# White Paper

# Axiomtek's Embedded Boards and Systems-on-Module

# with Intel® Apollo Lake Platform

## Apollo Lake - Intel's System-on-Chip (SoC) of the next generation – a processor successive after the Braswell product line

Intel® Apollo Lake platform, a successor to the Bay Trail and Braswell family, is a low-power SoC of the next generation for devices over the Internet of Things. The revamped line features Goldmont cores, 14nm process technology and Gen9 graphics core, bringing much better performance and much higher graphics capability with significantly lower power consumption.

The new line has two segments: the Apollo Lake-M and the Apollo Lake-I. The Apollo Lake-M is now known as the Intel® Pentium® processor N4200 and Celeron® processor N3350 for mobile computing devices. The Apollo Lake-I, which consists of the Intel® Atom™ x7-E39xx and x5-E39xx processors, supporting wide-temperature, is ideal for small form factor entry-level computer and intelligent digital display. Some of the key differences among five Apollo Lake processors for embedded applications are shown in [Table 1] below.

| | Celeron® N3350 | Pentium® N4200 | Atom™ x7-E3950 | Atom™ x5-E3940 | Atom™ x5-E3930 |
|---|---|---|---|---|---|
| **TDP (TeleData Processing)** | 6 W | 6 W | 12 W | 9.5 W | 6.5 W |
| **Cores** | 2 | 4 | 4 | 4 | 2 |
| **Base Frequency** | 1.10 GHz | 1.10 GHz | 1.60 GHz | 1.60 GHz | 1.30 GHz |
| **Burst Frequency** | 2.40 GHz | 2.50 GHz | 2.00 GHz | 1.80 GHz | 1.80 GHz |
| **Cache** | 2MB L2 | 2 MB L2 | 2 MB L2 | 2 MB L2 | 2MB L2 |
| **Graphics Base Frequency** | 200 MHz | 200 MHz | 500 MHz | 400 MHz | 400 MHz |
| **Graphics Burst Frequency** | 650 MHz | 750 MHz | 650 MHz | 600 MHz | 550 MHz |

Table 1

# Benefits

Intel® 14nm process technology brings value and efficiency to everyday computing with essential features including battery saving, improved memory performance, faster graphics performance, and improved I/O capacity.

- **Battery Saving**

  In addition to a 30 percent performance boost for CPU, Intel has also made Apollo Lake thoroughly efficient and 15% increase in battery life.

- **Improved Memory Performance**

  Intel® Apollo Lake platform features improved memory performance by supporting LPDDR4 RAM with up to 2400 MT/s. Compared to LPDDR3 and DDR3L RAM - both performing at 1867 MT/s - LPDDR4 RAM delivers approximately 30% improvement in memory performance and roughly 18.5% reduction in operating voltage down to 1.10 V instead of at 1.35 V.

  The maximum memory bandwidth is also improved from 25.6 GB/s to 38.4 GB/s - an increase of 50%. The 16GB of maximum capacity is significantly relative to the Braswell. Besides, Intel® Apollo Lake now supports dual-channel error correction code (ECC), a critical requirement for safety applications that demand single failure tolerance.

- **Fast Graphics Performance**

  The new Intel® Gen9 graphics engine integrated on the SoC provides up to 18 execution units and supports up to 4k decode and encode capabilities for HEVC4, H.264, VP8, SVC and MVC. The Graphics performance is estimated to be three times higher in contrast to the Bay Trail (see Figure 1).

## Apollo Lake 3D Graphics Performance Estimates[†]
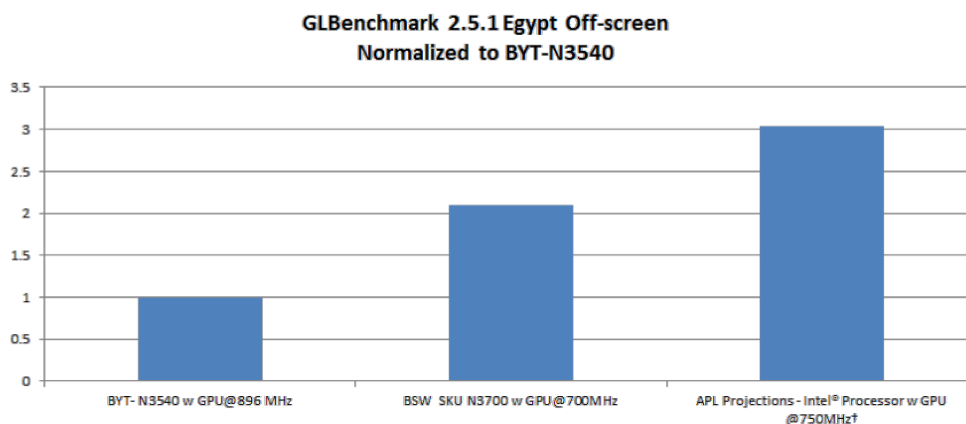


Figure 1 (Source: Intel®)

- **Improved I/O Capability**

The new-generation processor now supports six PCIe 2.0 lanes, up from four lanes with Braswell. Thanks to the new support for eMMC 5.0/5.1 standards, bandwidth is doubled to 3.2 Gbit/s (read) compared to eMMC 4.0 for shorter boot times and faster data load. New features also include support of two SATA-600, five USB 3.0, and two USB 2.0.

## Related Products

- **MANO310**

The MANO310, a Mini-ITX motherboard based on 14nm Intel® Celeron® processor N3350 (codename: Apollo Lake), supports up to 8GB of DDR3L-1600 RAM via a pair of 204-pin SO-DIMM sockets, and offers SATA-600 and M.2 SSD connections. Furthermore, it comes with one PCIe x1 slot, one PCI Express Mini Card slot and one SIM slot for enhanced functionality. The MANO310 takes advantage of the latest Intel® Apollo Lake platform to provide customers with advantageous energy-saving and cost-effective solutions. The brand-new Mini-ITX motherboard MANO310 is an ideal solution for gaming, digital signage, medical and IIoT-related applications.



**MANO310**

A Mini-ITX single-board-computer (SBC) with Intel® Celeron® processor N3350, VGA/HDMI/LVDS, USB 3.0, PCI Express Mini Card, M.2, PCIe x1, and HD Audio

- **PICO312**

The PICO312, a palm-sized fanless pico-ITX motherboard built with the latest 14 nm Intel® Pentium® processor N4200 or Celeron® processor N3350 (codename: Apollo Lake), supports one 204-pin DDR3L SO-DIMM socket with system memory up to 8GB The tiny 2.5" pico-ITX embedded board features Intel® Gen9 graphics engine bringing a true high definition visual experience with dual display configurations through one LVDS and choice of a VGA or HDMI. In addition, it was designed for special needs of fanless operation under wide industrial temperature from -20°C to +70°C. Its compact size also suits the PICO312 to various space-constrained embedded applications. The PICO312 is excellent for any media editing, imaging, graphics and video intensive applications popular in IIoT industries.



**PICO312**

A Pico-ITX SBC with Intel® Pentium® processor N4200, Celeron® processor N3350, and HDMI (VGA)/LVDS

- **CEM313**

The CEM313, a new COM Express Type 6 compact module based on the latest 14nm Intel® Pentium® processor N4200 and Celeron® processor N3350 (codename: Apollo Lake), is designed to deliver higher industry-leading performance, better power consumption, and lower cost per transistor. The system-on-module adopts two onboard 204-pin DDR3L-1600 SO-DIMM slots with a maximum system memory of 16GB and an optional eMMC flash up to 64GB. Integrated with Intel® Gen9 graphics engine, the module provides excellent graphic effects by supporting DX12.0, OCL 2.0 and OGL 4.3 with resolution up to 4K (3840 x 2160 @ 30 Hz). Also coming with advantages in low power consumption, wide temperature range, and seismic design, the CEM313 is definitely an excellent solution for industrial automatic system, medical imaging, digital signage, gaming machine, networking, just to name a few.



**CEM313**

A COM Express Type 6 Compact Module with Intel® Pentium® processor N4200 or Celeron® processor N3350

## About Axiomtek

As one of the world's leading designers and manufacturers of PC-based industrial computer products, Axiomtek specializes in data acquisitions and control systems of rich diversity and modularization. With the upmost enthusiasm in serving their customers, Axiomtek has mirrored PC evolutions in various industries by shifting its focus toward the design and manufacture of PC-based industrial automation solutions, standing as a trustworthy long-term provider of industrial computers.

Established in 1990, Axiomtek has partnered with more than 60 distributors globally, offering more than 400 products through product lines of Industrial PCs (IPCs), Single Board Computers (SBCs), System on Modules (SoMs), Fanless and Rugged Embedded Systems (eBOX and rBOX), Intelligent Transportation Systems (tBOX), Industrial IoT Gateway, Industrial Firewall, Touch Panel Computers (TPCs), Medical Panel Computers (MPCs), Digital Signage Solutions (DSSs), Network Appliances (NAs) and Industrial Ethernet products.

As an associate member of the Intel® Internet of Things Solutions Alliance, Axiomtek continuously develops and delivers cutting edge solutions based on the latest Intel® platforms.