GPS/GLONASS Module

Datasheet

Name: GPS/GLONASS Module

Model No.: VD-U7

Revision: V1.01

Revision History

Revision	Description	Approved	Date
V1.01	Initial Release to V1.01	George	20170905

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1 General Description

The VD-U7 is a high-performance GNSS solution module that features super sensitivity, ultra low power and small form factor. The RF signal is applied to the antenna input of module, and a complete serial data message with position, velocity and time information is presented at the serial interface with NMEA protocol or custom protocol.

It is based on the high performance features of the UBX-G7020 single-chip architecture, Its –161dBm tracking sensitivity extends positioning coverage into place like urban canyons and dense foliage environment where the GNSS was not possible before. The small form factor and low power consumption make the module easy to integrate into portable device like PNDs, mobile phones, cameras and vehicle navigation systems.

Figure 1: VD-U7 Top View

2 Applications

- LBS (Location Based Service)
- PND (Portable Navigation Device)
- Vehicle navigation system
- Mobile phone

3 Features

- GPS/GLONASS/SBAS/ QZSS receiver
- Ultra high sensitivity: -161dBm
- Interface support: UART, I2C
- Extremely fast TTFF at low signal level
- Ultra low power consumption
- SBAS: WAAS, EGNOS, MSAS
- Protocols: NMEA, UBX, RTCM
- Operating mode: Continuous Mode and Power Save Mode.
- Small form factor: 10.1 x 9.7 x 2.2mm
- RoHS compliance (Lead-free)
- FCC,CE compliance

4 Pin Assignment

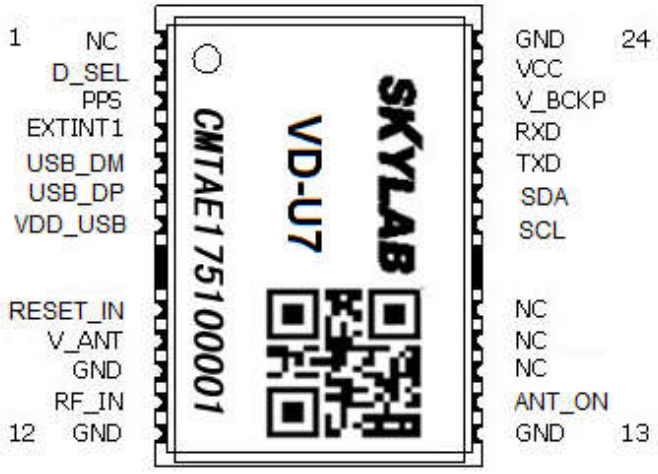

Figure 2: VD-U7 Pin Package

Pin Description

Pin No.	Pin name	I/O	Description	Remark
1	NC			
2	D_SEL	I	Selects The Interface	Used to select UART/DDC or SPI Open = UART/DDC; low = SPI
3	PPS	O	Time Pulse Signal (Default 100ms)	Leave open if not used
4	EXTINT1	I	External Interrupt	Leave open if not used
5	USB_DM	I/O		
6	USB_DP	I/O		
7	VDD_USB	P	USB Power Supply	To use the USB interface connect this pin to 3.0 – 3.6 V. If no USB serial port used connect to GND.
8	RESET_IN	I	Reset Input.	Leave open if not used
9	V_ANT	I	Active Antenna External Voltage Supply	V_ANT can be used to power an external active antenna.
10	GND	G	Ground	
11	RF_IN	I	RF Signal Input	50Ω

12	GND	G	Ground	
13	GND	G	Ground	
14	ANT_ON	O	ANT_ON	ANT_ON (antenna on) HIGH can be used to turn on and LOW to turn off an optional external LNA.
15	NC			
16	NC			
17	NC			
18	SDA	I/O	DDC Data.	DDC Data. If pin 2 low => SPI chip select.
19	SCL	I/O	DDC Clock.	DDC Clock. If pin 2 low => SPI clock.
20	TXD	O	UART Serial Data Output 0	Communication interface, Can be programmed as TX Ready for DDC interface. If pin 2 low => SPI MISO.
21	RXD	I	UART Serial Data Input 0	Serial input. Internal pull-up resistor to VCC. Leave open if not used. If pin 2 low => SPI MOSI.
22	V_BCKP	I	RTC and backup SRAM power	This pin may be connect to Battery or Power Supply(1.4~3.6V)
23	VCC	P	Module Power Supply	Operating range: 2.7V to 3.6V
24	GND	G	Ground	

5 Interfaces Configuration

Power Supply

Regulated power for the VD-U7 is required. The input voltage Vcc should be 2.7V to 3.6V range, current is no less than 100mA. Suitable decoupling must be provided by external decoupling circuitry (10uF and 1uF). It can reduce the Noise from power supply and increase power stability.

Main power supply Vcc current varies according to the processor load and satellite acquisition. Maximum Vcc peak current is about 40 mA during acquisition.

Backup Battery Power

In case of a power failure on pin Vcc, real-time clock and backup RAM are supplied through pin V_BCKP. This enables the VD-U7 GNSS Receiver to recover from power failure with either a hot start or a warm start (depending on the duration of Vcc outage). If no Backup Battery is connected, the receiver performs a cold start upon powered up.

Backup Battery Power V_BCKP draws typically 15 uA current in backup state.

Reset

The VD-U7 modules include a RESET pin. Driving RESET low activates a hardware reset of the system. RESET is only an input and will not reset external circuitry. At power down the reset is forced when the Vcc drops below 2.7V.

NOTE

If not used, leave RESET not connected (floating).

Antenna

The VD-U7 GNSS receiver is designed for supporting the active antenna or passive antenna connected with pin RF_IN. The gain of active antenna should be no more than 25dB (18~20dB Typical). The maximum noise figure should be no more than 1.5dB and output impedance is at 50 Ohm.

NOTE

With passive antenna keep the cable loss at minimum(<1dB).

Active antenna control (ANT_ON)

The ANT_ON Pin can be used to turn on and off an external LNA or an active antenna. This reduces power consumption in Power Save Mode or Backup mode.

V_ANT

Antenna power output pin. When user wants to use external active antenna. The pin supply power for active antenna.

UART Ports

The module supports one full duplex serial channels UART. The serial connections are at 2.85V LVTTL logic levels, if need different voltage levels, use appropriate level shifters. the data format is however fixed: X, N, 8, 1, i.e. X baud rate, no parity, eight data bits and one stop bit, no other data formats are supported, LSB is sent first. The modules default baud rate is set up 9600bps. The RXD0 & TXD0 recommended to pull up (10KΩ). It can increase the stability of serial data.

I2C

An I2C compliant DDC interface is available for communication with an external host CPU. The interface can be operated in slave mode only. The DDC protocol and electrical interface are fully compatible with the Fast-Mode of the I2C industry standard. Since the maximum SCL clock frequency is 400 kHz, the maximum transfer rate is 400 kb/s.

The DDC interface is I2C Fast Mode compliant. For timing parameters consult the I2C standard.

SPI

With VD-U7 modules, an SPI interface is available for communication to a host CPU.

SPI is not available in the default configuration, because its pins are shared with the UART and DDC interfaces. The SPI interface can be enabled by connecting D_SEL to ground . For speed and clock frequency see the Data Sheet.

RESET_N: Reset input

Driving RESET_N low activates a hardware reset of the system. Use this pin only to reset the module. Do not use RESET_N to turn the module on and off, since the reset state increases power consumption. With VD-U7 RESET_N is an input only.

EXTINT

The default EXTINT function is Standby mode control but the function is not supported; leave signal floating (not connected).

The pin control feature allows overriding the automatic active/inactive cycle of Power Save Mode. The state of the receiver can be controlled through the EXTINT pin.

The receiver can also be turned off and sent into Backup Mode using EXTINT when Power Save Mode is not active.

RF_IN

The transmission line must to be control impedance from RF_IN pin to the antenna or antenna connector of your choice. (Impedance 50Ω)

PPS

A pulse per second (1 PPS) is an electrical signal that very precisely indicates the start of a second. Depending on the source, properly operating PPS signals have an accuracy ranging 30ns. The PPS signals are used for precise timekeeping and time measurement.

6 Augmented GNSS

Assisted GNSS (A-GPS)

A-GPS improves GNSS performance by delivering aiding data to the GNSS receiver via wireless networks or the Internet. Supplying information such as ephemeris, almanac, approximate last position, time and satellite status and an optional time synchronization signal significantly reduces Time to First Fix (TTFF) and improves acquisition sensitivity.

AssistNow Online and AssistNow Offline are u-blox' end-to-end A-GPS services for devices with or without network connectivity. AssistNow Online and AssistNow Offline can either be used alone or in combination. They are very easy to implement, require no additional hardware, and generate virtually no CPU load. The

modules support u-blox' AssistNow Online, AssistNow Offline and AssistNow Autonomous A-GPS services, and are OMA SUPL compliant.

AssistNow Online

With AssistNow Online, an internet-connected GNSS device downloads assistance data from u-blox' AssistNow Online Service at system start-up. AssistNow Online is network operator independent and globally available. u-blox only sends ephemeris data for those satellites currently visible to the device requesting the data, thus minimizing the amount of data transferred.

AssistNow Offline

With AssistNow Offline, users download u-blox' Differential Almanac Correction Data from the Internet at their convenience. The correction data can be stored in the memory of the application processor. Therefore, the service requires no connectivity at system start-up and enables a position fix within seconds, even when no network is available.

AssistNow Autonomous

AssistNow Autonomous provides functionality similar to Assisted GNSS without the need for a host or external network connection. It is an embedded feature available free-of-charge that accelerates GNSS positioning by capitalizing on the periodic nature of GPS satellite orbits. GPS orbit predictions are directly calculated by the GNSS receiver and no external aiding data or connectivity is required. AssistNow Autonomous can be used alone, or together with AssistNow Online or AssistNow Offline for increased positioning speed and accuracy.

Satellite-Based Augmentation System (SBAS)

The positioning modules support SBAS. These systems supplement GPS data with additional regional or wide area GPS augmentation data. The system broadcasts augmentation data via satellite which can be used by GPS receivers to improve the resulting GPS precision. SBAS satellites can be used as additional satellites for ranging (navigation), further enhancing precision. The following SBAS are supported: WAAS, EGNOS and MSAS.

Aiding

The EXTINT pin can be used to supply time or frequency aiding data to the receiver. For time aiding the time can be supplied using hardware time synchronization where an accurate time pulse is connected to the EXTINT pin.

Frequency aiding can be implemented by connecting a periodic rectangular signal with a frequency up to 500 kHz and arbitrary duty cycle (low/high phase duration must not be shorter than 50 ns) to the EXTINT pin, and providing the applied frequency value to the receiver using UBX messages.

GNSS

The VD-U7 GNSS modules can receive and track multiple GPS (including SBAS and QZSS) and GLONASS signals. QZSS and SBAS signals (by default) can be received concurrently with GPS signals.

7 GNSS Performance Specification

GPS Performance

Parameter	Specification	
Receiver Type	56 Channels u-blox 7 engine GPS/QZSS L1C/A SBAS: WAAS, EGNOS, MSAS	
Sensitivity	Tracking Acquisition	-161dBm Typical -148dBm Typical
Accuracy	Position Velocity Timing (PPS)	2.5m CEP50 without SA(Typical Open Sky) 0.1m/s without SA 30ns RMS
Acquisition Time	Cold Start Warm Start Hot Start Aided Starts	29s(Typical Open Sky) 28s 1s 5s
Power Consumption	Tracking Acquisition	17mA @3.3V Typical 22mA @3.3V
Navigation Data Update Rate	Max 10Hz	Default 1Hz
Operational Limits	Altitude Velocity Acceleration	Max 50,000m Max 500m/s Less than 4g

GLONASS Performance

Parameter	Specification	
Receiver Type	56 Channels u-blox 7 engine GLONASS L1 FDMA	
Sensitivity	Tracking Acquisition	-158dBm Typical -145dBm Typical
Accuracy	Position Velocity Timing (PPS)	4.0m CEP50 without SA(Typical Open Sky) 0.1m/s without SA 50ns RMS
Acquisition Time	Cold Start Warm Start	30s(Typical Open Sky) 25s

	Hot Start	1s
Power Consumption	Tracking Acquisition	17mA @3.3V Typical 22mA @3.3V
Navigation Data Update Rate	Max 10Hz	Default 1Hz
Operational Limits	Altitude Velocity Acceleration	Max 50,000m Max 500m/s Less than 4g

8 Electrical Characteristics

Absolute Maximum Rating

Parameter	Symbol	Min	Max	Units
Power Supply				
Power Supply Volt.	VCC	-0.5	3.6	V
Input Pins				
Input voltage on any input connection	VIO	-0.5	3.6	V
Backup Battery	V_BCKP	-0.5	3.6	V
RF input power	RF_IN		13	dBm
Human Body Model ESD capability	RF_IN		2000	V
Machine Model ESD capability	RF_IN		100	V
Environment				
Storage Temperature	Tstg	-40	85	°C
Peak Reflow Soldering Temperature <10s	Tpeak		260	°C
Humidity			95	%

Note: Absolute maximum ratings are stress ratings only, and functional operation at the maxims is not guaranteed. Stress beyond the limits specified in this table may affect device reliability or cause permanent damage to the device. For functional operating conditions, refer to the operating conditions tables as follow.

The VD-U7 module is Electrostatic Sensitive Device (ESD) and may be damaged with ESD or spike voltage. Although it has built-in ESD protection circuitry at digital I/O, please handle with care to avoid permanent malfunction or performance degradation. Note that RFIN has no ESD protection circuits.

Operating Conditions

Parameter	Symbol	Condition	Min	Typ	Max	Units
Power supply voltage	VCC		2.7	3.3	3.6	V
USB power supply voltage	VDD_USB		3.0		3.6	V
Backup Battery	V_BCKP		1.4	3.3	3.6	V
Power supply voltage ripple	VCC_PP	Vcc=3.3V			30	mV
Supply current, navigation	Icc	Vcc=3.3V		22	40	mA
Supply current, backup state	Ibckp	Vcc=3.3V		15		uA
VCC_OUT Antenna bias supply	VCC_OUT			VCC-0.1		V
Input high voltage	VIH		0.7*VCC		VCC+0.5	V
Input low voltage	VIL		0		0.2*VCC	V
Output high voltage	VOH		VCC-0.4			V
Output low voltage	VOL				0.4	V
Operating temperature	Topr		-40		85	°C

9 Mechanical Specification

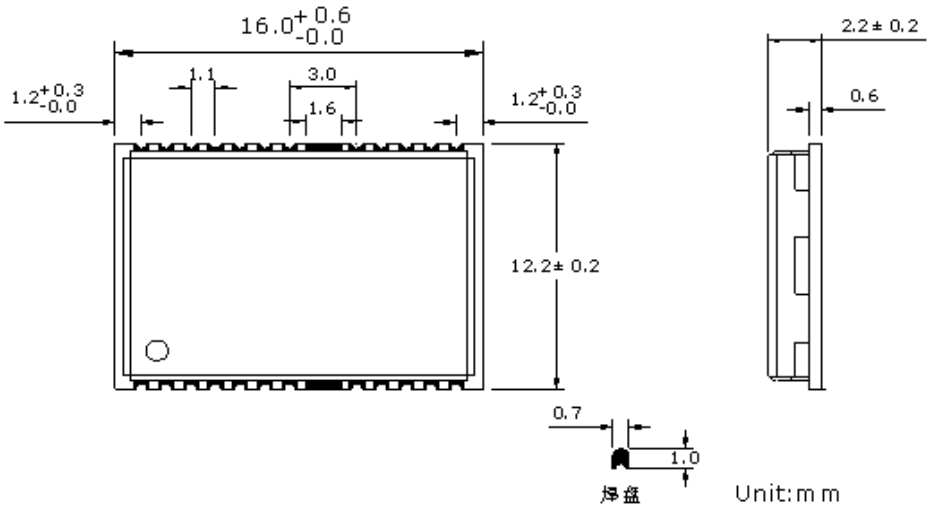

Figure 3: VD-U7 Dimensions

Recommend Layout

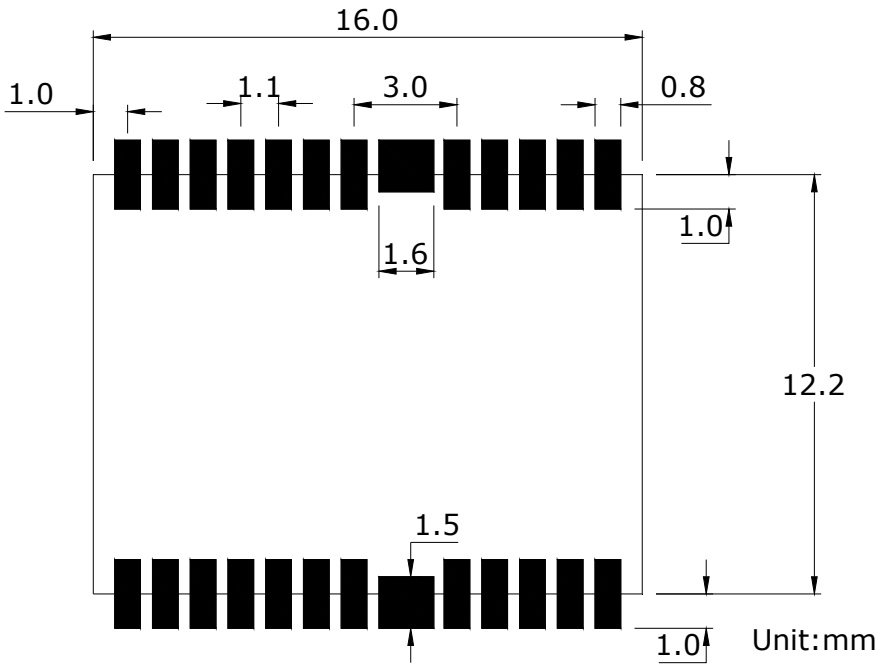

Figure 4: VD-U7 Footprint

10 Reference design schematic

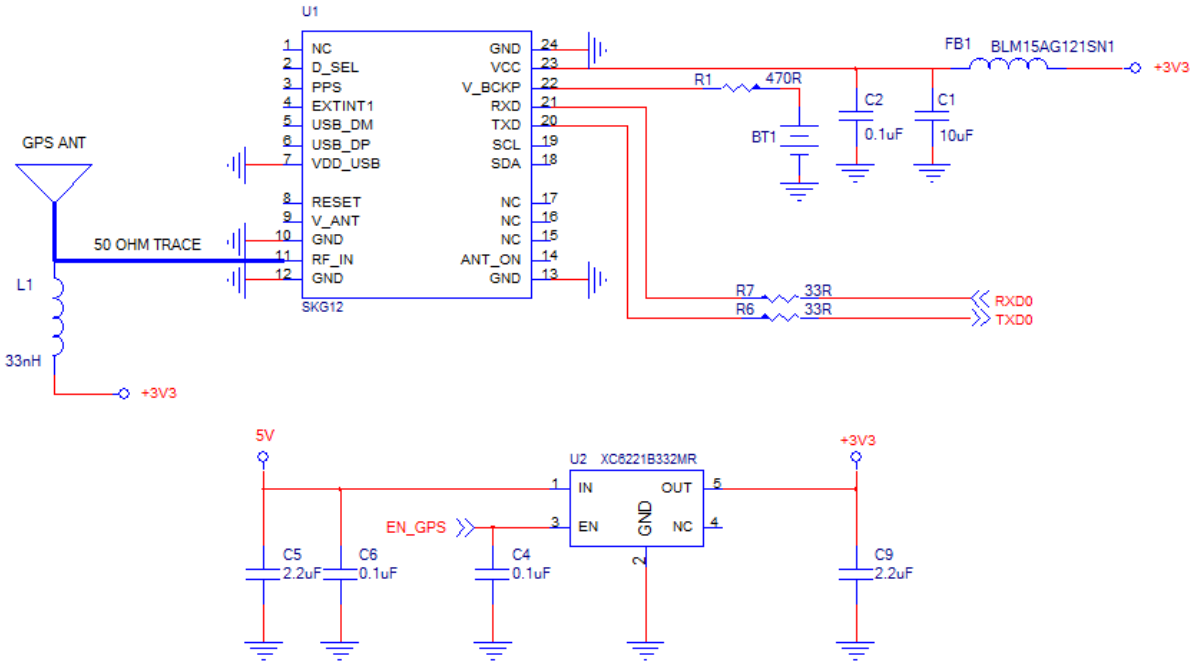

Figure 5: VD-U7 Typical Reference design schematic

11 Packaging Specification

VD-U7 modules are shipped in reel and with 2000 units per reel. Each tray is 'dry' package.

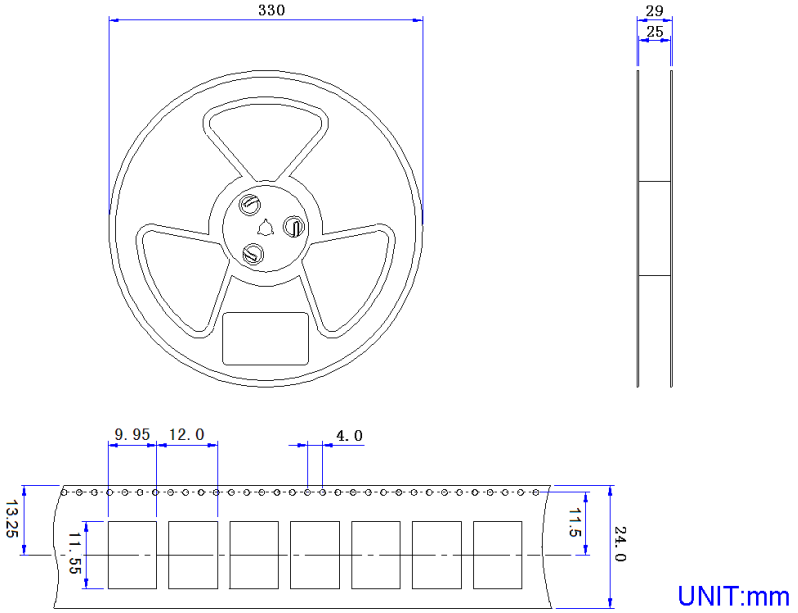

Figure 6: VD-U7 Packaging

12 Manufacturing Process Recommendations

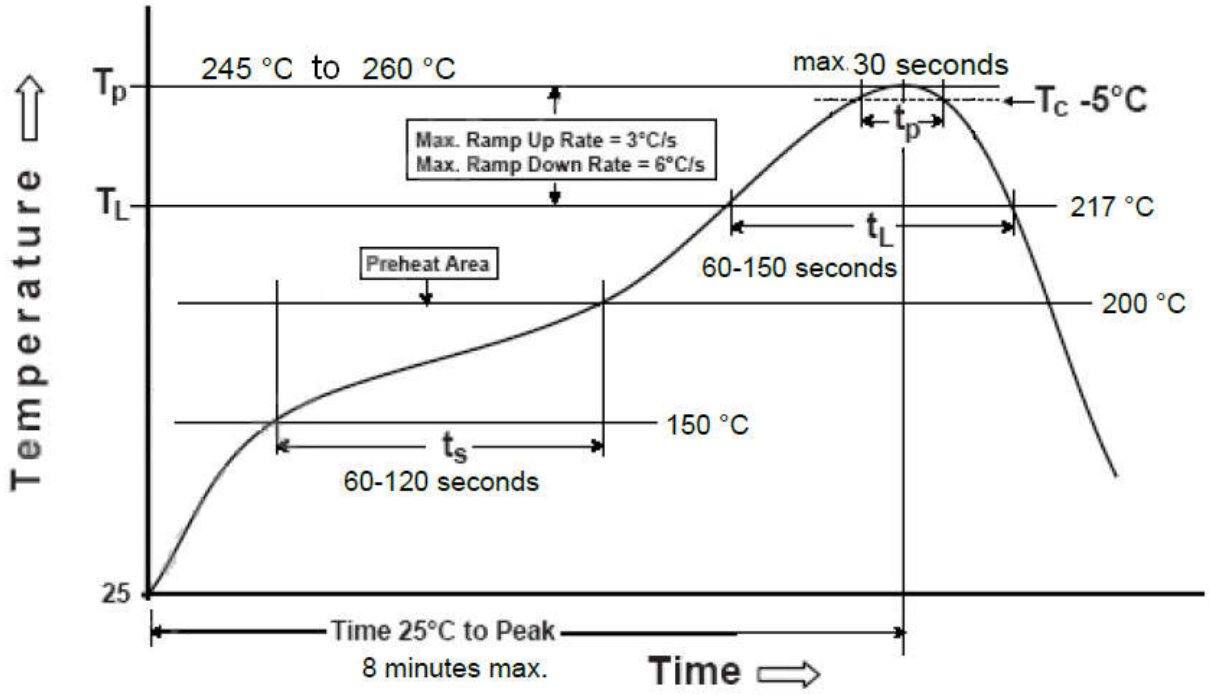

Figure 7: VD-U7 Typical Leadfree Soldering Profile

Note：The final soldering temperature chosen at the factory depends on additional external factors like choice of soldering paste，size，thickness and properties of the baseboard，etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

13 Contact Information

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