

## GENERAL DESCRIPTION

OB2301W is a high performance and tightly integrated secondary side synchronous rectifier for switch mode power supply system. It combines a much lower voltage drop N-channel MOSFET to emulate the traditional diode rectifier at the secondary side of Flyback converter, which can reduce heat dissipation, increases output current capability and efficiency and simplify thermal design. OB2301W can support low system output voltage down to 2V at constant current mode.

It is suitable for multiple mode applications including discontinuous conduction mode and quasi-resonant mode. With its versatility and optimization, OB2301W can be used in various switch mode power supply topologies including secondary-side control topology and primary-side control topology.

From the information on the secondary side of the isolation transformer, OB2301W generates a driving signal with dead time with respect to the primary side PWM signal to turn the integrated N-channel SR switch on and off in proximity of the zero current transition with the help of smart driver voltage control. It is optimized for 5V output voltage. In primary-side control topology, OB2301W can detect the output voltage and feed back a series of warning pulses to primary side controller when the output voltage is lower than an

inner-determined threshold to awaken the primary-side power switch to improve dynamic response.

The externally adjustable minimum on time and property off time control scheme effectively avoid the ring impact induced by parasitic elements so that a reliable and noise free operation of the SR system is insured.

OB2301W is offered in SOP8 package.

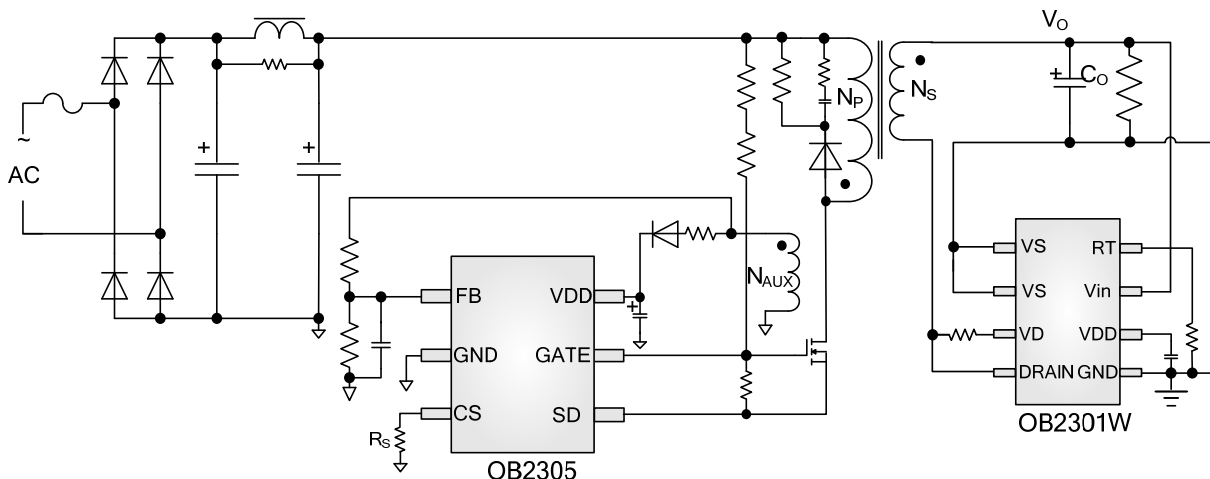
## FEATURES

- Secondary-side synchronous rectifier optimized for 5V output system
- Suitable for DCM, QR operation
- Accurate secondary side MOSFET Vds sensing
- Low cost small size CC/CV mode support
- Up to 200kHz operation frequency
- 3A/2A peak current sink/source driver capability
- Output voltage over-shoot and under-shoot control
- Enhanced dynamic response with firing warning pulses scheme
- VDD UVLO protection

## APPLICATIONS

- AC/DC 5V adaptors
- Cell phone charger
- 5V Bias supply
- Low voltage rectification circuits

## TYPICAL APPLICATION

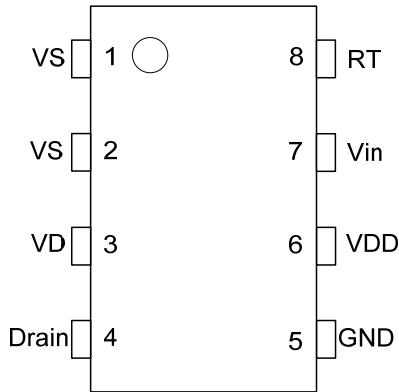




**GENERAL INFORMATION**

**Pin Configuration**

The OB2301W is offered in SOP8 package, shown as below.



**Absolute Maximum Ratings**

Parameter	Value
Vin pin	-0.6V to 7V
VDD pin	-0.6V to 7V
VD pin	-0.6V to 50V
VS pin	-0.6V to 7V
RT pin	-0.6V to 7V
Drain pin	-0.6V to BVdss
Min/Max Operating Junction Temperature T <sub>J</sub>	-40 to 150 °C
Operating Ambient Temperature T <sub>A</sub>	-40 to 85 °C
Min/Max Storage Temperature T <sub>stg</sub>	-55 to 150 °C
Lead Temperature (Soldering, 10secs)	260 °C

**Note:** Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.

**Ordering Information**

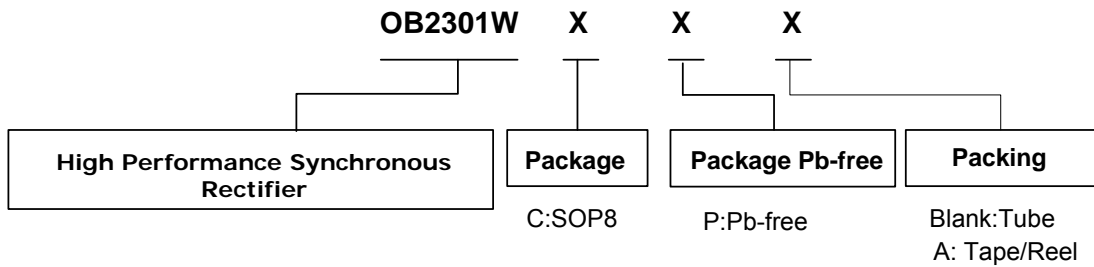
Part Number	Description
OB2301WCP	SOP8, Pb-free in Tube
OB2301WCPA	SOP8, Pb-free in T&R

**Package Dissipation Rating**

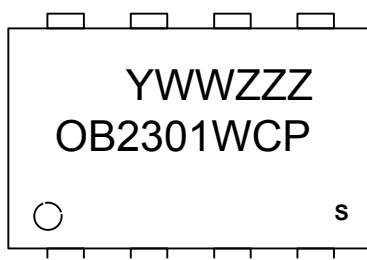
Package	R <sub>θJA</sub> (°C/W)
SOP8	90

**Recommended Operating Range**

Symbol	Parameter	Min/Max
VDD	VDD Supply Voltage	4V to 5.5V



### Marking Information



Y:Year Code  
WW:Week Code(01-52)  
ZZZ:Lot Code  
C:SOP8 Package  
P:Pb-free Package  
S:Internal Code(Optional)

### TERMINAL ASSIGNMENTS

Pin Name	I/O	Description
VS	I	This pin is connected to external n-channel MOSFET source
VD	I	This pin is connected to external n-channel MOSFET drain
Drain	I/O	SR Mosfet drain pin. This pin is connected to secondary-side winding of transformer
GND	P	Ground.
VDD	P	Power Supply
Vin	I	System output voltage detection
RT	O	Minimum on time control pin. A resistor is connected from this pin to GND





## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = 25°C, VDD=5V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Supply Voltage (VDD)</b>						
I_VDD_operation	Operation current	Frequency@Vd=65KHz,VD D=5V,1nF Cap load at GATE.		1.5	2.0	mA
		Frequency@Vd=2KHz,VDD =5V,No load at GATE.		0.5	0.7	mA
Vdd_regulation_mini	Minimum Vdd regulation voltage			4.2		V
UVLO(ON)	VDD Under Voltage Lockout Entry		2.8	3.0	3.2	V
UVLO(OFF)	VDD Under Voltage Lockout Exit (Recovery)		2.9	3.1	3.3	V
<b>VD Detection Section</b>						
Vth_SR_act	SR MOSFET turn on threshold voltage detection at VD			-350		mV
Vth_SR_deact	SR MOSFET turn off threshold voltage detection at Vd			-5		mV
Tdelay_on	SR MOSFET turn-on propagation delay				100	ns
Tdelay_off	SR MOSFET turn-off propagation delay				75	ns
T_minimum_on	SR MOSFET minimum on time	RT=25KΩ		1.9		Us
<b>RT Section</b>						
Vrt	Voltage reference at RT pin		0.95	1	1.05	V
<b>Over/Under Shoot Control Section</b>						
Vo_delta	Output delta variation in system output undershoot control			160		mV
Vo_delta_enb	Output delta variation detection enable voltage			5.25		V
Fsample	Output delta variation detection Sample frequency			15		KHz
Vo_low_clamp	System output undershoot clamp control trigger voltage		4.5	4.6	4.7	V
Vo_High_clamp	System output overshoot clamp control trigger voltage			5.8		V
IVo_High_clamp	System output overshoot clamp current			70		mA
Dsr_pulse	Warning signal pulse width when system output undershoot is detected			800		nS
Fsw	Warning signal frequency when system output undershoot is detected		27	30	33	KHz
Tdelay	Warning signal blanking time after secondary-side			65		us

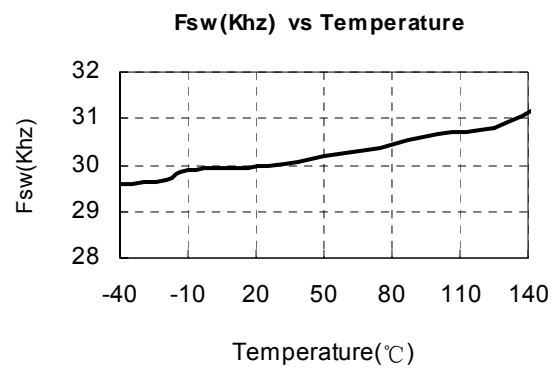
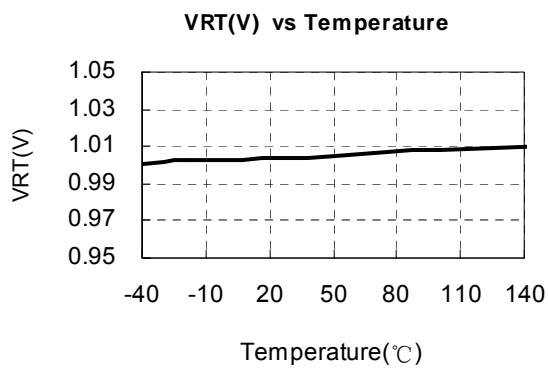
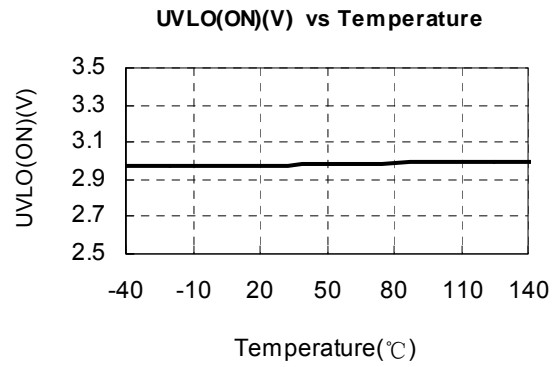
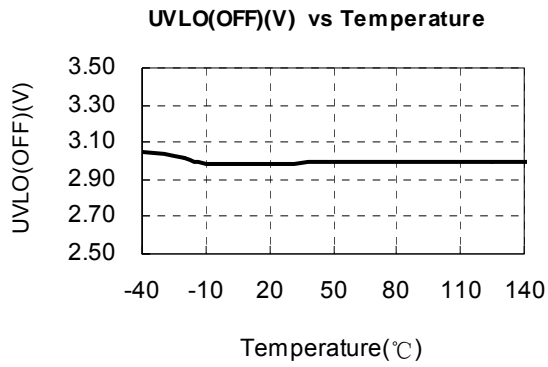


**OB2301W**  
High Performance Synchronous Rectifier

	demagnetization				
<b>SR Mosfet Section</b>					
BVdss	MOSFET Drain-Source Breakdown Voltage		50		V
Rdson	On Resistance			15	mΩ



**CHARACTERIZATION PLOTS**



## Operation Description

OB2301W is a high performance and versatile synchronous rectifier. It can emulate the behavior of Schottky diode rectifier which directly reduces power dissipation of the traditional rectifiers and indirectly reduces primary-side loss due to compounding of efficiency gains.

### Startup and under voltage lockout(UVLO)

OB2301W implements UVLO function during startup. When VDD rises above UVLO(off), the IC wakes up from under voltage lock out state and enter normal operation. When VDD drops below UVLO(on), the IC enter under voltage lock out state again and the SR gate is pulled low by 10K resistor on chip. In addition, there is a hysteresis window between UVLO(off) and UVLO(on) to make system work reliably.

### Synchronization rectifier

OB2301W controls the turn-on and turn-off of synchronization rectifier MOSFET (SR MOSFET) by detection of drain-source voltage. When demagnetization of transformer starts, the secondary-side current will flow through the body diode of SR MOSFET and the voltage at the drain will drop to about -700mV. As soon as OB2301W detects this negative voltage, the driver voltage is pulled high to turn on the SR MOSFET after very short delay time about 100nS, refer to Fig.1.

After the SR MOSFET is turned on, the drain voltage of SR MOSFET begins to rise based on its  $R_{dson}$  and secondary-side current. The drain voltage becomes higher with demagnetization going on. When the drain voltage rises above -5mV, the driver voltage will be pulled down to ground very quickly, refer to Fig.1

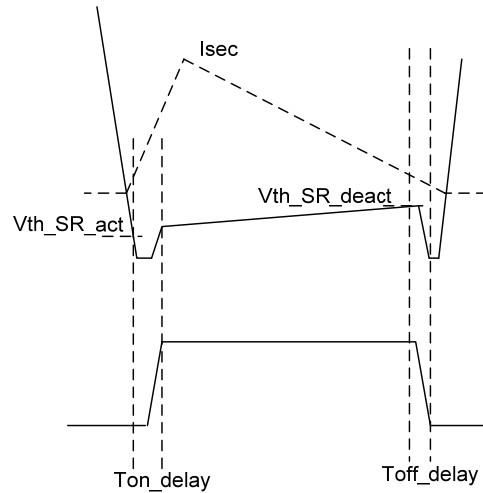


Fig.1 SR MOSFET turn-on and turn-off timing

### Adjustable minimum on time

OB2301W offers adjustable minimum on time control. This timer can avoid effectively false turn-off due to high frequency interference caused by parasitic element at the start of secondary-side demagnetization.

$$T_{onmin}=8*RT*10E(-11)$$

### Adaptive minimum off time

At the end of demagnetization, SR MOSFET will be turn off. The remaining current will flow through body diode again, which may result in negative voltage (about -700mV) appears at drain and SR MOSFET will turn on again. In addition, the resonance oscillation between the magnetization inductance and parasitic capacitance after demagnetization may cause negative drain voltage. These may turn on SR MOSFET by mistake. To avoid above mis-turn-on of SR MOSFET, constant minimum off time can be used to screen it. But it may disturb SR MOSFET operation. For reliable SR operation, proprietary adaptive minimum off time control is implemented in OB2301W, which can guarantee reliable synchronous rectification operation in DCM, QR.

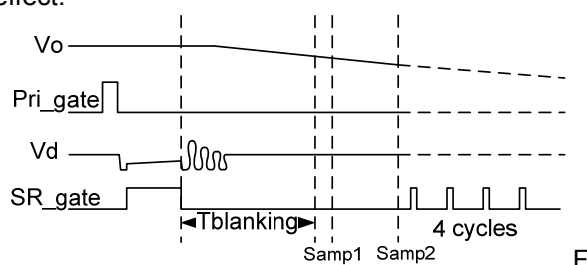
### Output voltage under-shoot Control

When a load transient event happens, the system output voltage may drops. OB2301W can prevent output voltage drop too low through direct detection of system output voltage. When the output voltage variation between the successive sample cycle exceeds 160mV, OB2301W can





output 4 pulses with pulse width 800nS and 30Khz frequency to wake up primary side controller to switch the primary-side power MOSFET on to deliver more power to the loading in order to make output voltage back to regulation. In addition, if the system output voltage drops to threshold voltage determined by OB2301W (4.6V), the above primary side wake up process is still in effect.



ig.2 Output voltage under-shoot control timing diagram

### Output overshoot clamp

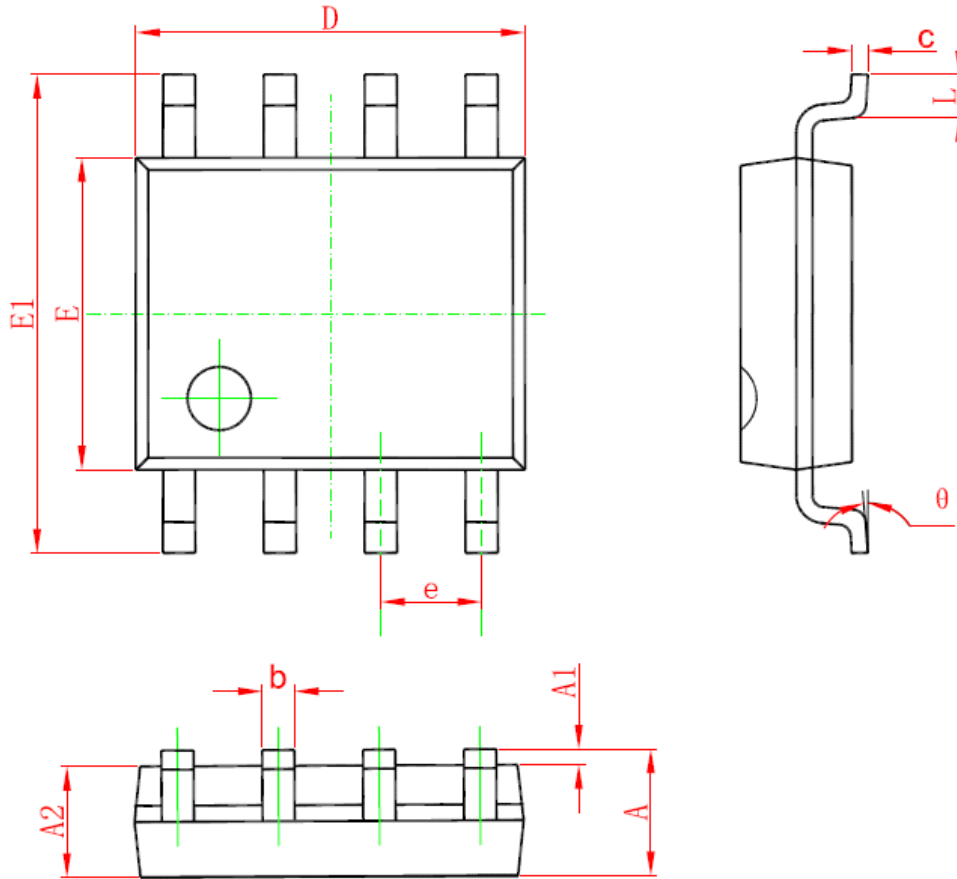
For poor system design, there is usually output overshoot during startup and load transient. To facilitate system design, OB2301W can detect output overshoot condition and prevent overshoot happen. When output voltage rises to meet the inner threshold, OB2301W will open a discharge path from Vdd to ground to clamp the system output voltage, so the system output overshoot can be prevented.

### Gate driver

For good and efficient synchronous rectification operation, the SR MOSFET should be turned on/off in very short time. Therefore strong driver capability is needed. OB2301W can offer typical source capability 2A and typical sink capability 3A. This guarantees fast turn-on and turn-off of SR MOSFET.

**PACKAGE MECHANICAL DATA**

**SOP8 PACKAGE OUTLINE DIMENSIONS**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.250	1.650	0.049	0.065
b	0.310	0.510	0.012	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.150	0.185	0.203
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.05 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



## IMPORTANT NOTICE

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