



SPECIFICATIONS AND FEATURES

DATASHEET

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UC6580x-00

Dual-Frequency GNSS Positioning Chip

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Foreword

Scope

This datasheet provides information on the hardware features and performance specifications of UC6580x-00 positioning chip.

Target Readers

This datasheet applies to technicians who have knowledge in the GNSS field but not to general readers.

Statement

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Revision History

Version	Revision History	Date
R1.0	First Release.	Sep. 2023
R1.1	Updated the working voltage in technical specifications; Updated the IO power domain description; Updated Table Analog Electrical Specifications 1.	Oct. 2023
R1.2	Updated the model to UC6580x-00 by adding sub-model; Updated the description of pin 20; Updated the description related to I2C; Updated the table in section Ordering Information.	Jan. 2024
R1.3	Updated the V_BACK voltage; Updated the description of V_BACK.	Mar. 2024

Version	Revision History	Date
R1.4	<p>Updated the main power voltage and IO voltage to 1.7 V ~ 3.6 V.</p> <p>Added thermal resistance in 1.3 Technical Specifications.</p> <p>Refined the description of pin4 in 2.2.2 Analog Pin.</p> <p>Removed the information about backup battery in 3.2 Power Management Unit.</p> <p>Corrected the PIO of SPI master in 5.1.3 SPI master.</p> <p>Added I2C timing requirements in 5.1.4 I2C.</p> <p>Modified section 6.2 "BOOT Mode" to "Firmware Upgrade Mode" and updated the time period that the CPU detects a firmware upgrade request.</p> <p>Added temperature conditions in 7 Electrical Specifications.</p> <p>Removed V_CORE in 7.1 DC Electrical Specifications and added description of V_CORE in 3.2 Power Management Unit.</p> <p>Updated the min. of TCXO_IN and added the recommended inductance and capacitance for DCDC_OUT in 7.1.1 Absolute Maximum Rating.</p> <p>Added section 7.2 PIO Electrical Specifications.</p> <p>Updated the LDO_RET, DCDC_OUT, and TCXO_IN_Vpp, added the recommended inductance and capacitance for DCDC_OUT in 7.3 Analog Electrical Specifications.</p> <p>Modified the typical value of L1_IN in 7.4 RF Electrical Specifications.</p> <p>Updated the picture of the product in 10.1 Product Appearance.</p> <p>Added section 10.3 Moisture Sensitivity Level.</p>	Mar. 2025
R1.5	<p>Updated the min. of TCXO_IN in 7.1.1 Absolute Maximum Rating.</p>	Jun. 2025

Product Introduction

1.1 Overview

UC6580x-00 is a dual-frequency multi-constellation positioning SoC developed by Unicore Communications, with sub-meter level accuracy, supporting BDS-3 signals. It adopts 22 nm process, low-power design, compact size, RF-baseband integrated technology, and supports multi-path mitigation, anti-jamming and high precision GNSS joint positioning, which performs well in the power and size sensitive scenarios.

UC6580x-00 is suitable for global applications. It has 96 tracking channels, supports GPS, GLONASS, BDS, Galileo, NavIC and QZSS multi-constellation joint positioning, as well as SBAS signal reception processing, providing fast and accurate positioning experience with high performance.

UC6580x-00 supports L1 + L5/L2 dual-frequency single point positioning and RTD, as well as AGNSS. It is suitable for wearables, handheld devices and walking navigation, significantly improving users' experience compared with single-frequency solution especially in urban multi-path environment.

UC6580x-00 has two models including automotive grade and industrial grade.

Model	Grade	Package
UC6580A-00	Automotive	QFN40
UC6580I-00	Industrial	QFN40

1.2 Product Features

- 22 nm dual-frequency multi-constellation GNSS SoC, with low power consumption and compact size
- Concurrent acquisition and tracking of dual frequencies from multiple constellations, including BDS-3 signals; supports:
 - BDS B1I/B1C* + B2a or B1I/B1C* + B2I
 - GPS L1 + L5 or L1 + L2
 - Galileo E1 + E5a or E1 + E5b
 - GLONASS G1 or G1+G2
 - QZSS L1 + L5 or L1 + L2

- SBAS L1
- NavIC L5*
- Real-time wideband and narrowband anti-jamming technology: detection and removal of wideband and narrowband jamming of no less than -75 dBm
- Supports L1 + L5/L2 dual-frequency single point positioning and sub-meter level RTD positioning, with excellent multi-path mitigation algorithm
- RF and baseband design with ultra-high sensitivity: acquisition sensitivity better than -148 dBm, tracking sensitivity better than -162 dBm
- Supports AGNSS
- Supports secure boot
- Automotive grade and industrial grade with QFN40 package (See the section [Ordering Information](#) for more details)
- Conforms to the requirement of AEC-Q100 Grade2 (UC6580A-00)

*. Supported by specific firmware. [↔](#)

1.3 Technical Specifications

Basic Information			
Channel	96 Channels		
Update Rate	10 Hz (max.)		
Data Format	NMEA-0183, Unicore, RTCM 3.x ^o		
Frequency		Mode 1	Mode 2 [*]
	BDS	B1I/B1C* + B2a	B1I/B1C* + B2I
	GPS	L1 + L5	L1 + L2
	Galileo	E1 + E5a	E1 + E5b
	GLONASS	G1	G1 + G2
	QZSS	L1 + L5	L1 + L2

	NavIC	L5*	-
	SBAS	L1	L1
Observation Accuracy			
Horizontal Accuracy (RMS)	Single point positioning: 1.5 m		
Vertical Accuracy (RMS)	Single point positioning: 2.5 m		
Time Accuracy (RMS)	5 ns, peak-to-peak value 30 ns (24h)		
Velocity Accuracy ¹	0.02 m/s		
TTFF ²			
Cold Start	26 s		
Hot Start	2 s		
Reacquisition	1 s		
Sensitivity ^{3,4}	GNSS		
Cold Start	-148 dBm		
Hot Start	-156 dBm		
Tracking	-162 dBm		
Reacquisition	-159 dBm		
Power Consumption (@25°C) ⁵			
DCDC Mode	Acquisition: 40 mA @ 3 V Tracking: 40 mA @ 3 V		
Backup Mode	5 µA @ 3 V		
Thermal Resistance (@25°C)			
ThetaJA	44.96 °C/W		
ThetaJB	11.48 °C/W		
Working Voltage			

Main Power Supply	1.7 V to 3.6 V
IO Power Supply	1.7 V to 3.6 V
Backup Power Supply	1.7 V to 3.6 V
Communication Interfaces	
UART x 2	
I2C x 1	
SPI ⁶ x 2	
Reliability Test and Certificates	
Reliability	Conforms to JESD47 standard (UC6580I-00)
	Conforms to AEC-Q100 standard (UC6580A-00)
Certificates	Conforms to RoHS and REACH requirements

⁰. Supports RTCM3.x input [↵](#)

*. Supported by specific firmware. [↵](#)

¹. Uniform linear motion of -33 mps using a simulator. [↵](#)

². Satellite signal strength @ -130 dbm. [↵](#)

³. To get the sensitivity index, CN0 needs to achieve 41 dB (The performance might be updated). [↵](#)

⁴. Connect to a matched external LNA to ensure superior performance. [↵](#)

⁵. Depends on the firmware version. [↵](#)


⁶. Not supported currently. [↵](#)

Pin Definition

2.1 Pin Assignment

UC6580A-00 and UC6580I-00 have the same pins, and the figure below gives the diagram of UC6580A-00 as an example.

QFN40 TOP VIEW (Marking Side)

		30	29	28	27	26	25	24	23	22	21		
		PIO3	PIO5	PIO1	PIO2	PIO4	PIO0	LDO_C	V_CORE	DCDC_OUT	DCDC_IN		
31	SCL											GND	20
32	SDA											TX	19
33	D_SEL											RX	18
34	BOOT_MODE											RESETN	17
35	PPS											TMS	16
36	PIO15											TCK	15
37	PIO16											PIO13	14
38	L5_IN											PIO14	13
39	NC											RTC_I	12
40	L1_IN											RTC_O	11
		NC	LDO_X	TCXO_IN	NC	LDO_EX	V_BACK	VDD_IO	V_DET	VDD_ANT	LDO_RET		
PIN Number		1	2	3	4	5	6	7	8	9	10		

2.2 Pin Description

2.2.1 Power Supply Pin

Name	Pin	Type	Description
DCDC_IN	21	Power	DC/DC power input. (DCDC_IN and VDD_IO are required to use the same external power supply.)
DCDC_OUT	22	Power	DC/DC power output
V_CORE	23	Power	Core power input
V_BACK	6	Power	Backup power input
VDD_IO	7	Power	IO/TCXO power input. (DCDC_IN and VDD_IO are required to use the same external power supply.)
LDO_C	24	Power	Core LDO voltage output
LDO_X	2	Power	TCXO LDO voltage output
LDO_EX	5	Power	Used by the chip itself, and cannot supply power to other circuits
GND	20	-	Connect to Ground
V_DET ¹	8	Power	Antenna detection power input
VDD_ANT	9	Power	Antenna power output
LDO_RET	10	Power	Backup power output
GND			Ground

¹. Not supported currently. [↩](#)

2.2.2 Analog Pin

Name	Pin	Type	Description
L1_IN	40	RF	L1 RF input
L5_IN	38	RF	L5 or L2 RF input
TCXO_IN	3	Clock	26 MHz TCXO input
RTC_I	12	Clock	32.768 kHz crystal or digital waveform input
RTC_O	11	Clock	32.768 kHz clock output
NC	4	-	Leave floating or connect to GND. Recommended to connect to GND.
NC	39	-	Leave floating
NC	1	RF	Leave floating

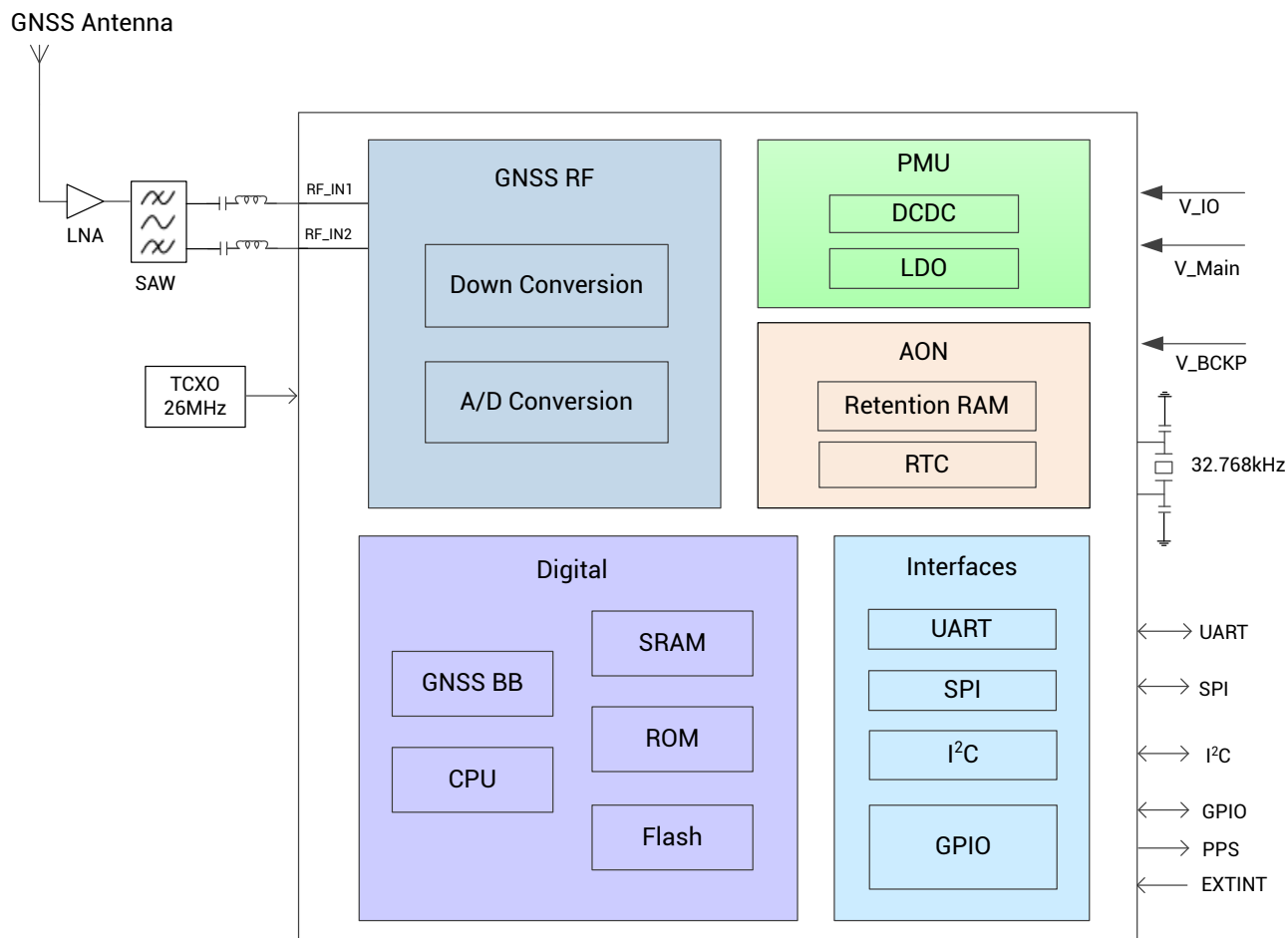
2.2.3 PIO Pin Description

Name	Pin	Type	IO Reset	Description
PIO0	25	IO	I/Pull-up	GPIO0
PIO1	28	IO	I/Pull-up	GPIO1
PIO2	27	IO	I/Pull-up	GPIO2
PIO3	30	IO	I/Pull-up	GPIO3
PIO4	26	IO	I/Pull-up	GPIO4
PIO5	29	IO	I/Pull-up	GPIO5
TX	19	IO	I/Pull-up	GPIO6
RX	18	IO	I/Pull-up	GPIO7
SCL	31	IO	I/Pull-up	GPIO8
SDA	32	IO	I/Pull-up	GPIO9
D_SEL	33	IO	I/Pull-up	GPIO10

Name	Pin	Type	IO Reset	Description
PPS	35	IO	I/Pull-up	GPIO11
BOOT_MODE	34	IO	I/Pull-up	GPIO12
PIO13	14	IO	I/Pull-up	GPIO13
PIO14	13	IO	I/Pull-up	GPIO14
PIO15	36	IO	I/Pull-up	GPIO15
PIO16	37	IO	I/Pull-up	GPIO16
TMS	16	IO	I/Pull-up	GPIO17
TCK	15	IO	I/Pull-up	GPIO18
RESETN	17	IO	I/Pull-up	-

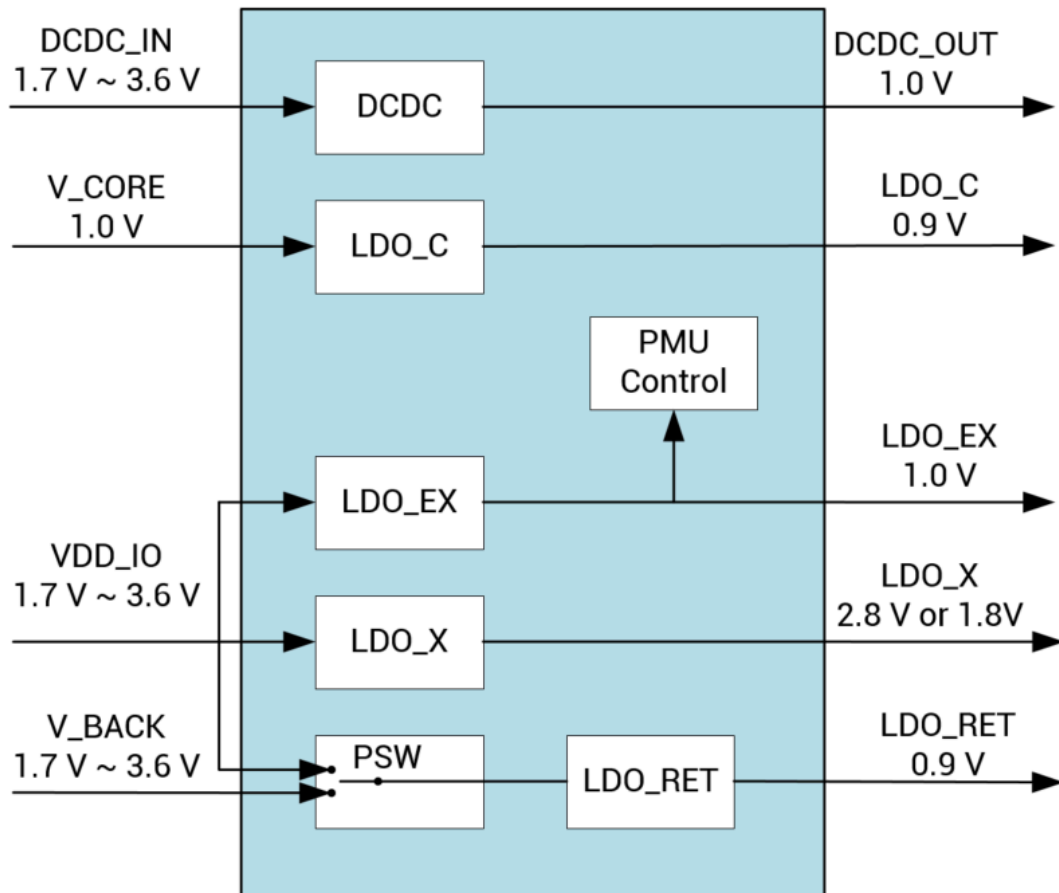
Chip Structure

3.1 Block Diagram



3.2 Power Management Unit

The Power Management Unit (PMU) provides four power domains that are internally generated by LDOs and supervised by several voltage monitors:



Core

Core domain is the main power domain for the RF and digital part inside the chip. It is powered by V_CORE, which is connected to LDO_EX or DCDC_OUT. The subsequent LDO_C converts the V_CORE input to respective voltages, which must be connected with a decoupling capacitor through the LDO_C pin. LDO_C drives the digital logic parts.

IO

IO power domain is powered by VDD_IO, including the chip IO devices, on-chip Flash, etc. The voltage supply of VDD_IO is 1.7 V to 3.6 V. Except IO devices, other PMU devices are powered by a dedicated LDO_EX. LDO_EX must be connected with a decoupling capacitor through LDO_EX pin.

Backup



Backup domain runs the RTC section and Retention RAM. This domain uses VDD_IO and V_BACK as the voltage sources. When the range of VDD_IO is normal, it uses VDD_IO, otherwise uses V_BACK. The allowed range of V_BACK is 1.7 V to 3.6 V. If you do not need the RTC and backup function, you must connect the V_BACK pin to VDD_IO.

TCXO

The clock domain supplies power to TCXO. This domain has a dedicated LDO called LDO_X, which is also powered by VDD_IO. If TCXO is powered by LDO_X, LDO_X should be connected to the power pin of TCXO and be decoupled by a capacitor. You can also choose an external power source other than LDO_X to power TCXO.

Based on the above division of power domains and hardware design, UC6580x-00 has three modes of power consumption:

- Running mode: Every power source of the chip is normal, CPU runs normally, and the power supply of each domain is set by the software. All events, including external interruption, communication request, timing, etc., can be processed normally.
- V_BACK mode: The IO and main power supply of the chip is cut off from the outside, and there is only V_BACK power supply left. At this time, the power consumption of the chip drops to a very low level, and the specific functions and power consumption depend on the mode set by the software. It can wake up as soon as it is powered on.
- Power off mode: All power supplies are cut off from the outside, and the chip does not work at all.

3.3 Clock

The chip requires an external 26 MHz clock, which is generated by TCXO, to provide reference frequency for RF and baseband PLL. In order to ensure the stable operation of the PLL when the chip is booted, the 26 MHz clock should work stably within 10 ms after the main and IO domains are powered.

The chip supports RTC crystal input. RTC crystal is usually driven by an on-chip 32.768 kHz oscillator, which connects to an external 32.768 kHz crystal. The chip also supports external RTC clock input. The input signal amplitude should be 0.9 V to 1.98 V, and the input signal frequency should be 32.768 kHz. The RTC clock frequency offset must be less than 20 ppm.

	Frequency Source	Frequency	Remark
System Clock	TCXO	26 MHz	Work stably within 10 ms after the main and IO domains are powered
RTC Clock	On-chip oscillator	32.768 kHz	Connect an external 32.768 kHz crystal
	External digital waveform generator	32.768 kHz	Input signal amplitude should be 0.9 V to 1.98 V

If the main power supply and IO power supply fail and a backup power is connected to V_BACK, the baseband, RF and CPU do not work, while RTC keeps running to provide time reference for the receiver. This operating mode is called RTC time keeping mode. Under this mode, the relevant data are saved in Retention RAM for GNSS hot start.

RTC time keeping mode is a prerequisite for GNSS hot start. Under this mode, RTC provides time information and Retention RAM provides ephemeris and almanac information. If you do not need GNSS hot start function, connect RTC_O to ground. In the AGNSS-based system, if time and ephemeris are provided through network as assistance, RTC is not necessary.

Mode	Power Supply	Working Parts				
		BB	RF	CPU	RTC	Retention RAM
RTC Time Keeping	V_BACK				√	√

3.4 System Reset

According to the power structure of UC6580x-00, there are two reset domains: Core domain and Backup domain.

Core domain can be reset by three methods:

- RESETN is the reset pin of the chip. When the voltage level at RESETN is low, the reset signal will be sent to the Core domain. The duration of RESETN low level should be more than 5 ms.
- The chip's software reset, which is controlled by the firmware.
- Watchdog RESET.

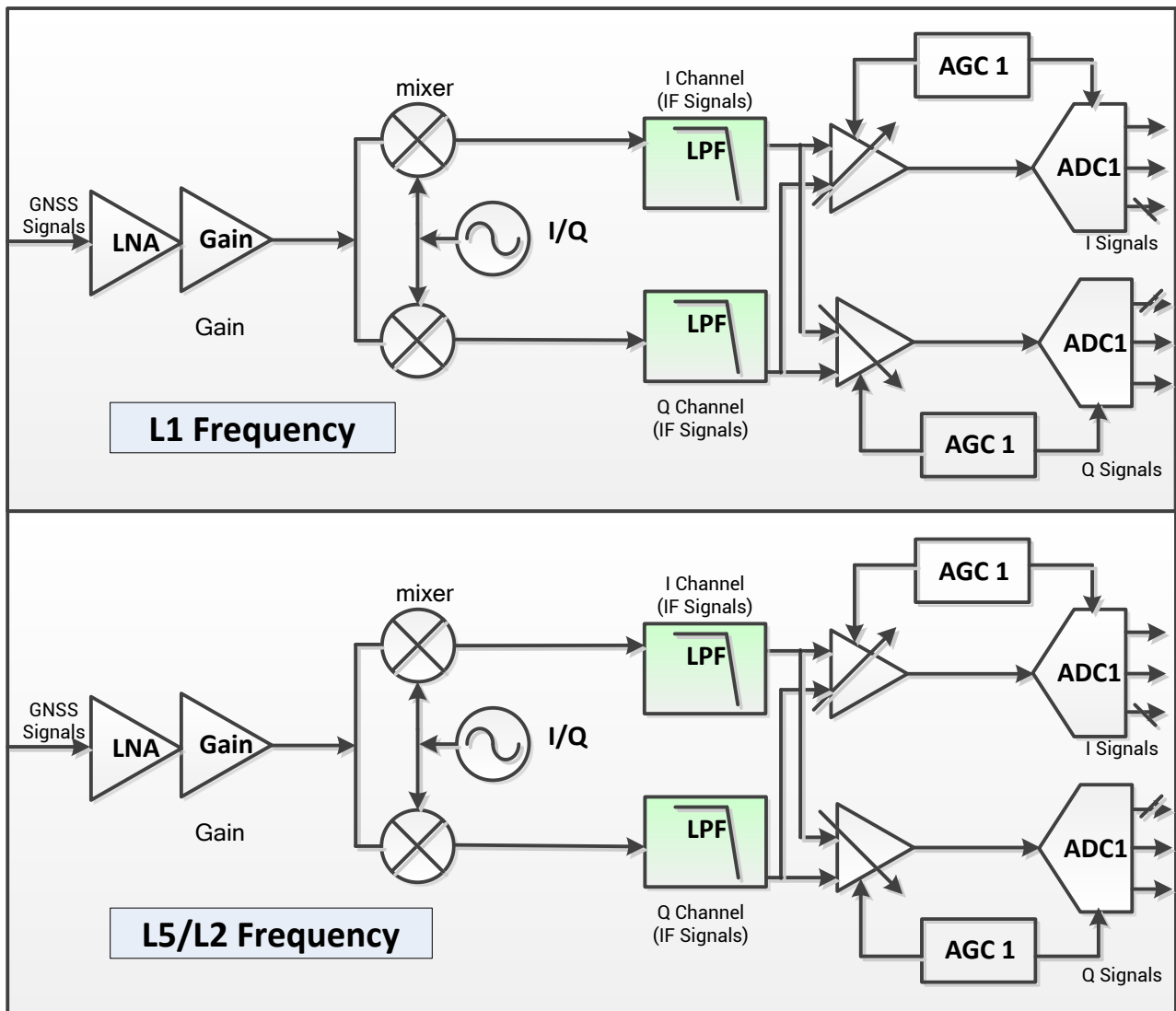
If any of the above reset sources issues a reset signal, the Core domain is reset.

Backup domain can be reset by two methods:

- When the voltage of V_BACK is lower than 1.2 V, it will trigger the reset.
- The software system sends the RTC RESET signal, which is controlled by the firmware and only resets the RTC counter.

RF Subsystem

The RF subsystem of UC6580x-00 adopts dual-frequency dual-channel architecture. The frequency of the input signal ranges from 1166 MHz to 1620 MHz. The received GNSS signals are amplified by a single-ended Low Noise Amplifier (LNA), and then fed to a RF gain block to be further amplified, thus reducing the noise figure requirements for the mixer. The RF gain block also provides a single-ended to differential conversion. After completing the orthogonal down-conversion, multi-GNSS signals are divided into two channels. Afterwards, the I and Q signals of both channels are low-pass filtered and amplified by a separate Programmable Gain Amplifier (PGA), after which both I and Q signals are sent to the high-speed ADC section for data conversion.



The RF subsystem of UC6580x-00 supports any mode below:

- Dual-frequency L1+L5

- Dual-frequency L1+L2
- L1 single-frequency multi-constellation mode.

4.1 LNA

The low noise amplifier (LNA) makes use of a single stage configuration and requires external matching to function satisfactorily. For improved performance, an external LNA should be added, of which the gain range is recommended to be within 17dB to 50dB. In an environment with complex interference, it is necessary to use an external SAW filter to suppress out-of-band interference.

4.2 Gain Block

A single stage differential amplifier follows the LNA providing further amplification and conversion from single-ended signals to differential signals.

4.3 Mixer

UC6580x-00 uses the active I/Q mixer to first convert the multi-GNSS signals to an intermediate frequency signals. At this stage, the signals are split into two IF channels after down-conversion.

4.4 IF Filter

UC6580x-00 integrates an I/Q low-pass filter to remove the out-of-band noise after RF down-conversion, which improves the noise performance of the RF system.

4.5 AGC

UC6580x-00 supports Automatic Gain Control (AGC), which reduces the convergence time and computing cost. AGC controls the gain configuration of each module in the radio frequency data link according to the signal energy required by the RF system.

4.6 PGA and ADC

UC6580x-00 integrates Programmable Gain Amplifier (PGA) and high-speed Analog Digital Convertor (ADC). The gain value of PGA is configured by AGC to ensure that the signal energy output by ADC remains unchanged when the RF input signal energy changes within a certain range, thereby ensuring that the output of the high-speed ADC does not saturate. The high-speed ADC supports the output of I/Q complex sampling signals.

Baseband Subsystem

UC6580x-00 provides multiple interfaces for data communication or access to external devices, such as UART, SPI, I2C, GPIO, etc.

This chapter covers the following aspects:

- Interfaces
- PIO Functions
- Time Management Unit
- Watchdog
- Timer Counter

5.1 Interfaces

5.1.1 UART

UC6580x-00 makes use of two UART interfaces: UART1 and UART2. Both of them can be used for communication with a host.

By default, PIO6/PIO7 corresponds to UART1, which serves as the main UART in standard firmware version. The communication interface of UC6580x-00 can be mapped to different PIO interfaces via BOOT_MODE. PIO6/PIO7 can also be used as SPI, and in this case, there is no UART1 function. See the description in section [Firmware Upgrade Mode](#) for the use of BOOT_MODE and the corresponding communication interface mapping.

UART2 can use PIO15/PIO16. It is mainly used for transmitting or debugging auxiliary information.

5.1.2 SPI slave

UC6580x-00 uses SPI slave interface as an optional way to communicate with the host to transfer data. At the same time, it supports loading firmware via the SPI slave interface. The maximum transmission rate using SPI slave is 8 Mbps, and the maximum SPI clock frequency is 8 MHz. When the SPI slave loads the firmware, the maximum transmission rate is 4 Mbps.

The SPI slave interface shares PIO6/PIO7 and PIO8/PIO9 with UART1 and I2C respectively. Users can select the communication interface via D_SEL and BOOT_MODE. If PIO6/PIO7/PIO8/PIO9 is used as SPI slave interface, there are no UART1 and I2C1 functions; if PIO6/PIO7 and PIO8/PIO9 are used as UART1 and I2C1, there is no SPI slave interface.

When the SPI slave interface is used for host communication, PIO14 should be used as the SRDY (Slave Ready) signal to indicate whether the SPI slave is ready.

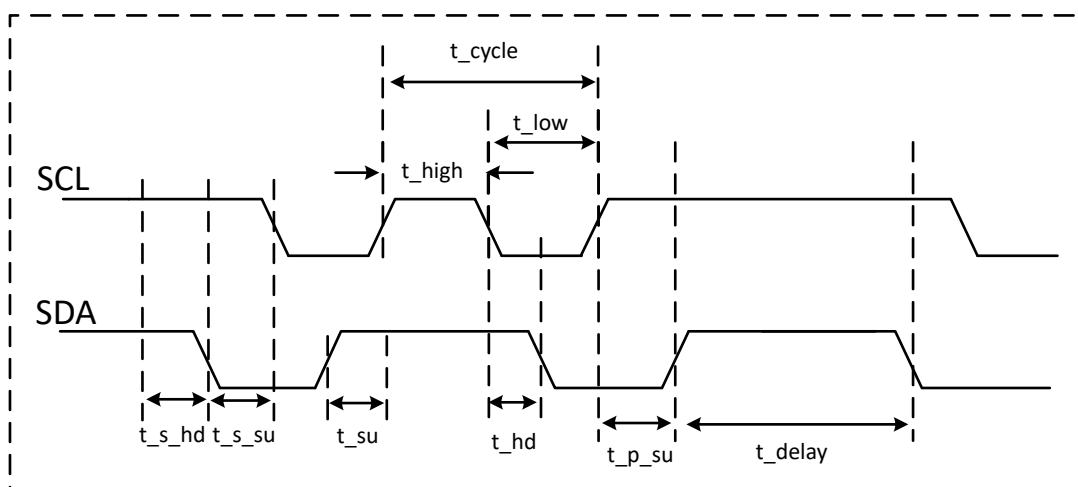
5.1.3 SPI master

UC6580x-00 provides SPI master interface by configuring PIO0/PIO1/PIO4/PIO5, which can be used to communicate with or control other SPI slave devices. The maximum transmission rate of the SPI master interface is 16 Mbps, and the maximum SPI clock frequency is 16 MHz.

The SPI master interface is disabled by default.

5.1.4 I2C

UC6580x-00 provides one I2C interface (I2C1) to load firmware and communicate with the host. The I2C1 works in slave mode. It is compatible with the I2C protocol, supporting the transmission rates of 100 Kbps, 400 Kbps and 3.4 Mbps. The current firmware supports 400 Kbps transmission. By default, the I2C1 uses PIO8/PIO9, and the BOOT_MODE pin should be in pull-up or open-circuit state when booting. For more information, please see the description in section [PIO Functions](#).



I2C Timing Requirement

Symbol	Parameter	Min.	Max.	unit
t_{cycle}	SCL clock period	100	3400	kbps
t_{high}	High period of SCL clock	0.06	5	μs
t_{low}	Low period of SCL clock	0.16	5	μs
t_{su}	Data setup time	0.072		μs
t_{hd}	Data hold time	0.072		μs

Symbol	Parameter	Min.	Max.	unit
t _{s_su}	Setup time for start condition	0.072		μs
t _{s_hd}	Hold time for start condition	0.072		μs
t _{p_su}	Setup time for stop condition	0.072		μs
t _{delay}	Delay time between a start and stop condition	0.5		μs

5.1.5 Serial Flash Interface

Serial Flash interface is used to connect UC6580x-00 with external SPI Flash. SPI Flash can be used for firmware storage and update.

The serial Flash interface uses PIO0/PIO1/PIO2/PIO3/PIO4/PIO5 only when the BOOT_MODE pin is in pull-up or open-circuit state when booting; otherwise, the serial Flash interface is invalid.

5.2 PIO Functions

The PIO module may be configured as GPIO or as the aforementioned communication interfaces. The following table describes all PIO functions.

PIO #	Default Function	I/O	Description	Alternate Function
0	GPIO	I/O	-	SPI master MISO SPI flash D0
1	GPIO	I/O	-	SPI master MOSI SPI flash D1
2	GPIO	I/O	-	PWM0 UART2 RXD SPI flash WP
3	GPIO	I/O	-	PWM1 UART2 TXD SPI flash HOLD
4	GPIO	I/O	-	SPI master CLK SPI flash CLK

PIO #	Default Function	I/O	Description	Alternate Function
5	GPIO		-	SPI master CSN SPI flash CSN
6	GPIO	I/O	Controlled by BOOT_MODE when booting: UART1 TXD (if BOOT_MODE is high when booting) SPI slave MISO (if BOOT_MODE is low when booting)	UART1 TXD SPI slave MISO
7	GPIO	I/O	Controlled by BOOT_MODE when booting: UART1_RXD (if BOOT_MODE is high when booting) SPI slave MOSI (if BOOT_MODE is low when booting)	UART1 RXD SPI slave MOSI
8	GPIO	I/O	Controlled by BOOT_MODE when booting: I2C1_SCL (if BOOT_MODE is high when booting) SPI slave CLK (if BOOT_MODE is low when booting)	I2C1_SCL SPI slave CLK
9	GPIO	I/O	Controlled by BOOT_MODE when booting: I2C1_SDA (if BOOT_MODE is high when booting) SPI slave CSN (if BOOT_MODE is low when booting)	I2C1_SDA SPI slave CSN
10	GPIO	I/O	Communication interface selection pin. Select from PIO6 to PIO9. Only valid when booting. This pin is pulled up if it is not connected.	PPS D_SEL 32.768 kHz clock out

PIO #	Default Function	I/O	Description	Alternate Function
11	GPIO	I/O	-	PPS EVENT UART1 RXD
12	GPIO	I/O	Bootstrap mode selection pin. Select firmware loading address, external/internal Flash or SPI interface. Only valid when booting. This pin is pulled up if it is not connected.	BOOT MODE PPS RF_READY UART1 TXD
13	GPIO	I/O	-	ODO_DIR EVENT
14	GPIO	I/O	-	ODO_CNT EVENT
15	GPIO	I/O	-	UART2 TXD LO1_DET
16	GPIO	I/O	-	UART2 RXD BLK LO2_DET
17	TMS	I/O	Debug interface	ODO_DR GPIO
18	TCK	I/O	Debug interface	ODO_CNT GPIO

If you want to change the I/O alternate function, please contact the Unicore FAE.

5.3 Time Management Unit

The Time Management Unit (TMU) manages all clock sources in the baseband, using more accurate clocks to calibrate less accurate clocks.

5.4 Watchdog

UC6580x-00 contains two watchdog timers which prevent the system-lockup caused by the software deadlock. During normal operation, the firmware resets the watchdog's internal counter at regular intervals before the timer overflow occurs.

5.5 Timer Counter

The timer counter has an EVENT input and a PPS output.

EVENT can be input via PIO11, PIO13 or PIO14, but only one EVENT can be input at a time. Event input is the external timestamp event relative to GPS time.

EVENT function is disabled by default. Please contact Unicore FAE if necessary.

PPS can be output via PIO11. PPS outputs pulse sequence synchronized with GPS or UTC time grid, and the time interval can be configured over a wide range of frequency.

All input and output signals are synchronized with the internal clock frequency of the receiver, so that the inherent maximum quantization error of the input and output signals reaches ± 10 ns.

System Configuration

6.1 Power Supply Scheme

UC6580x-00 supports two power supply schemes, including internal DC-DC mode and LDO mode.

DCDC_IN and VDD_IO use the same power.

V_BACK can use an independent power, or use the same power as DCDC_IN and VDD_IO.

TCXO is powered by LDO_X. The voltage could be 1.8 V or 2.8 V¹.

To prevent reverse current flowing from VDD_IO to V_BACK, the supply voltage of V_BACK should be no lower than VDD_IO or you should add a forward biased diode before V_BACK. Meanwhile, make sure that V_BACK is within the range of 1.7 V to 3.6 V. The diode is recommended to be of low power (mA-level forward current), low forward voltage drop (300 mV), and low reverse leakage current (< 100 μ A within the working temperature).

If you do not use the hot start and backup function, connect the V_BACK to VDD_IO

6.1.1 DC-DC Mode

In this mode, the main power (V_Main) connects to the pin DCDC_IN, and the output of the DCDC module DCDC_OUT provides the power to the rest circuits. At this time, the system is powered by the internal DC-DC:

- The system power supply is input to the DCDC_IN, and output from the DCDC_OUT, which is connected to the V_CORE input pin via a power inductor.

6.1.2 LDO Mode

In this mode, the main power (V_Main) connects to DCDC_IN while DCDC_IN and DCDC_OUT are short-circuited and the internal DC-DC is bypassed, so that the V_Main provides the power to the rest circuits directly. At this time:

- DCDC_IN and DCDC_OUT are short-circuited together.
- The system power supply is input by VDD_IO and output to V_CORE through LDO_EX.

For specific design scheme of the above modes, please refer to *UC6580x-00 Hardware Reference Design*.

¹. The output voltage of LDO_X is determined at the manufacturing of the chip and cannot be changed by firmware. The current mass-produced chips have an output of 1.8V. If you need a 2.8V output, please contact Unicore in advance. [↩](#)

6.2 Firmware Upgrade Mode

The UC6580x-00 chip supports three firmware upgrade modes, which is controlled by the D_SEL pin (PIO 10) and BOOT_MODE pin (PIO 12).

- Mode 1: firmware upgrade through UART1 (PIO6 and PIO7) or I2C1 (PIO8 and PIO9).
- Mode 2: firmware upgrade through UART1 (PIO11 and PIO12).
- Mode 3: firmware upgrade through SPI slave (PIO6 to PIO9).

See the following tables for the configuration of the pins at boot when upgrading the firmware.

BOOT_MODE is valid only at power-on or before the RESETN signal is sent. After the RESETN signal is sent, the BOOT_MODE pin can be used as an ordinary PIO pin.

Pin Configurations at Boot

Mode	D_SEL	BOOT MODE	Boot Mode	At Boot			Remark
				PIO 6/7	PIO 8/9	PIO 11/12	
Mode 1	1	X	Boots from UART1 and I2C1	UART1	I2C1	X	
Mode 2	0	1	Boots from UART1	X	X	UART1	Boots from UART1 (PIO11 and PIO12), no I2C1 boot
Mode 3	0	0	Boots from SPI slave	SPI slave	SPI slave	X	

The boot steps are as follows:

Step 1: CPU detects the firmware upgrade request from the interfaces.

- Mode 1

If	Then
CPU detected a firmware upgrade request from UART1 within 40 ms after power-on or reset.	CPU starts to adapt the baud rate and upgrade the firmware. After the upgrade, run the firmware.
CPU detected a firmware upgrade request from I2C1 within 40 ms after power-on or reset.	CPU starts to adapt the I2C1 clock and upgrade the firmware. After the upgrade, run the firmware.
CPU detected a firmware upgrade request from both UART1 and I2C1 within 40 ms after power-on or reset.	Initialize the interface whose baud rate has been identified first, and read the upgrade request from that interface. After the upgrade, run the firmware.
CPU has not detected any firmware upgrade request from UART1 or I2C1 within 40 ms after power-on or reset.	Do step 2

- Mode 2

If	Then
CPU detected a firmware upgrade request from UART1 within 40 ms after power-on or reset.	CPU starts to adapt the baud rate and upgrade the firmware. After the upgrade, run the firmware.
CPU has not detected any firmware upgrade request from UART1 within 40 ms after power-on or reset.	Do step 2

- Mode 3

If	Then
CPU detected a firmware upgrade request from SPI slave within 40 ms after power-on or reset.	CPU upgrades the firmware and runs it after the upgrade.

If	Then
CPU has not detected any firmware upgrade request from SPI slave within 40 ms after power-on or reset.	Do step 2

Step 2: CPU detects the built-in flash and external flash in order.

- CPU Detects Flash

If	Then
CPU detected a firmware in the built-in flash.	CPU reads the firmware and runs it.
CPU has not detected any firmware in the built-in flash.	CPU tries to read the firmware in the external flash and runs it.

Electrical Specifications

This chapter covers the electrical specifications of the UC6580 series chips.

The operating temperature range for UC6580A-00 is -40°C to 105°C, and for UC6580I-00 it is -40°C to 85°C.

These temperature conditions apply to all electrical specifications described in this chapter.

7.1 DC Electrical Specifications

7.1.1 Absolute Maximum Rating

Symbol	Parameter	Min.	Max.	Unit
DCDC_IN	Input voltage of the internal DC/DC converter	-0.2	3.6	V
DCDC_OUT	Output voltage of the internal DC/DC converter, externally connected to an inductor and two filter capacitors to provide 1.0 V power. The recommended inductance is 1 μ H and the recommended capacitance is 10 μ F.	-0.2	1.05	V
VDD_IO	Input voltage of I/O, LDO_X and flash	-0.2	3.6	V
V_BACK	Supply voltage of backup domain	-0.2	3.6	V
TCXO_IN	Input voltage on TCXO_IN	-0.6	2.9	V
RTC_I	Input voltage on RTC_I	-0.2	1.98	V
Vdig	Input voltage on PIO	-0.2	3.6	V
Prfin	RF input power on LNA_IN		+15	dBm
Ptot	Total power		360 (@room temperature)	mW
Tjun	Junction temperature	-40	+125	°C
Ts	Storage temperature	-50	+150	°C

The ripple voltage of all the input voltages must be within 50 mV.

7.1.2 Recommended Working Conditions

Symbol	Parameter	Min.	Typical	Max.	Unit
DCDC_IN	Input voltage of internal DC/DC converter	1.7	3.3	3.6	V
VDD_IO	Input voltage of I/O, LDO_X and flash	1.7	3.3	3.6	V
V_BACK	Supply voltage of backup domain	1.7	3.3	3.6	V

7.2 PIO Electrical Specifications

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
Ileak	Leakage current input pins				5	μA
Vil	Low level input voltage				0.2×VDD_IO	V
Vih	High level input voltage		0.8×VDD_IO			V
Vol	Low level output voltage	I _{out} = -5mA			0.4	V
Voh	High level output voltage	I _{out} = 5mA	VDD_IO-0.55			V
Rpu	Pull-up resistance		200	260	320	kΩ
Cap_DIG_IN	Input capacitance of digital IO			0.7		pF

The PIO output type is push-pull.

7.3 Analog Electrical Specifications

Analog Electrical Specifications 1

Symbol	Parameter	Min.	Typical	Max.	Unit
LDO_X ¹	LDO_X output voltage (1.8 V TCXO)	1.75	1.8	1.95	V
	LDO_X output voltage (2.8 V/2.9 V TCXO)	2.75	2.8	2.95	V
LDO_RET	LDO_RET output voltage (VDD_IO power on; V_BACK power on)	0.85	0.9	0.95	V
	LDO_RET output voltage (VDD_IO power off; V_BACK power on)	0.55	0.65	0.75	V
LDO_C	LDO_C output voltage	0.85	0.9	0.95	V
LDO_EX	LDO_EX output voltage	0.95	1.0	1.05	V
V_DET ²	Antenna detection input	2.7	3.3	3.6	V
VDD_ANT ³	Antenna power output	2.7	3.3	3.6	V
RTC_I	32.768 kHz crystal or digital waveform input			1.98	V
RTC_O	32.768 kHz clock output			1.98	V
DCDC_OUT	Output voltage of the internal DC/DC converter, externally connected to an inductor and two filter capacitors to provide 1.0 V power. The recommended inductance is 1 μ H and the recommended capacitance is 10 μ F.	0.95	1.0	1.05	V
TCXO_IN_Vpp	TCXO input peak-to-peak voltage	0.5	0.6	1.4	Vpp

¹. The output voltage of LDO_X is determined at the manufacturing of the chip and cannot be changed by firmware. The current mass-produced chips have an output of 1.8V. If you need a 2.8V output, please contact Unicore in advance. [↵](#)

². Not supported currently. [↵](#)

³. The output voltage of VDD_ANT = V_DET- (antenna current) * (10 Ω). [↵](#)

Analog Electrical Specifications 2: RTC Specifications

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
RTC_Fxtal	RTC crystal oscillator resonate frequency			32768		Hz
RTC_T_start	RTC startup time		0.2	1	2	s
RTC_CL	RTC load capacitance	ESR = 80 kΩ		12.5		pF
RTC_Vil	RTC low level input voltage	Shared RTC oscillator input	0.0		0.2	V
RTC_Vih	RTC high level input voltage	Shared RTC oscillator input	0.9		1.98	V

7.4 RF Electrical Specifications

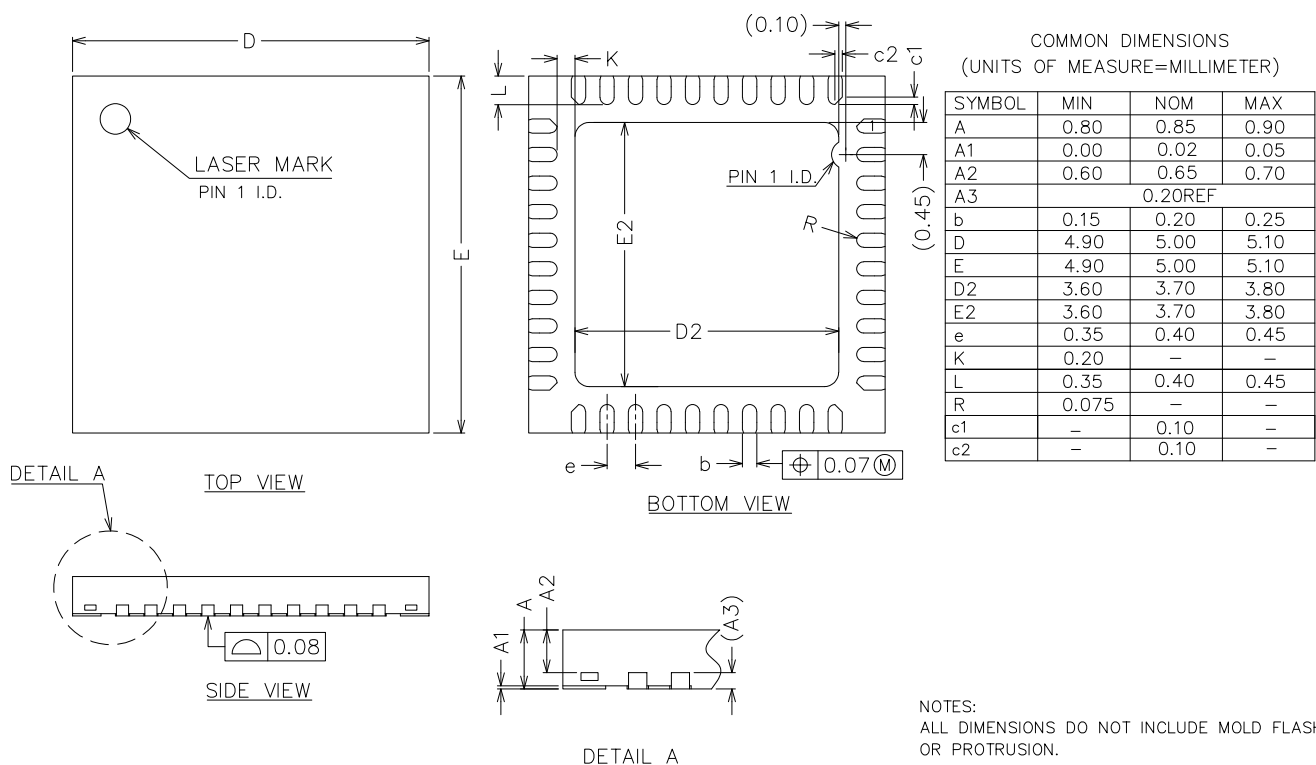
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
L1_IN	Receiver input frequency		1559.098	1575.42	1606	MHz

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
L5_IN	Receiver input frequency		1166.45	1176.45	1217.14	MHz
LNA_IN	LNA input impedance	Need matching components and DC blocking capacitors		50		Ω
LNA_S11	LNA input return loss	50 Ω environment		-10		dB
NFtot	Receiver cascaded noise figure	50 Ω environment		5		dB
Ext_Gain	External LNA gain	50 Ω environment	15	17	60*	dB
TCXO_Freq	TCXO frequency	0.5 ppm		26		MHz

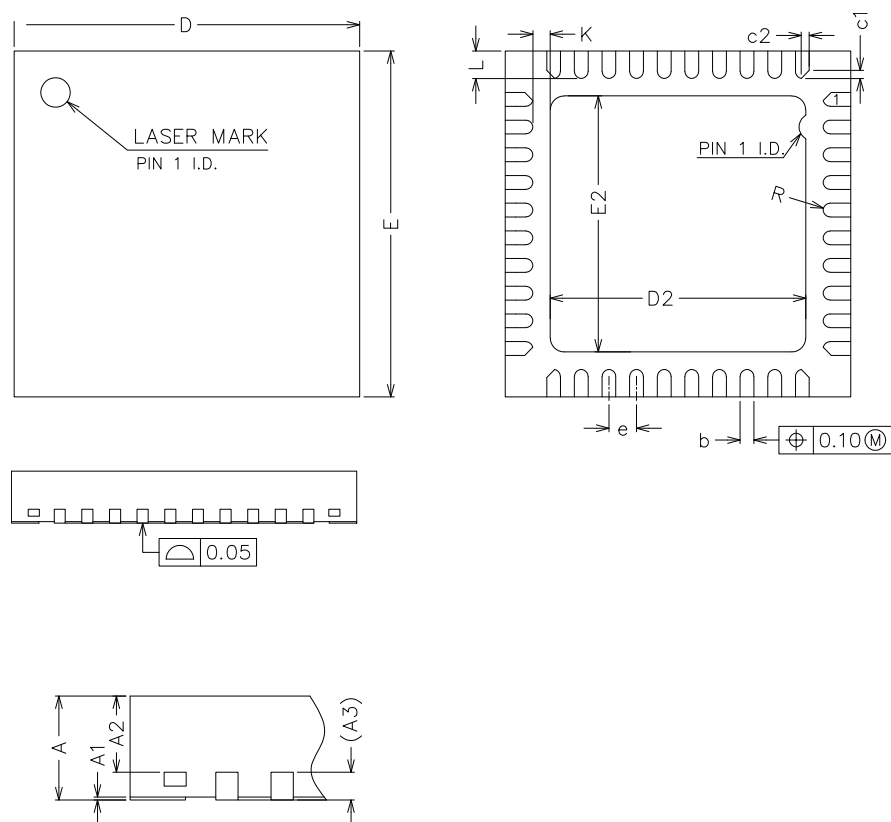
*. When the external LNA gain falls into this range, the system's CN0 fluctuates by 1 dB. [↩](#)

Mechanical Dimensions

8.1 UC6580A-00 (QFN40 Automotive)



8.2 UC6580I-00 (QFN40 Industrial)



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

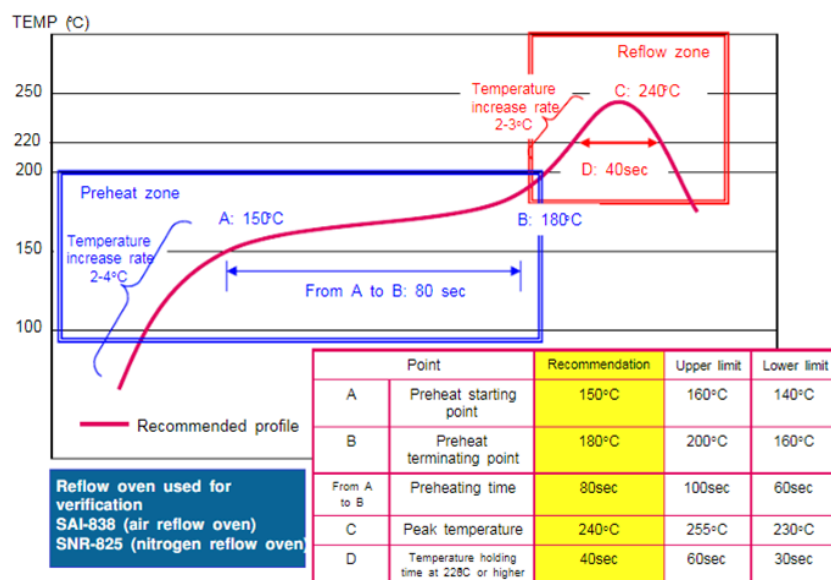
SYMBOL	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0	0.02	0.05
A2	0.60	0.65	0.70
A3	0.20REF		
b	0.15	0.20	0.25
D	4.90	5.00	5.10
E	4.90	5.00	5.10
D2	3.60	3.70	3.80
E2	3.60	3.70	3.80
e	0.35	0.40	0.45
K	0.20	—	—
L	0.35	0.40	0.45
R	0.09	—	—
C1	—	0.12	—
C2	—	0.12	—

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD
MO-220 WHHE-1.

Reflow Soldering



9.1 Reflow Soldering

The reflow soldering temperature curve is recommended as shown in the figure below (M705-GRN360 is recommended for solder paste).

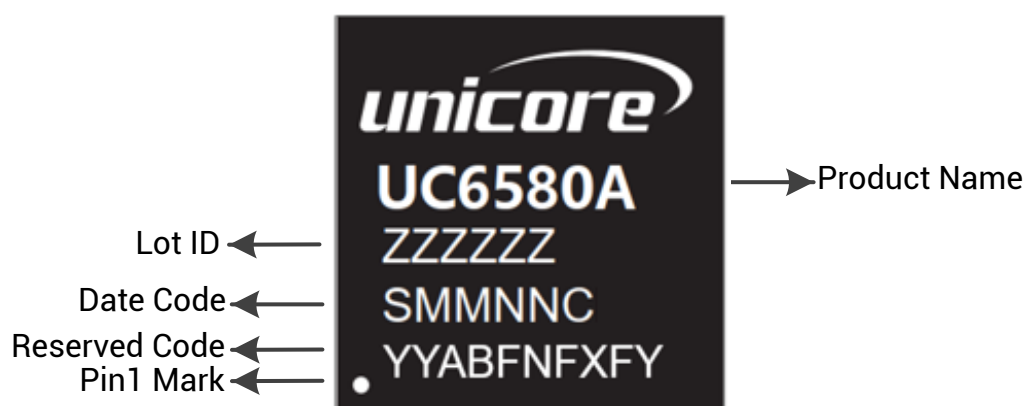


Product Appearance and Packaging

10.1 Product Appearance

 <p>UC6580A-00 (QFN40 Automotive)</p>	 <p>UC6580I-00 (QFN40 Industrial)</p>
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10.2 Label



Product Model	Description
UC6580A-00	Automotive grade
UC6580I-00	Industrial grade

10.3 Moisture Sensitivity Level

The Moisture Sensitivity Levels (MSL) of UC6580A and UC6580I are shown in the table below. Packaging and handling precautions related to the MSL should follow the standard IPC/JEDEC J-STD-033. For more information, visit the [JEDEC](http://www.jedec.org) website.

Model	MSL
UC6580A-00	MSL 1
UC6580I-00	MSL 3

10.4 Ordering Information

Model	Chip Scale Package	Built-in Flash	Operating Temperature	Grade	Product Package
UC6580A-00	QFN40 5 mm × 5 mm × 0.85mm	Yes	-40 °C to 105 °C	Automotive	Tape & Reel, 3000 pcs/reel
UC6580I-00	QFN40 5 mm × 5 mm × 0.85mm	Yes	-40 °C to 85 °C	Industrial	Tape & Reel, 3000 pcs/reel

和芯星通科技（北京）有限公司

Unicore Communications, Inc.

北京市海淀区丰贤东路 7 号北斗星通大厦三层
F3, No.7, Fengxian East Road, Haidian, Beijing, P.R.China,
100094

www.unicore.com

Phone: 86-10-69939800

Fax: 86-10-69939888

info@unicorecomm.com



www.unicore.com