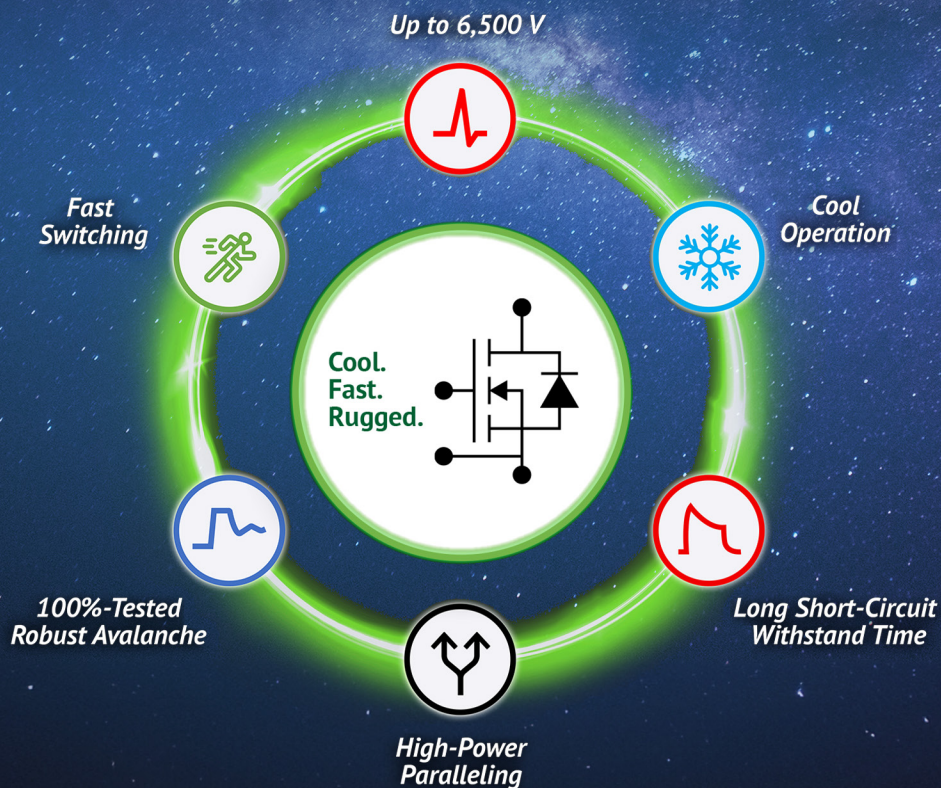




GeneSiC™ *Power Devices*



Markets and Technology

In applications from 20 W to 20 MW, and with device voltages from 650 V to 6.5 kV, GeneSiC silicon carbide (SiC) MOSFETs and Schottky MPS™ diodes drive high-speed, high-efficiency power conversion across diverse markets including EV, industrial automation, solar, wind, grid, motor drives and defense. High-volume, high-quality shipments ensure application performance, reliability and uptime availability.



Trench-assisted planar gate: No-compromise technology

SiC MOSFETs offer superior conductivity and switching performance compared to silicon (Si) due to their ‘wide bandgap’ characteristics and high electric-field strength. However, traditional designs using legacy planar or trench techniques must compromise between manufacturability, performance, and/or reliability.

GeneSiC’s patented trench-assisted planar gate design is a no-compromise, next-generation solution; high-yield manufacturing, fast and cool operation, and extended, long-life reliability.

	<div>Planar</div>	<div>Trench</div>	<div>GeneSiC™ Trench-Assisted Planar</div>
Manufacturability	<ul style="list-style-type: none"> » Repeatable » High yield » Low cost 	<ul style="list-style-type: none"> » Inconsistent trench etch » Lower yields » High cost 	<ul style="list-style-type: none"> » Repeatable » High yield » Low cost
Performance	<ul style="list-style-type: none"> » High $R_{DS(ON)}$ / area » Slow switching » High $R_{DS(ON)}$ / Δ temp 	<ul style="list-style-type: none"> » Lower $R_{DS(ON)}$ / area » Faster switching » High $R_{DS(ON)}$ / Δ temp 	<ul style="list-style-type: none"> » Lower $R_{DS(ON)}$ / area » Fastest switching » Lowest $R_{DS(ON)}$ / Δ temp
Reliability	<ul style="list-style-type: none"> » Rugged gate oxide (stable V_{TH}) 	<ul style="list-style-type: none"> » Failures due to non-uniform gate oxide » Lower short-circuit capability 	<ul style="list-style-type: none"> » Highest 100% tested avalanche » Long short-circuit withstand time » Rugged gate oxide (stable V_{TH})

Cool. Fast.

Efficient, cost-effective power conversion relies on a comprehensive understanding of modern circuit topologies and high-speed (frequency) switching techniques. There are two main device factors;

- How well does the MOSFET conduct current (measured in $R_{DS(ON)}$)?
- How efficiently does the device 'switch' (measured by energy loss, or E_{xx})?

For each question, we must understand the answer in both 'hard-switch' and 'soft-switch' topologies, and under tough high-temperature and high-speed conditions. Combined, a high-temperature, high-speed (frequency) figure-of-merit (FoM) is critical for system performance and reliability.

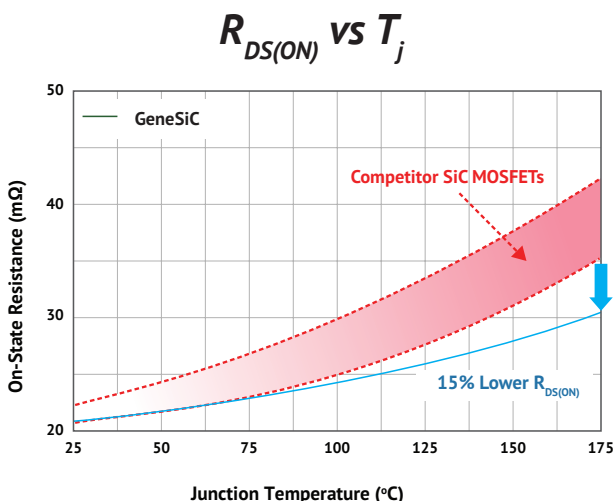
Supplier	Resistance		Energy Loss		Figure-of-Merit (Low number is better)	
	$R_{DS(ON)}$ @ 25°C (mΩ)	$R_{DS(ON)}$ @ 175°C (mΩ)	$E_{ON} + E_{OFF}$ (μJ)	E_{ZVS} (μJ)	Hard-Switching $R_{DS} @ 175°C \times (E_{ON} + E_{OFF})$ (Ω·μJ)	Soft-Switching $R_{DS} @ 175°C \times E_{ZVS}$ (Ω·μJ)
GeneSiC™	40	57	680	46	38.8	2.6
#2	40	68	680	40	46.2	2.7
#3	40	80	1240	355	99.2	28.4
#4	40	71	700	115	49.7	8.2
#5	45	85	585	36	49.7	3.1

**Lowest Power Loss at
High Temp, High Speed**

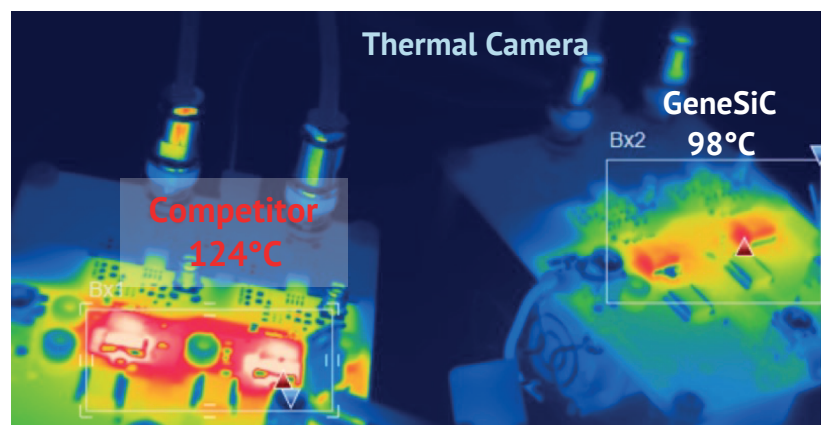
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**Highest Efficiency, Energy Savings
Small Size, Light Weight, Low System Costs!**

GeneSiC patented trench-assisted planar-gate technology delivers the lowest $R_{DS(ON)}$ at high temperature and the lowest energy losses at high speeds. This enables unprecedented, industry-leading levels of performance, robustness and quality.



In-circuit, high-speed test



GeneSiC vs. competitor SiC FET

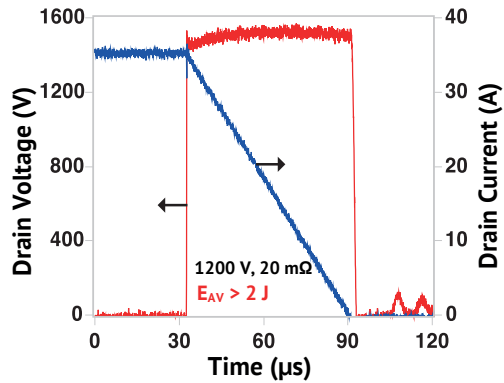
- » 1200 V, 20 mΩ, TO-247-4L
- » Higher drain current
- » Lower conduction losses
- » Cooler operation

GeneSiC vs. competitor SiC FET

- » 1200 V, 40 mΩ, D2PAK in half-bridge
- » 150 kHz switching = ~10x faster than Si IGBT
- » 30% lower FET loss vs. other SiC
- » 25°C cooler operation = 3x longer lifetime

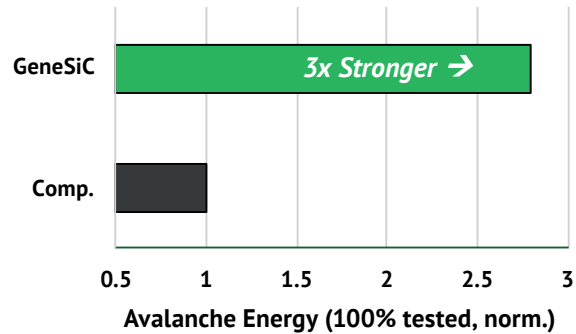
100%-tested avalanche

Highest published capability to handle excess energy in fault condition



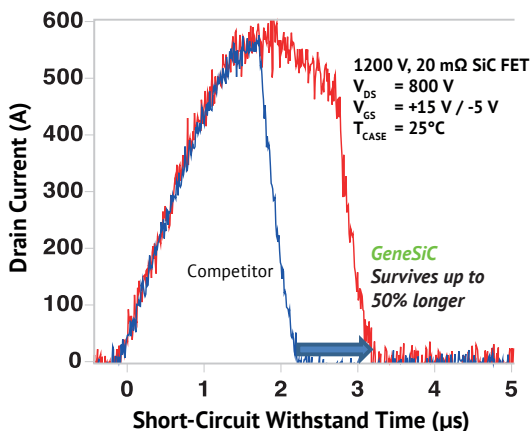
*refer to datasheet for EAS rating

Critical in applications like motor drives to withstand unclamped inductive load (UIL) energy dump in situations like motor open-circuit (O.C.)

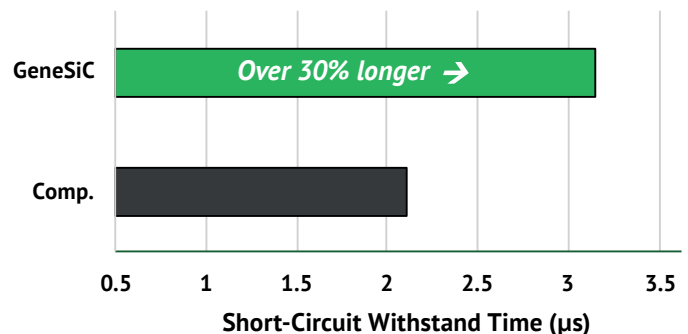


Long short-circuit withstand time

World-class survival duration in fault condition



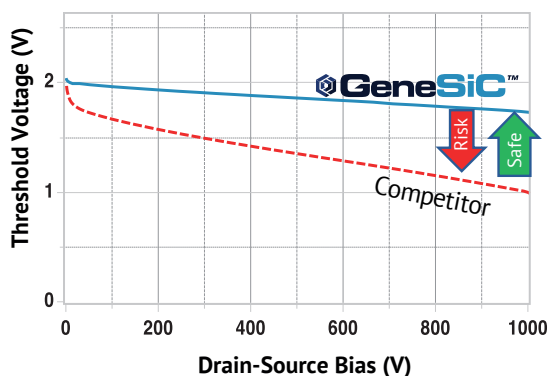
Critical to prevent failures like motor short-circuit where the FET faces full voltage (V_{DD}) in ON-state.



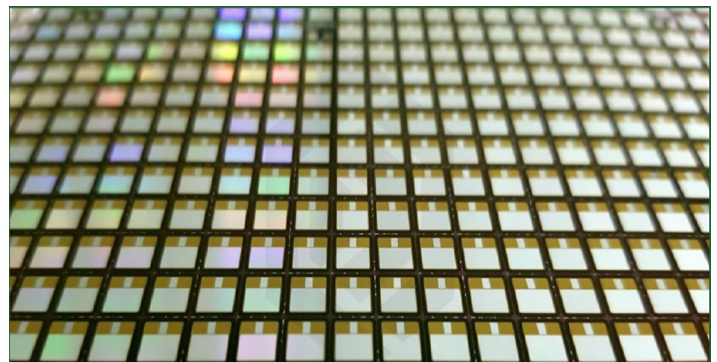
High power paralleling

Matching currents (Stable V_{TH})

Competitor products allow threshold voltage to drop under high-voltage, creating risk of turn-on error



GeneSiC packaged and bare-die FETs can be paralleled reliably for high-power applications



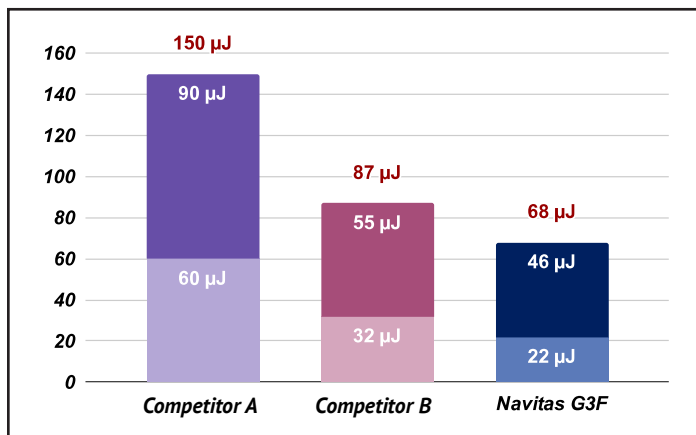
Gen 3 'Fast' SiC MOSFETs

GeneSiC's 3rd generation of fast SiC MOSFETs improves switching performance and system efficiency:

- Optimized EMI
- Low V_F and Q_{RR}
- Robust body diode
- 100% avalanche (UIL) tested
- Ultra-low $R_{DS(ON)}$ vs. temperature dependency

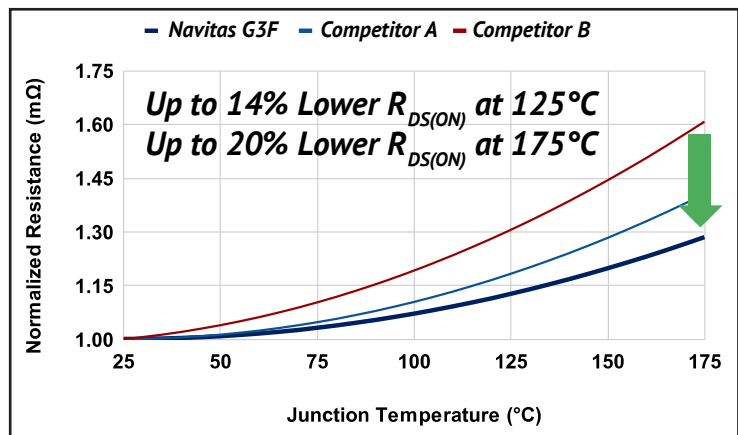
Target applications include EV charging, solar inverters, data center and telecom power supplies, and energy storage systems (ESS).

650V Hard-switching Figure of Merit (E_{ON} , E_{OFF})



Hard-switching E_{ON} & E_{OFF} at $V_{DD} = 400V$, $I_D = 35A$, $T_{amb} = 25^\circ C$

$R_{DS(ON)}$ vs. Temperature (Gen 3F 650V, 20mΩ vs Competition)

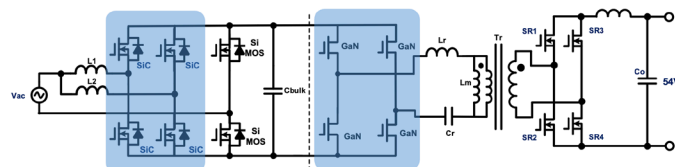


Measured on production parts at $I_D = 35A$, $V_{GS} = 18V$

4.5kW, 137W/in³, 97% efficiency AI data center PSU

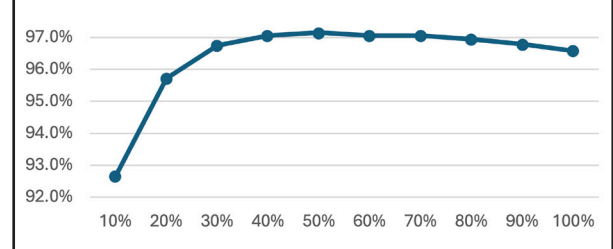


Gen 3 Fast SiC MOSFET: G3F45MT06L (650V, 40mΩ TOLL)



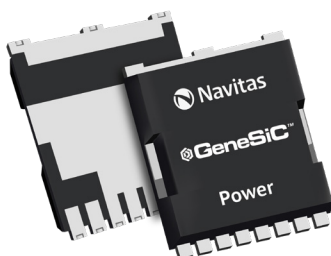
Interleaved CCM TP PFC with G3F SiC MOSFETs & GaNSafe Power ICs

CRPS 4.5 kW PSU Efficiency @ 230Vac



- Up to 137 W/in³ power density
- Exceeds Titanium efficiency (>97%)
- Hold up time: 10ms @4200W
- EMI: Class A with >6dB

TOLL package for high speed, high efficiency, and high-power density systems



- Extremely low package inductance of 2nH
- Small footprint with 30% savings in PCB area compared to D2PAK
- Lower height profile, with 60% lower volume than D2PAK
- Excellent thermal properties, with 9% lower R_{THJC} compared to D2PAK

Widest Range of SiC MOSFETs 650 V - 6.5 kV



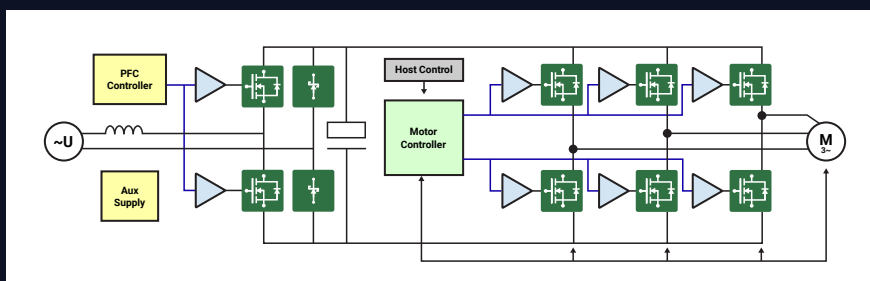
$V_{BR(DSS)}$ (V)	$R_{DS(ON)}$ typ. (m Ω) (@15 V _{GS})	$R_{DS(ON)}$ typ. (m Ω) (@18 V _{GS})	$R_{DS(ON)}$ typ. (m Ω) (@20 V _{GS})	TOLL	TO-263-7 (D2PAK-7L)	TO-247-3	TO-247-4	SOT-227	Die
650		21		G3F25MT06L⁽¹⁾	G3F25MT06J⁽¹⁾		G3F25MT06K⁽¹⁾		G3F25MT06-CAx
		29		G3F33MT06L⁽¹⁾	G3F33MT06J⁽¹⁾		G3F33MT06K⁽¹⁾		G3F33MT06-CAx
		42		G3F45MT06L⁽¹⁾	G3F45MT06J⁽¹⁾	G3F45MT06D ⁽¹⁾	G3F45MT06K⁽¹⁾		G3F45MT06-CAx
		55		G3F60MT06L⁽¹⁾	G3F60MT06J⁽¹⁾	G3F60MT06D ⁽¹⁾	G3F60MT06K⁽¹⁾		G3F60MT06-CAx
1200		18			G3F18MT12J⁽¹⁾		G3F18MT12K⁽¹⁾		G3F18MT12-CAx
		20			G3F20MT12J⁽¹⁾		G3F20MT12K⁽¹⁾		G3F20MT12-CAx
		25			G3F25MT12J⁽¹⁾		G3F25MT12K⁽¹⁾		G3F25MT12-CAx
		34			G3F34MT12J⁽¹⁾		G3F34MT12K⁽¹⁾		
		40			G3F40MT12J⁽¹⁾		G3F40MT12K⁽¹⁾		
		65			G3F65MT12J⁽¹⁾		G3F65MT12K⁽¹⁾		
		75			G3F75MT12J⁽¹⁾		G3F75MT12K⁽¹⁾		
1700	20						G3R20MT17K	G3R20MT17N	G3R20MT17-CAx
	45					G3R45MT17D	G3R45MT17K		G3R45MT17-CAx
	160				G3R160MT17J	G3R160MT17D			
	450				G3R450MT17J	G3R450MT17D			
3300			50				G2R50MT33K		G2R50MT33-CAx
			1000		G2R1000MT33J				
6500									Engineering Samples

⁽¹⁾ Automotive qualified

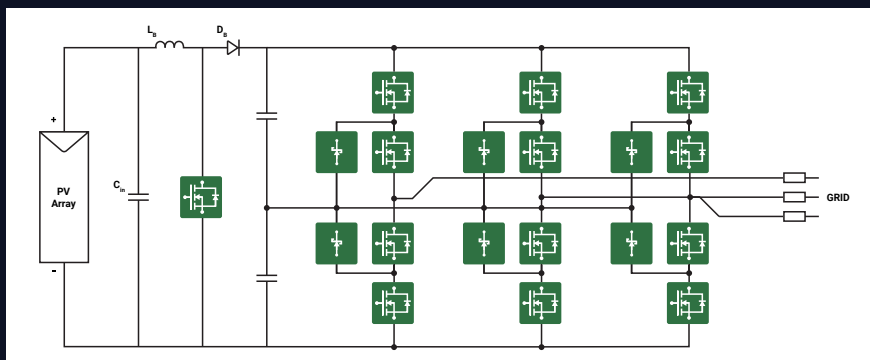
Bare Die Metallization - CAx (-CAL Aluminum, -CAU Gold)

Typical Circuits

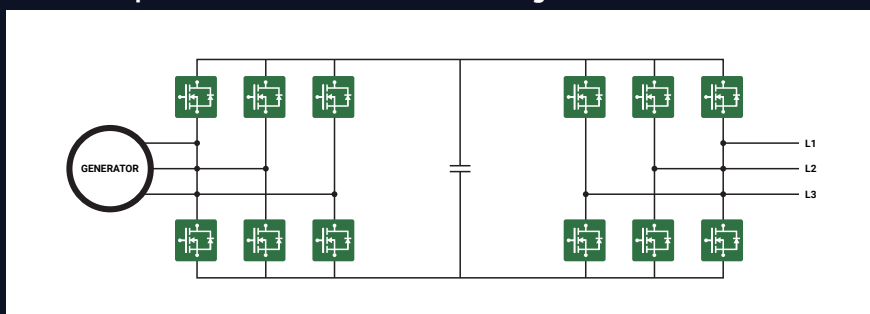
PFC and 3-Phase Motor Drive using 650 V SiC MOSFETs and Diodes



Transformer-less, 3-phase, 3-level NPC, using 1200 V SiC MOSFETs and Diodes

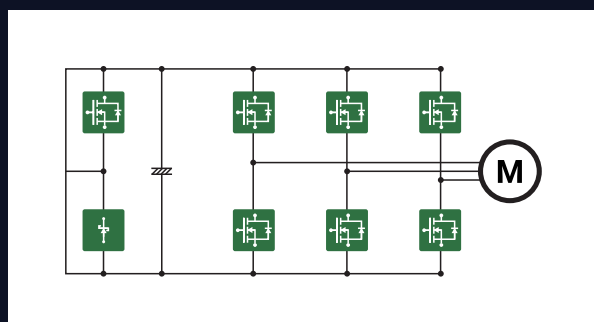


4-quadrant Full-Power Converter using 1700 V SiC MOSFETs

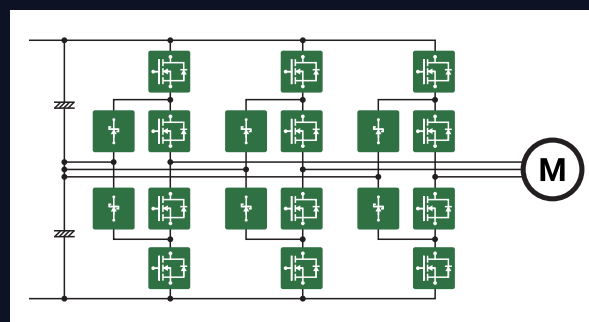


Locomotive Traction Inverters using 3.3 kV & 6.5 kV SiC MOSFETs and Diodes

2-Level Inverter (6.5 kV)



3-Level Inverter (3.3 kV)



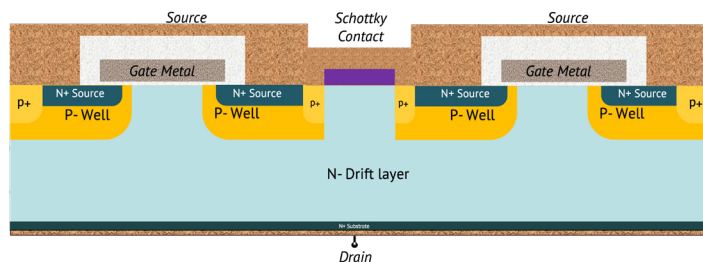
Built to the Highest Level of Reliability

High-voltage pioneers

Robust, high-voltage, high-efficiency SiC MOSFETs, critical for reliable, harsh-environment, high-power applications.

Unique, advanced, integrated 6.5 kV technology

- » Double-implanted metal oxide semiconductor (DMOSFET)
- » Monolithically-integrated Junction barrier Schottky (JBS) rectifier
- » Superior high-power performance



Higher efficiency bi-directional performance

- » Temperature independent switching
- » Fast (low switching loss) and cool (low conduction losses)
- » Longer-term reliability
- » Easy-to-parallel for high power (V_{TH} stability)



Alternative Energy

Solar and Wind Inverters



Automotive

Electric Vehicles and Fast Chargers



Industrial

Power Supply, Traction and Welding



Transportation

Rail and Ship-board



Power Grid

HVDC Transmission and FACTS



Aerospace and Defense

High Temperature

High power modules & die sales

GeneSiC SiCPAK™ modules and bare-die enable expanded applications ranging from 10s kW to MW in rail, EV, fast charging, industry, solar, wind and energy storage.

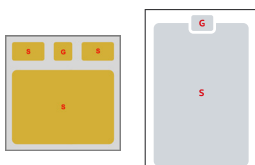


GeneSiC SiCPAK™ modules have been designed for superior performance and robustness, while meeting industry-standard footprint with pin-to-pin combability.

- Epoxy-Resin Potting Technology for High Reliability
 - Improved Temperature Cycling
 - Improved Power Cycling
- 'Gen3 Fast' SiC MOSFETs with Industry-Leading Current Density (A/mm²)
- Optimized Low-Inductance Design with Industry-Standard Press-Fit Connections with built-in NTC and Pin-to-Pin Compatibility

Part number	Voltage (V)	$R_{DS(ON)}$ per switch @ 18V (mΩ)	Topology	Package
G3F09MT12FB2(-T)	1200	9	Half-Bridge	SiCPAK F (33.8mm x 62.8mm)
G3F17MT12FB2(-T)		17		
G3F18MT12FB4(-T)		18	Full-Bridge	
G3F05MT12GB2(-T)		5	Half-Bridge	SiCPAK G (56.7mm x 62.8mm)
G3F09MT12GB4(-T)		9	Full-Bridge	
G3F09MT12G3T(-T)		9	3L-T-NPC	

*(-T) Thermal Interface Material Option



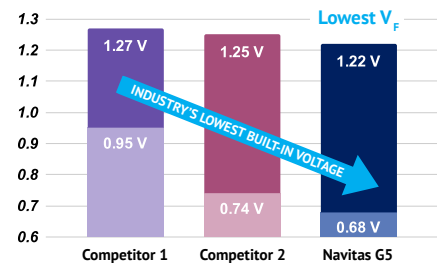
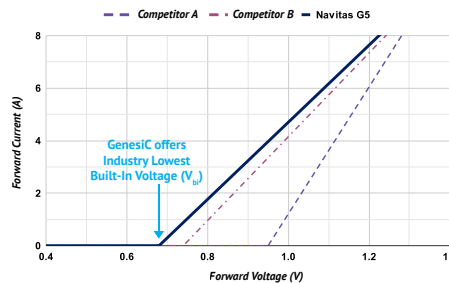
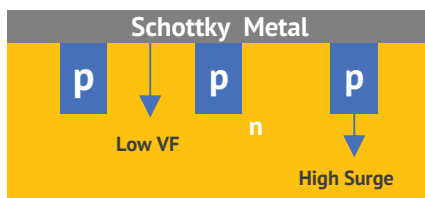
GeneSiC MOSFET and diode technologies range from 650 V to 6500 V using trench-assisted planar technology, to provide lowest $R_{DS(ON)}$ positive temp. coefficient to enable highest efficiency at real operating temperatures. Die has been optimized for different bonding and attach styles with various metallizations including aluminum and gold.

650 V MPS™ Diodes

GeneSiC's new 5th-generation 650 V Merged-PiN Schottky (MPS™) diodes integrate a unique PiN-Schottky structure, delivering 'low-built-in Voltage-Biasing' ("low knee") for highest efficiency across all load conditions with superior robustness. Applications include PFC in server/telecom power supplies, industrial motor drives, solar inverters, LCD/LED TVs, and lighting.

Merged-PiN schottky (MPS™) with low-built-in voltage-biasing technology

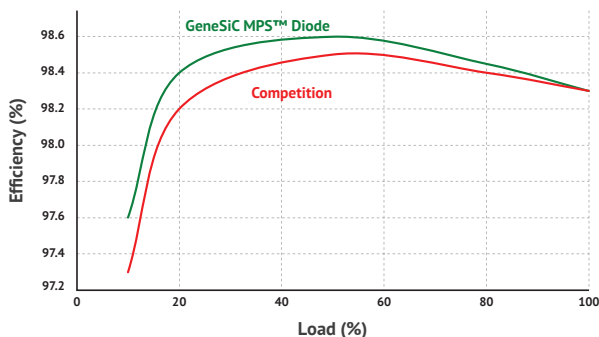
A novel GeneSiC merged-PiN Schottky design combines the best features from both PiN and Schottky diode structures, producing the lowest forward voltage drop (V_F), high surge-current capability (I_{FSM}), and minimized temperature-independent switching losses. Proprietary thin-chip technology further reduces V_F and improves thermal dissipation for cooler operation.



Superior figure-of-merit (FoM) drives high efficiency

Gen-5 MPS Diodes are ideal in PFC circuits in continuous-current mode (CCM) due to excellent figure of merit, comprising of a low V_F of 1.3 V, minimized capacitive charge (Q_C). In Addition, zero reverse recovery charge improves PFC MOSFET turn-on performance. The result is a cooler, more reliable system.

3 kW Interleaved Boost PFC



At light load, $T_j = 25^\circ\text{C}$, at full load, $T_j = 125^\circ\text{C}$

Features	Benefits
Low V_F (1.3 V) conduction losses	High system efficiency
Excellent FoM (V_F, Q_C)	Very high frequency operation
100% avalanche (UIL) tested	Reduced EMI
Exceptional dV/dt ruggedness	Superior robustness
Lowest reverse leakage current	Excellent reliability
Low thermal resistance	Reduced cooling requirements

Typical application circuits

Boost (Solar Inverter)		Boost converters are used in Solar inverters to generate a fixed, higher DC voltage. SiC diodes in QFN8x8 and TO-252 offering highest efficiencies for <3 kW microinverters.
CCM PFC		For PFC applications such as continuous-current mode (CCM) that require fastest reverse recovery to minimize switching losses and increase system efficiency, the TO-220-2 offer excellent performance with high thermal dissipation.
Interleaved PFC		The TO-247-3 package offers great flexibility for higher power density and BOM reduction in applications like the interleaved power factor correction (PFC) that shares a common cathode between two diodes.

SiC Schottky MPS™ Diodes

Merged-PIN Schottky (MPS) Diodes combine two beneficial features from the PIN and Schottky diode. The PIN sustains excessive surge currents with low leakage, while the Schottky element offers low forward-voltage drop and fast-switching characteristics. Target applications include PFC, Boost, and high-voltage, higher-power motor drives.



V_{RRM} (V)	I_F (A)	DO-214	PQFN 88	TO-252-2	TO-263-7 (D2PAK-7L)	TO-220-2	TO-247-2	TO-247-3	SOT-227	Bare Die
650	1	GB01SLT06-214								
	4		GE04MPS06Q	GE04MPS06E		GE04MPS06A				
	6		GE06MPS06Q	GE06MPS06E		GE06MPS06A				
	8		GE08MPS06Q	GE08MPS06E		GE08MPS06A				
	10		GE10MPS06Q	GE10MPS06E		GE10MPS06A				
	12		GE12MPS06Q	GE12MPS06E		GE12MPS06A				
	16							GE2X8MPS06D		
	20							GE2X10MPS06D		
	24							GE2X12MPS06D		
	30				GD30MPS06J	GD30MPS06A	GD30MPS06H			
	60						GD60MPS06H	GD2X30MPS06D	GD2X30MPS06N	
	100								GD2X100MPS06N	
	120								GD2X60MPS06N	
	200								GD2X100MPS06N	
	300								GD2X150MPS06N	
1200	1	GB01SLT12-214								
	2	GB02SLT12-214		GD02MPS12E						
	10			GD10MPS12E		GD10MPS12A	GD10MPS12H			GD10MPS12-CAx
	20					GD20MPS12A	GD20MPS12H	GD2X10MPS12D		GD20MPS12-CAx
	30				GD30MPS12J		GD30MPS12H			GD30MPS12-CAx
	40							GD2X20MPS12D		
	50						GD50MPS12H			GD50MPS12-CAx
	60							GD2X30MPS12D	GD2X30MPS12N	
	100								GD2X50MPS12N	GD100MPS12-CAx
	200								GD2X100MPS12N	
1700	5				GD05MPS17J		GD05MPS17H			
	10						GD10MPS17H			
	15						GD15MPS17H			
	25						GD25MPS17H			
	50								GD2X25MPS17N	
	60						GD60MPS17H			
	75									GD75MPS17-CAx
	150								GD2X75MPS17N	
3300	5			GC05MPS33J						

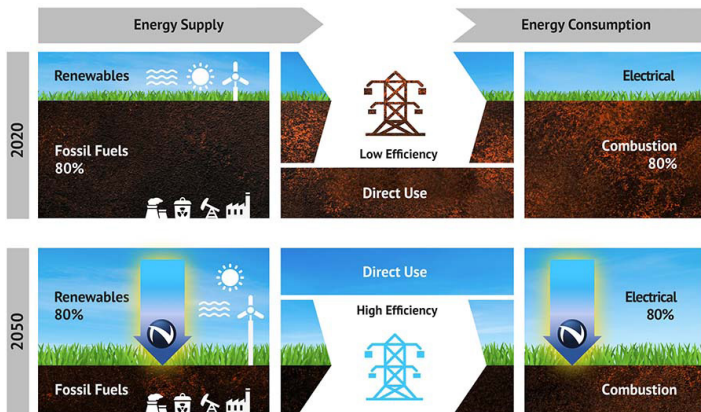
Engineering Samples

Electrify Our World™

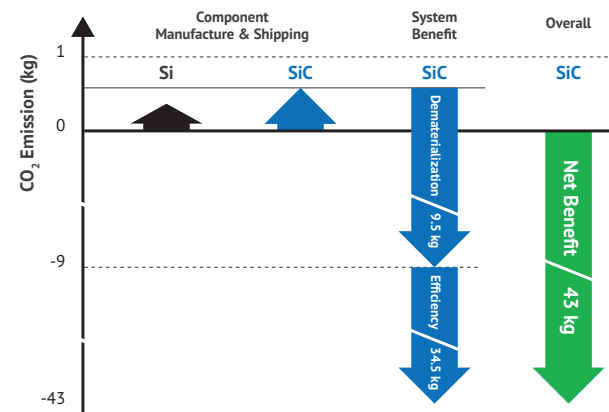
In May 2022, Navitas announced that it was the world's first semiconductor company to achieve CarbonNeutral®-company certification, another milestone towards Navitas' mission to "Electrify Our World" and to help Navitas' customers achieve their own sustainability goals.

Silicon Carbide technology enables CO₂ reduction by increasing system efficiency and through 'dematerialization' – using less case material, heatsink, PCBs, etc. vs. legacy silicon IGBTs.

Electrify Our World™



Every GeneSiC MOSFET shipped saves over 40 kg CO₂



Each KATEK coolcept fleX Steca solar inverter uses 16x GeneSiC G3R75MT12J SiC MOSFETs per 4.6 kW unit. The 1,200 V, 75 mΩ-rated devices are used in a two-level converter, with bi-directional boost converters and an H4-topology for AC voltage output. Increased switching frequency shrinks the size and weight.

"Next-generation GeneSiC technology has enabled a major step in system performance without compromising our high engineering standards, especially regarding EMI," said Dr. Peter Grabs, KATEK's Director of Innovation, Research and Development. "Navitas' excellent quality – with zero failures – and consistent, short lead-time delivery are critical success factors as we expand production into new markets."



Exide's high frequency chargers convert 220 V AC power to a battery-level voltage between 24 and 80 V for lead-acid and lithium-ion battery-powered industrial vehicles. The 7 kW module uses GeneSiC G3R60MT07D (750 V) MOSFETs and GD10MPS12A (1,200 V) MPS Schottky diodes, with frequency-optimized architecture. The same platform can be upgraded to 10 kW, with 4 modules in parallel to provide 40 kW of reliable fast-charging power.

"Exide Technologies delivers complete, carefully controlled fast-charging with close system monitoring for critical material-handling equipment, running 24/7," said Dr. Dominik Margraf, Director Product Management Motion at Exide Technologies. "Navitas' GeneSiC technology is easy-to-use, with excellent support, increased system efficiency, and cooler operation."

**Contact your local distributor or sales rep to
discover the power of GeneSiC technology!**

Navitas
Official Mascot

Sisi



Navitas
Official Mascot

Carbo



- Samples available immediately with short volume-production lead times
- Broadest silicon carbide portfolio – over 140 products in mass production (from 650 V to 6.5 kV)

Sales & Distribution Support

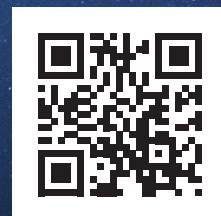
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Boran Technologies Ltd.	www.boran.co.il
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China	Skynoon	
China	Sunlord	www.sunlordinc.com
Taiwan	Alltec	www.alltech.com
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