



SMARTsemi™

SMARTsemi
Memory IC Datasheet

Industrial Grade eMMC 153b

September 2024

Rev 2.0

REVISION HISTORY

Date	Revision	Section(s)	Description
September 2023	1.0	All	Initial Release
September 2024	2.0	Performance	Add Burst Performance Numbers



ESD Caution – Handling

Static electricity may be discharged through this disk subsystem. In extreme cases, this may temporarily interrupt the operation or damage components. To prevent this, make sure you are working in an ESD-safe environment. For example, before handling the disk subsystem, touch a grounded device, such as a computer case, prior to handling.

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FEATURES

- **Capacity**
 - 16GB
- **Electrical/Physical Interface**
 - Compliant with eMMC Specification Version 5.1
 - 153 Ball Standard BGA Packages
- **Bus Mode¹**
 - High-speed eMMC protocol
 - SDR52, DDR52, HS200, and HS400
 - Clock frequency: 0-200MHz.
 - Ten-wire bus (clock, 1-bit command, 8-bit data bus) and a hardware reset
- **Bus Width**
 - 1-bit, 4-bit, 8-bit
- **Performance (HS400)**
 - Read:
 - Up to 320 MB/s
 - Write:
 - Up to 135 MB/s
- **Operating Temperature²**
 - Industrial grade: -40°C to +85°C
- **Storage Temperature²**
 - -40°C to +85°C
- **Input Power:**
 - V_{CC}: 2.7 – 3.6V
 - V_{CCQ} (Dual voltage): 1.7 – 1.95V or 2.7 – 3.6V
- **Power Consumption (HS400, I_{CC}/I_{CCQ})**
 - Read: 100/160mA
 - Write: 50/80mA
 - Standby: 80/250μA
- **Certification & Compliance**
 - RoHS
- **NAND Technology**
 - TLC
- **Reliability**
 - Configurable error correction code (ECC)
 - Defect block management
 - Wear leveling
 - Garbage collection
 - Uncorrectable bit error rate (UBER): 1 sector per 10¹⁵ bits read
- **Security**
 - Trim, Erase
 - Secure Write Protection
- **Additional Features**
 - Field firmware update (FFU)
 - Production state awareness (PSA)
 - Replay Protected Memory Block (RPMB)
 - Boot and Alternative Boot Mode
 - High Priority Interrupt (HPI)
 - Command Queuing
 - Cache flushing report
 - Cache barrier

NOTES:

¹ HS200 and HS400 modes are supported only when V_{CCQ} is in 1.7 – 1.95V.

² Ambient temperature.

GENERAL DESCRIPTION

Overview

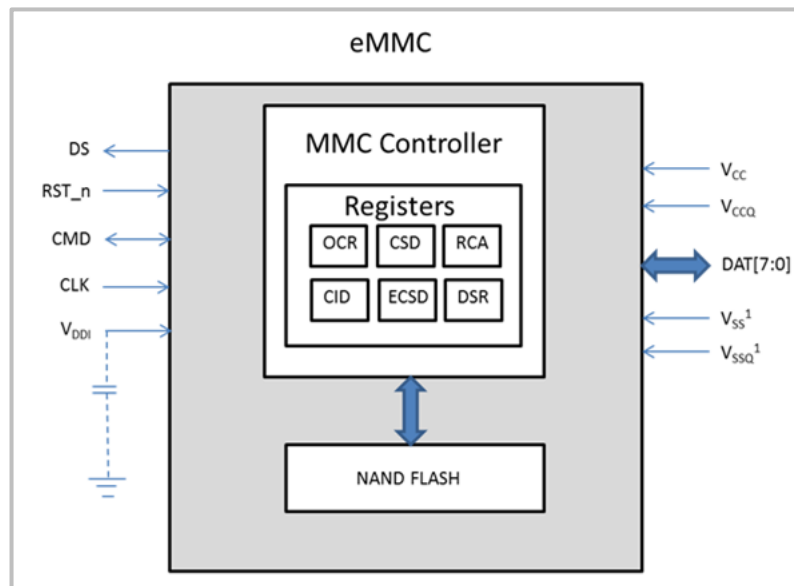
SMARTsemi's eMMC Product Family is an embedded Flash storage solution in a small BGA package designed specifically for the most demanding applications. SMARTsemi's eMMC products address the need for enhanced reliability by incorporating on-board error detection and correction, wear leveling algorithms, and other data management techniques to provide reliable operation and maximum NAND media life expectancy over the product life cycle.

Additionally, the eMMC controller and firmware hide the increased complexities of NAND media from the host processor and allow for faster product development and time to market.

Target applications for SMART's eMMC solution include but are not limited to IoT, Set Top Box, Industrial and Networking appliances wanting a rugged yet cost effective high density mass storage solution.

Functional Block Diagram

eMMC Block Diagram



PERFORMANCE

Performance Characteristics

Burst Performance

Capacity	HS400 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
16 GB	320	135	21000	20000

Capacity	HS200 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
16 GB	175	135	21000	20000

Capacity	DDR52 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
16 GB	85	75	19000	13000

Sustained Performance

Capacity	HS400 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
16 GB	310	15	14000	4400

Capacity	HS200 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
16 GB	175	15	14000	4400

Capacity	DDR52 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
16 GB	85	15	14000	4300

1. Performance measured based on the internal tool.
2. Write Cache is on.

ENDURANCE

Drive Lifetime¹

Capacity	Value (Max)
16GB	90 TBW

1 Endurance is related directly to the User Specific Workload. Measured with 100% Sequential Workload.

RELIABILITY

Failure rate

Parameter	Value (All Capacities)
FIT @ Tc = 40°C	136

Data Retention

Parameter	Value
Data Retention (@ 55°C)	10 years when 90% life remaining
	1 year when 10% life remaining

Operating and Storage Temperature¹

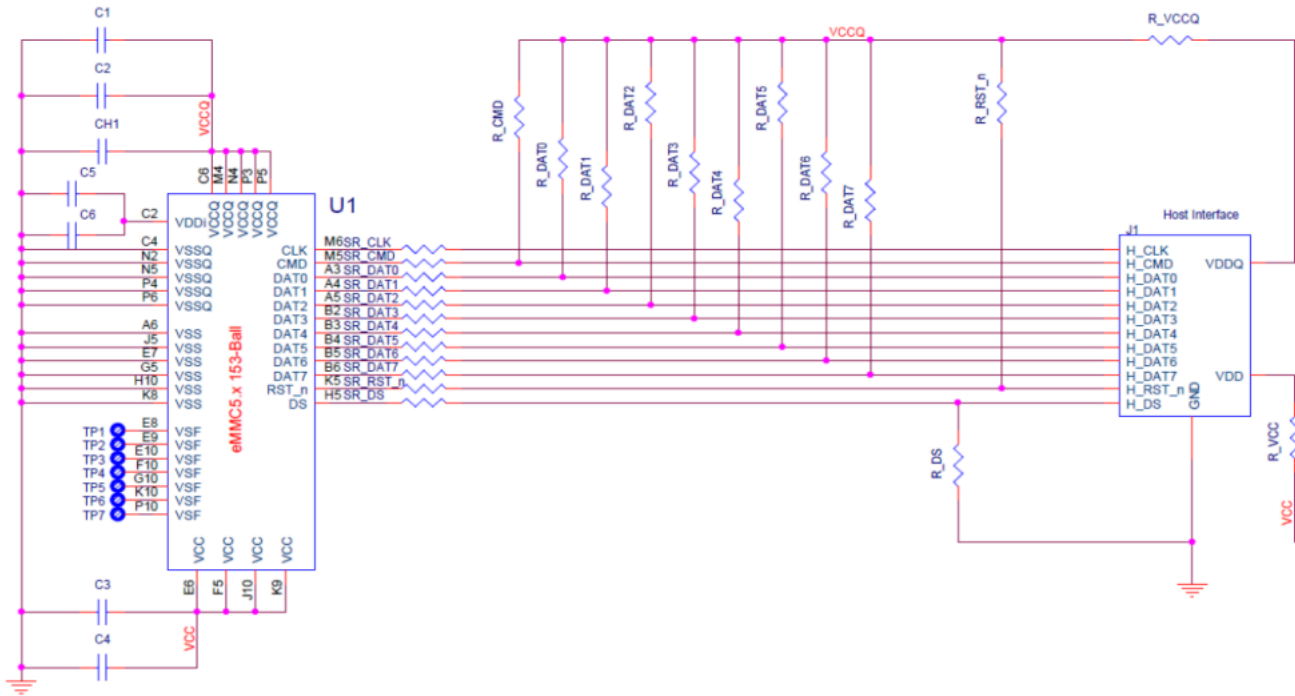
Parameter	Value
Operating Temperature	Industrial grade: -40°C to +85°C
Storage Temperature	-40°C to +85°C

¹ Operating temperature herein is Ambient Temperature.

POWER CONSUMPTION

Condition1		ICC/ICCQ (Typical)		Units
		16GB (native)		
Write	DDR52	50/70		mA
	HS200	50/80		mA
	HS400	50/80		mA
Read	DDR52	40/110		mA
	HS200	70/120		mA
	HS400	100/160		mA
Sleep current		180		μA
Standby		80/250		μA

1. Bus in x8 I/O mode; 25°C; VCCQ = 1.8 V in HS200 and HS400. Measurements done as maximum RMS current consumption over 100 milliseconds.

Recommended eMMC Connection


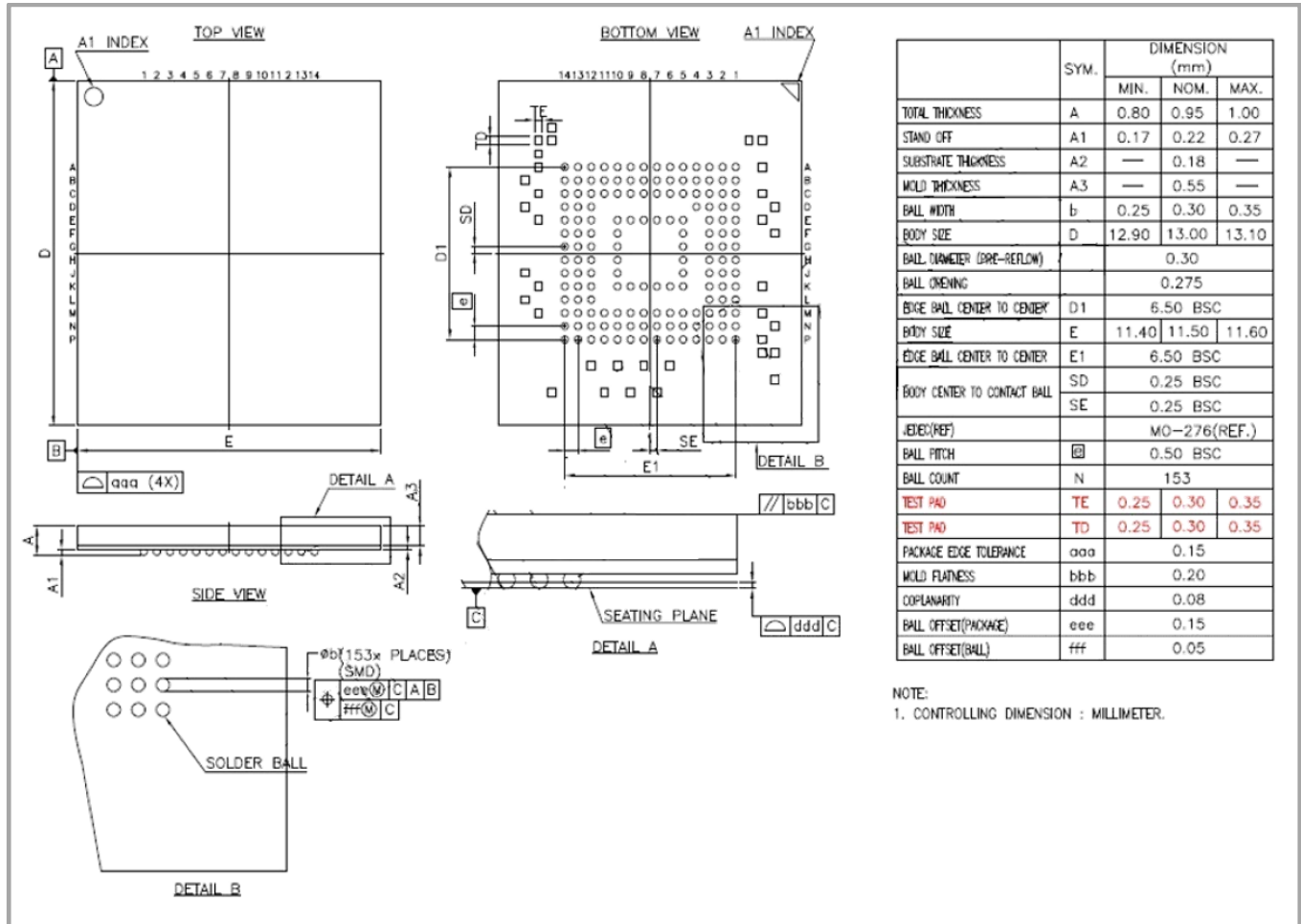
Capacitor and Resistor Specifications

Parameter	Symbol	Min	Max	Typ	Units	Remark
Pull-up resistance for CMD	R_CMD	4.7	50	10	Kohm	to prevent bus floating
Pull-up resistance for DAT0~7	R_DAT	10	50	10	Kohm	to prevent bus floating
Pull-up resistance for RST_n	R_RST_n	4.7	50	10	Kohm	It is not necessary to put pull-up resistance on RST_n (H/W reset) line if host does not use H/W reset. (Extended CSD register [162] = 0 b)
Pull-down resistance for Data Strobe	R_DS	10	50	10	Kohm	
Impedance on CLK / CMD / DAT0~7		45	55	50	ohm	Impedance match
Serial's resistance on CLK line	S	-	-	0	ohm	If customer want to put serial resistance except 0 ohm, they need to check timing are all in SPEC.
Serial's resistance on power trace	R_VCC R_VCCQ	-	-	0	ohm	Typical size 0603 or 0805.
Serial's resistance on CMD / DAT0~7 line / RST_n / RCLK	SR_RST_n SR_DS SR_CMD SR_DAT0~7	-	-	0	ohm	If customer want to put serial resistance except 0 ohm, they need to check timing are all in SPEC.
V _{CCQ} capacitor value	C1	2.2	4.7	4.7	μ F	Coupling capacitor should be connected with VDDQ and VSSQ as closely as possible
	C2	0.1	0.22	0.1	μ F	
	CH1	1	2.2	1	μ F	CH1 should be placed adjacent to V _{CCQ} -V _{SSQ} balls (#C6 and #C4 accordingly, next to DAT[7..0] balls), It should be located as close as possible to the balls defined in order to minimize connection parasitics.
V _{CC} capacitor value	C3	2.2	4.7	4.7	μ F	Coupling capacitor should be connected with VDD and VSS as closely as possible
	C4	0.1	0.22	0.22	μ F	
VDDi capacitor value (C _{FB3})	C5	1	4.7	2.2	μ F	Coupling capacitor should be connected with VDDi and VSSi as closely as possible
	C6	0.1	0.22	0.1	μ F	
Vendor Specific	TP1~7	-	-	-	-	The function of these signals is defined and specified by the controller vendor. A pin that is not to be used in normal applications and that may or may not have an internal connection. The VSF signals shall be treated as NU signals by the user. The VSF signals shall reserved test points on the PCB, avoid reference high speed layer and power plane.

Note: It doesn't matter to put Pull-up resistors and Serial's resistors closer to host or eMMC. However, it's recommended to put all resistors on the same PCB side. (Top or Bottom)

MECHANICAL SPECIFICATION

153-Ball BGA Dimensions – 11.5 mm x 13 mm x 1 mm



Mechanical Dimensions

Parameter	Value
Length	13.00 mm
Width	11.50 mm
Height	1.00 mm

Recommended Reflow Profiles

Parameter	Value
Peak Temperature	235 - 245°C
Time Above liquidus	45 to 70 seconds
Cooling Rate	< 4°C/sec

Note: Each solder paste manufacturer will have their own reflow profile specification. It's recommended customers follow the solder paste manufacturer's reflow profile specification and optimize the reflow profile based on product complexity for the assembly process.

EMMC BALL-OUT DIAGRAM

Figure 1 153-Ball Pin Assignments (Top View, Balls Down)*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
A	NC	NC	DAT0	DAT1	DAT2	VSS	RFU	NC	NC	NC	NC	NC	NC	NC	A
B	NC	DAT3	DAT4	DAT5	DAT6	DAT7	NC	NC	NC	NC	NC	NC	NC	NC	B
C	NC	VDDI	NC	VSSQ	NC	VCCQ	NC	NC	NC	NC	NC	NC	NC	NC	C
D	NC	NC	NC	NC								NC	NC	NC	D
E	NC	NC	NC		RFU	VCC	VSS	VSF	VSF	VSF		NC	NC	NC	E
F	NC	NC	NC		VCC					VSF		NC	NC	NC	F
G	NC	NC	RFU		VSS					VSF		NC	NC	NC	G
H	NC	NC	NC		DS					VSS		NC	NC	NC	H
J	NC	NC	NC		VSS					VCC		NC	NC	NC	J
K	NC	NC	NC		RST_n	RFU	RFU	VSS	VCC	VSF		NC	NC	NC	K
L	NC	NC	NC								NC	NC	NC	L	
M	NC	NC	NC	VCCQ	CMD	CLK	NC	NC	NC	NC	NC	NC	NC	NC	M
N	NC	VSSQ	NC	VCCQ	VSSQ	NC	NC	NC	NC	NC	NC	NC	NC	NC	N
P	NC	NC	VCCQ	VSSQ	VCCQ	VSSQ	RFU	NC	NC	VSF	NC	NC	NC	NC	P
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	

Pinout Descriptions

Signal Descriptions

Symbol	Type	Description
CLK	Input	Clock Signal.
RST_n	Input	Hardware Reset Signal.
CMD	I/O	Command Signal.
DAT[7:0]	I/O	Data Bus.
DS	Output	Data Strobe Signal, Used in HS400 mode.
V _{CC}	Supply	Supply voltage for controller and Flash memory power.
V _{CCQ}	Supply	Supply voltage for controller and eMMC I/O power.
V _{SS}	Supply	Supply voltage ground for controller and Flash memory. Can be short with VSSQ.
V _{SSQ}	Supply	Supply voltage ground for controller and IO Flash memory. Can be short with VSS.
V _{DDi}		Connect capacitor from VDDi to GND for stabilize internal power.
NC	-	In eMMC chip is no connect. Left it floating.
RFU	-	Reserved for future use. Left it floating for future use.
VSF	-	Vendor Specific Function. Reserved for test points on the PCB, default NU (Not Used)

REGISTERS

Supported Device Registers

Name	Width	Description
CID	128 (Bits)	Card Identification
OCR	32 (Bits)	Operation Condition Register
CSD	128 (Bits)	Card Specific Data
ECSD	512 (Bytes)	Extended Card Specific Data

CID Register Field Parameters

Name	Field	Width (Bits)	CID Bits	CID Value	
Manufacturer ID	MID	8	[127:120]	0xF6h	
Card BGA	CBX	2	[113:112]	01h	
OEM/Application ID	OID	8	[111:104]	00h	
Product name	PNM	48 ⁽¹⁾	[103:56]	16GB	0x414750334220
Product revision	PRV	8	[55:48]	10h	
Product serial number	PSN	32 ⁽²⁾	[47:16]	-- ⁽²⁾	
Manufacturing date	MDT	8 ⁽³⁾	[15:8]	-- ⁽³⁾	
Calculated CRC	CRC	7	[7:1]	-- ⁽⁴⁾	

1. The product name uses ASCII code.
2. Unique for each device. 32-bit unsigned binary integer.
3. 2 hex digits for device manufacturing month and year.
4. CRC for CID register. Different for each device.

OCR Register Field Definitions

VDD voltage window	Width (Bits)	OCR bits	OCR Value
Ready/Busy	1	[31]	card power up status bit (busy) ⁽¹⁾
Access mode	2	[30:29]	2h
VDD: 2.7 - 3.6 range	9	[23:15]	1FFh
VDD: 2.0 - 2.6 range	7	[14:8]	00h
VDD: 1.7 - 1.95 range	1	[7]	1h

1. This bit is set to low if the device has not finished the power up routine.

CSD Register Field Parameters

Name	Field	Width (Bits)	CSD Bits	CSD Value
CSD structure	CSD_STRUCTURE	2	[127:126]	0x03
System specification version	SPEC_VERS	4	[125:122]	0x04
Reserved	-	2	[121:120]	--
Data read access time 1	TAAC	8	[119:112]	0x4F
Data read access time 2 in CLK	NSAC	8	[111:104]	0x01
Maximum bus clock frequency	TRAN_SPEED	8	[103:96]	0x32
Device command classes	CCC	12	[95:84]	0x8F5
Maximum read data block length	READ_BL_LEN	4	[83:80]	0x9
Partial blocks for reads supported	READ_BL_PARTIAL	1	[79]	0x0
Write block misalignment	WRITE_BLK_MISALIGN	1	[78]	0x0
Read block misalignment	READ_BLK_MISALIGN	1	[77]	0x0
DSR implemented	DSR_IMP	1	[76]	0x0
Reserved	-	2	[75:74]	--
Device size	C-SIZE	12	[73:62]	0xFFF
Maximum read current as VDD,min	VDD_R_CURR_MIN	3	[61:59]	0x7
Maximum read current as VDD,max	VDD_R_CURR_MAX	3	[58:56]	0x7
Maximum write current as VDD,min	VDD_W_CURR_MIN	3	[55:53]	0x7
Maximum write current as VDD,max	VDD_W_CURR_MAX	3	[52:50]	0x7
Device size multiplier	C-SIZE_MULT	3	[49:47]	0x7
Erase group size	ERASE_GRP_SIZE	5	[46:42]	0x1F
Erase group size multiplier	ERASE_GRP_SIZE_MULT	5	[41:37]	0x1F
Write protect group size	WP_GRP_SIZE	5	[36:32]	0xF
Write protect group enable	WP_GRP_ENABLE	1	[31]	0x1
Manufacturer default ECC	DEFAULT_ECC	2	[30:29]	0x0
Write-speed factor	R2W_FACTOR	3	[28:26]	0x2
Maximum write data block length	WRITE_BL_LEN	4	[25:22]	0x9
Partial blocks for write allowed	WRITE_BL_PARTIAL	1	[21]	0x0
Reserved	-	4	[20:17]	--
Content protection application	CONTENT_PROT_APP	1	[16]	0x0
File-format group	FILE_FORMAT_GRP	1	[15]	0x0
Copy flag (OTP)	COPY	1	[14]	0x0
Permanent write protection	PERM_WRITE_PROTECT	1	[13]	0x0
Temporary write protection	TEMP_WRITE_PROTECT	1	[12]	0x0
File format	FILE_FORMAT	2	[11:10]	0x0
ECC code	ECC	2	[9:8]	0x0
CRC	CRC	7	[7:1]	-
Not used; always 1	-	1	[0]	-

ECSD Register Field Parameters

Name	Field	Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
Reserved	--	6	--	[511:506]	--
Extended Security Commands Error	EXT_SECURITY_ERR	1	R	[505]	0x00
Supported command sets	S_CMD_SET	1	R	[504]	0x01
HPI features	HPI_FEATURES	1	R	[503]	0x01
Background operations support	BKOPS_SUPPORT	1	R	[502]	0x01
Max packed read commands	MAX_PACKED_READS	1	R	[501]	0x20
Max packed write commands	MAX_PACKED_WRITES	1	R	[500]	0x20
Data tag support	DATA_TAG_SUPPORT	1	R	[499]	0x01
Tag unit size	TAG_UNIT_SIZE	1	R	[498]	0x03
Tag resources size	TAG_RES_SIZE	1	R	[497]	0x00
Context management capabilities	CONTEXT_CAPABILITIES	1	R	[496]	0x05
Large unit size	LARGE_UNIT_SIZE_M1	1	R	[495]	0x18
Extended partitions attribute support	EXT_SUPPORT	1	R	[494]	0x03
Supported Modes	SUPPORTED_MODES	1	R	[493]	0x03
FFU features	FFU_FEATURES	1	R	[492]	0x00
Operations code timeout	OPERATION_CODE_TIMEOUT	1	R	[491]	0x00
FFU Argument	FFU_ARG	4	R	[490:487]	0x00
Reserved	--	181	--	[486:306]	--
Number of FW sectors correctly programmed	NUMBER_OF_FW_SECTORS_CORRECTLY_PROGRAMMED	4	R	[305:302]	0x00
Vendor proprietary health report	VENDOR_PROPRIETARY_HEALTH_REPORT	32	R	[301:270]	-
Device life time estimation type B	DEVICE_LIFE_TIME_EST_TYP_B	1	R	[269]	Variable
Device life time estimation type A	DEVICE_LIFE_TIME_EST_TYP_A	1	R	[268]	Variable
Pre EOL information	PRE_EOL_INFO	1	R	[267]	Variable
Optimal read size	OPTIMAL_READ_SIZE	1	R	[266]	0x01
Optimal write size	OPTIMAL_WRITE_SIZE	1	R	[265]	0x08
Optimal trim unit size	OPTIMAL_TRIM_UNIT_SIZE	1	R	[264]	0x01
Device Version	Device version	2	R	[263:262]	0xC
Firmware version	FIRMWARE_VERSION	8	R	[261:254]	0x01

Name	Field	Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
Power class for 200MHz, DDR at VCC=3.6V	PWR_CL_DDR_200_360	1	R	[253]	0x00
Cache size	CACHE_SIZE	4	R	[252:249]	1536
Generic CMD6 timeout	GENERIC_CMD6_TIME	1	R	[248]	0x0A
Power off notification (long) timeout	POWER_OFF_LONG_TIME	1	R	[247]	0x32
Background operations status	BKOPS_STATUS	1	R	[246]	0x00
Number of correctly programmed sectors	CORRECTLY_PRG_SECTORS_NUM	4	R	[245:242]	0x00
First initialization time after partitioning	INI_TIMEOUT_AP	1	R	[241]	0x1E
Reserved	--	1	--	[240]	--
Power class for 52 MHz, DDR at 3.6V	PWR_CL_DDR_52_360	1	R	[239]	0x00
Power class for 52 MHz, DDR at 1.95V	PWR_CL_DDR_52_195	1	R	[238]	0x00
Power class for 200 MHz at 1.95V, VCC = 3.6V	PWR_CL_200_195	1	R	[237]	0x00
Power class for 200 MHz at 1.3V, VCC = 3.6V	PWR_CL_200_130	1	R	[236]	0x00
Minimum write performance for 8-bit at 52 MHz in DDR mode	MIN_PERF_DDR_W_8_52	1	R	[235]	0x4B
Minimum read performance for 8-bit at 52 MHz in DDR mode	MIN_PERF_DDR_R_8_52	1	R	[234]	0x00
Reserved	--	1	--	[233]	--
TRIM multiplier	TRIM_MULT	1	R	[232]	0x12
Secure feature support	SEC_FEATURE_SUPPORT	1	R	[231]	0x55
SECURE ERASE multiplier	SEC_ERASE_MULT	1	R	[230]	0x64
SECURE TRIM multiplier	SEC_TRIM_MULT	1	R	[229]	0x64
Boot information	BOOT_INFO	1	R	[228]	0x07
Reserved	--	1	--	[227]	--
Boot partition size	BOOT_SIZE_MULT	1	R	[226]	0x20
Access size	ACC_SIZE	1	R	[225]	0x07
High-capacity erase unit size	HC_ERASE_GRP_SIZE	1	R	[224]	0x01
High-capacity erase timeout	ERASE_TIMEOUT_MULT	1	R	[223]	0x12
Reliable write-sector count	REL_WR_SEC_C	1	R	[222]	0x01

Name	Field	Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
High-capacity write protect group size	HC_WP_GRP_SIZE	1	R	[221]	0x10
Sleep current (V _{CC})	S_C_VCC	1	R	[220]	0x08
Sleep current (V _{CCQ})	S_C_VCCQ	1	R	[219]	0x08
Production state awareness timeout	PRODUCTION_STATE_AWARENESS_TIMEOUT	1	R	[218]	0x00
Sleep/awake timeout	S_A_TIMEOUT	1	R	[217]	0x15
Sleep Notification Timeout	SLEEP_NOTIFICATION_TIME	1	R	[216]	0x0F
Sector count	SEC-COUNT	4	R	[215:212]	0x1D1F000
Reserved	--	1	--	[211]	--
Minimum write performance for 8-bit at 52 MHz	MIN_PERF_W_8_52	1	R	[210]	0x4B
Minimum read performance for 8-bit at 52 MHz	MIN_PERF_R_8_52	1	R	[209]	0x00
Minimum write performance for 8-bit at 26 MHz and 4-bit at 52 MHz	MIN_PERF_W_8_26_4_52	1	R	[208]	0x2B
Minimum read performance for 8-bit at 26 MHz and 4-bit at 52 MHz	MIN_PERF_R_8_26_4_52	1	R	[207]	0x00
Minimum write performance for 4-bit at 26 MHz	MIN_PERF_W_4_26	1	R	[206]	0x1E
Minimum read performance for 4-bit at 26 MHz	MIN_PERF_R_4_26	1	R	[205]	0x00
Reserved	--	1	--	[204]	--
Power class for 26 MHz at 3.6V 1 R	PWR_CL_26_360	1	R	[203]	0x00
Power class for 52 MHz at 3.6V 1 R	PWR_CL_52_360	1	R	[202]	0x00
Power class for 26 MHz at 1.95V 1 R	PWR_CL_26_195	1	R	[201]	0x00
Power class for 52 MHz at 1.95V 1 R	PWR_CL_52_195	1	R	[200]	0x00
Partition switching timing	PARTITION_SWITCH_TIME	1	R	[199]	0x03
Out-of-interrupt busy timing	OUT_OF_INTERRUPT_TIME	1	R	[198]	0x0A
I/O driver strength	DRIVER_STRENGTH	1	R	[197]	0x1F
Card type	CARD_TYPE	1	R	[196]	0x57
Reserved	--	1	--	[195]	--
CSD structure version	CSD_STRUCTURE	1	R	[194]	0x02
Reserved	--	1	--	[193]	--
Extended CSD revision	EXT_CSD_REV	1	--	[192]	0x08

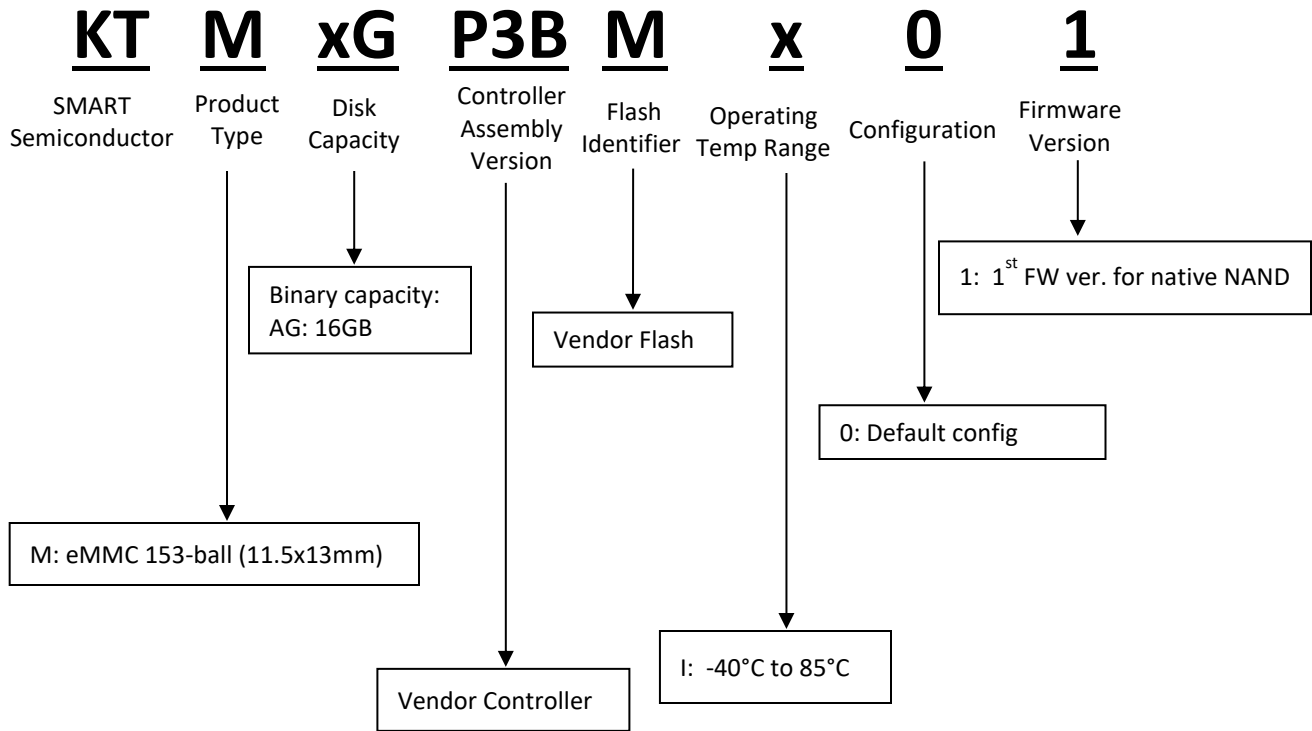
Name	Field	Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
Command set	CMD_SET	1	RW/E_P	[191]	0x00
Reserved	--	1	--	[190]	--
Command set revision	CMD_SET_REV	1	R	[189]	0x00
Reserved	--	1	--	[188]	--
Power class	POWER_CLASS	1	RW/E_P	[187]	0x00
Reserved	--	1	--	[186]	--
High-speed interface timing	HS_TIMING	1	RW/E_P	[185]	0x01
Reserved	--	1	--	[184]	0x01
Bus width mode	BUS_WIDTH	1	W/E_P	[183]	0x02
Reserved	--	1	--	[182]	--
Erased memory content	ERASED_MEM_CONT	1	R	[181]	0x00
Reserved	--	1	--	[180]	--
Partition configuration	PARTITION_CONFIG	1	RW/E, RW/E_P	[179]	0x00
Boot config protection	BOOT_CONFIG_PROT	1	RW, RW/C_P	[178]	0x00
Boot bus Conditions	BOOT_BUS_CONDITIONS	1	RW/E	[177]	0x00
Reserved	--	1	--	[176]	--
High-density erase group definition	ERASE_GROUP_DEF	1	RW/E_P	[175]	0x00
Boot write protection status registers	BOOT_WP_STATUS	1	R	[174]	0x00
Boot area write protection register	BOOT_WP	1	RW, RW/C_P	[173]	0x00
Reserved	--	1	-	[172]	--
User write protection register	USER_WP	1	RW, RW/C_P, RW/E_P	[171]	0x00
Reserved	--	1	--	[170]	--
Firmware configuration	FW_CONFIG	1	RW	[169]	0x00
RPMB size	RPMB_SIZE_MULT	1	R	[168]	0x20
Write reliability setting register	WR_REL_SET	1	RW	[167]	0x1F
Write reliability parameter register	WR_REL_PARAM	1	R	[166]	0x15
Start sanitize operation	SANITIZE_START	1	W/E_P	[165]	0x00
Manually start background operations	BKOPS_START	1	W/E_P	[164]	0x00

Name	Field	Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
Enable background operations handshake	BKOPS_EN	1	R/W	[163]	0x02
Hardware reset function	RST_n_FUNCTION	1	R/W	[162]	0x00
HPI management	HPI_MGMT	1	R/W/E/P	[161]	0x00
Partitioning support	PARTITIONING_SUPPORT	1	R/W/E, R/W/E_P	[160]	0x07
Maximum enhanced area size	MAX_ENH_SIZE_MULT	3	R	[159:157]	618
Partitions attribute	PARTITIONS_ATTRIBUTE	1	R/W	[156]	0x00
Partitioning setting	PARTITIONING_SETTING-COMPLETED	1	R/W	[155]	0x00
General-purpose partition size	GP_SIZE_MULT	12	R/W	[154:143]	0x00
Enhanced user data area size	ENH_SIZE_MULT	3	R/W	[142:140]	0x00
Enhanced user data start address	ENH_START_ADDR	4	R/W	[139:136]	0x00
Reserved	-	1	-	[135]	--
Bad block management mode	SEC_BAD_BLK_MGMNT	1	R/W	[134]	0x00
Production state awareness	PRODUCTION_STATE_AWARENESS	1	R/W/E	[133]	0x00
Package case temperature is controlled	TCASE_SUPPORT	1	W/E_P	[132]	0x00
Periodic wake-up	PERIODIC_WAKEUP	1	R/W/E	[131]	0x00
Program CID/CSD in DDR mode support	PROGRAM_CID_CSD_DDR_SUPPORT	1	R	[130]	0x01
Reserved	-	2	-	[129:128]	--
Vendor specific fields	VENDOR_SPECIFIC_NFIELD	64	<vs>	[127:64]	0x00
Native sector size	NATIVE_SECTOR_SIZE	1	R	[63]	0x00
Sector size emulation	USE_NATIVE_SECTOR	1	R/W	[62]	0x00
Sector size	DATA_SECTOR_SIZE	1	R	[61]	0x00
1st initialization after disabling sector size emulation	INI_TIMEOUT_EMU	1	R	[60]	0x00
Class 6 command control	CLASS_6_CTRL	1	R/W/E_P	[59]	0x00
Number of addressed groups to be released	DYNCAP_NEEDED	1	R	[58]	0x00
Exception events control	EXCEPTION_EVENTS_CTRL	2	R/W/E_P	[57:56]	0x00
Exception events status	EXCEPTION_EVENTS_STATUS	2	R	[55:54]	0x00
Extended partitions attribute	EXT_PARTITIONS_ATTRIBUTE	2	R/W	[53:52]	0x00

Name	Field	Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
Context configuration	CONTEXT_CONF	15	R/W/E_P	[51:37]	0x00
Packed command status	PACKED_COMMAND_STATUS	1	R	[36]	0x00
Packed command failure index	PACKED_FAILURE_INDEX	1	R	[35]	0x00
Power off notification	POWER_OFF_NOTIFICATION	1	R/W/E_P	[34]	0x00
Control to turn the cache on/off	CACHE_CTRL	1	R/W/E_P	[33]	0x00
Flushing of the cache	FLUSH_CACHE	1	W/E_P	[32]	0x00
Control to turn the Barrier ON/OFF	BARRIER_CTRL	1	R/W	[31]	0x00
Mode config	MODE_CONFIG	1	R/W/E_P	[30]	0x00
Mode operation codes	MODE_OPERATION_CODES	1	W/E_P	[29]	0x00
Reserved	-	2	-	[28:27]	--
FFU status	FFU_STATUS	1	R	[26]	0x00
Pre loading data size	PRE_LOADING_DATA_SIZE	4	R/W/E_P	[25:22]	0x00
Max pre loading data size	MAX_PRE_LOADING_DATASIZE	4	R	[21:18]	0x979000
Product state awareness enablement	PRODUCT_STATE_AWARENESS_ENABLEMENT	1	R/W/E & R	[17]	0x01
Secure removal type	SECURE_REMOVAL_TYPE	1	R/W & R	[16]	0x01
Reserved	-	16	-	[15:0]	--

PART NUMBERS

Part Number	Operating temperature	Capacity
KTMAGP3BMI01	-40°C to +85°C	16GB

PART NUMBER DECODER


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