

## 2–18 GHz SPI-Controlled Broadband RF Downconverter Module

Broadband RF downconverter covering 2–18 GHz with a fixed 1.8 GHz IF output and 28 dB minimum conversion gain. SPI selects RF filters and programmable attenuation; two external LO inputs serve the conversion chain.



### RF conversion performance

| Parameter                          | Specification | Unit | Notes                                         |
|------------------------------------|---------------|------|-----------------------------------------------|
| RF input frequency                 | 2–18          | GHz  | Broadband                                     |
| IF output centre frequency         | 1.8           | GHz  | Fixed                                         |
| Conversion gain                    | ≥28           | dB   | Minimum                                       |
| Noise figure                       | ≤12           | dB   | -                                             |
| Gain variation                     | ±0.5          | dB   | User calibrated                               |
| Output 1 dB compression point      | ≥12           | dBm  | OP1dB                                         |
| Output third-order intercept point | ≥25           | dBm  | OIP3                                          |
| RF attenuation range               | 31.5          | dB   | 0.5 dB steps; 6 bits                          |
| Calibration attenuation range      | 15.5          | dB   | 0.5 dB steps; 5 bits                          |
| Internal spurious                  | ≤−90          | dBm  | Equivalent RF input power; 1000 MHz bandwidth |
| Single-tone SFDR                   | ≥55           | dB   | Pin = −25 dBm                                 |
| Harmonic rejection                 | ≥45           | dB   | Pin = −29 dBm                                 |
| Image rejection                    | ≥70           | dB   | -                                             |
| Gain flatness                      | ≤5            | dB   | 1 GHz bandwidth                               |
| IF filter rejection                | ≥50           | dBc  | At 1.8 GHz ±700 MHz                           |

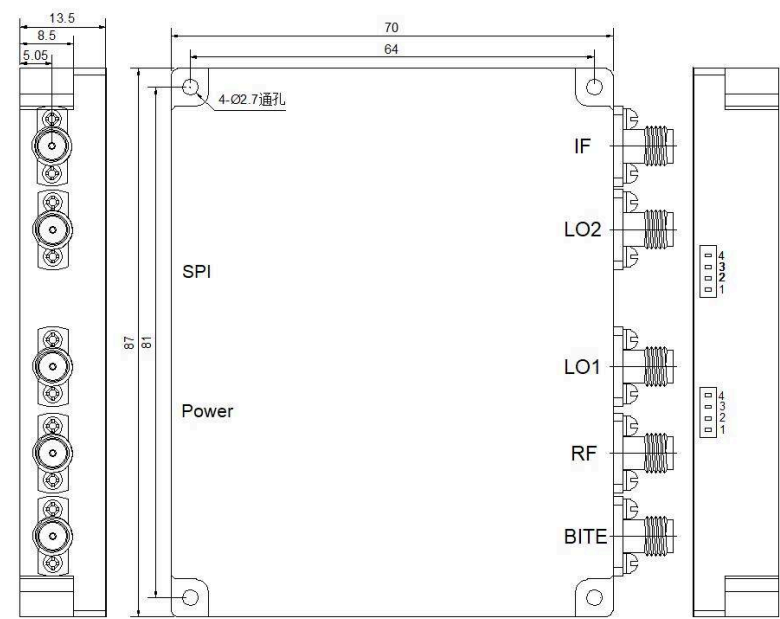
### Power and environmental limits

| Parameter             | Specification | Unit |
|-----------------------|---------------|------|
| Supply voltage        | +12 (Typical) | VDC  |
| Supply current        | 320 (Typical) | mA   |
| Operating temperature | −40 to +70    | °C   |
| Storage temperature   | −55 to +125   | °C   |

Mechanical outline

| Parameter             | Specification | Unit | Notes                                                |
|-----------------------|---------------|------|------------------------------------------------------|
| Housing dimensions    | 87×70×13.5    | mm   | Excludes connector protrusions                       |
| Mass                  | ≤500          | g    | -                                                    |
| Mounting holes        | 4×Ø2.7        | mm   | Through-holes                                        |
| Mounting-hole centres | 81×64         | mm   | Along the 87 mm and 70 mm housing edges respectively |

Mechanical Outline



All dimensions are in mm [in].

RF and LO interfaces

| Parameter                | Specification | Unit | Notes                    |
|--------------------------|---------------|------|--------------------------|
| RF input                 | RF            | -    | 2–18 GHz input           |
| Calibration signal input | BITE          | -    | User gain calibration    |
| First external LO input  | LO1: 22–40    | GHz  | Input power –3 to +3 dBm |
| Second external LO input | LO2: 20.2     | GHz  | Input power –3 to +3 dBm |
| IF output                | IF: 1.8       | GHz  | Fixed centre frequency   |

Power and SPI pin assignments

| Parameter           | Specification | Unit | Notes  |
|---------------------|---------------|------|--------|
| Power positions 1–2 | +12 V         | -    | Input  |
| Power positions 3–4 | GND           | -    | Ground |

Power and SPI pin assignments

| Parameter      | Specification | Unit | Notes  |
|----------------|---------------|------|--------|
| SPI position 1 | SPI_MOSI      | -    | Data   |
| SPI position 2 | SPI_SCK       | -    | Clock  |
| SPI position 3 | SPI_NSS       | -    | LE     |
| SPI position 4 | GND           | -    | Ground |

SPI control frame

| Parameter                | Specification       | Unit | Notes                                         |
|--------------------------|---------------------|------|-----------------------------------------------|
| Control rate             | 2 / 10              | Mbps | Typical / maximum                             |
| Frame header             | AA 55 (hexadecimal) | -    | Two bytes                                     |
| Control word             | Data[15:0]          | -    | Two bytes; byte order not defined in source   |
| Frame ending             | 44 BB (hexadecimal) | -    | Two bytes                                     |
| Power-down control state | Data[15:0] = 0      | -    | All data bits must be zero when powering down |

Control-word bit assignments

| Parameter       | Specification | Unit | Notes                                                                 |
|-----------------|---------------|------|-----------------------------------------------------------------------|
| Bits 15, 14, 13 | C2, C1, C0    | -    | RF filter selection; defined codes listed below                       |
| Bit 12          | EN            | -    | 1: power up; 0: power down                                            |
| Bit 11          | RF@BITE       | -    | 1: BITE calibration path; 0: RF path                                  |
| Bits 10–5       | RF ATT        | -    | Bits 10/9/8/7/6/5: 16/8/4/2/1/0.5 dB; 1 enables each step, 0 disables |
| Bits 4–0        | Cal ATT       | -    | Bits 4/3/2/1/0: 8/4/2/1/0.5 dB; 1 enables each step, 0 disables       |

Switched RF filter bank

| Parameter      | Specification                                               | Unit |
|----------------|-------------------------------------------------------------|------|
| C2:C1:C0 = 000 | 1.9–3.2 (Filter passband; product RF range starts at 2 GHz) | GHz  |
| C2:C1:C0 = 001 | 2.2–3.7                                                     | GHz  |
| C2:C1:C0 = 010 | 2.7–4.6                                                     | GHz  |
| C2:C1:C0 = 011 | 3.6–6.1                                                     | GHz  |

Switched RF filter bank

| Parameter      | Specification                                   | Unit |
|----------------|-------------------------------------------------|------|
| C2:C1:C0 = 100 | 5.1–8.9                                         | GHz  |
| C2:C1:C0 = 101 | 7.9–13.8                                        | GHz  |
| C2:C1:C0 = 110 | 12.8–18 (Code 111 is not defined in the source) | GHz  |

Current publication record

1.0 · 2026-10-05. First publication of approved product data.

Product overview

This broadband RF downconverter translates 2–18 GHz input signals to a fixed 1.8 GHz IF output for receiver, signal-monitoring, analysis and test systems. A switched RF filter bank precedes a two-stage frequency-conversion chain supplied by external LO1 and LO2 inputs. SPI control selects one of seven overlapping RF filters, switches between the RF and BITE calibration inputs, and sets separate RF and calibration attenuators in 0.5 dB steps. RF attenuation extends to 31.5 dB; calibration attenuation extends to 15.5 dB. The specified ±0.5 dB gain variation requires calibration by the user. Conversion gain is at least 28 dB and noise figure is at most 12 dB. The output-referred 1 dB compression point is at least 12 dBm, and OIP3 is at least 25 dBm. The source gives separate conditions for spurious, SFDR, harmonic and filter rejection; each is retained beside the corresponding specification. The aluminum housing measures 87×70×13.5 mm with four Ø2.7 mm mounting holes. Supply voltage is +12 VDC typical and current is 320 mA typical. The main image is a structural illustration based on the mechanical outline, not a product photograph; the original dimensioned drawing remains the installation reference.

Interfaces and system integration

LO1 accepts 22–40 GHz and LO2 accepts 20.2 GHz; each specified input power range is –3 to +3 dBm. These are external inputs. The functional diagram shows a 22 GHz first IF filter and a final 1.8 GHz ±500 MHz IF filter; the fixed 1.8 GHz specification is the IF centre frequency, not a 1.8 GHz-wide bandwidth. The RF and BITE paths share the conversion chain. Bit 11 selects the BITE path for user gain calibration or the RF path for signal reception. Filter codes cover overlapping sub-bands, and the 1.9 GHz lower edge of the first filter does not extend the specified 2 GHz RF operating limit. The SPI frame consists of 0xAA 0x55, a two-byte Data[15:0] control word, and 0x44 0xBB. Maximum control rate is 10 Mbps and typical rate is 2 Mbps. When powering down the module, all control data bits must be set to zero. The source does not define byte order, SPI mode or timing margins; these require engineering confirmation before writing a controller driver. The pin-assignment table preserves the source-defined positions for power and SPI. Connector part numbers and complete physical pin counts require engineering confirmation before making a harness. Allow for coaxial connector protrusions and cable clearance beyond the housing dimensions.

Document notice

Specifications are subject to revision. Before design release, confirm the current document revision and product-specific requirements with LCRF. The approved quotation and order documentation define the supplied configuration.