OS81212/4/6

Intelligent Network Interface Controller for 50 Mbit/s Automotive Networks Product Brief

Features

- Complete 50 Mbit/s synchronous network interface
- Embedded network management functions
  - Network protection mode
  - Hardware & application watchdog timer
  - Intelligent muting
  - Diagnostics
  - Emergency Response System (eCall)
- IEEE MAC addressing and Ethernet channel
- Media Local Bus (MediaLB®) Port (OS81212)
  - Eases inter-chip communication and streaming
  - MediaLB 3-pin interface at speeds up to 1024xFs
- I²C™ Control Port inter-chip message exchange
- Streaming Port supports synchronous, fixed latency data exchange for a variety of serial audio formats including time-division multiplex (TDM) and pulse density modulation (PDM)
- SPI Port supports asynchronous and control packets (OS81212/4)
- General Purpose I/O (GPIO) Port
- Remote control and configuration for operation without a local External Host Controller.
  - I²C (master) message tunneling
  - GPIO port control
- Operating voltages 3.3 V/1.8 V
- Available in 56-pin (OS81212) and 48-pin (OS81214/6) QFN packages with exposed pad
- -40 to +125 °C junction temperature

Conformity

This document applies to hardware revision B1A

Applications

- Automotive infotainment network nodes including instrument cluster, amplifier, headrest speakers, microphones, acoustic processing units, and rear seat entertainment.

General Description

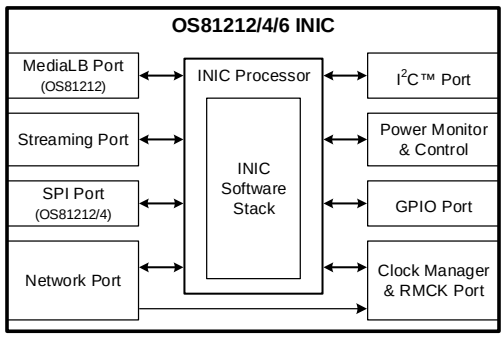
The OS81212/4/6 is a highly integrated *Intelligent Network Interface Controller* (INIC) for 50 Mbit/s INICnet-based automotive networks with a transformer-less balanced media physical layer (bPHY) optimized for unshielded twisted pair (UTP) copper wire.

The INIC provides encapsulation of all low-level functions necessary to develop a network-compliant device, significantly simplifying network implementation in a node. Integration of the *INIC Software Stack* into the INIC provides network-compliant real-time behavior. The *INIC Software Stack* significantly relieves an External Host Controller (EHC) from real-time processing tasks. Supervision of the application is also provided, including a protection mode that is entered when an application is not present (i.e. start-up) or the EHC malfunctions. This protection mode prevents application malfunctions from influencing the integrity of the network and the system.

When an EHC is engaged, a message-based interface, as opposed to a register-based interface, is available for communication with INIC. A unified and centralized network management software stack (UNICENS) is available for the EHC to build a complete, lean, system solution.

The INIC can also supports a fully compliant MOST® network.

FIGURE: OS81212/4/6 BLOCK DIAGRAM



TO OUR VALUED CUSTOMERS

It is our intention to provide our valued customers with the best documentation possible to ensure successful use of your Microchip products. To this end, we will continue to improve our publications to better suit your needs. Our publications will be refined and enhanced as new volumes and updates are introduced.

If you have any questions or comments regarding this publication, please contact the Marketing Communications Department via E-mail at **docerrors@microchip.com**. We welcome your feedback.

Most Current Data Sheet

To obtain the most up-to-date version of this data sheet, please register at our Worldwide Web site at:

http://www.microchip.com

You can determine the version of a data sheet by examining its literature number found on the bottom outside corner of any page. The last character of the literature number is the version number, (e.g., DS30000000A is version A of document DS30000000).

Errata

An errata sheet, describing minor operational differences from the data sheet and recommended workarounds, may exist for current devices. As device/documentation issues become known to us, we will publish an errata sheet. The errata will specify the revision of silicon and revision of document to which it applies.

To determine if an errata sheet exists for a particular device, please check with one of the following:

- Microchip's Worldwide Web site; **http://www.microchip.com**
- Your local Microchip sales office (see last page)

When contacting a sales office, please specify which device, revision of silicon and data sheet (include literature number) you are using.

Customer Notification System

Register on our web site at **www.microchip.com** to receive the most current information on all of our products.

1.0 PINOUT

FIGURE 1-1: OS81212 PIN DIAGRAM

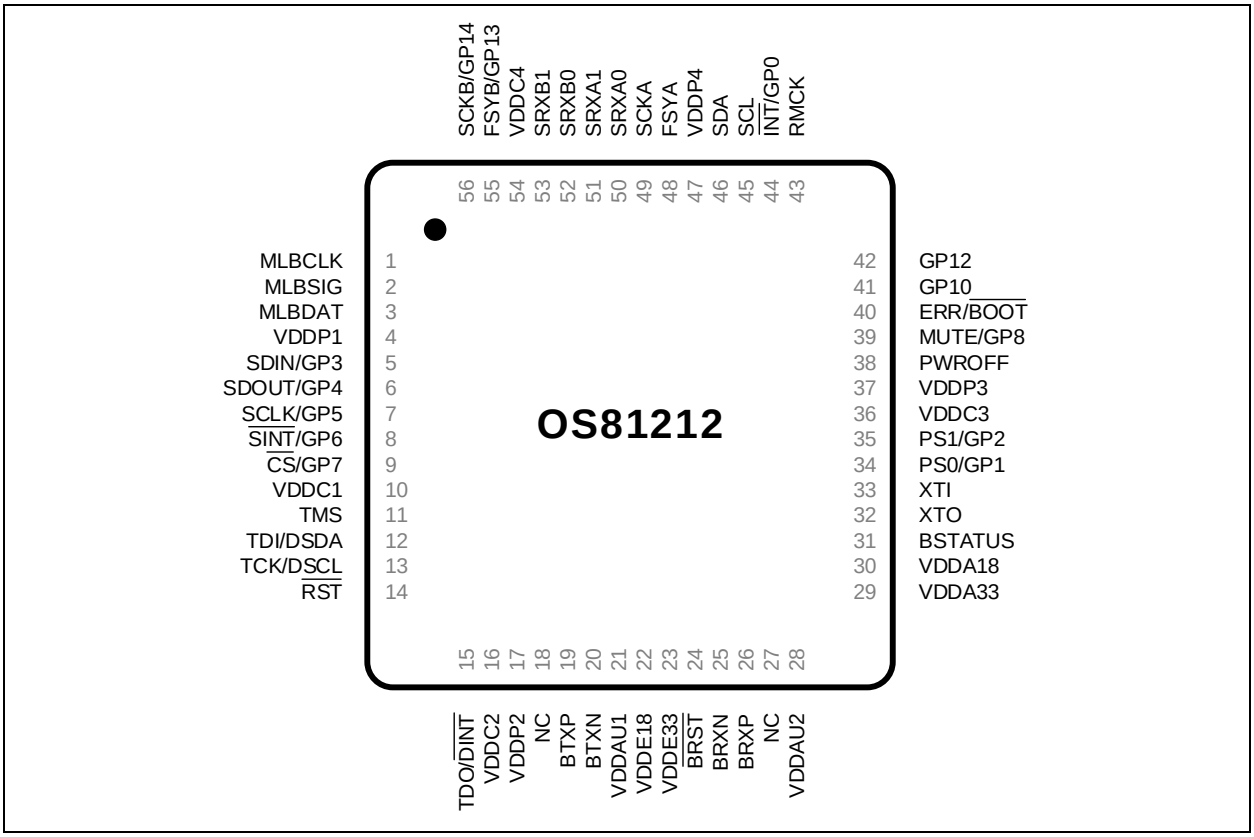


FIGURE 1-2: OS81214 PIN DIAGRAM

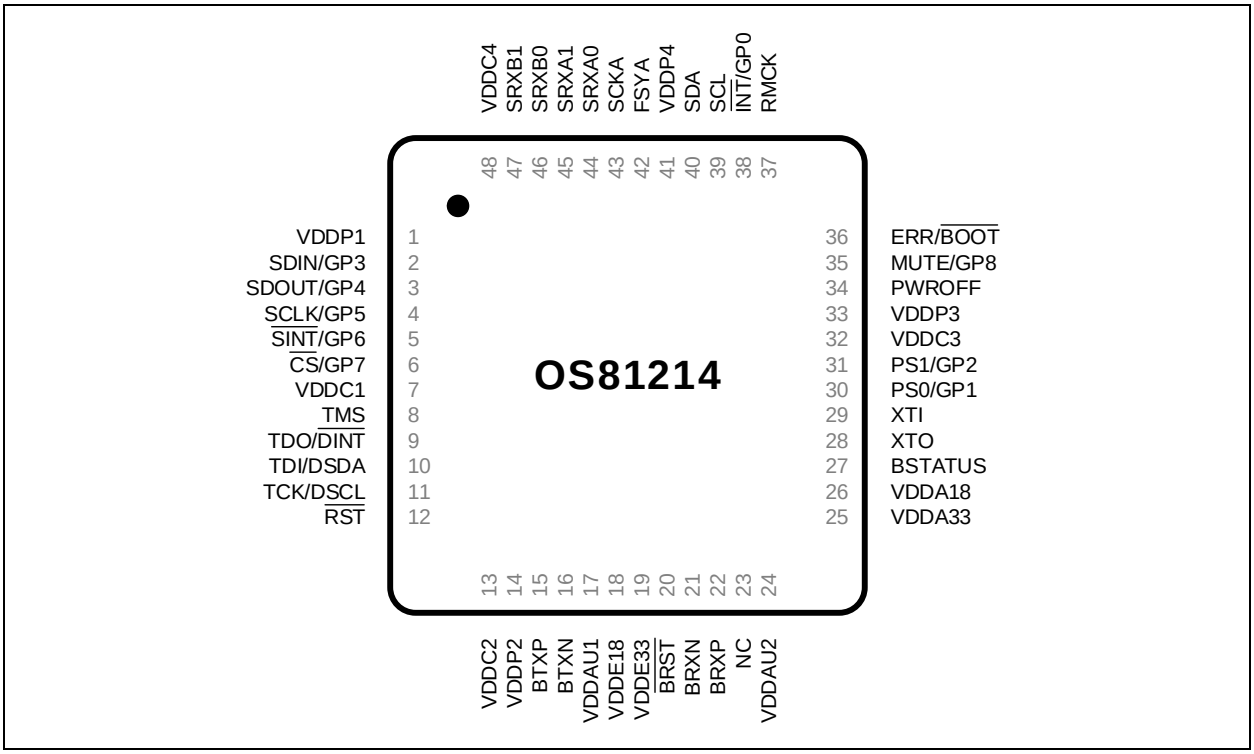


FIGURE 1-3: OS81216 PIN DIAGRAM

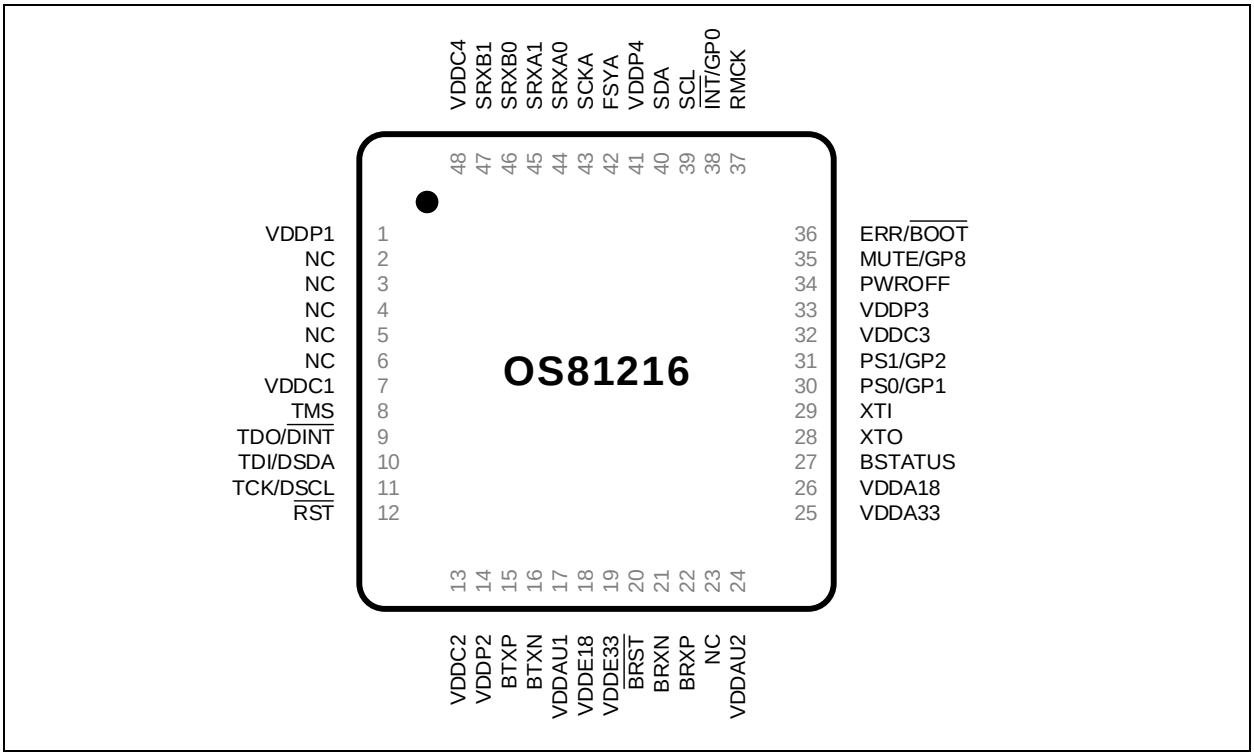


TABLE 1-1: PIN ALLOCATION TABLE

OS81212 Pin	OS81214 Pin	OS81216 Pin	Name	HW Port	Description
1	-	-	MLBCLK [2]	MediaLB	Singled-ended Clock line for MediaLB 3-pin Interface
2	-	-	MLBSIG [2]	MediaLB	Singled-ended Signal line for MediaLB 3-pin Interface
3	-	-	MLBDAT [2]	MediaLB	Singled-ended Data line for MediaLB 3-pin Interface
4	1	1	VDDP1		3.3 V periphery power supply (digital)
5	2	-	SDIN	SPI	Data In (MOSI - Master Out, Slave In)
			GP3	GPIO	General Purpose Input/Output 3
-	-	2	NC		No Connect. This pin must be left open and floating.
6	3	-	SDOUT	SPI	Data Out (MISO - Master In, Slave Out)
			GP4	GPIO	General Purpose Input/Output 4
-	-	3	NC		No Connect. This pin must be left open and floating.
7	4	-	SCLK	SPI	Clock
			GP5	GPIO	General Purpose Input/Output 5
-	-	4	NC		No Connect. This pin must be left open and floating.
8	5	-	$\overline{SINT}$	SPI	Interrupt (active low)
			GP6	GPIO	General Purpose Input/Output 6
-	-	5	NC		No Connect. This pin must be left open and floating.
9	6	-	$\overline{CS}$	SPI	Chip Select (active low)
			GP7	GPIO	General Purpose Input/Output 7
-	-	6	NC		No Connect. This pin must be left open and floating.
10	7	7	VDDC1		1.8 V core power supply (digital)

Note 1: Pull-up resistor required.

2: Pull-down resistor required.

TABLE 1-1: PIN ALLOCATION TABLE (CONTINUED)

OS81212 Pin	OS81214 Pin	OS81216 Pin	Name	HW Port	Description
11	8	8	TMS [1]	JTAG	Test Mode Select
-	9	9	TDO [1]	JTAG	Test Data Output
			$\overline{\text{DINT}}$ [1]		Debug Interrupt (active low)
12	10	10	TDI [1]	JTAG	Test Data Input
			DSDA [1]		Debug Data
13	11	11	TCK [1]	JTAG	Test Clock Input
			DSCL [1]		Debug Clock
14	12	12	$\overline{\text{RST}}$		Hardware Reset Input (active low). (Pull-up resistor to **VDDPn** supply should be used when not driven high by an external device. A series resistor should be used in lieu of the pull-up when always driven by an external device.)
15	-	-	TDO [1]	JTAG	Test Data Output
			$\overline{\text{DINT}}$ [1]		Debug Interrupt (active low)
16	13	13	VDDC2		1.8 V core power supply (digital)
17	14	14	VDDP2		3.3 V periphery power supply (digital)
18	-	-	NC		No Connect. This pin must be left open and floating.
19	15	15	BTXP	Network	Positive (differential) bPHY network transmitter output
20	16	16	BTXN	Network	Negative (differential) bPHY network transmitter output
21	17	17	VDDAU1		3.3 V continuous power supply (analog)
22	18	18	VDDE18		1.8 V bPHY power supply (analog)
23	19	19	VDDE33		3.3 V bPHY power supply (analog)
24	20	20	$\overline{\text{BRST}}$	Network	Hardware Reset Input (active low) for the Balanced Media Physical Layer. When asserted, the transmitter output is disabled.
25	21	21	BRXN	Network	Negative (differential) bPHY network receiver input
26	22	22	BRXP	Network	Positive (differential) bPHY network receiver input
27	23	23	NC		No Connect. This pin must be left open and floating.
28	24	24	VDDAU2		3.3 V continuous power supply (analog)
29	25	25	VDDA33		3.3 V power supply (analog)
30	26	26	VDDA18		1.8 V power supply (analog)
31	27	27	BSTATUS	Network	bPHY Network Activity Status Output: - Driven low when a valid signal is detected - Driven high to **VDDAUn** when a qualified signal is not present
32	28	28	XTO		Crystal Oscillator Output
33	29	29	XTI		Crystal Oscillator Input or External CMOS Clock Input
34	30	30	PS0		External Power Management Status Bit 0
			GP1	GPIO	General Purpose Input/Output 1
35	31	31	PS1		External Power Management Status Bit 1
			GP2	GPIO	General Purpose Input/Output 2
36	32	32	VDDC3		1.8 V core power supply (digital)
37	33	33	VDDP3		3.3 V periphery power supply (digital)

Note 1: Pull-up resistor required.

2: Pull-down resistor required.

TABLE 1-1: PIN ALLOCATION TABLE (CONTINUED)

OS81212 Pin	OS81214 Pin	OS81216 Pin	Name	HW Port	Description
38	34	34	PWROFF [1]		External Power Management Power-Down Indicator. This pin is driven low by INIC after initialization. When high, indicates that the INIC Processor is ready to be shut down. A pull-up resistor is required when used. If not used, this pin may be left unconnected.
39	35	35	MUTE [1]		Mute Indicator Output. A pull-up resistor is required when used. If not used, this pin may be left unconnected.
			GP8	GPIO	General Purpose Input/Output 8
40	36	36	ERR		Error Indicator Output
			$\overline{\text{BOOT}}$ [1]		Configuration Pin. This pin is attached to the configuration/debug header and used by the Microchip *INICkit Tool* to load initial configuration data into INIC. May also be connected to the EHC to allow in-system configuration of the INIC.
41	-	-	GP10	GPIO	General Purpose Input/Output 10
42	-	-	GP12	GPIO	General Purpose Input/Output 12
43	37	37	RMCK	RMCK	Recovered Master Clock Output
44	38	38	$\overline{\text{INT}}$ [1]	I^2C	Interrupt (active low). Indicates a service request from the EHC when the Control Port is operating as an I^2C slave.
			GP0	GPIO	General Purpose Input/Output 0
45	39	39	SCL [1]	I^2C	Clock
46	40	40	SDA [1]	I^2C	Data
47	41	41	VDDP4		3.3 V periphery power supply (digital)
48	42	42	FSYA	Streaming	Frame Sync for Streaming Port A
49	43	43	SCKA	Streaming	Bit Clock for Streaming Port A
50	44	44	SRXA0	Streaming	Data I/O Signal 0 for Streaming Port A
51	45	45	SRXA1	Streaming	Data I/O Signal 1 for Streaming Port A
52	46	46	SRXB0	Streaming	Data I/O Signal 0 for Streaming Port B
53	47	47	SRXB1	Streaming	Data I/O Signal 1 for Streaming Port B
54	48	48	VDDC4		1.8 V core power supply (digital)
55	-	-	FSYB	Streaming	Frame Sync for Streaming Port B
			GP13	GPIO	General Purpose Input/Output 13
56	-	-	SCKB	Streaming	Bit Clock for Streaming Port B
			GP14	GPIO	General Purpose Input/Output 14
ePAD	ePAD	ePAD	GND		The exposed paddle on the bottom side of the QFN package is the primary ground for the OS81212/4/6 and must be connected to ground on the PCB for proper operation.

Note 1: Pull-up resistor required.

2: Pull-down resistor required.

2.0 BASIC APPLICATION INFORMATION

The OS81210 and OS81212/4/6 INICs are part of the OS8121x 50 Mbit/s INICnet product family that support point-to-point, simplex daisy chain, and ring topologies through an integrated balanced media physical layer (bPHY). The integrated *INIC Software Stack* can independently run the network and manage the low-level protocols such as startup, shutdown, error reporting, or Plug-and-Play node positioning. Alternatively, INIC can operate in conjunction with an External Host Controller (EHC) managing the mid- and high-level functions. Additionally the OS81210 provides power management capabilities and industry standard application interfaces such a USB 2.0, MediaLB 3-Pin, Streaming Port, I^2C Port, SPI port, and GPIOs.

The OS81210 is optimized for high performance head unit applications with USB 2.0 or HSIC high-speed communication.

The OS81212 is targeted for audio / video streaming data applications with the dual Streaming Ports and MediaLB interface. It can operate with an EHC or it can exist remotely on the network.

The OS81214 is targeted for audio data applications using the Streaming Port or packets over the SPI Port. It can operate with an EHC or it can exist remotely on the network.

The OS81216 INIC is targeted for remotely configured microphone applications (without a local EHC).

FIGURE 2-1: OS8121x PRODUCT FAMILY OVERVIEW

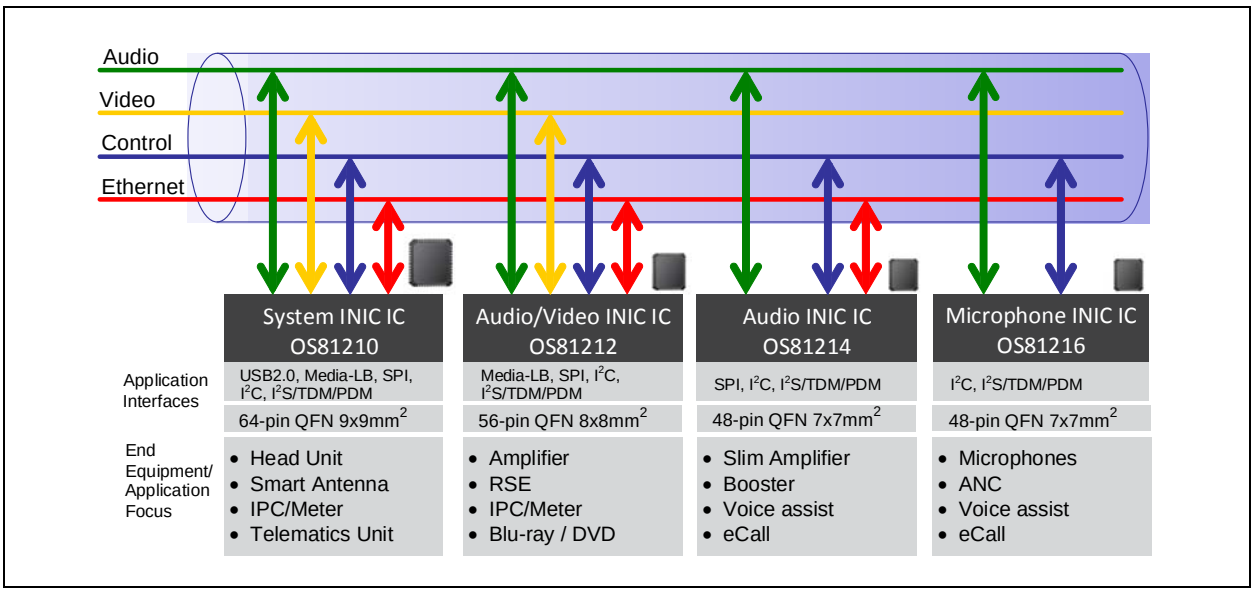
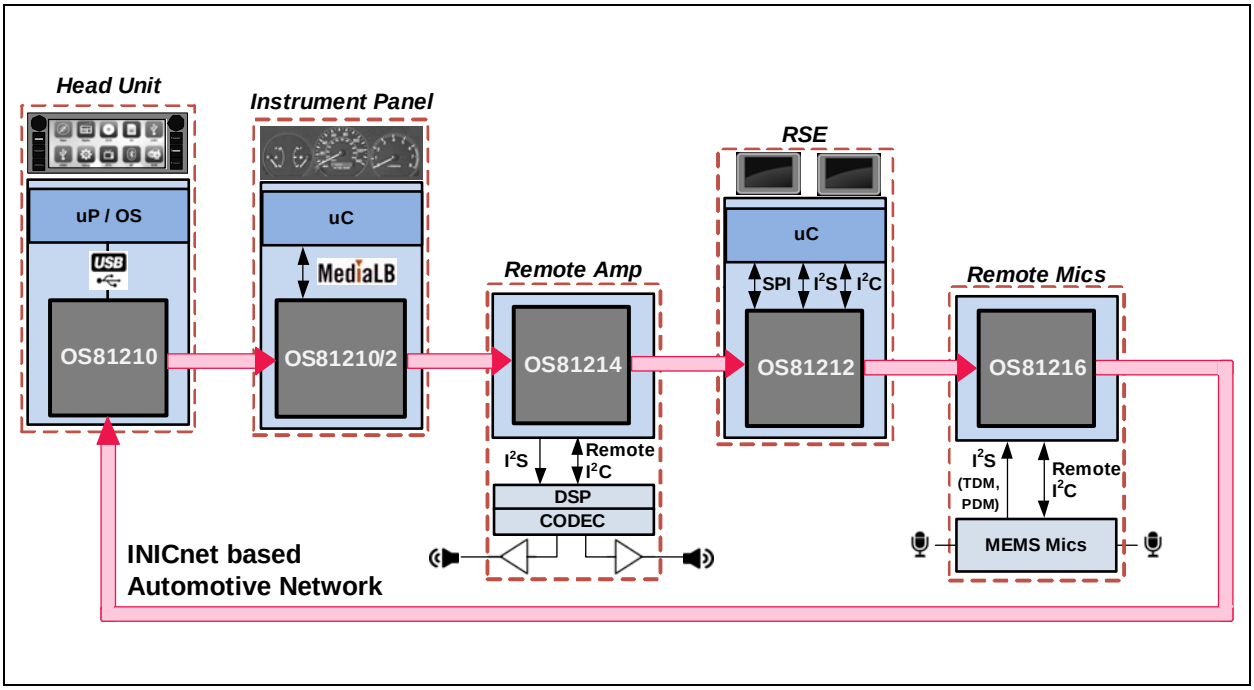


Figure 2-2 depicts an example 50 Mbit/s INICnet application. Using a combination of OS81210 and OS81212/4/6 INICs, a system supporting audio, video, and packet data applications can be easily configured. The Head Unit INIC can communicate with an operating system (such as a GNU/Linux, QNX, Android Auto, etc.) to manage the network and control the remote nodes. The asynchronous channel on the INIC can be used for high-speed routing of application packet data such as graphics images, system information, or software downloads. The EHC can access both synchronous and packet data through the OS81210 USB interface. An Instrument Panel can be implemented with control and Ethernet packets sent over the OS81210/2 MediaLB Port. Without a local EHC, the microphones are configured remotely over I^2C. Only a single INIC streaming pin is used to source a mono PDM bit stream from a MEMS microphone to the network. As shown in the Remote Amp, the amplifier is remotely controlled and configured. Synchronous audio data is routed over the network and is sourced/sinked through I^2S to CODECs or DSPs. The Rear Seat Entertainment (RSE) can route synchronous streams or asynchronous data such a IP packets over the network Ethernet Channel.

FIGURE 2-2: BASIC APPLICATION DIAGRAM



3.0 PACKAGING INFORMATION

3.1 Package Marking

FIGURE 3-1: OS81212 TOP MARKING

The package designators are:

- xx - Device Identifier
  - **OS81212AF** - Solderable Flank QFN
- rrr - Product Revision Code
- yy - last two digits of Assembly Year
- ww - Assembly Work Week
- nnn - Tracking Number
- cc - Country of Origin Abbreviation (optional - up to 2 characters)
- e3 - Pb Free Symbol

FIGURE 3-2: OS81214 TOP MARKING

The package designators are:

- xx - Device Identifier
  - **OS81214AF** - Solderable Flank QFN
- rrr - Product Revision Code
- yy - last two digits of Assembly Year
- ww - Assembly Work Week
- nnn - Tracking Number
- cc - Country of Origin Abbreviation (optional - up to 2 characters)
- e3 - Pb Free Symbol

FIGURE 3-3: OS81216 TOP MARKING

The package designators are:

- xx - Device Identifier
  - **OS81216AF** - Solderable Flank QFN
- rrr - Product Revision Code
- yy - last two digits of Assembly Year
- ww - Assembly Work Week
- nnn - Tracking Number
- cc - Country of Origin Abbreviation (optional - up to 2 characters)
- e3 - Pb Free Symbol

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

PART NO.	X	X	[X]	-	rrr	-	vvvvvv	[ss]	-	[xxx]
Device	Grade	Package Type	Tape and Reel Flag		Product Revision Code		Firmware Revision Code	Firmware Service Release		Special Feature Code

Device	OS81212	=	50 Mbit/s Automotive Intelligent Network Interface Controller with MediaLB
	OS81214	=	50 Mbit/s Automotive Intelligent Network Interface Controller (no MediaLB)
	OS81216	=	50 Mbit/s Automotive Intelligent Network Interface Controller (no MediaLB, SPI)
Grade	A	=	All Features
Package Type	F	=	QFN with solderable terminals
Tape and Reel Flag (optional)	Blank	=	Standard Packaging (Tube/Tray)
	R	=	Tape and Reel
Product Revision Code	rrr	=	3 character code specifying product revision
Firmware Revision Code	vvvvvv	=	6 character code specifying firmware revision
Firmware Service Release (optional)	ss	=	2 character code specifying service release
Special Feature Code (optional)	xxx	=	3 character code for special requirements

Examples:

a) OS81212AF-rrr-vvvvvv-xxx
56-pin solderable terminal QFN package

b) OS81212AFR-rrr-vvvvvv-xxx
56-pin solderable terminal QFN package, Tape and Reel

c) OS81214AF-rrr-vvvvvv-xxx
48-pin solderable terminal QFN package

d) OS81214AFR-rrr-vvvvvv-xxx
48-pin solderable terminal QFN package, Tape and Reel

e) OS81216AF-rrr-vvvvvv-xxx
48-pin solderable terminal QFN package

f) OS81216AFR-rrr-vvvvvv-xxx
48-pin solderable terminal QFN package, Tape and Reel

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
═ ISO/TS 16949 ═

Trademarks

ISBN: 978-1-5224-4062-8

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
http://www.microchip.com/support
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733

China - Beijing
Tel: 86-10-8569-7000

China - Chengdu
Tel: 86-28-8665-5511

China - Chongqing
Tel: 86-23-8980-9588

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115

China - Hong Kong SAR
Tel: 852-2943-5100

China - Nanjing
Tel: 86-25-8473-2460

China - Qingdao
Tel: 86-532-8502-7355

China - Shanghai
Tel: 86-21-3326-8000

China - Shenyang
Tel: 86-24-2334-2829

China - Shenzhen
Tel: 86-755-8864-2200

China - Suzhou
Tel: 86-186-6233-1526

China - Wuhan
Tel: 86-27-5980-5300

China - Xian
Tel: 86-29-8833-7252

China - Xiamen
Tel: 86-592-2388138

China - Zhuhai
Tel: 86-756-3210040

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444

India - New Delhi
Tel: 91-11-4160-8631

India - Pune
Tel: 91-20-4121-0141

Japan - Osaka
Tel: 81-6-6152-7160

Japan - Tokyo
Tel: 81-3-6880- 3770

Korea - Daegu
Tel: 82-53-744-4301

Korea - Seoul
Tel: 82-2-554-7200

Malaysia - Kuala Lumpur
Tel: 60-3-7651-7906

Malaysia - Penang
Tel: 60-4-227-8870

Philippines - Manila
Tel: 63-2-634-9065

Singapore
Tel: 65-6334-8870

Taiwan - Hsin Chu
Tel: 886-3-577-8366

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600

Thailand - Bangkok
Tel: 66-2-694-1351

Vietnam - Ho Chi Minh
Tel: 84-28-5448-2100

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-67-3636

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7288-4388

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820

Advance Information
January 2019