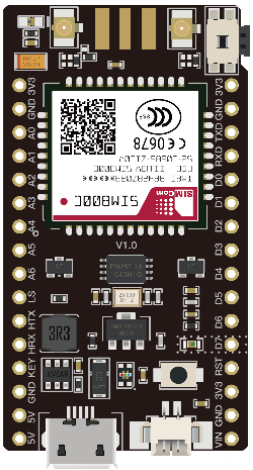
IntoRobot

Fox Datasheet



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Category

Chart Category

1 Overview

1.1 Product Description

IntoRobot-Fox (Fox, for short), designed by Shenzhen MOLMC Technology co., Ltd., is a kind of high-performance GSM/GPRS communication board, with the advantages of high computation ability and compact package. The board is useful for many applications, including smart agriculture, environment monitoring, and other smart products.

Fox integrates a high-performance data processing MCU, a 32-bit ARM Cortex-M3 chip STM32L151CE. The MCU supports 1.25DMOPS at 32MHz operating frequency, as well as DSP and DFU for float calculation. STM32L151CE provides rich interfaces, including SD card interface, SPI, USART, I2S and I2C, etc.

The GPRS module SIM800C, of small size, is integrated on Fox for direct Internet connection. SIM800C integrates complete transmit and receive RF modules, including the antenna switch, RF balun, power amplifier, and power management module. SIM800C supports for operating RF frequencies, i.e., GSM850, EGSM900, DCS1800 and PCS1900.

Fox is compatible with Arduino programming and internally integrates IntoRobot platform, which means the programming work can be decreased dramatically so the product development cycle can also be reduced. The most creative ideas can be achieved when Fox is combined with IntoRobot and IntoRobot-APP. The IoT demos can be quickly established, because a test led light and an illumination sensor are integrated on the board.

Fox provides high speed and long distance wireless communication, by supporting a transmission speed up to 85.6kbps and transmit power up to 33dBm. After all, Fox provides advanced technical specification, and exhibits high performance on compactness, wireless communication distance, power consumption, and Internet connection, etc. Applications include,

- Smart agriculture, forestry, animal husbandry and fishery;
- Smart logistics, e.g., cargo tracking, cold chain logistics, important assets monitoring;
- Smart city, e.g., smart metering, parking, street lighting, and fire alarms;
- Environment monitor, e.g., air quality monitoring (PM2.5, CO2, CO, and formaldehyde), forest fire monitoring, and water quality monitoring;
- Smart home and building, e.g., access control systems, security systems, and smoke alarms;
- Smart industry, e.g., industrial automation;
- Robotics and UAVs.

2 Hardware Specification

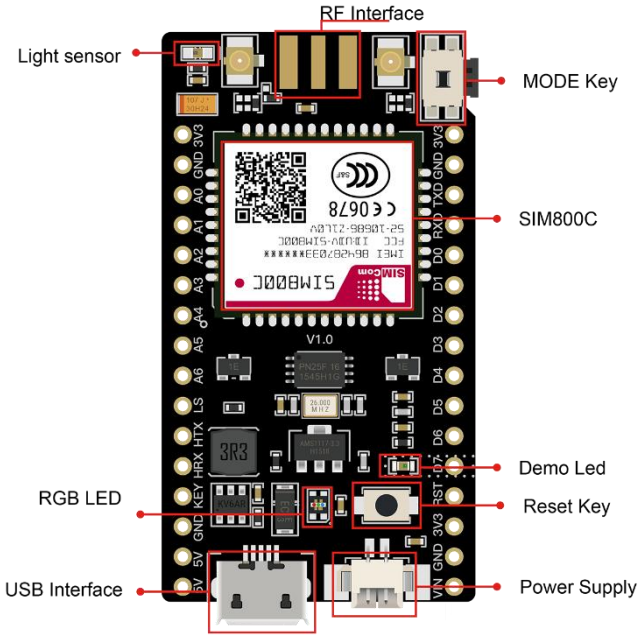
2.1 Specification Table

Chart 1: Specification Table

Product	IntoRobot-Fox
Cloud	**IntoRobot Cloud(www.intorobot.com)**
CPU	1.STM32F411CEU6 Cortex-M4 32 bit， 100MHz Flash: 512KB RAM: 128KB
GPRS	SIM800C
DC Output	3.3V: 600mA，5V 1000mA
GPIO	17
I2C	1
SPI	2
I2S	1
USART	1
PWM	9
ADC	7
DAC	2
Interrupt	17

2.2 Pin Description

Chart 2: Bloc Diagram (Front View)



17 Groups GPIO、7 Group AD、12 Groups PWM、1 Group serial ports、
1 Group I2C、1 Group I2S、2 Group SPI

Chart 3: Pin Diagram

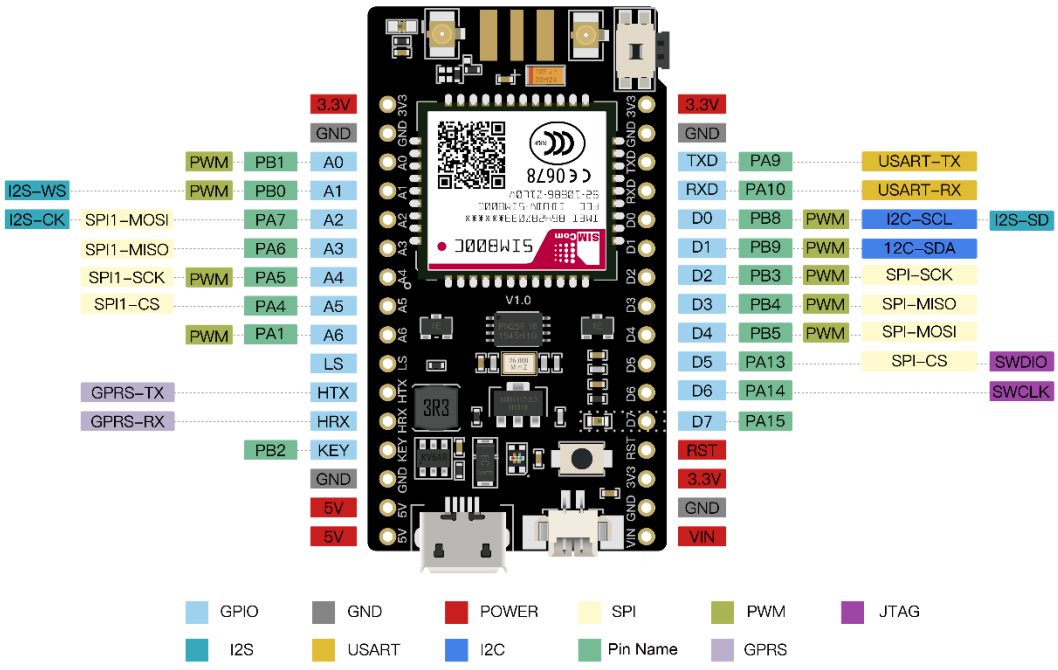


Chart 4: Pin Definition and Description

Pin	Name	Description
1	3V3	3.3V Power Output
2	GND	GND
3	A0	ADC_IN9/TIM3_CH4
4	A1	ADC_IN8 /TIM3_CH3
5	A2	ADC_IN7 /TIM3_CH2/SPI1_MOSI
6	A3	ADC_IN6 /TIM3_CH1 /SPI1_MISO
7	A4	PA5/ADC_IN5 /DAC_OUT2 /SPI1_SCK
8	A5	PA4/ADC_IN4 /DAC_OUT1 /SPI1_NSS
9	A6	PA1/ADC_IN1
10	LS	Light Sensor
11	HTX	GTRS_TX
12	HRX	GTRS_RX
13	KEY	PB2/Mode switch
14	GND	GND
15	5V	5V Power Output
16	5V	5V Power Output
17	VIN	5V Power Input，Maximum power current > 2A
18	GND	GND
19	3V3	3.3V Power Output
20	RST	Reset pin, Chip enable-pin, Active HIGH, Reset LOW
21	D7	TIM2_CH1
22	D6	JTCK-SWCLK
23	D5	JTMS-SWDIO /SPI_CS
24	D4	TIM3_CH2/ SPI_MOSI
25	D3	TIM3_CH1/SPI_MISO/NJTRST
26	D2	TIM2_CH2/SPI_SCK /JTDO
27	D1	TIM4_CH4/TIM11_CH1//I2C1_SDA
28	D0	TIM4_CH3/TIM10_CH1/I2C1_SCL
29	RXD	USART_RX
30	TXD	USART_TX
31	GND	GND
32	3V3	3.3V Power Output

2.3 Electrical characteristics

2.3.1 Operating Environment

Chart 5: Recommended Operating Environment

Item	Label	Min	Typical	Max	Unit
Operating Tempererature	-	-40	20	85	°C
Storage Temperature	-	-40	20	125	°C
Power Supply	VDD	1.8	3.3	3.6	V
Operating Humidity	-	10%	-	90%	-

Test condition: IPC/JEDEC J-STD-020.

2.3.2 Digital Port Characteristics

Chart 6: Digital Port Characteristics

Label	Description	Condition	Min	Max	Unit
VIL	Input Level Logic Low	-	-	1	V
VIH	Input Level Logic High	-	2.3	-	V
VOL_1	Output Level Logic Low	I_{IO} =8mA	-	0.4	V
VOH_1	Output Level Logic High		2.4	-	V
VOL_2	Output Level Logic Low	I_{IO} =20mA	-	1.3	V
VOH_2	Output Level Logic High		2	-	V

Note: Test temperature 20℃.

2.3.3 SPI Parameters

Chart 7: SPI Timing Parameters

Symbol	Parameter	Conditions	Min	Max(2)	Unit
f_{SCK} $1/t_{c(SCK)}$	SPI clock frequency	Master mode	-	16	MHz
		Slave mode	-	16	
		Slave transmitter	-	12(3)	
$t_{r(SCK)}$(2) $t_{f(SCK)}$(2)	SPI clock rise and fall time	Capacitive load: C = 30 pF	-	6	ns
DuCy(SCK)	SPI slave input clock duty cycle	Slave mode	30	70	%
$t_{su(NSS)}$	NSS setup time	Slave mode	$4t_{HCLK}$	-	ns
$t_{h(NSS)}$	NSS hold time	Slave mode	$2t_{HCLK}$	-	
$t_{w(SCKH)}$(2) $t_{w(SCKL)}$(2)	SCK high and low time	Master mode	$t_{SCK}/2-5$	$t_{SCK}/2+3$	
$t_{su(MI)}$(2)	Data input setup time	Master mode	5	-	
$t_{su(SI)}$(2)		Slave mode	6	-	
$t_{h(MI)}$(2)	Data input hold time	Master mode	5	-	
$t_{h(SI)}$(2)		Slave mode	5	-	
$t_{a(SO)}$(4)	Data output access time	Slave mode	0	$3t_{HCLK}$	
$t_{v(SO)}$(2)	Data output valid time	Slave mode	-	33	
$t_{v(MO)}$(2)	Data output valid time	Master mode	-	6.5	
$t_{h(SO)}$(2)	Data output hold time	Slave mode	17	-	
$t_{h(MO)}$(2)		Master mode	0.5	-	

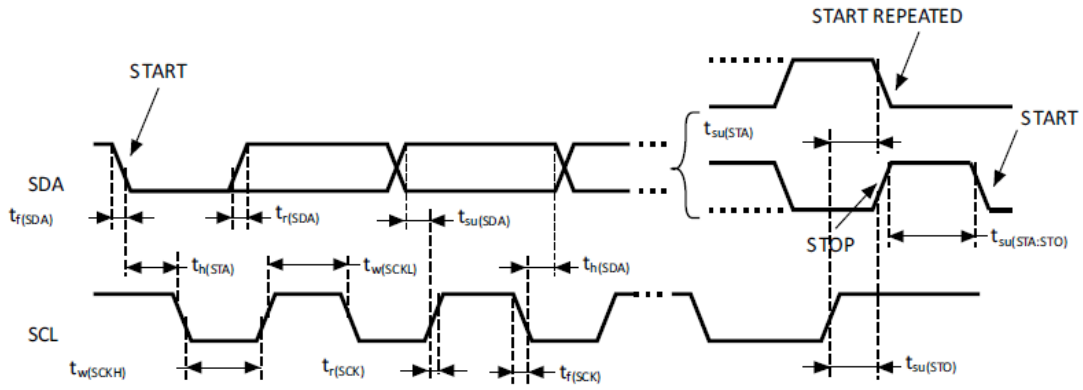
2.3.4 I2C Interface

I2C interface is open drain, requiring external pull-up resister (4.7KΩrecommended).

Chart 8: I2C Timing Parameters

Symbol	Parameter	Standard mode I²C(1)		Fast mode I²C(1)(2)		Unit
		Min	Max	Min	Max	
$t_{w(SCLL)}$	SCL clock low time	4.7	-	1.3	-	µs
$t_{w(SCLH)}$	SCL clock high time	4.0	-	0.6	-	
$t_{su(SDA)}$	SDA setup time	250	-	100	-	ns
$t_{h(SDA)}$	SDA data hold time	0	-	0	900(3)	
$t_{r(SDA)}$ $t_{r(SCL)}$	SDA and SCL rise time	-	1000	20 + 0.1C_b	300	
$t_{f(SDA)}$ $t_{f(SCL)}$	SDA and SCL fall time	-	300	-	300	
$t_{h(STA)}$	Start condition hold time	4.0	-	0.6	-	µs
$t_{su(STA)}$	Repeated Start condition setup time	4.7	-	0.6	-	
$t_{su(STO)}$	Stop condition setup time	4.0	-	0.6	-	µs
$t_{w(STO:STA)}$	Stop to Start condition time (bus free)	4.7	-	1.3	-	µs
C_b	Capacitive load for each bus line	-	400	-	400	pF

Chart 9: I2C Timing Chart



2.3.5 GPRS Specification

Chart 10: GPRS Specification

Specification	SIM800C
GSM	850/900/1800/1900 MHz
BT	Supported by internal software
FLASH	SIM800C(24Mbit)
RAM	32Mbit

2.3.6 Principal Characteristics

Chart 11: GSM/GPRS Characteristics

Characteristics	Specification
Power consumption	0.6mA current at sleep mode
Transmission Power	Class 4(2W)： GSM850 EGSM900 Class 1 (1W)： DCS1800 PCS1900
RAM	32Mbit
Encoding Format	CS-1/CS-2/CS-3/CS-4
RTC	Supported
SIM Card	Support China Mobile/Uni-Com 2G Card， Ali 13bit IoT card.
Audio	Support Mic input and speaker out（CTIA） of Apple, Xiaomi, Sunsang, Moto, Sony and Huawei; Not support OMTP

Chart 12: Encoding Format and Maximum Communication Speed

Encoding Format	1 Time Instant	2 Time Instants	4 Time Instants
CS-1	9.05kbps	18.1kbps	36.2kbps
CS-2	13.4kbps	26.8kbps	53.6kbps
CS-3	15.6kbps	31.2kbps	62.4kbps
CS-4	21.4kbps	42.8kbps	95.6kbps

Chart 13: Power Consumption

	Mode	GSM850	EGSM	DCS1800	PCS1900	Unit
I_{BAT}	Standby	12.5	12.5	12.5	12.5	mA
	Audio Mode	209	211	123	143	mA
	GPRS Data Transmit (1Rx 4Tx)	385	389	270	285	mA
	GPRS Data Transmit (1Rx 4Tx)	326	340	208	228	mA
	GPRS Data Transmit (1Rx 4Tx)	218	228	146	162	mA
	Sleep mode: AT+CFUN=1	BS-PA-MFRMS=9 I_{BAT}=0.9mA BS-PA-MFRMS=5 I_{BAT}=1mA BS-PA-MFRMS=2 I_{BAT}=0.9mA				

The power module for SIM800C GSM/GPRS module should provide stable voltage output between maximum and minimum voltages, typical 4V. When working at maximum RF power rate, the instant voltage dropout at transmission should be smaller than 500mV.

3 Mechanical Specification

Chart 14: Module Size (Front View) Unit mm