



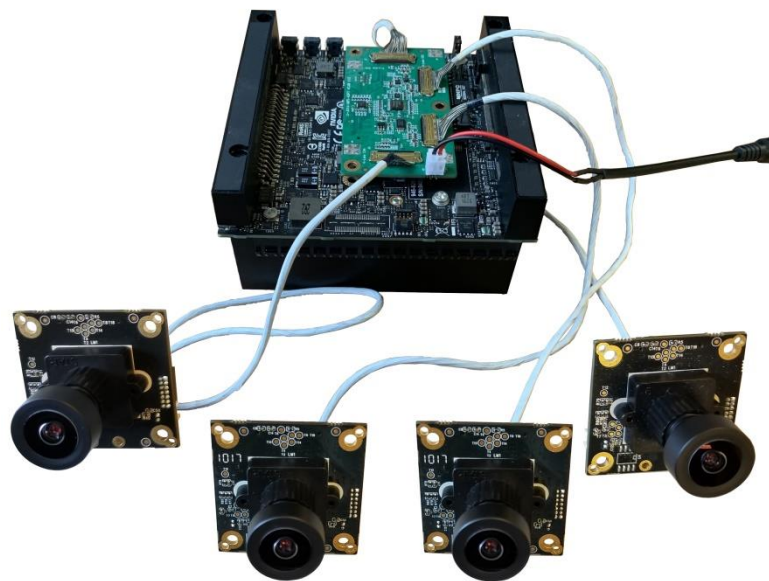
LEOPARD IMAGING INC

# LI-XAVIER-KIT-IMX335M12-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 6.52 mm (Type 1/2.8) 5MP CMOS Image Sensor IMX335
- Active pixels: 2608H x 1960V
- 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-IMX335M12**
  - (2 cam) **LI-XAVIER-KIT-IMX335M12-D**
  - (3 cam) **LI-XAVIER-KIT-IMX335M12-T**
  - (4 cam) **LI-XAVIER-KIT-IMX335M12-Q**
  - (6 cam) **LI-XAVIER-KIT-IMX335M12-H**



### Lens Spec

- Model: SYD1201A
- Focal length: 3.7 mm
- Aperture, F/#: 2.8 +/- 5%
- Built in 650nm IR cut filter
- FOV (D/H/V): 87 °/ 73.5 °/58.5 °
- TV Distortion: -1.0 %
- M12 x P0.5

### 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-IMX335-MIPI-M12                                     | 1, 2, 3, 4 or 6 |
| 3 | FAW-1233-03 cable                                      | 1, 2, 3, 4 or 6 |

### Applications

- Industrial Applications
- Intelligent Transportation System (ITS) Cameras



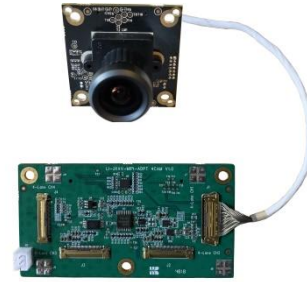
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## LI-XAVIER-KIT-IMX335M12

### BOM

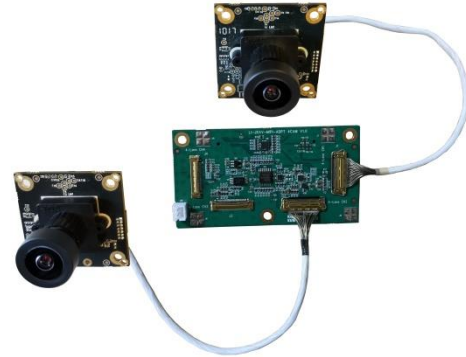
| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX335-MIPI-M12     | 1   |
| 3 | FAW-1233-03 cable      | 1   |



## LI-XAVIER-KIT-IMX335M12-D

### BOM

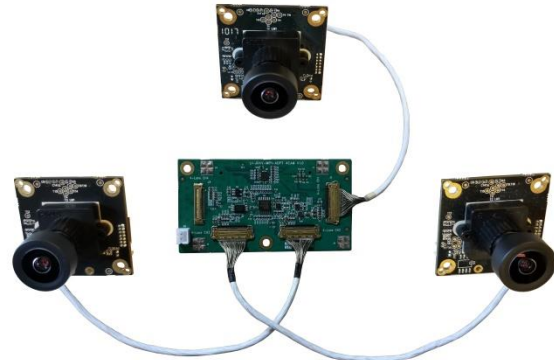
| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX335-MIPI-M12     | 2   |
| 3 | FAW-1233-03 cable      | 2   |



## LI-XAVIER-KIT-IMX335M12-T

### BOM

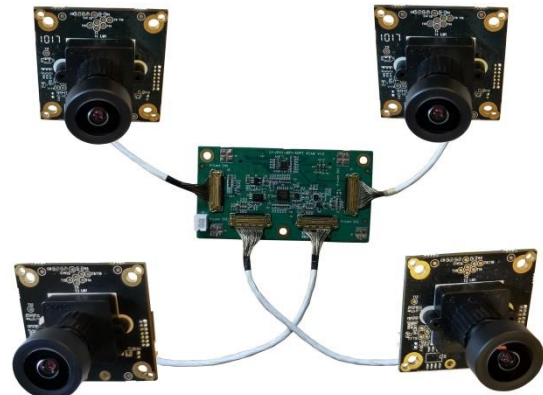
| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX335-MIPI-M12     | 3   |
| 3 | FAW-1233-03 cable      | 3   |



## LI-XAVIER-KIT-IMX335M12-Q

### BOM

| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX335-MIPI-M12     | 4   |
| 3 | FAW-1233-03 cable      | 4   |



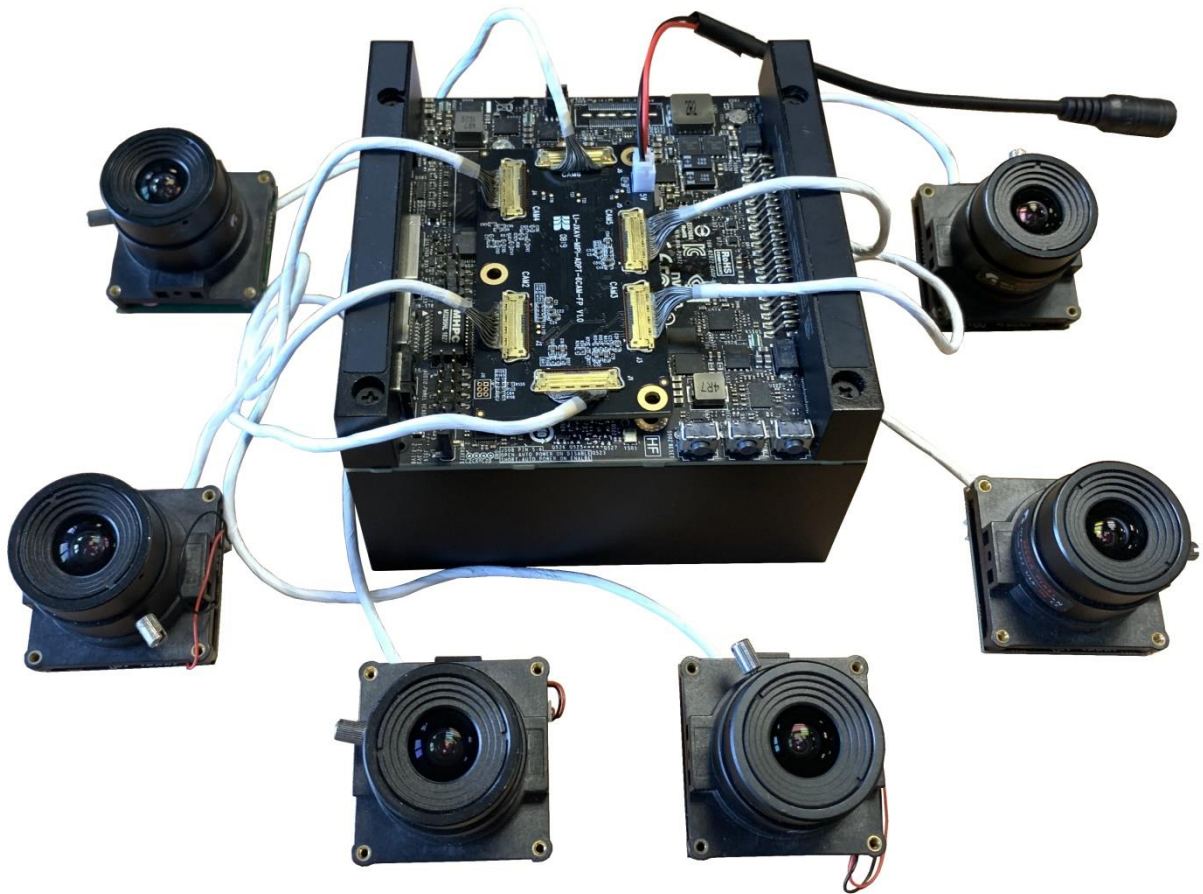
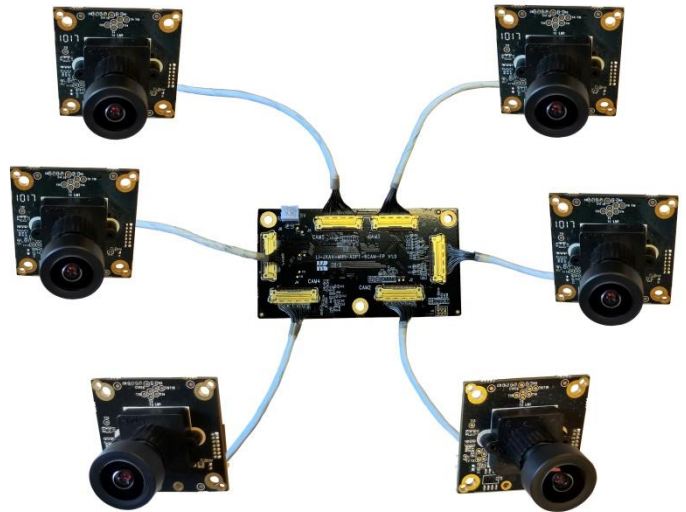
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## LI-XAVIER-KIT-IMX335M12-H

### BOM

| # | Items                     | QTY |
|---|---------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-6CAM-FP | 1   |
| 2 | LI-IMX335-MIPI-M12        | 6   |
| 3 | FAW-1233-03 cable         | 6   |

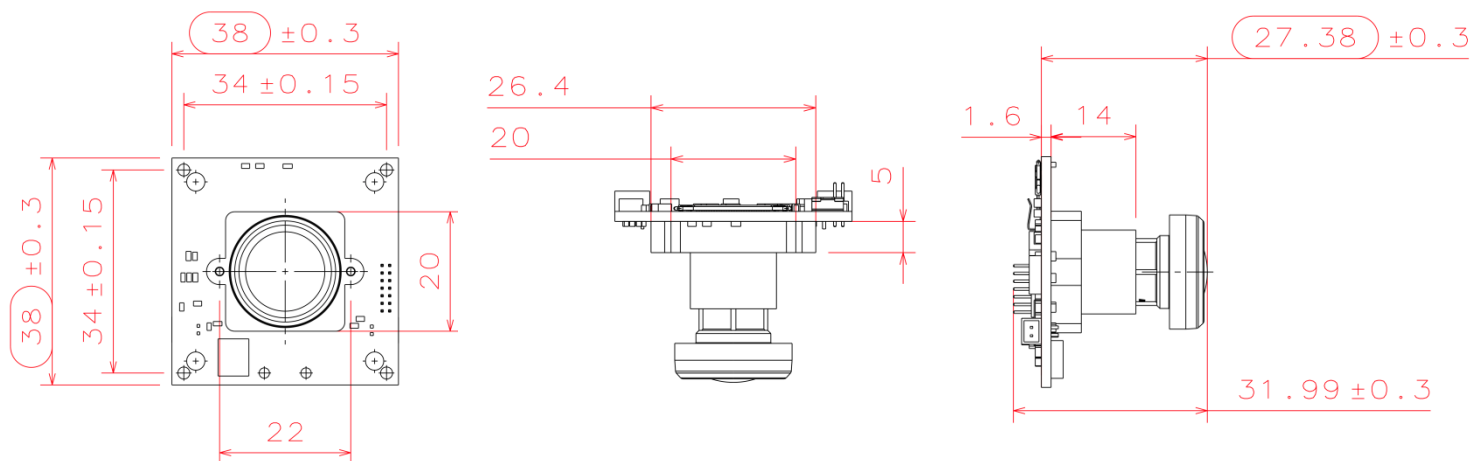


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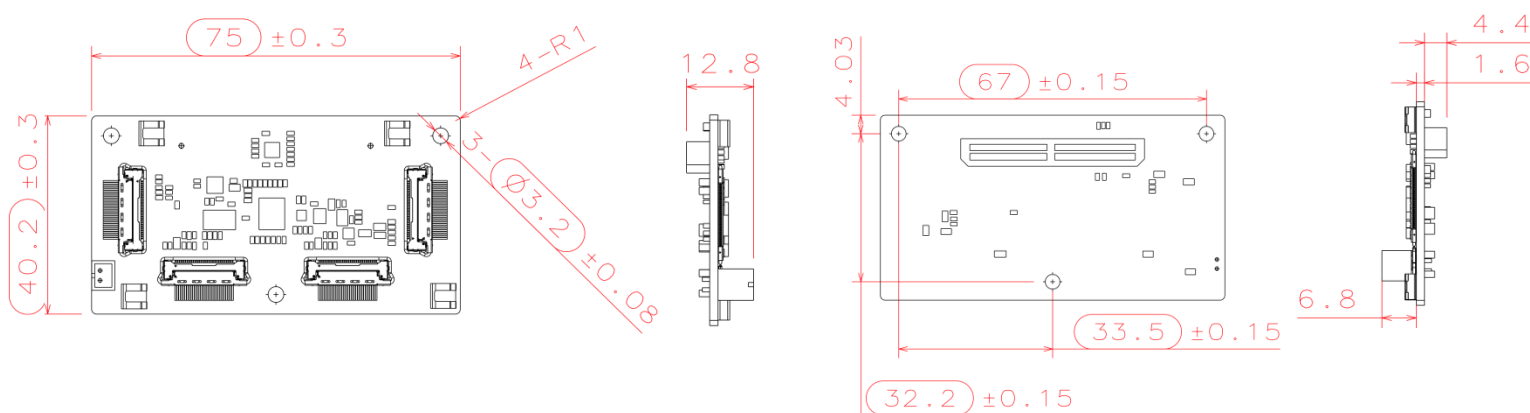
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# Dimensions

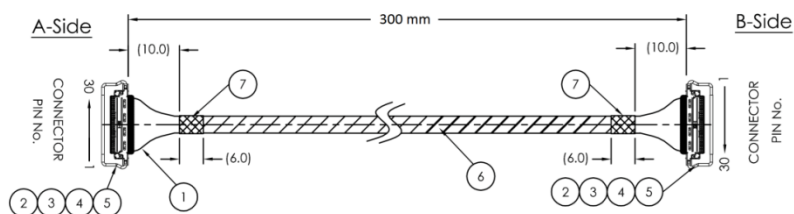
## LI-IMX335-MIPI-M12



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



## FAW-1233-03

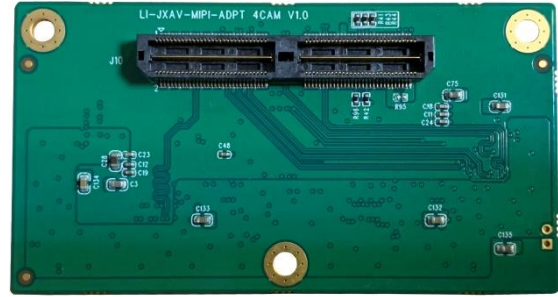


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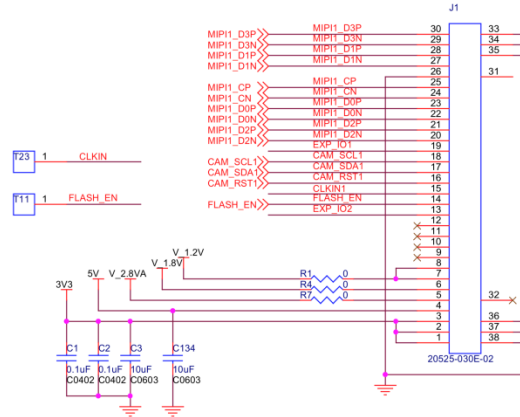
# LI-JXAV-MIPI-ADPT-4CAM



## Interfaces

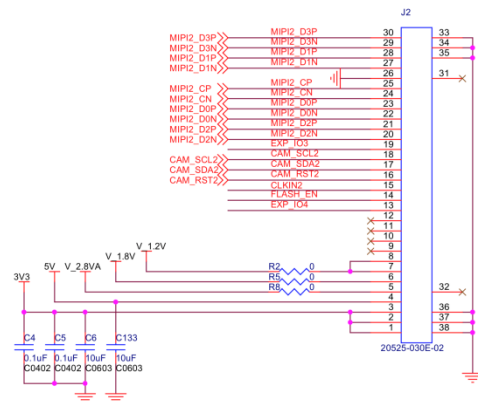
### Interface J1

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



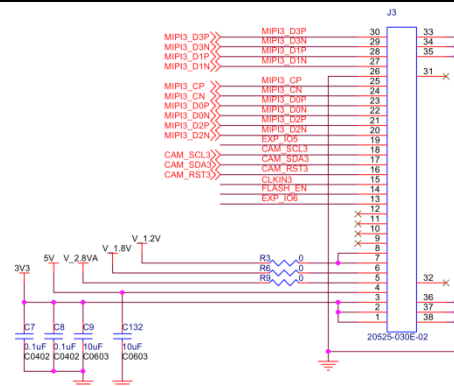
### Interface J2

- 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)

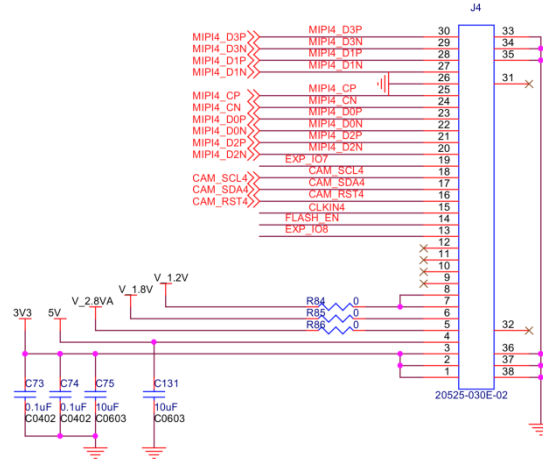


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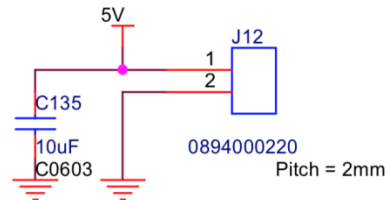
## Interface J4

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



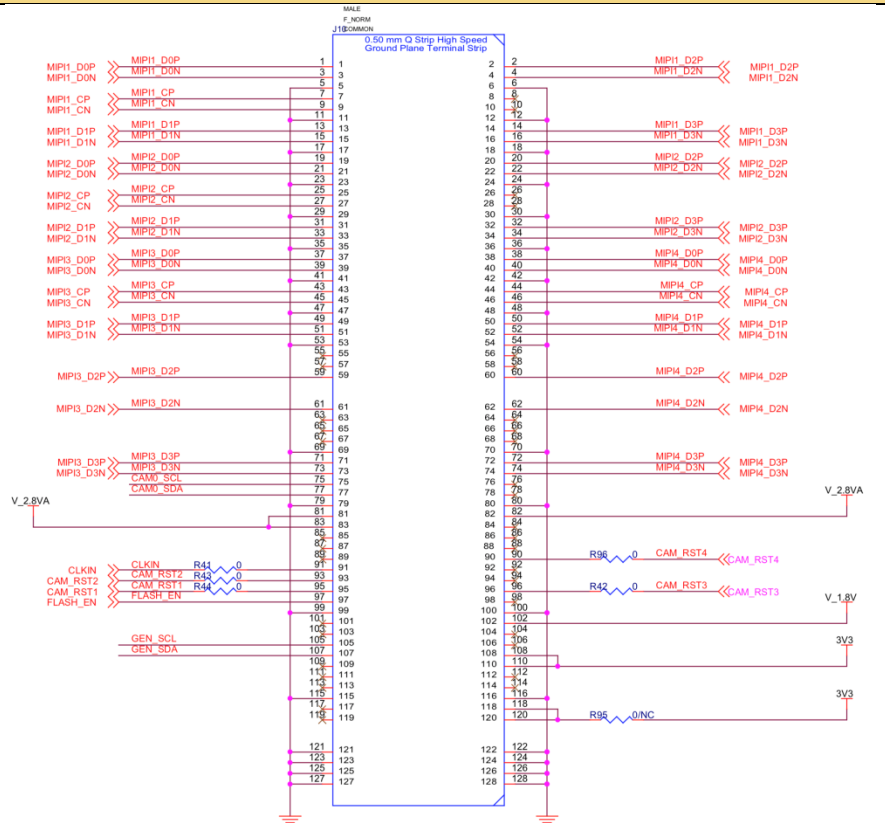
## Interface J5

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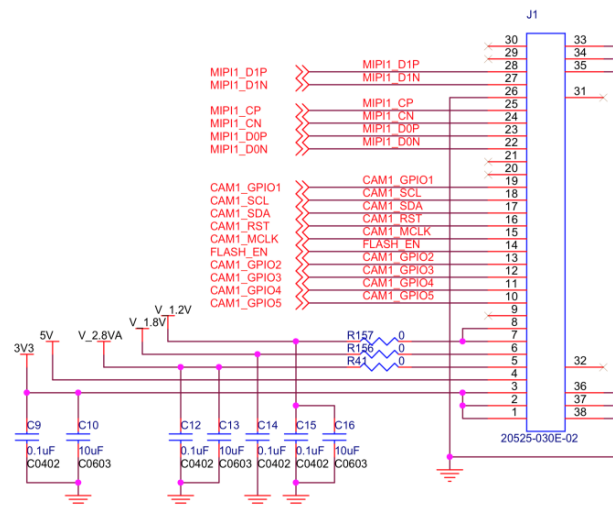
# LI-JXAV-MIPI-ADPT-6CAM-FP



## Interfaces

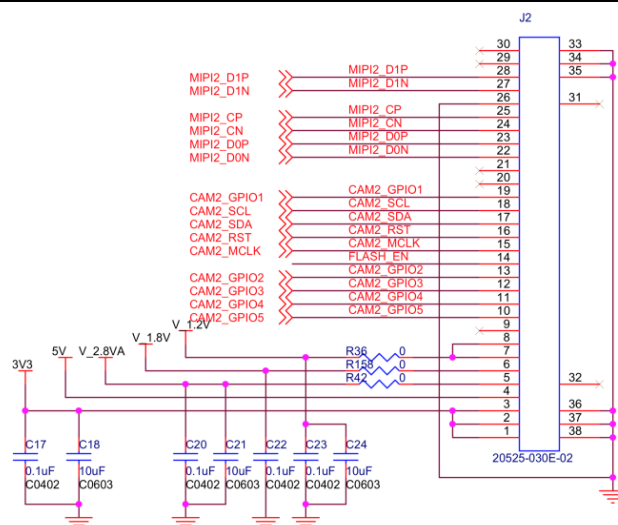
### Interface J1 (camera channel 1)

- 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

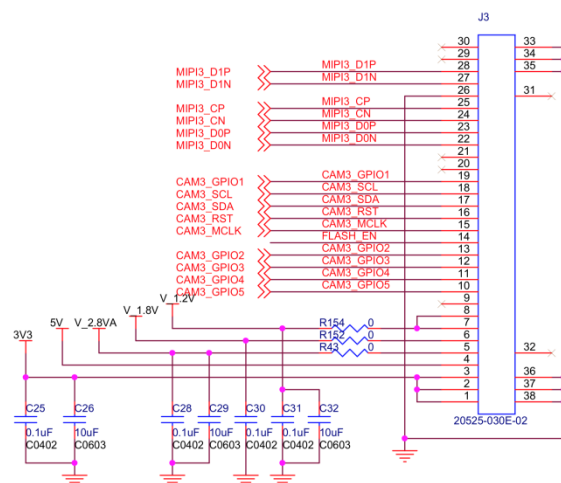


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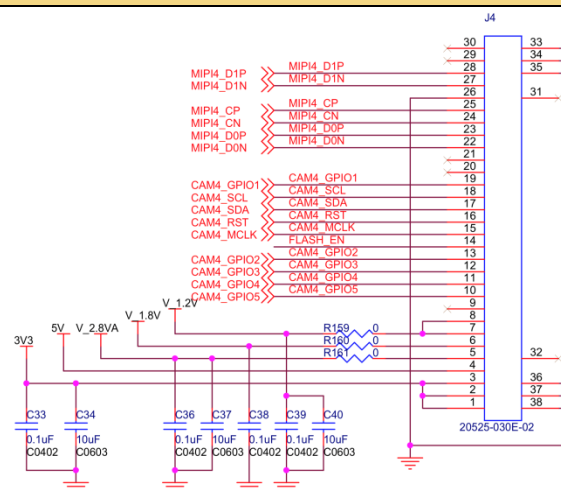
### Interface J3 (camera channel 3)

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



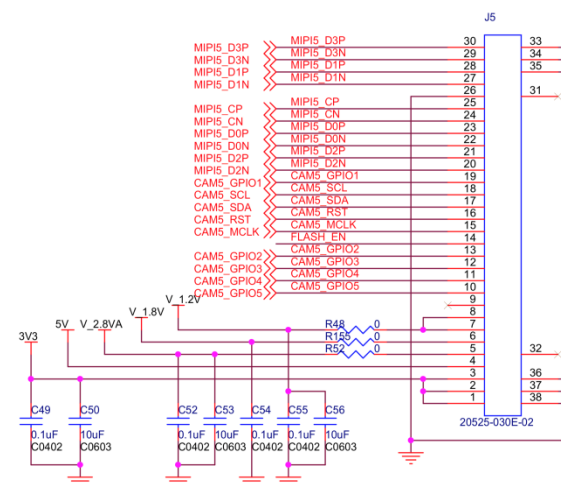
### Interface J4 (camera channel 4)

- 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



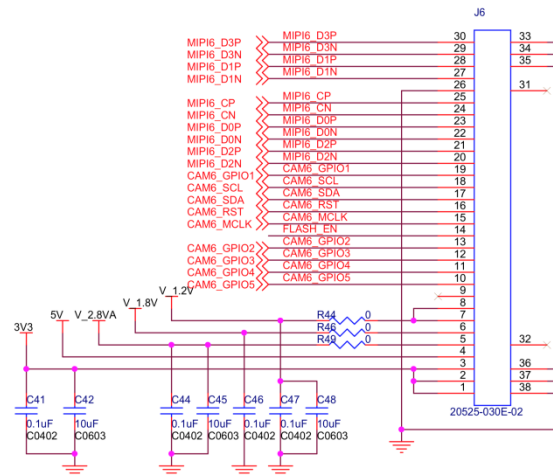
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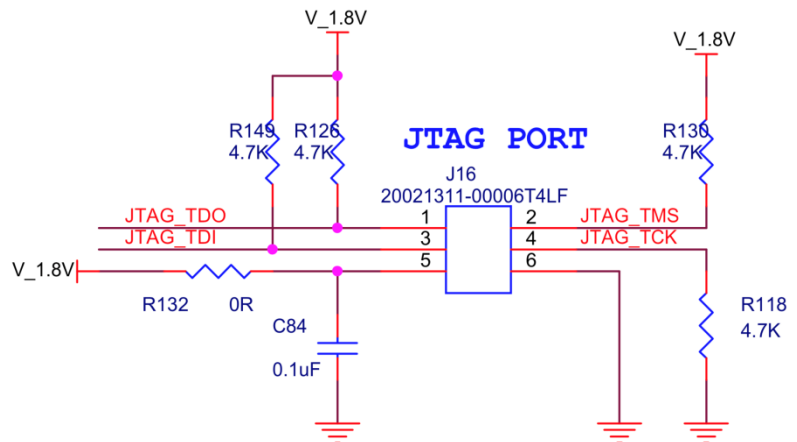
## Interface J6 (camera channel 6)

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



## Interface J16 (FPGA programming interface)

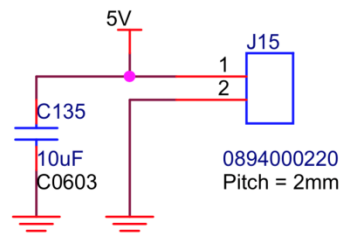
- Part#: 20021311-00006T4LF
- Number of Positions: 6
- Pitch: 0.050" (1.27mm)
- Number of Rows: 2



## Interface J15 (External power input interface)

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

### External Input Power

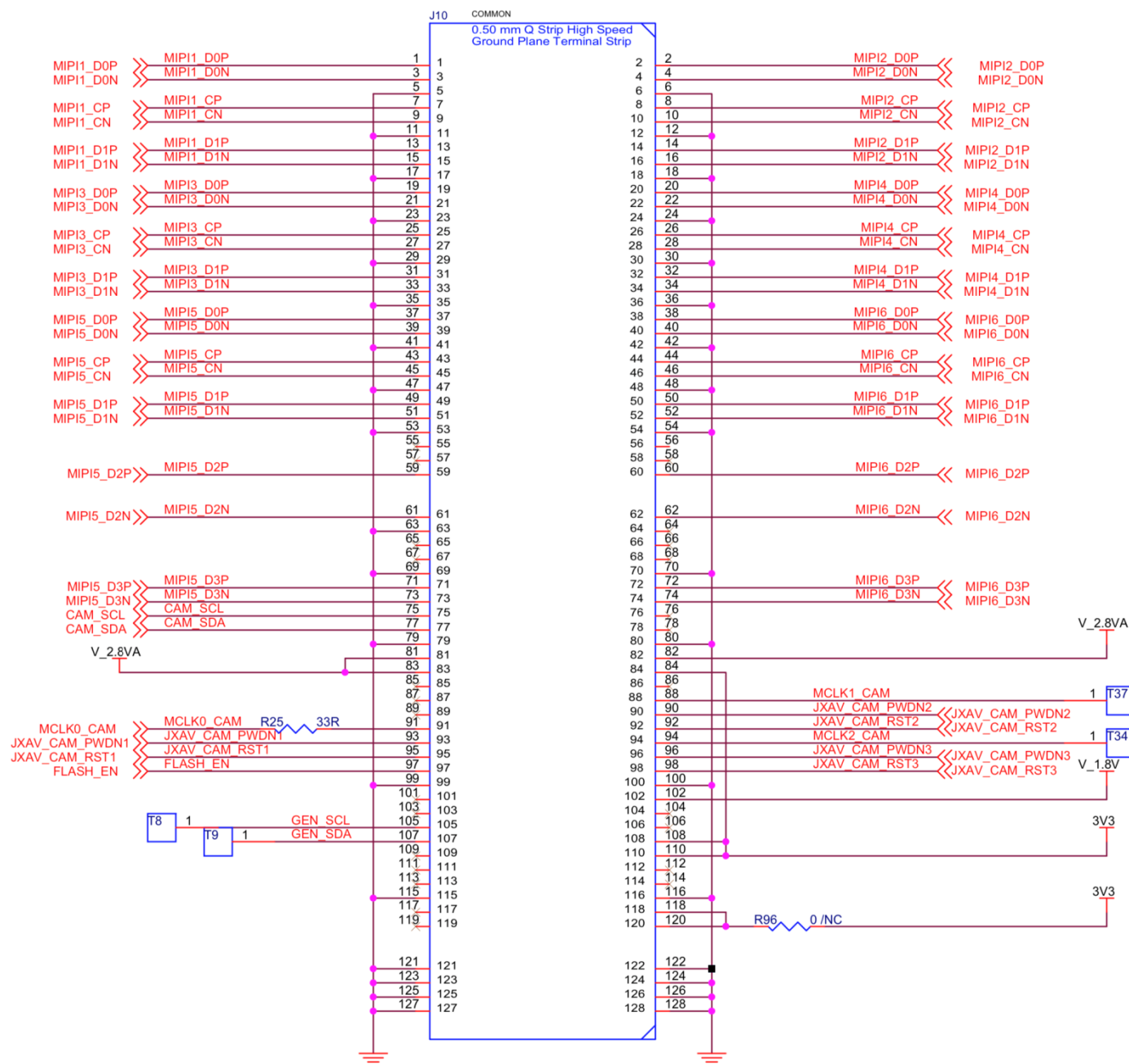


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## Interface J10 (To Xavier)

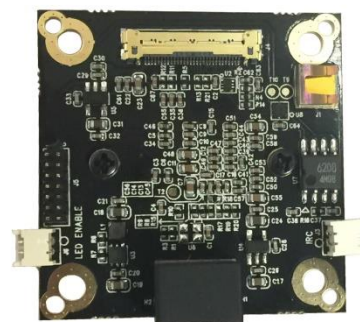
- Part#: QTH-060-01-L-D-A
- Number of Positions: 120
- Number of Rows: 2
- Pitch: 0.5 mm



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# LI-IMX335-MIPI-M12



| Camera Spec                                                                                                                                                                                          |                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Image Sensor                                                                                                                                                                                         | Sony Diagonal 6.52 mm (Type 1/2.8) 5MP CMOS Image Sensor IMX335 |
| Optical format                                                                                                                                                                                       | 1/2.8"                                                          |
| Number of active pixels                                                                                                                                                                              | 2608 (H) x 1960(V)                                              |
| Pixel size                                                                                                                                                                                           | 2.0um (H) x 2.0um (V)                                           |
| Color or Mono                                                                                                                                                                                        | Color                                                           |
| Interface                                                                                                                                                                                            | MIPI interface                                                  |
| Lens mount                                                                                                                                                                                           | M12                                                             |
| Weight                                                                                                                                                                                               | 14 g                                                            |
| Interfaces                                                                                                                                                                                           |                                                                 |
| <b>Interface J4:</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>                                                       |                                                                 |
| <b>Interface J6:</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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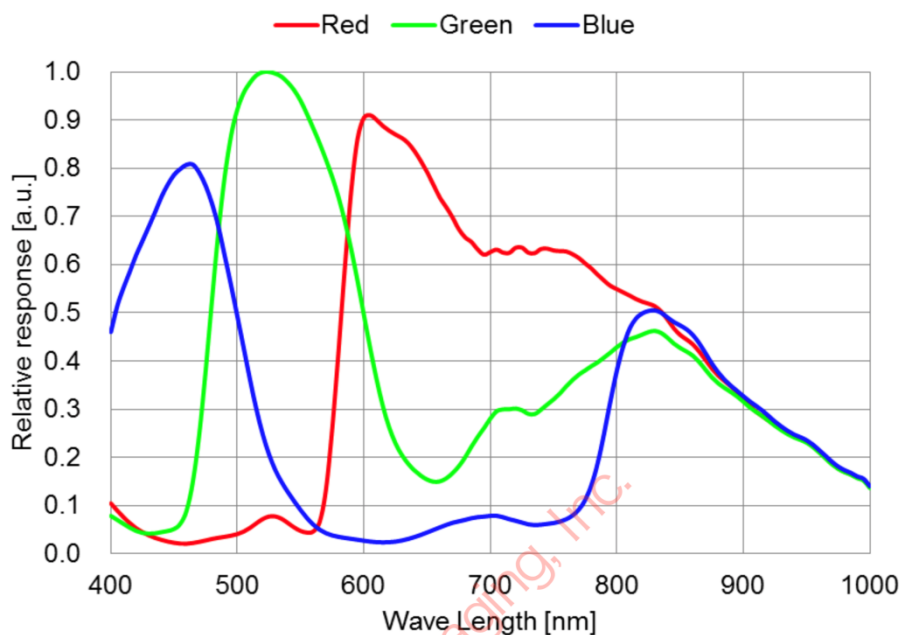
## Absolute Maximum Ratings

| Item                               | Symbol            | Min. | Max.                   | Unit | Remarks          |
|------------------------------------|-------------------|------|------------------------|------|------------------|
| Supply voltage (analog 1 : 2.9 V)  | AV <sub>DD1</sub> | -0.3 | 3.3                    | V    |                  |
| Supply voltage (analog 2 : 2.9 V)  | AV <sub>DD2</sub> | -0.3 | 3.3                    | V    |                  |
| Supply voltage (interface 1.8 V)   | OV <sub>DD</sub>  | -0.3 | 3.3                    | V    |                  |
| Supply voltage (digital1 : 1.2 V)  | DV <sub>DD1</sub> | -0.3 | 2.0                    | V    |                  |
| Supply voltage (digital 2 : 1.2 V) | DV <sub>DD2</sub> | -0.3 | 2.0                    | V    |                  |
| Input voltage                      | VI                | -0.3 | OV <sub>DD</sub> + 0.3 | V    | Not exceed 3.3 V |
| Output voltage                     | VO                | -0.3 | OV <sub>DD</sub> + 0.3 | V    | Not exceed 3.3 V |

## Application Conditions

| Item                               | Symbol            | Min. | Typ. | Max. | Unit |
|------------------------------------|-------------------|------|------|------|------|
| Supply voltage (analog 1 : 2.9 V)  | AV <sub>DD1</sub> | 2.80 | 2.90 | 3.00 | V    |
| Supply voltage (analog 2 : 2.9 V)  | AV <sub>DD2</sub> | 2.80 | 2.90 | 3.00 | V    |
| Supply voltage (interface 1.8 V)   | OV <sub>DD</sub>  | 1.70 | 1.80 | 1.90 | V    |
| Supply voltage (digital1 : 1.2 V)  | DV <sub>DD1</sub> | 1.10 | 1.20 | 1.30 | V    |
| Supply voltage (digital 2 : 1.2 V) | DV <sub>DD2</sub> | 1.10 | 1.20 | 1.30 | V    |
| Performance guarantee temperature  | Tspec             | -10  | —    | 60   | °C   |
| Operating guarantee temperature    | Topr              | -30  | —    | 85   | °C   |
| Storage guarantee temperature      | Tstg              | -40  | —    | 85   | °C   |

## Spectral Sensitivity Characteristics



## DC Characteristics

| Item                  | Pins                                                                    | Symbol                                                           | Condition                | Min.                  | Typ. | Max.                | Unit |
|-----------------------|-------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------|-----------------------|------|---------------------|------|
| Supply voltage        | Analog1                                                                 | VDDSUB<br>VDDHCP<br>VDDHDA<br>VDDHCM                             | AV <sub>DD1</sub>        | 2.80                  | 2.90 | 3.00                | V    |
|                       | Analog2                                                                 | VDDHPX                                                           | AV <sub>DD2</sub>        | 2.80                  | 2.90 | 3.00                | V    |
|                       | Interface                                                               | VDDMIO                                                           | OV <sub>DD</sub>         | 1.70                  | 1.80 | 1.90                | V    |
|                       | Digital1                                                                | VDDL <sub>CN</sub><br>VDDL <sub>SC</sub><br>VDDL <sub>PL1</sub>  | DV <sub>DD1</sub>        | 1.10                  | 1.20 | 1.30                | V    |
|                       | Digital2                                                                | VDDL <sub>PL2</sub><br>VDDL <sub>PL3</sub><br>VDDL <sub>IF</sub> | DV <sub>DD2</sub>        | 1.10                  | 1.20 | 1.30                | V    |
| Digital input voltage | XHS<br>XVS<br>XCLR<br>INCK<br>XMASTER<br>SLAMODE<br>SCL<br>SDA<br>TEST2 | VIH                                                              | XVS / XHS<br>Slave Mode  | 0.8OV <sub>DD</sub>   | —    | —                   | V    |
|                       |                                                                         | VIL                                                              |                          | —                     | —    | 0.2OV <sub>DD</sub> | V    |
|                       | XHS<br>XVS<br>TOUT<br>TEST1                                             | VOH                                                              | XVS / XHS<br>Master Mode | OV <sub>DD</sub> -0.4 | —    | —                   | V    |
|                       |                                                                         | VOL                                                              |                          | —                     | —    | 0.4                 | V    |

## Current Consumption

| Item                                                                                  | Symbol                 | Typ.                        |                              | Max.                        |                              | Unit |
|---------------------------------------------------------------------------------------|------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|------|
|                                                                                       |                        | Standard luminous intensity | Saturated luminous intensity | Standard luminous intensity | Saturated luminous intensity |      |
| Operating current<br>MIPI CSI-2 / 4 Lane<br>12 bit, 30 frame/s<br>All-pixel scan mode | I <sub>AVDD1</sub>     | 28                          | 27                           | 42                          | 41                           | mA   |
|                                                                                       | I <sub>AVDD2</sub>     | 22                          | 22                           | 33                          | 32                           | mA   |
|                                                                                       | I <sub>OVDD</sub>      | 1                           | 1                            | 1                           | 1                            | mA   |
|                                                                                       | I <sub>DVDD1</sub>     | 87                          | 102                          | 168                         | 193                          | mA   |
|                                                                                       | I <sub>DVDD2</sub>     | 32                          | 32                           | 62                          | 62                           | mA   |
| Standby current                                                                       | I <sub>AVDD1_STB</sub> | —                           |                              | 0.1                         |                              | mA   |
|                                                                                       | I <sub>AVDD2_STB</sub> | —                           |                              | 0.1                         |                              | mA   |
|                                                                                       | I <sub>OVDD_STB</sub>  | —                           |                              | 0.1                         |                              | mA   |
|                                                                                       | I <sub>DVDD1_STB</sub> | —                           |                              | 16.8                        |                              | mA   |
|                                                                                       | I <sub>DVDD2_STB</sub> | —                           |                              | 2.2                         |                              | mA   |

Operating current: (Typ.) Supply voltage 2.90 V / 1.8 V / 1.2 V, T<sub>j</sub> = 25 °C  
(Max.) Supply voltage 3.00 V / 1.9 V / 1.3 V, T<sub>j</sub> = 60 °C, worst state of internal circuit operating current consumption,

Standby: (Max.) Supply voltage 3.00 V / 1.9 V / 1.3 V, T<sub>j</sub> = 60 °C, INCK: 0 V, light-obstructed state.

Standard luminous intensity: luminous intensity at 1/3 of the sensor saturated

Saturated luminous intensity: luminous intensity when the sensor is saturated.

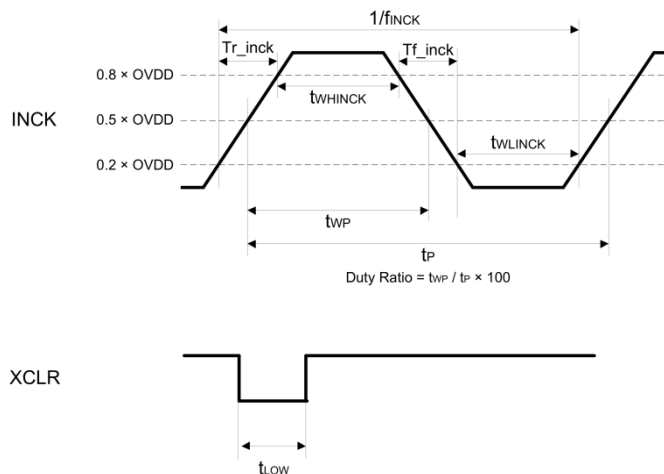


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## AC Characteristics



INCK 37.125MHz, 74.25MHz

| Item                        | Symbol       | Min.                   | Typ.       | Max.                   | Unit | Remarks                                            |
|-----------------------------|--------------|------------------------|------------|------------------------|------|----------------------------------------------------|
| INCK clock frequency        | $f_{INCK}$   | $f_{INCK} \times 0.96$ | $f_{INCK}$ | $f_{INCK} \times 1.02$ | MHz  | $f_{INCK} = 37.125 \text{ MHz}, 74.25 \text{ MHz}$ |
| INCK Low level pulse width  | $t_{WLINCK}$ | 4                      | —          | —                      | ns   | $f_{INCK} = 37.125 \text{ MHz}, 74.25 \text{ MHz}$ |
| INCK High level pulse width | $t_{WHINCK}$ | 4                      | —          | —                      | ns   | $f_{INCK} = 37.125 \text{ MHz}, 74.25 \text{ MHz}$ |
| INCK clock duty             | —            | 45.0                   | 50.0       | 55.0                   | %    | Define with $0.5 \times OV_{DD}$                   |
| INCK Rise time              | $Tr\_inck$   | —                      | —          | 5                      | ns   | 20 % to 80 %                                       |
| INCK Fall time              | $Tf\_inck$   | —                      | —          | 5                      | ns   | 80 % to 20 %                                       |
| XCLR Low level pulse width  | $t_{LOW}$    | 100                    | —          | —                      | ns   |                                                    |

\*The INCK fluctuation affects the frame rate.

INCK 6 to 27MHz

| Item                        | Symbol       | Min. | Typ. | Max. | Unit | Remarks                                 |
|-----------------------------|--------------|------|------|------|------|-----------------------------------------|
| INCK clock frequency        | $f_{INCK}$   | 6    | —    | 27   | MHz  | $f_{INCK} = 6 \text{ to } 27\text{MHz}$ |
| INCK Low level pulse width  | $t_{WLINCK}$ | 5    | —    | —    | ns   | $f_{INCK} = 6 \text{ to } 27\text{MHz}$ |
| INCK High level pulse width | $t_{WHINCK}$ | 5    | —    | —    | ns   | $f_{INCK} = 6 \text{ to } 27\text{MHz}$ |
| INCK clock duty             | —            | 45.0 | 50.0 | 55.0 | %    | Define with $0.5 \times OV_{DD}$        |
| INCK Rise time              | $Tr\_inck$   | —    | —    | 5    | ns   | 20 % to 80 %                            |
| INCK Fall time              | $Tf\_inck$   | —    | —    | 5    | ns   | 80 % to 20 %                            |
| XCLR Low level pulse width  | $t_{LOW}$    | 100  | —    | —    | ns   |                                         |

\*The INCK fluctuation affects the frame rate.

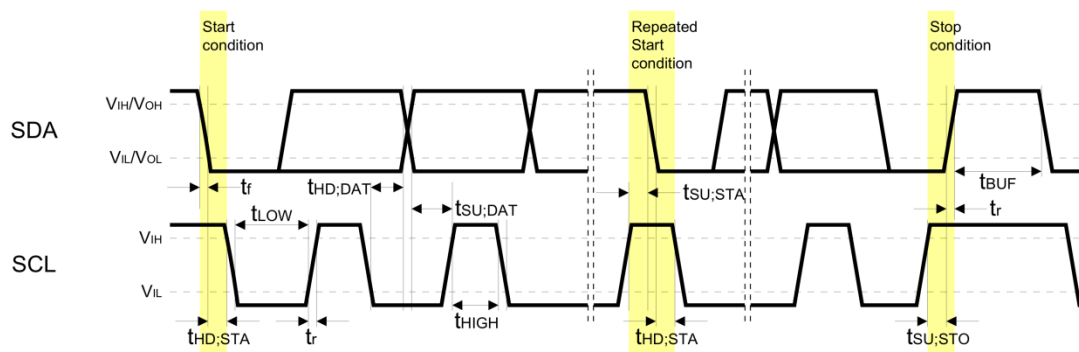


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## Serial Communication

I<sup>2</sup>C



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

| Item                            | Symbol | Min.                 | Typ. | Max.                 | Unit | 条件                                                                |
|---------------------------------|--------|----------------------|------|----------------------|------|-------------------------------------------------------------------|
| Low level input voltage         | VIL    | -0.3                 | —    | $0.3 \times OV_{DD}$ | V    |                                                                   |
| High level input voltage        | VIH    | $0.7 \times OV_{DD}$ | —    | 1.9                  | V    |                                                                   |
| Low level output voltage        | VOL    | 0                    | —    | $0.2 \times OV_{DD}$ | V    | $OV_{DD} < 2\text{ V}$ , Sink 3 mA                                |
| High level output voltage       | VOH    | $0.8 \times OV_{DD}$ | —    | —                    | V    |                                                                   |
| Output fall time                | tof    | —                    | —    | 250                  | ns   | Load 10 pF – 400 pF,<br>$0.7 \times OV_{DD} - 0.3 \times OV_{DD}$ |
| Input current                   | li     | -10                  | —    | 10                   | μA   | $0.1 \times OV_{DD} - 0.9 \times OV_{DD}$                         |
| Input Capacitance for SCL / SDA | Ci     | —                    | —    | 10                   | pF   |                                                                   |

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

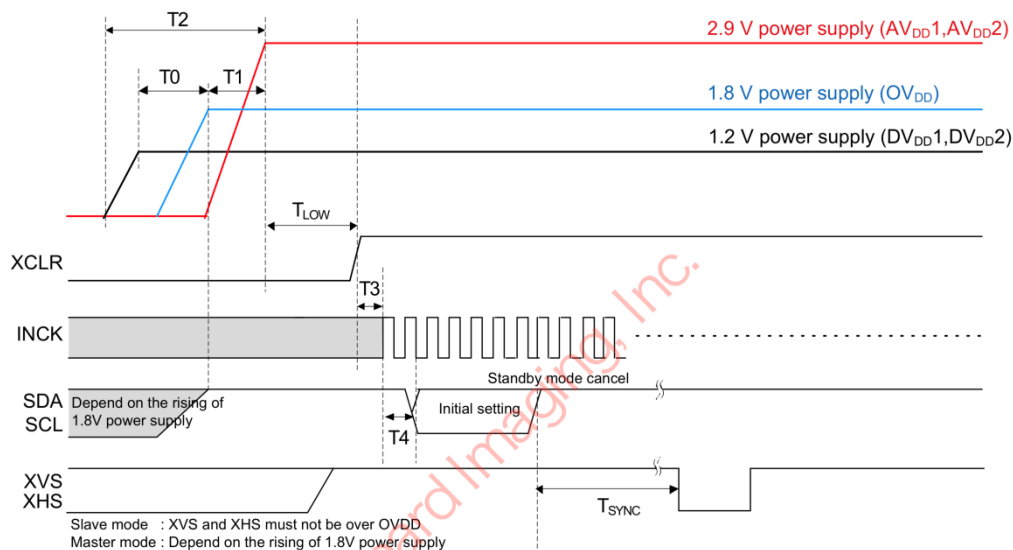
| Item                                             | Symbol              | Min. | Typ. | Max. | Unit |
|--------------------------------------------------|---------------------|------|------|------|------|
| SCL clock frequency                              | f <sub>SCL</sub>    | 0    | —    | 400  | kHz  |
| Hold time (Start Condition)                      | t <sub>HD;STA</sub> | 0.6  | —    | —    | μs   |
| Low period of the SCL clock                      | t <sub>LOW</sub>    | 1.3  | —    | —    | μs   |
| High period of the SCL clock                     | t <sub>HIGH</sub>   | 0.6  | —    | —    | μs   |
| Set-up time (Repeated Start Condition)           | t <sub>SU;STA</sub> | 0.6  | —    | —    | μs   |
| Data hold time                                   | t <sub>HD;DAT</sub> | 0    | —    | 0.9  | μs   |
| Data set-up time                                 | t <sub>SU;DAT</sub> | 100  | —    | —    | ns   |
| Rise time of both SDA and SCL signals            | t <sub>r</sub>      | —    | —    | 300  | ns   |
| Fall time of both SDA and SCL signals            | t <sub>f</sub>      | —    | —    | 300  | ns   |
| Set-up time (Stop Condition)                     | t <sub>SU;STO</sub> | 0.6  | —    | —    | μs   |
| Bus free time between a STOP and START Condition | t <sub>BUF</sub>    | 1.3  | —    | —    | μs   |



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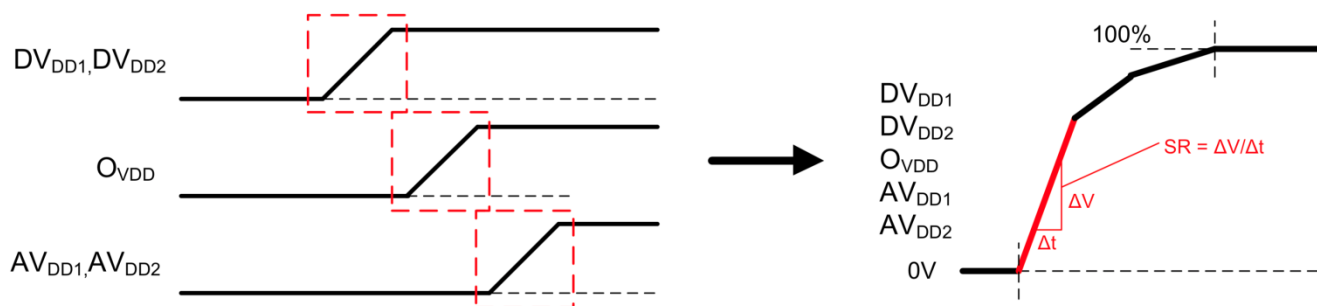
## Power-on Sequence



| Item                                                                       | Symbol            | Min. | Max. | Unit |
|----------------------------------------------------------------------------|-------------------|------|------|------|
| 1.2 V power supply rising → 1.8 V power supply rising                      | T <sub>0</sub>    | 0    | —    | ns   |
| 1.8 V power supply rising → 2.9 V power supply rising                      | T <sub>1</sub>    | 0    | —    | ns   |
| Rising time of all power supply                                            | T <sub>2</sub>    | —    | 200  | ms   |
| 2.9 V power supply rising → Clear OFF                                      | T <sub>LOW</sub>  | 500  | —    | ns   |
| Clear OFF → INCK rising                                                    | T <sub>3</sub>    | 0    | —    | μs   |
| Clear OFF → Communication start                                            | T <sub>4</sub>    | 20   | —    | μs   |
| Standby OFF (communication)<br>→ External input XHS, XVS (slave mode only) | T <sub>SYNC</sub> | 18   | —    | ms   |

## 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.



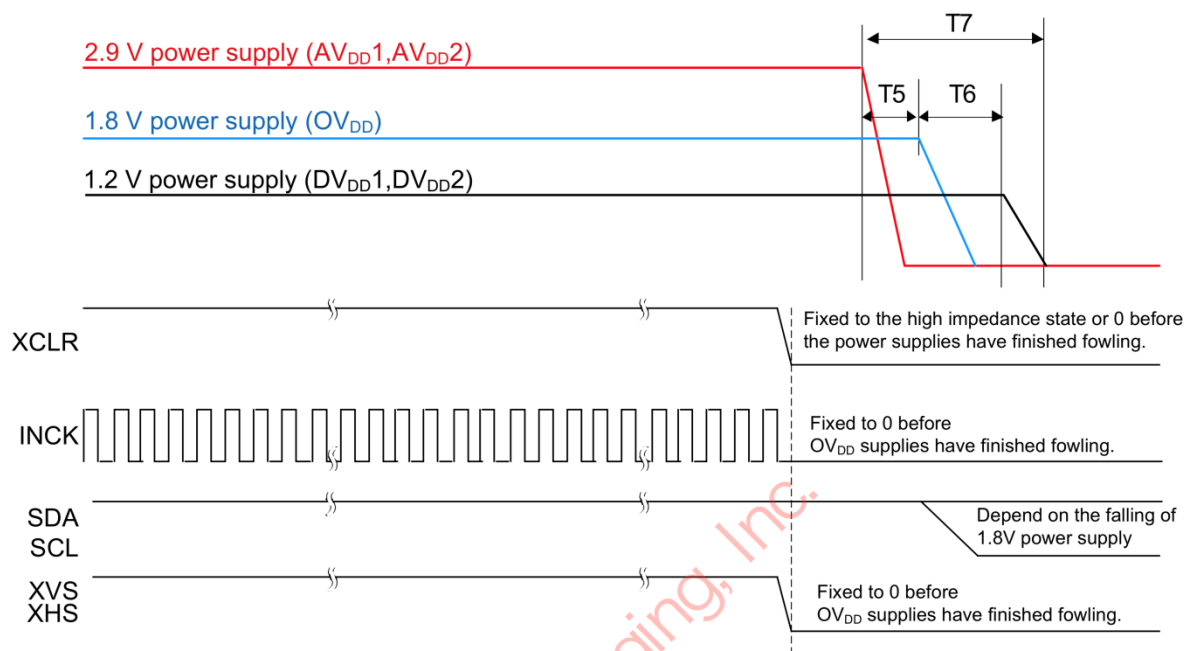
| Item      | Symbol | Power supply                                  | Min. | Max. | Unit  | Remarks |
|-----------|--------|-----------------------------------------------|------|------|-------|---------|
| Slew rate | SR     | DV <sub>DD1</sub> , DV <sub>DD2</sub> (1.2 V) | —    | 25   | mV/μs |         |
|           |        | OV <sub>DD</sub> (1.8 V)                      | —    | 25   | mV/μs |         |
|           |        | AV <sub>DD1</sub> , AV <sub>DD2</sub> (2.9 V) | —    | 25   | mV/μs |         |



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## Power-off Sequence



| Item                                          | Symbol | Min. | Max. | Unit |
|-----------------------------------------------|--------|------|------|------|
| 2.9 V power shut down → 1.8 V power shut down | T5     | 0    | —    | ns   |
| 1.8 V power shut down → 1.2 V power shut down | T6     | 0    | —    | ns   |
| Shut down time of all power supply            | T7     | —    | 200  | ms   |



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## Revision History

| Revision | Description                   | Release Date  |
|----------|-------------------------------|---------------|
| 1.0      | First Release                 | 11. May. 2019 |
| 1.1      | Add LI-JXAV-MIPI-ADPT-6CAM-FP | 6. Nov. 2019  |



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