WS2585 Low Power Primary Side AC/DC Converter

Features

- ■ Build-in 530V(Vceo) NPN power transistor
- ■ No-load power Less than100mW
- ■ Lower start-up current
- ■ Frequency jittering
- ■ Build-in Leading Edge Blanking
- ■ Cycle by cycle over current protection (OCP)
- ■ Under voltage lockout
- ■ ±5% CC、CV Accuracy
- ■ Ultra low standby power (<100mW)

General Description

The WS2585 is a high performance AC/DC power supply converter for battery charger and adapter applications.

The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies. The WS2585 provides accurate constant voltage and constant current (CC/CV) regulation without requiring the opto-coupler and the secondary control circuitry.

It also eliminates the need of loop compensation circuitry while maintaining stability.

The WS2585 achieves excellent regulation and high power efficiency, the no-load power consumption is less than 100mW.

The WS2585 is available in DIP8 package.

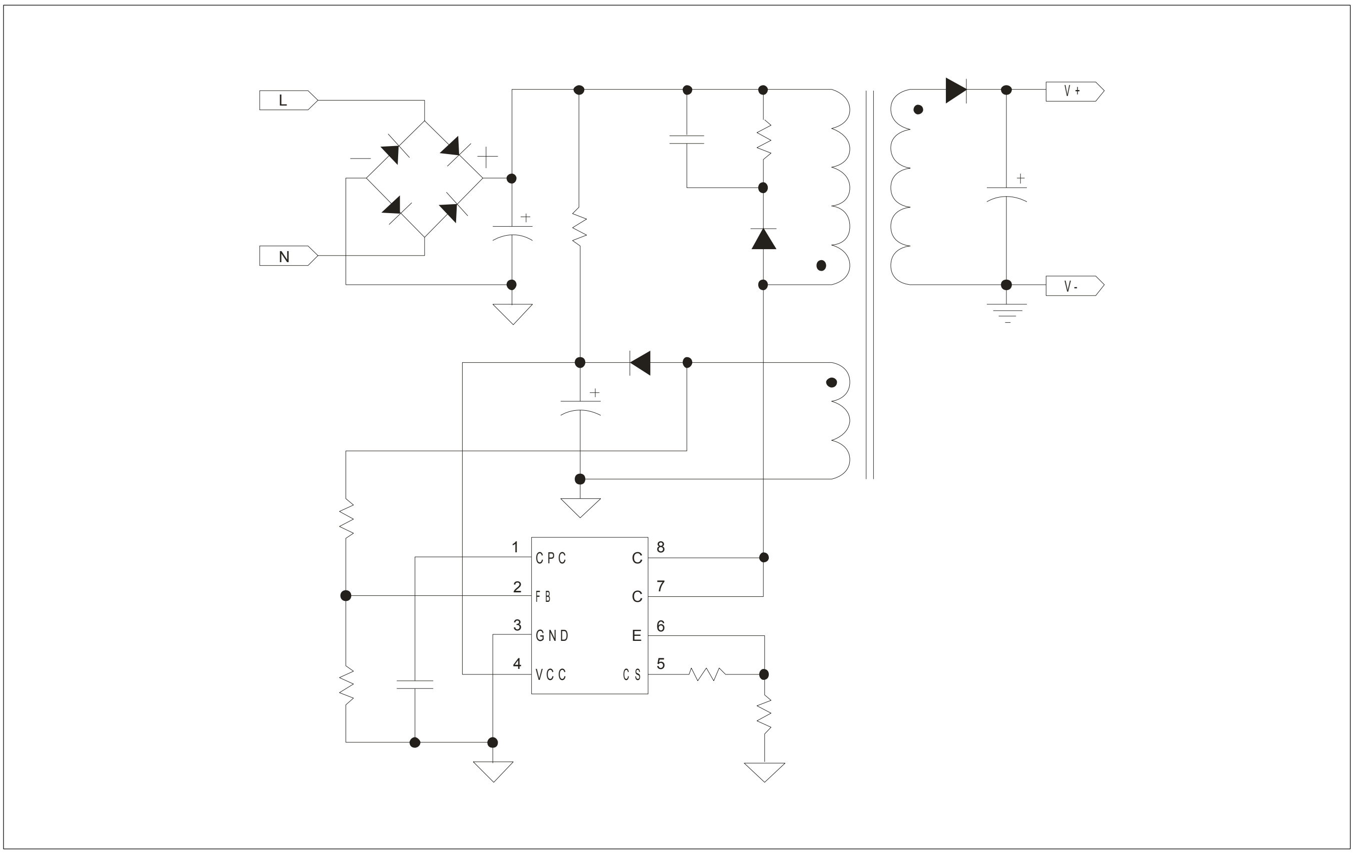
Applications

■ Adapters/Chargers for Cell phones, PDAs, MP3 and other portable apparatus

■ LED Driver

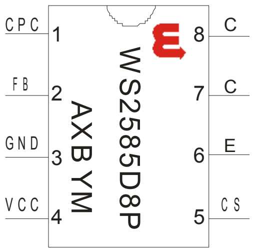
■ Standby and Auxiliary power supplies

Typical Application Circuit



Pin Definition and Device Marking

WS2585 is offered in DIP-8 packages，as shown below：

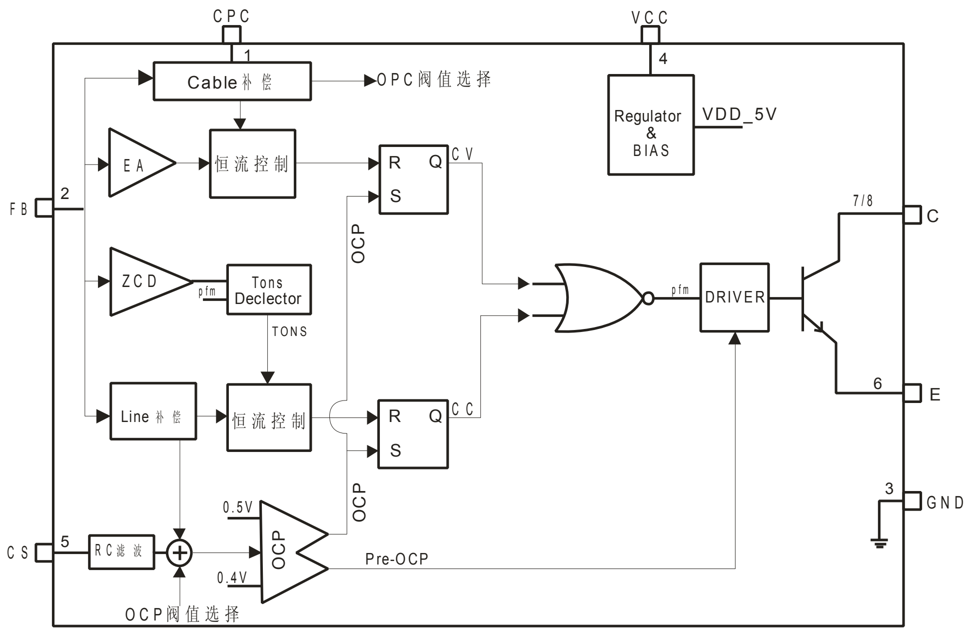


WS2585D8P:
A: Product Code
X: Internal Code
B：Area Code
YM：Year Month

Pin Function Description

Pin number	Pin name	Function
1	CPC	Cable voltage compensation input pin, connects to an external filter capacitor
2	FB	Feedback input
3	GND	Ground
4	VCC	Power supply
5	CS	Current sense input
6	E	Emitter of the internal NPN power transistor
7	C	Collector of the internal NPN power transistor
8	C	Collector of the internal NPN power transistor

Block Diagram



Ordering Information

Package	IC marking information	Purchasing device name
8 Pin DIP-8, Pb-free	WS2585D8P	WS2585D8P

Recommended Operating Condition

Parameter	Value	Unit
VCC supply voltage	10~30	V
Operating temperature	-20~85	℃

Absolute Maximum Ratings

Parameter	Value	Unit
Supply voltage （VCC）	30	V
Feedback voltage （FB）	-40~10	V
CS，CPC，OUT Voltage	-0.3~7	V
Output current	Internally limited	A
Operating junction temperature	150	℃
Storage temperature	-65~150	℃
Thermal resistance junction-to-ambient	250	℃/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.

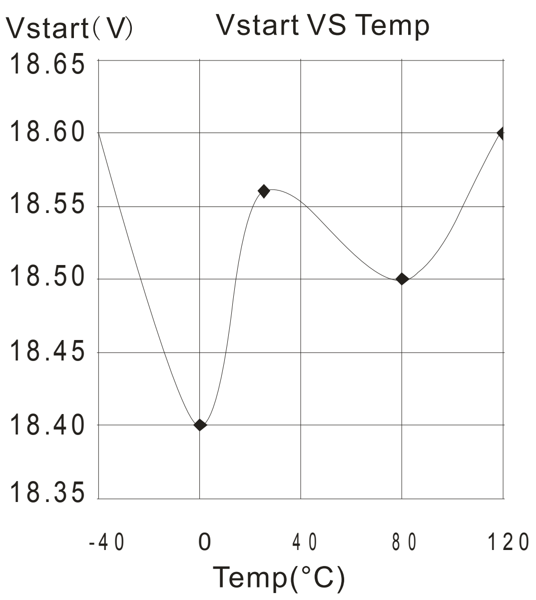
ESD Information

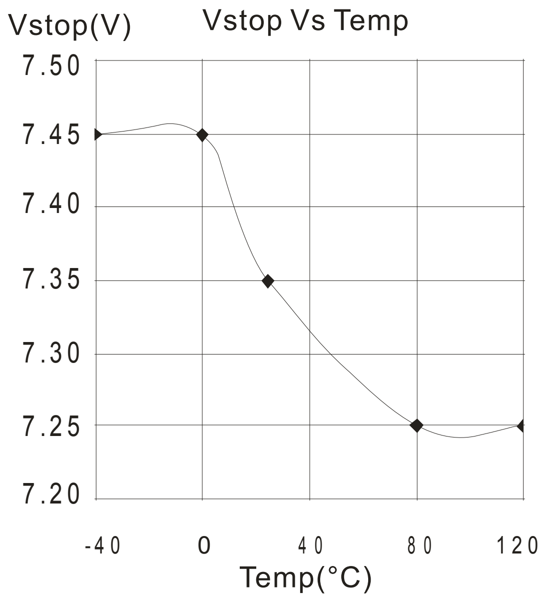
Symbol	Parameter	Value	Unit
V_{ESD_HBM}	Human model	2000	V
V_{ESD_MM}	Machine model	400	V

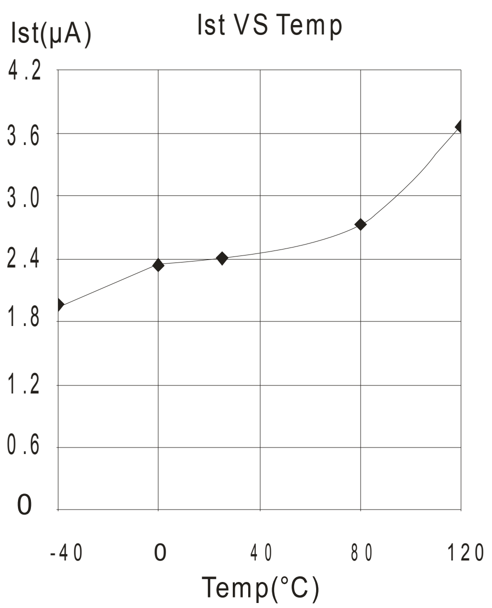
Electrical Characteristics (VCC=15V,T=25℃.(unless otherwise specified)

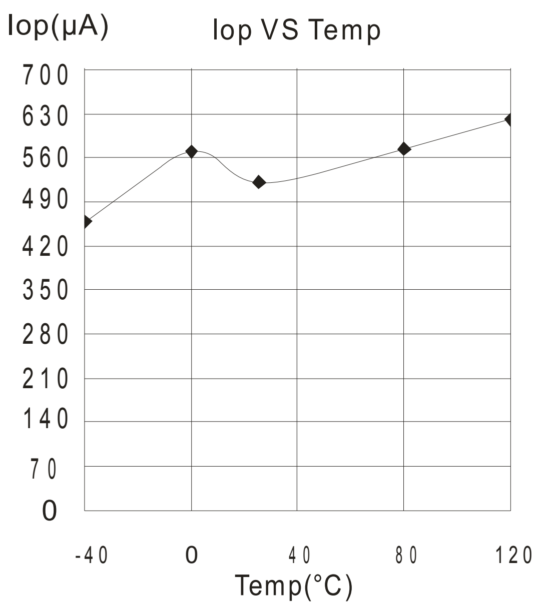
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Start-up section						
Start-up threshold	Vstu		17.8	19.4	21	V
UVLO threshold	Vlo		6	7.5	8.5	V
Start-up current	Istart	VCC=Vstu-0.5V		4	6	uA
Operating current	I_{VCC}	Static		500	700	uA
Drive output section						
Output current	Isourceh	Vout=2V	24.5	30	35.5	mA
Output current，Vcs>Vocp80%	Isoutcel	Vout=2V	0.3	1.4	1.8	mA
Current sense section						
CS compare threshold	Vocp		485	500	515	mV
80%CS compare threshold	Vocp80%		380	400	420	mV
Leading edge blanking	T_{leb}			500		ns
Feedback section						
Feedback threshold voltage	Vs&href			4		V
Transistor section						
Collector-Emitter Voltage	Vceo	I_{OC}=1mA	530			V
Collector-Emitter Saturation Voltage	Vce (SAT)	Ioc=600mA			1	V
Output rising time	Tr	CL=1nF			75	ns
Output falling time	Tf	CL=1nF			75	ns
maximum Collector current	Icm		600	650		mA

Typical Operating Characteristics









Function Description

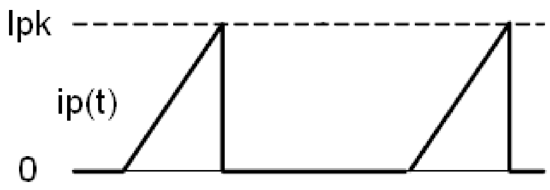
Start-up and UVLO

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 19.4V, 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 7.5V, and therefore, the voltage on the VP capacitor must not drop more than 7V while the output is charging up.

Constant Primary Peak Current

The primary current ip(t) is sensed by a current sense resistor Rcs, the current rises up linearly at a rate of:

$$\frac{dip(t)}{dt} = \frac{Vg(t)}{Lm} \qquad (1)$$



Primary current waveform

As illustrated in top figure，when the current ip(t) rises up to Ipk, the switch turns off. The constant peak current is given by:

$$Ipk = \frac{Vcs}{Rcs} \qquad (2)$$

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

$$Eg = \frac{1}{2} \times Lm \times Ipk^2 \qquad (3)$$

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

$$P = \frac{1}{2} \times Lm \times Ipk^2 \times f_{sw} \qquad (4)$$

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

Constant Voltage Operation

The WS2585 captures the auxiliary winding feedback voltage at FB 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:

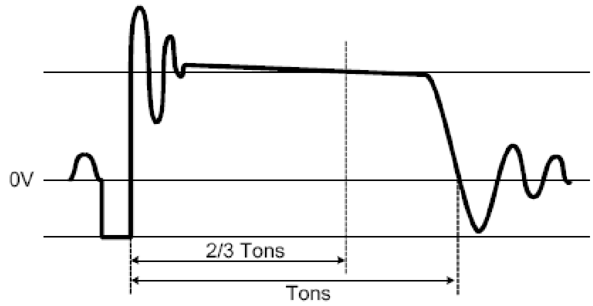
$$\frac{Vaux}{Naux} = \frac{Vs}{Ns}$$

$$Vs = Vo + Vd$$

So, $Vaux = \frac{Naux}{Ns} \cdot (Vo + Vd)$

$$Vaux = Vu * (1 + \frac{R2}{R3})$$

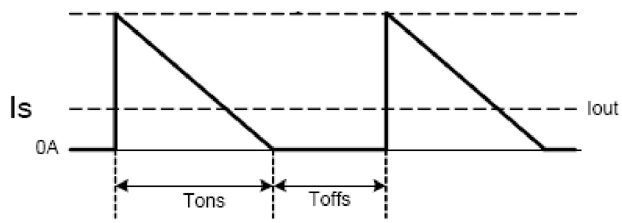
Where Vd is the diode forward drop voltage.



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 Vd. The voltage detection point is at two-thirds of the D1 on-time. The CV loop control function of WS2585 then generates a D1 off-time to regulate the output voltage.

Constant Current Operation



Secondary current waveform

In CC operation, the CC loop control function of WS2585 will keep a fixed proportion between D1 on-time Tons and D1 off-time Toffs by discharging or charging the capacitance. The fixed proportion is:

$$\frac{Tons}{Toffs} = \frac{4}{3}$$

The relationship between the output constant-current Iout and secondary peak current Ipks is given by:

$$Iout = \frac{1}{2} \times Ipks \times \frac{Tons}{Tons + Toffs}$$

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

$$Ipks = \frac{Np}{Ns} \times Ipk$$

Thus the output constant-current is given by:

$$Iout = \frac{1}{2} \times \frac{Np}{Ns} \times Ipk \times \frac{Tons}{Tons + Toffs} = \frac{2}{7} \times \frac{Np}{Ns} \times Ipk$$

Cable Compensation

WS2585 detects the duty cycle (Tons/T) of the secondary side using RC filter, which the filtering resistance is built-in; the filter capacitor connects to CPC pin. The larger the Tons/Tm， the lager the voltage on CPC pin, which means the greater the load, the IC drags more current from FB pin, thus through the feedback loop, the output voltage would be higher.

Line Compensation

WS2585 build-in line voltage compensation to achieve great system CC accuracy in 90-264VAC range. Thus the higher the line voltage, the lower the OCP threshold. By changing the resistance of R6, the amount of compensation can be set to achieve better line compensation effect.

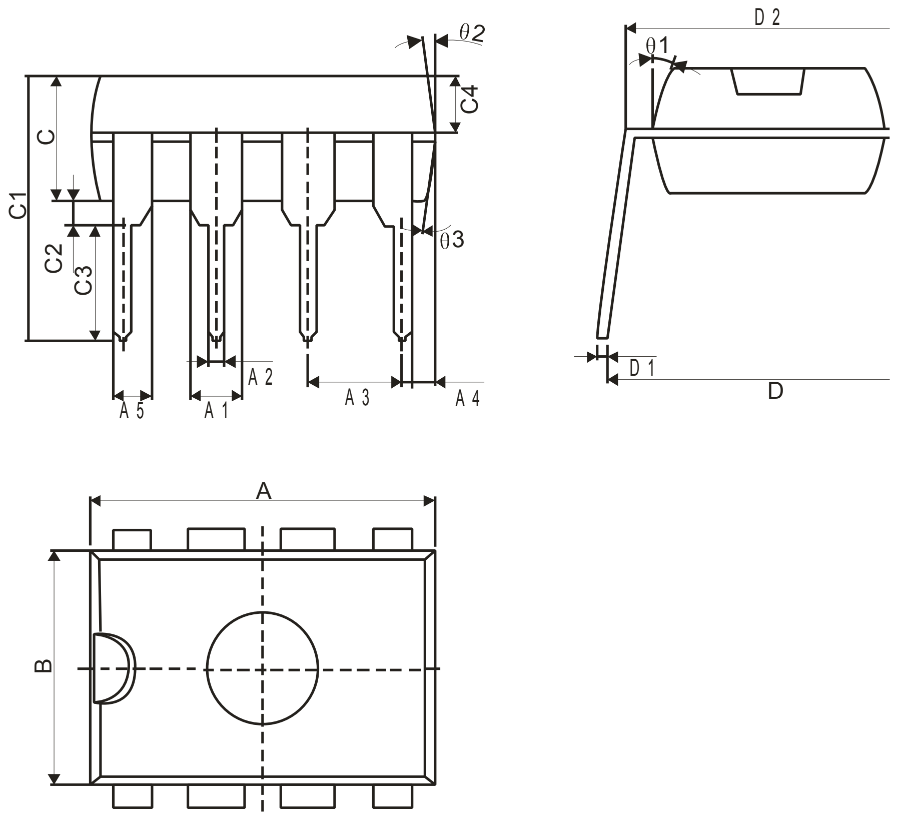
Leading Edge Blanking

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.

CCM Protection

The WS2585 is designed to operate in discontinuous conduction mode (DCM) in both CV and CC modes. To avoid operating in continuous conduction mode (CCM), the WS2585 detects the falling edge of the FB input voltage on each cycle. If a 0.1V falling edge of FB is not detected, the WS2585 will stop switching.

DIP -8 Package Information



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Symbol	**Dimensions in Millimeters**		**Dimensions in Inches**	
	Min	**Max**	**Min**	**Max**
A	9.00	9.50	0.354	0.374
B	6.10	6.60	0.240	0.260
C	3.0	3.4	0.118	0.134
A1	1.474	1.574	0.058	0.062
A2	0.41	0.53	0.016	0.021
A3	2.44	2.64	0.096	0.104
A4	0.51TYP		0.02TYP	
A5	0.99TYP		0.04TYP	
C1	6.6	7.30	0.260	0.287
C2	0.50TYP		0.02TYP	
C3	3.00	3.40	0.118	0.134
C4	1.47	1.65	0.058	0.065
D	7.62	9.3	0.300	0.366
D1	0.24	0.32	0.009	0.013
D2	7.62TYP		0.3TYP	

NOTE:

1.We strongly recommend customers check carefully on the trademark when buying our product, if there is any question, please don't be hesitate to contact us.

2.Please do not exceed the absolute maximum ratings of the device when circuit designing.

3.Winsemi Microelectronics Co., Ltd reserved the right to make changes in this specification sheet and is subject to change without prior notice.

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