iW9870

Zero Standby Power AC/DC Digital Quasi-Resonant Flyback GaN Controller for RapidCharge™

The iW9870 is a high-performance AC/DC primary-side digital flyback controller for secondary-side regulation (SSR) that can enable zero standby power consumption in 15W-63W rapid charge applications. The device operates in the Renesas' patented constant-frequency, quasi-resonant (QR) switching mode and adaptive multi-mode control (MMC). The iW9870 is optimized to work with Renesas' secondary-side controller, the iW760, which integrates SSR, synchronous rectification (SR) control and USB Power Delivery (PD) 3.0 with Programmable Power Supply (PPS) support. A typical 25W USB PD travel adapter (TA) built with the iW9870 and iW760 chipset can meet no-load power consumption of less than 5mW when the output USB cable is detached.

The iW9870'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 iW9870 and iW760 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 iW9870 and iW760 chipset can achieve high efficiency, high accuracy voltage/current control and fast dynamic load response, all with the lowest system cost.

Features

- Zero standby power consumption with low system cost (< 5mW 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-63W and other power profiles
- 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
- Optimized gate drive for GaN power devices
- Supports constant-voltage (CV) and constant-current (CC) regulation in fine steps using secondary-side regulation (SSR) control
- Supports high switching frequency up to 270kHz for driving GaN power device (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

1. Contents

1. Overview

1.1 Typical Application

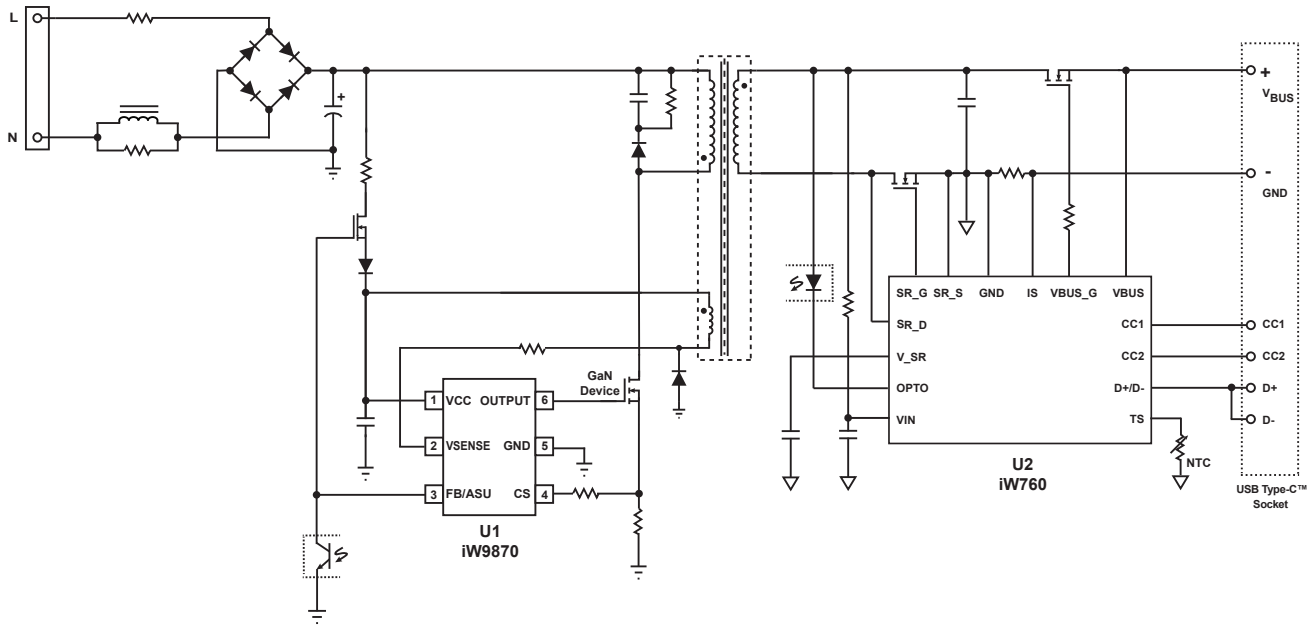


Figure 1. iW9870 Typical Application Circuit with Active Start-up Circuit
(Using iW760 as Secondary-Side Controller. Achieving < 5mW Standby Power Consumption at 230V_{AC})

2. Pin Information

2.1 Pin Assignments

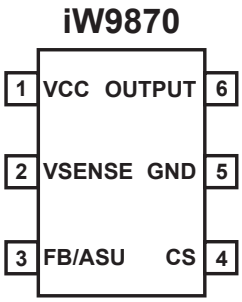


Figure 2. SOT23-6 Package. Top View

2.2 Pin Descriptions

Pin Number	Pin Name	Type	Pin 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
Continuous DC Supply Current at VCC Pin (V_{VCC} = 15V)	I_{VCC}	20	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 Recommended Operating Conditions

Parameter	Symbol	Minimum	Maximum	Unit
DC Supply Voltage Range	V_{VCC}	-0.3	45	V
Operating Junction Temperature	T_{JOPT}	-40	150	°C

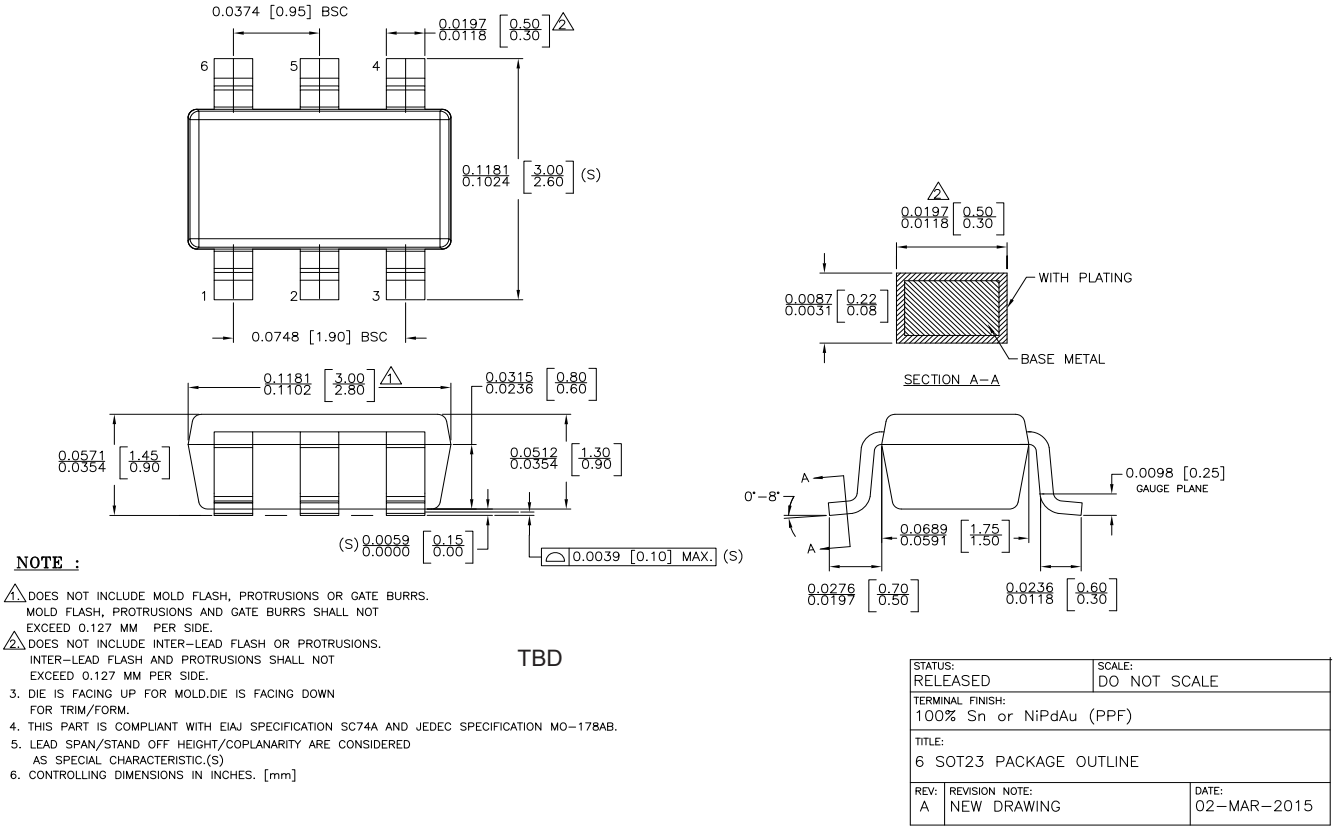
3.4 Thermal Specifications

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

Parameter	Symbol	Minimum	Maximum	Unit
Maximum Junction Temperature	T_{JMAX}		+150	°C
Maximum Storage Temperature Range	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.



NOTE :

1. DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED 0.127 MM PER SIDE.
2. DOES NOT INCLUDE INTER–LEAD FLASH OR PROTRUSIONS. INTER–LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.127 MM PER SIDE.
3. DIE IS FACING UP FOR MOLD.DIE IS FACING DOWN FOR TRIM/FORM.
4. THIS PART IS COMPLIANT WITH EIAJ SPECIFICATION SC74A AND JEDEC SPECIFICATION MO–178AB.
5. LEAD SPAN/STAND OFF HEIGHT/COPLANARITY ARE CONSIDERED AS SPECIAL CHARACTERISTIC.(S)
6. CONTROLLING DIMENSIONS IN INCHES. [mm]

TBD

STATUS: RELEASED	SCALE: DO NOT SCALE
TERMINAL FINISH: 100% Sn or NiPdAu (PPF)	
TITLE: 6 SOT23 PACKAGE OUTLINE	
REV: A / REVISION NOTE: NEW DRAWING	DATE: 02–MAR–2015

Figure 3. SOT23-6 package outline drawing

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		
iW9870-10	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	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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