

FS23_SBC

Safety system basis (SBC) with power management, CAN FD and LIN transceivers

Rev. 2.1 — 30 October 2023

Product brief



1 General description

The FS23 SBC offers an expandable family of devices that is pin-to-pin and software compatible. The FS23 SBC is scalable from the linear voltage regulator version to the DC-DC regulator version, as well as from QM to ASIL B. The FS23 SBC includes CAN and LIN transceivers, along with a number of system and safety features for the latest generation of automotive electronic control units (ECU).

The FS23 SBC provides a high level of integration in order to optimize the bill of material (BOM) cost for the body and comfort market.

The FS23 device is highly flexible. It is suitable for S32K processor-based applications, as well as multi-vendor processors because of its high level of flexibility.

Several device versions are available, offering choice in output-voltage settings, operating frequency, power-up sequencing, and inputs/outputs configuration to address multiple applications.



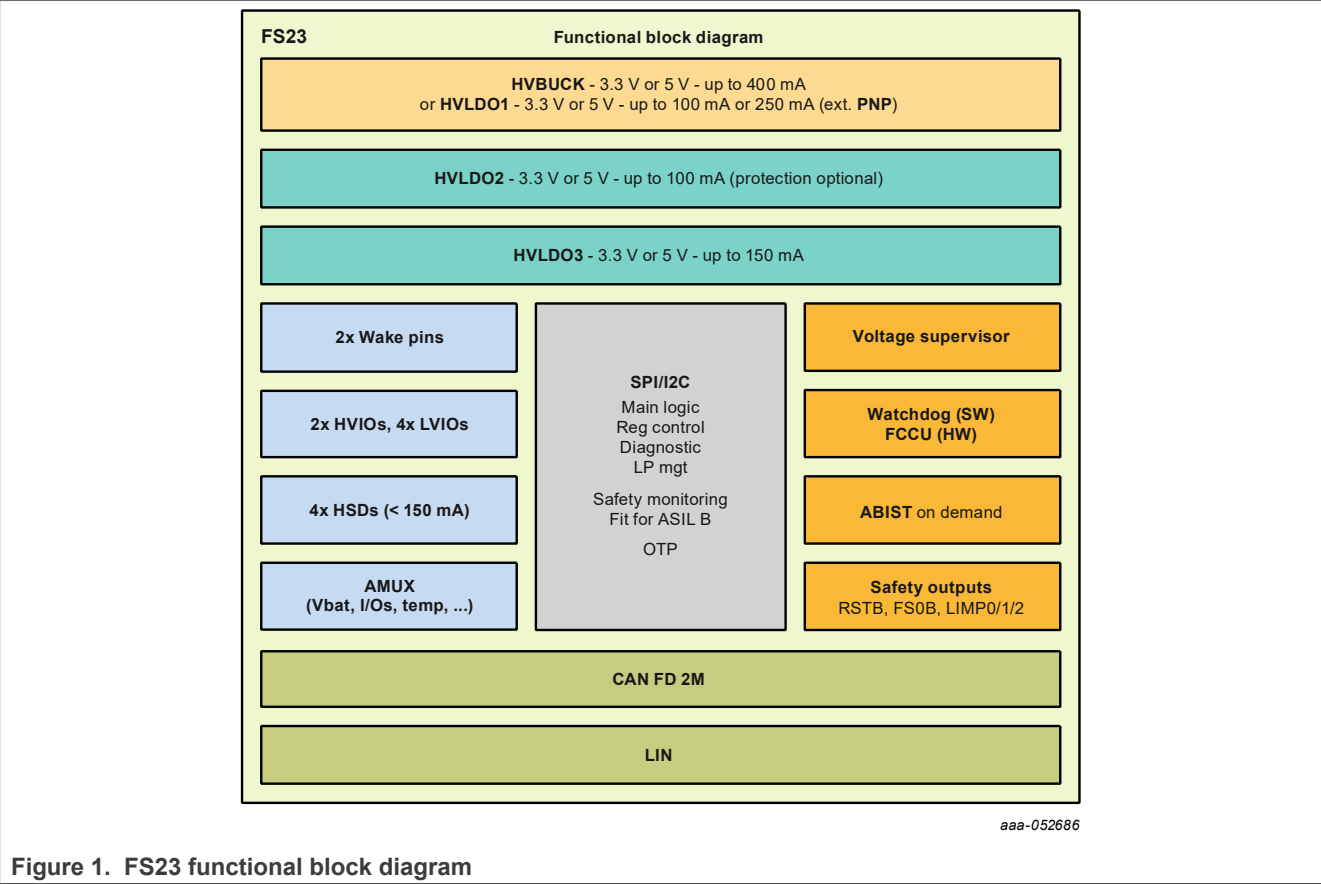


Figure 1. FS23 functional block diagram

2 Features and benefits

Operating modes

- Normal mode with all power management and functional safety features available
- Stop mode: Low-power OFF mode with multiple wake-up sources (LPOFF)
- Standby mode: Low-power ON mode with HVBUCK or HVLDO1 active and multiple wake-up sources (LPON)

Power management

- HVBUCK: Synchronous buck converter with integrated FETs. Configurable Normal mode output voltage and LPON mode output voltage (3.3 V or 5.5 V). Output DC current capability of 400 mA in Normal mode, and 100 mA current capability in Low-power ON mode
- HVLDO1: High-voltage LDO instead of the HVBUCK for MCU supply with selectable output voltage (3.3 V or 5.5 V) and up to 100 mA DC current capability with internal PMOS and 250 mA with external PNP
- HVLDO2: High-voltage LDO regulator for system loads, with optional external protection for off-board sensors, selectable output voltage (3.3 V or 5.0 V) and up to 100 mA DC current capability
- HVLDO3: High-voltage LDO regulator for CAN FD block supply or other with selectable output voltage (3.3 V or 5.0 V) and up to 150 mA current capability

System features

- One CAN FD supporting up to 2 Mbps communication following ISO 11898-2:2016 and SAE J2284 standards
- One LIN following LIN 2.2, ISO 17987-4 and SAE-J2602-2 standards
- Two wake-up inputs (40 V capable)
- Two high-voltage I/Os with wake-up capability (40 V capable)
- Up to four low-voltage I/Os with wake-up capability
- Four configurable high-side drivers with 150 mA drive capability, to supply LEDs or enable external devices (INH), and cyclic-sense capability
- Multiple wake-up sources: WAKE pins, HVIO pins, LVIO pins, CAN FD, LIN or dedicated SPI/I²C command
- Device control via 32 bits SPI interface or via I²C interface, with CRC
- Integrated long duration timer (LDT) for system shutdown and wake-up control, programmable up to 194 days
- 16-channel analog multiplexer (AMUX) for system monitoring (temperature, battery voltage, internal voltages)

Functional safety

- Developed following ISO 26262:2018 standard to fit for ASIL B applications
- Internal monitoring circuitry with its own reference
- Additional input for external voltage monitoring
- Window or timeout watchdog function to monitor the MCU failures by software
- FCCU inputs to monitor MCU failures by hardware
- Analog built-in self-test (ABIST) on demand
- Safety outputs (RSTB, FS0B, LIMP0 and LIMP1/2 with 1.25 Hz or 100 Hz PWM capability)

EMC compliance

- The FS23 EMC tests are performed according to ZVEI Generic IC EMC Test Specification version 2.1 (2017) and FMC1278 Electromagnetic Compatibility Specification for Electrical/Electronic Components and subsystems version 3.0 (2018).

Configuration and enablement

- QFN48EP: QFN 48 pins with exposed pad for optimized thermal management, wettable flanks, 7 x 7 x 0.85 mm, 0.5 mm pitch, 48 pins
- One-time programmable (OTP) memory for scalability, expandability and device customization
- OTP emulation mode for system development and evaluation

3 Applications

- Body control module
- HVAC
- Lighting
- Steering column lock
- Seat module
- Roof module
- Door control module
- Car access
- Gearshift
- Seat belt pre-tension
- Tail gate
- Alarm

4 Ordering information

This section describes the part numbers available to be purchased, along with their main differences. It also describes how the part number reference is built.

4.1 Part numbers definition

Two FS23 part numbering types can be found: a full part number reference and a simplified part number.

Figure 2 and Figure 3 describe how the FS23 part numbers are built.

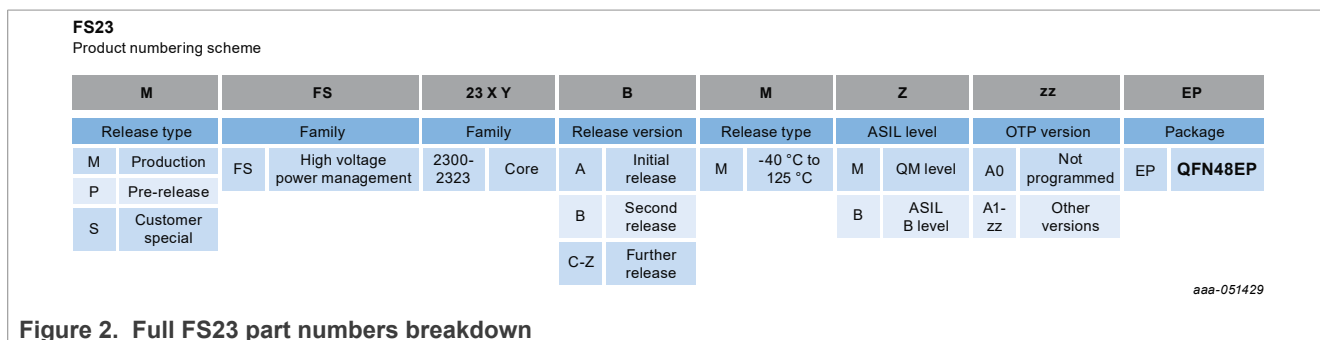


Figure 2. Full FS23 part numbers breakdown

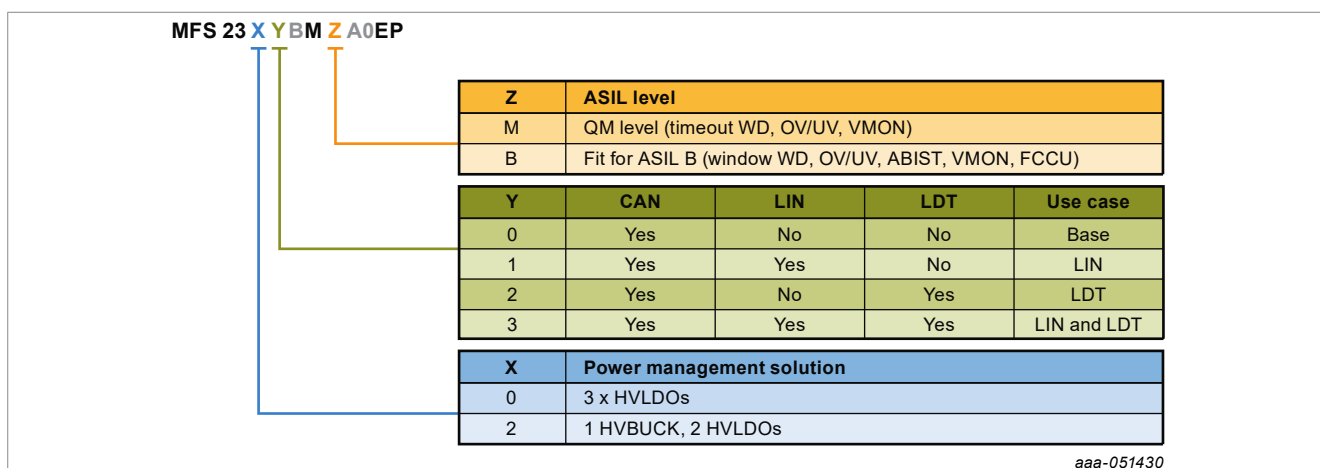


Figure 3. Simplified FS23 part numbers breakdown

Figure 4 maps FS23 part numbers versus the selectable product features.

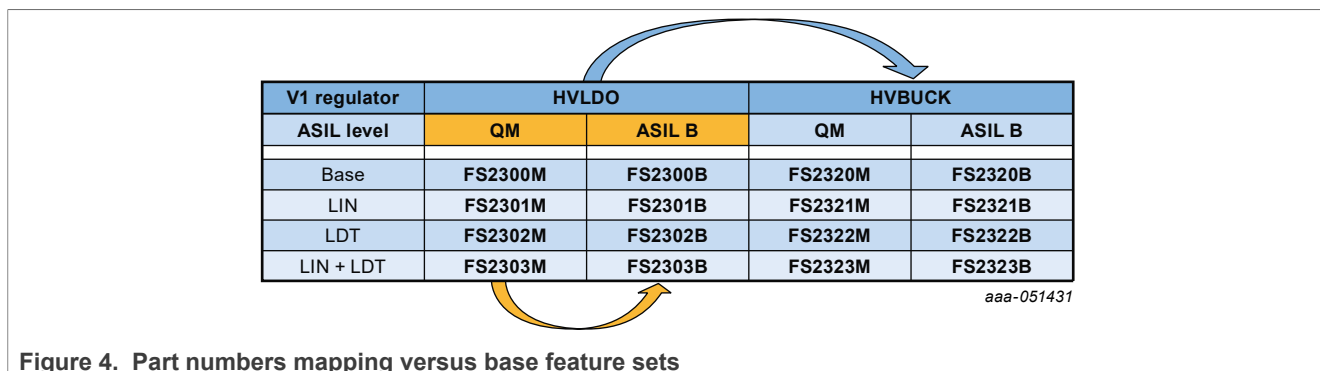


Figure 4. Part numbers mapping versus base feature sets

4.2 Part numbers list

Table 1. Device segmentation

Generic part number	V1 type	HV LDO2	HV LDO3	CAN	LIN	LDT	SPI/I ² C	AMUX	HVIOs	LVIOs	Wake pins	High-side drivers	Fit for ASIL	FS0B	LIMPx	VMON_EXT	FCCU	Watchdog	Cyclic CRC check	RSTB 8 s timer	ABIST on demand
FS2300M	HVLDO	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	QM	No	Yes	No	No	Opt.	Opt.	No	No
FS2301M	HVLDO	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	QM	No	Yes	No	No	Opt.	Opt.	No	No
FS2302M	HVLDO	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	QM	No	Yes	No	No	Opt.	Opt.	No	No
FS2303M	HVLDO	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	QM	No	Yes	No	No	Opt.	Opt.	No	No
FS2300B	HVLDO	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	ASIL B	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FS2301B	HVLDO	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	ASIL B	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FS2302B	HVLDO	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ASIL B	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FS2303B	HVLDO	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ASIL B	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FS2320M	HVBUCK	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	QM	No	Yes	No	No	Opt.	Opt.	No	No
FS2321M	HVBUCK	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	QM	No	Yes	No	No	Opt.	Opt.	No	No
FS2322M	HVBUCK	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	QM	No	Yes	No	No	Opt.	Opt.	No	No
FS2323M	HVBUCK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	QM	No	Yes	No	No	Opt.	Opt.	No	No
FS2320B	HVBUCK	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	ASIL B	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FS2321B	HVBUCK	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	ASIL B	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FS2322B	HVBUCK	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ASIL B	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FS2323B	HVBUCK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	ASIL B	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Additional part numbers will exist with different features and parametric settings. The device segmentation is also available on nxp.com.

[Table 2](#) is an example of orderable part number list.

Table 2. Orderable parts numbers

Part number ^[1]	Description	Package
MFS2300BMBA0EP	Superset covering FS2300B devices.	QFN48EP
MFS2303BMBA3EP	BASIC OTP configuration given as an example for FS2303B devices.	
MFS2320BMBB1EP	Configuration given as an example for S32K312 MCU, CAN enabled, LIN and LDT disabled.	
MFS2321BMBB2EP	Configuration given as an example for S32K324 MCU, CAN and LIN enabled, LDT disabled.	
MFS2323BMBA5EP	S32K311 + FS23 EVB ASIL B, S32K31X-Q100	
MFS2323BMMA0EP ^[2]	Superset covering FS2323M devices.	

[1] To order parts in tape and reel, add the R2 suffix to the full part number reference.

[2] A0 parts are non-programmed OTP configurations. Preprogrammed OTP configurations are managed through part number extension. For a custom OTP configuration, please contact a local NXP sales representative.

5 Block diagram

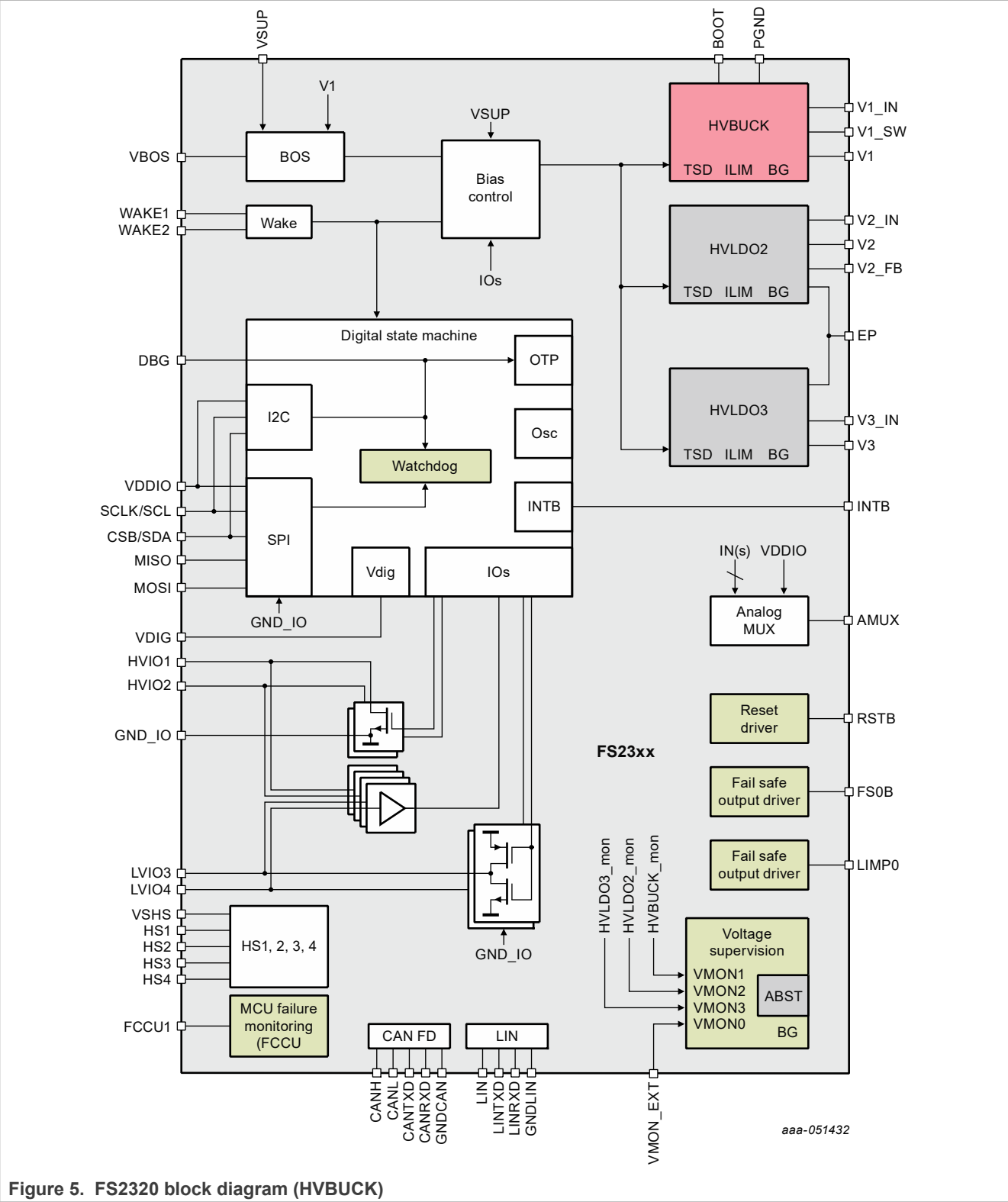


Figure 5. FS2320 block diagram (HVBUCK)

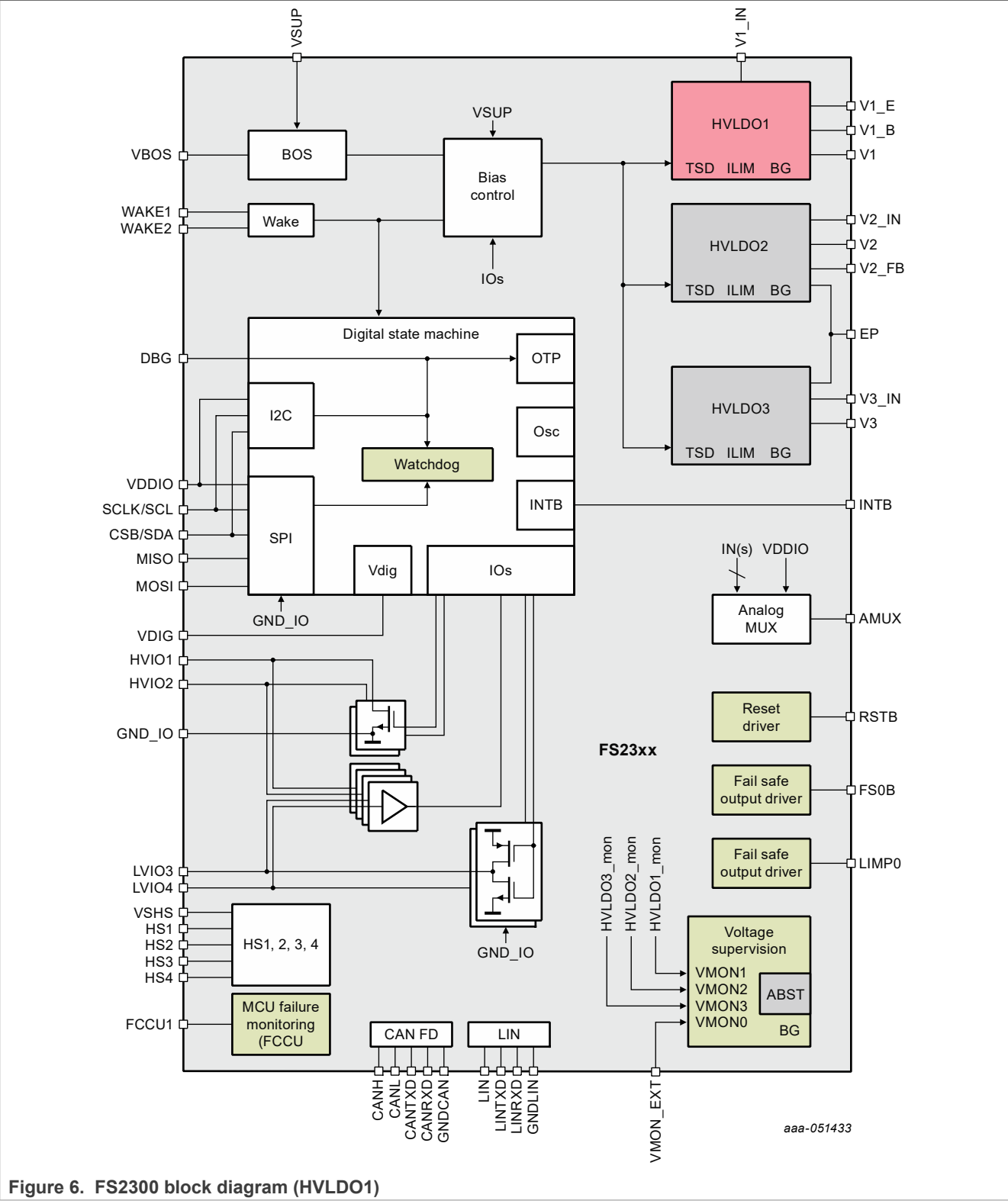
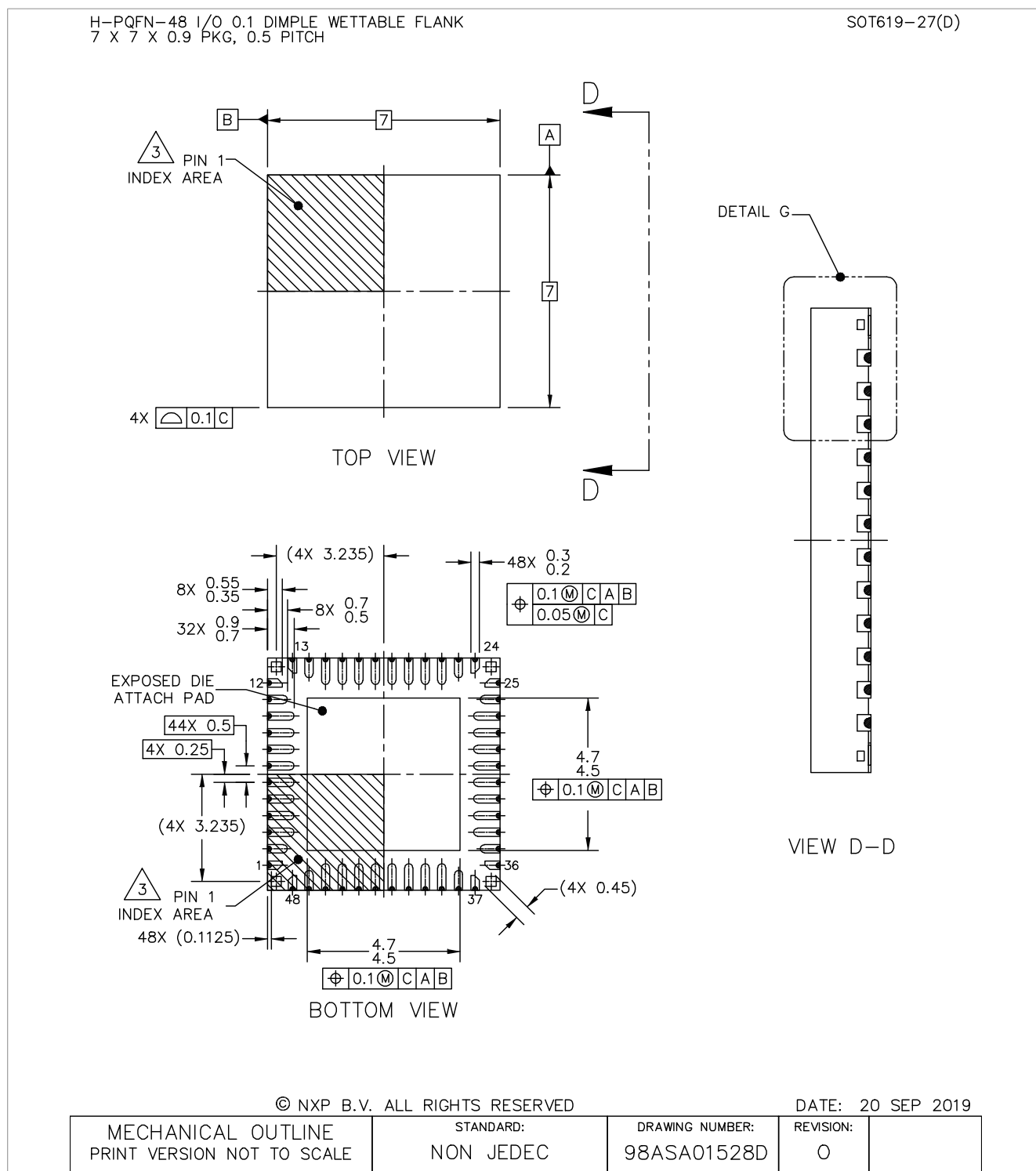


Figure 6. FS2300 block diagram (HVLDO1)

6 Package drawing



H-PQFN-48 I/O 0.1 DIMPLE WETTABLE FLANK
7 X 7 X 0.9 PKG, 0.5 PITCH

SOT619-27(D)

NOTES:

- 1. ALL DIMENSIONS ARE IN MILLIMETERS.
- 2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
- 3. PIN 1 FEATURE SHAPE, SIZE AND LOCATION MAY VARY.
- 4. COPLANARITY APPLIES TO LEADS AND DIE ATTACH PAD.
- 5. MIN. METAL GAP FOR LEAD TO EXPOSED PAD SHALL BE 0.2 MM.
- 6. ANCHORING PADS.

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DATE: 20 SEP 2019

MECHANICAL OUTLINE PRINT VERSION NOT TO SCALE	STANDARD: NON JEDEC	DRAWING NUMBER: 98ASA01528D	REVISION: 0	
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7 Revision history

Revision	Date	Description of changes
2.1	20231030	Updated Document title
2	20231020	- Updated appearance of Revision history - Updated Document title and identifier - Updated Section 1; Section 2; Section 3; Section 4; Section 8 - Removed section titled "Data sheet status"
1	20220608	Initial version

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