

## **Application Note**

# **V850**

## **32-Bit Single-Chip Microcontrollers**

## **AES 128 Encryption/Decryption**

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## Chapter 1 Supporting Data Security

NEC Electronics Europe (GmbH) has ported the Rijndael ANSI C code by Rijmen, Bosselaers and Barreto to our 32-bit V850 microcontroller, with a view to providing unrestricted AES128 middleware libraries free-of-charge to designers using, what is today, the world's number one selling 32-bit microcontroller. (Source: Gartner Dataquest, April 2008).

There are three main components included in the library:

- Source code of the encryption, decryption routines.
- Associated header file for the above.
- Test routines to verify the execution speed of the routines provided.

The software supports encryption key lengths of 128-bits, 192-bits and 256-bits and can be used with any V850 family microcontroller.

Implementing the library is very straightforward, following this simple process:

- Call a function that initialises the key that will be used to encrypt and decrypt the messages; you just need to pass the size of the key (128-, 192- or 256-bits) to the library function provided.
- Call a function to encrypt a 128-bit message; the result is a 128-bit encrypted message.
- Call the decrypt function.

Two test functions are also provided by NEC Electronics. The first, called SimpleAESTest, performs three encryptions / decryptions with three different key sizes (128-, 192- and 256-bits). Comparison is performed to verify that the result of each of these three encryptions / decryptions gives back the plaintext as well as measuring the encryption / decryption timings for each key size. The second function, ValidAES, performs a deeper validation of the Rijndael implementation using externally validated test vectors. Details on this validation method can be found on the Internet at

[http://blogs.msdn.com/si\\_team/archive/2006/05/19/602055.aspx](http://blogs.msdn.com/si_team/archive/2006/05/19/602055.aspx).

**It goes without saying that responsibility for the actual implementation lies with the user of the middleware.**

In terms of resource required, our middleware requires 4,494 bytes of code memory, 4,096 bytes of data memory and 10,376 bytes of constant memory, based on its usage in a V850 32-bit microcontroller.

It should be noted that whilst developed with a 32-bit microcontroller in mind, given the availability of 'C' source code in NEC Electronics' library, it would be practical to easily port the code to a 16-bit or even an 8-bit microcontroller, although the required response time should be considered as the CPU clock speed of the selected NEC Electronics microcontroller decreases.

Further details are available by contacting NEC Electronics at [www.eu.necel.com](http://www.eu.necel.com).

## Chapter 2 Revision History

Item	Date published	Document No.	Comment
1	January 22, 2009	U19668EE1V0AN00	1 <sup>st</sup> Release