

## iW610

Intelligent Synchronous Rectifier Controller with Low  $V_{CC}$  Charging Loss  
for Wide Range of AC/DC Converter Topologies

The **iW610** is an advanced synchronous rectifier (SR) controller with an integrated MOSFET driver. Renesas' proprietary lossless  $V_{DS}$  sensing and control technology optimizes the iW610 to work with multiple AC/DC topologies, such as quasi-resonant flyback (QR), discontinuous mode (DCM), continuous mode (CCM) flyback, zero-voltage switching (ZVS) and active clamp flyback (ACF).

The device works with an external power MOSFET to replace the main rectifying diode on the secondary of a flyback converter to achieve high efficiency on the secondary side. This versatility makes the iW610 ideal for the newest high power density AC/DC adapter/charger applications.

With Renesas' innovative and patent-pending  $V_{CC}$  charging technology, the iW610 supports both low-side and high-side synchronous rectification without the need for an extra transformer winding. The proprietary technology eliminates excess power dissipation, reducing the iW610 operating temperature and improving efficiency.

The iW610 has the ability to work at output voltages as high as 28V and as low as 3V under all conditions to accommodate a wide array of power supplies. It can sense drain voltages up to 150V, eliminating the need for an external clamping circuit in applications with multi-level output voltages.

## Features

- Optimized to support topologies such as QR, DCM, CCM flyback, ZVS and active clamp flyback
- Patent-pending, highly efficient  $V_{CC}$  charging technology
- Lowest operating current for zero-standby power.
- Support both high-side and low-side synchronous rectification topologies
- Optimized lossless  $V_{DS}$ -based SR sensing and driving control with wide output range
- Supports system output voltages from 3V to 28V in multi-level output voltage and current applications
- High-voltage drain sensing up to 150V with no additional external clamping circuits required
- 6-pin SOT23 package, supports compact system design

## Applications

- Compact, high power density AC/DC adapters for tablets, smart phones, laptops, portable devices
- USB Power Delivery (USB PD) chargers
- Low output voltage or high current offline power supplies
- High efficiency auxiliary power supplies in servers, appliances and desktops
- Industrial/home power tools

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## Contents

<b>1. Overview</b> .....	<b>4</b>
1.1 Block Diagram .....	4
1.2 Typical Application .....	4
<b>2. Pin Information</b> .....	<b>6</b>
2.1 Pin Assignments .....	6
2.2 Pin Descriptions.....	6
<b>3. Specifications</b> .....	<b>7</b>
3.1 Absolute Maximum Ratings .....	7
3.2 ESD Ratings .....	7
3.3 Thermal Specifications .....	7
3.4 Recommended Operating Conditions .....	7
<b>4. Package Outline Drawings</b> .....	<b>8</b>
<b>5. Ordering Information</b> .....	<b>8</b>

# 1. Overview

## 1.1 Block Diagram

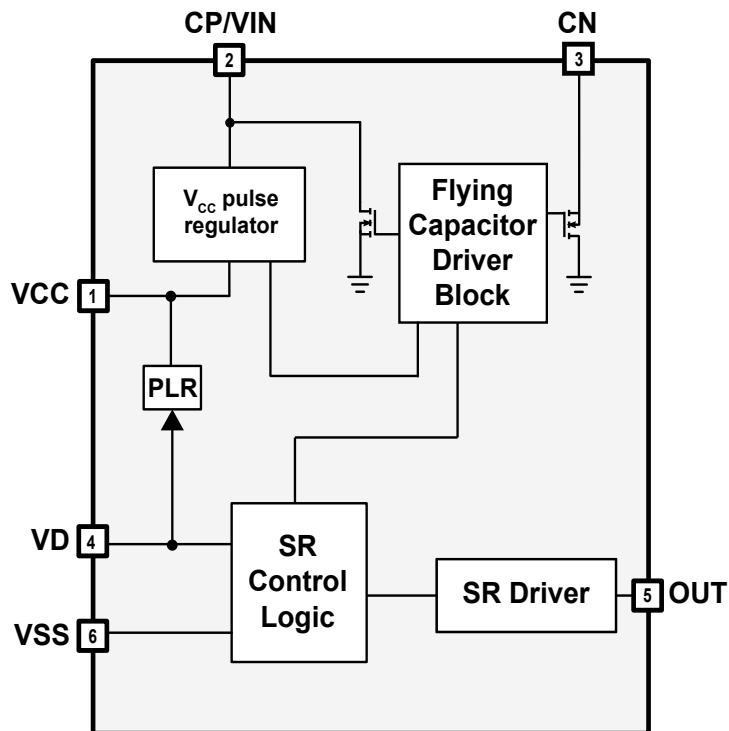


Figure 1. iW610 Functional Block Diagram

## 1.2 Typical Application

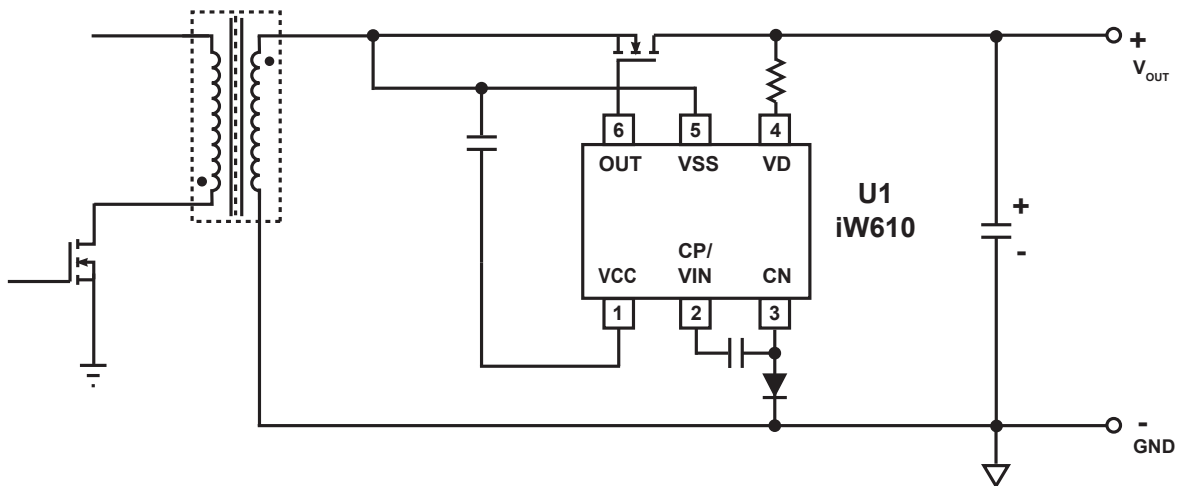


Figure 2. iW610 for High-Side Synchronous Rectification Applications

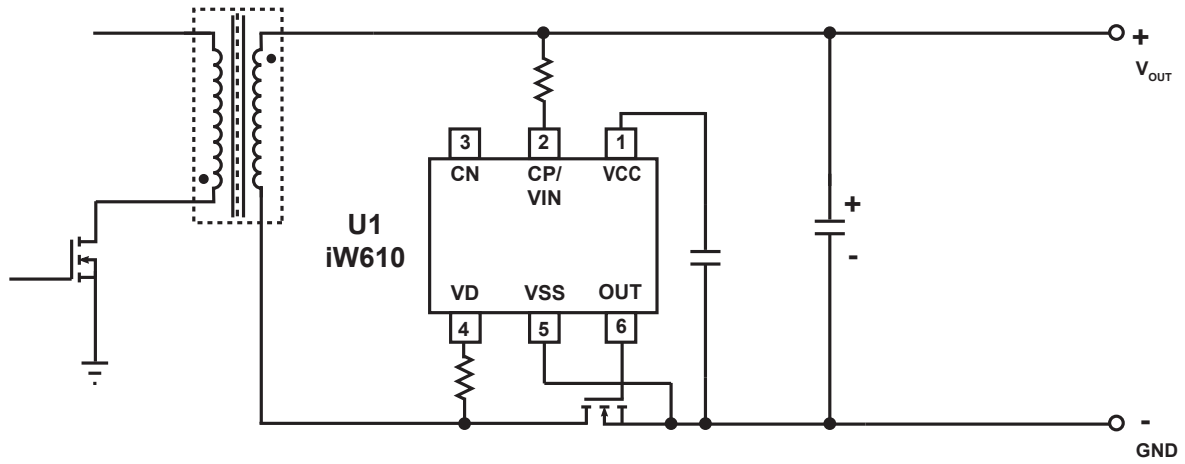


Figure 3. iW610 for Low-Side SR Rectification Applications

## 2. Pin Information

### 2.1 Pin Assignments

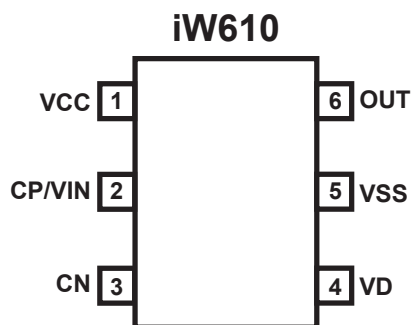


Figure 4. SOT23-6 Package (Top View)

### 2.2 Pin Descriptions

Pin Number	Pin Name	Type	Description
1	VCC	Power Input	It provides voltage supply for internal logic circuit and SR MOSFET driver. Connect this pin to a capacitor.
2	CP/VIN	Analog Input	High-side SR application: connected to the positive side of external flying capacitor. Low-side SR application: connected to the output capacitor positive side.
3	CN	Analog Input	High-side SR application: connected to the negative side of external flying capacitor. Low-side SR application: connect to VSS pin or leave it open.
4	VD	Analog Input	Synchronous rectifier MOSFET drain voltage sensing and internal VCC charge circuit input.
5	VSS	IC GND	IC Ground.
6	OUT	Analog Output	Synchronous rectifier MOSFET driver.

### 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
OUT pin voltage	$V_G$	-0.6	10	V
OUT pin peak pull-down current	$I_G$	-3		A
VCC voltage	$V_{VCC}$	-0.6	10	V
VD pin voltage (Note 1) (Note 2)	$V_{VD}$	-1.5	150	V
VD pin peak current	$I_{DRAIN}$		600	mA
CP/VIN pin voltage	$V_{CP}$	-0.7	30	V
CN pin voltage	$V_{CN}$	-30	0.7	V

1. VD pin voltage should not be below -0.6V for more than 500ns
2. VD pin voltage tested using 10 $\mu$ s pulse on-time, 20kHz repetitive testing.

#### 3.2 ESD Ratings

ESD Model/Test	Rating	Unit
JEDEC JS-001-2017 (HBM)	$\pm 2,000$	V

#### 3.3 Thermal Specifications

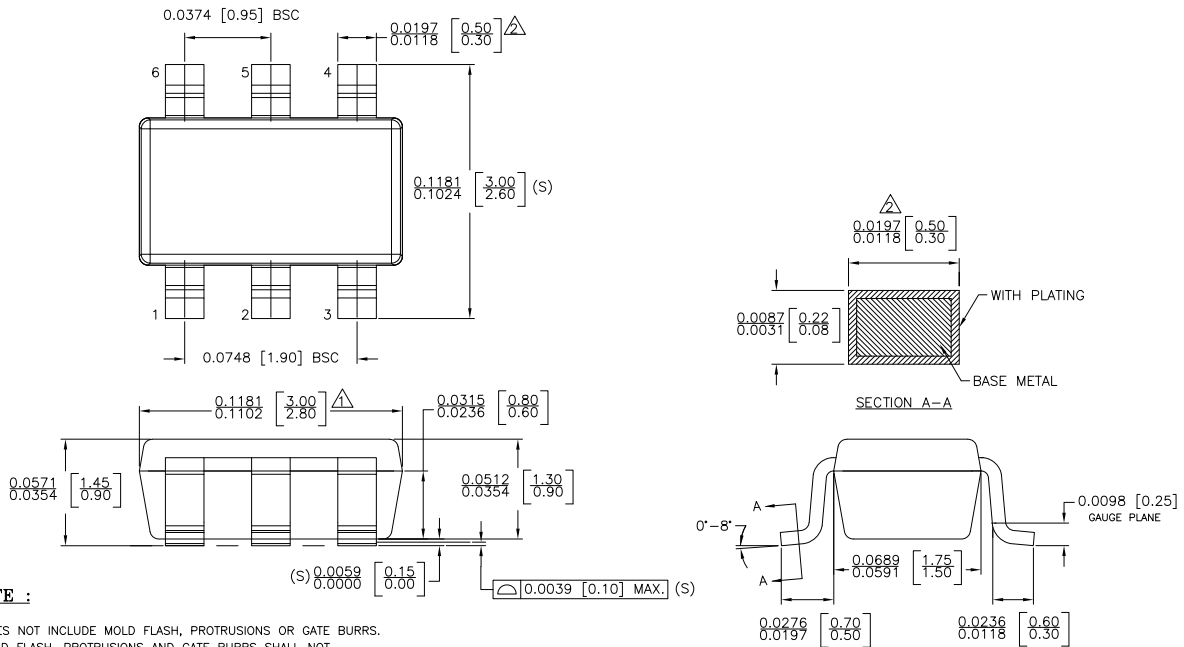
Thermal Resistance (Typical)	$\theta_{JA}$ ( $^{\circ}$ C/W)
SOT23-6 Package	208

#### 3.4 Recommended Operating Conditions

Parameter	Symbol	Minimum	Maximum	Unit
Maximum junction temperature	$T_{JMAX}$		150	$^{\circ}$ C
Operating junction temperature	$T_{JOPT}$	-40	150	$^{\circ}$ C
Storage temperature	$T_{STO}$	-65	150	$^{\circ}$ 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 :**

- △ DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED 0.127 MM PER SIDE.
- △ 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]

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 5. SOT23-6 Package

## 5. Ordering Information

Part no.	Options		Package	Description
	Minimum on-time	V <sub>VCC_UPPER</sub> voltage		
iW610-05	0.4μs	7.5V	SOT23-6	Tape & Reel <sup>1</sup>
iW610-06	0.4μs	6V	SOT23-6	Tape & Reel <sup>1</sup>

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

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