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APPLICATION NOTE 3850

MAX2160 ISDB-T Single-Segment Tuner

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Abstract: The rapidly growing demand for digital services in portable devices has created numerous applications where the MAX2160 Tuner IC is showing outstanding performance. The MAX2160 is designed for use in Japanese mobile digital TV (ISDB-T single-segment) applications.

Introduction

Click here for an overview of the wireless components used in a typical radio transceiver.

The MAX2160 is a Single-Segment, Low-IF Tuner IC designed for use in Japanese mobile digital TV (ISDB-T single-segment) applications. In ISDB-T one or more transport stream (TS) inputs, defined in MPEG-2 systems, are remultiplexed to create a single TS. This TS is then subjected to multiple channel-coding steps in accordance with the intentions of the service. It is finally sent as a single OFDM signal. ISDB-T also offers time interleaving to provide powerful channel coding for mobile reception where variations in field strength are inevitable.[1]

The MAX2160 tuner converts UHF band signals to low-IF using a broadband I/Q downconverter. The MAX2160 supports both I/Q low-IF interfaces and single-ended low-IF interfaces, making the device a universal tuner for various digital demodulator IC implementations.

The rapidly growing demand for digital services in portable devices has created numerous applications where the MAX2160 demonstrates outstanding performance. Several reference designs are available in a tiny module, which is particularly optimized for the Japanese CDMA cellular phone market. The design module easily fits into a cellular phone's main circuit board, and extensive performance data is available for them.

ISDB-T Radio

Figure 1 is a block diagram for a radio based on the MAX2160 and a generic baseband processor. RF from the antenna passes through the optional bandpass filter to the LNA, which has its gain set by an analog RF gain-control voltage. Optional front-end filtering helps to customize the tuner for the required blocking performance. The mixer is driven by an internal quadrature local oscillator which splits the signal flow into I and Q paths. The quadrature local oscillator is built on a fractional-N PLL with integrated VCO. A built-in reference oscillator uses an external crystal and can supply a buffered reference clock to the baseband processor.

The I/Q signals pass through adjustable lowpass filters and variable-gain amplifiers, which are controlled by an analog baseband, gain-control voltage. Baseband and application processors then process the I/Q signals to be displayed or distributed to the peripherals. The baseband processor controls all the adjustable functional blocks through a secondary I^2C interface. Dedicated outputs provide baseband gain-control voltage, as well as chip-select, standby, and shutdown control signals. Closed-loop RF power control is formed either by connecting the PWRDET pin directly to the GC1 pin, or by using the baseband processor and the integrated power detector in voltage-output mode.

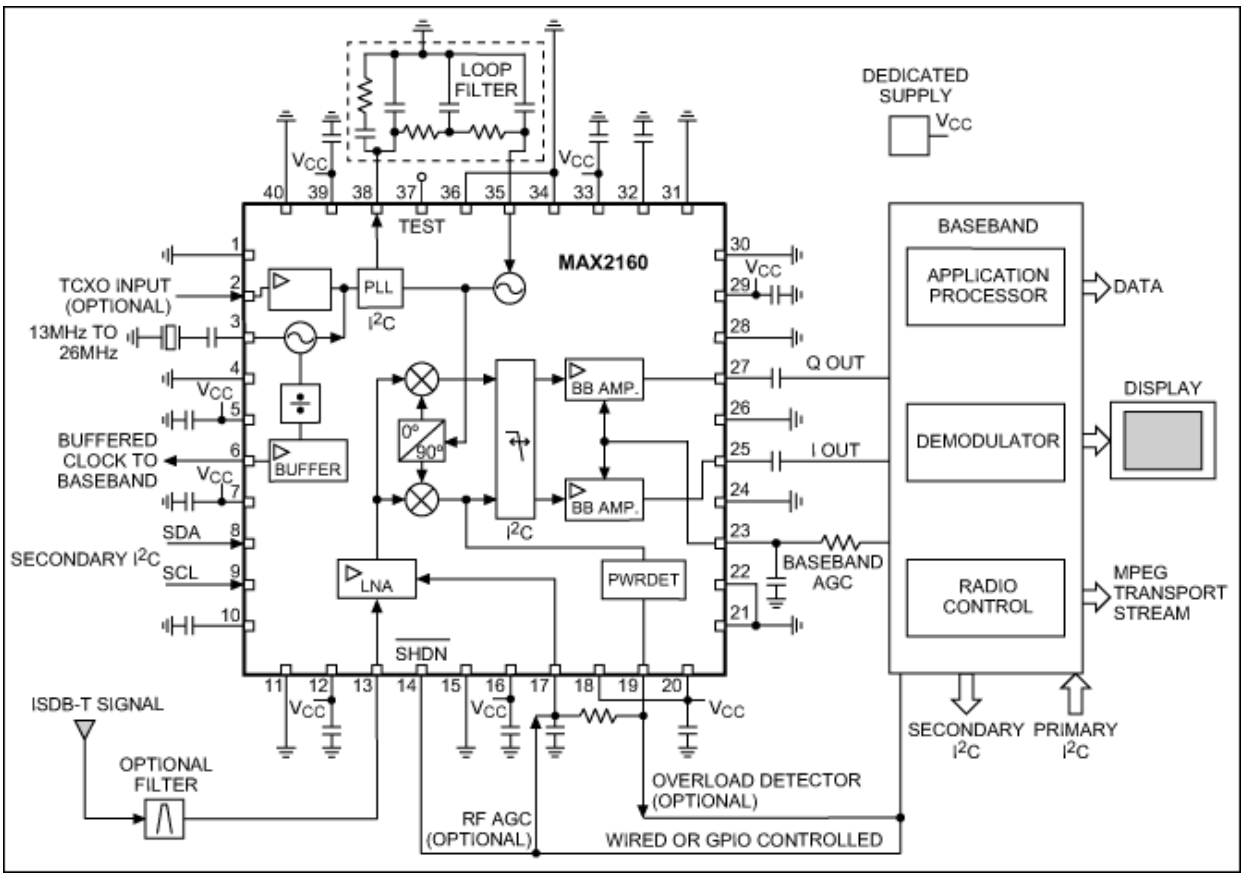

Figure 1. Diagram of a radio based on the MAX2160 tuner and a generic baseband processor.

MAX2160 ISDB-T Tuner Specifications

Parameter	Conditions	Typical
Frequency Range (MHz)		470 to 770
RF Input Impedance (Ω)		50
Return Loss (dB)	50Ω System Impedance	-7
Noise Figure (dB)		3.8
Input Power (dBm, min)	13 segment input	-98
Input Power (dBm, max)	13 segment input	5
Nominal Output-Voltage Swing (V_{P-P})	R load = 10k || 10pF	0.5

Frequencies and Channel Bandwidths

The receiver can downconvert UHF channels 13 through 62 with bandwidths of approximately 5.7MHz. See **Figure 2**. The center frequencies are defined as:

fc = 473.1428571MHz + (N - 13) × 6MHz
N = {13, ..., 62} (UHF channel number)

Each channel consists of 13 segments 428.57kHz wide. A single segment is defined as a partial reception, which assumes a 428.57kHz segment centered at channel frequency.

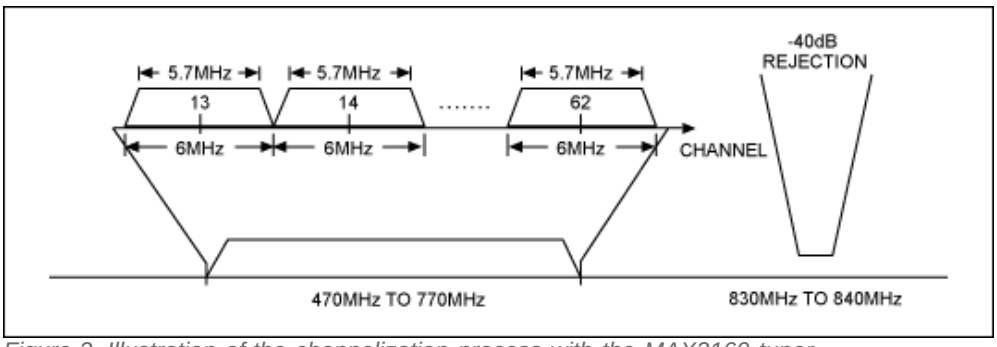

Figure 2. Illustration of the channelization process with the MAX2160 tuner.

Modulation and Modes

Single-segment ISDB-T systems use Orthogonal Frequency Division Multiplexing (OFDM) and support QPSK, 16-QAM, and 64-QAM with code rates of 1/2 and 2/3. There are three different spacings among OFDM carrier frequencies. These spacings are identified as system modes: mode 1—3.968kHz; mode 2—1.9841kHz; and mode 3—0.99206kHz.

Reference

[1]ARIB STD-B31 Version 1.2 Transmission System for Digital Terrestrial Television Broadcasting.

Related Parts	
MAX2160	ISDB-T Single-Segment Low-IF Tuners

More Information

For Technical Support: http://www.maximintegrated.com/support
For Samples: http://www.maximintegrated.com/samples
Other Questions and Comments: http://www.maximintegrated.com/contact

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