

1 MHz to 3.9 GHz RF Downconverter Core Module

The SC5306A is a three-stage superheterodyne downconverter with integrated local oscillators (LO) that delivers superior image rejection over single stage conversion. Designed to meet demanding applications such as cable modem testing, software defined radio development and spectral monitoring, and as a sub-system component in custom precision test equipment (e.g., spectrum analyzers), the SC5306A has both high signal-to-noise dynamic range and high spurious free dynamic range. These products also exhibit very low phase noise of -108 dBc/Hz at 10 kHz offset on a 100 MHz RF carrier.



The SC5306A has a typical noise floor of -150 dBm/Hz, which can be further reduced below -164 dBm/Hz by enabling the internal preamplifier. With gain control between -30 dB to +50 dB, a measurement signal-to-noise dynamic range greater than 180 dB is achievable. Using high reverse isolation devices and sharp cutoff filters, LO leakages and other spurious contents at the input connectors are well below -120 dBm. Inter-stage LO leakages are also kept very low to ensure that spurious in-band signals remain less than -80 dBc.

The excellent spurious free dynamic range is achieved using low noise linear amplifiers, low loss mixers, and high performance solid state attenuators. Frequency accuracy is provided by an onboard 10 MHz temperature compensated crystal oscillator (TCXO) which can be phase locked to an external reference source if required, and it is recommended to do so in applications that may require a more stable and accurate base reference.

Product Features

- Low residual phase noise better than -107 dBc/Hz @ 10 kHz offset, -142 dBc/Hz @ 1 MHz offset, measured on 1 GHz carrier
- 20 MHz signal bandwidth, 1 Hz tuning resolution (exact frequency)
- Measurement sensitivity -164 dBm/Hz
- Residual spurs < -100 dBm
- 3rd order intermodulation 80 dBc @ -20 dBm mixer level
- Image rejection > 100 dB
- LO leakage < -120 dBm
- Internal preamplifier

Applications

- RF Instrumentation
- Wireless communications
- Broadcast monitoring
- Spectral Analysis
- Software-defined radio
- Signal Intelligence

SC5306A SPECIFICATIONS

TECHNICAL SPECIFICATIONS (AT 25°C AMBIENT, SINE WAVEFORM)

SPECTRAL SPECIFICATIONS

| | |
|---|------------------------------|
| RF input frequency range | 1 MHz to 3.9 GHz |
| Flatness response ¹ | 8 dB typical |
| IF output center freq | 70 MHz inverted/non-inverted |
| Real-time IF Bandwidth | 20 MHz |
| Amplitude flatness ² | 3 dB peak |
| Internal frequency reference stability ³ | ±2.5 ppm |
| Aging | < 1 ppm after 1 year |
| Phase locking range | ±5 ppm |
| Tuning | |
| Resolution | 1 Hz |
| Speed (settled to .1 ppm) ⁴ | < 2 ms |

Sideband phase noise ⁵(typical, dBc/Hz)

| RF Frequency | | | | |
|--------------|---------|-------|-------|-------|
| Offset | 100 MHz | 1 GHz | 2 GHz | 3 GHz |
| 100 Hz | -88 | -87 | -85 | -83 |
| 1 kHz | -100 | -99 | -98 | -97 |
| 10 kHz | -108 | -107 | -106 | -105 |
| 100 kHz | -119 | -118 | -117 | -115 |
| 1 MHz | -143 | -142 | -142 | -141 |
| 10 MHz | -152 | -152 | -150 | -149 |

Sideband phase spurious signals

| | |
|-----------|-----------------|
| < 100 kHz | -70 dBc typical |
| > 100 kHz | -80 dBc typical |

AMPLITUDE SPECIFICATIONS

| | |
|--|--------------------|
| Input RF range | -164 dBm to 20 dBm |
| Max input (with 30 dB RF attenuation) | +27 dBm |
| Min detectable level (preamp on) | -160 dBm |
| | -165 dBm typical |
| RF attenuation | 0 to 60 dB |
| RF attenuation resolution | 1 dB |
| IF nominal output ⁶ | 0 dBm |
| IF attenuation | 0 to 30 dB |
| IF attenuation resolution | 1 dB |
| Accuracy (calibration applied) ⁷ | ±0.75 dB |
| Input P1dB compression (no RF attenuation) | 1 dBm typical |
| IP3 (2 tone at -20 dBm) ⁸ | 18 dBm |
| | @ 2 GHz typical |
| IMD3 (two -20 dBm tones, 1 MHz apart) | < -76 dBc |
| | @ 2 GHz typical |
| 2 nd order harmonics (-30 dBm tone) | < -80 dBc |

- (1) The raw RF amplitude response over the entire input frequency range. No calibration applied.
- (2) The raw IF amplitude response over the bandwidth range.
- (3) The internal reference is a TCXO. For better accuracies and stability one should phase lock to an external source.
- (4) For step change of less than 50 MHz.
- (5) The phase noise specs are for the YIG based oscillator in normal tuning speed setting.
- (6) The nominal IF is set to 0 dBm, and the specs are based on 0 dBm output. However, the output amplitude can be programmed to as high as 18 dBm.

Noise floor density at input. Set for best dynamic range (typical)

| Frequency | Preamplifier | |
|-----------|--------------|-------------|
| 100 Hz | -153 dBm/Hz | -167 dBm/Hz |
| 1 GHz | -152 dBm/Hz | -166 dBm/Hz |
| 3.6 GHz | -148 dBm/Hz | -164 dBm/Hz |

| | |
|----------------------------------|-------------------------|
| Image rejection | > 100 dB |
| Residual (system inherent) spurs | < -100 dBm |
| Input related spurs | < -80 dBc |
| LO leakage at RF terminal | -120 dBm |
| Gain (preamp disabled) | -60 dB to 30 dB typical |
| (preamp enabled) | -60 dB to 50 dB typical |
| Dynamic Range (DR) ⁹ | |
| Measurement DR | > 180 dB |
| Instantaneous DR | > 150 dB |

TERMINAL SPECIFICATIONS

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|--------------------------------------|---|
| RF input and IF output terminal | |
| Impedance | 50 Ω |
| Connector type | SMA female |
| Coupling | AC |
| Reference input terminal | |
| Impedance (single ended) | 50 Ω |
| Connector type | SMA female |
| Coupling | AC |
| Frequency | 10 MHz |
| Amplitude range | -5 dBm to 10 dBm |
| Lock range | ±5 ppm |
| Reference output terminal | |
| Impedance (single ended) | 50 Ω |
| Connector type | SMA female |
| Coupling | AC |
| Frequency ¹⁰ | 10/100 MHz |
| Amplitude | 6 dBm typical |
| Communication interface | USB/ RS-232/ SPI |
| Power consumption | 34 W typical |
| Weight | 2.0 lbs |
| Dimensions (W x H x D, max envelope) | 3.7" x 1.4" x 6.4" |
| Warranty | 1 year parts and labor on defects in materials or workmanship |

ORDER INFORMATION

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|------------|--|
| 7100014-01 | SC5306A, 1 MHz to 3.9 GHz |
| | RF Downconverter Core Module With USB Interface Adapter |
| 7100014-02 | SC5306A, 1 MHz to 3.9 GHz |
| | RF Downconverter Core Module With RS-232 Interface Adapter |
| 7100014-03 | SC5306A, 1 MHz to 3.9 GHz |
| | RF Downconverter Core Module With SPI Interface Adapter |

Specifications are subject to change without notice. For the most recent product specifications, please visit www.signalcore.com.

- (7) All units are factory calibrated and calibration is stored in onboard EEPROMs. The user must apply the calibration correction to the IF signal for accuracy specifications to be valid.
- (8) Measured within the IF pass-band, no narrow band (RBW) filters were used to suppress 3rd order inter-modulation spurs during measurement.
- (9) The dynamic range referred is the signal-to-noise dynamic range and is specified for 1 Hz RBW. The instantaneous dynamic range specifies the device's ability to make the measurement at a single device setting. The measurement dynamic range requires the device to change device settings.
- (10) User selectable.