GoMax Forum

Power Surge

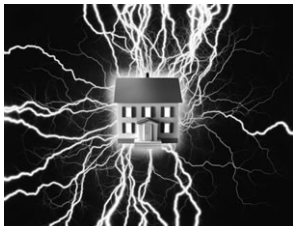
A power surge, or **transient voltage**, is an increase in voltage significantly above the designated level in a flow of electricity. For instance, in normal household and office wiring in the United States, the standard voltage is **120 volts**. If the voltage rises above 120 volts, there is a problem, and a surge protector helps to prevent that problem from destroying your computer.

- When the increase lasts three nanoseconds (billionths of a second) or more, it's called a **surge**.
- When it only lasts for one or two nanoseconds, it's called a **spike**

If the surge or spike is high enough, it can inflict some heavy damage on a machine. The effect is very similar to applying too much water pressure to a hose. If there is too much water pressure, a hose will burst. Approximately the same thing happens when too much electrical pressure runs through a wire -- the wire "bursts."

Power surges occur when something boosts the electrical charge at some point in the power lines. This causes an increase in the electrical potential energy, which can increase the current flowing to your wall outlet. The most familiar source is probably ***lightning***, though it's actually one of the least common causes. When lightning strikes near a power line, whether it's underground, in a building or running along poles, the electrical energy can boost electrical pressure by millions of volts. This causes an extremely large power surge that will overpower almost any surge protector. In a lightning storm, you should never rely on your surge protector to save your computer. The best protection is to unplug your computer.

A more common cause of power surges is the operation of **high-power electrical devices**, such as elevators, air conditioners and refrigerators. These high-powered pieces of equipment require a lot of energy to switch on and turn off components like compressors and motors. This switching creates sudden, brief demands for power, which upset the steady voltage flow in the electrical system. While these surges are nowhere near the intensity of a lightning surge, they can be severe enough to damage components, immediately or gradually, and they occur regularly in most building's electrical systems.



Other sources of power surges include *faulty wiring*, problems with the utility company's equipment, and downed power lines. The system of transformers and lines that brings electricity from a power generator to the outlets in our homes or offices is extraordinarily complex. There are dozens of possible points of failure, and many potential errors that can cause an uneven power flow. In today's system of electricity distribution, power surges are an unavoidable occurrence.

Surge Protector Ratings

On a listed surge protector, you should find a couple of ratings. Look for:

- **Clamping voltage** - This tells you what voltage will cause the MOVs to conduct electricity to the ground line. A lower clamping voltage indicates better protection. There are three levels of protection in the UL rating -- 330 V, 400 V and 500 V. Generally, a clamping voltage more than 400 V is too high.
- **Energy absorption/dissipation** - This rating, given in joules, tells you how much energy the surge protector can absorb before it fails. A higher number indicates greater protection. Look for a protector that is at least rated at 200 to 400 joules. For better protection, look for a rating of 600 joules or more.
- **Response time** - Surge protectors don't kick in immediately; there is a very slight delay as they respond to the power surge. A longer response time tells you that your computer (or other equipment) will be exposed to the surge for a greater amount of time. Look for a surge protector that responds in less than *one nanosecond*.
  You should also look for a protector with an **indicator light** that tells you if the protection components are functioning. All MOVs will burn out after repeated power surges, but the protector will still function as a power strip. Without an indicator light, you have no way of knowing if your protector is still functioning properly.

The power supply units (PSU) are the most common components that are exposed to the danger of power surges in all products! Without passing power surge protection test, all the products with such PSUs are under high risks to be damaged. At GoMax, all the PSUs, including external and internal modules, are required at least pass IEC 61000-4-5 surge immunity test to ensure all the power durability and stability.

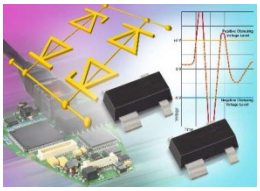
Basic Standard:	IEC 61000-4-5
Wave-Shape:	Combination Wave 1.2/50 us Open Circuit Voltage 8/20 us Short Circuit Current
Test Voltage:	☒ AC Power Port ~ line to line: 1kV, line to earth (ground): 2kV ☐ DC Power Port ~ line to earth: 0.5kV ☐ Signal Ports and Telecommunication Ports ~ line to ground: 1kV
Surge Input/Output:	☒ AC Power Port: L-N / L-PE / N-PE ☐ DC Power Port: L-PE ☐ Signal Ports and Telecommunication Ports: T to Ground/ R to Ground
Generator Source Impedance:	2 ohm between networks 12 ohm between network and ground
Polarity:	Positive/Negative
Phase Angle:	0 / 90 / 180 / 270
Pulse Repetition Rate:	1 time / min. (maximum)
Number of Tests:	5 positive and 5 negative at selected points

Electrostatic Discharge

Electrostatic discharge (**ESD**) is the sudden and momentary electric current that flows between two objects at different electrical potentials caused by direct contact or induced by an electrostatic field. An ESD event is a rapid transfer of charge (electrons) from one object to another in an attempt to become electrically neutral. Electrostatic charge is most commonly created by the constant and separation of two electrically nonconductive materials. The amount and type of charge depends on the materials involved. Common sources of static electricity are plastic materials, packing tape, and paperwork etc.

ESD is a serious issue in solid state electronics, such as integrated circuits. Integrated circuits are made from semiconductor materials such as silicon and insulating materials such as silicon dioxide. Either of these materials can suffer permanent damage when subjected to high voltages. The electrical pulse which forms the core of an ESD also acts like a power surge on electrical devices, and can short out or permanently damage the system.

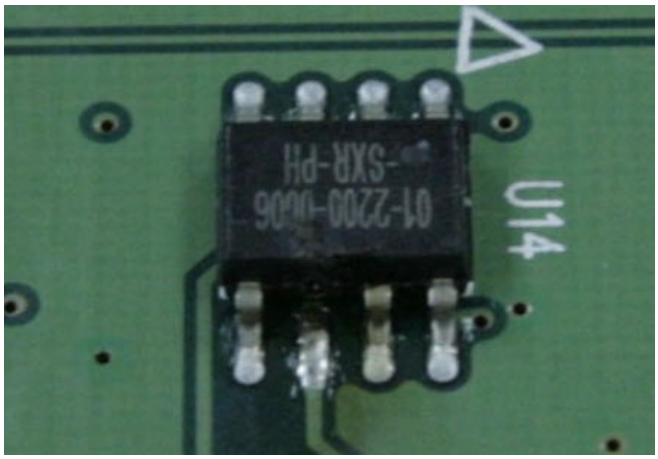
ESD protection

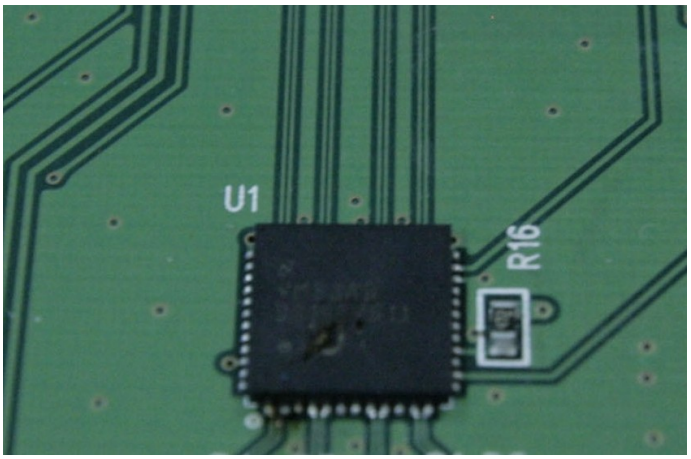


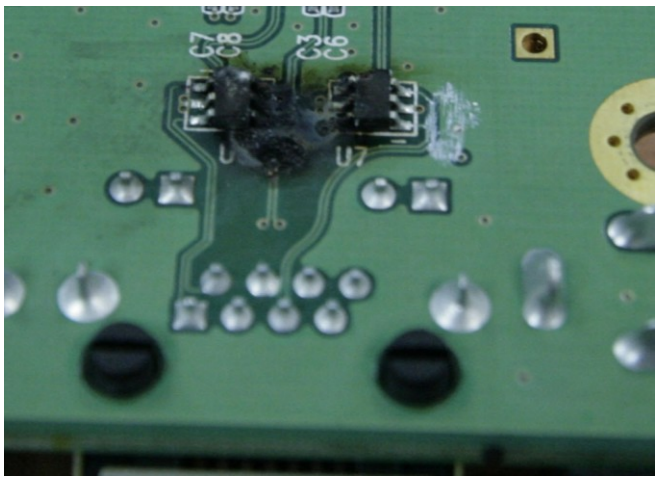
Traditional methods of ESD protection include Zener diodes, metal oxide varistors (MOVs), transient-voltage-suppression (TVS) diodes and regular CMOS or bipolar clamp diodes. At higher data rates, these methohds can cause distortion and deterioration of the signal integrity. Therefore, for such applications, well designed ESD protection elements must be in consideration.

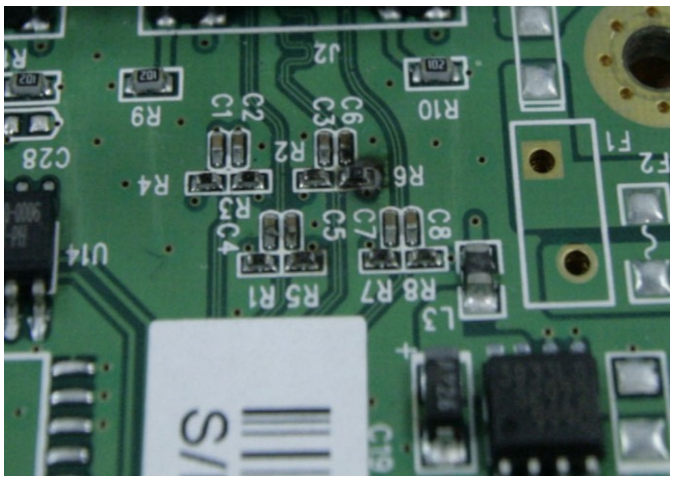
GoMax adopts ESD elements which can provide ESD, EFT, and surge protection for high speed data ports meeting IEC61000 standards with low capacitance 0.55pF and ESD protection voltage larger than 15KV!

Power Surge Damage Examples









Most common standards for power surge, ESD, and lightning

IEC 61000-4-2: Testing and measurement techniques - Electrostatic discharge immunity tests. Basic EMC publication

IEC 61000-4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test. Basic EMC publication

IEC 61000-4-5: Testing and measurement techniques - Surge immunity test