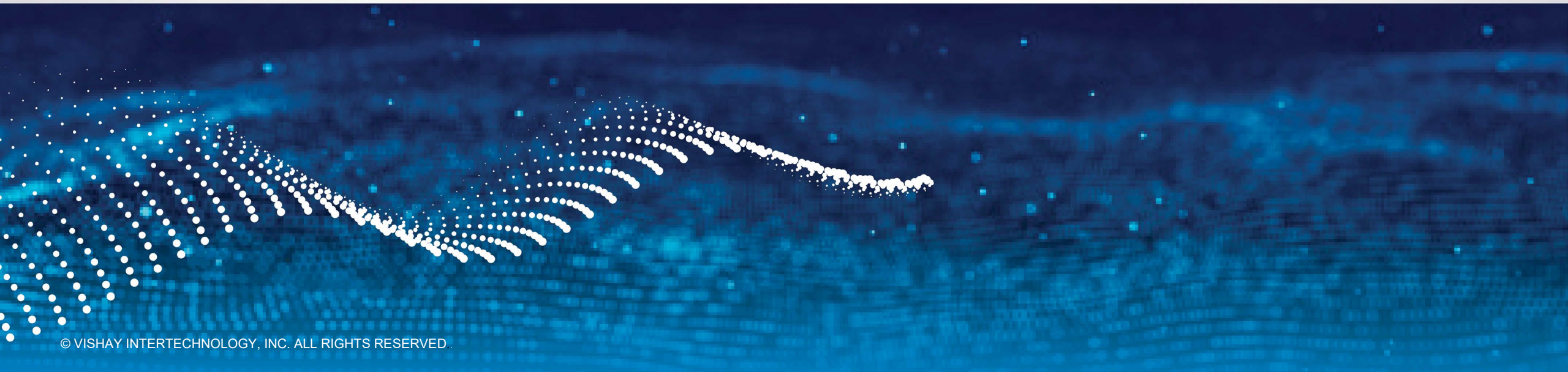
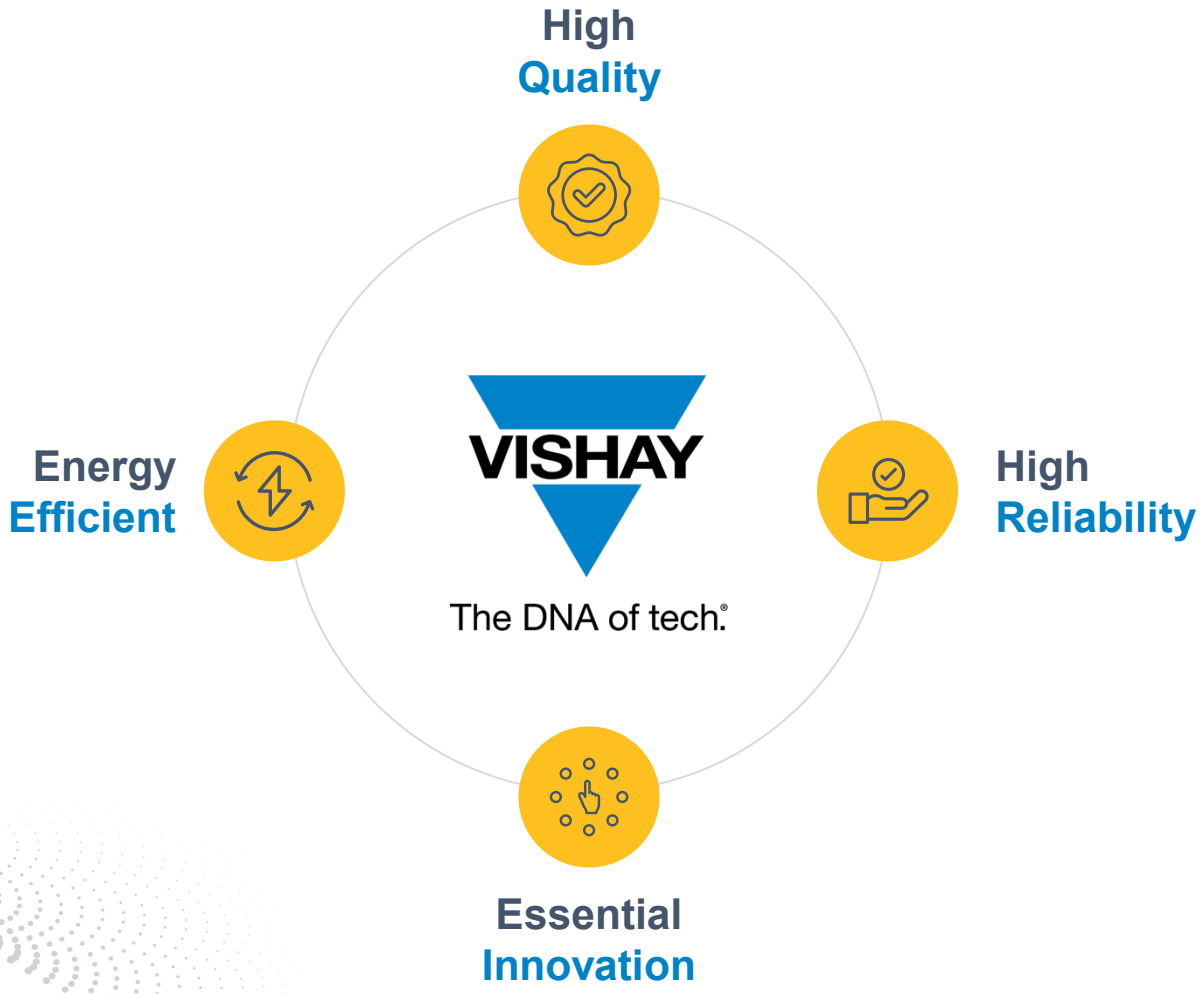
Innovations in Active and Passive Components for AI Servers

Vincent Hu — Business Development Asia



We manufacture one of the world's largest portfolios

of discrete semiconductors and passive electronic components



VISHAY

The DNA of tech.®

We are proud to be the go-to manufacturer for engineers to innovate with the ease and confidence that **The DNA of tech.®** is behind them all the way.

DISCRETE SEMICONDUCTORS ▶ PASSIVE COMPONENTS

LOWEST VOLTAGE DIODES ▶ HIGHEST ENERGY CAPACITORS

In power applications, we can supply

~ 80 %

of your BOM

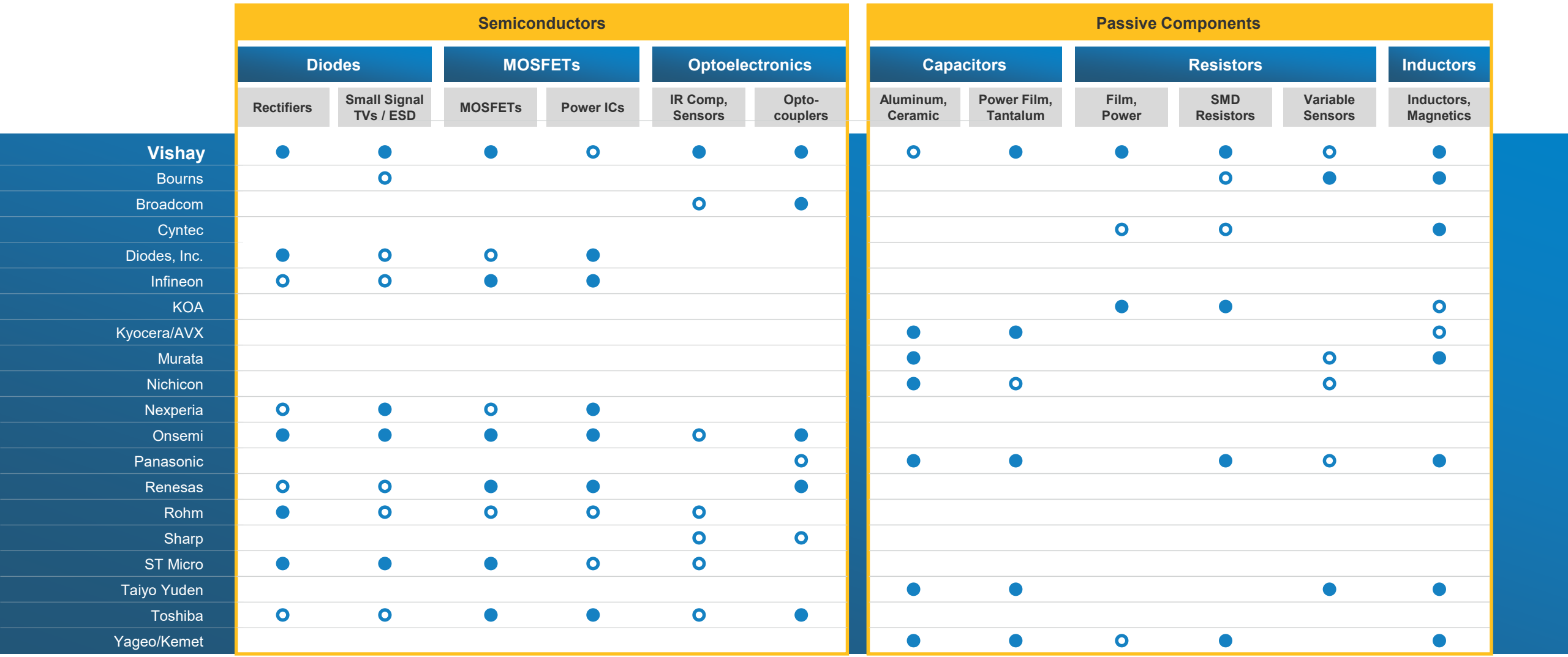
VISHAY

The DNA of tech.®

Vishay Is Close by

We operate in
every region
to meet you
wherever you are

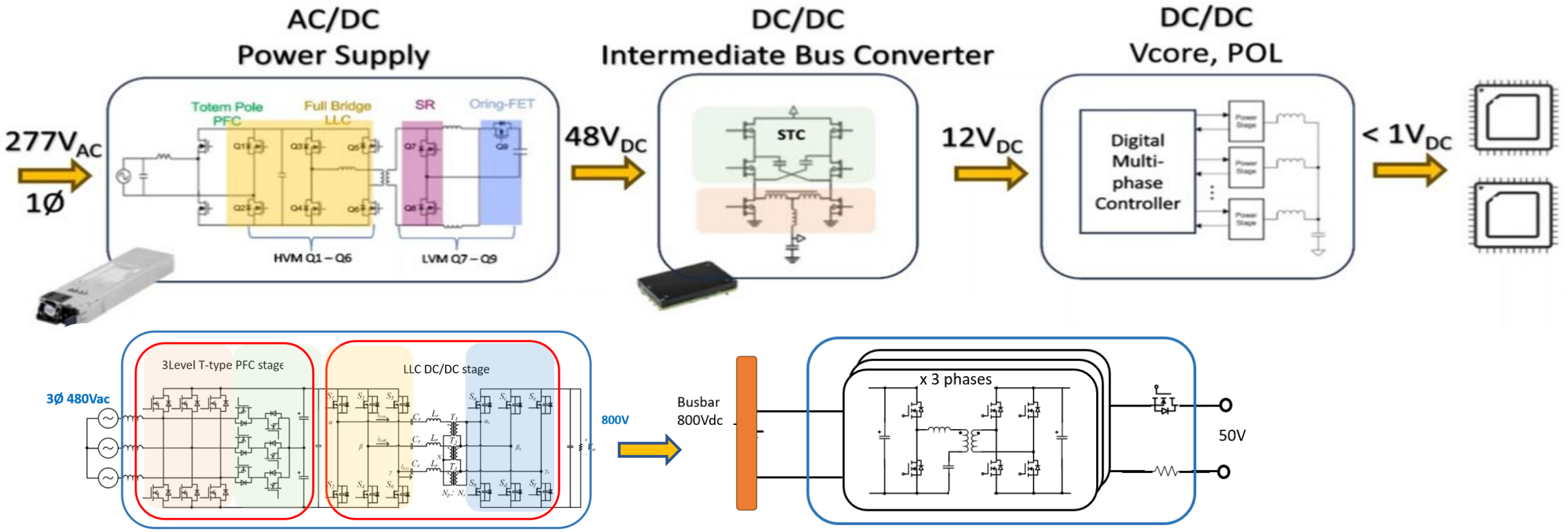
One of the world's largest portfolios of discrete semiconductors and passive electronic components - **essential to your innovative designs**



Source: Company estimates

● = Major Position ○ = Minor Position

AI Data Center Infrastructure – Typical Power Conversion Scheme



AC/DC PSU

MOSFETs: 1200 V / 650 V SiC MOSFET, 650 V superjunction, 60 V – 100 V LVM
Diodes: 1200 V / 650 V SiC diode, rectifier, Schottky
Resistors: Current sense resistor
Capacitors: DC-Link, aluminum capacitors

STC

MOSFETs: 60 V – 100 V LVM
Magnetics: Inductor, transformer
Diodes: TVS, Schottky
ICs: microBUCK®, power module
Resistors: Current sense resistor
Capacitors: MLCC, polymer tantalum

Mainboard

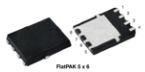
ICs: eFuse, microBUCK®, smart power stage, multi-phase controller
Diodes: TVS, Schottky
Magnetics: Inductors
Resistors: Current sense resistor
Capacitors: MLCC, polymer tantalum

AC/DC For +/-400Vout or 800Vout

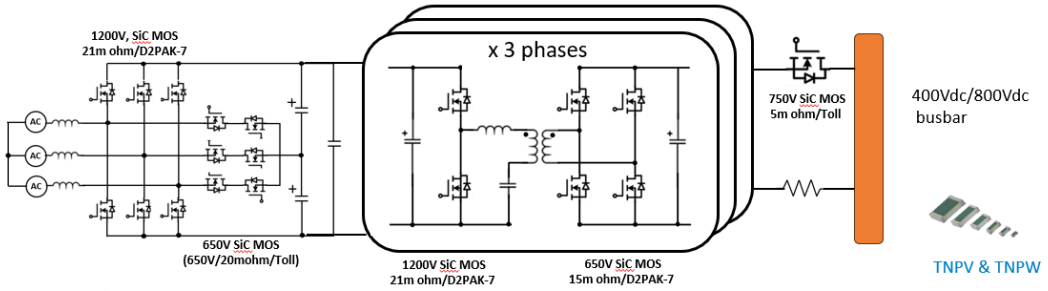

1200V SiC MOS
Power Module


650V/1200V SiC MOS


SiC Diode
1200V/2A SiC diode for Bootstrap diode – VS-3C02EJ12-M3


TMBS Diode


High Isolation Optocoupler

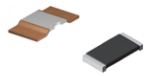


TNPV & TNPW


PTC


Voltage divider
Resistor


Capacitor


Shunt resistor


NTC


Film cap

Isolated DC/DC Converter

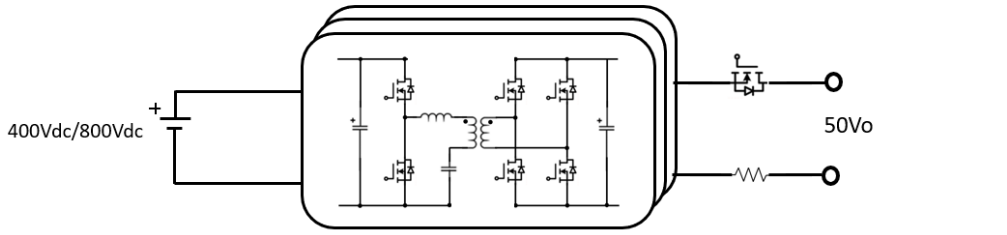

1200V SiC MOS
Power Module

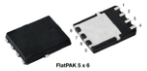

650V/1200V SiC MOS


SiC Diode


Low Voltage
MOSFET

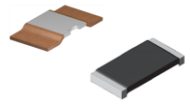

High Isolation
Optocoupler




TMBS Diode


Voltage divider
Resistor


Capacitor


Shunt resistor


NTC

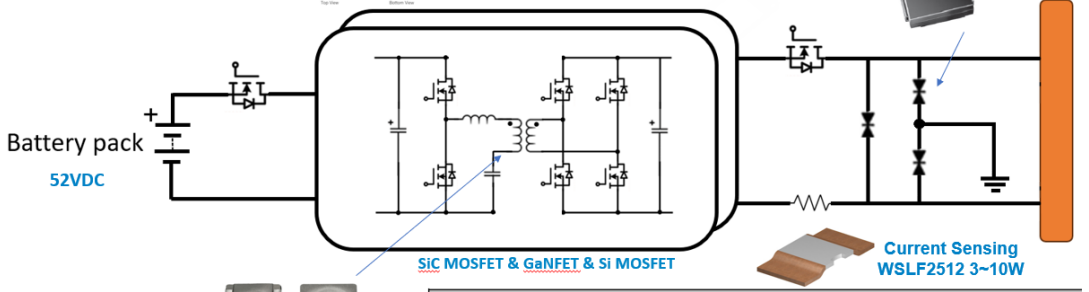
AI Server 12KW BBU

SIRS5100DP 100V/2.5mΩ

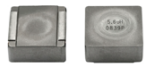
SiRS5800DP-T1-RE3
80V/1.8mΩ

XClampR® flat clamping TVS
XFC7K58CA-M3


50V BUSBAR



Power Inductor
IHLP6767



High Current Inductor
IHDM-1107BB-x0

PRELIMINARY ELECTRICAL SPECIFICATIONS

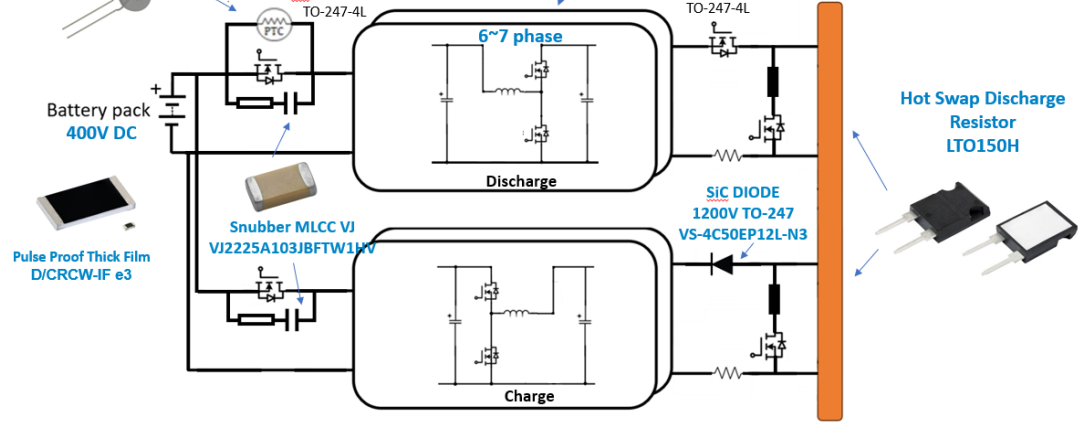
PART NUMBER	L_0 INDUCTANCE µH ±20% @100KHz, .25V, 0A	DCR mOhms TYPICAL 25°C	DCR mOhms MAX 25°C	HEAT RATING CURRENT DC AMPS[3] TYPICAL	SATURATION CURRENT DC AMPS[4] TYPICAL	SATURATION CURRENT DC AMPS[5] TYPICAL
IHLP6767GZEK2R2M0P	2.2	2.21	2.36	37.9	33.9	47.2
IHLP6767IZEK2R2M0P	2.2	1.35	1.44	43.0	44.3	61.1

26KW BBU for 800V BUSBAR

PTC
PTCEL17R102UTE404

SiC MOS 1200V/40~80mOhm
TO-247-4L
MXP120A045SL/063SL/080SL


Gate protection
Zener BZT52C16-G3-08
16V,500mW SOD-123



Pulse Proof Thick Film
D/CRCW-IF e3

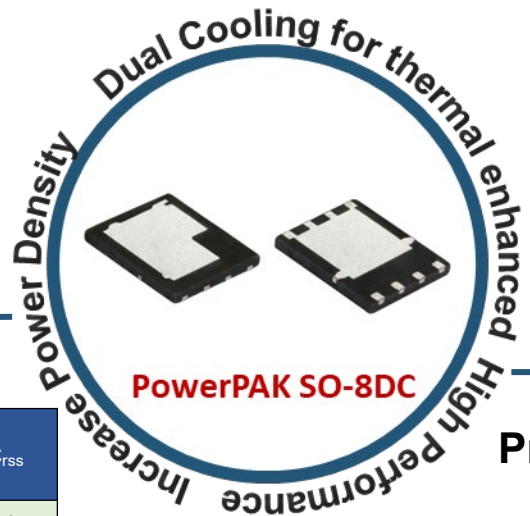
SiC MOS 1200 V / 180 Ohm TO-247 4L

Vishay MOSFETs for AI Server Solutions

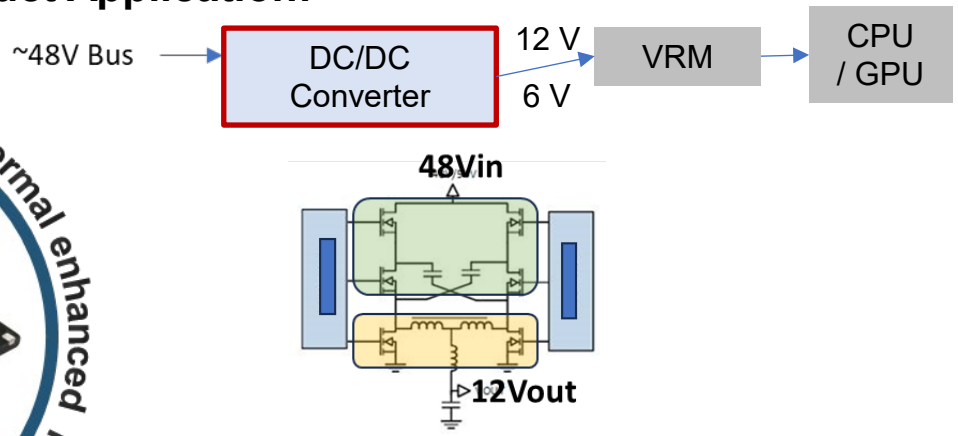
Vishay MOSFET Performance in HSC Applications

Product Features:

- Low on-resistance
- Excellent R_{DS}-Q_g and R_{DS}-Q_{oss} for switch performance
- High performance products that improve efficiency of power conversion and increase power density
- Dual cooling for thermal enhancement



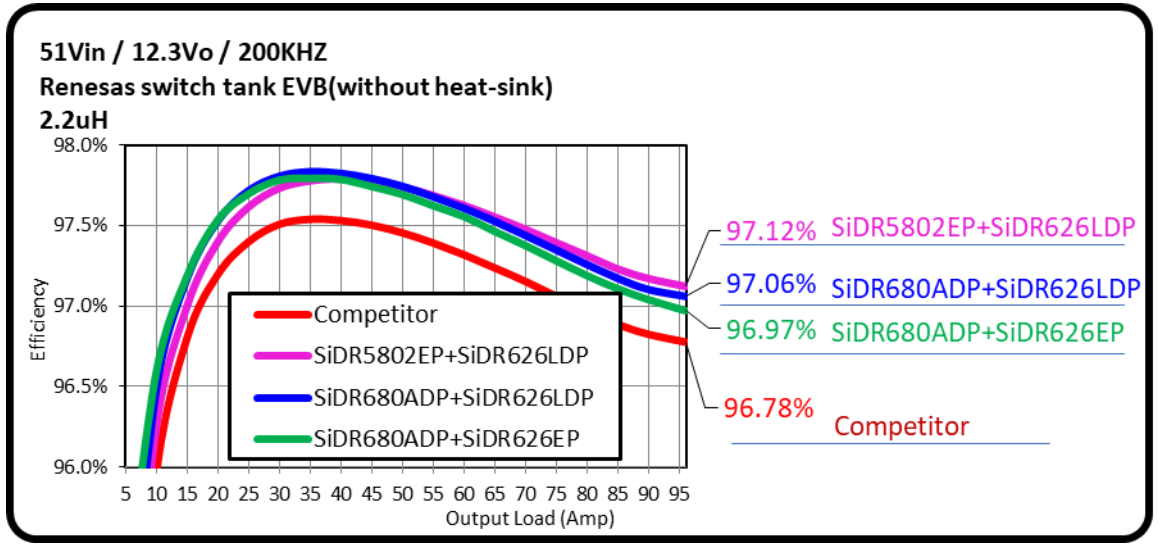
Product Application:



Product Portfolio:

Series	V_{DS} (V)	$R_{DS(on)}$ @ 10 V (Ω)	Q_g @ 10 V (nC)	C_{oss} @ 48 V	C_{rss}
SiDR680ADP	80	0.00288	55	550	26
SiDR5802EP	80	0.0029	37.3	1000	11
SiDR5818EP (in dev.)	80	0.00252	39	1193	
SiDR5816EP (in dev.)	80	0.00218	47	1423	
Competitor	80	0.0023	78	750	42
SiDR626LDP	60	0.0015	89	1340	60
SiDR626EP	60	0.00174	68	1190	39
SiDR4612LEP	60	0.00135	110	1840	110
SiDR4600EPF (in dev.)	60	0.00112	123	3080	
Competitor	60	0.0014	89	1500	59

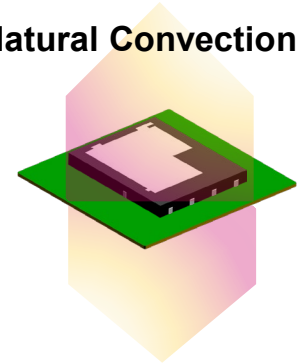
Product Performance:

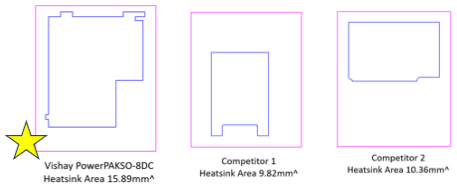


VISHAY
The DNA of tech.®

PowerPAK® SO-8DC Portfolio

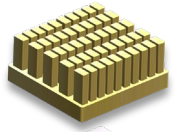
Natural Convection





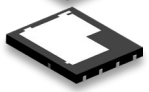
Forces major power dissipation to go though the MOSFET's top side, with heat carried away by the heatsink and airflow.

Heatsink Mounting in Application

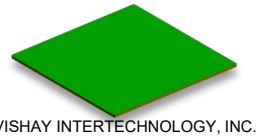


Heatsink

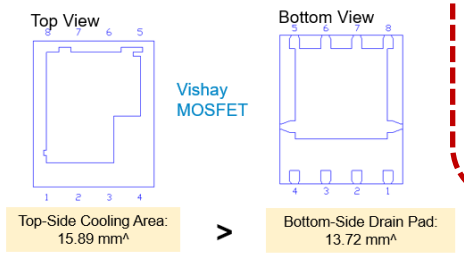
Thermal gap filler / interface



PowerPAK® SO-8DC



PCB



Features:

- Low on-resistance
- Excellent R_{DS}-Q_g and R_{DS}-Q_{oss} for switchmode power supply designs
- High performance products that improve efficiency of power conversion and increase power density
- Board-level reliability (BLR) meets IPC-9701A requirements
- **SiDRXXXEP - 175 °C junction temperature – with "EP"**

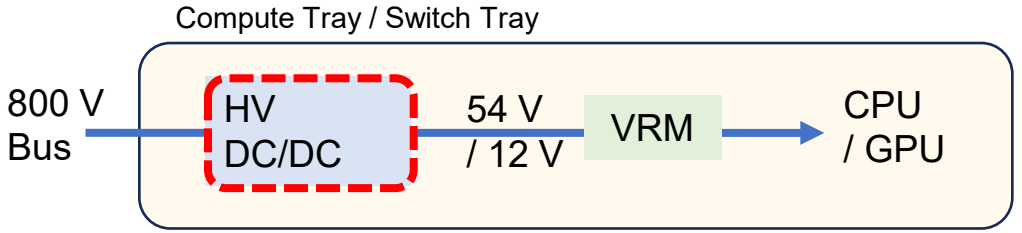
Part Number	V_{DS} (V)	V_{GS} (V)	$R_{DS(on)}$ @ 10 V (Ω)	$R_{DS(on)}$ @ 4.5 V (Ω)	Q_g (nC)		Q_{gs} (nC)	Q_{gd} (nC)	C_{oss} (pF)	Sample
			Max.	Max.	10 V	4.5 V				
SiDR402DP/EP	**40**	20, -16	**0.88**	1.16	110	53	22.5	9.5	1650	Now
SiDR608DP/EP	**45**	20, -16	**1.2**	1.8	111	50.5	26	7.8	1244	Now
SiDR626LDP/LEP	**60**	± 20	**1.5**	2.1	89	41	17.4	10.8	1340	Now
SiDR626EP	**60**	± 20	**1.7**	-	68	-	21	8	992	Now
SiDR4612LEP	**60**	± 20	**1.35**							In dev
SiDR4600EPF	**60**	± 20	**1.1**							In dev.
SiDR680ADP	**80**	± 20	**2.88**	-	54	-	17.5	11.4	395	Now
SiDR5802EP	**80**	± 20	**2.9**	-	37.3	-	16.5	3.2	1285	Now
SiDR5818EP	**80**	± 20	**2.52**	-	39	-			1193	In dev.
SiDR5816EP	**80**	± 20	**2.18**	-	47	-			1423	In dev.
SiDR510EP	**100**	± 20	**3.6**	-	54	-	23.3	3	1050	Now
SiDR5102EP	**100**	± 20	**4.1**	-	33.7	-	15.7	1.7	1050	Now
SiDR104ADP/AEP	**100**	± 20	**6.1**	-	46.1	-	15.4	7.1	335	Now
SiDR870ADP	**100**	± 20	**6.6**	10.5	53.5	25.2	10	10.6	719	Now

PowerPAK® SO-8S Part List

(5 x 6 mm²)

Features:

- Ultra low $R_{DS(on)}$ for high density solutions
- Lower thermal resistance to enhance power dissipation
- Dimensions & land pattern compatible with PowerPAK® SO-8
- Robust SOA capability



Package	V_{DS} (V)	Part Numbers	V_{GS} (V)	$R_{DS(ON)}$ (mΩ) @ 10 V Max.	Q_g (nC)	Q_{gs} (nC)	Q_{gd} (nC)	C_{oss} (pF)	Rg	Status
PowerPAK® SO-8S	30	SiRS4300DP	+20 / -16	**0.4**	180	40	18	5000	1.4	Released
		SiRS4302DP	+20 / -16	**0.57**	153	30	17	4325	1.2	Released
	40	SiRS4400DP	+20 / -16	**0.69**	195	45	18	2350	0.95	Released
	60	SiRS4600DP	± 20	**1.2**	108	33	14	1775	1.2	Released
	80	SiRS5800DP	± 20	**1.8**	81	31	7.6	1635	1.3	Released
	100	SiRS5100DP	± 20	**2.5**	68	24	5.1	1600	1.4	Released
		SiRS700DP	± 20	**3.5**	86	29	14	580	1.1	Released
	150	SiRS5700DP	± 20	**5.6**	73	25	7.6	480	1.4	Released
		SiRS5702DP	± 20	7.2	58	22	5.1	405	1.2	Released
	-30	SiRS4301DP	± 20	**1.5**	365	64	55	2070	2.4	Released
	-40	SiRS4401DP	± 20	**2.2**	392	65	59	1500	2.5	Released

PowerPAK® 10x12(TO-LL)

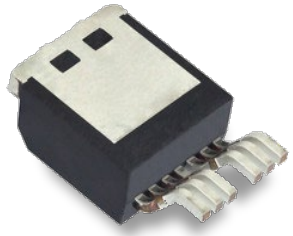
Features:

- Best in class $R_{DS(on)}$
- 30 % space savings compared to D^2PAK
- Low profile, thickness reduced by 50 %

Target Applications:

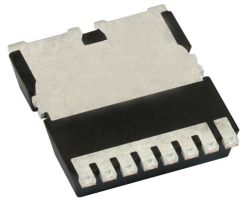
- Synchronous buck converters
- Hot-swap
- Industrial power supplies
- Motor drive control
- BMS (battery management system)

Package	V_{DS} (V)	Part Numbers	$R_{DS(ON)}$ (mΩ) @ 10 V Max.	Q_g (nC)	Q_{gs} (nC)	Q_{gd} (nC)	C_{oss} (pF)	Rg	Status
PowerPAK® 10x12 (TO-LL)	40	SiJK140E	**0.47**	312	84	70	8540	1.1	Released
	60	SiJK4610	**1.25**	211	58	28	3510	1	Released
	80	SiJK4810	**1.75**	214	62	28	1670	0.9	Released
		SiJK5814E	**0.92**	142.4	44.4	12.2	4395.8	1.5	Q1, 26
	100	SiJK5100E	**1.4**	131	53	5.3	3210	0.8	Released
	150	SiJK5716E	**2.8**	131.1			1033.3	1.5	Q1, 26



10.4 mm x 15.5 mm x 4.8 mm

30 % space savings
Thickness reduced by 50 %



10 mm x 12 mm x 2.3 mm

Power IC Product Family Overview

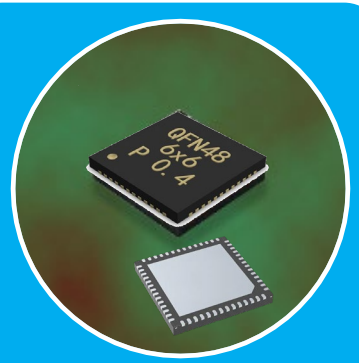
VRPower®

Smart Power Stage

Smart Driver + MOSFETs

Multi-Phase

Synchronous Buck Power Stages



Multi-Phase Controller

PMIC

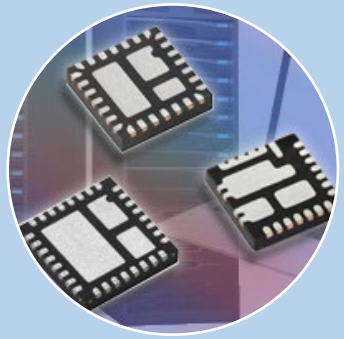
8-Ph / 12-Ph / 16-Ph Digital Control

SVID / SVI3 / PMBUS

4-Channel PMIC – INTEL ROP Support Up to 100 A

Complete Power Solution

Telemetry & Sequencing



microBUCK®

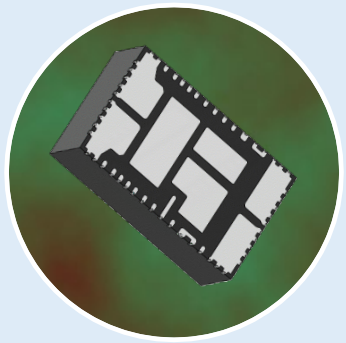
POL DC\DC Regulator Controller + MOSFETs

Singl- Phase

Wide Input Voltage

Scalable Solution

Integrated Regulators



microBRICK®

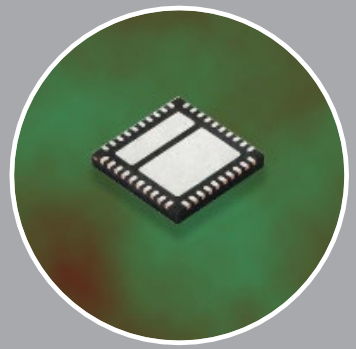
POL DC\DC Regulator Regulator + Magnetics

Highest Power Density

Ease of Use

Minimum Peripherals

Integrated Modules



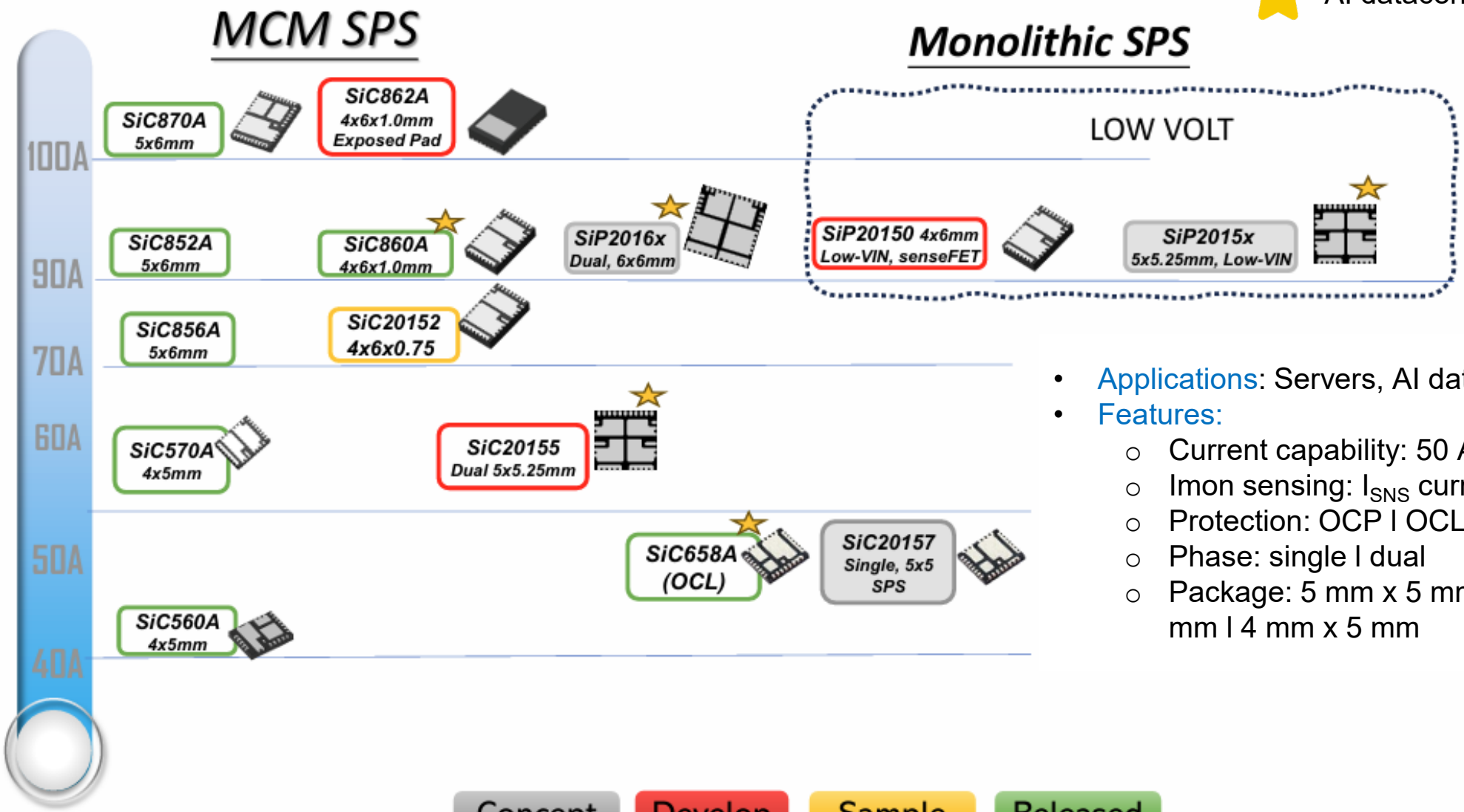
Smart Load Switches

eFuse

O-ring

Power Stage Roadmap – High Current

AI datacenter solution



- Applications: Servers, AI datacenters
- Features:
  - Current capability: 50 A – 100 A
  - Imon sensing: I_{SNS} current reporting
  - Protection: OCP I OCL
  - Phase: single I dual
  - Package: 5 mm x 5 mm I 4 mm x 6 mm I 4 mm x 5 mm

Concept | Develop | Sample | Released

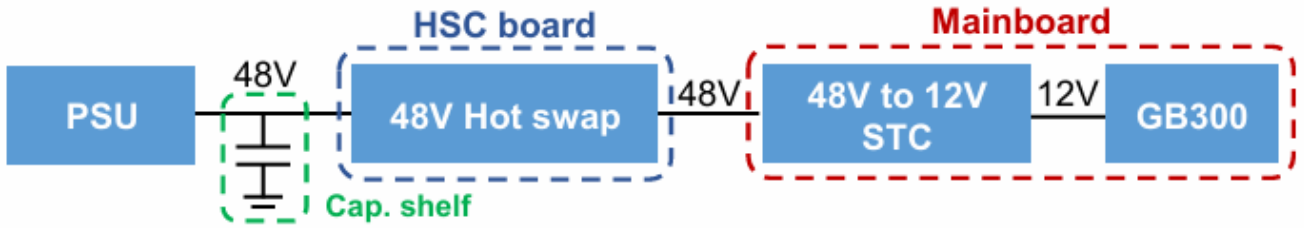
54 V / 12 V Regulated, Non-Isolated IBC

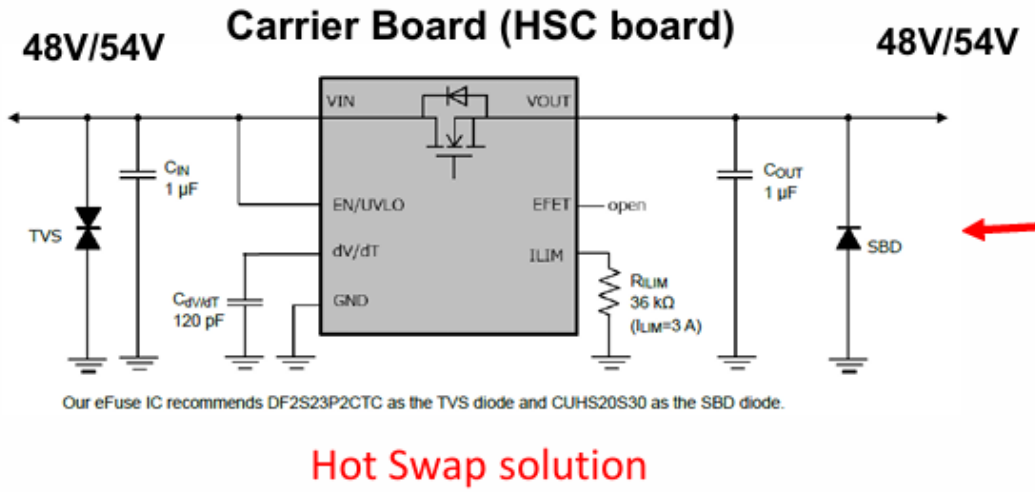



	VNQ05412130N Series	**VNQ05412110N Series**	**VNQ05412072N Series**	**VNQ05412170N Series**
V_{IN}	40 V_{DC} – 60 V_{DC}	40 V_{DC} – 60 V_{DC}	38 V_{DC} – 60 V_{DC}	40 V_{DC} – 60 V_{DC}
V_{OUT}	12.2 V	12.2 V	12.2 V	12.2 V
P_{OUT}	1600 W (2400 W / 200 ms)	1300 W (2000 W / 200 ms)	860 W (1200 W / 50 ms)	2000 W (3000 W / 20 ms)
Dimensions	58.4 x 36.8 x 14.2 mm Quarter brick	58.4 x 36.8 x 13.9 mm Quarter brick	58.4 x 36.8 x 12.9 mm Quarter brick	58.4 x 36.8 x 14.7 mm Quarter brick
Efficiency	Up to 98 %	Up to 98 %	Up to 98 %	Up to 98 %
Isolation	No	No	No	No
Status	Released	Released	Released	Released

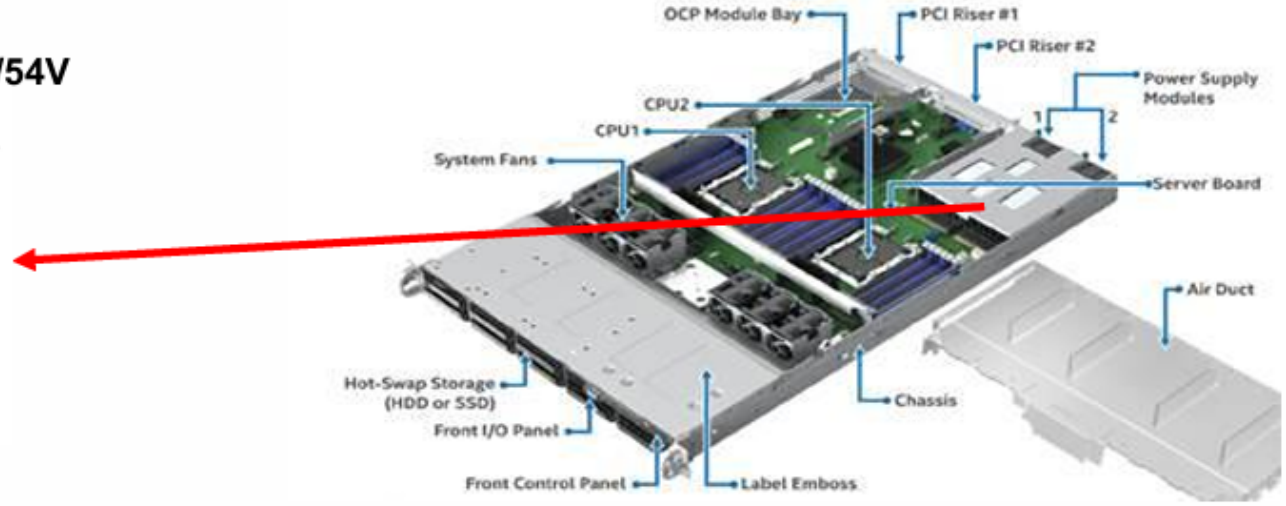
Vishay Diodes for AI Server Solutions

Server Main Board Architecture





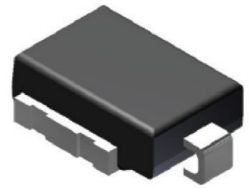
Hot Swap solution



P/N	Usage / Per Hot Swap	Comment
XFC7K60CA-M3; SMC5K60A-M3	2 ~ 4	TVS for Hot Swap Circuit
SS20PH102-M3/H; V20P103S-M3/H	2 ~ 4	Schottky Rectifier for Hot Swap Circuit

New Product - Bi-Directional Flat Clamping TVS

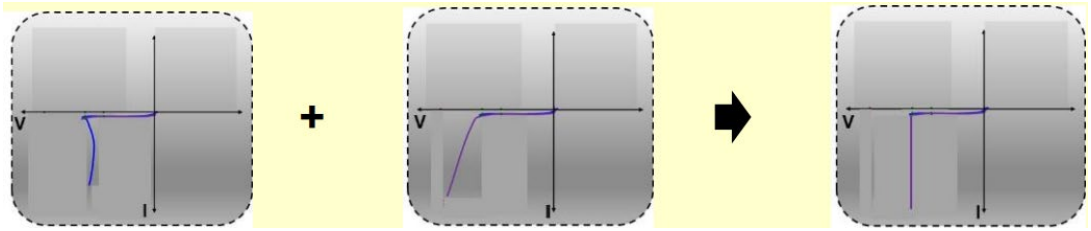
Core P/N	V_{WM}	P_{PPM} @ 10/1000 us	Package	Max T_J	Remark
XFD8AxxCA-M3/HM3 XFD5AxxCA-M3/HM3	36 V ~ 85 V	> 9000 W > 7000 W	DO-218AC	175 ˚C	Bi-directional



Core P/N	V_{WM}	P_{PPM} @10/1000 us	Package	Max T_J	Remark
XFC7KxxCA-M3/HM3	36 V~ 85 V	> 7000 W	SMC (DO-214AB)	175 ˚C	Bi-directional

Core P/N	V_{WM}	P_{PPM} @ 10/1000us	Package	Max T_J	Remark
X15NxxCAHM3	33 V~ 110 V	1500 W	DFN6546	175 ° C	AGP is preferred
1.5DFNxxCA-M3				175° C	N

- ✓ **C/R (= VC / VBR) ≈ 1.0**
- ✓ Application target for automotive EV / HEV 48V system power line surge protection, ADAS, EPS, BMS, DC/DC converters, and industrial automation, energy storage, server power, and telecom



650 V & 1200 V SiC Diodes in SlimSMA HV Package

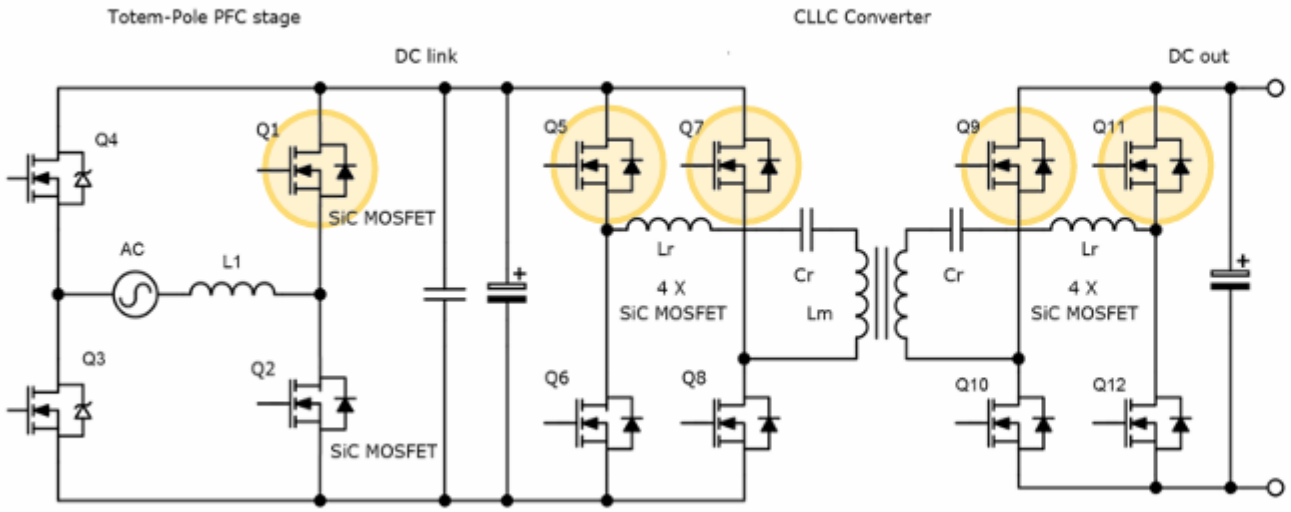
- SiC diodes keeps bootstrap capacitors charged for high side MOSFETs or GaN transistors above 100 kHz
- SlimSMA HV package: 3.2 mm creepage, CTI ≥ 600, IEC 60664-1 compliant up to 630 V_{RMS}
- Low profile design (0.95 mm) with SMA- / SMB-compatible pad layout

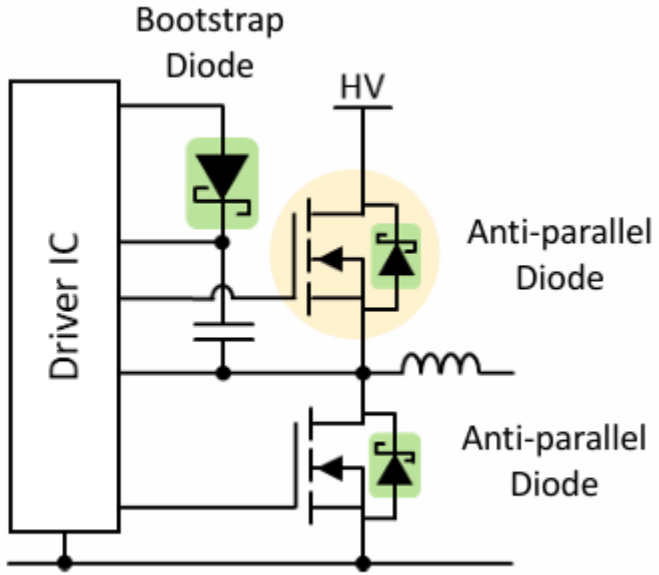
SlimSMA HV

2.6 mm x 5.2 mm x 0.95 mm (H)

High CTI ≥ 600 molding compound

- PN: VS-3C01EJ07-M3, VS-3C01EJ12-M3, VS-3C02EJ12-M3





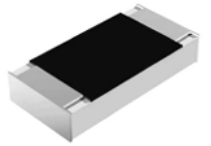
High-side SiC or GaN transistors in bootstrap driver configurations benefit from a SiC diode, ensuring fast switching, low losses, and reliable operation.

Vishay Resistors for AI Server Solutions

Server / Server Power / IPC

High Power

Type	Product Series	Rated Power	Standard
Thick film	CRCW-HP series	1.5 W in 2512 (0.2 W in 0402)	0.75 W in 2512
Thick film	RCC series	0.125 W in 0402	0.063 W in 0402
Thick film	RCS series	0.2 W in 0402	0.063 W in 0402
Thick film	RCL (long side termination)	0.25 W in 0406 (2 W in 1225)	0.1 W in 0603
Thick film	RCP series	1.5 W in 0603 (3.5 W in 2512)	0.1 W in 0603
Thin film	PCAN series	1 W in 0603 (6 W in 2512)	0.21 W in 0603



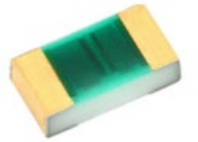
High Voltage

Type	Product Series	Rated Voltage	Standard	
Thick film	RCV series	3 KV in 2512	500 V in 2512	
Thick film	CRHV series	3 KV in 2512	500 V in 2512	High R value up to 50 GΩ
Thick film	CRMV series	800 V in 2512	500 V in 2512	High R value up to 75 MΩ
Thin film	TNPV series	1 KV in 1210	300 V in 1210	
Thin film	MELF-HV series	700 V in 1206	200 V in 1206	

Server / Server Power / IPC

High Temperature

Type	Product Series	Working Temp.	Standard
Thick film	CHPHT series	245 °C	125 °C
Thin film	PATT series	250 °C	125 °C

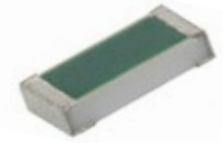


Ultra Precision

Type	Product Series	Tol / TCR	Standard
Thin film	TNPU series	Tol: 0.02 % / TC: 2 ppm	Tol: 0.1 % / TC: 25 ppm

Load Life Stability

Type	Product Series	Max. Resistance Change at P_{70}	Standard
Thin film	TNPW series	< 0.3 % after 225 000 h	< 0.1 % after 1000 h
Thin film	MELF series	< 0.3 % after 225 000 h	< 0.1 % after 1000 h



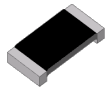
Shunt Resistor Overview

WSLP0603

0.4 W

10 mΩ to 100 mΩ

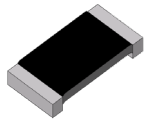
WSLP0805



0.5 W

5 mΩ to 100 mΩ

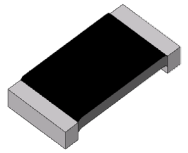
WSLP1206



1 W

0.5 mΩ to 50 mΩ

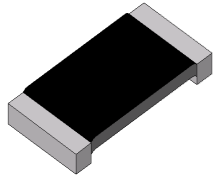
WSLP2010



2 W

1 mΩ to 30 mΩ

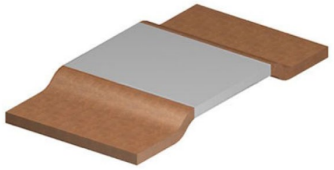
WSLP2512



3 W

0.5 mΩ to 10 mΩ

WSLF2512



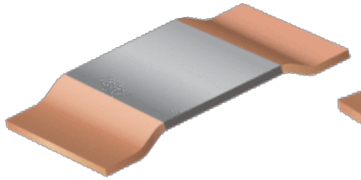
WSLF2512, 10 W

0.3 mΩ to 0.5 mΩ

WSLF2512, 3 W

4 mΩ

WSLP3921



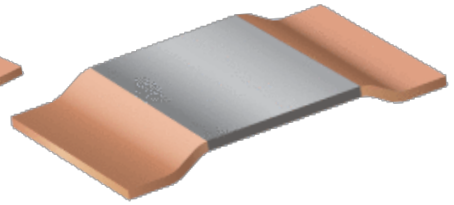
WSLP3921, 9 W

0.1 mΩ to 1 mΩ

WSLP3921, 5 W

2 mΩ to 4 mΩ

WSLP5931



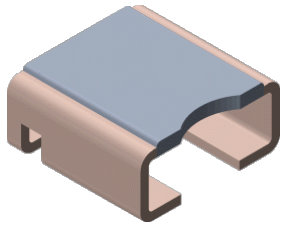
WSLP5931, 15 W

0.1 mΩ to 0.5 mΩ

WSLP5931, 7 W

1 mΩ to 3 mΩ

WSLP2726



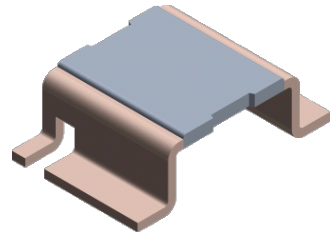
WSLP2726, 12 W

0.2 mΩ to 0.5 mΩ

WSLP2726, 5 W

1.3 mΩ to 5mΩ

WSLP4026



WSLP4026, 12 W

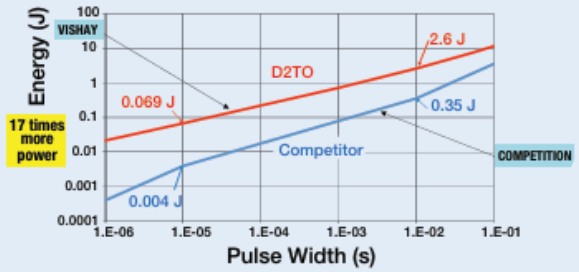
0.2 mΩ

WSLP4026, 5 W

1.3 mΩ to 5 mΩ

BMS / BBU – Discharge

ENERGY CURVE: D2TO VS. COMPETITOR



PROVEN QUALITY

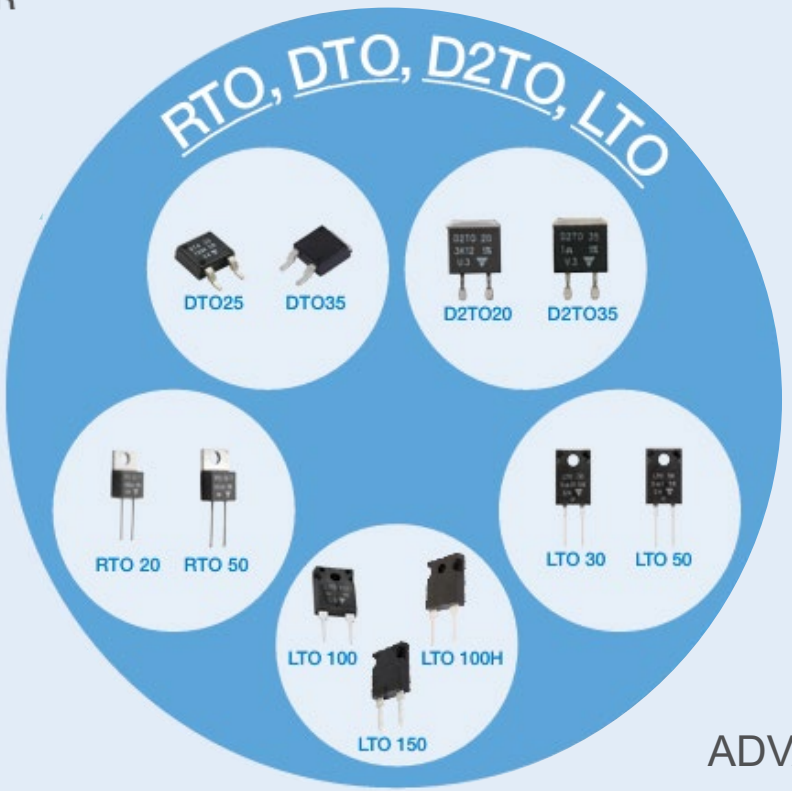
AUTOMOTIVE GRADE

With PPAP available

Driving the main EV / HEV manufacturers

AEC-Q200 RESISTORS

- LTO 100 / LTO 100H / LTO 150
- D2TO20 / D2TO35
- DTO25 / DTO35



NON-INDUCTIVE

Widest Ω range

SPACE-SAVING

Fewer components on PCB

Can replace **5** to **20** chip resistors

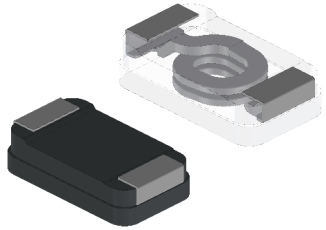
APPLICATIONS

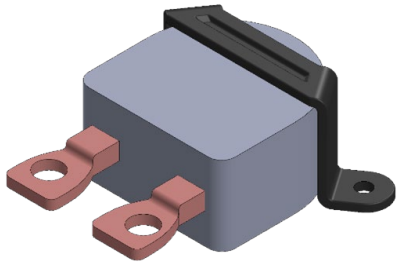
ADVANTAGES:

- High energy ratings for harsh pulses up to 60 J / 0.1 s
- High power for long pre-charge / discharge up to 150 W at 45 °C
- High dielectric strength for protection up to 3000 V_{RMS}

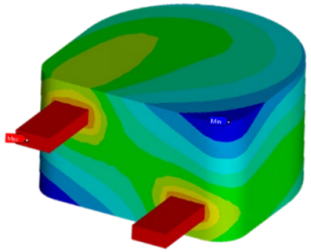
Vishay Inductors for AI Server Solutions

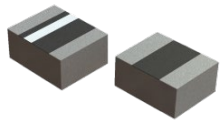
Vishay Power Inductors

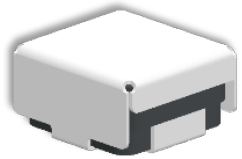


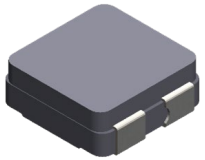


- Leader in Composite Power Inductor Technology
- High Quality / Reliability
- Competitive Lead Times
- Partner for Supply Chain Risk Mitigation
- Customization Options
- Cost-Effective
- AEC-Q200 Compliant



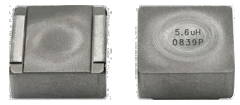


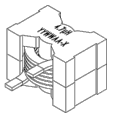


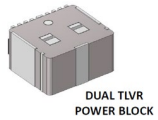


Focus Products for AI Power

Application	Usage	Vishay Products	Remark
PSU (480 V_{AC} to 800 V_{DC})	DC/DC filter	IHLP6767, IHLP7575, IHDV	High current ~100 A IHDV core to coil DWV 1500 V_{DC}
HVDC (800 V_{DC} to 54 V_{DC})	DC/DC filter	IHLP6767/7575, IHDV, and custom inductors	IHDV core to coil DWV 1500 V_{DC}
BBU (battery backup unit)	DC/DC filter	IHLP6767,7575, and Custom inductors	High current ~100 A core to coil DWV 500 V_{DC}
DC/DC module	Switching Inductor	Dual TLVR power block	Vertical power delivery





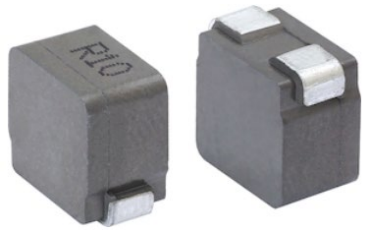


High Frequency, High Current

Where? For high computing power, multiphase converters, servers, datacenters, LC filters

- Fast switching > 500 kHz
- Tight ripple control
- Ideal for converting low level IC voltage **12 V → 1 V**
- High load capable up to 100 A due to **ultra low DCR**

IHVR-4025JZ-3Z



100 nH to 150 nH
110 A
10.3 mm x 6.4 mm x 10 mm

IHSR-1616BZ-01

33 nH to 68 nH
35 A
4.5 mm x 4.1 mm x 1.2 mm

IHSR-2525CZ-5A

AUTOMOTIVE GRADE

80 nH to 100 nH
55 A
7.4 mm x 6.7 mm x 3.0 mm

IHSR-4040DZ-5A

AUTOMOTIVE GRADE

130 nH
70 A
11.3 mm x 10.3 mm x 4.0 mm

IHSR-6767GZ-5A

AUTOMOTIVE GRADE

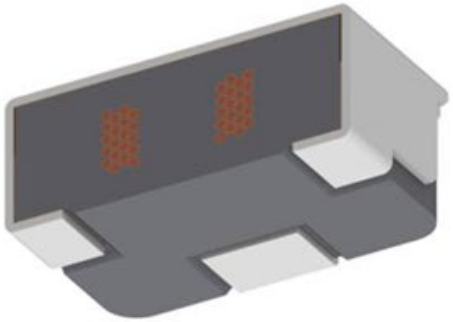
220 nH
100 A
18 mm x 17 mm x 7.0 mm

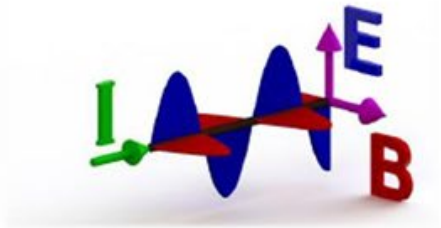
B-Field and E-Field Shielded IHLE® Inductors

- Special shielded IHLP inductor
- Significant EMI reduction
- Prevent circuit malfunction
- Six footprints available
- New 6767 size

NEW IHLE-6767

AUTOMOTIVE GRADE



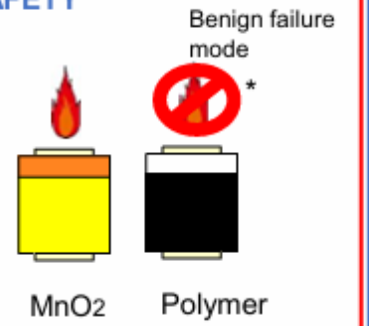


Integrated E-field shielding

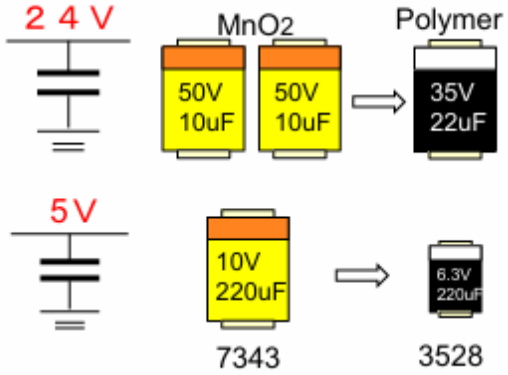
Vishay Capacitors for AI Server Solutions

Vishay - Tantalum Division -
Key strengths of tantalum capacitor

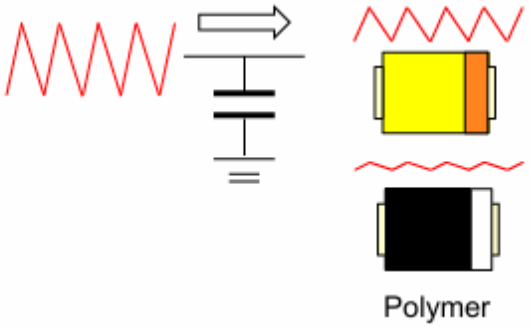
Safety



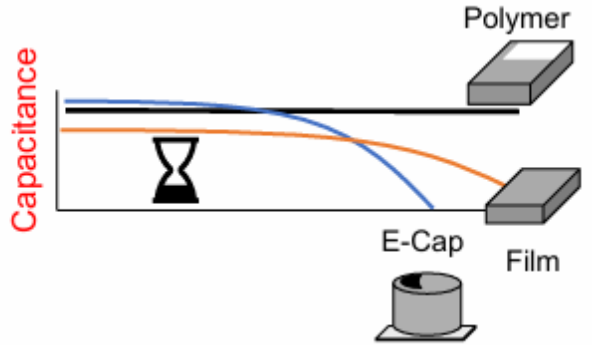
Derating & Size



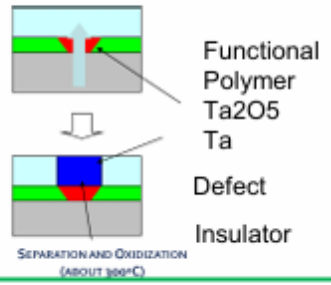
Low ESR and ESL



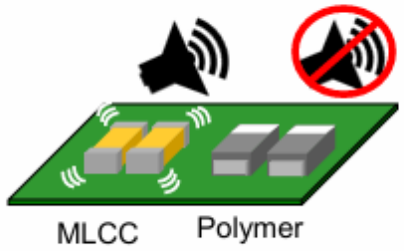
Long Life No Wear Out



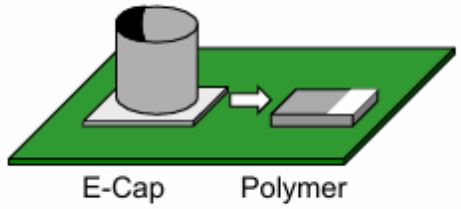
Self Healing



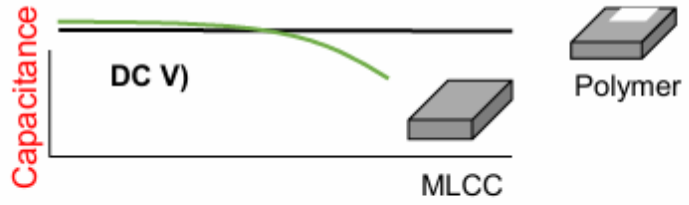
No Piezo Effect Noise



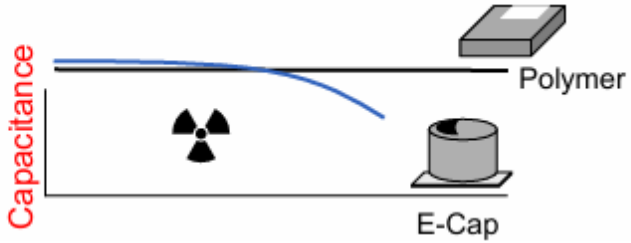
Small Footprint, High Density & Low Profile



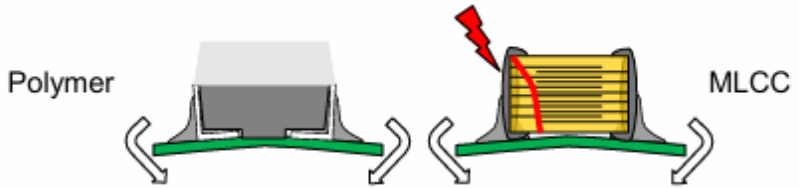
No Cap Drop with DC Bias



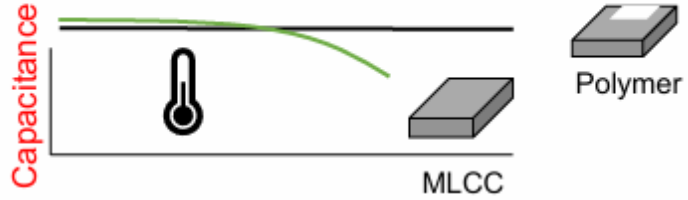
No Degradation with Radiations*



Not Sensitive to Board Flex and Mechanical Stress



No Cap Drop with Temperature (85-125° C)



VISHAY
The DNA of tech.®

T55 Series

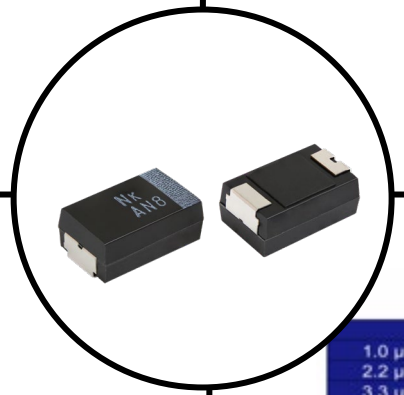
Industrial-Grade

Market Segments / Applications

- Power management in
  - DC/DC converters
  - Industrial power supplies
  - Telecom infrastructure
  - Smart meters
  - Factory automation

What You Should Know

- We continue to expand our product portfolio
- We continue to increase our capacity



Features

- Capacitance range: 3.3 µF – 1000 µF
- Voltage range: 2.6 V_{DC} to 63 V_{DC}
- Molded packaging in nine case codes
  - Smallest case size is 0603

Updated CV Chart

	2.5 V	4.0 V	6.3 V	10 V	16 V	20 V	25 V	35 V	50 V	63 V
1.0 µF										B
2.2 µF								B	B	
3.3 µF			J/P	J/P						
4.7 µF			J/P/A	P/A				B		C/D
6.8 µF			P/A	A	B		B	B		
10 µF		J/P/A	P/A	P/A	B		B	B/D	D	D
15 µF		P/A	A	A	B	B/V	B/V	V	D	X
22 µF	A	A/B	A/T/B	A/T/B	B	V	B/V	Z/V/D	X	
33 µF	A	A/B	A/T/B	A/T/B	B/V/D	V	Z/V/D	D	X	
47 µF	A	A/T/B	A/T/B	B	Z/V/D	Z/V	D	D		
68 µF	A/B	A/T/B	T/B	V	V		D	X		
100 µF	A/T/B	A/T/B	A/T/B Z/V/D	Z/V/D	Z/V/D	D	D			
150 µF	B	B/Z/V	B/Z/V/D	Z/V/D	D	X	X			
220 µF	B/V	B/Z/V/D	B/Z/V/D	Z/V/D	X					
330 µF	B/Z/V/D	Z/V/D	V/D	D						
470 µF	B/Z/V/D	Z/D	V/D	X						
680 µF	D	D	D							
1000 µF	D	X	X						Approved	
1500 µF	X								In Development	

T52 Series

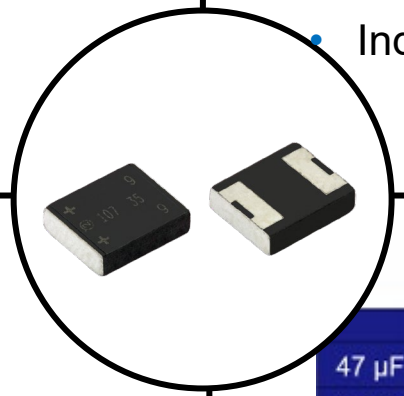
High Energy, Low Profile

Market Segments / Applications

- Bulk energy storage for all space-constrained applications, e.g. SSDs and HDDs
- Infrastructure equipment
- Storage and networking
- Computer motherboards

What You Should Know

- We improve and expand our product portfolio
- Leadframeless designs increase volumetric efficiency
- Double anode structure achieves low ESR
- Industry-leading energy storage solution



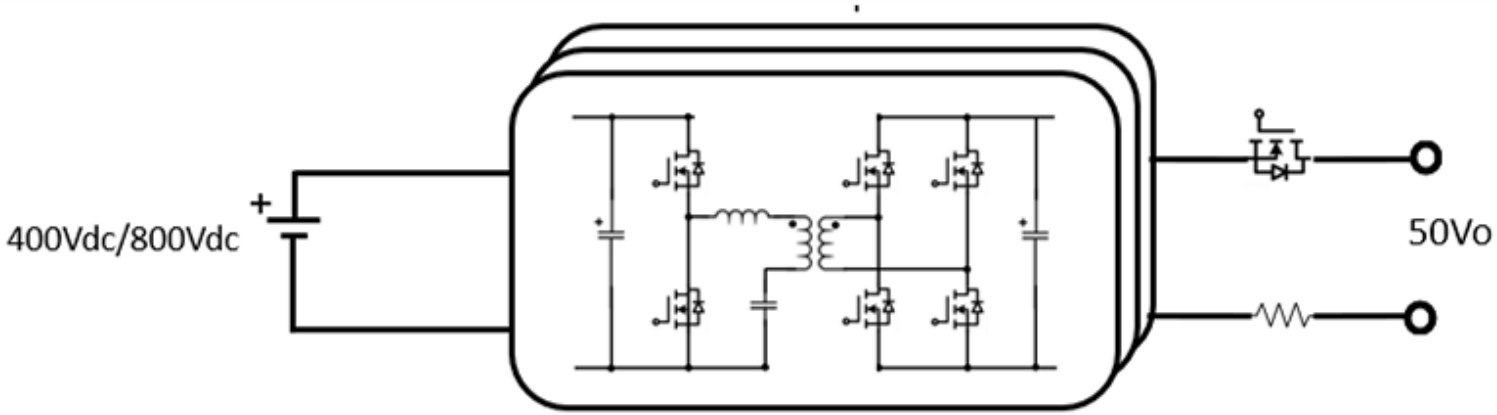
Features

- Extreme energy density
- E5 / B2 case (1 anode), M1 / M9 case (2 anodes)
- Capacitance: 47 µF – 470 µF
- Voltage: 10 V_{DC} to 35 V_{DC}
- Operating temperature: -55 °C to + 105 °C

CV Chart

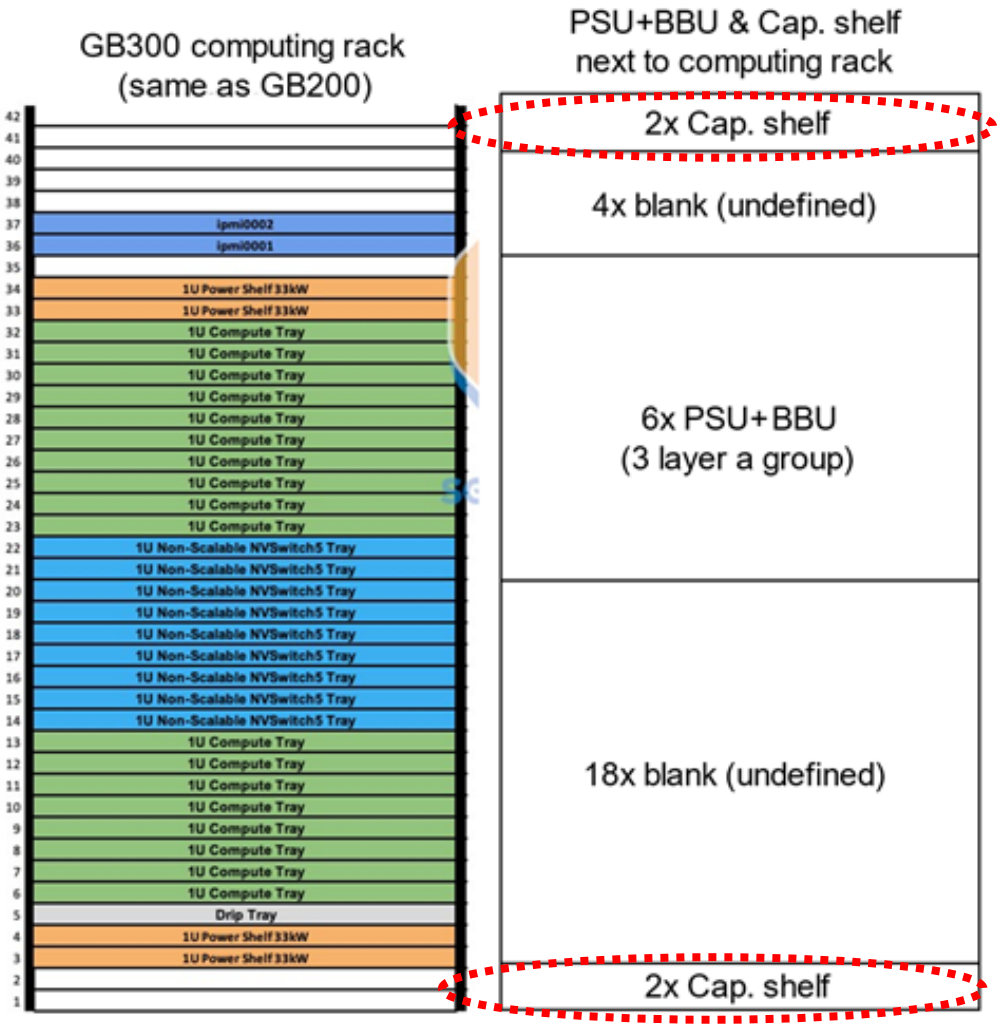
	10 V	16 V	20 V	25 V	35 V	40 V
47 µF		B2 (200)		E5 (55)	E5 (55)	E5
56 µF					E5	
100 µF			E5 (55)		M1 (55) ACC	M1
150 µF		E5 (55)		M1 (70)		
220 µF	M1 (55)	M1 (55)		M1 (55)		
330 µF	M1 (55)	M1 (55)			Approved	
470 µF		M1 (55)			In Development	

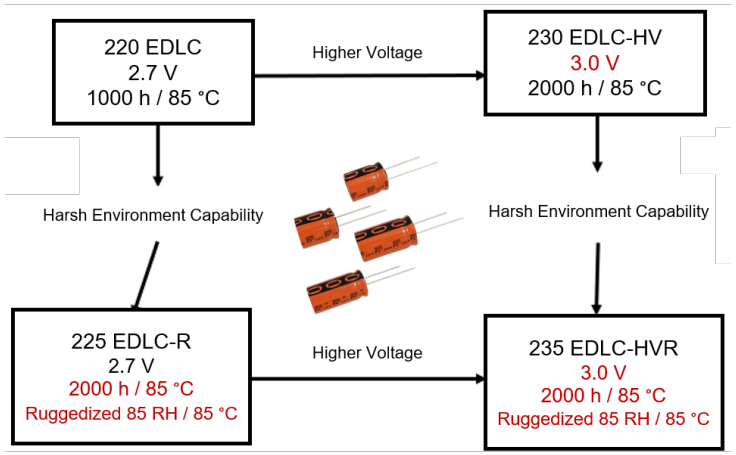
Vishay Capacitors for 800 V → 50 V DC/DC



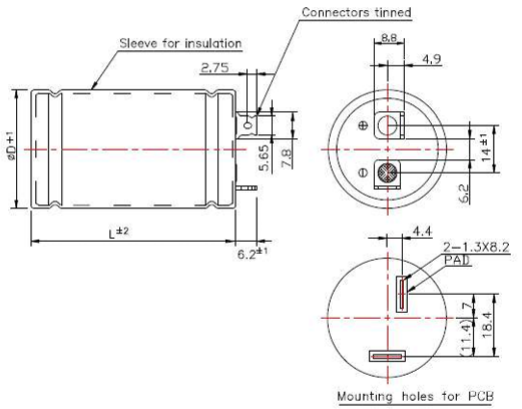
Function	Vishay Products Series	Typical Capacitance Value
DC-Link capacitor	MKP1848e, MKP1848T, MKP1848HD	1 µF, 3 µF, 5 µF, 10 µF, 20µF
DC-Link capacitor	MKT1820	63 V / 10 µF to 100 µF
High voltage filter	HV MLCC	≥ 1000 V, size bigger than 1206
Resonant capacitor AC & pulse	MKP385e	1000 V / 1000 nF
12 V filter capacitor	T55	100 µF / 25 V
48 V filter capacitor	T55, T59	63 V / 10 µF

Vishay ENYCAP™ Portfolio





Schematic

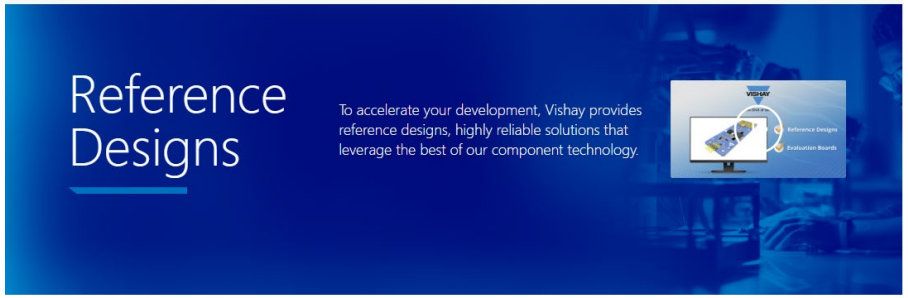


(dimensions in mm)

QUICK REFERENCE: ELECTRICAL DATA (at 20°C, unless otherwise specified)

Capacitance, initial C_R	360 F
Tolerance on C_R, initial	0% / +20 %
Rated voltage, U_R (T_{MAX} 65°C)	3.0 V
Surge voltage, U_S (< 1sec, non repetitive)	3.2 V
Max. ESR_{DC}, initial(2)	1.7 mΩ
Max. peak current, I_{Peak}(3)	335 A
Max. leakage Current after 72 hours, I_{L1}	<1mA
Stored energy E at U_R (65°C)	0.45Wh
Operating temperature range:	
Minimum, T_{MIN}	-40 °C
Maximum, T_{MAX} (U_R 3V)	+65°C
Useful life:	1,500 hours @ U_R, T_{MAX}
Max. Continuous Current ΔT=15 °	30A
Max. Continuous Current ΔT=40 °	49A
Thermal Resistance (°C/W)	9.8

Vishay Reference Designs



BROWSE DESIGNS

- Active Discharge
- DC/DC Converter
- eFuse
- Isolated Current and Voltage Sensing
- Backup
- Filter

All of the resources needed for fast development are easily accessed:

Schematics, PCB Layouts, BOMs, 3D Views And Gerber Files.

SEARCH / NARROW

Search Designs

Voltage

3.3 V
12 V
24 V

Reset

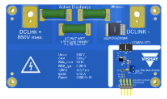
Results displayed below are indexed from the Reference Design area of the site.

15 Results

Active Discharge Circuit for 400 V Systems

Our Active Discharge Circuit reference designs provide reliable solutions for discharging stored energy in 400 V and 800 V capacitors. Ideal for automotive applications, they ensure system voltage reaches safe levels within required timeframes set by legal and manufacturer standards.

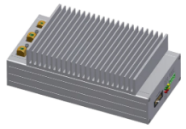
Reference Design | Reference Board



Active Discharge Circuit for 800 V Systems

Our Active Discharge Circuit reference designs provide reliable solutions for discharging stored energy in 400 V and 800 V capacitors. Ideal for automotive applications, they ensure system voltage reaches safe levels within required timeframes set by legal and manufacturer standards.

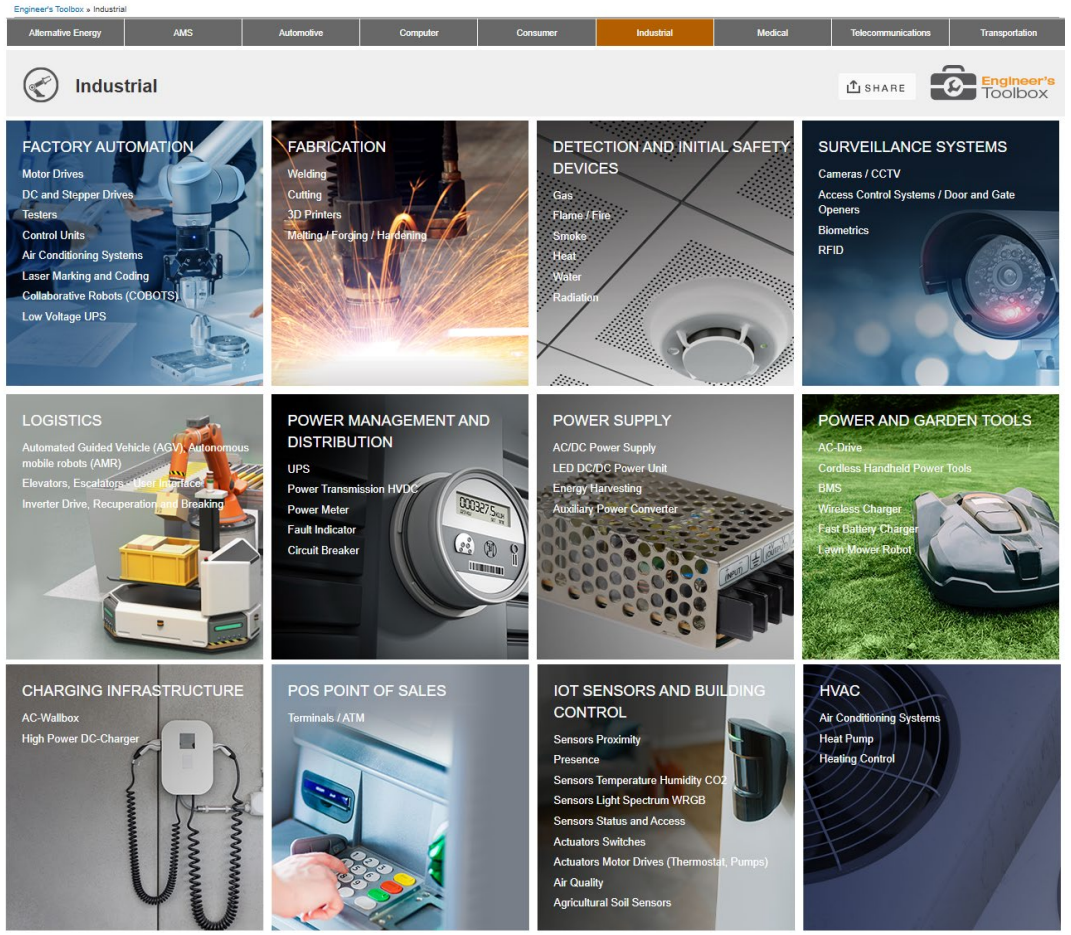
Reference Design | Reference Board



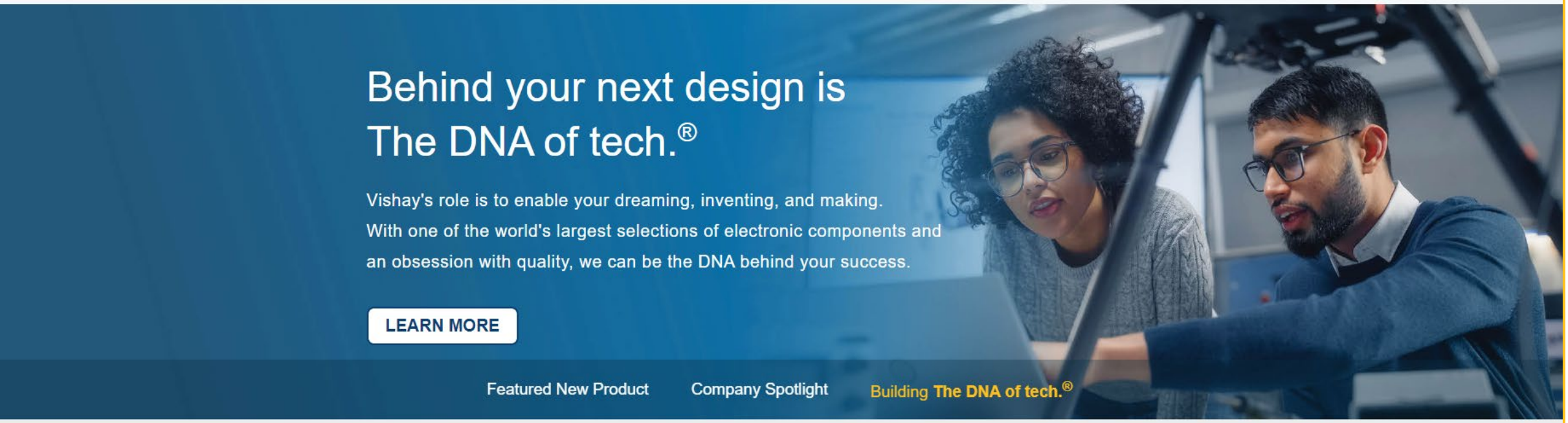
1 kW DC/DC Converter 48 V DC to 12 V DC

This 1 kW, 48 V/12 V DC-DC converter uses a two-phase, interleaved buck-boost topology. The design protects the input and output, automatically switches between buck and boost modes, and operates at a switching frequency of 185 kHz, resulting in a compact form factor.

Reference Design | Reference Board



Vishay Engineer's Toolbox



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