



# Wolverine™

## Programmable Digital Signal Processor for Ultra Low Power Processing

### Key Features

- Highly efficient processing architecture offering the current efficiency of hardwired ASICs with the programmable flexibility of DSP processors
- Matchless processing capabilities
  - 50 MIPS equivalent processing available @ 2MHz clock
  - Minimum 20-bit end-to-end audio-path re-configurable architecture
  - Support for Time Domain and Frequency Domain based processing
  - On-chip support for active noise cancellation
  - Support for advanced adaptive filtering algorithms with programmable coprocessors
- Ultra high fidelity audio processing
  - Dual A/Ds featuring 95dB input dynamic range with HRX™ headroom extension
  - D/A with 88dB output dynamic range
  - Variable sampling rate support up to 48kHz
- Four analog inputs for microphones, telecoil and direct audio (from music players)
- Direct drive output for zero-biased receivers
- Ultra low-delay signal processing supporting sub 1ms system processing latency
- On-chip clock multiplication up to 16MHz for higher processing MIPS
- On-chip non-volatile One Time Programmable (OTP) memory
- Encrypted firmware security
- Complete Development Tools Suite

### Product Description

Wolverine™ is a powerful programmable multi-processor DSP platform maximizing MIPS/ $\mu$ W with a unique reconfigurable architecture. Integrated high-resolution dual ADCs, DAC featuring unmatched DSP processing capability and flexibility in a miniature foot print with best-in-industry power consumption makes Wolverine™ an ideal platform for mobile and battery-operated audio or data processing algorithms.

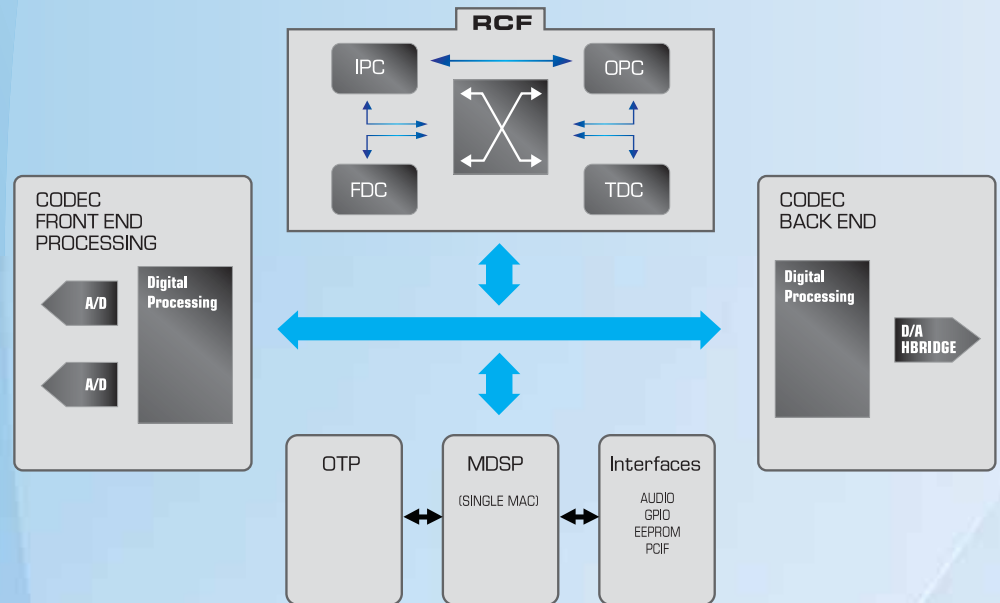
Wolverine™ platform is supported with a complete suite of development tools, including Sound Design Guide that offers developers a complete solution for firmware development, debugging and testing. Wolverine™ DSP is available in alternate miniaturized chip scale packages (CSPs) that allow for easy integration into a wide range of product applications such as hearing instruments, consumer and professional headsets, biomedical sensors and analyzers, and environmental sensors. The platform delivers high performance audio processing with superior power efficiency enabling the implementation of advanced DSP algorithms.

### Wolverine™ Benefits

- The lowest power, smallest size high-fidelity DSP available for audio, wireless and data processing
- Maximizing programming flexibility
  - SoC with 5 embedded DSP processors and programmable filter engines offer best-in class processing horsepower (50 MIPS base) for executing advanced algorithms.
- Enabling high performance low-power signal processing:
  - Wolverine™'s highly versatile multi-core architecture featuring localized processing enables best in-class low-power algorithm implementations providing efficiencies of hardwired ASICs with flexibility of embedded DSPs.
  - Optimized second generation inter processor communication structure supports easy resource planning and algorithm partitioning.
- Re-configurable and distributed processing architecture allows easy product enhancements and fully scalable computational power
- Wide bandwidth, high precision digital processing ensures the highest sound quality in audio applications
- Fully integrated development environment (Guide), technical support and training enable swift product development and rapid time-to market.

# Wolverine™

Programmable Digital Signal Processor for  
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a closer look



approximate size representation

## Architecture Description

WOLVERINE™ features a reconfigurable multi core system consisting of hardwired accelerators and DSP cores. The digital processor provides the optimal balance between low power, fixed-function hardware and flexible open DSPs. This architecture is made possible by the patented re-configurable coprocessor fabric (RCF) architecture. The RCF contains a set of programmable crossover switches that allow audio to be routed between a variety of programmable DSP and filter blocks in the system automatically, without the assistance of a DSP.

The system includes 5 embedded DSP cores, 4 of which are dual MAC with customized instruction-set for audio processing including single cycle LOG and EXP functions. In addition WOLVERINE™ contains FFT/IFFT accelerators, hardwired filter engine blocks (FENG) of FIR and IIR filters and a 10-band programmable time domain filter bank for sub-band audio processing. The wealth of processing capabilities available on WOLVERINE easily accommodate the most advanced algorithms in the industry today and provides added capabilities for future complex algorithms.

## Codec Front End Processing

WOLVERINE contains an integrated high-fidelity codec featuring sampling rates of up to 48kHz, 95dB input dynamic range, 88dB output dynamic range and low processing delay. In addition, it has exceptionally low noise and distortion levels and delivers excellent sound quality.

## On-chip Peripherals

Wolverine™ features highly flexible interfaces and on-chip peripherals:

- I2C and SDA programming
- Voltage doubled interface to multiple EEPROM styles (I2C and SPI)
- GPIO pins
- Full data and control ports to interface with additional ICs (I2S, I2C, PCM)
- Robust power management block to handle a variety of battery conditions such as battery insertion, removal, supply voltage spikes or near end of life with both ZnAir and Ni-MH batteries
- Clock generation and management block for an optimized computational efficiency/power consumption ratio
- IP security protection to prevent unauthorized access to algorithm code.

## Packaging

- Reflowable hybrid package (5.6 x 3.2 x 1.65 mm)
- Industry-standard QFN or BGA
- Bare die in wafer pack (3.8 x 2.8 mm)

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