iW760

Zero Standby Power AC/DC Secondary-Side Regulation Controller with Integrated Synchronous Rectification for USB PD 3.0 w/PPS

The iW760 is an AC/DC secondary-side controller for USB Power Delivery (PD) 3.0 with Programmable Power Supply (PPS) support which integrates a secondary-side regulation controller, interface protocol controller, USB V_{BUS} driver and synchronous rectifier controller into a single IC.

The iW760 allows rapid charge of USB PD PPS enabled mobile devices (MDs). It resides on the secondary side of an AC/DC travel adapter (TA) and allows the TA to be configured for multi-level output voltage and current.

The iW760 measures the output voltage and load current and sends the results to a digital compensator for closed-loop control of flyback converter. The digital control signal generated by the compensator is converted to an analog signal and transferred to primary controller via an optocoupler.

The iW760 controller is a hard-wired state machine, so no MCU coding is required. This eliminates potential malicious or inadvertent access to chargers or power supplies designed with the iW760 and prevents them from sourcing volt- ages via the USB cable higher than a smartphone, tablet, laptop or other product can handle, which may damage the product.

The iW760 is also an advanced synchronous rectifier (SR) controller with an integrated MOSFET driver. The device works with an external power MOSFET to replace the main rectifying diode on the secondary of a flyback converter. The SR control block with proprietary technologies optimizes the SR on/off timing and driving voltage to achieve best efficiency.

The iW760 should be paired with Renesas' high power-density Flyback primary-side controllers such as the iW9860 or iW9870 to achieve high efficiency, accurate voltage/current control and fast dynamic load response. Furthermore, iW9860/iW9870 and iW760 can enter an extremely low consumption state when MD is unplugged so that TA standby power is < 5mW (Zero standby power).

Features

- Zero standby power consumption with lowest system cost (< 5mW at $230V_{AC}$ when output USB cable is detached in a typical 25W USB PD travel adapter)

- Supports USB PD3.0 with PPS for output voltage from 3.3V to 21V in 20mV steps and output current in 50mA steps

- High resolution accuracy multi-level output voltage and current control

- Built-in digital loop compensation to minimize the external component count

- Built-in synchronous rectification controller with integrated driver

- Optimized V_{DS}-based SR timing and driving control with wide output range

- Supports D- Impedance detection

- NFET driver for V_{BUS} switch

- Active fast discharge from a high voltage to 5V at MD unplug or from a high voltage level to a lower level upon request

- Hard-wired state machine

  - No MCU and firmware required

  - Prevents chargers and power supplies from being hacked and damaged

- Supports DCM and CCM operation

- 14-Lead TDFN package

Applications

- AC/DC adapters for USB PD enabled smart phones, tablets and other mobile devices

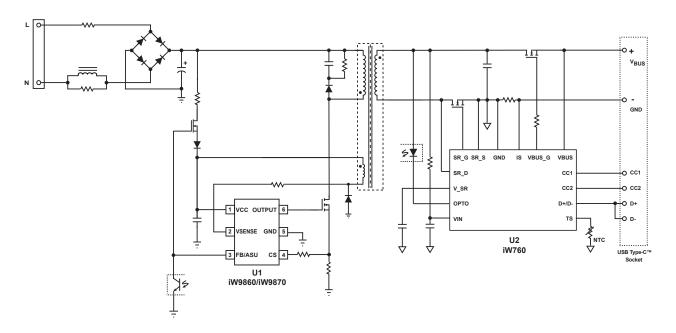# Contents

1. Overview

1.1 Typical Application

**Figure 1. iW760 Typical Application Circuit for Multi-Level Voltage and Current
(Using iW9860 or iW9870 as Primary-Side Controller, Achieving < 5mW No-Load Power Consumption).**
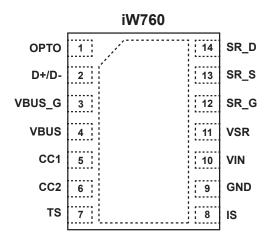
2. Pin Information

2.1 Pin Assignments

iW760

Left	Pin		Pin	Right
OPTO	1		14	SR_D
D+/D-	2		13	SR_S
VBUS_G	3		12	SR_G
VBUS	4		11	VSR
CC1	5		10	VIN
CC2	6		9	GND
TS	7		8	IS

Figure 2. Top View

2.2 Pin Description

Pin Number	Pin Name	Type	Description
1	OPTO	Analog Output	Optocoupler driver to transfer the output regulation control signal to primary side.
2	D+/D-	Analog Input/Output	USB D+/D- signal, tied together.
3	VBUS_G	Analog Input/Output	Gate drive for external N-FET switch.
4	VBUS	Analog Input/Output	Connect to V_{BUS} after N-FET switch.
5	CC1	Analog Input/Output	Communication channel 1.
6	CC2	Analog Input/Output	Communication channel 2.
7	TS	Analog Input/Output	Temperature sensing pin. Connect to an external NTC resistor to measure the power adapter temperature.
8	IS	Analog Input	Output current sensing, connect to current sensing resistor "+" terminal.
9	GND	Ground	Ground, connect to current resistor "-" terminal.
10	VIN	Power Analog Input	Input of the internal LDO and output voltage sensing circuit.
11	V_SR	Power	Voltage supply for SR drive. Connect this pin to a capacitor.
12	SR_G	Analog Output	Synchronous rectifier MOSFET driver.
13	SR_S	Analog Input	Synchronous rectifier MOSFET source input.
14	SR_D	Analog Input	Synchronous rectifier MOSFET drain voltage sensing and the Pulse Linear Regulator (PLR) input.

3. Specifications

[The spec data in the following tables is for example purposes only and will vary per device or technology.]

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
V_{VIN} DC supply voltage range (I_{VIN} = 12mA max)	V_{VIN}	-0.3	25	V
Continuous DC supply current at VIN pin (V_{VIN} = 12V)	I_{VO}		12	mA
SR_G peak output current	I_{SR_G}		±2	A
SR_G voltage	V_{SR_G}	-0.6	6	V
SR_D voltage (Note 1)	V_{SR_D}	-1.5	100	V
SR_D peak current	I_{DRAIN}	-40	300	mA
SR_S voltage	V_{SR_S}	-0.5	6	V
V_SR voltage	V_{V_SR}		6	V
OPTO voltage	V_{OPTO}	-0.6	25	V
D+/D- voltage	$V_{D+/D-}$	-0.3	25	V
CC1 voltage	V_{CC1}	-0.3	25	V
CC2 voltage	V_{CC2}	-0.3	25	V
IS voltage	V_{IS+}	-0.3	7	V
TS voltage	V_{SD}	-0.3	7	V
VBUS voltage (IBUS < 10mA)	V_{VBUS}	-0.7	25	V
VBUS_G voltage	V_{VBUS_G}	-0.7	30	V

1. The DRAIN pin voltage should not be below -0.6V for more than 500ns.

3.2 ESD Ratings

ESD Model/Test	Rating	Unit
JEDEC JS-001-2017 (HBM) (CC1/CC2/D+/D- pins)	±8,000	V
JEDEC JS-001-2017 (HBM) (all other pins)	±2,000	V
Latch-up test per JESD78E	±100	mA

3.3 Recommended Operating Conditions

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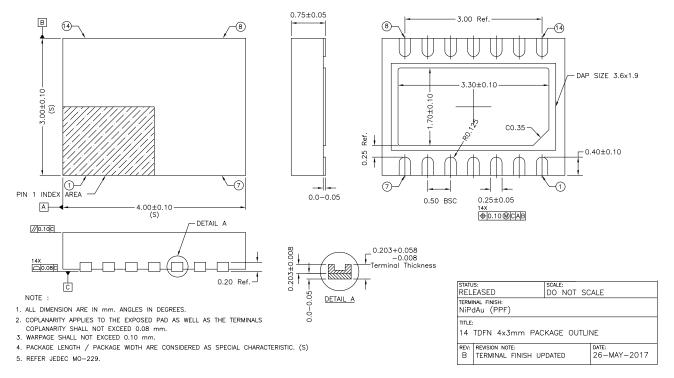

Figure 3. 14-Lead TDFN Package

5. Ordering Information

Part no.	Options			Package	Description
	Protocol and V/I Profile	**Output Power**	**Primary-Side Controller**		
iW760-XX-YYYY	USB PD 3.0 PDO & APDO: support up to 21V/3A	Up to 63W	iW9860 iW9870	14-Lead TDFN	Tape & Reel[1]

1. Tape & Reel packing quantity is 3,000/reel. Minimum packing quantity is 3,000.

6. Part Number Code Description

iW760-XX-YYYY

Base Part Number

Travel Adapter Maximum Output Power (W)
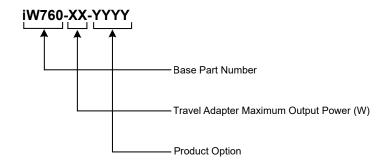
Product Option

Figure 4. iW760 Part Number Decoder

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