Intel® Ethernet Controller I210/I211

Frequently Asked Questions

Networking Division (ND)

December 2016

Revision History

Revision	Date	Comments
1.0	December 8, 2016	**FAQs added or updated:** • Section 2.9, "Does the I210/I211 support Non-Volatile Memory (NVM)-less (EEPROM-less) designs?" (Updated)
0.6	August 5, 2014	**FAQs added or updated:** • Section 2.25, "Why does the I210 not work after EEUPDATE successfully programs the image?" (Updated) • Section 2.38, "I plan to use the I210 as an iSCSI interface or iSCSI boot device. The Datasheet lists EEPROM word 0x1E bit 11 as iSCSI enable. Should I set that bit?" (Added)
0.5	May 2, 2014	Initial public release.

Contents

1.0　　Summary

This document contains a list of Technical and Design Frequently Asked Questions (FAQs) and Sales and Marketing FAQs for the Intel® Ethernet Controllers I210 and I211. It consolidates two separate FAQ lists into one.

1.1　　Product Name

Intel® Ethernet Controller I210

Intel® Ethernet Controller I211

1.2　　Background

The Intel® Ethernet Controller I210 (I210) is a single port, compact, low power component that supports GbE designs. The I210-AT and IT offer a fully-integrated GbE Media Access Control (MAC) and a Physical Layer (PHY) port. The I210-IS offers a fully-integrated MAC and an SGMII/SerDes port that can be connected to a backplane or an external PHY. The I210 also supports PCI Express* [PCIe v2.1 (2.5 GT/s)].

The Intel® Ethernet Controller I211 (I211) is a single port, compact, low power component that supports GbE designs. The I211 offers a fully-integrated GbE MAC, PHY port, and supports PCI Express* [PCIe v2.1 (2.5 GT/s)]. Note that the I211 operates without an external flash memory.

2.0　　Technical and Design FAQ

The intended audience for this section is technical support and design engineers.

Note:　　The following FAQ entries are not listed in any particular order or priority.

2.1　　How do I find all the I210/I211 collateral?

Some collateral is only available on Intel Business Link/ Intel Business Portal (IBL/IBP), which is protected under a Non-Disclosure Agreement (NDA). Other collateral is available to the general public. Contact your Intel Field Representative for access to NDA content.

2.2　　Can any magnetics, RJ-45, or Integrated Connector Module (ICM) be used with the I210/I211?

No. The magnetics module has a critical effect on overall IEEE and emissions conformance. The device should meet the performance required for a design with reasonable margin to allow for manufacturing variation. Occasionally, components that meet basic specifications can cause the system to fail IEEE testing because of interactions with other components or the Printed Circuit Board (PCB) itself. Carefully qualifying new magnetics modules prevents this problem. Refer to the latest "Design Considerations" section of the *Intel® Ethernet Controller I210/I211 Datasheets* for a list of magnetics that have been qualified to work with the I210/I211.

2.3　　Where can I get a recommended Bill of Materials (BOM)?

The I210/I211 Datasheets list the recommended components to use with the I210/I211. The list contracts and expands over time, even after product launch, because some components reach end-of-life and new components are validated.

2.4 What power supplies does the I210/I211 require?

The I210/I211 requires three power rails: 3.3 Vdc, 1.5 Vdc, and 0.9 Vdc. Intel recommends that board designers use the integrated switching voltage regulators derived from a single 3.3 Vdc supply to reduce BOM costs. A central power supply can provide the required voltage sources designed by a system power engineer. If the LAN wake capability is used, all voltages must remain present during system power down. External voltage regulators need to generate the proper voltage, supply current requirements (with adequate margin), and provide the proper power sequencing. Refer to the "Power Supplies" section in the I210/I211 Datasheets for additional information.

2.5 Do the I210/I211 have start-up and shut-down power rail requirements?

Designs must comply with power sequencing requirements to avoid latch-up and forward-biased internal diodes. Refer to the I210/I211 Datasheets for more information.

2.6 Is the I210/I211 backward-compatible with other Ethernet controllers?

Intel makes every effort to keep things as simple as possible from a design migration perspective when providing a follow-on Ethernet controller, while providing our customers the richest feature set possible. The I210 adds Integrated Switching Voltage Regulators (iSVR), JTAG, NC-SI hardware arbitration, and four Software Definable Pins (SDPs) from previous Intel Ethernet controllers. The I211 adds Integrated Non-Volatile Memory (iNVM), an iSVR, and four SDPs. Due to this added functionality, exact pin compatibility with previous generations could not be maintained. *The Intel® Ethernet Controllers 82574/82583 to I210/I211 Design Guide* explains what is required for a dual 82574/82583-to-I210/I211 design, but we do not recommend this option.

2.7 Does Intel provide design review support?

Yes. The Intel Networking Division (ND) Platform Application Engineer (PAE) group can provide schematic and Computer Aided Design (CAD) layout support (the layout file needs to be in the Cadence file format). Submit your design review request through Intel Premier Support (IPS) against the I210/I211 product. Intel requires that the relevant checklist has been filled out by the design engineer and is submitted with the schematic and/or layout file (contact your Intel representative for access to the checklist). This enables many design errors to be caught very early in the design process, and greatly speeds up the turnaround time on the ND review. Once a PAE resource has been assigned the review, expect one week for schematic review feedback, and two weeks for layout review feedback.

2.8 Does I210-IS support backplane applications?

Yes. The I210-IS has an interface that can support backplane applications.

2.9 Does the I210/I211 support Non-Volatile Memory (NVM)-less (EEPROM-less) designs?

The I211 is designed to work without an attached flash memory.

The I210 is designed to use an external flash memory, but can be used without one with very limited features. For example, no management interface or autonomous external PHY control via MDIO or I^2C is available without flash memory.

2.10 Does the I210 need to be reset after updating bits in the flash memory or upgrading to a completely new flash memory?

Firmware updates are now automatically followed by a firmware reset, which means the following flash memory words and section are the only ones requiring an AC power cycle:

- Flash Device Size (FL_SIZE only) – word 0x11
- CSR Auto Configuration Power-Up LAN – module pointed by word 0x27

If updating data in these sections, the power cord should be removed for ~20 seconds and a cold reboot needs to occur to reset the I210 and re-read the external flash memory contents into its internal registers.

2.11 What speeds do the I210/I211 support?

The I210 and I211 support the following speeds:

- 1 GbE
- 100 Mb/s
- 10 Mb/s

All three speeds are supported in copper and SGMII mode. SerDes modes only support GbE.

2.12 Is Management Component Transport Protocol (MCTP) supported?

The I210 supports MCTP in the following combinations:

- MCTP over SMBus/I^{2}C Binding
- MCTP over PCIe VDM Binding
- NC-SI over MCTP

2.13 What are the PCI Device IDs for the I210/I211?

- I210-AT – 0x1531 (hardware default, indicating an un-programmed device)
- I211-AT – 0x1532 (hardware default, indicating an un-programmed device)
- I210-AT – 0x1533
- I210-IS/AS - 0x1536 SERDES Fiber
- I210-IS/AS - 0x1537 SERDES Backplane (KX, BX)
- I210-IS/AS - 0x1538 SGMII (external PHY controlled via MDIO or I^{2}C)
- I211-AT – 0x1539
- I210-IS/AS – 0x157C using iNVM (no flash memory)
- I210-AT – 0x157B using iNVM (no flash memory)

2.14 What file should I use to program the I210 or I211?

The image files are available on the Intel Business Link in document 513655. When programming the flash memory on an I210, you should always use the binary (.bin) file. When programming the iNVM on an I210 or I211, you should use the appropriate text file.

2.15 What tools do I use to program the I210/I211?

The tools for supporting these products are available on IBL in document number 348742. EEUPDATE is used to program the flash memory or iNVM in production environments. LANConf is designed for test and development purposes, but can also be used to program the flash memory or iNVM.

2.16 What NVM image should I select for the I210?

The production images archive (document 513655) contains a list of images and their features. The SGMII image is intended for use with the I210-IS when interfacing with an external SGMII PHY and controlling it via the I^{2}C or MDIO interface. When connecting to an SGMII switch, use the appropriate KX image.

2.17 Does the Intel device driver support the 1588 protocol standard?

Yes. The I210 supports IEEE 1588/802.1AS precision time synchronization.

2.18 Do the I210 or I211 support pre-boot?

The I210 supports PXE, iSCSI boot, and UEFI. A SMASH-CLP agent expansion ROM is also available for instances where the iSCSI boot and PXE expansion ROMs are stored in the I210 local flash memory.

The I211 only supports PXE, only by storing the expansion ROM in system/BIOS flash memory, and only operating with default settings.

2.19 Where does the pre-boot (PXE, iSCSI, UEFI) Option ROM code reside?

The available expansion ROMs can be stored in the local flash memory for NIC designs, or in the system/BIOS flash memory for LOM designs. When storing the expansion ROMs in the local flash memory, a minimum flash memory component size of 16 Mb is required.

Also, note that PXE is only supported for the I211 by storing the PXE code in the system BIOS flash memory.

The tools for displaying and configuring the pre-boot firmware are available on downloadcenter.intel.com in the archive Preboot.exe. The tools for BIOS developers to use to create images for inclusion in a BIOS are available in documents 387754 (for PXE) and 388381 (for iSCSI boot) on the Intel Business Link.

2.20 Does the I210 and I211 support WoL?

Yes. However, the complete WoL solution is complex, and the system design engineer needs to assure all platform stack ingredients (BIOS, power delivery, software, NVM) interacting with the I210 or I211 are implemented correctly.

2.21　Can the Subsystem PCI ID be changed in the I210/I211?

Yes. The device, sub-device, and sub-vendor ID's can be changed. The device ID is a protected field and cannot be changed without loading a new signed image with a different ID.

2.22　Does the I210 support 100BASE-FX?

The I210 does not support 100BASE-FX natively. It is supported through SGMII with Intel's software device driver. It requires an external PHY like the Marvell* 88E1112. The 88E112 could be embedded into an SFP module that supports 100BASE-FX.

This solution could be:

> The I210 in SGMII mode <-> Marvell 88e112 <-> SFP cage.

2.23　How does the security feature of the I210 work?

When the I210 is initializing, it checks for the presence of a flash memory component. If a flash memory component is present, it checks for a valid digital signature. If either of these conditions is false, the I210 reverts to the internal iNVM. If the internal iNVM is not programmed, the I210 assumes all hardware defaults, including a PCI ID of 0x1531. This may also happen if the flash memory is not ready at the time that the I210 initializes, so it is important that the flash memory component be powered from the same source as the I210.

The NVM firmware images for the I210 are signed. Once the I210 successfully initializes with a signed firmware image, security is enforced (unless security is disabled by pulling down pin 12) and the image cannot be overwritten except a by a new signed image that has the same or higher security revision.

Pin 12 on the I210 is designated for the purpose of overriding the security feature. To override the security when it is in effect, a pull down resistor can be applied to that pin. This pin is sampled during initialization to determine if security is disabled.

Not all fields in the image are protected. Fields that are normally subject to change by the OEM, such as the MAC address, PCI subsystem ID fields and LED customizations, can be changed without invalidating the digital signature.

The I210 can potentially be used without an external flash memory (with significant limitations) by using the iNVM instead. In that case, it operates the same as an I211. Refer to Section 2.24 for a description of the I211 security feature.

2.24　How does the security feature of the I211 work?

The I211 has a lock-out mechanism after the iNVM is programmed to prevent any tampering/retry of the iNVM programming. It is activated by writing a special iNVM word auto-load structure, iNVM word address 0xA, bit 15 is set to 1b. The lock-out is active as long as the pin 12 (SECURITY-EN) strapping option is enabled (pulled up, not down). For details, refer to Section 3.2 in the *Intel® Ethernet Controller I211 Datasheet*.

2.25　Why does the I210 not work after EEUPDATE successfully programs the image?

When EEUPDATE stores the new image in an un-programmed flash, it is not active until a power cycle forces the new image to be loaded into shadow RAM in the controller. Until a power cycle occurs, EEUPDATE functions like /verify, and /mac_dump will not work correctly. Once an I210 is programmed and running with a valid image, updates can be performed with only a system reboot with some exceptions (refer to Section 2.10).

2.26 I am trying to setup AVB on my system. How can I do it?

Intel provides the following resources to get AVB up and running on your system:

- The I210 with AVB support included on a validation adapter (NIC) – limited availability
- IEEE 802.1Qav Traffic shaper (w/SW extensions)
- IEEE1588/802.1AS Precision Time Stamping
- Time based transmission
- Linux Reference Driver (IGB driver modified)
- FreeBSD Reference Code (GPL free driver)
- *Intel® Ethernet Controller I210 [Springville]– Traffic Shaping and Time Synchronization Technical Brief* (Document ID: 496740)

This document describes the various features supported by the Intel I210 LAN controller to enable solutions to participate in time synchronization protocols and controls for transmission timing and scheduling within the Intel I210 LAN controller.

Please consult these items and contact us if you need further support.

The Ecosystem will need to provide:

- Protocol Stack that formats the packets in the Media Protocol stack format (as defined per IEEE 802.1BA). This stack typically runs in user mode (this is the heavy lifting, and is the secret sauce for vendors to generate revenue).
- Application to take advantage of the protocol stack.

2.27 Does the I210 support IPMI?

The I210 does not inherently support IPMI itself, but rather it supports the ability to send and receive Ethernet traffic that could be IPMI to and from a management controller. Since IPMI is such a common traffic type for a management controller, we have added specific filters to the I210 (and all other server controllers) to make filter configuration easier. However, the BMC could just as easily create filters for only FTP or HTTP traffic. We provide a highly-configurable filtering mechanism which the management controller can use to configure the type of Ethernet traffic it needs to receive, ranging from all traffic to only a specific type.

2.28 The layout guidelines describe the advantages of 85 Ω design vs. 100 Ω design for the differential traces (PCIe). But for SerDes, 100 Ω impedance is recommended. Are the same benefits not also valid for SerDes?

PCIe Gen1 is 100 Ω, PCIe Gen2 is 85 Ω, and SerDes is 100 Ω impedance ONLY. The I210 is recommended to use 85 Ω for PCIe signals.

2.29 Is there a way to monitor the GMII interface (between MAC and PHY) on the I210?

The GMII is not exposed in the I210.

For external PHY use SerDes SKU and configure to use SGMII with SGMII capable PHY such as a Marvell 88e1112. Be advised, ND has not been able to inter-operate with BRCM SGMII PHY so far.

2.30 Since SGMII is configurable, can the I210 be a MAC, and the other end a PHY, or vice versa?

In SGMII mode, the I210 is always a MAC and is never an SGMII PHY.

2.31 What are the I210 SMBus slave addresses?

The SMBus slave address is configured in the NVM. The 7-bit address in the images supplied by Intel is 0x49.

For additional details, refer to the NVM settings in Section 6.7.3.4, "SMBus Slave Addresses — Offset 0x03" in the *Intel® Ethernet Controller I210 Datasheet*.

2.32 How do I interpret the chip markings on my I210 or I211?

Refer to the "Marking Diagram" section in the associated Specification Update document.

2.33 Why is the Sample Validation Kit (SVK) not being updated?

When Intel ND products are production-ready, the SVK ingredients are delivered to different customer downloadable locations, thus the SVK process terminates. The software tools and NVM images continue to be available on IBL/IBP as separate deliverables and the software drivers are available to the public at the Intel Download Center.

2.34 Where do I find the latest software drivers for the I210 or I211?

Intel Download Center. The software drivers linked from this page are generic versions, and can be used for general purposes. However, OEMs might have altered the features, incorporated customizations, or made other changes to the software or software packaging they provide. To avoid any potential installation incompatibilities on your OEM system, Intel recommends that you check with your OEM and use the software provided via your system manufacturer. Intel or the OEM might not provide technical support for some or all issues that could arise from the usage of this generic version of software drivers.

2.35 Do the I210 and I211 support PCIe Spread Spectrum Clocking (SSC)?

Yes. Both devices support PCIe SSC.

2.36 Where can I get technical support?

Technical support is provided by the computer vendor. You can use the following links for Intel® Desktop Board and Intel® Server Board to find support information:

- Intel® Desktop Board support
- Intel® Server Board support

Intel develops network components used in motherboards and network adapters sold by OEMs such as Dell*, HP*, Gateway*, and IBM*. Network controllers that are built into the motherboard or network adapters sold by an OEM are supported by the OEM. Intel does not provide support for OEM integrated network controllers or OEM adapters.

2.37 Where can I find product briefs, Datasheets, application notes, design guides, and other resources for developers?

You can use the following link for product information on Intel® Ethernet Controllers:

- Product information on Intel® Ethernet Controllers

Intel offers a complete line of industry-leading, single- and multi-port 10 GbE, 1 GbE, and fast Ethernet LAN controllers with integrated MAC and PHY, providing high performance, low power consumption, and a smaller footprint. Offering 10 GbE, 1 GbE, and 100 Mb/s LAN controllers, PCIe, PCI, PCI-X, or LCI bus interfaces, in 16-, 32- or 64-bit architectures, Intel produces Ethernet LAN controllers that enable faster, smaller, and simpler designs.

2.38 I plan to use the I210 as an iSCSI interface or iSCSI boot device. The Datasheet lists EEPROM word 0x1E bit 11 as iSCSI enable. Should I set that bit?

No. The class code should be left as LAN controller (word 0x1E bit 11 = 0b). The iSCSI boot firmware and / or the iSCSI software client will emulate an iSCSI host bus adapter and provide the necessary support.

3.0 Sales and Marketing FAQ

The intended audience for this section sales, marketing, and management.

Note: The following FAQ entries are not listed in any particular order or priority.

3.1 When did the Intel® Ethernet Controller I210/I211 launch?

The I210/I211 products launched in November 2012.

3.2 How can I purchase the Intel® Ethernet Controller I210 or I211?

Orders should be placed with an Intel® Authorized Distributor or through your Intel contact.

Ordering information can be found in the *Intel® Ethernet Controller I210 Specification Update* or the *Intel® Ethernet Controller I211 Specification Update*.

3.3 What is the product name?

The products are marketed as:

- Intel® Ethernet Controller I210 Family
- Intel® Ethernet Controller I211-AT.

Note: 1 GbE wording is not used in the product name since the Roman numeral "I" already denotes the 1 GbE speed.

3.4   Why did the naming convention change?

The Intel® Ethernet Controllers I210/I211 follow the new product naming convention that ND products are using going forward. The new naming convention makes it easier to tell what type of product it is. The "I" is the Roman numeral for 1 denoting 1 GbE speed. Likewise, if the first letter is a Roman numeral "X", it is a 10 GbE product. The next number is the series and then the version of the product. The I210/I211 are the follow-on product and feature set in the 200 series of products. The Intel® 82574 and 82583 1 GbE Ethernet Controllers use the old naming.

3.5   Is there an EDK and Collateral List for the I210/I211?

Yes, the link to the collateral list is:

Networking and Comms Ethernet: Intel® Ethernet Controller I210_I211 (Springville_Pearsonville)

The EDK is at:

Ethernet: Gigabit Ethernet Controller

3.6   What is the price of the I210/I211?

Please contact your authorized Intel distributor for pricing for the Intel® Ethernet Controller I210 Family and Intel® Ethernet Controller I211-AT.

3.7   Does the I210/I211 support Energy Efficient Ethernet (EEE)?

Yes.

3.8   Does the I210/I211 support any offloads?

Yes. The I210/I211 supports Intel's stateless offload technologies such as TCP/UDP IPv4 and IPv6 Checksum offloads, Transmit Segmentation Offloads, intelligent interrupt moderation, and RSS (Receive Side Scaling). These intelligent offloads take advantage of new processor architectures and efficiencies to provide exceptional performance.

3.9   What virtualization technologies does the I210/I211 support?

The I210/I211 supports virtualization environments in software. Customers requiring high performance virtualization should consider using the Intel® Ethernet Controller I350 family of 1 GbE controllers or Intel® Ethernet Controller X540/Intel® 82599 10 Gigabit Ethernet controllers for higher performance.

3.10   What management interfaces are on the I210?

The I210 supports SMBus and NC-SI interfaces with Operating System to Baseboard Management Controller (OS2BMC), MCTP and WoL support.

The I211 does not support management.

3.11 What is the OS2BMC feature on the I210?

Previously, server management software has to implement a local communication method (using chipset-based registers) to interact with the local Management Controller (MC) of the platform. Intel has added a filtering method to enable the server management software to communicate with the MC via the networking interface (using standard network protocols – such as TCP/IP) rather than a chipset-specific interface.

The I211 does not support OS2BMC.

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