

General description

The RSE02401/00 is a fully integrated K-band FMCW radar sensor. It utilizes packaged low-cost components, enabling low unit prices and high volumes, using SMT assembly technology, with no tuning required. The user can control the unit and receive data over a USB to Serial interface. A reconfigurable patch antenna is included, or an external antenna may be optionally used. The sensor has been designed from the ground up using a modular approach, allowing rapid customization and adaption to the customer's application specific requirements. The primary intended applications involve short range distance or speed measurement in commercial or industrial applications such as level measurement, proximity detection, presence detection and requiring presence, speed or distance measurement.

Features

General

- Complete 24 GHz Radar Sensor
- Synthesized Frequency Source
- Wideband Sweep
- Low Power Consumption
- 24 to 24.25 GHz operating frequency
- 24 to 26 GHz operation with ext. antenna
- Integrated high-performance MCU
- Built in speed and distance measurement
- Single TX and RX channels
- Single antenna (combined TX/RX) capability

Specifications in this datasheet are subject to change without notice.

1 SYSTEM SPECIFICATION

1.1 Absolute maximum ratings

Stressing the device beyond the conditions shown in Table 1-1 may cause permanent damage to the device.

Table 1-1 Absolute maximum ratings

| Parameter | Conditions | Min | Max | Unit |
|-----------------------|----------------------------------|------|-----|------|
| Operating temperature | Complete Sensor | 0 | 50 | °C |
| Storage temperature | Complete Sensor | 0 | 50 | °C |
| Operating temperature | Radar Front End only | -40 | 85 | °C |
| Storage temperature | Radar Front End only | -40 | 125 | °C |
| Max ESD voltage, HBM | JEDEC JESD22-A114-B HBM Class 1B | 2000 | | V |

2 GENERAL SPECIFICATION

Table 2-1 Performance Specification – RF Front End

| Parameter | Temperature | | | | Notes |
|--|-------------|------|-------|----------------------------|---|
| | 25°C | | | | |
| | Min | Typ | Max | Units | |
| Tx frequency range Internal Antenna | 24.0 | | 24.25 | GHz | Limited due to antenna bandwidth |
| Tx frequency range External Antenna | 24.0 | | 26.0 | GHz | ISM regulations limit to 24-24.25 if license free operation required |
| Transmitted power (EIRP) | 8 | | 19 | dBm | Using internal antenna |
| Transmitted power (at connector) | | 2 | | dBm | When using external antenna connector |
| TX power adjustment range | -9 | | 0 | dB | Software configurable |
| Spurious emissions | | <-40 | | dBc | |
| Rx frequency range Internal Antenna | 24.0 | | 24.25 | GHz | Limited due to antenna bandwidth |
| Rx frequency range External Antenna | 24.0 | | 26.0 | GHz | ISM regulations limit to 24-24.25 if license free operation required |
| Sensitivity | | | | dBm | See Figure 1, 3 For SNR=10dB, BW=100Hz. Strongly dependent on baseband frequency and gain setting, see figure for internal antenna or external antenna |
| Maximum received power | | | | | See Figure 1 Strongly dependent on baseband frequency and gain setting, see figure for internal antenna or external antenna |
| Receiver gain dBm/m ² | | | | dBV- dBm/m ² | See Figure 2, 4 For narrowest antenna beam configuration or external antenna |
| PLL settling time | | 11 | | µs | |
| Max output at baseband | | | 3 | V, peak to peak | |
| Baseband bandwidth | | | 10 | kHz | |

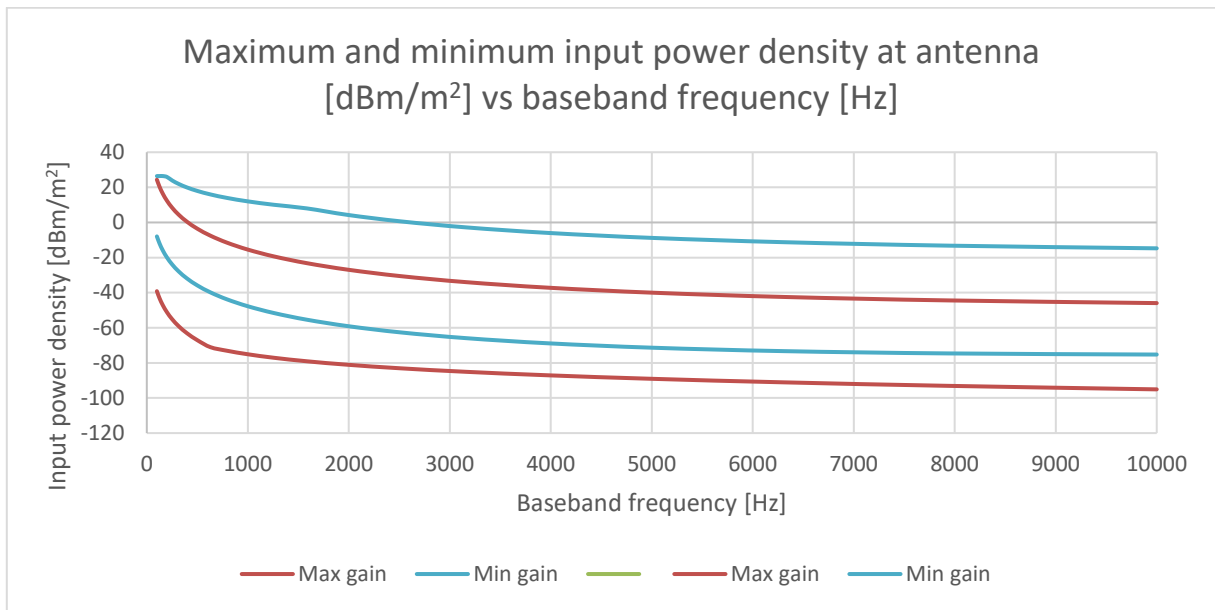


Figure 1. Input range, dBm/m², internal antenna

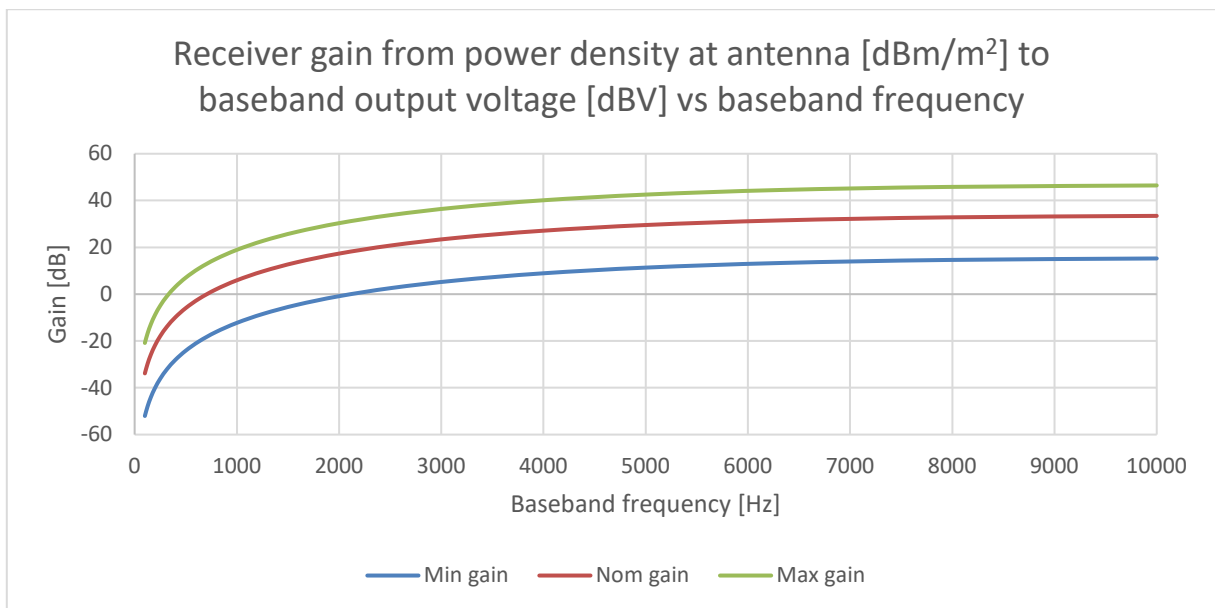


Figure 2. Receiver gain dBm/m² at antenna to dBV at baseband output, internal antenna

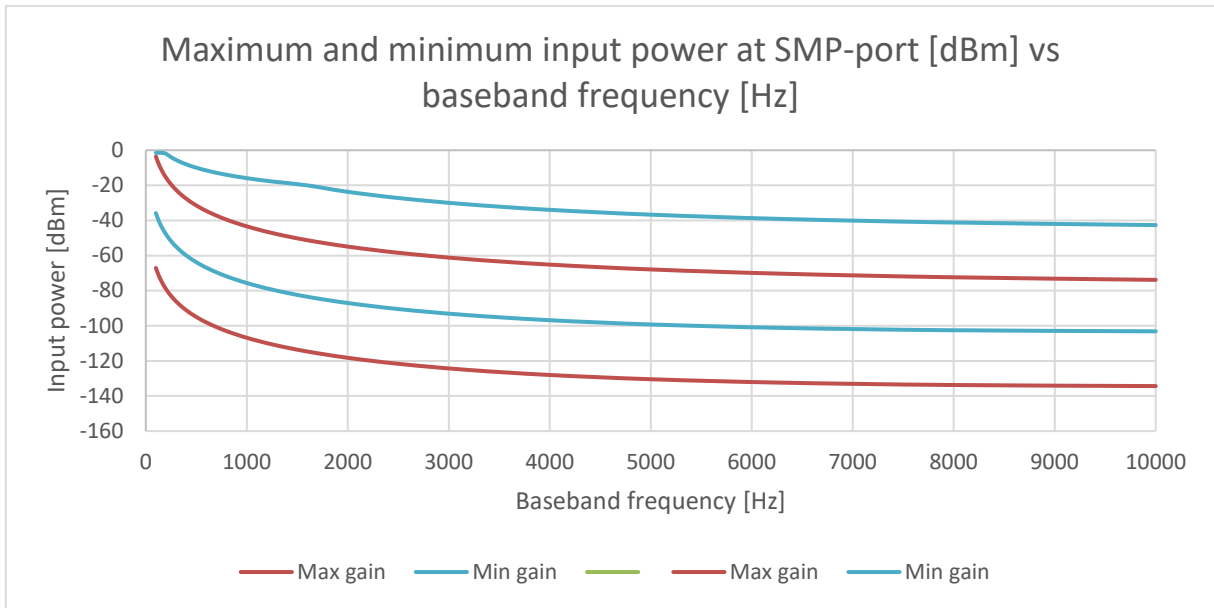


Figure 3. Input range, dBm/m², at external antenna connector

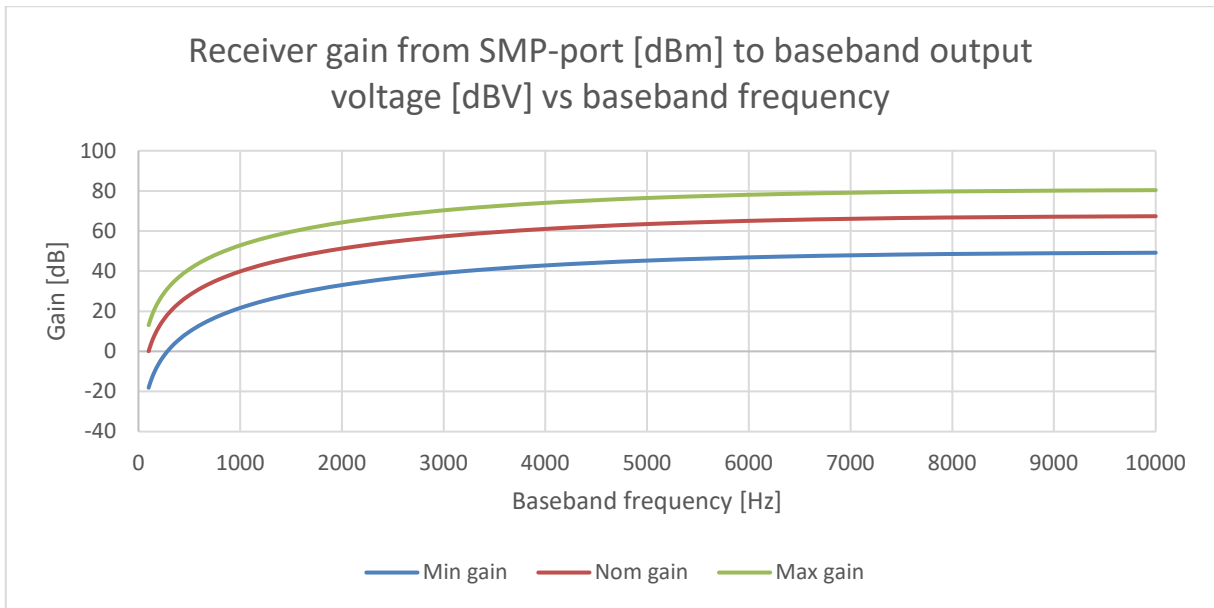


Figure 4. Receiver gain dBm/m² at connector to dBV at baseband output, external antenna

Table 2-2 Performance Specification – MCU, including ADCs

| Parameter | Temperature 25°C | | | | |
|------------------------|---------------------|---------|-----|-------|--|
| | Min | Typ | Max | Units | Notes |
| CPU clock frequency | | | 216 | MHz | |
| Flash memory | | | 1 | MB | |
| SRAM | | | 320 | KB | |
| Data interface | | | | | Serial via USB |
| ADC resolution | | 12 | | Bits | |
| ADC sampling frequency | | 13719.5 | | Hz | Min = 13719.5 Hz Max supported by MCU = 1.8 MHz |

Full MCU specification available at:

<http://www.st.com/en/microcontrollers/stm32f7x6.html?querycriteria=productId=LN1902>

Table 2-3 Performance Specification –Signal processing

| Parameter | Temperature | | | | |
|---|-------------|-----|-----|--------|--|
| | 25°C | | | | |
| | Min | Typ | Max | Units | Notes |
| Sweep time, FMCW | 10 | | | ms | |
| Sensor update rate | | | 100 | Hz | |
| Sampling frequency | | 10 | | kHz | |
| FFT size | | 128 | | | Max supported = 2048 |
| Image rejection | | | 15 | dBc | Can be digitally compensated |
| Range resolution | | 0.6 | | meters | |
| Range accuracy | | 1 | | cm | |
| Speed resolution | | 1 | | m/s | |
| Speed accuracy | | 0.1 | | m/s | |
| Maximum detectable speed | | 100 | | m/s | Can be modified via baseband filter adjustment |
| Min detectable RCS depending on distance (Internal antenna) | | | | | See Figure 5 For SNR=10dB, BW=100Hz. Strongly dependent on baseband frequency and gain setting, see figure. Numbers are for narrowest beam and increases with beam width. |
| Max detectable RCS depending on distance (Internal antenna) | | | | | See Figure 5 Strongly dependent on baseband frequency and gain setting, see figure. Numbers are for narrowest beam and increases with beam width. |

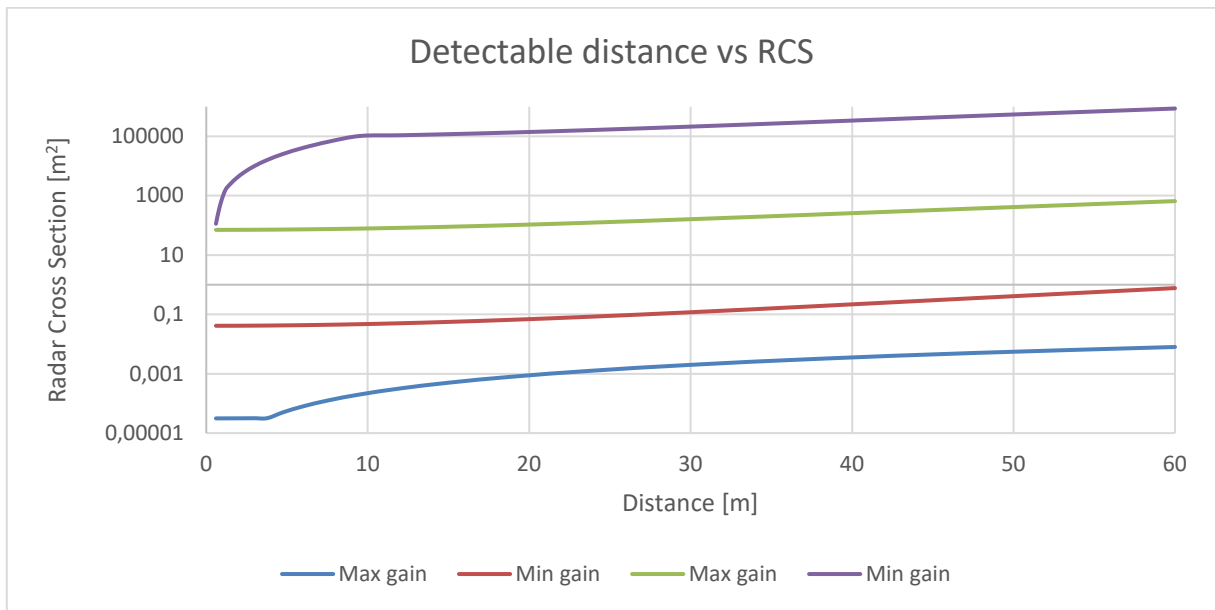


Figure 5. Detectable distance vs Radar Cross Section

3 INTERFACE

Table 3-1 Digital, power

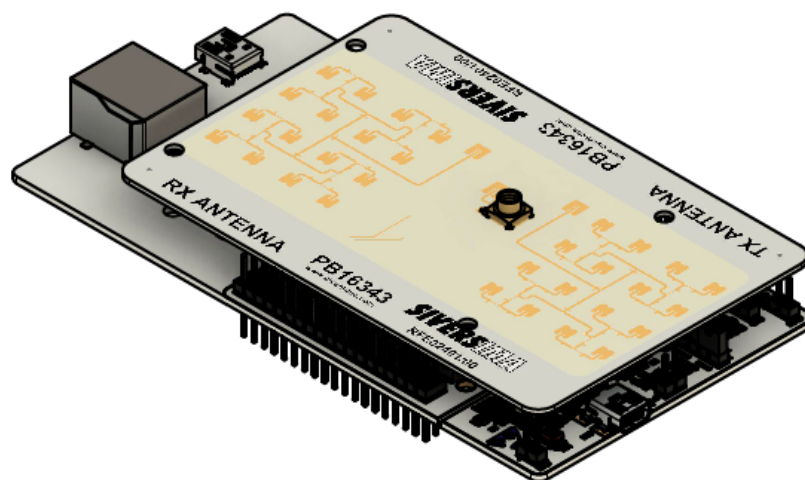
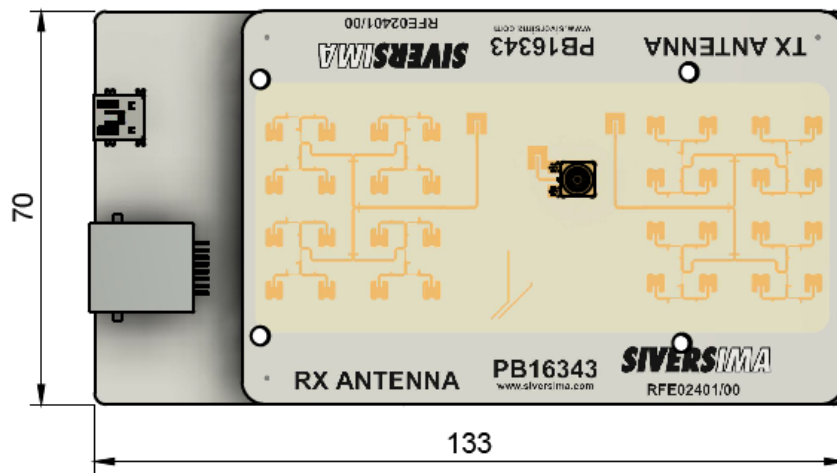
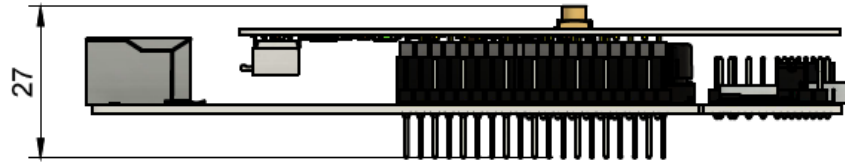
| Connector | Description | Notes |
|------------------------------|-----------------------------|--|
| USB1 | Serial communication, power | Nominal 5V, 1A USB power supply, micro USB connector |
| 5V | External power supply | |
| GND | Ground | |
| Power consumption, operation | 5.03 V, 411 mA | |

4 ANTENNA

Table 4-1 Specification – Antenna

| Parameter | Temperature | | | | |
|-------------------------|-------------|-----|-----|---------|--|
| | 25°C | | | | |
| Parameter | Min | Typ | Max | Units | Notes |
| Antenna type | | | | | Internal patch, reconfigurable by PCB modification |
| Azimuth field of view | 20 | | 80 | Degrees | Reconfigurable by PCB modification, |
| Elevation field of view | 20 | | 80 | Degrees | Reconfigurable by PCB modification |
| Polarization | | | | | Linear |

5 DRAWING



6 CONTACT

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