

# SX126x-FM33LE0xx-SDK 介绍

## V1.1

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# 1 概述

## 1.1 工程简介

代码 `sx126x-fm33le0xx-sdk` 是针对节点间功能的测试，可以使用 LoRa 或者 GFSK 方式进行通信测试。使用的硬件是以复旦微电子的 FM33LE026 芯片为 MCU、Semtech 的 SX126x 系列为射频芯片组成的节点。

注：本代码工程不针对 LoRaWAN 网关。

## 1.2 硬件介绍

复旦微电子的 FM33LE0xx 系列芯片包含如下图所示：

型号	Flash 容量 (KBytes)	RAM 容量 (KBytes)	封装
FM33LE026	128	16	LQFP64
FM33LE025	128	16	LQFP48
FM33LE023	128	16	QFN32
FM33LE022	128	16	TSSOP24
FM33LE016	64	16	LQFP64
FM33LE015	64	16	LQFP48
FM33LE013	64	16	QFN32
FM33LE012	64	16	TSSOP24

Figure 1: FM33LE0xx 系列

本工程支持的射频芯片是 Semtech 的 SX126x 系列，包括 SX1261/SX1262/SX1268。针对此系列芯片，Semtech 设计了多款 EVK 测试板，本代码工程所支持的 EVK 列表详情请看根目录中的 README.md 文档。同时，与复旦微电子合作，复旦微设计了可以与 EVK 板直接对插的测试板，客户拿到整套测试板和代码后就可以直接进行芯片性能测试。硬件示例如下图所示：



Figure 2: 硬件设备

## 1.3 软件工程介绍

### 1.3.1 软件 demo

本工程提供了 7 个测试 demo，列表如下图所示：

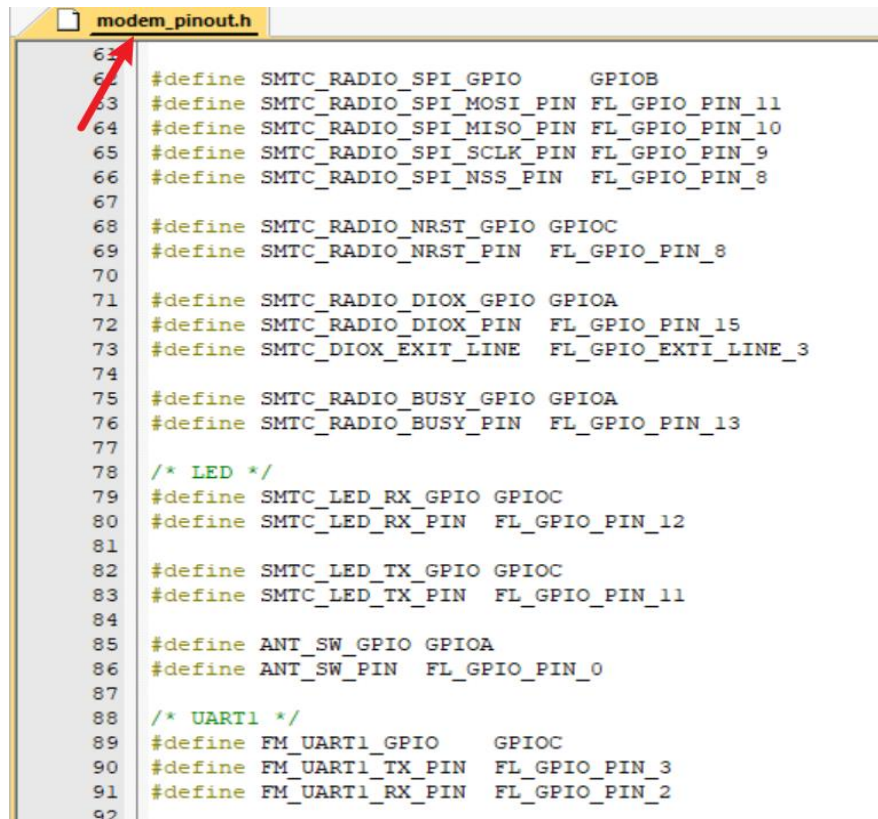
1	cad	11/10/2022 12:25 PM
	common	11/10/2022 12:25 PM
2	per	11/10/2022 12:25 PM
3	ping_pong	11/10/2022 12:25 PM
4	spectral_scan	11/10/2022 12:25 PM
5	spectrum_display	11/10/2022 12:25 PM
6	tx_cw	11/10/2022 12:25 PM
7	tx_infinite_preamble	11/10/2022 12:25 PM
	keil_compile.py	11/10/2022 12:25 PM

Figure 3: 软件 demo 列表

每个 demo 所实现的功能请看对应工程下的 README.md 文档。

### 1.3.2 使用到的硬件引脚

在整个工程中，所使用到的 MCU 硬件引脚都放到了头文件 modem\_pinout.h 中，客户可根据需要进行相应修改，如下如所示：



```

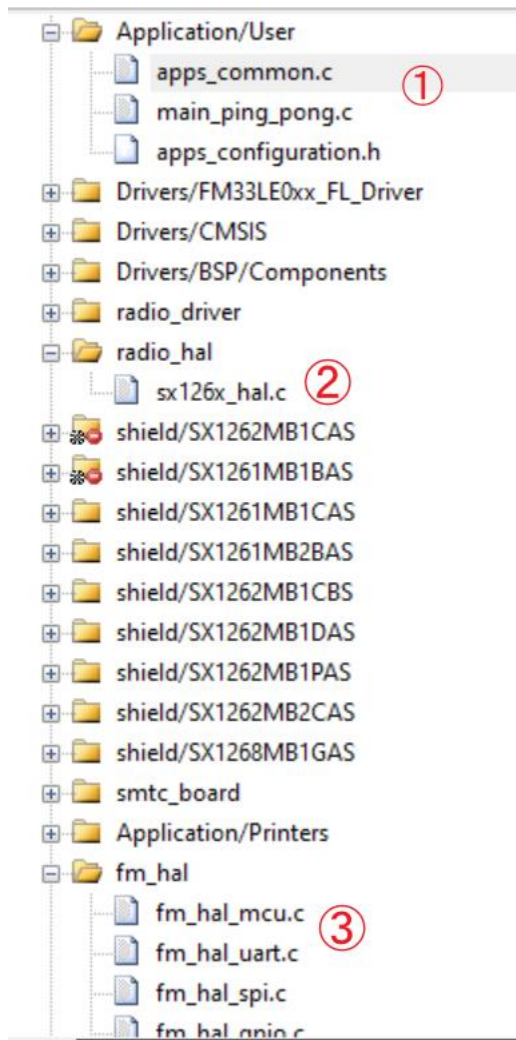
62
63 #define SMTc_RADIO_SPI_GPIO      GPIOB
64 #define SMTc_RADIO_SPI_MOSI_PIN FL_GPIO_PIN_11
65 #define SMTc_RADIO_SPI_MISO_PIN FL_GPIO_PIN_10
66 #define SMTc_RADIO_SPI_SCLK_PIN FL_GPIO_PIN_9
67 #define SMTc_RADIO_SPI_NSS_PIN  FL_GPIO_PIN_8
68
69 #define SMTc_RADIO_NRST_GPIO GPIOC
70 #define SMTc_RADIO_NRST_PIN   FL_GPIO_PIN_8
71
72 #define SMTc_RADIO_DIOX_GPIO GPIOA
73 #define SMTc_RADIO_DIOX_PIN  FL_GPIO_PIN_15
74 #define SMTc_DIOX_EXIT_LINE  FL_GPIO_EXTI_LINE_3
75
76 #define SMTc_RADIO_BUSY_GPIO GPIOA
77 #define SMTc_RADIO_BUSY_PIN  FL_GPIO_PIN_13
78
79 /* LED */
80 #define SMTc_LED_RX_GPIO GPIOC
81 #define SMTc_LED_RX_PIN   FL_GPIO_PIN_12
82
83 #define SMTc_LED_TX_GPIO GPIOC
84 #define SMTc_LED_TX_PIN   FL_GPIO_PIN_11
85
86 #define ANT_SW_GPIO GPIOA
87 #define ANT_SW_PIN   FL_GPIO_PIN_0
88
89 /* UART1 */
90 #define FM_UART1_GPIO      GPIOC
91 #define FM_UART1_TX_PIN    FL_GPIO_PIN_3
92 #define FM_UART1_RX_PIN    FL_GPIO_PIN_2

```

Figure 4: 使用的引脚列表

### 1.3.3 修改工程

客户如果想在在此工程的基础上修改为自己的工程，需要关心的文件如下图中的①、②、③所示：



### 1.3.4 参数配置

如果要选择 LoRa 或者 GFSK，然后配置不同的 SF、frequency 等参数，直接在 apps\_configuration.h 文件中修改即可实现。

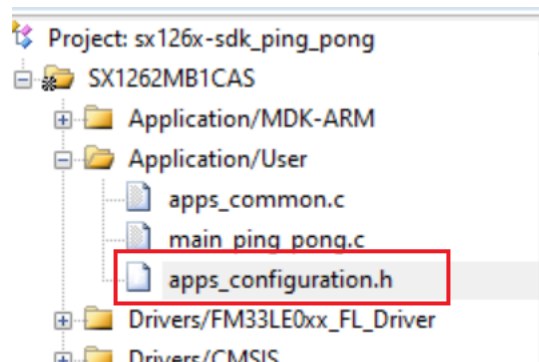


Figure 5: 参数配置



## 2 工程测试举例

如果要测试此 SDK 中所有工程，需要准备两套硬件测试板，一套用于发送 TX，一套用于接收 RX。下表列出了如何选择软件工程下载到测试板进行测试。

Table 2-1 工程测试列表

功能	TX Project	RX Project
CAD	sx126x- sdk_tx_infinite_preamble	sx126x-sdk_cad
	sx126x- sdk_per_transmitter	sx126x- sdk_cad_then_receive
	sx126x- sdk_cad_then_transmit	sx126x- sdk_per_receiver
PER	sx126x- sdk_per_transmitter	sx126x- sdk_per_receiver
Ping Pong	sx126x-sdk_ping_pong	
Spectral scan	sx126x-sdk_tx_cw or sx126x- sdk_tx_infinite_preamble	sx126x- sdk_spectral_scan
Spectrum display	sx126x-sdk_tx_cw or sx126x- sdk_tx_infinite_preamble	sx126x- sdk_spectrum_display
sx126x-sdk_tx_cw	这两个工程比较简单，只是一种信号发射，可以配着以上工程检测信号状态，或者有条件的，在频谱仪上观察波形状态。	
sx126x- sdk_tx_infinite_preamble		

## 3 注意事项

### 3.1 README

每个工程下的 README，一定要读，这是每个工程的简单介绍，对这个工程实现的功能的一个概括。

### 3.2 选择不同测试板

如果要测试不同芯片比如 SX1261、SX1262 和 SX1268，首先，需要选择硬件 EVK 板，然后在软件工程中选择对应的 Target 进行编译、下载。如下图：

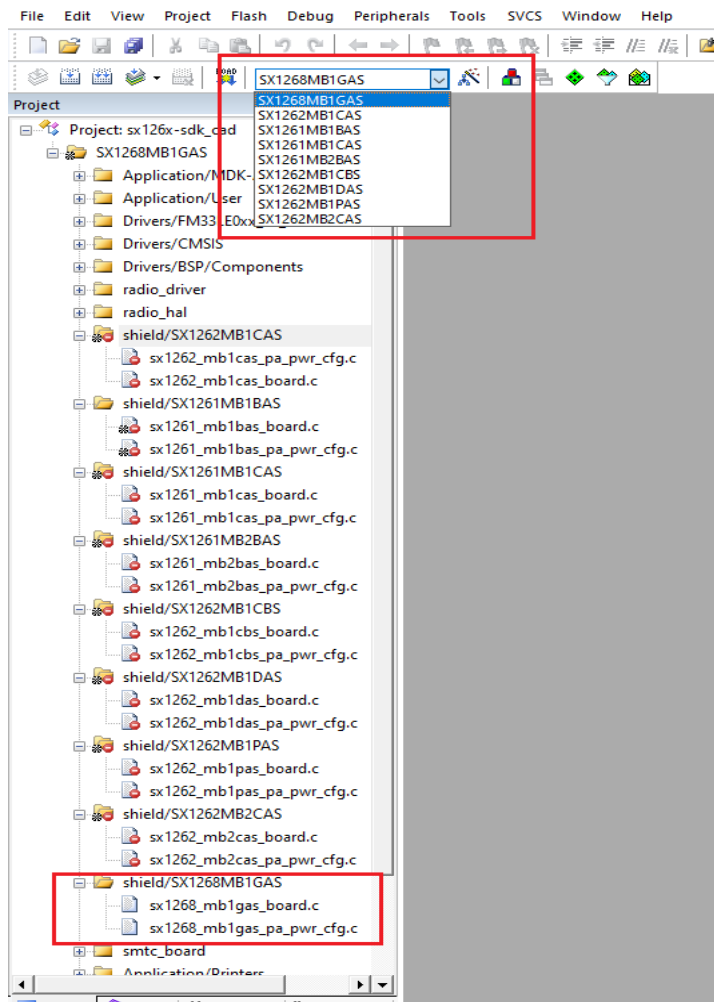


Figure 6: Target 选择

### 3.3 同一目录下多工程

当在同一目录下有多个 keil 工程时，编译、下载，有时候会出现下载固件错乱的情况。解决方法有两种：

第一种：编译时不要选择 Build，而是选择 Rebuild 去编译。

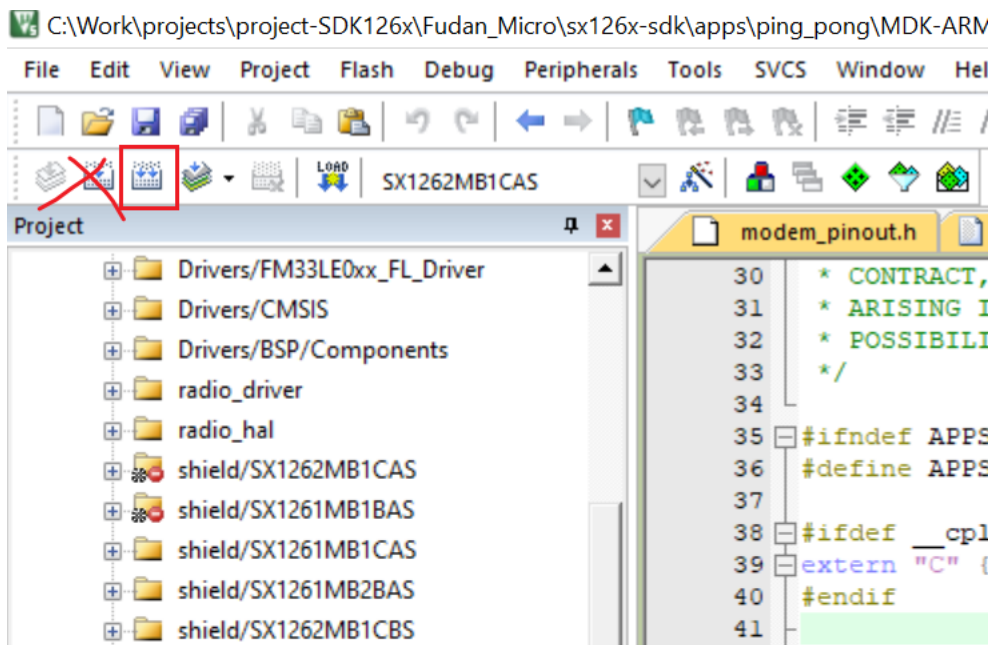


Figure 7: rebuild

第二种：编译前先选择 Clean Target 清除一下，再选择 Build。

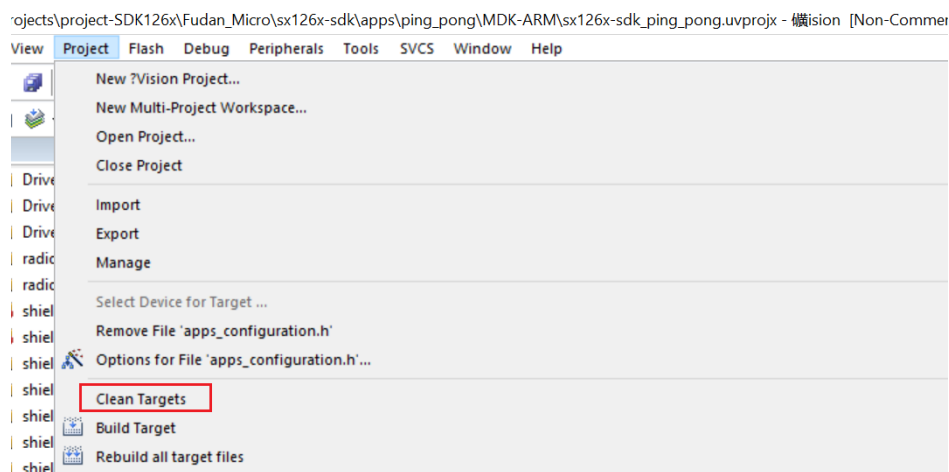


Figure 8: clean target

## 4 EVK 板资料官网下载

Table 4-1 EVK 板官网

Shield	PCB	官网网址
SX1261MB1BAS	E406v03a	<a href="#">Development Kit, SX1261, 868 MHz for Europe   Semtech</a>
SX1261MB1CAS	E449V01A	<a href="#">Development Kit, SX1261, 923 MHz for Asia   Semtech</a>
SX1261MB2BAS	E498V01A	<a href="#">Mbed Shield, SX1261, 868 MHz for Europe   Semtech</a>
SX1262MB1CAS	E428V03A	<a href="#">Development Kit, SX1262, 915 MHz for North America   Semtech</a>
SX1262MB1CBS	E449V01A	<a href="#">Development Kit, SX1262, 923 MHz for Korea   Semtech</a>
SX1262MB1DAS	E449V01A	<a href="#">Development Kit, SX1262, 866 MHz for India   Semtech</a>
SX1262MB1PAS	E449V01A	<a href="#">Development Kit, SX1262, 915 MHz for Australia and North America   Semtech</a>
SX1262MB2CAS	E499V01B	<a href="#">Mbed Shield, SX1262, 915 MHz for North America   Semtech</a>
SX1268MB1GAS	E512V01A	<a href="#">Development Kit, SX1268, 490 MHz for China and Asia   Semtech</a>

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## 5 Revision History

Version	Date	Changes and/or Modifications
1.0	November 25, 2022	Initial Version
1.1	February 17, 2023	Rewrite all the contents



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## Contact Information

Semtech Corporation  
Wireless & Sensing Products  
200 Flynn Road, Camarillo, CA 93012  
E-mail: [sales@semtech.com](mailto:sales@semtech.com)  
Phone: (805) 498-2111, Fax: (805) 498-3804  
[www.semtech.com](http://www.semtech.com)