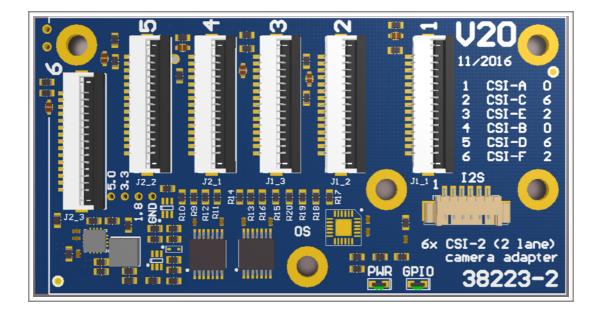


### J20 technical reference manual 38223 Version 1.0



# Preliminary

November 2016

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### Features

J20 six camera adapter module for the NVIDIA® Jetson™ TX1 dev kit

The J20 adapter module is specifically designed for the TX1 dev kit. It plugs into the 120 pin CSI-2 camera socket. Six 2 lane CSI-2 interfaces are provided. The 15 pin CSI-2 connector is compatible to the Raspberry Pi camera connector. Up to six identical camera modules may be plugged in. To access all 6 cameras individually 3 I2C busses are used. Each bus connects to 2 connectors. To separate the 2 cameras on a single I2C bus, the 2nd connector (J2\_x) is connected through an I2C address translation device. This changes the I2C address of the camera so that 2 cameras can coexist on the same I2C bus.

#### Software drivers

The J20 is intended for software developers who wish to develop a software driver for setups with multiple cameras.

- Ridgerun (<u>ridgerun.com</u>) is developing drivers for multiple Raspberry Pi camera setups. Please contact Ridgerun for details.
- Raytrix (raytrix.de) is developing a driver for their C41 4k CSI-2 camera module. Please contact Raytrix for details.

#### Status

- Rev 1: 38223 very limited supply patch for power up reset of GPIO port expander
- Rev 2: 38223-2 first samples end of November 2016

# **I2C** configuration

#	port	I2C device	CSI-2 bus	address translation	Pi camera 1.3	Pi camera 2.1	B101
1	J1_1	0	CSI-A	-	0x36	0x64	0x0F
2	J1_2	6	CSI-C	-	0x36	0x64	0x0F
3	J1_3	2	CSI-E	-	0x36	0x64	0x0F
4	J2_1	0	CSI-B	$\checkmark$	0x34	0x12	0x0D
5	J2_2	6	CSI-D	$\checkmark$	0x34	0x12	0x0D
6	J2_3	2	CSI-F	$\checkmark$	0x34	0x12	0x0D

#### Example: Pi Camera 1.3 plugged into port J1\_1 (I2C device 0)

\$ i	2cd	ete	ct	-у	-r	0											
	0	1	2	3	4	5	6	7	8	9	а	b	С	d	е	f	
00:																	
10:																	
20:																	
30:							36										
40:													UU				
50 <b>:</b>																	
60:																	
70:								—									

The "36" is the hex address 0x36 and indicates that no driver is loaded yet. If a driver would have been loaded it would show as "UU" in location "36".

#### Connecting the cable for the cameras or B101 modules

The cameras are connected with the standard 15 pin FFC cable with 1.0mm pitch. To plug in the cable just lift the brown hatch of the connector, insert the cable the press the hatch down.

### Note: please make sure that the contacts of the FFC cable face down. They have to be on the opposite side of the brown hatch.

The cable is now safely locked in place. Some cables may have lengthy stiffeners on the opposite side of the contacts. So it may be difficult to slide the cable in, as the connectors are placed close to each other. In this case please use scissors to shorten the FFC cable. So contact length of 2mm is fine for the connectors on the J20 module.

Auvidea supplies FFC cables with contact on the same side in various lengths.

Note: The Pi cameras and the B101 require FFC cables with contacts on the same side.

### Initialization

The J20 rev1 requires a supply of 1.8V from the dev kit board. This has to be enabled first by writing to the GPIO port expander on the dev kit board. Rev 2 of the J20 features an on-board 1.8V LDO, so the enabling of the 1.8V supply is not required. Please run the following commands every time after powering up the system, so that the J20 is initialized.

i2cset -f -y 1 0x77 3 0xfb	- enable 1.8V power to the J20 (rev 1 only)
i2cset -f -y 6 0x20 6 0x3e	<ul> <li>configure the outputs of the I2C port expander (low byte) - clock lines remain input, so there</li> </ul>
	is no data collision
i2cset -f -y 6 0x20 7 0x33	<ul> <li>configure the outputs of the I2C port expander (high byte)</li> </ul>
i2cset -f -y 6 0x20 2 0xfe	- write ones to all GPIO outputs and turn on LED (low byte)
i2cset -f -y 6 0x20 3 0xff	- write ones to all GPIO outputs (high byte)

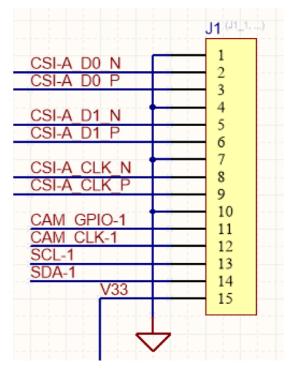
If the initialization commands above have been executed successfully the GPIO LED should be lighted up. The power (PWR) LED should be always on. A Pi camera connected should respond to I2C accesses. We have tested the port detection with i2cdetect. After init the GPIO port expander should show up on address 0x20 (device 6).

In the default configuration the J20 is configured that the GPIO port expander only supplies the CAM\_GPIO signal to the CSI-2 connectors.

With the Raspberry Pi cameras the CAM\_GPIO is the reset to the camera. It must be inactive to allow the camera to work.

The CAM\_CLK by default is connected to the CAM\_CLK signals of the 120 pin dev kit connector. So R11, R12, R15, R16, R17, and R18 are installed. OR resistors (0603 size) or solder jumpers.

Please make sure that the on-board GPIO expander is configured correctly with the i2cset commands as listed above. The clock pins must be configured as inputs. If not then the port expander will drive against the clock signals of the dev kit board. This potentially could cause a hardware damage.



Default conf	figuration of the rea	sistors:	U12 <u>23</u> VccI2C P15	A_GPIO
CLK provideo expander.	d by the dev kit, GP	IO by the GPIO board	$\begin{array}{c} 16 \\ 15 \\ 16 \\ 17 \\ 17 \\ 17 \\ 17 \\ 17 \\ 17 \\ 17$	B_GPIO A_CLK B_CLK C_GPIO D_GPIO C_CLK D_CLK
A_GPIO B_GPIO A_CLK B_CLK	R9 nb R10 nb R11 0R R12 0R	SNN_CAM1_RST_3.3 SNN_CAM1_MCLK_3.3	$\begin{array}{c c} 19 \\ 20 \\ \hline \\ 20 \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	E_GPIO F_GPIO E_CLK F_CLK
C GPIO D GPIO C CLK D_CLK	R13nb R14nb R150R R160R	CAM_RST_3.3 CAMFQ_MCLK_3.3	22     /INT     P4     44       24     RESET     P2       9     GND     P1       Pad     P0       TCA6416ARTWR	
E_GPIO F_GPIO E_CLK F_CLK	R20 nb R19 nb R18 0R R17 0R	SNN_CAM2_RST_3.3 SNN_CAM2_MCLK_3.3	R48 499R D8	ST-S220KGKT V3.3

If you want to modify the settings of the GPIOs to the 6 connectors just change the data in the following 2 commands:

GPIOs all 1:

i2cset -f -y 6 0x20 2 0xfe i2cset -f -y 6 0x20 3 0xff

GPIOs all 0:

i2cset -f -y 6 0x20 2 0x00 i2cset -f -y 6 0x20 3 0x00

#### J20 rev 1

The "clock" resistors are equipped with solder jumpers.

The black rubber covers the power on reset patch for the GPIO port expander.

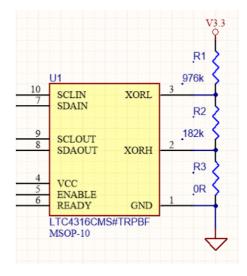


### **I2C address translation**

Configuration resistors for the address translation

The J20 employs an address translation device to change the I2C address for the 2nd connector (J2). This device is configured by 3 resistors (R1, R2 and R3).

By default the address translation is configured for cameras which have a single I2C address. Cameras with multiple I2C addresses may require a custom configuration of the three resistors (R1, R2, and R3).



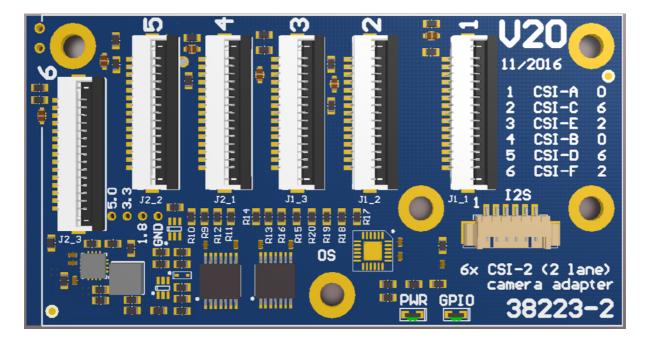
120 pin SAMTEC connector to the TX1 dev kit

		73			
SNN_CSLA_D0_P	. 1	1	2	2	SNN_CSI_B_D0_P
SNN_CSLA_D0_N	3	3	4	4	SNN_CSI_B_D0_N
SNN CSI A CLK P	. 5	5	6	6	SNN CSI B CLK P
SNN CSI A CLK N	9	7	8	10	SNN CSI B CLK N
	11	9 11	10	12	CHIT_COLD_CERCIT
SNN_CSI_A_D1_P	13	13	12	14	SNN_CSI_B_D1_P
SNN_CSI_A_D1_N	15	15	14	16	SNN_CSI_B_D1_N
	17	17	18	18	
CON CSI C D0 P	19 21	19	20	20 22	SNN_CSI_D_D0_P SNN_CSI_D_D0_N
CON_CSI_C_DU_N	21	21	22	24	SNN_CSI_D_DU_N
CON CSI C CLK P	25	23	24	26	SNN CSI D CLK P
CON CSI C CLK N	27	25 27	26	23	JNN CSI D CLK N
	29	29	30	30	
CON_CSI_C_D1_P	31	31	32	32	.SNN_CSI_D_D1_P
CON_CSI_C_D1_N	33	33	34	34	SNN_CSI_D_D1_N
SNN CSI E D0 P	35	35	36	36	SNN CSI F D0 P
SNN_CSI_E_D0_P	30	37	38	40	SNN_CSI_F_D0_N
0.00 00 E DO 11	41	39	40	42	0011_00_N
SNN_CSI_E_CLK_P	43	41	42	44	SNN_CSI_F_CLK_P
SNN CSI E CLK N	45	43	44	46	SNN_CSI_F_CLK_N
	47	47	40	48	
SNN CSI E D1 P	49	49	50	50	SNN CSLF D1 P
SNN_CSI_E_D1_N	51	51	52	52 54	SNN_CSI_F_D1_N
DVDD CAM LV 1	55	53	54	56	
TYOD CHALLET	57	55	56	58	DVDD CAM LV 2
SNN UART PRESENT	39	57 59	58	60	SNN PIN60
		29	00		
				0	
SNN_UART_TX SNN_UART_RX	61	61	62	62	SNN SPI SCK
SNN_UART_CTS	65	63	64	66	SNN SPLCS0
SNN UART RTS	67	65	66	63	SNN_SPI_SCK SNN_SPI_DIN SNN_SPI_CS0 SNN_SPI_DOUT
-	69	67 69	68 70	70	
SNN_DMIC_CLK	71	71	72	72	SNN_12S_CLK
SNN_DMIC_CLK SNN_DMIC_DAT CAM_I2C3_SCL CAM_I2C3_SDA	73	73	74	74	SNN 125 LRCLK SNN 125 SDIN SNN 125 SDOUT
CAM_I2C3_SCL	75	75	76	76	SNN 125 SDIN
CAM_12C3_SDA	79	77	78	70 S0	SNN_125_50001
	\$1	79	80	82	AVDD CAM
VDD CAM FQ HV CAM	83	\$1	82	84	VDD AF
CAM AE DIAIDAL	\$5	83 85	84 86	\$6	
CAM_12C2_SCL CAM_12C2_SDA	\$7	87	30	83	SNN_CAM1_MCLK
CAM_I2C2_SDA	39	39	90	90	CAM VSYNC SNN CAMT MCLK SNN CAMT PWDN SNN CAMT RST SNN CAM2 PWDN SNN CAM2 PWDN SNN CAM2 RST
CAMFQ_MCLK CAMFQ_PWDN	91	91	92	92 94	SNN_CAM1_RST
CAMEQ_PWDN CAM_RST	93	93	94	94	SNN CAM2 MOLK
SNN FLASH EN	97	95	96	98	SNN CAM2 RST
	99	97	98	100	
DVDD_CAM_IO_1V2	101	99 101	100	102	DVDD_CAM_IO_1V8
SNN_FLASH_MASK	103	101	102	104	SNN_TORCH_EN SNN_FLASH_STROB
CAMEIZC1_SCL CAMEIZC1_SDA	105	105	104	106	SNN_FLASH_STROB
CAM_I2C1_SDA	107	107	103	103	VDD_3V3_SLP
IR READY	109	109	110	110	SNN GYRO INT
IR_TRIGGER	113	111	112	112	SNN IR EN
	115	113	114	116	
CAM_INTR	117	115	116	118	V5.0
VDD_SYS_EN	119	119	115	120	VDD_SYS 9
	121	121	122	122	
	123 125	123	124	124	
	125	125	126	120	
		127	128		
	-	QTH-060-01-L-D-A-			

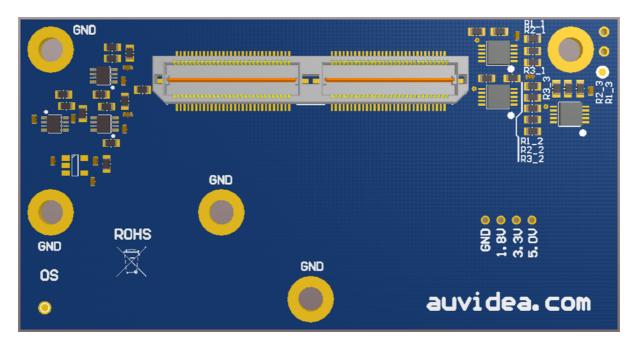
### J20 rev 2

Rev 2 adds the power on reset circuitry and the 1.8V LDO. Also the silkscreen on top on bottom has been extended.

top view:



bottom view:





1. to be added

### Disclaimer

Thank you for reading this manual. If you have found any typos or errors in this document, please let us know.

This is the preliminary version of this data sheet. Please treat all specifications with caution as there may be any typos or errors.

The Auvidea Team

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