

Primary Side AC/DC Controller

Features

- Lower no-load power
- Lower start-up current
- Built-in cable compensation
- Built-in peak current compensation
- Random frequency modulation to reduce system EMI
- Built-in leading edge blanking
- Current limited protection in each cycle
- Over voltage protection
- Open circuit protection
- Under voltage lockout

Application

- Adapters/Chargers for Cell/Cordless phones, PDAs, MP3 and other portable apparatus
- Standby and Auxiliary power supplies

General Description

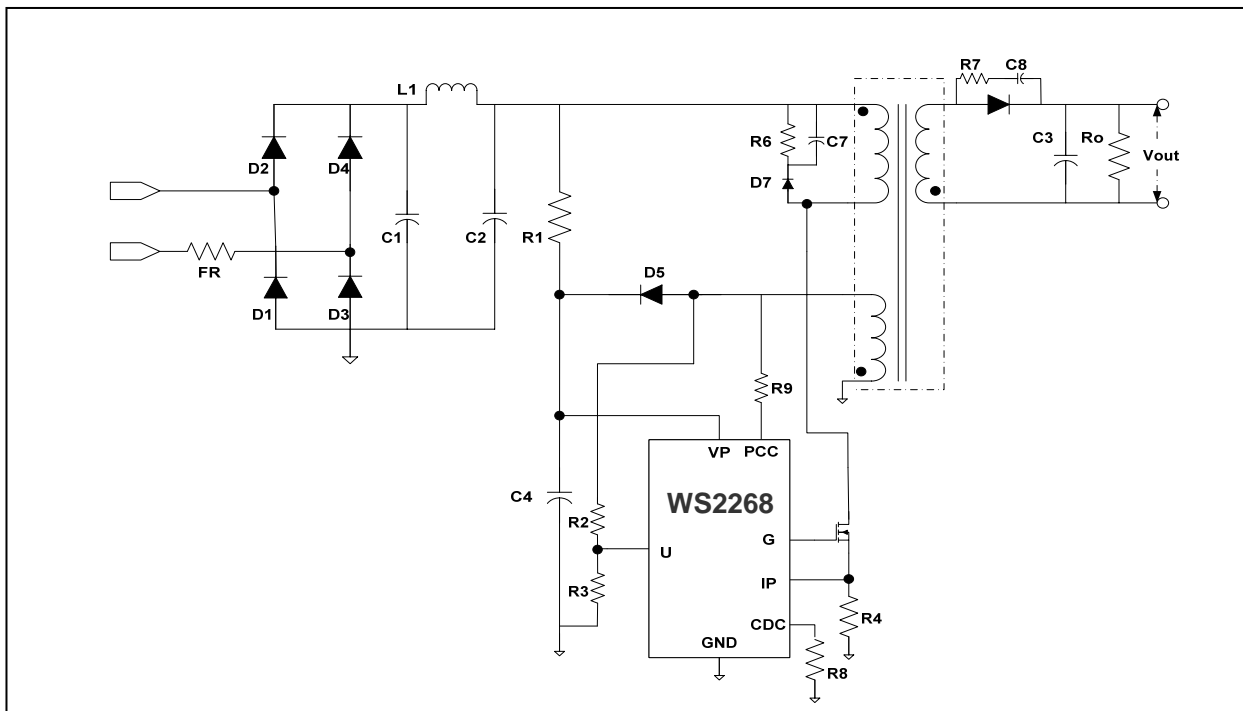
The WS2268 is a high performance AC/DC power supply controller for battery charger and adapter applications. The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies.

The WS2268 provides accurate constant voltage, constant current (CV/CC) regulation without requiring the opto-coupler and the secondary control circuitry. It also eliminates the need of loop compensation circuitry while maintaining stability.

The WS2268 achieves excellent regulation and high power efficiency, the no-load power consumption is less than 100mW.

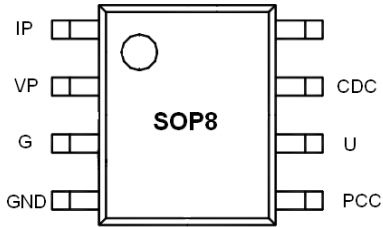
The WS2268 is available in SOP8 package.

Typical Application



General Information

Pin Configuration



Marking Information

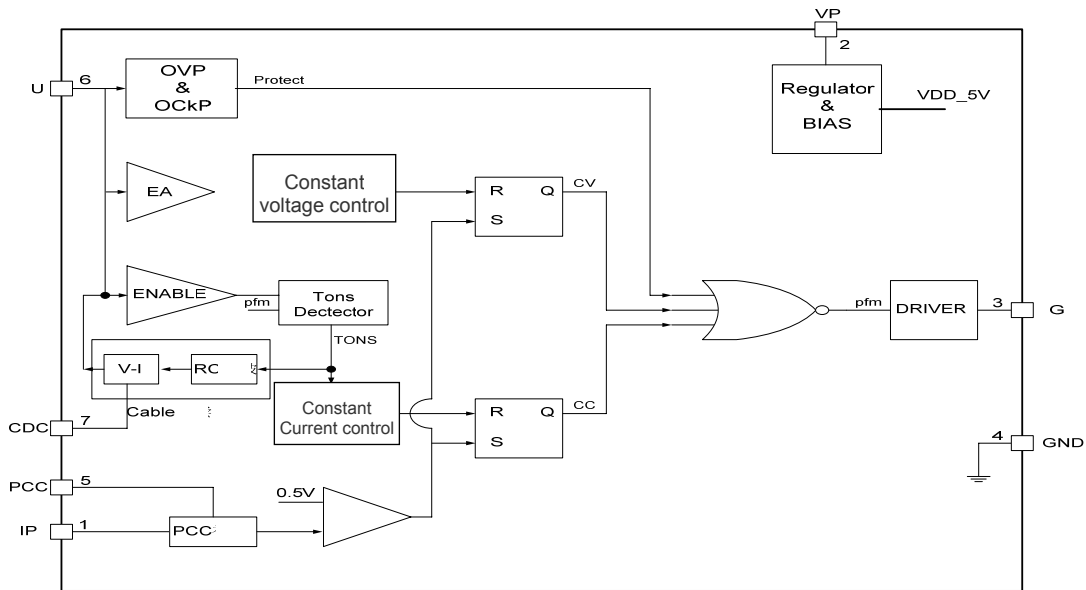


Line1 W :Winsemi Logo
 Line2 Device Name(WS2268SP)
 Line3 Lot Code
 Y: Year code(0:2010,1:2011……)
 ww: Week code(1-52)

Terminal Assignments

Pin number	Pin name	Function
1	IP	The primary current sense
2	VP	Supply voltage
3	G	This pin drives the base of external power NPN switch
4	GND	Ground
5	PCC	This pin connects a resistor for peak current compensation
6	U	The voltage feedback from the auxiliary winding
7	CDC	This pin connects a resistor for cable compensation
8	-	Null

Block Diagram



Recommended Condition

Parameter	Value	Unit
Supply voltage (VP)	10~30	V
Operating temperature	-20~85	°C

Absolute Maximum Ratings(Note 1)

Parameter	Value	Unit
Supply voltage (VP)	30	V
Feedback voltage (U)	-40~10	V
others (IP, G, PCC, CDC)	-0.3~7	V
Output current at G	Internally limited	A
Power dissipation at Ta=25°C	0.657	W
Operating junction temperature	150	°C
Storage temperature	-65~150	°C
Thermal resistance junction-to-ambient	190	°C/W

Note 1: Stresses greater than those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only, and 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 Rating" for extended periods may affect device reliability.

Electrical Characteristics (Tc = 25°C)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Start-up section						
Start-up threshold	Vstu		18	20	22	V
UVLO threshold	Vlo		7	9	11	V
Start-up current	Istart	VP=Vstu-0.5V		3	5	µA
Operating current	Iis	Static		600	900	µA
Current sense section						
IP compare threshold	Vip		475	500	525	mV
Leading edge blanking	Tleb			500		ns
Feedback section						
Feedback threshold voltage	Vs&href			4		V
Input resistor	Ru	Dynamic		350		KΩ
Over voltage protection	Vovp		7	8	9	V
Open circuit protection vlotage	Vockp		-1.2	-1	-0.8	V
Drive output section						
Output low voltage	VOL	Io = -20mA			0.8	V
Output high voltage	VOH	Io = 20mA	8			V
Output clamp	VClamp			19		V
Rise time	Tr	CL = 1nf		200		ns
Fall time	Tf	CL = 1nf		70		ns

ESD Information

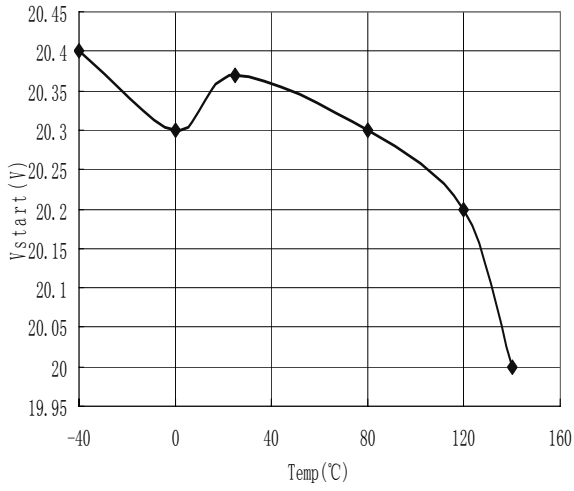
Symbol	Parameter	Value	Unit
V _{ESD_HBM}	Human model	2000	V
V _{ESD_MM}	Machine model	400	V

Ordering Information

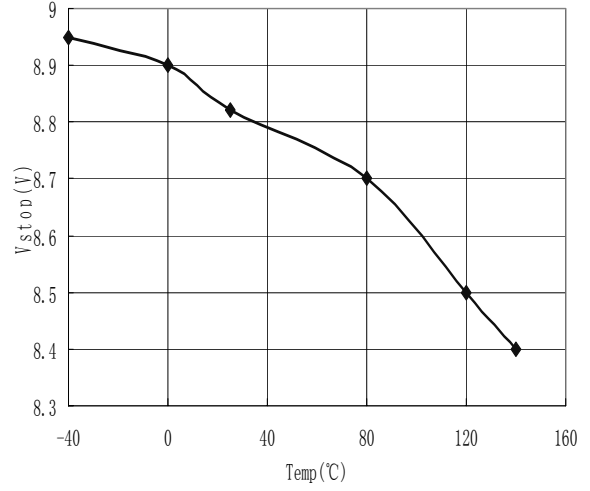
Package	IC marking information	Purchasing device name
8 Pin SOP8, Pb-free	WS2268SP	WS2268

Typical Operating Characteristics

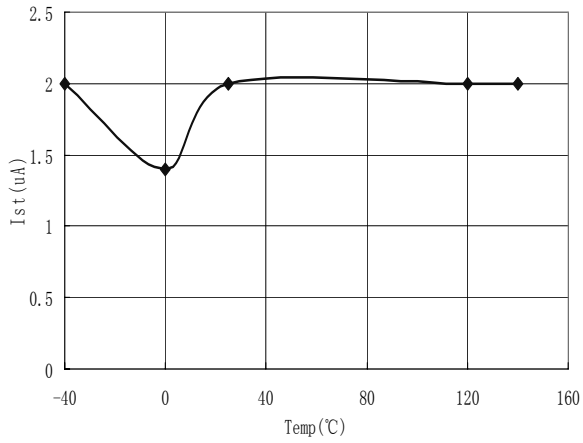
V_{start} VS Temp



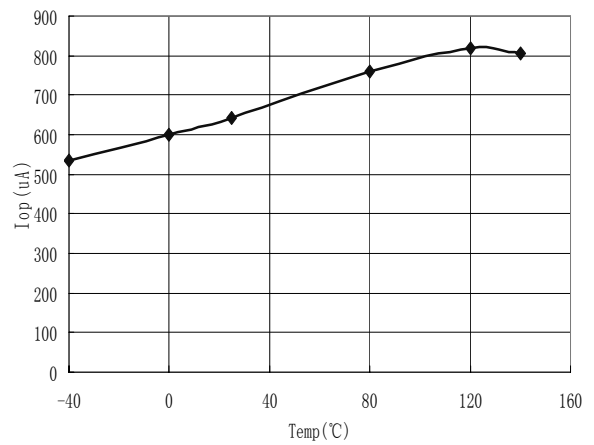
V_{stop} VS Temp



I_{st} VS Temp



I_{op} VS Temp



Operation Description

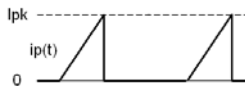
1. Startup Mode

At the phase of power-on, the rectified high voltage DC charges the capacitor of VP through the start-up resistor. When VP rises to 20V, the IC enters normal operation, then switching begins and the output voltage begins to rise. The VP bypass capacitor must supply the IC until the output voltage builds up enough to provide power from the auxiliary winding to sustain the VP. The under-voltage threshold of VP is 9V, and therefore, the voltage on the VP capacitor must not drop more than 11V while the output is charging up.

2. Constant Primary Peak Current

The primary current $i_p(t)$ is sensed by a current sense resistor R_{cs} , the current rises up linearly at a rate of:

$$\frac{di_p(t)}{dt} = \frac{V_g(t)}{L_m} \quad (1)$$



Primary current waveform

As illustrated in top figure, when the current $i_p(t)$ rises up to I_{pk} , the switch turns off. The constant peak current is given by:

$$I_{pk} = \frac{V_{cs}}{R_{cs}} \quad (2)$$

The energy stored in the magnetizing inductance L_m each cycle is:

$$E_g = \frac{1}{2} \times L_m \times I_{pk}^2 \quad (3)$$

So the power transferring from the input to the output is given by:

$$P = \frac{1}{2} \times L_m \times I_{pk}^2 \times f_{sw} \quad (4)$$

Where f_{sw} is the switching frequency. When the peak current I_{pk} is constant, the output power depends on the switching frequency f_{sw} .

3. Constant Voltage Operation

The WS2268 captures the auxiliary winding feedback voltage at U pin and operates in constant-voltage (CV) mode to regulate

The output voltage. Assuming the secondary winding is master, the auxiliary winding is slave during the D1 on-time. The auxiliary voltage is given by:

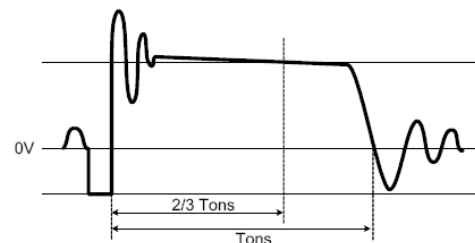
$$\frac{V_{aux}}{N_{aux}} = \frac{V_s}{N_s}$$

$$V_s = V_o + V_d$$

$$\text{So, } V_{aux} = \frac{N_{aux}}{N_s} \cdot (V_o + V_d)$$

$$V_{aux} = V_u \cdot \left(1 + \frac{R_2}{R_3}\right)$$

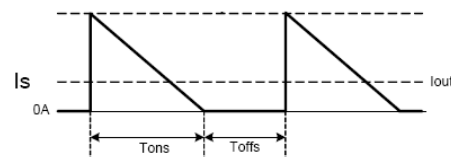
Where V_d is the diode forward drop voltage.



Auxiliary voltage waveform

The output voltage is different from the secondary voltage in a diode forward drop voltage that depends on the current. If the secondary voltage is always detected at a fixed secondary current, the difference between the output voltage and the secondary voltage will be a fixed V_d . The voltage detection point is at two-thirds of the D1 on-time. The CV loop control function of WS2268 then generates a D1 off-time to regulate the output voltage.

4. Constant Current Operation



Secondary current waveform

In CC operation, the CC loop control function of WS2268 will keep a fixed proportion between D1 on-time T_{ons} and D1 off-time T_{offs} by discharging or charging the capacitance. The fixed proportion is:

$$\frac{T_{ons}}{T_{offs}} = \frac{4}{3}$$

The relationship between the output constant-current I_{out} and secondary peak current I_{pks} is given by:

$$I_{out} = \frac{1}{2} \times I_{pks} \times \frac{T_{ons}}{T_{ons} + T_{offs}}$$

At the instant of D1 turn-on, the primary current transfers to the secondary at an amplitude of:

$$I_{pks} = \frac{N_p}{N_s} \times I_{pk}$$

Thus the output constant-current is given by:

$$I_{out} = \frac{1}{2} \times \frac{N_p}{N_s} \times I_{pk} \times \frac{T_{ons}}{T_{ons} + T_{offs}} = \frac{2}{7} \times \frac{N_p}{N_s} \times I_{pk}$$

5. Leading Edge Blanking

When the power switch is turned on, a turn-on spike will occur on the sense-resistor. To avoid false-termination of the switching pulse, a 430ns leading-edge blanking is built in.

During this blanking period, the current sense comparator is

disabled and the gate driver can not be switched off.

6. CCM Protection

The WS2268 is designed to operate in discontinuous conduction mode (DCM) in both CV and CC modes. To avoid operating in continuous conduction mode (CCM), the WS2268 detects the falling edge of the U input voltage on each cycle. If a 0.1V falling edge of U is not detected, the WS2268 will stop switching.

7. OVP & OckP

WS2268 include output over-voltage protection (OVP) and open circuit protection (OckP) circuitry. If the voltage at U pin exceeds 8V, 100% above the normal detection voltage, or the -1V falling edge of U input can not be monitored, the WS2268 will immediately shut off and enter hiccup mode. The WS2268 sends out a fault detection pulse every 19ms in hiccup mode until the fault has been removed.

SOP8 Package Information

Unit:mm(inch)

