

Computer On Module

- Processor Freescale i.MX283, 454 MHz
- RAM 64MB DDR2 SDRAM
- ROM 128MB NAND Flash
- Power supply Single 5.0V
- Size 26mm SO-DIMM
- Temp.-Range 0°C..70°C

Key Features

- 10/100Mbps Ethernet port
- Two High-Speed USB 2.0 ports
- True colour LCD controller
- 4/5 wire Touchscreen interface
- Several peripheral interfaces:
UART, SD-CARD, I2C, PWM, Serial Audio, SPI
- Power management optimized for long battery life
- i.MX28 battery charger
- 3.3V I/O

OS Support

- Windows Embedded CE
- Linux

Development System

- Starter-Kit V



**454 MHz
ARM9**

Board highlights:

- Lowest cost 454MHz ARM9
- Standard TX-DIMM pinout
- as small as possible - only 26mm

The TX28 is a member of a module series, specially designed for Freescales i.MX multimedia processors. TX modules are complete computers, implemented on a board smaller than a credit card, and ready to be designed into your embedded system. TX modules includes a Freescale® i.MX processor, SDRAM and Flash memory. The integrated LCD-controller enables direct connection of an LCD screen. The TX28 is specifically targeted at embedded applications where size, high cpu-performance and cost are critical factors.

Computer on module

- Freescale® i.MX283, 454 MHz
- 64 MByte DDR2-400 SDRAM (16bit)
- 128 MByte NAND Flash memory
- DIMM200-module (67,6mm x 26 mm x 3,6mm)
- Operating temperature range 0..70°C

The i.MX28 family of multimedia applications processors is the latest extension of Freescales ARM9 product portfolio. The i.MX28 family integrates display, power management, and connectivity features unmatched in ARM9-based devices, reducing system cost and complexity for cost sensitive applications. And easy-to-use tools and software help you design differentiated industrial and consumer products in less time.

With optimized performance and power consumption, the i.MX283 is an ideal fit for fanless systems or for portable equipment that need to be battery operated. The LCD controller with touch screen capability makes it possible to design creative and intuitive user interfaces that are required by many applications.

The i.MX283 multimedia application processor integrates display, power management, USB, and Ethernet connectivity. The combination of advanced connectivity peripherals with a 454Mhz ARM9 processor core creates a platform for gateway products that bridge multiple networks. With attention to overall system cost, i.MX28 integrates physical USB interfaces (PHY), 10/100 Ethernet, power management, and a resistive touch screen display controller.

Standard TX-DIMM pinout:

- One 4-wire UART
- One 2-wire UART
- LCD
- I2C / PWM
- Serial Audio Interface
- 4-wire SD-Card/SDIO

High-Speed communication interfaces incl. onboard Ethernet PHY / on-chip USB PHY allows direct use of connectors/magnetics on the baseboard without the need for additional logic:

- 10/100 Mbps Ethernet
- 480 Mbps USB OTG
- 480 Mbps USB Host

Additional interfaces like CAN, 4/5-wire resistive touch-screen, 2 UARTs and external memory interface are available on TX28 specific pins. Some interfaces are multiplexed with other functions.

Power Supply

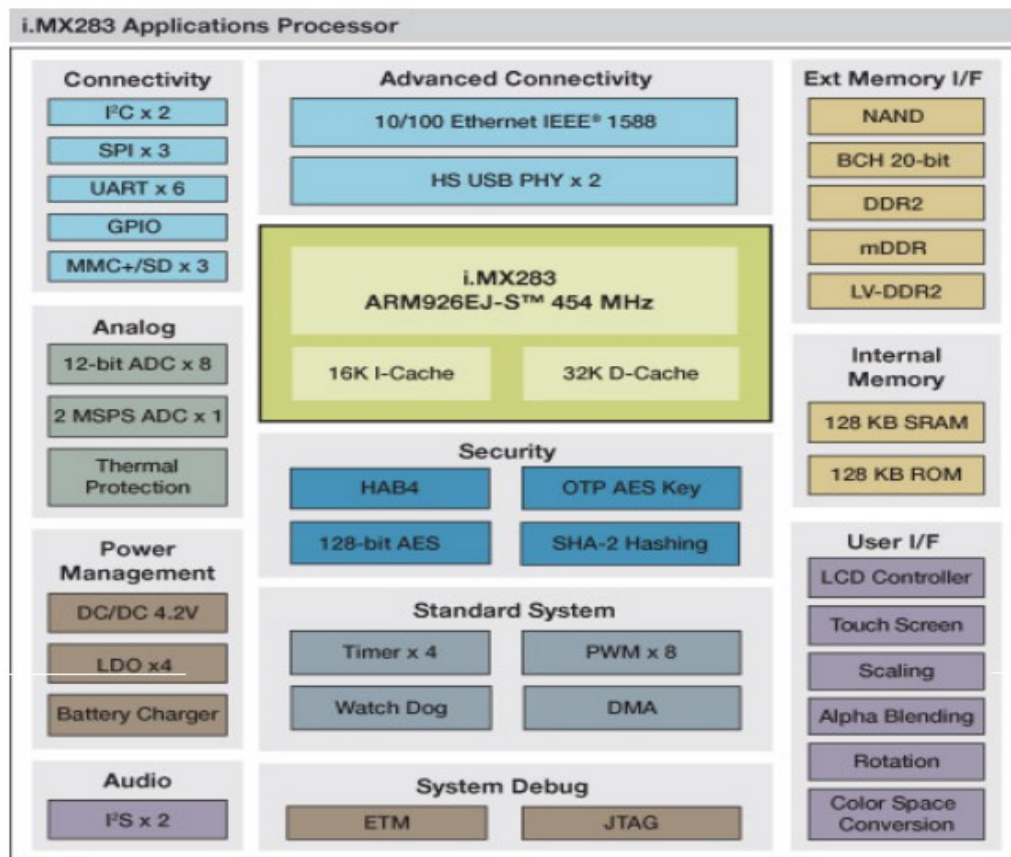
The TX28 accepts a 5V input voltage:

- 5.0V USB supply or AC wall adapter

It's possible to use the battery charger feature of the processor on a custom baseboard.

Read more in our TX-Guide:

www.karo-electronics.com/TX-Guide



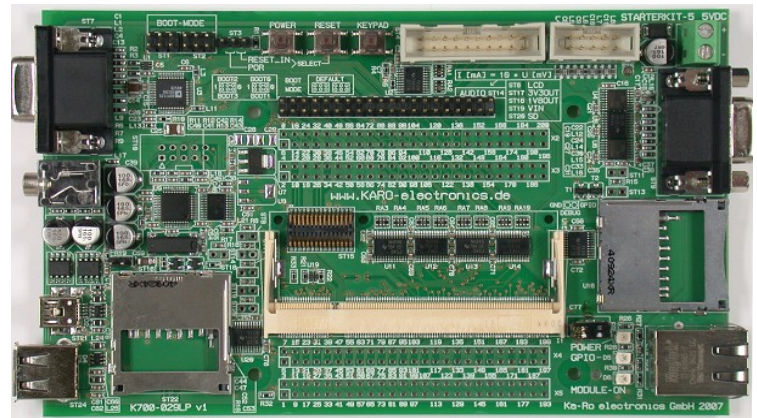
Ordering Information

Order Number	CPU	SDRAM	Flash	Temp.
TX28S/454/64S/128F	454MHz i.MX283	64MB	128MB	0°C..70°C

STARTER-KIT V

The Starter-Kit V is a ready-to-use development system for building applications based on the TX embedded processor boards.

- DIMM200 TX socket
- Two SD-card sockets
- USB 2.0 OTG and USB 2.0 Host connector
- D-SUB 15 VGA connector
- 40pin LCD flat cable header
- 3.5mm headphone connector
- JTAG interface
- SGTL5000 audio codec
- TSC2007 touchscreen controller
- RS232 on 10pin flat cable and SUB-D header
- All pins of the TX socket are connected to daughter board slot for easy application design-in
- 10/100 Mbit/s Ethernet
- 5VDC Power Supply by USB-OTG or power jack.
- 100mm x 160mm
- Schematics of the base board are included for reference.



DISPLAY OPTIONS

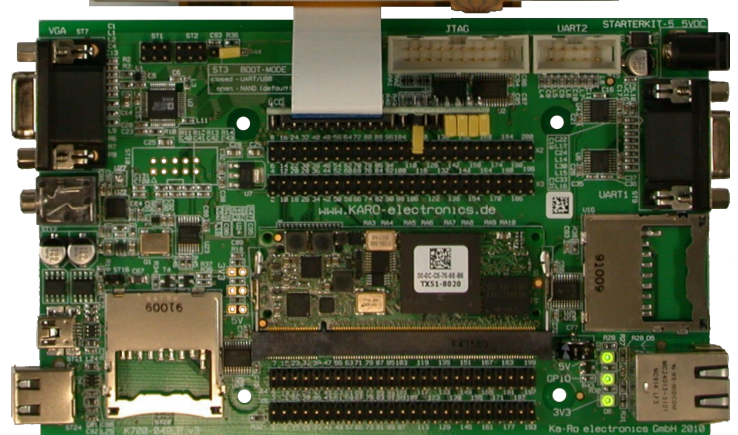
The optional display comes with an FFC cable and a small adapter PCB which can be plugged directly onto the Starter-Kit 40pin LCD header.

Option 1: 5,7" VGA Resistive Touch

- 5,7 inch TFT display
- 640 x 480 dots
- White LED backlight
- Resistive Touchscreen

Option 2: 5,7" VGA PolyTouch™

- 5,7 inch TFT display
- 640 x 480 dots
- White LED backlight
- Capacitive Touchscreen



Differences between TX28 and TX28S

Module Features	TX28	TX28S
SDRAM	128MB	64MB
Processor	i.MX287	i.MX283
RTC	DS1339	-
Temp. Range	-40°C..85°C	0..70°C
Qual.	Industrial	Consumer

Processor Features	TX28	TX28S
Ethernet	x2	x1
L2 Switch	Yes	-
CAN	x2	-

PINOUT differences	TX28	TX28S
1-4	Module power supply input (3.0V-5.5V)	Module power supply input connected to VDD5V (5V +/-5%) Refer to i.MX28 datasheet for ratings.
5-7, 9-12	3.3V power supply output (up to 0.2A)	3.3V power supply output driven by DCDC_VDDIO Refer to i.MX28 datasheet for ratings.
13	DS1339 RTC backup power supply.	NC
14	100K-PU to 3.3V / 47K-PD	47K-PU to VDDXTAL
15	FEC_RESET_B / i.MX28 pad: ENET0_RX_CLK	Connected to pin 115 / i.MX28 pad: PWM1
16	#POR, 10K-PU, turns off the module while active.	NC
27	USBH_VBUSEN / i.MX28 pad: SPDIF	NC / 10K-PU
34	USBOTG_VBUSEN / i.MX28 pad: GPMI_CE2N	NC / 10K-PU
36	#USBOTG_OC / i.MX28 pad: GPMI_CE3N	NC
44-49	CSPI – Configurable Serial Peripheral Interface	NC
65-66	2 nd UART RTS/CTS	NC
67-70	3 rd UART	NC
72-81	KEYPAD / 1 st CAN	NC
89-93	Serial Audio Port 2	NC
101	ENET_CLK	NC
104-105	i.MX28 pads: SSP1_SCK / SSP1_CMD	NC
109-110	i.MX28 pads: SSP1_DATA0 / SSP1_DATA3	NC
115	PWM1	PWM1 / CONNECTED TO PIN 15
151	LCD_ENABLE	GPMI_RDY1 / CONNECTED TO PIN 159
152	ENET0_RXD2	NC
153	ENET0_RXD3	GPMI_CE1N / CONNECTED TO PIN 158
154-157	ENET0_TXD2 / ENET0_TXD3 / ENET0_COL / ENET0_CRS	NC
158	GPMI_CE1N	GPMI_CE1N / CONNECTED TO PIN 153
159	GPMI_RDY1	GPMI_RDY1 / CONNECTED TO PIN 151
193-196	NC	BATTERY
197	ENET0_TX_CLK	NC

PINOUT				Marked yellow: Not connected		
PIN	Type	Function	i.MX28 Pad Name	Alternate functions	GPIO	Description (refer to i.MX28 manuals for details)
POWER SUPPLY & RESET						
1-4	power	VIN	VDD5V			Module power supply input (5V +/- 5%)
8	3V3	BOOTMODE			47K-PU	Boot mode select H: Boot from NAND / L: Boot from UART/USB
5-7, 9-12	power	VOUT	DCDC_VDDIO			3.3V power supply output (keep as low as possible / up to ~20mA)
13	NC	VBACKUP				not connected
14	special		PSWITCH		10K series	Used for chip power on or recovery. PSWITCH is at MID LEVEL & STARTUP by default. A 10kΩ resistor in series is used. Connect to GND for LOW LEVEL, connect to 3V3 for HIGH LEVEL, leave unconnected (MID LEVEL) if not used. => i.MX28 Reference manual chap 11.4 "PSWITCH Pin Functions"
15	3V3	FEC_RESET_B	PWM1	CONNECTED TO PIN 115	GPIO3_17	Ethernet PHY reset – active low output signal. This pin is hard wired to the onboard Ethernet PHY and provides a fixed function.
16	NC	#POR				not connected
17	3V3	#RESETIN	RESETN			This pin resets the chip if it is low. This pin is pulled up to VDDIO33 with an internal resistor. No external pull up resistors are needed
18	GND	GND				
Ethernet						
19	analog	ETN_TXN				Transmit Data Negative: 100Base-TX or 10Base-T differential transmit output to magnetics.
20	3V3	#ETN_LED2				Active low - output is driven active when the operating speed is 100Mbps. This LED will go inactive when the operating speed is 10Mbps or during line isolation.
21	analog	ETN_TXP				Transmit Data Positive: 100Base-TX or 10Base-T differential transmit output to magnetics.
22	power	ETN_3V3				+3.3V analog power supply output to magnetics
23	analog	ETN_RXN				Receive Data Negative: 100Base-TX or 10Base-T differential receive input from magnetics.
24	3V3	#ETN_LED1				Active low - output is driven active whenever the device detects a valid link, and blinks indicating activity.
25	analog	ETN_RXP				Receive Data Positive: 100Base-TX or 10Base-T differential receive input from magnetics.
26	GND	GND				
USB-HOST						
27	3V3	USBH_VBUSEN			47K-PU	not connected to any other pin
28	3V3	#USBH_OC	JTAG_RTCK		GPIO4_20 47K-PU	Active low over-current indicator input connected to a GPIO.
29	analog	USBH_DM	USB1DM			D- pin of the USB cable
30	NC					not connected
31	analog	USBH_DP	USB1DP			D+ pin of the USB cable
32	GND	GND				
USB-OTG / 2nd CAN						
33	3V3	USBOTG_ID	USB0ID	PWM2 USB1_OVERCURRENT	GPIO3_18	ID pin of the USB cable. For an A-Device ID is grounded. For a B-Device ID is floated.
34	3V3	USBOTG_VBUSEN			47K-PU	not connected to any other pin
35	analog	USBOTG_DM	USB0DM			D- pin of the USB cable
36	NC	#USBOTG_OC				not connected
37	analog	USBOTG_DP	USB0DP			D+ pin of the USB cable
38	power	USBOTG_VBUS	VDD5V			
39	GND	GND				
I2C						
40	3V3	I2C_DATA	I2C0_SDA	TIMROT_ROTARYB DUART_TX	GPIO3_25 1K-PU	I2C Data
41	3V3	I2C_CLK	I2C0_SCL	TIMROT_ROTARYA DUART_RX	GPIO3_24 10K-PU	I2C Clock

PIN	Type	Function	i.MX28 Pad Name	Alternate functions	GPIO	Description (refer to i.MX28 manuals for details)
PWM						
42	3V3	PWM	PWM0	I2C1_SCL DUART_RX	GPIO3_16	PWM Output
1-WIRE						
43	3V3	OWDAT	SSP0_DATA7	SSP2_SCK	GPIO2_7	The i.MX28 has no 1-Wire controller – a GPIO is used here instead. 1-Wire bus. Requires an external pull-up resistor. The recommended resistor is specified by the generic 1-Wire device used in a given system.
CSPI – Configurable Serial Peripheral Interface						
44	NC					not connected
45	NC					not connected
46	NC					not connected
47	NC					not connected
48	NC					not connected
49	NC					not connected
50	GND	GND				
SD – Secure Digital Interface 1						
51	3V3	SD1_CD	SSP0_DETECT		GPIO2_9	SD Card Detect – connected to a GPIO
52	3V3	SD1_D[0]	SSP0_DATA0		GPIO2_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	3V3	SD1_D[1]	SSP0_DATA1		GPIO2_1	
54	3V3	SD1_D[2]	SSP0_DATA2		GPIO2_2	
55	3V3	SD1_D[3]	SSP0_DATA3		GPIO2_3	
56	3V3	SD1_CMD	SSP0_CMD		GPIO2_8	SD Command bidirectional signal
57	3V3	SD1_CLK	SSP0_SCK		GPIO2_10	SD Output Clock.
58	GND	GND				
1st UART						
59	3V3	TXD	AUART0_RTS	AUART4_TX DUART_TX	GPIO3_3	Debug UART Transmit Data output signal
60	3V3	RXD	AUART0_CTS	AUART4_RX DUART_RX	GPIO3_2	Debug UART Receive Data input signal
61	3V3	RTS/CTS IN	AUART0_RX	I2C0_SCL DUART_CTS	GPIO3_0	Debug UART RTS/CTS handshake input signal (not available on version 2 - TX28-4020 and TX28-4021)
62	3V3	CTS/RTS OUT	AUART0_TX	I2C0_SDA DUART_RTS	GPIO3_1	Debug UART RTS/CTS handshake output signal (not available on version 2 - TX28-4020 and TX28-4021)
2nd UART						
63	3V3	TXD	AUART1_TX	SSP3_CARD_DETECT PWM_1	GPIO3_5	Application UART 1 Transmit Data output signal
64	3V3	RXD	AUART1_RX	SSP2_CARD_DETECT PWM_0	GPIO3_4	Application UART 1 Receive Data input signal
65	NC					not connected
66	NC					not connected
3rd UART						
67	NC					not connected
68	NC					not connected
69	NC					not connected
70	NC					not connected
71	GND	GND				

PIN	Type	Function	i.MX28 Pad Name	Alternate functions	GPIO	Description (refer to i.MX28 manuals for details)
KEYPAD / 1st CAN						
72	NC					not connected
73	NC					not connected
74	NC					not connected
75	NC					not connected
76	NC					not connected
77	NC					not connected
78	NC					not connected
79	NC					not connected
80	NC					not connected
81	NC					not connected
82	GND	GND				
SSI 1 - Serial Audio Port 1						
83	3V3	SSI1_INT	SAIF0_MCLK	PWM_3 AUART4_CTS	GPIO3_20	GPIO
84	3V3	SSI1_RXD	SAIF1_SDATA0	PWM_7 SAIF0_SDATA1	GPIO3_26	Serial Audio Interface 0 serial data line 1
85	3V3	SSI1_TXD	SAIF0_SDATA0	PWM_6 AUART4_TX	GPIO3_23	Serial Audio Interface 0 serial data line 0
86	3V3	SSI1_CLK	SAIF0_BITCLK	PWM_5 AUART4_RX	GPIO3_22	Serial Audio Interface 0 serial bit clock
87	3V3	SSI1_FS	SAIF0_LRCLK	PWM_4 AUART4_RTS	GPIO3_21	Serial Audio Interface 0 left/right clock
88	GND	GND				
SSI 2 - Serial Audio Port 2						
89	NC					not connected
90	NC					not connected
91	NC					not connected
92	NC					not connected
93	NC					not connected
94	GND	GND				
Secure Digital Interface 2						
95	NC					not connected
96	NC					not connected
97	NC					not connected
98	NC					not connected
99	NC					not connected
100	NC					not connected
101	NC					not connected
102	GND	GND				
Synchronous Serial Port 2 instead of the standard CMOS Sensor Interface						
103	3V3		SSP0_DATA4	SSP2_D0	GPIO2_4	

PIN	Type	Function	i.MX28 Pad Name	Alternate functions	GPIO	Description (refer to i.MX28 manuals for details)
104	NC					not connected
105	NC					not connected
106	3V3		SSP2_SS0	AUART3_TX SAIF1_SDATA2	GPIO2_19	
107	3V3		SSP2_SS1	SSP2_D1 USB1_OVERCURRENT	GPIO2_20	
108	3V3		SSP2_SS2	SSP2_D2 USB0_OVERCURRENT	GPIO2_21	
109	NC					not connected
110	NC					not connected
111	GND	GND				
112	3V3		SSP2_MISO	AUART3_RX SAIF1_SDATA1	GPIO2_18	
113	3V3		SSP2_MOSI	AUART2_TX SAIF0_SDATA2	GPIO2_17	
114	3V3		SSP2_SCK	AUART2_RX SAIF0_SDATA1	GPIO2_16	
115	3V3		PWM1	CONNECTED TO PIN 15	GPIO3_17	Ethernet PHY reset – active low output signal. This pin is hard wired to the onboard Ethernet PHY and provides a fixed function.
116	GND	GND				

LCD Controller and Smart LCD Controller

117	3V3	LD0	LCD_D00	ETM_DA0	GPIO1_0 57K-PD	Boot mode selection at startup: BM0 (47K-PU if BOOTMODE=L) LCD Data Bus
118	3V3	LD1	LCD_D01	ETM_DA1	GPIO1_1 47K-PD	Boot mode selection at startup: BM1 LCD Data Bus
119	3V3	LD2	LCD_D02	ETM_DA2	GPIO1_2 57K-PU	Boot mode selection at startup: BM2 (10K-PD if BOOTMODE=L) LCD Data Bus
120	3V3	LD3	LCD_D03	ETM_DA3 ETM_DA8	GPIO1_3 57K-PD	Boot mode selection at startup: BM3 (47K-PU if BOOTMODE=L) LCD Data Bus
121	3V3	LD4	LCD_D04	ETM_DA4 ETM_DA9	GPIO1_4 47K-PD	Boot mode selection at startup: VOLTAGE SELECTOR LCD Data Bus
122	3V3	LD5	LCD_D05	ETM_DA5	GPIO1_5 47K-PD	Boot mode selection at startup: ETM ENABLE LCD Data Bus
123	3V3	LD6	LCD_D06	ETM_DA6	GPIO1_6	LCD Data Bus
124	3V3	LD7	LCD_D07	ETM_DA7	GPIO1_7	LCD Data Bus
125	3V3	LD8	LCD_D08	ETM_DA8 ETM_DA3	GPIO1_8	LCD Data Bus
126	3V3	LD9	LCD_D09	ETM_DA9 ETM_DA4	GPIO1_9	LCD Data Bus
127	3V3	LD10	LCD_D10	ETM_DA10	GPIO1_10	LCD Data Bus
128	3V3	LD11	LCD_D11	ETM_DA11	GPIO1_11	LCD Data Bus
129	GND	GND				
130	3V3	LD12	LCD_D12	ETM_DA12	GPIO1_12	LCD Data Bus
131	3V3	LD13	LCD_D13	ETM_DA13	GPIO1_13	LCD Data Bus
132	3V3	LD14	LCD_D14	ETM_DA14	GPIO1_14	LCD Data Bus
133	3V3	LD15	LCD_D15	ETM_DA15	GPIO1_15	LCD Data Bus
134	3V3	LD16	LCD_D16	ETM_DA7	GPIO1_16	LCD Data Bus
135	3V3	LD17	LCD_D17	ETM_DA6	GPIO1_17	LCD Data Bus
136	3V3	LD18	LCD_D18	ETM_DA5	GPIO1_18	LCD Data Bus
137	3V3	LD19	LCD_D19	ETM_DA4	GPIO1_19	LCD Data Bus
138	3V3	LD20	LCD_D20	ENET1_1588_EVENT2_O ETM_DA3	GPIO1_20	LCD Data Bus
139	3V3	LD21	LCD_D21	ENET1_1588_EVENT2_IN ETM_DA2	GPIO1_21	LCD Data Bus
140	3V3	LD22	LCD_D22	ENET1_1588_EVENT3_O ETM_DA1	GPIO1_22	LCD Data Bus
141	3V3	LD23	LCD_D23	ENET1_1588_EVENT3_IN ETM_DA0	GPIO1_23	LCD Data Bus

PIN	Type	Function	i.MX28 Pad Name	Alternate functions	GPIO	Description (refer to i.MX28 manuals for details)
142	GND	GND				
143	3V3	HSYNC	LCD_WR_RWN	LCD_HSYNC ETM_TCLK	GPIO1_25	
144	3V3	VSYNC	LCD_RD_E	LCD_VSYNC ETM_TCTL	GPIO1_24	
145	3V3	OE_ACD	LCD_CS	LCD_ENABLE	GPIO1_27	
146	3V3	LSCLK	LCD_RS	LCD_DOTCLK	GPIO1_26 47K-PU	Boot mode selection at startup: OTP / RESISTOR LCD Dotclock
147	GND	GND				

Module Specific Signals

148	3V3	GPIO	SSP0_DATA5	SSP2_D3	GPIO2_5	
149	3V3	GPIO	SSP0_DATA6	SSP2_CMD	GPIO2_6	
150	3V3	GPIO	LCD_RESET	LCD_VSYNC	GPIO3_30	
151	3V3	GPIO	GPMI_RDY1	SSP1_CMD	GPIO0_21	CONNECTED TO PIN 159
152	NC					not connected
153	3V3	GPIO	GPMI_CE1N	SSP3_D3	GPIO0_17	CONNECTED TO PIN 158
154	NC					not connected
155	NC					not connected
156	NC					not connected
157	NC					not connected
158	3V3	GPIO	GPMI_CE1N	SSP3_D3	GPIO0_17	CONNECTED TO PIN 153
159	3V3	GPIO	GPMI_RDY1	SSP1_CMD	GPIO0_21	CONNECTED TO PIN 151
160	GND	GND				
161	3V3	D[0]	GPMI_D00			Fixed function used for NAND flash
162	3V3	D[1]	GPMI_D01			Fixed function used for NAND flash
163	3V3	D[2]	GPMI_D02			Fixed function used for NAND flash
164	3V3	D[3]	GPMI_D03			Fixed function used for NAND flash
165	3V3	D[4]	GPMI_D04			Fixed function used for NAND flash
166	3V3	D[5]	GPMI_D05			Fixed function used for NAND flash
167	3V3	D[6]	GPMI_D06			Fixed function used for NAND flash
168	3V3	D[7]	GPMI_D07			Fixed function used for NAND flash
169	NC					not connected
170	NC					not connected
171	GND	GND				
172	NC					not connected
173	NC					not connected
174	NC					not connected
175	NC					not connected
176	NC					not connected
177	NC					not connected
178	NC					not connected
179	3V3		GPMI_CLE			Fixed function GPMI_CLE used for NAND flash

PIN	Type	Function	i.MX28 Pad Name	Alternate functions	GPIO	Description (refer to i.MX28 manuals for details)
180	3V3		GPMI_ALE			Fixed function GPMI_ALE used for NAND flash
181	3V3		GPMI_WRN			Fixed function GPMI_WRN used for NAND flash
182	3V3		GPMI_RDN			Fixed function GPMI_RDN used for NAND flash
183	GND	GND				
184	NC					not connected
185	analog	XN	LRADC4			Touscreen ADC input channels
186	analog	XP	LRADC2			
187	analog	YN	LRADC5			
188	analog	YP	LRADC3			
189	analog	WIPER	LRADC6			
190	analog		LRADC0			General purpose measurements channels
191	analog		LRADC1			
192	analog		HSADC0			
193	power		BATTERY			
194						
195						
196						
197	NC					not connected
198	3V3		ENET_MDC			Fixed function ENET_MDC used for Ethernet PHY
199	3V3		ENET0_MDIO		1K-PU	Fixed function ENET0_MDIO used for Ethernet PHY
200	GND	GND	GND			

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