

ACE9010

R.F. FRONT END WITH VCO

ACE9010 is a combined LNA, Mixer and VCO for use in the receive path of cellular telephones. High frequency front end functions previously realised in discrete components are integrated into one device. The design is optimised for low power whilst retaining high intercept performance and low noise operation.

Power saving modes are included for battery economy.

FEATURES

- Low Power and Low Voltage (3.6 to 5.0 V) Operation
- Power Down Modes
- Low Noise Figure - LNA 1.6 dB typical
- 1GHz VCO, Buffer, and Mixer
- Part of the ACE Integrated Cellular Phone Chipset
- Small Outline 20 pin SSOP Package

APPLICATIONS

- AMPS and TACS Cellular Telephones
- GSM and IS54 Digital Cellular Telephones
- Radio Systems

RELATED PRODUCTS

ACE9010 is part of the following chipset:

- ACE9020 Receiver and Transmitter interface
- ACE9030 Radio Interface and Twin Synthesiser
- ACE9040 Audio Processor
- ACE9050 System Controller and Data Modem

ABSOLUTE MAXIMUM RATINGS

| | |
|-----------------------|-----------------------------|
| Supply voltage | 6 V |
| Storage temperature | - 65 °C to + 150 °C |
| Operating temperature | - 30 °C to + 85 °C |
| Voltage at any pin | - 0.3 V to $V_{CC} + 0.3 V$ |

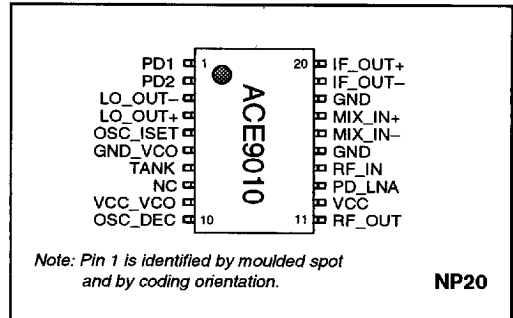


Fig.1 Pin connections - top view

ORDERING INFORMATION

SSOP 20 lead package, code NP20

ACE9010/KG/NP1S - devices shipped in tubes

ACE9010/KG/NP1T - devices shipped on tape

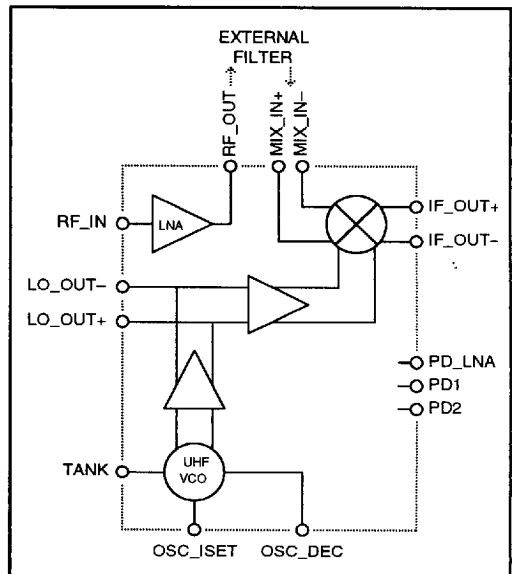


Fig. 2 ACE9010 simplified block diagram

PIN CONNECTIONS

| Pin No. | Name | Type | Description |
|---------|----------|--------|--|
| 1 | PD1 | I | Power down control input 1 |
| 2 | PD2 | I | Power down control input 2 |
| 3 | LO_OUT- | I(O) | VCO differential buffer output (LO1 mixer input with VCO powered down) |
| 4 | LO_OUT+ | I(O) | VCO differential buffer output (LO1 mixer input with VCO powered down) |
| 5 | OSC_ISET | I | VCO current set, oscillator emitter, typ. 220 Ω in series with 47 nH to GND |
| 6 | GND_VCO | I | VCO ground |
| 7 | TANK | I | Oscillator external resonator & varactor circuit connection |
| 8 | nc | - | No connection |
| 9 | VCC_VCO | Supply | VCO V_{CC} supply (leave open to power VCO down) |
| 10 | OSC_DEC | - | VCO decoupling, typ. 12 nF to GND_VCO |
| 11 | RF_OUT | O | LNA RF open collector output. |
| 12 | VCC | Supply | V_{CC} supply for LNA and mixer |
| 13 | PD_LNA | I | LNA power down |
| 14 | RF_IN | I | LNA input |
| 15 | GND | Supply | Ground |
| 16 | MIX_IN- | I | Differential mixer input (with pin 17) |
| 17 | MIX_IN+ | I | Differential mixer input (with pin 16) |
| 18 | GND | Supply | Ground |
| 19 | IF_OUT- | O | Mixer I.F. differential output (with pin 20) |
| 20 | IF_OUT+ | O | Mixer I.F. differential output (with pin 19) |

ELECTRICAL CHARACTERISTICS

These characteristics apply over these ranges of conditions (unless otherwise stated):

$T_{AMB} = -30^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = 3.75 \pm 0.15\text{ V}$ or $4.85 \pm 0.15\text{ V}$, $f_{RF} = 869$ to 950 MHz , $f_{LO} = 914$ to 995 MHz , $IF = 45\text{ MHz}$,
Interstage filter loss = 3 dB.

| Parameter | Min. | Typ. | Max. | Unit | Conditions |
|---|------|------|------|--------|------------|
| LNA and MIXER | | | | | |
| Supply current | | | 11 | mA | |
| Conversion power gain | 17 | | | dB | See note 1 |
| Noise Figure - LNA only | | 1.6 | 2.3 | dB | |
| Noise Figure - Total | | 3.5 | 4 | dB | See note 1 |
| 1 dB input compression | -18 | | | dBm | See note 2 |
| VCO | | | | | |
| Supply current | | 9 | 12 | mA | |
| Output level | | -5 | | dBm | |
| Phase noise, $\Delta f = 25\text{ kHz}$ | | | -109 | dBc/Hz | |
| Phase noise, $\Delta f = 45\text{ MHz}$ | | | -155 | dBc/Hz | |

Notes:

1. Includes LNA and Mixer plus interstage filter with 3 dB loss
2. Jamming signal at 45 MHz below f_{RF}

VCO OPTIONS

In normal operation the VCO will internally drive the mixer and also drive the outputs LO_OUT- and LO_OUT+ to provide the local oscillator signal to the ACE9020 prescaler and upconverter. It is possible to use an external VCO if preferred, by disconnecting VCC_VCO (pin 9) to power down the VCO and to then drive in on pins LO_OUT- and LO_OUT+.

Power Down Modes

| PD2 | PD1 | PD_LNA | Mode |
|-----|-----|--------|---------------------------|
| 0 | 0 | x | Sleep |
| 0 | 1 | 1 | VCO powered on |
| 1 | x | 1 | Receive -All circuitry on |
| 1 | x | 0 | LNA powered off |