G-NiceRF®

user guide

Note: Revision History

Revision	Date	Comment
V1.0	2022-4	First release
V1.1	2022-9	Update Block Diagram

1. Descriptions

DMR818S-U is a 1W long distance DMR walkie talkie module, it comes with built-in high performance microcontroller, digital mobile radio IC and RF power amplifier. All parameters(CTCSS, CDCSS, SQ, Predefined channels etc.) can be easily modified with protocol. With external power supply, speaker, and audio amplifier, it is easy to become a professional digital walkie talkie. Simplified interface and Ultra small size make this module widely used in various applications and conveniently embedded into various handheld device.

➢ **DMR mode:**

■ Message transmission and reception.

■ Enhanced encryption of Voice and Text message.

■ Various voice call types: All call, Group call and Private call;

■ Reminder for input calling, calling status checking

■ Emergency alarm and radio monitor;

■ Repeater

➢ **Analog mode:**

■ CTCSS/CDCSS configurable   ■ Squelch levels configurable

2. Features

■ UHF band frequency: 400~470 MHz

■ Distance up to 5Km

■ High Sensitivity: -124dBm

■ Bit error rate down to 1% under -121dBm

■ Independent frequency for Tx and Rx.

■ 9 adjustable volume

■ Message transmission and reception

■ DMR(Digital Mobile Radio)/ Analog walkie talkie

■ Built-in EEPROM, data saved even powered off

■ 1ppm TCXO crystal

■ 51 CTCSS

■ 166 CDCSS

3. Application

■ DMR walkie talkie module   ■ Building security system

■ Invisible intercom system   ■ Audio surveillance system

4. Electrical Characteristics

Parameters	Test condition	Min.	Typ.	Max	Unit
Voltage range		3.4	4.2	5.0	V
Operating Temperature		-20	25	80	℃
Frequency range	@UHF	400		470	MHz
Start time			2000		ms
Uart baud rate			57600		bps
Current Consumption					
Sleep current	CS pulled low for 3 seconds		< 55		uA
Rx current			<135		mA
Tx current （high power）	@VCC=4.2V, 1w analog		<1300		mA
	@VCC=4.2V, 1w digital		<1000		mA
Tx current （low power）	@VCC=4.2V, 0.5w analog		<650		mA
	@VCC=4.2V, 0.5w digital		<500		mA
RF Parameters					
Tolerance of frequency			1	1.5	ppm
Modulation sensitivity	1.5KHz/2.5KHz frequency offset	6	7	12	mv

Adjacent-channel power	@12.5K offset	-60	-62		dBm
Mic input voltage			0.1	1.6	Vpp
CTCSS modulation frequency offset		0.35	0.4	0.6	KHz
Modulation characteristics	300HZ	-13	-11	-9	dB
	500HZ	-9	-6	-5	dB
	1000HZ	-3	0	1	dB
	2000HZ	3	6	7	dB
	3000HZ	5	7	11	dB
Rx Parameters					
Sensitivity	Analog (12db SNR)		-120		dBm
Receiving BER(DMR modulation)	@ -118dBm		5		%
Audio output amplitude				500	mV
Audio Output impedance			30		KOhm
Adjacent channel selectivity	Offset:+12.5KHz	60			dB
	Offset:+12.5KHz				

5. Functions descriptions:

1）Voice transmission

"PTT" pin is used to control the voice transmission. Pull low to enable voice transmission; High to end transmission.

Timing operation:
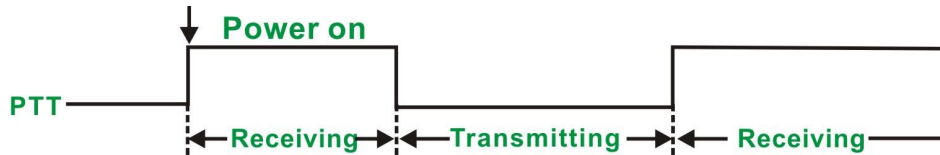
2）Voice receiving

After power on, DMR818S-U will enter into receiving mode automatically. It will return back to receiving mode after voice transmission ended.

For details of receiving process, please check "DMR818S-U communication protocol".

3) Sleep function

The module can switch work and sleep mode through CS pin. When the CS pin is high, it is the working mode, and when the CS pin is low, it is the sleep mode. In sleep mode, all peripherals of the module are turned off and cannot communicate and respond to serial commands.

Note: CS pin is low level by default, in sleep mode, the user needs to give high level externally to make the module work.

After the CS pin level changes, the state needs 3 seconds to switch.

4) Switch of Audio amplifier

Pin "SPK_EN" is used to control external audio amplifier. When playing voice, SPK_EN in high level, low level when other status. The timing of SPK_EN as blow:
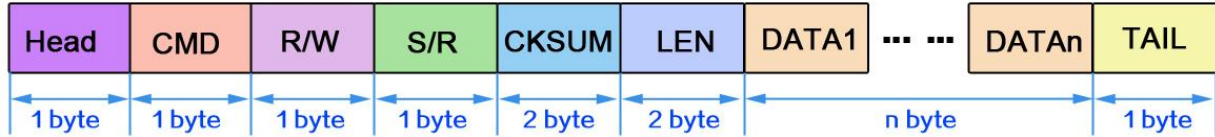
6. Brief of Serial Communication Protocol

All the parameters of DMR818S-Ucan be configured using Serial Communication Protocol.

MSB for the command.

Format as below：

The definition of protocol as below：

Offset	Flag	Length	Comment	Detail
0	Head	1	Packet header	0x68
1	CMD	1	command	0x01~0x28：parameter function refer to table 1
2	R/W	1	Read /write operation	0x00：reading ; 0x01：writing ; (external CPU TX is writing， external CPU RX is reading) 0x02：initiative sending
3	S/R	1	Setting/Responding	setting： 0x01：start answering： 0x00　Done 0x01　busy or fail（**note 2**） 0x02　No channel or channel errors （**note 3**） 0x07　 module killed 0x09　check error note：message, voice refer to below corresponding specification
4、5	CKSUM	2	Checksum	Checksum for all the packet
6、7	LEN	2	Data length	DATA length，no information， LEN is 0
8	DATA	len	Data info	
	TAIL	1	Tail of packet	0x10

Note 1：CMD as below：

CMD	Function	Message available for All channels or current channel	Message save when Power off (yes / no)
0x01	Channel change		**yes**
0x02	Receive volume	**All**	**yes**
0x03	scanning	current channel	no
0x04	Transceiver status checking	current channel	no
0x05	Signal strength value	current channel	no
0x06	Various call modes（Call Type）	current channel	no
0x07	Message mode setting and transmit	current channel	no
0x09	Emergency alarm	current channel	no
0x0a	Enhancements	current channel	no
0x0b	Mic Gain configuration	**All**	**yes**
0x0c	Power-saving mode configuration	**All**	**yes**
0x0d	Transceiver frequency	current channel	**yes**
0x0e	Repeater/off-web	current channel	no
0x10	Receive/call type, number output	current channel	no
0x11	Read received data	current channel	no
0x12	SQ setting	current channel	**yes**
0x13	Mode of CTCSS/CDCSS	current channel	**yes**
0x14	CTCSS/CDCSS	current channel	**yes**
0x15	Monitor switch	current channel	no
0x16	Bit Error rates		no
0x17	High/low power	current channel	**yes**
0x18	Contact person	current channel	no
0x19	Encryption switch	current channel	no
0x1a	Completed initialization		no

0x22	Transmit contacts information	current channel	no
0x23	Testing message	current channel	no
0x24	ID reading	**all**	no
0x25	Firmware Version reading	**all**	no
0x28	Checking encryption status	current channel	no
0x29	Set up a contact to receive group calls	current channel	**yes**
0x30	Delete group call contact	current channel	**yes**
0x1B	Set the phone number	current channel	**yes**
0x31	Set native color code	current channel	**yes**
0x32	Set analog bandwidth	current channel	**yes**
0x33	Set time slot	current channel	**yes**
0xF0	Restore default parameters	**all**	**yes**
0xF2	Software reset	**all**	no

Note 2: When DMR818S-U **is transmitting, receiving, and configuring, it will show 0x01 to tell setting fail for busy.**
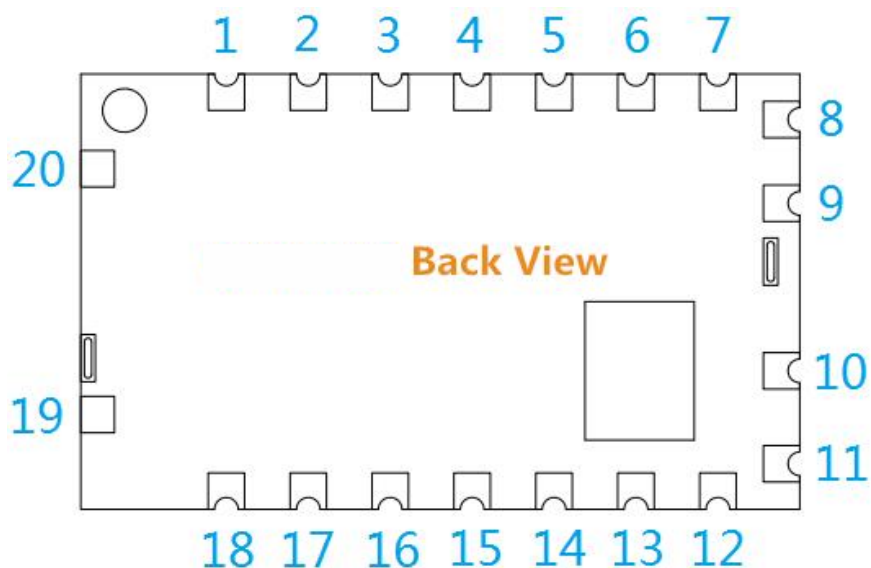
Note 3: It show 0x02 for below condition:

3.1: When change to non-exist channel;

3.2: It all happen when configure DMR settings in analogy channel(such as: message, special functions) ,

**3.3 : Configure analog parameters in DMR channel.**

7. Pin Assignment

| Pin NO.	Pin name	I/O	Level standard	Description
1	MIC_IN	I		Microphone or line in
2	UART-TX	O	0-3.3V	Transmit
3	UART-RX	I	0-3.3V	receive
4, 12	NC			
5	HST_TXD	O	0-3.3V	Transmit data pin (for upgrading program)
6	HST_RXD	I	0-3.3V	Receive data pin (for upgrading program)
7	ANT			connect 50 ohm antenna
8, 9, 10	GND	-		Ground
11	VCC	-	0-5V	External and Positive supply 3.3~5V
13	CS	I	0-5V	High level for normal working, leave open or pull low to enter sleeping mode
14	PTT	I	0-3.3V	Module Input, Transmitting/receiving control, pull low to force the module to enter TX state; pull high for Rx state
15	+3.3V	-		3.3V output，connect to 50mA
16	LINE_OUT	O		Audio output
17	T/R	O	0-3.3V	Module Output, status of Transmitting/receiving, High for TX and low for Rx
18	SPKEN	O	0-3.3V	Audio amplifier control
19, 20	GND	-		Ground

8. Accessories

1)   Antenna

The antenna is very important for RF communication,Its performance will affect the communication, the module requires the antenna with 50Ω impedance. Universal antennas are Rod antenna, sucker antenna and telescopic antenna, User can choose the right antenna according to their application. We advise to use antennas listed on our website to get better performance.
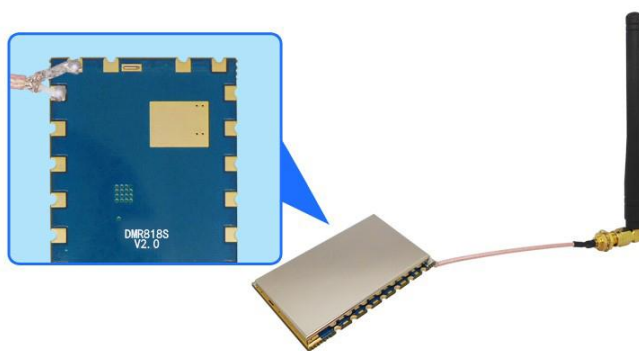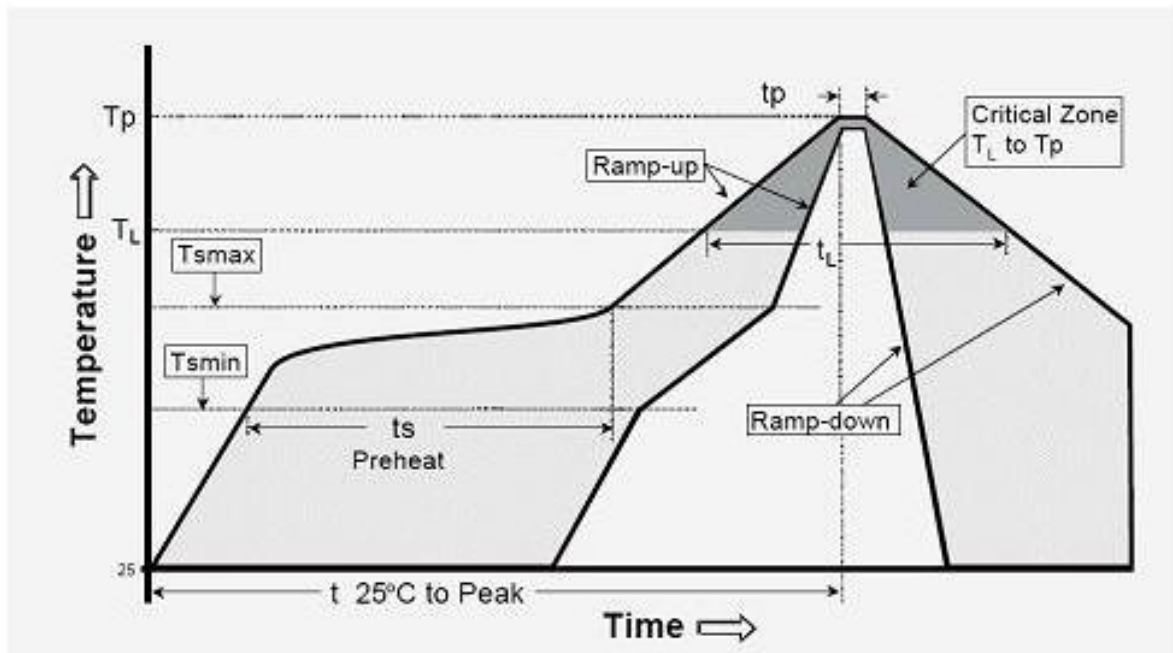

9 . Mechanism Dimension(Unit:mm)
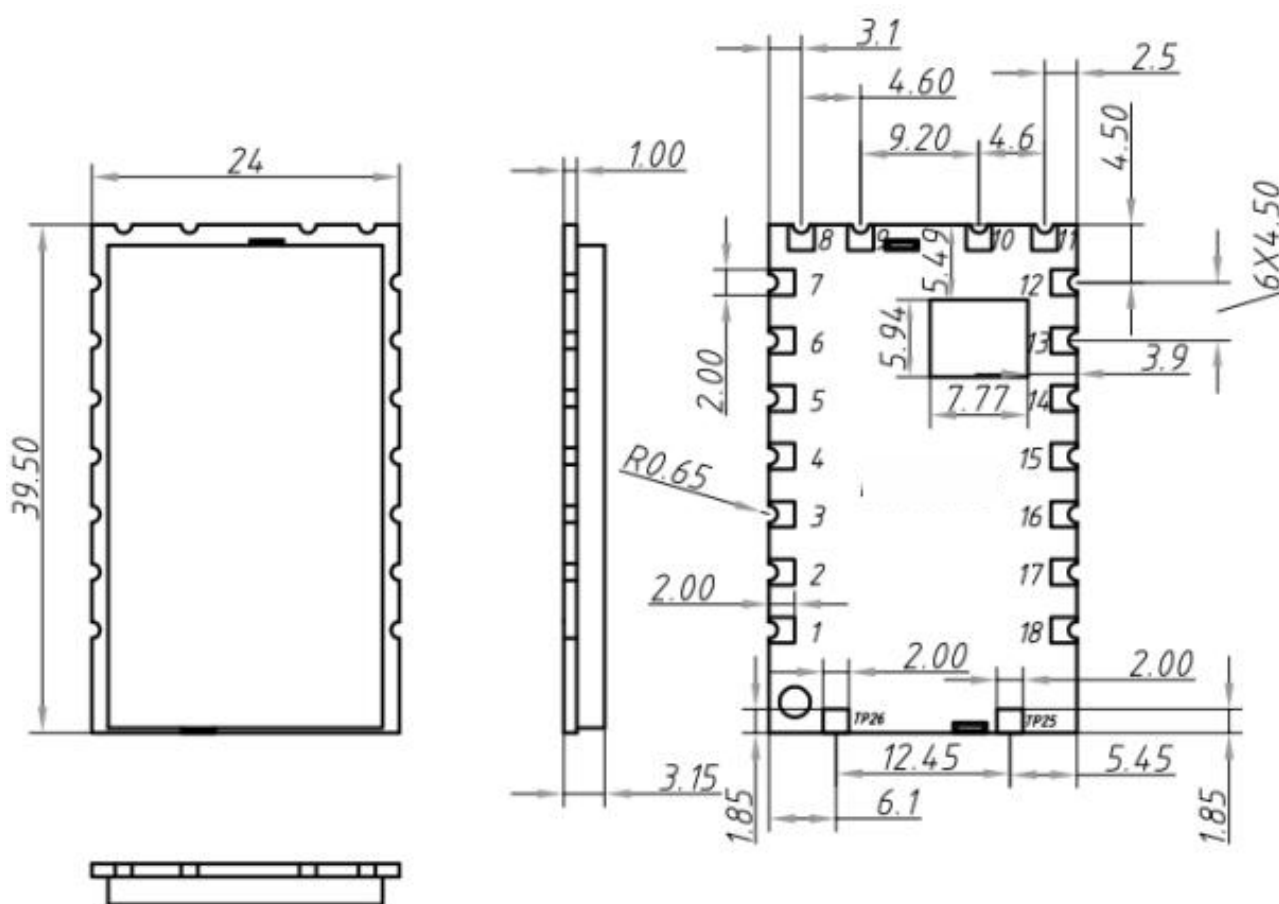
Appendix：SMD Reflow Chart

We recommend you should obey the IPC related standards in setting the reflow profile:

IPC/JEDEC J-STD-020B the condition for lead-free reflow soldering	big size components (thickness >=2.5mm)
The ramp-up rate (Tl to Tp)	3℃/s (max.)
preheat temperature - Temperature minimum (Tsmin) - Temperature maximum (Tsmax) - preheat time (ts)	 -20℃ 80℃ 60~180s
Average ramp-up rate (Tsmax to Tp)	3℃/s (Max.)
- Liquidous temperature (TL)	217℃
- Time at liquidous (tL)	60~150 second
peak temperature (Tp)	-20℃ - 80℃

FCC WARNING:

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an controlled environment.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

2.2 List of applicable FCC rules
CFR 47 FCC PART 90 has been investigated. It is applicable to the modular.

2.3 Specific operational use conditions
This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.
2.4 Limited module procedures
Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

To maintain compliance with FCC's RF Exposure guidelines, this equipment should be installed and operated with minimum distance of 20cm from your body and the maximum antenna gain should not exceed 2.5dBi. For modules used in host that not compliance with the requirement, such as less distance or greater antenna gain or in portable device or with other transmitters simultaneously, requires additional evaluation, testing, or testing and Class 2 permissive change.

2.7 Antennas

This radio transmitter FCC ID: 2AD66-DMR818S-U has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

No.	Antenna Type	Antenna Gain	Impedance	Frequency Range
1	external antenna	2.5dBi	50Ω	400-470MHz

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains FCC ID: 2AD66-DMR818S-U”

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B