

### Automotive synchronous Buck-Boost controller



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

# Product status link STPM802A

Product summary				
Order code	Package	Packing		
STPM802A-TR	VFQPN32+4L	Tape		
STPW002A-TR		and reel		

#### **Features**





Synchronous switching

Input voltage range: 4.2 V to 60 V
 Output voltage range: 3.3 V to 14 V
 Spread-spectrum frequency modulation

Integrated bootstrap diodes

Adjustable switching frequency: 177 kHz to 500 kHz

Peak drive current > 2.8 A

Standby mode

Developed according to ISO26262 for use in ASIL–D systems

#### **Description**

The STPM802A is a synchronous 4-switch single-phase non-inverting buck-boost DC/DC controller that regulates the output voltage, from an input voltage above, below, or equal to the output voltage. It offers an adjustable fixed-frequency operation and spread-spectrum capability to reduce EMI emissions.

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

The IC implements a low-power mode function, in which control loop management is adjusted in order to reduce power dissipation.

STPM802A offers a set of features to support applications that must meet functional safety requirements as defined by the Automotive Safety Integrity Level (ASIL) A-B-C-D depending on the application TSR.



#### 1 Overview

- The IC is a current mode DC/DC controller that can regulate output voltage and output current from an input voltage above, below or equal to the output voltage.
- A key pin (WAKE) is present.
- An internal comparator senses the VIN–ISN voltage drop, thus defining the regulation strategy for the control loop (buck mode, boost mode and transition mode).
- The device works regulating 1.2 V (internal reference voltage) at the FB pin. The regulated voltage is defined by means of an external voltage divider network.
- Shunt resistances (1 m $\Omega$  minimum) must be used both on the output high-side load current path (ISN/ISP) and on the low-side buck/boost current path (LSN/LSP). OVC\_LS and OVC\_HS thresholds can be selected from six different combinations by changing the external resistance on the OVC\_BUCK\_SEL and OVC\_BOOST\_SEL pins. The target inductor value with a 1 m $\Omega$  LSP/LSN shunt resistor is 3.3  $\mu$ H.
- Using external resistors of different values at the FS\_SEL pin is also used to configure the buck-boost switching frequency. The response in case of an undervoltage event on the VOUT pin (keep running, auto retry function, or turn-off) can be configured via the UV\_SS\_MODE pin, where spread spectrum can also be enabled.
- The device is equipped with a 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 the bootstrap capacitors.
- The bootstrap structure is used to drive high-side external MOSFETs.
- The device implements a standby function (using the STBY pin), in which some functions are turned off and the control loop is adjusted to ensure a reduction in power consumption.

DB5586 - Rev 1 page 2/10



# Block diagram and pin description

### 2.1 Block diagram

Figure 1. Block diagram INTVCC i\_dcm\_comp Charge Pump VINC Internal Supply Bandgap Generator **Ģ**GLS1 WAKE **Ģ**GLS2 Oscillators FAULT1 ₽LSS Control FAULT2 фгв\_мол logic **PGOOD** STBY\_ECHO STBY\_IN ↓ ↓ ↓ ↓ ↓ LSN OVCRED\_TSS OVC\_BUCK\_SELO SOFT\_START **ADC** UV\_SS\_MODE фсомр

DB5586 - Rev 1 page 3/10



## 2.2 Applicative circuit

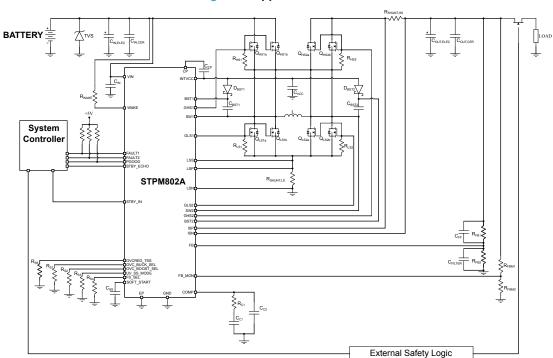
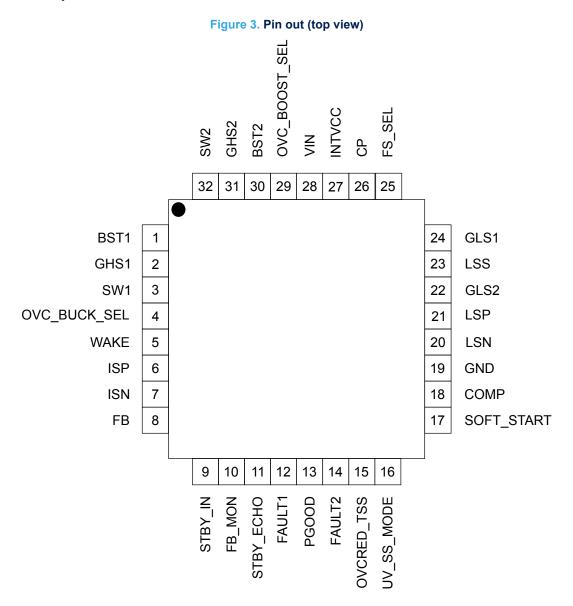


Figure 2. Applicative circuit

DB5586 - Rev 1 page 4/10



### 2.3 Pin description



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

DB5586 - Rev 1 page 5/10



Table 1. Pin functions and description

No.	Name	Туре	Description	
1	BST1	Local	Bootstrap capacitor/ bootstrap diode 1	
2	GHS1	Local	High-side gate 1	
3	SW1	Local	Switching node 1	
4	OVC_BUCK_SEL	Local	Overcurrent value selection for buck operation and overload detection	
5	WAKE	Local	Device wake-up pin	
6	ISP	Local	Load peak current detection shunt resistance – upper side	
7	ISN	Local	Load peak current detection shunt resistance – lower side	
8	FB	Local	Regulation feedback (external voltage divider)	
9	STBY_IN	Local	If the defined pattern is applied to this pin, the device enters standby mode. An internal 30 $\mu$ A pull-up guarantees operation in normal mode if the pin is not driven externally	
10	FB_MON	Local	Safety redundancy pin for UV/OV diagnosis. The voltage divider is a copy of the one connected between the VOUT and FB pins. This pin is only a monitor, not used by the control loop	
11	STBY_ECHO	Local	Open Drain with internal pull-up, IC provides an indication to the microcontroller whether the device is in normal or standby mode	
12	FAULT1	Local	Fault open drain	
13	PGOOD	Local	Power-good open drain	
14	FAULT2	Local	Fault open drain (safety redundancy)	
15	OVCRED_TSS	Local	Selection of reduced overcurrent threshold and of soft short diagnosis filter time	
16	UV_SS_MODE	Local	Behavior in case of VOUT undervoltage and selection of spread spectrum function enable	
17	SOFT_START	Local	Soft start selection (external capacitor)	
18	COMP	Local	Pin for external compensation network	
19	GND	Local	Signal ground	
20	LSN	Local	Low-side current limitation shunt resistance – lower side	
21	LSP	Local	Low-side current limitation shunt resistance – upper side	
22	GLS2	Local	Low-side gate 2	
23	LSS	Local	Low-side source common point	
24	GLS1	Local	Low-side gate 1	
25	FS_SEL	Local	Switching frequency selection	
26	СР	Local	External capacitor, charge pump tank	
27	INTVCC	Local	Pin for LDO external bypass capacitor, bootstrap and low-side drivers supply	
28	VIN	Local	Battery voltage	
29	OVC_BOOST_SEL	Local	Overcurrent value selection for boost operation	
30	BST2	Local	Bootstrap capacitor / bootstrap diode 2	
31	GHS2	Local	High-side gate 2	
32	SW2	Local	Switching node 2	

DB5586 - Rev 1 page 6/10



## 3 Package information

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

BOTTOM VIEW D2  $\oplus$ В Д  $_{\Omega}$ ⋖ ppp ppp Z SECT Z-Z 7 L1 0.05 ref. PIN1 ID PLATED AREA eee CCCSIDE VIEW SEATING PLANE A2 (TOP VIEW  $\square$ Α В INDEX AREA  $(D/2 \times E/2)$ ш PPP ∆|aaa|C

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

DB5586 - Rev 1 page 7/10



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

Symbol	Dimension in mm			
	Min.	Тур.	Max.	
A	A 0.80		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	-	
е	-	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 fo	rm and position		
aaa	aaa 0.15			
bbb	0.10			
ccc	0.10			
ddd	0.05			
eee		80.0		
fff	0.10			
	Expose PA	D variation		
D2	3.55	3.60	3.65	
E2	3.55	3.60	3.65	

Note:

4L additional corner pins are electrically floating, but it is recommended to solder them to GND in order to ensure the mechanical integrity of the package.

DB5586 - Rev 1 page 8/10



## **Revision history**

Table 3. Document revision history

Date	Version	Changes
07-Jul-2025	1	Initial release.

DB5586 - Rev 1 page 9/10



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DB5586 - Rev 1 page 10/10