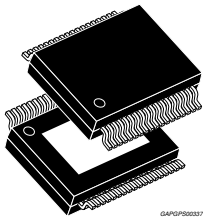
# L9301

# Octal low side driver or quad low side plus quad high side driver

**Data brief**



**PowerSSO36**

## Features

- Eight integrated PowerMOS configurable as:
  - 8 low side ON-OFF with $R_{ON(max)}$ = 0.3 Ω @ $T_j$ = 175 °C
  - High/low side PWM with $R_{ON(max)}$ = 0.6 Ω @ $T_j$ = 175 °C and 4 Low side with $R_{ON(max)}$ = 0.3 Ω @ $T_j$ = 175 °C
- Operating battery supply voltage 5 V to 18 V
- Operating $V_{dd}$ supply voltage 4.75 V to 5.25 V
- Logic inputs TTL/CMOS-compatible
- Output voltage clamping 37 V typ. in low-side configuration
- SPI interface for outputs control and for diagnosis data communication
- Additional PWM inputs for 8 outputs
- Over temperature protection
- Open load, short to GND, short to VB
- Overcurrent diagnostics in latched or unlatched mode for each channel
- Controlled SR for improved EMC behavior

## Description

The L9301 is a SPI (Serial Peripheral Interface) controlled octal channel with 4 high/low and 4 low side drivers with the possibility to use four integrated PowerMOS as recirculation diodes for PWM load driving.

L9301 contains 12 PowerMOS: 4 configurable High/Low side drivers with $R_{onmax}$ = 0.6 Ω (DRN1-4, SRC1-4), 4 low side drivers with $R_{onmax}$ = 0.6 Ω (OUT1-4) and 4 low side drivers with $R_{onmax}$ = 0.3 Ω (OUT5-8).

The power DRN/SRC1-4 and OUT1-4 can be connected in parallel outside the device in order to get 4 low-side drivers with $R_{onmax}$ = 0.3 Ω: DRN1//DRN2, DRN3//DRN4, OUT1//OUT2, OUT3//OUT4.

In this way there are a total of 8 LS channels for ON-OFF mode with $R_{onmax}$ = 0.3 Ω.

There is also the possibility to connect the OUT1-4 and OUT5-8 in order to drive in PWM mode a load connected to VB or GND without the necessity of a freewheeling diode. In this case the $R_{onmax}$ = 0.6 Ω.

The above configuration can be driven by parallel input or SPI command.

Through the SPI it is possible to configure the device parameters like configuration, Slew-rate, Overcurrent threshold, to send the drivers commands and to read back the diagnosis results.

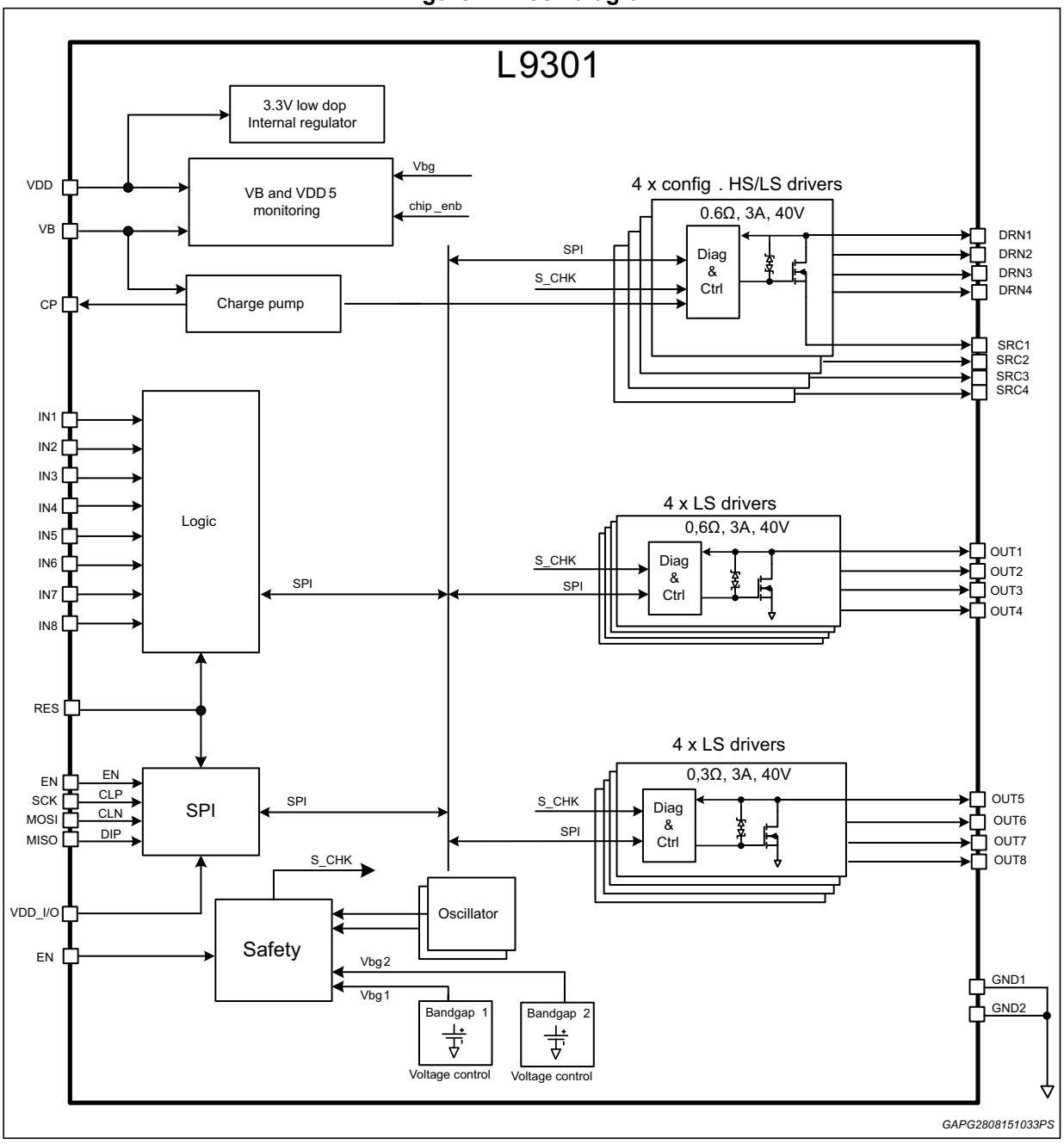
**Table 1. Device summary**

| Order code | Package | Packing |
|---|---|---|
| L9301-TR | PowerSSO36 | Tape & Reel |

# Contents

# 1 Block diagram

**Figure 1. Block diagram**



# 2 Pin description

**Figure 2. Pin connection diagram**

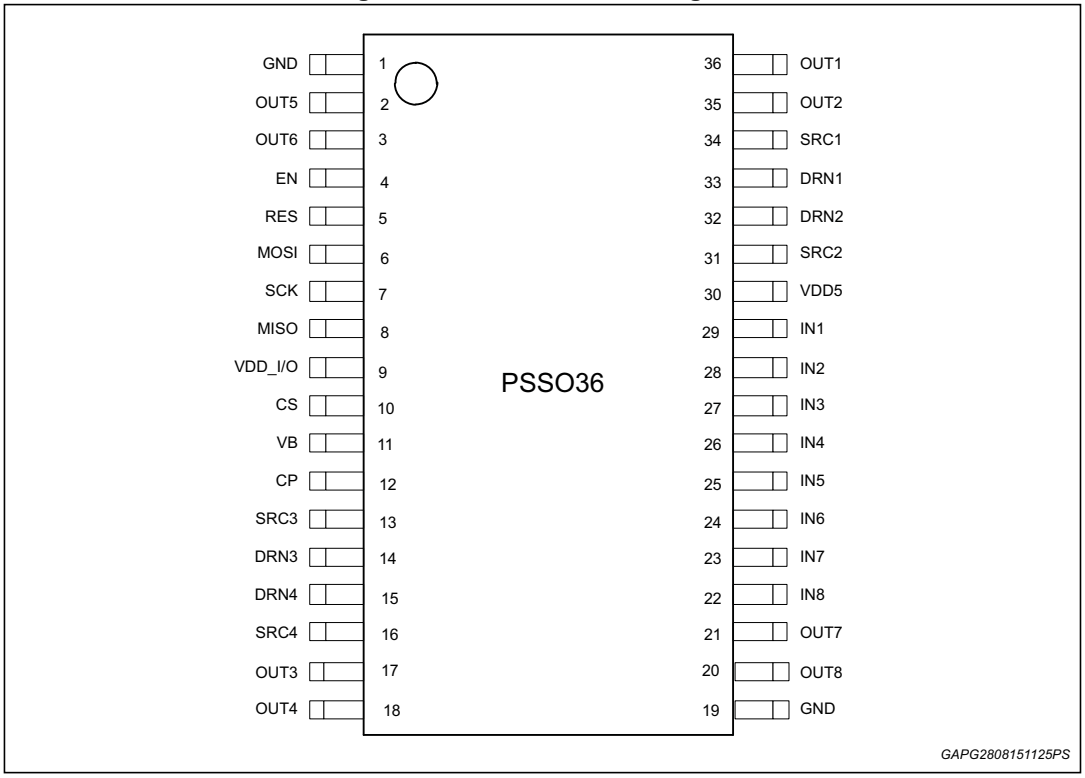



**Table 2. Pin description**

| Pin | Symbol | Function |
|---|---|---|
| 1 | GND | Power ground of OUT1,2,5,6 |
| 2 | OUT5 | Output 5 |
| 3 | OUT6 | Output 6 |
| 4 | EN | Enable |
| 5 | RES | Reset input (active low) |
| 6 | MOSI | SPI data in |
| 7 | SCK | SPI serial clock input |
| 8 | MISO | SPI data out |
| 9 | VDD_I/O | Microcontroller logic interface voltage |
| 10 | CS | SPI chip select (active low) |
| 11 | VB | Battery supply voltage |
| 12 | CP | Charge pump |
| 13 | SRC3 | Source pin of configurable driver #3 |
| 14 | DRN3 | Drain pin of configurable driver #3 |

Table 2. Pin description (continued)

| Pin | Symbol | Function |
|---|---|---|
| 15 | DRN4 | Drain pin of configurable driver #4 |
| 16 | SRC4 | Source pin of configurable driver #4 |
| 17 | OUT3 | Output 3 |
| 18 | OUT4 | Output 4 |
| 19 | GND | Power ground of OUT3,4,7,8 |
| 20 | OUT8 | Output 8 |
| 21 | OUT7 | Output 7 |
| 22 | IN8 | Discrete input used to PWM output driver #8 |
| 23 | IN7 | Discrete input used to PWM output driver #7 |
| 24 | IN6 | Discrete input used to PWM output driver #6 |
| 25 | IN5 | Discrete input used to PWM output driver #5 |
| 26 | IN4 | Discrete input used to PWM output driver #4 |
| 27 | IN3 | Discrete input used to PWM output driver #3 |
| 28 | IN2 | Discrete input used to PWM output driver #2 |
| 29 | IN1 | Discrete input used to PWM output driver #1 |
| 30 | VDD5 | 5 Volt supply input |
| 31 | SRC2 | Source pin of configurable driver #2 |
| 32 | DRN2 | Drain pin of configurable driver #2 |
| 33 | DRN1 | Drain pin of configurable driver #1 |
| 34 | SRC1 | Source pin of configurable driver #1 |
| 35 | OUT2 | Output 2 |
| 36 | OUT1 | Output 1 |
| EP | GND | Exposed pad: connected to GND |

# 3 Electrical specifications

## 3.1 Absolute maximum ratings

**Table 3. Absolute maximum ratings**

| Symbol | Parameter | Value [DC voltage] | Unit |
|---|---|---|---|
| VB | Supply voltage | -0.3 to 35 | V |
| VDD, VDD_I/O | Stabilized supply voltage | -0.3 to 18(1) | V |
| $V_{CS}$, $V_{SCK}$, $V_{MOSI}$, $V_{MISO}$, $V_{EN}$, $V_{IN1-8}$, $V_{RES}$ | Logic input/output voltage range | -0.3 to 18(1) | V |
| OUT1-8 | - | -1 to VCL | V |
| SRC1-4 | - | -1 to VB | V |
| DRN1-4 | - | -1 to VCL | V |
| CP | - | -0.3 to (VB+CP_DELTA) | V |
| GND | - | -0.3 to +0.3 | V |

1. Short to 18 V for 100 h max.

*Note: A suitable device to clamp the voltage during 'load dump' event to a value ≤35 V must be present at application level.*

## 3.2 ESD protection

**Table 4. ESD protection**

| Parameter | Value | Unit |
|---|---|---|
| ESD according Human Body Model (HBM), Q100-002 for pins (1); (100 pF/1.5 kΩ) | ±4000 | V |
| ESD according Human Body Model (HBM), Q100-002 for all other pins; (100 pF/1.5 kΩ) | ±2000 | V |
| ESD according Charged Device Model (CDM), Q100- 011 Corner pins | ±750 | V |
| ESD according Charged Device Model (CDM), Q100-011 Non-corner pins | ±500 | V |

1. VB, DRN1-4, SRC1-4, OUT1-8.

## 3.3 Operating range

**Table 5. Operating range**

| Symbol | Parameter | Min. | Max. | Unit |
|---|---|---|---|---|
| VB | Supply voltage | VB_UV | 18 | V |
| VDD | Stabilized supply voltage | VDD_UV | VDD_OV | V |
| VDD_IO | Logic output supply voltage | 3.0 | 5.5 | V |

## 3.4 Thermal data

**Table 6. Thermal data**

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $T_{amb}$ (1) | Operating ambient temperature | -40 | - | 125 | °C |
| $T_{stg}$ | Storage temperature | -40 | - | 150 | °C |
| $T_j$ | Junction temperature | -40 | - | 175 | °C |
| $T_{sd}$ | Thermal shutdown temperature | 180 | - | 195 | °C |
| $T_{sd\text{-}hys}$ | Thermal shutdown temperature hysteresis | - | 10 | - | °C |
| $R_{th\ j\text{-}amb}$ (2) | Thermal Resistance junction to ambient | - | - | 24 | °C/W |
| $R_{th\ j\text{-}case}$ | Thermal Resistance junction to case | - | - | 2 | °C/W |

1. For information only, in any case $T_j$ limits must not exceed.
2. With 2s2p PCB thermally enhanced.

# 4 Package information

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.

## 4.1 PowerSSO-36 (exposed pad) package information

**Figure 3. PowerSSO-36 (exposed pad) package outline**

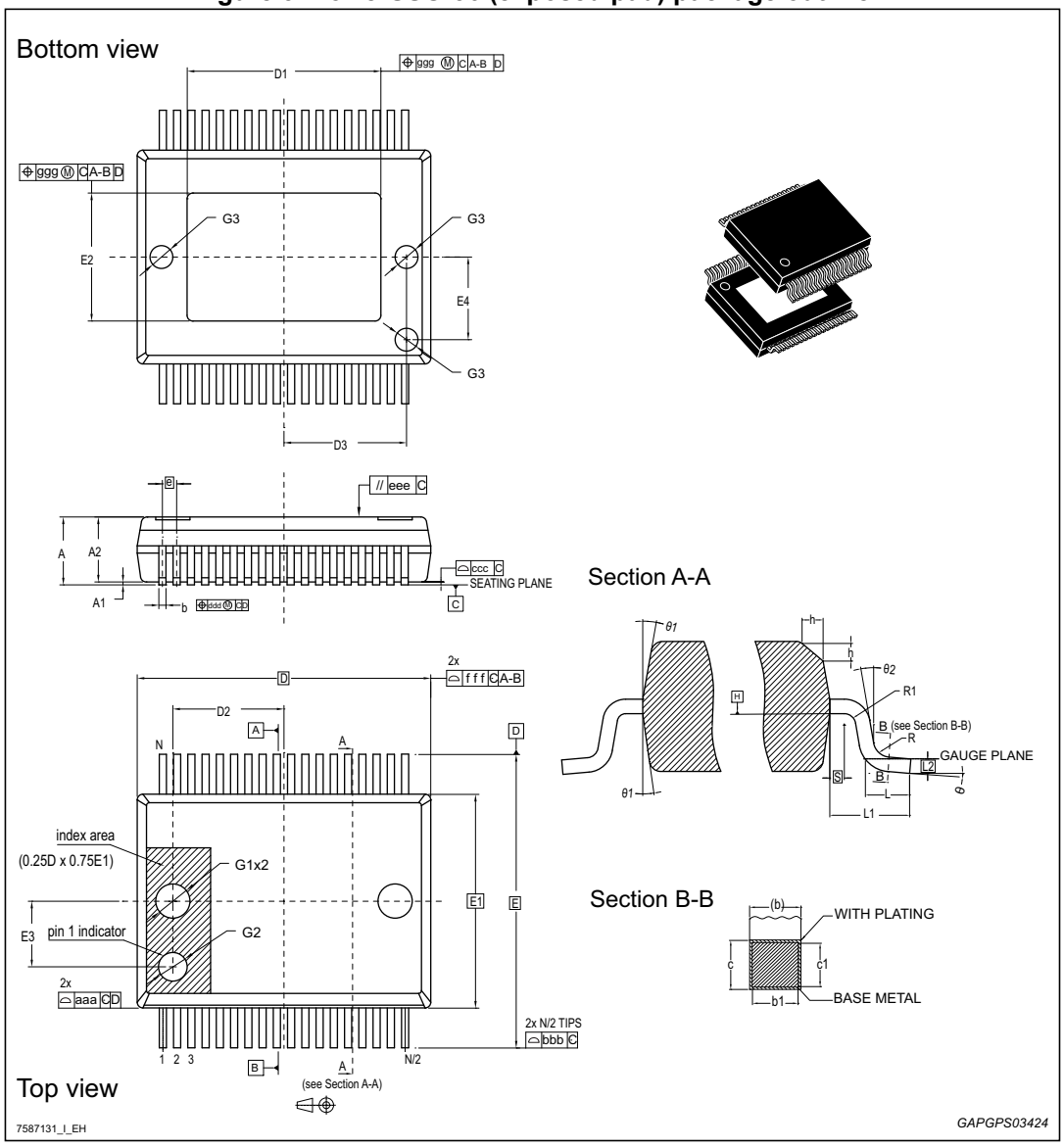


Table 7. PowerSSO-36 (exposed pad) package mechanical data

| Ref | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| Θ | 0° | - | 8° | 0° | - | 8° |
| Θ1 | 5° | - | 10° | 5° | - | 10° |
| Θ2 | 0° | - | - | 0° | - | - |
| A | 2.15 | - | 2.45 | 0.0846 | - | 0.0965 |
| A1 | 0.0 | - | 0.1 | 0.0 | - | 0.0039 |
| A2 | 2.15 | - | 2.35 | 0.0846 | - | 0.0925 |
| b | 0.18 | - | 0.32 | 0.0071 | - | 0.0126 |
| b1 | 0.13 | 0.25 | 0.3 | 0.0051 | 0.0098 | 0.0118 |
| c | 0.23 | - | 0.32 | 0.0091 | - | 0.0126 |
| c1 | 0.2 | 0.2 | 0.3 | 0.0079 | 0.0079 | 0.0118 |
| D[2] | 10.30 BSC | | | 0.4055 BSC | | |
| D1 | VARIATION | | | | | |
| D2 | - | 3.65 | - | - | 0.1437 | - |
| D3 | - | 4.3 | - | - | 0.1693 | - |
| e | 0.50 BSC | | | 0.0197 BSC | | |
| E | 10.30 BSC | | | 0.4055 BSC | | |
| E1[2] | 7.50 BSC | | | 0.2953 BSC | | |
| E2 | VARIATION | | | | | |
| E3 | - | 2.3 | - | - | 0.0906 | - |
| E4 | - | 2.9 | - | - | 0.1142 | - |
| G1 | - | 1.2 | - | - | 0.0472 | - |
| G2 | - | 1 | - | - | 0.0394 | - |
| G3 | - | 0.8 | - | - | 0.0315 | - |
| h | 0.3 | - | 0.4 | 0.0118 | - | 0.0157 |
| L | 0.55 | 0.7 | 0.85 | 0.0217 | - | 0.0335 |
| L1 | 1.40 REF | | | 0.0551 REF | | |
| L2 | 0.25 BSC | | | 0.0098 BSC | | |
| N | 36 | | | 1.4173 | | |
| R | 0.3 | - | - | 0.0118 | - | - |
| R1 | 0.2 | - | - | 0.0079 | - | - |
| S | 0.25 | - | - | 0.0098 | - | - |

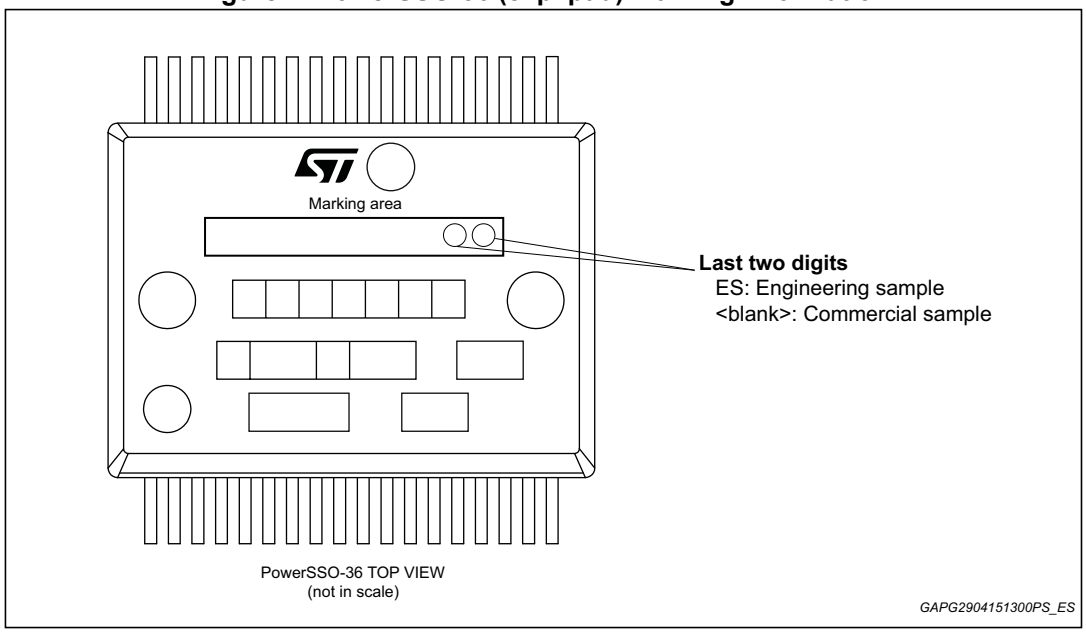
Table 7. PowerSSO-36 (exposed pad) package mechanical data (continued)

| Ref | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| **Tolerance of form and position** | | | | | | |
| aaa | | 0.2 | | | 0.0079 | |
| bbb | | 0.2 | | | 0.0079 | |
| ccc | | 0.1 | | | 0.0039 | |
| ddd | | 0.2 | | | 0.0079 | |
| eee | | 0.1 | | | 0.0039 | |
| ffff | | 0.2 | | | 0.0079 | |
| ggg | | 0.15 | | | 0.0059 | |
| **VARIATIONS** | | | | | | |
| **Option A** | | | | | | |
| D1 | 6.5 | - | 7.1 | 0.2559 | - | 0.2795 |
| E2 | 4.1 | - | 4.7 | 0.1614 | - | 0.1850 |
| **Option B** | | | | | | |
| D1 | 4.9 | - | 5.5 | 0.1929 | - | 0.2165 |
| E2 | 4.1 | - | 4.7 | 0.1614 | - | 0.1850 |
| **Option C** | | | | | | |
| D1 | 6.9 | - | 7.5 | 0.2717 | - | 0.2953 |
| E2 | 4.3 | - | 5.2 | 0.1693 | - | 0.2047 |

1. Values in inches are converted from mm and rounded to 4 decimal digits.
2. Dimensions D and E1 do not include mold flash or protrusions. Allowable mold flash or protrusions is ‘0.25 mm’ per side D and ‘0.15 mm’ per side E1. D and E1 are Maximum plastic body size dimensions including mold mismatch.

## 4.2 PowerSSO-36 (exp. pad) marking information

**Figure 4. PowerSSO-36 (exp. pad) marking information**




*Note: Engineering Samples: these samples are clearly identified by last two digits 'ES' in the marking of each unit. These samples are intended to be used for electrical compatibility evaluation only; usage for any other purpose may be agreed only upon written authorization by ST. ST is not liable for any customer usage in production and/or in reliability qualification trials.*

*Commercial Samples: Fully qualified parts from ST standard production with no usage restrictions.*

# 5 Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 01-Dec-2015 | 1 | Initial release. |