NHD-C0216AZ-FN-GBW

COG (Chip-on-Glass) Liquid Crystal Display Module

NHD-	Newhaven Display
C0216-	COG, 2 Lines x 16 Characters
AZ-	Model
F-	Transflective
N-	No Backlight
G-	STN Positive Gray
B-	6:00 Optimal View
W-	Wide Temp
	RoHS Compliant

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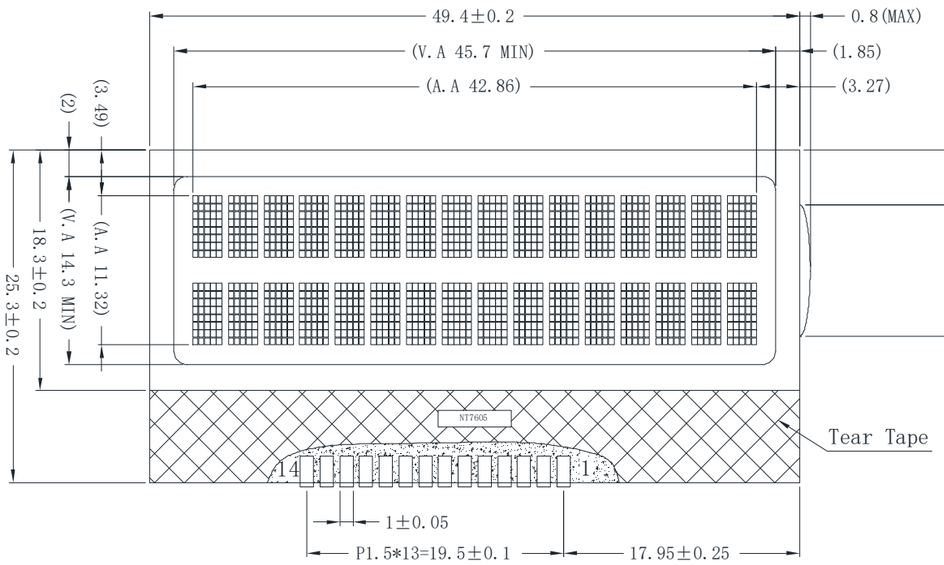
Document Revision History

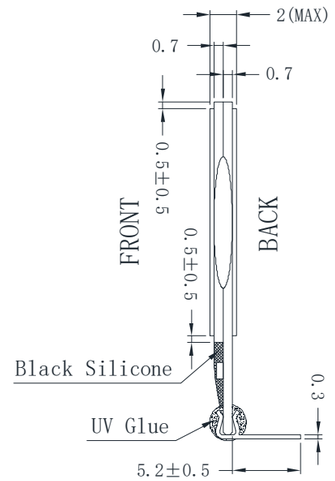
Revision	Date	Description	Changed by
0	7/20/07	Initial Release	-
1	8/1/07	Edit temp. range errors	CL
2	6/4/08	Edit incorrect pinout	CL
3	9/9/09	User guide reformat	BE
4	10/9/09	Updated Electrical Characteristics information	MC
5	10/15/09	Updated Block Diagram	MC
6	6/2/11	Timing characteristics updated	AK
7	4/14/17	Updated Mechanical Drawing	TM
8	7/5/19	Added PCB Footprint Drawing	AS
9	1/30/20	Glass Panel Updated	SB

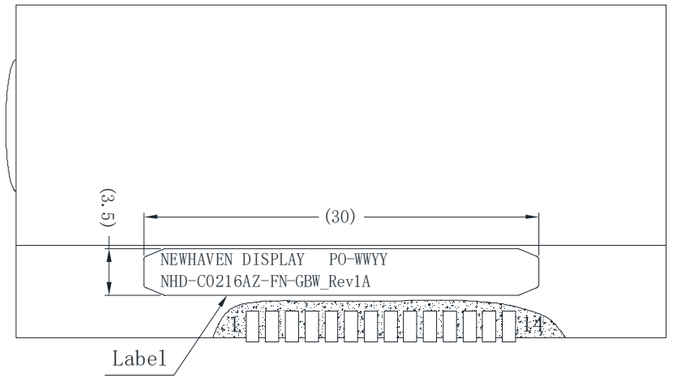
Functions and Features

- 2 lines x 16 characters
- Built-in NT7605 controller
- 5x8 dots with cursor
- +5V power supply
- 1/16 duty, 1/5 bias
- RoHS Compliant

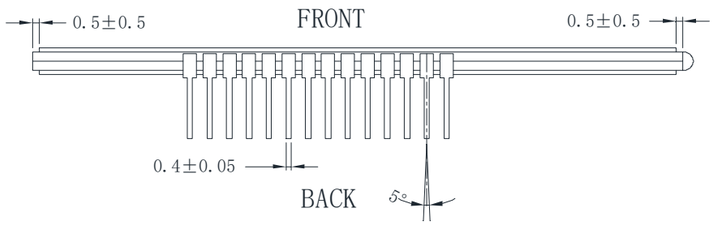
SYMBOL	REVISION	DATE

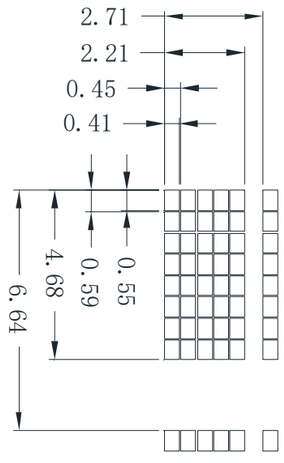






Pin assignment	
NO.	Symbol
1	VSS
2	V0
3	VDD
4	RS
5	R/W
6	E
7	D0
8	D1
9	D2
10	D3
11	D4
12	D5
13	D6
14	D7





Notes:

1. Driving:	1/16 Duty, 1/5 Bias
2. Voltage:	5.0V VDD, 4.7V VLCD
3. Display View:	STN Gray Positive / Transflective
4. Optimal View:	6:00
5. Backlight:	No Backlight
6. Driver IC:	NT7605H 4-bit / 8-bit MCU Interface

STANDARD TOLERANCE:
(UNLESS OTHERWISE SPECIFIED)
LINEAR: ±0.3mm

NEWHAVEN DISPLAY INTERNATIONAL

DRAWING/PART NUMBER: NHD-C0216AZ-FN-GBW
REVISION: 1A
SIZE: A3
SCALE: NS

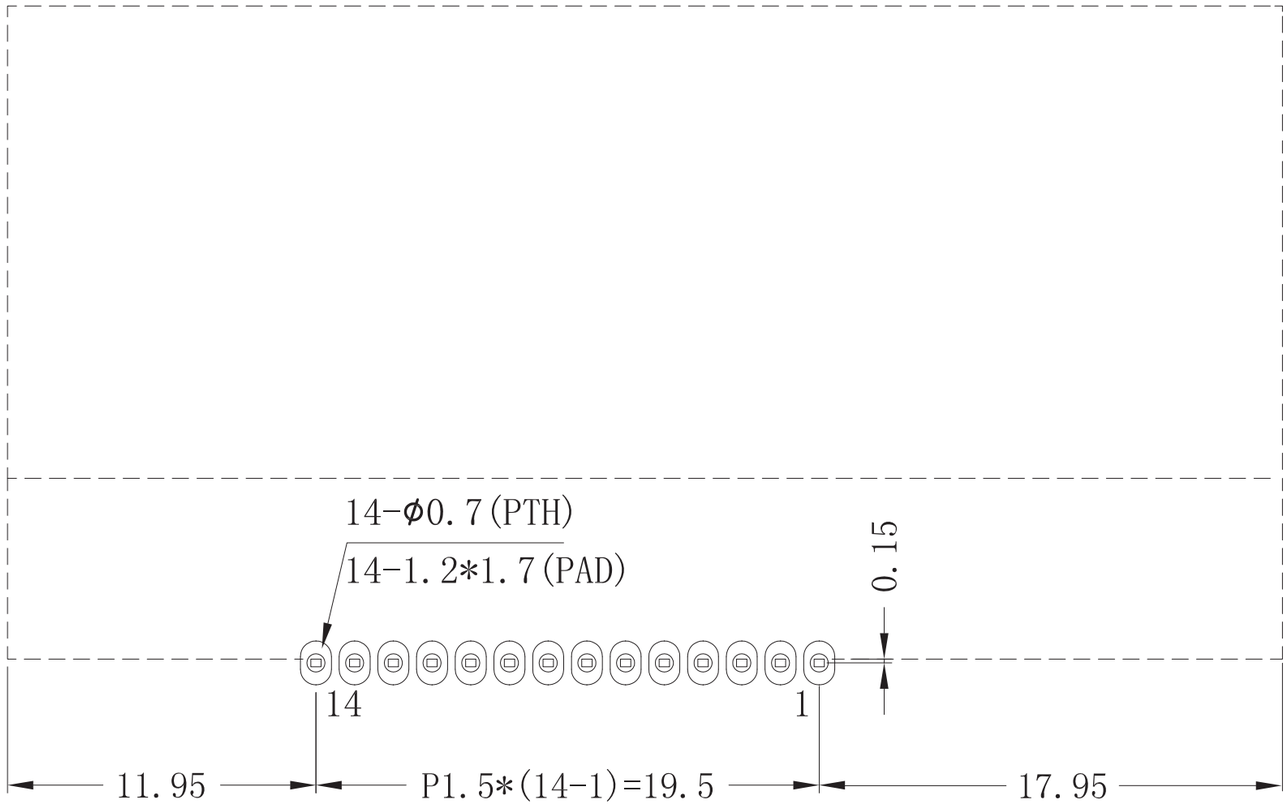
UNLESS OTHERWISE SPECIFIED:
- DIMENSIONS ARE IN MILLIMETERS
- THIRD ANGLE PROJECTION

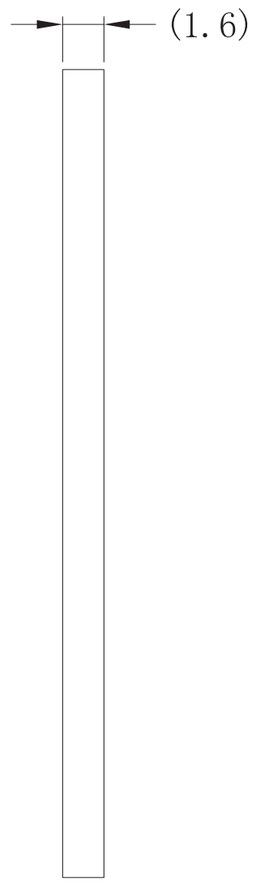
DRAWN BY: S. Baxi
APPROVED BY: S. Baxi
DRAWN DATE: 1/30/20
APPROVED DATE: 1/30/20

DO NOT SCALE DRAWING
SHEET 1 OF 1

SYMBOL	REVISION	DATE

Recommended PCB Footprint





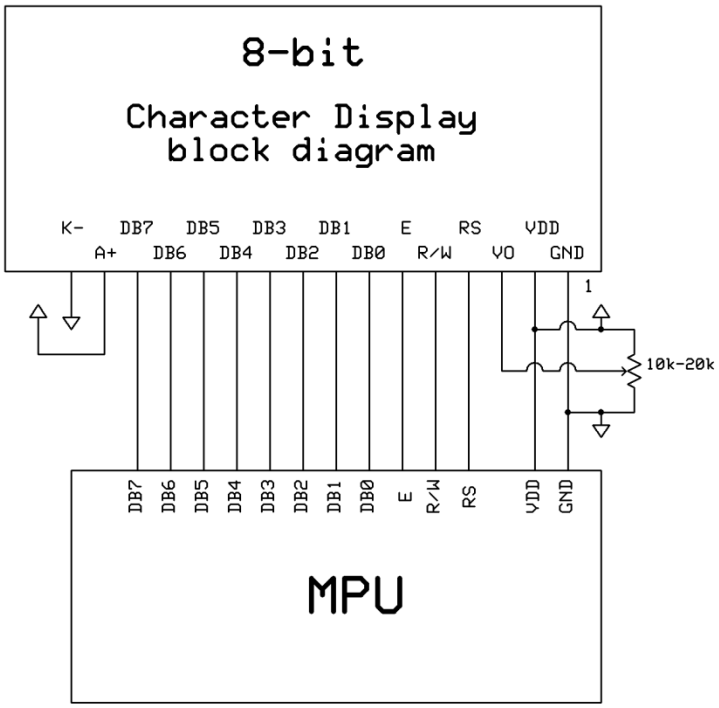
Applicable Displays:
1) NHD-C0216AZ-FN-GBW

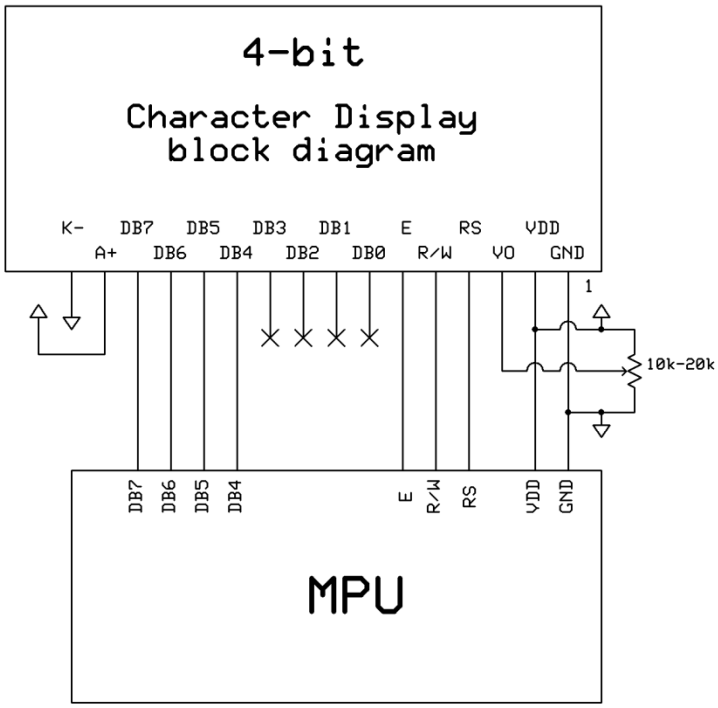
STANDARD TOLERANCE: (UNLESS OTHERWISE SPECIFIED) LINEAR: ±0.3mm	NEWHAVEN DISPLAY INTERNATIONAL		
	DRAWING/PART NUMBER: NHD-C0216AZ-FN-Footprint		REVISION: 1.0
UNLESS OTHERWISE SPECIFIED: - DIMENSIONS ARE IN MILLIMETERS - THIRD ANGLE PROJECTION	DRAWN BY: A. Shah	APPROVED BY: A. Khan	SIZE: A3
	DRAWN DATE: 7/3/19	APPROVED DATE: 7/3/19	SCALE: NS
	DO NOT SCALE DRAWING		SHEET 1 OF 1

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1	V_{SS}	Power Supply	Ground
2	V_0	Adj. Power supply	Power supply for contrast (approx. 0.3V)
3	V_{DD}	Power Supply	Supply voltage for logic (5.0V)
4	RS	MPU	Register select signal. RS=0: Command, RS=1: Data
5	R/W	MPU	Read/Write select signal, R/W=1: Read R/W=0: Write
6	E	MPU	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.

Recommended LCD connector: 1.5 mm pitch, 14 pins Soldered to PCB
Recommended Breakout Board: NHD-PCB40





Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	T_{OP}	Absolute Max	-20	-	+70	°C
Storage Temperature Range	T_{ST}	Absolute Max	-30	-	+80	°C
Supply Voltage	V_{DD}	-	4.5	5.0	5.5	V
Supply Current	I_{DD}	T_{OP} =25°C, V_{DD}=5.0V	0.6	1.83	2.8	mA
Supply for LCD (contrast)	V_{LCD}		4.4	4.7	5.0	V
"H" Level input	V_{IH}	-	0.8 * V_{DD}	-	V_{DD}	V
"L" Level input	V_{IL}	-	V_{SS}	-	0.2 * V_{DD}	V
"H" Level output	V_{OH}	-	V_{DD} – 0.8	-	V_{DD}	V
"L" Level output	V_{OL}	-	V_{SS}	-	V_{SS} + 0.4	V

Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Optimal Viewing Angles	Top	φY+	CR ≥ 2	-	35	-	º
	Bottom	φY-		-	60	-	º
	Left	θX-		-	40	-	º
	Right	θX+		-	40	-	º
Contrast Ratio		CR	-	2	4	-	-
Response Time	Rise	T_R	T_{OP} = 25°C	-	150	250	ms
	Fall	T_F		-	150	250	ms

Controller Information

Built-in NT7605 Controller.
Please download specification at http://www.newhavendisplay.com/app_notes/NT7605.pdf

DDRAM address location:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

Table of Commands

Instruction	Code										Function	Execution time (max) (fosc = 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, Restore display from shift, and load address counter with DD RAM address 00H.	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	BF	AC							Read Busy Flag (BF) and contents of Address Counter (AC).	1µs
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	

Timing Characteristics

Read Operation

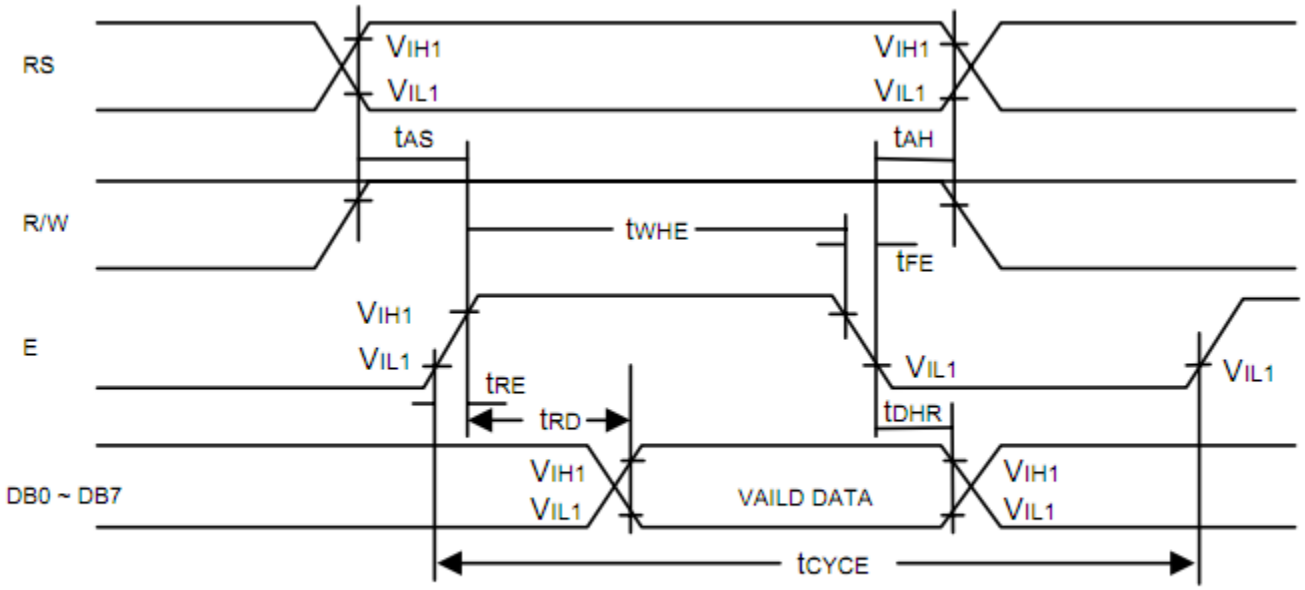


Figure 1. Bus Read Operation Sequence
(Reading out data from NT7605 to MPU)

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

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

Write Operation

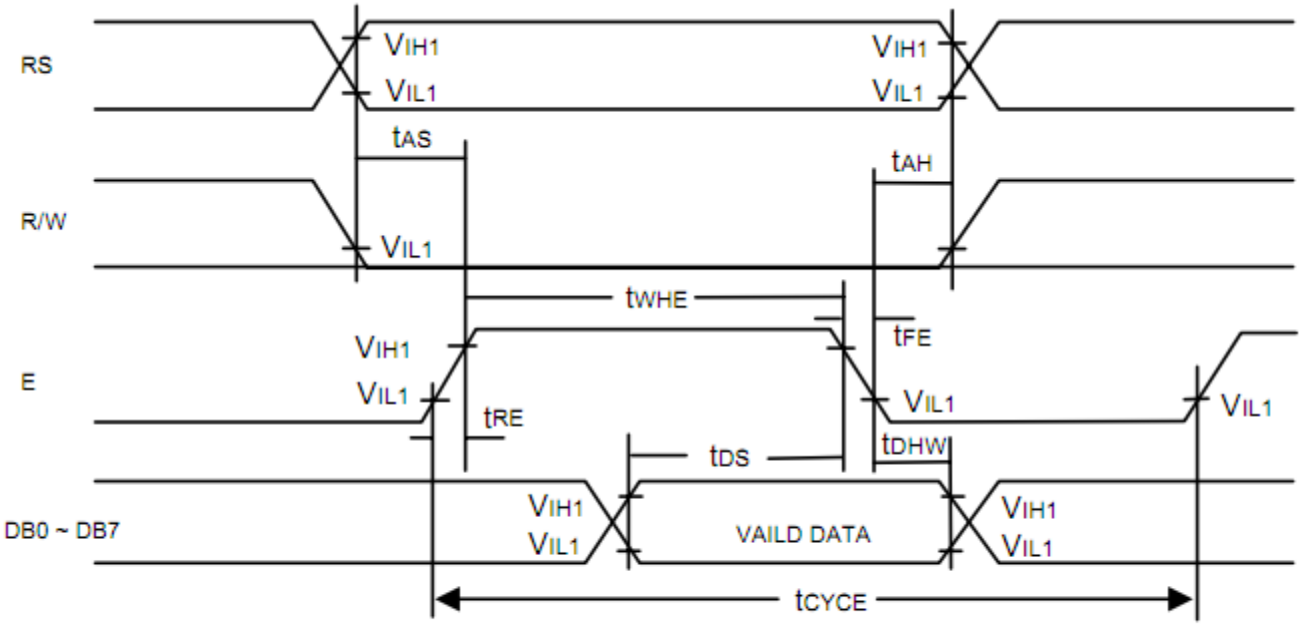


Figure 2. Bus Write Operation Sequence
(Writing data from MPU to NT7605)

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_{DHW}	Data Hold Time	10	-	-	ns	Figure 2

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

Built-in Font Table

Lower 4 Bits \ Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	@	P	`	p				ー	タ	ミ	α	p
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	ム	ä	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	メ	ß	θ
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	モ	ε	∞
xxxx0100	(5)		$	4	D	T	d	t			、	エ	ト	ヤ	μ	Ω
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	ユ	σ	ü
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ
xxxx0111	(8)		'	7	G	W	g	w			ァ	キ	ヌ	ラ	g	π
xxxx1000	(1)		(	8	H	X	h	x			ィ	ク	ネ	リ	√	x̄
xxxx1001	(2)		)	9	I	Y	i	y			ゥ	ケ	ノ	ル	⁻¹	y
xxxx1010	(3)		*	:	J	Z	j	z			ェ	コ	ハ	レ	j	千
xxxx1011	(4)		+	;	K	[	k	{			ォ	サ	ヒ	ロ	ˣ	万
xxxx1100	(5)		,	<	L	¥	l	|			ャ	シ	フ	ワ	¢	円
xxxx1101	(6)		−	=	M	]	m	}			ュ	ス	ヘ	ン	£	÷
xxxx1110	(7)		.	>	N	^	n	→			ョ	セ	ホ	゛	ñ	
xxxx1111	(8)		/	?	O	_	o	←			ッ	ソ	マ	°	ö	■

Example Initialization Program

```
'INIT-------------------------------------------------------------------------
A = &H30
Call Writecom                                                          'wake up
Waitms 100
Call Writecom                                                          'wake up
Waitms 10
Call Writecom                                                          'wake up
Waitms 10
A = &H38
'function set
Call Writecom
A = &H10
'shift display=no
Call Writecom
A = &H0C
'display on
Call Writecom
A = &H06
'entry mode set
Call Writecom
'-----------------------------------------------------------------------------
Sub Writecom
P1 = A
Reset P3.0
'instruction
Reset P3.7
'RW
Waitms 1
Set P3.4
'E
Waitms 1
Reset P3.4                                                               'E
End Sub
'-----------------------------------------------------------------------------
Sub Writedata
P1 = A
Set P3.0
'data
Reset P3.7
'RW
Waitms 1
Set P3.4
'E
Waitms 1
Reset P3.4                                                               'E
End Sub
'-----------------------------------------------------------------------------
```

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C, 96 Hrs.	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C, 96 Hrs.	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C, 96 Hrs.	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C, 96 Hrs.	1,2
High Temperature / Humidity Operation	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+50°C, 90% RH, 96 Hrs.	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	0°C, 30min -> 25°C, 5min -> 50°C, 30min = 1 cycle For 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz, 1.5mm amplitude. 60 sec in each of 3 directions X, Y, Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge. (5 Times)	Air: ±8KV / C: 150pF Contact: ±4KV / R: 330Ω	

Note 1: No condensation to be observed.
Note 2: Conducted after 4 hours of storage at 25°C, 0%RH.
Note 3: Test performed on product itself, not inside a container.

Precautions for using LCDs/LCMs

See Precautions at www.newhavendisplay.com/specs/precautions.pdf

Warranty Information and Terms & Conditions

http://www.newhavendisplay.com/index.php?main_page=terms

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