



# L6925D

## HIGH EFFICIENCY MONOLITHIC SYNCHRONOUS STEP DOWN REGULATOR

### 1 FEATURES

- 2.7V TO 5.5V BATTERY INPUT RANGE
- HIGH EFFICIENCY: UP TO 95%
- INTERNAL SYNCHRONOUS SWITCH
- NO EXTERNAL SCHOTTKY REQUIRED
- EXTREMELY LOW QUIESCENT CURRENT
- 800mA MAX OUTPUT CURRENT
- ADJUSTABLE OUTPUT VOLTAGE FROM 0.6V
- LOW DROP-OUT OPERATION: UP TO 100% DUTY CYCLE
- SELECTABLE LOW NOISE/LOW CONSUMPTION MODE AT LIGHT LOAD
- LOW BATTERY INPUT
- LOW BATTERY OUTPUT
- $\pm 1\%$  OUTPUT VOLTAGE ACCURACY
- CURRENT-MODE CONTROL
- 600kHz SWITCHING FREQUENCY
- EXTERNALLY SYNCHRONIZABLE FROM 500kHz TO 1.4MHz
- OVP
- SHORT CIRCUIT PROTECTION

#### 1.1 APPLICATIONS

- BATTERY-POWERED EQUIPMENTS
- PORTABLE INSTRUMENTS
- CELLULAR PHONES
- PDAs AND HAND HELD TERMINALS
- DSC
- GPS

Figure 1. Package

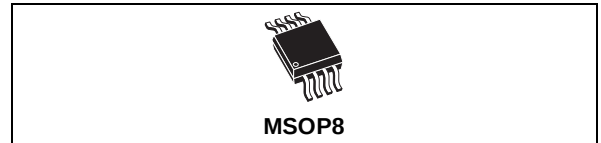


Table 1. Order Codes

| Part Number | Package      |
|-------------|--------------|
| L6925D      | MSOP8 (Tube) |
| L6925D013TR | Tape & Reel  |

### 2 DESCRIPTION

The device is dc-dc monolithic regulator specifically designed to provide extremely high efficiency.

The device has on UVLO set at 2.7V cause it is particularly thought for single Li-ion cell applications. Output voltage can be selected by an external divider down to 0.6V. Duty Cycle can saturate to 100% allowing low drop-out operation.

The device is based on a 600kHz fixed-frequency, current mode-architecture. Low Consumption Mode operation can be selected at light load conditions, allowing switching losses to be reduced. L6925D is externally synchronizable with a clock which makes it useful in noise-sensitive applications.

LBI pin can be used to have a  $\overline{\text{LBO}}$  signal when the Battery voltage is lower than a preset value. Other features like, Overvoltage protection, Shortcircuit protection and Thermal Shutdown (150°C) are also present.

Figure 2. Application Test Circuit

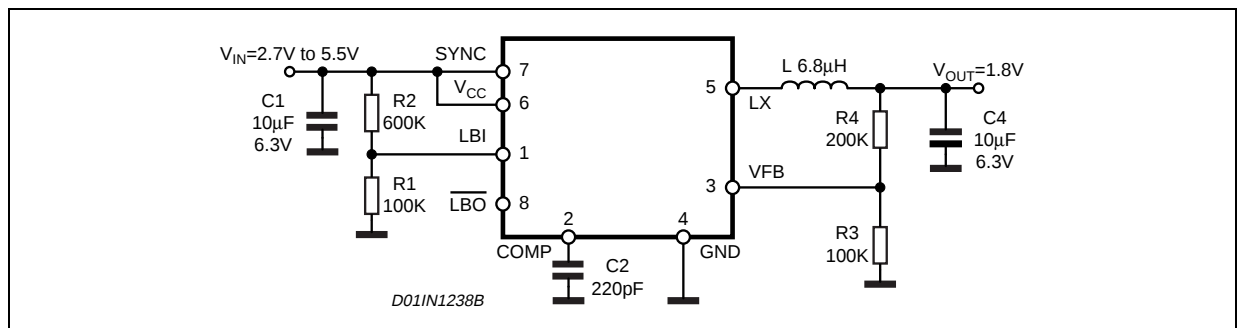


Table 2. Absolute Maximum Ratings

| Symbol                          | Parameter                                                                                                                         | Value                   | Unit |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------|------|
| V <sub>6</sub>                  | Input voltage                                                                                                                     | -0.3 to 6               | V    |
| V <sub>5</sub>                  | Output switching voltage                                                                                                          | -1 to V <sub>CC</sub>   | V    |
| V <sub>1</sub> , V <sub>8</sub> | Low Battery Input, Low Battery Output                                                                                             | -0.3 to V <sub>CC</sub> | V    |
| V <sub>3</sub>                  | Feedback voltage                                                                                                                  | -0.3 to V <sub>CC</sub> | V    |
| V <sub>2</sub>                  | Error Amplifier Output Voltage                                                                                                    | -0.3 to V <sub>CC</sub> | V    |
| V <sub>7</sub>                  | Synchronization / Mode Selector                                                                                                   | -0.3 to V <sub>CC</sub> | V    |
| P <sub>tot</sub>                | Power dissipation at Tamb=70°C                                                                                                    | 0.45                    | W    |
| T <sub>j</sub>                  | Junction operating temperature range                                                                                              | -40 to 150              | °C   |
| T <sub>stg</sub>                | Storage temperature range                                                                                                         | -65 to 150              | °C   |
| LX Pin                          | Maximum Withstanding Voltage Range Test Condition: CDF-AEC-Q100-002- "Human Body Model" Acceptance Criteria: "Normal Performance" | ±1000                   | V    |
| Other pins                      |                                                                                                                                   | ±2000                   | V    |

Figure 3. Pin Connection

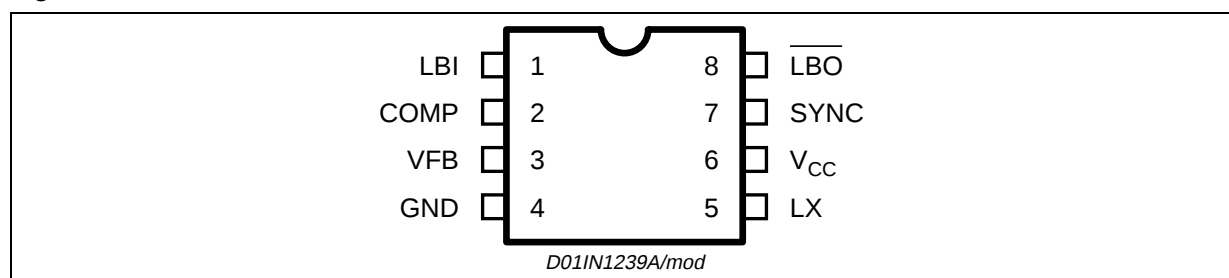


Table 3. Thermal Data

| Symbol                | Parameter                              | Value | Unit |
|-----------------------|----------------------------------------|-------|------|
| R <sub>th j-amb</sub> | Thermal Resistance Junction to Ambient | 180   | °C/W |

Table 4. Pin Functions

| N | Name | Description                                                                                                                                                                                                                         |
|---|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | LBI  | Battery low voltage detector input. The internal threshold is set to 0.6V. The external threshold can be adjusted by using an external resistor divider.                                                                            |
| 2 | COMP | Error amplifier output. Compensate it with a 220pF capacitor                                                                                                                                                                        |
| 3 | VFB  | Error amplifier input. The output voltage can be adjusted by using an external resistor divider connected to this pin (V <sub>FB</sub> = 0.6V).                                                                                     |
| 4 | GND  | Ground.                                                                                                                                                                                                                             |
| 5 | LX   | Switch node connection to the inductor.                                                                                                                                                                                             |
| 6 | VCC  | Input voltage.                                                                                                                                                                                                                      |
| 7 | SYNC | This pin allows to select Low Noise/ Low Consumption Mode or to synchronize the device.                                                                                                                                             |
| 8 | LBO  | Battery low voltage detector output. If the voltage at the LBI pin drops below the internal threshold, LBO goes low. The LBO is an open drain output. A pull_up resistor should be connected between the pin and the output voltage |

**Table 5. ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$ ,  $V_{CC} = 3.6\text{V}$  unless otherwise specified)

| Symbol                          | Parameter                                   | Test Condition                                                           | Min   | Typ  | Max             | Unit  |
|---------------------------------|---------------------------------------------|--------------------------------------------------------------------------|-------|------|-----------------|-------|
| V <sub>CC</sub>                 | Operating input voltage                     | After Turn On                                                            | 2.7   |      | 5.5             | V     |
| V <sub>CC ON</sub>              | Turn On threshold                           |                                                                          |       | 2.8  |                 | V     |
| V <sub>CC OFF</sub>             | Turn Off threshold                          |                                                                          |       | 2.65 |                 | V     |
| V <sub>CC hys</sub>             | Hysteresis                                  |                                                                          |       | 150  |                 | mV    |
| R <sub>p</sub>                  | High side Ron                               | V <sub>CC</sub> = 3.6V, I <sub>LX</sub> =100mA                           |       | 240  |                 | mΩ    |
| R <sub>n</sub>                  | Low side Ron                                | V <sub>CC</sub> = 3.6V, I <sub>LX</sub> =100mA                           |       | 215  |                 | mΩ    |
| I <sub>lim</sub>                | Peak current limit                          | V <sub>CC</sub> = 3.6V                                                   |       | 1.2  |                 | A     |
|                                 | Valley current limit                        | V <sub>CC</sub> = 3.6V                                                   |       | 1.4  |                 | A     |
| V <sub>out</sub>                | Output voltage range                        |                                                                          | 0.6   |      | V <sub>CC</sub> | V     |
| f <sub>osc</sub>                | Oscillator frequency                        |                                                                          |       | 600  |                 | KHz   |
| f <sub>sync</sub>               | Sync mode clock (*)                         |                                                                          | 500   |      | 1400            | KHz   |
| DC CHARACTERISTICS              |                                             |                                                                          |       |      |                 |       |
| I <sub>q</sub>                  | Quiescent current (low noise mode)          | V <sub>sync</sub> = 0V, no load, V <sub>FB</sub> > 0.6V                  |       | 230  |                 | μA    |
|                                 | Quiescent current (low consumption mode)    | V <sub>sync</sub> = V <sub>CC</sub> , no load, V <sub>FB</sub> > 0.6V    |       | 25   |                 | μA    |
| I <sub>sh</sub>                 | Shutdown current                            | V <sub>CC</sub> < 2.7V, V <sub>FB</sub> > 0.6V                           |       | 0.2  |                 | μA    |
| I <sub>LX</sub>                 | LX leakage current (*)                      | V <sub>CC</sub> < 2.7V, V <sub>LX</sub> = V <sub>CC</sub>                |       | 1    |                 | μA    |
|                                 |                                             | V <sub>CC</sub> < 2.7V, V <sub>LX</sub> = 0V                             |       | 1    |                 | μA    |
| ERROR AMPLIFIER CHARACTERISTICS |                                             |                                                                          |       |      |                 |       |
| V <sub>fb</sub>                 | Voltage feedback                            |                                                                          | 0.593 | 0.6  | 0.607           | V     |
| I <sub>fb</sub>                 | Feedback input current (*)                  | V <sub>FB</sub> = 0.6V                                                   |       | 25   |                 | nA    |
| SYNC/MODE FUNCTION              |                                             |                                                                          |       |      |                 |       |
| V <sub>sync_H</sub>             | Sync mode threshold high                    |                                                                          |       |      | 1.3             | V     |
| V <sub>sync_L</sub>             | Sync mode threshold low                     |                                                                          | 0.5   |      |                 | V     |
| LB SECTION                      |                                             |                                                                          |       |      |                 |       |
| V <sub>LBI</sub>                | LBI Threshold                               |                                                                          |       | 0.6  |                 | V     |
| V <sub>LBO</sub>                | $\overline{\text{LBO}}$ Logic Low           | I <sub>sink</sub> = 1mA, V <sub>CC</sub> = 3.6V, V <sub>LBI</sub> < 0.6V |       | 0.2  | 0.4             | V     |
| I <sub>LK-LBO</sub>             | $\overline{\text{LBO}}$ Leakage Current (*) | V <sub>LBO</sub> = 3.6V, V <sub>CC</sub> = 3.6V, V <sub>LBI</sub> > 0.6V |       |      | 50              | nA    |
| PROTECTIONS                     |                                             |                                                                          |       |      |                 |       |
| HOVP                            | Hard overvoltage threshold                  |                                                                          |       | 10   |                 | %Vout |

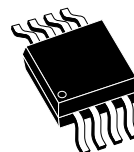
(\*) Guaranteed by design

Figure 4. MSOP8 Mechanical Data &amp; Package Dimensions

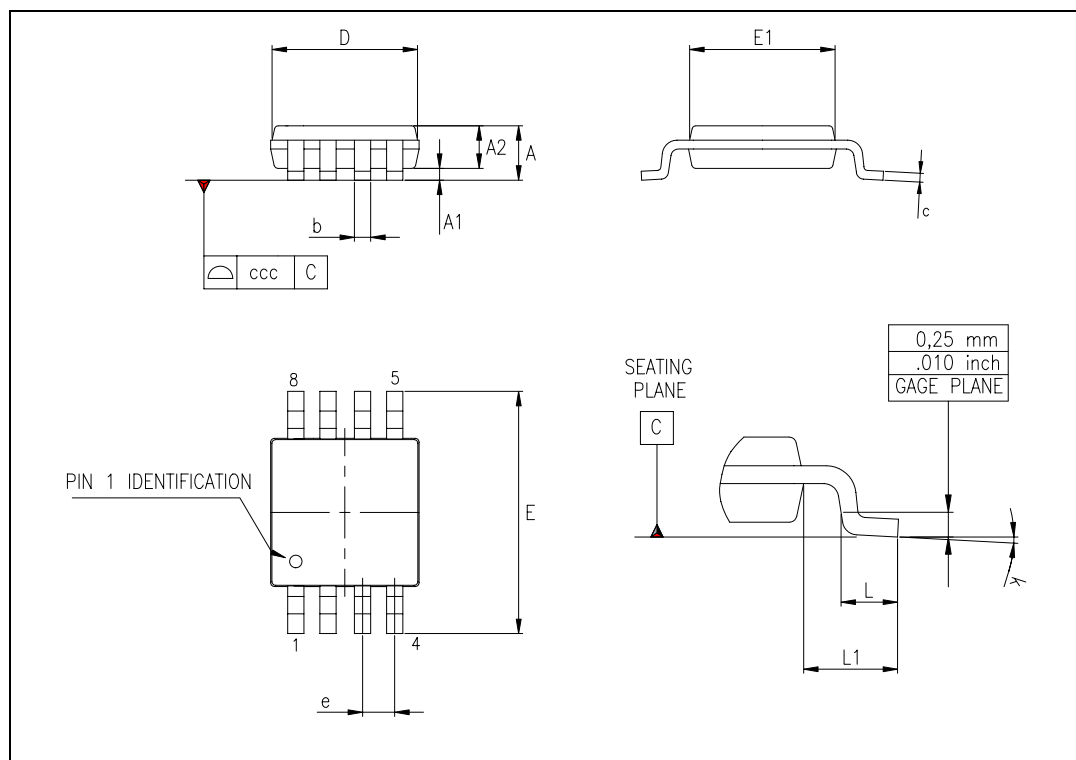
| DIM.   | mm                  |       |       | inch  |       |       |
|--------|---------------------|-------|-------|-------|-------|-------|
|        | MIN.                | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| A      |                     |       | 1.10  |       |       | 0.043 |
| A1     | 0.050               |       | 0.150 | 0.002 |       | 0.006 |
| A2     | 0.750               | 0.850 | 0.950 | 0.03  | 0.033 | 0.037 |
| b      | 0.250               |       | 0.400 | 0.010 |       | 0.016 |
| c      | 0.130               |       | 0.230 | 0.005 |       | 0.009 |
| D (1)  | 2.900               | 3.000 | 3.100 | 0.114 | 0.118 | 0.122 |
| E      | 4.650               | 4.900 | 5.150 | 0.183 | 0.193 | 0.20  |
| E1 (1) | 2.900               | 3.000 | 3.100 | 0.114 | 0.118 | 0.122 |
| e      |                     | 0.650 |       |       | 0.026 |       |
| L      | 0.400               | 0.550 | 0.700 | 0.016 | 0.022 | 0.028 |
| L1     |                     | 0.950 |       |       | 0.037 |       |
| k      | 0° (min.) 6° (max.) |       |       |       |       |       |
| aaa    |                     |       | 0.100 |       |       | 0.004 |

Note: 1. D and F does not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (.006inch) per side.

### OUTLINE AND MECHANICAL DATA



### MSOP8 (Body 3mm)



**Table 6. Revision History**

| <b>Date</b>    | <b>Revision</b> | <b>Description of Changes</b>   |
|----------------|-----------------|---------------------------------|
| January 2004   | 2               | First Issue in EDOCS DMS        |
| September 2004 | 3               | Changed Style-sheet and Table 2 |

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