

KEELOQ® HCS1XX/2XX/3XX Encoder Family

The KEELOQ® family of encoders offers a complete range of products for Remote Control and secure Remote Keyless Entry (RKE) Applications. The encoders range from the HCS101, a fixed code encoder designed for remote control systems to the HCS2XX and HCS3XX products, which utilize Microchip's patented KEELOQ hopping technology. The devices incorporate a small package outline, low cost and the minimum external components to make these devices suited for unidirectional remote keyless entry, remote control and access control systems. The Code Hopping Encoders combine a 32-bit hopping code generated by a non-linear encryption algorithm, with a 32-bit serial number and information bits to create a transmission stream of up to 69 bits. The length of the transmission eliminates the threat of code scanning, and the code hopping mechanism makes each transmission unique, thus rendering code capture and resend schemes useless.

Security Features:

- Up to 2 programmable 32-bit serial numbers
- Up to 2 programmable 64-bit encoder keys
- Up to 2 programmable 60-bit seed values
- Each transmission is unique
- Up to 69-bit transmission code length
- 32-bit hopping code
- Encoder keys are read protected

Operating Features:

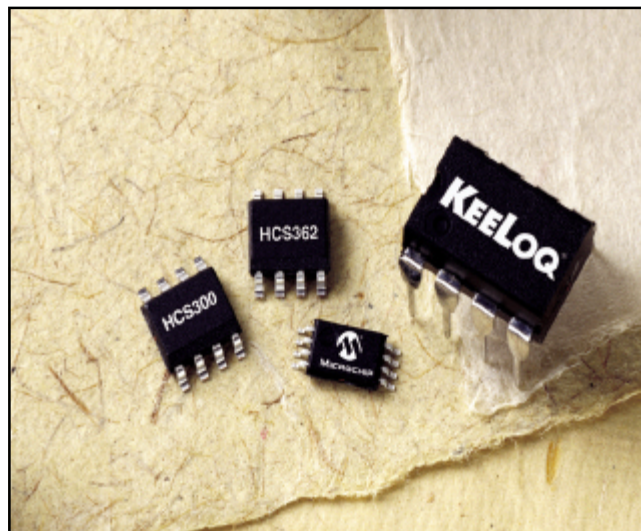
- 2.0 – 13.3V operation
- Up to six button inputs
- 15 functions available
- Up to four selectable baud rates
- Selectable minimum code word completion
- Battery low signal transmitted to receiver
- Nonvolatile synchronization data
- PWM, VPWM, PPM and Manchester modulation
- Button queue information transmitted
- Dual Encoder functionality

Other Features:

- On-chip EEPROM
- On-chip tuned oscillator ($\pm 10\%$)
- Button inputs have internal pull-down resistors
- LED output
- PLL control for ASK and FSK
- Low external component count

Typical Applications:

- Automotive RKE systems
- Automotive alarm systems
- Automotive immobilizers
- Gate and garage door openers
- Identity tokens



- Burglar alarm systems

Related Application Notes:

- AN217 – KEELOQ HCS30X, HCS200 Stand-Alone Programmer
- AN645 – PIC16C57 -Based Code Hopping Security System
- AN661 – Code Hopping Decoder using PIC16C56
- AN662 – Code Hopping Decoder using Secure Learn
- AN663 – Simple Code Hopping Decoder
- AN665 – Using KEELOQ to Generate Hopping Passwords
- AN672 – PICmicro® Mid-range MCU Code Hopping Decoder
- AN740 – Decoding the HCS101 for Non-Secure Applications
- AN742 – Modular PICmicro Mid-Range Code Hopping Decoder
- AN744 – Modular Mid-Range PICmicro KEELOQ Decoder in C
- TB001 – Secure Learning RKE Systems using KEELOQ Encoders
- TB003 – An Introduction to KEELOQ Code Hopping
- TB021 – A Guide to Designing for EuroHomelink Compatibility
- TB042 – Interfacing a KEELOQ Encoder to a PLL Circuit
- TB043 – KEELOQ CRC Verification Routines



MICROCHIP

KEELOQ® Secure Data Products

Additional Information:

- Microchip's web site: www.microchip.com
- Microchip's Technical Library CD-ROM, [Order No. DS00161](#)
- *Secure Data Products Handbook*, [Order No. DS40168](#)
- Application Notes are available in:
 - *Embedded Control Handbook*, [Order No. DS00092](#)
 - *Embedded Control Handbook, Volume 2, Math Library*, [Order No. DS00167](#)
 - *Embedded Control Handbook Update 2000*, [Order No. DS00711](#)
- Microchip's *Non-Volatile Memory Products Data Book*, [Order No. DS00157](#)
- Microchip's *Overview, Quality Systems and Customer Interface System*, [Order No. DS00169](#)
- Third Party software and hardware support:
 - Emulators
 - Programmers
 - Gang Programmers
 - Software Tools
 - Development Boards and Accessories
 - Design Consultants
 - *Third Party Guide*, [Order No. DS00104](#)

HCS4XX Family Lineup								
Product	Encryption Key (bits)	Switch Inputs	Code word Length (bits)	Code Hopping (bits)	Seed Length (bits)	Other Features	Operating Voltage	Packages Pins
HCS101	—	3	66	—	—	Tuned oscillator	3.5V – 13V	8P, 8SN
HCS200	64	3	66	32	32	—	3.5V – 13V	8P, 8SN
HCS201	64	3	66	32	32	Tuned osc, Step-up Regulator	3.5V – 13V	8P, 8SN
HCS300	64	4	66	32	32	LED, Time-out, overflow	2.0V – 6.3V	8P, 8SN
HCS301	64	4	66	32	32	LED, Time-out, overflow	3.5V – 13V	8P, 8SN
HCS320	64	4	66	32	32	LED, Time-out, overflow, shift function	3.5V – 13V	8P, 8SN
HCS360	64	4	67	32	48	Time-out, overflow, IR Mode, PWM, Manchester, CRC	2.0V – 6.3V	8P, 8SN
HCS361	64	4	67	32	48	Time-out, overflow, IR Mode, PWM VPWM, CRC	2.0V – 6.3V	8P, 8SN
HCS362	64	4	69	32	60	Time-out, Guard Time, PWM, Manchester, CRC, Tuned osc	2.0V – 6.3V	8P, 8SN,
TSSOP								
HCS365	2 x 64	4	69	32	60	Tuned osc, Dual mode, PWM, PPM, Manchester, VPWM	2.0V – 5.5V	8P, 8SM

Development Tools from Microchip		Resale Price*
KEELOQ Evaluation Kit	Demonstrate, evaluate and prototype KEELOQ devices	\$299
KEELOQ Transponder Evaluation Kit	Demonstrate, evaluate and prototype KEELOQ devices	\$399

*All prices are manufacturer's suggested resale for North America.

Frequently asked questions

What is KEELOQ Code Hopping and why do I need it?

KEELOQ Code Hopping is a technology developed specifically for secure remote keyless entry and authentication. The basic principle is that the code change (hop) each time it is transmitted. It is equivalent to changing the mechanical key on a door each time after you lock or unlock the door. This makes it nearly impossible for a thief to capture and re-transmit the code used to lock/unlock a door or vehicle.

How do I get started with KEELOQ?

The easiest way to get hands-on experience with KEELOQ is to purchase a KEELOQ Evaluation Kit. The evaluation kit contains a complete hardware system that includes receiver, decoder and different learning options. It also includes easy to use software that allows you to program the various devices and display the results of encrypting and decrypting data.

What is the KEELOQ Licensing disk and how do I get it?

The KEELOQ Licensing disk contains various firmware implementations of decoders that enable you to decrypt the code-hopping portion of the KEELOQ transmissions. It also contains application notes and Windows® software that allows you to encrypt, decrypt and experiment with various Learning Schemes. The Licensing disk is free and available through the Literature Center (DS40149).

What is Learning?

Learning is a method to match the encoder (transmitter) to the decoder (receiver). There are various Learning methods that depend on the level of security the user requires.

Customer Support:

Microchip maintains a worldwide network of distributors, representatives, local sales offices, Field Application Engineers, and

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