

# 新能源應用方案

高效能馬達控制

Ace Wang 王超羣

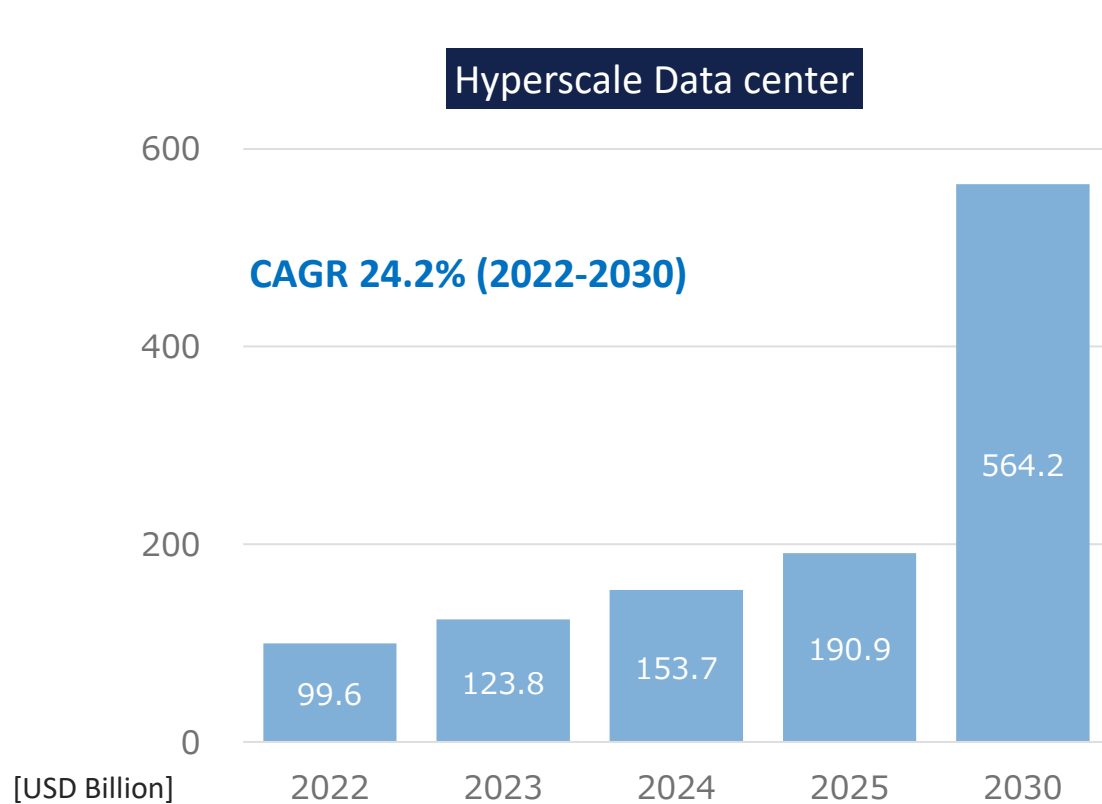


# Industrial 48V Fan Motor Driver

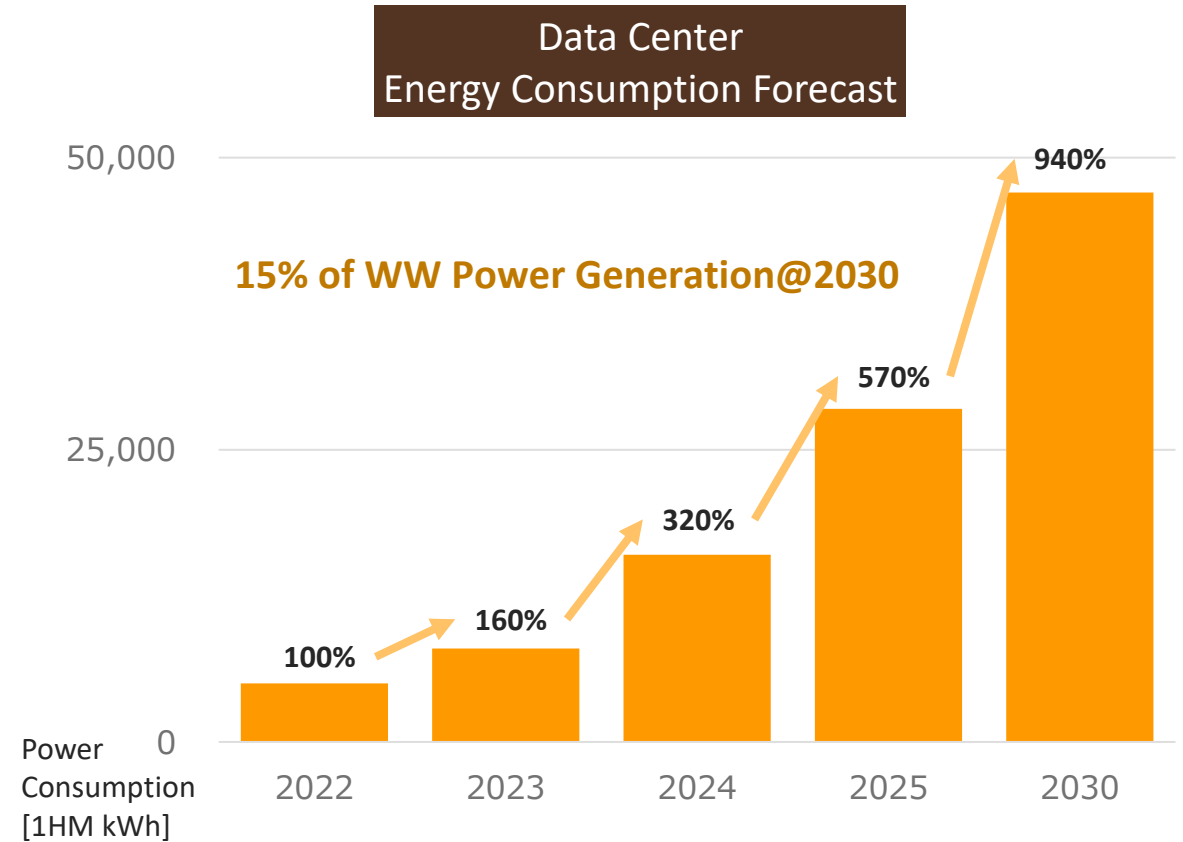


# Datacenter market

Power consumption increases due to high performance requirement



Source : Panoramadatainsights, WW Hyperscale Forecast, 2022-2030



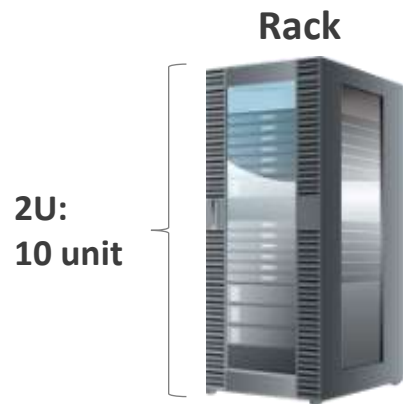
Source: [https://www.tdk.com/ja/featured\\_stories/entry\\_015.html](https://www.tdk.com/ja/featured_stories/entry_015.html)

# Server trend

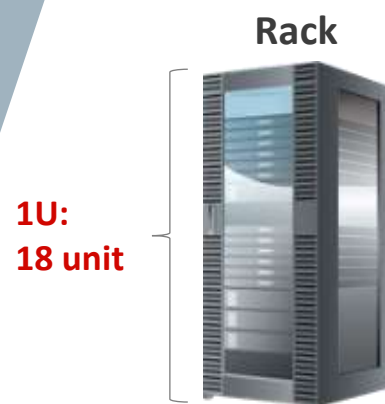
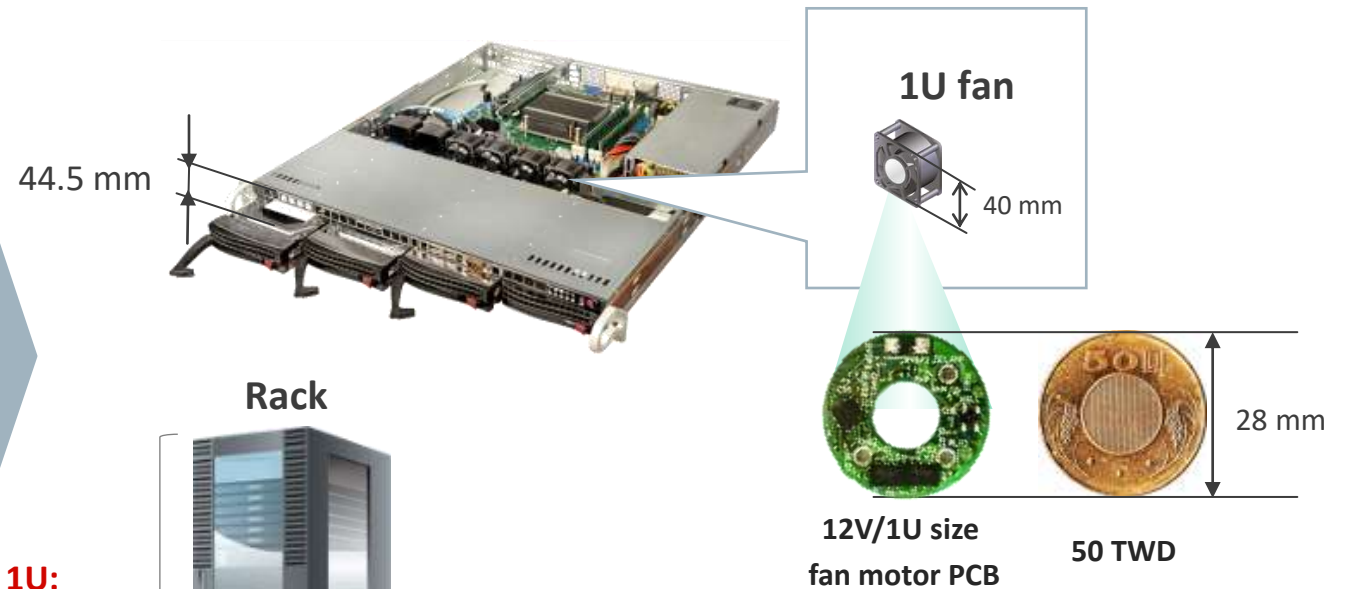
Require reliable and high performance Fan fits into 1U size

- Server Trend: **High speed and High density** for increasing processing data

2U server: Max unit/rack = 10 unit



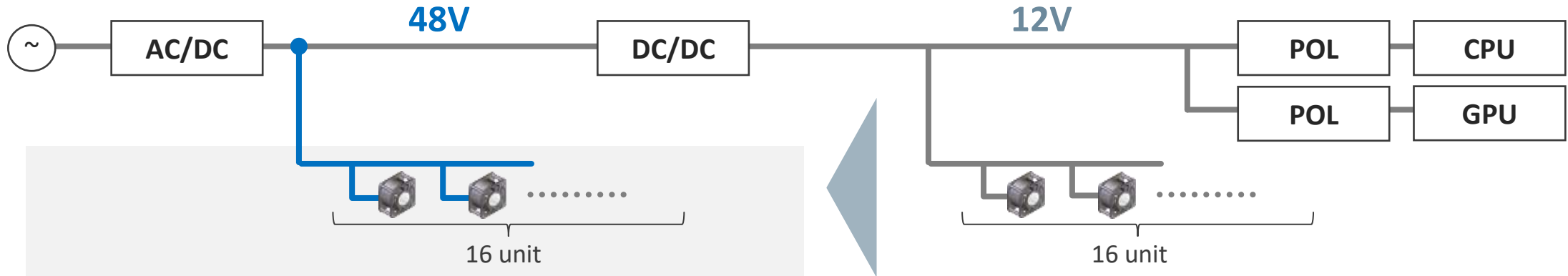
1U sever: Max unit/rack = 18 unit



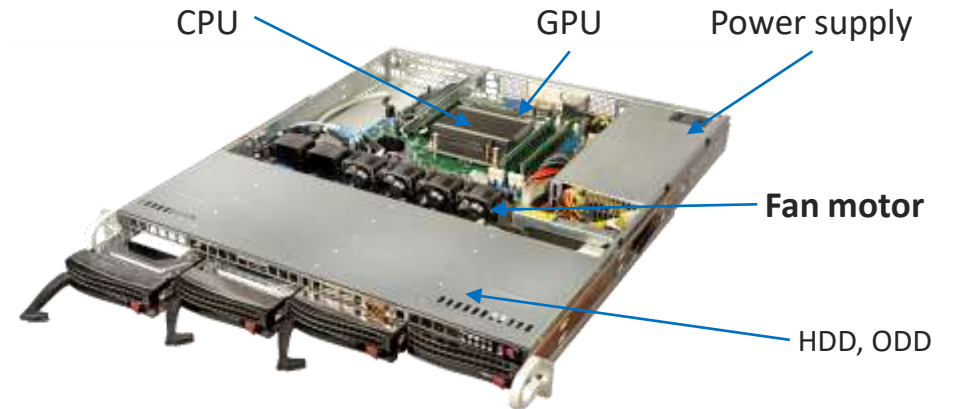
**For small size PCB  
→ Small Motor driver IC package  
and Minimizes components**

# Server Fan motor (48V)

Require 48V Fan with 1U size for high efficiency server performance



**48V Fan motor system has High efficiency**  
 → Power consumption of MTD is **1/16 less** than 12V Fan motor system



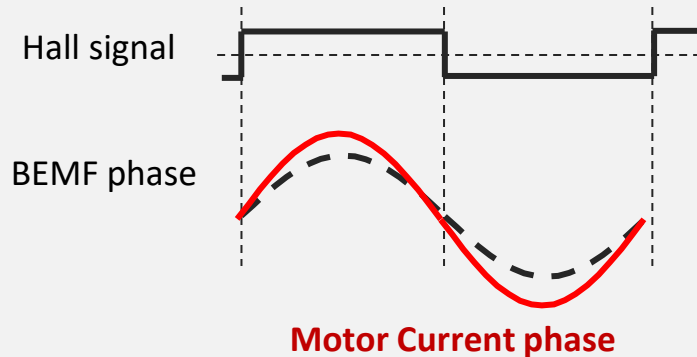
FAN Size	Power Supply voltage	
	12V	48V
1U	✓	Next Challenge ✓
2U ≧	✓	✓

# Nuvoton Exclusive Solution

Realizes automatic fine control for high efficiency

## Core technology

### Phase Control



## Nuvoton exclusive technology

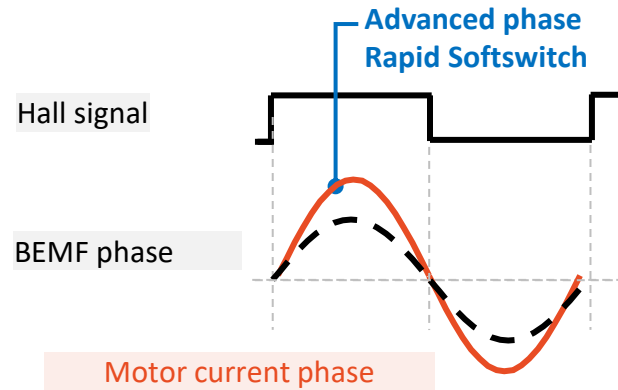
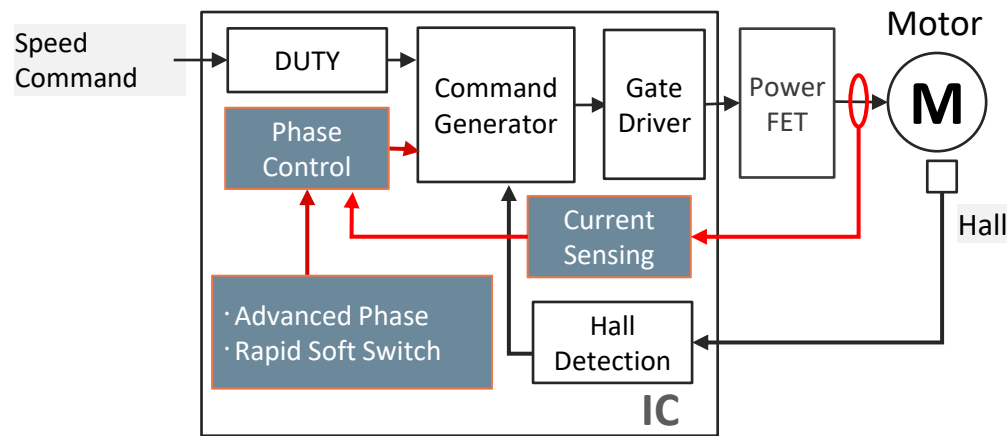
**A2PRaS** for efficiency  
at wide speed range

Auto Advanced Phase  
& Rapid Softswitch



# A2PRaS optimizes waveforms throughout all speed

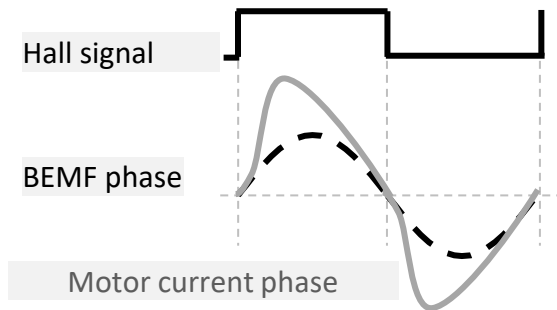
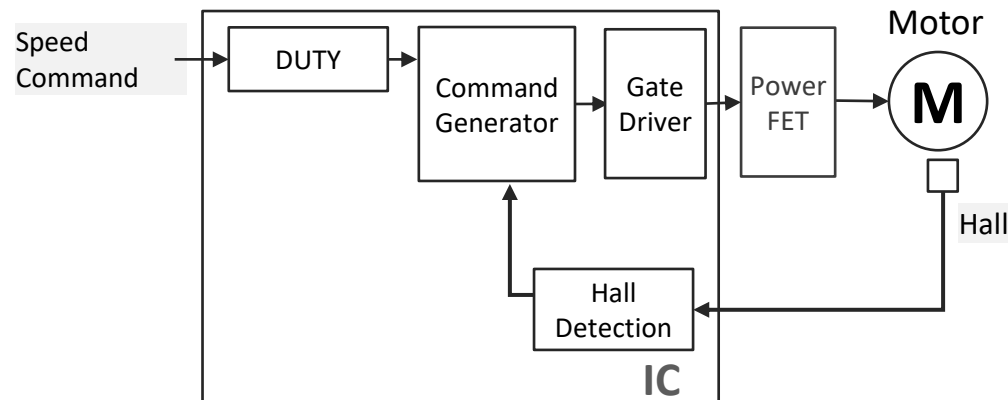
## With A2PRaS (Nuvoton exclusive technology)



### Advantage

- ✓ No fine adjustment is required
- ✓ Automatically adjust shift from mechanical deterioration

## Without A2PRaS



### Phase shift

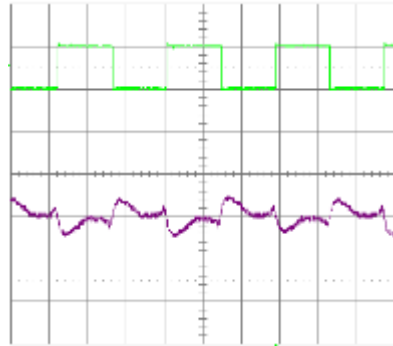
- ✓ Adjustment required
- ✓ Another adjustment required from mechanical deterioration

Low efficiency due to distorted motor current at high speed

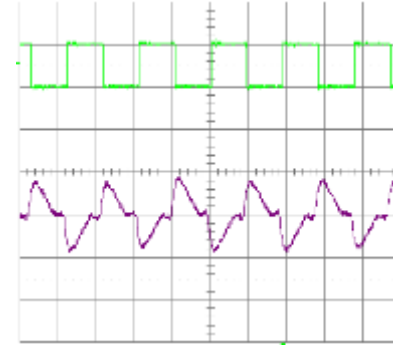
# Benefits: High efficiency at wide speed range

Achieves high efficiency throughout all speed by waveform optimization of A2PRaS

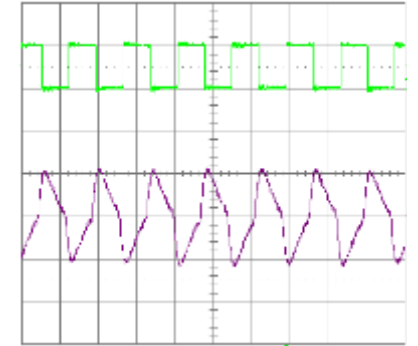
Without A2PRaS



Input Power  
**2.45W**

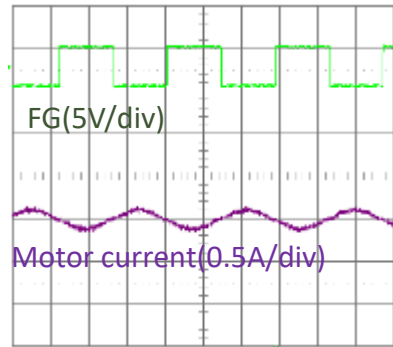


Input Power  
**5.38W**

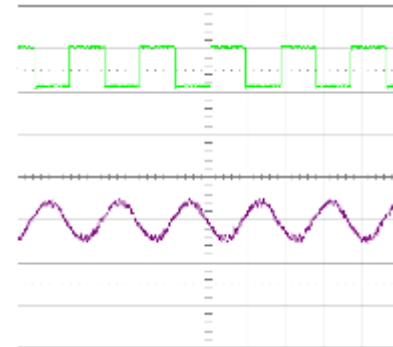


Input Power  
**10.70W**

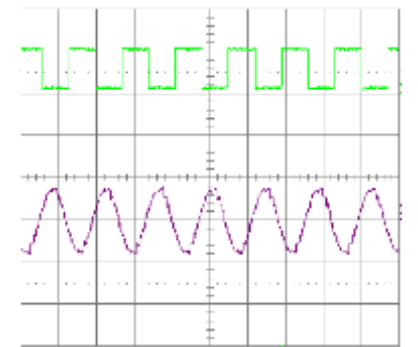
With A2PRaS  
(KA44370A)



**1.92W**  
▲ 22%



**4.32W**  
▲ 20%



**9.20W**  
▲ 14%

10.7krpm

16.1krpm

21.4krpm

Low Speed

High Speed



# Benefits: Suitable configuration for 1U Fan

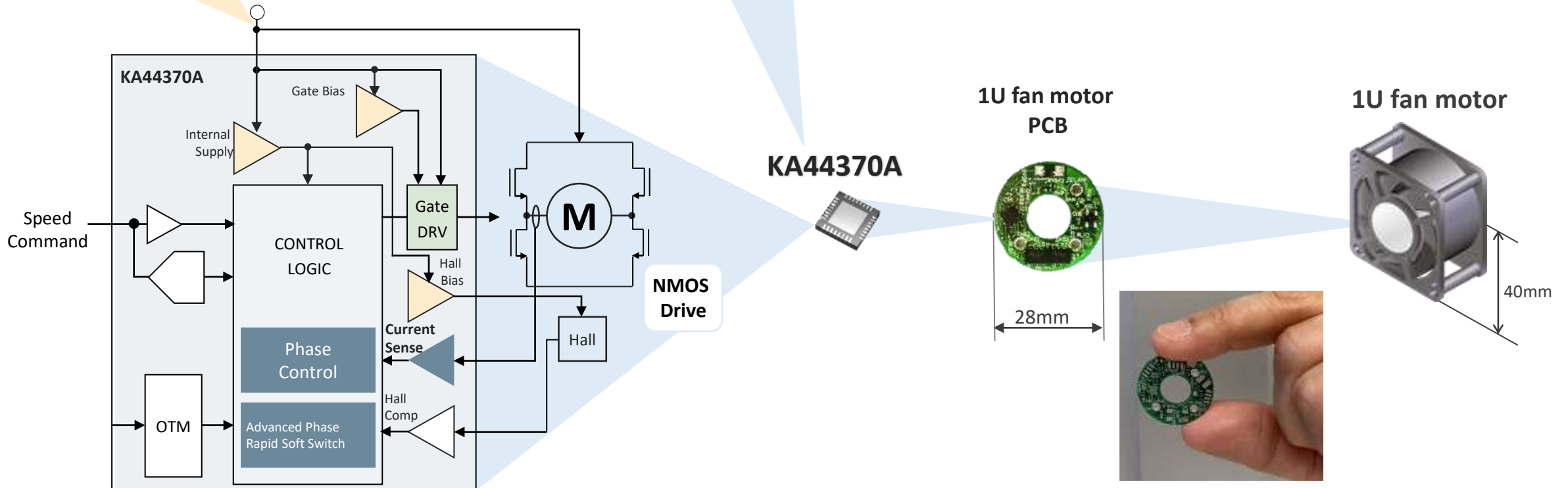
Realize 1U Fan by 48V direct input with Small package

## 48V input directly

- ✓ No need parts for high voltage
- ✓ High efficiency

## QFN4x4

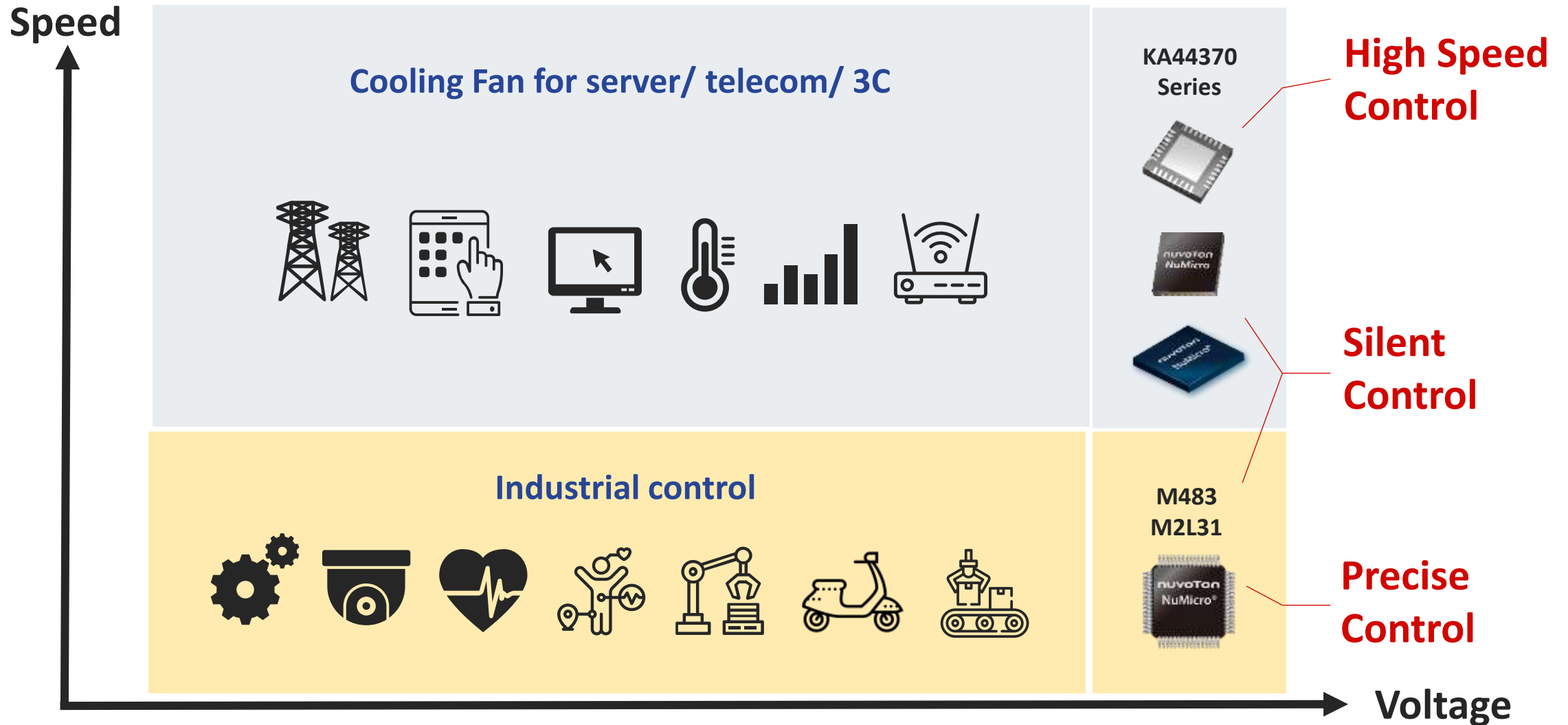
- ✓ Achieve 1U Fan



# High performance MCU for Motor Control

Joy of innovation  
**NUVOTON**

# How to select motor controller



# MCU for Motor Control



## Performance

- Core: M23/M4
- Clock rate: 72 to 200 MHz



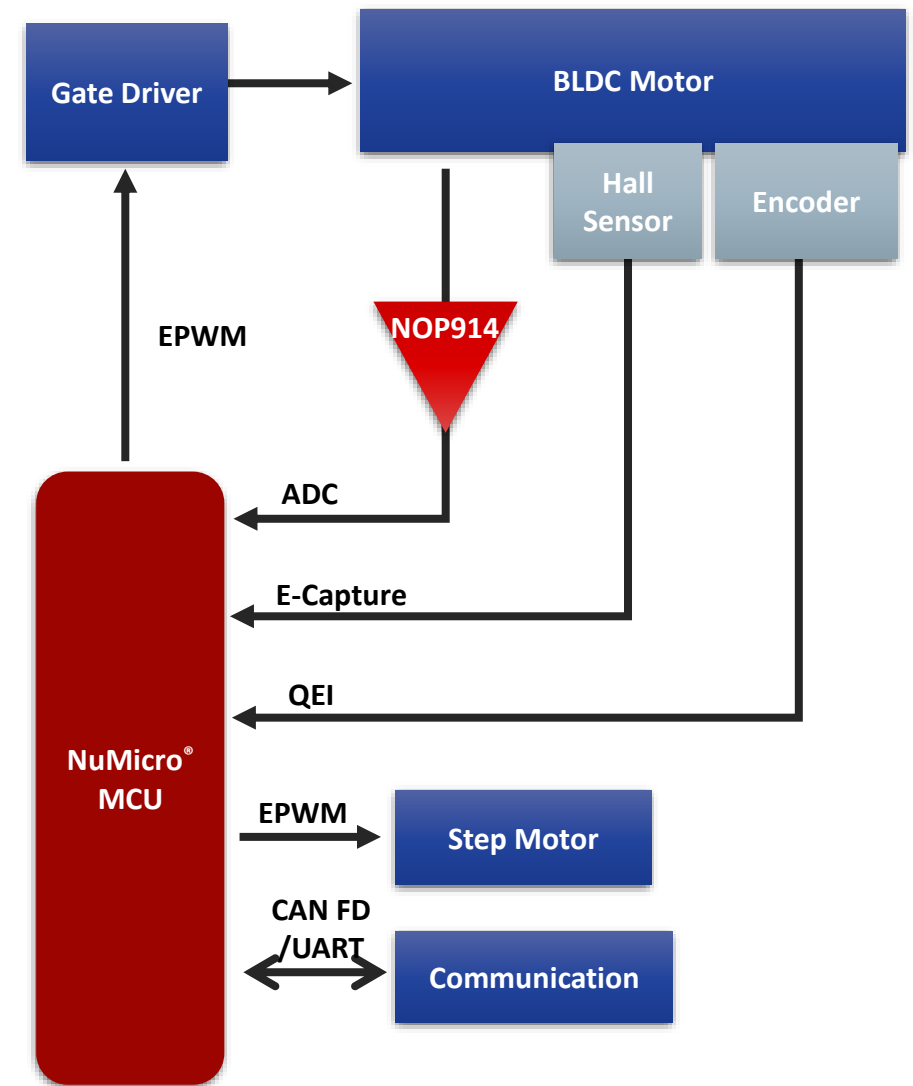
## Memory

- Flash: 256 to 1024 KB
- SRAM: 128 to 512 KB



## Peripheral

- PWM: up to 12 channels
- ADC: 1 to 3 sets, up to 5 MSPS
- DAC, CMP, OP (Protection)
- E-Capture, QEI (Motor position detecting)
- CAN, UART, SPI, etc.

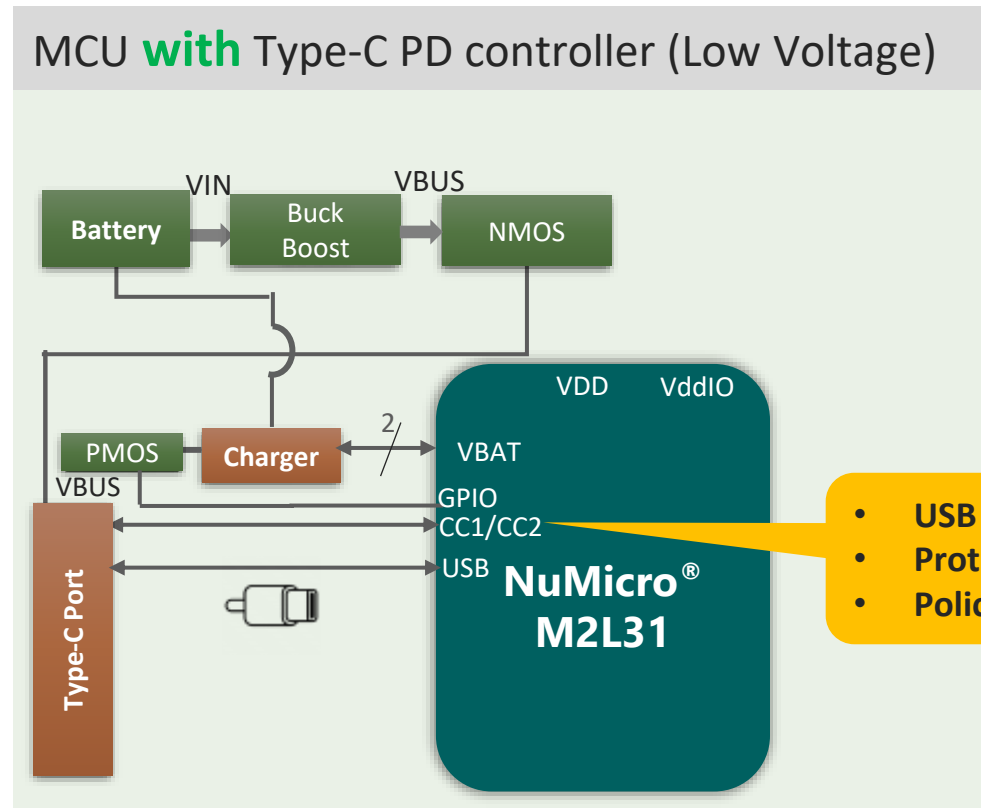
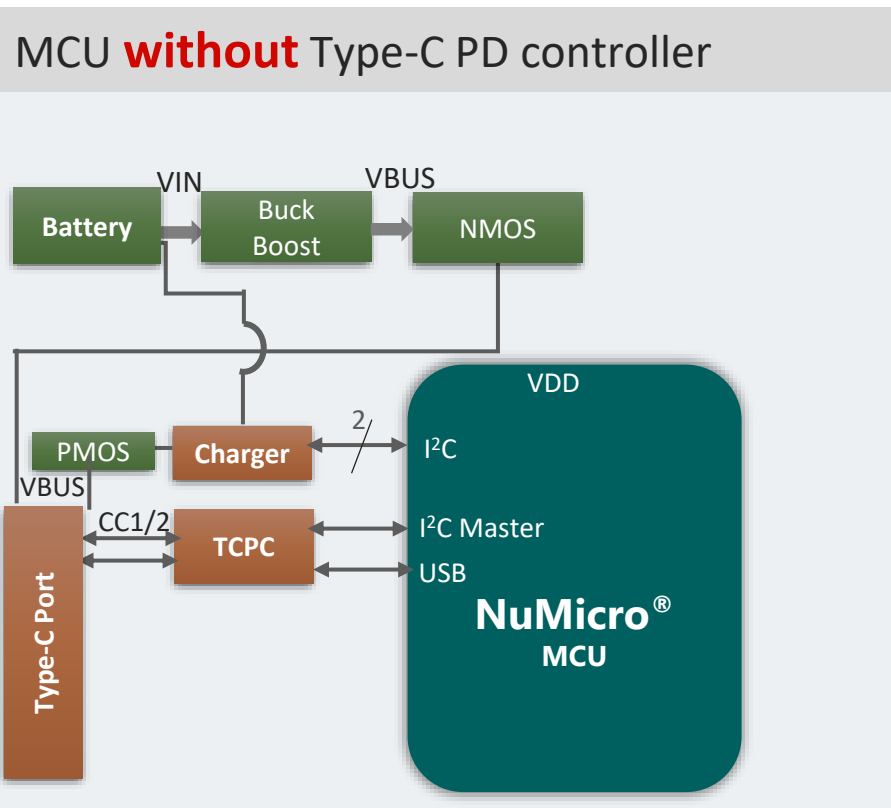


# MCU Platforms for Motor Control

Series	M467	M463	M483	M2L31
Core	Cortex-M4	Cortex-M4	Cortex-M4	Cortex-M23
Clock rate (MHz)	200	200	192	72
Flash (KB)	1024 (dual bank)	256	256	256/512 (RRAM, dual bank)
SRAM (KB)	512	128	128	168
PWM	12ch EPWM + 12ch BPWM	12ch EPWM + 12ch BPWM	12ch EPWM + 12ch BPWM	12ch EPWM + 12ch PWM
CAN	Up to 4x CAN FD	Up to 2x CAN FD	Up to 3x CAN2.0B	Up to 2x CAN FD
ADC	3 sets, 12bit, 5MSPS, up to 28ch	1 set, 12bit, 5MSPS, up to 16ch	2 sets, 12bit, 5MSPS, up to 24ch	1 set, 12bit, 3.6MSPS, up to 24ch
DAC	2 sets, 12bit, 1MSPS	-	1 set, 12bit, 1MSPS	2 sets, 12bit, 1MSPS
Analog Comparator	4 sets	2 sets	2 sets	3 sets
QEI	4 sets	2 sets	2 sets	2 sets
eCapture	4 sets	2 sets	2 sets	2 sets
OP Amp	External <a href="#">NOP912/914</a>	External <a href="#">NOP912/914</a>	External <a href="#">NOP912/914</a>	Build-in 3 sets PGA External <a href="#">NOP912/914</a>
PD3.1 support	-	-	-	<a href="#">available</a>

# Advantages of M2L31 PD 3.1 Solution

- Dual port certified solution
- Supports sink, source and dual Role
- Supports PD 3.1 240W (EPR 48V)

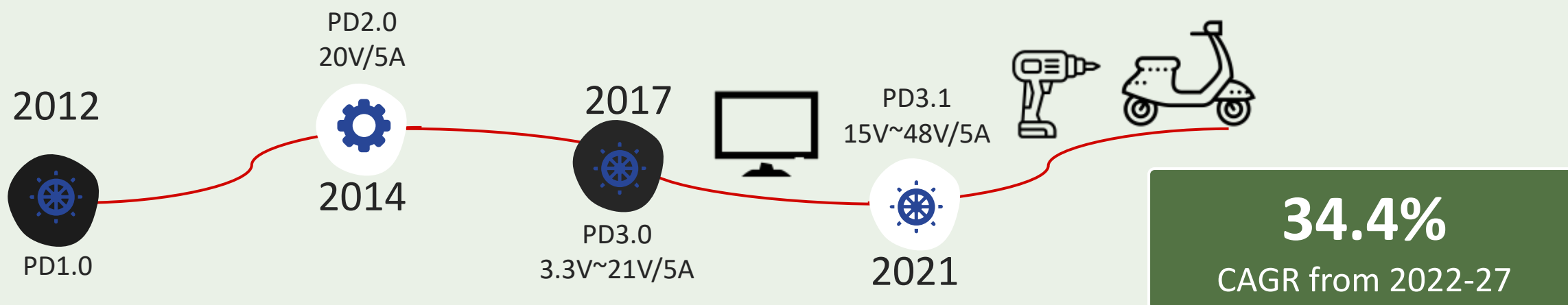




# Global USB Type-C Market

## Factors driving Growth

- Wide-spreading demand for laws on standardization of chargers for electronics.
- Deployment of USB-C ports from mobile to personal computers



Source: <https://www.graniteriverlabs.com/en-us/technical-blog/usb-pd-power-delivery-spec-versions>

# Conclusion



## Cooling Fan Solution

- High Speed Control



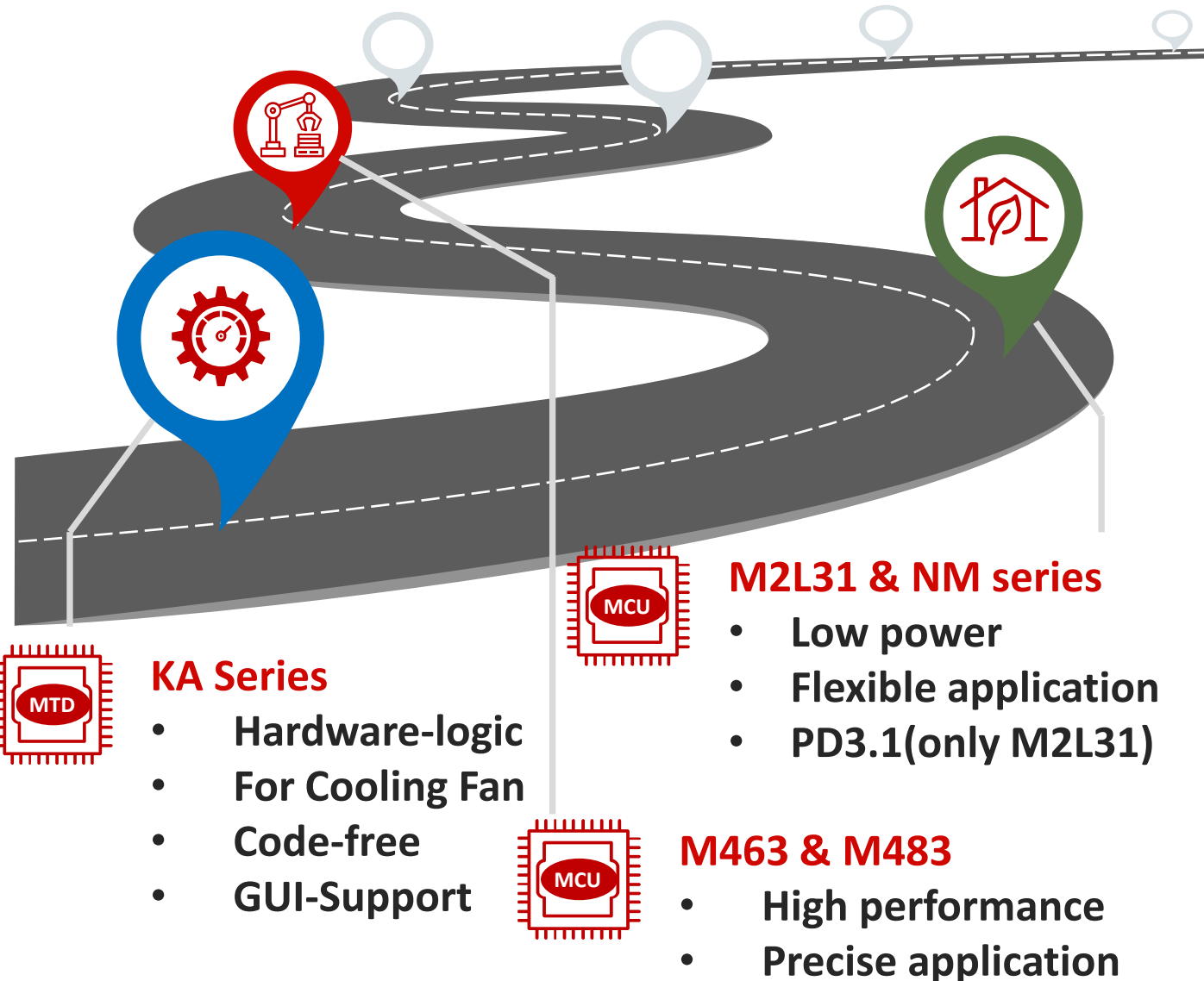
## Home Appliances/Computer

- Medium Speed Control
- Silent Control



## Industrial Solution

- Ultra Low Speed Control
- Precise Control



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