Digital Green-Mode Synchronous Rectifier Controller

1 Description

The iW671 is a high performance synchronous rectifier controller with an integrated MOSFET driver for flyback converters operating at discontinuous conduction mode. Combined with the MOSFET, the iW671 can emulate the diode rectifier at the secondary side of the flyback to reduce conduction loss. The iW671 determines the timing of the driver by sensing the voltage across the $R_{DS(ON)}$ to achieve lossless sensing. The iW671 uses proprietary digital adaptive turn-off control technology to minimize the turn-off deadtime of the synchronous rectifier so that the parallel Schottky diode required by conventional synchronous rectifiers can be eliminated. The integrated driver has strong driving capability for high efficiency. The operating power consumption of the controller excluding the driver is less than 4mW at no load to achieve the ultra-low no-load power consumption for 5V applications. The iW671 integrates a pulse linear regulator to maintain the operation of the synchronous rectifier at low system output voltage when the system is operating in constant current (CC) mode.

The iW671 also integrates the adaptive voltage position monitor to detect the flyback converter output voltage undershoot, enabling faster recovery from standby. Dialog's iW1766C1 primary-side controllers are optimized to work with the iW671 for very low output ripple, fast dynamic load response (DLR), and very low no-load power consumption (< 15mW) at $230V_{AC}$ input in a typical 5V, 2.5A power supply.

2 Features

- Digital adaptive turn-off control minimizes deadtime and eliminates the parallel Schottky diode
- Integrated pulse linear regulator (PLR) allows SR operation at low system output voltage down to 2V in typical 5V, 2.5A USB charger applications
- Wide input operating voltage up to 30V
- Optimized 5V MOSFET gate driver

- Intelligent low power management achieves ultra-low no-load operating current < 0.65mA
- Lossless MOSFET V_{DS} sensing for SR timing control
- Integrated adaptive voltage position monitor for fast flyback output voltage undershoot detection
- 8-pin SOIC and 8-pin MSOP packages

3 Applications

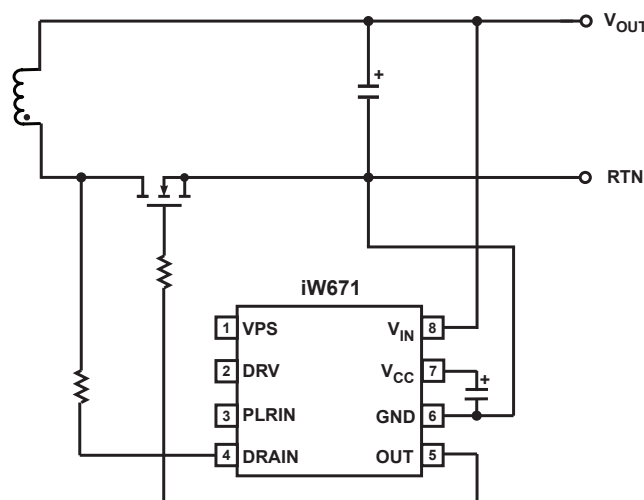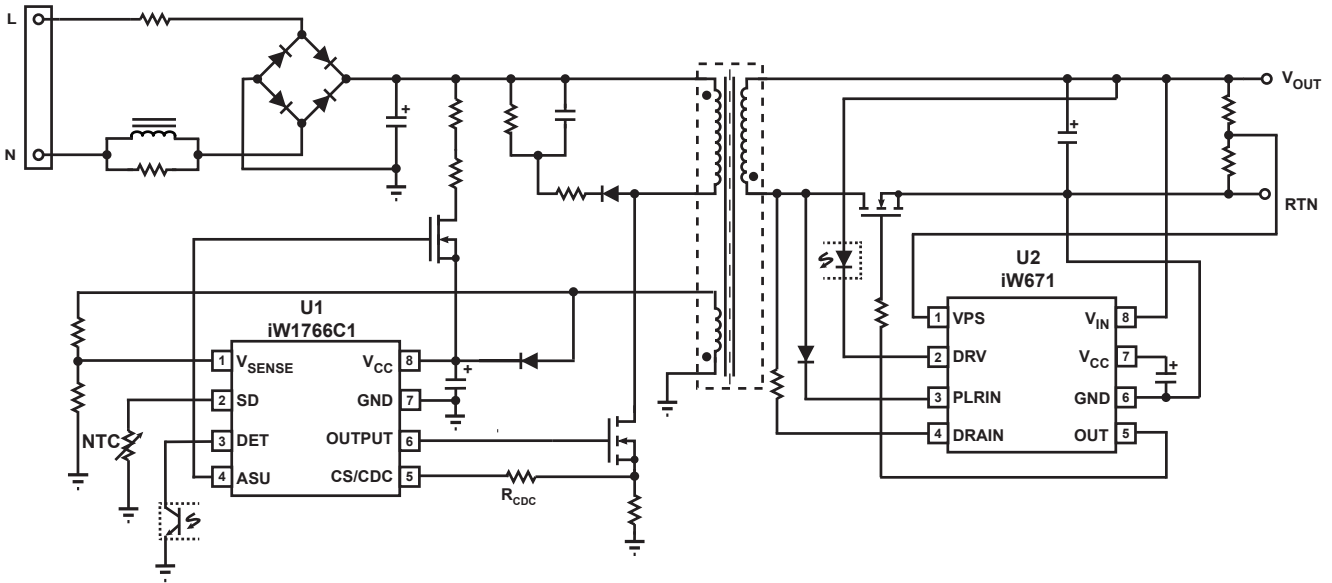- Compact AC/DC adapters/chargers for media tablets and smart phones

Figure 3.1 : iW671 Typical Application Circuit

Figure 3.2 : iW671 Typical Application Circuit (Using iW1766C1 as Primary-Side Controller)
(Achieving < 15mW No-Load Power Consumption in 5V, 2.5A Adapter Designs with Fast Dynamic Load Response,
and Supporting Constant Current Operation down to 2V System Output)
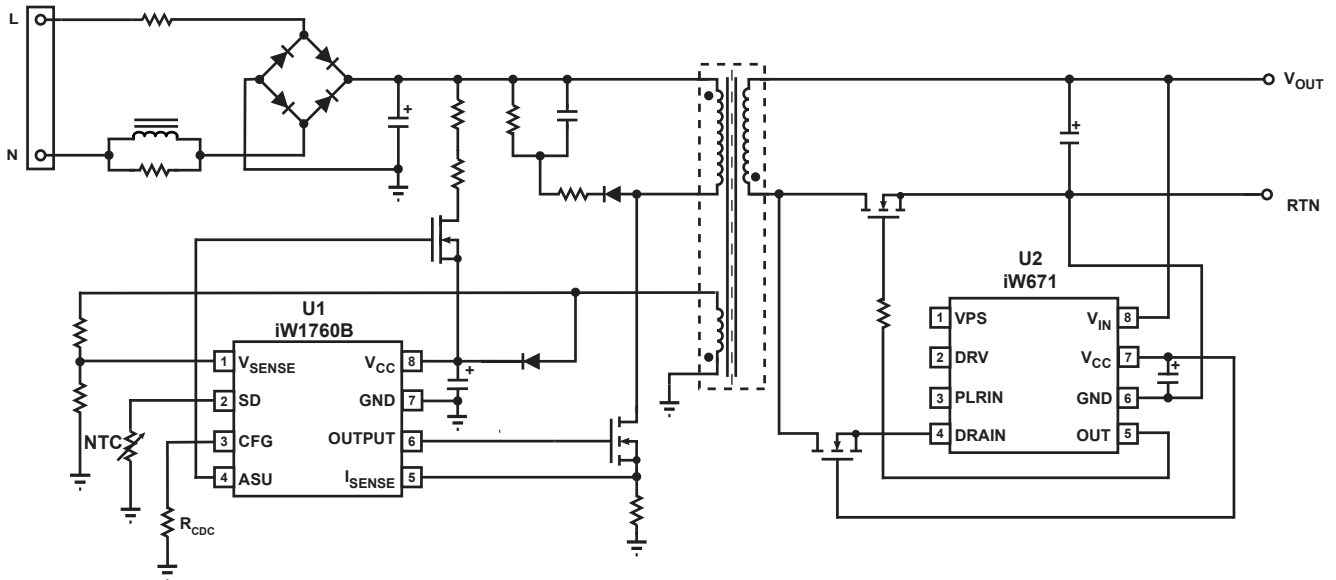
Figure 3.3 : iW671 Typical Application Circuit for 12V-Output Application
(Using iW1760B as Primary-Side Sensing Flyback Controller with the PLRIN Pin Floating)

4 Pinout Description

iW671

1	VPS	V_{IN}	8
2	DRV	Vcc	7
3	PLRIN	GND	6
4	DRAIN	OUT	5
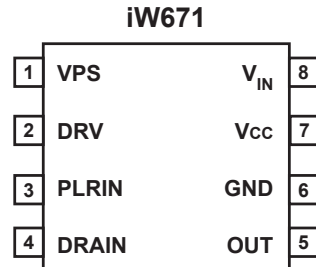
Figure 4.1 : 8-Pin SOIC/MSOP Package

Pin No.	Pin Name	Type	Pin Description
1	VPS	Analog Input	Voltage position sense. Power supply output voltage information to be compared with the internal reference voltage.
2	DRV	Analog Output	External circuit drive. It drives an external circuit such as the opto-coupler LED.
3	PLRIN	Power Input	Pulse linear regulator (PLR) input. Connect this pin through a diode (cathode to the pin) to the drain of the synchronous rectifier MOSFET.
4	DRAIN	Analog Input	Synchronous rectifier MOSFET drain voltage sensing.
5	OUT	Output	Synchronous rectifier MOSFET driver.
6	GND	Ground	Ground.
7	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.
8	V_{IN}	Power Input	Connect to adapter/charger output for bias voltage. The internal LDO clamps the V_{CC} voltage at 5V when V_{IN} > 5V. The 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.

Parameter	Symbol	Value	Units
V_{IN} DC supply voltage range (pin 8, 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	V_D	-1.5 to 60	V
PLRIN pin voltage	V_{PLRIN}	-1.5 to 60	V
PLRIN peak input current	I_{PLRIN_LR}	500	mA
V_{CC} pin voltage	V_{CC}	6	V
DRV pin voltage		-0.3 to 33	V
DRV pin current range (continuous)		15	mA
VPS pin voltage		-0.3 to V_{CC}	V
VPS pin current rating		1	mA
Operating junction temperature	T_{JOPT}	-40 to 150	°C
Storage temperature	T_{STG}	-65 to 150	°C
Thermal resistance junction-to-ambient (SOIC-8 package)	θ_{JA_SO8}	160	°C/W
Thermal resistance junction-to-case (SOIC-8 package)	θ_{JC_SO8}	4.8	°C/W
Thermal resistance junction-to-board (SOIC-8 package)	θ_{JB_SO8}	66.4	°C/W
Thermal resistance junction-to-ambient (MSOP package)	θ_{JA_MSOP}	240	°C/W
Thermal resistance junction-to-case (MSOP package)	θ_{JC_MSOP}	4.3	°C/W
Thermal resistance junction-to-board (MSOP package)	θ_{JB_MSOP}	127.8	°C/W
ESD rating per JEDEC JESD22-A114		±2,000	V

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6 Physical Dimensions

Symbol	Min	Max
A	–	1.10
A1	0.05	0.15
A2	0.75	0.95
b	0.22	0.38
c	0.13	0.23
D	2.90	3.10
E1	2.90	3.10
E	4.80	5.00
L	0.40	0.70
L1	0.95 REF	
e	0.65 BSC	
θ	0°	8°

Notes:
1. All dimensions are in millimeters.
2. Dimensions are inclusive of plating.
3. Dimensions are exclusive of mold flash & metal burr.
4. Comply to JEDEC MO−187.
5. This package outline are for full PPF (Ni/Pd) matrix leadframe.
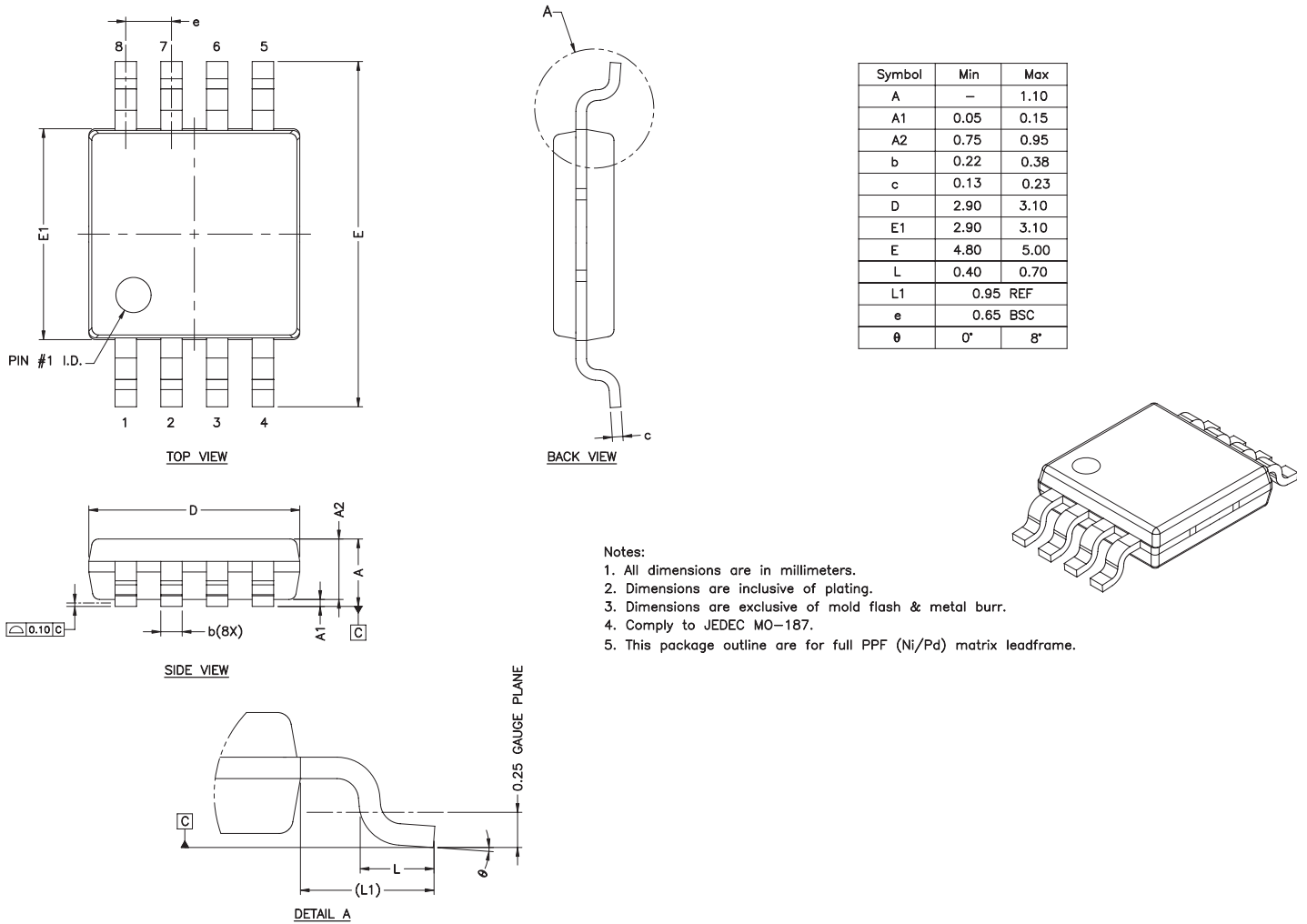
Figure 6.1 : Physical Dimensions of 8-pin MSOP Package

Physical Dimensions (continued)

8-Lead Small Outline (SOIC) Package
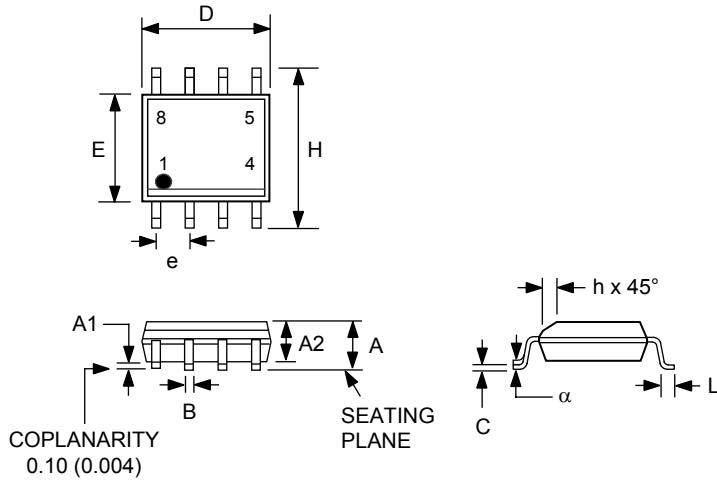
Symbol	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.0040	0.010	0.10	0.25
A2	0.049	0.059	1.25	1.50
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
D	0.189	0.197	4.80	5.00
E	0.150	0.157	3.80	4.00
e	0.050 BSC		1.27 BSC	
H	0.228	0.244	5.80	6.20
h	0.10	0.020	0.25	0.50
L	0.016	0.049	0.4	1.25
α	0°	8°		

Compliant to JEDEC Standard MS12F

Controlling dimensions are in inches; millimeter dimensions are for reference only

This product 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; package 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 0.15 mm per end. Dimension E1 does not include interlead flash or protrusion. Interlead flash or protrusion 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, gate burrs and interlead flash, but including any mismatch between the top and bottom of the plastic body.

Figure 6.2 : Physical Dimensions of 8-pin SOIC Package

Part no.	Options	Package	Description
iW671-00-SO8-B2	External current limit circuit may be needed if PLRIN is used	SOIC, 8 pin	Tape & Reel[1]
iW671-00-MSO8	External current limit circuit may be needed if PLRIN is used	MSOP, 8 pin	Tape & Reel[1]

Note 1: Tape and reel packing quantity is 2,500/reel. Minimum ordering quantity is 2,500.

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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:
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