

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family

About this document

Scope and purpose

This application note provides guidelines for migrating from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash families.

Intended audience

This is intended for Infineon NOR flash memory users who intend to migrate Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash families.

Table of contents

About this document.....	1
Table of contents.....	1
1 Introduction	2
2 Feature Comparison	3
2.1 Density	4
2.2 Sector Architecture	5
2.3 Data Bus Width	5
2.4 Read Page Size	5
2.5 Write Buffer Size	5
2.6 Synchronous Mode.....	5
2.7 Asynchronous Mode.....	5
2.8 Secure Silicon OTP Area	5
2.9 Sector Protection	5
2.10 Program Erase Suspend and Resume	6
2.11 Data Polling	6
2.12 Accelerated Programming	6
3 Package Comparison	7
4 Signal Comparison	10
5 Command Set Comparison	11
6 Device ID Comparison	16
7 Status Register Comparison	17
8 DC Specifications	20
9 Program or Erase Suspend / Resume	22
10 Power Up Timing.....	23
References.....	24
Revision history.....	25

1 Introduction

This application note provides migration guidelines for migrating from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Families.

The discussions will focus on same-density migrations, specifically the cases when migrating from PC28F to S29GL-S/S29GL-T. Considerations regarding migration to and from other densities can be extrapolated from these discussions. This application note is based on information currently available from data sheets and other application notes publicly available from Infineon and Micron. You should also see the latest relevant specifications.

2 Feature Comparison

Table 1 shows a feature comparison summary of the Micron PC28F flash memory devices to the Infineon S29GL-S/S29GL-T MirrorBit™ flash family device.

Table 1 General Feature Comparison

Products	PC28FxxxM	PC28FxxxP	S29GL-S / S29GL-T	Migration Issue
Process Node	65 nm MLC	65 nm MLC	65 nm SLC	No
V _{CC}	2.7 ~ 3.6 V	1.7 ~ 2.0 V	2.7 ~ 3.6 V	Maybe
V _{IO}	1.65 ~ 3.6 V	1.7 ~ 3.6 V	1.65 ~ V _{CC} V	No
Random Access Time	100 ns	100 ns: 512 Mb, 1 Gb 105 ns: 2 Gb	Density: V _{CC} =V _{IO} /Versatile I/O 512 Mbit: 100 ns/110 ns 1 Gbit: 100 ns/110 ns	No
Page Access Time	25 ns	25 ns	Density: V _{CC} =V _{IO} /Versatile I/O 512 Mbit: 15 ns/25 ns 1 Gbit: 15 ns/25 ns	No
Test Condition (Output Load Capacitance)	30 pF	30 pF	30 pF	No
Buffer Programming (512 Bytes)	505 µs (Typ.)	505 µs (Typ.)	451 µs (Typ.)	No
Sector Erase (128 KB)	800 ms (Typ.)	800 ms (Typ.)	535 ms (Typ.)	No
Active Read at 5 MHz, 30 pF	19 mA	26 mA	60 mA	Maybe
Program Current Consumption	35 mA	35 mA	100 mA	Maybe
Erase Current Consumption	35 mA	35 mA	100mA	Maybe
Standby Current Consumption	65 µA (256 Mbit) 70 µA (512 Mbit) 75 µA (1 Gbit) 150 µA (2 Gbit)	70 µA (512 Mbit) 75 µA (1 Gbit) 150 µA (2 Gbit)	100 µA (+85°C) 200 µA (+105°C) 215 µA (+125°C)	Maybe

Density

128 Mbit	No	No	S29GL128S	No
256 Mbit	Yes	No	S29GL256S	No
512 Mbit	Yes	Yes	Yes	No
1024 Mbit	Yes	Yes	Yes	No
2048 Mbit	Yes	Yes	No	Maybe

Sector Architecture

Parameter Block	No	Yes	No	Maybe
-----------------	----	-----	----	-------

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



Feature Comparison

Products	PC28FxxxM	PC28FxxxP	S29GL-S / S29GL-T	Migration Issue
Uniform (128 KB)	Yes	Yes	Yes	No
Access				
x8 Data Bus Width	Yes	Yes	S29GL-T	No
x16 Data Bus Width	Yes	Yes	Yes	No
Synchronous	No	Yes	No	Maybe
Asynchronous	Yes	Yes	Yes	No
Read Page Mode	Yes	Yes	Yes	No
Read Page Size	32 bytes	32 bytes	32 bytes	No
Write Buffer Size	512 bytes	512 bytes	512 bytes	No
Security				
Individual Sector Protection	Yes	No	Yes	No
Secure Silicon OTP Area	256 bytes	256 bytes	2 x 512 bytes	No
Other				
12V Accelerated Programming	Yes	No	S29GL-T	No
Unlock Bypass Command	Yes	No	S29GL-T	No
Multi-Sector Erase	Yes	No	S29GL-T	No
Blank Check	Yes	No	Yes	No
Suspend/Resume	Yes	Yes	Yes	No
Device ID	Yes	No	Yes	No
Autoselect Access	Yes	No	Yes	No
CFI	Yes	Yes	Yes	No
Status via Data Polling	Yes	Yes	Yes	No
Status via Status Register	Yes	Yes	Yes	No
Packaging and Ordering Options				
48-pin TSOP	No	No	No	No
56-pin TSOP	No	No	Yes	No
64-ball FAA BGA 10 x 13 mm	No	No	No	No
64-ball LAA BGA 11 x 13 mm	Yes	Yes	Yes	No
64-ball LAE BGA 9 x 9 mm	No	No	Yes	No
56-ball VBU BGA 9 x 7 mm	No	No	Yes	No

2.1 Density

PC28F family is available in monolithic 256, 512, 1024, and 2048 Mbit densities. S29GL-T family is available in monolithic 512 and 1024 Mbit densities, and S29GL-S family is available in monolithic 128, 256, 512, and 1024 Mbit densities.

2.2 Sector Architecture

S29GL-S/S29GL-T and PC28FxxxM families have 128-KB uniform sectors while PC28FxxxP family has 128-KB uniform and total four of 32-KB parameter sectors. Modifications are required if software was structured to M28W parameter sector architecture.

2.3 Data Bus Width

S29GL-T supports x8 data bus width while S29GL-S doesn't. The BYTE# input on previous generations of MirrorBit GL devices (Pin 53 on 56-TSOP and Pad F7 on 64-BGA) has been reserved for S29GL-T. No software and hardware modifications are required to operate in x8 or x16 data bus width.

2.4 Read Page Size

S29GL-S/S29GL-T and PC28F have a 32-bytes read page buffer. No software modifications are required to operate with 32-bytes maximum page transfers supported by S29GL-S/S29GL-T.

2.5 Write Buffer Size

PC28F and S29GL-S/S29GL-T have a 512-bytes write buffer. No software modifications are required to continue use of a 512-bytes write buffer fill supported by PC28F.

2.6 Synchronous Mode

PC28FxxxM and S29GL-S/S29GL-T devices do not support the synchronous mode operation while PC28FxxxP supports it.

2.7 Asynchronous Mode

All the devices support asynchronous mode. S29GL-S/S29GL-T supports asynchronous single and page read modes. No software modifications are required to continue use of an asynchronous mode supported by PC28F.

2.8 Secure Silicon OTP Area

The Secure Silicon Region (SSR) provides an extra flash memory area that can be programmed once and permanently protected from further changes i.e. it is a One Time Program (OTP) area. The SSR is 1024 bytes in length. It consists of 512 bytes for Factory Locked Secure Silicon Region and 512 bytes for Customer Locked Secure Silicon Region.

The sector address supplied during the Secure Silicon Entry command selects the Flash Memory Array sector that is overlaid by the Secure Silicon Region address map.

The SSR is overlaid starting at location 0 in the selected sector. Use of the Sector 0 address is recommended for future compatibility. While the SSR ASO is entered the content of all other sectors is undefined. Locations above the maximum defined address of the SSR ASO to the maximum address of the selected sector have undefined data.

2.9 Sector Protection

PC28F supports Volatile/Nonvolatile Protection through block locking that has a different method than the S29GL-S/S29GL-T. S29GL-S/S29GL-T supports Advanced Sector Protection (ASP) program and erase protection via password, non-volatile and volatile control. Details of ASP program and erase protection implementations can be found in S29GL-S/S29GL-T data sheets.

2.10 Program Erase Suspend and Resume

PC28F supports program erase suspend and resume in the same way as S29GL-S/S29GL-T.

2.11 Data Polling

PC28F and S29GL-S/S29GL-T support data polling. These are referred to as DQ bits as they appear on the data bus during a read access while an embedded algorithm is in progress. DQ bits 15 to 8, DQ4, and DQ0 are reserved and provide undefined data. Status monitoring software must mask the reserved bits and treat them as don't care.

Note that data polling may not be supported on future smaller process MirrorBit GL flash families. Status Register reads will be required to determine the status of embedded program and erase operations if data polling is not supported.

2.12 Accelerated Programming

PC28F and S29GL-T support accelerated programming. Details of accelerated program can be found in the S29GL-T datasheet.

3 Package Comparison

There are different pinouts and ballouts between PC28F and S29GL-S/S29GL-T regarding TSOP and BGA, as shown in [Figure 1](#) through [Figure 4](#).

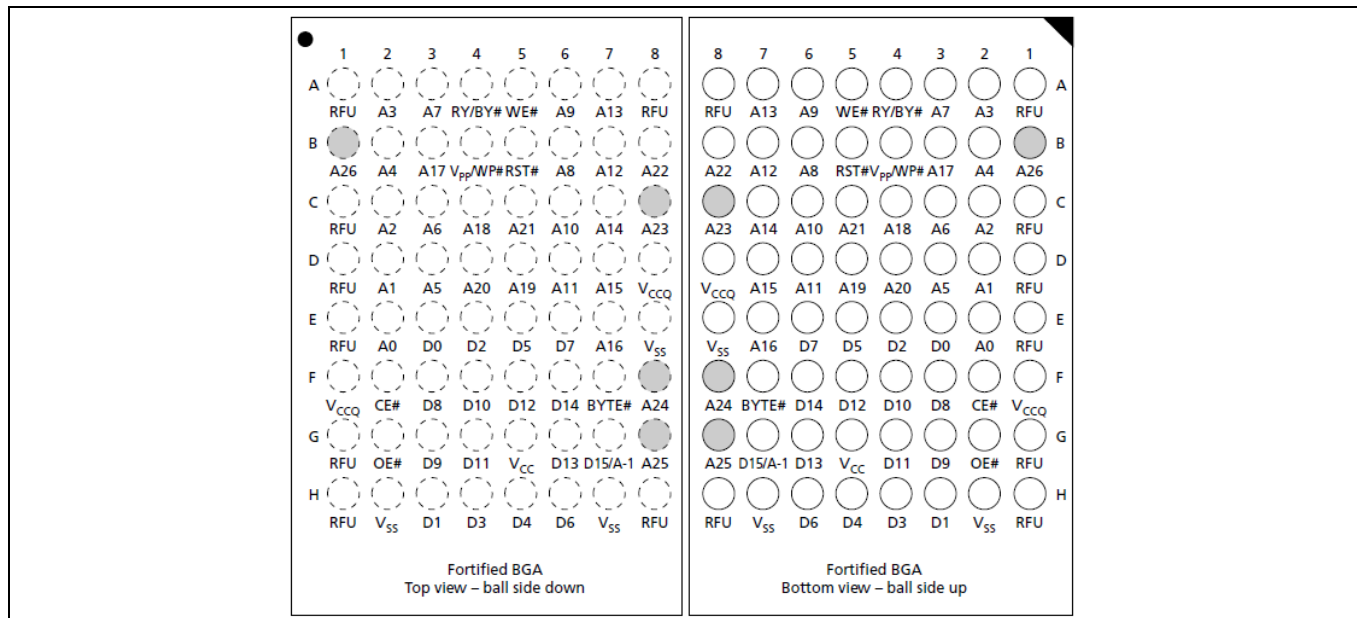


Figure 1 PC28FxxxM 64-ball Fortified BGA and 64-Ball TBGA

Note:

1. A-1 is the least significant address bit in x8 mode.
2. A23 is valid for 256 Mb and above; otherwise, it is RFU.
3. A24 is valid for 512 Mb and above; otherwise, it is RFU.
4. A25 is valid for 1 Gb and above; otherwise, it is RFU.
5. A26 is valid for 2 Gb only; otherwise it is RFU.

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family

Package Comparison

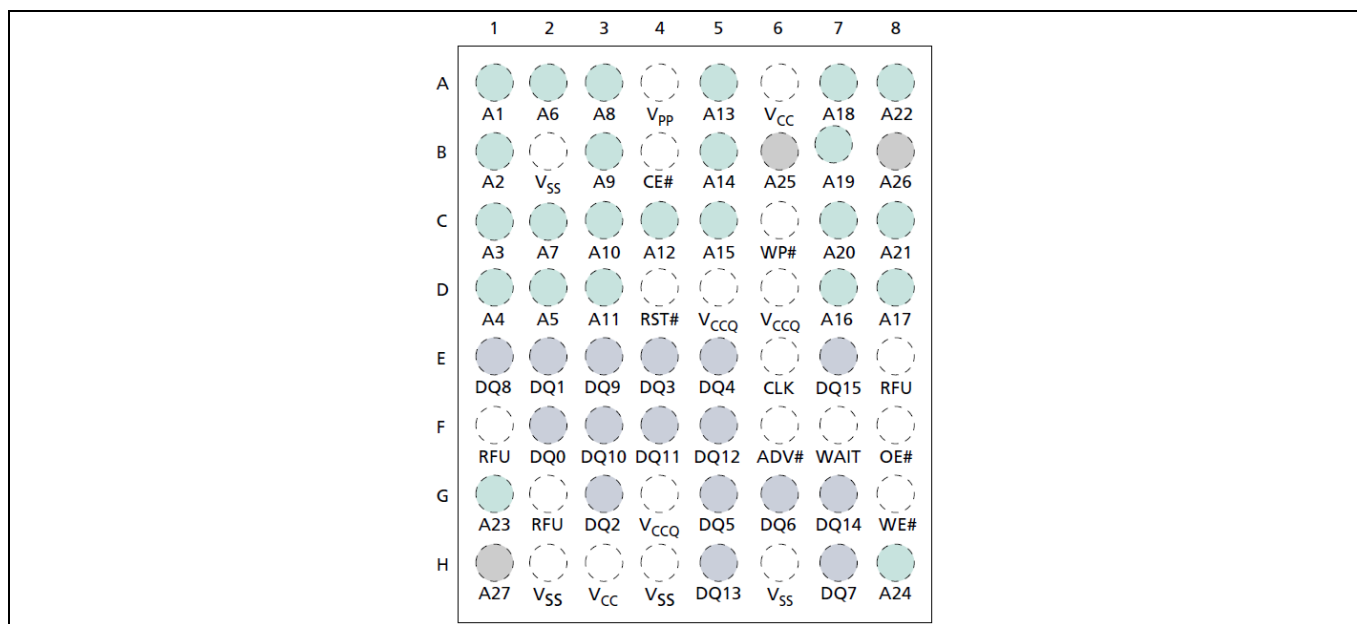


Figure 2 PC28FxxxP 64-ball Fortified BGA

Note:

1. A1 is the least significant address bit.
2. A25 is valid for 512Mb densities and above; otherwise, it is a no connect (NC).
3. A26 is valid for 1Gb densities and above; otherwise, it is a no connect (NC).
4. A27 is valid for 2Gb densities and above; otherwise, it is a no connect (NC).
5. A dimple on the package denotes Pin 1 which will always be in the upper left corner of the package, in reference to the product mark.

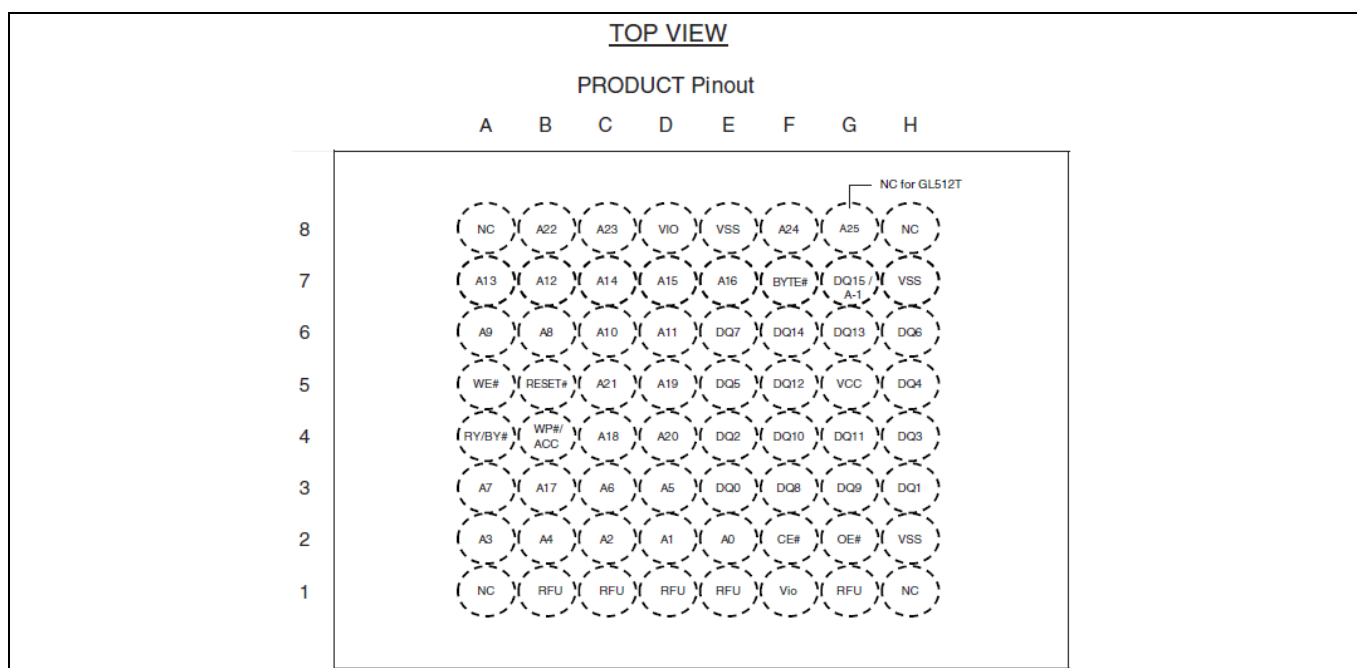


Figure 3 S29GL-S/S29GL-T 64-Ball Fortified BGA

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



Package Comparison

Note:

1. Balls A1, A8, H1, and H8, No Connect (NC).
2. Balls B1, C1, D1, E1, and G1 Reserved for Future Use (RFU).

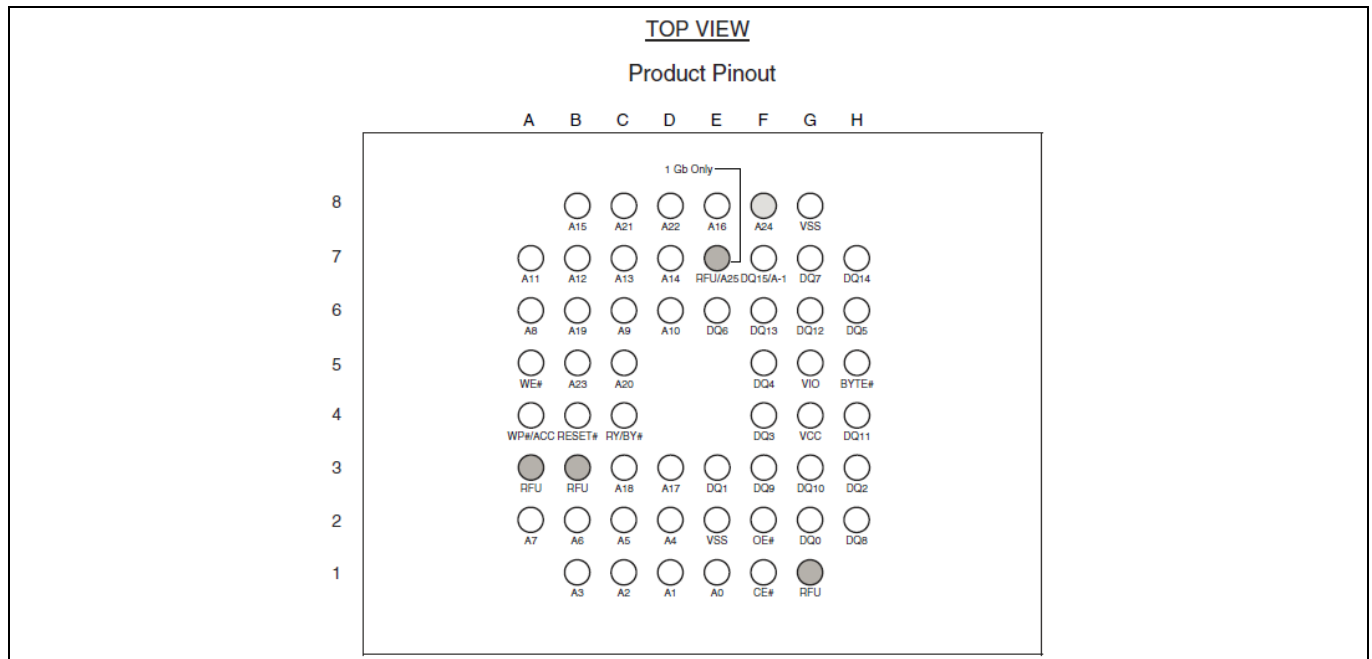


Figure 4 S29GL-S/S29GL-T 56-Ball Fortified BGA

Note:

1. Balls A3, B3, and G1 Reserved for Future Use (RFU).

4 Signal Comparison

Table 2 shows a signal comparison summary of Infineon S29GL-S/S29GL-T to PC28FxxxM/PC28FxxxP.

Table 2 Signal Comparison

PC28FxxxM/PC28FxxxP		S29GL-S/S29GL-T	
Symbol	Description	Symbol	Description
RESET#	Hardware Reset	RESET#	Hardware Reset
CE#	Chip Enable	CE#	Chip Enable
OE#	Output Enable	OE#	Output Enable
WE#	Write Enable	WE#	Write Enable
A _{MAX} –A0	Address inputs. A26–A0 for 2048 Mbit A25–A0 for 1024 Mbit A24–A0 for 512 Mbit A23–A0 for 256 Mbit	A _{MAX} –A0	Address inputs. A25–A0 for S29GL01GS(T) A24–A0 for S29GL512S(T)
DQ15–DQ0	Data inputs and outputs	DQ15–DQ0	Data inputs and outputs
V _{PP} /WP#	V _{PP} /Write Protect	WP#	Write Protect
BYTE#	Selects data bus width	BYTE#	Selects data bus width (S29GL-T only)
RY/BY#	Ready/Busy	RY/BY#	Ready/Busy
V _{CC}	Supply voltage	V _{CC}	Core power supply
V _{CCQ}	I/O supply voltage	V _{IO}	Versatile I/O power supply
V _{SS}	Ground	V _{SS}	Power supplies ground
NC	Not Connected internally	NC	Not Connected internally
RFU	Reserved for Future Use	RFU	Reserved for Future Use
DNU	Do Not Use	DNU	Do Not Use

5 Command Set Comparison

For comparison, PC28F and S29GL-S/S29GL-T device commands vary from one to seven bus cycles, as shown in [Table 3](#) and [Table 4](#).

Table 3 Table. PC28F Command Set (x16)

Command and Code/Subcode	Cycles	Address and Data Cycles												Notes
		1 st		2 nd		3 rd		4 th		5 th		6 th		
		A	D	A	D	A	D	A	D	A	D	A	D	
Read and Autoselect Operations														
Read/Reset	1	X	F0											
	3	555	AA	2AA	55	X	F0							
Read CFI	1	55	98											
Autoselect	4	555	AA	2AA	55	555	90	*2	*2					2, 3, 4
Bypass Operations														
Unlock Bypass	3	555	AA	2AA	55	555	20							
Unlock Bypass Reset	2	X	90	X	00									
Program Operations														
Program	4	555	AA	2AA	55	555	A0	PA	PD					
Unlock Bypass Program	2	X	A0	PA	PD									5
Write to Buffer Program	5	555	AA	2AA	55	BAd	25	BAd	N	PA	PD			6, 7, 8
Unlock Bypass Write to Buffer Program	3	BAd	25	BAd	N	PA	PD							5
Write to Buffer Program Confirm	1	BAd	29											
Buffered Program Abort and Reset	3	555	AA	2AA	55	555	F0							
Enter Enhanced Buffered Program	3	555	AA	2AA	55	555	38							

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



Command Set Comparison

Command and Code/Subcode	Cycles	Address and Data Cycles												Notes
		1 st		2 nd		3 rd		4 th		5 th		6 th		
		A	D	A	D	A	D	A	D	A	D	A	D	
Enhanced Buffered Program	3	BAd	33	BAd	Data	BAd	Data							9
Exit Enhanced Buffered Program	2	X	90	X	00									
Enhanced Buffered Program Abort	3	555	AA	2AA	55	555	F0							
Program Suspend	1	X	B0											
Program Resume	1	X	30											

Erase Operations

Chip Erase	6	555	AA	2AA	55	555	80	555	AA	2AA	55	555	10	
Unlock Bypass Chip Erase	2	X	80	X	10									5
Block Erase	6	555	AA	2AA	55	555	80	555	AA	2AA	55	BAd	30	10
Unlock Bypass Block Erase	2	X	80	BAd	30									5
Erase Suspend	1	X	B0											
Erase Resume	1	X	30											

Blank Check Operations

Blank Check Setup	6	555	AA	2AA	55	BAd	EB	BAd	76	BAd	00	BAd	00	
Blank Check Confirm and Read	2	BAd	29	BAd	*2									2

Note:

1. A = Address; D = Data; X = Don't Care; BAd = Any address in the block; N = Number of bytes to be programmed; PA = Program Address; PD = Program Data; Gray shading = Not applicable. All values in the table are hexadecimal. Some commands require both a command code and subcode. For the 2Gb device, the set-up command must be issued for each selected die.
2. These cells represent read cycles (versus write cycles for the others).
3. Autoselect enables the device to read the Device ID, block protection status, and extended memory block protection indicator.

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



Command Set Comparison

- Autoselect addresses and data are specified in [Table 5](#).
- For any Unlock Bypass Erase/Program command, the first two Unlock cycles are unnecessary.
- BAd must be the same as the address loaded during the Write-to-Buffer Program 3rd and 4th cycles.
- Write-to-Buffer Program operation: maximum cycles = 261 (x8) and 517 (x16). Unlock Bypass Write-to-Buffer Program operation: maximum cycles = 259 (x8), 515 (x16). Write-to-Buffer Program operation: N + 1 = bytes to be programmed; maximum buffer size = 256 bytes (x8) and 1024 bytes (x16).
- For x8, A[*MAX*:7] address pins should remain unchanged while A[6:0] and A-1 pins are used to select a byte within the N + 1 byte page. For x16, A[*MAX*:9] address pins should remain unchanged while A[8:0] pins are used to select a word within the N+1 word page.
- Block Erase address cycles can extend beyond six address-data cycles, depending on the number of blocks to erase.

Table 4 S29GL-S/S29GL-T Major Command Set (x16)

Command Sequence ^{*1}	Cycles	Address and Data Cycles											
		1 st		2 nd		3 rd		4 th		5 th		6 th	
		A	D	A	D	A	D	A	D	A	D	A	D
Read ^{*6}	1	RA	RD										
Reset/ASO Exit ^{*7, *17}	1	XXX	F0										
Status Register Read	2	555	70	XXX	RD								
Status Register Clear	1	555	71										
Word Program	4	555	AA	2AA	55	555	A0	PA	PD				
Write to Buffer	6	555	AA	2AA	55	SA	25	SA	WC	WBL	PD	WBL	PD
Program Buffer to Flash	1	SA	29										
Write-to-Buffer-Abort Reset ^{*13}	3	555	AA	2AA	55	555	F0						
Chip Erase	6	555	AA	2AA	55	555	80	555	AA	2AA	55	555	10
Sector Erase ^{*20}	6	555	AA	2AA	55	555	80	555	AA	2AA	55	SA	30
Erase Suspend/Program Suspend Legacy Method ^{*11}	1	XXX	B0										
Erase Suspend Enhanced Method	1	XXX	B0										
Erase Resume/Program Resume Legacy Method ^{*12}	1	XXX	30										
Erase Resume Enhanced Method	1	XXX	30										
Program Suspend Enhanced Method	1	XXX	51										
Program Resume Enhanced Method	1	XXX	50										
Blank Check	1	(SA) 55	33										
Unlock Bypass													
Enter	3	555	AA	2AA	55	555	20						
Program ^{*9}	2	XXX	A0	PA	PD								

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



Command Set Comparison

Command Sequence ^{*1}	Cycles	Address and Data Cycles											
		1 st		2 nd		3 rd		4 th		5 th		6 th	
		A	D	A	D	A	D	A	D	A	D	A	D
Write-to-Buffer ^{*9}	4	SA	25	SA	WC	WBL	PD	WBL	PD				
Program Buffer to Flash (confirm)	1	SA	29										
Write-to-Buffer-Abort Reset ^{*13}	3	555	AA	2AA	55	555	F0						
Sector Erase ^{*9}	2	XXX	80	SA	30								
Chip Erase ^{*9}	2	XXX	80	XXX	10								
Command Set Exit ^{*10}	2	XXX	90	XXX	00								
ID-CFI (Autoselect) ASO													
ID (Autoselect) Entry	3	555	AA	2AA	55	(SA) 555	90						
CFI Enter ^{*8}	1	(SA) 55	98										
ID-CFI Read	1	RA	RD										
Reset/ASO Exit ^{*7, *18}	1	XXX	F0										

Legend:

X = Don't care.

RA = Address of the memory to be read.

RD = Data read from location RA during read operation.

PA = Address of the memory location to be programmed.

PD = Data to be programmed at location PA.

SA = Address of the sector selected. Address bits Amax-A16 uniquely select any sector.

WBL = Write Buffer Location. The address must be within the same Line.

WC = Word Count is the number of write buffer locations to load minus 1.

PWAx = PPB Password address for Word 0 = 00h, Word 1 = 01h, Word 2 = 02h, and Word 3 = 03h. SSR3 Password address for Word 0 = 10h, Word 1 = 11h, Word 2 = 12h, and Word 3 = 13h.

PWDx = Password data Word 0, Word 1, Word 2, and Word 3.

Gray vs. White Box = Read vs. Write Operation.

Note:

1. See Interface Status for description of bus operations on the S29GL-S/S29GL-T datasheet.
2. All values are in hexadecimal.
3. Except for the following, all bus cycles are write cycle: read cycle during Read, ID/CFI Read (Manufacturing ID / Device ID), Indicator Bits, Secure Silicon Region Read, SSR Lock Read, and 2nd cycle of Status Register Read.
4. Data bits DQ15-DQ8 are don't care in command sequences, except for RD, PD, WC and PWD.

Command Set Comparison

5. Address bits Amax-A11 are don't care for unlock and command cycles, unless SA or PA required. (Amax is the highest address pin.).
6. No unlock or command cycles required when reading array data.
7. The Reset command is required to return to reading the array data when the device is in the ASO mode, or if DQ5 goes HIGH (while the device is providing the status data).
8. The Command is valid when the device is ready to read the array data.
9. The Unlock-Bypass command is required prior to the Unlock-Bypass-Program and the Unlock-Bypass-Write to buffer commands.
10. The Unlock-Bypass-Reset command is required to return to reading the array data when the device is in the Unlock-Bypass mode.
11. The system can read and program/program suspend in non-erasing sectors, or enter the ID-CFI ASO, when in the Erase Suspend mode. The Erase Suspend command is valid only during a Sector Erase operation.
12. The Erase Resume/Program Resume command is valid only during Erase Suspend/Program Suspend modes.
13. Issue this command sequence to return to Read State after detecting device is in a Write-to-Buffer-Abort state.
IMPORTANT: The full command sequence is required if resetting out of ABORT.
14. The Exit command returns the device to reading the array.
15. The password portion can be entered or read in any order as long as the entire 64-bit password is entered or read. Addresses are 10h-13h if the SSR3 is being accessed.
16. For PWDx, only one portion of the password can be programmed per each A0 command. Portions of the password must be programmed in sequential order (PWD0 - PWD3).
17. All Lock Register bits are one-time programmable. The program state = 0 and the erase state = 1. Also, both the Persistent Protection Mode Lock Bit and the Password Protection Mode Lock Bit cannot be programmed at the same time; the Lock Register Bits Program operation halts and returns the device to Read State if you attempt this. Lock Register Bits that are reserved for future use are undefined.
18. If any of the Entry commands was issued, an Exit command must be issued to reset the device into Read State.
19. Protected State = 00h, Unprotected State = 01h. The sector address for DYB set, DYB clear, or PPB Program command may be any location within the sector - the lower order bits of the sector address are don't care.
20. See Sector Erase Section for description of Multi-Sector Erase from the S29GL-S/S29GL-T datasheet.

6 Device ID Comparison

This section provides a comparison between Micron PC28F families (PC28FxxxM and PC28FxxxP) and Infineon S29GL-S/S29GL-T flash memory Device ID.

Table 5 Device ID Comparison

			Infineon	Micron
		Address (x16)		PC28F 2 Gbit
Manufacturer ID				0089h
Device ID	Word 1			227Eh
	Word 2			2248h
	Word 3			2201h
			Infineon	Micron
		Address (x16)	S29GL01GS(T)	PC28F 1 Gbit
Manufacturer ID		(Base)+00h	0001h	0089h
Device ID	Word 1	(Base)+01h	227Eh	227Eh
	Word 2	(Base)+0Eh	2228h	2228h
	Word 3	(Base)+0Fh	2201h	2201h
			Infineon	Micron
		Address (x16)	S29GL512S(T)	PC28F 512 Mbit
Manufacturer ID		(Base)+00h	0001h	0089h
Device ID	Word 1	(Base)+01h	227Eh	227Eh
	Word 2	(Base)+0Eh	2223h	2223h
	Word 3	(Base)+0Fh	2201h	2201h
			Infineon	Micron
		Address (x16)	S29GL256S	PC28F 256 Mbit
Manufacturer ID		(Base)+00h	0000h	0089h
Device ID	Word 1	(Base)+01h	227Eh	227Eh
	Word 2	(Base)+0Eh	2222h	2222h
	Word 3	(Base)+0Fh	2201h	2201h

7 Status Register Comparison

PC28F supports Status Register reads as an alternative method to data polling to determine the embedded operation status. The Status Register feature is also supported on S29GL-S/S29GL-T family. The 16-bit Status Register is accessed via a two-cycle sequence consisting of a Read Status Register Command write cycle followed immediately by a read cycle to the same targeted sector address. Using the Status Register is advantageous because, unlike legacy data polling, software does not need to track active address regions or compare sequential polling read values to determine embedded algorithm status; one Status Register access provides all the information necessary to determine the flash state. A Clear Status Register command is available to reset the last completed embedded operation portion of the Status Register.

Status Register usage is optional. If required, software can be modified to take advantage of this feature by querying the Lower Software Bits at offset 000Ch in Autoselect mode. If Bit 0 is set, the Status Register functionality is supported. Details of the Status Register implementation are provided in the S29GL-S/S29GL-T datasheet.

The status register contains bits related to the results - success or failure - of the most recently completed Embedded Algorithms (EA) and bits related to the current state of any EA in process:

- Erase Status (Bit 5)
- Program Status (Bit 4)
- Write Buffer Abort (Bit 3)
- Sector Locked Status (Bit 1)
- RFU (Bit 0)

Current State of EA in Process:

- Device Busy (Bit 7)
- Erase Suspended (Bit 6)
- Program Suspended (Bit 2)

The Current State bits indicate whether an EA is in process, suspended, or completed. The upper eight bits (Bits 15:8) are reserved. These have undefined HIGH or LOW value that can change from one status read to another. These bits should be treated as don't care and ignored by any software reading the status. The Soft Reset Command will clear bits [5, 4, 1, 0] of the status register to 0 if Status Register Bit 3 = 0. This will not affect the Current State bits. The Clear Status Register command will clear the results related bits of the status register to 0, but will not affect the Current State bits.

Table 6 PC28F Status Register

Bit	Name	Settings	Description	Note
DQ7	Data Polling Bit	0 or 1, depending on operations	Monitors whether the program/erase has successfully completed its operation, or has responded to an Erase Suspend operation.	2, 3, 4
DQ6	Toggle Bit	Toggles: 0 to 1; 1 to 0; and so on	Monitors whether the program/erase has successfully completed its operations, or has responded to an Erase Suspend operation. During a Program/Erase operation, DQ6 toggles from 0 to 1, 1 to 0, and so on, with each successive read operation from any address.	3, 4, 5
DQ5	Error Bit	0 = Success 1 = Failure	Identifies errors detected by the program/erase. DQ5 is set when a Program, Block Erase, or Chip Erase operation fails to write the correct data to the memory.	4, 6

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



Status Register Comparison

Bit	Name	Settings	Description	Note
DQ3	Erase Timer Bit	0 = Erase not in progress 1 = Erase in progress	Identifies the start of program/erase operation during a Block Erase command. Before the program/erase controller starts, this bit set to 0, and additional blocks to be erased can be written to the command interface.	4
DQ2	Alternative Toggle Bit	Toggles: 0 to 1; 1 to 0; and so on	Monitors the program/erase during Erase operations. During Chip Erase, Block Erase, and Erase Suspend operations, DQ2 toggles from 0 to 1, 1 to 0, and so on, with each successive read operation from addresses within the blocks being erased.	3, 4
DQ1	Buffered Program Abort Bit	1 = Abort	Indicates a buffer program operation abort. The Buffered Program Abort and reset command must be issued to return the device to read mode.	

Note:

1. The status register can be read during Program, Erase, or Erase Suspend operations; the Read operation outputs data on DQ[7:0].
2. For a Program operation in progress, DQ7 outputs the complement of the bit being programmed. For a read operation from the address previously programmed successfully, DQ7 outputs the existing DQ7 data. For a read operation from addresses with blocks to be erased while an Erase Suspend operation is in progress, DQ7 outputs 0; upon a successful completion of the Erase Suspend operation, DQ7 outputs 1. For an erase operation in progress, DQ7 outputs 0; upon either operation's successful completion, DQ7 outputs 1.
3. After the successful completion of a Program or Erase operation, the device returns to read mode.
4. During Erase Suspend mode, read operations to addresses within blocks not being erased output the memory array data as if in read mode. A protected block is treated in the same way as a block not being erased.
5. During Erase Suspend mode, DQ6 toggles when addressing a cell within a block being erased. The toggling stops when the program/erase has suspended the erase operation.
6. When DQ5 is set to 1, a Read/Reset command must be issued before any subsequent command.

Table 7 S29GL-S/S29GL-T Status Register

Bit #	15:8	7	6	5	4	3	2	1	0
Bit Description	Reserved	Device Ready Bit	Erase Suspend Status Bit	Erase Status Bit	Program Status Bit	Write Buffer Abort Status Bit	Program Suspend Status Bit	Sector Lock Status Bit	Continuity Check Bit
Bit Name		DRB	ESSB	ESB	PSB	WBASB	PSSB	SLSB	CC
Reset Status	X	1	0	0	0	0	0	0	0
Busy Status	Invalid	0	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Ready Status	X	1	0 = No erase in suspension 1 = Erase in suspension	0 = Erase successful 1 = Erase fail	0 = Program successful 1 = Program fail	0 = Program not aborted 1 = Program aborted	0 = No program in suspension 1 = Program in suspension	0 = Sector not locked during operation	X

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



Status Register Comparison

Bit #	15:8	7	6	5	4	3	2	1	0
						during Write to Buffer command		1 = Sector locked error	

Note:

1. Bits 15 through 8 are RFU and may display as 0 or 1. These bits should be ignored (masked) when checking the status.
2. Bit 7 is 1 when there is no Embedded Algorithm in progress in the device.
3. Bits 6 through 1 are valid only if Bit 7 is 1.
4. All bits are put in their reset status by a cold reset or warm reset.
5. Bits 5, 4, 3, and 1 are cleared by the Clear Status Register command or Reset command.
6. Upon issuing the Erase Suspend Command, you must continue to read the status register until DRB becomes 1.
7. ESSB is cleared by the Erase Resume Command.
8. ESB reflects the success or failure of the most recent erase operation.
9. PSB reflects the success or failure of the most recent program operation.
10. During Erase Suspend, programming to the suspended sector or a sector in the queue, will be ignored and no error is reported.
11. Upon issuing the Program Suspend command, you must continue to read the Status Register until DRB becomes 1.
12. PSSB is cleared by the Program Resume Command.
13. SLSB indicates that a program or erase operation failed because the sector was locked.
14. SLSB reflects the status of the most recent program or erase operation.

8 DC Specifications

S29GL-S/S29GL-T and PC28F have primarily compatible specifications. Differences in DC Characteristics between the devices are highlighted in [Table 8](#). The potential impact of any parameter specification differences should be evaluated and validated. Refer to the respective Micron PC28F and Infineon S29GL-S/S29GL-T datasheets to verify the latest specifications.

Table 8 DC Specifications

	Infineon			Micron					
	S29GL-S/S29GL-T			PC28FxxxM			PC28FxxxP		
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
Input Load Current		+0.02 μ A	± 1.0 μ A			± 1 μ A			± 2 μ A (512 Mb, 1 Gb) ± 4 μ A (2 Gb)
Output Leakage Current		+0.02 μ A	± 1.0 μ A			± 1 μ A			± 10 μ A (512 Mb, 1 Gb) ± 20 μ A (2 Gb)
V _{CC} Active Read Current (5 MHz)		55 mA	60 mA		26 mA	31 mA		26 mA	31 mA
V _{CC} Intra-Page Read Current		9 mA	25 mA		12 mA	16 mA		16 mA	18 mA
V _{CC} Active Erase/Program Current		45 mA	100 mA		35 mA	50 mA			20 mA
V _{CC} Standby Current		70 μ A	100 μ A		2 μ A	15 μ A			100 μ A
V _{CC} Reset Current		10 mA	20 mA		0.2 μ A	5 μ A			
Automatic Sleep Mode		3 mA	6 mA						
V _{CC} Current During Power Up		53 mA	80 mA						
Input LOW Voltage	-0.5 V		0.3 \times V _{IO} V	-0.5 V		0.8 V	-0.5 V		0.4 V (CMOS input) 0.6 V (TTL input)
Input HIGH Voltage	0.7 \times V _{IO} V		V _{IO} + 0.4 V	0.7 \times V _{IO} V		V _{IO} + 0.4 V	V _{IO} - 0.4 V (CMOS input) 2 V (TTL input)		V _{IO} + 0.5 V
Output LOW Voltage			0.15 \times V _{IO} V			0.15 \times V _{IO} V			0.2 V

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



DC Specifications

	Infineon			Micron					
	S29GL-S/S29GL-T			PC28FxxxM			PC28FxxxP		
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
Output HIGH Voltage	0.85 × V_{IO} V			0.85 × V_{IO} V			$V_{IO} - 0.2$ V		

9 Program or Erase Suspend / Resume

There are specification differences at Program or Erase Suspend / Resume specifications between Micron and Infineon flash memory devices.

Table 9 Program or Erase Suspend / Resume Specification

		Infineon		Micron	
		S29GL-S/S29GL-T		PC28F	
		Typ	Max	Typ	Max
Erase	Erase Suspend latency		50 μ s	27 μ s	32 μ s
Erase Suspend	Erase Resume to next Erase Suspend	100 μ s			
Program	Program Suspend latency		50 μ s	27 μ s	32 μ s
Program Suspend	Program Resume to next Program Suspend	100 μ s			

10 Power Up Timing

This section provides a comparison of power up timing of Micron and Infineon flash memory devices.

Table 10 Power Up Timing Specification

	Infineon	Micron
	S29GL-S/S29GL-T	PC28F
	Min	Min
V _{CC} setup time to first access	300 µs	350 µs
V _{IO} setup time to first access	300 µs	350 µs
RESET# LOW to CE# LOW during embedded operation	35 µs (Max)	32 µs (Max)
RESET# pulse width during embedded operation	200 ns	50 µs
Time between RESET# HIGH and CE# LOW	50 ns	50 ns

References

- [1] Micron Parallel NOR Flash Embedded Memory PC28F256M29EWxx datasheet
- [2] Micron Parallel NOR Flash Embedded Memory (P30-65nm) PC28F512P30BFx datasheet

Migration from Micron PC28F to Infineon S29GL-S/S29GL-T NOR Flash Family



Revision history

Revision history

Document version	Date of release	Description of changes
**	2018-12-19	Initial release
*A	2021-06-11	Updated to Infineon template

Trademarks

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

Edition 2021-06-11

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

002-25881 Rev. *A

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.