FS04

High voltage safety PMIC with SMPS and LDO

Rev. 1.0 — 25 June 2026 Product short data sheet

1 General description

The FS04 is an automotive multi-output power management IC (PMIC) that focuses on central compute, gateway, domain, and zonal controllers applications. The device includes a high-voltage buck converter, multiple high-efficiency switched-mode power supplies, and a linear voltage regulator.

The FS04 includes enhanced safety features with fail-safe outputs and dedicated safety pins for the processor S32N. The device covers ASIL B and ASIL D safety integrity levels. It complies with the ISO 26262 standard and is qualified in accordance with AEC-Q100 rev H (Grade 1, MSL3). The FS04 can be fully used in safety-oriented system partitioning, and can also be configured to operate as a non-safety QM-version part.

The FS04 is available in several versions that support various safety applications, offering choices regarding the number of output rails, output voltage settings, and power up sequencing.

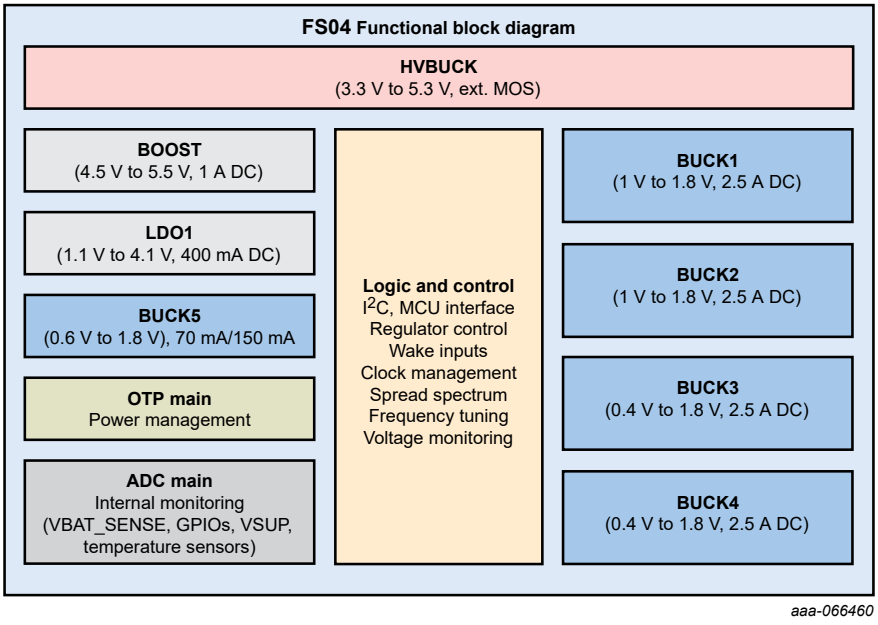

Figure 1. Functional block diagram

2 Features and benefits

One high-voltage synchronous buck controller (VPRE), driving external MOSFETs:

- Input voltage: 3.0 V to 60 V
- Output voltage from 3.3 V to 5.3 V
- Up to 1.5% DC accuracy in PWM mode and 3% DC accuracy in PFM mode
- Up to 20 A DC output current capability
- Switching frequency: 430 kHz to 480 kHz

Five buck regulators with internal power stage:

- BUCK1 single phase operation: 1.0 V to 1.8 V, 2.5 A DC with up to 1.0% DC accuracy
- BUCK2 single phase operation: 1.0 V to 1.8 V, 2.5 A DC with up to 1.0% DC accuracy
- BUCK3 single phase operation: 0.4 V to 1.8 V, 2.5 A DC with up to 1.0% DC accuracy (between 0.8 V to 1.5 V)
- BUCK4 single phase operation: 0.4 V to 1.8 V, 2.5 A DC with up to 1.0% DC accuracy (between 0.8 V to 1.5 V)
- BUCK5 / switch mode: 0.6 V to 1.8 V, 70 mA in buck mode and 150 mA in switch mode

One low-power linear regulator:

- LDO1: LDO / load switch with output voltage from 1.0 V to 4.1 V, 400 mA DC

One boost regulator with integrated low side switch:

- BOOST: output voltage 4.5 V to 5.5 V, 1 A DC with up to 2.0% DC accuracy

Functional safety

- Functional safety architecture to target ASIL D applications
- ABIST and LBIST for latent fault detection

System support

- Optimized low-power architecture, 35 µA quiescent in Standby mode with three regulators enabled
- High speed I^2C interface with up to 3.4 MHz operation
- Advanced frequency management: frequency spread spectrum, slew-rate control, manual frequency tuning
- Advanced thermal monitoring and thermal shutdown protection

Package

- 64-pin QFN package with exposed pad, 0.5 mm pitch

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
- Automotive qualified AEC-Q100 up to grade 1

3 Ordering information

Part number structure and orderable FS04 variants are detailed to facilitate the selection of the configuration matching in particular the processor attach, ASIL target and safety features.

3.1 Part number definition

Figure 2 shows the FS04 part number breakdown used to describe the available feature set of each device.

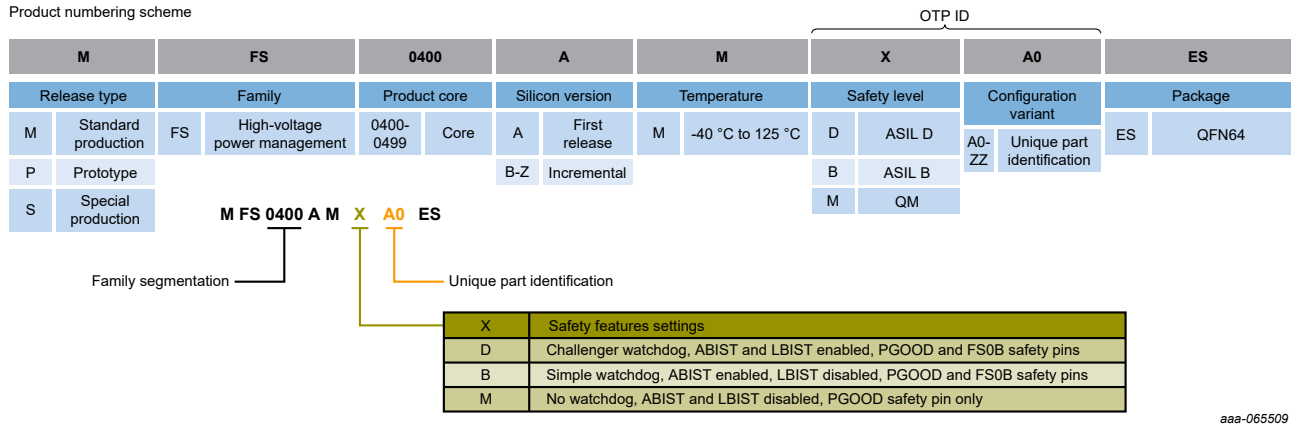

Figure 2. Part number breakdown

3.2 Orderable part numbers

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

Table 1. Ordering information

Family	Part number	Processor / memory	Reference design	Safety level	OTP ID
FS04	MFS0400AMMA0ES	Non programmed	-	-	MA0
FS04	MFS0400AMDA3ES	S32N55 / LPDDR5	S32N55-RDB	ASIL D	DA3

During engineering phase, NXP may provide blank (unprogrammed) or programmed samples with an additional laser marking with the **configuration variant** composed of three alphanumeric characters. This identifier is also called OTP ID. The OTP ID is the same to be used when the production part number is generated.

4 Maximum ratings

Absolute electrical and environmental operating conditions are defined to prevent device malfunction or permanent damage.

Table 2. Maximum ratings

All voltages are with respect to ground, unless otherwise noted. Exceeding these ratings may cause a malfunction or permanent damage to the device.

Symbol	Description (Rating)	Min	Max	Unit
Voltage ratings — FS04 supplies				
V_{SUP}	DC voltage at VSUP pin	-0.3	60	V
V_{BAT_SENSE}	DC voltage at VBAT_SENSE pin	-35	60	V
V_{BHS}	DC voltage at BHS pin	$V_{BAT\_SENSE} - 0.3$	$V_{BAT\_SENSE} + 9.0$	V
V_{DDIO}	DC voltage at VDDIO pin	-0.3	5.5	V
V_{BOS}	DC voltage at VBOS pin	-0.3	5.5	V
V_{DIG}	DC voltage at VDIG pin	-0.3	2.0	V
V_{GND}	DC voltage at GND pin	-0.3	0.3	V
V_{GND_FS}	DC voltage at GND_FS pin	-0.3	0.3	V
V_{GND_EP}	DC voltage at GND exposed pad	-0.3	0.3	V
Voltage ratings — FS04 basic functions				
V_{PWRON1}	DC voltage at PWRON1 pin	-0.3	60	V
V_{PWRON2}	DC voltage at PWRON2 pin	-0.3	5.5	V
V_{GPIO1}, V_{GPIO2}	DC voltage at GPIO1 and GPIO2 pin	-0.3	5.5	V
$V_{GPIO3/INTB}$	DC voltage at GPIO3/INTB pin	-0.3	V_{DDIO} + 0.3	V
V_{GPIO4}	DC voltage at GPIO4 pin	-0.3	V_{DDIO} + 0.3	V
V_{DDOTP}	DC voltage at VDDOTP pin	-0.3	10	V
V_{BAT_SW}	DC voltage at BAT_SW pin	-0.3	$V_{BAT\_SW\_OUT} + 9.0$	V
$V_{BAT\_SW\_OUT}$	DC voltage at BAT_SW_OUT pin	-4.0	60	V
V_{STBY}, V_{STBY_WKUP}, $V_{STBY\_VDD\_OK}$	DC voltage at STBY, STBY_WKUP, STBY_VDD_OK pins	-0.3	5.5	V
Voltage ratings — FS04 port communication				
V_{SCL}, V_{SDA}	DC voltage at SCL, SDA pins	-0.3	5.5	V
Voltage ratings — FS04 power management				
V_{PRE_SW}	DC voltage at PRE_SW pin	-2.0	60	V
	Transient voltage < 20 ns at PRE_SW pin	-3.0	60	V
V_{PRE_GHS}, V_{PRE_BOOT}	DC voltage at PRE_GHS, PRE_BOOT pins	-0.3	65.5	V
V_{PRE_COMP}, V_{PRE_GLS}, V_{PRE_CSN}, V_{PRE_CSP}, V_{PRE_FB}	DC voltage at PRE_COMP, PRE_GLS, PRE_CSN, PRE_CSP, PRE_FB pins	-0.3	5.5	V

Table 2. Maximum ratings...*continued*

All voltages are with respect to ground, unless otherwise noted. Exceeding these ratings may cause a malfunction or permanent damage to the device.

Symbol	Description (Rating)	Min	Max	Unit
V_{BUCKx_SW}	DC voltage at BUCKxSW pins	-0.3	5.5	V
	Transient voltage < 20 ns at BUCKxSW pin	-1.0	6.5	V
V_{BUCKx_FB}	DC voltage at BUCKxFB pins	-0.3	5.5	V
V_{BUCKx_IN}	DC voltage at BUCKxIN pins	-0.3	5.5	V
$V_{BUCK5\_SW\_IN}$	DC voltage at BUCK5_SW_IN pin	-0.3	5.5	V
V_{LDO1_OUT}, V_{LDO1_IN}	DC voltage at LDO1_IN and LDO1_OUT pins	-0.3	5.5	V
V_{BOOST}, V_{BOOST_LS}	DC voltage at BOOST_LS, VBOOST pins	-0.3	8.5	V
Voltage ratings — FS04 safety pins				
V_{RSTB}, V_{FS0B}, V_{FCCU1}, V_{FCCU2}, V_{POR_REQ}, V_{PGOOD}	DC voltage at RSTB, FS0B, FCCU1, FCCU2, POR_REQ, PGOOD safety pins	-0.3	60	V

5 Package information

FS04 package is a QFN (sawn) with following characteristics: 64 pins, thermally enhanced wettable flanks, 9 mm x 9 mm x 0.9 mm body, 0.5 mm pitch, MSL3[1].

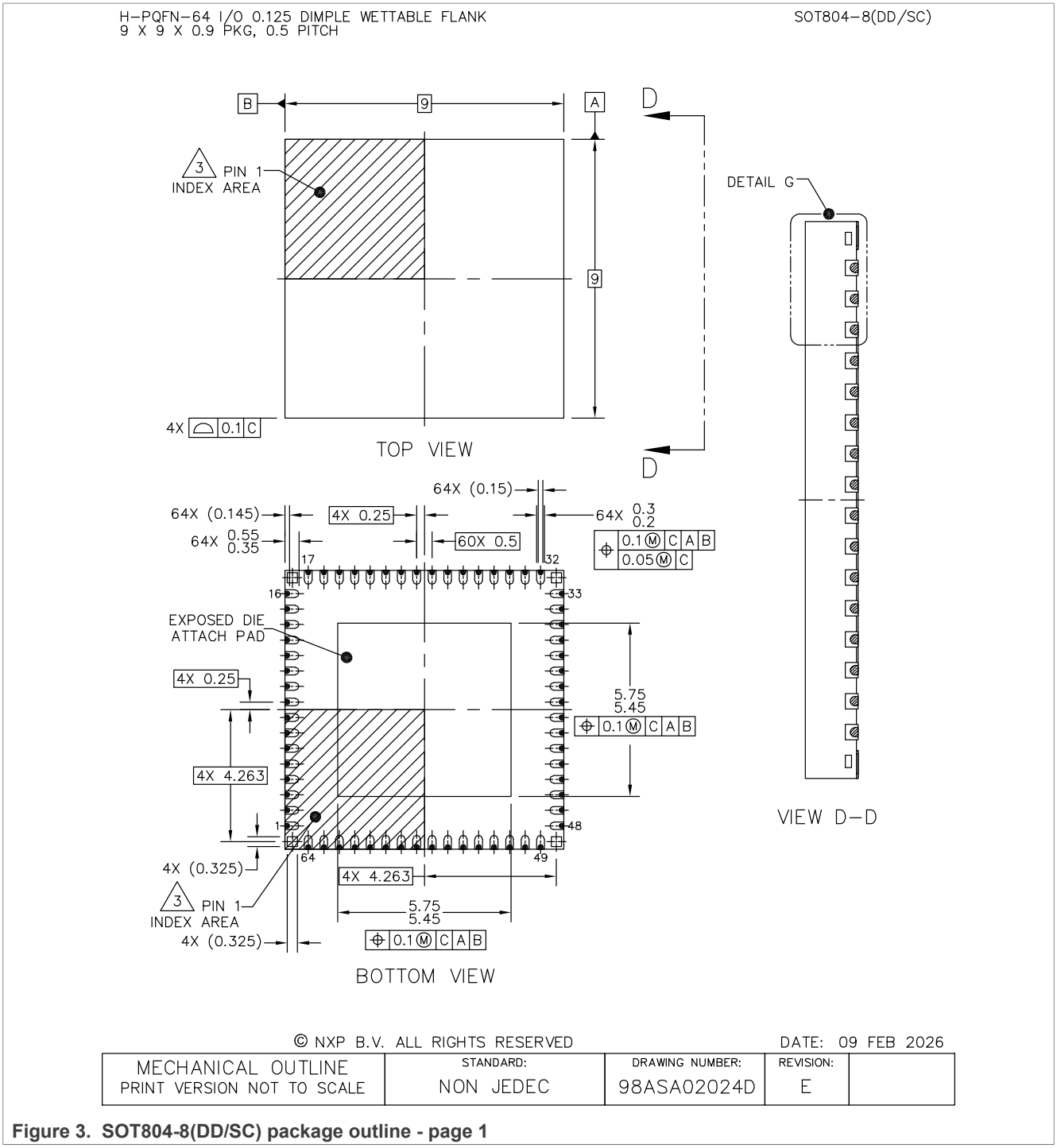

Figure 3. SOT804-8(DD/SC) package outline - page 1

1 Moisture Sensitivity Level

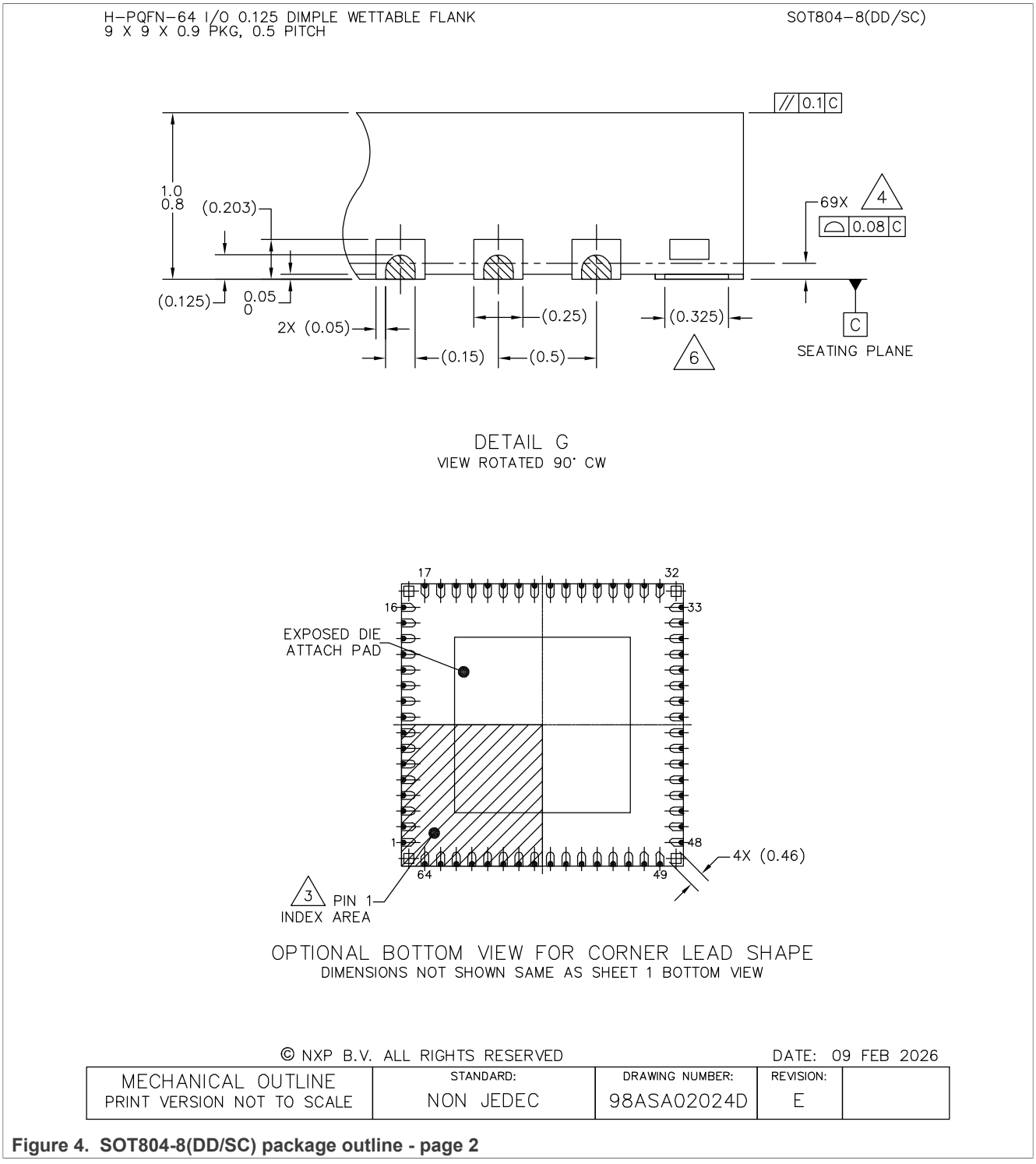

Figure 4. SOT804-8(DD/SC) package outline - page 2

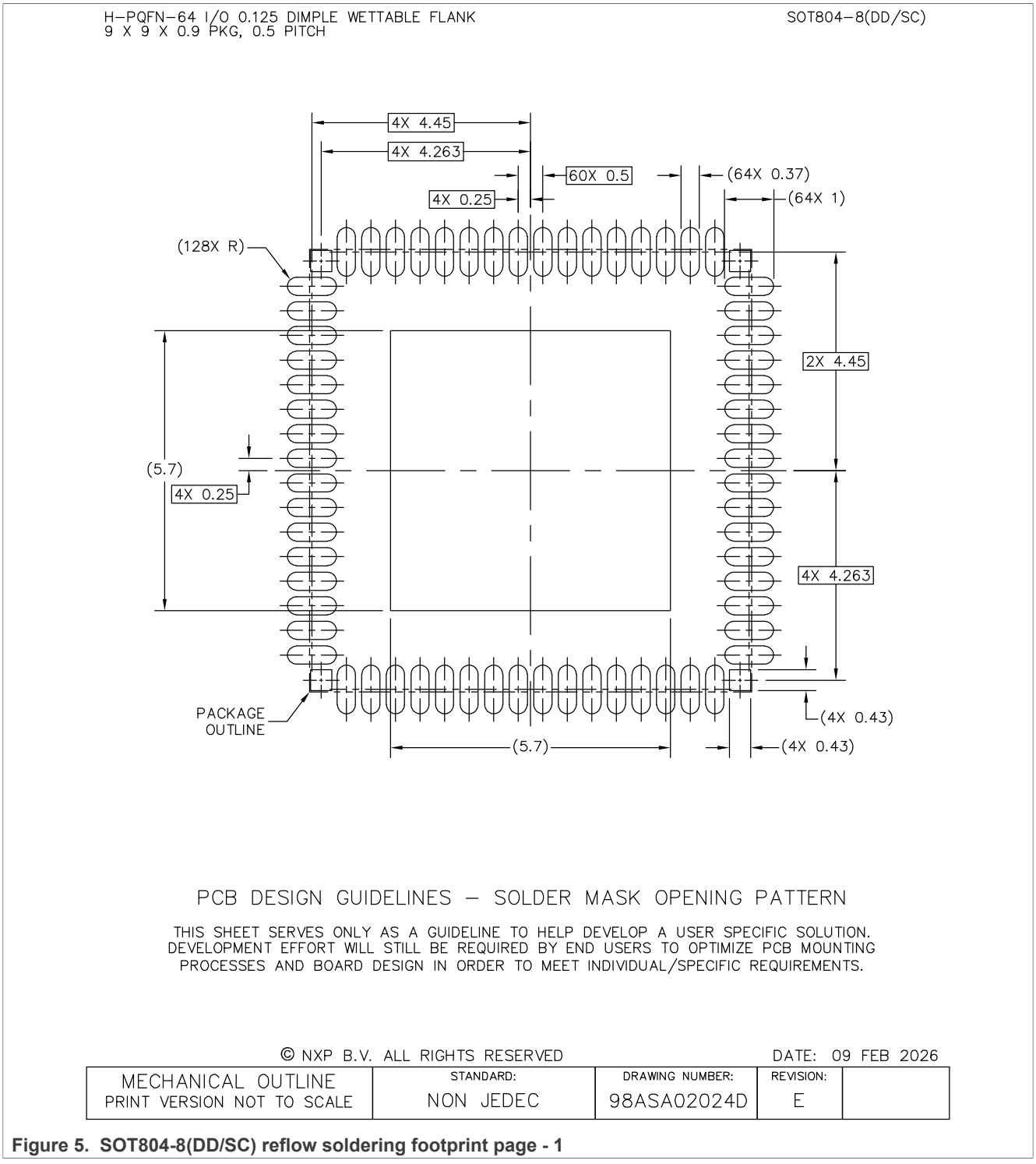

Figure 5. SOT804-8(DD/SC) reflow soldering footprint page - 1

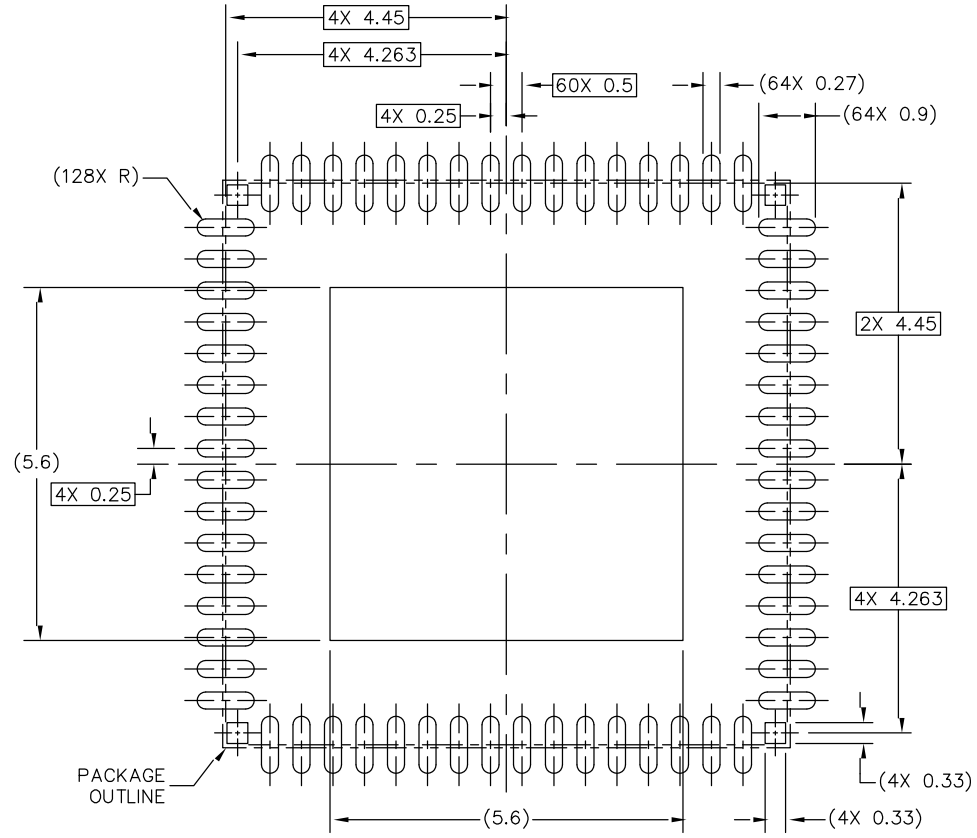

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Figure 6. SOT804-8(DD/SC) reflow soldering footprint page - 2

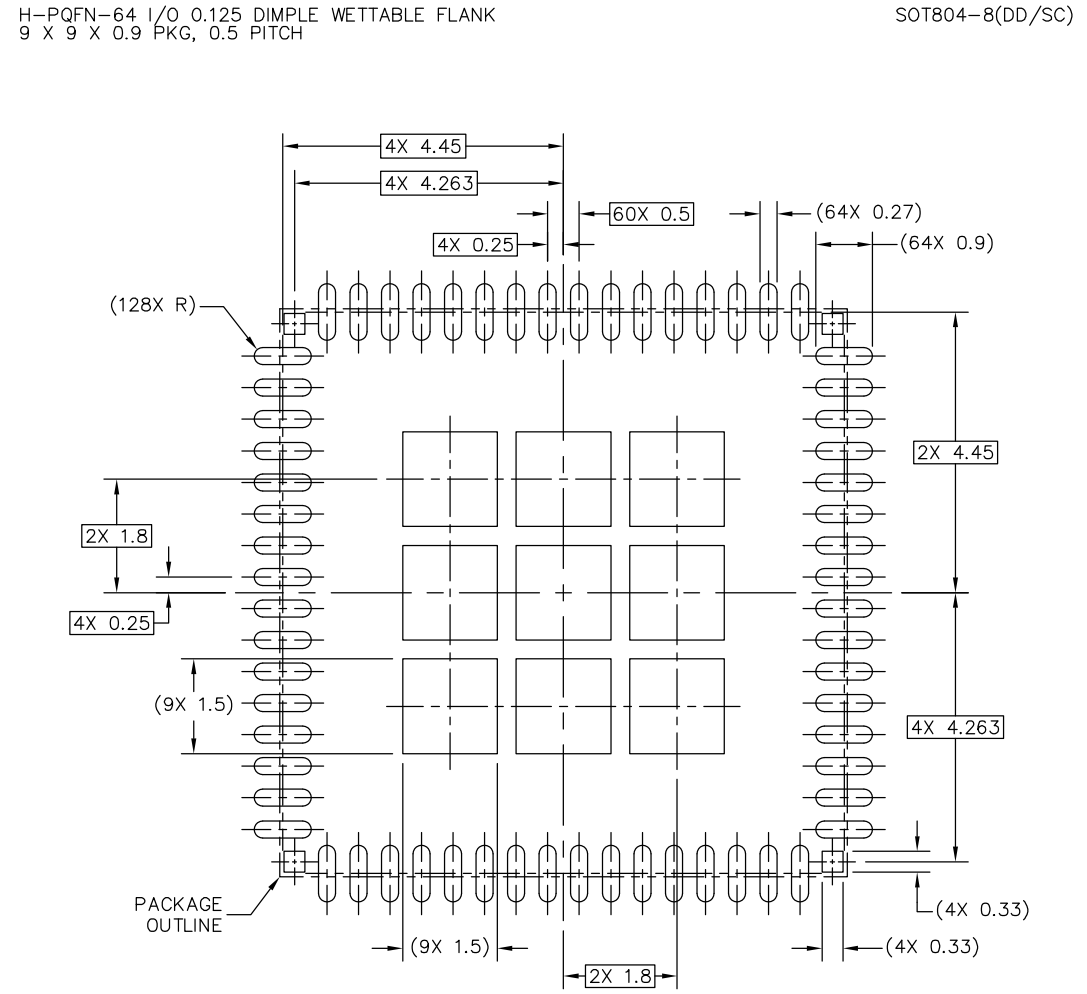

Figure 7. SOT804-8(DD/SC) reflow soldering footprint page - 3

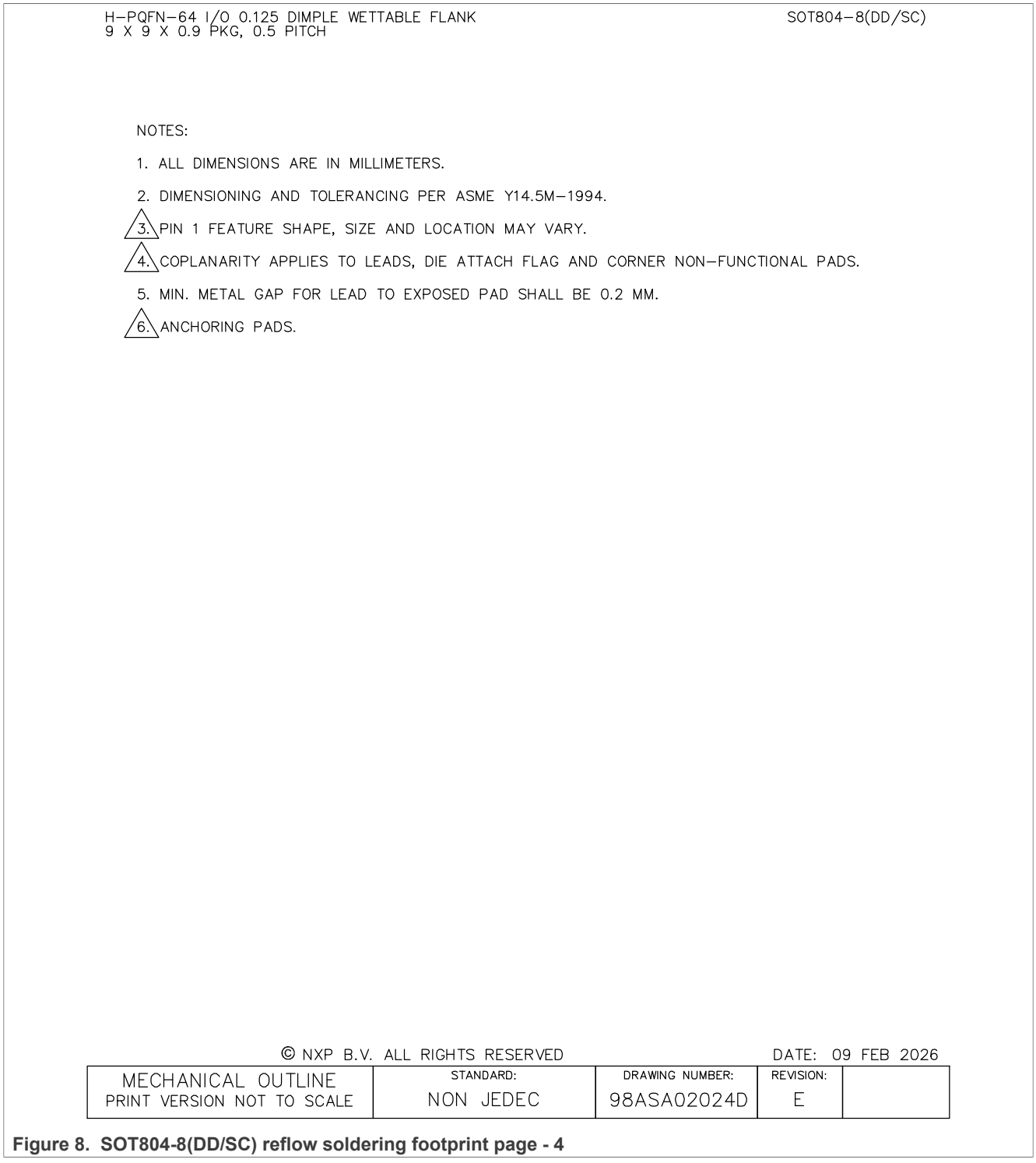

Figure 8. SOT804-8(DD/SC) reflow soldering footprint page - 4

6 Revision history

Table 3. Revision history

Document ID	Release date	Description
FS04_SDS.v.1.0	25 June 2026	Initial version

Legal information

Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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