

RoHS Compliant
SATA Disk Chip 4 Series
Datasheet for SDC 4
February 7, 2013
Revision 1.4



***This Specification Describes the Features and Capabilities of
the Standard and Industrial Temperature
SATA Disk Chip***

***Please Contact Fortasa Memory Systems Sales for any
Custom Features Required For Your Specific Application***



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Features:

- **Standard Serial SATA 2.5 (Gen. 2)**
 - SATA command set compatible
 - Serial SATA II –3.0 Gbps
 - ATA compatible command set
- **Low power consumption (typical)**
 - Supply voltage: 3.3V
 - Active mode: 360 mA
 - Sleep mode: 120 mA
- **Performance**
 - Burst transfer rate: 300 MB/sec
 - Sustained read: up to 85 MB/sec
 - Sustained write: up to 80 MB/sec
- **Capacity**
 - 2, 4, 8, 16, 32 GB
- **NAND flash type: SLC**
- **Temperature ranges**
 - Operation:
 - Standard Temperature: 0 °C to 70 °C
 - Industrial Temperature: -40 °C to 85 °C
 - Storage: -40 °C to 100 °C
- **Intelligent endurance design**
 - Built-in hardware BCH ECC, correcting 16-bit or 24-bit error per 512-byte data sector
 - Global wear-leveling scheme together with dynamical block allocation to significantly increase the lifetime of a flash device and optimize the disk performance
 - Flash bad-block management
 - S.M.A.R.T. technology
- **Connector Type**
 - Standard 32/18 pin 600mil DIP
 - Dimension: 42.6x19.3x5.7, unit: mm
- **RoHS compliant**

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1 Product Description

1.1 General Description

Fortasa's SDC is a high-performance, SATA interface, solid state drive (SSD) designed to replace a conventional SATA hard disk drive. SDC supports standard SATA protocol and can be plugged into a standard SATA connector commonly found in rugged laptops, military devices, thin clients, Point of Sale (POS) terminals, telecom, medical instruments, surveillance systems and industrial PCs. Packaged in a 600 mil 32 or 18 round pin DIP package for easy and cost-effective mounting to a system motherboard, SDCs are designed to work at 3.3 Volts and use a standard SATA driver that is part of all major operating systems such as Microsoft's Windows series, Apple's MAC OS family, and UNIX variants.

The SDC offers capacities of up to 32 gigabytes, providing full support for the SATA II high-speed interface standard. It can operate at sustained access rates of up to 80 megabytes per second, which is much faster than other solid-state or traditional HDD SATA drives currently available on the market.

SDC offers high reliability global data wear-leveling scheme to allow uniform use of all storage blocks, increasing the lifetime of Flash media and optimizing drive performance. The SDC also offers Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.) feature that follows the SATA Rev. 2.5, ATA/ATAPI-7 specifications and uses the standard SMART command B0h to read data from the drive. This capability monitors the drive accesses and provides the host with vital information about drive condition to schedule maintenance and service times.

1.2 Functional Block

The SDC includes a single-chip SATA II Flash Controller and the flash media. The controller integrates the flash management unit with the controller itself to support multi-channel, multi-bank flash arrays. Figure 1-1 shows the functional block diagram.

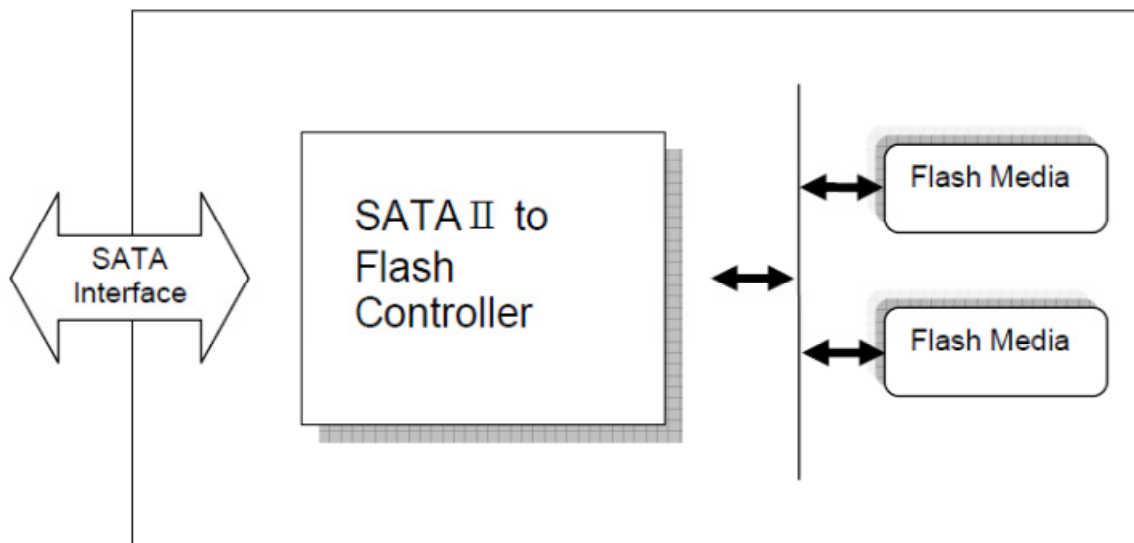


Figure 1-1: Functional block diagram

1.3 SATA Mode Support

The SATA-Disk Chip supports the following SATA operating modes:

- Supports up to PIO Mode-4
- Supports up to Multi-word DMA Mode-2
- Supports up to Ultra DMA Mode-5

1.4 Capacity Specification

Standard capacity specification of the SATA Disk Chip product is shown in Table 1-1. The table lists the specific capacity and the default numbers of heads, sectors and cylinders (CHS) for each product line.

Table 1-1: Capacity specifications

Capacity	Total Bytes	Cylinders	Heads	Sectors	Max LBA
2GB	2,002,452,480	3,880	16	63	3,911,040
4GB	4,021,936,128	7,793	16	63	7,885,344
8GB	8,061,419,520	15,620	16	63	15,744,960
16GB	16,013,942,784	15,620	16	63	31,277,232
32GB	32,017,047,552	15,620	16	63	62,533,296

1. Cylinders, heads or sectors are not applicable for these capacities. Only LBA addressing applies.

Please contact factory for any non-listed SATA Disk Chip capacity or custom CHS requirement.

1.5 Performance Specification

Performance of the SATA Disk Chip are listed in Table 1-2.

Table 1-2: Performance specifications

Capacity \ Performance	2GB	4 GB	8 GB	16 GB	32 GB
Sustained read (MB/s)	75	80	80	85	85
Sustained write (MB/s)	28	55	55	80	80

1.6 Pin Assignments

1.6.1 32 pins (16 x 2)

Figure 1-2: 32 Pin Package Pin-out

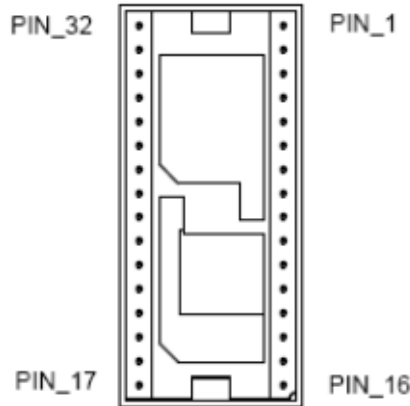


Table 1-3: Pin assignments for the 32-pin configuration

Pin No	Name	Type	Pin No	Name	Type
1	S1	GND	17	GND	GND
2	S2	RX+	18	CS7	Data Act.
3	S3	RX-	19	CS8	RS
4	S4	GND	20	CS9	RS
5	S5	TX-	21	CS10	RS
6	S6	TX+	22	CS11	RS
7	S7	GND	23	CS12	RS
8	NC		24	CS13	RS
9	GND	GND	25	CS14	RS
10	CS1	RS ¹	26	CS15	RS/WP
11	CS2	RS	27	P6	NA/UGND
12	CS3	RS	28	P5	NA/USB+
13	CS4	RS	29	P4	NA/USB-
14	CS5	RS	30	P3	NA/UVCC
15	CS6	PHY RDY	31	P2	GND
16	NC		32	P1	VCC3.3

1. RS: Reserved

1.6.2 18 pins (7x2 + 2x2)

Figure 1-3: 18 Pin Package Pin-out

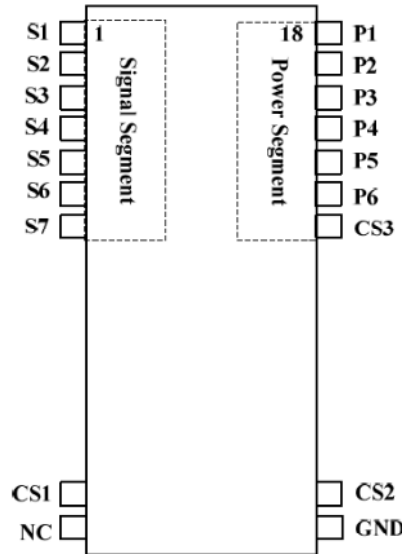


Table 1-4: Pin assignments for the 18-pin configuration

Pin No	Name	Type	Pin No	Name	Type
1	S1	GND	17	GND	GND
2	S2	RX+	18	CS2	Data Act
3	S3	RX-	19	CS3	RS ¹ /WP
4	S4	GND	20	P6	NA/UGND
5	S5	TX-	21	P5	NA/USB+
6	S6	TX+	22	P4	NA/USB-
7	S7	GND	23	P3	NA/UVCC
8	CS1	PHY RDY	24	P2	GND
9	NC	-	25	P1	VCC3.3

1. RS: Reserved

2. Software Interface

2.1 Command Set

Table 2-1 summarizes the command set with the paragraphs that follow describing the individual commands and the task file for each.

Table 2-1: Command set

Command	Code	FR ¹	SC ²	SN ³	CY ⁴	DH ⁵	LBA ⁶
Check-Power-Mode	E5H	-	-	-	-	D8	-
Execute-Drive-Diagnostic	90H	-	-	-	-	D	-
Flush-Cache	E7H	-	-	-	-	D	-
Identify-Drive	ECH	-	-	-	-	D	-
Idle	E3H	-	Y	-	-	D	-
Idle-Immediate	E1H	-	-	-	-	D	-
Initialize-Drive-Parameters	91H	-	Y	-	-	Y	-
Read DMA	C8H or C9H	-	Y	Y	Y	Y	Y
Read-Multiple	C4H	-	Y	Y	Y	Y	Y
Read-Sector(s)	20H or 21H	-	Y	Y	Y	Y	Y
Read-Verify-Sector(s)	40H or 41H	-	Y	Y	Y	Y	Y
Recalibrate	1XH	-	-	-	-	D	-
Security-Disable-Password	F6H	-	-	-	-	D	-
Security-Erase-Prepare	F3H	-	-	-	-	D	-
Security-Erase-Unit	F4H	-	-	-	-	D	-
Security-Freeze-Lock	F5H	-	-	-	-	D	-
Security-Set-Password	F1H	-	-	-	-	D	-
Security-Unlock	F2H	-	-	-	-	D	-
Seek	7XH	-	-	Y	Y	Y	Y
Set-Features	EFH	Y	-	-	-	D	-
SMART	B0H	Y	Y	Y	Y	D	-
Set-Multiple-Mode	C6H	-	Y	-	-	D	-
Set-Sleep-Mode	E6H	-	-	-	-	D	-
Stand-By	E2H	-	-	-	-	D	-
Stand-By-Immediate	E0H	-	-	-	-	D	-
Write DMA	CAH	-	Y	Y	Y	Y	Y
Write-Multiple	C5H	-	Y	Y	Y	Y	Y
Write-Sector(s)	30H	-	Y	Y	Y	Y	Y

1. FR - Features register

2. SC - Sector Count register

3. SN - Sector Number register

4. CY - Cylinder registers

5. DH - Drive/Head register

6. LBA - Logical Block Address mode supported (see command descriptions for use)

7. Y - The register contains a valid parameter for this command

8. For the Drive/Head register:

Y means both the SDC and Head parameters are used

D means only the SDC parameter is valid and not the Head parameter

3. Flash Management

3.1 Error Correction/Detection

The SATA Disk Chip implements a hardware BCH-based ECC scheme to achieve up to 16 bits or 24 bits error per 512 bytes page.

3.2 Wear Leveling

All NAND flash devices are limited by a finite number of write cycles. Under a standard file system, frequent file table updates are mandatory. As a painful side effect of OS file overhead, some areas of flash address space wear out faster than others. As these certain sections get a substantially higher write occurrence the whole SATA Disk Chip can wear out very quickly. This uneven wear would significantly reduce the lifetime of the whole device, even if majority of the Flash sectors are far from the write cycle limit. Fortasa's SATA Disk Chip products offer advanced data wear leveling which distributes Flash writes evenly across the SATA Disk Chip memory space. By utilizing this advanced wear leveling feature, the lifetime of the media can be significantly extended.

3.3 Power Failure Management

The Low Power Detection on the Flash controller initiates cached data saving before the power supply to the device drops too low for operation. This feature prevents the device from system crash and ensures data integrity during an unexpected brownout. This feature makes sure that there are no catastrophic failures of the SATA Disk Chip due to system power glitches.

3.4 Quick Erase

Accomplished by the Secure Erase (SE) command, which added to the open ANSI standards that control disk drives, "Quick Erase" is built into the disk drive itself and thus far less susceptible to malicious software attacks than external software utilities. It is a positive easy-to-use data destroy command, amounting to electronic data shredding. Executing the command causes a drive to internally completely erase all possible user data. This command is carried out within disk drives, so no additional software is required. The erase process will not stop until it is completed. In case of power failure, the erase process will continue when the power is reapplied to the device.

3.5 S.M.A.R.T. Technology

S.M.A.R.T. is an acronym for Self-Monitoring, Analysis and Reporting Technology, an open standard allowing disk drives to automatically monitor their own health and report potential problems. It protects the user from unscheduled downtime by monitoring and storing critical drive performance and calibration parameters. Ideally, this should allow taking proactive actions to prevent impending drive failure. Fortasa SMART feature follows the SATA Rev. 2.5, ATA/ATAPI-7 specifications, using the standard SMART command B0h to read data from the drive. and identify Initial bad block count, Bad block count, Spare block count, Maximum erase count, Average erase count and Power cycle.

4. Environmental Specifications

4.1 Environments

Environmental specification of the SATA Disk Chip series follows the MIL-STD-810F standard as shown in Table 4-1.

Table 4-1: Environmental specifications

Environment		Specification
Temperature	Operation	0°C to 70°C (Standard); -40°C to +85°C (Industrial)
	Storage	-40°C to 100°C
Vibration		Sine wave: 20~2000Hz, 16.3G (X, Y, Z axes)
Shock-Operating		Half sine wave, Peak acceleration 50 G, 11 ms (X, Y, Z; All 6 axes)
Humidity		5% to 95% RH (Non-condensing)

5. Electrical Specification

5.1 Operating Voltage

Caution: Absolute Maximum Stress Ratings – Applied conditions greater than those listed under “Absolute Maximum Stress Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions or conditions greater than those defined in the operational sections of this data sheet is not implied. Exposure to absolute maximum stress rating conditions may affect device reliability.

Table 5-1: Operating range

Range	Ambient Temperature	3V
Standard	0°C to +70°C	3.3-3.6V
Industrial	-40°C to +85°C	

5.2 Power Consumption

Table 5-2 lists the SDC 4 power consumption.

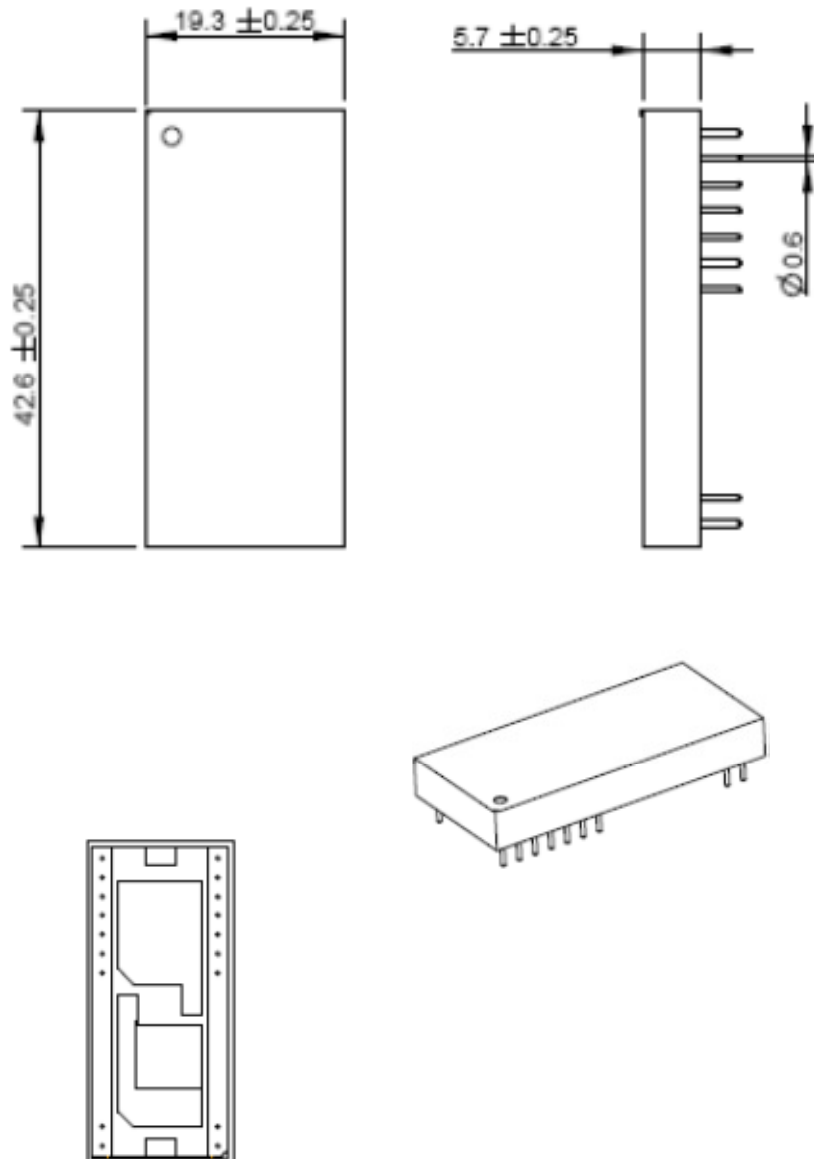
Table 5-2 SDC 4 power consumption (typical)

Performance \ Capacity	2GB	4GB	8GB	16GB	32GB
	Active Mode (mA)	271	320	320	340
Idle Mode (mA)	110	110	113	120	110

6. Physical Characteristics

6.1 Dimensions of 18 pins (7x2 + 2x2)

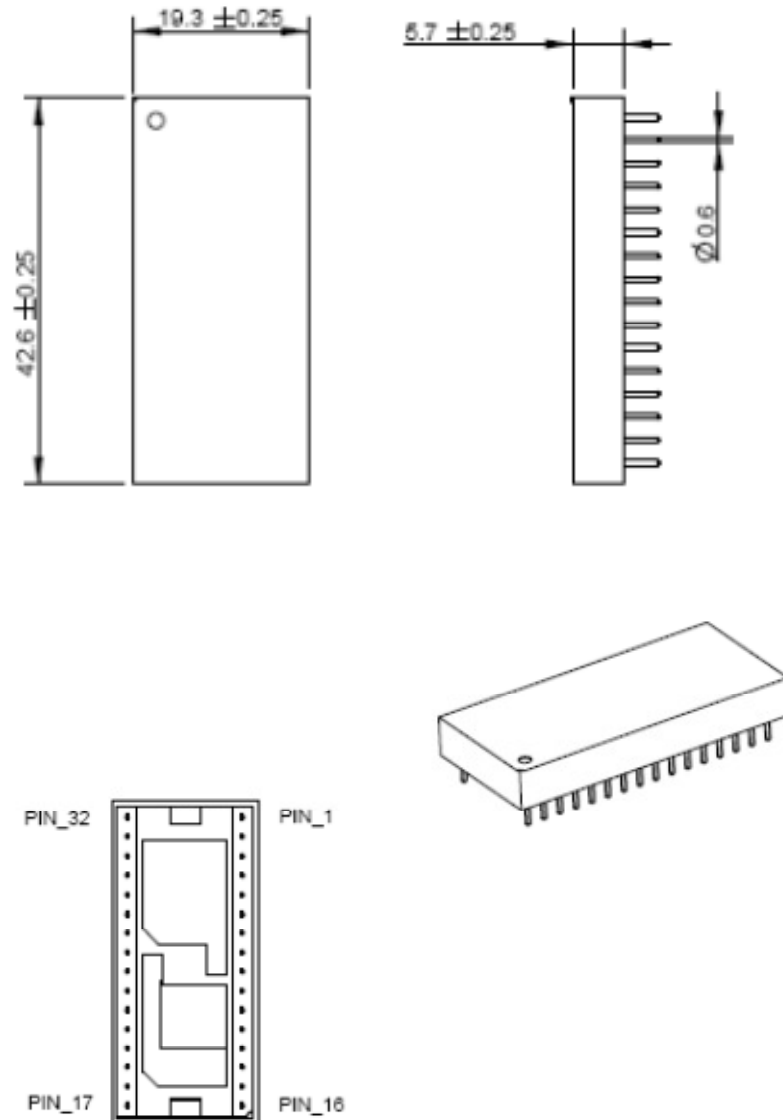
FIGURE 6-1: Physical dimensions of 18-pin SDC



Units: mm
Tolerance: ± 0.25

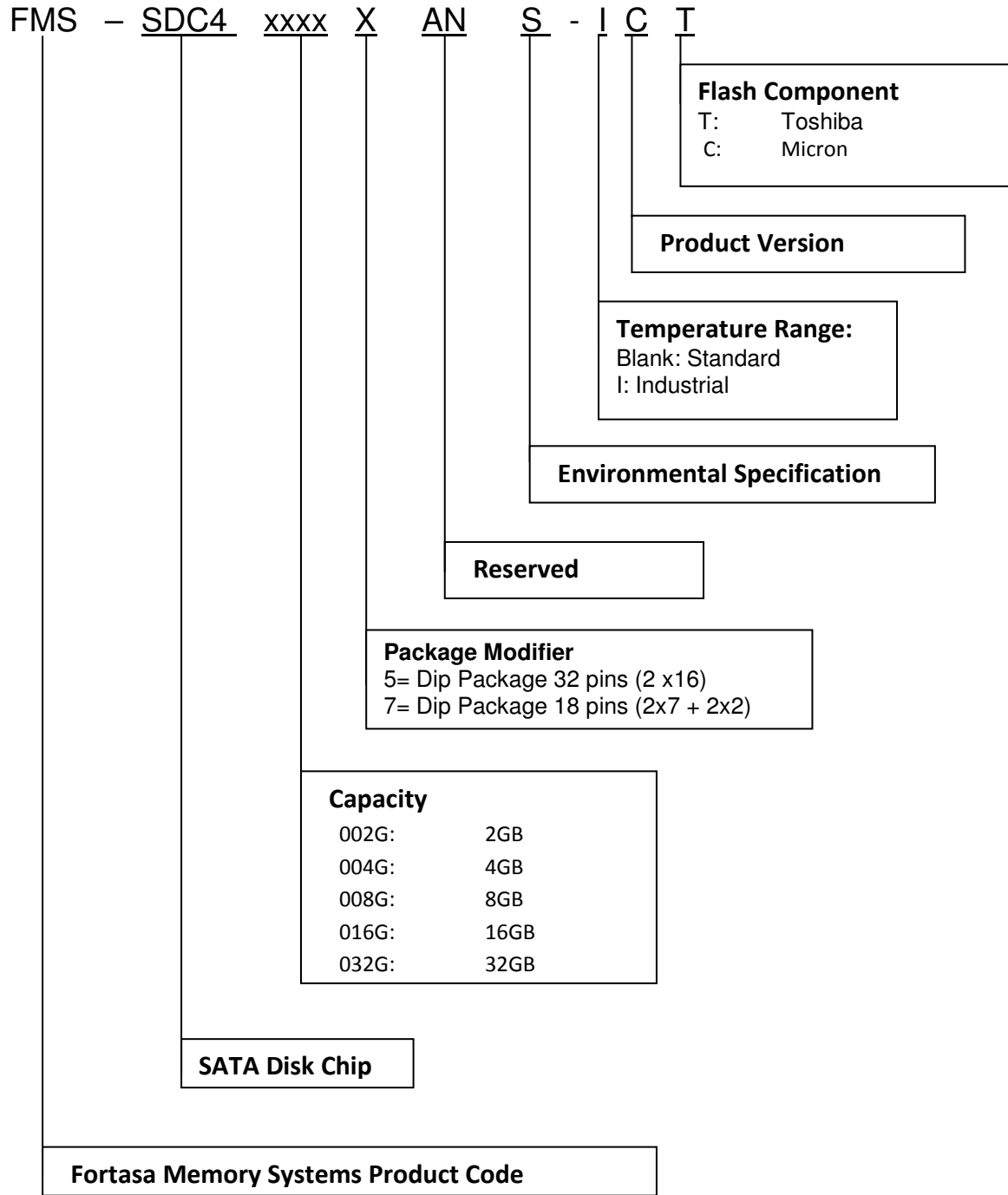
6.2 Dimensions of 32 pins (16x2)

FIGURE 6-2: Physical dimensions of 32-pin SDC



7. Product Ordering Information

7.1 Product Code Designations



7.2 Valid Combinations

SDC 32 pin

Capacity	Standard Temperature	Industrial Temperature
2GB	FMS-SDC4002G5ANS-CC	FMS-SDC4002G5ANS-ICC
4GB	FMS-SDC4004G5ANS-CC	FMS-SDC4004G5ANS-ICC
8GB	FMS-SDC4008G5ANS-CC	FMS-SDC4008G5ANS-ICC
16GB	FMS-SDC4016G5ANS-CT	FMS-SDC4016G5ANS-ICT
32GB	FMS-SDC4032G5ANS-CT	FMS-SDC4032G5ANS-ICT

SDC 18 pin

Capacity	Standard Temperature	Industrial Temperature
2GB	FMS-SDC4002G7ANS-CC	FMS-SDC4002G7ANS-ICC
4GB	FMS-SDC4004G7ANS-CC	FMS-SDC4004G7ANS-ICC
8GB	FMS-SDC4008G7ANS-CC	FMS-SDC4008G7ANS-ICC
16GB	FMS-SDC4016G7ANS-CT	FMS-SDC4016G7ANS-ICT
32GB	FMS-SDC4032G7ANS-CT	FMS-SDC4032G7ANS-ICT

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Fortasa sales representative to confirm availability of valid combinations and to determine availability of new product combinations

8. Revision History

Revision	Date	Description	Comments
1.0	12/14/2011	Initial Release	
1.1	1/16/2012	Revised capacity information	
1.2	3/23/2012	Revised S.M.A.R.T information	
1.3	9/28/2012	Updated Product Ordering Information due to firmware upgrade	
1.4	2/7/2013	Corrected 18-pin part numbers	