APPROVAL   SHEET

Customer   :   _____

Part Name   :   **LCD MODULE**

Model NO.   :   **EDM19264-08R (ROHS)**

Date   :   **2006. 01**

Dalian Dongfu Color Display Co., Ltd

www.dongfu.com

sales@dongfu.com

Contents

1. Scope

This manual defines general provisions as well as inspection standards for standard LCD module supplied by Dalian Dongfu Color Display Co., Ltd.

If the event of unforeseen problem or unspecified items may occur, please contact the nearest supplier or our company.

2. Warranty

If module is not stored or used as specified in this manual, it will be void the 12-month warranty.

3. Features

3-1. Features

Display mode：	⌈ Transflective and positive type
	⌊ STN LCD
Display color:	⌈ Display dot: dark blue
	⌊ Background: yellow green
Display format:	192(w)×64 (h) full dots
Input data:	8-bit parallel data interface from a MPU
Multiplexing ratio:	1/64 Duty
Viewing direction:	6 O'clock
Back light:	LED

3-2．Mechanical features

Item	Specification	Unit
Outline dimensions	113.0(W)×71.0(H) ×15.3 Max.(T)	mm
Number of dots	192(W) ×64(H) Dots	—
Viewing area	97.0(W)×48.0(H)	mm
Image area	92.12(W)×42.20(H)	mm
Dot pitch	0.48W)×0.66(H)	mm
Dot size	0.44(W)×0.62(H)	mm
Weight	Approx. 80	g

3-3. Absolute maximum ratings

Item		Symbol	Min.	Max.	Unit	Note
Supply	Logic	Vcc	0.3	7.0	V	
Voltage	LCD drive	Vcc – Vee	0	15.0	V	
Input Voltage		Vi	0	Vdd	V	
Operating Temperature		Top	0	50	℃	
Storage Temperature		Tstg	-20	70	℃	

3-4.　　Electrical Characteristics

3-4-1　　Electrical Characteristics

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply	Logic	Vcc		4.5	5.0	5.5	V
Voltage	LCD drive	Vcc–Vee		10.0	12.0	14.0	
Input Voltage	"H" Level	Vih	Vcc=5V±5%	0.7Vcc	—	Vcc	
	"L" Level	Vil		0	—	0.3Vcc	
Frame Frequency		Fflm	Vdd=5V	70	75	80	Hz
Current	Logic	Idd	Vdd=5V Vdd–Vee= 15.0V Fflm=75Hz	—	—	2.8	mA
Consumption	LCD drive	Iee		—	0.15	0.2	
LCD Driving Voltage (Recommended Voltage)		Vdd–Vee	Ta= 0℃ $\phi=0°$, $\theta=0°$	—	13.0	13.5	V
			Ta= 25℃ $\phi=0°$, $\theta=0°$	10.0	12.0	14.0	
			Ta= 50℃ $\phi=0°$, $\theta=0°$	10.5	11.0	—	

Note:　　<1> Duty =1/64　　　<2> All dots on static state

3-4-2. Back light specifications for LED

(The users can select the modules with or without backlight according to their own needs.)

Item	Unit	Standard values			Conditions
		Min.	Typ.	Max.	
Power supply	V	—	4.2	—	If=400mA
Luminance	Cd/m^2(nit)	—	—	—	If=400mA
Forward current	mA	—	—	800	—
Life time	Hrs	20000			Note <1>
Luminous color	—	Yellow green			—
Operating temperature	℃	-20 ~ 70			—
Storage temperature	℃	-30 ~80			—

Note<1>: Half value of initial brightness at 20℃ 60%RH

3-5.　　Electro-optical Characteristics

Item		Symbol	Temp.	Conditions	Min.	Typ.	Max.	Unit	Note
LCD Driving Voltage (Recommended voltage)		V_{OP} (VDD-VO)	0℃	$\phi=0°$, $\theta=0°$	—	14.0	14.5	V	1,2,5
			25℃		11.0	12.0	13.0		
			50℃		9.5	10.0	—		
Response Time	Rise Time	tr	0℃	$\phi=0°$, $\theta=0°$	—	1500	2000	Ms	1,3,5
			25℃		—	150	200		
	Decay Time	td	0℃		—	3000	3500		
			25℃		—	200	250		
Viewing angle		$\triangle \phi$	25℃	Vertical	-35	—	35	deg.	1,4,5
				Horizontal	-30	—	30		
Contrast Ratio		K	25℃	$\phi=0°$, $\theta=0°$	2.0	5.0	—	—	1,5,6

Note: <1> Definition of ϕ and θ <2> Contrast ratio higher than 2 (k≥2) can be obtained in this voltage range.

[Vertical]

θ=0° ø=0°

ø2

ø1

θ=180° ø=−90°

θ=270°

θ=90°

[Horizontal]

θ=0° ø=+90°

[Bottom]
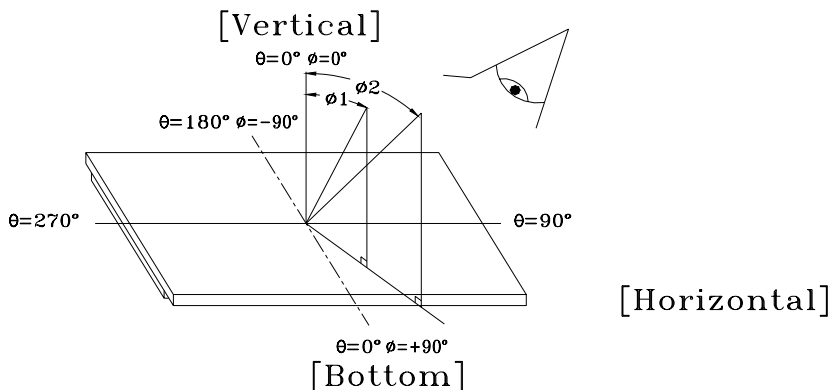
Note: <3>Definition of response time waveform

Positive Display   Negative Display

Non-select   Select   Non-select   Non-select   Select   Non-select

Brightness   10%   90% 100%   Brightness   100% 90%   10%

Tr   Td Time   Tr   Td Time
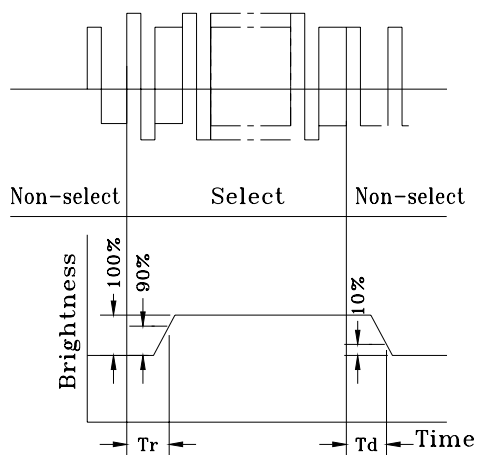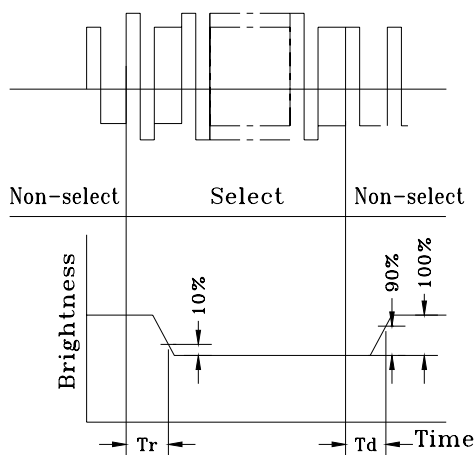
Note: <4>Definition of viewing angle
($\triangle\Phi$) $\triangle\Phi=|\Phi1-\Phi2|$
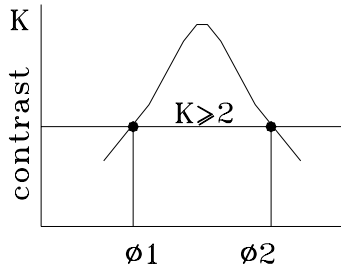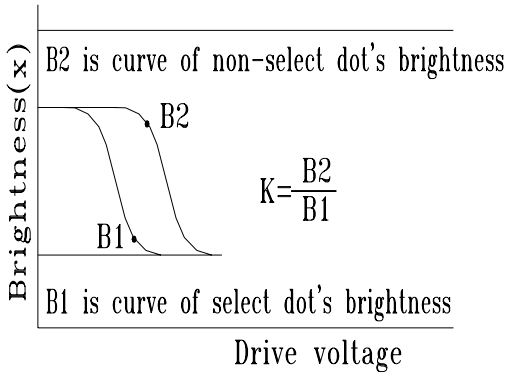
Note: <5> Optical measuring system temperature-regulated chamber

Viewing angle
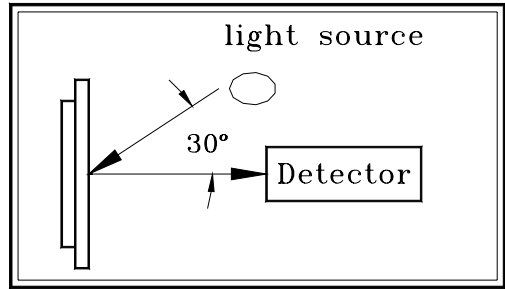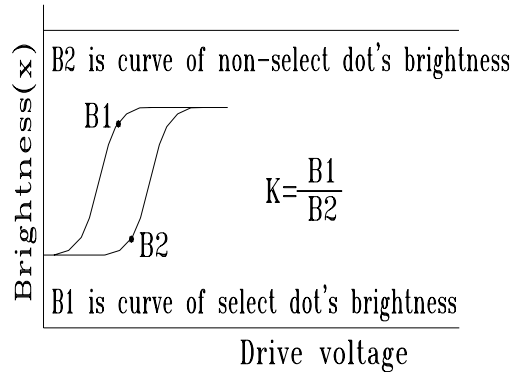
Measuring equipment: DMS
(Made in AUTRONIC)

Note: <6> Definition of Contrast Ratio (K)

Positive Display

Negative Display

B2 is curve of non-select dot's brightness

B2

$K=\dfrac{B2}{B1}$

B1

B1 is curve of select dot's brightness

Drive voltage

B2 is curve of non-select dot's brightness

B1

$K=\dfrac{B1}{B2}$

B2

B1 is curve of select dot's brightness
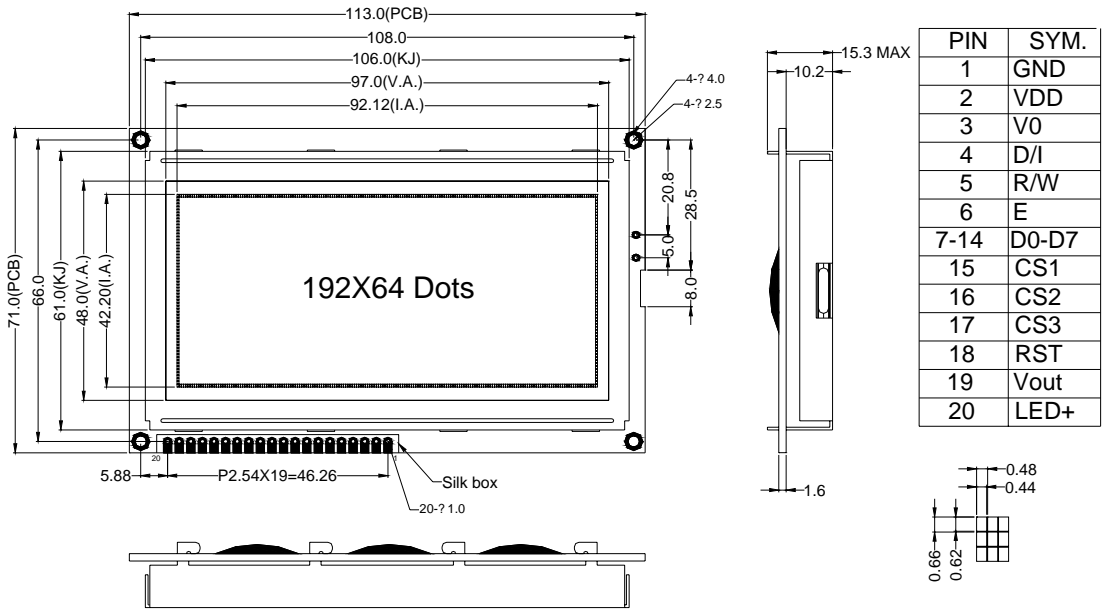
Drive voltage

Positive display   Contrast (K)= $\dfrac{\text{Brightness of non-selected dot (B2)}}{\text{Brightness of selected dot (B1)}}$

Negative display   Contrast (K)= $\dfrac{\text{Brightness of non-selected dot (B1)}}{\text{Brightness of selected dot (B2)}}$

4. Dimensional outline

| PIN	SYM.
1	GND
2	VDD
3	V0
4	D/I
5	R/W
6	E
7-14	D0-D7
15	CS1
16	CS2
17	CS3
18	RST
19	Vout
20	LED+

I/O terminal

5-1. I/O terminal table

Pin No.	Pin name	Level	Functions
1	GND	--	Ground (0V)
2	VDD	--	Power supply for logic circuit:+5V
3	V0	--	Operating voltage for LCD driving
4	D/I	H/L	When D/I="H", it indicates that DB7~DB0 is display data; When D/I="L", it indicates that DB7~DB0 is instruction data.
5	R/W	H/L	While R/W="H" and E="H" , data is read to DB7~DB0 While R/W="L" and E="H->L" , data is written to DB7~DB0
6	E	H.H→ L	Enable signal. While R/W="L", data of DB7~DB0 is latched at falling edge of E While R/W="H" and E="H" , data of DD RAM appears at DB7~DB0
7~14	DB0~DB7	H/L	Data bus line.
15	CS1	H/L	Chip selection.
16	CS2	H/L	Chip selection.
17	CS3	H/L	Chip selection.
18	/RST	H/L	Controller reset at low level
19	Vout	--	Negative voltage output
20	LED+	--	Power Supply for LED

5-2. Timing and timing diagram
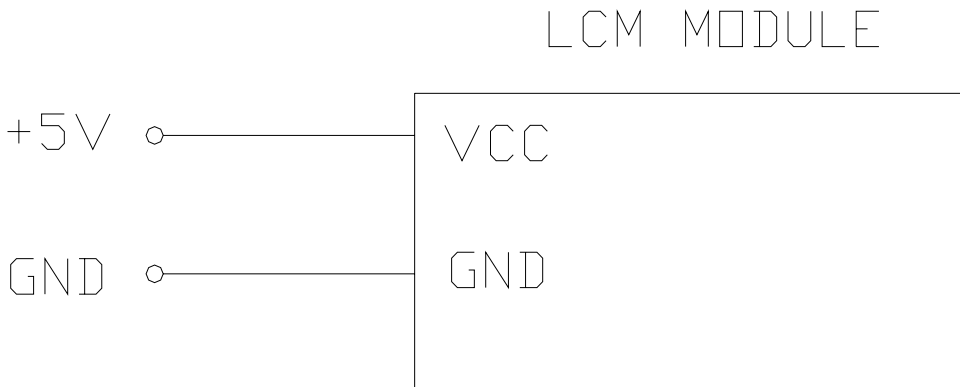
5-2-1. Timing diagram for write operation
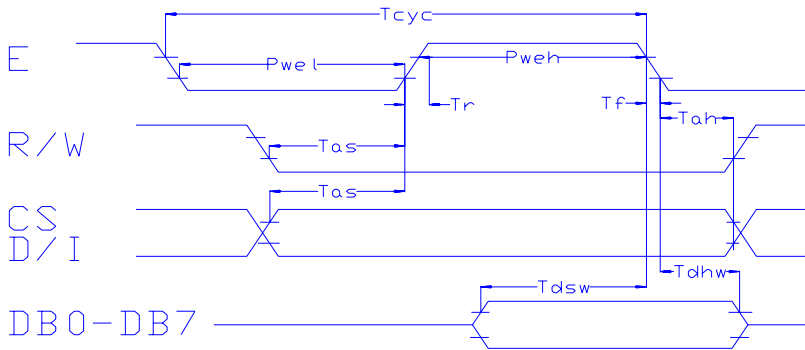
5-2-2. Timing diagram for read operation
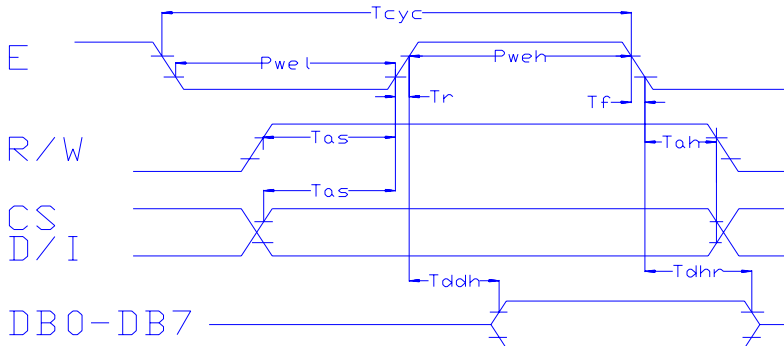

5-2-3. Timing characteristics

Name	Symbol	Min.	Typ.	Max.	Unit
E cycle	Tcyc	1000	-	-	ns
E High Level Width	Pweh	450	-	-	ns
E Low Level Width	Pwel	450	-	-	ns
E rise time	Tr	-	-	25	ns
E fall time	Tf	-	-	25	ns
Address setup time	Tas	140	-	-	ns
Address hold time	Tah	10	-	-	ns
Data set-up time	Tdsw	200	-	-	ns
Data delay time	Tddr	-	-	320	ns
Write data hold time	Tdhw	10	-	-	ns
Read data hold time	Tdhr	20	-	-	ns

5-3. Power supply connection diagram

- Dalian Dongfu Color Display Co., Ltd.

LCM MODULE

```
+5V  o────────────────┐ VCC
                      │
                      │
GND  o──────────────┐ │ GND
                    │ │
                    └─┴──────────
```

5-4. Logic block diagram

The LCD module needs power sources: VCC for logic
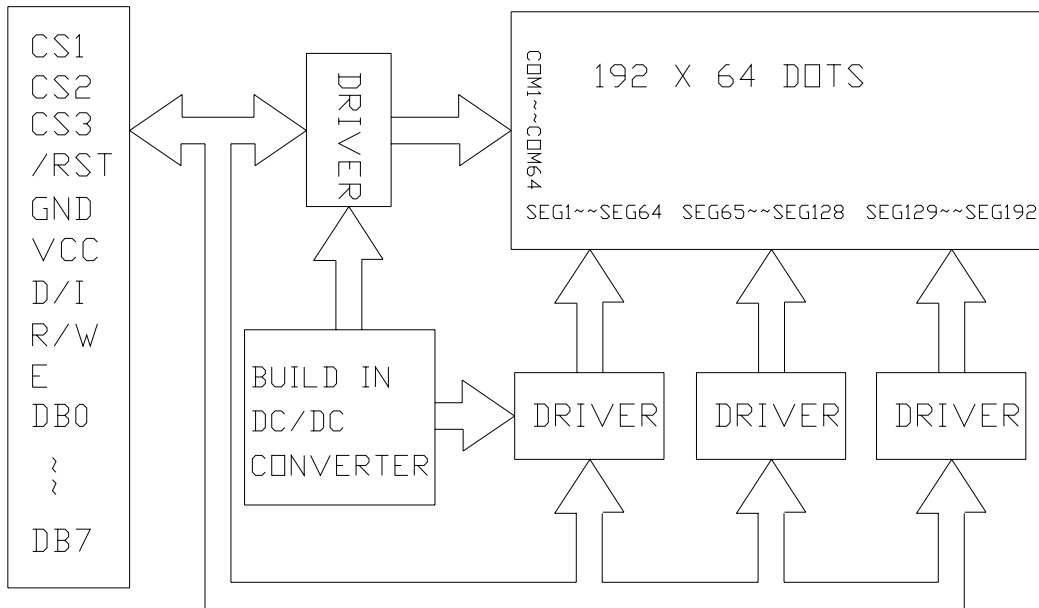
Note: It is necessary to guard all signals from external noise as signal lines are directly connected to C-MOS and are not pull-up or pull-down internally.

5-5.　　Description for software and hardware

5-5-1.　　The internal structure of module

From the above diagram, we may find that the module is mainly composed of LCD panel, controllers and segment drivers.

The control circuit mainly consists of Instruction Register (IR), Data Register (DR),

Busy Flag (BF), Display On/Off flip-flop (DFF) and XY Counter.

● Instruction Register (IR)

IR stores instruction code. When D/I=0, the instruction is written into IR on the falling edge of E.

● Data Register (DR)

DR stores data. When DR=1, graphic display data are written into DR or are read into DB7 to DB0 data buses under the action of E. The data transfer between DR and DDRAM are executed by internal operation automatically.

● Busy Flag (BF)

Busy flag indicates that the module is operating or not operating. When BF=1, the module is in the internal operation and does not receive any external instruction and data. When BF=0, the module is in the ready status and can accept the data or instruction at any time.

● Display on/off flip-flop (DFF)

The display on/off flip-flop makes on/off the liquid crystal display. When DFF=1, display on. The contents of DDRAM are on the screen. When DFF=0, display off.

● XY address counter

XY address counter is a 9-bit counter. X address counter is higher 3 bits. Y address counter is lower 6 bits. In fact, XY address counter is used as the address pointer of DDRAM. X address counter is page address pointer of DDRAM. Y address counter is Y address pointer of DDRAM.

● Display Data RAM (DDRAM)

DDRAM stores a display data for liquid crystal display. To express on state dot matrix of liquid crystal display, write data 1. The other way, off state writes 0. (See also DDRAM Address Table for the relation between the DDRAM address and the display position)

● Z Address Counter

Z address counter is a 6-bit counter. It has cycle-count function, which is used to display with synchronous column scanning. When one column scanning is completed, the address counter is increased by 1 automatically and points to the next column scanning data. After reset, Z address counter is 0.

Z address counter can be preset by DISPLAY START LINE instruction. Therefore, the display start line is controlled by this instruction. That is to say, where the DDRAM data start is the first line on the screen. There are 64 lines in DDRAM, which can be cycle-displayed on the screen.

5-5-2 Control instructions

1. Display ON/OFF

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

D=1 DISPLAY ON

D=0 DISPLAY OFF. Internal status and display RAM data is not affected.

When the value of D is changed from 0 into 1, the former display is on the screen.

2. Display Start Line

R/W	D/I	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	1	A5	A4	A3	A2	A1	A0

As explained above in Z address counter, the display start line is controlled by Z address counter. A5~A0 are automatically put into Z address counter.The address of start line can be any line of line 0 to line 63.

For example:

A5~A0 is selected 62, and the correspondence of the first line and DDRAM column is as follows:

DD RAM Column: 62 63 0   1   2   3   ··········· 60 61

Display column on the screen: 1   2   3   4   5   6   ··········· 63 64

3. Set Page (X ADDRESS)

R/W	D/I	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	A2	A1	A0

Page address is line address of DDRAM. There are 8 lines in one page. There are 64 lines in DDRAM (8 pages). A2~A0 represent page 0 to page 7.

Read/write data does not affect page address. Page address is changed by this instruction or RST signal. After reset, page address is 0.

See also the address table for correspondence of page address and DDRAM.

4. Set Y Address

R/W	D/I	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	A5	A4	A3	A2	A1	A0

The function of this instruction is to send A5~A0 to Y address counter. They are used as Y address pointer of DDRAM. Y address pointer is automatically incremented by 1 and points to the next unit of DDRAM after write/read is made to DDRAM.

Table 4-4   DDRAM Address Table

	CS1=1,CS2=0,CS3=0			CS1=0,CS2=1,CS3=0			CS1=0,CS2=0,CS3=1			
Y=	0	–	63	0	-	63	0	-	63	Line No.
X=0	DB0 ↓ DB7		DB0 ↓ DB7	DB0 ↓ DB7		DB0 ↓ DB7	DB0 ↓ DB7		DB0 ↓ DB7	0 ↓ 7
↓	DB0 ↓ DB7		DB0 ↓ DB7	DB0 ↓ DB7		DB0 ↓ DB7	DB0 ↓ DB7		DB0 ↓ DB7	8 ↓ 55
X=7	DB0 ↓ DB7		DB0 ↓ DB7	DB0 ↓ DB7		DB0 ↓ DB7	DB0 ↓ DB7		DB0 ↓ DB7	56 ↓ 63

5. STATUS READ

R/W	D/I	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	BF	0	ON/OFF	RST	0	0	0	0

When R/W=1 and D/I=0, status read is output into the corresponding bits of data

buses (DB7~DB0) (E in "H" level).

BF: (See also BF part)

ON/OFF: It means the status of Display On/Off flip-flop (See also Display On/Off flip-flop part)

RST: When RST=1, it indicates that the system are in the initialization and any instruction and data except status read may not be accepted.

6.   Write Display Data

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

D7-D0 is display data. This instruction writes 8-bit data (D7-D0) into D7-D0 to the corresponding units of DDRAM. The Y address is incremented by 1 automatically.

7.   Read Display Data

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

Reads out 8-bit data (D7~D0) from the DD RAM. Then Y address is increased by 1 automatically.

The instruction reads out the contents of DDRAM (D7-D0) to the data buses D7-D0.

The Y address is incremented by 1 automatically

Note: After the setting of DDRAM address, the dummy read is made at the time of reading data.

5-5-3   Method of interfacing module to MPU

The interface circuit is as follows:
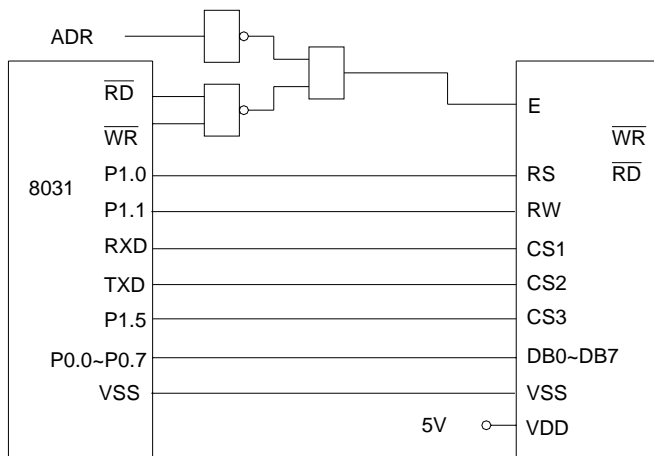
The data bus P0 of 8031 is directly connected to the data bus of module. RD and WR of 8031 act as read/write control signal, interfaced to E signal terminal of module by NAND gate.

6.Handling precautions

6-1 Mounting method

A panel of LCD module made by Dalian Dongfu Color Display Co., Ltd. consists of two thin glass plates with polarizers that easily get damaged.

And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

6-2 Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

  □ Isopropyl alcohol

  □ Ethyl alcohol

  □ Trichlorotriflorothane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

  □ Water

  □ Ketene

  □ Aromatics

6-3 Caution against static charge

The LCD module use C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to V_{dd} or V_{ss}. Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

6-4 Packaging

- Module employs LCD elements, and must be treated as such.
  Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity.

6-5 Caution for operation

- It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.
  An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

6-6 Storage

In the case of storing for a long period of time, the following ways are

recommended:
- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

6-7 Safety
- It is recommendable to crash damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.

7. Precaution for use

7-1 Both parties should provide a limit sample on an occasion when both parties agree its necessity.

The judgement by a limit sample shall take effect after the limit sample has been established and confirmed by both parties

7-2 On the following occasions, the handling of problem should be decided through discussion and agreement between responsible of the both parties.
- When a question is arisen in this manual.
- When a new problem which is not specified in this manual is arisen.
- Some problem is arisen due to the change of inspection and operating conditions in users.
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

Inclosure: 1. The position of bracket solder position: A (SOLDER POINT)

　　　　* Show as asterisk close to IC6 (LM324) in picture 1-1
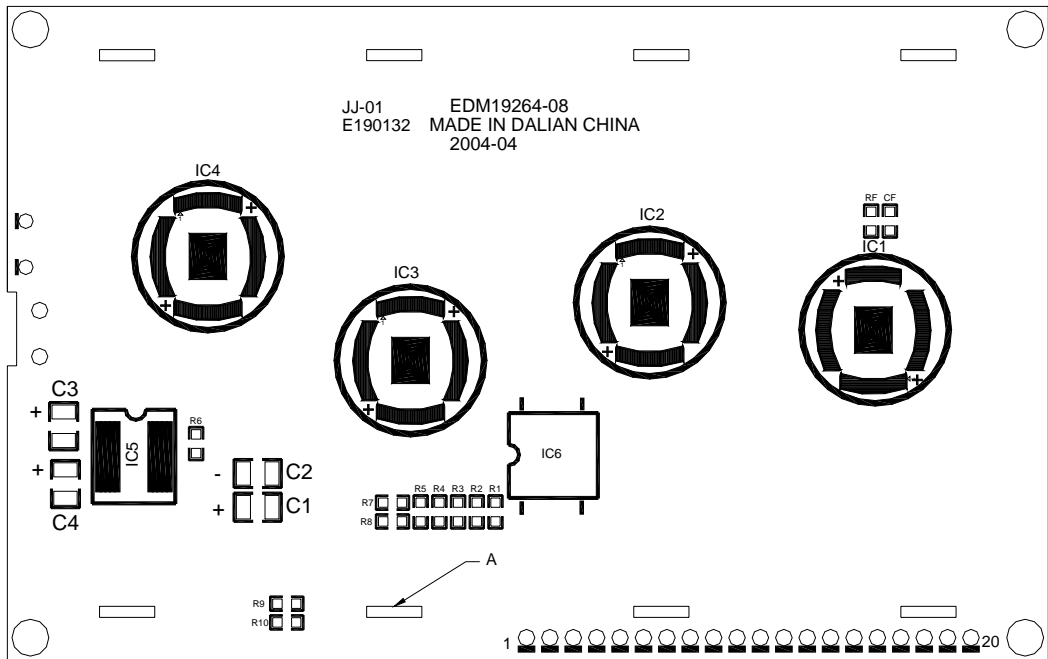
　　2. PCB Silk drawing: (Figure 1-1)

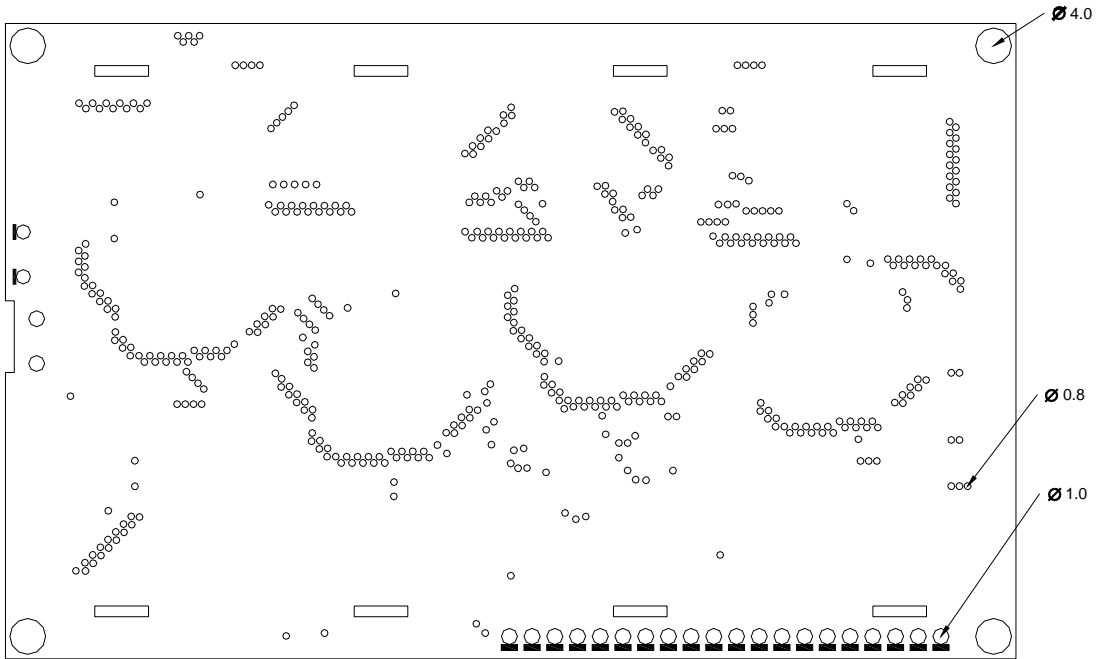Figure 1-1

　　3. PCB Hole drawing:(Figure 1-2)

Ø 4.0

Ø 0.8

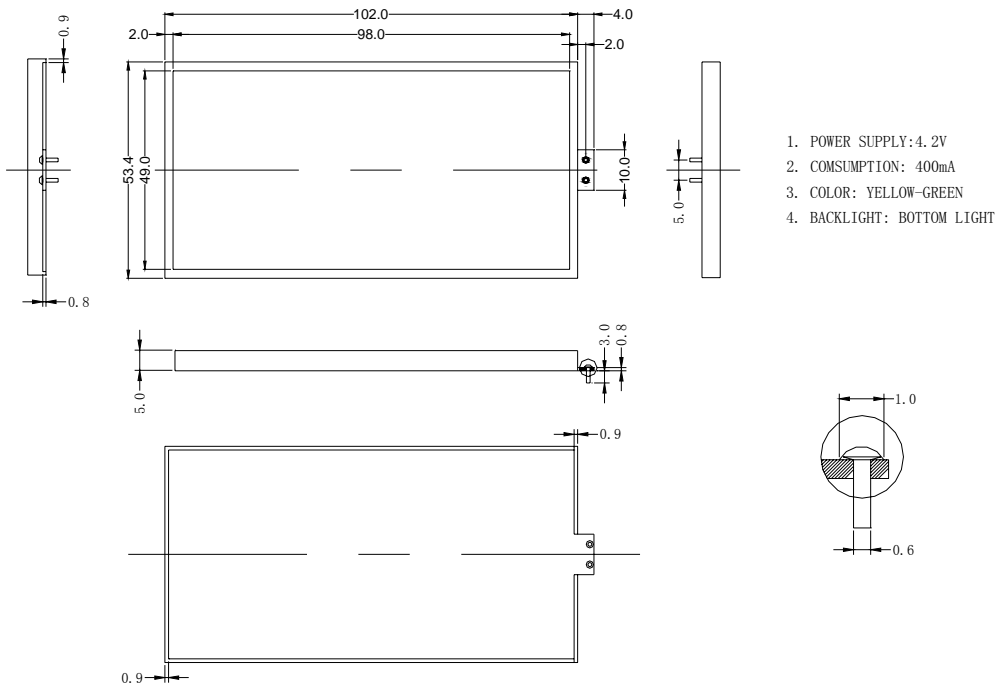Ø 1.0

Figure 1-2

4. The drawing of LED back light:(Figure 1-3)

1. POWER SUPPLY:4.2V
2. COMSUMPTION: 400mA
3. COLOR: YELLOW-GREEN
4. BACKLIGHT: BOTTOM LIGHT

Figure 1-3

5.Parts list :

| NO.	PART NAME	SPECIFICATION	PART NO.	VENDER	QTY	REMARK	TYPE
1	PCB	EDM19264-08		JIJIN	1		
2	LCD	19264SC2-08		DONGFU COLOR DISPLAY	1		
3	FRAME	EDM19264-08 KH		HengChang	1		
4	LED	EDM19264-08 BL		Shen zhen DiXian	1		
5	ZEBRA	104.4X8.6X2.5		YouLian	2		
6	IC	S6B0107	IC1	SAMSUNG	1		
7	IC	S6B0108	IC2、IC3,IC4	SAMSUNG	3		
8	IC	NJU7670	IC5	JRC	1		
9	IC	LM324	IC6	NS	1		
10	R	47K	RF	GuangDong FengHua	1		
11	R	2.4K	R1,R2,R4,R5	GuangDong FengHua	4		
12	R	12K	R3	GuangDong FengHua	1		
13	R	1M	R6	GuangDong FengHua	1		
14	R	3.3K	R7	GuangDong FengHua	1		
15	R	4.7K	R8	GuangDong FengHua	1		
16	R	0	R9	GuangDong FengHua	1		
17	C	20pF	CF	GuangDong FengHua	1		
18	Q	10uF/16V	C1,C2,C3,C4	VISHAY	4		

6. PCB Pattern :
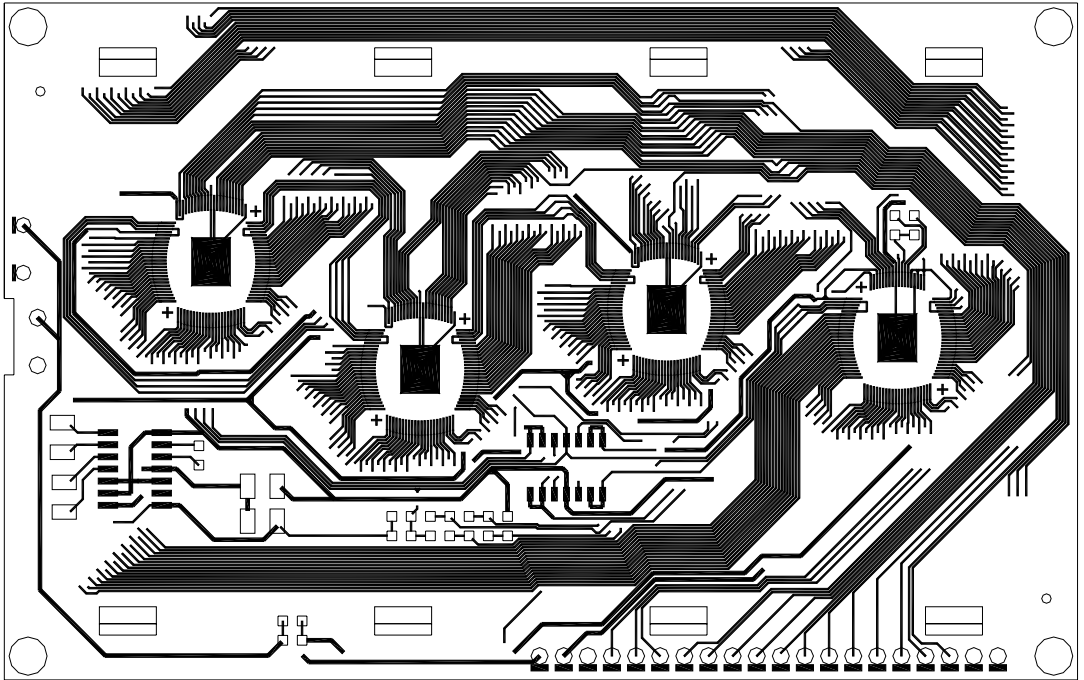
7. PCB Location Map
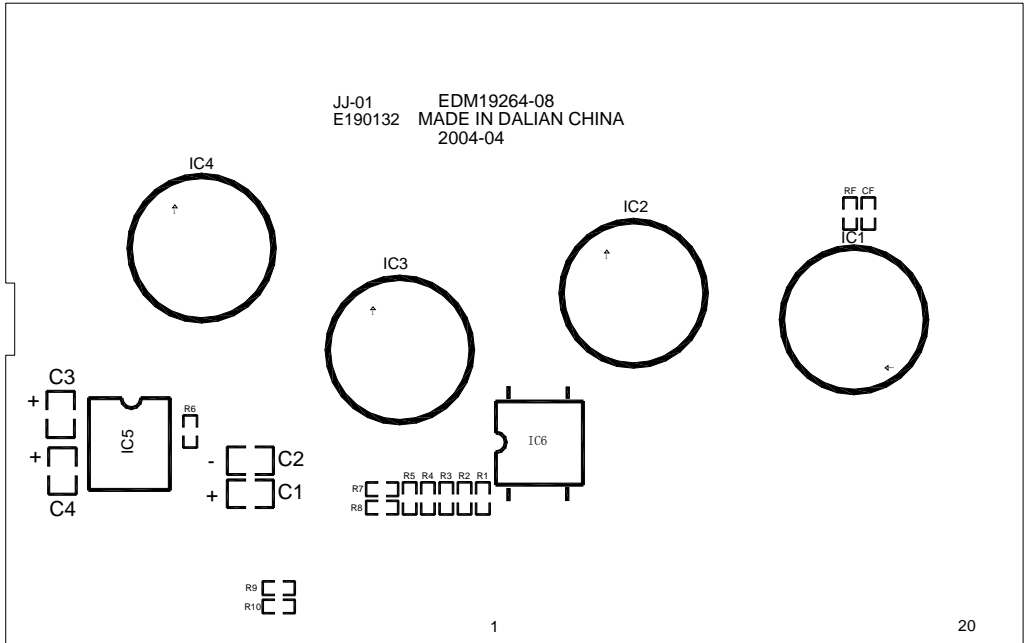
8. Packing

1   Package inside (Anti-Static Electricity Bag with 1 pcs EDM19264-08 in)
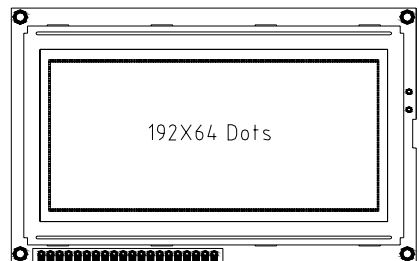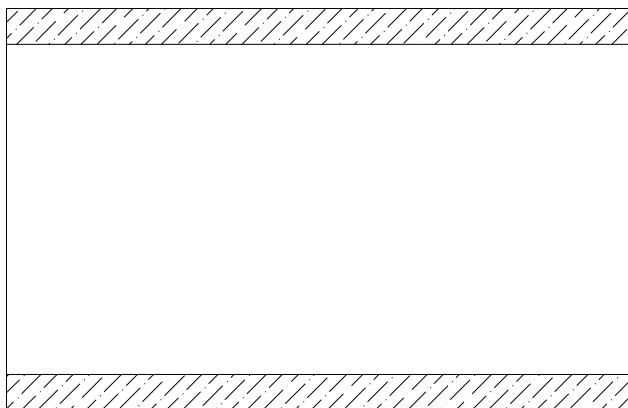
2   Package inside (LCM-package with 27 pcs EDM19264-08 in)

中心距22.0X9

3.0壁厚

9.0壁厚

90外径

235外径

510外径

中心距14.0X3
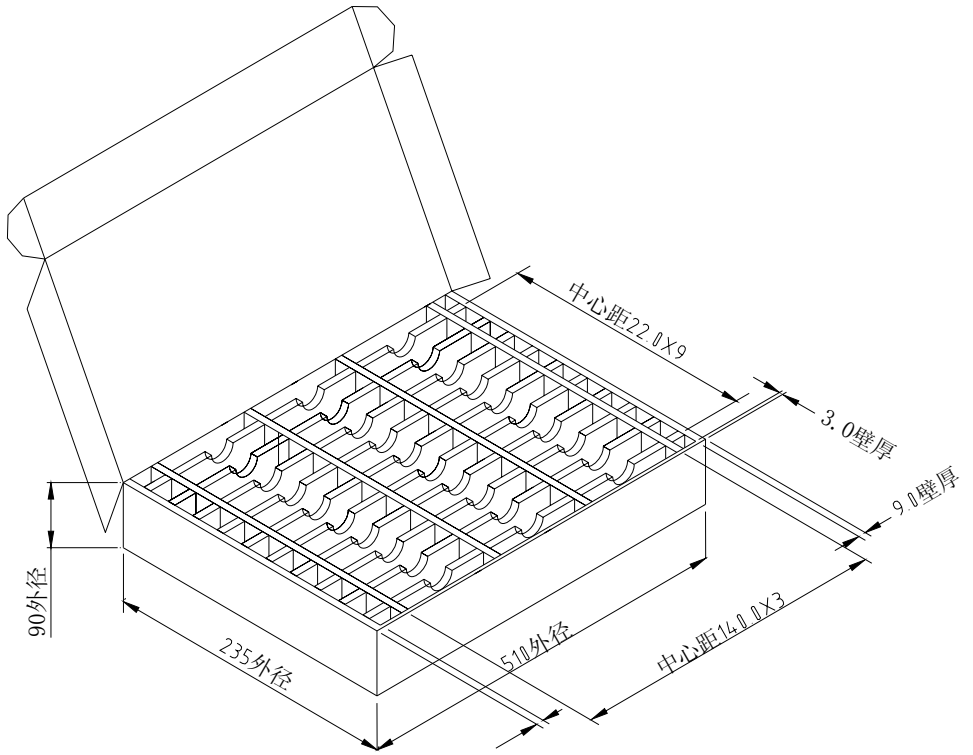
3　Package outside (with 3 LCM-package in)