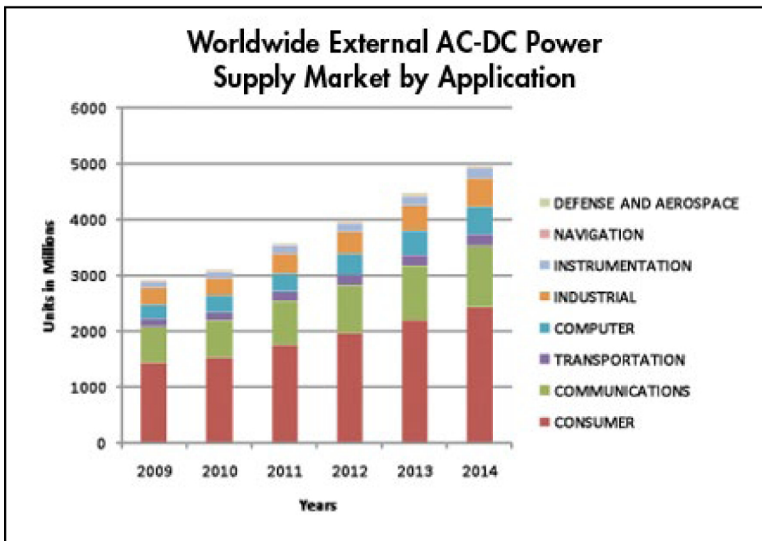


## Achieve ultra-low standby power ratings without design compromises

### Strong Demand for External AC-DC Power Supplies



The demand for AC-DC external power supplies is projected to increase from just over 3 billion units in 2010 to 4.97 billion units in 2014, a 60% increase in just four years. While this expansion is expected in all power ranges, a key growth area will be communications, driven by mobile phones.

Further, consider the potential impact of America using battery chargers that follow Energy Star guidelines, which are 35% more efficient than conventional models. That one change would save more than 2 billion kilowatt hours (kWh) of energy and \$200 million annually while preventing the release of more than two million tons of greenhouse gas emissions - equivalent to the emissions of 300,000 cars.

The worldwide demand for AC-DC power supplies is expected to grow 60% in 4 years. Source: Selantek Power Report 2010.

These growth numbers are also indicators of the scope of the problems associated with reducing standby power consumption. On one level the growth in external power supplies is a proxy for the growth in the appliances and electronic equipment segments that populate more homes and offices worldwide. On another level, consider that the single biggest application for power adapters—cell phone chargers—typically sit plugged in and unused for 20 hours a day, wasting energy that entire time.

### Energy Waste in Consumer Electronics

Standby power is electricity used by appliances and equipment while they are switched off or not performing their primary function. Almost any product with an external power supply, remote control function, constant display (LED clock for example) or that charges batteries will draw power continuously. A typical American home has 40 products constantly drawing power (standby power). Together these amount to almost 10% of residential electricity use, or about \$220 per year. Figures for most developed countries also show 5% to 10% of power consumption going to standby power.

When you look at the cumulative data, the scope of the situation is more dramatic. In the US the collective bill for standby power usage now exceeds \$4 billion annually. Altogether (offices and homes) standby power use is roughly responsible for 1% of the global CO2 emissions. Further, experts agree that a majority of standby power consumption can be eliminated with regulatory policies, smart engineering and changes in personal habits.

Is overall standby power growing or shrinking? Experts believe it is growing. Despite the regulatory and technology efforts to reduce standby power, the absolute increase in the number of appliances and equipment that constantly draw power continues, especially in developing countries.

## Energy Regulations are Evolving

Regional regulatory agencies have been actively involved in setting standards and guidelines for energy efficiency for equipment in both active mode and in standby. These include:

- CECP (China Energy Conservation Program)
- ENERGY STAR
- EUP and the EU Ecodesign concept

While some variations exist in specifications and enforcement dates from region to region, in general the current guidelines call for the no-load (standby) power consumption of external AC-DC power supplies to be:

- 300 mW (0.30 W) for supplies rated up to 50 W
- 500 mW (0.50 W) for supplies rated from 51 W to 250 W

While more stringent standards are expected to be in place in the next two years, some applications have been preceding at a faster pace. For example, most notebook computers and LCD monitors are now shipping with <100 mW of standby power consumption. And, LCD TV manufacturers are now asking for 30 mW standby performance.

## Business and Technical Challenges for Standby Power Solutions

For leading electronic equipment brands, they see energy savings and environmental responsibility as competitive advantages. Given that price is also a market driver, these manufacturers may forgo the lowest standby power ratings if the cost of the power supplies are too high. Thus power semiconductor solutions that require additional components and add cost to the BOM (Bill of Materials) are at a competitive disadvantage.

For semiconductor companies like Fairchild, the technical challenges to accomplish ultra-low standby with the fewest possible components are not trivial. There are multiple sources of power loss in the standby/no-load condition, and it requires multiple technologies to address them all. Consider these examples:

- By leveraging up to a 700V JFET fabrication process, Fairchild can cut off the current path after the device is turned on so that start-up resistor losses are eliminated.
- It is known that MOSFET switching losses can be addressed by reducing the switching frequency at light loads and operating in burst mode. Fairchild has taken this one step further by using an innovative technology that reduces numerous losses in both the Power MOSFET and the PWM IC in the same part of the design, at the same time.
- For adapters larger than 15 W range, an X-capacitor is needed to suppress EMI. This necessitates a bleeding resistor to safely discharge high voltage energy. Fairchild offers a patented circuit technology including a 700 V MOSFET to eliminate this resistor and the resultant power loss within the primary power IC. Other companies have only been able to solve this problem by requiring one or more additional circuits.
- Secondary side regulation circuits are used to provide feedback control functions. Fairchild has patented a primary side regulation (PSR) technology that not only reduces feedback losses, but that also further reduces losses in the Power IC.

While various process, circuit and packaging advantages can reduce aspects of standby consumption, the real breakthroughs are possible only when all these forms of technologies can be leveraged at the same time to meet those never-before-possible standby specifications being requested by leading equipment brands.



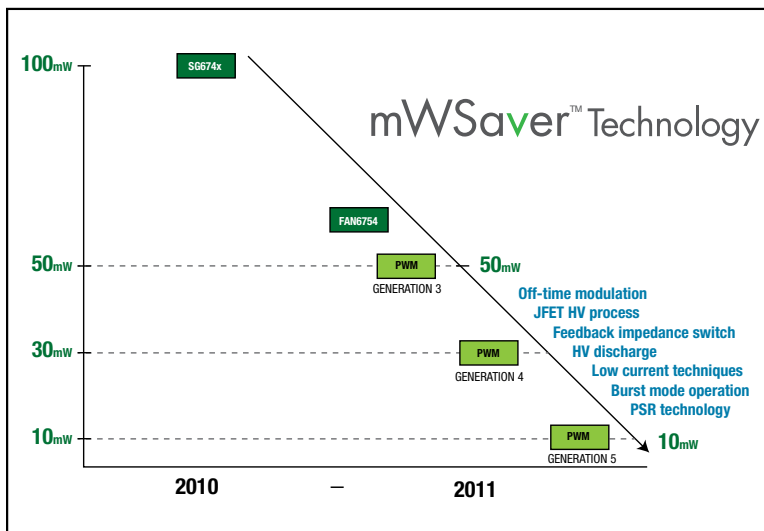
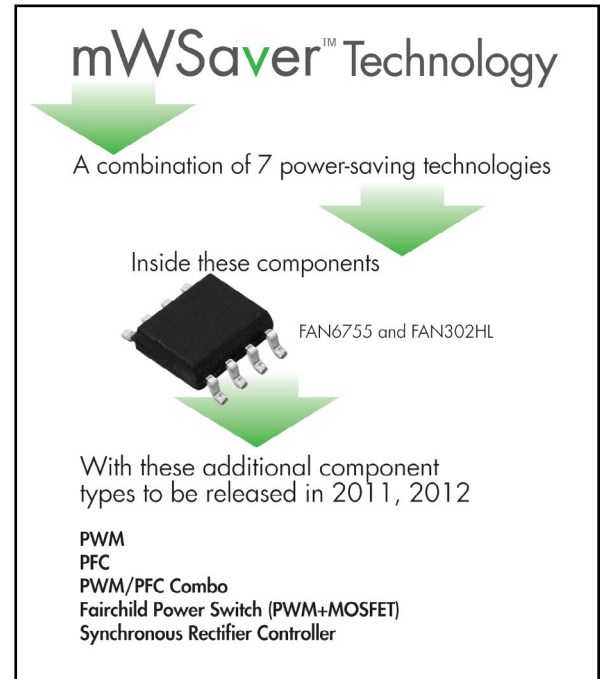
## Fairchild's mWSaver™ Technology Solution

mWSaver™ is the name Fairchild is giving to an optimized combination of process and circuit technologies that will be embedded in key power adapter components. These power innovations include 5 patented technologies (off time modulation, JFET HV start-up circuit, feedback impedance switch, HV discharge, and PSR control); as well as burst mode operation and low quiescent current techniques.

Initially implemented in the FAN6755 PWM to provide power ratings below 50 mW, mWSaver™ technology is also embedded in the new FAN302HL PWM, which offers an industry-best 10 mW standby for 15 W adapters and below. Additional "green" SMPS ICs will be released throughout 2011 and 2012. Included will be other PWMs, PFC, PFC/PWM combo controller, Fairchild Power Switch (PWM + MOSFET) and a Synchronous Rectifier controller. These will enable the ultra-low standby power ratings in demand for various adapter power ranges.

All components with the mWSaver™ brand designation will feature:

- The industry's lowest standby/no-load power consumption per component
- The ability to lower power dissipation for external components, such as resistors, capacitors, inductors and rectifiers
- Excellent efficiency ratings at full load
- The ability to exceed all no-load regulatory requirements worldwide
- A reduced BOM and lower overall system costs by eliminating the need for additional circuits and components, while integrating protection functions like brownout, under-voltage lockout (ULVO), over-voltage protection (OVP), open-loop protection (OLP) and over-temperature protection (OTP).



Reduction of standby power loss with mWSaver technology embedded in Fairchild's new PWM controllers.

For power supply manufacturers, mWSaver™ technology means the end of compromises. They can get the ultra-low standby power performance their customers want, while eliminating components, and lowering the cost of the BOM. And for society as a whole, it means a noteworthy step forward to further reduce energy losses, prevent the unnecessary consumption of natural resources, and to enable a cleaner environment.

Designers can download datasheets at <http://www.fairchildsemi.com/pf/FA/FAN302HL.html>



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## PRODUCTS

## APPLICATIONS

## DESIGN SUPPORT

## ABOUT FAIRCHILD

### POWER MANAGEMENT

#### Power Factor Correction

- Continuous Conduction Mode (CCM) PFC Controllers
- Critical/Boundary Conduction Mode (CrCM/BCM) PFC Controllers
- Interleaved PFC Controllers
- PFC + PWM Combination (Combo) Controllers

#### Off-Line and Isolated DC-DC

- Flyback & Forward PWM Controllers
- Flyback & Forward PWM Controllers with Integrated MOSFET
- LLC Resonant & Asymmetric Half Bridge PWM Controllers
- LLC Resonant & Asymmetric Half Bridge PWM Controllers with Integrated MOSFETs
- Primary-Side Regulation CV/CC Controllers
- Primary-Side Regulation CV/CC Controllers with Integrated MOSFET
- Standard PWM Controllers
- Supervisory/Monitor ICs
- Synchronous Rectifier Controllers

#### Non-Isolated DC-DC

- Charge-Pump Converters
- DrMOS FET plus Driver Multi-Chip Modules
- Multi-Phase Controllers
- Step-Down Controllers (External Switch)
- Step-Down Regulators, Non-Synchronous (Integrated Switch)
- Step-Down Regulators, Synchronous (Integrated Switch)
- Synchronous (Integrated Switch)
- Step-Up Regulators (Integrated Switch)

#### MOSFET & IGBT Gate Drivers

- 3-Phase Drivers
- Half-Bridge Drivers
- High- & Low-Side Drivers
- High-Side Drivers
- Low-Side Drivers
- Synchronous Rectifier Drivers

#### Voltage Regulators

- LDOs
- Positive Voltage Linear Regulators
- Negative Voltage Linear Regulators
- Shunt Regulators

#### Motion Control

- BLDC/PMSM Controller
- Motion-SPM™ (Smart Power Modules)
- PFC SPM® (Smart Power Modules)

#### Diodes & Rectifiers

- Bridge Rectifiers
- Circuit Protection & Transient Voltage Suppressors (TVS)
- Rectifiers
- Schottky Diodes & Rectifiers
- Small Signal Diodes
- Zener Diodes

#### IGBTs

- Discrete IGBTs
- Ignition IGBTs

#### MOSFETs

- Discrete MOSFETs
- Level-Shifted Load Switches
- MOSFET/Schottky Combos

#### Transistors

- BJTs
- Darlingtons
- Digital/Bias-Resistor Transistors
- JFETs
- RF Transistors
- Small Signal Transistors

#### Advanced Load Switches

- Advanced Current Limited Load Switches
- Slew Rate Controlled Load Switches

#### Battery Management

- Battery Charger ICs
- Current Sensing

#### Ground Fault Interrupt (GFI) Controllers

#### SIGNAL PATH ICs

##### Amplifiers & Comparators

- Comparators
- Current Sensing
- Operational Amplifiers

##### Battery Protection ICs

##### Interface

- LVDS
- Serializers/Deserializers (µSerDes™)
- USB Transceivers

##### Signal Conditioning

- Video Filter Drivers
- Video Switch Matrix/Multiplexers

##### Signaling, Sensing & Timing

##### Switches

- Analog/Audio Switches
- Bus Switches
- Camera Switches
- Multimedia Switches
- USB Switches
- Video Switches

### OPTOELECTRONICS

#### High Performance Optocouplers

- Low Voltage, High Performance
- High Speed Logic Gate
- High Performance Transistor
- IGBT/MOSFET Gate Drivers
- Specific Function

#### Infrared

- Emitting Diodes
- Photo Sensors
- Reflective Sensors
- Optical Interrupt Switches

#### Phototransistor Optocouplers

- Isolated Error Amplifier
- Phototransistor Output - DC Sensing Input
- Phototransistor Output - AC Sensing Input
- Photo Darlington Output

#### Solid State Relay Optocouplers

- Solid State Relay

#### TRIAC Driver Optocouplers

- Random Phase TRIAC Driver
- Zero Crossing TRIAC Driver

### LIGHTING ICs

- CCFL Inverter ICs
- CFL ICs
- LFL ICs
- HID Lamp ICs
- LED Lighting ICs
- Portable LED Drivers

### LOGIC

- Buffers, Drivers, Transceivers
- Flip Flops, Latches, Registers
- Gates
- MSI Functions
- Multiplexer/Demultiplexer Encoders/Decoders
- Specialty Logic
- TinyLogic®
- Voltage Level Translators

### AUTOMOTIVE PRODUCTS

- Automotive Power Modules

#### Discrete Power

- Ignition IGBTs
- IGBTs
- N-Channel MOSFETs
- P-Channel MOSFETs
- Rectifiers

#### Automotive High Voltage Gate Drivers (HVICs)