



SYNCHRONOUS ETHERNET WAN PLL and Clock Generation for IEEE-1588

Product Brief 82V3391

FEATURES

HIGHLIGHTS

- Single chip PLL:
 - Features 0.5 mHz to 560 Hz bandwidth
 - Provides node clock for ITU-T G.8261/G.8262 Synchronous Ethernet (SyncE)
 - Exceeds GR-253-CORE (OC-192) and ITU-T G.813 (STM-64) jitter generation requirements
 - Provides node clocks for Cellular and WLL base-station (GSM and 3G networks)
 - Provides clocks for DSL access concentrators (DSLAM), especially for Japan TCM-ISDN network timing based ADSL equipments
 - Provides clocks for 1 Gigabit and 10 Gigabit Ethernet application
 - Supports clock generation for IEEE-1588 applications

MAIN FEATURES

- Provides an integrated single-chip solution for Synchronous Equipment Timing Source, including Stratum 3, Stratum 4E, Stratum 4, SMC, EEC-Option 1 and EEC-Option 2 Clocks
- Supports 1PPS input and output
- Employs PLL architecture to feature excellent jitter performance and minimize the number of external components
- Integrates T4 DPLL and T0 DPLL; T4 DPLL locks independently or locks to T0 DPLL
- Supports programmable DPLL bandwidth (0.5 mHz to 560 Hz in 19 steps) and damping factor (1.2 to 20 in 5 steps)
- Supports 1.1×10^{-5} ppm absolute holdover accuracy and 4.4×10^{-8} ppm instantaneous holdover accuracy
- Supports hitless reference switching to minimize phase transients on T0 DPLL output to be no more than 0.61 ns
- Supports programmable input-to-output phase offset adjustment
- Limits the phase and frequency offset of the outputs
- Provides OUT1~OUT7 output clocks whose frequency cover from 1PPS to 644.53125 MHz
 - Includes 25 MHz, 125 MHz and 156.25 MHz for CMOS outputs
 - Includes 25.78125 MHz, 128.90625 MHz and 161.1328125 MHz for CMOS outputs
 - Includes 25 MHz, 125 MHz, 156.25 MHz, 312.5 MHz and 625 MHz for differential outputs
 - Includes 25.78125 MHz, 128.90625 MHz, 161.1328125 MHz, 322.265625 MHz and 644.53125 MHz for differential outputs
- Provides OUT8 for composite clocks and OUT9 for 1.544 MHz/2.048 MHz (BITS/SSU)
- Provides IN1 and IN2 for composite clocks

- Provides IN3~IN14 input clocks whose frequencies cover from 2 kHz to 625 MHz
 - Includes 25MHz, 125 MHz and 156.25 MHz for CMOS inputs
 - Includes 25MHz, 156.25 MHz, 312.5 MHz and 625 MHz for differential inputs
- Internal DCO can be controlled by an external processor to be used for IEEE-1588 clock generation
- Supports Forced or Automatic operating mode switch controlled by an internal state machine. Automatic mode switch supports Free-Run, Locked and Holdover modes
- Supports manual and automatic selected input clock switch
- Supports automatic hitless selected input clock switch on clock failure
- Supports three types of input clock sources: recovered clock from STM-N or OC-n, PDH network synchronization timing and external synchronization reference timing
- Provides a 2 kHz, 4 kHz, or 8 kHz frame sync input signal, and a 2 kHz or 8 kHz frame sync output signal
- Provides a 1PPS sync Input signal, and a 1PPS sync output signal
- Provides output clocks for BITS, GPS, 3G, GSM, etc.
- Supports AMI, PECL/LVDS and CMOS input/output technologies
- Supports master clock calibration
- Supports Master/Slave application (two chips used together) to enable system protection against single chip failure
- Supports Telcordia GR-1244-CORE, Telcordia GR-253-CORE, ITU-T G.812, ITU-T G.8262, ITU-T G.813 and ITU-T G.783 Recommendations

OTHER FEATURES

- Multiple microprocessor interface modes: EPROM, Multiplexed, Intel, Motorola, I2C and Serial
- IEEE 1149.1 JTAG Boundary Scan
- Single 3.3 V operation with 5 V tolerant CMOS I/Os
- 100-pin TQFP package, green package options available

APPLICATIONS

- 1 Gigabit Ethernet and 10 Gigabit Ethernet
- BITS / SSU
- SMC / SEC (SONET / SDH)
- DWDM cross-connect and transmission equipment
- Synchronous Ethernet equipment
- Central Office Timing Source and Distribution
- Core and access IP switches / routers
- Gigabit and Terabit IP switches / routers
- IP and ATM core switches and access equipment
- Cellular and WLL base-station node clocks
- Broadband and multi-service access equipment

DESCRIPTION

The IDT82V3391 is an integrated, single-chip solution for the Synchronous Equipment Timing Source for Stratum 3, Stratum 4E, Stratum 4, SMC, EEC-Option1, EEC-Option2 clocks in SONET / SDH / Synchronous Ethernet equipment, DWDM and Wireless base station.

The device supports several types of input clock sources: recovered clock from Synchronous Ethernet, STM-N or OC-n, PDH network synchronization timing and external synchronization reference timing.

The device consists of T0 and T4 paths. The T0 path is a high quality and highly configurable path to provide system clock for node timing synchronization within a SONET / SDH / Synchronous Ethernet network. The T4 path is simpler and less configurable for equipment synchronization. The T4 path locks independently from the T0 path or locks to the T0 path.

An input clock is automatically or manually selected for T0 and T4 path. Both the T0 and T4 paths support three primary operating modes: Free-Run, Locked and Holdover. In Free-Run mode, the DPLL refers to the master clock. In Locked mode, the DPLL locks to the selected input clock. In Holdover mode, the DPLL resorts to the frequency data

acquired in Locked mode. Whatever the operating mode is, the DPLL gives a stable performance without being affected by operating conditions or silicon process variations.

There are 2 high performance APLLs that can be used for low jitter SONET and Ethernet Clocks

The device provides programmable DPLL bandwidths: 0.5 mHz to 560 Hz in 19 steps and damping factors: 1.2 to 20 in 5 steps. Different settings cover all SONET / SDH clock synchronization requirements.

A highly stable input is required for the master clock in different applications. The master clock is used as a reference clock for all the internal circuits in the device. It can be calibrated within ± 741 ppm.

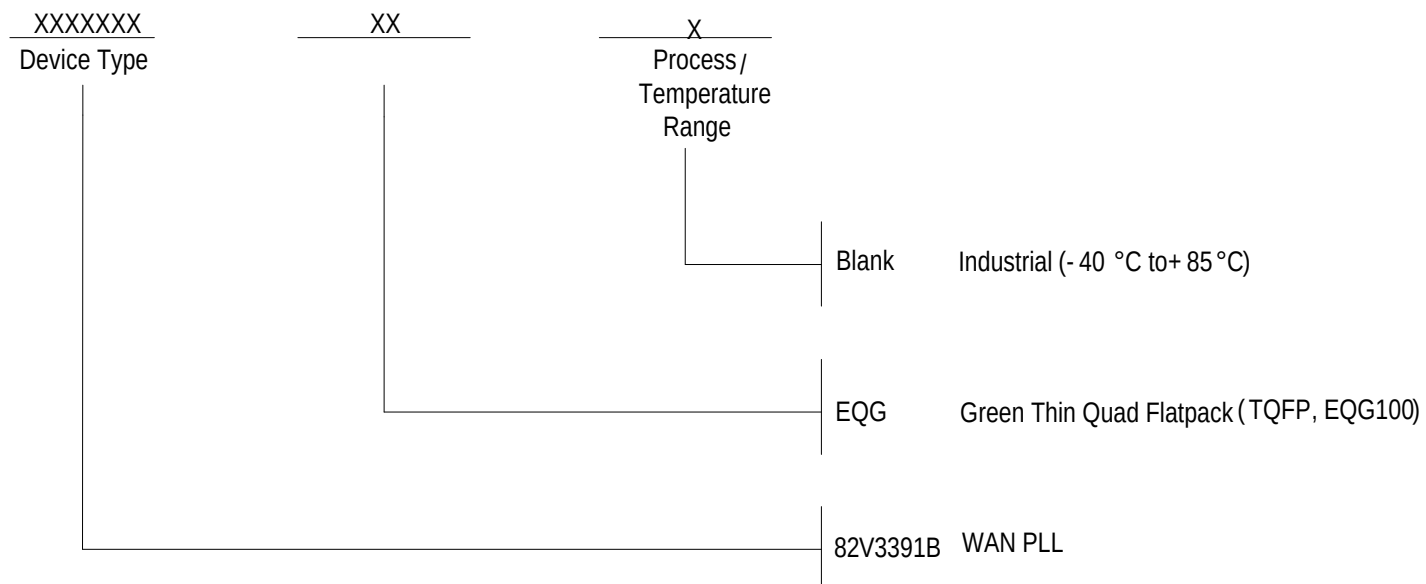
All the read/write registers are accessed through a microprocessor interface. The device supports six microprocessor interface modes: EPROM, Multiplexed, Intel, Motorola, I2C and Serial.

In general, the device can be used in Master/Slave application. In this application, two devices should be used together to enable system protection against single chip failure.

The diagram illustrates the T4/T0 PLL architecture, which is a multi-channel phase-locked loop system. It is organized into four main functional blocks:

- Input:** A set of 14 input channels (IN1 to IN14) and an EX_SYNC1 input. Each input channel passes through an "Input Pre-Divider" and a "Priority" block before entering a "T4 Input Selector".
- T4 DPLL (Data Path Lock Loop):** This block processes the selected T4 input. It includes a "MUX" (multiplexer) that selects between the input and a feedback path. The signal then passes through a "T4 PFD & LPF" (Phase-Frequency Detector and Low-Pass Filter) block. The output of the PFD is divided by a "Divider" and fed back to the MUX. The main output of the T4 DPLL is a 77.76 MHz signal, which is also divided by an "8 k Divider" to produce an 8 kHz signal.
- T0 DPLL (Time Base Lock Loop):** This block processes the selected T0 input. It includes a "MUX" that selects between the input and a feedback path. The signal then passes through a "T0 PFD & LPF" block. The output of the PFD is divided by a "Divider" and fed back to the MUX. The main output of the T0 DPLL is a 77.76 MHz signal, which is also divided by an "8 k Divider" to produce an 8 kHz signal.
- Output:** The outputs of the T4 and T0 DPLLs are multiplexed by a "T4 APLL MUX" and a "T0 APLL MUX" respectively. These multiplexers are controlled by "T4 APLL" and "T0 APLL" signals. The outputs of the APLLs are then fed into a series of "Dividers" and "Auto Dividers" to produce the final output signals (OUT1 to OUT14, OUT15 to OUT18, OUT19 to OUT22, OUT23 to OUT26, OUT27 to OUT30, OUT31 to OUT34, OUT35 to OUT38, OUT39 to OUT42, OUT43 to OUT46, OUT47 to OUT50, OUT51 to OUT54, OUT55 to OUT58, OUT59 to OUT62, OUT63 to OUT66, OUT67 to OUT70, OUT71 to OUT74, OUT75 to OUT78, OUT79 to OUT82, OUT83 to OUT86, OUT87 to OUT90, OUT91 to OUT94, OUT95 to OUT98, OUT99 to OUT102, OUT103 to OUT106, OUT107 to OUT110, OUT111 to OUT114, OUT115 to OUT118, OUT119 to OUT122, OUT123 to OUT126, OUT127 to OUT130, OUT131 to OUT134, OUT135 to OUT138, OUT139 to OUT142, OUT143 to OUT146, OUT147 to OUT150, OUT151 to OUT154, OUT155 to OUT158, OUT159 to OUT162, OUT163 to OUT166, OUT167 to OUT170, OUT171 to OUT174, OUT175 to OUT178, OUT179 to OUT182, OUT183 to OUT186, OUT187 to OUT190, OUT191 to OUT194, OUT195 to OUT198, OUT199 to OUT202, OUT203 to OUT206, OUT207 to OUT210, OUT211 to OUT214, 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