

# High Performance Motor Control Solution

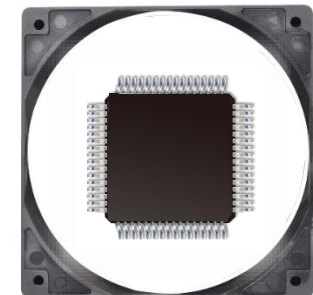
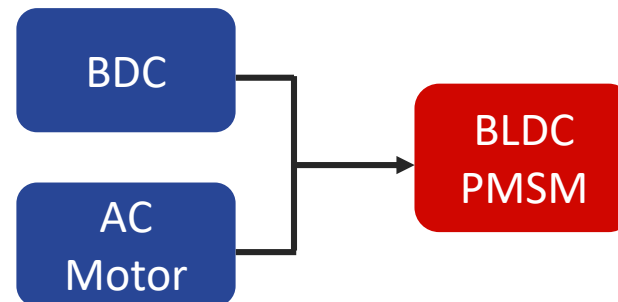
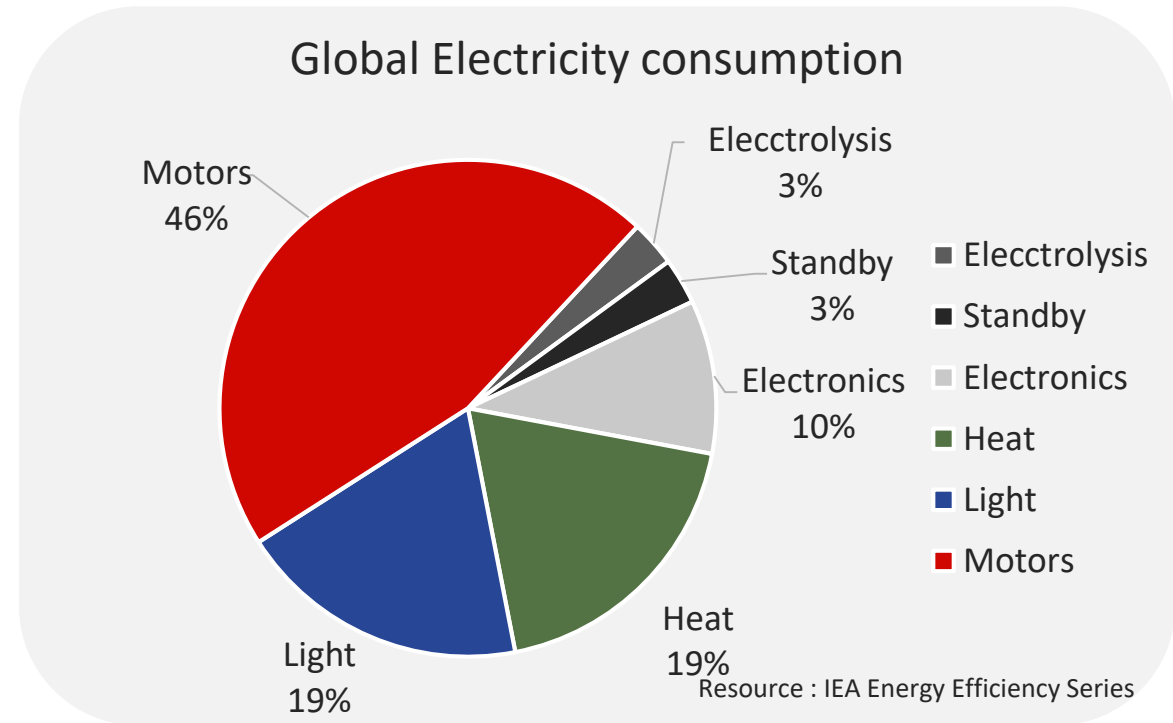
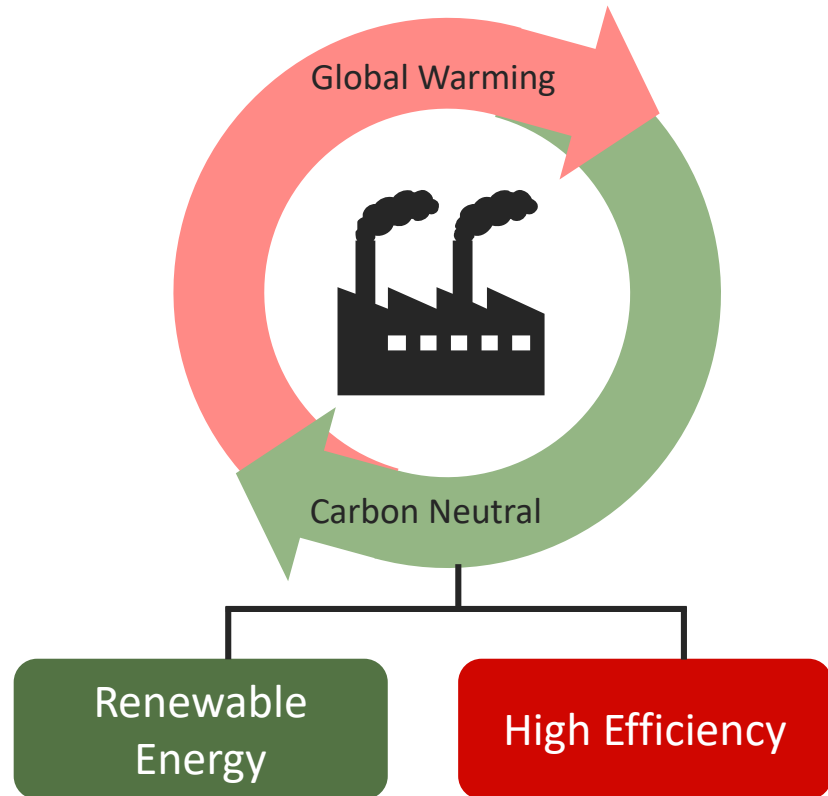
黃暉舜 Wei-Shuen Huang

Motor Application Marketing Department

PM & Technology Manager



# | Motor Application Market Trend



# | Product Lines for Motors in Nuvoton

## **NM Series**

MCU based  
General-purposed



## **KA Series**

ASIC  
Dedicated

**nuvoTon**  
新唐科技

## **KM Series**

MCU based  
Home Appliance



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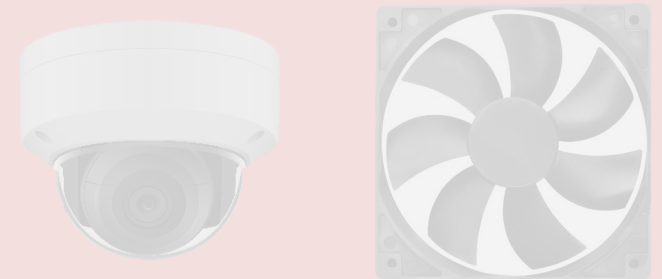
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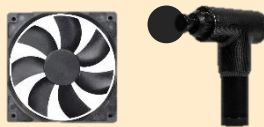


## **KM Series**

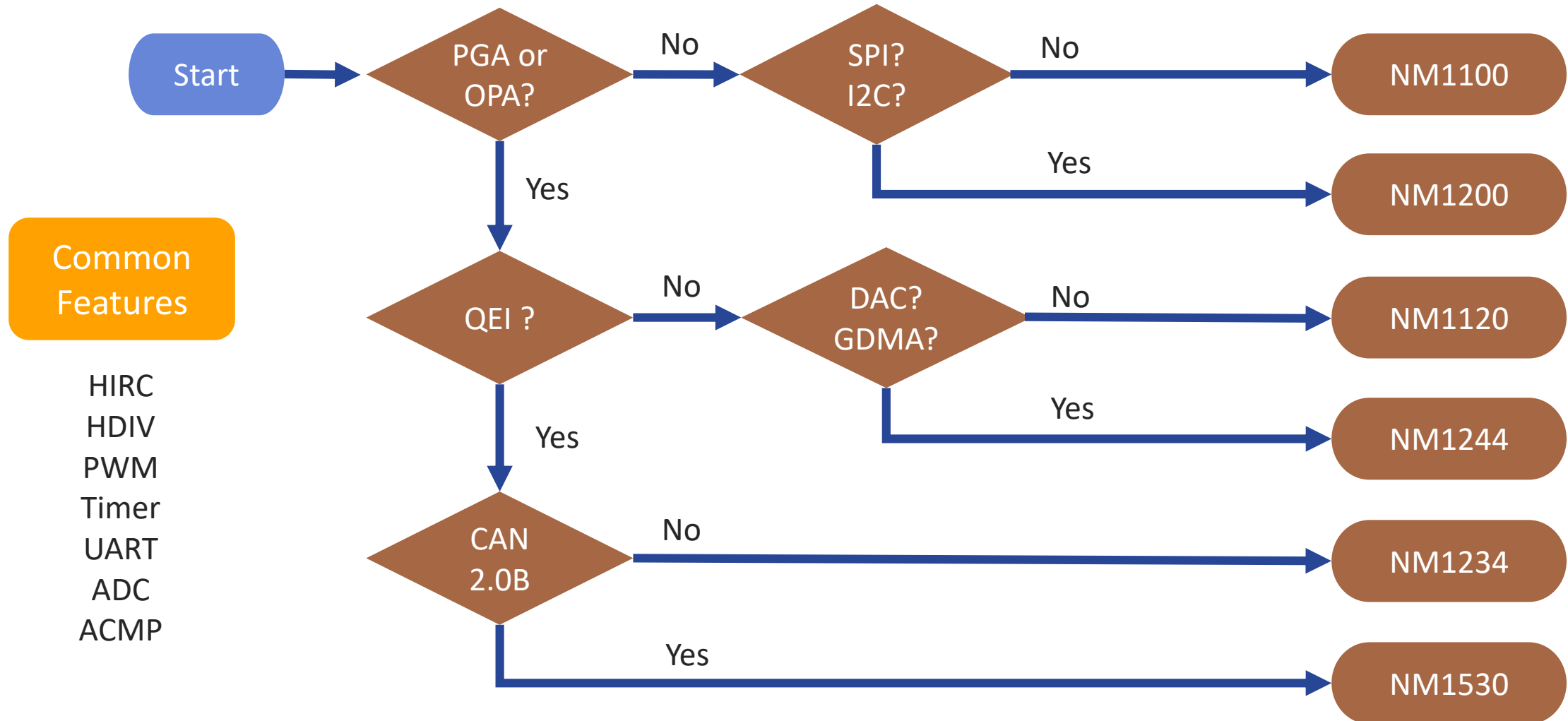
MCU based  
Home Appliance



# NuMotor MCU Series Product Roadmap

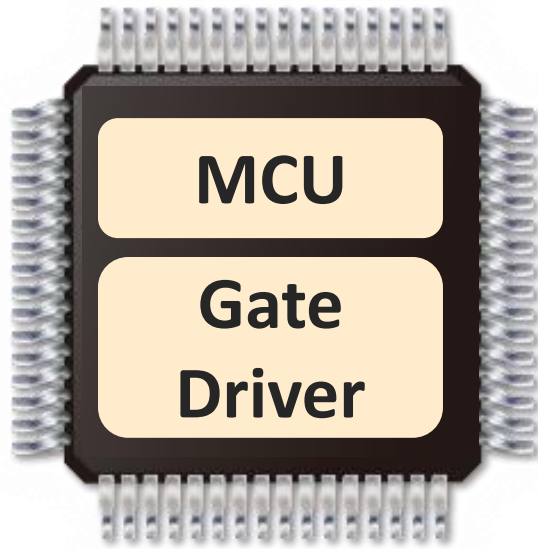
128 kB	NM1530	Cortex-M0, HDIV, -40~105°C, 2.5V~5.5V,  HIRC 1%@25°C, 16-bit PWM, 24-bit Timer, 12/10-bit ADC, UART, ACMP	LQFP48 <sub>(7x7mm<sup>2</sup>)</sub> LQFP64 <sub>(10x10mm<sup>2</sup>)</sub> LQFP100 <sub>(14x14mm<sup>2</sup>)</sub>	CAN2.0b/MDU/ OPA x 2/QEI/2 motors compatible 72MHz, 8kB/16kB RAM, I <sup>2</sup> C x 1, SPI x 3, ECAP	
64 kB	NM1234		LQFP48 <sub>(7x7mm<sup>2</sup>)</sub>	72MHz/OPA x 3/PGA x1/DAC x 2 /QEI 8kB/16kB RAM, I <sup>2</sup> C x 3, SPI x 2 , ECAP	
	NM1244		QFN48 <sub>(7x7mm<sup>2</sup>)</sub> LQFP48 <sub>(7x7mm<sup>2</sup>)</sub>	60MHz/Standby < 1μA/ DAC x 2/DMA 8kB RAM, I <sup>2</sup> C x 2, SPI x 1, ECAP , OPA x 1	
29.5 kB	NM1120		QFN20 <sub>(4x4mm<sup>2</sup>)</sub> TSSOP20 <sub>(4.4x6.5mm<sup>2</sup>)</sub> TSSOP28 <sub>(4.4x9.7mm<sup>2</sup>)</sub>	48MHz/PGA x 1 4kB RAM, I <sup>2</sup> C x 2, SPI x 2, ECAP	
17.5 kB	NM1200		QFN33 <sub>(5x5mm<sup>2</sup>)</sub> LQFP48 <sub>(7x7mm<sup>2</sup>)</sub>	48MHz 2kB RAM, I <sup>2</sup> C x 1, SPI x 1	
	NM1100		TSSOP20 <sub>(4.4x6.5mm<sup>2</sup>)</sub>	48MHz 2kB RAM	

# | Selection Guide for MCU Series





# NuMotor MCP Series Product Roadmap

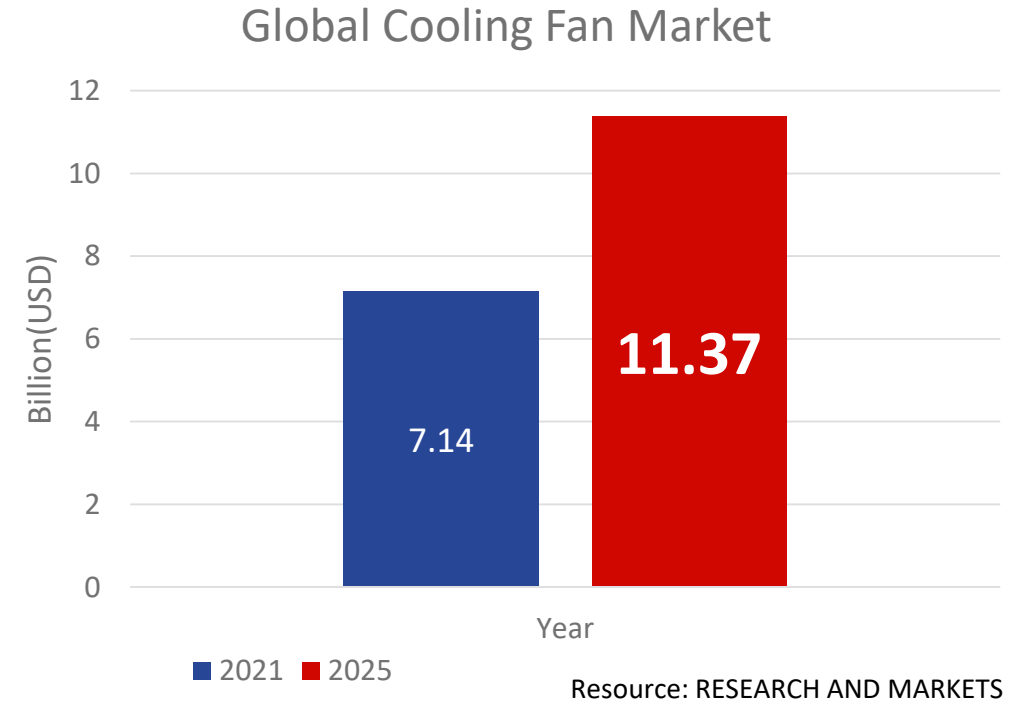
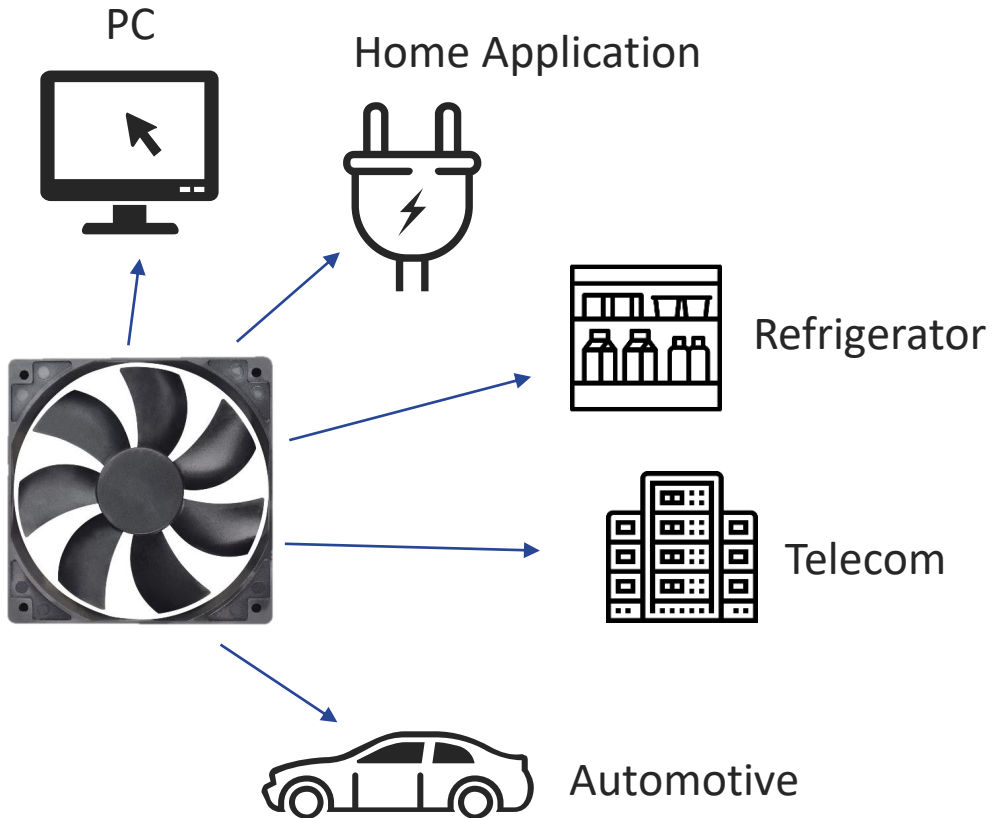


## Built-in functions:

- 5V LDO
- Comparators
- Shoot-through protection
- Thermal protection
- UVLO

	600V		<b>NM1817</b> LQFP44(10x10)	
	200V			<b>NM18440</b> LQFP48(7x7)
	40V	<b>NM18002</b> QFN24(4x4)	<b>NM18107</b> QFN32(5x5)	
MCU		MS51	NM1120	NM1244
Application		Single phase	Three phase	

# | Market for Cooling Fan



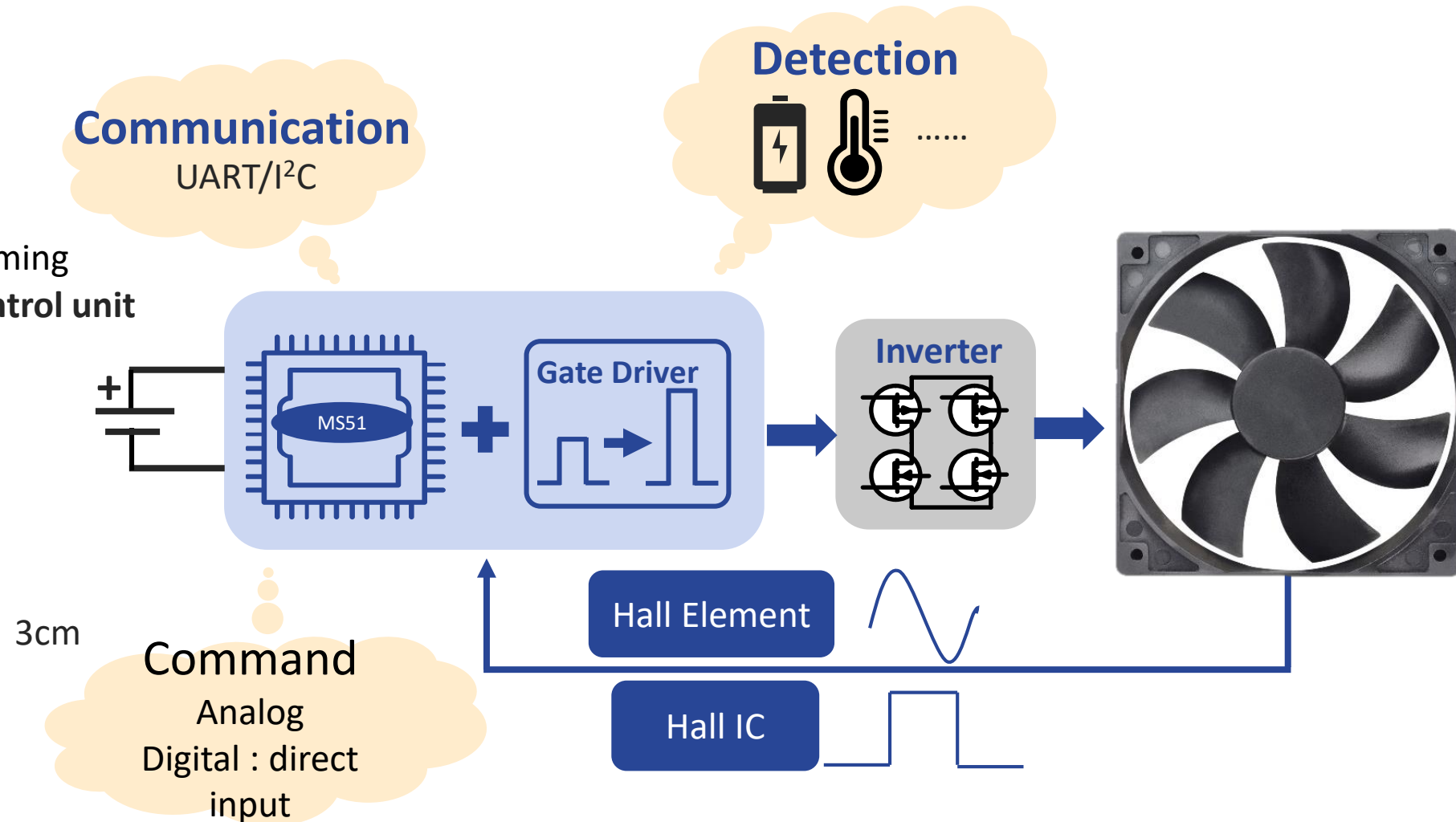
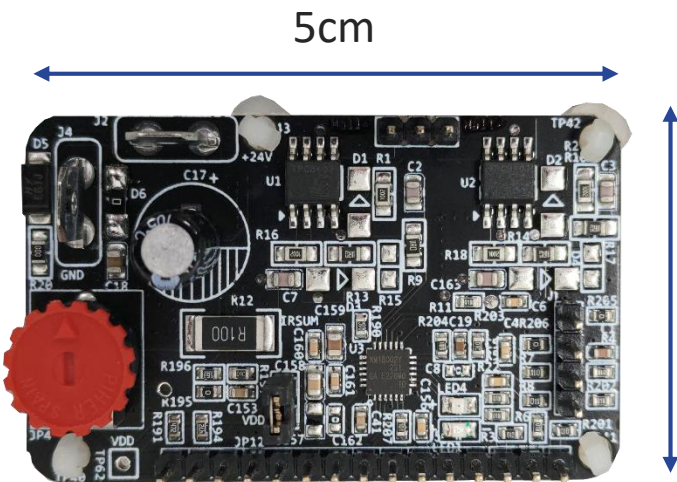
CAGR is about **12.34%**.



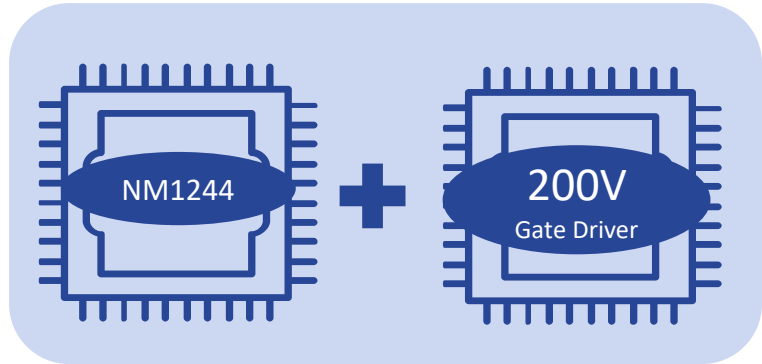
# NM18002Y

## Highlights

- 12V-24V Fan
- PN gate driver
- Supports 4-Wire Programming
- Passive part → Active control unit

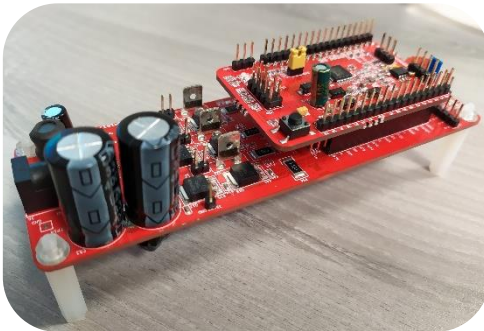


# NM18440D



## Highlights

- 200V application : 110VAC, 24~96VDC
- LQFP48(7x7)
- Up to 29 GPIO



Cooling fan  
in  
refrigerator

Hand  
Drier



Ceiling  
fan

Soy-milk  
maker



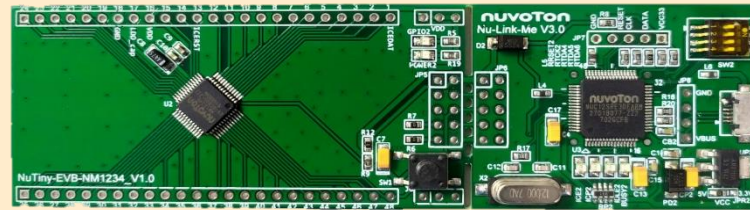
# | Tools for Development



## Tiny Board

NT-NM1200  
NT-NM1120  
NT-NM1230  
NT-NM1240  
NT-NM1530

## Hardware



MCU + NuLink

## Software

NM1200\_BSP\_CMSIS  
NM1120\_BSP\_CMSIS  
NM1230\_BSP\_CMSIS  
NM1240\_BSP\_CMSIS  
NM1530\_BSP\_CMSIS

## Motor System Board

NK-NM1200L NK-NM1120L  
NK-NM1230L NK-NM1240L  
NK-NM1530L

NK-NM18107L NK-NM18002  
NK-NM18440 NK-NM1817H



MCU + GateDriver +MosFET

NuMotor\_NM1200  
NuMotor\_NM1120  
NuMotor\_NM1240  
NuMotor\_NM1230  
NuMotor\_NM1530  
NuMotor\_NM18002Y

# | We Provide.....



Balanced Product Line



Technical consult



Shipment > 100kk



High quality



Long life cycle





# | Product Lines for Motors in Nuvoton

## NM Series

MCU based  
General-purposed



## KA Series

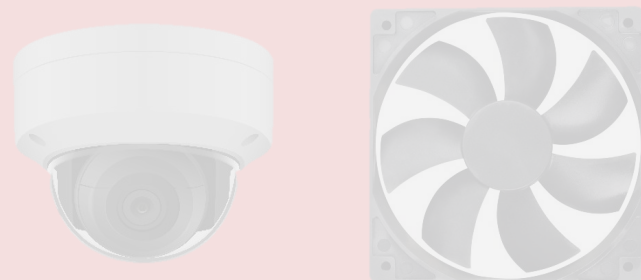
ASIC  
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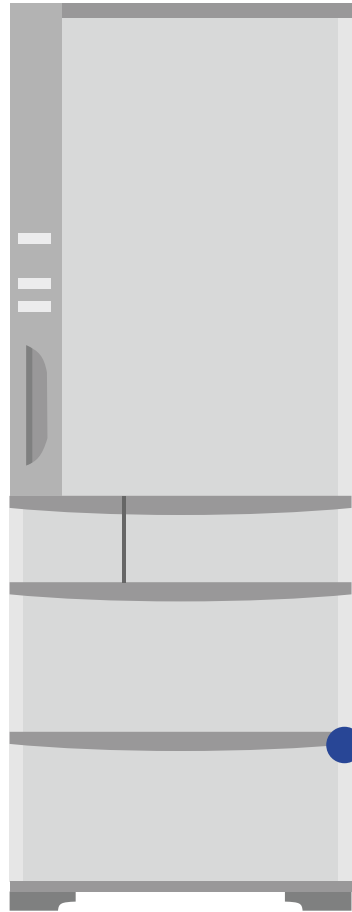


## KM Series

MCU based  
Home Appliance



# | Home Appliance



## Inverter controller

### • High-end Model

- Core: Cortex-M7 160MHz
- Flash: 256~512KB
- Data Flash: 64KB
- PIN: 100~144

### • Middle-end Model

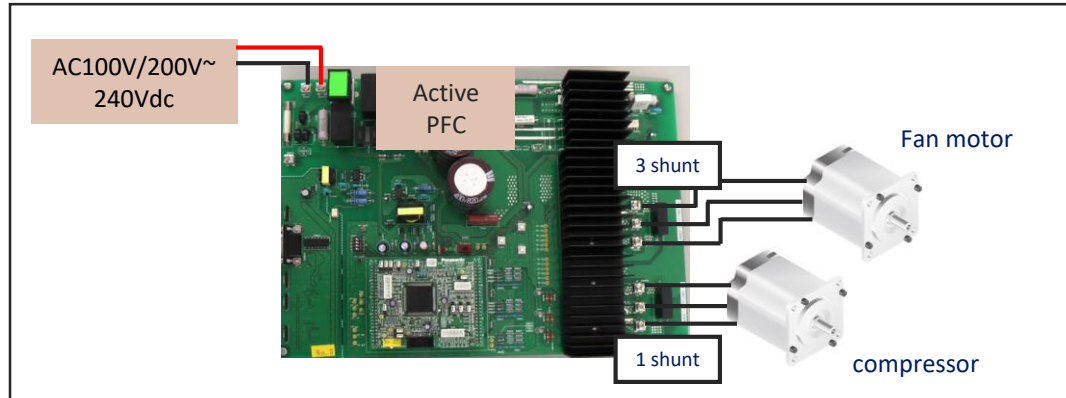
- Core: AM32R 120MHz
- Flash: 128~512KB
- Data Flash: 16~64KB
- PIN: 48~144

### • Low-end Model

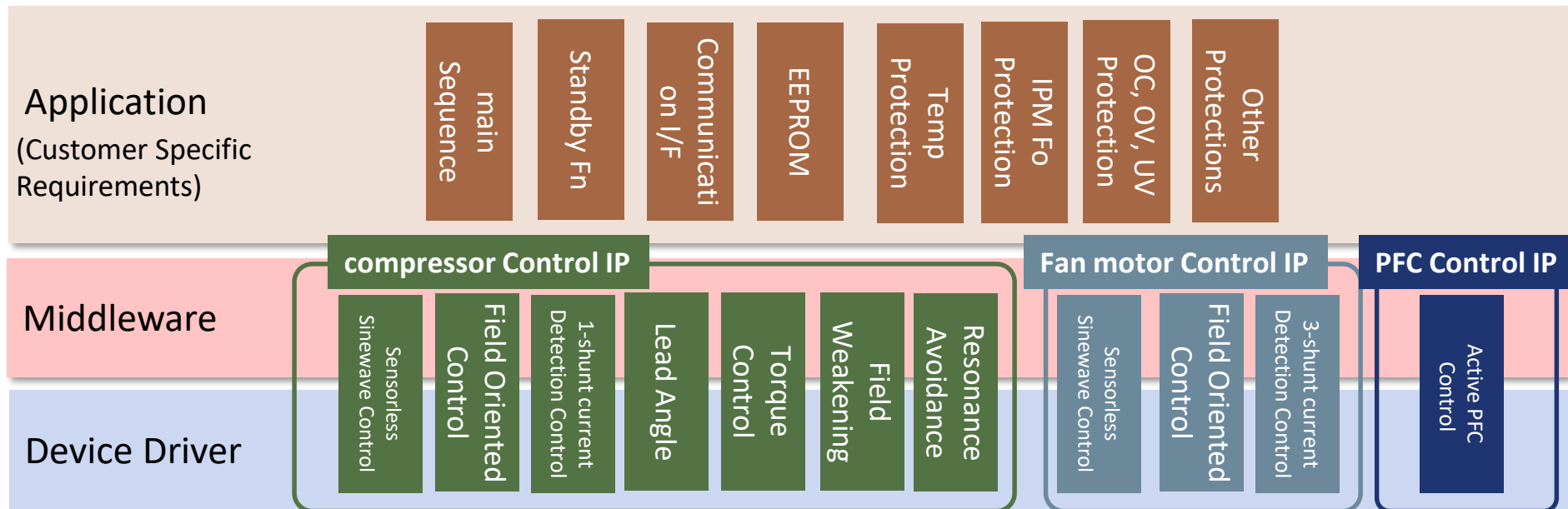
- Core: Cortex-M4 120MHz
- Flash: 128~256KB
- Data Flash: 8~32KB
- PIN: 48~100



# Reference for Air conditioner



It is easy to use because it implements the required IP.





# | NTC Inverter MCU Concepts

- With our 20 years of experience in Inverter MCU technology development and production knowhow, we can offer **“3S”**

## Speed up development

Product development is always a battle against schedule.  
⇒ **Simple is best.**

- Motor parameters are extracted in 1 minute (accuracy No. 1 in industry) and then automatically adjusted.
- Ensure processing time by synchronizing so that multiple motor control tasks do not conflict.
- AD and comparator pin assignments are stress-free with internal settings

## Safety ensuring

Destruction of power devices can lead to fire.  
⇒ **Safety is first.**

- Various protection circuits protect devices from multiple perspectives
- The internal mask function can avoid accidental system stop due to noise.
- Supports certification such as ISO60730

## Save system cost

Parts around the microcomputer  
⇒ **Built-in is implemented.**

- Built-in operational amplifier (differential input and negative input are supported)
- Each comparator has an internal reference voltage(external reference with noise isn't required)
- The number of parts can be reduced and wiring can be simply routed.

# Inverter MCU Series Product

## New ArmCortex-M4 series

## New Arm Cortex-M7 series

## KM7BFBFx

## KM103HFBx

# KM103HFDx

performance	Type name ROM/RAM			KM1M7BF02N 512kB/64kB		KM1M7BF00N 512kB/64kB
				KM1M7BF02M 384kB/48kB		KM1M7BF00M 384kB/48kB
				KM1M7BF02K 256kB/32kB		KM1M7BF00K 256kB/32kB
	KM1M7CF05K 256kB/64kB Under planning	KM1M7CF04K 256kB/64kB Under planning	KM1M7CF03K 256kB/64kB Under planning	Now planning ARM-M7 Higher performance		
160MHz +iRAM			KM103HFD5N 512kB/32k	KM103HFD6N 512kB/32k	KM103HFD7N 512kB/32k	KM103HFD8N 512kB/32k
		KM103HFD4M 408kB/20kB	KM103HFD5M 408kB/20kB	KM103HFD6M 408kB/20kB	KM103HFD7M 408kB/20kB	KM103HFD8M 408kB/20kB
		KM103HFD4K 264kB/16kB	KM103HFD5K 264kB/16kB	KM103HFD6K 264kB/16kB	KM103HFD7K 264kB/16kB	
120MHz +iRAM		KM103HFD4K 264kB/16kB	KM103HFD5K 264kB/16kB	KM103HFD6K 264kB/16kB	KM103HFD7K 264kB/16kB	
		KM1M4BF04K 264kB/16kB	KM1M4BF03K 264kB/16kB	KM1M4BF02K 264kB/16kB		
	KM1M4BF05G 136kB/16kB	KM1M4BF04G 136kB/16kB	KM1M4BF03G 136kB/16kB	KM1M4BF02G 136kB/16kB	New M4-series Under development	
120MHz						
80MHz	KM103HFB3K 264kB/20kB	KM103HFB4K 264kB/20kB	KM103HFB5K 264kB/20kB	KM103HFB6K 264kB/20kB		
	KM103HFB3G 132kB/16kB	KM103HFB4G 132kB/16kB				
<div>QFP48QFP64QFP80QFP100QFP128QFP144</div>						

# | Product Lines for Motors in Nuvoton

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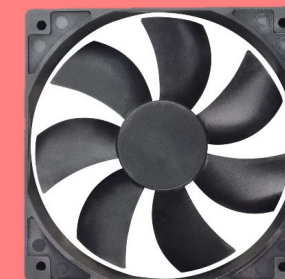
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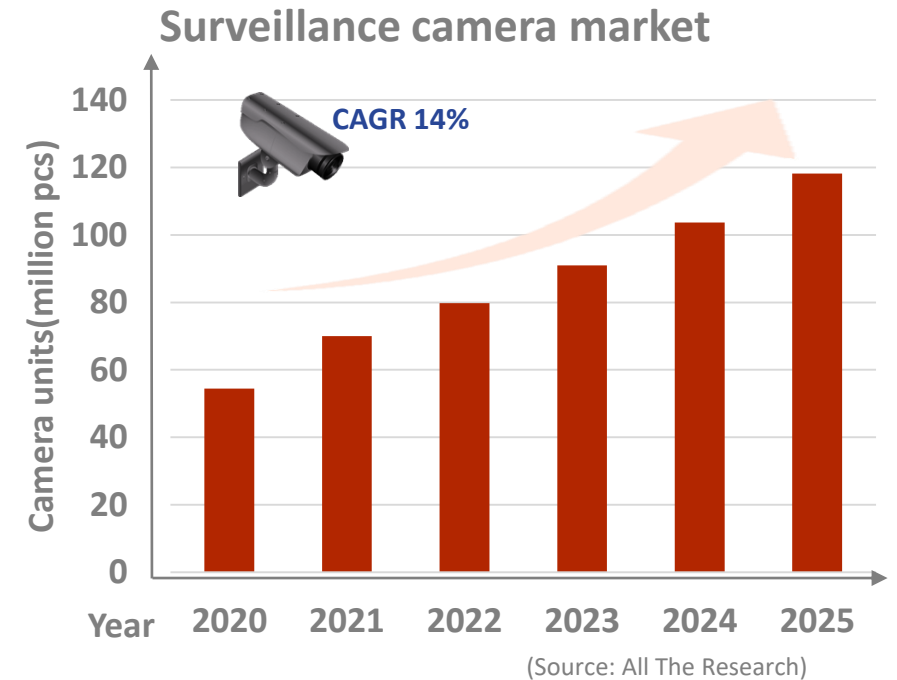
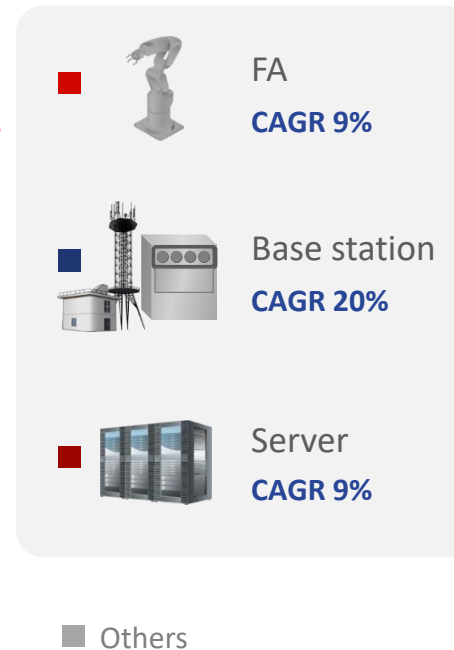
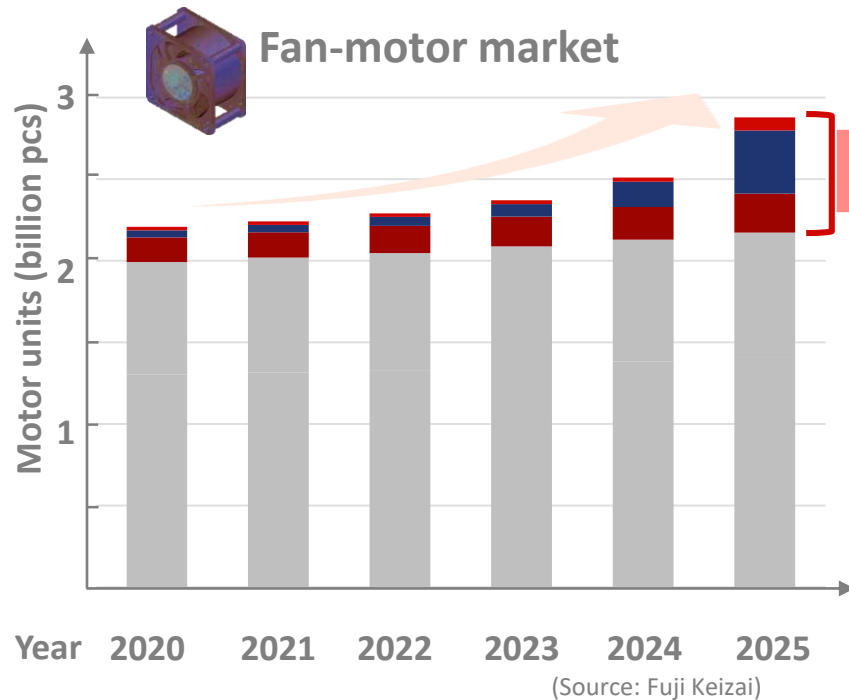
## **KM Series**

MCU based  
Home Appliance



# | Global Market Trend

- The Applications needed for “Smart Factory” have significant growth rate

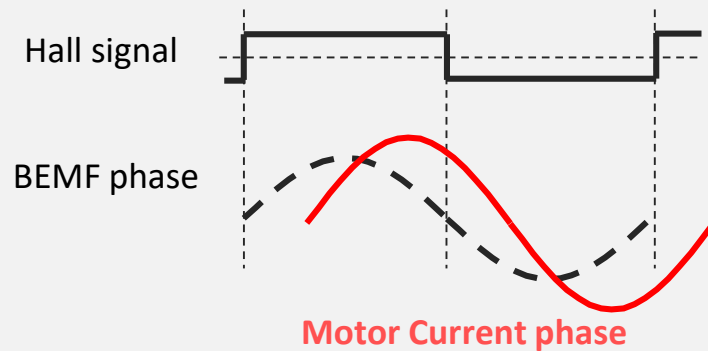


# | Our Solution

Solution

- Customize “Core Technology” to realize our proposal

## (Core Technology) Phase Control



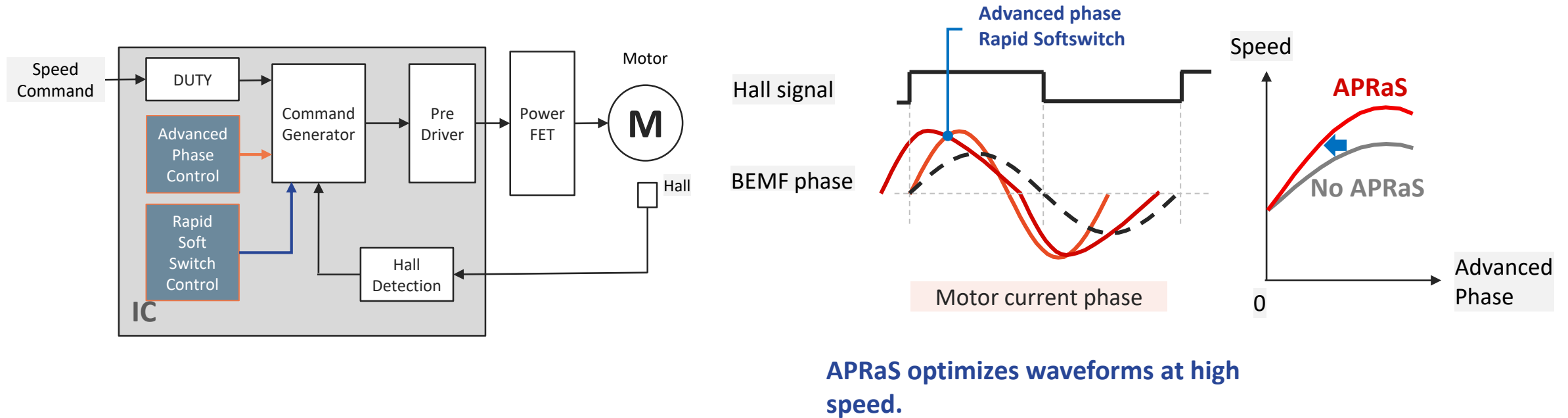
**For High Speed**  
**Advanced Phase**  
**& Rapid Softswitch**

**For Low Vibration**  
**Correction**  
**Amplitude & Phase**

# | What is APRaS

- APRaS optimizes motor performance and enable to set more than 100 krpm

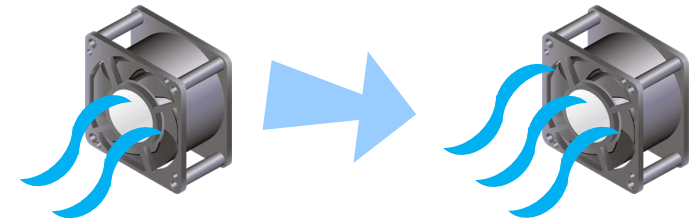
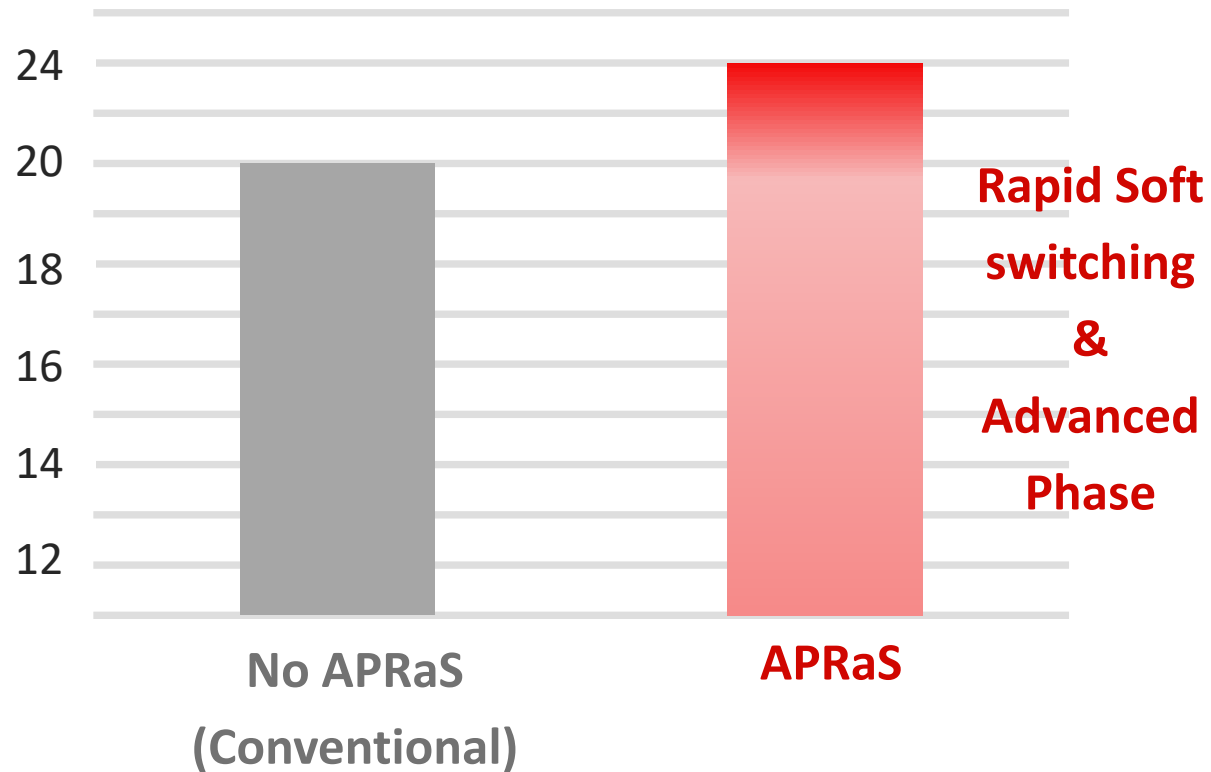
## APRaS



# Benefit High Air flow

- APRaS increases maximum rotation speed

Speed [krpm]



If same size,  
⇒ Realize high air flow

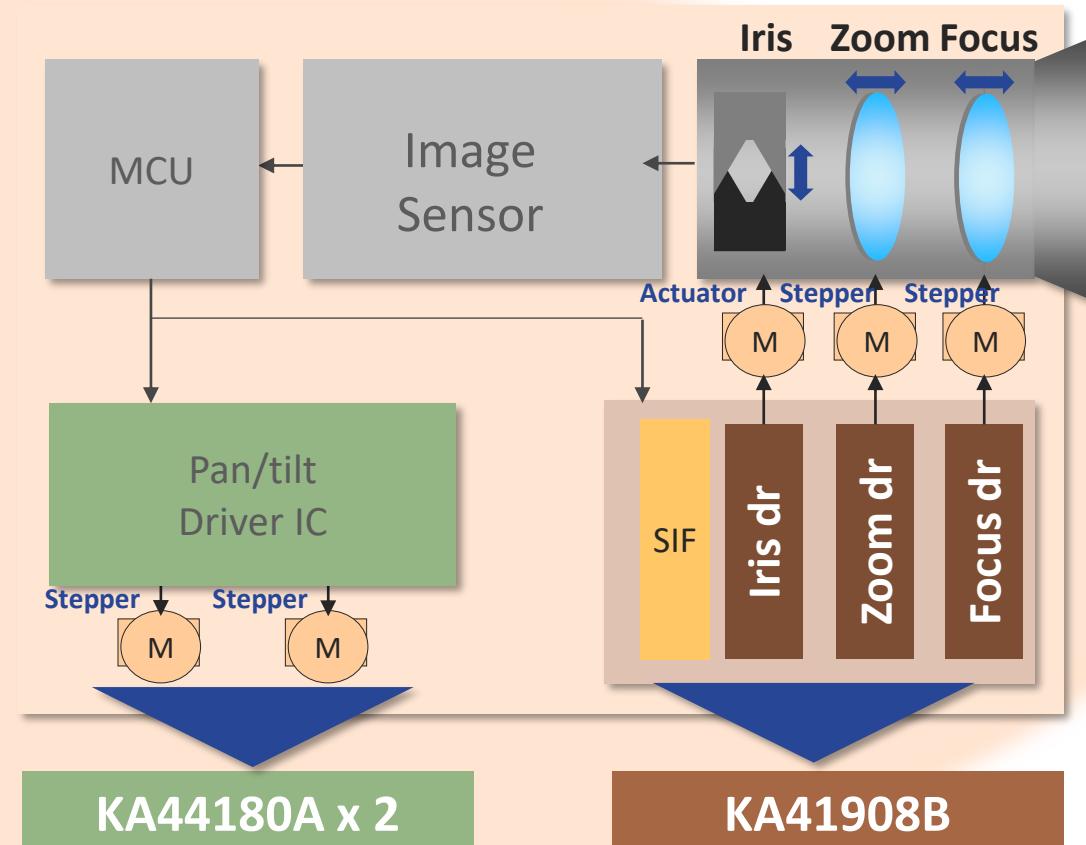
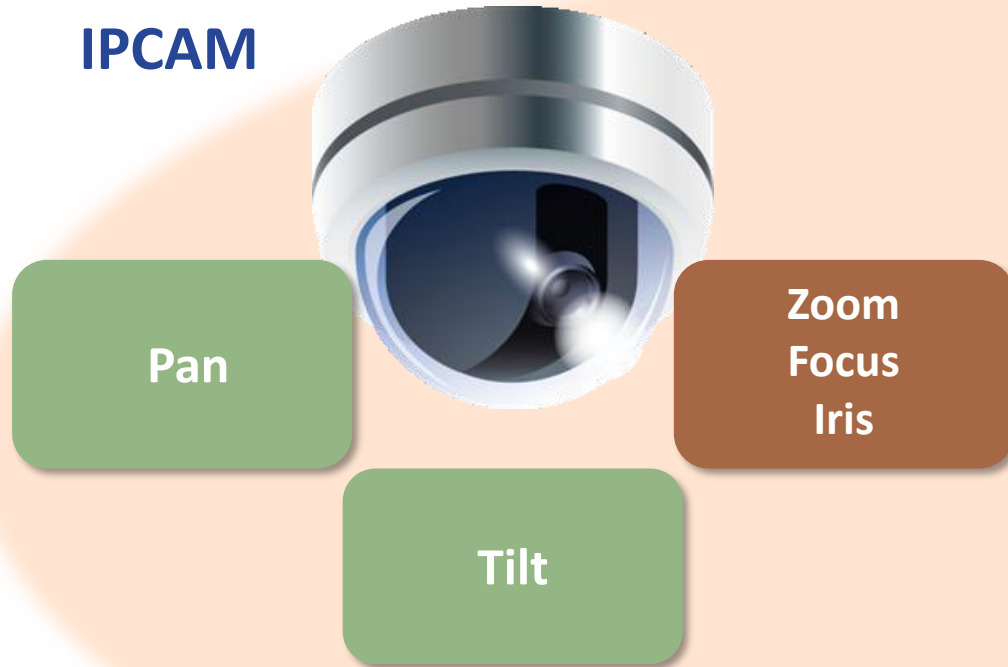
Realize High Speed Operation



# Use Case (Lens Driver)

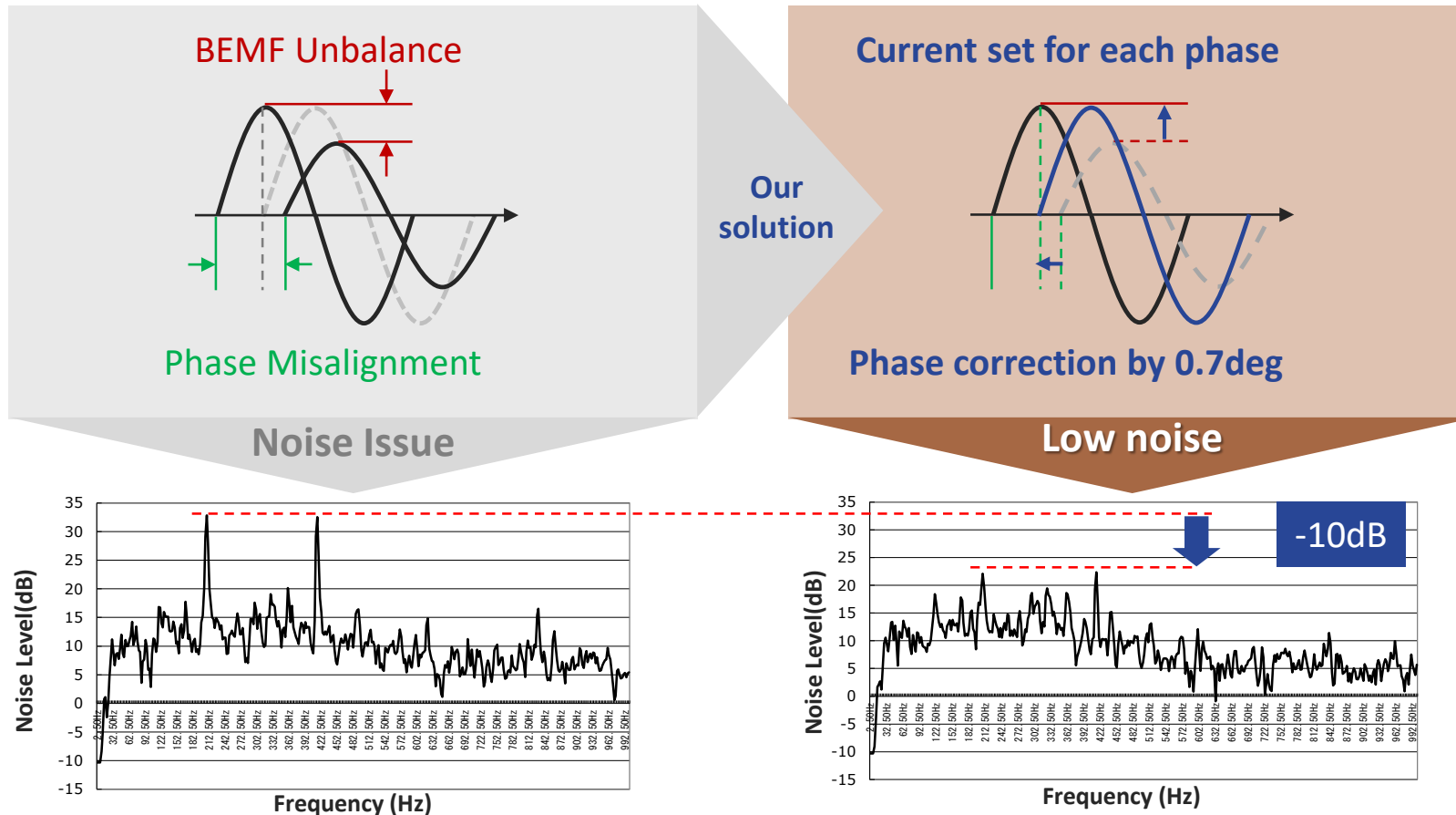
Market

## Surveillance IPCAM



# What is CAP



- CAP (Correction Amplitude & Phase) function reduces Acoustic noise  
Due to manufacture variation

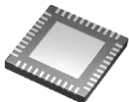
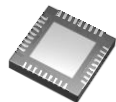


Realize  
Low vibration  
& Quick Monitoring

# KA Series Portfolio

Line-up

Fan MTD	For Single Phase					For Three Phase
	KA44171A	KA44168A	KA44169A	KA44169AB	KA44170A	KA44143A
Package	 HQN20 3mm x 3mm 0.4mm pitch	 MSOP8 3mm x 4.9mm 0.65mm pitch			TSSOP14 5mm x 6.4mm 0.65mm pitch	 HQN24 4mm x 4mm 0.4mm pitch
Absolute max. rated voltage/current	39V/ <b>Pre-Driver</b>	35V/1.4A	36V/1.4A		36V/ <b>1.6A</b>	<b>28V/2.2A</b>
Ron (Upper + Lower)	External FET	1.6Ω	1.6Ω		1.25Ω	1.0Ω
Phase control	<b>APRaS</b>	APC				APC
IF : INPUT / OUTPUT	PWM or VSP / FG or LD	Non / FG	PWM / FG+LD	VSP / FG	PWM / FG+LD	PWM or VSP /FG+LD
Feature	<b>High speed</b> (~100Krpm)	<b>Smallest driver</b>	<b>General function</b>		<b>High speed</b> (~15Krpm)	<b>1 Hall /Silent drive</b>

Stepper MTD	For Lens driver	For General purpose
	KA41908B	KA44180A
Package	 HQN44 6mm x 6mm 0.4mm pitch	 HQN36 5mm x 5mm 0.4mm pitch
Absolute max. rated voltage/current	MVCC:6V, DVDD:4V / 0.25A(Stepper), 0.15A(Actuator)	37V/1.5A
Ron (Upper + Lower)	2.5Ω(Stepper) , 5Ω(Actuator)	1.4Ω
Stepper Driver	<b>2ch (for Zoom / Focus)</b>	<b>1ch</b>
Actuator Driver	<b>1ch (for Iris)</b>	-
IF : INPUT / OUTPUT	SPI / SPI	Parallel / NFALT
Feature	<b>Built-in Hall Iris control</b>	<b>High speed/High torque</b>

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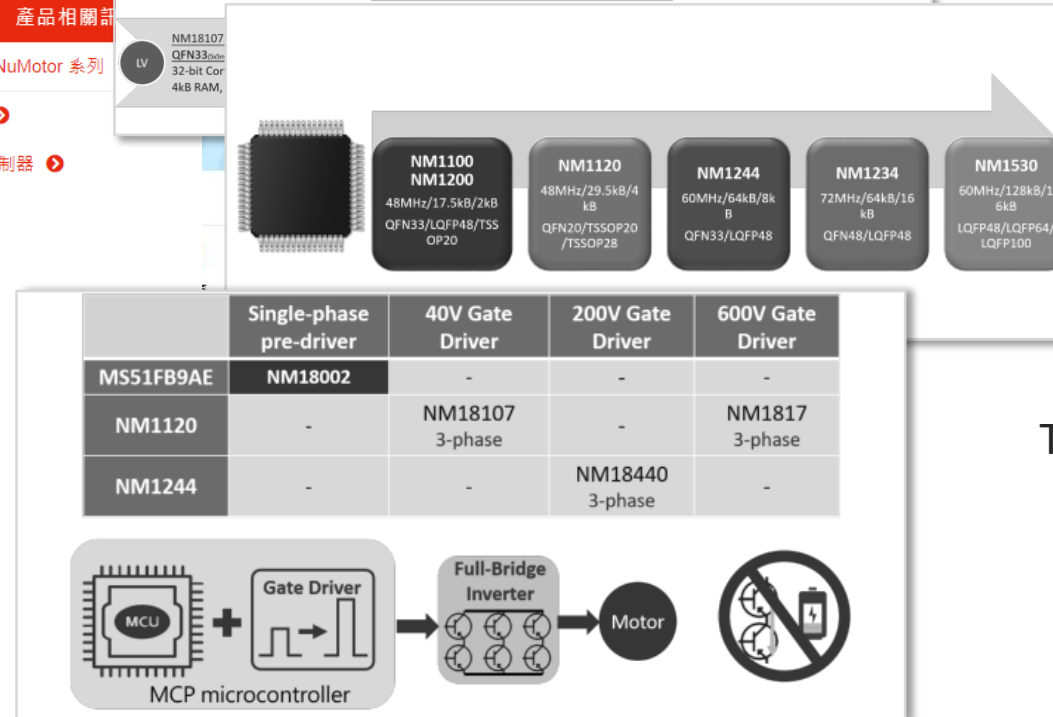
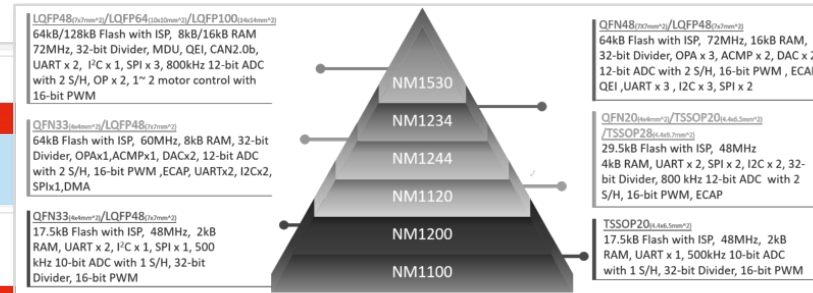


## **KM Series**

MCU based  
Home Appliance



# Synchronize with Nuvoton NOW!



[www.nuvoton.com](http://www.nuvoton.com)

Tools, Datasheets, BSPs, Example Codes, Circuits, Manuals are

**Ready!**

Joy of innovation  
**nuvoTon**

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