# USB High Speed Flash Controller

## Introduction

### General description

5212 is a single-chip High-Speed USB flash disk controller. It is compliant to USB 2.0 High-Speed and Full-Speed protocol. The features of USB-boot-up and driver-less make the flash disk very convenient for end-users.

5212 is designed with flash management technology including wear-leveling and on-the-fly error-correction coding, which increase the life time of the flash disk. The flexibility in the interface design covers support to SLC, MLC and TLC NAND flash.

For data security, 5212 offers multiple levels of protection. In non-protection level, data in the disk is fully accessible. In low protection level, disk is read-only to protect from virus and accidental data removal. In high protection level, the disk data cannot be accessed without authentication.

User-programmable device name based on USB Mass Storage protocol (SCSI) is also provided.

### Features

**Host Interface**

- USB 2.0 compliant and USB 1.1 compatible
- USB-ZIP/USB-HDD boot-up
- Support Windows Auto-Run
- Support multiple LUN
- Support data security
- Compatible with Windows 7/Vista/ XP/2K/98, MacOS, and Linux kernel 2.4+
- Configurable Removable or Fixed media types
- Support serial number for each disk
- Configurable USB vendor/product ID
- Configurable USB vendor/product string
- Write protect switch
- Ready/busy LED

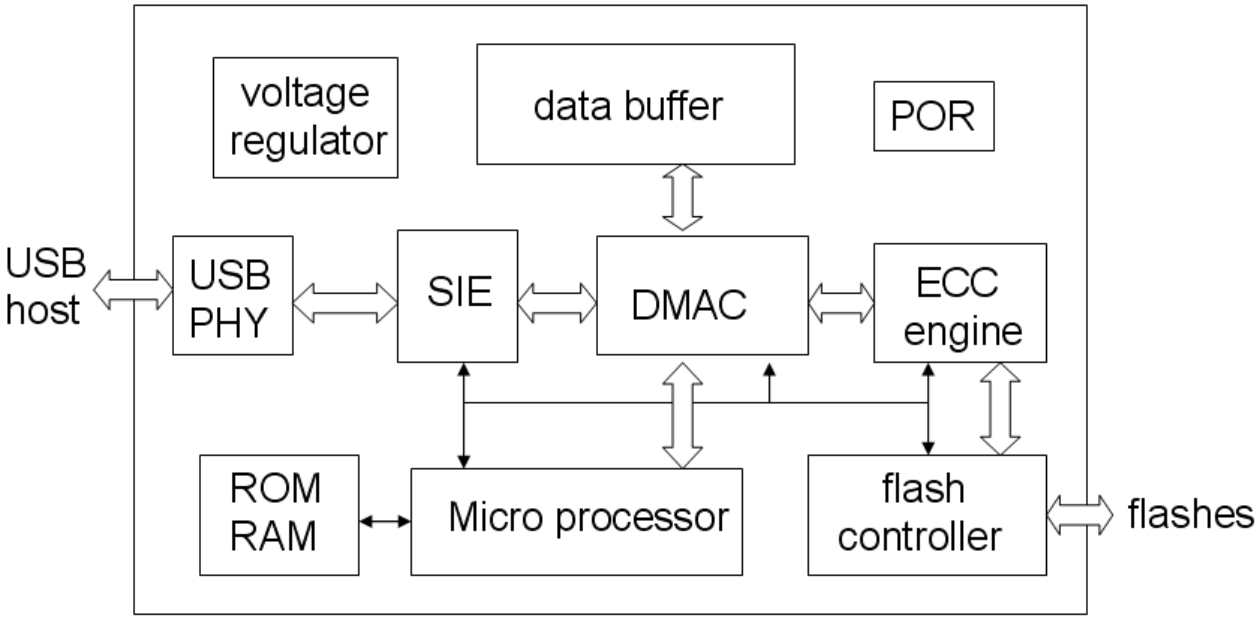
**Flash Control**

- Support page sizes of 2K/4K/8K Byte per page SLC, MLC and TLC NAND type flash
- Single channel flash interface
- Support asynchronous flash interface
- Programmable clock rate for flash data strobe
- Supports 4 flash CE pins with 8bit data bus
- On-the-fly ECC, 8 to 30 bit correction
- Wear-leveling extends product life time
- Defect block concealment and dynamic defect block handling
- Flash scan engine for error bit search

**System Functions**

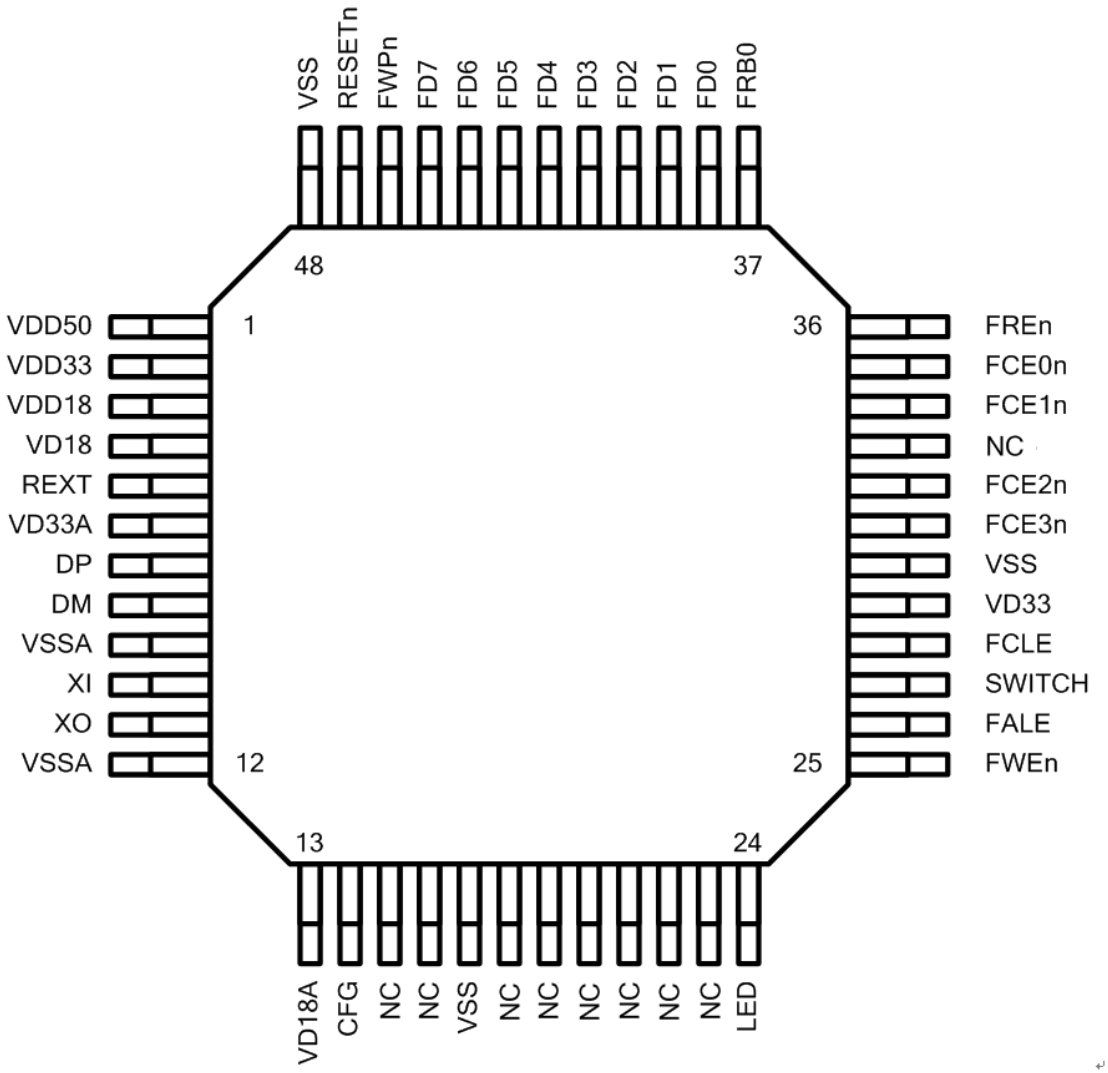
- On-chip voltage detector for power-on-reset
- Integrated 5V to 3.3V/1.8V LDO regulator
- Downloadable firmware (ISP)
- 12MHz external clock for low EMI
- Integrated pull-up resistors to simplify PCB design
- 0 to 70 $^{o}$C operation temperature
- 48 pin LQFP/TQFP package

## Block Diagram



## Pin Configuration and Definition

**5212, 48pin configuration**




**5212, 48Pin definition**

| Pin Number | Name | IO Type | Function |
|---|---|---|---|
| **USB Transceiver** | | | |
| 7 | DP | Analog | USB bus D+. |
| 8 | DM | Analog | USB bus D-. |
| 5 | REXT | Analog | Connect to ground through 330Ohm resistor |
| **Clock** | | | |
| 10 | XI | Clock In | 12MHz crystal input. |
| 11 | XO | Clock Out | 12MHz crystal output. |

| | | | |
|---|---|---|---|
| **Flash** | | | |
| 38, 39, 40, 41, 42, 43, 44, 45 | FD7, FD6, FD5, FD4, FD3, FD2, FD1, FD0 | IO, 3.3V | Bi-directional data bus signals to flash, low 8 bits. |
| 31, 32, 34, 35 | FCE3n, FCE2n, FCE1n, FCE0n | O, 3.3V | Active-low chip enable signals to flash. |
| 28 | FCLE | O, 3.3V | Command latch enable to flash. |
| 26 | FALE | O, 3.3V | Address latch enable to flash. |
| 36 | FREn | O, 3.3V | Active-low read strobe to flash. |
| 25 | FWEn | O, 3.3V | Active-low write strobe to flash. |
| 37 | FRB0 | I, ST, PU, 3.3V | Ready/Busy from flash. Typical internal pull-up resistance is 33KΩ |
| 46 | FWPn | O, 3.3V | Write protect to flash |
| **System Control and Status** | | | |
| 27 | SWITCH | I, 3.3V | Write protect switch |
| 24 | LED | O, 3.3V | Ready/busy LED |
| 14 | CFG | I, 3.3V | Chip config. Must be connected to 3.3V. |
| 47 | RESETn | I, ST, PU, 3.3V | Chip reset |
| **Power and Ground** | | | |
| 1 | VDD50 | Power | 5V Power input |
| 2 | VDD33 | Power | 3.3V Power output |
| 3 | VDD18 | Power | 1.8V Power output |
| 29 | VD33 | Power | 3.3V Power input |
| 4 | VD18 | Power | 1.8V Power input |
| 17, 30, 48 | VSS | Ground | Ground |
| 6 | VD33A | Power | 3.3V Analog power input |
| 13 | VD18A | Power | 1.8V Analog power input |
| 9, 12 | VSSA | Ground | Analog ground |

**Function of I/O types**

| | |
|---|---|
| I | Input |
| ST | Input with Schmitt trigger |
| PU | Input with internal pull-up |
| O | Output |
| IO | I/O |

# Electrical Specifications

### Recommended Operating Condition

| Symbol | Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| $V_5$ | 5V Voltage Input | 4.5 | 5 | 5.5 | V |
| $T_{OPR}$ | Operating temperature | 0 | | 70 | °C |

| Symbol | Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| $V_{18}$ | 1.8V Voltage | 1.65 | 1.8 | 1.95 | V |
| $T_{OPR}$ | Operating temperature | 0 | | 70 | °C |

### DC Characteristics of Flash Interface and System Pins.

| Symbol | Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| $V_{IL}$ | Input LOW voltage | | | 0.8 | V |
| $V_{IH}$ | Input HIGH voltage | 2.0 | | | V |
| $V_{OL}$ | Output LOW voltage | | | 0.4 | V |
| $V_{OH}$ | Output HIGH voltage | 2.4 | | | V |
| $V_{T+}$ | Schmitt trig LOW to HIGH voltage | | 1.5 | | V |
| $V_{T-}$ | Schmitt trig HIGH to LOW voltage | | 0.94 | | V |

### DC and Operating Characteristics

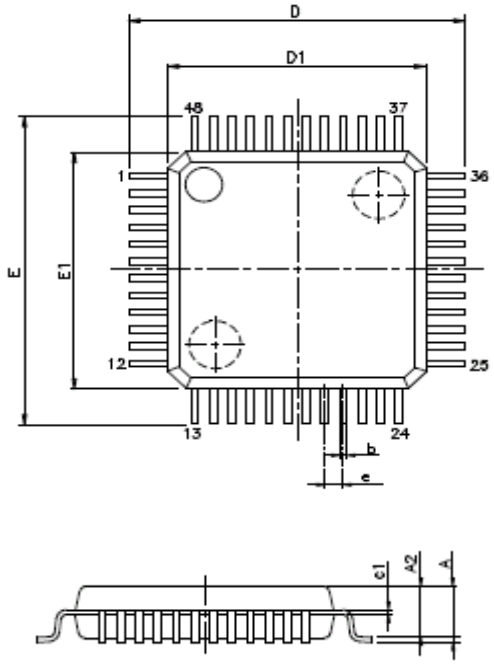
| Symbol | Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| $I_{IDLE-HS}$ | High-Speed Idle current (no access, no suspend) | | 54 | | mA |
| $I_{RD-HS}$ | High-Speed Read current | | 71 | | mA |
| $I_{WR-HS}$ | High-Speed Write current | | 68 | | mA |
| $I_{SP}$ | Suspend current | | 420 | | uA |

### LDO Regulator Characteristics

| Symbol | Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| $I_{DD33}$ | 3.3V supply current | | | 100 | mA |
| $I_{DD18}$ | 1.8V supply current | | | 100 | mA |

# Package Dimensions

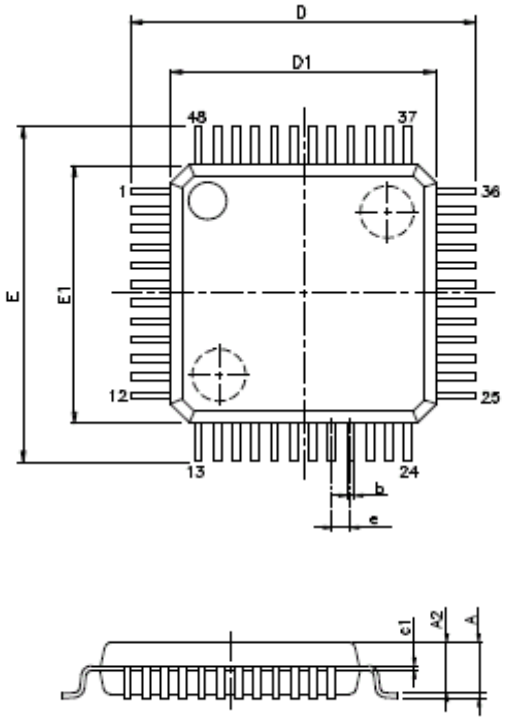
**48pin LQFP**




VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

| SYMBOLS | MIN. | MAX. |
|---|---|---|
| A | -- | 1.6 |
| A1 | 0.05 | 0.15 |
| A2 | 1.35 | 1.45 |
| c1 | 0.09 | 0.16 |
| D | 9.00 BSC | |
| D1 | 7.00 BSC | |
| E | 9.00 BSC | |
| E1 | 7.00 BSC | |
| e | 0.5 BSC | |
| b | 0.17 | 0.27 |
| L | 0.45 | 0.75 |
| L1 | 1 REF | |

**48pin TQFP**




VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

| SYMBOLS | MIN. | NOM. | MAX. |
|---|---|---|---|
| A | -- | -- | 1.20 |
| A1 | 0.05 | -- | 0.15 |
| A2 | 0.95 | 1.00 | 1.05 |
| b | 0.17 | 0.22 | 0.27 |
| c | 0.09 | -- | 0.16 |
| D | 9.00 BSC | | |
| D1 | 7.00 BSC | | |
| E | 9.00 BSC | | |
| E1 | 7.00 BSC | | |
| e | 0.50 BSC | | |
| L | 0.45 | 0.60 | 0.75 |
| L1 | 1.00 REF | | |
| θ | 0° | 3.5° | 7° |

## Revision History

| Revision | Issue Date | Description of Change |
|---|---|---|
| V0.1 | 2010-04-09 | Initial release. |
| V0.2 | 2010-09-15 | Add power consumption information |
| V0.3 | 2010-10-27 | Revise block diagram |
| V0.4 | 2010-10-29 | Revise pin diagram |