

Title : PLED 20x2 Characters Module PDC2002M02 Specifications

Document NO : E912112021

Revision :

A0	A1	B0	C0	C1	
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Issue Date :

2003.05.14	2003.06.30	2003.12.08	2004.03.30	2005.03.17	
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Dept. : Product Div.

Approved By	Review By	Prepared By
	Control ☐ Yes	
	Document ☐ No	
	Confidential Document ☐	

PDC2002M

**PLED 20x2 Character Module PDC2002M02
Specifications**

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[illegible]

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3. Features

Item	Contents
Display Format	2 lines of 20 characters of 5 x 8 (dots)
Character Size	5.5 x 3.15 mm
Dot Size	0.55 x 0.65 mm
View Area	79.0 x 17.0 mm
General Dimensions	113.0(W) x 41.4(H) x 9.6(T)(Max.) mm
Controller	PTC6880
Driver	PTC6800
Temperature Range	-20~60°C
Display Color	Green
Weight	34 g

4. Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
VDD	Supply voltage for Logic	4.5	5.0	5.5	V
Topr	Operating temperature	-20	25	60	°C
Tstg	Storage temperature	-30		70	°C
Vbt	Brightness control voltage		3		V
Tsolder	Soldering Temperature	260 °C for 5 seconds			
Pd	Module power consumption @Vbt=3V (Note 1) VDD=5V	50	80	130	mW

Item	Operating		Storage	
	Min.	Max.	Min.	Max.
Ambient Temperature	-20°C	60°C	-30°C	70°C
Humidity	40°C 90%RH		40°C 90%RH	

Note:

1. Power consumption was measured with VBT=3V, VDD=5V and 3 test patterns (all pixels off, random texts, all pixels on)

5. Electrical Characteristics

5.1 DC Electrical Characteristics

(Ta= -20 to 50 °C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Power supply voltage	VDD		4.5	5	5.5	V
Brightness control voltage	VB _T			3		V
Power supply current	I _{cc}	VDD=5V		0.35	0.6	mA
High level input voltage	V _{ih}		0.7VDD		VDD	V
Low level input voltage	V _{il}		-0.3		0.55	V
Leakage current	I _l		-1		1	uA

6. Optical Specifications

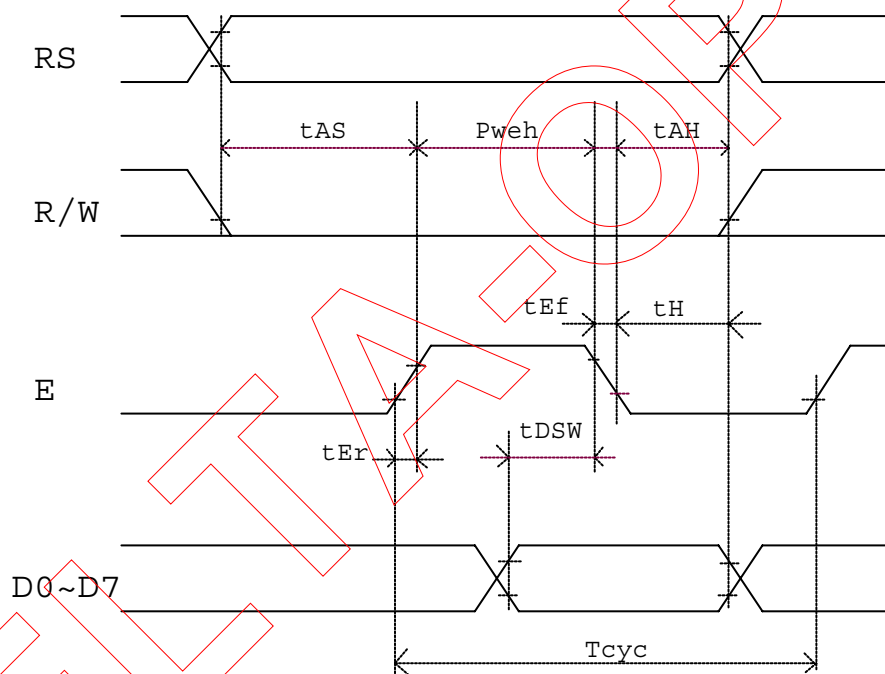
Item	Condition	Min.	Typ.	Max.	Unit
Response time	Rise	-	10	-	us
	Fall	-	10	-	us
Contrast ratio	100 lux	-	100	-	
Viewing angle	Top	-	80	-	deg
	Bottom	-	80	-	deg
	Left	-	80	-	deg
	right	-	80	-	deg
Brightness	With polarizer	-	40	-	nits
Color		-	G ¹	-	

Note 1. G=green

7. AC Electrical Characteristics

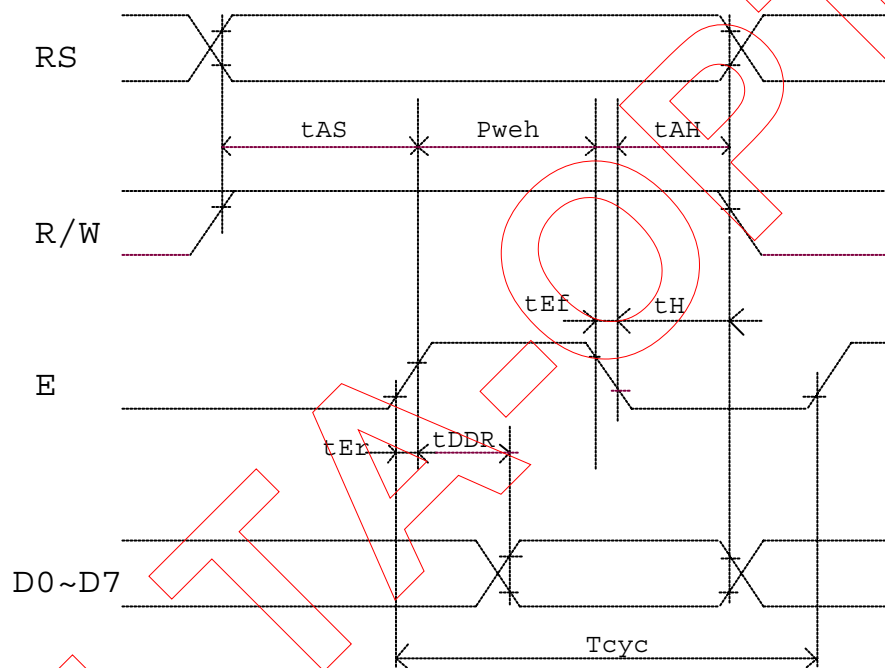
7.1 Write operation

Item	Symbol	Min	Typ	Max	Unit
Enable Cycle Time	T _{cyc}	500			ns
Enable Pulse Width (High level)	P _{weh}	230			ns
Enable Rise/ Fall Time	t _{Ef} , t _{Er}			20	ns
Address Set-up Time	t _{AS}	40			ns
Address Hold Time	t _{AH}	10			ns
Data Set-up Time	t _{DSW}	80			ns
Data Hold Time	t _H	10			ns



7.2 Read operation

Item	Symbol	Min	Typ	Max	Unit
Enable Cycle Time	Tcyc	500			ns
Enable Pulse Width (High level)	Pweh	230			ns
Enable Rise/ Fall Time	tEf, tEr			20	ns
Address Set-up Time	tAS	40			ns
Address Hold Time	tAH	10			ns
Data Delay Time	tDDR			160	ns
Data Hold Time	tH	5			ns



7.3 Display Data RAM (DDRAM)

Display Position	1	2	3	4	5	6		15	16	17	18	19	20
DDRAM	00	01	02	03	04	05		22	23	24	25	26	27
Address (Hex)	40	41	42	43	44	45		62	63	64	65	66	67

For shift left

DDRAM	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14
Address	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53	54

For shift right

DDRAM	27	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	50	51	52
Address	67	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	50	51	52	53

7.4 Character Font Table

UPPER BITS LOWER BITS		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM1			0	1	2	3	4	5				6	7	8	9	A
0001	CG RAM2			1	2	3	4	5	6				7	8	9	A	B
0010	CG RAM3			2	3	4	5	6	7				8	9	A	B	C
0011	CG RAM4			3	4	5	6	7	8				9	A	B	C	D
0100	CG RAM5			4	5	6	7	8	9				A	B	C	D	E
0101	CG RAM6			5	6	7	8	9	A				B	C	D	E	F
0110	CG RAM7			6	7	8	9	A	B				C	D	E	F	G
0111	CG RAM8			7	8	9	A	B	C				D	E	F	G	H
1000	CG RAM1			8	9	A	B	C	D				E	F	G	H	I
1001	CG RAM2			9	A	B	C	D	E				F	G	H	I	J
1010	CG RAM3			A	B	C	D	E	F				G	H	I	J	K
1011	CG RAM4			B	C	D	E	F	G				H	I	J	K	L
1100	CG RAM5			C	D	E	F	G	H				I	J	K	L	M
1101	CG RAM6			D	E	F	G	H	I				J	K	L	M	N
1110	CG RAM7			E	F	G	H	I	J				K	L	M	N	O
1111	CG RAM8			F	G	H	I	J	K				L	M	N	O	P

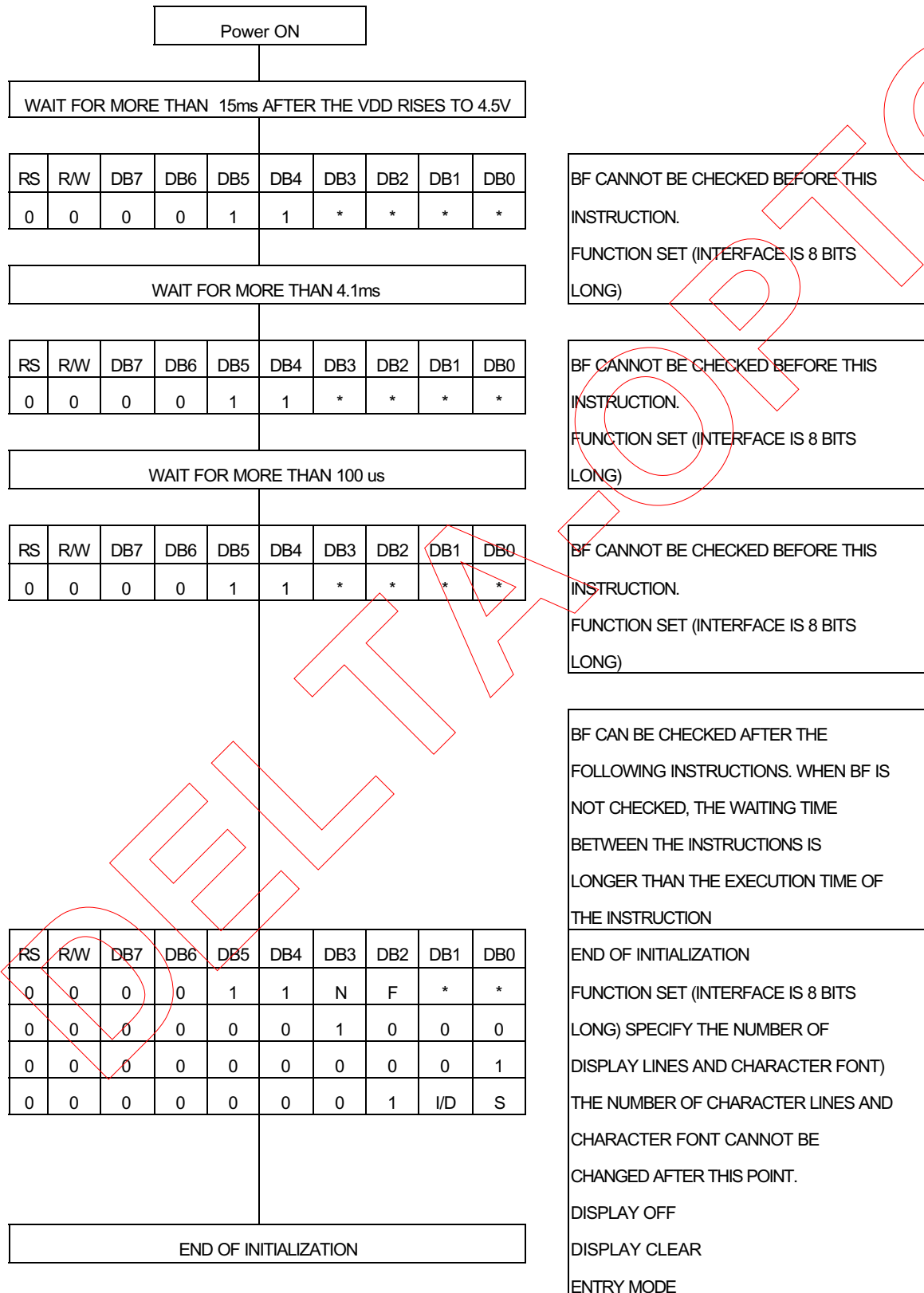
7.5 Instruction set

Instruction	Code										Description	Execution time
	RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clear entire display. Sets DDRAM address 0 into address counter	1.52ms
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift	37us
Display On/Off control	0	0	0	0	0	0	1	D	C	B	Sets entire display (D) On/Off Sets cursor (C) On/Off Sets Blinking (B) of cursor position character	37us
Cursor/display shift	0	0	0	0	0	1	S/C	R/L	X	X	Moves cursor & shifts display without changing DDRAM contents	37us
Function set	0	0	0	0	1	DL	N	F	X	X	Sets interface data length (DL) Sets number of display lines (N) Sets character font (F)	37us
Set CGRAM address	0	0	0	1	ACG	ACG	ACG	ACG	ACG	ACG	Sets CGRAM address. CGRAM data is sent and received after this setting.	37us
Set DDRAM address	0	0	1	ADD	ADD	ADD	ADD	ADD	ADD	ADD	Sets DDRAM address. The DDRAM data bus sent and received after this setting	37us
Read busy flag & address	0	1	BF	AC	AC	AC	AC	AC	AC	AC	Reads busy flag (BF) indicating that internal operation is being performed Reads address counter contents	0us
Write data into the CGRAM or DDRAM	1	0	Write data								Write data into the CGRAM or DDRAM	37us
Read data into the CGRAM or DDRAM	1	1	Read data								Read data from the CGRAM or DDRAM	37us
	I/D =1: Increment S =1: Display shift on D =1: Display on C =1: Cursor display on B =1: Cursor blink on S/C =1: Shift display R/L =1: Shift right DL =1: 8-bit N =1: Dual line F =1: 5x10 dots BF =1: Internal operation BF =0: Ready for instruction I/F=0: Decrement S/C=0: Move cursor R/L=0: Shift left DL=0: 4-bit N =0: Single line F =0: 5x8 dots										DDRAM: Display Data RAM CGRAM: Character Generator RAM ACG: Character Generator RAM Address ADD: Display Data RAM Address AC: Address Counter	

7.6 Initialization via Instruction

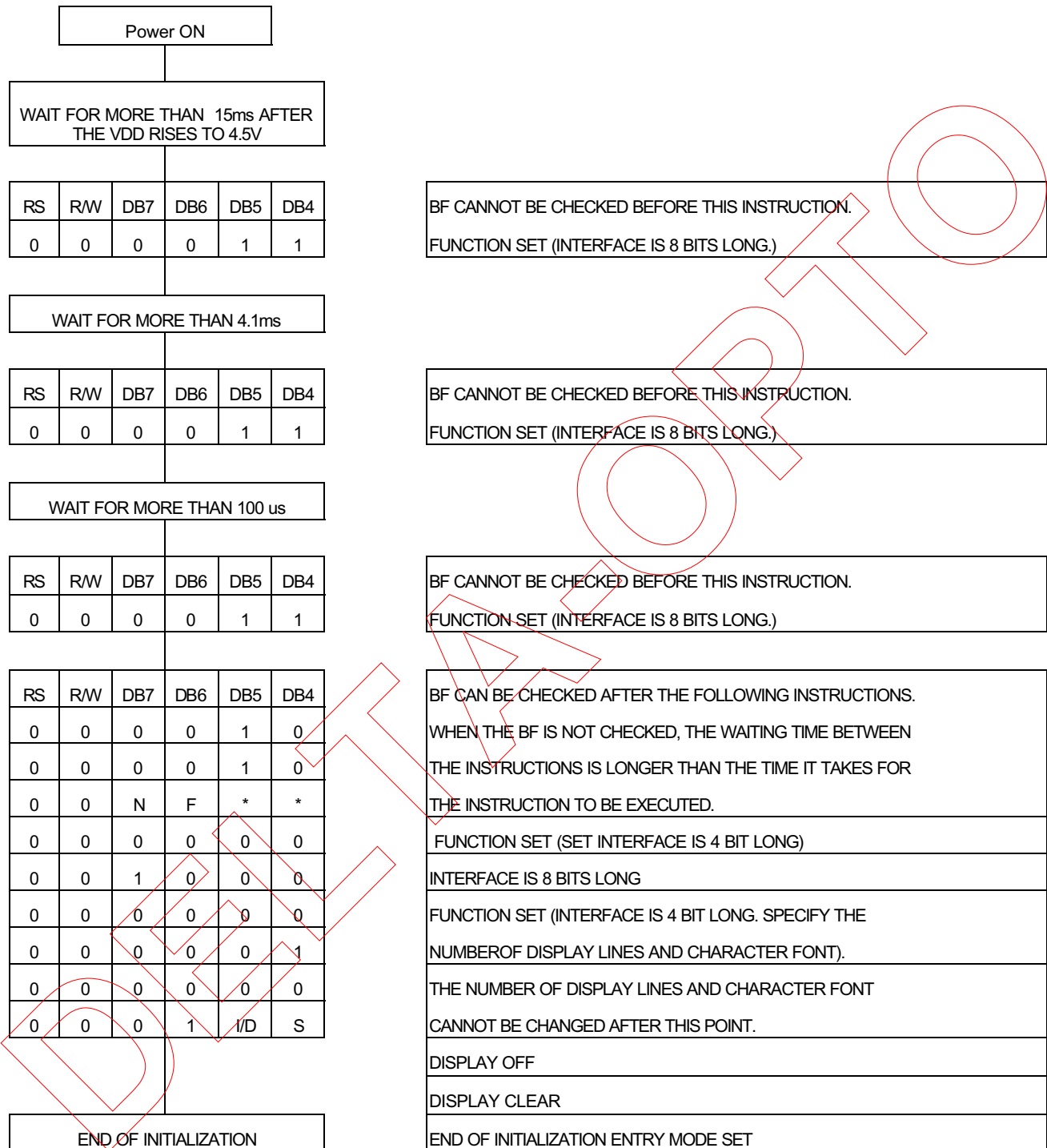
8-BIT INTERFACE

The procedures of the initialization of an 8-bit MPU as follows.

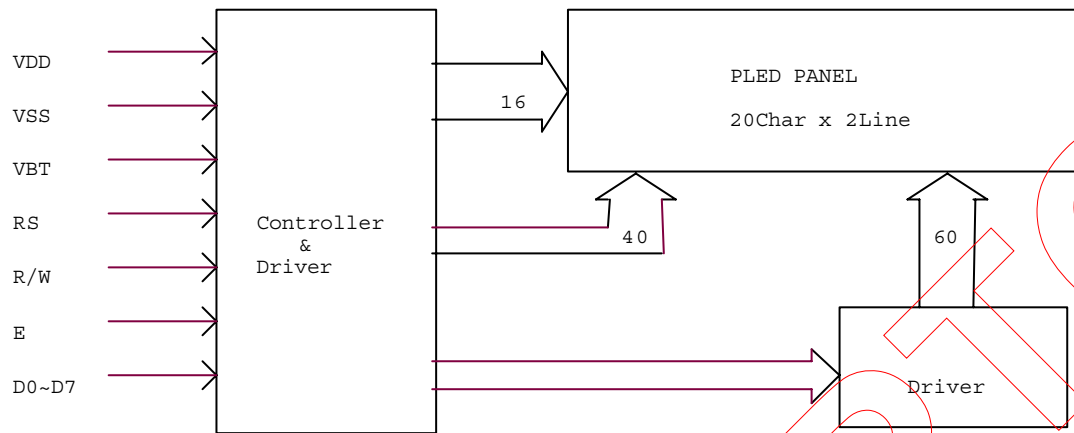


4-BIT INTERFACE

The procedures of the initialization of an 4-bit MPU as follows.



8. Block Diagram



9. Interface Pin Function

Pin No.	Symbol	I/O	Function
1	VSS	I	Ground
2	VDD	I	Power supply for logic
3	VBT	I	Brightness adjustment
4	RS	I	H: Data L: Instruction code
5	R/W	I	H: Read L: Write
6	E	I	H→L: Enable
7	D0	I	Data bus
8	D1	I	
9	D2	I	
10	D3	I	
11	D4	I	
12	D5	I	
13	D6	I	
14	D7	I	
15	NC	-	-
16	NC	-	-

1	2	3	4	5	6	7	8	9	10	11	12	
A												A
B												B
C												C
D												D
E												E
F												F
G												G
H												H

11. Reliability

11.1 Reliability test item

NO.	Test items	Conditions
1	High temperature storage	70 °C , 240 hrs
2	Low temperature storage	-30 °C, 240 hrs
3	High temperature operation	60 °C, 240 hrs
4	Low temperature operation	-20 °C, 240 hrs
5	High temperature and high humidity storage test	40°C, 90% RH, 240 hrs
6	Temperature Shock (operating)	-20→60°C , 20 cycles

11.2 Life

Item	Standard value	Unit
Operation	10000	Hours
Storage	5	Years

Note :

1. Simulation pattern for operation test: interchanging with all-pixels on, chess, reversed chess, all-pixels off.
2. The brightness decay does not exceed 50%.

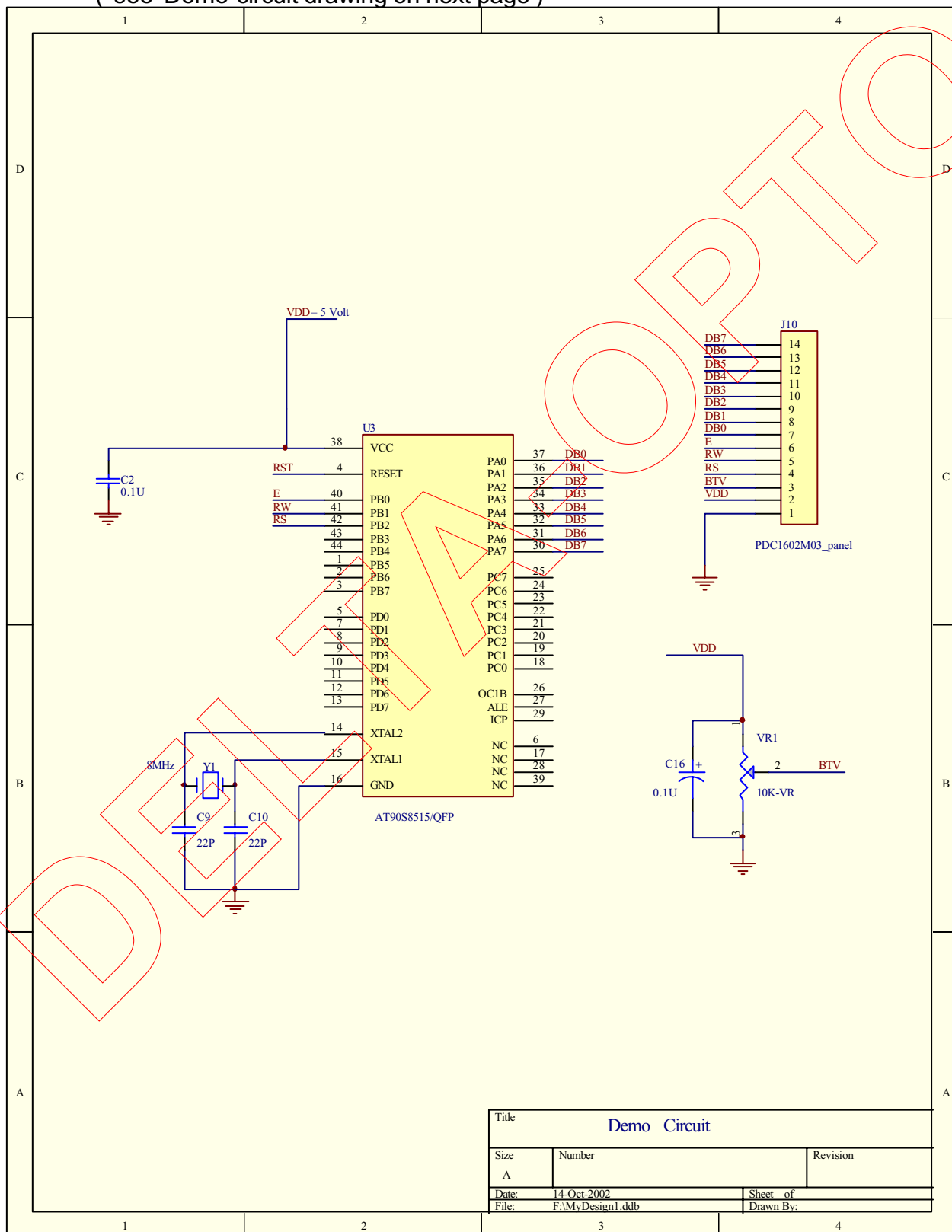
12.Quality Standards

ITEM	SPEC	Quantity	Judgment	Inspection method
Black spot	1. $> \phi 0.3\text{mm}$	-	Not allowed	Visual inspection with Compare spot sheet
	2. $\phi 0.1\text{mm} \leq \text{spot} \leq \phi 0.3\text{mm}$	≤ 3	Acceptable	
	3. $< \phi 0.1\text{mm}$	-	Acceptable	
Crack	1. $> 0.5\text{mm}$	-	Not allowed	Visual inspection at active area and ITO pin area
	2. $0.3\text{mm} \leq \text{crack} \leq 0.5\text{mm}$	≤ 3	Acceptable	
	3. $< 0.3\text{mm}$	-	Acceptable	
Line Scratches	1.Length $> 1\text{mm}$ & width $> 0.1\text{mm}$	-	Not allowed	Visual inspection at active area and ITO pin area
	2.Length $\leq 1\text{mm}$ & width $\leq 0.1\text{mm}$	≤ 1	Acceptable	
Active area protective film damaged	1. Length $> 1\text{mm}$ & Width $> 1\text{mm}$	-	Not allowed	Visual inspection
	2. Length $\leq 1\text{mm}$ & width $\leq 1\text{mm}$	≤ 1	Acceptable	
Brightness uniformity	$\geq 80\%$	-	Acceptable	Min./Max. $\times 100\%$

13.Application Note

13.1 Reference Circuit

(see Demo-circuit drawing on next page)



13.2 Ref. Program

(The program use language-C to run Random-texts.)

//LCD display test Rounting 2002/04/15

#include <io8515.h>

//-----SET 1602LCD MODULE CONTROL I/O PORT-----

#define RS 0x04

#define RW 0x02

#define EN 0x01

#define P0 PORTA

#define P0_IO DDRA

#define P0_in PINA

//end of SET 1602LCD MODULE CONTROL I/O PORT-----

void delay(void) // functin of delay time

```
{
float j,k;
for ( j=0;j<1;j++)
{
for ( k=0;k<1;k++)
{
j=j;
k=k;
}
}
}
```

void setRS(void) // Set RS High

```
{
PORTB |= RS;
delay();
}
```

void clrRS(void) // Set RS Low

```
{
PORTB &=(~RS);
delay();
}
```

void setRW(void) // Set RW High

```
{
PORTB |= RW;
delay();
}
```

void clrRW(void) // Set RS Low

```
{
```

```
PORTB &=(~RW);
delay();
}
void setEN(void)    // Set EN High
{
PORTB |= EN;
delay();
}
void clrEN(void)    // Set RS Low
{
PORTB &=(~EN);
delay();
}
```

```
void write_command(unsigned char command) //function of write instruction to LCD
{
```

```
unsigned char in;
```

```
while (1) //check the busy flag
{
```

```
    P0_IO=0xff;
    P0= 0xFF ;
    clrRS();
    setRW();
    setEN();
    P0_IO=0x00;
    in = P0_in;
    clrEN();
    if( (in & 0x80) == 0 )
    {
        break;
    }
}
```

```
delay();
```

```
P0_IO=0xff;
PORTA = command;
clrRW();
clrRS();
setEN();
clrEN();
```

```
}
```

```
void write_data(unsigned char DD) // function of write the data to Display RAM of LCD
{
```

unsigned char in1;

while (1) //check the busy flag

{

 P0_IO=0xff;

 P0 = 0xFF ;

 clrRS();

 setRW();

 setEN();

 P0_IO=0x00;

 in1 = P0_in;

 clrEN();

 if((in1 & 0x80) == 0)

 {

 break;

 }

}

P0_IO=0xff;

P0 = DD;

clrRW();

setRS();

setEN();

clrEN();

}

void initial_LCD(void) // function of initial the LCD

{

write_command(0x38); // 8 bits data length ; 2 Line display; 5x7 dots per word

write_command(0x08); //display off; no cursor;

write_command(0x01); //clear display

write_command(0x06); // display Insert mode: cursor shift right and AC++

}

void main(void) //the main function start

{

int i;

// initial I/O port-----

DDRB = 0xff;

DDRA = 0xff;

DDRC = 0xff;

DDRD = 0xff;

//-----

clrEN();

for (;)

```
{  
initial_LCD();
```

```
write_command(0x02); // cursor to zero  
write_command(0x81); // display data adress = 0;
```

```
for ( i = 0 ; i < 96 ; i ++ )  
{  
write_data(0xA0+i); // show the some character on LCD  
delay2(delaytime3);  
}
```

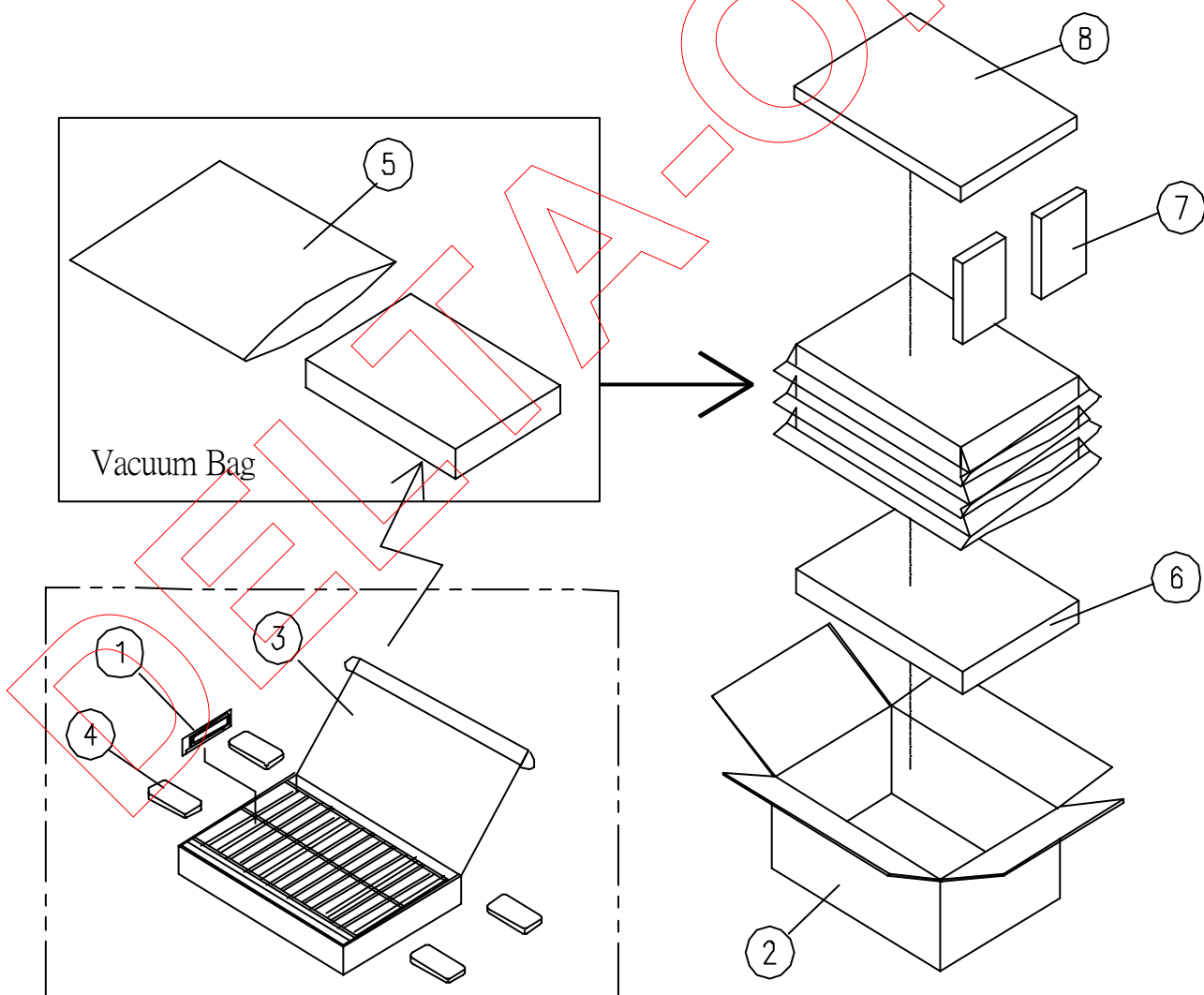
```
//end of for(;;)
```

```
// void main(void)
```

DELTA OPTO

14.Package

1.	912112021	PDC2002M02	120 pcs
2.	630100401	CARTON (Standard) size:395*326*297	1 pcs
3.	630100601	Packing Box 2 Column W/Sponge PDC2002M	3 pcs
4.	800400041	Drier (Silica Gel 20g)	12 pcs
5.	800203071	Vacuum Bag 100 μ *W:400*L:500m/m	3 pcs
6.	800201011	PU size: 305*375*40 (CL1803U)	1 pcs
7.	800201041	EPE 120*200*25mm PLED	2 pcs
8.	800201051	PU 290*370*25mm PLED	1 pcs



15. Precaution in Design

- (1) Please do not expose the module to mechanical stress, which will cause damage to the metal, plastic, and PLED glass.
- (2) Polarizer is easily scratched and should be carefully handled. Please do not touch the polarizer use hard material, such as tweezers, pencil lead and glass. Please do not touch it by barehand.
- (3) This module is easily damaged when exposed to static discharge, please take care of static electricity and insure human body grounding.
- (4) Do not hold the same display picture over 1 min, because they will cause none uniformity in the display screen.