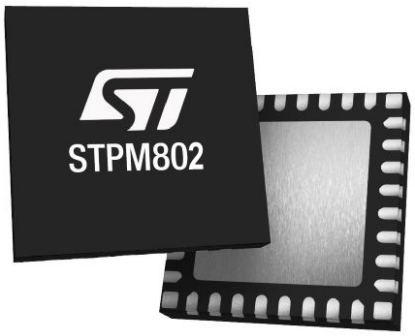
# STPM802

Data brief

## Automotive synchronous Buck-Boost controller




VFQFN 32+4L
(5x5x0.9 mm)

## Features

- AEC-Q100 qualification ongoing
- 4-Switch single inductor architecture
- Synchronous switching
- Input voltage range: 4.2 V to 60 V
- Spread spectrum frequency modulation
- Integrated bootstrap diodes
- Adjustable switching frequency from 177 kHz to 500 kHz
- Peak drive current > 2.8 A
- Standby mode
- Developed according to ISO26262 to be used in ASIL–D systems

## Description

| Product status |
|---|
| STPM802 |

| Product summary | | |
|---|---|---|
| Order code | Package | Packing |
| STPM802-TR | VFQPN32+4L | Tape and Reel |

The STPM802 is a synchronous 4-Switch single phase non inverting buck-boost DC/DC controller that regulates output voltage, from an input voltage above, below, or equal to the output voltage. It offers an adjustable fixed frequency operation and spread spectrum to reduce EMI emissions.

The IC provides inductor and output current monitor, OV/UV protections and Power Good flag. Fault protection is also provided to detect output short-circuit condition, during which the IC retries, latches off, or keeps running.

The IC implements a low power mode function in which control loop management changes in order to reduce power dissipation.

STPM802 offers a set of features to support applications that need to fulfill functional safety requirements as defined by Automotive Safety Integrity Level (ASIL) A-B-C-D depending on application TSR.

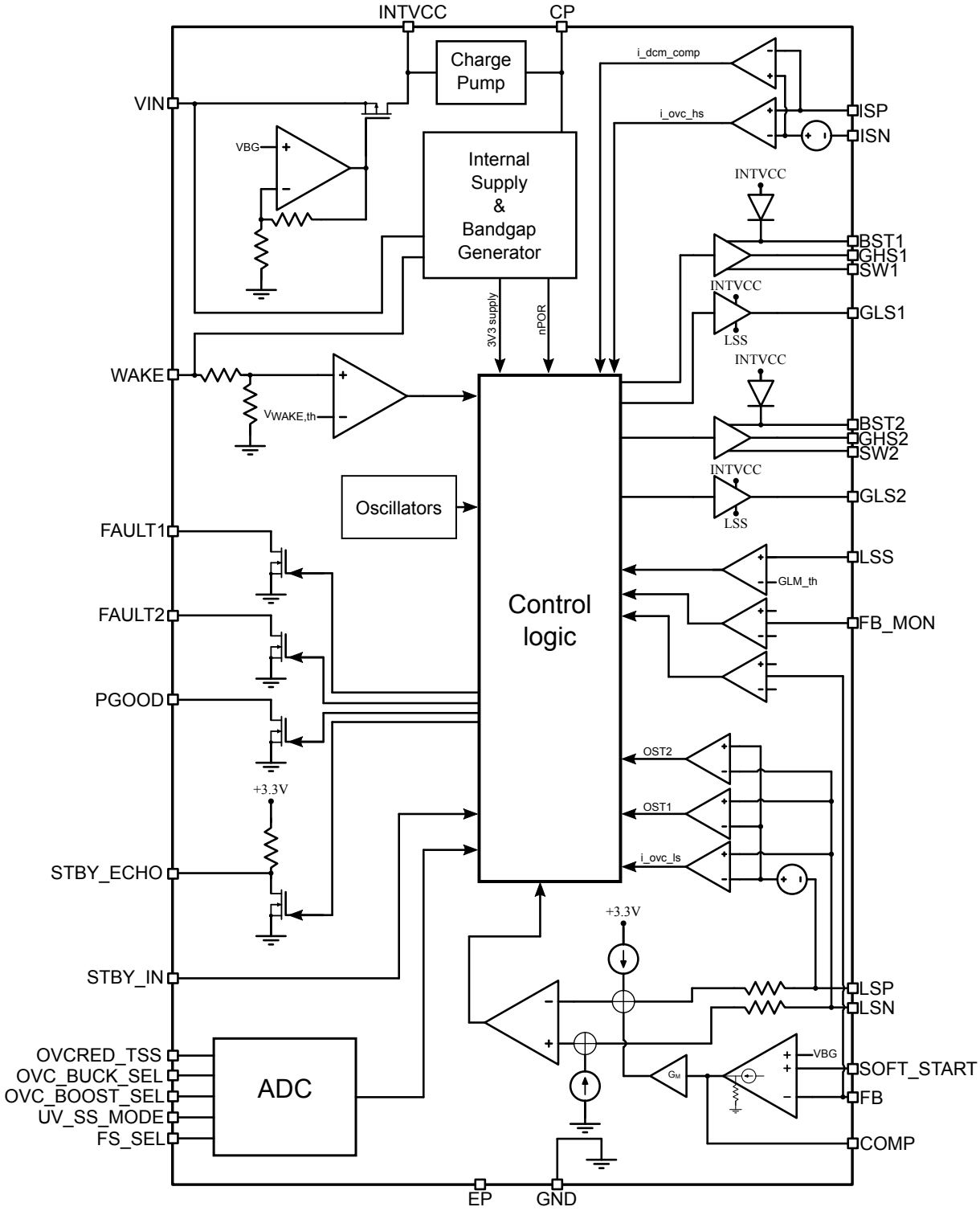
# 1 Overview

- The IC is a current mode DC/DC controller that can regulate output voltage and output current from input voltage above, below or equal to the output voltage.
- A key pin (WAKE) is present.
- An internal comparator is sensing VIN – ISN voltage drop thus defining regulation strategy for control loop (Buck mode, Boost mode and Transition mode).
- The device works regulating 1.2 V (internal reference voltage) at FB pin. Regulated voltage is defined by means of external voltage divider network.
- At light load, the device supports Discontinuous Current Mode (DCM) function.
- Shunt resistances (1 mΩ minimum) shall be used both on output High Side load current path (ISN/ISP) and on Low Side buck/boost current path (LSN/LSP). OVC_LS and OVC_HS thresholds can be selected within six different combinations by changing external resistance on OVC_BUCK_SEL and OVC_BOOST_SEL pins. Target inductor value with 1mOhm LSP/LSN shunt resistor is 3.3 µH: when increasing Low Side shunt resistor value, also inductor value must be increased of the same ratio.
- Configuration using external resistors of different values is used also to define Buck-Boost switching frequency at FS_SEL pin, and reaction to be taken in case of an Undervoltage on VOUT pin (keep running, auto retry function or turn-off) at UV_SS_MODE pin, also defining Spread Spectrum enable.
- The device is equipped with VOUT Undervoltage/Overvoltage detection, open drain fault pins (two for safety redundancy) and PGOOD diagnosis (output voltage within expected range).
- An internal low drop-out linear regulator (INTVCC) is present in order to drive Low Side External MOSFETs and to recharge Bootstrap capacitors.
- Bootstrap structure is used to drive High Side External MOSFETs.
- The device implements a standby function (using STBY pin) in which some functions are turned-off and control loop changes to ensure a reduction of power consumption.

# 2 Block diagram and pin description

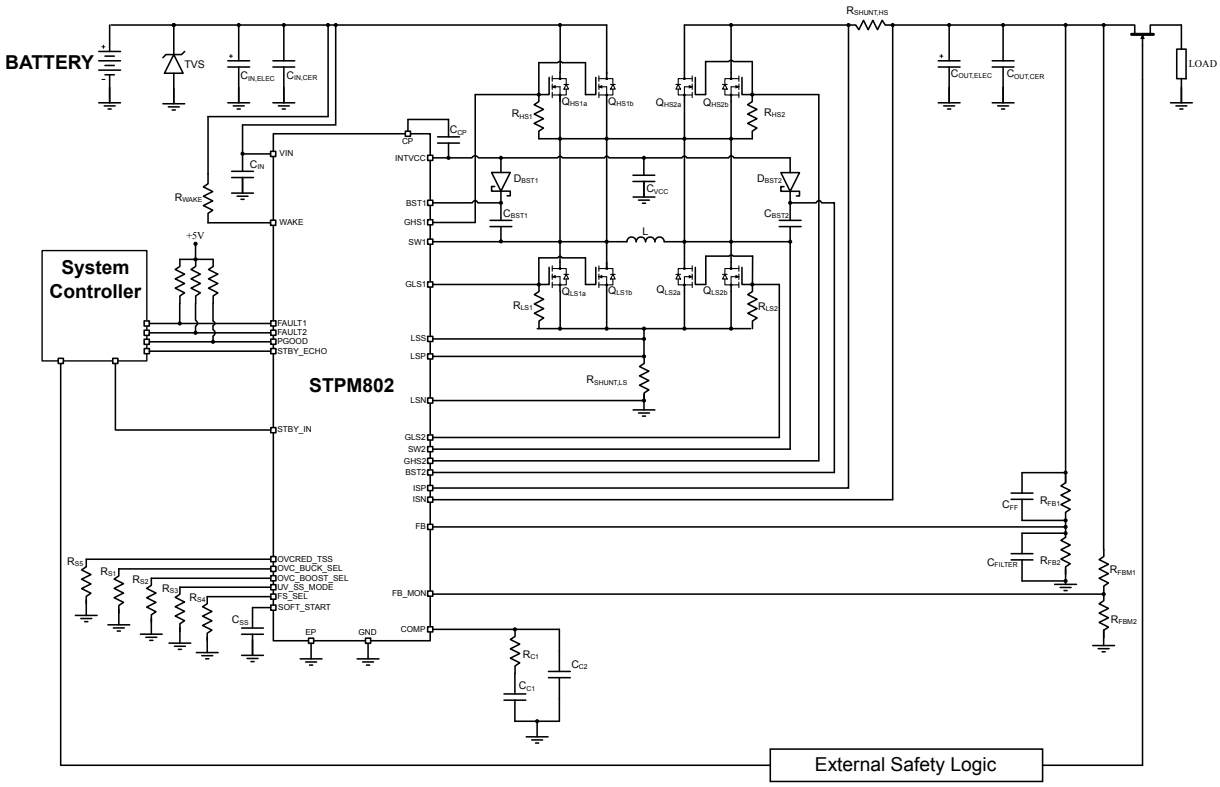
## 2.1 Block diagram

Figure 1. **Block diagram**



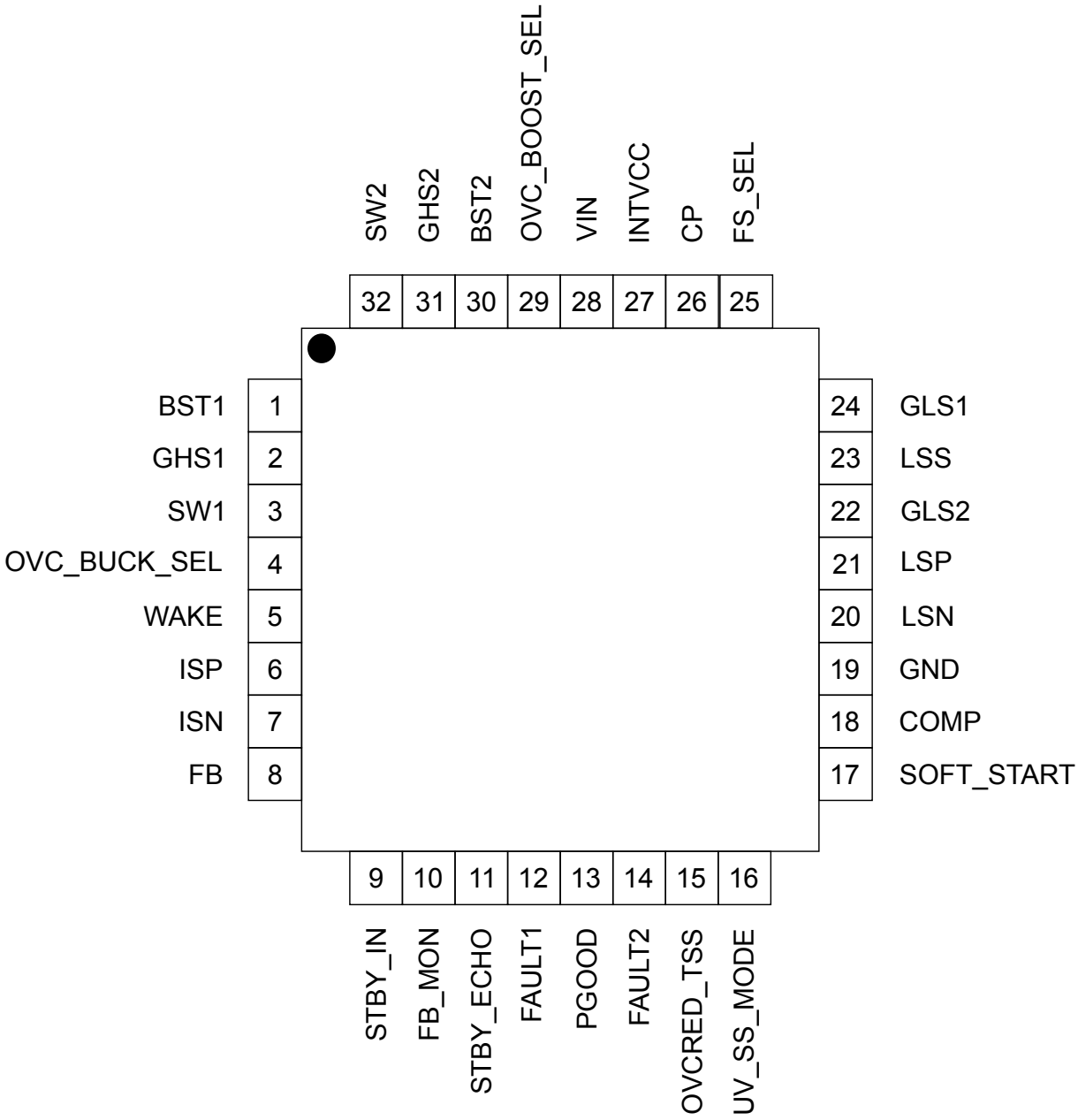
## 2.2 Applicative circuit

Figure 2. Applicative circuit



## 2.3 Pin description

Figure 3. **Pin out (top view)**




The exposed pad is not electrically connected to internal substrate. Connecting the exposed pad to PCB ground plane through thermal vias improves thermal dissipation.

**Table 1. Pin functions and description**

| No. | Name | Description |
|---|---|---|
| 1 | BST1 | Bootstrap capacitor/bootstrap diode 1 |
| 2 | GHS1 | High Side gate 1 |
| 3 | SW1 | Switching node 1 |
| 4 | OVC_BUCK_SEL | Overcurrent value selection for buck operation and for Overload detection |
| 5 | WAKE | Device Wake-up pin |
| 6 | ISP | Load peak current detection shunt resistance – upper side |
| 7 | ISN | Load peak current detection shunt resistance – lower side |
| 8 | FB | Regulation feedback (external voltage divider) |
| 9 | STBY_IN | If the defined pattern is applied to this pin, the device enters in Standby mode. Internal 30 µA pull-up guarantees to stay in Normal mode if the pin is not driven externally |
| 10 | FB_MON | Safety redundancy pin for UV/OV diagnosis. Voltage divider is a copy of the one connected between VOUT and FB pins. This pin is only a monitor, not used by control loop |
| 11 | STBY_ECHO | Open Drain with internal pull-up, IC provide to µC indication whether device is in Normal or in Standby mode |
| 12 | FAULT1 | Fault open drain |
| 13 | PGOOD | Power Good open drain |
| 14 | FAULT2 | Fault open drain (safety redundancy) |
| 15 | OVCRED_TSS | Selection of reduced Overcurrent threshold and of soft short diagnosis filter time |
| 16 | UV_SS_MODE | Behavior in case of VOUT Undervoltage and selection of Spread Spectrum function enable |
| 17 | SOFT_START | Soft Start selection (external capacitor) |
| 18 | COMP | Pin for external compensation network |
| 19 | GND | Signal Ground |
| 20 | LSN | Low Side current limitation shunt resistance – lower side |
| 21 | LSP | Low Side current limitation shunt resistance – upper side |
| 22 | GLS2 | Low Side Gate 2 |
| 23 | LSS | Low Side Source common point |
| 24 | GLS1 | Low Side Gate 1 |
| 25 | FS_SEL | Switching frequency selection |
| 26 | CP | External capacitor, charge pump tank |
| 27 | INTVCC | Pin for LDO external bypass capacitor, Bootstrap and Low Side Drivers supply |
| 28 | VIN | Battery voltage |
| 29 | OVC_BOOST_SEL | Overcurrent value selection for boost operation |
| 30 | BST2 | Bootstrap capacitor / bootstrap diode 2 |
| 31 | GHS2 | High Side gate 2 |
| 32 | SW2 | Switching node 2 |

# 3 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.

## 3.1 VFQFN (5x5x0.9, 32+4L) package information

**Figure 4. VFQFN (5x5x0.9, 32+4L) package outline**

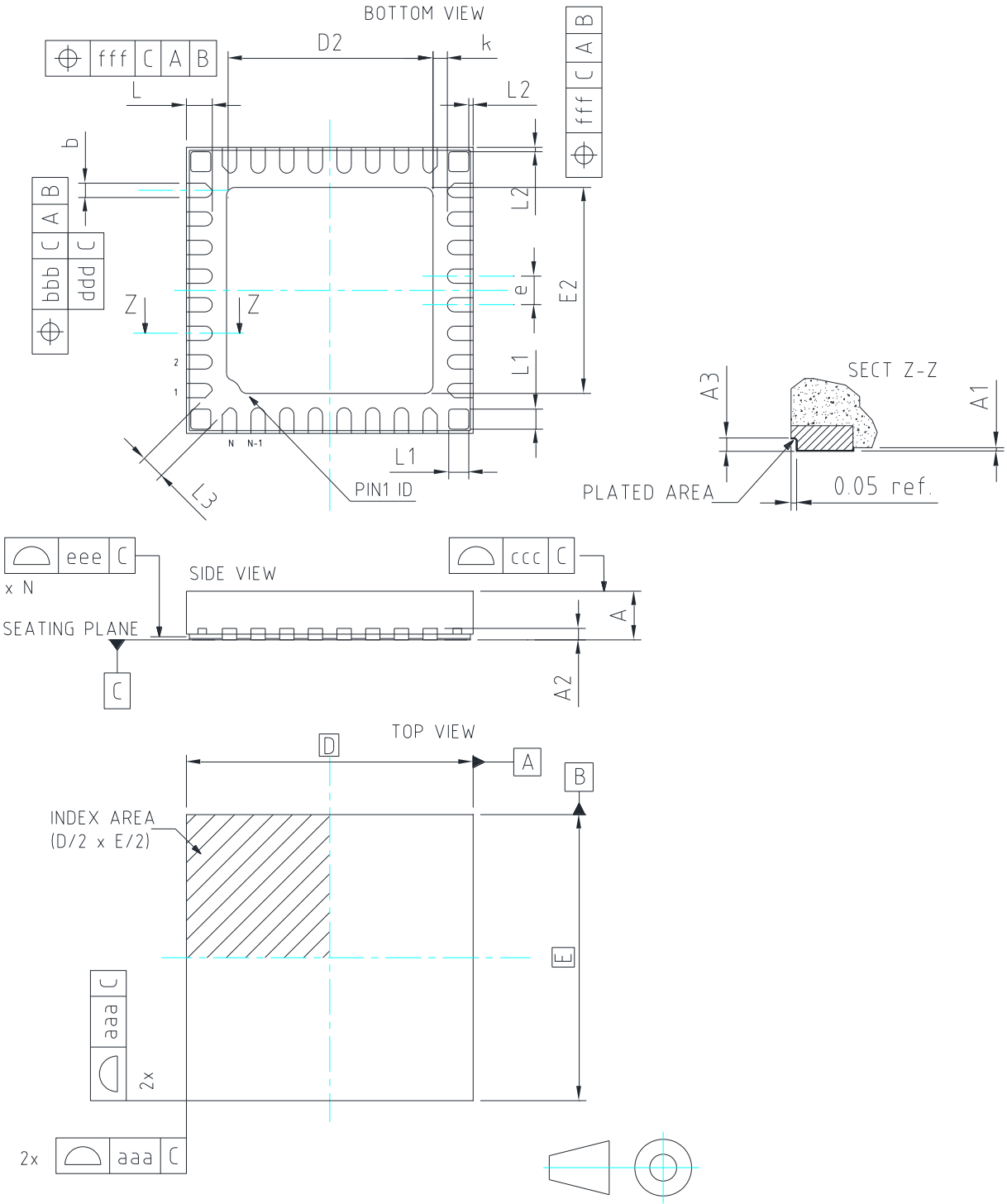


Table 2. **VFQFN (5x5x0.9, 32+4L) package mechanical data**

| Symbol | Dimension in mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 0.80 | 0.90 | 1.00 |
| A1 | 0.00 | 0.02 | 0.05 |
| A2 | | 0.2 REF | |
| A3 | 0.10 | - | - |
| b | 0.20 | 0.25 | 0.30 |
| D | - | 5.00 | - |
| e | - | 0.5 | - |
| E | - | 5.00 | - |
| L | 0.35 | 0.45 | 0.55 |
| L1 | - | 0.35 | - |
| L2 | - | 0.075 | - |
| L3 | - | 0.42 | - |
| k | 0.20 | - | - |
| N | | 32+4 | |
| **Tolerance of form and position** | | | |
| aaa | | 0.15 | |
| bbb | | 0.10 | |
| ccc | | 0.10 | |
| ddd | | 0.05 | |
| eee | | 0.08 | |
| fff | | 0.10 | |
| **Expose PAD variation** | | | |
| D2 | 3.55 | 3.60 | 3.65 |
| E2 | 3.55 | 3.60 | 3.65 |

*Note: 4L additive corner pins are electrically floating but it is recommended to solder them towards GND in order to guarantee the mechanical integrity of the package.*

## Revision history

Table 3. **Document revision history**

| Date | Version | Changes |
|---|---|---|
| 28-Nov-2023 | 1 | Initial release. |

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