FS27_PB

Safety system basis chip with low power for ASIL D/ASIL B

Rev. 1.0 — 19 June 2025 **Product brief**

SAFE ASSURE by NXP

Document information

Information	Content
Keywords	Safety, SBC, automotive, low power, ASIL B, ASIL D
Abstract	Devices in the FS27 automotive safety system basis chip (SBC) family are designed to support 28 nm entry and mid-range safety microcontrollers.

1 General description

Devices in the FS27 automotive safety system basis chip (SBC) family are designed to support entry and mid-range safety 28 nm microcontrollers. FS27 devices have multiple power supplies and the flexibility to work with other microcontrollers targeting automotive electrification. Possible FS27 applications include power train, chassis, safety, and low-end gateway technology.

This family of devices consists of several versions that are pin-to-pin and software compatible. These versions support a wide range of applications with automotive safety integrity levels (ASIL) B or D, offering choices in number of output rails, output voltage settings, operating frequencies, power-up sequencing, and integrated system-level features.

The FS27 features multiple switch mode regulators and low dropout (LDO) voltage regulators to supply the microcontroller, sensors, peripheral ICs, and communication interfaces. It offers a high-precision reference voltage supply for the system, and for two independent tracking regulators. The FS27 also offers various functionalities for system control and diagnostics, including an analog multiplexer, general-purpose input/outputs (GPIOs), and selectable wake-up events from I/O, long duration timer, serial peripheral interface (SPI) or inter integrated circuit (I^2C) communications.

The FS27 is developed in compliance with the ISO 26262 standard, and includes enhanced safety features with multiple fail-safe outputs. It uses the latest on demand latent fault monitoring, and can be part of a safety-oriented system partitioning scheme covering both ASIL B and ASIL D safety integrity levels.

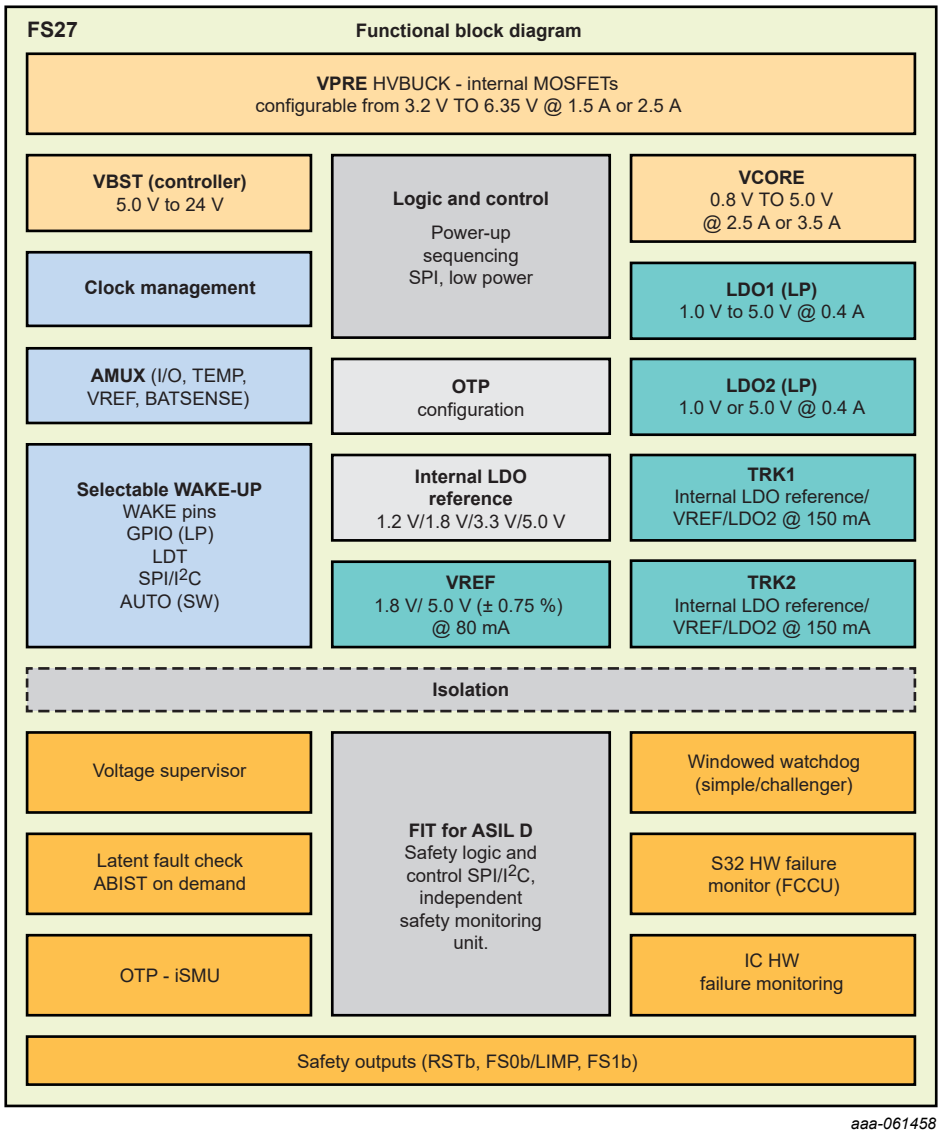

Figure 1. Functional block diagram

2 Features and benefits

Operating range

- 70 V DC maximum input voltage
- Support operating voltage range down to battery 3.2 V with VBST in front-end
- Support operating voltage range down to battery 4.5 V without VBST in front-end
- Low Power LPOFF mode with 30 µA quiescent current
- Low Power standby mode with 32 µA quiescent current with VPRE active. LDO1 or LDO2 activation selectable via OTP configuration. GPIO1 or GPIO2 activation selectable via SPI/I²C communication.
- Low Power Run mode LPRUN mode with selectable power rails configurable by SW

Power supplies

- VPRE: Synchronous buck converter with integrated FETs. Configurable output voltage and switching frequency, output DC current capability up to 1.5 A or 2.5 A and PFM mode for Low Power standby mode operation.
- VCORE: Synchronous buck converter with integrated FETs. VCORE is dedicated for microcontroller core supply. Output DC current up to 2.5 A or 3.5 A, output voltage range setting from 0.8 V to 5 V.
- VBST: Asynchronous low-side controller with external low-side switch, diode, and current sense resistor. VBST is configurable as front-end supply to withstand low voltage cranking profiles, in back-end supply with configurable output voltage and scalable output DC current capability, SEPIC controller to withstand 24 V applications and flyback controller to withstand 48 V applications.
- LDO1: LDO regulator for microcontroller I/O support with selectable output voltage between 1.0 V and 5.0 V and up to 400 mA current capability.
- LDO2: LDO regulator for system peripheral support with selectable output voltage between 1.0 V and 5.0 V and up to 400 mA current capability.
- VREF: High-precision reference voltage with 0.75 % accuracy for External ADC reference and internal tracking reference.
- TRK1 and TRK2: Voltage tracking regulators with selectable output voltage between VREF, LDO2, or Internal LDO reference. Support high-voltage protection for ECU off board operation up to 40 V. Each Tracker has a current capability up to 150 mA.

System support

- Two wake-up inputs with high-voltage support for system robustness
- Two programmable GPIO with wake-up capability or LS driver for GPIO1 and HS/LS driver for GPIO2
- Programmable long duration timer (LDT) for system shutdown and wake-up control
- Monitoring of system voltages (including battery voltage monitoring) through the analog multiplexer
- Selectable wake-up sources from: WAKE/GPIO pins, LDT, or SPI/I²C activity
- Device control via 32-bit SPI or 40-bit I²C interface with cyclic redundancy checks (CRC)
- Multi PMIC power-up/down synchronization
- DCLINK capacitor discharge command with NXP GD3163

Compliance

- Electromagnetic compatibility (EMC) optimization techniques for switching regulators, including spread spectrum, slew rate control, and manual frequency tuning.
- Electromagnetic interference (EMI) robustness supporting various automotive EMI test standards.

Functional safety

- Scalable portfolio from Automotive safety integrity levels (ASIL) B to D
- Independent monitoring circuitry, dedicated interface for microcontroller monitoring, simple or challenger watchdog function
- Analog built-in self-test (ABIST1) and logical built-in self-test (LBIST) at start-up
- Analog built-in self-test (ABIST2) on demand
- Safety outputs with latent fault detection mechanism (RSTB, FS0B/LIMP, FS1B). FS0B/LIMP upon part number

Configuration and enablement

- LQFP48 pins with exposed pad for optimized thermal management
- Permanent device customization via one time programmable (OTP) fuse memory
- OTP emulation mode for hardware development and evaluation
- Debug mode for software development, MCU programming, and debugging

3 Simplified application diagram

Figure 2 shows a simplified block diagram for a typical system with an FS27, using the boost controller to support battery cold-crank events.

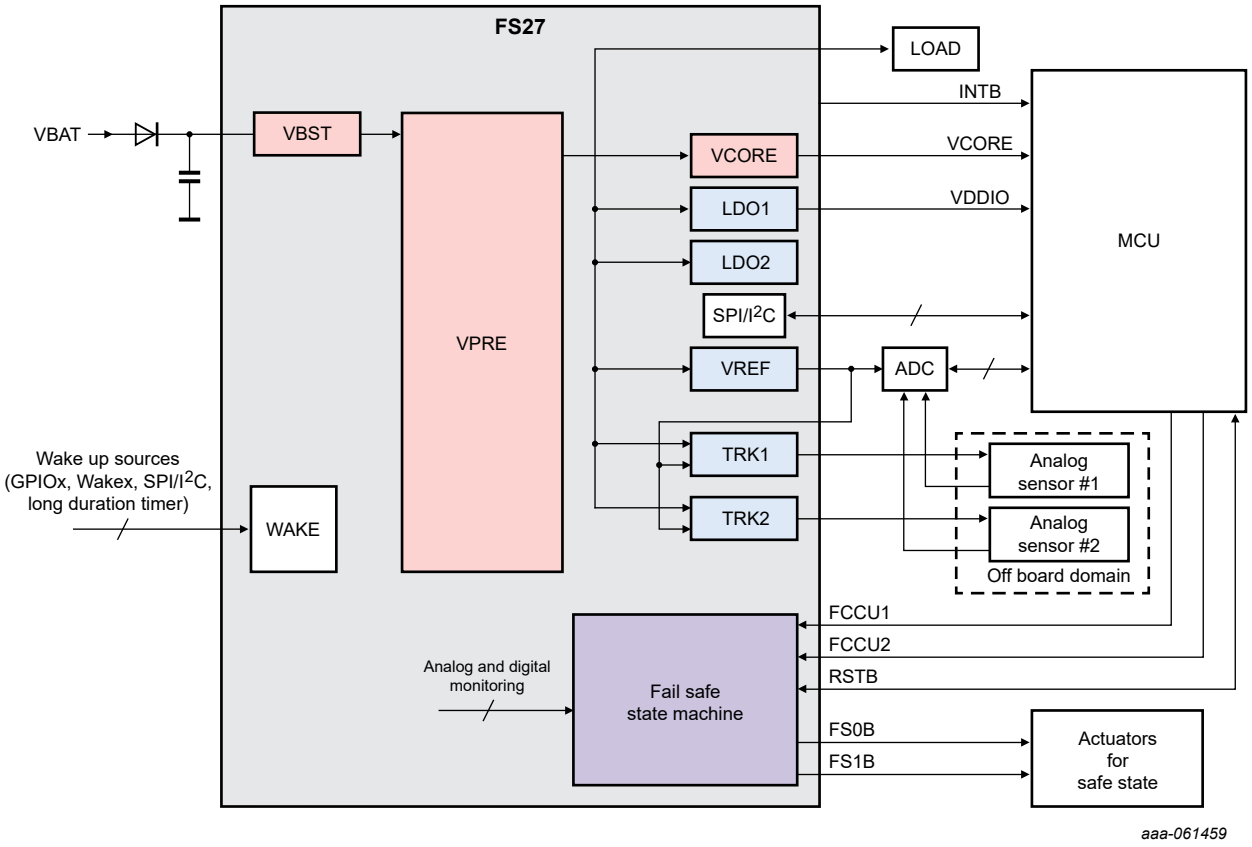

Figure 2. Example of application diagram with VBST as a front-end regulator

Figure 3 shows a simplified block diagram for a typical system with an FS27, using the boost controller to generate a voltage above the high-voltage buck output voltage.

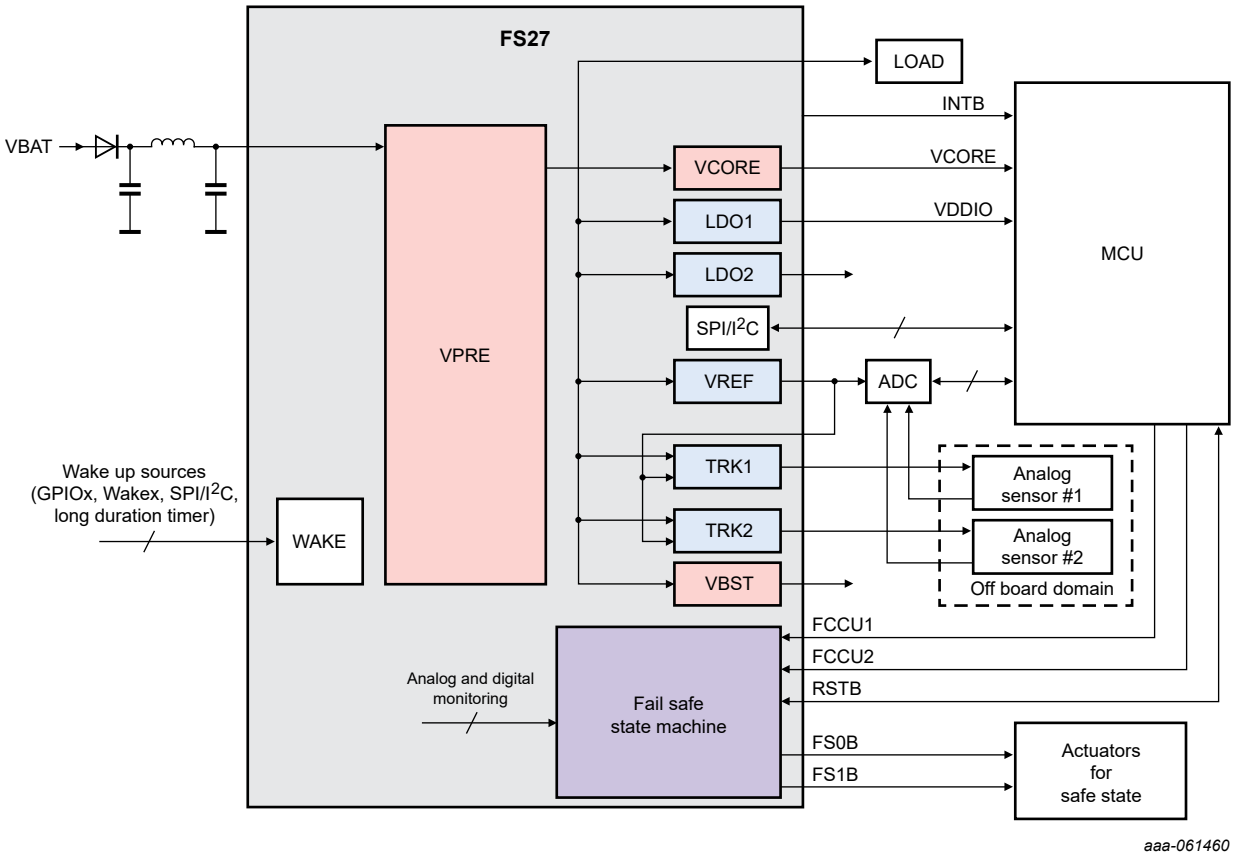

Figure 3. Example of application diagram with VBST as a back-end regulator

Figure 4 shows a simplified block diagram for a typical system with an FS27, using the low-side controller to support 24 V and 48 V battery applications.

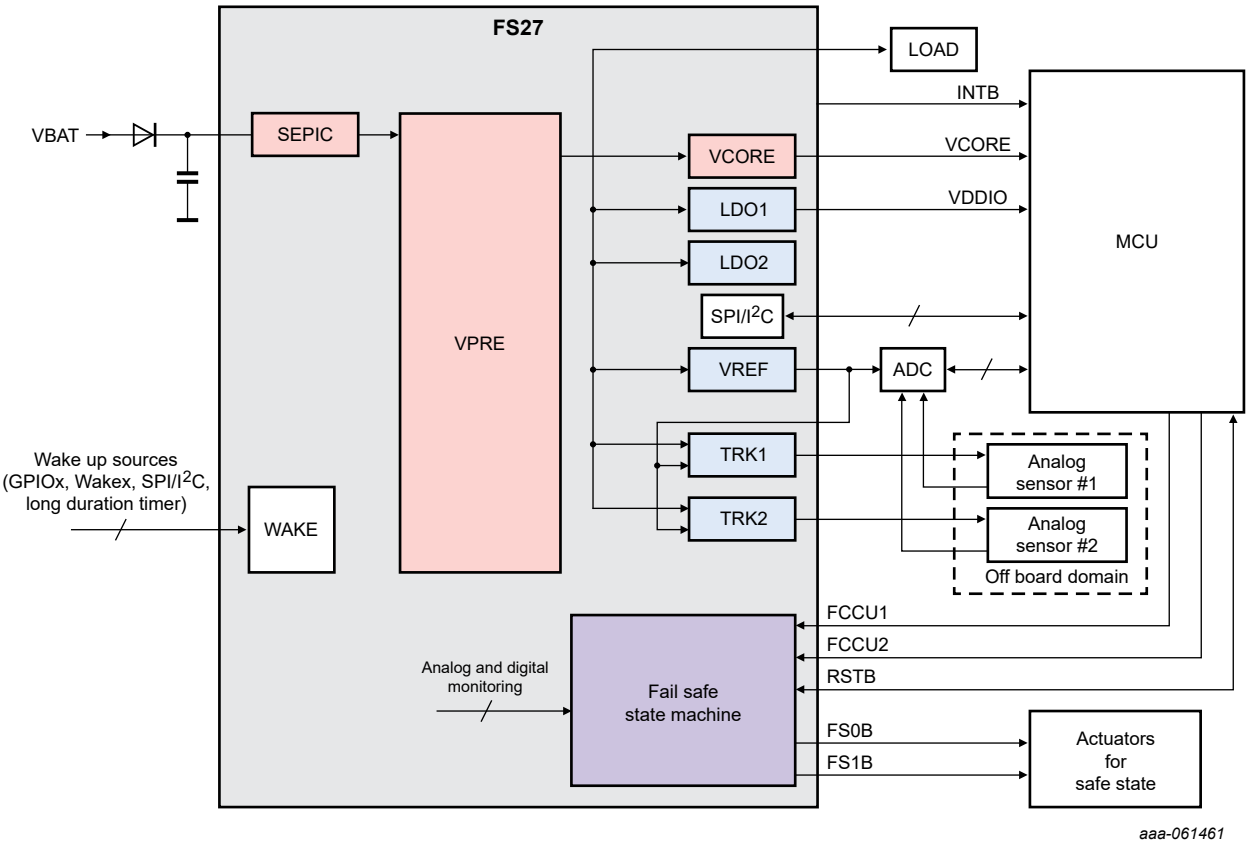

Figure 4. Example of application diagram with low-side controller as SEPIC

Figure 5 shows a simplified block diagram for a typical system with an FS27, using the low-side controller to support 48 V battery applications.

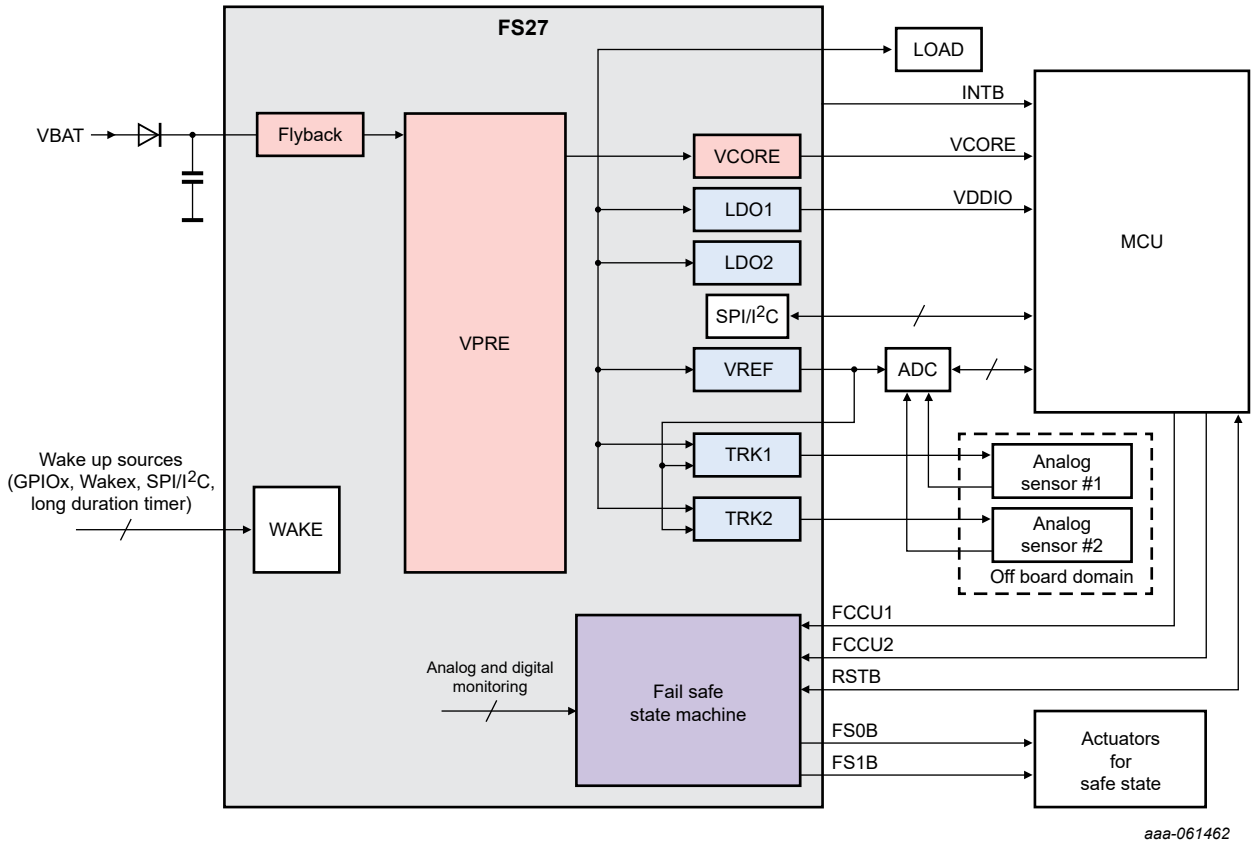

Figure 5. Example of application diagram with low-side controller as Flyback

4 Ordering information

This section describes the part numbers available for purchase, with their main differences. It also depicts how the part number reference is built.

4.1 Part number list

Table 1 shows a non-exhaustive list of part number examples.

Table 1. Device segmentation

Part number	Low-side controller configuration	VPRE current capability	VCORE current capability	Long duration timer (LDT)	Watchdog type	LBIST	Safe state pin	FS1B	DCLINK discharge function	Fault recovery	FCCU monitoring
FS2711xxB	Boost	2.5 A	3.5 A	Optional	Simple	No	FS0B	Optional	Optional	No	Optional
FS2711xxD	Boost	2.5 A	3.5 A	Optional	Challenger	Yes	FS0B	Optional	Optional	Optional	Yes
FS2713xxB	Boost	2.5 A	3.5 A	Optional	Simple	No	LIMP	Optional	No	No	Optional
FS2713xxD	Boost	2.5 A	3.5 A	Optional	Challenger	Yes	LIMP	Optional	No	Optional	Yes
FS2731xxD	SEPIC	2.5 A	3.5 A	Optional	Challenger	Yes	FS0B	Optional	Optional	Optional	Yes

Additional part numbers will exist with different features and parametric settings.

Table 2. Orderable part numbers

Part number	Description	Package
PFS2700BMDA0AD	Blank B0 superset FS0B prototype version	LQFP48
PFS2702BMDA0AD	Blank B0 superset LIMP prototype version	LQFP48

5 Applications

xEV and powertrain market

- Inverter
- Onboard charger (OBC), DCDC
- Battery management system (BMS)
- Belt starter generator (BSG)

Body market

- Gateway
- Zonal control
- Body controller
- Smart junction box

Safety and chassis

- Suspension
- Power steering

MCU attach

- S32K3xx high-end family
- Infineon Aurix family (TC4x)
- Renesas RH850 family
- ST SR6 family

6 Power management

Table 3. Voltage regulator summary

#	Regulator	Type	Input range	Output range	Output current
1	VBST	High-voltage boost controller	3.2 V to 70 V	up to 18 V	up to 3 A
2	VPRE	Single-phase buck converter	3.2 V to 36 V	3.2 V to 6.35 V	up to 2.5 A
3	VCORE	Single-phase buck converter	3.3 V to 6.35 V	0.8 V to 5.0 V	up to 3.5 A
4	LDO1	LDO	3.3 V to 6.35 V	1.0 V to 5.0 V	up to 400 mA
5	LDO2	LDO	3.3 V to 6.35 V	1.0 V to 5.0 V	up to 400 mA
6	VREF	LDO	3.3 V to 6.35 V	1.8 V to 5.0 V	up to 80 mA
7	TRK1	LDO/tracker	3.3 V to 6.35 V	1.0 V to 5.0 V	up to 150 mA
8	TRK2	LDO/tracker	3.3 V to 6.35 V	1.0 V to 5.0 V	up to 150 mA

7 Package information

Package dimensions are provided in package drawings. To find the most current package outline drawing, go to http://www.nxp.com and perform a keyword search for the drawing's document number.

Table 4. Package mechanical dimensions

Package	Suffix	Package outline drawing number
7.0 mm × 7.0 mm, 48-pin LQFP exposed pad, with 0.5 mm pitch, and a 4.5 mm × 4.5 mm exposed pad	AE	98ASA00945D

8 Revision history

Table 5. Revision history

Document ID	Release date	Description
FS27_PB v.1.0	19 June 2025	Initial version

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