LZC9205

High Performance PWM Flyback Controller

LOZEN TECNOLOGY INC

General Description

LZC9205 is a high performance, current mode PWM controller. It provides functions of low start-up current, fast start-up, fixed switching frequency. Those features make it to achieve high efficiency and low standby power with effective system cost.

At heavy load, the LZC9205 operate in fixed switching frequency. At light load condition, the system operates in green mode for high efficiency. And at zero load, the IC will operate in BURST mode to enhance power saving.

The LZC9205 offers comprehensive protection to prevent the circuit from damage under abnormal conditions. Furthermore, the LZC9205 features frequency swapping and soft driving function to minimize the noise and improve EMI performance.

The LZC9205 is offered in SOT23-6 package.

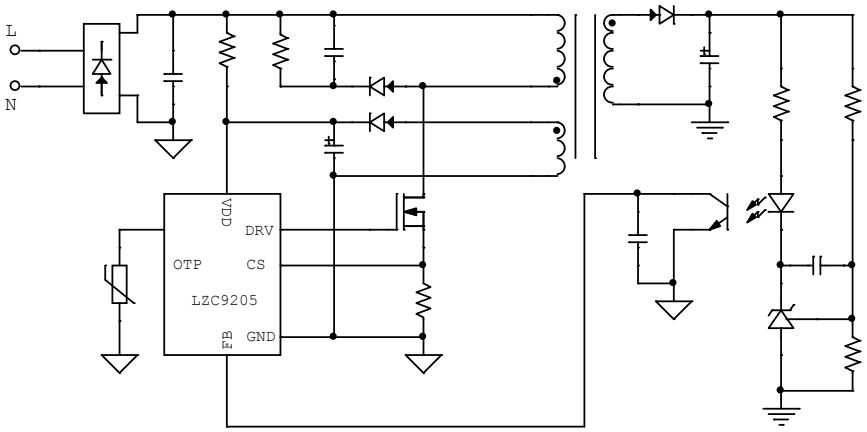
Features

- Internal Soft Start
- Fixed 67KHz Switching Frequency
  - CCM @ Heavy Load and Low Line
  - Green mode reduces frequency @ Light Load
  - Burst Mode @ No Load
- VDD Over voltage protection
- Cycle by cycle current limit
- Second level over current protection
- Output over voltage protection (OVP)
- Output short protection (SCP)
- Over Load protection (OLP)
- External precision OTP

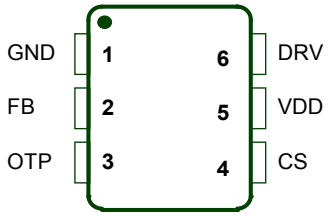
Applications

- Switching AC/DC power adapter
- SMPS Power Supply

Typical Application



Pin Configuration（SOT23-6）



Absolute Maximum Ratings (Note 1)

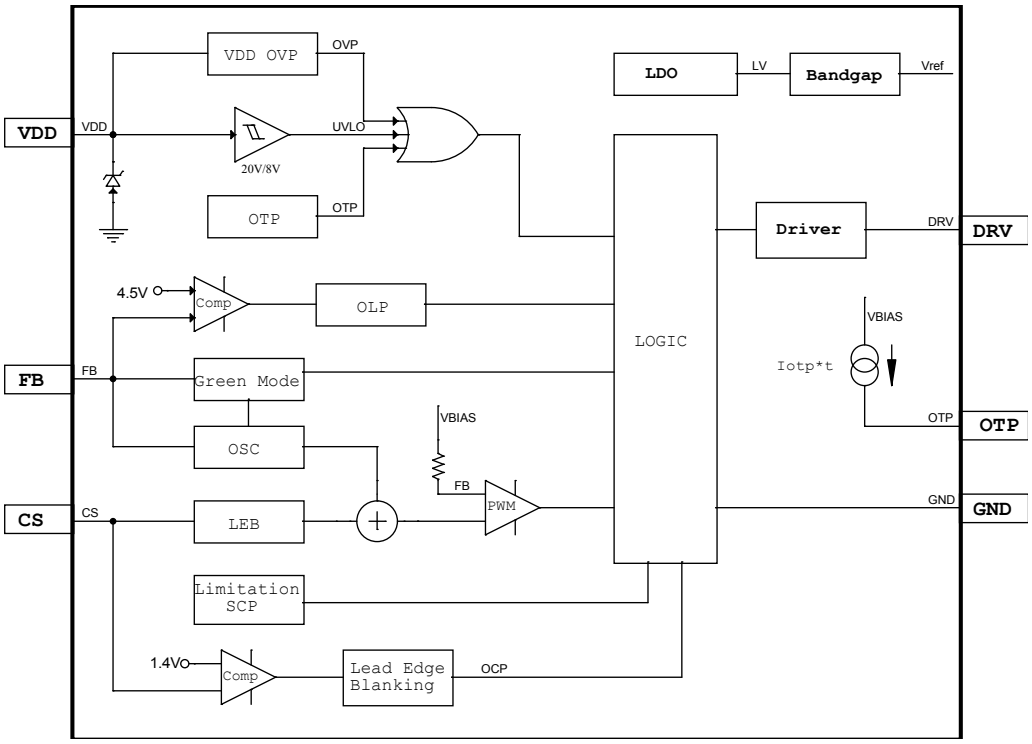
- Supply Input Voltage, VDD ---------- 30V
- Gate pin---------- 30V
- other Pins ---------- - 0.3V to 6.5V
- Package Thermal Resistance, θ_{JA}

  SOT23-6 ---------- 200℃ /W
- Junction Temperature ---------- 160℃
- Lead Temperature (Soldering, 10 sec.) ---------- 260℃
- Storage Temperature Range ---------- -55℃ to 150℃
- ESD Susceptibility (Note2)
- HBM (Human Body Mode) ---------- 2kV
- MM (Machine Mode) ---------- 200V

Recommended Operating Conditions (Note3)

- Junction Temperature ---------- -40℃ to 125℃
- Ambient Temperature ---------- -40℃ to 85℃
- Supply Input Voltage, VDD ---------- 11V to 23V
- VDD capacitor ---------- 1uF to 3.3uF

Block Diagram



Pin Assignment

Name	I/O	Pin No.	Description
GND	POWER	1	Power Ground.
FB	I	2	Secondary side voltage feedback. The capacitor is placed between it and GND.
OTP	I/O	3	Connected to a NTC resistor for sensing the detection point temperature.
CS	I	4	Current sense pin, a resistor connects to sense the MOSFET current.
VDD	POWER	5	Power Supply.
DRV	O	6	Totem-pole output to drive the external power MOSFET, Maximum Voltage is internally clamped to 16V.

Electrical Characteristics

V_{DD}=15V, T_A=25℃, unless otherwise specified

Symbol	Parameter	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Supply Voltage (VDD Pin)						
VDD_{ON}	UVLO ON			20		V
VDD_{OFF}	UVLO OFF			8		V
VDD_{HOLDH}	VDD holding exit voltage			10		V
VDD_{HOLDL}	VDD holding enter voltage			9		V
VDD_{OVP}	VDD OVP voltage			28		V
I_{ST}	Startup current			1		uA
I_{SS_OP}	Normal operation current	FB floating		500		uA
I_{SS_BST}	Burst Mode operation current	FB=0V		400		uA
Voltage Feedback (FB Pin)						
V_{FB_OPEN}	FB open voltage	FB floating		5.12		V
R_{FB}	FB pull up resistor			25		KΩ
V_{FB_GREEN}	Green mode threshold			1.5		V
V_{FB_BSTH}	Exit burst mode threshold			1.2		V
V_{FB_BSTL}	Enter burst mode threshold			1.1		V
V_{FB_OLP}	Over Load protection threshold			4.5		V
T_{FB_OLP}	Over Load protection debounce time			140		ms
Current sense (CS Pin)						
V_{CS_MAX}	Cycle by cycle current limit	0.7V<ZCD<3.3V		0.75		V
V_{CS_SEC}	Second CS voltage limit state			1.4		V
V_{CS_MIN}	Minimum CS voltage limit			183		mV
V_{SS_SCP}	Secondary side SCP CS Valley Voltage			0.7		V

T_{SS_SCP}	Secondary side SCP debounce time			5		mS
T_{SS}	Soft start period			6.2		mS
T_{LEB}	Lead edge time			330		nS
Over temperature protection (OTP Pin)						
I_{OTP}	OTP Detection current	V_{OTP} < 3V		120		uA
VOTP	Below OTP Trigger voltage, DRV drive shutdown			1.22		V
T_{OTP}	OTP detection cycle			5		mS
Oscillator						
F_{OSC}	CCM Frequency			67		KHz
F_{BURST}	Burst Frequency			24		KHz
D_{MAX}	Maximum duty cycle			80		%
T_{ONMAX}	Maximum Ton time			12		uS
Internal OTP						
OTP_H	OTP Temperature			150		℃
OTP_{HYS}	OTP Hysteresis			30		℃
GATE Driver (DRV Pin)						
T_R	DRV rising time	C_{GATE}=1nF		100		ns
T_F	DRV falling time	C_{GATE}=1nF		50		ns
V_{GCLAMP}	DRV Clamping voltage			16		V

Note 1. Stresses listed as the above “Absolute Maximum Ratings” may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2. Devices are ESD sensitive. Handling precaution is recommended.

Note 3. The device is not guaranteed to function outside its operating conditions.

Operation

LZC9205 is a high performance, current mode PWM controller. It provides functions of low start-up current, fast start-up, fixed switching frequency. Those features make it to achieve high efficiency and low standby power with effective system cost.

Startup Current

The typical start-up current is 1uA. Very low start-up current allows the LZC9205 to increase the value of start-up resistor and then reduce the power dissipation on it.

Under Voltage Lockout (UVLO)

A hysteresis UVLO comparator is implemented in LZC9205, then the turn-on and turn-off thresholds level are fixed at 20V and 8V respectively. This hysteresis ensures that the start-up capacitor will be adequate to supply the chip during start-up.

Operation Mode

LZC9205 operate in fixed switching frequency. At light load condition, the system operates in green mode for high efficiency. And at zero load, the IC will operate in BURST mode to enhance power saving.

When output load continue decreased, the IC will enter GREEN MODE for high power conversion efficiency. The max switching frequency clamp will start to linearly decrease from 67kHz to 24kHz. That is, when load decreases, the switching frequency is thus reduced.

At no load or very light load conditions, switching loss of MOSFET is the main power dissipation. The LZC9205 enters BURST MODE control and the gate output driver will be disabled immediately if VFB drops below V_{FB_BSTL}. When VFB rise back to V_{FB_BSTH}, the gate output driver again. Otherwise, the gate will remains at off state to enhance power saving.

Soft Start

The LZC9205 integrated an internal 6.2ms soft start function during system power on period.

Leading-edge Time(LEB)

Each time the power MOSFET is switched on, a turn-on spike will inevitably occur at the sense resistor. To avoid fault trigger, a leading-edge time is built in. During this period, the current-limit comparator is disabled and cannot switch off the gate driver.

Internal Slope Compensation

A built-in slope compensation circuit is constructed in LZC9205. When the switch is on, a ramp voltage is added to the sensed voltage across the CS pin, which helps to stabilize the system and prevent sub-harmonic oscillations.

VDD Holding

In order to avoid the VDD UVLO in burst mode operation, the LZC9205 build in the VDD Holding function. When LZC9205 stop output gate pulse in burst mode, VDD will continue decreasing. And LZC9205 will output gate pulse if VDD drop below VDD_{HOLDL} value. This state will release after VDD reach VDD_{HOLDH} value.

VDD over Voltage Protection (OVP) –Auto recovery

When the VDD voltage is higher than the OVP threshold voltage, the output gate driver circuit will be shut down immediately to stop the switching of power MOSFET.

The VDD OVP function is an auto-recovery type protection. If OVP happens, the pulses will be stopped and recover at the next UVLO on.

Output SCP -- Auto recovery and Latch optional

An output short circuit protection is implemented in the LZC9205. The CS pin has a voltage exceeding 0.7V at the moment the DRV is turned on, and lasts for more than 5ms. It is considered that short-circuit protection has occurred and the system is turned off until UVLO.

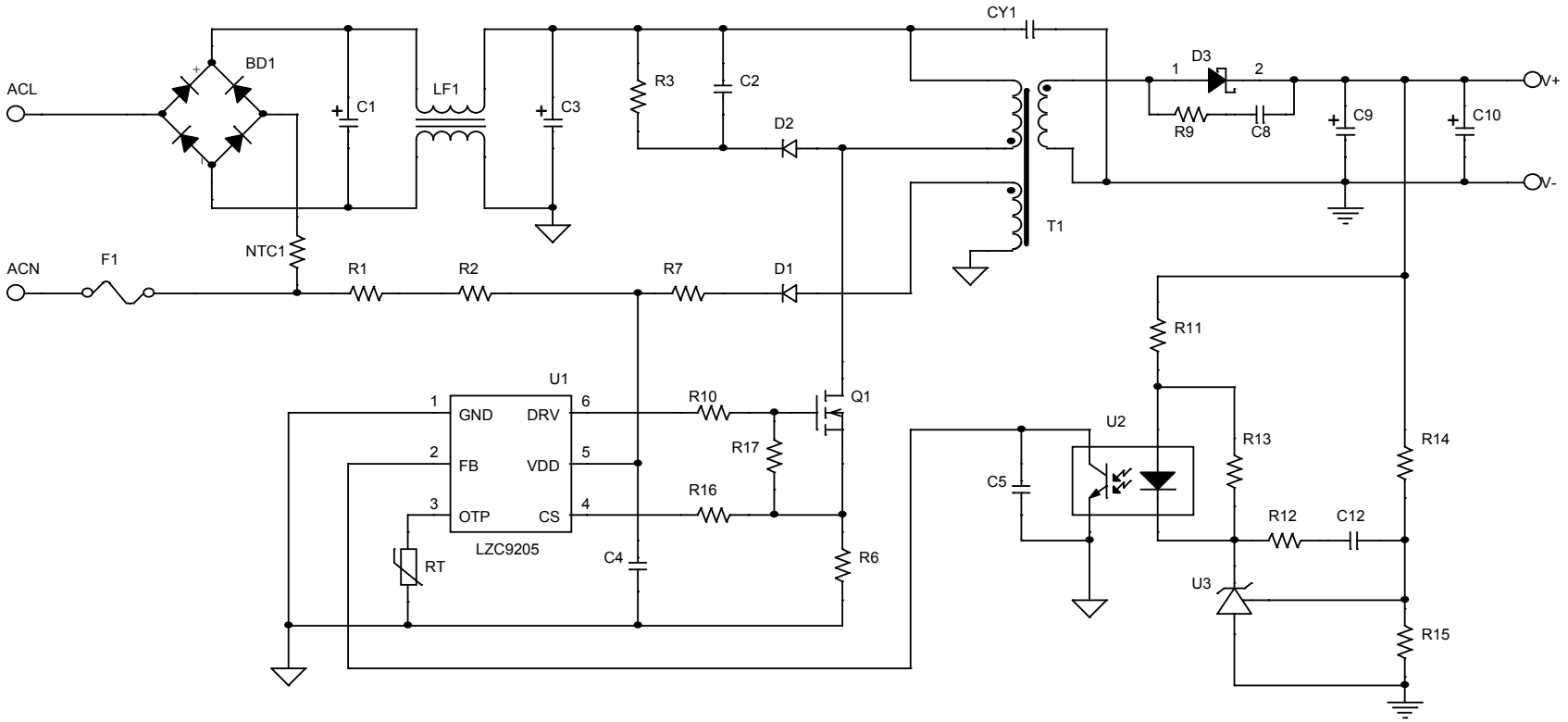
Over Load protection (OLP) -- Auto recovery and Latch optional

An over load protection is implemented in the LZC9205. When VFB input voltage exceeds the OLP threshold voltage 4.5V for more than T_{FB_OLP}, the protection will be activated to turn off the gate.

Over Temperature Protection (OTP)

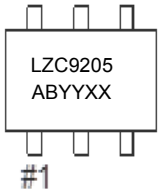
The overtemperature protection point can be precisely set by an external NTC resistor. The OTP pin current is 120uA. The OTP pin temperature detection period is 5mS. When the OTP pin voltage is higher than 1.22V, the DRV turns off..

Reference Application Schematic



Ordering & Marking Information

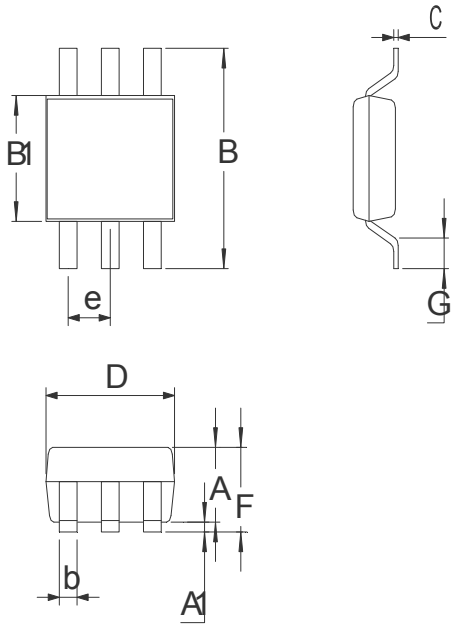
Device Name: LZC9205 for SOT23-6



LZC9205

ABYYXX: AB for Assembly house，YYXX for Date code

Package information



Dimension in mm

Dimension	A	A1	B	B1	b	C	D	e	F	G
Min.	0.90	0.00			0.30	0.08				0.30
Typ.	1.15		2.80	1.60			2.90	0.95		0.45
Max.	1.30	0.15			0.50	0.22			1.45	0.60