

FD6818B Application Notes

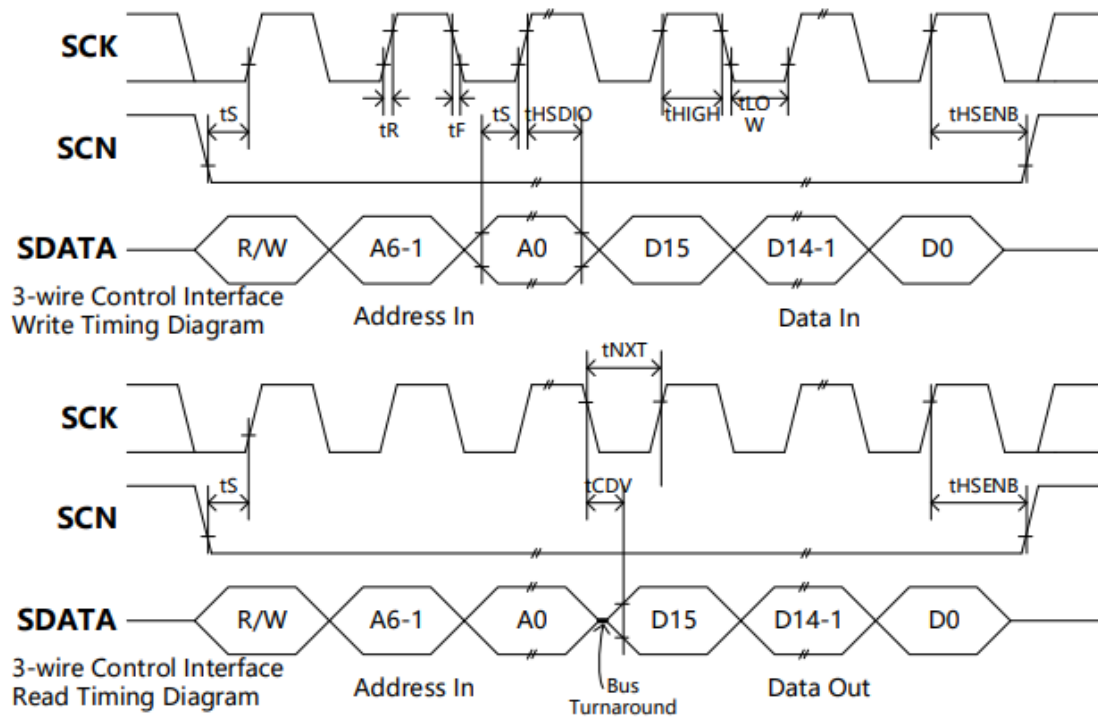
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1.MCU Interface - 3 Wire SPI

| Parameter | Symbol | Min. | Typ. | Max. |
|--|---------|-----------|------|-------|
| SCK Frequency | fSCK | 0 MHz | — | 8 MHz |
| SCK High Time | tHIGH | 25 ns | — | — |
| SCK Low Time | tLOW | 25 ns | — | — |
| SDATA Input, SCN to SCK \uparrow Setup | tS | 20 ns | — | — |
| SDATA Input to SCK \uparrow Hold | tHSDATA | 10 ns | — | — |
| SCN Input to SCK \downarrow Hold | tHSCN | 10 ns | — | — |
| SCK \downarrow to SDATA Output Valid | tCDV | 2 ns | — | 25 ns |
| SCK \downarrow to next SCK \uparrow after Address In | tNXT | 1 μ s | — | — |
| SCK, SCN, SDATA, Rise/Fall Time | tR,tF | — | — | 10 ns |



2.Reigster Initialization

芯片上电后进行 Soft Reset、内部 Power Up 和其他初始化设置。使用 RF_Initial(), 在 RF_Initail()里根据需求设置静噪门限、接收音量、接收 AGC、MIC 灵敏度、VoX 门限、调制深度、发射功率、亚音频等。

3. Tx/Rx Audio

- 1) 初始化后默认状态为正常 Speech 模式，可进行语音（300~3kHz）收发。
- 2) 开启压扩需要设置 RF_EnterCompander(), 关闭压扩使用 RF_ExitCompander()。
- 3) 注意压缩本身有一定增益，所以发射时要降低 REG_7D 的增益以保持原有的 MIC 灵敏度。

| Register | Default | Description |
|--------------|----------|--|
| REG_31<3> | 0 | Enable Compander Function. 1= Enable; 0=Disable |
| REG_28<11:9> | 0b101 | Rx DCC Filter(HPF1) 000=Bypass DC filter; |
| REG_28<8> | 0 | Rx AF Noise Gate Enable. |
| REG_28<7:0> | 0 | Rx AF Noise Gate Level |
| REG_29<11:9> | 0b011 | Tx DCC Filter(HPF1) 000=Bypass DC filter; |
| REG_29<8> | 0 | Tx AF Noise Gate Enable. |
| REG_29<7:0> | 0 | Tx AF Noise Gate Level |
| REG_2A<13:8> | 0b010000 | Noise Gate Time Constant. |

| | | |
|---------------|-------|---|
| | | <p><5:3>for Release Time</p> <p><2:0>for Attack Time.</p> <p>000=0 ms</p> <p>001=6 ms</p> <p>010=12 ms</p> <p>011=24 ms</p> <p>100=48 ms</p> <p>101=96 ms</p> <p>110=192 ms</p> <p>111=384 ms</p> |
| REG_2C<14:12> | 0b011 | <p>AF Amplitude Detection Frame Length,(after Pre/De-emphasis)</p> <p>000=0 ms</p> <p>001=4 ms</p> <p>010= 8ms</p> <p>011=16 ms</p> <p>...</p> |

| | | |
|--------------|----------|---|
| | | 111=28 ms |
| REG_2C<11:6> | 0b010001 | <p>Pre/De-emphasis DRC Time Constant.</p> <p><5:3>for Release Time.</p> <p><2:0>for Attack Time.</p> <p>000=0 ms</p> <p>001=6 ms</p> <p>010=12ms</p> <p>011=24 ms</p> <p>100=48 ms</p> <p>101=96 ms</p> <p>110=192 ms</p> <p>111=384 ms</p> |
| REG_2C<5:0> | 34 | <p>Pre-emhpasis Gain(dB)</p> <p>24=0dB</p> <p>25=1dB</p> <p>34=10dB</p> |
| REG_2F<13:8> | 24 | De-emhpasis Gain(dB) |

| | | |
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| | | 24=0dB 25=1dB 34=10dB |
| REG_2F<7:5> | 0b110 | Tx Soft Limiter Factor 000=bypass ... 111=hard limit |
| REG_2F<4:0> | 24 | Tx Soft Limiter Threshold 0=0.5 .. 31=0.99 |
| REG_6F<7:0> | Read Only | AF Tx/Rx Input Amplitude(dB) |
| REG_7E<5:3> | 0b101 | DC Filter Band Width for Tx (MIC In). 000=Bypass DC filter; |

Tx: MIC In->DCC->(CMPRESS)->HPF1->LPF1->PreEmph(->SCRMB)->LPF3K->HPF300->Limiter

Rx: FM Dem Out->HPF1->LPF1->HPF300(->SCRMB)->LPF3K->DeEmph ->(EXPAND)->Volume

4. 开启扰频

需要设置 RF_EnterScramble(), 关闭扰频使用 RF_ExitScramble()。

| Register | Default | Description |
|--------------|---------|---|
| REG_31<1> | 0 | Enable Scramble Function. 1=Enable; 0=Disable |
| REG_71<15:0> | 0x8517 | Scramble/Tone1 Frequency Control Word. =3300(Hz)* 10.32444 for XTAL 13M/26M or =3300(Hz)* 10.48576 for XTAL 12.8M/19.2M/25.6M/38.4M. - The scrambler inversion mixing frequency should be kept between 2.6kHz and 3.5kHz |

5. 滤波器开关使能

| Register | Default | Description |
|-------------|---------|---|
| REG_2B<10> | 0 | Disable AF Rx HPF300 filter. 0=Enable; 1=Disable |
| REG_2B<9> | 0 | Disable AF Rx LPF3K filter. 0=Enable; 1=Disable |
| REG_2B<8> | 0 | Disable AF Rx de-emphasis filter. 0=Enable; 1=Disable |
| REG_2B<2> | 0 | Disable AF Tx HPF300 filter. 0=Enable; 1=Disable |
| REG_2B<1> | 0 | Disable AF Tx LPF1 filter. 0=Enable; 1=Disable |
| REG_2B<0> | 0 | Disable AF Tx pre-emphasis filter. 0=Enable; 1=Disable |
| REG_43<8:6> | 0b001 | AF Tx LPF2 filter Band Width (Apass=1dB) Selection. |

| | | |
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| | | <p>100 = 4.5 kHz</p> <p>101 = 4.25 kHz</p> <p>110 = 4 kHz</p> <p>111 = 3.75 kHz</p> <p>000 = 3 kHz (for 25k Channel Space) 001</p> <p>= 2.5 kHz (for 12.5k Channel Space) 010 =</p> <p>2.75 kHz</p> <p>011 = 3.5 kHz</p> |
|--|--|--|

6. 音频响应调整

使用 `RF_SetAfResponse(u8 tx, u8 f3k, u8 db)`，其中参数 `tx=1` 发射/`tx=0` 接收，`f3k=1` 调整 3kHz/`f3k=0` 调整 300Hz，`db`=调整范围-1~+4dB。例如：

发射 300Hz 增大 2dB： `RF_SetAfResponse(1,0,2)`。

接收 3kHz 减小 3dB： `RF_SetAfResponse(0,1,-3)`。

7. 接收音量设置

| Register | Default | Description |
|-------------|---------|--|
| REG_48<9:4> | 0x3C | AF Rx Gain2. -28dB~3.5dB, 0.5dB/step. |
| REG_48<3:0> | 0b1111 | AF DAC Gain (after Gain1 and Gain2). 1111=max; 0000=min; about 2dB/step |

8. 发射调制设置及发射 mute

| Register | Default | Description |
|--------------|---------|--|
| REG_40<12> | 1 | Enable RF Tx Deviation. 1=Enable; 0=Disable |
| REG_40<11:0> | 0x4D0 | RF Tx Deviation Tuning (Apply for both in-band signal and sub-audio signal). 0=min; 0xFFF=max |
| REG_50<15> | 0 | Enable AF Tx Mute (for DTMF Tx or other applications). 1=Mute; 0=Normal |

9. MIC 灵敏度设置

| Register | Default | Description |
|-------------|---------|---|
| REG_7D<5:0> | 0x0e | MIC Sensitivity Tuning. 0x00=min; 0x3F=max; 0.5dB/step |

10. AF 输出选择

使用 RF_SetAf(u8 mode)，产生本地按键音、提示音可参考 RF_Key()，产生铃音并发射可参考 RF_Call()

| Register | Default | Description |
|--------------|----------|---|
| REG_47<13> | 1 | AF Output Inverse Mode. 1=Inverse |
| REG_47<11:8> | 0x1 | AF Output Selection. 0x0=Mute; 0x1=Normal AF Out; 0x2=Tone Out for Rx (Should enable Tone1 first); 0x3=Beep Out for Tx (Should enable Tone1 first andset REG_03[9]=1 to enable AF; 0x6=CTCSS/CDCSS Out for Rx Test; 0x8=FSK Out for Rx Test; Others=Reserved; |
| REG_6E<15:9> | ReadOnly | AF Freq Out, Nout. $\text{Freq} = \text{Nout} * 25390.625 / \text{Rout}$ Or $\text{Freq} = \text{Nout} * 25000 / \text{Rout}$ for 19.2M/38.4M |

AF 输出选择

| | | |
|-------------|----------|--|
| REG_6E<8:0> | ReadOnly | AF Freq Out, Rout. $\text{Freq} = \text{Nout} * 25390.625 / \text{Rout}$ Or $\text{Freq} = \text{Nout} * 25000 / \text{Rout}$ for 19.2M/38.4M |
|-------------|----------|--|

11. CTCSS/CDCSS

- 1) 开启 CTCSS 需要设置 RF_SetCtcss()和 RF_SetCtcs2(), 其中后者仅用于接收频率 55Hz (或其他 100Hz 以内频率) 的 CTCSS 尾音; 前者用于接收和发射正常 CTCSS。
- 2) 开启 CDCSS 需要设置 RF_SetCdcss(), 需要设置 134.4Hz 码率和 CDCSS 码。
- 3) 关闭亚音频使用 RF_ExitSubau()
- 4) 发射结束时产生尾音 使用 RF_GenTail(), 相位尾音使用参数 CTC120/CTC180/CTC240 , 如 RF_GenTail(CTC180); 换频尾音 (如 55Hz) 使用参数 CTC55, 如 RF_GenTail(CTC55); 在 CDCSS 模式下产生 134.4Hz 尾音使用参数 CTC134, 如 RF_GenTail(CTC134)
- 5) 读取 CTCSS 状态使用 RF_GetCtcss(), 返回 1 表示收到 CTC1 (主 CTC), 返回 2 表示收到 CTC2 (如 55Hz 尾音); 读取 CDCSS 状态使用 RF_GetCdcss(), 返回 1 表示收到 CDC 正码, 返回 2 表示收到 CDC 反码; 读取相位尾音状态使用 RF_GetTail(), 返回 1 表示收到 120°相位变化尾音, 返回 2 表示收到 180°相位变化尾音, 返回 3 表示收到 240°相位变化尾音。

| Register | Default | Description |
|------------|---------|--|
| REG_51<15> | 0 | 1=Enable Tx CTCSS/CDCSS; 0=Disable |
| REG_51<14> | 0 | 1= GPIO0(PIN2) Input for CDCSS; 0=Normal Mode |
| REG_51<13> | 0 | 1=Transmit negative CDCSS code 0=Transmit positive CDCSS code |

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|--------------|------|--|
| REG_51<12> | 0 | CTCSS/CDCSS mode selection. 1=CTCSS, 0=CDCSS |
| REG_51<11> | 0 | CDCSS 24/23bit selection. 1=24bit, 0=23bit |
| REG_51<10> | 0 | 1050Hz Detection Mode. 1=1050/4 Detect Enable, CTC1 should be set to 1050/4 Hz |
| REG_51<9> | 0 | Auto CDCSS Bw Mode. 1=Disable; 0=Enable. |
| REG_51<8> | 0 | Auto CTCSS Bw Mode. 0=Enable; 1=Disable |
| REG_51<6:0> | 0 | CTCSS/CDCSS Tx Gain1 Tuning. 0=min; 0x7F=max |
| REG_2E<9:8> | 0x10 | CTCSS/CDCSS Tx Gain2 Tuning (after Gain1). 00=12dB; 01=6dB; 10=0dB; 11=-6dB |
| REG_07<15:0> | | When <15:13>=0 for CTC1 <12:0>=CTC1 frequency control word |

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| | | <p> $= \text{freq(Hz)} * 20.64888$ for XTAL 13M/26M or $= \text{freq(Hz)} * 20.97152$ for XTAL 12.8M/19.2M/25.6M/38.4M </p> <p> When $\langle 15:13 \rangle = 1$ for CTC2(Tail 55Hz Rx detection) $\langle 12:0 \rangle = \text{CTC2 (should below 100Hz) frequency}$ control word </p> <p> $= 25391 / \text{freq(Hz)}$ for XTAL 13M/26M or $= 25000 / \text{freq(Hz)}$ for XTAL 12.8M/19.2M/25.6M/38.4M </p> <p> When $\langle 15:13 \rangle = 2$ for CDCSS 134.4Hz $\langle 12:0 \rangle = \text{CDCSS baud rate frequency (134.4Hz)}$ control word </p> <p> $= \text{freq(Hz)} * 20.64888$ for XTAL 13M/26M or $= \text{freq(Hz)} * 20.97152$ for XTAL 12.8M/19.2M/25.6M/38.4M </p> |
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| | | <p>When<15:13>=3 for CTC3(Tail 62Hz Rx detection)</p> <p><12:0>=CTC3 (should below 100Hz)frequency control word</p> <p>= 25391/freq(Hz) for XTAL 13M/26M or</p> <p>= 25000/freq(Hz) for XTAL 12.8M/19.2M/25.6M/38.4M</p> |
| REG_08<15:0> | | <p><15>=1 for CDCSS high 12bit</p> <p><15>=0 for CDCSS low 12bit</p> <p><11:0>=CDCSS high/low 12bit code</p> |
| REG_52<15> | 0 | <p>Enable 120/180/240 degree shift CTCSS or 134.4HzTail when CDCSS mode. When Rx, you can set this bit=1 to clear CTCSS Phase Shift Detect.</p> <p>0=Normal, 1=Enable</p> |
| REG_52<14:13> | 0b00 | <p>CTCSS tail mode selection (only valid when REG_52<15>=1).</p> <p>00= for 134.4Hz CTCSS Tail when CDCSS mode.</p> |

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| | | 01= CTCSS0 120°phase shift, 10= CTCSS0 180°phase shift 11= CTCSS0 240°phase shift |
| REG_52<12> | 0 | CTCSS Detection Threshold Mode, 1=~0.1%; 0=0.1 Hz |
| REG_52<11:6> | 0x0A | CTCSS found detect threshold. |
| REG_52<5:0> | 0x0F | CTCSS lost detect threshold. |
| REG_0C<15:14> | Read Only | <14>:CDCSS positive code received <15>:CDCSS negative code received |
| REG_0C<13:12> | Read Only | CTCSS Phase Shift Received. 00=No phase shift 01=CTCSS0 120°phase shift, 10= CTCSS0 180°phase shift 11= CTCSS0 240°phase shift |
| REG_0C<4> | Read Only | <4>:CTC3(62Hz) received |

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| | | |
| REG_0C<10:11> | Read Only | <11>:CTC2(55Hz) received <10>:CTC1 received |

12. SELCALL

- 1) 开启 SELCALL(5Tone)模式使用 RF_Enter5tone(), 该函数仅对接收频率系数、接收门限、发射通路进行了设置, 不会影响到正常音频收听。
- 2) 退出 SELCALL(5Tone)模式使用 RF_Exit5tone()
- 3) 发射 SELCALL(5Tone)使用 RF_5toneTransmit(), 使用 MCU 计时根据发射码更换发射 SELCALL(5Tone)的频率 (Tone1)。
- 4) 接收 SELCALL(5Tone)使用 RF_5toneReceive(), 返回 1 失败, 返回 0 成功

13. DTMF

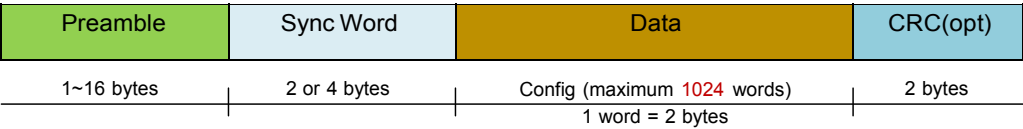
- 1) 开启 DTMF 模式使用 RF_EnterDtmf(), 该函数仅对 DTMF 接收频率系数、接收门限、发射通路进行了设置, 不会影响到正常音频收听。
- 2) 退出 DTMF 模式使用 RF_ExitDtmf()
- 3) 发射 DTMF 使用 RF_DtmfTransmit(), 使用 MCU 计时根据发射码更换发射 DTMF 的频率 (Tone1+Tone2)。
- 4) 接收 DTMF 使用 RF_DtmfReceive(), 返回 1 失败, 返回 0 成功

| Register | Default | Description |
|--------------|---------|---|
| REG_70<15> | 0 | Enable TONE1 1=Enable; 0=Disable. |
| REG_70<14:8> | 0 | TONE1 tuning gain |
| REG_70<7> | 0 | Enable TONE2 1=Enable; 0=Disable. |
| REG_70<6:0> | 0 | TONE2/FSK tuning gain |
| REG_71<15:0> | 0x8517 | TONE1/Scramble frequency control word. =freq(Hz)* 10.32444 for XTAL 13M/26M or |

| | | |
|--------------|-----------|---|
| | | $\text{=freq(Hz)} * 10.48576$ for XTAL 12.8M/19.2M/25.6M/38.4M. |
| REG_72<15:0> | 0x2854 | TONE2/FSK frequency control word $\text{=freq(Hz)} * 10.32444$ for XTAL 13M/26M or $\text{=freq(Hz)} * 10.48576$ for XTAL 12.8M/19.2M/25.6M/38.4M. |
| REG_50<15> | 0 | Enable AF Tx Mute (for DTMF Tx or other applications). 1=Mute; 0=Normal |
| REG_0B<11:8> | Read Only | DTMF/5Tone Code Received. |

14. FSK

- 1) 开启 FSK 模式使用 RF_EnterFsk(), 不会影响到正常音频收听, 且可以同时进入 DTMF/SELCALL 模式进行接收。FSK 速率寄存器与 Tone2 寄存器复用。使用 2400bps 模式需要开启宏定义 FSK2400
- 2) 退出使用 RF_ExitFsk()
- 3) 发射 FSK 使用 RF_FskTransmit(), 返回 1 失败, 返回 0 成功
- 4) FSK 帧格式 (CRC 为可选), 如果要兼容 BK4815/BK4818 则需要在 Data 部分完成 BK4815/BK4818 FSK 帧结构里的Addr/Type/Size/CRCA/Payload/CRCB 数据组帧, 并且关掉 FD6818BFSK 帧结构的CRC 部分, 设置相同的 Preamble 和 Sync Word。



1. 接收 FSK 使用 RF_FskReceive(), 返回 1 失败, 返回 0 成功

| Register | Default | Description |
|---------------|---------|---|
| REG_58<15:13> | 000 | FSK Tx Mode Selection. 000 for FSK1.2K and FSK2.4K Tx; 001 for FFSK1200/1800 Tx; 011 for FFSK1200/2400 Tx; |

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| | | 101 for NOAA SAME Tx |
| REG_58<12:10> | 000 | FSK Rx Mode Selection. 000 for FSK1.2K, FSK2.4K Rx and NOAA SAME Rx; 111 for FFSK1200/1800 Rx; 100 for FFSK1200/2400 Rx; |
| REG_58<9:8> | 00 | FSK Rx Gain. |
| REG_58<5:4> | 00 | FSK Preamble Type Selection. 11=0xAA; 10=0x55; 00=0xAA or 0x55 due to the MSB of FSK Sync Byte 0. |
| REG_58<3:1> | 000 | FSK Rx Band Width Setting. 100 for FSK 2.4K and FFSK1200/2400; 000 for FSK 1.2K; 001 for FFSK1200/1800; 010 for NOAA SAME Rx |
| REG_58<0> | 0 | FSK Enable. 1=Enable; 0=Disable. |
| REG_59<15> | 0 | Clear TX FIFO, 1=clear |

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| REG_59<14> | 0 | Clear RX FIFO, 1=clear |
| REG_59<13> | 0 | 1=Enable FSK Scramble |
| REG_59<12> | 0 | 1=Enable FSK RX |
| REG_59<11> | 0 | 1=Enable FSK TX |
| REG_59<10> | 0 | 1=Invert FSK data when RX |
| REG_59<9> | 0 | 1=Invert FSK data when TX |
| REG_59<7:4> | 0 | FSK Preamble Length Selection 0=1 byte; 1=2 bytes; 2=3 bytes; ...; 15=16 bytes. |
| REG_59<3> | 0 | FSK Sync Length Selection. 1=4 bytes (FSK Sync Byte 0,1,2,3) 0=2 bytes (FSK Sync Byte 0,1) |
| REG_5A<15:8> | 0x85 | FSK Sync Byte 0 (Sync Byte 0 first, then 1,2,3) |
| REG_5A<7:0> | 0xCF | FSK Sync Byte 1 |
| REG_5B<15:8> | 0xAB | FSK Sync Byte 2 |
| REG_5B<7:0> | 0x45 | FSK Sync Byte 3 |
| REG_5C<6> | 1 | CRC Option Enable. 1=Enable; 0=Disable. |

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| REG_5D<15:8> | 0x0F | FSK Data Length(Byte) Low 8bits(Total 11 bits). For example, 0xF means 16 bytes length. |
| REG_5D<7:5> | 0 | FSK Data Length(Byte) High 3bits(Total 11 bits). |
| REG_5E<9:3> | 64 | FSK Tx FIFO (Total 128 Words) Almost Empty Threshold. |
| REG_5E<2:0> | 4 | FSK Rx FIFO (Total 8 Words) Almost Full Threshold. |
| REG_5F<15:0> | x | FSK Word Input/Output. |
| REG_70<6:0> | 0 | TONE2/FSK tuning gain |
| REG_72<15:0> | 0x2854 | TONE2/FSK frequency control word =freq(Hz)* 10.32444 for XTAL 13M/26M or =freq(Hz)* 10.48576 for XTAL 12.8M/19.2M/25.6M/38.4M. |
| REG_0B<7> | Read Only | FSK Rx SyncN Fround. |
| REG_0B<6> | Read Only | FSK Rx SyncP Fround. |
| REG_0B<4> | Read Only | FSK Rx CRC Indicator. |

FSK

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| | | 1=CRC Pass; 0=CRC Fail. |
|--|--|-------------------------|

15. MDC1200

- 1) 开启 MDC 模式使用 `RF_EnterMdc()`，不会影响到正常音频收听，且可以同时进入 DTMF/SELCALL 模式进行接收。MDC 速率寄存器与 Tone2 寄存器复用。默认模式为 1200/1800，若想使用 1200/2400 模式需要开启宏定义 `MDC2400`
- 2) 退出使用 `RF_ExitMdc()`
- 3) 发射 MDC 使用 `RF_MdcTransmit()`，返回 1 失败，返回 0 成功
- 4) 接收 MDC 使用 `RF_MdcReceive()`，返回 1 失败，返回 0 成功
- 5) 可支持 HDC1200 模式

16. NOAA SAME

- 1) 接收 NOAA SAME 码使用 RF_EnterNoaa (), 不会影响到正常音频收听, 且可以同时进入 NOAA 模式进行接收。NOAA 速率寄存器与 Tone2 寄存器复用
- 2) 退出使用 RF_ExitNoaa()
- 3) 接收 FSK 使用 RF_NoaaReceive(), 返回 1 失败, 返回 0 成功, MCU 根据收到的码进行协议处理

17. VoX

- 1) 开启 VoX 使用 RF_EnterVox(); 关闭使用 RF_ExitVox()
- 2) 获取 VoX 状态使用 RF_GetVox(), 返回 1 收到 MIC 语音, 返回 0 未收到语音。
- 3) 获取 VoX 幅度使用 RF_GetVoxAmp(), 返回值为 MIC 语音幅度, 供 MCU 自行 VoX 判断使用。

| Register | Default | Description |
|---------------|-----------|--|
| REG_31<2> | 0 | Enable VOX detection. 1=Enable; 0=Disable |
| REG_7A<15:12> | 8 | VoX=0 Detection delay, *128ms |
| REG_46<10:0> | 0x50 | Voice Amplitude Threshold for VOX=1 detect |
| REG_79<15:11> | 8 | VoX Detection Interval Time. |
| REG_79<10:0> | 0x40 | Voice Amplitude Threshold for VOX=0 detect |
| REG_64<15:0> | Read Only | Voice Amplitude Out. |
| REG_0C<2> | Read Only | VoX Indicator 0: No 1: Yes |

18. Power Saving

- 1) 进入睡眠使用 RF_Slee(), 唤醒可以使用 RF_WakeUp(), 也可以直接进入发射 RF_Txon()或接收 RF_Rxon()
- 2) 睡眠状态下电流 200uA? (待改进); 唤醒后 IDLE 电流 3mA?

| Register | Default | Description |
|---------------|---------|--|
| REG_37<15> | 0 | DSP Enable. |
| REG_37<14:12> | 0b001 | DSP Voltage Setting. |
| REG_37<11> | 1 | ANA LDO Selection. 1=2.7v, 0=2.4v |
| REG_37<10> | 1 | VCO LDO Selection. 1=2.7v, 0=2.4v |
| REG_37<9> | 1 | RF LDO Selection. 1=2.7v, 0=2.4v |
| REG_37<8> | 1 | dac_drv2_en |
| REG_37<7> | 0 | ANA LDO Bypass. 1=Bypass, 0=Enable. |
| REG_37<6> | 0 | VCO LDO Bypass. |

| | | |
|-----------|---|--|
| | | 1=Bypass, 0=Enable. |
| REG_37<5> | 0 | RF LDO Bypass. 1=Bypass, 0=Enable. |
| REG_37<4> | 0 | ANA LDO ENABLE |
| REG_37<3> | 0 | RF LDO ENABLE |
| REG_37<2> | 0 | 1=Enable, 0=Disable. VCO LDO ENABLE |
| REG_37<1> | 0 | XTAL Enable. 1=Enable, 0=Disable. |
| REG_37<0> | 0 | Band-Gap Enable. 1=Enable, 0=Disable. |

19. Tx/Rx Mode Switch

1. 发射使用 RF_Txon()
2. 接收使用 RF_Rxon()
3. 发射带侧音（如发送铃声）时，使用 RF_Txon_Beep()

| Register | Default | Description |
|---------------|---------|--|
| REG_30<15> | 0 | VCO Calibration Enable. 1=Enable, 0=Disable |
| REG_30<13:10> | 0 | Rx Link Enable (include LNA/MIXER/PGA/ADC). 1111=Enable, 0000=Disable |
| REG_30<9> | 0 | AF DAC Enable. 1=Enable, 0=Disable. |
| REG_30<7:4> | 0 | PLL/VCO Enable. 1111=Enable, 0000=Disable |
| REG_30<3> | 0 | PA Gain Enable. 1=Enable, 0=Disable |
| REG_30<2> | 0 | MIC ADC Enable. |

| | | |
|-----------|---|---------------------------------------|
| | | 1=Enable, 0=Disable |
| REG_30<1> | 0 | Tx DSP Enable. 1=Enable, 0=Disable |
| REG_30<0> | 0 | Rx DSP Enable. 1=Enable, 0=Disable |

20. Squelchuelch, RSSI, Ex-Noise, Glitch

可通过 RF_GetRssi(), RF_GetNoise(), RF_GetGlitch()获取相应的参数，便于设置静噪等级。

| Register | Default | Description |
|---------------|--------------|---|
| REG_78<15:8> | 0x48 | RSSI threshold for Squelch=1, 0.5dB/step |
| REG_78<7:0> | 0x46 | RSSI threshold for Squelch =0, 0.5dB/step |
| REG_4F<14:8> | 0x2F | Ex-noise threshold for Squelch =0 |
| REG_4F<6:0> | 0x2E | Ex-noise threshold for Squelch =1 |
| REG_4D<7:0> | 0x20 | Glitch threshold for Squelch =0 |
| REG_4E<7:0> | 0x08 | Glitch threshold for Squelch =1 |
| REG_4E<15:12> | 0b0110 | Squelch=1 Delay Setting. |
| REG_4E<11:8> | 0b1111 | Squelch=0 Delay Setting. |
| REG_67<8:0> | Read Only | 0.5dB/step, RSSI (dBm) \approx REG_67<8:0>/2 – 160. |
| REG_65<6:0> | Read Only | Ex-noise indicator, dB/step. |

| | | |
|-------------|--------------|--|
| REG_63<7:0> | Read Only | Glitch indicator. |
| REG_0C<1> | Read Only | Squelch result output. 1=Link; 0=Loss |

21. AFC, ALC, MIC AGC

MIC PGA 增益自动控制可扩展 MIC 信号动态范围，使较大幅度 MIC 信号不失真发射。用在 DMR 方案中发射时应该关掉此功能（**REG_19<15>=1**），同时 ALC 功能也应关闭（**REG_4B<5>=1**）。

| Register | Default | Description |
|---------------|---------|---|
| REG_73<13:11> | 0b000 | Automatic Frequency Correction(AFC) Range Selection. 000=max; 111=min |
| REG_73<4> | 0 | Automatic Frequency Correction(AFC) Disable. 1=Disable; 0=Enable. |
| REG_19<15> | 1 | Automatic MIC PGA Gain Controller(MIC AGC) Disable. 1=Disable; 0=Enable. |
| REG_7D<6> | 0 | AF Level Controller(ALC) Disable. 1=Disable; 0=Enable. |
| REG_7D<5:0> | 28 | ALC Make Up Gain(0.5dB)->MIC Sens Gain |
| REG_53<13:8> | 0x11 | ALC Time Constant. |

| | | |
|-------------|---|---|
| | | <p><5:3>for Release Time</p> <p><2:0>for Attack Time</p> <p>000= 0 ms</p> <p>001=6 ms</p> <p>010=12ms</p> <p>011=24ms</p> <p>100=48ms</p> <p>101=96ms</p> <p>110=192ms</p> <p>111=384ms</p> |
| REG_53<4:2> | 4 | <p>ALC Amplitude Detection Frame Length</p> <p>000=0 ms</p> <p>001=2ms</p> <p>010=4ms</p> <p>...</p> <p>100=14ms</p> |

22. Frequency Setting

设置频率使用 RF_SetFreq(u16 freq_hi16, u16 freq_lo16), 注意换算公式: $\text{Frequency(Hz)} = (\text{freq_hi16} \ll 16 + \text{freq_lo16}) * 10$

| Register | Default | Description |
|--------------|---------|---|
| REG_38<15:0> | 0x3A98 | Frequency(Hz)= (freq_hi16<<16 + freq_lo16)*10 |
| REG_39<15:0> | 0x0271 | |

如设置 409.75MHz 频点, 则 RF_SetFreq((40975000>>16)&0xFFFF, 40975000&0xFFFF)

23. Tx Output Power

| Register | Default | Description |
|--------------|---------|--|
| REG_36<15:8> | 0 | PA Bias output 0~3.2V 0x00=0V ... 0xFF=3.2V |
| REG_36<7> | 0 | 1=Enable PACTL output; 0=Disable(Output 0 V) |
| REG_36<5:3> | 0b111 | PA Gain1 Tuning. 111(max)->000(min) |
| REG_36<2:0> | 0b111 | PA Gain2 Tuning. 111(max)->000(min) |

功率输出表（近似）

| Power(dBm) | PA Gain1 | | | | | | | |
|------------|----------|-----|-----|-----|-----|-----|-----|-----|
| PA Gain2 | 111 | 110 | 101 | 100 | 011 | 010 | 001 | 000 |

Tx Output Power

| | | | | | | | | |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| 111 | 7.26 | 7.01 | 6.67 | 6.17 | 5.39 | 4.10 | 1.52 | -5.02 |
| 110 | 6.38 | 6.08 | 5.67 | 6.06 | 4.12 | 2.53 | -0.72 | -9.45 |
| 101 | 5.65 | 5.30 | 4.82 | 4.13 | 3.03 | 1.18 | -2.58 | -13.4 |
| 100 | 5.01 | 4.62 | 4.08 | 3.30 | 2.08 | 0.01 | -4.16 | -16.9 |
| 011 | 4.19 | 3.73 | 3.11 | 2.21 | 0.84 | -1.48 | -6.11 | -20.5 |
| 010 | 2.60 | 2.04 | 1.24 | 0.13 | -1.56 | -4.25 | -9.50 | -22.9 |
| 001 | 1.04 | 0.35 | -0.63 | -1.98 | -3.90 | -6.80 | -12.3 | -23.7 |
| 000 | -0.70 | -1.51 | -2.65 | -4.16 | -6.20 | -9.35 | -14.9 | -24.3 |

24. Interrupt

中断信号可由任意 GPIO 送出（见 GPIO 设置函数），也可轮询 REG_0C<0>位，高有效，默认低。

中断可由芯片任意 GPIO 口输出，中断通过对 REG_02 寄存器写任意值来清除，如

```
RF_Write (0x02,0x0000); //clear interrupt
```

中断高电平（或中断寄存器 REG_0C<0>为 1）有效，得到中断时，要先清除中断，才能去读取中断向量表。

| Register | Default | Description |
|------------|-----------|---|
| REG_0C<0> | Read Only | Interrupt Indicator. 1=Interrupt Request; 0=No Request. |
| REG_3F<15> | 0 | FSK Tx Finished Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<14> | 0 | FSK FIFO Almost Empty Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<13> | 0 | FSK Rx Finished Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<12> | 0 | FSK FIFO Almost Full Interrupt Enable. |

| | | |
|------------|---|--|
| | | 1=Enable; 0=Disable. |
| REG_3F<11> | 0 | DTMF/5TONE Found Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<10> | 0 | CTCSS/CDCSS Tail Found Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<9> | 0 | CDCSS Found Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<8> | 0 | CDCSS Lost Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<7> | 0 | CTCSS Found Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<6> | 0 | CTCSS Lost Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<5> | 0 | VoX Found Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<4> | 0 | VoX Lost Interrupt Enable. 1=Enable; 0=Disable. |

| | | |
|------------|-----------|---|
| REG_3F<3> | 0 | Squelch Found Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<2> | 0 | Squelch Lost Interrupt Enable. 1=Enable; 0=Disable. |
| REG_3F<1> | 0 | FSK Rx Sync Interrupt Enable. 1=Enable; 0=Disable. |
| REG_02<15> | Read Only | FSK Tx Finished Interrupt. |
| REG_02<14> | Read Only | FSK FIFO Almost Empty Interrupt Enable. |
| REG_02<13> | Read Only | FSK Rx Finished Interrupt Enable. |
| REG_02<12> | Read Only | FSK FIFO Almost Full Interrupt. |
| REG_02<11> | Read Only | DTMF/5TONE Found Interrupt. |
| REG_02<10> | Read Only | CTCSS/CDCSS Tail Found Interrupt. |
| REG_02<9> | Read Only | CDCSS Found Interrupt. |
| REG_02<8> | Read Only | CDCSS Lost Interrupt. |
| REG_02<7> | Read Only | CTCSS Found Interrupt. |
| REG_02<6> | Read Only | CTCSS Lost Interrupt. |
| REG_02<5> | Read Only | VoX Found Interrupt. |

Interrupt

| | | |
|-----------|-----------|--------------------------|
| REG_02<4> | Read Only | VoX Lost Interrupt. |
| REG_02<3> | Read Only | Squelch Found Interrupt. |
| REG_02<2> | Read Only | Squelch Lost Interrupt. |
| REG_02<1> | Read Only | FSK Rx Sync Interrupt. |

25. GPIO

- 1) 根据对应的 PIN 及输出的模式使用 `RF_SetGpioOut(u8 num, u8 type, u8 val)`，其中 `num` 为 GPIO 序号，`type` 为输出模式，`val` 为 GPIO 输出模式下输出值。输出模式详见参考代码 `drive.c`
- 2) 获取 GPIO 输入值使用 `RF_GetGpioIn(u8 num)`，其中 `num` 为 GPIO 序号。

| Register | Default | Description |
|-----------|-----------|--|
| REG_0A<6> | Read Only | GPIO6 (PIN28) Input Indicator. 1=High; 0=Low. |
| REG_0A<5> | Read Only | GPIO5 (PIN29) Input Indicator. 1=High; 0=Low. |
| REG_0A<4> | Read Only | GPIO4(PIN30) Input Indicator. 1=High; 0=Low. |
| REG_0A<3> | Read Only | GPIO3 (PIN31) Input Indicator. 1=High; 0=Low. |
| REG_0A<2> | Read Only | GPIO2 (PIN32) Input Indicator. 1=High; 0=Low. |
| REG_0A<1> | Read Only | GPIO1 (PIN1) Input Indicator. |

| | | |
|------------|-----------|---|
| | | 1=High; 0=Low. |
| REG_0A<0> | Read Only | GPIO0 (PIN2) Input Indicator. 1=High; 0=Low. |
| REG_33<14> | 1 | GPIO6 (PIN28) Output Disable. 1=Output Disable; 0=Output Enable. |
| REG_33<13> | 1 | GPIO5 (PIN29) Output Disable. 1=Output Disable; 0=Output Enable. |
| REG_33<12> | 1 | GPIO4 (PIN30) Output Disable. 1=Output Disable; 0=Output Enable. |
| REG_33<11> | 1 | GPIO3 (PIN31) Output Disable. 1=Output Disable; 0=Output Enable. |
| REG_33<10> | 1 | GPIO2 (PIN32) Output Disable. 1=Output Disable; 0=Output Enable. |
| REG_33<9> | 1 | GPIO1 (PIN1) Output Disable. 1=Output Disable; 0=Output Enable. |
| REG_33<8> | 1 | GPIO0 (PIN2) Output Disable. 1=Output Disable; 0=Output Enable. |

| | | |
|-----------|---|--|
| REG_33<6> | 0 | GPIO6 (PIN28) Output Value. 1= High when Output Enable; 0=Low when Output Enable. |
| REG_33<5> | 0 | GPIO5 (PIN29) Output Value. 1= High when Output Enable; 0=Low when Output Enable. |
| REG_33<4> | 0 | GPIO4 (PIN30) Output Value. 1= High when Output Enable; 0=Low when Output Enable. |
| REG_33<3> | 0 | GPIO3 (PIN31) Output Value. 1= High when Output Enable; 0=Low when Output Enable. |
| REG_33<2> | 0 | GPIO2 (PIN32) Output Value. 1= High when Output Enable; 0=Low when Output Enable. |
| REG_33<1> | 0 | GPIO1 (PIN1) Output Value. 1= High when Output Enable; 0=Low when Output Enable. |

| | | |
|---------------|-----|---|
| REG_33<0> | 0 | GPIO0 (PIN2) Output Value. 1= High when Output Enable; 0=Low when Output Enable. |
| REG_34<15:12> | 0x0 | GPIO3 (PIN31) Output Type Selection. The Definitions is the same as REG_34<3:0>. |
| REG_34<11:8> | 0x0 | GPIO2 (PIN32) Output Type Selection. The Definitions is the same as REG_34<3:0>. |
| REG_34<7:4> | 0x0 | GPIO1 (PIN1) Output Type Selection. The Definitions is the same as REG_34<3:0>. |
| REG_34<3:0> | 0x0 | GPIO0 (PIN2) Output Type Selection. 0=High/Low 1=Interrupt 2=Squelch 3=VoX 4=CTCSS/CDCSS Compared Result 5=CTCSS Compared Result 6=CDCSS Compared Result |

| | | |
|--------------|-----|---|
| | | <p>7=Tail Detected Result 8=DTMF/5Tone</p> <p>Symbol Received Flag</p> <p>9=CTCSS/CDCSS Digital Wave</p> <p>Others=Reserved</p> |
| REG_35<11:8> | 0x0 | <p>GPIO6 (PIN28) Output Type Selection.</p> <p>The Definitions is the same as REG_34<3:0>.</p> |
| REG_35<7:4> | 0x0 | <p>GPIO5 (PIN29) Output Type Selection.</p> <p>The Definitions is the same as REG_34<3:0>.</p> |
| REG_35<3:0> | 0x0 | <p>GPIO4 (PIN30) Output Type Selection.</p> <p>The Definitions is the same as REG_34<3:0>.</p> |

26. XTAL

1. 芯片支持 26M，25.6M，13M，12.8M，19.2M 和 38.4M 的晶体或温补。默认 26M，若使用 26M 外的其他频率晶体或温补使用 `RF_SetXtal(u8 mode)`，如 `RF_SetXtal(XTAL19M2)`

27. Frequency Scan

- 1) 扫频使用 RF_FreqScan() 可以获取 LNAIN 脚的射频频率（需要较大幅度 > -40dBm），返回 1 表示失败，返回 0 表示成功。频率写入到全局变量 FRQ_HI16 和 FRQ_LO16。
- 2) 扫到频率后，设置接收频率到该频点，使用 RF_CtcDcsScan() 可获取 CTCSS 频率或 CDCSS 码，返回 0 表示失败，返回 1 表示收到 CTCSS 且频率写入全局变量 CtC_FREQ，返回 2 表示收到 23bit CDCSS，返回 3 表示收到 24bit CDCSS，23 或 24bit CDCSS 均写入全局变量 DCS_HI12 和 DCS_LO12。

| Register | Default | Description |
|---------------|-----------|--|
| REG_32<15:14> | 0b00 | Frequency Scan Time. 00=0.2 Sec; 01=0.4 Sec; 10=0.8 Sec; 11=1.6 Sec |
| REG_32<0> | 0 | Frequency Scan Enable. 1=Enable; 0=Disable. |
| REG_0D<15> | Read Only | Frequency Scan Indicator. 1=Busy; 0=Finished. |
| REG_0D<10:0> | Read Only | Frequency Scan High 16 bits. |
| REG_0E<15:0> | Read Only | Frequency Scan Low 16 bits. = REG_0D<10:0><<16 + REG_0E<15:0>, unit is 10Hz |

| | | |
|--------------|-----------|--|
| REG_68<15> | Read Only | CTCSS Scan Indicator. 1=Busy; 0=Found. |
| REG_68<12:0> | Read Only | CTCSS Frequency. Frequency(Hz) = REG_68<12:0>/20.64888 for 13M/26M XTAL and = REG_68<12:0>/ 20.97152 for 12.8M/19.2M/25.6M/38.4M XTAL |
| REG_69<15> | Read Only | CDCSS Scan Indicator. 1=Busy; 0=Found. |
| REG_69<14> | Read Only | 23 or 24 bit CDCSS Indicator. 1=24 bit; 0=23 bit. |
| REG_69<11:0> | Read Only | CDCSS High 12 bits. |
| REG_6A<11:0> | Read Only | CDCSS Low 12 bits. |

28. Channel Spacing

芯片支持多种带宽，包括常见的 12.5k/25k/6.25k/20k，使用 RF_SetChnSpace(u8 space)，输入参数 SPACE_12K5/SPACE_25K/SPACE_6K25/SPACE_20K 即可。可根据实际需求设置发射接收带宽。

| Register | Default | Description |
|---------------|---------|---|
| REG_43<14:12> | 0b100 | RF filter bandwidth (Apass=0.1dB) 000 = 2 kHz 001 = 2.5 kHz 010 = 3 kHz 011 = 3.5 kHz 100 = 4 kHz 101 = 4.5 kHz 110 = 5 111 = 5.5 kHz if REG_43<5>=1, RF filter bandwidth *=2; |
| REG_43<11:9> | 0b000 | RF filter bandwidth when signal is weak (Apass=0.1dB) |

| | | |
|-------------|-------|--|
| | | 000 = 2 kHz 001 = 2.5 kHz 010 = 3 kHz 011 = 3.5 kHz 100 = 4 kHz 101 = 4.5 kHz 110 = 5 111 = 5.5 kHz if REG_43<5>=1, RF filter bandwidth *=2; |
| REG_43<8:6> | 0b001 | AF Tx LPF2 filter Band Width (Apass=1dB) Selection. 110 = 5.5 111 = 5 110 = 4.5 kHz 111 = 4 kHz 000 = 3 kHz 001 = 2.5 kHz 010 = 2.75 kHz |

Channel Spacing

| | | |
|-------------|------|--|
| | | 011 = 3.5 kHz |
| REG_43<5:4> | 0b00 | BW Mode Selection. 00=12.5k; 01=6.25k; 10=25k/20k |

29. Digital Walkie-Talkie

当做数字收发机使用时需要 **bypass** 所有音频滤波器，使用 `RF_EnterBypass()`，退出该模式使用 `RF_ExitBypass()`。

30. Hardware Design

See FD6818B Datasheet

