NuMicro® MA35H0 Series

New Option for Industrial HMI Applications

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Joy of innovation

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NuMicro® MA35H0 Series Key Specifications

- The NuMicro® MA35H0 series is a high-performance MPU designed for Industrial HMI applications

- Built-in display interface and 2D GFx & video decoder

- Supports TFT-LCD with a resolution of 1280 x 800, providing smooth graphics and video playback

Core & Memory

- Dual 64-bit Cortex-A35 cores @ 650 MHz
- 32 KB I/D L1 cache & 512 KB L2 cache
- Stacking 128 MB DDR in LQFP216 Package
- Operating temperature (Tj): -40°C ~ +125°C

Display & Video

- Display resolution up to 1280 x 800 @ 60 fps
- Display interface included RGB, SPI, i80
- 2D Graphic Accelerator
- JPEG & H.264 decoder resolution up to 1280 x 800 @ 60fps

Practical Security

- Arm® TrustZone® & Secure Boot
- Crypto Engines (AES, SHA, ECC, RSA, SM) & TRNG
- OTP memory & Keystore

High-Speed Connectivity

- Megabit Ethernet with IEEE 1588v2
- USB 2.0 High Speed Host & Device
- SDIO3.0, QSPI, CAN FD, UARTs, I2S

NuDeveloper Ecosystem – Make engineers' jobs easier.

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NuMicro® MA35H0 Series Features Highlight

High-Performance with Power Efficiency

Smooth Graphics & Video Playback

Practical Security

High-Speed Connectivity

Stacking DDR in LQFP Package

Industrial Grade Operating Temp.

MA35 Family
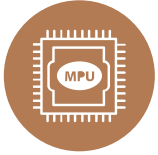
Rich Design Resource

Graphics Library	SEGGER	LVGL	Qt
OS	freeRTOS	RT-Thread	Linux
Platform Resource	EVB	SW Tools	BSP & Docs

Rich Design Resource

NuDeveloper Ecosystem – Make engineers' jobs easier.

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NuMicro® MA35H0 Series Features

Core & Memory

- Dual 64-bit/32-bit Arm Cortex-A35 high-performance cores running up to 650 MHz
- 32 KB I/D L1 cache for each core, and a 512 KB shared L2 cache
- Supports discrete power supply and PMIC solutions
- Operating temperature (Tj): -40°C ~ +125°C
- Offering LQFP package parts with stacking a DDR SDRAM up to 128 MB

Security

- TrustZone
- Secure Boot
- Hardware Security Features
  - Crypto Engine: AES256, SHA512, ECC, RSA4096, SM2/3/4
  - True Random Number Generator (TRNG)
  - 8 Kbits One Time Programmable (OTP) memory with Key Store to protect key
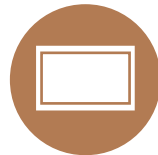
Display

- LCD RGB I/F display with the resolution up to 1280 x 800@60 FPS
- Integrated a 2D Graphic Engine
- JPEG decoder, picture size up to 16368 x 16368
- H.264 decoder supports baseline, main profile, high profile, and resolution up to 1280 x 800 @60 FPS
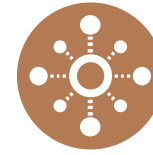
High-Speed Connectivity & I/O

- 4 sets of PDMA
- 1 set of 10/100 Mbps Ethernet
- 1 set of USB HS Host, 1 set of USB HS Host/Device dual role
- 1 set of SDIO3.0 and 1 set of SDIO2.0
- 2 sets of CAN FD
- 1 sets of QSPI
- 1 sets of I²S
- 2 sets of SPI/I²S
- 6 sets of UART
- 3 sets of I²C
- Up to 150x GPIO (LQFP216)
- 18-channel 28-bit Enhanced PWM (EPWM)
- 12-channel 32-bit Timer PWM (Timer PWM)
- RTC with V_{BAT}
- 1 set of 12-bit 500 ksps ADC with 8 input channels, supports 4/5-wire resistive touch

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NuMicro® MA35 Family P/N and Packages

Series & CPU / DDR	MA35H0 Dual A35@650 MHz	MA35D1 Dual A35@800 MHz		
DDR				
(External)				MA35D16A087C
512 MB		MA35D16F987C		
256 MB		MA35D16F887C	MA35D16A887C	
128 MB	MA35H04F764C	MA35D16F787C		
Package	LQFP216 (MCP DDR) (24 x 24 mm)	LQFP216 (MCP DDR) (24 x 24 mm)	BGA312 (MCP DDR) (15 x 15 mm)	BGA364 (14 x 14 mm)
Features	• Megabit Ethernet • 2 sets of CAN-FD • 6 sets of UART • 154 x GPIO	• Megabit + Gigabit Ethernet • 4 sets of CAN-FD • 17 sets of UART • 154 x GPIO	• 2 sets of Gigabit Ethernet • 4 sets of CAN-FD • 17 sets of UART • EADC • 208 x GPIO	• 2 sets of Gigabit Ethernet • 4 sets of CAN-FD • 17 sets of UART • EADC • 208 x GPIO
Security	• TrustZone & Secure Boot • Practical Hardware Security		• TrustZone & Secure Boot • TSI Advanced Security • Temper pins	
Display & Video	• 720P Display + H.264 Decoder		• 1080P Display + H.264 Decoder • 2 sets of Camera Interface	
Operating Temp. (Tj)	-40°C ~ +125°C		-40°C ~ +105°C	

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MA35H0 & MA35D1 Functions Comparison

Part Number & Functions		MA35H04F764C	MA35D16F787C / MA35D16F887C / MA35D16F987C
Cortex-A35		x2	
CPU Frequency		650 MHz	800 MHz
Real-time Processor Cortex-M4		-	x1
Stacked DDR Size(MB)		128	128, 256, 512
LCD Display (RGB)		24-bit/18-bit 1280x800	24-bit/18-bit 1920x1080
2D Graphic & JPEG Decoder		√	
H.264 Decoder		√	
CMOS Sensor Interface		-	2
10 / 100Mb / 1Gb Ethernet MAC		10/100M x1	10/100M x1 + 1G x1
USB 2.0 HS Host		1	
USB 2.0 HS Host / Device		1	
Connectivity	UART	6	17
	ISO-7816 (Smart Card I/F)	2	
	Quad SPI	1	2
	SPI/I²S	2	4
	I²S	1	2
	I²C	3	6
	CAN FD	2	4
	SDHC/SDIO/eMMC	2	
Security	TSI (Trusted Secure Island)	-	√
	Secure Boot	√	
	Tamper pins	-	

Part Number & Functions		MA35H04F764C	MA35D16F787C / MA35D16F887C / MA35D16F987C
Crypto	PRNG 512	√	
	AES 256	√	
	RSA 4096	√	
	ECC	√	
	TRNG 128	√	
	SHA 512	√	
	SM 2/3/4	√	
	Key Store	√	
	OTP 8K-bit	√	
External Bus Interface		√	
32-bit Timer		12	
Enhanced Capture (ECAP)		-	3
Enhanced PWM (EPWM)		18	
Quadrature Encoder Interface (QEI)		-	3
12-bit ADC channel		8	
GPIO		154	
INT		4	
Watchdog		2	3
Window Watchdog		2	3
RTC (VBAT 3.3V)		√	
Power Control Pin for PMIC		√	
Temperature Sensor		√	
Operating Temperature (Tj)		-40°C to 125°C	-40°C to 105°C
Package		LQFP216-EP 24x24x1.4mm, 0.4mm pitch	

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The Advantages of Stacking the DDR SDRAM

- Nuvoton MPU provides LQFP and BGA package parts with stacking a 128 MB to 512 MB DDR2/DDR3 SDRAM

- The advantages of stacking the DDR SDRAM:

Stacking a large DDR up to 512 MB

Easy system design and manufacturing
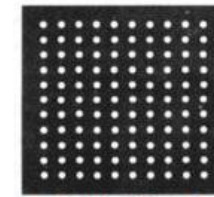
Lower EMI interference

Reducing the PCB layers

Reducing the PCB area

Saving BOM cost

Saving production cost

LQFP   BGA

Nuvoton MPU stacking DDR SDRAM inside.
W/O External DDR SDRAM

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High-Performance with Power Efficiency

- The NuMicro MA35 Family is a multi-core microprocessor.
  - **MA35H0**
    - **Dual 64bit Cortex-A35 high-performance cores up to 650 MHz**
  - MA35D1
    - **Dual 64bit Cortex-A35 high-performance cores up to 800 MHz**
    - **One Cortex-M4 real-time processor up to 180 MHz**

- Compared to Cortex-A7, Cortex-A35 has improved the overall performance 6% to 40%.

- The high-performance and real-time cores help edge data processing and enable the tiny AI/ML ability.

- For tiny AI/ML, we provide sample code in Keyword Spotting, Face Detection and People Counting

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MA35 Family

Cortex-A35 Offers more Efficiency over Cortex-A7

- **10%** low power

- **6% to 40%** performance uplift

- **64b capable** with full backwards compatibility

Relative Performance

■ Cortex-A7
■ Cortex-A35

|	Integer	Browsing	Float	Geekbench MPI
Cortex-A35	1.06x	1.16x	1.36x	1.40x
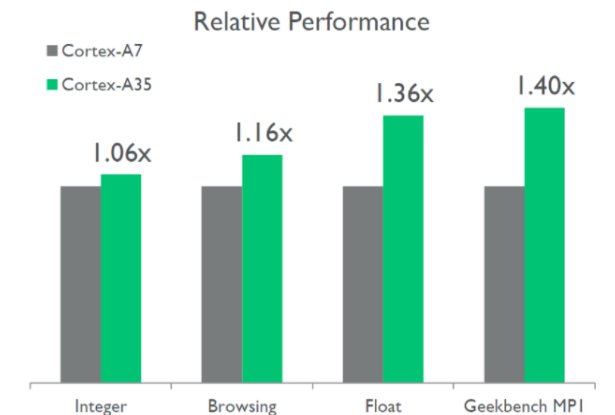
*Comparisons assume same process technology and implementation for both processors
*Captured from Arm Community blogs

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Practical Security Features for Industrial HMI Applications

- Root of Trust, Internal Boot ROM with OTP key to satisfy the secure boot requirement

- Built-in cryptographic accelerators, Key Store, and OTP memory

- The secure environment and features realize the **Protection**, **Detection**, and **Recovery** for IoT products.

- Easily established
  - **Execution Security**
    - Trust Firmware–A , OP-TEE, Secure boot
  - **Communication Security**
    - Hardware cryptographic accelerators
  - **Chip-level Storage Security**
    - Key Store and OTP memory, accessed by the cryptographic engines, without the need of CPU access

Dual Cortex-A35		Secure Boot	OTP Memory
		Key Store	TRNG
		Cryptographic Engines AES, SHA, ECC, RSA, SM2/3/4	
Linux		**OP-TEE**	
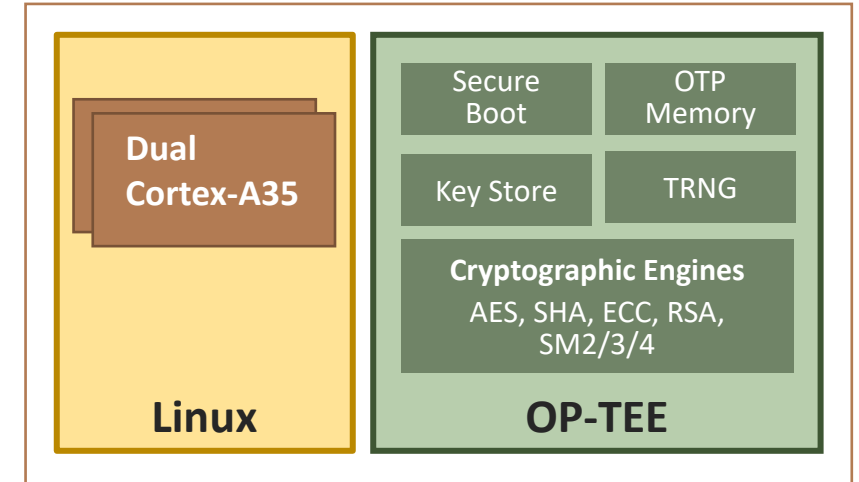
The MA35H0 is a trusted system for Industrial HMI required security

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The Graphics and Video Acceleration for Industrial HMI

- For better user experience in graphics HMI, integrates an LCD display I/F, resolution up to 1280 x 800 at 60 FPS and with the features
  - Hardware cursor
  - On Screen Display (OSD)
- For increasing graphics performance, integrates the 2D graphics engine and with the features
  - BitBlt
  - Rotation
  - Multi-source Alpha Blending
  - Color Format Converting
- Supports video playback by hardware JPEG and H.264 decoder
- Supports 4/5-wire resistive touch without an external IC

The MA35H0 provides more effective GUIs in high-resolution display

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NuMicro® MA35 Family Targets Applications

Edge Gateway

IIoT Edge Gateway
Smart Agriculture
Telematics Box
4G/5G Base Station

Tiny AI/ML

Keyword Spotting
Face Recognition
Number Recognition

High-Performance Advanced Security

HMI & Industrial Control

Industrial HMI
Smart Building
Home Appliance
PC Gaming Accessories
Speed Meter
Medical Devices

New Energy

PV Inverter
BMS
Smart Grid
EV Charging Station

Get Started with the NuMicro® MPU Platform

Evaluation Board	Operating System	Software Tool

Choose Evaluation Board → Refer User Manual for Quick Start → Choose Operating System → Compiling Target Board Image → Download Programming Tool → Check Result on Terminal
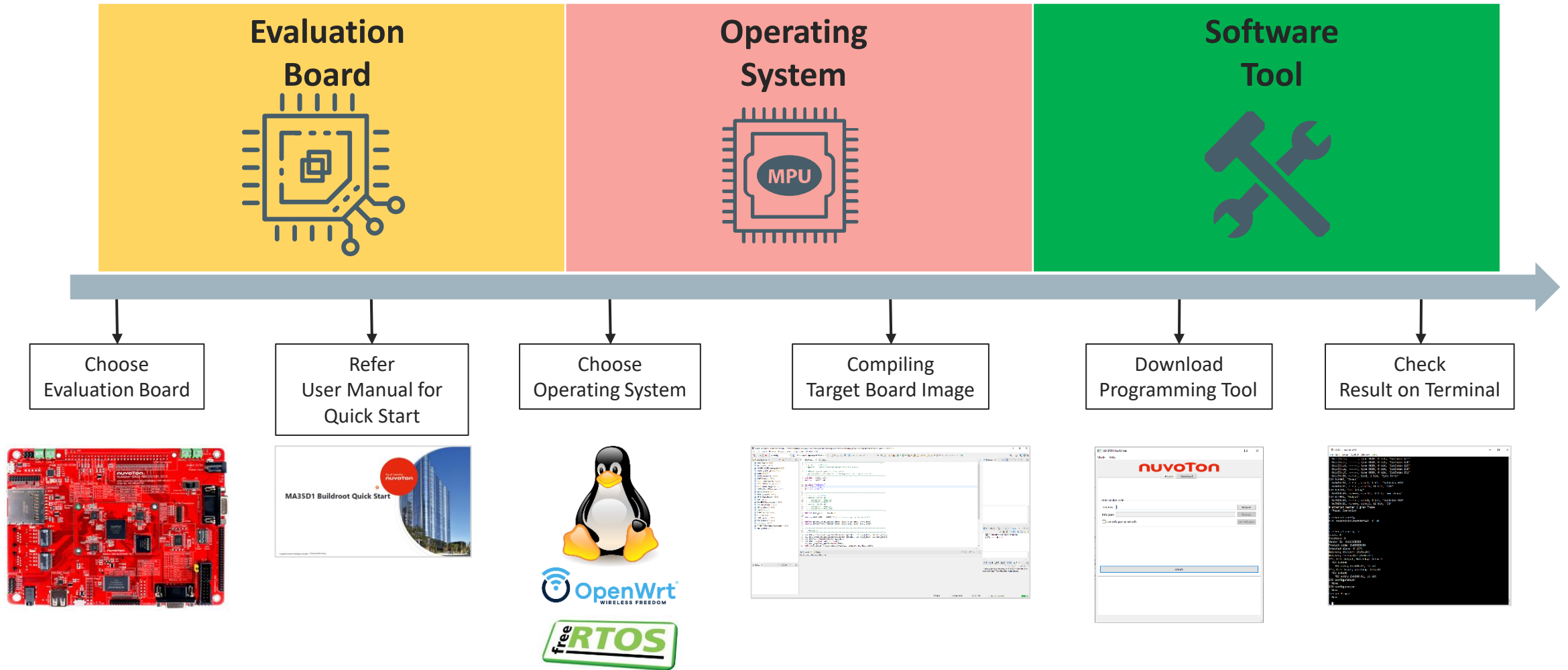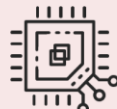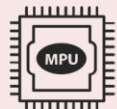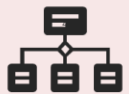
Rich MA35 Family Design Resource

Development Ecosystem for MPU

Graphics Library	emWin SEGGER	LVGL	Qt
OS	Linux	FreeRTOS RT-Thread	Bare Metal
Linux Development Environment	yocto PROJECT	BuildRoot Making Embedded Linux Easy	U-BOOT

Nuvoton Webpage – MA35 Family Design Resource

Evaluation Board	• NuMaker-IoT-MA35D1-A1
	  ▪ User Manual
	  ▪ Default Image
	• NuMaker-HMI-MA35D1-S1
	  ▪ User Manual
	  ▪ Default Image
		Operating System	• Linux
			  ▪ Buildroot / Quick Start
			  ▪ Yocto / Quick Start
			  ▪ OpenWrt / README.md
			• RTOS
			  ▪ FreeRTOS
			  ▪ RT-Thread

Expressway	• VMware Image • RTP M4 Development Slide	Hardware Reference	• Schematic, PCB, Gerber File & BOM • Approved Vendor List • Hardware Development Guide

Software & Debugging Tools	• Programming
	  ▪ NuWriter
	  ▪ SWriter
	  ▪ NuLink2-Pro (Debug RTP)
	• Pin Configure
	• High-Speed IP Calibration
		Repository / Sample Code	• Nuvoton GitHub
			• Nuvoton Gitee
			• Sample code
			  ▪ Example Code
			  ▪ Linux Applications

Technical Documents	• Document
	• Application Note
	• User Manual
		Support	• Forum
			  ▪ NuForum
			  ▪ 牛臥堂
			• Sales and Agent Support
			• Video Resource
			  • Youtube & BiliBili

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NuMaker-HMI-MA35H0-A1 EVB

Features

- MA35H04F764C / LQFP216 package (MCP with 128MB DDR)
- Dual Cortex-A35, CPU speed up to 650MHz
- Discrete power supply
- Memory Device
    - NAND Flash 1GB
    - QSPI NAND Flash 512MB
    - SD3.0 (Standard SD slot) x1, SD2.0(Micro SD slot) x1
- High-speed Connectivity
    - Megabit Ethernet x1
    - USB2.0 HS Host x1, USB2.0 HS Host/Device x1
    - CAN FD x1
    - RS485 / RS232 x2
- Audio Codec (NAU88C22YG) with Mic &Headset Jack
- Analog and Digital I/O header
- 7" TFT-LCD(1024 x 600) with Resistive Touch

EVB Info

- EVB Web Page for Introduction
- PN: NuMaker-HMI-MA35H0-A1
- Ordering Number: NK-HMA35H0A1

EV Charging Station

Industrial Control

Coffee Machine

Speed Meter

Contact Us

- MA35 Family Product Information
  https://www.nuvoton.com/products/microprocessors/arm-cortex-a35-mpus/

- Seles Support Mail for Business Support
  salessupport@nuvoton.com

- Nuvoton NuForum for Technical Support

  http://forum.nuvoton.com/

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谢谢
謝謝
Děkuji
Bedankt
Thank you
Kiitos
Merci
Danke
Grazie
ありがとう
감사합니다
Dziękujemy
Obrigado
Спасибо
Gracias
Teşekkür ederim
Cảm ơn

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