



L6902D

UP TO 1A SWITCHING REGULATOR WITH ADJUSTABLE CURRENT LIMIT

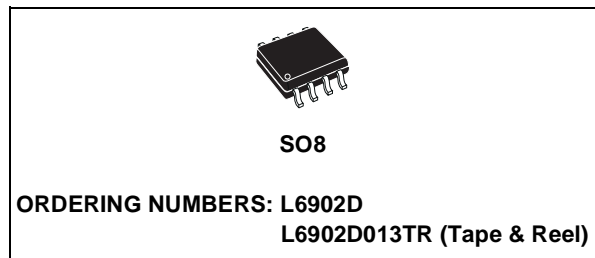
- UP TO 1A OUTPUT CURRENT
- OPERATING INPUT VOLTAGE FROM 8V TO 36V
- PRECISE 3.3V ($\pm 2\%$) REFERENCE VOLTAGE
- 5% OUTPUT CURRENT ACCURACY
- OUTPUT VOLTAGE ADJUSTABLE FROM 1.235V TO 34V
- 250KHz INTERNALLY FIXED FREQUENCY
- VOLTAGE FEEDFORWARD
- ZERO LOAD CURRENT OPERATION
- ADJUSTABLE CURRENT LIMIT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

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

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 cur-



rent error amplifier to have a constant voltage and constant current control.

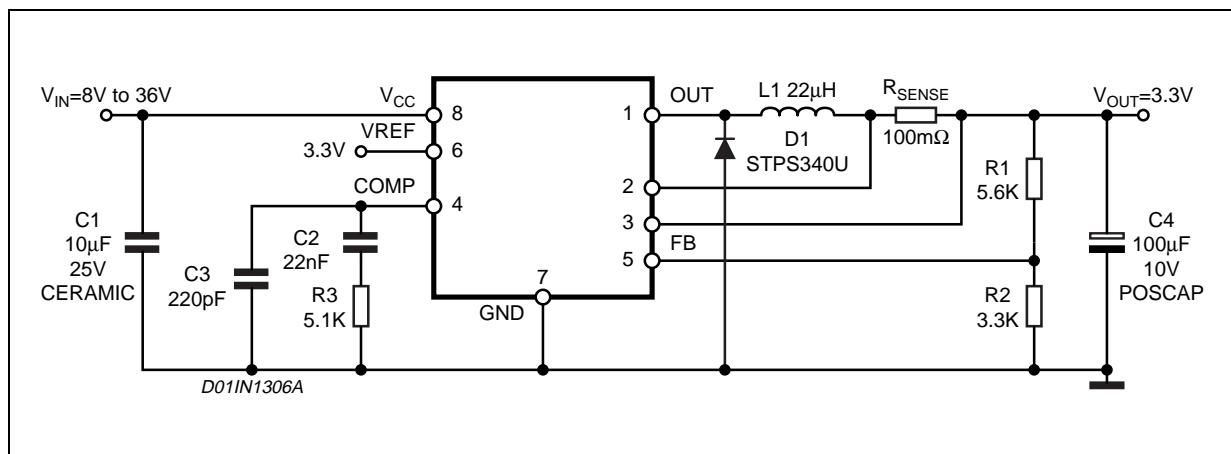
By means of an on board current sense resistor and the availability of the current sense pins (both compatible to Vcc and for Cs- compatible with GND too) a current limit programming is very simple and accurate ($\pm 5\%$). Moreover constant current control can be used to charge NiMH and NiCd batteries.

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 250m Ω assures high efficiency and a minimal 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.

TEST AND APPLICATION CIRCUIT



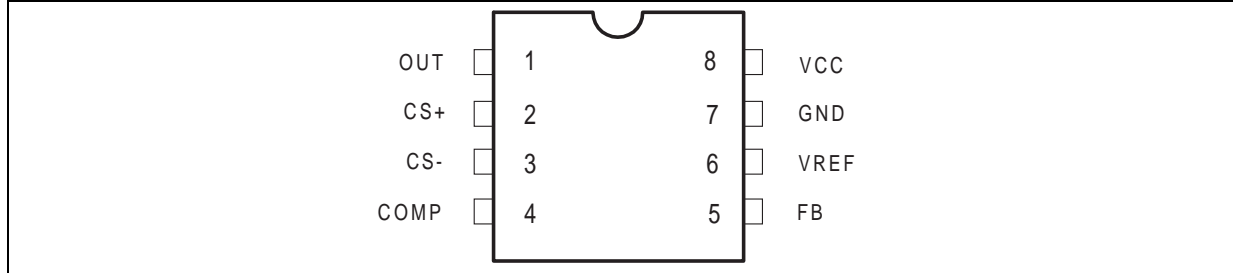
L6902D

DESCRIPTION (Continued)

Other protections beside thermal shutdown complete the device for a safe and reliable application: overvoltage protection, frequency fallback 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.

PIN CONNECTION



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

THERMAL DATA

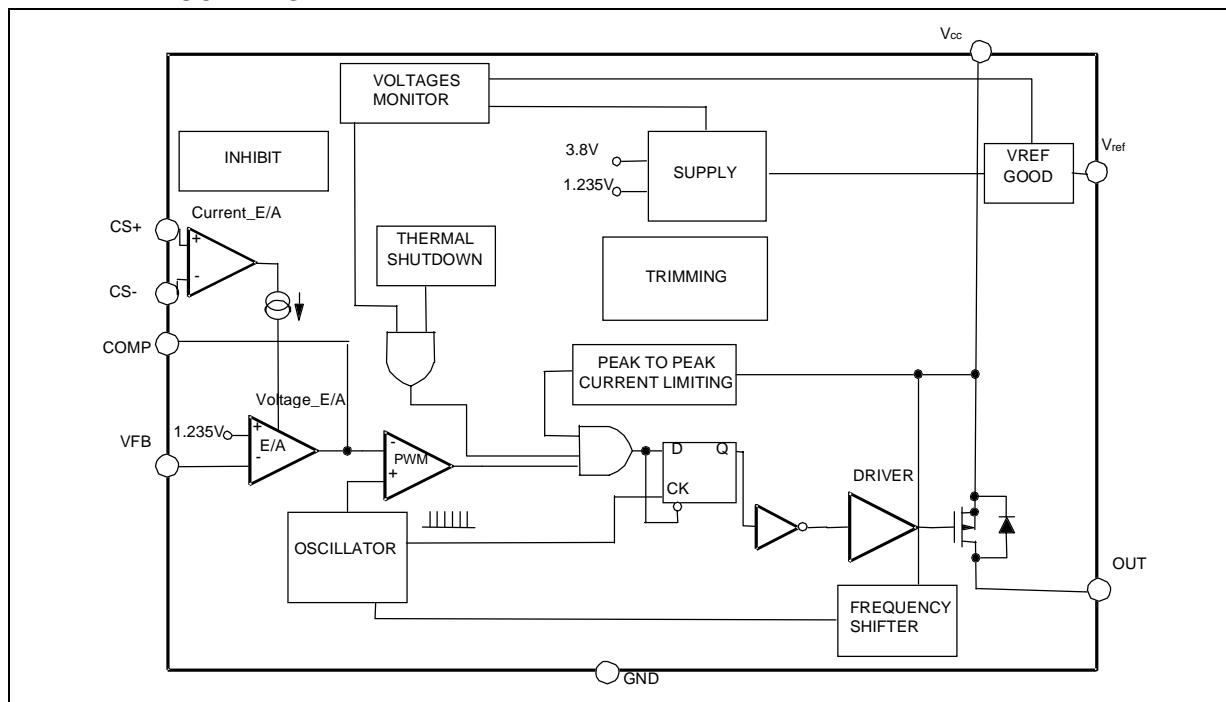
| Symbol | Parameter | Value | Unit |
|-----------------------|---|---------|------|
| R _{th j-amb} | Thermal Resistance Junction to Ambient Max. | 110 (*) | °C/W |

(*) Package mounted on board.

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---------------------------------|---|--------------------------|--------|
| V ₈ | Input Voltage | 40 | V |
| V ₁ | Output DC voltage Output 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} ≤ 70 °C | 0.7 | W |
| T _j | Operating junction temperature range | -40 to 150 | °C |
| T _{stg} | Storage temperature range | -55 to 150 | °C |

INTERNAL BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS

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

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit | |
|--------------------------------|-----------------------------------|--|------|-------|-------|-------|-----|
| V_{CC} | Operating input voltage range | $V_O = 1.235\text{V}$; $I_O = 1\text{A}$ | • 8 | | 36 | V | |
| V_d | Dropout voltage | $V_{CC} = 8\text{V}$; $I_O = 1\text{A}$ | • | 0.25 | 0.5 | V | |
| I_O | Operating charging current | $R_{\text{sense}} = 0.1\Omega$ | • | 0.95 | 1 | 1.05 | A |
| | | | • | 0.92 | | 1.08 | A |
| I_l | Maximum limiting current | $V_{CC} = 8\text{V}$ to 36V | • 2 | 2.5 | 3.2 | A | |
| f_s | Switching frequency | | • | 212 | 250 | 287 | kHz |
| | | | | | 225 | 250 | 275 |
| d | Duty cycle | | | 0 | 100 | % | |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| V_5 | Voltage feedback (FB) | $8\text{V} < V_{CC} < 36\text{V}$, $20\text{mA} < I_O < 1\text{A}$ | | 1.21 | 1.235 | 1.259 | V |
| | | | • | 1.198 | 1.235 | 1.272 | V |
| η | Efficiency | $V_O = 5\text{V}$, $V_{CC} = 12\text{V}$ | | 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 | |

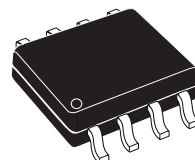
ELECTRICAL CHARACTERISTICS (continued)

(T_j = 25°C, V_{CC} = 12V, unless otherwise specified.) (*) Specification Referred to T_j 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} | 90 | 100 | 110 | 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 | |

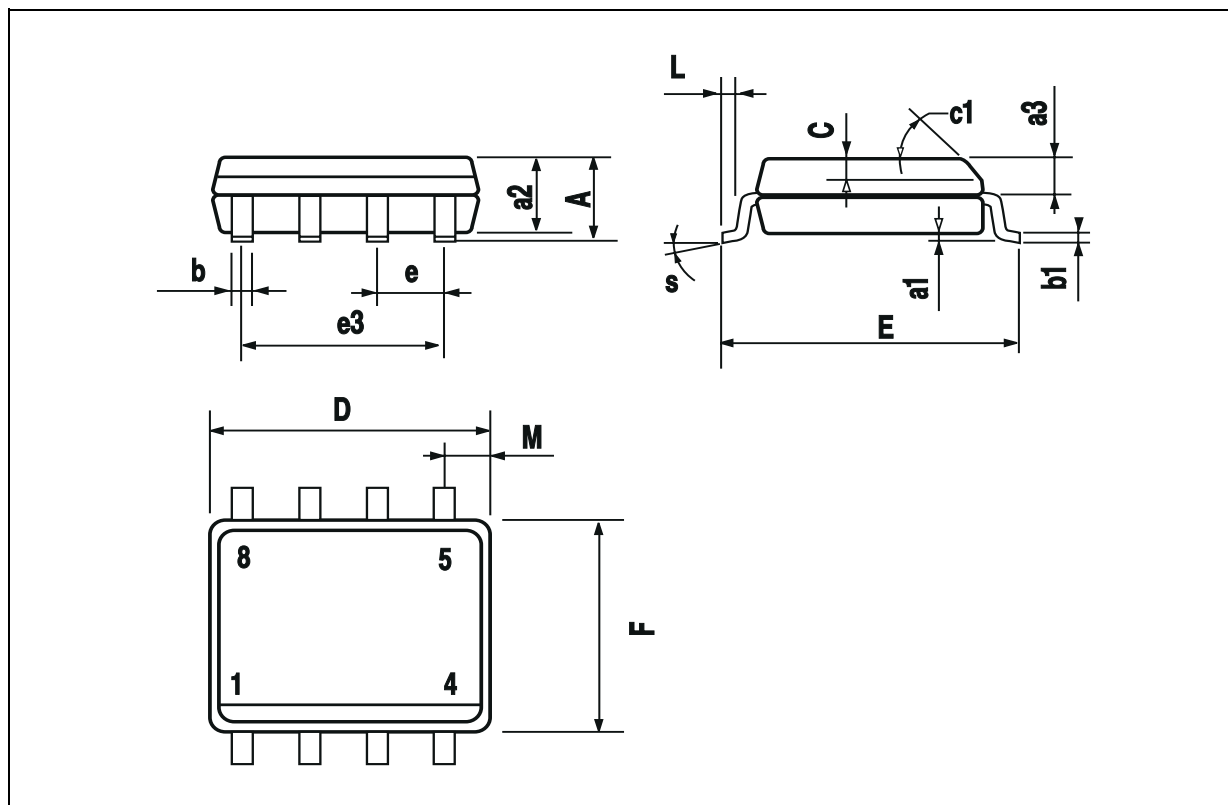
| DIM. | mm | | | inch | | |
|-------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.65 | | | 0.065 |
| a3 | 0.65 | | 0.85 | 0.026 | | 0.033 |
| b | 0.35 | | 0.48 | 0.014 | | 0.019 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | | 0.5 | 0.010 | | 0.020 |
| c1 | 45° (typ.) | | | | | |
| D (1) | 4.8 | | 5.0 | 0.189 | | 0.197 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F (1) | 3.8 | | 4.0 | 0.15 | | 0.157 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| M | | | 0.6 | | | 0.024 |
| S | 8° (max.) | | | | | |

OUTLINE AND MECHANICAL DATA



SO8

(1) D and F do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (.006inch).



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