Technical Article

Staying Cool, Efficiently

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Looking back at my childhood in one of coastal India's cities, I remember dense humidity paired with tolerable heat in the low 90s – a classic equatorial climate. But when I visit now, I notice that the temperatures are much higher, often exceeding 100°F. I also notice split air conditioners installed almost everywhere; these were rare during my childhood. Split air conditioners consist of an indoor and outdoor unit. The outdoor unit is installed outside the wall of the room and houses the condenser coils and compressor. Finally, I noticed many signs and advertisements from major air-conditioning suppliers.

Air-conditioner units draw a lot of power, so their increasing popularity makes it imperative to keep energy costs lower. The only way to do this is to have energy-efficient air-conditioners and a well-insulated home. When selecting the right air conditioner, its capacity and seasonal energy efficiency ratio (SEER) rating are key. A higher SEER rating means greater energy efficiency. Fortunately, a majority of air-conditioner brands have high energy-efficiency ratings.

Energy-efficient air conditioners use variable frequency drives (VFDs) in compressors and condenser fans. The other usage is the inclusion of active power factor correction (PFC) in air-conditioning power supplies. Both trends represent the adoption of switched-mode power conversion in systems that previously relied on less-efficient line-frequency electronics to power compressors and fans. VFDs have a motor in the compressor unit, whose speed can vary by modulating the voltage, current and frequency of the power delivered to the compressor. As a result, the system does not have to run at full speed. This dramatically cuts down on energy costs and is by far the largest benefit of VFDs. And since air conditioners operate at relatively high power levels, typically on the order of a few kilowatts, implementing active PFC improves power quality and reduces harmonic distortion. This reduces the amount of reactive power that ends up going back to the grid as wasted or unutilized power.

Both VFDs and PFC in air-conditioning units require high-voltage systems that are trending towards implementing integrated circuit (IC)-based solutions. Using the right power supply ICs, such as a high-voltage isolated driver like the UCC21520, can provide an ecosystem for air conditioners that enables high system-level efficiency and lower bill-of-materials cost, allowing you to stay cool, efficiently.

Additional Resources

- Get to the know the UCC21520.
- Explore TI's PFC controllers, including UCC28180, UCC28070 and UCC28950.
- Learn more about TI system solutions for indoor and outdoor air conditioner designs.

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