

Replacing Serial EEPROMs with User Flash Memory in Altera MAX Series

2014.09.22

AN-631



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MAX[®] II, MAX V, and MAX 10 devices have a user flash memory (UFM) block. You can use the UFM block to replace on-board flash and EEPROM memory devices to store ASSP or processor configuration bits, or electronic identification (ID) information for a board during manufacturing. The logic capacity of MAX II, MAX V, and MAX 10 devices allows integration of system power-on reset (POR), interface bridging, and I/O expansion designs in addition to these serial flash capabilities.

UFM Array Size

Table 1: UFM Array Size for MAX II and MAX V Devices

This table lists the capacity for the UFM block for all MAX II and MAX V devices.

Device Family	Device	Total Bits	Sectors
MAX II Devices	EPM240	8,192	2 (4,096 bits per sector)
	EPM570	8,192	2 (4,096 bits per sector)
	EPM1270	8,192	2 (4,096 bits per sector)
	EPM2210	8,192	2 (4,096 bits per sector)
MAX V Devices	5M40Z	8,192	2 (4,096 bits per sector)
	5M80Z	8,192	2 (4,096 bits per sector)
	5M160Z	8,192	2 (4,096 bits per sector)
	5M240Z	8,192	2 (4,096 bits per sector)
	5M570Z	8,192	2 (4,096 bits per sector)
	5M1270Z	8,192	2 (4,096 bits per sector)
	5M2210Z	8,192	2 (4,096 bits per sector)

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Table 2: UFM and CFM Array Size for MAX 10 Devices

This table lists the dimensions of the UFM and CFM arrays for MAX 10 devices. The Altera On-Chip Flash IP core also gives you access to configuration flash memory (CFM) when you turn on the dual image configuration mode option.

Device	Page Size (Kb)	Pages per Sector (UFM1)	Pages per Sector (UFM0)	Pages per Sector (CFM2)	Pages per Sector (CFM1)	Pages per Sector (CFM0)	Total Size (Kb)
10M02	16	3	3	0	0	34	640
10M04	16	0	8	41	29	70	2488
10M08	16	8	8	41	29	70	2496
10M16	32	4	4	38	28	66	4480
10M25	32	4	4	52	40	92	6144
10M40	64	4	4	48	36	84	11264
10M50	64	4	4	48	36	84	11264

Design Considerations

To successfully replace the serial EEPROMs with the UFM blocks of the supported Altera devices, you must consider the following:

- Logic array interface
- Erase and reprogram sequence
- Size and operating conditions

Logic Array Interface

You can program, erase, and verify the UFM block through the JTAG port or through connections to and from the logic array in accordance with the following IEEE standards:

- IEEE Std. 1532-2002 for MAX II and MAX V devices
- IEEE Std. 1149.1 for MAX 10 devices

There are 13 interface signals to and from the UFM block and the logic array that allow the logic array to read from or write to the UFM during device user mode for MAX II and MAX V devices only.

Table 3: Supported IP Cores

IP Core (Protocol)	Interface	MAX II	MAX V	MAX 10
Altera User Flash Memory for I2C Interface Protocol ⁽¹⁾	Serial	Supported	Supported	Not supported

⁽¹⁾ Beginning from the Quartus II software version 14.0, the name of this IP core has been changed from ALTUFM_I2C to the Altera User Flash Memory for I2C Interface Protocol IP core.

IP Core (Protocol)	Interface	MAX II	MAX V	MAX 10
Altera User Flash Memory for SPI Interface Protocol ⁽²⁾	Serial	Supported	Supported	Not supported
Altera User Flash Memory for Parallel Interface Protocol ⁽³⁾	Parallel	Supported	Supported	Not supported
ALTUFM_NONE	Serial	Supported	Supported	Not supported
Altera On-Chip Flash	Parallel/Serial	Not supported	Not supported	Supported

For MAX II and MAX V devices, the Altera User Flash Memory for I²C Interface Protocol, Altera User Flash Memory for SPI Interface Protocol, Altera User Flash Memory for Parallel Interface Protocol and ALTUFM_NONE IP cores provide interface logic for a subset of these interfaces. For interfaces not provided by the IP core or design examples, you must create user logic to bridge the UFM block to your desired interface protocol.

The Altera On-Chip Flash IP core provides Avalon-MM interface. Use the SPI or I²C interface protocol to avalon MM interface logic to communicate with the UFM.

Related Information

- [Using User Flash Memory in MAX II Devices](#)
Provides information about programming and erasing the UFM block and the ALTUFM and Altera On-Chip Flash IP cores for MAX II devices
- [User Flash Memory in MAX V Devices](#)
Provides information about programming and erasing the UFM block and the ALTUFM and Altera On-Chip Flash IP cores for MAX V devices
- [User Flash Memory in MAX 10 Devices](#)
Provides information about programming and erasing the UFM block and the ALTUFM and Altera On-Chip Flash IP cores for MAX 10 devices

Erase and Reprogram Sequence

The differences between the UFM block and serial EEPROMs that you should consider in your integration of serial EEPROM applications are the sector-based erase and erase/reprogram cycles. Serial EEPROMs support byte-wide erase, which is automatically implemented during a byte write sequence. The UFM block supports byte writes, but does not support byte erase, requiring a sector-based erase sequence prior to any programming or writing. If the data content of a specific byte location needs to be overwritten in the UFM, the entire sector that the byte resides in must be erased unless the byte location was already erased (all 1s). For programming endurance, the UFM erase/reprogram cycles do not meet the 107 and greater cycles seen in serial EEPROMs.

⁽²⁾ Beginning from the Quartus II software version 14.0, the name of this IP core has been changed from ALTUFM_SPI to the Altera User Flash Memory for SPI Interface Protocol IP core.

⁽³⁾ Beginning from the Quartus II software version 14.0, the name of this IP core has been changed from ALTUFM_PARALLEL to the Altera User Flash Memory for Parallel Interface Protocol IP core.

Related Information

- [DC and Switching Characteristics for MAX II Devices](#)
Provides MAX II devices UFM block erase/programming endurance specifications
- [DC and Switching Characteristics for MAX V Devices](#)
Provides MAX V devices UFM block erase/programming endurance specifications
- [DC and Switching Characteristics for MAX 10 Devices](#)
Provides MAX 10 devices UFM block erase/programming endurance specifications

Size and Operating Conditions

The memory size that can be replaced using the UFM must not exceed the devices UFM size. The operating conditions for the on-board flash and EEPROM memory devices you intend to replace must be within the range of the Altera devices.

This list provides a non-exhaustive list of vendors for 2-Kbit, 4-Kbit, and 8-Kbit non-volatile memory devices that could be potentially replaced by the UFM blocks of supported Altera devices.

- Asahi Kasei Microsystems Corp.
- NXP Semiconductors
- Atmel Corp.
- ON Semiconductor
- Maxim Integrated Products
- Holtek Semiconductor Inc.
- Microchip Technology Inc.
- Rohm Co., Ltd.
- Seiko Instruments Inc.
- STMicroelectronics
- Renesas Electronics Corporation

Related Information

- [Asahi Kasei Microsystems EEPROM Device Characteristics](#)
Provides product information for Asahi Kesai Microdevices EEPROM
- [NXP Semiconductors I2C Serial EEPROM/RAM Selection Guide](#)
Provides product information for NXP Semiconductors I2C Serial EEPROM/RAM
- [Atmel Corporation Serial EEPROM Product Page](#)
Provides product information for Atmel Corporation Serial EEPROM
- [Holtek EEPROM List](#)
Provides product information for Holtel Semiconductor EEPROM
- [ROHM Semiconductor Serial EEPROM List](#)
Provides product information for ROHM Semiconductor Serial EEPROM
- [STMicroelectronics Serial EEPROM Portfolio](#)
Provides product information for STMicroelectronics Serial EEPROM
- [ON Semiconductor Memory Products](#)
Provides product information for ON Semiconductor Serial EEPROM
- [Maxim Integrated Product List](#)
Provides product information for Maxim Integrated EEPROM list

- **Microchip Serial EEPROM List**
Provides product information for Microchip Technology EEPROM
- **Seiko Instruments General use Serial EEPROM**
Provides product information for Seiko Instruments general use Serial EEPROM
- **Seiko Instruments Automotive use Serial EEPROM**
Provides product information for Seiko Instruments automotive use serial EEPROM
- **Renesas Electronics EEPROM List**
Provides product information for Renesas Electronics EEPROM

Document Revision History

Date	Version	Changes
September 2014	2014.09.22	Added MAX 10 devices information
December 2010	1.0	Initial release.