IS27TH064G21

IS27TH128G21

IS27TH256G21

64GB/128GB/256GB Embedded UFS 2.1

PRELIMINARY DATA SHEET

64GB/128GB/256GB Embedded UFS 2.1

FEATURES

- Interface:
  - MIPI M-PHY specification version v3.0 up to HS-Gear 3, Rates A and B x 2-Lanes,
  - MIPI UniPro specification version v1.6
  - Universal Flash Storage (UFS) - Version 2.1

- Features defined by JEDEC - UFS 2.1:
  - High speed: Gear 1/2/3 supported, Rates A and B
  - Permanent and power-on write protection
  - Boot partitions (high-speed boot)
  - Sleep mode
  - Replay Protected Memory Block (RPMB)
  - Background operation
  - Reliable write
  - Discard/Erase
  - Command queuing
  - FFU
  - Cache

- Power Supply Voltages:
  - VCC: 3.3V
  - VCCQ: N/C
  - VCCQ2: 1.8V

- Temperature Range:
  - Industrial Grade (I): -40℃~85℃
  - Automotive Grade (A1): -40℃~85℃
  - Automotive Grade (A2): -40℃~105℃

    ※ Operation Tcase max ≦110℃

- Reliability & Quality:
  - AEC-Q100 reliability qualification (RoHS, HF, and TSCA compliant)

GENERAL DESCRIPTION

ISSI automotive eUFS 2.1 is a universal flash storage (embedded UFS), a mass data storage device compliant with JEDEC specification JESD220C-2.1 and AEC-Q100 reliability qualification.
The host interface is capable of speeds up to HS-Gear 3 x 2-Lanes, which provides a maximum RAW data transfer rates of approximately. 1.0 GB/s.

Reference Documents

These are the documents containing specification for devices and standards mentioned in this datasheet:

Table 0-1 Reference Documents

UFS 2.1	JEDEC –JESD220C-2.1, Universal Flash Storage (UFS) - Version 2.1
M-PHY 3.0	MIPI M-Phy Specification - Version 3.0
UniPro® 1.6	MIPI Specification for Unified Protocol (UniPro®) – Version 1.6
Component	AEC-Q100 Chip reliability qualification

Contents

1. Device Specification

1.1. Block Diagram

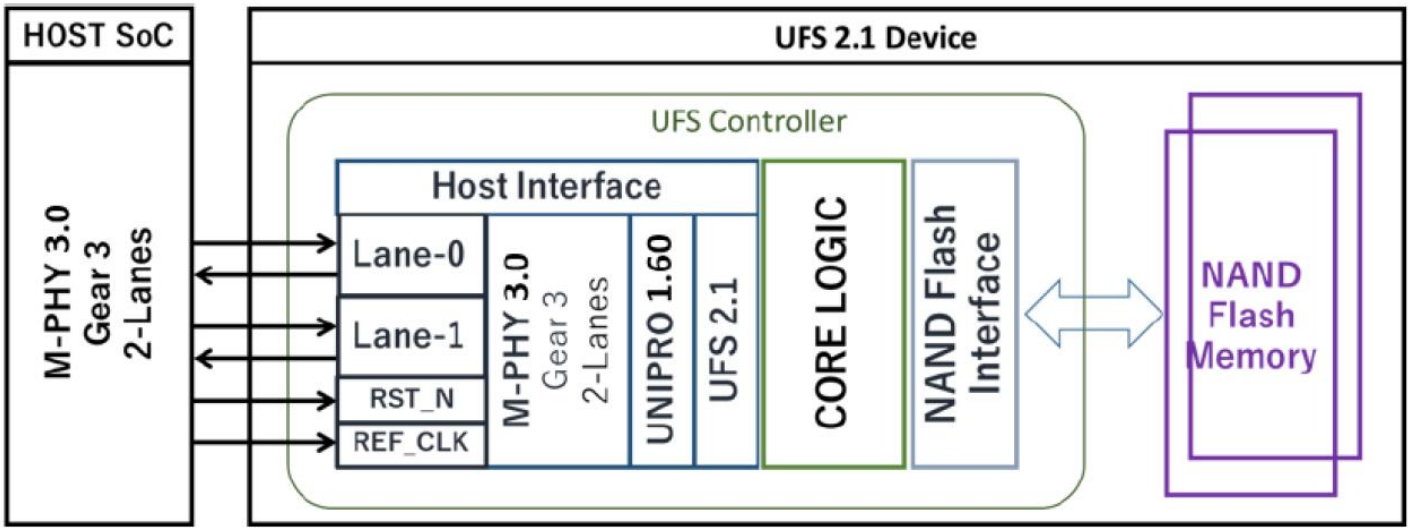


Figure 1-1 Device Block Diagram

1.2. Logical Units

Table 1-1 Logical Unit Information

Part Number	Capacity	Total Raw Device Capacity (KBytes)
IS27TH064G21	64GB	62,582,784
IS27TH128G21	128GB	125,165,568
IS27TH256G21	256GB	250,331,136

Table 1-2 Logical Unit: Default Setting

Logical Unit		Values
User Area	Size	See Logical Unit table (Table 2-1)
	bUnitIndex	00h
Boot Partition 1 (Boot1)	Size	4MB
	bUnitIndex	01h
	bBootLunID	01h : Boot LU A
Boot Partition 2 (Boot2)	Size	4MB
	bUnitIndex	02h
	bBootLunID	02h : Boot LU B
RPMB[1,2]	Size	16MB
	bUnitIndex	C4h

Note 1: The RPMB Logical Unit size is defined by RPMB Unit Descriptor which is configured by the manufacturer.
Note 2: Please refer to chapter 12.4 of JEDEC - JESD220C-2.1, for information on RPMB feature and operations.

1.3. Performance[1]

Table 1-3 Burst Read/Write Performance[1]

Part Number	Capacity	Burst Values			
		Read Sequential (MB/s)	Write Sequential (MB/s)	Random Read (x1000 IOPS)	Random Write (x1000 IOPS)
IS27TH064G21	64GB	700	300	40	60
IS27TH128G21	128GB	1020	645	85	115
IS27TH256G21	256GB	1020	910	120	165

Table 1-4 Sustained Read/Write Performance[1]

Part Number	Capacity	Sustained Values			
		Read Sequential (MB/s)	Write Sequential (MB/s)	Random Read 4KB (x1000 IOPS)	Random Write 4KB (x1000 IOPS)
IS27TH064G21	64GB	690	65	25	15
IS27TH128G21	128GB	1020	130	50	30
IS27TH256G21	256GB	1020	210	80	50

Note 1:
Sequential access of 512KB chunk; random access of 4KB chunk (Command Queue Depth=32);
The benchmark was executed on the default LU;
Performance numbers might be subject to changes without notice;
For performance data on a specific platform/system, please contact ISSI.

1.4. Supported Power States

There are multiple power modes supported by UFS devices. Those are controlled by the command START STOP UNIT (SSU) and some attributes.

Below are the supported power modes for this device when operating in High Speed + Fast-Auto Mode.

Power State	UFS Power Mode	UniPro Power Mode	M-PHY Power Mode	VCC Power Status
Active[1]	Active	FAST_STATE	HS-BURST	ON
Idle[1]	IDLE	SLEEP_STATE	STALL	ON
SSU Sleep[1]	SLEEP	SLEEP_STATE	STALL	OFF
Hibernate	IDLE	HIBERNATE_STATE	Hibern8	ON
Hibernate + SSU Sleep	SLEEP	HIBERNATE_STATE	Hibern8	OFF
SSU Power Down	POWER DOWN	OFF_STATE	UNPOWERED	OFF
Hibernate + SSU Power Down	POWER DOWN	OFF_STATE	UNPOWERED	OFF
Note 1: For operation modes different from High-Speed + Fast-Auto Mode, please refer to the supported power modes defined in MIPI M-Phy Spec. – Ver. 3.0 and Spec. for Unified Protocol (UniPro®) – Ver. 1.6				

1.5. Power Supply

1.5.1. Supply Voltages

Part Number	Voltage Rail	Min.	Typical	Max.	Unit
IS27TH064G21	VCC	2.7	3.3	3.6	V
IS27TH128G21	VCCQ	Not Supported	Not Supported	Not Supported	N/A
IS27TH256G21	VCCQ2	1.7	1.8	1.95	V
Note: A power cycle implementation requires a supply voltage (VCC and VCCQ2) below 0.5V for at least 1ms before the power increases again.					

1.5.2. Power Consumption

Table 1-5 Device Power Consumption

Part Number	Capacity	Power State	I_{CCQ2} (mA)	I_{CC} (mA)
IS27TH064G21	64GB	Active – Read	430	70
		Active - Write	370	80
		Hibernate	0.025	0.6
		Sleep + Hibernate	0.025	0.6
IS27TH128G21	128GB	Active – Read	495	100
		Active - Write	415	140
		Hibernate	0.035	0.6
		Sleep + Hibernate	0.035	0.6
IS27TH256G21	256GB	Active – Read	495	100
		Active - Write	445	180
		Hibernate	0.065	0.6
		Sleep + Hibernate	0.065	0.6
Note 1: Device set to High Speed + Fast-Auto Mode at 25°C ambient temperature; **Note 2:** Host interface running in HS Gear 3 x 2-Lanes; **Note 3:** The current and power are RMS, measured over a period of 100ms.				

1.6. Temperature

Below table contains the temperature ranges for operational condition and for non-operational storage of ISSI Standard grade UFS devices at T Ambiance.

T Case refers to the temperature measured approximately on the center of the top face of the device.

Table 1-6 Temperature

Condition	Min.	Max.	Unit.
Operating (1)	-40	105	°C
Storage (not-operating)	-40	105	°C

(1) Tcase max ≦110℃

1.7. Reference Clock

External reference clock is required for operation modes:

- HS-Gear 1, 2, 3;
- PWM-Gear 1, 2, 3, 4.

Table 1-7 Reference Clock Support

Frequency	Support.
19.2MHz (Default)	Yes
26.0MHz	Yes
38.4MHz	Yes

1.8. Ball Assignment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
A	NC	NC	V_{DDiQ}	NC	NC	V_{CCQ2}	V_{CCQ2}	V_{DDiQ2}	V_{DDi}	NC	NC	NC	NC	NC	A
B	NC	VSS	RFU	NC	NC	V_{CCQ2}	V_{CCQ2}	V_{CC}	V_{CC}	NC	VSS	VSS	RFU	NC	B
C	NC	VSS	VSS	NC	NC	V_{CCQ2}	V_{CCQ2}	V_{CC}	V_{CC}	RFU	VSS	VSS	RFU	RFU	C
D	D_{IN1_t}	D_{IN1_c}	VSS	NC								VSS	VSS	VSS	D
E	NC	VSS	VSS		NC	VSF1	VSF2	V_{CC}	VSF3	VSF4		VSS	RFU	RFU	E
F	D_{IN0_t}	D_{IN0_c}	VSS		NC					VSF5		VSS	VSS	VSS	F
G	NC	VSS	VSS		VSF6					VSS		VSS	RFU	RFU	G
H	REF_CLK	RST_n	VSS		VSS					VSS		VSS	VSS	VSS	H
J	NC	VSS	VSS		VSS					VSF7		VSS	RFU	RFU	J
K	D_{OUT0_c}	D_{OUT0_t}	VSS		VSS	V_{CCQ2}	V_{CCQ2}	V_{CC}	NC	VSF8		VSS	VSS	VSS	K
L	NC	VSS	VSS									VSS	RFU	RFU	L
M	D_{OUT1_c}	D_{OUT1_t}	VSS	VSS	VSS	RFU	RFU	NC	NC	RFU	NC	VSS	VSS	VSS	M
N	NC	VSS	VSS	VSS	VSS	RFU	RFU	V_{CC}	V_{CC}	RFU	VSS	VSS	RFU	NC	N
P	NC	NC	RFU	VSS	VSS	RFU	RFU	V_{CC}	V_{CC}	VSF9	VSS	VSS	NC	NC	P
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	

Figure 1-2: BGA 153 Ball Assignment

Table 1-8 BGA 153 Ball Description

Pin	Type	Description
VCC	Supply	Supply voltage for the memory device
VCCQ	-	No Connect: This pin shall be left floating (Externally)
VCCQ2	Supply	Supply voltage used for the host interface, the memory controller, memory interface and other internal circuits.
VDDi	Input	Capacitor for internal voltage regulator
VDDiQ	Input	Capacitor for internal voltage regulator
VDDiQ2	Input	Capacitor for internal voltage regulator
VSS	Supply	Ground
REF_CLK	Input	Reference Clock – When not active, this signal should be pull-down or driven low by the host SoC.
RST_n	Input	Hardware Reset Signal – This is an active low signal
DIN0_t, DIN1_t DIN0_c, DIN1_c	Input	Downstream data lane 0 & lane 1 – Differential input signals into device from the host
DOUT0_t, DOUT1_t DOUT0_c, DOUT1_c	Output	Upstream data lane 0 & lane 1 – Differential output signals into device from the host
C+, C-	-	Not Connected: These pins shall be left floating (Externally)
CP OUT1, CP OUT2	-	Not Connected: These pins shall be left floating (Externally)
NC	-	Not Connected - These pins can be connected to ground or left floating (Externally)
RFU	-	Reserved for Future Use - RFU pins should be left floating (Externally)
VSF [9:1]	Input/ Output	Vendor Specific Function

2. Feature Support

2.1. Functional Features

Table 2-1 Functional Features Support

Function		Support	Description
H/W	**H/W Reset Pin**	Yes	-
Logical Unit / Partitions	LUs	Yes (up to 32)	Chapter 2.1
	Boot LUs	Yes (up to 2)	
	RPMB LUs	Yes (up to 1)	
	LU Priority	Yes	-
	LU Type	Yes	-
	Logical Block Size (1)	4KB	Chapter 2.1
UFS Security Features	ERASE	Yes	-
	DISCARD	Yes	
	Purge	Yes	
	Wipe Device	Yes	
	Write Protection (2)	Yes	-
	Secure Write Protection	Yes	-
	RPMB	Yes	Chapter 2.1
Host Device Interaction	Inter-LU Priority	Yes	-
	Background Operation Mode	Yes	-
	Power Off Notification	Yes	-
	Dynamic Device Capacity	No	-
	Data Reliability	Yes	-
	Real-Time Clock Information	Yes	-
	Context Management	Yes	-
	System Data Tag Mechanism	Yes	-
	Exception Events Mechanism (3)	Yes	-
	Queue Priority [HPI]	Yes	-
	Out of Order Data Transfer	No	-
	Command Priority	Yes	-
UFS Cache	Cache	Yes	-
Command Status Response	Illegal Request	Yes	-
	Medium Error	Yes	-
	Hardware Error	Yes	-
	Unit Attention	Yes	-
Vendor Specific Function	FW Update	Yes	-
UFS Feature	Device Health Information	Yes	-

Note 1: bLogicalBlockSize= 4KByte and is not reconfigurable.
Note 2: Write Protection (WP) Should be independently executed for each LU and Software WP shall be enabled using Mode Select.
Note 3: Only URGENT_BKPOS is supported

2.2. SCSI Features

Table 2-2- SCSI Features Support

Command name	Opcode	Support	Comments
FORMAT UNIT (1)	04h	YES	-
INQUIRY	12h	YES	-
MODE SELECT (10)	55h	YES	-
MODE SENSE (10)	5Ah	YES	-
PRE-FETCH (10)	34h	YES	-
PRE-FETCH (16)	90h	NO	Not required under 2TB
READ (6)	08h	YES	-
READ (10)	28h	YES	-
READ (16)	88h	NO	Not required under 2TB
READ BUFFER	3Ch	YES	-
READ CAPACITY (10)	25h	YES	-
READ CAPACITY (16)	9Eh	YES	-
REPORT LUNS	A0h	YES	-
REQUEST SENSE	03h	YES	-
SECURITY PROTOCOL IN	A2h	YES	-
ECURITY PROTOCOL OUT	B5h	YES	-
SEND DIAGNOSTIC (2)	1Dh	YES	-
START STOP UNIT	1Bh	YES	-
YNCHRONIZE CACHE (10)	35h	YES	-
YNCHRONIZE CACHE (16)	91h	NO	Not required under 2TB
TEST UNIT READY	00h	YES	-
UNMAP	42h	YES	-
VERIFY (10)	2Fh	YES	-
WRITE (6)	0Ah	YES	-
WRITE (10)	2Ah	YES	-
WRITE (16)	8Ah	NO	Not required under 2TB
WRITE BUFFER	3Bh	YES	-

2.2.1. Background Operations Mode

The background operations mode grants the device time to execute Flash management operations such as wear leveling, bad block management, garbage collection and others.

These operations will only occur when Background Operations Mode is enabled and the command queue is empty.

2.3. Security Features

Table 2-3 Security Features

Features		Target Area	Description	
			Value of deallocated LBA	Erase of Physical Memory
ERASE		Unmapped LBA	0	No
DISCARD		Unmapped LBA	any data	No
PURGE	ERASE	Unmapped LBA	0	Yes
	DISCARD		any data	Yes
WIPE Device (1)		All device	0	No
Note 1: A FORMAT UNIT command is issued to a Device Well-Known logical unit will request the device to format all enabled logical units except the RPMB well known logical unit. If any logical unit is Write Protected when the FORMAT UNIT command is issued to Device Well-Known logical unit, the FORMAT UNIT command will fail and the content of the medium will not be altered.				

2.4. Queue Priority

A Logical Unit contains a task queue that will support the processing of one or more Tasks, managed by the Logical Unit.

Below table describes the Task Attribute that defines the queue type.

Table 2-4 Command Queue – Task Attribute Description

Task Attribute	Bit 1	Bit 0	Support
Simple	0	0	Yes
Ordered	0	1	Yes
Head of Queue	1	0	Yes

2.5. Cache

The cache is a device level cache, applied to all LUs and is expected to be volatile. Data in the cache is not expected to remain valid over power cycles neither SW/HW reset cycles.

2.6. Power Off Notification

Power Off Notification is the mechanism utilized by the host to inform the storage device to get ready for power off. The device then will require time to complete ongoing operations and execute the NAND Flash management tasks required to prevent data loss and to optimize the device for a faster initialization upon the next power up.

3. Attributes

An Attribute is a parameter that represents a specific range of numeric values that can be written or read.

Table 3-1 Attributes

IDN	Name	Access Property	Size	Type, #Index, #Selector	MDV	Descr.
00h	bBootLunEn	Read / Persistent	1	D	00h	-
01h	Reserved	N/A	1	N/A	N/A	-
02h	bCurrentPowerMode	Read only	1	D	11h	-
03h	bActiveICCLevel	Read / Volatile	1	D	00h	-
04h	bOutOfOrderDataEn	Read / Write once	1	D	00h	-
05h	bBackgroundOpStatus	Read only	1	D	00h	-
06h	bPurgeStatus	Read only	1	D	00h	-
07h	bMaxDataInSize (1)	Read / Persistent	1	D	40h	-
08h	bMaxDataOutSize (2)	Read / Persistent	1	D	40h	-
09h	dDynCapNeeded	Read only	4	N/A	N/A	-
0Ah	bRefClkFreq	Read / Persistent	1	D	01h	-
0Bh	bConfigDescrLock	Read / Write once	1	D	00h	-
0Ch	bMaxNumOfRTT	Read / Persistent	1	D	02h	-
0Dh	wExceptionEventControl	Read / Volatile	2	D	00h	-
0Eh	wExceptionEventStatus	Read only	2	D	00h	-
0Fh	dSecondsPassed	Write Only	4	D	00h	-
10h	wContextConf	Read / Volatile	2	N/A	N/A	-
11h	Obsolete	N/A	Not Defined	N/A	N/A	-
12h	Reserved	N/A	Not Defined	N/A	N/A	-
13h	Reserved	N/A	Not Defined	N/A	N/A	-
14h	bDeviceFFUStatus	Read Only	1	D	00h	-
15h	bPSAState	Read/Persistent	1	D	00h	-
16h	dPSADataSize	Read/Persistent	8	D	0000h	-
Note 1: bMaxDataInSize = bMaxDataOutSize = 4Kbytes. These values are NOT reconfigurable.						

4. Flags

A flag is a single Boolean value that represents a TRUE or FALSE, 0‘ or 1‘, ON or OFF type of value.
A flag can be cleared or reset, set, toggled or read.

Table 4-1 Flags

IDN	Name	Access Property	Type, #Index, #Selector	Default	Description
00h	Reserved	N/A	N/A	N/A	-
01h	fDeviceInit	Read / Set only	D	00h	-
02h	fPermanentWPEn	Read / Write once	D	00h	-
03h	fPowerOnWPEn	Read / Power on reset	D	00h	-
04h	fBackgroundOpsEn	Read / Volatile	D	01h	-
05h	fDeviceLifeSpanModeEn	Read / Volatile	D	00h	-
06h	fPurgeEnable	Write only / Volatile	D	00h	-
07h	Reserved	N/A	N/A	N/A	-
08h	fPhyResourceRemoval	Read / Persistent	D	00h	-
09h	fBusyRTC	Read Only	D	00h	-
0Ah	Reserved	N/A	N/A	N/A	-
0Bh	fPermanentlyDisableFwUpdate	Read / Write once	D	00h	-
0Ch	Reserved	N/A	N/A	N/A	-
0Dh	Reserved	N/A	N/A	N/A	-

5. Descriptors

5.1. Device Descriptor

Table 5-1 Device Descriptor

IDN	Descriptor	Offset	Size (Bytes)	Name	MDV	User Conf.	Description
00h	Device	00h	1	bLength	40h	No	-
		01h	1	bDescriptorIDN	00h	No	-
		02h	1	bDevice	00h	No	-
		03h	1	DeviceClass	00h	No	-
		04h	1	bDeviceSubClass	00h	No	-
		05h	1	bProtocol	00h	No	-
		06h	1	bNumberLU	03h	Yes	-
		07h	1	bNumberWLU	04h	No	-
		08h	1	bBootEnable	01h	Yes	01h = Bootable feature enabled
		09h	1	bDescrAccessEn	01h	Yes	-
		0Ah	1	bInitPowerMode	01h	Yes	-
		0Bh	1	bHighPriorityLUN	7Fh	Yes	-
		0Ch	1	bSecureRemovalType	00h	Yes	-
		0Dh	1	bSecurityLU	01h	No	-
		0Eh	1	bBackgroundOpsTermLat	05h	No	-
		0Fh	1	bInitActiveICCLevel	00h	Yes	-
		10h	2	wSpecVersion	0210h	No	-
		12h	2	wManufactureDate	-	No	eg. 0522 means 2022/05
		14h	1	iManufacturerName	01h	No	-
		15h	1	iProductName	02h	No	-
		16h	1	iSerialNumber	04h	No	-
		17h	1	iOemID	03h	No	-
		18h	2	wManufacturerID	019Dh	No	-
		1Ah	1	bUD0BaseOffset	10h	No	-
		1Bh	1	bUDConfigPLength	10h	No	-
		1Ch	1	bDeviceRTTCap	08h	No	-
		1Dh	2	wPeriodicRTCUpdate	00h	Yes	-
		1Fh	1	bUFSFeatureSupport	07h	No	-
		20h	1	bFFUTimeout	0Ah	No	-
		21h	1	bQueueDepth	20h	No	-
		22h	2	wDeviceVersion	00h	No	This field provides the device version.
		24h	1	bNumSecureWPArea	20h	No	This value specifies the total number of Secure Write Protect Areas supported by the device. The value shall be equal to or greater than bNumberLU and shall not exceed 32 (bNumberLU ≤ bNumSecureWPArea ≤ 32)
		25h	4	dPSAMaxDataSize	004A64FFh (064GB) 0094CFFFh (128GB) 0129A7FFh (256GB)	No	-
		29h	1	bPSAStateTimeout	12h	No	-
		2Ah	1	iProductRevisionLevel	06h	No	-
		2Bh	5	Reserved	00h	No	
		30h	16	Reserved	00h	No	

5.2. Device Health Descriptor

Table 5-2 Device Health Descriptor

Offset	Size (Bytes)	Name	MDV	User Conf.	Description
00h	1	bLength	25h	No	Size of this descriptor
01h	1	bDescriptorType	09h	No	Device Health Descriptor Type Identifier
02h	1	bPreEOLInfo	Device specific	No	Pre End of Life Informations This field provides indication about device life time reflected by average reserved blocks. 00h: Not defined 01h: Normal 02h: Warning. Consumed 80% of reserved blocks. 03h: Critical. Consumed 90% of reserved blocks. Others: Reserved
03h	1	bDeviceLifeTimeEstA	Device specific	No	This field provides indication about current averaged program erase cycle of memory relative to its maximum estimated capability. It is calculated by vendor specific method A. 00h: Not defined 01h: 0% - 10% device life time used 02h: 10% - 20% device life time used 03h: 20% - 30% device life time used 04h: 30% - 40% device life time used 05h: 40% - 50% device life time used 06h: 50% - 60% device life time used 07h: 60% - 70% device life time used 08h: 70% - 80% device life time used 09h: 80% - 90% device life time used 0Ah: 90% - 100% device life time used 0Bh: Exceeded its maximum estimated device life time Others: Reserved
04h	1	bDeviceLifeTimeEstB	Device specific	No	This field provides indication about current averaged program erase cycle of memory relative to its maximum estimated capability. It is calculated by vendor specific method B. 00h: Not defined 01h: 0% - 10% device life time used 02h: 10% - 20% device life time used 03h: 20% - 30% device life time used 04h: 30% - 40% device life time used 05h: 40% - 50% device life time used 06h: 50% - 60% device life time used 07h: 60% - 70% device life time used 08h: 70% - 80% device life time used 09h: 80% - 90% device life time used 0Ah: 90% - 100% device life time used 0Bh: Exceeded its maximum estimated device life time Others: Reserved
05h	32	VendorPropInfo	Device specific	No	Reserved for Vendor Proprietary Health Report

5.3. Configuration Descriptor

Table 5-3 Configuration Descriptor

IDN	Descriptor		Offset	Size (Byte)	Name	MDV	Conf. User	Description
01h	Configuration	Header and Device Descriptor Configuration parameters	00h	1	bLength	90h	No	-
			01h	1	bDescriptorType	01h	No	-
			02h	1	bConfDescContinue	00h	Yes	-
			03h	1	bBootEnable	01h	Yes	01h = Bootable feature enabled
			04h	1	bDescrAccessEn	01h	Yes	-
			05h	1	bInitPowerMode	01h	Yes	-
			06h	1	bHighPriorityLUN	7Fh	Yes	-
			07h	1	bSecureRemovalType	00h	Yes	-
			08h	1	bInitActiveICCLevel	00h	Yes	-
			09h	2	wPeriodicRTCUpdate	0000h	Yes	-
			0Bh	5	Reserved	00h	No	-
		Unit Descriptor[0] configurable parameters	00h	1	bLUEnable	01h	Yes	-
			01h	1	bBootLunID	00h	Yes	-
			02h	1	bLUWriteProtect	00h	Yes	-
			03h	1	bMemoryType	00h	Yes	-
			04h	4	dNumAllocUnits	1D1Fh	Yes	-
			08h	1	bDataReliability	00h	Yes	-
			09h	1	bLogicalBlockSize	0Ch	Yes	Logical Block Size is 4KByte
			0Ah	1	bProvisioningType	03h	Yes	-
			0Bh	2	wContextCapabilities	00h	Yes	-
			0Dh	3	Reserved	00h	No	-
		Unit Descriptor[1] configurable parameters	00h	1	bLUEnable	01h	Yes	-
			01h	1	bBootLunID	01h	Yes	-
			02h	1	bLUWriteProtect	00h	Yes	-
			03h	1	bMemoryType	03h	Yes	-
			04h	4	dNumAllocUnits	03h	Yes	-
			08h	1	bDataReliability	00h	Yes	-
			09h	1	bLogicalBlockSize	0Ch	Yes	-
			0Ah	1	bProvisioningType	03h	Yes	-
			0Bh	2	wContextCapabilities	00h	Yes	-
			0Dh	3	Reserved	00h	No	-
		Unit Descriptor[2] configurable parameters	00h	1	bLUEnable	01h	Yes	-
			01h	1	bBootLunID	02h	Yes	-
			02h	1	bLUWriteProtect	00h	Yes	-
			03h	1	bMemoryType	03h	Yes	-
			04h	4	dNumAllocUnits	03h	Yes	-
			08h	1	bDataReliability	00h	Yes	-
			09h	1	bLogicalBlockSize	0Ch	Yes	-
			0Ah	1	bProvisioningType	03h	Yes	-
			0Bh	2	wContextCapabilities	00h	Yes	-
			0Dh	3	Reserved	00h	No	-
		Unit Descriptor [3] ~ [7] configurable parameters	00h	1	bLUEnable	00h	Yes	-
			01h	1	bBootLunID	00h	Yes	-
			02h	1	bLUWriteProtect	00h	Yes	-
			03h	1	bMemoryType	00h	Yes	-
			04h	4	dNumAllocUnits	00h	Yes	-
			08h	1	bDataReliability	00h	Yes	-
			09h	1	bLogicalBlockSize	0Ch	Yes	-
			0Ah	1	bProvisioningType	03h	Yes	-
			0Bh	2	wContextCapabilities	00h	Yes	-
			0Dh	3	Reserved	00h	No	-

5.4. Geometry Descriptor

Table 5-4 Geometry Descriptor

IDN	Descriptor	Offset	Size (Byte)	Name	MDV	User Conf.	Descr.
07h	Geometry	00h	1	bLength	48h	No	-
		01h	1	bDescriptorType	07h	No	-
		02h	1	bMediaTechnology	00h	No	-
		03h	1	Reserved	00h	No	-
		04h	8	qTotalRawDeviceCapacity	0775E000h (064G) 0EEBC000h (128G) 1DD78000h (256G)	No	-
		0Ch	1	bMaxNumberLU	01h	No	-
		0Dh	4	dSegmentSize	2000h	No	-
		11h	1	bAllocationUnitSize	01h	No	-
		12h	1	bMinAddrBlockSize	08h	No	-
		13h	1	bOptimalReadBlockSize	40h	No	-
		14h	1	bOptimalWriteBlockSize	40h	No	-
		15h	1	bMaxInBufferSize	40h	No	-
		16h	1	bMaxOutBufferSize	40h	No	-
		17h	1	bRPMB_ReadWriteSize	18h	No	-
		18h	1	bDynamicCapacityResourcePolicy	01h	No	-
		19h	1	bDataOrdering	00h	No	-
		1Ah	1	bMaxContexIDNumber	0Fh	No	-
		1Bh	1	bSysDataTagUnitSize	00h	No	-
		1Ch	1	bSysDataTagResSize	00h	No	-
		1Dh	1	bSupportedSecRTypes	0Fh	No	-
		1Eh	2	wSupportedMemoryTypes	807Fh	No	-
		20h	4	dSystemCodeMaxNAllocU	3BAFh (064G) 775Eh (128G) EEBCh (256G)	No	-
		24h	2	wSystemCodeCapAdjFac	0300h	No	-
		26h	4	dNonPersistMaxNAllocU	3BAFh (064G) 775Eh (128G) EEBCh (256G)	No	-
		2Ah	2	wNonPersistCapAdjFac	0300h	No	-
		2Ch	4	dEnhanced1MaxNAllocU	3BAFh (064G) 775Eh (128G) EEBCh (256G)	No	-
		30h	2	wEnhanced1CapAdjFac	0300h	No	-
		32h	4	dEnhanced2MaxNAllocU	3BAFh (064G) 775Eh (128G) EEBCh (256G)	No	-
		36h	2	wEnhanced2CapAdjFac	0300h	No	-
		38h	4	dEnhanced3MaxNAllocU	3BAFh (064G) 775Eh (128G) EEBCh (256G)	No	-
		3Ch	2	wEnhanced3CapAdjFac	0300h	No	-
		3Eh	4	dEnhanced4MaxNAllocU	3BAFh (064G) 775Eh (128G) EEBCh (256G)	No	-
		42h	2	dEnhanced4CapAdjFac	0300h	No	-
		44h	4	dOptimalLogicalBlockSize	00000001h	No	-

5.5. UNIT Descriptor Configurable Parameters

Table 5-5 UNIT Descriptor Configurable Parameters for each Individual LU

IDN	Descriptor		Offset	Size (Byte)	Name	MDV	User Conf.	Descri.
02h	Unit	Normal[0]	00h	1	bLength	23h	No	-
			01h	1	bDescriptorType	02h	No	-
			02h	1	bUnitIndex	00h	No	-
			03h	1	bLUEnable	01h	Yes	-
			04h	1	bBootLunID	00h	Yes	-
			05h	1	bLUWriteProtect	00h	Yes	-
			06h	1	bLUQueueDepth	00h	No	-
			07h	1	bPSASensitive	01h	No	-
			08h	1	bMemoryType	00h	Yes	-
			09h	1	bDataReliability	00h	Yes	-
			0Ah	1	bLogicalBlockSize	0Ch	Yes	-
			0Bh	8	qLogicalBlockCount	0EEA400h (064G) 1DD6000h (128G) 3BAD800h (256G)	Yes	-
			13h	4	dEraseBlockSize	0400h	No	-
			17h	1	bProvisioningType	03h	Yes	-
			18h	8	qPhyMemResourceCount	0EEA400h (064G) 1DD6000h (128G) 3BAD800h (256G)	No	-
			20h	2	wContextCapabilities	00h	Yes	-
			22h	1	bLargeUnitGranularity_M1	00h	No	-
		Normal[1]	00h	1	bLength	23h	No	-
			01h	1	bDescriptorType	02h	No	-
			02h	1	bUnitIndex	01h	No	-
			03h	1	bLUEnable	01h	Yes	-
			04h	1	bBootLunID	01h	Yes	-
			05h	1	bLUWriteProtect	00h	Yes	-
			06h	1	bLUQueueDepth	00h	No	-
			07h	1	bPSASensitive	01h	No	-
			08h	1	bMemoryType	03h	Yes	-
			09h	1	bDataReliability	00h	Yes	-
			0Ah	1	bLogicalBlockSize	0Ch	Yes	-
			0Bh	8	qLogicalBlockCount	0400h	Yes	-
			13h	4	dEraseBlockSize	0400h	No	-
			17h	1	bProvisioningType	03h	Yes	-
			18h	8	qPhyMemResourceCount	0400h	No	-
			20h	2	wContextCapabilities	00h	Yes	-
			22h	1	bLargeUnitGranularity_M1	00h	No	-
02h	Unit	Normal[2]	00h	1	bLength	23h	No	-
			01h	1	bDescriptorType	02h	No	-
			02h	1	bUnitIndex	02h	No	-
			03h	1	bLUEnable	01h	Yes	-
			04h	1	bBootLunID	02h	Yes	-
			05h	1	bLUWriteProtect	00h	Yes	-
			06h	1	bLUQueueDepth	00h	No	-
			07h	1	bPSASensitive	01h	No	-
			08h	1	bMemoryType	03h	Yes	-
			09h	1	bDataReliability	00h	Yes	-
			0Ah	1	bLogicalBlockSize	0Ch	Yes	-
			0Bh	8	qLogicalBlockCount	0400h	Yes	-
			13h	4	dEraseBlockSize	0400h	No	-
			17h	1	bProvisioningType	03h	Yes	-
			18h	8	qPhyMemResourceCount	0400h	No	-
			20h	2	wContextCapabilities	00h	Yes	-
			22h	1	bLargeUnitGranularity_M1	00h	No	-

IDN	Descriptor		Offset	Size (Byte)	Name	MDV	User Conf.	Descri.
	Unit	Normal[3]~[31]	00h	1	bLength	23h	No	-
			01h	1	bDescriptorType	02h	No	-
			02h	1	bUnitIndex	03h ~ 1Fh	No	-
			03h	1	bLUEnable	00h	Yes	-
			04h	1	bBootLunID	00h	Yes	-
			05h	1	bLUWriteProtect	00h	Yes	-
			06h	1	bLUQueueDepth	00h	No	-
			07h	1	bPSASensitive	01h	No	-
			08h	1	bMemoryType	00h	Yes	-
			09h	1	bDataReliability	00h	Yes	-
			0Ah	1	bLogicalBlockSize	0Ch	Yes	-
			0Bh	8	qLogicalBlockCount	00h	Yes	-
			13h	4	dEraseBlockSize	0400h	No	-
			17h	1	bProvisioningType	03h	Yes	-
			18h	8	qPhyMemResourceCount	00h	No	-
			20h	2	wContextCapabilities	00h	Yes	-
			22h	1	bLargeUnitGranularity_M1	00h	No	-
02h		RPMB	00h	1	bLength	23h	No	-
			01h	1	bDescriptorType	02h	No	-
			02h	1	bUnitIndex	C4h	No	-
			03h	1	bLUEnable	01h	No	-
			04h	1	bBootLunID	00h	No	-
			05h	1	bLUWriteProtect	00h	No	-
			06h	1	bLUQueueDepth	00h	No	-
			07h	1	bPSASensitive	00h	No	-
			08h	1	bMemoryType	0Fh	No	-
			09h	1	bRpmbRegionEnable	00h	No	-
			0Ah	1	bLogicalBlockSize	08h	No	-
			0Bh	8	qLogicalBlockCount	8000h	No	-
			13h	4	dEraseBlockSize	00h	No	-
			17h	1	bProvisioningType	00h	No	-
			18h	8	qPhyMemResourceCount	8000h	No	-
			20h	3	Reserved	00h	No	-

5.6. Other Descriptors

Table 5-6 Other Descriptors

IDN	Descriptor		Offset	Size (Byte)	Name	MDV	User Conf.	Descr.
04h	Interconnect		00h	1	bLength	06h	No	
			01h	1	bDescriptorIDN	04h	No	
			02h	2	bcdUniproVersion	0160h	No	Unipro 1.6
			04h	2	bcdMphyVersion	0300h	No	M-PHY 3.0
05h	String	Manufacturer Name	00h	1	bLength	12h	No	-
			01h	1	bDescriptorIDN	05h	No	-
			02h	16	UC[0] Unicode string character	“ISSI”	No	-
05h		Product Name	00h	1	bLength	22h	No	-
			01h	1	bDescriptorIDN	05h	No	-
			02h	32	UC[0] Unicode string character	“eUFS2.1_064” “eUFS2.1_128” “eUFS2.1_256”	No	-
05h		Serial Number	00h	1	bLength	40h	No	-
			01h	1	bDescriptorIDN	05h	No	-
			02h	2	UC[0] Unicode string character	[customizable]	No	-
			04h	2	UC[1] Unicode string character		No	-
			…	.	…		No	-
			3Eh	2	UC[30] Unicode string character		No	-
05h		OEM ID	00h	1	bLength	FEh	Yes	-
			01h	1	bDescriptorIDN	05h	No	-
			02h	2	UC[0] Unicode string character	00h	Yes	-
08h	Power		00h	1	bLength	62h	No	-
			01h	1	bDescriptorIDN	08h	No	-
			02h	32	wActiveICCLevelsVCC[15:0]	81F4h	No	-
			22h	32	wActiveICCLevelsVCCQ[15:0]	00h	No	-
			42h	32	wActiveICCLevelsVCCQ2[15:0]	81F4h	No	-
09h	Device Health		00h	1	bLength	25h	No	-
			01h	1	bDescriptorIDN	09h	No	-
			02h	1	bPreEOLInfo	01h	No	-
			03h	1	bDeviceLifeTimeEstA	01h	No	-
			04h	1	bDeviceLifeTimeEstB	01h	No	-

6. Supported Pages

This section describes the supported mode pages used with MODE SELECT command and MODE SENSE command.

6.1. Control Mode Page

The Control mode page provides controls over SCSI features that are applicable to all device types (e.g., task set management and error logging).

Table 6-1 Control Mode Page

Mode Page	Offset	Size	Field	MDV	User Conf.	Description
Control [0]~[7]	00h	6b	PAGE CODE	0Ah	No	-
	00h	1b	SPF	0b	No	-
	00h	1b	PS	1b	No	-
	01h	01h	PAGE LENGTH	0Ah	No	-
	02h	1b	RLEC	0b	No	-
	02h	1b	GLTSD	0b	No	-
	02h	1b	D_SENSE	0b	No	-
	02h	1b	DPICZ	0b	No	-
	02h	1b	TMF_ONLY	0b	No	-
	02h	3b	TST	0b	No	-
	03h	1b	Obsolete	0b	No	-
	03h	2b	QERR	00b	No	-
	03h	1b	NUAR	0b	No	-
	03h	4b	QUEUE ALGORITHM MODIFIER	0001b	No	-
	04h	3b	Obsolete	000b	No	-
	04h	1b	SWP	0b	Yes	-
	04h	2b	UA_INTLCK_CTRL	00b	No	-
	04h	1b	RAC	0b	No	-
	04h	1b	VS	0b	No	-
	05h	3b	AUTOLOAD MODE	000b	No	-
	05h	1b	Reserved	0b	No	-
	05h	1b	RWWP	0b	No	-
	05h	1b	ATMPE	0b	No	-
	05h	1b	TAS	0b	No	-
	05h	1b	ATO	0b	No	-
	06h	02h	Obsolete	0000h	No	-
	08h	02h	BUSY TIMEOUT PERIOD	01h	No	-
	0Ah	02h	EXTENDED SELF-TEST COMPLETION TIME	0000h	No	-

6.2. Read-Write Error Recovery Mode Page

The Read-Write Error Recovery mode page specifies the error recovery parameters the device server shall use during any command that performs a read or write operation to the medium (e.g., READ command, WRITE command, or VERIFY command).

Table 6-2- Read-Write Error Recovery Mode Page

Mode Page	Offset	Size	Field	MDV	User Conf.	Description
Read-Write Error Recovery	00h	6b	PAGE CODE	01h	No	-
	00h	1b	SPF	0b	No	-
	00h	1b	PS	1b	No	-
	01h	01h	PAGE LENGTH	0Ah	No	-
	02h	1b	DCR	0b	No	-
	02h	1b	DTE	0b	No	-
	02h	1b	PER	0b	No	-
	02h	1b	EER	0b	No	-
	02h	1b	RC	0b	No	-
	02h	1b	TB	0b	No	-
	02h	1b	ARRE	0b	No	-
	02h	1b	AWRE	1b	No	-
	03h	01h	READ RETRY COUNT	05h	No	-
	04h	01h	Obsolete	00h	No	-
	05h	01h	Obsolete	00h	No	-
	06h	01h	Obsolete	00h	No	-
	07h	2b	Restricted for MMC-6	00b	No	-
	07h	5b	Reserved	00000b	No	-
	07h	1b	TPERE	0b	No	-
	08h	01h	WRITE RETRY COUNT	02h	No	-
	09h	01h	Reserved	00h	No	-
	0Ah	02h	RECOVERY TIME LIMIT	4B0h	No	-

6.3. Caching Mode Page

The caching mode page defines the parameters that affect the use of the cache. A UFS device shall implement support for following parameters.

Table 6-3 Caching Mode Page

Mode Page	Offset	Size	Field	MDV	User Conf.	Description
Caching	00h	6b	PAGE CODE	08h	No	-
	00h	1b	SPF	0b	No	-
	00h	1b	PS	1b	No	-
	01h	01h	PAGE LENGTH	12h	No	-
	02h	1b	RCD	0b	Yes	-
	02h	1b	MF	0b	No	-
	02h	1b	WCE	1b	Yes	-
	02h	1b	SIZE	0b	No	-
	02h	1b	DISC	0b	No	-
	02h	1b	CAP	0b	No	-
	02h	1b	ABPF	0b	No	-
	02h	1b	IC	0b	No	-
	03h	4b	WRITE RETENTION PRIORITY	0000b	No	-
	03h	4b	DEMAND READ RETENTION PRIORITY	0000b	No	-
	04h	02h	DISABLE PRE-FETCH TRANSFER LENGTH	0000h	No	-
	06h	02h	MINIMUM PRE-FETCH	0000h	No	-
	08h	02h	MAXIMUM PRE-FETCH	0000h	No	-
	0Ah	02h	MAXIMUM PRE-FETCH CEILING	0000h	No	-
	0Ch	1b	NV_DIS	0b	No	-
	0Ch	2b	Reserved	00b	No	-
	0Ch	2b	Vendor Specific	00b	No	-
	0Ch	1b	DRA	0b	No	-
	0Ch	1b	LBCSS	0b	No	-
	0Ch	1b	FSW	0b	No	-
	0Dh	01h	NUMBER OF CACHE SEGMENTS	00h	No	-
	0Eh	02h	CACHE SEGMENT SIZE	0000h	No	-
	10h	01h	Reserved	00h	No	-
	11h	03h	Obsolete	000000h	No	-

7. Vital Product Data Parameters

Table 7-1 Caching Mode Page

Mode Page	Offset	Size	Field	MDV	User Conf.	Description
Standard Inquiry	00h	5b	PERIPHERAL DEVICE TYPE	00000b	No	-
	00h	3b	PERIPHERAL QUALIFIER	000b	No	-
	01h	7b	Reserved	0000000b	No	-
	01h	1b	RMB	0b	No	-
	02h	1h	VERSION	06h	No	-
	03h	4b	RESPONSE DATA FORMAT	0010b	No	-
	03h	1b	HISUP	0b	No	-
	03h	1b	NORMACA	0b	No	-
	03h	1b	Obsolete	0b	No	-
	03h	1b	Obsolete	0b	No	-
	04h	01h	ADDITIONAL LENGTH	1Fh	No	-
	05h	1b	PROTECT	0b	No	-
	05h	2b	Reserved	0b	No	-
	05h	1b	3PC	0b	No	-
	05h	2b	TPGS	0b	No	-
	05h	1b	ACC	0b	No	-
	05h	1b	SCCS	0b	No	-
	06h	1b	ADDR16	0b	No	-
	06h	1b	Obsolete	0b	No	-
	06h	1b	Obsolete	0b	No	-
	06h	1b	Obsolete	0b	No	-
	06h	1b	MULTIP	0b	No	-
	06h	1b	VS	0b	No	-
	06h	1b	ENCSERV	0b	No	-
	06h	1b	Obsolete	0b	No	-
	07h	1b	VS	0b	No	-
	07h	1b	CMDQUE	1b	No	-
	07h	1b	Obsolete	0b	No	-
	07h	1b	Obsolete	0b	No	-
	07h	1b	SYNC	0b	No	-
	07h	1b	WBUS16	0b	No	-
	07h	1b	Obsolete	0b	No	-
	07h	1b	Obsolete	0b	No	-
	08h	08h	VENDOR IDENTIFICATION	“ISSI”	No	-
	10h	10h	PRODUCT IDENTIFICATION	“eUFS2.1_032”	No	-
	20h	04h	PRODUCT REVISION LEVEL	"00.0" ~ "99.9"	No	-
Supported VPD Pages	00h	5b	PERIPHERAL DEVICE TYPE	00000b	No	-
	00h	3b	PERIPHERAL QUALIFIER	000b	No	-
	01h	01h	PAGE CODE	00h	No	-
	02h	02h	PAGE LENGTH	0007h	No	-
	04h	01h	Supported VPD Page List[0]	00h	No	-
	05h	01h	Supported VPD Page List[1]	80h	No	-
	06h	01h	Supported VPD Page List[2]	83h	No	-
	07h	01h	Supported VPD Page List[3]	87h	No	-
	08h	01h	Supported VPD Page List[4]	B0h	No	-
	09h	01h	Supported VPD Page List[5]	B1h	No	-
	0Ah	01h	Supported VPD Page List[6]	B2h	No	-

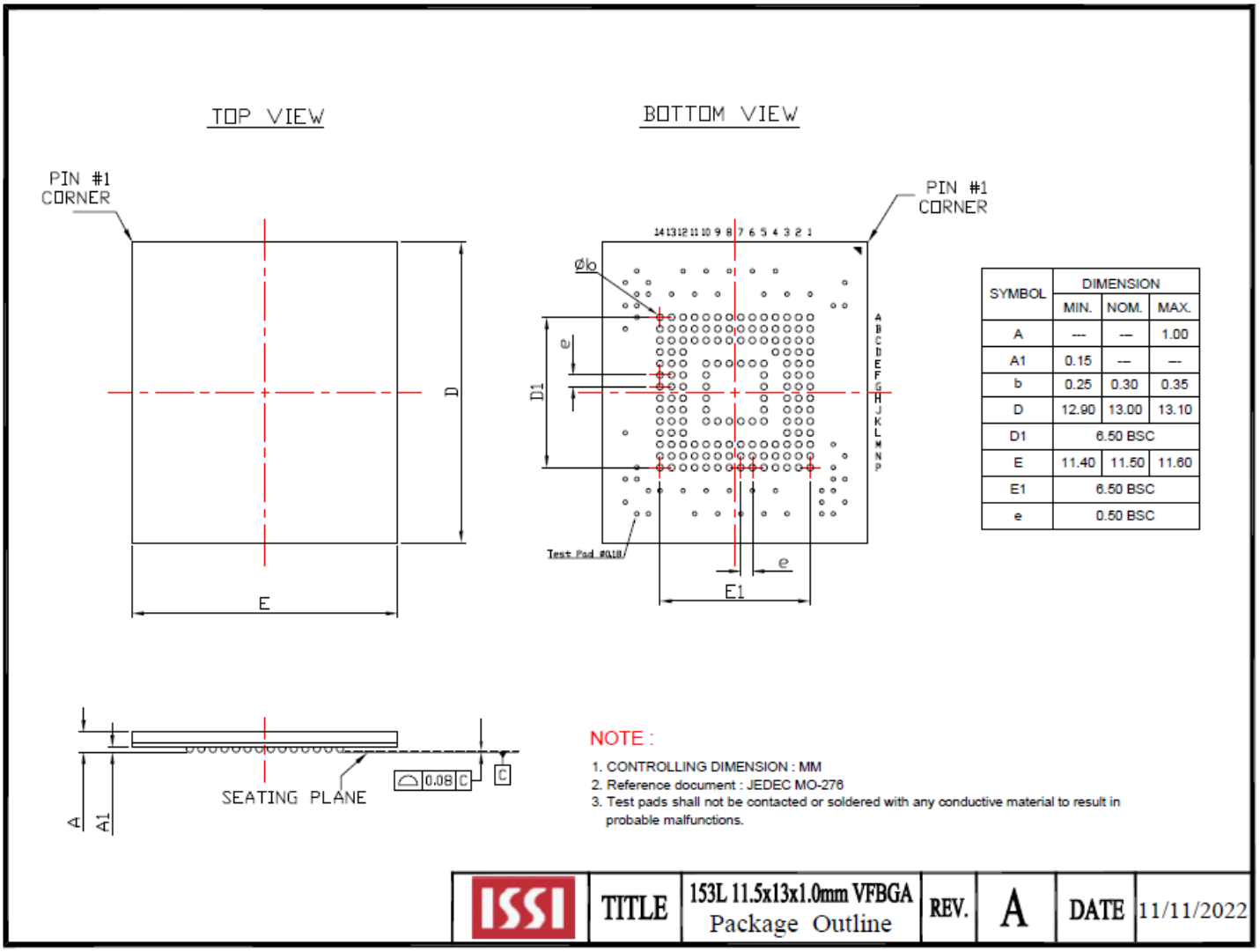
Mode Page	Offset	Size	Field	MDV	User Conf.	Description
Unit Serial Number	00h	5b	PERIPHERAL DEVICE TYPE	00000b	No	-
	00h	3b	PERIPHERAL QUALIFIER	000b	No	-
	01h	01h	PAGE CODE	80h	No	-
	02h	02h	PAGE LENGTH	-	No	-
	04h	20h	PRODUCT SERIAL NUMBER[0-31]	[customizable]	No	-
Device Identification	00h	5b	PERIPHERAL DEVICE TYPE	00000b	No	-
	00h	3b	PERIPHERAL QUALIFIER	000b	No	-
	01h	01h	PAGE CODE	83h	No	-
	02h	02h	PAGE LENGTH	0008h	No	-
	04h	4b	CODE SET	0001b	No	-
	04h	4b	PROTOCOL IDENTIFIER	0000b	No	-
	05h	4b	DESIGNATOR TYPE	0110b	No	-
	05h	2b	ASSOCIATION	10b	No	-
	05h	1b	Reserved	0b	No	-
	05h	1b	PIV	0b	No	-
	06h	01h	Reserved	0b	No	-
	07h	01h	DESIGNATOR LENGTH	04h	No	-
	08h	01h	DESIGNATOR[0]	00h	No	-
	09h	01h	DESIGNATOR[1]	00h	No	-
	0Ah	01h	DESIGNATOR[2]	00h	No	-
	0Bh	01h	DESIGNATOR[3]	00h	No	-
Mode Page Policy	00h	5b	PERIPHERAL DEVICE TYPE	00000b	No	-
	00h	3b	PERIPHERAL QUALIFIER	000b	No	-
	01h	01h	PAGE CODE	87h	No	-
	02h	02h	PAGE LENGTH	10h	No	-
	04h	06b	POLICY PAGE CODE[0]	01h	No	R/W Error Recovery Mode Page
	04h	02b	Reserved	00b	No	-
	05h	01h	POLICY SUBPAGE CODE[0]	00h	No	-
	06h	02b	MODE PAGE POLICY[0]	00b	No	-
	06h	05b	Reserved	00000b	No	-
	06h	01b	MLUS[0]	1b	No	-
	07h	01h	Reserved	00h	No	-
	08h	06b	POLICY PAGE CODE[1]	08h	No	Caching Mode Page (08h)
	08h	02b	Reserved	00b	No	-
	09h	01h	POLICY SUBPAGE CODE[1]	00h	No	-
	0Ah	02b	MODE PAGE POLICY[1]	00b	No	-
	0Ah	05b	Reserved	00000b	No	-
	0Ah	01b	MLUS[1]	1b	No	-
	0Bh	01h	Reserved	00h	No	-
	0Ch	06b	POLICY PAGE CODE[2]	0Ah	No	Control Mode Page
	0Ch	02b	Reserved	00b	No	-
	0Dh	01h	POLICY SUBPAGE CODE[2]	00h	No	-
	0Eh	02b	MODE PAGE POLICY[2]	00b	No	-
	0Eh	05b	Reserved	00000b	No	-
	0Eh	01b	MLUS[2]	1b	No	-
	0Fh	01h	Reserved	00h	No	-
	10h	06b	POLICY PAGE CODE[3]	3Fh	No	All Page
	10h	02b	Reserved	00b	No	-
	11h	01h	POLICY SUBPAGE CODE[3]	00h	No	-

Mode Page	Offset	Size	Field	MDV	User Conf.	Description
	12h	02b	MODE PAGE POLICY[3]	00b	No	-
	12h	05b	Reserved	00000b	No	-
	12h	01b	MLUS[3]	1b	No	-
	13h	01h	Reserved	00h	No	-
Block Limits	00h	5b	PERIPHERAL DEVICE TYPE	00000b	No	-
	00h	3b	PERIPHERAL QUALIFIER	000b	No	-
	01h	01h	PAGE CODE	B0h	No	-
	02h	02h	PAGE LENGTH	003Ch	No	-
	04h	01h	Reserved	00h	No	-
	05h	01h	MAXIMUM COMPARE AND WRITE LENGTH	00h	No	-
	06h	02h	OPTIMAL TRANSFER LENGTH GRANULARITY	20h	No	-
	08h	04h	MAXIMUM TRANSFER LENGTH	00h	No	-
	0Ch	04h	OPTIMAL TRANSFER LENGTH	20h	No	-
	10h	04h	MAXIMUM PREFETCH XDREAD XDWRITE TRANSFER LENGTH	08h	No	-
	14h	04h	MAXIMUM UNMAP LBA COUNT	01DD7800h	No	-
	18h	04h	MAXIMUM UNMAP BLOCK DESCRIPTOR COUNT	01h	No	-
	1Ch	04h	OPTIMAL UNMAP GRANULARITY	01h	No	-
	20h	04h	UNMAP GRANULARITY ALIGN MENT	00h	No	-
	24h	1Bh	Reserved	00h	No	-
Block Device Charac teristics	00h	5b	PERIPHERAL DEVICE TYPE	00000b	No	-
	00h	3b	PERIPHERAL QUALIFIER	000b	No	-
	01h	01h	PAGE CODE	B1h	No	-
	02h	02h	PAGE LENGTH	003Ch	No	60Byte
	04h	02h	MEDIUM ROTATION RATE	0001h	No	0001h : Non-rotating medium (e.g., solid state)
	06h	01h	Reserved	00h	No	-
	07h	4b	NOMINAL FORM FACTOR	00h	No	0h : Nominal form factor is not reported 1h : 5.25 inch 2h : 3.5 inch 3h : 2.5 inch 4h : 1.8 inch 5h : Less than 1.8 inch All others : Reserved
	07h	4b	Reserved	00h	No	-
	08h	38h	Reserved	00h	No	-

Mode Page	Offset	Size	Field	MDV	User Conf.	Description
Logical Block Provisioning	00h	5b	PERIPHERAL DEVICE TYPE	00000b	No	-
	00h	3b	PERIPHERAL QUALIFIER	000b	No	-
	01h	01h	PAGE CODE	B2h	No	-
	02h	02h	PAGE LENGTH	0004h	No	-
	04h	01h	THRESHOLD EXPONENT	18h	No	-
	05h	1b	DP	0b	No	-
	05h	1b	ANC_SUP	0b	No	-
	05h	1b	LBPRZ_TPRZ	1b	No	-
	05h	2b	Reserved	00b	No	-
	05h	1b	LBPWS 10	0b	No	-
	05h	1b	LBPWS	0b	No	-
	05h	1b	LBPU	1b	No	-
	06h	3b	PROVISIONING TYPE	00h	No	0 : Thin provision, 1 : Full provision
	06h	5b	Reserved	00h	No	-
	07h	01h	Reserved	00h	No	-

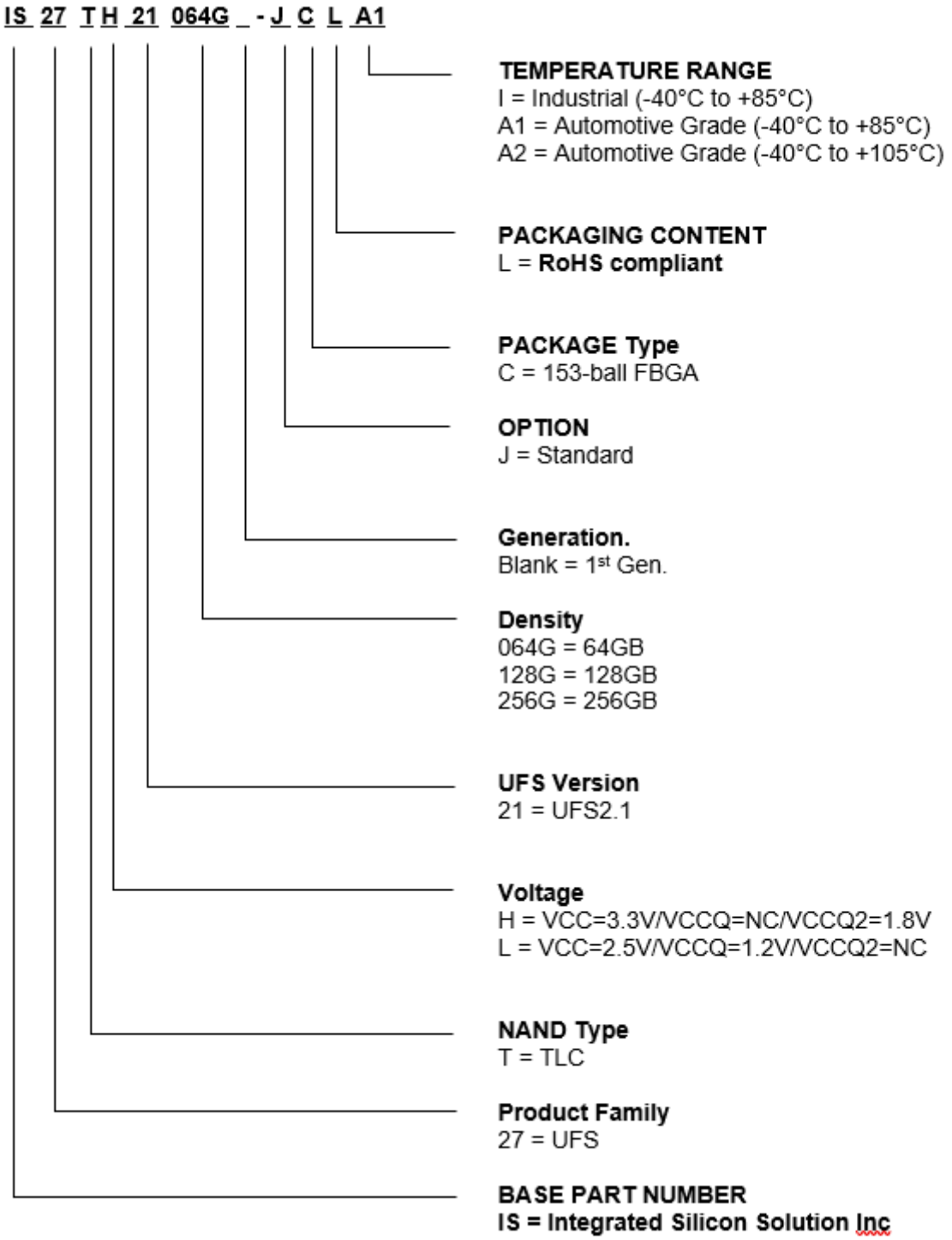
8. PACKAGE TYPE INFORMATION

8.1. 153-BALL FBGA Package (C)



SYMBOL	DIMENSION		
	MIN.	NOM.	MAX.
A	---	---	1.00
A1	0.15	---	---
b	0.25	0.30	0.35
D	12.90	13.00	13.10
D1		6.50 BSC	
E	11.40	11.50	11.60
E1		6.50 BSC	
e		0.50 BSC	

9. ORDERING INFORMATION – Valid Part Numbers



Density	Interface	Operating Voltage	Package	Temp. Grade	Order Part Number
64GB	UFS2.1	VCC = 3.3V VCCQ = NC VCCQ2 = 1.8V	153 FBGA	Industrial	IS27TH064G21-JCLI
				Automotive, A1	IS27TH064G21-JCLA1
				Automotive, A2	IS27TH064G21-JCLA2
128GB				Industrial	IS27TH128G21-JCLI
				Automotive, A1	IS27TH128G21-JCLA1
				Automotive, A2	IS27TH128G21-JCLA2
256GB				Industrial	IS27TH256G21-JCLI
				Automotive, A1	IS27TH256G21-JCLA1
				Automotive, A2	IS27TH256G21-JCLA2