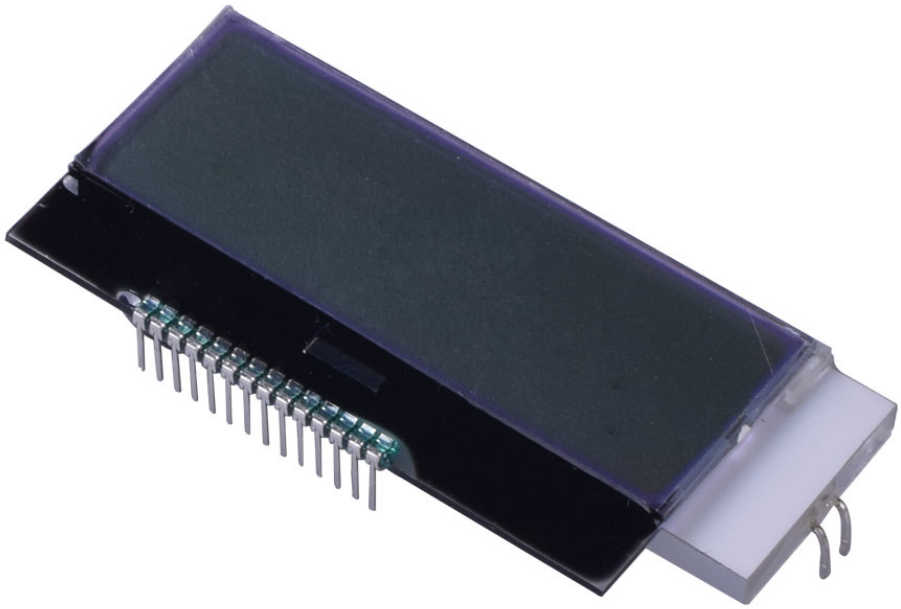
DisplayModule



DM-COG1602-702

1602 COG CHARACTER LCD WITH 4/8-BIT MPU INTERFACE

Contents

1 Revision History

Date	Changes
2015-03-13	First release

2 Main Features

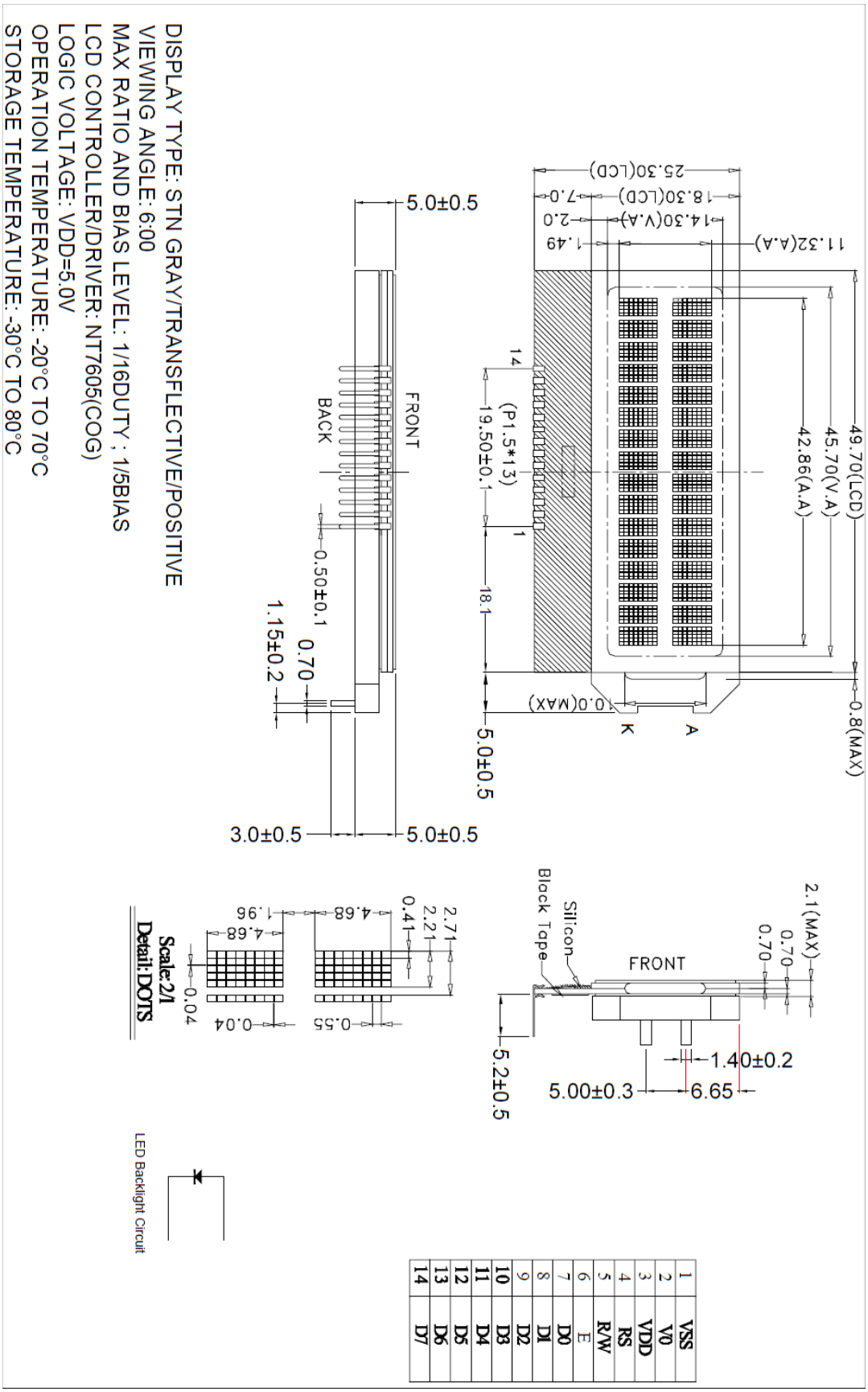
Item	Specification	Unit
Number of Characters	16 characters x 2 lines	
Display Mode	STN GRAY, Transflective	
Characters Resolution	5 x 8 dots with cursor	
Controller IC	NT7605 or equivalent	-
Interface	4/8-bit MPU Interface	-
Power Supply	5V	V
View Direction	6:00	-
Duty	1/16 duty, 1/5 bias	
Backlight	Side White LED	-
Weight	8.8	g

3 Pin Description

Pin No.	Symbol	Function Description
1	VSS	Ground
2	V0	Power supply for contrast (approx. 0.3V)
3	VDD	Supply voltage for logic (5.0V)
4	RS	Register select signal. RS=0: Command, RS=1: Data
5	R/W	Read/Write select signal, R/W=1: Read R/W=0: Write
6	E	Operation enable signal. Falling edge triggered.
7~10	DB0-DB3	Four low order bi–directional three state data bus lines. These four are not used during 4–bit operation
11~14	DB4-DB7	Four high order bi–directional three state data bus lines.
15	A	Power supply for LED Backlight (3.0V)
16	K	Ground for Backlight

Recommend Lcd connector: 1.5 mm pitch, 14 pins Soldered to PCB
Backlight connector: A and K pins Mates with: Solder to wires or PCB

4 Mechanical Drawing



5 Electrical Characteristics

Item	Symbol	Condition	Min	Typ.	Max	Unit
Supply Voltage For Logic	VDD		4.7	5.0	5.5	V
Digital Operation Current	IDD	-	-	1.5	2.0	mA
Low Level Input Voltage	V_{IL}		0	-	0.6	V
High Level Input Voltage	V_{IH}		2.2	-	VDD	V
Low Level Output Voltage	V_{OL}		-		0.4	V
High Level Output Voltage	V_{OH}		2.4		-	V
Backlight Forward Voltage	V_{LED}			5.0		V
Backlight Forward Current	I_{LED}			30		mA
Operating Temperature	TOP	Absolute Max	-20		70	℃
Storage Temperature	TST	Absolute Max	-30		80	℃

6 Optical Characteristics

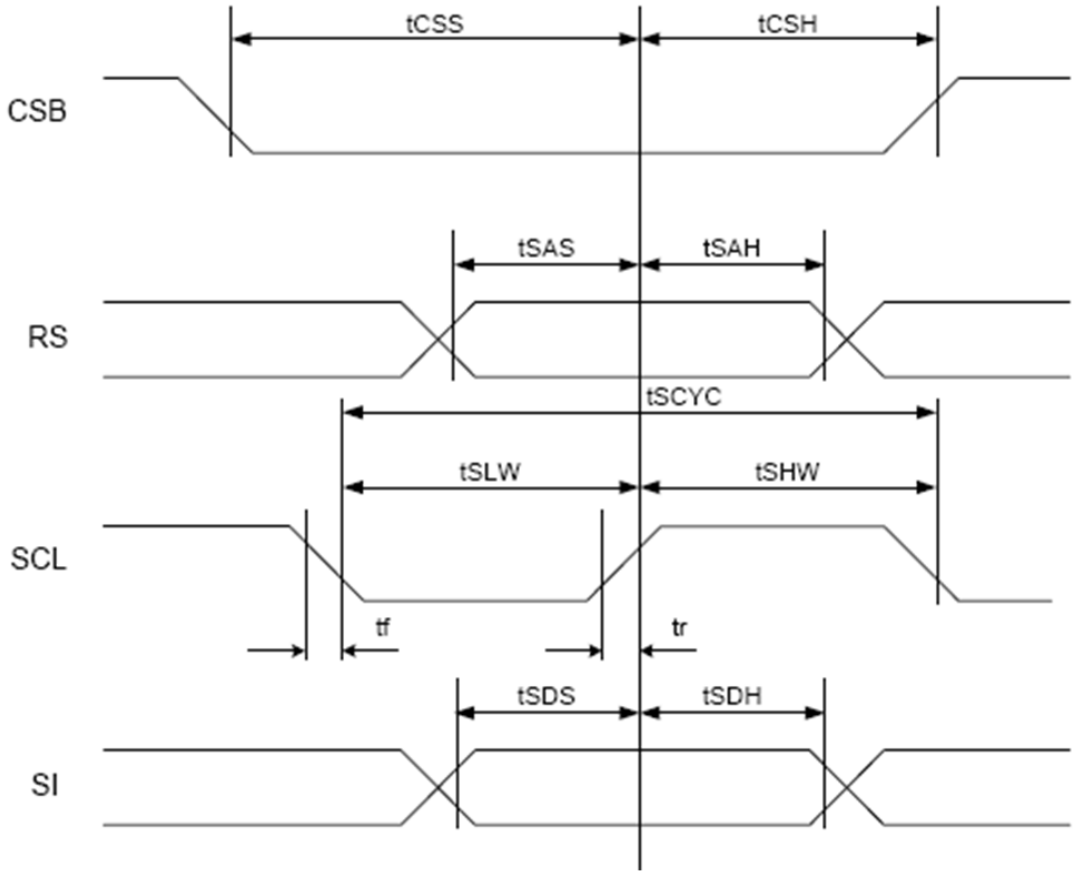
Ta=25℃, VDD=5.0V

Item	Symbol	Min	Typ	Max	Unit	Note
View Angles-Horizontal	AH	50			°	
View Angles-Vertical	AV		±30		°	
Response Time (25°C)	Tr + Tf		350	550	us	
Contrast Ratio	CR	3	5			
Luminance	L_V				cd/m²	

7 Timing Characteristics

Write Cycle (VDD=5.0V, TA=25℃)

Symbol	Parameter	Min.	Typ.	Max.	Unit
t_C	Enable Cycle Time	500			ns
t_W	Enable pulse width	300			ns
t_R, t_F	Enable Rise/Fall Time	-		25	ns
t_{su1}	RS,R/W Setup Time	100			ns
t_{h1}	RS,R/W Address Hold Time	10			ns
t_{su2}	Read Data Output Delay	60			ns
t_{h2}	Read data hold time	10			ns



8 Table of Commands

Instruction table at Normal mode

Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC= 380KHz	OSC= 540kHz	OSC= 700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	**1.08 ms**	**0.76 ms**	**0.59 ms**
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	**1.08 ms**	**0.76 ms**	**0.59 ms**
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	**26.3 us**	**18.5 us**	**14.3 us**
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	**26.3 us**	**18.5 us**	**14.3 us**
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	**26.3 us**	**18.5 us**	**14.3 us**
Function Set	0	0	0	0	1	DL	N	x	x	x	DL: interface data is 8/4 bits N: number of line is 2/1	**26.3 us**	**18.5 us**	**14.3 us**
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	**26.3 us**	**18.5 us**	**14.3 us**
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	**26.3 us**	**18.5 us**	**14.3 us**
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	**0**	**0**	**0**
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM)	**26.3 us**	**18.5 us**	**14.3 us**
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM)	**26.3 us**	**18.5 us**	**14.3 us**

Instruction table at Extension mode

Instruction	Instruction Code										Description	Instruction Execution Time		
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		OSC= 380KHz	OSC= 540kHz	OSC= 700KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM. and set DDRAM address to "00H" from AC	1.08 ms	0.76 ms	0.59 ms
Return Home	0	0	0	0	0	0	0	0	1	x	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.08 ms	0.76 ms	0.59 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies display shift. These operations are performed during data write and read.	26.3 us	18.5 us	14.3 us
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	D=1:entire display on C=1:cursor on B=1:cursor position on	26.3 us	18.5 us	14.3 us
Function Set	0	0	0	0	1	DL	N	DH	*0	IS	DL: interface data is 8/4 bits N: number of line is 2/1 DH: double height font IS: instruction table select	26.3 us	18.5 us	14.3 us
Set DDRAM address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	26.3 us	18.5 us	14.3 us
Read Busy flag and address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0	0	0
Write data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us
Read data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM/ICONRAM)	26.3 us	18.5 us	14.3 us

Note: this bit is for test command, and must always set to “0”

Instruction table 0(IS=0)														
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	S/C and R/L: Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.	26.3 us	18.5 us	14.3 us
Set CGRAM	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter	26.3 us	18.5 us	14.3 us

Instruction table 1(IS=1)														
Internal OSC frequency	0	0	0	0	0	1	BS	F2	F1	F0	BS=1:1/4 bias BS=0:1/5 bias F2~0: adjust internal OSC frequency for FR frequency.	26.3 us	18.5 us	14.3 us
Set ICON address	0	0	0	1	0	0	AC3	AC2	AC1	AC0	Set ICON address in address counter.	26.3 us	18.5 us	14.3 us
Power/ICON control/Contrast set	0	0	0	1	0	1	Ion	Bon	C5	C4	Ion: ICON display on/off Bon: set booster circuit on/off C5,C4: Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us
Follower control	0	0	0	1	1	0	Fon	Rab 2	Rab 1	Rab 0	Fon: set follower circuit on/off Rab2~0: select follower amplified ratio.	26.3 us	18.5 us	14.3 us
Contrast set	0	0	0	1	1	1	C3	C2	C1	C0	Contrast set for internal follower mode.	26.3 us	18.5 us	14.3 us

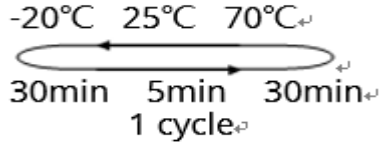
9 Built-in Font Tables

10 Driver/Controller Information

Built-in NT7605 Controller

https://drive.google.com/file/d/0Bxu0OURUiyL5NFhLZ09RM3lGYnc/view?usp=sharing

11 Reliability

Test Item	Content of Test	Test Condition	Note
High Temperature Storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	2
Low Temperature Storage	Endurance test applying the high storage temperature for a long time.	-30℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	-
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20 ℃ 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max, for 96hrs under no-load condition excluding the polarizer. Then taking it out and drying it at normal temperature.	60℃,90%RH 96hrs	1,2
Thermal Shock Resistance	The sample should be allowed stand the following 10 cycles of operation 	-20℃/70℃ 10 cycles	-
Vibration Test	Endurance test applying the vibration during transportation and using	Total fixed amplitude: 15mm; Vibration: 10~55Hz; One cycle 60 seconds to 3 directions of X, Y, Z, for each 16 minutes.	3
Static Electricity Test	Endurance test apply the electric stress to the terminal.	VS=800V, RS=1.5kΩ, CS=100pF, 1 time.	-

Note1: No dew condensation to be observed.
Note2: The function test shall be conducted after 4 hours storage at the normal. Temperature and humidity after remove from the rest chamber.
Note3: Test performed on product itself, not inside a container.

12 Warranty and Conditions

http://www.displaymodule.com/pages/faq