Zephyr Engineering Inc.

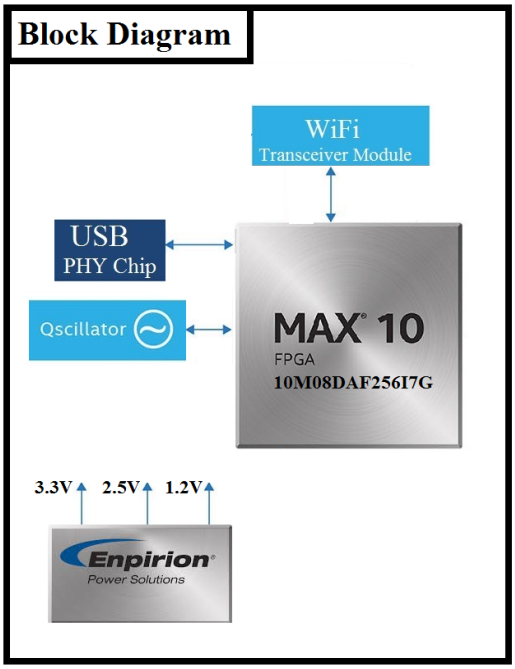
MAX10 System on Module

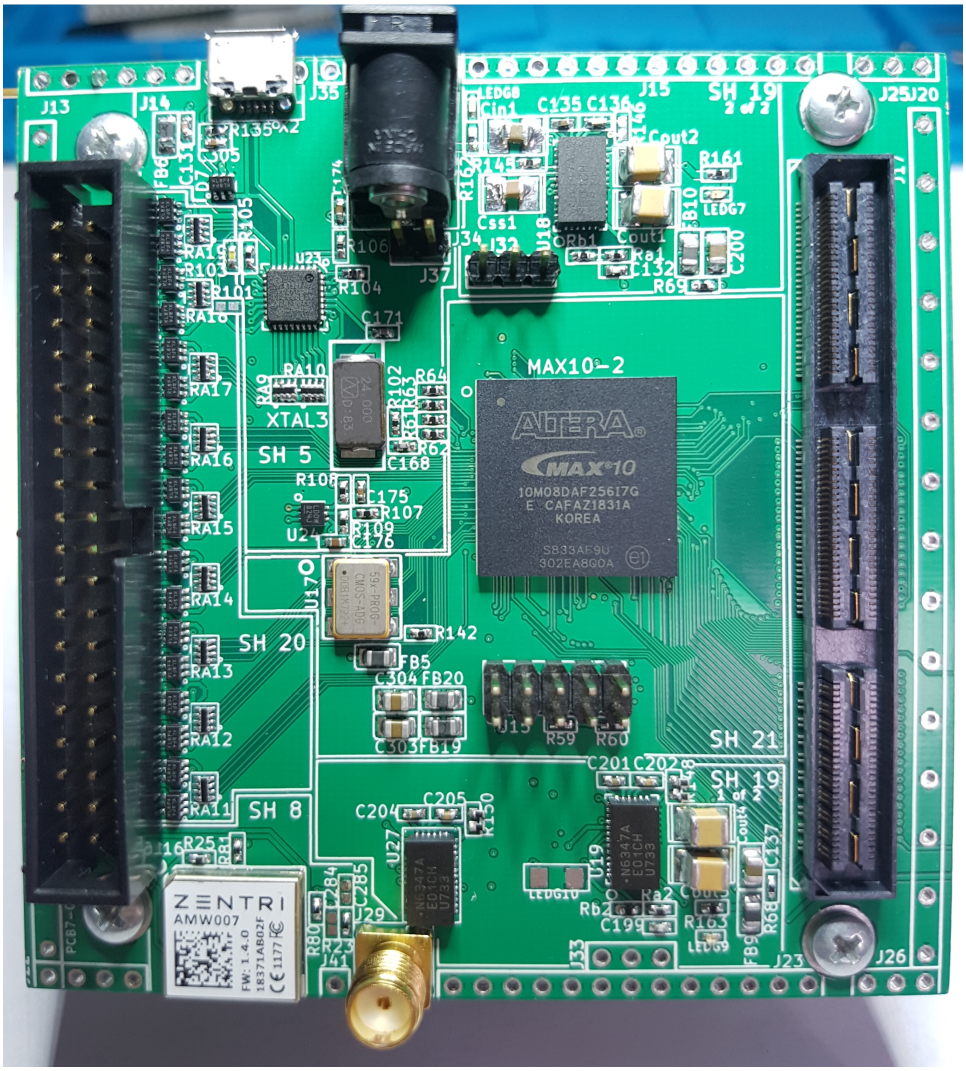
(For use as a Production Module and/or Development Kit with built in USB and WiFi)

FALCON nano ™

User's Manual / Datasheet MAX10-SoM

Block Diagram





Assembled in USA
with
ISO-9001 and AS9100
Quality Management Processes

Contents

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1.0 Introduction

The MAX10 System on Module, part number MAX10-SoM, is a board level solution for applications which require an FPGA. The MAX10-SoM provides all the functionality of the Intel 10M08DAF256I7G. It is suitable for both development work on a bench top or to be embedded into products for production.

Because the MAX10-SoM has built in clocks, power supplies, USB, WiFi and connectors, it can save system and design engineers weeks or months of development time. With a temperature rating of -40~185°F (-40 ~+85° C), specific applications include: industrial IoT, cubesats, automotive (Grade 3 & 4), drones, etc.

2.0 Features

Intel MAX10 10M08DAF256I7G (with options for other versions):
- programmable in Quartus Prime
- 8k logic elements (with options for 2k or 50k)
- 38k bits RAM
- Analog I/O

USB 2.0
WiFi 802.11b/g/n
Connector, 40 pin header
Connector, 172 pin HSMC
Power supplies, 3.3V, 2.5V, 1.2V
Low transmission power consumption for battery life
FCC and IC Certification (other certifications available upon request)

3.0 Applications

Internet of Things (IoT)
Drones
Mobile devices
Smart metering
Home automation and security
Commercial security and automation
Factory, petrochemical and industrial
Biomedical telemetry
Hospitals and health care facilities
Satellite (including geostationary, LEO, cubesat, nanosat and picosat)
Scientific and industrial telemetry
Machine-to-Machine (M2M) networks
Smart cities

3.1

Functional Block Diagram of Sample Applications

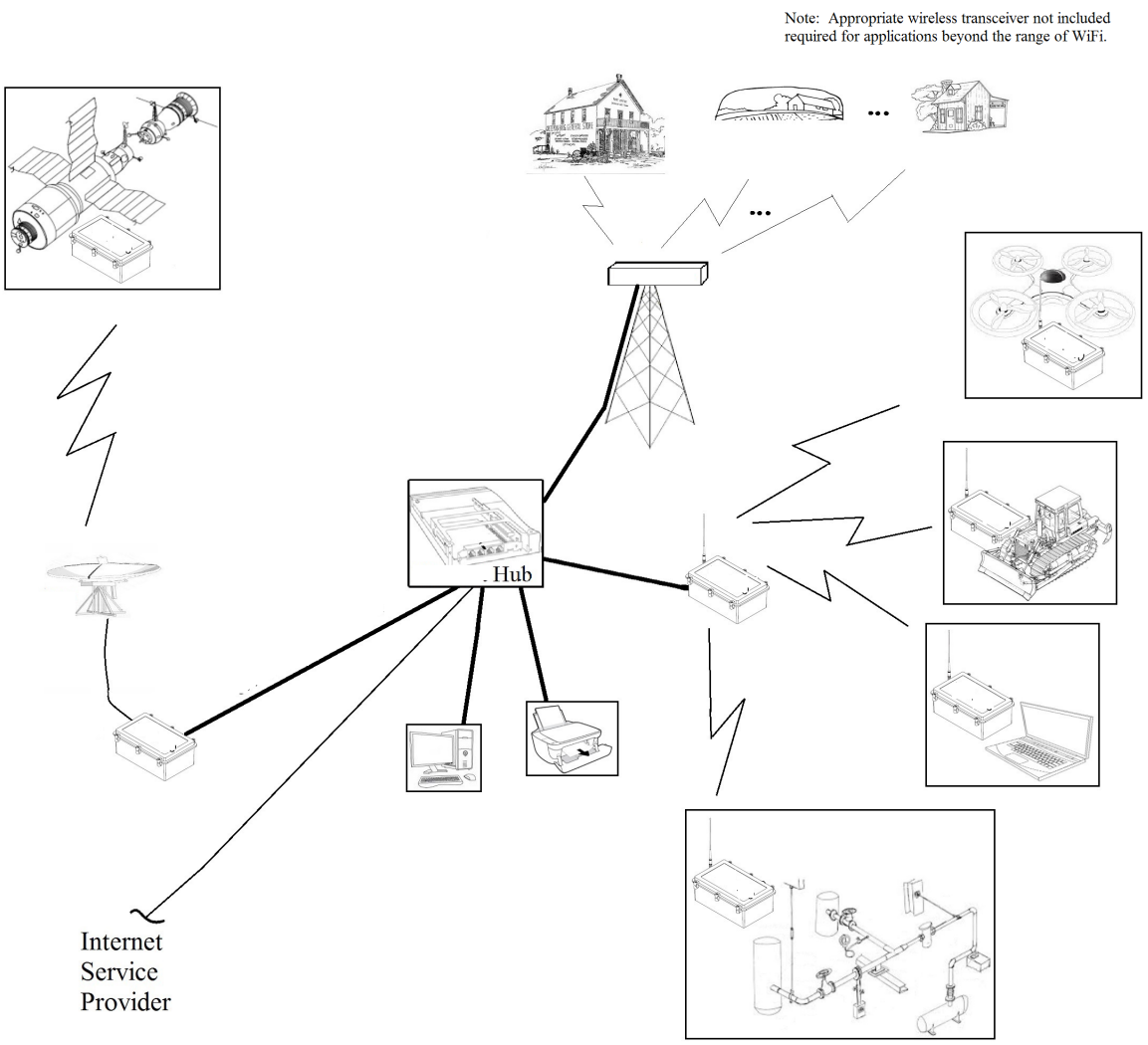
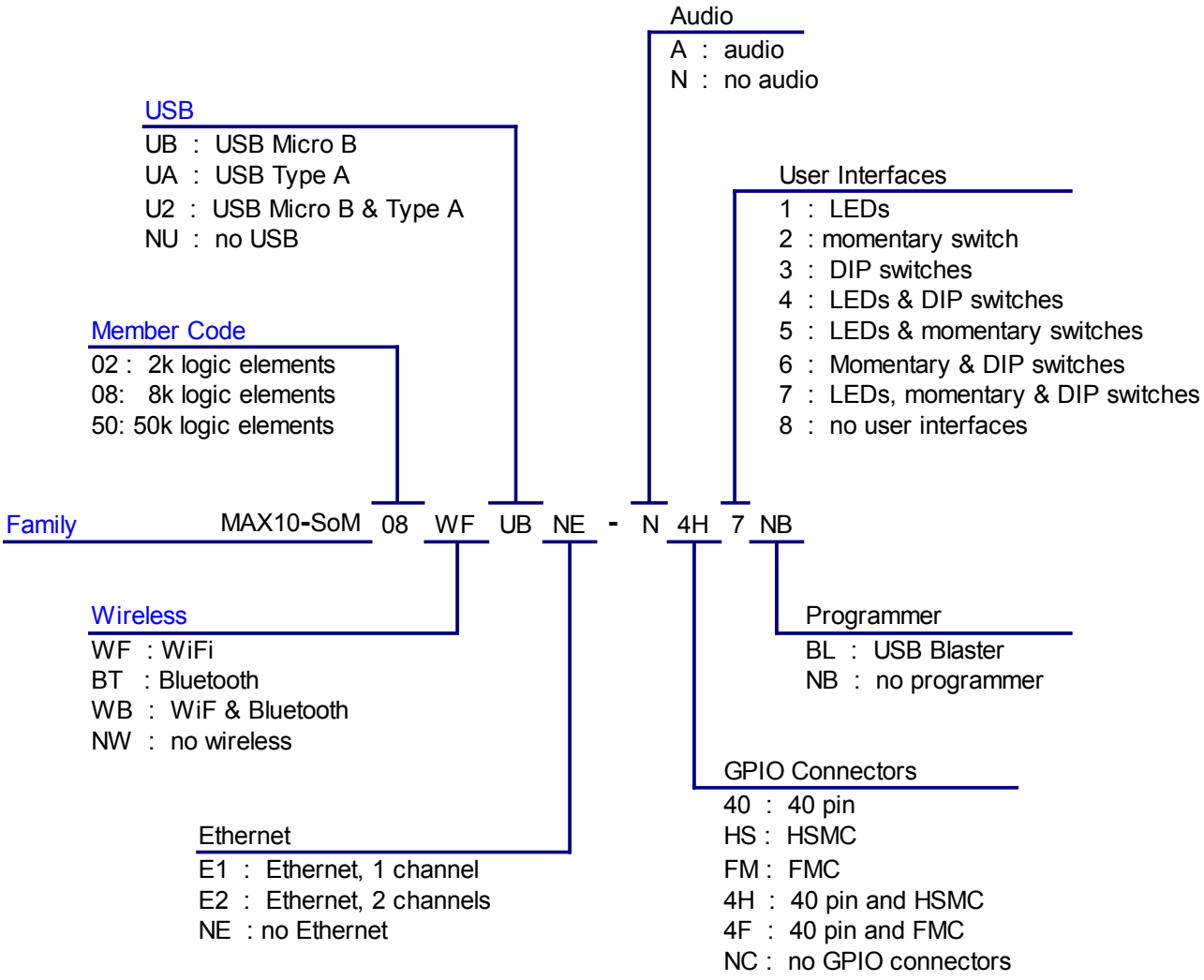


Illustration 1: Functional Block Diagram of Sample Applications

4.0 MAX10-SoM Part Numbers

Sample Part Number and Available Options for the MAX10-SoM.



5.0 Customization (Hardware and/or Software)

Zephyr Engineering Inc and Falcon Nano Inc can customize the MAX10-SoM hardware or develop software to meet your specific requirements. Contact your local distributor, Zephyr or Falcon Nano.

6.0 Compatibility with Intel PSG Daughter Cards

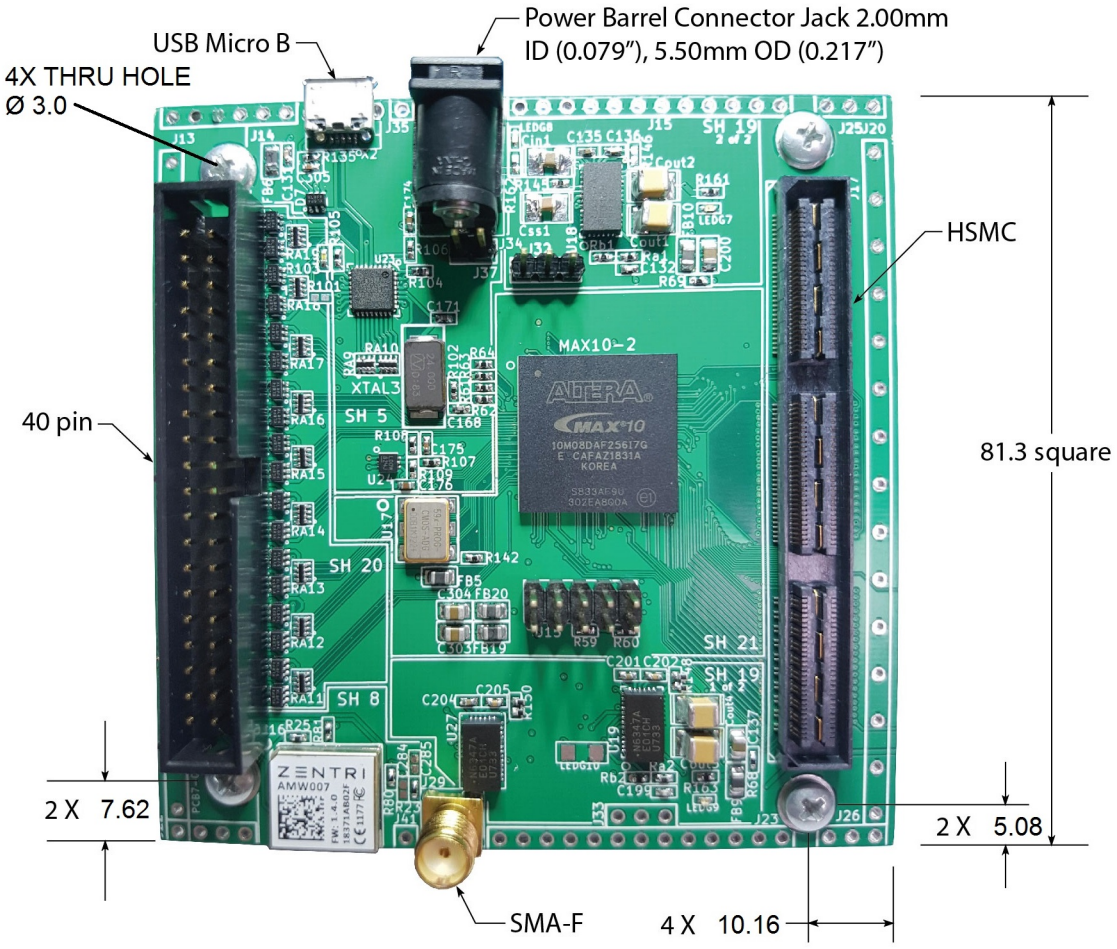
The MAX10-SoM is hardware compatible with the following Intel PSG (Altera) daughter cards:

Product Name	Distributor/ Manufacturer	Link for more details
Servo Motor Kit	Arrow/ Terasic	https://www.arrow.com/en/products/p0288/terasic-technologies
SDI-HSMC Card	Arrow/ Terasic	https://www.arrow.com/en/products/p0498/terasic-technologies
AD/DA Data Conversion Card	Arrow/ Terasic	https://www.arrow.com/en/products/p0003-hsmc/terasic-technologies
Highspeed AD/DA Card	Arrow/ Terasic	https://www.arrow.com/en/products/p0003/terasic-technologies
DUAL XAUI TO SFP+ HSMC BOARD	Arrow/ Terasic	https://www.arrow.com/en/products/p0092/terasic-technologies
Transceiver Serial Digital Interface HSMC Board	Arrow/ Terasic	https://www.arrow.com/en/products/p0039/terasic-technologies
HSMC Debug and Loopback Connector Package	Arrow/ Terasic	https://www.arrow.com/en/products/p0057/terasic-technologies
HSMC to Santa Cruz/USB/Mictor Daughter Card	Arrow/ Terasic	https://www.arrow.com/en/products/p0006/terasic-technologies
HSMC AR Radio Daughter Card	Arrow/ Terasic	https://www.arrow.com/en/products/p0204/terasic-technologies
8 Mega Pixel Digital Camera Board with GPIO Interface	Terasic	https://www.intel.com/content/www/us/en/programmable/solutions/partners/partner-profile/terasic-inc-/board/8-mega-pixel-digital-camera-board-with-gpio-interface.html
SATA/SAS HSMC Card	Arrow/ Terasic	https://www.arrow.com/en/products/p0053/terasic-technologies
GPIO-HSTC Card	Terasic	https://www.terasic.com.tw/cgi-bin/page/archive.pl?Language=English&CategoryNo=67&No=322
Multi-Touch LCD Module Second Edition (MTL2)	Terasic	https://www.terasic.com.tw/cgi-bin/page/archive.pl?Language=English&CategoryNo=68&No=989
Aptina Sensor Adapter Card (AHA-HSMC)	Terasic	https://www.terasic.com.tw/cgi-bin/page/archive.pl?Language=English&CategoryNo=68&No=625
CLR-HSMC Camera Link Receiver Daughter Card	Terasic	https://www.terasic.com.tw/cgi-bin/page/archive.pl?Language=English&CategoryNo=68&No=588
IEEE1588GE Card	Macnica, Inc.	https://www.intel.com/content/www/us/en/programmable/solutions/partners/partner-profile/macnica--inc-/board/ieee1588ge-card.html

7.0 Specifications

FPGA: Intel PSG 10M08DAF256I7G (unless specified otherwise, see *4.0 MAX10-SoM Part Numbers* above for alternatives.)
Power Systems: Enpirion EN6347AQ. 5.0, 3.3, 2.5 and 1.2 VDC
Input Power: 2.5 to 6.6 VDC, 4 Amp (max continuous operating current), barrel connector jack 2.00 mm ID, 5.50 mm OD.
Operating Temp: -40C ~ +85C (-40F~185F) ambient
Size: 81.3x81.3 mm (3.20x3.20 inch). PCB thickness 1.57 mm (0.62 inch)

All dimensions are in mm unless specified otherwise.



8.0 Pin Outs

The pin outs listed are for the MAX10-SoM with 8k logic elements. Consult factory for the 2k and 50k logic element versions.

8.1 40 Pin Connector - JP2

40 Pin Connector - JP2

40 pin connector	MAX10 or other	Description	Bank	40 pin connector	MAX10 or other	Description	Bank
1	L3	IO,CLK0p,DIFFOUT_L18p	2	2	P1	IO,DPCLK1,DIFFOUT_L22p	2
3	M3	IO,CLK0n,DIFFOUT_L18n	2	4	N1	IO	2
5	L6	IO,DIFFOUT_L25p	2	6	M2	IO,DIFFOUT_L21n	2
7	L2	IO,DIFFOUT_L21p	2	8	N2	IO,DPCLK0,DIFFOUT_L22n	2
9	L1	IO,DIFFOUT_L19n	2	10	J6	IO,CLK1n,DIFFOUT_L20n	2
11	VCC5			12	GND		
13	K5	IO,DIFFOUT_L25n	2	14	K2	IO,DIFFOUT_L19p	2
15	H6	IO,DIFFOUT_L14p	1	16	J5	IO,DIFFOUT_L14n	1
17	J3	IO,DIFFOUT_L16n	1	18	J2	IO,DIFFOUT_L16p	1
19	N4	IO,PLL_L_CLKOUTp,DIFFOUT_L27p	2	20	H5	IO,ADC1IN3,DIFFOUT_L3n	1
21	N3	IO,PLL_L_CLKOUTn,DIFFOUT_L27n	2	22	G5	IO,ADC1IN4,DIFFOUT_L3p	1
23	F5	IO,ADC1IN1,DIFFOUT_L1n	1	24	F4	IO,ADC1IN2,DIFFOUT_L1p	1
25	G2	IO,ADC1IN5,DIFFOUT_L5n	1	26	F1	IO,ADC1IN6,DIFFOUT_L5p	1
27	E3	IO,ADC1IN11,DIFFOUT_L4n	1	28	F2	IO,ADC1IN12,DIFFOUT_L4p	1
29	VCC3P3			30	GND		
31	E1	IO,ADC1IN7,DIFFOUT_L7n	1	32	D1	IO,ADC1IN8,DIFFOUT_L7p	1
33	C2	IO,ADC1IN13,DIFFOUT_L6n	1	34	C1	IO,ADC1IN10,DIFFOUT_L8p	1
35	B1	IO,ADC1IN15,DIFFOUT_L8n	1	36	B2	IO,ADC1IN14,DIFFOUT_L6p	1
37	C4	IO,ADC1IN9,DIFFOUT_L2n	1	38	C3	IO,ADC1IN16,DIFFOUT_L2p	1
39	A2	IO,DIFFOUT_T25n	8	40	A3	IO,DIFFOUT_T25p	8

8.2 HSMC Connector - J17, Pins 1-40

HSMC Connector - J17, Pins 1-40

HSMC connector	MAX10 or other	Description	Bank	HSMC connector	MAX10 or other	Description	Bank
1	nc			2	nc		
3	nc			4	nc		
5	nc			6	nc		
7	nc			8	nc		
9	nc			10	nc		
11	nc			12	nc		
13	nc			14	nc		
15	nc			16	nc		
17	nc			18	nc		
19	nc			20	nc		
21	nc			22	nc		
23	nc			24	nc		
25	nc			26	nc		
27	nc			28	nc		
29	nc			30	A10	IO	7
31	nc			32	A14	IO	7
33	M10	IO,DIFFOUT_B27p	4	34	L10	IO,DIFFOUT_B27p	4
35	nc			36	nc		
37	nc			38	nc		
39	G11	IO,DPCLK3,DIFFOUT_R26p	6	40	G12	IO,DPCLK2,DIFFOUT_R26n	6

8.3 HSMC Connector - J17, Pins 41-100

HSMC Connector - J17, Pins 41-100

HSMC connector	MAX10 or other	Description	Bank	HSMC connector	MAX10 or other	Description	Bank
41	N5	IO,DIFFOUT_B1p	3	42	H11	IO,DIFFOUT_R20p	6
43	P4	IO,DIFFOUT_B1n	3	44	H12	IO,DIFFOUT_R20n	6
45	VCC3P3			46	VCC6		
47	L7	IO,DIFFOUT_B3p	3	48	G14	IO,DIFFOUT_R22p	6
49	M6	IO,DIFFOUT_B3n	3	50	G15	IO,DIFFOUT_R22n	6
51	VCC3P3			52	VCC6		
53	P5	IO,DIFFOUT_B5p	3	54	G16	IO,DIFFOUT_R23p	6
55	R4	IO,DIFFOUT_B5n	3	56	F16	IO,DIFFOUT_R23n	6
57	VCC3P3			58	VCC6		
59	R5	IO,DIFFOUT_B7p	3	60	F14	IO,DIFFOUT_R27p	6
61	R6	IO,DIFFOUT_B7n		62	E14	IO,DIFFOUT_R27n	6
63	VCC3P3			64	VCC6		
65	L8	IO,DIFFOUT_B9p	3	66	E15	IO,DIFFOUT_R28p	6
67	M7	IO,DIFFOUT_B9n	3	68	E16	IO,DIFFOUT_R28n	6
69	VCC3P3			70	VCC6		
71	P6	IO,DIFFOUT_B10p	3	72	D15	IO,DIFFOUT_R34p	6
73	R7	IO,DIFFOUT_B10n	3	74	C15	IO,DIFFOUT_R34n	6
75	VCC3P3			76	VCC6		
77	P8	IO,DIFFOUT_B12p	3	78	D16	IO,DIFFOUT_R18p	6
79	P9	IO,DIFFOUT_B12n	3	80	C16	IO,DIFFOUT_R18n	6
81	VCC3P3			82	VCC6		
83	M9	IO,DIFFOUT_B14p	3	84	K15	IO,DIFFOUT_R15n	6
85	M8	IO,DIFFOUT_B14n	3	86	H16	IO,DIFFOUT_R17n	6
87	VCC3P3			88	VCC6		
89	P13	IO,DIFFOUT_B21n	4	90	J14	IO,DIFFOUT_R15p	6
91	R11	IO,DIFFOUT_B19n	4	92	H15	IO,DIFFOUT_R17p	6
93	VCC3P3			94	VCC6		
95	D14	IO,PLL_R_CLKOUTp,DIFFOUT_R33p	6	96	J11	IO,CLK2p,DIFFOUT_R14p	6
97	C14	IO,PLL_R_CLKOUTn,DIFFOUT_R33n	6	98	J12	IO,CLK2n,DIFFOUT_R14n	6
99	VCC3P3			100	VCC6		

8.4 HSMC Connector - J17, Pins 101-160

HSMC Connector - J17, Pins 101-160

HSMC connector	MAX10 or other	Description	Bank	HSMC connector	MAX10 or other	Description.	Bank
101	R8	IO,DIFFOUT_B11p	3	102	L11	IO,DIFFOUT_R3p	5
103	T8	IO,DIFFOUT_B11n	3	104	L12	IO,DIFFOUT_R3n	5
105	VCC3p3			106	VCC6		
107	R9	IO,DIFFOUT_B13p	3	108	L16	IO,DIFFOUT_R11n	5
109	T9	IO,DIFFOUT_B13n	3	110	M16	IO,DIFFOUT_R11p	5
111	VCC3p3			112	VCC6		
113	R1	IO,DIFFOUT_B2p	3	114	L15	IO,DIFFOUT_R10n	5
115	P2	IO,DIFFOUT_B2n	3	116	K14	IO,DIFFOUT_R10p	5
117	VCC3p3			118	VCC6		
119	R2	IO,DIFFOUT_B4p	3	120	M14	IO,DIFFOUT_R6n	5
121	R3	IO,DIFFOUT_B4n	3	122	M15	IO,DIFFOUT_R6p	5
123	VCC3p3			124	VCC6		
125	T2	IO,DIFFOUT_B6p	3	126	P15	IO,DIFFOUT_R5n	5
127	T3	IO,DIFFOUT_B6n	3	128	N14	IO,DIFFOUT_R5p	5
129	VCC3p3			130	VCC6		
131	T4	IO,DIFFOUT_B8p	3	132	R14	IO,DIFFOUT_R1n	5
133	T5	IO,DIFFOUT_B8n	3	134	P14	IO,DIFFOUT_R1p	5
135	VCC3p3			136	VCC6		
137	P11	IO,DIFFOUT_B18p	4	138	P16	IO,DIFFOUT_R7n	5
139	M11	IO,DIFFOUT_B27n	4	140	N16	IO,DIFFOUT_R7p	5
141	VCC3p3			142	VCC6		
143	R12	IO,DIFFOUT_B19p	4	144	T15	IO,DIFFOUT_R2n	5
145	P10	IO,DIFFOUT_B18n	4	146	T14	IO,DIFFOUT_R2p	5
147	VCC3p3			148	VCC6		
149	P12	IO,DIFFOUT_B21p	4	150	K11	IO,DIFFOUT_R8p	5
151	L9	IO,DIFFOUT_B20p	4	152	K12	IO,DIFFOUT_R8n	5
153	VCC3p3			154	VCC6		
155	R10	IO,DIFFOUT_B16p	3	156	J15	IO,CLK3p,DIFFOUT_R16p	6
157	T11	IO,DIFFOUT_B16n	3	158	J16	IO,CLK3n,DIFFOUT_R16n	6
159	VCC3p3			160	VCC6		

8.5 HSMC Connector - J17, Pins 161-172

HSMC Connector - J17, Pins 161-172

HSMC connector	MAX10 or other	Description.	Bank
161	GND		
162	GND		
163	GND		
164	GND		
165	GND		
166	GND		
167	GND		
168	GND		
169	GND		
170	GND		
171	GND		
172	GND		

8.6 LEDs - LED1 & LED2

LEDs - LED1 & LED2

LED1	MAX10 or other	Description	Bank	LED2	MAX10 or other	Description	Bank
1	VCCIO3p3			1	VCCIO3p3		
2	T6	IO	3	2	C10	IO,DIFFOUT_T16p	8
3	T12	IO	4	3	A12	IO,DIFFOUT_T17n	8
4	R15	IO	5	4	A11	IO,DIFFOUT_T17p	8

8.7 DIP switches - S1

DIP switches - S1

DIP switches	MAX10 or other	Description.	Bank	DIP switches	MAX10 or other	Description.	Bank
1	GND			5	A9	IO,VREFB8N0	8
2	GND			6	A15	IO,VREFB7N0	7
3	GND			7	M1	IO,VREFB2N0	2
4	GND			8	B10	IO,DEV_CLRn,DIFFOUT_T16n	8

8.8 Momentary switches - SW1 & SW2

Momentary switches - SW1 & SW2

SW1	MAX10 or other	Description.	Bank	SW2	MAX10 or other	Description.	Bank
1	GND			1	GND		
2	B9	IO,DIFFOUT_T19p	8	2	A10	IO	8

8.9 USB PHY Circuit: Microchip Technology USB3300 and USB-Micro-B Connector

USB PHY Circuit: Microchip Technology USB3300 and USB-Micro-B Connector

USB PHY data	MAX10 or other	Description	Bank	USB3300	Connector, USB-MICRO-B
0	A4	IO,DIFFOUT_T26n	8	24	
1	A5	IO,DIFFOUT_T23n	8	23	
2	B6	IO,DIFFOUT_T20p	8	22	
3	C6	IO,DIFFOUT_T20n	8	21	
4	C5	IO,DIFFOUT_T22n	8	20	
5	B5	IO,DIFFOUT_T22p	8	19	
6	B4	IO,DIFFOUT_T23p	8	18	
7	B3	IO,DIFFOUT_T26p	8	17	
Reset	A8	IO,DIFFOUT_T19n	8	10	
NXTB	B8	IO,DEV_OE,DIFFOUT_T18p	8	11	
STPB	A7	IO,DIFFOUT_T21p	8	13	
DIRB	B7	IO,DIFFOUT_T18n	8	12	
CLKB	A6	IO,DIFFOUT_T21n	8	14	
D-/DM				8	2
D+/DP				7	3
ID/ID				5	4

8.10 WiFi Modules: Silicon Labs WGM160P

WiFi Modules: Silicon Labs WGM160P

WiFi	MAX10 or other	Description	Bank	WiFi Module WGM160P
UART RX	E11	IO,DIFFOUT_T1n	7	47/PE6
UART TX	C12	IO,DIFFOUT_T2n	7	46/PE7
SWDIO	E10	IO,DIFFOUT_T8n	7	45/PF1
SWCLK	F10	IO,DIFFOUT_T8p	7	44/PF0
Reset	C9	IO,DIFFOUT_T12n	8	34/RESETn
UART CTS	F11	IO,DIFFOUT_T3p	7	26/PB6
UART RTS	D12	IO,DIFFOUT_T1p	7	25/PB5
SCLK	D9	IO,DIFFOUT_T12p	8	14/PE14
CS0	E9	IO,DIFFOUT_T14n	8	16/PA0
CS1	F9	IO,DIFFOUT_T14p	8	17/PA1
DQ0	B11	IO,DIFFOUT_T15n	8	18/PA2
DQ1	B12	IO,DIFFOUT_T17n	8	19/PA3
DQ2	C13	IO,DIFFOUT_T12p	7	20/PA4
DQ3	F12	IO,DIFFOUT_T3n	7	21/PA5
DQ4	A13	IO,DIFFOUT_T10n	7	22/PB3
DQ5	B13	IO,DIFFOUT_T10p	7	24/PB4

RF1 I/O	On-chip-antenna
RF2 I/O	SMA Connector, J70

9.0 Initial Testing and Troubleshooting

Your MAX10-SoM was manufactured by AS9100 and ISO9001 processes. It was fully tested and passed a burn in process before being shipped to you. It is ready for your custom program to be downloaded and the MAX10-SoM installed into your final product. (Contact your local distributor, Zephyr Engineering or Falcon Nano if you wish to have your custom program installed in your MAX10-SoM before it is shipped to you.)

If your project is still in the development stage, we recommend the following. After removing your MAX10-SoM from it's factory box the first time, apply power. The factory program will start a self-test. You will see the user programmable LEDs of LED 1 and LED 2 cycling in a sequence of "on" for 1 second and then off followed by the adjacent LED until the pattern repeats. Once you have seen the LED 1 and LED 2 sequence properly, remove power from the MAX10-SoM. Install the MAX10-SoM 40-pin Loopback Connector Board and the MAX10-SoM HSMC Loopback Connector Board. Apply power. The factory program will perform a more advanced self-test. The factory program will be sending signals sequentially to pins and verifying receipt of those signals by other pins. The LEDs on the Connector Boards will continuously cycle through a series of LEDs on and off.

If at any point during these self-tests, the factory program detects an error, it will stop cycling the LEDs on and off. Depending on the error, the factory program may give an indication of what the problem is. See the *MAX10-SoM Look Back Connector Board Instructions* for details on further troubleshooting steps.

If your MAX10-SoM has already had your custom program installed and you suspect the MAX10-SoM hardware may not be operating properly, power off the MAX10-SoM. Apply power again. If you are still not getting the results you expect, re-install the factory program. Perform the steps listed in the paragraphs above. If the MAX10-SoM does not pass the self-tests, your MAX10-SoM may be damaged and may need to be returned for repair. Contact Zephyr Engineering or Falcon Nano.

10.0 Limited Warranty

Effective July 29, 2019

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A copy of the invoice showing the date of sale must accompany products returned for warranty repair or replacement.

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Customer shall comply with and require its employees to comply with directions set forth in instructions, manuals and customer training furnished by Seller and shall use and require its employees to follow such instructions, manuals and customer training and to use reasonable care in the use and maintenance of the Products. Customer shall not remove or permit anyone to remove any warning or instruction signs on the Products. In the event of personal injury or damage to property or business arising from the use of the Products, Customer shall within forty-eight (48) hours thereafter give Seller written notice of such injury or damage. Customer shall cooperate with Seller in investigating any such injury or damage and in the defense of any claims arising therefrom.

Falcon Nano Inc. reserves the right to change product specifications at any time without notice, including but not limited to performance, dimensions, component part numbers, manufacturing processes, test procedures, etc.

Seller provides no warranties or guaranties of merchantability or fitness for the purposes for which product is sold. Customer shall indemnify and hold Seller harmless against any claims, loss or expense for injury or damage arising from the use of the Products.

No person, including any agent, distributor, or representative of Falcon Nano Inc., is authorized to make any representation or warranty on behalf of Falcon Nano Inc. concerning any Products manufactured by Falcon Nano Inc., except to refer purchasers to this warranty. This warranty is good only to the original purchaser of the product during the warranty period as long as it is in the U.S. including Alaska, Hawaii and U.S. Territories.

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