

Applied Biosystems® SOLiD™ 4 System

SOLiD™ 4

SYSTEM SEQUENCING

Key Benefits

- **Higher accuracy**—detection of causative variation enabled at lower coverage and cost per sample
- **Scalable throughput on a single platform**—80–100 GB of mappable sequence per run with scalability up to 300 GB of mappable sequence per run with the SOLiD™ 4hq System upgrade
- **Automated workflow**—80% reduction in hands-on time and increased reproducibility in yield allow for significant time and labor savings
- **True paired-end sequencing**—bidirectional sequencing facilitates detection of genetic alterations as well as splice variants and fusion transcripts with lower sample input
- **Robust multiplexing kits**—intelligent barcode strategy enables accurate assignment without introduction of bias
- **Sample-to-results application support**—additional application-specific kits and flexible analysis framework for optimized end-to-end application-specific workflows
- **Unrivaled support**—over 800 dedicated service and support specialists as well as a catalog of in-depth chemistry and bioinformatics courses available



See the Difference

The SOLiD™ 4 System enables you to obtain more high-quality sequence at a lower cost per run. New optimized reagents and algorithms provide more uniform coverage across the genome and result in higher throughput and accuracy for all applications. Accelerate your time to results with automated workflows, intelligent barcoding designs, and the broadest portfolio of application-specific kits and analysis tools. With the SOLiD™ 4 System, you have the throughput and accuracy to cost-effectively discover causative variation—you have the Quality Genome.

Experience Peace of Mind

The SOLiD™ System's open slide format and flexible bead densities continue to yield increases in throughput on the same platform with minor upgrades. The SOLiD™ 4 System can generate up to 100 Gb of mappable sequence or greater than 1.4 billion reads per run and scales to 300 Gb of mappable sequence or greater than 2.4 billion reads per run with the SOLiD™ 4hq System upgrade. Discover the peace of mind provided by the confidence that you will benefit from future technology advances.

The Quality Genome

The Quality Genome is the product of more accurate data from fewer runs at a lower cost. Accuracy drives the Quality Genome by providing the sensitivity to detect more variation with less coverage. The SOLiD™ System's advantage in detecting variation at lower coverage has been demonstrated in numerous publications.¹ The inherent error-checking properties of two-base encoding and a reduction in raw error rates provide highly accurate data with more than 80% of bases having quality values of ≥30 (Figure 1). This attribute translates to less coverage required for variant detection, helps yield fewer false positives, and facilitates a corresponding reduction in overall project time and cost.

$$\text{Quality Genome} = \frac{\text{Accuracy} \times \text{Throughput}}{\text{Cost}}$$

Streamlined Analysis and Data Management

The SOLiD™ BioScope™ Software provides a flexible, open analysis framework, preconfigured with optimized pipelines and advanced algorithms, to increase mapping rates by up to 30%. Standard file outputs, including sequence alignment map (SAM) and binary alignment map (BAM) formats, provide base calls and associated quality values to enable multi-platform or project-based analyses. Experience the benefits of the higher accuracy and the flexibility to export SOLiD™ System data to your preferred downstream analysis tool for tertiary analysis.

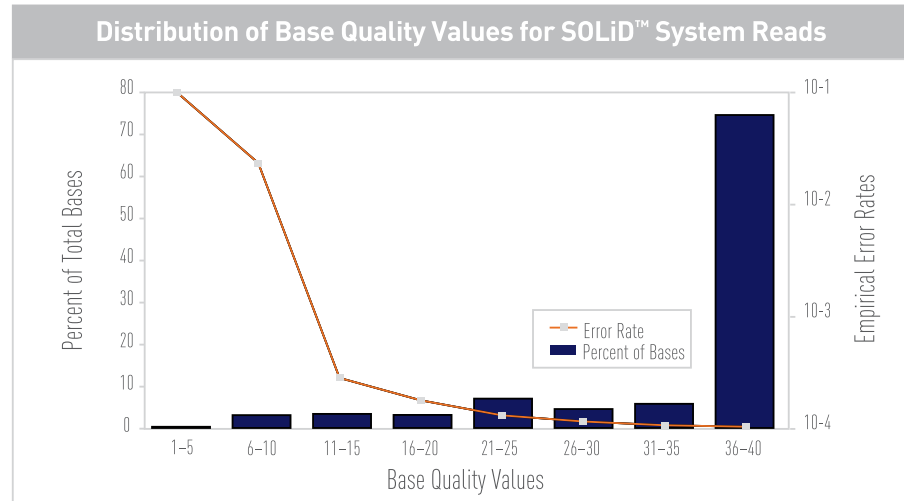


Figure 1. Greater than 80% of bases higher than QV 30. The SOLiD™ System automatically reports quality values for each base. The base quality values demonstrate high correlation with empirically-generated error rates.

SOLiD™ 4 System Specifications*

Throughput	Up to 100 GB of mappable sequence or 1.4 billion reads per run with SOLiD™ ToP reagents
Library Type	<ul style="list-style-type: none"> Mate-paired libraries (insert sizes from 600 bp to 10 KB) Paired-end libraries Fragment libraries
Starting Material Type	DNA or cDNA isolated from blood or single cells, RNA, BACs, plasmids, fosmids, tissue (high tumor load), and PCR products
Amount of Starting Material	Required input of starting material varies by application <ul style="list-style-type: none"> 10 ng to 5 µg for fragment library 10 ng to 5 µg for paired-end library 5 µg to 20 µg for mate-paired library
Slide Configuration	Individual samples: 1 to 8 per flow cell Multiplexed samples: up to 1,536 per run
Flow Cells	2 independent flow cells
System Accuracy	Greater than 99.94% accuracy due to 2-base encoding
Consensus Base Accuracy	Greater than 99.999% accuracy at 15x coverage
Base Quality	Greater than 80% of bases at ≥QV30
Multiplexing	96 DNA and 48 RNA barcodes available
Analysis	<ul style="list-style-type: none"> SAM and BAM format exports Advanced informatics for 20% more mappable reads and reductions in raw accuracy down to an average of 1% Customizable application analysis with comprehensive bioinformatics analysis framework for flexible data review

* Specifications are subject to change.

1. Selected Publications:

- Clark MJ, et al. (2010) U87MG Decoded: The Genomic Sequence of a Cytogenetically Aberrant Human Cancer Cell Line. *PLoS Genetics*, 6 (11): e1000832 DOI: 10.1371/journal.pgen.1000832.
 McKernan, K.J. et al. (2009) Sequence and structural variation in a human genome uncovered by short-read, massively parallel ligation sequencing using two base encoding. *Genome Research* 19:1527-1541.
 Rubin C.-J. et al. (2010) Whole-genome resequencing reveals loci under selection during chicken domestication. *Nature* 464, 587-591.

System Workflow Reagents and Analysis Tools

	Application	Sample Preparation ¹	Library Preparation	Templated Bead Production ^{2,3}	Sequencing	Data Analysis Resources ⁷
Supernatant/Quantification	SAGE™	TRizol® Plus RNA Purification System (PN 12183-555)	SOLiD™ SAGE™ with Barcoding Adaptor Module (PN 4452811); SOLiD™ RNA Barcoding Kit Module 1-16 (PN 4425680); 17-32 (PN 4453189); 33-48 (PN 4453191)			SOLiD™ Accuracy Enhancer Tool and SOLiD™ SAGE™ Analysis Software
	Whole Transcriptome ⁴	TRizol® Plus RNA Purification System (PN 12183555); MagMAX™-96 Total RNA Isolation Kit (PN AM1830); RNAqueous® Kit (PN AM1912); RiboMinus™ Plant Kit for RNA-Seq (PN A1083808); RiboMinus™ Eukaryote Kit for RNA-Seq (A1083708); MicroPoly(A)Purist™ Kit (PN AM1910); PureLink™ RNA Mini Kit (PN 1213020)	SOLiD™ Total RNA-Seq Kit (PN 4445374); SOLiD™ RNA Barcoding Kit Module 1-16 (PN 4425680); 17-32 (PN 4453189); 33-48 (PN 4453191);	EZ Bead™ E10 System Consumables, 4 pack (PN 4453093); EZ Bead™ E20 System Consumables, 4 pack (PN 4453094); EZ Bead™ E80 System Consumables, 4 pack (PN 4453095); SOLiD™ Pre Deposition Kit (PN 4455808); SOLiD™ XD Slide & Deposition Kit (PN 4448393)	SOLiD™ ToP Sequencing Kit—Frag. Lib., F3 Tag, MM35 (PN 4449352); MM50 (PN 4449388); SOLiD™ ToP Frag. BC Sequencing Kit—BC Frag. Lib., MM35/5 (PN 4452696); MM35/10 (PN 4452698); MM50/5 (PN 4452697); MM50/10 (PN 4452699); SOLiD™ ToP Paired End Sequencing Kit—Frag. Lib., MM35/25 (PN 4452690); MM50/25 (PN 4452693); SOLiD™ ToP Paired End Sequencing Kit—BC Frag. Lib., MM35/25/5 (PN 4452691); MM35/25/10 (PN 4452692); MM50/25/5 (PN 4452694); MM50/25/10 (PN 4452695); SOLiD™ Workflow Analysis Reagents (PN 4406463); SOLiD™ ToP Instrument Buffer Kit (PN 4452688)	SOLiD™ Accuracy Enhancer Tool and SOLiD™ BioScope™ 1.2 Integrated Whole Transcriptome Analysis Pipeline for tag counting and for detection of alternative and fusion transcripts
	Small RNA	mirVana™ miRNA Isolation Kit for cells & tissues (PN AM1560); RecoverAll™ Kit for FFPE samples (PN AM1975); PureLink™ miRNA isolation Kit (PN K157001)				SOLiD™ Accuracy Enhancer Tool and SOLiD™ System Small RNA Analysis Pipeline Tool (PN RNA2MAP)
	ChIP	SOLiD™ ChIP-Seq Kit (PN 4449638); SOLiD™ Frag. Lib. Barcoding Kit Module 1-96 (PN 4449637); ⁵ SOLiD™ Libr. TaqMan® Quantitation Kit (PN 4449639)				SOLiD™ Accuracy Enhancer Tool and Applied Biosystems ChIP-Seq accessory tools
	Methylation	MethylMiner™ Methylated DNA Enrichment Kit (PN ME10025)	SOLiD™ Frag. Lib. Constr. Kit with SizeSelect™ Gels (PN 4443471); ¹ SOLiD™ Frag. Lib. Oligos Kit (PN 4401151); SOLiD™ Frag. Lib. Barcoding Kit Module 1-96 (PN 4449637); ⁵ SOLiD™ Lib. TaqMan® Quantitation Kit (PN 4449639)			http://info.appliedbiosystems.com/solidsoftwarecommunity
Resequencing	Whole Genome Resequencing	MagMAX™ DNA Multi-Sample Kit (PN 4413020) ⁶	SOLiD™ Frag. Lib. Constr. Kit with SizeSelect™ Gels (PN 4443471); ¹ SOLiD™ 2 X 25 Mate-Paired Lib. Constr. Kit (PN 4443472); SOLiD™ Long Mate-Paired Lib. Constr. Kit (PN 4443474); SOLiD™ Mate-Paired Lib. Oligos Kit (PN 4400468); SOLiD™ Frag. Lib. Barcoding Kit Module 1-96 (PN 4449637); ⁵ SOLiD™ Lib. TaqMan® Quantitation Kit (PN 4449639)		SOLiD™ ToP Sequencing Kit—Fragment Library, F3 Tag, MM35 (PN 4449352); MM50 (PN 4449388); SOLiD™ ToP Frag. BC Sequencing Kit—BC Frag. Lib., MM35/5 (PN 4452696); MM35/10 (PN 4452698); MM50/5 (PN 4452697); MM50/10 (PN 4452699); SOLiD™ ToP Paired End Sequencing Kit—Frag. Lib., MM35/25 (PN 4452690); MM50/25 (PN 4452693); SOLiD™ ToP Paired End Sequencing Kit—BC Frag. Lib., MM35/25/5 (PN 4452691); MM35/25/10 (PN 4452692); MM50/25/5 (PN 4452694); MM50/25/10 (PN 4452695); SOLiD™ ToP Mate-Paired Seq. Kit—Mate-Pair Lib., MM35/35 (PN 4452684); MM50/50 (PN 4452685); SOLiD™ ToP Instrument Buffer Kit (PN 4452688); SOLiD™ Workflow Analysis Reagents (PN 4406463)	SOLiD™ BioScope™ 1.2 Integrated Resequencing Pipeline for detection of SNPs, small and large insertions and deletions, inversions, and copy number variation
	de novo	PureLink™ Genomic DNA Mini Kit (PN 1820-00); ChargeSwitch® gDNA Mini Bacteria Kit (PN CS11301)	SOLiD™ Frag. Lib. Constr. Kit with SizeSelect™ Gels (PN 4443471); ¹ SOLiD™ Frag. Lib. Oligos Kit (PN 4401151); SOLiD™ 2 X 25 Mate-Paired Lib. Constr. Kit (PN 4443472); SOLiD™ Long Mate-Paired Lib. Constr. Kit (PN 4443474); SOLiD™ Mate-Paired Lib. Oligos Kit (PN 4400468); SOLiD™ Lib. TaqMan® Quantitation Kit (PN 4449639)	EZ Bead™ E10 System Consumables, 4 pack (PN 4453093); EZ Bead™ E20 System Consumables, 4 pack (PN 4453094); EZ Bead™ E80 System Consumables, 4 pack (PN 4453095); SOLiD™ Pre Deposition Kit (PN 4455808); SOLiD™ XD Slide & Deposition Kit (PN 4448393)		SOLiD™ Accuracy Enhancer Tool and SOLiD™ System de novo accessory tools
	Targeted Resequencing ⁵	MagMAX™ DNA Multi-Sample Kit (PN 4413020); SequalPrep™ Long PCR Kit with dNTPs (PN A10498); SequalPrep™ Normalization Plate (96) Kit (PN A10510-01)	SOLiD™ Frag. Lib. Constr. Kit with SizeSelect™ Gels (PN 4443471); ¹ SOLiD™ Frag. Lib. Oligos Kit (PN 4401151); SOLiD™ Frag. Lib. Barcoding Kit Module 1-96 (PN 4449637); ⁵ SOLiD™ Lib. TaqMan® Quantitation Kit (PN 4449639)			SOLiD™ Accuracy Enhancer Tool and SOLiD™ BioScope™ 1.2 Integrated Resequencing Pipeline for detection of SNPs, small insertions and deletions, and copy number variation

1. Sample preparation kits may vary based on source of material or on kit size. Visit www.ambion.com or www.invitrogen.com for more information on various product offerings.

2. Templated bead preparation kits may vary based on run configuration. Visit www.appliedbiosystems.com for more information on various product offerings.

3. Internal controls available.

4. Whole transcriptome analysis of a single cell: application note and peer-reviewed publication. For more details, visit solid.appliedbiosystems.com.

5. Third-party targeted enrichment—Agilent SureSelect™ DNA Capture Array, Agilent SureSelect Targeted Enrichment System, febit HybSelect Sequence Capture Solution, and Raindance Sequence Enrichment Solution.

6. Additional barcoding module kits available for multiplexing of less than 96 samples. Visit www.invitrogen.com or www.appliedbiosystems.com for more information on various product offerings.

7. Visit info.appliedbiosystems.com/solidsoftwarecommunity for more information.

Performance Specifications*

Library Type	Read Length	Days/Run	Total Tags/Run	Mappable Data	Mappable Data With Base Calls With QV≥30 (~80%)
Mate-Paired	2 x 35 bp	8-9	>1.4 B	50-70 GB	40-56 GB
	2 x 50 bp	12-16	>1.4 B	80-100 GB	64-80 GB
Paired-End	50 bp x 25 bp	11-13	>1.4 B	55-70 GB	44-56 GB
Fragment	1 x 35 bp	3.5-4.5	>700 M	25-35 GB	20-28 GB
	1 x 50 bp	6-8	>700 M	40-50 GB	32-40 GB

*Based on 2 slides/run.

System Workflow Hardware

Workflow Step	Library Preparation			Templated Bead Preparation	Sequencing		Data Analysis	System Updates
Instrumentation	Covaris™ S2 System ¹ (PN 4387833 (US)), (PN 4392718 (Int'l)) CE/NL Marked	WVR® Compact Chiller ¹ Supplied with Covaris™ S2 system	Hydroshear® ² (PN 4382889 (US)), (PN 4382890 (Int'l)) CE/UL Marked	SOLiD™ EZ Bead™ System ^{3,4} (PN 4448417) CE/UL Marked	SOLiD™ 4 Analyzer ¹ (PN 4452775) CE/UL Marked	UPS ⁵ (recommended) (PN 4397781 (US)), (PN 4393695 (Int'l))	SOLiD™ Accessory Disk Drive (PN 4426101) CE/UL Marked	SOLiD™ 3 to SOLiD™ 4 Upgrade 4.0 (PN 4452785) or SOLiD™ 3 Plus to SOLiD™ 4 Upgrade (PN 4452784) CE/UL Marked
System Components	System includes instrument, machine tube holders, fill level labels, and Dell® Latitude laptop computer	WVR® Compact Chiller, Model 117-612	Unit equipped with syringe, shearing control software, standard shearing assemblies, and tool kit assembly	SOLiD™ EZ Bead™ Emulsifier, ⁴ SOLiD™ EZ Bead™ Amplifier, ⁴ and SOLiD™ EZ Bead™ Enricher	Reagent delivery system includes keyboard, monitor, mouse, installa- tion setup and accessories, computer system, and software suite v4.0	Two UPS units with output power capacity of 2,100 W/3,000 VA	Additional MD1000 for on-instrument secondary analysis for larger genomes	Updates existing SOLiD™ 3 or SOLiD™ 3 Plus analyzer to attain SOLiD™ 4 specifications. To attain specifications for SOLiD™ 4hg (expected output of 300 GB of mappable data or >2.4 B mappable reads in a single run), must update SOLiD™ 4 to SOLiD™ 4hg upgrade (PN 4452848)
Operating Environment: Temperature Humidity	15–32°C 80% at 31°C; 50% at 40°C	-10 to 40°C	15–40°C 20–80% at 40°C	5–40°C Up to 80%	15–24°C with no more than 2°C fluctuation in a 24 hr period 20–80% (non-condensing)	0–40°C Up to 95%	10–35°C 20–80% (non-condensing)	
Dimensions: Width x Depth x Height Weight	21 cm x 52 cm x 31 cm 13.6 kg	30.5 cm x 47 cm x 33 cm 28 kg	13 cm x 25.5 cm x 30.5 cm 4.5 kg	169.2 cm x 125.5 cm x 134.4 cm 87 kg	176 cm x 60 cm x 178 cm 373 kg	13 cm x 66 cm x 43.2 cm 55 kg	13.11 cm x 44.63 cm x 48.01 cm 35.37 kg	
Power Requirements:								
Nominal Voltage	120 V ± 10% (US); 100 V (Japan); 220–240 V (Int'l)	120 V (US); 220 V (Int'l)	110 V ± 10% (US); 220 V ± 10% (Int'l)	100–240 V	200–240 V	Input and output— 208 V (US); 230 V (Int'l)	100–240 V	
Current	2 A (US and Japan); 1 A (Int'l)	7 A (US); 3.5 A (Int'l)	15 A (US); 10 A (Int'l)	0.8 A (input)	25 A (maximum)	Adjustable range for input voltage mains operation = 100–208 V	7.2 A (US); 3.6 A (Int'l)	
Frequency	60 Hz ± 10% (US); 50–60 Hz (Japan and Int'l)	60 Hz (US); 50 Hz (Int'l)	50–60 Hz	50–60 Hz	50–60 Hz	50–60 Hz	47–63 Hz	
Power	300 W		300 W	20 W (input)	5,000 W (dissipation)	2,100 W/3,000 VA	488 W maximum continuous; 550 W peak; 200 W (dissipation)	

Computer Requirements

Covaris™ S2 System¹

- Laptop Computer: Intel® Core 2 Duo Processor, 2.4 GHz with 4 GB RAM
- Operating System: Microsoft® Windows® XP Professional, Service Pack 3
- Hard disk storage: 160 GB

SOLiD™ Accessory Disk Drive

- Dell® PowerVault™
- MD1000 with 15x 1 TB SATA hard disk (RAID-5 w/hot spare)

SOLiD™ 4 Analyzer¹

- Instrument Controller: Dell® PowerEdge™ 1950 with Intel® Xeon® Processor, 2 GHz minimum, 4 GB RAM minimum; PNY GeForce GT 240, 512 MB, 128-bit GDDR5 PCI Express card, 2x 80 GB minimum SATA hard disks (RAID-1), Microsoft® Windows® XP Professional, Service Pack 2
- Head Node: Dell® PowerEdge™ R710 with Intel® Xeon® Processor, 2.4 GHz, 24 GB RAM, 6x 1 TB SATA hard disks (RAID-5); 64-bit CentOS 4.7

- Compute Nodes: 3x Dell® PowerEdge™ R410 with Intel® Xeon® Processor, 2.26 GHz, 24 GB RAM, 2x 1 TB SATA hard disks (RAID-0)
- Storage: Dell® PowerVault™ MD1000 with 15x 1 TB SATA hard disk (RAID-5 w/hot spare)
- Gigabit Ethernet Switch: Dell® PowerConnect™ 2816, 2x 10/100/1000BASE-T auto-sensing, switching ports
- Power Distribution Units: 2x APC® Rack PDU, Switched, 1U, 16A, 208/230 V, [8]C13

1. Included component of the SOLiD™ 4 System (PN 4452773 (110 V), PN 4452774 (220 V)).

2. Recommended for selected applications.

3. Output connection: US=(2)NEMA L6-20R and (2)NEMA L6-30R; International=(8) IEC 320 C13, (2) IEC 320 C19, (3) IEC jumpers. Input Connections: US=NEMA L6-30P; International=British BS1363A, IEC-320 C20, and Schuko CEE 7/UE1-16P.

4. System components may be purchased separately: SOLiD™ EZ Bead™ Emulsifier (PN 4448419); SOLiD™ EZ Bead™ Amplifier (PN 4448418); SOLiD™ EZ Bead™ Enricher (PN 4448420).

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