HLK-GS475 GNSS MODULE

Third-Generation GNSS Location Hub with Dual Frequency Support

Version：V3.2

Date：2020/11/17

Revision History

Date	Revision Content	Revised By	Version
2019/05/16	- Initial released		1.0
2019/08/25	- Update description	Mark	2.0
2019/12/12	- Update Antenna and GPIO	Mark	3.0
2019/12/25	- Update Bottom outline	Jerry	3.0
2020/01/07	- Update Data	Mark	3.0
2020/02/13	- Update Datasheet	Jacky	3.0

1. Function Introduction

1.1 Function

The HLK-GS475 sensor hub includes a dual-processor architecture (ARM CM4+CM0) that ensures each task is handled in the most power efficient manner. The HLK-GS475 GNSS includes two RF paths, a low power path and a high-performance path, enabling the lowest power consumption at any received signal condition.

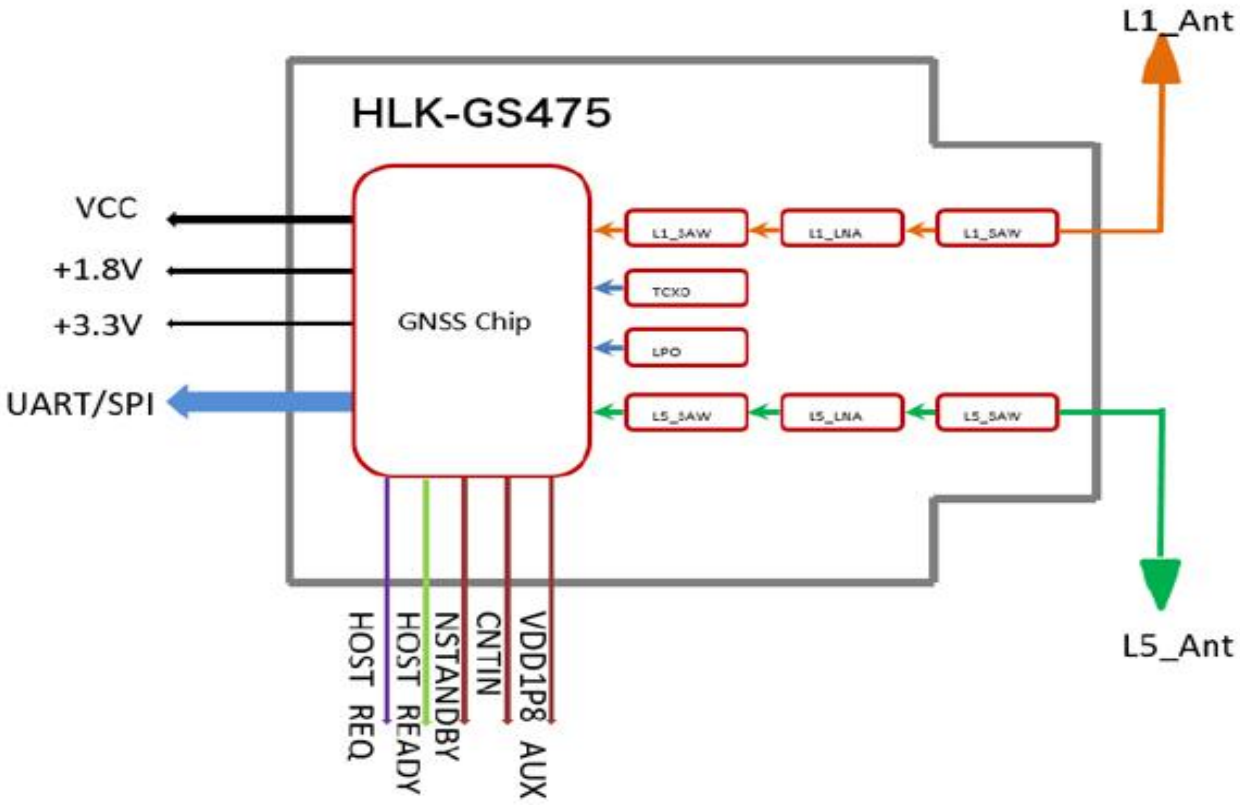
The HLK-GS475 simultaneously supports GPS, GLONASS, BeiDou, Galileo, SBAS, and QZSS in both the L1/B1/E1 and L5/E5a frequency bands. This industry-first dual-band capability provides the most accurate positioning available in the market today.

The HLK-GS475 achieves system-level performance benefits from tightly integrating the sensor and GNSS signals. Measurements from sensors such as accelerometers, gyroscopes, magnetometers, and others are fused with GNSS measurements to provide a highly accurate, cross-calibrated output to applications while helping to maintain a lower system power profile. Cross-calibration is achieved by using sensor measurements to aid GNSS for small movements and by using GNSS to calibrate sensor measurements, the latter having inherent drift that accumulates over time and larger movements.

1.2 Interface

- High-speed system interface (to an applications processor):
  - – Serial streaming SPI slave (up to 50 MHz).
  - – Alternate UART system interface supports rates up to 3.2 Mbps.
- Up to 17 programmable GPIOs.
- Sensor interfaces:
  - – Three BSC master ports.
  - – Two SPI masters (normal, dual, quad, up to 50 MHz).
  - – Two ADC channels.
  - – UART (up to 3.2 Mbps with hardware flow control).

2.Function Block diagram



3. HLK-GS475 Key Feature

- Systems Integrated multi-frequency GNSS baseband and RF front end for simultaneous reception of GPS, GLONASS, BeiDou (BDS), Galileo (GAL), and SBAS satellite systems.
- Support for position batching, geofencing, sensor fusion and sensor navigation
- ARM-based 32-bit Cortex-M4F (CM4) CPU:
  – Single-precision Floating Point Unit (FPU).
  – Memory Protection Unit (MPU).
  – Internal SRAM (single-cycle access at full speed).
  –ROM with bootloader capability.
  –Single Instruction Multiple Data (SIMD)
- Digital Signal Processing (DSP) functions.
  – 1.25 Dhrystone MIPS/MHz
  – Operating frequency up to 150 MHz.

Benefits:

- Highest levels of navigation performance.
- Reduced application-processor load by performing on-chip PVT computations.
- Multipath rejection
- better weak signal tracking
- Sub-meter accuracy in open sky
- Reduces signal cross correlation
- Very low GNSS and sensor hub power consumption.

4.General Specification

4.1 General Specification

Module Name	HLK-GS475
Function	GNSS Band L1 and L5 Support
HOST Interface	UART/SPI, IRQ, READY INDICATE
OUT Interface	UART2, I2C, IOS
Operating temperature	-40°C to 85°C
Storage temperature	-40°C to 125°C
Module size	12.2mmX16mmX1.8mm

4.2 Voltage

VBAT and VDDIO	**Min.**	**Typ.**	**Max.**	**Unit**
Operating Temperature	-40	25	85	deg.C
VCC	3.0	3.3	4.8	V
+3.3V	2.7	3.3	5.0	V
+1.8V	1.22	1.8	1.98	V
V1.8_OUT	1.7	1.8	1.98	V

NOTICE; IF VBAT FOR POWER SUPPLY V1.8 MUST BE NC

IF VBAT NC THEN MAIN POWER IS V1.8 INPUT

5.HLK-GS475 RF Performance

5.1.The HLK-GS475 can receive the following signals:

- GPS L1 C/A
- GLONASS L1
- BeiDou(BDS)B1
- Galileo (GAL) E1
- GPS/QZSS L5 and Galieo E5a
- QZSS L1 C/A
- IRNSS

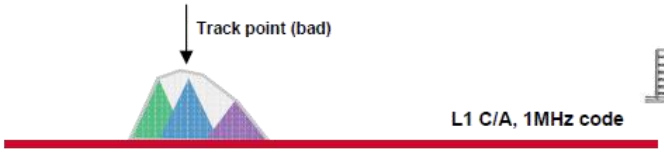
5.2.L5/E5 Signal Benefits

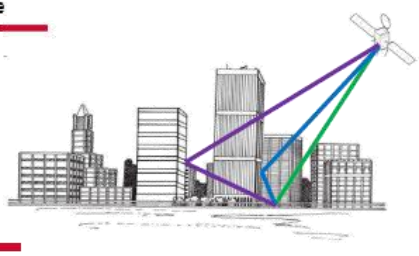
Signal attribute	L1	L5	E5	Benefits
10x higher chipping rate	☐	☑	☑	multipath rejection
up to 3dB increased signal power	☐	☑	☑	better weak signal tracking
pilot signal	☐	☑	☑	6dB better weak signal tracking
ionospheric estimation using dual frequency	☐	☑	☑	sub-meter accuracy in open sky
error correction code on nav messages	☐	☑	☑	more reliable autonomous cold start
more frequent nav messages	☐	☐	☑	faster autonomous cold start
50MHz signal bandwidth using E5B	☐	☐	☑	further improvement in multipath rejection
secondary codes	☐	☑	☑	reduces signal cross correlation

5.3.L5 higher resolution and higher multipath rejection

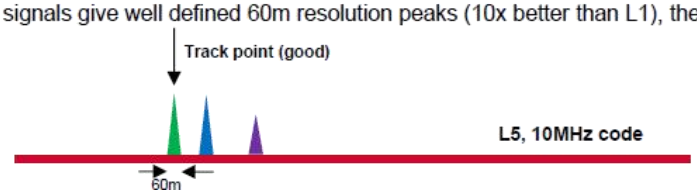
L1 GNSS receivers measure the delay of the incoming satellite signal with a resolution of 600m

In a multipath scenario, L1 GNSS signals create a blurry multipath "blob"





Instead, L5 GNSS signals give well defined 60m resolution peaks (10x better than L1), therefore multipath can be rejected



6.PIN Assignments

6.1 TOP VIEW

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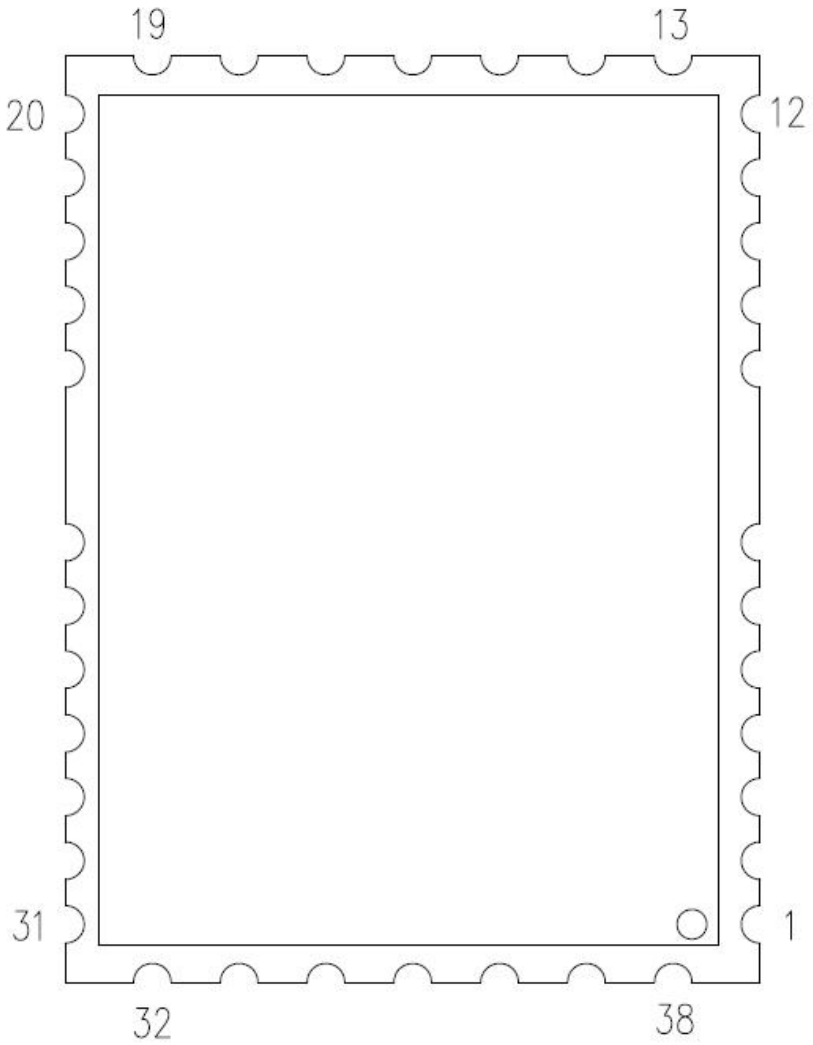


6.2 PIN Definition

PIN NO.	PIN NAME	PIN TYPE	PIN Description
1	ADC_IN1/GPIO26	I/O	ADC channel input 1
2	ADC_IN2/GPIO27	I/O	ADC channel input 2
3	UART1_TX_GPIO12	I/O	UART1_TX
4	UART1_RX_GPIO13	I/O	UART1_RX
5	SDA_M2	I/O	I2C Interface DATA
6	SCL_M2	I/O	I2C Interface CLK
7	DATA/SDI/GPIO44	I/O	I/O Interface
8	NSTANDBY	I/O	NSTAND is the power-up signal
9	VDD1P8_RTC	P	1.8V to Power
10	UART2_TX	O	UART interface

11	UART2_RX	I	UART interface
12	UART2_CTS	I	UART interface
13	GND	P	Ground Pad
14	GND	P	Ground Pad
15	L1 ANT	RF IO	GNSS L1 Band Antenna In
16	GND	P	Ground Pad
17	L5 ANT	RF IO	GNSS L5 Band Antenna In
18	GND	P	Ground Pad
19	GND	P	Ground Pad
20	UART2_RTS	I	UART interface
21	MCU_REQ	I	IRQ signal input
22	GPIO14	1/O	I/O Interface
23	GPIO15	1/O	I/O Interface
24	GPIO_33	-	I/O Interface
25	SPI_SS_N/UART	I	SPI Interface FSS/ UART_RX
26	SPI_CLK/UART	O	Host SPI master CLK/ UART_TX
27	SPI_MISO/UART	O	Host SPI master in / UART_RTS
28	SPI_MOSI/UART	I	Host SPI master out / UART_CTS
29	+3.3V	P	Backup power 3.3V input
30	IO2/GPIO34	1/O	I/O Interface
31	GND	-	Ground Pad
32	+1.8	P	1.8V Input
33	SWCLK	-	GNSS calibration clock
34	GND	-	Ground Pad
35	SDA_S1	-	I2C Interface DATA
36	SCL_S1	-	I2C Interface CLK
37	MCU_RDY	O	HOST REQUEST
38	H_HOST_REQ	O	Host request BSC slave 1

7. Performance

7.1 Power consumption

Mode	Host based(mA)	PVT on chip(mA)
Acquisition	33	38
Tracking	26	30
Low power tracking	9	13

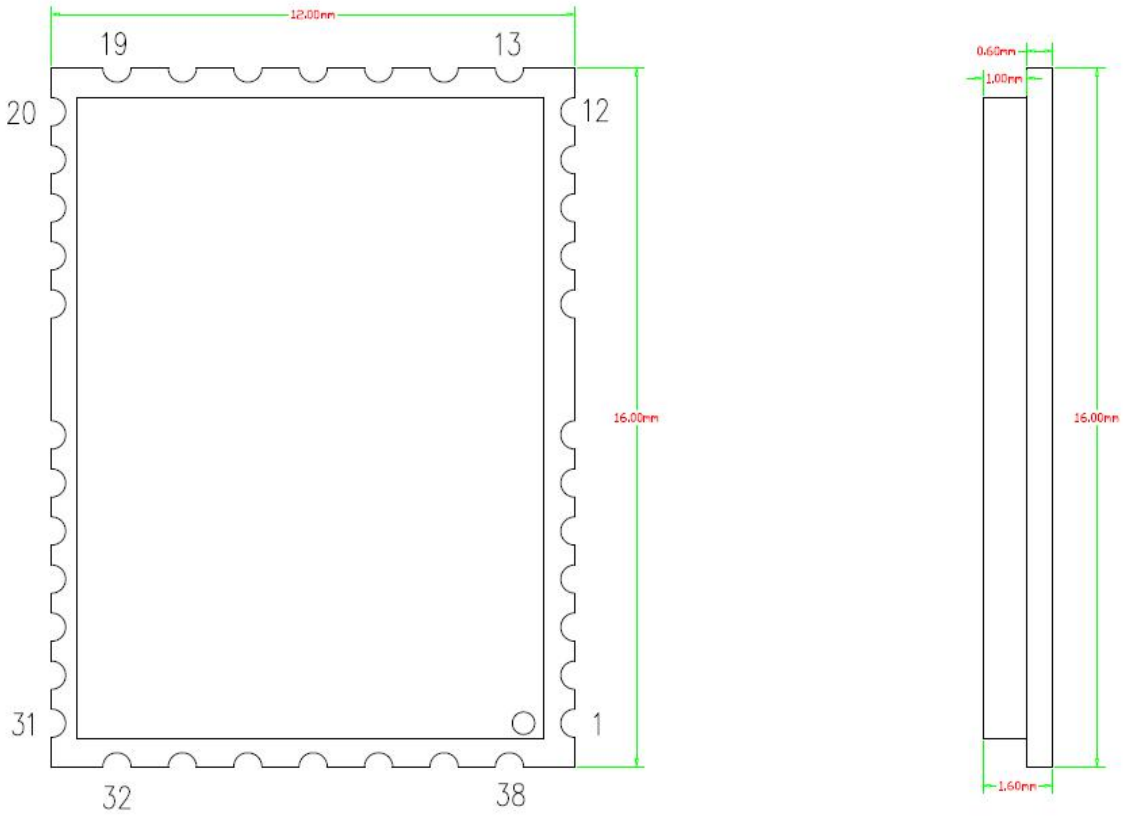
7.2 Performance

Mode	
Cold start TTFF	30s
Accuracy	1m
Cold start Sensitive	-148dbm

8.Dimensions

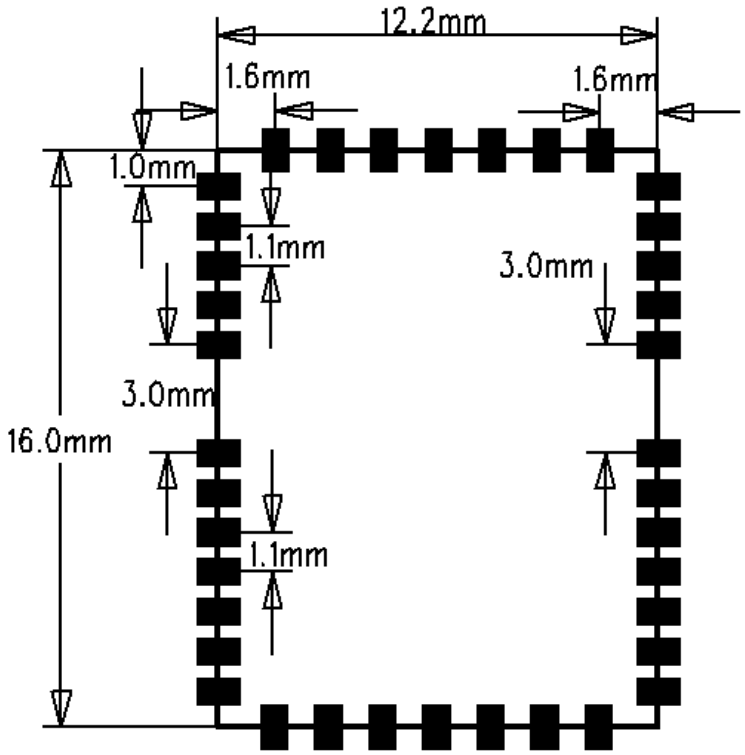
8.1 Physical Dimension

(Unit: mm)



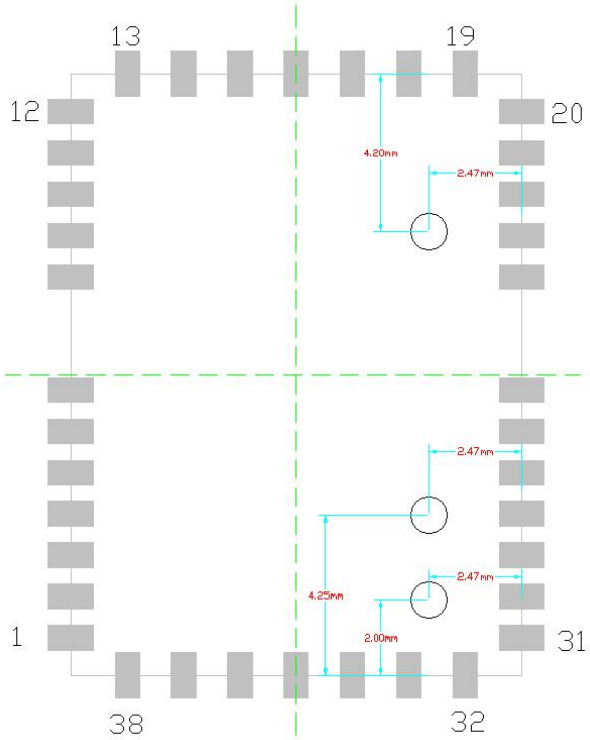
9. Recommend PCB layout

< TOP VIEW >

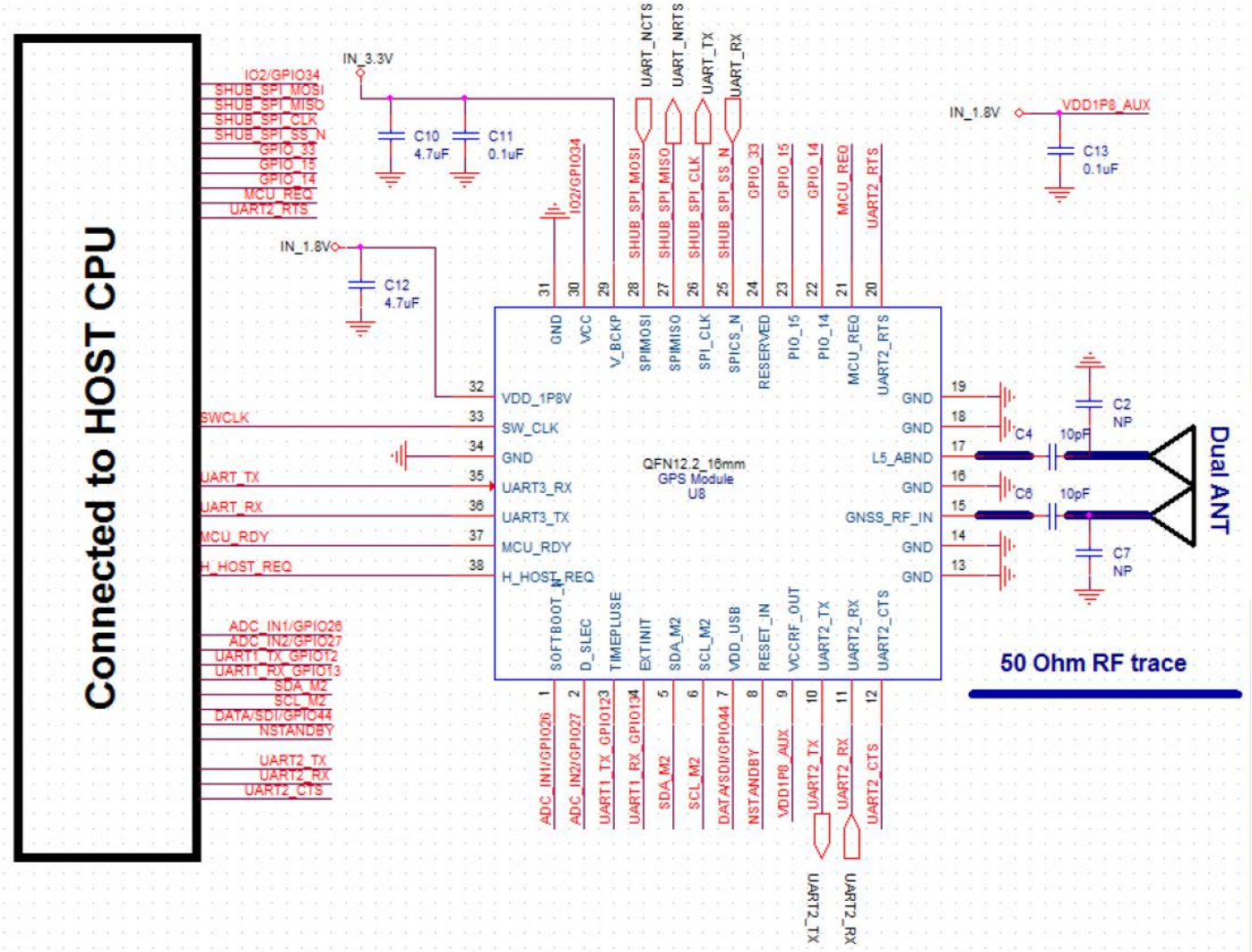


Pad SIZE; 0.75mmX1.2mm

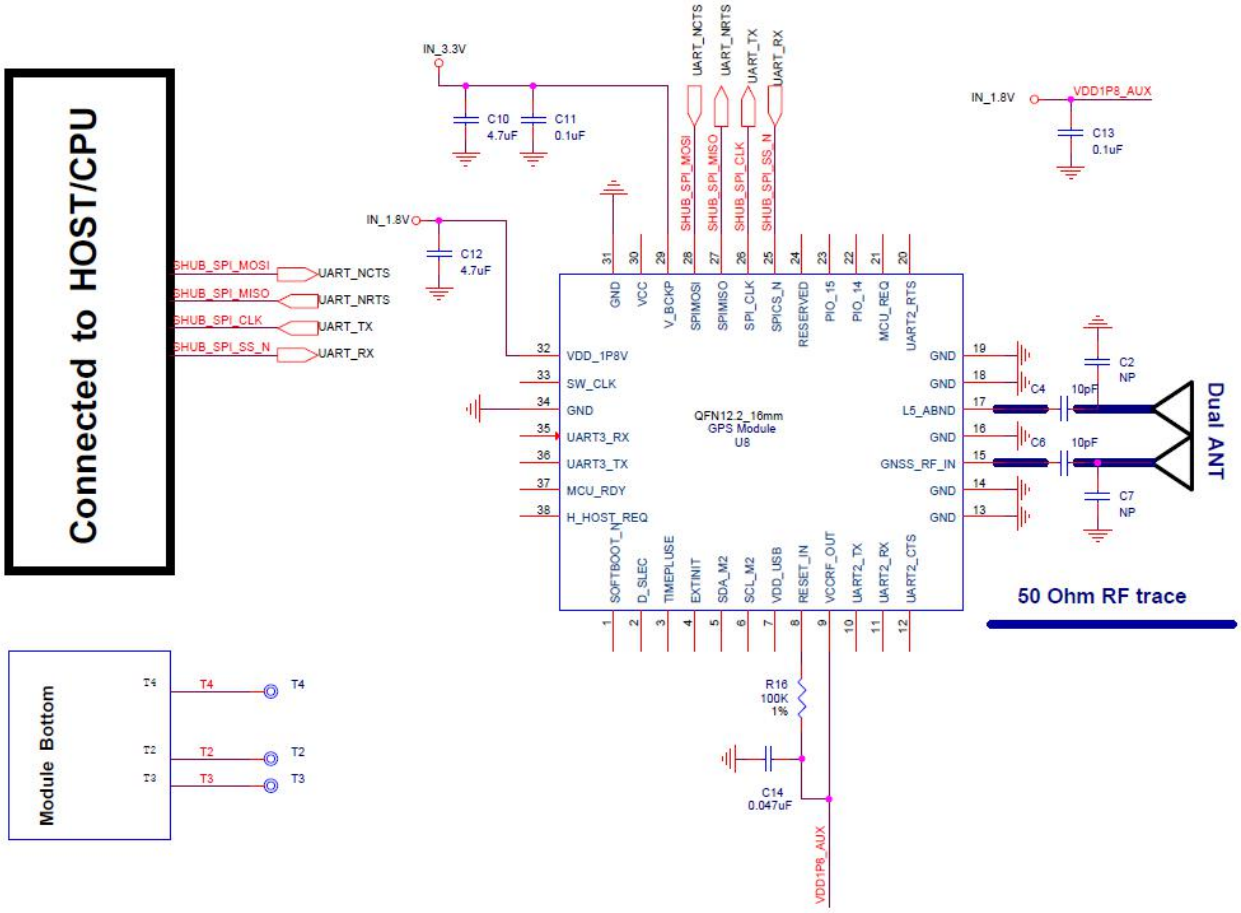
< BOTTOM VIEW >



9.2Reference Design



9.3Simple Application



10.Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times