

Computer On Module

- Processor ARM® Quad Cortex®-A53 based Qualcomm® Snapdragon™ 410E 1.2GHz 64-bit processor
- RAM 1GB LPDDR3 SDRAM
- ROM 4GB eMMC
- Power supply Single 5V or Battery
- Size 26mm SO-DIMM
- Temperature -25°C to 85°C

Key Features

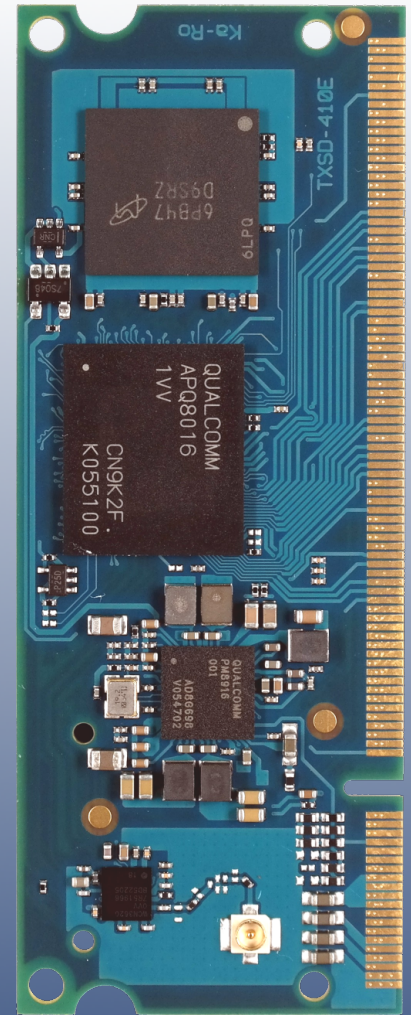
- HD (1280 x 720) LCD controller
- LVDS display interface
- Qualcomm® Adreno™ GPU 306 up to 400 MHz 3D graphics accelerator
- 1080p30 video decoder / 720p30 video encoder
- Two MIPI Camera Interfaces
- SD-card interface
- High Speed USB 2.0
- Six configurable UART/SPI/I2C interfaces
- Configurable GPIOs
- 1.8V IO

Wireless Option (OEM part)

- 802.11b/g/n 2.4GHz WLAN / BT 4.0
(For additional information, contact your local sales office)

OS Support

- Linux
- Android



**1.2 GHz
quad
Cortex®-A53**

Board highlights:

- Highly integrated
- Standard TX-DIMM pinout
- as small as possible - only 26mm

The TXSD is a member of the TXCOM module series. TXCOM modules are complete computers, implemented on a board smaller than a credit card, and ready to be designed into your embedded system. TXCOM modules includes an processor, SDRAM and Flash memory. The integrated LCD-controller enables direct connection of an LCD screen. The TXSD is specifically targeted at embedded applications where size, high cpu-performance and cost are critical factors.

Computer on module

- Qualcomm Snapdragon 410E (APQ8016E) processor, 1.2 GHz
- 1GByte LPDDR3 SDRAM
- 4GB eMMC
- TXCOM DIMM200-module (67,6mm x 26 mm x 4mm)
- Operating temperature ranges -25°C ..85°C

Processor

Embedded computing devices continue to integrate more and increasingly complex functions, and support more functionality while maintaining performance, board space, and cost. These demands are met by the APQ8016E – with its ARM Cortex-A53 application processors – which further expand mass-market chipset capabilities by making rich multimedia features accessible to more consumers worldwide. The APQ8016E has a high level of integration that reduces the bill-of-material (BOM), which delivers board-area savings.

Standard TXCOM pinout:

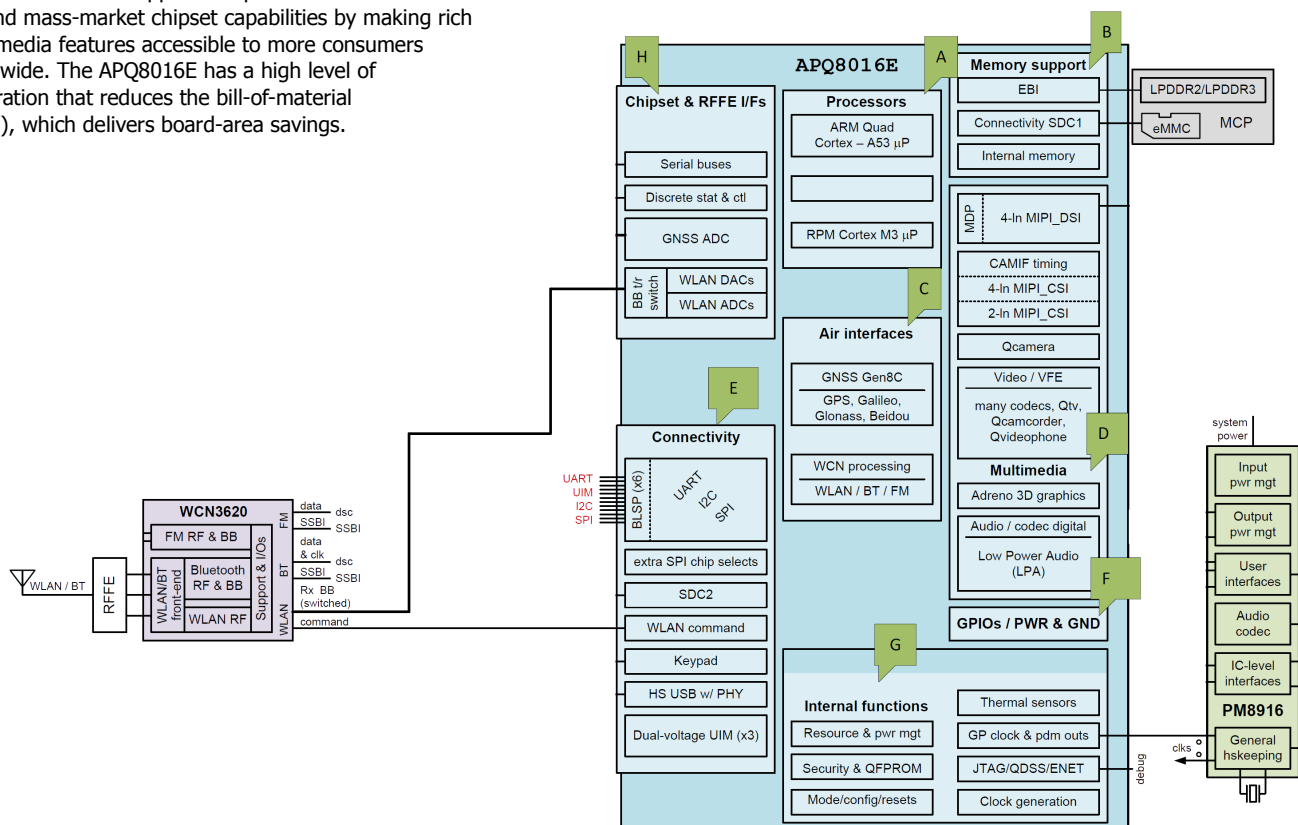
- UARTs (x2)
- I2C / PWM
- Serial Audio Interfaces (x2)
- SD-Card
- LVDS Display Interface

Power Supply

The TXSD is supplied either from single 5V source connected to the VIN pins or a lower voltage source (up to 4.5V) connected to the VBAT pins. The battery charger is left unused in that case. Alternatively a battery can be connected to the VBAT pins, charged by the linear charger from a 5V source.

Read more in our TX-Guide:

www.karo-electronics.com/TX-Guide



Order Number	CPU / Wireless	SDRAM	Flash	Temp. Grade
TXSD-410E/1200/1GS/4GF/LVDS	1.2GHz Snapdragon 410E	1GB LPDDR3	4GB eMMC	-25°C..85°C
TXSD-410E/1200/1GS/4GF/LVDS/WLAN (OEM part, contact sales)	1.2GHz Snapdragon 410E WCN3620 U.FL connector			

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PINOUT

PIN	Type	Function	Chipset Pad Name	Alternate functions	GPIO	Description (refer to i.MX6 Dual manuals for details)
POWER SUPPLY & RESET						
1-4	power	VIN	PM8916: USB_IN			Module power supply input 4.4V to 6.2V USB source with built-in 16 V over-voltage protection.
5-7	power	VDDIO	PM8916: VREG_L16			1.8V output (55mA max.)
8	DI	BOOTMODE				Boot mode select Connect to GND to force booting from USB. Leave unconnected for normal operation.
9-12	power	VDD33	PM8916: VREG_L17			3.3V output (450mA max. at VBAT>3.8V)
13	power	VBACKUP	PM8916: VCOIN			Coin cell or keep-alive battery. Sense input or charge output. Coin cell voltage 2.0V to 3.25V
14	DI		PM8916: OPT_1			Connect to GND if an external charger is present or VBAT is used as the main power supply input. VIN supply is disconnected in that case. Leave unconnected for normal use, don't connect otherwise.
15	DO	#RESET_OUT	PM8916: GPIO_3			#RESET_OUT may be used to reset peripherals on the carrier board. PM8916 configurable GPIO.
16	DI	#POR	PM8916: PS_HOLD			Power-supply hold control input. PS_HOLD dropping will force PON_RESET_N to APC8016 going low. Drive to GND to reset. Leave unconnected for normal operation, don't connect otherwise.
17	1V8	#RESET_IN	SRST_N			JTAG reset for debug
18	GND					

BATTERY

19 21 23 25	power		PM8916: VBAT			Battery node; input during battery operation, output during charging, and sense point for UVLO detection.
20	analog		PM8916: BAT_THERM			Battery-temperature monitoring. If BAT_THERM is not used, it can be grounded, and the software's battery temperature feature must be disabled. If external charger is used, then BAT_THERM should be grounded. Onboard resistors / wiring: Pin 20 – 16K2 – BAT_THERM – 90K9 – VREF_BAT_THM
22	power		PM8916: VBAT_SNS			Main battery voltage sense point for VM-BMS, Vtrkl, VDD_MAX, and VBAT_WEAK
24	analog		PM8916: CHG_LED_SINK			CHG_LED_SINK to drive LED during charging. This pin cannot be used to drive LED if Linear Battery Charger (LBC) is not used (OPT_1 is grounded).
26	analog		PM8916: BAT_ID			Battery-presence detection. If BAT_ID is not used, that pin can be grounded. Onboard resistors / wiring: Pin 26 – BAT_ID – 100K – VREF_BAT_THM

USB-HOST

27	GND					
28						Not connected
29						Not connected
30	power		PM8916: VREG_BOOST			5V Boost converter output
31						Not connected
32	GND					

USB-OTG / 2nd CAN

33	5V IN	USBOTG_ID	GPIO_61	UIM_BATT_ALARM	GPIO[61]	Onboard resistors / wiring: Pin 33 – 100K – GPIO_61 – 47K – GND
34	3V3 OUT	USBOTG_VBUSEN	GPIO_56	UIM2_PRESENT	GPIO[56]	Active high external 5V supply enable. This pin is used to enable the external VBUS power supply.
35	analog	USBOTG_DM	USB_HS_DM			USB HS data minus
36	3V3 IN	#USBOTG_OC	GPIO_60	UIM1_PRESENT	GPIO[60]	Active low over-current indicator input connected to a GPIO. Onboard resistors / wiring: Pin 36 – 47K – GPIO_60 – 47K – GND
37	analog	USBOTG_DP	USB_HS_DP			USB HS data plus
38	analog IN	USBOTG_VBUS	GPIO_121	BLSP2_SPI_CS1_N	GPIO[121]	VBUS pin of the USB cable. This pin is used for the VBUS comparator inputs. Onboard resistors / wiring: Pin 38 – 100K – GPIO_121 – 47K – GND
39	GND					

PIN	Type	Function	Chipset Pad Name	Alternate functions	GPIO	Description (refer to i.MX6 Dual manuals for details)
I2C						
40	1V8	I2C_DATA	GPIO_18	BLSP5_SPI_CS_N BLSP5_I2C_SDA_B	GPIO[18]	I2C Data
41	1V8	I2C_CLK	GPIO_19	BLSP5_SPI_CLK BLSP5_I2C_SCL_B	GPIO[19]	I2C Clock
PWM						
42	1V8	PWM	GPIO_98	LCD_BL_EN GP_PDM_2A	GPIO[98]	PWM Output (PDM: Pulse-density modulation)
1-WIRE						
43	power		PM8916: VREG_L11			Linear regulator L11 output
CSPI – Configurable Serial Peripheral Interface						
44	1V8	CSPI_CS	GPIO_10	BLSP3_SPI_CS_N BLSP3_I2C_SDA_A	GPIO[10]	Chip select 0 for SPI on BLSP3
45	1V8	CSPI_CS	GPIO_120	BLSP3_SPI_CS1_N	GPIO[120]	Chip select 1 for SPI on BLSP3
46	1V8	CSPI_MOSI	GPIO_8	BLSP3_SPI_MOSI	GPIO[8]	Master Out/Slave In signal
47	1V8	CSPI_MISO	GPIO_9	BLSP3_SPI_MISO	GPIO[9]	Master In/Slave Out signal
48	1V8	CSPI_SCLK	GPIO_11	BLSP3_SPI_CLK BLSP2_I2C_SCL_A	GPIO[11]	Serial Clock signal
49	1V8	CSPI_CS	GPIO_69	MAG_INT BLSP3_SPI_CS3_N	GPIO[69]	Chip select 3 for SPI on BLSP3
50	GND					
SD – Secure Digital Interface 1						
51	1V8	SD_CD	GPIO_38	SD_CARD_DET_N CCI_TIMER2	GPIO[38]	SD Card Detect
52	1V8	SD_D[0]	SDC2_DATA_0			SD Data bidirectional signals—If the system designer does not want to make use of the internal pull-up, via the Pull-up enable register, a 50 K–69 K external pull up resistor must be added.
53	1V8	SD_D[1]	SDC2_DATA_1			
54	1V8	SD_D[2]	SDC2_DATA_2			
55	1V8	SD_D[3]	SDC2_DATA_3			
56	1V8	SD_CMD	SDC2_CMD			SD Command bidirectional signal
57	1V8	SD_CLK	SDC2_CLK			SD Output Clock.
58	GND					
1st UART / BAM-enabled low-speed peripheral 2 (BLSP2)						
59	1V8	TXD	GPIO_4	BLSP2_SPI_MOSI BLSP2_UART_TX	GPIO[4]	Application UART Transmit Data output signal
60	1V8	RXD	GPIO_5	BLSP2_SPI_MISO BLSP2_UART_RX	GPIO[5]	Application UART Receive Data input signal
61	1V8	CTS (DTE)	GPIO_6	BLSP2_SPI_CS_N BLSP2_UART_CTS_N BLSP2_I2C_SDA_A	GPIO[6]	Application UART CTS input signal
62	1V8	RFR (DTE)	GPIO_7	BLSP2_SPI_CLK BLSP2_UART_RFR_N BLSP2_I2C_SCL_A	GPIO[7]	Application UART ready-for-receiving output signal
2nd UART / BAM-enabled low-speed peripheral 1 (BLSP1)						
63	1V8	TXD	GPIO_0	BLSP1_SPI_MOSI BLSP1_UART_TX	GPIO[0]	Application UART Transmit Data output signal
64	1V8	RXD	GPIO_1	BLSP1_SPI_MISO BLSP1_UART_RX	GPIO[1]	Application UART Receive Data input signal
65	1V8	CTS (DTE)	GPIO_2	BLSP1_SPI_CS_N BLSP1_UART_CTS_N BLSP1_I2C_SDA_A	GPIO[2]	Application UART CTS input signal
66	1V8	RFR (DTE)	GPIO_3	BLSP1_SPI_CLK BLSP1_UART_RFR_N BLSP1_I2C_SCL_A	GPIO[3]	Application UART ready-for-receiving output signal
BAM-enabled low-speed peripheral 4 (BLSP4)						
67	1V8		GPIO_14	BLSP4_SPI_CS_N BLSP4_I2C_SDA_A	GPIO[14]	
68	1V8		GPIO_15	BLSP4_SPI_CLK BLSP4_I2C_SCL_A	GPIO[15]	
69	1V8		GPIO_16	BLSP5_SPI_MOSI	GPIO[16]	
70	1V8		GPIO_17	BLSP5_SPI_MISO	GPIO[17]	
71	GND					

PIN	Type	Function	Chipset Pad Name	Alternate functions	GPIO	Description (refer to i.MX6 Dual manuals for details)
KEYPAD						
72	1V8	KP_COL[0]	GPIO_107	KYPD_SNS0	GPIO[107]	Keypad sense bit 0 (VOL/ZOOM+)
73	1V8	KP_COL[1]	GPIO_108	KYPD_SNS1	GPIO[108]	Keypad sense bit 1
74	1V8	KP_COL[2]	GPIO_109	KYPD_SNS2	GPIO[109]	Keypad sense bit 2
75	1V8	KP_COL[3]	PM8916: KPD_PWR_N			PM8916: Keypad poweron detect input (PHONE ON)
76	1V8	KP_COL[4]	PM8916: RESIN_N			PMIC reset input. Drive to GND to reset. (VOL/ZOOM-) Leave unconnected for normal operation, don't connect otherwise.
77	1V8	KP_ROW[0]	GPIO_95		GPIO[95]	Configurable I/O
78	1V8	KP_ROW[1]	GPIO_78		GPIO[78]	
79	1V8	KP_ROW[2]	GPIO_96	EXT_GNSS_LNA_EN	GPIO[96]	Configurable I/O
80	1V8	KP_ROW[3]	GPIO_79		GPIO[79]	
81	Not connected					
82	GND					
Serial Audio Port 1						
83	1V8	SSI1_INT	GPIO_102		GPIO[102]	
84	1V8	SSI1_RXD	GPIO_112	MI2S_2_D1	GPIO[112]	
85	1V8	SSI1_TXD	GPIO_119	MI2S_2_D0	GPIO[119]	
86	1V8	SSI1_CLK	GPIO_118	MI2S_2_SCLK	GPIO[118]	
87	1V8	SSI1_FS	GPIO_117	MI2S_2_WS	GPIO[117]	
88	GND					
Serial Audio Port 2						
89	1V8	SSI2_INT	GPIO_116	MI2S_1_MCLK	GPIO[116]	GPIO
90	1V8	SSI2_RXD	GPIO_115	MI2S_1_D1 GYRO_ACCEL_INT_N	GPIO[115]	Serial Audio Interface serial data line 1
91	1V8	SSI2_TXD	GPIO_114	MI2S_1_D0	GPIO[114]	Serial Audio Interface serial data line 0
92	1V8	SSI2_CLK	GPIO_113	MI2S_1_SCLK GP_PDM_2B	GPIO[113]	Serial Audio Interface serial bit clock
93	1V8	SSI2_FS	GPIO_110	BLSP1_SPI_CS1_N MI2S_1_WS GP_MN USB_HS_ID	GPIO[110]	Serial Audio Interface left/right clock
94	GND					
Secure Digital Interface 2						
95	1V8		GPIO_93	BOOT_CONFIG_12	GPIO[93]	
96	AI		GNSS_BB_IM			GNSS receiver baseband input, in-phase minus
97	AI		GNSS_BB_QM			GNSS receiver baseband input, quadrature minus
98	AI		GNSS_BB_IP			GNSS receiver baseband input, in-phase plus
99	AI		GNSS_BB_QP			GNSS receiver baseband input, quadrature plus
100	DO		PM8916: RFCLK1			RF (low-noise) XO output 1
101	power		PM8916: VREG_L1			1.225V Linear regulator L1 output
102	GND					
MISC						
103	1V8		GPIO_99		GPIO[99]	
104	1V8		GPIO_85	SDC1_EMMC_1P2_EN	GPIO[85]	
105	1V8		GPIO_89	BOOT_CONFIG_8	GPIO[89]	
106	1V8		GPIO_90	BOOT_CONFIG_9	GPIO[90]	

PIN	Type	Function	Chipset Pad Name	Alternate functions	GPIO	Description (refer to i.MX6 Dual manuals for details)
107	1V8		GPIO_100		GPIO[100]	
108	1V8		GPIO_92	BOOT_CONFIG_11	GPIO[92]	
109	1V8		GPIO_91	BOOT_CONFIG_10	GPIO[91]	
110	1V8		GPIO_101		GPIO[101]	
111	GND					
112	1V8		GPIO_94	BOOT_CONFIG_13	GPIO[94]	Configurable I/O
113	1V8		GPIO_106	SSBI_WTR1_TX	GPIO[106]	
114	1V8		GPIO_88	BOOT_CONFIG_7	GPIO[88]	
115	1V8		GPIO_104	SSBI_WTR0_TX	GPIO[104]	
116	GND					
LVDS Display / MIPI CSIO						
117	MIPI		MIPI_CSIO_LN2_N			MIPI camera serial interface 0 lane 2 – negative
118	MIPI		MIPI_CSIO_LN1_N			MIPI camera serial interface 0 lane 1 – negative
119	MIPI		MIPI_CSIO_LN2_P			MIPI camera serial interface 0 lane 2 – positive
120	MIPI		MIPI_CSIO_LN1_P			MIPI camera serial interface 0 lane 1 – positive
121	MIPI		MIPI_CSIO_LN3_N			MIPI camera serial interface 0 lane 3 – negative
122	MIPI		MIPI_CSIO_LN0_N			MIPI camera serial interface 0 lane 0 – negative
123	MIPI		MIPI_CSIO_LN3_P			MIPI camera serial interface 0 lane 3 – positive
124	MIPI		MIPI_CSIO_LN0_P			MIPI camera serial interface 0 lane 0 – positive
125	MIPI		MIPI_CSIO_CLK_N			MIPI camera serial interface 0 clock – negative
126	LVDS		LVDS_TX3_P			LVDS display output lane 3 – positive
127	MIPI		MIPI_CSIO_CLK_P			MIPI camera serial interface 0 clock – positive
128	LVDS		LVDS_TX3_N			LVDS display output lane 3 – negative
129	GND					
130	LVDS		LVDS_CLK_P			LVDS display output clock – positive
131	LVDS		LVDS_TX2_P			LVDS display output lane 2 – positive
132	LVDS		LVDS_CLK_N			LVDS display output clock – negative
133	LVDS		LVDS_TX2_N			LVDS display output lane 2 – negative
134	LVDS		LVDS_TX1_P			LVDS display output lane 1 – positive
135	LVDS		LVDS_TX0_P			LVDS display output lane 0 – positive
136	LVDS		LVDS_TX1_N			LVDS display output lane 1 – negative
137	LVDS		LVDS_TX0_N			LVDS display output lane 0 – negative
138	1V8		GPIO_87	BOOT_CONFIG_6	GPIO[87]	
139	1V8		GPIO_75		GPIO[75]	
140	1V8		GPIO_84	BOOT_CONFIG_4	GPIO[84]	
141	1V8		GPIO_73		GPIO[73]	
142	GND					
143	Not connected					
144	1V8		GPIO_24	MDP_VSYNC_P	GPIO[24]	
145	Not connected					

PIN	Type	Function	Chipset Pad Name	Alternate functions	GPIO	Description (refer to i.MX6 Dual manuals for details)
146	1V8		PM8916: BB_CLK2			Baseband (low power) XO output 2
147	GND					

Module Specific Signals

148	1V8		GPIO_13	BLSP4_2 GP_CLK_3B	GPIO[13]	
149	1V8		GPIO_12	BLSP4_3 GP_CLK_2B	GPIO[12]	
150	1V8		GPIO_25	DSI_RST_N GP_PDM_0B	GPIO[25]	
151	1V8		GPIO_72		GPIO[72]	
152	1V8		GPIO_77		GPIO[77]	
153	1V8		GPIO_71		GPIO[71]	
154	1V8		GPIO_105	SSBI_WTR1_RX	GPIO[105]	
155	1V8		GPIO_76		GPIO[76]	
156	1V8		GPIO_97	LCD_DRIVER_5V_EN GP_CLK_1B BOOT_CONFIG_14	GPIO[97]	Configurable I/O
157	1V8		GPIO_74		GPIO[74]	
158	1V8		GPIO_103	SSBI_WTR0_RX	GPIO[103]	
159	1V8		GPIO_70		GPIO[70]	
160	GND					
161	1V8		GPIO_52	UIM3_PRESENT GP_PDM_1A	GPIO[52]	
162	1V8		GPIO_20	BLSP6_3 GP_PDM_0A	GPIO[20]	
163	1V8		GPIO_21	BLSP6_2 GP_PDM_1B	GPIO[21]	
164	1V8		GPIO_23	BLSP6_0	GPIO[23]	
165	1V8		GPIO_22	BLSP6_1	GPIO[22]	
166	MIPI		MIPI_CSI1_CLK_N			MIPI camera serial interface 1 clock – negative
167	MIPI		MIPI_CSI1_LN1_N			MIPI camera serial interface 1 lane 1 – negative
168	MIPI		MIPI_CSI1_CLK_P			MIPI camera serial interface 1 clock – positive
169	MIPI		MIPI_CSI1_LN1_P			MIPI camera serial interface 1 lane 1 – positive
170	MIPI		MIPI_CSI1_LN0_N			MIPI camera serial interface 1 lane 0 – negative
171	GND					
172	MIPI		MIPI_CSI1_LN0_P			MIPI camera serial interface 1 lane 0 – positive
173	1V8		GPIO_62	SMB_INT	GPIO[62]	
174	1V8		GPIO_35	CAM0_RST_N	GPIO[35]	
175	1V8		GPIO_36	FLASH_LED_RESET	GPIO[36]	
176	1V8		GPIO_31	CCI_TIMER0 GP_CLK0	GPIO[31]	
177	1V8		GPIO_34	CAM0_STANDBY_N	GPIO[34]	
178	1V8		GPIO_32	CCI_TIMER1 GP_CLK1	GPIO[32]	
179	1V8		GPIO_29	CAM_I2C_SDA	GPIO[29]	
180	1V8		GPIO_28	CAM1_RST_N	GPIO[28]	
181	1V8		GPIO_30	CAM_I2C_SCL	GPIO[30]	
182	1V8		GPIO_33	CCI_ASYNC0	GPIO[33]	
183	GND					

PIN	Type	Function	Chipset Pad Name	Alternate functions	GPIO	Description (refer to i.MX6 Dual manuals for details)
184	1V8		GPIO_26	CAM_MCLK0	GPIO[26]	
185	1V8		GPIO_27	CAM_MCLK1	GPIO[27]	
186	LED current sink		PM8916: MPP_3			BT_LED_CTRL - Configurable MPP
187			PM8916: MPP_2			WLAN_LED_CTRL - Configurable MPP
188	audio		PM8916: MIC_BIAS1			Microphone bias #1
189	audio		PM8916: HS_DET			Headset detection
190	audio		PM8916: MIC1_IN			Main mic
191	audio		PM8916: MIC2_IN			Headset mic
192	audio		PM8916: GND_CFILT			Ground reference
193	audio		PM8916: MIC_BIAS2			Microphone bias #2
194	power		PM8916: VDD_EAR_SPKR			Ear and class-D speaker amplifier supply
195	audio		PM8916: HPH_L			Headphone PA left channel output
196	audio		PM8916: HPH_R			Headphone PA right channel output
197	audio		PM8916: SPKR_DRV_P			Class-D speaker amp + output
198	audio		PM8916: HPH_REF			Headphone PA ground sensing
199	audio		PM8916: SPKR_DRV_N			Class-D speaker amp – output
200	GND					

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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