STM32H7R/S high-performance lines

Scalable & secure bootflash microcontrollers
The STM32 portfolio

Five product categories

- **Wireless MCU**: Short- and long-range connectivity
- **Ultra-low-power MCU**: 32-bit general-purpose microcontrollers: from 75 to 3,224 CoreMark score
- **Mainstream MCU**:
- **High-performance MCU**:
- **Embedded MPU**: 32- and 64-bit microprocessors

- Enabling edge AI solutions
- Scalable security
Opening new innovation possibilities with scalable and secure bootflash-microcontrollers

General-purpose MCU lines
STM32H7R3/S3

Graphics MCU lines
STM32H7R7/S7

Run MPU-like applications on a real-time MCU

Leverage more design freedom

Fast-track your development with MCU ecosystem
What the STM32H7R/S lines offer

Max performance: 600 MHz bootflash MCU
- Real-time execution from internal or external memories
- High speed serial & parallel memory interfaces up to 200 MHz DTR
- Large internal SRAM

High scalability to optimize your design & reduce costs
- Flexible external memory capacity
- 10 packages: from cost-effective 68 to 225 pins

Security assurance: ready for future security directives
- Target security certification: SESIP Level 3 and PSA certified L3.
- On-the-fly decrypt/encrypt & secure boot

Best-in-class platform for graphics applications
- Powerful 2.5D NeoChrom GPU - smart DMA architecture memory/GPU
- Enabling UIs with HD resolution.
High-performance & multi-purpose MCUs for a wide range of applications

- Smart homes & cities
- Industrial
- Medical
- Point of sales
- Robotics
A high-performance architecture leveraging internal and external memories

**Arm® Cortex®-M7 @ 600 MHz**

- Double precision FPU, MPU, advanced DSP
- 32 Kbytes + 32 Kbytes L1 I/D allowing zero wait-state execution from external memories
- 620 Kbytes of SRAM
- High speed external memory support up to 200 MHz DTR

1284 DMIPS
3174 CoreMark
Why choose the STM32H7R/S bootflash MCU?

The STM32HR/S lines are the most cost-effective STM32H7 MCUs. They offer fast external memory interfaces to provide more freedom on memory selection and architecture.

#1 Lowest cost STM32H7 to-date

#2 Fast memory interfaces up to 200MHz DTR

#3 More freedom to connect any MCU memory type

#4 Ecosystem to configure boot & code execution

#5 Load & run code in large internal SRAM for faster execution

Connect most types of parallel memories

Up to 32 bit interfaces @ 100MHz

Connect most types of serial memories

1-16 bit interfaces Up to 200MHz DTR

600 MHz Cortex-M7

64Kbytes bootflash

620Kbytes SRAM

FMC32bit

xSPI1

SDMMC

xSPI2
Bringing new features to the STM32H7 series

- 200 MHz Hexadeca SPI with PHY and DTR-mode
  Fewer pins, more performance

- NeoChrom GPU, JPEG Codec and LTDC
  Accelerating MPU-like GUIs

- Code execution from external/internal memory
  Securing internal & external code & data

- I3C with DMA & 2xUSB HS/FS with PHY & UCPD
  Enriched communication interfaces
Securing external memories

Security option with memory crypto engine for on-the-fly encryption and decryption

<table>
<thead>
<tr>
<th>STM32H7S3 or STM32H7S7 S=Crypto</th>
<th>MCE1 w. AES: Block &amp; Stream</th>
<th>MCE2 w. Noekeon: Block</th>
<th>MCE3 w. Noekeon: Block</th>
<th>2x SDMMC No MCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>xSPI1/2</td>
<td>xSPI2/1</td>
<td>FMC8/16/32</td>
<td>SD/SDIO/MMC</td>
<td></td>
</tr>
</tbody>
</table>

Choose your preferred memory type

- Up to 200MHz 16-bit Serial RAM and Flash (DTR)
- Up to 200MHz 8-bit Serial RAM and Flash
- Up to 100MHz 32-bit Parallel RAM and Flash
- Up to 100MHz e.MMC, SDCard,

Performance impact example using MCE security option

Code execution from external memory with Data in D-TCM

<table>
<thead>
<tr>
<th>CoreMark</th>
<th>Fast fourier transform (FFT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Cipher vs Block AES/Noekeon:</td>
<td>0-1% impact</td>
</tr>
<tr>
<td>No cipher vs Fast Block AES/Noekeon:</td>
<td>0-1% impact</td>
</tr>
<tr>
<td>No Cipher vs AES Stream:</td>
<td>0% impact</td>
</tr>
</tbody>
</table>
### STM32H7RS power consumption

### Flexible low power modes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Current / MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortex-M7 RUN (VOS HIGH) 600 MHz</td>
<td>112 µA / MHz</td>
</tr>
<tr>
<td>Cortex-M7 RUN (VOS LOW) 400 MHz</td>
<td>92 µA / MHz</td>
</tr>
<tr>
<td>Cortex-M7 SLEEP (VOS High) 600 MHz</td>
<td>33 µA / MHz</td>
</tr>
<tr>
<td>CM7 STOP (SVOS LOW), Flash low power</td>
<td>265 µA</td>
</tr>
<tr>
<td>STANDBY, 3.3V</td>
<td>3.7 µA</td>
</tr>
<tr>
<td>vBAT</td>
<td>0.8 µA</td>
</tr>
</tbody>
</table>

**Notes:**
- IDD RUN, code int flash, TYP SMPS, perip off, cache on
- IDD SLEEP: ECC enabled, perip OFF, VOS High
- IDD STANDBY: IWDG OFF, Backup SRAM Off, RTC & LSE ON, 3.3V
- IDD vBAT: Backup SRAM OFF, RTC/LSE ON
STM32H7RS MCU block diagram

**Fast & flexible external memory I/F**

**Scalable security**

**Large embedded RAM memory**

**High performance**

**Advanced graphic capabilities**
STM32H7Rx/Sx portfolio

General-purpose & graphics lines, security options, large package offering

Flash memory size / RAM size (bytes)

Legend:
- Without HW crypto/hash
- With HW crypto/hash
- Option: 16-bit Serial High speed PHY / 32-bit FMC
- Graphics (NeoChrom + LTDC)

Legend:
- STM32
- Longevity 10 years commitment

Graphics line:
- STM32H7S7Z8
- STM32H7S7A8
- STM32H7S7I8
- STM32H7S7L8
- STM32H7R7Z8
- STM32H7R7A8
- STM32H7R7I8
- STM32H7R7L8
- STM32H7S3Z8
- STM32H7S3A8
- STM32H7S3I8
- STM32H7S3L8
- STM32H7R3Z8
- STM32H7R3A8
- STM32H7R3I8
- STM32H7R3L8

Pin count:
- 68-pin VQFN
- 100-pin WLCSP/LQFP/TFBGA
- 144-pin LQFP
- 144-pin UFBGA
- 169-pin UFBGA
- 176-pin LQFP
- 176-pin UFBGA
- 176+25-pin UFBGA
- 225-pin TFBGA
The NeoChrom GPU offloads the CPU from the graphic computations, freeing up the memory and boosting performance.

Fully supported in the X-CUBE-TOUCHGFX

Smoother and richer graphics with NeoChrom GPU

- Scale/animate bitmaps
- Full screen transitions
- 360° Bitmap rotations
- Text scrolling
- Vector graphics (SW)
- Perspective correct texture mapping
- Fast 2D bitmap copy
- Color format conversion
- MJPEG videos
GUI application example

MPU-like applications
Run rich GUIs and much more

Watch video now!

Additional tasks
- USB communications
- Sensor fusion
- Ethernet
- Edge AI

CPU Load

External memory usage

Other tasks

GFX operations

Max

Min
Scalable security to boost your time to market

How many security building blocks do you need to reach your security goals?

Choose between different security offers

From secure hardware to full solution owned & maintained by ST

target certifications
Robust hardware features and turnkey SoC software implementations

**Memory protections**
against illegal access control
- OTP, HDP, WRP, MPU
- Ext. Flash Enc/Dec MCE
- Ext. RAM Enc/Dec MCE
- Secure Debug, Active Tamper

**Cryptography**
for hardware robustness
- Side channel AES, PKA
- TRNG, MCE1, MCE2, HUK
- NIST - CAVP certified CryptoLib

**Platform authentication**
during product lifecycle
- 2 boot stages
- Protection level states
- Debug authentication

**Code isolation**
for runtime protection
- 3 isolation stages
- 4 encrypted MCE domains
- Dedicated keystores

**Turnkey SOC security services**
- STM32Trust RoT reference codes
- Hardware Security robustness
- Secure Firmware IP Installation
- XIP encrypted code
- Immutable Root of Trust

**State-of-the-art security assurance level**
Scalable security to accelerate time to market

- Scalable configurations
- Security for int./ext. memories
- Supporting remote provisioning
- Ready for device certification

STM32H7R

- Non-Privilege Application
- Privilege Application
- Boot

STM32H7S

- Non-Privilege Application
- Privilege Application
- OEM-iRoT

STM32H7S

- Non-Privilege Application
- Privilege Application
- Trust ROM code

Secure Hardware

SESIP certification

Internal memory

External memory Flash / RAM

Up to 4 encrypted MCE runtime areas
Secure your production flow
secure firmware install (SFI)

Protect application firmware during the manufacturing stage

Complete toolset to encrypt OEM binaries with the STM32 Trusted Package Creator software

Securely flash the STM32 with licenses from a STM32HSM at the programming partner location

Control the number of devices programmed with the firmware
Accelerate your development with our dedicated ecosystem
STM32Cube framework

Tools and software supporting you during all your design steps

Evaluation, prototyping and selection
Hardware and software configuration
Application development and debug
Code and hardware options programming
Run-time application monitoring

STM32Finder
STM32CubeMX
STM32CubeMCU Packages
STM32CubeExpansion
STM32CubeIDE
STM32CubeProgrammer
STM32CubeMonitor

Worldwide support channels
Development tools for STM32H7R series

Jump-start your development with STM32H7R evaluation kits

**Prototyping with STM32H7S Nucleo board**
- 256 Mbit Octo-SPI NOR Flash
- Ethernet, USB,
- STLINK debugger, Arduino UNO extension interface

**Feature-rich prototyping with STM32H7S discovery kit**
- 1 Gbit Octo-SPI NOR Flash, 256Mbit Octo-SPI PSRAM
- WVGA TFT display, Ethernet, USB, microSD, audio, microphone mems
- STLINK debugger, Arduino UNO, and camera extension interfaces

**Move from idea to implementation in no time**
- STM32CubeMX assisted project start on STM32H7S Nucleo board
- Full project template with BSP and ready to call services
- Preconfigured STM32 clocks, pinout, and peripherals

*Recommended Resale Price (RRP)*

NUCLEO-H7S3L8

STM32H7S78-DK

* $35
* $99
Simplified external memory-based development

**Application**
STM32CubeMX assisted application project initialization with pinout, clock tree, MCU peripherals and middleware configuration.

**External memory loader**
STM32CubeMX assisted creation of memory loader tuned for your selected external memory.

**Boot**
STM32CubeMX assisted creation of your boot project including access management to your selected external memory with Load-and-Run or Execute-in-place boot options.
Simplified external memory-based development

Application

STM32CubeMX assisted application project initialization with pinout, clock tree, MCU peripherals and middleware configuration.

- Configure and generate code
- Edit, Build and debug
- Application code
Simplified external memory-based development

External memory loader

STM32CubeMX assisted creation of memory loader tuned for your selected external memory.
Simplified external memory-based development

STM32CubeMX assisted creation of your boot project including access management to your selected external memory with Load-and-Run or Execute-in-place boot options.
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Our technology starts with You