



LEOPARD IMAGING INC

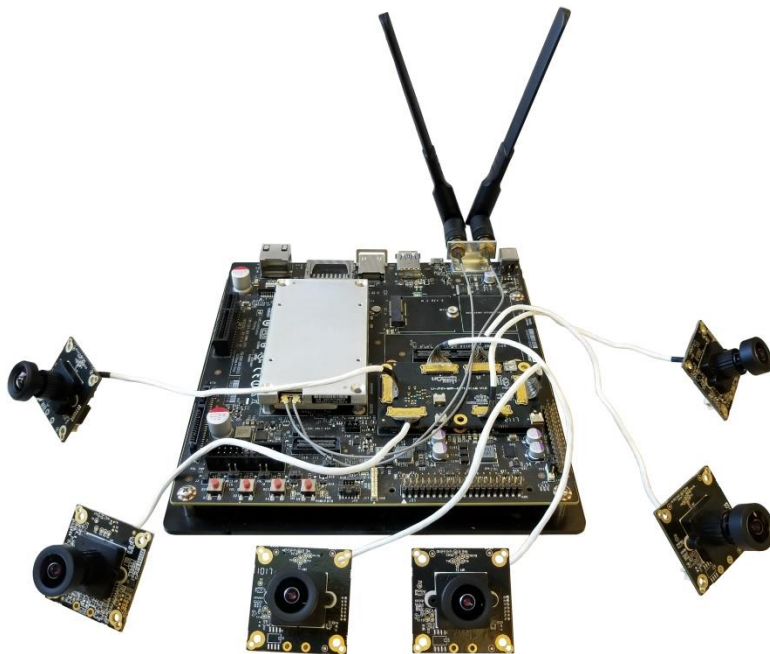
Rev 1.0

LI-JETSON-KIT-IMX335M12-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 6.52 mm (Type 1/2.8)
5MP CMOS Image Sensor IMX335
- Active pixels: 2608H x 1960V
- Pixel size: 2.0 um x 2.0 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-IMX335M12
 - (2 cam) LI-JETSON-KIT-IMX335M12-D
 - (3 cam) LI-JETSON-KIT-IMX335M12-T
 - (6 cam) LI-JETSON-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 %

BOM

Nvidia TX1/TX2 Developer Kit not included

#	Items	QTY
1	LI-JTX1-MIPI-ADPT or LI-JTX1-MIPI-ADPT-6CAM	1
2	LI-IMX335-MIPI-M12	1,2,3 or 6
3	FAW-1233-03 cable	1,2,3 or 6



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LI-JETSON-KIT-IMX335M12

BOM

#	Items	QTY
1	LI-JTX1-MIPI-ADPT	1
2	LI-IMX335-MIPI-M12	1
3	FAW-1233-03 cable	1



LI-JETSON-KIT-IMX335M12-D

BOM

#	Items	QTY
1	LI-JTX1-MIPI-ADPT	1
2	LI-IMX335-MIPI-M12	2
3	FAW-1233-03 cable	2



LI-JETSON-KIT-IMX335M12-T

BOM

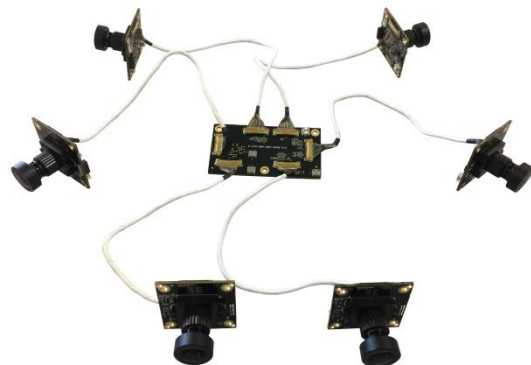
#	Items	QTY
1	LI-JTX1-MIPI-ADPT	1
2	LI-IMX335-MIPI-M12	3
3	FAW-1233-03 cable	3



LI-JETSON-KIT-IMX335M12-H

BOM

#	Items	QTY
1	LI-JTX1-MIPI-ADPT-6CAM	1
2	LI-IMX335-MIPI-M12	6
3	FAW-1233-03 cable	6

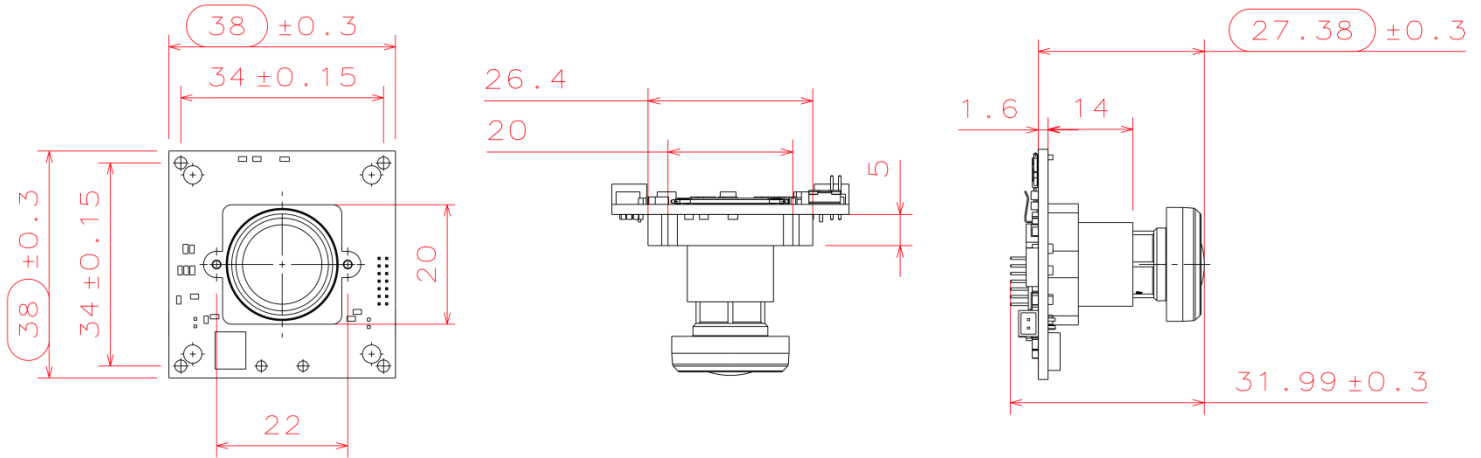


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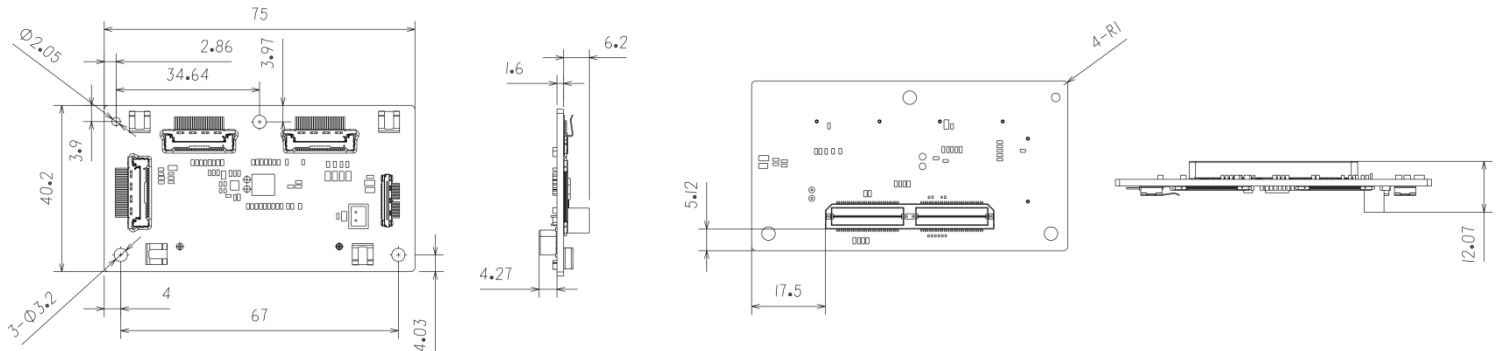
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Dimensions

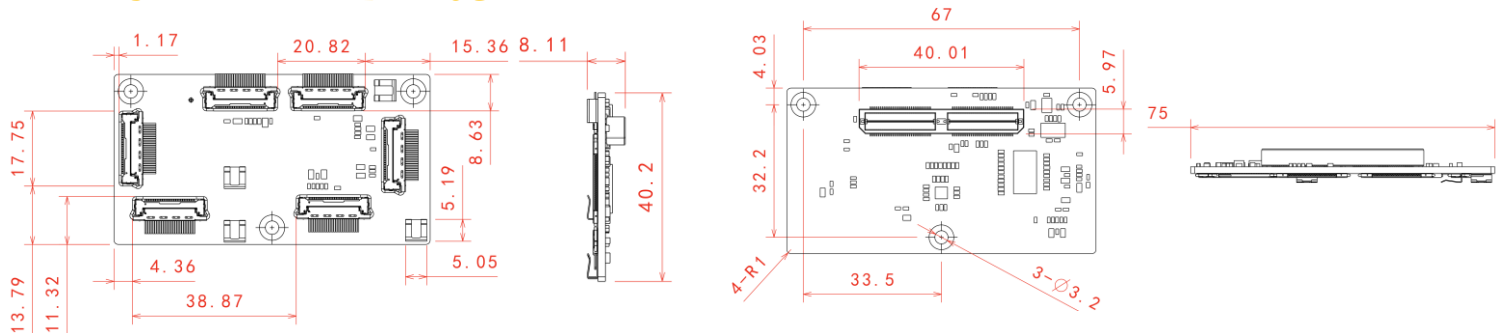
LI-IMX335-MIPI-M12



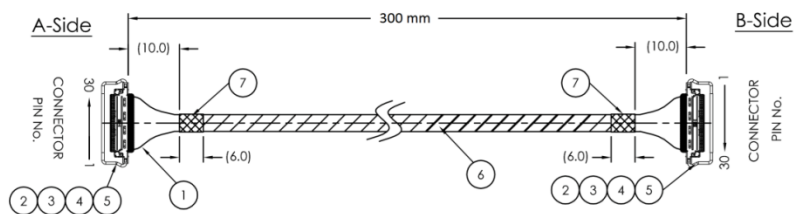
LI-JTX1-MIPI-ADPT



LI-JTX1-MIPI-ADPT-6CAM



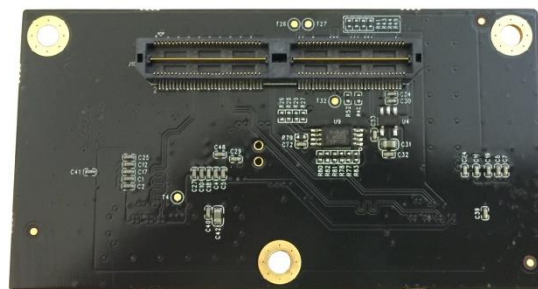
FAW-1233-03



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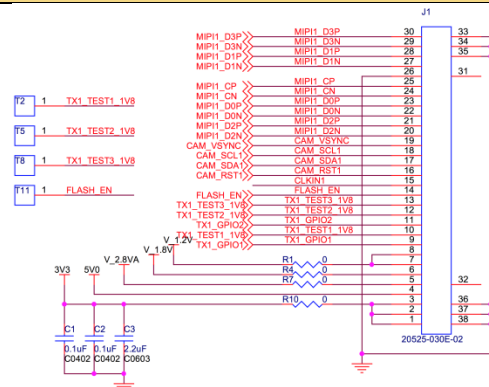
LI-JTX1-MIPI-ADPT



Interfaces

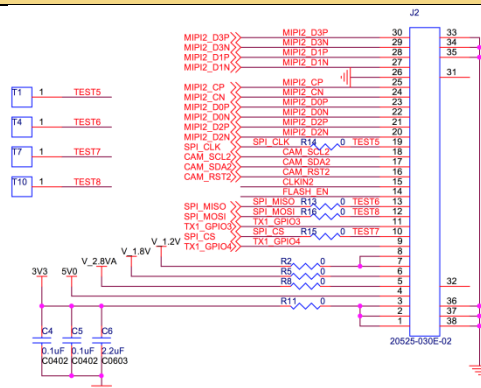
Interface J1

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



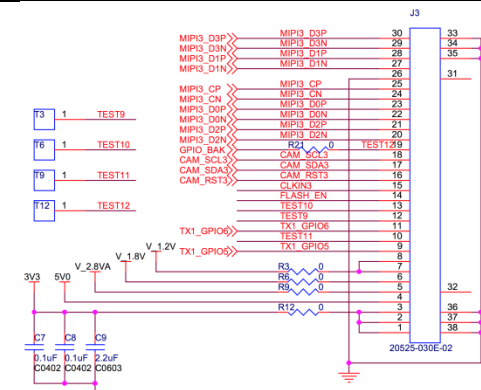
Interface J2

- 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)



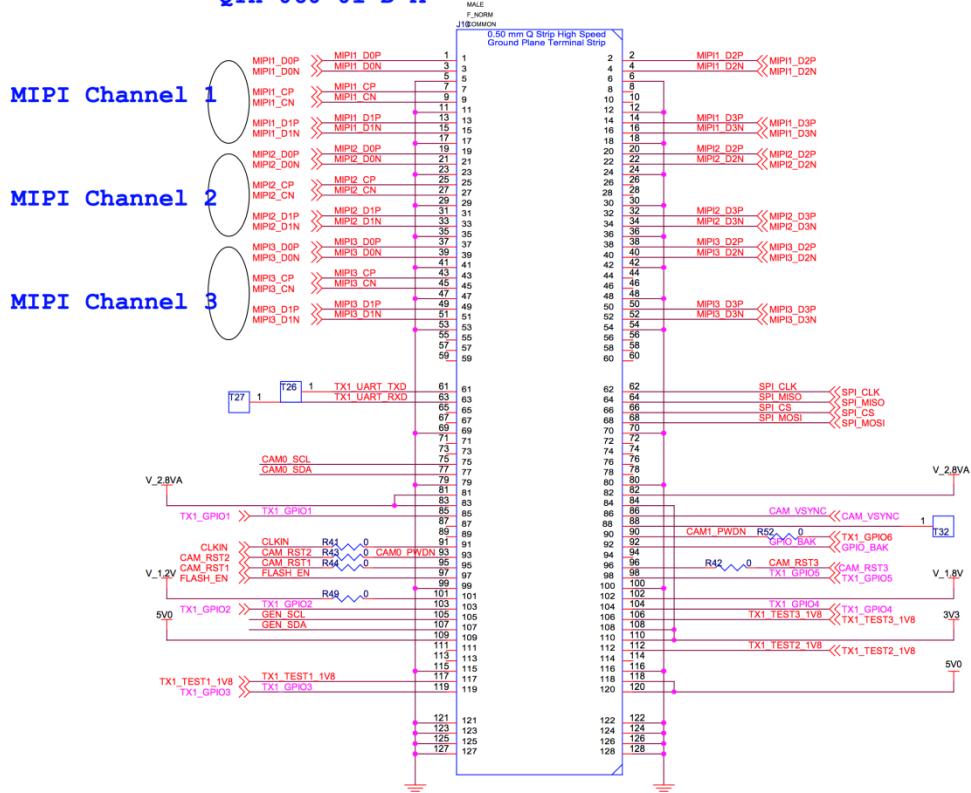
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Interface J10

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

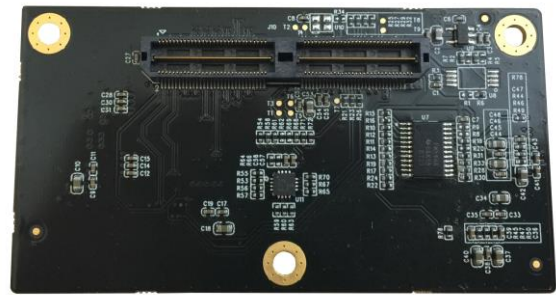
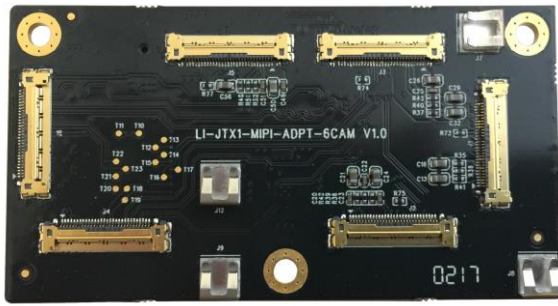
Vertical Mating connector of Jetson TX1 J22 QTH-060-01-D-A



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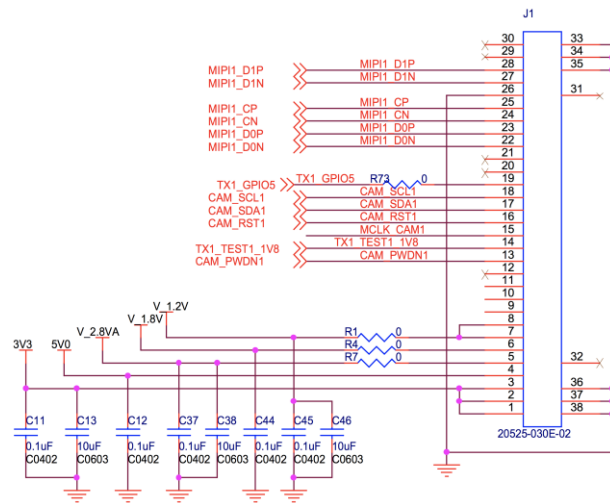
LI-JTX1-MIPI-ADPT-6CAM



Interfaces

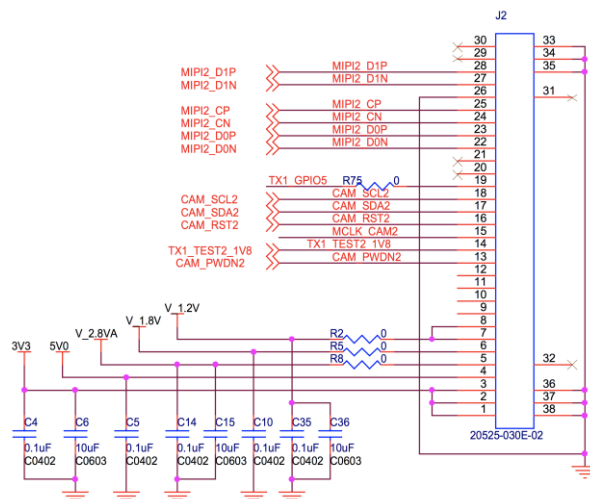
Interface J1

- 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)

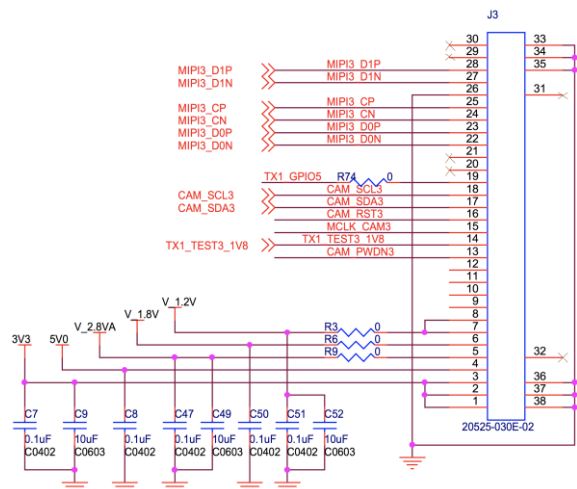


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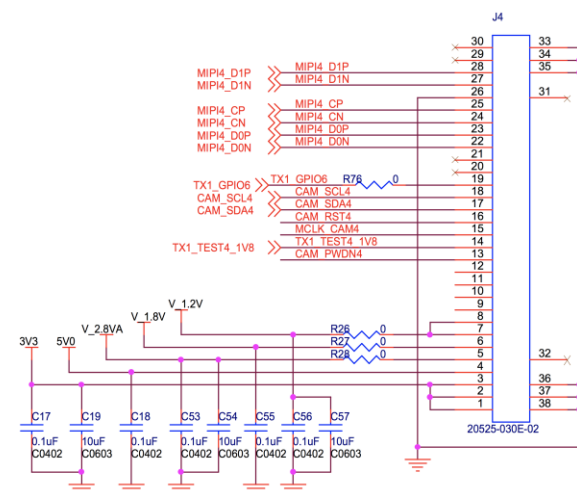
Interface J3

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



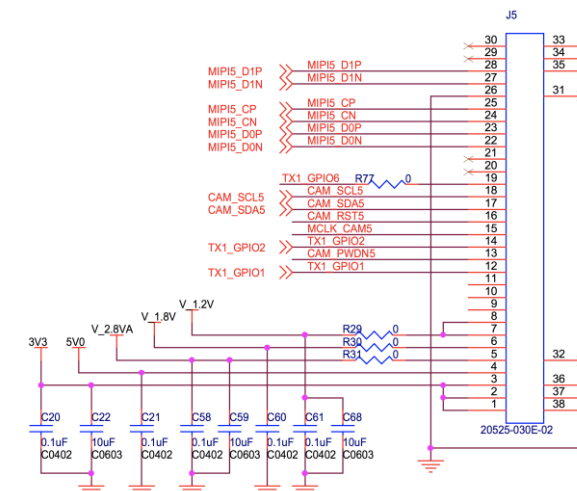
Interface J4

- 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)

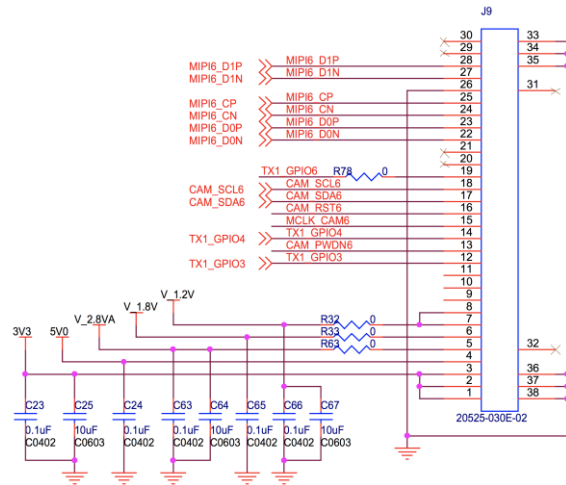


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Interface J9

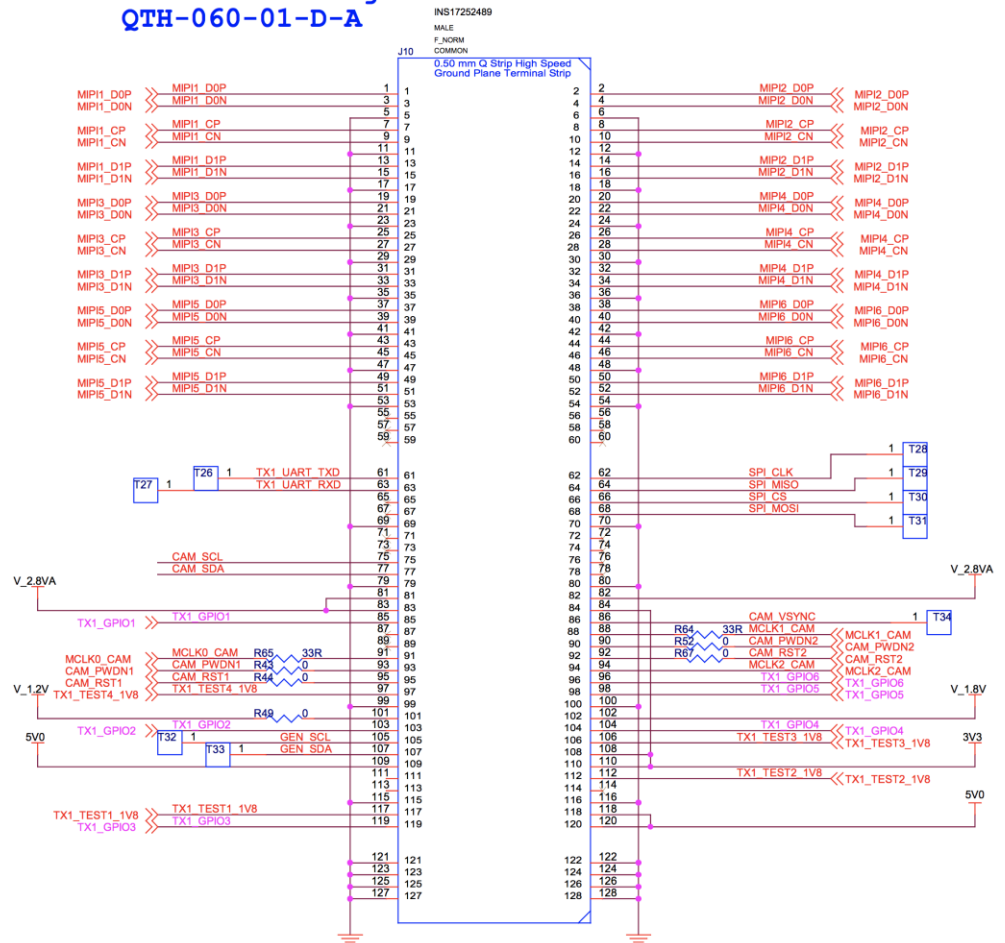
- Part#: 20525-030E-02C
 - Number of Positions: 30
 - Pitch: 0.4mm
- Mating I-PEX cable: FAW-1233-03 (300mm)



Interface J10

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

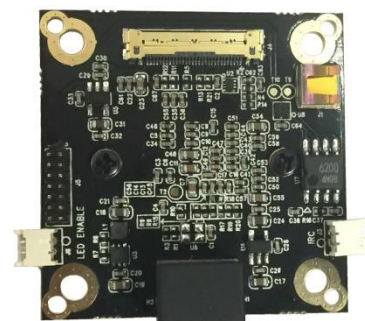
Vertical Mating connector of Jetson TX1 J22 QTH-060-01-D-A



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LI-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	
Interface J4: - Part#: 20525-030E-02C - Number of Positions: 30 - Pitch: 0.4mm - Mating I-PEX cable: FAW-1233-03 (300mm)	
Interface J3: - Part#: 1734829-2 - Number of Positions: 2 - Pitch: 1.25mm	
Interface J6: - Part#: 1734829-2 - Number of Positions: 2 - Pitch: 1.25mm	



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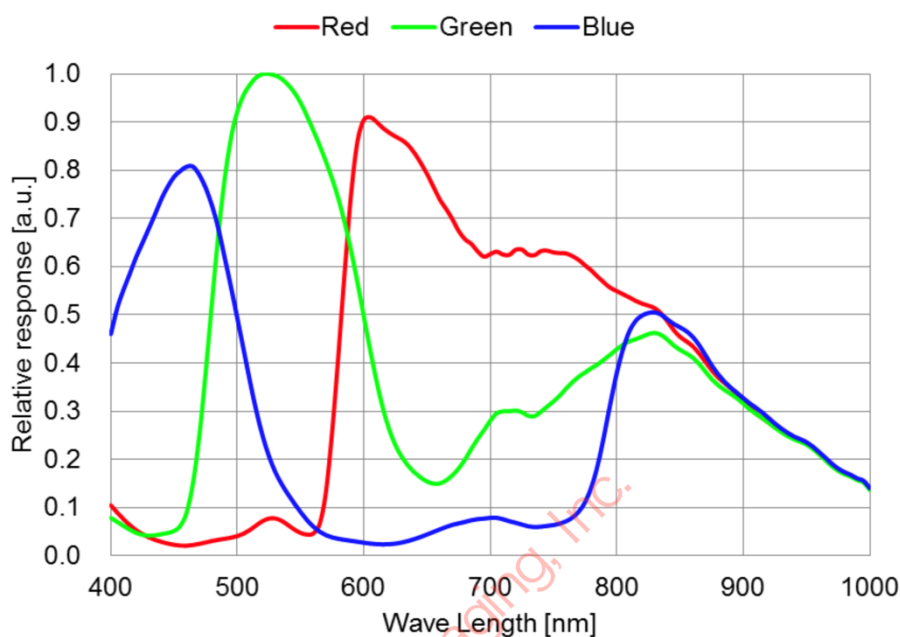
Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remarks
Supply voltage (analog 1 : 2.9 V)	AV _{DD1}	-0.3	3.3	V	
Supply voltage (analog 2 : 2.9 V)	AV _{DD2}	-0.3	3.3	V	
Supply voltage (interface 1.8 V)	OV _{DD}	-0.3	3.3	V	
Supply voltage (digital1 : 1.2 V)	DV _{DD1}	-0.3	2.0	V	
Supply voltage (digital 2 : 1.2 V)	DV _{DD2}	-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 1 : 2.9 V)	AV _{DD1}	2.80	2.90	3.00	V
Supply voltage (analog 2 : 2.9 V)	AV _{DD2}	2.80	2.90	3.00	V
Supply voltage (interface 1.8 V)	OV _{DD}	1.70	1.80	1.90	V
Supply voltage (digital1 : 1.2 V)	DV _{DD1}	1.10	1.20	1.30	V
Supply voltage (digital 2 : 1.2 V)	DV _{DD2}	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 VDDHCP VDDHDA VDDHCM	AV _{DD1}	2.80	2.90	3.00	V
	Analog2	VDDHPX	AV _{DD2}	2.80	2.90	3.00	V
	Interface	VDDMIO	OV _{DD}	1.70	1.80	1.90	V
	Digital1	VDDL _{CN} VDDL _{SC} VDDL _{PL1}	DV _{DD1}	1.10	1.20	1.30	V
	Digital2	VDDL _{PL2} VDDL _{PL3} VDDL _{IF}	DV _{DD2}	1.10	1.20	1.30	V
Digital input voltage	XHS XVS XCLR INCK XMASTER SLAMODE SCL SDA TEST2	VIH	XVS / XHS Slave Mode	0.8OV _{DD}	—	—	V
		VIL		—	—	0.2OV _{DD}	V
	XHS XVS TOUT TEST1	VOH	XVS / XHS Master Mode	OV _{DD} -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 MIPI CSI-2 / 4 Lane 12 bit, 30 frame/s All-pixel scan mode	I _{AVDD1}	28	27	42	41	mA
	I _{AVDD2}	22	22	33	32	mA
	I _{OVDD}	1	1	1	1	mA
	I _{DVDD1}	87	102	168	193	mA
	I _{DVDD2}	32	32	62	62	mA
Standby current	I _{AVDD1_STB}	—		0.1		mA
	I _{AVDD2_STB}	—		0.1		mA
	I _{OVDD_STB}	—		0.1		mA
	I _{DVDD1_STB}	—		16.8		mA
	I _{DVDD2_STB}	—		2.2		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.

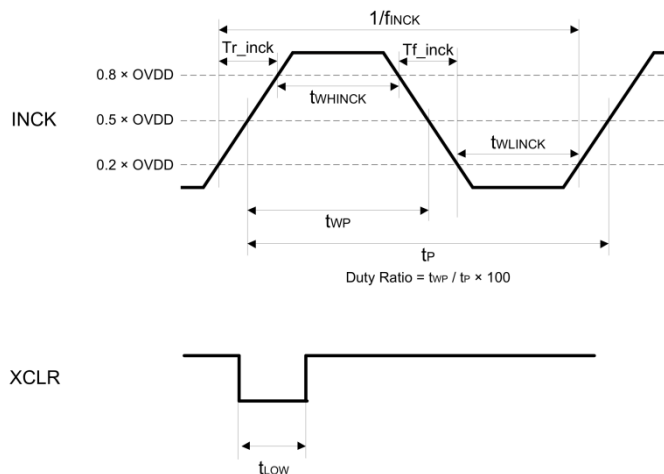
Standard luminous intensity: luminous intensity at 1/3 of the sensor saturated
Saturated luminous intensity: luminous intensity when the sensor is saturated.



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AC Characteristics



INCK 37.125MHz, 74.25MHz

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
INCK clock frequency	f_{INCK}	$f_{\text{INCK}} \times 0.96$	f_{INCK}	$f_{\text{INCK}} \times 1.02$	MHz	$f_{\text{INCK}} = 37.125 \text{ MHz}, 74.25 \text{ MHz}$
INCK Low level pulse width	t_{WLINCK}	4	—	—	ns	$f_{\text{INCK}} = 37.125 \text{ MHz}, 74.25 \text{ MHz}$
INCK High level pulse width	t_{WHINCK}	4	—	—	ns	$f_{\text{INCK}} = 37.125 \text{ MHz}, 74.25 \text{ MHz}$
INCK clock duty	—	45.0	50.0	55.0	%	Define with $0.5 \times \text{OV}_{\text{DD}}$
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	$f_{\text{INCK}} = 6 \text{ to } 27\text{MHz}$
INCK Low level pulse width	t_{WLINCK}	5	—	—	ns	$f_{\text{INCK}} = 6 \text{ to } 27\text{MHz}$
INCK High level pulse width	t_{WHINCK}	5	—	—	ns	$f_{\text{INCK}} = 6 \text{ to } 27\text{MHz}$
INCK clock duty	—	45.0	50.0	55.0	%	Define with $0.5 \times \text{OV}_{\text{DD}}$
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.

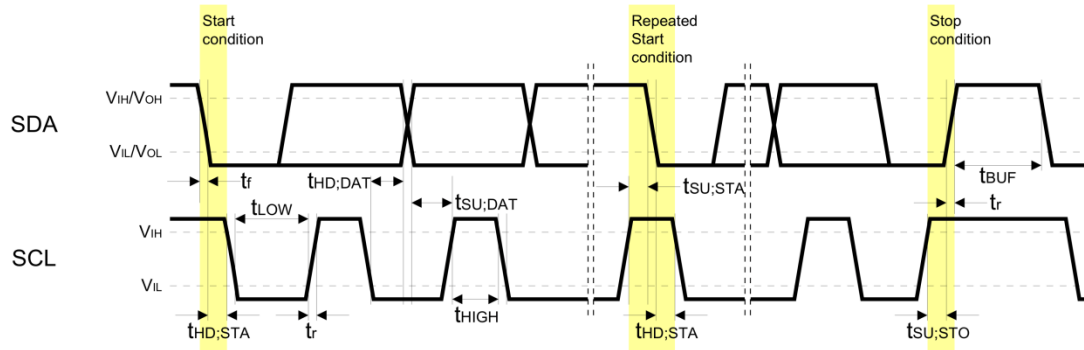


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Serial Communication

I²C



I²C 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, $0.7 \times OV_{DD} - 0.3 \times OV_{DD}$
Input current	li	-10	—	10	μA	$0.1 \times OV_{DD} - 0.9 \times OV_{DD}$
Input Capacitance for SCL / SDA	Ci	—	—	10	pF	

I²C AC Characteristics

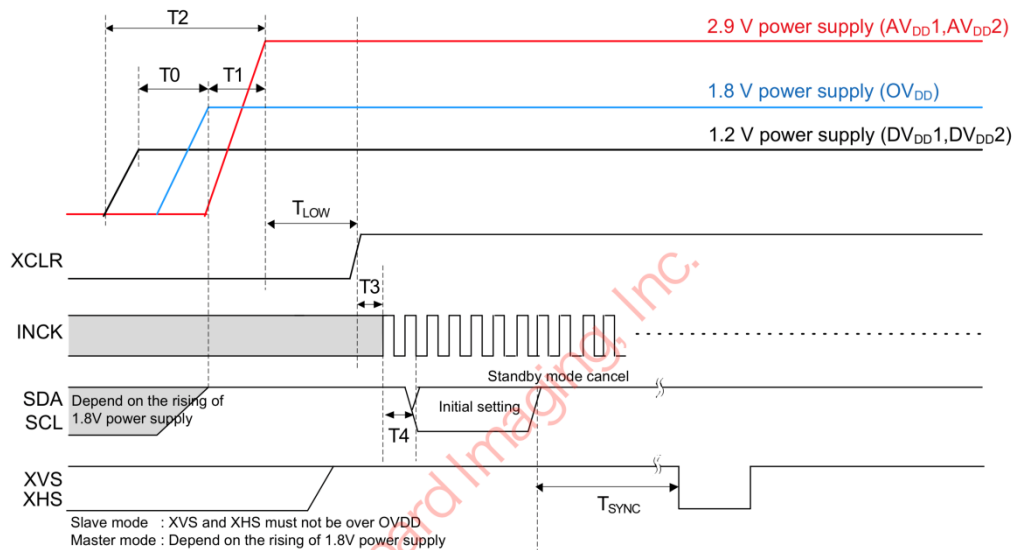
Item	Symbol	Min.	Typ.	Max.	Unit
SCL clock frequency	f_{SCL}	0	—	400	kHz
Hold time (Start Condition)	$t_{HD;STA}$	0.6	—	—	μs
Low period of the SCL clock	t_{LOW}	1.3	—	—	μs
High period of the SCL clock	t_{HIGH}	0.6	—	—	μs
Set-up time (Repeated Start Condition)	$t_{SU;STA}$	0.6	—	—	μs
Data hold time	$t_{HD;DAT}$	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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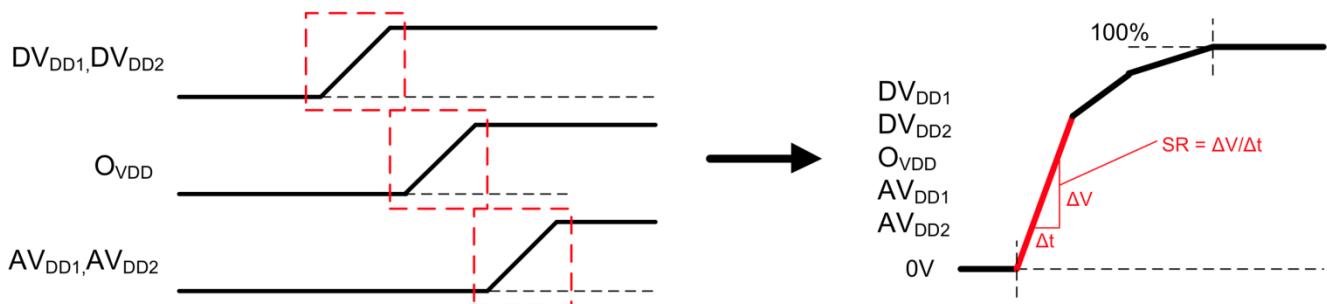
Power-on Sequence



Item	Symbol	Min.	Max.	Unit
1.2 V power supply rising → 1.8 V power supply rising	T0	0	—	ns
1.8 V power supply rising → 2.9 V power supply rising	T1	0	—	ns
Rising time of all power supply	T2	—	200	ms
2.9 V power supply rising → Clear OFF	T _{LOW}	500	—	ns
Clear OFF → INCK rising	T3	0	—	μs
Clear OFF → Communication start	T4	20	—	μs
Standby OFF (communication) → External input XHS,XVS (slave mode only)	T _{SYNC}	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.



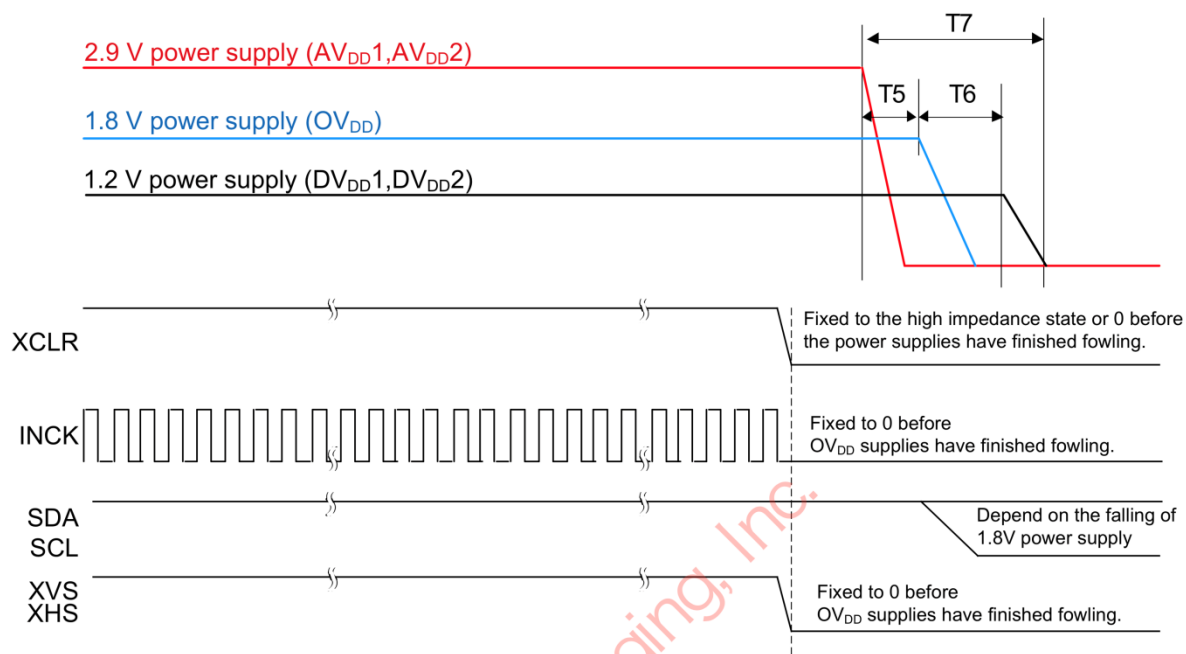
Item	Symbol	Power supply	Min.	Max.	Unit	Remarks
Slew rate	SR	DV _{DD1} , DV _{DD2} (1.2 V)	—	25	mV/μs	
		OV _{DD} (1.8 V)	—	25	mV/μs	
		AV _{DD1} , AV _{DD2} (2.9 V)	—	25	mV/μs	



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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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