

# KEELOQ® Code Hopping Devices

The KEELOQ code hopping technology is a worldwide standard providing a simple yet highly secure solution for authentication, remote-keyless-entry (RKE) or passive-keyless-entry (PKE) applications.

These off-the-shelf code hopping devices allow you to easily implement very secure system designs at a low-cost in a small form factor. All the devices, from the low-cost, low-end HCS101 encoder to the high-end HCS370 encoder and HCS410/412/473 transcoders, incorporate high security, a small package outline and low cost to form an ideal combination for multifunctional, security designs.

## Typical Applications:

Authentication	User authorization
Remote Keyless Entry (RKE)	Passive Keyless Entry (PKE)
Odometer counter	Immobilizers
Property identification	Wireless home security
Garage door openers	Remote control
Remote gate openers	Clone protection

## The Key?

KEELOQ is based on a proprietary, non-linear encryption algorithm that creates a unique transmission on every use, rendering code capture and resend schemes useless. The algorithm uses a programmable 64-bit encryption key unique to each device to generate 32-bit hopping code. The key-length and code-hopping combination reduces the possibility of unwanted access.

## KEELOQ Encoders:

The encoders range from the HCS101, a fixed encoder designed for remote control systems, to HCS2XX and HCS3XX products, which utilize Microchip's patented KEELOQ code hopping technology. The devices incorporate a small package outline, are low-cost and have minimal external components making them well suited for uni-directional RKE, 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.



## KEELOQ Decoders:

The HCS5XX decoders offer a standard solution when used with the KEELOQ encoders to implement uni-directional remote and access control systems. The HCS5XX decoders operate over a wide voltage range and can be used as stand-alone decoders or in conjunction with PIC®MCUs through a serial or parallel interface. Microchip also offers a variety of software decoders that allows the system designer to integrate the KEELOQ decoding functions with their applications onto a single PIC MCU. The software decoders come as part of a licensing package (DS40038) and include the decoding algorithm, receive routines and support various learning schemes to reduce development time and get the product to market faster.

## KEELOQ Transcoder/Encoder Family:

The KEELOQ HCS4XX family of transponder and encoder combinations provide a single-chip solution that brings together uni-directional code hopping and bi-directional transponder identification (IFF). The HCS4XX devices integrate the transponder circuitry needed to perform electronic verification of authenticity. The HCS4XX family forms a complete line of products ranging from the HCS410 for short range battery-less operation, the HCS412 for longer range single antenna applications and the HCS473 providing three sensitive antenna inputs for long range omni-directional communication.



## Comprehensive Development Systems and Support:

Microchip is committed to providing useful and innovative development tools that allow designers to meet design and time-to-market requirements. KEELoQ evaluation kits and programming tools support Microchip's KEELoQ code hopping devices. The KEELoQ development tools allow system engineers to quickly evaluate, prototype, make code changes, and get designs to market faster than ever before.

The **PRO MATE®II Programmer (DV007003)** provides manufacturing with the capability to program KEELoQ devices in production quantities. The PRO MATE II Programmer is supplied with software to automate the programming in the customer's factory production environment. The Manufacturer's Code is protected by two custodian keys that have to be entered before programming can start. Microchip supplies the various socket adapters for PDIP and SOIC devices as well as In-Circuit Serial Programming™ (ICSP™).

## Application Notes:

A wide range of application notes offer design engineers detailed technical information to remove roadblocks during the development cycle. The application notes available are:

- KEELoQ HCS30X, HCS200 Stand-Alone Programmer (AN217)
- PIC16C57 Based Code Hopping Security System (AN645)
- Designing a Transponder Coil for the HCS410 (AN650)
- KEELoQ Code Hopping Decoder Using a PIC16C56 (AN661)
- KEELoQ Code Hopping Decoder Using Secure Learn (AN662)
- KEELoQ Simple Code Hopping Decoder (AN663)
- Using KEELoQ to Generate Hopping Passwords (AN665)
- KEELoQ Code Hopping Decoder Implemented on Microchip Midrange MCUs (PIC16C6X, PIC16C7X, PIC16C62X) (AN672)
- KEELoQ HCS410 Transponder Decoder Using a PIC16C56 (AN675)
- Designing a Base Station Coil for the HCS410 (AN677)
- Wireless Home Security Implementing KEELoQ and the PICmicro® Microcontroller (AN714)
- Decoding the HCS101 for Non-Secure Applications (AN740)
- Modular Picmicro Mid-Range MCU Code Hopping Decoder (AN742)
- Modular Mid-Range PICmicro KEELoQ Decoder in C (AN744)
- Secure Learning RKE Systems Using Encoders (TB001)
- An Introduction to KEELoQ Code Hopping Technical Brief (TB003)
- Interfacing a KEELoQ Encoder to a PLL Circuit (TB042)
- KEELoQ CRC Verification Routines (TB043)
- KEELoQ Manchester Encoding Receive Routines (TB045)

## Additional Information:

- KEELoQ secure solution CD, [Order No. DS40038](#)
- Microchip's web site: [www.microchip.com](http://www.microchip.com)



## KEELoQ Evaluation Kits:

The KEELoQ Evaluation Kit II (DM303006) and KEELoQ Transponder Evaluation Kit (DM303005) demonstrate the capabilities of KEELoQ code hopping technology. The KEELoQ Evaluation Kit II contains all the necessary hardware to evaluate a code hopping system, including two transmitters and a multi-function receiver board that supports the HCS5XX stand-alone decoders. Additionally, it allows the user to develop his own software to receive, decode and interpret the KEELoQ transmission. The KEELoQ Transponder Evaluation Kit consists of a base station, a transmitter/transponder, a batteryless transponder, and various HCS4XX samples. All KEELoQ evaluation kits include PC software to configure, program and evaluate the KEELoQ system without additional hardware.

## Microchip Evaluation Kits Offer Complete Development Cycle Support:



### Step 1

Configure the system to match encoders with decoders.



### Step 2

Set-up product specific parameters and program the devices



### Step 3

Evaluate and monitor transmissions as received by the decoders.

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