



RVT3.5A320240TFWN00

LCD TFT Datasheet

Rev.1.2

2015-02-09

| ITEM | CONTENTS | UNIT |
|--------------------------------|---------------------------------|----------|
| LCD Type | TFT/Transmissive/Normally white | / |
| Size | 3.5 | Inch |
| Viewing Direction | 12:00 (without image inversion) | O' Clock |
| Gray Scale Inversion Direction | 6:00 | O' Clock |
| LCM (W × H × D) | 77.70 × 64.70 × 3.68 | mm3 |
| Active Area (W × H) | 70.08 × 52.56 | mm2 |
| Dot Pitch (W × H) | 0.73 × 0.219 | mm2 |
| Number Of Dots | 320 (RGB) × 240 | / |
| Driver IC | NV3035C | / |
| Backlight Type | 6 LEDs | / |
| Surface Luminance | 540 | cd/m2 |
| Interface Type | 24bit RGB | / |
| Color Depth | 16.7M | / |
| Pixel Arrangement | RGB Vertical Stripe | / |
| Surface Treatment | Anti-glare | |
| Input Voltage | 3.3 | V |
| With/Without TSP | Without Touch Panel | / |
| Weight | 45 | g |

Note 1: RoHS compliant

Note 2: LCM weight tolerance: ± 5%.

REVISION RECORD

| REVNO. | REVDATE | CONTENTS | REMARKS |
|--------|------------|---|---------|
| 1.0 | 2014-10-16 | Initial Release | |
| 1.1 | 2015-01-20 | Update surface luminance, update LED lifetime, add LED forward voltage information. | |
| 1.2 | 2015-02-09 | Update dimension information on mechanical drawing. | |
| | | | |
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1 MODULE CLASSIFICATION INFORMATION

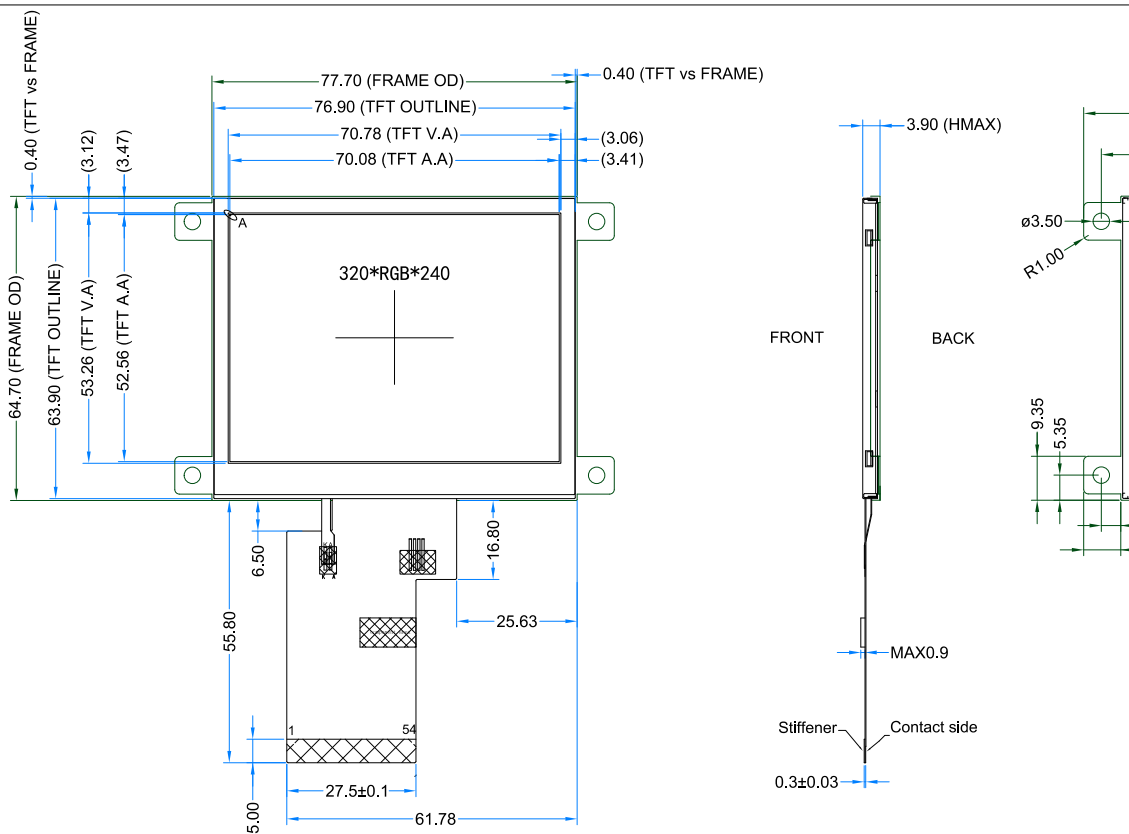
| | | | | | | | | | |
|-----------|----------|------------|----------|---------------|----------|----------|----------|----------|-----------|
| RV | T | 3.5 | A | 320240 | T | F | W | N | 00 |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. |

| | | |
|-----|-------------------------|--|
| 1. | BRAND | RV – Riverdi |
| 2. | PRODUCT TYPE | T – TFT Standard F – TFT Custom |
| 3. | DISPLAY SIZE | 3.5 – 3.5” 4.3 – 4.3” 5.7 – 5.7” 7.0 – 7.0” |
| 4. | MODEL SERIAL NO. | A (A-Z) |
| 5. | RESOLUTION | 320240 – 320x240 px 480272 – 480x272 px 800480 – 800x480 px |
| 6. | INTERFACE | T – TFT LCD, RGB L – TFT LCD, LVDS C – TFT + Controller |
| 7. | FRAME | N – No Frame F – Mounting Frame |
| 8. | BACKLIGHT TYPE | W – LED White |
| 9. | TOUCH PANEL | N – No Touch Panel R – Resistive Touch Panel C – Capacitive Touch Panel |
| 10. | VERSION | 00 (00-99) |

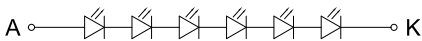
LCD TFT Datasheet Rev.1.2

RVT3.5A320240TFWN00

| TFT PINOUT | | | |
|------------|-------|----|-------|
| 1 | VLED- | 28 | D16 |
| 2 | VLED- | 29 | D17 |
| 3 | VLED+ | 30 | D18 |
| 4 | VLED+ | 31 | D19 |
| 5 | NC | 32 | D20 |
| 6 | NC | 33 | D21 |
| 7 | NC | 34 | D22 |
| 8 | RESET | 35 | D23 |
| 9 | SPENA | 36 | HSYNC |
| 10 | SPCK | 37 | VSYNC |
| 11 | SPDA | 38 | CLK |
| 12 | D00 | 39 | NC |
| 13 | D01 | 40 | NC |
| 14 | D02 | 41 | VDD |
| 15 | D03 | 42 | VDD |
| 16 | D04 | 43 | NC |
| 17 | D05 | 44 | NC |
| 18 | D06 | 45 | NC |
| 19 | D07 | 46 | NC |
| 20 | D08 | 47 | NC |
| 21 | D09 | 48 | NC |
| 22 | D10 | 49 | NC |
| 23 | D11 | 50 | NC |
| 24 | D12 | 51 | NC |
| 25 | D13 | 52 | DEN |
| 26 | D14 | 53 | GND |
| 27 | D15 | 54 | GND |

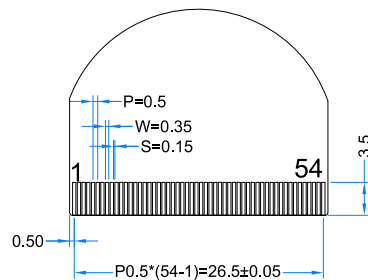
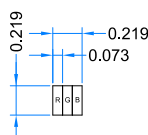


BACKLIGHT LED CIRCUIT DIAGRAM



DETAIL B
SCALE 2:1

DETAIL A
SCALE 60:1



NOTES:

1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMALLY WHITE
2. OPERATION VOLTAGE: VDD=3.3V
3. VIEWING DIRECTION: 12 O'CLOCK
4. IC CONTROLLER: NV3035C
5. OPERATING TEMP.: -20°C ~ 70°C
6. STORAGE TEMP.: -30°C ~ 80°C
7. LED BACKLIGHT: 6-LED WHITE
8. SURFACE LUMINANCE: 540 cd/m2
9. GENERAL TOLERANCE: ±0.2
10. RoHS COMPLIANT

| |
|---------------|
| CUSTOMER APVL |
| DRAWN |
| DFTG CHK |
| ENGR CHK |
| APPROVAL |



3 ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | MIN | MAX | UNIT |
|--------------------------------|-----------------|---------|----------------|------|
| Supply Voltage For Logic | VDD | -0.3 | 5 | V |
| Input Voltage For Logic | VIN | VSS-0.5 | VDD | V |
| LED forward voltage (each LED) | IF | - | 25 | mA |
| Operating Temperature | T _{OP} | -20 | 70 | °C |
| Storage Temperature | T _{ST} | -30 | 80 | °C |
| Humidity | RH | - | 90% (Max 60°C) | RH |

4 ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|-------------------------|-----------------|--------|-----|--------|------|
| Power voltage | VDD | 3.0 | 3.3 | 3.6 | V |
| Input Current | IVDD | - | 10 | - | mA |
| Input Voltage 'H' level | V _{IH} | 0.8VDD | - | VDD | V |
| Input Voltage 'L' level | V _{IL} | 0 | - | 0.2VDD | V |

5 BACKLIGHT CHARACTERISTICS

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT |
|---------------------------|----------------|-------|-------|------|------|
| Voltage for LED backlight | V _I | 9.0 | 19.2 | 20.4 | V |
| Current for LED backlight | I _I | - | 20 | 25 | mA |
| LED Life Time | - | 40000 | 50000 | - | Hrs |

Note: The LED life time is defined as the module brightness decrease to 50% original brightness at Ta=25°C.

6 ELECTRO-OPTICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT | REMARK | NOTE |
|-------------------------|----------------|---|-------|-------|-------|-------------------|----------|------|
| Response Time | Tr+Tf | $\theta=0^\circ$ $\phi=0^\circ$ Ta=25 | - | 25 | 35 | ms | Figure 1 | 4 |
| Contrast Ratio | Cr | | - | 350 | - | --- | Figure 2 | 1 |
| Luminance Uniformity | δ WHITE | | 75 | 80 | - | % | Figure 2 | 3 |
| Surface Luminance | Lv | | - | 540 | - | cd/m ² | Figure 2 | 2 |
| Viewing Angle Range | θ | $\phi = 90^\circ$ | 30 | 40 | - | deg | Figure 3 | 6 |
| | | $\phi = 270^\circ$ | 50 | 60 | - | deg | Figure 3 | |
| | | $\phi = 0^\circ$ | 50 | 60 | - | deg | Figure 3 | |
| | | $\phi = 180^\circ$ | 50 | 60 | - | deg | Figure 3 | |
| CIE (x, y) Chromaticity | Red | x | 0.574 | 0.624 | 0.674 | Figure 2 | 5 | |
| | | y | 0.318 | 0.368 | 0.418 | | | |
| | Green | x | 0.300 | 0.350 | 0.400 | | | |
| | | y | 0.500 | 0.550 | 0.600 | | | |
| | Blue | x | 0.093 | 0.143 | 0.193 | | | |
| | | y | 0.069 | 0.119 | 0.169 | | | |
| | White | x | 0.260 | 0.310 | 0.360 | | | |
| | | y | 0.283 | 0.333 | 0.383 | | | |
| NTSC | - | - | - | 50 | - | % | - | |

Note 1. Contrast Ratio(CR) is defined mathematically as below, for more information see Figure 1.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see Figure 2.

L_v = Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)

Note 3. The uniformity in surface luminance δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see Figure 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from white to black (Rise Time, T_r) and from black to white (Decay Time, T_f). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope series.

Note 5. CIE (x, y) chromaticity, the x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see Figure 3.

Note 7. For viewing angle and response time testing, the testing data is based on Autronic-Melchers's ConoScope series. Instruments for Contrast Ratio, Surface Luminance, Luminance Uniformity, CIE the test data is based on TOPCON's BM-5 photo detector.

Figure 1. The definition of response time

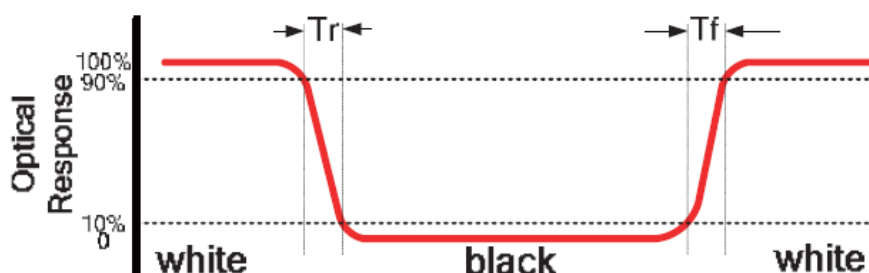


Figure 2. Measuring method for Contrast ratio, surface liminance, Luminance uniformity, CIE (x,y) chromaticity

A : 5 mm
B : 5 mm
H, V : Active Area

Light spot size $\varnothing=5\text{mm}$, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

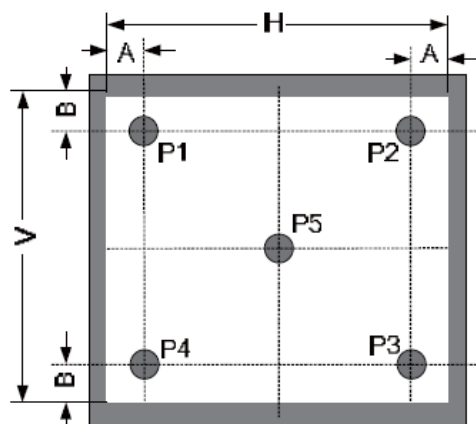
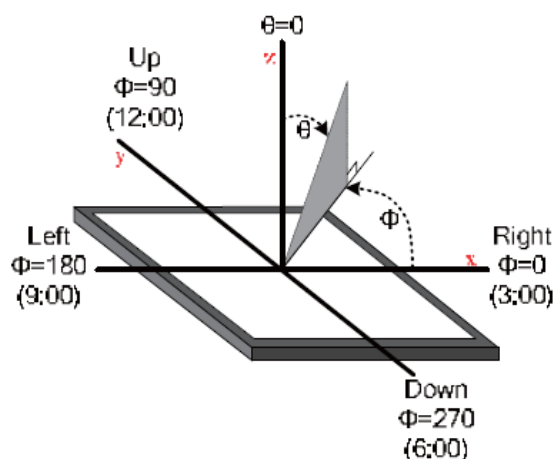


Figure 3. The definiton of viewing angle



7 INTERFACE DESCRIPTION

| PIN NO. | SYMBOL | DESCRIPTION | REMARK |
|---------|---------|--------------------------------|--------|
| 1 | VLED- | Cathode Of LED Backlight | |
| 2 | VLED- | Cathode Of LED Backlight | |
| 3 | VLED+ | Anode Of LED Backlight | |
| 4 | VLED+ | Anode Of LED Backlight | |
| 5 | NC | No Connect | |
| 6 | NC | No Connect | |
| 7 | NC | No Connect | |
| 8 | RESET | Reset | |
| 9 | SPENA | Serial Port Data Enable Signal | |
| 10 | SPCK | SPI Serial Clock | |
| 11 | SPDA | SPI Serial Data Input/Output | |
| 12-35 | D00-D23 | Data 00 – Data 23 | Note 1 |
| 36 | HSYNC | Horizontal Synchronous Signal | |
| 37 | VSYNC | Vertical Synchronous Signal | |
| 38 | CLK | Data Clock | |
| 39 | NC | No Connect | |
| 40 | NC | No Connect | |
| 41 | VDD | Power Supply (3.3V) | |
| 42 | VDD | Power Supply (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 Enabling Signal | |
| 53 | GND | Ground | |
| 54 | GND | Ground | |

Note1: D00-D23 (pins 12-35)

| MODE | D(23:16) | D(15:08) | D(07:00) | HSYNC | VSYNC |
|--------------|----------|----------|----------|-------|-------|
| ITU-R BT 656 | D(23:16) | GND | GND | NC | NC |
| ITU-R BT 601 | D(23:16) | GND | GND | HSYNC | VSYNC |
| 8 Bit RGB | D(23:16) | GND | GND | HSYNC | VSYNC |
| 24 Bit RGB | R(7:0) | G(7:0) | B(7:0) | HSYNC | VSYNC |

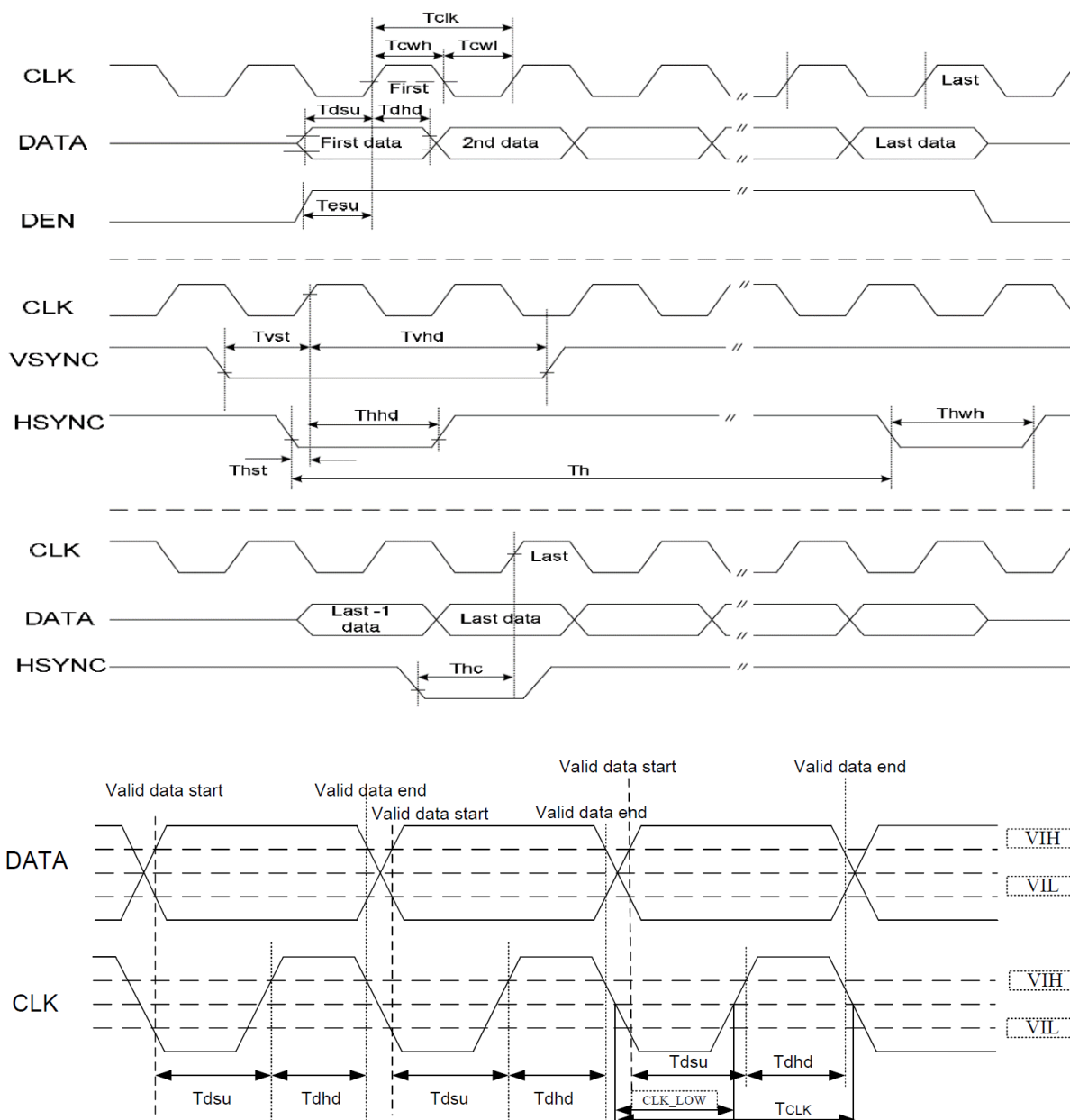
8 LCD TIMING CHARACTERISTICS

8.1 Timing Chart

Timing parameter (VDD=3.3V, GND=0V, Ta=25°C)

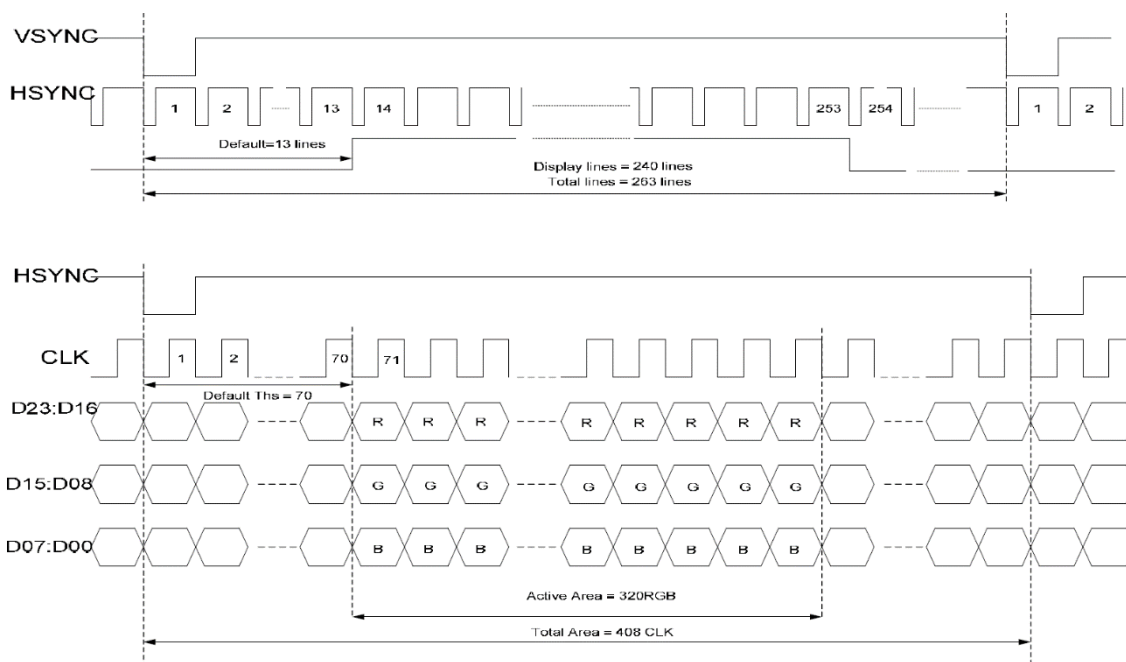
| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT | CONDITION |
|-------------------|-----------|------------------|-------|------------------|------|----------------|
| CLK Clock Time | T_{clk} | $1/Max(F_{CLK})$ | - | $1/Min(F_{CLK})$ | ns | - |
| CLK Pulse Duty | T_{chw} | 40 | 50 | 60 | % | T_{CLK} |
| HSYNC to CLK | T_{hc} | - | - | 1 | CLK | - |
| HSYNC Width | T_{hwh} | 1 | - | - | CLK | - |
| VSYNC Width | T_{vwh} | 1 | - | - | ns | - |
| HSYNC Period Time | T_h | 60 | 63.56 | 67 | ns | - |
| VSYNC Set-up Time | T_{vst} | 12 | - | - | ns | - |
| VSYNC Hold Time | T_{vhd} | 12 | - | - | ns | - |
| HSYNC Setup Time | T_{hst} | 12 | - | - | ns | - |
| HSYNC Hold Time | T_{hhd} | 12 | - | - | ns | - |
| Data Set-up Time | T_{dsu} | 12 | - | - | ns | D00~D23 to CLK |
| Data Hold Time | T_{dhd} | 12 | - | - | ns | D00~D23 to CLK |
| DEN Set-up Time | T_{esu} | 12 | - | - | ns | DEN to CLK |

Note: Each CLK Frequency of 24 Bit RGB Mode, 8 Bit RGB Mode, CCIR601 and CCIR656 are different.



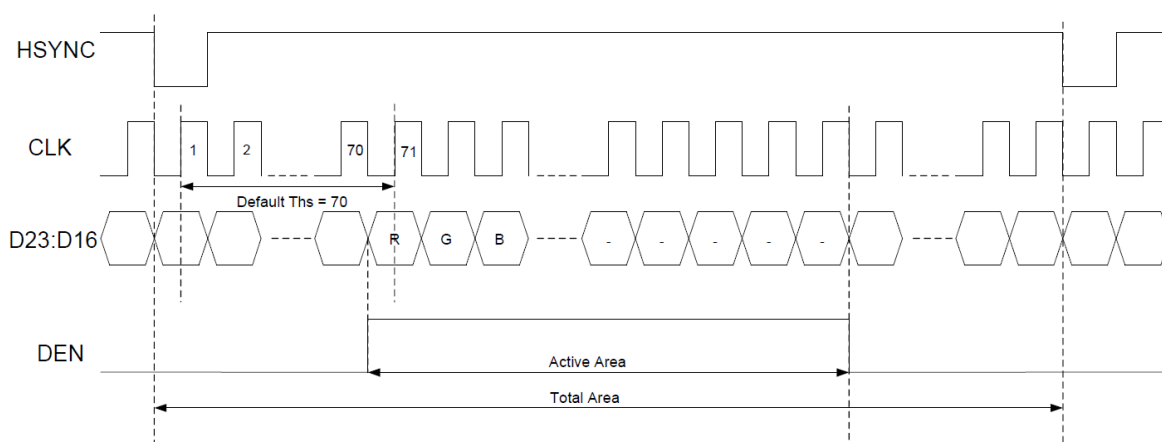
8.2 24 Bit RGB Mode for 320RGB x 240

| PARAMETER | SYM | MIN | TYP | MAX | UNIT | CONDITION |
|--|-----------|-----|-----|-----|------|----------------------------|
| | BOL | | | | | |
| CLK Frequency | F_{clk} | 6.1 | 6.4 | 8.0 | MHz | VDD=3.0V~3.6V |
| CLK Cycle Time | T_{clk} | 125 | 156 | 164 | ns | - |
| CLK Pulse Duty | T_{cwh} | 40 | 50 | 60 | % | - |
| Time that HSYNC to 1st Data Input (NTSC) | T_{hs} | 40 | 70 | 255 | CLK | DDLY=70 Offset=0(fixed) |



8.3 8 Bit RGB Mode for 320RGB x 240

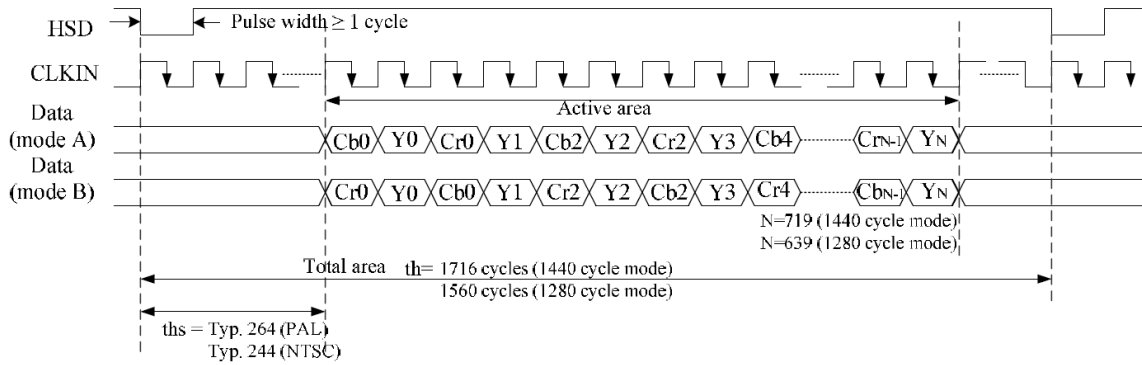
| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT | CONDITION |
|--|-----------|-----|-----|-----|------|----------------------------|
| CLK Frequency | F_{clk} | - | 27 | 30 | MHz | VDD=3.0V~3.6V |
| CLK Cycle Time | T_{clk} | - | 37 | - | ns | - |
| Time that HSYNC to 1st Data Input (NTSC) | T_{hs} | 35 | 70 | 255 | CLK | DDLY=70 Offset=0(fixed) |



8.4 CCIR601

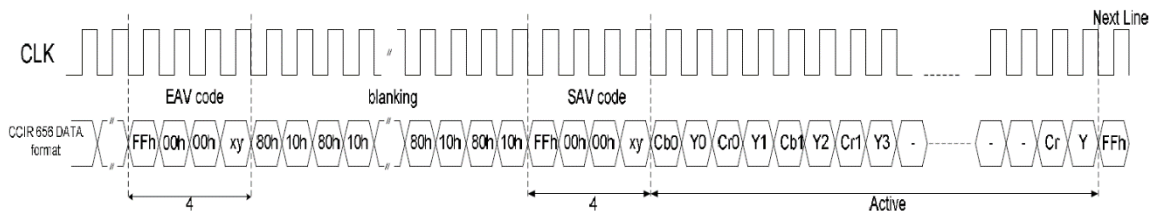
| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT | CONDITION |
|--|-----------|-----|----------|-----|------|-------------------------------|
| CLK Frequency | F_{clk} | - | 24.54/27 | 30 | MHz | VDD=3.0V~3.6V |
| CLK Cycle Time | T_{clk} | - | 40/37 | - | ns | - |
| Time From HSYNC to 1st Data Input (PAL) | T_{hs} | 128 | 264 | - | CLK | DDLY=136 Offset=128(fixed) |
| Time From HSYNC to 1st Data Input (NTSC) | T_{hs} | 128 | 244 | - | CLK | DDLY=116 Offset=128(fixed) |

CLKIN frequency:
24.54MHz for 1280-cycle mode
27MHz for 1440-cycle mode



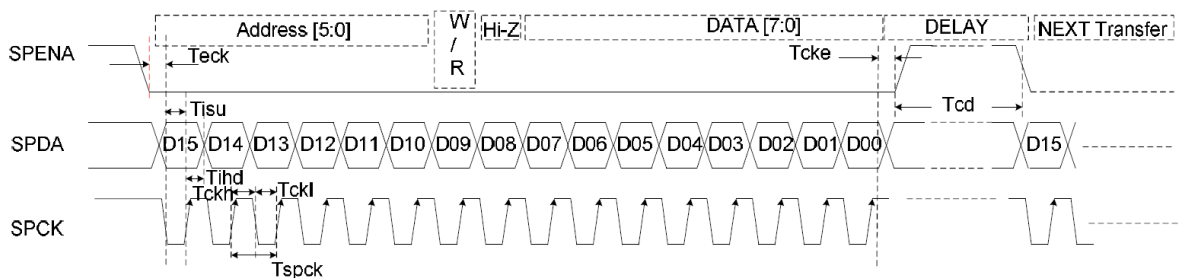
8.5 CCIR656

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT | CONDITION |
|--|-----------|-----|-----|-----|------|-------------------------------|
| CLK Frequency | F_{clk} | - | 27 | 30 | MHz | VDD=3.0V~3.6V |
| CLK Cycle Time | T_{clk} | - | 37 | - | ns | - |
| Time From EVA to 1st Data Input (PAL) | T_{hs} | 128 | 288 | - | CLK | DDLY=152 Offset=128(fixed) |
| Time From EVA to 1st Data Input (NTSC) | T_{hs} | 128 | 276 | - | CLK | DDLY=140 Offset=128(fixed) |



8.6 3-Wire serial communication AC Timing

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNIT |
|-------------------------|-------------|-----|-----|-----|------|
| Serial Clock | T_{SPCK} | 320 | - | - | ns |
| SPCK Pulse Duty | T_{scdut} | 40 | 50 | 60 | % |
| 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 | - | - | ns |



Note: DDLY Description (Ths=DDLY+Offset)

R04: Source Timing Delay Control Register

| BIT | NAME | INITIAL | DESCRIPTION |
|----------|-----------|---------|---|
| Bit[7:0] | DDLY[7:0] | 46h | Select the HSD signal to 1 st input data delay timing Under CCIR601 mode, Ths=DDLY[7:0] + 128, (Unit=CLKIN) Under CCIR656 mode, Ths=DDLY[7:0] +136, (Unit = CLKIN) The register value will be update to the different mode, such as 24RGB, 8RGB, CCIR mode Read the section of “24RGB, 8RGB, CCIR mode” for detail |

8.7 3-wire control register list

| 3-WIRE REGISTERS | | REGISTER DESCRIPTION | | |
|------------------|------|----------------------|-----|--------------------------------------|
| D[15:10] | Name | Init | R/W | Function Description |
| 000000b | R01 | 03h | R/W | System Control Register |
| 000001b | R02 | 00h | R/W | Timing Controller Function Register |
| 000010b | R03 | 03h | R/W | Operation Control Register |
| 000011b | R04 | CCh | R/W | Input Data Format Control Register |
| 000100b | R05 | 46h | R/W | Source Timing Delay Control Register |
| 000101b | R06 | 0Dh | R/W | Gate Timing Delay Control Register |
| 000111b | R07 | 00h | R/W | Internal Function Control Register |
| 001000b | R08 | 08h | R/W | RGB Contrast Control Register |
| 001001b | R09 | 40h | R/W | RGB Brightness Control Register |
| 001011b | R0B | 88h | R/W | R/B Sub-Contrast Control Register |
| 001100b | R0C | 20h | R/W | R Sub-Brightness Control Register |
| 001101b | R0D | 20h | R/W | B Sub-Brightness Control Register |
| 001110b | R0E | 2Bh | R/W | VCOMDC Level Control Register |
| 001111b | R0F | A6h | R/W | VCOMAC Level Control Register |
| 010000b | R10 | 04h | R/W | VGAM2 Level Control Register |
| 010001b | R11 | 24h | R/W | VGAM3/4 Level Control Register |
| 010010b | R12 | 24h | R/W | VGAM5/6 Level Control Register |
| 011101b | R1D | 00h | R/W | OTP Operation Control Register |
| 011110b | R1E | 00h | R/W | OTP Operation Control Register |
| 011111b | R1F | 00h | R/W | OTP Operation Control Register |

Note :

R03: C4h:CCIR656 Mode

C2h:CCIR601 Mode

C8h:8 bit RGB Mode(HV Mode)

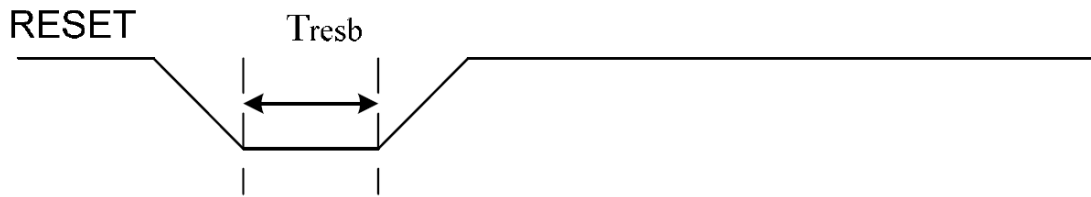
C9h:8 bit RGB Mode(DEN Mode)

CCh(default):24 bit RGB Mode (HV mode)

CDh:24 bit RGB Mode (DEN mode)

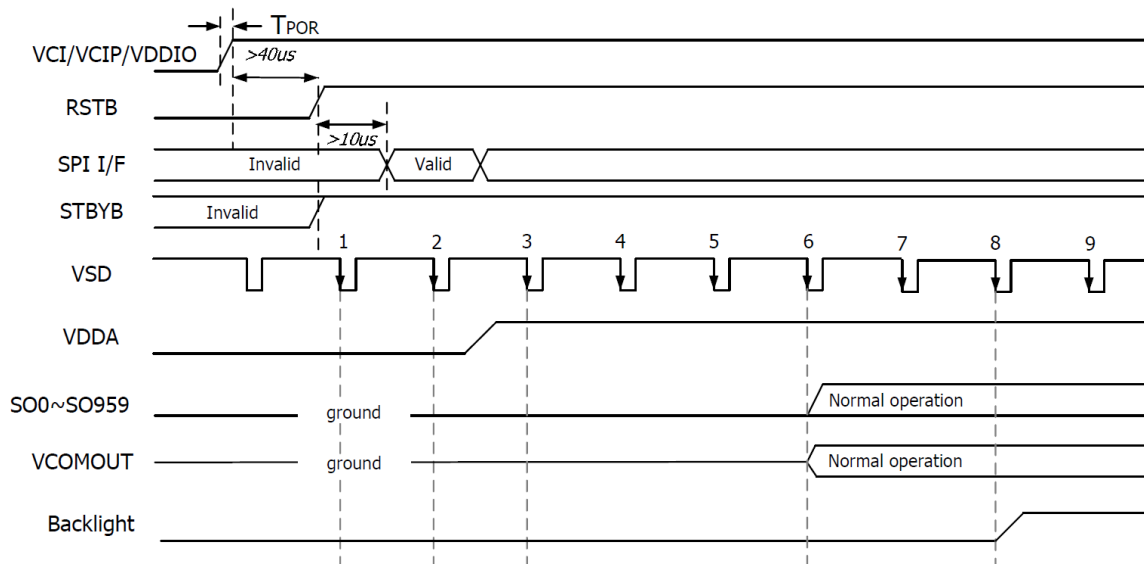
R0F: A4h(default):VGH=15V,VGL=-10V. 24h(recommend): VGH=15V,VGL=-7V.

8.8 Reset timing

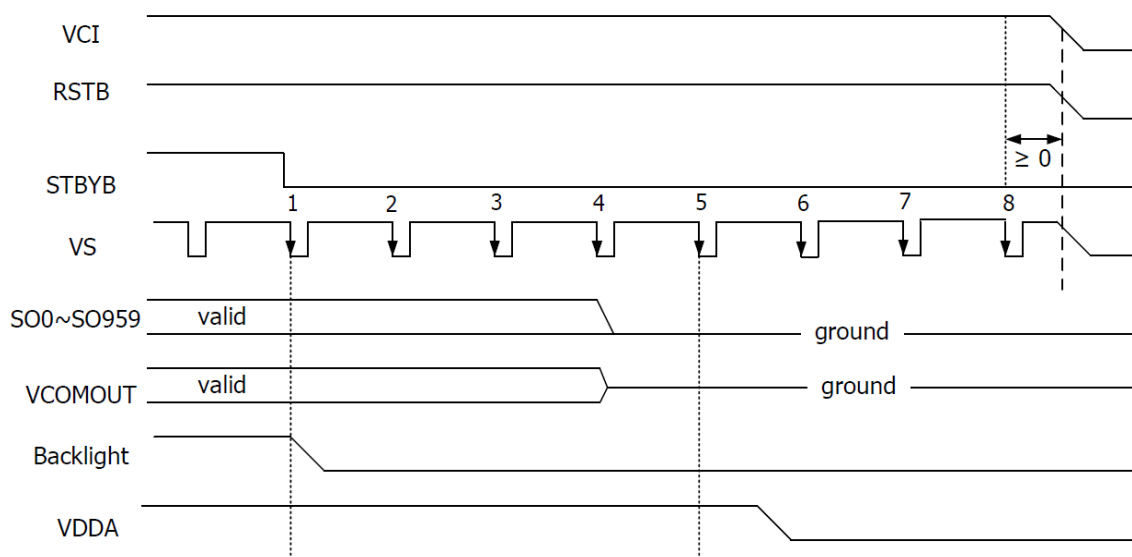


| PARAMETER | MIN | TYP | MAX | UNIT | CONDITI ONS |
|-------------------|-----|-----|-----|------|----------------|
| T _{resb} | 40 | - | - | us | VDD=3.3V |

8.9 Power on sequence



8.10 Power off sequence



9 RELIABILITY TEST

| NO. | TEST ITEM | TEST CONDITION | INSPECTION AFTER TEST |
|-----|----------------------------|--|---|
| 1 | High Temperature Storage | 80±2°C/240 hours | Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects: <ol style="list-style-type: none"> Air bubble in the LCD Seal leak Non-display Missing segments Glass crack Current I_{dd} is twice higher than initial value The surface shall be free from damage Linearity must be no more than 1.5% by the linearity tester The Electric characteristics requirements shall be satisfied |
| 2 | Low Temperature Storage | -30±2°C/240 hours | |
| 3 | High Temperature Operating | 70±2°C/240 hours | |
| 4 | Low Temperature Operating | -20±2°C/240 hours | |
| 5 | Temperature Cycle | -30±2°C~25~70±2°C × 30 cycles | |
| 6 | Damp Proof Test | 60°C ±5°C × 90%RH/160 hours | |
| 7 | Vibration Test | Frequency 10Hz~55Hz Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 2 hours For each direction of X, Y, Z (6 hours for total) | |
| 8 | Mechanical Shock | 60G 6ms, ± X, ± Y, ± Z 3 times for each direction | |
| 9 | Packing Drop Test | Height: 80 cm 1 corner, 3 edges, 6 surfaces | |
| 10 | Package Vibration Test | Random vibration: 0.015G ² /Hz from 5-200Hz -6dB/Octave from 200-500Hz 2 hours for each direction of X, Y, Z (6 hours for total) | |
| 11 | Electrostatic Discharge | Air: ±8KV 150pF/330Ω 5 times Contact: ±4KV 150pF/330Ω 5 times | |
| 12 | Hitting Test | 1,000,000 times in the same point | |

| | | | |
|----|-----------------------------|--|--|
| | | Hitting pad: tip R3.75mm, Silicone rubber, Hardness: 40deg. Load: 2.45N Hitting speed: Twice/sec Electric load: none Test area should be at 1.8mm inside of insulation. | |
| 13 | Pen Sliding Durability Test | 100,000 times minimum Hitting pad: tip R0.8mm plastic pen Load: 1.47N Sliding speed: 60 mm/sec Electric load: none Test area should be at 1.8mm inside of insulation. | |

Remark:

1. The test samples should be applied to only one test item.
2. Sample size for each test item is 5~10pcs.
3. For Damp Proof Test, Pure water(Resistance 10MΩ) should be used.
4. In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
5. EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
6. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

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