FEATURES

- Wide Input Voltage Range:-0.3V-40V
- Programmable Switching Frequency 150KHz
- Output Voltage：5V/3.4A
- No Loop Compensation Required
- Low Quiescent Current: 1.0mA
- Thermal Shutdown
- ON/OFF Control
- Up to 95% Efficiency
- Available in SOP-8L Package

APPLICATIONS

- DC-DC power supply
- Car Charger
- Pre-Regulator for Linear Regulators
- Distributed Power Systems
- Battery Charger
- LED backlight driver

DESCRIPTION

The MX3019C is a synchronous step down regulator from a high voltage input supply.Operating with an inpot voltage range from 8V-32V，the MX3019C achieves 3.4A continuous output current with excellent load and line regulation.The switching frequency is programmable from 150KHz and the synchronous architecture peovides for highly efficient designs.Current mode operation procides fast transient response and eases loop stabilization.

The MX3019C requires a minimum number of readily available standard external components.Other features include cable compensation,programmable current limit and thermal shutdown.

The MX3019C converters are available in the industry standard SOP-8L packages.

TYPICAL APPLICATION CIRCUIT

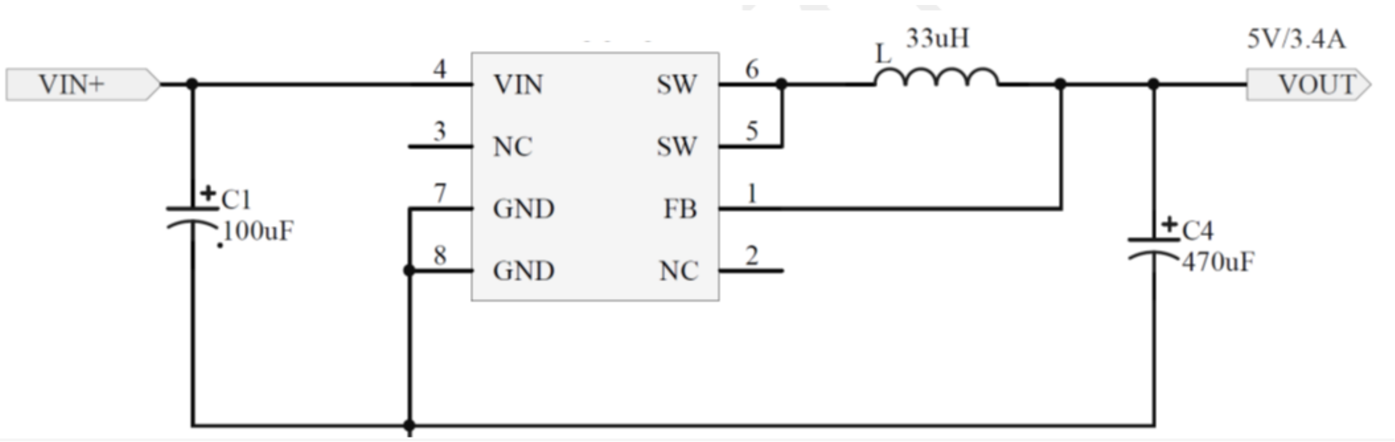


Figure 1.

PACKAGE REFERENCE

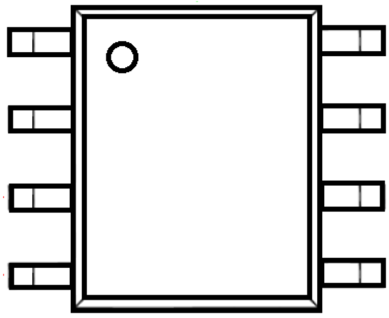


Figure 2.

PIN DESCRIPTION

PIN NO.	NAME	FUNCTION DESCRIPTION
1	VOUT	Output Voltage
2	NC	---
3	NC	---
4	VIN	Input Supply Voltage
5	SW	Switch Node
6	SW	Switch Node
7	GND	Ground
8	GND	Ground

ABSOLUTE MAXIMUM RATINGS(Note 1)

PARAMETER(SYMBOL)	MIN	MAX	UNITS
Input Supply Voltage	-0.3	33	V
VOUT,CS Voltages	-0.3	6	V
Operating Temprature Range(Note 2)	-40	85	℃
Storage Temprature Range	-65	150	℃
Junction Temprature Range	150		℃
Lead Temprature Range(Soldering,10 sec)	260		℃

Note1:Stresses beyond those listed Absolute Maximum Ratings may cause permanent damage to the device.
Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.
Note 2:The MX3019C is guaranteed to meet performance specifications from 0℃ to 70℃.Specifications over the -40℃ to 85℃ operating temperature range are assured by design,characterization and correlation with statistical peocess controle.

ELECTRICAL CHARACTERISTICS

Operating Conditions:TA=25℃,V_{IN}=12V, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Operating Voltage Range		4.5		36	V
I_Q	Quiescent Current	I_{LOAD} = 0A		8		mA
I_{SHDN}	Shutdown Current			110	150	µA
V_{UVLO}	Input UVLO Threshold			4.25	4.5	V
ΔV_{UVLO}	UVLO Hysteresis			18		mV
V_{OUT}	Output Voltage Range	$I_{OUT} = 0A$	4.974	5.075	5..176	V
I_{FB}	Feedback Pin Input Current				0.05	µA
f_{OSC}	Oscillator Frequency range			150		kHz
DC	Max Duty Cycle				100	%
I_{LIM-TH}	Current Limit Sense pin Source Current		7	8.5	10	µA
R_{RFET}	$R_{DS(ON)}$ of P − Channel FET			35		mΩ
R_{NFET}	$R_{DS(ON)}$ of N − Channel FET			25		mΩ
T_{SD}	Thermal Shutdown	Temperature Rising		145		℃
ΔT_{SD}	Thermal Shutdown Hysteresis			30		℃

APPLICATION INFORMATION

Thermal Protection

The total power dissipation in MX3019C is limited by a thermal protection circuit.When the device temperature rises to approximately 145℃,this circuit tums pff the output,allowing the IC to cool.The thermal protection circuit can protect the device from being damaged by overheating in the event of fault conditions.Continuously running the MX3019C into thermal shutdown degrades device reliability.

Output Cable Resistance Compensation

To comprnsate for resistive voltage drop across the charger's output cable,the MX3019C integrates a simple,user-programmable cable voltage drop compensation using the impedance at the FB pin.Choose the proper feedback resistance values for cable compensation refer to the curve in .The delta VOUT voltage rises when the feedback resistance Rdown value rises.

Inductor Selection

For most applications,the value of the inductor will fall in the range of 10μH to 47μH.Its value is chosen based on the desired ripple current. Large value inductors lower ripple current and small value inductors result in higher ripple currents.Higher V_{IN} or V_{OUT} also increases the ripple current an shown in equation.A reasonable starting ripple current is △I_L=1000mA(40% of2.4A).

$$\triangle I_L = \frac{1}{(f)(L)} * V_{OUT}(1 - \frac{V_{OUT}}{V_{IN}})$$

The DC current rating of the inductor should be at least equal to the maximum load current plus half the ripple current to prevent core saturation.Thus a 3.4A rated inductor should be enough for most applications(2.4 A+500mA).For better efficiency,choose a low DC-resistance inductor.

Different core materials and shapes will change the size/current and price/current relationship of an inductor.Toroid or shielded pot cores in ferrite or perm alloy materials are small and don't radiate much energy,but generally cost more than powdered iron core inductors with similar electrical characteristics.The choice of which style inductor to use often depends more on the price vs.size requirements and any radiated field/EMI requirements than on what the MX3019C requires to orerate.

Output and Input Capacitor Selection

In continuous mode,the source current of the top MOSFET is a square wace of duty cycle VOUT/VIN.To precent large voltage transiente,a low ESR input capacitor sized for the maximum RMS current must be used.The maximum RMS capacitor current is given by:

$$C_{IN} required I_{RMS} \cong I_{OMAX} \frac{[V_{OUT}(V_{OUT} - V_{OUT})]^{1/2}}{V_{IN}}$$

This formula has a maximum at V_{IN}=2V_{OUT},where $I_{RMS} = I_{OUT}/2$.This simple worst-case condition is commonly used for design because even significant deviationgs do not offer much relief.Note that the capacitor manufacturer's ripple current ratings are often based on 2000 hours of life.This makes it adcisable to further derate the capacitor,or choose a capacitor rated at a higher temperature than required.Always consult the manufacturer if there is any question.

The selection of C_{OUT} is driven by the required effective series resistance(ESR).Typically,once the ESR requirement for C_{OUT} has been met,the RES current rating generally far exceeds the $I_{RIPPLE(P-P)}$ requiremtnt.The output ripple $\triangle V_{OUT}$ is determined by:

$$\triangle V_{OUT} \cong \triangle I_L (ESR + \frac{1}{8fC_{OUT}})$$

Where f=operating frequency, C_{OUT}=output capacitance and $\triangle I_L$=ripple current in the inductor.For a fixed output coltage,the output ripple is highest at maximum input voltage since $\triangle I_L$ increases with input voltage.

Aluminum electrolytic and dry tantalum capacitors are both available in surface mount configurations.In the case of tantalum,it is critical that the capacitors are surge thsted for use in switching power supplies.An excellent choice is the AVX TPS series of surface mount tantalum.These are specially constructed and tested for low ESR so they give the lowest ESR for a given volume.

Efficiency Considerations

The efficiency of a switching regulator is equal to the output power divided by the input power times 100%.It is often useful to analyze individual losses to determine what is limiting the efficiency and which change would produce the most improvement.Efficiency can be expressed as:Efficiency=100%-(L1+L2+L3+...)where L1,L2,etc.are the indicidual losses as a percentage of input power.Although all dissipative elements in the circuit produce losses,two main sources usually account for most of the losses:VIN quiescent current and I^2R losses.The VIN quiescent current loss dominates the efficiency loss at very low load currents whereas the I^2R loss dominates the efficiency loss at medium to high load currents.In a typical efficiency plot,the efficiency curve at very low load currents can be misleading since the actual power lost is of no consequence.

1.The VIN quiescent current is due to two components:the DC bias current as given in the electrical characteristics and the internal main switch and synchronous switch gate charge currents.The gate charge current results from switching the gate capacitance of the internal power MOSFET switches.Esch timg the gate is switched from high to low to high again,a packet or charge △Q moves from VIN to ground.The resulting △Q/△t is the current out of VIN that is typically larger than the DC bias current.

In continuous mode, $I_{GATECHG} = f*(Q_T + Q_B)$ where Q_T and Q_B are the gate charges of the internal top and bottom switches.Both the DC bias and gate charge losses are proportional to VIN and thus their effects will be more pronounced at higher supply voltages.

2.I^2R losses are calculated from the resistances of the internal switches, R_{SW} and external inductor R_L.

In continuous mode the acarage output current flowing through inductor L is "chopprd" between the main switch and the synchronous switch.Thus,the series resistance looking into the SW pin is a function of both top and bottom MOSFET $R_{DS(ON)}$ and the duty cycle (DC) as follows: $R_{SW} = R_{DS(ON)TOP}$ *DC +$R_{DS(ON)BOP}$ *(1-DC)The $R_{DS(ON)}$ for both the top and bottom MOSFETS can be obtained from the Typical Performance Characteristics curves.Thus,to obtain I^2R losses,simply add R_{sw} to R_L and multiply the result by the square of the average output current.Other losses including C_{IN} and C_{OUT} ESR dissipative losses and inductor core losses generally account for less than 2% of the total loss.

Board Layout Suggestions

When laying out the printed circuit board,the following checklist should be used to ensure proper operation of the MX3019C.Check the following in your layout.

1.The power traces,consisting of the GND trace, the SW trace and the VIN trace should be kept short,direct and wide.

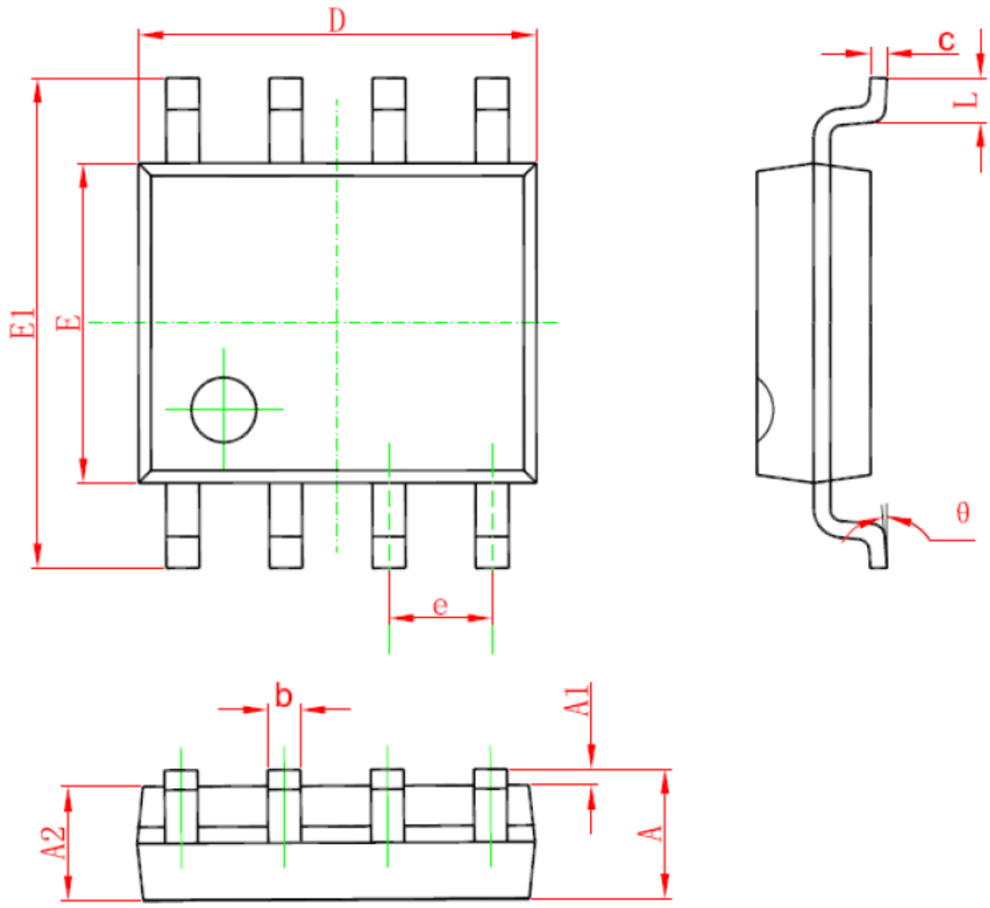
2.Put the input capacitor as close as possilbe to the device pins(VIN and GND).

3.SW node is with high frequrncy voltage swing and should be kept small area.Keep analog components away from SW node to prevent stray capacitive noisw pick-up.

4.Conntct all analog grounds to a command node and then connect the command node to the power ground behind the output capacitors.

PACKAGING INFORMATION

SOP-8L PACKAGE OUTLINE DIMENSION



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°