

USB EDC Vertical 2SE2

Customer:

Customer

Part Number:

Innodisk

Part Number:

Innodisk

Model Name:

Date:

Innodisk Approver	Customer Approver

Table of contents

TABLE OF CONTENTS	2
REVISION HISTORY	3
LIST OF FIGURES	4
1. PRODUCT OVERVIEW	6
1.1 INTRODUCTION OF USB EDC	6
1.2 PRODUCT VIEW	6
1.3 PRODUCT MODELS	6
1.4 CAPACITY	6
1.5 VID/PID	6
2. THEORY OF OPERATION	7
2.1 OVERVIEW	7
2.2 ERROR DETECTION AND CORRECTION	7
2.3 WEAR-LEVELING	7
2.4 BAD BLOCKS MANAGEMENT	8
3. SPECIFICATIONS	9
3.1 CE AND FCC COMPATIBILITY	9
3.2 RoHS COMPLIANCE	9
3.3 ENVIRONMENTAL SPECIFICATIONS	9
3.4 PIN ASSIGNMENT	10
3.5 MECHANICAL DIMENSIONS	11
3.6 WEIGHT	11
3.7 PERFORMANCE	11
3.8 NAND FLASH MEMORY	12
4. ELECTRICAL SPECIFICATIONS	12
4.1 POWER REQUIREMENT	12
4.2 POWER CONSUMPTION	12
4.3 DEVICE PARAMETERS	12
5. PART NUMBER RULE	13

REVISION HISTORY

Revision	Description	Date
1.0	First Release	Feb., 2022
1.1	Update mechanical drawing	Mar., 2022

List of Figures

FIGURE 1: USB EDC VERTICAL 2SE2.....6

FIGURE 2: USB EDC VERTICAL 2SE2 BLOCK DIAGRAM7

FIGURE 3: USB EDC VERTICAL 2SE2 MECHANICAL DIMENSIONS..... 11

List of Tables

TABLE 1: SHOCK/VIBRATION TESTING FOR USB EDC VERTICAL 2SE2	9
TABLE 2: USB EDC VERTICAL 2SE2 MTBF	10
TABLE 3: USB EDC VERTICAL 2SE2 TBW	10
TABLE 4: USB EDC VERTICAL 2SE2 PIN ASSIGNMENT	10
TABLE 5: PERFORMANCE	11
TABLE 6: USB EDC VERTICAL 2SE2 POWER REQUIREMENT	12
TABLE 7: USB EDC VERTICAL 2SE2 POWER CONSUMPTION	12
TABLE 8: USB EDC VERTICAL 2SE2 DEVICE PARAMETERS.....	12

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 2SE2

1.3 Product Models

USB EDC Vertical 2SE2 is available in follow capacities.

- USB EDC Vertical 2SE2 512MB
- USB EDC Vertical 2SE2 1GB
- USB EDC Vertical 2SE2 2GB
- USB EDC Vertical 2SE2 4GB
- USB EDC Vertical 2SE2 8GB
- USB EDC Vertical 2SE2 16GB

1.4 Capacity

USB EDC Vertical 2SE2 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 2SE2 from the system level, including the major hardware blocks.

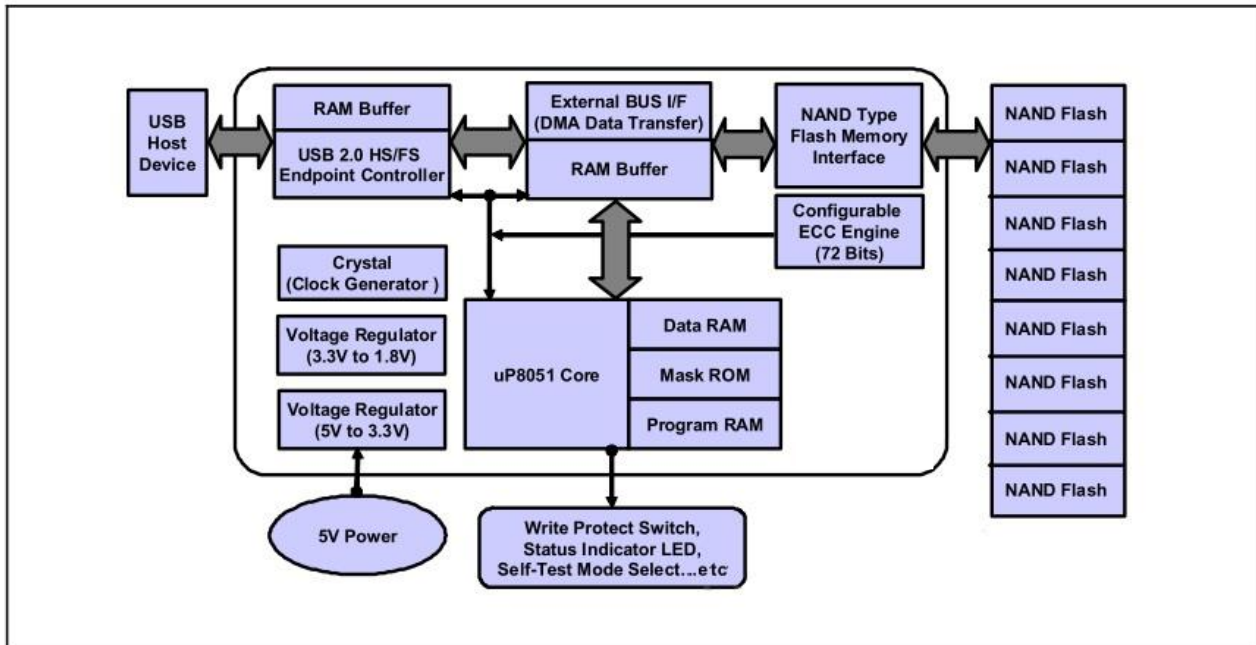


Figure 2: USB EDC Vertical 2SE2 Block Diagram

USB EDC Vertical 2SE2 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 2SE2 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 2SE2 conforms to CE and FCC requirements.

3.2 RoHS Compliance

USB EDC Vertical 2SE2 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: -40°C ~ +85°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 2SE2

3.3.4 Mean Time between Failures (MTBF)

Table 2 summarizes the MTBF prediction results for various USB EDC Vertical 2SE2 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 2SE2	Telcordia SR-332 GB, 25°C	>3,000,000

Table 2: USB EDC Vertical 2SE2 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 2SE2 TBW

3.4 Pin Assignment

USB EDC Vertical 2SE2 is designed within USB 2.0 Interface. Particularly, its built-in power pin enables the device more compactable. Table 4 demonstrates USB EDC Vertical 2SE2 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 2SE2 Pin Assignment

3.5 Mechanical Dimensions

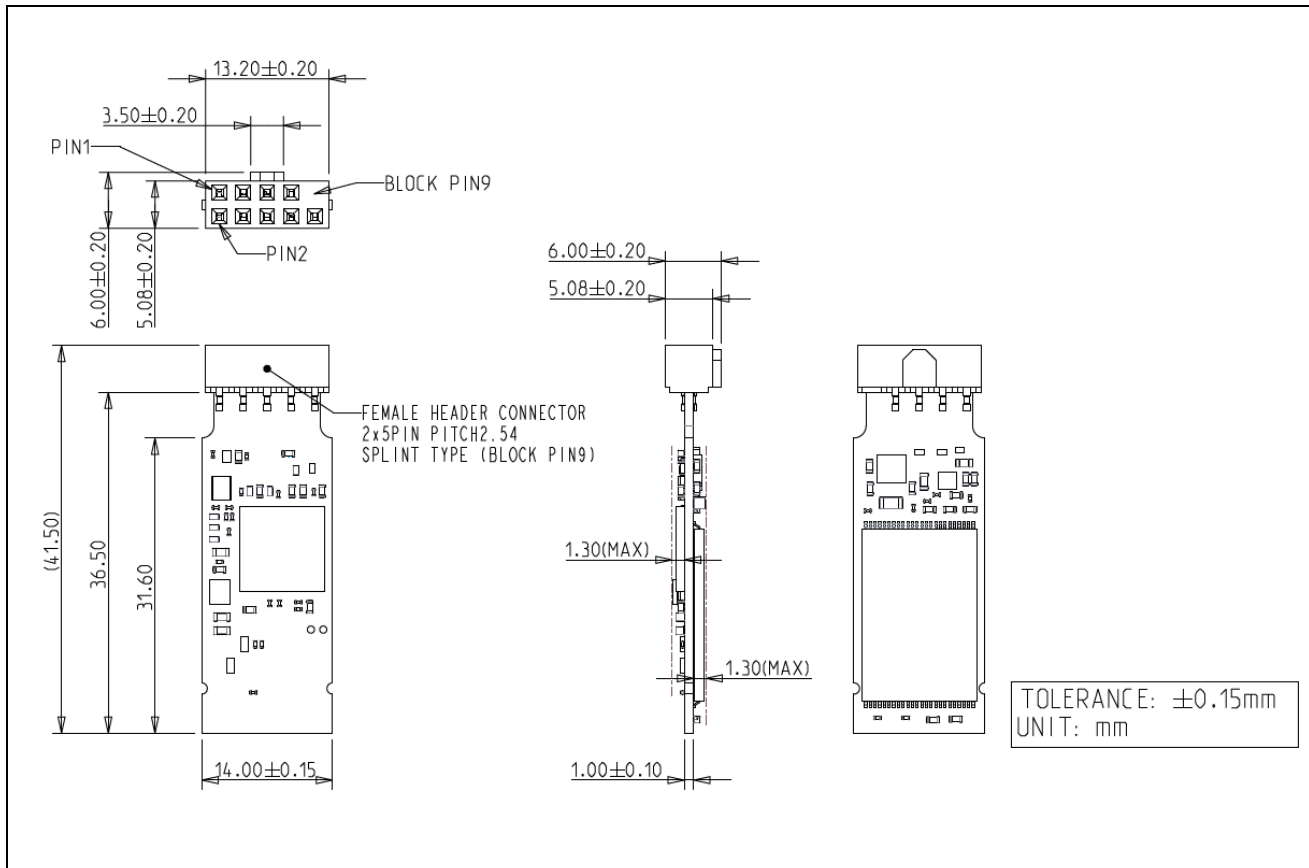


Figure 3: USB EDC Vertical 2SE2 mechanical dimensions

3.6 Weight

3g±2

3.7 Performance

Product name		Units	512MB	1GB	2GB	4GB	8GB	16GB
USB EDC Vertical 2SE2	Sequential Read	MB/s	30	30	30	30	30	30
	Sequential Write		15	15	20	25	30	30

Table 5: Performance

Note: * Performance results are measured in Room Temperature with Out-of-Box devices and may vary depending on overall system setup.

Note: ** Performance results are based on CrystalDiskMark 6.0.2 with typical tolerances for range from 1% to 10%.

3.8 NAND Flash Memory

USB EDC Vertical 2SE2 uses Single Level Cell (SLC) NAND flash memory, which is non-volatility, high reliability and high speed memory storage.

4. Electrical Specifications

4.1 Power Requirement

Item	Symbol	Rating	Unit
Input voltage	V _{IN}	+5 DC +- 5%	V

Table 6: USB EDC Vertical 2SE2 Power Requirement

4.2 Power Consumption

Mode	Power Consumption(W)
Read	0.54
Write	0.50
Idle	0.28
The power consumption is based on 16GB model.	

Table 7: USB EDC Vertical 2SE2 Power Consumption

4.3 Device Parameters

USB EDC device parameters listed in Table 8.

Capacity	LBA	User capacity (MB)
512MB	974848	476
1GB	1974672	964
2GB	3928176	1918
4GB	7835184	3826
8GB	15649200	7641
16GB	31277232	15272

Table 8: USB EDC Vertical 2SE2 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	D	Q	1	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 1 st (Disk)										Code 13 th (Flash mode)											
D: Disk										A: Async Flash											
Code 2 nd ~ 5 th (Form Factor)										Code 14 th (Operation Temperature)											
EUV1: USB EDC Vertical										C: Standard Grade (0℃~ +70℃)											
										W: Industrial Grade (-40℃~ +85℃)											
Code 7 th ~9 th (Capacity)										Code 15 th (PCB Version)											
512: 512MB										1: TSOP PCB											
01G: 1GB																					
02G: 2GB										Code 16 th (Channel)											
04G: 4GB										S: Single channel											
08G: 8GB																					
16G: 16GB										Code 17 th (Flash)											
										B: Toshiba SLC											
Code 10 th ~12 th (Category)										Code 19 th ~21 st (Customize code)											
DQ1:USB EDC 2SE2 Series																					