

Display Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 320240J TMH-PW-N

3,5“ Colour-TFT
with 8-Bit-Parallel Interface

Product Specification

Ver.: 5

19/05/2010

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
0	04.01.2010	First Issue	
1	25.03.2010	Correct Supply Current for LCM Correct Supply Current for Backlight	
2	05.05.2010	Add LED Life time	
3	07.05.2010	Correct Dimensional outline	
4	11.05.2010	Correct Backlight Characteristics	
5	19.05.2010	Correct LED Characteristics	

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1. Functions & Features

Display Format	: 320 x 240 Dots
LCD Mode	: Normally White, Transmissive
Viewing Direction	: 6 O'clock
Display Color	: 256 Colors
Operation Temperature	: -20~70°C
Storage Temperature	: -30~80°C
Power Supply Voltage (V _{DD})	: 3.3 Volt (typ.)
LED Power Voltage	: 3.0~5.0V
Backlight Color	: White (LED)
LCM Contrast Ratio	: 300:1
LCM Brightness	: 200 nit (typ)

2. MECHANICAL SPECIFICATIONS

Module Size	: 92.00 x 78.4 x 10.50 mm
Viewing Area	: 73.30 x 55.80 mm
Pixel Size	: 0.073 (RGB) x 0.219 mm

3. BLOCK DIAGRAM

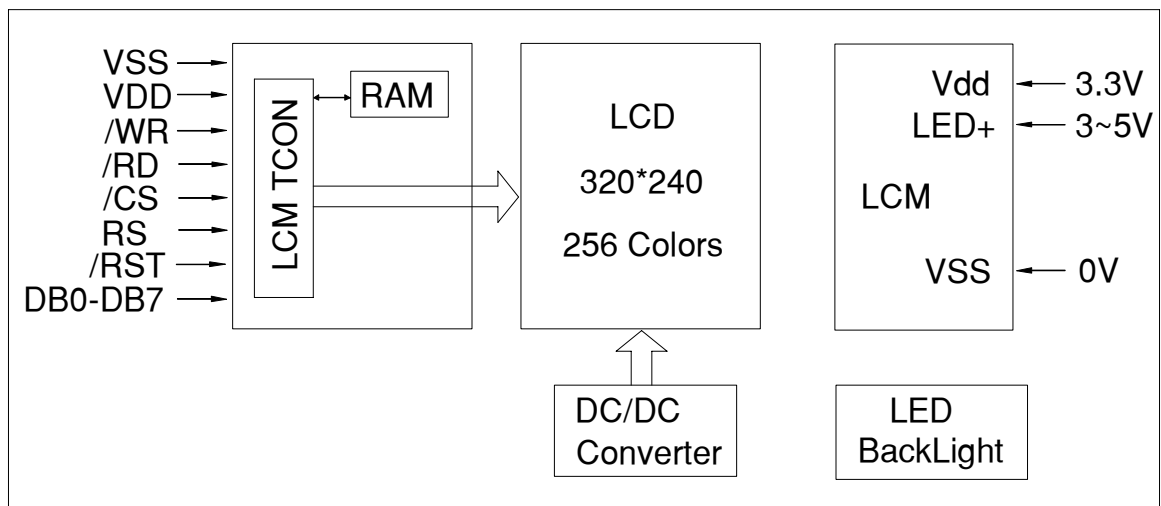
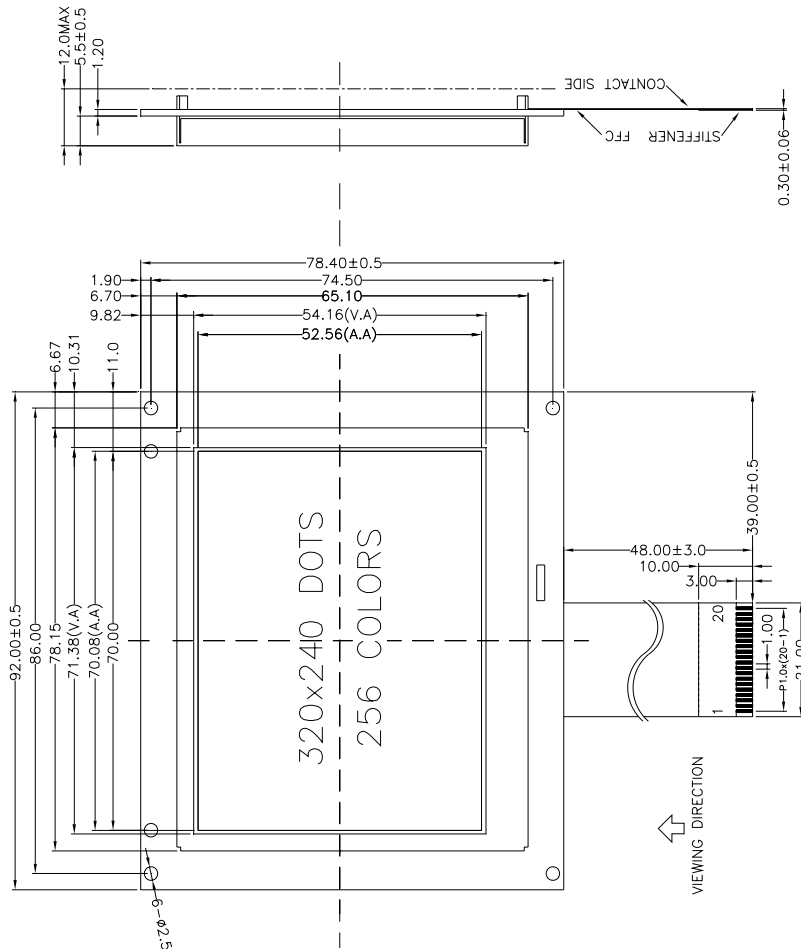


Figure 1. Block diagram

4. DIMENSIONAL OUTLINE

- Specification:
- 1). LCM TYPE: 320x240 DOTS, 256 COLORS
 - 2). LCD VIEW DIRECTION: 6 O'CLOCK
 - 3). DISPLAY MODE: TRANSMISSIVE/NORMAL WHITE
 - 4). OPERATING TEMP.: -20°C~+70°C
 - 5). STORAGE TEMP.: -30°C~+80°C
 - 6). OPERATING VOLTAGE: VDD=3.3V
 - 7). BACK LIGHT: Vled=3.0~5.0V, COLOR(WHITE)



PIN	1	2	3	4	5	6	7	8	9	10
CONNECTOR	VSS	VDD	LED+ /RST	/WR	/RD	/CS	AO	DO	D0	D1
PIN	11	12	13	14	15	16	17	18	19	20
CONNECTOR	D2	D3	D4	D5	D6	D7	NC	NC	NC	NC

Figure 2-1. Dimensional outline

5. PIN DESCRIPTION

No.	Symbol	Function
1	VSS	GND
2	VDD	Logic supply voltage (3.3V)
3	LED+	Power supply for backlight(+3.0V~+5.0V)
4	/RST	Reset signal (L)
5	/WR	Write signal
6	/RD	Read signal
7	/CS	Chip enable signal
8	A0	Register selection (H:Data register, L:Instruction register)
9	D0	Data bus line
10	D1	Data bus line
11	D2	Data bus line
12	D3	Data bus line
13	D4	Data bus line
14	D5	Data bus line
15	D6	Data bus line
16	D7	Data bus line
17	NC	---
18	NC	---
19	NC	---
20	NC	---

6. MAXIMUM ABSOLUTE LIMIT

Item	Symbol	MIN	MAX	Unit
Supply Voltage for Logic	V_{DD}	-0.3	5.0	V
Input Voltage	V_{in}	-0.3	$V_{DD}+0.3$	V
Supply Current (Without Backlight)	$I_{DD}(Ta = 25^{\circ}C)$		75	mA
Supply Current for Backlight	$I_F(Ta = 25^{\circ}C)$	---	130	mA
Reverse Voltage for Backlight	$V_R(Ta = 25^{\circ}C)$	---	5.5	V
Operating Temperature	T_{op}	-20	70	$^{\circ}C$
Storage Temperature	T_{st}	-30	80	$^{\circ}C$

7. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	V _{DD-VSS}	Ta = 25°C	3.0	3.3	3.6	V
Input High Voltage	V _{IH}	Ta = 25°C	0.8V _{DD}	---	V _{DD}	V
Input Low Voltage	V _{IL}	Ta = 25°C	0	---	0.2V _{DD}	V
Output High Voltage	V _{OH}	Ta = 25°C	0.8V _{DD}	---	V _{DD}	V
Output Low Voltage	V _{OL}		0	---	0.2V _{DD}	V
Supply Current (Without Backlight)	I _{DD}	Ta = 25°C	--	65	75	mA

8. BACKLIGHT CHARACTERISTICS

Ta = 25°C

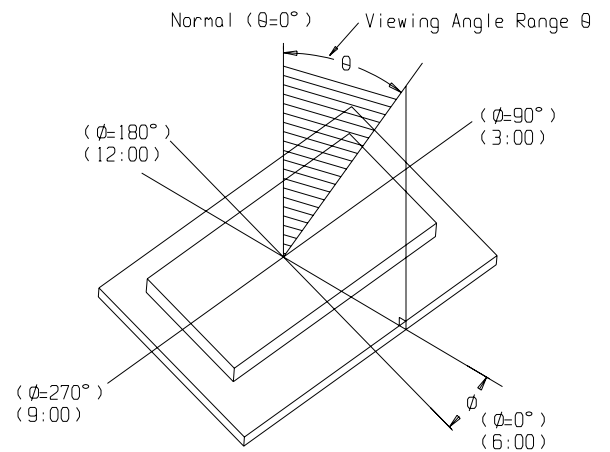
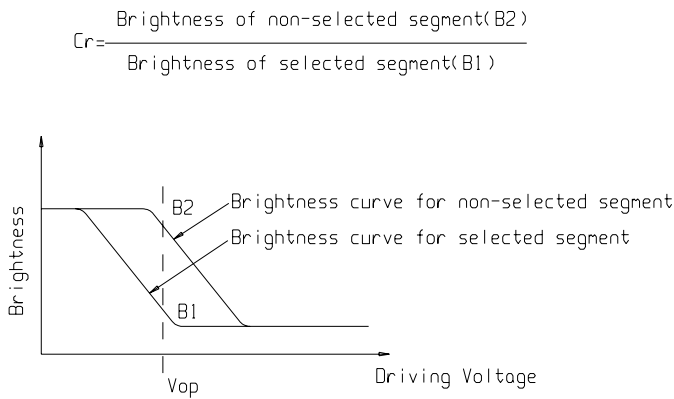
Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	V _{led} =5.0V	3.0	5.0	5.2	V
Forward Current	IR	V _{led} =5.0V	88	120	128	mA
Luminous Intensity (With LCD dots off)	IV	V _{led} =5.0V	150	200	---	Cd/m ²
LED Backlight Color	White					

Item	Symbol	Condition	Min	Typ	Max	Unit
LED Life time	---	Ta = 25°C Humidity: 70% below Forward Current: 20mA	20,000	50,000	72,000	Hr

9. ELECTRO-OPTICAL CHARACTERISTICS

(VDD=3.3V, Vled=5.0V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (CR≥10)	θL	Φ=180°(9 o'clock)	45	60	---	degree
	θR	Φ=0°(3 o'clock)	45	60	---	
	θT	Φ=90°(12 o'clock)	35	50	---	
	θB	Φ=270°(6 o'clock)	40	55	---	
Response time	Ton	Normal θ=Φ=0°	---	10	20	ms
	Toff		---	15	25	ms
Contrast ratio	Cr		150	300	---	---
Luminance	L1		150	200		Cd/m2



10. TIMING CHARACTERISTICS

10.1 Interface Timing

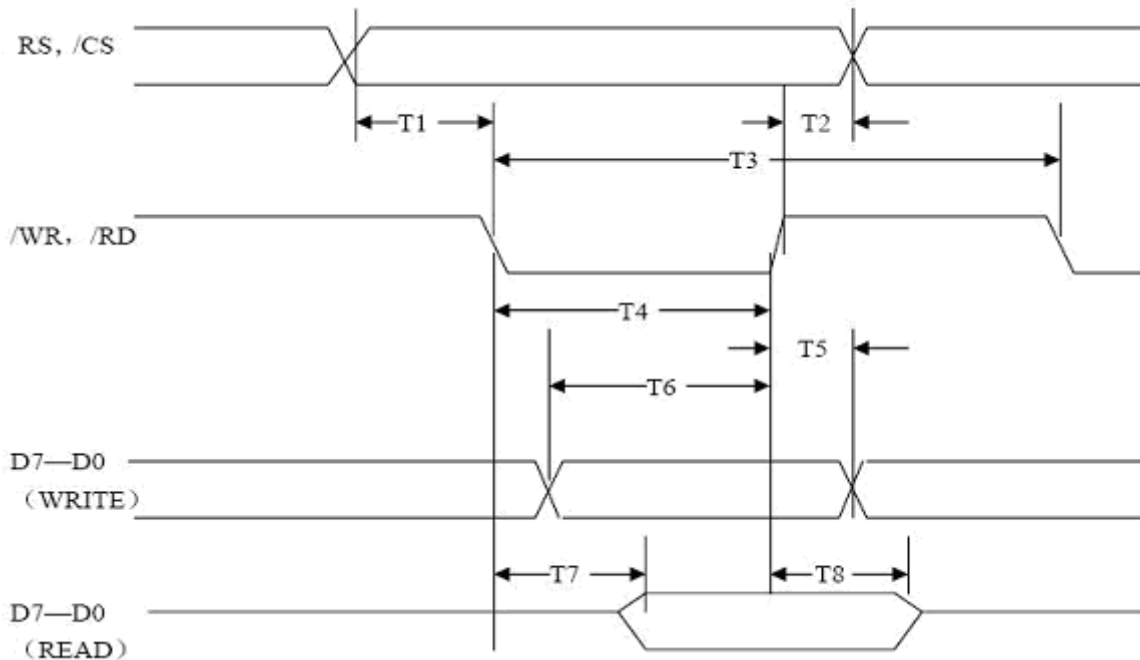


Figure 4. 8080 family Interface Timing

10.2 MCU Interface

Signal	Symbol	Parameter	VDD=3.3V		Unit	Condition
			Min	Max		
RS,/CS	T2	Address hold time	10	-	ns	CL=100p F
	T1	Address setup time	0	-	ns	
/WR,/RD	T3	System cycle time	350	-	ns	
	T4	Strobe pulsewidth	180	-	ns	
D0-D7	T5	Data hold time	80	-	ns	
	T6	Data setup time	120	-	ns	
	T7	/RD Access time	-	50	ns	
	T8	Output disable time	10	50	ns	

11. CONTROL AND DISPLAY INSTRUCTION

11.1 Instruction

/CS	RS	/WR	/RD	DB0~DB7
H	H/L	H/L	H/L	Command non-active
L	L	L	H	Write display data
L	H	L	H	Write Address(X,Y) X_Address: 0~ 319 Y_Address: 0~239
L	L	H	L	Command non-active
L	H	H	L	Read display data

Example:

```
wcomd(0x00); wcomd(0x00); wcomd(0x00); wdata(0xe0); //display red
X-Address(H), X-Address(L), Y-Address, Display data
Continuum write display data, Address is increased by 1 automatically.
```

11.2 Display Data format(256 Colors)

DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
R2	R1	R0	G2	G1	G0	B1	B0
MSB RED (000~111)		LSB		MSB GREEN(000~111)		LSB BLUE(00~11)	

11.3 Program Example

```
//----- MCU: 89C52, 24M -----  
#include <reg51.h>  
#define uint unsigned int  
#define uchar unsigned char  
  
sbit CS    = P3^2;  
sbit RS    = P3^3;  
sbit WRR   = P3^4;  
sbit RDD   = P3^5;  
sbit RST   = P3^6;  
  
void wcomd(uchar ch)  
{  
    CS=0;RDD=1;RS=0;  
    P1=ch;  
    WRR=0;  
    WRR=1;  
    CS=1;  
}  
  
void wdata(uchar ch)  
{  
    CS=0;RDD=1;RS=1;  
    P1=ch;  
    WRR=0;  
    WRR=1;  
    CS=1;  
}  
  
unsigned char rdata(void)  
{  
    uchar ch;  
    CS=0;WRR=1;RS=1;  
    P1=0xff;  
    RDD=0;  
    ch=P1;  
    RDD=1;  
    CS=1;  
    return(ch);  
}  
  
void waddr(uint xdat,uint ydat)  
{  
    uint xxh,xxl;  
    xxh=xdat/256;
```

```
    xxl=xdat%256;
    wcomd(xxh);
    wcomd(xxl);
    wcomd(ydat);
}
```

```
void disp_all(uchar xsdata)
{
    uint j,k;
    waddr(0x00,0x00);
    for(k=0;k<240;k++)
    {
        for(j=0;j<320;j++)
        { wdata(xsdata);}
    }
}
```

```
void main(void)
{
    RST=0;delay(50);RST=1;delay(20);
    while(1)
    {
        disp_all(0xff); delay(200);    //white
        disp_all(0x00); delay(200);    //black
        disp_all(0xe0); delay(200);    //red
        disp_all(0x1c); delay(200);    //green
        disp_all(0x03); delay(200);    //blue
        disp_all(0xfc); delay(200);    //yellow
        .....
    }
}
```

12. Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isoprophyl alcohol, ethyl alcohol or trichlorotrifloroethane, do not use water, keytone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting DISPLAY.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: $280^{\circ}\text{C}\pm 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

DISPLAY LCDs and modules are not consumer products, but may be incorporated by DISPLAY's customers into consumer products or components thereof, DISPLAY does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of DISPLAY is limited to repair or replacement on the terms set forth below. DISPLAY will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between DISPLAY and the customer, DISPLAY will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with DISPLAY general LCD inspection standard . (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.