

# NHD-5.7-320240WFB-ATXI#-1

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

|         |                                |
|---------|--------------------------------|
| NHD-    | Newhaven Display               |
| 5.7-    | 5.7" Diagonal                  |
| 320240- | 320xRGBx240 Pixels             |
| WFB-    | Model                          |
| A-      | Built-in driver, No Controller |
| T-      | White LED backlight            |
| X-      | TFT                            |
| I-      | 12:00 Optimal View, Wide Temp  |
| #-1     | <b>RoHS Compliant</b>          |

### Newhaven Display International, Inc.

2661 Galvin Ct.

Elgin IL, 60124

Ph: 847-844-8795

Fax: 847-844-8796

[www.newhavendisplay.com](http://www.newhavendisplay.com)

[nhtech@newhavendisplay.com](mailto:nhtech@newhavendisplay.com)

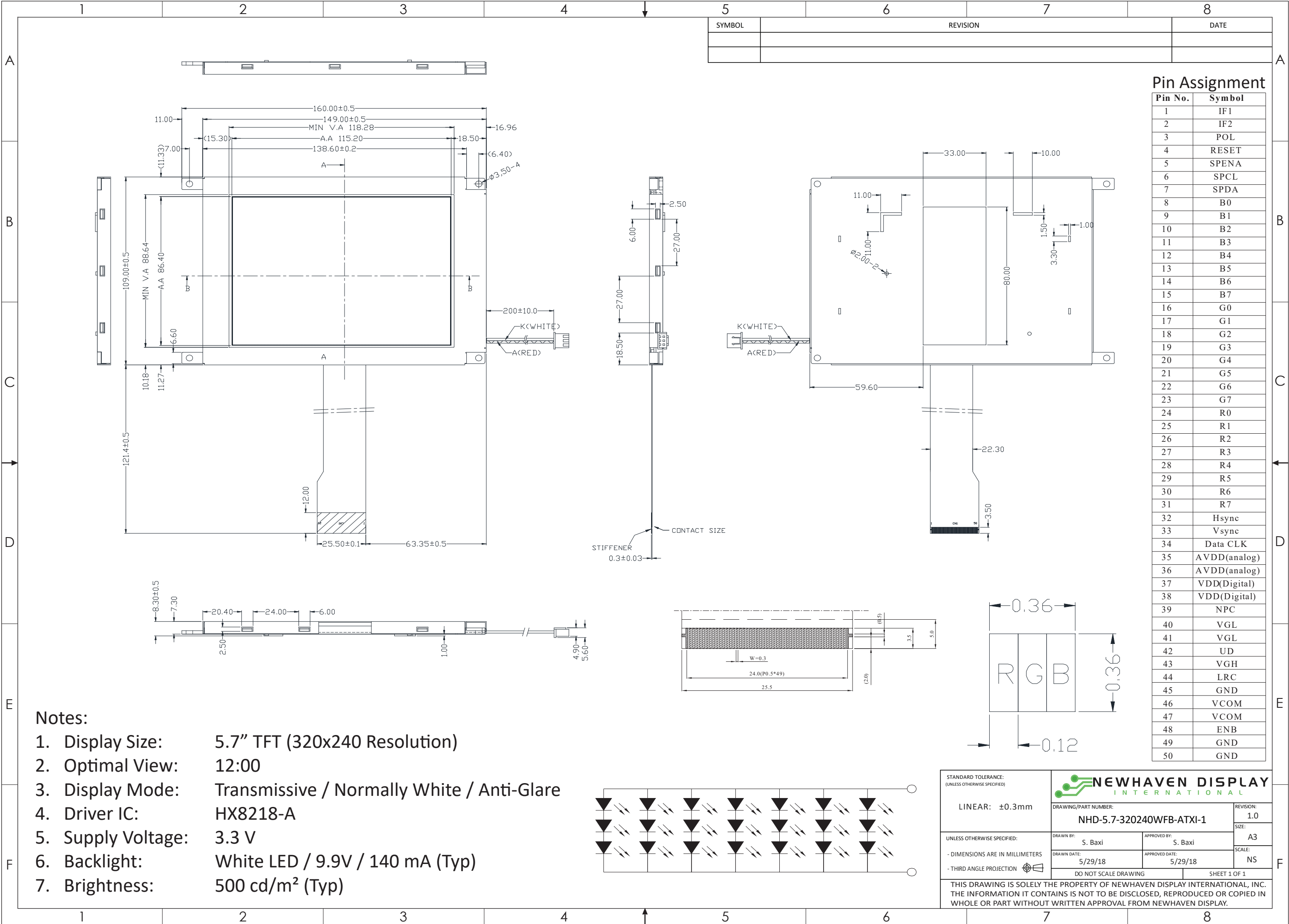
[nhsales@newhavendisplay.com](mailto:nhsales@newhavendisplay.com)

## Document Revision History

| Revision | Date    | Description                         | Changed by |
|----------|---------|-------------------------------------|------------|
| 0        | 5/23/12 | Initial Release                     | AK         |
| 1        | 5/29/12 | Optical characteristics updated     | AK         |
| 2        | 4/7/17  | Viewing Angle Clarification         | SB         |
| 3        | 5/29/19 | Supply Current & Brightness Updated | SB         |

## Functions and Features

- 320xRGBx240 resolution
- LED backlight
- 24-bit Parallel RGB interface
- Built-in Source Driver: HX8218-A
- Built-in Gate Driver: HX8615



## Pin Description

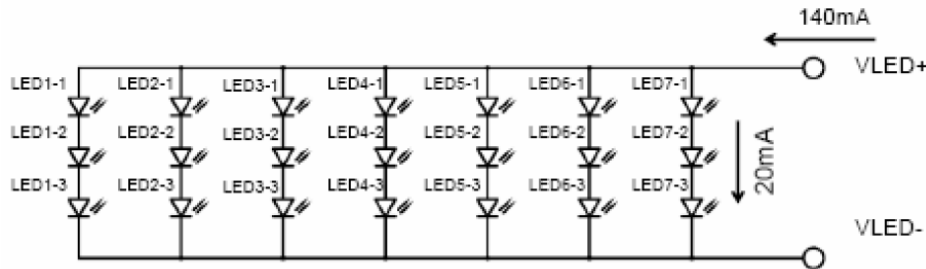
| Pin No. | Symbol       | I/O | Description                                                | Remark |
|---------|--------------|-----|------------------------------------------------------------|--------|
| 1       | IF1          | I   | Input data format control (Note1)                          | Note1  |
| 2       | IF2          | I   | Input data format control (Note1)                          | Note1  |
| 3       | POL          | O   | Polarity Signal connect to VCOM driving circuit.           | Note3  |
| 4       | RESET        | I   | Hardware reset.                                            |        |
| 5       | SPENA        | I   | Chip select                                                | Note2  |
| 6       | SPCL         | I   | Serial Clock                                               | Note2  |
| 7       | SPDA         | I/O | Serial Data                                                |        |
| 8       | B0           | I   | Blue Data bit (LSB)                                        |        |
| 9       | B1           | I   | Blue Data bit                                              |        |
| 10      | B2           | I   | Blue Data bit                                              |        |
| 11      | B3           | I   | Blue Data bit                                              |        |
| 12      | B4           | I   | Blue Data bit                                              |        |
| 13      | B5           | I   | Blue Data bit                                              |        |
| 14      | B6           | I   | Blue Data bit                                              |        |
| 15      | B7           | I   | Blue Data bit(MSB)                                         |        |
| 16      | G0           | I   | Green Data bit(LSB)                                        |        |
| 17      | G1           | I   | Green Data bit                                             |        |
| 18      | G2           | I   | Green Data bit                                             |        |
| 19      | G3           | I   | Green Data bit                                             |        |
| 20      | G4           | I   | Green Data bit                                             |        |
| 21      | G5           | I   | Green Data bit                                             |        |
| 22      | G6           | I   | Green Data bit                                             |        |
| 23      | G7           | I   | Green Data bit(MSB)                                        |        |
| 24      | R0           | I   | Red Data bit(LSB)                                          |        |
| 25      | R1           | I   | Red Data bit                                               |        |
| 26      | R2           | I   | Red Data bit                                               |        |
| 27      | R3           | I   | Red Data bit                                               |        |
| 28      | R4           | I   | Red Data bit                                               |        |
| 29      | R5           | I   | Red Data bit                                               |        |
| 30      | R6           | I   | Red Data bit                                               |        |
| 31      | R7           | I   | Red Data bit(MSB)                                          |        |
| 32      | Hsync        | I   | Horizontal synchronous signal                              |        |
| 33      | Vsync        | I   | Vertical synchronous signal                                |        |
| 34      | Data CLK     | I   | Dot data clock                                             |        |
| 35      | AVDD(analog) | I   | Analog power: 4.5V~5.5V                                    |        |
| 36      | AVDD(analog) | I   | Analog power: 4.5V~5.5V                                    |        |
| 37      | VDD(digital) | I   | Digital power: 3V~3.5V                                     |        |
| 38      | VDD(digital) | I   | Digital power: 3V~3.5V                                     |        |
| 39      | NPC          | O   | NTSC/PAL mode Auto detection result<br>H:NTSC/L:PAL        |        |
| 40      | VGL          | I   | Gate off power                                             |        |
| 41      | VGL          | I   | Gate off power                                             |        |
| 42      | UD           | I   | Up/Down scan setting. H: Reverse scan / L: Normal scan     |        |
| 43      | VGH          | I   | Gate on power                                              |        |
| 44      | LRC          | I   | Shift direction of device internal shift register control. |        |
| 45      | GND          | I   | GROUND                                                     |        |
| 46      | VCOM         | I   | VCOM driving input                                         | Note3  |
| 47      | VCOM         | I   | VCOM driving input                                         |        |
| 48      | ENB          | I   | Data enable input. Normally pull low.                      | Note4  |
| 49      | GND          | I   | GROUND                                                     |        |
| 50      | GND          | I   | GROUND                                                     |        |

**Recommended LCD connector:** 50-pin, 0.5mm pitch FFC connector. Molex 54132-5097

### Backlight:

| Pin No. | Symbol | Connection   | Description                   |
|---------|--------|--------------|-------------------------------|
| 1       | VDD    | Power Supply | Red, LED Anode (140mA @ 9.9V) |
| 2       | NC     | -            | No Connect                    |
| 3       | VSS    | Power Supply | White, LED Cathode            |

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



### Note 1: Input data format

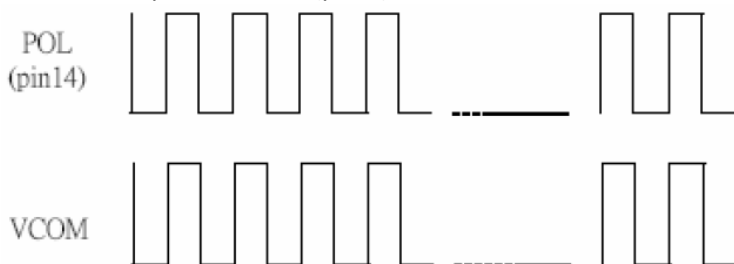
| IF2, IF1      | Input data format |
|---------------|-------------------|
| L,L (default) | Serial RGB        |
| L,H           | Parallel RGB      |
| H,L           | CCIR601           |
| H,H           | CCIR656           |

**Note 2:** Pins 5 and 6 typically pulled high

**Note 3:** Polarity of VCOM (pins 46,47) should be generated from POL (pin 3)

**Note 4:** For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If ENB signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used.

**Note 5:** The phase of POL (pin 3):



## Driver Information

Built-in Source Driver HX8218-A: [http://www.newhavendisplay.com/app\\_notes/HX8218.pdf](http://www.newhavendisplay.com/app_notes/HX8218.pdf)

Built-in Gate Driver HX8615: [http://www.newhavendisplay.com/app\\_notes/HX8615.pdf](http://www.newhavendisplay.com/app_notes/HX8615.pdf)

## Electrical Characteristics

| Item                           | Symbol            | Condition                                           | Min.                | Typ. | Max.                | Unit |
|--------------------------------|-------------------|-----------------------------------------------------|---------------------|------|---------------------|------|
| Operating Temperature Range    | T <sub>OP</sub>   | Absolute Max                                        | -20                 | -    | +70                 | °C   |
| Storage Temperature Range      | T <sub>ST</sub>   | Absolute Max                                        | -30                 | -    | +80                 | °C   |
| Supply Voltage for Logic       | V <sub>DD</sub>   |                                                     | 3.0                 | 3.3  | 3.6                 | V    |
| Supply Voltage for LCD & Logic | AV <sub>DD</sub>  |                                                     | 4.5                 | 5.0  | 5.5                 | V    |
| “H” Level input                | V <sub>IH</sub>   |                                                     | 0.7*V <sub>DD</sub> | -    | V <sub>DD</sub>     | V    |
| “L” Level input                | V <sub>IL</sub>   |                                                     | V <sub>SS</sub>     | -    | 0.3*V <sub>DD</sub> | V    |
| TFT Gate ON operating voltage  | V <sub>GH</sub>   | Duty=1/240                                          | -                   | 15   | -                   | V    |
| TFT Gate OFF operating voltage | V <sub>GL</sub>   | Duty=1/240                                          | -                   | -10  | -                   | V    |
| VCOM Driving Voltage (Note 6)  | V <sub>COM</sub>  | Duty=1/240                                          | -2.0                | -    | 5.5                 | V    |
| Supply Current for LCD         | I <sub>DD</sub>   | VDD=3.3V,<br>AVDD=5V,<br>VGH=15V,<br>VGL=-10V       | 5                   | 17   | 25                  | mA   |
| Supply Current for Analog      | IAV <sub>DD</sub> |                                                     | -                   | 4.7  | 7                   | mA   |
| Supply Current for Gate ON     | I <sub>GH</sub>   |                                                     | -                   | 0.05 | 0.1                 | mA   |
| Supply Current for Gate OFF    | I <sub>GL</sub>   |                                                     | -                   | 0.05 | 0.1                 | mA   |
|                                |                   |                                                     |                     |      |                     |      |
| Backlight Supply Current       | I <sub>LED</sub>  | -                                                   | -                   | 140  | 175                 | mA   |
| Backlight Supply Voltage       | V <sub>LED</sub>  | I <sub>LED</sub> = 140 mA<br>T <sub>OP</sub> = 25°C | 9.0                 | 9.9  | 10.5                | V    |
| Backlight Lifetime             |                   |                                                     | -                   | 50K  |                     | Hr   |

**Note 6:** VCOM must be adjusted to optimize display quality, contrast ratio, etc.

## Optical Characteristics

| Item                   | Symbol         | Condition                 | Min. | Typ. | Max. | Unit              |
|------------------------|----------------|---------------------------|------|------|------|-------------------|
| Optimal Viewing Angles | Top            | CR ≥ 5                    | -    | 70   | -    | °                 |
|                        | Bottom         |                           | -    | 50   | -    | °                 |
|                        | Left           |                           | -    | 70   | -    | °                 |
|                        | Right          |                           | -    | 70   | -    | °                 |
| Contrast Ratio         | CR             | -                         | 150  | 250  | -    | -                 |
| Luminance              | L <sub>V</sub> | I <sub>LED</sub> = 140 mA | 400  | 500  | -    | cd/m <sup>2</sup> |
| Response Time          | Rise           | T <sub>OP</sub> = 25°C    | -    | 15   | -    | ms                |
|                        | Fall           |                           | -    | 30   | -    | ms                |

## Timing Characteristics

### CCIR601/656 Interface

#### Input Signal Characteristics

| PARAMETER       | Symbol    | Min. | Typ. | Max. | Unit |
|-----------------|-----------|------|------|------|------|
| CLK period      | $T_{OSC}$ | -    | 37   | -    | ns   |
| Data setup time | $T_{SU}$  | 12   | -    | -    | ns   |
| Data hold time  | $T_{HD}$  | 12   | -    | -    | ns   |

#### Hardware Reset Timing

| PARAMETER             | Symbol    | Min. | Typ. | Max. | Unit    |
|-----------------------|-----------|------|------|------|---------|
| RESET low pulse width | $T_{RSB}$ | 10   | -    | -    | $\mu$ s |

#### Output Signal Characteristics

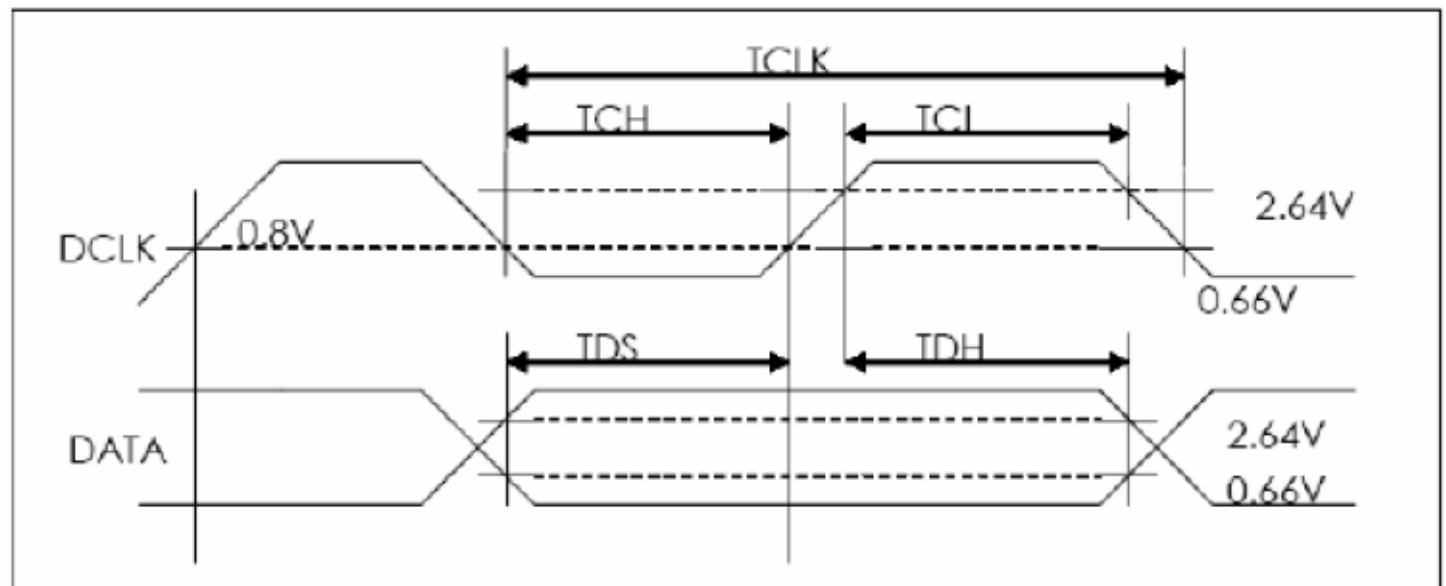
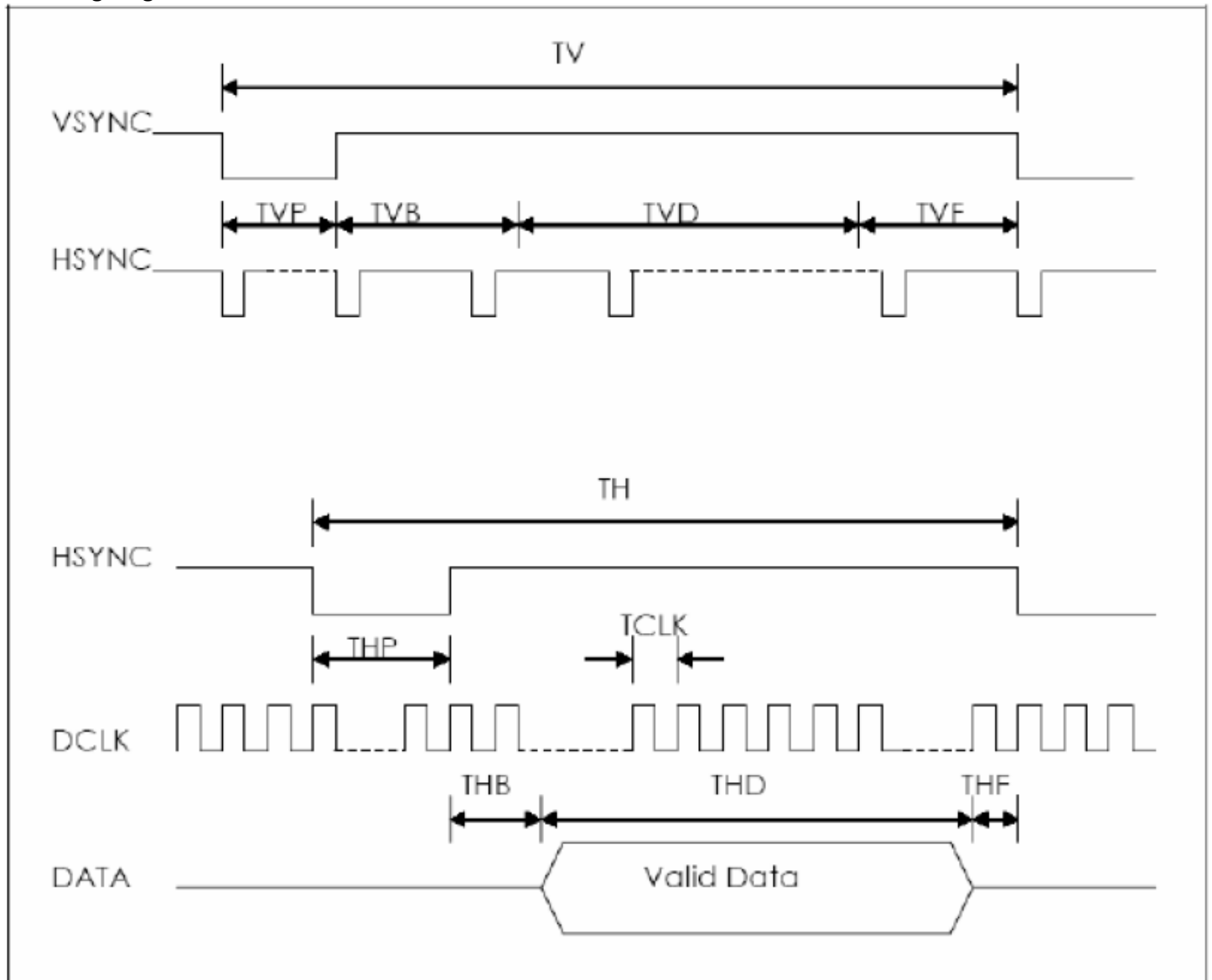
| PARAMETER                |      | Symbol    | Min. | Typ. | Max. | Unit    |
|--------------------------|------|-----------|------|------|------|---------|
| Rising time              |      | $T_r$     | -    | -    | 10   | ns      |
| Falling time             |      | $T_f$     | -    | -    | 10   | ns      |
| Internal STH setup time  |      | $T_{SUS}$ | 12   | -    | -    | ns      |
| Internal STH hold time   |      | $T_{HDS}$ | 12   | -    | -    | ns      |
| Internal data setup time |      | $T_{SUD}$ | 60   | -    | -    | ns      |
| Internal data hold time  |      | $T_{HDD}$ | 40   | -    | -    | ns      |
| OEH pulse width          |      | $T_{OEH}$ | -    | 1248 | -    | ns      |
| OEV pulse width          |      | $T_{OEV}$ | -    | 4992 | -    | ns      |
| CKV pulse width          |      | $T_{CKV}$ | -    | 3744 | -    | ns      |
| Hsync – DEH time         |      | $T_1$     | -    | 4368 | -    | ns      |
| Hsync – CKV time         |      | $T_2$     | -    | 2496 | -    | ns      |
| Hsync – OEV time         |      | $T_3$     | -    | 624  | -    | ns      |
| Vsync – setup time       |      | $T_{SUV}$ |      | 1872 | -    | ns      |
| Vsync – pulse time       |      | $T_{STV}$ |      | 1    | -    | $T_H$   |
| Vsync – STV time         | NTSC | $T_{VS1}$ | -    | 19   | -    | $T_H$   |
|                          | PAL  | $T_{VS1}$ | -    | 27   | -    | $T_H$   |
| OEH – STV time           |      | $T_{HE}$  | -    | 2    | -    | $T_H$   |
| Output settling time     |      | $T_{OES}$ | -    | 12   | 20   | $\mu$ s |

## 24-bit Parallel RGB Interface

### AC Timing Characteristics

| Signal | Item           |      | Symbol | Min | Typ   | Max | Unit |
|--------|----------------|------|--------|-----|-------|-----|------|
| Dclk   | Frequency      |      | Dclk   | -   | 6.4   | -   | MHZ  |
|        | High Time      |      | Tch    | -   | 78    | -   | ns   |
|        | Low Time       |      | Tcl    | -   | 78    | -   | ns   |
| Data   | Setup Time     |      | Tds    | 12  | -     | -   | ns   |
|        | Hold Time      |      | Tdh    | 12  | -     | -   | ns   |
| Hsync  | Period         |      | TH     | -   | 408   | -   | DCLK |
|        | Pulse Width    |      | Thp    | -   | 30    | -   | DCLK |
|        | Back-Porch     |      | Thb    | -   | 38    | -   | DCLK |
|        | Display Period |      | Thd    | -   | 320   | -   | DCLK |
|        | Front-Porch    |      | Thf    | -   | 20    | -   | DCLK |
| Vsync  | Period         | NTSC | Tv     | -   | 262.5 | -   | TH   |
|        |                | PAL  |        |     | 312.5 |     |      |
|        | Pulse Width    |      | Tvp    | 1   | 3     | 5   | TH   |
|        | Back-Porch     | NTSC | Tvb    | -   | 15    | -   | TH   |
|        |                | PAL  |        |     | 23    |     |      |
|        | Display Period |      | Tvd    | -   | 240   | -   | TH   |
|        | Front-Porch    | NTSC | Tvf    | -   | 4.5   | -   | TH   |
|        |                | PAL  |        |     | 46.5  |     |      |

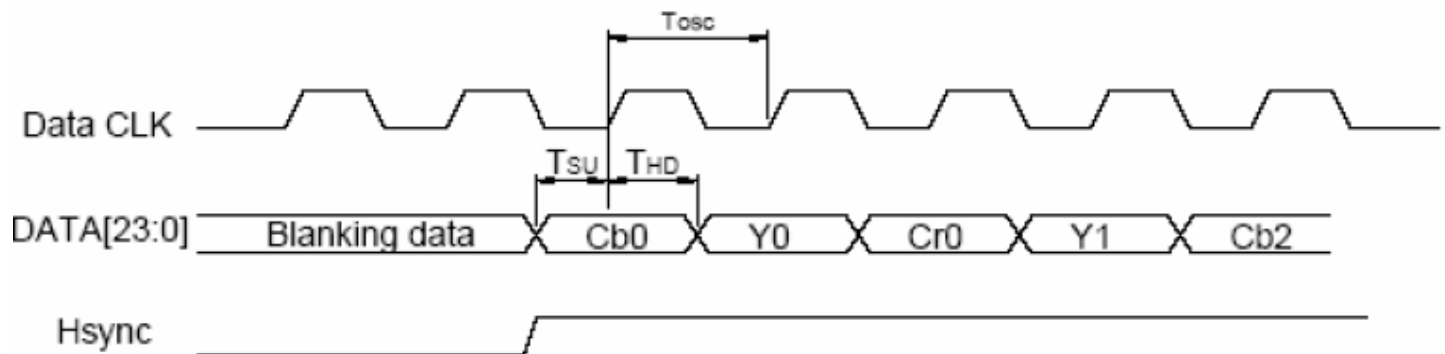
## AC Timing Diagrams



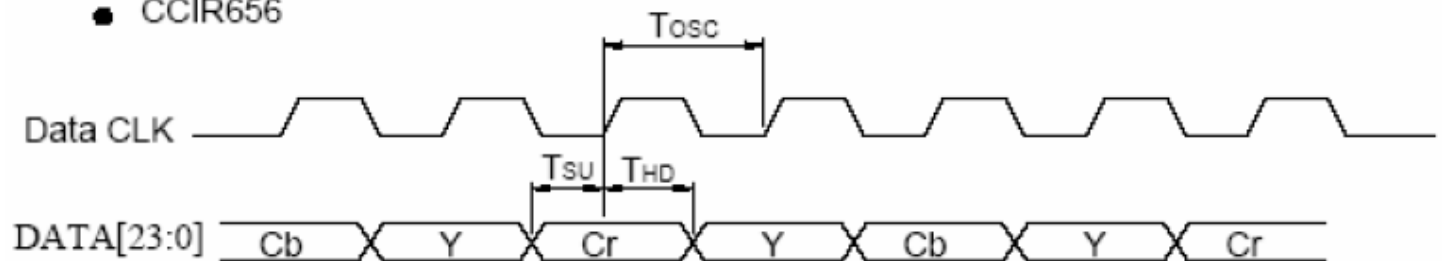
## Waveforms

### Clock and Data waveform

- CCIR601( HS\_POL="L" in Register R2)



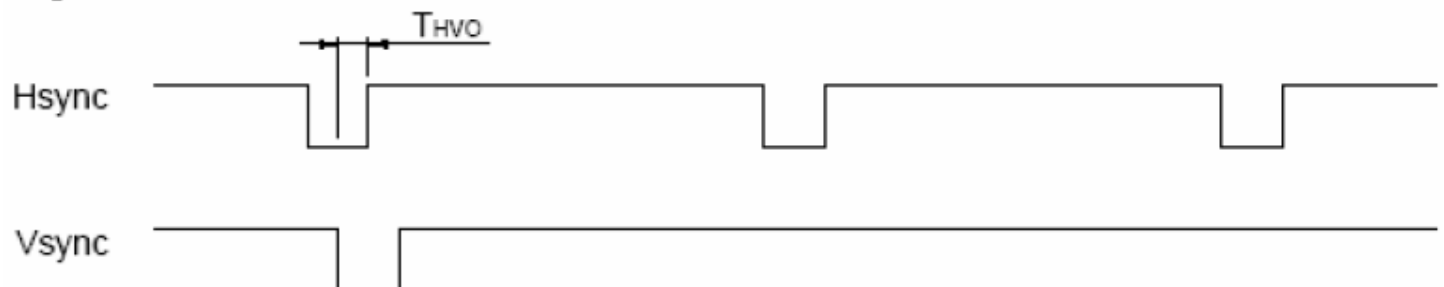
- CCIR656



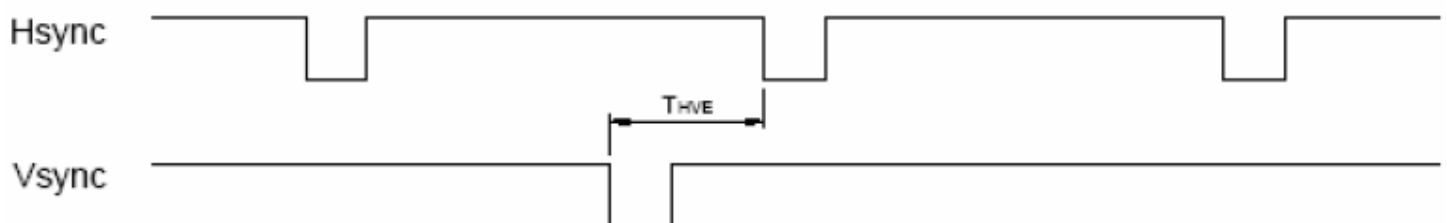
### Digital/Analog RGB timing waveform

#### Hsync and Vsync Timing

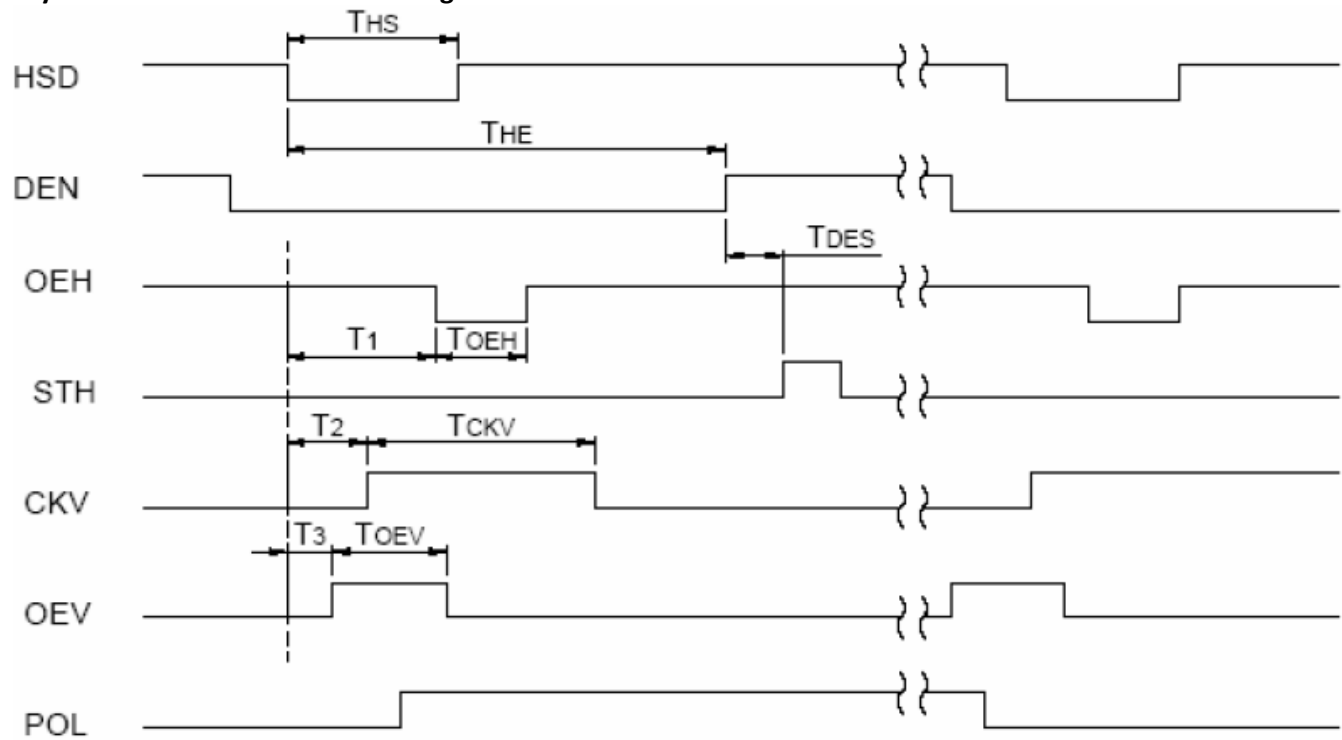
- Odd field



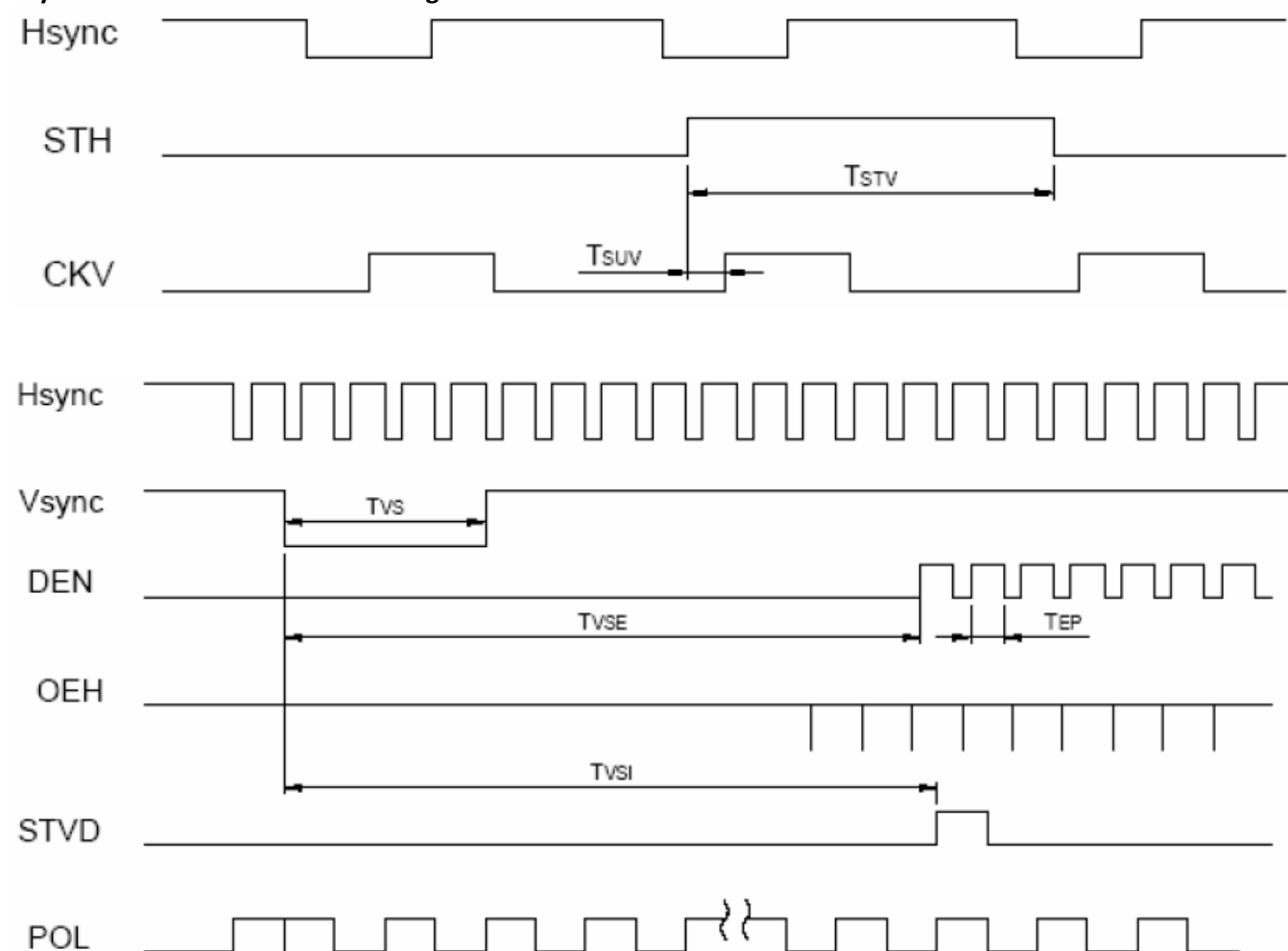
- Even field



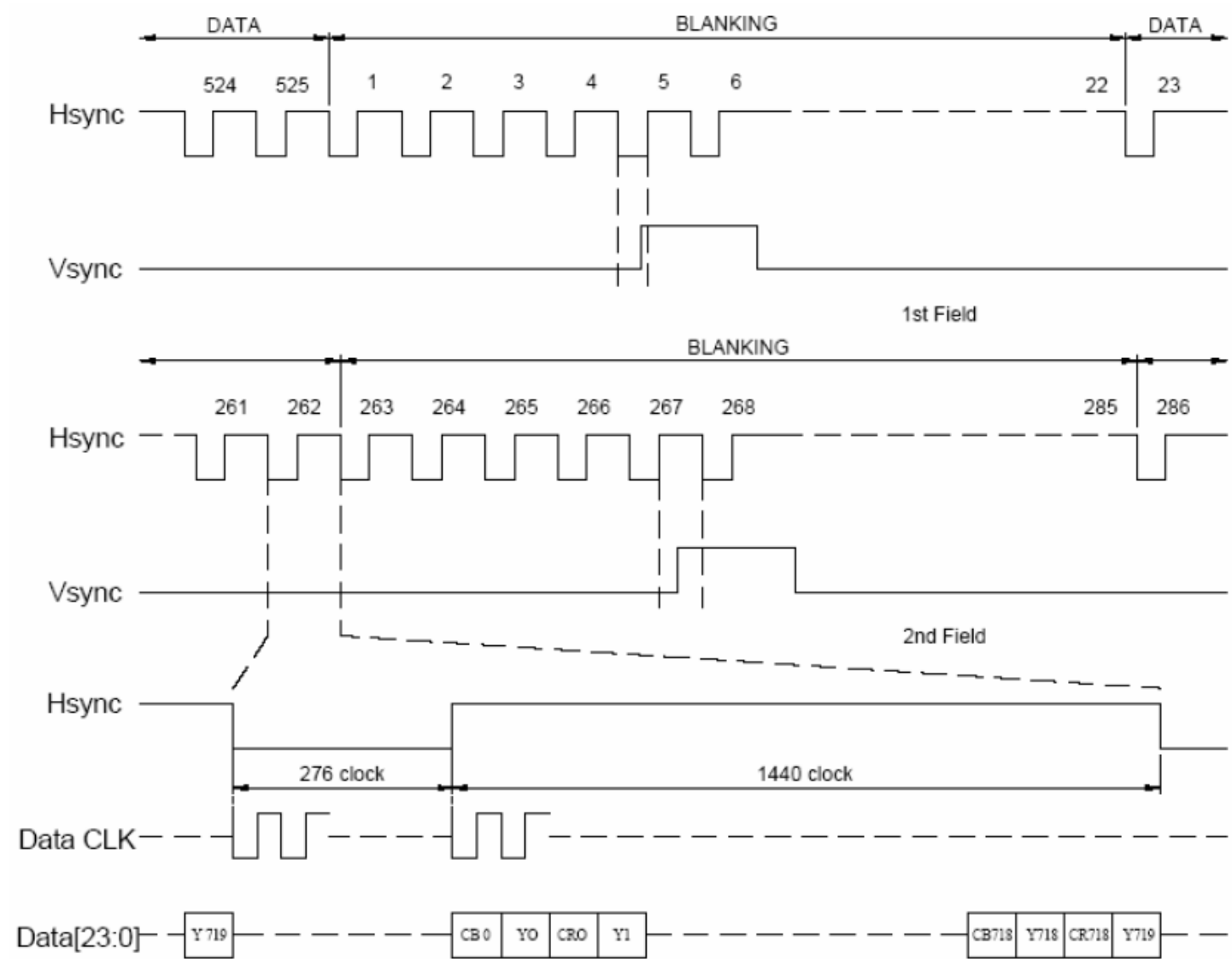
### Hsync and Horizontal Control Timing Waveform



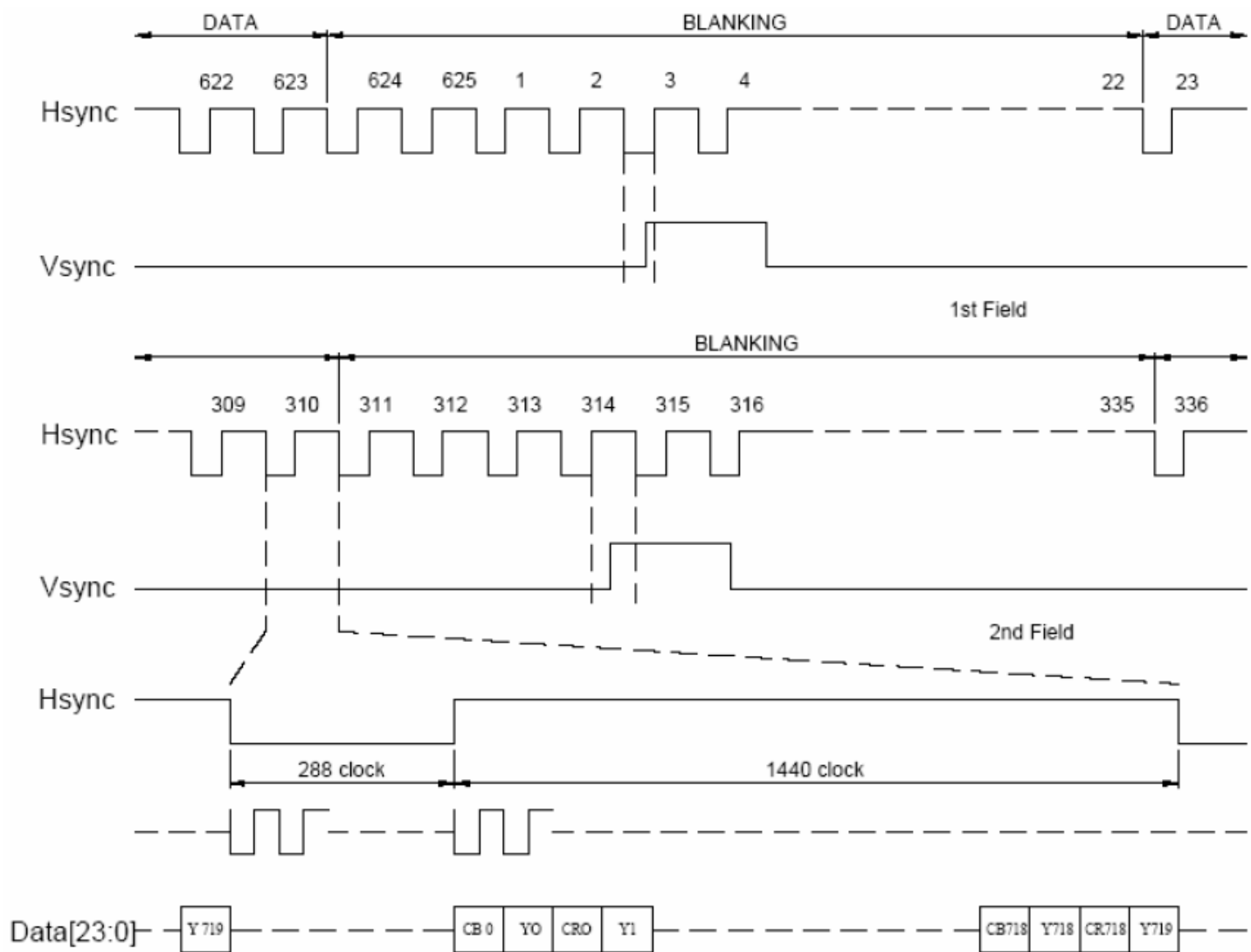
### Hsync and Vertical Shift Clock Timing Waveform



CCIR601 Timing Waveform (VS\_POL = "H", HS\_POL = "L" in register R2)

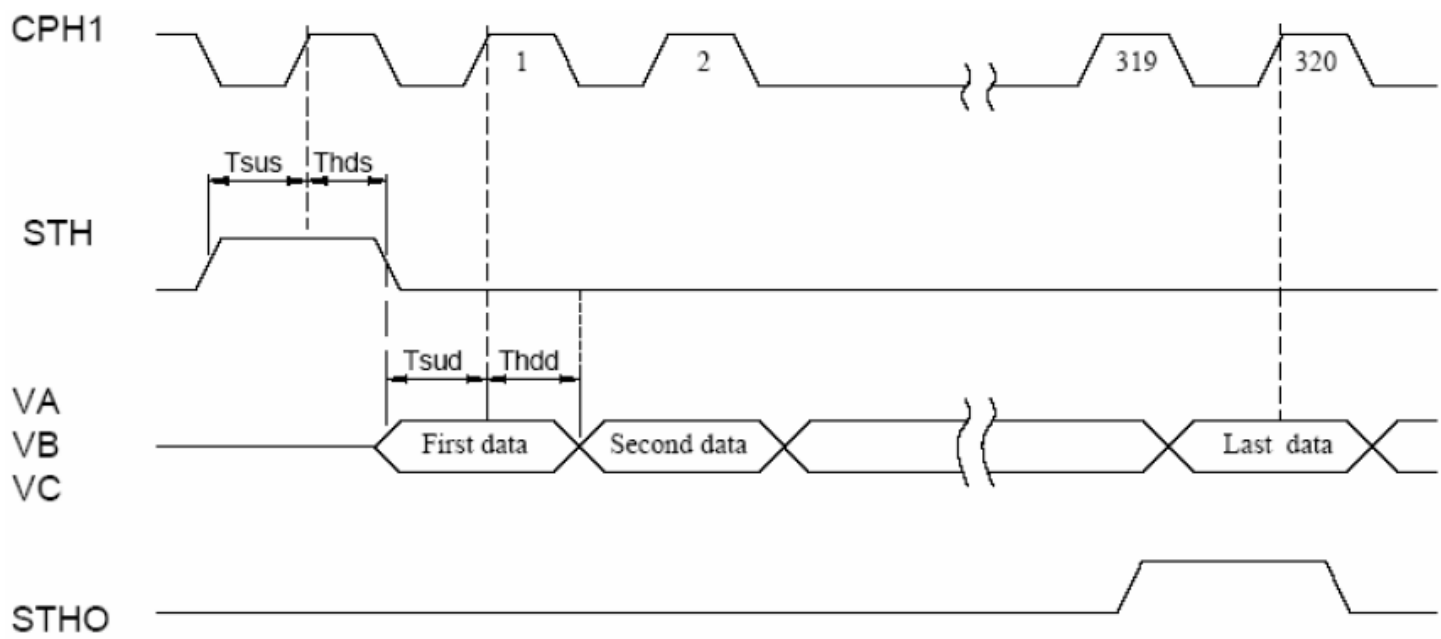


ITU-BT.601 NTSC Input Timing

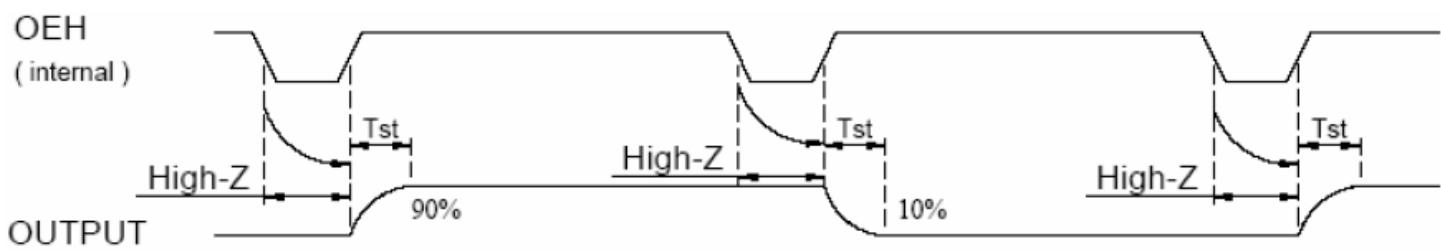


ITU-BT.601 PAL Input Timing

Clock and Start Pulse Timing Waveform

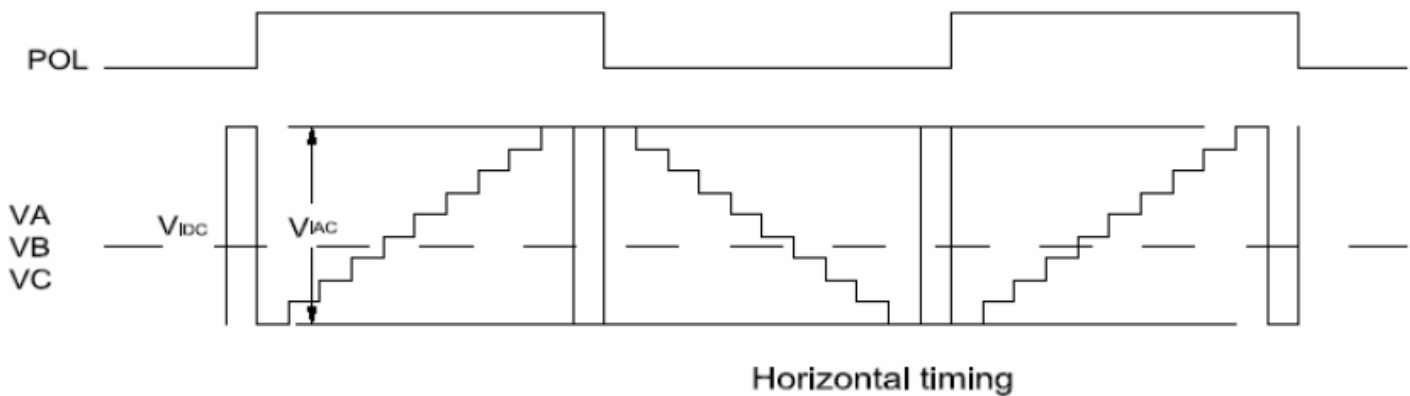


OEH and Data Output timing Waveform



Analog Video Signal Characteristics

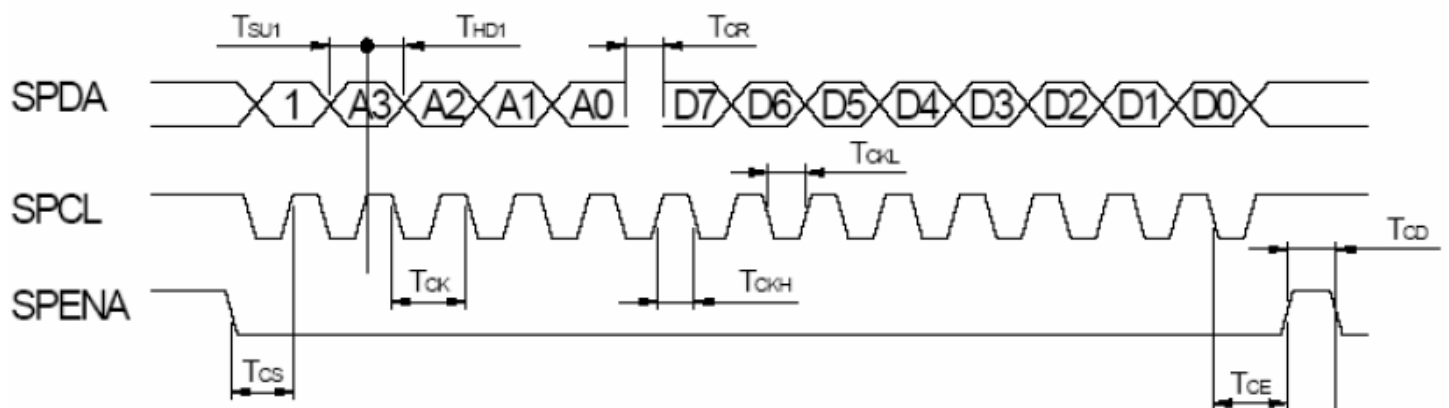
| PARAMETER                           | Symbol    | Min. | Typ.  | Max. | Unit |
|-------------------------------------|-----------|------|-------|------|------|
| Video signal amplitude (VA, VB, VC) | $V_{IAC}$ | -    | 3.81  | -    | V    |
|                                     | $V_{IDC}$ | -    | 2.385 | -    | V    |



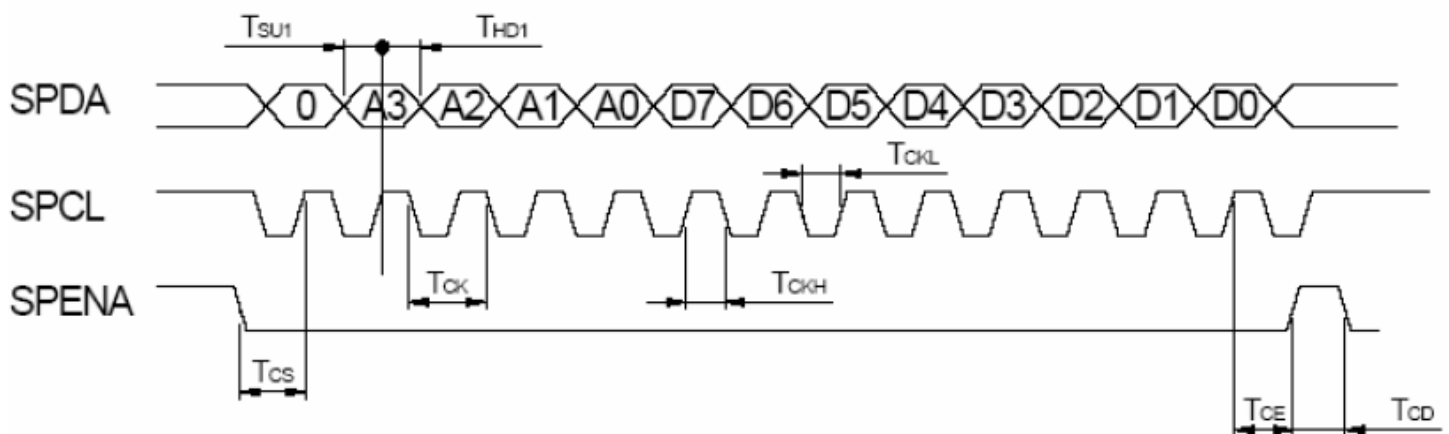
## SPI Timing Characteristics

| PARAMETER                | Symbol    | Min. | Typ. | Max. | Unit     |
|--------------------------|-----------|------|------|------|----------|
| SPCL period              | $T_{CK}$  | 60   | -    | -    | ns       |
| SPCL high width          | $T_{CKH}$ | 30   | -    | -    | ns       |
| SPCL low width           | $T_{CKL}$ | 30   | -    | -    | ns       |
| Data setup time          | $T_{SU1}$ | 12   | -    | -    | ns       |
| Data hold time           | $T_{HD1}$ | 12   | -    | -    | ns       |
| SPENA to SPCK setup time | $T_{CS}$  | 20   | -    | -    | ns       |
| SPENA to SPDA hold time  | $T_{CE}$  | 20   | -    | -    | ns       |
| SPENA high pulse width   | $T_{CD}$  | 50   | -    | -    | ns       |
| SPDA output latency      | $T_{CR}$  |      | 1/2  | -    | $T_{CK}$ |

### ● SPI "read" timing

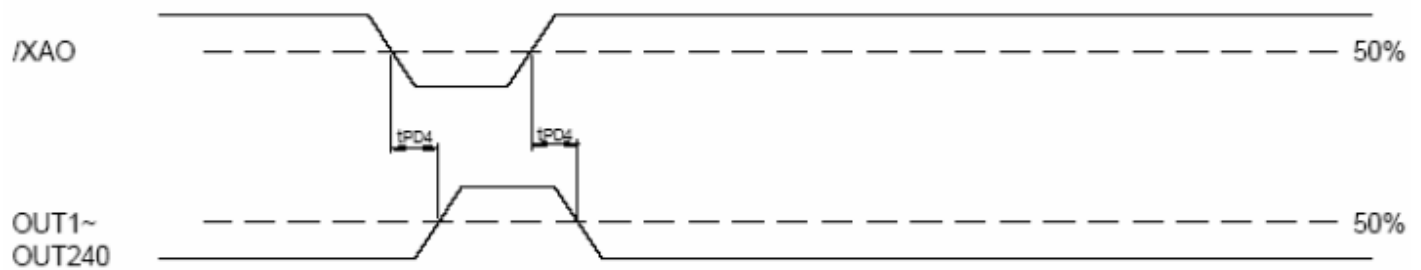
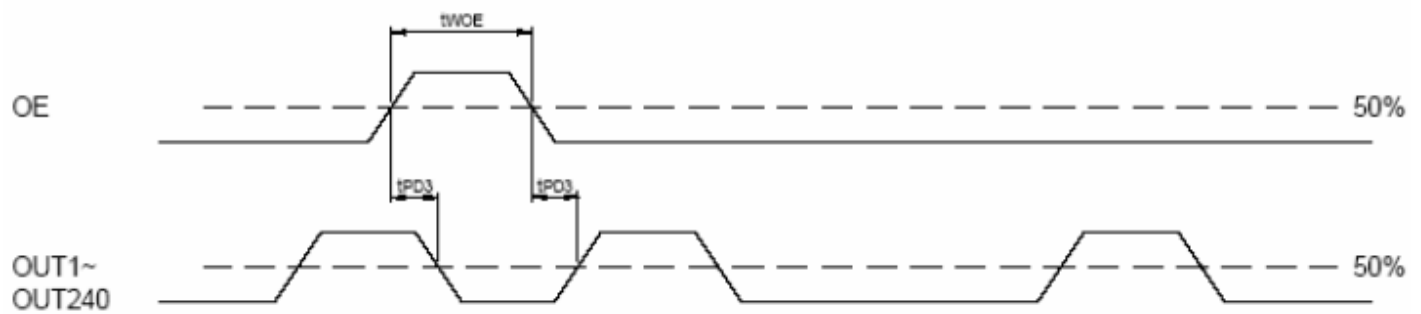
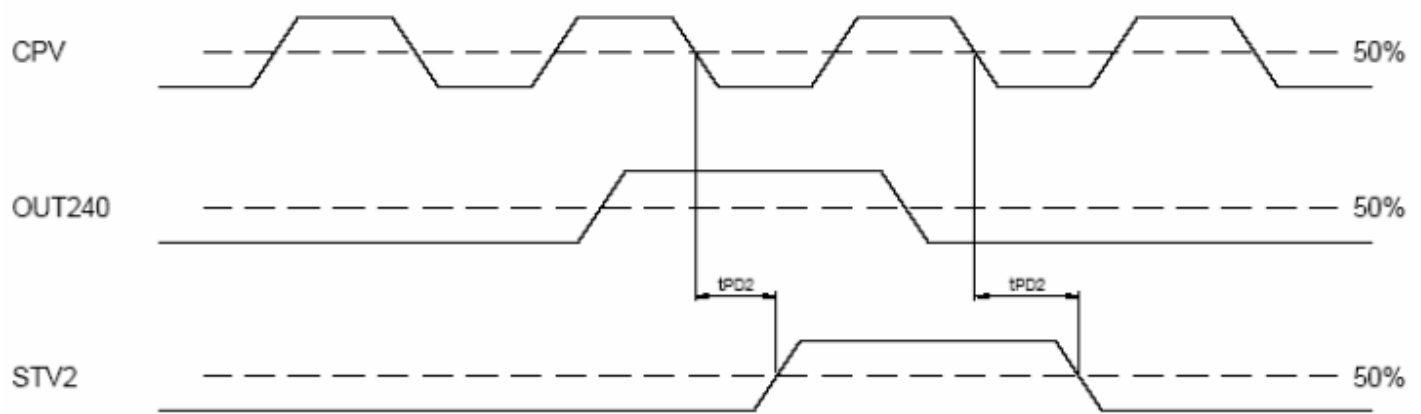
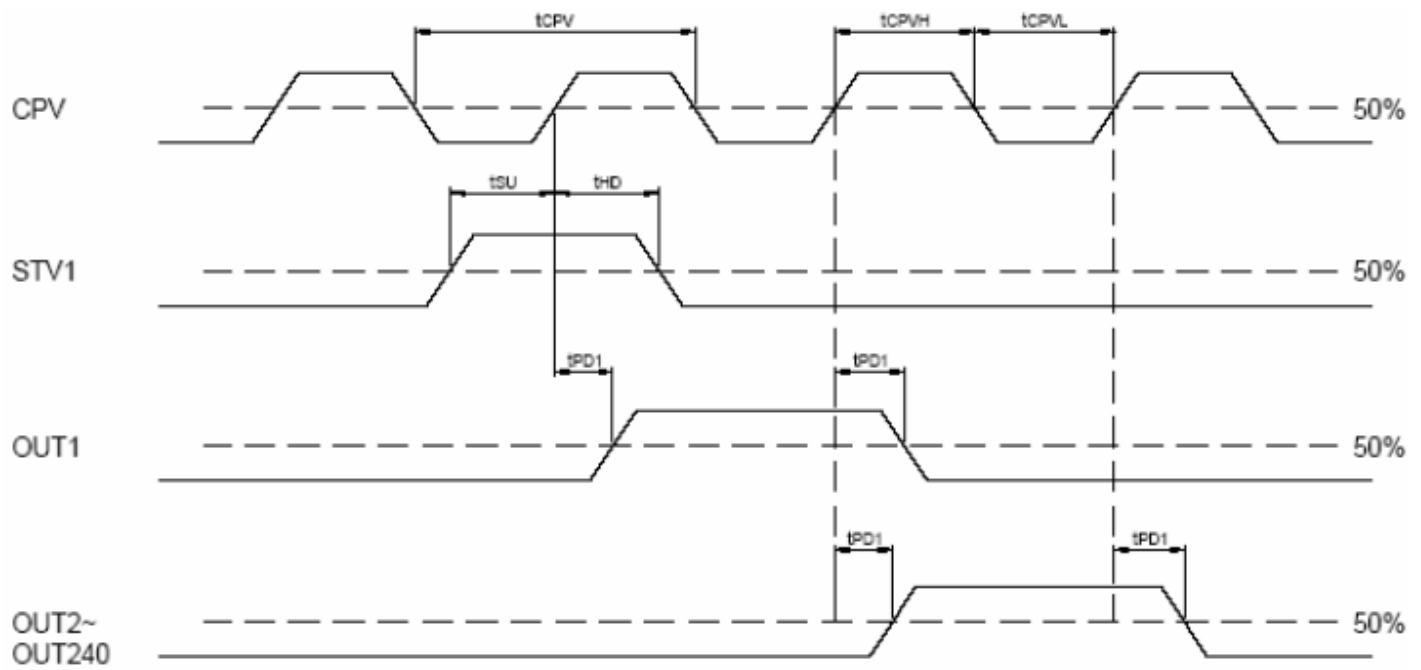


### ● SPI "write" timing



## Gate Driver Timing Chart

| Parameter           | Symbol      | Condition     | Spec |      | Unit    |
|---------------------|-------------|---------------|------|------|---------|
|                     |             |               | Min. | Max. |         |
| Operation frequency | tCPV        |               | 5    | -    | $\mu$ s |
| CPV pulse width     | tCPVH,tCPVL | 50%duty cycle | 2.5  | -    |         |
| OE pulse width      | twOE        |               | 1    | -    |         |
| Data setup time     | tsu         |               | 0.4  | -    | us      |
| Data hold time      | thd         |               | 0.7  | -    |         |
| Output delay time   | tpd1        | CL=300pF      | -    | 1    |         |
| Output delay time   | tpd2        | CL=300pF      | -    | 0.8  |         |
| Output delay time   | tpd3        | CL=300pF      | -    | 0.8  |         |
| Output delay time   | tpd4        | CL=300pF      | -    | 10   |         |



## 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 , 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.                    | +70°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 , 240hrs                                                             | 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<br>10 cycles                       |      |
| Vibration test                        | Endurance test applying vibration to simulate transportation and use.                                                           | 10-55Hz , 15mm amplitude.<br>60 sec in each of 3 directions X,Y,Z<br>For 15 minutes | 3    |
| Static electricity test               | Endurance test applying electric static discharge.                                                                              | VS=800V, RS=1.5kΩ, CS=100pF<br>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](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)

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