

Product Specification

- ❖ Product Name: AMOLED
- ❖ Model Name: DO0200PFS12
- ❖ Description: 1.91 inch (240x536)

| Proposed by | | | Customer's Approval |
|-------------|---------|----------|---------------------|
| Designed | Checked | Approved | |
| | | | |

Document Revision History

| Rev. No. | Date | Contents | Remark |
|-----------------|-------------|-----------------|---------------|
| 0.0 | 2024-06-03 | -Initial issue | Preliminary |
| | | | |
| | | | |
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| | | | |
| | | | |

1.General Description:

- Driving Mode: Active Matrix.
- Color Mode: 16.7M/262K/65K color
- Display Format: 1.91" (240RGB x 536)
- Pixel arrangement: Real RGB arrangement
- Display Driver IC : RM67162 or Compatible
- Touch Driver IC : FT3168 or Compatible
- Interface: QSPI / SPI-3Wire / SPI-4Wire
- Touch Interface: IIC [**Slave Addr A[6:0]---0X38**]
- Application: Handheld & PDA & Wearable
- RoHS Compatible

2.Mechanical Data

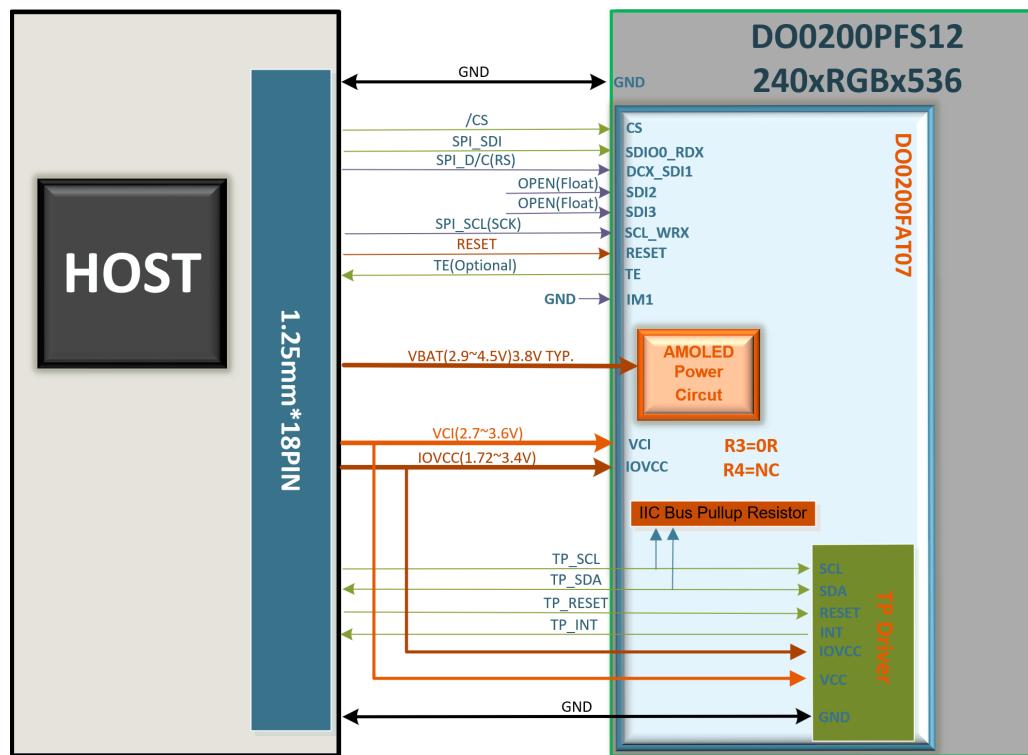
| Item | Specifications | Unit |
|---------------------------------|---|------|
| MODULE Dimensional outline(X*Y) | 26.4(W) * 57.52 (H)* Thickness | mm |
| AMOLED Dimensional outline(X*Y) | 22.4(W) * 51.32 (H) | mm |
| Thickness | Total 5.38(T) --- TP=1.18mm; --- Foam=3mm; --- PCB=1.2mm | mm |
| Number of dots | 240(W) x RGB x 536(H) | Dots |
| Active area | 19.8(W) x 44.22(H) | mm |
| Pixel Size | 82.5*82.5 | um |
| Diameter Inch | 1.91 | inch |
| Frame rate | 60 | Hz |

*See attached drawing for details.

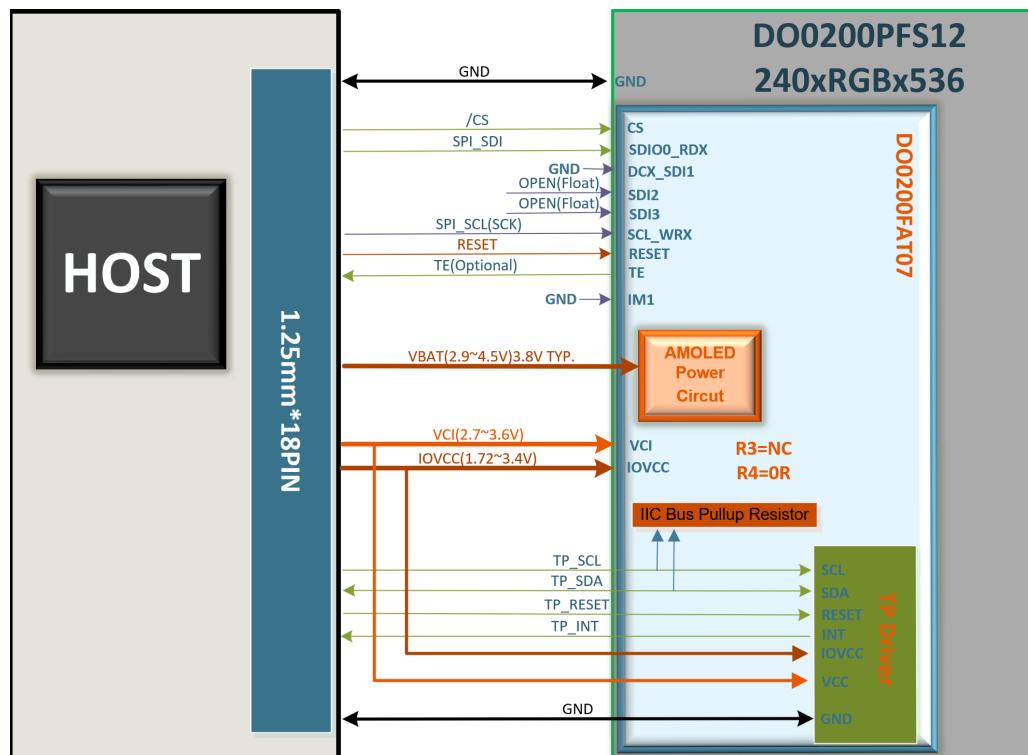
3. Block Diagram

DO0200PFS12 support three kinds of SPI interfaces, and interfaces are selected by setting the IM1 & IM0[R3,R4] pins.

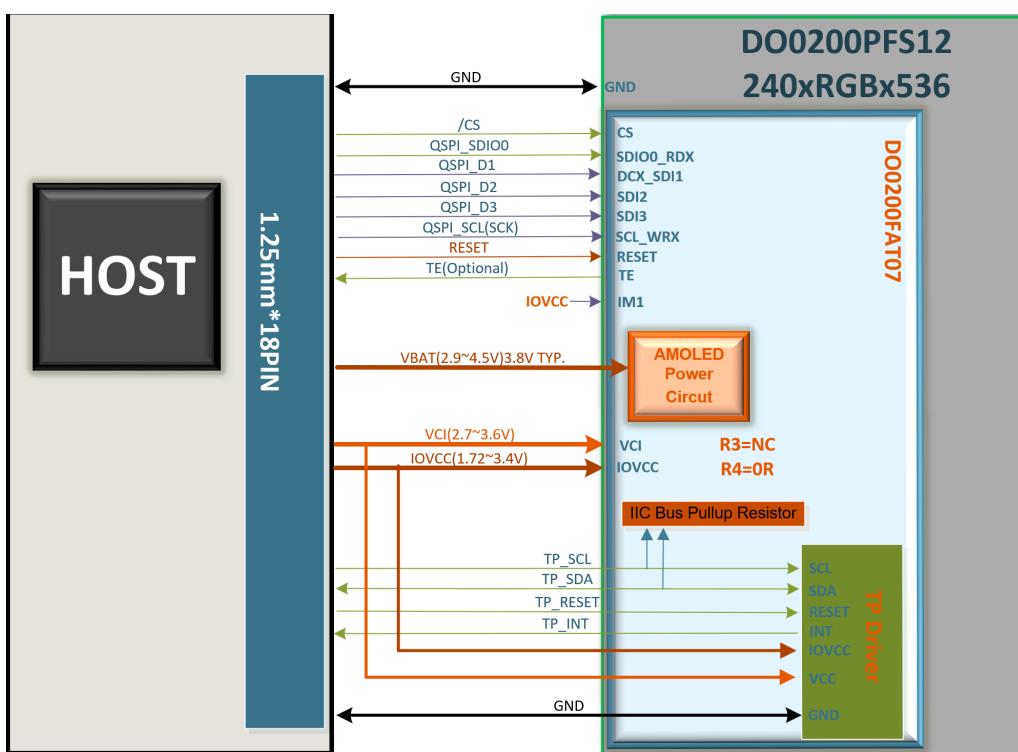
A: If IM1=0, R3=OR,R4=NC, DO0200PFS12 set to spi-4wire interface



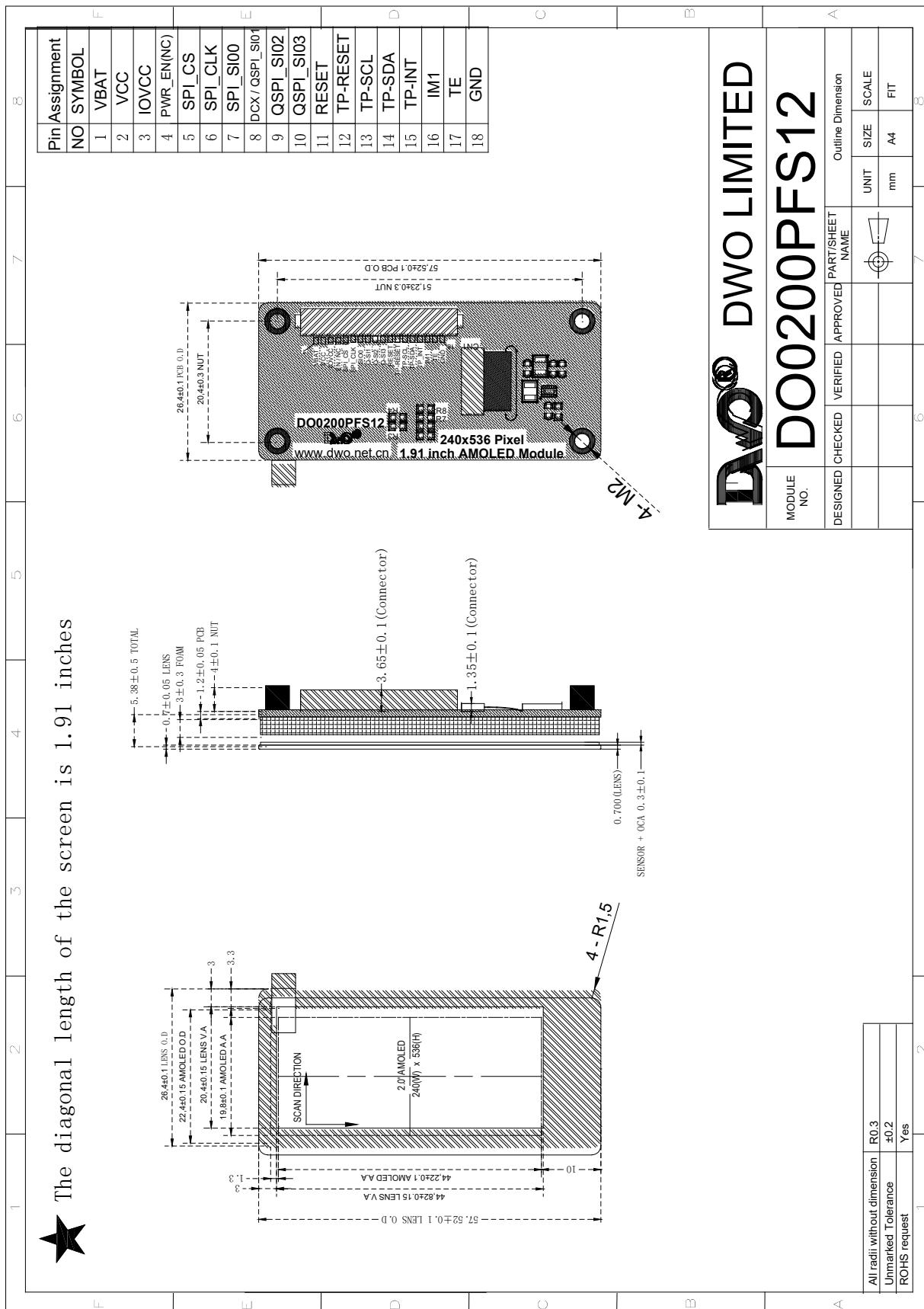
B: If IM1=0,R4=0R,R3=NC, DO0200PFS12 set to spi-3wire interface



C: If IM1=1, R4=OR, R3=NC, DO0200PFS12 set to **QSPI interface**



4.Dimension



5.Pin Description

| NO. | Pin Name | I/O | Description |
|-----|------------|-----|--|
| 1 | VBAT | P | Battery Voltage 3.8V TYP. (2.9-4.5V) |
| 2 | VCC | P | Power supply for display driver IC analog system. |
| 3 | IOVCC | P | Power supply for display driver IC interface and logic system |
| 4 | PWR_EN | I | Power IC enable control pin. Unused, please open this pin. |
| 5 | SPI_CS | I | Chip select input pin ("Low" enable) |
| 6 | SPI_CLK | I | SCL: A synchronous clock signal in SPI I/F. |
| 7 | SIO0 | I/O | Serial Data Input input & output in QSPI,data Lane 0 |
| 8 | DCX /Q-SI1 | I | Serial Data Input in QSPI,data Lane 1; Display data / command selection in 4-wire SPI I/F. D/CX = "0" : Command D/CX = "1" : Display data or Parameter If not used, please connect to VSSI. |
| 9 | Q-SI2 | I | Serial Data Input in QSPI,data Lane 2 |
| 10 | Q-SI3 | I | Serial Data Input in QSPI,data Lane 3 |
| 11 | SPI_RESET | I | Display driver reset, must be applied to properly initialize the chip. Signal is active low. |
| 12 | TP_RESET | I | TP driver reset. Signal is active low. |
| 13 | TP-SCL | I | Touch Panel Clock Input. Communication Voltage follow IOVCC If not used, please open this pin. |
| 14 | TP_SDA | I/O | Touch Panel Data Input and output. Communication Voltage follow IOVCC If not used, , please open this pin. |
| 15 | TP-INT | O | Touch Panel Interrupt Output. If not used, please open this pin. |
| 16 | IM1 | I | Dsipaly Interface type selection; |
| 17 | TE | O | Tearing Effect |
| 18 | GND | P | Ground |

Note:

6. DC Characteristics

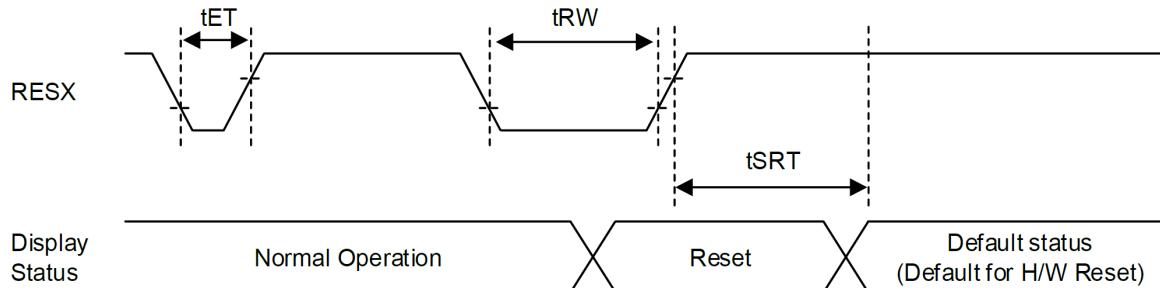
Test Conditions :Voltage Referenced to GND=VSS=0V, VCCC=3.3V, IOVCC =1.8 V, TA = 25°C
Unless otherwise specified

| Ite m | Symb ol | Condition | Min. | Typ. | Max. | Unit | |
|----------------------|----------------------|--------------------|---------------------------------|-----------|------|-----------|--|
| Supply voltage | IOVCC | - | 1.72 | 1.8 | 3.4 | V | |
| | VCC | - | 2.7 | 3.3 | 3.36 | | |
| | VBAT | - | 2.9 | 3.8 | 4.5 | | |
| Input Voltage | "H" level | VIH | - | 0.8*IOVCC | - | IOVCC | |
| | "L" level | VIL | - | -0.2 | - | 0.2*IOVCC | |
| Output Voltage | "H" level | VOH | IOH = -0.1mA IOL = 0.1mA | 0.8*IOVCC | - | IOVCC | |
| | "L" level | VOL | | -0.2 | - | 0.2*IOVCC | |
| Leakage Current | Input | ILI | Vin=IOVCC or VSS | -1.0 | - | 1.0 | |
| | Output | ILO | | -3.0 | - | 3.0 | |
| Current (Display) | Sleep out mode | I _{VCC} | Full white display, 350nits, | - | 12 | 18 | |
| | | I _{IOVCC} | | - | 1.6 | 3 | |
| | | I _{VBAT} | | - | 66 | 95 | |
| | Sleep in mode | I _{VCC} | | - | 20 | 50 | |
| | | I _{IOVCC} | | - | 50 | 100 | |
| | | I _{VBAT} | | - | 50 | 100 | |
| | Deep Standby Mode | I _{VCC} | | - | 2 | 4 | |
| | | I _{IOVCC} | | - | 2 | 4 | |
| | | I _{VBAT} | | - | 50 | - | |
| Frame Frequency | | f _{FRM} | | - | 60 | - | |
| | | | | - | - | Hz | |

7.AC characteristics

7-1 Reset Timing

Reset timing characteristic



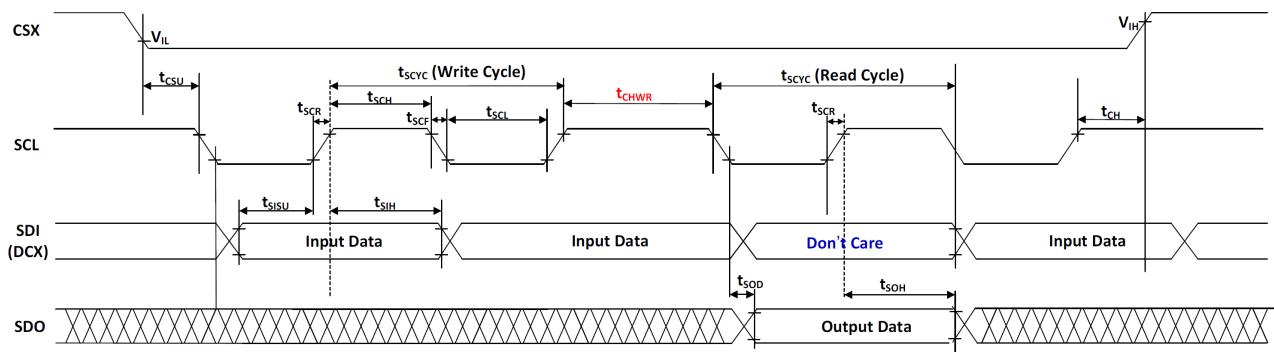
VSS=0V, VDDIO=1.72V to 3.3V, VCI=2.5V to 3.3V, Ta = -30 to 70°C

| Parameter | Symbol | Pad | Min. | Typ. | Max. | Unit | Note |
|------------------------------|--------|------|------|------|------|------|-----------------------------|
| Reset low pulse width | tRW | RESX | 10 | — | — | μs | — |
| Secure reset completion time | tSRT | RESX | — | — | 5 | ms | Reset during Sleep In mode |
| | | RESX | — | — | 150 | | Reset during Sleep Out mode |
| Reset un-reacted pulse width | tET | RESX | | | 5 | μs | — |

7-2 SPI Timing

SPI-3Wire/ SPI-4Wire Interface Characteristics

3/4-wire SPI

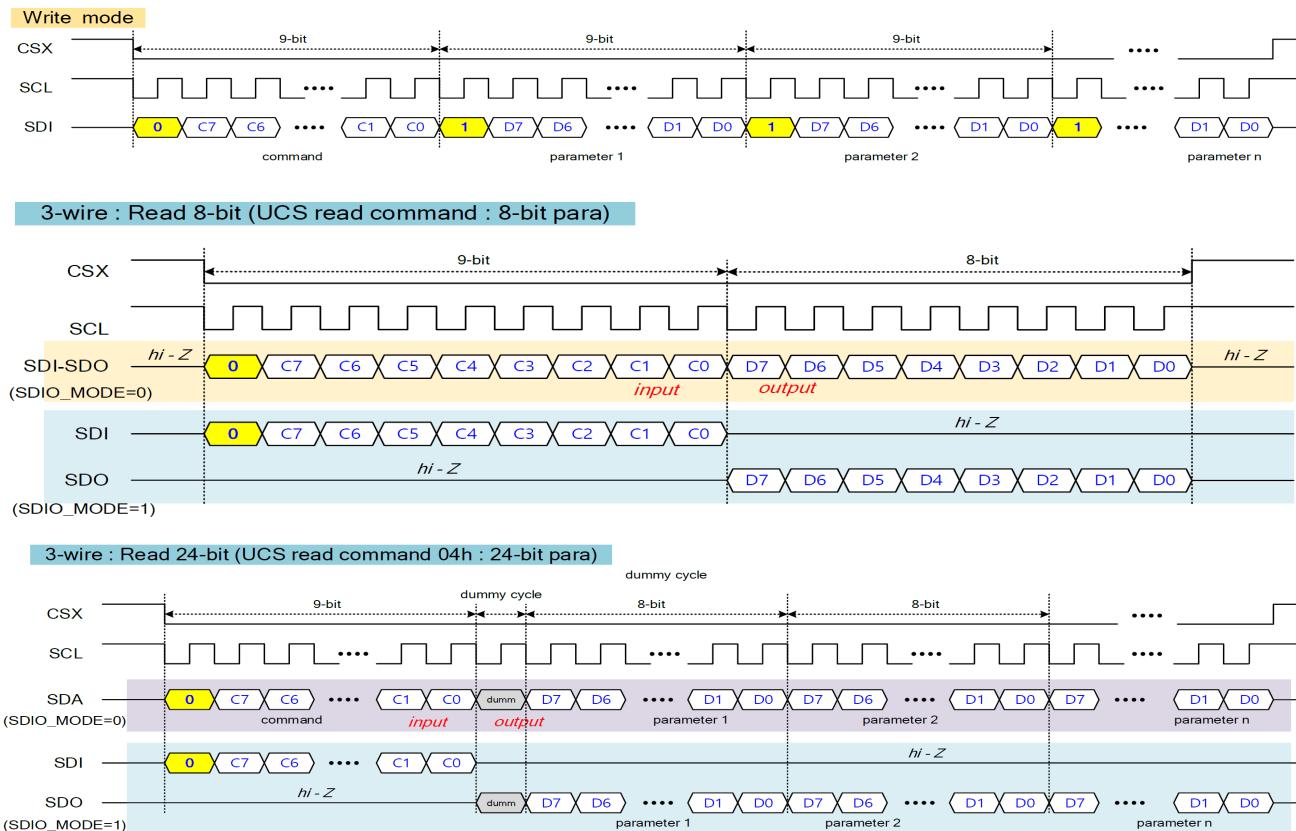


| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--|------------|---|------|------|------|------|
| Clock cycle | t_{SCYC} | Write | 20 | | | ns |
| | | Read | 300 | | | ns |
| Clock high pulse width | t_{SCH} | Write | 6.5 | | | ns |
| | | Read | 140 | | | ns |
| Clock low pulse width | t_{SCL} | Write | 6.5 | | | ns |
| | | Read | 140 | | | ns |
| Clock rise time | t_{SCR} | $0.2 \times VDDI \rightarrow 0.8 \times VDDI$ | | | 3.5 | ns |
| Clock fall time | t_{SCF} | $0.8 \times VDDI \rightarrow 0.2 \times VDDI$ | | | 3.5 | ns |
| Chip select setup time | t_{CSU} | | 10 | | | ns |
| Chip select hold time | t_{CH} | | 10 | | | ns |
| Data input setup time | t_{SISU} | To V_{IL} of SCL's rising edge | 5 | | | ns |
| Data input hold time | t_{SIH} | | 5 | | | ns |
| Access time of output data | t_{SOD} | From V_{IL} of SCL's falling edge | | | 120 | ns |
| Hold time of output data | t_{SOH} | From V_{IH} of SCL's rising edge | 5 | | | ns |
| Transition time from Write cycle to Read cycle | t_{CHWR} | From V_{IH} of SCL's rising edge | 150 | | | ns |

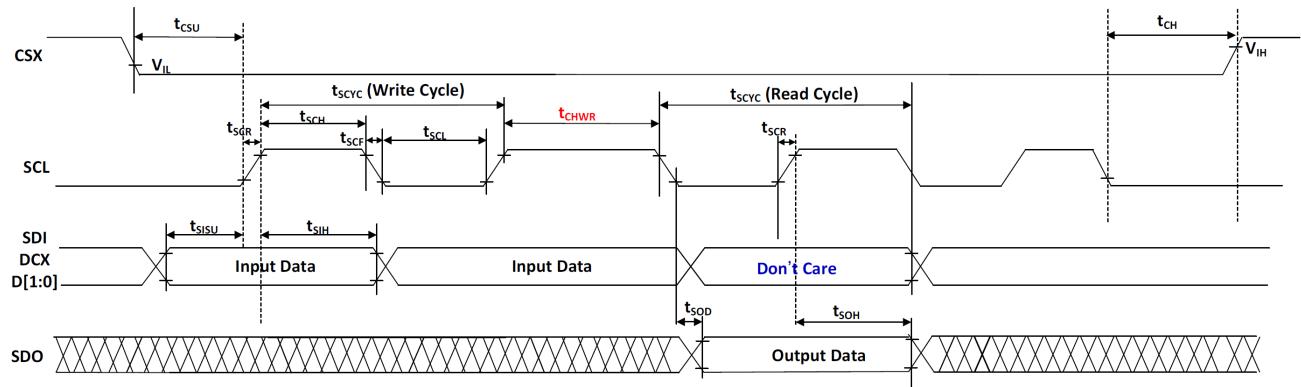
Notes:

- (1) Logic high and low levels are specified as 80% and 20% of VDDI for Input signals.
- (2) For the 4-wire SPI, the DCX's timing is the same as input data.
- (3) $T_a = -30^{\circ}\text{C}$ to 70°C , $VDDI=1.65\text{V}$ to 3.3V , $VCI=2.7\text{V}$ to 3.6V , and $VSS=0\text{V}$

SPI-3Wire Timing



7-3 QSPI Interface Characteristics



Note: The max SCL frequency for each pixel data format is specified as the below table.

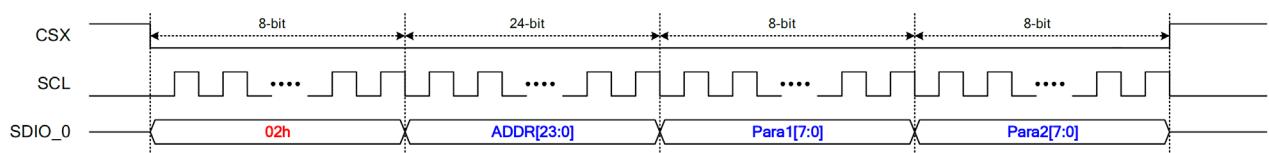
Note: Logic high and low levels are specified as 20% and 80% of VDDI for Input signals.

Note: $T_a = -30$ to 70 °C, VDDI=1.65V to 3.3V, VCI=2.7V to 3.6V, GND=0V

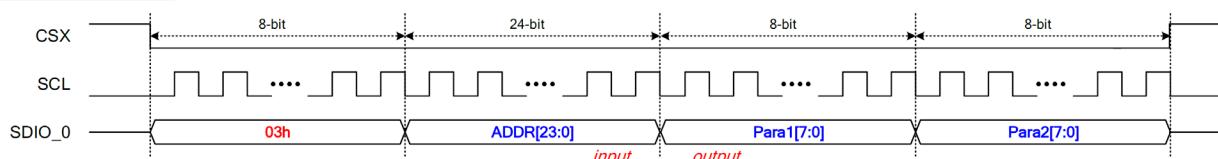
QSPI Timing

Quad SPI Interface Protocol – Register Read and Write

Command Write

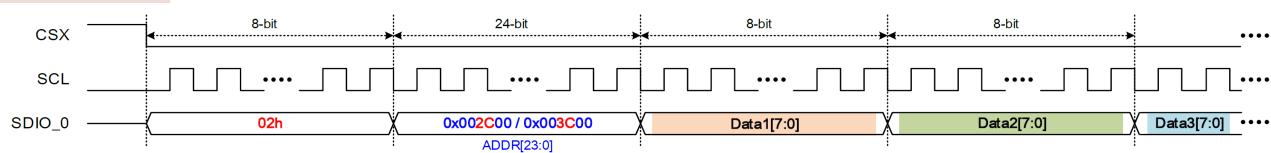


Command Read

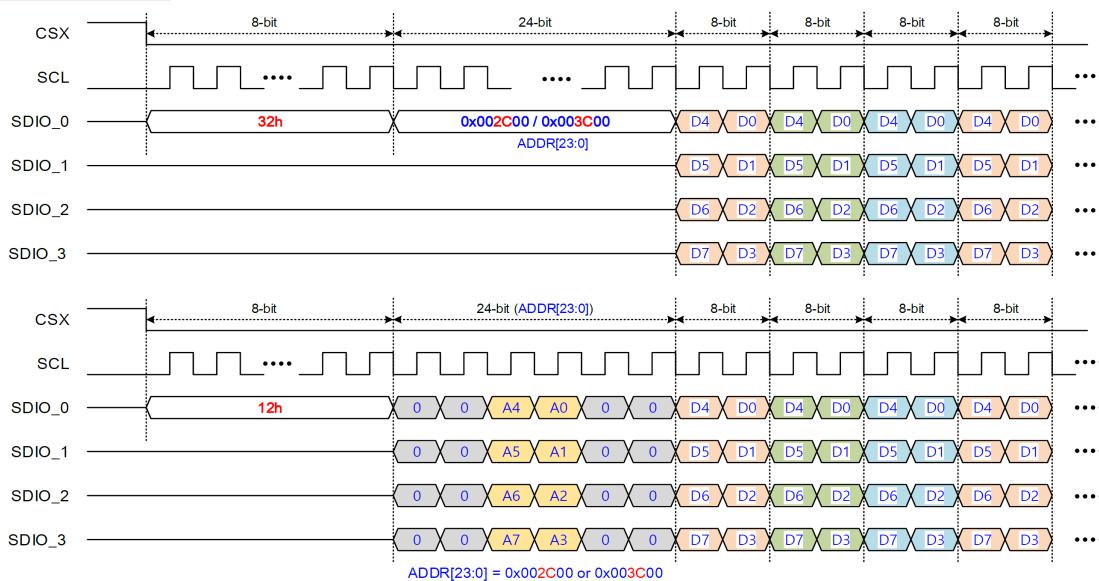


Quad SPI Interface Protocol – Pixel Interface

1-Wire Pixel Write

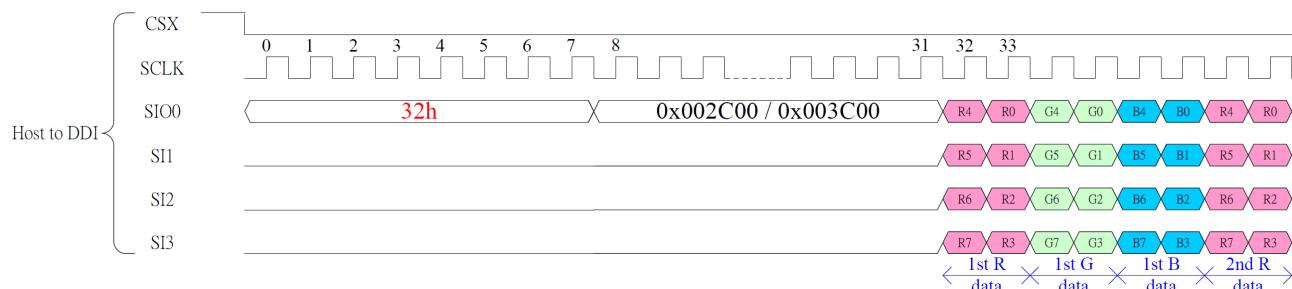


4-Wire Pixel Write

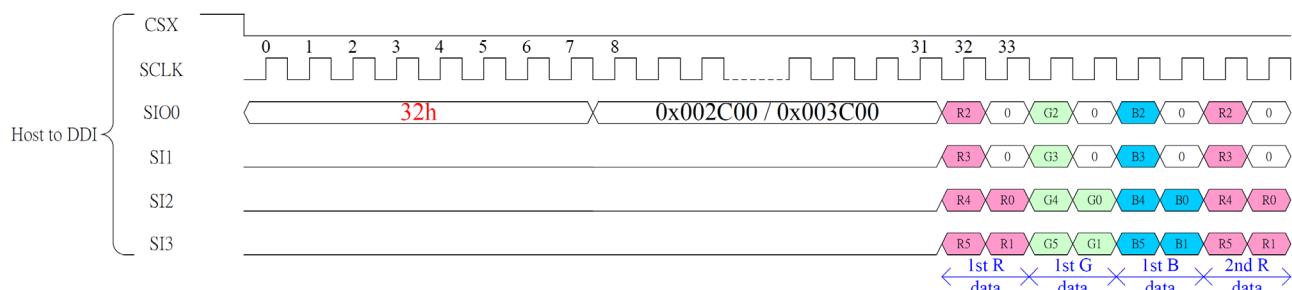


SPI-4Lanes Pixel Write Data Waveform

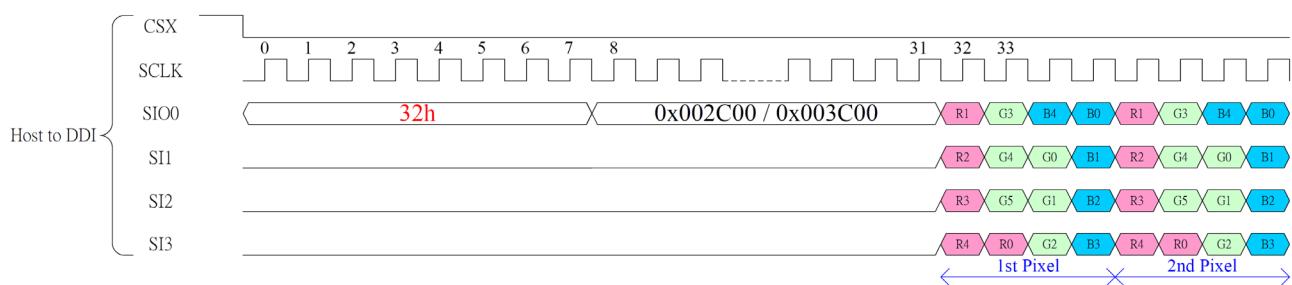
RGB888 – 4-Lanes



RGB666 – 4-Lanes

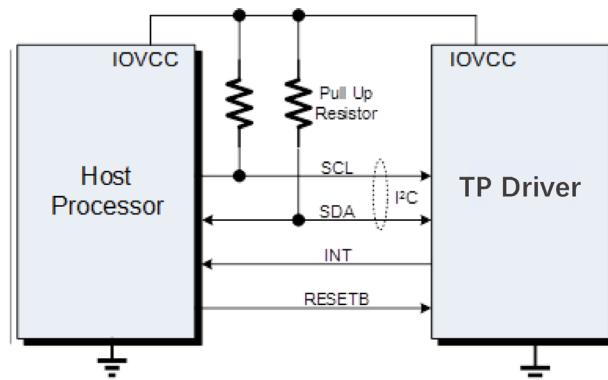


RGB565 – 4-Lanes

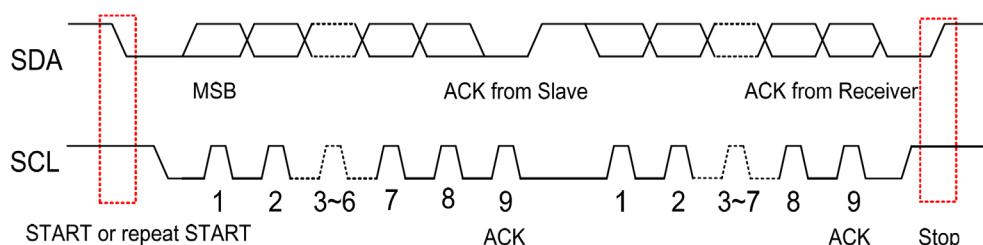


7-5 Touch Panel(TP) IIC Timing Characteristics

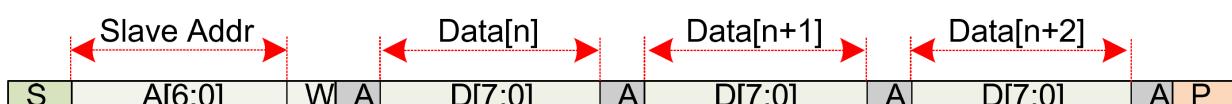
The TP driver communicates to the host through the IIC interface and follows the IIC protocol. IIC bus utilize the SCL and SDA, a two-wire synchronous communication interface and can operate at a maximum bit rate of 400kbps.



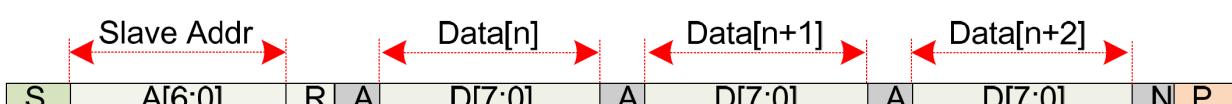
IIC Serial Data Transfer Format



IIC Interface Timing



IIC Master Write, Slave Read



IIC Master Read, Slave Write

TP Driver IC Slave Addr A[6:0]---0X38

| Mnemonics | Description |
|-----------|--|
| S | I ² C Start or I ² C Restart |
| A[6:0] | Slave address |
| R/W | READ/WRITE bit, '1' for read, '0' for write |
| A(N) | ACK(NACK) |
| 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 the beginning of the next packet) |

IIC Timing Characteristics

| Parameter | Standard Mode | | Fast Mode | | Unit |
|--|---------------|-----|-----------|-----|------|
| | Min | Max | Min | Max | |
| SCL frequency (fast mode support) | 0 | 100 | 0 | 400 | KHz |
| Clock low period | 4.7 | - | 1.3 | - | us |
| Clock high period | 4.0 | - | 0.6 | - | us |
| Bus free time between a STOP and START condition | 4.7 | - | 1.3 | - | us |
| Hold time (repeated) START condition | 4.0 | - | 0.6 | - | us |
| Data setup time | 250 | - | 100 | - | ns |
| Setup time for a repeated START condition | 4.7 | - | 0.6 | - | us |
| Setup Time for STOP condition | 4.0 | - | 0.6 | - | us |

TP I/O Communication Voltage follow IOVCC

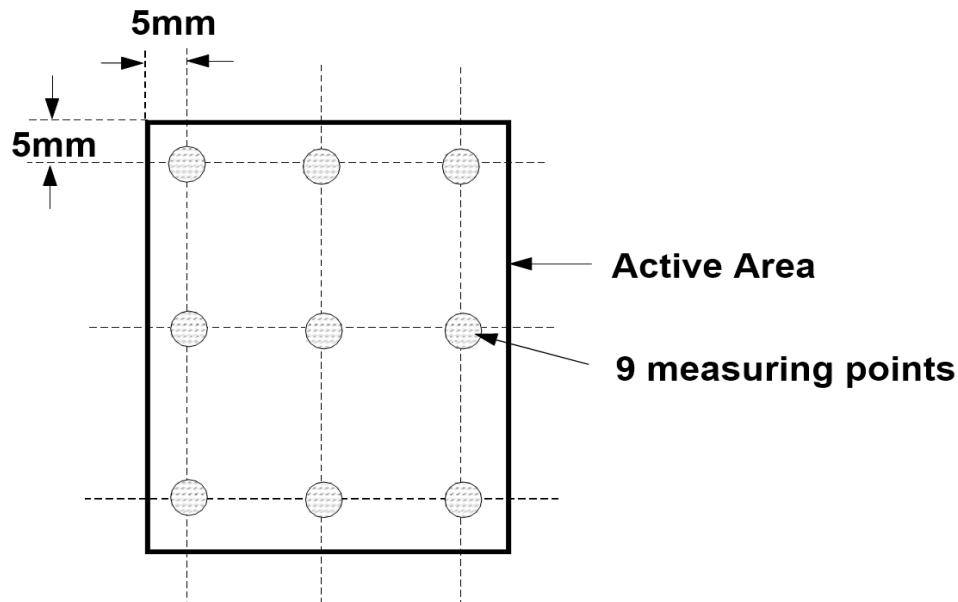
TP DC Characteristics

| Item | Symbol | Test Condition | Min. | Typ. | Max. | Unit | Note |
|---|--------|---------------------------------|-------------|------|-------------|------|------|
| Input high-level voltage | VIH | | 0.7 × IOVCC | - | IOVCC | V | |
| Input low -level voltage | VIL | | -0.3 | - | 0.3 × IOVCC | V | |
| Output high -level voltage | VOH | IOH=-0.1mA | 0.7 × IOVCC | - | - | V | |
| Output low -level voltage | VOL | IOH=0.1mA | - | - | 0.3 × IOVCC | V | |
| I/O leakage current | ILI | Vin=0~AVDD | -1 | - | 1 | µA | |
| Current consumption (Normal operation mode) | Iopr | AVDD=2.8V Ta=25°C MCLK=15MHz | - | 1.5 | - | mA | |
| Current consumption (Monitor mode) | Imon | AVDD=2.8V Ta=25°C MCLK=15MHz | - | 30 | - | µA | |
| Current consumption (Sleep mode) | Islp | AVDD=2.8V Ta=25°C | - | 10 | - | µA | |
| Power Supply voltage | AVDD | | 2.8 | - | 3.6 | V | |

8.Electro-optical characteristics

| Item | Symbol | Condition | Value | | | Unit | Remark | |
|--|-------------|---|-------|-------|-------|-------------------|--------|--|
| | | | Min | Typ | Max | | | |
| Luminance | L | $\theta=0^\circ \Phi=0^\circ$ without CG | 315 | 350 | - | cd/m ² | | |
| Uniformity | | | 85 | 90 | - | % | Note 2 | |
| Viewing Angle | Left | $Cr \geq 200$ | 80 | 85 | - | Deg. | | |
| | Right | | 80 | 85 | - | | | |
| | Top | | 80 | 85 | - | | | |
| | Bottom | | 80 | 85 | - | | | |
| Contrast Ratio | CR | $\theta=0^\circ$ | 5000 | 10000 | - | - | | |
| Adobe cover Ratio | S0R | ICE1931 | - | 100 | - | % | Note 1 | |
| Response Time | Tr+Tf | $\Phi=0^\circ$ | - | 2 | 4 | ms | | |
| Color Coordinate of CIE1931 | Red | $\theta=0^\circ$ $\Phi=0^\circ$ | 0.64 | 0.67 | 0.70 | - | | |
| | | | 0.30 | 0.33 | 0.36 | | | |
| | Green | | 0.17 | 0.21 | 0.25 | | | |
| | | | 0.69 | 0.73 | 0.77 | | | |
| | Blue | | 0.11 | 0.14 | 0.17 | | | |
| | | | 0.01 | 0.04 | 0.07 | | | |
| | White | | 0.28 | 0.30 | 0.32 | | | |
| | | | 0.29 | 0.31 | 0.33 | | | |
| NTSC Ratio | NTSC | CIE1931 | 100 | 103 | - | % | | |
| Color Uniformity | $\Delta u'$ | $\theta=0$ deg. Condition 1 | - | - | 0.007 | $\Delta u'$ | Note 2 | |
| | $\Delta v'$ | | | | 0.007 | $\Delta u'$ | | |
| Flicker | - | 60Hz, Worst pattern | - | -30 | - | dB | | |
| Gamma | - | $\theta=0$ deg. | 2.0 | 2.2 | 2.4 | | | |
| Crosstalk | | - | - | - | TBD | % | Note 3 | |
| Color temperature | CT | | 6700 | 7500 | 8300 | K | | |
| Luminance decrease ratio of full white | | $\theta L=30^\circ$ | | 40 | 45 | % | | |
| | | $\theta R=30^\circ$ | | 40 | 45 | % | | |
| | | $\psi T=30^\circ$ | | 40 | 45 | % | | |
| | | $\psi B=30^\circ$ | | 40 | 45 | % | | |
| White color shift | WAD | G255, 0 to 45 deg. | - | - | 0.022 | $\Delta u'v'$ | Note 4 | |

Note 1): Uniformity Measuring Point

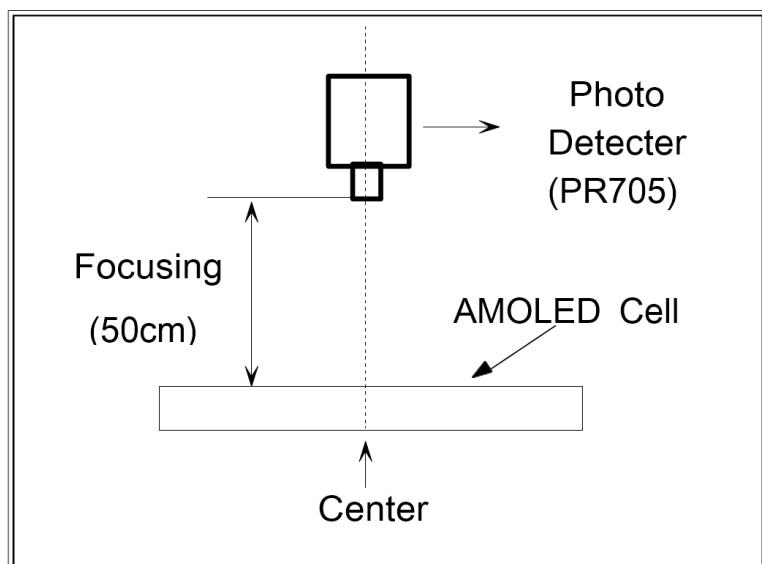


$$\text{Uniformity} = \frac{L_{\min}}{L_{\max}} * 100 \ [\%]$$

Note 2): Definition of contrast ratio (K)

$$\text{Contrast Ratio(K)} = \frac{\text{Brightness of selected dot (White patterned area) at } 250\text{cd/m}^2}{\text{Brightness of non-selected dot (Black patterned area) at } 250\text{cd/m}^2}$$

Note 3): Optical measuring system : temperature regulated chamber



Note 4): Life Time

The elapsed time that the full white brightness decreases to the half of initial value

9. Standard Specification For Reliability

| No | Item | Condition | Cycles | Judgment Criterion |
|----|-------------------------------------|------------------------|--------|--------------------|
| 1 | High Temperature Operation | 80°C/ 240hours | 10 | |
| 2 | Low Temperature Operation | -30°C/ 240hours | 10 | |
| 3 | High Temperature Storage | 85°C/ 240hours | 5 | |
| 4 | Low Temperature Storage | -40°C/ 240hours | 5 | |
| 5 | High Temperature Humidity Operation | 60°C/90%RH/ 240hours | 5 | |
| 6 | Thermal Shock | -40°C~85°C / 100cycles | 5 | |

Note: The results must be measured after 2 hours later under room temperature keeping.

- END -