

4A, 28V, 1.2MHz Step-UP DC/DC Controller

General Description

FC1208 is a high efficiency, current-mode control Boost DC to DC regulator with an integrated $100\text{m}\Omega R_{\text{DS(ON)}}$ N-channel MOSFET. The fixed 1.2MHz switching frequency and internal compensation reduce external component count and save the PCB space. The build-in internal soft start circuitry minimizes the inrush current at start -up.

The FC1208 features automatic shifting to pulse frequency modulation mode at light loads. The FC1208 includes under-voltage lockout, current limiting, and thermal overload protection to prevent damage in the event of an output overload. The FC1208 is available in SOT-23-6 package.

Features

- Wide input range: 2-24V
- 1.2MHz switching frequency
- up to 97% Efficiency
- Internal Compensation
- Max output voltage: 28V
- Low $R_{\text{DS(ON)}}$: $100\text{m}\Omega$
- Internal 4A Switch Current Limit
- Automatic Pulse Frequency Modulation
- Mode at Light Loads
- RoHS Compliant and Halogen Free
- Compact package: SOT-23-6

Applications

- Cell Phone and Smart Phone
- PDA, PMP, MP3
- Digital Camera

Package Types

SOT-23-6

Figure 1. Package Types of FC1208

Pin Configurations

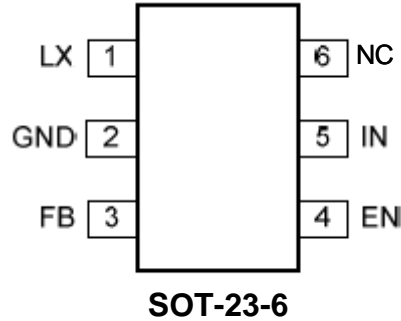
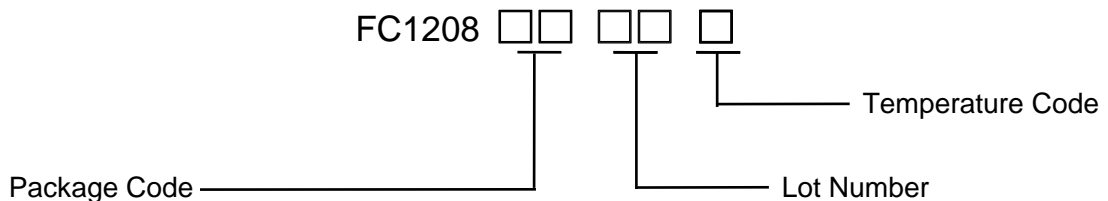


Figure 2 Pin Configuration of FC1208 (Top View)

Pin Description

Pin Number	Pin Name	Description
1	LX	Inductor node. Connect an inductor between IN pin and LX pin.
2	GDN	GND
3	FB	Fee dback pin. Connect a resistor R1 between V _{OUT} and FB, and a resistor R2 between FB and GND to program the output voltage: $V_{OUT} = 0.6 V * (R2/R1 + 1)$
4	EN	Enable control. High to turn on the part. and a low input turns it off.
5	IN	Power Input pin.
6	NC	No connection.

Ordering Information



Temperature Range: 40°C to 85°C

Ordering Number	Package Type	MOQ
FC1208 LR-N1	SOT-23-6	3000

Function Block

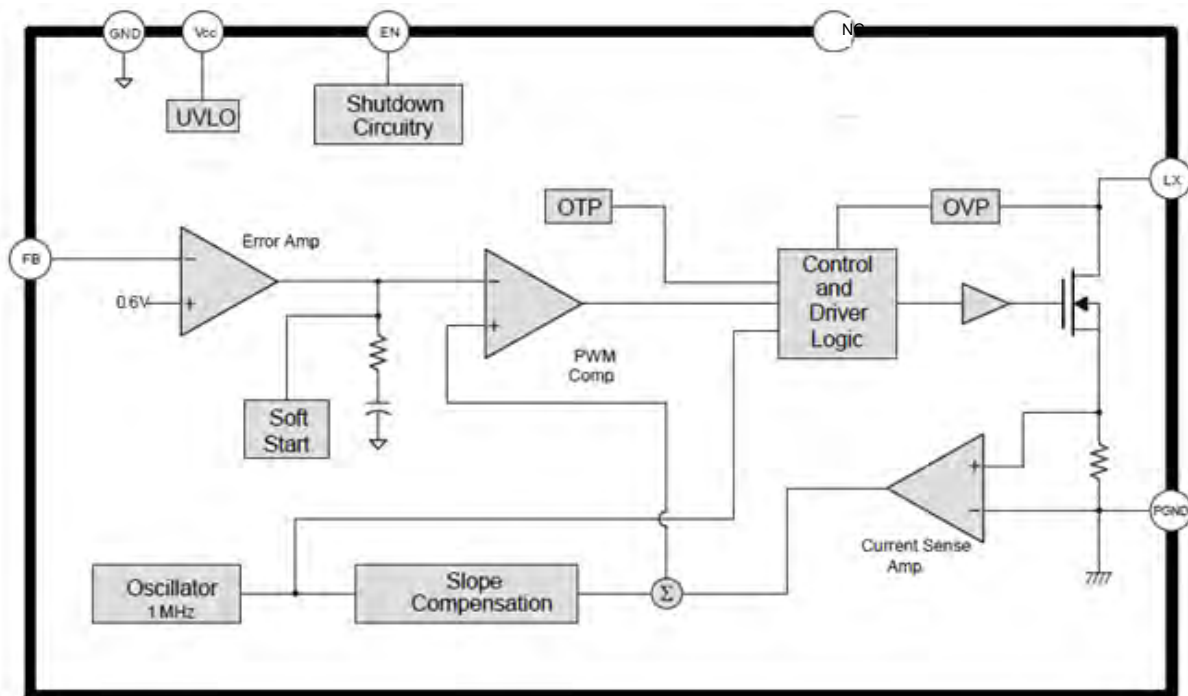


Figure 3 Function Block Diagram of FC1208

Typical Application Circuit

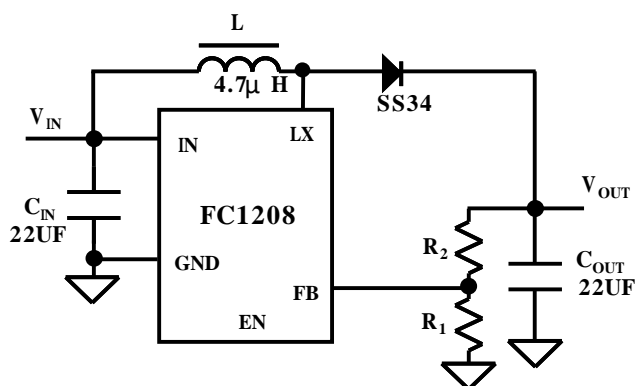


Figure 4. Schematic Diagram

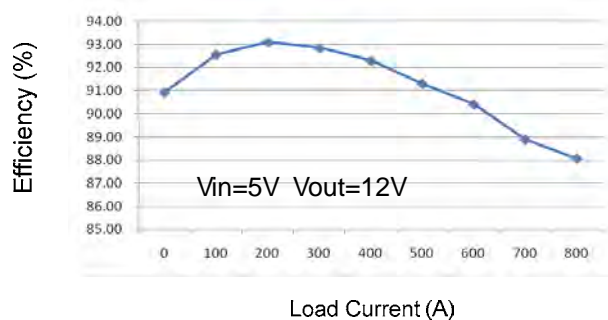
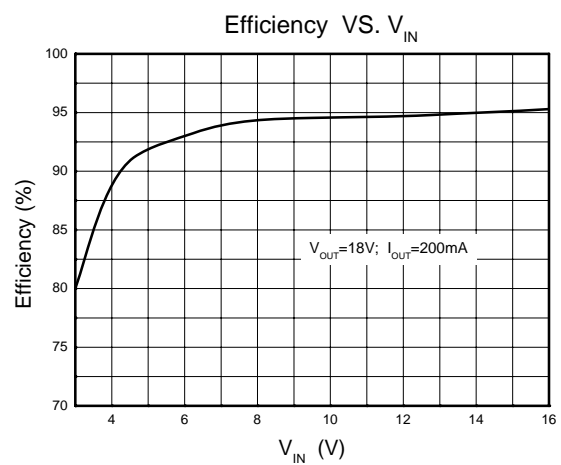
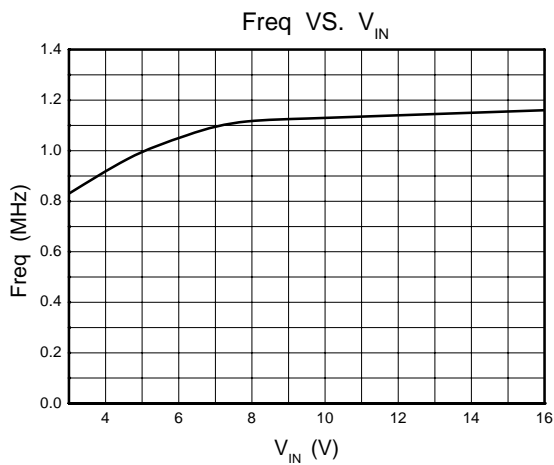
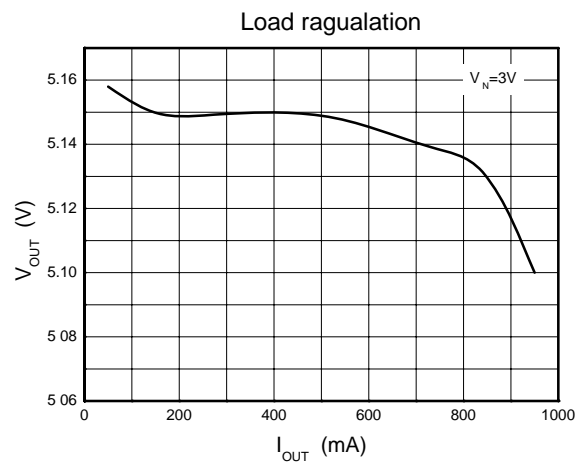
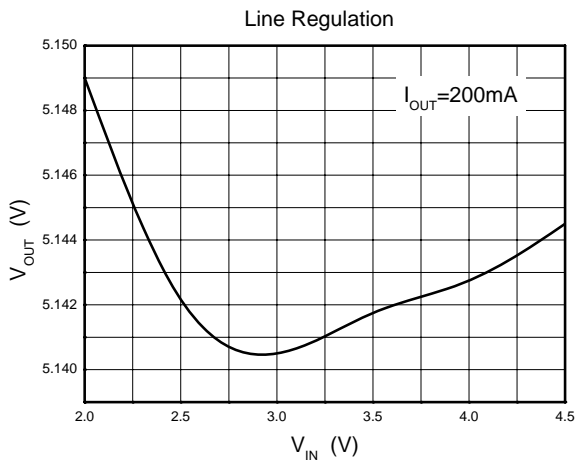
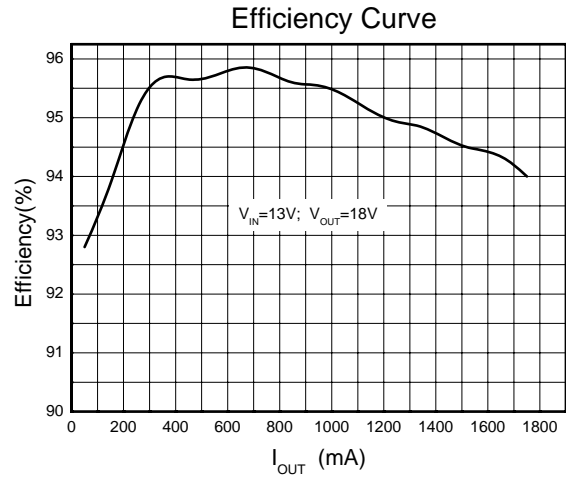
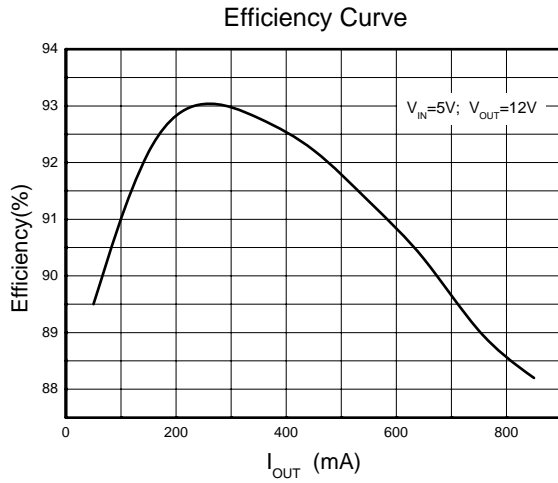


Figure 5. Efficiency vs Load Current

Typical Operating Characteristics





FC1208

Absolute Maximum Ratings

IN, EN voltages	-----0.3 to 26V
SW voltages	-----6V
FB	-----0.3 to 6V
Peak SW Sink and Source Current	-----4A
Junction Temperature Range	-----160°C
Lead Temperature (Soldering, 10 sec.)	-----300°C
Storage Temperature Range	-----65°C to 150°C
Ambient Temperature Range	-----40°C to 85°C

Electrical Characteristics

($V_{IN} = 5V$, $V_{OUT} = 12V$, $I_{OUT} = 100mA$, $T_A = 25^\circ C$ unless otherwise specified)

Parameters	Test Condition	Min.	Typ.	Max.	Unit
Input Voltage Range		2		24	V
Quiescent Current (PFM)	$V_{FB} = 0.7V$ (No switch)		100	200	μA
Quiescent Current (PWM)	$V_{FB} = 0.5V$ (Switch)		0.1	1	mA
Switching Frequency			1.2		MHz
Maximum Duty Cycle	$V_{FB} = 0V$	90			%
Feedback Reference		0.588	0.6	0.612	V
Current shutdown	$V_{EN} = 0V$		0.1	1	μA
Thermal Shutdown			155		$^\circ C$
Under Voltage Lockout		1.98			V
Under Voltage Lockout Hysteresis			100		mV
EN Input High Voltage		1.5			V
EN Input Low Voltage			0.4		V
SW On Resistance (1)			80	150	$m\Omega$
SW Current Limit (1)	$V_{IN} = 5V$ Duty cycle=50%		4		A
SW Leakage	$V_{SW} = 20V$			1	μA

Note:

1) Guaranteed by design, not tested.



Operation

The FC1208 uses a fixed frequency, peak current mode boost regulator architecture to regulate voltage at the feedback pin. The operation of the FC1208 can be understood by referring to the block diagram of Figure 3. At the start of each oscillator cycle the MOSFET is turned on through the control circuitry. To prevent sub-harmonic oscillations at duty cycles greater than 50 percent, a stabilizing ramp is added to the output of the current sense amplifier and the result is fed into the negative input of the PWM comparator. When this voltage equals the output voltage of the error amplifier the power MOSFET is turned off. The voltage at the output of the error amplifier is an amplified version of the difference between the 0.6V bandgap reference voltage and the feedback voltage. In this way the peak current level keeps the output in regulation. If the feedback voltage starts to drop, the output of the error amplifier increases. These results in more current to flow through the power MOSFET, thus increasing the power delivered to the output. The FC1208 has internal soft start to limit the amount of input current at startup and to also limit the amount of overshoot on the output.

Application Information

• Setting the Output Voltage

The internal reference VREF is 0.6V (Typical). The output voltage is divided by a resistor divider, R1 and R2 to the FB pin. The output voltage is given by:

$$V_{out} = 0.6V * (1 + R2/R1)$$

• Inductor Selection

The recommended values of inductor are 4.7 to 22μH. Small size and better efficiency are the major concerns for portable device, such as FC1208 used for mobile phone. The inductor should have low core loss at 1.2MHz and low DCR for better FC1208 efficiency. To avoid inductor saturation current rating should be considered.

• Capacitor Selection

Input and output ceramic capacitors of 22μF are recommended for FC1208 applications. For better voltage filtering, ceramic capacitors with low ESR are recommended. X5R and X7R types are suitable because of their wider voltage and temperature ranges.

• Diode Selection

Schottky diode is a good choice for FC1208 because of its low forward voltage drop and fast reverse recovery. Using Schottky diode can get better efficiency. The high speed rectification is also a good characteristic of Schottky diode for high switching frequency. Current rating of the diode must meet the root mean square of the peak current and output average current multiplication as following :

$$I_D (RMS) \approx \sqrt{I_{OUT} \times I_{PEAK}}$$

The diode's reverse breakdown voltage should be larger than the output voltage.

• Layout Consideration

For best performance of the FC1208, the following guidelines must be strictly followed.

Input and Output capacitors should be placed close to the IC and connected to ground plane to reduce noise coupling.

The GND should be connected to a strong ground plane for heat sinking and noise protection.

Keep the main current traces as possible as short and wide.

SW node of DC-DC converter is with high frequency voltage swing. It should be kept at a small area.

Place the feedback components as close as possible to the IC and keep away from the noisy devices.

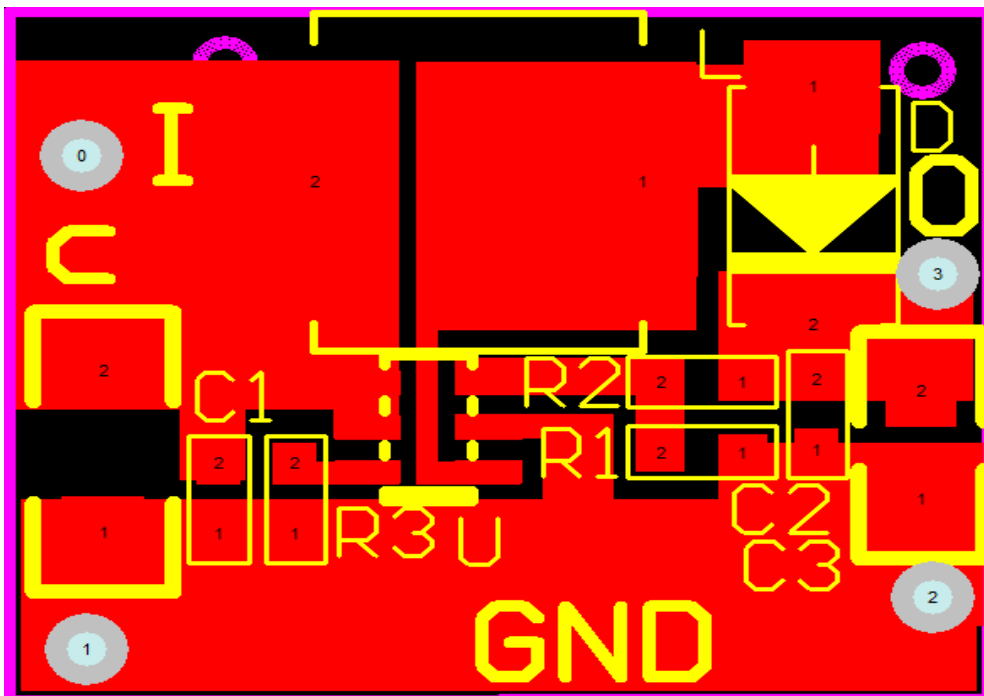


Figure 6. Suggested Layout

Package Information

SOT-23-6 Package Outline Dimensions

