UTSA RESEARCH

Office of Commercialization and Innovation

Technology Summary

Non-Inductive Si Sub-V_{th} Boost Converter Battery Charger

The majority of existing Voltage Boost Converters in the market are supported by inductive switching systems. Few newer ASIC designs are also available that have switching clock circuitry, but they require additional power to run. These systems often pose challenges such as:

- Designs comprised of inductors result in considerable loss of efficiency due to dynamic current leakage.
- Semiconductor ASIC designs of boost converters are complex, require high-speed clock circuitry and also they can adversely affect efficiency at low power (μ-power) load applications.

Researchers at UT San Antonio have developed ASIC of SoC for a trickle charging capable non-inductive voltage boost converter (NVB-TC) that can charge various batteries of wide power ranges. It is made simple, less components, reliable and very cost-effective. It performs excellent at Silicon Sub-V_{th}. It also provides controllable trickle voltage required as specific to rechargeable batteries. Furthermore, it provides protection to batteries from overcharging related damages.

The new design consist a voltage boost conversion sequence on the single rail where input voltage can be as low as 0.15V and it also has these:

1. Directional triple current paths create the stage of voltage step-up.
2. SoC design compactness is optimized for min. components: $2CN_0 + (3P+2C)N_1+2(P+C)N_2,\ _{m-1}+(3P+2C+R)N_m$
3. Energy is compromised by auto-dummy-load (ADL) at full charge.
4. Energy transfer depends upon the battery only and the system was found to have the max. efficiency at 98.5%.
5. Source voltage ground supports as the common charging ground.

The NVB-TC consists of four simple steps, shown below.

MEET THE INVENTOR

Dr. Shuza Binzaid is a researcher and the Faculty Associate of MeMDRL-UTSA. He has more than ten years of industry experiences in Semiconductor Technology for devices, VLSI ASIC design, fabrication process and testing. He also has extensive design experiences in energy harvesting systems. He is a pioneer in Microelectronics and specializes in design engineering of novel systems for real-world applications. Learn more about Dr. Binzaid at http://engineering.utsa.edu/~memdrl/

COMPETITIVE ADVANTAGES

- Compact voltage step-up, reliable and cost-effective.
- Very high efficiency at 98.5%.
- Does not use any expensive charge delivery components.
- Eliminates the need for complex high-speed clock circuitry.
- Triple charging is calibrated to match the type of batteries.
- The singular rail of triple directional current paths forms proper charge delivery and assures no current losses.
- Source ground references as the output's common ground.
- Higher efficiency is also maintained for Sub-V_{th} μ-power charging.

COMMERCIAL APPLICATIONS

- Very suitable for μ-power charging.
- Sub-V_{th} energy is converted to usable charge levels.
- Suitable for energy storage of NTV circuitry and also thin-film batteries.
- Highly adaptive in renewable energy harvesting systems.

IP STATUS

- Patent Pending
- Licenses Available

REFERENCES

- http://engineering.sdsu.edu/~hev/energy.html
- http://www.nature.com/ncomms/journal/v4/n5/full/ncomms2932.html

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