



SMART[®]
Modular Technologies



Think Memory.
Think SMART.

DuraMemory[™]

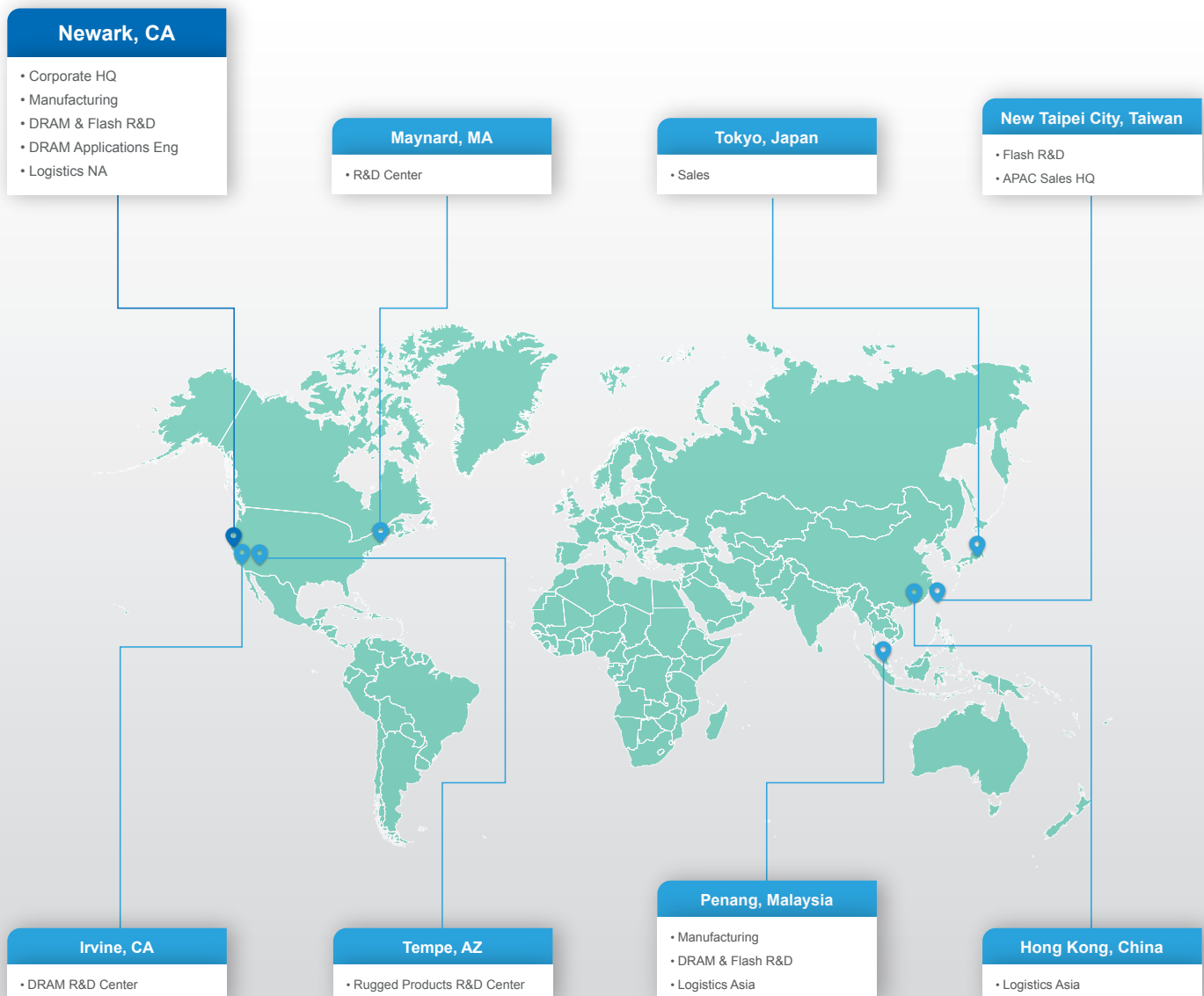
Memory Module Products

About SGH and SMART Modular Technologies

SGH (SMART Global Holdings, Inc.) is a NASDAQ listed holding company (NASDAQ:SGH). Over the past few years, the SGH business units have evolved and grown into as leading designers and manufacturers of electronics for Intelligent Computing, Specialty Memory, and LED Solutions. SGH's success is based on a customer-focused approach characterized by a commitment to raise the bar, execute with discipline and focus on what's next.

As an SGH company, SMART Modular is a global leader in specialty memory products including memory modules, solid-state storage products, and hybrid solutions. SMART has been serving the industry for over 30 years, providing standard, ruggedized and custom memory and storage solutions that meet the needs of diverse applications in high-growth markets.

SMART Modular delivers solutions to a broad customer base, including OEMs in computing, networking, communications, storage, mobile, military, aerospace and industrial markets. Focused on providing extensive customer-specific design capabilities, technical support and value-added testing services, SMART collaborates closely with their global OEM customers throughout the design process and across multiple projects to create solutions for demanding applications with differentiated requirements. For more information, visit SMART Modular's website at www.smartm.com



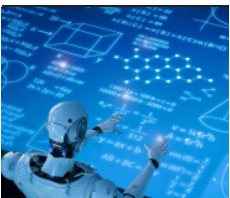
■ Designed for Intensive Workloads

SMART is known for its advanced technologies and product quality. We focus on providing specialty high-value memory, storage and compute products for various applications. We are widely trusted by our tier 1 OEM partners. The DuraMemory brand conveys SMART's continued commitment to provide the highest quality and reliability in industrial and computing memory products.



Data Centers

Data centers require reliable, high-density memory with low latency and low power consumption. SMART's Zefr (Zero Failure Rate) Memory products provide flexible options to meet the ever-changing needs of fast growing data demand in server applications. Zefr Memory has been intensely processed to filter out weak memory modules, providing one of the lowest DPPMs in the industry.



Artificial Intelligence / High-Performance Computing

Data intensive applications like AI and HPC generate and process large amounts of data, while requiring low latency and high performance. SMART Modular's DuraFlash embedded and removable drives are designed for compute intensive, high throughput and high capacity storage applications.



Networking

Requiring small to standard form factors, networking applications have strict footprint and thermal specifications. DuraFlash removable and embedded solutions with low latency provide high performance and signal integrity for networking applications.



Industrial Internet of Things

Industrial applications need replacement storage solutions with extended life cycles. Key requirement features include reliability, security and performance. DuraFlash PCIe NVMe, embedded, and microSD removable solutions are just some of the industrial Flash options customers can choose from with SMART Modular.



Transportation

Memory applications for the transportation industry demand a flexible range of options, whether it's performing in harsh environments or for synchronized computing. SMART Modular's DuraFlash options can accommodate any vehicle telematics application whether it requires a standard or small form factor.



POS / Gaming

Gaming applications typically require memory with compact form factors, reduced voltage demands, high performance and high reliability. DuraFlash embedded and removable memory products provide a wide variety of solutions for POS and gaming applications.



Military / Aerospace

Defense and aerospace applications require the utmost in reliable, robust storage, and they must be able to withstand punishing conditions. Factors including extreme changes in temperature gradient, vibration, altitude and humidity all need to be considered when designing in memory for these types of mission-critical, high-reliability applications.



Durable and Reliable Memory for Industrial Workloads

SMART's DuraMemory portfolio provides a superior level quality, durability and reliability to meet the needs of today's demanding industrial specifications and applications.

All DuraMemory products are backed by SMART's extensive expertise in design, manufacturing, testing and logistical support. The DuraMemory line provides an added level of confidence and security, knowing that these products will perform to the highest standards for durability and reliability, while meeting industrial workload requirements and exceeding performance expectations.

**Enterprise Quality for
High Reliability**

**Undergoes Triple Stress
Testing and Burn-In**

**Encryption and
Other Features Available**



DuraMemory Product Family

DDR5 / DDR4 / DDR3



NVDIMM



LRDIMM



RDIMM



UDIMM



SODIMM



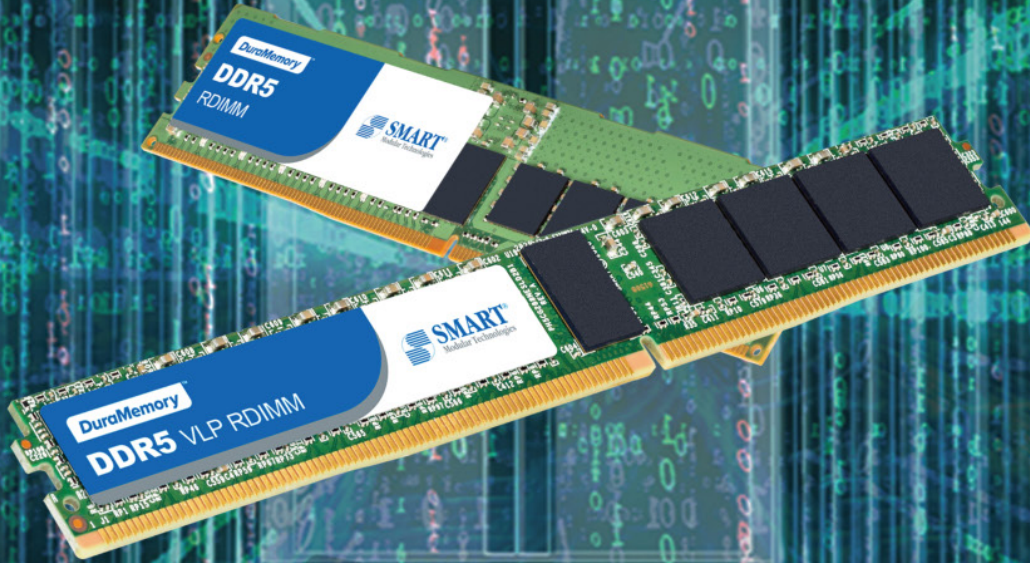
Mini DIMM



XRDIMM



MIP™

**NEW**

Generation DDR5

Advancing High Performance Computing

RDIMM**UDIMM****SODIMM****VLP RDIMM**

Onboard 12V integrated voltage regulators
for better signal integrity and reduction of noise

Dual 40-bit wide channel architecture
for higher memory efficiency, lower latency

Generates CRC checksum in
READ data frames

Independent clocks for each channel
improves signal integrity,
lowers the noise margin

On-die ECC provides further protection
against single-bit errors inside the DDR5
memory arrays

Servers/Data Centers

- Enterprise Memory for High Reliability
- Supports ECC Memory for Error Detection and Correction
- Register to Support Signal and Address Buffer
- LRDIMM Buffer Memory Reinforces Data Integrity



DIMM Type	RDIMM		LRDIMM
Technology	DDR5	DDR4	DDR4
Density	16GB-64GB	4GB-256GB	64GB-256GB
Height	31.25mm	31.25/24.4mm	31.25mm
Configuration	80bit	72bit	72bit
Speed (MT/s)	4800	2666-3200	2666
Voltage	1.1V	1.2V	1.2V
Operating Temperature*	C Temp	C/I Temp	C Temp

Blade/Compact Servers

- For 1U and <1U Blade System Form Factors
- For Low-Profile Server Applications
- Supports ECC Memory for Error Detection and Correction



DIMM Type	VLP RDIMM		VLP/ULP Mini RDIMM	
Technology	DDR5	DDR4	DDR4	DDR3
Density	32GB	4GB-64GB	8GB-32GB	2GB-8GB
Height	18.75mm	18.75mm	18.75/17.78mm	18.75/18.3/17.78mm
Configuration	80bit	72bit	72bit	72bit
Speed (MT/s)	4800	2666-3200	2666-3200	1333-1600
Voltage	1.1V	1.2V	1.2V	1.35V/1.5V
Operating Temperature*	C Temp	C/I Temp	C Temp	C/I Temp

*C Temp (0°C to +70°C); I Temp (-40°C to +85°C)

Networking

- 100% High and Low Temperature Testing
- Conformal Coating for Moisture and Environmental Protection
- Anti-Sulfur Passive Components - Protection Against Environmental Decay



DIMM Type	UDIMM		UDIMM ECC	
Technology	DDR5	DDR4	DDR5	DDR4
Density	8GB-32GB	4GB-32GB	16GB	4GB-32GB
Height	31.25mm	31.25mm	31.25mm	31.25mm
Configuration	64bit	64bit	72bit	72bit
Speed (MT/s)	4800	2666-3200	4800	2666-3200
Voltage	1.1V	1.2V	1.1V	1.2V
Operating Temperature*	C Temp	C/I Temp	C Temp	C/I Temp

Telecommunication

- Component Underfill for Vibration Resistance
- Rigorous Testing to Prevent Failure in the Field
- Specific Enhancements for Extra Environmental Protection



DIMM Type	SODIMM		SODIMM ECC		SORDIMM ECC
Technology	DDR5	DDR4	DDR4	DDR3	DDR3
Density	8GB-32GB	2GB-32GB	4GB-32GB	2GB-16GB	2GB-8GB
Height	30mm	30mm	30mm	30/25.4mm	30mm
Configuration	64bit	64bit	72bit	72bit	72bit
Speed (MT/s)	4800	2400-3200	2666-3200	1600-1866	1600
Voltage	1.1V	1.2V	1.2V	1.35V/1.5V	1.35V/1.5V
Operating Temperature*	C Temp	C/I Temp	C/I Temp	C/I Temp	C/I Temp

*C Temp (0°C to +70°C); I Temp (-40°C to +85°C)

■ Compact Systems

- Ultra Low and Very Low System Architecture Available
- Extra Power and Ground Pins Provide Greater Reliability and Data Integrity
- Supports ECC Memory for Error Detection and Correction



DIMM Type	VLP UDIMM	VLP/ULP UDIMM ECC	
Technology	DDR3	DDR4	DDR3
Density	4GB-8GB	16GB-32GB	4GB-8GB
Height	18.3mm	17.78mm	18.75/18.3mm
Configuration	64bit	72bit	72bit
Speed (MT/s)	1600	2666-3200	1600
Voltage	1.35V/1.5V	1.2V	1.35V/1.5V
Operating Temperature*	C Temp	C/I Temp	C Temp

■ Industrial Internet of Things

- Broad Choice of Products, Form Factors, Technologies, Speeds and Densities
- Multiple Solutions to Protect Against Environmental Threats
- Shorter Lead Times from Order to Delivery



DIMM Type	Mini UDIMM ECC	VLP/ULP Mini UDIMM ECC	
Technology	DDR3	DDR4	DDR3
Density	4GB-8GB	4GB-32GB	2GB-8GB
Height	30mm	18.75/17.78mm	18.75/17.78mm
Configuration	72bit	72/64bit	72bit
Speed (MT/s)	1600	2400-3200	1333-1600
Voltage	1.35V/1.5V	1.2V	1.35V/1.5V
Operating Temperature*	C Temp	C/I Temp	C/I Temp

*C Temp (0°C to +70°C); I Temp (-40°C to +85°C)

Aerospace/Military

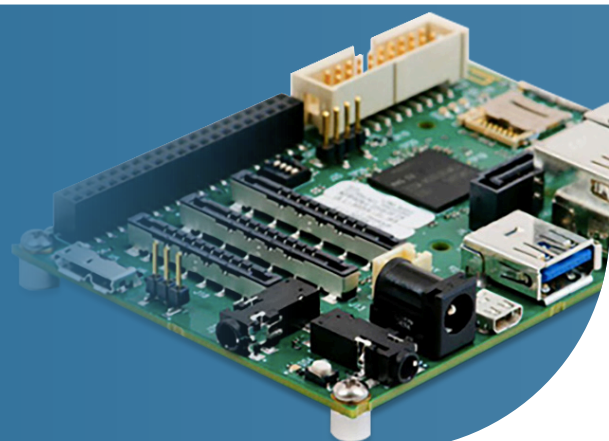
- Underfill for Excessive Shock and Vibration
- Optional Module Retention Clips for Extra Secure Attachment
- Conformal Coating for Moisture Exposure
- Industrial Temperature and Low Power Options Available



DIMM Type	XRDIMM ECC	SODIMM ECC	
Technology	DDR3	DDR4	DDR3
Density	4GB-8GB	4GB-32GB	2GB-16GB
Height	38mm	30mm	30/25.4mm
Configuration	72bit	72bit	72bit
Speed (MT/s)	1600	2666-3200	1600-1866
Voltage	1.35V/1.5V	1.2V	1.35V/1.5V
Operating Temperature*	C/I Temp	C/I Temp	C/I Temp

SBC/SOM (Module-In-A-Package™)

- MIP Small Form Factor 22.25 x 22.25 x 3.85 mm
- Simplified System Design to Avoid Back-to-Back Chip Placements
- Better Signal Integrity and Reduced Flight Time
- Build-to-Order Model with Multiple Standard DRAM Sources Available



DIMM Type	Module-In-A-Package (MIP)	
Technology	DDR4	DDR3
Density	2GB-16GB	2GB
Height	22.25 x 22.25 x 3.85 mm	22.25 x 22.25 x 3.85 mm
Configuration	64bit	64bit
Speed (MT/s)	2400-3200	1866
Voltage	1.2V	1.35V/1.5V
Operating Temperature*	C/I Temp	C/I Temp

*C Temp (0°C to +70°C); I Temp (-40°C to +85°C)

Industrial Temperature (-40°C to +85°C)

I Temp Server DIMM



DIMM Type	RDIMM		VLP RDIMM		VLP/ULP Mini RDIMM
Technology	DDR4	DDR3	DDR4	DDR3	DDR3
Density	4GB-256GB	2GB-32GB	4GB-64GB	4GB-16GB	2GB-8GB
Height	31.25/24.4mm	30mm	18.75mm	18.75mm	18.75/18.3/17.78mm
Configuration	72bit	72bit	72bit	72bit	72bit
Speed (MT/s)	2666-3200	1333-1866	2666-3200	1600-1866	1333-1600
Voltage	1.2V	1.35V/1.5V	1.2V	1.35V/1.5V	1.35V/1.5V
Operating Temperature	I Temp	I Temp	I Temp	I Temp	I Temp

I Temp UDIMM



DIMM Type	UDIMM		UDIMM ECC
Technology	DDR4	DDR3	DDR4
Density	4GB-32GB	2GB-8GB	4GB-32GB
Height	31.25mm	30mm	31.25mm
Configuration	64bit	64bit	72bit
Speed (MT/s)	2666-3200	1600-1866	2666-3200
Voltage	1.2V	1.35V/1.5V	1.2V
Operating Temperature	I Temp	I Temp	I Temp

I Temp SODIMM



DIMM Type	SODIMM		SODIMM ECC		SORDIMM ECC
Technology	DDR4	DDR3	DDR4	DDR3	DDR3
Density	2GB-32GB	128MB-16GB	4GB-32GB	2GB-16GB	2GB-8GB
Height	30mm	30mm	30mm	30/25.4mm	30mm
Configuration	64bit	64bit	72bit	72bit	72bit
Speed (MT/s)	2400-3200	1600-1866	2666-3200	1600-1866	1600
Voltage	1.2V	1.35V/1.5V	1.2V	1.35V/1.5V	1.35V/1.5V
Operating Temperature	I Temp	I Temp	I Temp	I Temp	I Temp

I Temp VLP/ULP UDIMM



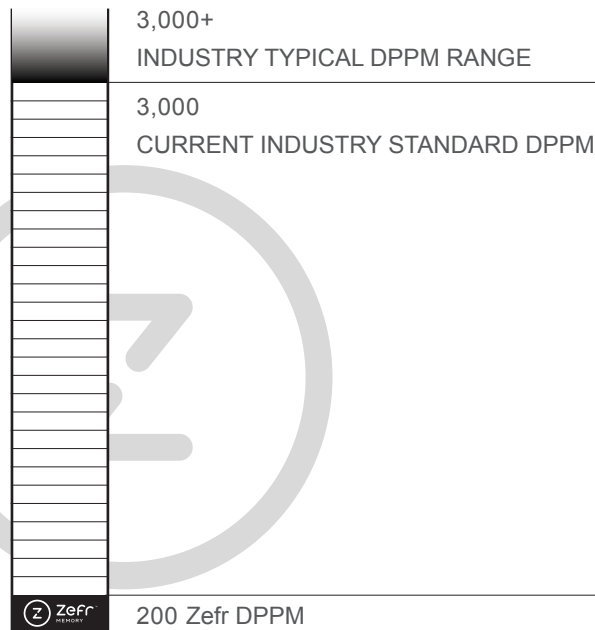
DIMM Type	ULP UDIMM ECC	VLP/ULP Mini UDIMM ECC	
Technology	DDR4	DDR4	DDR3
Density	16GB-32GB	4GB-32GB	2GB-8GB
Height	17.78mm	18.75/17.78mm	18.75/17.78mm
Configuration	72bit	72/64bit	72bit
Speed (MT/s)	2666-3200	2400-3200	1333-1600
Voltage	1.2V	1.2V	1.35V/1.5V
Operating Temperature	I Temp	I Temp	I Temp



Zefr (Zero Failure Rate) Eliminating Over 90% of Memory Reliability Failures

Zefr is a screening process performed on OEM original memory modules or SMART Modular built memory modules to deliver ultra-high reliability for demanding workloads.

Industry Standard Memory Reliability isn't Sufficient



Zefr Screens Memory to Real-World Conditions

Zefr Memory has been intensely processed to filter out weak memory modules. The Zefr Process combines five key testing ingredients.



* For more Zefr information, please visit www.smtreports.com/zefr/



Rugged Memory

Taking Memory to the Extreme

SMART Rugged is a portfolio of value added services to enhance the reliability of your memory products. SMART Rugged Memory is dedicated to developing the industry's most rugged, robust, and reliable memory that meets the needs of a wide variety of demanding applications found in the defense, aerospace, IIoT, telecommunications, transportation, energy, and other industries where devices are exposed to extreme temperatures and susceptible to corrosion.



Anti-Sulfur Resistor



Conformal Coating



30µm Gold Finger



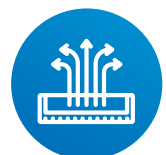
Industrial Temperature*



Underfill



Retention Clips



Heat Spreaders

*Industrial Temperature (-40°C to +85°C); Wide Temperature (-40°C to +105°C)



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**For more product details, please contact the
SMART sales team or visit our website.**

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