

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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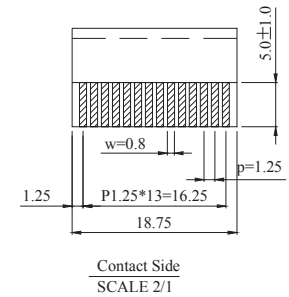
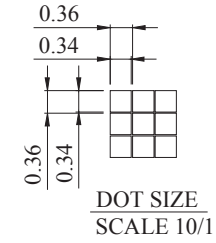
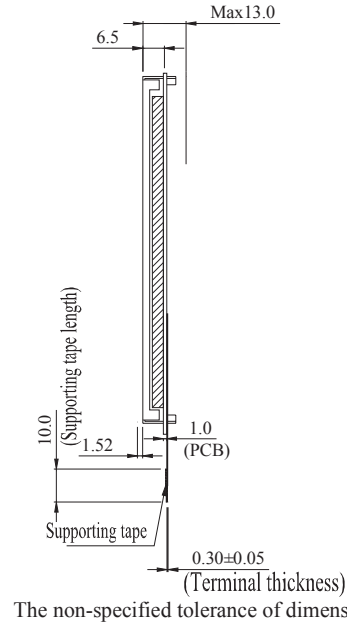
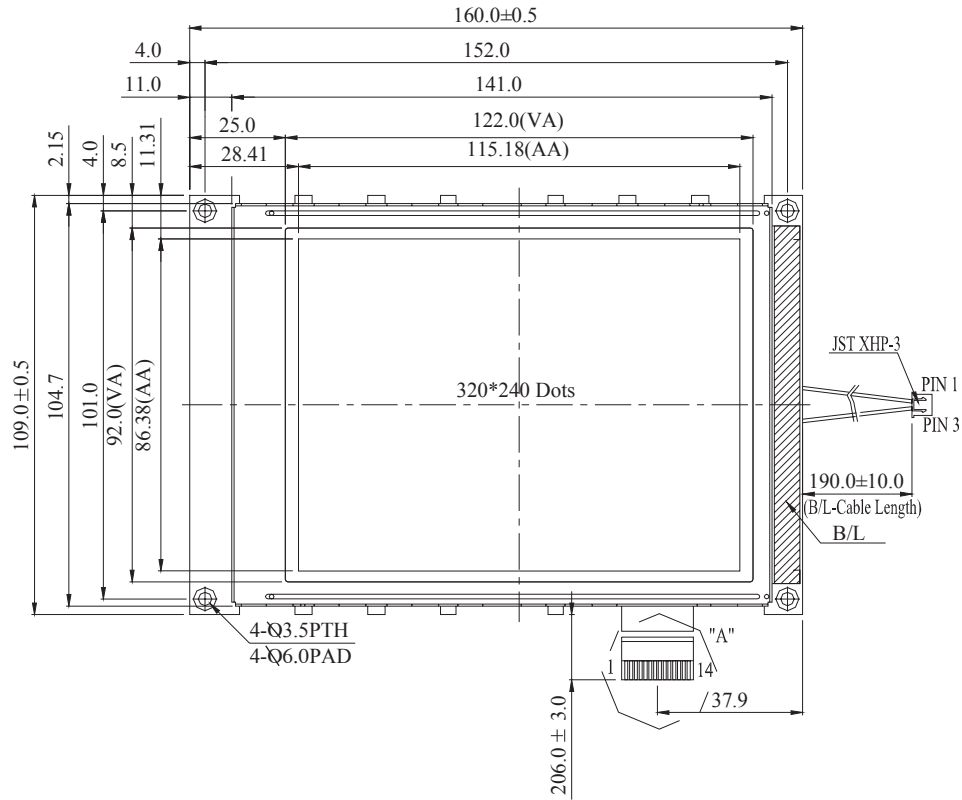
Document Revision History

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

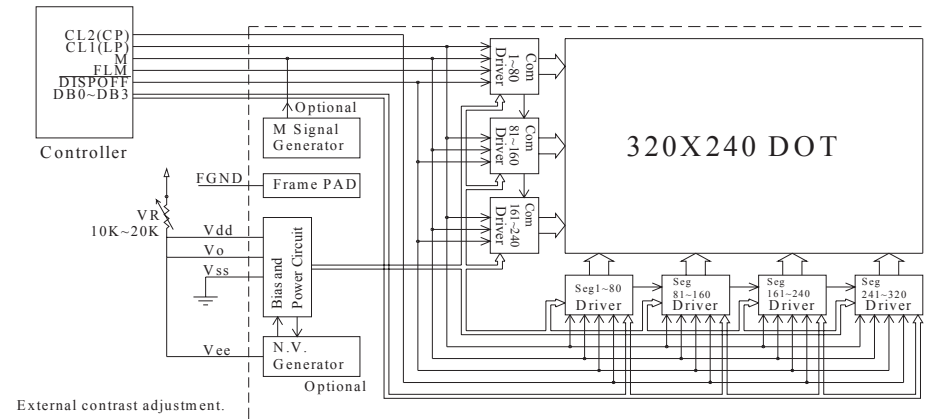
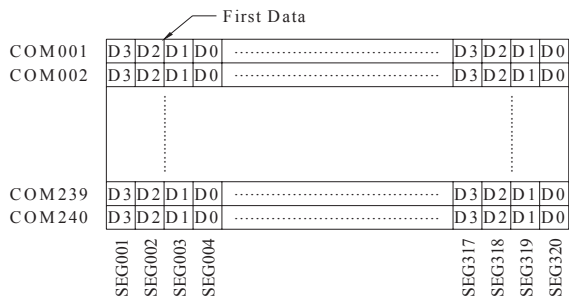
- 320 x 240 pixels
- Built-in Negative Voltage
- No Controller
- NT7086 Driver
- +5.0V power supply
- RoHS Compliant

Mechanical Drawing



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

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



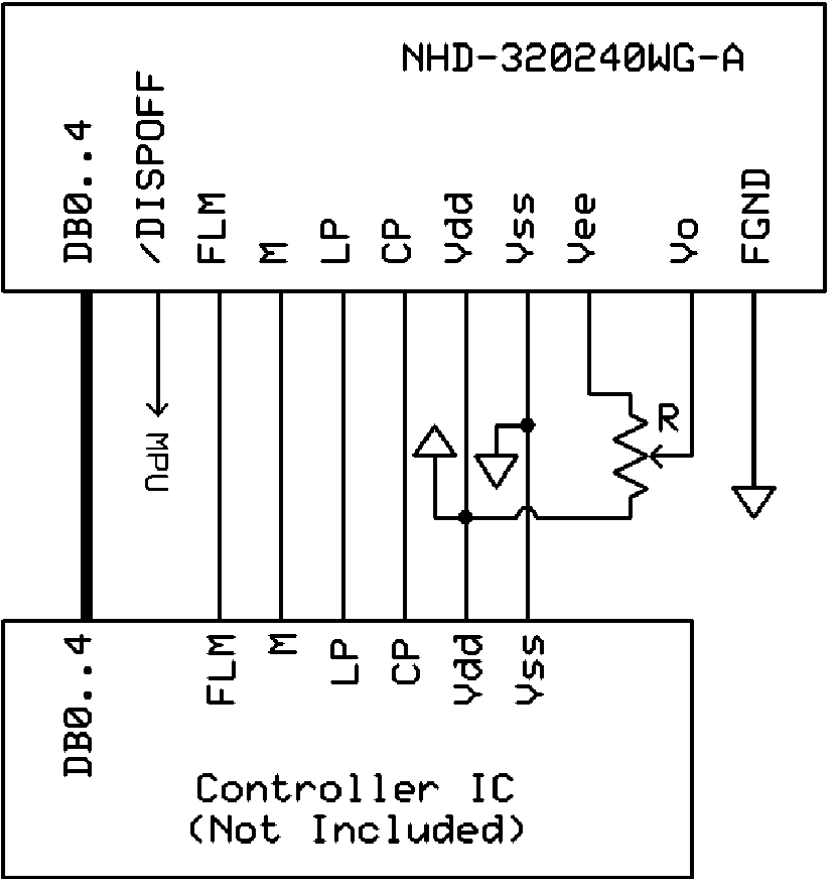
Newhaven Display

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 _{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	μ A
Input leakage current 2 (3)	I _{IL2}	V _{IN} =V _{DD} to V _{EE}		-25	-	25	
On resistance(4)	R _{ON}	I _{ON} =100 μ A		-	2	4	k Ω
Supply current(5)	I _{STBY}	f _{CL1} =32kHz, M=VSS	V _{SS} PIN	-	-	100	μ A
	I _{DD}	f _{CL1} =32kHz F _M =80HZ	V _{DD} =5V	-	-	5	mA
			V _{DD} =3V	-	-	2	
	I _{EE}		V _{DD} =5V	-	-	500	μ A

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 _{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 μA	-	2	4	kΩ	
Supply current(6)	I _{STBY}	f _{CL1} =32kHz, M=VSS	V _{SS} PIN	-	-	100	μA
	I _{DD}	f _{CL1} =32kHz F _M =80HZ	V _{DD} =5V	-	-	200	
			V _{DD} =3V	-	-	120	
			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, Ta = - 30 ~ +85°C)

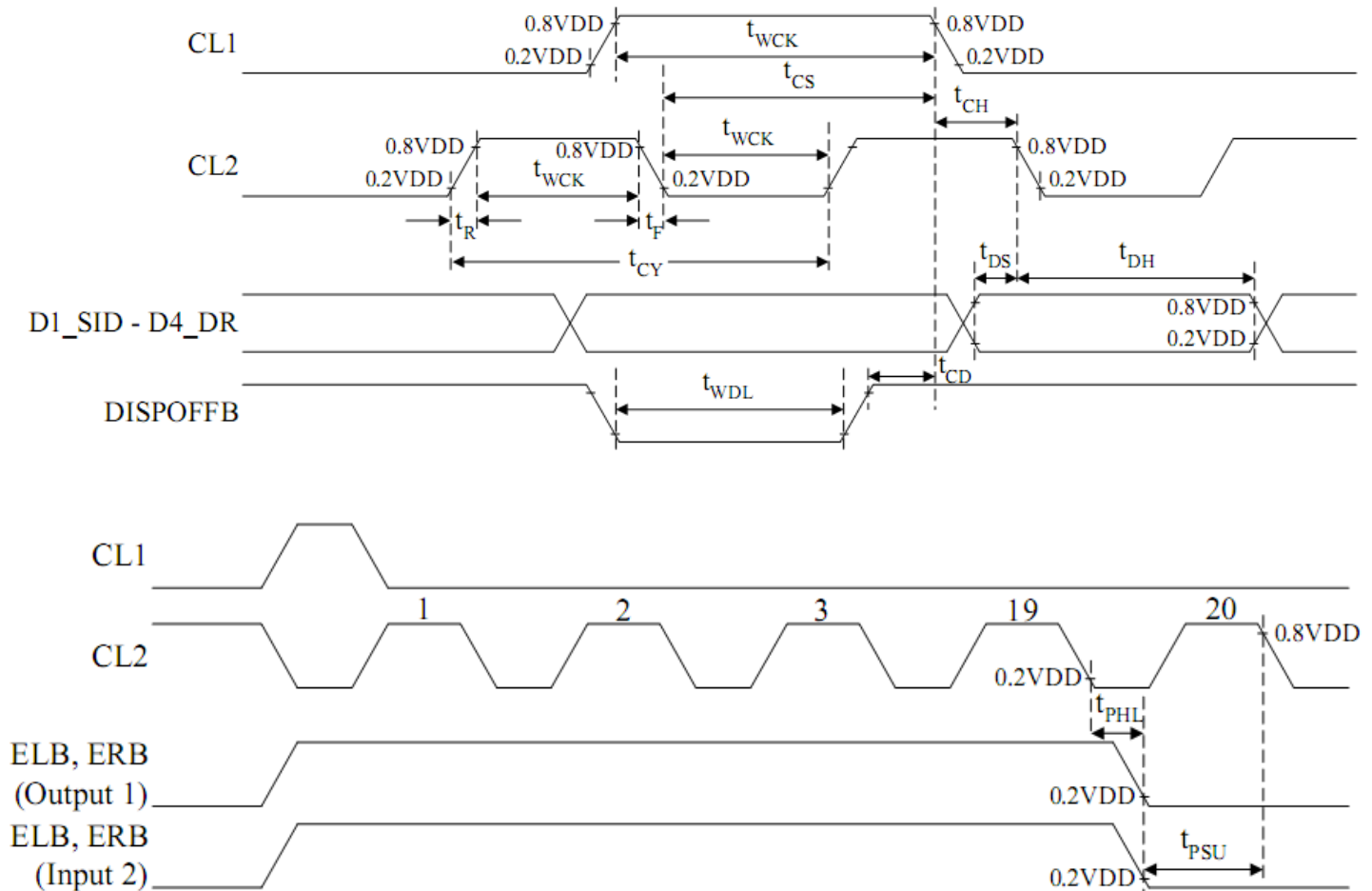
Characteristic	Symbol	Test condition	(1) VDD=5V±10%			(2) VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t _{CY}	Duty=50%	125	-	-	250	-	-	ns
Clock pulse width	t _{WCK}	-	45	-	-	95	-	-	
Clock rise/ fall time	t _R / t _F	-	-	-	-	-	-	30	
Data set-up time	t _{DS}	-	30	-	-	65	-	-	
Data 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	ns
		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	-	-	-	

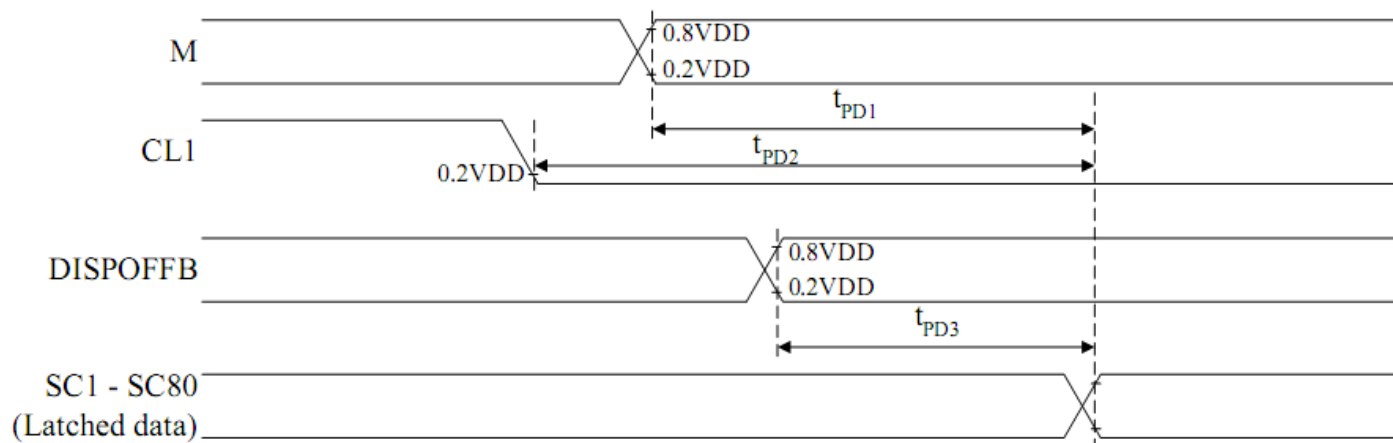
(2) Common Driver Application

(V_{SS} = 0V, Ta = - 30 ~ +85°C)

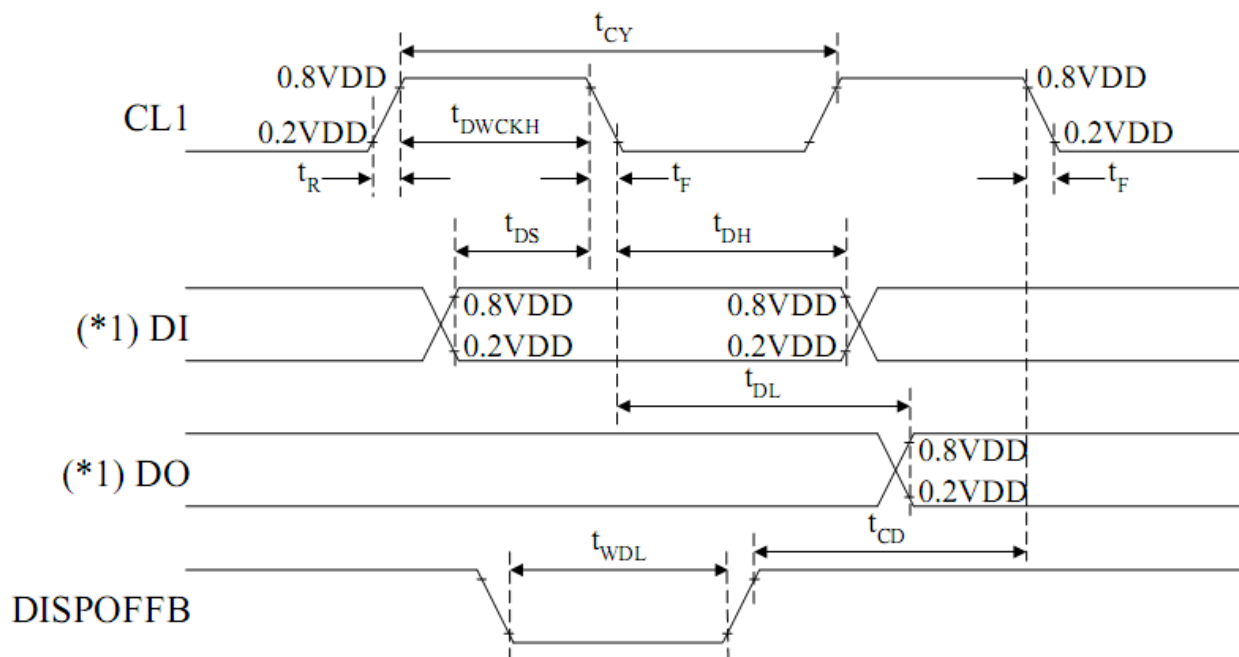
Characteristic	Symbol	Test condition	(1) VDD=5V±10%			(2) VDD=3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t _{CY}	Duty=50%	250	-	-	500	-	-	ns
Clock pulse width	t _{WCK}	-	45	-	-	95	-	-	
Clock rise/ fall time	t _R / t _F	-	-	-	50	-	-	50	
Data set-up time	t _{DS}	-	30	-	-	65	-	-	
Data 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	
M – OUT propagation delay time	t _{PD1}		-	-	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	-	-	1.2	

(3) Segment Driver Application Timing





(4) Common Driver Application Timing



(*1) When in single-type interface mode

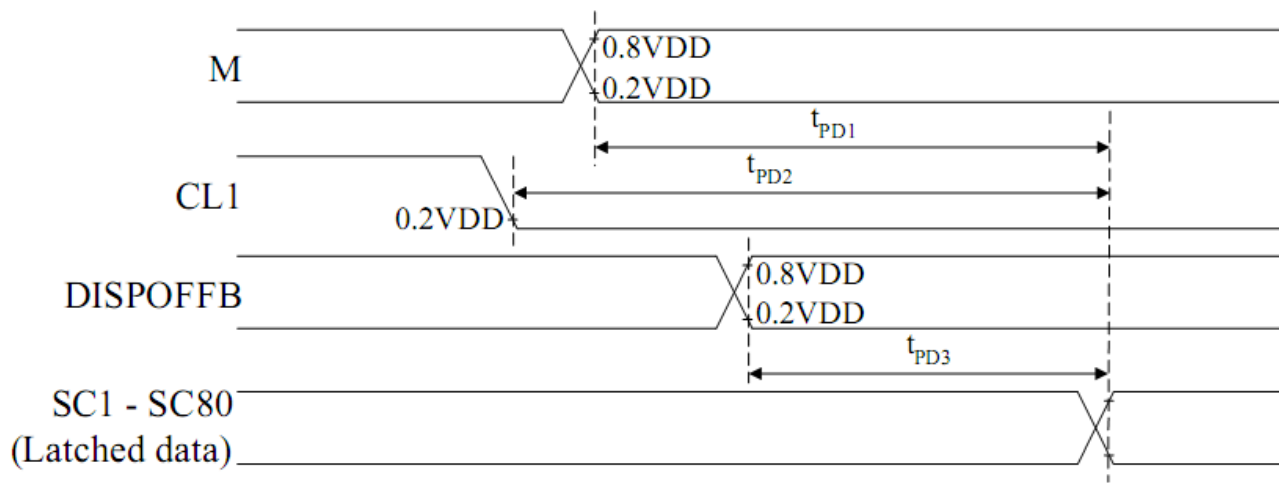
DI=>DDL(SHL=L), D4_DR(SHL=H)

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