



uSIC 存储硬盘芯片

HTUSTUNNNN-XM 数据手册

修订历史

修订版本	日期	内容	修订人
V1.0	2020/06/10	初版	隗军宝
V1.1	2021/09/08	增加 512GB 容量 相关信息	隗军宝

产品概况

- 标称容量：16GB、32GB、64GB、128GB、256GB、512GB
- FLASH 类型：TLC NAND FLASH
- 尺寸规格：16mm(L) x 20mm(W) x 1.7mm(H)
- 接口规范
 - 满足协议 SATA Revision 3.1
 - 兼容 SATA 1.5Gbps, 3Gbps 及 6Gbps 接口
 - 最大连续读取速率：550MB/s
 - 最大连续写入速率：500MB/s
- 电源功耗：最大工作功耗 1.8W
- 工作温度：
 - 商业级(C)：0°C~+70°C
 - 工业级(I)：-25°C~+70°C
 - 宽温级(W)：-40°C~+85°C
- 认证标准：CE、FCC、RoHS

注：产品名称中 NNNN 标识容量，X 标识温度范围，具体含义请参见 2.2、2.5

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1、简介

鸿秦 uSIC 支持 SATA III 接口标准，具有集成主控、缓存、FLASH 于一体的单芯片解决方案 Micro SATA independent Chip，遵循 JESD-MO276 规范进行芯片结构设计高速率、轻量化、低功耗的优点，可完美应用于高集成的小型科技产品领域。

产品特性

- 高速 SATA III 接口
- 动态损耗均衡和静态损耗均衡算法
- 主动垃圾回收和被动垃圾回收算法
- FLASH 侧高效 ECC 算法
- 坏块管理算法
- SMART 信息管理
- 高可靠性保障

2、产品规格

2.1、通用规格

产品外形	uSIC
总线接口	SATA III
FLASH 类型	TLC NAND FLASH
尺寸规格	16mm(L) x 20mm(W) x 1.7mm(H)
输入电压	+3.3V±5%, +1.8V±5%,
产品重量	<2g

2.2、容量

型号中 NNNN	标称容量	默认实际容量
016G	16GB	14.7GB
032G	32GB	29.8GB
064G	64GB	59.6GB
128G	128GB	119.2GB
256G	256GB	238.5GB
512G	512GB	476.9GB

注：

- 1、实际容量受 NAND FLASH 颗粒选择及固件版本等的影响，数值会有所浮动；
- 2、“默认实际容量”的数值是由 HD Tune V5.0 测试得出；

2.3、性能

容量	连续读取 (MB/s)	连续写入 (MB/s)
16GB	285	70
32GB	290	75
64GB	550	250
128GB	550	450
256GB	550	480
512GB	550	500

注：

- 1、性能受测试平台、测试软件、环境、Flash 及固件版本等影响，数值会有所浮动；
- 2、测试环境：连续性能数值、随机性能数值均由 CrystalDiskMark5.1.2 测试得出；

2.4、功耗

容量	待机	读取	写入
16GB	0.4W	0.9W	1.1W
32GB	0.4W	1.0W	1.2W
64GB	0.4W	1.2W	1.3W
128GB	0.4W	1.3W	1.5W
256GB	0.4W	1.4W	1.7W
512GB	0.4W	1.5W	1.8W

注：

- 1、功耗受测试环境、Flash 及固件版本等影响，数值会有所差异；
- 2、功耗测试采用 IOMeter.2006.07.27 软件，在进行 1MB Sequential 100% read/write 时进行读取；
- 3、功耗测试不包含供电电路转换效率；

2.5、环境条件

工作温度 (产品命名中字母 “X” 取值)		▪ 商业级(C): 0°C~+70°C ▪ 工业级(I): -25°C~+70°C ▪ 宽温级(W): -40°C~+85°C
存储温度		-55°C ~ +95°C
湿度	工作湿度	5%~95% (不凝结)
	存储湿度	5%~95% (不凝结)
抗冲击能力		1500G (at 0.5ms half sine wave)
抗振动能力		15G (10 to 2000Hz)

2.6、可靠性

数据存取年限	10 年
平均无故障时间	2,000,000 小时
不可修复错误比特率	$\leq 10^{-16}$
容量	可写入数据总量

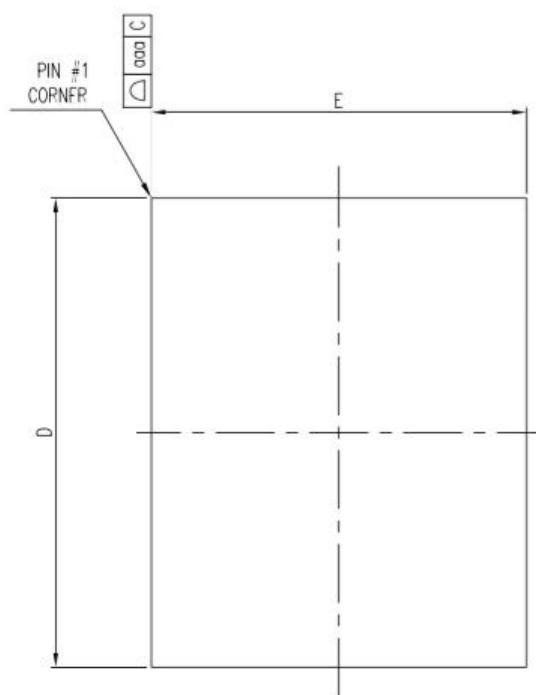
16GB	24TB
32GB	48TB
64GB	96TB
128GB	192TB
256GB	384TB
512GB	768TB

注:

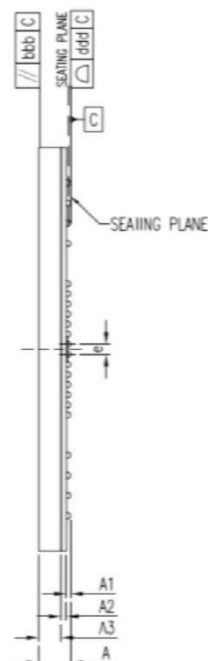
(1) 寿命与用户写入数据模型有关, 例如写缓存设置、IO 对齐、传输数据大小、随机与连续操作占比。不同的写入数据模型将得出不同的寿命结果。

(2) 1PB=1024TB, 1TB=1024GB。

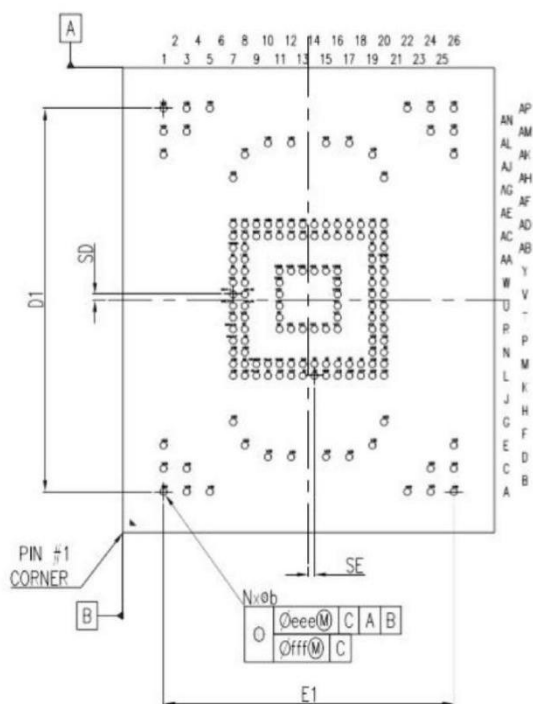
3、外形结构



顶视图



侧视图



底视图



N	SE (MM)	SD (MM)	D1 (MM)	E1 (MM)
156	0.25 BSC.	0.25 BSC.	16.50 BSC.	12.50 BSC.

Symbol	Dimension In MM		
	MIN.	NOM.	MAX.
A	1.45	1.57	1.70
A1	0.16	0.21	0.26
A2	0.26		
A3	1.10		
D	20		
E	16		
BALL DIAMEIER	0.30		
BALL OPENING	0.275		
b	0.25	0.30	0.35
e	0.50		
n	156		
D1	16.50 BSC		
E1	12.50 BSC		
SD	0.25 BSC		
SE	0.25 BSC		
JEDEC(REF)	MO-276(REF)		
aaa	0.15		
bbb	0.20		
ddd	0.08		
eee	0.15		
fff	0.05		

4、引脚定义

4.1、引脚排布

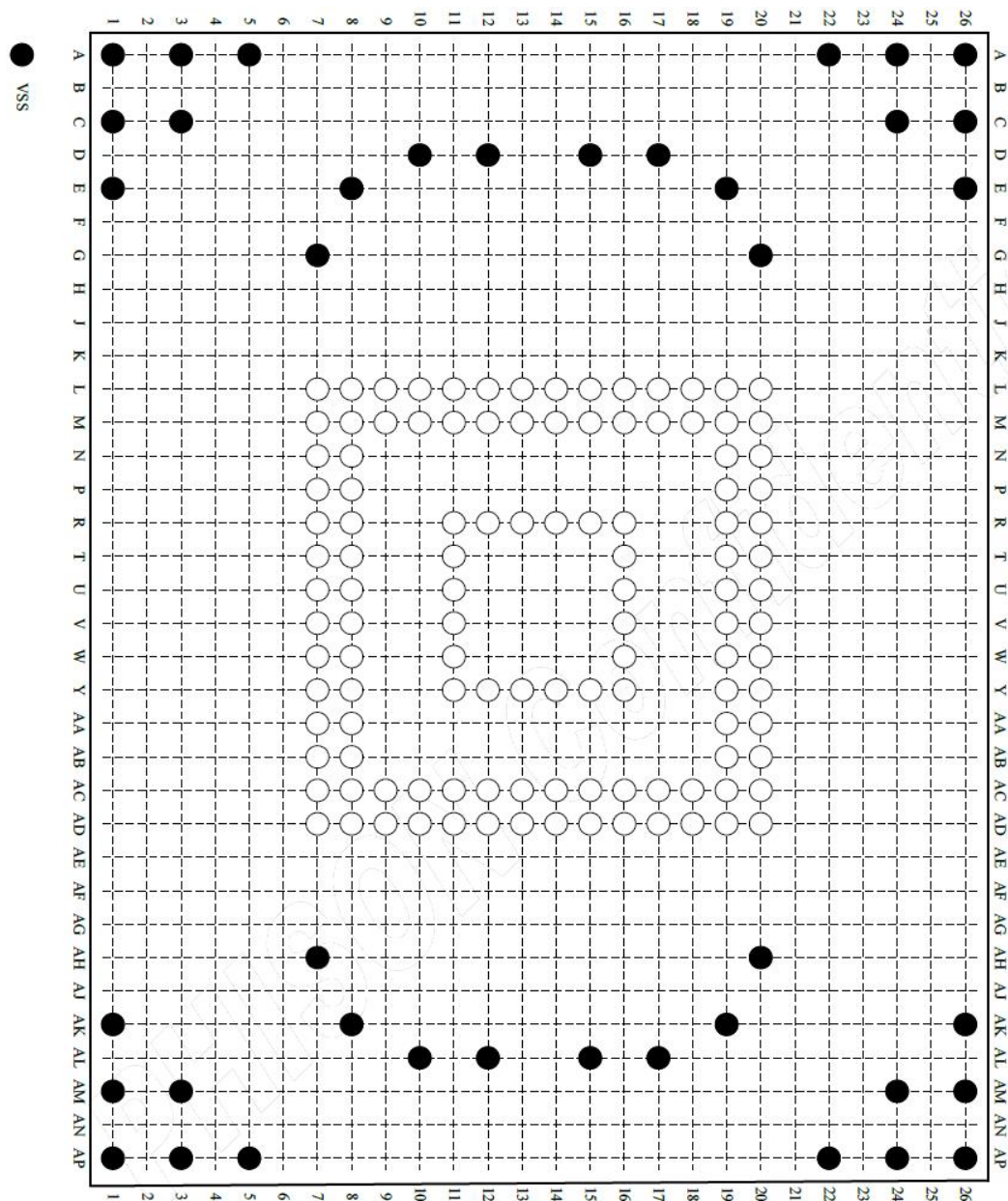


图 4-1 uSIC 引脚分配 (顶视图)

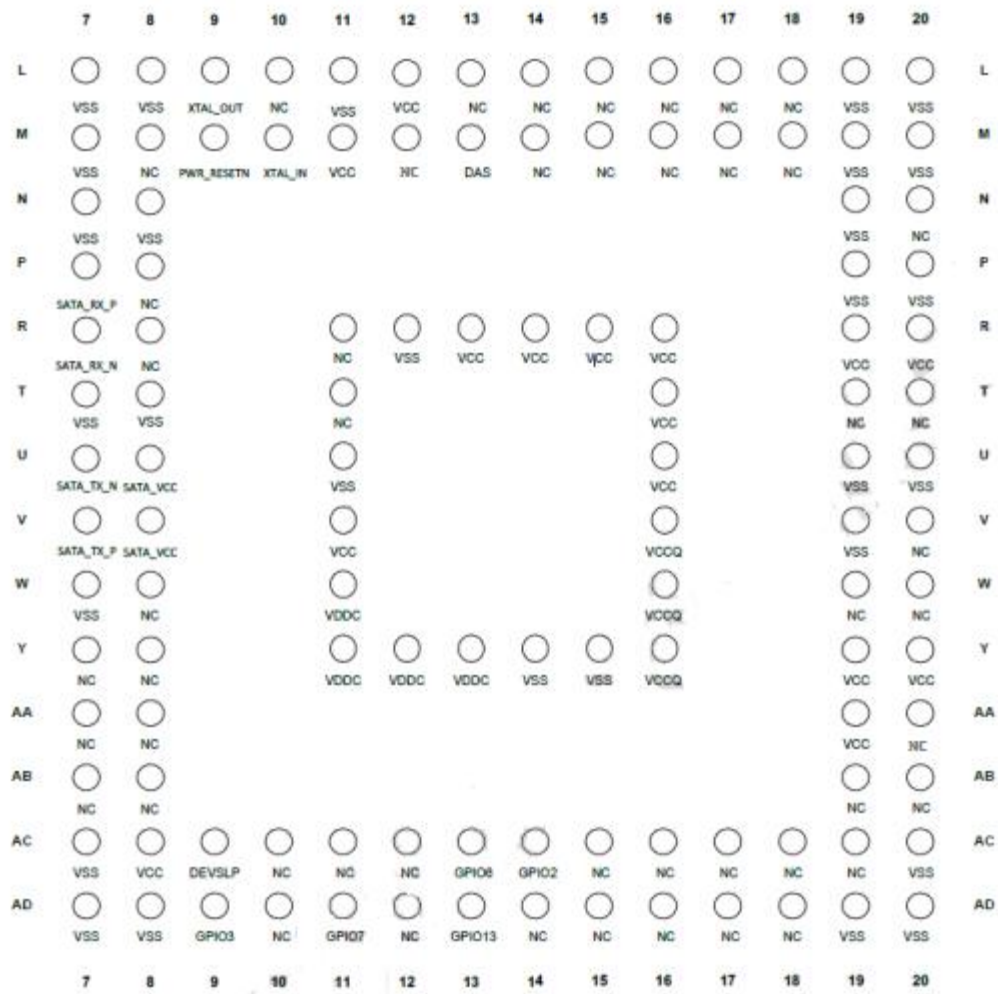


图 4-2 uSIC 主控引脚分配

4.2、信号描述

Pin Name	BGA 156	Pin Type	PU/PD	Description
GPIO				
GPIO2 GPIO3 GPIO6 GPIO7 GPIO13	AC14 AD9 AC13 AD11 AD13	IO	PU 75K	General purpose input/output pins
SATA Interface signals				
SATA_RX_N SATA_RX_P	R7 P7	I		Differential Signal Pair A. SATA Device Receive Signal Differential Pair.
SATA_TX_N SATA_TX_P	U7 V7	O		Differential Signal Pair B. SATA Device Transmit Signal Differential Pair.
DAS	M13	O		Device Activity Signal
SATA_VCC	U8 V8			+3.3V
Control Signals				
XTAL_IN XTAL_OUT	M10 L9	I O		Crystal input/output (30MHz)
PWR_RESETN	M9	I		Internal Power On Reset. ^{note 1}
Power supply Signals				
VCC	L12, M11, R13, R14, R15, R16, R19, R20, T16, U16, V11, Y19, Y20, AA19, AC8			+3.3V
VCCQ	V16, W16, Y16			+1.8V
VDDC	W11, Y11, Y12, Y13			NC(must not connect, VDDC for future used)
SATA_VDD	P8, R8			NC(must not connect, SATA_VDD for future used)
VDD	R11, T11			NC(must not connect, VDD for future used)
GND Signals				



VSS	R12, U11, L7, L8, M7, N7,T7, W7, L11,L15,L16,L17,L18, L19, L20, M19, M20, N19, P19, AC20, AD20, AD19, AD8, AD7, T8, Y14, Y15, U19, P20, U20, V19, AC7, N8, A1, C1, E1, AK1, AM1, AP1, A3, C3, AM3, AP3, A5, AP5, G7, AH7, E8, AK8, D10, AL10, D12, AL12, D15, AL15, D17, AL17, E19, AK19, G20, AH20, A22, AP22, A24, C24, AM24, AP24, A26, C26, E26, AK26, AM26, AP26			Ground
Other Signals				
DEVSLP	AC9	I	PU 69.8K & PD 75K	DEVICE SLEEP, High active. (Normal is low)
NC	AA7, AA8,AA20, AB7,AB8, AB19, AB20, AC10, AC11, AC12, AC15, AC16, AC17, AC18, AC19, AD10, AD12, AD14, AD15, AD16, AD17, AD18, L10, M16, M17, M8, T19, T20, W19, W8, Y7, Y8, L13, L14, M12,M14, M15, M18, N20, V20, W20	--	--	DNU

NOTE:

1. There is an internal Power On Reset at ball #M9 and power on sequence of internal POR is 22ms. It's an optional function to choose whether POR (M9) is connected to an external capacitance or not.

5、支持指令集

Op Code	Description	Op Code		Description	
00h	NOP	C9h		Read DMA without Retry	
06h	Data Set Management	CAh		Write DMA	
10h-1Fh	Recalibrate	CBh		Write DMA without Retry	
20h	Read Sectors	CEh		Write Multiple FUA EXT	
21h	Read Sectors without Retry	E0h		Standby Immediate	
24h	Read Sectors EXT	E1h		Idle Immediate	
25h	Read DMA EXT	E2h		Standby	
27h	Read Native Max Address EXT	E3h		Idle	
29h	Read Multiple EXT	E4h		Read Buffer	
2Fh	Read Log EXT	E5h		Check Power Mode	
30h	Write Sectors	E6h		Sleep	
31h	Write Sectors without Retry	E7h		Flush Cache	
34h	Write Sectors EXT	E8h		Write Buffer	
35h	Write DMA EXT	E9h		READ BUFFER DMA	
37h	Set Native Max Address EXT	EAh		Flush Cache EXT	
38h	CFA WRITE SECTORS WITHOUT ERASE	EBh		Write Buffer DMA	
39h	Write Multiple EXT	ECh		Identify Device	
3Dh	Write DMA FUA EXT	EFh		Set Features	
3Fh	Write Long EXT	EFh	02h	Enable volatile write cache	
40h	Read Verify Sectors	EFh	03h	Set transfer mode	
41h	Read Verify Sectors without Retry	EFh	05h	Enable the APM feature set	
42h	Read Verify Sectors EXT	EFh	10h	Enable use of SATA feature set	
44h	Zero EXT	EFh	10h	02h	Enable DMA Setup FIS Auto-Activate optimization
45h	WRITE UNCORRECTABLE EXT	EFh	10h	03h	Enable Device-initiated interface power state (DIPM) transitions
47h	Read Log DMA EXT	EFh	10h	06h	Enable Software Settings Preservation (SSP)
57h	Write Log DMA EXT	EFh	10h	07h	Enable Device Automatic Partial to Slumber transitions
60h	Read FPDMA Queued	EFh	10h	09h	Enable Device Sleep
61h	Write FPDMA Queued	EFh	55h		Disable Device Sleep
70h-7Fh	Seek	EFh	66h		Disable reverting to power-on defaults
90h	Execute Device Diagnostic	EFh	82h		Disable volatile write cache
91h	Initialize Device Parameters	EFh	85h		Disable the APM feature set
92h	Download Microcode	EFh	90h		Disable use of SATA feature set
93h	DOWNLOAD MICROCODE DMA	EFh	90h	02h	Disable DMA Setup FIS

						Auto-Activate optimization
B0h		SMART	EFh	90h	03h	Disable Device-initiated interface power state (DIPM) transitions
B0h	D0h	SMART READ DATA	EFh	90h	06h	Disable Software Settings Preservation (SSP)
B0h	D1h	SMART READ ATTRIBUTE THRESHOLDS	EFh	90h	07h	Disable Device Automatic Partial to Slumber transitions
B0h	D2h	SMART ENABLE/DISABLE ATTRIBUTE AUTOSAVE	EFh	90h	09h	Disable Device Sleep
B0h	D3h	SMART SAVE ATTRIBUTE VALUES	EFh	AAh		Enable read look-ahead
B0h	D4h	SMART EXECUTE OFF-LINE IMMEDIATE	EFh	CCh		Enable reverting to power-on defaults
B0h	D5h	SMART READ LOG	F1h			Security Set Password
B0h	D6h	SMART WRITE LOG	F2h			Security Unlock
B0h	D8h	SMART ENABLE OPERATIONS	F3h			Security Erase Prepare
B0h	D9h	SMART DISABLE OPERATIONS	F4h			Security Erase Unit
B0h	DAh	SMART RETURN STATUS	F5h			Security Freeze Lock
B0h	DBh	SMART ENABLE/DISABLE AUTOMATIC OFF-LINE	F6h			Security Disable Password
B1h		Device Configuration	F8h			Read Native Max Address
B4h		Sanitize	F9h			Set Max Address
C4h		Read Multiple	F9h	01h		SET MAX SET PASSWORD
C5h		Write Multiple	F9h	02h		SET MAXLOCK
C6h		Set Multiple Mode	F9h	03h		SET MAX UNLOCK
C8h		Read DMA	F9h	04h		SET MAX FREEZE LOCIK