SMARTsemi
Memory IC Datasheet

Industrial Grade eMMC 153b

July 2023

Rev 1.0

REVISION HISTORY

Date	Revision	Section(s)	Description
April 2023	0.1	All	Preliminary Release
July 2023	1.0	All	Initial Release

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**
  - 8GB, 16GB, 32GB, 64GB and 128GB
- **Electrical/Physical Interface**
  - Compliant with eMMC Specification Version 5.1
  - 153 Ball Standard BGA Packages
- **Bus Mode**[1]
  - 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 320MB/s
  - Write:
    - TLC: Up to 170 MB/s
- **Operating Temperature**[2]
  - Industrial grade: -40°C to +85°C
  - Consumer grade: -25°C to +85°C
- **Storage Temperature**[2]
  - -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: 35/77mA
  - Write: 70/78mA
  - Standby: 28/80µA
- **Certification & Compliance**
  - RoHS
  - REACH
- **NAND Technology**
  - TLC
- **Reliability**
  - Configurable error correction code (ECC)
  - Defect block management
  - Wear leveling
  - Garbage collection
  - Uncorrectable bit error rate (UBER): 1 sector per 10^{15} bits read
- **Security**
  - Sanitize, Discard, 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

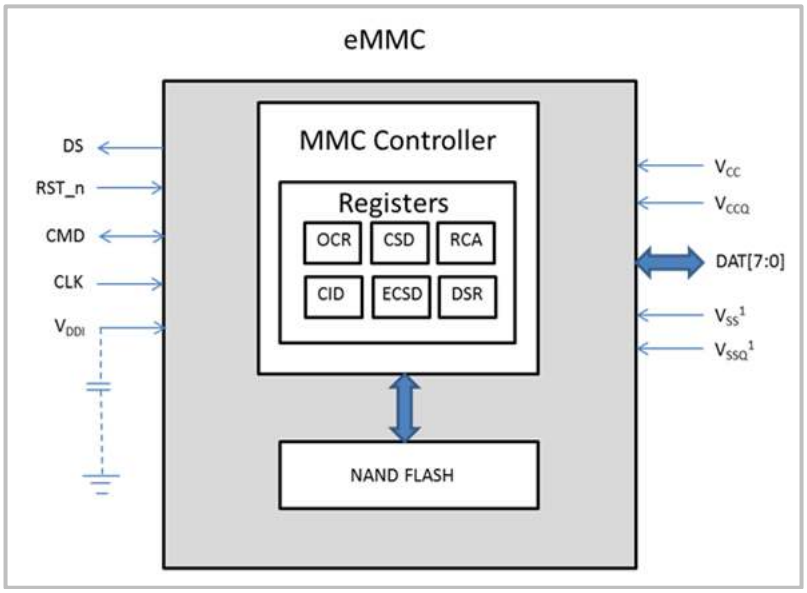
SMARTsemi's eMMC Product Family is an embedded Flash storage solution in a small BGA package designed specifically for the most demanding applications. SMARTsemi's eMMC products address the need for enhanced reliability by incorporating on-board error detection and correction, wear leveling algorithms, 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 (TLC Partition Burst Performance)

Capacity	HS400 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
8 GB	320	145	3700	6500
16 GB	320	145	3700	6500
32 GB	320	145	3700	6500
64 GB	320	145	3700	6500
128 GB	320	170	3700	6500

Capacity	HS200 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
8 GB	175	145	3000	5000
16 GB	175	145	3000	5000
32 GB	175	145	3000	5000
64 GB	175	145	3000	5000
128 GB	175	150	3000	5000

Capacity	DDR52 Performance			
	Seq. Read (MB/s)	Seq. Write (MB/s)	Random Read 4KB (IOPS)	Random Write 4KB (IOPS)
8 GB	90	80	2800	4500
16 GB	90	80	2800	4500
32 GB	90	80	2800	4500
64 GB	90	80	2800	4500
128 GB	90	80	2800	4500

Performance measured based on the CrystalDiskMark

ENDURANCE

Drive Lifetime[1]

Capacity	Value (Max)
8GB	25 TBW
16GB	25 TBW
32GB	25 TBW
64GB	50 TBW
128GB	100 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 = 55°C	102

Data Retention

Parameter	Value
Data Retention (@ 40°C)	10 years when 90% life remaining
	1 year when 10% life remaining

Operating and Storage Temperature[1]

Parameter	Value
Operating Temperature	Industrial grade: -40°C to +85°C Consumer grade : -25°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
		8GB (native)	16GB (native)	32GB (native)	64GB (native)	128GB (native)	
Write	DDR52	16/45	17/48	17/45	18/48	18/48	mA
	HS200	52/66	54/69	64/70	65/70	68/70	mA
	HS400	59/69	63/72	65/75	68/75	70/78	mA
Read	DDR52	13/63	14/65	14/67	15/68	25/70	mA
	HS200	22/68	24/71	24/72	24/72	32/75	mA
	HS400	25/73	25/76	25/77	30/77	35/77	mA
Sleep current		80	80	80	80	80	µA
Standby		28/80	28/80	28/80	28/80	28/80	µA

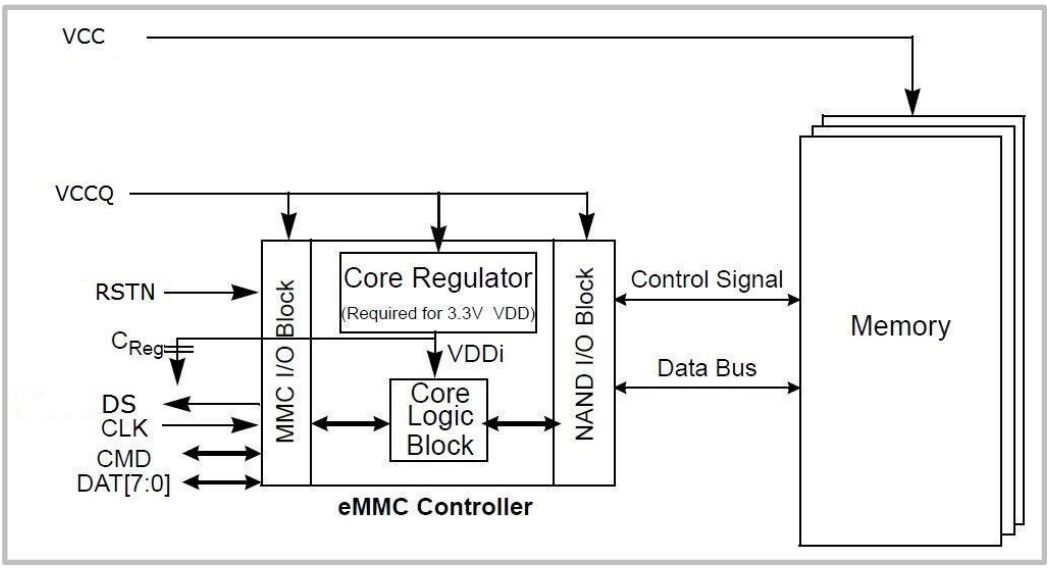
(1) Bus in x8 I/O mode; 25°C; V_{CCQ} = 1.95 V in HS200 and HS400 V_{CCQ} = 3.6V in DDR52. *The testing result is measured by TestMetrix VTE-4100.*

ELECTRICAL SPECIFICATION

The device current consumption for various device configurations is defined in the power class fields of the ECSD register.

V_{CC} is the supply voltage for controller and Flash memory power; V_{CCQ} is the supply voltage for controller and eMMC I/O voltage.

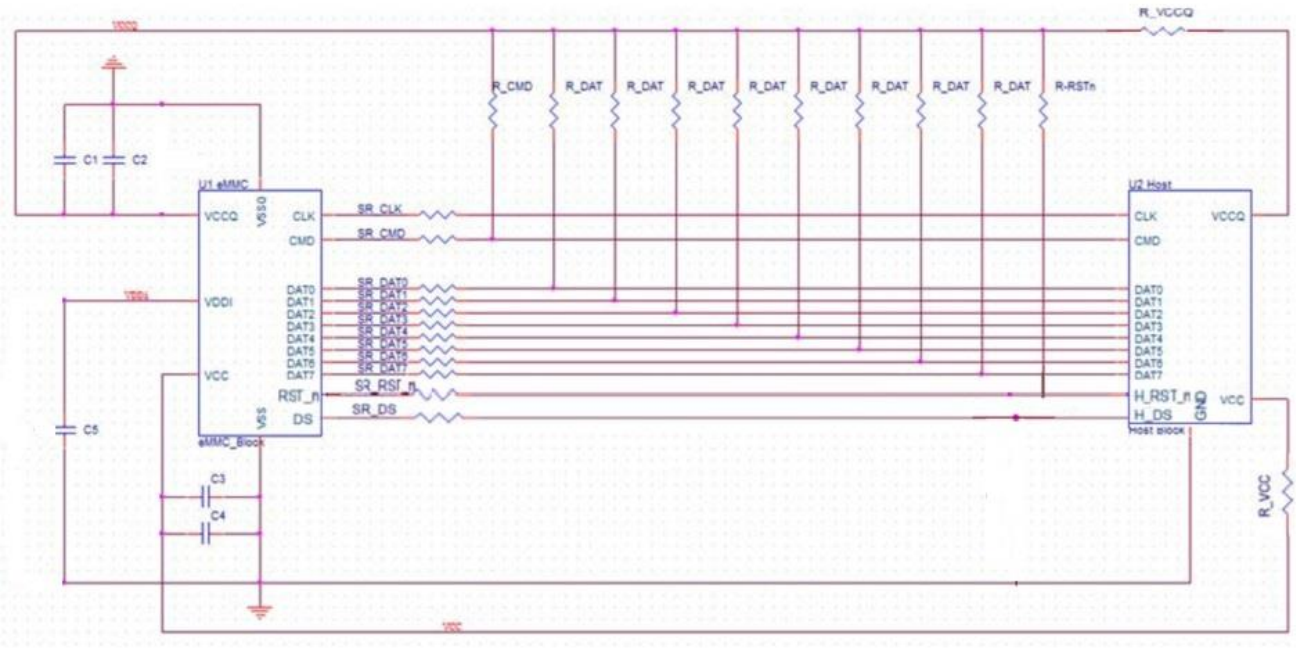
Power Connections



Power Requirements

Symbol	Parameter	Value (Minimum)	Value (Typical)	Value (Maximum)	Unit
V_{CC}	Voltage supply to Flash memory	2.7	3.3	3.6	V
V_{CCQ}	Voltage supply to host interface	2.7 (high range) 1.70 (low range)	3.3 (high range) 1.80 (low range)	3.6 (high range) 1.95 (low range)	V
V_{DDi}	Internal voltage regulator connection to external capacitor	-	-	-	-

Recommended eMMC Connection



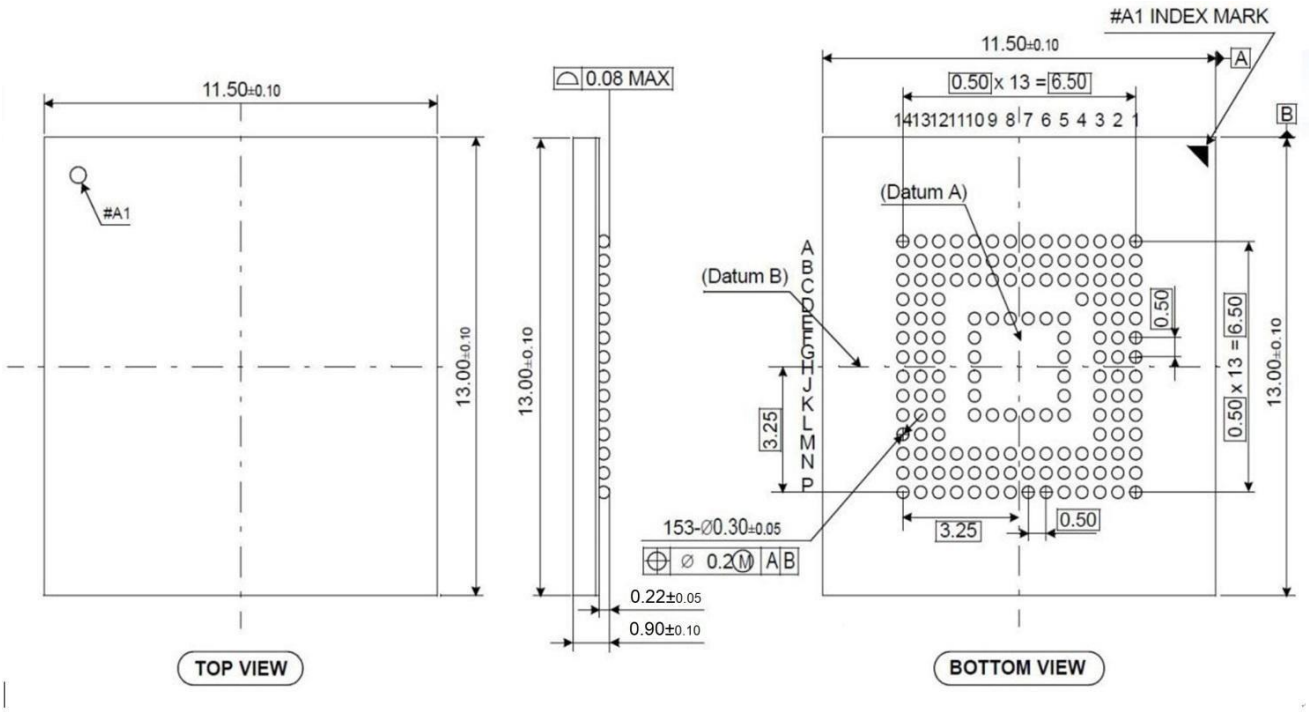
Capacitor and Resistor Specifications

Parameter1	Symbol	Min.	Max.	Recommended	Unit	Remark
Pull-up resistance for CMD	R_CMD	4.7	50	10	kΩ	To prevent bus from floating
Pull-up resistance for DAT0-7	R_DAT	10	50	10	kΩ	To prevent bus from floating
Pull-up resistance for RST_n	R_RST_n	4.7	50	10	kΩ	It's not necessary to put pull-up resistance on RST_n (H/W reset) line if host does not use H/W reset.
Serial resistance on CLK	SR_CLK	-	-	0	Ω	To put serial resistance except 0 ohm, check timing are all in Spec.
Serial resistance on power trace	R_VCC R_VCCQ	-	-	0	Ω	Typical size 0603 or 0805.
Serial resistance on CMD/DS/DAT0~7/RST_n	SR_CMD SR_DS SR_DAT0~7 SR_RST_n	-	-	0	Ω	To put serial resistance except 0 ohm, check timing are all in Spec.
VccQ capacitor value	C1	2.2	4.7	2.2	µF	Coupling capacitor should be connected with VccQ and VssQ as closely as possible.
	C2	0.1	0.22	0.1		
Vcc capacitor value	C3	2.2	4.7	2.2	µF	Coupling capacitor should be connected with Vcc and Vss as closely as possible.
	C4	0.1	0.22	0.1		
VDDi capacitor value	C5	1	4.7	1	µF	Coupling capacitor should be connected with VDDi and Vss as closely as possible.

[1] It doesn't matter to put Pull-up resistors and Serial 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 0.9 mm



Mechanical Dimensions

Parameter	Value
Length	13.00 mm
Width	11.50 mm
Height	0.90 mm

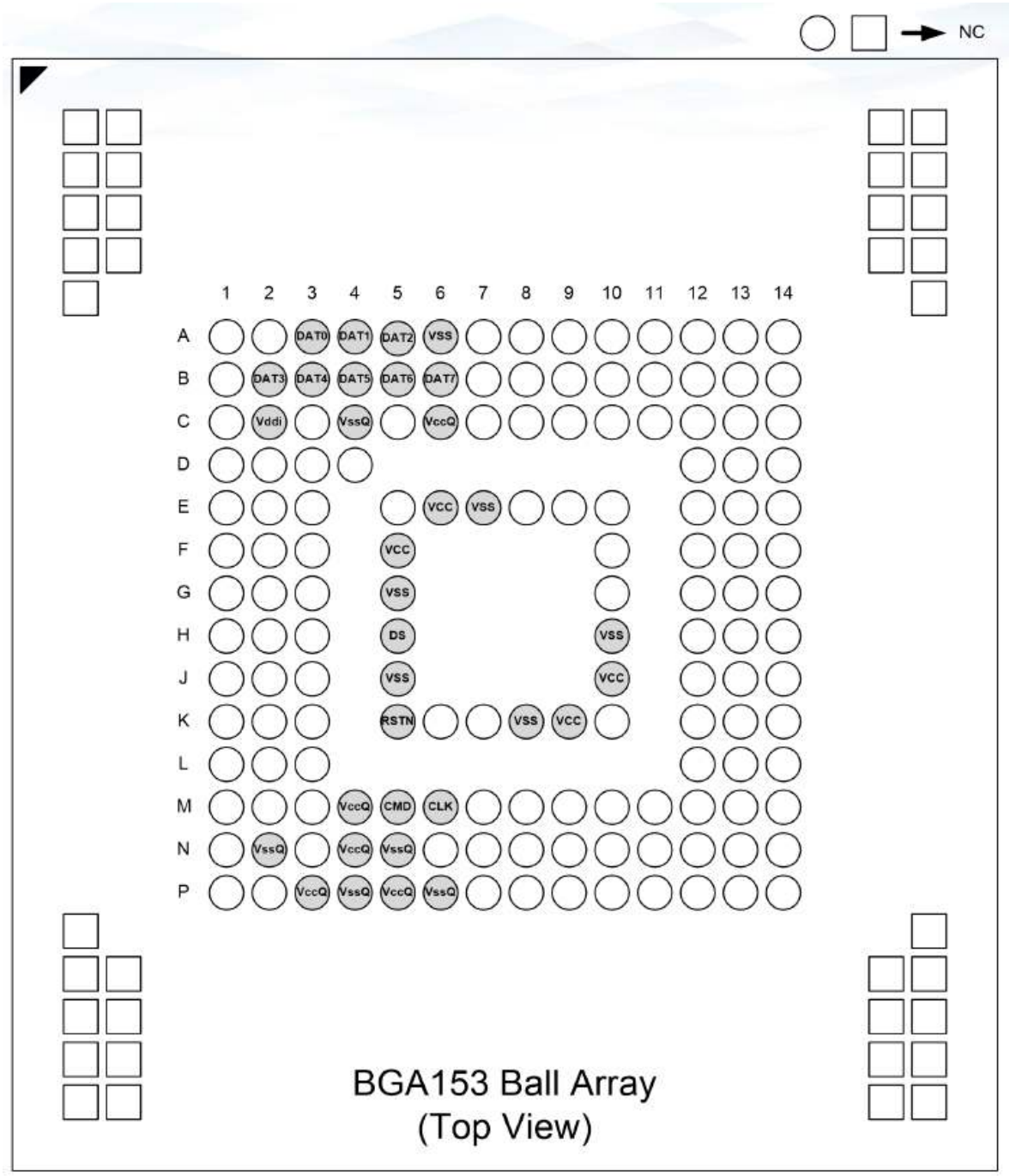
Recommended Reflow Profiles

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)*



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.

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]	F6h	
Card BGA	CBX	2	[113:112]	01h	
OEM/Application ID	OID	8	[111:104]	00h	
Product name	PNM(1)	48	[103:56]	8GB	8GY1AΔ
				16GB	AGY1AΔ
				32GB	BGY1AΔ
				64GB	CGY1AΔ
				128GB	DGY1AΔ
Product revision	PRV	8	[55:48]	10h	
Product serial number	PSN	32	[47:16]	--(2)	
Manufacturing date	MDT	8	[15:8]	--(3)	
Calculated CRC	CRC	7	[7:1]	--(3)	

1 The product name uses ASCII code and 'Δ' is a space (0x20).
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
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

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]	0x27	
Data read access time 2 in CLK cycles (NSAC x 100)	NSAC	8	[111:104]	0x01	
Maximum bus clock frequency	TRAN_SPEED	8	[103:96]	0x32	
Device command classes	CCC	12	[95:84]	0xF5	
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]	8GB 16GB 32GB 64GB	0xF
				128GB	0x1F
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	

Name	Field	Width (Bits)	CSD Bits	CSD Value
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]	0x1
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]	0x00
Not used; always 1	-	1	[0]	0x1

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]	0x00
Tag resources size	TAG_RES_SIZE	1	R	[497]	0x00
Context management capabilities	CONTEXT_CAPABILITIES	1	R	[496]	0x78
Large unit size	LARGE_UNIT_SIZE_M1	1	R	[495]	0x01
Extended partitions attribute support	EXT_SUPPORT	1	R	[494]	0x03
Supported Modes	SUPPORTED_MODES	1	R	[493]	0x01
FFU features	FFU_FEATURES	1	R	[492]	0x00
Operations code timeout	OPERATION_CODE_TIMEOUT	1	R	[491]	0x17

Name	Field		Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
FFU Argument	FFU_ARG		4	R	[490:487]	0xFFFAFFF0
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]	0x00
Device life time estimation type B	DEVICE_LIFE_TIME_EST_TYP_B		1	R	[269]	0x01
Device life time estimation type A	DEVICE_LIFE_TIME_EST_TYP_A		1	R	[268]	0x01
Pre EOL information	PRE_EOL_INFO		1	R	[267]	0x01
Optimal read size	OPTIMAL_READ_SIZE		1	R	[266]	0x40
Optimal write size	OPTIMAL_WRITE_SIZE		1	R	[265]	0x40
Optimal trim unit size	OPTIMAL_TRIM_UNIT_SIZE		1	R	[264]	0x07
Device Version	Device version	8GB 16GB 32GB	2	R	[263:262]	0x4205
		64GB				0x4305
		128GB				0x4405
Firmware version	FIRMWARE_VERSION		8	R	[261:254]	Variable (1)
Power class for200MHz, DDR at VCC=3.6V	PWR_CL_DDR_200_360		1	R	[253]	0x00
Cache size	CACHE_SIZE		4	R	[252:249]	0x400
Generic CMD6 timeout	GENERIC_CMD6_TIME		1	R	[248]	0x10
Power off notification (long) timeout	POWER_OFF_LONG_TIME		1	R	[247]	0x64
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]	0x0A
Reserved	--		1	--	[240]	0x01
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

Name	Field		Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
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]	0x00
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]	0x02
Secure feature support	SEC_FEATURE_SUPPORT		1	R	[231]	0x55
SECURE ERASE multiplier	SEC_ERASE_MULT	8GB 16GB 32GB 64GB	1	R	[230]	0x19
		128GB				0x32
SECURE TRIM multiplier	SEC_TRIM_MULT		1	R	[229]	0x0A
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]	0x06
High-capacity erase unit size	HC_ERASE_GRP_SIZE		1	R	[224]	0x01
High-capacity erase timeout	ERASE_TIMEOUT_ MULT		1	R	[223]	0x05
Reliable write-sector count	REL_WR_SEC_C		1	R	[222]	0x01
High-capacity write protect group size	HC_WP_GRP_SIZE	8GB 16GB 32GB 64GB	1	R	[221]	0x10
		128GB				0x20
Sleep current (V_{CC})	S_C_VCC		1	R	[220]	0x07
Sleep current (V_{CCQ})	S_C_VCCQ		1	R	[219]	0x07
Production state awareness timeout	PRODUCTION_STATE_AWARENE SS_TIMEOUT		1	R	[218]	0x17
Sleep/awake timeout	S_A_TIMEOUT		1	R	[217]	0x12
Sleep Notification Timeout	SLEEP_NOTIFICATION_TIME		1	R	[216]	0x0C
Sector count	SEC-COUNT	8GB	4	R	[215:212]	0xE8C000
		16GB				0x1D1C000
		32GB				0x3A3C000

Name	Field		Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
		64GB				0x7478000
		128GB				0xE8F0000
Reserved	--		1	--	[211]	0x01
Minimum write performance for 8-bit at 52 MHz	MIN_PERF_W_8_52		1	R	[210]	0x00
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]	0x00
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]	0x00
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]	0x0A
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
Command set	CMD_SET		1	R/W/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	R/W/E_P	[187]	0x00
Reserved	--		1	--	[186]	--

Name	Field	Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
High-speed interface timing	HS_TIMING	1	R/W/E_P	[185]	0x00
Reserved	--	1	--	[184]	0x01
Bus width mode	BUS_WIDTH	1	W/E_P	[183]	0x00
Reserved	--	1	--	[182]	--
Erased memory content	ERASED_MEM_CONT	1	R	[181]	0x00
Reserved	--	1	--	[180]	--
Partition configuration	PARTITION_CONFIG	1	R/W/E, R/W/E_P	[179]	0x00
Boot config protection	BOOT_CONFIG_PROT	1	R/W, R/W/C_P	[178]	0x00
Boot bus Conditions	BOOT_BUS_CONDITIONS	1	R/W/E	[177]	0x00
Reserved	--	1	--	[176]	--
High-density erase group definition	ERASE_GROUP_DEF	1	R/W/E_P	[175]	0x00
Boot write protection status registers	BOOT_WP_STATUS	1	R	[174]	0x00
Boot area write protection register	BOOT_WP	1	R/W, R/W/C_P	[173]	0x00
Reserved	--	1	-	[172]	--
User write protection register	USER_WP	1	R/W, R/W/C_P, R/W/E_P	[171]	0x00
Reserved	--	1	--	[170]	--
Firmware configuration	FW_CONFIG	1	R/W	[169]	0x00
RPMB size	RPMB_SIZE_MULT	1	R	[168]	0x20
Write reliability setting register	WR_REL_SET	1	R/W	[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
Enable background operations handshake	BKOPS_EN	1	R/W	[163]	0x00
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,	[160]	0x07

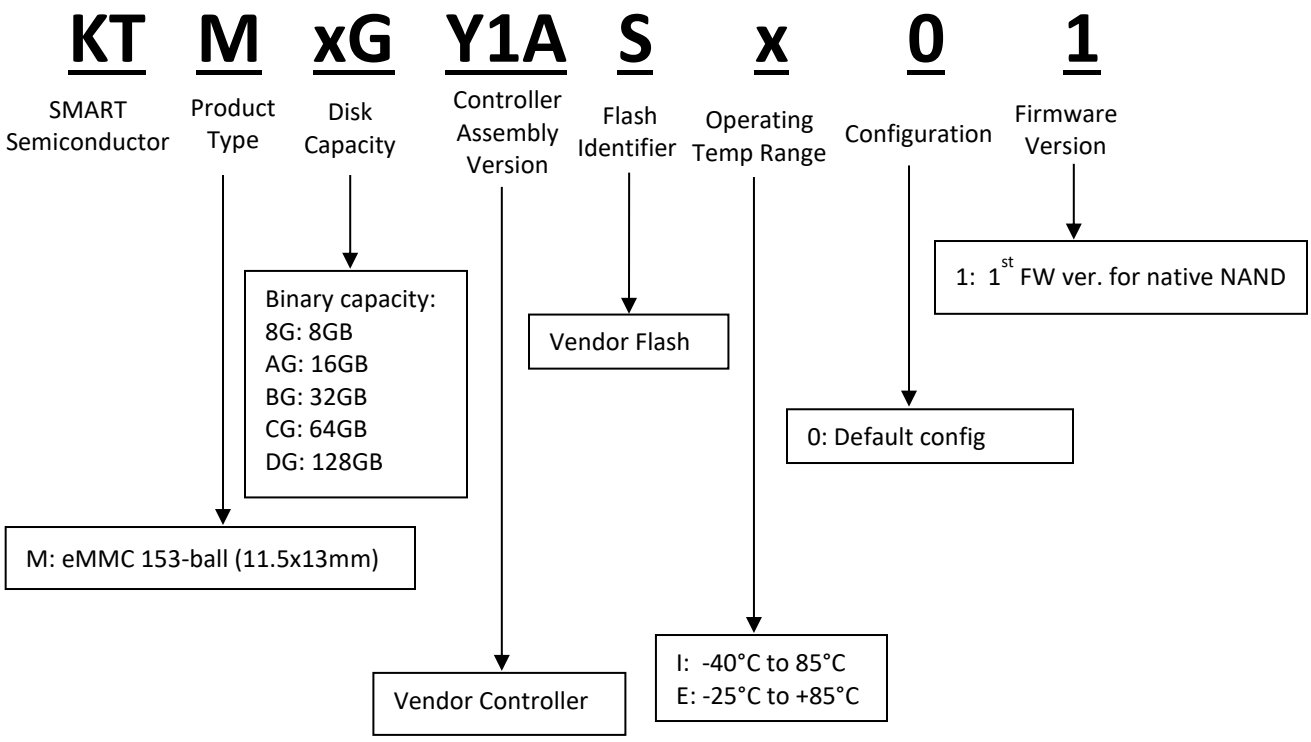
Name	Field		Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
				R/W/E_P		
Maximum enhanced area size	MAX_ENH_SIZE_MULT	8GB	3	R	[159:157]	0x136
		16GB				0x26D
		32GB				0x4DA
		64GB				0x9B4
		128GB				0x9B4
Partitions attribute	PARTITIONS_ATTRIBUTE	8GB/16GB 32GB/64GB 128GB	1	R/W	[156]	0x00
Partitioning setting	PARTITIONING_SETTING-COMPLETED	8GB/16GB 32GB/64GB 128GB	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	8GB/16GB 32GB/64GB 128GB	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]	0x01
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]	0x0A
Class 6 command control	CLASS_6_CTRL		1	R/W/E_P	[59]	0x00

Name	Field		Size (Bytes)	Cell Type(1)	ECSD Bytes	ECSD Values
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
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	8GB 16GB 32GB	4	R	[21:18]	0x1335555
		64GB				0x266AAAA
		128GB				0x4DAAAAA
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]	0x3B
Reserved	-		16	-	[15:0]	--

PART NUMBERS

Part Number	Operating temperature	Capacity
KTM8GY1ASI01	-40°C to +85°C	8GB
KTMAGY1ASI01		16GB
KTMBGY1ASI01		32GB
KTMCGY1ASI01		64GB
KTMDGY1ASI01		128GB
KTMAGY1ASE01	-25°C to +85°C	16GB
KTMBGY1ASE01		32GB
KTMCGY1ASE01		64GB
KTMDGY1ASE01		128GB

PART NUMBER DECODER



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