Design - In With SST's MPF (39SFxxx) Products

Application Note
March 1999

1.0 Introduction

This application note introduces the SST39SFxxx – SST's new Multi-Purpose Flash (MPF) product line. It describes how to convert applications based on AMD's Am29Fxxx series and Atmel's At49Fxxx series to SST's SST39SFxxx series. It discusses the differences between the SST39SFxxx series and SST's existing SST29EExxx series. This application note covers the 5V versions of 2M, 1M and 512K densities.

2.0 Comparisons with the AMD Am29F series

In the Am29F series, AMD has a 1M device – the Am29F010 and a 2M device – the Am29F002(N). AMD does not offer any 512K device in Am29F family.

2.1 Hardware comparisons

Both AMD devices – the Am29F010 and the Am29F002N – are offered in 32-pin PLCC, PDIP and TSOP (8mm x 20mm) packages.

- 1M Pinout Comparison

The SST39SF010 is fully pin compatible with the Am29F010 in PLCC and PDIP packages. In case of TSOP packages, AMD has an 8mm x 20mm package, as opposed to SST's 8mm x 14mm package. As mentioned in Section 3.1, the system design which uses an 8mm x 20mm package can use an 8mm x14mm package if a longer trace is used.

- 2M Pinout Comparison

In case of the 2M devices, AMD offers two products – the Am29F002 and Am29F002N. The Am29F002 has a RESET# pin, which is a no-connect on the Am29F002N. Both products are offered in 32-pin PDIP, PLCC and TSOP (8mm x 20mm). The SST39SF020 is fully pin compatible with the Am29F002N in PLCC and PDIP packages. In the case of the Am29F002, the only difference between this device and the SST39SF020 is the RESET# pin. The purpose of RESET# on the Am29F002 is to terminate any operation in progress because of long erase times and resetting the internal state machine to reading array data. This pin is a no-connect on the SST39SF020. The absence of this signal on the SST device does not affect the normal operation of the SST device. As a result, the SST39SF020 can be used in an Am29F002/002N design without any modifications in board layout for PLCC and PDIP designs.

In case of TSOP packages for the Am29F002/002N, AMD has an 8mm x 20mm package, as opposed to SST's 8mm x 14mm package. As mentioned in Section 3.1, the system design which uses an 8mm x 20mm package can use an 8mm x 14mm package if a longer trace is used.

2.2 Software comparisons

The SST39SFxxx and Am29Fxxx devices use the same command set for Byte-Program, Chip-Erase, Read-ID and Reset operation as described in the table below.

Command sequence	SST39SFxxx	Am29Fxxx
Byte-Program	4-Byte sequence	Same
Chip-Erase	6-Byte sequence	Same
Sector-Erase	6-Byte sequence (command data – 30h)	Same 6-Byte sequence, same command data 30h, different sector address
Software Exit ID/Reset	1-Byte sequence	Same
Read-ID	3-Byte-sequence	Same
Erase Suspend/ Resume	Not required	1-Byte-sequence

The primary difference is Sector-Erase operation which is described here: The Sector-Erase operation for both SST39SFxxx and Am29Fxxx devices use the same six byte command sequence with the same command data of 30h, but different sector addresses during that byte-sequence. This is due to the difference in sector sizes of the SST39SFxxx and Am29Fxxx devices.

- The Am29F010 is based on uniform sector architecture of 16 KBytes each, as opposed to 4 KBytes in the SST39SF010. This difference in sector size results in the SST39SF010 device having more sectors (thirty two on SST39SF010 vs. eight on Am29F010). Therefore, when a Sector-Erase operation is performed, the SST39SF010 device will use address lines A12-A16 to decode sector address as opposed to A14-A16 on the Am29F010 device. These differences in sector address decoding should be accounted for by the software drivers.
- The Am29F002/002N has one 16 KByte, two 8 KByte, one 32 KByte and three 64 KByte sectors. By contrast, the SST39SF020 has sectors of uniform sector size of 4 KBytes. This difference in sector size results in the SST39SF020 device having more sectors (sixty four on SST39SF020 vs. seven on Am29F002). Consequently, when a Sector-Erase operation is performed, the SST39SF020 device will use address lines A12-A17 to decode sector address as opposed to A13-A17 on the Am29F002 device. These differences in sector address decoding should be accounted for by the software drivers.

In addition to the above differences, AMD also has a command called Erase-Suspend/Resume on both the Am29F010 and the Am29F002/002N. This is needed because the Am29Fxxx devices take several seconds to erase the sector and therefore need the capability to interrupt and suspend erase operations to perform Read operation. On the other hand, SST only takes few milliseconds to perform an Erase operation, and therefore does not require this command. For this reason, the Erase-Suspend/Resume command is not supported and will be ignored by SST39SFxxx devices.

Consequently, the SST39SF020 and SST39SF010 can be used to substitute the Am29F002/002N and the Am29F010 with minimal design changes.

3.0 Comparisons with the Atmel At49F series

In the At49F series, Atmel offers the following 2M, 1M and 512K devices – the At49F020, At49F010 and At49F512 (in that order). SST's equivalent offerings are the SST39SF020, the SST39SF010 and the SST39SF512.

3.1 Hardware comparisons

The At49F512, At49F010 and At49F020 are all are offered in 32-pin PLCC, PDIP and TSOP packages.

- In the PLCC and PDIP packages, an SST39SF series is fully pin compatible with an Atmel At49F device of the same density. As a result, the SST39SF device can be used in an Atmel design without any modifications in board layout.
- For TSOP, Atmel offers both 8mm x 20mm and 8mm x 14mm packages. For 8mm x 14mm package, an SST39SF devices are fully pin compatible with Atmel's 8mm x 14mm TSOP device of the same density, and can therefore substitute it without any board layout modifications. A system design which currently uses Atmel's 8mm x 20mm package can use SST's 8mm x 14mm package if a longer trace is used.

3.2 Software comparisons

The SST39SFxxx and AT49Fxxx devices use the same command set for Byte-Program, Chip-Erase, Read-ID and Reset operation as described in the table below.

Command sequence	SST39SFxxx	At49Fxxx
Byte-Program	4-Byte-sequence	Same
Chip-Erase	6-Byte-sequence	Same
Sector-Erase	6-Byte-sequence	Not supported
Software Exit ID/Reset	1 or 3-Byte sequence	Same
Read-ID	3-Byte-sequence	Same
Boot block lockout	Not supported	6-Byte-sequence

The primary difference between SST and Atmel is the Sector-Erase operation, which is not offered by the AT49Fxxx products. Atmel has a boot block of 8 KBytes, and a single block comprising the remainder of the memory (like 248 KBytes for 49F020), and they only support Chip-Erase. SST, on the other hand, has uniform 4 KByte sectors. As a result, a SST39SFxxx device can use the same software a corresponding At49F device, since SST39SF devices offer both Sector-Erase and Chip-Erase, if the boot block is not protected.

Some Atmel designs may protect this 8 KByte sector, so that during Chip-Erase, this sector is not erased with the other block. If this feature is enabled, then the software would have to be modified to do Sector-Erase operations on the SST device in place of the Chip-Erase on the protected Atmel device, so that the sectors corresponding to the boot block are not erased. An alternative is to erase the entire chip, and then re-program the two SST sectors corresponding to the Atmel boot-block.

In conclusion, the SST39SF can be used in any application that uses the equivalent At49F, with minimal software changes.

4.0 Differences between SST39SFxxx and 29EExxx devices

This section compares SST39SFxxx and SST29EExxx in 2M (SST39SF020 and SST29EE020), 1M (SST39SF010 and SST29EE010) and 512K (SST39SF512 and SST29EE512) densities.

The SST29EExxx is based on Page-Write architecture where page size is 128 Bytes. The device is written on a page-by-page basis, which includes internal page erase operation. The system does not need to issue an erase command. Pages are loaded with SRAM-like timing, following which the Page-Write occurs with no further CPU interaction.

The SST39SFxxx is based on Sector-Erase, Byte-Program architecture where sector size is 4 KBytes. In order to program the device, one erases a sector, then programs on a byte-by-byte basis.

Although the Byte-Program operation of the SST39SFxxx uses the same JEDEC command set as the Page-Write operation of the SST29EExxx, the software has to recognize the differences in architecture between the two device families. In the SST29EExxx devices, the Page-Write command sequence is followed by the loading of 128 Bytes of data with appropriate address; the device will internally erase and program the page. In case of the SST39SF devices, the system has to issue a 6-Byte Sector-Erase command sequence. Once the sector is erased, the system can program the sector byte-by-byte using a 3-Byte command sequences.

If an application requires sectors as small as 128 Bytes or a Page-Write operation, in addition to in-system reprogrammability, the SST29EExxx series is recommended. For all other general purpose applications that require in-system re-programmability, the SST39SFxxx series is recommended.

The software drivers for both the SST39SFxxx and the SST29EExxx are available from SST.

5.0 Software Driver

SST provides software drivers for the device both in 'C' and 8086 assembly languages. The drivers are available on SST's website – http://www.ssti.com.