

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 20230 SGH

Product Specification

Version: 1

18.01.2013

GENERAL SPECIFICATION

MODULE NO. :

DEM 20230 SGH

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	14.12.2012
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1. Precautions in use of LCM

1.1 Use Modules

1. When modules switch on or off, after accessing positive supply power with 5 ± 0.5 voltage, 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, view angle, driving voltage when displaying, so you should adjust it to get best contrast and view 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 is 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. Storing temperature: -30°C to $+80^{\circ}\text{C}$
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: $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
2. Soldering time: $<3-4$ sec
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	5 x 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	81.00 x 28.30 x 2.85	mm
Active Area	46.70 x 10.00	mm
Viewing Area	50.00 x 16.00	mm
Lcd type	STN GREY, REFLECTIVE, POSITIVE	
Controller	NT7605H-BTDO1	
Duty	1/16	-
Bias	1/4	-
Viewing direction	6 O'clock	-
Backlight	-	-

3. Absolute Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Power supply Voltage	VDD	-	-0.3	6.0	V
Input voltage Range	VIN	-	-0.3	VDD+0.3	V
Operating temperature	TOPR	-	-20	70	°C
Storage temperature	TSTG	-	-30	80	°C
Static electricity	Be sure that you are grounded when handing LCM				

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

4. DC Electrical Characteristics (Without LED back-light)

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	

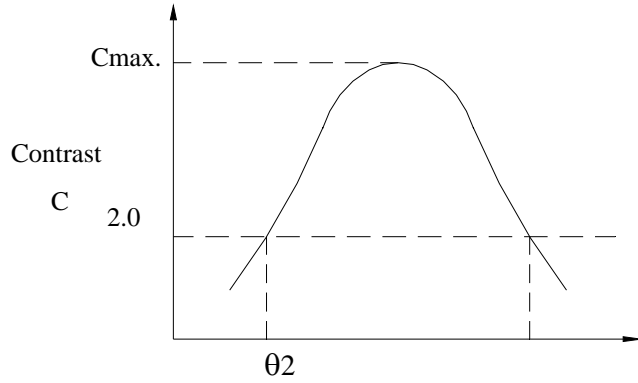
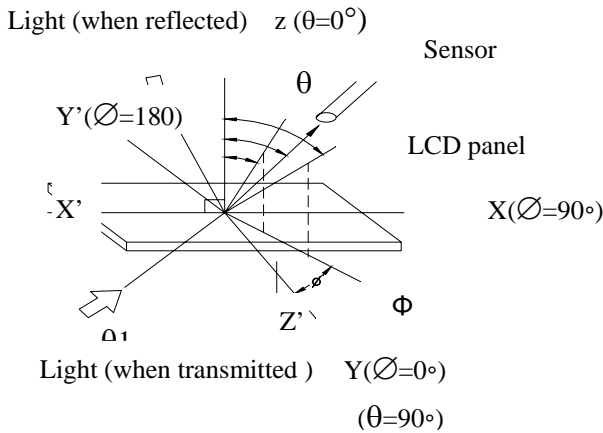
5. Optical Characteristics

1/16 Duty, 1/5 Bias, V_{lcd}=4.6Volt, T_a=25°C

Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Driving voltage	V _{lcd} =V _{dd} -V ₀		--	4.6	--	
Viewing angle	θ	C>2.0, ∅=0°C	30°	-	-	Notes 1 & 2
Contrast	C	θ=5°, ∅=0°	3.0	-	-	Note 3
Response time(rise)	t _{on}	θ=5°, ∅=0°	-	-	240ms	Note 4
Response time(fall)	t _{off}	θ=5°, ∅=0°	-	-	220ms	Note 4

Note 1: Definition of angles θ and ∅

Note 2: Definition of viewing angles θ₁ and ∅₂

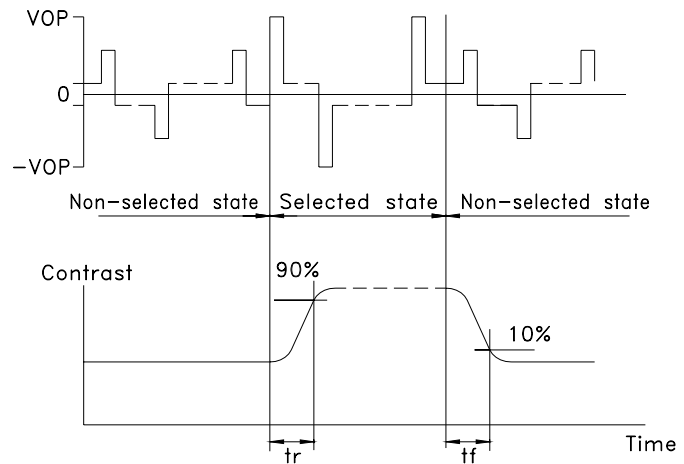
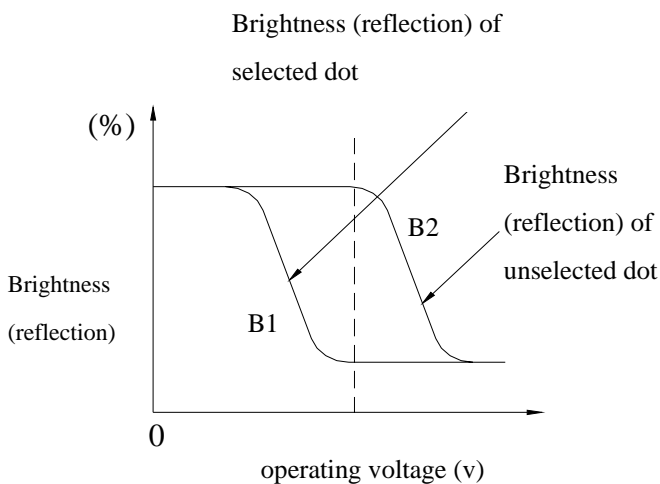


Note : Optimum viewing angle with the naked eye and viewing angle θ at C_{max}. Above are not always the same

Note 3: Definition of contrast C

Note 4: Definition of response time

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



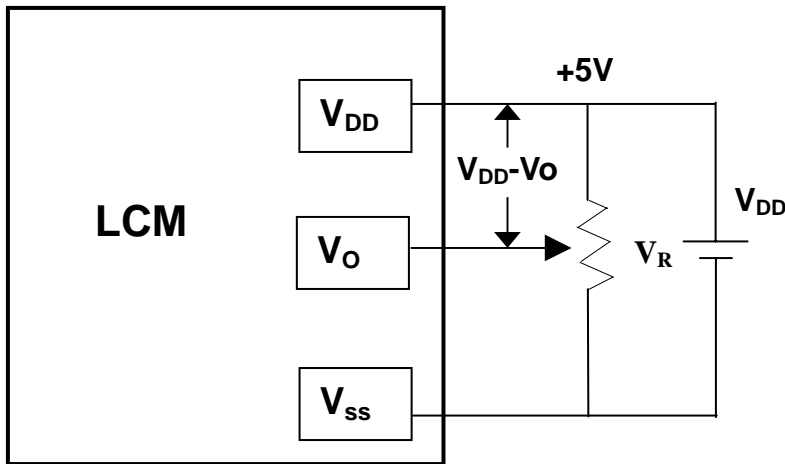
Note: Measured with a transmissive LCD panel which is displayed 1 cm²

V_{OPR} : Operating voltage f_{FRM} : Frame frequency
 t_{ON} : Response time (rise) t_{OFF} : Response time

fall)

6. 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

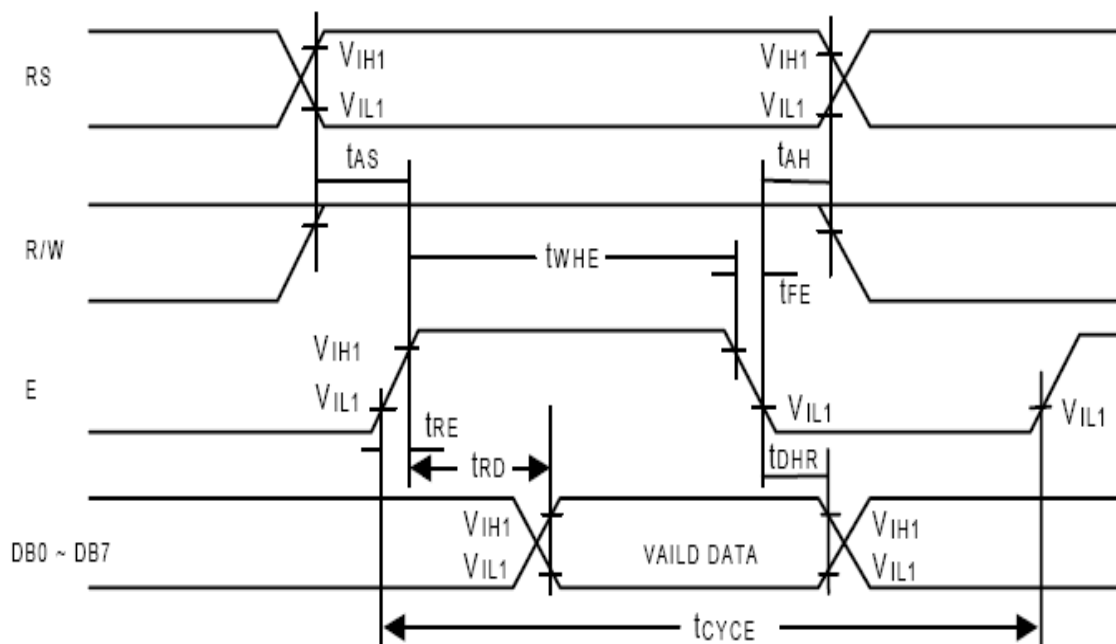


V_{DD}-V_O : LCD Driving Voltage

V_R : 10K~20K

7. Timing Characteristics

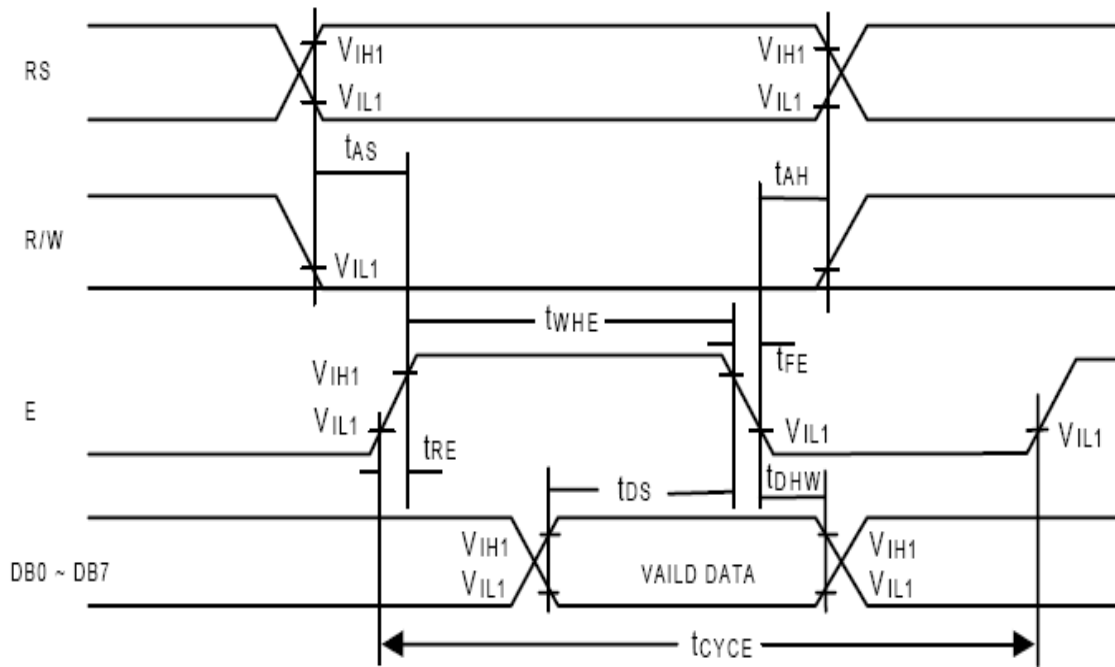
Read Operation



Read Cycle ($V_{DD} = 5.0V$, $GND = 0V$, $T_A = 25^{\circ}C$)

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 ($V_{DD} = 5.0V$, $GND = 0V$, $T_A = 25^\circ C$)

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

9. 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	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	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	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	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.

10. Character Pattern

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL																
LLLH																
LLHL																
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11. LCM Dimension

