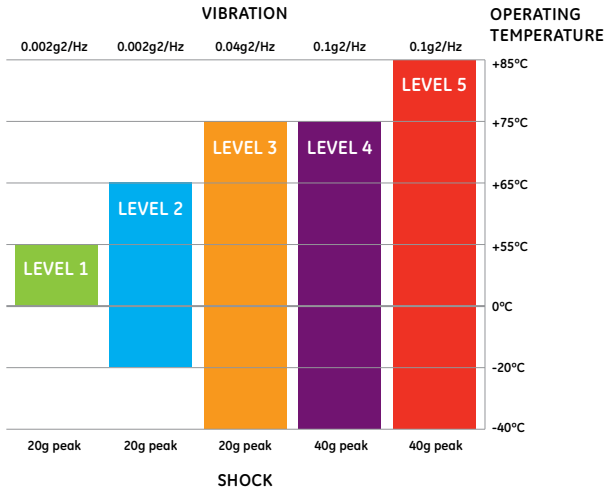
GE
Intelligent Platforms



Ruggedization

Full Environmental Compliance

Features

- Unique expertise/experience in ruggedization
- Products designed to be rugged
- Five levels of ruggedization available
- Compliant with all relevant standards, including:
  - ANSI/VITA 1.1-1997
  - ANSI/VITA 20-2001
  - ANSI/VITA 30.2-2002
  - PICMG 2.0 R3.0-1999
  - IEEE 1101.2-1992
- All build levels compatible, interoperable

GE Intelligent Platforms was among the very first companies to bring to market commercial off-the-shelf (COTS) products that were rugged by design – as opposed to commercial products that were ruggedized as an afterthought. Created to operate in the harshest environments, GE's products now reflect the company's unparalleled experience and expertise in ruggedization, with its unique combination of design evaluation and assembly and test practices through to advanced thermal management, mechanical engineering and hermetic control techniques.

GE ruggedizes its products by upgrading or screening parts for extended temperatures, adding mechanical stiffening bars, and/or changing substrate materials for thermal conduction. An integrated stiffening frame/thermal management assembly is used to optimize the mechanical dynamic and thermal performance. A variety of conformal coatings are available for humidity and static control.

The wide range of harsh military, aerospace and industrial environments for which GE products are designed sees them built in five distinct ruggedization levels. Development systems are compatible and interoperable with deployed systems through the use of shared circuit design and software compatibility, allowing the most cost-effective option to be selected: each of the five levels differ only in the mechanical build standard, type of cooling and the quality of the electronic components used.

GE's five ruggedization levels offer increasing levels of environmental durability, enabling operational goals to be met at the lowest possible cost. Each ruggedization level has been carefully tailored to provide the optimal trade-off between cost, performance and reliability. Selection will depend on the type of cooling required – either forced air or by conduction – and the overall requirements for environmental performance.

Fully compliant with the ANSI/VITA 1-1994 VMEbus and IEEE Std 1101.2-1992 conduction-cooled specifications, GE products can be used with complete confidence in conjunction with both in-house designs and other vendor products that meet the same internationally recognized standards.

Ruggedization – Full Environmental Compliance

Summary Table

Ruggedization Level 1 Standard (Air-cooled)	
Operating Temperature	0 to +55°C with 300 ft./min. airflow
Storage Temperature	-50 to +100°C
Vibration	0.002g /Hz from 10 to 2000Hz random and 2g sinusoidal from 5 to 500Hz
Shock	20g peak sawtooth, 11mS duration
Humidity	Up to 95% RH
Notes: Commercial grade, for use in benign environments and software development applications.	

Ruggedization Level 2 Extended Temperature (Air-cooled)	
Operating Temperature	-20 to +65°C with 300 ft./min. airflow
Storage Temperature	-50 to +100°C
Vibration	0.002g²/Hz from 10 to 2000Hz random and 2g sinusoidal from 5 to 500Hz
Shock	20g peak sawtooth, 11mS duration
Humidity	Up to 95% RH with varying temperature, 10 cycles, 240 hours
Notes: Similar to standard, conformally-coated for added protection and temperature characterized.	

Ruggedization Level 3 Rugged (Air-cooled)	
Operating Temperature	-40 to +75°C with 600 ft./min. airflow
Storage Temperature	-50 to +100°C
Vibration	0.04g²/Hz 20 to 2000Hz, with a flat response to 1000Hz, 6dB/ octave roll-off from 1000 to 2000Hz
Shock	20g peak sawtooth, 11mS duration
Humidity	Up to 95% RH with varying temperature, 10 cycles, 240 hours
Notes: Wide temperature, conformally-coated for added protection. Optional Environment Stress Screening (ESS).	

Ruggedization Level 4 Rugged (Conduction-cooled)	
Operating Temperature	-40 to +75°C at the thermal interface
Storage Temperature	-50 to +100°C
Vibration	Random, 0.1g²/Hz from 15 to 2000Hz per MIL-STD-810E Fig 514.4 - 8 for high performance aircraft. ~12g RMS
Shock	40g peak sawtooth, 11mS duration
Humidity	Up to 95% RH with varying temperature, 10 cycles, 240 hours
Notes: Designed for severe environment applications with high levels of shock and vibration, small space envelope and restricted cooling. Optional Environment Stress Screening (ESS).	

Ruggedization Level 5 Rugged (Conduction-cooled)	
Operating Temperature	-40 to +85°C at the thermal interface
Storage Temperature	-50 to +100°C
Vibration	Random, 0.1g²/Hz from 15 to 2000Hz per MIL-STD-810E Fig 514.4 - 8 for high performance aircraft. ~12g RMS
Shock	40g peak sawtooth, 11mS duration
Humidity	Up to 95% RH with varying temperature, 10 cycles, 240 hours
Notes: Designed for severe environment applications with high levels of shock and vibration, small space envelope and restricted cooling. Optional Environment Stress Screening (ESS).	

The above table summarizes the five standard ruggedization levels. For other levels of environmental qualification, please contact the factory

About GE Intelligent Platforms

GE Intelligent Platforms, a General Electric Company (NYSE: GE), is an experienced high-performance technology company and a global provider of hardware, software, services, and expertise in automation and embedded computing. We offer a unique foundation of agile, advanced and ultra-reliable technology that provides customers a sustainable advantage in the industries they serve, including energy, water, consumer packaged goods, government and defense, and telecommunications. GE Intelligent Platforms is a worldwide company headquartered in Charlottesville, VA and is part of GE Home and Business Solutions. For more information, visit www.ge-ip.com.

GE Intelligent Platforms Contact Information

Americas: **1 800 433 2682** or **1 434 978 5100**
Global regional phone numbers are listed by location on our web site at **www.ge-ip.com/contact**

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