

## 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

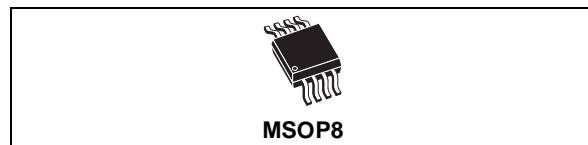


Table 1. Order Codes

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

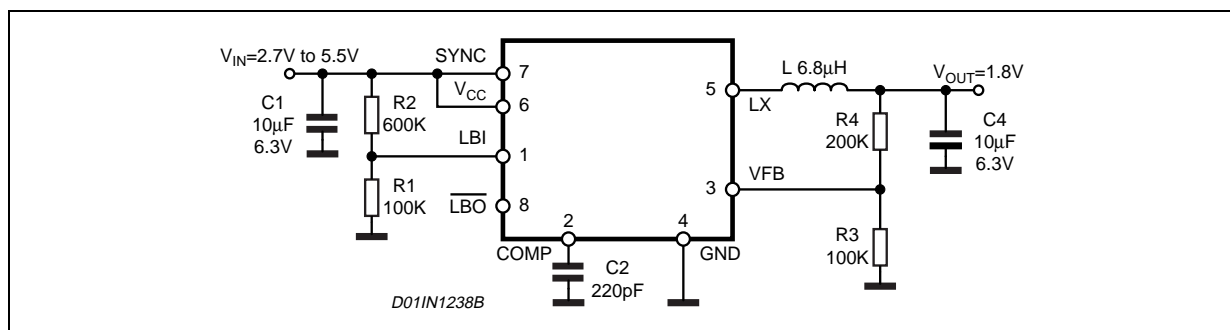


Table 2. Absolute Maximum Ratings

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

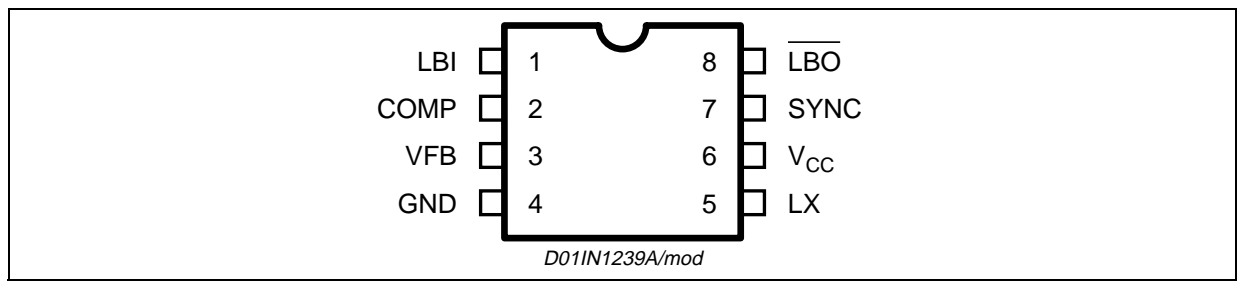


Table 3. Thermal Data

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	$\overline{\text{LBO}}$	Battery low voltage detector output. If the voltage at the LBI pin drops below the internal threshold, $\overline{\text{LBO}}$ goes low. The $\overline{\text{LBO}}$ 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
$V_{CC}$	Operating input voltage	After Turn On	2.7		5.5	V
$V_{CC\ ON}$	Turn On threshold			2.8		V
$V_{CC\ OFF}$	Turn Off threshold			2.65		V
$V_{CC\ hys}$	Hysteresis			150		mV
$R_p$	High side Ron	$V_{CC} = 3.6\text{V}$ , $I_{LX} = 100\text{mA}$		240		$\text{m}\Omega$
$R_n$	Low side Ron	$V_{CC} = 3.6\text{V}$ , $I_{LX} = 100\text{mA}$		215		$\text{m}\Omega$
$I_{lim}$	Peak current limit	$V_{CC} = 3.6\text{V}$		1.2		A
	Valley current limit	$V_{CC} = 3.6\text{V}$		1.4		A
$V_{out}$	Output voltage range		0.6		$V_{CC}$	V
$f_{osc}$	Oscillator frequency			600		KHz
$f_{sync}$	Sync mode clock (*)		500		1400	KHz
<b>DC CHARACTERISTICS</b>						
$I_q$	Quiescent current (low noise mode)	$V_{sync} = 0\text{V}$ , no load, $V_{FB} > 0.6\text{V}$		230		$\mu\text{A}$
	Quiescent current (low consumption mode)	$V_{sync} = V_{CC}$ , no load, $V_{FB} > 0.6\text{V}$		25		$\mu\text{A}$
$I_{sh}$	Shutdown current	$V_{CC} < 2.7\text{V}$ , $V_{FB} > 0.6\text{V}$		0.2		$\mu\text{A}$
$I_{LX}$	LX leakage current (*)	$V_{CC} < 2.7\text{V}$ , $V_{LX} = V_{CC}$		1		$\mu\text{A}$
		$V_{CC} < 2.7\text{V}$ , $V_{LX} = 0\text{V}$		1		$\mu\text{A}$
<b>ERROR AMPLIFIER CHARACTERISTICS</b>						
$V_{fb}$	Voltage feedback		0.593	0.6	0.607	V
$I_{fb}$	Feedback input current (*)	$V_{FB} = 0.6\text{V}$		25		nA
<b>SYNC/MODE FUNCTION</b>						
$V_{sync\_H}$	Sync mode threshold high				1.3	V
$V_{sync\_L}$	Sync mode threshold low		0.5			V
<b>LB SECTION</b>						
$V_{LBI}$	LBI Threshold			0.6		V
$V_{LBO}$	$\overline{\text{LBO}}$ Logic Low	$I_{sink} = 1\text{mA}$ , $V_{CC} = 3.6\text{V}$ , $V_{LBI} < 0.6\text{V}$		0.2	0.4	V
$I_{LK-LBO}$	$\overline{\text{LBO}}$ Leakage Current (*)	$V_{\overline{\text{LBO}}} = 3.6\text{V}$ , $V_{CC} = 3.6\text{V}$ , $V_{LBI} > 0.6\text{V}$			50	nA
<b>PROTECTIONS</b>						
HOVP	Hard overvoltage threshold			10		%Vout

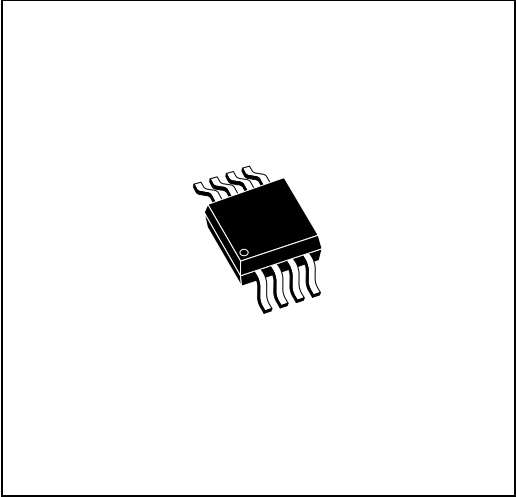
(\*) Guaranteed by design

Figure 4. MSOP8 Mechanical Data & Package Dimensions

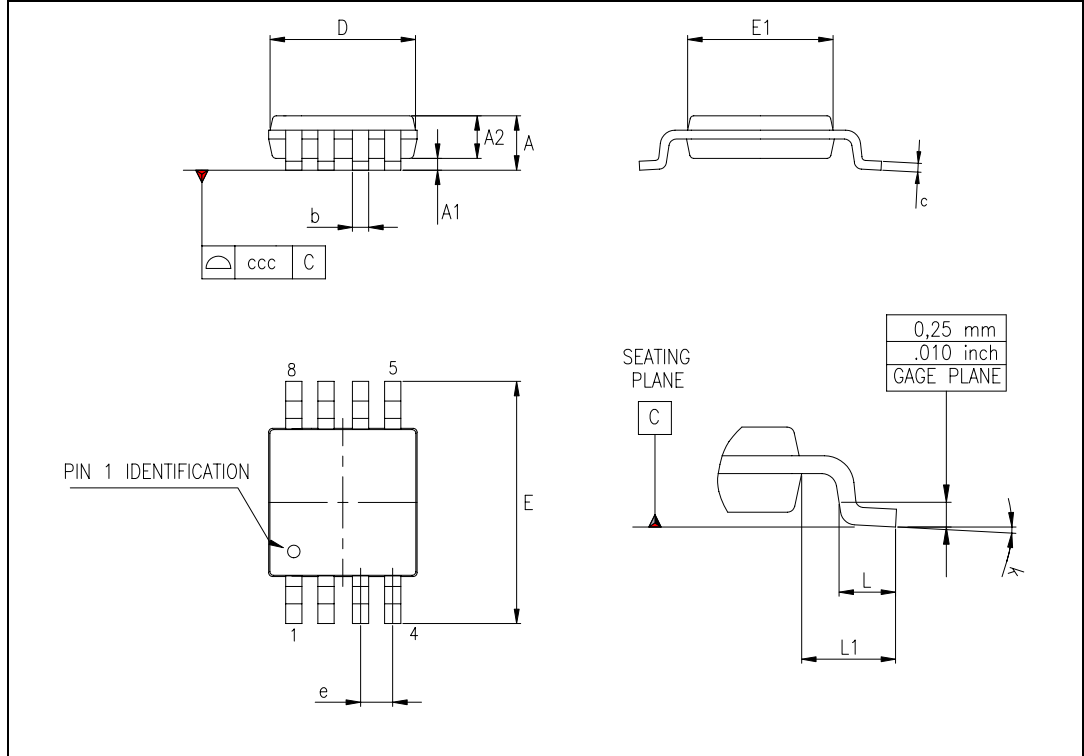
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.10			0.043
A1	0.050		0.150	0.002		0.006
A2	0.750	0.850	0.950	0.03	0.033	0.037
b	0.250		0.400	0.010		0.016
c	0.130		0.230	0.005		0.009
D (1)	2.900	3.000	3.100	0.114	0.118	0.122
E	4.650	4.900	5.150	0.183	0.193	0.20
E1 (1)	2.900	3.000	3.100	0.114	0.118	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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