



LED Lighting Solutions

High-performance products for commercial/industrial lighting



fairchildsemi.com/lighting

Introduction

Combined with innovative technologies and system expertise, Fairchild’s scalable lighting solutions help eliminate design complexities, meet the highest lighting quality standards, and enable smart controls.

Commercial and Industrial Lighting Solutions

The global demand for highly efficient LED products continues to grow dramatically as LEDs are now the preferred lighting source for nearly every lighting system.

LED lighting applications present complex design challenges. Requirements such as input and output voltage-current tolerance, safety and worldwide government agency requirements, thermal performance affecting reliability and system lifetime, smallest PCB footprint, and the need to meet time-to-market deadlines must all be addressed simultaneously.

In addition, scalability and integrating smart controls are now emerging as key requirements for designers.

Scalability

Designers are looking for scalable solutions that still maintain high PF and low THD. Scalability is achieved by varying the number of LEDs or adjusting the current with the dimming input. Fairchild provides products that offer scalability in both wattage and form factor, enabling fewer design complexities, lower cost, and quicker time-to-market.

Integrated Smart Control

LED lights are more than a replacement upgrade to an existing light source. Solutions need to include high-resolution dimming controls, sensors, efficient power solutions to the control and sensing elements, and wired or wireless interfaces. The resulting smart lighting systems can enable management of connected lighting solutions for optimum energy savings, as well as tailor to individual lighting preferences.

Fairchild’s new solutions cover the full range of power levels for demanding lighting applications.

- <20W Commercial: tube lighting, display lighting, down lights (standard and phase-cut dimmable)
- <60W Commercial: down lights, flat lighting, panel lights, troffers
- >60W Industrial: flood lights, bay lights, street lights

Our expanding product portfolio includes AC-DC LED controllers (single- and two-stage), Direct AC Drive controllers, low-side and high-voltage gate drivers, PFC+PWM combination controllers, mid- and high-voltage MOSFETs, phototransistors, and diodes.

Fairchild does more to help engineers complete their designs. We offer reference designs, application notes, tutorials, design tools, evaluation boards and technical expertise and support. Visit fairchildsemi.com/lighting to learn how you can simplify your LED challenges.

Featured Products

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FL7733A Single-Stage PSR LED Controller with PFC

Description

This highly integrated PWM controller with an advanced Primary-Side Regulation (PSR) technique provides features to enhance the performance of low- to mid-power LED lighting converters. The FL7733A LED driver is designed with minimum system components while the LED current is accurately controlled by Fairchild's TRUECURRENT® technique and improved feedback loop control. Constant Current (CC) tolerance less than $\pm 1\%$ over the universal line voltage range meets the requirement of highly reliable LED brightness management.

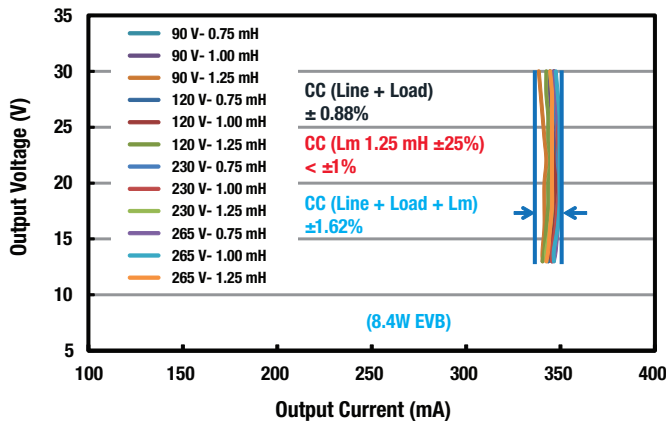
By minimizing the turn-on time fluctuation, high power factor, and low THD, $<10\%$ THD over the universal line range can be obtained. An integrated high-voltage start-up circuit implements fast start-up and high system efficiency. During start-up, the adaptive feedback loop control anticipates the steady-state condition and sets the initial feedback condition close to the steady state to ensure there is no overshoot or undershoot of the LED current.

Design Advantages

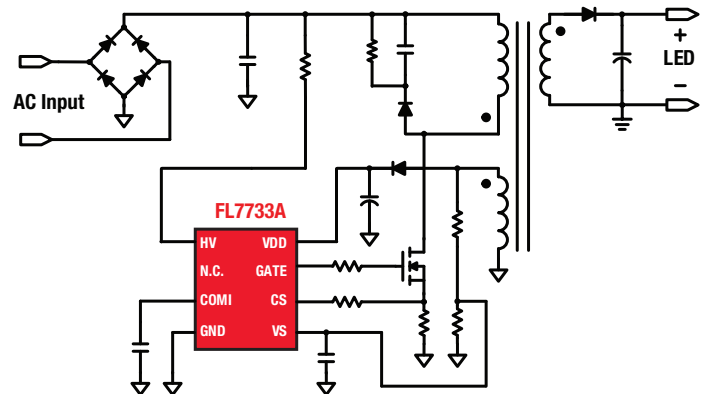
- Single-stage Primary-Side Regulation (PSR) design
- $\pm 1\%$ CC tolerance over line and load
- Better than $\pm 3\%$ CC total tolerance for uniform luminous intensity for the same SSL designs
- High PF, low THD ($>0.9/ <10\%$ over universal input)
- Ultra-wide V_{OUT} range: down to below 10% of max. V_{OUT} for high compatibility with LED modules
- High power driving capability: 5W to $>60W$
- Fast <200 ms start-up (@85 VAC) with internal start-up JFET
- No overshoot or undershoot with steady state prediction
- Includes LED short protection, LED open protection, output diode short protection, RCS short and open protections, and over temperature protection (TSD)

Applications

- Non-phase-cut dimming lighting from 5W to 60W, including A19 bulbs, PAR30/38 bulbs, down lights, flat lights, indoor/outdoor lights



Accurate CC Tolerance of $\pm 1\%$ Over Line and Load



Application Schematic Example

For a complete product overview please visit: fairchildsemi.com/FL7733A

FL7734 Phase-Cut Dimmable Single-Stage PSR LED Controller with PFC

Description

The FL7734 is a highly integrated PWM controller with an advanced Primary-Side-Regulation (PSR) technique to minimize components and enable design with tight Constant Current (CC) tolerance in low-power LED lighting solutions.

The controller can operate with all types of phase-cut dimmers. Fairchild's proprietary active dimmer-control technology achieves smooth and excellent dimmer compatibility without visible flicker, even at a low-power levels and higher input voltages.

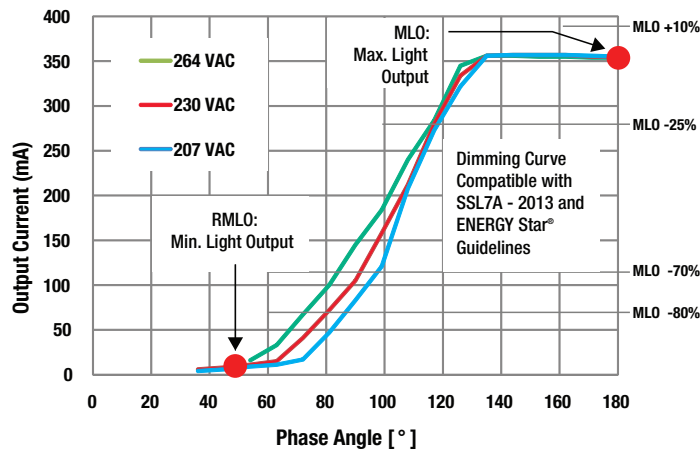
The FL7734 also optimizes the power factor and THD by enabling linear frequency and voltage mode control based on DCM.

Design Advantages

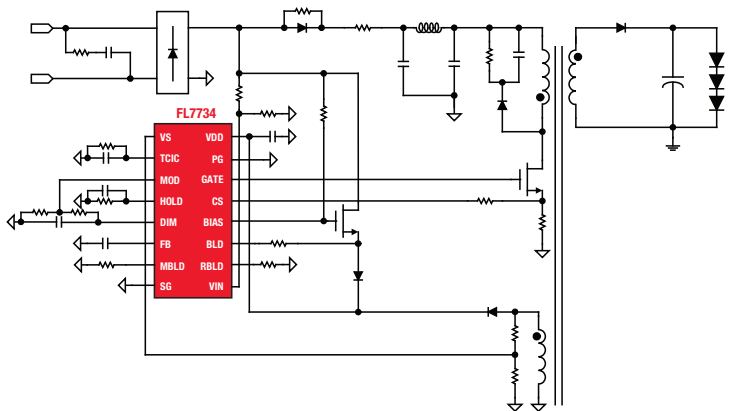
- Universal input voltage range from 90 VAC to 305 VAC
- Excellent dimmer compatibility performance with internal active dimming control
- Controllable dimming curve for NEMA SSL 7A-2013 compliance
- Wide range operation from 5W to >50W
- High PF, low THD (>0.9/<20% over universal input)
- Fast <300 ms start-up time even at low dimming angles
- Better than $\pm 3\%$ Constant Current (CC) tolerance for uniform luminous intensity for the same SSL designs
- Includes LED short protection, LED open protection, output diode short protection, RCS short and open protections, and over temperature protection (TSD)

Applications

- Phase-cut dimming lighting from 5W to 50W, including A19 bulbs, PAR30/38 bulbs, down lights, flat lights, indoor/outdoor lights



Dimming Regulation Compliance



FL7734 Solution with the Lowest BOM Count

For a complete product overview please visit: fairchildsemi.com/FL77334

FL7921R Integrated Critical Mode PFC and Quasi-Resonant Flyback Lighting Controller

Description

The highly integrated FL7921R combines a Power Factor Correction (PFC) controller and a quasi-resonant PWM controller. Integration provides a cost-effective LED lighting design and allows for fewer external components.

For the PFC, the FL7921R uses a controlled on-time technique to provide a regulated DC output voltage and perform a natural power factor correction. An innovative THD optimizer reduces the input current distortion at zero-crossing duration to improve THD performance. The PFC function is always on regardless of the PWM stage load condition to ensure that high PF can be achieved at light load conditions.

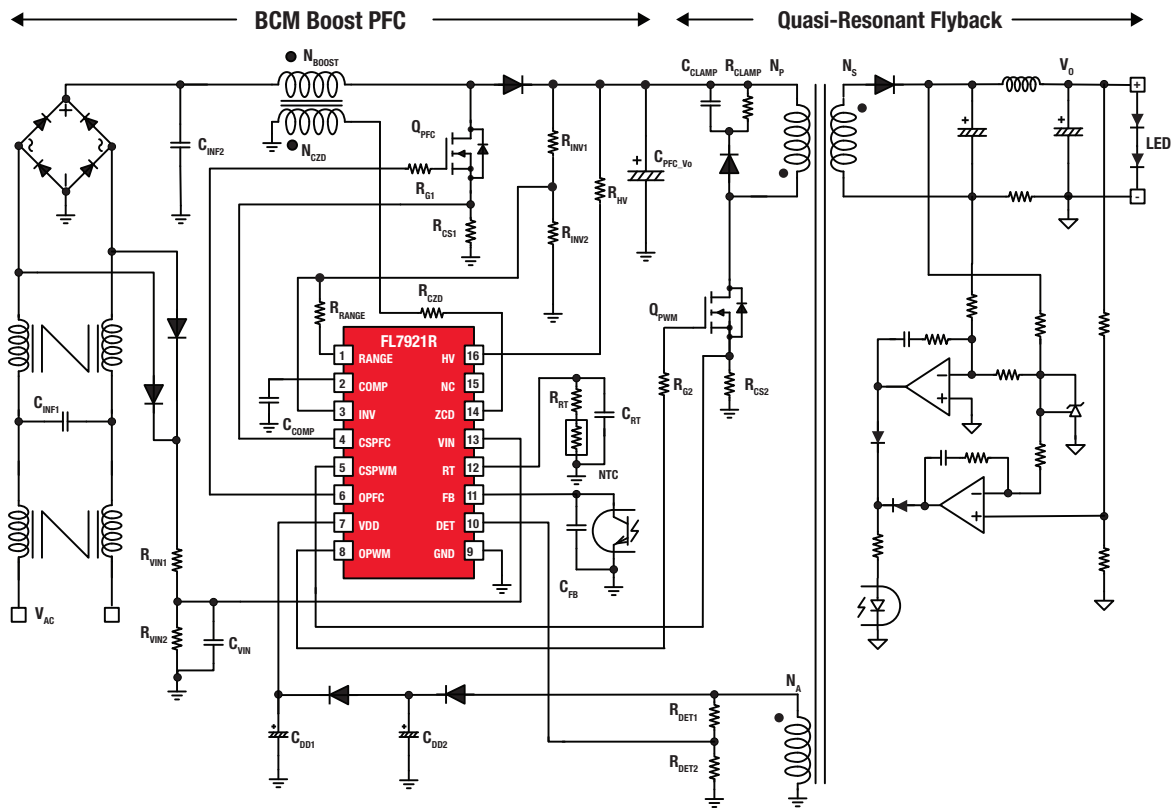
For the PWM, the FL7921R provides several functions to enhance the power system performance: valley detection, green-mode operation, and high/low line over-power compensation.

Design Advantages

- Integrated PFC and Flyback LED lighting controller
- High lighting system efficiency through Zero-Current Detection for PFC stage and Quasi-Resonant operation for PWM stage
- Maintains high PF at light load condition ideally suited for LED ballast applications
- Brown in and out protection
- High/low line over-power compensation
- Auto recovery over-current, open-loop, and over-temperature protections
- Adjustable over-temperature with external NTC through the RT pin
- Auto recovery VDD pin and output voltage OVP

Applications

- Mid- to high-power LED lighting driver applications



FL7921R Solution for High-Performance LED Drivers

For a complete product overview please visit: fairchildsemi.com/FL7921R

FL73282 900V High- and Low-Side Gate Driver

Description

The FL73282, a monolithic high- and low-side gate driver IC, can drive MOSFETs and IGBTs that operate up to +900V. Fairchild's high-voltage process and common mode noise canceling technique provides stable operation of the high-side driver under high dV/dt noise circumstances.

An advanced level-shift circuit allows a high-side gate driver operation up to $V_S = -9.8V$ (typical) for $V_{BS} = 15V$. The input logic level is compatible with standard TTL-series logic gates. UVLO circuits for both channels prevent malfunction when V_{CC} or V_{BS} is lower than the specified threshold voltage. Output drivers typically source/sink 350 mA/650 mA.

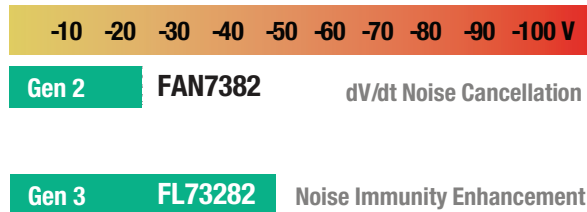
Design Advantages

- Excellent noise immunity - innovative common-mode dV/dt noise canceling circuit
- Allowable negative V_S swings of up to $-9.8V$ (at $V_{BS} = 15V$)
- Lowest temperature dependency achieved by optimizing the internal circuit design
- TTL compatible input logic threshold levels
- Topology applications cover high-side bucks, synchronous bucks, half-bridge gate drivers, and resonant LLC controllers

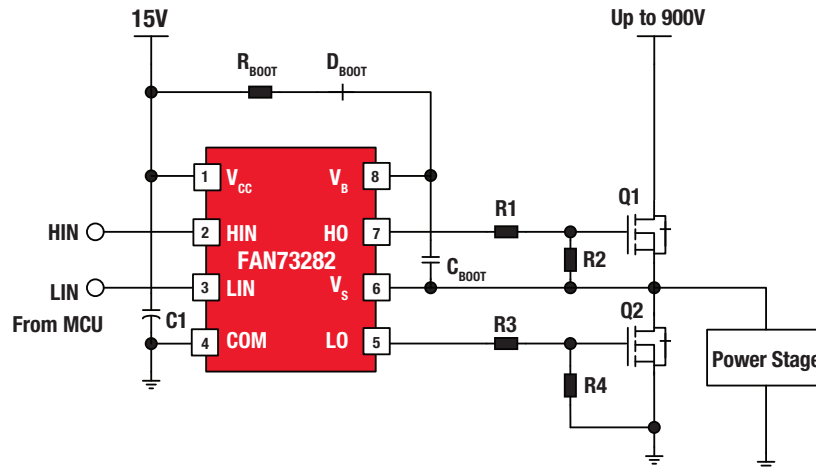
Applications

- Commercial and industrial three-phase input voltage LED lamp drivers, fluorescent lamp ballasts, and HID lamp ballasts

Negative V_S Noise Single Pulse Test with 50ns PW



Fairchild high-voltage gate driver ICs (HVICs) have strong robustness for V_S peak noise voltages without abnormal operation, being latched, or being damaged



FL73282 as the Buffer Stage Between the MCU and the Power Stage in a Digitally-Controlled Lighting Solution

For a complete product overview please visit: fairchildsemi.com/FL73282

FL779xx Direct AC Drive Family

Description

Fairchild's new LED Direct AC Drive family provides cost-effective integrated circuit solutions that enable phase-cut dimming, analog dimming, and PWM dimming capabilities for smart commercial lighting applications. Compared to other lighting solutions, these Direct AC Drive products enable customers to design with smaller and low-cost solutions that are easier to implement.

The FL779xx family provides solid-state lighting solutions that have smaller form factors, high performance, scalable power, and longer system lifetimes. These solutions can scale power from 12W to 120W, reducing the number of different ICs that customers need to have in their inventory. Unlike SMPS solutions, these drivers do not need magnetic components and electrolytic caps, enabling them to fit into tight spaces and increase system lifetimes. They can also be tuned for low flicker without compromising the PF and THD performance. Customers can evaluate Direct AC Drive solutions with available reference design boards.

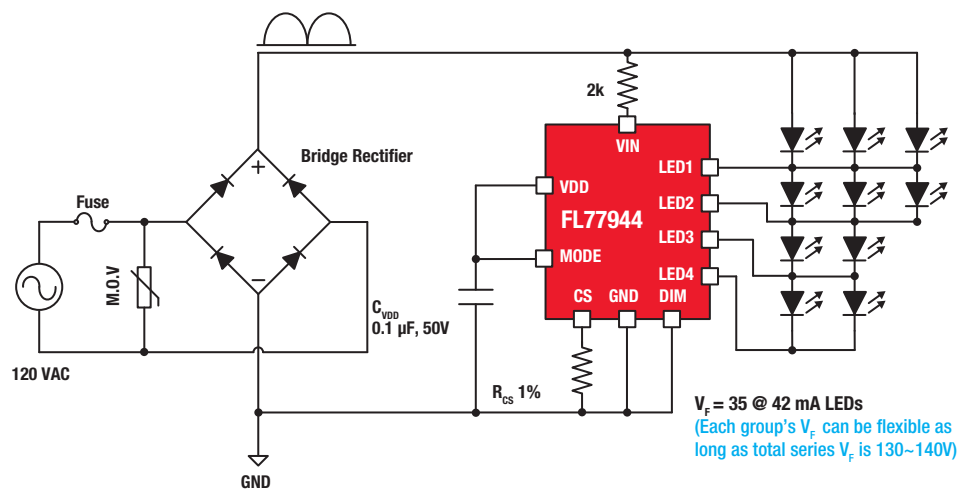
Design Advantages

- Lower cost of ownership and smaller footprint
- Reduced BOM increases reliability
- High PF (>0.9), low THD (<20%)
- Excellent EMI
- Phase-cut dimming
- Analog and PWM dimming
- Supports smart lighting system controls
- High quality of light
- Flexible LED configuration

Applications

- Down lights
- High bay lights
- Troffers
- Street lights, tunnel lights, and other outdoor lighting

Part #	Description	Analog and PWM Dimming	Taps	Max Power Ratings (at 120 VAC)
FL77904	Compact LED Direct AC Driver	—	4	9W
FL77905	Analog/PWM Dimmable Compact LED Direct AC Driver	✓	3	9W
FL77944	Analog/PWM Dimmable High Power LED Direct AC Driver	✓	4	18W



Down Light 12W LED Driver Using FL77944

For a complete product overview please visit: fairchildsemi.com/dacd

Lighting Solutions

Controllers Controller + Switch Switch

Low Power (<20W)

Topology	PFC	PFC Switch	Control	Gate Driver	Primary-Side Switch
Single-stage with PFC	FL7701 (Buck, Analog Dimming) FL7733A (PSR Buck-Boost, Flyback, Analog Dimming)				HV Planar 250 ~ 800V SJ MOSFET 600 ~ 800V
Single-stage PFC + integrated FET	FLS0116 (Buck, Analog Dimming) *FL77904/05/44 (Direct AC Drive)				
Single-stage phase-cut dimming	FL7734 (PSR Buck-Boost, Flyback)				HV Planar 250 ~ 800V

Controllers Controller + Switch Switch

Mid Power (20 to 60W)

Topology	PFC	PFC Switch	Control	Gate Driver	Primary-Side Switch	Secondary-Side Switch
CC/CV single-stage	FL6961/FL7930C (SSR Buck-Boost, Flyback)				HV Planar 250 ~ 800V SJ MOSFET 600 ~ 800V	
CC single-stage with or without analog dimming	FL7733A (PSR Buck-Boost, Flyback)					
	*FL77904/05/44 (Direct AC Drive)					
Single-stage phase-cut dimming	FL7734 (PSR Buck-Boost, Flyback)					
	*FL77904/05/44 (Direct AC Drive)					
Two-stage with or without DC-DC control	MCU	HV Planar & SJ MOSFET 600V	MCU	FAN7380/2/3 *FL73282 *FL3100T		
	FL6961 FL7930C *FL7921R (Combo PFC)		FL6300A (QR Flyback) *FL7921R (Combo QR)	HV Planar 500 - 600V SJ MOSFET 600V	MV Trench 40 ~ 200V	

Controllers Controller + Switch Switch

High Power (>60W)

Topology	PFC	PFC Switch	Control	Gate Driver	Primary-Side Switch	Secondary-Side Switch
Two-stage with or without DC-DC control	MCU	HV Planar and SJ MOSFET 600V	MCU	FAN7380/2/3 *FL73282 *FL3100T	HV Planar 500 - 600V SJ MOSFET 600V	MV Trench 40 ~ 200V
	FL6961 FL7930C *FL7921R		FAN7631S (LLC Res. Half-Bridge)			
	FLS1600, FLS1700, FLS1800, FLS2100 (LLC Res. HB Switch)					
Single-stage with analog dimming	FL7733A (PSR Buck-Boost, Flyback)				HV Planar 250 ~ 800V SJ MOSFET 600 ~ 800V	
	*FL77904/05/44 (Direct AC Drive)					

*New Products

For more information on Fairchild lighting solutions, including reference designs, visit fairchildsemi.com/lighting

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