DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 20230 FGH-PW

Product Specification **Version: 2**

09.04.2013

GENERAL SPECIFICATION

MODULE NO. :

DEM 20230 FGH-PW

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	07.02.2013
1	CHANGE OPTICAL CHARACTERISTICS	21.02.2013
2	CHANGE DRAWING	09.04.2013

PREPARED BY: AH DATE: 09.04.2013

APPROVED BY: MH DATE: 09.04.2013

CONTENTS

1. Precautions in use of LCM

1.1 Use Modules

1. When modules switch On or Off, after accessing positive Supply Power with 5V±0.5V, then Input Signal Levels, if Signal Levels Input before Supply Power becomes stable or switches off, IC circuits off, modules will be damaged, as a result, modules will be damaged.
2. Dot Matrix Modules are high path – number LCDs, they are largely related to the contrast, viewing angle, driving voltage when displaying, so you should adjust it to get best contrast and viewing angle, if it is too high, not only displays are effected, but also let life shorted.
3. When using under regulated working temperature below, the display responsiveness it too slow, when using under regulated temperature above, whole display surface turns dark, this is not damaged, when the temperature returns normal, all displays become normal

1.2 Module Storage

1. Storaging temperature:-30~+80°C
2. Place in dark sites to avoid strong lights
3. Don’t place other thing on their surfaces
4. Packaged in polyer materials (with anti-static electricity layers) and sealed

1.3 Soldering

1. Iron head temperature: 280±10°C
2. Soldering time: <3-4S
3. Soldering material: eutectic nature, low melting point
4. Don’t use acid solder
5. Soldering don’t repeat above 3 times

2. Mechanical Specifications

Item	Value	Unit
Number of Characters	20 x 2	Character
Character Format	5x 8	Dots
Character Pitch	3.70 x 5.95	mm
Character Size	3.20 x 5.55	mm
Dot Size	0.60 x 0.65	mm
Dot Pitch	0.65 x 0.70	mm
Module Dimension	85.00 x 28.30 x 5.30	mm
Active Area	73.50 x 11.50	mm
Viewing Area	77.00 x 16.50	mm
Lcd Type	FSTN TRANSFLECTIVE / POSITIVE	-
Controller	NT7605H-BTDO1 (Novatek)	-
Duty	1/16	-
Bias	1/4	-
Viewing Direction	6:00	-
Backlight	LED, WHITE	-
Backlight Dimension	85.00 x 21.00 x 2.50	mm
Module Connection	Pins	-

3. Absolute Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Power supply Voltage	V_{DD}	-	-0.3	6.0	V
Input voltage Range	V_{IN}	-	-0.3	V_{DD}+0.3	V
Operating temperature	T_{OPR}	-	-20	70	°C
Storage temperature	T_{STG}	-	-30	80	°C
Static electricity	Be sure that you are grounded when handling with LCM				

Notes: 1. Exceeding the absolute maximum ratings may cause permanent damage to the device. Functional operation under these conditions is not implied.

4. Backlight Characteristic

4.1 Electrical / optical specifications

Ta = 25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	V_f	If=40mA, White	3.0	3.2	3.4	V
LED *Luminous Intensity	I_V	If=40mA, White	300	400	--	cd/m2
Chromaticity Coordinate	x	If=40mA, White	0.26	0.28	0.30	
	y		0.26	0.28	0.30	
Reverse Current	I_R	VR=5V, White	--	--	40	uA
lluminance Power Deviation	ΔEH	If=40mA, White	75	---	---	%

Note: * Measured at the bare LED Backlight unit.

4.2 LED Maximum Operating Range

Item	Symbol	White	Unit
Power Dissipation	P_{AD}	170	mW
Forward Current	I_F	50	mA
Reverse Voltage	V_R	5	V

5. DC Electrical Characteristics (without LED Backlight)

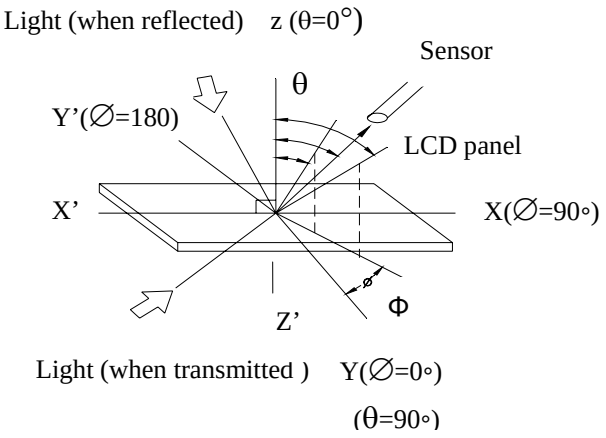
Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions	Applicable Pin
VDD	Operating Voltage	2.8	5.0	5.5	V		
V_{IH1}	"H" Level Input Voltage	0.8 V_{DD}	-	V_{DD}	V		DB0 – DB7, RS, R/W, E, OSC1
V_{IL1}	"L" Level Input Voltage	-0.3	-	0.2 V_{DD}	V		
V_{OH1}	"H" Level Output Voltage	V_{DD}-0.6	-	-	V	I_{OH} = -1.2mA	DB0 – DB7 (CMOS)
V_{OL1}	"L" Level Output Voltage	-	-	GND+0.6	V	I_{OL} = 1.2mA	
V_{COMD}	Driver Voltage Descending (COM)	-	-	0.3	V	I_D = 5µA	COM1 - 16
V_{SEGD}	Driver Voltage Descending (SEG)	-	-	0.3	V	I_D = 5µA	SEG1 - 100
I_{IL}	Input Leakage Current	-1	-	1	µA	V_{IN} = 0 to V_{DD}	
-I_P	Pull-up MOS Current	50	125	250	µA	V_{DD} = 5V	RS, R/W, DB0-DB7
I_{OP}	Supply Current Power Supply Current	-	1	1.5	mA	Rf oscillation, from external clock V_{DD} = 5V, f_{OSC} = f_{CP} = 540KHz, include LCD bias current.	V_{DD}
External Clock Operation							
f_{CP}	External Clock Operating Frequency	250	540	700	KHz		
t_{DUTY}	External Clock Duty Cycle	45	50	55	%		
t_{RCP}	External Clock Rise Time	0.1	-	0.5	µs		
t_{FCP}	External Clock Fall Time	0.1	-	0.5	µs		
Internal Clock Operation (Built-in RC Oscillator)							
f_{OSC}	Oscillator Frequency	380	540	700	KHz	Rf = 50KΩ (reference only)	
V_{LCD1} V_{LCD2}	LCD Driving Voltage	3.0	-	V_{DD}	V	V_{DD} - V_5	

6. Optical Characteristics

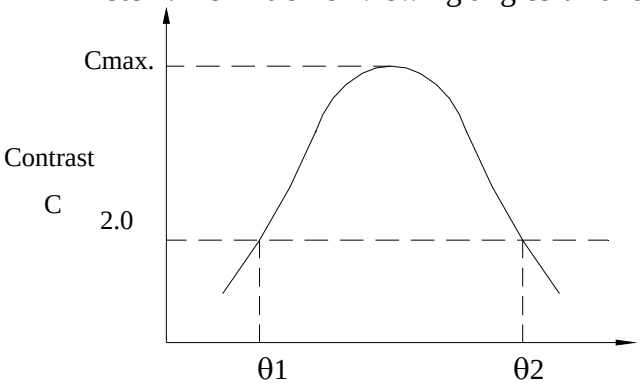
1/16 duty, 1/4 bias, Vlcd=4.6V, Ta=25℃

Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Driving voltage	Vlcd=VDD-VO		4.3	4.6	4.9	V
	Vlcd	-20°C	4.45	4.75	5.05	V
		+25°C	4.3	4.6	4.9	V
		+70°C	4.15	4.45	4.75	V
Viewing angle	θ	C≥2.0,∅=0°C	30°	-	-	Notes 1 & 2
Contrast	C	θ=5°, ∅=0°	3.0	-	-	Note 3
Response time(rise)	ton	θ=5°, ∅=0°	-		240ms	Note 4
Response time(fall)	toff	θ=5°, ∅=0°	-	-	220ms	Note 4

Note 1: Definition of angles θ and ∅



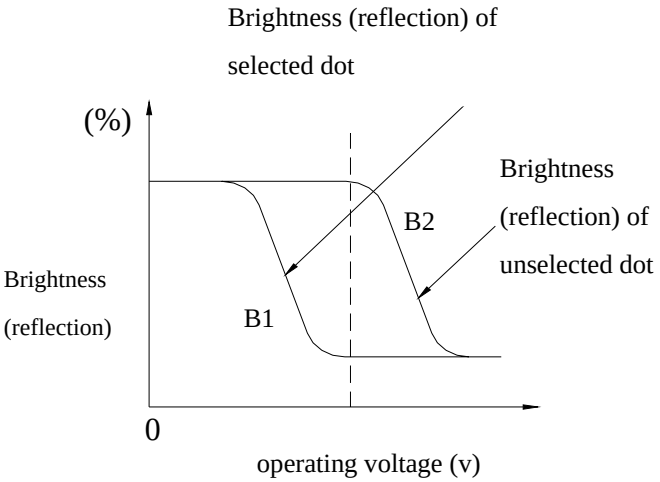
Note 2: Definition of viewing angles θ1 and ∅2



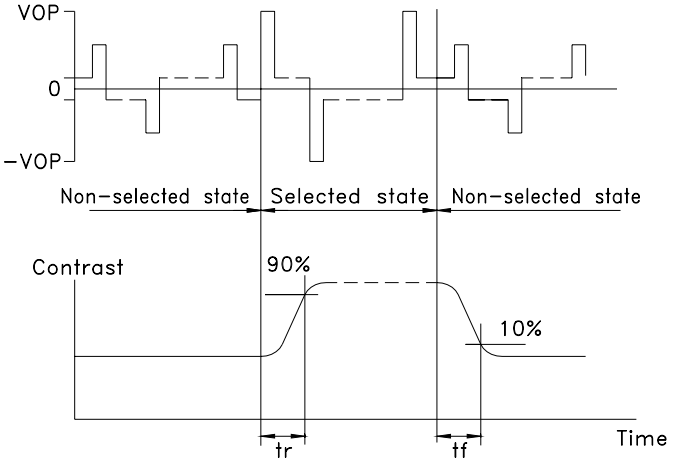
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

Note 3: Definition of contrast C

$$C = \frac{\text{Brightness (reflection) of unselected dot (B2)}}{\text{Brightness (reflection) of selected dot (B1)}}$$



Note 4: Definition of response time



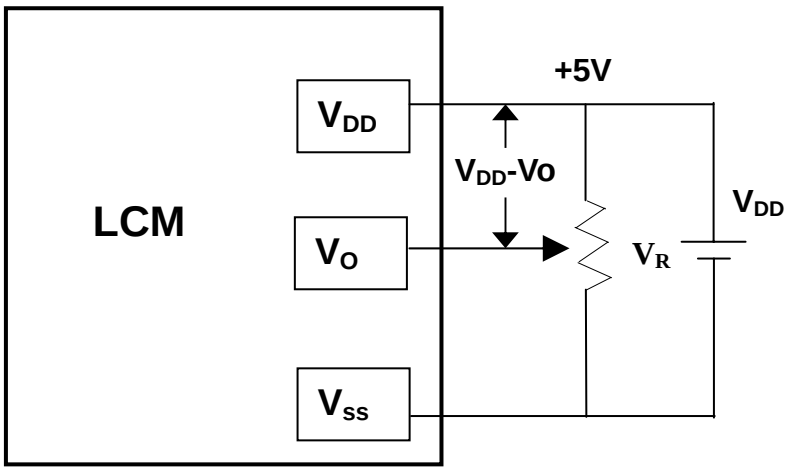
Note: Measured with a transmissive LCD panel which is displayed 1 cm^2

V_{OPR} : Operating voltage f_{FRM} : Frame frequency

t_{ON} : Response time (rise) t_{OFF} : Response time (fall)

7. Interface Pin Description

NO.	Symbol	Function
1	GND	Ground (0V)
2	VIN	Power Supply for Driving the LCD
3	VDD	Power supply for Logic circuit
4	RS	Data / Instruction select
5	R/W	Read / Write select
6	E	Enable signal
7-14	DB0-DB7	Data Bus line



V_{DD}-Vo : LCD Driving Voltage

V_R : 10k~20k

8. RELIABILITY

8.1 Reliability

Test item	Test condition	Evaluation and assessment
Operation at high temperature and humidity	40 °C±2 °C 90%RH for 500hours	No abnormalities in functions* and appearance**
Operation at high temperature	60 °C±2 °C for 500 hours	No abnormalities in functions* and appearance**
Heat shock	-20± ~ +60 °C Left for 1 hour at each temperature, transition time 5 min, repeated 10times	No abnormalities in functions* and appearance**
Low temperature	-20±2 °C for 500 hours	No abnormalities in functions* and appearance**
Vibration	Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions	No abnormalities in functions* and appearance**
Drop shock	Dropped onto a board from a height of 10cm	No abnormalities in functions* and appearance**

* Dissipation current, contrast and display functions

** Polarizing filter deterioration, other appearance defects

8.2 Liquid Crystal Panel Service Life

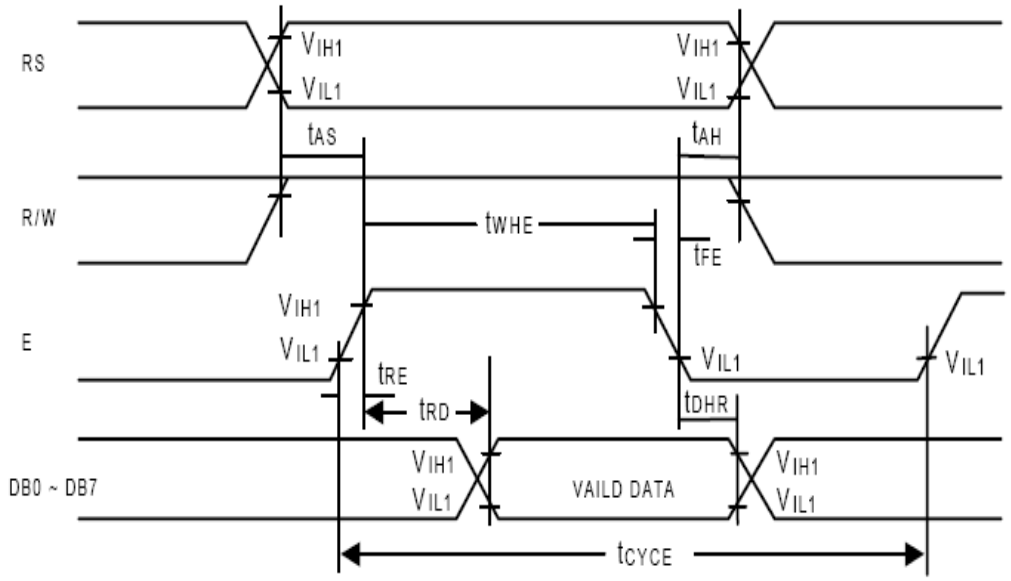
100,000 hours minimum at 25°C ± 10°C

8.3 Definition of Panel Service Life

- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

9. Timing Characteristics

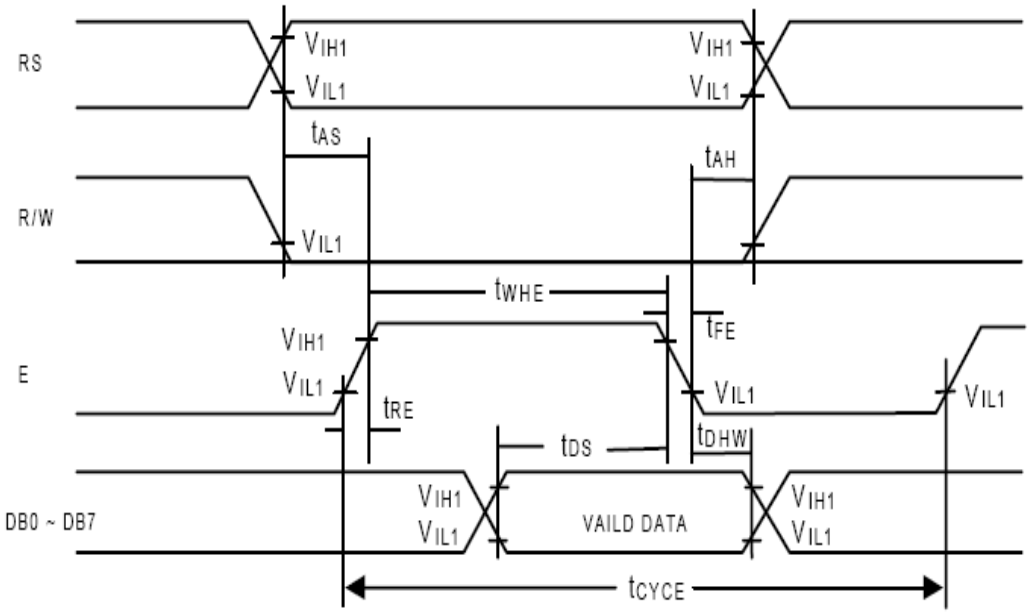
Read Operation



Read Cycle (V_{DD} = 5.0V, GND = 0V, T_A = 25°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
t_{CYCE}	Enable Cycle Time	500	-	-	ns	Figure 1
t_{WHE}	Enable "H" Level Pulse Width	300	-	-	ns	Figure 1
t_{RE}, t_{FE}	Enable Rise/Fall Time	-	-	25	ns	Figure 1
t_{AS}	RS, R/W Setup Time	60[1]	-	-	ns	Figure 1
		100[2]				
t_{AH}	RS, R/W Address Hold Time	10	-	-	ns	Figure 1
t_{RD}	Read Data Output Delay	-	-	190	ns	Figure 1
t_{DHR}	Read Data Hold Time	20	-	-	ns	Figure 1

Write Operation



Write Cycle (V_{DD} = 5.0V, GND = 0V, T_A = 25°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
t_{CYCE}	Enable Cycle Time	500	-	-	ns	Figure 2
t_{WHE}	Enable "H" Level Pulse Width	300	-	-	ns	Figure 2
t_{RE}, t_{FE}	Enable Rise/Fall Time	-	-	25	ns	Figure 2
t_{AS}	RS, R/W Setup Time	60[1]	-	-	ns	Figure 2
		100[2]				
t_{AH}	RS, R/W Address Hold Time	10	-	-	ns	Figure 2
t_{DS}	Data Output Delay	100	-	-	ns	Figure 2
t_{DHR}	Data Hold Time	10	-	-	ns	Figure 2

Notes: 1: 8-bit operation mode
2: 4-bit operation mode

10. Display Command

Instruction	Code										Function	Execution time (max) (f_{osc} = 250KHz)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Display Clear	0	0	0	0	0	0	0	0	0	1	Clear entire display area.	1.64ms
Display/ Cursor Home	0	0	0	0	0	0	0	0	1	*	Restore display from shift and load address counter with DD RAM address 00H.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Specify direction of cursor movement and display shift mode. This operation takes place after each data transfer (read/write).	40µs
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	Specify activation of display (D) cursor (C) and blinking of character at cursor position (B).	40µs
Display/ Cursor Shift	0	0	0	0	0	1	S/C	R/L	*	*	Shift display or move cursor.	40µs
Function Set	0	0	0	0	1	DL	N	F	*	*	Set interface data length (DL), number of display line (N), and character font (F).	40µs
RAM Address Set	0	0	0	1	ACG						Load the address counter with a CG RAM address. Subsequent data access is for CG RAM data.	40µs
DD RAM Address Set	0	0	1	ADD							Load the address counter with a DD RAM address. Subsequent data access is for DD RAM data.	40µs
Busy Flag/ Address Counter Read	0	1	AC								Read Busy Flag (BF) and contents of Address Counter (AC).	40µs
CG RAM/ DD RAM Data Write	1	0	Write data								Write data to CG RAM or DD RAM.	40µs
CG RAM/ DD RAM Data Read	1	1	Read data								Read data from CG RAM or DD RAM.	40µs
	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/D = 0 : Decrement S/C = 0 : Move Cursor R/L = 0 : Shift Left DL = 0 : 4-Bit N = 0 : Signal Line F = 0 : 5x8 dots	DD RAM : Display Data RAM CG RAM : Character Generator RAM ACG : Character Generator RAM Address ADD : Display Data RAM Address AC : Address Counter	

Note 1: Symbol "*" signifies an insignificant bit (disregard).
Note 2: Correct input value for "N" is predetermined for each model.

11. Character Pattern

12. LCD Dimensions