

## Introduction

This user guide provides details on the WILCS02 M.2 Wi-Fi® Module Card. It is an M.2 interface board that supports the IEEE® 802.11 b/g/n standard. It is designed to demonstrate the features and functionalities of Microchip's low-power Wi-Fi WILCS02UE Module.

## Features

- M.2 Key-E Interface with Two Main Interfaces
  - Secure Digital Input Output (SDIO)
  - Serial Peripheral Interface (SPI)
- Packet Traffic Arbitration (PTA)
- Powered from M.2 Host Board via M.2 Connector 3.3V VCC
- Hardware-Based Three-Wire PTA Interface to Address Wi-Fi®/Bluetooth® Co-existence
- Configurable Strapping Pins for Host Interface Selection
- Device Firmware Update (DFU)
- Functional APIs/Drivers Through SPI with Host MCU
- Functional APIs/Drivers Through SDIO with Host MPU for Linux-Based Systems
- U. FL Antenna Connector
- Dimensions: 22.00 mm x 30.00 mm x 2.1 mm

## Table of Contents

Introduction .....	1
Features.....	1
1. Quick References.....	3
1.1. Reference Documentation.....	3
1.2. Hardware Prerequisites.....	3
1.3. Acronyms and Abbreviations.....	3
2. Kit Overview.....	4
2.1. Kit Contents.....	4
3. Hardware.....	6
3.1. Power Supply.....	7
3.2. Firmware Update.....	7
3.3. M.2 Connector Pin Specification.....	7
4. Appendix A: Reference Circuit.....	10
5. WILCS02 M.2 Wi-Fi <sup>®</sup> Module Card Bill of Materials.....	11
6. Appendix B: Regulatory Approval.....	12
6.1. United States.....	12
6.2. Canada.....	12
7. Document Revision History.....	14
Microchip Information.....	15
Trademarks.....	15
Legal Notice.....	15
Microchip Devices Code Protection Feature.....	15

# 1. Quick References

## 1.1 Reference Documentation

- *WILCS02IC and WILCS02 Family Data Sheet* ([DS70005557](#))
- *WILCS02 Wi-Fi® Link Controller Application Developer's Guide*

## 1.2 Hardware Prerequisites

- WILCS02 M.2 Wi-Fi® Module Card Kit ([EV59Y78A](#))
- SAM9x75 Curiosity

## 1.3 Acronyms and Abbreviations

**Table 1-1.** Acronyms and Abbreviations

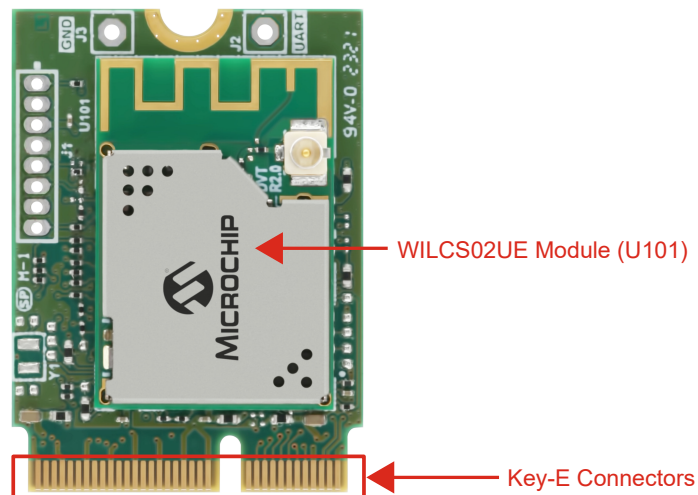
Acronyms and Abbreviations	Description
BOM	Bill of Materials
DFU	Device Firmware Update
I <sup>2</sup> C	Inter-Integrated Circuit
LED	Light Emitting Diode
MCU	Microcontroller Unit
NC	Not Connected
OOB	Out of the Box
PTA	Packet Traffic Arbitration
RX	Receiver
SDIO	Secure Digital Input Output
SCL	Serial Clock
SDA	Serial Data
SPI	Serial Peripheral Interface
TX	Transmitter
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus

## 2. Kit Overview

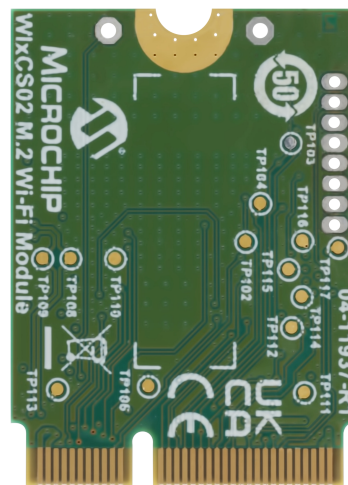
The WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card is an M.2 board containing the low-power WILCS02UE Module. The signals required for the control interface are connected to the M.2 Key-E connector of the M.2 board for connectivity, security and ease-of-use requirements.

**Note:** The following sample silkscreen is a WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card, which includes the WILCS02 Link controller module with Link Controller Firmware

**Figure 2-1.** WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card (EV59Y78A) – Top View



**Figure 2-2.** WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card (EV59Y78A) – Bottom View



### 2.1 Kit Contents

The EV59Y78A (WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card) kit contains the following:

1. WILCS02 M.2 Wi-Fi Module Card mounted with the WILCS02UE Module
2. Antenna (RFA-02-L2H1) and antenna holder (BPC2J5)

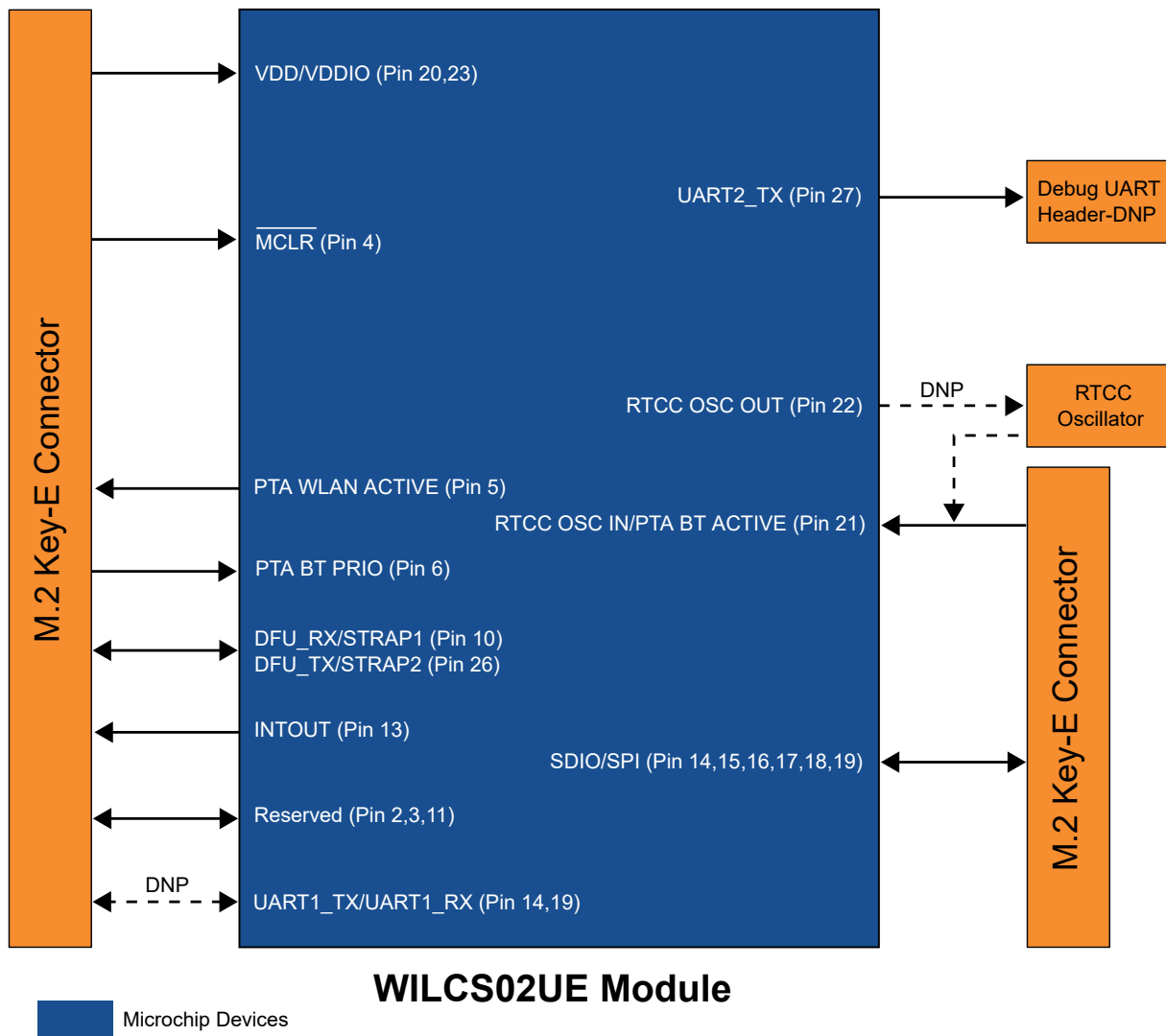
3. M.2 screw for SAM9x75

**Note:** If any of the above items are missing in the kit, go to [support.microchip.com](https://support.microchip.com) or contact your local Microchip Sales office. In this user guide, there is a list of Microchip offices for sales and services provided on the last page.

### 3. Hardware

This chapter describes the hardware features of the WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card.

**Figure 3-1.** WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card Block Diagram



**Note:**

- Using Microchip’s total system solution, which includes complementary devices, software drivers and reference designs, is highly recommended to ensure the proven performance of the WILCS02 M.2 Wi-Fi Module Card. For more details, go to [support.microchip.com](http://support.microchip.com) or contact your local Microchip Sales office.

**Table 3-1.** Microchip Components used in the WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card

S.No.	Designator	Manufacturer Part Number	Description
1	U101	WILCS02UE-I	MCHP RF Wi-Fi <sup>®</sup> 802.11 b/g/n WILCS02UE-I

### 3.1 Power Supply

From the M.2 host platform, the M.2 Key-E interface supplies a 3.3V power source to the WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card. The module's  $V_{DD}$  and  $V_{DDIO}$  pin are shorted on board.

### 3.2 Firmware Update

The WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card comes with pre-programmed firmware. Microchip periodically releases firmware to fix reported issues or to implement the latest feature support.

**Note:** For guidance on firmware updates, refer to the [WILCS02 Wi-Fi Link Controller Application Developer's Guide](#).

### 3.3 M.2 Connector Pin Specification

The following table provides details on the interface between the M.2 connector and the WILCS02UE module.

**Table 3-2.** M.2 Connector Pin Specification

M.2 Pin Number	M.2 Pin Name	M.2 Connector Pin Description	WILCS02UE Module Pin Description	WILCS02UE Module Pin Number
1	GND	GND	—	GND
3	USB_D+	USB differential data-positive	PTA_WLAN_ACTIVE	Pin 5
5	USB_D-	USB differential data-negative	PTA_BT_PRIO	Pin 6
7	GND	GND	—	GND
9	SDIO_CLK/SYSCLK(I) (0/1.8V)	SDIO clock input	SD_CLK/UART1_RX	Pin 19
11	SDIO_CMD(I/O)(0/1.8V)	SDIO command line	SD_CMD/SCK1	Pin 18
13	SDIO_DATA0(I/O) (0/1.8V)	SDIO data line 0	SD_DATA0/SDO1	Pin 17
15	SDIO_DATA1(I/O) (0/1.8V)	SDIO data line 1	SD_DATA1/ $\overline{CS1}$	Pin 16
17	SDIO_DATA2(I/O) (0/1.8V)	SDIO data line 2	SD_DATA2/SDI1	Pin 15
19	SDIO_DATA3(I/O) (0/1.8V)	SDIO data line 3	SD_DATA3/UART1_TX	Pin 14
21	SDIO_WAKE# (O) (0/1.8V)	Wake-up host (output)	INTOUT	Pin 13
23	SDIO_RESET#/ TX_BLANKING (I) (0/1.8V)	—	—	—
25	ADD-IN CARD KEY E			
27				
29				
31				
33	GND	—	—	GND
35	PERp0	—	—	—
37	PERn0	—	—	—
39	GND	—	—	GND
41	PETp0	—	—	—
43	PETn0	—	—	—
45	GND	—	—	GND
47	REFCLKp0	—	—	—

.....continued				
M.2 Pin Number	M.2 Pin Name	M.2 Connector Pin Description	WILCS02UE Module Pin Description	WILCS02UE Module Pin Number
49	REFCLKn0	—	—	—
51	GND	—	—	GND
53	CLKREQ0# (I/O)(0/1.8V/3.3V)	—	—	—
55	PEWAKE0# (I/O)(0/1.8V/3.3V)	—	—	—
57	GND	—	—	GND
59	RESERVED/PERp1	—	—	—
61	RESERVED/PERn1	—	—	—
63	GND	—	—	GND
65	RESERVED/PETp1	—	—	—
67	RESERVED/PETn1	—	—	—
69	GND	—	—	GND
71	RESERVED/REFCLKp1	—	—	—
73	RESERVED/REFCLKn1	—	—	—
75	GND	—	—	GND
2	3.3V	3.3V DC power	VDD	Pin 20
4	3.3V	3.3V DC power	VDD	Pin 20
6	LED_1# (O)(OD)	—	—	—
8	PCM_CLK/I2S_SCK (I/O)(0/1.8V)	—	—	—
10	PCM_SYNC/I2S_WS (I/O)(0/1.8V)	—	—	—
12	PCM_OUT/I2S_SD_OUT (O)(0/1.8V)	—	—	—
14	PCM_IN/I2S_SD_IN (I)(0/1.8V)	—	—	—
16	LED_2# (O)(OD)	—	—	—
18	VIO_CFG (O)	—	—	—
20	UART_WAKE# (O)(0/3.3V)	Wake-up Host (output)	INTOUT	Pin 13
22	UART_TXD (O)(0/1.8V)	UART Serial Data Output	SD_DATA3/UART1_TX	Pin 14
24				
26				
28				
30				
32	UART_RXD (I)(0/1.8V)	UART Serial Data Input	SD_CLK/UART1_RX	Pin 19
34	UART_RTS (O)(0/1.8V)	UART Request To Send (output)	SD_DATA2/SDI1	Pin 15
36	UART_CTS (I)(0/1.8V)	UART Clear To Send (input)	SD_DATA1/CS1	Pin 16
38	VENDOR DEFINED	Mode selection 1/DFU 1	DFU_RX/STRAP1	Pin 10
40	VENDOR DEFINED	WAKE (input)	Reserved	Pin 11
42	VENDOR DEFINED	Mode selection 2/DFU 2	DFU_TX/STRAP2	Pin 26
44	COEX3 (I/O)(0/1.8V)	PTA_BT_PRI0 (input)	PTA_BT_PRI0	Pin 6
46	COEX_TXD (O)(0/1.8V)	PTA_WLAN_Active (output)	PTA_WLAN_Active	Pin 5



.....continued

M.2 Pin Number	M.2 Pin Name	M.2 Connector Pin Description	WILCS02UE Module Pin Description	WILCS02UE Module Pin Number
48	COEX_RXD (I)(0/1.8V)	PTA_BT_Active (input)	RTCC_OSC_IN/ PTA_BT_ACTIVE	Pin 21
50	SUSCLK(I)(0/1.8V/3.3V)	32.768 kHz clock input from M.2 host platform	RTCC_OSC_IN/ PTA_BT_ACTIVE	Pin 21
52	PERST0# (I)(0/1.8V/ 3.3V)	—	—	—
54	W_DISABLE2# (I) (0/1.8V/3.3V)	Master Clear (input)	$\overline{\text{MCLR}}$	Pin 4
56	W_DISABLE1# (I) (0/1.8V/3.3V)	—	—	—
58	I2C_DATA (I/O)(0/1.8V)	I <sup>2</sup> C data	Reserved	Pin 3
60	I2C_CLK (I)(0/1.8V)	I <sup>2</sup> C clock	Reserved	Pin 2
62	ALERT# (O)(0/1.8V)	Wake-up host (output)	INTOUT	Pin 13
64	VIO1.8V	—	—	—
66	UIM_SWP/PERST1#	—	—	—
68	UIM_POWER_SNK/ CLKREQ1#	—	—	—
70	UIM_POWER_SRC/ GPIO_1/PEWAKE1#	—	—	—
72	3.3V	3.3V DC power	VDD	Pin 20
74	3.3V	3.3V DC power	VDD	Pin 20

**Note:** The PTA functionality is not supported while using the RTCC Oscillator.



## 5. **WILCS02 M.2 Wi-Fi® Module Card Bill of Materials**

Go to the [EV59Y78A](#) product web page for the WILCS02 M.2 Wi-Fi Module Card's Bill of Materials (BOM).

## 6. Appendix B: Regulatory Approval

This equipment (WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card/EV59Y78A) is an evaluation kit and not a finished product. It is intended for laboratory evaluation purposes only. It is not directly marketed or sold to the general public through retail; it is only sold through authorized distributors or through Microchip. Using this requires a significant engineering expertise towards understanding of the tools and relevant technology, which can be expected only from a person who is professionally trained in the technology.

Regulatory compliance settings have to follow the WILCS02 module certifications. The following regulatory notices are to cover the requirements under the regulatory approval.

### 6.1 United States

The WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card (EV59Y78A) contains the WILCS02 module, which has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C "Intentional Radiators" single-modular approval in accordance with Part 15.212 Modular Transmitter approval.

Contains FCC ID: 2ADHKWIXCS02U

**This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

---

#### **Important:** FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for uncontrolled environment. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 8 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. This transmitter is restricted for use with the specific antenna(s) tested in this application for certification.

---



Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

---

### 6.2 Canada

The WILCS02 M.2 Wi-Fi<sup>®</sup> Module Card (EV59Y78A) contains the WILCS02 module, which has been certified for use in Canada under Innovation, Science and Economic Development Canada (ISED, formerly Industry Canada) Radio Standards Procedure (RSP) RSP-100, Radio Standards Specification (RSS) RSS-Gen and RSS-247.

Contains IC: 20266-WIXCS02U

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference;
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.



This equipment complies with radio frequency exposure limits set forth by Innovation, Science and Economic Development Canada for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the device and the user or bystanders.

Cet équipement est conforme aux limites d'exposition aux radiofréquences définies par d'Innovation, Sciences et Développement économique Canada pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre le dispositif et l'utilisateur ou des tiers.

## 7. Document Revision History

The document revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Section	Description
B	1/2025	<a href="#">Kit Overview</a>	Added a note on WlxCS02 M.2 Wi-Fi <sup>®</sup> Module Card silkscreen
		Document	Updating the module name from "WlxCS02" to "WILCS02".
A	10/2024	Document	Initial revision

## Microchip Information

### Trademarks

The “Microchip” name and logo, the “M” logo, and other names, logos, and brands are registered and unregistered trademarks of Microchip Technology Incorporated or its affiliates and/or subsidiaries in the United States and/or other countries (“Microchip Trademarks”). Information regarding Microchip Trademarks can be found at <https://www.microchip.com/en-us/about/legal-information/microchip-trademarks>.

ISBN: 979-8-3371-0347-1

### Legal Notice

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at [www.microchip.com/en-us/support/design-help/client-support-services](http://www.microchip.com/en-us/support/design-help/client-support-services).

THIS INFORMATION IS PROVIDED BY MICROCHIP “AS IS”. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL, OR CONSEQUENTIAL LOSS, DAMAGE, COST, OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP’S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION.

Use of Microchip devices in life support and/or safety applications is entirely at the buyer’s risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

### Microchip Devices Code Protection Feature

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

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip products are strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is “unbreakable”. Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.