GENERAL DESCRIPTION

OB2001 is a high performance and tightly integrated secondary side synchronous rectification controller and driver used for secondary side rectification in switch mode power supply system. It drivers 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. OB2001 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, OB2001 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, OB2001 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.

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.
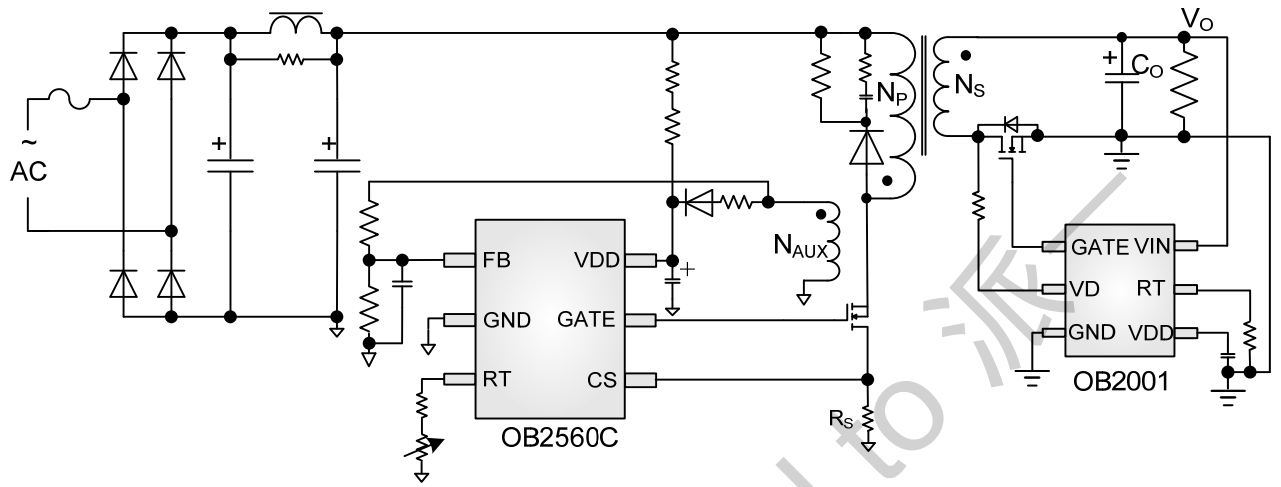
OB2001 is offered in SOT23-6 package.

FEATURES

■ Secondary-side synchronous rectification controller 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 overshoot control
■ VDD UVLO protection

APPLICATIONS

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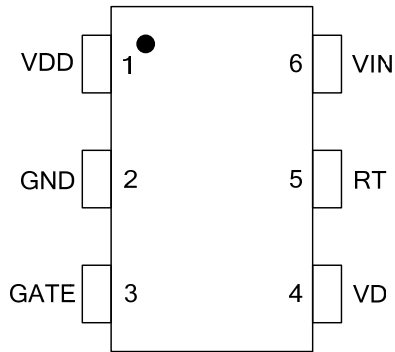■ Low voltage rectification circuits

TYPICAL APPLICATION

GENERAL INFORMATION

Pin Configuration

The OB2001 is offered in SOT23-6 package, shown as below.

SOT23-6

Ordering Information

Part Number	Description
OB2001MP	SOT23-6, Pb-free in T&R

Package Dissipation Rating

Package	RθJA(℃/W)
SOT23-6	200

Absolute Maximum Ratings

Parameter	Value
Vin pin	-0.6V to 7V
VDD pin	-0.6V to 7V
VD pin	-2.5V to 50V ^{Note2}
Gate pin	-0.6V to 7V
RT pin	-0.6V to 7V
Min/Max Operating Junction Temperature TJ	-40 to 150 ℃
Operating Ambient Temperature T_A	-20 to 85 ℃
Min/Max Storage Temperature Tstg	-55 to 150 ℃
Lead Temperature (Soldering, 10secs)	260 ℃

Note1: 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.

Note2: -2.5V applies to minimum duty cycle during normal operation only.

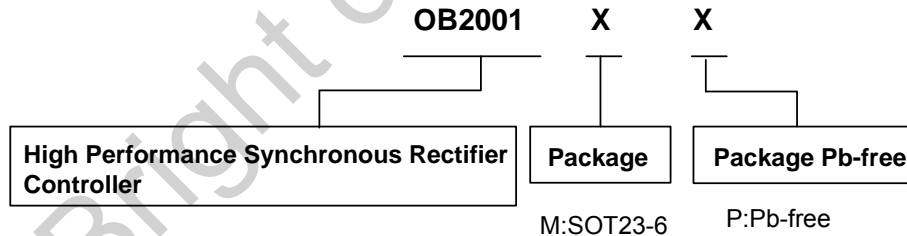**Recommended Operating Range**

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

OB2001   X   X

High Performance Synchronous Rectifier Controller	Package	Package Pb-free
	M:SOT23-6	P:Pb-free

Marking Information

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001YWW
. ZZZ s
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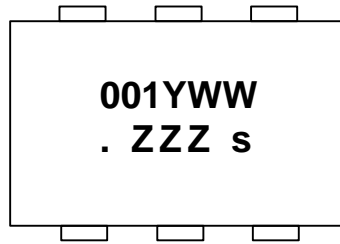
Y:Year Code
WW:Week Code(01-52)
ZZZ: Lot Code
s: Internal Code(Optional)

TERMINAL ASSIGNMENTS

| Pin Name	I/O	Description
VD	I	This pin is connected to external n-channel MOSFET drain
Gate	O	Driver output for external N-channel MOSFET
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

BLOCK DIAGRAM
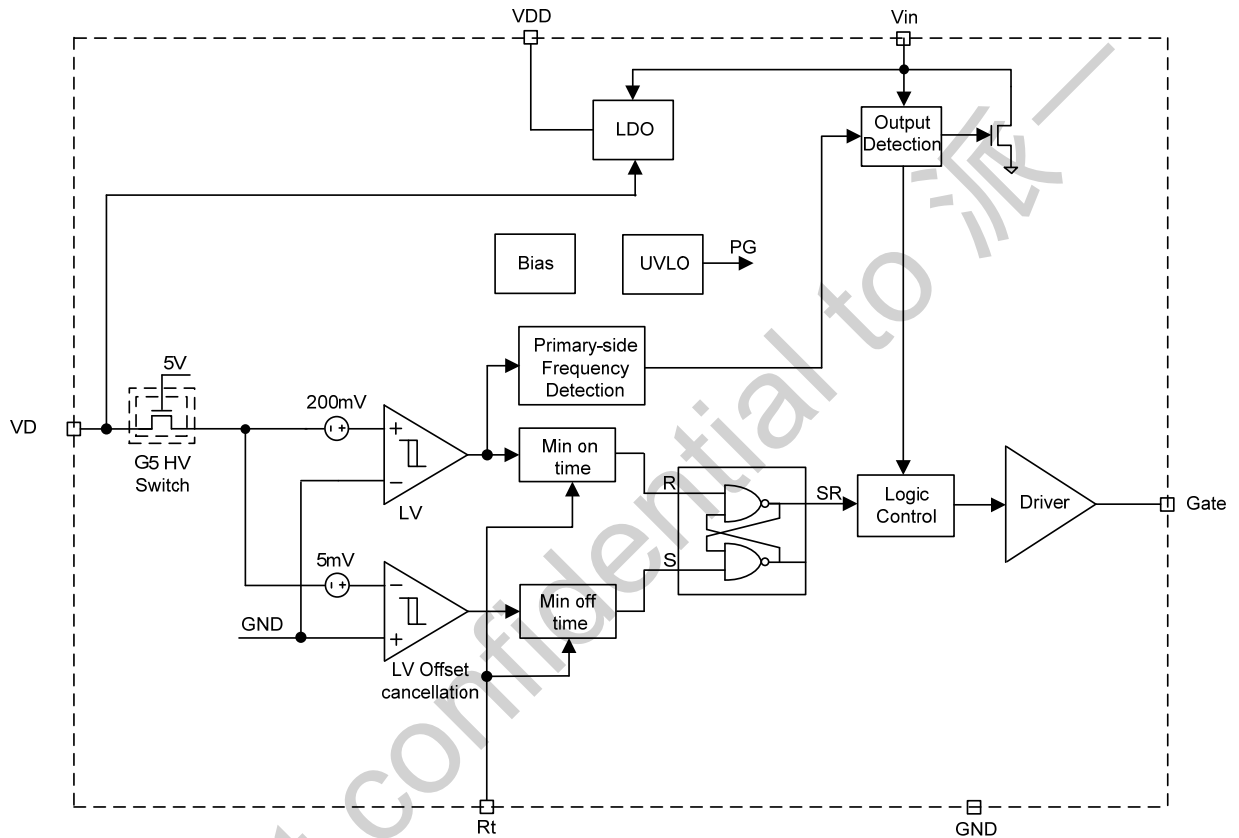
ELECTRICAL CHARACTERISTICS

(T_A = 25℃, VDD=5V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Supply Voltage (VDD)						
I_Vdd_operation	Operation current	Frequency@Vd=65KHz,VDD=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
VD Detection Section						
Vth_SR_act	SR MOSFET turn on threshold voltage detection at VD			-200		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
RT Section						
Vrt	Voltage reference at RT pin		0.95	1	1.05	V
Overshoot Control Section						
Vo_High_clamp_1st	System output 1st overshoot clamp control trigger voltage at Vin with SR frequency lower than 7.5KHz			5.65		V
Vo_High_clamp_2nd	System output 2nd overshoot clamp control trigger voltage at Vin			6.15		V
IVo_High_clamp	System output overshoot clamp current			100		mA
GATE driver Section						
VOH	Output high level @ VDD=5V		4.5			V
VOL	Output low level @ VDD=5V				1	V
Rds_on	Pull-up driver			2.5		Ω
	Pull-down driver			1.5		Ω
Isource	Source current			2		A
Isink	Sink current			3		A
Tf	Falling time	Gate voltage falling from 4V to 1V @ C_L=1nF		30		ns
Tr	Rising time	Gate voltage rising from 1V to 4V @ C_L=1nF		30		ns

CHARACTERIZATION PLOTS

UVLO(OFF)(V) vs Temperature

UVLO(ON)(V) vs Temperature

VRT(V) vs Temperature
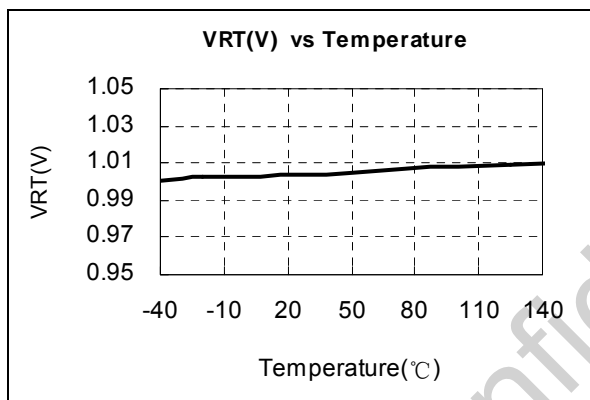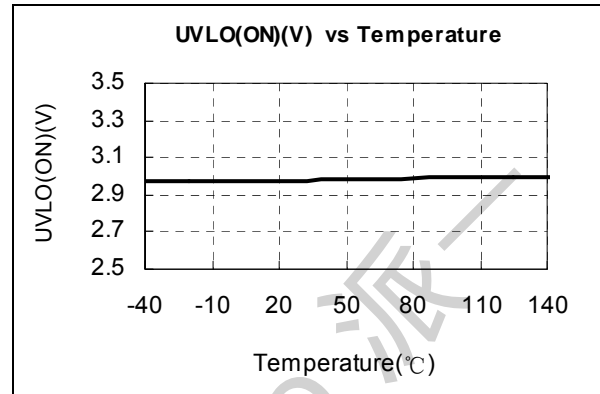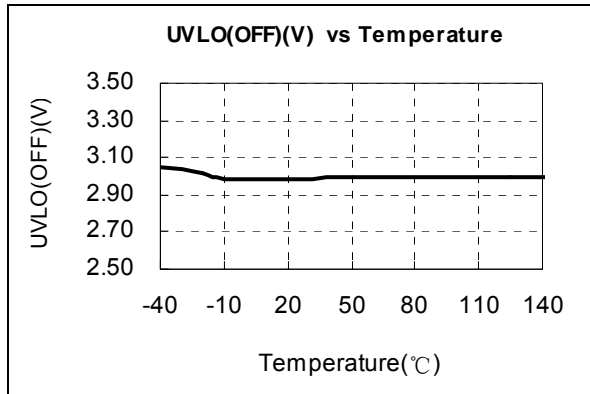
Operation Description

OB2001 is a high performance and tightly integrated secondary side synchronous rectification controller operating in DCM and QR mode and driver in switch mode power supply system. It drivers a much lower voltage drop N-channel MOSFET to emulate the traditional diode rectifier, which can reduce heat dissipation, increases output current capability and efficiency, and simplify thermal design.

Startup and under voltage lockout(UVLO)
OB2001 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
OB2001 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 OB2001 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 Rdson 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
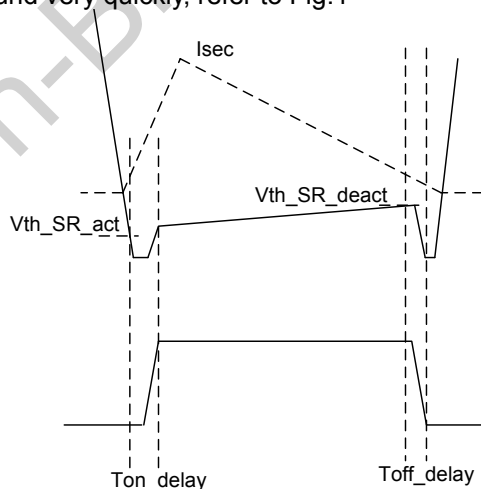
Adjustable minimum on time
OB2001 offers adjustable minimum on time control. This timer can avoid effectively false turn-off due to high frequency interference caused by parasitic element at the start of secondary-side demagnetization.

$$Tonmin = 8 \times RT \times 10E(-11)$$

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 OB2001, which can guarantee reliable synchronous rectification operation in DCM, QR.

Output overshoot clamp
For poor system design, there is usually output overshoot during startup and load transient. To facilitate system design, OB2001 can detect output overshoot condition and prevent overshoot happen. When output voltage rises to meet the inner threshold, OB2001 will open a discharge path from Vin 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. OB2001 can offer typical source capability 2A and typical sink capability 3A. This guarantees fast turn-on and turn-off of SR MOSFET.

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

PACKAGE MECHANICAL DATA

SOT-23-6L PACKAGE OUTLINE DIMENSIONS
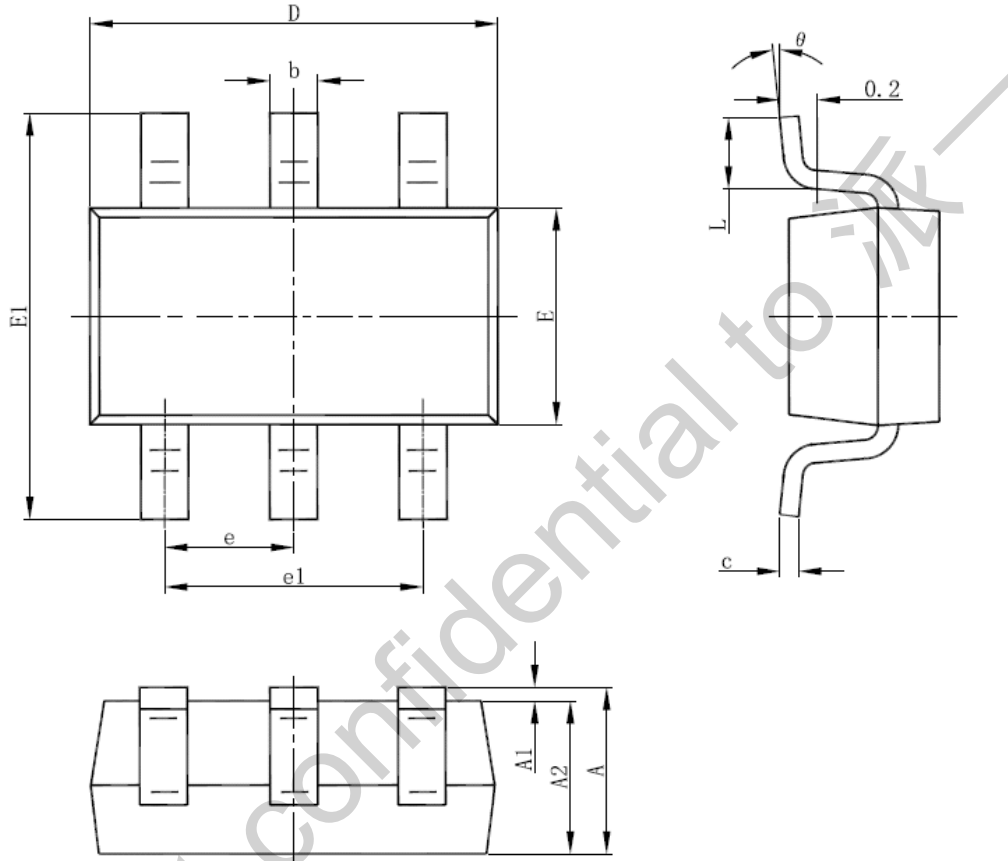
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.000	1.450	0.039	0.057
A1	0.000	0.150	0.000	0.006
A2	0.900	1.300	0.035	0.051
b	0.300	0.500	0.012	0.020
c	0.080	0.220	0.003	0.009
D	2.800	3.020	0.110	0.119
E	1.500	1.726	0.059	0.068
E1	2.600	3.000	0.102	0.118
e	0.950 (BSC)		0.037 (BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0º	8º	0º	8º

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