

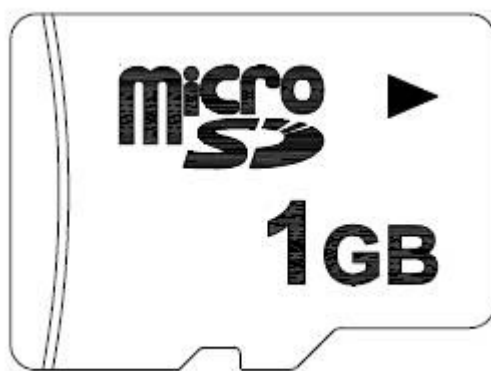
RoHS Compliant

Industrial microSD Card Series

Datasheet for MLC NAND-based Industrial microSD Card

March 24, 2014

Revision 1.0



***This Specification Describes the Features and Capabilities of
the Standard and Industrial Temperature
Industrial microSD Cards***

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



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Features:

- **Fully compatible with microSD Card standard specification 3.0**
- **Low power consumption (typical)**
 - Supply voltage: 2.7 – 3.6V
 - Operating mode: <200 mA
 - Standby mode: <150 μ A
- **Performance**
 - Sustained Read: up to 19 MB/sec
 - Sustained write: up to 12 MB/sec
- **Capacity**
 - 4, 8, 16, 32, 64 GB
- **NAND flash type: MLC**
- **Temperature ranges**
 - Operation:
 - Standard Temperature: -25 °C to 85 °C
 - Industrial Temperature: -40 °C to 85 °C
 - Storage: -40 °C to 100 °C
- **Intelligent endurance design**
 - Built-in hardware ECC, enabling up to 68 bit error correction
 - 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
- **Physical Dimensions**
 - 15.0 mm(L) x 11.0 mm(W) x 1.0 mm(H)
- **RoHS compliant**

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1 Product Description

1.1 General Description

Fortasa's Industrial microSD card is a high reliability solid state storage solution designed specifically to address the rigorous requirements of OEM customers. The MLC-NAND based Industrial microSD cards offer the highest endurance, reliability and environmental agility.

The microSD card fully complies with SD Card Association standard. The Command List is compatible with [Part 1 Physical Layer Specification Ver3.1 Final] definitions, while the Card Capacity of Non-secure Area, Secure Area supports [Part 3 Security Specification Ver3.0 Final] Specifications. The card allows selection of either SD or SPI mode for compatibility in data communication. To provide higher transfer rate, the card can extend to 100MHz clock frequency.

1.2 Functional Block

The Industrial microSD card includes a single-chip microSD Interface Flash Controller and the flash media. The controller integrates the flash management unit to support multi-channel, multi-bank flash arrays. Figure 1-1 shows the functional block diagram of the Industrial microSD card.

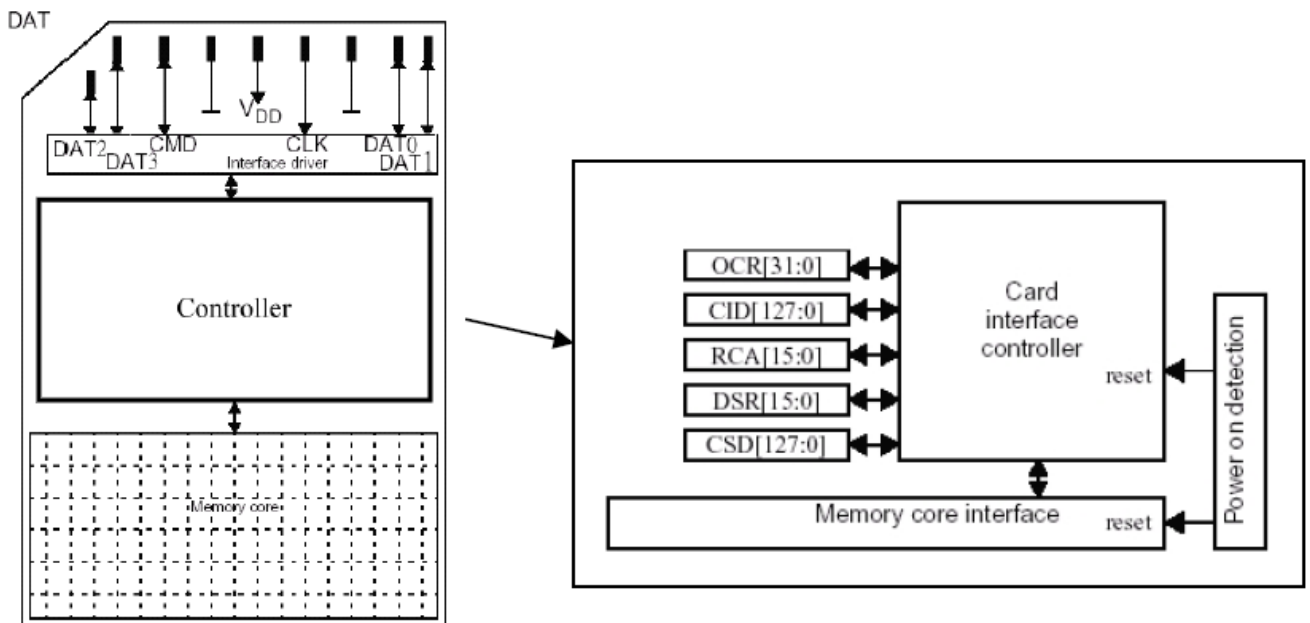


Figure 1-1: Functional block diagram

1.3 Functional Description

The Industrial microSD card contains an integrated logical subsystem that provides multiple management capabilities including:

- Powerful Error Correction Algorithm
- Global Wear Leveling Algorithm
- Critical Power Management for low power operation

1.3.1 Flash Management

The Industrial microSD Flash controller contains logic/physical flash block mapping and bad block management system. It manages all flash blocks including user data space, spare block space and system overhead blocks.

1.3.2 Powerful ECC Algorithm

The Industrial microSD also contains a sophisticated defect and error management system. In case that a bit is found to be defective, the Flash Controller on-the-fly ECC engine mathematically recalculates the missing bit to provide the requested with outmost integrity. This operation is completely transparent to the host and does not consume any user data space. The Flash controller supports up to 68-bit error correction.

1.3.3 Power Management

A power saving feature of the Industrial microSD is an automatic entrance and exit from sleep mode. Upon completion of an operation, the microSD will enter sleep mode to conserve power if no additional commands are received within a set number of seconds. The host does not have to take any action for this to occur. The microSD card is always in the sleep mode except when the host is accessing it, thus conserving power.

Any command issued by the host to the Industrial microSD will cause it to exit sleep mode and response to the host.

1.4 Capacity Specification

Standard capacity specification of the Industrial microSD product is shown in Table 1-1.

Table 1-1: Capacity specifications

Capacity	User Data Bytes
4GB	3,972,005,888
8GB	7,960,788,992
16GB	15,997,075,456
32GB	32,078,036,992
64GB	TBD

Please contact factory for any non-listed microSD capacity or custom setting requirement.

1.5 Performance Specification

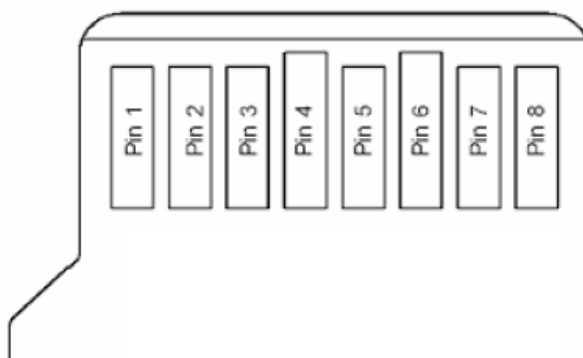
Performances of the Industrial microSD card are listed in Table 1-2.

Table 1-2: Standard Performance specifications

Performance \ Capacity	4GB	8GB	16GB	32GB	64GB
	Sustained read (MB/s)	26	26	26	26
Sustained write (MB/s)	12	12	12	12	16

Note: Performances vary from flash configurations or host device settings

1.6 Card Architecture



1.7 Pin Assignments

Pin	SD Mode		SPI Mode	
	Name	Description	Name	Description
1	DAT2	Data line[bit 2]	RSV	Reserved
2	CD/DAT3	Card Detect/Data line [bit 3]	CS	Chip select
3	CMD	Command/Response	DI	Data in
4	VDD	Supply voltage	VDD	Supply voltage
5	CLK	Clock	SCLK	Clock
6	VSS	Supply voltage ground	VSS	Supply voltage ground
7	DAT0	Data line[bit 0]	DO	Data out
8	DAT1	Data line[bit 1]	RSV	Reserved

2. Environmental Specifications

2.1 Environments

Environmental specification of the Industrial microSD series follows the MIL-STD-810F standard as shown in Table 2-1.

Table 2-1: Environmental specifications

Environment		Specification
Temperature	Operation	-25°C to 85°C (standard); -40°C to 85°C (industrial)
	Storage	-40°C to 85°C
Humidity	Operation	40°C - 95% RH (Non-condensing)
	Storage	55°C - 93% RH (Non-condensing)
Salt Spray	Non -Operating	3% NaCl Solution Temperature:35°C 24hr

3. Electrical Specification

3.1 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 3-1: Operating range

Range	Ambient Temperature	Conditions
Commercial	0°C to +70°C	2.7-3.6 V
Industrial	-40°C to 85°C	

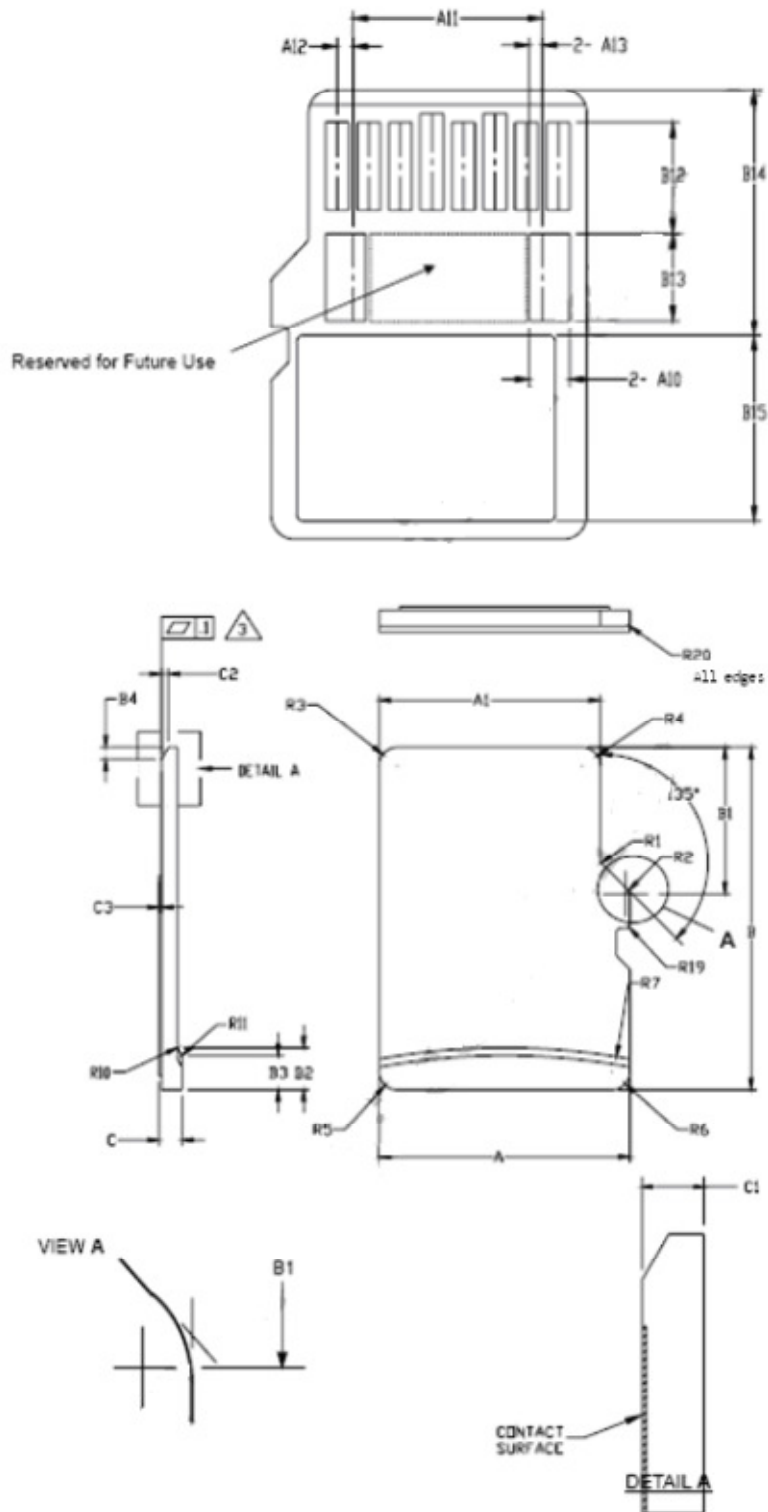
3.2 Power Consumption

Table 3-2 lists the Industrial microSD power consumption.

Table 3-2 Industrial microSD power consumption

Capacity	4GB	8GB	16GB	32GB
Performance				
Operating Mode (mA)	40	42	45	47
Standby Mode (µA)	100	100	100	150

4. Physical Dimensions



SYMBOL	COMMON DIMENSIONS			NOTE
	MIN	NOM	MAX	
A	10.90	11.00	11.10	
A1	9.60	9.70	9.80	
A2	-	3.85	-	BASIC
A3	7.60	7.70	7.80	
A4	-	1.10	-	BASIC
A5	0.75	0.80	0.85	
A6	-	-	8.50	
A7	0.90	-	-	
A8	0.60	0.70	0.80	
A9	0.80	-	-	
A10	1.35	1.40	1.45	
A11	6.50	6.60	6.70	
A12	0.50	0.55	0.60	
A13	0.40	0.45	0.50	
B	14.90	15.00	15.10	
B1	6.30	6.40	6.50	
B2	1.64	1.84	2.04	
B3	1.30	1.50	1.70	
B4	0.42	0.52	0.62	
B5	2.80	2.90	3.00	
B6	5.50	-	-	
B7	0.20	0.30	0.40	
B8	1.00	1.10	1.20	
B9	-	-	9.00	
B10	7.80	7.90	8.00	
B11	1.10	1.20	1.30	
B12	3.60	3.70	3.80	
B13	2.80	2.90	3.00	
B14	8.20	-	-	
B15	-	-	6.20	
C	0.90	1.00	1.10	
C1	0.60	0.70	0.80	
C2	0.20	0.30	0.40	
C3	0.00	-	0.15	
D1	1.00	-	-	
D2	1.00	-	-	
D3	1.00	-	-	
R1	0.20	0.40	0.60	
R2	0.20	0.40	0.60	
R3	0.70	0.80	0.90	
R4	0.70	0.80	0.90	
R5	0.70	0.80	0.90	
R6	0.70	0.80	0.90	
R7	29.50	30.00	30.50	
R10	-	0.20	-	
R11	-	0.20	-	
R17	0.10	0.20	0.30	
R18	0.20	0.40	0.60	
R19	0.05	-	0.20	
R20	0.02	-	0.15	

Notes:

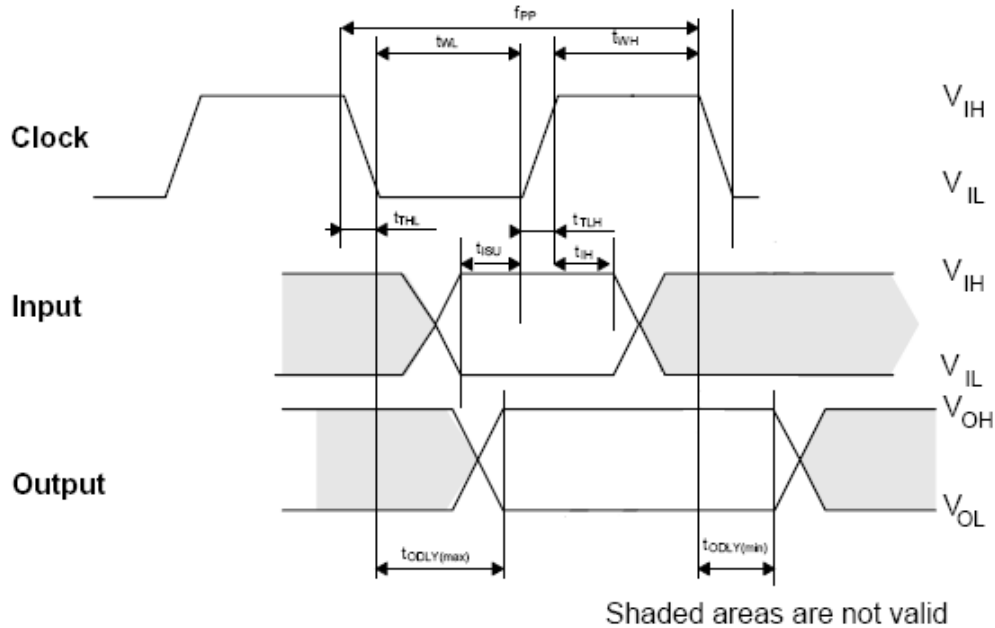
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

2. DIMENSIONS ARE IN MILLIMETERS.

3. COPLANARITY IS ADDITIVE TO C1 MAX THICKNESS.

5. AC Characteristics

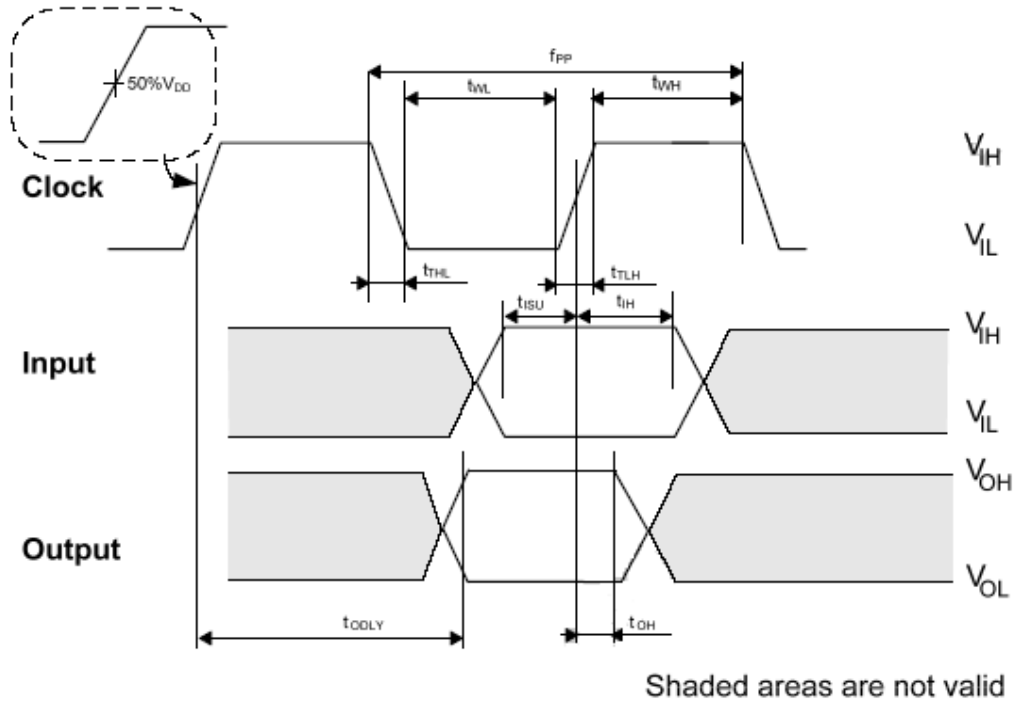
5.1 Bus Interface Timing (Standard)



SYMBOL	PARAMETER	MIN	MAX	UNIT	Note
Clock CLK (All values are referred to min(V _{IH}) and max(V _{IL}))					
f _{PP}	Clock frequency Data Transfer Mode	0	25	MHz	C _{card} ≤ 10 pF (1 card)
f _{OD}	Clock frequency Identification Mode	0 ₍₁₎ /100	400	kHz	C _{card} ≤ 10 pF (1 card)
t _{WL}	Clock low time	10	-	ns	C _{card} ≤ 10 pF (1 card)
t _{WH}	Clock high time	10	-	ns	C _{card} ≤ 10 pF (1 card)
t _{TLH}	Clock rise time	-	10	ns	C _{card} ≤ 10 pF (1 card)
t _{THL}	Clock fall time	-	10	ns	C _{card} ≤ 10 pF (1 card)
t _{ISU}	Input setup time	5	-	ns	C _{card} ≤ 10 pF (1 card)
t _{IH}	Input hold time	5	-	ns	C _{card} ≤ 10 pF (1 card)
t _{ODLY}	Output delay time	0	14	ns	C _L ≤ 40 pF (1 card)
t _{ODLY}	Output Delay time during Identification Mode	0	50	ns	C _L ≤ 40 pF (1 card)

(1) 0Hz means to stop the clock. The given minimum frequency range is for cases that requires the clock to be continued.

5.2 Bus Interface Timing (High-speed)



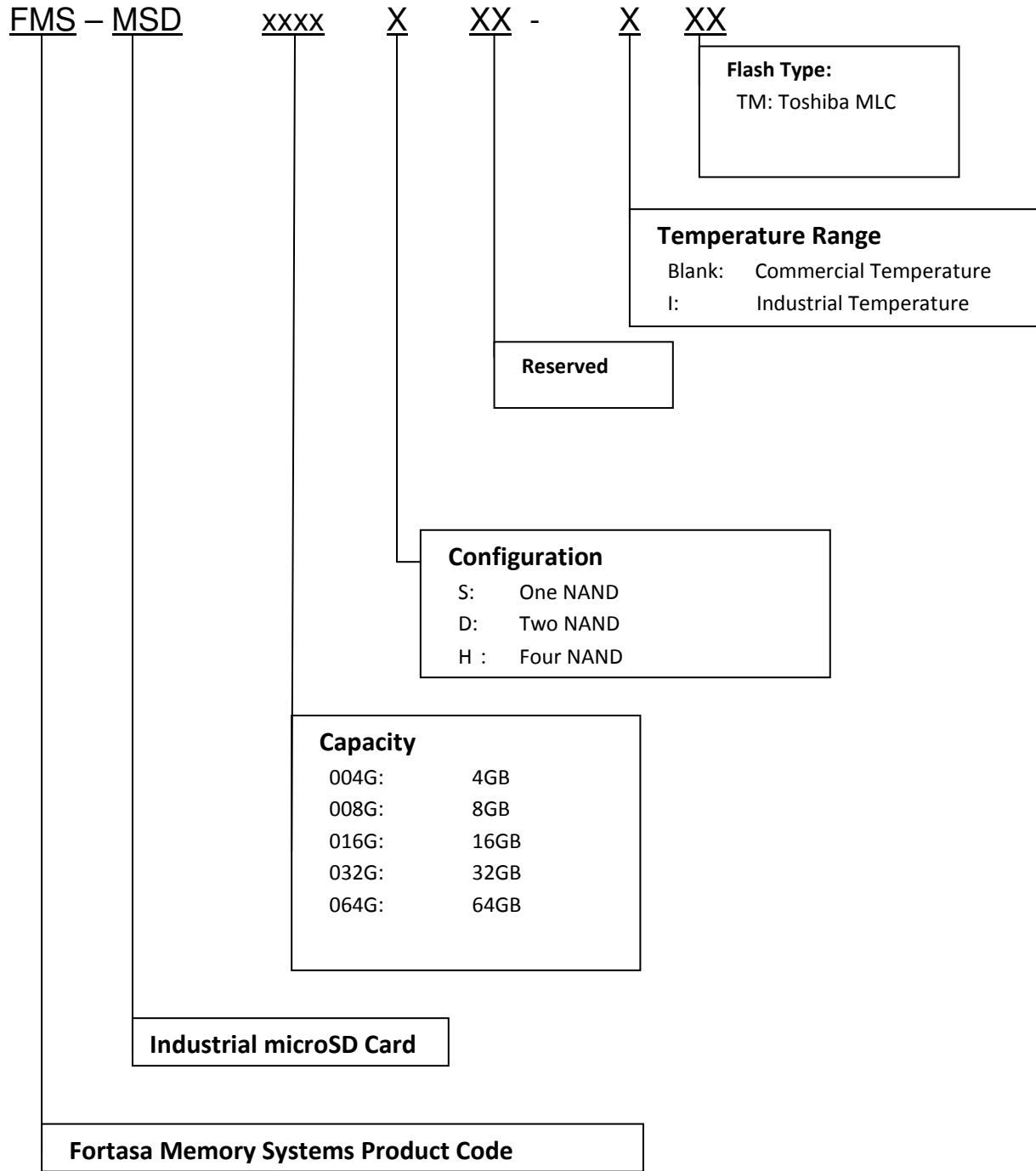
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SYMBOL	PARAMETER	MIN	MAX	UNIT	
f_{PP}	Clock frequency data transfer	0	50	MHz	$C_{card} \leq 10$ pF (1 card)
t_{WL}	Clock low time	7	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{WH}	Clock high time	7	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{TLH}	Clock rise time	-	3	ns	$C_{card} \leq 10$ pF (1 card)
t_{THL}	Clock fall time	-	3	ns	$C_{card} \leq 10$ pF (1 card)
t_{ISU}	Input setup time	6	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{IH}	Input hold time	2	-	ns	$C_{card} \leq 10$ pF (1 card)
t_{ODLY}	Output delay time		14	ns	$CL \leq 40$ pF (1 card)
t_{OH}	Output hold time	2.5	50	ns	$CL \leq 15$ pF (1 card)
C_L	System capacitance of each line*		40	pF	$CL \leq 15$ pF (1 card)

*In order to satisfy optimal timing, host shall interface with only one card

6. Product Ordering Information

6.1 Product Code Designations



6.2 Valid Combinations

Capacity	Standard Temperature Model Numbers	Industrial Temperature Model Numbers
4GB	FMS-MSD004GS4P-TM	FMS-MSD004GS4P-ITM
8GB	FMS-MSD008GS4P-TM	FMS-MSD008GS4P-ITM
16GB	FMS-MSD016GD4P-TM	FMS-MSD016GD4P-ITM
32GB	FMS-MSD032GH4P-TM	FMS-MSD032GH4P-ITM
64GB	FMS-MSD064GH4P-TM	FMS-MSD064GH4P-ITM

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

7. Revision History

Revision	Date	Description	Comments
1.0	03/24/2014	Initial Release	