Primary Side Feedback Single-stage Active PFC LED Driver IC

Description

MXT7261 is a single-stage, with the source power factor correction, high-precision primary side feedback LED constant current control IC, which can be applied to 85Vac-265Vac full range input voltage flyback isolated LED constant current powerThis controller integrates active power factor correction circuit, which can achieve high power factor and low total harmonic distortion. Due to operating in inductor current critical continuous mode, power MOS transistor is at zero current turn on condition, the switching loss can be reduced, while the utilization of transformer can be increased.

MXT7261 uses a proprietary current sampling system with the primary feedback mode，which can achieve high precision output constant current control without secondary feedback circuit, so it can not only save the cost and bulk, but also improve the system reliability. In order to achieve the low loss of primary side and the ultrafast system power and LED start-up, the IC uses the patent soured driving technology and an internal rapid charge circuit.

MXT7261 use the patent linear voltage compensation technology and load voltage compensation technology, which can achieve excellent linear voltage regulation load voltage regulation. Moreover, linear voltage compensation factor can also be flexible adjustment of the external device.

MXT7261 has multi-protecti on functions, to increase the system reliability. It concludes open circuit protection, short circuit protection, over voltage protection, under voltage protection, open circuit protection, short circuit protection of current sampling resistor, by-cycle current limiting, and over temperature protection. All protection status has the automatic restart function.

Features

- Single stage cascade, source power factor adjust, high PF value, low THD
- Primary feedback constant current control, no need secondly feedback circuit
- Very high speed to LED start up(<200ms @85Vac)
- ±3% LED output constant current precision
- Excellent linear voltage adjust rate and load voltage adjust rate
- Inductance current critical continue mode
- Source drive mode
- Very low (20Ua) start up current
- Very low (600uA) work current
- FB feedback resistance value is high, low power
- LED short / open circuit protection
- Current samples collect resistance short / open protect
- Transformer full protect
- By-cycle primary side current limiting
- IC provide voltage over / under voltage protect
- Over temperature protection
- Automatic restart function
- Available in SOP-8 package

Application

- GU10 / E27 LED bulb lamp, searchlight
- LED PAR30, PAR38 lamp
- LED day light lamp
- Others LED light

Typical Application

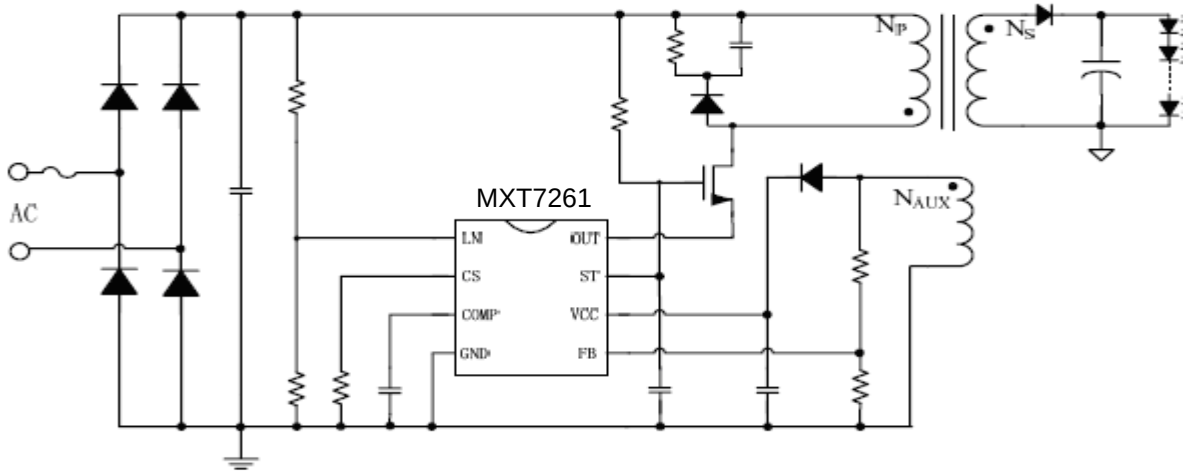
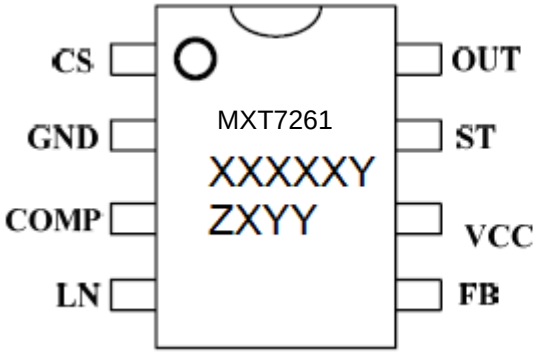


Figure1 MXT7261 typical application figure

Ordering Information

Model	Package	Temperature rage	Packing Type	Print
MXT7261	SOP8	-40℃ to 105℃	tape 1500 piece/dish	MXT7261 XXXXXY ZXYY

Pins Package



XXXXXY: lot code
Z: R(RoHS), G(GREEN)
X: Year
YY: Week

Figure 2 pins figure

Pin Description

Pin NO.	Pin name	Description
1	CS	Current samples collect, collecting resistance connect to CS and GND
2	GND	The IC ground
3	COMP	Loop compensate point
4	LN	Linear voltage sample collect input point

5	FB	Auxiliary winding feedback point
6	VCC	IC power
7	ST	IC start up pin. In application, it connect with outside power MOS gate
8	OUT	Pulse output point, connect the outside power MOS gate

Limiting Parameter (note 1)

Symbol	Parameter	Rage	Unit
Vcc	Power voltage	-0.3 to 22	V
CS	Current sample collect point	-0.3 to 6	V
COMP	Loop compensation point	-0.3 to 6	V
LN	Linear voltage sample collect input point	-0.3 to 6	
FB	Auxiliary winding feedback point	-0.3 to 6	
I_{ST_MAS}	ST pin max power current	5	Ma
OUT	Outside power MOS drive point	-0.3 to 18	V
I_{OUT}	Inside drive power MOS max work current	3	A
P_{DMAX}	Power waste (note 2)	0.45	W
θ_{JA}	PN junction to the environment hot resistance	145	℃\W
T_J	Work junction temperature range	-40 to 150	℃
T_{STG}	Conservation temperature range	-55 to 150	℃
	ESD (note 3)	2000	V

Note 1, Max limit is over the normal work range. The IC may damage. Suggest work range is in the suit range, the IC work normal. However, it can not confirm that it suit the entire capability target. Electric parameter define the device in the work range, and confirm in the special capability target in test condition in DC current and AD current electric parameter criterion. The limit parameter, which has not been shown, can not confirm its precision. But the type value can show its device capability.

Note 2, When the temperature high, the max power waste must be decrease. It depend by T_{JMAX}, θ_{JA}, and the environment T_A. The max accept power is PDMAX=(T_{JMAX}-T_A)/ θ_{JA}, or the lower data in limit range.

Note 3, Human mode 100pF capacitance electric 1.5KΩ resistance releasing the electricity.

Recommended Operating Range

Symbol	Parameter	Range	Unit
Vcc	Power supply	8-18	V

Electricity Parameter（notes 4，5）（VCC=14V, TA=25℃，unless otherwise specified ）

Symbol	Parameter description	Condition	Min	Type	Max	Unit
Start-up voltage						
V_{ST_ON}	V_{ST} start-up current	1mA, V_{CC}=10V	16	17	18	V
V_{ST_HYS}	V_{ST} the hysteresis voltage	V_{CC}=14V		2		V
I_{ST_ON}	ST start up current	V_{CC}=10V		20	35	uA
I_{ST_OP}	ST operating current	V_{CC}=14V		35	60	uA
Power voltage						
V_{CC_ON}	V_{CC} start up voltage	V_{CC} up	10	11	12	V
V_{CC_UVLO}	V_{CC} under voltage protect threshold	V_{CC} down	5.5	6.0	6.5	V
V_{CC_HOLD}	keep up the voltage	V_{CC} down	7	7.5	8	V
I_{CC_UVLO}	V_{CC} shutdown current	V_{CC} up, V_{CC} = 10V		40	70	uA
I_Q	V_{CC} static current	No any switch action V_{CC}=14V		320	600	uA
I_{CC}	V_{CC} typical operation current	F_{op}=60kHz		600		uA
V_{CC_OVP}	V_{CC} over voltage protection threshold			20		V
FB feedback						
V_{FB_FALL}	FB decrease threshold	FB down		0.4		V
V_{FB_HYS}	FB hysteresis voltage	FB up		0.6		V
V_{FB_OVP}	FB over voltage protect threshold			5.5		V
T_{OFF_MIN}	Min shutdown time			4.0		us
T_{OFF_MAX}	Max shutdown time			150		us
Current samples collection						
T_{LEB_CS}	Current samples collect, the time to clear up the sting in the pulse			350		ns
T_{DELAY}	IC shutdown the delay			180		ns
Loop circuit compensation						
V_{REF}	Inner drive MOS electric resistance		0.295	0.300	0.305	V
V_{COMP_LO}	COMP under voltage clamp			1.5		V

V_{COMP}	COMP linear voltage range		1.5		3.5	V
V_{COMP_OVP}	Output short, COMP check threshold			4.5		V
Linear voltage samples collect						
V_{LN}	LN linear work range		0		2.5	V
Drive						
R_{DS_ON}	Inner drive MOS electric resistance	VCC=14V				mΩ
Over temperature protect						
T_{SD}	Over temperature shut down temperature			150		℃
T_{SD_HYS}	Over temperature protect delay			30		℃

Note 4, type parameter value is test in 25℃,

Note 5, the max and min in the spec are confirmed by the test. The type value is confirmed by the design, test and statistical analyses.

Internal Structure Diagram

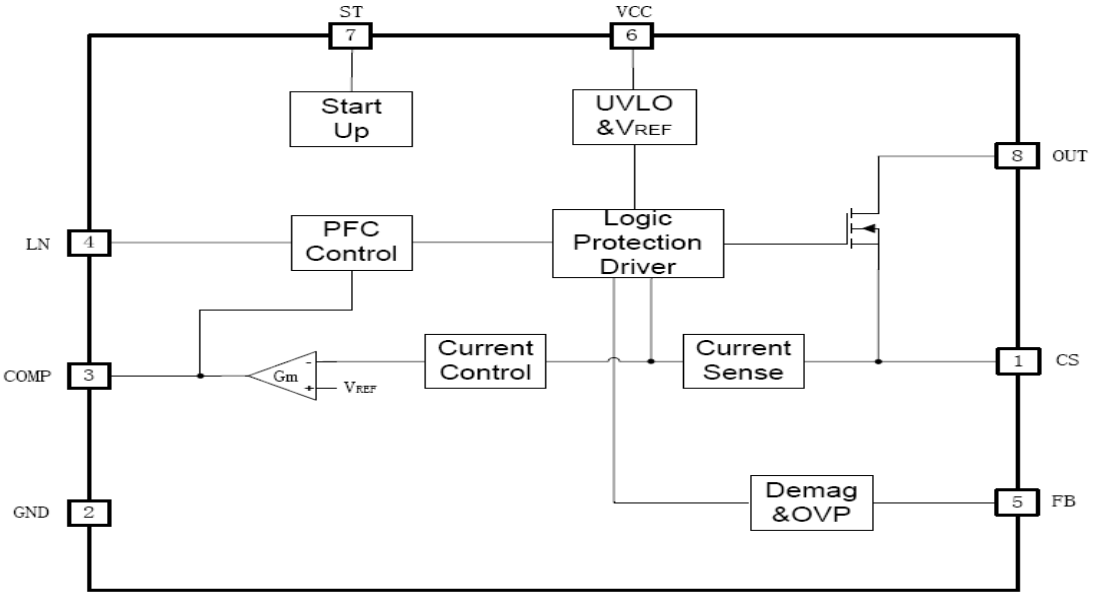


Figure3 MXT7261 Internal Structure Diagram

Application information

MXT7261 is a high precision primary feedback, single stage cascade, with a source power factor adjust, and LED constant current control IC. Since it works at the inductance current critical continue mode, the IC can work at a very high power factor and very low total harmonic distortion and high efficiency.

1, start-up

When the system start-up, generatrix voltage charge the ST pin inductance by the start up resistor. And the VCC voltage follows up the ST pin voltage's climb up. MXT7261 use the source drive and patent inner charge circuit. And VCC voltage can electrify fast, when the system do not loss any frequency.

After the VCC climb up to make the start up threshold voltage, MXT7261 begin to output pulse signal. And inner charge circuit will be shut down. Auxiliary winding resistor supply the power to the VCC. When the system just begins to work at 7 KHz switch frequency, the LED will begin the smooth start up, to prevent the current overshoot. At 85Vac condition, even if use the 1 MΩ start up resistance, it need 200ms from system electrify to LED electrify.

In the normal work time, if connect output pin's LED quantity is too less to make the output voltage very low, it will make the auxiliary winding can not supply the VCC. And then, VCC will level off at about 10V. This function make the system have a big range in LED used quantity and work normal.

2, constant current control, output current set up

MXT7261 use a special current sample collecting mec hanism. It works in primary feedback mode. It do not need any secondly feedback circuit. And it can output a high precision constant current control.

LED output current calculator method

$$IOUT \approx \frac{VREF}{2 \times RCS} \times \frac{NP}{NS}$$

VREF is an internal reference voltage.

NP is the number of turn of the transformer main winding.

NS is the number of turn of the transformer secondly winding.

3, feedback network

MXT7261 use the FB to feedback the output current zero state. FB falling threshold voltage set up at 0.4V. And the hysteresis voltage is 0.6V. FB pin can be used in exploring over voltage protection (OVP). And the threshold value is 5.5V. The proportion of FB upper and lower pressure resistor can be set up as follows:

$$\frac{RBL}{RFBL + RFBH} = \frac{5.5V}{VOVP} \times \frac{NS}{NA}$$

RFBL is upper and lower pressure resistor of feedback network

VOVP is the set point of output over voltage protection.

NS is the number of turn of the transformer secondly winding.

NA is the number of turn of the transformer auxiliary winding.

For increase the system efficiency, FB upper and lower pressure resistance can set up at about 300KΩ. And change this resistance, it can tiny adjust the linear voltage compensate to the LED output current.

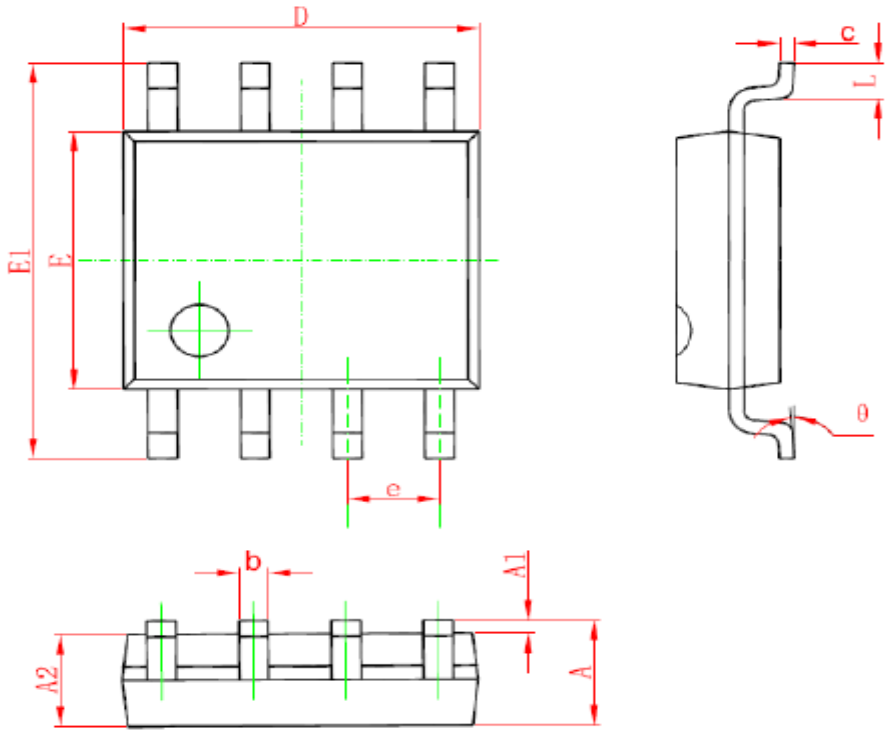
4, protection function

MXT7261 has multi protectionfunction to increase the system reliability. When the VCC voltage climb up at 20V OVP threshold, and when the LED open, it will protect the logic and lock. And then, the system will be stopping the switch.
When the LED short, system work at low frequency at 7KHz. So, the power is very low.
And COMP pin voltage begins to increase, when it arrive 4.5V, it will be protect logic and lock. And then, the system stop switch. When the singularity condition happens, such as CS collecting resistance short, or transformer is full, the high speed explore circuit touch off the protect logic and lock in the IC inner. And the system stops the switch working in the same time.
MXT7261 over temperature protect check the IC junction temperature. When the junction temperature is more then 150℃ threshold value, it will touch off the protect logic and lock, and the system will stop the switch working. After the junction temperature reduce 30℃, outside power MOS can back to work.
When the system get into the protect state, VCC voltage will begin to reduce. When VCC arrive the under voltage threshold value, system will be restart. And the system will continue check the load state. Such as troubleshooting, system will be restart normal working.

5, PCB design

When design the MXT7261 PCB board, need take care as below.
Bypass capacitor.
ST and VCC pin's bypass capacitor need close its IC pin.
Ground wire.
The power ground wire of the current sample collecting resistance need short (distance). And it need connect to the generatrix capacitor ground with IC ground wire and others small signal's ground.
Power loop area
Reduce the big current loop area, such as transformer main grade, power mos, absorption of network loop area, transformer secondly grade, secondly diode, output capacitor loop area. It can reduce the EMI radiation.
FB pin
The divider resistance connecting FB, it must close to the FB pin. And the junction must far away from the point of the transformer.

Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0℃	8℃	0℃	8℃