

NHD-320240WG-ATMI-VZ#

Graphic Liquid Crystal Display Module

NHD-	Newhaven Display
320240-	320 x 240 pixels
WG-	Display Type: Graphic
A-	Model
T-	White LED Backlight
M-	STN- negative Blue
I-	Transmissive, 6:00 view, Wide Temperature (-20°C ~+70°C)
VZ#-	Built-in Negative Voltage
	RoHS Compliant

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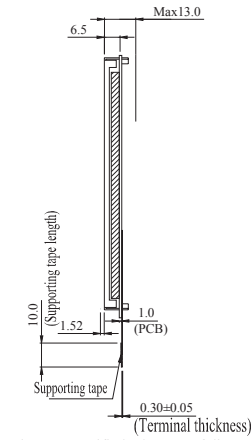
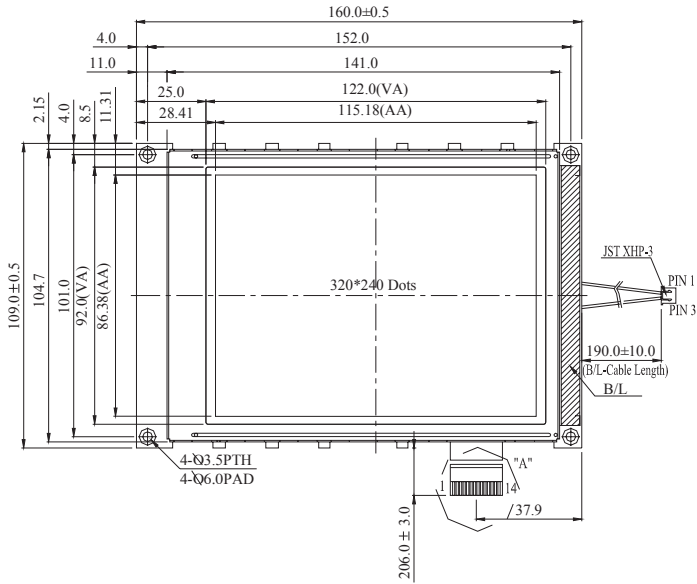
Document Revision History

Revision	Date	Description	Changed by
0	6/7/2007	Initial Release	-
1	4/7/2010	User guide reformat	MC
2	3/11/2011	Driver link updated	AK
3	4/12/2011	Pin description updated	AK

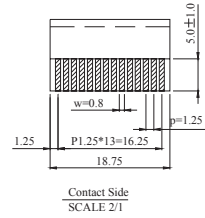
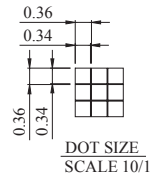
Functions and Features

- 320 x 240 pixels
- Built-in Negative Voltage
- No Controller
- NT7086 Driver
- +5.0V power supply
- RoHS Compliant

Mechanical Drawing

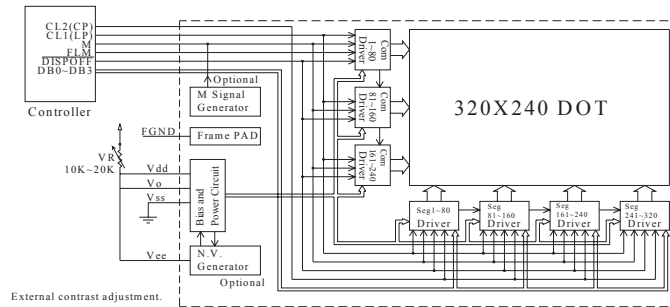
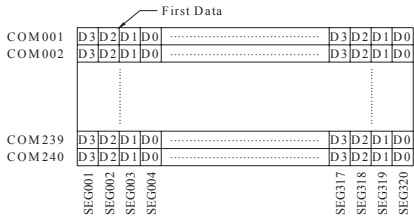


The non-specified tolerance of dimension is ±0.3 mm .



The stiffen tape of the FFC cable is in the same direction as LCD panel side and its contact side as PCB component's side

PIN NO.	SYMBOL
1	DB0
2	DB1
3	DB2
4	DB3
5	DISPOFF
6	FLM
7	M
8	LP
9	CP
10	Vdd
11	Vss
12	Vee
13	Vo
14	FGND



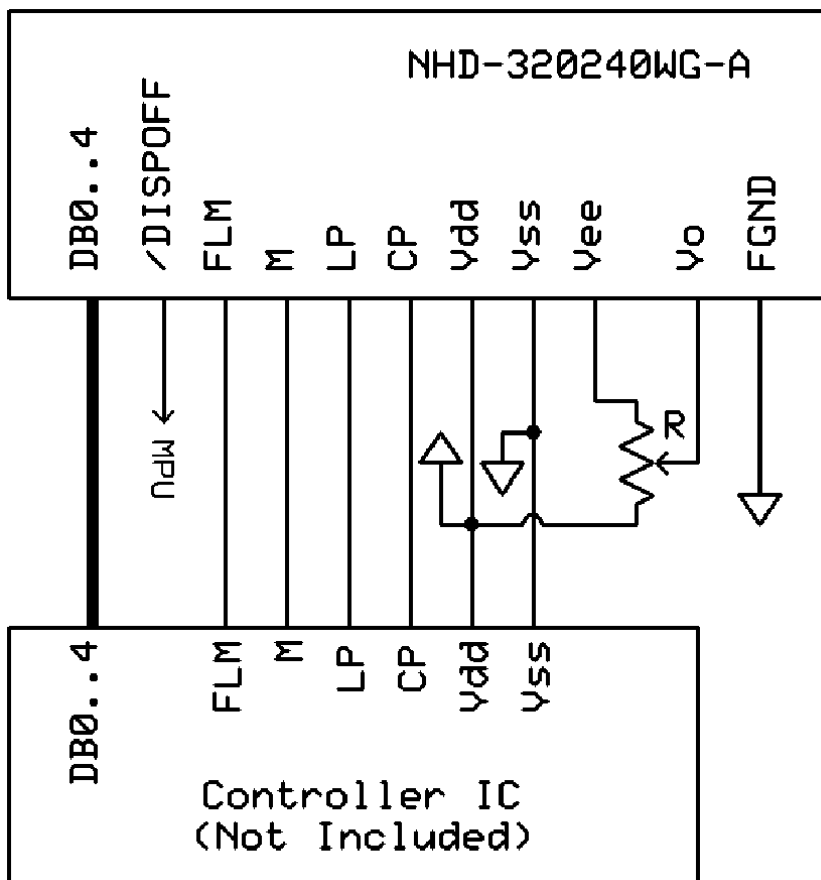
Newhaven Display
NHD-320240WG-ATMI-VZ#

Pin Description and Wiring Diagram

Pin No.	Symbol	External Connection	Function Description
1-4	DB0-DB3	MPU	Signal data bus
5	DISP OFF	MPU	Display On/Off
6	FLM	MPU	Scan Start-up signal
7	M	-	No Connect
8	LP	MPU	Data latch pulse
9	CP	MPU	Data shift pulse
10	VDD	Power Supply	Power supply for logic (+5.0V)
11	VSS	Power Supply	Ground
12	VEE	Power Supply	Negative voltage output (-25V)
13	VO	Adj. Power Supply	Power supply for contrast (approx. -19.0V)
14	FGND	-	No Connect

Recommended LCD connector: 1.25mm pitch, 14-pos FFC connector **Mates with:** Molex p/n 0039532144

Backlight connector: JST p/n: XHP-3 **Mates with:** JST p/n: B 3B-XH-A



Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-20	-	+70	°C
Storage Temperature Range	Tst	Absolute Max	-30	-	+80	°C
Supply Voltage	VDD		2.7	5.0	5.5	V
Supply Current	IDD	Ta=25°C, VDD=5.0V	70.0	75.0	80.0	mA
Supply for LCD (contrast)	VDD-V0	Ta=25°C	22.1	24.0	26.2	V
"H" Level input	VIH		0.8VDD	-	VDD	V
"L" Level input	VIL	-	-0.3	-	0.2VDD	V
"H" Level output	VOH	-	VDD-0.4	-	VDD	V
"L" Level output	VOL	-	-	-	0.4	V
Backlight Supply Voltage	VLED		3.4	3.5	3.6	V
Backlight Supply Current	ILED	VLED=3.5V	115.2	128	200	mA
Backlight Lifetime		ILED=128mA	-	50,000	-	Hrs

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	AV	Cr ≥ 2	-20	-	40	°
Viewing Angle - Horizontal	AH	Cr ≥ 2	-30	-	30	°
Contrast Ratio	Cr		-	3	-	-
Response Time (rise)	Tr	-	-	200	300	ms
Response Time (fall)	Tf	-	-	150	200	ms

Driver Information

Built-in NT7086. Download specification at http://www.newhavendisplay.com/app_notes/NT7086.pdf

Electrical Characteristics

DC CHARACTERISTICS

(1) Segment Driver Application

($V_{SS} = 0V$, $T_a = -30 \sim +85^\circ C$)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Operating Voltage 1	V_{DD}	-	2.7	-	5.5	V	
	V_{LCD}	$V_{IN} = V_{DD} - V_{EE}$	6	-	28		
Input voltage (1)	V_{IH}	-	$0.8V_{DD}$	-	V_{DD}	V	
	V_{IL}	-	0	-	$0.2V_{DD}$		
Input voltage (2)	V_{OH}	$I_{CH} = -0.4mA$	$V_{DD} - 0.4$	-	-	V	
	V_{OL}	$I_{OH} = -0.4mA$	-	-	0.4		
Input leakage current 1 (1)	I_{IL1}	$V_{IN} = V_{DD}$ to V_{SS}	-10	-	10	μA	
Input leakage current 2 (3)	I_{IL2}	$V_{IN} = V_{DD}$ to V_{EE}	-25	-	25		
On resistance(4)	R_{ON}	$I_{ON} = 100 \mu A$	-	2	4	$k\Omega$	
Supply current(5)	I_{STBY}	$f_{CL1} = 32kHz$, $M = V_{SS}$	V_{SS} PIN	-	-	100	μA
	I_{DD}	$f_{CL1} = 32kHz$, $F_M = 80Hz$	$V_{DD} = 5V$	-	-	5	mA
			$V_{DD} = 3V$	-	-	2	
I_{EE}		$V_{DD} = 5V$	-	-	500	μA	

NOTES:

1. Applied to CL1, CL2, ELB, ERB, D1_SID - D4_DR, SHL, DISPOFFB, M, CS, AMS pin

2. ELB, ERB pin

3. V0, V12, V43, V5 pin

4. $V_{LCD} = V_{DD} - V_{EE}$, $V0 = V_{DD} = 5V$, $V5 = V_{EE} = -23V$

$V12 = V_{DD} - 2/n(V_{LCD})$, $V43 = V_{EE} + 2/n(V_{LCD})$, $n = 17$ (1/256 duty, 1/17 bias)

5. $V0 = V_{DD}$, $V12 = 1.71V$ ($V_{DD} = 5V$) or $-0.06V$ ($V_{DD} = 3V$),

$V43 = -19.71V$ ($V_{DD} = 5V$) or $-19.94V$ ($V_{DD} = 3V$), $V5 = V_{EE} = -23V$, no-load condition (1/256 duty, 1/17 bias)

4-bit parallel interface mode

I_{STBY} : $V_{DD} = 5V$, $f_{CL2} = 5.12MHz$, $SHL = V_{SS}$, $DISPOFFB = V_{DD}$, $M = V_{SS}$, display data pattern = 0000

I_{DD} : $V_{DD} = 3V$, $f_{CL2} = 4MHz$, display data pattern = 0101

$V_{DD} = 5V$, $f_{CL2} = 5.12MHz$, display data pattern = 0101

I_{EE} : $V_{DD} = 5V$, $f_{CL2} = 5.12MHz$, display data pattern = 0101, V_{EE} pin

DC CHARACTERISTICS (CONTINUED)

(2) Common Driver Application

($V_{SS} = 0V$, $T_a = -30 \sim +85^\circ C$)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Operating Voltage 1	V_{DD}	-	2.7	-	5.5	V	
	V_{LCD}	$V_{IN} = V_{DD} - V_{EE}$	6	-	28		
Input voltage (1)	V_{IH}	-	$0.8V_{DD}$	-	V_{DD}	V	
	V_{IL}	-	0	-	$0.2V_{DD}$		
Input voltage (3)	V_{OH}	$I_{CH} = -0.4mA$	$V_{DD} - 0.4$	-	-	V	
	V_{OL}	$I_{OH} = -0.4mA$	-	-	0.4		
Input leakage current 1 (1)	I_{IL1}	$V_{IN} = V_{DD}$ to V_{SS}	-10	-	10	μA	
Input leakage current 2 (2)	I_{IL2}	$V_{IN} = 0V$, $V_{DD} = 5V$ (Pull up)	-50	-125	-250		
Input leakage current 3 (4)	I_{IL3}	$V_{IN} = V_{DD}$ to V_{EE}	-25	-	25		
On resistance(5)	R_{ON}	$I_{ON} = 100 \mu A$	-	2	4	$k\Omega$	
Supply current(6)	I_{STBY}	$f_{CL1} = 32kHz$, $M = V_{SS}$	V_{SS} PIN	-	-	100	μA
	I_{DD}	$f_{CL1} = 32kHz$, $F_M = 80Hz$	$V_{DD} = 5V$	-	-	200	
			$V_{DD} = 3V$	-	-	120	
	I_{EE}		$V_{DD} = 5V$	-	-	150	

NOTES:

- Applied to CL1, D2_DL (SHL = LOW), D4_DR (SHL = HIGH), SHL, DISPOFFB, M, CS, AMS pin
- Pull-up input pins : CL2, D1_SID, D3_DM (AMS = HIGH), ELB (SHL = LOW), ERB (SHL = HIGH)
- D2_DL (SHL = HIGH), D4_DR (SHL = LOW) pin
- V0, V12, V43, V5 pin
- $V_{LCD} = V_{DD} - V_{EE}$, $V0 = V_{DD} = 5V$, $V5 = V_{EE} = -23V$
 $V12 = V_{DD} - 1/n(V_{LCD})$, $V43 = V_{EE} + 1/n(V_{LCD})$, $n = 17$ (1/256 duty, 1/17 bias)
- $V0 = V_{DD}$, $V12 = 3.35V$ ($V_{DD} = 5V$) or $1.47V$ ($V_{DD} = 3V$),
 $V43 = -21.35V$ ($V_{DD} = 5V$) or $-21.47V$ ($V_{DD} = 3V$), $V5 = V_{EE} = -23V$, no-load condition (1/256 duty, 1/17 bias)
 single-type mode operation : AMS = V_{SS} , SHL = V_{SS} , DISPOFFB = V_{DD}
 $D1_SID = D3_DM = V_{DD}$, $D4_DR = OPEN$, ELB = ERB = OPEN,
 I_{STBY} : $V_{DD} = 5V$, $M = V_{SS}$, $D2_DL = V_{SS}$
 I_{DD} : $f_M = 80Hz$, $D2_DL = V_{DD}$
 $V_{DD} = 3V$, display data pattern = 10000000..., 01000000..., 00100000..., 00010000..., ..
 $V_{DD} = 5V$, display data pattern = 10000000..., 01000000..., 00100000..., 00010000..., ..
 I_{EE} : $f_M = 80Hz$, $D2_DL = V_{DD}$
 $V_{DD} = 5V$, current through V_{EE} Pin, display data pattern = 10000000..., 01000000..., 00100000..., 00010000...

Timing Characteristics

AC CHARACTERISTICS

(1) Segment Driver Application

(V_{SS} = 0V, T_a = - 30 ~ +85°C)

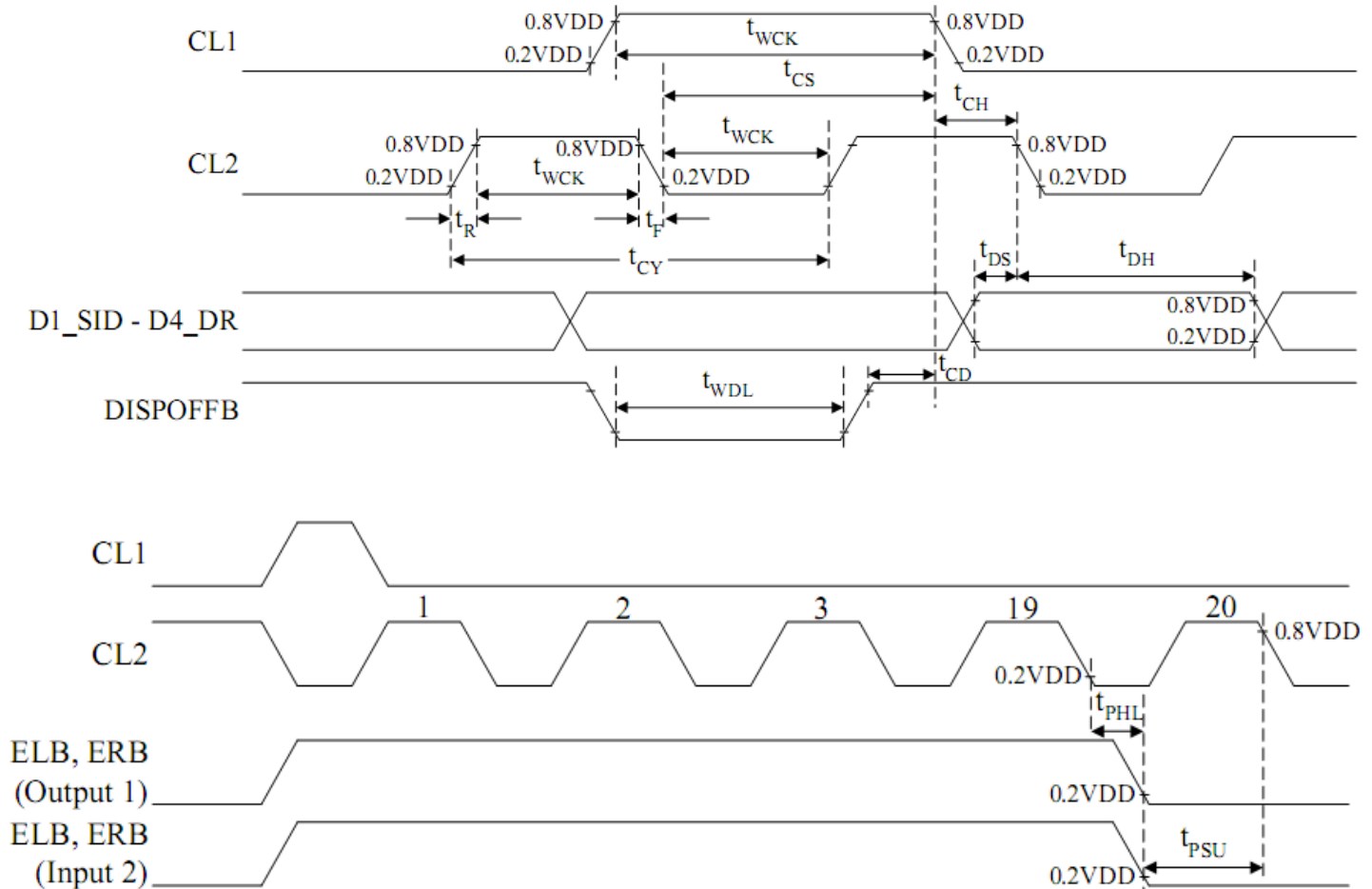
Characteristic	Symbol	Test condition	(1) VDD=5V±10%			(2) VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t _{CY}	Duty=50%	125	-	-	250	-	-	ns
Clock pulse width	t _{WCK}	-	45	-	-	95	-	-	
Clock rise/ fall time	t _R / t _F	-	-	-	-	-	-	30	
Data set-up time	t _{DS}	-	30	-	-	65	-	-	
Data hold time	t _{DH}	-	30	-	-	65	-	-	
Clock set-up time	t _{CS}	-	80	-	-	120	-	-	
Clock hold time	t _{CH}	-	80	-	-	120	-	-	
Propagation delay time	t _{PHL}	ELB output	-	-	60	-	-	125	
		ERB output	-	-	60	-	-	125	
ELB,ERB set-up time	t _{PSU}	ELB input	30	-	-	65	-	-	
		ERB input	30	-	-	65	-	-	
DISPOFFB low pulse width	t _{WDL}	-	1.2	-	-	1.2	-	-	μs
DISPOFFB clear time	t _{CD}	-	100	-	-	100	-	-	ns
M – OUT propagation delay time	t _{PD1}	C _L =15pF	-	-	1.0	-	-	1.2	μs
CL1 – OUT propagation delay time	t _{PD2}		-	-	1.0	-	-	1.2	
DISPOFFB – OUT propagation delay time	t _{PD3}		-	-	1.0	-	-	-	

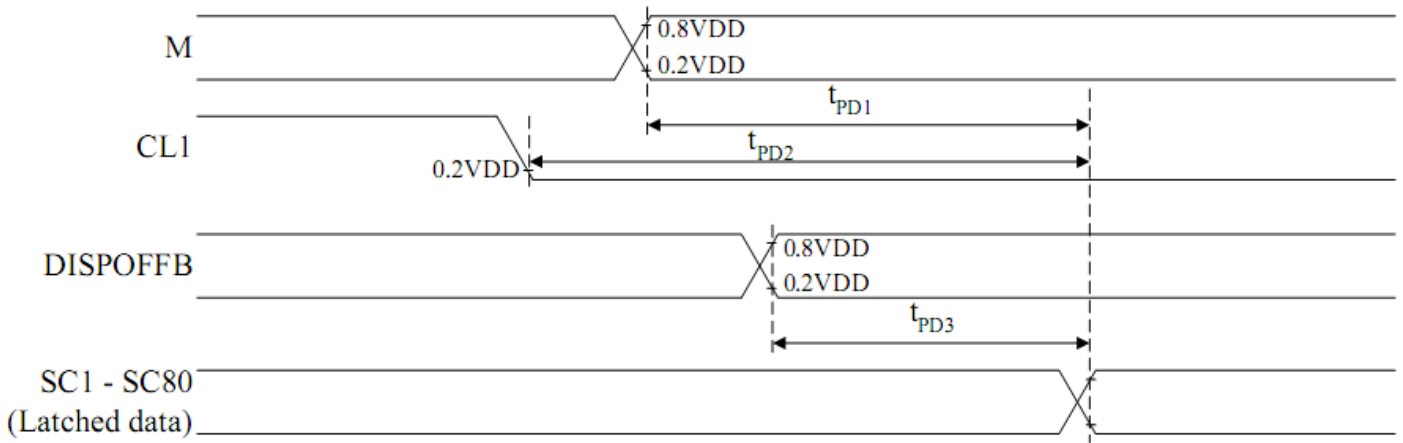
(2) Common Driver Application

($V_{SS} = 0V$, $T_a = -30 \sim +85^\circ C$)

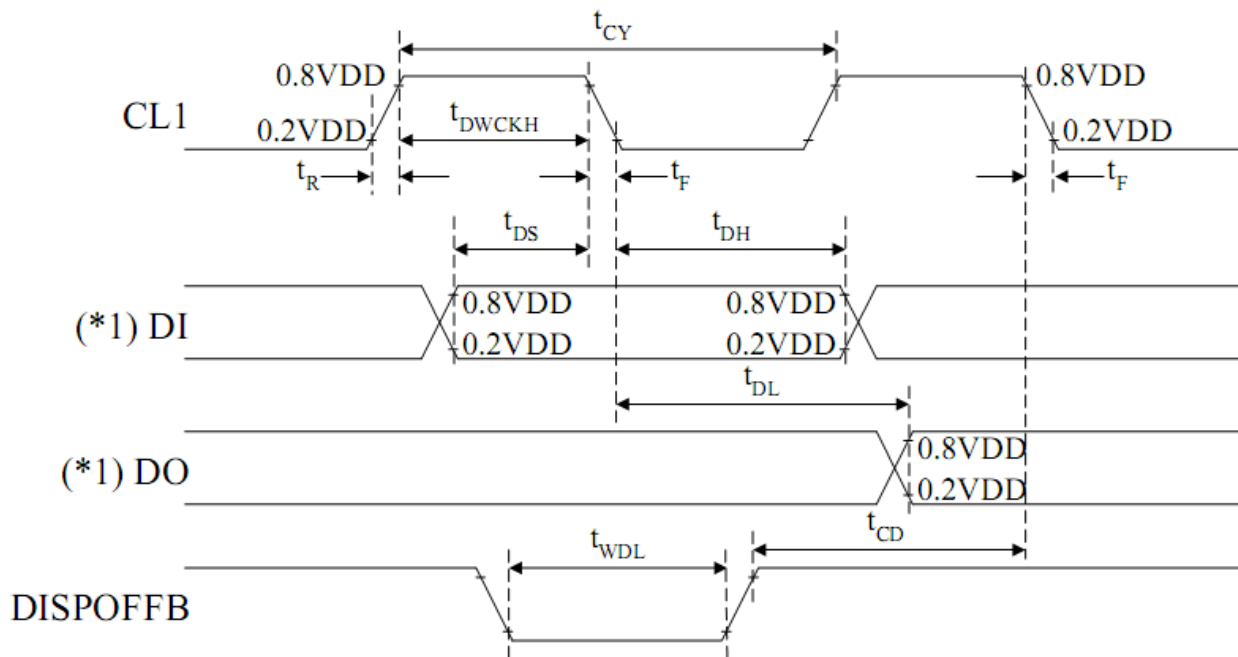
Characteristic	Symbol	Test condition	(1) $V_{DD}=5V \pm 10\%$			(2) $V_{DD}=3V \pm 10\%$			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t_{CY}	Duty=50%	250	-	-	500	-	-	ns
Clock pulse width	t_{WCK}	-	45	-	-	95	-	-	
Clock rise/ fall time	t_R / t_F	-	-	-	50	-	-	50	
Data set-up time	t_{DS}	-	30	-	-	65	-	-	
Data hold time	T_{DH}	-	30	-	-	65	-	-	
DISPOFFB low pulse width	t_{WDL}	-	1.2	-	-	1.2	-	-	μs
DISPOFFB clear time	t_{CD}	-	100	-	-	100	-	-	ns
Output delay time	t_{DL}	$C_L=15pF$	-	-	200	-	-	250	μs
M – OUT propagation delay time	t_{PD1}		-	-	1.0	-	-	1.2	
CL1 – OUT propagation delay time	t_{PD2}		-	-	1.0	-	-	1.2	
DISPOFFB – OUT propagation delay time	t_{PD3}		-	-	1.0	-	-	1.2	

(3) Segment Driver Application Timing





(4) Common Driver Application Timing



(*1) When in single-type interface mode

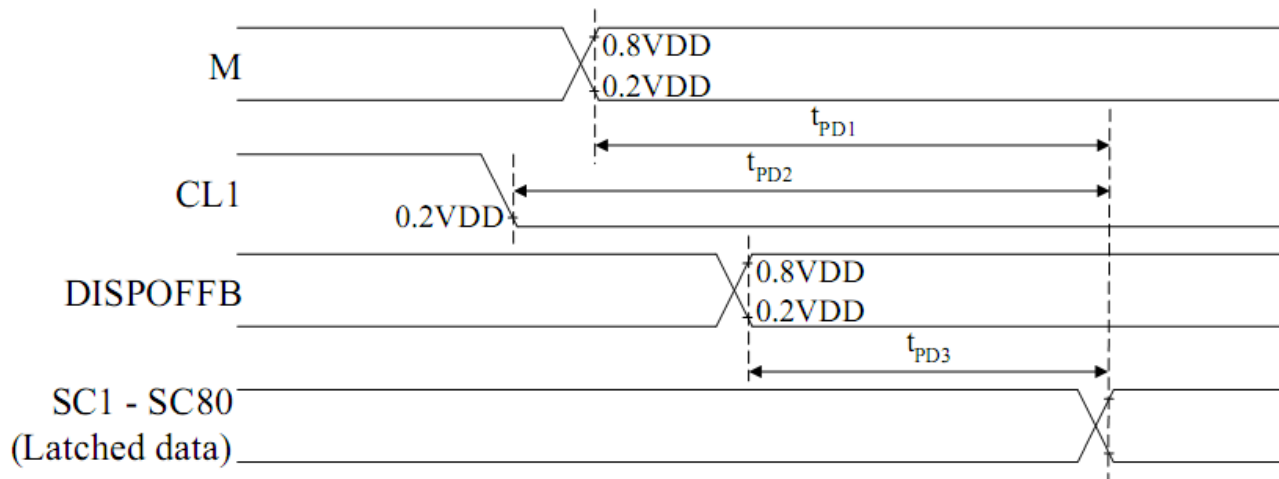
DI=>DDL(SHL=L), D4_DR(SHL=H)

DO=>D4_DR(SHL=L), D2_DL(SHL=H)

When in dual-type interface mode

DI=>D2_DL and D3_DM(SHL=L), D4_DR and D3_DM(SHL=H)

DO=>D4_DR(SHL=L), D2_DL(SHL=H)



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 , 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 200hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 200hrs	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.	+60°C , 90% RH , 96hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-20°C,30min -> 25°C,5min -> 70°C,30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

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