

HYC3N064, HYC3N128, HYC3N256

SD Cards

64,128,256 MB

SDA 1.01



Never stop thinking.

Edition 2004-10-27

**Published by Infineon Technologies AG,
St.-Martin-Strasse 53,
81669 München, Germany**

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Page	Subjects (major changes since last revision)
	Table 3 - Physical dimension was updated in the Thickness parameters for miniSD
	Figure 4 - Label Cavity Dimension was updated
Previous Version:	DS0301-1.40
Page	Subjects (major changes since last revision)
	CID and CSD registers added
	Reflection of the new non protected user area size
	miniSD form factor added
	Ordering information chapter updated
	Document look has changed (TOC added)
Previous Version:	DS0301-1.30
Page	Subjects (major changes since last revision)
	Editorial changes and corrections
Previous Version:	DS0301-1.20
Page	Subjects (major changes since last revision)
	Introduction of CE and FCC approval notes
Previous Version:	DS0301-1.10
Page	Subjects (major changes since last revision)
	TwinFlash name introduced
Previous Version:	DS0301-1.00
Page	Subjects (major changes since last revision)
	Initial Public Release

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1 Scope

This document describes the key features and specifications of the SD Card.

1.1 Product Models

The SD Card is available in the capacities shown in Table 1

Table 1 SD Card Capacities

Model No.	Densities
HYC3N064	64 MB
HYC3N128	128 MB
HYC3N256	256 MB

1.2 System Features

The SD Card provides the following features:

- Capacity: 64 MB¹⁾, 128 MB²⁾, 256 MB³⁾.
- SD Card protocol compatible.
- Supports SPI Mode.
- Targeted for portable and stationary applications for secured (copyright protected) and non-secured data storage.
- Voltage range:
 - Basic communication (CMD0, CMD15, CMD55, ACMD41): 2.0 to 3.6 V
 - Other commands and memory access: 2.7 to 3.6 V
- Functional clock rate 0-25 MHz.
- Transparent correction of memory field errors.
- Copyright Protection Mechanism - Complies with highest security of SDMI standard.
- Write Protect feature using mechanical switch.
- Built-in write protection features (permanent and temporary).
- Application specific commands.
- Comfortable erase mechanism.

The performance of the communication channel is described in Table 2.

Table 2 SD Bus/SPI Bus Comparison

SD Card Using SD Bus	SD Card Using SPI Bus
Six-wire communication channel (clock, command, 4 data lines).	Three-wire serial data bus (Clock, DataIn, DataOut) + card specific CS signal (hardwired card selection).
Error-protected data transfer.	Optional non-protected data transfer mode available.
Single or multiple block oriented data transfer.	Single or multiple block oriented data transfer.

- 1) Actual capacity: unprotected user area is 62,128,128 Bytes
- 2) Actual capacity: unprotected user area is 125,698,048 Bytes
- 3) Actual capacity: unprotected user area is 253,362,176 Bytes

1.3 Approvals



EU Declaration of Conformity:

Infineon Flash GmbH & Co. KG declares, that the products: SD Card HYC3N064, HYC3N128, HYC3N256 conforms to the following standards:

EN 55022:1998+A1:2001+A2:2003

EN 55024:1998+A1:2001+A2:2003

Conformity was verified by TÜV Rheinland - Report 21110964_001 of 2004-02-05.

This product carries the CE mark in accordance with the related European Directives.



US Declaration of Conformity:

Infineon Flash GmbH & Co. KG declares, that the products: SD Card HYC3N064, HYC3N128, HYC3N256 conforms to the following standards:

FCC 47 CFR Ch.1 Part 15

Conformity was verified by TÜV Rheinland - Report 21110965_001 of 2004-02-05.

1.4 SD Card Standard

Infineon Flash SD Cards are fully compatible with the SD Card Physical Layer Specification Version 1.01 standard [SD_Physical].

This specification may be obtained from:

SD Card Association

53 Muckelemi St.

P.O. Box 189

San Juan Bautista, CA 95045-0189

USA

Phone: 831-623-2107

Fax: 831-623-2248

E-mail: rcreech@sdcard.org

homepage: <http://www.sdcard.org>

2 Card Outline

The SD card is available in a choice of two packages:

- Full size—used in most common applications
- miniSD—used mainly in mobile phones. The reduced size version can be used in full size applications by means of an extension adapter. Special grips and notches allow the adapter to be attached to it.

2.1 Physical specifications

Table 3 Physical Specifications

Weight	2.0 g maximum (full size) 1.0 g maximum (miniSD)
Length	32 mm \pm 0.1 mm (full size) 21.5 mm \pm 0.1 mm (miniSD)
Width	24 mm \pm 0.1 mm (full size) 20 mm \pm 0.1 mm (miniSD)
Thickness	2.1 mm \pm 0.15 mm (full size) 1.4 mm \pm 0.10 mm (miniSD)

2.2 Dimensions

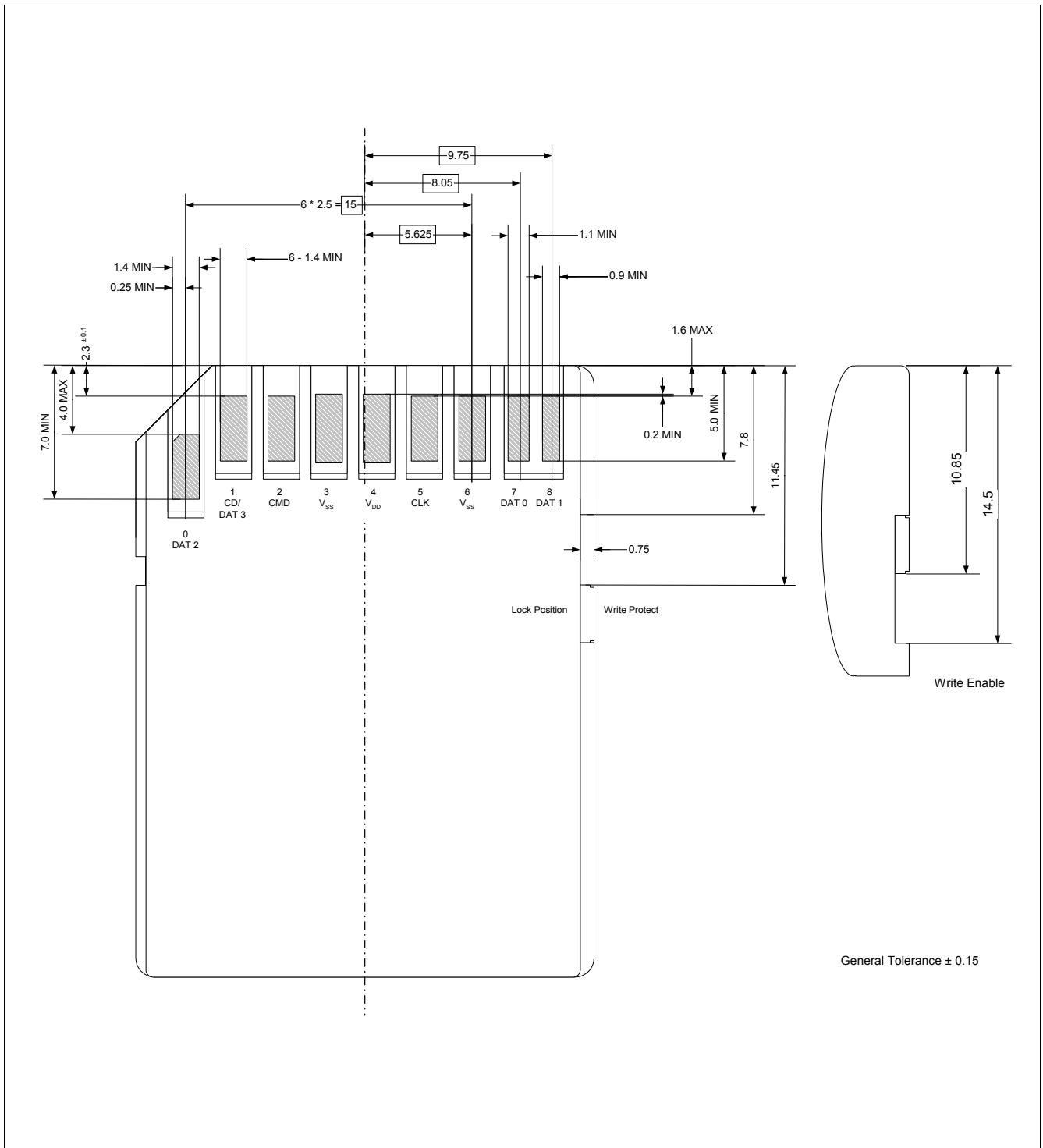


Figure 1 SD Card Dimensions (Pads)

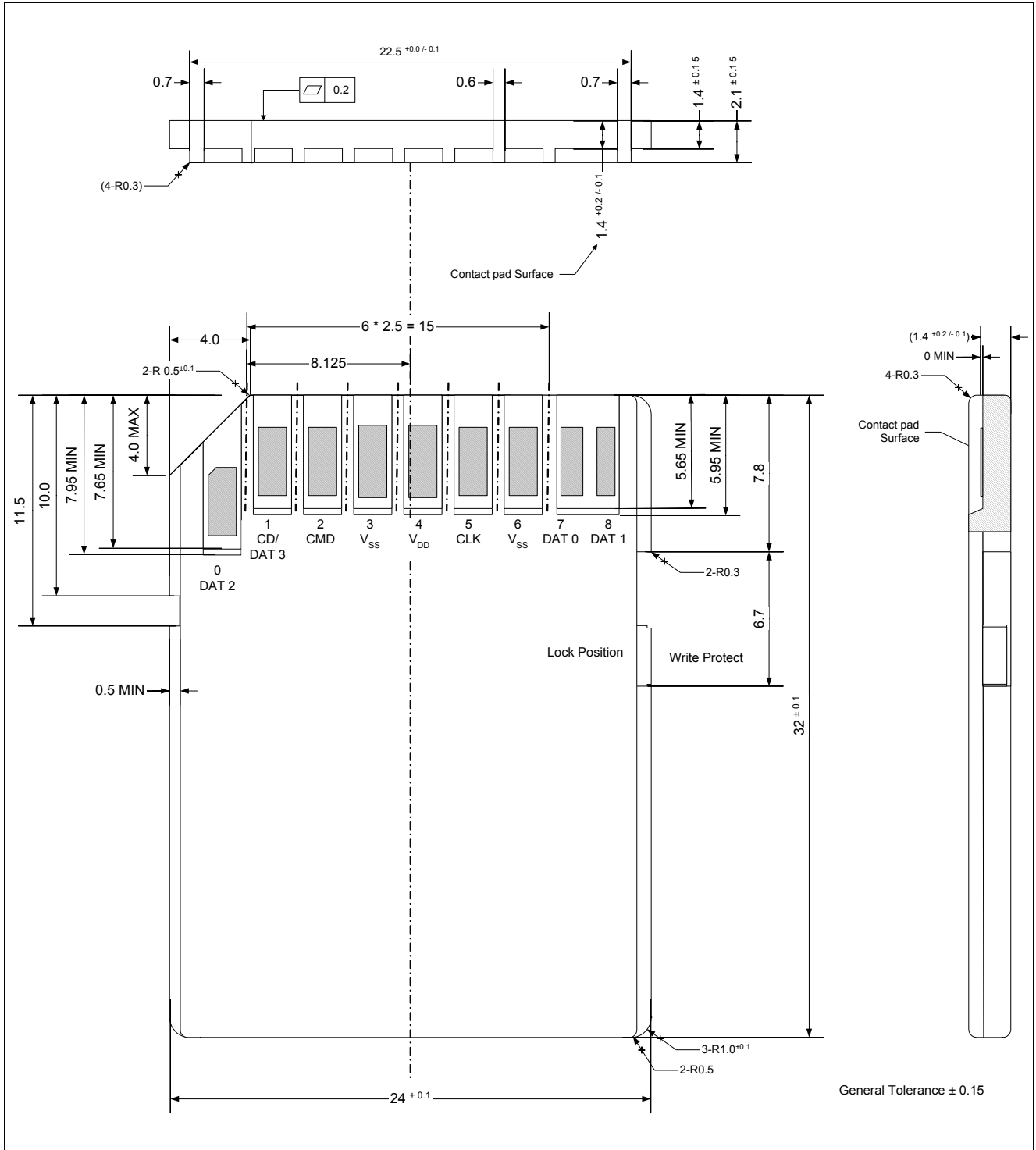


Figure 2 SD Card Dimensions (Outline)

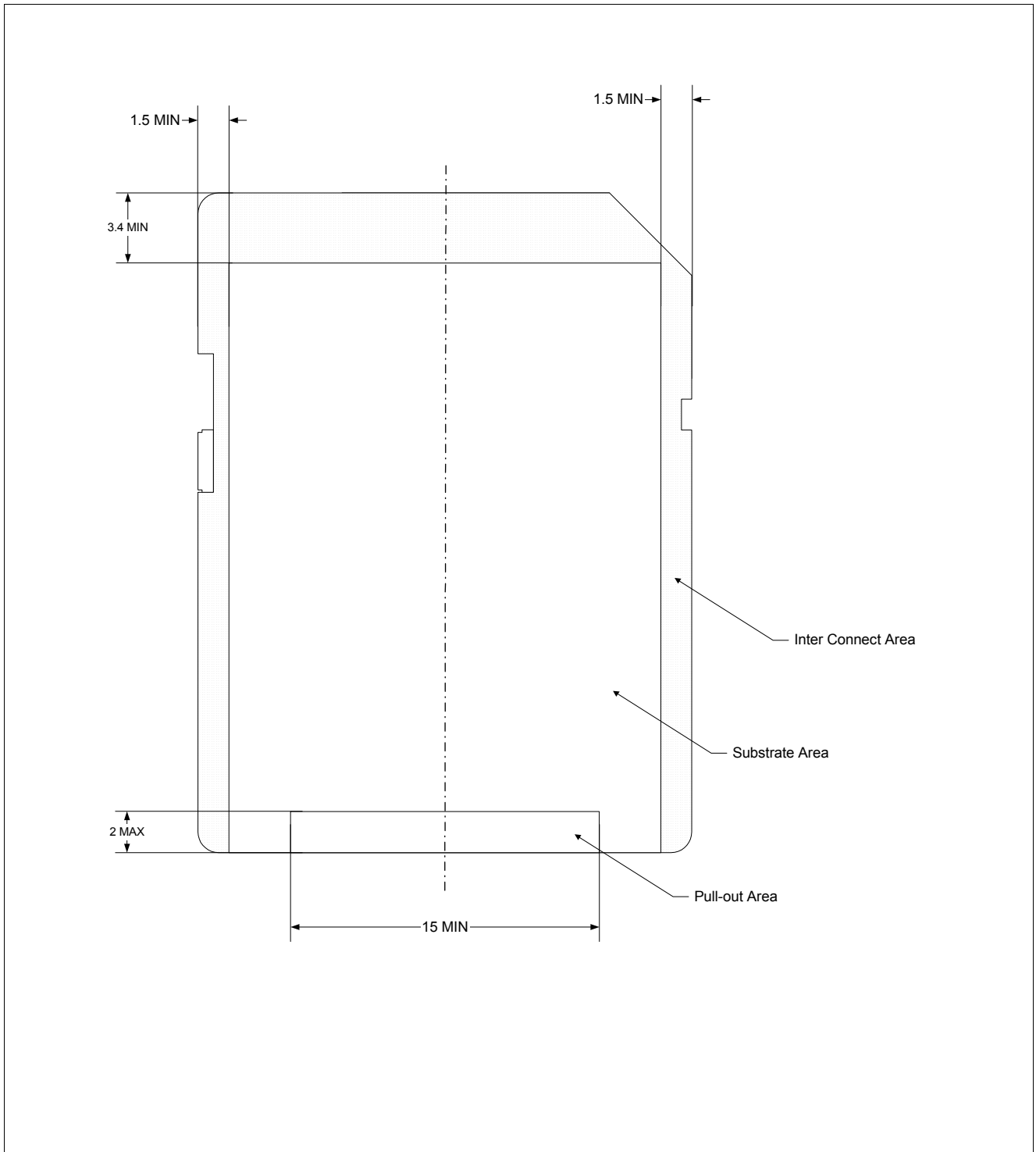


Figure 3 SD Card Dimensions (Interconnection)

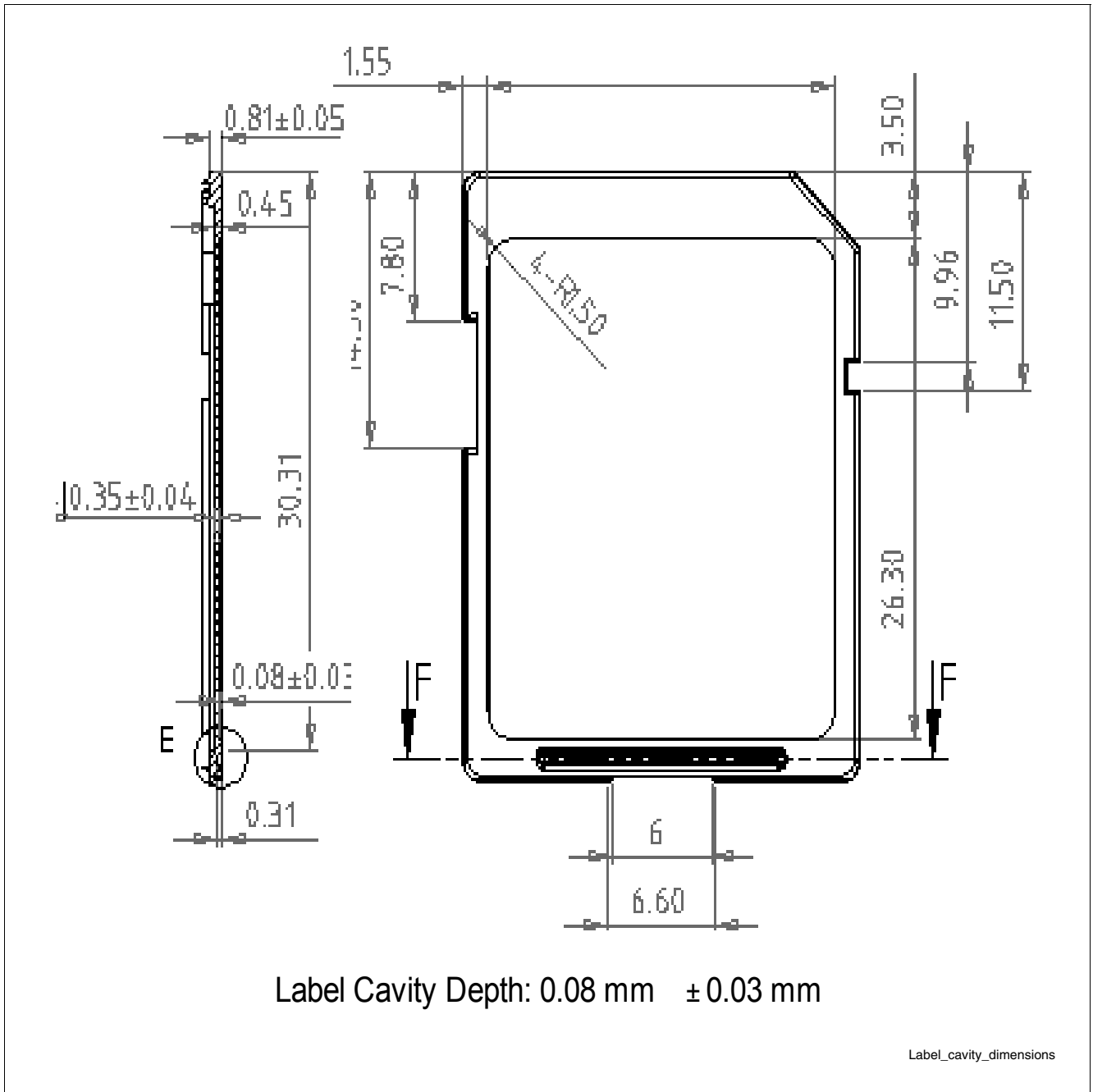


Figure 4 Label Cavity Dimensions

3 Card Registers

There is a set of seven registers within the card interface. The OCR, CID, CSD, and SCR registers carry the card configuration information. The RCA register holds the Card Relative Communication Address for the current session. The card status and SD status registers hold the communication protocol related status of the card.

3.1 CID Register

The CID register is 16 bytes long and contains a unique card identification number as shown in Table 5. It is programmed during card manufacturing and cannot be changed by SD hosts. Note that the CID register in the SD Card has a different structure than the CID register in the MultiMediaCard.

Table 5 CID Register

Name	Type	Width	CID-Slice	Comments	CID Value
MID - Manufacturer ID	Binary	8	[127:120]	The manufacturer IDs are controlled and assigned by the SD Card Association.	18 _H
OID - OEM/Application ID	ASCII	16	[119:104]	Identifies the card OEM and/or the card contents. The OID is assigned by the 3C.	'IF' = 4946 _H
PNM - Product Name	ASCII	40	[103:64]	5 ASCII characters long	"256MB", "128MB", "064MB"
PRV - Product Revision	Binary	8	[63:56]	Incremental number indicating the Product Revision for SD256, SD128 and SD064	For example 01 _H
PSN - Serial Number	Binary	32	[55:24]	32 Bits unsigned integer	Product Serial Number
Reserved		4	[23:20]		
MDT - Manufacture Date Code	BCD	12	[19:8]	Manufacture date-ymm (offset from 2000)	Manufacturer date (for example: Apr. 2001 = 014h)
CRC - CRC7 checksum	Binary	7	[7:1]	Calculated	CRC7
Not used, always '1'		1	[0:0]		

3.2 CSD Register

The Card Specific Data (CSD) register contains configuration information required in order to access the card data. In Table 4, the cell type column defines the CSD field as Read only (R), One Time Programmable (R/W) or erasable (R/W/E). This table shows, for each field, the value in “real world” units and coded according to the CSD structure. The CSD register in the SD Card has a different structure than the CSD in the MultiMediaCard.

Table 6 CSD Register

Name	Field	Width	Cell Type	CSD-slice	CSD Value	CSD Code
CSD structure	CSD_STRUCTURE	2	R	[127:126]	1.0	00 _b
Reserved	-	6	R	[125:120]	-	000000 _b
data read access-time-1	TAAC	8	R	[119:112]	2.5 msec	00110110 _b
data read access-time-2 in CLK cycles (NSAC*100)	NSAC	8	R	[111:104]	0	00000000 _b
max. data transfer rate	TRAN_SPEED	8	R	[103:96]	25 [Mbit/s]	00110010 _b
card command classes	CCC	12	R	[95:84]	Classes 0,2,4,5,6,8	175 _H
max. read data block length ¹⁾	READ_BL_LEN	4	R	[83:80]	512 Bytes	1001 _b
partial blocks for read allowed	READ_BL_PARTIAL	1	R	[79:79]	Yes	1 _b
write block misalignment	WRITE_BLK_MISALIGN	1	R	[78:78]	No	0 _b
read block misalignment	READ_BLK_MISALIGN	1	R	[77:77]	No	0 _b
DSR implemented	DSR_IMP	1	R	[76:76]	No	0 _b
Reserved	-	2	R	[75:74]	-	00 _b
device size ¹⁾	C_SIZE	12	R	[73:62]	SD256=1932 SD128=1917 SD064=1895	78C _H 77D _H 767 _H
64 MB						
max. read current @V _{DD} min.	VDD_R_CURR_MIN	3	R	[61:59]	60 [mA]	110 _b
max. read current @V _{DD} max	VDD_R_CURR_MAX	3	R	[58:56]	80 [mA]	110 _b
max. write current @V _{DD} min.	VDD_W_CURR_MIN	3	R	[55:53]	60 [mA]	110 _b
max. write current @V _{DD} max	VDD_W_CURR_MAX	3	R	[52:50]	80 [mA]	110 _b
128 MB						
max. read current @V _{DD} min.	VDD_R_CURR_MIN	3	R	[61:59]	60 [mA]	110 _b
max. read current @V _{DD} max	VDD_R_CURR_MAX	3	R	[58:56]	80 [mA]	110 _b
max. write current @V _{DD} min.	VDD_W_CURR_MIN	3	R	[55:53]	60 [mA]	110 _b
max. write current @V _{DD} max	VDD_W_CURR_MAX	3	R	[52:50]	80 [mA]	110 _b
256 MB						
max. read current @V _{DD} min.	VDD_R_CURR_MIN	3	R	[61:59]	60 [mA]	110 _b
max. read current @V _{DD} max	VDD_R_CURR_MAX	3	R	[58:56]	80 [mA]	110 _b
max. write current @V _{DD} min.	VDD_W_CURR_MIN	3	R	[55:53]	60 [mA]	110 _b
max. write current @V _{DD} max	VDD_W_CURR_MAX	3	R	[52:50]	80 [mA]	110 _b

Table 6 CSD Register (cont'd)

device size multiplier ¹⁾	C_SIZE_MULT	3	R	[49:47]	SD256=256 SD128=128 SD064=64	110 _b 101 _b 100 _b
erase single block enable	ERASE_BLK_EN	1	R	[46:46]	Yes	1 _b
erase sector size	SECTOR_SIZE	7	R	[45:39]	128 blocks	1111111 _b
write protect group size	WP_GRP_SIZE	7	R	[38:32]	2 sectors	0000001 _b
write protect group enable	WP_GRP_ENABLE	1	R	[31:31]	Yes	1 _b
Reserved for MultiMediaCard compatibility		2	R	[30:29]	-	00 _b
write speed factor	R2W_FACTOR	3	R	[28:26]	x 32	101 _b
max. write data block length	WRITE_BL_LEN	4	R	[25:22]	512 Bytes	1001 _b
partial blocks for write allowed	WRITE_BL_PARTIAL	1	R	[21:21]	No	0 _b
Reserved	-	5	R	[20:16]	-	00000 _b
File format group	FILE_FORMAT_GRP	1	R/W	[15:15]	0	0 _b
copy flag (OTP)	COPY	1	R/W	[14:14]	Copy	0 _b
permanent write protection	PERM_WRITE_PROTECT	1	R/W	[13:13]	Not Protected	0 _b
temporary write protection	TMP_WRITE_PROTECT	1	R/W/E	[12:12]	Not Protected	0 _b
File format	FILE_FORMAT	2	R/W	[11:10]	HD w/partition	00 _b
Reserved	-	2	R/W/E	[9:8]	-	00 _b
CRC	CRC	7	R/W/E	[7:1]	-	CRC7
not used, always '1'	-	1	-	[0:0]	-	1 _b

1) The device size indicates the user area size. It does not include the protected area that is used for security applications

4 Product Specifications

For all the following specifications, values are defined at ambient temperature and nominal supply voltage unless otherwise stated.

4.1 System Environmental Specifications

Table 7 System Environmental Specifications

Temperature	Operating:	-25°C to +85°C
	Storage:	-40°C to +85°C
Humidity	Operating:	25% to 95%, non-condensing
	Storage:	25% to 95%, non-condensing
ESD Protection	Contact Pads:	± 4 kV, Human body model according to ANSI EOS/ESD-S5.1-1998 [ANSI]
	Non Contact Pad Area:	± 8 kV (coupling plane discharge)
		± 15 kV (air discharge) Human body model per [IEC61000-4-2]

4.2 Reliability and Durability

Table 8 Reliability and Durability Specifications

Durability	10,000 mating cycles
Bending	10 N
Torque	0.15 Nm or ±2.5 deg.
Drop Test	1.5 m free fall
UV Light Exposure	UV: 254 nm, 15 Ws/cm ² according to [ISO 7816-1]
Visual Inspection/Shape and Form	No warpage; no mold skin; complete form; no cavities; surface smoothness ≤ -0.1 mm/cm ² within contour; no cracks; no pollution (oil, dust, etc.)
Minimum Moving Force of WP Switch	40 gf (ensures that the WP switch will not slide while it is inserted in the connector).
WP Switch Cycles	Minimum 1,000 Cycles @ slide force 0.4 N to 5 N

4.3 Typical Card Power Requirements

Table 9 Card Power Requirements

V_{DD} (ripple: max, 60mV peak to peak)	2.7 to 3.6 V	
($T_a = -25^\circ\text{C}$ to $+85^\circ\text{C}$)		
	@ $V_{DD} = 2.7\text{ V}$	@ $V_{DD} = 3.6\text{ V}$
Operating current (maximum rates) $f_{clk} = 25\text{ MHz}, 0.5\text{ Mbyte/s}$	Read: 60 [mA]	Read: 80 [mA]
	Write: 60 [mA]	Write: 80 [mA]
($T_a = -25^\circ\text{C}$ to $+85^\circ\text{C}$)		
	Typ.	Max.
Sleep Current	300 μA	400 μA

4.4 System Performance

Table 10 System Performance¹⁾

	Typical	Maximum
Block Read Access Time	1.5 ms	100 ms
CMD1 to Ready (after power up)	50 ms	500 ms

1) All values quoted are under the following conditions:

- Voltage range: 2.7 to 3.6 V.
- Temperature range: -25°C to +85°C.
- Independent of the SD Card clock frequency.

4.5 System Reliability and Maintenance

Table 11 System Reliability and Maintenance Specifications

Preventive Maintenance	None
Endurance	100,000 write/erase cycles (typical)

5 Ordering Information

This chapter describes the coding system for Infineon Flash SD Cards products. To place orders for Infineon Flash products, contact Info@infineon.com.

SD Cards

- HYC3N064 - 64 MB
- HYC3N128 - 128 MB
- HYC3N256 - 256 MB

Table 12 Coding System

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Detail				Supply Voltage	Technology	Card size			Speed	Label Shortcut		Label Size	Content	Firmware		Controller Revision	Memory Revision	Package/Product Type (Temperature Range)
Code item																		

Table 13 SD Products Code Examples

Type 1	H	Y	C	3	N	0	6	4	0	N	O	0	0	A	A	1	A	A
Type 2	H	Y	C	3	N	1	2	8	0	N	O	0	0	A	A	1	A	A
Type 3	H	Y	C	3	N	2	5	6	0	N	O	0	0	A	A	1	A	A

Table 14 Coding Definitions

Digit No.	Definition	Length	Example	Meaning
4	Supply Voltage	1	3	3.3 V
5	Technology	1	N	TwinFlash
6-8	Memory Size in MB	3	064	64 MB
			128	128 MB
			256	256 MB
9	Speed	1	0	standard
10-11	Label Shortcut	2	IF	Standard Infineon
			NO	None
			Cx	Customer Specific Version x
12	Label Size	1	X ¹⁾	
13	Content	1	X ¹⁾	
14-15	Firmware	2	XX ¹⁾	
16	Controller Generation	1	X ¹⁾	
17	Memory Revision	1	A	First generation
18	Package/Product Type (Temperature Range)	1	A	SD Card (commercial)

1) X stands for definitions that are customer specific. Please contact your local Infineon sales contact to obtain the complete ordering number.

6 Terminology

A

ASCII American Standard Code for Information Interchange (ISO 8859-1)

B

BCD Binary Coded Decimal

broadcast a command sent to all cards on the SD bus

Byte 8 bits

C

CID Card IDentification number register

CLK clock signal

CMD command line or SD bus command (if extended CMDxx)

CRC Cyclic Redundancy Check

CS Chip Select

CSD Card Specific Data - stored in a card register

D

DAT data line

E

ECC Error Correction Code

F

Flash a type of multiple time programmable non-volatile memory

H

HD Hard Disk

High binary interface state with defined assignment to a voltage level represented by "1"

I

IDE Integrated Device Electronics - HD interface description

L

LCM Licensed Compliant Module

Low binary interface state with defined assignment to a voltage level represented by "0"

LSB Least Significant Bit

M

MMCA MultiMediaCard Association

MSB Most Significant Bit

MTB Multiple Time Programmable Memory

MTBF Mean Time Between Failures

MultiMediaCard Memory Card defined by the MultiMediaCard Association

N

NSAC defines the worst case before the clock rate dependent factor of the data access time

NVM Non-Volatile Memory - keeps state even if supply voltage is removed

O

open-drain a logical interface operation mode. An external resistor or current source is used to pull the interface level to HIGH. The internal transistor pushes it to LOW.

OTP One-Time Programmable

P	
payload	net data
PCMCIA	Personal Computer Memory Card International Association
PD	Portable Device
push-pull	a logical interface operation mode. A complementary pair of transistors is used to push the interface to HIGH or LOW.
R	
RCA	Relative Card Address register
ROM	Read-Only Memory
S	
SDA	Secure Digital Association
SDMI	Secure Digital Music Initiative
sector	a number of blocks, basic erase unit
SPI	Serial Peripheral Interface
stuff bit	filling bits to ensure fixed length frames for commands and responses
T	
TAAC	defines the time dependent factor
tag	marker used to select groups or sectors to erase
TBD	To Be Determined (in the future)
three-state driver	a driver stage which has three output driver stages: HIGH, LOW and high impedance (which means that the interface does not have any influence on the interface level)
token	code word representing a command
V	
V_{DD}	positive power supply
V_{SS}	power supply ground
others	
3C	3 founding companies of the SDA - Matsushita Electronic Industries, Toshiba, SanDisk

7 References

Document Ref.	Description, Status
ANSI	ANSI EOS/ESD-S5.1-1998 (www.ansi.org)
IEC61000-4-2	IEC61000-4-2 (www.iec.org)
ISO 7816-1	ISO/IEC 7816-1
JESD8-1A	JEDEC JESD8-1A (www.jedec.org)
SD_Sec	SD Memory Card Specifications Part 3 "Security Specification" Version 1.01, April 15, 2001
SD_App	SD Physical Specification's Application Notes
SD_Physical	SD Memory Card Specifications Part 1 "Physical Layer Specification" Version 1.01, April 15, 2001

User Note:

www.infineon.com