ME2106 Series PFM step-up DC-DC driver of LED

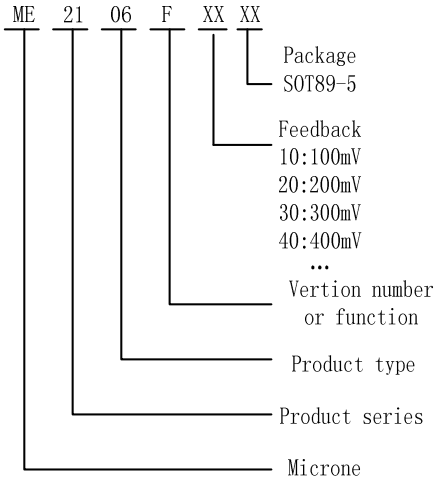
ME2106 Series is a PFM Step-up DC/DC driver IC with invariant current, design for LED applications. Thought the external resistance, output current reach 0mA~500mA.

A low ripple, high efficiency step-up DC/DC converter can be constructed of ME2106xx with only three external components. Also available is a CE (chip enable) function that reduce power consumption

Features

- Low start voltage：0.8V (at Iout=1mA)；
- Output Current range：0~ 500mA；
- Output Current accuracy：±10%；
- High Efficiency：82%(Type)；
- PACKAGE：SOT23-5，SOT89-5.

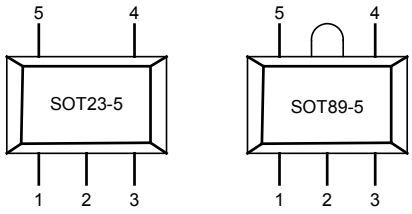
Selection Guide



Applications

- Power source for high-power LED；
- Power source for invariant current.

Pin Configuration

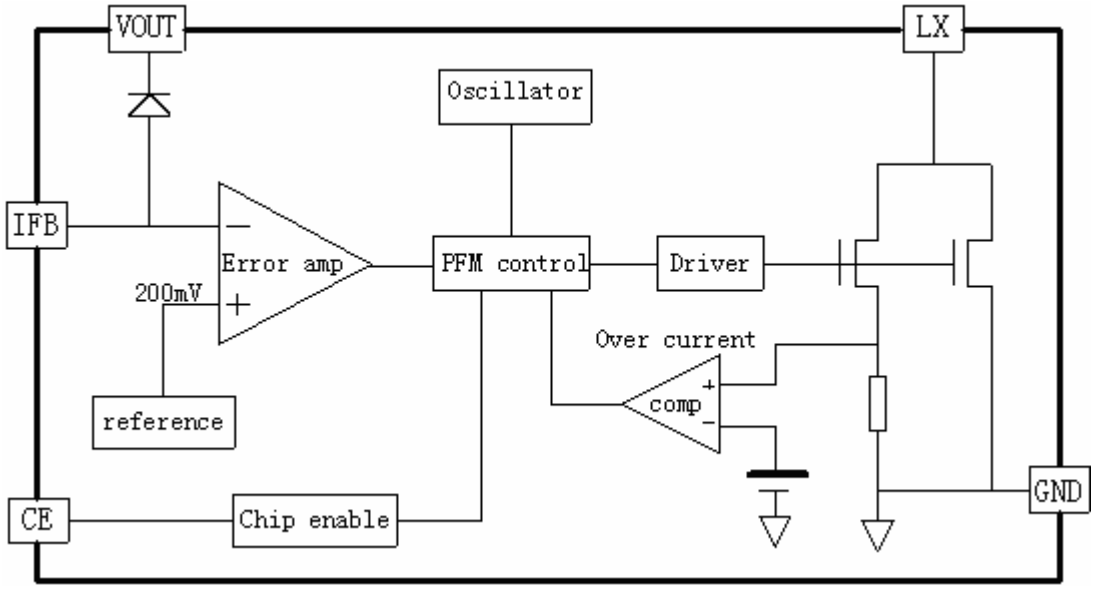


Pin Assignment

ME2106Fxx

PIN Number		PIN NAME	FUNCTION
SOT23-5	SOT89-5		
1	1	CE	Chip enable
2	2	Vout	Output voltage monitor, IC internal power supply
3	4	FB	Feedback
4	3	GND	Ground
5	1	Lx	Switch

Block Diagram



Absolute Maximum Ratings

PARAMETER		SYMBAL	RATINGS	UNITS
V_{IN} Input Voltage		V_{IN}	0.3~9	V
Lx Pin voltage		V_{LX}	0.3~Vout+0.3	V
CE Pin voltage		V_{CE}	0.3~Vout+0.3	V
IFB output voltage		V_{IFB}	0.3~Vout+0.3	V
Lx Pin current		I_{LX}	1.5	mA
Continuous Total Power Dissipation	SOT23-5	Pd	300	mW
	SOT89-5	Pd	500	mW
Maximum Operating Ambient Temperature		T_{max}	150	℃
Operating Ambient Temperature		T_{Opr}	-20~+85	℃
Storage Temperature		T_{stg}	-40~+125	℃
Soldering temperature and time		T_{solder}	260℃, 10s	

Recommend work conditions

PARAMETER	MIN	recommend	MAX	UNITS
Input voltage	0.8		Vout	V
Inductance	10	15	100	μH
Input inductance	0	≥22		μF
output inductance	47	100	220	μF
Operating Ambient Temperature	-20		85	℃

Electrical Characteristics

ME2106F **(Measuring conditions:** V_{IN}=2.5V，V_{CE}= V_{OUT}=3.3 V，R=33Ω，T_A = 25℃. Unless otherwise specified ）

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OUT}	feedback Voltage	I_{OUT}=100mA	180	200	220	mV
V_{start}	Starup Voltage	I_{OUT}=1mA, V_{IN}：0→2V		0.8	0.9	V
V_{hold}	holding Voltage	I_{OUT}=1mA, V_{IN}：2→0V	0.6	0.7		V
I_{DD2}	Supply Current	LX empty, V_{CE}=V_{IFB}=V_{OUT}=3.3V		36		μA
I_{LX}	Lx Switching Current	V_{LX}=0.4V, V_{IFB}=0	700			mA
I_{LXleak}	Lx Leakage Current	V_{OUT}=V_{LX}=V_{IFB}=6V			1	μA
I_{leak}	CE is “L”, Leakage Current of the chip	V_{OUT}=3.3V, V_{CE}=0, LX, IFB empty		<0.1	0.5	μA
F_{osc}	Oscillation Frequency	V_{IFB}=0	370	420	470	kHz
Maxdty	Duty Ratio	On(V_{LX} “L”)side	70	75	80	%
η	Efficiency	I_{OUT}=250mA		82		%
V_{CEH}	CE is “H”,input voltage	V_{CE}：0→2V (up to work slowly with the chip)	0.6	0.9		V
V_{CEL}	CE is “L”,input voltage	V_{CE}：0→2V (down to work off slowly with the chip)		0.3	0.6	V
I_{OM}	Maximum output diver power	V_{IFB} =0, V_{OUT} =3.3V		500		mA

notes：

1、Diode：Schottky diode（forward voltage drop ： 0.3V，0.3A ），such as IN5817 or 1N5819

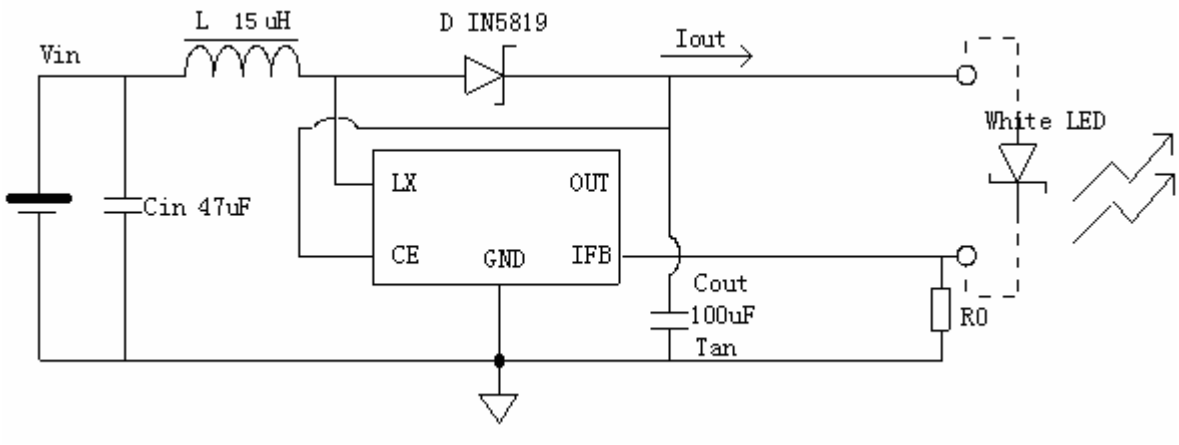
2、Inductor：15μH（R<0.5Ω）

3、Capacitor：100μF （Tantalum type ）

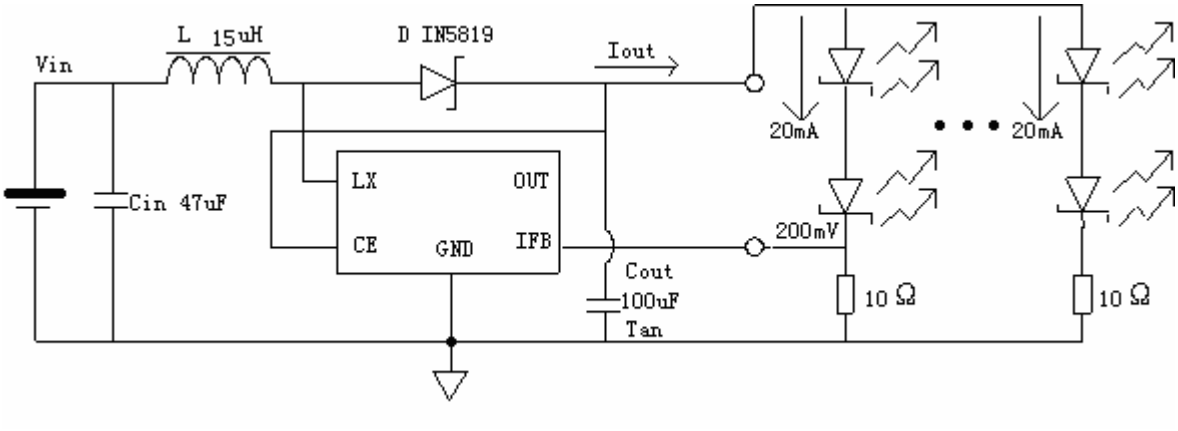
4、V_{IFB} (SET) is feedback voltage of the chip set up , is the first parameter of the table ,such as 100mV、200mV and so on。

Typical Applications

Output current



(A) Drive one white light LED with 1W



(B) Drive more serial two parallel white light LED with low power

suggestions:

you can increase the output capacitor properly for improve to the characteristic of the output invariant current (for example：150uF or 200uF).

Operation

ME2106 is a DC/DC step-up converter with voltage type , PFM control mode , output invariablenes current. It has only three Peripheral components that is a inductor 、a output capacitor、a schottky diode and a resistor with set-up output current, that can afford to a invariant output current between 0 and 500mA .

- Rc set-up method：

If the output current is Iout，that $Rc=V_{IFB}/Iout$ 。

For example, want to the current value of 100mA , select the chip of VIFB=200mV,
that Rc=200mV/100mA=2Ω。

Selection of Peripheral Components and Application Notes

Sum up , inductor , schottky diode would be affect the switching efficiency , capacitor and inductor would be affect the output ripple. Choose such an inductor, capacitor, schottky diode that have high switching efficiency, low ripple, low noises.

Before discussion, define to $D \equiv \frac{Vout - Vin}{Vout}$。

First, selection of inductor

Make sure DC-DC can natural work firstly in the model of the minimum continuous current that is Lmin， $Lmin \geqq \frac{D(1-D)^2 R_L}{2f}$.

This formula deduce that ignoring the autoecious resistor and a diode with the forward voltage drop, but the actual value is still big. If the inductance less than Lmin, inductor will reach magnetic saturation, efficiency will greatly drop, and hardly output steady voltage.

Secondly , considering the current ripple of the inductor, ignoring the autoecious parameter in the mode of continuous current.

$$\Delta I = \frac{D \bullet Vin}{Lf} \quad , \quad Imax = \frac{Vin}{(1-D)^2 R_L} + \frac{DVin}{2Lf} \quad .$$

When “L” is too small, will lead to high current ripple of the inductor , and the maximum current of the inductor , schottky diode , power tube of the chip are excessive .

Thirdly, generally speaking, not considering efficiency , small inductor can drive load more then large inductor .But in the same load conditions , large inductor with the current ripple and the maximum current value are small. So the large inductor should be able to start up circuit in the low input voltage.

Use inductor with an inductance of 10μH or more ,it’s ensure to normal work . If output port has load with output large current (for example: output current is more than 50mA), for improving to efficiency, suggest to use large inductor. At the same time, in the large load, the resistor is in series with the inductor that will affect the switching efficiency. Supposed , the resistor is rL，R_{load}，that the power consumption as follow：

$$\Delta \eta \approx \frac{r_L}{R_{load}(1-D)^2}$$

For example, input 1.5V, output 3.0V, load 20 Ω (150mA),rL=0.5Ω,efficiency loss 10% .
Considering, suggest to use an inductance of 15 uH , <0.5Ω.

second, selection of capacitor

No considering the inductor with equivalent series resistor(ESR), output voltage ripple is：

$$r=\frac{\Delta Vout}{Vout}=\frac{D}{R_{load}Cf}$$

considering the inductor's ESR, the output ripple will be increase：

$$r'=r+\frac{\mathrm{Im}ax\bullet R_{ESR}}{Vout}$$

Suggest to use Tantalum type with the low ESR or more parallel-resistor.

Third, selection of diode

It is recommended that the diode have great effect to DC-DC efficiency, we suggest to use schottky diode with the lower positive turn-on voltage and the lower corresponsive time. For example, 1N5817、1N5819 .

Fourth, selection of input capacitor

Power supply is stably, even if no input capacitor, DC-DC can output voltage with the lower ripple and the lower noise. But we suggest to connect with the capacitor of 10uF or more when the power supply was far away DC-DC, for minish the output noise.

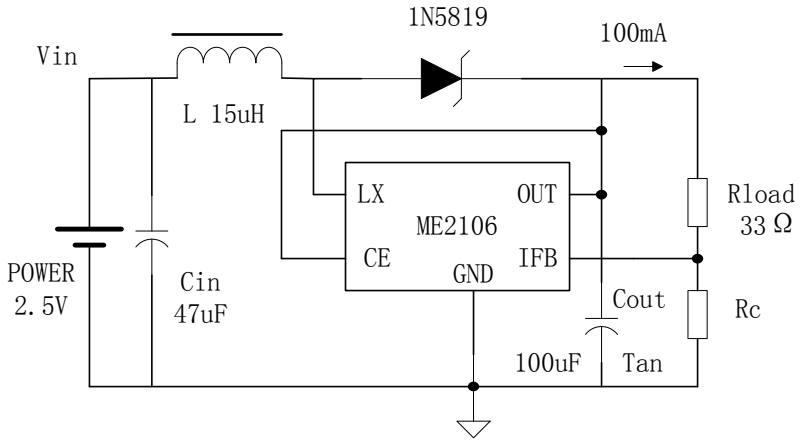
Fifth, selection of resistor R1, R2

Application to invariant current , the formula of R1、R2：

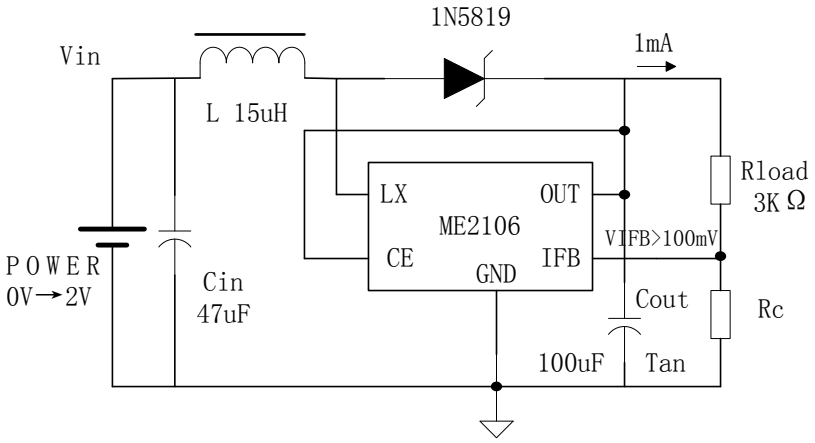
$$\frac{Vout}{V_{IFB}}=\frac{R1}{R2}+1$$

Testing circuit：

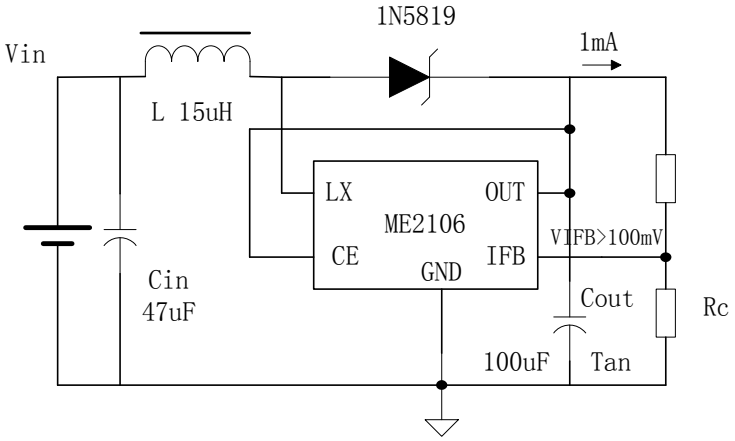
（One） test foldback voltage



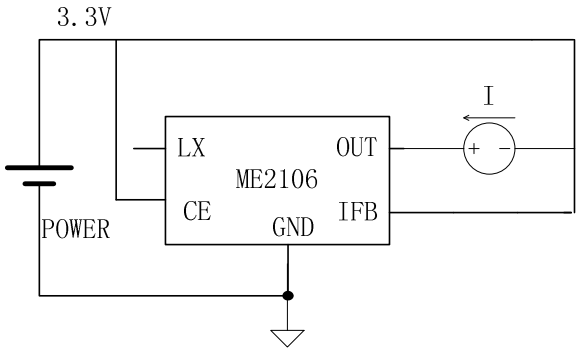
(Two) test startup voltage



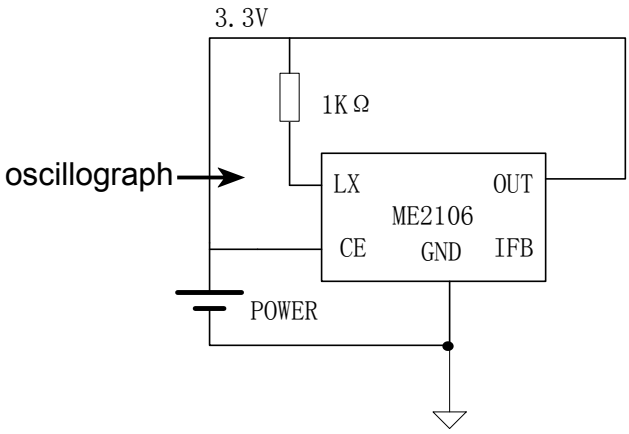
(Three) test holding voltage



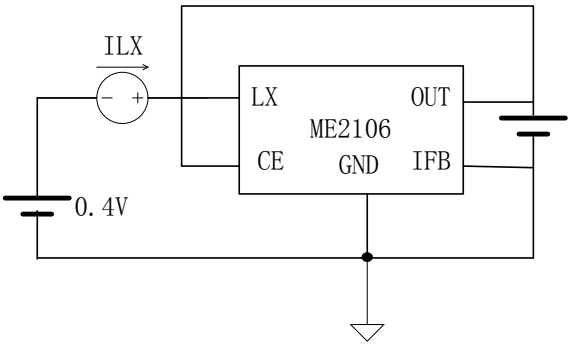
(Four) test supply current



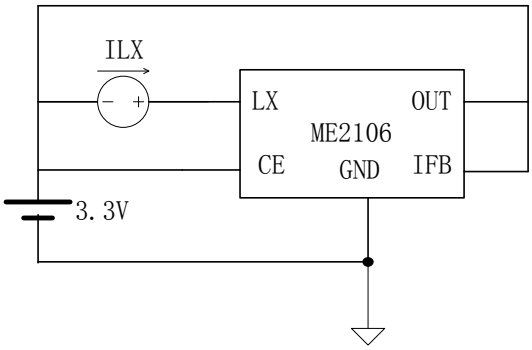
(Five) test Oscillation Frequency and Duty Ratio



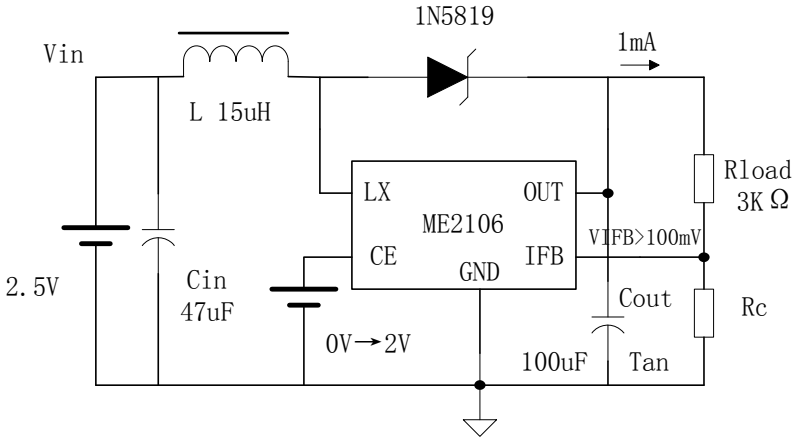
(Six) test switching current



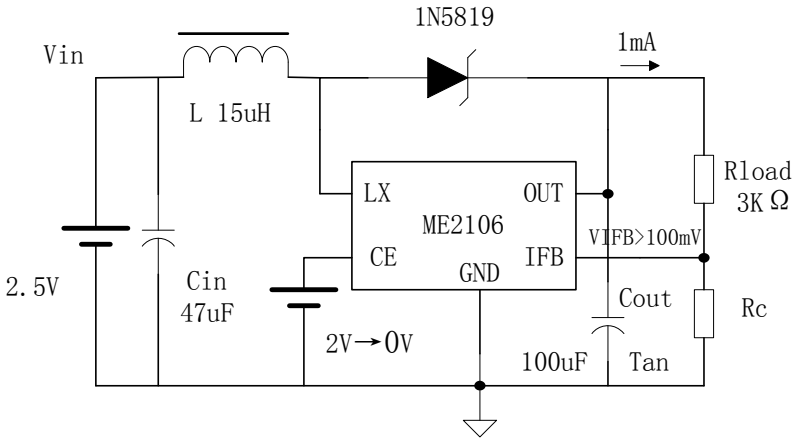
(Seven) test switch leakage current



(Eight) test CE high voltage



(Nine) test CE low voltage



Package Dimensions