Digital Synchronous Rectifier Controller Optimized for Wide Range Outputs with Optional Active Voltage Position Control

1 Description

The iW676 is an advanced synchronous rectifier (SR) controller with an integrated MOSFET driver for discontinuous mode flyback converters. The device works with an external power MOSFET to replace the main rectifying diode on the secondary of a flyback converter, improving efficiency by reducing conduction losses on the secondary. The iW676 uses lossless sensing by monitoring the voltage across the synchronous MOSFET to determine when to switch the FET, further improving efficiency. Dialog's digital adaptive turn-off control technology minimizes turn-off deadtime, eliminating the need for an additional Schottky diode that is typically needed in parallel with the synchronous MOSFET in conventional synchronous rectifiers.

The iW676 has the ability to work at output voltages as high as 25V and as low as 3V under all conditions to accommodate a wide array of power supplies. It can sense drain voltages up to 100V, eliminating the need for an external clamping circuit in applications with multi-level output voltage applications up to 12V. A unique internal regulator circuit enables the iW676 to operate down to very low voltages on the output of the power supply, optimizing the device for Direct Charging applications down to sub-3V levels.

The iW676-3X/3XC integrates Dialog's unique Active Voltage Positioning (AVP) control for fast dynamic load response and very low no-load power consumption (non-rapid charge applications), without increasing the package size or pin count.

2 Features

- Supports system output voltages from 3V to 25V in multi-level output voltage and current applications
  - » Integrated pulse linear regulator (PLR) enables high efficiency SR operation down to 3V under all load conditions and below 2.4V under constant current (CC) mode condition
    - » Supports Direct Charge down to sub-3V levels
  - » Wide V_{IN} pin operating voltage up to 25V
- High voltage Drain sensing up to 100V with no additional external clamping circuits required
- 6-pin SOT23 package
- Digital adaptive turn-off control minimizes dead-time and eliminates the parallel Schottky diode
- Lossless MOSFET V_{DS} sensing for SR timing control
- Optimized 5V MOSFET gate driver
- Intelligent low power management achieves ultra-low no-load operating current
- Built-in Active Voltage Positioning (AVP) to provide fast system output voltage transient detection with no additional pins or external components required. (iW676-3X/3XC options)

3 Applications

- Compact AC/DC adapters/chargers for media tablets and smart phones

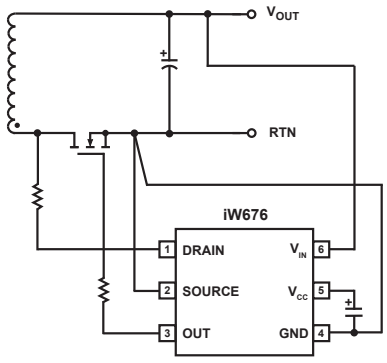


Figure 3.1 : iW676 Typical Application Circuit

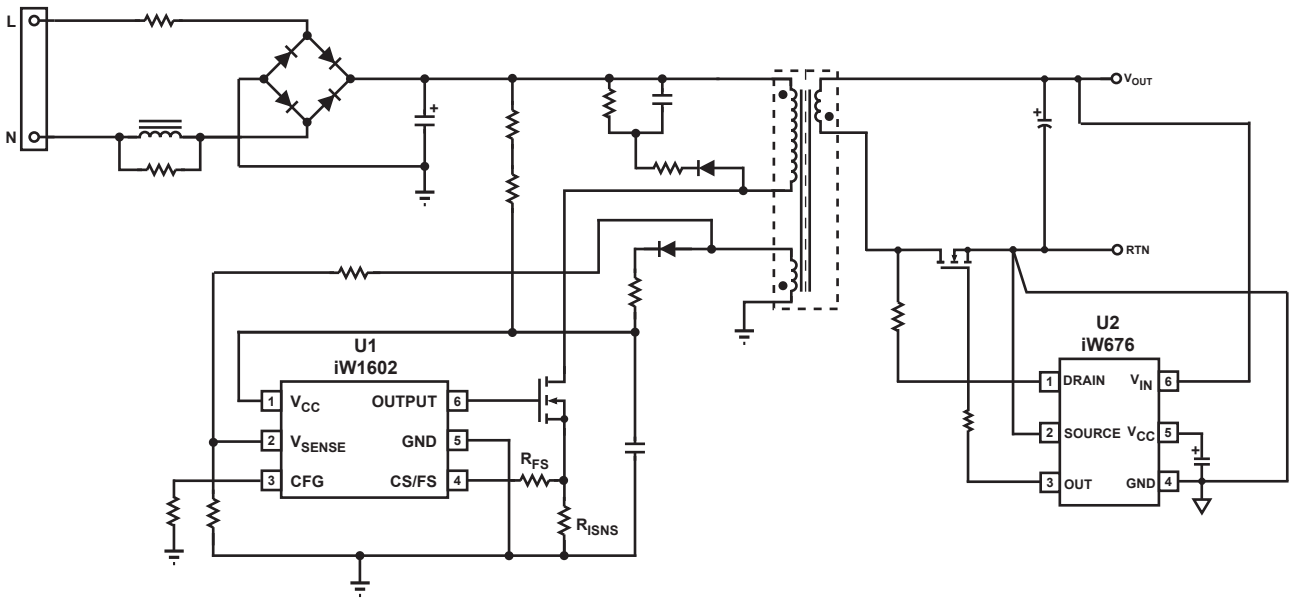


Figure 3.2 : iW676 Typical Application Circuit Using iW1602 as the Primary-Side Controller (Achieving < 30mW No-Load Power Consumption in 5V, 2.5A Adapter Designs with Fast Dynamic Load Response, and Supporting Constant Current Operation at Low System Output)

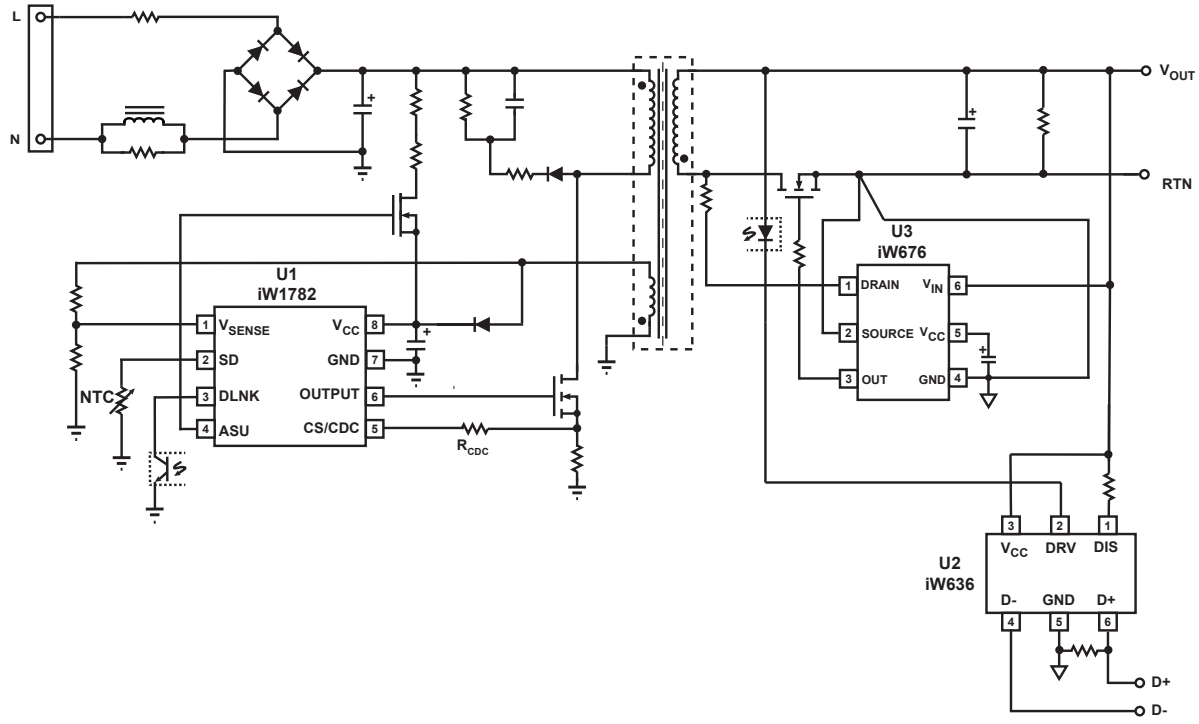


Figure 3.3 : iW676 Typical Application Circuit for Multi-Level Output Voltage and Current (Using iW1782 as Primary-Side Controller and iW636 as Secondary-Side Controller for Qualcomm® Quick Charge™ 3.0) (Achieving < 20mW No-Load Power Consumption)

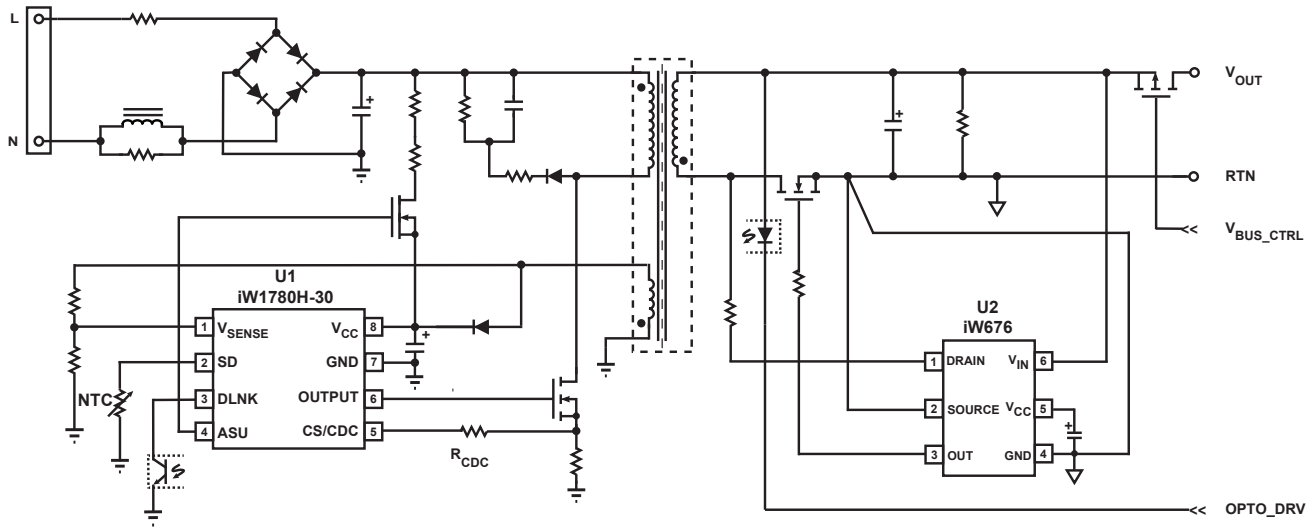


Figure 3.4 : Direct Charge Application with V_{BUS} Switch (Using Secondary-Side IC Interfacing MD with D+/D- or CC1/CC2 for Direct Charge and iW676 as SR Controller)

4 Pinout Description

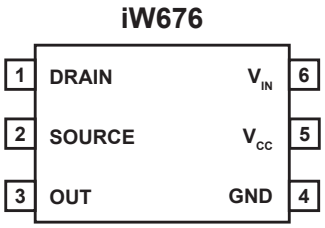


Figure 4.1 : 6-Pin SOT23 Package

Pin No.	Pin Name	Type	Pin Description
1	DRAIN	Analog Input	Synchronous rectifier MOSFET drain voltage sensing and the Pulse Linear Regulator (PLR) input. For iW676-3X/3XC, it is also the secondary-side Active Voltage Positioning function input and output.
2	SOURCE	Analog input	Synchronous rectifier MOSFET source voltage sensing input. In the iW676-xxC, this pin is internally connected to GND.
3	OUT	Output	Synchronous rectifier MOSFET driver.
4	GND	Ground	Ground.
5	V_{CC}	Power Input	Output of internal LDO and PLR. It provides bias voltage for the internal logic circuit and the MOSFET driver. Connect this pin to a capacitor.
6	V_{IN}	Analog Input	Input of internal LDO and system output voltage sensing circuit. Connect to adapter/charger output for bias voltage. The internal LDO clamps the V_{CC} voltage at 5V when V_{IN} > 5V. V_{IN} is also the input for the PLR enable comparator and the SR enable comparator.

5 Absolute Maximum Ratings

Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded. For maximum safe operating conditions, refer to Electrical Characteristics in Section 6.

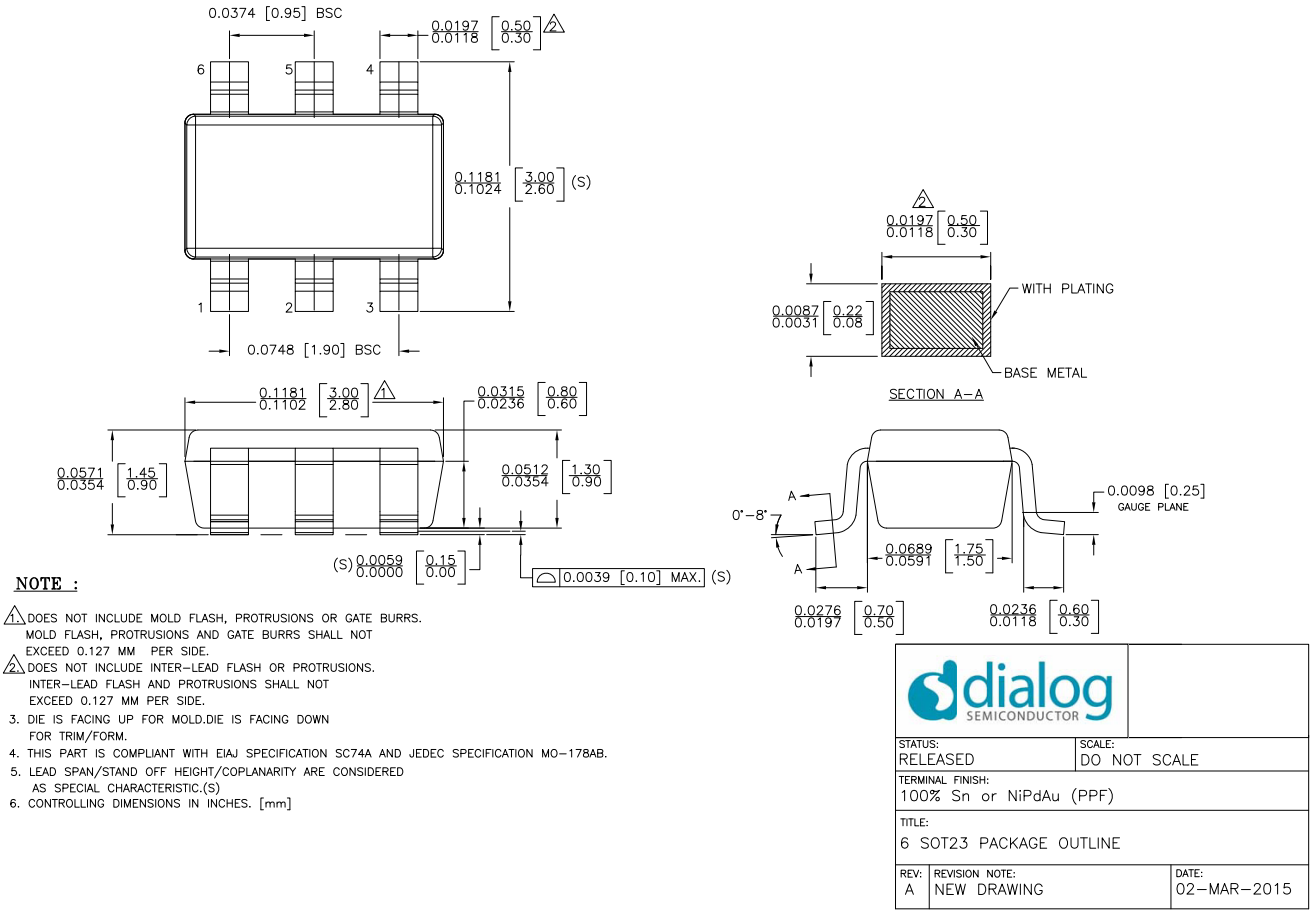
Parameter	Symbol	Value	Units
V_{IN} DC supply voltage range (pin 6, I_{CC} = 15mA max)	V_{IN}	-0.3 to 33	V
Continuous DC supply current at V_{IN} pin (V_{IN} = 30V)	I_{VO}	15	mA
Continuous DC supply current at V_{CC} pin (V_{CC} = 5.5V)	I_{VCC}	15	mA
Gate peak output current	I_G	±3	A
DRAIN pin voltage (Note 1)	V_D	-1.5 to 100	V
DRAIN pin peak current	I_{DRAIN}	-40 to 300	mA
SOURCE pin voltage (Note 2)	V_{SOURCE}	-0.6 to 1	V
V_{CC} pin voltage	V_{CC}	-0.6 to 6	V
Junction temperature	T_J	-40 to 150	°C
Storage temperature		-65 to 150	°C
Thermal resistance junction-to-ambient	θ_{JA}	190	°C/W
ESD rating per JEDEC JS-001-2017		±2,000	V

Notes:

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

Note 2: Only applies to iW676-XX. In iW676-XXC, this pin is internally connected to GND.

6 Physical Dimensions



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]

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

7 Ordering Information

Part no.	Options	Package	Description
iW676-00	No Active Voltage Positioning (AVP) function Not Recommended for New Designs, please use the iW676-00C	SOT23	Tape & Reel(1)
iW676-00C	No Active Voltage Positioning (AVP) function Recommended for New Designs	SOT23	Tape & Reel(1)
iW676-30	With secondary Active Voltage Positioning (AVP) function, under-voltage threshold (V_{UV}) = 4.75V(2). Not recommended for new designs, please use the iW676-30C.	SOT23	Tape & Reel(1)
iW676-30C	With secondary Active Voltage Positioning (AVP) function, under-voltage threshold (V_{UV}) = 4.75V(2). Recommended for new designs.	SOT23	Tape & Reel(1)
iW676-32	With secondary Active Voltage Positioning (AVP) function, under-voltage threshold (V_{UV}) = 11.2V(2)	SOT23	Tape & Reel(1)

Notes:

Note 1: Tape and reel packing quantity is 3,000/reel. Minimum packing quantity is 3,000.

Note 2: For availability of additional V_{UV} options, please contact marketing.

Digital Synchronous Rectifier Controller Optimized for Wide Range Outputs with Optional Active Voltage Position Control

IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas’ products are provided only subject to Renesas’ Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

RoHS Compliance

Dialog Semiconductor’s suppliers certify that its products are in compliance with the requirements of Directive 2011/65/EU of the European Parliament on the restriction of the use of certain hazardous substances in electrical and electronic equipment. RoHS certificates from our suppliers are available on request.

(Rev.1.0 Mar 2020)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.