



LEOPARD IMAGING INC

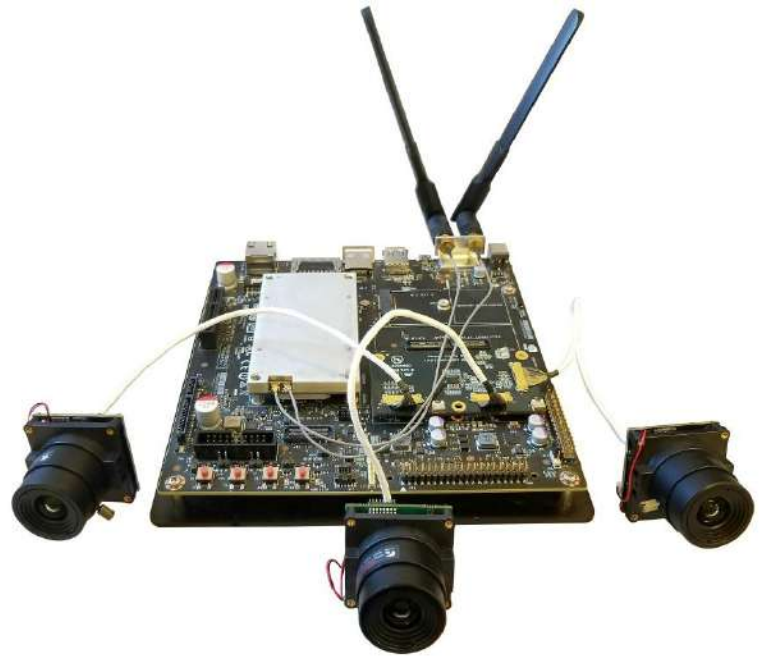
Rev 1.0

# LI-JETSON-KIT-IMX377CS-X

## Data Sheet

### Key Features

- Compatible with Nvidia Jetson TX1/TX2 Development Kit
- MIPI CSI-2 interface
- Support up to three cameras
- Adapter board:  
LI-JTX1-MIPI-ADPT  
Includes three 4-lane interface  
Support 13M@30fps
- Sony Diagonal 7.81 mm (Type 1/2.3)  
CMOS Image Sensor IMX377CQT
- Active pixels: 4024H x 3036V
- Pixel size: 1.55  $\mu\text{m}$  x 1.55  $\mu\text{m}$
- Color camera
- I-PEX cable part#: FAW-1233-03
- Length of the I-PEX cable: 300mm
- Support multiple length cables
- Connector Part#: 20525-030E-02C
- Support IR cut switch
- Support CS lens
- Provide customization services
- Part#:  
(1 cam) **LI-JETSON-KIT-IMX377CS**  
(2 cam) **LI-JETSON-KIT-IMX377CS-D**  
(3 cam) **LI-JETSON-KIT-IMX377CS-T**



### Lens Spec

- Model: ES0522F.IR
- Focal length: 5.0 mm
- Aperture, F/#: 2.2
- FOV (D/H/V): 87° / 76° / 43°
- TV Distortion: < -8%
- Mount Type: CS

### BOM

Nvidia TX1/TX2 Development Kit not included

| # | Items             | QTY      |
|---|-------------------|----------|
| 1 | LI-JTX1-MIPI-ADPT | 1        |
| 2 | LI-IMX377-MIPI-CS | 1,2 or 3 |
| 3 | FAW-1233-03 cable | 1,2 or 3 |



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## LI-JETSON-KIT-IMX377CS

### BOM

| # | Items             | QTY |
|---|-------------------|-----|
| 1 | LI-JTX1-MIPI-ADPT | 1   |
| 2 | LI-IMX377-MIPI-CS | 1   |
| 3 | FAW-1233-03 cable | 1   |



## LI-JETSON-KIT-IMX377CS-D

### BOM

| # | Items             | QTY |
|---|-------------------|-----|
| 1 | LI-JTX1-MIPI-ADPT | 1   |
| 2 | LI-IMX377-MIPI-CS | 2   |
| 3 | FAW-1233-03 cable | 2   |



## LI-JETSON-KIT-IMX377CS-T

### BOM

| # | Items             | QTY |
|---|-------------------|-----|
| 1 | LI-JTX1-MIPI-ADPT | 1   |
| 2 | LI-IMX377-MIPI-CS | 3   |
| 3 | FAW-1233-03 cable | 3   |

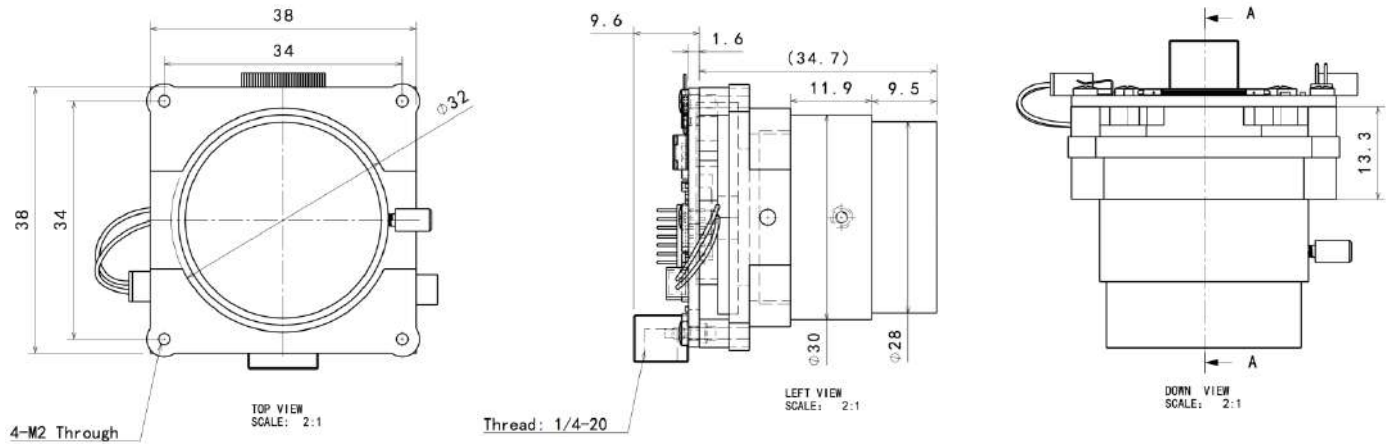


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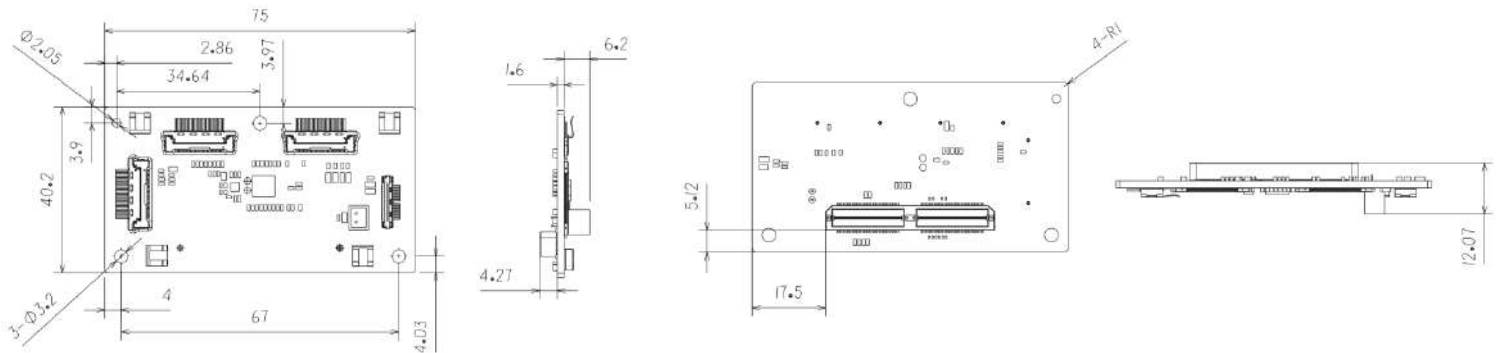
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# Dimensions

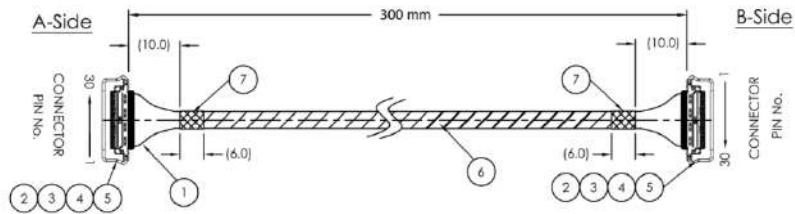
# LI-IMX377-MIPI-CS



## LI-JTX1-MIPI-ADPT



## FAW-1233-03



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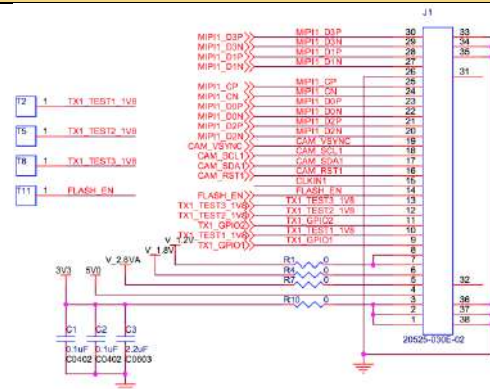
# LI-JTX1-MIPI-ADPT



## Interfaces

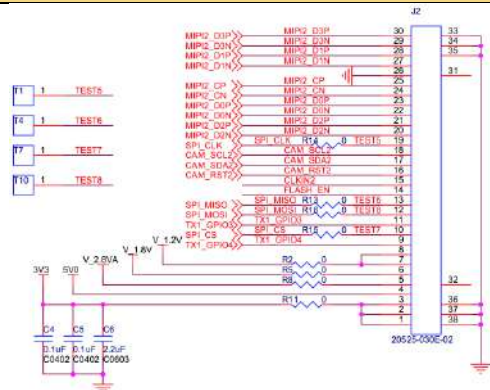
### Interface J1

- Part#: 20525-030E-02C
- Number of Positions: 30
- Pitch: 0.4mm
- Mating I-PEX cable: FAW-1233-03 (300mm)



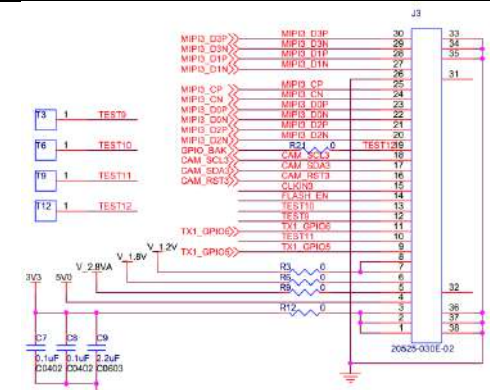
### Interface J2

- Part#: 20525-030E-02C
- Number of Positions: 30
- Pitch: 0.4mm
- Mating I-PEX cable: FAW-1233-03 (300mm)



### Interface J3

- Part#: 20525-030E-02C
- Number of Positions: 30
- Pitch: 0.4mm
- Mating I-PEX cable: FAW-1233-03 (300mm)

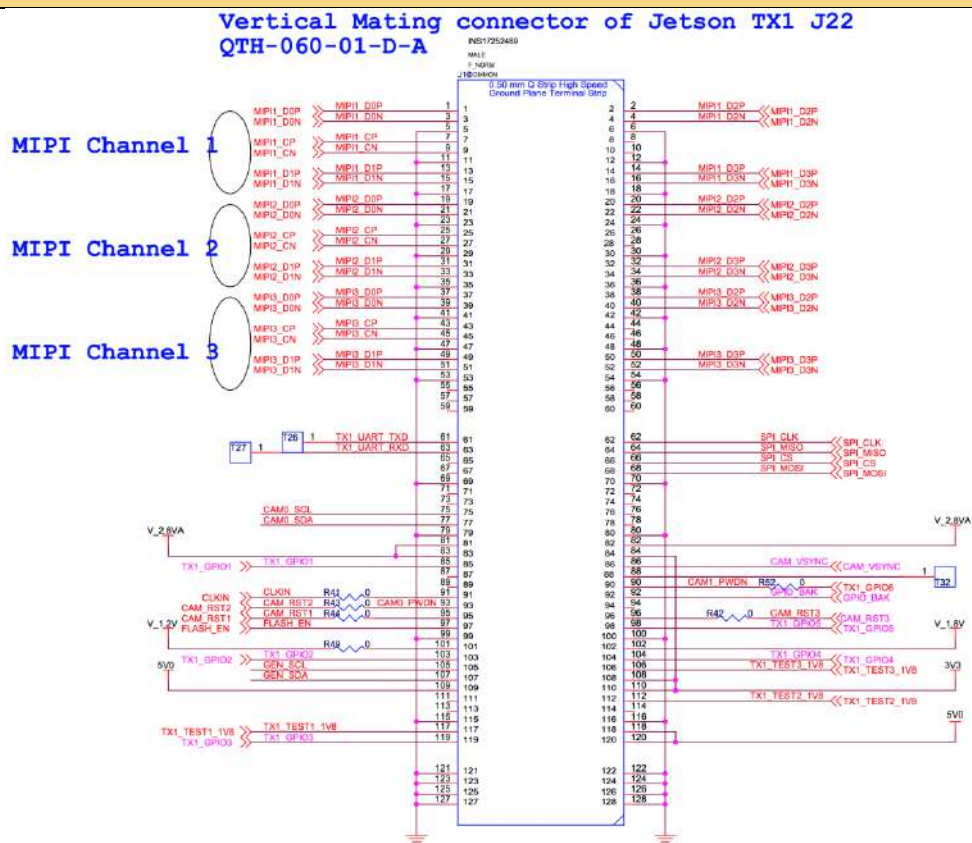


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## Interface J10

- Part#: QTH-060-01-L-D-A
- Number of Positions: 120
- Number of Rows: 2
- Pitch: 0.5 mm



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# LI-IMX377-MIPI-CS



| Camera Spec                                                                                                                                                                                          |                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| Image Sensor                                                                                                                                                                                         | Sony Diagonal 7.81 mm (Type 1/2.3) CMOS Image Sensor IMX377CQT |
| Optical format                                                                                                                                                                                       | 1/2.3"                                                         |
| Number of active pixels                                                                                                                                                                              | 4024 (H) x 3036 (V)                                            |
| Pixel size                                                                                                                                                                                           | 1.55um (H) x 1.55um (V)                                        |
| Color or Mono                                                                                                                                                                                        | Color                                                          |
| Interface                                                                                                                                                                                            | MIPI interface                                                 |
| Lens mount                                                                                                                                                                                           | CS                                                             |
| IR switcher                                                                                                                                                                                          | Support                                                        |
| Weight                                                                                                                                                                                               | 56 g                                                           |
| Interfaces                                                                                                                                                                                           |                                                                |
| <b>Interface J1:</b> <ul style="list-style-type: none"> <li>Part#: 20525-030E-02C</li> <li>Number of Positions: 30</li> <li>Pitch: 0.4mm</li> <li>Mating I-PEX cable: FAW-1233-03 (300mm)</li> </ul> |                                                                |
| <b>Interface J3:</b> <ul style="list-style-type: none"> <li>Part#: 1734829-2</li> <li>Number of Positions: 2</li> <li>Pitch: 1.25mm</li> </ul>                                                       |                                                                |



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## Absolute Maximum Ratings

|                                     |                 |                          |    |
|-------------------------------------|-----------------|--------------------------|----|
| ◆ Supply voltage (Analog)           | $V_{ADD}^{*1}$  | -0.3 to +3.3             | V  |
| ◆ Supply voltage (Digital 1)        | $V_{DDD1}^{*2}$ | -0.5 to +2.0             | V  |
| ◆ Supply voltage (Digital 2)        | $V_{DDD2}^{*3}$ | -0.5 to +3.3             | V  |
| ◆ Input voltage (Digital)           | $V_I$           | -0.3 to $V_{DDD2} + 0.3$ | V  |
| ◆ Output voltage (Digital)          | $V_O$           | -0.3 to $V_{DDD2} + 0.3$ | V  |
| ◆ Guaranteed operating temperature  | $T_{OPR}$       | -10 to +75               | °C |
| ◆ Storage guarantee temperature     | $T_{STG}$       | -30 to +80               | °C |
| ◆ Performance guarantee temperature | $T_{SPEC}$      | -10 to +60               | °C |

## Recommended Operating Conditions

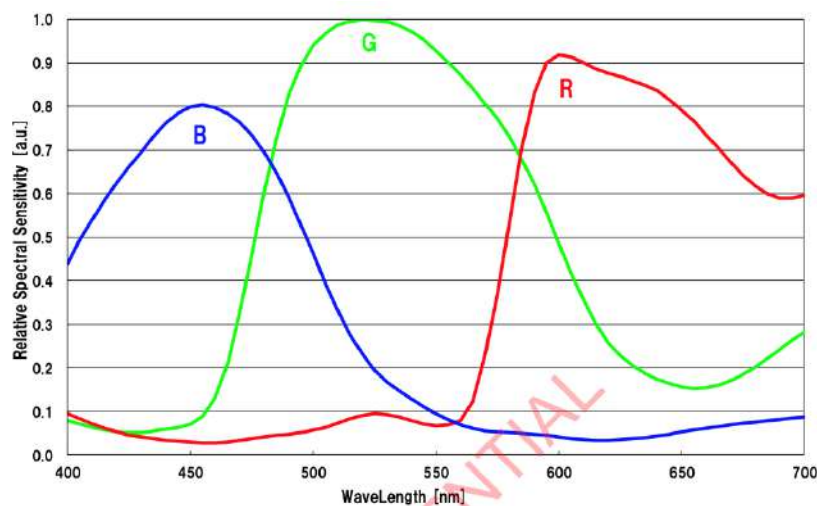
|                              |                 |                          |   |
|------------------------------|-----------------|--------------------------|---|
| ◆ Supply voltage (Analog)    | $V_{ADD}^{*1}$  | $2.8 \pm 0.1$            | V |
| ◆ Supply voltage (Digital 1) | $V_{DDD1}^{*2}$ | $1.2 \pm 0.1$            | V |
| ◆ Supply voltage (Digital 2) | $V_{DDD2}^{*3}$ | $1.8 \pm 0.1$            | V |
| ◆ Input voltage (Digital)    | $V_I$           | -0.1 to $V_{DDD2} + 0.1$ | V |
| ◆ Output voltage (Digital)   | $V_O$           | -0.1 to $V_{DDD2} + 0.1$ | V |

\*1  $V_{ADD}$ :  $V_{DDSUB}$ ,  $V_{DDHCM}$ ,  $V_{DDHPX}$ ,  $V_{DDHDA}$ ,  $V_{DDHCP}$  (2.8 V power supply)

\*2  $V_{DDD1}$ :  $V_{DDLNC1}$  to 2,  $V_{DDLSC1}$  to 2,  $V_{DDLPL1}$  to 3,  $V_{DDLIF1}$  to 2 (1.2 V power supply)

\*3  $V_{DDD2}$ :  $V_{DDMIO}$  (1.8 V power supply)

## Spectral Sensitivity Characteristics



## DC Characteristics

### Current Consumption and Gain Variable Range

( $V_{ADD} = 2.9\text{ V}$ ,  $V_{DDD1} = 1.3\text{ V}$ ,  $V_{DDD2} = 1.9\text{ V}$ ,  $T_j = 60\text{ }^{\circ}\text{C}$ , Reference Gain (0 dB), approximately 12.35 M pixels readout (MODE0), 34.97 frame/s)

| Item                            | Symbol        | Min. | Typ. | Max. | Unit          | Remarks     |
|---------------------------------|---------------|------|------|------|---------------|-------------|
| Current consumption (Analog)    | $I_{ADD}$     | —    | —    | 91   | mA            |             |
| Current consumption (Digital 1) | $I_{DDD1}$    | —    | —    | 256  | mA            |             |
| Current consumption (Digital 2) | $I_{DDD2}$    | —    | —    | 1    | mA            |             |
| Standby current (Analog)        | $I_{ADDSTB}$  | —    | —    | 150  | $\mu\text{A}$ | In the dark |
| Standby current (Digital 1)     | $I_{DDD1STB}$ | —    | —    | 40   | mA            | In the dark |
| Standby current (Digital 2)     | $I_{DDD2STB}$ | —    | —    | 50   | $\mu\text{A}$ | In the dark |
| PGA gain variable range         | PGAG          | 0    | —    | 27   | dB            |             |

### Supply Voltage and I/O Voltage

| Item                  |           | Pins                                                                                    | Symbol     | Min.                   | Typ. | Max.                   | Unit |
|-----------------------|-----------|-----------------------------------------------------------------------------------------|------------|------------------------|------|------------------------|------|
| Supply voltage        | Analog    | $V_{DDSUB}$ ,<br>$V_{DDHCM}$ ,<br>$V_{DDHPX}$ ,<br>$V_{DDHDA}$ ,<br>$V_{DDHCP}$         | $V_{ADD}$  | 2.70                   | 2.80 | 2.90                   | V    |
|                       | Digital 1 | $V_{DDL CN1}$ to 2,<br>$V_{DDL SC1}$ to 2,<br>$V_{DDL PL1}$ to 3,<br>$V_{DDL IF1}$ to 2 | $V_{DDD1}$ | 1.10                   | 1.20 | 1.30                   | V    |
|                       | Digital 2 | $V_{DDMIO}$                                                                             | $V_{DDD2}$ | 1.70                   | 1.80 | 1.90                   | V    |
| Digital input voltage |           | SDA,<br>SCL                                                                             | $V_{IH1}$  | $0.7 \times V_{DDD2}$  | —    | 1.9                    | V    |
|                       |           |                                                                                         | $V_{IL1}$  | −0.3                   | —    | $0.3 \times V_{DDD2}$  | V    |
|                       |           | XCLR,<br>INCK                                                                           | $V_{IH2}$  | $0.65 \times V_{DDD2}$ | —    | $V_{DDD2} + 0.3$       | V    |
|                       |           |                                                                                         | $V_{IL2}$  | −0.3                   | —    | $0.35 \times V_{DDD2}$ | V    |

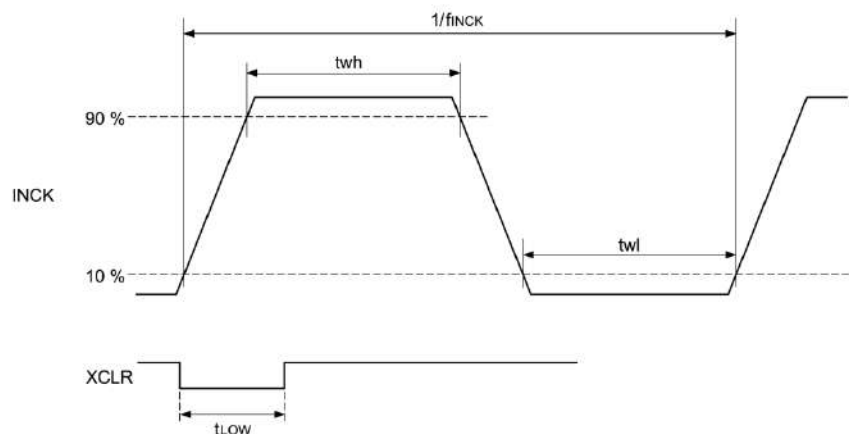


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## AC Characteristics

### INCK, XCLR



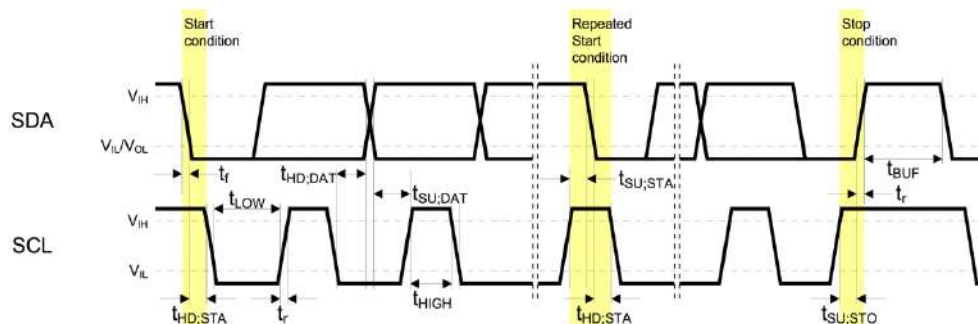
| Item                        | Symbol     | Min. | Typ. | Max. | Unit |
|-----------------------------|------------|------|------|------|------|
| INCK clock frequency        | $f_{INCK}$ | 6    | —    | 27   | MHz  |
| INCK Low level pulse width  | $t_{wl}$   | 5    | —    | —    | ns   |
| INCK High level pulse width | $t_{wh}$   | 5    | —    | —    | ns   |
| Clock duty                  | —          | 40   | 50   | 60   | %    |
| XCLR Low level pulse width  | $t_{LOW}$  | 100  | —    | —    | ns   |



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## I<sup>2</sup>C Communication



### I<sup>2</sup>C Specification

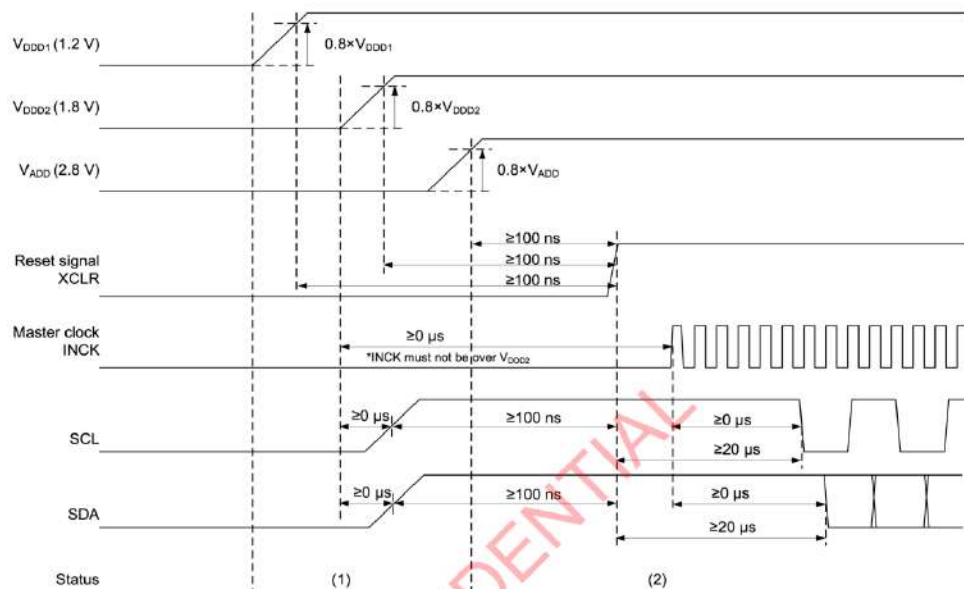
| Item                           | Symbol   | Min.                 | Typ. | Max.                 | Unit          | Remarks                                                               |
|--------------------------------|----------|----------------------|------|----------------------|---------------|-----------------------------------------------------------------------|
| Low level input voltage        | $V_{IL}$ | -0.3                 | —    | $0.3 \times V_{DD2}$ | V             |                                                                       |
| High level input voltage       | $V_{IH}$ | $0.7 \times V_{DD2}$ | —    | 1.9                  | V             |                                                                       |
| Low level output voltage       | $V_{OL}$ | 0                    | —    | $0.2 \times V_{DD2}$ | V             | $V_{DD2} < 2\text{ V}$ , Sink 3 mA                                    |
| Output fall time               | $t_{of}$ | —                    | —    | 250                  | ns            | Load 10 pF to 400 pF,<br>$0.7 \times V_{DD2}$ to $0.3 \times V_{DD2}$ |
| Input current                  | $I_i$    | -10                  | —    | 10                   | $\mu\text{A}$ | $0.1 \times V_{DD2}$ to $0.9 \times V_{DD2}$                          |
| Input capacitance of SCL / SDA | $C_i$    | —                    | —    | 10                   | pF            |                                                                       |

### I<sup>2</sup>C AC Characteristics

| Item                                             | Symbol       | Min. | Typ. | Max. | Unit          |
|--------------------------------------------------|--------------|------|------|------|---------------|
| SCL clock frequency                              | $f_{SCL}$    | 0    | —    | 400  | kHz           |
| Hold time (Start Condition)                      | $t_{HD,STA}$ | 0.6  | —    | —    | $\mu\text{s}$ |
| Low period of the SCL clock                      | $t_{LOW}$    | 1.3  | —    | —    | $\mu\text{s}$ |
| High period of the SCL clock                     | $t_{HIGH}$   | 0.6  | —    | —    | $\mu\text{s}$ |
| Set-up time (Repeated Start Condition)           | $t_{SU,STA}$ | 0.6  | —    | —    | $\mu\text{s}$ |
| Data hold time                                   | $t_{HD,DAT}$ | 0    | —    | 0.9  | $\mu\text{s}$ |
| Data set-up time                                 | $t_{SU,DAT}$ | 100  | —    | —    | ns            |
| Rise time of both SDA and SCL signals            | $t_r$        | —    | —    | 300  | ns            |
| Fall time of both SDA and SCL signals            | $t_f$        | —    | —    | 300  | ns            |
| Set-up time (Stop Condition)                     | $t_{SU,STO}$ | 0.6  | —    | —    | $\mu\text{s}$ |
| Bus free time between a STOP and START Condition | $t_{BUF}$    | 1.3  | —    | —    | $\mu\text{s}$ |



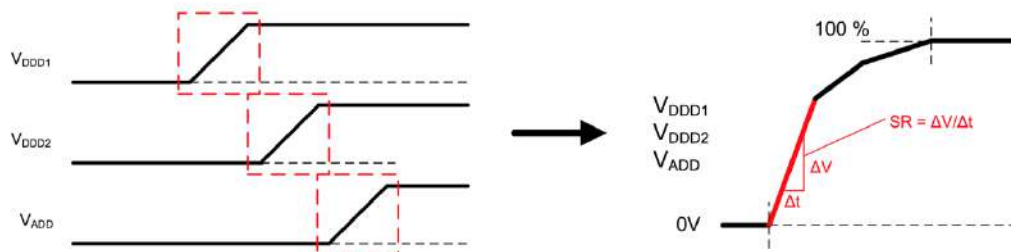
## Power-on Sequence



| Period name                                          | Remarks                                                                                                                                           |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| (1) Power stabilization period                       | All input signals are set to Low level.<br>There are no constraints of the power-on sequence with $V_{ADD}$ , $V_{DDD1}$ and $V_{DDD2}$ .         |
| (2) Register communication period for standby cancel | Wait 100 ns after the last power supply in $V_{ADD}$ , $V_{DDD1}$ and $V_{DDD2}$ .<br>Then set XCLR to "H" and start the standby cancel sequence. |

## Slew Rate Limitation of Power-on Sequence

Conform the slew rate limitation shown below when power supply change 0 V to each voltage (0 % to 100 %) in power-on sequence.



Slew rate of power supply

| Item      | Symbol | Power supply       | Min. | Max. | Unit  | Remarks |
|-----------|--------|--------------------|------|------|-------|---------|
| Slew rate | SR     | $V_{DDD1}$ (1.2 V) | —    | 25   | mV/μs |         |
|           |        | $V_{DDD2}$ (1.8 V) | —    | 25   | mV/μs |         |
|           |        | $V_{ADD}$ (2.8 V)  | —    | 25   | mV/μs |         |

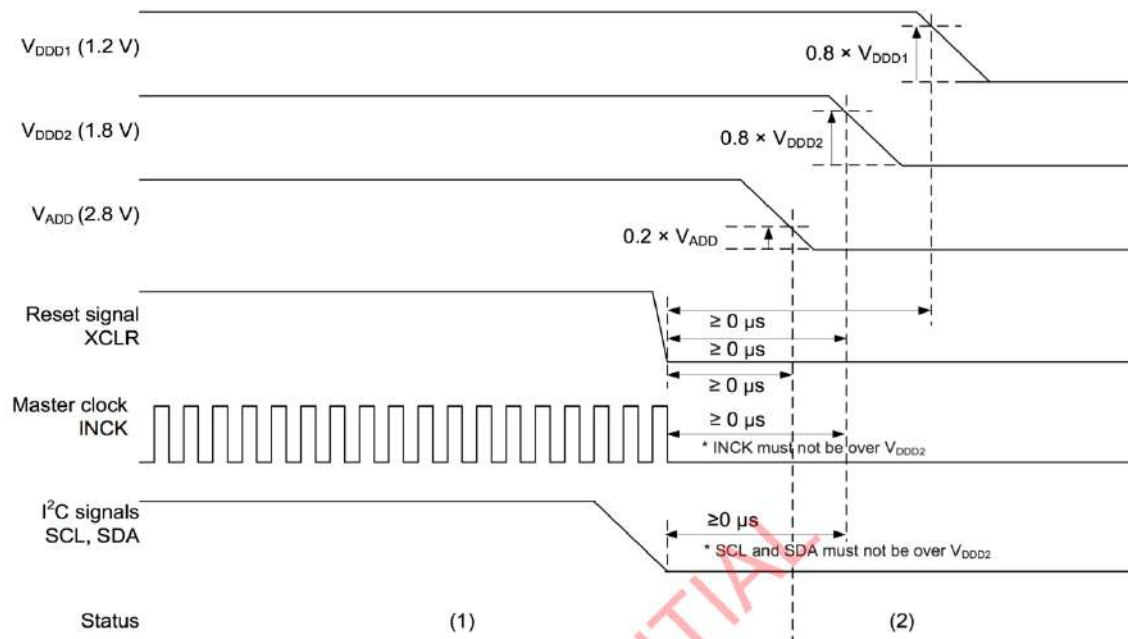


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## Power-off Sequence

Make sure that all input signals are set to LOW level in the area of (2).



| Period name             | Remarks                                                                                                                                                                                                                                                                                                                                  |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1) Pixel output period | Pixel signal output period                                                                                                                                                                                                                                                                                                               |
| (2) Power-off period    | <p>Turn the power supplies off after all input signals are set to "Low" level except SCL and SDA.</p> <p>Set SCL and SDA to "Low" level at the same time with turning off the power supply of V<sub>DD2</sub>.</p> <p>There are no constraints of the power-off sequence with V<sub>ADD</sub>, V<sub>DD1</sub>, and V<sub>DD2</sub>.</p> |



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