

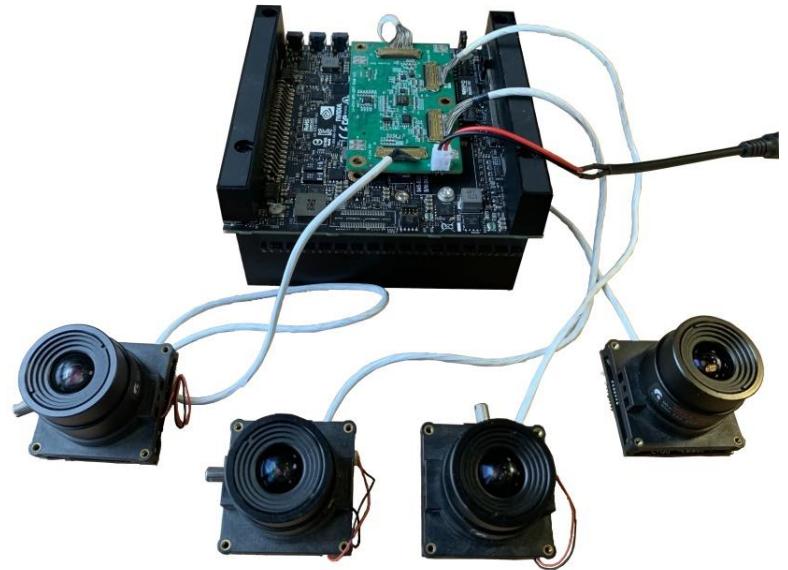


LEOPARD IMAGING INC

# LI-XAVIER-KIT-IMX477CS-X Data Sheet

## Key Features

- Compatible with Nvidia® Jetson AGX Xavier™ Developer Kit
- MIPI CSI-2 interface
- Support up to six cameras
- Two adapter board options
  - LI-JXAV-MIPI-ADPT-4CAM
  - LI-JXAV-MIPI-ADPT-6CAM-FP
- Sony Diagonal 7.857 mm (Type 1/2.3) CMOS Image Sensor IMX477
- Active pixels: 4056H x 3040V
- Color camera
- Length of the I-PEX cable: 300mm
- Support multiple length cables
- Connector Part#: 20525-030E-02C
- Provide customization services
- Part#:
  - (1 cam) [LI-XAVIER-KIT-IMX477CS](#)
  - (2 cam) [LI-XAVIER-KIT-IMX477CS-D](#)
  - (3 cam) [LI-XAVIER-KIT-IMX477CS-T](#)
  - (4 cam) [LI-XAVIER-KIT-IMX477CS-Q](#)
  - (6 cam) [LI-XAVIER-KIT-IMX477CS-H](#)



## Lens Spec

- Model: ES0522F.IR
- Focal length: 5.0 mm
- Aperture, F/#: 2.2
- FOV (D/H/V): 96.5 °/ 80 °/61.5 °
- TV Distortion: < -8%
- Mount Type: CS

## Applications

- Industrial Applications
- Intelligent Transportation System (ITS) Cameras

## BOM

Nvidia AGX Xavier Developer Kit not included

| # | Items  | QTY             |
|---|--|-----------------|
| 1 | LI-JXAV-MIPI-ADPT-4CAM or<br>LI-JXAV-MIPI-ADPT-6CAM-FP | 1               |
| 2 | LI-IMX477-MIPI-CS                                      | 1, 2, 3, 4 or 6 |
| 3 | FAW-1233-03 cable                                      | 1, 2, 3, 4 or 6 |



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 Website: www.leopardimaging.com

### LI-XAVIER-KIT-IMX477CS

#### BOM

| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX477-MIPI-CS      | 1   |
| 3 | FAW-1233-03 cable      | 1   |



### LI-XAVIER-KIT-IMX477CS-D

#### BOM

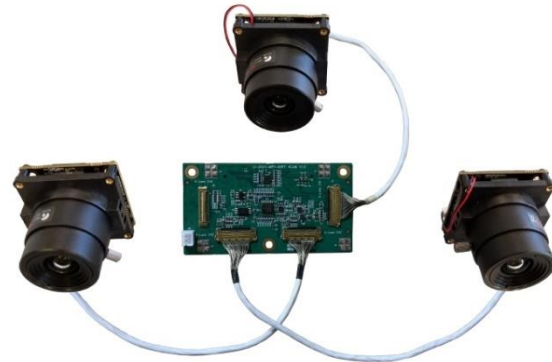
| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX477-MIPI-CS      | 2   |
| 3 | FAW-1233-03 cable      | 2   |



### LI-XAVIER-KIT-IMX477CS-T

#### BOM

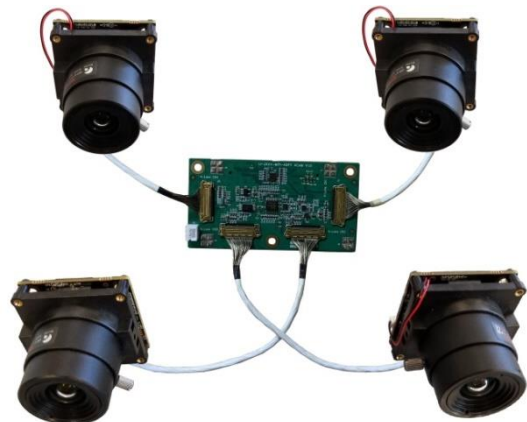
| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX477-MIPI-CS      | 3   |
| 3 | FAW-1233-03 cable      | 3   |



### LI-XAVIER-KIT-IMX477CS-Q

#### BOM

| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX477-MIPI-CS      | 4   |
| 3 | FAW-1233-03 cable      | 4   |



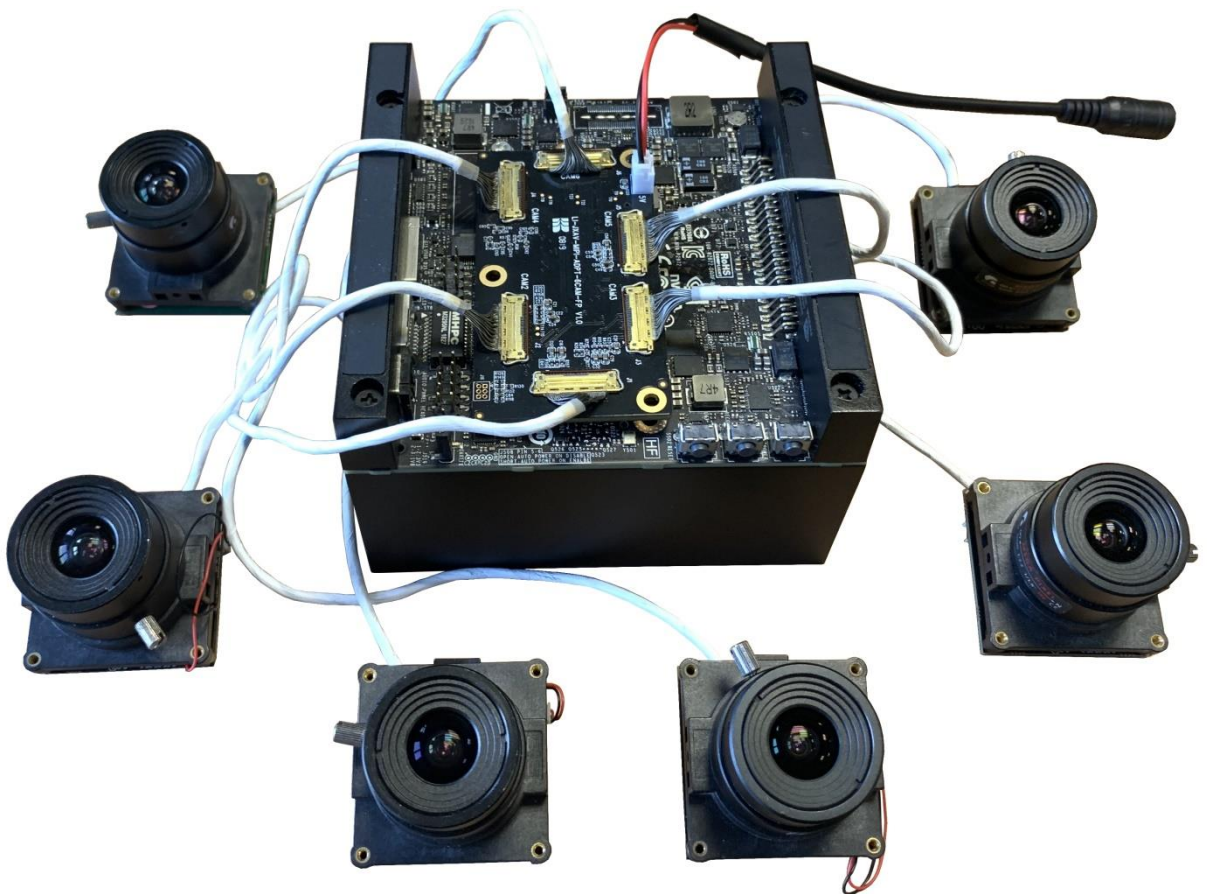
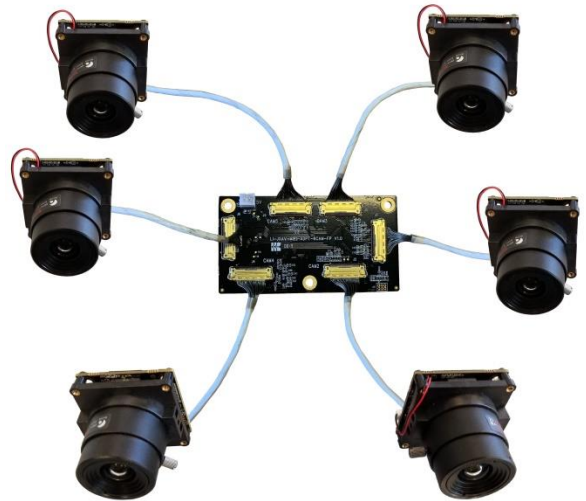
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# LI-XAVIER-KIT-IMX477CS-H

## BOM

| # | Items                     | QTY |
|---|---------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-6CAM-FP | 1   |
| 2 | LI-IMX477-MIPI-CS         | 6   |
| 3 | FAW-1233-03 cable         | 6   |

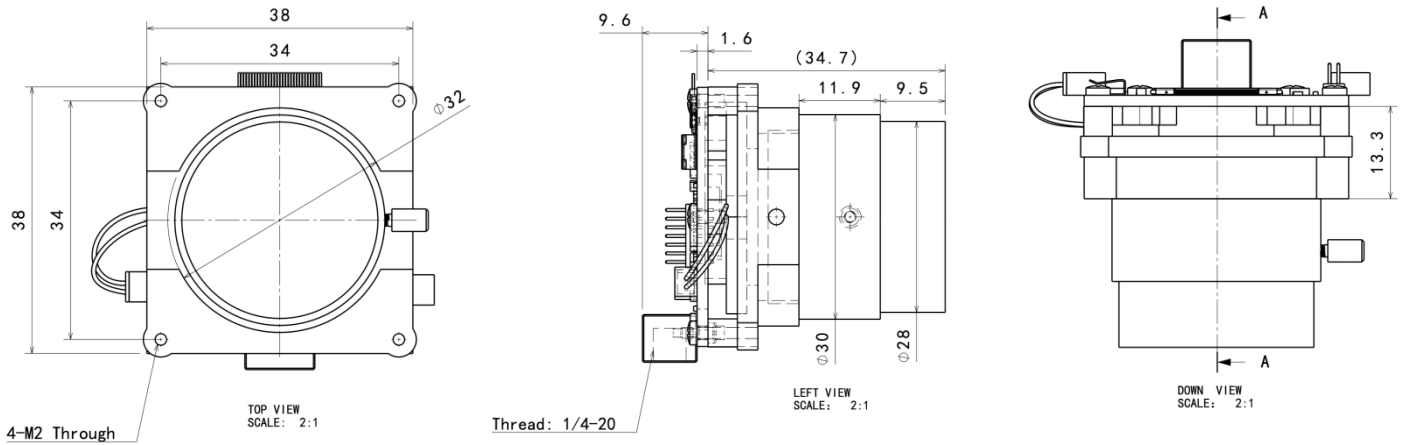


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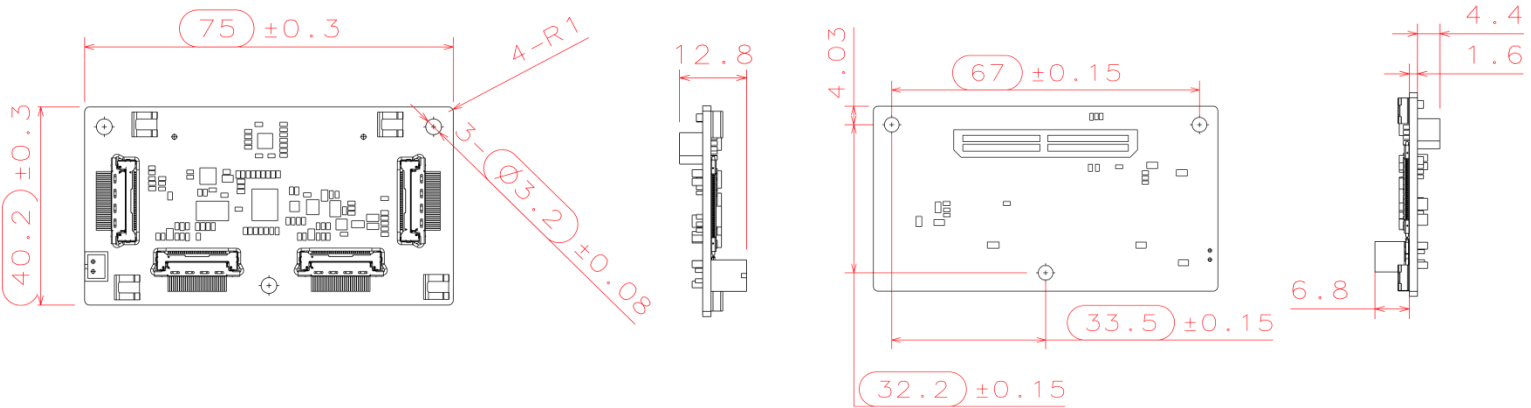
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# Dimensions

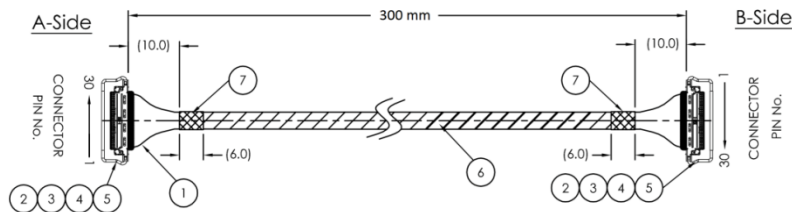
## LI-IMX477-MIPI-CS



## LI-JXAV-MIPI-ADPT-4CAM



## FAW-1233-03

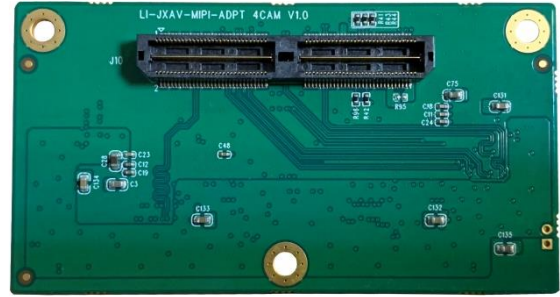


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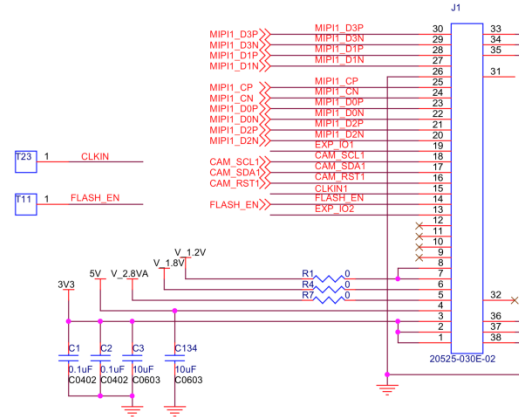
# LI-JXAV-MIPI-ADPT-4CAM



## Interfaces

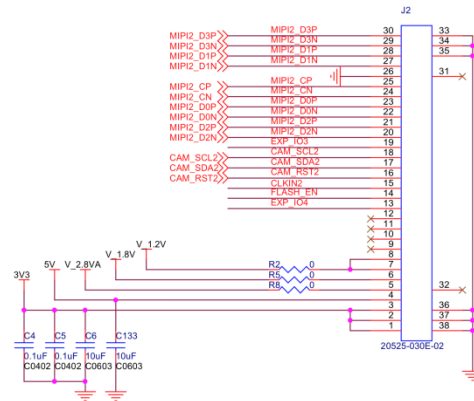
### Interface J1

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



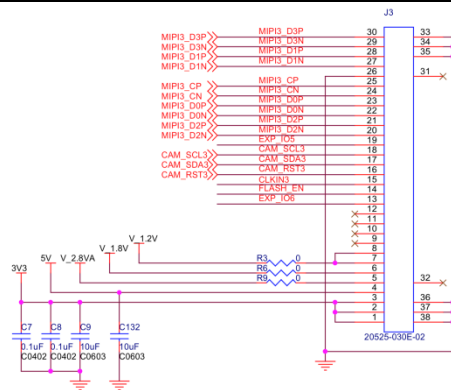
### Interface J2

- 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)

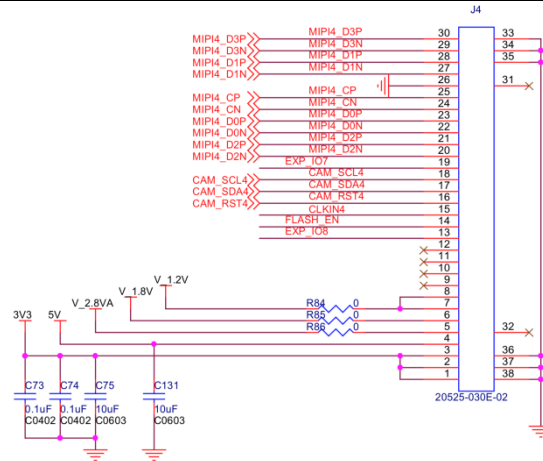


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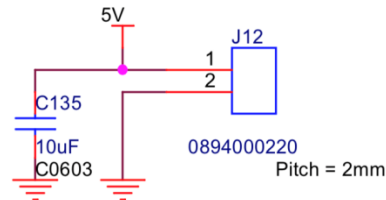
## Interface J4

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



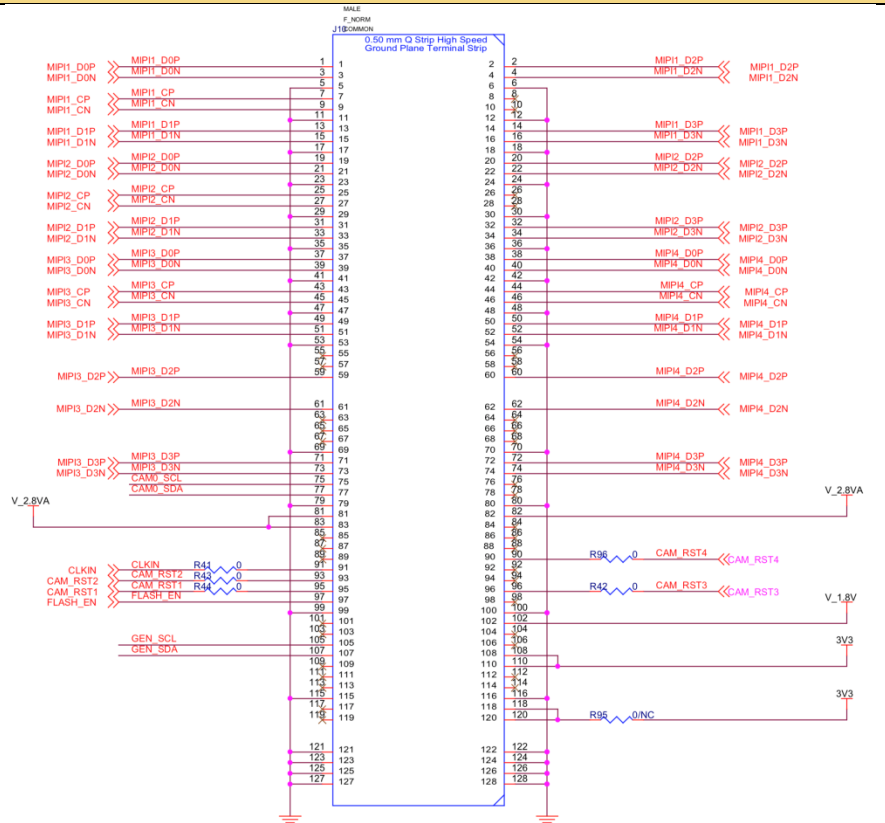
## Interface J5

- Part#: 0894000220
- Number of Positions: 2
- Pitch: 2mm



## Interface J10

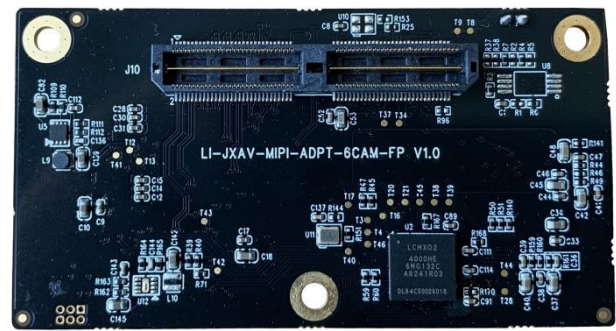
- Part#: QTH-060-01-L-D-A
- Number of Positions: 120
- Number of Rows: 2
- Pitch: 0.5 mm



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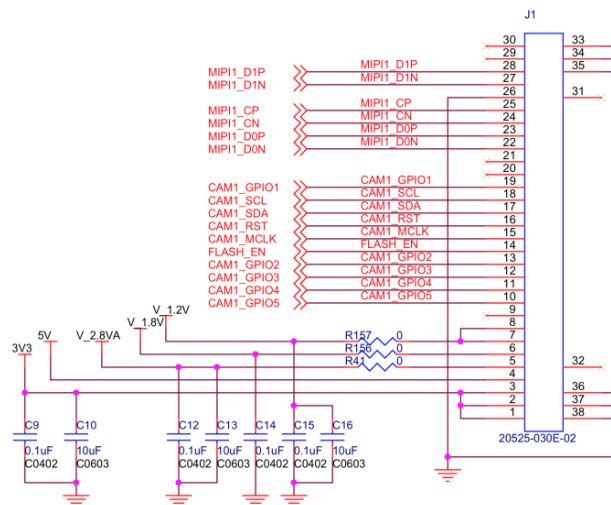
# LI-JXAV-MIPI-ADPT-6CAM-FP



## Interfaces

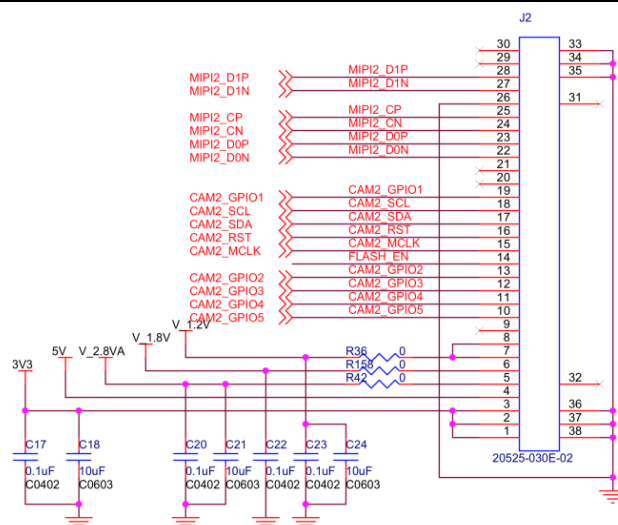
### Interface J1 (camera channel 1)

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



### Interface J2 (camera channel 2)

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

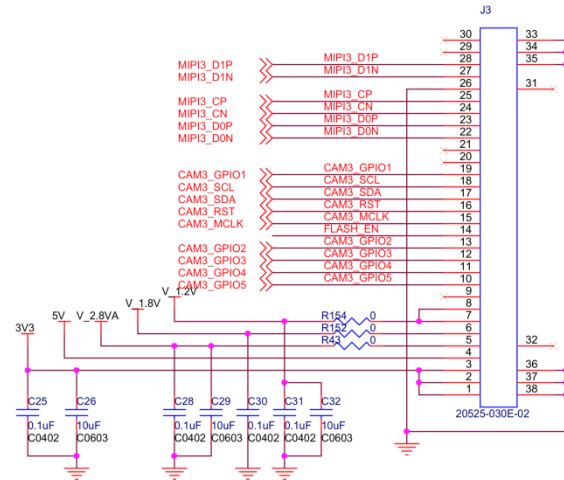


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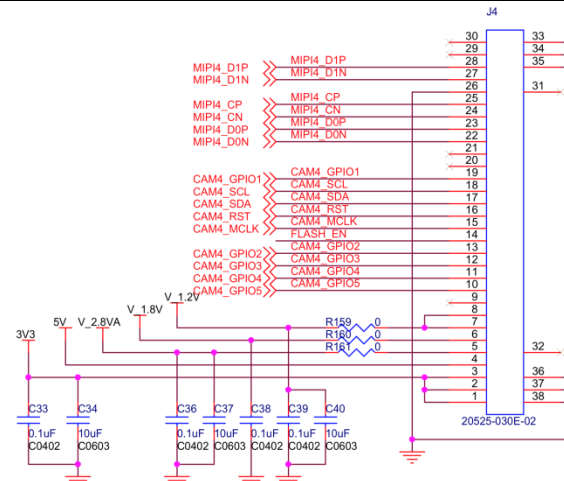
### Interface J3 (camera channel 3)

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



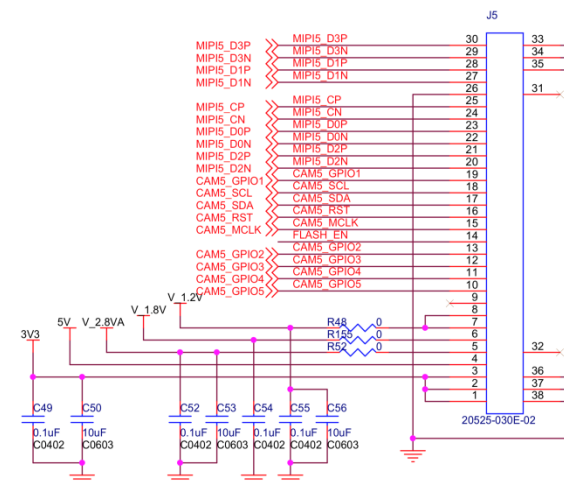
### Interface J4 (camera channel 4)

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



### Interface J5 (camera channel 5)

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



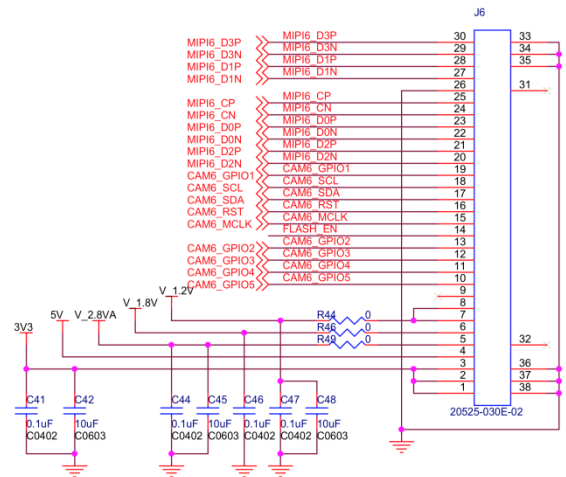
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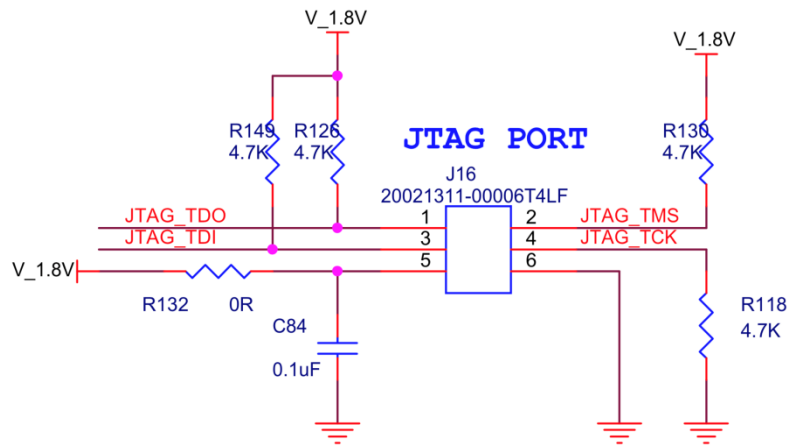
## Interface J6 (camera channel 6)

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



## Interface J16 (FPGA programming interface)

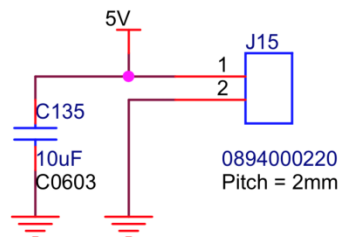
- Part#: 20021311-00006T4LF
- Number of Positions: 6
- Pitch: 0.050" (1.27mm)
- Number of Rows: 2



## Interface J15 (External power input interface)

- Part#: 0894000220
- Number of Positions: 2
- Pitch: 2 mm

### External Input Power

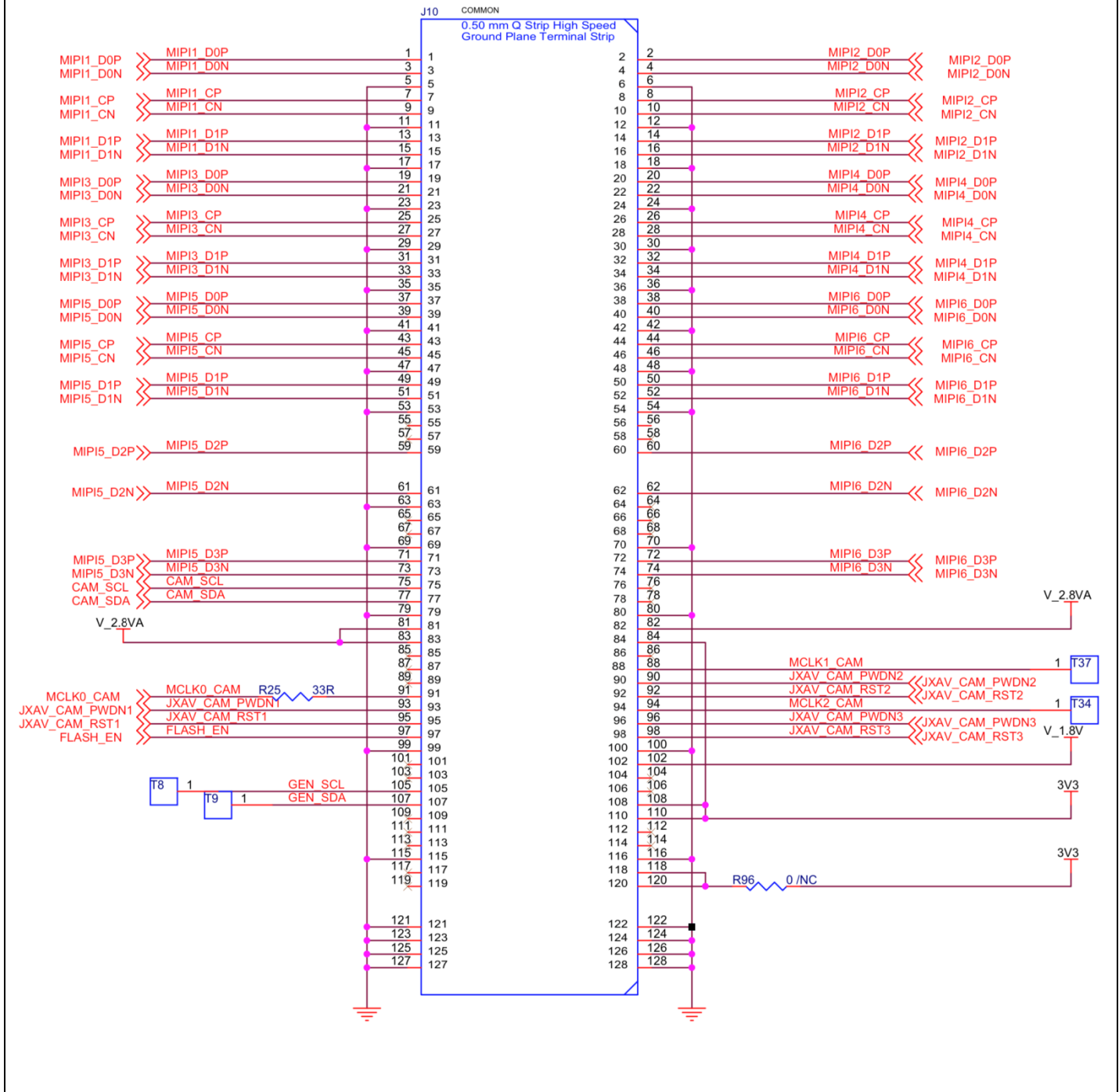


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## Interface J10 (To Xavier)

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



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# LI-IMX477-MIPI-CS



|                         |  |
|-------------------------|--|
| <b>Camera Spec</b>      |  |
| Image Sensor            | Sony Diagonal 7.857 mm (Type 1/2.3) CMOS Image Sensor IMX477 |
| Optical format          | 1/2.3"   |
| Number of active pixels | 4056(H) x 3040(V)  |
| Pixel size              | 1.55um (H) x 1.55um (V)                                      |
| Color or Mono           | Color  |
| Interface               | MIPI interface   |
| Lens mount              | CS   |
| Weight                  | 58 g   |
| <b>Interfaces</b>       |  |
| Interface J1:           |  |
| Interface J4:           |  |
| Interface J1:           |  |



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## Absolute Maximum Ratings

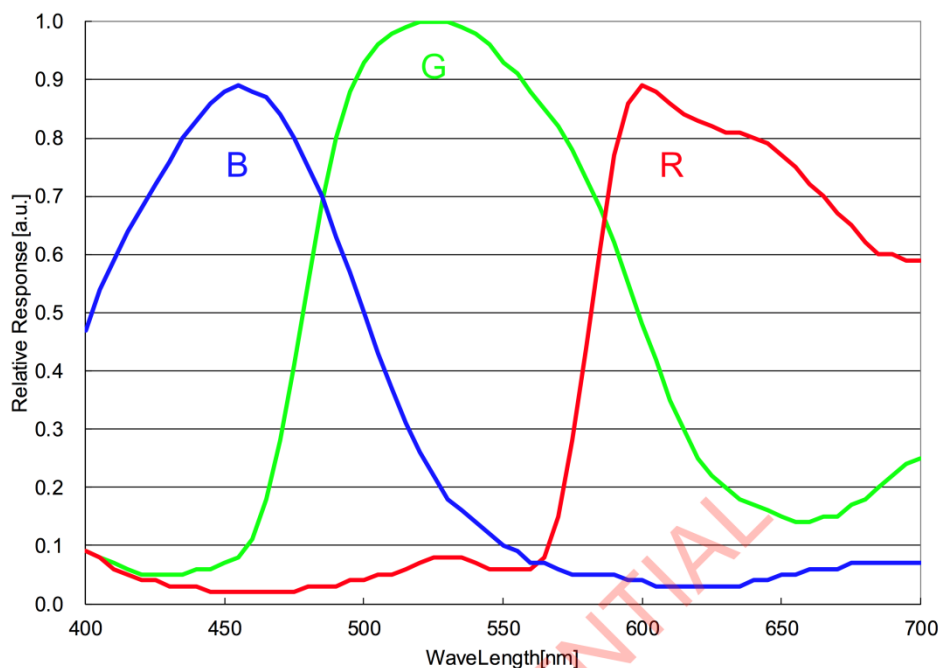
| Item                               | Symbol            | Ratings      | Unit | notes                          |
|------------------------------------|-------------------|--------------|------|--------------------------------|
| Supply voltage (analog)            | V <sub>ANA</sub>  | -0.3 to +3.3 | V    | refer to V <sub>SS</sub> level |
| Supply voltage (digital)           | V <sub>DIG</sub>  | -0.3 to +1.8 | V    |                                |
| Supply voltage (interface)         | V <sub>IF</sub>   | -0.3 to +3.3 | V    |                                |
| Input voltage (digital)            | V <sub>I</sub>    | -0.3 to +3.3 | V    |                                |
| Output voltage (digital)           | V <sub>O</sub>    | -0.3 to +3.3 | V    |                                |
| Guaranteed operating temperature   | T <sub>OPR</sub>  | -20 to +75   | °C   |                                |
| Guaranteed storage temperature     | T <sub>STG</sub>  | -30 to +80   | °C   |                                |
| Guaranteed performance temperature | T <sub>SPEC</sub> | -20 to +60   | °C   |                                |

## Recommended Operating Conditions

| Item                       | Symbol                         | Ratings    | Unit | notes                          |
|----------------------------|--------------------------------|------------|------|--------------------------------|
| Supply voltage (analog)    | V <sub>ANA</sub> <sup>*1</sup> | 2.8 ± 0.1  | V    | refer to V <sub>SS</sub> level |
| Supply voltage (digital)   | V <sub>DIG</sub> <sup>*2</sup> | 1.05 ± 0.1 | V    |                                |
| Supply voltage (interface) | V <sub>IF</sub> <sup>*3</sup>  | 1.8 ± 0.1  | V    |                                |

- \*1 V<sub>ANA</sub>: V<sub>DDSUB</sub>, V<sub>DDHAN</sub>, V<sub>DDHCM1</sub> to 2, V<sub>DDHSN1</sub> to 4 (2.8 V power supply)  
 \*2 V<sub>DIG</sub>: V<sub>DDLSC1</sub> to 4, V<sub>DDLGN1</sub> to 2, V<sub>DDLPL1</sub> to 2, V<sub>DDLIF</sub> (1.05 V power supply)  
 \*3 V<sub>IF</sub>: V<sub>DDMIO1</sub> to 2, V<sub>DDMIF</sub> (1.8 V power supply)

## Spectral Sensitivity Characteristics



## DC Characteristics

| Item                      | Pins  | Symbol           | Conditions | Min.                  | Typ. | Max.                  | Unit |
|---------------------------|---|------------------|------------|-----------------------|------|-----------------------|------|
| Supply voltage            | V <sub>DD</sub> SUB,<br>V <sub>DD</sub> HCM1 to 2,<br>V <sub>DD</sub> HSN1 to 4,<br>V <sub>DD</sub> HAN       | V <sub>ANA</sub> |            | 2.7                   | 2.8  | 2.9                   | V    |
|                           | V <sub>DD</sub> LCN1 to 2,<br>V <sub>DD</sub> LSC1 to 4,<br>V <sub>DD</sub> LIF,<br>V <sub>DD</sub> LPL1 to 2 | V <sub>DIG</sub> |            | 0.95                  | 1.05 | 1.15                  | V    |
|                           | V <sub>DD</sub> MIO1 to 2,<br>V <sub>DD</sub> MIF   | V <sub>IF</sub>  |            | 1.7                   | 1.8  | 1.9                   | V    |
| Digital<br>input voltage  | SDA,  | V <sub>IH</sub>  |            | 0.7 V <sub>IF</sub>   |      | 2.9                   | V    |
|                           | SCL   | V <sub>IL</sub>  |            | - 0.3                 |      | 0.3 V <sub>IF</sub>   | V    |
| Digital<br>input voltage  | XCLR, INCK,<br>GYINT,   | V <sub>IH</sub>  |            | 0.65 V <sub>IF</sub>  |      | V <sub>IF</sub> + 0.3 | V    |
|                           | SDI,SLASEL  | V <sub>IL</sub>  |            | - 0.3                 |      | 0.35 V <sub>IF</sub>  | V    |
| Digital<br>output voltage | SDA   | V <sub>OH</sub>  |            | V <sub>IF</sub> - 0.4 |      |                       | V    |
|                           |   | V <sub>OL</sub>  |            |                       |      | 0.4                   | V    |
| Digital<br>output voltage | GPO,SDO, SCSB,<br>FSTROBE   | V <sub>OH</sub>  |            | V <sub>IF</sub> - 0.4 |      |                       | V    |
|                           |   | V <sub>OL</sub>  |            |                       |      | 0.4                   | V    |

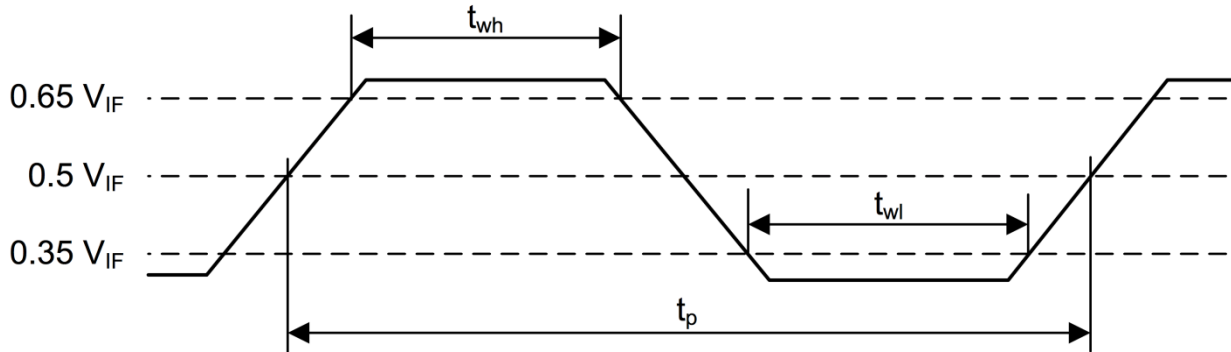




## AC Characteristics

### Master Clock Square Waveform Input Diagram

Input specifications are shown below when square-wave signal is input directly into the external pin INCK.



### Master Clock Square Waveform Input Characteristics

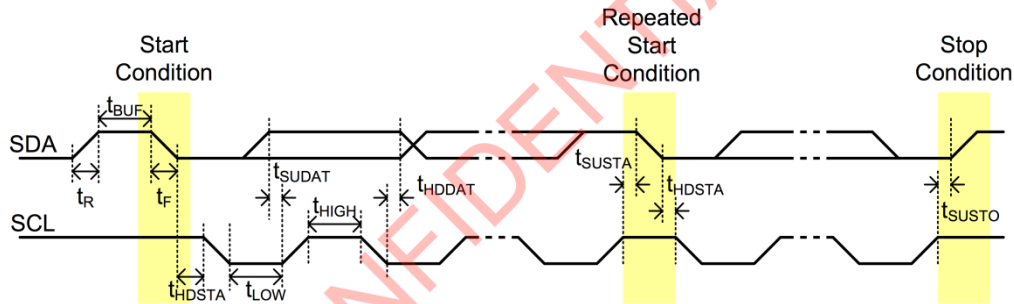
| PARAMETER             | Symbol       | Min.      | Typ. | Max.      | Unit |
|-----------------------|--------------|-----------|------|-----------|------|
| INCK clock frequency  | $f_{SCK}$    | 6         |      | 27        | MHz  |
| INCK clock period     | $t_p$        | 37.0      |      | 166.7     | ns   |
| INCK low level width  | $t_{wl}$     | $0.4 t_p$ |      | $0.6 t_p$ | ns   |
| INCK high level width | $t_{wh}$     | $0.4 t_p$ |      | $0.6 t_p$ | ns   |
| INCK jitter           | $T_{jitter}$ |           |      | 600       | ps   |



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## 2-wire serial communication block characteristics



## 2-wire serial communication block specification

| Parameter                | Symbol    | Conditions  | Min.<br>(Fast-mode Plus) | Max.<br>(Fast-mode Plus) | Unit    |
|--------------------------|-----------|---|--------------------------|--------------------------|---------|
| Low level input voltage  | $V_{IL}$  |   | -0.5                     | 0.3 $V_{IF}$             | V       |
| High level input voltage | $V_{IH}$  |   | 0.7 $V_{IF}$             | 2.9                      | V       |
| Low level output voltage | $V_{OL1}$ | $V_{IF} > 2$ V, Sink 3 mA                                     | 0                        | 0.4                      | V       |
|                          | $V_{OL2}$ | $V_{IF} < 2$ V, Sink 3 mA                                     | 0                        | 0.2 $V_{IF}$             | V       |
| Output fall time         | $t_{of}$  | Load 10 pF – 400 pF,<br>0.7 $V_{IF} \rightarrow$ 0.3 $V_{IF}$ |                          | 250 (120)                | ns      |
| Input current            | $I_I$     | 0.1 $V_{IF} \rightarrow$ 0.9 $V_{IF}$                         | -10                      | 10                       | $\mu$ A |
| SDA I/O capacitance      | $C_{I/O}$ |   |                          | 10                       | pF      |
| SCL Input capacitance    | $C_I$     |   |                          | 10                       | pF      |

## 2-wire serial communication block AC specification

| Parameter                                      | Symbol      | Min.<br>(Fast-mode Plus) | Max.<br>(Fast-mode Plus) | Unit    |
|--|-------------|--------------------------|--------------------------|---------|
| SCL clock frequency                            | $f_{SCL}$   | 0                        | 400 (1000)               | kHz     |
| Rise time (SDA and SCL)                        | $t_R$       | —                        | 300 (120)                | ns      |
| Fall time (SDA and SCL)                        | $t_F$       | —                        | 300 (120)                | ns      |
| Hold time (start condition)                    | $t_{HDSTA}$ | 0.6 (0.26)               | —                        | $\mu$ s |
| Setup time (rep.-start condition)              | $t_{SUSTA}$ | 0.6 (0.26)               | —                        | $\mu$ s |
| Setup time (stop condition)                    | $t_{SUSTO}$ | 0.6 (0.26)               | —                        | $\mu$ s |
| Data setup time                                | $t_{SUDAT}$ | 100 (50)                 | —                        | ns      |
| Data hold time                                 | $t_{HDDAT}$ | 0                        | —                        | $\mu$ s |
| Bus free time between Stop and Start condition | $t_{BUF}$   | 1.3 (0.5)                | —                        | $\mu$ s |
| Low period of the SCL clock                    | $t_{LOW}$   | 1.3 (0.5)                | —                        | $\mu$ s |
| High period of the SCL clock                   | $t_{HIGH}$  | 0.6 (0.26)               | —                        | $\mu$ s |

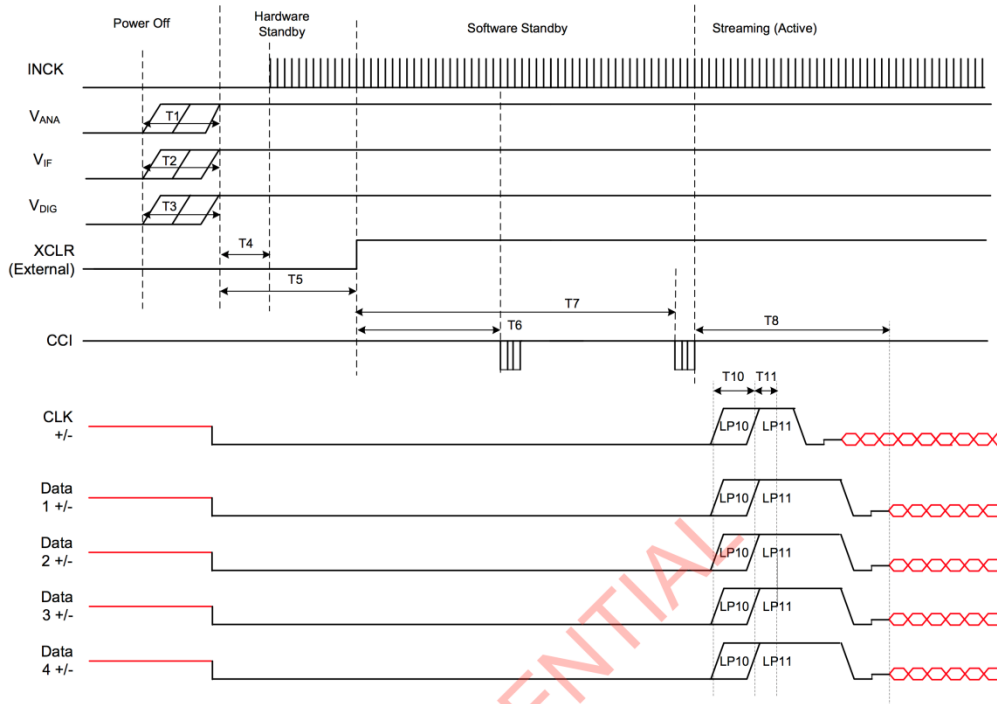
Note) Fast-mode Plus supports only available with INCK  $\geq$  8.0 MHz



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# Power-on Sequence



| Item   | Label | Min.   | Max.   | Unit | Comment  |
|--|-------|--|--|------|--|
| V <sub>ANA</sub> rising – V <sub>ANA</sub> ON  | T1    | V <sub>ANA</sub> and V <sub>IF</sub> and V <sub>DIG</sub> may rise in any order. |  | µs   | Slew rate of V <sub>ANA</sub> , V <sub>IF</sub> and V <sub>DIG</sub> (0 % - 100 %):<br>Max. 50 mV/µs |
| V <sub>IF</sub> rising – V <sub>IF</sub> ON  | T2    |  |  | µs   |  |
| V <sub>DIG</sub> rising – V <sub>DIG</sub> ON  | T3    |  |  | µs   |  |
| V <sub>ANA</sub> and V <sub>IF</sub> and V <sub>DIG</sub> rising - INCK start                                  | T4    | 0  |  | µs   | Presence of INCK during Power off is acceptable  |
| V <sub>ANA</sub> and V <sub>IF</sub> and V <sub>DIG</sub> rising - XCLR rising                                 | T5    | 0  |  | ms   | After T1, T2 and T3  |
| INCK start and XCLR rising till CCI Read version ID register wait time   | T6    | 0.6  |  | ms   |  |
| INCK start and XCLR rising till Send Streaming Command wait time (To complete reading all parameters from NVM) | T7    | 8  |  | ms   |  |
| Start of first streaming from Sending Streaming Command.   | T8    |  | 4.0 ms +<br>The delay of the coarse integration time value |      |  |
| D-PHY power up   | T10   | 1  | 1.1  | ms   |  |
| D-PHY init.  | T11   | 100  | 110  | µs   |  |

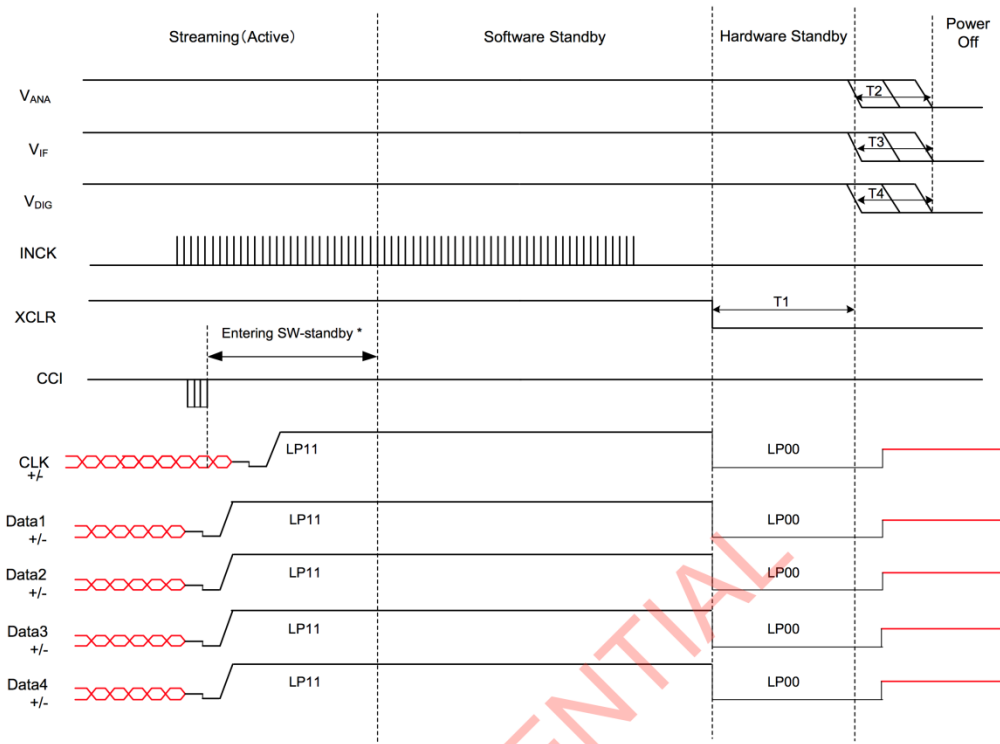
Note) XCLR needs to be Low until all power supplies complete power-on



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# Power-off Sequence



\*Note: See Software Reference Manual for details of Entering SW-standby

| Item   | Label    | Min. | Max.   | Unit | Comment  |
|--|----------|------|--|------|--|
| XCLR Neg-edge - V <sub>ANA</sub> (V <sub>IF</sub> or V <sub>DIG</sub> ) fall                       | T1       | 0    |  | µs   | Presence of INCK during Power Off is acceptable. |
| Sequence free of V <sub>ANA</sub> falling and V <sub>IF</sub> falling and V <sub>DIG</sub> falling | T2,T3,T4 |      | V <sub>ANA</sub> and V <sub>IF</sub> and V <sub>DIG</sub> may fall in any order. | µs   |  |

