NextFlex A15 Device Description

Document Rev 0.7.1

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Contents

1 Revision History

Table 1: Revision History

Date	Version	Description
March 2019	0.2	First Release of Document
May 2019	0.3	Document update for v4
June 2019	0.4	Update to Test Section
July 2019	0.4.1	Clean up for External Release
Aug 2019	0.4.2	Added in previous data in Appendix; Added more data and descriptions
Sept 2019	0.7.0	Preliminary Device Specifications for Engineering samples

2 About This Document

This Document is organized into chapters based on components that make up the device, the electrical and print designs, encapsulation methods, the testing protocols, and the build schedule.

The components chosen for this device are COTS, with the main IC attached in bare die form. The electrical and print designs are divided into separate subsections and include detailed information on the following:

- Functional descriptions
- Design parameters
- Screen design parameters
- Performance data tables, and recommended operating conditions*

2.1 Document Naming and Status

NextFlex uses three distinct naming conventions for this document, which reflect the maturity and status of this document and content

Table 2: Document Naming and Status

Document Name	Description
Objective Device Specification (ODS)	Applies to Document Versions up to 0.7 This Device specification contains target specifications for device development.
Preliminary Device Specification (PDS)	Applies to document versions 0.7 and up to 1.0. This device specification contains preliminary data. Supplementary data may be published by NextFlex later.
Device Specification (DS)	Applies to document versions 1.0 and higher. This device specification contains final device specifications. NextFlex reserves the right to make changes at any time without notice in order to improve design and supply the best possible device.

3 Device Specifications

Device Technical Specifications:

Table 3: Device Specifications

Microcontroller	ATmega328P
Board Power Supply (Vin on ZIF* Connector)	5-12V
Circuit Operating Voltage	5V
Regulated Supply (V+ pad)	3V-5V
Digital I/O Pins	14
PWM Pins	6
UART	1
SPI	1
I2C	1
Analog Input Pins	9
External Interrupts	2
DC Current per I/O Pin	40 mA
Flash Memory	32 KB (2 KB used by bootloader)
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

*Zero Insertion Force

4 Block Diagram

This Block Diagram illustrates the overall system design. The white arrows represent multiple signal lines. The GPIO connections are designed so that the board can fit into a 30pin Zero Insertion Force (ZIF) connector. There are 6 programming pads that require the use of a POGO Pin connector to program the device (Alternative is to program the device using the ZIF connector).

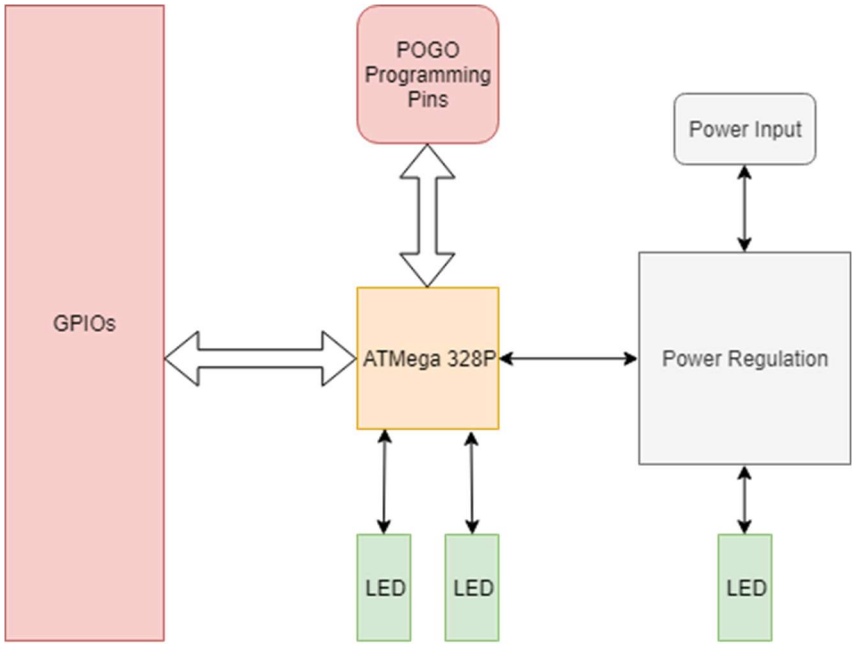

Figure 1: System Block Diagram

5 Interface Descriptions

5.1 Microcontroller

The Microcontroller used in this design is the Atmel picoPower ATmega328P. This processor is an 8-bit microcontroller based on the AVR enhanced RISC architecture, achieving close to 1MIPS per MHz.

The absolute max ratings from the **ATmega 328P Die** from the datasheet are as follows:

Table 4: ATmega 328P Die Specifications

Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Voltage on any Pin except $\overline{\text{RESET}}$ with respect to Ground	-0.5V to V_{CC}+0.5V
Voltage on $\overline{\text{RESET}}$ with respect to Ground	-0.5V to +13.0V
Maximum Operating Voltage	6.0V
DC Current per I/O Pin	40.0mA
DC Current V_{CC} and GND Pins	200.0mA

5.2 Power Management

If powered through the ZIF interface, the input supply goes through the LP2985-N linear regulator, which provides up to 150mA of 5V power to the device. Input power via the ZIF interface may be provided from 5 to 12 VDC. When powered via the ZIF interface a secondary device such as a slaved sensor can draw power from the + and – pads on the A15 device which provide a direct connection to the device ground (the – pad) and the regulated 5V supply (the + pad). Alternatively, a regulated power supply between 3V and 5V may be supplied to the device through the + and – pads with the ground being attached to the – pad and the positive voltage being supplied to the + pad. When powering the device directly through the + and – pads the power regulator is completely bypassed and does not provide any protection to the circuit from over voltage. As a result powering of the device through the + and – pads is not recommended.

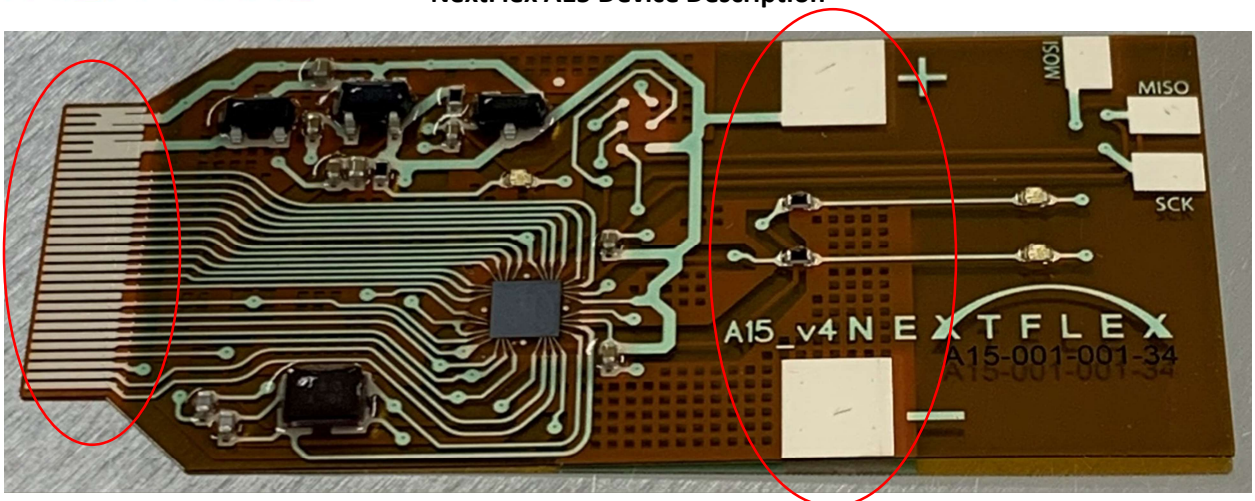

Figure 2: A15 device. Left circle is the ZIF connector portion, right is the power pad connection

Note: Never supply more than 5V through the power supply pads. This is an unregulated power point. Supplying voltages higher than 5V risks damaging the microcontroller.

5.3 Programming Pins

This device has 6 pads located at the center top of the top layer. These provide access to the VCC, GND, RESET, and serial pins of the ATmega328P microcontroller allowing the user to program the A15 device using a POGO pin programmer.

Figure 3(a) below lists the pin connections to the pads, while 3(b) shows the location on the board along with the pin numbering. Pin 1 is located at the bottom right, with Pin 6 as the top left. Details on programming the device via the pads can be found via the NextFlex programming guide.

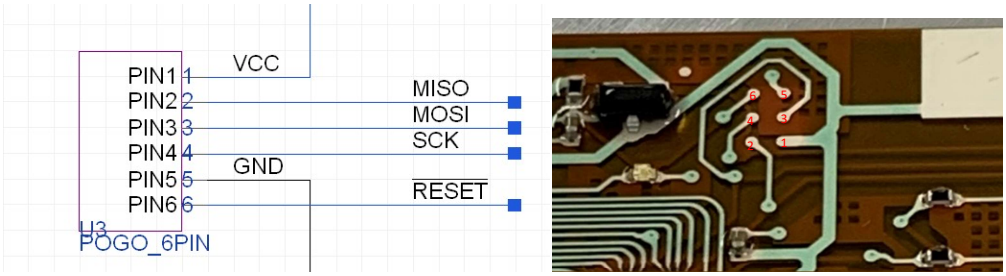

Figure 3: (a) POGO pin list; (b) pogo pin numbering and location

5.4 SPI Pads

For user convenience 3 additional pads are provided in the upper right corner of the A15 device as shown in Figure 4. These pads provide access to the MOSI, MISO and SCK pins of the SPI interface on the ATmega328p microcontroller. No chip select line is provided so any use of these pins requires either hardwiring the chip select pin on the slave device or the use of a chip select line from the ZIF interface. These pins are from top to bottom the MISO, MOSI, and SCK lines.

NOTE: The labelling on the A15 devices incorrectly labels the MOSI and MISO pads with the MOSI pad labelled as MISO and the MISO pad labelled as MOSI. The labelling of the SCK pad is correct.

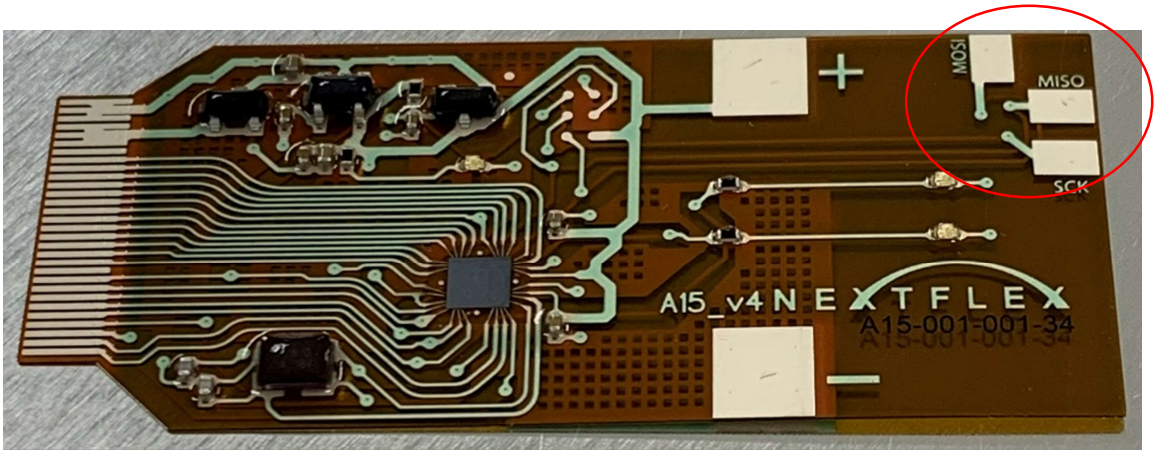

Figure 4: SPI Interface pads on A15 device

5.5 ZIF Interface

Access to the pins on the ATmega328P microcontroller is provided through Zero Insertion Force (ZIF) interface pads printed on the top layer of the A15 device. The ZIF interface is designed to connect through a standard 30 pin ZIF connector and is the recommended way to interface with the device. In addition to providing access to the I/O pins of the ATmega328p the power pins on the ZIF interface allow the user to power the device from a source providing between 5 and 12VDC. As most ZIF connectors have contacts on only a single side the device should be placed top face down (pads down) in the connector for the interface to work properly. As such, for the ZIF interface to match the pin numbers, the pins should be numbered with pin 1 starting at the bottom of the device and progressing sequentially upward as can be seen in Figure 5.

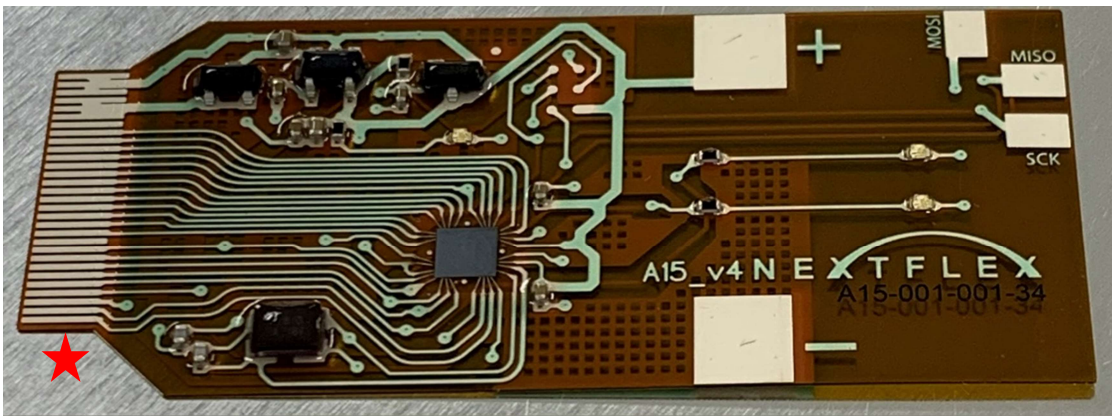

Figure 5: A15 device with Pin 1 for a face down ZIF connector marked with a red star

The table in the appendix provides a function mapping for each connection point on the ZIF interface along with the mapping of the ZIF interface pin to the functional pin in the Arduino IDE software. The pin mapping is provided for both face down and face up insertion into the ZIF connector.

6 Appendix: ZIF Interface Description Table

ZIF Connector Face Up	ZIF Connector Face Down	ATmega328	EXTINT	PCINT	ADC/AC	USART0	I2C0	SPI0	T/C #0	T/C #1	External Pads	Arduino IDE
1	30	GND									V-	
2	29	GND									V-	
3	28	GND									V-	
4	27	Vin										
5	26	Vin										
6	25	Vin										
7	24	N/C										
8	23	PD[4]		PCINT20		XCK0			T0			4
9	22	PD[3]	INT1	PCINT19					OC2B			3
10	21	PD[2]	INT0	PCINT18								2
11	20	PD[1]		PCINT17		TXD0						1
12	19	PD[0]		PCINT16		RXD0						0
13	18	PC[6]/~RESET		PCINT14								RESET
14	17	PC[5]		PCINT13	ADC5		SCL0					19
15	16	PC[4]		PCINT12	ADC4		SDA0					18
16	15	PC[3]		PCINT11	ADC3							17
17	14	PC[2]		PCINT10	ADC2							16
18	13	PC[1]		PCINT9	ADC1							15
19	12	PC[0]		PCINT8	ADC0							14
20	11	ADC7			ADC7							21
21	10	N/C										
22	9	PB[5]		PCINT5				SCK0			SCK	13
23	8	PB[4]		PCINT4				MISO0			MISO	12
24	7	PB[3]		PCINT3				MOSI0			MOSI	11
25	6	PB[2]		PCINT2				SS0			Bottom LED	10
26	5	PB[1]		PCINT1							Top LED	9
27	4	PB[0]		PCINT0					OC2A			8
28	3	PD[5]		PCINT21					OC0B	T1		5
29	2	PD[7]		PCINT23	AIN1				OC1B			7
30	1	PD[6]		PCINT22	AIN0				OC1A			6

Legend							
Power	Ground	Die Pins	Digital Interrupts	Analog Inputs	USART	SPI	Arduino Equivalent