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Renesas Technology to Release SH7777 (SH-NaviJ3) SoC for Dashboard-mounted Car Navigation and Infotainment Systems Offering Enhanced Audio and Video Functions

—OpenGL® ES1.1, the industry-standard programming interface for graphics processing, is supported, allowing sophisticated and flexible 3-D graphics applications to be developed in less time—

SAN JOSE, Calif. — October 27, 2009 — Renesas Technology America, Inc., today announced the SH7777 (SH-NaviJ3), the third product in the SH-NaviJ Series of system-on-chip (SoC) devices for compact portable navigation and infotainment systems and low- and mid-priced dashboard-mounted car navigation and infotainment systems. It speeds up development through OpenGL® ES1.1*[1] support and offers enhanced multimedia functions such as terrestrial digital TV broadcast support. The SH7777 (SH-NaviJ3) makes it possible for developers to create AV navigation and infotainment systems that combine low cost and compact size in less time. Sample shipments began in Japan on October 8, 2009.

The SH-NaviJ Series comprises compact, single-chip SoC devices that provide map rendering functions and high quality based on the SH-Navi series, which are already used in a variety of high-end systems, while offering a carefully chosen selection of functions suitable for low-end to midrange systems. The new SH7777 (SH-NaviJ3) offers the following enhancements over its predecessors.

(1) Sophisticated and flexible 3-D graphics applications to be developed in less time with OpenGL® ES1.1

The new product incorporates a more powerful version of the graphics processor, with 2-D and 3-D rendering support included from the earlier SH-NaviJ1 and SH-NaviJ2, while also implementing support for OpenGL® ES1.1, the industry-standard programming interface for graphics processing in embedded devices. This enables 3-D graphics software development that previously required the use of a development board to be performed on a PC. The graphics processor supports high-level image display, such as rendering a variety of 3-D objects on a map or implementing a graphical user interface*[2] (GUI) with very detailed and realistic looking 3-D elements. Support for OpenGL® ES1.1 greatly simplifies and speeds up development of the necessary software.

(2) High-performance, low-power multi-codec video processing IP

To fully meet the requirements of today's AV navigation and infotainment systems, the SH7777 (SH-NaviJ3) incorporates high-performance multi-codec video processing IP with support for the H.264/MPEG-4 AVC (H.264) video compression standard used in ISDB-T*[3] terrestrial digital broadcasts for mobile phones and other devices. This IP employs technologies and skills based on the SH-Mobile series of application processors for mobile phone systems and delivers encoding and decoding performance of 30 frames per second (fps) in VGA format (640×480 pixels), supports MPEG-4 encoding and decoding as well as VC-1 decoding, and can be used for a wide variety of video application functions. In addition, it supports terrestrial digital broadcast formats used overseas, such as DVB-H*[4] (Europe) and DMB*[5] (South Korea). This reduces the number of external components or software processing load required to build an AV navigation and infotainment system, lowering the system cost and shortening the development time. Finally, the SH7777 (SH-NaviJ3) is the same size (21 mm × 21 mm) as its predecessor, the second product in the SH-NaviJ Series, which contributes to compact system design.

(3) Numerous high-performance on-chip peripheral functions to support multimedia applications

For audio processing, the SH7777 (SH-NaviJ3) integrates a 24-bit dedicated audio DSP with support for a variety of compression formats, including AAC (Advanced Audio Coding), MP3, and WMA (Windows Media Audio).*[6] This 24-bit dedicated audio DSP also processes the AAC Plus (Advanced Audio Coding Plus)*[7] audio compression format used by terrestrial digital broadcasts. Performing this processing in hardware rather than in software, as was previously the case, reduces the processing load on the CPU by the equivalent of about 50 MHz according to comparisons done by Renesas Technology. This makes it possible to further reduce the power consumption of the CPU. There is also a built-in edge-emphasis function for high quality display of terrestrial digital broadcasts. It prevents blurring when QVGA-format (320×240 pixels) video is enlarged to VGA or WVGA (832×496 pixels) size. Other on-chip peripheral modules essential to car navigation and infotainment systems include a GPS*[8] baseband processor module, a TS interface for receiving terrestrial digital broadcasts, and CAN*[9] and MOST*[10] interfaces for a vehicle LAN. This large number of high-performance peripheral functions reduces the number of components required by the system, making it possible to reduce the overall cost while achieving excellent performance.

Additionally, a wide variety of middleware resources are available for the SH7777 (SH-NaviJ3), including video middleware supporting H.264, MPEG-4, and WMV*[6], and audio middleware supporting MP3, WMA and AAC Plus (Advanced Audio Coding Plus).

(4) Two-screen display support for implementing a wide range of applications

The SH7777 (SH-NaviJ3) supports two-screen display. For example, two screens of WVGA graphics images can be displayed at the same time. (When a single screen is used, the maximum display size is WXGA [1,280 × 768 pixels].) This enables, as an example, one screen to be used by the car navigation and infotainment system and a second screen to be used as a rear monitor for the backseat passengers. The range of possible applications expands enormously. Of the two input-output signal systems, one can be used to generate 24-bit color digital RGB output, enabling the display of subtle color gradations.

< **Product Background** >

Demand is expected to grow in the years ahead for low- and mid-priced car navigation and infotainment systems, such as compact “memory navigation” systems that employ flash memory to store map data and are suitable as dashboard-mounted car navigation systems for compact cars. At the same time, increasing demand for improved functionality and flexibility has led manufacturers of car navigation and infotainment systems to develop low-end and midrange products in parallel with the development of their high-end products, and the pace of this development work is speeding up. As a result, there is strong demand for SoC products that integrate on a single chip the key functions needed in a high-performance and compact car navigation and infotainment system, while also providing connectivity with storage devices such as flash memory cards and USB drives. Another important priority is increasing development efficiency by making effective use of software resources originally developed for high-end products. In response to these requirements, Renesas Technology launched the SH-NaviJ Series in 2008. These compact single-chip devices retain the sophisticated map rendering functions and high quality of the SH-Navi Series*[11] of SoCs for high-end systems and offer a carefully chosen selection of functions suitable for low-end to midrange products such as dashboard-mounted car navigation and infotainment systems.

In addition, dashboard-mounted car navigation systems and simple car navigation systems such as personal navigation devices (PNDs) are increasingly being equipped with the ability to receive terrestrial digital TV broadcasts, and this trend is expected to grow in the future. In response to the strong demand for support for such AV navigation and infotainment systems with digital TV broadcast playback capability, Renesas Technology has integrated into the SH-NaviJ Series intellectual property (IP) developed for the popular SH-Mobile Series of application processors for mobile phone systems. The result is the SH7777 (SH-NaviJ3) with enhanced multimedia functions.

< Product Details >

Like the previous products in the SH-Navi Series, the SH7777 is built around the SH-4A, the most powerful CPU core in the SuperH*[12] Family. At the maximum operating frequency of 533 MHz, CPU processing performance is 960 MIPS and floating-point processing unit (FPU) processing performance is 3.73 GFLOPS (giga [billion] floating-point operations per second). This ample processing power enables developers to build systems delivering high performance. The instruction set is upward-compatible with the SH-4, so programs developed for existing systems using the SH-4 can be reused. This contributes to a shorter system development time.

As with the SH77721 and SH77722, which preceded it in the SH-Navi Series, the SH7777 has an on-chip 2-D/3-D graphics processor with sophisticated rendering functions. In addition to 2-D rendering functions such as thick line rendering and anti-aliasing, it realized more spatial and real 3-D rendering by enhancing a variety of 3-D rendering functions such as triangle 3-D rendering and texture mapping, making means of expression like multi-texture, etc., possible.

In this way, a highly expressive GUI combining 2-D content such as maps, icons, and menus can be combined with 3-D content such as buildings or landmarks superimposed on the maps, using a single rendering processor. To extract the maximum performance from the graphics processor, high-performance 3-D and 2-D graphics libraries are provided. The 3-D graphics library supports OpenGL® ES1.1, the industry standard, for maximum convenience in making use of the rendering functions supported by the graphics processor. The 2-D graphics library complies with the GDI-Sub*[13] specification, which supports Windows® Automotive*[14] 5.0 Service Pack 2, from Microsoft Corporation.

A unified memory architecture is also used that enables modules to share the same memory, thereby reducing the need for external memory. The external buses provided are a 32-bit dedicated bus for connection of high-speed DDR2-SDRAM and a 16-bit expansion bus for connection of flash memory or SRAM.

The E10A-USB emulator, which connects to a host PC via a USB interface, is available as a development tool. There is also an on-chip debugging function that supports real-time debugging at the SoC's maximum operating frequency.

Renesas Technology will also prepare a reference platform for system development, according to order, that will offer the following features.

- Peripheral circuits, typical of vehicle information terminals, will be incorporated to provide a realistic verification environment for developers
- Ability to be used as a development tool for software applications
- Additional custom functions can be added by developers

The platform can be used to evaluate the functions of the SH-NaviJ3, to develop software applications, and for other tasks related to efficient system development.

Renesas Technology will continue to develop a range of SoC products for dashboard-mounted car navigation and infotainment systems that provide increased performance with multi-core products and superior functions for high-end systems and optimized performance and functions for low-end and midrange systems. In this way, the company hopes to respond to the evolving demands of the market in a timely manner.

< Notes >

1. OpenGL® ES: OpenGL is a programming interface for 3-D graphics processing developed principally by Silicon Graphics Inc. of the United States. Its outstanding feature is its cross-platform compatibility. OpenGL ES is an API that corresponds to a subset of OpenGL and is designed for embedded devices. The OpenGL specification was codified and is being promoted by the Khronos Group.

   OpenGL is a registered trademark of Silicon Graphics Inc. of the United States.
2. Graphical user interface (GUI): A user interface in which the information is graphically displayed and can be operated intuitively by pointing devices and the like.
3. ISDB-T (Integrated Services Digital Broadcasting – Terrestrial): A terrestrial digital broadcasting standard developed in Japan. Broadcasting for mobile devices such as mobile phones uses only one of the 13 ISDB-T segments, and is therefore known as one-segment (or OneSeg) broadcasting.
4. DVB-H (Digital Video Broadcasting for Handhelds): A mobile device version of the Digital Video Broadcast (DVB) standard developed in Europe.
5. DMB (Digital Multimedia Broadcasting): A digital TV broadcasting standard for mobile devices developed in South Korea. There are two versions: Terrestrial DMB (T-DMB) and Satellite DMB (S-DMB).
6. Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
7. AAC Plus (Advanced Audio Coding Plus) was developed by Dolby Sweden AB.
8. GPS is an abbreviation of "Global Positioning System."
9. CAN is an abbreviation of "Controller Area Network," an automobile network specification proposed by Robert Bosch Gmbh of Germany.
10. MOST: Media-oriented Systems Transport

11. SH-Navi Series: SoCs for car information systems such as car navigation, using a Renesas Technology 32-bit RISC CPU core SuperH. Three products are currently in mass production, including the SH7774 featuring an on-chip image recognition engine. In addition, Renesas also released a dual-core SoC product
12. SuperH™ is a trademark of Renesas Technology Corp.
13. GDI-Sub: A graphic framework exclusive to Windows Automotive that provides call instruction compatibility with the GDI (Graphics Device Interface). It is designed specifically for high-speed rendering of GUI and map elements and is optimized to extract the maximum performance from the graphics chip.
14. Windows® Automotive is an embedded operating system for car information terminals developed by Microsoft Corporation.

*Other product names, company names, and brands mentioned are the property of their respective owners.

< Typical Applications >

- Car information terminals: Low-end to midrange car navigation and infotainment systems, etc.

About Renesas Technology Corp.
Renesas Technology Corp. is the world's No.1 supplier of microcontrollers and one of the world's leading semiconductor system solutions providers for mobile, automotive and PC/AV (Audio Visual) markets. It is also a leading provider of Power MOSFETs, Smart Card microcontrollers, RF-ICs, High Power Amplifiers, Mixed Signal ICs, System-on-Chip (SoC), System-in-Package (SiP) and more. Established in 2003 as a joint venture between Hitachi, Ltd. (TSE:6501, NYSE:HIT) and Mitsubishi Electric Corporation (TSE:6503), Renesas Technology achieved consolidated revenue of 702.7 billion JPY in FY2008 (end of March 2009). Renesas Technology is based in Tokyo, Japan and has a global network of manufacturing, design and sales operations in 16 countries with 25,000 employees worldwide. For further information, please visit http://www.renesas.com

< **Specifications** >

Item	**SH7777 (SH-NaviJ3) Specifications**
Product name	R8A77770DA01BG
Power supply voltage	1.15 V to 1.3 V (internal)/3.3 V, 1.8 V (external)
Max. operating frequency	533 MHz
Processing performance	960 MIPS, 3.73 GFLOPS
CPU core	SH-4A
On-chip RAM	ILRAM: 16 KB, OLRAM: 16 KB
Cache memory	32 KB instruction/32 KB data separate, 4-way set-associative
External memory	DDR2 dedicated bus supporting direction connection of DDR2-SDRAM
	Expansion bus supporting direct connection of SRAM or ROM
Expansion bus	Address space: 64 MB × 3
Main on-chip peripheral functions	Renesas graphics processor (2-D/3-D)
	VPU5F (H.264, MPEG-4, VC-1)
	Video processing functions (color conversion, image enlargement/reduction, filter processing)
	Image blending function
	Display control 2-screen output (digital RGB × 2 channels)
	Video input interface
	SD*1 card host interface × 2 channels
	Multimedia card interface
	USB 2.0 Host/Function interface
	TS interface
	GPS baseband processor module
	FM multiplexing decoder
	Controller area network (RCAN) interface × 2 channels
	MOST interface module
	Various audio interfaces × 7 channels
	Dedicated DMAC × 34 channels
	I^2C bus interface × 4 channels
	Serial communication interface (SCIF) × 6 channels
	Remote control interface × 1 channel
	Timer × 9 channels
	On-chip debugging function
	Interrupt controller (INTC)
	Clock pulse generator (CPG): Integrated multiplier PLL
Power-down (low-power) modes	Sleep mode
	Module standby mode
	DDR-SDRAM power supply backup mode
Package	440-pin BGA (21 mm × 21 mm)

Notes: 1. SD card: It is necessary to obtain an SD card license in order to use the SD memory card interface in a product.