Low Power Primary Side AC/DC Controller

Features

- 100mW no-load power
- Lower start-up current
- PFM mode
- Build-in Leading Edge Blanking
- Cycle by cycle over current protection (OCP)
- Under voltage lockout
- ±5% CC、CV Accuracy
- Ultra low standby power (<100mW)

Applications

Universal switch power supply equipment and offline AC/DC flyback power converter

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

General Description

The WS2580 is a high performance AC/DC power supply controller for battery charger and adapter applications.

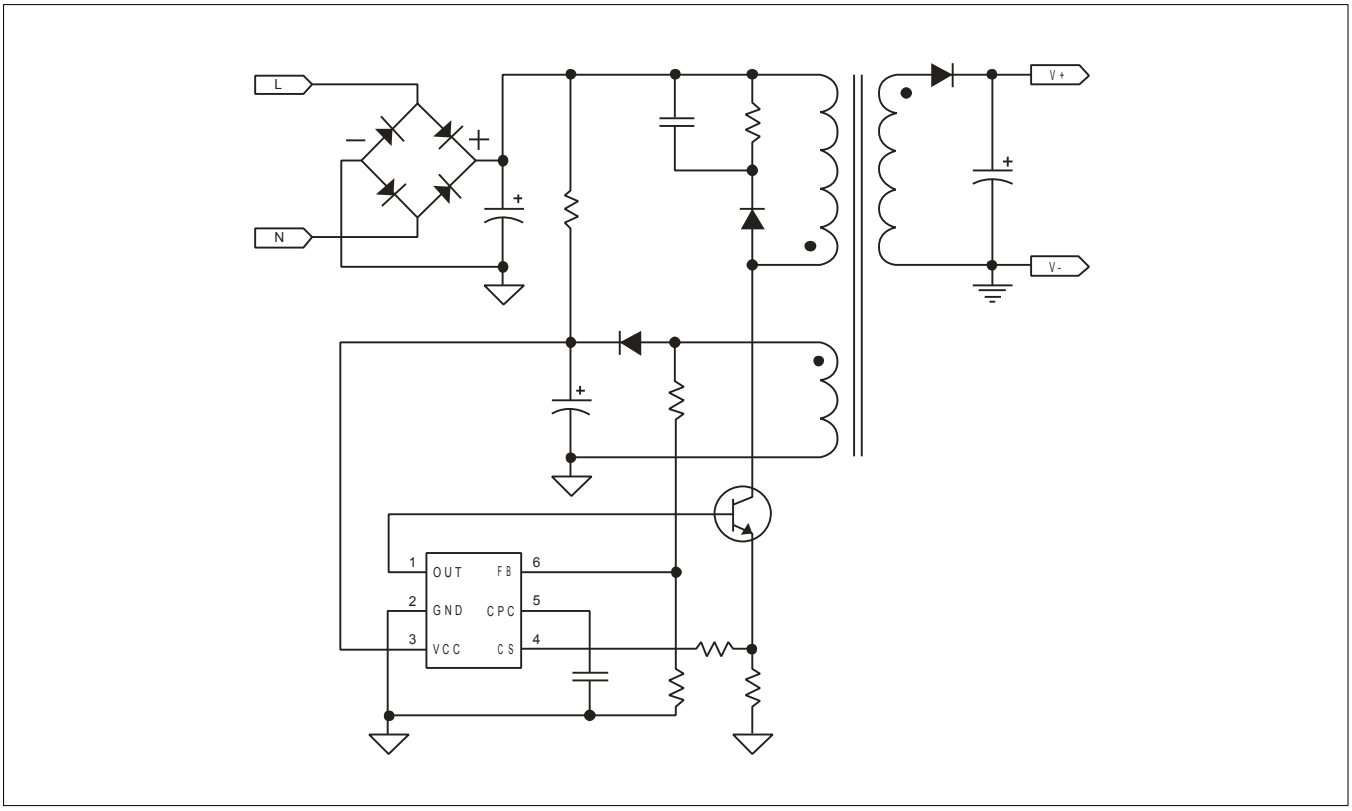
The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies. The WS2580 provides accurate constant voltage and constant current (CC/CV) regulation without requiring the opto-coupler and the secondary control circuitry.

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

The WS2580 achieves excellent regulation and high power efficiency, the no-load power consumption is less than 100mW.

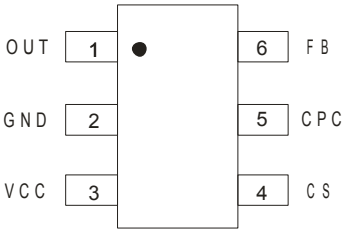
The WSWS2580 is available in SOT23-6 package.

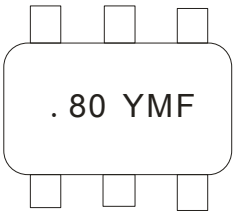
Typical Application Circuit



Pin Definition and Device Marking

WS2580 is available in SOT23-6 package:



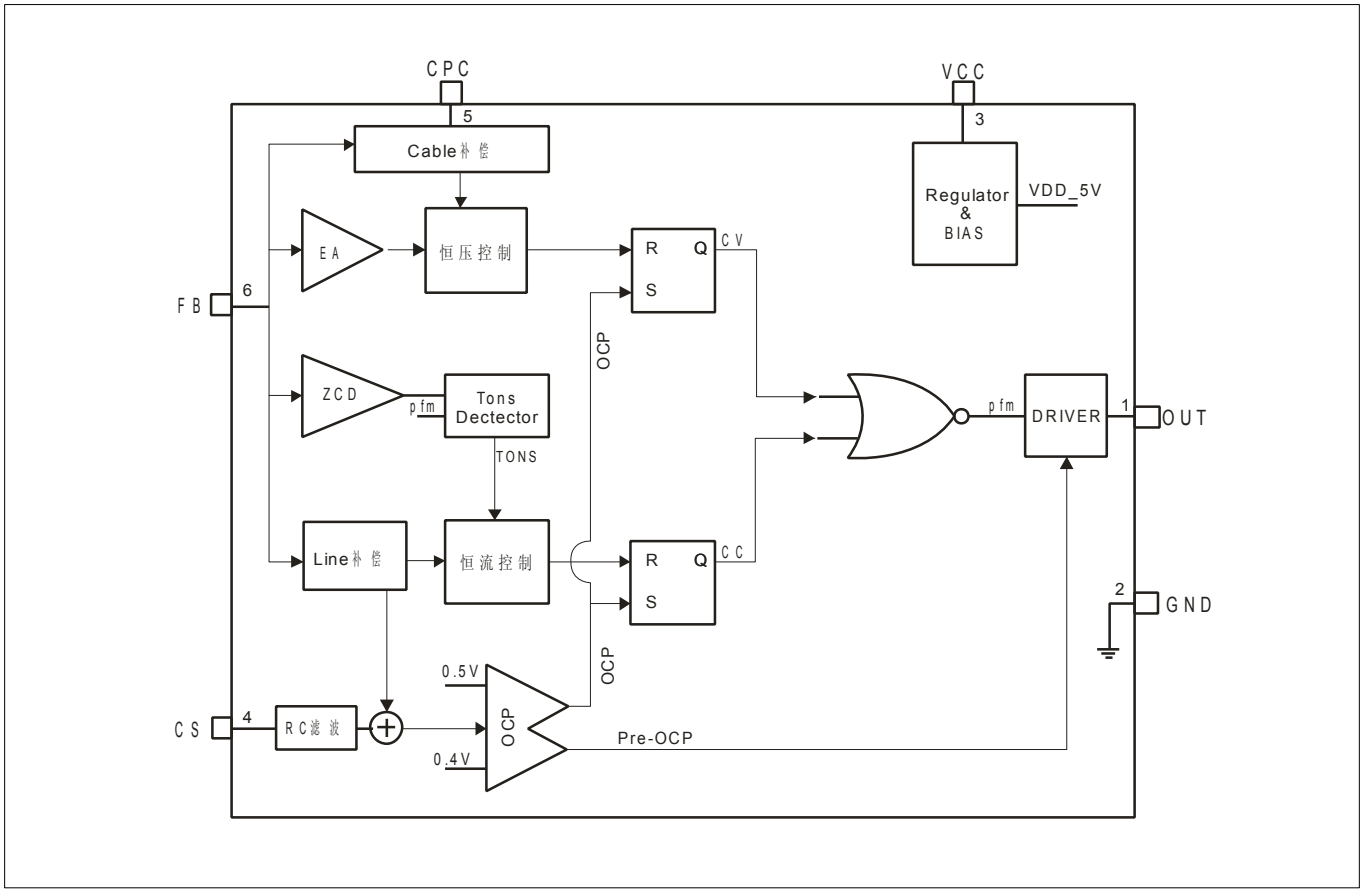


80: WSXX80;
Y: Year 2=2012，
M:Month 1,2…A=10,B=11,C=12
F: Factory No.

Pin Function Description

Pin Name	Pin Number	Function Description
OUT	1	Drive output. Connects to the power MOSFET
GND	2	Ground.
VCC	3	Power supply.
CS	4	Current sense input.
CPC	5	Cable voltage compensation input pin, connects to an external filter capacitor
FB	6	Feedback input

Block Diagram



Ordering Information

Package	IC Marking Information	Purchasing Device Name
6 Pin SOT23-6, Pb-free	WS2580	WS2580

Recommended Operating Condition

Symbol	Parameter	Value	Unit
VCC	VCC supply voltage	10~30	V
T_A	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.

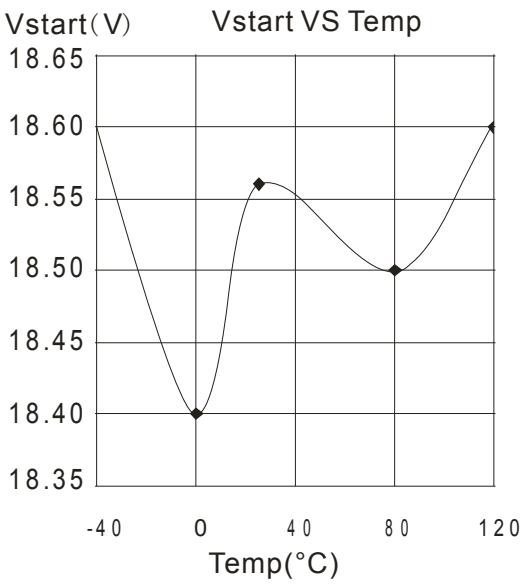
ESD Information

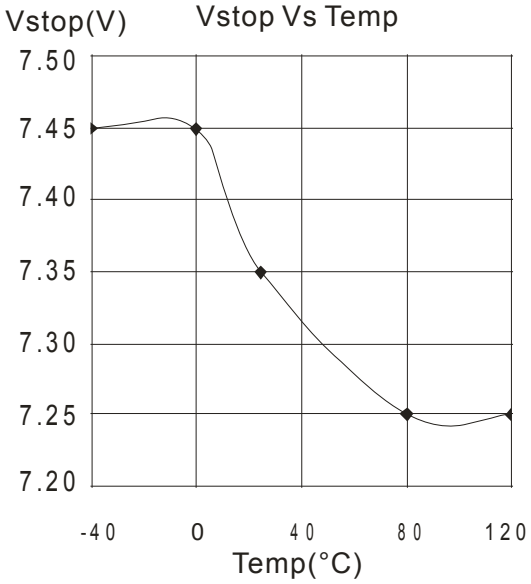
Symbol	**Parameter**	**Value**	**Unit**
V_{ESD_HBM}	Human model	2000	V
V_{ESD_MM}	Machine model	200	V

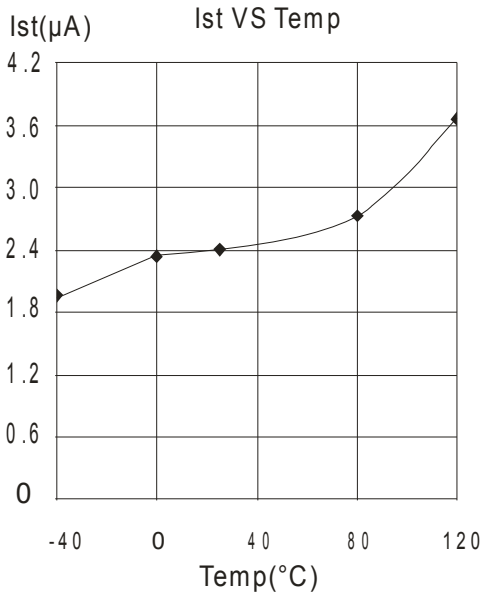
Electrical Characteristics(VCC=15V，TA=25℃if not otherwise noted)

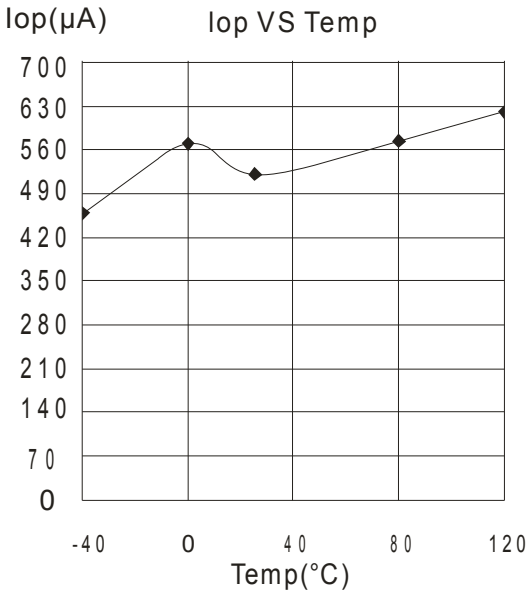
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Start-up section						
Start-up threshold	Vstu		17.8	19.4	21	V
UVLO threshold	Vlo		6	7.5	8.5	V
Start-up current	Istart	VCC=Vstu-0.5V		4	6	uA
Operating current	I_{VCC}	Static		500	700	uA
Drive output section						
Output current	Isourceh	Vout=2V	45	50	55	mA
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

Typical Operating Characteristics









Function Description

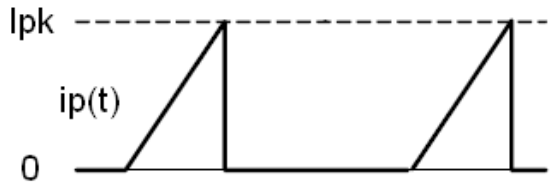
1、 Start-up and UVLO

At the phase of power-on, the rectified high voltage DC charges the capacitor of VCC through the start-up resistor. When VCC rises to 18V, the IC enters normal operation, then switching begins and the output voltage begins to rise. The VCC bypass capacitor must supply the IC until the output voltage builds up enough to provide power from the auxiliary winding to sustain the VCC. The under-voltage threshold of VCC is 7V, and therefore, the voltage on the VCC capacitor must not drop more than 11V while the output is charging up.

2、 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}.

3、 Constant Voltage Operation

The WS2580 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:

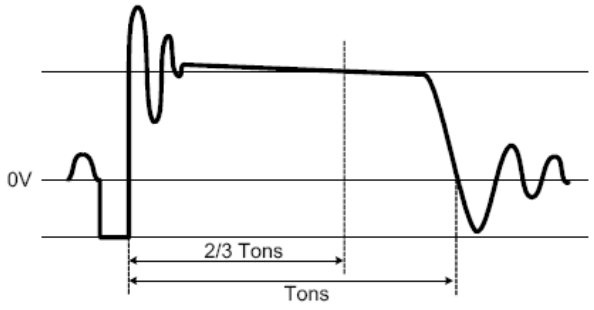
$$\frac{Vaux}{Naux} = \frac{Vs}{Ns}$$

$$Vs = Vo + Vd$$

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

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

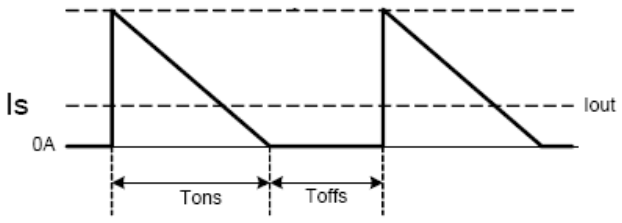
Where Vd is the diode forward drop voltage.



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 WS2580 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 WS2580 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:

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

5. Cable Compensation

WS2580 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.

6. Line Compensation

WS2580 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.

7. 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 500ns 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.

8. CCM Protection

The WS2580 is designed to operate in discontinuous conduction mode (DCM) in both CV and CC modes. To avoid operating in continuous conduction mode (CCM), the WS2580 detects the falling edge of the FB input voltage on each cycle. If a 0.1V falling edge of FB is not detected, the WS2580 will stop switching.

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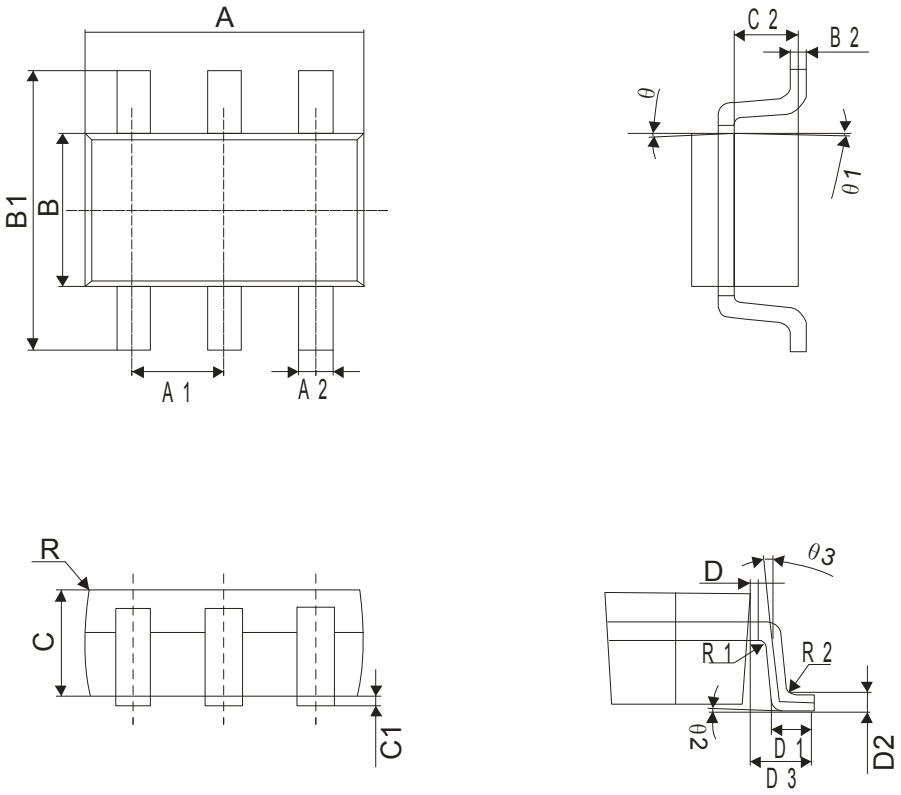
Package Information

SOT23-6 Package Outline Dimensions

Unit:mm



Symbol	Winsemi			
	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	2.72	3.12	0.107	0.123
B	1.40	1.80	0.055	0.071
C	1.00	1.20	0.039	0.047
A1	0.90	1.00	0.035	0.039
A2	0.30	0.50	0.012	0.020
B1	2.60	3.00	0.102	0.118
B2	0.119	0.135	0.005	0.005
C1	0.03	0.15	0.001	0.006
C2	0.55	0.75	0.022	0.030
D	0.03	0.13	0.001	0.005
D1	0.30	0.60	0.012	0.024
D2	0.25TYP		0.01TYP	
D3	0.60	0.70	0.024	0.028

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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