

USB EDC Vertical 2SE

Customer: _____

Customer

Part Number: _____

Innodisk

Part Number: _____

Innodisk

Model Name: _____

Date: _____

| Innodisk Approver | Customer Approver |
|------------------------------|------------------------------|
| | |

**The Total Solution For
Industrial Flash Storage**

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REVISION HISTORY

| Revision | Description | Date |
|----------|---|------------|
| 1.0 | First Release | Mar, 2013 |
| 1.1 | Add 16GB Capacity Add Industrial grade information Modify performance Modify power consumption Modify device parameters Remove endurance | June, 2013 |
| 1.2 | Add TBW | Sep, 2013 |
| 1.3 | Modify TBW based on NAND Flash specifications | Feb., 2015 |

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1. Product Overview

1.1 Introduction of USB EDC

The Innodisk USB EDC (Embedded Disk Card) products provide high capacity USB flash memory storage that electrically complies with High-speed USB 2.0 interface & backward compatible with USB 1.1. The device features attractive small form factor and the connectivity over USB2.0 and the NAND flash architecture provide a faster data transmission.

1.2 Product View



Figure 1: USB EDC Vertical 2SE

1.3 Product Models

USB EDC Vertical 2SE is available in follow capacities.

- USB EDC Vertical 2SE 512MB
- USB EDC Vertical 2SE 1GB
- USB EDC Vertical 2SE 2GB
- USB EDC Vertical 2SE 4GB
- USB EDC Vertical 2SE 8GB
- USB EDC Vertical 2SE 16GB

1.4 Capacity

USB EDC Vertical 2SE provides unformatted from 512MB up to 16GB capacities within SLC Flash IC.

1.5 VID/PID

Customize VID/PID(specify 4bits for each ID, Hexadecimal(0~F))

For Option, Default is 196D/0201.

2. Theory of operation

2.1 Overview

Figure 2 shows the operation of USB EDC Vertical 2SE from the system level, including the major hardware blocks.

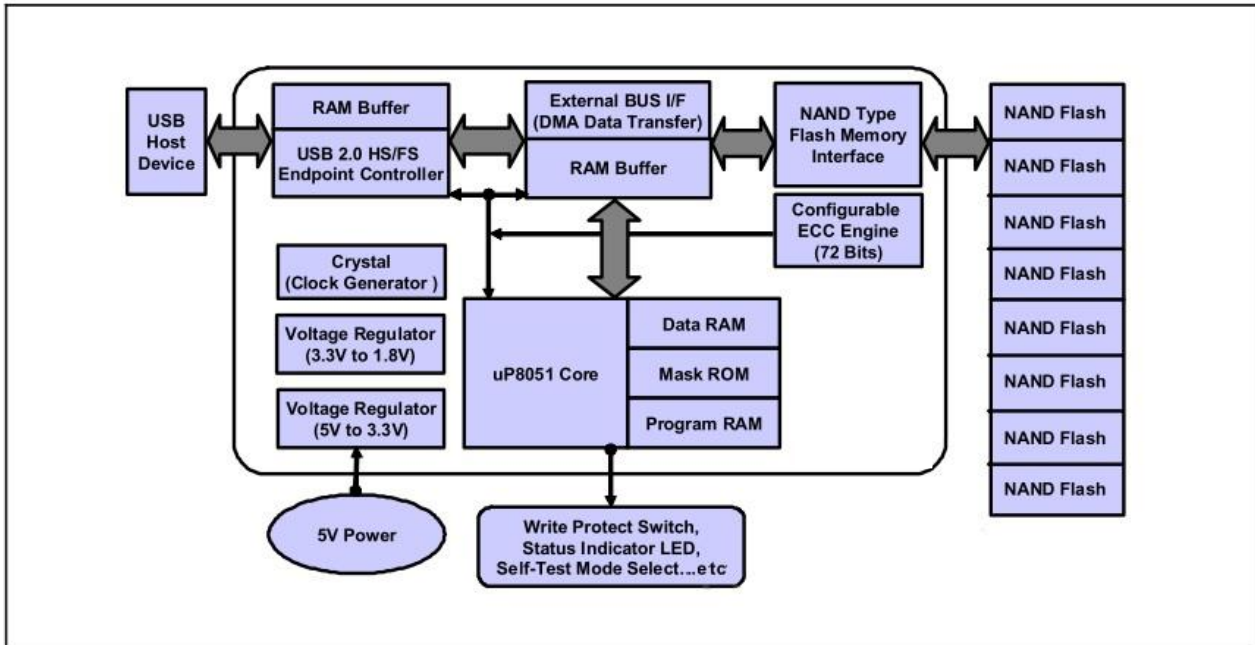


Figure 2: USB EDC Vertical 2SE Block Diagram

USB EDC Vertical 2SE integrates a USB2.0 controller and NAND flash memories. Communication with the host occurs through the host interface. Communication with the flash device(s) occurs through the flash interface.

2.2 Error Detection and Correction

Highly sophisticated Error Correction Code algorithms are implemented. The ECC unit consists of the Parity Unit (parity-byte generation) and the Syndrome Unit (syndrome-byte computation). This unit implements an algorithm that can correct 72 bits per 1024 bytes in an ECC block. Code-byte generation during write operations, as well as error detection during read operation, is implemented on the fly without any speed penalties.

2.3 Wear-Leveling

Flash memory can be erased within a limited number of times. This number is called the *erase cycle limit* or *write endurance limit* and is defined by the flash array vendor. The erase cycle limit applies to each individual erase block in the flash device.

USB EDC Vertical 2SE uses a static wear-leveling algorithm to ensure that consecutive writes of a specific

sector are not written physically to the same page/block in the flash. This spreads flash media usage evenly across all pages, thereby extending flash lifetime.

2.4 Bad Blocks Management

Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the SSD is shipped, or may generate during the life time of the SSD. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The SSD implement Bad Blocks management and replacement, Error Correct Code to avoid data error occurred. The functions will be enabled automatically to transfer data from Bad Blocks to spare blocks, and correct error bit. After the reserved block less than 40, the SSD will be locked, and cannot be written anymore.

3. Specifications

3.1 CE and FCC Compatibility

USB EDC Vertical 2SE conforms to CE and FCC requirements.

3.2 RoHS Compliance

USB EDC Vertical 2SE is fully compliant with RoHS directive.

3.3 Environmental Specifications

3.3.1 Temperature Ranges

Operating Temperature Range:

- Standard Grade: 0°C ~ +70°C
- Industrial Grade: -40°C ~ +85°C

Storage Temperature Range:

- Standard Grade: -55°C to +95°C

3.3.2 Humidity

Relative Humidity: 10-95%, non-condensing

3.3.3 Shock and Vibration

| Reliability | Test Conditions | Reference Standards |
|------------------|--------------------------------|---------------------|
| Vibration | 7 Hz to 2K Hz, 20G, 3 axes | IEC 68-2-6 |
| Mechanical Shock | Duration: 0.5ms, 1500G, 3 axes | IEC 68-2-27 |

Table 1: Shock/Vibration Testing for USB EDC Vertical 2SE

3.3.4 Mean Time between Failures (MTBF)

Table 2 summarizes the MTBF prediction results for various USB EDC Vertical 2SE configurations. The analysis was performed using a RAM Commander™ failure rate prediction.

- Failure Rate: The total number of failures within an item population, divided by the total number of life units expended by that population, during a particular measurement interval under stated condition.

- Mean Time between Failures (MTBF): A basic measure of reliability for repairable items: The mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

| Product | Condition | MTBF (Hours) |
|----------------------|---------------------------|--------------|
| USB EDC Vertical 2SE | Telcordia SR-332 GB, 25°C | >3,000,000 |

Table 2: USB EDC Vertical 2SE MTBF

3.3.5 Terabyte Written (TBW)

| Parameter | Value |
|-----------------------|-------|
| TBW(Sequential Write) | |
| 512MB | 27 |
| 01GB | 54 |
| 02GB | 108 |
| 04GB | 216 |
| 08GB | 432 |
| 16GB | 864 |

Table 3: USB EDC Vertical 2SE TBW

3.4 Pin Assignment

USB EDC Vertical 2SE is designed within USB 2.0 Interface. Particularly, its built-in power pin enables the device more compactable. Table 3 demonstrates USB EDC Vertical 2SE pin assignments.

| Horizontal Type | | | |
|-----------------|-------------|---------|--------|
| Pin No. | Signal | Pin No. | Signal |
| 1 | +5VDC | 2 | NC |
| 3 | USB Data(-) | 4 | NC |
| 5 | USB Data(+) | 6 | NC |
| 7 | GND | 8 | NC |
| 9 | NC | 10 | NC |

Table 4: USB EDC Vertical 2SE Pin Assignment

3.5 Mechanical Dimensions

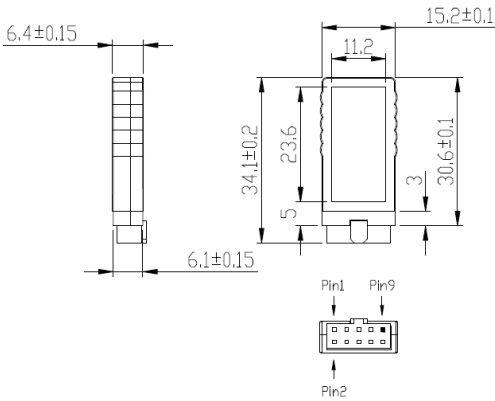


Figure 3: USB EDC Vertical 2SE mechanical dimensions

3.6 Weight

3g±2

3.7 Performance

| Product name | | 512MB | 1GB | 2GB | 4GB | 8GB | 16GB |
|-------------------------|---------------------|---------|---------|---------|---------|---------|---------|
| USB EDC Vertical 2SE | Sequential Read | 24 MB/S | 24 MB/S | 24 MB/S | 26 MB/S | 26 MB/S | 28 MB/S |
| | Sequential Write | 18 MB/S | 20 MB/S | 20 MB/S | 24 MB/S | 24 MB/S | 24 MB/S |

3.8 NAND Flash Memory

USB EDC Vertical 2SE uses Single Level Cell (SLC) NAND flash memory, which is non-volatility, high reliability which has 100,000 program/erase times and high speed memory storage.

4. Electrical Specifications

4.1 Absolute Maximum Ratings

| Item | Symbol | Rating | Unit |
|-------------------------------|----------------------|------------|------|
| Storage Temperature | T _{Storage} | -55 ~ +95 | °C |
| Ambient Operating Temperature | T _a | 0 ~ +70 | °C |
| 3.3V supply voltage | VCC33 | -0.3 ~ 3.6 | V |
| 1.8V supply voltage | VCC18 | -0.3 ~ 2 | V |
| 3.3V buffer input voltage | V _{in33} | -0.3 ~ 3.6 | V |
| 3.3V/5V buffer input voltage | V _{in335} | -0.3 ~ 5 | V |
| 1.8V buffer input voltage | V _{in18} | -0.3 ~ 2 | V |

Table 5: USB EDC Absolute Maximum Ratings

4.2 Operating Conditions

| Item | Symbol | Rating | Unit |
|-----------------------|--------------------|-----------|------|
| USB 5V supply voltage | USBV _{in} | 3.2 ~ 5.5 | V |
| 3.3V supply voltage | VDD33 | 3.0 ~ 3.6 | V |
| 1.8V supply voltage | VDD18 | 1.6 ~ 2 | V |

Table 6: USB EDC Operating Conditions

4.3 Power Consumption

| Mode | Power Consumption |
|---|-------------------|
| Read | 170 mA (max.) |
| Write | 160 mA (max.) |
| Idle | 110 mA (max.) |
| The power consumption is based on 16GB model. | |

Table 7: Power Consumption

4.4 Device Parameters

USB EDC device parameters listed in Table 7.

| Capacity | LBA | User capacity (MB) |
|----------|----------|--------------------|
| 512MB | 982016 | 479 |
| 1GB | 2014208 | 983 |
| 2GB | 4028416 | 1967 |
| 4GB | 8105984 | 3958 |
| 8GB | 16211968 | 7916 |
| 16GB | 32481280 | 15860 |

Table 8: Device parameters

5. Part Number Rule

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|------|-------------|---|---|---|---|----------|---|---|----------|---|----|------------|-----------------|-------------|---------|-------|----|-----------------|----|----|
| | D | E | U | V | 1 | - | 0 | 8 | G | I | 7 | 2 | A | C | 1 | S | B | - | X | X | X |
| Description | Disk | Form Factor | | | | - | Capacity | | | Category | | | Flash mode | Operation Temp. | PCB Version | Channel | Flash | - | Customized Code | | |
| Definition | | | | | | | | | | | | | | | | | | | | | |
| Code 1st (Disk) | | | | | | | | | | | Code 13th (Flash mode) | | | | | | | | | | |
| D: Disk | | | | | | | | | | | A: Async Flash | | | | | | | | | | |
| Code 2nd ~ 5th (Form Factor) | | | | | | | | | | | Code 14th (Operation Temperature) | | | | | | | | | | |
| EUV1: USB EDC Vertical | | | | | | | | | | | C: Standard Grade (0°C ~ +70°C) | | | | | | | | | | |
| Code 7th ~9th (Capacity) | | | | | | | | | | | W: Industrial Grade (-40°C ~ +85°C) | | | | | | | | | | |
| 512: 512MB | | | | | | | | | | | Code 15th (PCB Version) | | | | | | | | | | |
| 01G: 1GB | | | | | | | | | | | 1: First Version | | | | | | | | | | |
| 02G: 2GB | | | | | | | | | | | Code 16th (Channel) | | | | | | | | | | |
| 04G: 4GB | | | | | | | | | | | S: Single | | | | | | | | | | |
| 08G: 8GB | | | | | | | | | | | Code 17th (Flash) | | | | | | | | | | |
| 16G:16GB | | | | | | | | | | | B: Toshiba SLC | | | | | | | | | | |
| Code 10th ~12th (Category) | | | | | | | | | | | Code 19th ~21st (Customize code) | | | | | | | | | | |
| I72:USB Series | | | | | | | | | | | | | | | | | | | | | |

Verification of Compliance

Product Name : USB EDC Vertical 2SE/2ME
Model Number : DEUV1-XXXI72 #%※& *
XXX : 512MB~16GB
: Flash Mode
% : Temperature (C : Commercial Temp W : Industrial Temp
E: Extended Temp)
※ : PCB Version (A, B, C.... or 1, 2, 3...)
& : Channel (S : Single, D : Dual)
* : Flash Vender (T : Micron SLC, S : Samsung SLC, N : Micron MLC
B : Toshiba SLC, C: Toshiba MLC)

Applicant : InnoDisk Corporation
Address : 9F, No.100, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221,
Taiwan

Report Number : O22-U070-1302-271
Issue Date : April 1, 2013
Applicable Standards : EN 55022:2010 Class B ITE
AS/NZS CISPR22:2009 Class B ITE
EN 55024:2010
EN 61000-4-2:2009
EN 61000-4-3:2006+A1:2008+A2:2010
EN 61000-4-4:2004+A1:2010

Based on the EMC Directive 2004/108/EC and the specifications of the customer, one sample of the designated product has been tested in our laboratory and found to be in compliance with the EMC standards cited above.



TAF 0905
FCC CAB Code TW1053
NVLAP Lab Code 200575-0
IC Code 4699A
VCCI Accep. No. R-1527, C-1609, T-1441, G-10,
C-4400, T-1334, G-614



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Tel : 886-2-25984568
Fax: 886-2-25984546

(Tsun-Yu Shih/ General Manager)

Date: April 1, 2013

Verification of Compliance

Product Name : USB EDC Vertical 2SE/2ME
Model Number : DEUV1-XXXI72 # % ※ & *
XXX : 512MB~16GB
: Flash Mode
% : Temperature (C : Commercial Temp W : Industrial Temp
E: Extended Temp)
※ : PCB Version (A, B, C.... or 1, 2, 3...)
& : Channel (S : Single, D : Dual)
* : Flash Vender (T : Micron SLC, S : Samsung SLC, N : Micron MLC,
B : Toshiba SLC, C: Toshiba MLC)

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Address : 9F, No.100, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221,
Taiwan
Report Number : F-U070-1302-271
Issue Date : April 1, 2013

Applicable Standards : FCC Part 15, Subpart B Class B ITE
ANSI C63.4:2009
Industry Canada ICES-003 Issue 5
CSA-IEC CISPR22-10 Class B ITE

One sample of the designated product has been tested in our laboratory and found to be in compliance with the FCC rules cited above.



NVLAP LAB CODE 200575-0

TAF 0905

FCC CAB Code TW1053

IC Code 4699A

VCCI Accep. No. R-1527, C-1609, T-1441, G-10,
C-4400, T-1334, G-614



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Taipei, Taiwan, 104, R.O.C.
Tel : 886-2-25984568
Fax: 886-2-25984546

(Tsun-Yu Shih/ General Manager)

Date: April 1, 2013

REACH Declaration of Conformity**Manufacturer Product: All Innodisk EM Flash and Dram products**

1.宜鼎國際股份有限公司（以下稱本公司）特此保證此售予貴公司之產品，皆符合歐盟化學品法案(Registration , Evaluation and Authorization of Chemicals ; REACH)之規定

(<http://www.echa.europa.eu/de/candidate-list-table> last updated: 16/05/2014)。所提供之產品包含：(1) 產品或產品所使用到的所有原物料；(2) 包裝材料；(3) 設計、生產及重工過程中所使用到的所有原物料。

We Innodisk Corporation hereby declare that our products are in compliance with the requirements according to the REACH Regulation

(<http://www.echa.europa.eu/de/candidate-list-table> last updated: 16/06/2014).

Products include : 1) Product and raw material used by the product ; 2) Packaging material ; 3) Raw material used in the process of design, production and rework

2.本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成協議。

InnoDisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.

立 保 證 書 人 (Guarantor)

Company name 公司名稱：InnoDisk Corporation 宜鼎國際股份有限公司

Company Representative 公司代表人：Richard Lee 李鐘亮

Company Representative Title 公司代表人職稱：CEO 執行長

Date 日期：2014 / 07 / 29



RoHS 自我宣告書 (RoHS Declaration of Conformity)

Manufacturer Product: All Innodisk EM Flash and Dram products

- 一、宜鼎國際股份有限公司（以下稱本公司）特此保證售予貴公司之所有產品，皆符合歐盟 2011/65/EU 關於 RoHS 之規範要求。

Innodisk Corporation declares that all products sold to the company, are complied with European Union RoHS Directive (2011/65/EU) requirement

- 二、本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成協議。

Innodisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.

| Name of hazardous substance | Limited of RoHS ppm (mg/kg) |
|--------------------------------|-----------------------------|
| Cd | < 100 ppm |
| Pb | < 1000 ppm |
| Hg | < 1000 ppm |
| Chromium VI (Cr+6) | < 1000 ppm |
| Polybromodiphenyl ether (PBDE) | < 1000 ppm |
| Polybrominated Biphenyls (PBB) | < 1000 ppm |

立保證書人 (Guarantor)

Company name 公司名稱: Innodisk Corporation 宜鼎國際股份有限公司

Company Representative 公司代表人: Richard Lee 李鍾亮

Company Representative Title 公司代表人職稱: CEO 執行長

Date 日期: 2014 / 07 / 29



(Company Stamp/公司大小章)