



LEOPARD IMAGING INC

Rev 1.1

# LI-TX1-KIT-IMX185CS

## Data Sheet

### Key Features

- Compatible with Nvidia Jetson TX1
- MIPI interface
- Support up to three IMX185 cameras
- Sony Diagonal 8.58mm Type 1/1.9 CMOS Image Sensor IMX185LQJ
- Active pixels: 1937H x 1217V
- Length of the I-PEX cable: 300mm
- Support CS lens
- Provide customization services
- Weight: 78 g
- Part#: **LI-TX1-KIT-IMX185CS**



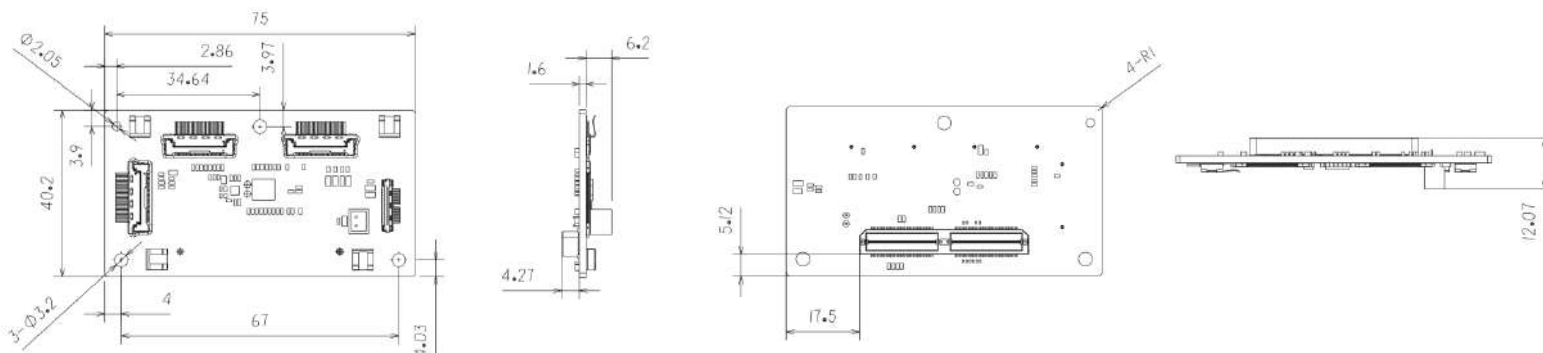
### BOM

| # | Items             | QTY |
|---|-------------------|-----|
| 1 | LI-JTX1-MIPI-ADPT | 1   |
| 2 | LI-IMX185-MIPI-CS | 1   |
| 3 | FAW-1233-03 cable | 1   |

### Lens Spec

- Model: ES0522F.IR
- Focal length: 5.0 mm
- Aperture, F/#: 2.2
- Built in 650nm IR cut filter
- FOV (D/H/V): 102° / 90° /50°
- TV Distortion: < -8%
- Mount Type: CS

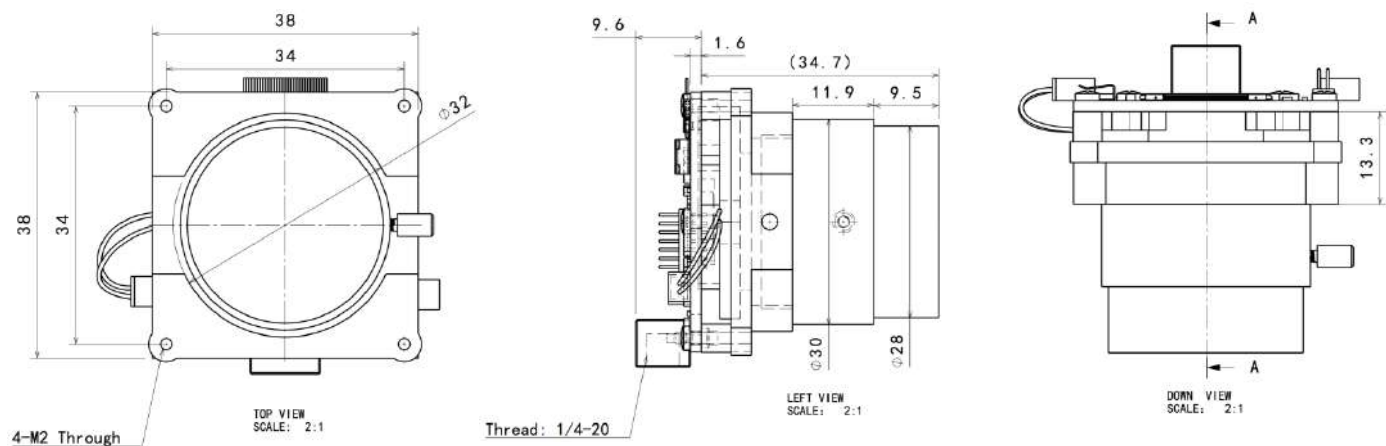
### Dimensions (LI-JTX1-MIPI-ADPT)



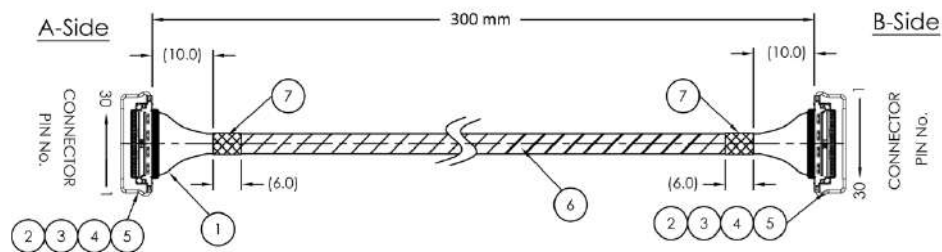
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## Dimensions (LI-IMX185-MIPI-CS)



## Dimensions (FAW-1233-03)



## Work on Nvidia Jetson TX1



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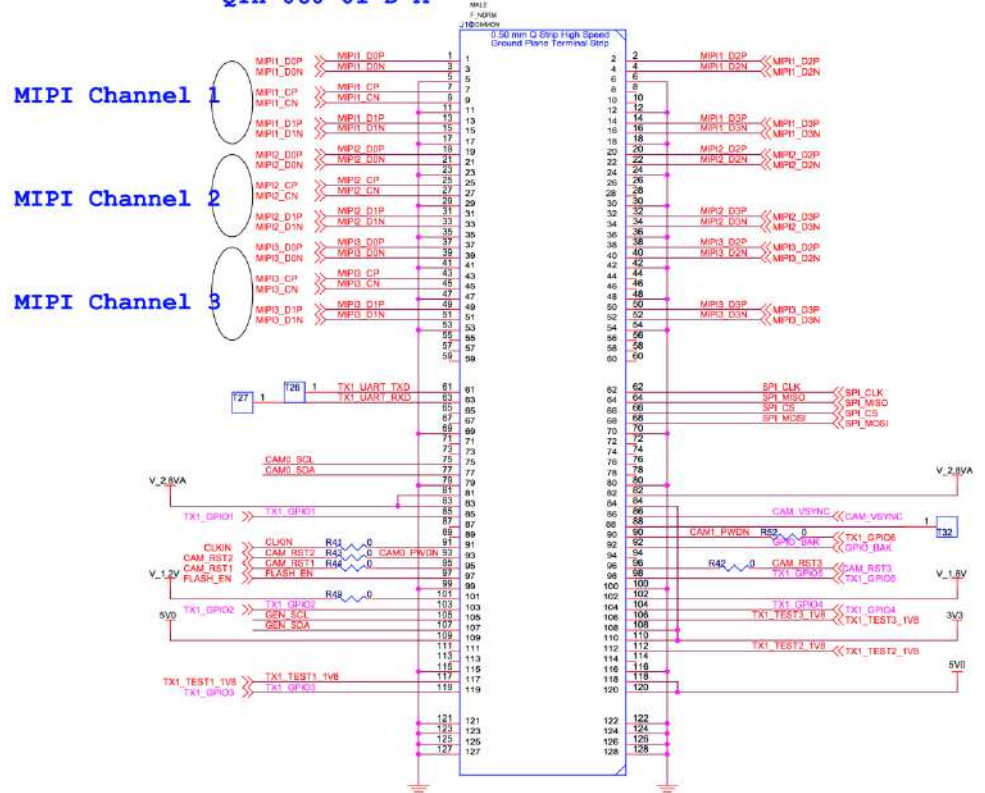
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## Interface J10

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

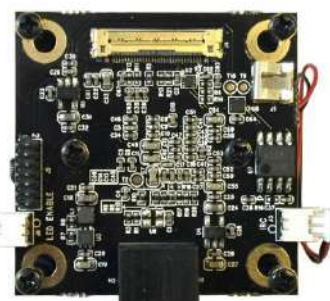
## Vertical Mating connector of Jetson TX1 J22 QTH-060-01-D-A



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# LI-IMX185-MIPI-CS



| Camera Spec             |                                                                                                                                                                                 |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Image Sensor            | Sony Diagonal 8.58 mm (Type 1/1.9) Solid-state Image Sensor IMX185                                                                                                              |
| Optical format          | 1/1.9"                                                                                                                                                                          |
| Number of active pixels | 1952 (H) x 1243 (V)                                                                                                                                                             |
| Pixel size              | 3.75um (H) x 3.75um (V)                                                                                                                                                         |
| Color or Mono           | Color                                                                                                                                                                           |
| Interface               | MIPI interface                                                                                                                                                                  |
| Lens mount              | CS                                                                                                                                                                              |
| IR switcher             | Support                                                                                                                                                                         |
| Weight                  | 58 g                                                                                                                                                                            |
| Interfaces              |                                                                                                                                                                                 |
| Interface J2:           | <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> |
| Interface J3:           | <ul style="list-style-type: none"> <li>Part#: 1734829-2</li> <li>Number of Positions: 2</li> <li>Pitch: 1.25mm</li> </ul>                                                       |
| Interface J5:           | <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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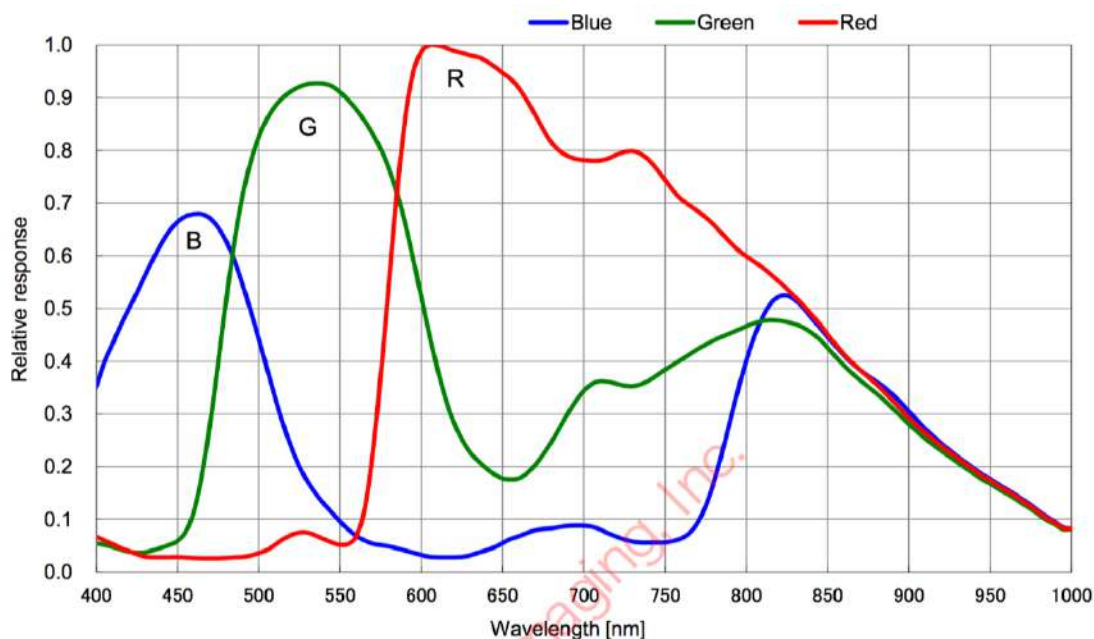
## Absolute Maximum Ratings

| Item                              | Symbol           | Min. | Max.                   | Unit | Remarks          |
|-----------------------------------|------------------|------|------------------------|------|------------------|
| Supply voltage (analog 3.3 V)     | AV <sub>DD</sub> | -0.3 | 4.0                    | V    |                  |
| Supply voltage (digital 1.8 V)    | OV <sub>DD</sub> | -0.3 | 3.3                    | V    |                  |
| Supply voltage (digital 1.2 V)    | DV <sub>DD</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 |
| Guaranteed operating temperature  | Topr             | -30  | +75                    | °C   |                  |
| Storage guarantee temperature     | Tstg             | -40  | +80                    | °C   |                  |
| Performance guarantee temperature | Tspec            | -10  | +60                    | °C   |                  |

## Recommended Operating Conditions

| Item                           | Symbol           | Min. | Typ. | Max. | Unit |
|--------------------------------|------------------|------|------|------|------|
| Supply voltage (analog 3.3 V)  | AV <sub>DD</sub> | 3.15 | 3.3  | 3.45 | V    |
| Supply voltage (digital 1.8 V) | OV <sub>DD</sub> | 1.7  | 1.8  | 1.9  | V    |
| Supply voltage (digital 1.2 V) | DV <sub>DD</sub> | 1.1  | 1.2  | 1.3  | V    |

## Spectral Sensitivity Characteristics



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## 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    |
|                        | Digital                                                                     | 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>OMODE<br>SCK/SCL<br>SDI/SDA<br>XCE | VIH               | XVS/XHS<br>in slave mode                              | 0.8 ×<br>OV <sub>DD</sub> | —                   | —                         | V    |
|                        |                                                                             | VIL               |                                                       | —                         | —                   | 0.2 ×<br>OV <sub>DD</sub> | V    |
| Digital output voltage | DOP [11:0]<br>DOM [11:0]<br>DCKP<br>DCKM                                    | VCM               | Low voltage LVDS                                      | —                         | OV <sub>DD</sub> /2 | —                         | V    |
|                        |                                                                             | VOD               | Low voltage LVDS<br>(Termination<br>resistance 100 Ω) | 100                       | 150                 | 200                       | mV   |
|                        | XHS<br>XVS<br>SDO                                                           | VOH               | XVS/XHS<br>in master mode                             | OV <sub>DD</sub><br>-0.4  | —                   | —                         | V    |
|                        |                                                                             | VOL               |                                                       | —                         | —                   | 0.4                       | V    |

## Power Consumption

| Item                                                                                   | Pins             | Symbol                | Typ.                              |                                    | Max.                              |                                    | Unit |
|----------------------------------------------------------------------------------------|------------------|-----------------------|-----------------------------------|------------------------------------|-----------------------------------|------------------------------------|------|
|                                                                                        |                  |                       | Standard<br>luminous<br>intensity | Saturated<br>luminous<br>intensity | Standard<br>luminous<br>intensity | Saturated<br>luminous<br>intensity |      |
| Operating current<br>CSI-2 serial output 4 Lane<br>12 bit, 60 frame/s<br>1080p-HD mode | V <sub>DDH</sub> | IAV <sub>DD</sub>     | 88                                | 88                                 | 113                               | 113                                | mA   |
|                                                                                        | V <sub>DDM</sub> | IOV <sub>DD</sub>     | 2                                 | 2                                  | 4                                 | 4                                  | mA   |
|                                                                                        | V <sub>DDL</sub> | IDV <sub>DD</sub>     | 110                               | 130                                | 150                               | 190                                | mA   |
| Standby current                                                                        | V <sub>DDH</sub> | IAV <sub>DD_STB</sub> | —                                 | —                                  | 0.2                               |                                    | mA   |
|                                                                                        | V <sub>DDM</sub> | IOV <sub>DD_STB</sub> | —                                 | —                                  | 0.1                               |                                    | mA   |
|                                                                                        | V <sub>DDL</sub> | IDV <sub>DD_STB</sub> | —                                 | —                                  | 7.0                               |                                    | mA   |

Operating current:

(Typical value condition) : Supply voltage 3.3 V / 1.8 V / 1.2 V, T<sub>j</sub> = 25 °C

(Maximum value condition) : Supply voltage 3.45 V / 1.9 V / 1.3 V, worst state of internal circuit operating current consumption, T<sub>j</sub> = 60 °C

Standby (Maximum value condition) : Supply voltage 3.45 V / 1.9 V / 1.3 V, T<sub>j</sub> = 60 °C, INCK = 0 V

Standard luminous intensity: luminous intensity at standard imaging condition I

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



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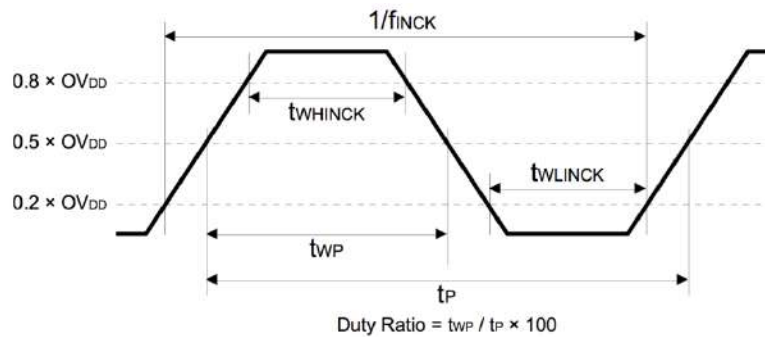
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## AC Specification

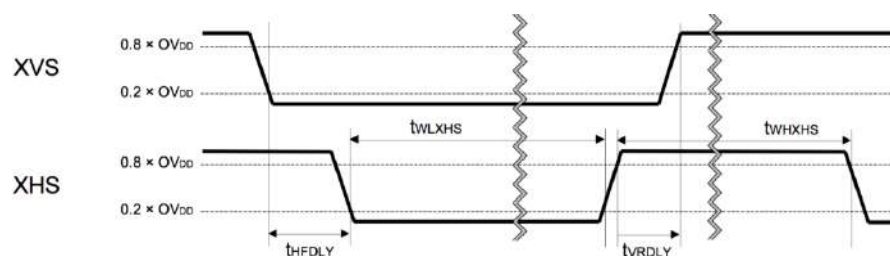
### INCK



| 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  | $f_{INCK} = 27 \text{ MHz}, 54 \text{ MHz}, 37.125 \text{ MHz}, 74.25 \text{ MHz}$ |
| INCK Low level width  | $t_{WLINCK}$ | 4                      | —          | —                      | ns   | $f_{INCK} = 27 \text{ MHz}, 54 \text{ MHz}, 37.125 \text{ MHz}, 74.25 \text{ MHz}$ |
| INCK High level width | $t_{WHINCK}$ | 4                      | —          | —                      | ns   | $f_{INCK} = 27 \text{ MHz}, 54 \text{ MHz}, 37.125 \text{ MHz}, 74.25 \text{ MHz}$ |
| INCK clock duty       | —            | 45.0                   | 50.0       | 55.0                   | %    | Define with $0.5 \times OV_{DD}$                                                   |

\* The INCK fluctuation affects the frame rate.

### XHS, XVS Input Characteristics In Slave Mode (XMASTER pin = High)



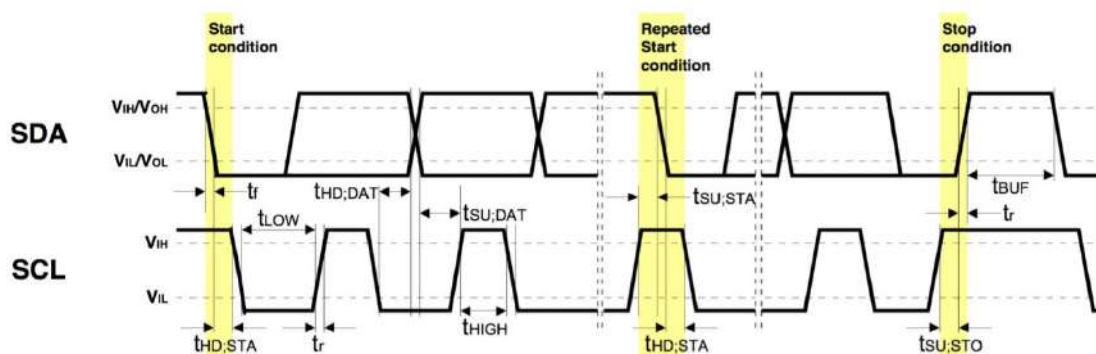
| Item                       | Symbol      | Min.           | Typ. | Max. | Unit | Remarks |
|----------------------------|-------------|----------------|------|------|------|---------|
| XHS Low level pulse width  | $t_{WLXHS}$ | $4 / f_{INCK}$ | —    | —    | ns   |         |
| XHS High level pulse 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   |         |



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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                 | —    | $0.3 \times OV_{DD}$ | V       |                                                                   |
| High level input voltage                   | $V_{IH}$ | $0.7 \times OV_{DD}$ | —    | 1.9                  | V       |                                                                   |
| Low level output voltage                   | $V_{OL}$ | 0                    | —    | $0.2 \times OV_{DD}$ | V       | $OV_{DD} < 2$ V, Sink 3 mA                                        |
| High level output voltage                  | $V_{OH}$ | $0.8 \times OV_{DD}$ | —    | —                    | V       |                                                                   |
| Output fall time                           | $t_{of}$ | —                    | —    | 250                  | ns      | Load 10 pF – 400 pF,<br>$0.7 \times OV_{DD} - 0.3 \times OV_{DD}$ |
| Input current                              | $i_i$    | -10                  | —    | 10                   | $\mu$ A | $0.1 \times OV_{DD} - 0.9 \times OV_{DD}$                         |
| Capacitance for SCK (/SCL) ,<br>SDI (/SDA) | $C_i$    | —                    | —    | 10                   | pF      |                                                                   |

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

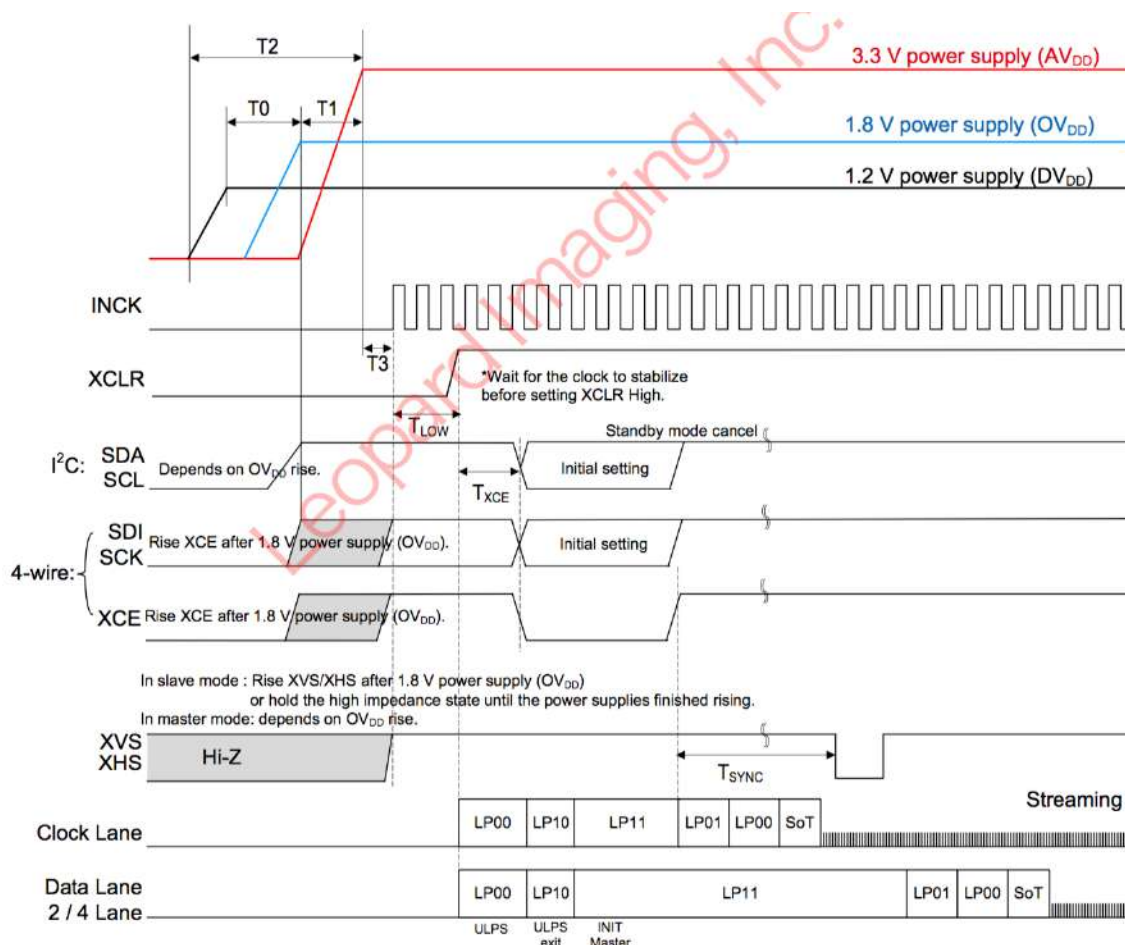
| Item                                             | Symbol      | Min. | Typ. | Max. | Unit    |
|--------------------------------------------------|-------------|------|------|------|---------|
| SCL clock frequency                              | $f_{SCL}$   | 0    | —    | 400  | kHz     |
| Hold time (Start Condition)                      | $t_{HDSTA}$ | 0.6  | —    | —    | $\mu$ s |
| Low period of the SCL clock                      | $t_{LOW}$   | 1.3  | —    | —    | $\mu$ s |
| High period of the SCL clock                     | $t_{HIGH}$  | 0.6  | —    | —    | $\mu$ s |
| Set-up time (Repeated Start Condition)           | $t_{SUSTA}$ | 0.6  | —    | —    | $\mu$ s |
| Data hold time                                   | $t_{HDDAT}$ | 0    | —    | 0.9  | $\mu$ s |
| Data set-up time                                 | $t_{SUDAT}$ | 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)                     | $t_{SUSTO}$ | 0.6  | —    | —    | $\mu$ s |
| Bus free time between a Stop and Start Condition | $t_{BUF}$   | 1.3  | —    | —    | $\mu$ s |



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## Power-on Sequence



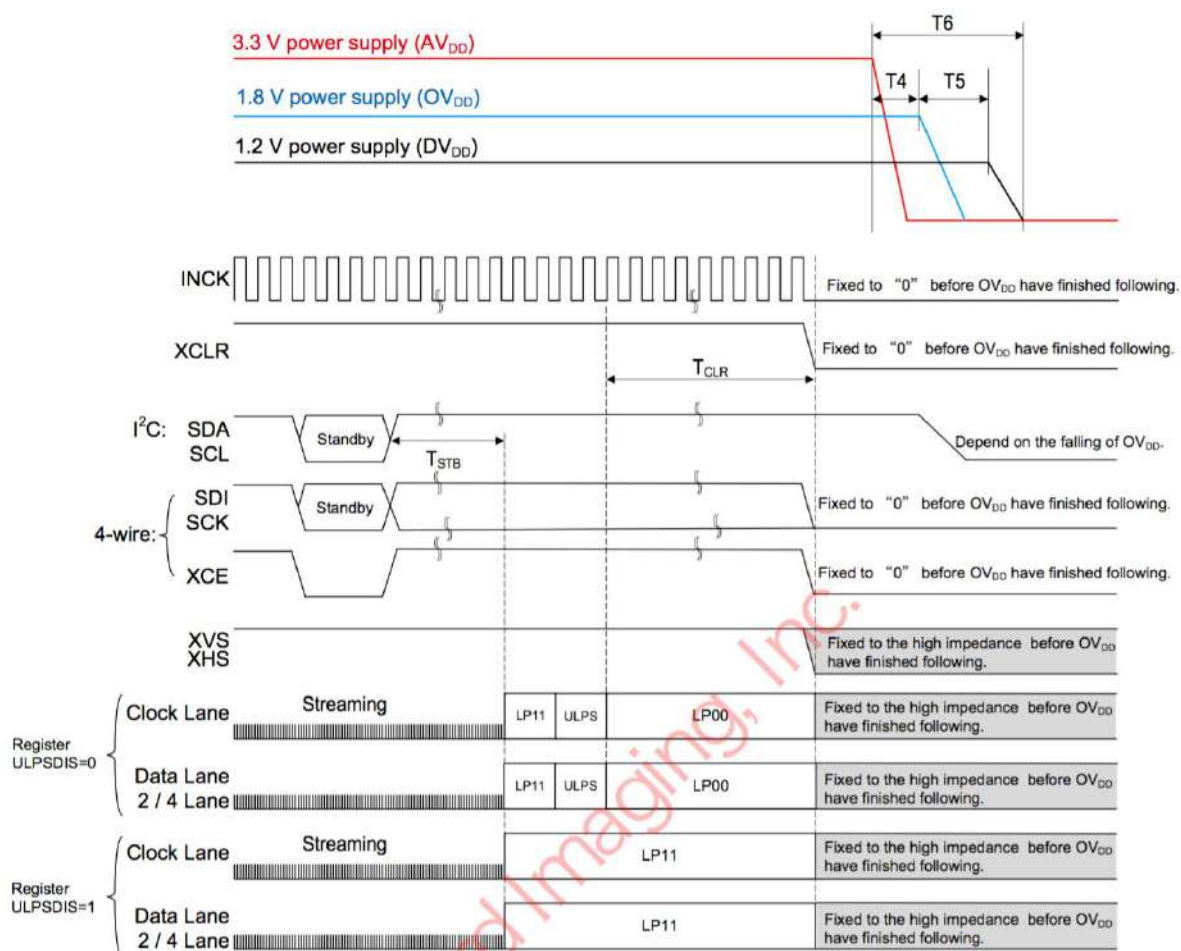
| Item                                                                       | Symbol     | Min. | Max. | Unit |
|----------------------------------------------------------------------------|------------|------|------|------|
| 1.2 V power supply rising → 1.8 V power supply rising                      | $T_0$      | 0    | —    | ns   |
| 1.8 V power supply rising → 3.3 V power supply rising                      | $T_1$      | 0    | —    | ns   |
| Rising time of all power supply                                            | $T_2$      | —    | 200  | ms   |
| All power supply rising → External input time of INCK                      | $T_3$      | 0    | —    | ns   |
| INCK active → Clear OFF                                                    | $T_{LOW}$  | 500  | —    | ns   |
| Clear OFF → Communication start                                            | $T_{XCE}$  | 20   | —    | μs   |
| Standby OFF (communication)<br>→ External input XHS, XVS (slave mode only) | $T_{SYNC}$ | 20   | —    | ms   |



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## Power-off Sequence



| Item                                          | Symbol    | Min.     | Max. | Unit  |
|-----------------------------------------------|-----------|----------|------|-------|
| Standby ON (communication) → LP11 mode start  | $T_{STB}$ | Until FE |      | —     |
| LP00 → XCLR falling (ULPSDIS = 0)             | $T_{CLR}$ | 128      | —    | cycle |
| 3.3 V power shut down → 1.8 V power shut down | $T_4$     | 0        | —    | ns    |
| 1.8 V power shut down → 1.2 V power shut down | $T_5$     | 0        | —    | ns    |
| Shut down time of all power supply.           | $T_6$     | —        | 200  | ms    |



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## Optical dimension

### ◆ Image size (recommended recording pixels)

All-pixel scan : diagonal 8.49mm (type 1/1.9)

1080p-HD : diagonal 8.26mm (type 1/1.9)

### ◆ Number of recommended recording pixels

All-pixel scan : 1920 (H) × 1200 (V) approx. 2.31 M pixels

1080p-HD : 1920 (H) × 1080 (V) approx. 2.07 M pixels

### ◆ Unit cell size

3.75  $\mu\text{m}$  (H) × 3.75  $\mu\text{m}$  (V)

### ◆ Recommended eye relief compensation distance : - 30mm to $-\infty$

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