

Migration from Adesto AT25SF to Infineon S25FL-L NOR Flash Family

About this document

Scope and purpose

This application note provides guidelines for migration from AT25SF from Adesto Technologies to Infineon S25FL-L SPI NOR Flash memory products. It describes the similarities and differences in specifications to facilitate this migration.

Intended audience

This is intended for flash memory users who intend to migrate from Adesto's AT25SF to Infineon S25FL-L SPI NOR flash.

Table of contents

About this document	1
Table of contents	1
1 Introduction	2
2 Features comparison	3
3 Sector architecture	5
4 Command set comparison	6
4.1 Identification commands.....	9
4.2 Reset command.....	9
4.3 Deep Power Down	10
4.4 Status and configuration registers	10
4.5 4-byte address mode.....	10
4.6 Read access commands.....	10
4.7 Program commands.....	10
4.8 QPI mode	11
4.9 Erase commands.....	11
4.10 Suspend and Resume.....	11
4.11 Security region	11
4.12 Array protection	11
4.13 Individual and region protection.....	11
4.14 Data learning pattern	11
5 Hardware comparison	12
5.1 Package compatibility	12
5.2 Signal compatibility	12
5.3 DC characteristics.....	13
5.4 AC characteristics.....	16
5.5 Embedded algorithms performance	20
6 Conclusion	21
References	22
Revision history	23

Introduction

1 Introduction

This application note compares Infineon SPI NOR flash device S25FL-L with AT25SF from Adesto. It details the similarities and differences between these two device families to facilitate the migration efforts. No actual tests are performed to verify the migration results. For specific device information, refer to their individual datasheets.

Features comparison

2 Features comparison

Table 1 Features comparison

Feature/parameter	AT25SF	S25FL-L
Densities	4 Mb, 8 Mb, 16 Mb, 32 Mb, 64 Mb, and 128 Mb	64 Mb, 128 Mb, and 256 Mb
Bus width	x1, x2, x4	x1, x2, x4
Supply voltage	4 Mb: 2.5 V–3.6 V 8 Mb: 2.3 V–3.6 V 16 Mb–32 Mb: 2.5 V–3.6 V 64 Mb–128 Mb : 2.7 V–3.6 V	64 Mb–256 Mb: 2.7 V–3.6 V
Normal Read speed	6.25 MB/s (50 MHz)	6.25 MB/s (50 MHz)
Fast Read speed	4 Mb, 16 Mb, 32 Mb: 10.625 MB/s (85 MHz) 8 Mb: 8.75 MB/s (70 MHz) 64 Mb: 13 MB/s (104 MHz) 128 Mb: 15 MB/s (120 MHz)	64 Mb: 13.5 MB/s (108 MHz) 128 Mb–256 Mb: 16.5 MB/s (133 MHz)
Dual Read speed	4 Mb–32 Mb: 21.25 MB/s (85 MHz) 64 Mb: 12.5 MB/s (50 MHz) 128 Mb: 30 MB/s (120 MHz)	64 Mb: 27 MB/s (108 MHz) 128 Mb–256 Mb: 33 MB/s (133 MHz)
Quad Read speed	66 Mb/s (133 MHz)	64 Mb: 54 MB/s (104 MHz) 128 Mb–256 Mb: 66 MB/s (133 MHz)
Quad Read speed (QIO - DDR)	–	64 Mb: 54 MB/s (54 MHz) 128 Mb–256 Mb: 66 MB/s (66 MHz)
Program buffer size	256 B	256 B
Erase sector size	4 KB / 32 KB/ 64 KB	4 KB / 32 KB / 64 KB
Security region / OTP	768 bytes	1024 bytes
Suspend / resume	Erase / Program	Erase / Program
Addressing	3-byte	3-byte, 4-byte
Hardware reset	Not supported	Yes
Operating temperature	–40°C to +85°C	–40°C to +125°C
Deep Power Down	Yes	Yes
XIP mode	Yes	Yes
ID and SFDP	Read ID SFDP (not supported in 4 Mb–32 Mb)	Read ID SFDP
Packages	8-pin SOIC (150 mil) 8-pin SOIC (208 mil) 8-contact WSON (6 × 8 mm) 24-ball FBGA (6 × 8 mm) 5x5 8-pad Ultra Thin UDFN (5×6×0.6 mm) 8-pad Ultra Thin UDFN (2×3×0.6 mm) 8-pad DFN (6×5×0.6 mm)	8-pin SOIC (208 mil) 16-pin SOIC (300 mil) 8-contact WSON (5×6 mm) 8-contact WSON (6×8 mm) 24-ball FBGA (6 × 8 mm) 5x5 24-ball FBGA (6 × 8 mm) 4x6



Features comparison

Feature/parameter	AT25SF	S25FL-L
	8-lead TSSOP (4×4 mm) 8-ball die BGA	

Sector architecture

3 Sector architecture

Adesto AT25SF 4 Mb–64 Mb devices have a uniform sector size of 64 KB. They also offer subsector erase size of 4 KB and 32 KB. The 128-Mb device has a uniform sector size of 4 KB and offers a block erase size of 32 KB and 64 KB. Infineon S25FL-L family offers also a uniform sector size of 4 KB and offers block erase size of 32 KB and 64 KB.

Command set comparison

4 Command set comparison

Table 2 summarizes the software command set supported in Adesto AT25SF and Infineon S25FL-L devices. Subsequent sections discuss pertinent differences between the devices.

Table 2 Command set comparison

Function	Command	Description	AT25SF		S25FL-L	
Read Device ID	RDID	Read ID (JEDEC Manufacturer ID)	4 Mb	-	9Fh	
			8 Mb-128 Mb	9Fh		
	READ_ID	Read Electronic Manufacturer Signature	4 Mb-128 Mb	90h	-	
	RSFDP	Read JEDEC Serial Flash Discoverable Parameters	4 Mb-32 Mb	-	5Ah	
			64 Mb-128 Mb	5Ah		
			Read Dual Manufacturer/Device ID	4 Mb-32 Mb	-	-
64 Mb-128 Mb				92h		
RDQID	Read Quad ID	4 Mb-32 Mb	-	AFh		
		64 Mb-128 Mb	94h			
Reset	RSTEN	Software Reset Enable	4 Mb-32 Mb	-	66h	
			64 Mb-128 Mb	66h		
	RST/RESET	Software Reset	4 Mb-32 Mb	-	99h	
			64 Mb-128 Mb	99h		
	MBR	Mode Bit Reset	16 Mb-32 Mb	FFh	FFh	
			4 Mb, 8 Mb, 64 Mb, 128 Mb	-		
Deep Power Down	DPD	Deep Power Down	B9h		B9h	
	RES	Release from DPD / Electronic Signature Read	ABh		ABh	
Register access	RDSR	Read Status Register	05h		05h	
	RDSR2	Read Status Register 2	35h		07h	
	RDSR3	Read Status Register 3	4 Mb-64 Mb	-	-	
			128 Mb	15h		
	RDCR	Read Configuration Register 1	-		35h	
			Read Configuration Register 2	-		15h
				Read Configuration Register 3	-	
	RDAR	Read Any Register	-		65h	
	WRR	Write Register (Status-1 and Configuration-1, 2, 3)	-		01h	
		Write Status Register	4 Mb-32 Mb	01h	-	
64 Mb-128 Mb			-			

Command set comparison

Function	Command	Description	AT25SF		S25FL-L	
		Write Status Register 1	4 Mb–32 Mb	–	–	
			64 Mb ¹ –128 Mb	01h		
		Write Status Register 2	4 Mb–32 Mb	–	–	
			64 Mb–128 Mb	31h		
		Write Status Register 3	4 Mb–64 Mb	–	–	
			128 Mb	11h		
	WRAR	Write Any Register	–		71h	
	CLSR	Clear Status Register	50h		30h	
	SBL	Set Burst Length	4 Mb–32 Mb	–	77h	
			64 Mb–128 Mb	77h		
	QPIEN	Enter QPI	4 Mb–32 Mb, 128 Mb	–	38h	
			64 Mb	38h		
	QPIEX	Exit QPI	4 Mb–32 Mb, 128 Mb	–	F5h	
			64 Mb	FFh		
4-byte mode	4BEN	Enter 4-byte Address Mode	–		B7h	
	4BEX	Exit 4-byte Address Mode	–		E9h	
Read flash array	READ	Read	03h		03h	
	FAST_READ	Fast Read	0Bh		0Bh	
			Burst Read With Wrap	64 Mb	0Ch	–
				4 Mb–2 Mb, 128 Mb	–	
			Set Read Parameter	64 Mb	C0h	–
				4 Mb–32 Mb, 128 Mb	–	
	DOR	Dual Output Read	3Bh		3Bh	
	QOR	Quad Output Read	6Bh		6Bh	
	DIOR	Dual I/O Read	BBh		BBh	
	QIOR	Quad I/O Read	EBh		EBh	
	DDRQIOR	DDR Quad I/O Read	–		EDh	
	4DDRQIOR	4-byte DDR Quad I/O Read	–		EEh	
	QIOWR	Quad I/O Word Fast Read	4 Mb–32 Mb	–	–	
			64 Mb–128 Mb	E7h		
	4READ	4-byte Read	–		13h	
4FAST_READ	4-byte Fast Read	–		0Ch		
4DOR	4-byte Dual Output Read	–		3Ch		
4QOR	4-byte Quad Output Read	–		6Ch		

¹ Can take up to 2 bytes of data

Command set comparison

Function	Command	Description	AT25SF		S25FL-L
	4DIOR	4-byte Dual I/O Read	-		BCh
	4QIOR	4-byte Quad I/O Read	-		ECh
Write operations	WREN	Write Enable	06h		06h
	WRENV	Write Enable for Volatile Status and Configuration Registers	50h		50h
	WRDI	Write Disable	04h		04h
Program flash array	PP	Page Program	02h		02h
	QPP	Quad Input Fast Program	4 Mb–32 Mb	-	32h
			64 Mb	33h	
			128 Mb	32h	
	4PP	4-byte Page Program	-		12h
	4QPP	4-byte Quad Input Fast Program	-		34h
		Fast Page Program	4 Mb–64 Mb	-	-
128 Mb			F2h		
Erase flash array	SE	Sector Erase (4 KB)	20h		20h
	4SE	4-byte Sector Erase	-		21h
	HBE	Half Block Erase (32 KB)	52h		52h
	4HBE	4-byte Half Block Erase	-		53h
	BE	Block Erase (64 KB)	D8h		D8h
	4BE	4-byte Block Erase	-		DCh
	CE	Chip Erase	60h/C7h		60h/C7h
Erase / Program Suspend / Resume	EPS	Erase / Program Suspend	4 Mb–8 Mb	-	75h
			16 Mb–128 Mb	75h	
	EPR	Erase / Program Resume	4 Mb–8 Mb	-	7Ah
			16 Mb–128 Mb	7Ah	
Security region array	SECRE	Security Region Erase	4 Mb–32 Mb, 128 Mb	44h	44h
			64 Mb	-	
	SECRP	Security Region Program	4 Mb–32 Mb, 128 Mb	42h	42h
			64 Mb	-	
	SECRR	Security Region Read	4 Mb–32 Mb, 128 Mb	48h	48h
			64 Mb	-	
		Enter Secured OTP	64 Mb	B1h	-
			4 Mb–32 Mb, 128 Mb	-	
		Exit Secured OTP	64 Mb	C1h	-
			4 Mb–32 Mb, 128 Mb	-	

Command set comparison

Function	Command	Description	AT25SF	S25FL-L	
		Read Security Register	64 Mb	2Bh	-
			4 Mb–32 Mb, 128 Mb	-	
		Write Security Register	64 Mb	2Fh	-
			4 Mb–32 Mb, 128 Mb	-	
Array protection	IBLRD	IBL Read	-	3Dh	
	4IBLRD	4-byte IBL Read	-	E0h	
	IBL	IBL Lock	-	36h	
	4IBL	4-byte IBL Lock	-	E1h	
	IBUL	IBL Unlock	-	39h	
	4IBUL	4-byte IBL Unlock	-	E2h	
	GBL	Global IBL Lock	-	7Eh	
	GBUL	Global Unlock	-	98h	
	SPRP	Set Pointer Region Protection	-	FBh	
	4SPRP	4-byte Set Pointer Region Protection	-	E3h	
Individual and region protection	IRPRD	IRP Register Read	-	2Bh	
	IRPP	IRP Register Program	-	2Fh	
	PRRD	Protection Register Read	-	A7h	
	PRL	Protection Register Lock (NVLOCK Bit Write)	-	A6h	
	PASSRD	Password Read	-	E7h	
	PASSP	Password Program	-	E8h	
	PASSU	Password Unlock	-	EAh	
Data learning pattern	DLPRD	Data Learning Pattern Read	-	41h	
	PNVDLR	Program NV Data Learning Pattern	-	43h	
	WDLRV	Write Volatile Data Learning Register	-	4Ah	

4.1 Identification commands

AT25SF devices can use the legacy 90Eh and 9Fh command, as well as Dual (92h) and Quad (94h) commands to read the Device ID. S25FL-L supports the 9Fh and Quad (AFh) commands only.

For Serial Flash Discoverable Parameters (SFDP) data, only 64-Mb and 128-Mb Adesto parts support this function. 4 Mb–32 Mb parts do not support it. All density devices of S25FL-L family support the 5Ah command.

4.2 Reset command

Both AT25SF and S25FL-L devices use the sequence 66h and 99h to perform a software reset.

The Mode Bit Reset command is supported by all S25FL-L parts and 4-Mb, 8-Mb, 64-Mb and 128-Mb Adesto parts. It is not supported by 16-Mb and 32-Mb Adesto parts.

Command set comparison

4.3 Deep Power Down

The Deep Power Down commands are same for both AT25SF and S25FL-L families.

4.4 Status and configuration registers

Status registers and configuration registers are defined differently in AT25SF and S25FL-L devices. The basic status register has some similar bits but other registers are different. You must look at the bits that are currently being used with AT25SF and find the corresponding registers in S25FL-L.

Only the basic read and write status register commands are common in these two devices. Other register access commands in AT25SF and S25FL-L are different.

4.5 4-byte address mode

In devices with higher capacities than 256 Mb, 4-byte addressing scheme is required. AT25SF does not support 4-byte addressing mode. S25FL-L does support extended addressing mode to enable compatibility with legacy SPI devices.

If you prefer to keep the old command values but want to use 4-byte addressing, S25FL-L supports a 4-byte address mode that can be entered or exited with a command.

4.6 Read access commands

Most read commands are compatible in both AT25SF and S25FL-L devices. Both of them support Normal Read, Fast Read, Dual Output Read, Quad Output Read, Dual I/O Read and Quad I/O Read. However, DDR and 4-byte Read commands are not supported in AT25SF.

Some read commands require a read latency to allow time to access the flash memory array. The read latency cycles are traditionally called dummy cycles. The dummy cycles can be set in Non-volatile Configuration Register in S25FL-L, while they are fixed in AT25SF. Look up the definitions of how the read latency is defined in FL-L datasheet to find the appropriate settings.

Table 3 shows the Latency Code definitions in CR3NV.

Table 3 Infineon S25FL-L CR3NV RL_NV bits

3	RL_NV	Read Latency Default	1	0 to 15 latency (dummy) cycles following read address or continuous mode bits.
2			0	
1			0	
0			0	

The 4-bit RL field selects the number of dummy cycles between the end of address and the start of the read data output.

4.7 Program commands

Both AT25SF and S25FL-L support normal Page Programming commands.

Quad Page Programming command is not supported in 4 Mb–32 Mb Adesto parts. The opcode for QPP command in AT25SF 64 Mb device (33h) is different from the standard opcode (32h) supported in the 128 Mb device and S25FL-L devices.

4-byte page programming commands are not supported in AT25SF devices. Fast Page Program command (F2h) is only supported in 128-Mb AT25SF device and is not supported in any of the other AT25SF or S25FL-L devices.

Command set comparison

4.8 QPI mode

QPI mode is supported in 64-Mb AT25SF and S25FL-L devices. The Exit QPI Mode command is different for AT25SF and S25FL-L devices. This mode is not supported in 4 Mb–32 Mb and 128-Mb AT25SF devices.

4.9 Erase commands

Both AT25SF and S25FL-L have the same commands for 4-KB, 32-KB and 64-KB sector erase. Chip erase commands are also same for both devices.

4-byte erase commands are not supported by the AT25SF device.

4.10 Suspend and Resume

Erase/Program and Suspend/Resume commands are same for 16-Mb–128-Mb AT25SF and S25FL-L devices. Suspend/Resume commands are not supported in 4-Mb–8-Mb AT25SF devices.

4.11 Security region

The basic Security Region read, program, erase commands are same for 4 Mb–32 Mb and 128 Mb AT25SF devices as well as S25FL-L devices. These commands are not supported in the 64-Mb AT25SF device.

However, the 64-Mb AT25SF device supports some extra commands such as Enter Secured OTP, Exit Secured OTP, Read Security Register, and Write Security Register.

4.12 Array protection

S25FL-L supports three types of memory array protection : Legacy Block (LBP), Individual Block Lock (IBL) and Pointer Region (PR). These commands are not supported in the AT25SF device. See the S25FL-L datasheet for more details.

4.13 Individual and region protection

S25FL-L supports Individual and Region Protection (IRP) which is the name used for a set of independent hardware and software methods used to disable or enable programming or erase operations on Security Regions and the Pointer Region Protection Register. These commands are not supported in the AT25SF device. See the S25FL-L datasheet for more details.

4.14 Data learning pattern

Data learning pattern commands are not supported in the AT25SF device. See the S25FL-L datasheet for more details.

Hardware comparison

5 Hardware comparison

5.1 Package compatibility

Table 4 shows the supported packages in AT25SF and S25FL-L families.

Table 4 Package compatibility

Package name	AT25SF						S25FL-L		
	4 Mb	8 Mb	16 Mb	32 Mb	64 Mb	128 Mb	64 Mb	128 Mb	256 Mb
8-pin SOIC (150 mil)	✓	✓	✓	✓					
8-pin SOIC (208 mil)	✓	✓	✓	✓	✓	✓	✓	✓	
16-pin SOIC (300 mil)							✓		
8-contact WSON (5 × 6 mm)							✓	✓	
8-contact WSON (6 × 8 mm)									✓
5 x 5 24-ball FBGA (6 × 8 mm)						✓	✓	✓	✓
4 x 6 24-ball FBGA (6 × 8 mm)							✓	✓	✓
8-pad Ultra Thin UDFN (5 × 6 × 0.6 mm)	✓	✓	✓	✓		✓			
8-pad Ultra Thin UDFN (2 × 3 × 0.6 mm)	✓	✓							
8-pad DFN (6 × 5 × 0.6 mm)					✓				
8-lead TSSOP (4 × 4 mm)	✓								
8-ball die BGA			✓						

5.2 Signal compatibility

Table 5 shows the signal pins comparison in AT25SF and S25FL-L families. All signals are compatible in both device families.

Table 5 Signal compatibility

AT25SF signal	S25FL-L signal	Description
CS#	CS#	Chip Select
SCK	SCK	Serial clock
I/O[3:0]	IO[3:0]	Data input and output
WP#	WP#	Write Protect (IO2)
HOLD#	HOLD#	Hold (IO3)
-	RESET#	Dedicated reset pin
Vcc	Vcc	Power supply
GND	Vss	Ground

Hardware comparison

5.3 DC characteristics

Table 6 shows a comparison of basic DC parameters for AT25SF and S25FL-L. For the complete parameters with details specified, see the datasheets.

Table 6 DC parameters comparison

Symbol	Operating parameter	Density	AT25SF			S25FL-L			Unit
			Min	Typ	Max	Min	Typ	Max	
V _{CC}	V _{CC} (supply voltage)	4 Mb	2.5	-	3.6	2.7	-	3.6	V
		8 Mb	2.3						
		16 Mb	2.5						
		32 Mb							
		64 Mb	2.7						
		128 Mb							
		256 Mb	-						
V _{IL}	Input low voltage	4 Mb	-	-	0.3 x V _{CC}	-0.3	-	0.3 x V _{CC}	V
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb	-0.5		0.2 x V _{CC}				
		128 Mb							
		256 Mb	-		-				
V _{IH}	Input high voltage	4 Mb	0.7 x V _{CC}	-	-	0.7 x V _{CC}	-	V _{CC} + 0.4	V
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb	0.8 x V _{CC}		V _{CC} + 0.4				
		128 Mb							
		256 Mb	-		-				
V _{OL}	Output low voltage	4 Mb	-	-	0.4	-	-	0.2	V
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb			0.2				
		128 Mb			0.4				
		256 Mb			-				
V _{OH}	Output high voltage	4 Mb	V _{CC} - 0.2	-		V _{CC} - 0.2	-	-	V
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb							
		128 Mb							

Hardware comparison

Symbol	Operating parameter	Density	AT25SF			S25FL-L			Unit
			Min	Typ	Max	Min	Typ	Max	
		256 Mb							
I _{LI}	Input leakage current	4 Mb	-	1	1	-	-	±2	µA
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb		-	±2				
		128 Mb							
		256 Mb							
I _{LO}	Output leakage current	4 Mb	-	1	1	-	-	±2	µA
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb		-	±2				
		128 Mb							
		256 Mb							
I _{CC1} ²	Active power supply current (READ) – Serial@50 MHz	4 Mb	-	4	7	-	-	-	mA
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb		-	15		15	20	
		128 Mb @80 MHz		10	16				
		256 Mb							
I _{CC2}	Active power supply current (Page Program)	4 Mb	-	10	16	-	-	-	mA
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb		15	25		17	25	
		128 Mb			20		40	50	
		256 Mb		-	-				
I _{CC3}	Active power supply current (WRR or WRAR)	4 Mb	-	-	-	-	-	-	mA
		8 Mb							
		16 Mb							
		32 Mb							
		64 Mb		10	20		11	20	
		128 Mb		-	5		24	30	

2 For the sake of simplicity, only the current value for read operation in SPI mode @ 50 MHz is mentioned. To get more detailed current values at different frequency values and Dual I/O and Quad I/O modes, see the datasheet.

Hardware comparison

Symbol	Operating parameter	Density	AT25SF			S25FL-L			Unit		
			Min	Typ	Max	Min	Typ	Max			
		256 Mb			-						
I_{CC4}	Active power supply current (SE)	4 Mb	-	10	16	-	-	-	mA		
		8 Mb									
		16 Mb									
		32 Mb		15	25					17	25
		64 Mb									
		128 Mb		9	15					20	25
		256 Mb		-	-						
I_{SB}^3	Standby current (industrial)	4 Mb	-	13	25	-	-	-	μ A		
		8 Mb									
		16 Mb									
		32 Mb		10	50					20	30
		64 Mb									
		128 Mb		13	25					20	35
		256 Mb		-	-					-	-
I_{DPD}	Deep Power Down current	4 Mb	-	2	5	-	-	-	μ A		
		8 Mb									
		16 Mb									
		32 Mb		-	-					2	20
		64 Mb									
		128 Mb		5							
		256 Mb		-	-						

3 The mentioned I_{SB} current value S25FL-L is only applicable for SPI, Dual I/O and Quad I/O modes. The I_{SB} value for QPI mode is higher. Refer to the device datasheet to know the exact standby current value for QPI mode.

Hardware comparison

5.4 AC characteristics

Table 7 shows a comparison of basic AC parameters for AT25SF and S25FL-L. For the complete parameter details specified, see the datasheets.

Table 7 AC Characteristics Comparison

Symbol	Parameter	Density	AT25SF		S25FL-L		Unit
			Min	Max	Min	Max	
F _{SCK,R}	SCK clock frequency for READ and 4READ instructions	4 Mb	-	50	-	-	MHz
		8 Mb					
		16 Mb					
		32 Mb	DC	DC	50		
		64 Mb					
		128 Mb	70				
		256 Mb	-	-			
F _{SCK,C}	SCK clock frequency for Dual and Quad commands	4 Mb	-	85	-	-	MHz
		8 Mb					
		16 Mb					
		32 Mb	DC	104	DC	108	
		64 Mb					
		128 Mb	133				
		256 Mb	-	-	-		
t _{WH} , t _{CH}	Clock HIGH time	4 Mb	5	-	-	-	ns
		8 Mb					
		16 Mb					
		32 Mb	3.5	50%/F _{SCK} - 5%			
		64 Mb					
		128 Mb	3.75	50%/F _{SCK} ± 5%			
		256 Mb	-	-			
t _{WL} , t _{CL}	Clock LOW time	4 Mb	5	-	-	-	ns
		8 Mb					
		16 Mb					
		32 Mb	3.5	50%/F _{SCK} - 5%			
		64 Mb					
		128 Mb	3.75	50%/F _{SCK} ± 5%			
		256 Mb	-	-			
t _{CRT} , t _{CLCH}	Clock rise time (slew rate)	4 Mb	0.1	-		-	V/ns
		8 Mb					
		16 Mb					
		32 Mb					
		64 Mb			0.1		

Hardware comparison

Symbol	Parameter	Density	AT25SF		S25FL-L		Unit	
			Min	Max	Min	Max		
		128 Mb						
		256 Mb	-					
$t_{\text{CFT}}, t_{\text{CHCL}}$	Clock fall time (slew rate)	4 Mb	0.1	-	-	-	V/ns	
		8 Mb						
		16 Mb						
		32 Mb						
		64 Mb						
		128 Mb						
		256 Mb						-
t_{CS}	CS# HIGH time (Any Read instructions)	4 Mb	10	-	-	-	ns	
		8 Mb						
		16 Mb						
		32 Mb						
		64 Mb						30
		128 Mb						20
		256 Mb						-
	CS# HIGH time (All other non-Read instructions)	4 Mb	10	-	-	-	ns	
		8 Mb						
		16 Mb						
		32 Mb						
		64 Mb						30
		128 Mb						20
		256 Mb						-
t_{CSS}	CS# Active Setup time (relative to SCK)	4 Mb	5	-	-	-	ns	
		8 Mb						
		16 Mb						
		32 Mb						
		64 Mb						3
		128 Mb						
		256 Mb						-
t_{CSH}	CS# Active Hold time (relative to SCK)	4 Mb	5	-	-	-	ns	
		8 Mb						
		16 Mb						
		32 Mb						
		64 Mb						5
		128 Mb						
		256 Mb						-
	Data in Setup time	4 Mb	2	-	-	-	ns	

Hardware comparison

Symbol	Parameter	Density	AT25SF		S25FL-L		Unit
			Min	Max	Min	Max	
t_{SU}		8 Mb					
		16 Mb					
		32 Mb					
		64 Mb					
		128 Mb					
		256 Mb	-				
t_{HD}	Data in Hold time	4 Mb	2	-	-	-	ns
		8 Mb					
		16 Mb					
		32 Mb					
		64 Mb	3				
		128 Mb	2				
		256 Mb	-				
t_V	Clock LOW to Output Valid	4 Mb	-	8^4	-	-	ns
		8 Mb					
		16 Mb					
		32 Mb					
		64 Mb		6			
		128 Mb		7			
		256 Mb		-			
t_{HO}	Output Hold time	4 Mb	0	-	-	-	ns
		8 Mb					
		16 Mb					
		32 Mb					
		64 Mb	1.5				
		128 Mb	0				
		256 Mb	-				
t_{DIS}	Output Disable time	4 Mb	-	6	-	-	ns
		8 Mb		7			
		16 Mb		6			
		32 Mb		6			
		64 Mb		7			
		128 Mb		6			
		256 Mb		-			
	WP# Setup time	4 Mb	20	-	-	-	ns

4 See the datasheet for more details.

5 Full VCC range and CL = 30 pF

6 Full VCC range and CL = 15 pF

Hardware comparison

Symbol	Parameter	Density	AT25SF		S25FL-L		Unit
			Min	Max	Min	Max	
t_{WPS}		8 Mb					
		16 Mb					
		32 Mb					
		64 Mb					
		128 Mb					
		256 Mb	-				
t_{WPH}	WP# Hold time	4 Mb	100	-	-	-	ns
		8 Mb					
		16 Mb					
		32 Mb					
		64 Mb					
		128 Mb					
		256 Mb	-				

Hardware comparison

5.5 Embedded algorithms performance

Table 8 shows a comparison of the program and erase performance for AT25SF and S25FL-L. For details of Program and Erase operations, see the datasheets.

Table 8 Program and Erase performance comparison

Symbol	Parameter	Density	AT25SF		S25FL-L		Unit
			Typical	Max	Typical	Max	
t _w	Non-volatile Register Write time	4 Mb	-	15	-	-	ms
		8 Mb					
		16 Mb					
		32 Mb					
		64 Mb	5	30	220	1200	
		128 Mb			145	750	
		256 Mb	-	-	-	-	
t _{pp}	Page Programming (256 bytes)	4 Mb	0.7	2.5	-	-	μs
		8 Mb		5			
		16 Mb		2.5			
		32 Mb		3			
		64 Mb	0.6	5	450	1350	
		128 Mb		2.4	300	1200	
		256 Mb	-	-	-	-	
t _{BE}	Block Erase time (64-KB sectors)	4 Mb	500	2200	-	-	ms
		8 Mb		3000			
		16 Mb					
		32 Mb					
		64 Mb	700	2000	450	1150	
		128 Mb			250	270	
		256 Mb	-	-	-	-	
t _{CE}	Chip Erase time	4 Mb	4	10	-	-	sec
		8 Mb	12	20			
		16 Mb	15	25			
		32 Mb	25	60			
		64 Mb	80	150	55	150	
		128 Mb	30	120	70	180	
		256 Mb	-	-	140	360	

Conclusion

6 Conclusion

The Infineon S25FL-L device is pin-to-pin compatible with Adesto AT25SF. To migrate to S25FL-L, you can keep most basic SPI commands but software modification efforts are needed to accommodate the sector architecture, register sets and data protection methods offered by the AT25SF family.

References

References

- [1] S25FL064L
 - [002-12878: S25FL064L 64 Mbit \(8 Mbyte\) 3.0V FL-L SPI Flash Memory](#)
- [2] S25FL128L/S25FL256L
 - [002-00124: S25FL256L/S25FL128L 256 Mbit \(32 Mbyte\)/128 Mbit \(16 Mbyte\), 3.0 V FL-L Flash Memory](#)
- [3] AT25SF04 datasheet
- [4] AT25SF08 datasheet
- [5] AT25SF16 datasheet
- [6] AT25SF32 datasheet
- [7] AT25SF64 datasheet
- [8] AT25SF128 datasheet



Revision history

Revision history

Document version	Date of release	Description of changes
**	2021-10-27	Initial release

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2021-10-27

Published by

Infineon Technologies AG

81726 Munich, Germany

© 2021 Infineon Technologies AG.

All Rights Reserved.

Do you have a question about this document?

Go to www.cypress.com/support

Document reference

002-33708 Rev. **

IMPORTANT NOTICE

The information contained in this application note is given as a hint for the implementation of the product only and shall in no event be regarded as a description or warranty of a certain functionality, condition or quality of the product. Before implementation of the product, the recipient of this application note must verify any function and other technical information given herein in the real application. Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind (including without limitation warranties of non-infringement of intellectual property rights of any third party) with respect to any and all information given in this application note.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.