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APPLICATION NOTE 173

DS1077L EconOscillator Architecture and Online Interactive Frequency Calculator

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Abstract: Theory of operation and description of the DS1077 dual-output all-silicon EconOscillator. A link to an interactive frequency calculator permits calculation of available frequencies online.

The DS1077L is a dual output, 3V EconOscillator™ available in an 8-SO or 8-µSOP package. EconOscillators are all-silicon squarewave oscillators requiring no external clock reference or timing components for operation. They provide an alternative to crystal-based oscillators in applications where size and cost are important but absolute frequency accuracy is not. Important features include the following: 4.8kHz to 66.666MHz frequency range, 1.25% frequency tolerance over temperature and voltage, 5µA power-down mode, and single or dual synchronous outputs. It may be used as a standalone oscillator or as a processor-controlled peripheral device. The DS1077L is available in four standard master frequencies with custom master frequencies available on request. A brief description of the architecture of the device and an interactive frequency calculator follows:

Block Diagram and Theory of Operation

The DS1077L 3V EconOscillator is comprised of five major blocks (**Figure 1**): an internal master squarewave oscillator, dual programmable prescalers, a single divider chain, gated output drivers, and a set of EEPROM configuration registers that are accessible via a 2-wire bus.
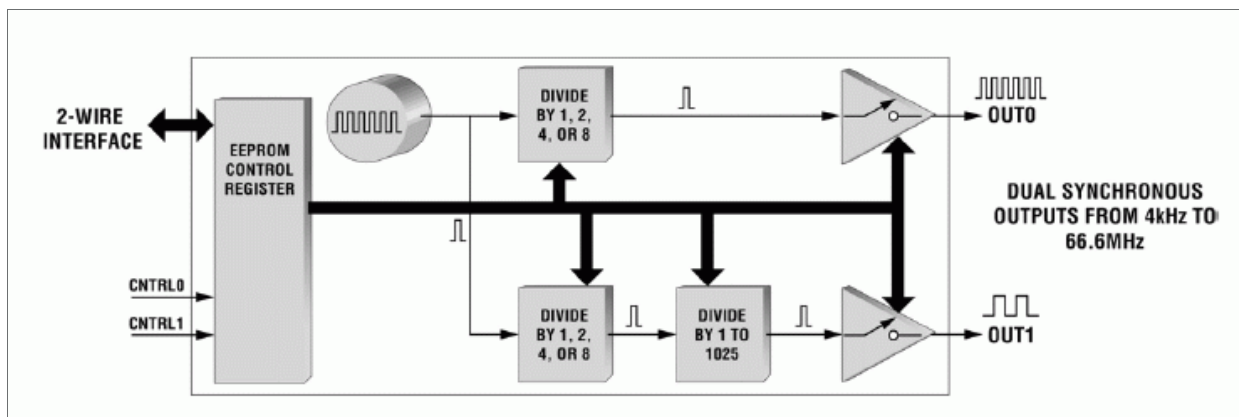

Figure 1. Dual Synchronous Outputs From 4kHz to 66.6MHz.

Internal Master Squarewave Oscillator

The master oscillator used in the DS1077L is a CMOS oscillator with compensation circuitry to eliminate most frequency variation over voltage and temperature. Four standard master frequency options are available: 40MHz, 50MHz, 60MHz, and 66.66MHz. These frequencies are calibrated at the factory and cannot be changed by the end user. In reality, the master oscillator can be factory calibrated to any frequency between 40MHz and 66.66MHz and special frequencies are available in volume quantities on request. Frequencies faster than 66.66MHz are in development at the time of the publication of this document.

Dual Programmable Prescalers

The output of the master oscillator is fed directly to two independent prescalers. These can be programmed by the user to provide an initial divide-by of the master frequency of 1, 2, 4, or 8. The prescaler settings are stored in EEPROM memory that is accessible to the end user via a 2-wire interface. These registers can be preset before installation (for fixed-frequency applications) or can be changed by a microprocessor via the 2-wire interface during operation.

The output of the first prescaler is fed directly to a gated output buffer. The second prescaler is fed into a 1-to-1025 divider chain.

Divider Chain

The 1-to-1025 divider chain receives the prescaled clock from the second prescaler and divides the clock signal down further. The division value can be programmed to any value between 1 and 1025. The divider chain settings are stored in EEPROM memory that is accessible via a 2-wire interface. These can be preset before installation into the application (for fixed-frequency applications) or can be interfaced to a microprocessor for dynamic frequency changes. The output of the divider is applied directly to a gated output buffer.

Gated Output Drivers

Two gated output buffers receive the clock signal from the first prescaler and the divider chain, respectively. The status of these buffers is determined by the values of EEPROM in the EEPROM block. These gates can be turned off and on either via the 2-wire interface via the EEPROM registers or the DS1077L can be configured so that the input status of the two control pins determine the status of the outputs. The control inputs may also be configured to put the DS1077L into a powerdown mode. Output gate switching and powerdown are configured to occur only when the clock output is low. This guarantees that only full clock pulses are generated.

EEPROM Configuration Registers

EEPROM configuration registers store all configuration information. These are accessible via a 2-wire interface and may be preprogrammed before installation for fixed-frequency applications or may be controlled by a processor in applications where dynamic frequency changes or configuration changes are necessary.

For more detailed information on the DS1077L refer to the data sheet: DS1077L.

Available Output Frequencies

With four options for the master oscillator and dual divider chains, thousands of different combinations of output frequencies are available. To ease in evaluation of the DS1077L for a possible application, an interactive frequency calculator (Microsoft Excel format) is available for download.

Related Parts		
DS1077L	3V EconOscillator/Divider	Free Samples