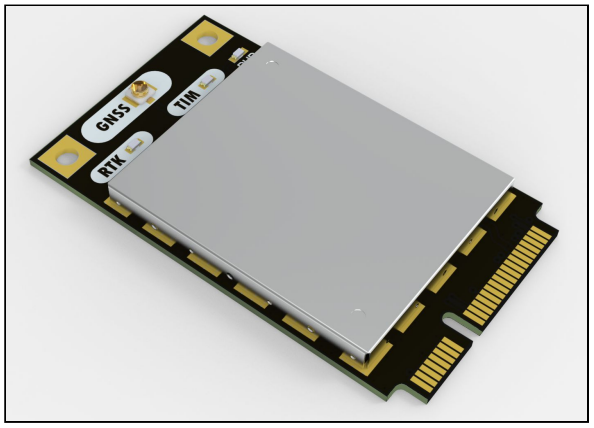
# DP0602 (mPCIe F9P)

Delivers centimeter level accuracy within seconds based on U-blox ZED-F9P L1/L2 GNSS module

*Datasheet - In Production*




## Features

- 3.3V - 100mA power supply
- LEDs status : Timepulse/Power/RTK
- Timepulse & External Interrupt
- USB/UART digital interfaces
- Gold plated u.FL connector
- ESD protection diodes

## Applications

- RTK Base
- Ground vehicles
- Precise navigation
- Automation of moving machinery

## Description

The DP0602 is an affordable compact and high precision L1/L2 GNSS RTK (Real Time Kinematic) device.

Based on the last generation of GNSS U-blox ZED-F9P modules, the DP0602 offers reliable and fast convergence time to provide centimeter accuracy within seconds.

The device allows concurrent reception of GPS / GLONASS / BeiDou & Galileo signals to improve signal availability.

Suitable for many integrated industrial applications, the mPCIe bus offer a very small form factor and a flexible interface.

The DP0602 GNSS RTK is guaranteed to operate over a temperature range of -20°C to +70°C.

Table 1. Device summary

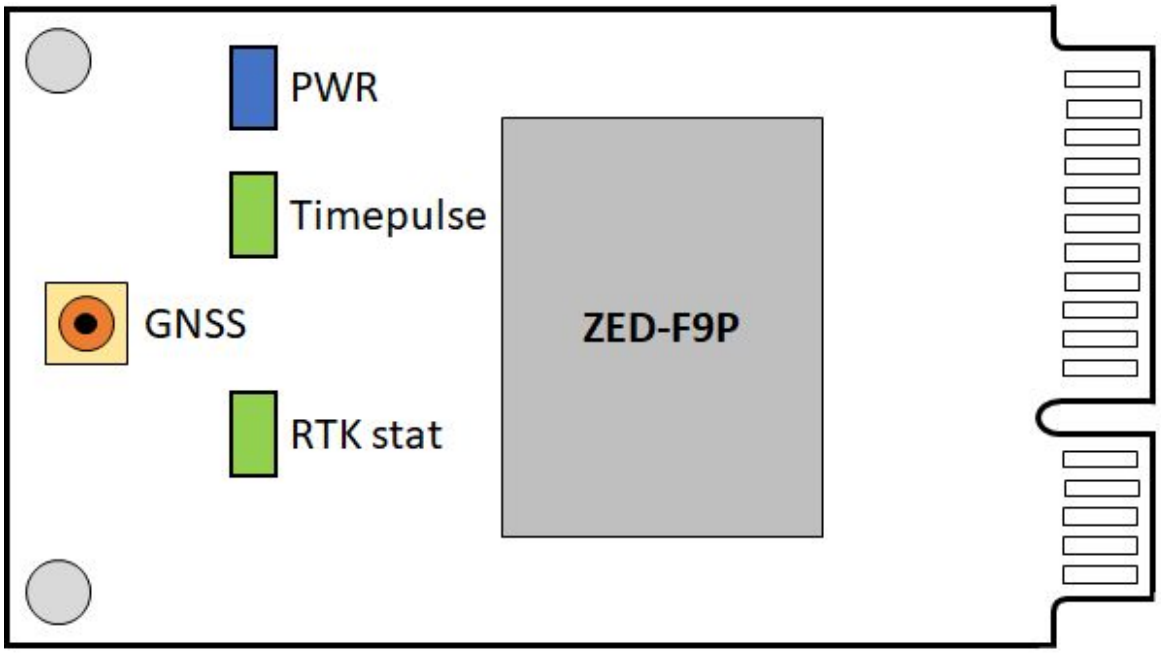
| Order ref code | Temperature range [°C] | Product size [mm] |
|---|---|---|
| 0923 | -20 to +70 | 51.0 x 30.0 x 5.0 |

# Contents

# 1. Block diagram and pin description

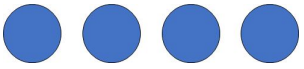
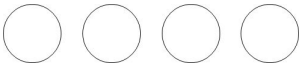
## 1.1 Block diagram

Figure 1. DP0602 block diagram & connectivity (top view)




## 1.2 LED description

Table 2. DP0602 LED sequence status

| LED name | Color | Light sequence | Comment |
|---|---|---|---|
| Timepulse | Green |  | Blinking LED when RTK fix is available |
| Power | Blue |  | Solid blue LED when powered ON |
| RTK Status | Green |  | 3D fix mode / No RTK fix |
| | |  | RTK fix but no FIXED RTK fix |
| | |  | FIXED RTK fix |

## 1.3 miniPCI-express pin description

Table 3. Pinout configuration

| | Pin | Name | Type | Function |
|---|---|---|---|---|
| UART 1&2 / TIM / INT | 19 | UART1 RX | I | UART1 receive |
| | 17 | UART1 TX | O | UART1 transmit |
| | 47 | UART2 RX | I | UART2 receive NMEA/RTCMdata |
| | 45 | UART2 TX | O | UART2 transmit NMEA/RTCMdata |
| | 49 | EXTINT | O | External interrupt |
| | 51 | TIMEPULSE | O | External interrupt on Timepulse |
| | 36 | USB D- | I/O | USB DATA- |
| | 38 | USB D+ | I/O | USB DATA+ |

P : Power / I : Input / O : Output

Figure 2. DP0602 pinout description (top & bot view)

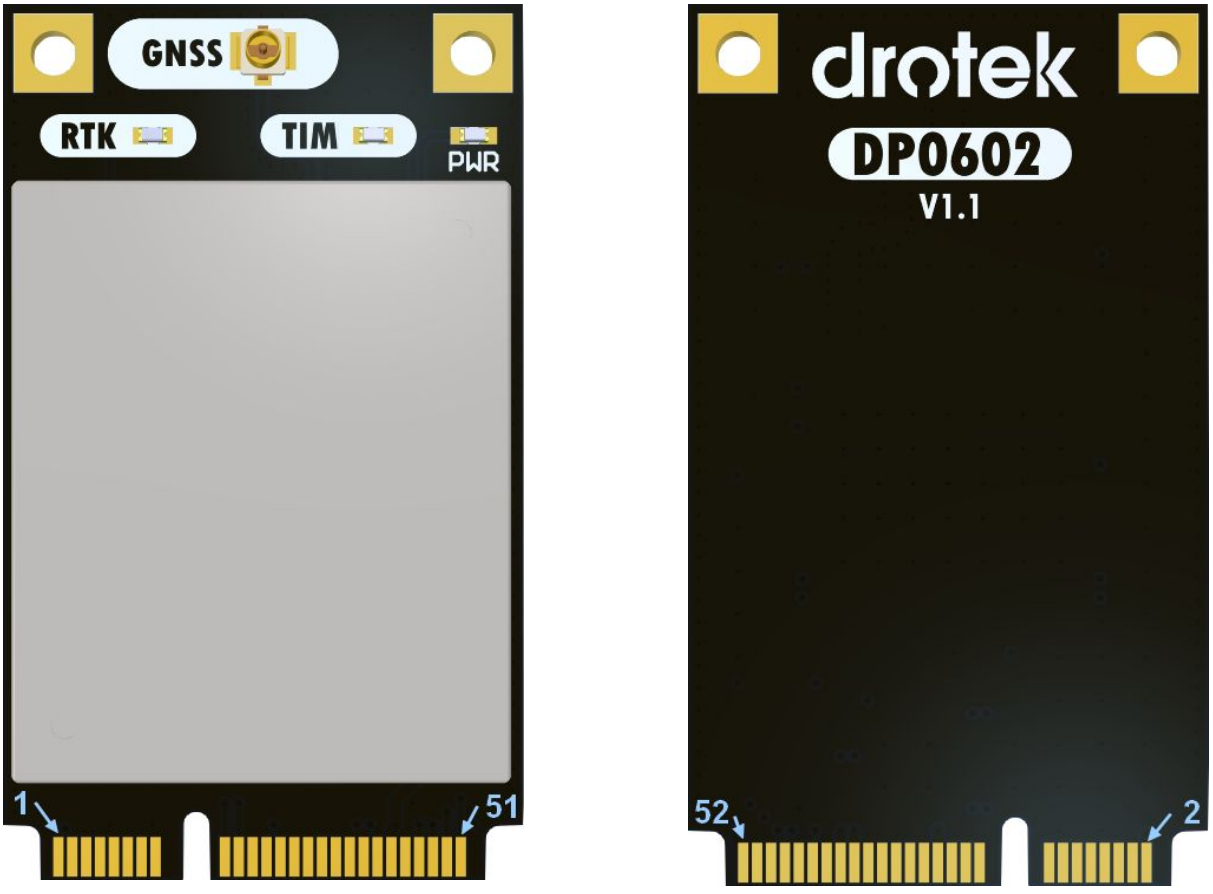


Table 4. mPCIe DP0602 pinout

| Pin n° | Bottom Side | Pin n° | Top Side |
|---|---|---|---|
| 2 | 3V3 | 1 | N.C. |
| 4 | GND | 3 | N.C. |
| 6 | N.C. | 5 | N.C. |
| 8 | N.C. | 7 | N.C. |
| 10 | N.C. | 9 | GND |
| 12 | N.C. | 11 | N.C. |
| 14 | N.C. | 13 | N.C. |
| 16 | N.C. | 15 | GND |
| Mechanical Key | | | |
| 18 | GND | 17 | UART1 Tx |
| 20 | N.C. | 19 | UART1 Rx |
| 22 | N.C. | 21 | GND |
| 24 | 3V3 | 23 | N.C. |
| 26 | GND | 25 | N.C. |
| 28 | N.C. | 27 | GND |
| 30 | N.C. | 29 | GND |
| 32 | N.C. | 31 | N.C. |
| 34 | GND | 33 | N.C. |
| 36 | USB_DATA- | 35 | GND |
| 38 | USB_DATA+ | 37 | GND |
| 40 | GND | 39 | 3V3 |
| 42 | N.C. | 41 | 3V3 |
| 44 | N.C. | 43 | GND |
| 46 | N.C. | 45 | UART2 Tx |
| 48 | N.C. | 47 | UART2 Rx |
| 50 | GND | 49 | EXTINT |
| 52 | 3V3 | 51 | TIMEPULSE |

# 2. Specifications

@Vdd = 3.3V, T = 25°C unless otherwise noted

Table 5. DP0602 mechanical and electrical specifications

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Vdd | Internal supply voltage | | | 3.3 | | V |
| Vdd_IO | Supply voltage for I/O | | | 3.3 | | V |
| Idd | Current consumption | w/o active antenna | | 50 | | mA |
| | | w/ TW7972 antenna | | 130 | | mA |
| Vil | IO pin low level input voltage | | 0 | | 0.8 | V |
| Vih | IO pin high level input voltage | | 2 | | Vdd+ 0.3 | V |
| Vol | IO pin low level output voltage | Iol = 2mA | | | 0.4 | V |
| Voh | IO pin high level output voltage | Ioh = 2mA | Vdd- 0.4 | | | V |
| W | Weight | w/o active antenna | | 18 | | g |
| Top | Operating temperature | | -20 | | +70 | °C |

Table 6. DP0602 general performance

| Parameter | Specifications | Value |
|---|---|---|
| Receiver type | Multi-band GNSS high precision | |
| Accuracy of Timepulse | RMS<br>99% | 30 ns<br>60 ns |
| Frequency of Timepulse | | 0.25 Hz to 10 MHz |
| Operational limits | Dynamics<br>Altitude<br>Velocity | < 4g<br>50,000 m<br>500 m/s |
| Velocity accuracy | | 0.05 m/s |

Table 7. DP0602 performance in different GNSS mode

| GNSS | Parameter | GPS+GLO+GAL +BDS | GPS+GLO | GPS+BDS | GPS |
|---|---|---|---|---|---|
| Acquisition | Cold start<br>Hot start<br>Aided start | 24 s<br>2 s<br>2 s | 26 s<br>2 s<br>2 s | 28 s<br>2 s<br>2 s | 29 s<br>2 s<br>2 s |
| Update rate | RTK<br>PVT<br>RAW | 8 Hz<br>10 Hz<br>20 Hz | 15 Hz<br>25 Hz<br>25 Hz | 15 Hz<br>25 Hz<br>25 Hz | 20 Hz<br>25 Hz<br>25 Hz |
| Convergence time | RTK | < 10 s | < 10 s | < 10 s | < 30 s |
| Horizontal pos. accuracy | PVT<br>RTK | 1.5 m CEP<br>0.01 m + 1ppm CEP | 1.5 m CEP<br>0.01 m + 1ppm CEP | 1.5 m CEP<br>0.01 m + 1ppm CEP | 1.5 m CEP<br>0.01 m + 1ppm CEP |
| Vertical pos. accuracy | RTK | 0.01 m + 1ppm CEP | 0.01 m + 1ppm CEP | 0.01 m + 1ppm CEP | 0.01 m + 1ppm CEP |
| Sensitivity | Tracking & Nav.<br>Reacquisition<br>Cold start<br>Hot start | -167 dBm<br>-160 dBm<br>-148 dBm<br>-157 dBm | | | |

Table 8. DP0602 moving-base performance in different GNSS mode

| GNSS | Parameter | GPS+GLO+GAL +BDS | GPS+GLO | GPS+BDS | GPS |
|---|---|---|---|---|---|
| Update rate | | 5 Hz | 8 Hz | 8 Hz | 10 Hz |
| Heading accuracy | | 0.4 deg | 0.4 deg | 0.4 deg | 0.4 deg |

# 3. Absolute maximum ratings

Stresses above those listed as “absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Table 9. DP0602 absolute maximum ratings

| Symbol | Parameter | Maximum value | Unit |
|---|---|---|---|
| Vdd | Internal supply voltage | -0.5 to +3.6 | V |
| Vdd_IO | I/O pins supply voltage | -0.5 to Vdd+0.5 | V |
| Icc_RF | RF output current | 100 | mA |
| Prfin | Input power at RF_IN | 10 | dBm |
| TOP | Operating temperature | -20 to +70 | °C |
| TSTG | Storage temperature | -40 to +80 | °C |


This device is sensitive to electrostatic discharge (ESD), improper handling can cause permanent damage to the part.

# 4. Applications

Figure 3. The mPCIe DP0602 is suitable for providing GNSS RTK capabilities to the Variscite i.MX8 devboard

# 5. Communication interfaces

There are several communications interfaces including UART, SPI, I2C and USB. All the inputs have internal pull-up resistors in normal operation and can be left open if not used. All the PIOs are supplied by VCC, therefore all the voltage levels of the PIO pins are related to Vdd supply voltage.

## 5.1 UART Interface

There are two UART interfaces: UART1 and UART2. UART1 and UART2 operate up to and including a speed of 921600 baud. No hardware flow control on UART1 and UART2 is supported. UART1 is enabled by default if there is no 5V input voltage on pin A1 (5V SPI).

Figure 4. UART chronogram specifications

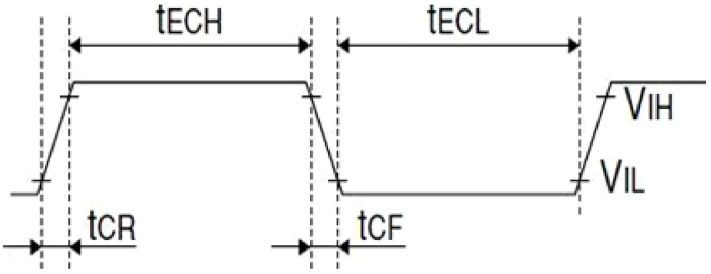



Table 10. DP0602 serial UART timing specifications

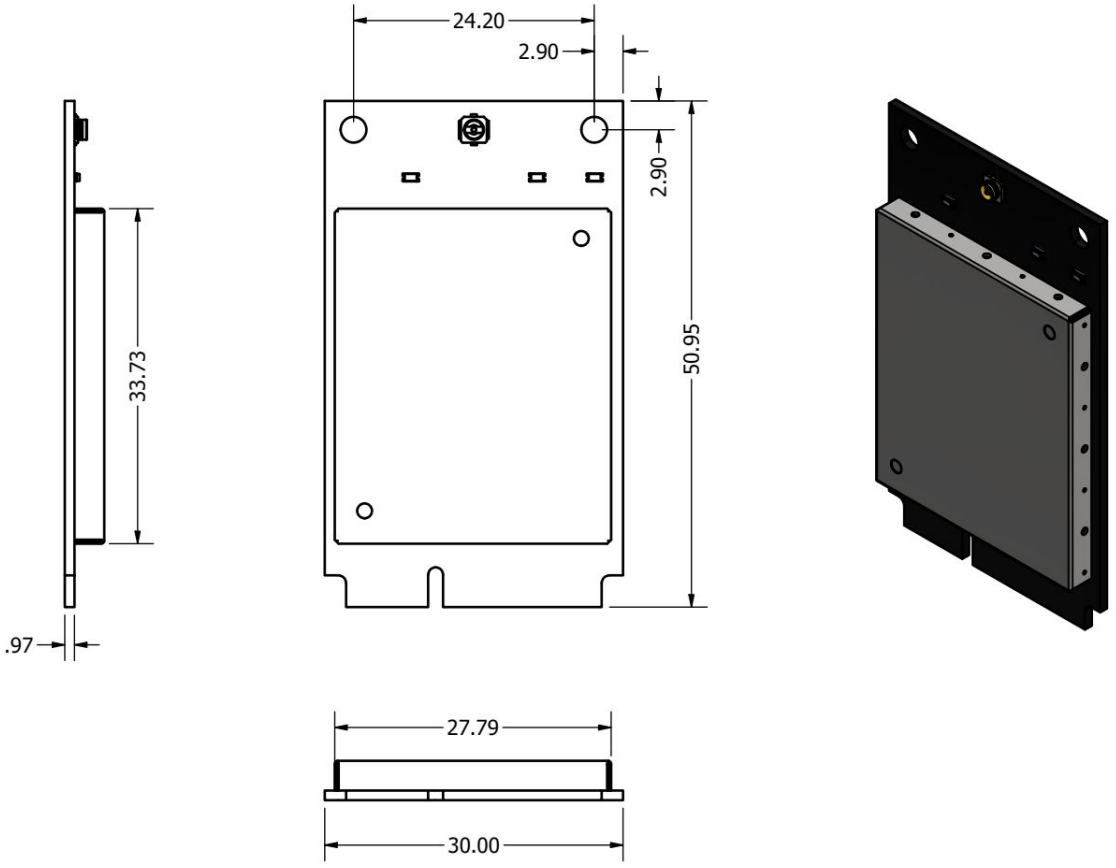
| Symbol | Parameter | Min. | Max. | Unit |
|---|---|---|---|---|
| Vil | LOW-LEVEL input voltage | 0 | 0.2xVdd | V |
| Vih | HIGH-LEVEL input voltage | 0.7xVdd | Vdd+0.3 | V |
| tECH | HIGH period of external data input | 0 | 0.4 | µs |
| tECL | LOW period of external data input | TBA | TBA | µs |
| Ru | Baudrate | 9600 | 921600 | bps |
| tCR | Rise time of data | | 5 | ns |
| tCF | Fall time of data | | 5 | ns |

## 5.2 USB interface

A USB interface, which is compatible to USB version 2.0 FS (Full Speed, 12 Mbit/s), can be used for communication as an alternative to the UART.

# 6. Mechanical drawings

Figure 5. DP0602 v1.1 mechanical drawings




(All dimensions are in millimeters)

# 7. Revision history

Table 11. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 10-July-2020 | 1.0 | DrotekDoc_0923 / Initial release |

# 8. Appendix

**U-blox ZED-F9P datasheet :**
https://www.u-blox.com/sites/default/files/ZED-F9P_DataSheet_%28UBX-17051259%29.pdf

**U-blox ZED-F9P integration manual :**
https://www.u-blox.com/sites/default/files/ZED-F9P_IntegrationManual_%28UBX-18010802%29.pdf

**U-blox ZED-F9P interface description :**
https://www.u-blox.com/sites/default/files/u-blox_ZED-F9P_InterfaceDescription_%28UBX-18010854%29.pdf

**Drotek user's guide :** https://drotek.gitbook.io/rtk-f9p-positioning-solutions/how-to-get-started

**Drotek tutorials :** https://drotek.gitbook.io/rtk-f9p-positioning-solutions/tutorials

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