L6902

Up to 1 A switching regulator with adjustable current limit

Features

- Up to 1 A output current
- Operating input voltage from 8 V to 36 V
- Precise 3.3 V (±2%) reference voltage
- 5 % output current accuracy
- Output voltage adjustable from 1.235 V to 34 V
- 250 kHz internally fixed frequency
- Voltage feedforward
- Zero load current operation
- Adjustable current limit
- Protection against feedback Disconnection
- Thermal shutdown

Applications

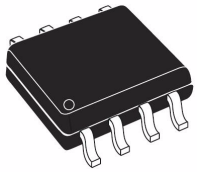
- Chargers for NiCd, NiMH batteries and preregulator for lithium-ion batteries
- Adjustable current generator
- Simple step-down converters with adjustable current limit
- Battery equipped systems
- Distributed power supply
- Mobile PC and subnotebook

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.



SO-8

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 250 mΩ assures high efficiency and a minimum dropout even at high output current level. The internal limiting current (latched function) of typical value of 2.5 A 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.

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.

Table 1. Device summary

Order codes	Package	Packaging
L6902D	SO-8	Tube
L6902D013TR		Tape and reel

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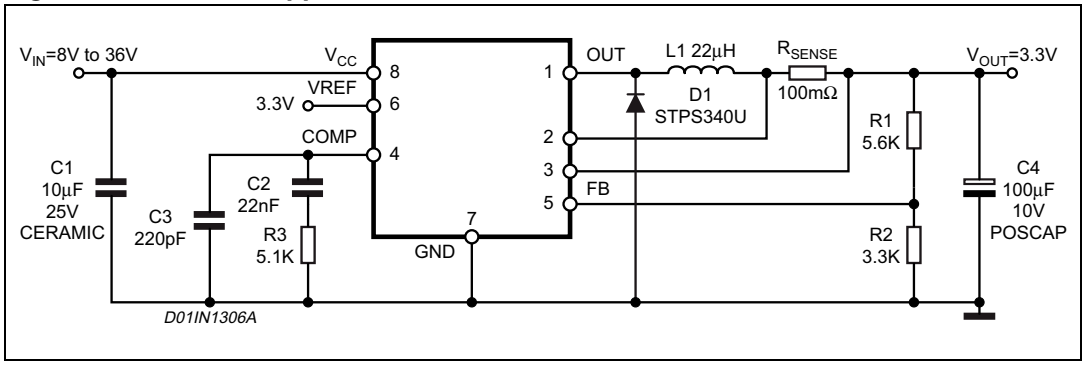
1 Test and application circuit

Figure 1. Test and application circuit



2 Pin connection

Figure 2. Pin connection

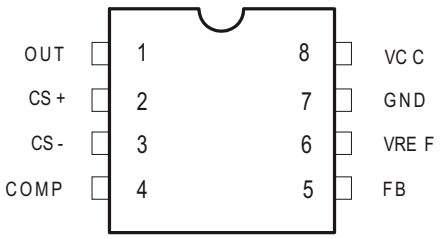


Table 2. Pin description

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 1.235 V. 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	VREF	3.3 V VREF. No cap is need for stability.
7	GND	Ground
8	VCC	Unregulated DC input voltage.

3 Maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_8	Input voltage	40	V
V_1	Output DC voltage output peak voltage at t = 0.1 µs	-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 VCC	V
P_{tot}	Power dissipation at $T_{amb} \leq 70$ °C	0.7	W
T_j	Operating junction temperature range	-40 to 150	°C
T_{stg}	Storage temperature range	-55 to 150	°C

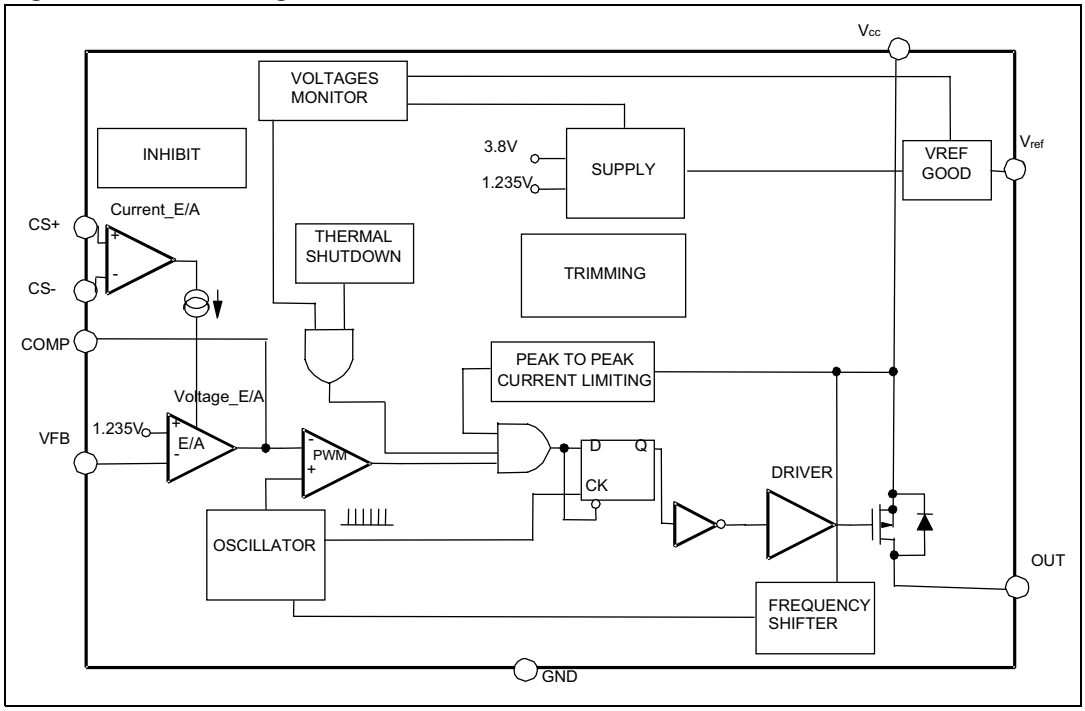
Table 4. Thermal data

Symbol	Parameter	Value	Unit
Rth j-amb	Thermal Resistance Junction to Ambient Max.	110 (1)	°C/W

1. Package mounted on board.

4 Internal block diagram

Figure 3. Block diagram



5 Electrical characteristics

T_j = 25°C, V_{CC} = 12V, unless otherwise specified.

Table 5. Electrical characteristics

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
			(1)	0.92		1.08	A
I_l	Maximum limiting current	V_{CC} = 8V to 36V		2	2.5	3.2	A
f_s	Switching frequency		(1)	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)	1.198	1.235	1.272	V
η	Efficiency	V_O = 5V, V_{CC} = 12V			90		%
DC characteristics							
I_{qop}	Total operating quiescent current		(1)		3	5	mA
I_q	Quiescent current	Duty cycle = 0; VFB = 1.5V				3	mA
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	Vcomp = 1.9V; VFB = 1V		200	300		µA
$I_{o\ sink}$	Sink output current	Vcomp = 1.9V; VFB = 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+} = Vcomp		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

Table 5. Electrical characteristics (continued)

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
Reference section							
	Reference voltage			3.234	3.3	3.366	V
		I_{REF} = 0 to 5mA V_{CC} = 8V to 36V	(1)	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 5 mA			8	15	mV
	Short circuit current			10			mA

1. Specification Referred to TJ from -40 to 125°C. Specification over the -40 to +125 TJ Temperature range are assured by design, characterization and statistical correlation

6 Package mechanical data

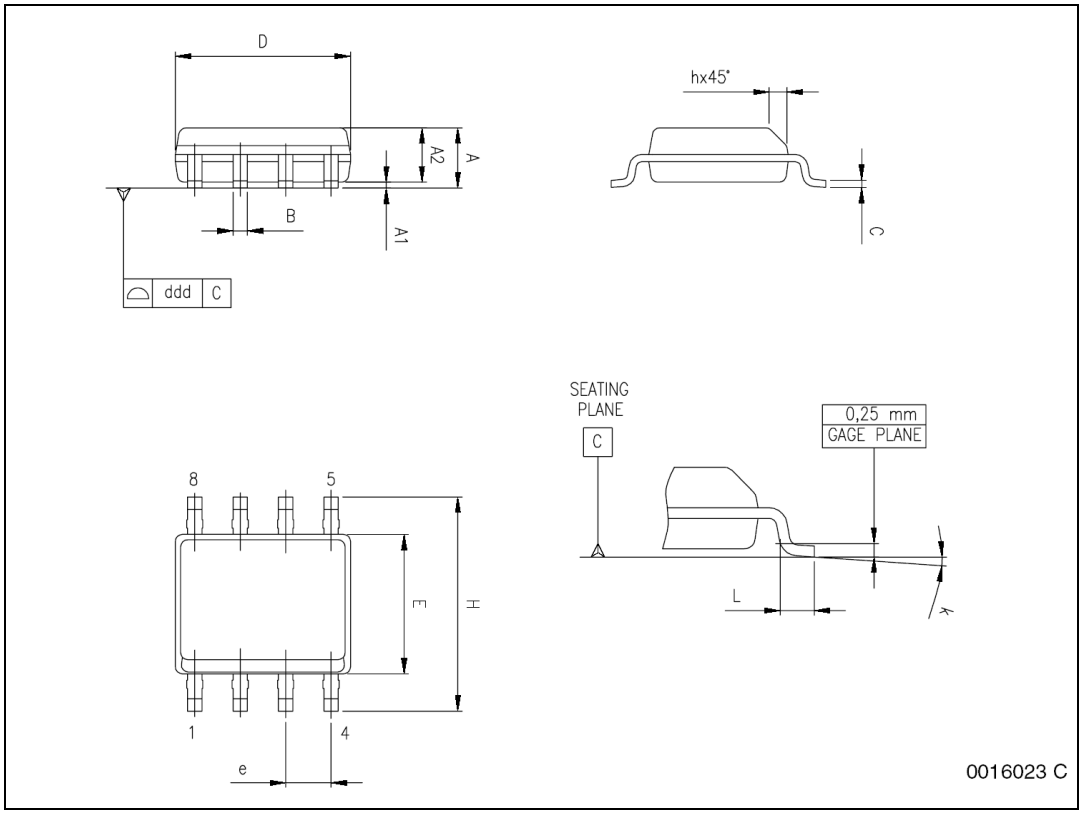
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

Table 1. SO-8 mechanical data

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

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).

Figure 4. Package dimensions



7 Revision history

Table 6. Document revision history

Date	Revision	Changes
January 2004	7	Technical migration from ST-PRESS to EDOCS.
October 2004	8	Changed style look and feel.
26-Nov-2010	9	Updated *Note 1 on page 7*