

iW9860

Zero Standby Power AC/DC Digital Quasi-Resonant Flyback Controller for RapidCharge™ and Fixed Voltage Applications

The **iW9860** is a high-performance AC/DC primary-side digital flyback controller for secondary-side regulation (SSR) that can enable zero standby power consumption in rapid charge and fixed voltage applications to 140W. The device operates in the Renesas' patented constant-frequency, quasi-resonant (QR) switching mode and adaptive multi-mode control (MMC). The iW9860 is optimized to work with multiple Renesas' secondary-side controllers such as the iW760, iW765 or iW690. These controllers integrate secondary-side regulation (SSR) and synchronous rectification (SR) control along with USB Power Delivery (PD) 3.0 with Programmable Power Supply (PPS) support and USB PD 3.1 support. A typical 25W USB PD travel adapter (TA) built with the iW9860 and iW760 chipset can meet no-load power consumption of less than 5mW when the output USB cable is detached.

The iW9860's unique MMC mode of operation includes PWM, PFM and burst mode, which optimizes flyback converter performance including efficiency and EMI. And it also provides a number of key built-in protection features. The iW9860 and iW760/iW765 chipset can achieve tight multi-level constant voltage (CV) and multi-level constant current (CC) regulation in high resolution steps, with fast and smooth CV/CC transition upon request by mobile devices (MD). With SSR digital compensation, the chipset eliminates the need for external loop compensation components while maintaining stability under all operation conditions.

Besides zero standby power, Renesas' innovative proprietary technology ensures that power supplies designed with the iW9860 and iW760/iW765 chipset can achieve high efficiency, high accuracy voltage/current control and fast dynamic load response, all with the lowest system cost. And, power supplies designed using the iW9860 and the iW690 secondary-side IC can achieve zero standby power at output powers up to 140W in fixed voltage applications.

Features

- Zero standby power consumption with low system cost ($< 5\text{mW}$ at 230V_{AC} when output USB cable is detached in a typical 25W USB PD travel adapter)
- Supports single-layer PCB design to reduce total system cost
- Supports Rapid Charge adapters applications of 15W-100W and fixed voltage applications to 140W
- Uses Renesas' patented switching modes [adaptive quasi-resonant (QR) operation and adaptive multi-mode control (MMC)] and continuous conduction mode (CCM)
 - Improves efficiency and eliminate audible noise
 - Enables optimization for size, efficiency and EMI performance
- Supports voltage sensing with dual polarity of V_{VCC} auxiliary winding for improving EMI and simplifying transformer design
- Intelligent gate drive control to minimize driving loop and eliminate high voltage capacitor
- Supports constant-voltage (CV) and constant-current (CC) regulation in fine steps using secondary-side regulation (SSR) control
- Max switching frequency range - 70kHz to 130kHz (by product option - see [section 7](#))
- Built-in single-point fault protections against AC line voltage brown-in, brown-out, output short-circuit, output over-voltage, and optocoupler failure
- User adjustable internal OTP threshold for various thermal requirements
- 6-lead SOT-23 package supports compact power supply design

Applications

- Rapid-charging AC/DC adapters for smart phones, tablets, power tools and other portable devices

Contents

1. Overview	3
1.1 Typical Application	3
2. Pin Information	5
2.1 Pin Assignments	5
2.2 Pin Descriptions.....	5
3. Specifications	5
3.1 Absolute Maximum Ratings	5
3.2 ESD Ratings	6
3.3 Thermal Specifications	6
3.4 Recommended Operating Conditions	6
4. Package Outline Drawings	7
5. Ordering Information	7

1. Overview

1.1 Typical Application

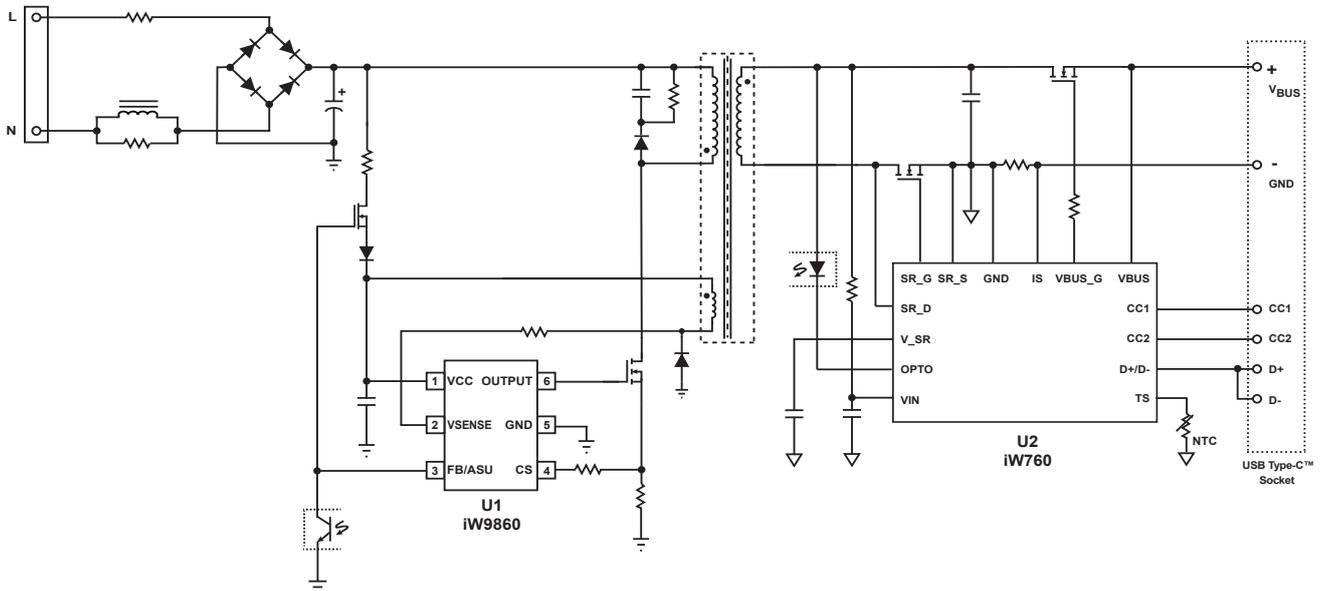


Figure 1. iW9860 Typical Application Circuit with Active Start-up Circuit
(Using iW760 as Secondary-Side Controller. Achieving < 5mW Standby Power Consumption at 230V_{AC})

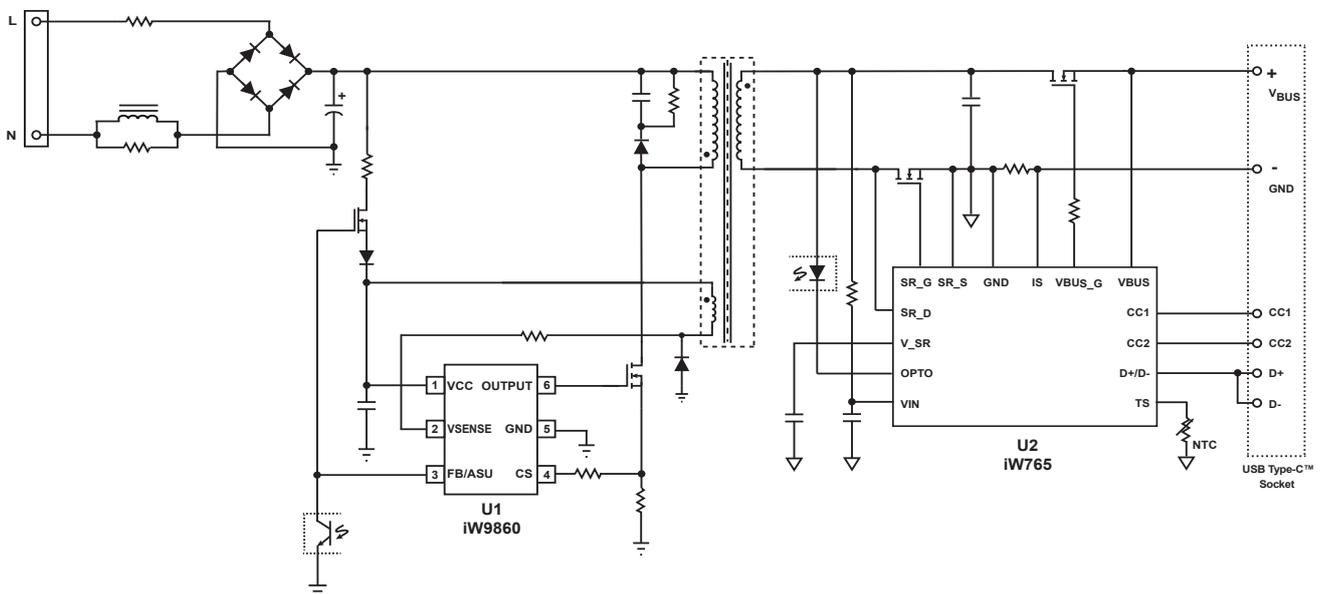


Figure 2. iW9860 Typical Application Circuit with Active Start-up Circuit
(Using iW765 as Secondary-Side Controller. Achieving < 5mW Standby Power Consumption at 230V_{AC})

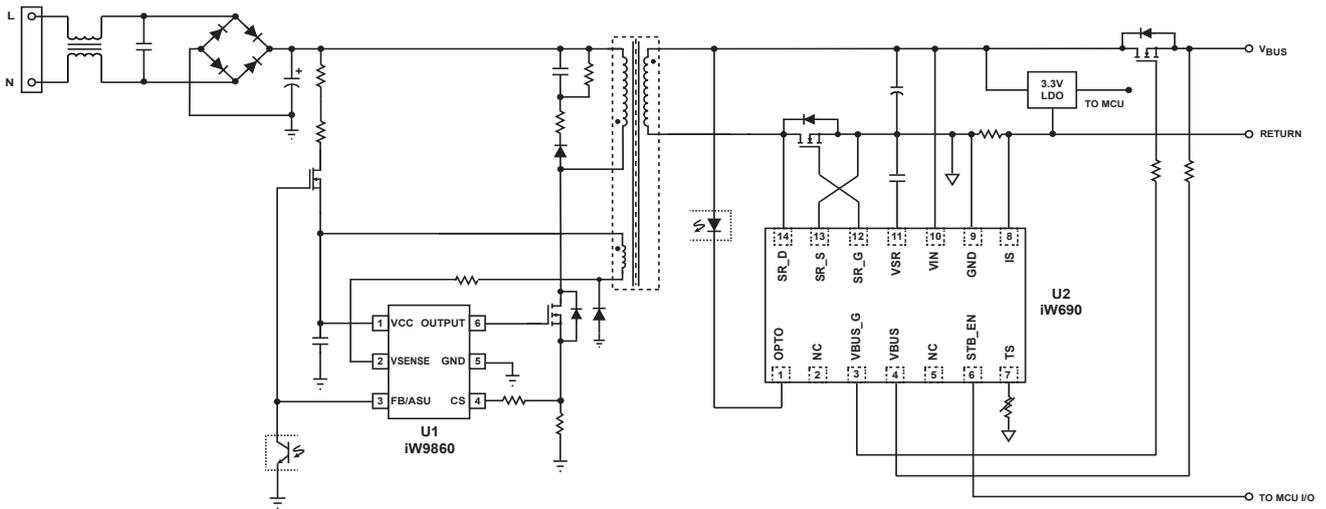


Figure 3. iW9860 Typical Application Circuit for Fixed Output Voltage, Zero Standby Power (Using iW690 as Secondary-Side Controller, Achieving < 5mW No-Load Power Consumption).

2. Pin Information

2.1 Pin Assignments

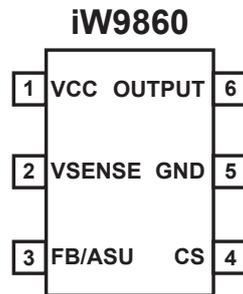


Figure 4. SOT23-6 Package (Top View)

2.2 Pin Descriptions

Pin Number	Pin Name	Type	Description
1	VCC	Power input	IC power supply
2	VSENSE	Analog input	Voltage sensing. Used for adapter output voltage sensing, valley mode switching and input bulk capacitor voltage sensing
3	FB/ASU	Analog input/output	Feedback voltage and active startup control. Used for determining multi-mode control and for controlling active start-up device (depletion mode NFET)
4	CS	Analog input	Current sensing and internal OTP setting
5	GND	Ground	IC power ground and signal ground
6	OUTPUT	Analog output	Gate drive for main power switch

3. Specifications

3.1 Absolute Maximum Ratings

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions can adversely impact product reliability and result in failures not covered by warranty.

Parameter	Symbol	Minimum	Maximum	Unit
DC supply voltage range	V_{VCC}	-0.3	45	V
Continuous DC supply current at VCC pin ($V_{VCC} = 15V$)	I_{VCC}		20	mA
VSENSE input		-0.7	45	V
FB/ASU voltage		-0.3	20	V
CS voltage		-0.3	5.5	V
OUTPUT voltage		-0.3	20	V

3.2 ESD Ratings

ESD Model/Test	Rating	Unit
JEDEC JS-001-2017 (HBM)	±2,000	V
Latch-up test per JESD78E	±100	mA

3.3 Thermal Specifications

Thermal Resistance (Typical)	θ_{JA} (°C/W)
SOT23-6 Package	208

3.4 Recommended Operating Conditions

Parameter	Symbol	Minimum	Maximum	Unit
Maximum junction temperature	T_{JMAX}		150	°C
Operating junction temperature	T_{JOPT}	-40	150	°C
Storage temperature	T_{STO}	-65	150	°C

4. Package Outline Drawings

The package outline drawings are located at the end of this document and are accessible from the Renesas website. The package information is the most current data available and is subject to change without revision of this document.

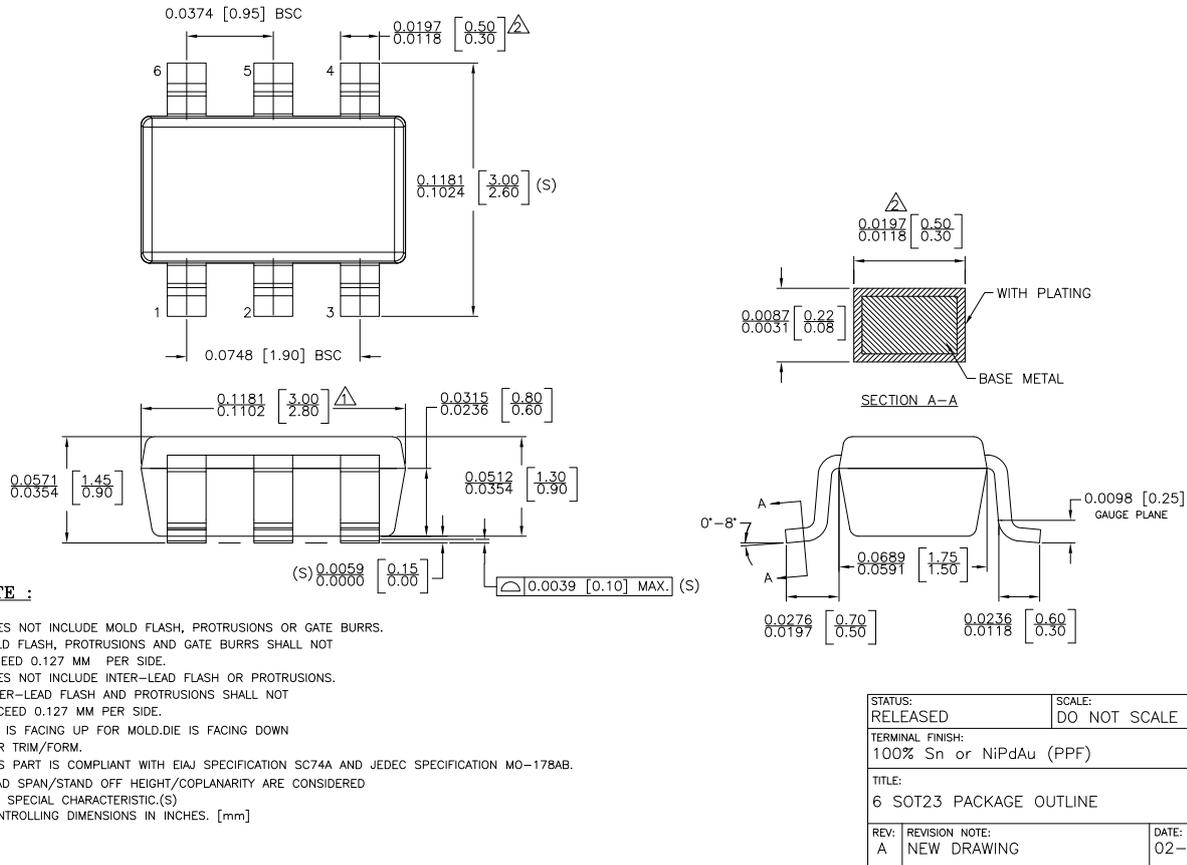


Figure 5. SOT23-6 Package

5. Ordering Information

Part Number	Options								Package	Description
	Output Voltage Range	Secondary Side Controller	Standby Power	OTP	Max f_{sw}	CCM/DCM	N_{PS}	Aux Winding Polarity		
iW9860-03	Supports 3.4V up to 20V	iW760	< 5mW ²	125°C	70kHz	DCM	4.5~5.75	VCC	SOT23-6	Tape & Reel ¹
iW9860-04	Supports 3.4V up to 12V	iW690	< 5mW ²	135°C	80kHz	CCM at Low-Line	5.75~6.75	GND	SOT23-6	Tape & Reel ¹
iW9860-21	Supports 3.4V up to 20V	iW760	< 5mW ²	135°C	80kHz	CCM at Low-Line	5.75~6.75	GND	SOT23-6	Tape & Reel ¹

1. Tape & Reel packing quantity is 3,000/reel. Minimum packing quantity is 3,000.
2. Typically with 25W power supplies when using start-up D-FET.

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