# FiO Std Datasheet

FEATURES

- Built-in RapidSTM32 native-support bootloader.

- ARM 32-bits Cortex^{TM} – M3 Processor (STM32F103RET6)
    - 90MIPS maximum speed
    - 64 KBytes SRAM
    - 51 GPIO
    - 16 channels 12-bit, 1μs ADC
    - 5 USART, 3 SPI, 2 I^{2}C, 1 CAN
    - On-chip temperature sensor
    - 4 General purpose 16-bits timers with 4 IC/OC/PWM per timer
    - 2 16-bits Advanced control timers
    - 2 Watchdog timer
    - 2 channels 12-bit DAC
    - USB 2.0 full speed interface

- Two onboard crystals
    - 32 kHz (for real-time clock)
    - 8 MHz (for MCU clock)

- Power supply management
    - Reverse supply voltage protection
    - USB or External (up to 15VDC) supply input selection via jumper settings
    - 3.3V (up to 800mA) LDO regulator for internal and external circuitries

- Flash programming
    - 496Kbytes available flash memory
    - In-Application Programming via either USB HID or serial (RS232) interfaces directly from Matlab^{TM} or MS Windows^{TM}.
    - Automatic compile and download directly from Matlab^{TM}.

- Other onboard peripherals
    - 3 user LED (red, yellow, green)
    - 2 user logic (H/L) input jumpers
    - 10K potentiometer

- High capacitance (0.33F) capacitor as RTC backup battery
    - RS232 (3232-series) level converter
    - Micro SD card socket

- Four built-in operating modes selectable via jumper settings
    - USB Mass Storage Device (micro SD card reader)
    - In-application programming via USB HID interface
    - In-application programming via serial (RS232/USART) interface
    - Stand-alone custom user application

- RoSH compliant

SAMPLE APPLICATIONS

- Affordable Rapid Prototyping training tools (especially for Automatic Control and Digital Signal Processing studies) when used together with RapidSTM32 blockset, example features include:
    - Support C code generation of a custom user program for STM32 from a Simulink^{TM} model (see minimum requirements).
    - Support various Hardware-in-the-Loop (HIL) simulation configurations, e.g. data acquisition in to, signal generation from Matlab^{TM}/Simulink^{TM}, and closed-loop control HIL simulation design and analysis.

- Create a data logger to micro SD card (FAT32) program directly from a Simulink model.

- Use in a laboratory as embedded system training kits or in-the-field for any student projects.

- Generic microcontroller evaluation board.

FiO Std

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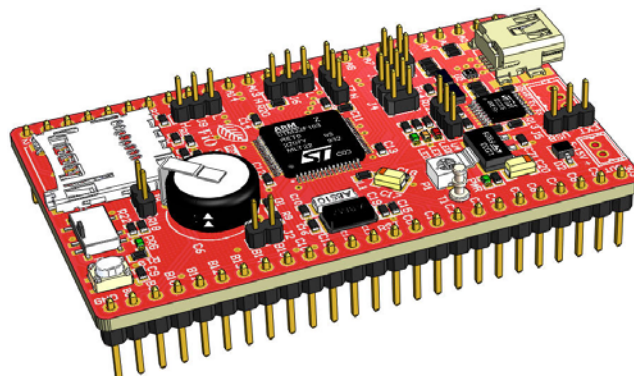
INTRODUCTION

FiO Std is an evaluation board (EVB) from FiO family of evaluation boards that are based on STMicroelectronics STM32™ ARM 32-bits Cortex™ – M3 processors.

FiO EVBs have been primarily designed as affordable embedded system training boards for used by instructors and students to supplement such courses and curriculums as design and analysis of automatic or embedded control systems and digital signal processing (DSP) systems. It is hoped that the introduction of FiO and RapidSTM32 Blockset will help lower the barrier and open up opportunities for more users to play around with Rapid Prototyping technology.

FiO family of evaluation boards have been specifically designed to be applicable both as LAB kits for uses in laboratories as well as a stand-alone system for used in-the-field in any student's science and engineering projects.

When used together with RapidSTM32 Blockset, FiO Std offers several capabilities, for examples:

- Real-Time Hardware in the Loop Simulations via USB HID.

Real-Time Hardware in the Loop (HIL) Simulation via USB HID interface		Maximum Update Rate[1] (Hz)
Open-Loop	Target → Host (Data Acquisition)	450
	Host→Target (Signal Generation)	200
Closed-Loop	Target↔Host (Control System)	200

- Higher HIL update rate available via other specially designed interfaces.

- Create working stand-alone embedded systems from Simulink™ models with just one click.

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[1] The actual update rate depends on several factors such as the host PC speed and other USB hardware in the communication loop; for example, communication speed is faster when the target is connected directly to host USB controller than via a USB hub.

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- Generated source code compatible with Realview MDK™ for ARM with options for automatic compile and download option.

- Data logger to micro SD card (FAT32).

- Support simulation and code generation for typical peripherals such as push/toggle button or character LCD.

- Supported on-chip peripherals include Digital IO, ADC, DAC, RTC, PWM, USART, USB (Virtual COM) and more.

- Support integration with Finite State Machine simulation and code generation via Stateflow™ and Stateflow Coder™.

MINIMUM REQUIREMENTS

Minimum requirements for FiO Std to fully function with RapidSTM32 Blockset.

- Matlab™ 2009a (v7.8)
- Simulink™ (v7.3)
- Real-Time Workshop™ (v7.3)
- Real-Time Workshop Embedded Coder™ (v7.3)
- Realview MDK™ for ARM (v4.0)
- Microsoft .NET Framework (v3.5)

CAUTIONS!!

All FiO EVBs are pre-installed with proprietary bootloader. FiO EVBs are solely intended to be programmed using FiO own Flash programmer which can program any FiO EVBs directly from Matlab and MS Windows via USB or RS232 interfaces. DO NOT use STMicroelectronics Flash Loader Program to program FiO EVBs because this will erase the pre-installed bootloader and void your warranty totally. Therefore, jumper J8 should not be tampered with in any circumstances.

FURTHER INFORMATION

For further information and tutorials please visit: http://www.aimagin.com/learningresources

OPERATING MODES

FiO Std supports 4 operating modes

1. In-Aplication Programming via USB HID
2. In-Aplication Programming via RS232
3. Mass Storage Device (microSD card reader)
4. Run Custom User Program

The following figures show required jumper(s) and program switch (SW1) settings for each operating mode. Each operating mode can be activated by pressing the reset switch (SW2).

1.1 USB IAP

J1, J3 Enable USB Link

J9 High

SW1 to right LED 4 On

1.2 RS232 IAP

Connect CN5 to PC (RS232)

J9 Low

SW1 to right LED 4 On

1.3 Mass Storage Device

J1, J3 Enable USB Link

J4 Enable LED1 and LED3

insert uSDcard

LED1 On when uSDcard inserted

LED3 flashes when read /write

J9 Low

SW1 to left LED 4 Off

1.4 Run Custom User Program

J9 High

SW1 to left LED 4 Off
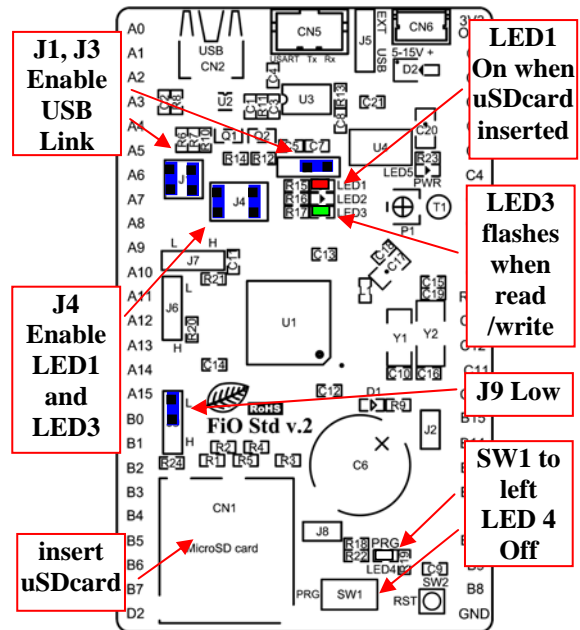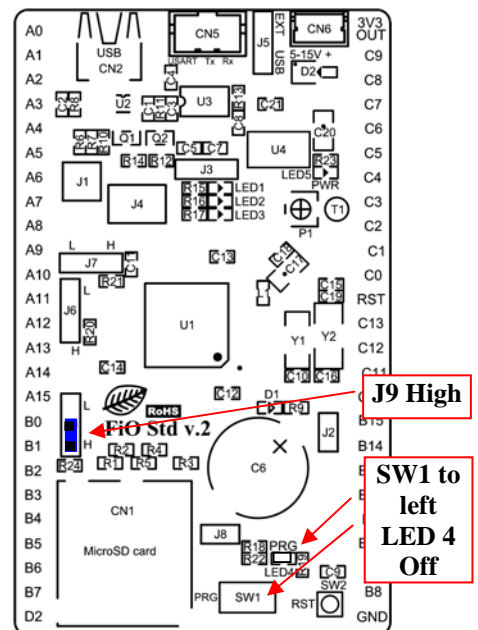
Warning: J8 should not be tampered with at all. Warranty is void if J8 is tampered.

Note: Other jumpers, e.g. J2, J6, J7 not mentioned in the above figures may be set or not, depending upon required functionalities.

SCHEMATIC DIAGRAM

MCU

U1
STM32F103RET6

PA0-WKUP / PA0 (14)
PA1 (15)
PA2 (16)
PA3 (17)
PA4 (20)
PA5 (21)
PA6 (22)
PA7 (23)
PA8 (41)
PA9 (42)
PA10 (43)
PA11 (44)
PA12 (45)
PA13/JTMS/SWDIO (46)
PA14/JTCK/SWCLK (49)
PA15/JTDI (50)

PB0 (26)
PB1 (27)
PB2/BOOT1 (28)
PB3/JTDO (55)
PB4/JNTRST (56)
PB5 (57)
PB6 (58)
PB7 (59)
PB8 (61)
PB9 (62)
PB10 (29)
PB11 (30)
PB12 (33)
PB13 (34)
PB14 (35)
PB15 (36)

PC0 (8)
PC1 (9)
PC2 (10)
PC3 (11)
PC4 (24)
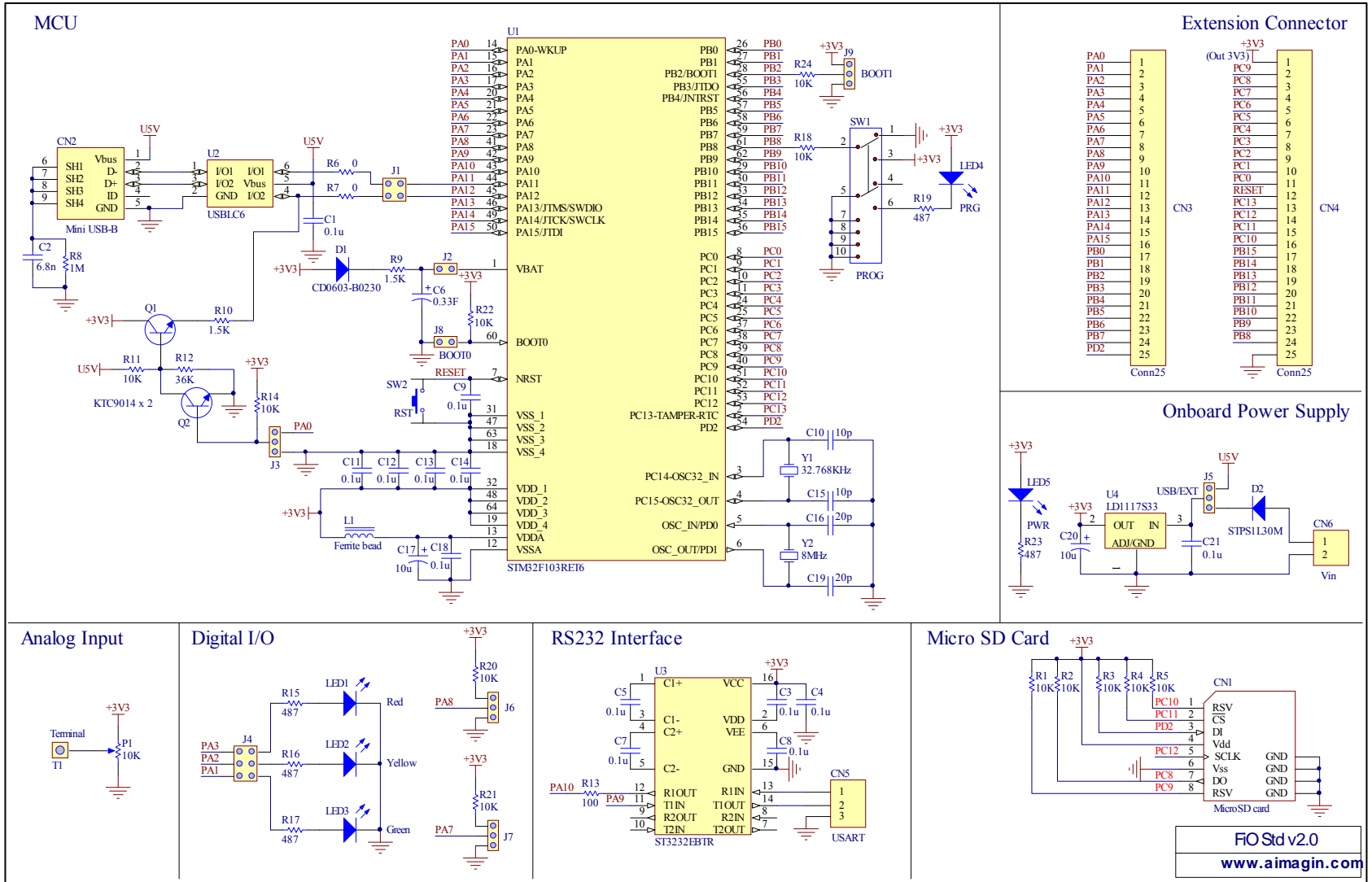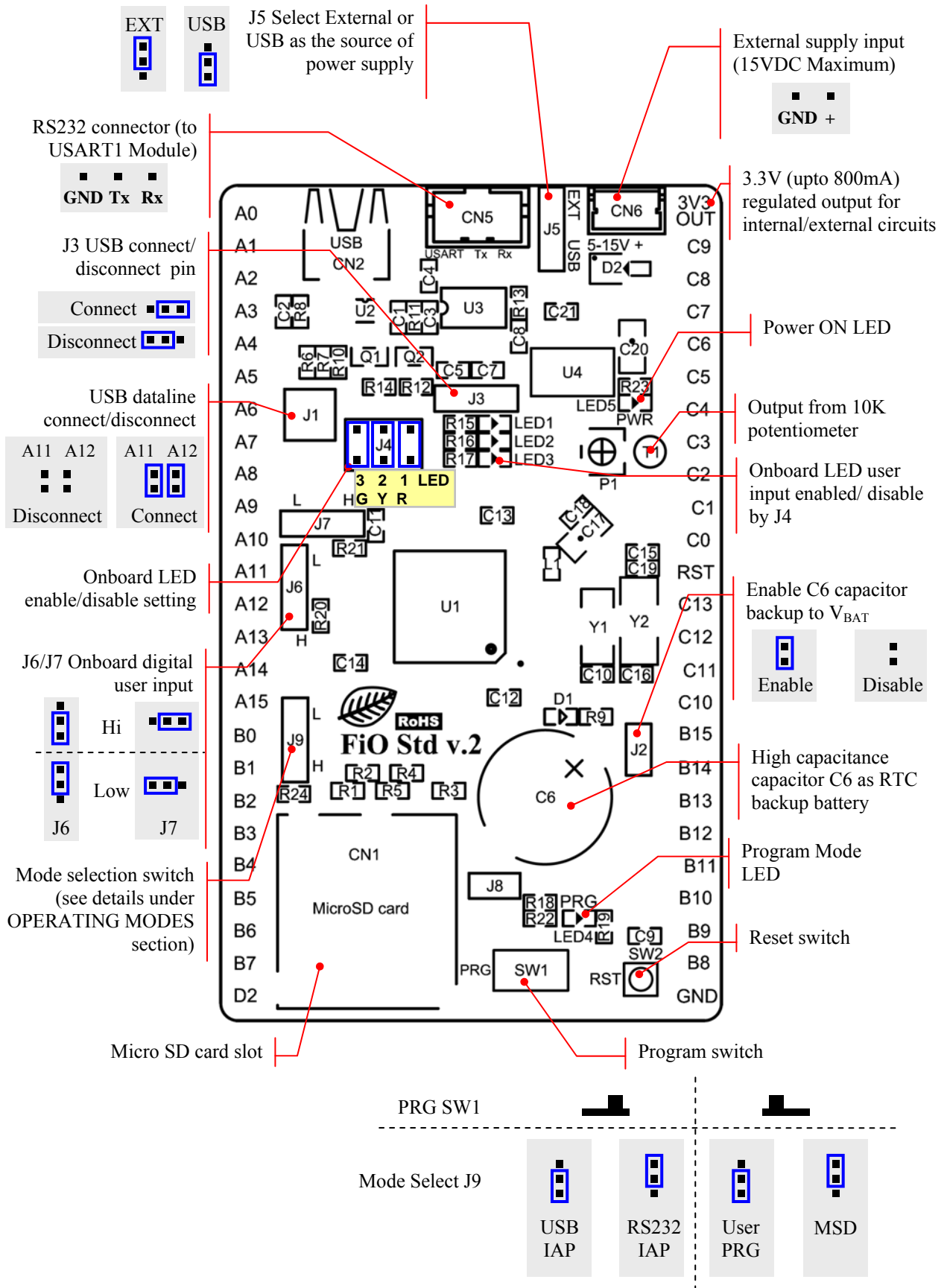PC5 (25)
PC6 (37)
PC7 (38)
PC8 (39)
PC9 (40)
PC10 (51)
PC11 (52)
PC12 (53)
PC13-TAMPER-RTC (2)
PD2 (54)

VBAT (1)
BOOT0 (60)
NRST (7)
VSS_1 (31)
VSS_2 (47)
VSS_3 (63)
VSS_4 (18)
VDD_1 (32)
VDD_2 (48)
VDD_3 (64)
VDD_4 (19)
VDDA (13)
VSSA (12)

PC14-OSC32_IN (3)
PC15-OSC32_OUT (4)
OSC_IN/PD0 (5)
OSC_OUT/PD1 (6)

CN2 Mini USB-B — SH1, SH2, SH3, SH4, Vbus, D-, D+, ID, GND
U2 USBLC6 — I/O1, I/O2, GND, Vbus
C1 0.1u
C2 6.8n
R8 1M
R6 0
R7 0
J1
R24 10K
J9 BOOT1
SW1
R18 10K
R19 487 PRG LED4
PROG
D1 CD0603-B0230
R9 1.5K
J2
C6 0.33F
R22 10K
J8 BOOT0
Q1
R10 1.5K
R11 10K
R12 36K
KTC9014 x 2
Q2
R14 10K
J3 PA0
C9 0.1u
SW2 RST
C11 0.1u C12 0.1u C13 0.1u C14 0.1u
L1 Ferrite bead
C17 10u C18 0.1u
Y1 32.768KHz
C10 10p C15 10p
Y2 8MHz
C16 20p C19 20p

Extension Connector

CN3 Conn25
PA0, PA1, PA2, PA3, PA4, PA5, PA6, PA7, PA8, PA9, PA10, PA11, PA12, PA13, PA14, PA15, PB0, PB1, PB2, PB3, PB4, PB5, PB6, PB7, PD2

CN4 Conn25
(Out 3V3), PC9, PC8, PC7, PC6, PC5, PC4, PC3, PC2, PC1, PC0, RESET, PC13, PC12, PC11, PC10, PB15, PB14, PB13, PB12, PB11, PB10, PB9, PB8

Onboard Power Supply

LED5 PWR
R23 487
U4 LD1117S33 OUT IN ADJ/GND
C20 10u
C21 0.1u
J5 USB/EXT
D2 STPS1130M
CN6 Vin

Analog Input

Terminal T1
P1 10K

Digital I/O

R15 487 LED1 Red
R16 487 LED2 Yellow
R17 487 LED3 Green
J4 PA3, PA2, PA1
R20 10K PA8 J6
R21 10K PA7 J7

RS232 Interface

U3 ST3232EBTR
C1+, C1-, C2+, C2-, VCC, VDD, VEE, GND
R1OUT, T1IN, R2OUT, T2IN, R1IN, T1OUT, R2IN, T2OUT
C5 0.1u C7 0.1u C3 0.1u C4 0.1u C8 0.1u
PA10 R13 100 PA9
CN5 USART

Micro SD Card

R1 10K R2 10K R3 10K R4 10K R5 10K
CN1 MicroSD card
PC10 — RSV
PC11 — CS
PD2 — DI
Vdd
PC12 — SCLK
Vss
PC8 — DO
PC9 — RSV
GND, GND, GND, GND

FiO Std v2.0
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FiO Std PCB LAYOUT

EXT   USB

J5 Select External or USB as the source of power supply

External supply input (15VDC Maximum)

GND +

RS232 connector (to USART1 Module)

GND Tx Rx

3.3V (upto 800mA) regulated output for internal/external circuits

J3 USB connect/ disconnect pin

Connect

Disconnect

Power ON LED

USB dataline connect/disconnect

A11 A12   A11 A12

Disconnect   Connect

Output from 10K potentiometer

Onboard LED user input enabled/ disable by J4

Onboard LED enable/disable setting

Enable C6 capacitor backup to V$_{BAT}$

Enable   Disable

J6/J7 Onboard digital user input

Hi

Low

J6   J7

High capacitance capacitor C6 as RTC backup battery

Program Mode LED

Mode selection switch (see details under OPERATING MODES section)

Reset switch

Micro SD card slot

Program switch

PRG SW1

Mode Select J9

USB IAP   RS232 IAP   User PRG   MSD

BILL OF MATERIALS

[Manufacture Part No.] Name	Designator	Source
[0603B682K500CT] 6.8nF	C2	www.es.co.th
[0603ZC104KAT2A] 0.1uF	C1, C3, C4, C5, C7, C8, C9, C11, C12, C13, C14, C18, C21	www.mouser.com
[C1608C0G1H100C] 10pF	C10, C15	www.mouser.com
[C1608C0G1H200J] 20pF	C16, C19	www.mouser.com
[293D106X0010A2TE3] 10uF	C17, C20	www.mouser.com
[EECS0HD334H] 0.33F	C6	www.mouser.com
[2908-05WB-MG] MicroSD socket	CN1	www.mouser.com
[67503-1020] USB Mini-B female	CN2	www.mouser.com
[CD0603-B0230] CD0603-B0230	D1	www.mouser.com
[STPS1L30M] STPS1L30M	D2	www.mouser.com
[MMZ1608S601A] Ferrite Beads	L1	www.mouser.com
[APT1608EC] LED Red	LED1	www.mouser.com
[APT1608YC] LED Yellow	LED2	www.mouser.com
[APT1608SGC] LED Green	LED3, LED4, LED5	www.mouser.com
[PVG3A103C01R00] 10K	P1	www.mouser.com
[KTC9014S-C-RTK/P] KTC9014	Q1,Q2	www.es.co.th
[0603WAJ0103T5E] 10K	R1, R2, R3, R4, R5, R11, R14, R18, R20, R21, R22, R24	www.es.co.th
[RC0603FR-0736KL] 36k	R12	www.mouser.com
[0603WAJ0101T5E] 100	R13	www.mouser.com
[CR0603-FX-4870ELF] 487	R15, R16, R17, R19, R23	www.mouser.com
[WR06X000PTL] 0	R6, R7	www.es.co.th
[RC0603JR-071ML] 1M	R8	www.mouser.com
[CRCW06031K50JNEB] 1.5k	R9, R10	www.mouser.com
[SSSS820201] Switch	SW1	www.mouser.com
[SKRPACE010] Switch	SW2	www.mouser.com
[534-1593-2] Terminal	T1	www.mouser.com
[STM32F103RET6TR] STM32F103RET6	U1	www.mouser.com
[USBLC6-2P6] USBLC6	U2	www.mouser.com
[ST3232EBTR] ST3232EBTR	U3	www.mouser.com
[LD1117S33TR] LD1117S33	U4	www.mouser.com
[ABS10-32.768KHZ-9-T] Xtal 32.768kHz	Y1	www.mouser.com
[ABM7-8.000MHZ-D2Y-T] Xtal 8MHz	Y2	www.mouser.com

ENGINEERING DRAWINGS (Units: mm)
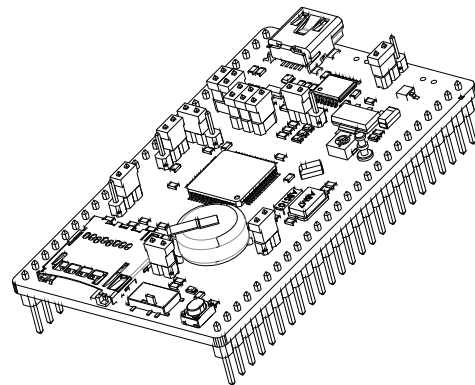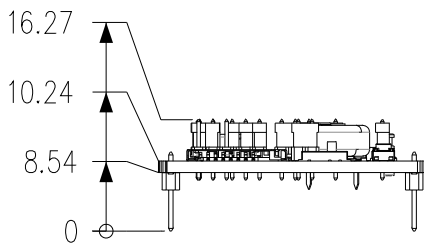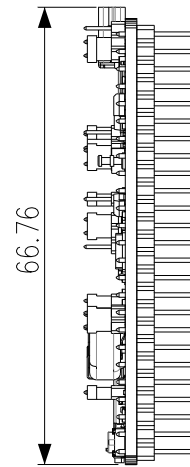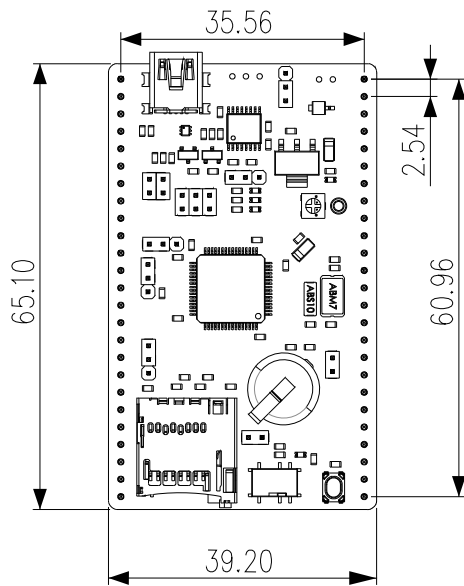
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