

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.

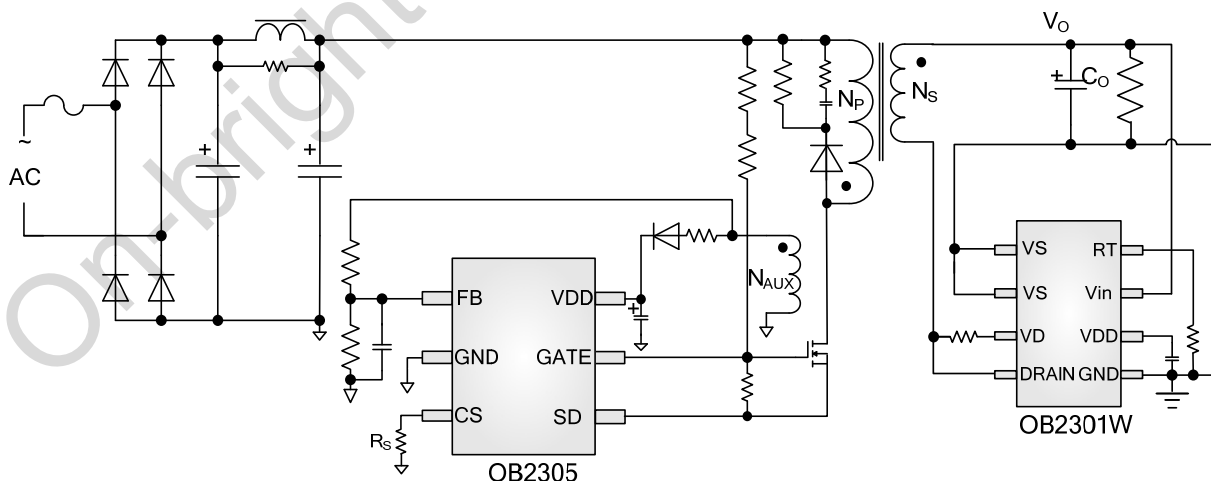
FEATURES

- 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

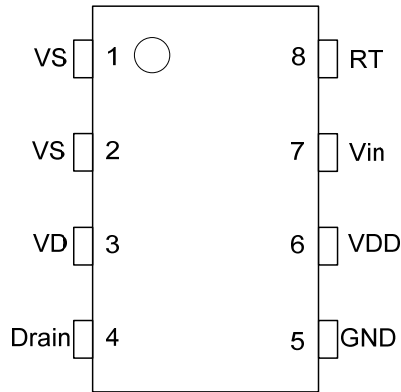
TYPICAL APPLICATION



GENERAL INFORMATION

Pin Configuration

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



Ordering Information

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

Package Dissipation Rating

| Package | R θ JA(°C/W) |
|---------|---------------------|
| SOP8 | 90 |

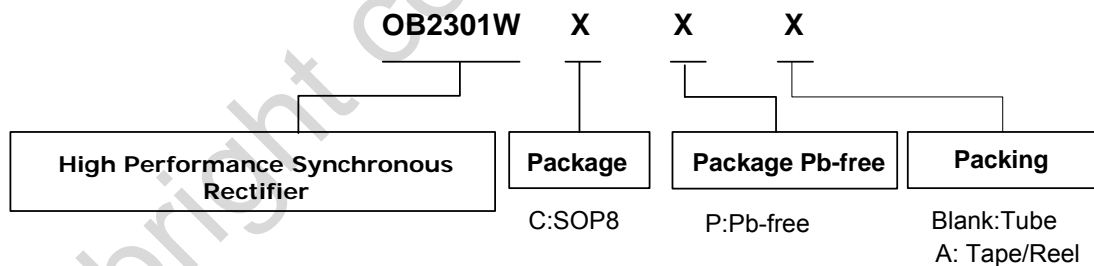
Absolute Maximum Ratings

| 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 _J | -40 to 150 °C |
| Operating Ambient Temperature T _A | -40 to 85 °C |
| Min/Max Storage Temperature T _{stg} | -55 to 150 °C |
| Lead Temperature (Soldering, 10secs) | 260 °C |

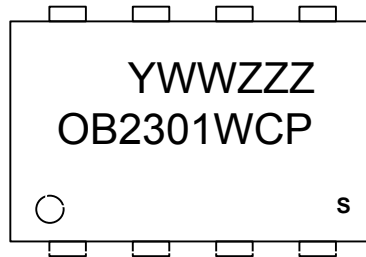
Note: Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to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

Recommended Operating Range

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



Marking Information

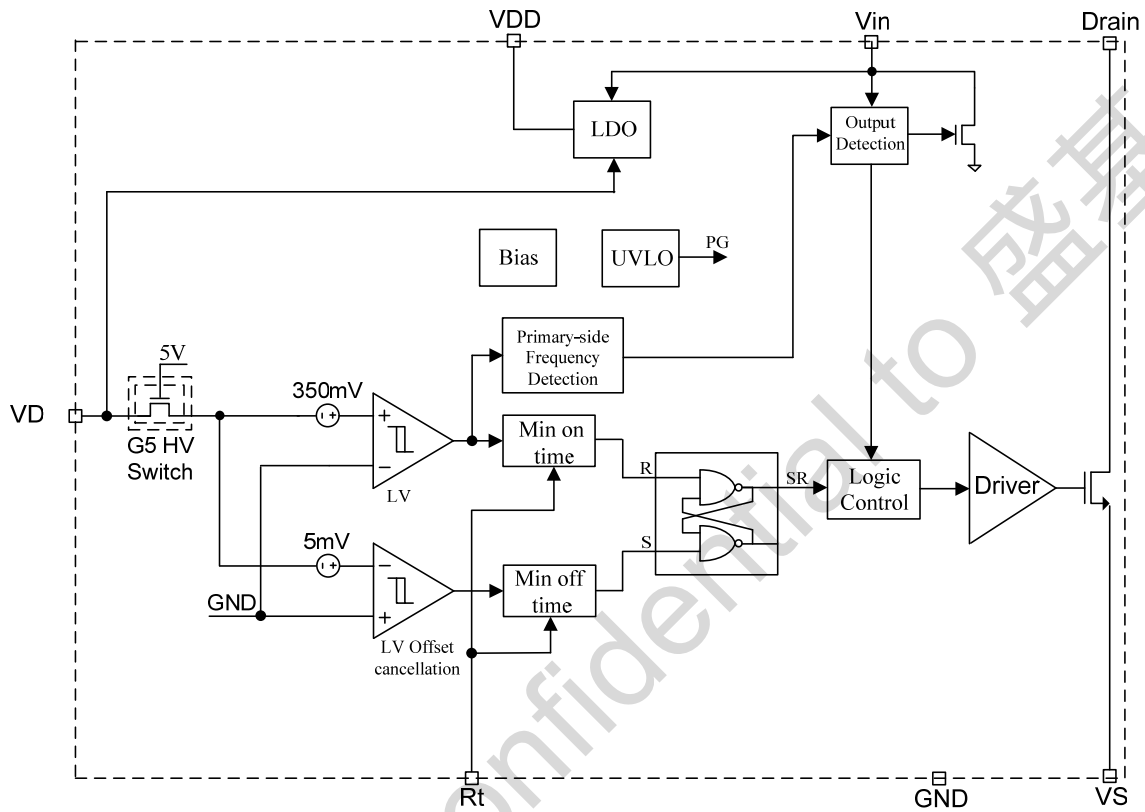


Y:Year Code
 WW:Week Code(01-52)
 ZZZ:Lot Code
 C:SOP8 Package
 P:Pb-free Package
 S:Internal Code(Optional)

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 |

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

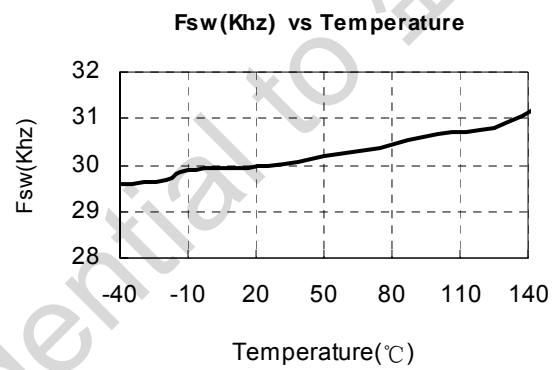
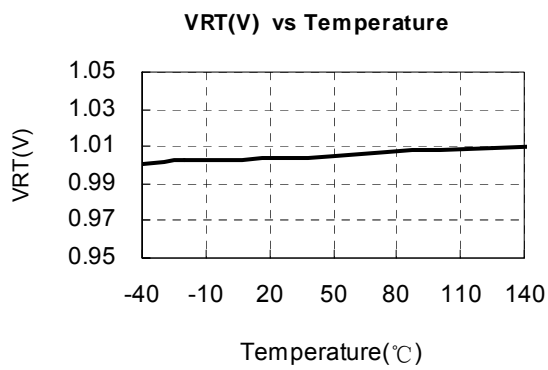
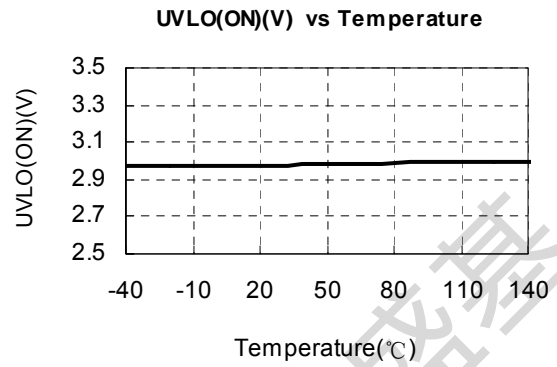
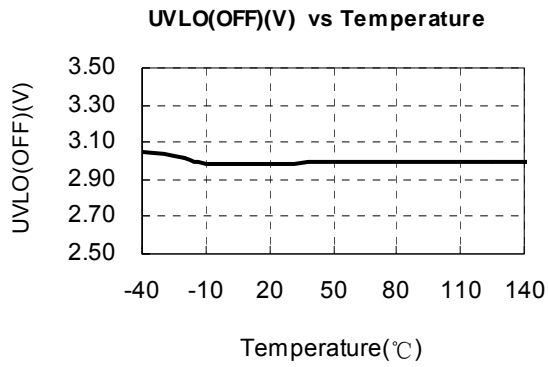
(T_A = 25°C, VDD=5V, unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|--|--|------|------|------|------|
| Supply Voltage (VDD) | | | | | | |
| 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 |
| VD Detection Section | | | | | | |
| 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 |
| RT Section | | | | | | |
| Vrt | Voltage reference at RT pin | | 0.95 | 1 | 1.05 | V |
| Over/Under Shoot Control Section | | | | | | |
| 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 |

| | | | | | |
|--------------------------|---------------------------------------|--|----|----|----|
| | demagnetization | | | | |
| SR Mosfet Section | | | | | |
| BVdss | MOSFET Drain-Source Breakdown Voltage | | 50 | | V |
| Rdson | On Resistance | | | 15 | mΩ |

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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

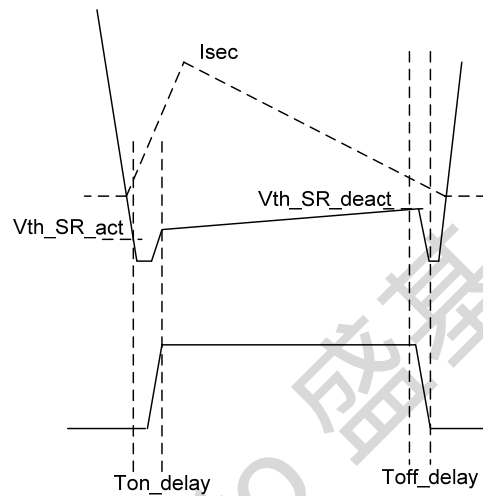


Fig.1 SR MOSFET turn-on and turn-off timing

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.

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

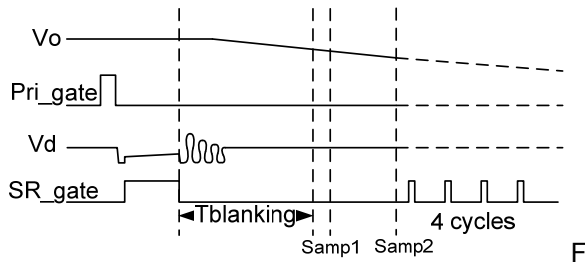
Adaptive minimum off time

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

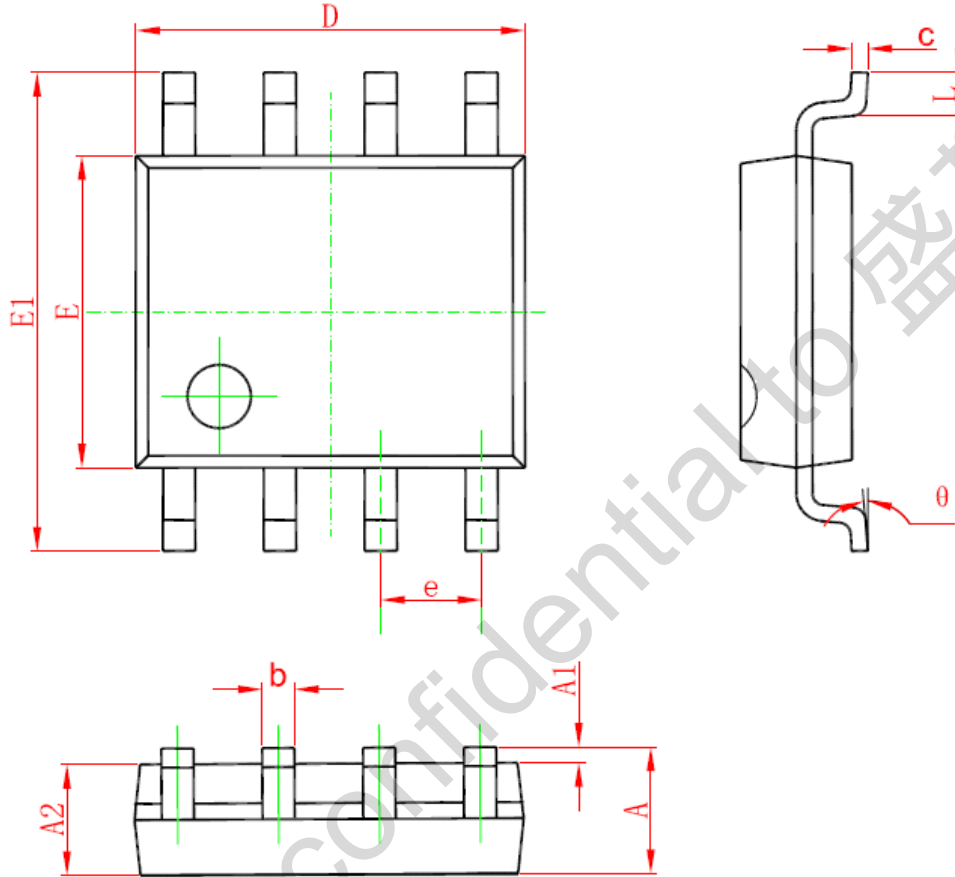
For poor system design, there is usually output overshoot during startup and load transient. To facilitate system design, OB2301W can detect output overshoot condition and prevent overshoot happen. When output voltage rises to meet the inner threshold, OB2301W will open a discharge path from V_{dd} to 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° |

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