M68/M64 IEEE 1588 Module (Master, Slave, Boundary Clock)
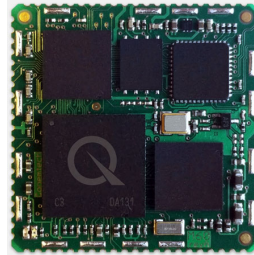

APPLICATIONS
- Small cells &macro-cells (eNodeBs)
- Mobile Backhaul
- Carrier Ethernet equipment
- Power grid time synchronization
- Sensor network slave devices
- Internet of things
- Industrial automation precision timing

FEATURES
- Full IEEE 1588 -2008 PTP master or slave clock (M64 and M68)
- A-PTS gateway clock (M68)
- Supports GPS and PTP input
- Supports one-step and two- step clock
- Compatible with peer-to-peer and end-to-end transparent clocks
- Supports multicast and unicast
- Supports up to 8 unicast slaves
- Supports up to 128 unicast sync messages per second total
- Supports time and frequency recovery
- Low power, small form factor
- Telecom, power and default profiles
- Fully transparent, low latency Ethernet pass-through
- Industry leading algorithms ensure superior time-recovery performance
- Fully validated against G.8261 test suite

BENEFITS
- Easy integration in host system
- Low power consumption allows POE capability on host system
- Low total cost of ownership
- Ongoing support from a leader in the synchronization field
- Access to future feature and performance enhancements

The combination of the explosive growth of *connectivity everywhere*, evermore demanding end applications and the continual increase in wireline and wireless data rates means that the need for precise time synchronization continues to grow – both in end appliances and in the networking equipment interconnecting them. This is no more evident than in the timing requirements for 4G LTE-TDD and LTE-A networks that are deploying now, and the 5G networks of tomorrow, along with applications such as geolocation for E911 and targeted marketing.

The M68/M64 modules are a full packet network-based synchronization engine supporting IEEE 1588-2008 PTP. The M64 Module can operate as either an advanced PTP slave for recovering time and frequency from a remote PTP grandmaster or as a cost-effective, low-capacity master for taking time from a local GNSS receiver and distributing this to one or more remote slaves over PTP. The M68 builds on the features of the M64 by adding a boundary/gateway clock capability making it ideal for applications that require distribution of frequency and phase synchronization from edge nodes, such as a Carrier Ethernet demarcation point or a macro base station that is aggregating traffic from small cells, through to a substation in power utility smart grids.

As a gateway clock, the M68 provides all the functions needed to operate in an Assisted Partial Timing Support (A-PTS) network in which the M68 is incorporated into an aggregation or access unit, taking time from a local GNSS receiver or a remote PTP grandmaster and distributing this to the associated end devices over PTP. This approach provides timing robustness, particularly against acts such as GNSS spoofing or jamming, while allowing time-sensitive end equipment to operate over non-time aware networks, thereby reducing deployment costs.

Design & Integration
The M64 is a self-contained clock module that provides a simple and cost effective option to integrate precision timing into designs such as femto cells, small cells and carrier Ethernet equipment. The M64 contains all the components needed to implement a PTP master or slave implementation, with the exception of an external high-stability (TCXO or OCXO) voltage-controlled oscillator. The M68 is fully pin compatible with the M64 but extends the functionality by providing a gateway clock function allowing a fully G.8273.4-compliant Assisted Partial Timing Support Clock (A-PTSC) to be implemented.

For rapid 'turnkey' integration, the P60 prototyping board integrates the M68 with an OCXO, two triple-speed RJ45 Ethernet ports and time-of-day connectors allowing low volume production with minimal design effort.

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SILICON LABS

Pass-Through Technology

The M64 and M68 provide two Ethernet interfaces with wire-speed pass-through, allowing *bump-on-the-wire* deployments in which the module is inserted in-line with a data link therefore not requiring a dedicated switch port or network interface.

Advanced Time Recovery Algorithms

The M64 and M68 have industry leading algorithms that enable them to achieve as the level of recovered time accuracy required by next-generation applications in the presence of high levels of packet delay variation (PDV) caused by network traffic loading and congestion. This allows operators to reduce overall system cost by alleviating the need to upgrade network nodes to support boundary clock or transparent clock operation.

System Features

- IEEE 1588-2008 PTP master or slave clock (M64 & M68)
- G.8273.4 A-PTS Assisted Partial Timing Support Clock (M68)
- Supports telecom, power and default profiles
- Frequency accuracy better than 10 ppb under ITU-T G.8261 test conditions [1]
- Phase accuracy better than ±1µs accuracy under G.8261 testing conditions [1]
- Enhanced synchronization and network performance metrics

Network Interface

- Upstream: 10Base-T, 100Base-Tx and 1000Base-T twisted pair interface (magnetics external as needed)
- Downstream: 1 RGMII port
- Wirespeed low latency pass-through
- Integrated TCP/IP stack
- Ethernet, IPv4 and IPv6 PTP

[1] ITUh T G.8261 tests conducted at internal labs and 3rd party labs – details available on request and under NDA

Technical Specifications

Ethernet

- Wire speed 1GbE pass-through

PTP Master

- Accuracy with GPS as reference better than ±25ns
- Supports up to 8 slaves – multicast or unicast
- Supports 1 step and 2 step operation
- Output Sync rate: up to 128 sync packets per second (uincast total shared between all slaves)

PTP Slave

- Time alignment, better than ±1 µs on a managed 10-switch GbE twork under G.8261 test conditions.[2]
- Frequency alignment, better than ±10 ppb on a managed 10-switch GbE network under G.8261 test conditions.[2]
- Supports 1-step and 2-step
- Input sync rate: up to 128 sync packets per second

Other Features

- DHCP client
- FTP rver
- TELNET rver
- SSH server
- Serial terminal
- Remote firmware upgrade
- Command line interface configuration (Telnet, SSH or serial port terminal)

Input Synchronization Interfaces

- PTP: Ethernet (L2) or UDP IPv4/IPv6 (L3)
- 1PPS

[2] With industry standard PDV profiles of switches and network conditions.

- ToD in: TTL, 4800/9600 bps, via dedicated pin port up to 115200 bps via serial port

Output Synchronization Interfaces

- Freq. out: 5/10/20/25 MHz
- 1PPS for precise top-of-second indication
- ToD out: TTL 4800/9600 bps on dedicated pin. Up to 115200 bps on serial port.
- PTP: Ethernet (L2) or UDP IPv4/IPv6 (L3)

ToD Format (output)

- ASCII (YYYY-MM-DD HH:MM:SS)
- NMEA & China Mobile binary format

Other Interfaces

- GPIO, Asynchronous serial, SPI RGMII, MDIO, LVTTL

Operating Specifications

- Supply: 3.3V, 1.8V, 1.2V +/- 10%
- Operating temperature: -40ºC to 85ºC
- RoHS (6/6) and WEEE compliant
- Low power processor module: 1.1W (typical)

Physical Specifications

- Package: LGA84
- Size: 29.2 mm X 29.2 mm X 2.8 mm

Ordering Information

- M64 Ordinary Clock Module
- M68 Gateway Clock Module

  For applications requiring Synchronous Ethernet and/or enhanced master performance, refer to the Silicon Labs M88 IEEE 1558/SyncE Module

Silicon Laboratories Inc. 400 West Cesar Chavez Austin, TX 78701 USA

Mouser Electronics

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