



MG126 BLE Transceiver

Application Note

Revision History:

Rev. No.	History	Issue Date	Remark
0.1	Initial issue	July 11, 2016	Preliminary
0.2	Add package info	April 6, 2017	Preliminary
03	更新电气特性	Sept 4, 2017	Preliminary
1.0	更新功耗指标	Jan 31, 2018	Release
1.1	更新 Receive 特性	April 2, 2018	Release

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1. 概述

MG126 是低功耗、低成本的 BLE 收发器，内部集成了发射机、接收机、GFSK 调制解调器和 BLE 基带处理。MG126 采用 QFN3x3 封装，搭配 Cortex-M0 MCU 和少数外围被动器件，可以实现 BLE 遥控、蓝牙键盘等数据传输应用。

- 电源电压 1.9~3.6，可以采用一个纽扣电池（3.0v）供电
- 3uA 待机电流
- 20mA@0dBm 持续发射
- 18mA 持续接收
- QFN3x3 封装，外围 BOM 很少

2. 管脚描述

MG126 采用 QFN16 封装，芯片大小为 3mm x 3mm。

Pin No.	Symbol	I/O	Function Description
1	CSN	DI	SPI Chip Select
2	GND	Ground	Power ground
3	SCK	DI	SPI Clock
4	MOSI	DI	SPI Slave Data Input
5	MISO	DO	SPI Slave Data Output
6	DVDD	Power	Digital VDD 1.2v Output
7	GND	Ground	Power ground
8	XTALO	AO	Crystal Pin
9	XTALI	AI	Crystal Pin
10	VBAT	Power	Power Supply
11	GND	Ground	Power ground
12	ANT	RF	Antenna interface
13	VBAT	Power	Power Supply



14	GND	Ground	Power ground
15	IRQ	DO	Interrupt pin
16	CT	DI	Test use

Table2.1 Pin Description

3. 数据和控制接口

MG126 通过 SPI 接口和 IRQ 信号与 MCU 进行通信，接口包括以下信号：

- IRQ (this signal is active low and is controlled by maskable interrupt sources)
- CSN (SPI signal)
- SCK (SPI signal)
- MOSI (SPI signal)
- MISO (SPI signal)

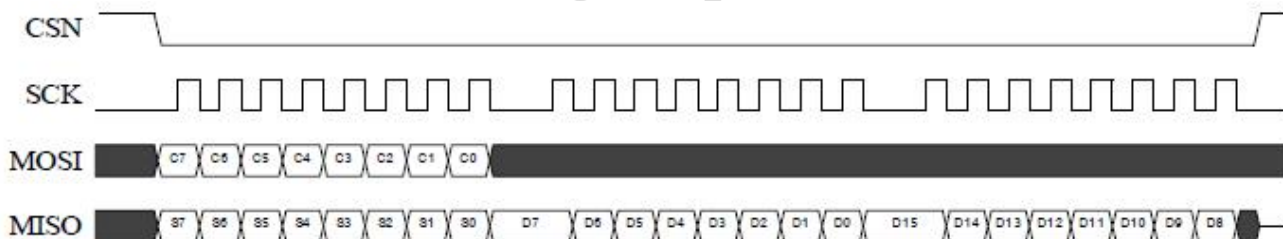


Figure3.1 SPI Read Operation

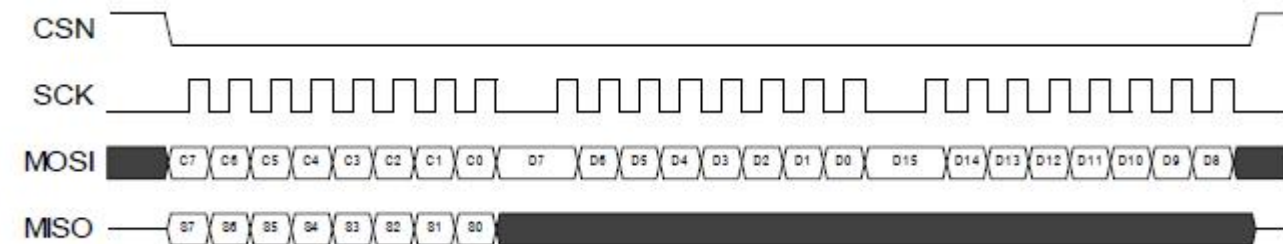


Figure3.2 SPI Write Operation

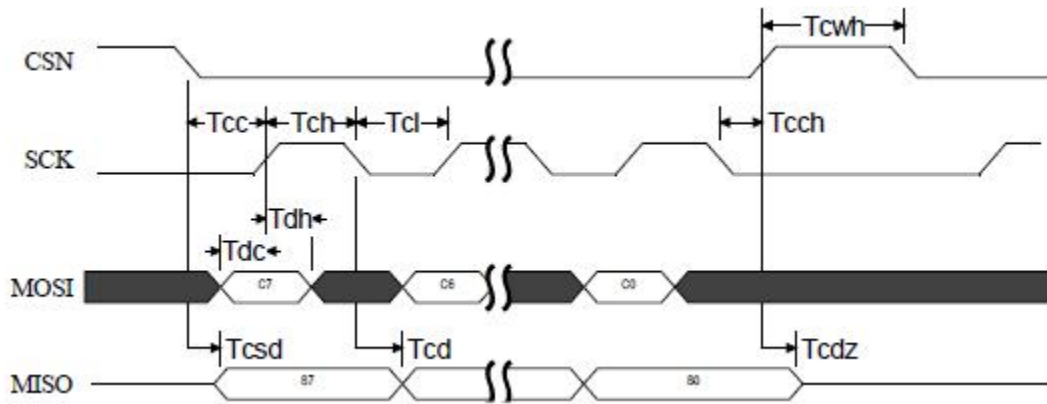


Figure3.3 SPI Timing Diagram

Symbol	Parameters	Min.	Max	Unit
Tcc	CSN to SCK setup	2		ns
Tch	SCK high time	40		ns
Tcl	SCK low time	40		ns
Tcwh	CSN inactive time	50		ns
Tcch	SCK to CSN hold	2		ns
Tdc	Data to SCK setup	2		ns
Tdh	SCK to Data hold	2		ns
Tcsd	CSN to Data Valid		42	ns
Tcd	SCK to Data Valid		58	ns
Tcdz	CSN to Output High Z		42	ns
Tr, Tf	SCK Rise and Fall		100	ns

Table3.1 SPI parameters

4. 寄存器信息

可以通过 SPI 访问这些寄存器。

Address (Hex)	Mnemonic	Bit	Reset Value	Description



01	CH_NO			BLE channel
		7:6	0	reserved
		5:0	0	BLE advertise channel number(37,38,39)
02	MODE_TYPE			ADV/Data Tx/Rx mode
		7:4	0	reserved
		3	1	Adv event
		2	0	Tx enable
		1:0	00	01 - Rx enable
03	ADV_HDR_TX			Advertise Pdu Header for Tx
		15:8	0	Pdu length
		7:0	0	Pdu type
04	ADV_HDR_RX			Advertise Pdu Header for Rx
		15:8	0	Pdu length
		7:0	0	Pdu type
07	START_TIME			Tx/Rx start time
		23:0	0	Start time
0E	INT_FLAG			Interrupt mask and flag
		15:8	0	Interrupt mask bit
		7	0	Pdu Header OK
		6	0	Pdu OK
		5	0	Pdu Err
		4	0	Tx_Start
		3	0	Mode Err
		2	0	Rx Timeout
		1	0	Enter Sleep
		0	0	Woken up
0F	SLEEP_WAKE			Sleep / wakeup configuration
		31:8	0	Wake up time
		7:2	0	reserved



		1	0	Enable sleep
		0	0	Enable wakeup
10	CLK_CNT			LF clock counter and HF clock counter
		47:24	0	LF clock counter
		23:0	0	HF clock counter
11	TIMEOUT			TX/RX TimeOut (us)
		16	1	Disable Timeout
		15:8	1	Timeout time byte1
		7:0	2c	Timeout time byte0
A0	TX_PLD			TX Data Payload, MaxLen is 31 Bytes

Table 4.1 Register Map

5. 应用电路原理图

下图是 MG126 的典型应用电路原理图。

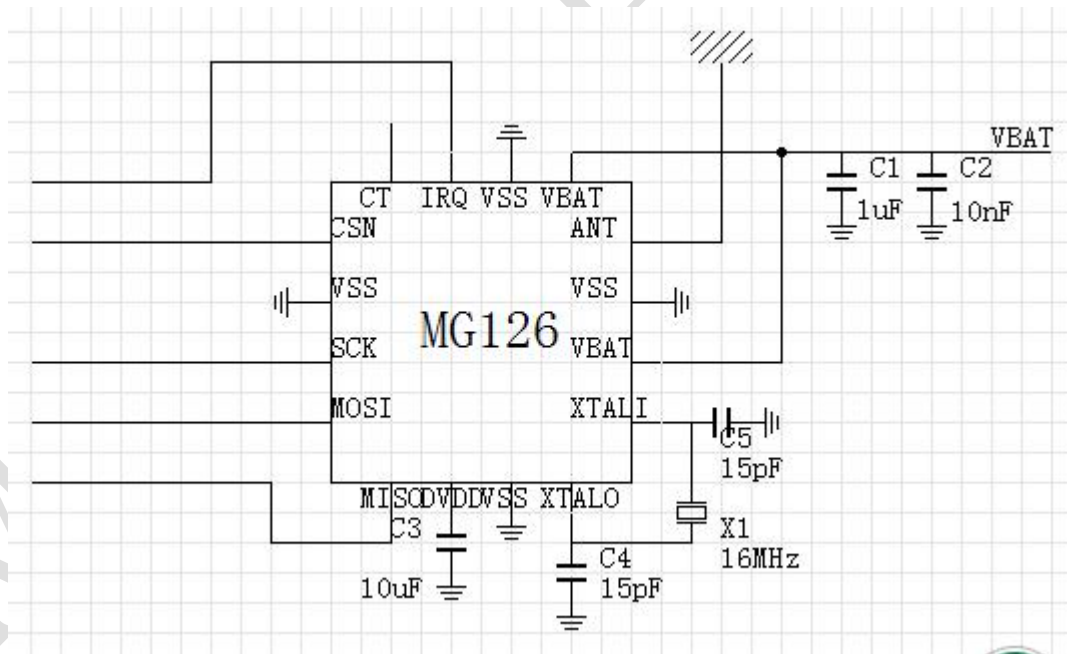


Figure5.1 example application schematic



6. 电气特性

Conditions: VDD = +3V, VSS = 0V, TA = - 40°C to + 85°C

Symbol	Parameter	Notes	Min.	Typ.	Max.	Unit
Operating Conditions						
VDD	Supply voltage		1.9	3.0	3.6	V
TEMP	Operating Temperature		-40	+27	+85	°C
Transmitter Operation						
P _{RF}	Maximum output power				+4	dBm
Receiver Operation						
RXsens	Sensitivity			-85		dBm

Table 6.1 Electrical Specification

7. 功耗指标

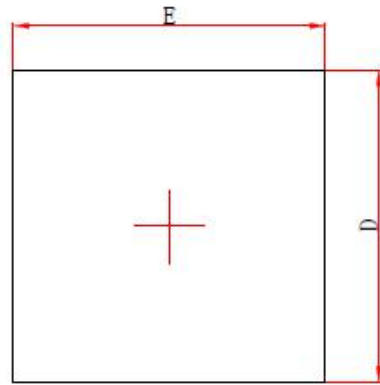
下表是在 3.3V 供电情况下，MG126 典型的功耗情况.

Mode	Description	Total Typical Current at 3.0v
Standby	待机状态下电流，通过 spi 唤醒	3 uA
Sleep	睡眠电流，不发射不接收	50 uA
TX active	持续发射	20 mA @ 0dBm output power
RX active	持续接收	18 mA

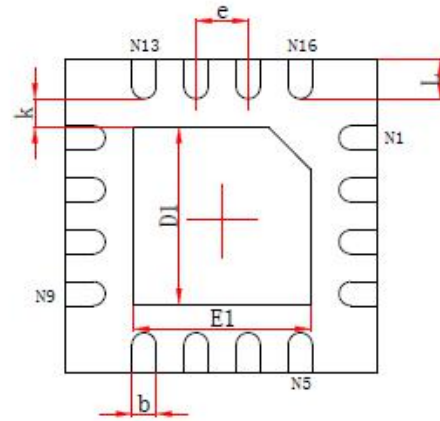
Table 7.1 Current Consumption

8. 封装

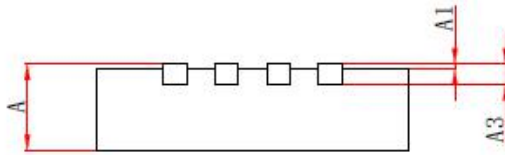
QFN16 3mm x 3mm, pitch 0.5mm



Top View



Bottom View



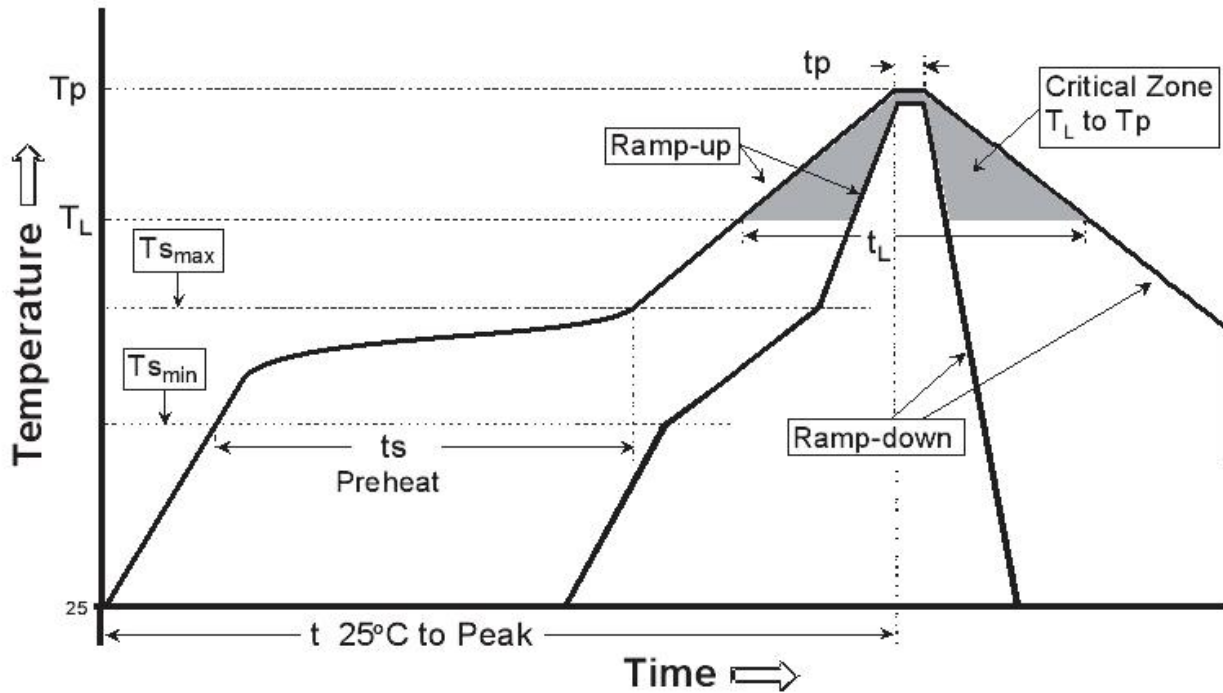
Side View

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
D/E	2.900	3.100	0.114	0.122
D1/E1	1.600	1.800	0.063	0.071
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203 REF		0.008 REF	
k	0.200 MIN.		0.008 MIN.	
b	0.180	0.300	0.007	0.012
e	0.500 TYP.		0.020 TYP.	
L	0.300	0.500	0.012	0.020

Table 8.1 Package outline

9. Reflow Profile

Follow: IPC/JEDEC J-STD-020 C



IPC-020c-5-1

IPC/JEDEC J-STD-020C

July 2004

Table 5-2 Classification Reflow Profiles

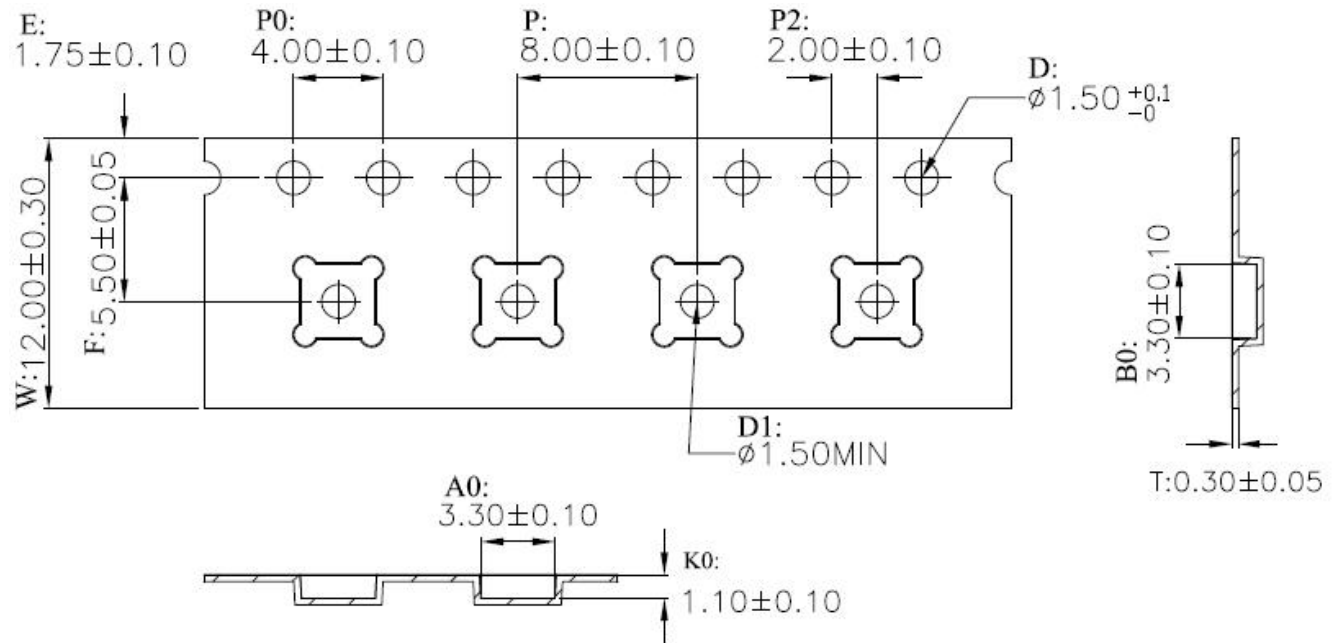
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (Ts _{max} to T _p)	3 °C/second max.	3° C/second max.
Preheat - Temperature Min (Ts _{min}) - Temperature Max (Ts _{max}) - Time (ts _{min} to ts _{max})	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-180 seconds
Time maintained above: - Temperature (T _L) - Time (t _L)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak/Classification Temperature (T _p)	See Table 4.1	See Table 4.2
Time within 5 °C of actual Peak Temperature (t _p)	10-30 seconds	20-40 seconds
Ramp-Down Rate	6 °C/second max.	6 °C/second max.
Time 25 °C to Peak Temperature	6 minutes max.	8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.



10. Tape and Reel Information

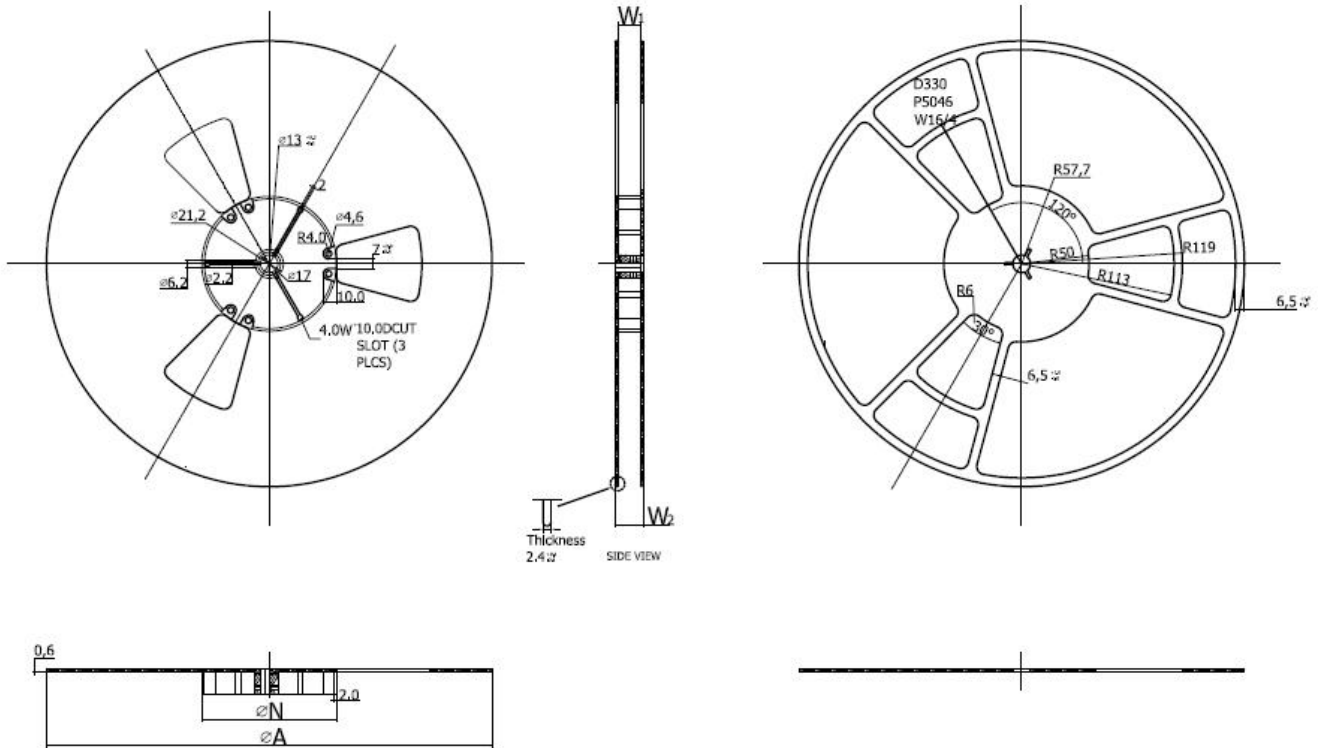
10.1 Tape Information



W	12.00 ±0.30	mm
A0	3.30 ±0.10	mm
B0	3.30 ±0.10	mm
K0	1.10 ±0.10	mm



10.2 Reel Information



Package Type	Tape Width	ϕA	ϕN	W1	W2max
3x3x0.8mm DFN	12 mm	330 mm	100 mm	12.8 mm	18.2 mm

11. PCB 布线注意事项

- 电源

电源线、地线的布线直接关系到产品的性能，把噪声干扰降到最低。布线时要尽量加宽地线、电源线宽度，地线>电源线>信号线，通常信号线宽 0.2~0.3mm，电源线宽 1.2~2.5mm，用大面积铜层做地线用，在 PCB 上把没有用的空间都铺成地。

电源加两个电容，如果用 LDO 供电，分别取值 1uF 和 0.1uF 用以滤波；如果用纽扣电池供电，电容分别取值 10uF 和 10uF 用以稳压。

- 晶振

晶振电路要尽量短和对称，靠近芯片，以减少噪声干扰以及分布电容的影响。晶振外壳要良好接地。

- 天线

天线对通信影响很大，请使用成熟的 2.4GHz 天线结构，或者严格按照天线要求制板。一般 PCB 天线需要净空，天线与地（铺铜）之间距离应大于 0.5mm。天线周围不要有元器件或金属结构。



芯片 ANT 到天线之间的走线不能太长，线宽要考虑阻抗匹配要求。

12. MCU 需求

实现 BLE 遥控、蓝牙键盘等数据传输应用，需要搭配 Cortex-M0 或者 M3 的 MCU，具体资源需求如下：

系统时钟：48MHz 及以上

通信接口：SPI，主设备，clk 6Mbps 及以上

ROM size: 16 KBytes (如果需要通过 OTA 则 size 加倍)

RAM size: 4 KBytes

13. FAQ

TBD