

500kHz 7A High Efficiency Synchronous PWM Boost Converter


General Description

The FP6277 is a current mode boost DC-DC converter with PWM/PSM control. Its PWM circuitry with built-in 30mΩ high side switch and 30mΩ low side switch make this regulator highly power efficient. The internal compensation network also minimizes external component counts to only 6. An internal 0.6V voltage is connected to error amplifier the non-inverting input as precision reference voltage. Built-in soft-start function can reduce the inrush current.

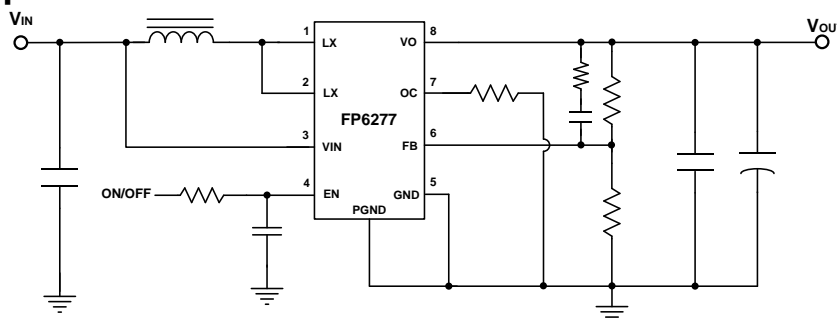
Features

- Current mode with PWM/PSM control
- Input voltage range: 2.4V~4.5V
- Adjustable Output up to 5.3V
- Shutdown current: <1uA
- Oscillator frequency: 500KHz
- Reference voltage: 0.6V +/-2%
- Disconnect load during shutdown
- Cycle-by-cycle current limit
- Low R_{DS(on)}: 30mΩ for both high and low side
- Protection: OTP, OCP, SCP
- Internal compensation
- Internal soft-start: 7ms
- Package: SOP-8L(EP)

Applications

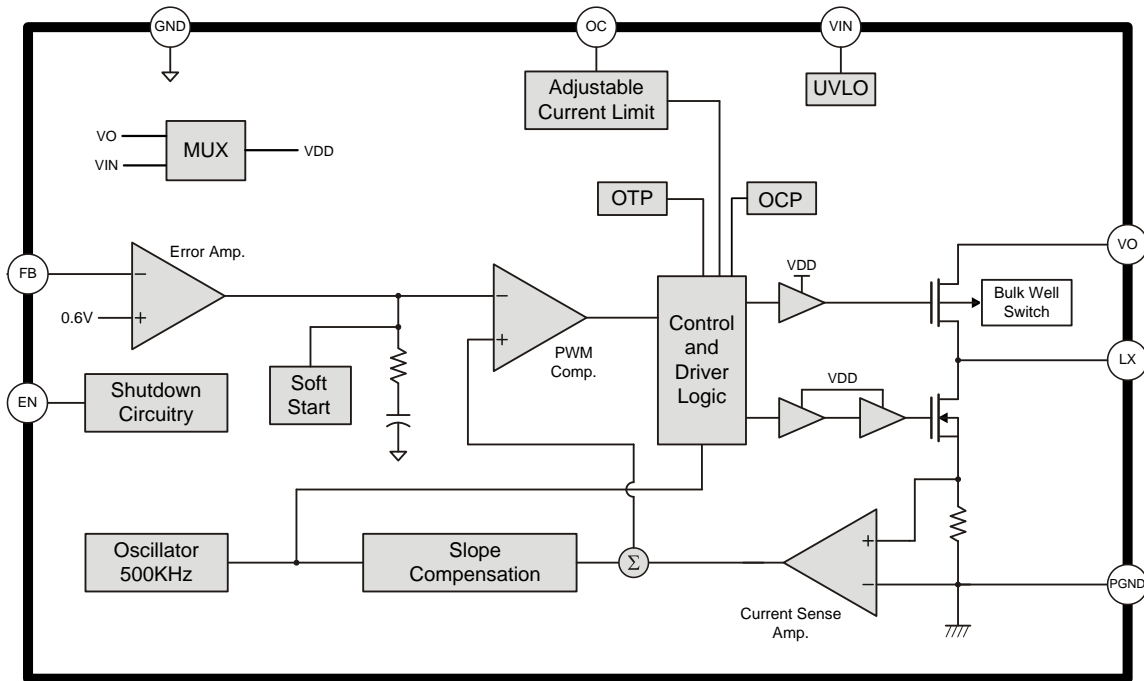
- Chargers
- Handheld Devices
- Portable Products
- Power Bank

Typical Application Circuit



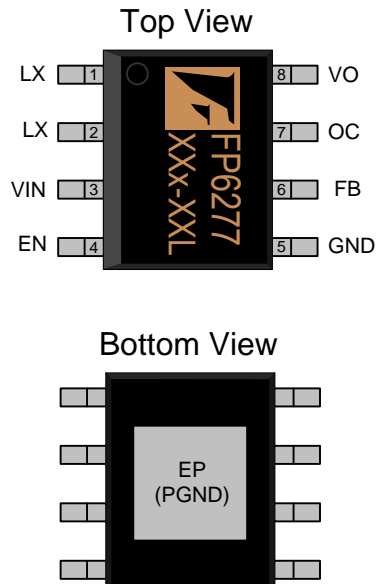
This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.

Function Block Diagram



Pin Descriptions

SOP-8L (EP)

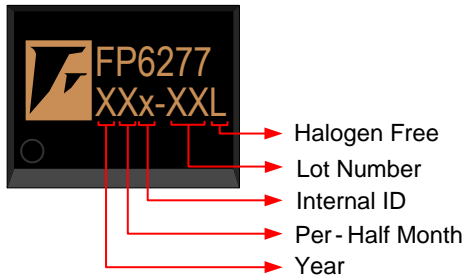


| Name | No. | I / O | Description |
|------|-----|-------|---|
| LX | 1 | I | Power Switch Output |
| LX | 2 | I | Power Switch Output |
| VIN | 3 | P | IC Power Supply |
| EN | 4 | I | Enable Control (Active High) |
| GND | 5 | P | IC Ground |
| FB | 6 | I | Error Amplifier Inverting Input |
| OC | 7 | I | Adjustable Current Limit (The resistor must be connected to ground.) |
| VO | 8 | O | Output Voltage Pin |
| PGND | EP | P | IC Power Ground (Must connect to GND) |

This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.

Marking Information

SOP-8L(EP)



Halogen Free: Halogen free product indicator

Lot Number: Wafer lot number's last two digits

For Example → Lot : 123456 → XXx-56L

Internal ID: Internal Identification Code

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

For Example : A → First Half Month of January
B → Second Half Month of January
C → First Half Month of February
D → Second Half Month of February

Year: Production year's last digit

Ordering Information

| Part Number | Operating Temperature | Package | MOQ | Description |
|-------------|-----------------------|------------|--------|-------------|
| FP6277XR-G1 | -40°C ~ 85°C | SOP-8L(EP) | 2500EA | Tape & Reel |

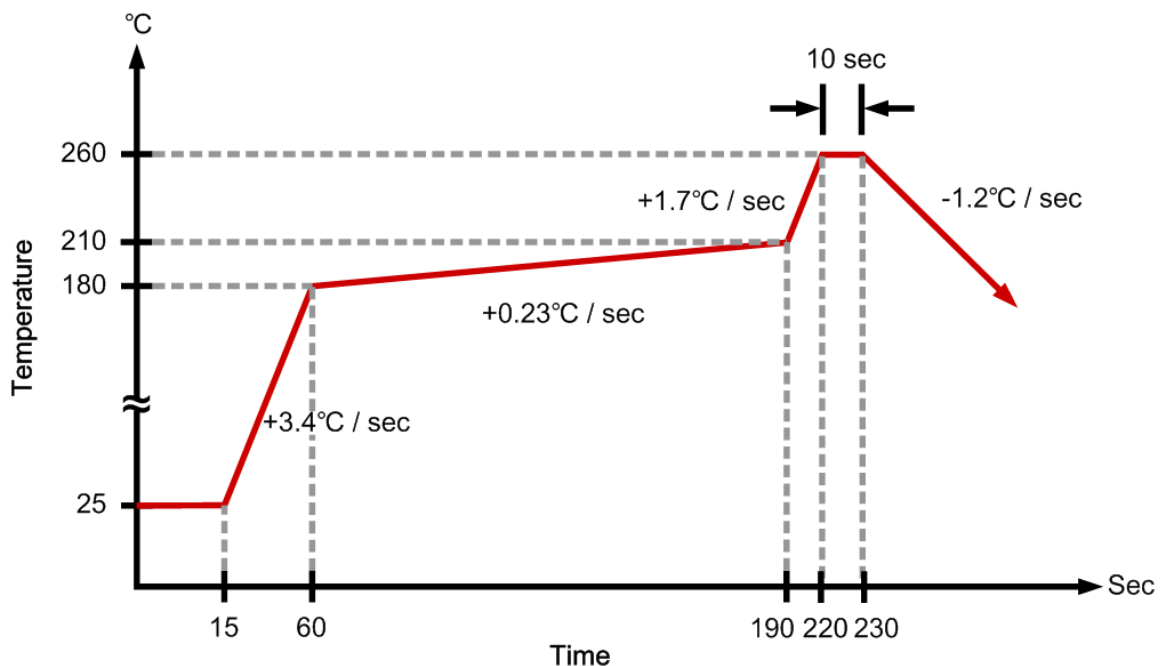
Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|----------------------------|---------------|---------------------|------|------|------|--------|
| Supply Voltage | V_{IN} | | 0 | | 6 | V |
| LX Voltage | V_{LX} | | 0 | | 7 | V |
| EN,FB,OC,VO Voltage | | | 0 | | 6 | V |
| Thermal Resistance (Note1) | θ_{JA} | SOP-8L(EP) | | | +60 | °C / W |
| Junction Temperature | T_J | | | | +150 | °C |
| Operating Temperature | T_{OP} | | -40 | | +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 $T_A=25^\circ\text{C}$ on a low effective thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

IR Re-flow Soldering Curve



This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.

Recommended Operating Conditions

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|-----------------------------|----------|---------------------|------|------|------|------|
| Supply Voltage | V_{IN} | | 2.4 | | 4.5 | V |
| Operating Temperature Range | T_A | Ambient Temperature | -40 | | +85 | °C |

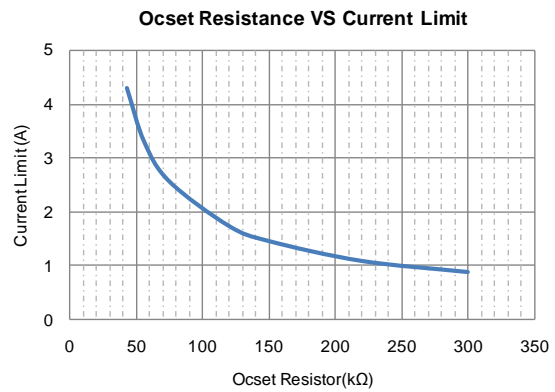
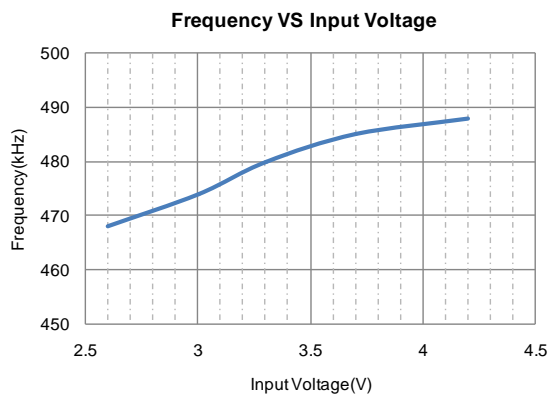
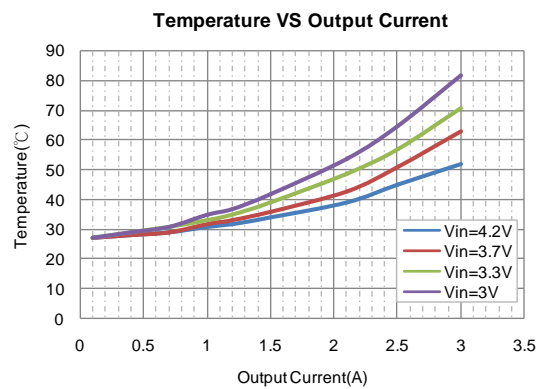
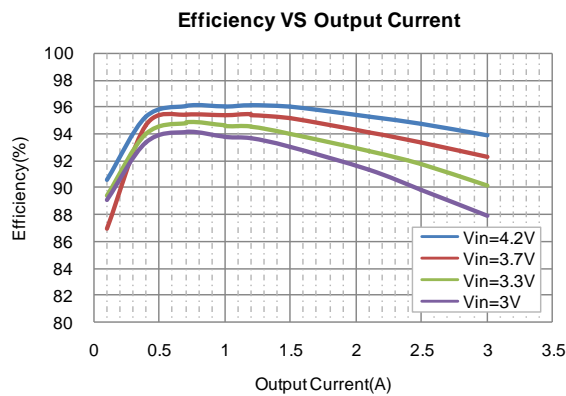
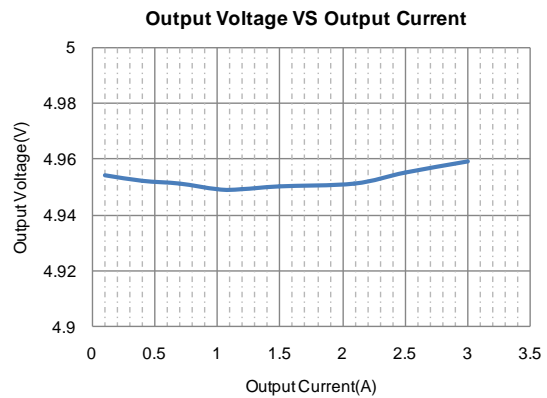
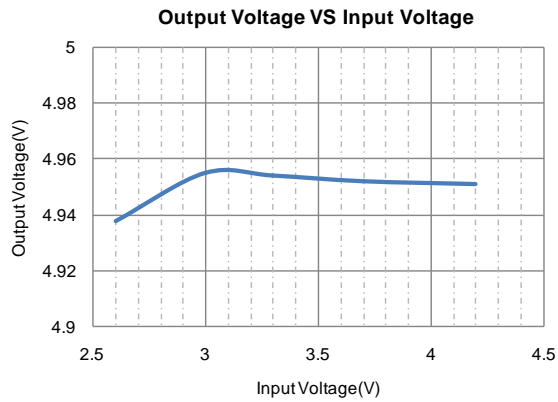
DC Electrical Characteristics ($V_{IN}=3.3V$, $T_A=25^{\circ}C$, unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------|---------------|-------------------------------|-------|------|-------|------------|
| Input Voltage | V_{IN} | | 2.4 | | 4.5 | V |
| Under Voltage Lockout | V_{UVLO} | | | 2.1 | | V |
| UVLO Hysteresis | | | | 0.1 | | V |
| Quiescent Current | I_{CC} | $V_{FB}=0.65V$, No switching | | 280 | | μA |
| Average Supply Current | I_{CC} | $V_{FB}=0.55V$, Switching | | 3.6 | | mA |
| Shutdown Current | I_{CC} | $V_{EN}=GND$ | | 0.1 | | μA |
| Linear Charge Current | I_{CHARGE} | $V_{OUT}<V_{IN}$ | 4.5 | | | A |
| Operation Frequency | f_{OSC} | $V_{FB}=0.55V$ | | 500 | | kHz |
| Maximum Duty Ratio | % | | | 90 | | % |
| Feedback Voltage | V_{REF} | $V_{IN}=4.5V$ | 0.588 | 0.6 | 0.612 | V |
| Enable Voltage | V_{EN} | | 0.96 | | | V |
| Shutdown Voltage | V_{EN} | | | | 0.6 | V |
| Soft-Start Time | t_{SS} | $V_{IN}=4.5V$ | | 7 | | ms |
| High Side Switch $R_{DS(ON)}$ | $R_{ON-PMOS}$ | | | 30 | | m Ω |
| Low Side Switch $R_{DS(ON)}$ | $R_{ON-NMOS}$ | | | 30 | | m Ω |
| Internal Switch Current Limit | I_{OCP} | | | 7 | | A |
| Thermal Shutdown Threshold | T_{OTP} | | | 150 | | °C |
| Thermal Shutdown Hysteresis | | | | 30 | | °C |

This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.

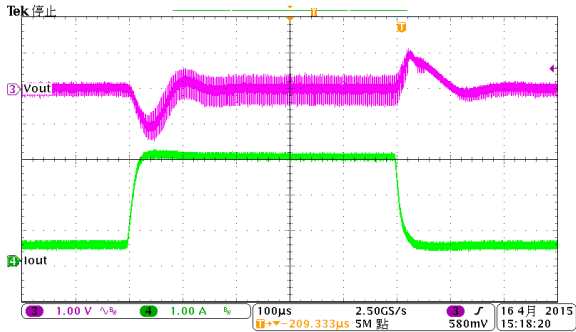
Typical Operating Characteristics

($V_{CC}=3V, V_{out}=5V, I_{out}=2.5A, T_A=25^{\circ}C$, unless otherwise specified)

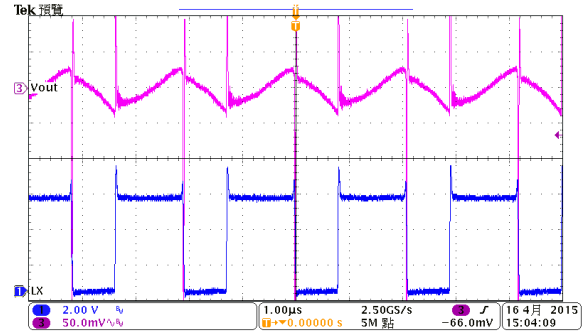


This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.

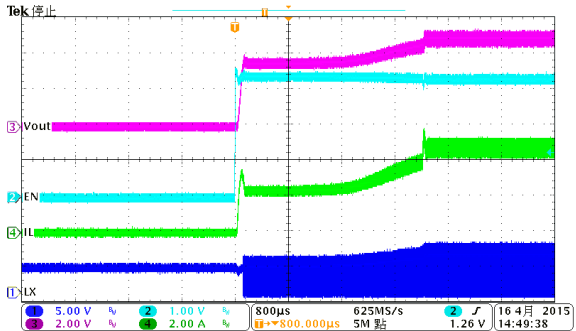
Transient Response
($V_{IN}=3.3V$, $V_{OUT}=5V$, $I_{OUT}=0.5\sim 3A$)



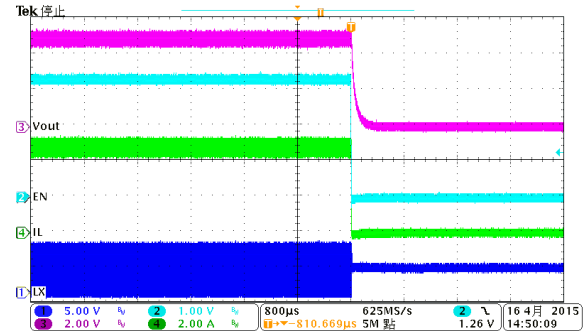
Output Ripple
($V_{IN}=3.3V$, $V_{OUT}=5V$, $I_{OUT}=3A$)



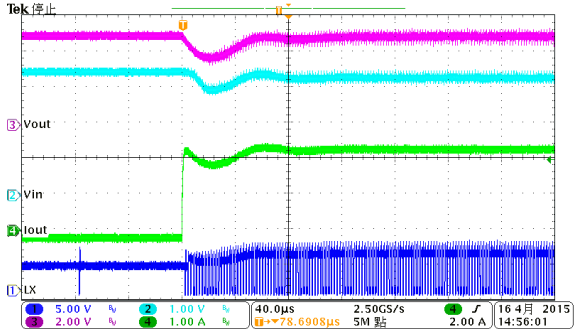
EN ON Test
($V_{IN}=3.3V$, $V_{OUT}=5V$, $I_{OUT}=3A$)



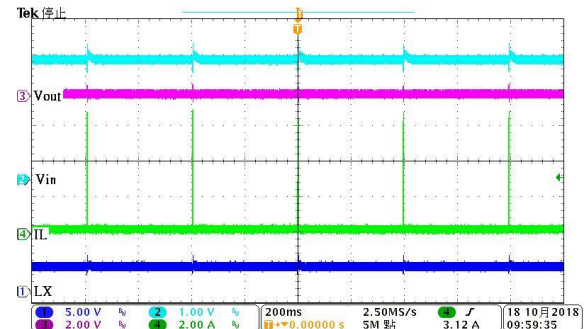
EN OFF Test
($V_{IN}=3.3V$, $V_{OUT}=5V$, $I_{OUT}=3A$)



Load ON Test
($V_{IN}=3.3V$, $V_{OUT}=5V$, $I_{OUT}=3A$)



Short Test
($V_{IN}=3.3V$, $I_{OUT}=3A$)



This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.

Function Description

Operation

The FP6277 is a current mode synchronous boost converter. The constant switching frequency is 500 kHz and operates with pulse width modulation (PWM). Build-in 30mΩ high side switch and 30mΩ low side switch provides a high efficient conversion.

Soft Start Function

Soft start circuitry is integrated into FP6277 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.

Current Limit Program

A resistor between OC and GND pin programs peak switch current. The resistor value should be between 26.5k and 300k. The current limit can be set from 7A to 0.8A. The OC pin can't float must connect a resistor to ground. Keep traces at this pin as short as possible. Do not put capacitance at this pin. Set the over current trip point according to the following equation:

$$I_{OCP} = \frac{180000}{R9} + 0.2$$

Over Temperature Protection (OTP)

FP6277 will turn off the power MOSFET automatically when the internal junction temperature is higher than 150°C. The power MOSFET wake up when the junction temperature drops 30°C under the OTP threshold temperature.

Application Information

Inductor Selection

Inductance value is decided based on different condition. 1.5uH 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, avoid inductor saturation which will cause circuit system unstable and lower core loss at 500KHz.

Capacitor Selection

The output capacitor is required to maintain the VO 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.

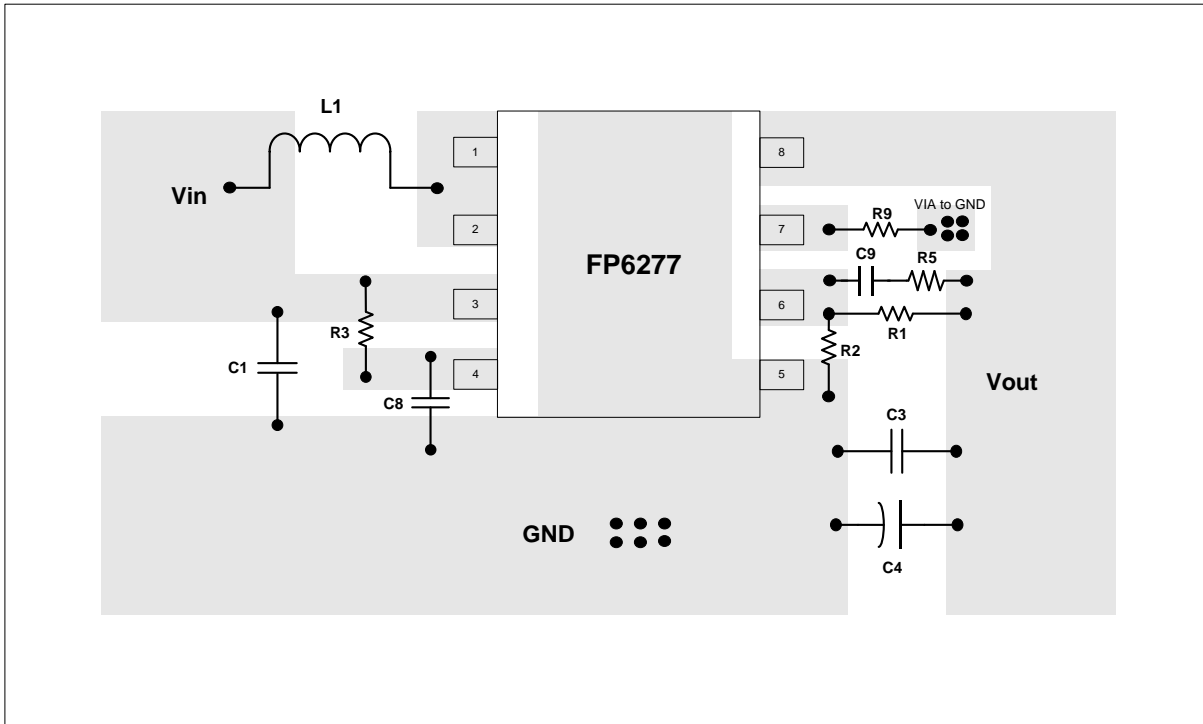
Output Voltage Programming

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

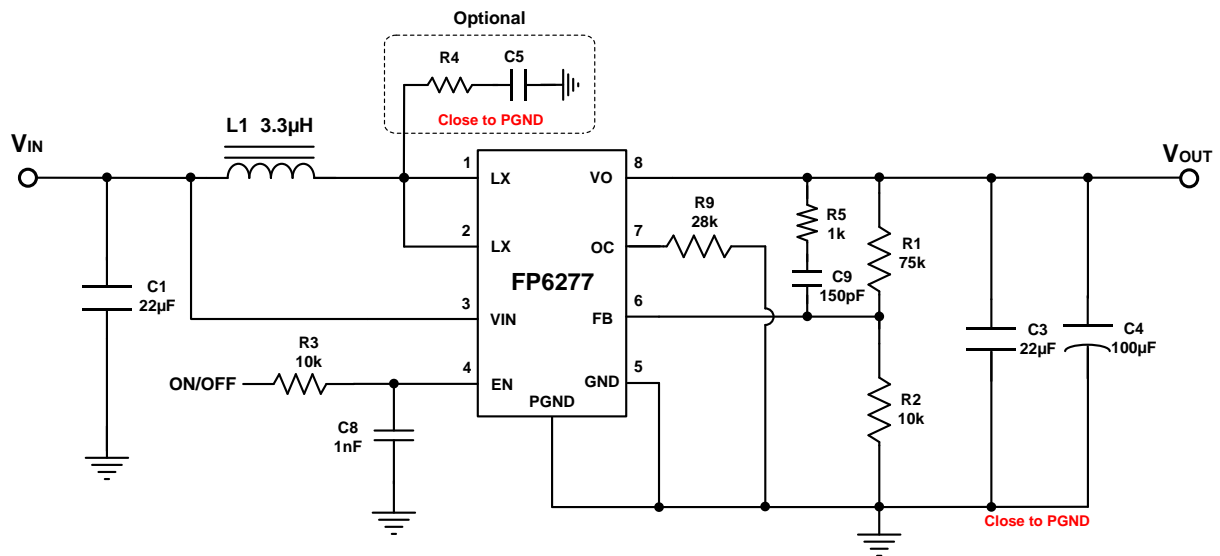
1. The power traces, consisting of the GND trace, the LX trace and the V_{IN} trace should be kept short, direct and wide.
2. Layout LX switching node wide and short trace to reduce EMI.
3. Place C1 near VIN pin as closely as possible to maintain input voltage steady and filter out the pulsing input current.
4. The resistive divider R1 and 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, C1, C3 and C4 should be connected close together directly to a power ground plane.



Suggested Layout

This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.

Typical Application



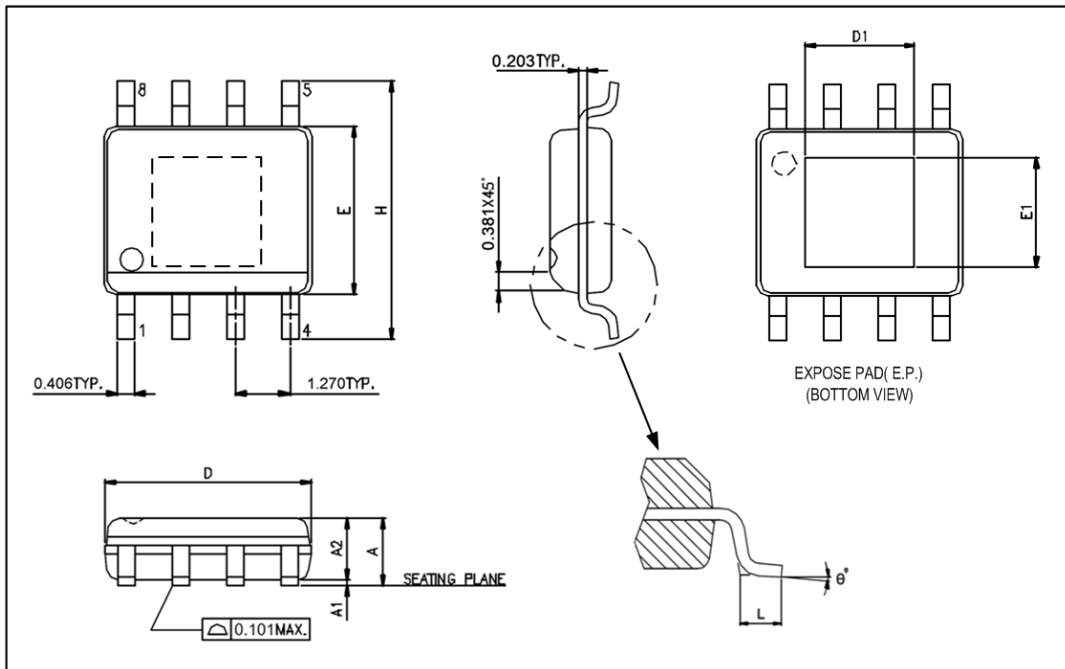
Note:

1. Use ceramic capacitor of X5R or X7R for C1 and C3.
2. R4 and C5 are added for reducing EMI (Electromagnetic Interference).
3. EN voltage must be less than or equal to VIN voltage.
4. The OC pin must connect a resistor R9 to ground setting current limit.

This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.

Package Outline

SOP-8L (EP)



Unit: mm

| 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° |

Exposed PAD Dimensions:

| Symbols | Min. (mm) | Max. (mm) |
|---------|-----------|-----------|
| D1 | | 3.302 REF |
| E1 | | 2.413 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.

This datasheet contains new product information. Advanced Analog Technology reserves the rights to modify the product specification without notice. No liability is assumed as a result of the use of this product. No rights under any patent accompany the sales of the product.