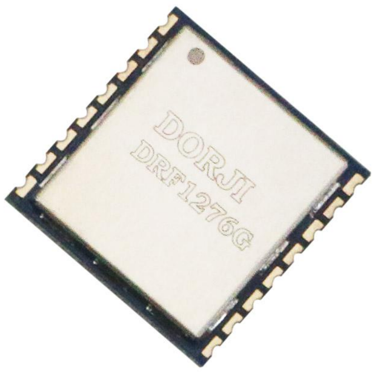
DRF1276G

20dBm LoRa Long Range RF Front-end Module V1.20

Features:



- Frequency Range: 868/915MHz
- Modulation: FSK/GFSK/MSK/LoRa
- SPI Data Interface
- Sensitivity: -139dBm
- Output Power: +20dBm
- Data Rate: <300 kbps
- 127dB dynamic Range RSSI
- Excellent blocking immunity
- Preamble detection
- Automatic RF sense and CAD monitor
- Built-in bit synchronizer for clock recovery
- Packet engine up to 256 bytes with CRC
- Working Temperature: -40°C ~+80°C
- Build-in temperature sensor
- Standby current: ≤ 1uA
- Supply voltage: 1.8~3.6V

Applications

- Remote Control
- Smart metering
- Home Automation
- Personal data logger
- Wireless sensor network
- Remote keyless entry
- Wireless PC peripherals

DESCRIPTION

DRF1276G is a type of low cost RF front-end transceiver module based on SX1276 from Semtech Corporation. It keeps the advantages of RFIC SX1276 but simplifies the circuit design. The high sensitivity (-139dBm) in LoRa modulation and 20dBm high power output make the module suitable for low range and low data rate applications.

DRF1276G module consists of RFIC SX1276, thin SMD crystal and antenna matching circuit. The antenna port is well matched to standard 50 Ohm impedance. Users don't need to spend time in RF circuit design and choose suitable antennas for different applications. DRF1276G operates at 1.8~3.6V with extra low standby current which makes it suitable for battery powered-up applications. Because DRF1276G is purely hardware module and it adopts ±10ppm crystal which the resolution of it places a important role in calculating spreading factor, bandwidth, etc. Users need to read the datasheet of SX1276 carefully in order to use the module in the best performance.

PIN FUNCTIONS

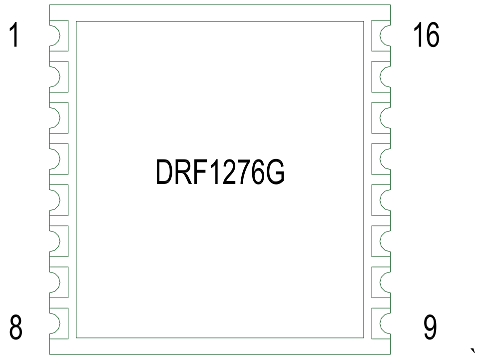


Figure 1: DRF1276G Pin Layout

PIN	Name	Function	Description
1	RESET	Input	Reset
2	DIO0	Input/Output	Digital I/O
3	DIO1	Input/Output	Digital I/O
4	DIO2	Input/Output	Digital I/O
5	DIO3	Input/Output	Digital I/O
6	DIO5	Input/Output	Digital I/O
7	VBAT	Power	Normal 3.3V
8	GND	Ground	Ground (0V)
9	SCK	Input	SPI clock input
10	MISO	Output	SPI data output
11	MOSI	Input	SPI data input
12	NSS	Output	SPI chip select input
13	NC	---	No connection
14	GND	Ground	Ground (0V)
15	ANT	Ground	50 Ohm Impedance
16	GND	Ground	Ground (0V)

Table 1: DRF1276G Pin Functions

ELECTRICAL SPECIFICATIONS

Symbol	Parameter (condition)	Min.	Typ.	Max.	Units
VCC	Supply Voltage	1.8		3.6	V
Temp	Operating temperature range	-40	25	80	°C
Freq	Frequency range @ 868MHz	862	868	878	MHz
	Frequency range @ 915MHz	900	915	928	MHz
IDD_R	Current in receive mode		12		mA
IDD_T	Current in transmit mode		120	125	mA
IDD_S	Current in sleep mode.			1	uA
Pout	Max. output power @868Mhz		18.5	19.5	dBm
	Max. output power @915Mhz		18	19	dBm
Sen	Receiver sensitivity @868MHz			-139	dBm
	Receiver sensitivity @915MHz			-137	dBm
ZANT	Antenna Impedance		50		Ohm

Table 2: DRF1276G Electrical Specifications

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min.	Max.	Units
VCC	Supply Voltage	-0.3	3.7	V
VI	Input voltage	-0.3	VCC+0.3	V
VO	Output voltage	-0.3	VCC+0.3	V
TST	Storage temperature	-55	125	°C

Table 3: DRF1276G Maximum Ratings

EXPLANATION

1. DRF1276G RESET Timing Sequence

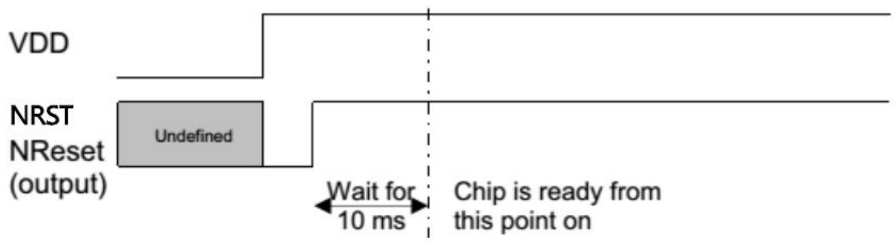


Figure 2: Power-On Reset Timing Diagram

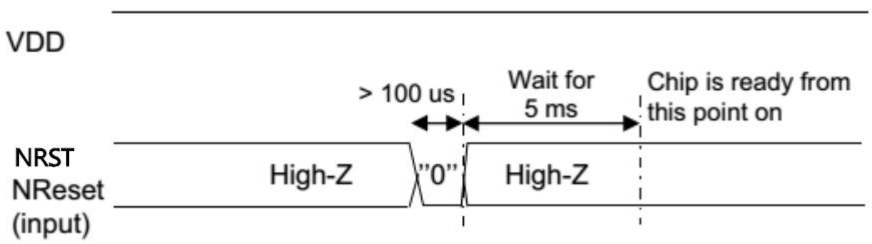


Figure 3: Manual Reset Timing Diagram

Designers can use MCU to reset the module through NRST pin by setting NRST=Low for more than 100us and then setting it to high for more than 5ms to fulfill the RESET.

2. SPI Interface

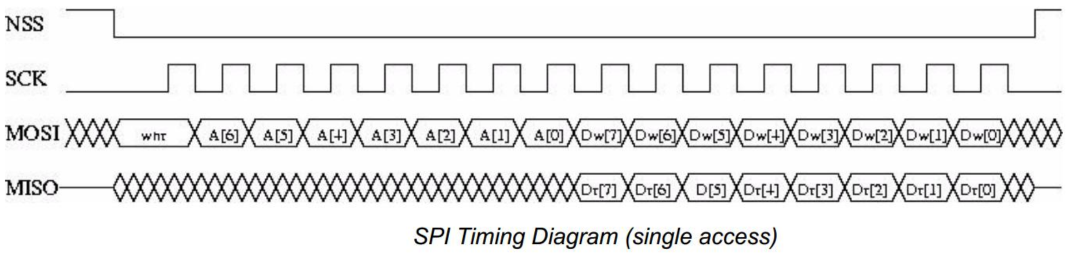


Figure 4: SPI Interface Timing Diagram

```
// SPI interface procedure
uint8_t SpiInOut( uint8_t outData )
{
	/* Send SPIy data */
	SPI_I2S_SendData( SPI_INTERFACE, outData );
	while( SPI_I2S_GetFlagStatus( SPI_INTERFACE, SPI_I2S_FLAG_RXNE ) == RESET );
	return SPI_I2S_ReceiveData( SPI_INTERFACE );
}
```

3. Connection Schematic

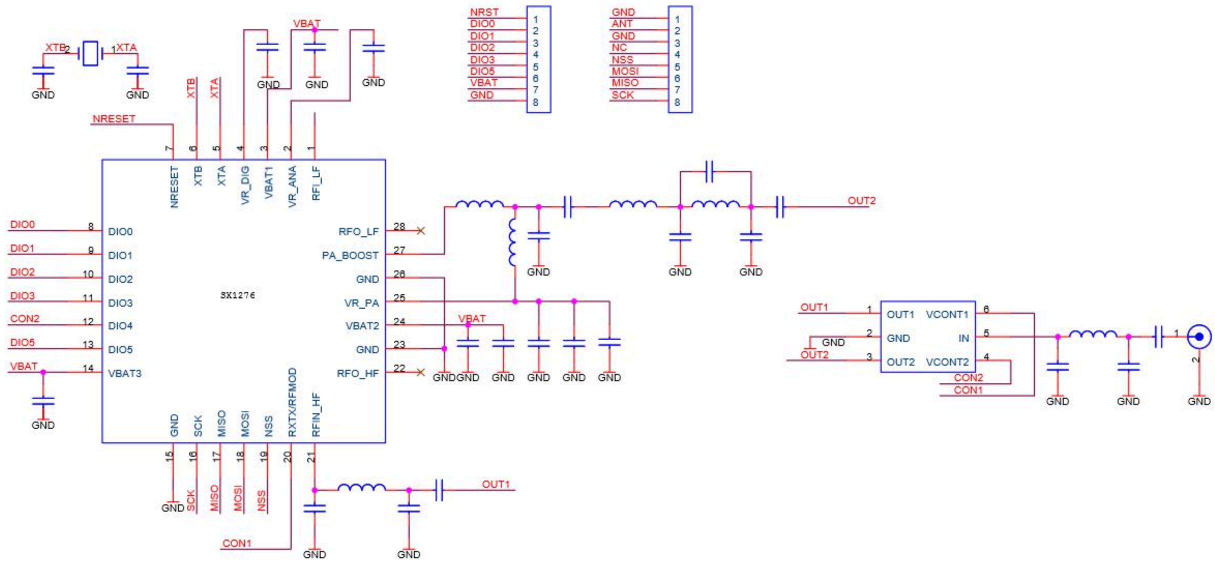


Figure 5: DRF1276G Schematic

The switch of TX/RX is realized by controlling the levels of RXTX/RFMOD and DIO4 pins in Lora mode. When RXTX/RFMOD=VHIGH and DIO4=0, TX is enabled and RX is disabled. When RXTX/RFMOD=0 and DIO4=VHIGH, the RX is enabled and TX is disabled. The level change of DIO4 is controlled by the related register.

Table 18 DIO Mapping LoRa^{TM} Mode

Operating Mode	DIOx Mapping	DIO5	DIO4	DIO3	DIO2	DIO1	DIO0
ALL	00	ModeReady	CadDetected	CadDone	FhssChangeChannel	RxTimeout	RxDone
	01	ClkOut	PllLock	ValidHeader	FhssChangeChannel	FhssChangeChannel	TxDone
	10	ClkOut	PllLock	PayloadCrcError	FhssChangeChannel	CadDetected	CadDone
	11	-	-	-	-	-	-

Figure 6: DIO Mapping Lora Mode

4. Initialization code

```
void RfRxInit(U8 Continuous)
{
U8 i;
//SX1276WriteReg(REG_LR_OPMODE,REG_LR_OPMODE_Const|RFLR_OPMODE_STANDBY);
// SX1276ReadReg( REG_LR_IRQFLAGS, &i );
```

```
SX1276WriteReg(REG_LR_IRQFLAGS,0xff );


SX1276WriteReg(REG_LR_PREAMBLEMSB,0x7f);
SX1276WriteReg(REG_LR_PREAMBLELSB,0xff);


SX1276WriteReg( REG_LR_DIOMAPPING1,
  RFLR_DIOMAPPING1_DIO0_00 | RFLR_DIOMAPPING1_DIO1_00 | RFLR_DIOMAPPING1_DIO2_
00 | RFLR_DIOMAPPING1_DIO3_00);
 SX1276WriteReg( REG_LR_DIOMAPPING2,RFLR_DIOMAPPING2_DIO4_01);

SX1276WriteReg( REG_LR_FIFOADDRPTR, 0x00 );

if(Continuous)
{
SX1276WriteReg(REG_LR_OPMODE,REG_LR_OPMODE_Const|RFLR_OPMODE_RECEIVER);
//Receive continuous (RXCONTINUOUS)
}
else
{
SX1276WriteReg(REG_LR_OPMODE,REG_LR_OPMODE_Const|RFLR_OPMODE_RECEIVER_SING
LE); //Receive single (RXSINGLE)
}

RxcRfSw;

RfState = MODE_RX;
LedPin_HI;
}


void RfTxInit(U8 TxPacketSize)
{
U8 i;
//TIM4_IER = 0x00;
AuxPin_HI;

SX1276WriteReg(REG_LR_OPMODE,REG_LR_OPMODE_Const|RFLR_OPMODE_STANDBY);
SX1276WriteReg(REG_LR_IRQFLAGS,0xff );
```

```
if(RfState != MODE_TX)
{


SX1276WriteReg( REG_LR_DIOMAPPING1,
   (RFLR_DIOMAPPING1_DIO0_01 | RFLR_DIOMAPPING1_DIO1_00 | RFLR_DIOMAPPING1_DIO2_
00 | RFLR_DIOMAPPING1_DIO3_00));
SX1276WriteReg( REG_LR_DIOMAPPING2,RFLR_DIOMAPPING2_DIO4_00);

if(LongPreambleFlag)
{
SX1276WriteReg(REG_LR_PREAMBLEMSB,(U8)(PreambleLength>>8));
SX1276WriteReg(REG_LR_PREAMBLELSB,(U8)(PreambleLength));
}
else
{
SX1276WriteReg(REG_LR_PREAMBLEMSB,0x00);
SX1276WriteReg(REG_LR_PREAMBLELSB,0x08);
}


TxcRfSw;

RfState = MODE_TX;

LedPin_LO;
}
else
{

SX1276WriteReg(REG_LR_PREAMBLEMSB,0x00);
SX1276WriteReg(REG_LR_PREAMBLELSB,0x08);
delay10us(2);
}

SX1276WriteReg( REG_LR_FIFOADDRPTR,0x00);
// Write payload buffer to LORA modem
SX1276WriteReg( REG_LR_PAYLOADLENGTH, TxPacketSize );


enableInterrupts();
SX1276WriteFifo( TxPacketSize);
```

```
disableInterrupts();

SX1276WriteReg(REG_LR_OPMODE,REG_LR_OPMODE_Const|RFLR_OPMODE_TRANSMITTER);

Time0_2Cnt = TxOverTimeConst;


if(RfOutBuffHeadPointer == RfOutBuffTailPointer)
{
RfOutBuffHeadPointer = 0;
RfOutBuffTailPointer = 0;
}
SafeCnt = 0;
}


// end of documented register in datasheet
// I/O settings
#define REG_LR_DIOMAPPING1                    0x40
#define REG_LR_DIOMAPPING2                    0x41

/*!
 * RegDioMapping1
 */
#define RFLR_DIOMAPPING1_DIO0_MASK            0x3F
#define RFLR_DIOMAPPING1_DIO0_00              0x00  // Default
#define RFLR_DIOMAPPING1_DIO0_01              0x40
#define RFLR_DIOMAPPING1_DIO0_10              0x80
#define RFLR_DIOMAPPING1_DIO0_11              0xC0

#define RFLR_DIOMAPPING1_DIO1_MASK            0xCF
#define RFLR_DIOMAPPING1_DIO1_00              0x00  // Default
#define RFLR_DIOMAPPING1_DIO1_01              0x10
#define RFLR_DIOMAPPING1_DIO1_10              0x20
#define RFLR_DIOMAPPING1_DIO1_11              0x30

#define RFLR_DIOMAPPING1_DIO2_MASK            0xF3
#define RFLR_DIOMAPPING1_DIO2_00              0x00  // Default
#define RFLR_DIOMAPPING1_DIO2_01              0x04
#define RFLR_DIOMAPPING1_DIO2_10              0x08
#define RFLR_DIOMAPPING1_DIO2_11              0x0C
```

```
#define RFLR_DIOMAPPING1_DIO3_MASK          0xFC
#define RFLR_DIOMAPPING1_DIO3_00             0x00  // Default
#define RFLR_DIOMAPPING1_DIO3_01             0x01
#define RFLR_DIOMAPPING1_DIO3_10             0x02
#define RFLR_DIOMAPPING1_DIO3_11             0x03

/*!
 * RegDioMapping2
 */
#define RFLR_DIOMAPPING2_DIO4_MASK          0x3F
#define RFLR_DIOMAPPING2_DIO4_00             0x00  // Default
#define RFLR_DIOMAPPING2_DIO4_01             0x40
#define RFLR_DIOMAPPING2_DIO4_10             0x80
#define RFLR_DIOMAPPING2_DIO4_11             0xC0

#define RFLR_DIOMAPPING2_DIO5_MASK          0xCF
#define RFLR_DIOMAPPING2_DIO5_00             0x00  // Default
#define RFLR_DIOMAPPING2_DIO5_01             0x10
#define RFLR_DIOMAPPING2_DIO5_10             0x20
#define RFLR_DIOMAPPING2_DIO5_11             0x30

#define RFLR_DIOMAPPING2_MAP_MASK                    0xFE
#define RFLR_DIOMAPPING2_MAP_PREAMBLEDETECT         0x01
#define RFLR_DIOMAPPING2_MAP_RSSI                    0x00  // Default
```

APPLICATION CIRCUIT

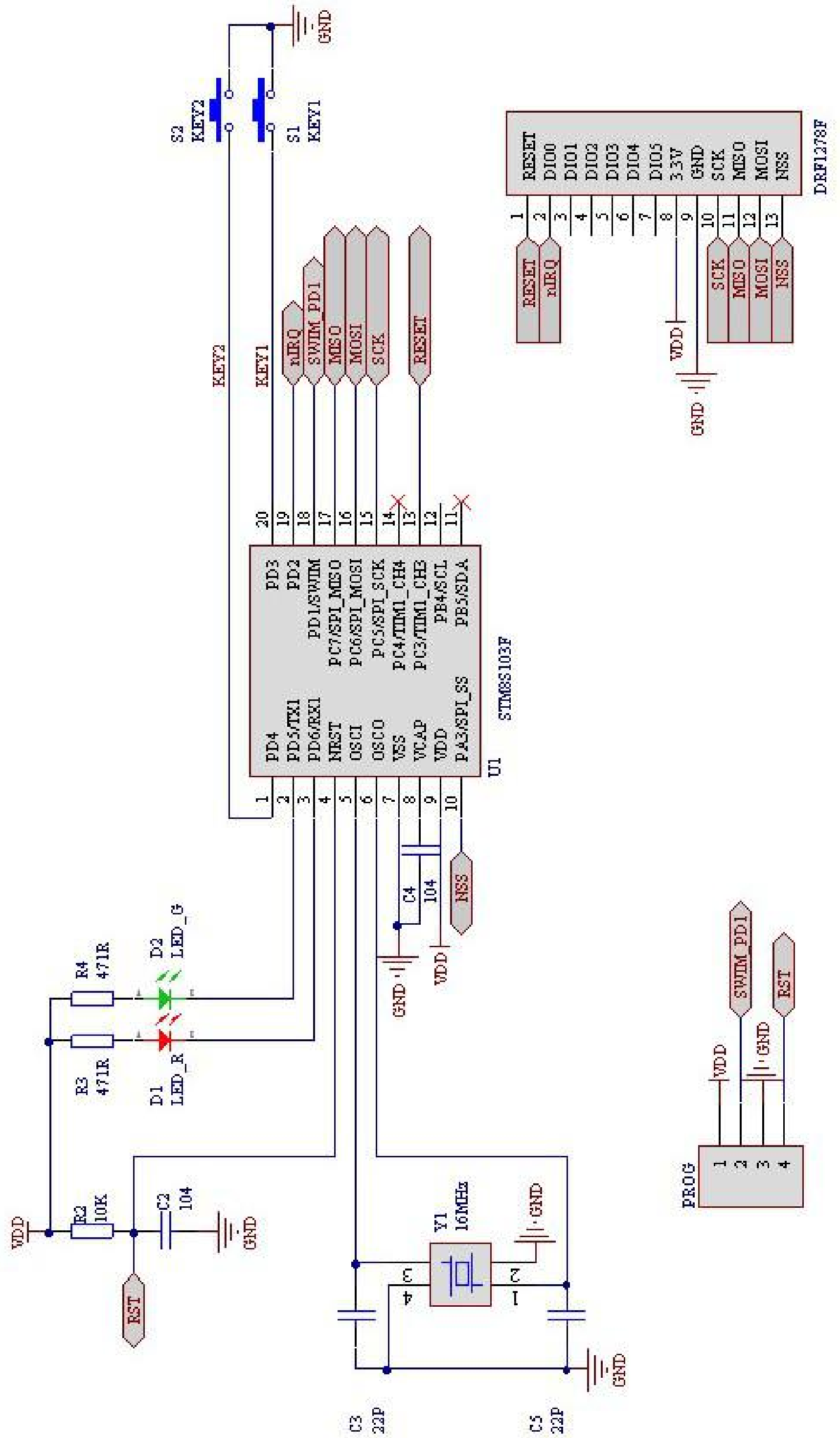


Figure 7: Application Circuit

MECHANICAL DATA

Unit: mm

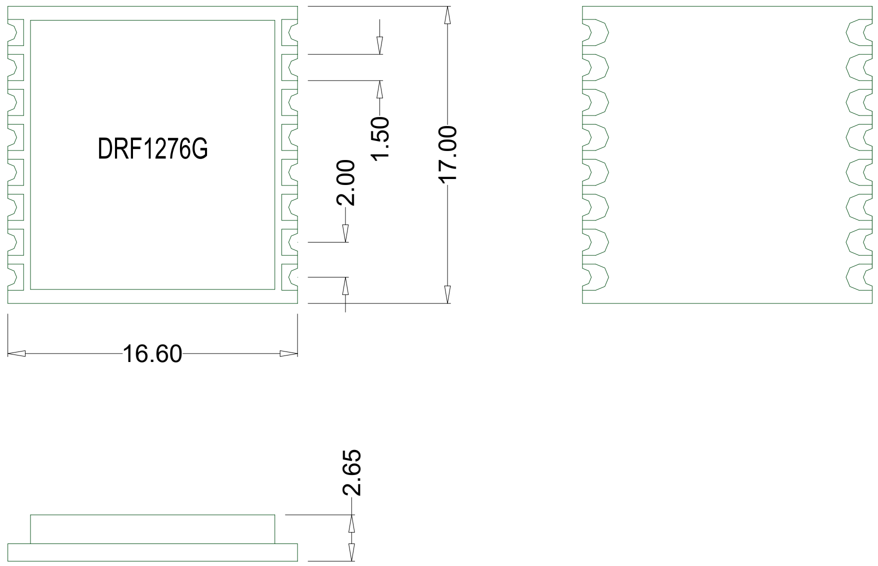


Figure 8: Mechanical Dimension

REFERENCE DOCUMENTS

1. SX1276 Datasheet
2. LoRa Calculator
3. LoRa Low Energy Design Guide
4. LoRa Modem Designer's Guide
5. SX1276 Development Kit User Guide

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