



SPECIFICATIONS OF HG12605

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1. FEATURES:

Common Options:	Display Mode	Background Color	Viewing	Back Polarizer	Backlight
HG12605NG	STN, Positive	Gray	6:00	Reflective	-
HG12605NY	STN, Positive	Yellow/Green	6:00	Reflective	-
HG12605F-DY	FSTN, Positive	Black/White	6:00	Transflective	Yellow/Green LED
HG12605NG-EW	STN, Positive	Gray	6:00	Transflective	White EL
HG12605NG-LY	STN, Positive	Gray	6:00	Transmissive	Yellow/Green LED
HG12605NY-LY	STN, Positive	Yellow/Green	6:00	Transmissive	Yellow/Green LED
HG12605NGU	STN, Positive	Gray	12:00	Reflective	-
HG12605NYU	STN, Positive	Yellow/Green	12:00	Reflective	-
HG12605NGU-LY	STN, Positive	Gray	12:00	Transmissive	Yellow/Green LED
HG12605NYU-LY	STN, Positive	Yellow/Green	12:00	Transmissive	Yellow/Green LED

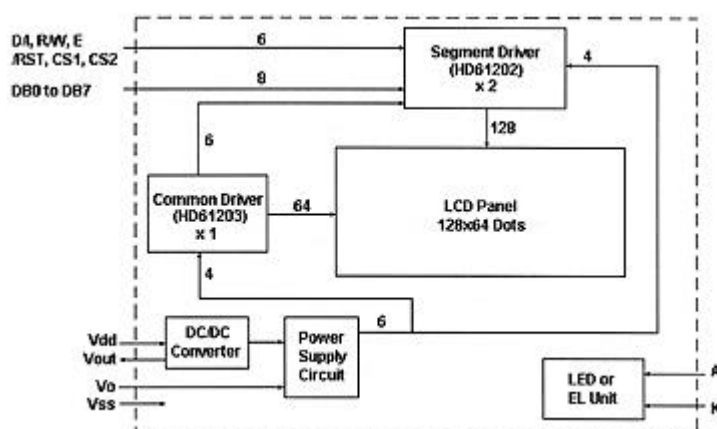
Standard Features:

- Display Format: 128 x 64 dots graphic LCD module
- Driving Method: 1/64 Duty, 1/6.4 Bias



SPECIFICATIONS OF HG12605

7. BLOCK DIAGRAM



8. MPU INTERFACE AND TIMING CHARACTERISTICS

8-1 MPU Interface Timing ($T_a = -20$ to 75°C , $V_{ss} = -5.0\text{V}$ 10%)

Parameter	Symbol	Rating			Unit	Note
		Min	Typ	Max		
E cycle time	t_{CYC}	1000	-	-	ns	
E high level width	P_{WEH}	450	-	-	ns	
E low level width	P_{WEL}	450	-	-	ns	
E rise time	t_f	-	-	25	ns	
E fall time	t_f	-	-	25	ns	
Address set-up time	t_{AS}	140	-	-	ns	
Address hold time	t_{AH}	10	-	-	ns	
Data set-up time	t_{DSW}	200	-	-	ns	
Data delay time	t_{DDR}	-	-	320	ns	
Data hold time (write)	t_{DHW}	10	-	-	ns	
Data hold time (read)	t_{DHR}	20	-	-	ns	

Figure 1 CPU Write Timing

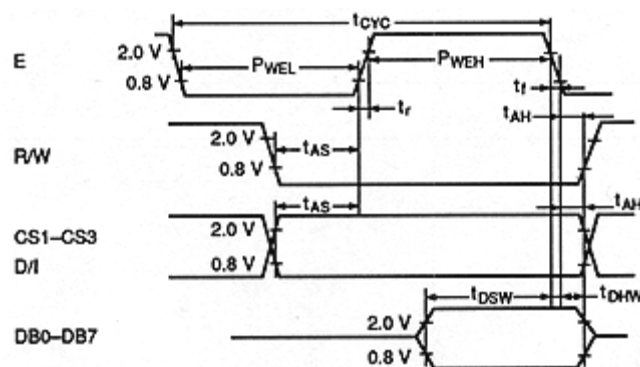


Figure 1 CPU Write Timing

Figure 2 CPU Read Timing

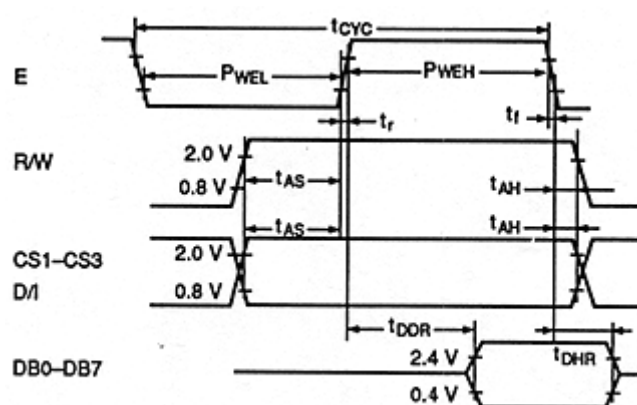


Figure 2 CPU Read Timing

8-2 Clock Timing (GND = 0 V, V_{CC} = 4.5 to 5.5 V, T_a = -20 to C)

Parameter	Symbol	Test Condition	Rating			Unit
			Min	Typ	Max	
1, 2 cycle time	t _{cyc}	Figure 3	2.5	-	20	s
1 low level width	t _{WL1}	Figure 3	625	-	-	ns
2 low level width	t _{WL2}	Figure 3	625	-	-	ns
1 high level width	t _{WH1}	Figure 3	1875	-	-	ns
2 high level width	t _{WH2}	Figure 3	1875	-	-	ns
1 - 2 phase difference	t _{D12}	Figure 3	625	-	-	ns
2 - 1 phase difference	t _{D21}	Figure 3	625	-	-	ns
1, 2 rise time	t _r	Figure 3	-	-	150	ns
1, 2 fall time	t _f	Figure 3	-	-	150	ns

Figure 3 External Clock Waveform

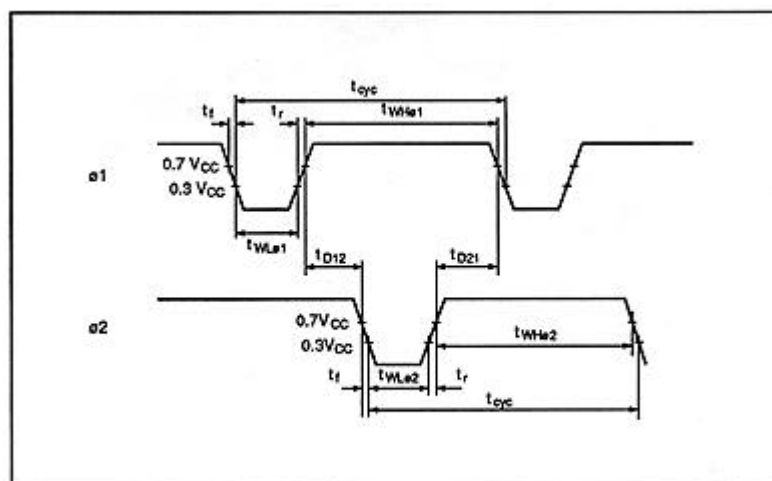


Figure 3 External Clock Waveform

8-3 Control timing for 80-port/68-port display

Parameter	Symbol	Condition	Rating			Unit
			Min	Typ	Max	
FRM delay time	t_{DFRM}	Figure 4	-2	-		ns
M delay time	t_{DM}	Figure 4	-2	-		ns
CL low level width	t_{WLCL}	Figure 4	35	-	-	ns
CL high level width	t_{WHCL}	Figure 4	35	-	-	ns

Figure 4 Display Control Signal Waveform

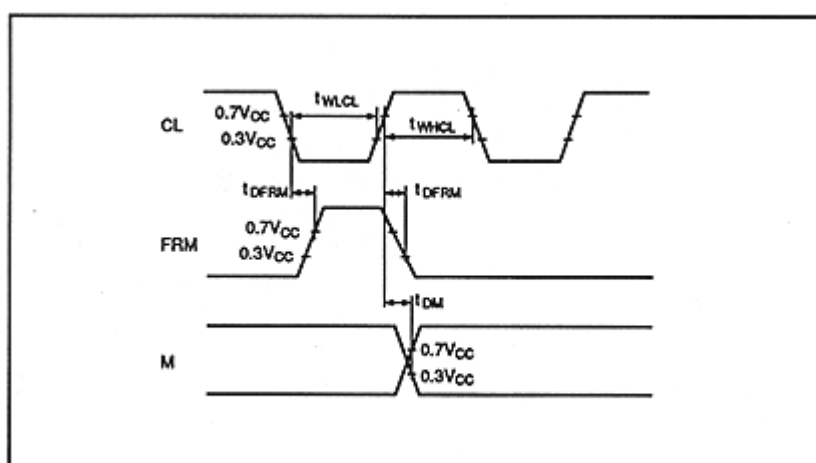


Figure 4 Display Control Signal Waveform

9. DISPLAY COMMANDS

(Based on the 80-port MPU; the /RD and /WR commands differ for the 68-port MPU.)

Command	R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0		
Display ON/OFF	0	0	0	0	1	1	1	1	1	1/0	Controls display on/off. RAM data and internal status are not affected. 1: on, 0: off.	
Display start line	0	0	1	1	Display start line (0-63)					Specifies the RAM line displayed at the top of the screen		
Set page (X address)	0	0	1	0	1	1	1	Page (0-7)		Sets the page (X address) of RAM at the page (X address) register.		
Set Y address	0	0	0	1	Y address (0-63)					Sets the Y address in the Y address counter.		
Status Read	1	0	B U S Y	0	O N /O F F	R E S E T	0	0	0	0	Reads the Status. Busy 1: Busy(internal processing) 0: READY status ON/OFF 1: Display OFF 0: Display ON RESET 1: Reset 0: Normal	
Write Display Data	0	1	Write Data								Writes the data DB0 (LSB) to DB7 (MSB) on the data bus to RAM	Has access to the address of the display RAM specified in advance. After the access, Y address is increased by 1.
Read Display Data	1	1	Read Data								Reads the data DB0 (LSB) to DB7 (MSB) on the data bus to RAM	

10. COMMANDS

The above table lists the commands used with the HD61202. This LSI uses a combination of R/W and D/I to identify a data bus signal. Interpretation and execution of a command depends not on external clock but on internal timing alone. Therefore, a command can be executed so fast that no busy check is needed.

A detailed description of commands follows.

10.1 DISPLAY ON/OFF

This command forces the display to turn on or off. The display data appears when D is 1 and disappears when D is 0. Though the data is not on the screen with D = 0, it remains in the display data RAM. Therefore, you can make it appear by changing D = 0 into D = 1.

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	1	1	1	1	1	D

D 0 = Display OFF

1 = Display ON

10.2 DISPLAY START LINE

This command specifies a line address marking the display line that corresponds to COM0 in the Display Data RAM. Display begins with the specified line address and covers as many lines as match the display duty in address ascending order. Dynamic line address change with the Display Start Line common enables column-wise scrolling or page change.

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
0	0	1	1	A5	A4	A3	A2	A1	A0

- High order bits

A5	A4	A3	A2	A1	A0	Line Address
0	0	0	0	0	0	0
0	0	0	0	0	1	1
			-			-
			-			-
1	1	1	1	1	1	63

10.3 SET PAGE (X ADDRESS)

This command is used to specify a page address equivalent to a row address for MPU access to the display data RAM. A required bit of the display data RAM can be accessed by specifying its page address and column address. Changing the page address causes no change in display.

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
0	0	1	0	1	1	1	A2	A1	A0

A2	A1	A0	Page	Rows
0	0	0	0	0 to 7
0	0	1	1	8 to 15
0	1	0	2	16 to 23
0	1	1	3	24 to 31
1	0	0	4	32 to 39
1	0	1	5	40 to 47
1	1	0	6	48 to 55
1	1	1	7	56 to 63

10.4 SET Y ADDRESS

This command specifies a display data RAM column Y address. The column address is incremented by 1 each time the data is written or read to or from the MPU.

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	1	A5	A4	A3	A2	A1	A0

A5	A4	A3	A2	A1	A0	Column Address
0	0	0	0	0	0	0
0	0	0	0	0	1	1
		-				-
		-				-
1	1	1	1	1	1	63

10.5 READ STATUS

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
1	0	Busy	0	ON/ OFF	Reset	0	0	0	0

BUSY: BUSY being "1" means that system is performing an internal operation or is reset. No command is accepted before BUSY = "0". As long as the cycle time requirement is met, no BUSY check is needed.

ON/OFF: Indicates display on or off.

- 0: Display on
- 1: Display off

This bit has polarity reverse to the Display ON/OFF command.

RESET: Indicates that system is being initialized by the /RES signal or the Reset command.

- 0: Display mode
- 1: Being reset

10.6 WRITE DISPLAY DATA

This command allows the MPU to write 8 bits of data into the display data RAM. Once the data is written, the column Y address is automatically incremented by 1.

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
0	1	Write Data							

10.7 READ DISPLAY DATA

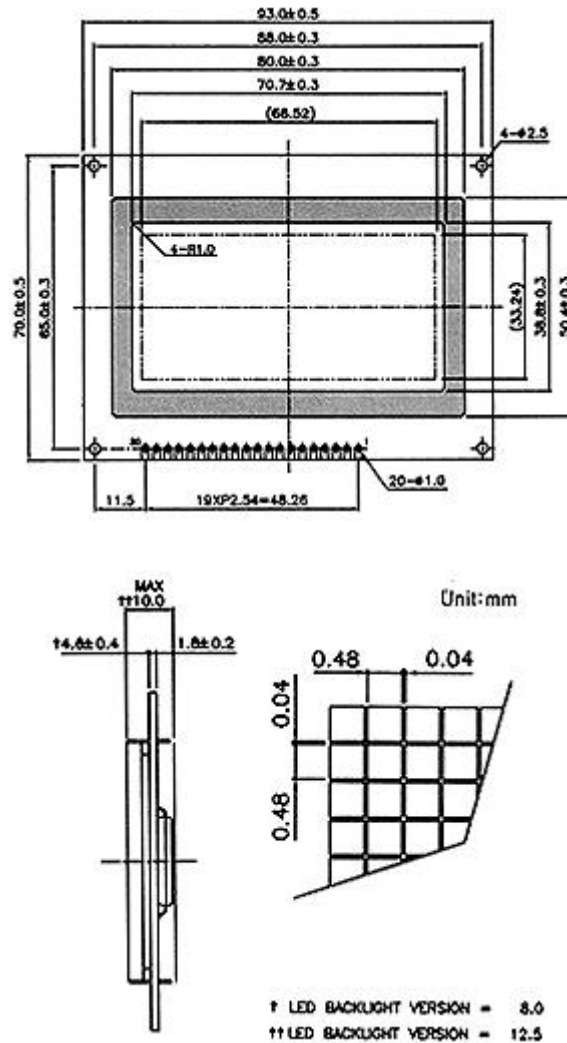
This command allows the MPU to read 8 bits of data into the display data RAM location specified by a column address and a page address. Once the data is read, the column Y

address is automatically incremented by 1..

A dummy read is needed immediately after the column address is set.

R/W	D/I	D7	D6	D5	D4	D3	D2	D1	D0
1	1	Read Data							

11. EXTERNAL DIMENSION



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2. MECHANICAL SPECIFICATIONS:

Item	Specification	Unit
Maximum Module Size	93 (W) X 70 (H) X 10 (T) (LED: 12.5 T)	mm
Viewing Area	70.7 (W) X 38.8 (H)	mm
Dot Size	0.48 (W) X 0.48 (H)	mm
Dot Pitch	0.52 (W) X 0.52 (H)	mm
Weight	100	g

3. ELECTRICAL SPECIFICATIONS:

3-1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Logic Supply Voltage	Vdd-Vss	0	-	7.0	V	Ta = 25 °C
LCD Drive Supply Voltage	Vdd-Vo	0	-	19.5	V	Ta = 25 °C
Input Voltage	Vi	-0.3	-	Vdd +0.3	V	Ta = 25 °C
Operating Temperature (Std)	Ta	0	-	+50	°C	-
Storage Temperature (Std)	Tstg	-20	-	+70	°C	-
Operating Temperature (Ext)	Ta	-20	-	+70	°C	-
Storage Temperature (Ext)	Tstg	-30	-	+85	°C	-

3-2 ELECTRICAL CHARACTERISTICS

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
Logic Supply Voltage	Vdd-Vss	4.75	5.00	5.25	V	
Logic Supply Current	Idd	-	9.5	14.3	mA	Vdd = 5V
LCD Supply Current	Io	-	3.0	4.5	mA	Vdd = 5V
LCD Operating Voltage	Vdd-Vo	-	-	-	V	Ta = 0 °C
		12.1	12.5	12.9	V	Ta = 25 °C
		-	-	-	V	Ta = 50 °C
Power Consumption	Pd	-	41.5	-	mW	Vdd = 5v
Input Voltage "High" Level	V _{IH}	0.7Vdd	-	Vdd	V	
Input Voltage "Low" Level	V _{IL}	0	-	0.3Vdd	V	
Output Voltage "High" Level	V _{OH}	2.4	-	-	V	
Output Voltage "Low" Level	V _{OL}	-	-	0.4	V	
Frame Frequency	Fr	-	60	-	Hz	Fosc=270KHz

3-3 BACKLIGHTING - EL UNIT

3-3-1 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Applied Voltage	Va	Ta = 25 °C	-	150	AC Vrms
Applied Frequency	Fa	Ta = 25 °C	-	1000	Hz

3-3-2 Optoelectric Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Applied Voltage	Va	Ta = 25 °C	80	100	120	AC Vrms
Applied Frequency	Fa		-	400	-	Hz
Current	Ia	Va = 100	-	4.57	4.7	mA
Power	Pd	Fa = 400	-	457	-	mW
Luminous		Va = 100 Fa = 400	45	55	-	cd/m ²

3-4 BACKLIGHTING - LED UNIT

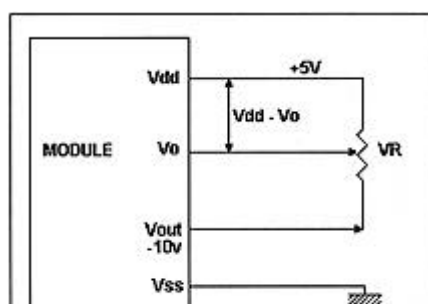
3-4-1 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Forward Current	If	Ta = 25 °C	-	308	mA
Applied Voltage	Vr	Ta = 25 °C	-	8	V
Power Dissipation	Pd	Ta = 25 °C	-	1322	mW

3-4-2 Optoelectric Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	Vf	Ta = 25 °C	3.9	4.1	4.3	V
Power	Pd		-	574	-	mW
Luminous		If = 140mA	70	-	-	cd/m ²

4. POWER SUPPLY

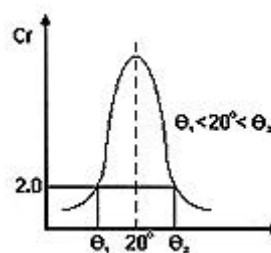
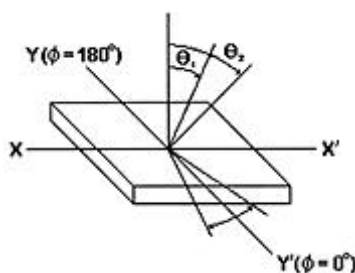




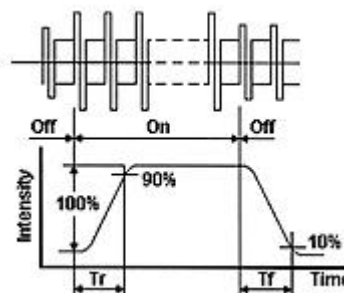
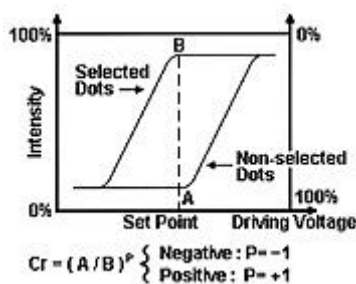
5. ELECTRO-OPTICAL CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition	Note
Viewing Angle	$\theta_2 - \theta_1$	60	-	-	deg	Cr = 2.0	1, 2
	ϕ	-90	-	-			
Contrast Ratio	Cr	-	4	-	-	$\theta = 20^\circ$ $\phi = 0^\circ$	3
Response Time (rise)	Tr	-	150	220	ms	$\theta = 20^\circ$ $\phi = 0^\circ$	4
Response Time (fall)	Tf	-	150	220	ms	$\theta = 20^\circ$ $\phi = 0^\circ$	4

Note 1: Definition of angle θ & ϕ



Note 3: Definition of contrast Cr



6. PIN ASSIGNMENT

Pin Number	Symbol	Level	Function
1	Vss	0V	Ground
2	Vdd	5V	Logic Supply Voltage
3	Vo	-	LCD Driving Voltage
4	D/I	H/L	H : Data Input L : Instruction Code
5	R/W	H/L	H: Read (Module MPU), L: Write (MPU Module)
6	E	H, HL	Chip Enable Signal

7	DB0	H/L	Data Bus Lines
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
15	CS1	H	Chip Select Signal for IC1
16	CS2	H	Chip Select Signal for IC2
17	/RES	H,HL	Reset Signal
18	Vout	-10V	Power supply for LCD driving
19	A	EL1	LED or EL connection
20	K	EL2	LED or EL connection

HG12605(continued)

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