



Gigabit Connectivity over Plastic Optical Fiber



Autonomous driving
safety redundancy



ADAS sensor
interconnection



Electric Vehicles:
Galvanic isolation for Battery
Management Systems

- EMC-compliant
- Seamless network integration
- 1 Gigabit and beyond
- Low latency, low jitter, low linking time



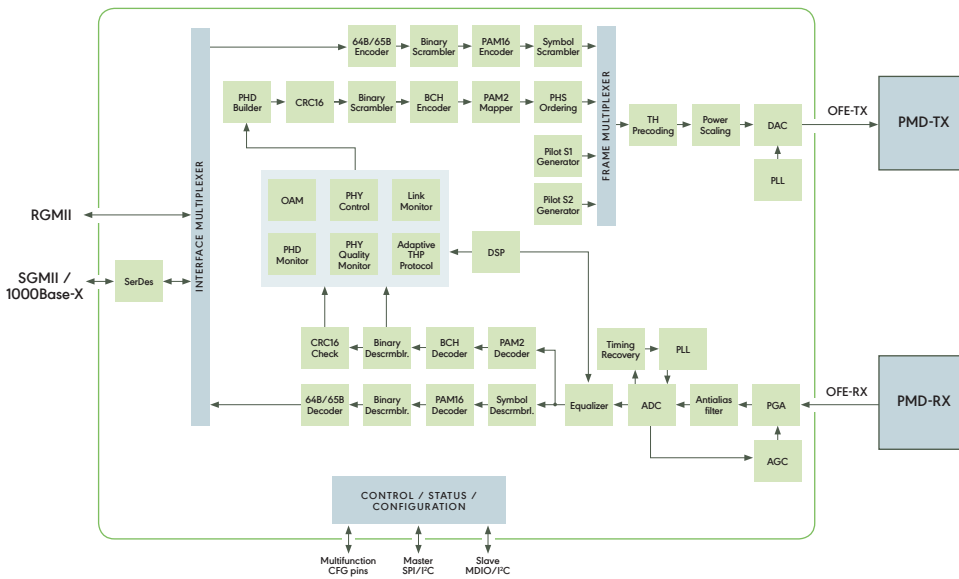
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KD1053

Automotive 1000BASE-H Transceiver

KD1000 FAMILY



OVERVIEW

The KD1053 is a 65nm CMOS ASIC that implements the Physical-Coding Sublayer (PCS) and Physical Medium Attachment (PMA) sublayer of a 1000BASE-RHx PHY, compliant with the specifications of IEEE Std 802.3bv™-2017 standard for gigabit optical communications over Plastic Optical Fiber (POF). The KD1053 must be connected to a compatible Fiber Optics Transceiver (FOT), which implements a Physical Medium Dependent (PMD) sublayer and a Medium Dependent Interface (MDI), to form a complete automotive 1000BASE-RHC physical layer.

The KD1053 implements the following optional features of IEEE Std 802.3bv™-2017: 1000BASE-H Operations Administration Maintenance (OAM) channel, support for Energy Efficient Ethernet (EEE) mode, exposed Management Data Input/Output (MDIO), and motor vehicle environmental requirements.

The KD1053 can operate at 1 Gbps and at 100 Mbps. It is optimized for EMC compatibility, low power, reduced BOM, and a small footprint. It is targeted for automotive applications using optical Ethernet over POF for the communications inside the vehicle. Infotainment and Advance Driver Assistance Systems (ADAS) are two of the key applications for future on-board POF networking development. Examples of products able to incorporate optical Ethernet ports based on the KD1053 ASIC include ECUs, cameras, and infotainment nodes.

Its built-in analog interface simplifies connectivity to the Physical Medium Dependent (PMD) sublayer. It supports different parallel and serial MAC interfaces for connecting a MAC station, an MCU or a switch. The KD1053 transceiver provides a Serial Management Interface (SMI), also called MDC/MDIO interface, and a master SPI/I²C port to access an external EEPROM memory for configuration.

The transceivers' parallel MAC interface pins are 1.8V, 2.5V and 3.3V LVTTTL compliant; and serial MAC interfaces are 2.5V LVDS.

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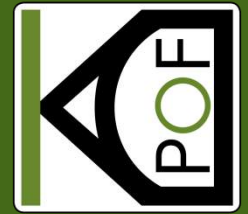
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FEATURES

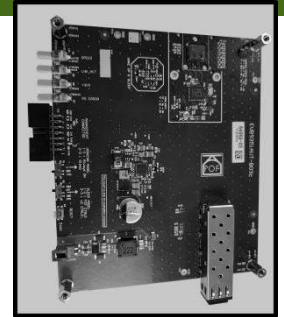
- In 1 Gbps operation mode, 1000BASE-H Physical Coding Sub-layer (PCS) and the Physical Medium Attachment (PMA) sublayers according to the IEEE Std 802.3bv™-2017
- 100 Mbps operation mode supported for applications requesting low data rates and high optical link margin
- Specified for multimode plastic optical fiber with the channel characteristics specified by IEEE Std 802.3bv™-2017 Clause 115. Designed to operate:
 - at 1 Gbps with the fiber optic channel type II and type III according to Clause 115 of IEEE Std 802.3bv™-2017;
 - at 100 Mbps with 120 m of SI-POF without in-line connectors, or with 40 m with up to 10 in-line connectors
- Support RGMII v2.0, RMII, MII, SGMII, 1000BASE-X and 100BASE-X standards in the MAC interface
- Support 1.8V 2.5V and 3.3V LVTTTL digital I/O standard for parallel MAC interface; and 2.5V LVDS for serial MAC interface
- SMI (MDC/MDIO) interface for configuration and monitoring supporting Clauses 22 and 45, which can be configured as an I2C bus
- SPI/I2C master interface for reading external boot and configuration EEPROM memory
- Support for EEE, OAM, Wake-up & Sleep, interruption generation
- Support for jumbo packets up to 10 KB
- PTP and Sync-E supported
- Different loopback modes and PMD test-modes for diagnostics
- Link/activity monitoring and speed LED outputs
- Support for high-level ASIL systems
- Fully integrated digital adaptive non-linear equalizers
- BER < 10⁻¹² for 1 Gbps and 100 Mbps operation modes
- 6.2 us latency for 1 Gbps operation and 1.4 us for 100 Mbps (local RGMII to remote RGMII); 5 ns RMS jitter for 1 Gbps operation and 9 ns for 100 Mbps
- 55 ms of link time for 1 Gbps operation
- Internal dependability functions: power supply, process and temperature sensors; and FOT received power monitoring
- Advanced power management with integrated linear voltage regulators for 2.5V; it can be supplied with only external 1.2V and 3.3V power voltages
- Low power, 460 mW at 1 Gbps
- Low-cost bill of materials (BOM)
- Designed to be EMC compliant with CISPR25 Class-5 at component level
- 65 nm CMOS process
- Automotive AEC-Q100 grade 2
- -40 to +105°C ambient temperature range
- 56-pin QFN (7 x 7 mm) ROHS package

EVB9351AUT KD9351+KD1053 Eval-Board

1000BASE-RHC Automotive Bridge



KD1050 FAMILY - Automotive



OVERVIEW

The KDPOF EVB9351AUT is a board for a comprehensive evaluation of the KDPOF KD9351 and KD1053 transceivers for automotive optical 1000BASE-RHC PHY implementation. The KD9351 IC (7 mm x 8 mm LGA-36) implements the PMD sublayer of the physical layer; while the KD1053 (7 mm x 7 mm QFN-56), the PCS and PMA sublayers as defined in IEEE Std 802.3bvTM-2017. It can operate at 1000 and 100 Mbps. The board hosts an SFP slot and it may function as media converter between the optical optical 1000BASE-RHC port and the SFP-module (1000/100BASE-T, 100BASE-FX, 1000BASE-S/LX, direct-attach passive twinax cable, passive serial loopback...).

The EVB9351AUT platform provides all the functional and performance evaluation capabilities requested by the automotive OEM, TIER-1 or test house, enabling product designers to successfully evaluate KDPOF's technology and to shorten the time to market. The board may be used in different setups such as to evaluate the KD1053. Design documentation as well as SDK software is provided together with the board.

KEY FEATURES

- One-gigabit full-duplex operation according to the 1000BASE-RHC physical layer (IEEE Std 802.3bvTM-2017) and hundred-megabit full-duplex operation according to the future 100BASE-H physical layer
- Operates at 1 Gbps with 15 m with up to three in-line connectors¹; and at 100 Mbps 40 m with up to four in-liners
- This board is compatible with diverse optical header connectors available in the market
- Support for SGMII, 1000BASE-X and 100BASE-X at the SFP interface
- RGMII loopback implemented
- Easy monitoring and configuration of the KD1053 through the management header (for the USB2ALL)
- Guaranteed 10^{-12} BER according to RFC 2544
- Wake-Up & Sleep supported
- Single power supply from battery voltage
- Operation temperature range from -40 to 105°C

MAJOR BENEFITS

- Ideal platform to test the functionality and the performance of KD9351 and KD1053 transceivers at 1000/100 Mbps.
- Designed for thermal testing in the whole temperature range.
- Power connectors are automotive specific; cables are thought to be connected to a laboratory power supply or battery.
- The USB2All module enables real-time monitoring of the optical link, reporting key performance parameters (received average optical power (dBm), local and remote link margin (dB)) and configuration. Register access is supported.
- Documentation and SDK included.

CONFIGURATION

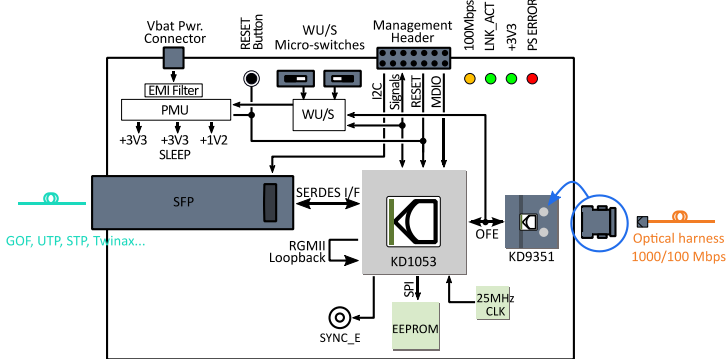


Figure 1. Block diagram of EVB9351AUT

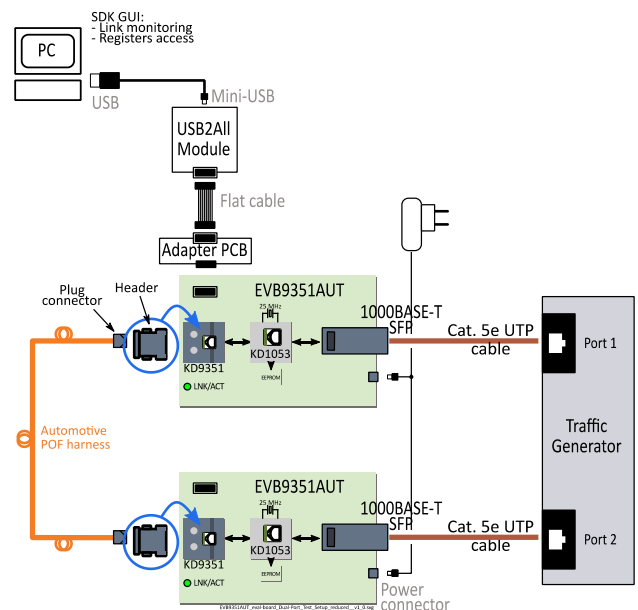


Figure 2. Typical traffic test setup for EVB9351AUT

¹ More in-line connectors can be added for ambient temperatures below 105°C.

Product Brochure

EVB9351AUT KD9351+KD1053 Eval-Board

PRODUCT DESCRIPTION

The KDPOF EVB9351AUT eval-board is a flexible tool that enables evaluation of the KDPOF KD9351 and KD1053 transceivers at 1 Gbps and 100 Mbps. A single version of the board is compatible with multiple headers and harnesses from different manufacturers.

The user can plug a standard SFP module into the cage and have a media-converter functionality, supporting Wake-Up & Sleep.

Complementary items can be provided, such as optical harness, loopback SFP or SFP direct-attach passive twinax cable.

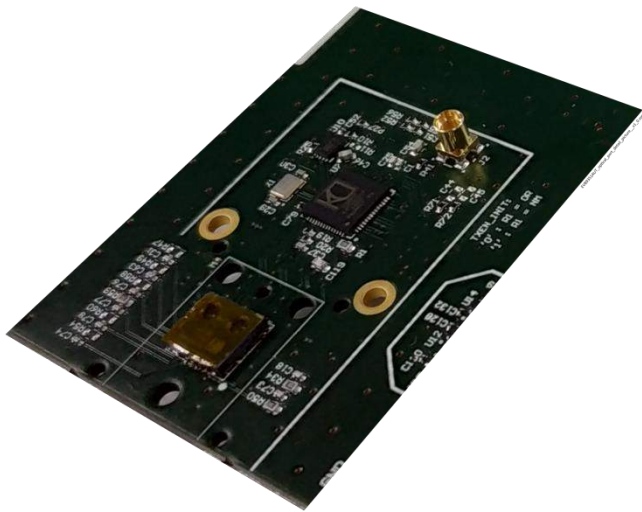


Figure 3. Detail of the optical port in the EVB9351AUT board

The configuration of the board is in an EEPROM memory. The provided SDK allows generating binaries for different configuration options and flashing the EEPROM.

In addition, control and status of the KD1053 transceiver is accessed through the GUI (included in the SDK), which may be run on a computer connected via an USB2All module. The GUI includes several panels that provide complete access to the KDPOF transceiver, providing information on the link status and its parameters.

User and design documentation is provided in order to simplify the evaluation and the development of automotive end products based on the two part numbers.



Figure 4. Typical content of an EVK9351AUT eval-kit



KDPOF

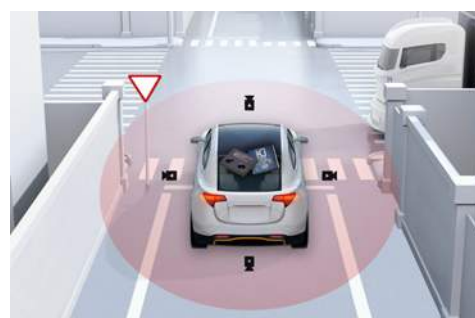
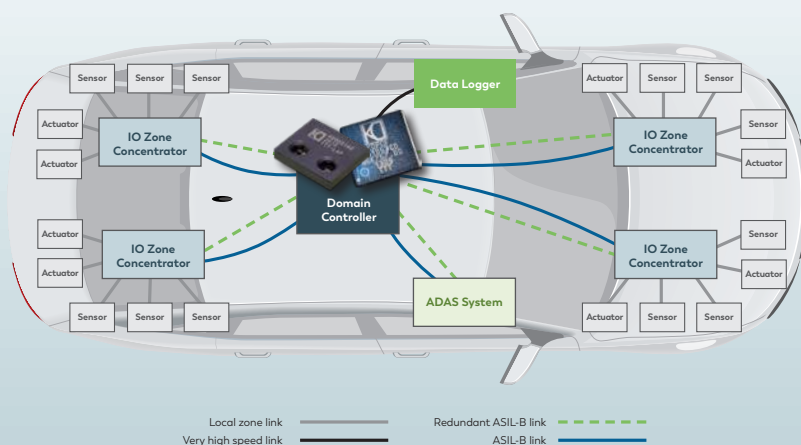
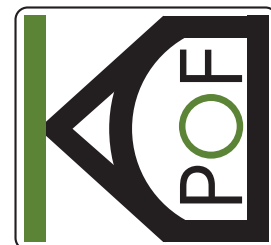
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Gigabit Ethernet over POF Automotive Evaluation Kit

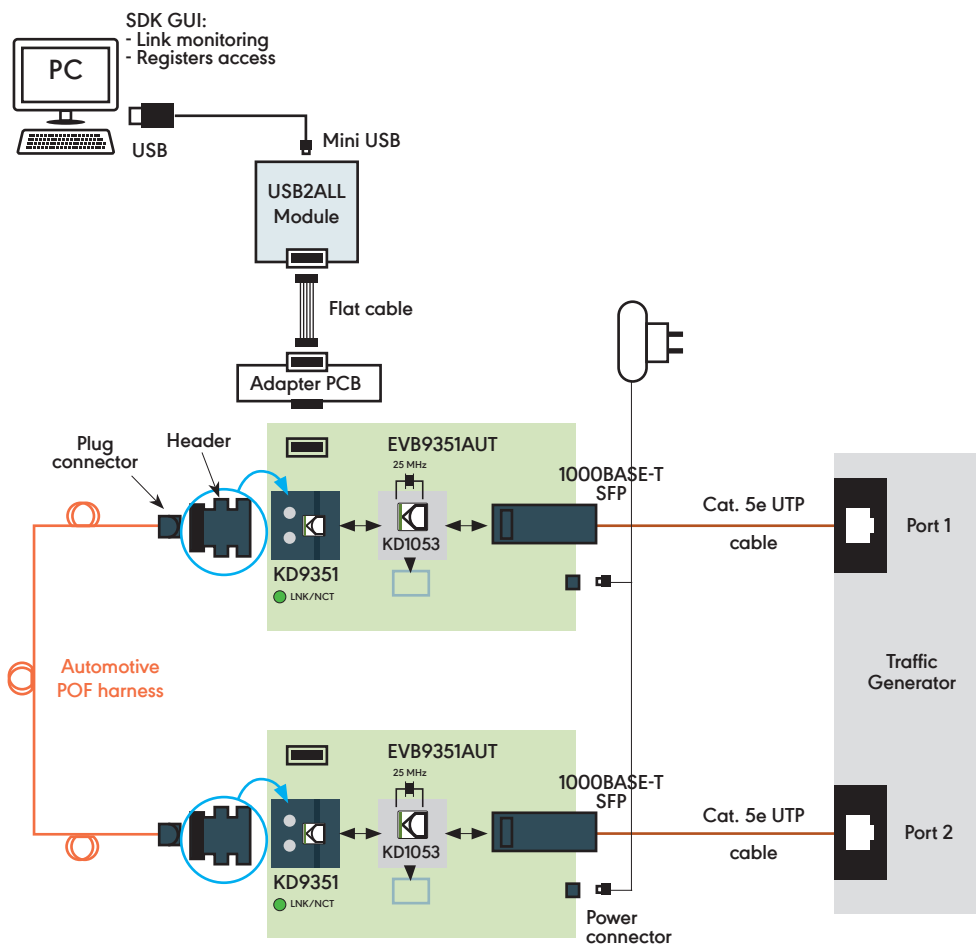


The extensive evaluation kit EVK9351AUT equips OEMs, Tier1s, and test houses to fully evaluate the KDPOF automotive transceivers KD9351 and KD1053 for automotive optical 1000BASE-RHC PHY implementation. The kit is self-contained including all the needed components to establish 100 and 1,000 Mb/s links over Plastic Optical Fiber (POF). Versatile, auto-grade, SFP-POF electronic boards allow for lab measurements in extreme operating temperature, radiation and voltage supply corners. The KD9351 FOT, in combination with the KD1053 IC, cuts the cost for 1 Gb/s optical connectivity by 30 percent, providing competitive pricing for EMC critical or galvanic isolated critical links. Applications include safe Ethernet backbones and sensor links for advanced driver assist systems (ADAS).

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Gigabit Ethernet over POF

Automotive Evaluation Kit



Content

- 2 EVB9351AUT evaluation boards
- 2 1000BASE-T SFP modules
- 1 USB2ALL monitoring box
- 1 Optical harness
- 2 Cat. 5e UTP cables
- User and design documentation
- 2 Evaluation board metal enclosures (optional)
- 2 100BASE-TX SFP modules (optional)
- 2 Direct-attach passive SFP twinax cables (optional)

Operating range: -40° C to +105° C
Power supply: +12 V battery
Target usage: Automotive environment

Key components suppliers:
PHY: KDPOF
Fiber Optical Transceiver (FOT): KDPOF
Header/In-liner and Harness: consult on options available

More information on KD9351 and KD1053: kdpof.com/automotive/

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