

## Secondary-Side Synchronous Rectifier

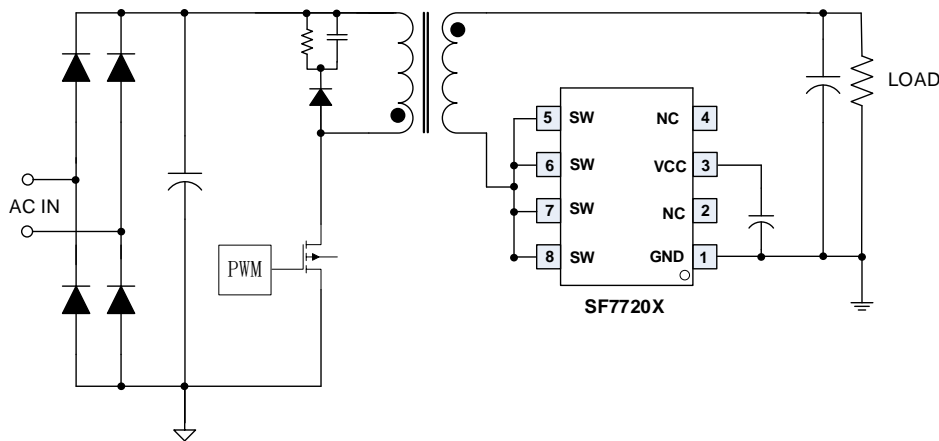
### FEATURES

- ◆ Supports CCM, DCM and Quasi-Resonant Topologies
- ◆ Original edge opening judgment
- ◆ Secondary edge discontinuity judgment
- ◆ Supports Low-side/High-side Rectification
- ◆ Strong anti-interference ability
- ◆ Unique VCC power supply technology
- ◆ Support USB-PD+PPS system
- ◆ Equipped with chip powered undervoltage protection
- ◆ Max 180kHz Switching Frequency
- ◆ Fast Turn-off Total Delay of 10ns
- ◆ Compatible with Energy Star
- ◆ ~150uA Low Quiescent Current
- ◆ Few peripheral components

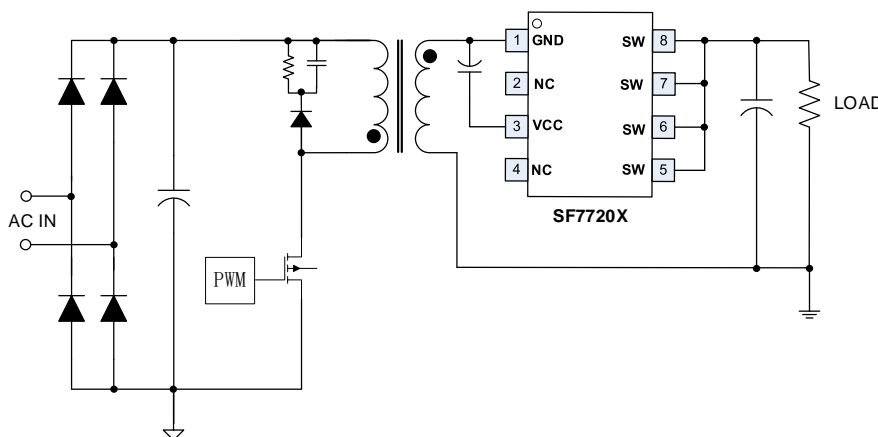
### APPLICATIONS

- ◆ Chargers for Cell Phones
- ◆ AC/DC adapter
- ◆ Industrial Power Systems
- ◆ Flyback Converters

### TYPICAL APPLICATION



Low-side Rectification



High-side Rectification

### GENERAL DESCRIPTION

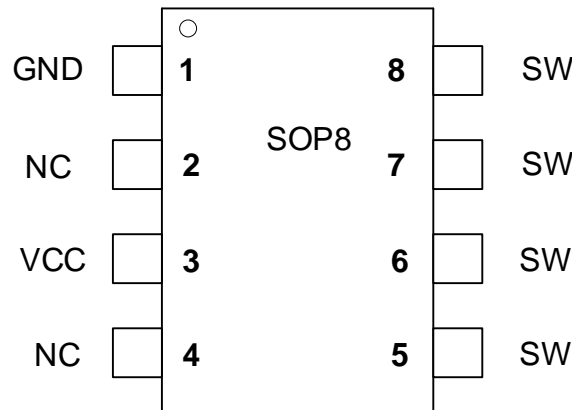
SF7720X is a high-performance secondary synchronous rectification chip with built-in MOS, suitable for isolated synchronous rectification applications, especially suitable for high efficiency requirements in chargers.

The SF7720X adopts the technology of opening the primary side and intermittent judgment of the secondary side, which can effectively avoid the misoperation of the driving chip caused by excitation oscillation.

The SF7720X adopts a unique VCC power supply technology, which can ensure that the chip will not operate under power in both constant current and constant voltage operating states of the primary control system.

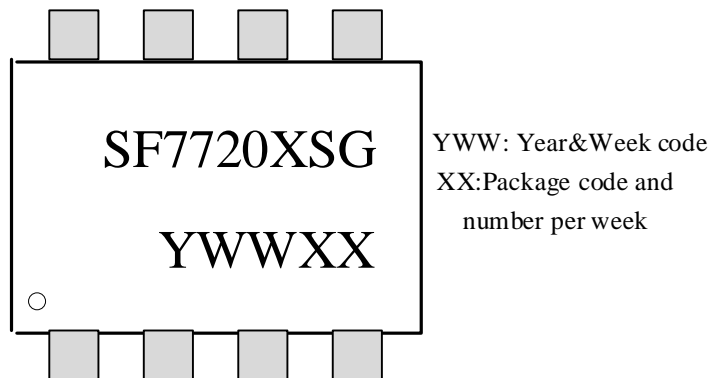
Compatible with CCM, DCM, and QR working modes.

SF7720X is offered in SOP8 package.

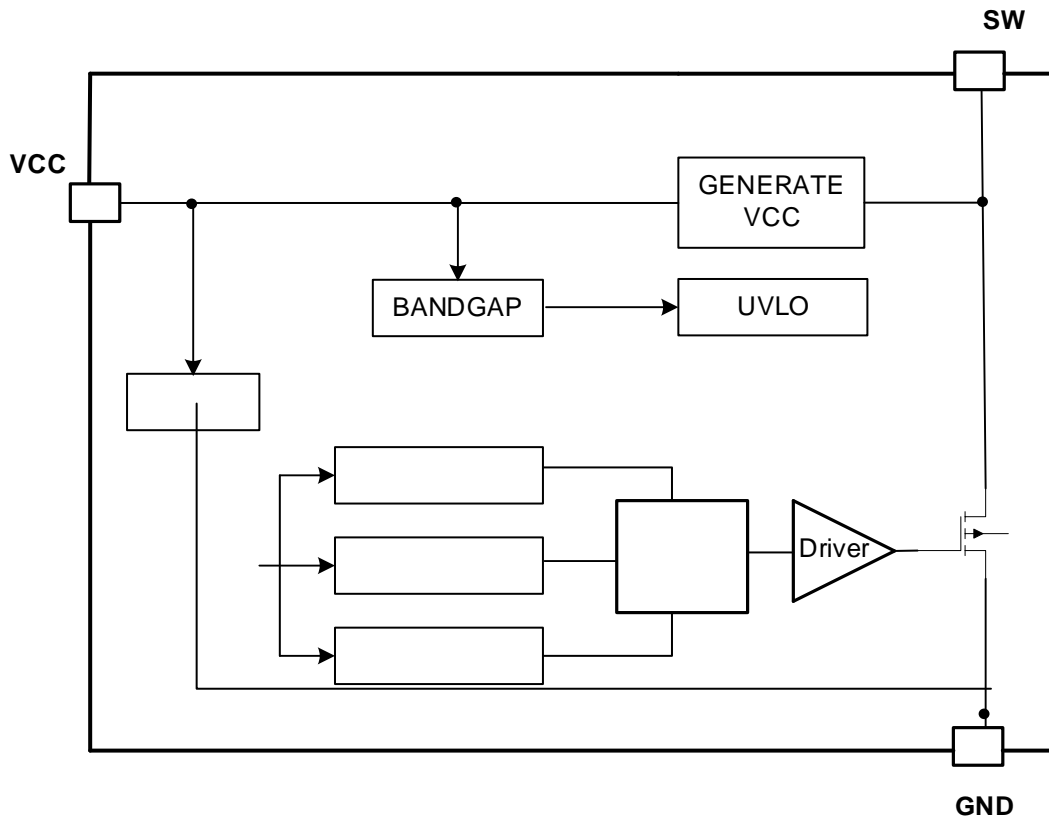
**Pin Configuration**

**Ordering Information**

Part Number	Top Mark	BVdss	Rdson	Package		Tape & Reel
SF7720ASGT	SF7720ASG	60V	10.5mΩ	SOP8 (*)	Green	Yes
SF7720DSGT	SF7720DSG	60V	14mΩ	SOP8 (*)	Green	Yes

(\*) MSL(Moisture Sensitivity Level) is level 3. Absorbed moisture could be sensitive to damage during solder reflow, so it's recommended to take floor life into consideration, according to IPC/JEDEC J-SMD-020E(Moisture/Reflow Sensitivity Classification for Non-hermetic Surface Mount Devices).

**Marking Information**

**Pin Description**

Pin Num	Pin Name	I/O	Description
1	GND	P	IC ground pin.
2	NC		NC
3	VCC	P	Output of internal LDO, it provides bias voltage for the internal circuit and MOSFET driver. Connect this pin to a capacitor
4	NC		NC
5,6,7,8	SW	P	Drain of internal N-MOS

**Block Diagram**

**Absolute Maximum Ratings** (at TA = 25°C)

Characteristics	Symbol	Rating	Unit
VCC to GND		-0.3 to 12	V
SW to GND		-0.3 to 60V	V
Operating Junction Temperature	TA	-40 to 150	°C
Storage Junction Temperature	Tstg	-65 to 150	°C

**Notes:**

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

**Recommended Operating Range**

ELECTRICAL PARAMETER	MINIMUM	TYPICAL	MAXIMUM	UNIT
Input Voltage(Vcc)	5		10	V
Thermal Resistance from Junction to case ( $\theta_{JC}$ )		80		°C/W
Thermal Resistance from Junction to ambient ( $\theta_{JA}$ )		160		°C/W

**ELECTRICAL CHARACTERISTICS**

 (T<sub>A</sub> = 25°C, V<sub>IN</sub>=6.8V, if not otherwise noted)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units	
<b>Supply Voltage Section</b>							
V <sub>OP</sub>	VCC	self-power		6.8		V	
VCC UVLO OFF	VCC <sub>UVLO_OFF</sub>	VCC drop		3.7		V	
VCC UVLO Voltage ON	VCC <sub>UVLO_ON</sub>	VCC rise		3.9		V	
VCC UVLO Hysteresis				0.2		V	
I <sub>OP</sub>		FSW=65K, load capacitance=2.2nF		2		mA	
I <sub>ST</sub>		VTH_ON-0.1V		25		uA	
Quiescent Current	VCC <sub>ICQ</sub>	VCC=5.0V, FSW=0	-	150	-	uA	
<b>Detection Section</b>							
Turn on Threshold	VTH_ON			-0.3		V	
Turn OFF Threshold	VTH_OFF			-5		mV	
TD <sub>ON</sub>	Ton delay			20		ns	
Turn-off Total Delay	Toff_delay			10		ns	
T <sub>LEB</sub>				1.8		us	
<b>Gate Driver Section</b>							
TR <sub>G</sub>	rise time	CL=4.7nF		50		ns	
TF <sub>G</sub>	fall time	CL=4.7nF		50		ns	
VG <sub>H</sub>	Output High Level	Iload=100mA		6.8		V	
VG <sub>L</sub>	Output low level	Iload=100mA		0.06		V	
I <sub>GSC</sub>		Drive source current (peak)		4		A	
I <sub>GSC</sub>		Drive current (peak)		-5		A	
<b>Built-in MOS Section</b>							
Breakdown Voltage	BV <sub>DSS</sub>	SF7720A	VGS=0V, ID=250μA	60		V	
		SF7720D		60			
NMOS RDS <sub>ON</sub>	RDS <sub>ON</sub>	SF7720A	VGS=10V, ID=18A	-	10.5	13	mΩ
		SF7720D	VGS=10V, ID=9A	-	14	20	
Gate threshold voltage	VGS(th)	SF7720A	ID=250μA, VDS=VGS	1.2	1.7	2.5	V
		SF7720D		1.4	1.9	2.5	
Leakage source leakage current	IDSS	SF7720A	VDS=60V, VGS=0V			1	uA
		SF7720D					
Gate body leakage current	IGSS	SF7720A	VDS=0V, VGS=±20V			±100	nA
		SF7720D					

## OPERATION DESCRIPTION

SF7720X is a high-performance and highly integrated secondary side synchronous rectification controller (upper and lower applications) in a switching power supply system with built-in N-MOSFET. It simulates traditional diode rectifiers and can improve output current capacity and efficiency.

### ◆ VCC Under voltage lockout(UVLO)

The normal operation of SF7720X depends on the UVLO function implemented on the chip. When the AC power is turned on, the VCC is charged from the secondary winding of the transformer. When the VCC rises above UVLO (off), the IC wakes up and operates normally. Please refer to the timing chart below.

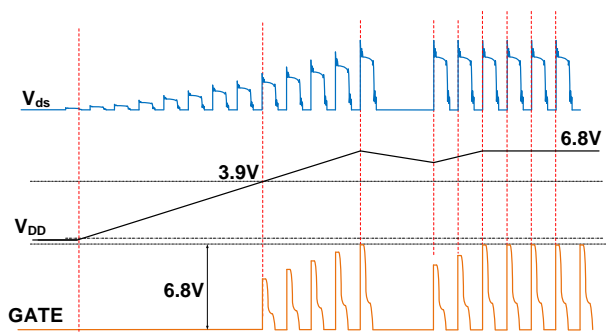


Fig 1 Start Sequence Diagram

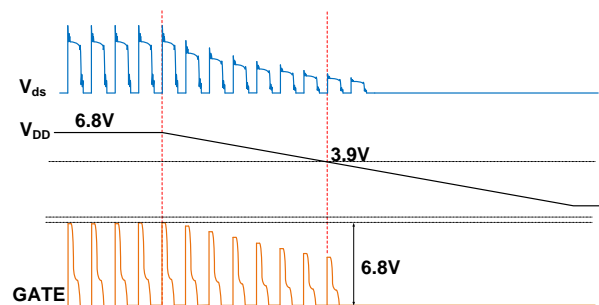


Fig 2 Closing Sequence Diagram

### ◆ Start

After the system is powered on, the output capacitor is charged through a built-in MOS body diode, and the output voltage rises.

After passing through the internal power supply circuit of the chip, the VCC capacitor is charged. When the voltage of the VCC reaches the opening threshold voltage, the internal control circuit of the chip begins to work, and the MOS conducts and turns off normally.

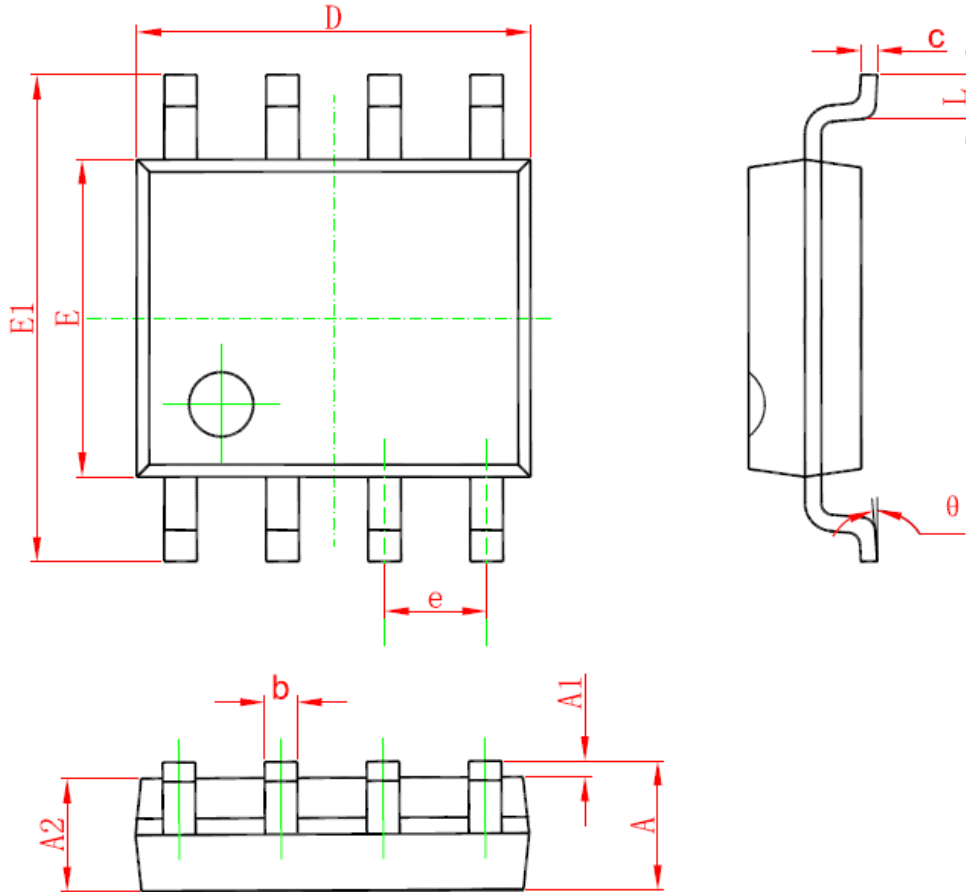
When MOS conducts normally, current no longer flows through the body diode, but through the MOS channel. When the chip operates normally, the required working current is supplied to the VCC through the VD pin.

### ◆ Synchronous rectifier tube conduction

When the flyback converter is in DCM, CCM, or QR operation, Due to the excitation effect of the inductor, oscillation will occur when the primary chip is turned off. In order to prevent false detection of oscillation signals, which may cause abnormal opening of synchronous rectifier tubes, SF7720X adopts patented original side opening judgment technology. When the primary chip is conductive, a flyback voltage is generated between the secondary output GND and the chip GND through a transformer; When the primary chip is turned off, the voltage between the drain D and GND of the secondary SF7720X decreases. SF7720X can accurately determine the opening of the synchronous rectifier by detecting the drop voltage of the drain.

### ◆ Synchronous rectifier tube shutdown

In order to avoid false detection of the shutdown signal caused by large excitation oscillation amplitude during the conduction of the synchronous rectifier tube, SF7720X adopts adaptive minimum shutdown time control to ensure reliable synchronous rectifier operation.

**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
$\theta$	0°	8°	0°	8°

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