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Off-Line High PF Constant-Voltage Controller with Integrated Power MOSFET

1 Description

The iW3827 is a high-performance single-stage AC/DC constant voltage (CV) controller with high power factor (PF) correction. This device includes an internal power FET and operates in quasi-resonant mode to provide high efficiency along with a number of key built-in features while minimizing the external component count and lowering the total bill of material cost. It supports most commonly used isolated and non-isolated topologies including flyback, buck-boost, and buck. The device operates in constant on-time mode to achieve high power factor (> 0.9) across a wide load range. It can achieve excellent output voltage regulation over line and load variation without the need for a secondary feedback circuit. It also eliminates the need for external loop compensation while maintaining stability over all operating conditions with different types of loads, including downstream DC-DC converter, constant current (CC) load, LED load, and constant resistive (CR) load.

The iW3827 integrates a proprietary technique that adaptively adjusts output voltage limits to maintain overshoot and undershoot transients to less than 10% of the nominal output voltage for any load transient. The iW3827 operates in pulse-frequency-modulation (PFM) mode at light load to eliminate audible noise, and at the same time achieving less than 200mW no-load standby power consumption.

Dialog's innovative proprietary technology maximizes the iW3827 performance. It provides two multi-function pins that allow users to configure maximum and minimum switching frequencies for design flexibility, with no cost or size impact. In addition to providing input voltage sensing for input under-voltage protection, the V_{IN} pin also enables the active start-up scheme to achieve the shortest possible start-up time without sacrificing active efficiency.

2 Features

- Supports universal input ($90V_{AC}$ - $264V_{AC}$) in flyback, buck-boost and buck topologies
- Internal 650V power MOSFET delivers up to 8W output power
- *PrimAccurate™* primary-side control technology achieves very tight line and load regulation (±3%)
- PF > 0.9 and THD < 20% across a wide output power range
- User-configurable minimum switching frequency (600Hz/1kHz) ensures no-load standby power consumption < 200mW at $230V_{AC}$
- Internal loop compensation ensures stable operation under all load conditions

- Supports wide range of output capacitance
- Fast dynamic load response
- User-configurable maximum PWM switching frequency (90kHz or 120kHz)
- Built-in soft-start achieves fast and smooth start-up
- Active start-up scheme enables fast start-up
- Built-in single-point fault protection features: output over-load, output over-voltage, output short and input voltage under-voltage protections
- Built-in over-temperature protection

3 Applications

- Smart LED lighting
- Front-end pre-regulator

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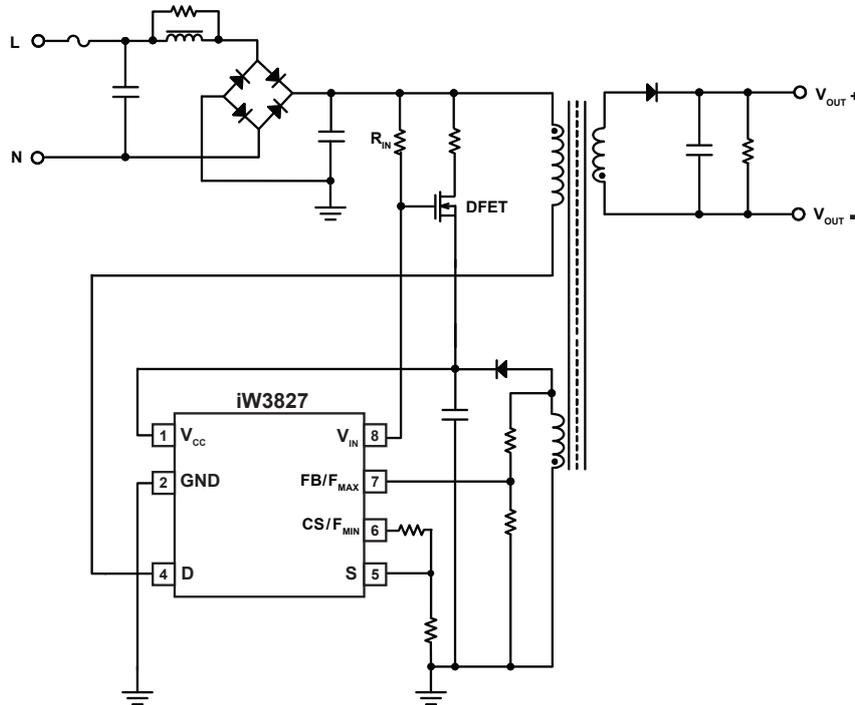
**Figure 3.1 : iW3827 Typical Application Circuit (Isolated Flyback Application)**
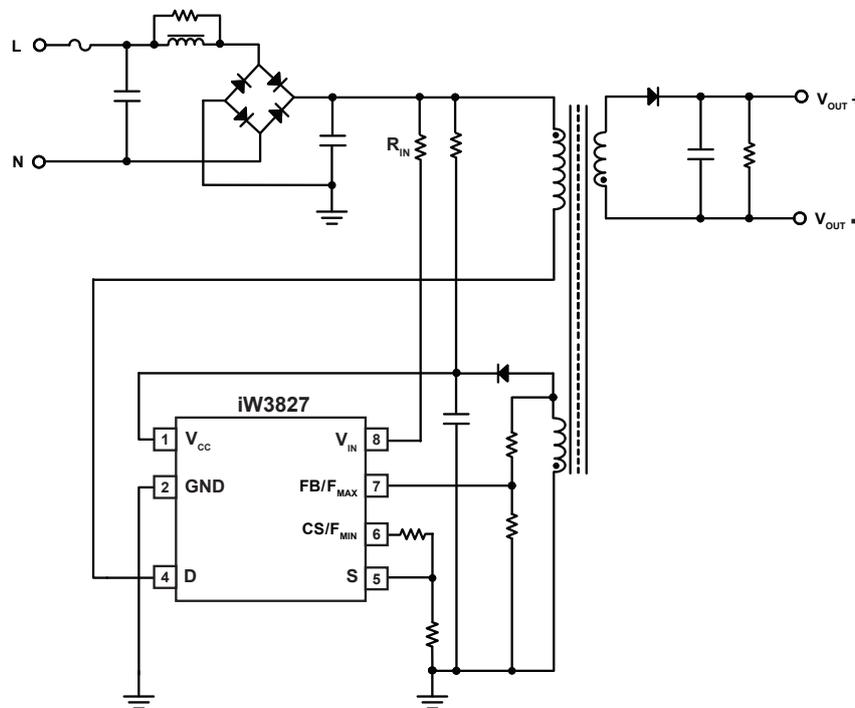
Figure 3.2 : iW3827 Typical Application Circuit (Isolated Flyback Application Without Using Active Start-up Device)

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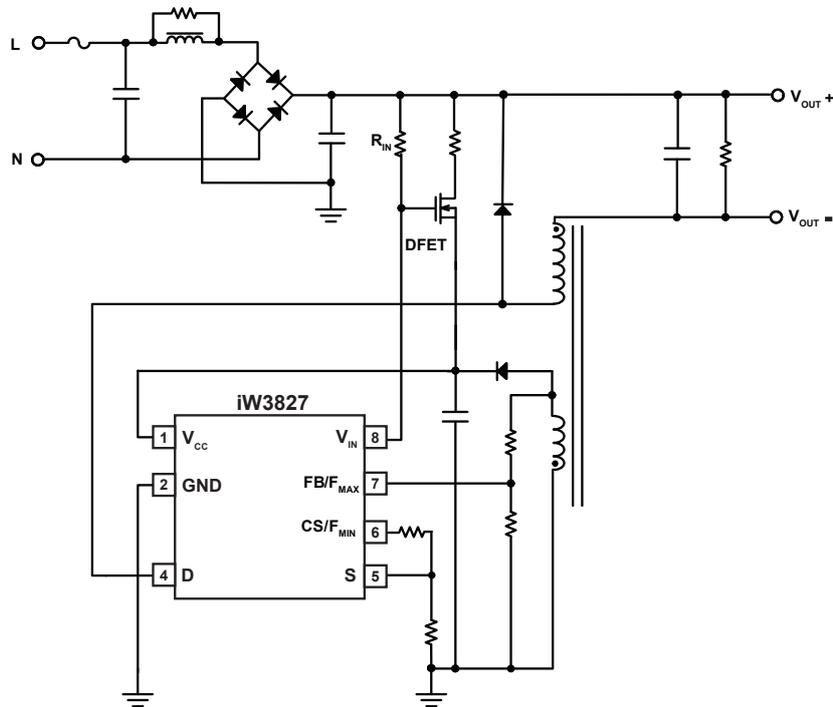
Figure 3.3 : iW3827 Typical Application Circuit (Buck Application)
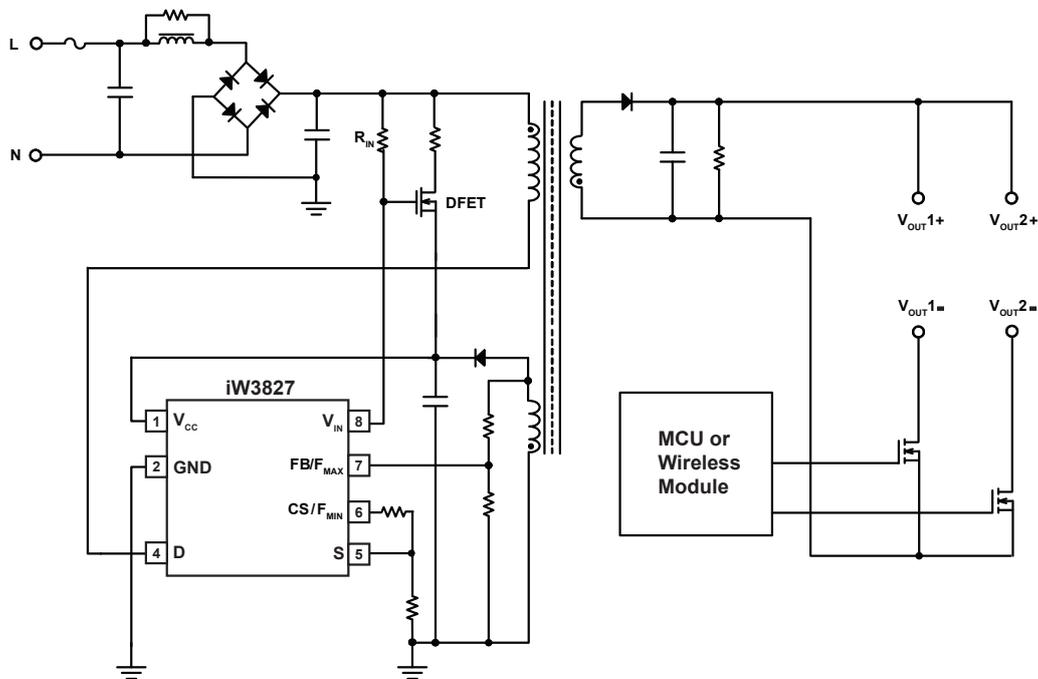
Figure 3.4 : iW3827 Typical Application Circuit (Smart Lighting)

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4 Pinout Description

iW3827

```
  ┌─────────────────────┐
1 │ V_CC          V_IN │ 8
  │                     │
2 │ GND        FB/F_MAX │ 7
  │                     │
  │            CS/F_MIN │ 6
  │                     │
4 │ D              S    │ 5
  └─────────────────────┘
```
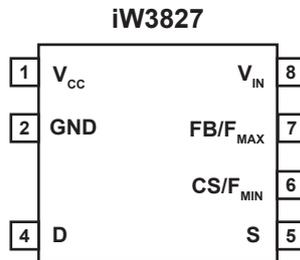
Figure 4.1 : 7-Lead SOIC Package

Pin Number	Pin Name	Type	Pin Description
1	V_{CC}	Power Input	Power supply to control logic and MOSFET drive.
2	GND	Ground	Ground.
4	D	MOSFET Drain	Drain of the internal power MOSFET.
5	S	MOSFET Source	Source of the internal power MOSFET. Pin 5 and pin 6 can be shorted externally or install one resistor in between for configuration.
6	CS/F_{MIN}	Analog Input	Multi-function pin. Used to configure minimum switching frequency (F_{MIN}) at the beginning of the start-up. It also provides primary current sense for cycle-by-cycle peak current control and limit during normal operation.
7	FB/F_{MAX}	Analog Input	Multi-function pin. Used to configure maximum switching frequency (F_{MAX}), and to enable/disable over-load protection (OLP) at the beginning of start-up. It also provides output voltage sense for primary regulation during normal operation.
8	V_{IN}	Analog Input	Multi-function pin. Used to control active start-up device and sense line voltage.

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5 Absolute Maximum Ratings

Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded.

Parameter	Symbol	Value	Units
DC supply voltage range (pin 1, I_{CC} = 20mA max)	V_{CC}	-0.3 to 18.0	V
Continuous DC supply current at V_{CC} pin (V_{CC} = 15V)	I_{CC}	20	mA
V_{IN} (pin 8)		-0.3 to 18.0	V
FB/F_{MAX} input (pin 7, $I_{FB/OTP}$ ≤ 10mA)		-0.7 to 4.0	V
CS/F_{MIN} input (pin 6)		-0.3 to 4.0	V
Drain-source voltage	V_{DSS}	650	V
Continuous drain current @ T_C = +25ºC	I_D	2	A
Continuous drain current @ T_C = +100ºC		1.2	A
Pulsed drain current (Note 1)	I_{DM}	8	A
Maximum junction temperature	T_{JMAX}	150	°C
Operating junction temperature	T_{JOPT}	-40 to 150	°C
Storage temperature	T_{STG}	-65 to 150	°C
ESD rating per JEDEC JESD22-A114		±2,000	V
Latch-up test per JESD78D		±100	mA

Note 1.   Repetitive rating; pulse width limited by maximum junction temperature.

6 Thermal Characteristics

Parameter	Symbol	Value	Units
Thermal Resistance Junction-to-Ambient (Note 1)	θ_{JA}	TBD	°C/W
Thermal Resistance Junction-to-GND pin (pin 2) (Note 2)	ψ_{JB}	TBD	°C/W
Thermal Resistance Junction-to-Drain pin (pin 4) (Note 2)	$\psi_{J\text{-}MOSFET}$	TBD	°C/W
Thermal Shutdown Threshold (Note 3)	T_{SD}	150	°C
Thermal Shutdown Recovery (Note 3)	$T_{SD\text{-}R}$	125	°C

Notes:

Note 1. θ_{JA} is measured in a one-cubic-foot natural convection chamber.

Note 2. ψ_{JB} [Psi Junction to Board] provides an estimation of the die junction temperature relative to the PCB [Board] surface temperature. $\psi_{J\text{-}MOSFET}$ [Psi Junction to Drain pin] provides an estimation of the die junction temperature relative to the Drain pin [internal MOSFET Drain] surface temperature. ψ_{JB} is measured at the ground pin (pin 2) without using any thermal adhesives.

Note 3.   These parameters are typical and they are guaranteed by design.

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7 Physical Dimensions
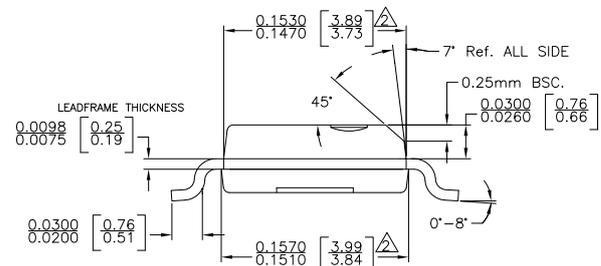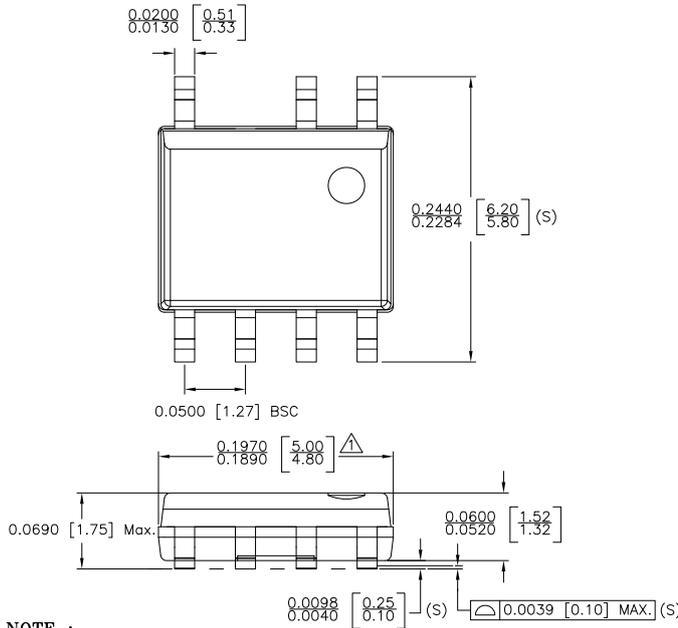
NOTE :

1. DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
   MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT
   EXCEED .006 INCH PER SIDE.
2. DOES NOT INCLUDE INTER−LEAD FLASH OR PROTRUSIONS.
   INTER−LEAD FLASH AND PROTRUSIONS SHALL NOT
   EXCEED .010 INCH PER SIDE.
3. PACKAGE DIMENSION CONFORM TO JEDEC SPECIFICATION MS−012
4. LEAD SPAN/STAND OFF HEIGHT/COPLANARITY ARE CONSIDERED
   AS SPECIAL CHARACTERISTIC.(S)
5. CONTROLLING DIMENSIONS IN INCHES.[mm]

STATUS: RELEASED	SCALE: DO NOT SCALE
TERMINAL FINISH: 100% Sn or NiPdAu (PPF)	
TITLE: 7 SOIC (NO PIN 3) PACKAGE OUTLINE	
REV: C	REVISION NOTE: ADD PACKAGE CHAMFER	DATE: 01−JUNE−2015

8 Ordering Information

Part Number	Description	Package	Description
iW3827-01		SOIC-7	Tape & Reel[1]

Note 1. Tape & Reel packing quantity is 2,500/reel. Minimum packing quantity is 2,500.

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