IEI

IFM-3310IM

Datasheet

iEi P/N
IFM-3310IM-128GB-R20
IFM-3310IM-64GB-R20
IFM-3310IM-32GB-R20
IFM-3310IM-16GB-R20
IFM-3310IM-8GB-R20

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REVISION HISTORY

Revision	Description	Date
Preliminary	First Released	May, 2013
1.0	Official release	July, 2013
1.1	Performance update	Nov., 2013
1.2	Update ME. drawing Add power cable SPEC.	Feb., 2014
1.3	Modify PN rule.	August, 2014

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1. Product Overview

1.1 Introduction of IEI SATADOM-MV 3ME

IEI Serial ATA Disk on Module (SATADOM) supports SATA III standard (6.0Gb/s) interface with excellent performance, and SATADOM-MV 3ME is designed as the smallest form factor size that could enhance compatibility with various design applications. Particularly the 7th pin of standard SATA 7pin connector can optionally be the built-in power VCC pin. In other words, it could be connected directly to the SATA on-board socket on customers' system without additional power cable. Besides, the booting time for operation and the power consumption is less than hard disk drive (HDD). SATADOM-MV 3ME can work under harsh environment compile with ATA protocol, no additional drives are required, and the SSD can be configured as a boot device or data storage device.

1.2 Product View and Models

IEI SATADOM-MV 3ME is available in follow capacities within MLC flash ICs.

SATADOM-MV 3ME 8GB
SATADOM-MV 3ME 16GB
SATADOM-MV 3ME 32GB
SATADOM-MV 3ME 64GB
SATADOM-MV 3ME 128GB

Figure 1: IEI SATADOM-MV 3ME

1.3 SATA Interface

IEI SATADOM-MV 3ME supports SATA III interface, and compliant with SATA I and SATA II. SATA III interface can work with Serial Attached SCSI (SAS) host system, which is used in server computer. IEI SATADOM-MV 3ME is compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps /3.0Gbps/6.0Gbps data rate). SATA connector uses a standard 7-pin signal segment.

2. Product Specifications

2.1 Capacity and Device Parameters

SATADOM-MV 3ME device parameters are shown in Table 1.

Table 1: Device parameters

Capacity	LBA	Cylinders	Heads	Sectors	User Capacity(MB)
8GB	15649200	15525	16	63	7,641
16GB	31277232	16383	16	63	15,272
32GB	62533296	16383	16	63	30,533
64GB	125045424	16383	16	63	61,057
128GB	250069680	16383	16	63	122,104

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance

Capacity	8GB	16GB	32GB	64GB	128GB
PN	DESMV-XXXD07RX1XC		DESMV -XXXD06RX1XC		
Sequential Read (max.)	90 MB/sec	240 MB/sec	450 MB/sec	460 MB/sec	460 MB/sec
Sequential Write (max.)	13 MB/sec	40 MB/sec	80 MB/sec	150 MB/sec	160 MB/sec

Note: the information is based on CrystalDiskMark 3.01 with file size 1000MB test patent

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: IEI SATADOM-MV 3ME Power Requirement

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

2.3.2 Power Consumption

Table 4: Power Consumption

Mode	Power Consumption (mA)
Read	180 (max.)
Write	200 (max.)
Idle	120 (max.)

* Target: 128GB SATADOM-MV 3ME

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for SATADOM-MV 3ME

Temperature	Range
Operating	Standard Grade: 0°C to +70°C
	Industrial Grade: -40°C to +85°C
Storage	-55°C to +95°C

2.4.2 Humidity

Relative Humidity: 10-95%, non-condensing

2.4.3 Shock and Vibration

Table 6: Shock/Vibration Testing for SATADOM-MV 3ME

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

2.4.4 Mean Time between Failures (MTBF)

Table 7 summarizes the MTBF prediction results for various SATADOM-MV 3ME 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.

Table 7: SATADOM-MV 3ME MTBF

Product	Condition	MTBF (Hours)
IEI SATADOM-MV 3ME	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

SATADOM-MV 3ME conforms to CE and FCC requirements.

2.6 RoHS Compliance

SATADOM-MV 3ME is fully compliant with RoHS directive.

2.7 Reliability

Parameter	Value
Read Cycles	Unlimited Read Cycles
Flash endurance	3,000 P/E cycles
Wear-Leveling Algorithm	Support
Bad Blocks Management	Support
Error Correct Code	Support
TBW	
16GB	43.2 (Sequential write)
32GB	86.4 (Sequential write)
64GB	172.8 (Sequential write)
128GB	345.6 (Sequential write)

2.8 Transfer Mode

SATADOM-MV 3ME support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

2.9 Pin Assignment

IEI SATADOM-MV 3ME uses a standard SATA pin-out. See Table 8 for SATADOM-MV 3ME pin assignment.

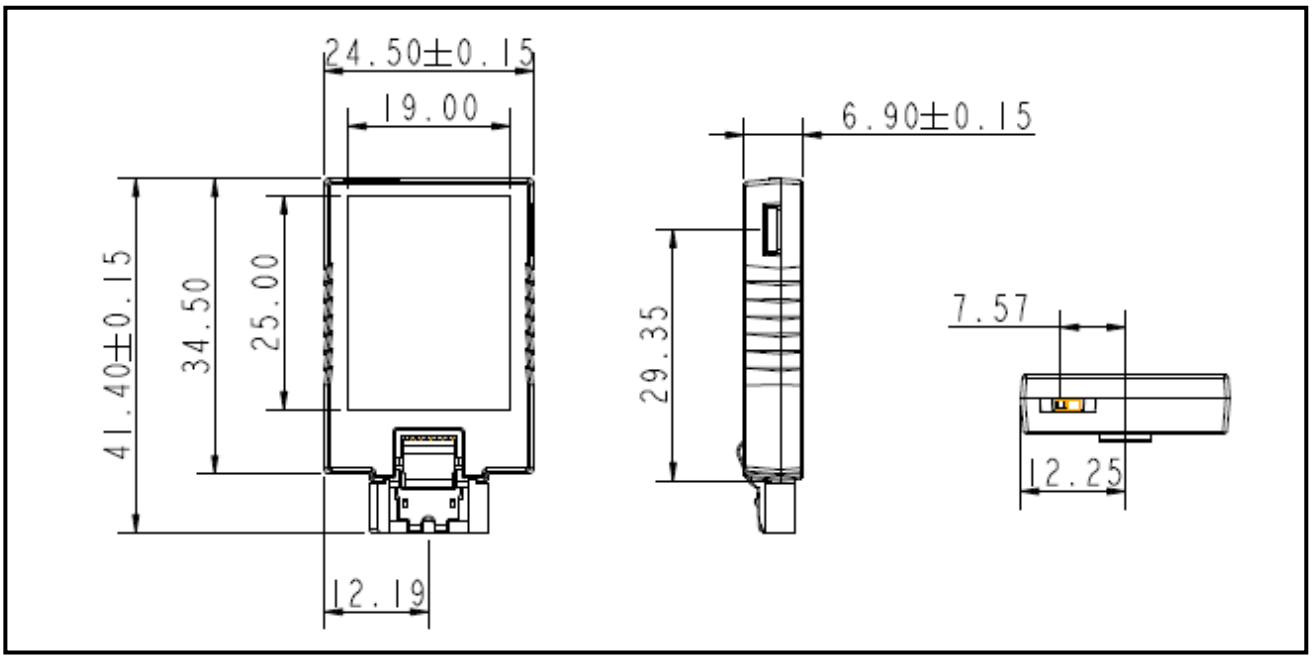
Table 8: IEI SATADOM-MV 3ME Pin Assignment

Name	Type	Description
Pin 1	GND	Shielding
Pin 2	A+	Differential signal to A
Pin 3	A-	Differential signal to A-
Pin 4	GND	Shielding
Pin 5	B-	Differential signal to B-
Pin 6	B+	Differential signal to B
Pin 7	GND/VCC	Shielding/Power*

CAUTION

SATADOM Pin 7 with power supply version (PN end with F) is provided with different model and PN, which request specific M/B designed with 5V power supply through SATA port(7th Pin), and cannot use external cable for power supply!

2.10 Mechanical Dimensions



2.11 Assembly Weight

An IEI SATADOM-MV 3ME within flash ICs, 128GB's weight is 8 grams approximately.

2.12 Seek Time

IEI SATADOM-MV 3ME is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 Hot Plug

The SSD support hot plug function and can be removed or plugged-in during operation. User has to avoid hot plugging the SSD which is configured as boot device and installed operation system.

Surprise hot plug : The insertion of a SATA device into a backplane (combine signal and power) that has power present. The device powers up and initiates an OOB sequence.

Surprise hot removal: The removal of a SATA device from a powered backplane, without first being placed in a quiescent state.

2.14 NAND Flash Memory

IEI SATADOM-MV 3ME uses Multi Level Cell (MLC) NAND flashes memory, which is non-volatility, high reliability and high speed memory storage. Each cell stores 2 bits or holds four states per cell.

Read or Write data to flash memory for SSD is control by microprocessor.

3. Theory of Operation

3.1 Overview

Figure 2 shows the operation of IEI SATADOM-MV 3ME from the system level, including the major hardware blocks.

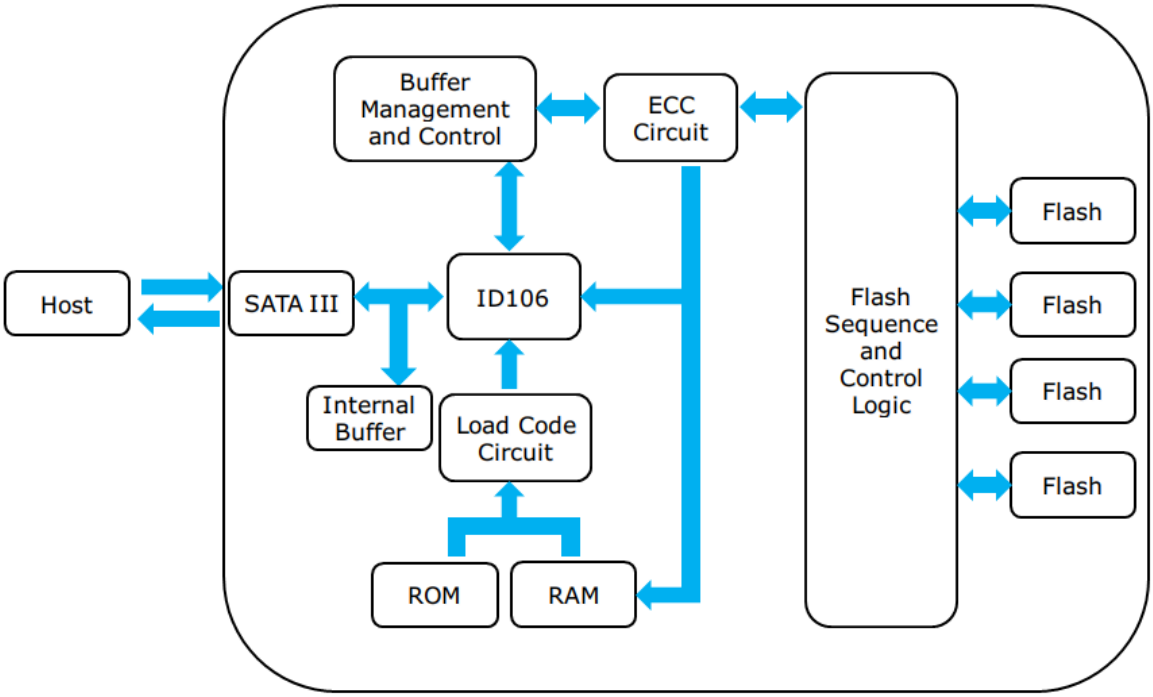


Figure 2: IEI SATADOM-MV 3ME Block Diagram

IEI SATADOM-MV 3ME integrates a SATA III controller and NAND flash memories. Communication with the host occurs through the host interface, using the standard ATA protocol. Communication with the flash device(s) occurs through the flash interface.

3.2 SATA III Controller

IEI SATADOM-MV 3ME is designed with ID 106, a SATA III 6.0Gbps (Gen. 3) controller. The Serial ATA physical, link and transport layers are compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps/3.0Gbps/6.0Gbps data rate). The controller has 4 channels for flash interface.

3.3 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 40 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.

3.4 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.

IEI SATADOM-MV 3ME 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.

3.5 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 develop 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, Bad Blocks 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.

3.6 Power Cycling

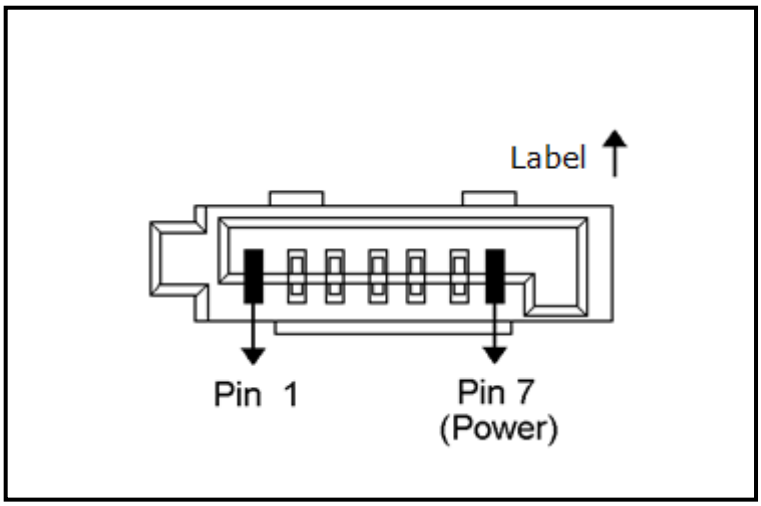
IEI's power cycling management is a comprehensive data protection mechanism that functions before and after a sudden power outage to SSD. Low-power detection terminates data writing before an abnormal power-off, while table-remapping after power-on deletes corrupt data and maintains data integrity. IEI's power cycling provides effective power cycling management, preventing data stored in flash from degrading with use.

3.7 Garbage Collection

Garbage collection is used to maintain data consistency and perform continual data cleansing on SSDs. It runs as a background process, freeing up valuable controller resources while sorting good data into available blocks, and deleting bad blocks. It also significantly reduces write operations to the drive, thereby increasing the SSD's speed and lifespan.

4. Installation Requirements

4.1 SATADOM-MV 3ME Pin Directions



* All SATADOM Pin 7 with power is separate model, with different PN

Figure 3: Signal Segment and Power Segment

4.2 Electrical Connections for SATADOM-MV 3ME

A Serial ATA device may be either directly connected to a host or connected to a host through a cable. For connection via cable, the cable should be no longer than 1meter. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

4.3 Write Protection

SATADOM-MV 3ME within the write-protect function could prevent the device from modification and deletion. Write-protected data could only be read, that is, users could not write to it, edit it, append data to it, or delete it. When users would like to make sure that neither themselves nor others could modify or destroy the file, users could switch on write-protection. Thus, SATADOM-MV 3ME could process write-protect mechanism and disable flash memory to be written-in any data. Only while the system power-off, users could switch on write-protection. Write-protection could not be switched-on, after OS booting.

Figure 4: SATADOM-MV 3ME hardware write protect

4.4 Device Drive

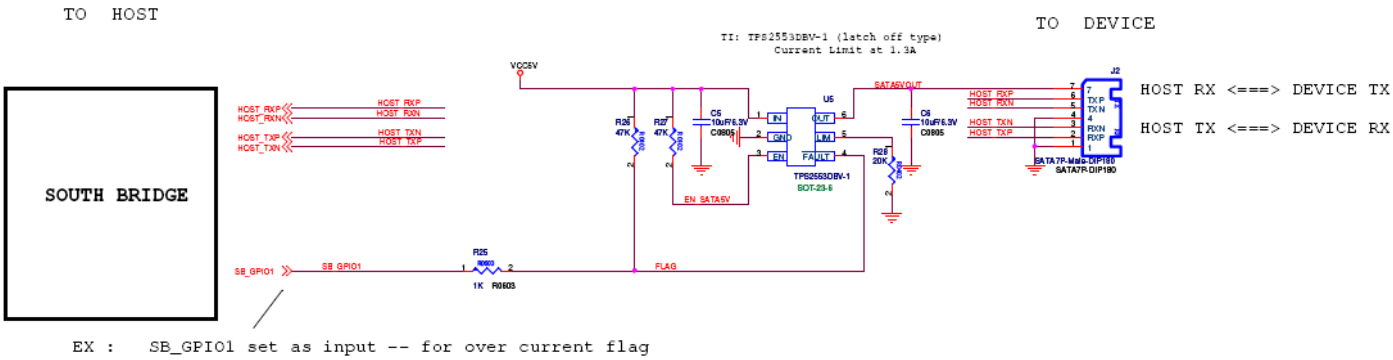
No additional device drives are required. The IEI SATADOM-MV 3ME can be configured as a boot device.

4.5 Pin7 VCC

IEI SATADOM series products have an optional design to provide power supply through the 7th Pin of SATA connector, and customers DO NOT have to use the power cable for power supply. Such a cable-less design of SATADOM series products with Pin7 VCC brings more convenience to customers' system. The followings are the points customers have to be careful of while designing in SATADOM series products with Pin7 VCC.

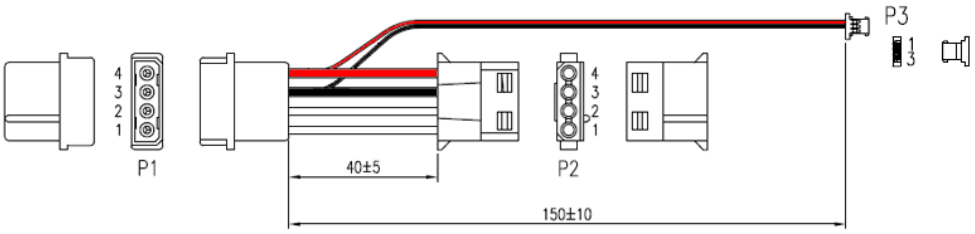
SATADOM series products with Pin7 VCC is designed with a fuse (poly switch 500mA, 6V) on Pin7's circuit. Such a design could avoid any potential damage to customers' system.
To have the advantages of SATADOM series with Pin7 VCC, and to avoid any potential damage to customers' board designed with VCC power supply, IEI suggests that customers MUST design their

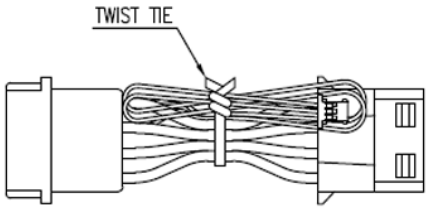
board with a fuse which should be designed before the SATA socket Pin7 VCC. In other words, customers are suggested NOT TO layout 5V VCC to SATA socket on board directly. A circuit diagram example to explain this is shown as below.



4.6 Power cable

A power cable is shipped with each SATADOM product, which has standard 4pins power connector and special 3 pins power connector for SATADOM. The male and female power connector of SATADOM have foolproof design to avoid misconnection, please check it before power on.





P1	P2	P3	AWG	COLOR
4	---	1	28 AWG/UL 3385	RED
	4	---	18 AWG/UL 3385	RED
3	---	2	28 AWG/UL 3385	BLACK
	3	---	18 AWG/UL 3385	BLACK
2	2	---	18 AWG/UL 3385	BLACK
1	1	---	18 AWG/UL 3385	YELLOW

* PN end with F is SATADOM Pin 7 with power supply version, which doesn't provide power cable.