

- Motorola is first to market with an end-to-end solution for in-vehicle communications and networking – LIN (Local Interconnect Network)
- Developed by a consortium of industry leaders: Motorola, Audi AG, BMW AG, DaimlerChrysler AG, Volkswagen AG, Volvo Car Corp. AB, Volcano Communications Technologies AB
- This sub-bus solution complements CAN, providing lower cost connection within local network clusters.
- Offers systems' advantages of cost, flexibility, re-use and logistics

As more and more intelligent systems are developed for remote automotive applications, communication between these systems and the main body network becomes increasingly challenging. Historically controlled directly with wires and switches, functions such as door locks, seat positions, electric mirrors, and window operations are today controlled by ECUs (Electronic Control Units) together with sensors and actuators in a multiplexed Controller Area Network (CAN). Connecting with the main body network directly via a CAN bus system can be expensive because of increased costs per node and because high overall network traffic can make management extremely difficult. To help reduce costs, the logical extension is to structure the network hierarchically.

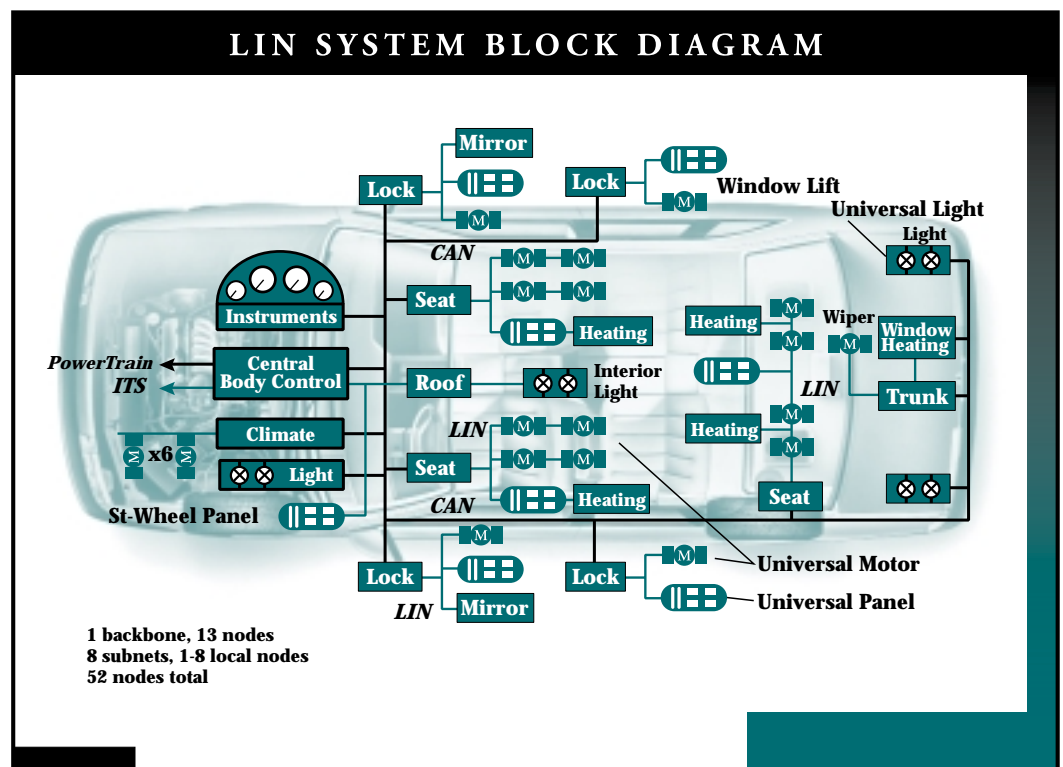
The LIN solution

In 1998, Motorola joined with Audi AG, BMW AG, DaimlerChrysler AG, Volkswagen AG, Volvo Car Corporation AB, and the tool company Volcano Communications Technologies AB (VCT) to form a consortium aimed at finding a cost-competitive sub-bus network solution. The result was the Local Interconnect Network (LIN) that brings systems' advantages of cost, flexibility, re-use and logistics.

The systems approach begins with a description of the LIN network using the LIN configuration language. This provides a detailed description of the network data flows and schedules, and facilitates re-use. Each network node can then be implemented based on the data it provides and receives. Tools and drivers are available that implement each step of the network design from systems planning, through node software driver support, to network debugging capability.

A LIN sub-bus system uses a single-wire implementation (enhanced ISO9141), which can significantly reduce manufacturing and component costs. Component costs are further reduced by self-synchronization, without crystal or ceramics resonator, in the slave node. The system is based on common UART/SCI interface hardware that is shared by most microcontrollers, for a more flexible, lower-cost silicon implementation.

With these cost benefits, high-end comfort and convenience features no longer need be limited only to top-of-the-line cars.



Motorola makes it happen

Advanced system portfolio

Motorola, as the only semiconductor member of the LIN consortium, has the industry's most advanced range of components, software, tools and support available to get our customers started using LIN.

Our portfolio includes all the system building blocks necessary for a complete, integrated LIN solution:

- 'Hyperintegration' microcontrollers with on-chip SMOS functions like voltage regulators and LIN physical interface
- Extensive range of cost effective, highly integrated 8- and 16-bit microcontrollers for both master and slave nodes
- Discrete LIN Physical Interface
- LIN master and slave driver software
- CAN driver software
- OSEK™ operating system.

Network configuration, analysis and debug support provided by our tool partners

Proven software expertise

Motorola is working closely with the leading LIN tool supplier to ensure a first class, seamless development and debug environment for Motorola LIN products. Motorola silicon is supported by production quality master and slave LIN software products which are available today. Motorola's expertise of supplying and supporting OSEK™ software and device drivers to the automotive market, positions us as the reliable, dependable partner for LIN software needs.

Advanced integration microcontrollers: Hyperintegration / Mechatronics

Motorola's advanced 'hyperintegration' and 'mechatronics' processes allow the merging of SMARTMOS™ and microcontroller functionality in a single package or connector. Ideal microcontrollers in the LIN environment will integrate the voltage regulator, physical interface and high voltage I/O provide space, cost and

reliability benefits. Motorola's hyperintegration and mechatronics solutions provide this capability today.

Embedded controllers: A Motorola legacy

Since the LIN sub-bus is based on common UART/SCI interface hardware, today's system designers can choose from a wide range of devices. Motorola's microcontroller solutions form the backbone of millions of automotive systems on the road today. The 8-bit 68HC05, 68HC08, 68HC11 and 16-bit 68HC12 product families provide the industry's broadest range of performance and features, affording designers the freedom to choose whatever part is ideally suited to their needs.

Always thinking ahead: Your future with Motorola

With the radical and rapid changes occurring in the automotive industry, planning for future requirements and meeting present needs are equally important priorities. As transportation systems continue to move toward more advanced functionality, Motorola will continue to stay one step ahead. To learn more, visit the LIN homepage at www.lin-subbus.org, or call 1-800-441-2447 to speak with a Motorola representative.

LIN Master MCUs

Device	ROM (bytes)	RAM (bytes)	FLASH (bytes)	EEPROM (bytes)	Features
68HC908AZ60	-	2K	60K	1K	Timer, PWM, A/D, SCI, SPI, CAN
68HC08AZ32	32K	1K	-	512	Timer, PWM, A/D, SCI, SPI, CAN
68HC912B32	-	1K	32K	768	Timer, PWM, A/D, SPI, SCI, J1850
68HC12BE32	32K	1K	-	768	Timer, PWM, A/D SCI, SPI, J1850
68HC912BC32	-	1K	32K	768	Timer, PWM, A/D, SCI, SPI, CAN
68HC912D60	-	2K	60K	1K	Timer, PWM, 2xA/D, 2xSCI, SPI, CAN
68HC912DG128	-	8K	128K	2K	Timer, PWM, 2xA/D, 2xSCI, SPI, CAN

LIN Slave MCUs

Device	ROM (bytes)	RAM (bytes)	FLASH (bytes)	EEPROM (bytes)	Features
68HC908JK3*	-	128	4K	-	Timer, PWM, A/D
68HC908JL3	-	128	4K	-	Timer, PWM, A/D
68HC908JK1*	-	128	1.5K	-	Timer, PWM, A/D
68HC908KX8*	-	192	8K	-	Timer, PWM, A/D, SCI Oscillator
68HC908MR24*	-	512	24K	-	Timer, PWM, A/D, SCI, SPI
68HC908GP20*	-	512	20K	-	Timers, PWM, 2x A/D, SCI, SPI
68HC08AB16A	16K	512	-	-	Timer, PWM, A/D, SCI, SPI
68HC908GP32*	-	512	32K	-	Timers, PWM, A/D, SCI, SPI

Hyperintegration / Mechatronics LIN Slave MCUs

Device	ROM (bytes)	RAM (bytes)	FLASH (bytes)	EEPROM (bytes)	Features
68HC05PV8	8K	192	-	128	Timer, PWM, A/D, Oscillator, Vreg, HV I/O, Op amp, Physical I/F
68HC805PV8	-	192	8K	128	Timer, PWM, A/D, Oscillator, Vreg, HV I/O, Op amp, Physical I/F
33393TM	-	64	-	1K	Timer, Oscillator, 2x175mA H-Bridge, Mechatronics

LIN Software Products

	M68HC05	M68HC08	M68HC12	Available
LIN Master		X	X	Now
LIN Slave	X	X	X	Now
OSEK Operating System		X	X	Now

LIN Physical Interface

Device	Supply	Wake-up	Sleep mode	Slew Rate
MC33399D	7V to 27V	Several modes	Yes	1 to 2V/us

*Motorola qualification only, PPAP not available. Please contact sales for further information.