

AD911A Converter Card

Performance & Burn In Test Rev. 1.0

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1. Overview

AD911A Interposer card, is M.2 (NGFF) to M.2 (NGFF) converter. It built M.2 (NGFF) 67pin B key connector, and use 22x80(mm) form factor with B + M key dual notch golden finger board. AD911A allows 22x30(mm), 22x42(mm), 22x60(mm) M.2 SSD inserted using.

2. Tools and Results of Performance Measurement

2.1 Test Platform

| M/B : | ASUS P8P67 |
|-------------|---|
| CPU : | Intel i5-2500, 3.3MHz/ 6G Cache/ 5GT |
| Memory : | Kingston KVR1333D3N9K2/4G, DDR3-1333MHz,4G(2GB DIMM*2) |
| ATX Power : | TC START W500, 500W ATX ,12V V2.2 Power Supplier |
| Graphic : | MSI , R6700 / AMD HD 6700 Series |
| OS : | Microsoft Windows 7 64bit OS |

2.2 Test target: AD911A adapter and M.2 NGFF SSD(LITE-ON LSS-16L6G)

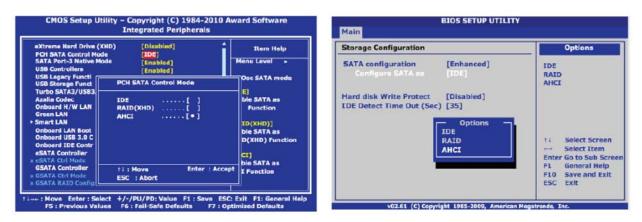


2.3 Install Hardware

Insert M.2(NGFF) SSD(LITE-ON LSS-16L6G) into AD903D converter's M.2 67pin B key connector, and then with coppers, and screws to fix SSDs. Connect AD911A converter to SATA III Port of ASUS P8P67 motherboard.

2.4 BIOS & Windows 7 OS environment setup

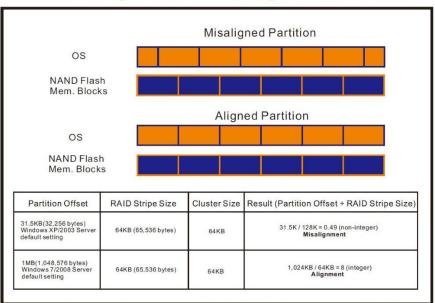
2.4.1 In BIOS(Basic Input/Output Setup) – Change IDE Mode into AHCI Mode



2.4.2 Partition Alignment & I/O Alignment

Windows XP and Windows Server 2000/2003 start partition offset at 31.5KB (32,256 bytes). Due to this misalignment, clusters of data are spread across physical memory block boundaries, incurring a read- modify-write penalty. As a result, the SSD controller must write up to 200% more data to the flash than is sent from the host to the drive.

When choosing a partition starting offset, Storage Systems recommends that system integrators correlate the partition offset with the RAID stripe size and cluster size to achieve optimal SSD I/O performance. As following Figure shows an example of a misaligned partition offset and an example of an aligned partition offset for Windows Server.



Misaligned Partition vs. Aligned Partition

| E: WDC WD5000AACS-00ZU | B0 • | | D: IN TEL SSDSA2M080G2G | c • | |
|---|-------|--------|---|----------------------------|--------|
| WDC 01.0 iaStor - OK 31 K - BAD 465.76 GB | Read: | Write: | INTEL 2CV1 iaStor - OK 1024 K - OK 74.53 GB | Read: tition is aligned | Write: |
| 🗷 Seq | MB/s | MB/s | ☑ Seq | MB/s | MB/s |
| ☑ 4K | MB/s | MB/s | ☑ 4K | MB/s | MB/s |
| 4K-64Thrd | MB/s | MB/s | 4K-64Thrd | MB/s | MB/s |
| Acc.time | ms | ms | Acc.time | ms | ms |
| Score: | | | Score: | | 1 |
| | | | | | |

XUsing AS SSD Benchmark viewing partition is aligned

 \times Using AS SSD Benchmark to check vendor AHCI Drive is installed

| AS SSD Benchmark 1.7.47 | and the second se | | 🕍 AS SSD Benchmark 1.7.4739.38088 | | | | | |
|---|---|--------|--|--------------------------|--------------|--|--|--|
| File Edit View Too E: WDC WD5000AACS-00ZU | | | File Edit View Tools Language Help G: MINERVA-Mercury PRO(64GB) ATA Device Image: Compared to the second | | | | | |
| WDC 01.0 iaStor - OK 31 K - BAD 465.76 GB | Read: 使用Intel AHCI Driver | Write: | MINERVA-Mercury 1916 msahci - OK 1024 K - OK 59.62 GB | Read: 使用Microsoft AHG | Write: CI | | | |
| ☑ Seq | MB/s | MB/s | I Seq | MB/s | MB/s | | | |
| ☑ 4K | MB/s | MB/s | ✓ 4K | MB/s | MB/s | | | |
| ☑ 4K-64Thrd | MB/s | MB/s | ☑ 4K-64Thrd | MB/s | MB/s | | | |
| Acc.time | ms | ms | Acc.time | ms | ms | | | |
| Score: | | | Score: | | | | | |
| Start Abort | | | | | | | | |

- 2.4.3 In Windows 7, formatted SSD to NTFS Mode. Don't install any program. Because FAT32 previous versions do not support NCQ, recommended formatted NTFS file mode.
- 2.4.4 AHCI support Queue CommandAHCI queue command protocol allows each disk contains 32 commands. So QD(Queue Depth) is 32.
- 2.4.5 SSD Write Cache Setting Enable the Write Cache setting in Windows 7.

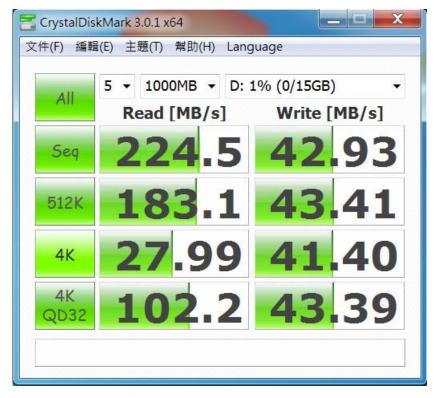
2.5 SSD I/O Performance impact factors

- 2.5.1 SATA I/O performance -- depending on the SSD Controller IC
- 2.5.2 SATA I/O performance -depending on the NAND Flash IC.
 - 2.5.2.1 Toggle DDR mode or ONFI synchronous NAND Flash IC, will show good performance
 - 2.5.2.2 Traditional asynchronous or SDR NAND Flash IC, will show poor performance

Suggestion:

Please use the motherboard containing native SATA 6Gb/s Port testing, can provide more correct I/O performance. (Such as Intel 6 Series chipsets or AMD 9 Series Chipsets). If you are using a motherboard plus SATA III host bus adapter, non-native 6Gb/s Port or SATA to PCI-e adapter provides 6Gb/s Port. I/O performance testing will be very much lower than the native SATA III Port.

- 2.6 CrystalDiskMark 3.0.1 x64 performance test %Benchmark (Sequential Read & Write / default = 1MB)
 - 2.6.1 Used LITE-ON LSS-16L6G performance as below:



AD911A Interposer Card

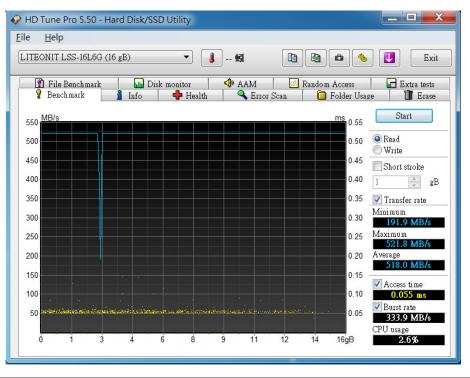
2.7 AS SSD Benchmark 1.7 performance test

※Benchmark (Read & Write by MB/s, default block size = 16MB)

2.7.1 Used LITE-ON LSS-16L6G performance as below:

| 🖄 AS SSD Benchmark 1.7.4739.38088 | | | | | | | | | | |
|--|-------------|------------|--|--|--|--|--|--|--|--|
| File Edit View Tools Language Help | | | | | | | | | | |
| D: LITEONIT LSS-16L6G | | | | | | | | | | |
| LITEONIT LSS-16L6G DS46 iaStor - OK 1024 K - OK 14.91 GB | Read: | Write: | | | | | | | | |
| I Seq | 203.32 MB/s | 41.06 MB/s | | | | | | | | |
| ✓ 4K | 24.99 MB/s | 38.92 MB/s | | | | | | | | |
| ☑ 4K-64Thrd | 93.71 MB/s | 39.02 MB/s | | | | | | | | |
| Acc.time | 0.081 ms | 0.135 ms | | | | | | | | |
| Score: | 139 | 82 | | | | | | | | |
| | 295 | | | | | | | | | |
| | | | | | | | | | | |
| Abort | | | | | | | | | | |

- 2.8 <u>HD Tune Pro 5.5 performance test</u>
 ※Benchmark (Sequential Read / default block size = 8MB)
 - 2.8.1 Used LITE-ON LSS-16L6G performance as below:



Minerva Innovation Company

2.9 AnvilBenchmark_V110_B337

2.9.1 Used LITE-ON LSS-16L6G performance as below:

| ile Benchmarks | IOmeter System | Info Settings | Test size 1GB | • Drive 🔲 d: [新纬 | 曾磁碟區] | Screenshot Help |
|--|-------------------------|---------------------|---------------|------------------|---|---------------------------------------|
| SD Benchma | LITEONIT LSS-16L6G 16GE | | | | | |
| Read | Resp. time | MB read | IOPS | MB/s | | |
| Seq 4MB | 19.4696ms | 1,644.0 | 51.36 | 205.45 | | |
| 4K | 0.1469ms | 332.4 | 6,806.92 | 26.59 | | |
| 4K QD4 | 0.1871ms | 1,043.9 | 21,378.14 | 83.51 | | 967.46 |
| 4K QD16 | 0.6415ms | 1,217.9 | 24,942.42 | 97.43 | Run read | 967.46 |
| 32K | 0.3948ms | 1,188.0 | 2,533.05 | 79.16 | | |
| 128K | 1.1500ms | 1,631.3 | 869.59 | 108.70 | Deres | 1,410.35 |
| Write | Resp. time | MB written | IOPS | MB/s | Run | 1,410.35 |
| Seq 4MB | 97.5000ms | 1,024.0 | 10.26 | 41.03 | | |
| 4K | 0.1009ms | 387.0 | 9,907.11 | 38.70 | Run write | 442.89 442.89 |
| 4K QD4 | 0.3809ms | 413.1 | 10,497.38 | 41.01 | Hunwhie | 442.05 |
| 4K QD16 | 1.5115ms | 415.4 | 10,585.86 | 41.35 | | |
| Microsoft Windows 7 旗艦版 64-bit Build (7600) P8P67/1502, LGA1155 Intel(R) Core(TM) i5-2500 CPU @ 3.30GHz Memory : 4,073 MB | | Drives : Notes : | | | LITEONIT LSS-16L6G 16GB/D Drive D: 14.9/14.8GB free (99.4% NTFS - Cluster size 4096B Storage driveriaStor 10.5.0.102 | |

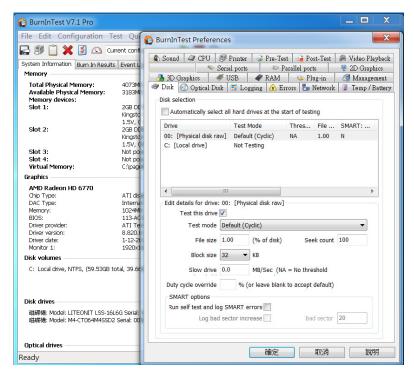
Burn In Tests and Results

3.1 BurnInTest v7.1 Pro

3.1.1 system information for LITE-ON LSS-16L6G as below:

| 🜔 BurnInTest V7.1 Pro | | _ D X | | BurnInTest V7.1 Pro | | × |
|--|--|--------------------------|----|---|---|--|
| File Edit Configuration Tes | t Quick Tests Help | | | File Edit Configuration Te | est Quick Tests Help | |
| 🕞 🗐 📋 💥 💆 🖎 Curre | ant configuration 💌 խ 🧱 🕢 | | | 🖬 🗐 🗋 X 🖉 🕰 🛛 | ment configuration 💌 խ 📕 🕢 | |
| System Information Burn In Results | Event Log Temperature | | | System Information Burn In Results | Event Log Temperature | |
| System summary | | | | Memory | 1 Sectors | • |
| Windows 7 Utimate Edition build 76 1 x Intel(R) Core(TM) I5-2500 CPU e 4.038 RAM, AMD Radeon HD 6770, 15GB SSD, 60GB SSD, General | | Ö | | Total Physical Memory: Available Physical Memory: Memory devices: Slot 1: Slot 2: | 407398 318306 208 00R3 SORAM PC3-10600 Kington 9905471-002 A01LF, seliaf: 1713266634, wk/yr: 11/2011 1.5%, Cic. 666.7M+R, Tringg 9-9-924 (@ Max. heg.) 208 DDR3 SDRAM PC3-10600 Kington 9905471-002.A01LF, seliaf: 1713263818, wk/yr: 11/2011 | 4 |
| Motherboard Model: Motherboard Version: Motherboard Serial Number: BIOS Manufacturer: BIOS Version: | PBRY-PC ASUSTRY Computer INC. PBP57 Rev 1.xx MITUI342-2007223 America Megatrends Inc. 1502 00(20/2011 | 3 | | Slot 3: Slot 4: Virtual Memory: Graphics AMD Radeon HD 6770 Chp Type: DAC Type: | 1.5%, Cik. 665.7M4k, Trining, 9-9-9-24 (@ Max, freq.) Not populated Cr(pagefile.sys (allocated base size 407248) ATI display adapter (0n688A) Interna DAC(4004H2) | - |
| CPUID: Physical CPU's: Cores per CPU: | GeruneIntel <u>Online G3J comparison</u> Intel(R) Core(TM) 6-2300 CPU (th 3-30GHz Family 6, Model 2A, Stepping 7 | (Intel) inter CORE'IS | | Memory: BIOS: Driver provider: Driver version: Driver date: Monitor 1: Disk volumes | 102498 113 4 - CR460-103 ATT Terhnologies Inc. 8.820.0.0 1-32-2011 1920-(1080:62 COHt (Pinnary monitor) | and a second sec |
| Multiplier: Base Clock: | Deabled MMX SSE SSE3 SSE3 SSE3 SSE4.1 SSE4.2 DEP PAE Intol64 VMX SMX Turbo AES 3011.6 M Ver [Turbo: 3713.0M v] xd3.0 [Turbo: x37.0] 10.00 M ve | | | C: Local drive, NTFS, (59:53GB t | otal, 39.6600 free) | |
| Cache per CPU package: L1 Instruction Cache: L1 Data Cache: L2 Cache: | Cache per CPU package: L1 Instruction Cache: 4 x 32 kB L1 Data Cache: 4 x 32 kB L2 Cache: 4 x 26 kB | | Ŧ | | 16G Serak 50C411542125C4002811 (Delc 0, Sae: 14.91GB, Volumer: N/A) Serak 00000000121005082940 (Delc 1, Sae: 59.62GB, Volumer: C) | <i>a</i> |
| Ready | | | ,ŝ | Ready | | |

3.1.2 show Disk test mode(default cyclic -- 10 ways cycle test)



3.1.3 show LITE-ON LSS-16L6G 24-hour Burn-in test PASSED

| 👸 BurnInTest V7.1 Pro | | | | | | | | X | | |
|--|--------------|---------------------------|-----------|-----------------------|-----------|--------------|---|---|--|--|
| File Edit Configuration Test Quick Tests Help | | | | | | | | | | |
| 류 🗐 📋 💥 🔯 🖎 Current configuration 🔻 🍉 📕 🚷 | | | | | | | | | | |
| System Information Burn In Results Event Log Temperature | | | | | | | | | | |
| Results for PERRY-PC | | | | | | | | | | |
| Test configuration file: LastUsed | | | | | | | | | | |
| | | 4 Stop time | : Tue Fel | 0 04 17:09:59 2014 | Duration: | 024h 00m 08s | | | | |
| 000600100000000000000000000000000000000 | | | | | | | | | | |
| | | | | | | | | | | |
| | | | - | | | | | | | |
| Test Name Poisk (0:) | Cycle 647 | Operations 215 Billion | O | Last Error Descriptio | n | | | | | |
| Temperature | - | - | 0 | No errors | | | | | | |
| | BurnIn | Test test resu | dt | | | | | X | | |
| | burnin | rest test rest | unc | | | | | | | |
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| View errors by categories | | | | 0 | ĸ | | | | | |
| Ready | | | _ | | _ | | _ | | | |

4. Summary

- 4.1 L LITE-ON LSS-16L6G SSD is SATA III Interface, I/O speed, max. to 600MB/s.
- 4.2 AD911A adapter I/O performance is based on M.2(NGFF) SSD