MOTOROLA

Semiconductor Products Sector

Information Brief

Multi-Protocol Digital Transceiver IC Supports GSM/DCS/TDMA/AMPS Phones, PDAs, and Other Applications

- First transceiver IC to combine multiple bands and protocols

The MC13760 Multi-Protocol, Multi-Band Digital Transceiver IC combines, on a single Advanced RF BiCMOS chip, the major building blocks required for next generation multiple purpose, multi-band wireless products. This mixed-signal IC provides a high level of design flexibility through a serial programming interface that enables innovative and cost effective platform solutions. The MC13760 features Fractional-N synthesizers, a re-configurable zero IF receiver with programmable bandwidth, receive A/D conversion, multi-rate data interface to the baseband DSP, direct launch digital modulator, and full transmit support circuits. General purpose support circuits such as D/A and A/D converters, battery save and tri-state control switches are also included. The device operates at 2.75 V and provides a "deep sleep" mode with drain current as low as 50 µA. This software programmable IC functions over a wide range of input frequencies in multi-band, multi-mode, GSM/DCS/TDMA/AMPS cellular phones, including GPRS. It also finds application in other diverse products such as Personal Digital Assistants (PDAs), satellite phones, iDEN, and TETRA radios.

This highly integrated device interfaces directly to Motorola baseband processors for portable equipment through a common programming and data interface. Motorola's DSP56690 is an excellent example of a multi-protocol baseband processor that will directly interface with the MC13760. The DSP56690 can execute

processors for portable equipment through a common programming and data interface. Motorola's DSP56690 is an excellent example of a multi-protocol baseband processor that will directly interface with the MC13760. The DSP56690 can execute *all* major existing wireless standards including, but not limited to, GSM/DCS, TDMA/AMPS, and iDEN. When combined with a suitable Motorola baseband processor, the high level of integration in the MC13760 reduces design complexity, system cost, and manufacturing costs.

FEATURES

- Receiver functions for all GSM/DCS/TDMA IS-136/AMPS modes & frequencies
- Multi-mode, multi-frequency operation
- Direct interface to Motorola baseband processors such as the DSP56690 through a common programming and data interface
- Main three accumulator (24-bit) Fractional-N Synthesizer
  - Prescaler maximum frequency input > 2.0 GHz
  - Resolution capability of 6.0 Hz
  - Phase noise as low as -119 dBc/Hz at 25 kHz with appropriate reference
  - Frequency hopping main LO, with external VCO
  - Dual-Mode charge pump output for TDMA TX VCO and all RX
  - Independent charge pump output for the GSM/DCS TX VCO
  - GMSK lookup ROM for direct digital transmission in GSM/DCS mode
  - Digital 16-bit Automatic Frequency Control
- Secondary three accumulator (24-bit) Fractional-N Synthesizer for use as an
- Secondary three accumulator (24-bit) Fractional-N Synthesizer for use as an accurate frequency-corrected clock in GSM, or as an additional low frequency LO
- Operates at 2.75 V with all digital interfaces capable of 1.8 V or 2.7 Voperation
- Deep sleep mode with drain current as low as 50 µA
- GPRS compatible
- Coarse tuning of the VCO(s) via a 6-bit D/A with adapt
- Versatile frequency generation including linear and constant envelope modulation paths
- Full transmit support circuits including ramp and power level control
- Reference oscillator with a buffered output, that can use an inexpensive external crystal
- Compensation/fine tuning of reference oscillator crystal via 10-bit D/A
- Direct gain control of the RFPA in the TDMA mode

FEATURES (continued)

- Receive sensitivity of less than 1.0 μV

- Quadrature downconversion of an IF signal up to 400 MHz

- Filtering of the receive baseband signals down to 6.0 kHz

- Receiver linear gain adjustment programmed over the SPI bus

- Receiver step gain adjustment programmed over the SPI bus

- A/D conversion of RXI and RXQ to 8-bit or 10-bit resolution

- D/A conversion of TDMA TXI and TXQ

- Available in a 104-pin Ball Grid Array surface mount package

TYPES OF APPLICATIONS

The MC13760 Multi-Protocol, Multi- Band Digital Transceiver IC is ideal for use in global roaming cellular phones operating with GSM/DCS and TDMA/AMPS in the 800/900 MHz and 1.8/1.9 GHz bands. Operation at VHF and UHF bands is also fully supported, allowing innovative architectures combining cellular and conventional 2-way or trunked radio. The IC is also GPRS compatible. The extensive circuitry in the IC makes this versatile device very effective for applications as diverse as PDAs, satellite phones, iDEN, and TETRA radios.

The device is designed to interface directly to Motorola baseband processors for portable equipment through a common programming and data interface. Motorola's DSP56690 is an excellent example of a multi-protocol baseband processor that will directly interface with the MC13760.

This IC can also be used in 900 MHz and 2.4 GHz Industrial, Scientific and Medical (ISM) band applications. Typical ISM band applications include wireless LANs, industrial remote controls, consumer wireless products, and full-duplex data radios.

BENEFITS TO YOU

- Reduces time-to-market with simplified design of wireless products due to higher levels of integration for baseband and receive functions.

- Lower end-product cost due to fewer components with all major synthesizers, modulators and receivers for GSM/DCS/TDMA/AMPS operation in a single IC.

- Simplifies design of next generation GSM phones incorporating GPRS with most needed circuitry on-chip.

- Increased design flexibility in the Automatic Frequency Control (AFC) function, because the AFC can be implemented through fine (6.0 Hz) steps of either synthesizer, or through tuning the reference crystal frequency.

(continued)

BENEFITS TO YOU (continued)

- Lowers system cost and manufacturing costs due to highly integrated digital receiver functions that directly interface to Motorola baseband processors through a common programming and data interface.

- Longer battery life for portable applications with low drain current of only 50 µA in deep sleep mode.

- Simplified GSM transmitter design using direct digital transmission, conforming to the wideband GSM operation standard 0.3GMSK (Gaussian Minimum Shift Keying) modulation format with on-chip GMSK lookup ROM.

- Improved battery life, and smaller battery size, with software controlled sleep modes that allow unused circuitry to be shut down dynamically and independently.

- Higher circuit and system density with 104-pin Ball Grid Array surface mount package.

- Versatility for non-cellular designs with fine tuning steps implemented through the frequency synthesizer.

A SOLUTION FOR THESE QUESTIONS

- Do you want to reduce the parts count and lower your manufacturing costs by using an IC that has all synthesizers, modulators and receivers for GSM/DCS/TDMA/AMPS operation in a single package?

- Would you like to simplify your wireless product design process with higher levels of integration for the baseband and receive functions?

- Does your design require that the battery size be reduced by minimizing the power consumption of your portable product?

- Would you like to have your receiver gain adjustments programmable by the baseband processor over a SPI bus?

- Do you need to improve the battery life of your portable wireless product by incorporating power down modes for unused circuitry?

- Do you want to combine cellular and conventional 2-way or trunked radio in a product that includes VHF and UHF bands?

- Does your next GSM product need to support GPRS?

- Do you want to shrink the size of your next multi-protocol cellular phone by reducing the pc board area through the use of a highly integrated transceiver IC?

- Does your AFC design philosophy require fine tuning steps of the frequency synthesizer, or compensation of the reference crystal.

- Are you designing a non-cellular product such as a PDA, satellite phone, or TETRA radio where you could benefit from an existing multi-mode transceiver IC?

EVALUATION BOARD

The MC13760EVK is available to simplify the system development process. This evaluation board contains hardware and software that allows the operational modes of the device to be evaluated. The software is PC-compatible and uses the serial port as the SPI control.

LITERATURE

A complete data sheet of over 100 pages contains full specifications, circuit and functional descriptions, as well as application information, and is available through Motorola's LDC as MC13760/D.

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC13760	T_A = -40 to +85°C	BGA-104

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