NHD-2.4-240320SF-CTXI#-T

TFT (Thin-Film Transistor) Liquid Crystal Display Module

NHD-	Newhaven Display
2.4-	2.4” diagonal
240320-	240 x 320 pixels (portrait mode)
SF-	Model
C-	Built-in Controller (ILI9328)
T-	White LED backlight
X-	TFT- normally black
I-	Wide Temp (-20C ~ +70C), 12:00 view direction
#-	**RoHS Compliant**
T-	Touch Panel

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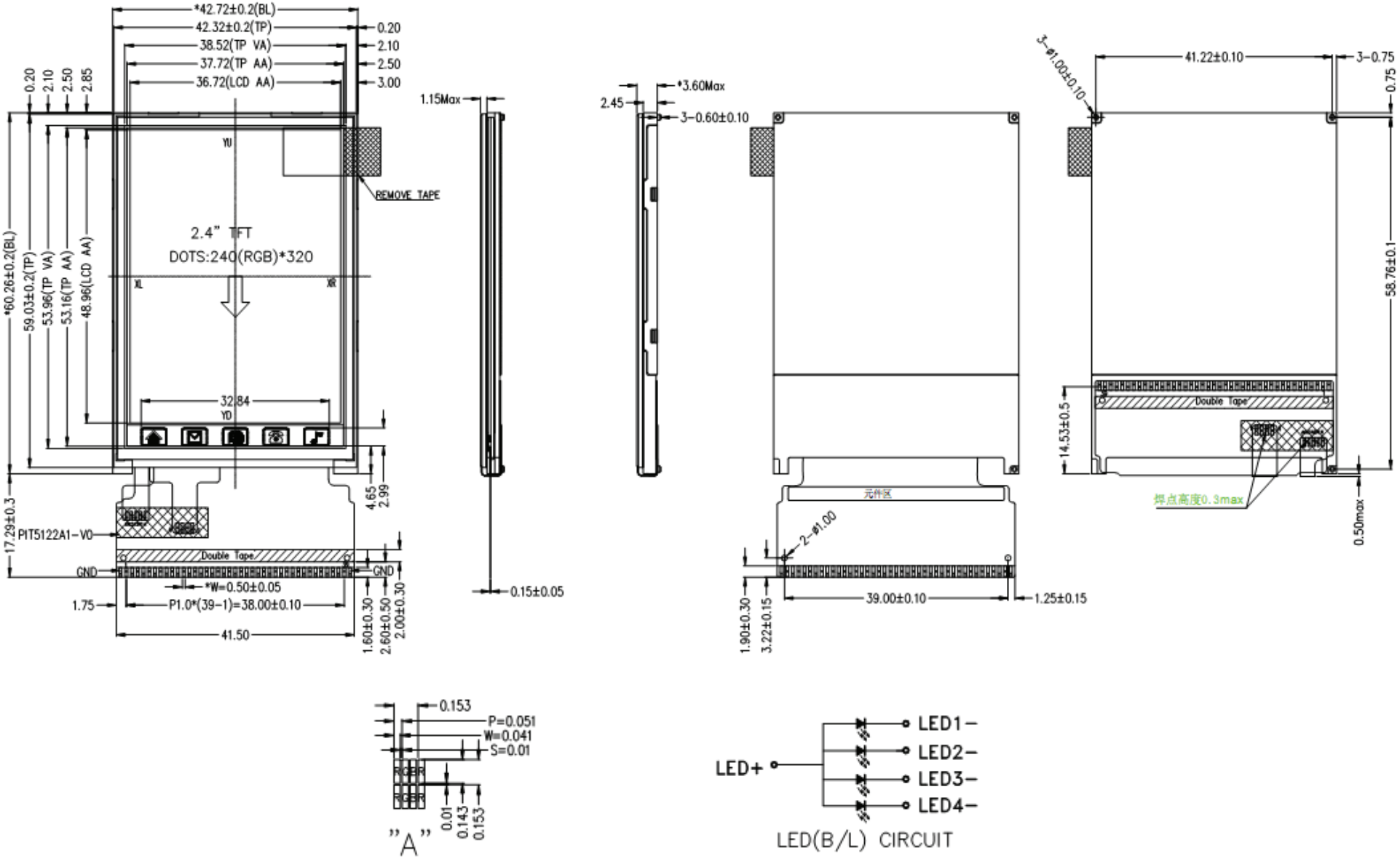
Document Revision History

Revision	Date	Description	Changed by
0	7/1/2009	Initial Release	
1	3/1/2010	Updated Pin 13 to “Active low Read strobe”	MC

Functions and Features

- **240x320 pixels**
- **LED backlight**
- **2.8V power supply**
- **8-bit or 16-bit Parallel interface**
- **Built-in ILI9328 controller**
- **4-wire resistive Touch Panel**

Mechanical Drawing



Pin Description

Pin No.	Symbol	External Connection	Function Description
1	GND	Power Supply	GND
2	Y-	Touch Panel	Touch Panel – DOWN
3	X+	Touch Panel	Touch Panel – LEFT
4	Y+	Touch Panel	Touch Panel – UP
5	X-	Touch Panel	Touch Panel – RIGHT
6	LCD_ID	MPU/NC	LCD ID pin (No Connect)
7	VCC	Power Supply	Power Supply for LCD (2.8V)
8	IOVCC	Power Supply	Logic Signal Supply IOVCC= 1.65 ~ VCC
9	FMARK	MPU/NC	Used when writing RAM data in sync with frame (No connect)
10	/CS	MPU	Active low Chip Select (can tie to GND)
11	RS	MPU	Register Select: 0= write index register, 1= write data
12	/WR	MPU	Active low Write strobe
13	/RD	MPU	Active low Read strobe
14	DB0	MPU	Bi-directional data bus 8-bit: use DB15-DB8 16-bit: use DB15-DB0
15	DB1	MPU	
16	DB2	MPU	
17	DB3	MPU	
18	DB4	MPU	
19	DB5	MPU	
20	DB6	MPU	
21	DB7	MPU	
22	DB8	MPU	
23	DB9	MPU	
24	DB10	MPU	
25	DB11	MPU	
26	DB12	MPU	
27	DB13	MPU	
28	DB14	MPU	
29	DB15	MPU	
30	/RESET	MPU	Active LOW reset
31	IM0	MPU	IM0=0 : 16-bit i80 IM0=1: 8-bit i80
32	NC	NC	No Connect
33	GND	Power Supply	GND
34	LED-1	Power Supply	LED Cathode (GND)
35	LED-2	Power Supply	LED Cathode (GND)
36	LED-3	Power Supply	LED Cathode (GND)
37	LED-4	Power Supply	LED Cathode (GND)
38	LED-A	Power Supply	LED Anode (3.2V)
39	GND	Power Supply	GND

LCD connector: Hot-bar solder directly to PCB

Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Top	Absolute Max	-10	25	+60	°C
Storage Temperature Range	Tst	Absolute Max	-20	25	+70	°C
Supply Voltage	VCC		2.5	2.8	3.3	V
I/O Supply Voltage	IOVCC		1.65	2.8	3.3	V
Supply Current	ICC	VCC=2.8V	-	7	9	mA
"H" Level input	Vih		0.8VCC	-	VCC	V
"L" Level input	Vil		0	-	0.2VCC	V
"H" Level output	Voh		0.8VCC	-	VCC	V
"L" Level output	Vol		0	-	0.2VCC	V
Backlight Supply Voltage	Vf		-	3.2	-	V
Backlight Supply Current	Iled	Vf=3.2V	-	20	-	mA
Brightness			-	350	-	cd/m2

Optical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle - Vertical	VA	Cr ≥ 10	-15		+35	º
Viewing Angle - Horizontal	VH	Cr ≥ 10	-45		+45	º
Contrast Ratio	Cr	3.2V, 25°C		250		
Response Time (rise)	Tr			10		ms
Response Time (fall)	Tr			20		ms

Touch Panel Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Linearity			-	-	1.5	%
Insulation Resistance			10	-	-	MΩ
Operation Voltage			-	5	-	V
Response Time			-	-	10	ms
Transmittance			80	-	-	%
Operating Force			50	-	200	G
Touch Durability			1,000,000	-	-	Times
Handwriting Durability			100,000	-	-	Times
Hardness			3	-	-	H

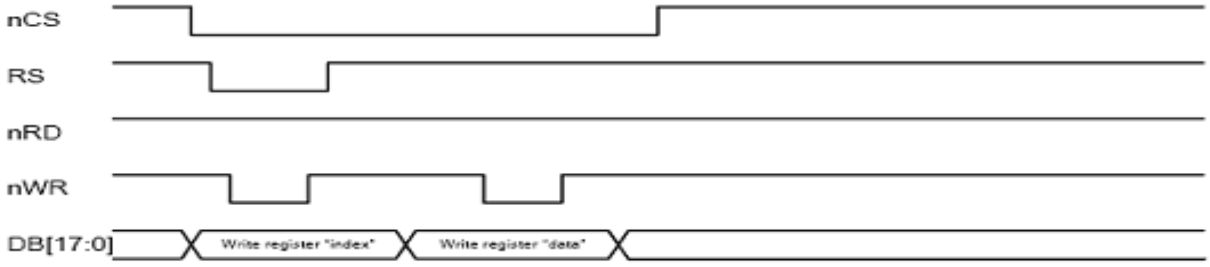
Driver Information

Built-in ILI9328 controller.

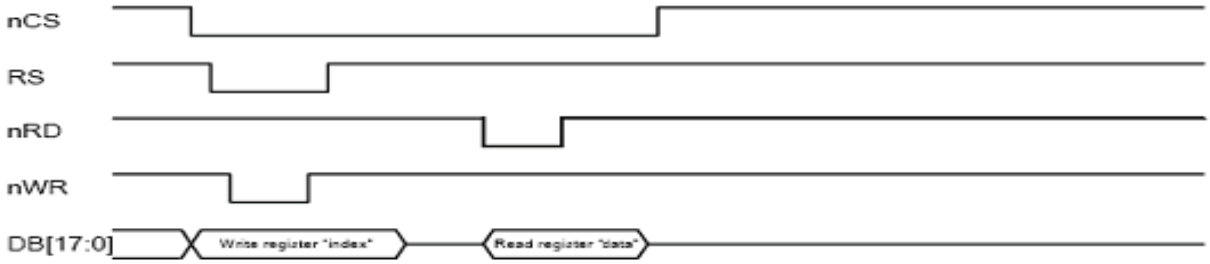
See specification at http://www.newhavendisplay.com/app_notes/ILI9328.pdf

i80 18-/16-bit System Bus Interface Timing

(a) Write to register

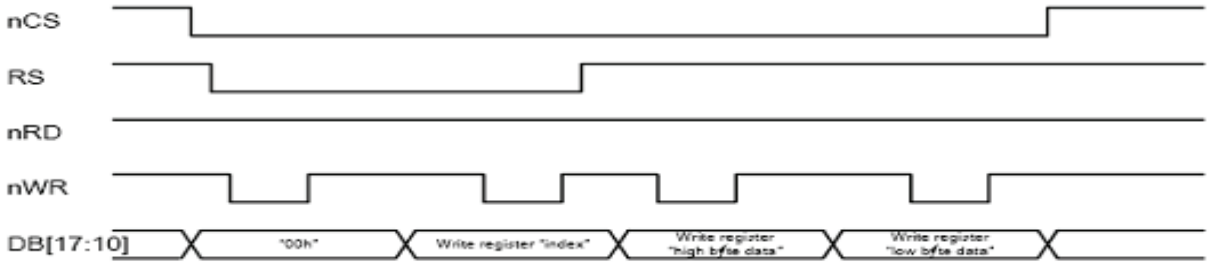


(b) Read from register

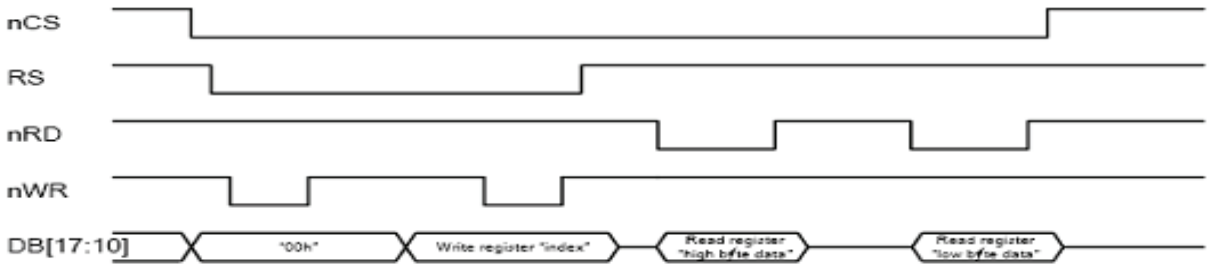


i80 9-/8-bit System Bus Interface Timing

(a) Write to register



(b) Read from register



No.	Registers Name	R/W	RS		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
IR	Index Register	W	0		-	-	-	-	-	-	-	-	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
SR	Status Read	R	0		L7	L6	L5	L4	L3	L2	L1	L0	0	0	0	0	0	0	0	0
00h	Driver Code Read	R	1		1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0
01h	Driver Output Control 1	W	1		0	0	0	0	0	SM	0	SS	0	0	0	0	0	0	0	0
02h	LCD Driving Control	W	1		0	0	0	0	0	0	BC0	EOR	0	0	0	0	0	0	0	0
03h	Entry Mode	W	1		TRI	DFM	0	BGR	0	DACKE	HWM	0	0	0	I/D1	I/D0	AM	0	0	0
04h	Resize Control	W	1		0	0	0	0	0	0	RCV1	RCV0	0	0	RCH1	RCH0	0	0	RSZ1	RSZ0
07h	Display Control 1	W	1		0	0	PTDE1	PTDE0	0	0	0	BASEE	0	0	GON	DTE	CL	0	D1	D0
08h	Display Control 2	W	1		0	0	0	0	FP3	FP2	FP1	FP0	0	0	0	0	BP3	BP2	BP1	BP0
09h	Display Control 3	W	1		0	0	0	0	0	PTS2	PTS1	PTS0	0	0	PTG1	PTG0	ISC3	ISC2	ISC1	ISC0
0Ah	Display Control 4	W	1		0	0	0	0	0	0	0	0	0	0	0	0	FMARKOE	FMI2	FMI1	FMI0
0Ch	RGB Display Interface Control 1	W	1		0	ENC2	ENC1	ENC0	0	0	0	RM	0	0	DM1	DM0	0	0	RIM1	RIM0
0Dh	Frame Maker Position	W	1		0	0	0	0	0	0	0	FMP8	FMP7	FMP6	FMP5	FMP4	FMP3	FMP2	FMP1	FMP0
0Fh	RGB Display Interface Control 2	W	1		0	0	0	0	0	0	0	0	0	0	0	VSPL	HSPL	0	DPL	EPL
10h	Power Control 1	W	1		0	0	0	SAP	0	BT2	BT1	BT0	APE	AP2	AP1	AP0	0	DSTB	SLP	STB
11h	Power Control 2	W	1		0	0	0	0	0	DC12	DC11	DC10	0	DC02	DC01	DC00	0	VC2	VC1	VC0
12h	Power Control 3	W	1		0	0	0	0	0	0	0	0	VCIRE	0	0	PON	VRH3	VRH2	VRH1	VRH0
13h	Power Control 4	W	1		0	0	0	VDV4	VDV3	VDV2	VDV1	VDV0	0	0	0	0	0	0	0	0
20h	Horizontal GRAM Address Set	W	1		0	0	0	0	0	0	0	0	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
21h	Vertical GRAM Address Set	W	1		0	0	0	0	0	0	0	AD16	AD15	AD14	AD13	AD12	AD11	AD10	AD9	AD8
22h	Write Data to GRAM	W	1		RAM write data (WD17-0) / read data (RD17-0) bits are transferred via different data bus lines according to the selected interfaces.															
29h	Power Control 7	W	1		0	0	0	0	0	0	0	0	0	0	VCM5	VCM4	VCM3	VCM2	VCM1	VCM0
2Bh	Frame Rate and Color Control	W	1		0	0	0	0	0	0	0	0	0	0	0	0	FRS[3]	FRS[2]	FRS[1]	FRS[0]
30h	Gamma Control 1	W	1		0	0	0	0	0	KP1[2]	KP1[1]	KP1[0]	0	0	0	0	0	KP0[2]	KP0[1]	KP0[0]
31h	Gamma Control 2	W	1		0	0	0	0	0	KP3[2]	KP3[1]	KP3[0]	0	0	0	0	0	KP2[2]	KP2[1]	KP2[0]
32h	Gamma Control 3	W	1		0	0	0	0	0	KP5[2]	KP5[1]	KP5[0]	0	0	0	0	0	KP4[2]	KP4[1]	KP4[0]
35h	Gamma Control 4	W	1		0	0	0	0	0	RP1[2]	RP1[1]	RP1[0]	0	0	0	0	0	RP0[2]	RP0[1]	RP0[0]
36h	Gamma Control 5	W	1		0	0	0	VRP1[4]	VRP1[3]	VRP1[2]	VRP1[1]	VRP1[0]	0	0	0	0	VRP0[3]	VRP0[2]	VRP0[1]	VRP0[0]
37h	Gamma Control 6	W	1		0	0	0	0	0	KN1[2]	KN1[1]	KN1[0]	0	0	0	0	0	KN0[2]	KN0[1]	KN0[0]
38h	Gamma Control 7	W	1		0	0	0	0	0	KN3[2]	KN3[1]	KN3[0]	0	0	0	0	0	KN2[2]	KN2[1]	KN2[0]
39h	Gamma Control 8	W	1		0	0	0	0	0	KN5[2]	KN5[1]	KN5[0]	0	0	0	0	0	KN4[2]	KN4[1]	KN4[0]
3Ch	Gamma Control 9	W	1		0	0	0	0	0	RN1[2]	RN1[1]	RN1[0]	0	0	0	0	0	RN0[2]	RN0[1]	RN0[0]
3Dh	Gamma Control 10	W	1		0	0	0	VRN1[4]	VRN1[3]	VRN1[2]	VRN1[1]	VRN1[0]	0	0	0	0	VRN0[3]	VRN0[2]	VRN0[1]	VRN0[0]

No.	Registers Name	R/W	RS		D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
50h	Horizontal Address Start Position	W	1		0	0	0	0	0	0	0	0	HSA7	HSA6	HSA5	HSA4	HSA3	HSA2	HSA1	HSA0
51h	Horizontal Address End Position	W	1		0	0	0	0	0	0	0	0	HEA7	HEA6	HEA5	HEA4	HEA3	HEA2	HEA1	HEA0
52h	Vertical Address Start Position	W	1		0	0	0	0	0	0	0	VSA8	VSA7	VSA6	VSA5	VSA4	VSA3	VSA2	VSA1	VSA0
53h	Vertical Address End Position	W	1		0	0	0	0	0	0	0	VEA8	VEA7	VEA6	VEA5	VEA4	VEA3	VEA2	VEA1	VEA0
60h	Driver Output Control 2	W	1		GS	0	NL5	NL4	NL3	NL2	NL1	NL0	0	0	SCN5	SCN4	SCN3	SCN2	SCN1	SCN0
61h	Base Image Display Control	W	1		0	0	0	0	0	0	0	0	0	0	0	0	0	NDL	VLE	REV
6Ah	Vertical Scroll Control	W	1		0	0	0	0	0	0	0	VL8	VL7	VL6	VL5	VL4	VL3	VL2	VL1	VL0
80h	Partial Image 1 Display Position	W	1		0	0	0	0	0	0	0	PTDP08	PTDP07	PTDP06	PTDP05	PTDP04	PTDP03	PTDP02	PTDP01	PTDP00
81h	Partial Image 1 Area (Start Line)	W	1		0	0	0	0	0	0	0	PTSA08	PTSA07	PTSA06	PTSA05	PTSA04	PTSA03	PTSA02	PTSA01	PTSA00
82h	Partial Image 1 Area (End Line)	W	1		0	0	0	0	0	0	0	PTEA08	PTEA07	PTEA06	PTEA05	PTEA04	PTEA03	PTEA02	PTEA01	PTEA00
83h	Partial Image 2 Display Position	W	1		0	0	0	0	0	0	0	PTDP18	PTDP17	PTDP16	PTDP15	PTDP14	PTDP13	PTDP12	PTDP11	PTDP10
84h	Partial Image 2 Area (Start Line)	W	1		0	0	0	0	0	0	0	PTSA18	PTSA17	PTSA16	PTSA15	PTSA14	PTSA13	PTSA12	PTSA11	PTSA10
85h	Partial Image 2 Area (End Line)	W	1		0	0	0	0	0	0	0	PTEA18	PTEA17	PTEA16	PTEA15	PTEA14	PTEA13	PTEA12	PTEA11	PTEA10
90h	Panel Interface Control 1	W	1		0	0	0	0	0	0	DIVI1	DIVI00	0	0	0	0	RTNI3	RTNI2	RTNI1	RTNI0
92h	Panel Interface Control 2	W	1		0	0	0	0	0	NOWI2	NOWI1	NOWI0	0	0	0	0	0	0	0	0
95h	Panel Interface Control 4	W	1		0	0	0	0	0	0	DIVE1	DIVE0	0	0	RTNE5	RTNE4	RTNE3	RTNE2	RTNE1	RTNE0
A1h	OTP VCM Programming Control	W	1		0	0	0	0	OTP_ PGM_EN	0	0	0	0	0	VCM_ OTP5	VCM_ OTP4	VCM_ OTP3	VCM_ OTP2	VCM_ OTP1	VCM_ OTP0
A2h	OTP VCM Status and Enable	W	1		PGM_ CNT1	PGM_ CNT0	VCM_ D5	VCM_ D4	VCM_ D3	VCM_ D2	VCM_ D1	VCM_ D0	0	0	0	0	0	0	0	VCM_ EN
A5h	OTP Programming ID Key	W	1		KEY 15	KEY 14	KEY 13	KEY 12	KEY 11	KEY 10	KEY 9	KEY 8	KEY 7	KEY 6	KEY 5	KEY 4	KEY 3	KEY 2	KEY 1	KEY 0

Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+70°C , 96hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-20°C , 96hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+60°C , 96hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-10°C , 96hrs	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 , 96hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	-10°C,30min -> 25°C,5min -> 60°C,30min = 1 cycle 100 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-150Hz , 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=4KV, RS=330kΩ, CS=150pF Five times	

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

See Terms & Conditions at http://www.newhavendisplay.com/index.php?main_page=terms