

TAKE FREE ¥0

KADEN HIHYO

Monthly home electrical appliance review

TEST, REVIEW and BUY

Special report

Now is the
time to decide
which one
suits you
best!

High
speed

Most
powerful

SSD

Stable

Reliable

RANKING

Ranking

SAMSUNG / Crucial / ADATA / SanDisk
CFD / Transcend / Kingston

Thorough tests reveal
the best of the latest
SSD models!



You'll be able to feel vast improvements!



The key to choosing an SSD

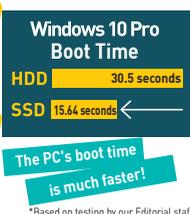
Now is the time for an SSD. Your PC lifestyle will be transformed!

Things to focus on **01** **A 250 GB capacity SSD can now be purchased for less than 10,000 Yen, so now is the time to buy!**

If you are dissatisfied with your current PC setup because you are having these kinds of problems, then replacing your existing drive with an SSD should solve the problem for you!

CASE01 My PC has been sluggish recently and I want to speed it up!

When a PC is running slowly, it's usually due to the speed at which system files are read. This is particularly true in the case of PC models that have a HDD installed, because the slow read speed is directly attributable to the hard drive. Just replacing the HDD with an SSD will have an amazing impact in terms of improving the speed at which your PC runs.



CASE02 I want to keep using my old PC and not spend a lot of money!

Replacing an old PC with a new, SSD equipped PC can be very expensive. If you want to experience a definitive performance boost, without spending a lot of money, you may want to simply replace the HDD in your existing PC with an SSD. In this situation, you can experience significant benefits just by replacing the drive in your old PC with an SSD.

If you replace your existing PC with a new PC...

100,000Yen

The problem is the high cost

If you just replace the system drive...

10,000Yen or less

You can experience similar benefits at a low price!

CASE03 The capacity of my built-in disk drive is too low and I want to increase it!

If the capacity on your existing built-in disk drive is inadequate, then by replacing it with a high-capacity SSD, you can solve the problem of insufficient capacity whilst also seeing an improvement in your PC's running speed. Nowadays there are many SSDs with a capacity of over 1 TB, and you can get SSDs with capacities up to 4 TB.

SAMSUNG 850 EVO

Capacity: 4 TB **MANU:** Samsung **W-MANU:** Dimensions: 100 × 69.85 × 6.8 mm
Controller: Samsung-developed controller
Cache memory: 4 GB
MTBF (Mean time between failures): 1,500,000 hours
TBW: 300 TB **Warranty period:** 5 years



Things to focus on **02** **For both, Desktop PCs and Notebook PCs, replacing your existing HDD with an SSD is really quite simple. You'll definitely be able to do it yourself!**

1 Discharge static electricity



2 Remove the battery



3 Remove screws from storage cover



4 Remove screws that hold the HDD mounting bracket in place



5 Remove the HDD from the mounting bracket



6 Fit the SSD into the mounting bracket



7 Fix it back into place in the body of the PC



8 Replace the cover



By cloning your HDD, you can start using your PC system with your new SSD right away!



Connect up to the Samsung SSD that you want to clone to and click on the "Start" button



When the SSD is shown under "Target Disk," then click "Start"

Software name: Samsung Data Migration
 Publisher: Samsung
 Price: Free (Available from the publisher's website)

*Please note that the part of the PC where the HDD is mounted varies from model to model. Please check in your PC's instruction manual or your PC's online help site.

Practical advice for choosing an SSD

What you need to pay most attention to in SSD specifications is the **NAND type!**

The single most important trick for avoiding problems!



Things to focus on

01

Depending on the NAND type, data is stored in different ways, which can have a big impact on performance!

NAND Flash memory is the underlying technology that allows data to be stored on an SSD. It is no exaggeration to say that the type of NAND used, has not only a big impact on the speed with which data can be written to the memory but also for its reliability and storage capacity. As the vast majority of SSDs that are currently available on the market are either MLC or TLC types, let's take a closer look at the special features of these two categories.

MLC Offers superior reliability, but the price tends to be a bit on the high side

The type of NAND memory that can record 2 bits of data in a single cell is known as "MLC". Because the amount of data stored in each cell is relatively small, there is less of a problem with use-related degradation, making for higher durability. However, the price of MLC NAND tends to be rather high.

Cell	
00	
01	
10	
11	

A single cell can store 2 bits of data.

Advantages Because the number of bits of data that can be stored in each memory circuit (cell) is relatively small at just 2 bits, data access speed is high, and there is less of a problem with memory degradation over time. The maximum possible number of rewrites is also very high.

Disadvantages Compared to TLC, the price per unit of memory capacity tends to be rather high. Also, because the amount of data that can be stored in each memory circuit is limited, it is difficult to develop large-capacity MLC NAND SSDs.

TLC Advances in technology have led to a significant improvement in performance, and if you want NAND memory that is reasonably cheap, this is the one to go for!

The type of NAND that can record 3 bits of data in a single cell is known as "TLC". When TLC NAND was first introduced, there were concerns about durability, but today's TLC NAND SSDs have no problems with durability or usability. Another plus point is that TLC NAND SSDs can be purchased at reasonably low prices.

Cell	
000	100
001	101
010	110
011	111

Can stand a lot of use thanks to enhanced durability!

With the ability to store 3 bits of data in each cell, TLC NAND makes it possible to create high capacity SSDs

Advantages Because more data can be stored in each cell, it is easier to develop large-capacity SSDs. Unit price per unit of memory capacity is also relatively low, so TLC NAND SSDs are quite affordable.

Disadvantages Because more data is stored in each cell, as the number of times that the data is accessed increases, usable lifespan tends to be reduced.

Things to focus on

02

3D NAND makes it possible to increase speed and capacity even more rapidly!

3D NAND is a new technology that uses stacks of planar memory cells to realize high data storage capacity. Following Samsung's launch of V-NAND, other companies have followed suit. 3D NAND

Planar NAND



Up until recently, planar memory cells were the mainstream product.

3D NAND, V-NAND



Stacking data storage cells up vertically makes it possible to achieve not just high capacities, but also improved speed and durability.

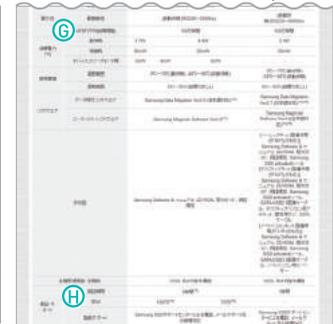
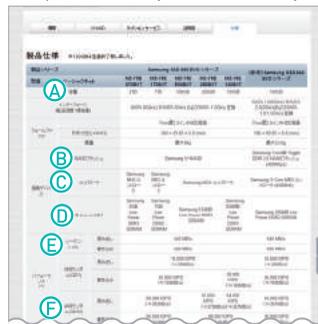


Things to focus on

03

Official SSD specs should be used as reference only, as reliably evaluating SSD performance can only be done after the SSD has been in use for a certain time and has reached a "steady state" of operations.

SSDs have a slightly more complex structure than HDDs. This is why the single most important thing that you need to be aware of to avoid having problems with an SSD is to not pay too much attention to basic specifications such as capacity and cache capacity, but instead to focus on items such as the controller, which controls how the SSD operates. Because the process of reading from and writing to the SSD causes degradation, it is important to choose an SSD that still operates smoothly when it has already been in use for some time and is in a steady state.



(A) Capacity	This is the SSD's memory capacity. Because this is calculated on the basis of 1 KB = 1024 bytes, the actual capacity will be slightly lower than the capacity displayed on the OS.
(B) NAND	NAND is a type of non-volatile flash memory. Depending on the number of data bits that can be stored in each memory cell, NAND can be divided into various categories, including MLC and TLC etc.
(C) Controller	The controller controls access to memory cells, and has a major impact on access speeds; however, in some cases the type of controller chip used is not made public by the manufacturer.
(D) DRAM Cache	This is an area where data read from or written to the SSD is stored temporarily. If there is no DRAM cache or if it is too small, this is often the cause of the computer freezing up or hanging.
(E) Sequential read/write	This denotes how much sequential data can be read or written in the space of 1 second. In the case of SSD, this specification value is usually expressed in units of MB/s.
(F) Random read/write	This represents the SSD's performance when reading or writing random data. In the case of SSD, this specification value is usually expressed in terms of input/output operations per second (IOPS).
(G) MTBF (Mean time between failures)	MTBF is the abbreviation for "Mean Time Between Failure". The higher this value is, the less likely it is that the SSD will suffer a breakdown.
(H) TBW (Warranty period)	SSD lifespan is measured in terms of the maximum number of terabytes of data that can be written, abbreviated as "TBW". The number of years of warranty provided by the manufacturer is known as the "warranty period". As a rule, the warranty is terminated when either the TBW limit is reached or the warranty period expires, whichever comes first.

It is important to get the balance right between TBW and warranty period!

If you divide the specified TBW by the number of years in the warranty period, you can calculate the usage per day. It's important to select an SSD that you can use without having to worry about usage constraints.

How much can you use per day?

MX300 275 GB 80 TBW	
80 TBW ÷ (365 days × 3 years)	
Roughly equivalent to 73 GB / 1day	
850 EVO 250 GB 75 TBW	
75 TBW ÷ (365 days × 5 years)	
Roughly equivalent to 41 GB / day	

What does writing 40 GB per day equate to?

E-mail (Assuming 500 KB per e-mail)	80,000 e-mails
Maps (Assuming 2MB per map displayed)	20,000 maps
Websites (Assuming 1MB per website displayed)	40,000 websites
Photos (Assuming 5MB per photo)	8,000 photos

Overview of the results obtained in our rigorous SSD test

What particularly stands out is the random read/write performance test results!

The most powerful **SSD** Ranking **BEST 10**

We can see at a glance which SSDs perform best with respect to random read/write performance (which has a big impact on how smoothly the PC system runs)!

For these tests, we used new SSDs that you would expect to be in the best condition, and began by performing tests when the SSD was in a "clean" state immediately after being integrated into the PC system. We then filled up the empty capacity in the SSD with random data and performed tests again in a "dirty" state.

The products that show the smallest variation in performance between states are the ones that can be expected to provide the smoothest performance when the PC is actually in use. The test results clearly show the disparities in performance between SSD models that are currently available, so let's take a look at the results!

Test 1 Random Read/Write (IOPS) iometer



Test 2 Sequential Read/Write (MB/s) CrystalDiskMark

Test content	SAMSUNG 850 EVO	SAMSUNG 750 EVO	Crucial CT240BX200SSD1	Crucial CT275MX300SSD1	ADATA Technology Premier SP550	SanDisk Ultra II SSD (J26)	SanDisk SSDPlus (J26)	Kingston Technologies SUV400S37/240G	Transcend Japan TS240G SSD220S	CFDSales Inc. CSSD-S6T240 NM61Q
Clean state read (MB/s)	505.9	505.2	510	473	505.1	501.3	489.9	504.3	508.6	510.5
Dirty state read (MB/s)	504.8	509.8	508.4	474.4	496.7	497.2	502.9	488	489.1	500.2
Clean state Write (MB/s)	487.3	486.3	449.4	479.1	447.1	476.3	380.6	459.9	442.3	485.1
Dirty state Write (MB/s)	490.6	487.8	449.7	396.2	443.6	476.6	376.2	455.1	442.9	485

Test 3 Test results from testing of actual operation (transmission of photos and video content)

Test content	SAM SUNG 850 EVO	SAM SUNG 750 EVO	Crucial CT240 BX200	Crucial CT275 MX300	ADATA Premier SP550	San Disk Ultra II SSD (J26)	San Disk SSD Plus (J26)	Kingston Technologies SUV400 S37/240G	Transcend Japan TS240G SSD2205	CFD CSSD-56T240 NMG10
Photo transmission 500 photos 3.26GB (seconds)	① 6.13	② 8.47	41.63	12.73	41.17	③ 9.20	15.07	14.67	37.57	14.20
Photo transmission 1000 photos 6.53 GB (seconds)	① 17.77	② 21.87	104.47	37.97	104.50	32.70	62.67	56.53	100.97	③ 30.43
Video file transmission 2.6 GB (seconds)	① 8.33	10.36	③ 8.68	② 8.49	9.31	15.81	13.82	11.84	10.10	9.03
Video file transmission 7.9 GB (seconds)	② 42.52	③ 55.24	107.37	① 30.93	130.47	62.32	66.05	68.09	122.71	70.07

Explanation

We show you the actual performance when the SSD is in a steady state!

For the benchmarks for these tests, we used the data transmission speed for a new SSD in a clean state measured using Crystal Disk Mark and Iometer as well as the IOPS. We also measured real performance by performing the testing again when each SSD was in a dirty state, with all memory cells filled with random data. In addition, we performed parallel testing of the transmission speed for photos etc.

- Test environment**
- OS: Windows 10 Pro 64bit
 - CPU: Intel Core i7 6700 (Skylake) 3.40 GHz
 - Memory: 16 GB 8 GB*2
 - Motherboard: GIGABYTE H170-HD3-CF
 - Graphics processor: NVIDIA GeForce GTX 960

Scoring system

Test content	5 points	4 points	3 points	2 points	1 points
Clean state Sequential read (MB/s)	510.1 or higher	505.1~510.0	500.1~505.0	480.1~500.0	480.0 or lower
Clean state Sequential write (MB/s)	480.1 or higher	470.1~480.0	450.1~470.0	400.1~450.0	400.0 or lower
Clean state random read (IOPS)	95001 or higher	90001~95000	80001~90000	70001~80000	70000 or lower
Clean state random write (IOPS)	85001 or higher	80001~85000	75001~80000	65001~75000	65000 or lower
Dirty state sequential read (MB/s)	505.1 or higher	500.1~505.0	495.1~500.0	490.1~495.0	490.0 or lower
Dirty state sequential write (MB/s)	490.1 or higher	480.1~490.0	460.1~480.0	430.1~460.0	430.0 or lower
Dirty state random read (IOPS)	95001 or higher	90001~95000	80001~90000	70001~80000	70000 or lower
Dirty state random write (IOPS)	75001 or higher	70001~75000	60001~70000	50001~60000	50000 or lower
Photo transmission 500photos (seconds)	10.0 or lower	10.1~15.0	15.01~20.0	20.1~30.0	30.1 or higher
Photo transmission 1000photos (seconds)	20.0 or lower	20.1~30.0	30.1~50.0	50.1~100.0	100.1 or higher
Video file transmission 2.6 GB (seconds)	8.50 or lower	8.51~9.00	9.01~9.50	9.51~11.0	11.1 or higher
Video file transmission 7.9GB (seconds)	35.0 or lower	35.1~45.0	45.1~60.0	60.1~80.0	80.1 or higher

Content	-1 point	-2 point	-3 point	-4 point	-5 point
Clean state random read (IOPS) compared to Dirty state random read (IOPS)	-10% or more	-20% or more	-30% or more	-40% or more	-50% or more
Clean state random write (IOPS) compared to Dirty state random write (IOPS)	-10% or more	-20% or more	-30% or more	-40% or more	-50% or more



The SSD that demonstrated the best overall stability and speed in both clean and dirty states was: **Samsung 850EVO!!**

In terms of overall performance

this was the best model!!

SAMSUNG 850 EVO

Capacity: 250 GB NAND: Samsung V-NAND
 Dimensions: 100 x 69.85 x 6.8 mm
 Controller: Samsung-developed controller
 Cache memory: 512 MB
 MTBF (Mean time between failures): 1,500,000 hours
 TBW: 75 TB Warranty period: 5 years

Overall score **57** point



These are the areas where the 850 EVO stands out from the crowd!

It maintains impressively high speed even when it's already in use in a steady state!

The "850 EVO" demonstrates high performance, with test values close to the values given in the product catalog for both sequential data and random data. Even when this SSD is in a dirty state, filled up with random data, it still maintains high performance; this is an SSD where you can really feel the superior performance, no matter how much use you put it through.

Sequential read (MB/s)

505.9 Clean	95272.8 Clean
504.8 Dirty	95173.78 Dirty

random read (IOPS)

95272.8 Clean
95173.78 Dirty

Sequential write (MB/s)

487.3 Clean
490.6 Dirty

random write (IOPS)

85739.5 Clean
79365.24 Dirty

It also provides outstanding performance when in actual use!

The 850 EVO demonstrated outstanding performance not only in benchmark testing, but also in actual use for activities such as moving photo and video files. Here the superior performance of the 850 EVO could really be felt. Overall, the results showed that this SSD can be used effectively both to enhance system speed and for actual system usage.



Actual use report

Even with continued use in a severe environment there is no deterioration in performance!

When writers for this magazine who have been using the 850 EVO for an extended period implemented benchmark tests, the scores obtained were almost the same as those for the same model when new. SSDs usually don't respond very well to being written to repeatedly, but in this case the test results showed no deterioration in performance.

Read (MB/s)	Write (MB/s)
550.2	490.2
328.2	301.3
502.9	428.9
30.86	132.4

* Used for a period of approximately 13 months, the 850 EVO SSD in question had a capacity of 172 GB / 223 GiB

Demonstrating overall high performance, from benchmarking to actual use!!

The 850 EVO, which came first in our tests, demonstrated overwhelmingly superior performance in the benchmarking tests used to measure the capabilities of the different SSDs. A significant feature of the 850 EVO was that hardly any deterioration in performance was observed when changing from the clean state to the dirty state, or after an extended period of use. It can be assumed that the 850 EVO will still provide users with a real sense of speed when implementing real tasks such as system activation or file transfer.

Performance that is just as good as the 850 EVO in the clean state!

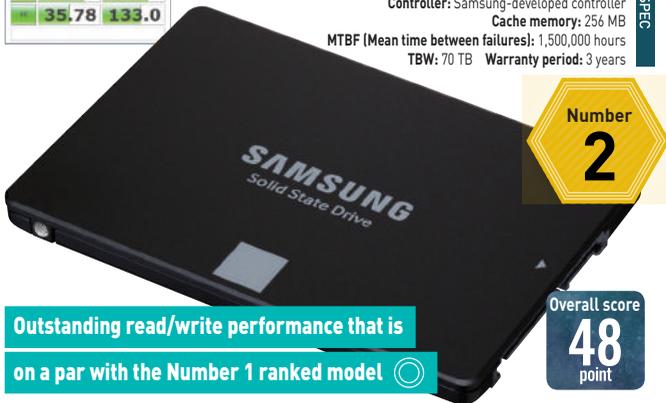
Read (MB/s)	Write (MB/s)
554.7	530.5
357.7	315.7
505.2	486.3
35.78	133.0

In the benchmark tests, this model demonstrated high performance almost comparable to that of the 850 EVO in terms of read/write speed and IOPS, for both sequential and random data

SAMSUNG 750 EVO

Capacity: 250 GB NAND: Planar TLC
 Dimensions: 100 × 69.85 × 6.8 mm
 Controller: Samsung-developed controller
 Cache memory: 256 MB
 MTBF (Mean time between failures): 1,500,000 hours
 TBW: 70 TB Warranty period: 3 years

SPEC



Number 2

Overall score 48 point

Outstanding read/write performance that is on a par with the Number 1 ranked model

Although this is an entry-level model that is quite inexpensive, it also offers good performance!

While this SSD is positioned as Samsung's entry-level model, the benchmark test results show that its performance is on par with the 850 EVO. The 750 EVO achieves a good balance between cost and performance. The results obtained in the usage tests were also quite good, indicating that this would be an ideal choice for a first-time SSD buyer.

CFD Sales Inc.

CSSD-S6T240NMG1Q

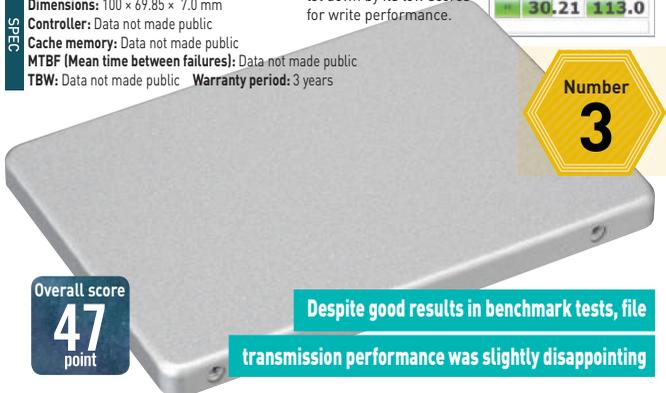
Capacity: 240 GB NAND: Planar TLC
 Dimensions: 100 × 69.85 × 7.0 mm
 Controller: Data not made public
 Cache memory: Data not made public
 MTBF (Mean time between failures): Data not made public
 TBW: Data not made public Warranty period: 3 years

SPEC

Read speed had the highest score of all the models tested!

Scored higher than any of the other models for random data read speed. Despite having generally high scores, this model was let down by its low scores for write performance.

Read (MB/s)	Write (MB/s)
546.6	437.5
334.7	325.8
510.5	485.1
30.21	113.0



Number 3

Overall score 47 point

Despite good results in benchmark tests, file transmission performance was slightly disappointing

The benchmark test results were top-class! The model's weakness is its low data transmission speed when in actual use

This model surpassed the Number 2 model in terms of random data read performance (both transmission speed and IOPS). However, despite its high scores on all the benchmark test items, its test results for real usage items - photo and video file transmission - were not so impressive.

Crucial CT275MX 300SSD1

Capacity: 275 GB NAND: 3D NAND TLC
 Dimensions: Thickness 7.0 mm
 Controller: Data not made public
 Cache memory: Data not made public
 MTBF (Mean time between failures): 1,500,000 hours
 TBW: 80 TB Warranty period: 3 years

SPEC



Number 4

Ranked No. 1 in its class for capacity, giving users plenty of flexibility!

Giving you just that bit more!

Although the score obtained for sequential read and write speeds was nothing special, this model achieved an impressive score for random reads and writes. With a capacity of 275 GB, it gives you that bit more capacity than other models, and so is a good choice for users who are particularly concerned about capacity.

Overall score 29 point

SanDisk Ultra IISSD (J26)

Capacity: 240 GB NAND: Planar TLC
 Dimensions: 100.5 × 69.85 × 7.0 mm
 Controller: Data not made public
 Cache memory: Data not made public
 MTBF (Mean time between failures): 1,750,000 hours
 TBW: Data not made public Warranty period: 3 years

SPEC



Number 5

Offers good all-round reliability

Achieved reasonable scores in both benchmark testing and usage testing!

This model achieved reasonably high scores overall, for both sequential and random data read/write. Unfortunately, in the read/write IOPS testing, there was a significant disparity between the test results and the values given in the product catalog.

Overall score 28 point

Number 6	Crucial CT240BX 200SSD1	Overall score 27 point	While some of the benchmark test results (including sequential data transmission speed etc.) were top class, the results for random data read/write IOPS were only average. This model also failed to gather much in the way of extra points for photo and video file transmission speed.
Number 7	SanDisk SSD Plus (J26)	Overall score 24 point	This is a reasonably inexpensive model that people should find affordable; the benchmark test results were also acceptable. It's overall score was dragged down by a relatively low score for dirty state performance and by rather slow file transmission speed.
Number 8	ADATA Technology Premier SP550	Overall score 21 point	The benchmark test results measuring read/write speed were on a par with those of the best-performing model. However, the model's overall ranking was negatively affected by the file transmission speed (aimed at testing performance in actual usage) where this model scored worse than any of the other models tested.
Number 9	Transcend Japan TS240G SSD220S	Overall score 20 point	The benchmark testing results for sequential data transmission were very good, but the results for random data were only average. The lower overall ranking is due mainly to the fact that the transmission speed for large files such as photos etc. was disappointing compared to the other models.
Number 9	Kingston Technologies SUV400 S37/240G	Overall score 20 point	The clean state benchmark test results were not too bad, but the deterioration in speed in the dirty state was very noticeable. File transmission speed was only so-so; overall, there was no area where this model really excelled and which could have given it a higher overall points score.

[Important information] The testing for this special report was conducted using new SSDs under uniform test conditions. All of the data and specifications given in the report were obtained through research undertaken by the editorial team. Please be aware that data may vary depending on the testing environment used. The specifications given were correct as of September 2016. This report should not be taken as guaranteeing the performance of any of the products referred to in the report.