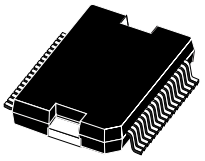
# L9352B

## Four channel valve driver

**Data Brief**

## Features

- Four low-side output driver with protection diagnostics.
  - 2 channels designed as conventional switch ($r_{ON}$ = 0.2 Ω typ.) with integrated 60 V Zener diodes clamp.
  - 2 current controlled channels ($r_{ON}$ = 0.2 Ω typ.) with current range from 0 mA to 2.25 A typ. with integrated recirculation diodes.
- Output slope control
- Short circuit protection
- Selective overtemperature shutdown
- Open load and over load current detection
- Ground and supply loss detection
- External clock control
- Recirculation path control
- Regulator drift detection
- Regulator error control
- Electrostatic discharge (ESD) protection



**PowerSO-36**

## Description

The L9352B is designed to drive inductive loads in low side configurations like hydraulic valves used in ABS/ESC systems.

Integrated active Zener diodes clamp (for channel1 and 2) or free wheeling diodes (for channel 3 and 4) allow the recirculation of the inductive loads.

All four channels are monitored with a status output. All wiring to the loads and supply pins of the device are controlled. The device is self-protected against short circuit at the outputs and overtemperature. For each channel, one independent push-pull status output is used for a parallel diagnostic function.

Channel 3 and 4 work as current controlled channels. The target value of the current is given by the duty cycle (DC) of the 2 kHz PWM input signal.

The output current is controlled through the output PWM of the power stage. The regulator limits of 10% or 90% are detected and monitored with the status signal. The current is measured during the recirculation phase of the load. Using an external clock frequency of 250 kHz, the PWM output frequancy is 3.9 kHz.

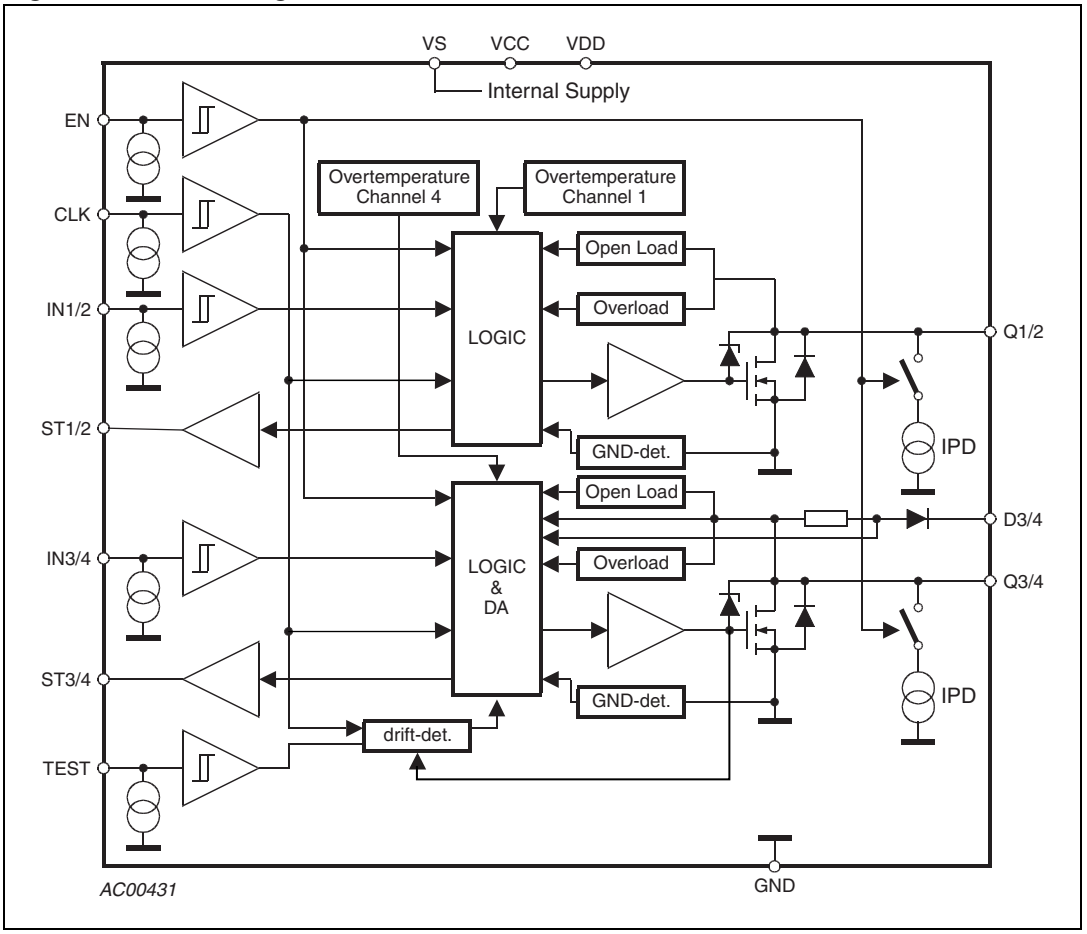
A digital PI (proportional and integrating) regulator is performed in order to internally control the target current basing on the load current measurements.

**Table 1. Device summary**

| Order code | Package | Packing |
|---|---|---|
| L9352B-LF | PowerSO-36 | Tray |
| L9352B-TR-LF | PowerSO-36 | Tape and reel |

# 1 Block diagram

**Figure 1. Block diagram**



# 2 Pins description

**Figure 2. Pins connection (top view)**

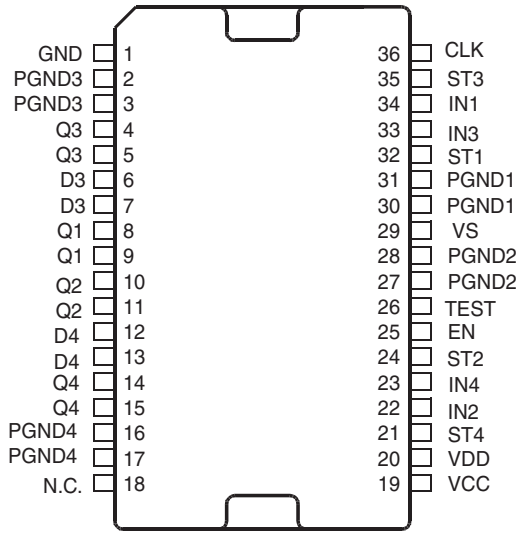



**Table 2. Pins description**

| N° | Pin | Description |
|---|---|---|
| 1 | GND | Logic ground |
| 2, 3 | PGND3 | Power ground - Channel 3 |
| 4, 5 | Q3 | Power output - Channel 3 |
| 6, 7 | D3 | Free-wheeling diode - Channel 3 |
| 8, 9 | Q1 | Power output - Channel 1 |
| 10, 11 | Q2 | Power output - Channel 2 |
| 12, 13 | D4 | Free-wheeling diode - Channel 4 |
| 14, 15 | Q4 | Power output - Channel 4 |
| 16, 17 | PGND4 | Power ground - Channel 4 |
| 18 | NC | Not Connected |
| 19 | VCC | 5 V supply |
| 20 | VDD | 5 V supply |
| 21 | ST4 | Status output - Channel 4 |
| 22 | IN2 | Control input - Channel 2 |
| 23 | IN4 | Control input - Channel 4 |
| 24 | ST2 | Status output - Channel 2 |
| 25 | EN | Enable input for all four channels |

Table 2. Pins description (continued)

| N° | Pin | Description |
|---|---|---|
| 26 | TEST | Enable input for drift detection |
| 27, 28 | PGND2 | Power ground - Channel 2 |
| 29 | VS | Supply voltage |
| 30, 31 | PGND1 | Power ground - Channel 1 |
| 32 | ST1 | Status output - Channel 1 |
| 33 | IN3 | Control input - Channel 3 |
| 34 | IN1 | Control input - Channel 1 |
| 35 | ST3 | Status output - Channel 3 |
| 36 | CLK | Clock input |

# 3 Electrical specifications

## 3.1 Absolute maximum ratings

**Table 3. Absolute maximum ratings**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_S$ | Supply voltage | | -0.3 | | 40 | V |
| $V_{CC}$, $V_{DD}$ | Supply voltage | | -0.3 | | 6 | V |
| $V_Q$ | Output voltage static | | | | 40 | V |
| $V_Q$ | Output voltage during clamping | t < 1 ms | | | 60 | V |
| $V_{IN}$, $V_{EN}$ | Input voltage IN1 to IN4, EN | $I_I$ < \|10\|mA | -1.5 | | 6 | V |
| $V_{CLK}$ | Input voltage CLK | | -1.5 | | 6 | V |
| $V_{ST}$ | Output voltage status | | -0.3 | | 6 | V |
| $V_D$ | Recirculation circuits D3, D4 | | | | 40 | V |
| $V_{DRmax}$ | Max. reverse breakdown voltage of free wheeling diodes D3, D4 | | | | 55 | V |
| $I_{Q1/2}$ | Output current for Q1 and Q2 | | >5 | | internal limited | A |
| $I_{Q3/4}$ | Output current for Q3 and Q4 | | >3 | | internal limited | A |
| $I_{Q1/2}$, $I_{PGND1/2}$ | Output current at reversal supply for Q1 and Q2 | | -4 | | | A |
| $I_{Q3/4}$, $I_{PGND3/4}$ | Output current at reversal supply for Q3 and Q4 | | -2 | | | A |
| $I_{ST}$ | Output current status pin | | -5 | | 5 | mA |
| $E_Q$ | Switch off energy for inductive loads | | | | 50 | mJ |

## 3.2 ESD susceptibility

**Table 4. Human body model**

| Pin | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| All pins | | ±2 | | | kV |
| Output pins (Qx, Dx) | vs. common GND (PGND1-4 + GND) | ±4 | | | kV |

# 4 Package information

In order to meet environmental requirements, ST (also) offers these devices in ECOPACK® packages. ECOPACK® packages are lead-free. 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.

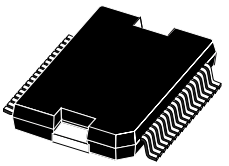
ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

**Figure 3. PowerSO-36 mechanical data and package dimensions**

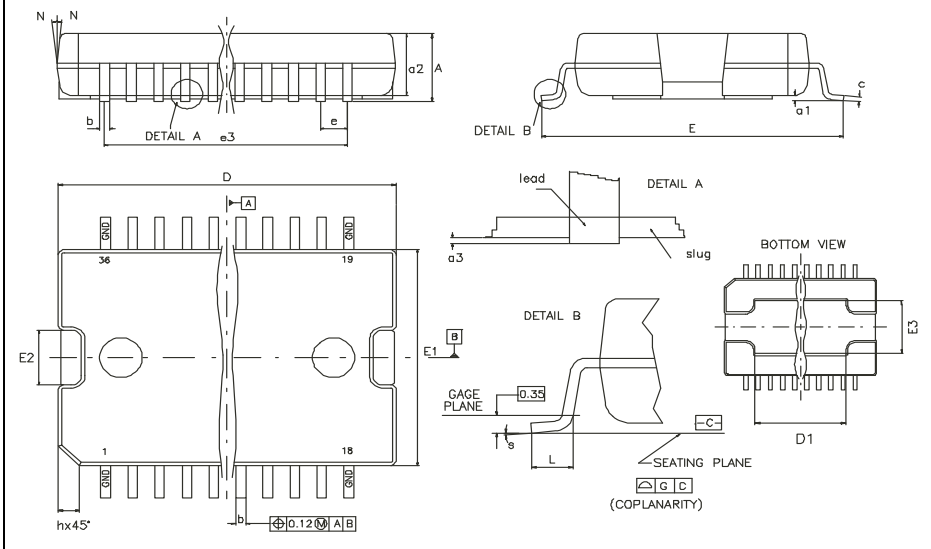
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 3.60 | | | 0.1417 |
| a1 | 0.10 | | 0.30 | 0.0039 | | 0.0118 |
| a2 | | | 3.30 | | | 0.1299 |
| a3 | 0 | | 0.10 | | | 0.0039 |
| b | 0.22 | | 0.38 | 0.0087 | | 0.0150 |
| c | 0.23 | | 0.32 | 0.0091 | | 0.0126 |
| D | 15.80 | | 16.00 | 0.6220 | | 0.6299 |
| D1 | 9.40 | | 9.80 | 0.3701 | | 0.3858 |
| E | 13.90 | | 14.5 | 0.5472 | | 0.5709 |
| E1 | 10.90 | | 11.10 | 0.4291 | | 0.4370 |
| E2 | | | 2.90 | | | 0.1142 |
| E3 | 5.80 | | 6.20 | 0.2283 | | 0.2441 |
| e | | 0.65 | | | 0.0256 | |
| e3 | | 11.05 | | | 0.4350 | |
| G | 0 | | 0.10 | | | 0.0039 |
| H | 15.50 | | 15.90 | 0.6102 | | 0.6260 |
| h | | | 1.10 | | | 0.0433 |
| L | 0.8 | | 1.10 | 0.0315 | | 0.0433 |
| N | 10° (max) | | | | | |
| s | 8° (max) | | | | | |

Note: "D and E1" do not include mold flash or protusions.
- Mold flash or protusions shall not exceed 0.15mm (0.006")
- Critical dimensions are "a3", "E" and "G".

**OUTLINE AND MECHANICAL DATA**



**PowerSO-36**



# 5 Revision history

Table 5. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 17-Jun-2008 | 1 | Initial release. |
| 17-Sep-2013 | 2 | Updated Disclaimer. |

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