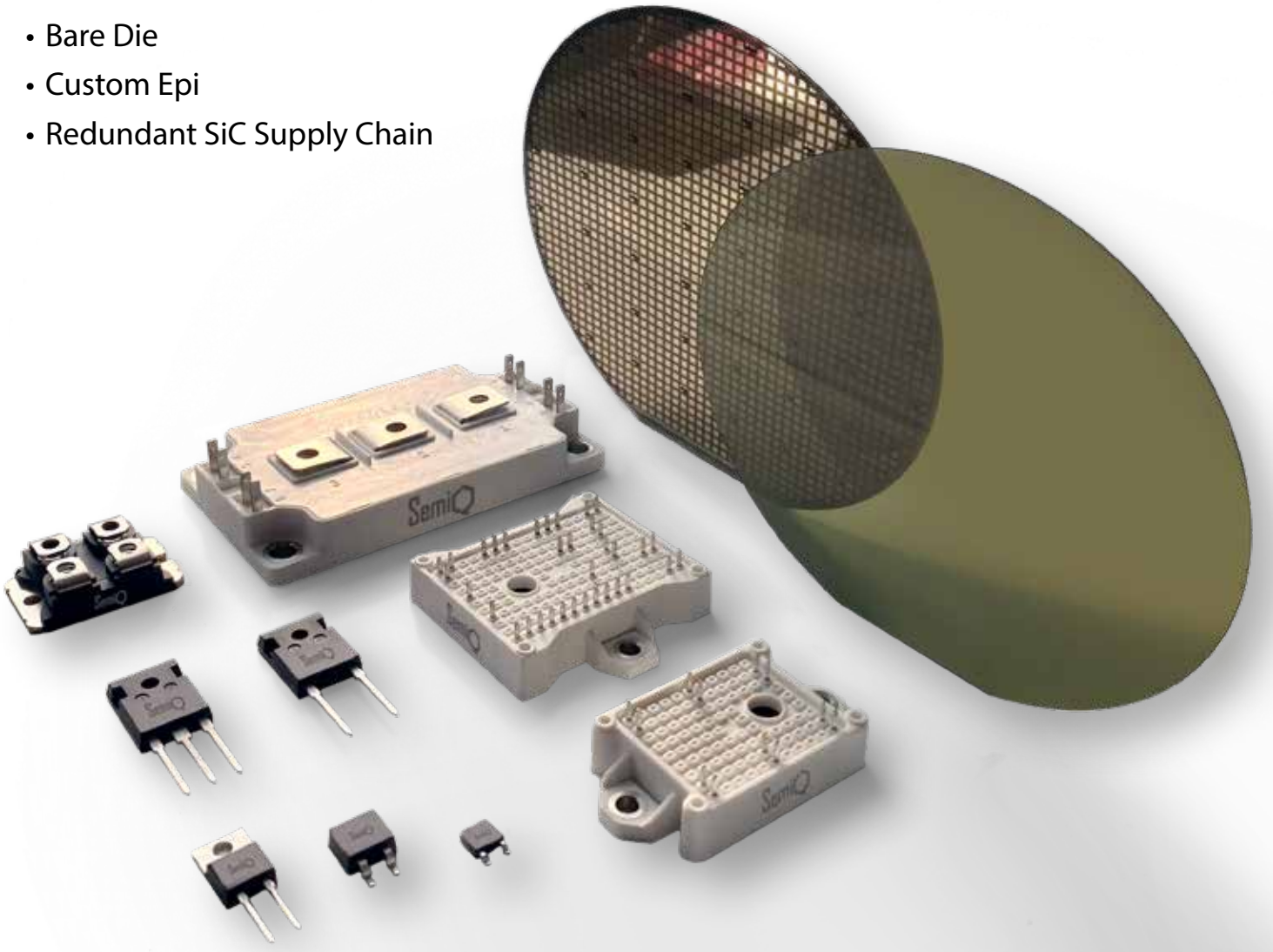
SemiQ
POWER SEMICONDUCTORS
TM

The Power behind tomorrow's energy efficient applications

Silicon Carbide Power Semiconductor Manufacturing

- SiC Diodes – 650V, 1200V, 1700V
- SiC MOSFETs
- Bare Die
- Custom Epi
- Redundant SiC Supply Chain



ABOUT SEMIQ

SemiQ Inc. is a US based developer and manufacturer of Silicon Carbide (SiC) power semiconductor devices and materials including:

- SiC Power MPS Diodes (650V, 1200V, 1700V)
- SiC Power MOSFETs
- SiC Bare Die
- SiC Modules
- SiC Custom Modules
- SiC Custom N-Type Epi Wafers

SemiQ is privately held and partially employee owned.

SemiQ (previously known as Global Power Technologies Group) began developing Silicon Carbide technologies in 2012 at its headquarters in Southern California where it also grows Epi and designs devices.

Recently, SemiQ released its Gen 3 SiC Schottky diodes (Merged PiN Schottky type) which included improvements in surge current, moisture resistance, and overall robustness and ruggedness. Accelerated high temperature reliability testing has exceeded over 8 million device hours. SemiQ Gen 3 diodes are 100% Avalanche Tested.

APPLICATIONS

SemiQ products are deployed in EV charging systems, induction heating, power supplies, Fuel Cell power generation, and solar inverters around the world.

Additionally, SemiQ offers power conversion application expertise and has extensive experience designing inverters of 3.3kW, 6.6kW and above.

REDUNDANT SIC SUPPLY CHAIN

In order to mitigate risk to customers, SemiQ is building a fully redundant supply chain with multiple sources for:

- SiC Substrates
- SiC Epi Wafers
- SiC Wafer Fabrication
- Assembly and Test Factories
- Warehouses

Contact SemiQ now to benefit from our extensive Silicon Carbide experience, expertise and robust supply chain.

3RD GENERATION SIC PRODUCTS

SemiQ Gen 3 diodes represent a huge improvement in reliability, device ruggedness, surge current capability and moisture resistance.

These devices feature two layers of passivation on each chip. Extensive reliability testing includes over 8 million hours of HTRB and H3TRB.

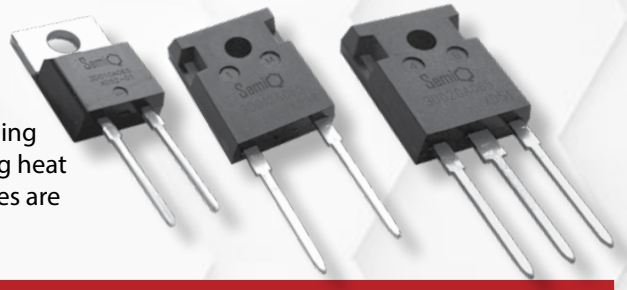
The Merged PiN Schottky (MPS) device structure improves ruggedness and surge.

To improve ruggedness even further, packaged Gen 3 devices are 100% tested for unclamped inductive load. To protect customers from risk, SemiQ is setting up a fully redundant supply chain, including multiple sources for: SiC substrates, SiC epi, SiC wafer fab, assembly and testing.

OFF THE SHELF:

SIC SCHOTTKY DIODES - DISCRETES

SiC Schottky diodes from SemiQ operate with zero switching losses thereby increasing overall efficiency and decreasing heat dissipation. All Gen 3 Schottky Diodes in discrete packages are 100% Avalanche Energy tested



Product	VDC	I_F	Package
GP3D010A065A	650	10 A	TO-220-2L
GP3D010A065B		10 A	TO-247-2L
GP3D012A065B		12 A	TO-247-2L
GP3D012A065A		12 A	TO-220-2L
GP3D020A065B		20 A	TO-247-2L
GP3D024A065U		24 A	TO-247-3L
GP3D030A065B		30 A	TO-247-2L
GP3D040A065U		40 A	TO-247-3L
GP3D010A120B	1200	10 A	TO-247-2L
GP3D010A120A		10 A	TO-220-2L
GP3D015A120A		15 A	TO-220-2L
GP3D015A120B		15 A	TO-247-2L
GP3D020A120U		20 A	TO-247-3L
GP3D020A120B		20 A	TO-247-2L
GP3D030A120B		30 A	TO-247-2L
GP3D030A120U		30 A	TO-247-3L
GP3D040A120U		40 A	TO-247-3L
GP3D060A120U		60A	TO-247-3L
GP3D005A170B	1700	5 A	TO-247-2L
GP3D010A170B		10A	TO-247-2L
GP3D020A170B		20A	T0-247-2L

OFF THE SHELF:

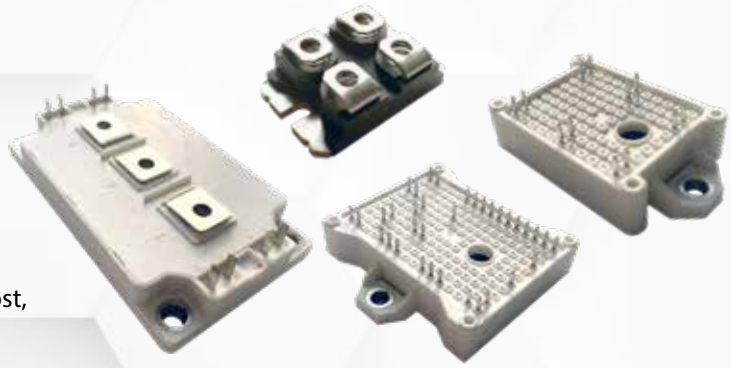
SIC SCHOTTKY DIODES - MODULES

SiC Schottky Diode Modules offer a cost-effective solution with both ruggedness and low stray inductance. These SOT-227 have built in electrical isolation from the base plate.

Product	VDC	Idav	Package
GHXS010A060S-D3	600	10 A	SOT-227
GHXS020A060S-D3		20 A	SOT-227
GHXS030A060S-D3		30 A	SOT-227
GHXS030A060S-D1E		30 A	SOT-227
GHXS050A060S-D3		50 A	SOT-227
GHXS015A120S-D3	1200	15 A	SOT-227
GHXS030A120S-D3		30 A	SOT-227
GHXS030A120S-D1E		30 A	SOT-227
GHXS045A120S-D3		45 A	SOT-227
GHXS060A120S-D3		60 A	SOT-227
GHXS050A170S-D3	1700	50 A	SOT-227

CUSTOM & MODIFIED STANDARD

SIC MOSFETS - MODULES



SemiQ provides customized circuit topologies in multiple standardized package platforms. We offer quick sample delivery with low NRE cost, reducing development costs and challenges.

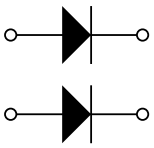
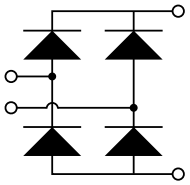
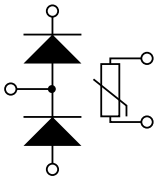
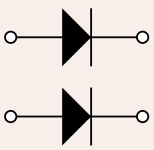
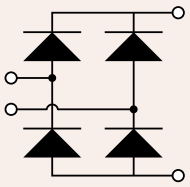
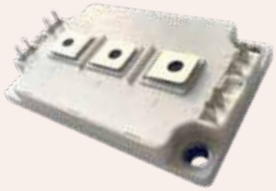
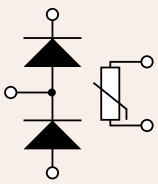
Product	VDC	Id	Rds_on	Configuration	Package
GCMS010A120S7B1	1200	160 A	10 mohm	-	106.4 x 61.4 x 20.5mm
GCMS012A120S1-E1		100 A	12.5 mohm	-	SOT-227
GCMS020A120S1-E1		60 A	20 mohm	-	SOT-227
GCMS020A120B1H1		80 A	20 mohm	-	66.2 x 31.0 x 15.8mm
GCMS040A120B1H1		40 A	40 mohm	-	66.2 x 31.0 x 15.8mm
GCMS004A120S7B1		320 A	4 mohm	-	105.7 x 60.7 x 18.1mm
GCMS007A120S7B1		240 A	7 mohm	Half-Bridge	106.4 x 61.4 x 20.5mm
GCMS008A120B1B1		200 A	8.3 mohm	Half-Bridge	66.2 x 31.0 x 15.8mm
GCMS080A120S1-E1		20 A	80 mohm	-	SOT-227
GCMS080A120B3C1		20 A	80 mohm	Six-Pack	62.8 x 56.7 x 16.5mm
GCMS080A120B1H1		20 A	80 mohm	-	66.2 x 31.0 x 20.8mm
GCMS040A120S1-E1		40 A	40 mohm	-	SOT-227

IN DEVELOPMENT:

SIC SCHOTTKY MODULES

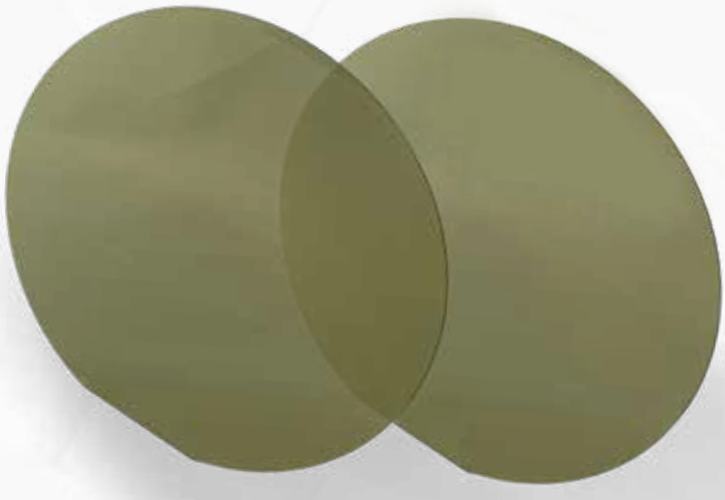
These power modules utilize SemiQ's Gen 3 Silicon Carbide diodes which feature:

- Merged PiN Schottky (MPS) device structure
- Enhanced two-layer chip passivation for improved moisture resistance
- Over 8 million device hours of HTRB and H3TRB
- Improved surge current and ruggedness

Product	VDC	I_F	Package	Circuit
GHXS030A065S-D3	650	30	SOT-227 DUAL SiC Diode 	
GHXS030B065S-D3		30		
GHXS050B065S-D3		50		
GHXS070B065S-D3		70		
GHXS100B065S-D3		100		
GHXS030B065S-D1E		30	SOT-227 Full Bridge SiC Diode 	
GHXS050B065S-D1E		50		
GHXS300A065S7D5		300	S7 Half Bridge SiC Diode 	
GHXS400A065S7D5		400		
GHXS500A065S7D5		500		
GHXS600A065S7DV		600		
GHXS030A120S-D3	1200	30	SOT-227 DUAL SiC Diode 	
GHXS030B120S-D3		30		
GHXS050B120S-D3		50		
GHXS060B120S-D3		60		
GHXS070B120S-D3		70		
GHXS100B120S-D3		100		
GHXS030B120S-D1E		30	SOT-227 Full Bridge SiC Diode 	
GHXS050B120S-D1E		50		
GHXS300A120S7D5		300	S7 Half Bridge SiC Diode 	
GHXS400A120S7D5		400		
GHXS500A120S7D5		500		
GHXS600A120S7DV		600		

SILICON CARBIDE (SIC) EPITAXIAL WAFERS

SemiQ has developed well defined epitaxial growth processes on the Si-face of 4H-SiC substrates. SemiQ can also provide customized epiwafers with superior doping and thickness uniformity, and low defect density. Our reference specification is shown below.

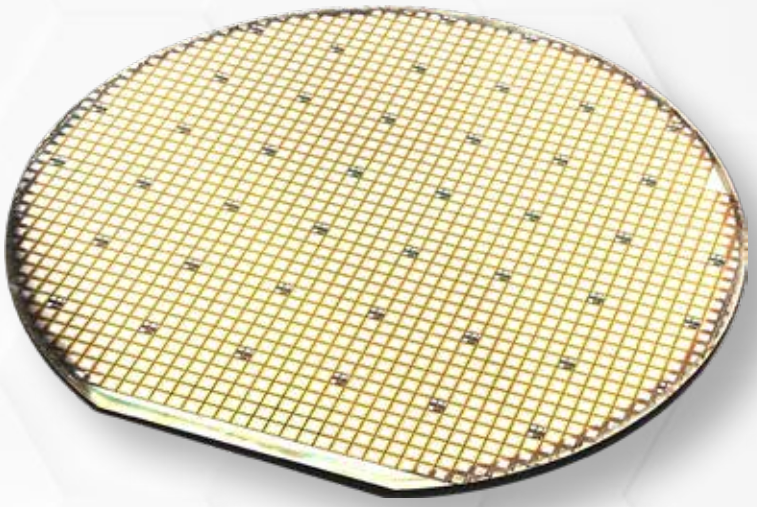


	Parameter	Unit	Nominal
Substrate [1]	*Diameter	mm	150 ±0.25
	PolyType/Conduction Type	--	4H n-type
	*Surface-face/Orientation	Deg	4° tilt towards <11$\bar{2}$0> ±0.5
	*Resistivity	Ω-cm	0.02 ±0.005
	*Thickness	µm	350 ± 25
	*MPD (Micro Pipe Density)	cm^{-2}	< 1
Epi Layer	Conduction Type	--	n-type
	Dopant	--	Nitrogen
	Thickness [2]	µm	1 ~ 60
	Thickness Uniformity [4]	%	< 10
	Carrier Concentration [3]	cm^{-3}	2E+15 ~ 2E+17
	Carrier Concentration Uniformity [4]	%	< 15
	Surface Defect Density [5]	cm^{-2}	< 1.0 (Typical < 0.5)
Wafer Shape	Total thickness variation (TTV)	µm	≤15
	Bow (3p)	µm	≤ ±40
	Warp (3p)	µm	<50
	Local Thickness Var [SBIR] max [6]	µm	< 3
	LTIR-SBF [SFQR] max 6)	µm	< 3

NOTE:

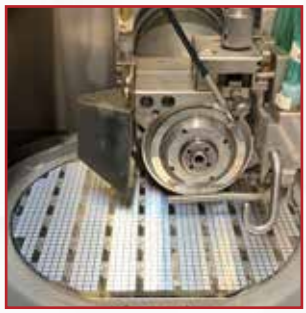
1) The "*" marked substrate data items will be provided by the substrate vendor. Not measured by SemiQ
2) Edge Exclusion = 5mm, Average data of Spectral Reflectance Measurement points (40 points)
3) Edge Exclusion = 5mm, Average data of CV Measurement points (standard 17 points)
4) Uniformity of thickness and doping concentration is calculated with (Maximum-Minimum)/(2*Average)
5) Edge Exclusion = 5mm, Surface defects (Down fall, Triangle) are inspected by nSpec PS tool from Nanotronics
6) SBIR (Site Flatness Back-surface Ideal Range) and SFQR (Site Flatness Front-surface, Least-squares fit (site) Range) map will be provided with 10mm □ in size

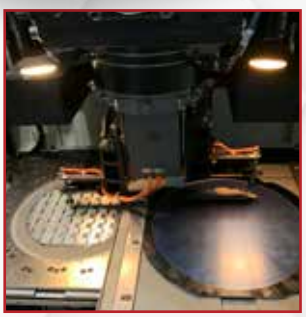
GEN3 SIC DIODE BARE DIE



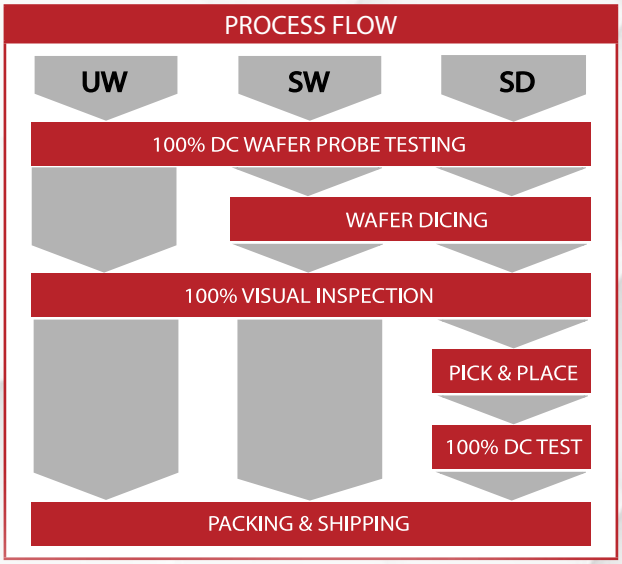
Fabricated on 150mm wafers with robust characteristics including:

- Improved moisture resistance
- Over 8 million hours (HTRB & H3TRB)
- Improved surge currents
- Low defect density





Part Number	VDC	Amps	Size (mm)
GP3D008A065X	650	8 A	1.62 x 1.62
GP3D010A065X		10 A	1.78 x.1.78
GP3D012A065X		12 A	1.50 x 2.90
GP3D020A065X		20 A	2.39 x 2.39
GP3D030A065X		30 A	2.86 x 2.86
GP3D050A065X		50 A	3.50 x 3.50
GP3D010A120X	1200	10 A	2.40 x 2.40
GP3D015A120X		15 A	2.12 x 4.10
GP3D020A120X		20 A	3.25 x 3.25
GP3D030A120X		30 A	3.90 x 3.90
GP3D050A120X		50 A	4.93 x 4.93
GP3D005A170X	1700	5 A	2.16 x 2.16
GP3D010A170X		10 A	2.91 x 2.91
GP3D020A170X		20 A	3.95 x 3.95

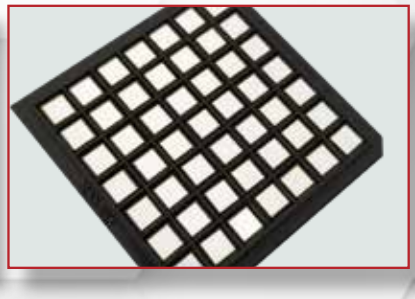


Available in these formats:

UW - Full Unsawn Wafer
Individually packaged or in carrier box

SW - Sawn and Mounted
UV Tape or Plastic Frame

SD - Singulated Bare Die
Waffle Pack



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