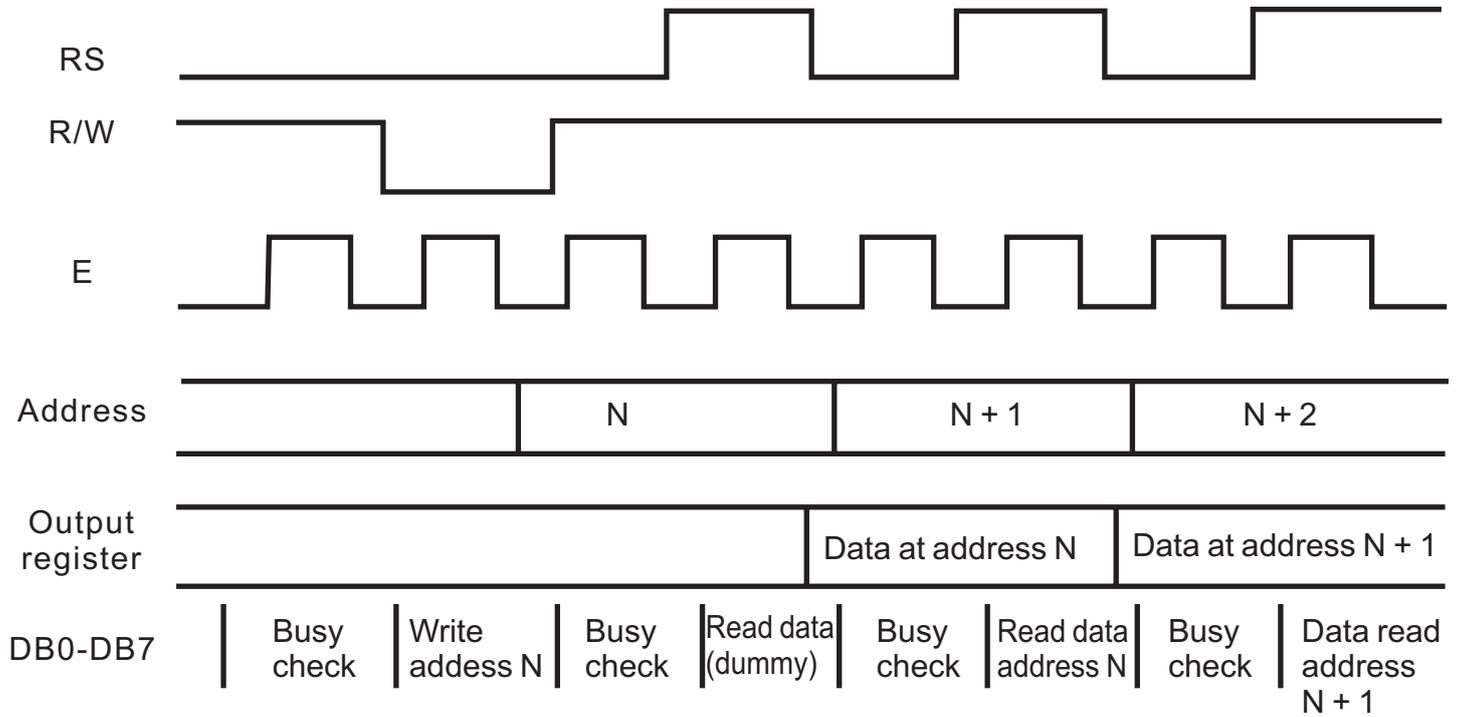
The busy flag diagram is shown below.

$1/f_{CLK} \leq T\,Busy \leq 3/f_{CLK}$

f_{CLK} is CLK1,CLK2 frequency

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13. INSTRUCTION

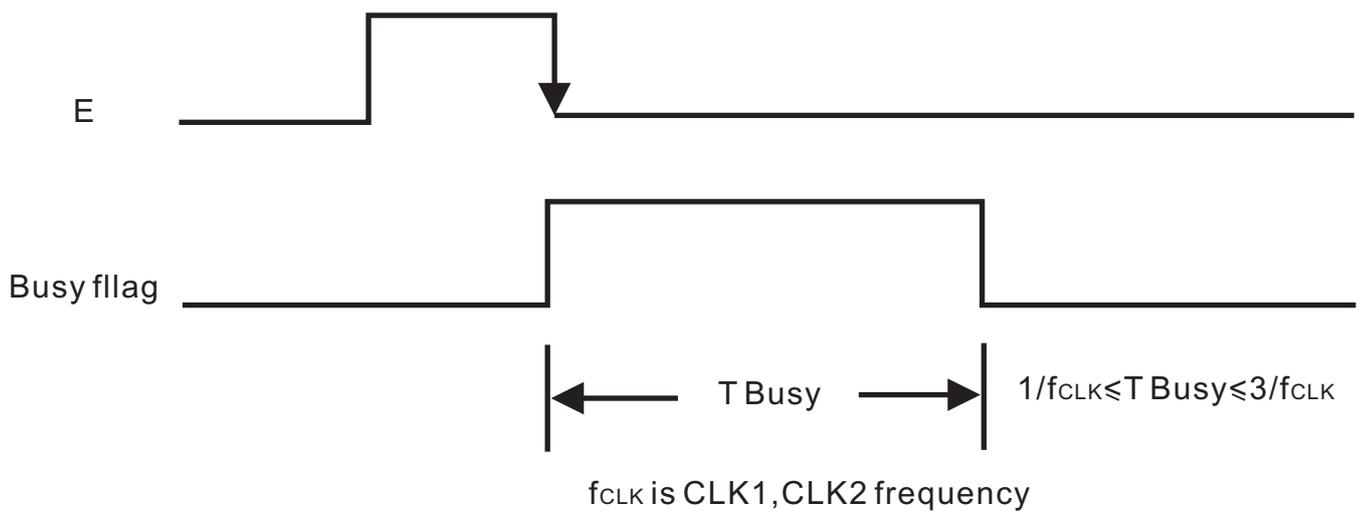| Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF H:ON
Set address (Y address)	L	L	L	H	Y address (0~63)						Sets the Y address in the Y address counter.
Set Page (X address)	L	L	H	L	H	H	H	Page (0~7)			Sets the X address at the X address register.
Display Start Line (Z address)	L	L	H	H	Display start line (0~63)						Indicates the display data RAM displayed at the top of the screen.
Status Read	L	H	BUSY	L	ON/OFF	RESET	L	L	L	L	BUSY L:Ready H:In operation ON/OFF L:Display ON H:Display OFF RESET L:Normal H:Reset
Write Display Data	H	L	Write Data								Writes data (DB0:7) into display data RAM,After writing instruction,Y address is increased by 1 automatically.
Read Display Data	H	H	Read Data								Reads data (DB0:7) from display data RAM to the data bus.

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14. DESCRIPTION OF COMMAND

Display On/Off

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	1	1	1	D

The display data appears when D is 1 and disappears when D is 0.
Though the data is not on the screen with D=0,it remains in the display data RAM.
Therefore, you can make it appear by changing D=0 into D=1.

Set Address(Y Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

Y address (AC0-AC5) of the display data RAM is set in the Y address counter.
An address is set by instruction and increased by 1 automatically by
read or write operations of display data.

Set Page(X Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	AC2	AC1	AC0

X address (AC0-AC2) of the display data RAM is set in the X address register.
Writing or reading to or from MPU is executed in this specified page until the
next page is set.

Display Start Line(Z Address)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	1	AC5	AC4	AC3	AC2	AC1	AC0

Z address (AC0-AC5) of the display data RAM is set in the display start line register and
displayed at the top of the screen.
When the display duty cycle is 1/64 or others(1/32-1/64),the data of total line number of
LCD screen, from the line specified by display start line instruction ,is displayed.

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Status Read

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	Db1	DB0
0	1	BUSY	0	ON/OFF	RESET	0	0	0	0

● BUSY
When BUSY is 1,the Chip is executing internal operation and no instructions are accepted.
When BUSY is 0,the Chip is ready to accept any instructions.

● ON/OFF
When ON/OFF   is 1,the display is off
When ON/OFF   is 0,the display is on.

● RESET
When RESET is 1,the system is being initialized.
In this condition, no instructions except status read can be accepted.
When RESET is 0,initializing has finished and the system is in the usual operation condition.

Write Display Data

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

Writes data (D0-D7) into the display data RAM.
After writing instruction, Y address is increased by 1 automatically.

Read Display Data

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

Reads data (D0-D7) from the display data RAM.
After reading instruction, Y address is increased by 1 automatically.

BOOKBINDING AREA
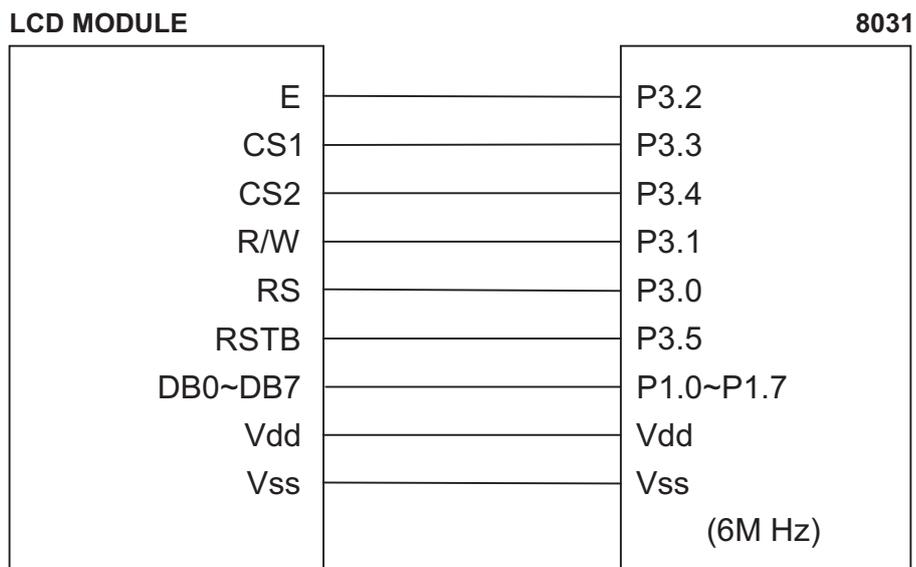
FORDATA ELECTRONIC CO.,LTD
PROFESSIONAL LCD SUPPLIER FROM CHINA
| PRODUCT SPEC. | MODE NO. FDCG12864B-FLYYBW-51BN | PAGE 16/17 |

15. APPLICATION EXAMPLE

Application Flowchart

```
┌─────────────────────┐
│     display on      │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│  set page address   │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│    set Y address    │
└─────────────────────┘
           │
           ▼
┌─────────────────────┐
│     write data      │
└─────────────────────┘
```

Application Circuit

```
LCD MODULE                                    8031
┌──────────────────────┐        ┌──────────────────────┐
│                  E ───┼────────┼─── P3.2              │
│                CS1 ───┼────────┼─── P3.3              │
│                CS2 ───┼────────┼─── P3.4              │
│                R/W ───┼────────┼─── P3.1              │
│                 RS ───┼────────┼─── P3.0              │
│               RSTB ───┼────────┼─── P3.5              │
│            DB0~DB7 ───┼────────┼─── P1.0~P1.7         │
│                Vdd ───┼────────┼─── Vdd               │
│                Vss ───┼────────┼─── Vss               │
│                      │        │                      │
│                      │        │        (6M Hz)       │
└──────────────────────┘        └──────────────────────┘
```
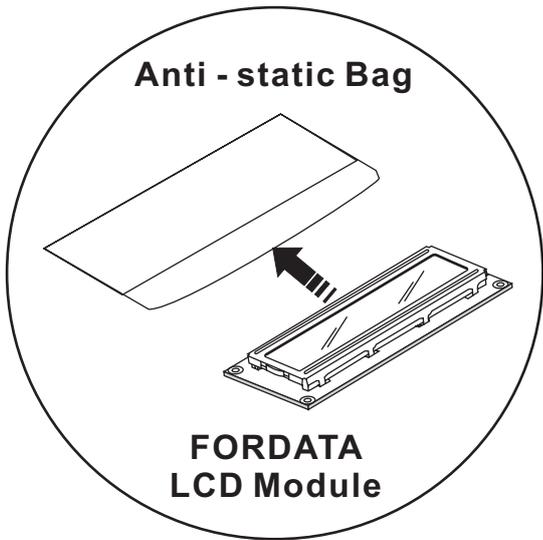
FORDATA ELECTRONIC CO.,LTD PROFESSIONAL LCD SUPPLIER FROM CHINA	PRODUCT SPEC.	MODE NO. FDCG12864B-FLYYBW-51BN	PAGE	17/17

16. PACKING DETAIL

WITH LED BKL
30 PCS/BOX
8 BOXES/CARTON
240 PCS/CARTON
19.00 KGS/CTN(G.W.)
0.07 M^3/CARTON

WITHOUT LED BKL
30 PCS/BOX
8 BOXES/CARTON
240 PCS/CARTON
17.00 KGS/CTN(G.W.)
0.07 M^3/CARTON

NOTE
1. The weight is estimated for reference only.
2. Packing detail may be changed without notice.

Anti - static Bag

FORDATA
LCD Module

BOX

CARTON