

# KStar50M-GNSS

## GNSS Disciplined Oscillator Module

High Precision, Functional Flexible Oscillator



Holdover accuracy is better than  $\pm 0.32\text{ppm}$  over 24 hours from  $-20$  to  $+70^\circ\text{C}$

The KStar50M-GNSS GNSSDO is time and frequency synchronized to GNSS and provides a low noise 10MHz and a 1PPS outputs. It receives GNSS signals with a sensitivity of down to  $-167\text{dBm}$ . With a long-term frequency stability that shows deviations of less than  $1\text{E}-12$ . The new KStar50M achieves the quality standards of Stratum 3 of the Network Time Protocol.

### Key Features

- Support GPS, GLONASS, BeiDou & Galileo
- Better than  $1\text{E}-12$  long term frequency stability
- Holdover of less than  $\pm 0.32\text{ppm}$  over 24 hours at full operating temperature range
- Fast frequency locking time as Stratum 3 clock source
- Compact form factor in  $72 \times 41 \times 14$  mm

### Applications

- Stratum 3 Clock Source
- Precision Time Base Reference
- General Timing and Synchronization



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## GNSS Receiver

| GNSS Receiver        |  |   |             |          |
|----------------------|--|---|-------------|----------|
| Bands                |  | GPS L1C/A, SBAS L1C/A, QZSS L1C/A, QZSS L1 SAIF, GLONASS L1OF, BeiDou B1, Galileo E1B/C |             |          |
| Channels             |  | 32  |             |          |
| Sensitivity          |  | GPS   | Tracking    | -166 dBm |
|                      |  |   | Acquisition | -157 dBm |
|                      |  | GLONASS   | Tracking    | -166 dBm |
|                      |  |   | Acquisition | -151 dBm |
|                      |  | BeiDou  | Tracking    | -159 dBm |
|                      |  |   | Acquisition | -146 dBm |
|                      |  | Galileo   | Tracking    | -159 dBm |
|                      |  |   | Acquisition | -142 dBm |
| Antenna Connector    |  | SMA   |             |          |
| Antenna Impedance    |  | 50 Ω  |             |          |
| Antenna Bias Voltage |  | 3.3 V   |             |          |

| GNSS Antenna (Optional) |   |                                     |     |       |
|-------------------------|---|-------------------------------------|-----|-------|
| Bias Voltage            |   | 3.3                                 |     | V     |
| Gain                    |   | 28                                  |     | dBi   |
| Cable Type              |   | RG58                                |     |       |
| Material                |   | PVC                                 |     |       |
| Connector               |   | SMA male                            |     |       |
| Cable Length            |   | 10                                  |     | meter |
|                         |   | Other length available upon request |     |       |
| Dimensions              |  | Antenna Diameter                    | 95  | mm    |
|                         |   | Mount Diameter                      | 105 | mm    |
|                         |   | Height                              | 175 | mm    |



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|  | Parameters                     | Conditions                       | Min  | Typ   | Max    | Unit   |     |
|--|--------------------------------|----------------------------------|--|-------|--------|--------|-----|
| Environment                                | Operating Temperature          |                                  | -20  |       | +70    | °C     |     |
|  | Storage Temperature            |                                  | -40  |       | +85    | °C     |     |
|  | Operation Humidity             |                                  |  |       | +85    | %R.H.  |     |
| Power                                      | Supply Voltage                 |                                  | 4.75   | 5.0   | 5.25   | V (DC) |     |
|  | Supply Current                 | @ 25 °C                          |  |       | 100    | mA     |     |
| 1PPS Output                                | Output voltage high            | LVC MOS, I <sub>OH</sub> = -12mA | 2.4  |       |        | V      |     |
|  | Output voltage low             | LVC MOS, I <sub>OL</sub> = 12mA  |  |       | 0.7    | V      |     |
|  | Nominal output impedance       |                                  |  | 50    |        | Ω      |     |
|  | Programmable Duty Cycle        |                                  | 10   |       | 90     | %      |     |
|  | Rising / Falling Time          | 5pF load                         |  | 0.7   | 1      | ns     |     |
|  | Accuracy                       | Locked to GNSS                   |  |       | ± 10   | ns     |     |
|  | Stability                      | Locked to GNSS                   |  |       | ± 4    | ns     |     |
|  | Holdover Accuracy              |                                  | @ 4 hours Holdover (full operating temperature range)  |       | ± 4.1  |        | ms  |
|  |                                |                                  | @ 4 hours Holdover (constant temperature)              |       | ± 0.1  |        | ms  |
|  |                                |                                  | @ 24 hours Holdover (full operating temperature range) |       | ± 27.6 |        | ms  |
| @ 24 hours Holdover (constant temperature) |                                |                                  |  | ± 3.5 |        | ms     |     |
| 10MHz Output                               | Output voltage high            | LVC MOS, I <sub>OH</sub> = -12mA | 2.4  |       |        | V      |     |
|  | Output voltage low             | LVC MOS, I <sub>OL</sub> = 12mA  |  |       | 0.7    | V      |     |
|  | Nominal output impedance       |                                  |  | 50    |        | Ω      |     |
|  | Duty Cycle                     |                                  | 45   |       | 55     | %      |     |
|  | Rising / Falling Time          | 5pF load                         |  | 0.7   | 1      | ns     |     |
|  | Long Term Stability            | Locked to GNSS, 24 hours average |  |       | ±1E-12 |        |     |
|  | Allan Deviation (ADEV)         | Locked to GNSS, at τ=1sec.       |  |       | 1E-10  |        |     |
|  | Holdover Accuracy              |                                  | @ 24 hours Holdover (full operating temperature range) |       |        | ±0.32  | ppm |
| @ 24 hours Holdover (constant temperature) |                                |                                  |  |       | ±0.04  | ppm    |     |
| Lock Time                                  | Power On to Lock (≤ ±0.28 ppm) |                                  |  | < 5   |        | min    |     |
|  | Holdover to Lock (≤ ±0.28 ppm) |                                  |  | < 3   |        | min    |     |
| Communication Interface                    | UART                           | 115200-8-N-1                     |  |       |        |        |     |
| Protocol                                   | Proprietary ASCII Commands     |                                  |  |       |        |        |     |
| Compliances                                | Frequency Accuracy & Holdover  | ITU-T G.812                      |  |       |        |        |     |

|                             | Conditions     | Offset Frequency (Hz) | Phase Noise max. (dBc/Hz) |
|-----------------------------|----------------|-----------------------|---------------------------|
| Phase Noise at 10MHz Output | Locked to GNSS | 10                    | -98                       |
|                             |                | 100                   | -125                      |
|                             |                | 1K                    | -143                      |
|                             |                | 10K                   | -151                      |
|                             |                | 100K                  | -152                      |
|                             |                | 1M                    | -155                      |



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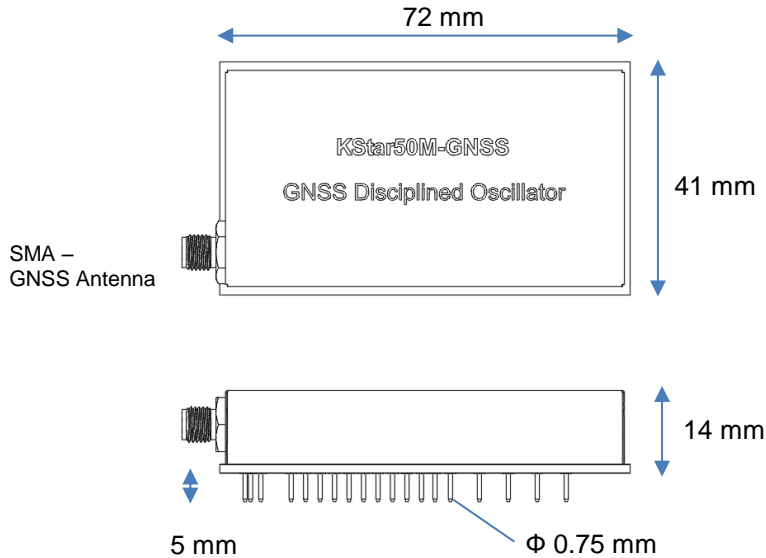


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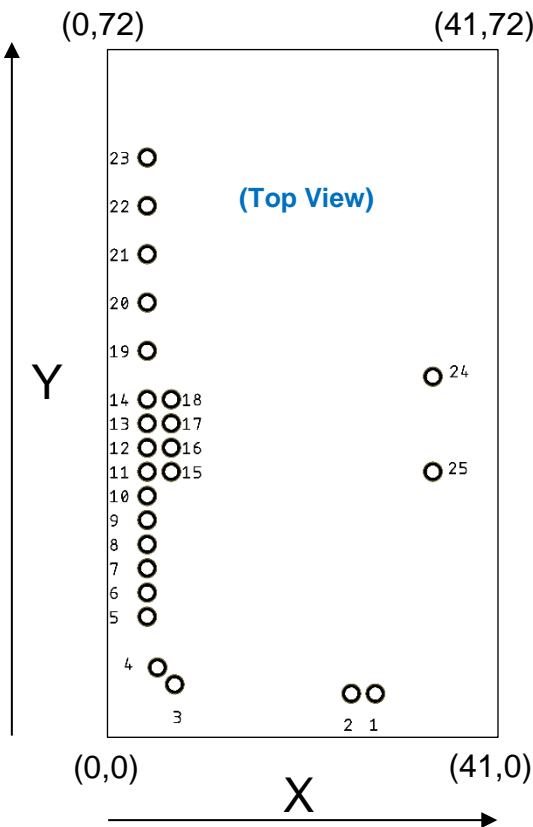


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## Dimensions



## Pin Coordinates



| Pin | Signal Type    | Function                 | X (mm) | Y (mm) |
|-----|----------------|--------------------------|--------|--------|
| 1   | Gnd            | GND                      | 28.3   | 4.45   |
| 2   | Supply Voltage | +5V                      | 25.76  | 4.45   |
| 3   | Gnd            | GND                      | 7.19   | 5.41   |
| 4   | No Connection  |                          | 5.4    | 7.2    |
| 5   | Output         | 1PPS Output              | 4.3    | 12.53  |
| 6   | Input          | Reset                    | 4.3    | 15.07  |
| 7   | Output         | UART TxD                 | 4.3    | 17.61  |
| 8   | Input          | UART RxD                 | 4.3    | 20.15  |
| 9   | Output         | PLL Locked               | 4.3    | 22.69  |
| 10  | Input          | Forced Holdover          | 4.3    | 25.23  |
| 11  | Output         | Holdover                 | 4.3    | 27.77  |
| 12  | Output         | Alarm                    | 4.3    | 30.31  |
| 13  | Do Not Connect | Reserved for Factory Use | 4.3    | 32.85  |
| 14  | Do Not Connect | Reserved for Factory Use | 4.3    | 35.39  |
| 15  | Do Not Connect | Reserved for Factory Use | 6.84   | 27.77  |
| 16  | Do Not Connect | Reserved for Factory Use | 6.84   | 30.31  |
| 17  | No Connection  |                          | 6.84   | 32.85  |
| 18  | Gnd            | GND                      | 6.84   | 35.39  |
| 19  | Output         | 10MHz Output #1          | 4.3    | 40.47  |
| 20  | Do Not Connect | Reserved for Factory Use | 4.3    | 45.55  |
| 21  | Gnd            | GND                      | 4.3    | 50.63  |
| 22  | Gnd            | GND                      | 4.3    | 55.71  |
| 23  | Gnd            | GND                      | 4.3    | 60.79  |
| 24  | Gnd            | GND                      | 34.34  | 37.77  |
| 25  | Gnd            | GND                      | 34.34  | 27.77  |

All dimensions are in millimeter (mm)



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## Extension Board (Optional)

An Extension Board is available for easy evaluation of KSTAR modules. It extends the pin connections from the module to SMA connectors and headers on the extension board, and optionally provides additional features as below:



### Programmable Frequency Dual Synthesizer Output (optional)

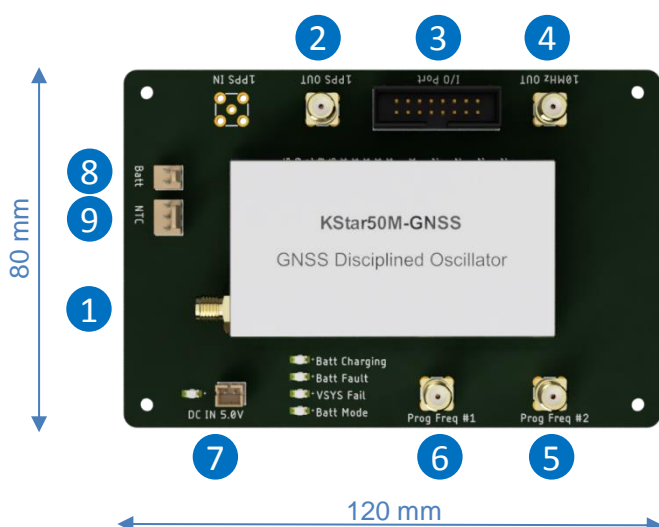
|                          | Min | Typ | Max  | Unit     |
|--------------------------|-----|-----|------|----------|
| Output #1                | 1   |     | 200  | MHz      |
| Output #2                | 1   |     | 200  | MHz      |
| Duty Cycle               | 40  | 50  | 60   | %        |
| VOH                      | 2.4 |     | 3.3  | V        |
| VOL                      |     |     | 0.45 | V        |
| Nominal Output Impedance |     | 50  |      | $\Omega$ |
| Accuracy                 |     |     | 50   | ppb      |
| Phase Jitter (RMS)       |     | 0.5 |      | ps       |



### Batteries Backup (optional)

|              | Conditions                             | Min | Typ     | Max | Unit  |
|--------------|--|-----|---------|-----|-------|
| Battery type |  |     | Lithium |     |       |
| Voltage      | 1. Connected USB, ref, 1PPS and 10MHz. |     | 3.7     |     | V     |
| Capacity     | 2. Temperature at 25°C.                |     | 4.4     |     | AH    |
| Backup Time  | 3. Without synthesizer option.         |     | 3       |     | Hours |

The above Battery life test is used for reference information only, values not guaranteed.



- 1 SMA - GNSS Antenna
- 2 SMA - 1PPS Output
- 3 2 x 8 Header – User I/Os (UART)
- 4 SMA – 10MHz Output
- 5 SMA – Programming Freq. Output #1
- 6 SMA – Programming Freq. Output #2
- 7 2 x 1 Header – Power Input
- 8 2 x 1 Header – Li-Ion / LiFePO4 Battery
- 9 3 x 1 Header – Battery NTC Input

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE.  
ALL PICTURES SHOWN ARE FOR ILLUSTRATION PURPOSE ONLY.  
ACTUAL PRODUCT MAY VARY DUE TO PRODUCT ENHANCEMENT.



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