High Efficiency 3MHz, 1.2A Inductor Built-in Synchronous Step Down Regulator

General Description

FC8101 is a 3MHz, 1.2A synchronous step-down converter which integrates an inductor and a control IC in one tiny package (2.5mm×2.0mm). It can operate over a wide input voltage range from 2.5V to 6V and integrate main switch and synchronous switch with very low $R_{DS(ON)}$ to minimize the conduction loss.

Ordering Information

FC8101 (□□)□
└ Temperature Code
Package Code

Ordering Number	Package	Note
FC8101ACC	QFN2.5×2-8	V_{OUT} Adjustable

Features

- Low $R_{DS(ON)}$ for internal switches (top/bottom): 230mΩ/150mΩ
- Integrate an inductor to minimizes the external components and PCB layout design
- 2.5~ 6V input voltage range
- 1.2A continuous output current capability
- High switching frequency 3MHz minimizes the external components
- Internal soft-start limits the inrush current
- RoHS Compliant and Halogen Free
- Compact package: QFN2.5×2-8

Applications

- Mobile phone, Smart phone
- Bluetooth Headsets
- WiMAX PDA, MID, UMPC
- Portable game console
- Digital camera, Camcorder

Typical Applications

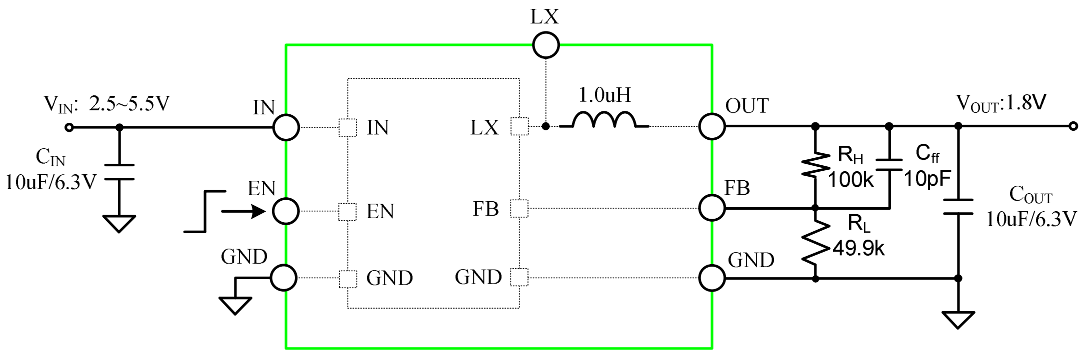
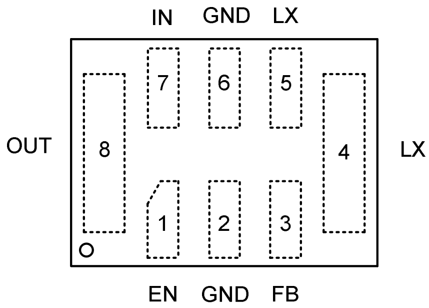


Figure1. Schematic Diagram

Pinout (Top View)



Top Mark: Dt*xyz* for FC8101 (device code: Dt, ***x=year code, y=week code, z= lot number code)***

Pin Name	Pin Number	Pin Description
EN	1	Enable control. Pull high to turn on. Do not float.
GND	2, 6	Ground pin.
FB	3	Output adjustable version. Connect this pin to the center point of the output resistor divider to program the output voltage: $V_{OUT}=0.6\times(1+R_1/R_2)$.
LX	4, 5	Built-in inductor node. Leave it floating.
IN	7	Input pin. Decouple this pin to GND pin with at least 10uF ceramic cap.
OUT	8	Output Pin. Decouple this pin to ground with at least 10uF ceramic cap.

Absolute Maximum Ratings (Note 1)

Supply Input Voltage, LX, OUT pins ---------- 6.0V
Enable, FB Voltage---------- V_{IN} + 0.6V
Power Dissipation, P_D @ T_A = 25°C,
QFN2.5×2-8 ---------- TBD
Package Thermal Resistance (Note 2)
θ_{JA} ---------- TBD
θ_{JC} ----------TBD
Junction Temperature Range ----------150°C
Lead Temperature (Soldering, 10 sec.) ---------- 260°C
Storage Temperature Range ---------- -65°C to 150°C

Recommended Operating Conditions (Note 3)

Supply Input Voltage ---------- 2.5V to 6V
Junction Temperature Range ---------- -40°C to 125°C
Ambient Temperature Range ---------- -40°C to 85°C

Electrical Characteristics

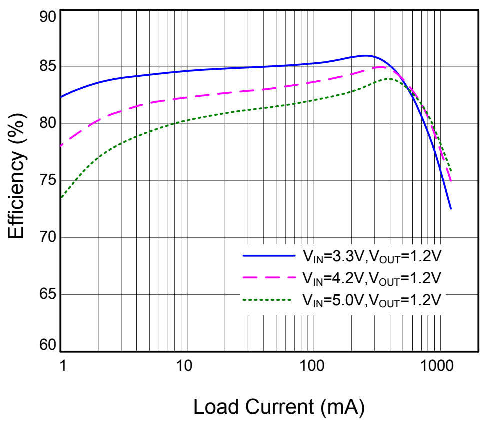
(V_{IN} = 5V, V_{OUT} = 1.8V, C_{OUT} = 10uF, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		2.5		6	V
Quiescent Current	I_Q	I_{OUT}=0, V_{FB}=V_{REF}×105%		25		µA
Shutdown Current	I_{SHDN}	EN=0		0.1	1	µA
Feedback Reference Voltage	V_{REF}		0.588	0.6	0.612	V
PFET RON	$R_{DS(ON),P}$			230		mΩ
NFET RON	$R_{DS(ON),N}$			150		mΩ
Inductance	L			1.0		uH
PFET Current Limit	I_{LIM}		1.5			A
EN rising threshold	V_{ENH}		1.2			V
EN falling threshold	V_{ENL}				0.4	V
Input UVLO threshold	V_{UVLO}				2.5	V
UVLO hysteresis	V_{HYS}			0.1		V
Oscillator Frequency	F_{OSC}			3		MHz
Min ON Time				65		ns
Max Duty Cycle			100			%
Soft Start Time	T_{SS}			1		ms
Thermal Shutdown Temperature	T_{SD}			150		°C
Thermal Shutdown Hysteresis	T_{HYS}			15		°C
Output discharge resistor	R_{DSC}			120		Ω

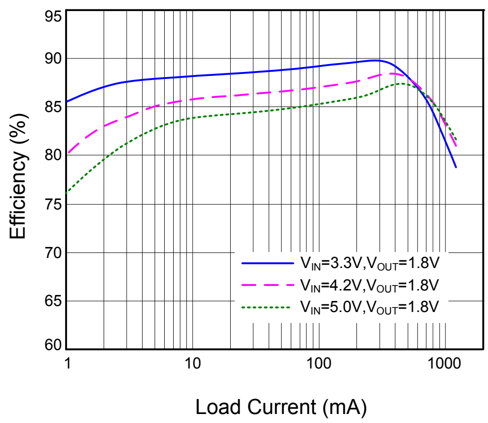
Note 1: Stresses beyond the "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Typical Performance Characteristics

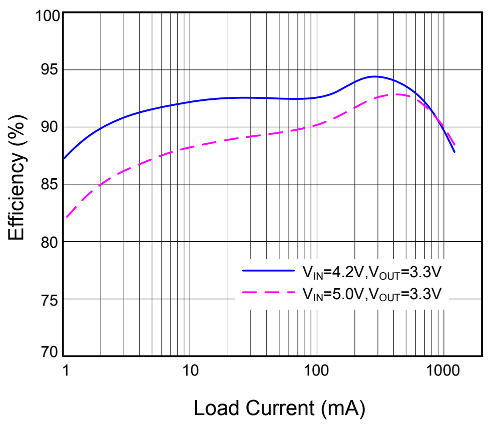
Efficiency vs. Load Current



Efficiency vs. Load Current

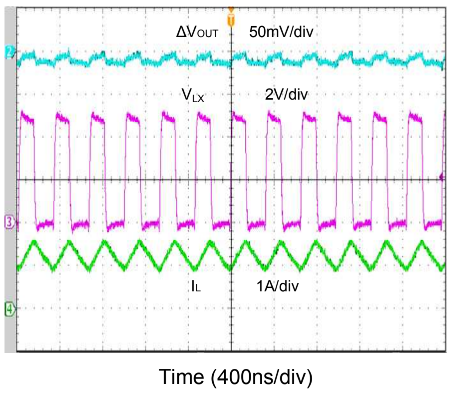


Efficiency vs. Load Current



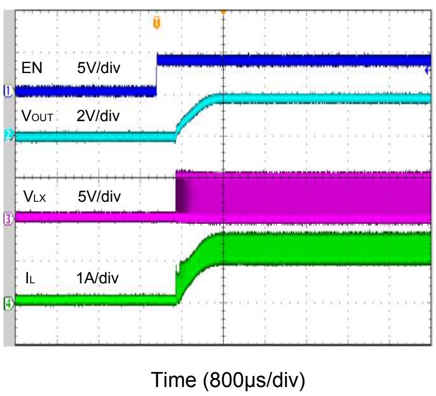
Output Ripple

(V_{IN}=5.0V,V_{OUT}=1.8V, I_{LOAD}=1.2A)



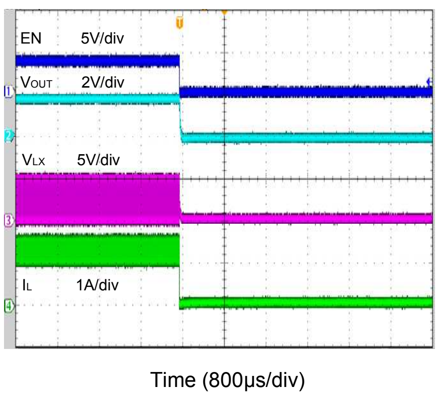
Startup From Enable

(V_{IN}=5.0V, V_{OUT}=1.8V, I_{LOAD}=1.2A)



Shutdown from Enable

(V_{IN}=5.0V, V_{OUT}=1.8V, I_{LOAD}=1.2A)



Applications Information

Because of the high integration in FC8101, the application circuit based on this regulator IC is rather simple. Only input capacitor C_{IN} and output capacitor C_{OUT} and feedback resistors (R_H and R_L) need to be selected for the targeted application specifications.

Feedback resistor dividers R_H and R_L:

Choose R_H and R_L to program the proper output voltage. To minimize the power consumption under light loads, it is desirable to choose large resistance values for both R_H and R_L. A value of between 100kΩ and 1MΩ is highly recommended for both resistors. If R_L=120kΩ is chosen, then R_H can be calculated to be:

$$R_H = \frac{(V_{OUT} - 0.6\,V) \cdot R_L}{0.6V}$$

Input capacitor C_{IN}:

A typical X7R or better grade ceramic capacitor and greater than 10uF capacitance is recommended. To minimize the potential noise problem, place this ceramic capacitor really close to the IN and GND pins. Care should be taken to minimize the loop area formed by C_{IN}, and IN/GND pins.

Output capacitor C_{OUT}:

The output capacitor is selected to handle the output ripple noise requirements. Both steady state ripple and transient requirements must be taken into consideration when selecting this capacitor. For the best performance, it is recommended to use X7R or better grade ceramic capacitor with 6V rating and greater than 10uF capacitance.

Layout Design:

For the minimum noise problems, we should place the following components close to the IC: C_{IN} and C_{OUT}.

1) It is desirable to maximize the PCB copper area connecting to GND pin to achieve the best thermal and noise performance. If the board space allowed, a ground plane is highly desirable.

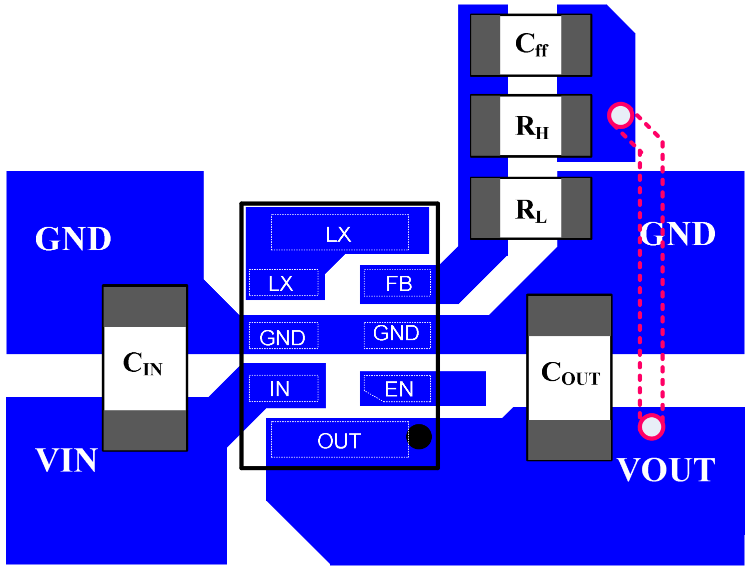
2) C_{IN} must be close to IN and GND pins. The loop area formed by C_{IN} and GND must be minimized.

3) Connect the LX pins together to reduce the inductor DCR. It is strongly recommended to reduce the LX routing area to avoid the potential noise problem.

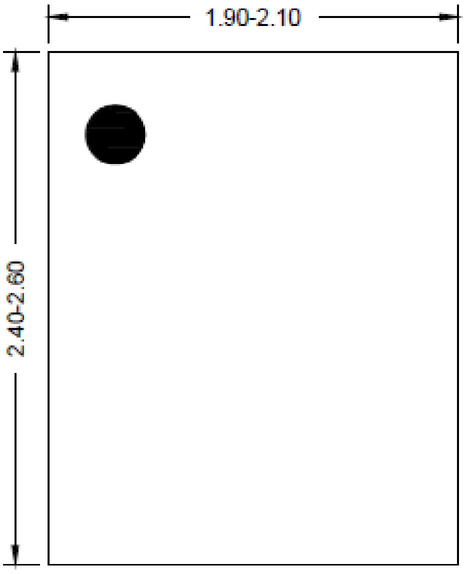
4) The trace connecting to the FB pin must NOT be adjacent to the LX node on the PCB layout to minimize the noise coupling to FB pin.

Load Transient Considerations:

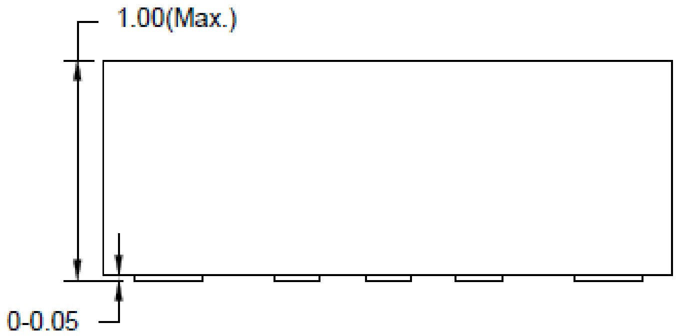
FC8101 integrates the compensation components to achieve good stability and fast transient response. In some applications, adding a 10pF ceramic cap in parallel with R_H may further speed up the load transient responses and is thus recommended for applications with large load transient step requirements.


Cff
RH
RL
GND
LX
LX
FB
GND
GND
GND
CIN
IN
EN
COUT
VIN
OUT
VOUT

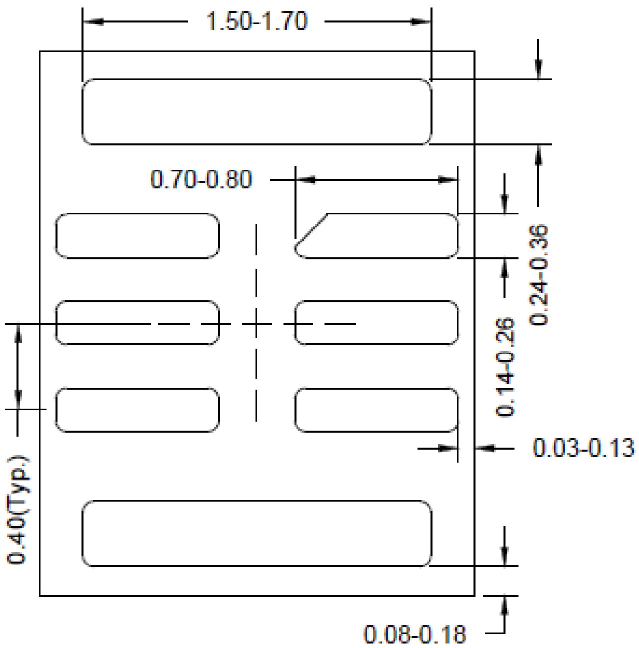
QFN2.0x2.5-8 Package Outline



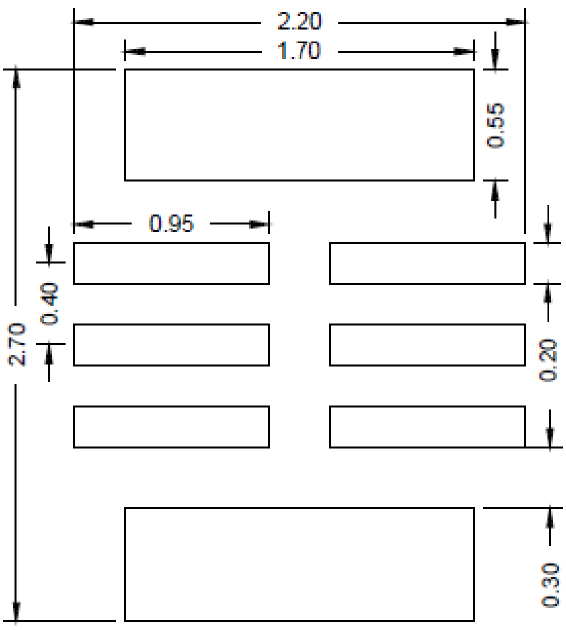
Top view



Side view



Bottom view

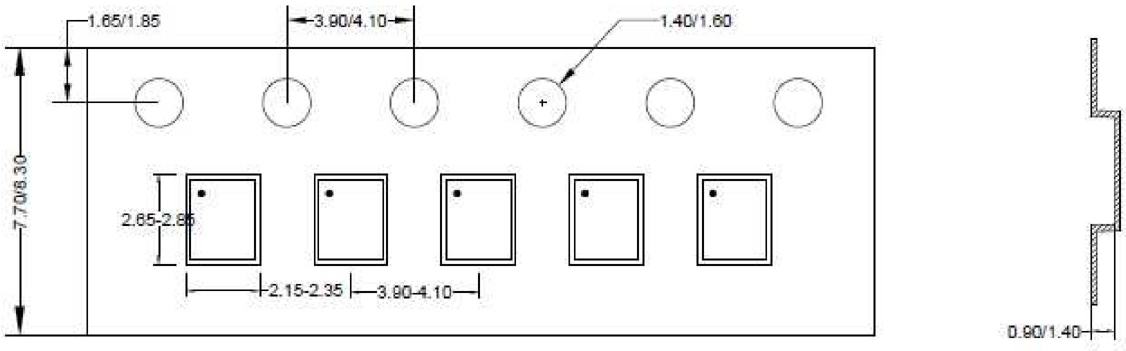


Recommended PCB layout
(Reference only)

Notes: **All dimension in millimeter and exclude mold flash & metal burr**

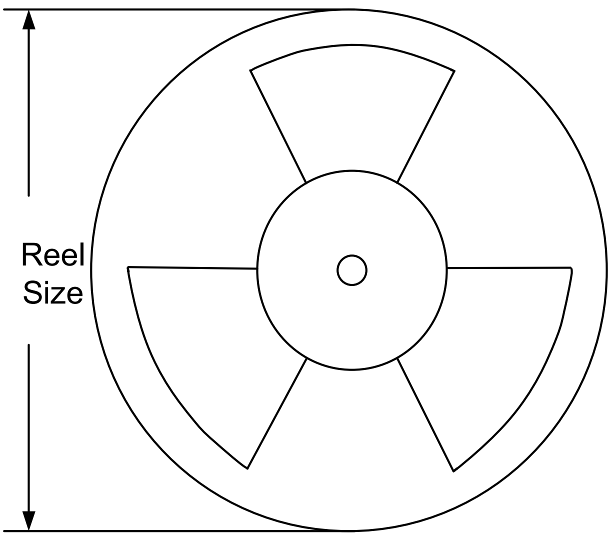
Taping & Reel Specification

1. QFN2.5x2 taping orientation



Feeding direction →

2. Carrier Tape & Reel specification for packages



Package type	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel (pcs)
QFN2.5x2	8	4	7"	400	400	3000

3. Others: NA