

White List

# MicroSD Cards



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## Why This Document?

MicroSD cards are available in many different quality levels. When recording video data, the most important criteria are the **write speed** (speed class) and the life expectancy of the storage cells that is directly dependent on the **type of storage cell** used. Depending on the requirements regarding the availability and the security of the recorded video data, you can use MicroSD cards with different types of storage cells:

Reliability

- **SLC (“Single-Level Cell”)**: One SLC cell stores **two** states (= 1 bit). As a result, these cells are suitable for the highest requirements regarding life expectancy and data throughput.
- **aMLC (“Advanced Multi-Level Cell”)**: Variant of the MLC type that is suitable for very high requirements regarding life expectancy and data throughput.
- **pSLC (“Pseudo Single-Level Cell”)**: Variant of the MLC type for similar requirements and temperature ranges with considerably higher life expectancy and data throughput than MLC cells.
- **MLC (“Multi-Level Cell”)**: One MLC cell stores **several** states ( $\geq 2$  bits). SD cards of this type are geared towards recording many events per day with low security requirements; the temperature range is the same as for the MOBOTIX outdoor cameras.
- **TLC (“Triple-Level Cell”)**: Variant of the MLC type that is suitable for recording only a few events per day without security requirements and with restrictions regarding the temperature range.

## General Notes

- All listed MicroSD cards have been tested in MOBOTIX P3 cameras with PXA 320 processor. You can also use the cards in MOBOTIX Mx6 cameras, which can achieve considerably higher throughput rates and shorter formatting times (due to increased processor performance). All statements regarding quality, write cycles/life expectancy and the recommended usage scenarios are applicable to both P3 and Mx6 cameras.
- Since the cameras are using the MxFFS storage method, the maximum size of SD cards is virtually unlimited.

- Since the MicroSD card market and the technical progress are developing very rapidly, the measurement results in this document cannot always reflect the current state of the technology. The measurements are thus intended to be used for making a good decision when purchasing SD cards.
- Besides the data listed in this document, MOBOTIX cannot provide any further information regarding the reliability and life expectancy of the storage cards. Please contact the card manufacturer directly if you need more detailed information.
- MOBOTIX will not be liable for the serviceability of the storage media used in its cameras.
- **Beware of “fake products”!** Make sure that you obtain MicroSD cards only from reliable sources. So-called “fake products” deliver only a fraction of the specified write cycles!

## More Information

If you want to use different frame rates, image sizes or JPEG quality settings than the **typical image settings** in the tables, we recommend that you consult the **Storage Requirements Planner** on the MOBOTIX website [www.mobotix.com](http://www.mobotix.com) under **Support > Tools > Storage Requirements Planner**.

## Overview

Storage Cell Type	Current Maximum Size <sup>1)</sup>	Security Requirements	Write Cycles/ Storage cell	Measurement Results
SLC	8 GB	Extremely high	100,000	
aMLC	64 GB	High	40,000	
pSLC	64 GB	High	10,000 – 20,000	
MLC/3D NAND TLC	256 GB	Low	700 – 1,500	
TLC <sup>2)</sup>	400 GB	None	100	

<sup>1)</sup> Date: 04/2019

<sup>2)</sup> MOBOTIX generally recommends not to use any TLC cards in MOBOTIX cameras.

# SLC/aMLC/pSLC Cards

SLC/aMLC/pSLC Cards								MxFFS Formatting Time <sup>1)</sup>	
Storage Size (GB)	Manufacturer	Order Number	Source	Card Type	Speed Class	Storage Cell Type	Throughput on MxFFS Storage (kB/s)	Quick Formatting (hh:mm:ss)	Secure Formatting [hh:mm:ss]
2	swissbit	SFSD2048N1BW1MT-I-ME-111-STD	www.swissbit.com	SDHC	6	SLC	7,667	00:01:06	00:05:38
4	swissbit	SFSD4096N1BW1MT-I-DF-111-STD	www.swissbit.com	SDHC	10	SLC	7,339	00:07:04	00:11:34
4	Phison	4GB-pSLC-PS8210	www.mouser.com	SDHC	10	pSLC <sup>3)</sup>	8,736	00:00:43	00:12:07
8	ATP	AF8GUD3A-OEM	www.digikey.de	SDHC	10	aMLC	5,429	—	—
8	swissbit	SFSD8192N1BW1MT-I-QG-111-STD	www.swissbit.com	SDHC	10	SLC	6,498	00:13:53	00:23:11
32	Panasonic	RP-SMPT32DA1	www.digikey.de	SDHC	UHS-I U1 <sup>2)</sup>	pSLC	5,944	00:07:28	01:35:02
64	ATP	AF64GUD3A-WAAXM	www.storesys.de	SDHC	10	aMLC	4,047	00:12:42	04:03:13

MicroSD cards can also be used in D22M, M12D, D12D, Q22M cameras with an adapter (speed may be different)

<sup>1)</sup> Internet Explorer/Firefox with Windows 7 64 Bit

<sup>2)</sup> UHS classification (*Ultra-High Speed*)

<sup>3)</sup> MOBOTIX MicroSD card as of 09/2018 and with camera software MX-V5.2.x and higher (Flash Wear is adjusted accordingly)

## Assumptions

- 100,000 write cycles for SLC cards
- 40,000 write cycles for aMLC cards
- 20,000 write cycles for MOBOTIX pSLC cards
- 10,000 write cycles for pSLC cards
- 1 GB = 1,000,000,000 bytes = 10<sup>9</sup> bytes
- MicroSD card is to be used for ten years.

## Maximum Throughput Rates and Typical Image Settings

Given an SD card lifespan of 10 years and the assumed number of write cycles, you should make sure not to exceed the following **throughput rates**:

Card Size (GB)	Storage Cell Type	Data (MB/Day)	Throughput Rate (Mbps)	Recording Type	Image Size	Codec	Frame Rate (fps)	JPEG Quality (%)
8	SLC	219,178	<b>20.29</b>	Continuous rec.	3840x1280	MxPEG	19	90
8	aMLC	87,671	<b>8.11</b>	Continuous rec.	3072x2048	MxPEG	14	80
4	MOBOTIX pSLC	21,917	<b>2.03</b>	Continuous rec.	1280x960	MxPEG	10	60
32	pSLC	87,671	<b>8.11</b>	Continuous rec.	1920x1280	MxPEG	14	80

## Hints for Usage

- Max. data security
- Very high data throughput
- Very many events per day/large image formats at high frame rates
- Same temperature range as for MOBOTIX cameras

## Typical Applications

- Buffer when archiving on NAS/file servers
- Extreme throughput rates when recording on MicroSD card with or without additional MxFFS archiving
- Extreme data security requirements when recording on MicroSD card with or without additional MxFFS archiving

## MLC/3D NAND TLC Cards

MLC/3D NAND TLC Cards								MxFFS Formatting Time <sup>1)</sup>	
Storage Size (GB)	Manufacturer	Order Number	Source	Card Type	Speed Class	Storage Cell Type	Throughput on MxFFS Storage (kB/s)	Quick Formatting (hh:mm:ss)	Secure Formatting [hh:mm:ss]
4	Transcend	—	MOBOTIX	SDHC	10	MLC	4,602	00:02:37	00:14:29
16	ATP	AF16GUD	www.glyn.de	SDHC	10	MLC	5,295	00:17:45	00:57:07
16	Transcend	—	www.rutronik.com	SDHC	10	MLC	3,157	00:04:07	00:45:48
32	ATP	AF32GUD	www.glyn.de	SDHC	10	MLC	6,776	00:15:50	02:17:14
32	Micron	MTSD032AHC6MS-1WT	e.g. www.mouser.de, www.avnet.com	microSD	UHS-1	3D NAND TLC	6,065	00:00:47	01:18:02
32	Transcend	—	www.rutronik.com	SDHC	10	MLC	4,055	00:16:01	01:32:43
32	Western Digital (WD)	WDD032G1P0A	Electronics supply	SDHC	UHS-I U1 <sup>2)</sup>	3D NAND TLC	4,887	00:01:07	00:54:06
64	Micron	MTSD064AHC6MS-1WT	e.g. www.mouser.de, www.avnet.com	microSD	UHS-3	3D NAND TLC	5,702	00:01:15	02:38:06
64	Panasonic	RP-SMTE64DA1	www.digikey.de	SDHC	UHS-I U1 <sup>2)</sup>	MLC	4,111	00:35:41	04:21:02
64	SanDisk	SDSDQQ-064G-G46A	Electronics supply	SDXC	10	MLC <sup>3)</sup>	5,730	00:07:59	03:14:36
64	Sony	—	—	SDXC	10	MLC	5,261	00:20:00	03:29:53
64	Transcend	TS64GUSDU3	Electronics supply	SDXC	UHS-I U3 <sup>2)</sup>	MLC	4,955	00:21:30	03:45:08
64	Western Digital (WD)	WDD064G1P0A	Electronics supply	SDXC	UHS-I U1 <sup>2)</sup>	3D NAND TLC	4,900	00:01:57	01:49:34
128	Micron	MTSD128AHC6MS-1WT	e.g. www.mouser.de, www.avnet.com	microSD	UHS-3	3D NAND TLC	5,626	00:02:15	05:29:54
128	Sony	—	—	SDXC	10	MLC	5,169	00:44:29	07:16:02
128	Transcend	TS128GUSDU3M	www.storesys.de	SDXC	UHS-I U3 <sup>2)</sup>	MLC	3,681	00:45:11	11:19:45
128	Western Digital (WD)	WDD1258G1P0A	Electronics supply	microSD	UHS-3	3D NAND TLC	5,943	00:02:55	05:27:18
256	Micron	MTSD256AHC6MS-1WT	e.g. www.mouser.de, www.avnet.com	microSD	UHS-3	3D NAND TLC	5,722	00:04:14	10:59:37
256	Western Digital (WD)	WDD256G1P0A	Electronics supply	microSD	UHS-3	3D NAND TLC	5,854	00:05:34	10:56:53

MicroSD cards can also be used in D22M, M12D, D12D, Q22M cameras with an adapter (speed may be different)

<sup>1)</sup> Internet Explorer/Firefox with Windows 7 64 Bit

<sup>2)</sup> UHS classification (*Ultra-High Speed*)

<sup>3)</sup> Probably MLC, unconfirmed

**3D NAND technology** is a revolutionary enhancement to TLC-based memory components, lifting the application to the industrial sector. Recent enhancements to Flash architectures, including 3D NAND, and the ongoing development of techniques for data placement and error correction have given the technology a place in read-intensive enterprise memory applications.

**3D NAND flash** are non-volatile memories with sequential access, in which the planar memory cells are stacked vertically on top of each other. These NANDs are also called V-NANDs or 3D-V-NANDs (V = vertically stacked).

## MLC/3D NAND TLC Cards (Continued)

### Assumptions

- 1,500 write cycles for MLC cards
- 700 to 1,000 write cycles for 3D NAND TLC cards
- 1 GB = 1,000,000,000 bytes =  $10^9$  bytes
- MicroSD card is to be used for ten years.

### Maximum Throughput Rates and Typical Image Settings

Given an SD card lifespan of 10 years and the assumed number of write cycles, you should make sure not to exceed the following **throughput rates**:

Card Size (GB)	Storage Cell Type	Data (MB/Day)	Throughput Rate (Mbps)	Recording Type	Image Size	Codec	Frame Rate (fps)	JPEG Quality (%)
32	MLC	13,150	<b>1.22</b>	Continuous rec.	1024x768	MxPEG	6	60
64	MLC	26,300	<b>2.44</b>	Continuous rec.	Full HD	MxPEG	10	60
256	MLC	50,500	<b>4.68</b>	Continuous rec.	Full HD	MxPEG	18	60

### Hints for Usage

- Medium to high data throughput
- Many events per day
- Same temperature range as for MOBOTIX cameras

### Typical Applications

- Buffer when archiving on NAS/file servers
- High throughput rates when recording on MicroSD card with or without additional MxFFS archiving

## TLC Cards (Not Recommended for Use in MOBOTIX Cameras)

TLC Cards (Not Recommended for Use in MOBOTIX Cameras)								MxFFS Formatting Time <sup>1)</sup>	
Storage Size (GB)	Manufacturer	Order Number	Source	Card Type	Speed Class	Storage Cell Type	Throughput on MxFFS Storage (kB/s)	Quick Formatting (hh:mm:ss)	Secure Formatting [hh:mm:ss]
64	SanDisk	SDSQUNC-064G	Electronics supply	SDXC	10	TLC	4,195	00:01:51	04:46:30
128	Transcend	TS128GUSDU1	Electronics supply	SDXC	UHS-I U1 <sup>2)</sup>	TLC	5,376	01:58:03	08:04:12
128	SanDisk	SDSDQUAN-128G-G4A – 128GB	Electronics supply	SDXC	10	TLC	6,180	00:39:30	08:00:12
200	SanDisk	SDSDQUAN-200G-G4A – 200GB	Electronics supply	SDXC	UHS-I U1 <sup>2)</sup>	TLC	5,096	00:39:30	—
256	SanDisk	SDSQAM-256G-GN6MA	Electronics supply	SDXC	10	TLC	5,020	00:05:15	11:48:30
256	Samsung	MB-MC256GA/EU	Electronics supply	SDXC	UHS-I U3 <sup>2)</sup>	TLC	4,420	00:06:23	15:04:04
400	SanDisk	SDSQAR-400G-GN6MA	Electronics supply	SDXC	UHS-I U1 <sup>2)</sup>	TLC	4,258	00:07:47	18:54:19

MicroSD cards can also be used in D22M, M12D, D12D, Q22M cameras with an adapter (speed may be different)

<sup>1)</sup> Internet Explorer/Firefox with Windows 7 64 Bit

<sup>2)</sup> UHS classification (*Ultra-High Speed*)

### Assumptions

- 100 write cycles for TLC cards
- 1 GB = 1,000,000,000 bytes = 10<sup>9</sup> bytes
- MicroSD card is to be used for ten years.

### Maximum Throughput Rates and Typical Image Settings

Given an SD card lifespan of 10 years and the assumed number of write cycles, you should make sure not to exceed the following **throughput rates**:

Card Size (GB)	Storage Cell Type	Data (MB/Day)	Throughput Rate (Mbps)	Recording Type	Image Size	Codec	Frame Rate (fps)	JPEG Quality (%)
32	TLC	876	<b>0.08</b>	Continuous rec.	640x480	MxPEG	1	60

### Hints for Usage

- **MOBOTIX generally recommends not to use any TLC cards in MOBOTIX cameras.**
- Low / safe formatting required (even several times) → bad sectors are flagged and won't be used any more
- No data security
- Very low data throughput
- Few events per day
- No extreme temperatures

### Typical Applications

- Camera primarily not used for making recordings
- Recording with very low data throughput
- Not to be used in security applications
- Indoor applications

## Adjusting the MAXIMUM\_BLOCK\_SWEEPS Value on the Camera

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### Adjusting the MAXIMUM\_BLOCK\_SWEEPS Value on the Camera

#### What does this value do?

The **MAXIMUM\_BLOCK\_SWEEPS** value refers to the number of **write cycles per flash cell** (i.e., the endurance) of an SD card that is different for every storage cell type, i.e., 100 for TLC cards, 1.500 for MLC, etc. A value of 1,500 basically means that every Flash cell can be written about 1,500 times before its reliability decreases.

The camera automatically monitors the reliability of its SD card as **Flash wear** and by default uses a value of 2,000 (for MOBOTIX pSLC cards, the camera will automatically increase this value to 20,000).

#### What should you do?

If the SD card you are using is specified for a number of write cycles that is higher or lower than 2,000, you should adjust this value on the camera as outlined in the corresponding article on the MOBOTIX Community website.

Please see the MOBOTIX Community website and search for “MAXIMUM\_BLOCK\_SWEEPS”, then proceed as outlined in the article.

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