POWER ICs FOR AI SERVERS Selector Guide

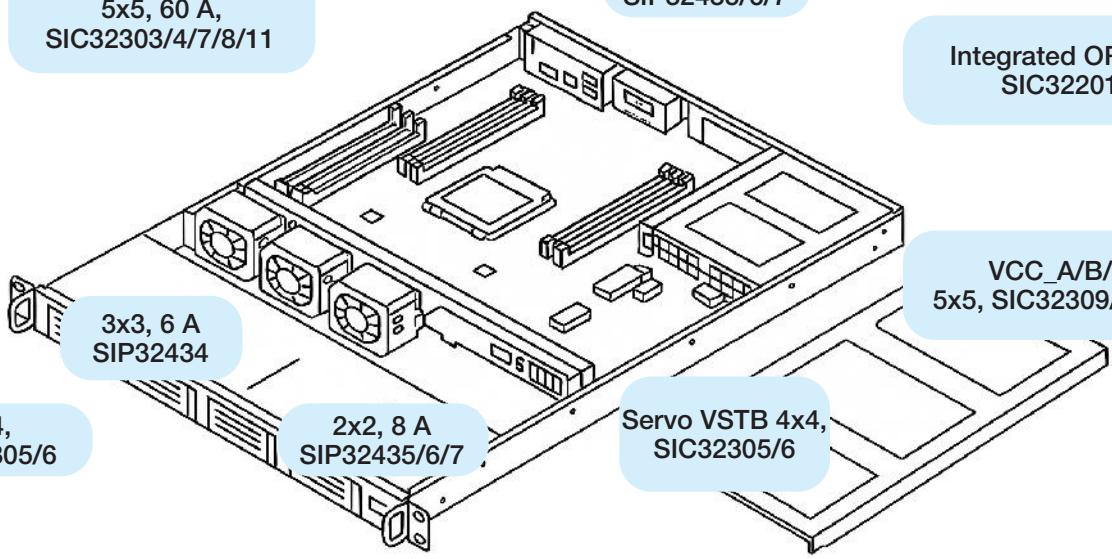
MAXIMIZING POWER EFFICIENCY FOR AI SERVERS

As AI servers take center stage in modern technology, they place greater demands on their power supplies than ever before. With increasing expectations for efficiency, power density, and overall performance, these systems require power solutions that adhere to strict standards. This AI selector guide simplifies the selection process, helping designers quickly find solutions that achieve high efficiency while meeting critical space and performance requirements.

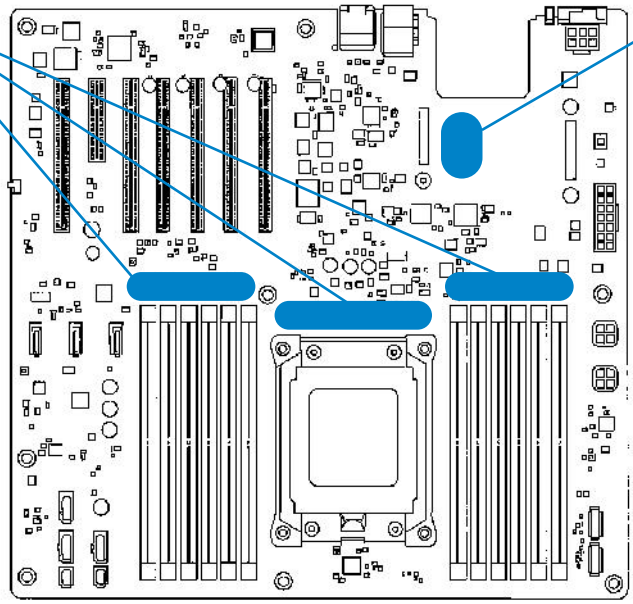
RESOURCES

- For technical support, contact powerictechsupport@vishay.com
- Material categorization: for definitions of compliance, please see www.vishay.com/doc?91000

Efuse in Server and Cloud Computing Applications



Server Power Design



High Performance Load Switch Solutions for Increased Power Density

Vishay's load switches deliver industry-leading power efficiency and compact designs, helping AI server manufacturers meet the growing demands for higher power density, reliability, and performance. Offering 10 % lower on-resistance than competing devices, the SiC3231E eFuse supports the highest voltage tolerance for increased reliability, while the SiP32437A/B provides comprehensive control and protection in the ultra compact 2 mm by 2 mm TDFN10-22 package. For protection against downstream circuit and power source abnormalities, the SiP32434 smart load switch's wide operating voltage and current limit setting ranges provide design flexibility and simplify the BOM. Vishay's load switches are engineered to optimize power efficiency, system reliability, and design flexibility, meeting the evolving power needs of next-generation AI servers.

The SiC32201, the industry's first fully integrated power OR-ing solution for 12 V operation, cuts power loss by approximately 50 %, enhancing system efficiency and dynamic power response. With a 70 % smaller solution size and advanced capabilities like lossless current sensing and real-time health diagnostics, it is an ideal choice for high density power redundancy and reverse current blocking in AI server architectures.

Part Type	eFuse switch	eFuse switch	eFuse switch	OR-ing switch
Part Number	SiC32311E	SiP32437A/B	SiC32305/6	SiC32201
$R_{DS(on)}$ at V_{IN} Min. (mΩ)	0.6	14	1.2	
$R_{DS(on)}$ at V_{IN} Max. (mΩ)	0.6	9.5	1.2	0.45
Cont. Current (A)	60	8	30	100
Description	60 A, 4.5 V to 25 V, 0.6 mΩ, hot-swap eFuse, IMON, GOK, D_OC report latch on fault	8 A, 2.7 V to 23 V, 9.2 mΩ eFuse with transient overcurrent blanking, adjustable OVP, and circuit breaker	30 A, 4.5 V to 18 V, 1.2 mΩ Hot-Swap eFuse Switch with IMON	0.45 mΩ, integrated OR-ing switch with OR-ing controller, lossless current sense, and temperature report
Comment	Common pinout. Vishay offers more than 10 % lower $R_{DS(on)}$ versus the competition for better efficiency, while supporting the highest voltage tolerance for reliability	One of the most compact and efficient eFuses in a 2 mm x 2 mm package, while providing comprehensive control and protection	High current at 30 A. Competition at 20 A max in 4x4 package	First and only integrated solution including OR-ing and current sensing. This saves significant solution size, component count, and improves efficiency by nearly 50 %
Slew Rate Time (µs)	Adjustable	Adjustable	Adjustable	-
On Delay Time (µs)	1000	655	1000	-
V_{IN} Min. (V)	4.5	2.7	4.5	9
V_{IN} Max. (V)	25	23	25	18
Output Discharge (Y / N)	Yes	No	Yes	No
Reverse Blocking (Y / N)	No	No	No	Yes
Package	PowerPAK® MLP32S-55	TDFN10-22	PowerPAK® MLP28S-44	PowerPAK® MLP66-40L
Package Size (W, L, H) (mm)	5 x 5 x 1	2.0 x 2.0 x 0.76	4 x 4 x 1	6.0 x 6.0 x 0.75

High Efficiency, Compact DC/DC Regulators Optimize Power Delivery

Vishay's microBUCK® DC/DC regulators deliver a combination of high efficiency and compact designs, making them well-suited for AI server power architectures. Models such as the SiC461, SiC431, and SiC450 offer wide input voltage ranges, high current capabilities, and peak efficiencies up to 98 %, enabling optimized power delivery and thermal performance in AI workloads.

With package sizes that reduce PCB footprints by up to 64 %, these regulators free up valuable board space, supporting higher power density and scalability in AI server designs. By minimizing power losses and maximizing efficiency, Vishay's microBUCK® regulators ensure reliable, high performance power management in AI-driven data centers and compute-intensive applications.

microBUCK® DC/DC Converter Regulators	SiC461	SiC431	SiC450
Description	10 A, 4.5 V to 60 V input, 100 kHz to 2 MHz, synchronous buck regulator	3 V to 24 V input, 24 A, 300 kHz to 1 MHz synchronous buck regulator	4.5 V to 20 V input, 40 A synchronous buck regulator with PMBus interface
V_{IN} Min. (V)	4.5	4.5 (SiC431A, SiC431B), 3 (SiC431C, SiC431D)	4.5
V_{IN} Max. (V)	60	24	20
V_{OUT} Min. (V)	0.8	0.6	0.3
V_{OUT} Max. (V)	0.92 x V_{IN}	0.92 x V_{IN} and < 20 V	12
Continuous Output Current (A)	10	24	40
Switch Freq Min. (kHz)	100	300	300
Switch Freq Max. (kHz)	2000	1000	1500
Pre Bias Oper. (Y / N)	Yes	Yes	Yes
Internal Bias Regulator	Yes	No	Yes
Compensation (Y / N)	External	Internal	Internal
Enable (Y / N)	Yes	Yes	Yes
PGOOD (Y / N)	Yes	Yes	Yes
Overcurrent Protection (Y / N)	Yes	Yes	Yes
Protection	OVP, OCP, UVP / SCP, OTP, UVLO	OVP, OCP, UVP / SCP, OTP, UVLO	OVP, OCP, UVP / SCP, OTP, UVLO
Light Load Mode	Selectable powersave / ultrasonic	Selectable powersave / ultrasonic	Yes
Peak Eff. (%)	98	97	96
Package	PowerPAK® MLP55-27L	PowerPAK® MLP44-24L	PowerPAK® MLP34-57
Package Size (W, L, H) (mm)	5 x 5 x 0.75	4 x 4 x 0.75	5 x 7 x 0.75

High Efficiency Smart Power Stages for AI Server Power Architectures

Vishay's VRPower® smart power stages integrate high side and low side MOSFETs with a driver IC, current monitoring, and temperature monitoring in a compact package. Designed for high-current, multi-phase converters powering AI servers, these devices improve efficiency and thermal performance while reducing component counts. Featuring current monitoring with ± 3 % accuracy and temperature monitoring with ± 3 % accuracy, they eliminate the need for external shunt resistors and thermistors. With switching frequencies up to 1.5 MHz, Vishay's smart power stages enable reduced ripple and the use of smaller inductors. Available in 50 A through 100 A versions with support for 3.3 V PWM logic, they offer compatibility with a wide range of PWM controllers from leading suppliers. These industry-standard footprint devices provide robust protection features, including overcurrent protection, overtemperature alerts, and undervoltage lockout, ensuring reliable operation in AI datacenter power architectures.

Part Type	Power stage	Smart power stage	Smart Power Stage	Smart power stage	Smart power stage	Smart power stage
Part Number	SiC658A	SIC870A	SIC852A	SIC856A	SIC860A	SIC570A
Description	50 A power stage plus, 4.5 V to 24 V_{IN}, 3.3 V PWM	100 A smart power stage, 4.5 V_{IN} to 16 V_{IN}, 3.3 V PWM	90 A smart power stage, 4.5 V_{IN} to 16 V_{IN}, 3.3 V PWM	70 A smart power stage, 4.5 V_{IN} to 16 V_{IN}, 3.3 V PWM	90 A smart power stage, 4.5 V_{IN} to 16 V_{IN}, 3.3 V PWM	60 A smart power stage, 4.5 V_{IN} to 16 V_{IN}, 3.3 V PWM
V_{IN} Min. (V)	4.5	4.5	4.5	4.5	4.5	4.5
V_{IN} Max. (V)	24	16	16	16	16	16
Continuous Current Rating Max. (A)	50	100	90	70	90	60
Switch Freq Max. (kHz)	1500	1500	1500	1500	1500	1500
Enable (Y / N)	Yes	Yes	Yes	Yes	Yes	Yes
Monitoring Features	THDN	TMON, IMON	TMON, IMON	TMON, IMON	TMON, IMON	TMON, IMON
Protection	VDRV UVLO, overcurrent, overtemperature, high side short	BOOT UVLO, overcurrent, overtemperature, high side short				
Light Load Mode	ZCD	None	None	None	None	None
PWM (V)	3.3	3.3	3.3	3.3	3.3	3.3
Package	PowerPAK® MLP55-31L	MLP 5x6	MLP 5x6	MLP 5x6	MLP 4x6	MLP 4x5
Package Size (W,L,H) (mm)	5.0 x 5.0 x 0.75	5.0 x 6.0 x 0.75	5.0 x 6.0 x 0.75	5.0 x 6.0 x 0.75	4.0 x 6.0 x 1.0	4.0 x 5.0 x 1.0