ATP Industrial Grade Vertical SATA Embedded Module Specification

Version 2.0

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Revision History

Date	Version	Changes compared to previous issue
Jan. 5th, 2012	2.0	- First release

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Introduction

The ATP Industrial Vertical SATA Embedded Module is a high performance and high capacity mass storage solution in mini form factor. Utilizing SLC (Single Level Cell) NAND flash components, ATP Industrial SATA Embedded Module provides outstanding performance and proven reliability for products operating.

ATP Industrial Vertical SATA Embedded Module is perfect for industrial applications such as transportation, industrial PC, healthcare, telecommunications, and other harsh environments where data integrity and consistent performance is mission critical.

Main Feature

- Capacities: 2GB to 16GB

- SLC (Single Level Cell) NAND flash memory

- Power consumption on idle mode is 0.52W/Operational mode is 1.36W

- Maximum performance: Sequential read up to 113MB/s, sequential write up to 81MB/s

- Random Read 4K IOPS: 1,700

- Operating temperature: -40°C to 85°C

- Compliant with Serial ATA Revision 2.6.

- Support PIO mode 0~4, MDMA mode 0~2,UDMA mode 0~6

- Compatible with SATA 1.5Gbps and SATA 3.0Gbps interface rates

- Enhanced endurance by Global wear-leveling

- Supports S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology) ATA feature set

- SMART tool for Windows 2000/XP/Vista/7 and Linux

- Support TRIM command (Windows 7 and up, latest Linux Kernel), Off-line TRIM utility available for Windows XP/2000/2003/Vista

- PowerProtector, data integrity under power-cycling (except 2GB version).

- RoHS compliant

- CE&FCC certification

Block Diagram

ATP Industrial Vertical SATA Embedded Module consists of below functional blocks. The advanced architecture is optimized to provide highest data reliability and transfer performance.
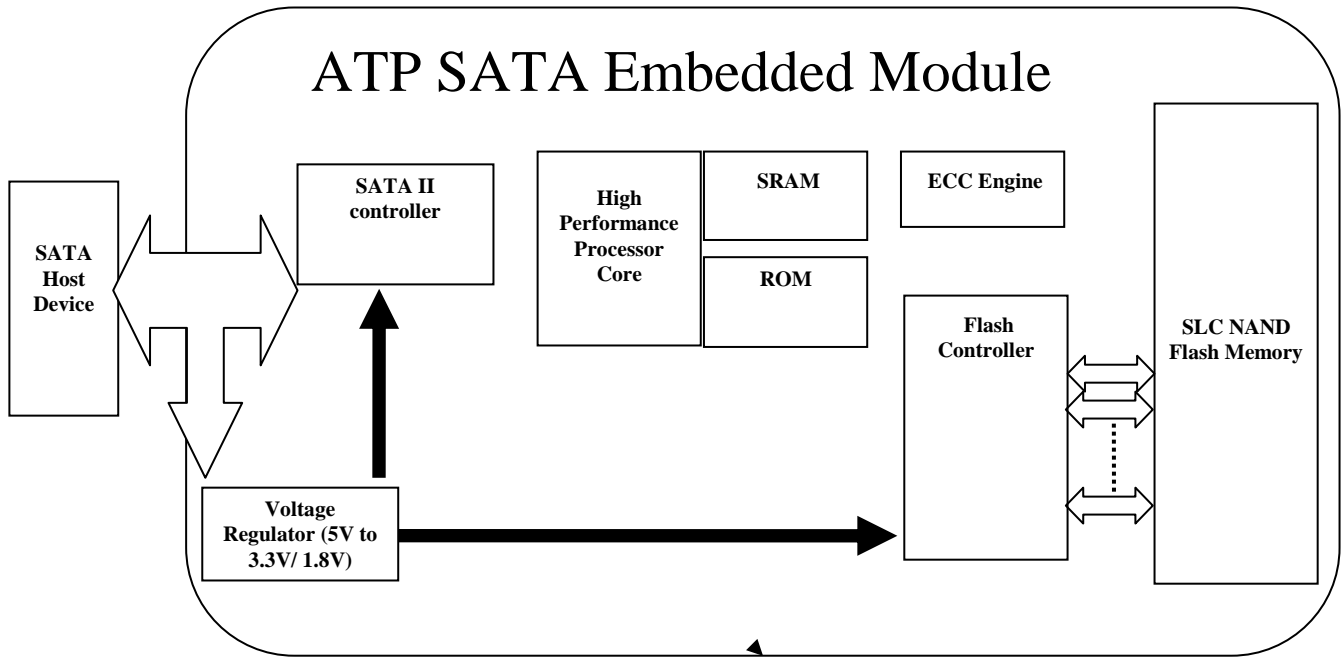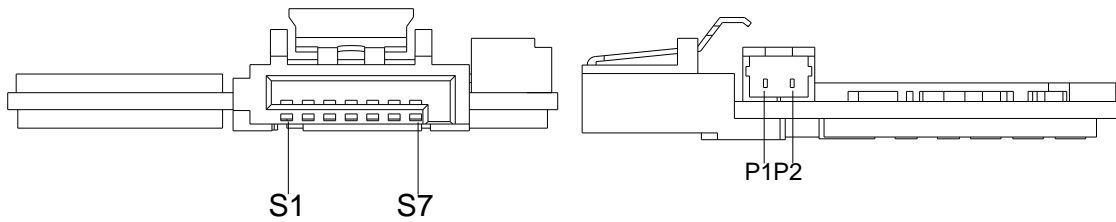
Product Image

Capacities

ATP P/N	EXTERNAL P/N	CAPACITY
AF2GSSEH-10/11	AF2GSSEH-BAAXX	2GB
AF4GSSEH-10/11	AF4GSSEH-BABXP	4GB
AF8GSSEH-10/11	AF8GSSEH-BABXP	8GB
AF16GSSEH-10/11	AF16GSSEH-BABXP	16GB

Notes:

1:1 GB = 1,000,000,000 Byte

2:"-10/11" is optional cable: "-10" is 2pin to 4pin; "-11" is 2pin to 2pin.
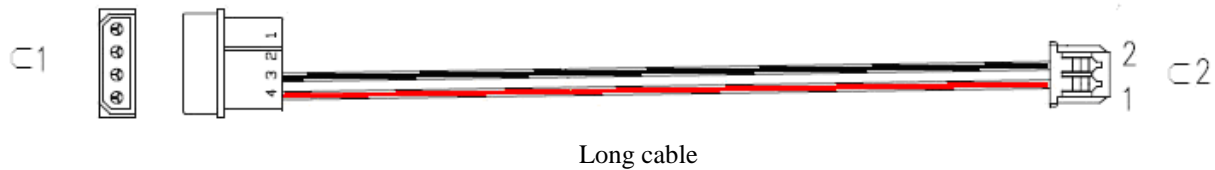
SATA Embedded Module Pin Assignment

Group	Pin No.[1]	Function	Description
Signal Segment	S1	GND	Ground
	S2	A+	Differential signal pair A
	S3	A-	
	S4	GND	Ground
	S5	B-	Differential signal pair B
	S6	B+	
	S7	GND	Ground
Power Segment	P1	Vcc	5V power input
	P2	GND	Ground

Notes:

Signal Pin with a 1.27 mm pitch.
Power Pin with a 1.25 mm pitch

Cable Pin Assignment

Long cable

Group	No.	Function	Description
C1	1	Vcc	5V power
	2	GND	Ground
C2	1,2	NC	
	3	GND	Ground
	4	Vcc	5V power

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Short cable

Group	No.	Function	Description
C1	1	Vcc	5V power
C1	2	GND	Ground
C2	1	Vcc	5V power
C2	2	GND	Ground

System Power Requirement

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Supply voltage	V_{CC}	4.5	5.0	5.5	V	
Sustained write power	P_W	-	1.30	-	W	RMS value
Sustained read power	P_R	-	1.36	-	W	RMS value
Idle power	P_S	-	0.52	-	W	RMS value

Environment Specifications

Type		Value
Temperature	Operating	-40°C to 85°C
Temperature	Non-Operating	-45°C to 85°C
Humidity	Operating	25°C，8% to 95%, noncondensing
Humidity	Non-Operating	40°C，8% to 93%, noncondensing
Vibration	Operating	sine 16.4G, 10~2000Hz
Shock	Operating	Half sine 1500G/0.5ms
Altitude	Operating	80,000 feet Max.
Altitude	Non-Operating	80,000 feet Max.

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Reliability

Type	Value
Data Retention	10 years
MTBF (@ 25°C) [1]	2GB: 1,090,000 hours 4GB: 1,070,000 hours 8GB: 1,070,000 hours 16GB: 1,040,000 hours

Notes:

      1. The Mean Time Between Failures (MTBF) is calculated using a prediction methodology, Telcordia SR-332, which based on reliability data of the individual components in the SSD. It assumes nominal voltage, with all other parameters within specified range.

Write/Erase Endurance

Type	Value
Endurance Technology	Enhanced global wear-leveling algorithm SLC flash block: 100,000 program/erase cycles
SSD Endurance	2GB: 80 terabyte random write 4GB: 160 terabyte random write 8GB: 320 terabyte random write 16GB: 640 terabyte random write

Performance

Type	Value
Host Interface Speed	SATA 1.5Gb/s and SATA 3.0 Gb/s
Data Transfer Rate[1]	Sequential Read: up to 113MB/s
	Sequential Write: up to 81MB/s
Random Read IOPS[2]	4KB Random Read: 1,700 IOPS

Notes:

    1. The performance may vary according to different product capacity.

    2. IOPS: Input/Output Operations per Second

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SMART Information

ATP Industrial Vertical SATA Embedded Module Support S.M.A.R.T. ATA feature set in IDE mode, not support in RAID mode and AHCI mode.

SMART Subcommand Sets

In order to select a subcommand the host must write the subcommand code to the device's Features Register before issuing the SMART Function Set command. The subcommands are listed below.

Command	Command Code (Hex)
SMART READ DATA	D0h
SMART SAVE ATTRIBUTE VALUES	D3h
SMART EXECUTE OFF-LINE IMMIDIATE	D4h
SMART READ LOG	D5h
SMART WRITE LOG	D6h
SMART ENABLE OPERATIONS	D8h
SMART DISABLE OPERATIONS	D9h
SMART RETURN STATUS	DAh
SMART ENABLE/DISABLE AUTOMATIC OFF-LINE	DBh

SMART Read Data (subcommand D0h)

Byte	F/V	Description
0~1	X	Revision code
2~361	X	Vendor Specific
362	V	Off-line data collection status
363	X	Self-test execution status byte
364~365	V	Total time in seconds to complete off-line data collection activity
366	X	Vendor Specific
367	F	Off-line data collection capability
368~369	F	SMART capability
370	F	Error logging capability：7-1　　Reserved 0 -1 = Device error logging supported

Byte	F/V	Description
371	X	Vendor Specific
372	F	Short self-test routine recommended polling time(in minutes)
373	F	Extended self-test routine recommended polling time(in minutes)
374	F	Conveyance self-test routine recommended polling time(in minutes)
375~385	R	Reserved
386~395	F	Firmware Version/Date Code
396~397	F	Number of initial invalid block (396=MSB, 397=LSB)
398~399	V	Number of run time bad block (398=MSB, 399=LSB)
400~406	F	Number of spare block
407~415	X	Vendor specific
416	F	Reserved
417	F	Program/write the strong page only
418~419	V	Number of spare block
420~423	V	Average erase count
424~425	V	Number of child pair
426~431	X	Vendor specific
432~439	F	Reserved
440~510	X	Vendor specific
511	V	Data structure checksum

Notes:

F=content (byte) is fixed and does not change

V=content (byte) is variable and maybe change depending on the state of the device or the command executed by the device

X= content (byte) is vendor specific and maybe fixed or variable

R=content (byte) is reserved and shall be zero

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ATP SMART Tool

ATP provides SMART Tool for Windows 2000/XP/Vista/7 and Linux, it can monitor the state of SSD. The following picture shows SMART tool operation.
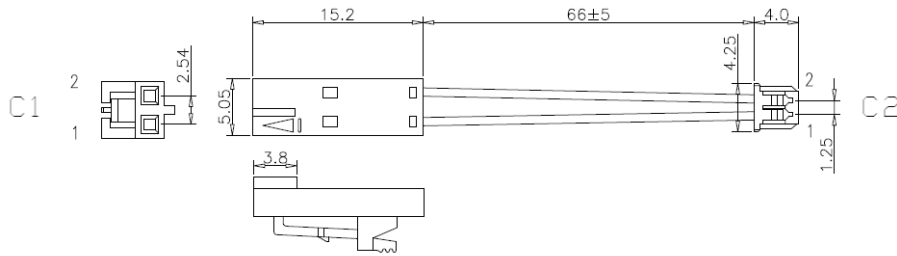

Physical Dimension Specifications

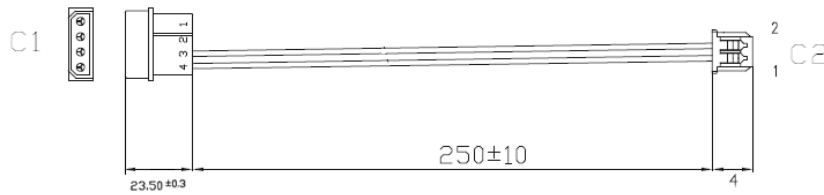| Type		Value
Embedded module (With housing)	Length	35.5 mm +/- 0.10mm
	Width	33.1 mm +/- 0.20mm
	Thickness	7.6 mm +/- 0.10mm
Cable	Long cable Length	277.5mm+/-10mm
	Short cable Length	85.2mm+/-5mm

Mechanical Form Factor (Units in mm)
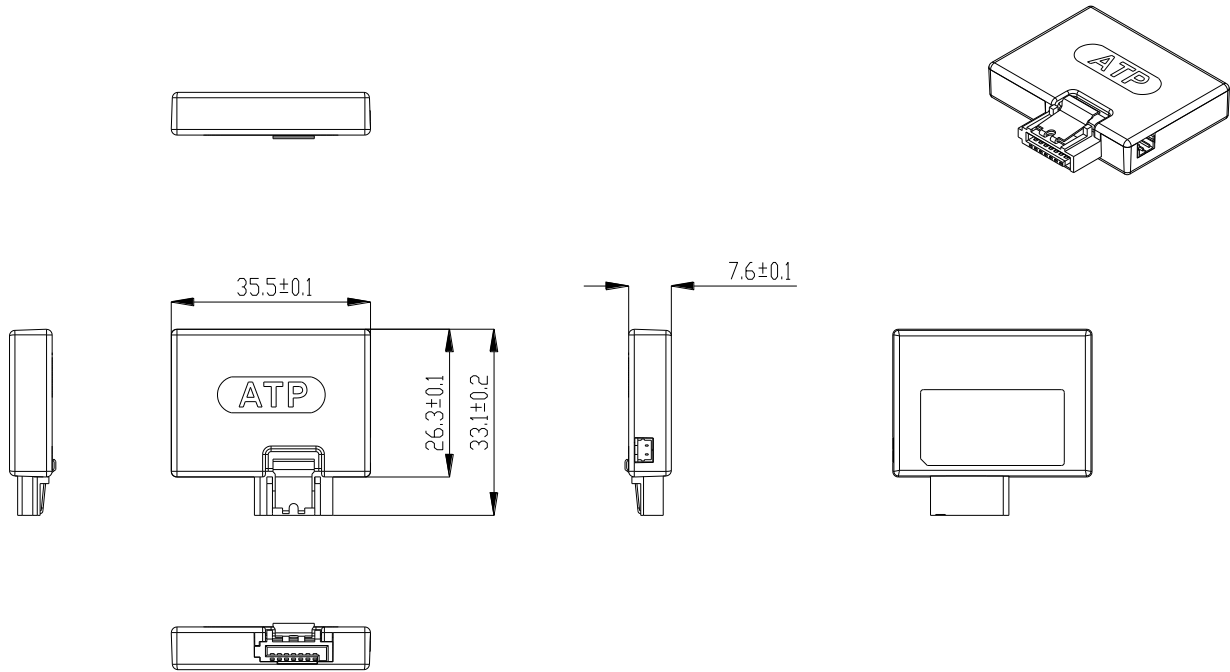
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Short cable

Long cable

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SDINBDG4-32G-XI1 SSDSC2KR120H6XN SDSDQAD-128G SM668GXB-ACS O1118 SDSDAA-016G SDLF1CRM-016T-1HA1
0T00327 MTFDDAA240MBB-2AE1ZABYY SSDSC2BX200G401940779 SQF-S25V4-240G-SCC SQF-SDMM2-256G-S9E SQF-SHMM2-64G-SBE APSDM001G12AN-PT 96FD25-ST256G-M13 SQF-SM8V4-240G-SCC