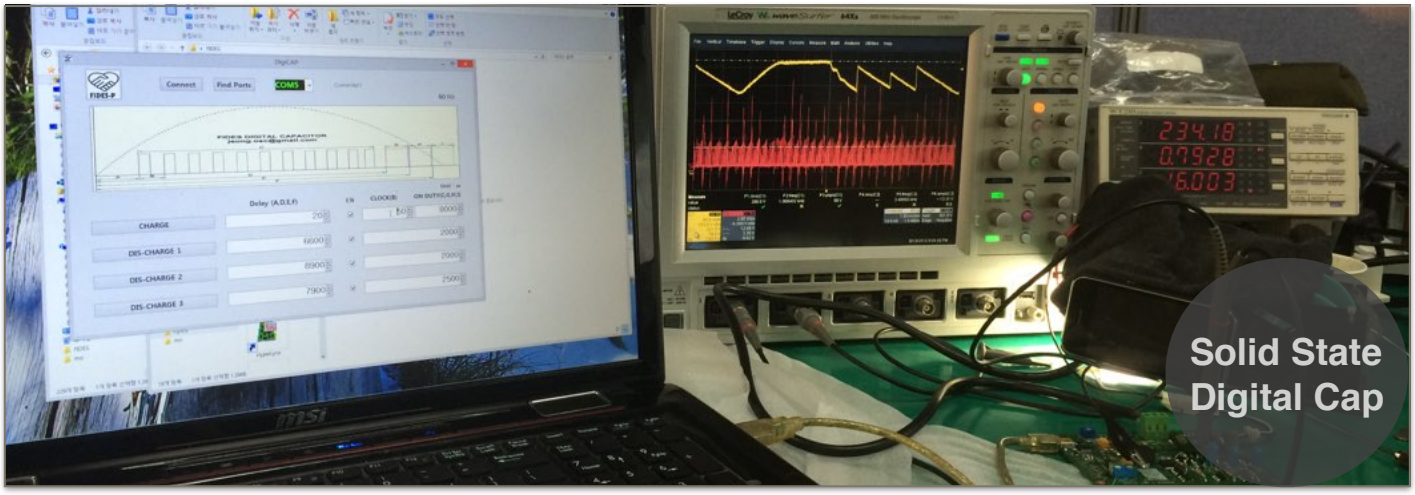
September 2016

FIDES-P6

UHV Solid State Digital Capacitor substitute to Aluminum Electrolytic Capacitor

DIGITAL CAP



Novel Theory of Valley Fill Capacitor

Especially LED lighting markets are harsh reality of products reliability and sustainability with flicker problems. While AC-DC LED driver half-wave and full-wave rectification can deliver unidirectional current, neither produces a constant voltage.Producing steady DC from a rectified AC supply requires a smoothing circuit or filter. In its simplest form this can be just a reservoir capacitor or smoothing capacitor, placed at the DC output of the rectifier. There is still an AC ripple voltage component at the power supply frequency for a half-wave rectifier, twice that for full-wave, where the voltage is not completely smoothed. Electrolytic capacitors can evaporate through a temperature-dependent drying-out process, which causes electrical parameters to drift, limiting the service life time of the capacitors. High-amplitude ripple currents and temperature shorten the life of electrolytic capacitors.

When AC-DC rectifier DC output are unsuitable to application which need a “steady and smooth” DC supply voltage. Usually we used electrolytic aluminum capacitor.

The smoothing capacitor are DC voltage pulses from the rectifier charging up the capacitor to peak voltage reduce ripple output.

Disadvantages are weak of temperature and low PFC with big body size.

However, their are two important parameters to consider when choosing a suitable smoothing capacitor and there are its Working Voltage, which must be higher then the no load output value of the rectifier and its Capacitance Value, which determines the amount of ripple that will be appear superimposed in the top of the DC voltage.

But aluminum electrolytic capacitors have a limited life span in terms of reliability. This occurs because the electrolyte in the element eventually dissipates.

The changes in performance over time can be described as fellow:

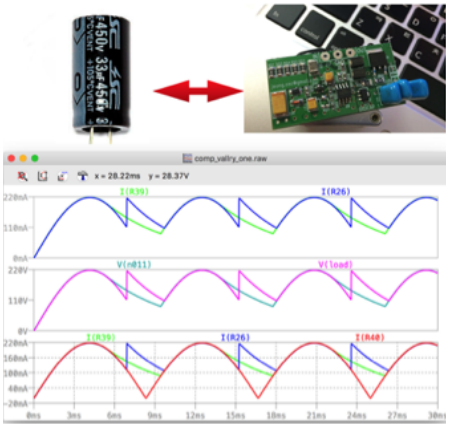
Eventually, the capacitance begins to drop off. The tangent of the loss handle begins to increase.

Generally, when voltages are applied, the leakage current begins to drop.

At the end of the life span, the capacitor enters an open-circuit mode as the dielectric dries up.

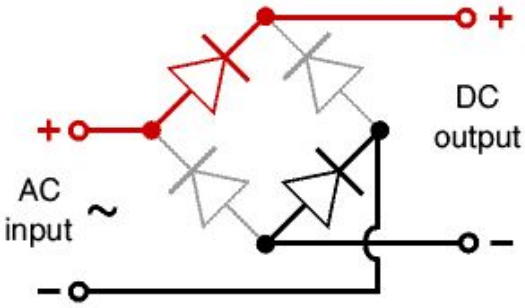
For every rise in operating temperature by 10degrees centigrade, the service life is shortened to on half, and double for every 10 degree drop(10degree 2 fold rule). Aluminum electrolytic capacitor life expectancy is limited as liquid electrolyte dries out over time and temperature.

Such a problems are increased to SMPS failure with lighting flickers to LED lights many claims.



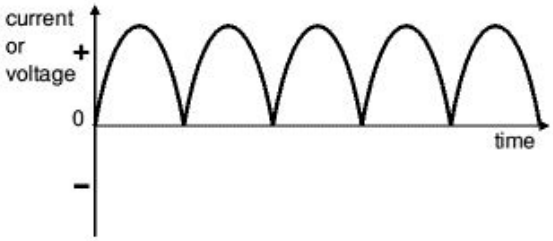
- Novel digital capacitor -

Digital Capacitor



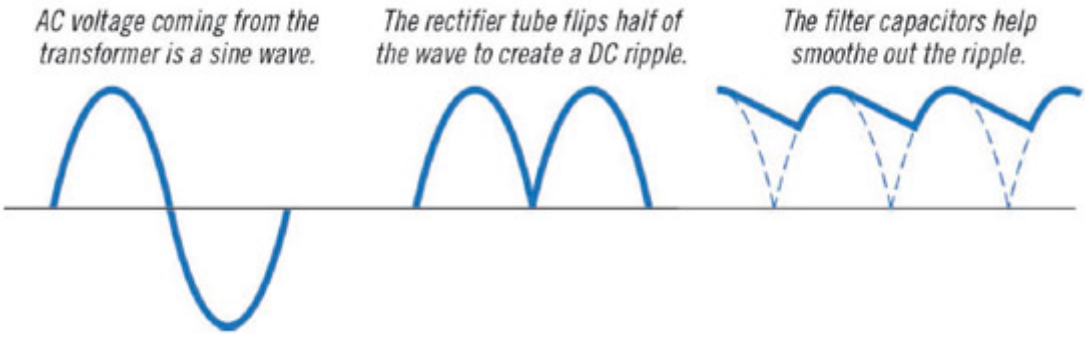
Bridge rectifier

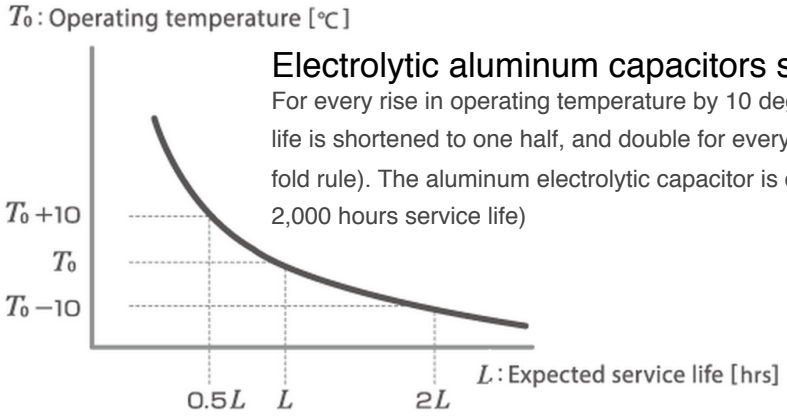
Alternate pairs of diodes conduct, changing over the connections so the alternating directions of AC are converted to the one direction of DC.



Output: full-wave varying DC

(using all the AC wave)

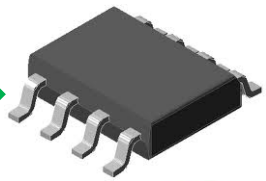




Electrolytic aluminum capacitors service life problem

For every rise in operating temperature by 10 degrees centigrade, the service life is shortened to one half, and double for every 10 degree drop(10 degree 2 fold rule). The aluminum electrolytic capacitor is commonly 85°C or 105°C 2,000 hours service life)

Substitution

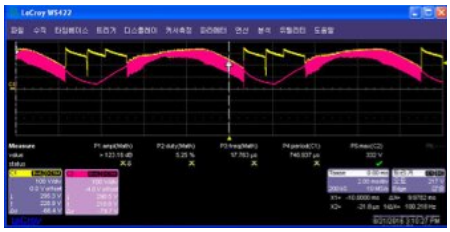


Benefits :

- Long service life MTBF
- Good PFC (Over 0.9)
- Strong thermal durability
- Small size

Evaluation

- Digital cap evaluation -



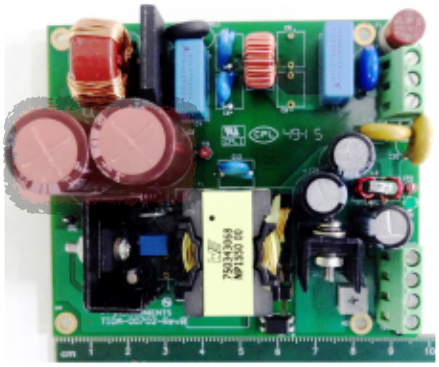
- Valley fill wave form of Digital cap evaluation -

Digital capacitor for substitute 25watts power consumption 33uF/450V electrolytic aluminum capacitor evaluation examples.

Summary and Features

When 230 VAC rectify unregulated DC voltage is applied, Fides-P6 circuit current flow in the small solid ceramic capacitor charge and discharge for valley fill works to smoothness high voltage DC and increase power factor.
When SMPS power over load condition also essentially reducing ripple and safety without a degradation of DC quality.
Also, benefits of no EMI 230 VAC.
When load DC voltage is disconnected, Fides-P6 automatically stopped discharges to the load. Also, over load condition will operation allows total flexibility in the discharge time change t the phase voltages dropped. Choice of the charge ceramic capacitor to optimiz differential mode EMI filtering and reduce inductor costs, with reduced second smooth capacitor capacitance to SMPS output stages.

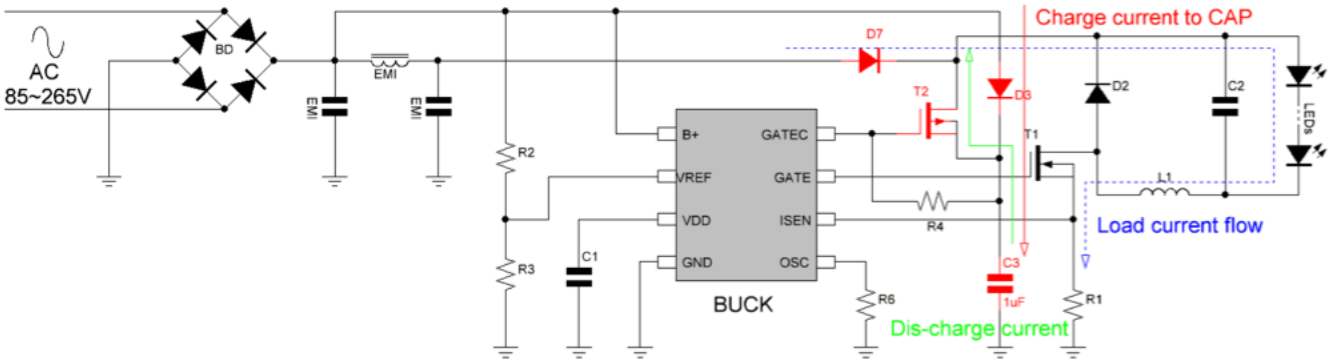
Fides-P6 solid power capacitor supports led drive design without electrolytic capacitor, used mainly for bulb, T8 lamp, PF value may reach the European standard EN 0.70, less peripheral elements, low price, long life span and space saving. Life is 20 times of the original LED drivers, the design life is as much as 100,000 hours or more, can be well matched with the life LED lamp, small size, only 15 percent of the original LED driver capacitors area. Products are mainly used in low to medium power lighting, suitable scope is 3W ~ 50W.



- Example of 60watt SMPS electrolytic aluminum condenser 80uF/450V x 2 -

ONE CHANNEL LED BUCK IC APPLICATION

UHV process for novel buck converter IC applications of non galvanic isolation driver for LED bulbs



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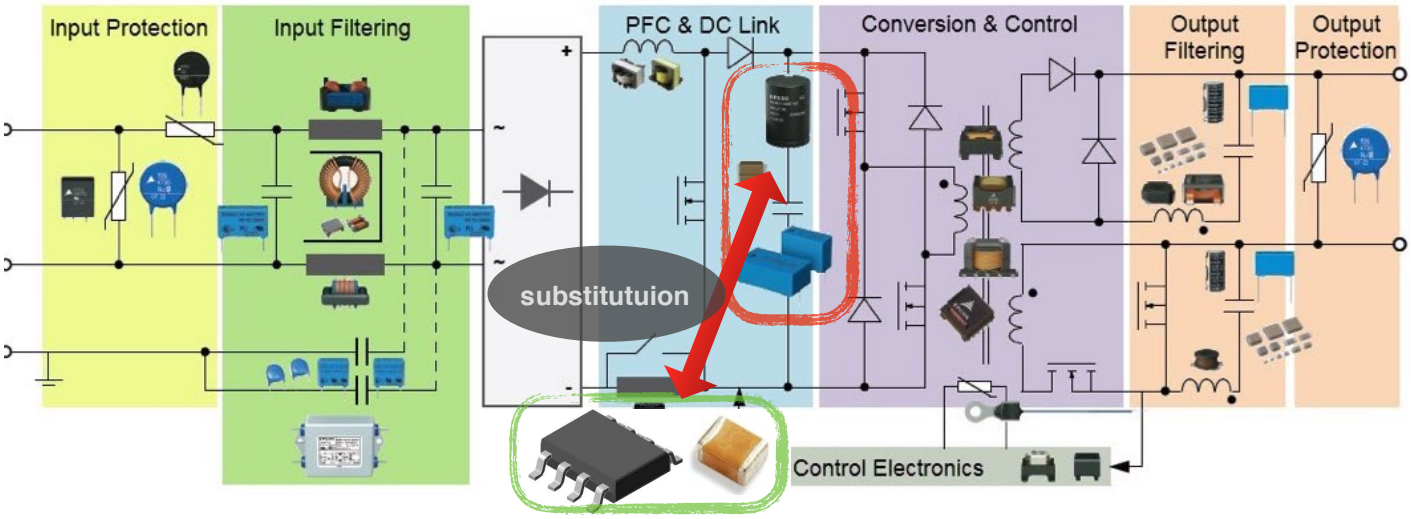
SMPS BLOCK



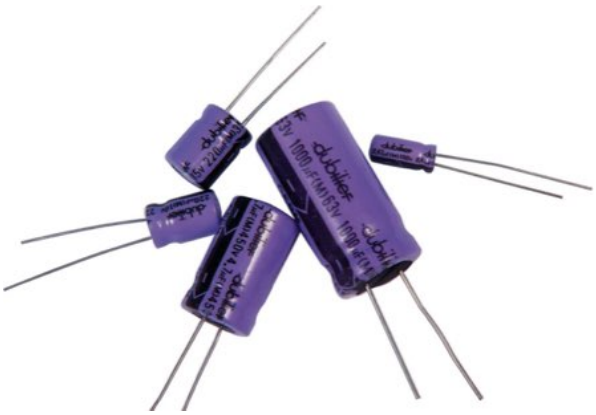
ALUMINUM ELECTROLYTIC CAPACITOR FAILURE

Fails open or shorted.

Aluminum Electrolytic Capacitors are low or high temperature environment are degradation capacitance with relatively shorter life spans.

Catastrophic explosive venting of aluminum electrolytic capacitor

- From Over-Voltage of capacitor
- From exceeding the Ripple Current Ration of a capacitor
  (May have the same effect as over voltage but it takes longer for the capacitor to overheat and vent.)
- From low temperature be frozen up (-20ºC)to failure makes burn SMPS.

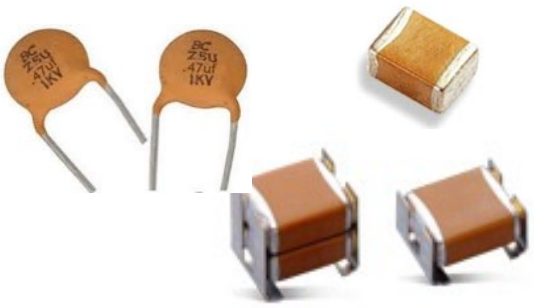


Aluminum Electrolytic Weaknesses

- Loose cap tolerance +-20%typical
- Limited high frequency <100Khz
- Limited current handling from high DF
- Perceived as less reliable due to wear out and explosion failures.
- Ripple current flow thru the ESR heats the capacitor and shortens its life.

Compared to Ceramic

- Cracking problem in large chip
- Good for AC and high frequency
- Max capacitance is 220uF but growing
- Good assemble in SMT



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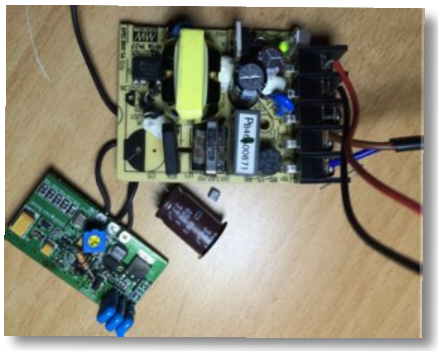
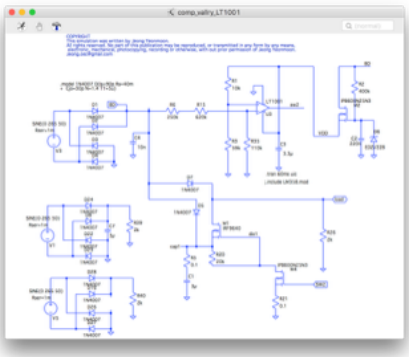
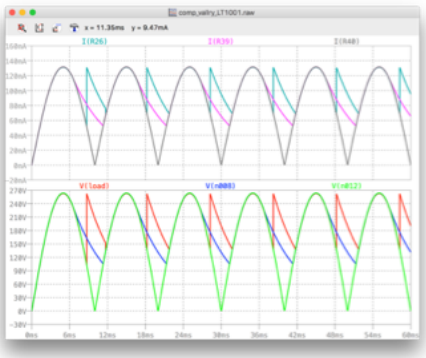
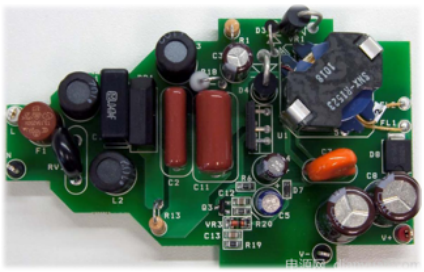
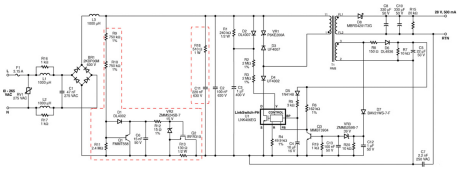
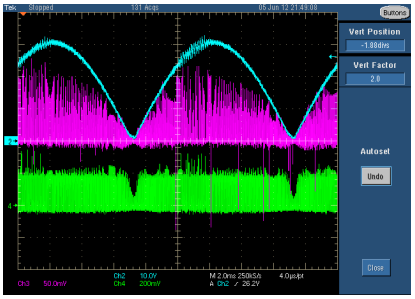
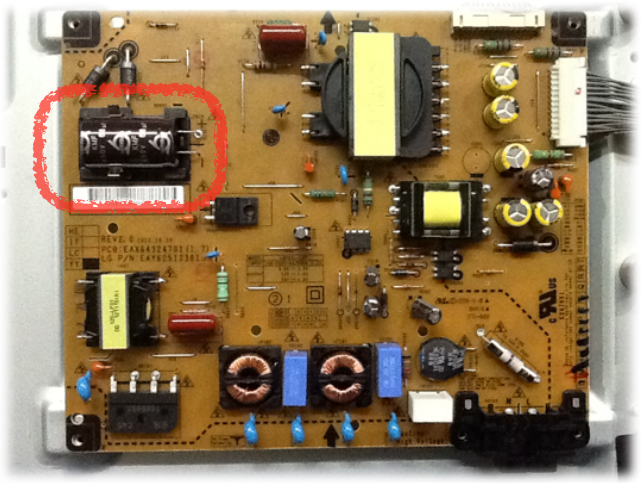
Demonstration video : https://youtu.be/Hfugb6z84zI

FIDES-P6 EVALUATION ; Compare with ordinary smooth filter DC ripple.

Examples of ordinary LNK406EG isolation type LED driver

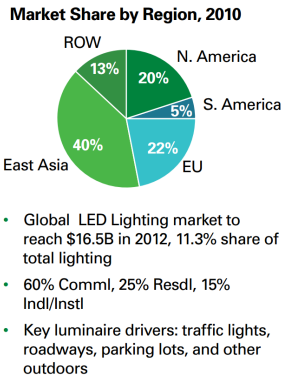


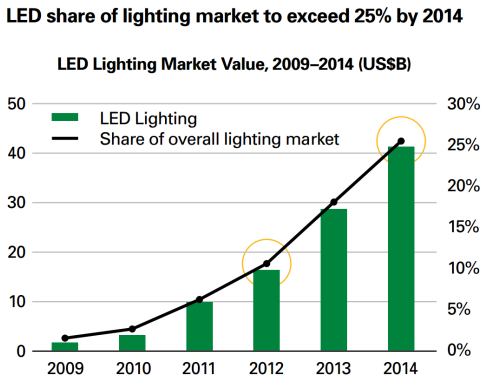
LG TV 32inch SMPS TOP side

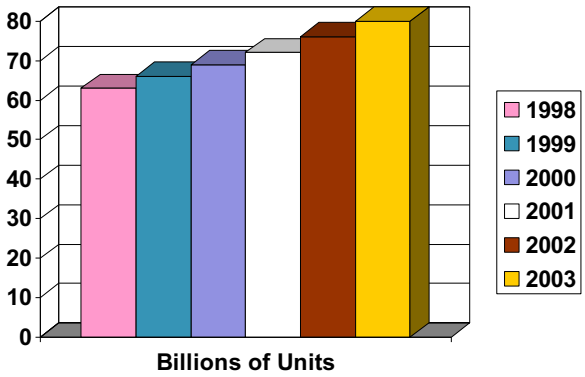
High voltage solid states digital capacitor

Reliability, Availability, Maintain free and durability technology provides tangible benefits for 100,000 hours life cycles.

Electronic Appliance Example	LED Lighting	TV, Monitor	Phone Charger	PC, Notebook
				







Worldwide Unit Shipment Forecast of Aluminum Electrolytic Capacitor Market

The first LED lamps were introduced in the late 1990s. Since then, the unit costs have been steadily declining by double-digit percentages, making LED lighting technology viable for commercial, industrial and outdoor lighting applications. In addition, large strides have been made in improving the efficiency, lumen output and performance of LED lights. The global LED lighting market is estimated to be $16B in 2012 and expected to reach nearly $40B by 2014 (Figure 1). The US market CAGR for commercial and outdoor LED lighting alone is expected to grow 26-30% through 2016.
Aluminum electrolytic capacitors are 20% of the 11⁄2 billion dollar North American market for capacitors, and aluminum electrolytic sales are up about 40% over 2009, an admittedly bad year. The North American consumption of aluminum electrolytic capacitors is only 4.3% of the world market.

SPECIAL CONSIDERATIONS

Now a day, AC to DC power converter likes conventional fly-back technology SMPS are Power Factor (PFC) controllers and PFC-PWM combo controllers offer cost and energy saving solutions that address the demanding requirements of a diverse range of medium and high power Switch Mode Power Supply (SMPS) designs. But aluminum electrolytic capacitor makes decrease efficiency and life time failure.

FIDES-topologies are only one of solution of non electrolytic aluminum capacitor with increase efficiency by full solid states high voltage digital capacitor with innovated absolute standby zero function power supply integrated circuit are allow the use of smaller external components helping to minimize board size and cost depreciation.
This technology can provide ideally makes an epoch-making free ripple and is sustainable.

When a general lighting system requires a lot of power, then the first power-conversion stage, the AC-DC stage, gets integrated. That's because while it's a long way from the LEDs, the U.S. Department of Energy (DoE) and the European Union have made it clear that they want it to exhibit a very clean power factor, which is difficult because of that drawbacks of thermal damaged aluminum electrolytic capacitor on the output of the rectifier bridge.

This is approached in different ways. The EU's IEC61000-3-2 specifies acceptable levels for the first 32 harmonics of the ac line frequency, while the DoE's Energy Star program (which is voluntary but enforced by the buying power of the U.S. government) specifies a power factor of at least 0.7. On top of that, real customers for general lighting applications demand a minimum power factor of 0.9, so that's what designers aim for.

That in turn requires a somewhat sophisticated fly-back topology for the first stage, with operation in critical conduction mode. Subsequent stages of switching regulation, buck, boost, or buck/boost support a final stage that provides the drive to the string or parallel strings of LEDs. This is generally a switcher also.
Alternatively, it is possible to use this dis-charged energy at near by zero cross moments regulations, which makes it less expensive to achieve the required overall efficiency. The output stage, in that case, could be designed to supply the full stable currents to small capacitances needed by the 100Hz or 120Hz currents valley while dissipating less than a volt in its own passive capacitors.

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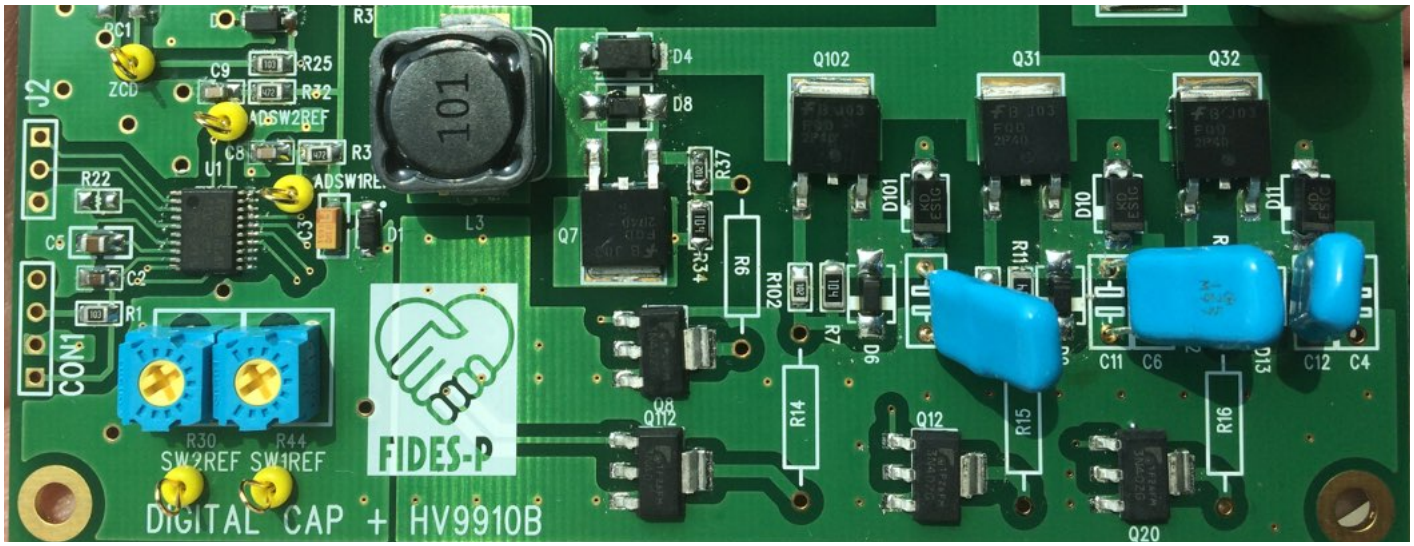
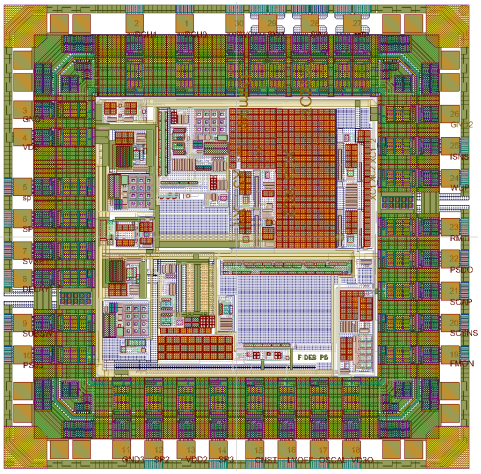


FIDES AC-DC Power

Reliable novel circuit theory based technology.



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