

1 介绍

i.MX RT1170是一款新型处理器系列，以恩智浦的先进技术整合了高性能的 Arm® Cortex®-M7内核及高能效的ARM Cortex-M4内核。它提供高CPU性能和实时的响应。

i.MX RT1170 集成了先进的电源管理模块以及DC-DC和LDO，降低了外部电源的复杂性并简化了电源时序。

该处理器的内置DC-DC稳压器适用于高达105°C的消费类应用和工业应用。对于汽车应用来说，当结温 (T_j) 提高到125°C时，内核平台功耗可能超过其内部 DC-DC 的容量。在这种情况下，请配合恩智浦的 PF5020 PMIC 使用 i.MX RT1170。

目录

- 1 介绍 1
- 2 电源方案 2
- 3 原理图 4
- 4 软件 4
 - 4.1 PF5020驱动程序功能 4
 - 4.2 PF5020驱动程序示例 4
 - 4.3 电源控制演示 5
- 5 物料清单 5
- 6 参考资料 5
- 7 修订历史 6

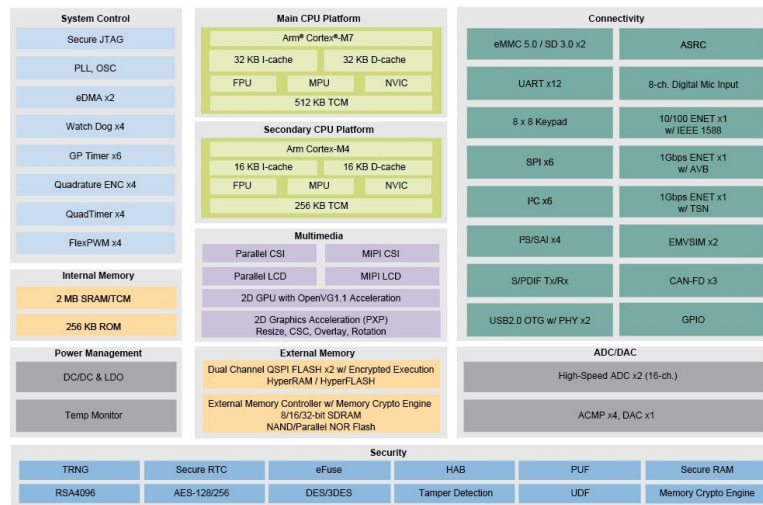
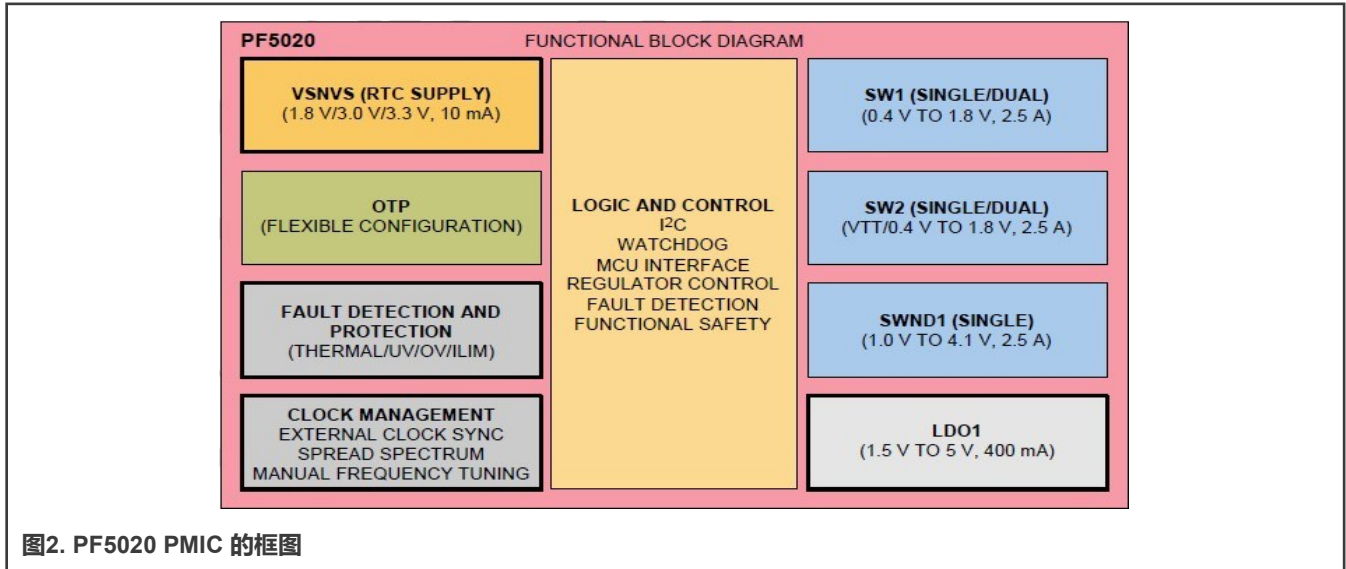


图1. i.MX RT1170框图

PF5020是恩智浦的多通道电源管理集成电路 (PMIC) 器件，专门适用于高性能汽车和工业应用。PF5020 可满足各种系统级电源需求。PF5020集成了独立的电压监控电路，确保符合 ISO 26262 标准，功能安全达到 ASIL-B 级。PF5020 内置一次性可编程存储器，可存储重要启动配置，这大大减少了通常用于设置输出电压和外部稳压器时序的外部元器件。稳压器参数可在启动后通过高速 I²C 进行调整，提供不同系统状态的灵活性。PF5020 也可用作标准的非安全设备，用于不需要符合 ISO 标准的应用。

图 2 显示了PF5020 PMIC 的框图。





PF5020 完全适用于基于 i.MX RT117x 处理器的各种汽车应用。PF5020 包含三个高效降压稳压器和一个带负载开关选择的线性稳压器。PF5020 的每个降压稳压器的额定电流高达 2500 mA，线性稳压器则高达400 mA。PF5020 的两个降压转换器 SW1 和 SW2 支持动态电压调节 (DVS)。

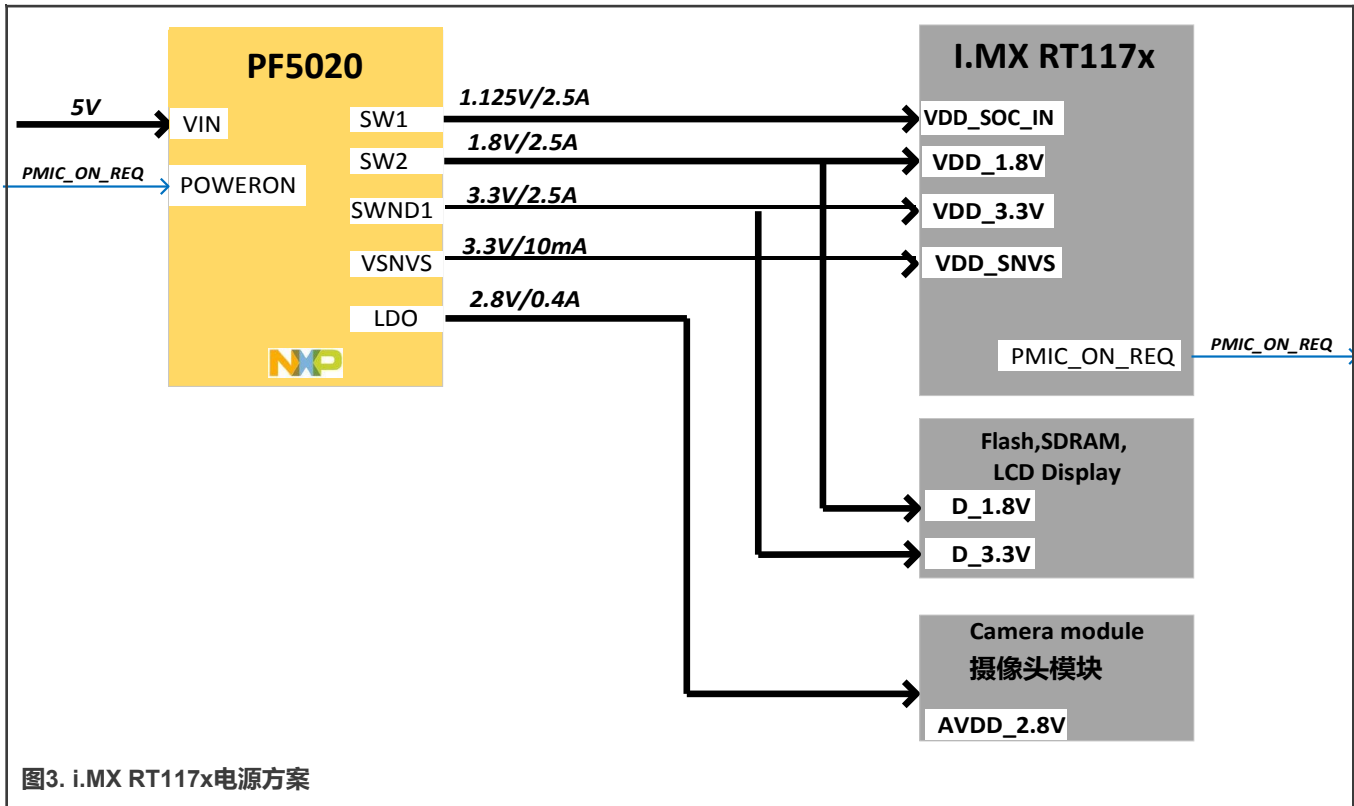
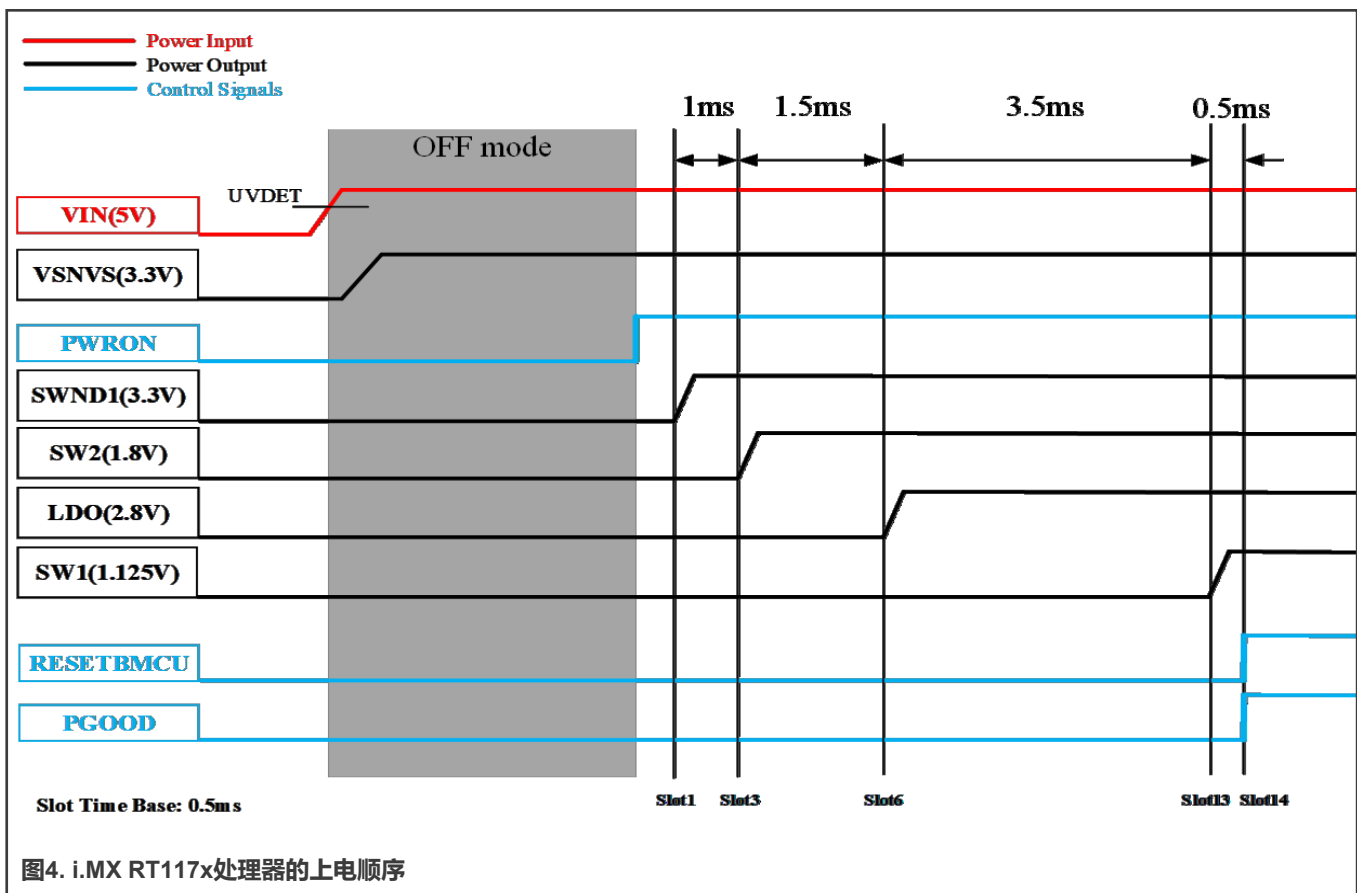


表1 显示了i.MX RT117x 电源轨的要求和 PMIC 的输出配置。

表1. PMIC配置

PF5020连接	输出电压/V	电流容量/mA	RT117x电源轨	上电顺序	断电顺序
SW1	1.125	2500	VDD_SOC_IN	5	2
SW2	1.8	2500	VDD_1.8V	3	4
SWND1	3.3	2500	VDD_3.3V	2	5
LDO	2.8	400	AVDD_2.8V	4	3
VSNVS	3.3	10	VDD_SNVS	1	6
RESETBMCU	—	—	RST_B	6	1

PF5020 的默认顺序可通过 OTP 配置寄存器进行编程。图 4 显示了 RT117x 处理器的上电/断电顺序。PF5020 的 OTP 寄存器可对 RT117x 的特定电源顺序配置进行编程。当 PF5020 的 VIN 超过 UNVDET 阈值时，VSNVS 通电。当 PWRON 被拉高时，PMIC 启动上电事件。稳压器按照 PF5020 OTP 文件中配置的上电顺序自动上电。当 PF5020 的 RESETBMCU 释放时，上电顺序完成，且 RT117x 启动。RT117x 的断电顺序是上电顺序的镜像。



3 原理图

图5显示了基于 PF5020 的 i.MX RT117x 处理器电源方案原理图。i.MX RT 1170 用户可用此图作为指导。

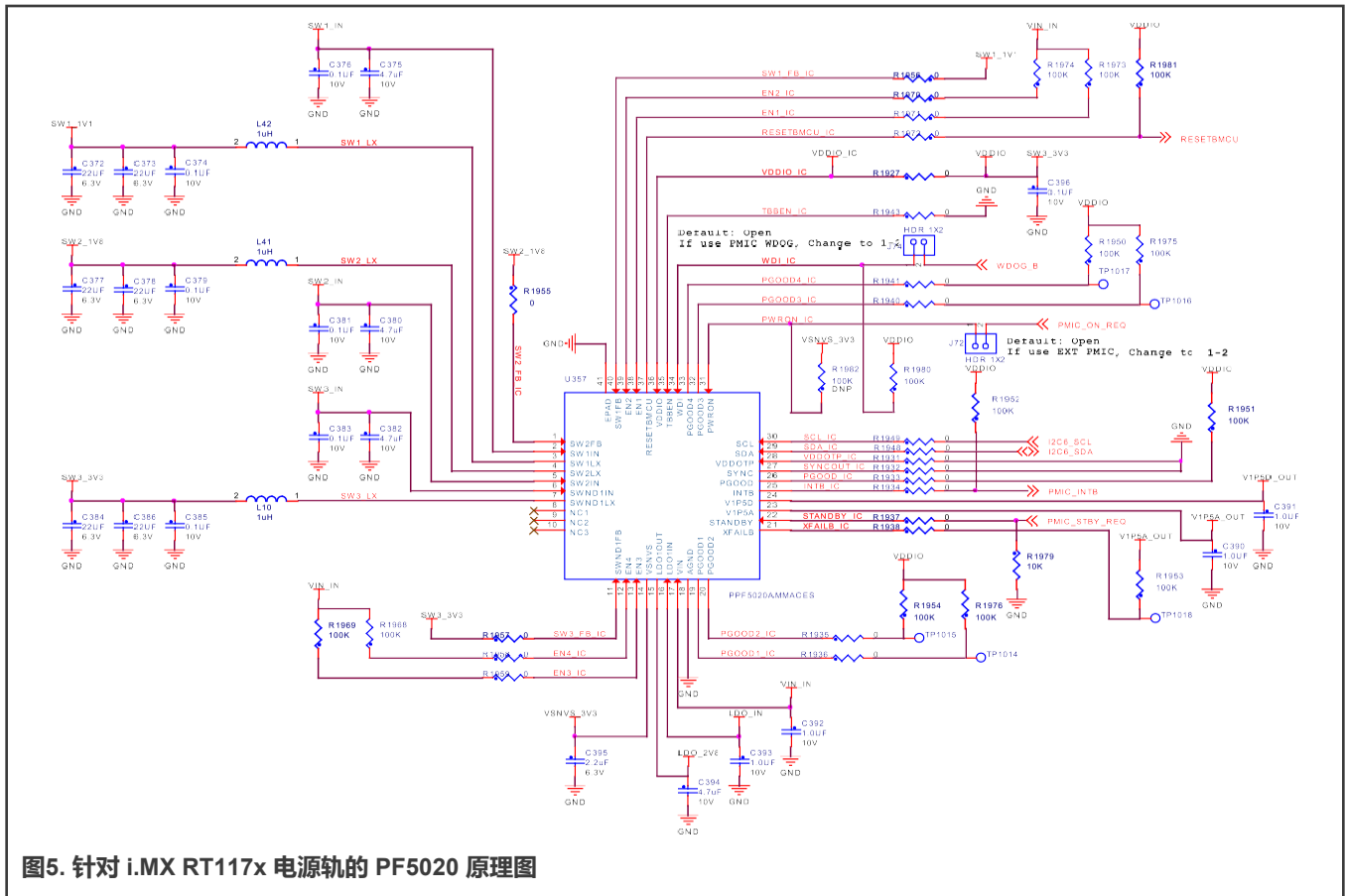


图5. 针对 i.MX RT117x 电源轨的 PF5020 原理图

4 软件

4.1 PF5020驱动程序功能

- SW1、SW2、SWND1和LDO1的配置，例如运行/待机状态下的输出电压和工作模式
- 与电压监视器 (OV/UV/ILIM) 相关的配置
- 获取/清除/启用/禁用中断
- 内部看门狗定时器配置
- 上电/断电顺序配置
- 内部高速时钟配置
- 温度传感器配置
- 模拟多路复用器配置

4.2 PF5020驱动示例

- 演示如何在稳压器的运行/待机状态下更改输出电压和工作模式

- 演示如何调整内部时钟的频率
- 演示如何将 PF5020 设置为待机状态
- 演示如何导出 PF5020 的内部寄存器的值
- 当 RT1170 不处于待机模式时，使用软件方法实现设定点 0/1/5/10 的更改
- 当 RT1170 进入待机模式时，使用硬件方法实现设定点 0/1/5/10 的更改
- SNVS 模式

4.3 电源控制演示

- Power_mode_switch_demo + PMIC

注意

装有 PMIC 软件的电路板不是公开发布的套件。如需了解更多信息，请联系您的恩智浦代表。

5 物料清单

表2列出了配备 PF5020 的 i.MX RT117x 电源方案的推荐元器件。这些元器件都提供了示例型号，也可使用等效的其他器件。

表2. PF5020 电源方案物料清单

值	数量	部件编号	说明	厂商	组件
	1	MPF5020CMMACES	电源管理IC	NXP恩智浦	PMIC
1.0 μ F	4	GCM155C71A105KE38D	10 V 10 % X7S 0402	MURATA	输入电容器
2.2 μ F	1	GRT155C71A225KE13	10 V 10 % X7S 0402	MURATA	输出电容器
4.7 μ F	4	GRT188C81E475KE13	25 V 10 % X6S 0603	MURATA	输出电容器
0.1 μ F	7	GCM155R71C104KA55D	16 V 10 % X7R 0402	MURATA	输入和输出电容器
22 μ F	6	GRT21BC81A226ME13	10 V 20 % X6S 0805	MURATA	输出电容器
1.0 μ H	3	TFM252012ALMA1R0MTAA	4.7 A 20 % SMD	TDK	输出电感器

6 参考资料

i.MX RT1170

- i.MX RT1170
 - [i.MX RT1170文档](#)中的数据手册和应用笔记
- RT-4-Digit论坛
 - [RT-4-Digit文档](#)
- PF5020
 - [PF5020文档](#)中的数据手册和应用笔记
 - [PF5020工具和软件](#)中的NXPGUI (带集成OTP配置和电源工具)
 - [PF5020多通道PMIC评估板](#)中的PCB和原理图

- [电源管理论坛](#)
[电源管理](#)

7 修订历史

版本号	日期	说明
0	2021年6月30日	初版发布

How To Reach Us

Home Page:

nxp.com

Web Support:

nxp.com/support

Information in this document is provided solely to enable system and software implementers to use NXP products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits based on the information in this document. NXP reserves the right to make changes without further notice to any products herein.

NXP makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does NXP assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in NXP data sheets and/or specifications can and do vary in different applications, and actual performance may vary over time. All operating parameters, including "typicals," must be validated for each customer application by customer's technical experts. NXP does not convey any license under its patent rights nor the rights of others. NXP sells products pursuant to standard terms and conditions of sale, which can be found at the following address: nxp.com/SalesTermsandConditions.

Right to make changes - NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Security — Customer understands that all NXP products may be subject to unidentified or documented vulnerabilities. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer's applications and products. Customer's responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer's applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately. Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP. NXP has a Product Security Incident Response Team (PSIRT) (reachable at PSIRT@nxp.com) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

NXP, the NXP logo, NXP SECURE CONNECTIONS FOR A SMARTER WORLD, COOLFLUX, EMBRACE, GREENCHIP, HITAG, ICODE, JCOP, LIFE, VIBES, MIFARE, MIFARE CLASSIC, MIFARE DESFire, MIFARE PLUS, MIFARE FLEX, MANTIS, MIFARE ULTRALIGHT, MIFARE4MOBILE, MIGLO, NTAG, ROADLINK, SMARTLX, SMARTMX, STARPLUG, TOPFET, TRENCHMOS, UCODE, Freescale, the Freescale logo, Altivec, CodeWarrior, ColdFire, ColdFire+, the Energy Efficient Solutions logo, Kinetis, Layerscape, MagniV, mobileGT, PEG, PowerQUICC, Processor Expert, QorIQ, QorIQ Qonverge, SafeAssure, the SafeAssure logo, StarCore, Symphony, VortiQa, Vybrid, Airfast, BeeKit, BeeStack, CoreNet, Flexis, MXC, Platform in a Package, QUICC Engine, Tower, TurboLink, EdgeScale, EdgeLock, eIQ, and Immersive3D are trademarks of NXP B.V. All other product or service names are the property of their respective owners. AMBA, Arm, Arm7, Arm7TDMI, Arm9, Arm11, Artisan, big.LITTLE, Cordio, CoreLink, CoreSight, Cortex, DesignStart, DynamIQ, Jazelle, Keil, Mali, Mbed, Mbed Enabled, NEON, POP, RealView, SecurCore, Socrates, Thumb, TrustZone, ULINK, ULINK2, ULINK-ME, ULINK-PLUS, ULINKpro, μ Vision, Versatile are trademarks or registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere. The related technology may be protected by any or all of patents, copyrights, designs and trade secrets. All rights reserved. Oracle and Java are registered trademarks of Oracle and/or its affiliates. The Power Architecture and Power.org word marks and the Power and Power.org logos and related marks are trademarks and service marks licensed by Power.org.

© NXP B.V. 2021.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 30 June 2021

Document identifier: AN13213

arm