



Security & Chip Card ICs

SLE 66C160P

16-Bit Security Controller

with Memory Management and Protection Unit

in 0.25 μm CMOS Technology

64-Kbytes ROM, 2304 bytes RAM, 16-Kbytes EEPROM

112-Bit/ 192-Bit DDES-EC2 Accelerator

SLE 66C160P Short Product Information		Ref.: SPI_SLE66C160P_0801.doc
This document contains preliminary information on a new product under development. Details are subject to change without notice.		
Revision History: Current Version 08.01		
Previous Releases: 04.00		
Page	Subjects (changes since last revision)	
3	RMS size changed from 2 Kbytes to 1 KByte	

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Information

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office in Germany or our Infineon Technologies Representatives world-wide (see address list).

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16-Bit Security Controller with MMU in 0.25µm CMOS Technologie **64-Kbyte ROM, 2304 bytes RAM, 16-Kbyte EEPROM** **112-Bit/ 192-Bit DDES-EC2 Accelerator**

Features

- 16-bit microcomputer in 0.25 µm CMOS technology
- Instruction set opcode compatible with standard SAB 8051 processor
- Enhanced 16-bit arithmetic
- Additional powerful instructions optimized for chip card applications
- Dedicated, non-standard architecture with **execution time 6 times faster (18 times by PLLmax)** than standard SAB 8051 processor at same external clock
- **63 Kbytes User ROM** for application programs
- Additional 1 Kbyte reserved ROM for Resource Management System (RMS+) with intelligent EEPROM write/erase routines
- **16 Kbytes EEPROM**
- **2 Kbytes XRAM, 256 Bytes IRAM**
- **Memory Management and Protection Unit (MMU)**
- **Dual Key Triple DES (DDES) and EC2 accelerator GF (2ⁿ)**
- CRC Module
- Interrupt Module
- Two 16-bit Autoreload Timer
- **PLL**
- Power saving sleep mode
- **External clock frequency 1 to 7.5 MHz for internal clock ≤ 10 MHz**
- **UART for handling serial interface** in accordance with ISO/IEC 7816 part 3 **supporting transmission protocols T=1 and T=0**
- I/O routines realized in software executable
- Supply voltage range: 2.7 V to 5.5 V
- Current consumption:
 < 10 mA @ 5.5 V
 < 6 mA @ 3.3 V

EEPROM

- Reading, erasing and writing byte by byte
- Flexible page mode for 1 to 64 bytes write/erase operation
- 32 bytes security area (OTP)
- Erase + Write time < 4.5 ms
- **Minimum of 500.000 write/erase cycles at 25°C**
- Data retention for a minimum of 10 years
- EEPROM programming voltage generated on chip

Memory Management and Protection Unit

- Addressable memory up to 1 MByte
- Separates OS (system) and application (user)
- System routines called by traps
- OS can restrict access to peripherals in application mode
- Code execution from XRAM possible

Security Features

Operation state monitoring mechanism

- Low and high voltage sensors
- Frequency sensors and filters

Memory Security

- 16 bytes security PROM, hardware protected
- Unique chip identification number for each chip
- MED - memory encryption/decryption device for XRAM, ROM and EEPROM
- True Random Number Generator with Firmware test function
- Security optimised layout and layout scrambling

- Temperature range: -25 to +85°C
- ESD protection larger than 6 kV

Testmode

- Irreversible Lock - Out of testmode

Anti Snooping

- HW-countermeasures against SPA/DPA-, Timing- and DFA-attacks (differential fault analysis – DFA)
- CRC – Module
- Non standard dedicated Smart Card CPU – Core
- Active Shield with automatic and user controlled attack detection

Support

- HW-& SW-Tools (Emulator, ROM Monitor, Card Emulator, Simulator, Softmasking)
- Application notes

Supported Standards

- ISO/IEC 7816
- EMV 2000
- GSM 11.1x
- ETS I TS 102 221

Document References

- Confidential Data Book SLE 66CxxxP
- Qualification report
- Chip delivery specification for wafer with chip-layout (die size, orientation,...)
- Module specification containing description of package, etc.
- Qualification report module

Development Tools Overview

- Short Product Information Software Development Kit SDK CC
- Short Product Information Card Emulator CE66P
- Short Product Information ROM Monitor RM66P
- Short Product Information Emulator ET66P Hitex or ET66P KSC
- Short Product Information Smart Mask Package

Performance DDES-EC2 Accelerator

Operation	Data Block Length	Encryption Time for an 8-Byte Block incl. Data Transfer		
		5 MHz	10 MHz	15 MHz
56-bit Single DES Encryption	64 bit	23 µs	11 µs	8 µs
112-bit Triple DES Encryption	64 bit	35 µs	17 µs	12 µs
	Operand Length	Calculation Time		
		5 MHz	10 MHz	15 MHz
Elliptic Curves GF(2 ⁿ) EC-DSA Signature Generate	192 bit	285 ms	142 ms	95 ms
Elliptic Curves GF(2 ⁿ) EC-DSA Signature Verify	192 bit	540 ms	270 ms	180 ms

Ordering Information

Type	Package ¹	Voltage Range	Temperature Range	Frequency Range (ext. clock frequency)
SLE 66C160P M5	M5	2.7 V - 5.5 V	– 25°C to + 70°C	1 MHz - 5 MHz
SLE 66C160P C	die			
SLE 66C160P-T85 M5	M5	2.7 V - 5.5 V	– 25°C to + 85°C	1 MHz - 5 MHz
SLE 66C160P-T85 C	die			
SLE 66C160P-F7 M5	M5	2.7 V - 5.5 V	– 25°C to + 70°C	1 MHz – 7.5 MHz
SLE 66C160P-F7 C	die			

Production sites:

- Dresden SLE 66CxxxP
- UMC Taiwan SLE 66CxxxPU

¹ available as wire-bonded module (M5) for embedding in plastic cards or as die (C) for customer packaging

Pin Configuration

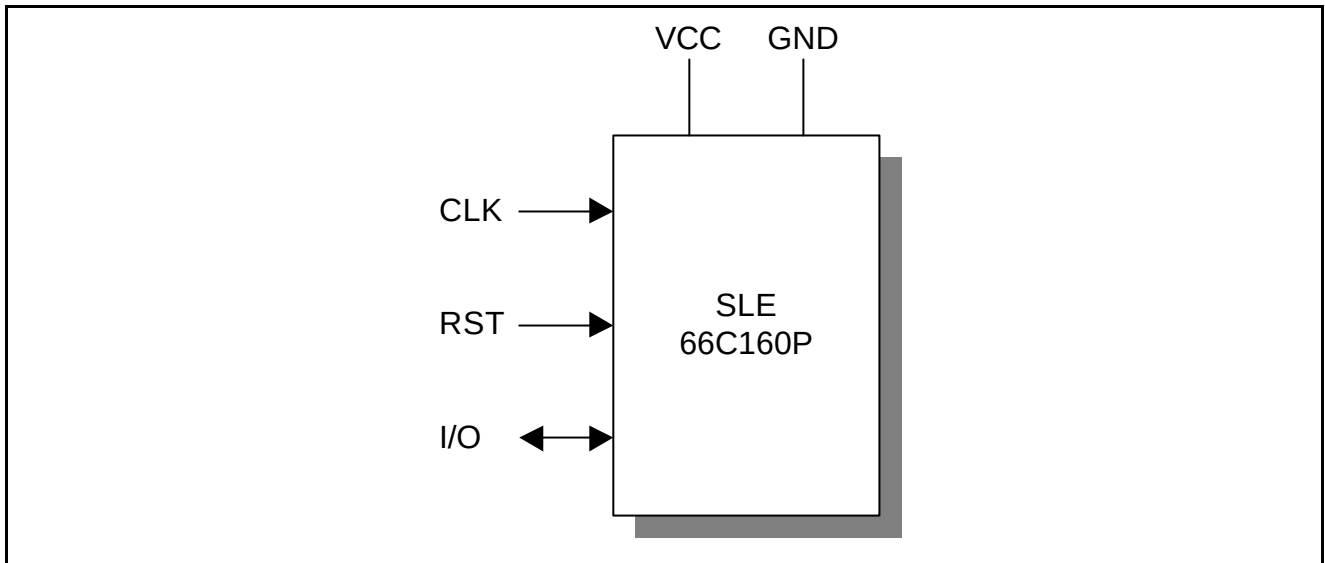


Figure 1: Pin Configuration

Pin Definitions and Functions

Symbol	Function
VCC	Operating voltage
RST	Reset input
CLK	Processor clock input
GND	Ground
I/O	Bi-directional data port

General Description

SLE 66C160P is another member of Infineon Technologies high end security controller family in advanced 0.25 μm CMOS technology. The CPU provides the high efficiency of the SAB 8051 instruction set extended by additional powerful instructions together with enhanced performance, memory sizes and security features. The internal clock frequency can be adjusted up to 10 MHz independent of the clock rate of the terminal with the help of the PLL.

The controller IC offers at least 63 Kbytes of User-ROM, 256 bytes internal RAM, 2048 bytes XRAM and 16 Kbytes EEPROM. The Memory Management and Protection Unit allows a secure separation of the operating system and the applications. Furthermore the MMU makes a secure downloading of applications possible after the personalization of a card. These new features suit the requirements of the next generation of multi application operating systems. For code compatibility to the SLE 66CxxS family, a transparent mode for the MMU is established which allows to keep the memory mapping of the SLE 66CxxS products.

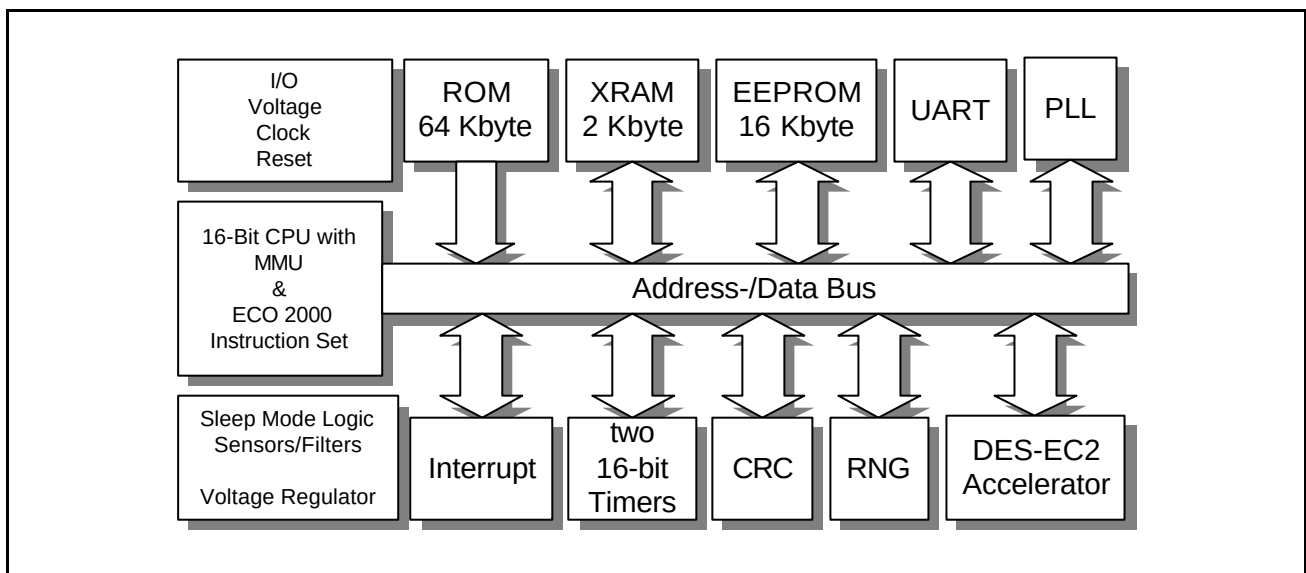


Figure 2: Block Diagram SLE 66C160P

The CRC module allows the easy generation of checksums according to ISO/IEC 3309 (16-Bit-CRC). To minimize the overall power consumption, the chip card controller IC offers a sleep mode. The UART supports the half-duplex transmission protocols T=0 and T=1 according to ISO/IEC 7816-3. All relevant transmission parameters can be adjusted by software, as e.g. the clock division factor, direct/inverse convention and the number of stop bits. Additionally, the I/O port can be driven by communication routines realized in software.

The DES accelerator consists of two modules. The DES module supports symmetrical crypto algorithms according to the Data Encryption Standard in the Electronic Code Book Mode. The EC2 module accelerates the multiplication in $\text{GF}(2^n)$ and therefore the operations for elliptic curve cryptography.

The random number generator (RNG) is able to supply the CPU with true random numbers on all conditions.

As an important feature, the chip provides a new and enhanced level of on-chip security.

In conclusion, the SLE 66C160P fulfills the requirements of today's chip card applications, especially for payment, and offers a powerful platform for future multi application cards. The SLE 66C160P integrates outstanding memory sizes, additional peripherals in combination with enhanced performance and optimized power consumption on a minimized die size. Therefore, the SLE 66C160P offers the basis for a generation of new chip card applications.