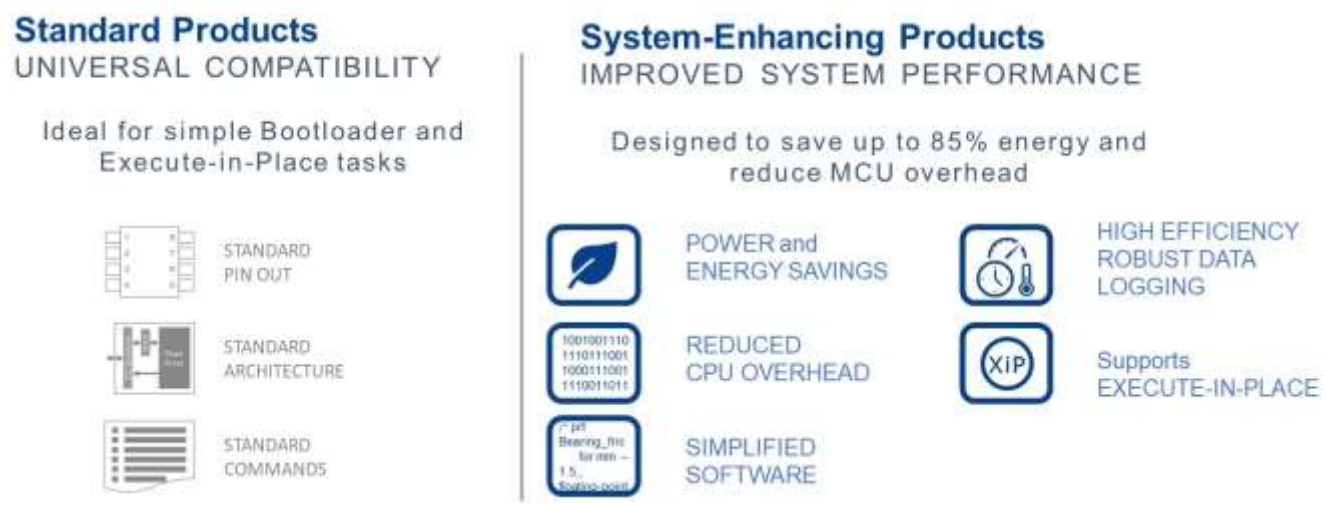
SPI NOR FLASH Guide

Standard and System Enhancing Memory

More choices for the system designer

Renesas gives the system designer more choices in data and code storage to meet the power, processing and bandwidth challenges of power-conscious environments.

In addition to our Standard class of Flash that is designed for tasks such as system boot, our System-Enhancing class of memory can reduce MCU overhead and save up to 85% energy.



How to use this Guide

Use the links in the Table of Contents on the next page to navigate to the listings of density, voltage and tips on how to save system energy and improve performance.

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Flash by Task

How the Flash is used in the system will determine which Renesas solution will deliver the best performance and energy efficiency to your design.

While the Standard class is well suited for a bootloader task, Renesas goes further with its System-Enhancing products that reduce host controller overhead and significantly reduce power consumption in power-hungry tasks such as data logging.

Task	Requirement
Boot and Code Shadow	• Low power fast Read • Low power Sleep
Execute-in-Place	• Continuous Read mode • Low power fast Read • Low power Sleep
System Settings & configuration	• Fast update • Fast erase • Low power programming • Low power Sleep
Data Logging	• High Endurance • Fast update • Low power programming • Fast save on power failure • User-controlled SRAM buffer

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Memory selection by Task

Renesas offers a broad range of Flash products to fit the Task, ranging from 256 Kb up to 128 Mb available in 1.8 Volt, 3 Volt and our WIDE Vcc choices.

Task	Density	Renesas Flash Families
Boot and Code Shadow	• 32Mbit - 128Mbit • 4Mbit - 128Mbit • 4Mbit - 32Mbit • 1Mbit - 4Mbit	• AT25SL • AT25SF • AT25FF • AT25EU Ultra Low Energy
Execute in Place	• 4Mbit - 32Mbit • 4Mbit - 32Mbit • 32Mbit - 128Mbit • 4Mbit - 128Mbit	• AT25XE FusionHD • AT25FF • AT25SL • AT25SF
System Settings and configuration	• 1Mbit - 4Mbit • 4Mbit - 32Mbit • 4Mbit - 32Mbit • 256Kbit - 4Mbit	• AT25EU Ultra Low Energy • AT25XE FusionHD • AT25FF • AT25DF Fusion
Data Logging	• 2Mbit - 64Mbit • 4Mbit - 32Mbit	• AT45DB DataFlash® • AT25XE FusionHD

Power vs Energy

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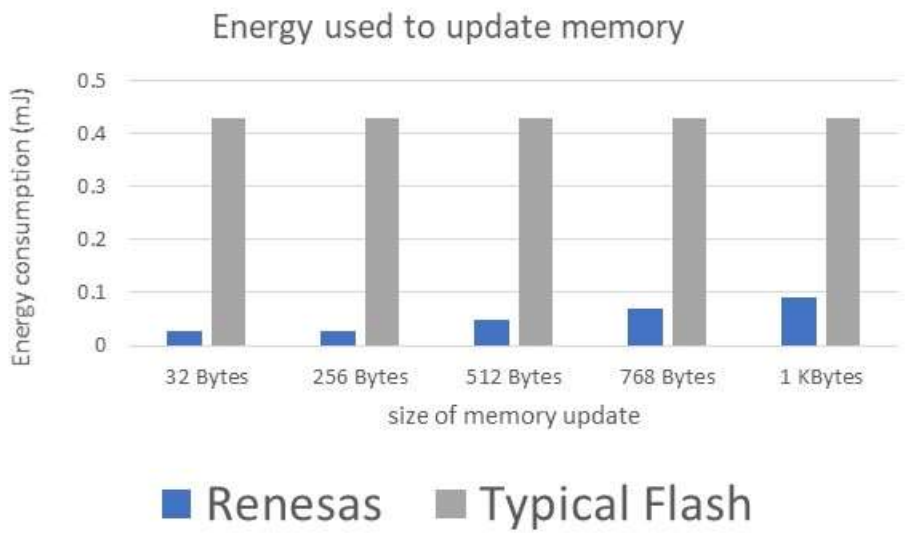
voltage x current x *time*

The pursuit of smaller and more powerful devices challenges system designers to achieve longer battery life without sacrificing performance. Often, low-power Flash devices come at the expense of longer execute times that can consume more energy and shorten battery life.

Renesas System-Enhancing solutions are designed with features that make it easy to achieve significant energy savings to your design through faster execute times and lower power circuits.

Ordinary low power Flash can consume up to 4 times more energy than our System Enhancing Flash depending upon the task.



*Based on AT25EU using Small Page Erase option

ALL PRODUCTS

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DENSITY

Up to 1 Mb | 2 Mb | 4 Mb | 8 Mb | 16 Mb | 32 Mb | 64 Mb | 128 Mb | 256 Mb

OPERATING VOLTAGE

WIDE VCC | 3 V | 1.8 V

SYSTEM-ENHANCING FLASH; Save energy and improve performance

DataFlash™ | FusionHD™

Up to 1 Mb

Density	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)			Bootloader	XiP	Sys Settings	Data Logging
1 Mb	AT25EU0011A	85	1.65 V to 3.6 V	SPI, Dual, Quad	100 nA	1.2	Lowest energy Flash	For battery-powered designs	●	●	●	
1 Mb	AT25DF011	104	1.65 V to 3.6 V	SPI, Dual	200 nA	4.5		For battery-powered designs	●		●	●
1 Mb	AT25XE011	104	1.65 V to 3.6 V	SPI, Dual	200 nA	3.5		For battery-powered designs	●		●	●
1 Mb	AT25DN011	104	2.3 V to 3.6 V	SPI, Dual	350 nA	6			●		●	●
512 Kb	AT25DF512C	104	1.65 V to 3.6 V	SPI, Dual	200 nA	4.5		For battery-powered designs	●		●	●
512 Kb	AT25XE512C	104	1.65 V to 3.6 V	SPI, Dual	200 nA	4.5		For battery-powered designs	●		●	●
512 Kb	AT25DN512C	104	2.3 V to 3.6 V	SPI, Dual	350 nA	6			●		●	●
256 Kb	AT25DF256	104	1.65 V to 3.6 V	SPI, Dual	200 nA	4.5		For battery-powered designs	●		●	●
256 Kb	AT25DN256	104	2.3 V to 3.6 V	SPI, Dual	350 nA	6			●		●	●

2 Mb

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Energy Saving System Enhancing Class	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)			Bootloader	XiP	Sys Settings	Data Logging
★	AT25EU0021A	85	1.65 V to 3.6 V	SPI, Dual, Quad	100 nA	1.2	lowest energy Flash	For battery-powered designs	●	●	●	
★	AT45DB021E	85	1.65 V to 3.6 V	SPI	200 nA	4.5	Robust, highest efficiency	User-controlled SRAM included			●	●
★	AT25DF021A	104	1.65 V to 3.6 V	SPI, Dual	200 nA	4.5			●		●	●
★	AT25XE021A	70	1.65 V to 3.6 V	SPI, Dual	200 nA	3.5			●		●	●
★	AT25XV021A	70	1.65 V to 4.4 V	SPI, Dual	200 nA	4.5			●		●	●
★	AT25PE20	85	1.65 V to 3.6 V	SPI	200 nA	4.5	Robust, highest efficiency with STANDARD pin-out	User-controlled SRAM included			●	●

4 Mb

Energy Saving System Enhancing Class	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)			Bootloader	XiP	Sys Settings	Data Logging
★	AT25DF041B	85	1.65V to 3.6V	SPI, Dual	200 nA	4.5			●		●	●
★	AT25EU0041A	108	1.65 V to 3.6 V	SPI, Dual, Quad	100 nA	1.2	lowest energy Flash	For battery-powered designs	●	●	●	
★	AT25XE041B	85	1.65 V to 3.6V	SPI, Dual	200 nA	3.5			●		●	●
★	AT25XE041D	133	1.65V to 3.6V	SPI, Dual, Quad	7 nA	5.6	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
★	AT25XV041B	85	1.65V to 4.4V	SPI, Dual	200 nA	3.5			●		●	●
★	AT45DB041E	104	1.65V to 3.6V	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
	AT25FF041A	133	1.65 V to 3.6V	SPI, Dual, Quad	7 nA	8.5	Lowest power Sleep		●	●	●	
	AT25SF041B	108	2.5V to 3.6V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
★	AT25PE40	104	1.65V to 3.6V	SPI	400 nA	6	Robust, highest efficiency with STANDARD pin-out	User-controlled SRAM included			●	●

8 Mb

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Energy Saving System Enhancing Class	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)			Bootloader	XiP	Sys Settings	Data Logging
★	AT25XE081D	133	1.65 V to 3.6 V	SPI, Dual, Quad	7 nA	5.6	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
★	AT25EU0081A	108	1.65 V to 3.6 V	SPI, Dual, Quad	100 nA	5.6	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
★	AT45DB081E	133	1.7 V to 3.6 V	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
	AT25DL081	85	1.65 V to 1.95 V	SPI, Dual	8 uA	10			●			
	AT25FF081A	133	1.65 V to 3.6 V	SPI, Dual, Quad	7 nA	8.5	Lowest power Sleep		●	●	●	
	AT25SF081B	108	2.5 V to 3.6 V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
	AT25DF081A	100	2.7 V to 3.6 V	SPI, Dual	5 uA	12			●			
★	AT25PE80	133	1.7 V to 3.6 V	SPI	400 nA	6	Robust, highest efficiency with STANDARD pin-out	User-controlled SRAM included			●	●

16 Mb

Energy Saving System Enhancing Class	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)			Bootloader	XiP	Sys Settings	Data Logging
★	AT25XE161D	133	1.65 V to 3.6V	SPI, Dual, Quad	7 nA	5.5	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
★	AT25EU0161A	108	1.65 V to 3.6V	SPI, Dual, Quad	100 nA	5.5	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
★	AT45DB161E	104	2.3V to 3.6V	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
★	AT45DQ161	100	2.3V to 3.6V	SPI, Dual, Quad	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
	AT25DL161	85	1.65 V to 1.95 V	SPI, Dual	8 uA	10			●			
	AT25FF161A	133	1.65V to 3.6V	SPI, Dual, Quad	7 nA	8.5	Lowest power Sleep		●	●	●	
	AT25SF161B	108	2.7 V to 3.6V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
★	AT25PE16	104	2.3V to 3.6V	SPI	400 nA	6	Robust, highest efficiency with STANDARD pin-out	User-controlled SRAM included			●	●

32 Mb

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Energy Saving System Enhancing Class	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)			Bootloader	XiP	Sys Settings	Data Logging
★	AT25XE321D	133	1.65 V to 3.6 V	SPI, Dual, Quad	7 nA	5.5	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
★	AT45DB321E	104	2.3 V to 3.6 V	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
★	AT45DQ321	104	2.3 V to 3.6 V	SPI, Dual, Quad	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
	AT25FF321A	133	1.65 V to 3.6 V	SPI, Dual, Quad	7 nA	8.5	Lowest power Sleep		●	●	●	
	AT25QL321	104	1.7 V to 2 V	SPI, Dual, Quad-default	2 uA	5			●	●		
	AT25SF321B	108	2.7 V to 3.6 V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
	AT25SL321	104	1.7 V to 2 V	SPI, Dual, Quad	2 uA	5			●	●		
	AT25DF321A	100	2.7 V to 3.6 V	SPI, Dual	5 uA	12			●			

64 Mb

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Energy Saving System Enhancing Class	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)			Bootloader	XiP	Sys Settings	Data Logging
★	AT45DB641E	85	1.7 V to 3.6 V	SPI	400 nA	7	Robust, highest efficiency	User-controlled SRAM included			●	●
	AT25QF641B	104	2.7 V to 3.6 V	SPI, Dual, Quad-default	1.2 uA	3.3			●	●		
	AT25QL641	133	1.7 V to 2 V	SPI, Dual, Quad-default	2 uA	5			●	●		
	AT25SF641B	104	2.7 V to 3.6 V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
	AT25SL641	133	1.7 V to 2 V	SPI, Dual, Quad	2 uA	5			●	●		
	AT25DF641A	100	2.7 V to 3.6 V	SPI, Dual	5 uA	25			●			

128 Mb

Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)	Bootloader	XiP	Sys Settings	Data Logging
AT25QF128A	133	2.7 V to 3.6 V	SPI, Dual, Quad-default	2 uA	12	●	●		
AT25QL128A	133	1.7 V to 2 V	SPI, Dual, Quad-default	2 uA	7	●	●		
AT25SF128A	133	2.7 V to 3.6 V	SPI, Dual, Quad	2 uA	12	●	●		
AT25SL128A	133	1.7 V to 2 V	SPI, Dual, Quad	2 uA	7	●	●		

For 1.8 Volt applications

★ **Wide voltage solutions also available (go to WIDE VCC)**

Wide Voltage Available	Density	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)	Bootloader	XiP	Sys Settings	Data
	128 Mb	AT25QL128A	133	1.7 V to 2 V	SPI, Dual, Quad-default	2 uA	7	●	●		
	128 Mb	AT25SL128A	133	1.7 V to 2 V	SPI, Dual, Quad	2 uA	7	●	●		
	64 Mb	AT25QL641	133	1.7 V to 2 V	SPI, Dual, Quad-default	2 uA	5	●	●		
	64 Mb	AT25SL641	133	1.7 V to 2 V	SPI, Dual, Quad	2 uA	5	●	●		
★	32 Mb	AT25QL321	104	1.7 V to 2 V	SPI, Dual, Quad-default	2 uA	5	●	●		
★	32 Mb	AT25SL321	104	1.7 V to 2 V	SPI, Dual, Quad	2 uA	5	●	●		
★	16 Mb	AT25DL161	85	1.65 V to 1.95 V	SPI, Dual	8 uA	10	●			
★	8 Mb	AT25DL081	85	1.65 V to 1.95 V	SPI, Dual	8 uA	10	●			

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For 3 Volt applications

★ **Wide voltage solutions also available (go to WIDE VCC)**

Wide Voltage Available	Density	Product #	Read Speed (MHz)	Oper Voltage	Interface	Low power Sleep	Read current (mA)			Bootloader	XIP	Sys Settings	Data Logging
	128 Mb	AT25QF128A	133	2.7 V to 3.6 V	SPI, Dual, Quad-default	2 uA	12			●	●		
	128 Mb	AT25SF128A	133	2.7 V to 3.6 V	SPI, Dual, Quad	2 uA	12			●	●		
	64 Mb	AT25QF641B	104	2.7 V to 3.6 V	SPI, Dual, Quad-default	1.2 uA	3.3			●	●		
	64 Mb	AT25SF641B	104	2.7 V to 3.6 V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
	64 Mb	AT25DF641A	100	2.7 V to 3.6 V	SPI, Dual	5 uA	25			●			
★	32 Mb	AT45DB321E	104	2.3 V to 3.6 V	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
★	32 Mb	AT45DQ321	104	2.3 V to 3.6 V	SPI, Dual, Quad	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
★	32 Mb	AT25SF321B	108	2.7 V to 3.6 V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
	32 Mb	AT25DF321A	100	2.7 V to 3.6 V	SPI, Dual	5 uA	12			●			
★	16 Mb	AT45DB161E	104	2.3 V to 3.6 V	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
★	16 Mb	AT45DQ161	100	2.3 V to 3.6 V	SPI, Dual, Quad	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
★	16 Mb	AT25PE16	104	2.3 V to 3.6 V	SPI	400 nA	6	Robust, highest efficiency with STANDARD pin-out	User-controlled SRAM included			●	●
★	16 Mb	AT25SF161B	108	2.7 V to 3.6 V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
★	8 Mb	AT25SF081B	108	2.5 V to 3.6 V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
★	4 Mb	AT25SF041B	108	2.5 V to 3.6 V	SPI, Dual, Quad	1.2 uA	3.3			●	●		
★	1 Mb	AT25DN011	108	2.3 V to 3.6 V	SPI, Dual	350 nA	6			●		●	●
★	512 Kb	AT25DN512C	108	2.3 V to 3.6 V	SPI, Dual	350 nA	6			●		●	●
★	256 Kb	AT25DN256	108	2.3 V to 3.6 V	SPI, Dual	350 nA	6			●		●	●

Widest voltage range

System Enhancing	Density	Product #	Read Speed (MHz)	Interface	Low power Sleep	Read current (mA)			Bootloader	XiP	Sys Settings	Data
★	64 Mb	AT45DB641E	85	SPI	400 nA	7	Robust, highest efficiency	User-controlled SRAM included			●	●
★	32 Mb	AT25XE321D	133	SPI, Dual, Quad	7 nA	5.5	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
	32 Mb	AT25FF321A	133	SPI, Dual, Quad	7 nA	8.5	Lowest power Sleep		●	●	●	
★	16 Mb	AT25XE161D	133	SPI, Dual, Quad	7 nA	5.5	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
	16 Mb	AT25FF161A	133	SPI, Dual, Quad	7 nA	8.5	Lowest power Sleep		●	●	●	
★	8 Mb	AT25XE081D	133	SPI, Dual, Quad	7 nA	5.6	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
★	8 Mb	AT45DB081E	133	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
★	8 Mb	AT25EU0081A	108	SPI, Dual, Quad	100 nA	1.2	lowest energy Flash	power-conscious designs	●	●	●	
	8 Mb	AT25FF081A	133	SPI, Dual, Quad	7 nA	8.5	Lowest power Sleep		●	●	●	
★	4 Mb	AT25EU0041A	108	SPI, Dual, Quad	100 nA	1.2	lowest energy Flash	power-conscious designs	●	●	●	
★	4 Mb	AT25DF041B	85	SPI, Dual	200 nA	4.5					●	●
★	4 Mb	AT25XE041B	85	SPI, Dual	200 nA	3.5			●		●	●
★	4 Mb	AT25XE041D	133	SPI, Dual, Quad	7 nA	5.6	Uses up to 70% less power	reduce MCU overhead	●	●	●	●
★	4 Mb	AT25XV041B	85	SPI, Dual	200 nA	3.5			●		●	●
★	4 Mb	AT45DB041E	104	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
★	4 Mb	AT25PE40	104	SPI	400 nA	6	Robust, highest efficiency	User-controlled SRAM included			●	●
	4 Mb	AT25FF041A	133	SPI, Dual, Quad	7 nA	8.5	Lowest power Sleep		●	●	●	
★	2 Mb	AT25EU0021A	85	SPI, Dual, Quad	100 nA	1.2	lowest energy Flash	power-conscious designs	●	●	●	
★	2 Mb	AT45DB021E	85	SPI	200 nA	4.5	Robust, highest efficiency	User-controlled SRAM included			●	●
★	2 Mb	AT25PE20	85	SPI	200 nA	4.5	Robust, highest efficiency	User-controlled SRAM included			●	●
★	2 Mb	AT25DF021A	104	SPI, Dual	200 nA	4.5					●	●
★	2 Mb	AT25XE021A	70	SPI, Dual	200 nA	3.5			●		●	●
★	2 Mb	AT25XV021A	70	SPI, Dual	200 nA	4.5			●		●	●
★	1 Mb	AT25EU0011A	85	SPI, Dual, Quad	100 nA	1.2	lowest energy Flash	power-conscious designs	●	●	●	
★	1 Mb	AT25DF011	104	SPI, Dual	200 nA	4.5					●	●
★	1 Mb	AT25XE011	104	SPI, Dual	200 nA	3.5			●		●	●
★	512 Kb	AT25DF512C	104	SPI, Dual	200 nA	4.5					●	●
★	512 Kb	AT25XE512C	104	SPI, Dual	200 nA	4.5			●		●	●
★	256 Kb	AT25DF256	104	SPI, Dual	200 nA	4.5					●	●

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System-Enhancing FusionHD and DataFlash™

Renesas Standard Flash is ideal for Bootloader and XiP tasks, but Renesas goes further and incorporates a suite of easy-to-use features in its FusionHD and DataFlash brands that can save significant system energy and overhead. All products are Wide Voltage, operating at a minimum of 1.65 Volts and up to 4.4 Volts.

Use FusionHD to realize 5x faster execution for less than 70% energy and take advantage of user-controlled SRAM buffers in every DataFlash to create the most efficient and robust Data Logging application in your design.

Click on the Benefits below to learn about the features that can improve system level performance.

						click below to learn more							
Brand	Density	Product #	Read Speed (MHz)	Interface	Low power Sleep	Reduce MCU Overhead by 75%	Power Fail fast save	Save up to 70% energy on memory update	Eliminate polling Auto-alert MCU	Bootloader	XiP	Sys Settings	Data Logging
DataFlash™	64 Mb	AT45DB641E	85	SPI	400 nA	●	●	●	●			●	●
FusionHD™	32 Mb	AT25XE321D	133	SPI, Dual, Quad	7 nA	●	●	●	●	●	●	●	●
DataFlash™	32 Mb	AT45DB321E	104	SPI	400 nA	●	●	●	●			●	●
DataFlash™	32 Mb	AT45DQ321	104	SPI, Dual, Quad	400 nA	●	●	●	●			●	●
FusionHD™	16 Mb	AT25XE161D	133	SPI, Dual, Quad	7 nA	●	●	●	●	●	●	●	●
DataFlash™	16 Mb	AT45DB161E	104	SPI	400 nA	●	●	●	●			●	●
DataFlash™	16 Mb	AT45DQ161	100	SPI, Dual, Quad	400 nA	●	●	●	●			●	●
FusionHD™	8 Mb	AT25XE081D	133	SPI, Dual, Quad	7 nA	●	●	●	●	●	●	●	●
DataFlash™	8 Mb	AT45DB081E	133	SPI	400 nA	●	●	●	●			●	●
FusionHD™	4 Mb	AT25XE041D	133	SPI, Dual, Quad	7 nA	●	●	●	●	●	●	●	●
DataFlash™	4 Mb	AT45DB041E	104	SPI	400 nA	●	●	●	●			●	●
DataFlash™	2 Mb	AT45DB021E	85	SPI	200 nA	●	●	●	●			●	●

Significant energy savings on memory updates

Feature: Small Page Erase

Same architecture as standard Flash but with additional 256-byte erase block for superior small update performance

Benefit

Save energy; 70% less energy versus typical Flash

Faster updates

75% less overhead required vs typical Flash

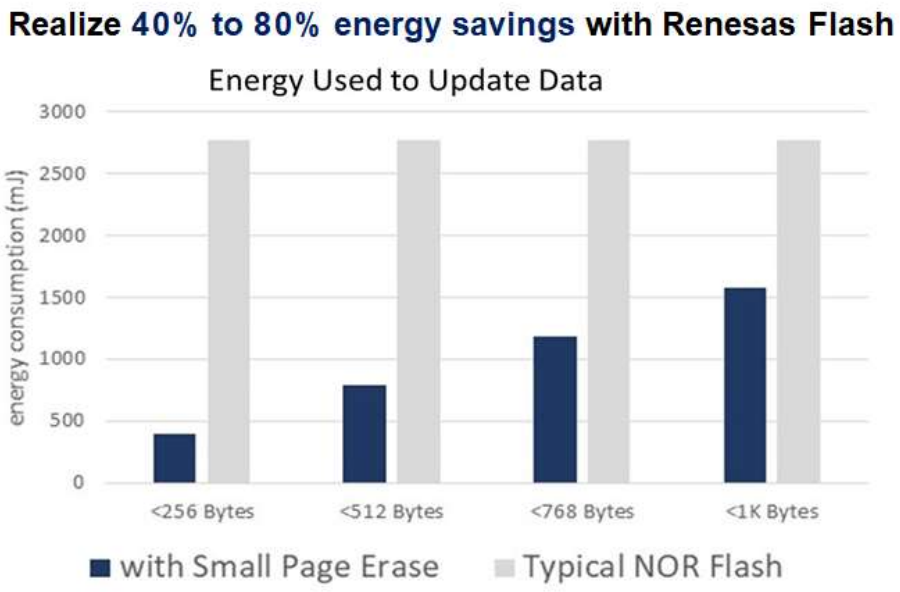
Reduce Flash wear

Ideal for

Small updates < 1 KBytes

Data Logging task

Update system settings task



Feature

Small Page Erase

Available on

AT45 DataFlash

AT25XE FusionHD

AT25EU Ultra Low Energy

AT25PE

See all products with feature

Tip

Add the Active Interrupt feature

Eliminates polling

Save on MCU overhead

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Reduce MCU overhead and enable multi-tasking

Feature: Active Interrupt

Auto-alerts the host controller upon task completion

Benefit

- Eliminate MCU polling
- Reduced system power and MCU overhead
- No waiting for maximum completion times when updating memory
- Execute other operations versus continually monitoring the Flash

Ideal for

Data Logging task

Update system settings task

Feature
Active Interrupt

Available on
AT25XE FusionHD

AT25EU Ultra Low Energy

See all products with feature

Tip
Use with Small Page Erase feature to save more MCU overhead

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Video

App Note

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Controllable SRAM buffer

Feature: Flexible R/W buffer

Same architecture as standard Flash
With added independent control of the SRAM buffer

Read, hold and modify data directly in the buffer
Fast transfer into main memeory with a single command

Hold data in the buffer while in Deep Power Down mode

Benefit

Save system energy; hold and modify frequently changing values without programming to main memory

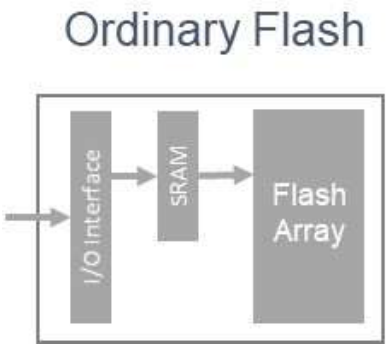
Reduce Flash wear in update-intensive applications

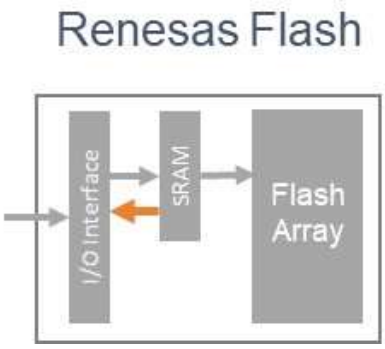
Use as scratchpad function

Hold critical values for fast save on system power fail

Ideal for

Data Logging task
Update system settings task





Feature
Flexible R/W buffer

Available on
AT45 DataFlash
AT25XE FusionHD
At25PE

See all products with feature

Go To

Video

App Note

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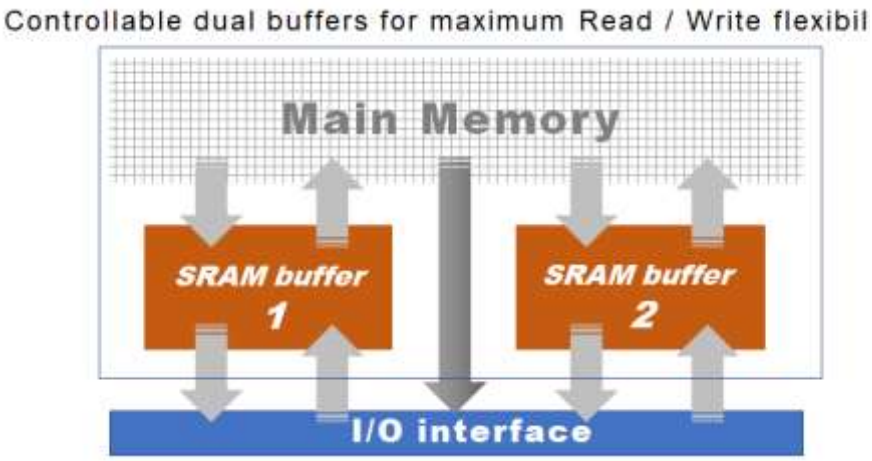
Highest efficiency for demanding Data Logging tasks

Feature: Dual SRAM buffers

Same architecture as standard Flash but with 2 built-in SRAM buffers

Fully independent- *programmable, readable controllable*



Benefit

- Achieve maximum Read / Write flexibility
  Read Buffer 1 while loading Buffer 2
- Fast Save
  Preserve critical data during system power fail events

  Smaller power budget for 'last save'
- Continuous Read
- Reduce Flash wear
- Robust for industrial environments

Ideal for

Data Logging task

Update system settings task

Feature
Dual SRAM buffers

Available on
AT45 DataFlash

AT25PE

See all products with feature

Tip

Add the Small Page Erase for

Go To

Video

App Note

Single command reduces MCU overhead for memory updates

Feature: Read-Modify-Write

Use 90% fewer instructions than typical Flash in updates

Easily modify a single data byte or a block of sequential data bytes

Only 1 MCU command required

EEPROM emulation

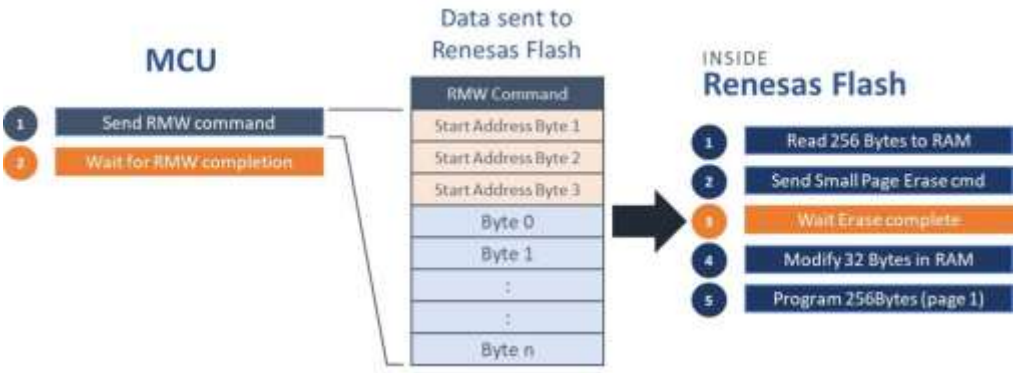
Benefit

- Significant system energy savings
  75% faster and lower energy consumption versus ordinary Flash for small data updates
- Avoid big block reprogramming as required by ordinary Flash
- 90% reduction of MCU instructions when making small updates
- Simplify software
- Preserve data integrity

Ideal for

Data Logging task

Update system settings task



Feature
Read-Modify-Write

Available on
AT45 DataFlash

See all products with feature

Tip
Lower MCU even further with the Active Interrupt feature

Go To
Video

App Note

Lowest Sleep power

Feature: Ultra-deep Sleep power

Power down is critical in bootloader and XiP tasks that infrequently access the Flash

Save system energy with Renesas products that drop power consumption to as low as 7 nA

Benefit

- Longer system battery life
- No power switching required

Ideal for

Bootloader tasks especially in battery-operated equipment

Execute-in-Place tasks

Infrequent updates such as system settings

Feature

Ultra-deep Sleep power

Available on

AT25XE FusionHD

AT25FF

AT25EU Ultra-low Energy

See all products with feature

Tip

Best solutions for battery-powered designs:

AT25XE FusionHD

AT25EU Ultra-low Energy

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App Note

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All products with features that improve system performance

Density	Product #	Operating Voltage	256 Byte Small page Erase	Active Interrupt	Flexible R/W buffer	Dual SRAM buffers	Read-Modify-Write	Ultra-deep Sleep power	
256 Kb	AT25DF256	Widest Vcc	●		●			200 nA	
256 Kb	AT25DN256	2.3 V to 3.6 V	●					350 nA	
512 Kb	AT25DF512C	Widest Vcc	●		●			200 nA	
512 Kb	AT25XE512C	Widest Vcc	●		●			200 nA	
512 Kb	AT25DN512C	2.3 V to 3.6 V	●					350 nA	
1 Mb	AT25EU0011A	Widest Vcc	●	●	●			100 nA	
1 Mb	AT25DF011	Widest Vcc	●		●			200 nA	
1 Mb	AT25XE011	Widest Vcc	●		●			200 nA	
1 Mb	AT25DN011	2.3 V to 3.6 V	●					350 nA	
2 Mb	AT45DB021E	Widest Vcc	●		●		●	200 nA	
2 Mb	AT25PE20	Widest Vcc	●		●		●	200 nA	STANDARD pin-out
2 Mb	AT25DF021A	Widest Vcc	●		●			200 nA	
2 Mb	AT25EU0021A	Widest Vcc	●	●	●			100 nA	
2 Mb	AT25XE021A	Widest Vcc	●		●			200 nA	
2 Mb	AT25XV021A	Widest Vcc	●		●			200 nA	
4 Mb	AT25EU0041A	Widest Vcc	●	●	●			100 nA	
4 Mb	AT25DF041B	Widest Vcc	●		●			200 nA	
4 Mb	AT25XE041B	Widest Vcc	●		●			200 nA	
4 Mb	AT25XE041D	Widest Vcc	●	●	●		●	7 nA	***LOWEST POWER***
4 Mb	AT25XV041B	Widest Vcc	●		●			200 nA	
4 Mb	AT45DB041E	Widest Vcc	●			●	●	400 nA	
4 Mb	AT25PE40	Widest Vcc	●			●	●	400 nA	STANDARD pin-out
8 Mb	AT25XE081D	Widest Vcc	●	●	●		●	7 nA	***LOWEST POWER***
8 Mb	AT45DB081E	Widest Vcc	●			●	●	400 nA	
8 Mb	AT25EU0081A	Widest Vcc	●	●	●			100 nA	●
16 Mb	AT25XE161D	Widest Vcc	●	●	●		●	7 nA	***LOWEST POWER***
16 Mb	AT45DB161E	3 V	●			●	●	400 nA	
16 Mb	AT25PE16	3 V	●			●	●	400 nA	STANDARD pin-out
16 Mb	AT45DQ161	3 V	●			●	●	400 nA	
32 Mb	AT25XE321D	Widest Vcc	●	●	●		●	7 nA	***LOWEST POWER***
32 Mb	AT45DB321E	3 V	●			●	●	400 nA	
32 Mb	AT45DQ321	3 V	●			●	●	400 nA	
64 Mb	AT45DB641E	Widest Vcc	●			●	●	400 nA	
4 Mb	AT25FF041A	Widest Vcc						7 nA	***LOWEST POWER***
8 Mb	AT25FF081A	Widest Vcc						7 nA	***LOWEST POWER***
16 Mb	AT25FF161A	Widest Vcc						7 nA	***LOWEST POWER***
32 Mb	AT25FF321A	Widest Vcc						7 nA	***LOWEST POWER***

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Recommendations based on Task

Renesas Family	Bootloader	XiP	System Settings	Data Logging	Data Logging Lite	
AT25DFxxx	●		●	●	●	
AT25DLxxx	●					
AT25EUxxx	●	●	●		●	***lowest energy Flash***
AT25FFxxx	●	●	●			***Standard Flash with lowest power Sleep***
AT25QFxxx	●	●				
AT25QLxxx	●	●				
AT25SFxxx	●	●				
AT25SLxxx	●	●				
AT25XExxx	●	●	●	●	●	***5x faster / save 70% energy***
AT45xxx			●	●	●	***Robust, most efficient data logging***
AT25PExxx			●	●	●	***Robust, most efficient data logging includes STANDARD pin-out***

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High Temperature and Die products

Renesas Standard and System-Enhancing products are available in the wafer formfactor.

Incorporate energy saving features directly into IoT SIP solutions, motor drives, actuators, and sensors for all applications including those designed for harsh environments.

Look for the 'DWF' (**D**ie in **W**afer **F**orm) package suffix in the ordering table on every datasheet.

100% functional testing, inducing:

- DC Characteristics per product datasheet
- High temperature preconditioning
- Program and Read of rigorous data patterns

Operating Range

- -40 °C to +85 °C
- Up to +125 °C for select products

High temperature products

Renesas System-Enhancing products are designed, built and 100% tested to provide reliable long-life performance in high temperature industrial applications.

Density	Product #	Operating Temp up to	Formfactor Package	Formfactor Wafer
128 Mb	AT25SF128A	105 °C	●	
128 Mb	AT25QF128A	105 °C	●	
32 Mb	AT45DQ321	105 °C	●	●
16 Mb	AT25FF161A	105 °C	●	
16 Mb	AT25DL161	105 °C	●	
4 Mb	AT45DB041E	125 °C	●	●
4 Mb	AT25XE041B	125 °C	●	●
4 Mb	AT25DF041B	125 °C	●	●
2 Mb	AT25DF021A	125 °C	●	●
1 Mb	AT25DF011	125 °C	●	●

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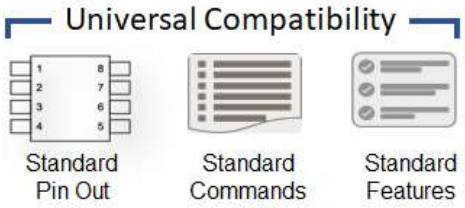
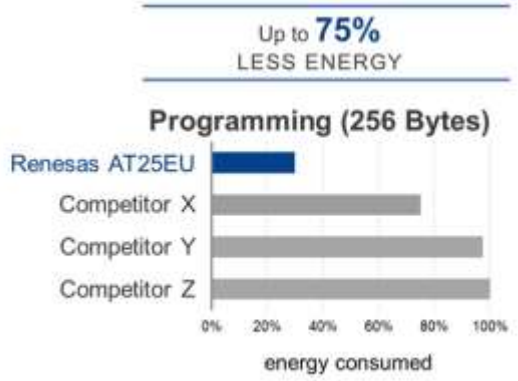
Product Spotlight- AT25EU Ultra-low Energy Flash memory

- Energy and power savings of more than 70% versus typical Flash
- 60x faster low-power erase
- Ideal for bootloader and system settings update tasks





Part Number	Size	Wide Operating Voltage	Ideal for
AT25EU0011A	1 Mbit	1.65 V to 3.6 V	Bootloader, XiP and Data Logging-Lite
AT25EU0021A	2 Mbit	1.65 V to 3.6 V	
AT25EU0041A	4 Mbit	1.65 V to 3.6 V	
AT25EU0081A	8 Mbit	1.65 V to 3.6 V	

Product Spotlight

Ideal for all tasks spanning Bootloader to Datalogging

Save up to 70% energy with FusionHD Memory

Combines system-enhancing features with low power

Faster updates and lower energy consumption than typical Flash

Features

4 Mb to 32 Mb

Continuous read, wrap and burst modes for XiP

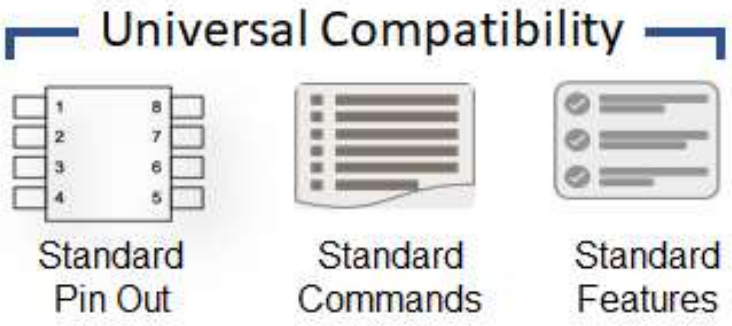
7 nA Sleep power for bootloader tasks

Preserve data during system power fail with the controllable R/W SRAM buffer

Active Interrupt to reduce MCU overhead and eliminate polling

256-byte page erase for efficient Data Logging

Ideal for small updates; Read Modify Write feature reduces MCU overhead by 90%



Part Number	Density	Wide Voltage	Low Sleep power	Speed	Supports XiP
AT25XE321D	32 Mbit	1.65 V to 3.6 V	7 nA	133 MHz	●
AT25XE161D	16 Mbit	1.65 V to 3.6 V	7 nA	133 MHz	●
AT26XE081D	8 Mbit	1.65 V to 3.6 V	7 nA	133 MHz	●
AT25XE041D	4 Mbit	1.65 V to 3.6 V	7 nA	133 MHz	●

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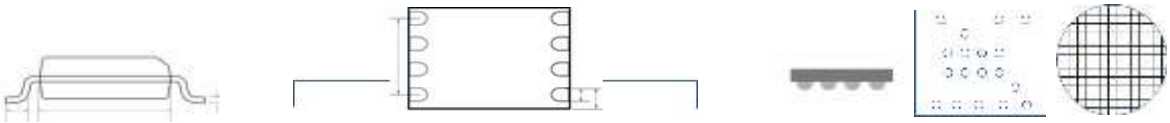
Packages



Product Part Number	N-SOIC 3.81 mm	W-SOIC 5.18 mm	DFN 2 x 3 mm	DFN 3 x 4 mm	DFN 5 x 6 mm	DFN 6 x 8 mm	BGA	WLCSP	Wafer
AT25DF011	●		●					●	
AT25DF021A	●		●		●			●	
AT25DF041B	●		●		●			●	
AT25DF081A	●				●				
AT25DF256	●		●						
AT25DF321A		●			●				
AT25DF512C	●		●						
AT25DF641A		●			●				
AT25DL081	●				●				
AT25DL161	●				●				
AT25DN011	●		●						
AT25DN256	●		●						
AT25DN512C	●		●						
AT25EU0011A	●		●						
AT25EU0021A	●		●						
AT25EU0041A	●		●						
AT25EU0081A	●	●	●						
AT25FF041A	●	●	●					●	
AT25FF081A	●	●	●					●	
AT25FF161A	●	●	●					●	
AT25FF321A	●	●		●	●			●	
AT25PE16	●	●			●				
AT25PE20	●	●			●				
AT25PE40	●	●			●				
AT25PE80	●	●			●				
AT25QF128A		●			●				
AT25QF641B		●			●				
AT25QL128A					●		●	●	
AT25QL321				●	●		●	●	
AT25QL641					●		●		
AT25SF041B	●	●	●		●				
AT25SF081B	●	●	●						

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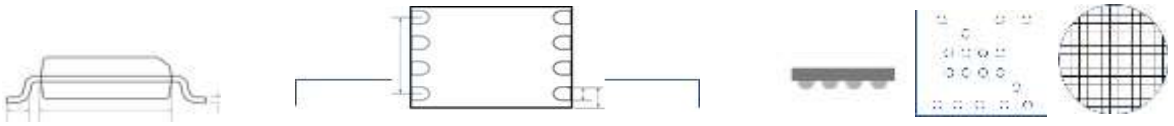
Packages (cont'd)



Product Part Number	N-SOIC 3.81 mm	W-SOIC 5.18 mm	DFN 2 x 3 mm	DFN 3 x 4 mm	DFN 5 x 6 mm	DFN 6 x 8 mm	BGA	WLCSP	Wafer
AT25SF128A		●			●				
AT25SF161B	●	●			●			●	
AT25SF321B	●	●			●				
AT25SF641B		●			●				
AT25SL128A					●		●	●	
AT25SL321	●			●	●			●	
AT25SL641					●		●		
AT25XE011	●		●					●	
AT25XE021A	●		●		●			●	
AT25XE041B	●		●		●			●	
AT25XE041D	●	●	●					●	
AT25XE081D	●	●	●					●	
AT25XE161D	●	●	●					●	
AT25XE321D	●	●			●			●	
AT25XE512C	●		●						
AT25XV021A	●		●		●			●	
AT25XV041B	●		●		●			●	
AT45DB021E	●	●			●			●	
AT45DB041E	●	●			●		●		
AT45DB081E	●	●			●		●	●	
AT45DB161E	●	●			●			●	
AT45DB321E		●			●				
AT45DB641E		●			●	●			
AT45DQ161	●	●			●	●			
AT45DQ321		●			●	●			

Revision History

Date	Revision	Description
03/15/2022	A	Initial release
09/14/2022	B	Add new product AT25EU0041A
06/16/2023	C	Add AT25EU0081A