

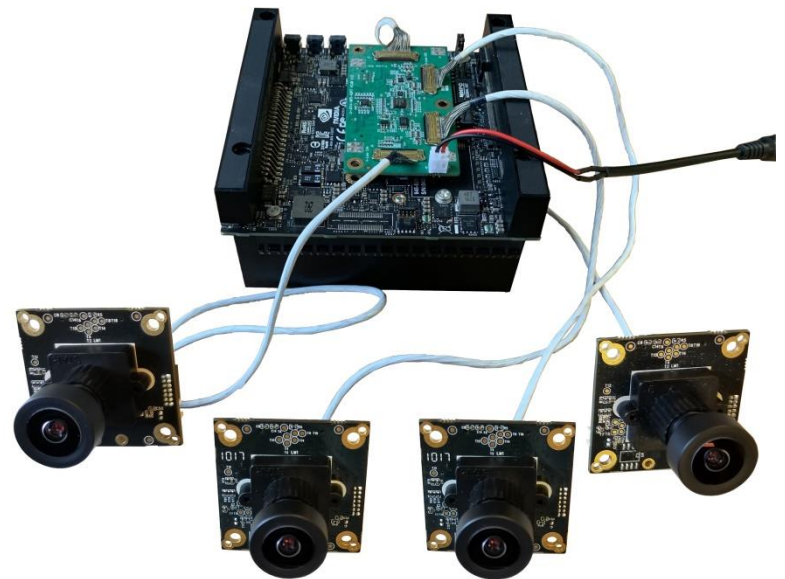


LEOPARD IMAGING INC

# LI-XAVIER-KIT-IMX264M12-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 11.1 mm (Type 2/3) 5MP CMOS Image Sensor IMX264
- Global shutter
- Camera synchronization supported (6CAM version only)
- Length of the I-PEX cable: 300mm
- Support multiple length cables
- Provide customization services
- Part#:
  - (1 cam) [LI-XAVIER-KIT-IMX264M12](#)
  - (2 cam) [LI-XAVIER-KIT-IMX264M12-D](#)
  - (3 cam) [LI-XAVIER-KIT-IMX264M12-T](#)
  - (4 cam) [LI-XAVIER-KIT-IMX264M12-Q](#)
  - (6 cam) [LI-XAVIER-KIT-IMX264M12-H](#)



## Lens Spec

- Model: FIFO-F1225FM
- Focal length: 12 mm
- Aperture, F/#: 2.5
- Built in 650nm IR cut filter
- FOV (H): 37 °
- TV Distortion: < -1.2 %
- M12 x P0.5

## 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-IMX264-MIPI-M12                                     | 1, 2, 3, 4 or 6 |
| 3 | FAW-1233-03 cable                                      | 1, 2, 3, 4 or 6 |



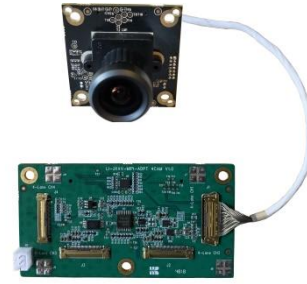
Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com

## LI-XAVIER-KIT-IMX264M12

### BOM

| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX264-MIPI-M12     | 1   |
| 3 | FAW-1233-03 cable      | 1   |



## LI-XAVIER-KIT-IMX264M12-D

### BOM

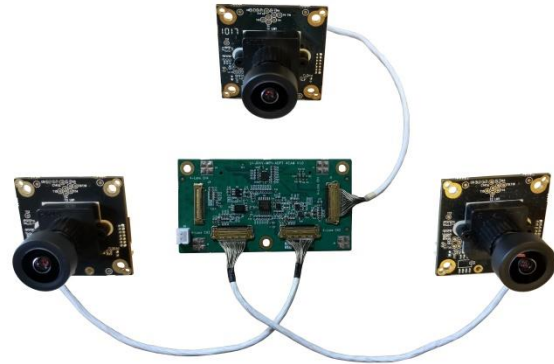
| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX264-MIPI-M12     | 2   |
| 3 | FAW-1233-03 cable      | 2   |



## LI-XAVIER-KIT-IMX264M12-T

### BOM

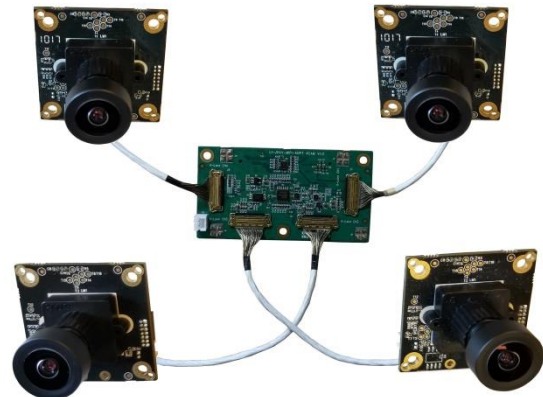
| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX264-MIPI-M12     | 3   |
| 3 | FAW-1233-03 cable      | 3   |



## LI-XAVIER-KIT-IMX264M12-Q

### BOM

| # | Items                  | QTY |
|---|------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-4CAM | 1   |
| 2 | LI-IMX264-MIPI-M12     | 4   |
| 3 | FAW-1233-03 cable      | 4   |



Leopard Imaging Inc.

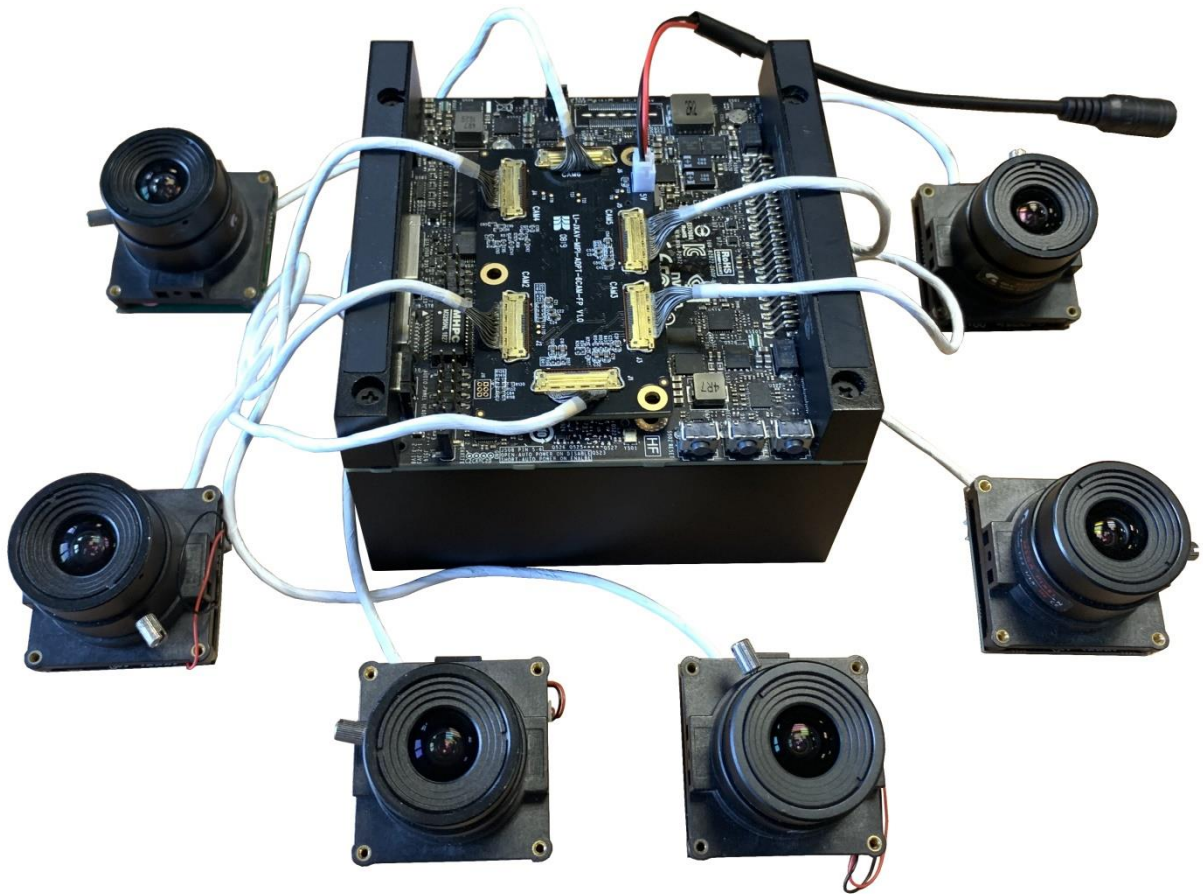
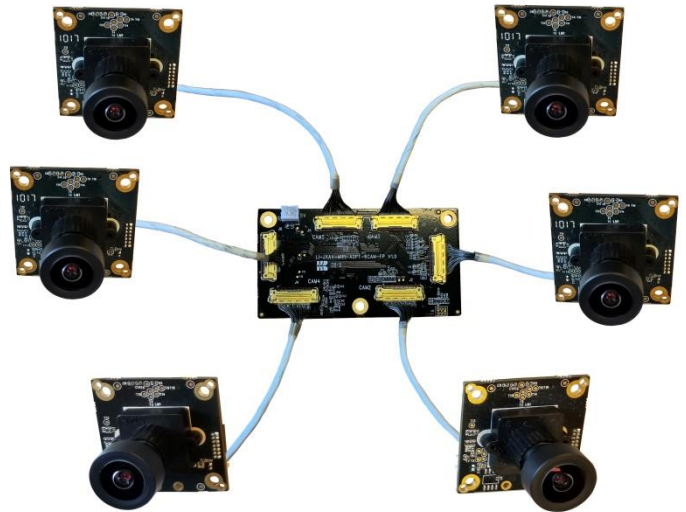
48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
Phone: +1-408-263-0988  
Fax: +1-408-217-1960  
Email: sales@leopardimaging.com  
Website: www.leopardimaging.com

## LI-XAVIER-KIT-IMX264M12-H

### BOM

| # | Items                     | QTY |
|---|---------------------------|-----|
| 1 | LI-JXAV-MIPI-ADPT-6CAM-FP | 1   |
| 2 | LI-IMX264-MIPI-M12        | 6   |
| 3 | FAW-1233-03 cable         | 6   |

Note: This camera kit supports camera synchronization.

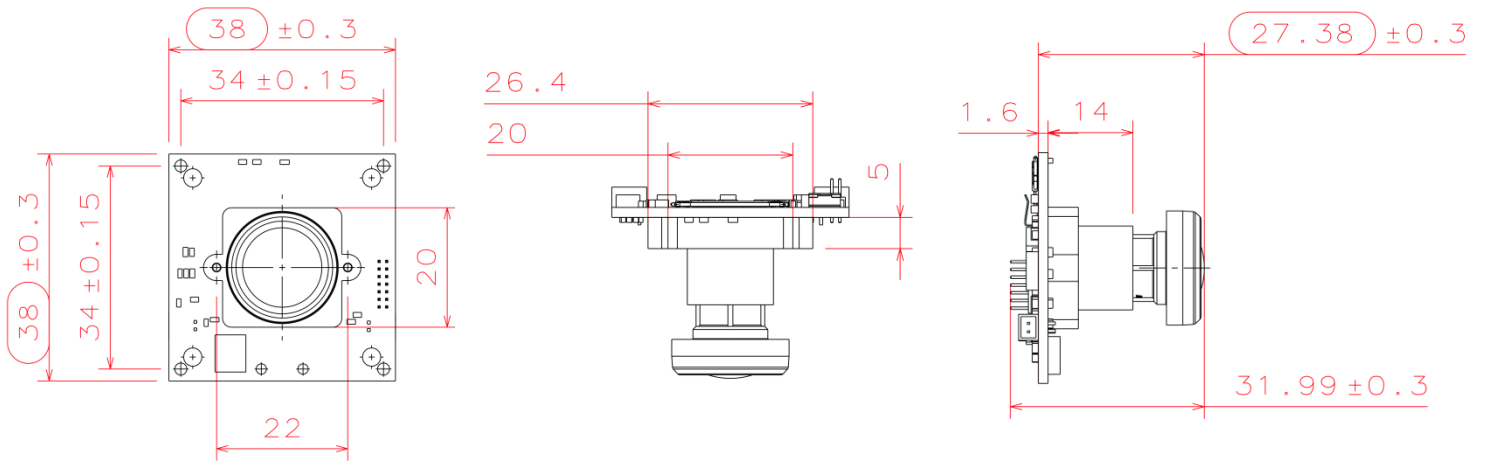


Leopard Imaging Inc.

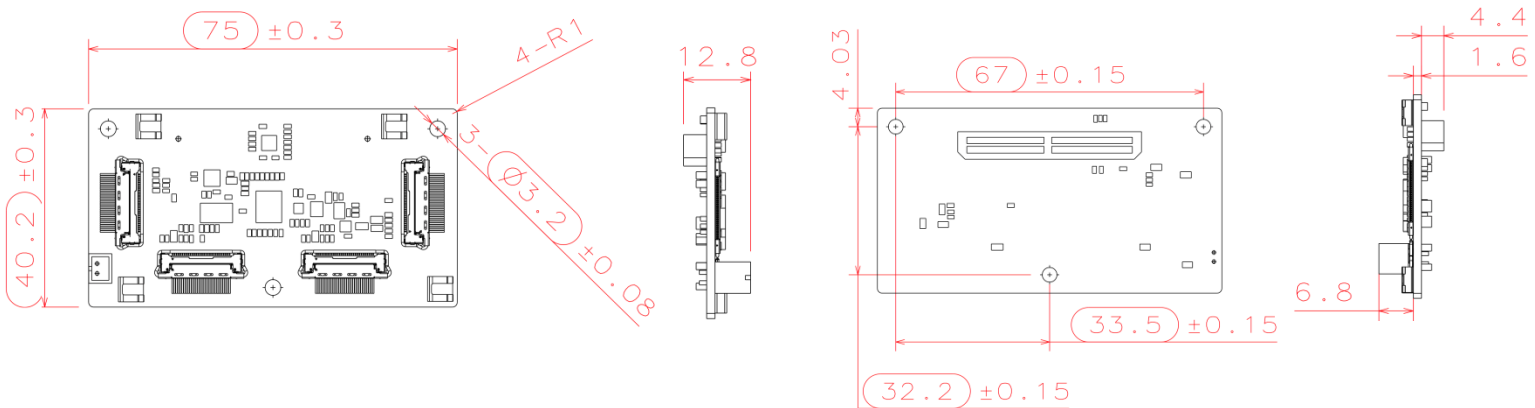
48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
Phone: +1-408-263-0988  
Fax: +1-408-217-1960  
Email: sales@leopardimaging.com  
Website: www.leopardimaging.com

# Dimensions

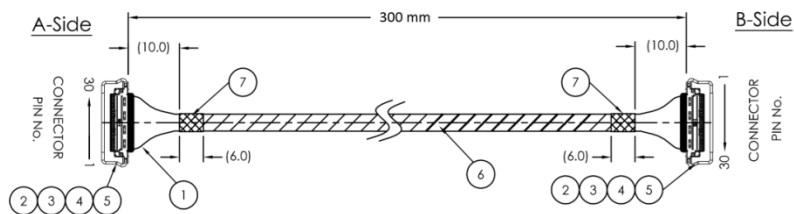
## LI-IMX264-MIPI-M12



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



## FAW-1233-03

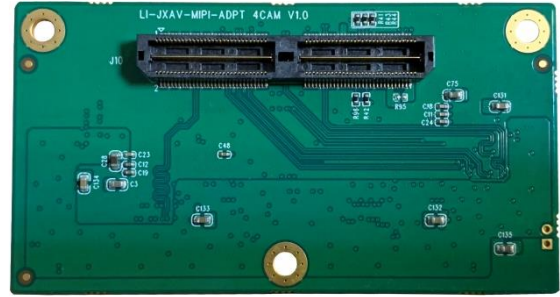


Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com



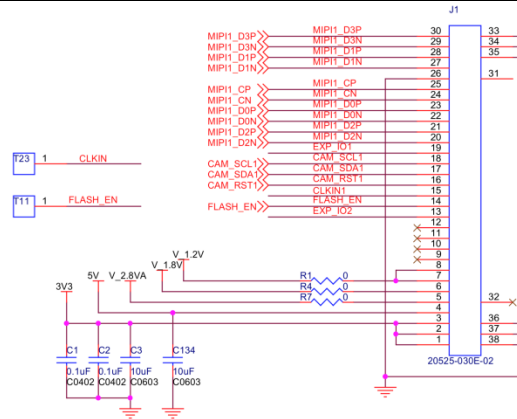
# LI-JXAV-MIPI-ADPT-4CAM



## Interfaces

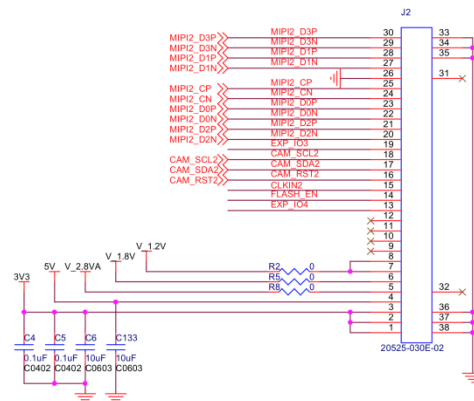
### Interface J1

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



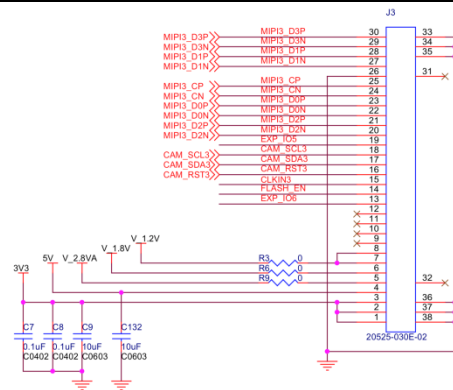
### Interface J2

- 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)

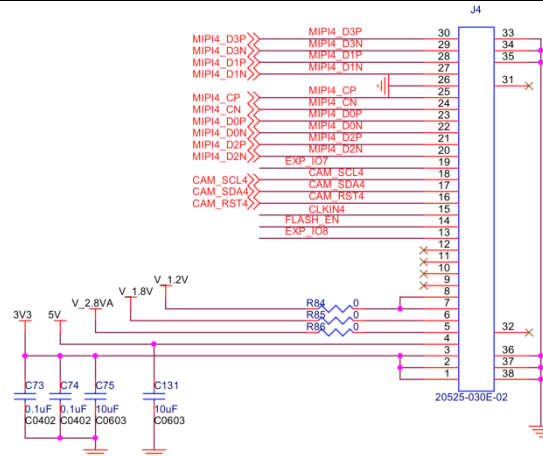


Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com

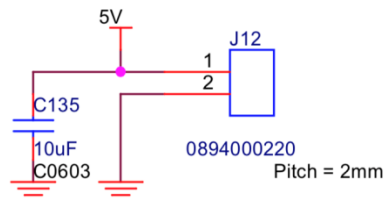
## Interface J4

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



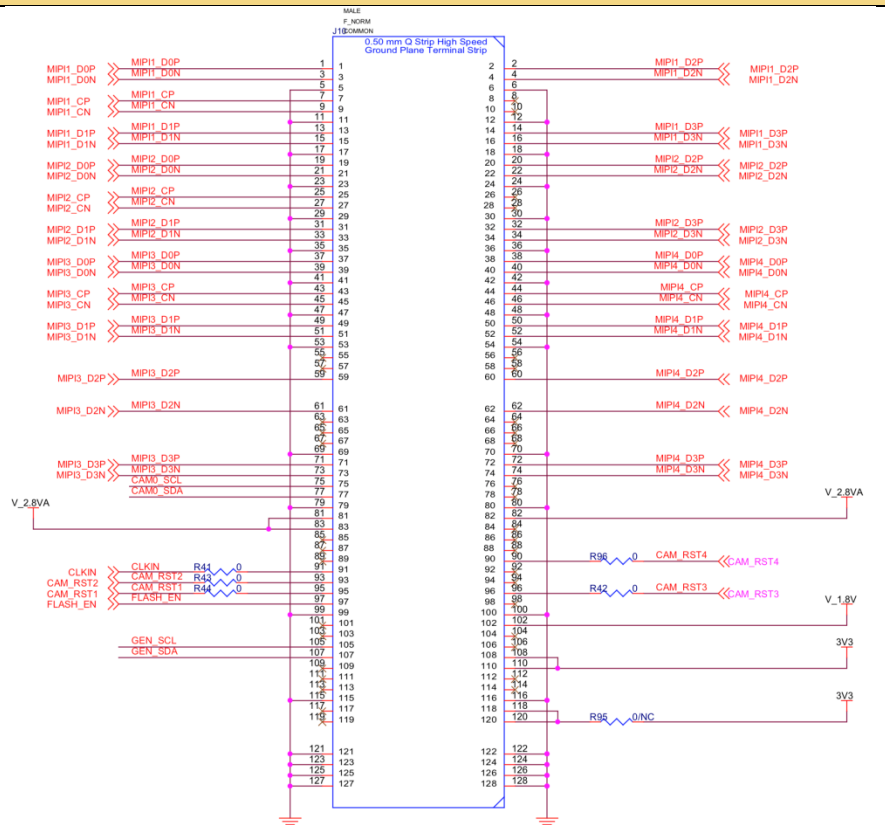
## Interface J5

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



## Interface J10

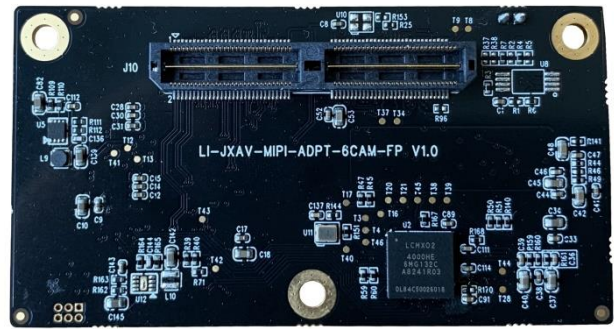
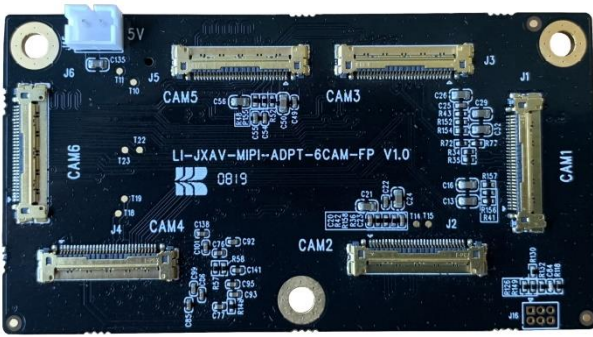
- Part#: QTH-060-01-L-D-A
- Number of Positions: 120
- Number of Rows: 2
- Pitch: 0.5 mm



Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com

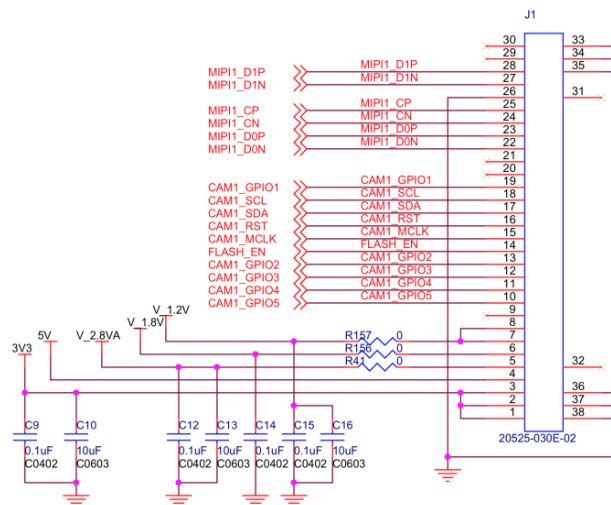
# LI-JXAV-MIPI-ADPT-6CAM-FP



## Interfaces

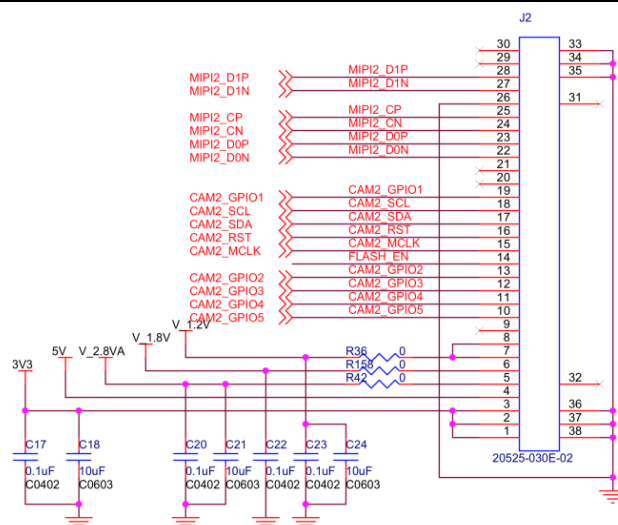
### Interface J1 (camera channel 1)

- 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

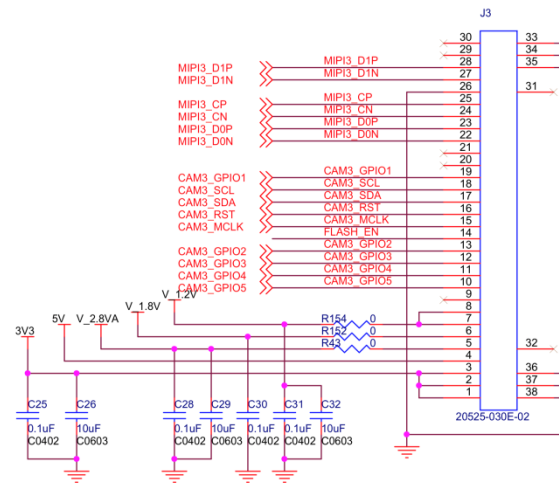


Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com

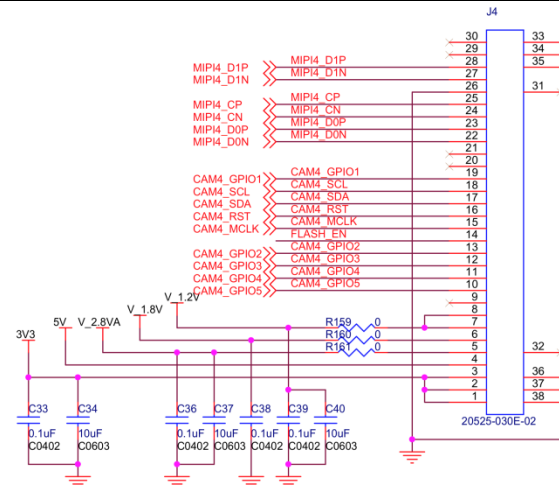
### Interface J3 (camera channel 3)

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



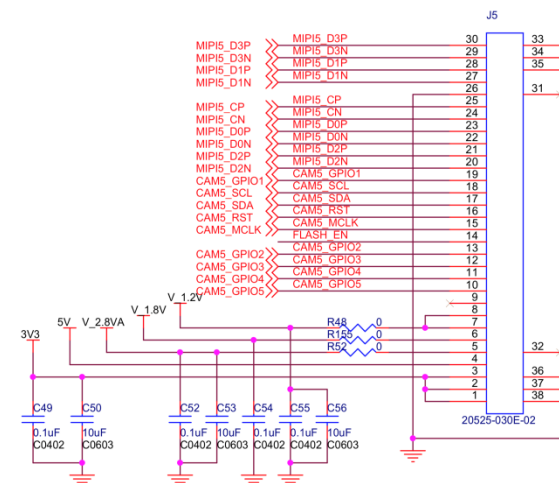
### Interface J4 (camera channel 4)

- 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



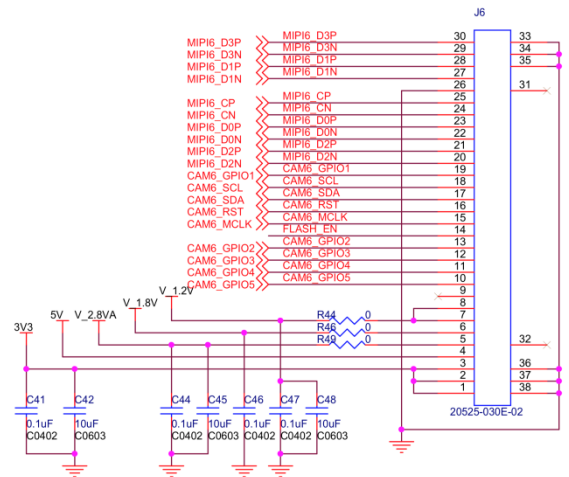
Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com



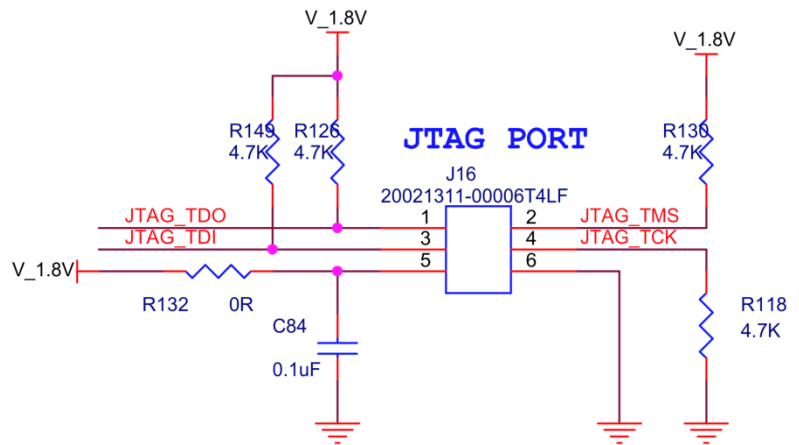
## Interface J6 (camera channel 6)

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



## Interface J16 (FPGA programming interface)

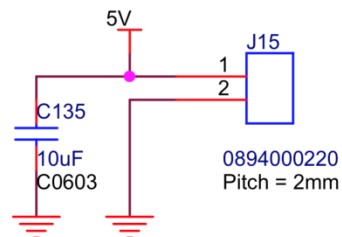
- Part#: 20021311-00006T4LF
- Number of Positions: 6
- Pitch: 0.050" (1.27mm)
- Number of Rows: 2



## Interface J15 (External power input interface)

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

### External Input Power

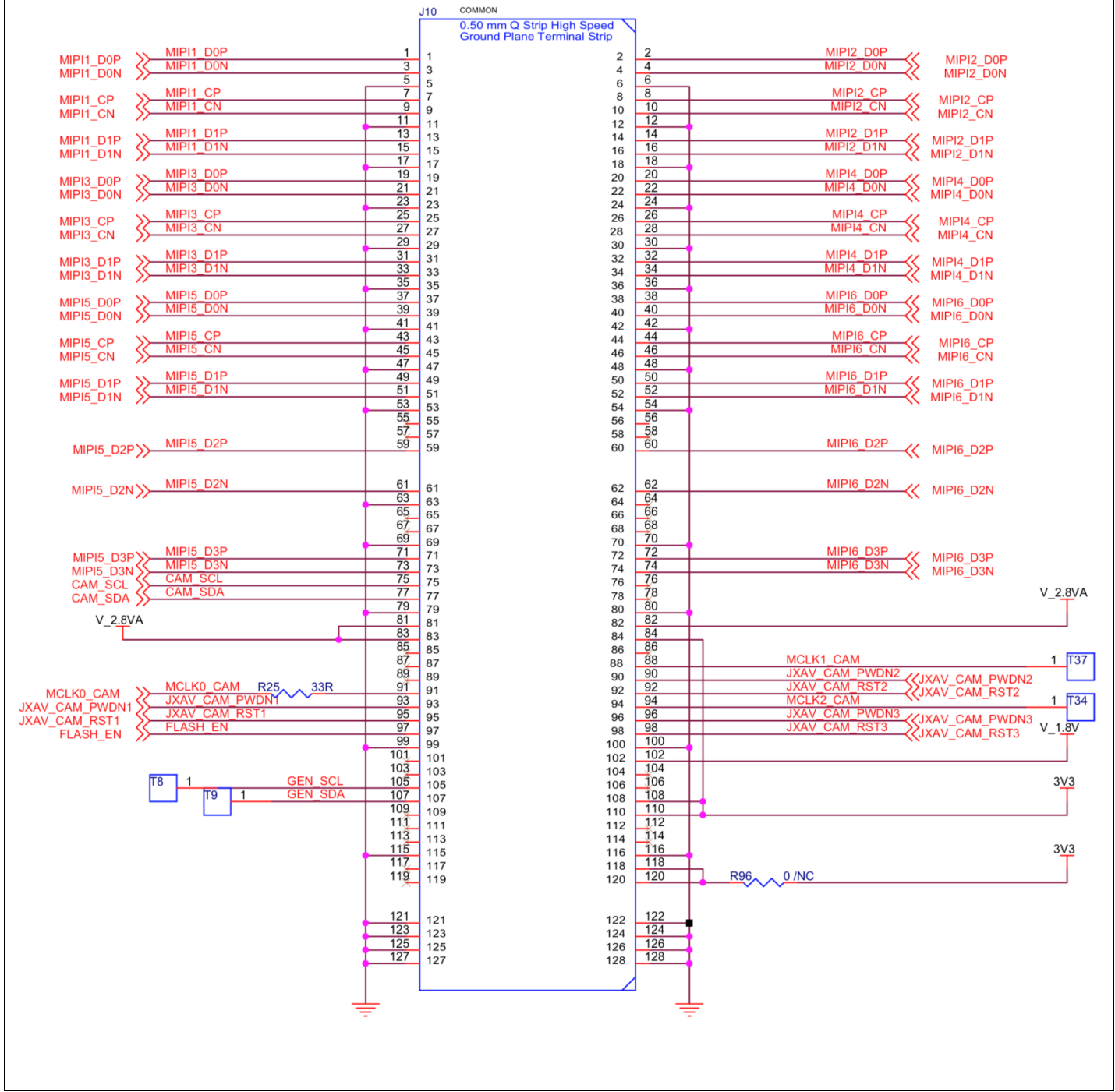


Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com

## Interface J10 (To Xavier)

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



Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com

# LI-IMX264-MIPI-M12



|  |  |
|--|--|
| <b>Camera Spec</b>   |  |
| Image Sensor   | Sony Diagonal 11.1 mm CMOS Image Sensor IMX264 |
| Optical format   | 2/3"   |
| Number of active pixels  | 2464 (H) x 2056(V)                             |
| Pixel size   | 3.45um (H) x 3.45um (V)                        |
| Color or Mono  | Color  |
| Interface  | MIPI interface                                 |
| Shutter  | Global shutter                                 |
| Lens mount   | M12  |
| Weight   | 14 g   |
| <b>Interfaces</b>  |  |
| <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 J8:</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 J2:</b> <ul style="list-style-type: none"> <li>Part#: 20021321-00010C4LF</li> <li>Number of Positions: 10</li> <li>Pitch: 1.27mm</li> </ul>   |  |
| <b>Interface J3:</b> <ul style="list-style-type: none"> <li>Part#: 20021321-00006C4LF</li> <li>Number of Positions: 6</li> <li>Pitch: 1.27mm</li> </ul>  |  |



Leopard Imaging Inc.

48820 Kato Rd, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com

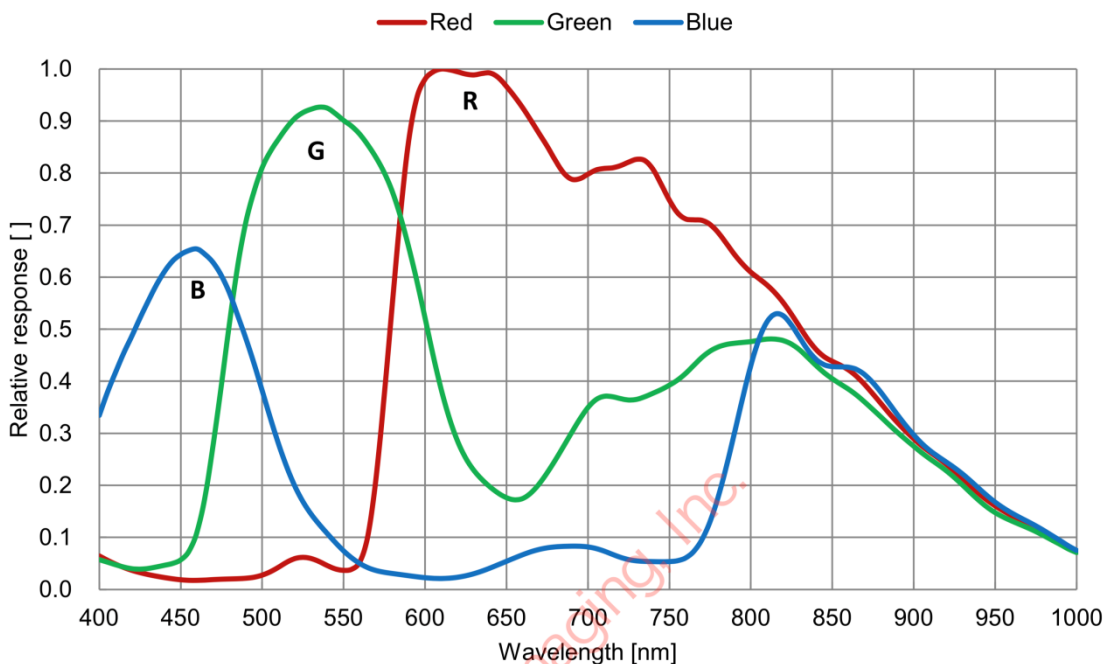
## Absolute Maximum Ratings

| Item                              | Symbol           | Rating                        | Unit | Remarks          |
|-----------------------------------|------------------|-------------------------------|------|------------------|
| Supply voltage (Analog 3.3 V)     | AV <sub>DD</sub> | -0.3 to +4.0                  | V    |                  |
| Supply voltage (Interface 1.8 V)  | OV <sub>DD</sub> | -0.3 to +3.3                  | V    |                  |
| Supply voltage (Digital 1.2 V)    | DV <sub>DD</sub> | -0.3 to +2.0                  | V    |                  |
| Input voltage                     | VI               | -0.3 to OV <sub>DD</sub> +0.3 | V    | Not exceed 3.3 V |
| Output voltage                    | VO               | -0.3 to OV <sub>DD</sub> +0.3 | V    | Not exceed 3.3 V |
| Operating temperature             | Topr             | -30 to +75                    | °C   |                  |
| Storage temperature               | Tstg             | -40 to +85                    | °C   |                  |
| Performance guarantee temperature | Tspec            | -10 to +60                    | °C   |                  |

## Recommended Operating Conditions

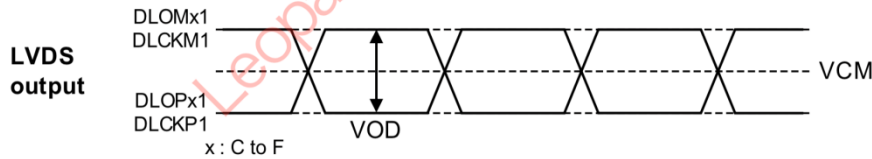
| Item                             | Symbol           | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------|------|------|------|------|
| Supply voltage (Analog 3.3 V)    | AV <sub>DD</sub> | 3.15 | 3.30 | 3.45 | V    |
| Supply voltage (Interface 1.8 V) | OV <sub>DD</sub> | 1.70 | 1.80 | 1.90 | V    |
| Supply voltage (Digital 1.2 V)   | DV <sub>DD</sub> | 1.10 | 1.20 | 1.30 | V    |

## Spectral Sensitivity Characteristics



## DC Characteristics

| Item                   | Pins   | Symbol            | Conditions   | Min.                   | Typ.                | Max.                   | Unit |   |
|------------------------|--|-------------------|--|------------------------|---------------------|------------------------|------|---|
| Supply voltage         | Analog   | V <sub>DDHx</sub> | AV <sub>DD</sub>                                       | —                      | 3.15                | 3.30                   | 3.45 | V |
|                        | Interface  | V <sub>DDMx</sub> | OV <sub>DD</sub>                                       | —                      | 1.70                | 1.80                   | 1.90 | V |
|                        | Digital  | V <sub>DDLx</sub> | DV <sub>DD</sub>                                       | —                      | 1.10                | 1.20                   | 1.30 | V |
| Digital input voltage  | XHS<br>XVS<br>XCLR<br>INCK<br>XMASTER<br>SLAMODE | VIH               | XVS / XHS<br>in Slave mode                             | 0.8 × OV <sub>DD</sub> | —                   | —                      | V    |   |
|                        | SCK<br>SDI<br>XCE<br>XTRIG                       | VIL               |  | —                      | —                   | 0.2 × OV <sub>DD</sub> | V    |   |
| Digital output voltage | DLOPx1<br>DLOMx1<br>DCKP1<br>DCKM1<br>x: C to F  | VCM               | Low voltage LVDS<br>(termination<br>resistance: 100 Ω) | —                      | OV <sub>DD</sub> /2 | —                      | V    |   |
|                        |  | VOD               |  | 100                    | 150                 | 210                    | mV   |   |
|                        | XHS<br>XVS<br>SDO<br>TOUT1<br>TOUT2              | VOH               | XVS / XHS<br>in Master mode                            | OV <sub>DD</sub> -0.4  | —                   | —                      | V    |   |
|                        |  | VOL               |  | —                      | —                   | 0.4                    | V    |   |



## Power Consumption

| Item   | Pins             | Symbol                | Typ. | Max. | Unit |
|--|------------------|-----------------------|------|------|------|
| Operating current<br>Serial LVDS 4 ch<br>12 bit 35.7 frame/s | V <sub>DDH</sub> | I <sub>AVDD</sub>     | 120  | 175  | mA   |
|  | V <sub>DDM</sub> | I <sub>OVDD</sub>     | 11   | 20   | mA   |
|  | V <sub>DDL</sub> | I <sub>DVDD</sub>     | 120  | 180  | mA   |
| Standby current  | V <sub>DDH</sub> | I <sub>AVDD_STB</sub> | —    | 0.5  | mA   |
|  | V <sub>DDM</sub> | I <sub>OVDD_STB</sub> | —    | 0.5  | mA   |
|  | V <sub>DDL</sub> | I <sub>DVDD_STB</sub> | —    | 20   | mA   |

Operating current:

(Typical value condition):

Supply voltage: 3.30 V / 1.80 V / 1.20 V, T<sub>j</sub> = 25 °C

(Maximum value condition):

Supply voltage: 3.45 V / 1.90 V / 1.30 V, T<sub>j</sub> = 60 °C

Worst state of internal circuit operating current consumption.

Standby current:

(Maximum value condition):

Supply voltage: 3.45 V / 1.90 V / 1.30 V, T<sub>j</sub> = 60 °C, INCK = 0 V,

The device in the light-obstructed state.



Leopard Imaging Inc.

48820 Kato Road, Suite 100B, Fremont, CA 94538, USA

Phone: +1-408-263-0988

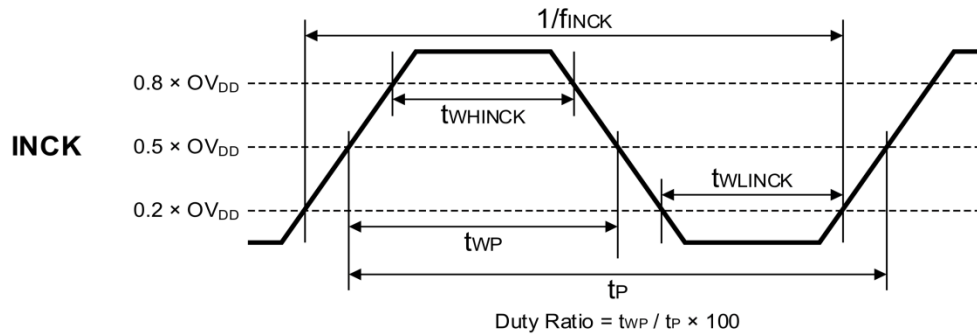
Fax: +1-408-217-1960

Email: sales@leopardimaging.com

Website: www.leopardimaging.com



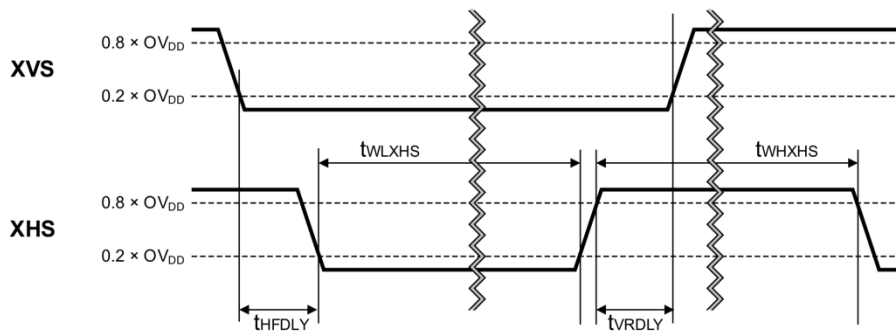
## AC Characteristics



| 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  | $f_{INCK} =$<br>37.125 MHz, 74.25 MHz,<br>54 MHz |
| INCK Low level pulse width  | $t_{WLINCK}$ | 4                      | —          | —                      | ns   |  |
| INCK High level pulse width | $t_{WHINCK}$ | 4                      | —          | —                      | ns   |  |
| INCK clock duty             | —            | 45.0                   | 50.0       | 55.0                   | %    | Define with $0.5 \times OV_{DD}$                 |

\* The INCK fluctuation affects the frame rate.

## XVS / XHS Input Characteristics in Slave Mode (XMASTER = High)



| Item                       | Symbol      | Min.         | Typ. | Max. | Unit |
|----------------------------|-------------|--------------|------|------|------|
| XHS Low level pulse width  | $t_{WLXHS}$ | $4/f_{INCK}$ | —    | —    | ns   |
| XHS High level pulse width | $t_{WHXHS}$ | $4/f_{INCK}$ | —    | —    | ns   |
| XVS - XHS fall width       | $t_{HFDLY}$ | $1/f_{INCK}$ | —    | —    | ns   |
| XHS - XVS rise width       | $t_{VRDLY}$ | $1/f_{INCK}$ | —    | —    | ns   |

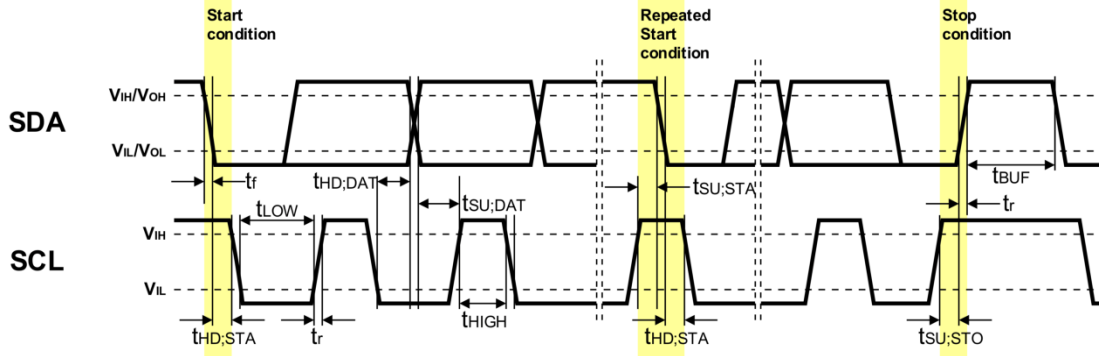
Synchronization cannot be performed from XVS and XHS signal in master mode. Detect the sync code.



Leopard Imaging Inc.

48820 Kato Road, Suite 100B, Fremont, CA 94538, USA  
 Phone: +1-408-263-0988  
 Fax: +1-408-217-1960  
 Email: sales@leopardimaging.com  
 Website: www.leopardimaging.com

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



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

| Item                                    | Symbol          | Min.                   | Typ. | Max.                   | Unit | Remarks  |
|---|-----------------|------------------------|------|------------------------|------|--|
| Low level input voltage                 | V <sub>IL</sub> | -0.3                   | —    | 0.3 × OV <sub>DD</sub> | V    |  |
| High level input voltage                | V <sub>IH</sub> | 0.7 × OV <sub>DD</sub> | —    | 1.9                    | V    |  |
| Low level output voltage                | V <sub>OL</sub> | 0                      | —    | 0.2 × OV <sub>DD</sub> | V    | OV <sub>DD</sub> < 2 V, Sink 3 mA                                    |
| High level output voltage               | V <sub>OH</sub> | 0.8 × OV <sub>DD</sub> | —    | —                      | V    |  |
| Output fall time                        | t <sub>of</sub> | —                      | —    | 250                    | ns   | Load 10 pF – 400 pF, 0.7 × OV <sub>DD</sub> – 0.3 × OV <sub>DD</sub> |
| Input current                           | i <sub>i</sub>  | -10                    | —    | 10                     | μA   | 0.1 × OV <sub>DD</sub> – 0.9 × OV <sub>DD</sub>                      |
| Capacitance for SCK (/SCL) , SDI (/SDA) | C <sub>i</sub>  | —                      | —    | 10                     | pF   |  |

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

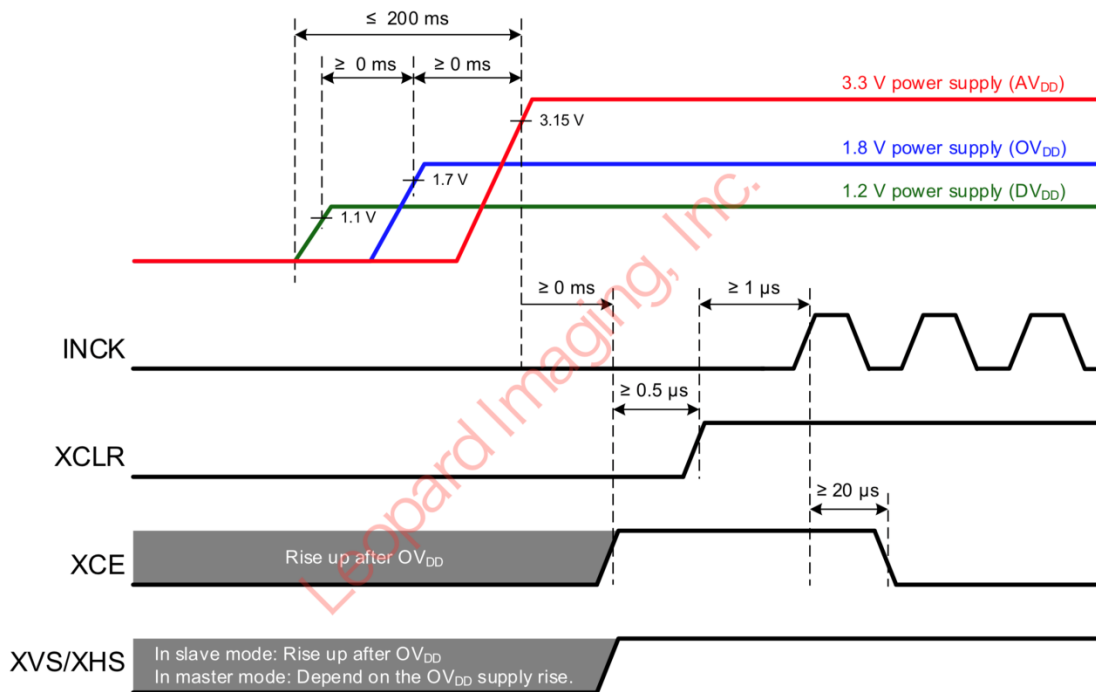
| Item   | Symbol             | Min. | Typ. | Max. | Unit |
|--|--------------------|------|------|------|------|
| SCL clock frequency                              | f <sub>SCL</sub>   | 0    | —    | 400  | kHz  |
| Hold time (Start Condition)                      | t <sub>HSTA</sub>  | 0.6  | —    | —    | 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>SUSTA</sub> | 0.6  | —    | —    | μs   |
| Data hold time                                   | t <sub>HDDAT</sub> | 0    | —    | 0.9  | μs   |
| Data set-up time                                 | t <sub>SUDAT</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>SUSTO</sub> | 0.6  | —    | —    | μs   |
| Bus free time between a Stop and Start Condition | t <sub>BUF</sub>   | 1.3  | —    | —    | μs   |



## Power-on Sequence

Follow the sequence below to turn On the power supplies.

1. Turn On the power supplies so that the power supplies rise in order of 1.2 V power supply ( $DV_{DD}$ ) → 1.8 V power supply ( $OV_{DD}$ ) → 3.3 V power supply ( $AV_{DD}$ ). In addition, all power supplies should finish rising within 200 ms.
2. The register values are undefined immediately after power-on, so the system must be cleared. Hold XCLR at Low level for 500 ns or more after all the power supplies have finished rising. (The register values after a system clear are the default values.)  
In addition, hold XCE to High level during this period. Rise XCE after 1.8 V power supply ( $OV_{DD}$ ), so hold XCE at High level until INCK is input.
3. Start the input of INCK after turning the level of XCLR into the high.
4. Make the sensor setting by register communication after the system clear. A period of 0  $\mu$ s or more should be provided after setting XCLR High before inputting the communication enable signal XCE.



## Power-off Sequence

Turn Off the power supplies so that the power supplies fall in order of 3.3 V power supply ( $AV_{DD}$ ) → 1.8 V power supply ( $OV_{DD}$ ) → 1.2 V power supply ( $DV_{DD}$ ). In addition, all power supplies should finish falling within 200 ms. Set each digital input pin (INCK, XCE, SCK, SDI, XCLR, XMASTER, XTRIG, SLAMODE, XVS, XHS) to 0 V or high impedance before the 1.8 V power supply ( $OV_{DD}$ ) falls.

