

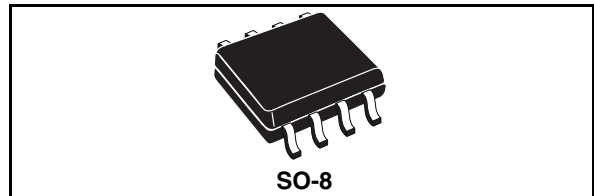


A6902D

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

Features

- Qualified following the AEC-Q100 requirements (temperature Grade 3), see PPAP for more details.
- Temperature range -40°C to 85°C
- Up to 1A DC output current
- Operating input voltage from 8V to 36V
- Output voltage adjustable from 1.235V to 35V
- Precise 3.3V ($\pm 2\%$) reference voltage
- 250kHz Internally fixed frequency
- Voltage feedforward
- Zero load current operation
- Internal current limiting
- Protection against feedback disconnection
- Thermal shutdown



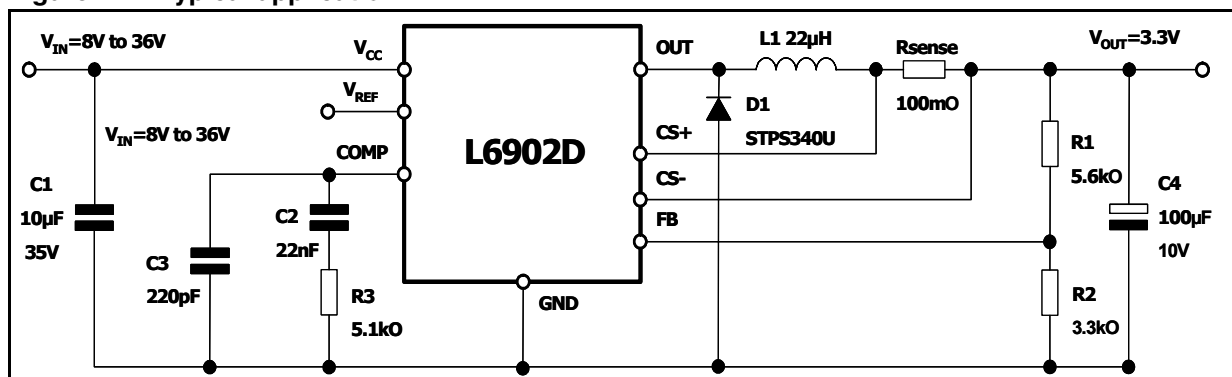
Description

The A6902D is a complete and simple step down switching regulator with adjustable current limit, capable to deliver up to 1A at output voltages from 1.2V to 35V. The internal robust P-channel DMOS transistor with a typical of 250m Ω assures high efficiency and a minimum dropout even at high output current level. 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.

Applications

- Dedicated to automotive applications
- Adjustable current generator
- Simple step-down converters with adjustable current limit

Figure 1. Typical application



Contents

1	Device summary	3
2	Pin settings	4
	2.1 Pin connection	4
	2.2 Pin description	4
3	Electrical data	5
	3.1 Maximum ratings	5
	3.2 Thermal data	5
4	Electrical characteristics	6
5	Package mechanical data	8
6	Order codes	10
7	Revision history	11

1 Device summary

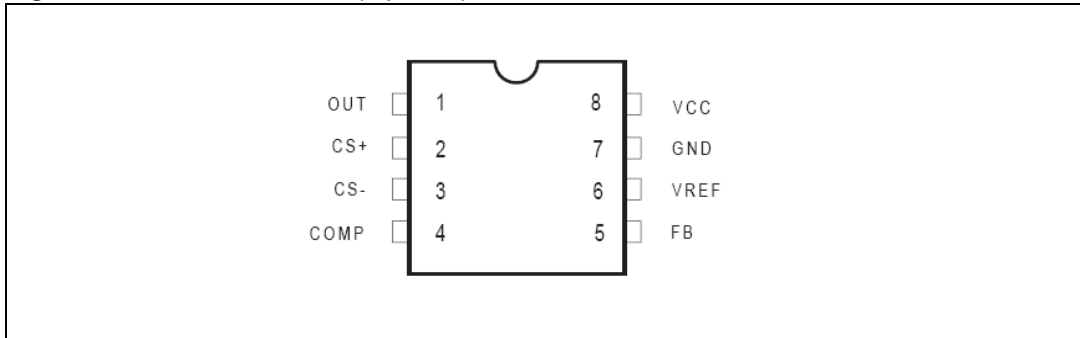
The A6902D is a complete and simple step down switching regulator with adjustable current limit. Based on a voltage mode structure it integrates a current error amplifier to have a constant voltage and constant current control. By means of an on board current sense resistor and the availability of the 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 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.

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.

2 Pin settings

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 1.23V. An external resistive divider is required for higher output voltages.
6	V _{REF}	3.3V 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	-1 to 40	V
	OUT pin peak voltage at $\Delta t=0.1\mu s$	-5 to 40	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 $T_A \leq 70^\circ C$	0.7	W
T_j	Operating junction temperature range	-40 to 150	$^\circ C$
T_{STG}	Storage temperature range	-55 to 150	$^\circ C$

3.2 Thermal data

Table 3. Thermal data

Symbol	Parameter	SO-8	Unit
R_{thJA}	Maximum thermal resistance junction-ambient	110 ⁽¹⁾	$^\circ C/W$

1. Package mounted on board

4 Electrical characteristics

Table 4. Electrical characteristics ($T_J = -40$ to 85°C , $V_{CC} = 12\text{V}$, unless otherwise specified)

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
V_{CC}	Operating input voltage range	$V_0 = 1.235\text{V}$; $I_0 = 2\text{A}$	8		36	V
$R_{DS(on)}$	Mosfet on resistance			0.250	0.5	Ω
I_L	Maximum limiting current	$V_{CC} = 8.5\text{V}$	2	2.5	3.2	A
I_0	Operating charging current	$R_{sense} = 0.1\Omega$	0.92		1.08	A
f_{SW}	Switching frequency		212	250	280	kHz
	Duty cycle		0		100	%
Dynamic characteristics (see test circuit).						
V_5	Voltage feedback	$8\text{V} < V_{CC} < 36\text{V}$, $20\text{mA} < I_0 < 1\text{A}$	1.198	1.235	1.272	V
η	Efficiency	$V_0 = 5\text{V}$, $V_{CC} = 12\text{V}$		90		%
DC characteristics						
I_{qop}	Total operating quiescent current			3	5	mA
I_q	Quiescent current	Duty cycle = 0; $V_{FB} = 1.5\text{V}$			2.7	mA
Error amplifier						
V_{OH}	High level output voltage	$V_{FB} = 1\text{V}$	3.6			V
V_{OL}	Low level output voltage	$V_{FB} = 1.5\text{V}$			0.4	V
$I_{o\ source}$	Source output current	$V_{COMP} = 1.9\text{V}$; $V_{FB} = 1\text{V}$	190	300		μA
$I_{o\ sink}$	Sink output current	$V_{COMP} = 1.9\text{V}$; $V_{FB} = 1.5\text{V}$	1	1.5		mA
I_b	Source bias current			2.5	4	μA
	DC open loop gain	$R_L = \infty$	50	58		dB
g_m	Transconductance	$I_{COMP} = -0.1\text{mA}$ to 0.1mA ; $V_{COMP} = 1.9\text{V}$		2.3		mS
V_{OFFS}	Input offset voltage	$V_{CS-} = 1.8\text{V}$; $V_{CS+} =$ V_{comp}	90	100	110	mV
I_{CS+}	CS+ output current	$I_0 = 1\text{A}$; R_{SENSE} $= 100\text{m}\Omega$; $V_{OUT} < V_{CC} - 2\text{V}$		1.5	3	μA
I_{CS-}	CS- output current	$I_0 = 1\text{A}$; R_{SENSE} $= 100\text{m}\Omega$; $V_{OUT} < V_{CC} - 2\text{V}$		1.5	3	μA

Table 4. Electrical characteristics ($T_J = -40$ to 85°C , $V_{CC} = 12\text{V}$, unless otherwise specified)

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

5 Package mechanical data

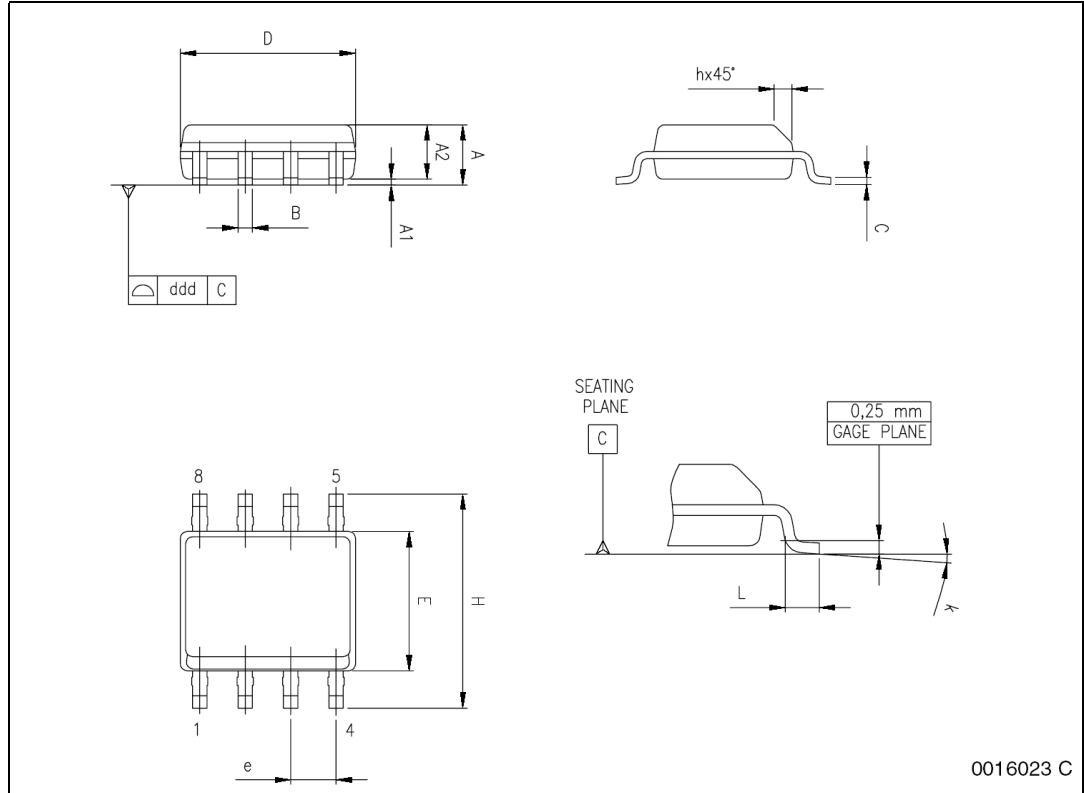
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

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

Figure 3. Package dimensions



6 Order codes

Table 6. Order code

Order code	Package	Packing
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

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