L6902D

UP TO 1A SWITCHING REGULATOR WITH ADJUSTABLE CURRENT LIMIT

1 FEATURES

- UP TO 1A OUTPUT CURRENT
- OPERATING INPUT VOLTAGE FROM 8V TO 36V
- PRECISE 3.3V (±2%) REFERENCE VOLTAGE
- 5% OUTPUT CURRENT ACCURACY
- OUTPUT VOLTAGE ADJUSTABLE FROM 1.235V TO 34V
- 250KHz INTERNALLY FIXED FREQUENCY
- VOLTAGE FEEDFORWARD
- ZERO LOAD CURRENT OPERATION
- ADJUSTABLE CURRENT LIMIT
- PROTECTION AGAINST FEEDBACK DISCONNECTION
- THERMAL SHUTDOWN

2 APPLICATIONS

- CHARGERS FOR NiCd, NiMH BATTERIES AND PREREGULATOR FOR LITHIUM-ION BATTERIES
- ADJUSTABLE CURRENT GENERATOR
- SIMPLE STEP-DOWN CONVERTERS WITH ADJUSTABLE CURRENT LIMIT
- BATTERY EQUIPPED SYSTEMS
- DISTRIBUTED POWER SUPPLY
- MOBILE PC & SUBNOTEBOOK

3 DESCRIPTION

The L6902D is a complete and simple step down switching regulator with adjustable current limit.

Based on a voltage mode structure it integrates a current error amplifier to have a constant voltage and constant current control.

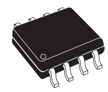
By means of an on board current sense resistor and the availability of the current sense pins (both compatible to Vcc and for Cs- compatible with GND too) a current limit programming is very simple and accurate (±5%). Moreover constant current control can be used to charge NiMH and NiCd batteries.

The device can be used as a standard DC/DC converter with adjustable current limit (set by using the external sense resistor).

The internal robust P-Channel DMOS transistor with a typical of 250mΩ assures high efficiency and a minimum dropout even at high output current level. The internal limiting current (latched function) of typical value of 2.5A protects the device from accidental output short circuit avoiding dangerous loads damage.

If the temperature of the chip goes higher than a fixed internal threshold (150°C with 20°C hysteresis), the power stage is turned off.

Figure 1. Package

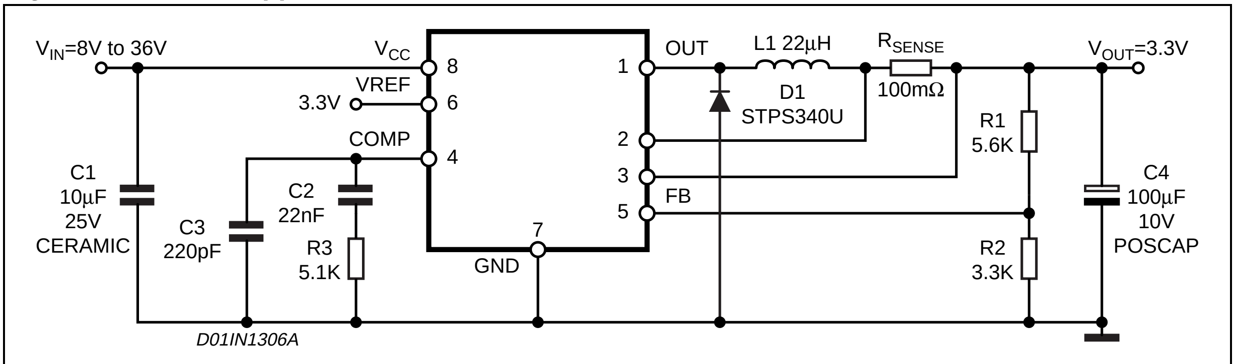


SO-8

Table 1. Order Codes

Part Number	Package
L6902D	SO-8
L6902D013TR	SO-8 in Tape & Reel

Figure 2. Test And Application Circuit



3 DESCRIPTION (continued)

Other protections beside thermal shutdown complete the device for a safe and reliable application: overvoltage protection, frequency folback overcurrent protection and protection vs. feedback disconnection.
The internal fixed switching frequency of 250KHz, and the SO-8 package pin allow to built an ultra compact DC/DC converter with a minimum board space.

Figure 3. Pin Connection

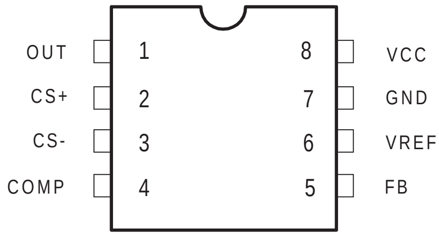


Table 2. Pin Description

N°	Pin	Function
1	OUT	Regular Output
2	CS+	Current Error Amplifier input (current sense at higher voltage)
3	CS-	Current Error Amplifier input (current sense at lower voltage)
4	COMP	E/A output to be used for frequency compensation
5	FB	Stepdown feedback input. Connecting directly to this pin results in an output voltage of 1.235V. An external resistive divider is required for higher output voltages. In this case: $V_{out} = V_{FB} \cdot \left(1 + \frac{R1}{R2}\right) = 1.235V\left(1 + \frac{R1}{R2}\right)$
6	V_{REF}	3.3V VREF. No cap is need for stability.
7	GND	Ground
8	VCC	Unregulated DC input voltage.

Table 3. Thermal Data

Symbol	Parameter	Value	Unit
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction to Ambient Max.	110 (*)	°C/W

(*) Package mounted on board.

Table 4. Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_8	Input Voltage	40	V
V_1	Output DC voltageOutput peak voltage at t = 0.1µs	-1 to 40 -5 to 40	V V
I_1	Maximum output current	Internally limited	
V_4, V_5	Analog pins	4	V
V_2, V_3	Analog pins	-0.3V to V_{CC}	V
P_{tot}	Power dissipation at $T_{amb} \leq 70$ °C	0.7	W
Tj	Operating junction temperature range	-40 to 150	°C
T_{stg}	Storage temperature range	-55 to 150	°C

Figure 4. Internal Block Diagram

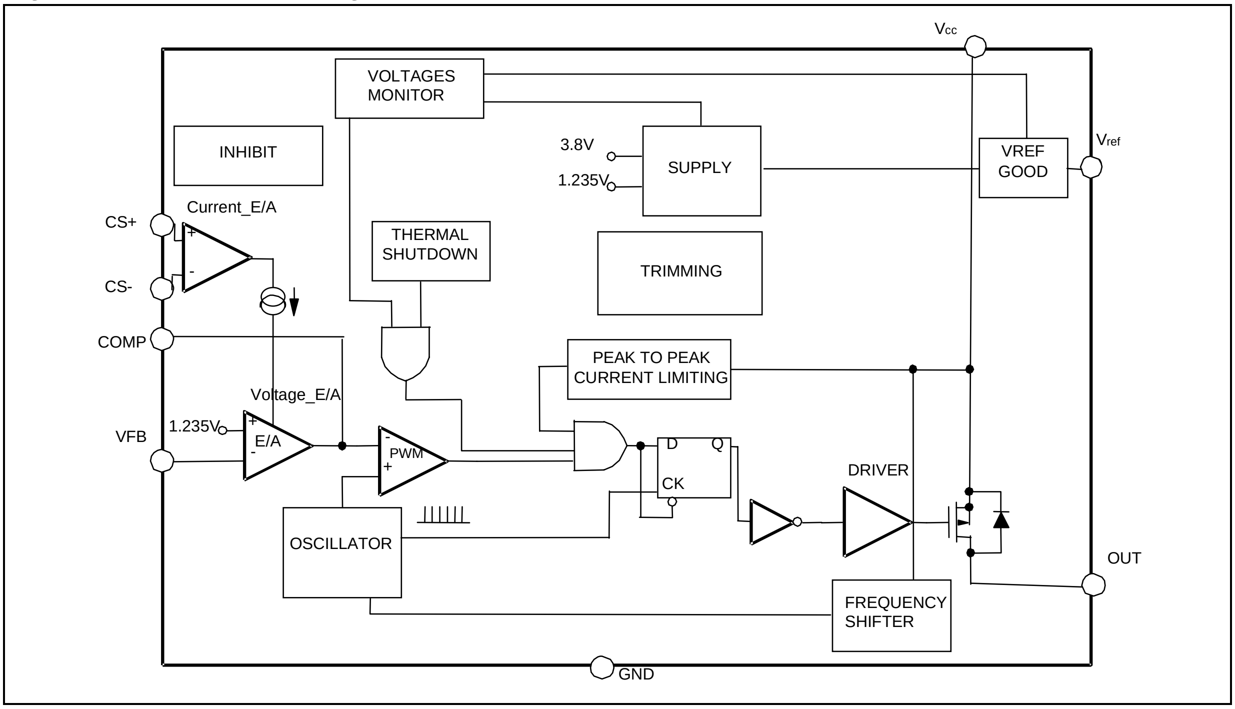


Table 5. Electrical Characteristcs

(T_j = 25°C, V_{CC} = 12V, unless otherwise specified.) (•) Specification Referred to Tj from 0 to 125°C.

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
V_{CC}	Operating input voltage range	V_O = 1.235V; I_O = 1A	•	8		36	V
V_d	Dropout voltage	V_{CC} = 8V; I_O = 1A	•		0.25	0.5	V
I_O	Operating charging current	R_{sense} = 0.1Ω		0.95	1	1.05	A
			•	0.92		1.08	A
I_l	Maximum limiting current	V_{CC} = 8V to 36V	•	2	2.5	3.2	A
fs	Switching frequency		•	212	250	287	kHz
				225	250	275	kHz
d	Duty cycle			0		100	%
DYNAMIC CHARACTERISTICS							
V_5	Voltage feedback (FB)	8V < V_{CC} < 36V, 20mA < I_O < 1A		1.21	1.235	1.259	V
			•	1.198	1.235	1.272	V
η	Efficiency	V_O = 5V, V_{CC} = 12V			90		%
DC CHARACTERISTICS							
I_{qop}	Total operating quiescent current		•		3	5	mA
I_q	Quiescent current	Duty cycle = 0; VFB = 1.5V				3	mA

Table 5. Electrical Characteristcs (continued)
(T_j = 25°C, V_{CC} = 12V, unless otherwise specified.) (•) Specification Referred to Tj from 0 to 125°C.

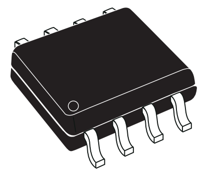
Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
VOLTAGE ERROR AMPLIFIER							
V_{OH}	High level output voltage	V_{FB} = 1V		3.6			V
V_{OL}	Low level output voltage	V_{FB} = 1.5				0.4	V
$I_{o\ source}$	Source output current	V_{comp} = 1.9V; V_{FB} = 1V		200	300		µA
$I_{o\ sink}$	Sink output current	V_{comp} = 1.9V; V_{FB} = 1.5V		1	1.5		mA
I_b	Source bias current				2.5	4	µA
	DC open loop gain	R_L = 0		50	58		dB
g_m	Transconductance	I_{comp} = -0.1 to 0.1mA V_{comp} = 1.9V			2.3		mS
CURRENT ERROR AMPLIFIER							
V_{offs}	Input offset voltage	V_{CS-} = 1.8V; V_{CS+} = V_{comp}		95	100	105	mV
I_{CS+}	CS+ Output Current	I_O = 1A, R_{sense} = 100mΩ V_{out} < V_{CC} -2V			1.5	3	µA
I_{CS-}	CS- Output Current	I_O = 1A, R_{sense} = 100mΩ V_{out} < V_{CC} -2V			1.5	3	µA
REFERENCE SECTION							
	Reference Voltage			3.234	3.3	3.366	V
		I_{REF} = 0 to 5mA V_{CC} = 8V to 36V	•	3.2	3.3	3.399	V
	Line Regulation	I_{REF} = 0mA V_{CC} = 8V to 36V			5	10	mV
	Load Regulation	I_{REF} = 0 to 5mA			8	15	mV
	Short Circuit Current			10			mA

Figure 5. SO-8 Mechanical Data & Package Dimensions

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.004		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D (1)	4.80		5.00	0.189		0.197
E	3.80		4.00	0.15		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	0° (min.), 8° (max.)					
ddd			0.10			0.004

Note: (1) Dimensions D does not include mold flash, protrusions or gate burrs. Mold flash, potrusions or gate burrs shall not exceed 0.15mm (.006inch) in total (both side).

OUTLINE AND MECHANICAL DATA



SO-8

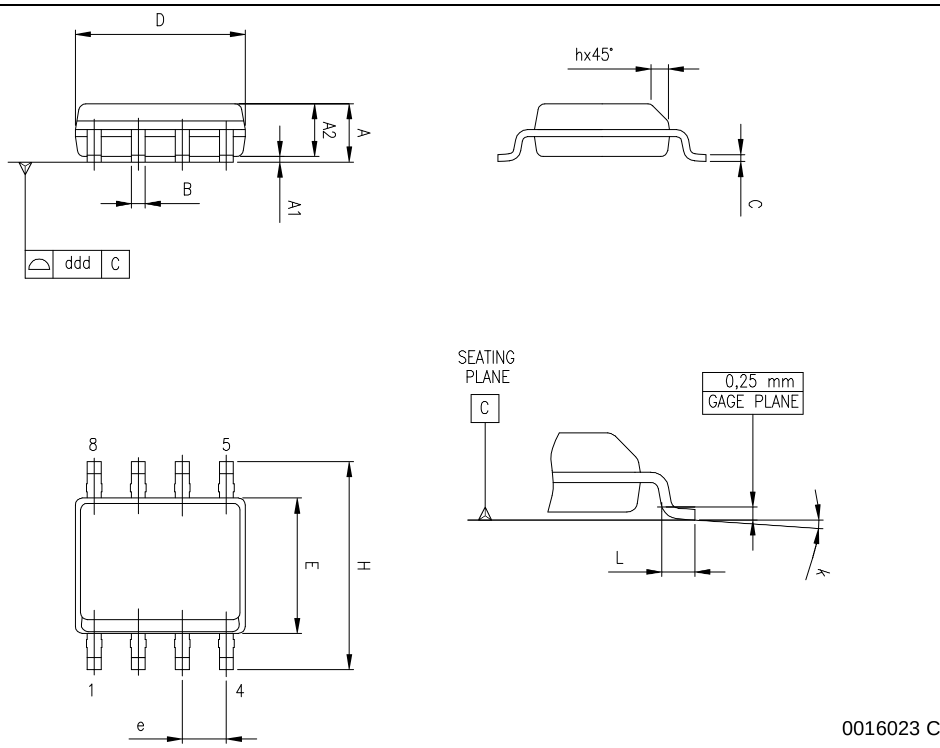


Table 6. Revision History

Date	Revision	Description of Changes
January 2004	7	Technical Migration from ST-PRESS to EDOCS.
October 2004	8	Changed Style Look & Feel. Changed Iq value in Table 5 page 3/7 from 2.7mA max. to 3.0mA max.