JINWEI
JINWEI INTEGRATED CIRCUIT

DM711 Series Modules

Hardware Design Manual

We are committed to serve every person as a leading global provider of navigation and positioning services based on our homegrown chips

Document Information

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1. Introduction

DM711 series modules include two products: DM711 and DM711-B. The series are compact accuracy positioning modules based on the "Dolphin III" chip independently developed by JINWEI INTEGRATED CIRCUIT, and support the tracking of Global Navigation Satellite System (GNSS) signals of all-constellation multi-frequency. Supporting multiple differential positioning modes (such as Real-Time Kinematic (RTK) and differential GNSS (DGNSS)) and the Precise Point Positioning (PPP) mode, DM711 series modules can provide positioning services to an accuracy of centimeter, decimeter and meter.

The series modules come with anti-multipath design. DM711-B also supports GNSS/INS integrated navigation. Products can be widely used in the professional markets such as surveying and mapping, deformation monitoring, precision agriculture, machinery control, intelligent driving, unmanned aerial vehicle, and lawn mower.

2. Hardware Functional Block

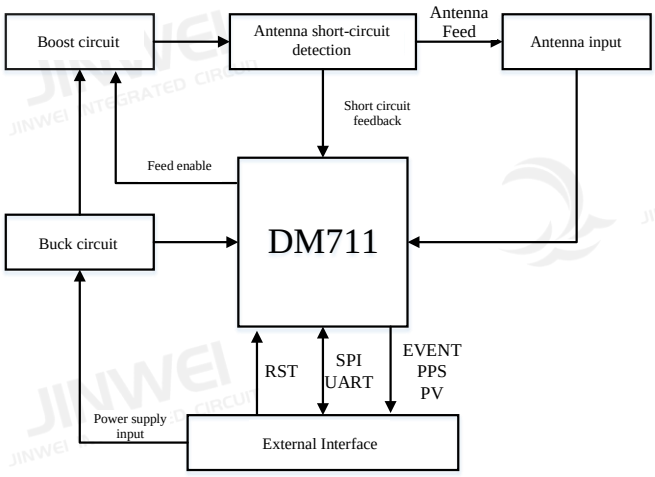

Figure 1 DM711 series modules hardware reference design blocks

(1) Buck circuit

The DC power supply VCC_EXT, which is input from an external source, is converted from 5V step-down to 3V output by a step-down circuit, and is provided for the DM711 module.

(2) Boost circuit

The 3V output from the buck circuit is boosted to 5.0V by the booster circuit, and then provided to the antenna for feeding.

(3) Antenna short-circuit detection

The 5.0V output from the boost circuit is detected by the antenna short circuit and then provided to the antenna.

(4) Antenna input

GNSS signals are obtained from the antenna via coaxial cables and fed to the DM711 series modules.

(5) External Interface

The product provides pulse-per-second (PPS), event input (EVENT) and reset (RST) interfaces, as well as multiple serial ports and SPI.

3. Circuit Reference Design

3.1. **Peripheral Circuit Reference Design**

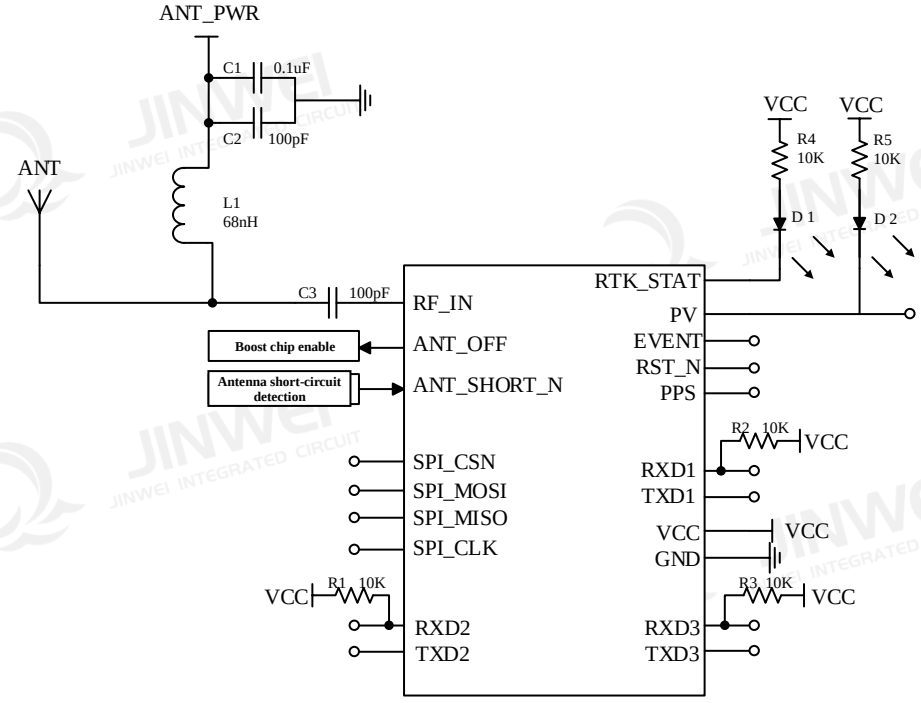

Figure 2 DM711 Series module hardware design reference circuit

Table 1 Components recommended for DM711 series module hardware design reference circuit

No.	Device	Description
1	L1	Feeder inductance, 68nh
2	C1	Capacitance, 0.1uF
3	C2-C3	Capacitance, 100pF
4	R1-R5	Resistor, 10kΩ

3.2. **Power Supply Circuit Reference Design**

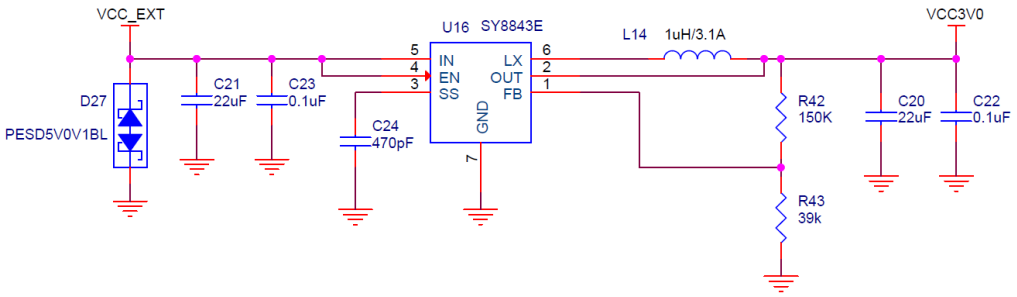

Figure 3 Power Supply Circuit Reference Design

The power supply is from VCC_EXT on pin 6 of the external connector, and is stepped down to 3.0V by the DC-DC chip for DM711 series modules.

Note: This circuit is designed to adapt to lower input voltage. In practical applications, the 3.3V power supply is recommended.

Note:

a) A LDO or DC-DC chip with low noise and low voltage-drop is used to ensure the normal operation of the module. It is recommended that the peak-to-peak value of the module power supply voltage ripple does not exceed 50 mVpp. The recommended model is SY8843E;

b) To prevent the voltage drop of DM711 module, please use the power supply chip with 1A over-current capability;

c) VCC_EXT power-up time should be less than 1 ms.

d) The voltage input range of VCC_EXT is 3.1V-5.5V.

3.3. **Boost Circuit Reference Design**

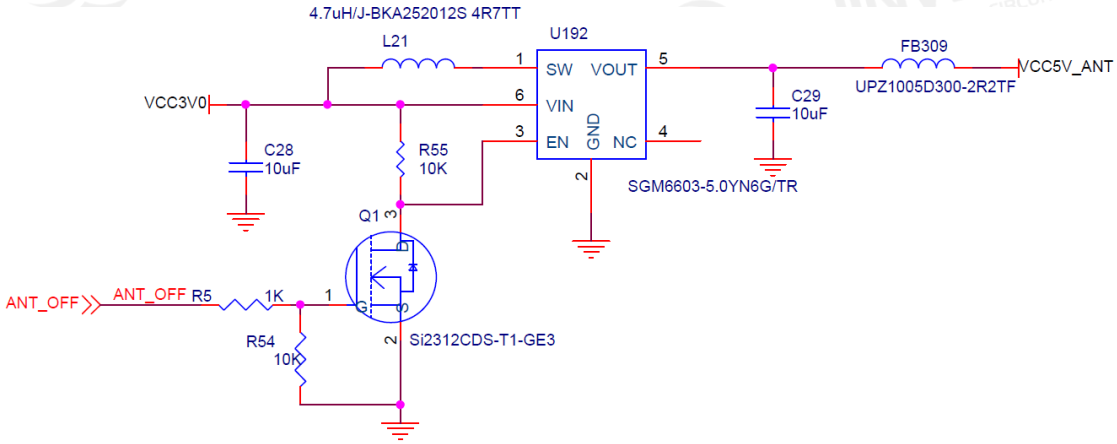

Figure 4 Boost circuit reference design

The antenna feed can be provided by the VCC_RF output at pin 7 of the DM711 module, with a voltage value of ANT_PWR -0.1V. Alternatively, the antenna can be directly fed by an external circuit. In order to ensure stable operation of antenna, it is recommended to use an external circuit to feed the antenna, with the use of a low-noise power supply.

The reference circuit in this part is designed to boost 3.0V through SGM6603 to 5.0V for the antenna.

ANT_OFF connects to DM711 pin 5. It is the external antenna enable output, and can be used to control the external antenna feed. When ANT_OFF is high level, SGM6603 has no voltage output, and the external antenna cannot be used. When ANT_OFF is low level, the SGM6603 is enabled, to output 5.0V as a feed for the external antenna.

3.4. **Reference Design of Antenna Short Circuit Detection Circuit**

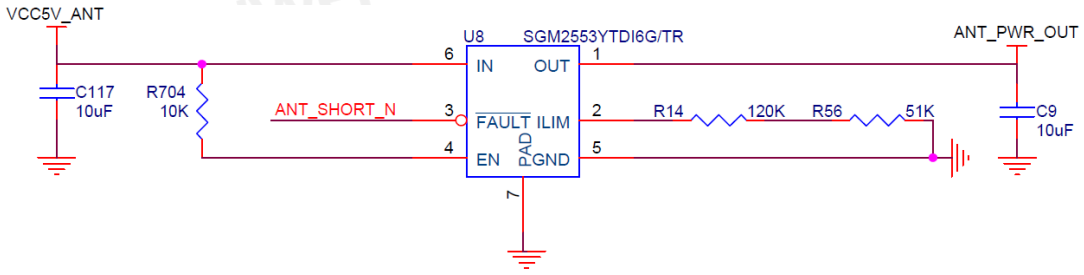

Figure 5 Reference design of antenna short circuit detection circuit

ANT_SHORT_N is connected to pin 6 of DM711. It is the external antenna short circuit signal input. By default, it is internal pull-up. When the antenna works normally, ANT_SHORT_N pin is high. When the antenna is short-circuited, ANT_PWR_OUT is pulled down, ANT_SHORT_N outputs a low level to DM711. Then DM711 shuts down the external antenna to enable output. There is no output voltage from SGM6603.

3.5. **Antenna Selection and Circuit Reference Design**

Antenna selection:

a) The antenna needs to be mounted in a suitable location to achieve the best performance. It should be installed in the places such as the bottom of the vehicle and the rear view mirror.

b) When the antenna is installed, it is recommended to use an active antenna that meets the requirements. For the antenna specifications, see Table 2.

Table 2 Antenna specifications of DM711 series modules

Requirement	Specification
Frequency	GPS: L1CA/L1C/L2C/L5 Galileo: E1/E5a/E5b BDS: B1I/B2I/B3I/B1C/B2a/B2b
Input gain	20 dB~42 dB
Noise coefficient	≤2dB
Output standing wave	≤2
Outband compression	40dB
Polarization direction	Right Hand Circularly Polarized (RHCP)
Phase center error	±2mm
Differential transmission delay	≤5ns

The reference design of the antenna feed circuit is shown below:

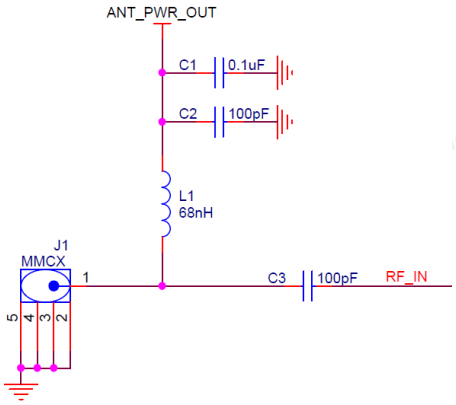

Figure 6 Reference design of antenna feed circuit

The antenna feed passes through the inductor for antenna after capacitive filtering. The inductor L1 is used to suppress high frequencies, to prevent the power supply and signal from affecting each other.

Note:

a) The antenna cabling impedance is controlled at 50 ohm.

b) It should be noted that the antenna cabling is arranged with grounding. The ground through-holes are preferred.

3.6. **Interface Circuit Reference Design**

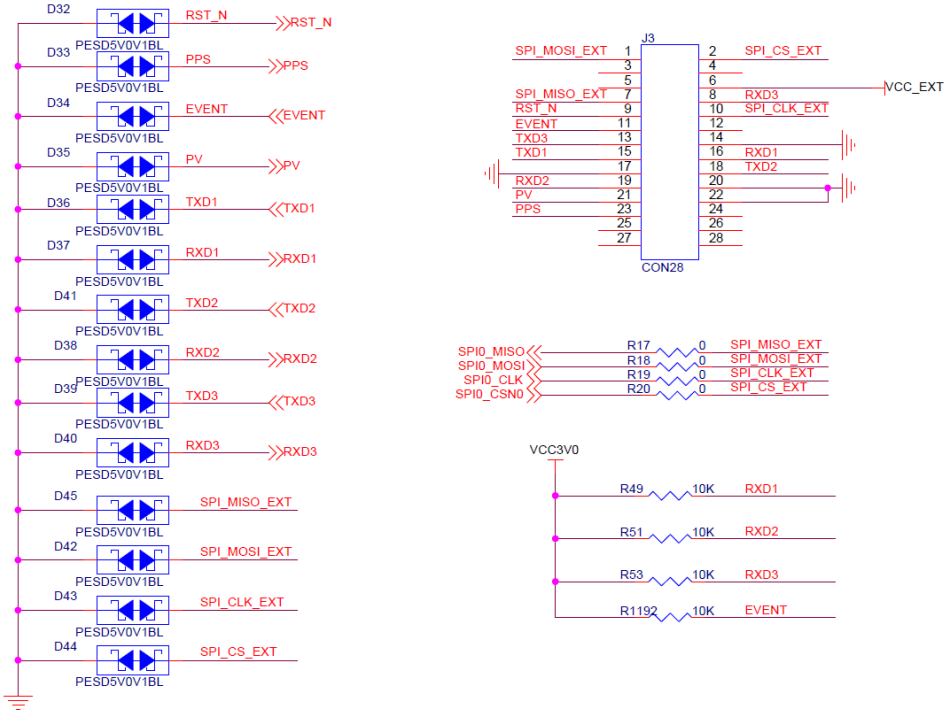

Figure 7 Interface circuit reference design

The connector leads some signal lines from the DM711 module. An ESD device should be connected on each signal line. A 10,000 ohm resistor should be installed on the RXD and EVENT signal lines of the serial port. For the details of pin definitions, see the table below.

3.7. **Indicator Circuit Reference Design**

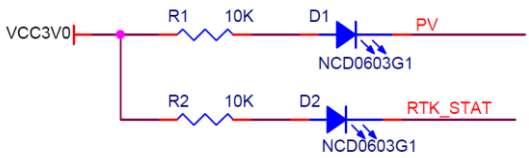

Figure 8 Indicator circuit reference design

PV status indication: By default, it is high level. It is flashing when differential data is received.

RTK_STAT status indication: By default, it is high level. It is lit after RTK solution.

3.8. **Reset Circuit Reference Design**

DM711 series modules are internally integrated with power-on reset chip. By default, RESET pin is internal pull-up, with low level active. If the reset circuit is designed externally, the low level duration should be not less than 10 ms.

4. PCB Design

4.1. **Package Size**

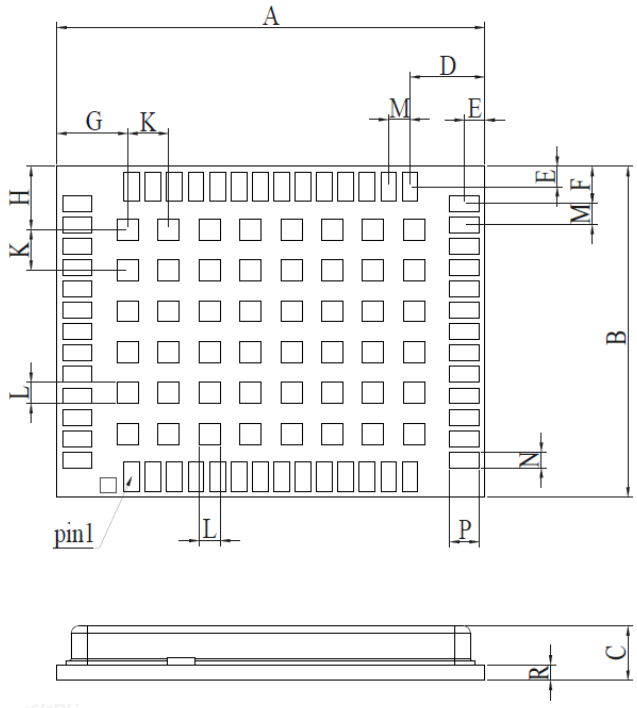

Figure 9 Package size of DM711 series modules

Table 3 Package size of DM711 series modules

Parameter	Minimum value (mm)	Typical value (mm)	Maximum value (mm)
A	21.80	22.00	22.20
B	16.80	17.00	17.20
C	2.50	2.80	3.10
D	3.75	3.85	3.95
E	0.95	1.05	1.15
F	1.80	1.90	2.00
G	3.55	3.65	3.75
H	3.15	3.25	3.35
K	2.00	2.10	2.20
L	1.00	1.10	1.20
M	1.00	1.10	1.20
N	0.70	0.80	0.90
P	1.40	1.50	1.60
R	0.70	0.80	0.90

4.2. **Precautions for PCB Design**

The precautions as follows:

a) A reference ground should be retained to provide a minimum current loop. As shown in Figure 10: The ground of the DM711 series modules need to be well connected to the ground of the PCB. In order to reduce the current return path, a whole piece of ground is generally laid on the bottom of the module, and a cross-pad connection is recommended for better soldering and heat dissipation performance.

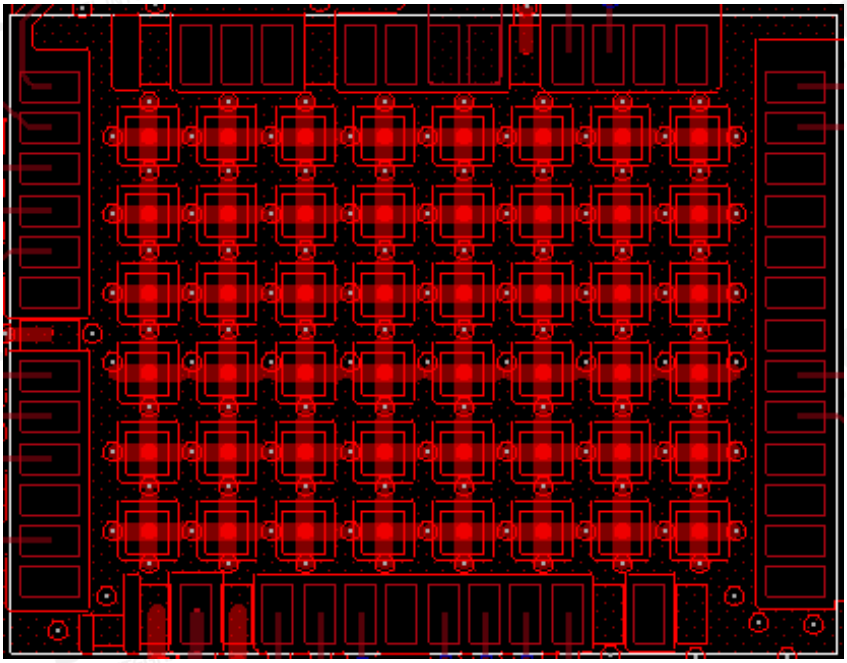

Figure 10 Bottom PCB design of DM711 series modules

b) In order to prevent the introduction of interference, there should be a 50 ohm impedance during the antenna cabling to ensure signal integrity, and the length is as short as possible with grounding. The ground pad of the feed filter capacitor should be placed close to the antenna, and the inductor L1 should be placed in the cabling path. See Figure 11.

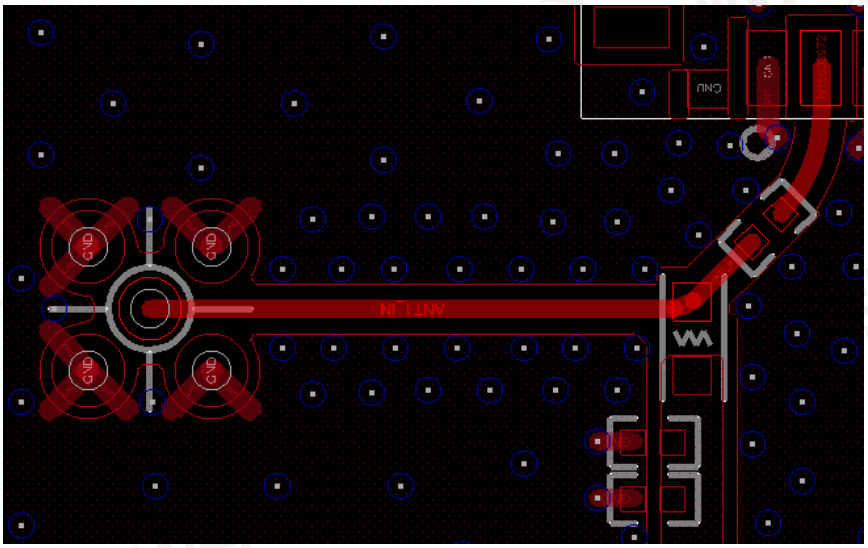

Figure 11 PCB design of antenna module

c) Filter capacitors and bypass capacitors are placed close to the DM711 module, connecting to the power supply with full connection in copper. See Figure 12.

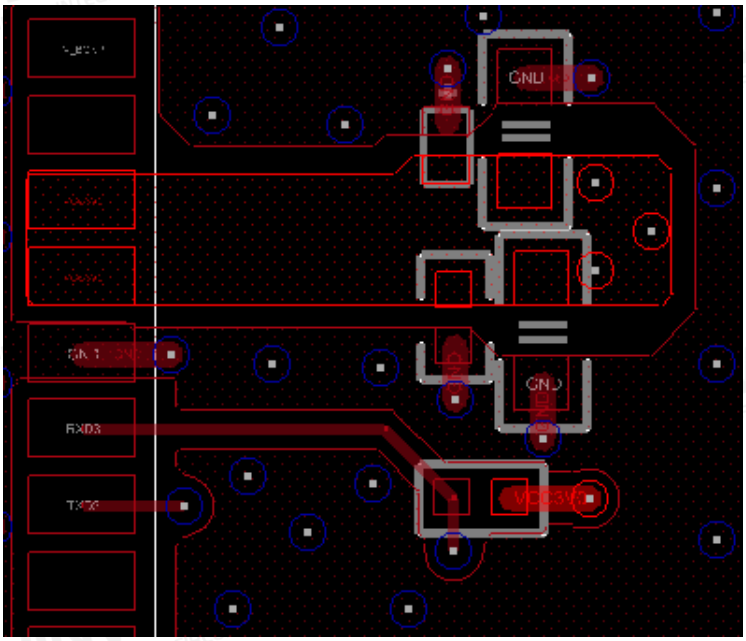

Figure 12 DM711 module power supply

Appendix

The main manuals are as follows:

JINWEI INTEGRATED CIRCUIT_JWAN0001_DM711 Series Modules User Manual

JINWEI INTEGRATED CIRCUIT_JWAN0002_DM711 Series Modules Hardware Design Manual

JINWEI INTEGRATED CIRCUIT_JWAN0003_DM712 Series Modules User Manual

JINWEI INTEGRATED CIRCUIT_JWAN0004_DM712D Modules Hardware Design Manual

JINWEI INTEGRATED CIRCUIT_JWAN0005_7 Series Modules EVK Board User Manual

JINWEI INTEGRATED CIRCUIT_JWAN0025_High-Precision Device Common Commands Protocol Manual

JINWEI INTEGRATED CIRCUIT_JWAN0027_GNSS Evaluation Center Instruction Manual

JINWEI INTEGRATED CIRCUIT_JWAN0028_OTA Upgrade Tool Instruction Manual

Record of Revision

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1	V1.0	First release	2023.7

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