SAS 2.5-inch Hybrid Hard Drives for System x
Product Guide (withdrawn product)

The IBM® SAS 2.5-inch Hybrid hard disk drives (HDDs) for System x® provide cost-effective performance and density by combining a cache of NAND flash and conventional HDD media in a single industry-standard small form factor (SFF) drive. These hybrid drives accelerate HDD performance for small and medium business and distributed large enterprise application environments, enabling higher I/O performance for most frequently used data while leveraging the capacity and cost of spinning media for primary storage.

Figure 1 shows the IBM SAS 2.5-inch Hybrid HDD.

Figure 1. IBM SAS 2.5-inch Hybrid HDD

Did you know?

While conventional hard disk drives can meet capacity requirements, HDD performance enhancements have remained relatively flat and confined to the rotational speed of the media. Hybrid HDDs offer accelerated performance by utilizing integrated NAND flash to cache data. The result is significantly improved performance over today's conventional HDDs.

Rigorous testing of 2.5-inch Hybrid HDDs by IBM through the IBM ServerProven® program assures a high degree of confidence in storage subsystem compatibility and reliability. Providing additional peace of mind, these drives are covered under IBM warranty.

Part number information

Table 1 lists the information for ordering part numbers and feature codes for the IBM SAS Hybrid HDDs.

Table 1. Ordering part numbers and feature codes

Description	Part number	Feature code
Hot-swap drives		
IBM 600GB 10K 6Gbps SAS 2.5" G2HS Hybrid	00AD102	A4G7
Simple-swap drives		
IBM 600GB 10K 6Gbps SAS 2.5" G2SS Hybrid	00AD107	A4G8

The part numbers include the following items:

- One Hybrid HDD with a hot-swap or simple-swap drive tray
- Warranty Flyer
- *Important Notices* document

Features

The IBM SAS 2.5-inch Hybrid HDDs have the following features:

- Industry standard 2.5-inch form factor supports 2.5-inch drive bays on selected System x, IBM iDataPlex®, BladeCenter® and IBM Flex System™ servers.
- Combine a cache of NAND flash and conventional media to accelerate hard disk drive performance.
- Enable higher IO performance while leverage the capacity and cost of spinning media for primary storage.
- Bring transparent enhanced performance to data with high locality (*hot* data).
- Transparently cache data at I/O block level.
- Improve performance of server internal storage in lower cost configurations, without a need to utilize SSDs and storage tiering.
- Performance features:
  - 128 MB DRAM data buffer
  - 16 GB Hybrid read cache
  - 8 MB Hybrid NVC-backed write cache
  - Support up to 6 Gbps SAS interface speeds
  - 128 queue depth
- Reliability features:
  - ECC maximum burst correction length of 530 bits
  - S.M.A.R.T. (self-monitoring, analysis, and reporting technology) support
  - Drive Self Test (DST)
  - Background Media Scan (BMS)
  - Idle Read After Write (IRAW)

Hybrid HDDs integrate three media types: HDD, DRAM, and NAND. HDD memory is used as a primary data storage for all data. DRAM memory is used for buffering all reads and caching all writes. NAND memory is divided into two parts: eMLC flash memory is used as a read cache for frequently used data; and SLC flash memory is used as a non-volatile storage for write cache in DRAM in case of a power failure.

Technical specifications

Table 2 presents technical specifications for the IBM SAS 2.5-inch Hybrid HDDs.

Table 2. IBM SAS 2.5-inch Hybrid HDD technical specifications

Specification	**600 GB**	
Part number	00AD102	00AD107
Interface	6 Gbps SAS	6 Gbps SAS
Hot-swap drive	Yes	No
Form factor	2.5-inch	2.5-inch
Capacity	600 GB	600 GB
Rotational speed	10,000	10,000
Data reliability	< 1 in 10^{16} bits read	< 1 in 10^{16} bits read
MTBF, hours	2,000,000	2,000,000
Average sustained transfer rate	151 MBps	151 MBps
Average rotational latency	2.9 ms	2.9 ms
Shock	40 *g,* 11 ms; 25*g,* 2 ms	40 *g,* 11 ms; 25*g,* 2 ms
Vibration, operating	5-500 Hz at 0.5 *g*	5-500 Hz at 0.5 *g*
Vibration, non-operating	5-500 Hz at 3.0 *g*	5-500 Hz at 3.0 *g*
Typical power	< 7.5 W	< 7.5 W

Supported servers

The compatibility information for the IBM SAS 2.5-inch Hybrid HDDs and System x, iDataPlex, and NeXtScale servers is shown in Table 3 (Parts 1, 2, and 3).

Table 3. System x, iDataPlex, and NeXtScale compatibility (Part 1)

Part number	**Description**	x3250 M5 (5458)	x3500 M4 (7383, E5-2600 v2)	x3550 M4 (7914, E5-2600 v2)	x3650 M4 (7915, E5-2600 v2)	x3650 M4 HD (5460)	dx360 M4 (7912, E5-2600 v2)	nx360 M4 (5455)
00AD102	IBM 600GB 10K 6Gbps SAS 2.5" G2HS Hybrid	N	Y	Y	Y	N	N	N
00AD107	IBM 600GB 10K 6Gbps SAS 2.5" G2SS Hybrid	N	N	N	N	N	Y	N

Table 3. System x, iDataPlex, and NeXtScale compatibility (Part 2)

Part number	Product description	x3100 M4 (2582)	x3250 M4 (2583)	x3300 M4 (7382)	x3500 M4 (7383, E5-2600)	x3530 M4 (7160)	x3550 M4 (7914, E5-2600)	x3630 M4 (7158)	x3650 M4 (7915, E5-2600)	x3690 X5 (7147)	x3750 M4 (8722)	x3850 X5 (7143)	dx360 M4 (7912, E5-2600)
00AD102	IBM 600GB 10K 6Gbps SAS 2.5" G2HS Hybrid	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
00AD107	IBM 600GB 10K 6Gbps SAS 2.5" G2SS Hybrid	N	Y	N	N	Y	N	N	N	N	N	N	Y

Table 3. System x, iDataPlex, and NeXtScale compatibility (Part 3)

Part number	Product description	x3200 M3 (7327, 7328)	x3250 M3 (4251, 4252)	x3400 M3 (7378, 7379)	x3500 M3 (7380)	x3550 M3 (7944)	x3620 M3 (7376)	x3630 M3 (7377)	x3650 M3 (7945)	x3755 M3 (7164)	dx360 M3 (6391)
00AD102	IBM 600GB 10K 6Gbps SAS 2.5" G2HS Hybrid	N	N	N	N	Y	N	Y	Y	N	N
00AD107	IBM 600GB 10K 6Gbps SAS 2.5" G2SS Hybrid	N	N	N	N	N	N	N	N	N	N

The compatibility information for the IBM SAS 2.5-inch Hybrid HDDs and BladeCenter and Flex System servers is shown in Table 4.

Table 4. BladeCenter and Flex System compatibility

Part number	Product description	HS12 (8028)	HS22 (7870)	HS22V (7871)	HS23 (7875)	HS23E (8038)	HX5 (7872)	HX5 (7873)	x220 (7906)	x222 (7916)	x240 (8737, E5-2600)	x240 (8737, E5-2600 v2)	x440 (7917)
00AD102	IBM 600GB 10K 6Gbps SAS 2.5" G2HS Hybrid	N	Y	N	Y	Y	N	N	Y	N	Y	Y	Y
00AD107	IBM 600GB 10K 6Gbps SAS 2.5" G2SS Hybrid	N	N	N	N	N	N	N	N	N	N	N	N

See the IBM ServerProven® website for the latest compatibility information for System x, BladeCenter, iDataPlex, and Flex System servers: http://ibm.com/servers/eserver/serverproven/compat/us/

Supported storage controllers

The IBM SAS 2.5-inch Hybrid HDDs require a supported disk controller. Tables 5 and 6 list the System x, BladeCenter, and Flex System controllers that support these Hybrid HDDs installed in a supported server.

Table 5. RAID controllers for System x and iDataPlex servers supported with hybrid HDDs (Part 1)

Part number	Product description	x3250 M5 (5458)	x3500 M4 (7383, E5-2600 v2)	x3550 M4 (7914, E5-2600 v2)	x3650 M4 (7915, E5-2600 v2)	x3650 M4 HD (5460)	dx360 M4 (7912, E5-2600 v2)	nx360 M4 (5455)
Onboard	ServeRAID M5210e SAS/SATA Controller	N	N	N	N	Y	N	N
46C9110	ServeRAID M5210 SAS/SATA Controller	N	Y	Y	Y	Y	N	N
Onboard	ServeRAID M5110e SAS/SATA Controller	N	N	N	Y	N	N	N
81Y4481	ServeRAID M5110 SAS/SATA Controller	N	Y	Y	Y	N	Y	N
81Y4448	ServeRAID M1115 SAS/SATA Controller	N	Y	Y	N	N	Y	N
81Y4492	ServeRAID H1110 SAS/SATA Controller	N	N	Y	N	Y	Y	N
90Y4304	ServeRAID M5016 SAS/SATA Controller	N	N	N	N	N	N	N
46M0829	ServeRAID M5015 SAS/SATA Controller	N	N	N	N	N	N	N
46M0916	ServeRAID M5014 SAS/SATA Controller	N	N	N	N	N	N	N
46M0831	ServeRAID M1015 SAS/SATA Controller	N	N	N	N	N	N	N
Onboard	ServeRAID C100 / C105	N	N	N	N	N	N	N
46M0912	IBM 6Gb Performance Optimized HBA	N	Y	Y	Y	N	Y	N
46C8988	N2115 SAS/SATA HBA	N	Y	Y	Y	N	N	N
47C8675	N2215 SAS/SATA HBA	N	Y	Y	Y	Y	N	N

Table 5. RAID controllers for System x and iDataPlex servers supported with hybrid HDDs (Part 2)

Part number	Product description	x3100 M4 (2582)	x3250 M4 (2583)	x3300 M4 (7382)	x3500 M4 (7383, E5-2600)	x3530 M4 (7160)	x3550 M4 (7914, E5-2600)	x3630 M4 (7158)	x3650 M4 (7915, E5-2600)	x3690 X5 (7147)	x3750 M4 (8722)	x3850 X5 (7143)	dx360 M4 (7912, E5-2600)
Onboard	ServeRAID M5210e SAS/SATA Controller	N	N	N	N	N	N	N	N	N	N	N	N
46C9110	ServeRAID M5210 SAS/SATA Controller	N	N	N	Y	N	Y	N	Y	N	N	N	N
Onboard	ServeRAID M5110e SAS/SATA Controller	N	N	N	N	N	N	N	Y	N	Y	N	N
81Y4481	ServeRAID M5110 SAS/SATA Controller	N	N	Y	Y	Y	Y	N	Y	N	Y	N	Y
81Y4448	ServeRAID M1115 SAS/SATA Controller	N	N	Y	Y	Y	Y	N	N	N	Y	N	Y
81Y4492	ServeRAID H1110 SAS/SATA Controller	Y	Y	Y	N	Y	Y	N	N	N	N	N	Y
90Y4304	ServeRAID M5016 SAS/SATA Controller	N	N	N	N	N	N	N	N	Y	N	Y	N
46M0829	ServeRAID M5015 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	Y	N	Y	N
46M0916	ServeRAID M5014 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	Y	N	Y	N
46M0831	ServeRAID M1015 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	Y	N	Y	N
Onboard	ServeRAID C100 / C105	N	N	N	N	N	N	N	N	N	N	N	N
46M0912	IBM 6Gb Performance Optimized HBA	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
46C8988	N2115 SAS/SATA HBA	N	N	N	Y	N	Y	N	Y	N	Y	Y	N
47C8675	N2215 SAS/SATA HBA	N	N	N	Y	N	Y	N	Y	N	N	N	N

Table 5. RAID controllers for System x and iDataPlex servers supported with hybrid HDDs (Part 3)

Part number	Product description	x3200 M3 (7327, 7328)	x3250 M3 (4251, 4252)	x3400 M3 (7378, 7379)	x3500 M3 (7380)	x3550 M3 (7944)	x3620 M3 (7376)	x3630 M3 (7377)	x3650 M3 (7945)	x3755 M3 (7164)	dx360 M3 (6391)
Onboard	ServeRAID M5110e SAS/SATA Controller	N	N	N	N	N	N	N	N	N	N
81Y4481	ServeRAID M5110 SAS/SATA Controller	N	N	N	N	N	N	N	N	N	N
81Y4448	ServeRAID M1115 SAS/SATA Controller	N	N	N	N	N	N	N	N	N	N
81Y4492	ServeRAID H1110 SAS/SATA Controller	N	N	N	N	Y	N	N	Y	N	N
90Y4304	ServeRAID M5016 SAS/SATA Controller	N	N	N	N	Y	N	N	Y	N	N
46M0829	ServeRAID M5015 SAS/SATA Controller	N	N	N	N	Y	N	Y	Y	N	N
46M0916	ServeRAID M5014 SAS/SATA Controller	N	N	N	N	Y	N	Y	Y	N	N
46M0831	ServeRAID M1015 SAS/SATA Controller	N	N	N	N	Y	N	Y	Y	N	N
Onboard	ServeRAID C100 / C105	N	N	N	N	N	N	N	N	N	N
46M0912	IBM 6Gb Performance Optimized HBA	N	N	N	N	Y	N	Y	Y	N	N
46C8988	N2115 SAS/SATA HBA	N	N	N	N	N	N	N	N	N	N
47C8675	N2215 SAS/SATA HBA	N	N	N	N	N	N	N	N	N	N

Table 6. RAID controllers for BladeCenter and Flex System servers supported with Hybrid HDDs

Part number	Product description	HS12 (8028)	HS22 (7870)	HS22V (7871)	HS23 (7875)	HS23E (8038)	HX5 (7872)	HX5 (7873)	x220 (7906)	x222 (7916)	x240 (8737, E5-2600)	x240 (8737, E5-2600 v2)	x440 (7917)
90Y4390	ServeRAID M5115 SAS/SATA Controller	N	N	N	N	N	N	N	Y	N	Y	Y	Y
90Y4750	ServeRAID H1135 Controller	N	N	N	N	Y	N	N	Y	N	N	N	N
Onboard	ServeRAID C105	N	N	N	N	N	N	N	N	N	N	N	N
Onboard	Integrated LSI SAS2004	N	N	N	Y	N	N	N	N	N	Y	Y	Y
46C7167	ServeRAID-MR10ie (CIOv) Controller	N	N	N	N	N	N	N	N	N	N	N	N
Onboard	Integrated LSI SAS1064e	N	Y	N	N	N	N	N	N	N	N	N	N
46M6908	SSD Expansion Card for BladeCenter HX5	N	N	N	N	N	N	N	N	N	N	N	N

See the IBM ServerProven website for the latest information about the adapters supported by each System x server type: http://ibm.com/servers/eserver/serverproven/compat/us/

Supported operating systems

Hybrid HDDs operate transparently to users, applications, databases, and operating systems. The controllers that support Hybrid HDDs are supported by the following operating systems:

- Microsoft Windows Server 2012 R2
- Microsoft Windows Server 2012
- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2008, Datacenter x64 Edition
- Microsoft Windows Server 2008, Datacenter x86 Edition
- Microsoft Windows Server 2008, Enterprise x64 Edition
- Microsoft Windows Server 2008, Enterprise x86 Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Microsoft Windows Server 2008, Standard x86 Edition
- Microsoft Windows Server 2008, Web x64 Edition
- Microsoft Windows Server 2008, Web x86 Edition
- Microsoft Windows Server 2008 Foundation
- Microsoft Windows Server 2008 HPC Edition
- Microsoft Windows HPC Server 2008
- Microsoft Windows Small Business Server 2008 Premium Edition
- Microsoft Windows Small Business Server 2008 Standard Edition
- Microsoft Windows Essential Business Server 2008 Premium Edition
- Microsoft Windows Essential Business Server 2008 Standard Edition
- Red Hat Enterprise Linux 6 Server Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 5 Server Edition
- Red Hat Enterprise Linux 5 Server Edition with Xen
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 4 AS for AMD64/EM64T
- Red Hat Enterprise Linux 4 AS for x86
- SUSE Linux Enterprise Server 11 for AMD64/EM64T
- SUSE Linux Enterprise Server 11 for x86
- SUSE Linux Enterprise Server 11 with Xen for AMD64/EM64T
- SUSE Linux Enterprise Server 10 for AMD64/EM64T
- SUSE Linux Enterprise Server 10 for x86
- SUSE Linux Enterprise Server 10 with Xen for AMD64/EM64T
- SUSE Linux Enterprise Server 10 with Xen for x86
- VMware vSphere 5.1
- VMware vSphere 5.0
- VMware ESX 4.1
- VMware ESXi 4.1
- VMware ESX 4.0
- VMware ESXi 4.0

See the IBM ServerProven website for the latest information about the specific supported versions and service packs: http://ibm.com/servers/eserver/serverproven/compat/us/. Click **System x**, then **Storage controllers & SSD adapters** to see the support matrix. Click the check mark that is associated with the System x server in question to see the details about operating system support.

Warranty

The IBM SAS 2.5-inch Hybrid HDDs carry a one-year, customer-replaceable unit (CRU) limited warranty. When installed in a supported IBM server, these drives assume your system's base warranty and any IBM ServicePac® upgrade.

Physical specifications

The IBM SAS 2.5-inch Hybrid HDDs have the following physical specifications.

Dimensions and weight (approximate):

- Height: 15 mm (0.6 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (3.9 in.)
- Weight: 219 g (0.5 lb)

Shipping dimensions and weight (approximate):

- Height: 63 mm (2.5 in.)
- Width: 133 mm (5.2 in.)
- Depth: 174 mm (6.9 in.)
- Weight: 579 g (1.3 lb)

Operating environment

The IBM SAS 2.5-inch Hybrid HDDs are supported in the following environment:

- Temperature: 5 - 60 °C (41 - 158°F) at -61 m to 3,048 m (-200 ft to 10,000 ft)
- Relative humidity: 5 - 90% (noncondensing)
- Maximum altitude: 2,133 m (7,000 ft)

Agency approvals

The IBM SAS 2.5-inch Hybrid HDDs have the following agency approvals:

- UL
- CSA
- TUV
- CE Mark
- C-Tick Mark
- IEC
- Taiwan (BSMI Certification)
- Korea EMI

Related publications

For more information, see the following documents:

- IBM US Announcement Letter - IBM 15,000 rpm SAS 2.5-inch Hybrid HDDs for System x
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS113-156
- IBM US Announcement Letter - IBM 10,000 rpm SAS 2.5-inch Hybrid HDDs for System x
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS113-102
- IBM Redbooks® publication: *IBM ServeRAID Adapter Quick Reference*
  http://www.redbooks.ibm.com/abstracts/tips0054.html?Open
- *System x Configuration and Options Guide*
  http://www.ibm.com/systems/xbc/cog/
- IBM ServerProven
  http://ibm.com/servers/eserver/serverproven/compat/us/

Related product families

Product families related to this document are the following:

- Drives

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