## General Description

The HM5377 is a current mode boost DC-DC converter with built-in handshake interface circuitry to QC2.0 compatible cellphones and other similar devices. If the interface is successful, HM5377 will automatically increase the voltage to 9V and 1.5A to provide fast charging. If the plugged device is not QC2.0 compatible, HM5377 will provide up to 5V/2A for fast charging.

HM5377 integrates an super efficient MOSFET with Rds(ON) ~ 40mΩ. This makes power conversions very efficient. The internal compensation network are fined turned to provide the best compensation for both 5V and 9V operations. This allows HM5377 to use only 8 components to provide either 9V/1.5A or 5V/2A operations. The soft-start function is also onboard..

The HM5377 is available in the SOP8 package and provides space-saving PCB for the application fields.
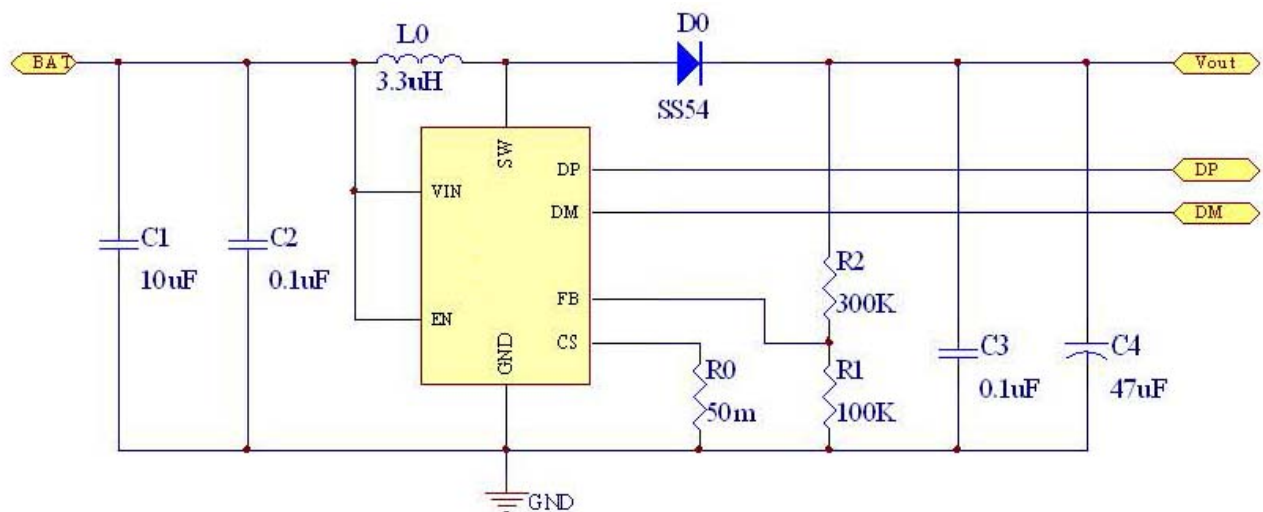
## Features

- Built-in D-/D+ interface with QC2.0 devices
- Automatic Output Selection between 5V and 9V
- Internal Fixed PWM frequency: 1.0MHz
- Precision Feedback Reference Voltage:
  1.275V@Vout=5V; 2.275V@Vout=9V (±2%)
- Internal 40mΩ, 6A, 20V Power MOSFET
- Shutdown Current: 0.1μA
- Over Temperature Protection
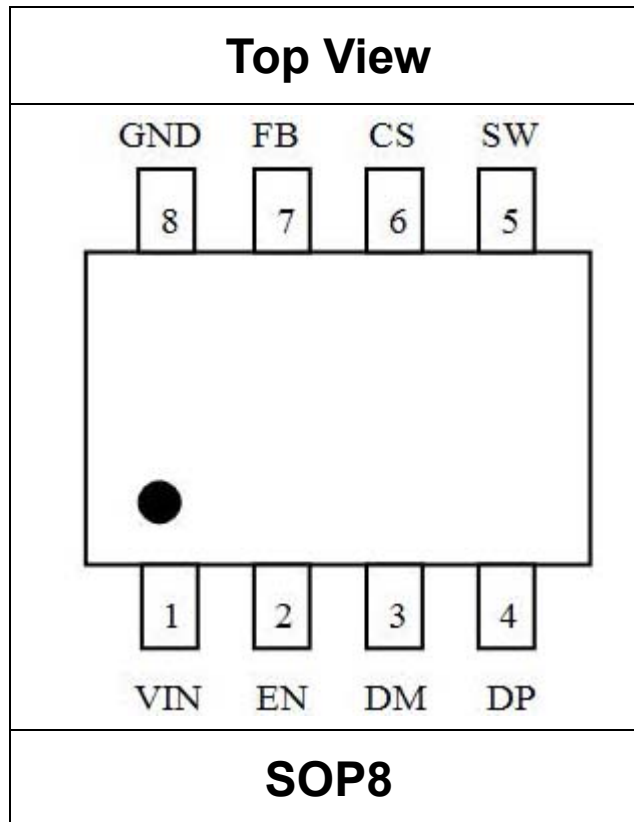- Over Current Protection: 2.4A@Vout=5V;
  1.8A@ Vout=9V
- Package: SOP8

## Application

- Portable Chargers compatible with QC2.0
- LCD Displays
- Digital Cameras
- Handheld Devices
- Portable Products

## Typical   Application

## Pin Configuration

**Top View**

| GND | FB | CS | SW |
|:---:|:---:|:---:|:---:|
| 8 | 7 | 6 | 5 |

| 1 | 2 | 3 | 4 |
|:---:|:---:|:---:|:---:|
| VIN | EN | DM | DP |

**SOP8**

## Pin Description

| Number | Pin | Pin Function Description |
|:---:|:---:|:---:|
| 1 | VIN | Input power supply pin |
| 2 | EN | Shutdown control input, Connect this pin to logic high level to enable the device |
| 3 | DM | USB D- Data Line Input |
| 4 | DP | USB D+ Data Line Input |
| 5 | SW | Switch pin |
| 6 | CS | Current Sense PIN |
| 7 | FB | Feedback pin |
| 8 | GND | Power ground |

## Ordering Information

| Part Number | Marking Information | Package | Remarks |
|---|---|---|---|
| HM5377 | HM5377 YYWW | SOP8 | YY:Year WW:Week |

## Functional Block Diagram
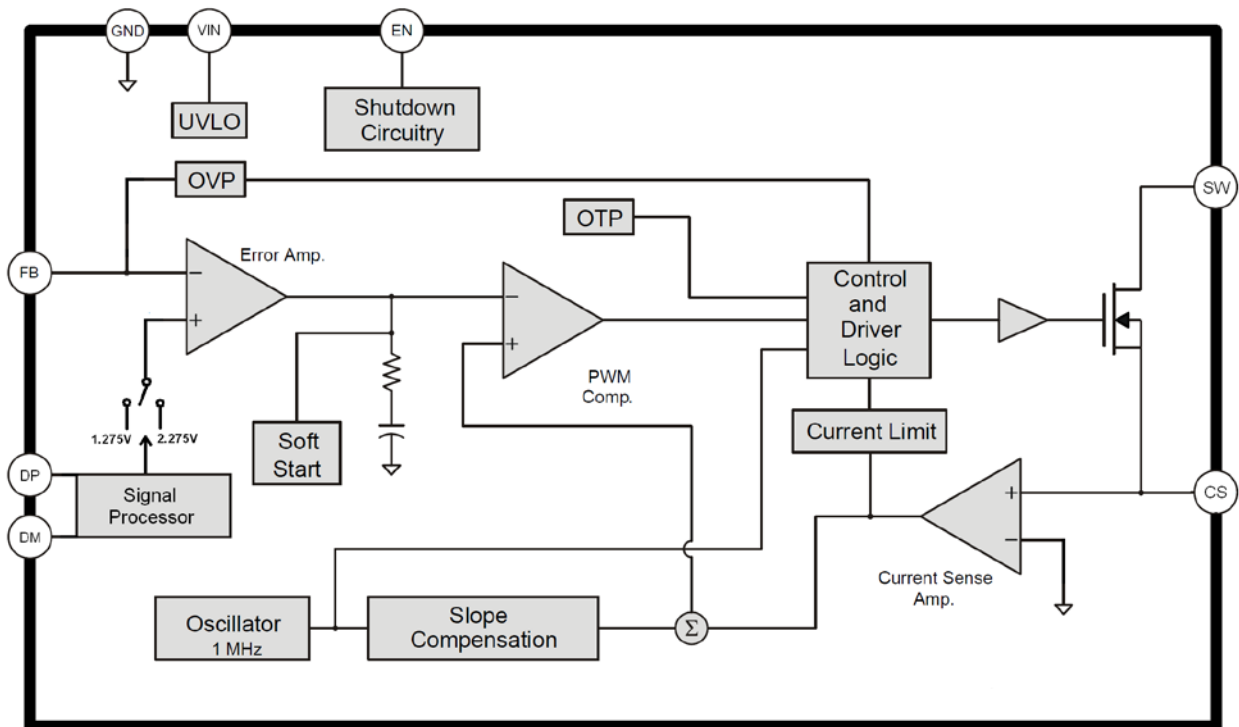
## Absolute Maximum Ratings

| Parameter | Symbol | Maximum | Units |
|---|---|---|---|
| Supply Voltage VIN | VIN | 6 | V |
| SW Voltage | $V_{SW}$ | 20 | V |
| EN, DM, DP, CS, FB Voltage | | 6 | V |
| Power Dissipation | $P_D$ | 455 | mW |
| Thermal Resistance | $\theta_{JA}$ | +220 | °C/W |
| Junction Temperature | $T_J$ | +150 | °C |
| Operating Temperature | $T_{OP}$ | -40 to +85 | °C |
| Storage Temperature | $T_{ST}$ | -65 to 150 | °C |
| Lead Temperature (Soldering, 10 sec) | | +260 | °C |

## Recommended Operating Conditions

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Supply Voltage | VIN | 2.8 | | 5.5 | V |
| Operating Temperature Range | $T_A$ | -40 | | +85 | ℃ |

## Electrical Characteristics

VIN = 3.3V, $T_A$ = 25℃; unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **System Supply Input** | | | | | | |
| VIN | Input Supply Range | | 2.8 | | 5.5 | V |
| $V_{UVLO}$ | Under Voltage Lockout | | | 2.8 | | V |
| | UVLO Hysteresis | | | 0.17 | | V |
| Iq | Quiescent Current | $V_{FB}$=90% *Vref, No switching | | 0.19 | | mA |
| Iq | Average Supply Current | $V_{FB}$=110%*Vref, Switching | | 2 | | mA |
| Iq | Shutdown Supply Current | $V_{EN}$=GND | | 0.1 | | µA |
| **Oscillator** | | | | | | |
| $F_{OSC}$ | Operation Frequency | $V_{FB}$=90% *Vref | 0.8 | 1.0 | 1.2 | MHz |
| $\triangle f / \triangle V$ | Frequency Change with Voltage | VIN=2.8V to 5.5V | | 5 | | **%** |
| $T_{DUTY}$ | Maximum Duty Cycle | | | 90 | | **%** |
| **Reference Voltage** | | | | | | |
| $V_{REF}$ | Reference Voltage | Vout=5V | 1.25 | 1.275 | 1.3 | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Vout=9V | 2.23 | 2.275 | 2.32 | |
| | Line Regulation | VIN=2.7V to 5.5V | | 0.05 | | %/V |
| **Enable Control** | | | | | | |
| V$_{EN}$ | Enable Voltage | | 0.9 | | | V |
| V$_{EN}$ | Shutdown Voltage | | | | 0.7 | V |
| **MOSFET** | | | | | | |
| R$_{DS (ON)}$ | On Resistance of Driver | I$_{sw}$=4.5A | | 40 | | mΩ |
| **Protection** | | | | | | |
| I$_{OCP}$ | OCP Current | Vout=5V | | 2.4 | | A |
| | | Vout=9V | | 1.8 | | A |
| T$_{OTP}$ | OTP Temperature | | | +150 | | ℃ |

## Functional Description

### Operation

The HM5377 is a current mode boost converter. The constant switching frequency is 1MHz and operates with pulse width modulation (PWM). Build-in 20V / 6A MOSFET provides a strong enough power output to provide either 5V/2A or 9V/1.5A. The control loop architecture is current mode control; The slope compensation circuit is internally added to the current signal to allow stable operation for duty cycles larger than 50%.

### Internal QC2.0 Interface

The QC 2.0 interface circuitry is internally built-in for HM5377. When the Device to be charged is first connected to charger, HM5377 will attempt to broadcast the QC2.0 interface signal to the Device. If the devices is QC2.0 compatible and responses back with standard QC2.0 information, and completes the interface protocol, HM5377 will automatically deliver 9V and up to 1.5A to the device. On the other hand, if the connected Device is not QC2.0 compatible, the HM5377 will automatically deliver 5V and up to 2 A.

### Soft Start Function

Soft start circuitry is integrated into HM5377 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 widthto increase in a controlled fashion and thus reducing input input surge current.

### Over Temperature Protection (OTP)

HM5377 will turn off the power MOSFET automatically when the internal junction temperature is over 150° C. The power MOSFET wakes up when the junction temperature drops 20° C under the OTP threshold temperature.

## Application Information

### Inductor Selection

Inductance value is decided based on different condition. 3.3uH to 4.7μH 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 1 MHz.

### 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 ratings exceed the average output current and peak inductor current. In addition, the diode's reverse breakdown voltage must exceed the output voltage.

### Layout Considerations

1. The power traces, consisting of the GND trace, the SW trace and the VIN trace should be kept short, direct and wide.

2. SW、L and D switching node, wide and short trace to reduce EMI.

3. Place $C_{IN}$ 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 as closely as possible.

5. FB is a sensitive node. Please keep it away from switching node, SW.

6. The GND of the IC, $C_{IN}$ and $C_{OUT}$ should be connected close together directly to a ground plane.

## Outline Drawing For SOP8
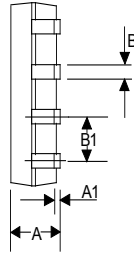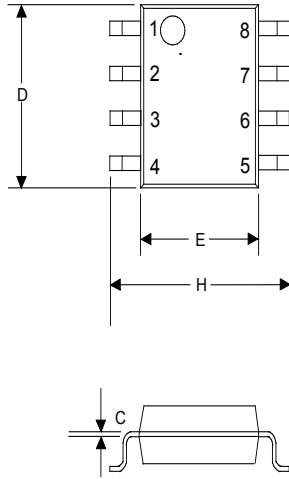


| DIMENSIONS | | | | |
|---|---|---|---|---|
| DIM$^N$ | INCHES | | MM | |
| | MIN | MAX | MIN | MAX |
| A | 0.0532 | 0.0688 | 1.35 | 1.75 |
| A1 | 0.0040 | 0.0098 | 0.10 | 0.25 |
| B | 0.0130 | 0.0200 | 0.33 | 0.51 |
| B1 | 0.050 BSC | | 1.27 BSC | |
| C | 0.0075 | 0.0098 | 0.19 | 0.25 |
| D | 0.1890 | 0.1968 | 4.80 | 5.00 |
| H | 0.2284 | 0.2440 | 5.80 | 6.20 |
| E | 0.1497 | 0.1574 | 3.80 | 4.00 |