

## 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 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 option)

### 3 Applications

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

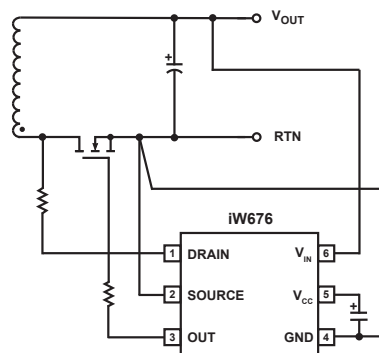
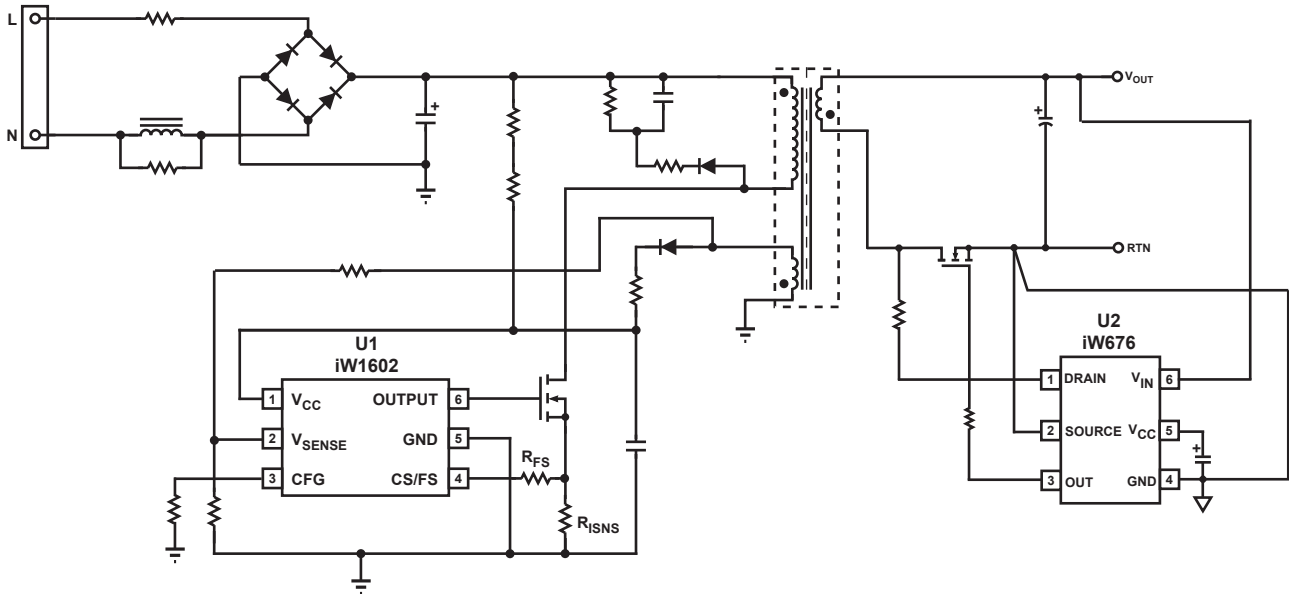
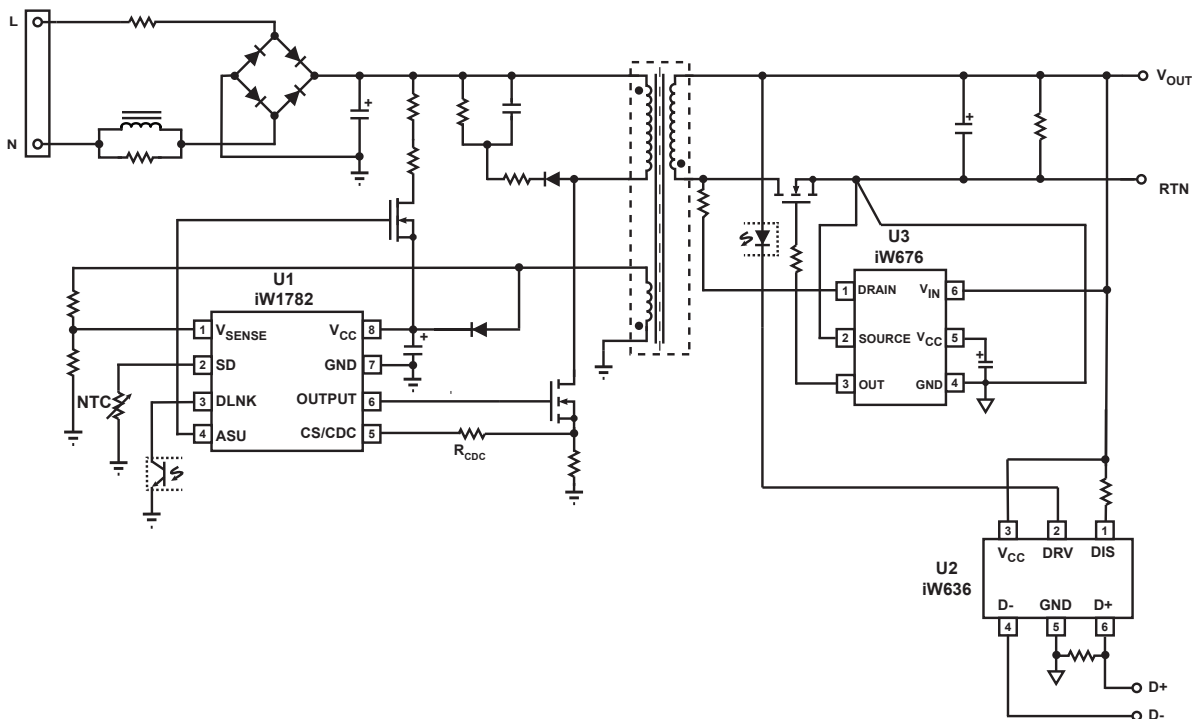


Figure 3.1 : iW676 Typical Application Circuit

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**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)**

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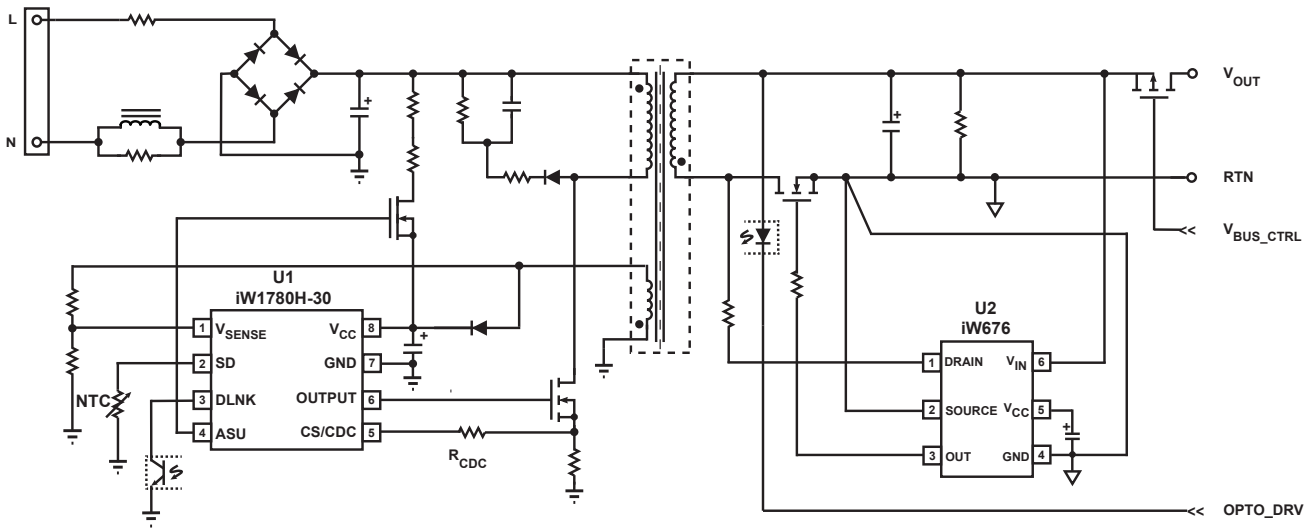


Figure 3.4 : Direct Charge Application with  $V_{BUS}$  Switch (Using Secondary-Side IC Interfacing MD with D+/D- or CC1/CC2 for Direct Charge and iW676 as SR Controller)

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### 4 Pinout Description

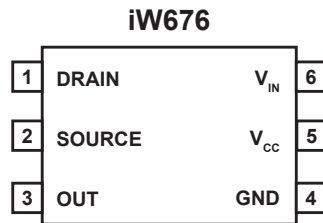


Figure 4.1 : 6-Pin SOT23 Package

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, it is also the secondary-side Active Voltage Positioning function input and output.
2	SOURCE	Analog input	Synchronous rectifier MOSFET source voltage sensing input.
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.

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### 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, $I_{CC} = 15\text{mA}$ max)	$V_{IN}$	-0.3 to 33	V
Continuous DC supply current at $V_{IN}$ pin ( $V_{IN} = 30\text{V}$ )	$I_{VO}$	15	mA
Continuous DC supply current at $V_{CC}$ pin ( $V_{CC} = 5.5\text{V}$ )	$I_{VCC}$	15	mA
Gate peak output current	$I_G$	$\pm 3$	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	$V_{SOURCE}$	-0.6 to 1	V
$V_{CC}$ pin voltage	$V_{CC}$	-0.6 to 6	V
Junction temperature	$T_J$	-40 to 150	$^{\circ}\text{C}$
Storage temperature		-65 to 150	$^{\circ}\text{C}$
Thermal resistance junction-to-ambient	$\theta_{JA}$	190	$^{\circ}\text{C}/\text{W}$
ESD rating per JEDEC JESD22-A114		$\pm 2,000$	V

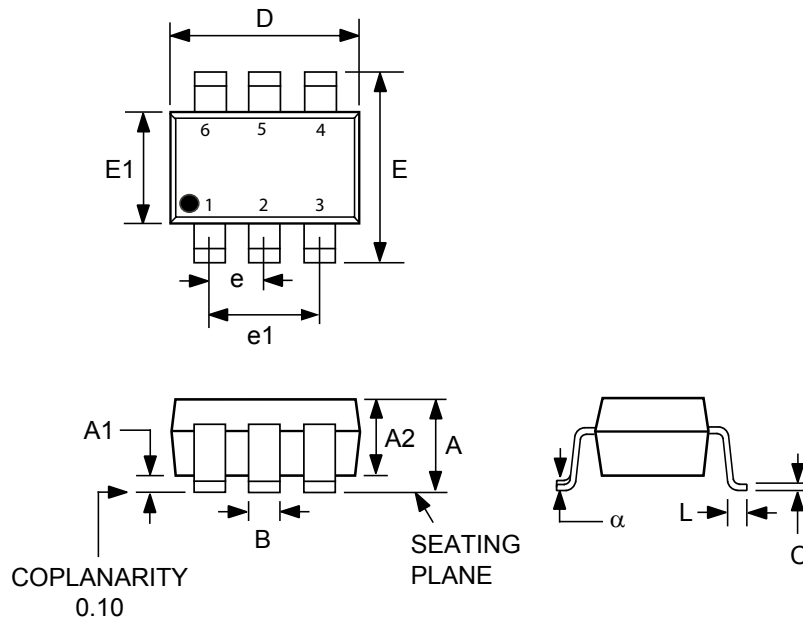
#### Notes:

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

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### 6 Physical Dimensions

#### 6-Lead SOT Package



Symbol	Millimeters	
	MIN	MAX
A	-	1.45
A1	0.00	0.15
A2	0.90	1.30
B	0.30	0.50
C	0.08	0.22
D	2.90 BSC	
E	2.80 BSC	
E1	1.60 BSC	
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
$\alpha$	0°	8°

Compliant to JEDEC Standard MO-178AB

Controlling dimensions are in millimeters

This package is RoHS compliant and Halide free.

Soldering Temperature Resistance:

[a] Package is IPC/JEDEC Std 020D Moisture Sensitivity Level 1

[b] Package exceeds JEDEC Std No. 22-A111 for Solder Immersion Resistance; packages can withstand 10 s immersion < 260°C

Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.25 mm per side.

The package top may be smaller than the package bottom. Dimensions D and E1 are determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar burrs and interlead flash, but including any mismatch between top and bottom of the plastic

### 7 Ordering Information

Part no.	Options	Package	Description
iW676-00	No Active Voltage Positioning (AVP) function	SOT23	Tape & Reel <sup>(1)</sup>
iW676-30	With secondary Active Voltage Positioning (AVP) function, under-voltage threshold ( $V_{UV}$ ) = 4.75V <sup>(2)</sup>	SOT23	Tape & Reel <sup>(1)</sup>
iW676-32	With secondary Active Voltage Positioning (AVP) function, under-voltage threshold ( $V_{UV}$ ) = 11.2V <sup>(2)</sup>	SOT23	Tape & Reel <sup>(1)</sup>

#### Notes:

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

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

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