
Getting Started with LAN938x

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1.0 INTRODUCTION

This application note features preliminary information essential for starting a new Hardware (HW) and Software (SW) design with the LAN938x family of Gigabit Ethernet Switches. The Microchip LAN9381, LAN9382, LAN9383, and LAN9384 are scalable, compact 100BASE-T1 Ethernet Gigabit Switches based on the IEEE 802.3bw-2015 specification. The LAN938x incorporates a layer-2+-managed, high-performance Ethernet switch of up to five 100BASE-T1 physical layer transceivers (PHYs) (four for the LAN9381/2 and five for the LAN9383/4), up to three MAC ports, and an ARM Cortex M7 CPU subsystem. With the addition of integrated 2 MB code flash memory and a hardware security engine, the LAN938x family delivers a fully integrated, single-chip AVB/TSN bridge solution. All four switches are available in Grade 2 Automotive (–40°C to +105°C) temperature range and are AEC-Q100-qualified for automotive use cases such as gateways, Automated Driver-Assistance Systems (ADAS), infotainment, telematics, and in-vehicle networking. The switches are also available in an industrial temperature version (–40°C to +85°C) and are ideal for non-automotive applications, such as industrial vehicles, automation, robotics and transportation.

The LAN938x is functionally similar to the LAN937x family of switches. The main difference is that the LAN938x switches have an integrated CPU and memory subsystem that enable them to operate in a Stand-alone mode. Switch configurations are loaded and saved into internal flash memory, allowing the switch to be passing data traffic quickly from power-up.

1.1 Sections

This document covers the following sections:

- [Section 2.0, Product Overview](#)
- [Section 3.0, Switch Configuration Options](#)
- [Section 4.0, Software Guide](#)
- [Section 5.0, Hardware and EVB Guide](#)
- [Section 6.0, Overview of Microchip Collateral](#)

1.2 References

[Table 1](#) lists critical documentation for designing with the LAN938x family of parts. For a more comprehensive list of references, navigate to the LAN938x product landing pages for each part and look in the “Documentation” section. Refer to [Section 6.0, Overview of Microchip Collateral](#) for more information on repositories provided by Microchip.

Note: Designers must access the Secure Documents Extranet (SDE) when finalizing a design. Essential references that contain confidential proprietary information from Microchip Technology, such as device errata and register definitions, are only available on SDE . Refer to Table 1 and Section 6.2, myMicrochip Secure Documents Extranet (SDE) for additional details on SDE.

TABLE 1: LAN938X FAMILY DOCUMENTATION

Category	Resource	Description	Location
Data Sheet and Errata	<i>LAN9381/2/3/4 Data Sheet</i>	This is a core device data sheet that covers specifications and device operation.	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page
	<i>LAN938x Errata</i>	This document should be consulted by end-system integrators to ensure that the end application is not affected by device errata and follows the necessary mitigations or workarounds.	SDE
Hardware Design Checklist	<i>LAN938x Hardware Design Checklist</i>	This reference provides a checklist of items that should be followed when utilizing the LAN938x switches in a new design.	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page
Application Notes	<i>AN4770 LAN938x Register Definitions Application Note</i>	This application note features a list and description of all the registers in the LAN938x parts. (See Note 1 .)	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page
	<i>AN6008 LAN938x Software Upgrade Process</i>	This document details step-by-step instructions for flashing firmware onto the LAN938x switches.	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page
	<i>AN4050 Access Control List (ACL) for LAN937x and LAN938x Application Note</i>	This application note provides a description and configuration of the Access Control List (ACL) in LAN938x family of parts.	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page
	<i>AN18.15 - PCB Design Guidelines for QFN and DQFN Packages</i>	This document shows how to design a PCB to ensure proper operation of the LAN938x family of switches.	Link to Application Note
	<i>LAN938x Client Library Package</i>	This is the C source code and documentation on how to interface to the LAN938x firmware.	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page
User Guides	<i>LAN938x RTOS User Guide</i>	This manual provides steps on how to interact with LAN938x parts using Ethut-ilEpc.exe (Command Line Interface).	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page
	<i>EVB-LAN9383 Evaluation Board User's Guide</i>	This document is a guide for using the EVB-LAN9383 Evaluation Board. It includes specifications, circuit schematics, and a quick start guide.	LAN9383 Product Page
	<i>LAN938x PTP Stack User Guide</i>	This document is for configuring PTP on LAN938x Switches. It includes both command and application examples.	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page
	<i>LAN938x eRPC Client Library User Guide</i>	This user guide covers the eRPC Client Library's use, build procedure, and API details.	LAN9381 Product Page LAN9382 Product Page LAN9383 Product Page LAN9384 Product Page

Note 1: All the parts in the LAN938x family have the same registers between them.

2: Various versions of the firmware are available on SDE.

TABLE 1: LAN938X FAMILY DOCUMENTATION (CONTINUED)

Category	Resource	Description	Location
Model	LAN9381/2/3/4 IBIS	This is the LAN9381/2/3/4 IBIS Model for Signal Integrity (SI) and timing simulation of the SGMII/RGMII/MII/RMII interfaces.	SDE
Knowledge Base Article	How to Save the Configuration of LAN938x Parts	This article indicates instructions for saving the configuration of the LAN938x switches to the switch's memory.	Microchip Knowledge Base
Software Package	LAN938x Firmware Release Package	This .zip file contains firmware for the LAN938x family of switches and software tools for configuring switches and upgrading firmware. (See Note 2 .)	SDE
Microchip Help Page	Secure Document Extranet User Guide Microchip Technology	This is a guide on how to access the SDE via myMicrochip.	Microchip Support Page

Note 1: All the parts in the LAN938x family have the same registers between them.

2: Various versions of the firmware are available on SDE.

2.0 PRODUCT OVERVIEW

The LAN938x family is composed of Ethernet Switches with SGMII/RGMII/MII/RMII interfaces and integrated PHYs. [Table 2](#) describes the differing feature sets of these devices.

Note: Certain ports perform double duty and support multiple functions. The total number of ports listed is the total number of connections the switch can support at once. Refer to the product data sheet for more details.

TABLE 2: LAN9381/2/3/4 PRODUCT SPECIFICATIONS

Feature	LAN9381	LAN9382	LAN9383	LAN9384
Package	128-TQFP	128-TQFP	128-TQFP	128-TQFP
Total Number of Ports	7	7	7	7
Integrated 100BASE-T1 PHYs	4	4	5	5
100BASE-TX Ports	0	1	0	1
RGMII/RMII/MII Ports	2	1	1	0
SGMII/HSGMII/RGMII/RMII/MII Ports	1	1	1	1
MDIO Support	Yes	Yes	Yes	Yes
JTAG Support	Yes	Yes	Yes	Yes
LED/GPIO Pins	8	10	10	10

3.0 SWITCH CONFIGURATION OPTIONS

The LAN938x switches provide various methods for configuring and operating the devices. The method used is determined by the required features and system availability. There are trade-offs and limitations to each method, and certain features can only be enabled through specific methods.

The four main operation modes are:

1. Pin-Strapping
2. Serial Interface Configuration: UART
3. Ethernet In-Band Access (IBA) Configuration
4. Embedded Processor Configuration

Additional information on switch configuration options can be found in the documentation listed in the [Section 1.2, References](#).

4.0 SOFTWARE GUIDE

4.1 FreeRTOS

The LAN938x contains firmware that can be upgraded securely over the network or via the UART interface. Firmware images are provided by Microchip. The firmware is hosted in the SDE within myMicrochip labeled “LAN938x Firmware Release Package.” This .zip file contains the following:

1. Firmware images for the LAN9381/2/3/4
2. EthutilErpc.exe, a Command Line Interface (CLI) utility for programming switch configurations. (For a more in-depth guide on how to use EthutilErpc.exe, consult the LAN938x RTOS User Guide.)
3. LAN938XProgUtility for flashing firmware images to the switch over UART.
4. chirp_watcher.rb, for flashing firmware to the switches over an Ethernet network. Consult the document, *LAN938x_SW_Upgrade_Process* for more details.
5. Supporting collateral, such as the *LAN938x RTOS User Guide*, *LAN938x PTP Stack User Guide*, and the *LAN938x Software Upgrade Process*.

Note: Several revisions of the LAN938x Firmware exist on the SDE. This is meant to maintain legacy support for customers using specific versions of the software.

5.0 HARDWARE AND EVB GUIDE

The evaluation hardware for the LAN938x switches is the EVB-LAN9383 Evaluation Board, which comes with five 100BASE-T1 ports, one 10BASE-T1S port, one 1000BASE-TX port, and UART headers for direct firmware and register access to the switch. While there are no evaluation boards for other members of the LAN938x part family, the EVB-LAN9383 should be sufficient for development since all parts have the same register configuration and strap resistors. More information can be found in the product data sheet.

5.1 EVB-LAN9383 Evaluation Board

The EVB-LAN9383 Evaluation Board contains five 100BASE-T1 ports and one 10BASE-T1S port with two-wire, screw-down terminal blocks, along with one 1000BASE-TX port with an RJ45 jack. This board can be used as a self-contained switch.

- UART ports on the switch for register access
- JTAG ports

6.0 OVERVIEW OF MICROCHIP COLLATERAL

There are three main collateral repositories for Microchip parts:

1. [Microchip Product Pages](#)
2. [myMicrochip Secure Documents Extranet \(SDE\)](#)
3. [Microchip Knowledge Base Articles](#)

6.1 Microchip Product Pages

Several pieces of support collateral for the LAN938x family of parts can be found on their respective product pages on the Microchip website:

- [LAN9381 | Microchip Technology](#)
- [LAN9382 | Microchip Technology](#)
- [LAN9383 | Microchip Technology](#)
- [LAN9384 | Microchip Technology](#)

Available collaterals include data sheets, critical application notes, links to Evaluation Boards, and directions for ordering parts through Microchip Direct.

6.2 myMicrochip Secure Documents Extranet (SDE)

The [Secure Documents Extranet](#) within myMicrochip is a repository of confidential collateral, such as firmware packages and confidential application notes under NDA. Customers are also notified of any new updates/additions to the repository, tailored to the products they are developing with. For a guide on how to access the SDE, follow the [Secure Documents Extranet Portal User Guide](#).

To finalize a design with the LAN938x family, designers must go into the SDE within myMicrochip to find the *LAN938x Errata* and the *AN4770 LAN938x Register Definitions Application Note*. These documents, along with the corresponding data sheet and *LAN938x Hardware Design Checklist*, are necessary reading materials for developing products and applications with the switch.

6.3 Microchip Knowledge Base Articles

Knowledge Base (KB) articles are available through the [Microchip Knowledge Base \(KB\)](#). This database is searchable and contains pertinent information about all members of the part family as well as other products that Microchip supports.

Articles in the Microchip Knowledge Base typically explain specific topics, contain step-by-step tutorials for device configuration, and provide answers to specific technical questions. Information featured in the articles can be published ahead of official document updates, so the Knowledge Base is an ideal reference for the latest enhancements on Microchip products. [Table 1](#) shows an important Knowledge Base article on the LAN938x.

APPENDIX A: REVISION HISTORY

TABLE A-1: REVISION HISTORY

Revision Level & Date	Section/Figure/Entry	Correction
DS00005827A (02-27-25)	Initial release	

NOTES:

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