



LEOPARD IMAGING INC

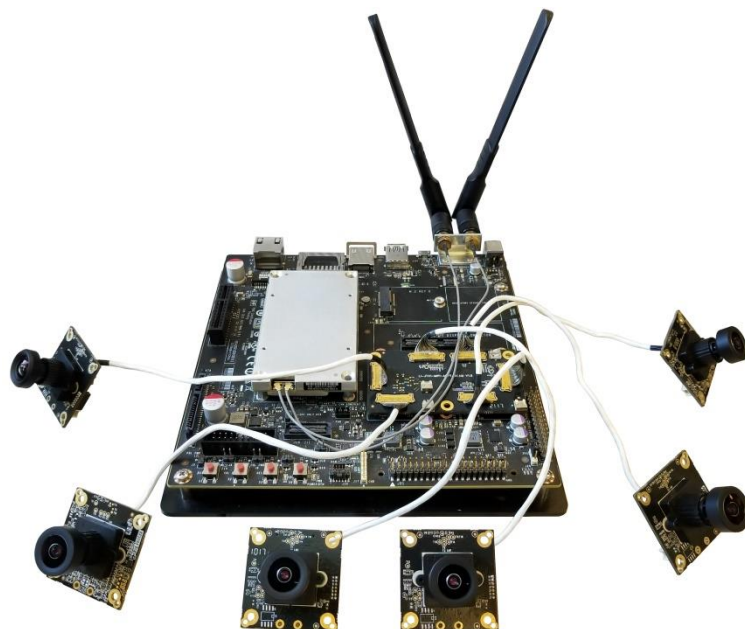
Rev 1.0

LI-JETSON-KIT-IMX327M12-X

Data Sheet

Key Features

- Compatible with Nvidia Jetson TX1/TX2 Developer Kit
- MIPI CSI-2 interface
- Support up to six cameras
- Two adapter board options
 - LI-JTX1-MIPI-ADPT
Includes three 4-lane interface
 - LI-JTX1-MIPI-ADPT-6CAM
Includes six 2-lane interface
- Sony Diagonal 6.46 mm (Type 1/2.8) 2MP CMOS Image Sensor IMX327
- Active pixels: 1937H x 1097V
- Pixel size: 2.9 um x 2.9 um
- Color camera
- Length of the I-PEX cable: 300mm
- Support multiple length cables
- Connector Part#: 20525-030E-02C
- Support M12 x P0.5 lens
- Provide customization services
- Part#:
 - (1 cam) **LI-JETSON-KIT-IMX327M12**
 - (2 cam) **LI-JETSON-KIT-IMX327M12-D**
 - (3 cam) **LI-JETSON-KIT-IMX327M12-T**
 - (6 cam) **LI-JETSON-KIT-IMX327M12-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): 86.5 °/ 78 °/49.5 °
- TV Distortion: -1.0 %

BOM

Nvidia TX1/TX2 Developer Kit not included

#	Items	QTY
1	LI-JTX1-MIPI-ADPT or LI-JTX1-MIPI-ADPT-6CAM	1
2	LI-IMX327-MIPI-M12	1,2,3 or 6
3	FAW-1233-03 cable	1,2,3 or 6



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LI-JETSON-KIT-IMX327M12

BOM

#	Items	QTY
1	LI-JTX1-MIPI-ADPT	1
2	LI-IMX327-MIPI-M12	1
3	FAW-1233-03 cable	1



LI-JETSON-KIT-IMX327M12-D

BOM

#	Items	QTY
1	LI-JTX1-MIPI-ADPT	1
2	LI-IMX327-MIPI-M12	2
3	FAW-1233-03 cable	2



LI-JETSON-KIT-IMX327M12-T

BOM

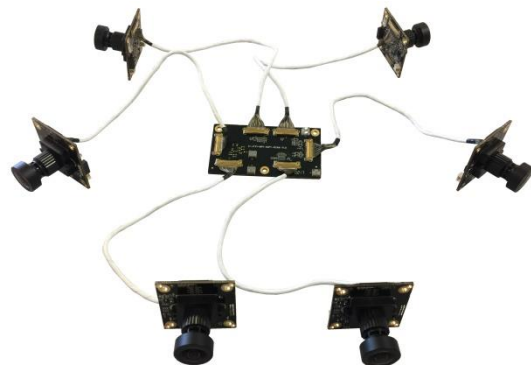
#	Items	QTY
1	LI-JTX1-MIPI-ADPT	1
2	LI-IMX327-MIPI-M12	3
3	FAW-1233-03 cable	3



LI-JETSON-KIT-IMX327M12-H

BOM

#	Items	QTY
1	LI-JTX1-MIPI-ADPT-6CAM	1
2	LI-IMX327-MIPI-M12	6
3	FAW-1233-03 cable	6

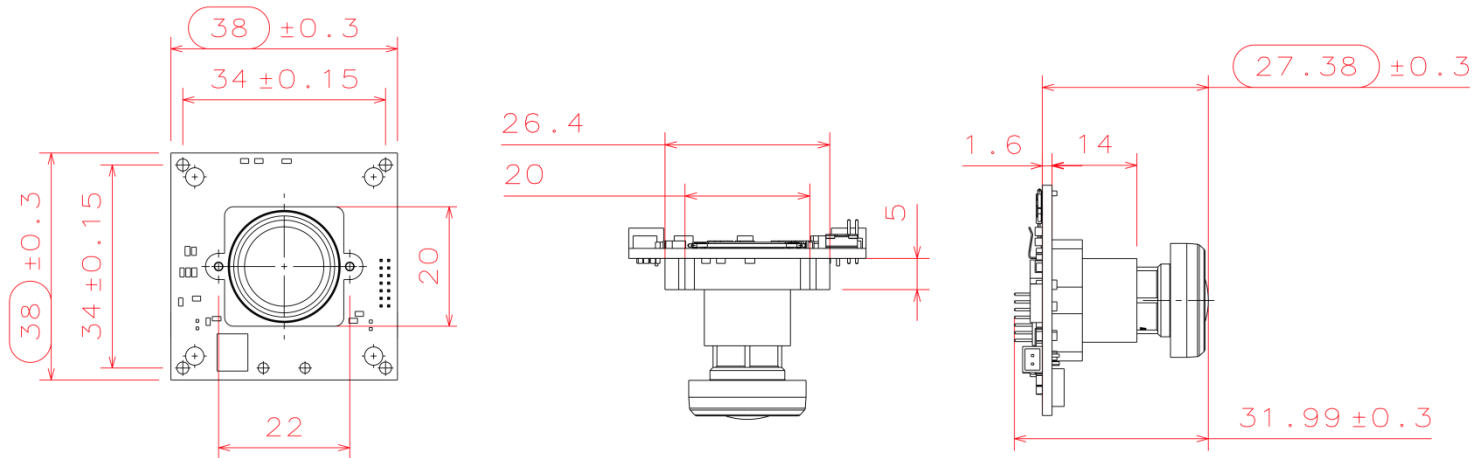


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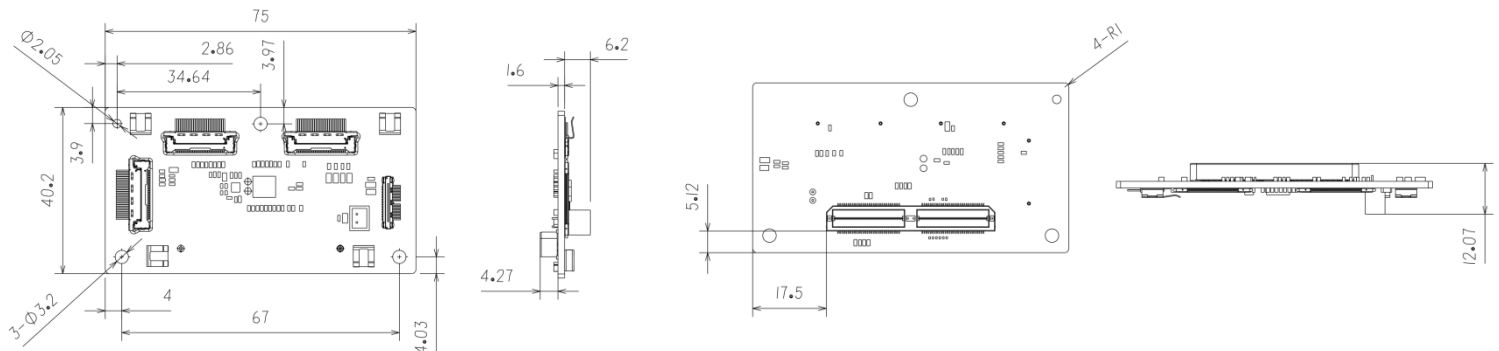
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Dimensions

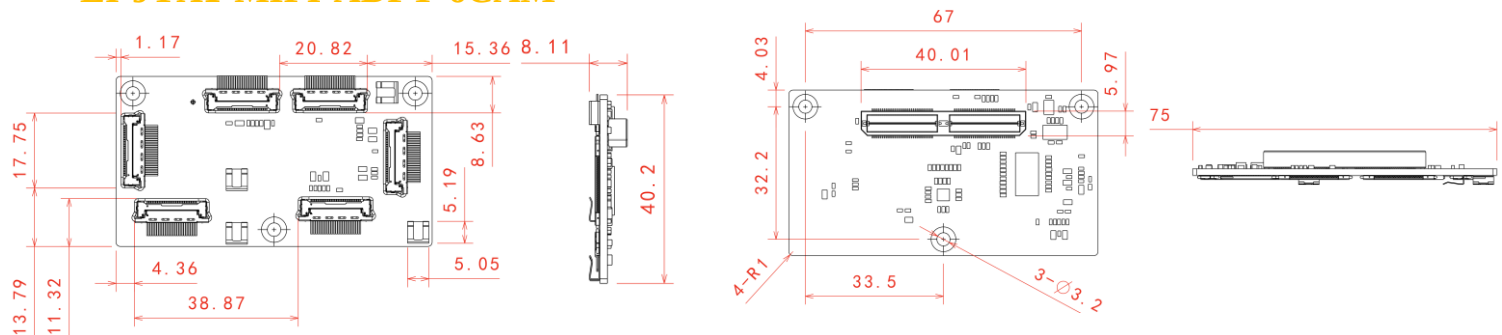
LI-IMX327-MIPI-M12



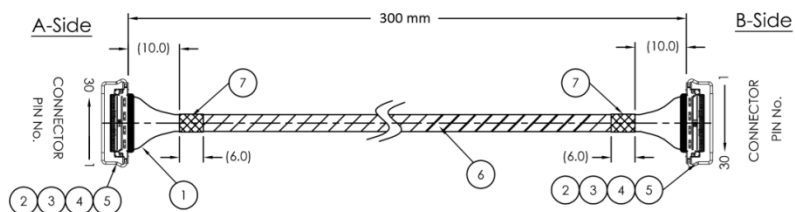
LI-JTX1-MIPI-ADPT



LI-JTX1-MIPI-ADPT-6CAM



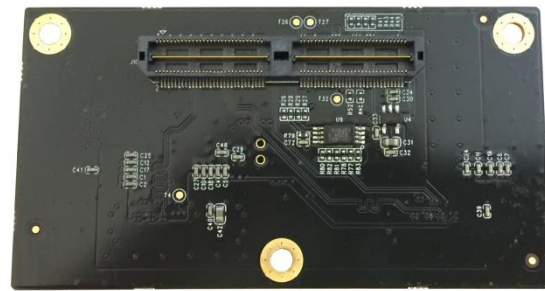
FAW-1233-03



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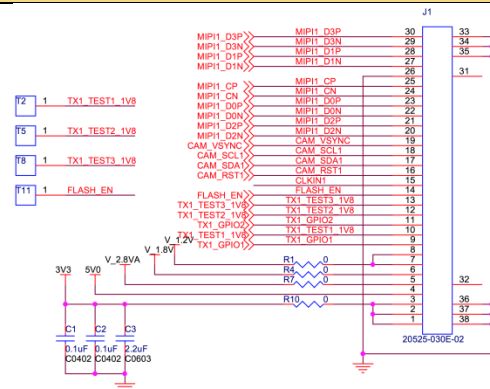
LI-JTX1-MIPI-ADPT



Interfaces

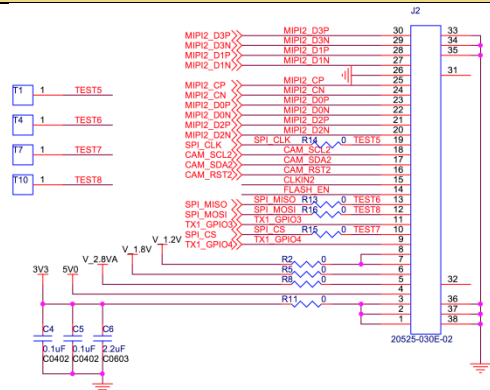
Interface J1

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



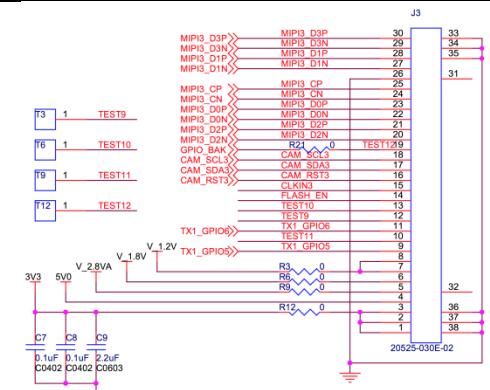
Interface J2

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



Interface J3

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



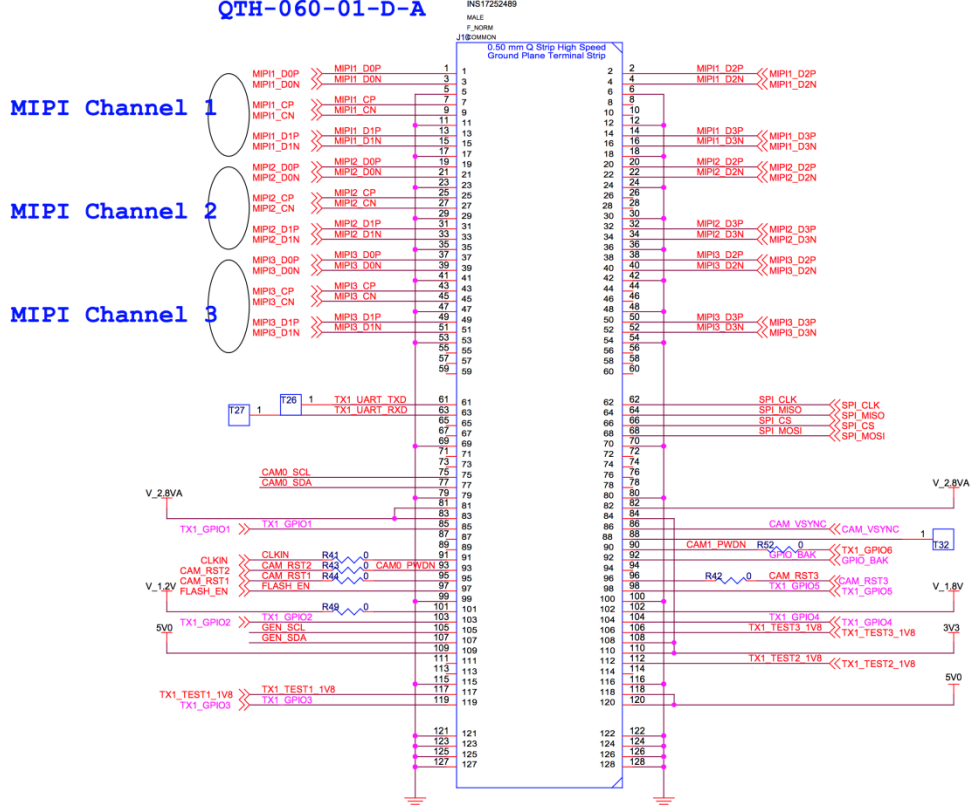
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Interface J10

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

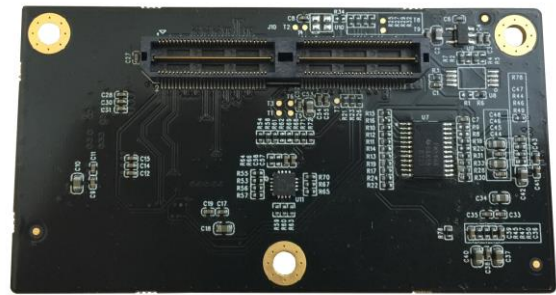
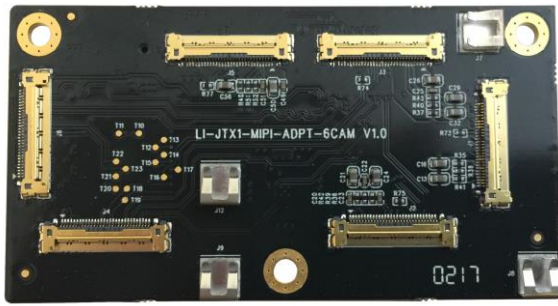
Vertical Mating connector of Jetson TX1 J22 QTH-060-01-D-A



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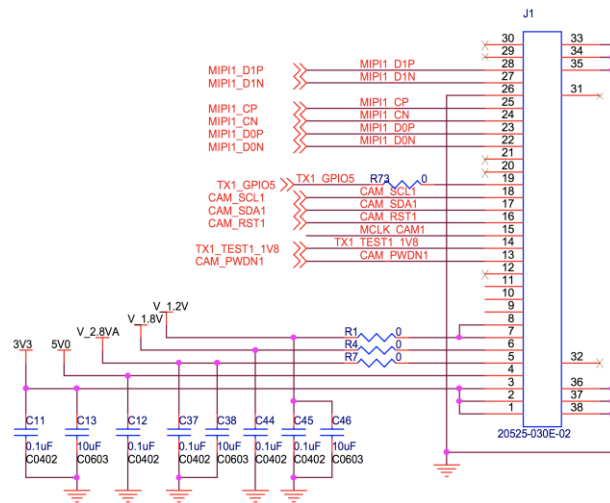
LI-JTX1-MIPI-ADPT-6CAM



Interfaces

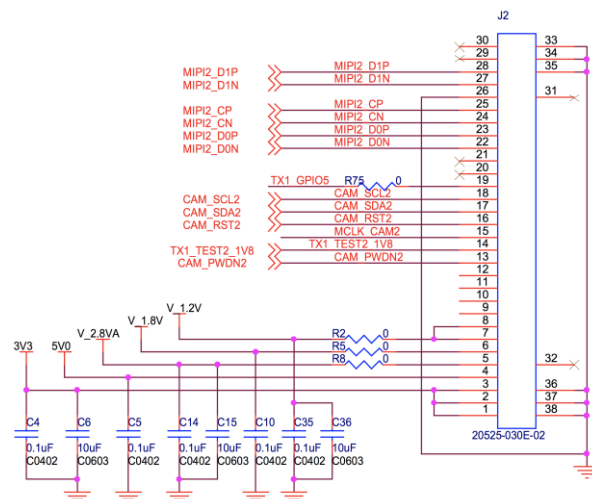
Interface J1

- 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)

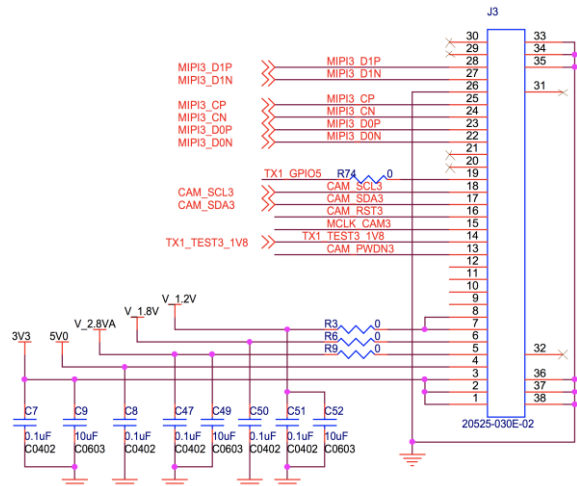


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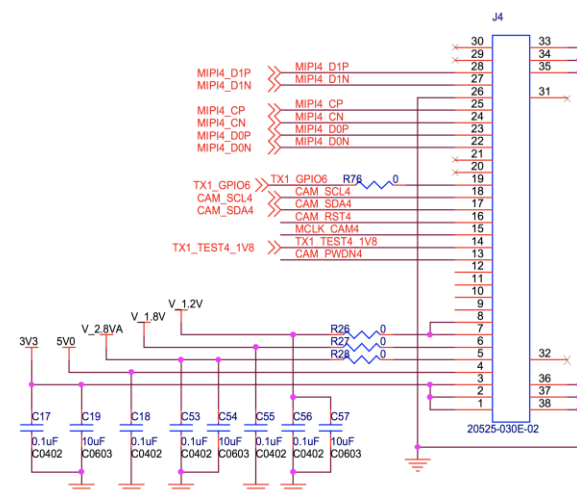
Interface J3

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



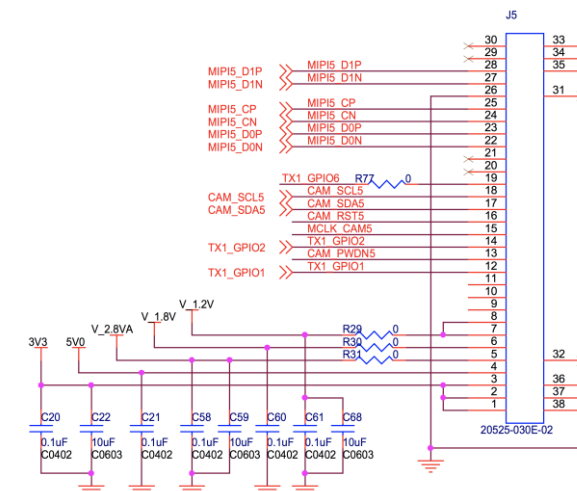
Interface J4

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



Interface J5

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

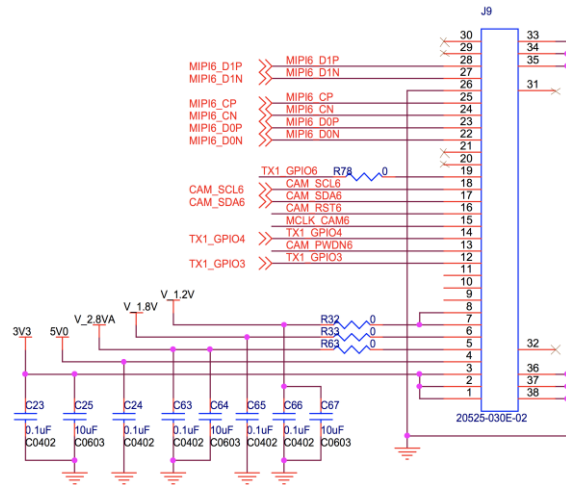


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Interface J9

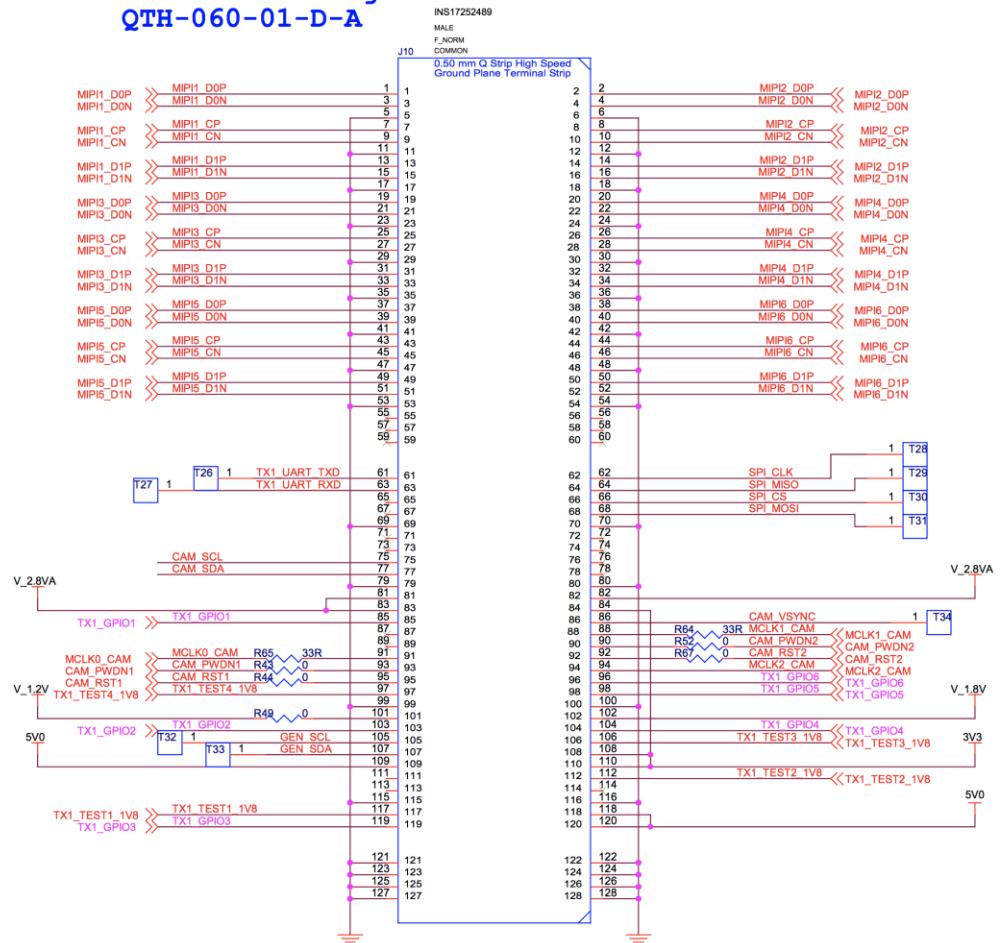
- Part#: 20525-030E-02C
 - Number of Positions: 30
 - Pitch: 0.4mm
- Mating I-PEX cable: FAW-1233-03 (300mm)



Interface J10

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

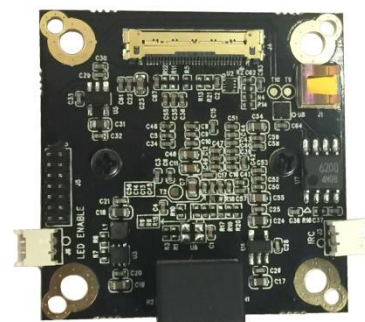
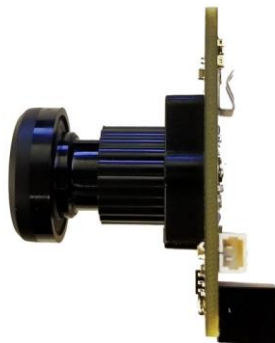
Vertical Mating connector of Jetson TX1 J22 QTH-060-01-D-A



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LI-IMX327-MIPI-M12



Camera Spec	
Image Sensor	Sony Diagonal 6.46 mm (Type 1/2.8) 2MP CMOS Image Sensor IMX327
Optical format	1/2.8"
Number of active pixels	1937 (H) x 1097 (V)
Pixel size	2.9um (H) x 2.9um (V)
Color or Mono	Color
Interface	MIPI interface
Lens mount	M12
Weight	14 g
Interfaces	
Interface J2:	- Part#: 20525-030E-02C - Number of Positions: 30 - Pitch: 0.4mm - Mating I-PEX cable: FAW-1233-03 (300mm)



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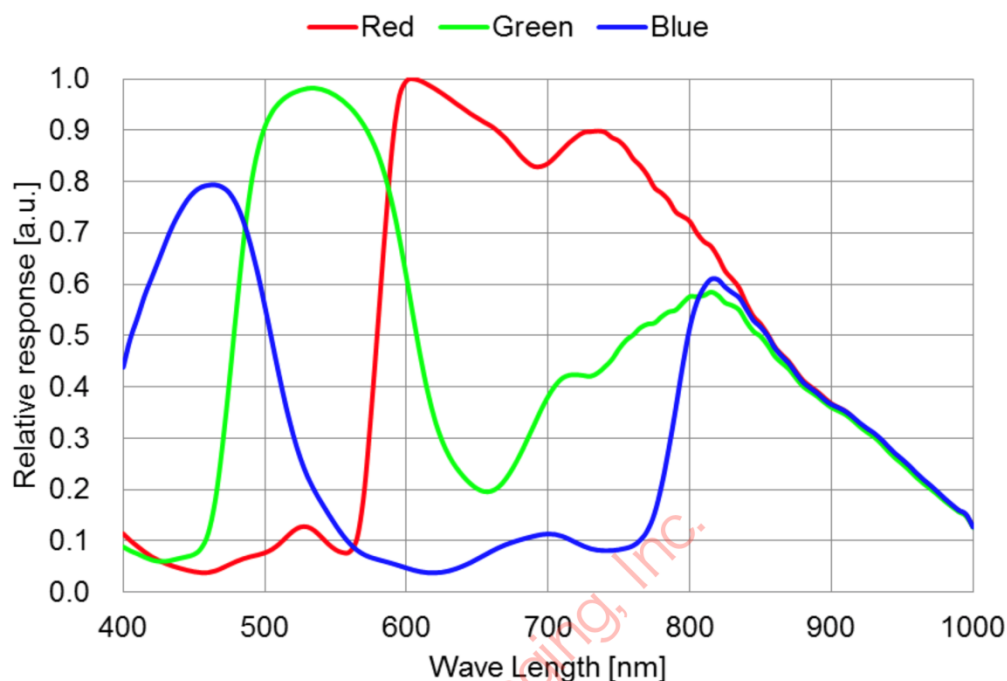
Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remarks
Supply voltage (analog 2.9 V)	AV _{DD}	-0.3	3.3	V	
Supply voltage (interface 1.8 V)	OV _{DD}	-0.3	3.3	V	
Supply voltage (digital 1.2 V)	DV _{DD}	-0.3	2.0	V	
Input voltage	VI	-0.3	OV _{DD} + 0.3	V	Not exceed 3.3 V
Output voltage	VO	-0.3	OV _{DD} + 0.3	V	Not exceed 3.3 V

Application Conditions

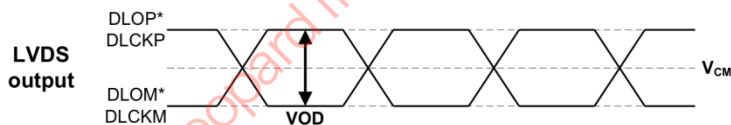
Item	Symbol	Min.	Typ.	Max.	Unit
Supply voltage (analog 2.9 V)	AV _{DD}	2.80	2.90	3.00	V
Supply voltage (Interface 1.8 V)	OV _{DD}	1.70	1.80	1.90	V
Supply voltage (digital 1.2 V)	DV _{DD}	1.10	1.20	1.30	V
Performance guarantee temperature	Tspec	-10	—	60	°C
Operating guarantee temperature	Topr	-30	—	85	°C
Storage guarantee temperature	Tstg	-40	—	85	°C

Spectral Sensitivity Characteristics



DC Characteristics

Item	Pins	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	analog	VDDHx	AV _{DD}	2.80	2.90	3.00	V
	Interface	VDDMx	OV _{DD}	1.70	1.80	1.90	V
	digital	VDDLx	DV _{DD}	1.10	1.20	1.30	V
Digital input voltage	XHS XVS XCLR INCK XMASTER OMODE SCK SDI XCE XTRIG	VIH	XVS / XHS Slave Mode	0.8OV _{DD}	—	—	V
		VIL		—	—	0.2OV _{DD}	V
Digital output voltage	DLOP [A:D] DLOM [A:D] DLCKP DLCKM	VCM	Low voltage LVDS	—	OV _{DD} /2	—	V
		VOD	Low voltage LVDS (Termination resistance: 100 Ω)	100	150	220	mV
	XHS XVS SDO TOUT	VOH	XVS / XHS Master Mode	OV _{DD} -0.4	—	—	V
		VOL		—	—	0.4	V



Power Consumption

Item	pin	Symbol	Typ.		Max.		Unit
			Standard luminous intensity	Saturated luminous intensity	Standard luminous intensity	Saturated luminous intensity	
Operating current Low voltage LVDS serial 4ch 12 bit, 60 frame/s Full HD 1080p mode	VDDHx	IAV _{DD}	54	53	99	97	mA
	VDDMx	IOV _{DD}	16	15	25	24	mA
	VDDLx	IDV _{DD}	77	95	110	142	mA
Operating current MIPI CSI-2 / 4 Lane 12 bit, 60 frame/s Full HD 1080p mode	VDDHx	IAV _{DD}	55	54	99	97	mA
	VDDMx	IOV _{DD}	1	1	1	1	mA
	VDDLx	IDV _{DD}	94	111	130	164	mA
Standby current	VDDHx	IAV _{DD_STB}	—		0.1		mA
	VDDMx	IOV _{DD_STB}	—		0.1		mA
	VDDLx	IDV _{DD_STB}	—		14.9		mA

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

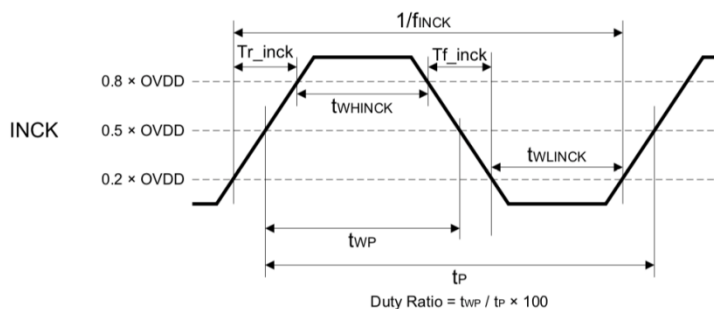


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AC Specification

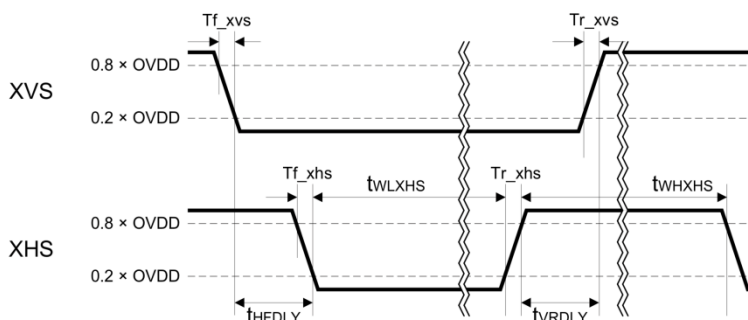
Master Clock Waveform (INCK)



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	$f_{INCK} = 37.125 \text{ MHz}, 74.25 \text{ MHz}$
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 %

*The INCK fluctuation affects the frame rate.

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



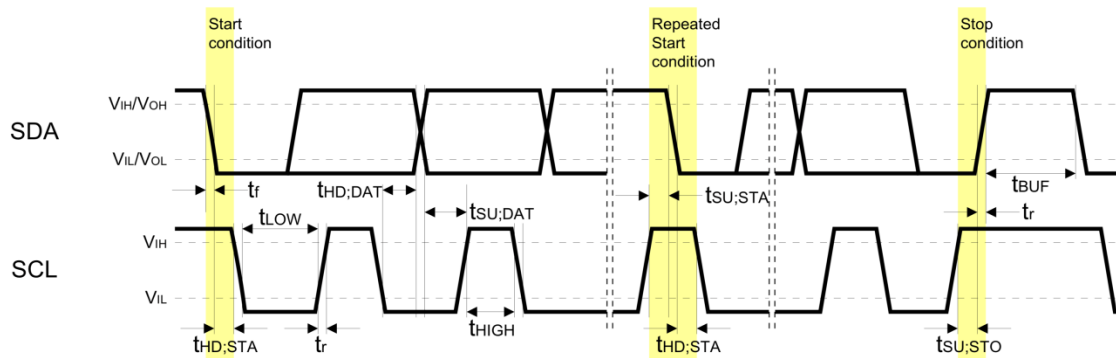
Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
XHS Low level pulse width	t_{WLXHS}	$4 / f_{INCK}$	—	—	ns	
XHS High level pulse width	t_{WHXHS}	$4 / f_{INCK}$	—	—	ns	
XVS - XHS fall width	t_{HFDLY}	$1 / f_{INCK}$	—	—	ns	
XHS - XVS rise width	t_{VRDLY}	$1 / f_{INCK}$	—	—	ns	
XVS Rise time	Tr_xvs	—	—	5	ns	20 % to 80 %
XVS Fall time	Tf_xvs	—	—	5	ns	80 % to 20 %
XHS Rise time	Tr_xhs	—	—	5	ns	20 % to 80 %
XHS Fall time	Tf_xhs	—	—	5	ns	80 % to 20 %



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I²C Communication



I²C Specification

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

I²C AC Characteristics

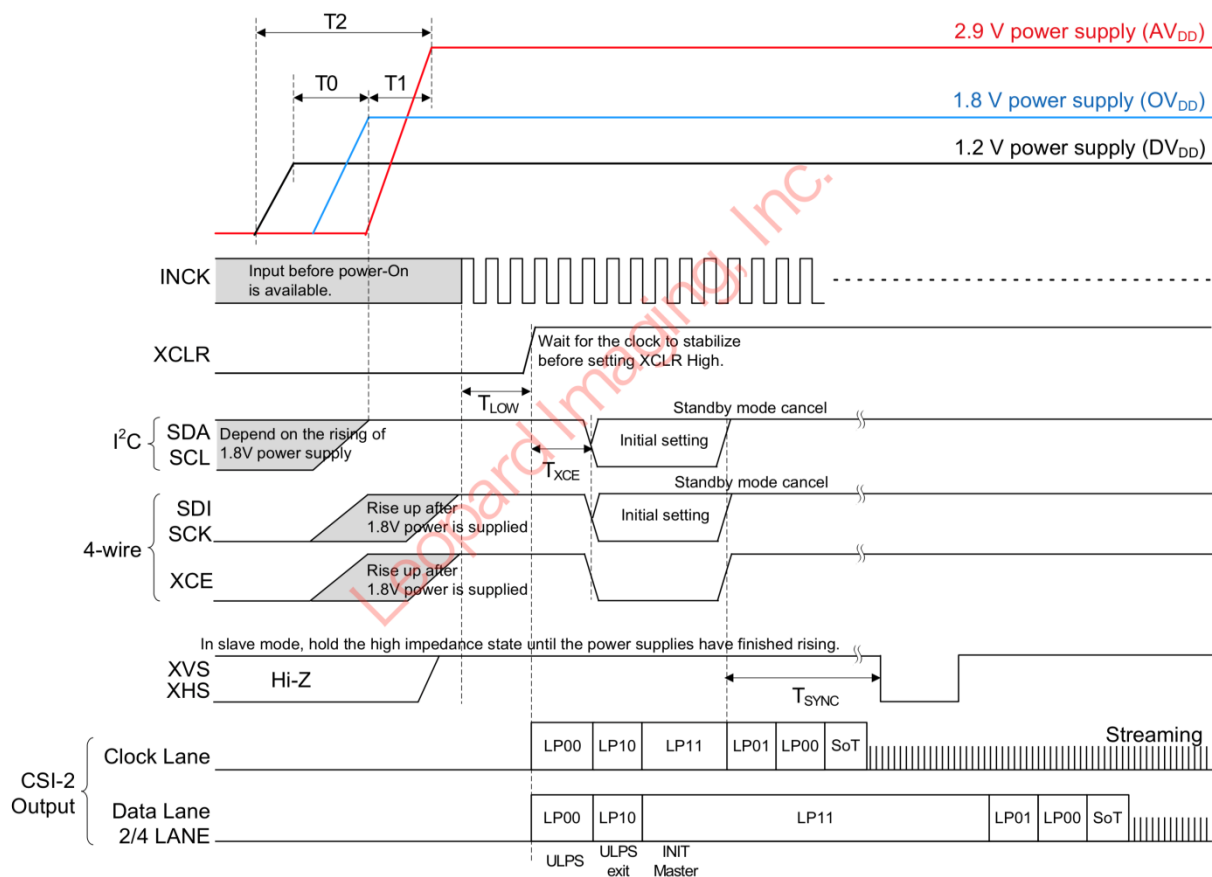
Item	Symbol	Min.	Typ.	Max.	Unit
SCL clock frequency	f_{SCL}	0	—	400	kHz
Hold time (Start Condition)	$t_{HD;STA}$	0.6	—	—	μs
Low period of the SCL clock	t_{LOW}	1.3	—	—	μs
High period of the SCL clock	t_{HIGH}	0.6	—	—	μs
Set-up time (Repeated Start Condition)	$t_{SU;STA}$	0.6	—	—	μs
Data hold time	$t_{HD;DAT}$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



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Power-on Sequence



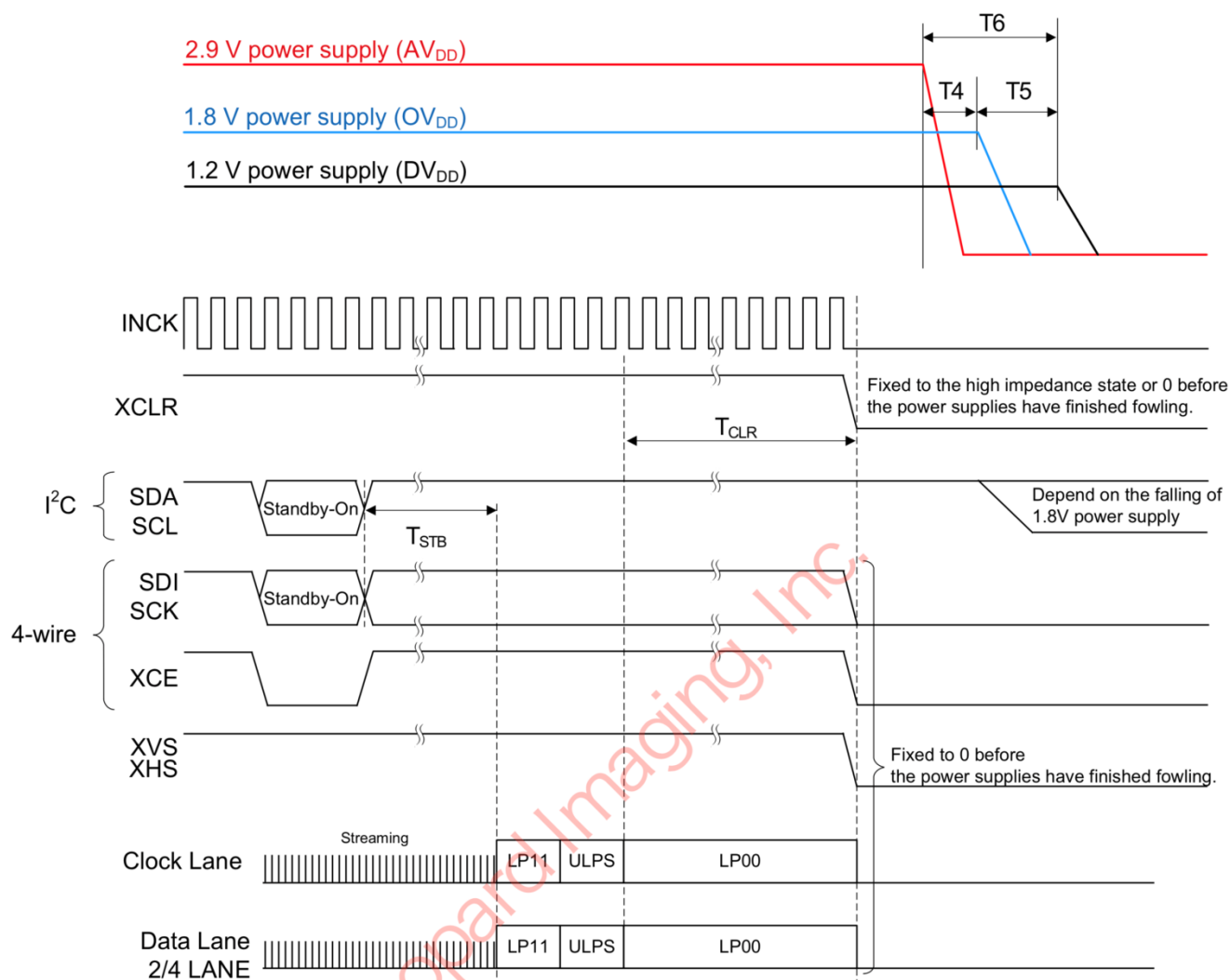
Item	Symbol	Min.	Max.	Unit
1.2 V power supply rising → 1.8 V power supply rising	T ₀	0	—	ns
1.8 V power supply rising → 2.9 V power supply rising	T ₁	0	—	ns
Rising time of all power supply	T ₂	—	200	ms
INCK active → Clear OFF	T _{LOW}	500	—	ns
Clear OFF → Communication start	T _{XCE}	20	—	μs
Standby OFF (communication) → 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	T_{CLR}	128	—	cycle
2.9 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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