Software Library for 1394 Automotive Devices

1394 Automotive Protocol Stack Middleware

The 1394 Automotive protocol stack is a software library for application development of 1394 Automotive systems. This software library eases development of an automotive network system utilizing 1394 Automotive, dramatically reducing software development time and cost.

Overview

Analog terrestrial broadcasting is due to be phased out by 2011 and analog broadcasting for Blu-ray Disc by 2013. As a result, digitalized video transmissions in vehicles has become essential and mandated—a result of the rapid advancement in digitization around the globe. The 1394 Automotive technology, an international automotive information network standard, achieves rear-seat entertainment at low cost, satisfies copyright protection requirements and significantly reduces the number of wire harnesses. The reduction in the vehicle’s cable system weight is significant as it contributes to fuel efficiency and lessens the CO2 footprint.

By combining our newly developed 1394 Automotive protocol stack (hereafter referred to as the Middleware) with the Fujitsu 1394 system, it is possible to simplify and securely achieve intercommunication among the devices connected to the 1394 Automotive network on an application level. This will also significantly reduce the software development time and help reduce overall development costs.

Photo 1 1394 Automotive LSI "MB88395"

Photo 2 Evaluation Board
Product Features

The Middleware is a protocol library that handles all the necessary 1394 Specifications (AV/C, IEC61883, Transaction Layer, Serial Bus Management, and DTCP) that are featured in the target silicon device. The Middleware also enhances the performance unique to the silicon itself.

Figure 1 presents the configuration of the Middleware. The Middleware provides various APIs for interfacing with 1394 applications. It also controls the 1394 Automotive LSI (MB88395) by calling up the Low Level Driver.

The module functions of the Middleware have been developed into modular style units of 1394 specification protocol. The functions of each module are described as follows:

■ AV/C General
  Executes transmission and reception of AV/C frames according to the AV/C protocol.
  • Transmission of AV/C commands
  • Reception of AV/C commands (call-back)

■ Function Control Protocol processing (FCP)
  Executes transmission and reception of asynchronous packets according to the protocol.
  • Addressing of FCP frame transmission/reception

■ Connection Management Procedure processing (CMP)
  Executes partitioning/discarding and connection/disconnection of isochronous channels.
  • Connection ProP
  • Disconnection
  • Allocation
  • Deallocation

■ PLUG
  Executes Plug management and control for isochronous transmission/reception.
  • Input/Output MPR (Master Plug Register) setup
  • Input/Output PCR (Plug Control Register) setup
  • PCR connection/disconnection

■ BT.601
  Executes video transmission control in conformance to IEC61883-1, 8.

■ Audio
  Executes audio transmission control in conformance to IEC61883-1, 6.

Figure 1 Configuration of the 1394 Middleware
Transaction Layer
Executes packet communication control in accordance with the 1394 Specifications.
- Asynchronous transmission
- Detection of Ack reception errors
- Detection of Ack reception
- Detection and processing of Asynchronous reception
- Detection and processing of Asynchronous reception errors

Serial Bus Management processing (SBM)
Executes node management, isochronous resource management, and bus management.
- Detection of bus reset start/completion
- Detection of Self ID errors
- IRM (Isochronous Resource Manager) management operations

Digital Transmission Content Protection (DTCP) processing
Executes DTCP-protected data transmission sequence.
- Execution of device authentication/key exchange

Low Level Driver
Executes reading and writing on the 1394 Automotive LSI register in accordance with the requested process.
- Operation setup on link register
- Operation setup on physical register
- Issuance of bus reset event
- Partitioning and releasing of bands
- Asynchronous data transmission/reception/lock
- Isochronous data transmission/reception request
- Data acquisition for received isochronous data

Development Environment
We provide the Middleware library, manual, and sample source code. To conduct application development for 1394 Automotive devices using the Middleware and the Fujitsu MCU development environment, the FR Family SOFTUNE Workbench (Version V60L06 or later) can be used, as an example.
Table 1 presents the development environment and the operating specifications.

Summary
We will continually add to the lineup of 1394 Automotive-related products to support the real-time multiplex transmission of ever-increasing informational content, camera images, videos, and so forth within automobile applications. We are also contributing further system-level design enhancements at an optimized cost for these products.

Table 1 Development Environment and Operating Specifications

<table>
<thead>
<tr>
<th>Development environment</th>
<th>Development tool</th>
<th>ANSI/ISO C compatible</th>
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</thead>
<tbody>
<tr>
<td>Development tool</td>
<td>FR Family SOFTUNE Workbench V60L06 or later</td>
<td></td>
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<tr>
<td>Development language</td>
<td></td>
<td></td>
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<tr>
<td>Subject systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating environment</td>
<td>FR60 (MB91F353A)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 1 hardware timer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ROM/RAM (Approx. 260Kbytes/4Kbytes) MB88395</td>
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<tr>
<td>Operating specifications</td>
<td></td>
<td></td>
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<tr>
<td>1394 module initialization period (period from power ON for 1394 module until startup completion)</td>
<td>Approx. 300ms</td>
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<tr>
<td>1394 module data acquisition completion period</td>
<td>1 unit: approx. 30ms When 2 units are connected: approx. 45ms When 3 units are connected: approx. 60ms</td>
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<tr>
<td>DTCP authentication period</td>
<td>Approx. 1.5 seconds per authorized device (2 channels)</td>
<td></td>
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<tr>
<td>Transmission preparation period</td>
<td>When 1 unit is connected: approx. 15ms</td>
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<tr>
<td></td>
<td>When 2 units are connected: approx. 20ms</td>
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* The operating specifications will vary depending on the CPU adopted.
* The above values are for operating only the 1394 middleware.