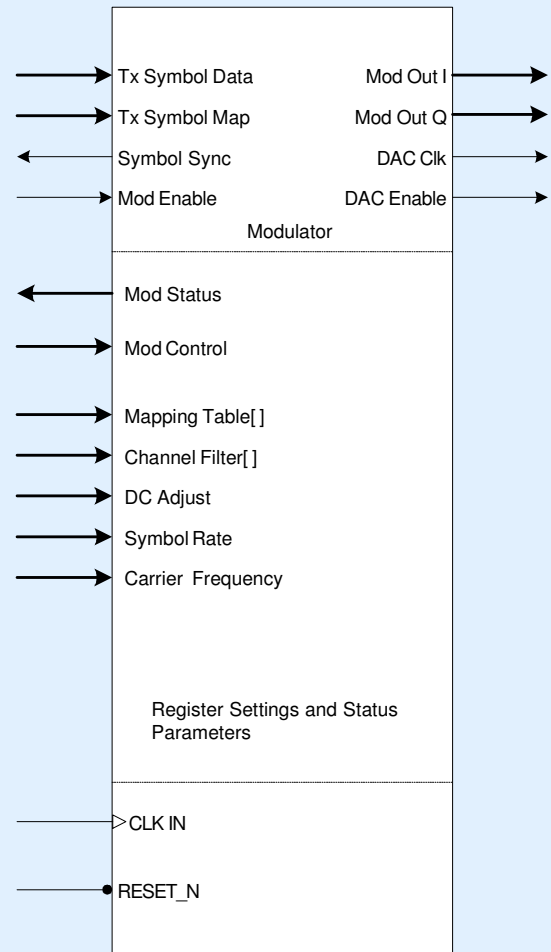


- Continuous or burst-mode operation.
- Symbol mapping for QAM orders from 2 (BPSK) to 256 (256-QAM) including support for cross, circular (MPSK) and offset (staggered) QAM (e.g. OQPSK).
- Arbitrary symbol rate at up to one half of the master clock frequency.
- Register programmable or symbol-by-symbol selection of mapping scheme to support variable-rate and adaptive physical-layer protocols.
- Complex or real intermediate frequency (IF) output from DC up to half the master clock frequency.
- DAC aperture correction and output DC offset adjustment.
- Fixed or register programmable channel filter coefficients.
- Comprehensive range of synthesis options to allow optimal trade-off between gate-count and feature set.
- Compatible with the IEEE 802.16.x wireless MAN-SC and 802.15.3 wireless PAN Standards.

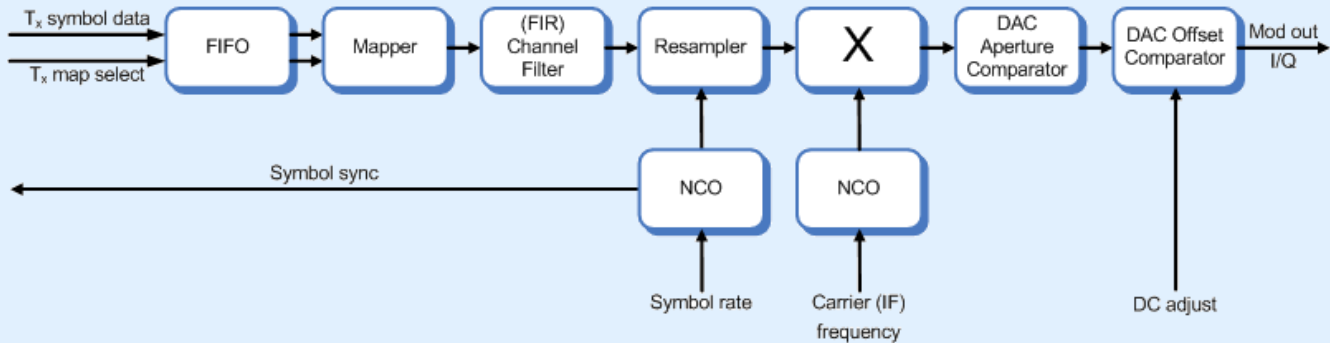


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Block Diagram



Detailed Description

The Commsonic CMS0004 Universal QAM/PSK Modulator is a flexible, high-performance, linear modulator core designed for a wide range of broadband applications including point-to-point and point-to-multipoint terrestrial, satellite and wireline transceiver systems.

It supports both continuous and burst-mode operation and its synchronous control interface readily accommodates physical-layer protocols that employ variable-rate frame structures.

The modulator's symbol rate and carrier (IF) frequency are both programmable over a range extending from 0 Hertz (DC) to approximately half the applied master clock frequency.

The upper limit on master clock frequency is dependent upon the target platform (FPGA or ASIC) and process technology.

In a typical application, symbol transmit data is applied together with corresponding mapper control information.

The data passes through a FIFO buffer into the Mapper that selects the appropriate (QAM or PSK) mapping table, constellation point and transmit level from one or more lookup tables held in RAM or ROM.

The selected constellation point is up-sampled and then shaped/interpolated by a complex FIR filter using either hardwired or programmable coefficients, depending upon a synthesis option.

A separate, and optional, resampling stage provides baseband I/Q samples at the desired DAC clock frequency.

The CMS0004 supports baseband I/Q and complex and real intermediate frequency (IF) outputs and

provides compensation for DAC aperture distortion and DC offsets.

Register Configuration

In operation, static configuration of the modulator is performed through a small number of control ports. These would typically be driven from a bank of registers mapped into the address space of an embedded, or external, Cpu.

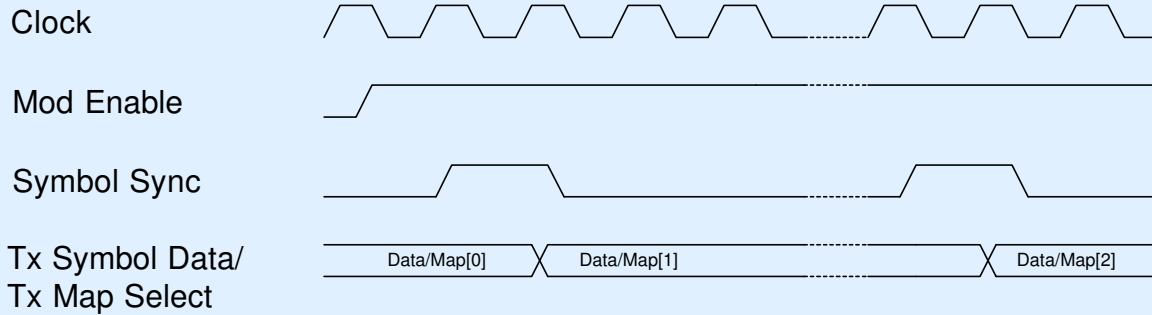
Parameters that may be controlled through this interface include: Symbol rate, Carrier frequency, Mapping tables, Channel filter coefficients.

Principle I/O Description

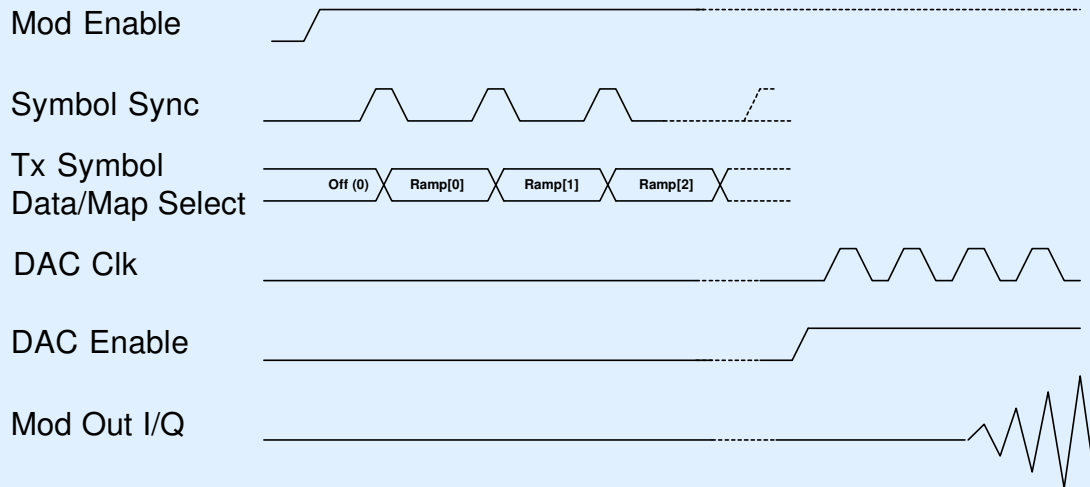
Transmit Data Interface	
Tx Symbol Data	Parallel Tx symbol data (1 to 8 bits). Synchronous with the Symbol Sync output.
Tx Map Select	Per-symbol map data indicating bits-per-symbol (1 to 4 bits). Synchronous with the Symbol Sync output. The value 0 defines a null symbol which flushes the modulator (for the purposes of burst ramping).
Mod Enable	Set high to enable modulation and to synchronise the Symbol Sync output.
Symbol Sync	Active high stobe at the symbol rate. Qualifies the Symbol Data and Symbol Map inputs.
Modulator Output Interface	
Mod Out I	Parallel I channel output at a sub-multiple of the frequency applied at CLOCK.
Mod Out Q	Parallel Q channel output at a sub-multiple of the frequency applied at CLOCK. This output may be omitted in the case of real IF outputs.
DAC Clk	DAC interface clock at a an integer sub-multiple of the rate applied at CLOCK.
DAC Enable	DAC power control signal.
Others	
clock	Master clock input at a rate not less than 2x the maximum operational symbol rate.
reset_n	Asynchronous active-low reset input.

Timing Diagrams

Transmit Data Interface:



Modulator Output Interface:



EXAMPLE APPLICATIONS

The CMS0004 is designed for both continuous and burst mode QAM applications and is especially well suited to broadband applications that are beyond the reach of (DSP) software-implemented modulators.

Application	Configuration
Point-to-point terrestrial microwave (backhaul), 56MHz channel	32-QAM @ 40Ms/s provides sufficient capacity for an STM-1/SDH link allowing overhead for FEC.
Point-to-point terrestrial microwave (backhaul), 28MHz channel	128-QAM @ 24Ms/s provides sufficient capacity for an STM-1/SDH link allowing overhead for FEC.
Point-to-multipoint wireless MAN (IEEE 802.16-SC) 25MHz channel	64-QAM @ 20Ms/s provides 120Mb/s raw
Point-to-multipoint wireless PAN (IEEE 802.15.3) 15MHz channel	64-QAM @ 11Ms/s supports TCM-encoded 55Mb/s burst MPDUs

About Commsonic:

Commsonic is an IP and design services company that specialises in the development of ASIC, FPGA, DSP and board-level sub-systems for applications in wireless and wireline communications.

Our expertise is primarily in the gate- and power-efficient implementation of physical-layer (PHY) functions such as modulation, demodulation and channel coding, but we have extensive experience with all of the major elements of a modern baseband 'core' including medium access control (MAC), voiceband DSP, mixed-signal interfaces and embedded CPU and software.

Our services are available on a turn-key basis but they are usually provided as part of a support package attached to members of our expanding family of licensable IP cores.

Commsonic's IP spans the major Standards for cable, satellite and terrestrial digital TV transmission and includes high-performance, adaptable, single-carrier (QAM) and multi-carrier (COFDM) modulator and demodulator solutions for DVB-S2, DVB-C/J.83/A/B/C and DVB-T/H.

Commsonic's customers are typically semiconductor vendors and manufacturers of broadband transceiver equipment that demand leading-edge Standards-based or proprietary PHY solutions but don't have the internal resources necessary to get their products to market soon enough.

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