



Brick Environmental Qualification Testing Standards (Maxi, Mini, Micro, VI-200 & VI-J00 Brick Product Platforms)



Maxi, Mini, Micro



VI-200, VI-J00

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1. Purpose

This report outlines environmental testing which were performed to qualify Vicor Brick (Maxi, Mini, Micro, VI-200 and VI-J00) product platforms.

2. Executive Summary

Vicor Brick products are considered qualified to the following environmental testing standards. Representative samples from each product family were tested to the standards referenced below. As part of Vicor's Ongoing Reliability Monitoring (ORM) program representative samples of Brick products are tested to verify continued compliance to the standards referenced below.

TABLE 1

Testing Activity	Reference Standard	Applicable Grade (C,T,H or M)
High Temperature Operating Bias/Life (HTOB/HTOL)	JESD22-A108D	All Grades
Temperature Cycling Test (TCT)	JESD22-A104D	All Grades
Temperature Humidity Bias(THB)	JESD22-A101C	All Grades
High Temperature Storage (HTS)	JESD22-A103D	All Grades
Low Temperature Storage (LTS)	JESD22-A119	All Grades
Random Vibration	MIL-STD-810F	Industrial-Military Grades
Mechanical Shock	MIL-STD-810F	Industrial-Military Grades
Highly Accelerated Life Test (HALT)	Internal Vicor Procedure DP-0265	All Grades
Salt Fog	MIL-STD-810F	Industrial-Military Grades
Fungus	MIL-STD-810F	Industrial-Military Grades
Humidity	MIL-STD-810F	Industrial-Military Grades
Solderability	MIL-STD-202G	All Grades
ESD Human Body Model	JEDEC JS-001-2012	All Grades
ESD Charged Device Model	JESD22-C101E	All Grades
Acceleration	MIL-STD-810F	Industrial-Military Grades
Altitude	MIL-STD-810F	Industrial-Military Grades
Explosive Atmosphere	MIL-STD-810F	Industrial-Military Grades

3. Environmental Test Conditions.

3.1. High Temperature Operating Bias Test (HTOB)

HTOB Test Criteria

Input Voltage:	Nominal Line Typical. Applied Voltage is within product specifications.
Operating Temperature:	Maximum Operating temperature +/- 5°C
Test Duration:	1000 hours.
Test monitoring:	Product temperature, output voltage and current monitored throughout the test.
Output Conditions:	Full Load.
Functional Verification:	Pre and post functional testing performed.
Applicable standard:	JESD22-A108D.
Qty Tested:	Minimum 10.

3.2. Temperature Cycling (TC) Test

Temperature Cycling (TC) Test Criteria

Temperature extremes: 125°C to –55°C (Industrial and Military Grades)
125°C to –40°C (All other Grades)

Dwell: 5 minute dwell at each temperature extreme.

Temp Transition rate: 8°C per minute.

Test Duration: 1000 cycles

Sample Size: Minimum 15 units

Functional Verification: Pre and post ATE testing as well as ATE testing at the 250 cycles.

Applicable standard: JESD22-A104D

3.3. Temperature Humidity Bias (THB)

THB Test Conditions

Input Voltage: Nominal Input Voltage.

Output Conditions: Minimum load

Temperature: 85°C, 85%RH

Test Duration: 1000 hrs.

Test Monitoring: Continuous Monitoring. Full functional ATE testing every 250 hrs

Quantity Tested: Minimum quantity of 10.

Applicable standard: JESD22-A101C

3.4. Low Temperature Storage Test (LTS)

Test Temperature:	-65°C, Non Biased.
Test Duration:	1000 Hours
Sample Size:	3 units
Functional Verification:	Pre and post ATE testing as well as ATE testing at the 250 hour test points.
Applicable standard:	JESD22–A119

3.5. High Temperature Storage Test (HTS)

Test Temperature:	125°C, Non Biased.
Test Duration:	1000 Hours
Sample Size:	13 units
Functional Verification:	Pre and post ATE testing as well as ATE testing at the 250 hour test points.
Applicable standard:	JESD22-A103-D

3.6. Highly Accelerated Life Test (HALT)

3.6.1. HALT Test Detail

Test Standard: Internal Vicor specification DP-0265

HALT test equipment:

Model: QualMark Typhoon 2.0 calibration.

Equipment Limitations:

Maximum air temperature of 200°C

Minimum air temperature of – 100°C

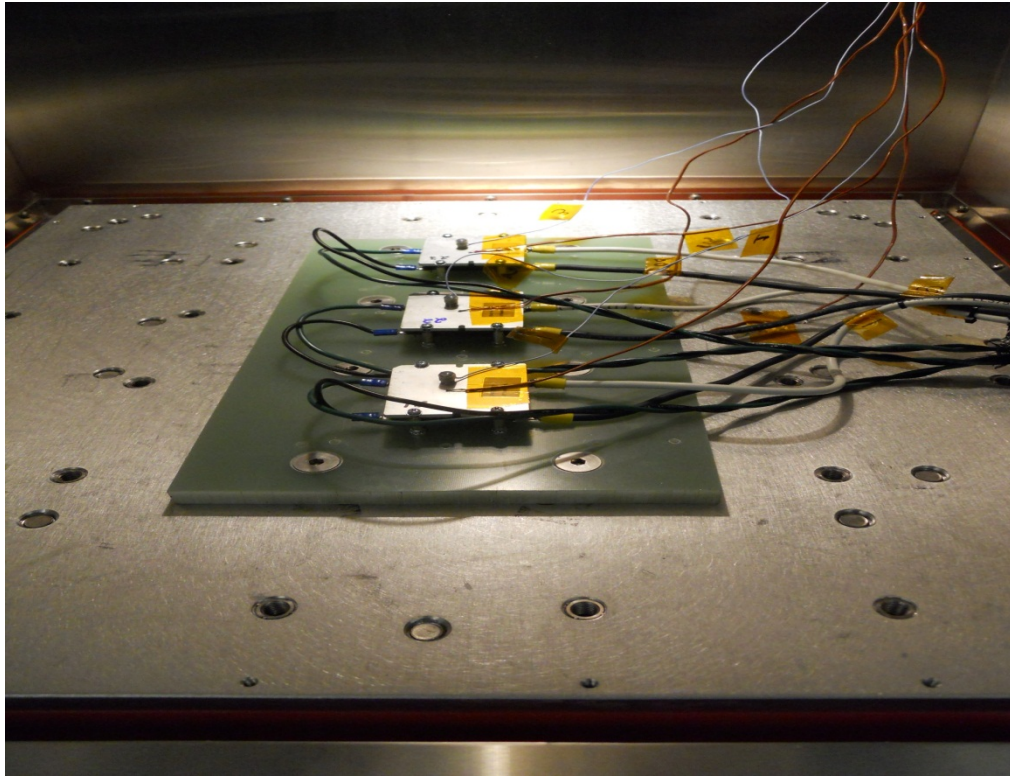
Maximum vibration level of 75 Grms

Vibration type: Omni-axis vibration system.



Typical setup sample.

Product is mounted in a manner which mimics a customer application.

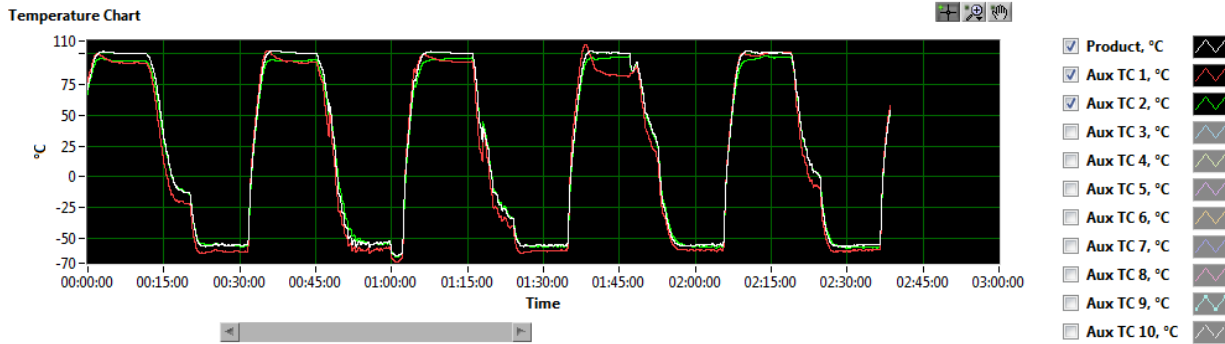


Test Conditions:

- a. **Low Temp** – Product low temperature operation specification verified, followed by reducing temperature to minimum operating temperature of chamber to induce failure.
- b. **High Temp** - Product maximum operating temperature specification verified, followed by increasing temperature to product shutdown or product failure.

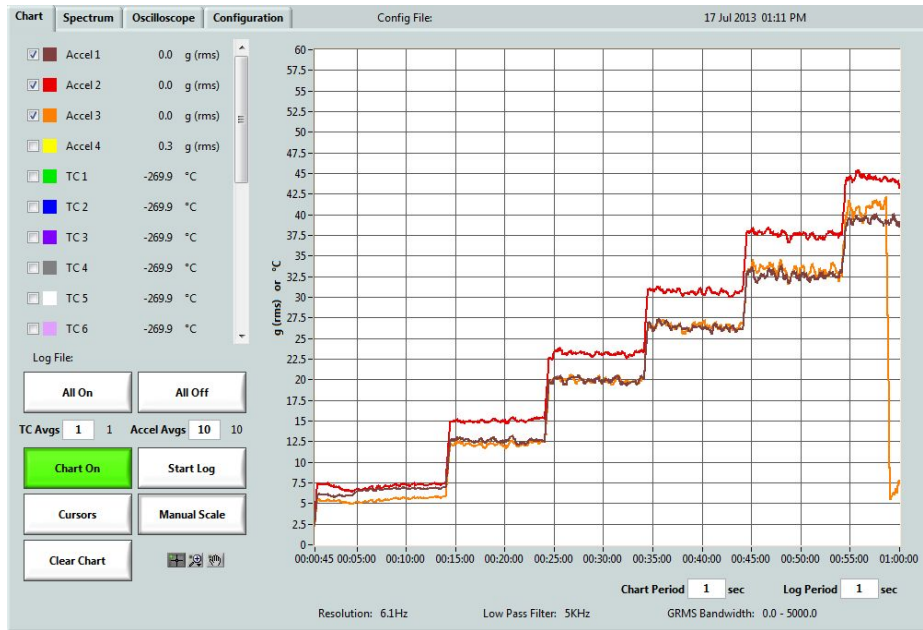
- c. **Rapid Thermal Cycling** – 5 rapid temperature cycles from maximum to minimum operating temperature under full load.

Sample Profile



- d. **Random Vibration Test** – Sample product exposed to increasing levels of vibration to point of failure to establish destruct point, remaining samples exposed to a vibration level 25% less than destruct point.

Sample Profile



- e. **Combined Stresses Test** - Product temperature cycled under load for 5 cycles with increasing vibration levels to test structural integrity of package.
- f. **Vibration Destruct limits.** Product samples vibrated to point of failure.

3.7. **Random Vibration Testing (Operating)-**

A total of 3 samples are exposed to the test environment noted below at an external test laboratory. All units are ATE tested pre and post exposure to vibration test. Units are also inspected for any signs of damage with no anomalies noted.

Test standard: MIL-STD-810F

Test Conditions: Method 514.5, Procedure I, Category 14, helicopter AH-6J Main Rotor with overall level of 5.6grms, 4 hrs per axis.

3.8. **Mechanical Shock (Operating)-**

A total of 3 samples are exposed to the test environment noted below. All units are tested pre and post exposure to shock testing. Units are also inspected for any signs of damage.

Test Standard: MIL-STD-810F

Test Conditions: Method 516.5, Procedure I, Functional shock 40G, total of 18 shocks. Product mounted on an evaluation board.

3.9. **Salt Fog**

A total of 3 samples are exposed to the test environment noted below at an external test laboratory. Units are also inspected for any signs of damage.

Test Standard: MIL-STD-810F

Test Conditions: Method 509.4.

3.10. Humidity Test

A total of 10 samples are exposed to the test environment noted below.

Test Standard: MIL-STD-810F

Test Conditions: Method 507.4, 95% Relative Humidity.

3.12. Through-Hole Solderability

Three devices are tested in-house to the referenced standard.

Test standard: MIL-STD-202G

Test Conditions: Method 208H 8hr aging.

3.13. ESD Classification Testing.

Human Body Model (JEDEC JS-001-2012 Table 2B) Units meet class 1C– Qty 6

Charged Device Model (JESD22-C101E) Units meet Class II - Qty 6

3.14. Acceleration

Three devices are tested to the referenced standard at an external test laboratory.

Test standard: MIL-STD-810F

Test Method: Method 513.5, Procedure II, 2-7g, 6 directions.

3.15. Altitude

Three devices are tested to the referenced standard at an external test laboratory.

Test standard: MIL-STD-810F

Test Method: Method 500.4, Procedure I and II, Conditions, 40k feet and 70k.

3.16. Explosive Atmosphere

One device is tested to the referenced standard at an external test laboratory.

Test standard: MIL-STD-810F
Test Method: Method 511.4, Procedure I, Operational.

4. Product Requirements

All products which undergo testing are manufactured using the standard process.

5. Testing Requirements

All products are tested at the scheduled intervals as outlined in the test datasheets or as dictated by the test standard specific to the individual test.

Definition of Electrical Failure: Components that are no longer generating valid output voltage are considered hard failures. These components must be evaluated to root cause. Changes in electrical performance (parameters outside acceptable tolerance limits of specification) or electrical failures caused by thermal transitions require that Vicor perform an evaluation.

Corrective Action – All product failures must be fully investigated, determining root cause and assigning corrective actions as deemed appropriate.