Non-Synchronous PWM Boost Converter

General Description

The FP6280 is a boost topology switching regulator for wide operating voltage applications. Its built-in 20 mΩ power MOSFET makes this regulator highly power efficient. The internal compensation network minimizes external component counts, and the non-inverting input of error amplifier connects to a 0.6V precision reference voltage. The FP6280 has internal soft start and programmable over current protection set by external resistor.

The FP6280 is available in the small footprint SOP-8L(EP) package to fit in space-saving PCB layout for miscellaneous application fields.

Features

➢ Wide Supply Voltage Operating Range: 2.4 to 5.5V
➢ Precision Feedback Reference Voltage: 0.6V (±2%)
➢ Shutdown Current: <1µA
➢ Internal Fixed PWM frequency: 550KHz
➢ Internal Soft Start Function :7ms (SS)
➢ Over Current Protection Function (OCP)
➢ Over Voltage Protection
➢ Package: SOP-8L(EP)
➢ Duty Cycle: PWM/PFM Switching Control Circuit (15%~90%)
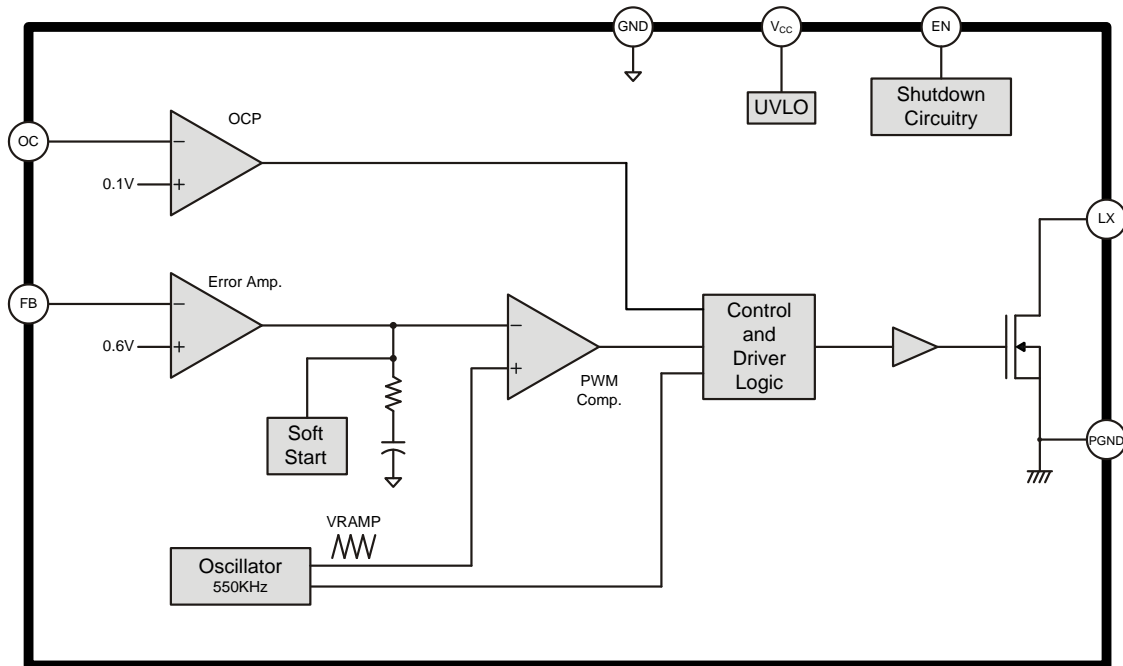
Applications

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

Typical Application Circuit
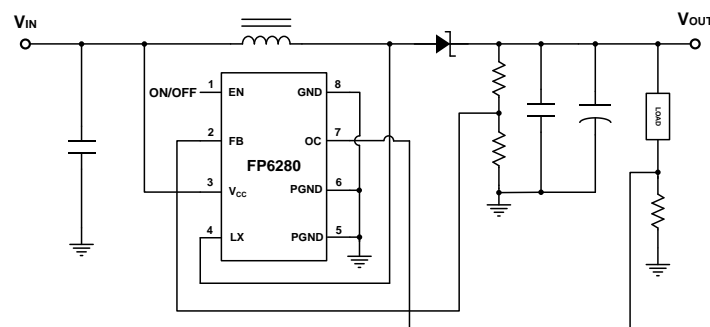
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Function Block Diagram

Pin Descriptions

SOP-8L(EP)

Top View
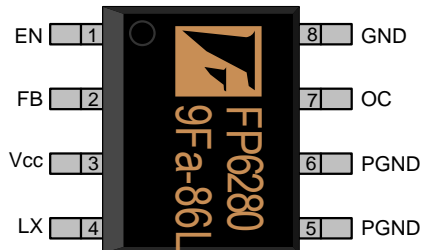
Bottom View
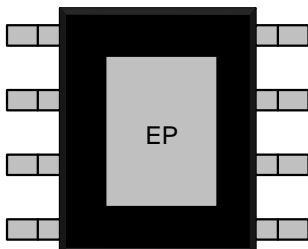
Name	No.	I / O	Description
EN	1	I	Enable Control (Active High)
FB	2	I	Error Amplifier Inverting Input
Vcc	3	P	IC Power Supply
LX	4	O	Power Switch Output
PGND	5	P	IC Ground
PGND	6	P	IC Ground
OC	7	I	Adjustable Output Current Protection
GND	8	P	IC Ground
EP	9	P	Exposed PAD. Must connect to LX

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Marking Information

SOP-8L(EP)
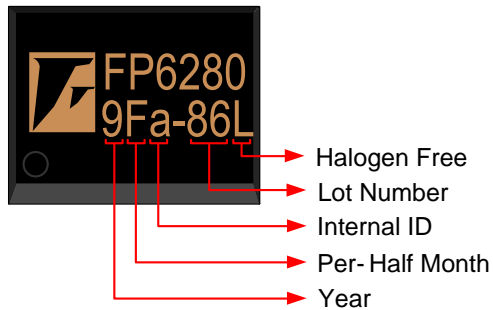
Halogen Free: Halogen free product indicator.

Lot Number: Wafer lot number's last two digits.

> For Example: 132386TB → 86

Internal ID: Internal Identification Code.

Per-Half Month: Production period indicated in half month time unit.

> For Example: January→A(Front Half Month),B(Last Half Month)
>
> February→C(Front Half Month),D(Last Half Month)

Year: Production year's last digit

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Ordering Information

Part Number	Operating Temperature	Package	MOQ	Description
FP6280XR-G1	-25°C ~ 85°C	SOP-8L(EP)	2500EA	Tape & Reel

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}		0		5.5	V
LX Voltage	V_{LX}		0		20	V
EN,FB Voltage			0		6	V
Thermal Resistance (Note1)	θ_{JA}	SOP-8L(EP)			+83	°C / W
Junction Temperature	T_J				+150	°C
Operating Temperature	T_{OP}		-25		+85	°C
Storage Temperature	T_{ST}		-65		+150	°C
Lead Temperature		(soldering, 10 sec)			+260	°C

Note1:

θ_{JA} is measured in the natural convection at T_A=25°C on a low effective thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

IR Re-flow Soldering Curve
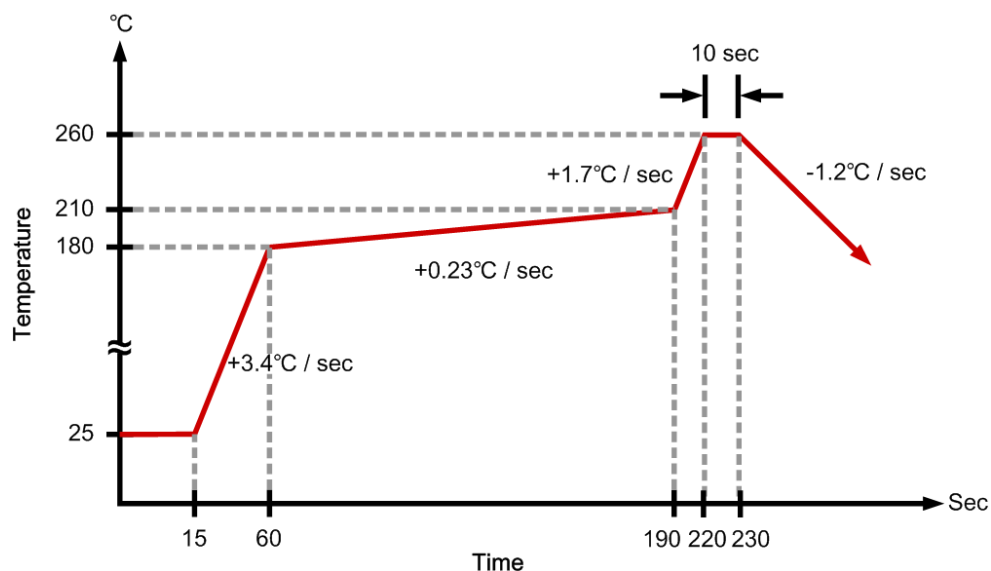
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Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}		2.4		5.5	V
Operating Temperature Range	T_A	Ambient Temperature	-25		+85	°C

DC Electrical Characteristics (V_{CC}=3.3V, T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
System Supply Input						
Input Supply Range	V_{CC}		2.4		5.5	V
Under Voltage Lockout	V_{UVLO}			2.1		V
UVLO Hysteresis				0.1		V
Quiescent Current	I_{CC}	FB=1.0V, No switch		70		µA
Shutdown Current	I_{CC}	V_{EN}=GND		0.1		µA
Oscillator						
Operation Frequency	f_{OSC}	V_{FB}=0.6V		550		kHz
PFM Switching Duty Ratio	%			15		%
Maximum Duty Ratio	%			90		%
Soft-Start Time	t_{SS}	V_{CC}=5V		7		ms
Reference Voltage						
Feedback Voltage	V_{REF}	V_{CC}=5V	0.588	0.6	0.612	V
Enable Control						
Enable Voltage	V_{EN}		0.96			V
Shutdown Voltage	V_{EN}				0.6	V
MOSFET						
On Resistance of Driver	$R_{DS (ON)}$	I_{LX}=2A		20		mΩ

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Function Description

Operation

The FP6280 is a voltage mode boost controller. The switching frequency is 550kHz and operates with pulse width modulation (PWM). Build-in 20V/4.5A MOSFET provides a high output voltage. An internal resistive divider provides 0.6V reference for the error amplifier. The FP6280 changes to PFM mode when output is light load. It can increase efficiency, but PFM mode also increases output voltage ripple.

Soft Start Function

Soft start circuitry is integrated into FP6280 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 Current Protection

The FP6280 provides an output current limit protection function. The circuit is shown in Figure 1. The output current limiting will be activated when the OC pin voltage is higher than 0.1V. The OCP will make PWM duty reduced and output voltage drops at the same time.

To set the over current trip point, follow below equation:
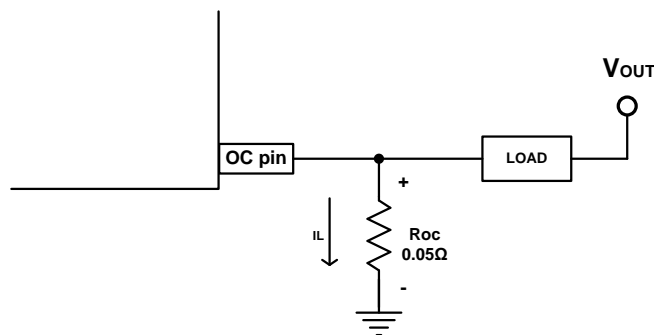
$$I_{OCP} = \frac{0.1}{Roc}$$

Figure1. OC pin circuit

Shutdown Function

Drive Enable pin to ground to shut down the FP6280. Shutdown mode forces to turn off all internal circuitry, and reduces the VIN supply current to 0.1µA (typ). The Enable pin rising threshold is 0.96V (typ). Before any operation begins, the voltage at Enable pin must exceed 0.96V (typ).

Application Information

Inductor Selection

Inductance value is decided based on different condition. 3.3uH to 4.7µH inductance 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.

Capacitor Selection

The output capacitor is required to maintain the DC voltage during switching. 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:

$$V_{OUT} = 0.6V\left(1 + \frac{R1}{R2}\right)$$

Layout Considerations

1. The power traces, consisting of the GND trace, the LX trace and the V_{CC} trace should be kept short, direct and wide.
2. Layout switching node LX, inductor and diode connection traces wide and short to reduce EMI.
3. Place C_{IN} nearby V_{CC} 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 and as closely as possible.
5. FB is a sensitive node. Please keep it away from switching node, LX.
6. The GND of the IC, C_{IN} and C_{OUT} should be connected close together and directly to a ground plane.

Suggested Layout

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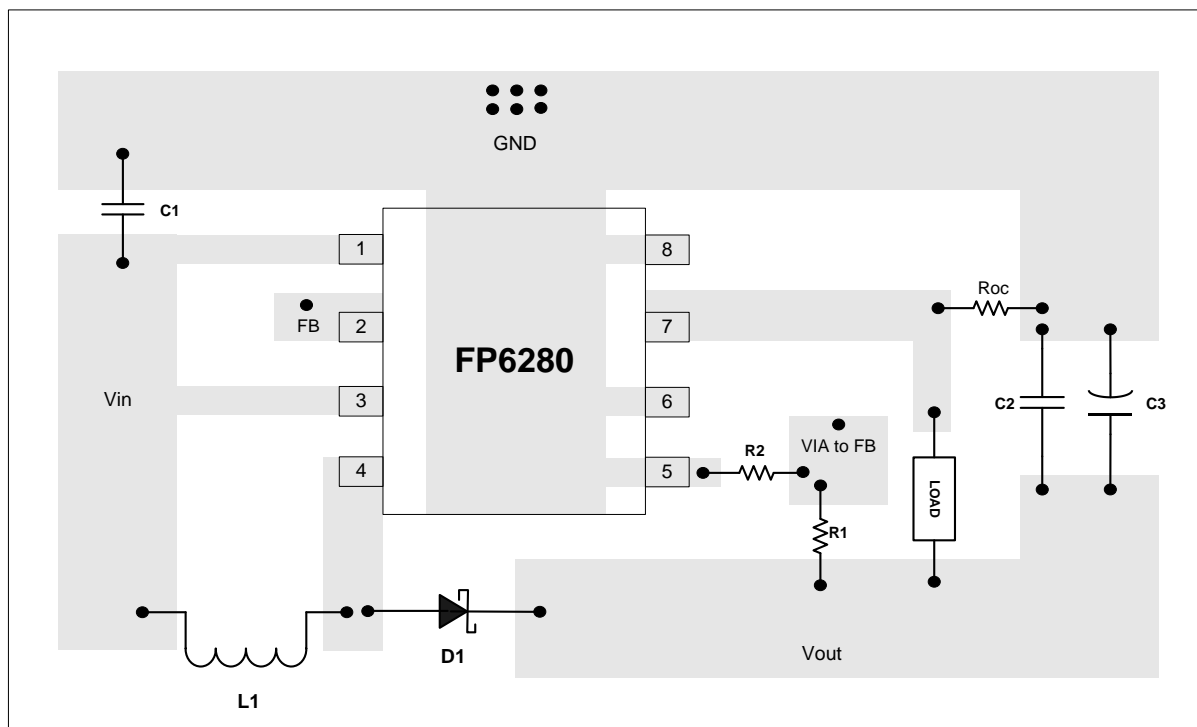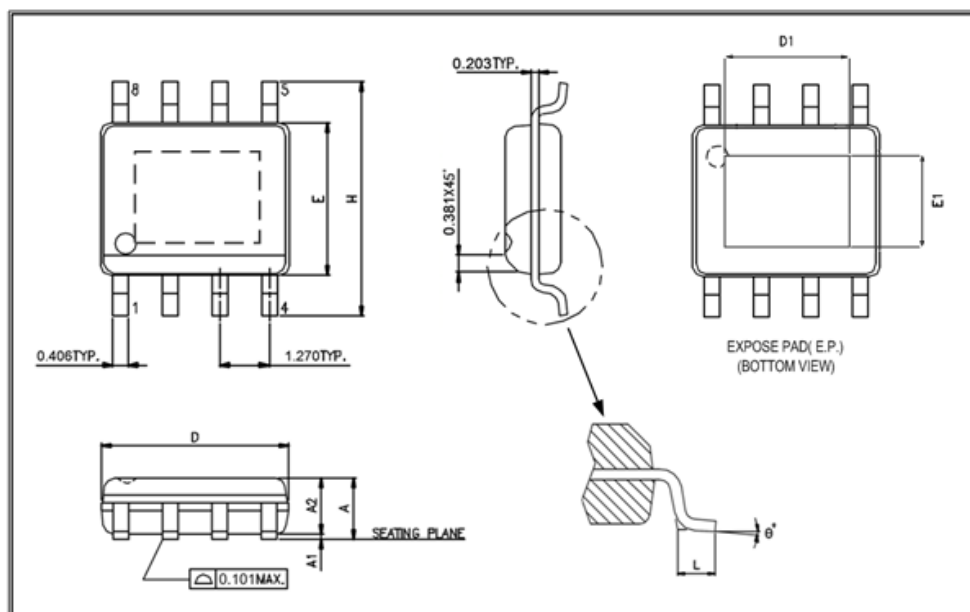
Application Information
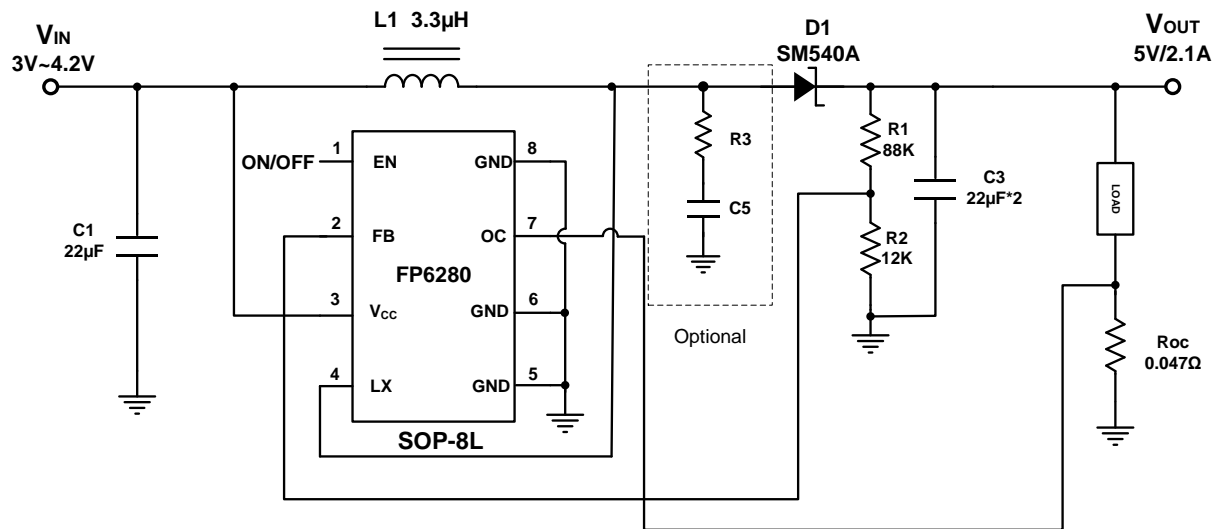
Note:
1.   C1 and C3 choose ceramic capacitor of X5R or X7R.
2.   R3 and C5 are added for reducing EMI (Electromagnetic Interference).

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Package Outline

SOP-8L(EP)

Symbols	Min. (mm)	Max. (mm)
A	1.346	1.752
A1	0.050	0.152
A2		1.498
D	4.800	4.978
E	3.810	3.987
H	5.791	6.197
L	0.406	1.270
θ°	0°	8°

UNIT: mm

Exposed PAD Dimensions:

Symbols	Min. (mm)	Max. (mm)
E1	2.184 REF	
D1	2.971 REF	

Note:

1. Package dimensions are in compliance with JEDEC outline: MS-012 AA.

2. Dimension "D" does not include molding flash, protrusions or gate burrs.

3. Dimension "E" does not include inter-lead flash or protrusions.