

Technical Article

Why Is the Cloud Isolated?



Nagarajan Sridhar



In this day and age of bits and bytes, the demand for information transfer and retrieval is ubiquitous. Whether in line at the grocery store or waiting for a train, we use our smartphones to check our social media accounts, text messages or emails. But have you ever paused to think about from where this information comes? The answer is the cloud; that workhorse of real-time connectivity across the globe. Because information retrieval and storage such as your music playlists and video streams happens behind the scenes and requires high power levels to do so, you can see why the cloud is isolated.

But first, let us look at where the cloud is physically located: the data center. Fiber or coax cables or wireless telecom base stations transmit information to and from data centers.

Now let's peel back the layers of the cloud and see what is inside it. The first layer is the power delivery unit, commonly referred to as the power supply. Why is the power supply so important? All of the information is stored in servers, known as cloud servers. These servers need power to store and retrieve information back and forth to consumers. Power delivery units are in the range of a few hundred to thousands of watts. They operate off the grid, which has AC line voltage in the range of hundreds to thousands of volts, hence they are referred to as the high-voltage unit.

Because high voltages and high power levels are involved, it is imperative to ensure the safety of humans. The server systems have low-voltage units, which are controllers for voltage regulation and communications and human machine interfaces (HMI). Humans involved in cloud operations interact with the servers through the HMI. Any breakdown and leakage of current from the high-voltage unit into the HMI can be lethal to humans. In addition, it will damage all the voltage components as well. So how do you protect humans and these low-voltage units from breaking down?

The answer is isolation. An isolation device, which is a semiconductor integrated circuit, enables data and power transfer between the high-voltage and the low-voltage unit while preventing any hazardous DC or uncontrolled transient current flowing from the grid, such as a lightning strike.

However, humans are hungry for more information. From watching video to listening to your favorite music in a crowded place such as an airport terminal or a food court, the demand for more information is only increasing. Not only that, but people expect to get this information instantaneously. The cloud is getting bigger and bigger by the day with increasing data demand, which means that power delivery systems need to supply more and more power. The cloud has limited real estate, however. Scaling them to a larger size is expensive and highly uneconomical.

There are two solutions that address both the safety requirements and increased information demand: increase the power density and provide isolation robustness. To increase the power density, you improve the power-supply efficiency significantly and increase the power transfer rate, (also known as the switching frequency measured in kilohertz), which helps make the power-supply units smaller. To provide isolation robustness, you ensure that the isolator is part of the system in such a way that you save on real estate on the power-supply board by integrating the isolator with a key power component like a high-speed gate driver. This is known as an isolated gate driver.

Having such a driver, such as the [UCC21520](#), in power-supply units helps service providers improve the performance of data centers and base stations to handle higher and higher capacities for the same given size. Power supplies are usually developed and built externally by manufacturers, who in turn supply these power-delivery units to data center customers. The data center in turn leases a portion of the cloud space to customers. Now you can see what I really mean by the phrase “Why is the cloud isolated?” It is behind the scenes and shielded by isolation since high power and high voltage are involved.

If you are looking to provide isolation robustness and improved power density where space is a constraint for high-performance applications such as cloud servers, consider a reinforced isolated gate driver like the [UCC21520](#). Watch the video below to learn more about the value of an isolated gate driver. The next installment in this series will discuss other high-performance applications where high power density and isolation robustness are key, such as solar inverters, electric and hybrid electric vehicles and medical.

Discover TI's [gate driver portfolio](#) and [isolation solutions](#).

Additional Resources

- Download the application note, “[UCC21520: A Universal Isolated Gate Driver with Fast Dynamic Response](#).”
- Start your design with the Reference Design for Reinforced Isolation on 3-Phase Inverter with Current, Voltage and Temp Protection ([TIDA-00366](#))
- Read the white paper, “[High-voltage reinforced isolation: Definitions and test methodologies](#).”
- Visit the [TI E2E™ Community Power Management forum](#) to search for solutions, get help, share knowledge, and solve problems with fellow engineers and TI experts.
- Read more about the cloud with the blog post, “[Are we ready for Industry 4.0?](#)”

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