



1.0A Step-Up Current Mode PWM Converter

Description

The FC2159BM6G is a current mode boost DC-DC converter. Its PWM circuitry with built-in 0.18Ω power MOSFET make this regulator highly power efficient. The internal compensation network also minimizes as much as 6 external component counts. The non-inverting input of error amplifier connects to a 0.6V precision reference voltage and internal soft-start function can reduce the inrush current.

Features

- Precision Feedback Reference Voltage: 0.6V • Reference Voltage accuracy: $\pm 2\%$
- Adjustable Output up to 12V
- Internal Fixed PWM frequency: 650KHz
- Internal 0.18Ω, 2A, 16V Power MOSFET
- Shutdown Current: 0.1μA
- Over Temperature Protection: 165℃

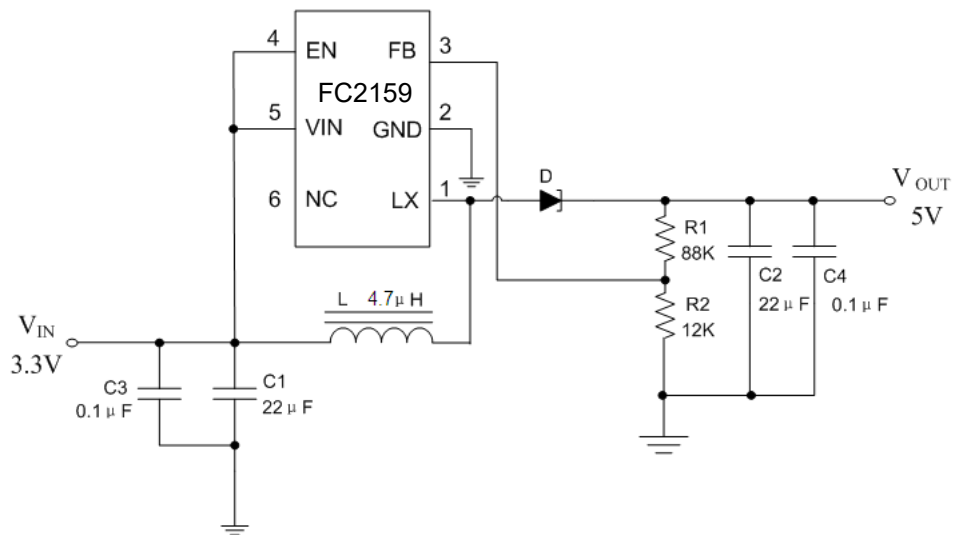
Applications

- Chargers
- LCD Displays
- Digital Cameras
- Handheld Devices
- Portable Products

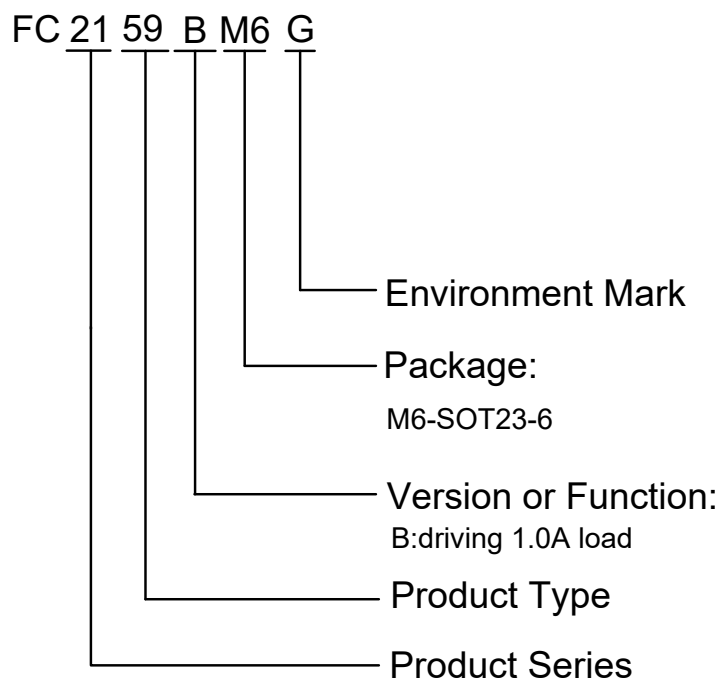
Package

- 6-pin SOT23-6

Typical Application

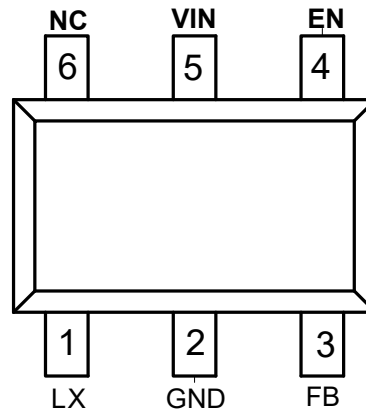


Selection Guide



| product series | product function | Output voltage | Package |
|----------------|-------------------|-----------------------|---------|
| FC 2159BM6G | Driving 1.0A Load | $V_{FB}=600\text{mv}$ | SOT23-6 |

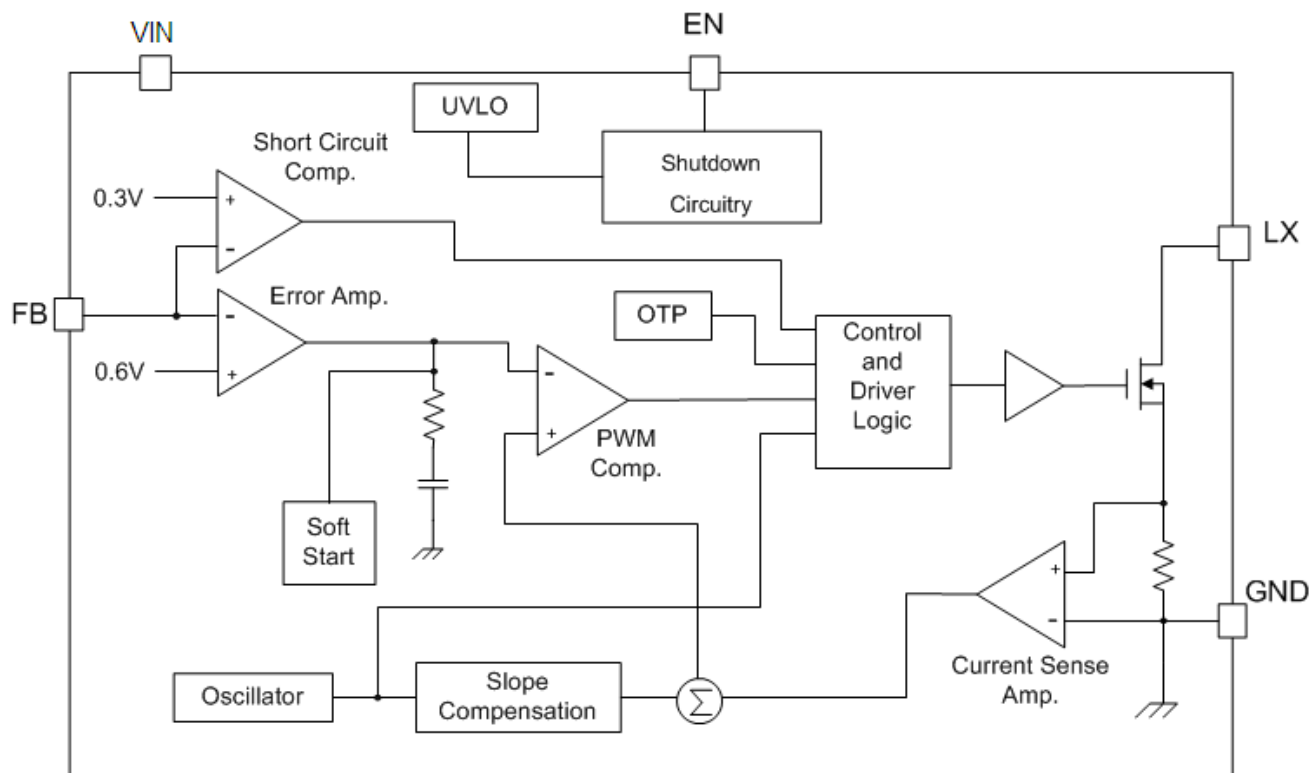
Pin Configuration



Pin information

| Pin Number | Name | Function |
|------------|------|--------------------------|
| 1 | LX | Power Switch Output |
| 2 | GND | Ground |
| 3 | FB | Feedback |
| 4 | EN | Chip Enable(Active High) |
| 5 | VIN | Power Supply |
| 6 | NC | NC |

Block Diagram





FC2159BM6G

Absolute Maximum Ratings

| Parameter | Symbol | Rating | Unit |
|--------------------------------------|------------------|--------------------------------------|------|
| Power supply voltage, V_{IN} | V_{IN} | -0.3 ~ 6.0 | V |
| voltage at EN, FB Pin | V_{EN}, V_{FB} | -0.3 ~ V_{IN} | V |
| voltage at SW Pin | V_{LX} | -0.3 ~ 12 | V |
| LX Pin Current | I_{LX} | 2200 ($V_{IN}=3.0V, V_{OUT}=5.0V$) | mA |
| Internal Power Dissipation (SOT23-6) | P_D | 300 | mW |
| Operating Ambient Temperature | T_{opr} | -40~125 | °C |
| Storage Temperature | T_{stg} | -40~+150 | °C |
| Soldering temperature and time | T_{solder} | 260°C, 10S | °C |

Electrical Characteristics

($V_{IN} = V_{EN}=3.3V$, $V_{OUT}=5V$, $C1= C2= 22\mu F$, $L=4.7\mu H$, $T_A =25\text{ }^{\circ}C$, unless otherwise noted.)

| Parameter | Symbol | Test condition | Min | Typ. | Max | Unit |
|----------------------------|------------|-------------------------------|-------|------|-------|---------|
| System Supply Input | | | | | | |
| Input voltage range | V_{IN} | | 2.5 | - | 5.5 | V |
| Under Voltage Lockout | V_{UVLO} | | | 2.15 | | V |
| UVLO Hysteresis | | | | 0.08 | | V |
| Average Supply Current | I_{SS1} | $V_{FB}=0.55V$, Switching | | 0.8 | 1.5 | mA |
| Quiescent Current | I_{SS2} | $V_{FB}=0.66V$, No Switching | | 280 | 360 | μA |
| Shutdown Supply Current | I_{SS3} | $V_{EN}=GND$ | | 0.1 | 5 | μA |
| Oscillator | | | | | | |
| Operation Frequency | F_{OSC} | $V_{FB}=1.0V$ | 0.5 | 0.65 | 0.8 | MHz |
| Maximum Duty Cycle | D_{MAX} | | | 90 | | % |
| Minimum Duty Cycle | D_{MIN} | | | 22 | | % |
| Reference Voltage | | | | | | |
| Reference Voltage | V_{FB} | | 0.588 | 0.6 | 0.612 | V |
| Line Regulation | | $V_{IN}=2.6V$ to $4.3V$ | | 0.03 | 0.1 | %/V |
| Enable Control | | | | | | |

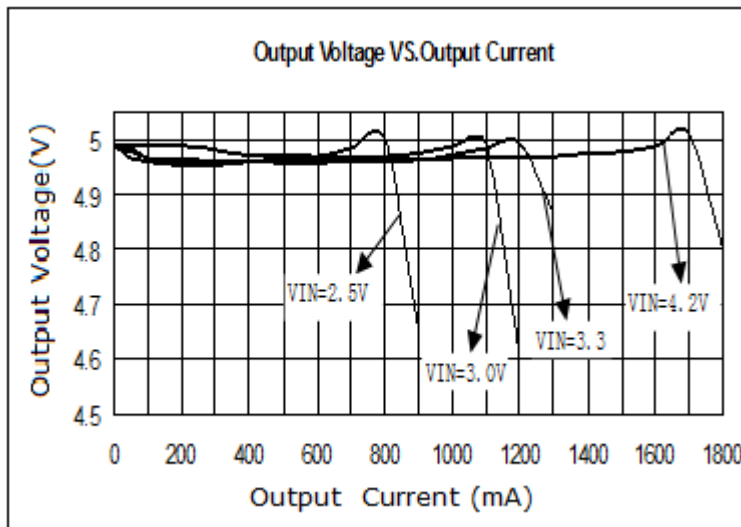


FC2159BM6G

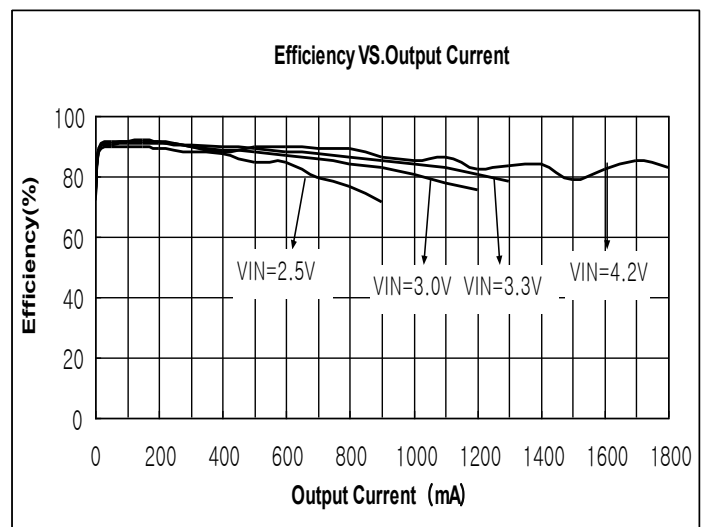
| | | | | | | |
|-----------------------------|--------------|-------------|-----|------|-----|-------------|
| Enable Voltage | V_{EN} | | 1.5 | | | V |
| Shutdown Voltage | V_{EN} | | - | | 0.6 | V |
| MOSFET | | | | | | |
| On Resistance of Driver | $R_{DS(ON)}$ | $I_{LX}=2A$ | | 0.18 | | Ω |
| Protection | | | | | | |
| OCP Current | I_{OCP} | | | 2.2 | | A |
| Over Temperature Protection | OTP | | - | 165 | - | $^{\circ}C$ |
| OTP Hysteresis | OTH | | - | 25 | - | $^{\circ}C$ |

Typical Performance Characteristics (FC2159BM6G)

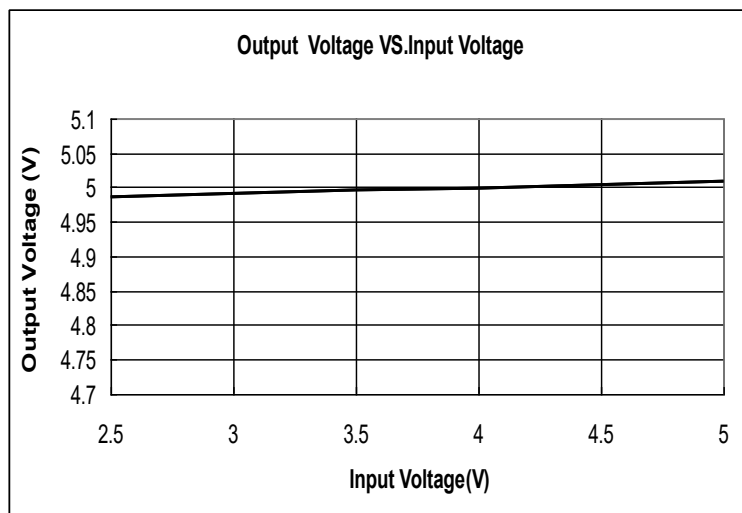
1. Output Voltage VS. Output Current ($V_{out}=5.0V$)



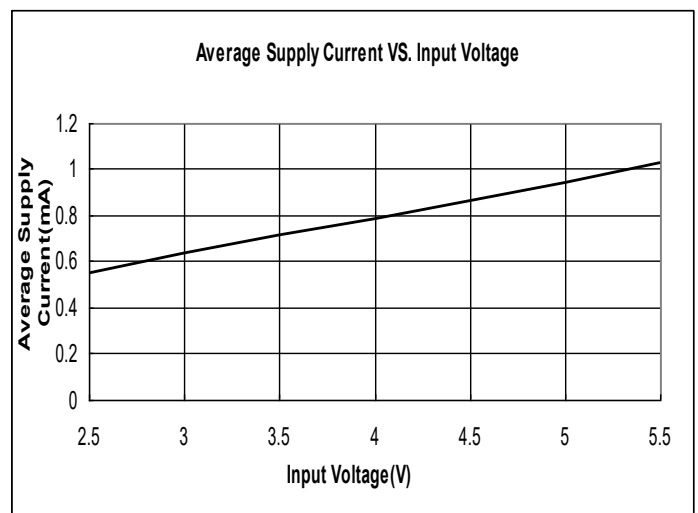
2. Efficiency VS. Output Current ($V_{out}=5.0V$)



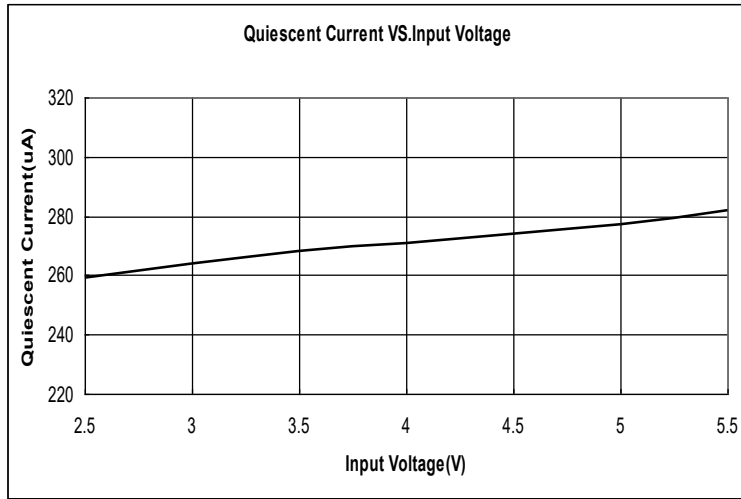
3. V_{OUT} VS. Input Voltage ($I_{OUT}=10mA$)



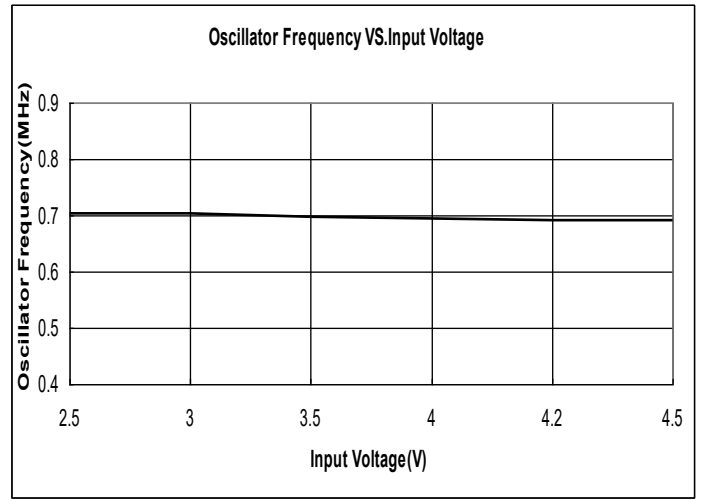
4. I_{SS1} VS. Input Voltage



5. ISS2 VS. Input Voltage



6. Oscillator Frequency VS. Input Voltage



Function Description

Operation

The FC2159B is a current mode boost converter. The constant switching frequency is 1MHz and operates with pulse width modulation (PWM). Build-in 16V / 2A MOSFET provides a high output voltage. The control loop architecture

is peak current mode control; therefore slope compensation circuit is added to the current signal to allow stable operation for duty cycles larger than 50%.

Soft Start Function

Soft start circuitry is integrated into FC2159B to avoid inrush current during power on. After the IC is enabled, the output of error amplifier is clamped by the internal soft-start function, which causes PWM pulse width increasing slowly and thus reducing input surge current.

Over Temperature Protection (OTP)

The FC2159B will turn off the power MOSFET automatically when the internal junction temperature is over 150°C. The power MOSFET wake up when the junction temperature drops 30°C under the OTP threshold temperature.

Output Disconnect

When power on and the EN pin will be pulled high. The FC2159B start up and operates. The external PMOS is turned on and current through it for output loading. While output loading is increase, output voltage is drop. When the FB pin voltage is under 0.3V, the EN pin sinks 20μA current, the external PMOS will be turn off. The output short condition will be disconnected.



Application Information

Inductor Selection

Inductance value is decided based on different condition. 3.3uH to 4.7uH inductor value is recommended for general application circuit. There are three important inductor specifications, DC resistance, saturation current and core loss. Low DC resistance has better power efficiency. Also, it avoids inductor saturation which will cause circuit system unstable and lower core loss at 1MHz.

Capacitor Selection

The output capacitor is required to maintain the DC voltage. Low ESR capacitors are preferred to reduce the output voltage ripple. Ceramic capacitor of X5R and X7R are recommended, which have low equivalent series resistance (ESR) and wider operation temperature range.

Diode Selection

Schottky diodes with fast recovery times and low forward voltages are recommended. Ensure the diode average and peak current rating exceed the average output current and peak inductor current. In addition, the diode's reverse breakdown voltage must exceed the output voltage.

Output Voltage Programming

The output voltage is set by a resistive voltage divider from the output voltage to FB. The output voltage is:

$$V_{OUT} = 0.6 \times \left(1 + \frac{R_1}{R_2} \right)$$

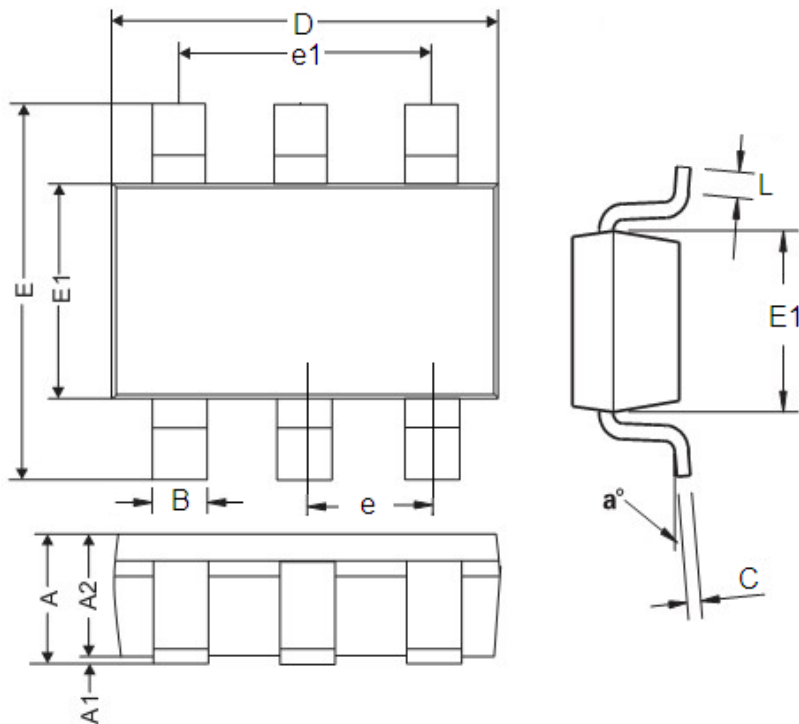
PCB Layout Check List

When laying out the printed circuit board, the following checklist should be used to ensure proper operation of the FC 2159B.

1. The power traces, consisting of the GND trace, the SW trace and the V_{IN} trace should be kept short, direct and wide.
2. LX、L and D switching node, wide and short trace to reduce EMI.
3. Place CIN near VCC pin as closely as possible to maintain input voltage steady and filter out the pulsing input current.
4. The resistive divider R1and R2 must be connected to FB pin directly as closely as possible. the internal power MOSFETs.
5. FB is a sensitive node. Please keep it away from switching node, LX.
6. The GND of the IC, CIN and COUT should be connected close together directly to a ground plane.

Package Information

● Package type:SOT23-6



| DIM | Millimeters | | Inches | |
|-----|-------------|------|-----------|--------|
| | Min | Max | Min | Max |
| A | 0.9 | 1.45 | 0.0354 | 0.0570 |
| A1 | 0 | 0.15 | 0 | 0.0059 |
| A2 | 0.9 | 1.3 | 0.0354 | 0.0511 |
| B | 0.2 | 0.5 | 0.0078 | 0.0196 |
| C | 0.09 | 0.26 | 0.0035 | 0.0102 |
| D | 2.7 | 3.10 | 0.1062 | 0.1220 |
| E | 2.2 | 3.2 | 0.0866 | 0.1181 |
| E1 | 1.30 | 1.80 | 0.0511 | 0.0708 |
| e | 0.95REF | | 0.0374REF | |
| e1 | 1.90REF | | 0.0748REF | |
| L | 0.10 | 0.60 | 0.0039 | 0.0236 |
| a° | 0° | 30° | 0° | 30° |