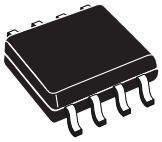
A6902D

Up to 1 A step down switching regulator with adjustable current limit for automotive applications

Features

- Qualified following the AEC-Q100 requirements (see PPAP for more details)
- Up to 1 A DC output current
- Operating input voltage from 8 V to 36 V
- Output voltage adjustable from 1.235 V to 35 V
- Precise 3.3 V (±2 %) reference voltage
- 250 kHz Internally fixed frequency
- Voltage feedforward
- Zero-load current operation
- Internal current limiting
- Protection against feedback disconnection
- Thermal shutdown

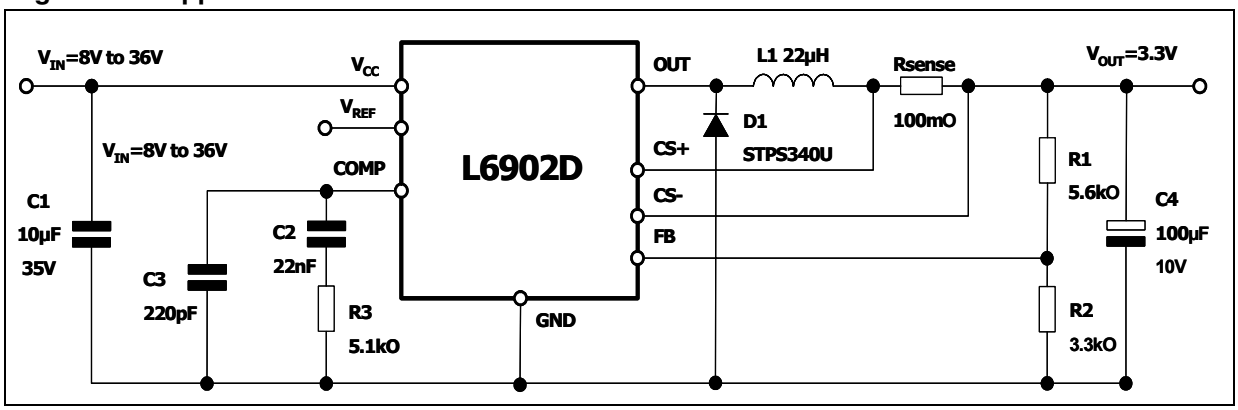


SO-8

Applications

- Automotive applications
- Adjustable current generator
- Simple step-down converters with adjustable current limit

Figure 1. Application schematic



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1 Description

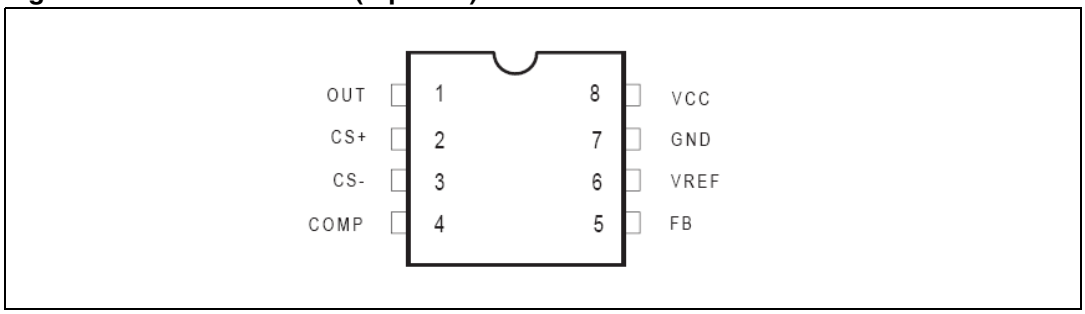
The A6902D is a complete and simple step down switching regulator with adjustable current limit. Based on a voltage mode structure it integrates a current error amplifier to have a constant voltage and constant current control. By means of an on board current sense resistor and the availability of the current sense pins (both compatible to Vcc and for Cs- compatible with GND too) a current limit programming is very simple and accurate. 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 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 250 kHz, and the SO-8 package pin allow to built an ultra compact DC/DC converter with a minimum board space.

2 Pin connection

2.1 Pin connection

Figure 2. Pin connection (top view)



2.2 Pin description

Table 1. Pin description

N°	Pin	Description
1	OUT	Regulator 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 for frequency compensation.
5	FB	Feedback input. Connecting directly to this pin results in an output voltage of 1.23 V. An extenal resistive divider is required for higher output voltages.
6	V_{REF}	3.3 V reference voltage. No cap is need for stability.
7	GND	Ground.
8	VCC	Unregulated DC input voltage.

3 Electrical data

3.1 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_8	Input voltage	40	V
V_1	OUT pin DC voltage OUT pin peak voltage at Δt = 0.1 µs	-1 to 40 -5 to 40	V V
I_1	Maximum output current	int. limit.	
V_4 , V_5	Analog pins	4	V
V_2, V_3	Analog pins	-0.3 to V_{CC}	V
P_{TOT}	Power dissipation at $T_A \leq 70$ °C	0.7	W
T_J	Operating junction temperature range	-40 to 150	°C
T_{STG}	Storage temperature range	-55 to 150	°C

3.2 Thermal data

Table 3. Thermal data

Symbol	Parameter	SO8	Unit
R_{thJA}	Maximum thermal resistance junction-ambient	110 (1)	°C/W

1. Package mounted on board

4 Electrical characteristics

T_J = -40 to 125 °C, V_{CC} = 12 V, unless otherwise specified

Table 4. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{CC}	Operating input voltage range	V_0 = 1.235 V; I_0 = 2 A	8		36	V
$R_{DS(on)}$	MOSFET on resistance			0.250	0.5	Ω
I_L	Maximum limiting current (1)	V_{CC} = 8.5 V	1.8	2.5	3.2	A
		V_{CC} = 8.5 V, T_J = 25 °C	2	2.5	3.2	
f_{SW}	Switching frequency		212	250	280	kHz
	Duty cycle		0		100	%
Dynamic characteristics (see test circuit)						
V_5	Voltage feedback	8 V < V_{CC} < 36 V, 20 mA < I_0 < 1 A	1.198	1.235	1.272	V
η	Efficiency	V_0 = 5 V, V_{CC} = 12 V		90		%
DC characteristics						
I_{qop}	Total operating quiescent current			3	5	mA
I_q	Quiescent current	Duty cycle = 0; V_{FB} = 1.5 V			2.7	mA
Error amplifier						
V_{OH}	High level output voltage	V_{FB}=1 V	3.6			V
V_{OL}	Low level output voltage	V_{FB}=1.5 V			0.4	V
$I_{o\ source}$	Source output current	V_{COMP} = 1.9 V; V_{FB} = 1 V	160	300		µA
$I_{o\ sink}$	Sink output current	V_{COMP} = 1.9 V; V_{FB} = 1.5 V	1	1.5		mA
I_b	Source bias current			2.5	4	µA
	DC open loop gain	RL= ∞	50	58		dB
gm	Transconductance	I_{COMP} = -0.1 mA to 0.1 mA; V_{COMP} = 1.9 V		2.3		mS
V_{OFFS}	Input offset voltage	V_{CS-} = 1.8 V; V_{CS+} = V_{comp}	90	100	110	mV
I_{CS+}	CS+ output current	I_0 =1 A; R_{SENSE} =100 mΩ; V_{OUT} < V_{CC}-2 V		1.5	3	µA
I_{CS-}	CS- output current	I_0 =1A; R_{SENSE} =100 mΩ; V_{OUT} < V_{CC}-2 V		1.5	3	µA

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Reference section						
	Reference voltage	I_{REF} = 0 to 5 mA V_{CC} = 8 V to 36 V	3.2	3.3	3.399	V
	Line regulation	I_{REF} = 0mA V_{CC} = 8 V to 36 V		5	10	mV
	Load regulation	I_{REF} = 0 to 5 mA		8	15	mV
	Short circuit current		5	18	35	mA

1. With T_J = 85 °C, I_{lim_min} = 2 A, assured by design, characterization and statistical correlation.

5 Package mechanical data

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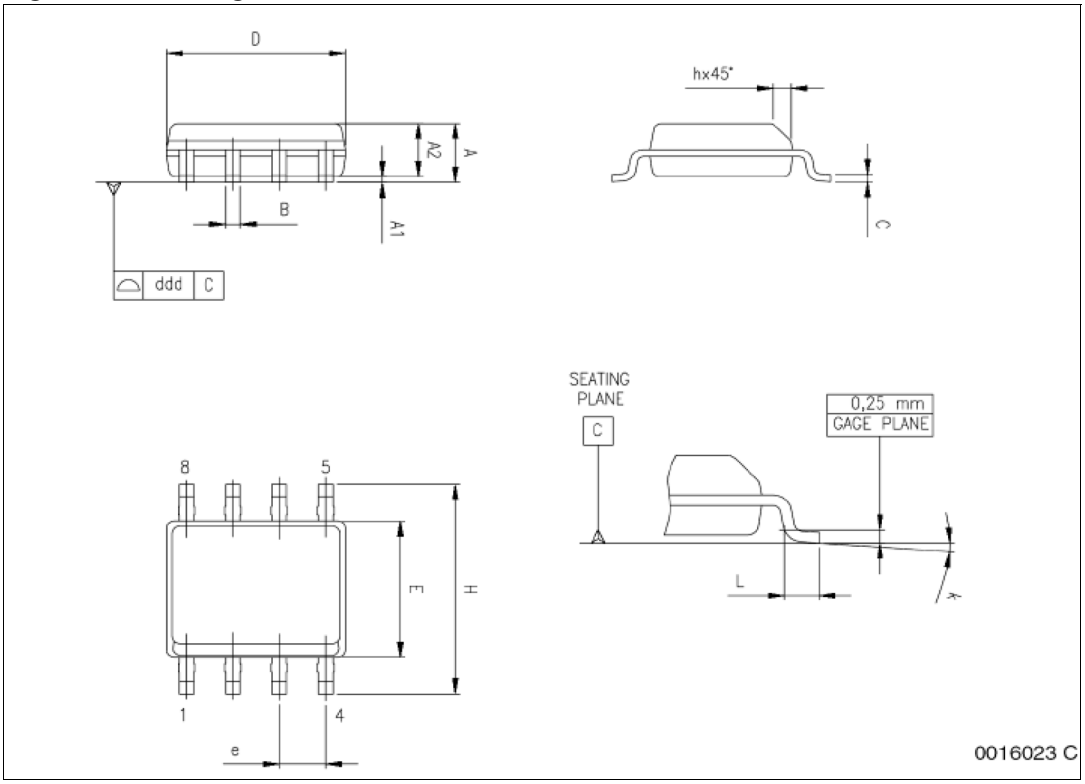
Table 5. SO-8 mechanical data

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. 1. Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15 mm (0.006 inch) in total (both side).

Figure 3. Package dimensions



6 Order codes

Table 6. Ordering information

Order codes	Package	Packaging
A6902D	SO-8	Tube
A6902D13TR		Tape and reel

7 Revision history

Table 7. Document revision history

Date	Revision	Changes
02-Oct-2007	1	Initial release
5-Nov-2007	2	Updated: *Table 4 on page 6*
2-May-2008	3	Updated: *Table 4 on page 6*
28-Aug-2008	4	Updated: Coverpage and *Table 4 on page 6*
23-Apr-2009	5	Updated first feature in coverpage

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