

# Sync. Rectifier Step Up Converter

## Features

- Up to 90% Efficiency at  $I_{OUT}=2A$   $V_{OUT}=5V$  from 3.3V Input
- Low 70 $\mu A$  Quiescent Current
- Guaranteed 3A Output Current at  $V_{OUT}=5V$  from 3.3V Input
- 1MHz PWM Switching Frequency
- Synchronous and Embedded Power Mosfets; No Schottky Diode Required
- Internal Soft-Start to Limit Inrush Current
- Adjustable Output
- Output turn off true shutdown function
- Current Mode Operation with Internal Compensation for Excellent Line and Load Transient Response
- Overload/Short-Circuit Protection with hiccup control
- Shutdown Current <1 $\mu A$
- Thermal Shutdown
- Compact 8 pin, SOP8 (FD) package

## Application

- iPad-like computers, smart phones and portable handheld devices.

## General Description

The G5177B is a compact, high-efficiency, synchronous step-up converter with power Mosfets embedded and with output turn off true shutdown function and adjustable output current limiting with foldback for a single-cell Li-ion/polymer battery. The G5177B uses only 70 $\mu A$  (typ) quiescent current and allows the converter to switch only when needed at no load and light loads, and when load is higher than 100mA, it uses fixed-frequency PWM technique at 1MHz. It features a current mode control for fast transient response with internal compensation. The G5177B includes cycle-by-cycle current limit to maximum inductor current and over-temperature protection circuit. The G5177B is suitable for iPad-like computers, smart phones and portable handheld devices.

The G5177B is available in a SOP8 (FD) package. The operating temperature range is from -45°C to +85°C.

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 勝特力电子(上海) 86-21-34970699  
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## Ordering Information

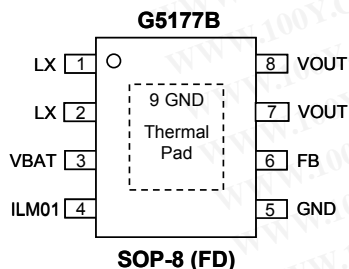
| ORDER NUMBER | MARKING | TEMP. RANGE  | PACKAGE (Green) |
|--------------|---------|--------------|-----------------|
| G5177BF11U   | G5177B  | 0°C to +85°C | SOP-8 (FD)      |

Note: F1:SOP-8 (FD)

1: Bonding Code

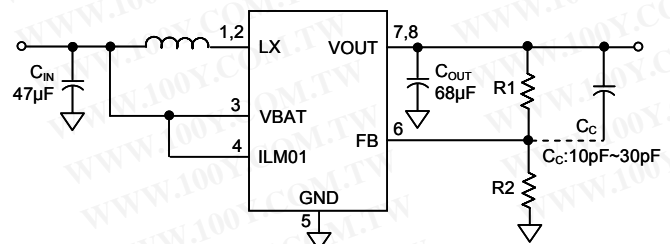
U: Tape & Reel

## Pin Configuration



Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.

## Typical Application Circuit



$V_{OUT}=V_{REF}*(1+R1/R2)$ , where  $V_{REF}$  typical is 1.23V.

**Absolute Maximum Ratings**

V<sub>OUT</sub> to GND ..... -0.3V to 6V  
 LX to GND ..... -0.3V to 6V  
 ILIM0 to GND ..... -0.3V to 6V  
 ILIM1 to GND ..... -0.3V to 6V  
 FB to GND ..... -0.3V to 6V  
 BAT to GND ..... -0.3V to 6V

Thermal Resistance of Junction to Ambient ( $\theta_{JA}$ )

SOP-8 (FD) ..... TBD

Continuous Power Dissipation ( $T_A = +25^\circ\text{C}$ )

SOP-8 (FD) ..... TBD

Storage Temperature ..... -55~150°C

Operation Temperature ..... -40~85°C

**Electrical Characteristics**

(V<sub>OUT</sub> = 5V, V<sub>BAT</sub> = 3.6V, L = 2.2μH, C<sub>IN</sub> = 47μF, C<sub>OUT</sub> = 68μF, T<sub>A</sub> = 25°C)

The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

| PARAMETER                        | SYMBOL                      | CONDITIONS                                                                               | MIN   | TYP              | MAX   | UNITS |
|----------------------------------|-----------------------------|------------------------------------------------------------------------------------------|-------|------------------|-------|-------|
| <b>General</b>                   |                             |                                                                                          |       |                  |       |       |
| Input operation voltage          | V <sub>BAT</sub>            |                                                                                          | 2.5   | ---              | 5     | V     |
| Output voltage                   | V <sub>OUT</sub>            | Line and Load Regulation in CCM (IL>100mA) V <sub>BAT</sub> =2.5~4.5                     | 4.925 | 5                | 5.075 | V     |
| Input Quiescent current          | I <sub>BAT</sub>            | V <sub>BAT</sub> = 3.6V FB=1.28 No load, no switching (exclude input current from ILM01) | ---   | 50               | 70    | μA    |
| Shutdown supply current          | I <sub>BAT</sub>            | (ILM01=0 in SOP-8)                                                                       | ---   | 0.1              | 1     | μA    |
| <b>Oscillator&amp;Protection</b> |                             |                                                                                          |       |                  |       |       |
| Switching Frequency              | F <sub>osc</sub>            |                                                                                          | 0.7   | 1.0              | 1.3   | MHz   |
| Soft-Start Interval              | SS                          |                                                                                          | 4     | 5                | 6     | ms    |
| FB Regulation Voltage            | V <sub>FB</sub>             |                                                                                          | 1.208 | 1.227            | 1.246 | V     |
| FB Input Current                 | I <sub>FB</sub>             | FB=1.0V                                                                                  | ---   | ---              | 100   | nA    |
| T <sub>scp_restart</sub>         | Restart time in SCP         |                                                                                          | ---   | 80               | ---   | ms    |
| short-Circuit Response Time      | T <sub>short_response</sub> | V <sub>OUT</sub> < V <sub>OUT</sub> X25%,                                                | ---   | T <sub>osc</sub> | ---   | μs    |
| Current Limit Response Time      | T <sub>oc_response</sub>    |                                                                                          | ---   | T <sub>osc</sub> | ---   | μs    |
| Maximum Duty Cycle               | D <sub>max</sub>            | FB=0.95V                                                                                 | 86    | 93               | 96    | %     |
| <b>DC-DC Switches</b>            |                             |                                                                                          |       |                  |       |       |
| V <sub>OUT</sub> Leakage Current | I <sub>PVOUT_LK</sub>       | (ILM01=0 in SOP-8) V <sub>OUT</sub> =5V                                                  | ---   | 1                | 5     | μA    |
| LX Leakage Current               | I <sub>LX_LK</sub>          | (ILM01=0 in SOP-8) V <sub>OUT</sub> =5V                                                  | ---   | 1                | 5     | μA    |
| Switch ON Resistance             | R <sub>ON-N</sub>           |                                                                                          | ---   | 39               | 55    | mΩ    |
|                                  | R <sub>ON-P</sub>           |                                                                                          | ---   | 42               | 60    |       |
| Peak Current Limit               | I <sub>LIM</sub>            | ILM01=1                                                                                  | 6.5   | ---              | ---   | A     |
| Efficiency                       |                             | ILM01=1 V <sub>BAT</sub> =3V, V <sub>OUT</sub> =5V, I <sub>OUT</sub> =2A                 | ---   | 87               | ---   | %     |

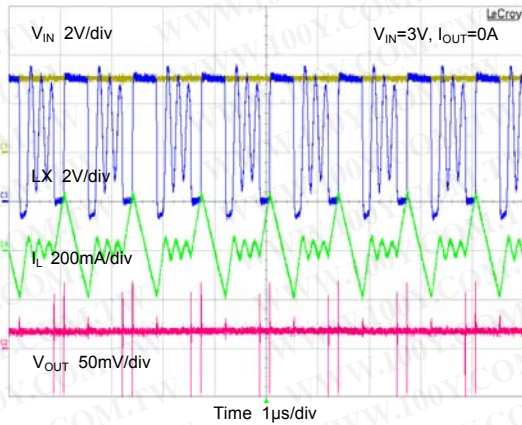
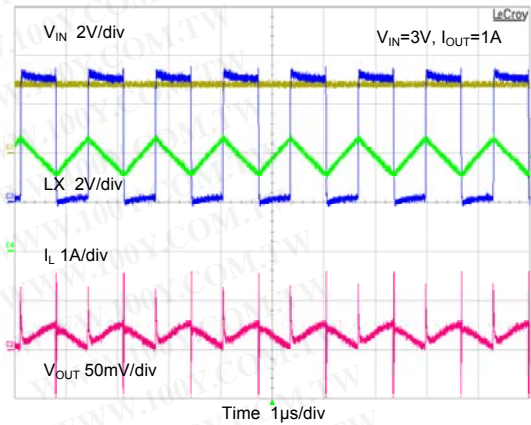
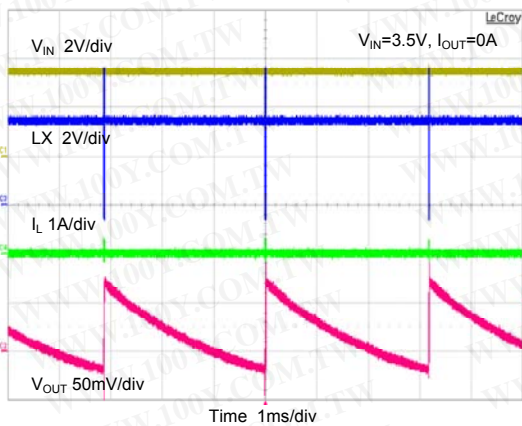
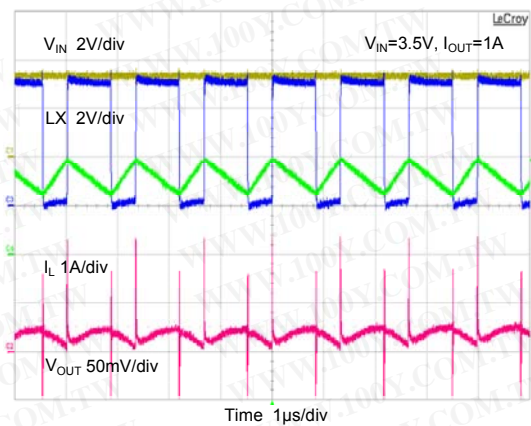
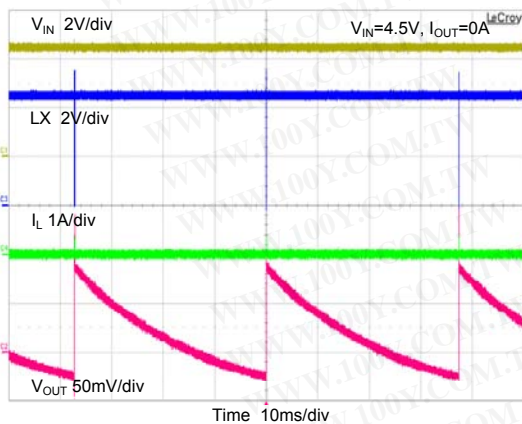
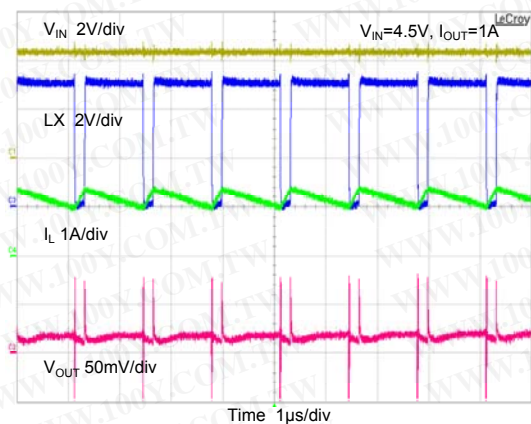
## Electrical Characteristics (Continued)

| PARAMETER                           | SYMBOL        | CONDITIONS                   | MIN | TYP               | MAX | UNITS      |
|-------------------------------------|---------------|------------------------------|-----|-------------------|-----|------------|
| <b>Protection Block</b>             |               |                              |     |                   |     |            |
| VOOUT Short-Circuit Threshold       | $V_{SCP}$     | Falling Edge                 | --- | $V_{OUT}(1-0.27)$ | --- | V          |
| VOOUT Short-Circuit Threshold       | $V_{SCP}$     | Ring Edge                    | --- | $V_{OUT}(1-0.19)$ | --- | V          |
| VBAT UVLO Threshold                 | $V_{UVLO}$    | Falling Edge                 | 1.7 | 1.9               | 2.2 | V          |
| VBAT UVLO Threshold                 | $V_{UVLO}$    | Rising Edge                  | 2   | 2.2               | 2.5 | V          |
| Thermal Shutdown Threshold          |               | Rising Edge, 20°C hysteresis | --- | 150               | --- | °C         |
| <b>Control Block</b>                |               |                              |     |                   |     |            |
| ILM01 Input High Level              | $V_{ih\_ilm}$ |                              | 1.5 | ---               | 5.5 | V          |
| ILM01 Input Low Level               | $V_{il\_ilm}$ |                              | 0   | ---               | 0.5 | V          |
| ILIM01 Internal Pull-Low Resistance | $R_{in\_ilm}$ |                              | 200 | 250               | 300 | K $\Omega$ |

\*note1: If ILM01 connect to Vbat, It will consume current  $I_{ilm01} = V_{bat}/250k$

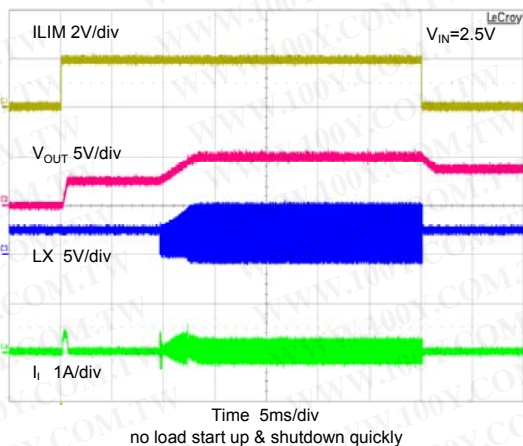
## Typical performance Characteristics

( $V_{IN}=2.5V\sim4.2V$ ,  $V_{OUT}=5V$ ,  $C_{IN}=47\mu F$ ,  $C_{OUT}=47\mu F + 22\mu F$ ,  $L=2.2\mu H$ ,  $T_A = 25^\circ C$ )

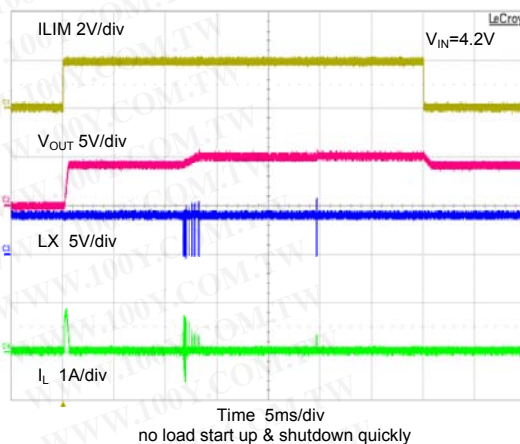
 $V_{IN}$ ,  $V_{OUT}$ ,  $I_L$  Waveform $V_{IN}$ ,  $V_{OUT}$ ,  $I_L$  waveform $V_{IN}$ ,  $V_{OUT}$ ,  $I_L$  Waveform $V_{IN}$ ,  $V_{OUT}$ ,  $I_L$  Waveform $V_{IN}$ ,  $V_{OUT}$ ,  $I_L$  Waveform $V_{IN}$ ,  $V_{OUT}$ ,  $I_L$  Waveform

## Typical Performance Characteristics (continued)

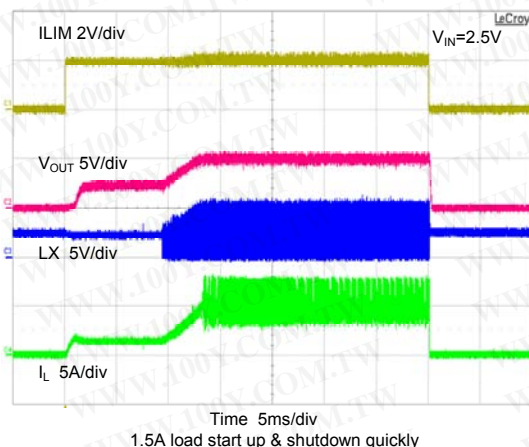
Start Up Waveform



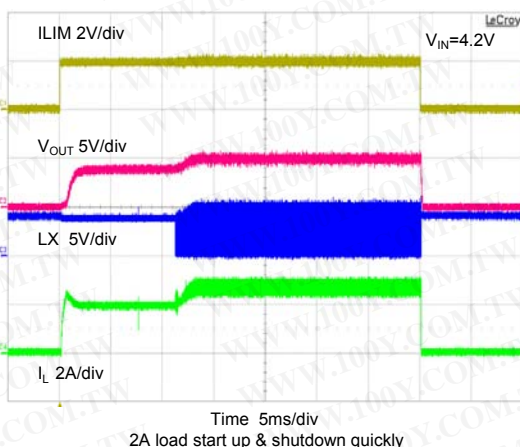
Start Up Waveform



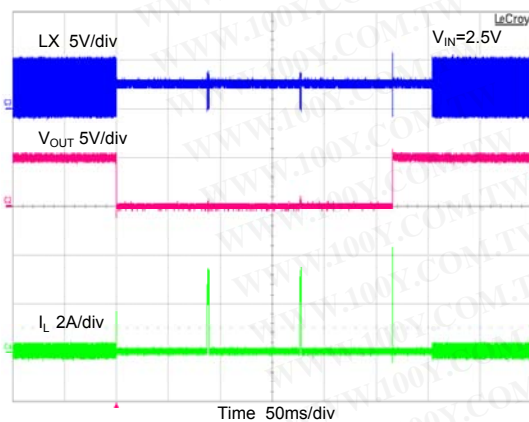
Start Up Waveform



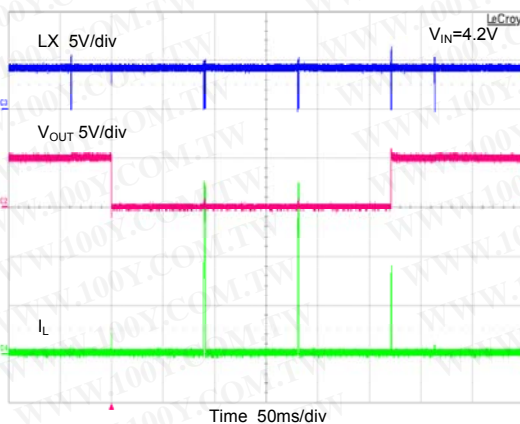
Start Up Waveform



Short Circuit Waveform

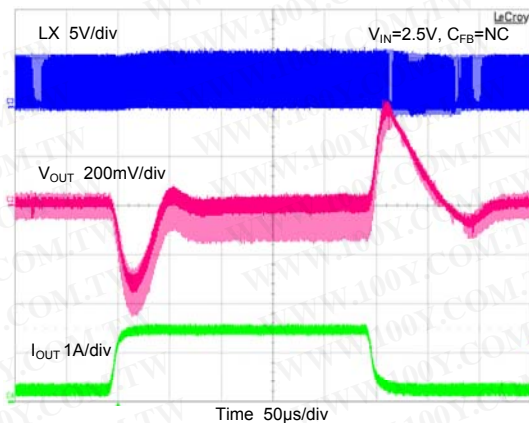


Short Circuit Waveform

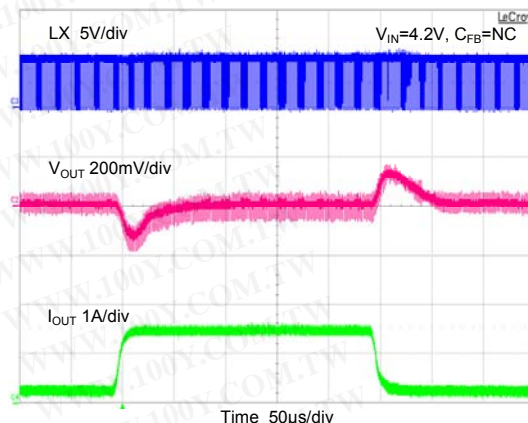


## Typical Performance Characteristics (continued)

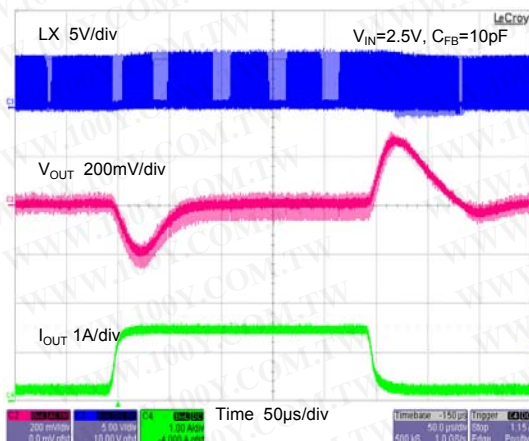
200mA ~ 1.5A Load Transient Waveform



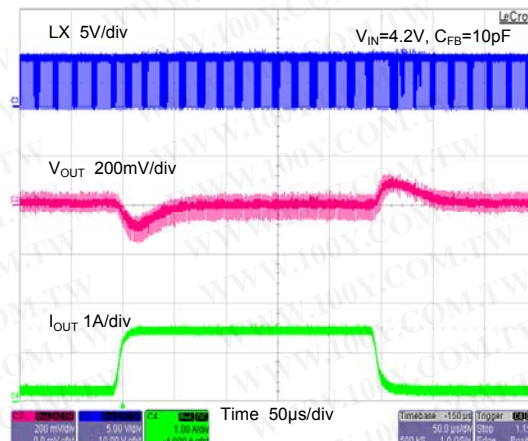
200mA ~ 1.5A Load Transient Waveform



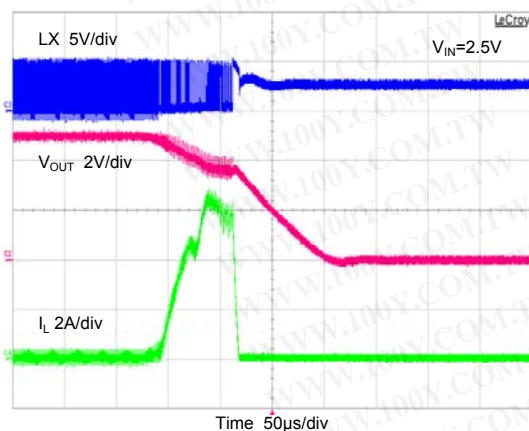
200mA ~ 1.5A Load Transient Waveform



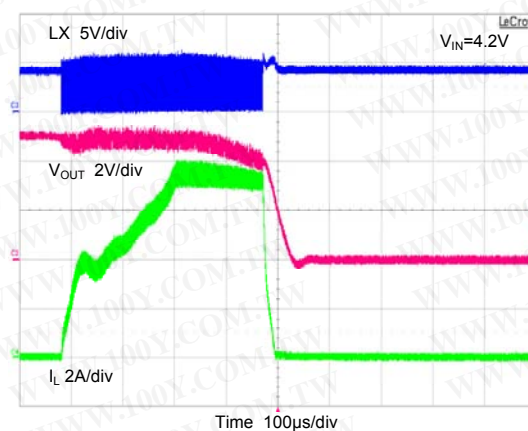
200mA ~ 1.5A Load Transient Waveform



Over Current &amp; Under Voltage Waveform

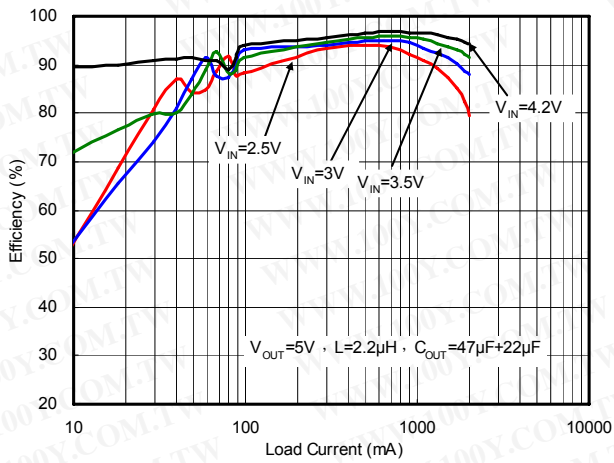


Over Current &amp; Under Voltage Waveform

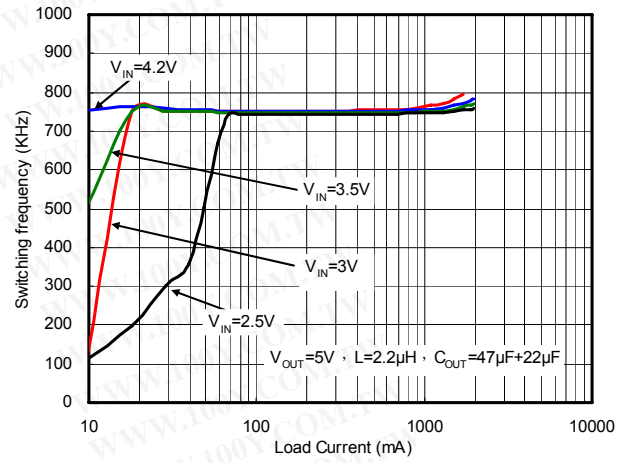


## Typical Performance Characteristics (continued)

Efficiency VS. Load Current

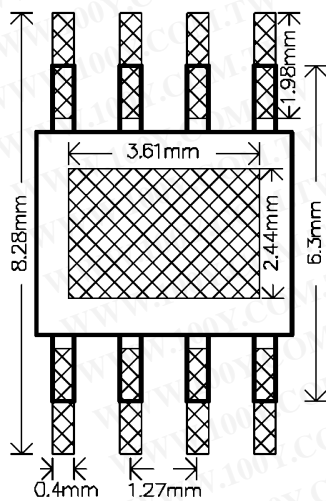


Switching Frequency VS. Load Current



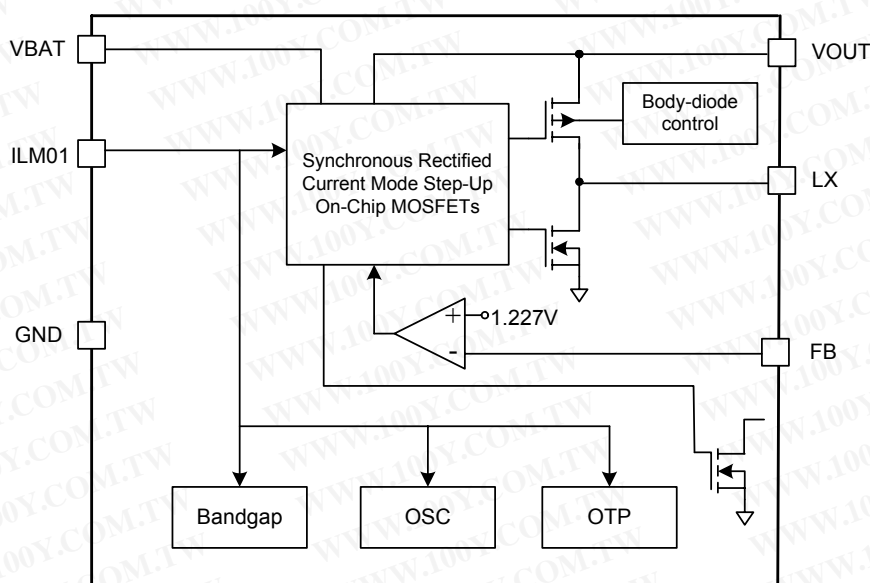
## Minimum Footprint PCB Layout Section

SOP-8 (FD)



**Pin Description For SOP-8 (FD)**

| PIN | NAME   | FUNCTION                                                                                                                                                                                     |
|-----|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1,2 | LX     | Inductor Node.                                                                                                                                                                               |
| 3   | VBAT   | IC Power Supply Input.                                                                                                                                                                       |
| 4   | ILIM01 | Output Current Limit Setting, and On/Off Control.                                                                                                                                            |
| 5   | GND    | IC Analog Ground.                                                                                                                                                                            |
| 6   | FB     | Converter Feedback Input.                                                                                                                                                                    |
| 7,8 | VOUT   | Converter Output.                                                                                                                                                                            |
|     | EP     | Exposed Paddle. Connect to the ground plane to optimize thermal performance. EP is internally connected to GND. EP must be connected to GND at a single point with a star ground connection. |

**Block Diagram (For SOP-8 (FD))****Function Description**

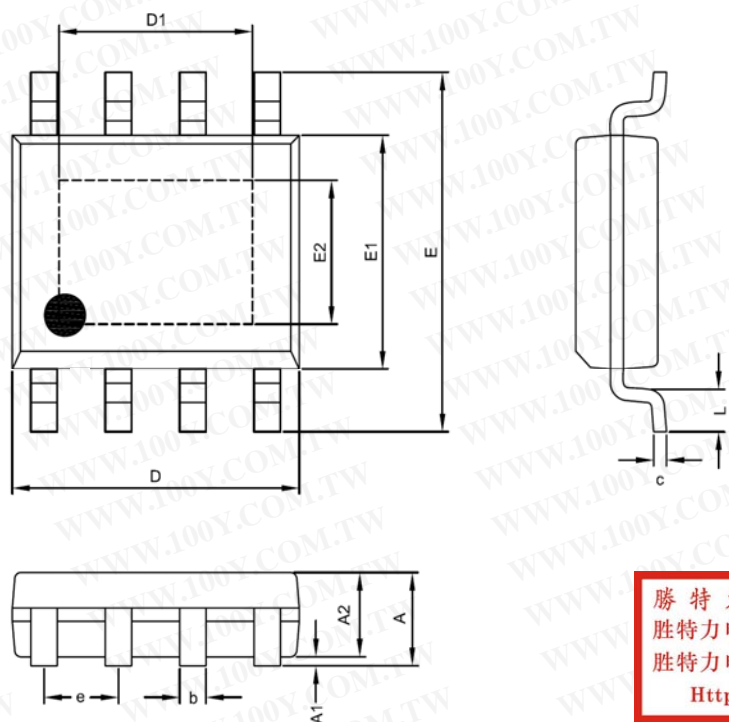
The G5177B current-mode step-up DC-DC switching converter uses a fixed-frequency PWM architecture with output shutdown. In light-load mode, the converter switches when needed, consuming only 70µA of quiescent current. In heavy-load mode of higher than 100mA, the converter switches every cycle at a constant frequency as fixed-PWM, thus enabling noise filtering. The G5177B is highly efficient, with internal and synchronous switches. Shutdown reduces the quiescent current to less than 0.1µA. Low quiescent current and high efficiency make this device ideal for portable equipment.

The G5177B step-up DC-DC switching converter typically generates a 5V output voltage from a single-cell battery input voltage. The minimum output peak current limit is 6.5A in SOP8-FD package. When an

over-current, short-circuit or thermal shutdown condition is encountered. The converter will turn off until the over-current or over-temperature condition is removed, and during the state of short-circuit after precharge is end, the converter will turn off 64ms first and then turn on 1ms cycle by cycle to protect converter under short circuit operation. Internal soft-start limits the inrush current to less than 500mA under no-load conditions during startup. The G5177B is adjustable by 2 external resistors with calculating the value for R1 as  $R1 = R2 (VOUT/VFB - 1)$ .

The G5177B switches at a 1MHz frequency, allowing for tiny external components. The G5177B is optimized for use in iPad-like computers, smart phones, portable handheld devices and other applications requiring low quiescent current for maximum battery life.

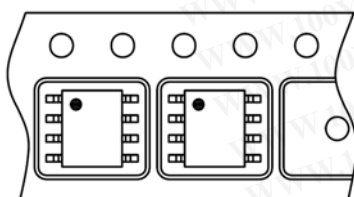
## Package Information



SOP-8 (FD) Package

| Symble | DIMENSION IN MM |      |      | DIMENSION IN INCH |       |       |
|--------|-----------------|------|------|-------------------|-------|-------|
|        | MIN.            | NOM. | MAX. | MIN.              | NOM.  | MAX.  |
| A      | 1.35            | 1.55 | 1.65 | 0.053             | 0.061 | 0.065 |
| A1     | 0.00            | ---  | 0.15 | 0.000             | ---   | 0.006 |
| A2     | 1.15            | 1.35 | 1.50 | 0.045             | 0.053 | 0.059 |
| D      | 4.80            | 4.90 | 5.00 | 0.189             | 0.192 | 0.197 |
| D1     | 2.29            | ---  | 3.71 | 0.090             | ---   | 0.146 |
| E      | 5.80            | 6.00 | 6.20 | 0.228             | 0.236 | 0.244 |
| E1     | 3.80            | 3.90 | 4.00 | 0.150             | 0.153 | 0.157 |
| E2     | 2.29            | ---  | 2.64 | 0.090             | ---   | 0.104 |
| c      | 0.19            | 0.23 | 0.27 | 0.007             | 0.009 | 0.011 |
| b      | 0.33            | 0.43 | 0.53 | 0.013             | 0.017 | 0.021 |
| e      | 1.27 BSC        |      |      | 0.050 BSC         |       |       |
| L      | 0.40            | 0.70 | 1.00 | 0.016             | 0.028 | 0.039 |

## Taping Specification



Feed Direction

| PACKAGE    | Q'TY/REEL |
|------------|-----------|
| SOP-8 (FD) | 2,500 ea  |

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Ver: 0.1

Jul 31, 2013