MCU

Temperature sensor

I²C address: 0x19

U101 MCP9808

VCC_P3V3, C100 100n, GND, R100 4.7k, R101 4.7k, R102 100k

PF2_I2C1_SDA, PF3_I2C1_SCL

3.3V I2C bus

RGBCIR color sensor

VEML3328 is powered by 3.3V, but the I2C interface works on 1.8V

I²C address: 0x10

U100 VEML3328

PC2_I2C0_SDA, PC3_I2C0_SCL

C108 100n

Crypto device

I²C address: 0x58

U102 ATECC608B-MAHI-S

VCC_P3V3, VCC_P1V8, C102 100n, R104 4.7k, R105 4.7k

PC2_I2C0_SDA, PC3_I2C0_SCL

1.8V I2C bus

4-Mb (512K x 8-BIT) Serial EEPROM

U104 25CSM04

C104 100n, R106 0R

PE3_SPI0_CS_EEPROM, PA5_SPI0_MISO, PA4_SPI0_MOSI, PA6_SPI0_SCK

Leds

D100 BLUE LED	CELLULAR	R107 1k	PA0_LED0
D101 GREEN LED	CONNECTION	R110 1k	PA1_LED1
D102 YELLOW LED	DATA	R111 1k	PA2_LED2
D103 RED LED	ERROR	R112 1k	PA3_LED3
D104 YELLOW LED	USER	R113 1k	PB2_DBG1_DGI1_LED4

Buttons

PF6_RESET_SW1, PD2_DBG2_DGI0_SW0

R108 1k, R109 1k, SW100, SW101

Note that the supply voltage to the phototransistor will drop below 3.3V when running from battery and the battery voltage is low. The VCC_P3V3 voltage should be measured before measuring the phototransistor in order to calculate the correct light sensor value.

Add solder to solder-strap J101 to get AREF from AREF pin on Feather connector to PD7, AREF pin on AVR128DB48.

U103 AVR128DB48-E/6LXT

C101 100n, C103 100n, C105 100n

PA5_SPI0_MISO, PA6_SPI0_SCK, PA7_CLKO, PB0_USART3_TX, PB1_USART3_RX, PB2_DBG1_DGI1_LED4, PB3_MEASURE_EN, PB4_LOWQ_EN, PB5_SPI0_CS, PC0_USART1_TXD_CELL, PC1_USART1_RXD_CELL, PC2_I2C0_SDA

PF2_I2C1_SDA, PF1_XTAL32K2, PF0_XTAL32K1, PE3_SPI0_CS_EEPROM, PE2, PE1, PE0_VMUX_MEASURE, PD7_A5_AREF, PD6_A0_DAC, PD5_A4

PA4_SPI0_MOSI, PA3_LED3, PA2_LED2, PA1_LED1, PA0_LED0, DBG0_UPDI, PF6_RESET_SW1, PF5_USART2_RX, PF4_USART2_TX, PF3_I2C1_SCL

PC3_I2C0_SCL, PC4_CELL_CTS0, PC5_CELL_RESETN, PC6_CELL_RING0, PC7_CELL_RTS0, PD0_A1, PD2_DBG2_DGI0_SW0, PD3_A2, PD4_A3

32KHz Crystal

XC100 32.768kHz, C106 6.8p, C107 6.8p

PF0_XTAL32K1, PF1_XTAL32K2

Crystal datasheet:
Crystal = 7pF
max ESR = 70kOhm
Accuracy ±20ppm

AVR128DB48 datasheet:
Cxin = 4pF (typical value)
Cxout = 4pF (typical value)
Cl ≈ 1/((1/4pF)+ (1/4pF)) ≈ 2.0pF
Maximum Load = 8pF
Maximum ESR = 50kOhm

Estimated Cpcb = 1.0pF

Estimated load
C = 2 (Crystal- Cpara - Cpcb)
C = 2 (7pF - 2.0pF - 1.0pF)
C = 8pF

Selected in design after verification
C= 6.8pF/6.8pF

J100

USB, VCC_FEATHER, VCC_FEATHER_EN, VBAT, VBUS, F100 MC36213

PF6_RESET_SW1, PD6_A0_DAC, PD1_A1, PD3_A2, PD4_A3, PD5_A4, PD7_A5_AREF, PA6_SPI0_SCK, PA4_SPI0_MOSI, PA5_SPI0_MISO, PF5_USART2_RX, PF4_USART2_TX

VBUS_FEATHER, PB2_DBG1_DGI1_LED4, PA7_CLKO, PD2_DBG2_DGI0_SW0, PB5_SPI0_CS, PD0, PE1, PE2, PF3_I2C1_SCL, PF2_I2C1_SDA

Debugger Connections

PB1_USART3_RX, PB0_USART3_TX, DBG0_UPDI, PB2_DBG1_DGI1_LED4, PD2_DBG2_DGI0_SW0

CDC_TX, CDC_RX, DBG0_UPDI, DBG1_DGI1_LED4, DBG2_DGI0_SW0

Power Supply Connections

PB4_LOWQ_EN, PB3_MEASURE_EN, PE0_VMUX_MEASURE

Cellular Module Connections

PC0_USART1_TXD_CELL, PC1_USART1_RXD_CELL, PC7_CELL_RTS0, PC4_CELL_CTS0, PC6_CELL_RING0, PC5_CELL_RESETN

J102

PF3_I2C1_SCL, PF2_I2C1_SDA, VCC_P3V3, GND

GWIK CONNECTOR

WF1001A-WZ04ER1

Drawn By:	PB		
Engineer:	PB, ST, TF, AH		
Project Title	AVR-IoT Cellular Mini		
Sheet Title	MCU		
Size	A3	PCB Assembly Number: A09-3437	PCBA Revision: 6
		PCB Number: A08-3135	PCB Revision: 2
File:	AVR-IoT-Cellular-Mini_MCU.SchDoc		
Designed with	Altium.com		
Date:	2022-05-04		
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