

NHD-3.5-320240MF-ASXV#

TFT (Thin-Film-Transistor) Color Liquid Crystal Display Module

| | |
|---------|--------------------------------------|
| NHD- | Newhaven Display |
| 3.5- | 3.5" Diagonal |
| 320240- | 320xRGBx240 Pixels |
| MF- | Model |
| A- | Built-in Driver / No Controller |
| S- | High Brightness, White LED Backlight |
| X- | TFT |
| V- | MVA, Wide Temperature |
| # | RoHS Compliant |

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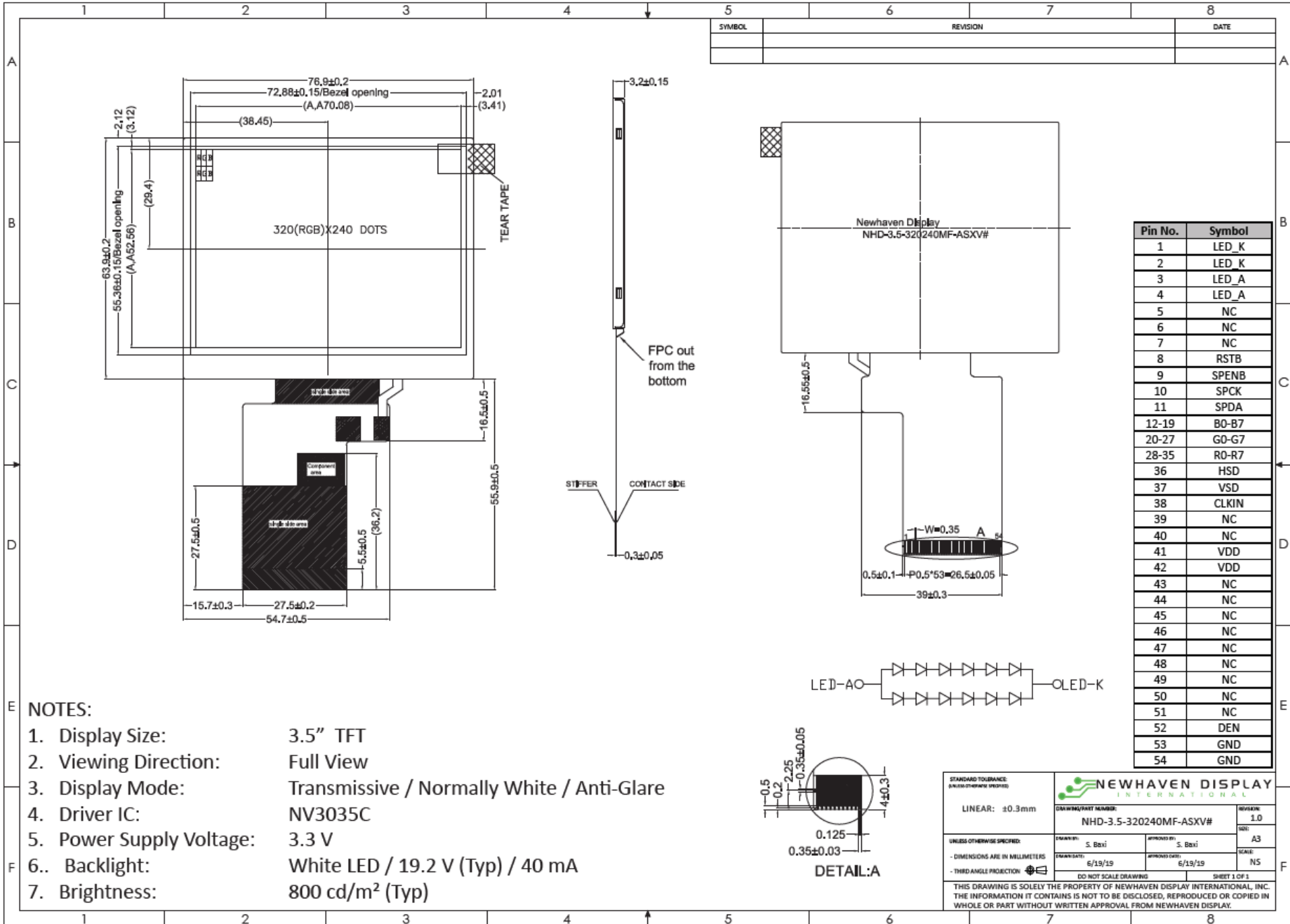
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Document Revision History

| Revision | Date | Description | Changed by |
|----------|---------|--|------------|
| 0 | 4/29/16 | Initial Release | SB |
| 1 | 6/30/16 | Added Chromaticity | SB |
| 2 | 9/23/16 | Updated I_{LED} , I_{DD} , and Chromaticity Values | SB |
| 3 | 6/19/19 | Backlight Characteristics & Supply Current Updated | SB |

Functions and Features

- 320xRGBx240 resolution
- LED backlight
- 3.3V power supply
- 24-bit Parallel digital RGB interface (6.4MHz)
- Premium high brightness display



| SYMBOL | REVISION | DATE |
|--------|----------|------|
| | | |

| Pin No. | Symbol |
|---------|--------|
| 1 | LED_K |
| 2 | LED_K |
| 3 | LED_A |
| 4 | LED_A |
| 5 | NC |
| 6 | NC |
| 7 | NC |
| 8 | RSTB |
| 9 | SPENB |
| 10 | SPCK |
| 11 | SPDA |
| 12-19 | B0-B7 |
| 20-27 | G0-G7 |
| 28-35 | R0-R7 |
| 36 | HSD |
| 37 | VSD |
| 38 | CLKIN |
| 39 | NC |
| 40 | NC |
| 41 | VDD |
| 42 | VDD |
| 43 | NC |
| 44 | NC |
| 45 | NC |
| 46 | NC |
| 47 | NC |
| 48 | NC |
| 49 | NC |
| 50 | NC |
| 51 | NC |
| 52 | DEN |
| 53 | GND |
| 54 | GND |

NOTES:

- 1. Display Size: 3.5" TFT
- 2. Viewing Direction: Full View
- 3. Display Mode: Transmissive / Normally White / Anti-Glare
- 4. Driver IC: NV3035C
- 5. Power Supply Voltage: 3.3 V
- 6. Backlight: White LED / 19.2 V (Typ) / 40 mA
- 7. Brightness: 800 cd/m² (Typ)

| | | | |
|---|------------------------|--|------------------|
| STANDARD TOLERANCE: UNLESS OTHERWISE SPECIFIED | | | |
| LINEAR: ±0.3mm | | DRAWING/PART NUMBER: NHD-3.5-320240MF-ASXV# | REVISION: 1.0 |
| UNLESS OTHERWISE SPECIFIED: | DRAWN BY: S. Baxi | APPROVED BY: S. Baxi | SCALE: A3 |
| - DIMENSIONS ARE IN MILLIMETERS | DRAWN DATE: 6/19/19 | APPROVED DATE: 6/19/19 | SCALE: N5 |
| - THIRD ANGLE PROJECTION: | DO NOT SCALE DRAWING | | SHEET 1 OF 1 |
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Pin Description

| Pin No. | Symbol | External Connection | Function Description |
|---------|--------|---------------------|---|
| 1 | LED_K | Power Supply | Backlight Cathode (Ground) |
| 2 | LED_K | Power Supply | Backlight Cathode (Ground) |
| 3 | LED_A | Power Supply | Backlight Anode (40mA @ 19.2V) |
| 4 | LED_A | Power Supply | Backlight Anode (40mA @ 19.2V) |
| 5 | NC | - | No Connect |
| 6 | NC | - | No Connect |
| 7 | NC | - | No Connect |
| 8 | RSTB | MPU | Active LOW Reset signal |
| 9 | SPENB | MPU | Active LOW Serial Chip Select signal |
| 10 | SPCK | MPU | Serial Clock signal |
| 11 | SPDA | MPU | Serial Data signal |
| 12-19 | B0-B7 | MPU | Blue Data signals |
| 20-27 | G0-G7 | MPU | Green Data signals |
| 28-35 | R0-R7 | MPU | Red Data signals |
| 36 | HSD | MPU | Horizontal (Line) Sync signal |
| 37 | VSD | MPU | Vertical (Frame) Sync signal |
| 38 | CLKIN | MPU | Dot Clock signal |
| 39 | NC | - | No Connect |
| 40 | NC | - | No Connect |
| 41 | VDD | Power Supply | Supply Voltage for LCD and logic (3.3V) |
| 42 | VDD | Power Supply | Supply Voltage for LCD and logic (3.3V) |
| 43 | NC | - | No Connect |
| 44 | NC | - | No Connect |
| 45 | NC | - | No Connect |
| 46 | NC | - | No Connect |
| 47 | NC | - | No Connect |
| 48 | NC | - | No Connect |
| 49 | NC | - | No Connect |
| 50 | NC | - | No Connect |
| 51 | NC | - | No Connect |
| 52 | DEN | - | Data Enable signal (No Connect) |
| 53 | GND | Power Supply | Ground |
| 54 | GND | Power Supply | Ground |

Recommended connector: 54pin, 0.5mm pitch, FFC connector. Molex P/N 51296-5494

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 |
| Digital Supply Voltage | V _{DD} | - | 3.0 | 3.3 | 3.6 | V |
| Supply Current | I _{DD} | V _{DD} =3.3V | 5 | 10 | 15 | mA |
| "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} -0.4 | - | V _{DD} | V |
| "L" Level output | V _{OL} | - | V _{SS} | - | V _{SS} +0.4 | V |
| | | | | | | |
| Backlight Supply Current | I _{LED} | - | 30 | 40 | 50 | mA |
| Backlight Supply Voltage | V _{LED} | I _{LED} = 40 mA | 17.4 | 19.2 | 19.8 | V |
| Backlight Lifetime* | - | T _{OP} = 25° C | 20,000 | 50,000 | - | Hrs. |

*Backlight lifetime is rated as Hours until **half-brightness**, under normal operating conditions. The LED of the backlight is driven by current drain; drive voltage is for reference only. Drive voltage must be selected to ensure backlight current drain is below MAX level stated

Optical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | |
|------------------------|----------------|--------------------------|------|-------|-------|-------------------|---|
| Optimal Viewing Angles | Top | CR ≥ 10 | - | 70 | - | ° | |
| | Bottom | | - | 70 | - | ° | |
| | Left | | - | 70 | - | ° | |
| | Right | | - | 70 | - | ° | |
| Contrast Ratio | CR | - | 200 | 350 | - | - | |
| Luminance | L _V | I _{LED} = 40 mA | 640 | 800 | - | cd/m ² | |
| Response Time | Rise | T _{OP} = 25° C | - | 25 | 40 | ms | |
| | Fall | | - | 25 | 40 | ms | |
| Chromaticity | Red | X _R | - | 0.554 | 0.604 | 0.654 | - |
| | | Y _R | - | 0.298 | 0.345 | 0.395 | - |
| | Green | X _G | - | 0.263 | 0.313 | 0.363 | - |
| | | Y _G | - | 0.552 | 0.602 | 0.652 | - |
| | Blue | X _B | - | 0.094 | 0.144 | 0.194 | - |
| | | Y _B | - | 0.056 | 0.106 | 0.156 | - |
| | White | X _W | - | 0.229 | 0.279 | 0.329 | - |
| | | Y _W | - | 0.271 | 0.321 | 0.371 | - |

Driver Information

Built-in NV3035C driver. No controller.

Please download specification at http://www.newhavendisplay.com/app_notes/NV3035C.pdf

Note: To achieve optimum VCOM and VGL settings, the SPI interface may be used to set the following registers:

ROEh = 6Bh

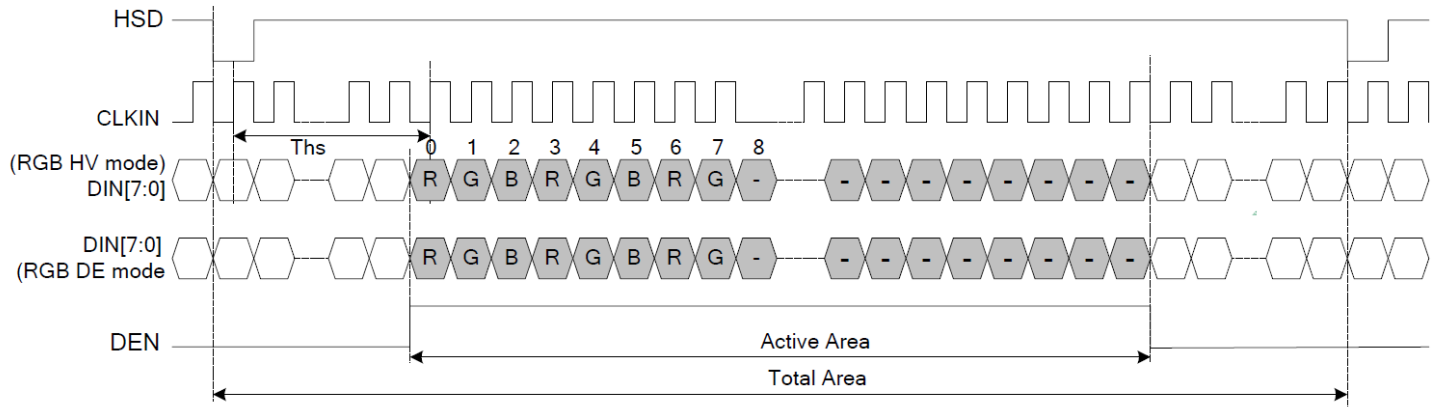
ROFh = 24h

Timing Characteristics

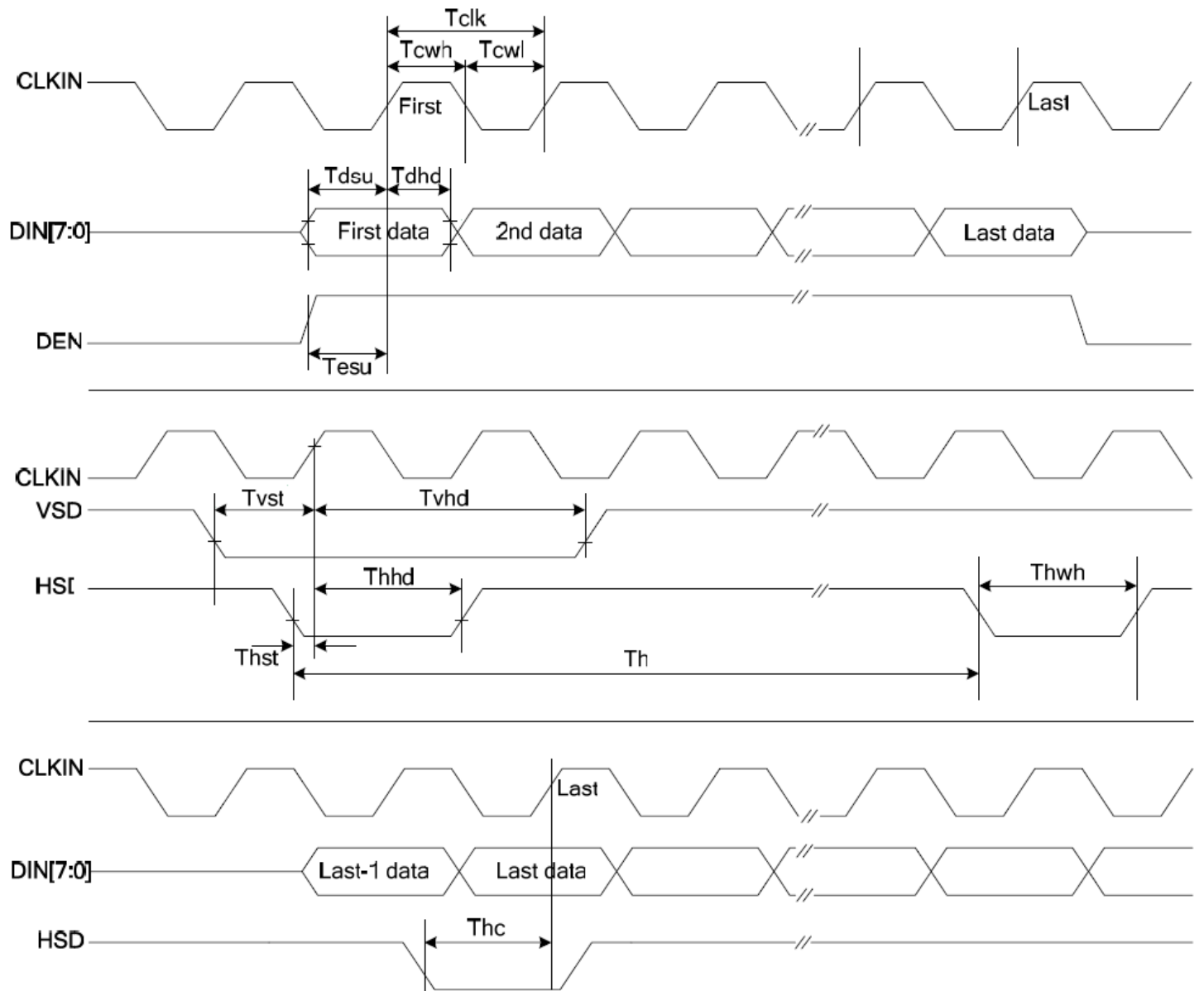
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|--------------------|------|-------|------|-------|--|
| System Operation Timing | | | | | | |
| VDD power source slew time | T _{POR} | | | 1000 | us | From 0V to 90% VDD |
| RSTB active pulse width | T _{RSTB} | 40 | | | us | VDD=3.3V |
| Input Output Timing | | | | | | |
| CLKIN clock time | Tclk | - | | 35.7 | ns | Please refer to timing table(P25) |
| HSD to CLKIN | T _{hc} | - | - | 1 | CLKIN | |
| HSD width | T _{hwh} | 1 | - | - | CLKIN | |
| VSD width | T _{vwh} | 1 | - | - | Th | |
| HSD period time | T _h | 60 | 63.56 | 67 | us | |
| VSD setup time | T _{vst} | 12 | - | - | ns | |
| VSD hold time | T _{vhd} | 12 | - | - | ns | |
| HSD setup time | T _{hst} | 12 | - | - | ns | |
| HSD hold time | T _{hhd} | 12 | - | - | ns | |
| Data set-up time | T _{dsu} | 12 | - | - | ns | DIN[23:0] to CLKIN |
| Data hold time | T _{dhd} | 12 | - | - | ns | DIN[23:0] to CLKIN |
| DEN setup time | T _{esd} | 12 | - | | ns | DEN to CLKIN |
| Time that VSD to 1 st line data input | T _{vs} | 2 | 13 | 127 | Th | @CIR601/8bit RGB HV mode Control by HDLY[6:0] setting T _{vs} =HDLY[6:0] |
| Time that CCIR_V to 1 st line data input | T _{vs} | 12 | 20 | 28 | Th | @CCIR656 NTSC mode Control by HDLY[6:0] setting T _{vs} =HDLY[6:0] |
| Time that CCIR_V to 1 st line data input | T _{vs} | 17 | 25 | 33 | Th | @CCIR656 PAL mode Control by HDLY[6:0] setting T _{vs} =HDLY[6:0] |
| Time that VSD to 1 st line data input | T _{vs} | 2 | 13 | 127 | Th | @24bit RGB HV mode Control by HDLY[6:0] setting T _{vs} =HDLY[6:0] |
| Source output stable time 1 | T _{st} | - | 25 | 30 | us | 96% final, CL=30pF, RL=2K |
| Gate output stable time | T _{gst} | - | 500 | 1000 | ns | 96% final, CL=40pF |
| VCOMOUT output stable time | T _{est} | - | 4 | 8 | us | 96% final, CL=33nF, RL=100ohm |
| 3-wire serial communication AC timing | | | | | | |
| Serial clock | T _{spck} | 320 | - | - | ns | |
| SPCK pulse duty | T _{scdut} | 40 | 50 | 60 | % | T _{ckh} /T _{spck} |
| Serial data setup time | T _{isu} | 120 | - | - | ns | |
| Serial data hold time | T _{ihd} | 120 | - | - | ns | |
| Serial clock high/low | T _{ssw} | 120 | - | - | ns | |
| Chip select distinguish | T _{cd} | 1 | - | - | us | |
| SPENA to VSD | T _{ev} | 1 | - | - | us | |
| SPENB input setup time | T _{eck} | 150 | - | - | Ns | |
| SPENB input hold time | T _{cke} | 150 | - | - | ns | |

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|------------------|------|------|------|-------|-------------------------|
| CLKIN frequency | Fclk | 6.1 | 6.4 | 8.0 | MHz | VDD=3.0~3.6V |
| CLKIN cycle time | Tclk | 125 | 156 | 164 | ns | |
| CLKIN pulse duty | T _{cwh} | 40 | 50 | 60 | % | Tclk |
| Time that HSD to 1 st data input(NTSC) | T _{hs} | 40 | 70 | 255 | CLKIN | DDLY=70,Offset=0(fixed) |

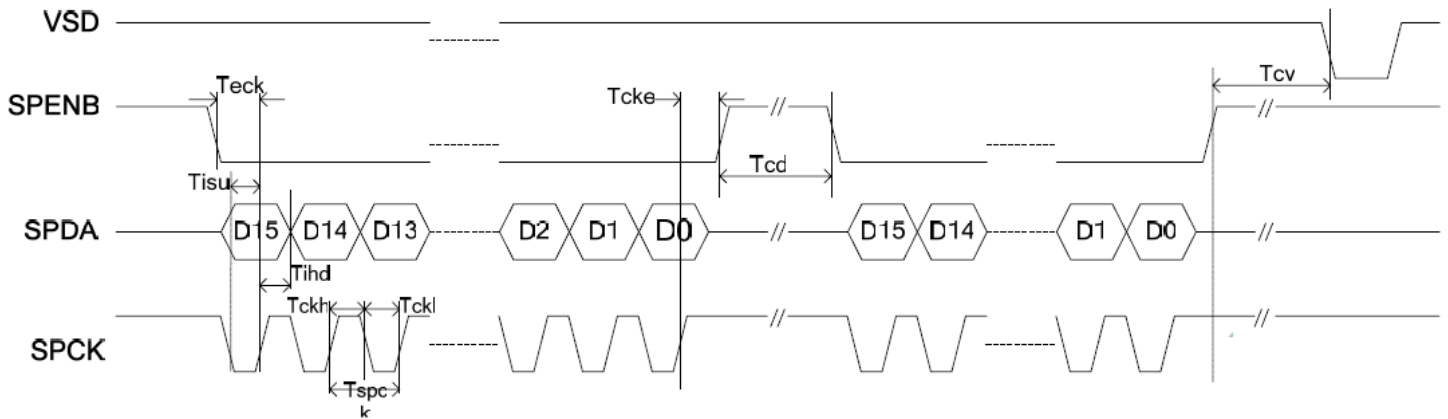
Input Data Format



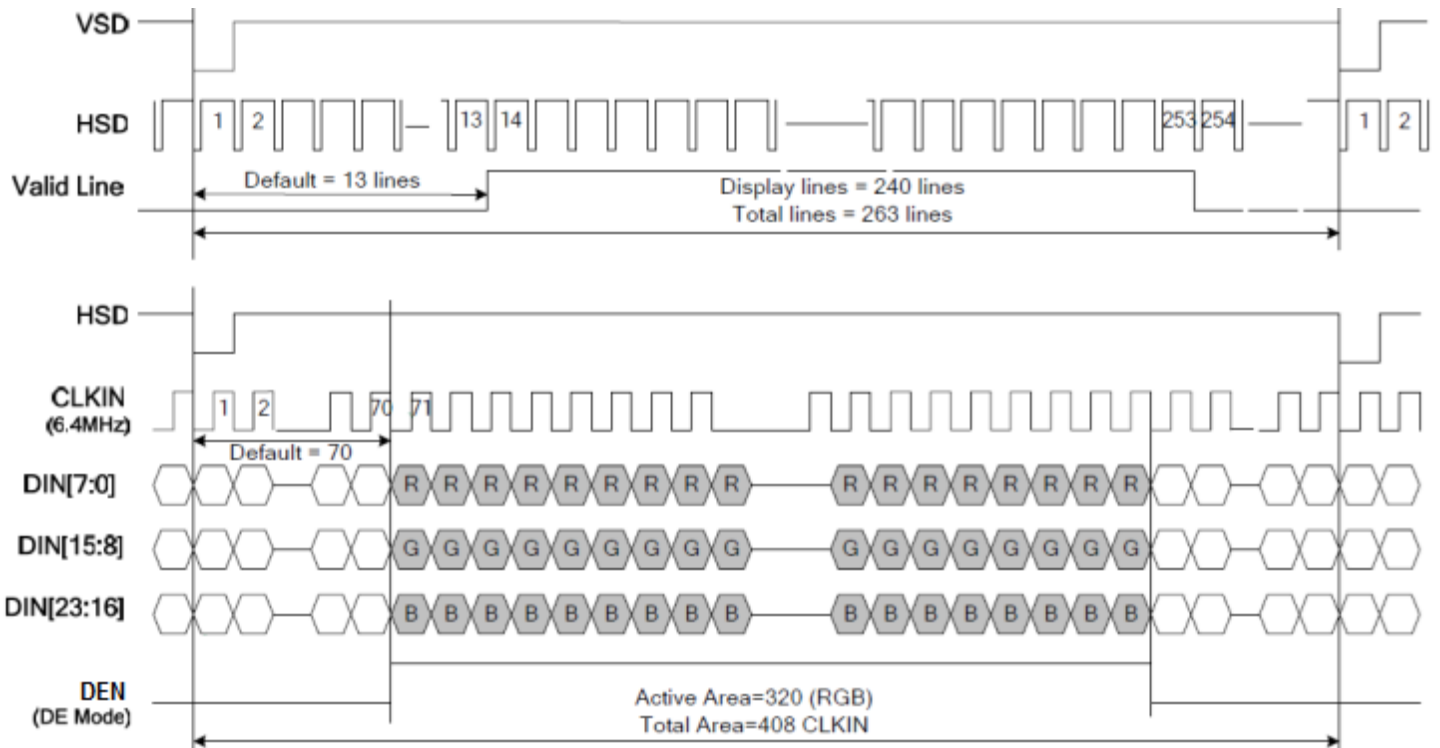
Clock and Data Input Timing Diagram



3-wire Timing Diagram



Input Data Timing



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 , 240hrs | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C , 240hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time. | +60°C , 240hrs | 2 |
| Low Temperature Operation | Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time. | -20°C , 240hrs | 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 , 160hrs | 1,2 |
| Thermal Shock resistance | Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress. | -30°C,30min -> 25°C,5min -> 80°C,30min = 1 cycle 100 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=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 and Terms & Conditions

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