



RAYSTAR

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RFC35AL-AIW-DNC

SPECIFICATION

CUSTOMER:

| | |
|-------------|--|
| APPROVED BY | |
| PCB VERSION | |
| DATE | |

FOR CUSTOMER USE ONLY

| SALES BY | APPROVED BY | CHECKED BY | PREPARED BY |
|----------|-------------|------------|-------------|
| | | | |

Release DATE:

Revision History

| VERSION | DATE | REVISED PAGE NO. | Note |
|---------|------------|------------------|--------------------------------|
| 0 | 2016/03/07 | | First issue |
| A | 2016/06/01 | | Modify Touch Panel Information |

RAYSTAR OPTRONICS

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1.Module Classification Information

| | | | | | | | | | | | | |
|----------|----------|----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|
| R | F | C | 35 | AL | - | A | I | W | - | D | N | C |
| 1 | 2 | 3 | 4 | 5 | - | 6 | 7 | 8 | - | 9 | 10 | 11 |

| Item | Description | |
|------|---|--|
| 1 | R : Raystar Optronics Inc. | |
| 2 | Display Type : F→TFT Type, J→ Custom TFT | |
| 3 | Solution: A: 128x160 B:320x234 C:320x240 D:480x234 E:480x272 F:800x480 G:640x480 H:1024x600 I:320x480 J:240x320 K:1280x800 L:240x400 M:1024x768 N:128x128 O:480x800 P:640x320 Q:800x600 S:480x128 T:800x320 | |
| 4 | Display Size : 3.5" TFT | |
| 5 | Version Code. | |
| 6 | Model Type: A : TFT LCD E : TFT+FR+CONTROL BOARD J : TFT+FR+A/D BOARD N : TFT+FR+A/D BOARD+CONTROL BOARD S : TFT+FR+POWER BOARD (DC TO DC) 1 : TFT+CONTROL BOARD | 6 : TFT+FR H : TFT+D/V BOARD I : TFT+FR+D/V BOARD B : TFT+POWER BD |
| 7 | Polarizer Type, Temperature range, View direction | I→Transmissive, W. T, 6:00 ; C→Transmissive, N. T, 6:00 L→Transmissive, W.T,12:00 ; F→Transmissive, N.T,12:00 Y→Transmissive,W.T, IPS TFT ; A→Transmissive, N.T, IPS TFT Z→Transmissive, W.T, O-TFT R→Transmissive, Super W.T, O-TFT N→Transmissive, Super W.T, 6:00; Q→Transmissive, Super W.T, 12:00 V→Transmissive, Super W.T, VA TFT |
| 8 | Backlight | W : LED, White H : LED, High Light White F : CCFL, White |
| 9 | Driver Method | D: Digital A: Analog L : LVDS M:MIPI |
| 10 | Interface | N : without control board A : 8Bit B : 16Bit S:SPI Interface R: RS232 U:USB I: I2C |
| 11 | TS | N : Without TS S : resistive touch panel C : capacitive touch panel capacitive touch panel (G-F-F) G : capacitive touch panel(G-G) |

2.Summary

This technical specification applies to 3.45' color TFT-LCD panel. The 3.45' color TFT-LCD panel is designed for camcorder, digital camera application and other electronic products which require high quality flat panel displays. This module follows RoHS.

RAYSTAR OPTRONICS

3.General Specifications

- Size: 3.5 inch
- Dot Matrix: 320 x RGBx240(TFT) dots
- Module dimension: 76.9x 63.9x 4.52 mm
- Active area: 70.08 x 52.56 mm
- Dot pitch: 0.073 x 0.219 mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12o'clock
- Gray Scale Inversion Direction: 6 o'clock
- Backlight Type: LED ,Normally White
- With /Without TP: With CTP
- Surface: Glare

*Color tone slight changed by temperature and driving voltage.

4.Interface

4.1. LCM PIN Definition

| Pin | Symbol | Function | Remark |
|-----|--------|--|--------|
| 1 | LED- | Power for LED backlight cathode | |
| 2 | LED- | Power for LED backlight cathode | |
| 3 | LED+ | Power for LED backlight anode | |
| 4 | LED+ | Power for LED backlight anode | |
| 5 | NC | No connect | |
| 6 | NC | No connect | |
| 7 | NC | No connect | |
| 8 | /RESET | Hardware reset | |
| 9 | SPENA | Chip select pin of serial interface | |
| 10 | SPCLK | Clock pin of serial interface | |
| 11 | SPDAT | Data input pin in serial mode | |
| 12 | B0 | Data bus | |
| 13 | B1 | Data bus | |
| 14 | B2 | Data bus | |
| 15 | B3 | Data bus | |
| 16 | B4 | Data bus | |
| 17 | B5 | Data bus | |
| 18 | B6 | Data bus | |
| 19 | B7 | Data bus | |
| 20 | G0 | Data bus | |
| 21 | G1 | Data bus | |
| 22 | G2 | Data bus | |
| 23 | G3 | Data bus | |
| 24 | G4 | Data bus | |
| 25 | G5 | Data bus | |
| 26 | G6 | Data bus | |
| 27 | G7 | Data bus | |
| 28 | R0 | Data bus | |
| 29 | R1 | Data bus | |
| 30 | R2 | Data bus | |
| 31 | R3 | Data bus | |
| 32 | R4 | Data bus | |
| 33 | R5 | Data bus | |
| 34 | R6 | Data bus | |
| 35 | R7 | Data bus | |
| 36 | HSYNC | Line synchronization signal | |
| 37 | VSYNC | Frame synchronization signal | |
| 38 | DCLK | Dot-clock signal and oscillator source | |
| 39 | NC | No connect | |
| 40 | NC | No connect | |
| 41 | VCC | Power Supply | |
| 42 | VCC | Power Supply | |

| | | | |
|-----------|-------------|--|--|
| 43 | NC | No connect | |
| 44 | NC | No connect | |
| 45 | NC | No connect | |
| 46 | NC | No connect | |
| 47 | NC | No connect | |
| 48 | SEL2 | Input pin to select input interface mode | |
| 49 | SEL1 | Input pin to select input interface mode | |
| 50 | SEL0 | Input pin to select input interface mode | |
| 51 | NC | No connect | |
| 52 | DE | Display enable pin from controller. Internal pull high Connect to VDDIO or floating if not used | |
| 53 | DGND | System ground pin of the IC. Connect to system ground. | |
| 54 | AVSS | Grounding for analog circuit -Connect to system ground | |

Note:

1. The mode control (SEL2) not use, it can't control CCIR601 interface, If not use CCIR601, it can floating.
2. For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used. Suggest used SYNC mode!!_
3. Usually pull high._
4. IF select serial RGB or CCIR601/656 input mode is selected, only DX0-DX7 used, and the other short to GND, Only selected serial RGB_CCIR601/656 interface, DX BUS will enable, Digital input mode DX0 is LSB and DX7 is MSB.
5. Control the input data format

| SEL2 | SEL1 | SEL0 | Format | Operating Frequency |
|-------------|-------------|-------------|---|----------------------------|
| 0 | 0 | 0 | Parallel-RGB data format (only support stripe type color filter) | 6.5MHZ |
| 0 | 0 | 1 | Serial-RGB data format | 19.5 MHZ |
| 0 | 1 | 0 | CCIR 656data format (640RGB) | 24.54 MHZ |
| 0 | 1 | 1 | CCIR 656data format (720RGB) | 27 MHZ |
| 1 | 0 | 0 | YUV mode A data format(Cr-Y-Cb-Y) | 24.54 MHZ |
| 1 | 0 | 1 | YUV mode A data format(Cr-Y-Cb-Y) | 27 MHZ |
| 1 | 1 | 0 | YUV mode B data format(Cr-Y-Cr-Y) | 27 MHZ |
| 1 | 1 | 1 | YUV mode B data format(Cr-Y-Cr-Y) | 24.54 MHZ |

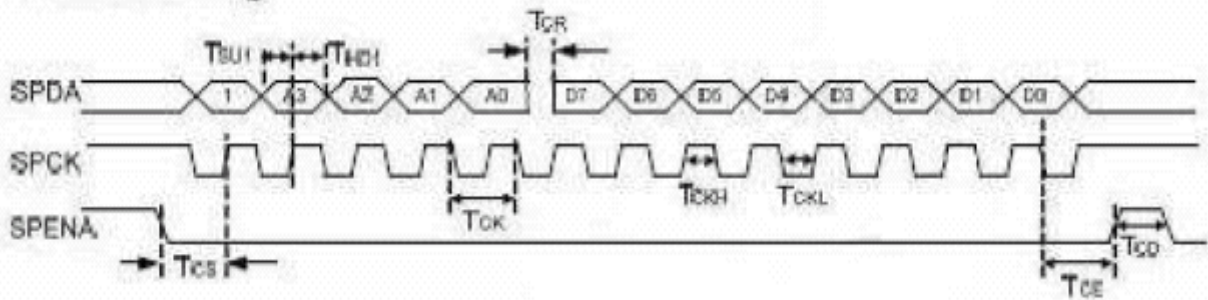
| Input format | DOTCLK Ferg(MHz) | Display Data | Active Area (DOTCLK) |
|---------------------|-------------------------|---------------------|-----------------------------|
| YUV mode | 24.54 | 640 | 1280 |
| | 27 | 720 | 1440 |

| Mode | D[23:16] | D[15:8] | D[7:0] | IHS | IVS | DEN |
|--------------|-----------------|----------------|---------------|------------|------------|------------------|
| ITU-R BT 656 | D[23:16] | GND | GND | NC | NC | NC |
| ITU-R BT 601 | D[23:16] | GND | GND | IHS | IVS | NC |
| 8 bit RGB | D[23:16] | GND | GND | IHS | IVS | NC for HV Mode |
| | | | | | | DEN for DEN Mode |
| 24 bit RGB | R[7:0] | G[7:0] | B[7:0] | IHS | IVS | NC for HV Mode |
| | | | | | | DEN for DEN Mode |

SPI timing Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------|--------|------|------|------|------|
| SPCK period | Tcx | 60 | - | - | ns |
| SPCK high width | Tcxh | 30 | - | - | ns |
| SPCK low width | Tcxl | 30 | - | - | ns |
| Data setup time | Tsu1 | 12 | - | - | ns |
| Data hold time | Thd1 | 12 | - | - | ns |
| SPENA to SPCK setup time | Tcs | 20 | - | - | ns |
| SPENA to SPDA hold time | Tce | 20 | - | - | ns |
| SPENA high pulse width | Tcd | 50 | - | - | ns |
| SPDA output latency | Tcs | - | 1/2 | - | Tcx |

● SPI read timing



● SPI write timing

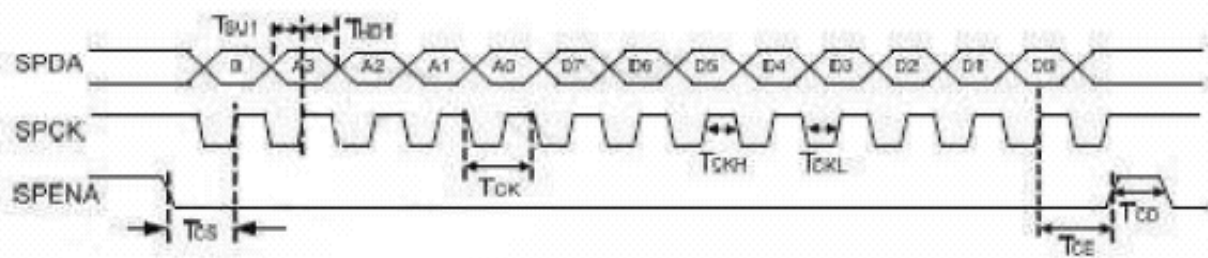


Figure11 SPI read and write timing

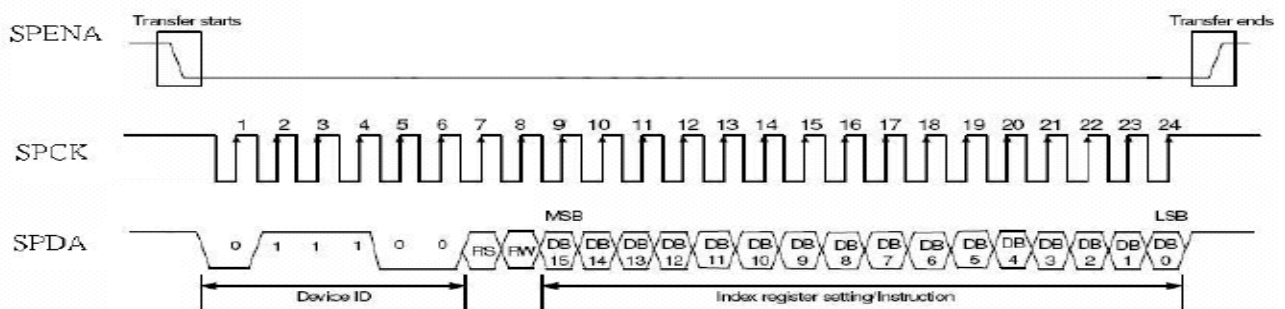


Figure12 SPI timing

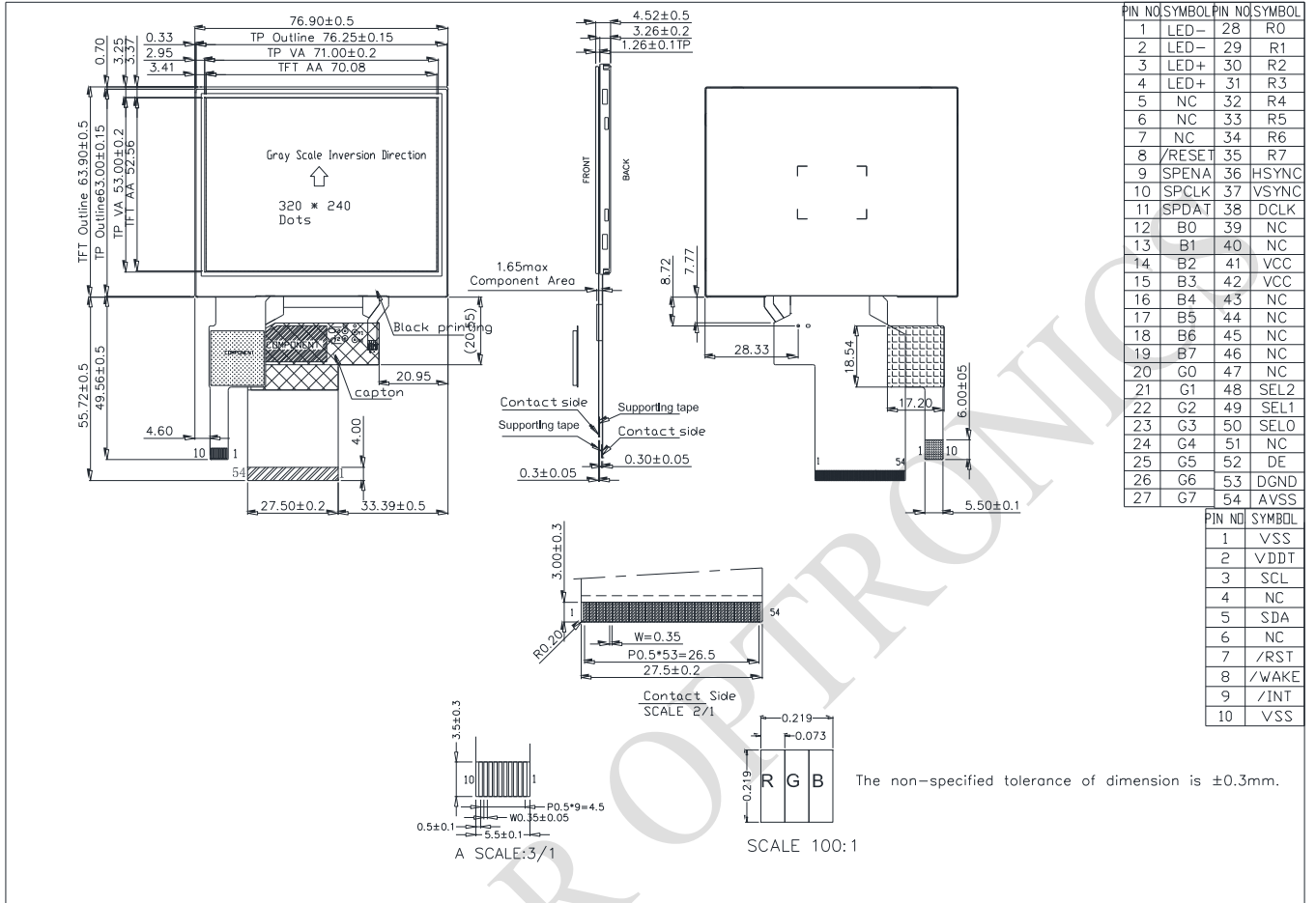
Basic Display Color and Gray Scale

| Color | | Input Color Data | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------|---------------|------------------|----|----|----|----|-----|-------|----|----|----|----|-----|------|----|----|----|----|-----|----|----|----|----|----|----|
| | | Red | | | | | | Green | | | | | | Blue | | | | | | | | | | | |
| | | MSB | | | | | LSB | MSB | | | | | LSB | MSB | | | | | LSB | | | | | | |
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Colors | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Red | Red(0) Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Red(253) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(254) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red(255) Bright | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Green | Green(0) Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Green(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Green(255) Bright | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Blue | Blue(0) Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Blue(253) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| Blue(255) Bright | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

4.2. CTP PIN Definition

| Pin | Symbol | Function | Remark |
|-----|--------|---|--------|
| 1 | VSS | System ground pin of the IC. Connect to system ground. | |
| 2 | VDDT | Power Supply : +3.3V | |
| 3 | SCL | SPI Slave mode, chip select, active low / I2C clock input | |
| 4 | NC | No connect | |
| 5 | SDA | SPI Slave mode, data input / I2C data input and output | |
| 6 | NC | No connect | |
| 7 | /RST | External Reset, Low is active | |
| 8 | /WAKE | External interrupt from the host | |
| 9 | /INT | External interrupt to the host | |
| 10 | VSS | System ground pin of the IC. Connect to system ground. | |

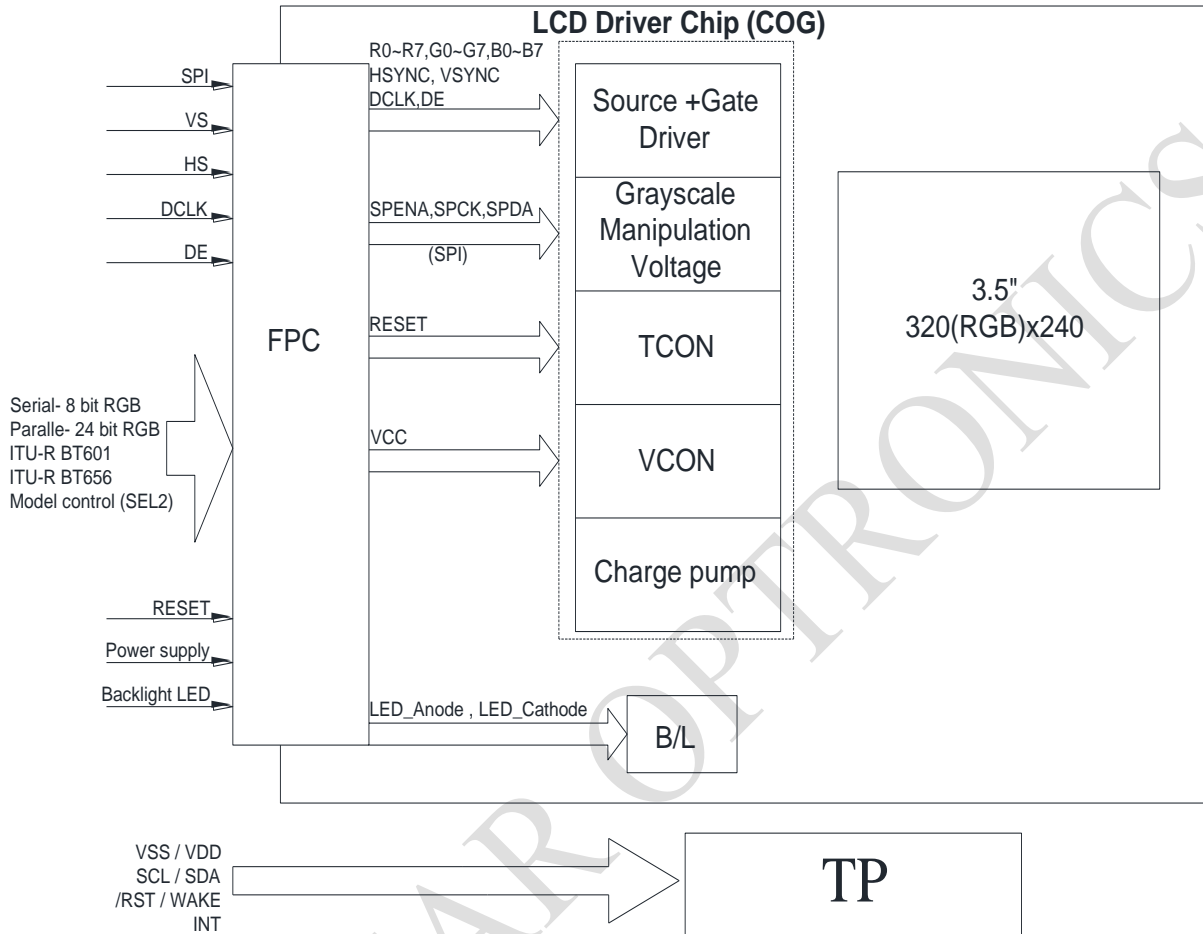
5. Contour Drawing



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

6. Block Diagram

LCD Panel

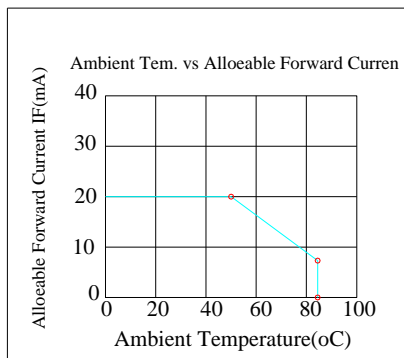


7. Absolute Maximum Ratings

| Item | Symbol | Min | Typ | Max | Unit |
|-----------------------|--------|-----|-----|-----|------|
| Operating Temperature | TOP | -20 | — | +70 | °C |
| Storage Temperature | TST | -30 | — | +80 | °C |

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

- Temp. $\leq 60^{\circ}\text{C}$, 90% RH MAX. Temp. $> 60^{\circ}\text{C}$, Absolute humidity shall be less than 90% RH at 60°C



8. Electrical Characteristics

8.1. Operating conditions:

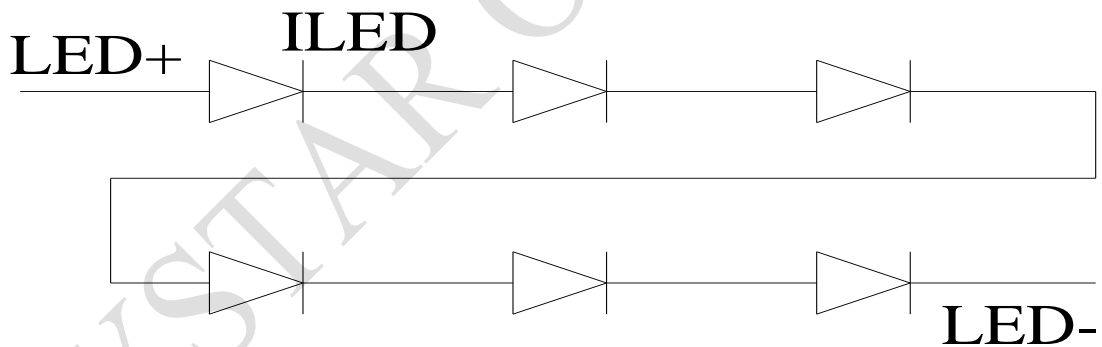
| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|--------------------------------|--------|-----------|-----|-----|-----|------|--------|
| Supply Voltage For LCM | VCC | — | 3.0 | 3.3 | 3.6 | V | |
| Supply Current For LCM | ICC | — | — | 8.6 | 15 | mA | Note 1 |
| Supply Voltage For Touch Logic | VDDT | — | 2.8 | - | 3.3 | V | |

Note 1 : This value is test for VDD=3.3V , Ta=25 °C only

8.2. LED driving conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------|--------|------|--------|------|------|------------|
| LED current | | - | 20 | - | mA | |
| Power Consumption | | 348 | 384 | 408 | mW | |
| LED voltage | LED+ | 17.4 | 19.2 | 20.4 | V | Note 1 |
| LED Life Time | | - | 50,000 | - | Hr | Note 2,3,4 |

Note 1 : There are 1 Groups LED



Note 2 : Ta = 25 °C

Note 3 : Brightness to be decreased to 50% of the initial value

Note 4 : The single LED lamp case

9.DC CHARATERISTICS

| Parameter | Symbol | Rating | | | Unit | Condition |
|--------------------------|----------|--------|-----|--------|------|-----------|
| | | Min | Typ | Max | | |
| Low level input voltage | V_{IL} | 0 | - | 0.3VCC | V | |
| High level input voltage | V_{IH} | 0.7VCC | - | VCC | V | |

RAYSTAR OPTRONICS

10.AC Characteristics

Digital Parallel RGB interface

| Signal | Item | Symbol | Min | Typ | Max | Unit |
|--------|----------------|--------|-----|-----|-----|------|
| Dclk | Frequency | Tosc | - | 6.5 | 10 | MHz |
| | High Time | Tch | - | 77 | - | ns |
| | Low Time | Tcl | - | 77 | - | ns |
| Data | Setup Time | Tsu | 12 | - | - | ns |
| | Hold Time | Thd | 12 | - | - | ns |
| Hsync | Period | TH | - | 408 | | Tosc |
| | Pulse Width | THS | 5 | 30 | - | Tosc |
| | Back-Porch | Thb | - | 38 | - | Tosc |
| | Display Period | TEP | - | 320 | - | Tosc |
| | Hsync-den time | THE | 36 | 68 | 88 | - |
| | Front-Porch | Thf | - | 20 | - | Tosc |
| Vsync | Period | Tv | - | 262 | - | TH |
| | Pulse Width | Tvs | 1 | 3 | 5 | TH |
| | Back-Porch | Tvb | - | 15 | - | TH |
| | Display Period | Tvd | - | 240 | - | TH |
| | Front-Porch | Tvf | 2 | 4 | - | TH |

Note:

1. $T_{hp} + T_{hb} = 68$, the user is make up by yourself.
2. $T_v = T_{vs} + T_{vb} + T_{vd} + T_{vf}$, the user is make up by yourself.
3. When SYNC mode is used, 1st data start from 68th Dclk after Hsync falling

CCIR601/656 Interface

| Signal | Item | Symbol | Min | Typ | Max | Unit |
|--------|------------|--------|-----|-----|-----|------|
| Dclk | Frequency | Tosc | - | 37 | - | ns |
| | High Time | Tch | - | 78 | - | ns |
| | Low Time | Tcl | - | 78 | - | ns |
| Data | Setup Time | Tsu | 12 | - | - | ns |
| | Hold Time | Thd | 12 | - | - | ns |

10.1. Waveform

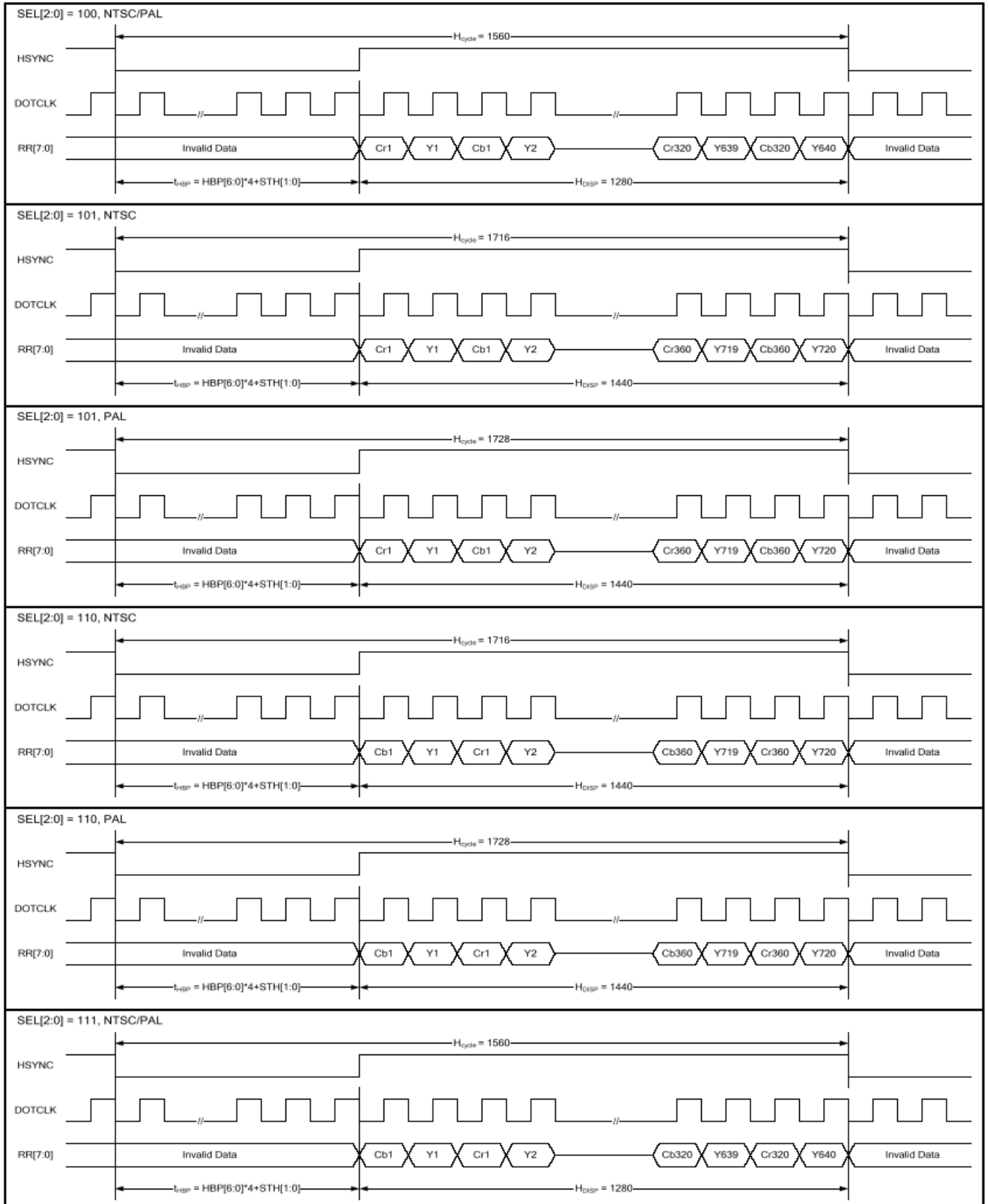


Figure 1 CCIR601 Horizontal Timing

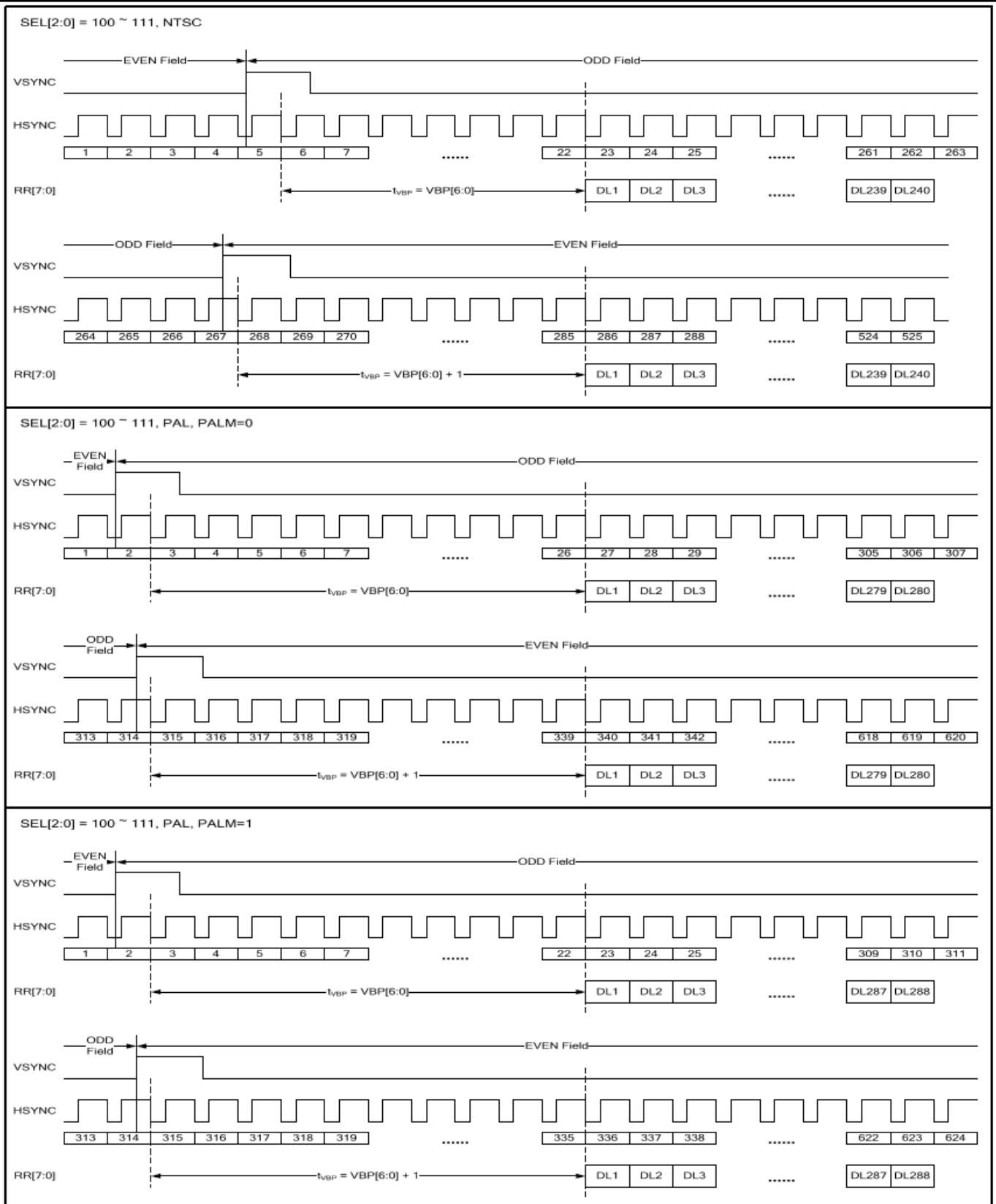


Figure 1 CCIR601 Vertical Timing

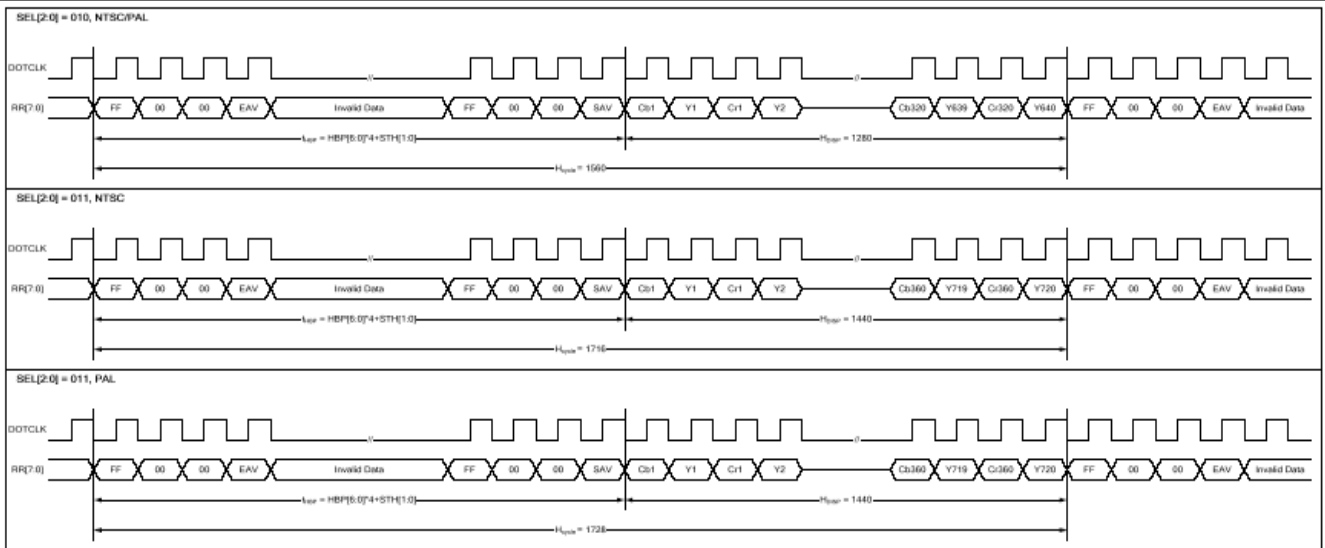


Figure 2 CCIR656 Horizontal Timing

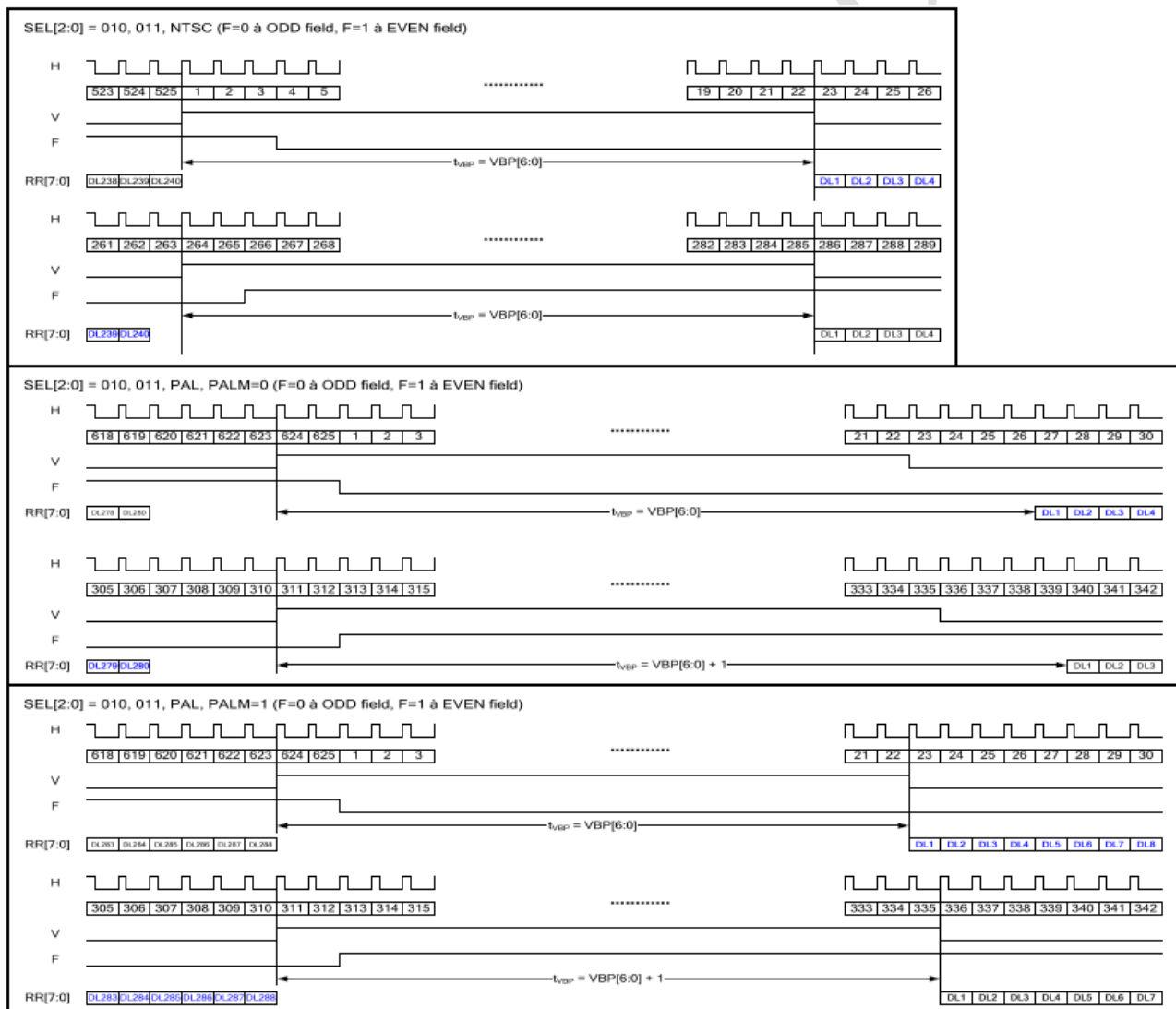


Figure 2 CCIR656 Vertical Timing

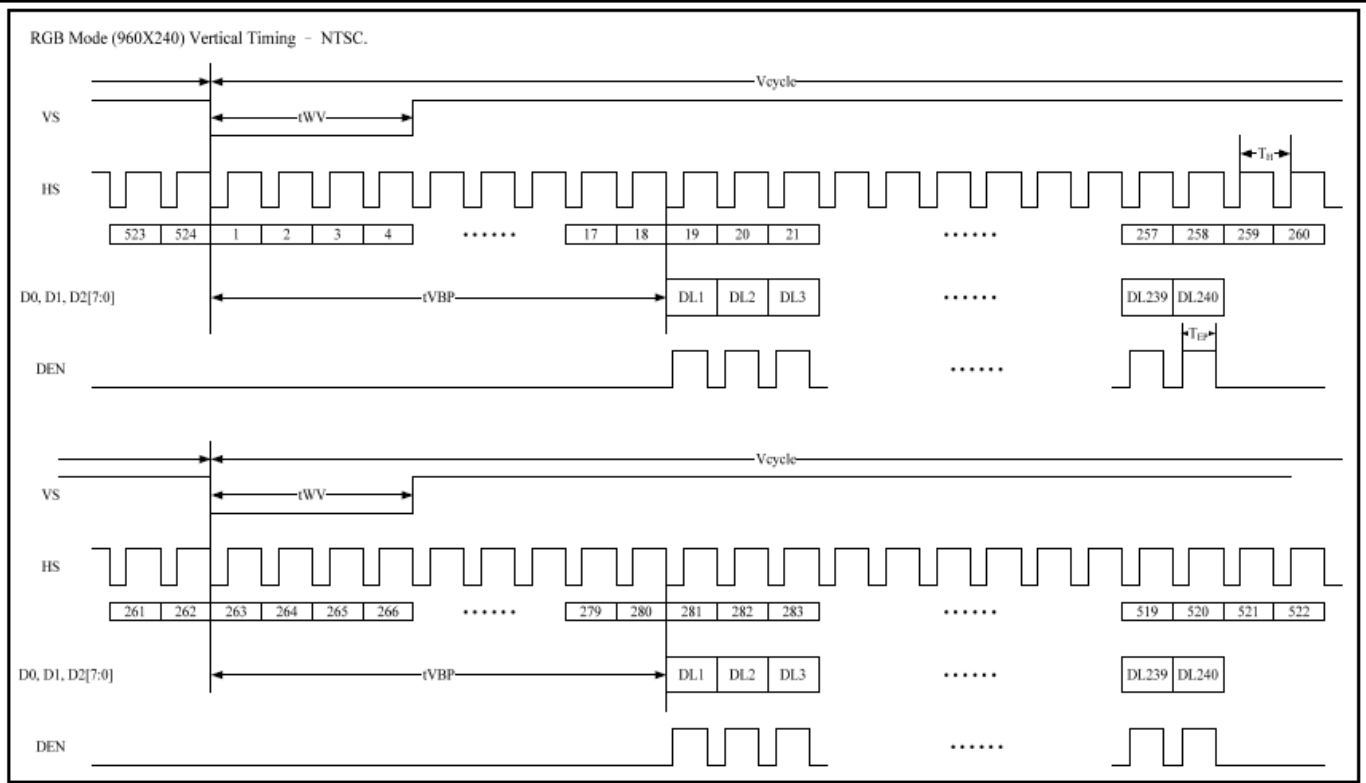
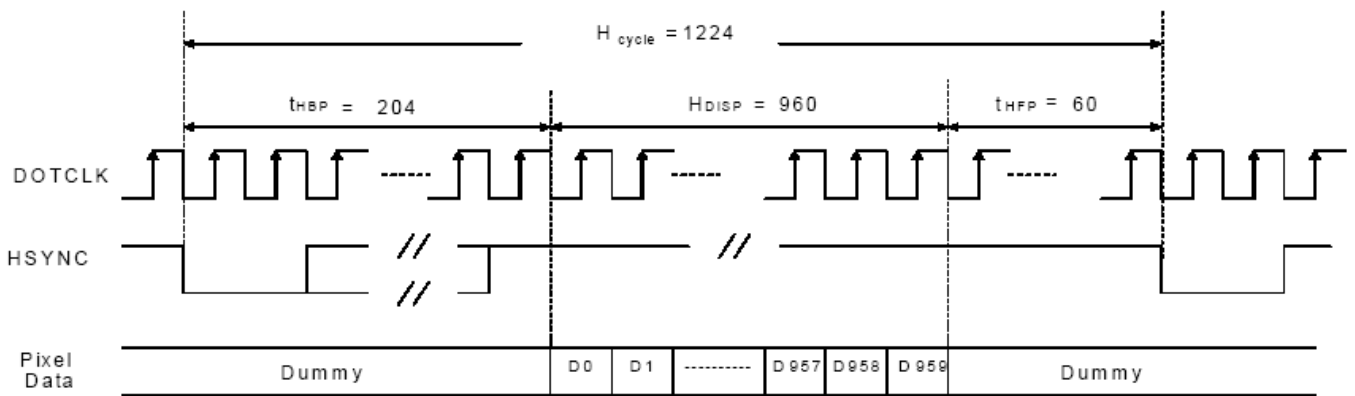
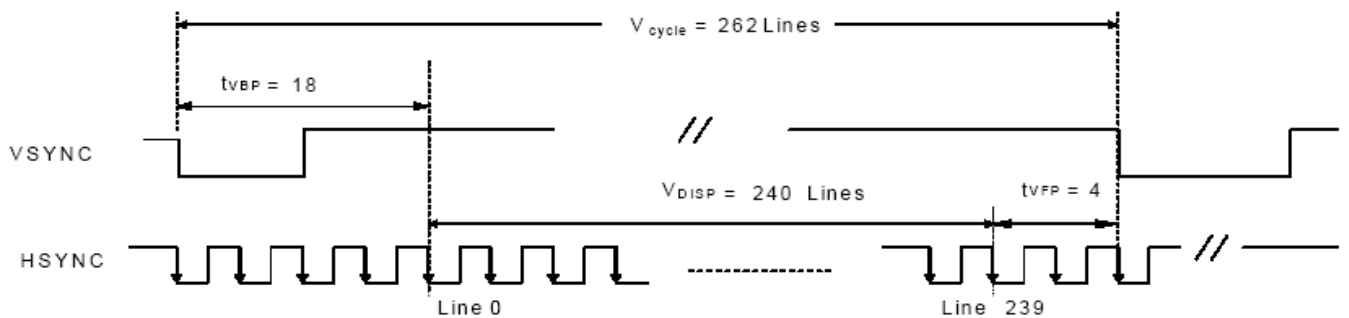


Figure 3 Digital RGB NTSC mode Vertical Data Format for 262T_H



a) Horizontal Data Transaction Timing



Vertical Data Transaction Timing

Figure 3 Data Transaction Timing in Serial RGB (8 bit) Interface (SYNC Mode)

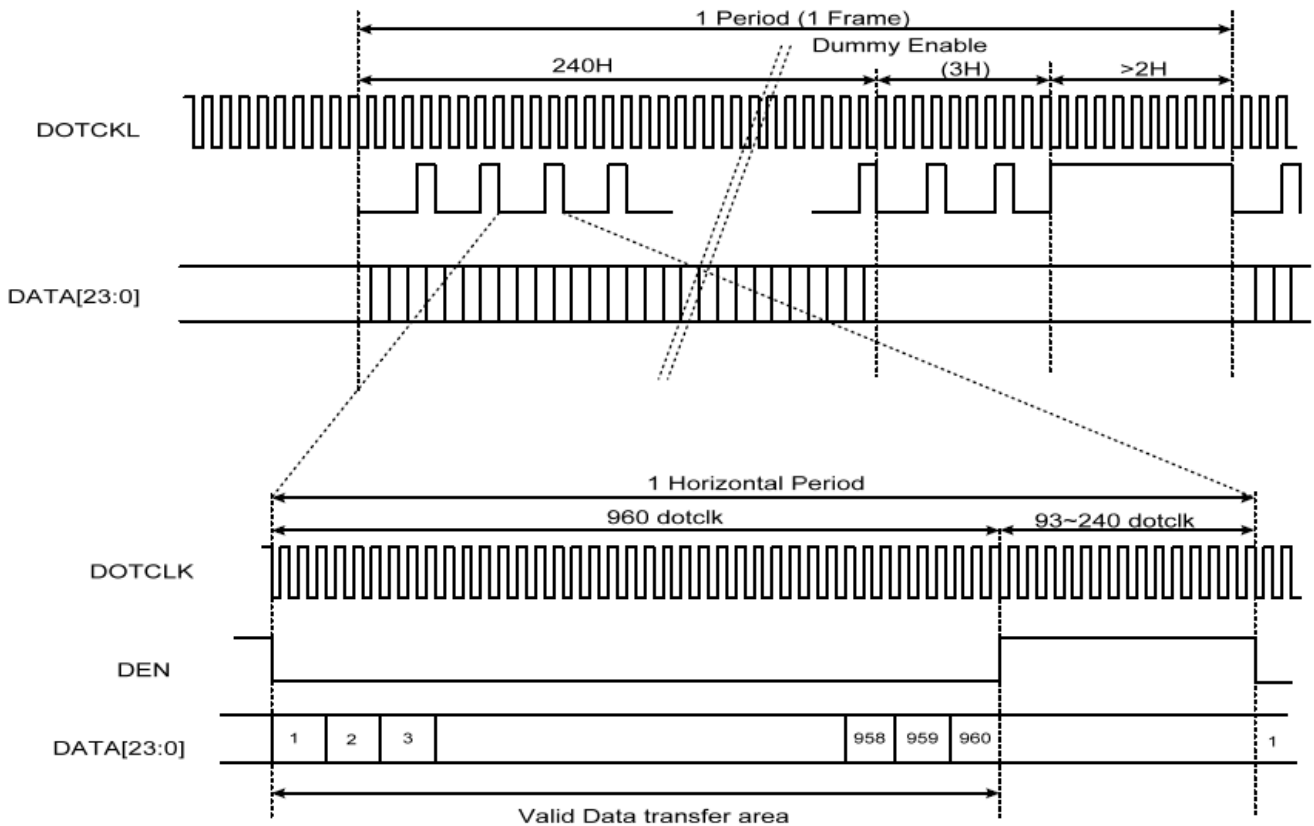
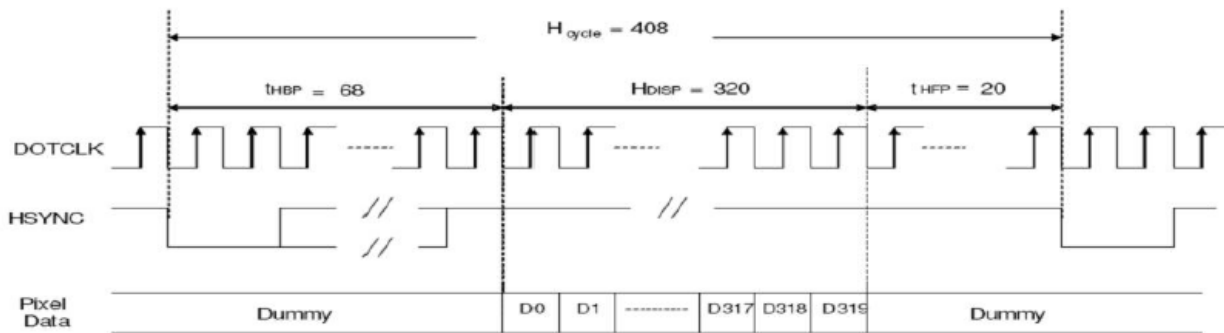
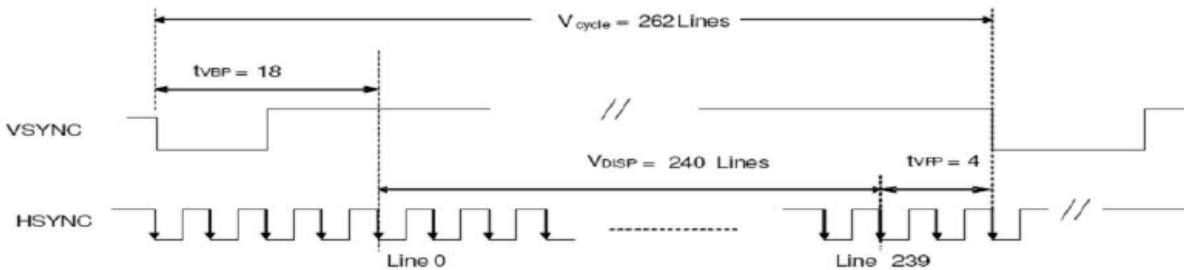


Figure 3 Data Transaction Timing in Serial RGB (8 bit) Interface (DE Mode)



a) Horizontal Data Transaction Timing



b) Vertical Data Transaction Timing

Figure 3 Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)

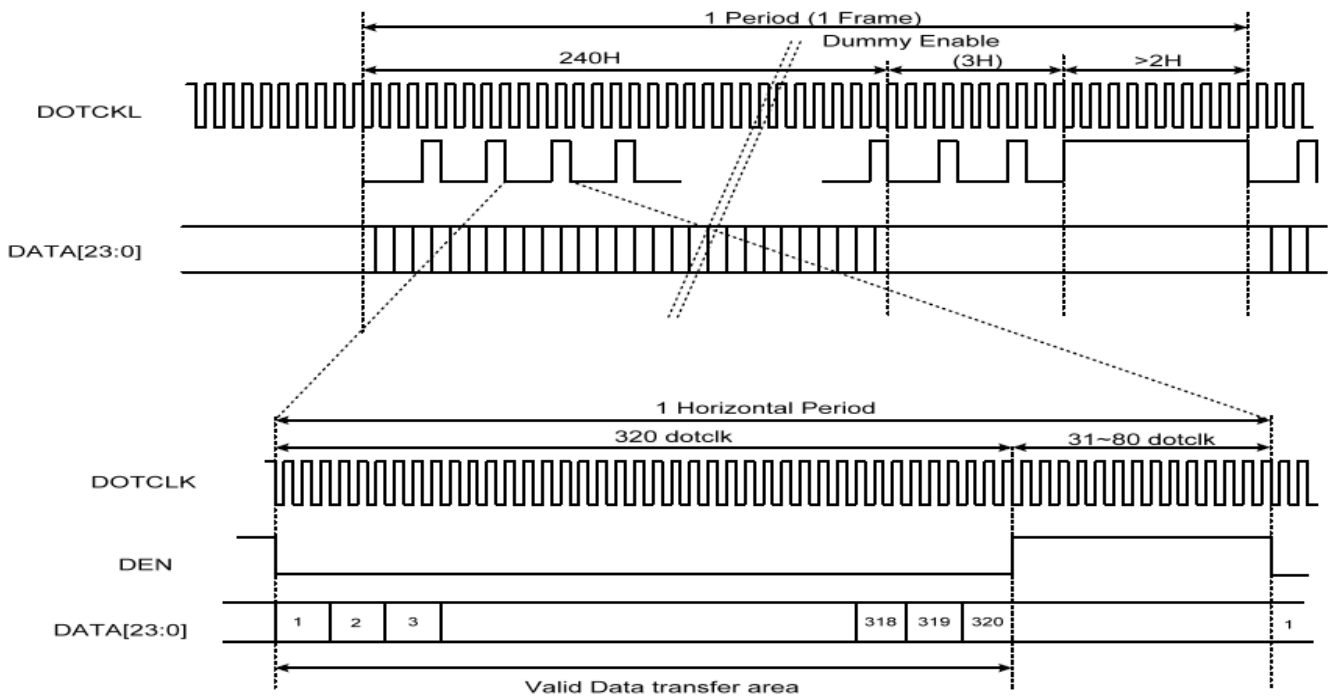


Figure 3 Data Transaction Timing in Parallel RGB (24 bit) Interface (DE Mode)

10.2. Clock and Sync waveforms

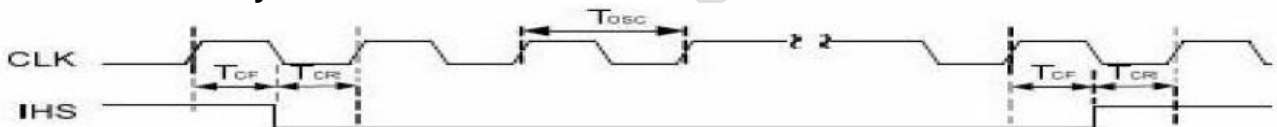


Figure 6 CLK and IHS timing waveform

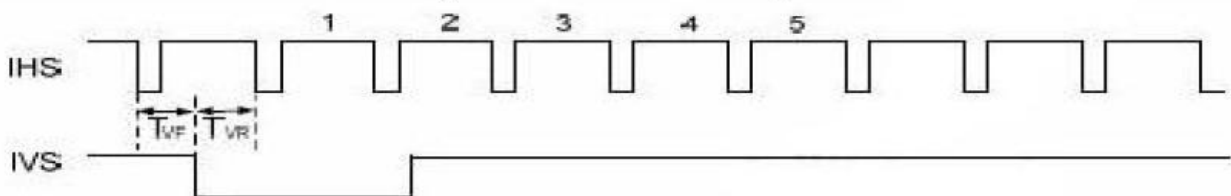
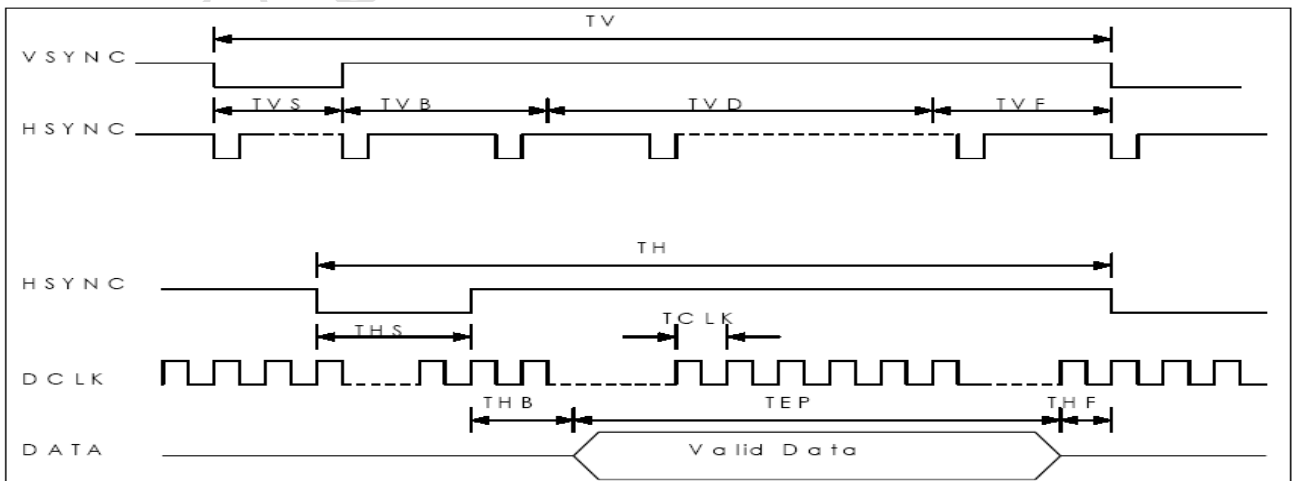
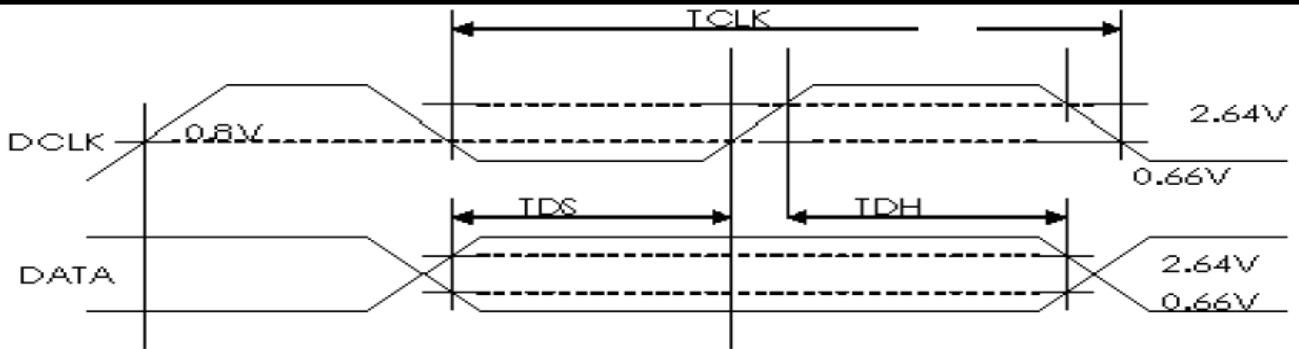


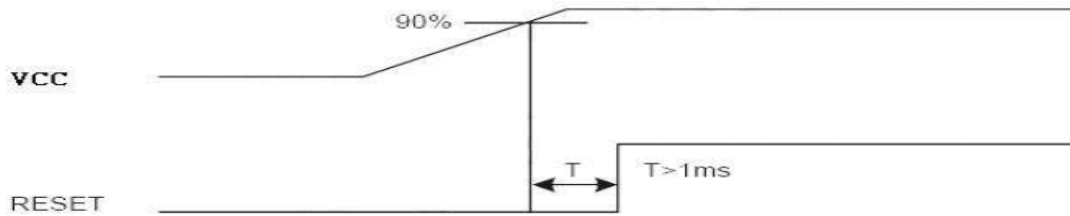
Figure 4 IHS and IVS timing waveforms





10.3. Reset Timing Chart

The RESET input must be held at least 1ms after power is stable



Reset timing

11. Optical Characteristics

| Item | Symbol | Condition. | Min | Typ | Max | Unit | Remark | |
|---|--------|-----------------------------------|------------|------|------|-------------------|-------------------|--------|
| Response time | Tr | $\theta=0^\circ$ 、 $\phi=0^\circ$ | - | 10 | - | ms | Note 3,5 | |
| | Tf | | - | 15 | - | ms | | |
| Contrast ratio | CR | At optimized viewing angle | 300 | 350 | - | - | Note 4,5 | |
| Color Chromaticity | White | $\theta=0^\circ$ 、 $\phi=0^\circ$ | 0.26 | 0.31 | 0.36 | - | Note 2,6,7 | |
| | Wy | | 0.28 | 0.33 | 0.38 | - | | |
| Viewing angle (Gray Scale Inversion Direction) | Hor. | $CR \geq 10$ | θ_R | - | 55 | - | Deg. | Note 1 |
| | | | θ_L | - | 55 | - | | |
| | Ver. | | ϕ_T | - | 45 | - | | |
| | | | ϕ_B | - | 50 | - | | |
| Brightness | - | - | 280 | 340 | - | cd/m ² | Center of display | |

Ta=25±2°C, IL=20mA

Note 1: Definition of viewing angle range

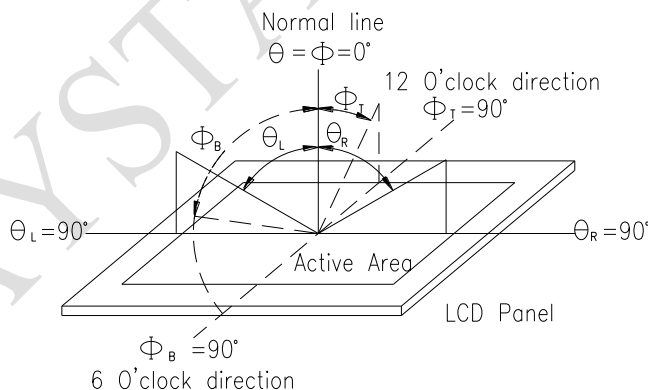


Fig. 11.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 or BM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

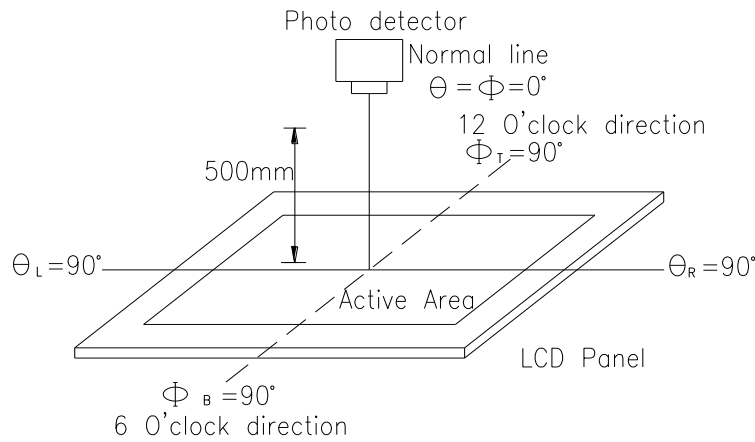
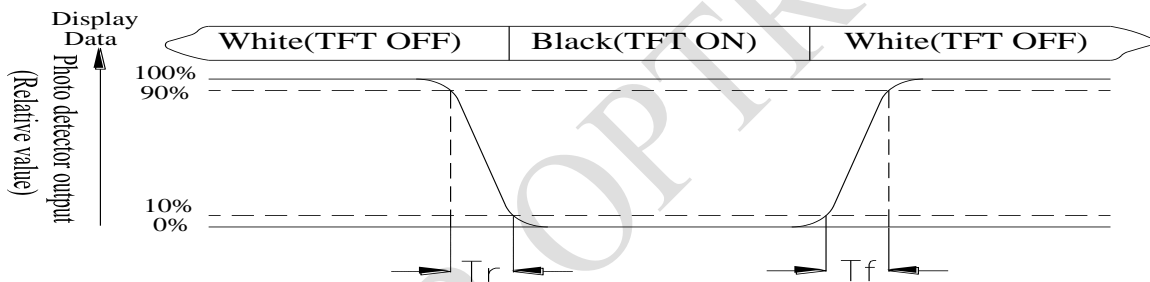


Fig. 11.2. Optical measurement system setup

Note 3: Definition of Response time:

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time, T_r , is the time between photo detector output intensity changed from 90% to 10%. And fall time, T_f , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: White $V_i = V_{i50} \pm 1.5V$

Black $V_i = V_{i50} \pm 2.0V$

“±” means that the analog input signal swings in phase with VCOM signal.

“±” means that the analog input signal swings out of phase with VCOM signal.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

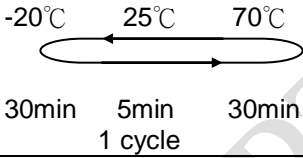
Note 6: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

12. Reliability

Content of Reliability Test (Wide temperature, -20°C ~70°C)

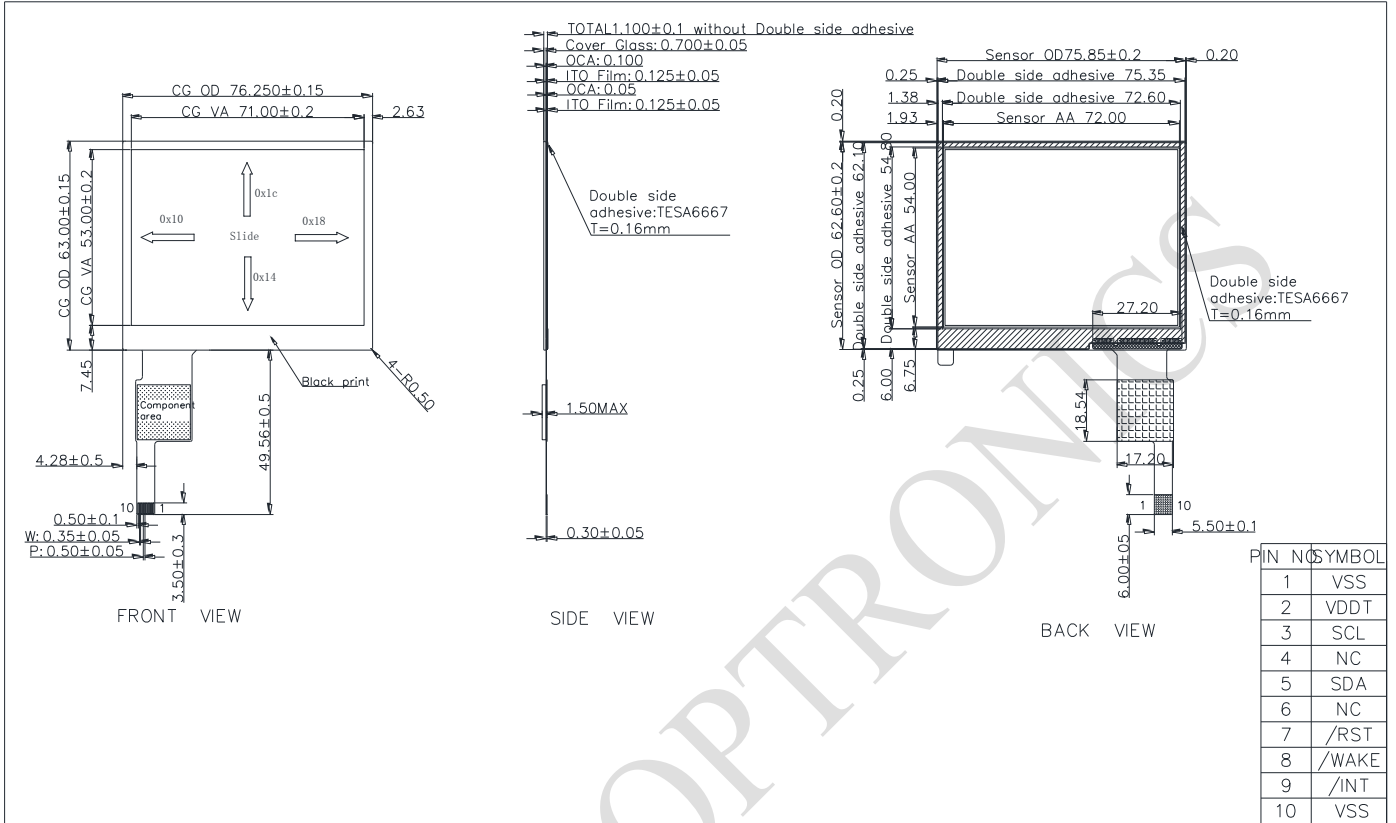
| Environmental Test | | | |
|--------------------------------------|--|---|------|
| Test Item | Content of Test | Test Condition | Note |
| High Temperature storage | Endurance test applying the high storage temperature for a long time. | 80°C 200hrs | 2 |
| Low Temperature storage | Endurance test 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 thermal stress to the element for a long time. | 70°C 200hrs | — |
| Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | -20°C 200hrs | 1 |
| High Temperature/ Humidity Operation | The module should be allowed to stand at 60°C, 90%RH max | 60°C, 90%RH 96hrs | 1,2 |
| Thermal shock resistance | The sample should be allowed stand the following 10 cycles of operation <div style="text-align: center;">  <p>-20°C 25°C 70°C</p> <p>30min 5min 30min</p> <p>1 cycle</p> </div> | -20°C/70°C 10 cycles | — |
| Vibration test | Endurance test applying the vibration during transportation and using. | Total fixed amplitude : 3 15mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes | 3 |
| Static electricity test | Endurance test applying the electric stress to the terminal. | VS=±600V(contact) ,±800v(air), RS=330Ω CS=150pF 10 times | — |

Note1: No dew condensation to be observed.

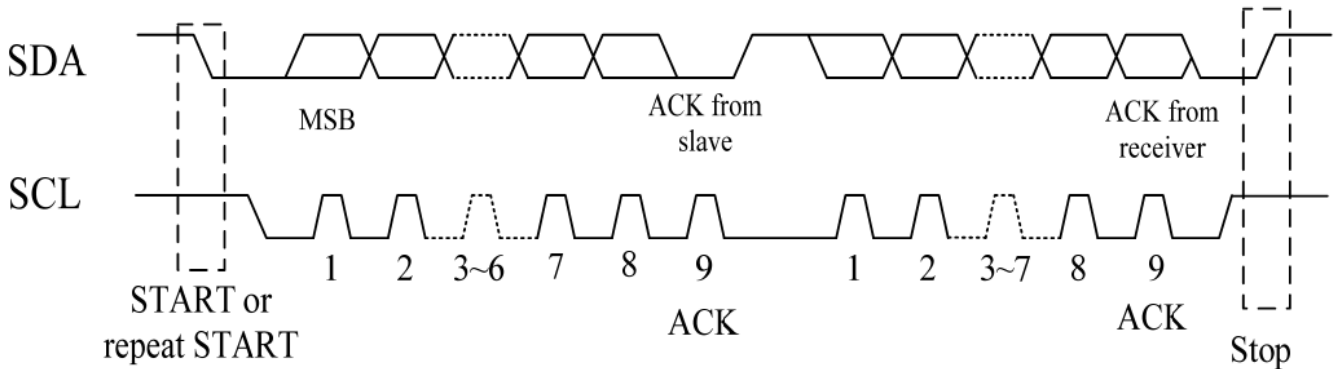
Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

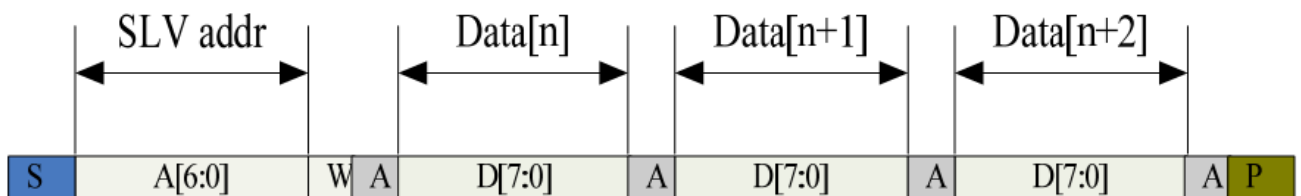
13.Touch Panel Information



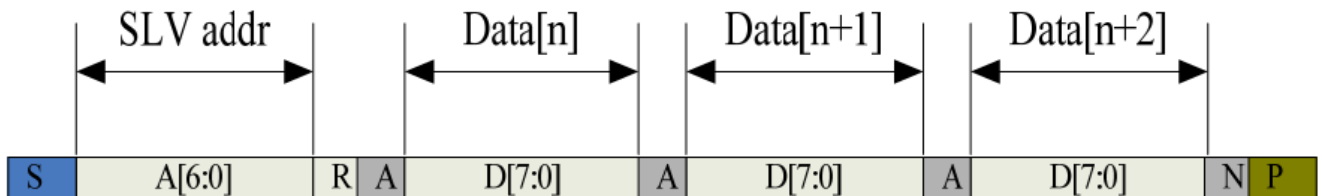
13.1. CTP I2C Timing:



I2C Serial Data Transfer Format



I2C master write, slave read



I2C master read, slave write

| Mnemonics | Description |
|-----------|---|
| S | 12C Start or 12C Restart |
| A[6:0] | Slave address |
| R/W | READ/WRITE bit, '1' for read, '0' for write |
| A(N) | ACK(NACK) bit |
| P | STOP :the indication of the end of a packet(if this bit is missing, S will indicate the end of the current packet and beginning of the next packet) |

Lists the meanings of the mnemonics used in the above figures

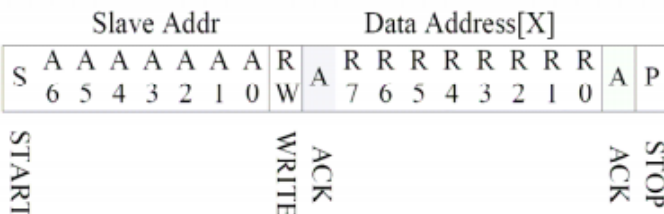
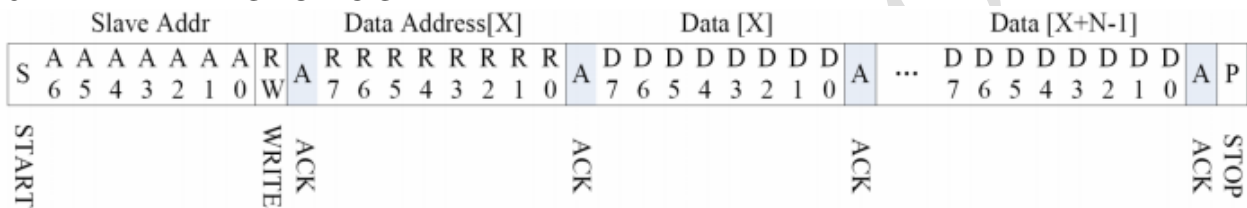
| Parameter | Unit | Min | Max |
|--|------|-----|-----|
| SCL frequency | KHz | 0 | 400 |
| Bus free time between a STOP and START condition | us | 4.7 | \ |
| Hold time (repeated) START condition | us | 4.0 | \ |
| Data setup time | ns | 250 | \ |
| Setup time for a repeated START condition | us | 4.7 | \ |
| Setup time for STOP condition | us | 4.0 | \ |

Interface Timing Characteristics

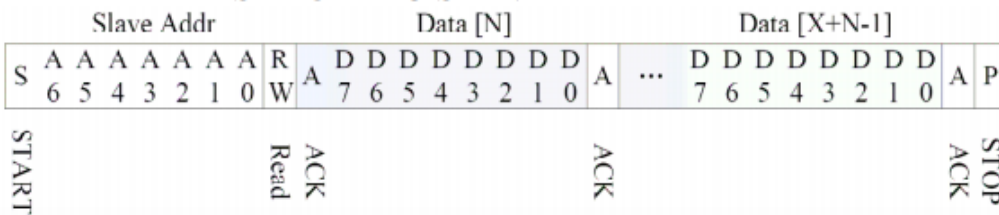
AS FOR STANDARD CTM, HOST NEED TO USE BOTH INTERRUPT CONTROL SIGNAL AND SERIAL DATA INTERFACE TO GET THE TOUCH DATA.

HERE IS THE TIMING TO GET TOUCH DATA.

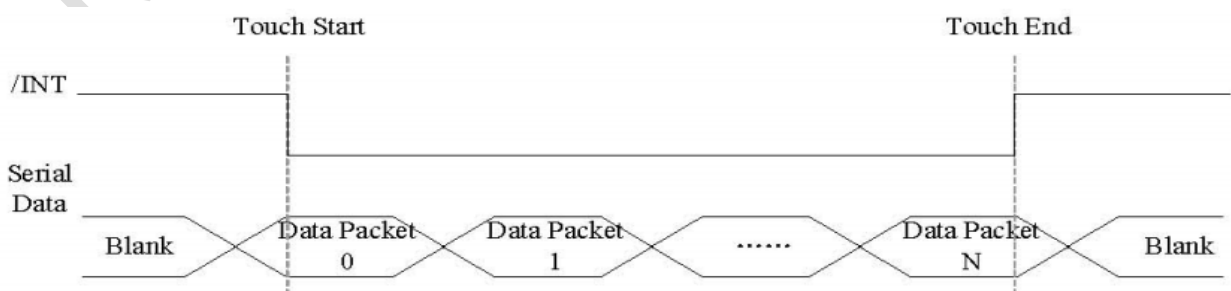
13.2. WRITE BYTES TO I2C SLAVE



READ X BYTES FROM I2C SLAVE



AS FOR STANDARD CTM, HOST NEED TO USE BOTH INTERRUPT CONTROL SIGNAL AND SERIAL DATA INTERFACE TO GET THE TOUCH DATA, HERE IS THE TIMING TO GET TOUCH DATA.



Address: 0x38

TOUCH DATA READ PROTOCOL

| NAME | VALUE | DESCRIPTION |
|-----------------------------------|-------|--|
| START CH | 0X00 | START COMMAND FOR CTPM TOUCH DATA PACKET,HOST MUST SEND CTPM A START CH COMMAND BEFORE READ TOUCH DATA |
| 1st READ BYTE ~ LAST READ BYTE | | TOUCH DATA PACKET SENT BY CTPM,EACH BYTE HAS 8-BIT DATA ,A TOUCH DATA PACKET CONSISTS OF N BYTE |

A DATA PACKET STARTS WITH A HEADER AND ENDS WITH CRC CODE,AS FOR 5 POINTS DATA PACKET,THE LENGTH OF THE PACKET IS ALWAYS 26 BYTES IN SPITE OF ACTUAL TOUCH POINTS.

| Address | Name | Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 | Host Access |
|---------|--------------|---------------------------------------|-------------------|------|--|--|------|------|------|-------------|
| 00h | Devide__Mode | | Device Model[2:0] | | | | | | | RW |
| 01h | Gest__ID | Gesture ID[7:0] | | | | | | | | R |
| 02h | TD__Status | | | | | Number of touch points[3:0] | | | | R |
| 03h | Touch1__XH | 1 st Event Flag | | | | 1 st Touch X Position[11:8] | | | | R |
| 04h | Touch1__XL | 1 st Touch X Position[7:0] | | | | | | | | R |
| 05h | Touch1__YH | 1 st Touch ID[3:0] | | | 1 st Touch Y Position[11:8] | | | | R | |
| 06h | Touch1__YL | 1 st Touch Y Position[7:0] | | | | | | | | R |
| 09h | Touch2__XH | 2 nd Event Flag | | | | 2 nd Touch X Position[11:8] | | | | R |
| 0Ah | Touch2__XL | 2 nd Touch X Position[7:0] | | | | | | | | R |
| 0Bh | Touch2__YH | 2nd Touch ID[3:0] | | | 2ndTouch Y Position[11:8] | | | | R | |
| 0Ch | Touch2__YL | 2nd Touch Y Position[7:0] | | | | | | | | R |

| | | | | | |
|-----|------------|---------------------------|--|------------------------------|---|
| 0Fh | Touch3__XH | 3rdEvent Flag | | 3rdTouch X Position[11:8] | R |
| 10h | Touch3__XL | 3rd Touch X Position[7:0] | | | R |
| 11h | Touch3__YH | 3rdTouch ID[3:0] | | 3rdTouch Y Position[11:8] | R |
| 12h | Touch3__YL | 3rd Touch Y Position[7:0] | | | R |
| 15h | Touch4__XH | 4thEvent Flag | | 4thTouch X Position[11:8] | R |
| 16h | Touch4__XL | 4th Touch X Position[7:0] | | | R |
| 17h | Touch4__YH | 4thTouch ID[3:0] | | 4thTouch Y Position[11:8] | R |
| 18h | Touch4__YL | 4th Touch Y Position[7:0] | | | R |
| 1Bh | Touch5__XH | 5thEvent Flag | | 5thTouch X Position[11:8] | R |
| 1Ch | Touch5__XL | 5th Touch X Position[7:0] | | | R |
| 1Dh | Touch5__YH | 5thTouch ID[3:0] | | 5thTouch Y Position[11:8] | R |
| 1Eh | Touch5__YL | 5th Touch Y Position[7:0] | | | R |

LCM Sample Estimate Feedback Sheet

Module Number : _____

1 、 Panel Specification :

| | | |
|----------------------------|-------------------------------|-------------------------------------|
| 1. Panel Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. View Direction : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Numbers of Dots : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. View Area : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Active Area : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Operating Temperature : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Storage Temperature : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. Others : | _____ | |

2 、 Mechanical Specification :

| | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 1. PCB Size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Frame Size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Material of Frame : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Connector Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Fix Hole Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Backlight Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Thickness of PCB : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. Height of Frame to PCB : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 9. Height of Module : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 10. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

3 、 Relative Hole Size :

| | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 1. Pitch of Connector : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Hole size of Connector : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Mounting Hole size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Mounting Hole Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

4 、 Backlight Specification :

| | | |
|---|-------------------------------|-------------------------------------|
| 1. B/L Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. B/L Color : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. B/L Driving Voltage (Reference for LED Type) : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. B/L Driving Current : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Brightness of B/L : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. B/L Solder Method : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

>> **Go to page 2** <<

| | | |
|--|-------------------------------|-------------------------------------|
| Module Number : _____ | | |
| 5 · <u>Electronic Characteristics of Module</u> : | | |
| 1.Input Voltage : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2.Supply Current : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3.Driving Voltage for LCD : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4.Contrast for LCD : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5.B/L Driving Method : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6.Negative Voltage Output : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7.Interface Function : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8.LCD Uniformity : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 9.ESD test : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 10.Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6 · <u>Summary</u> : | | |
| <p style="text-align: right;"> Sales signature : _____ Customer Signature : _____ Date : / / _____ </p> | | |

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