



性能卓越的灵活的无刷电动工具解决方案

5.23 2018 苏州

技领半导体（上海）有限公司

内容概述

- I. 走进Active-semi 技领半导体
- II. Power Application Controller[®] (PAC[®]) 一个灵活高效的电机应用平台
- III. Power Application Controller[®] (PAC[®])平台给电动工具/园林工具应用带来的优势
- IV. Power Application Controller[®] (PAC[®])产品在电动工具/园林工具领域的应用实例和展台展示



走进技领半导体

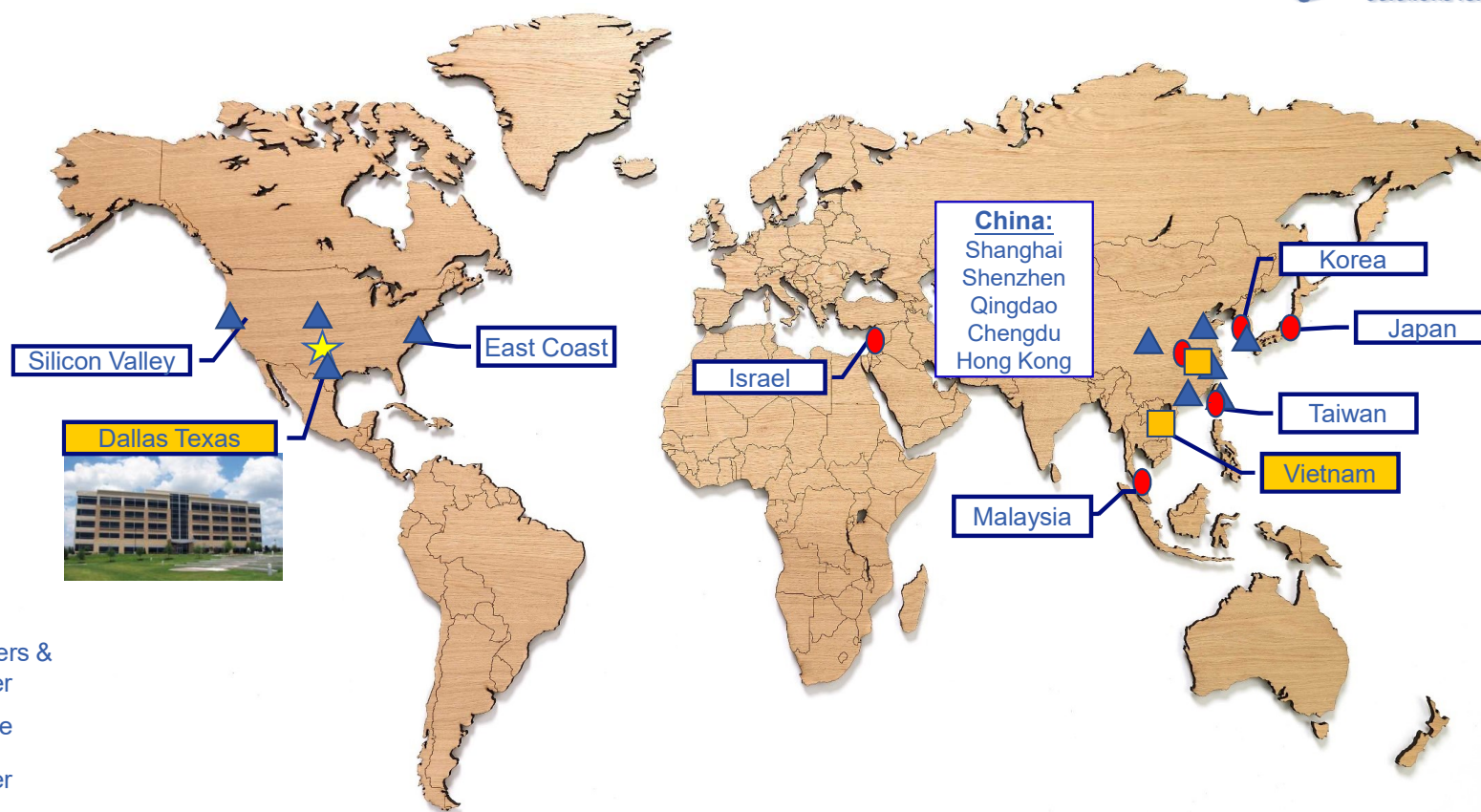
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Corporate Overview

- Mixed signal semiconductor provider focusing on Power Management and Intelligent Motor Control
- Founded in 2004 in Silicon Valley, HQ in Dallas, and Shanghai (~150 employees)
- 170 Patents & pending in analog power & motor drive
- Proven Products: 1.5 billion IC's shipped.
100% Growth in 2016. 70% in 2017 50%+ expected in 2018
- Multi-foundry strategy: SMIC, TowerJazz, Dongbu...
- Multiple Assembly/Test: Unisem & JCET...
- Renowned team with TI DNA
 - Larry Blackledge, CEO – 22 years at TI
 - David Briggs, VP/GM of PL – 20 years at TI
 - Wayne Chen, VP of R&D, 20+ years, TI Fellow
 - Dee Hunter, VP, Human Resources – 33 years at TI
 - Winston Fu, CFO, - 16 years at USVP



Global Organization



- ★ Headquarters & R&D Center
- ▲ Sales Office
- R&D Center
- Fab/A&T Partners

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Some of our Customers



Haier



FOXCONN®

SONY



PHILIPS



ZTE中兴



BELKIN®



Active-Semi Products



Modular Power PMUs



Intelligent Motor Control

- ❑ Off-line, DC and Battery Power
- ❑ Drones
- ❑ White Goods
- ❑ HVAC
- ❑ 12V/48V FANs
- ❑ Garden/Power Tools
- ❑ Hand/Hair Dryers
- ❑ Vacuum



Power Loss Protection



Battery Management



DC-DC Converter

Power Tools/Garden Tools



Device	MCU	FLASH/ SRAM	UL/ Class B	V _{in}	Gate Drv V, I _{SINK} /I _{SOURCE}	DC/DC	Pkg	Avail
PAC5223	Cortex-M0 50MHz	32kB/8kB		70V	70V 1A/1A	70V NCH Buck, SEPIC	48-pin QFN	Today
PAC5225	Cortex-M0 50MHz	32kB/8kB	•	70V	70V 1A/1A	70V NCH Buck, SEPIC	48-pin QFN	Today
PAC5232	Cortex-M0 50MHz	32kB/8kB	•	160V	180V 2A/2A	160V NCH Buck	51-pin QFN	Today
PAC5253	Cortex-M0 50MHz	32kB/8kB		600V	600V 250mA/500mA	600V AC/DC Flyback, PCH Buck	43-pin QFN	Today
PAC5255	Cortex-M0 50MHz	32kB/8kB	•	600V	600V 250mA/500mA	600V AC/DC Flyback, PCH Buck	57-pin QFN	Today



- Single Motor, FOC or BEMF
- Integrated Power Management
 - DC/DC, LDO, Hibernate
- Integrated Gate Drivers
 - 70V/180V/600V
- Integrated Signal Conditioning
 - Differential PGA, Single PGA, OCP, Current Limit
- Integrated ARM[®] Cortex[®]-M0 MCU

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Power Application Controller®



- Brushless DC (BLDC) Motor: single chip, smallest BLDC and PMSM solution with highest precision, sensor-less BEMF or FOC control, 5V to 600V operation with integrated gate drivers and all-in-one switching power manager.
- High Voltage Motor Applications: Appliances, Pumps, Compressors, Fans, Blowers, Air Cleaners, Ceiling Fan
- Low and Medium Voltage Motor Applications: Power Tools, Drones, RC, E-Bike
- PAC® Valued Features
 - Fully Programmable: 32-bit MCU for complex functions/algorithms, & feature evolution
 - Lowest Standby/Sleep Mode Dissipation: total system hibernate-mode permitted by complete system IC integration and associated power domain control.
 - Lower Cost Power Supply: integrated power manager & higher voltage bus topology reduces cost/PCB size of external power supply circuitry
 - Highly Configurable & Integrated Analog-Front-End (AFE)- reduces system footprint & cost.



PAC[®] Selection Table

Power Driver Resources by Part Numbers



PART #	PIN	POWER MANAGER	CONFIGURABLE ANALOG FRONT END				APPLICATION SPECIFIC POWER DRIVERS		MICRO-CONTROLLER		PRIMARY APPLICATION	STATUS
		INPUT VOLTAGE	DIFF-PGA	PGA	COMP ARAT OR	ADC	GATE DRIVER	PWM	GPIO	SERIAL		
PAC5210	56-pin 8x8 TQFN	5.2V to 600V	3	4	10	11	3 OD (24V/50mA)	14 GPIO	36	UART I2C SPI	IPM Controller or general purpose controller	In Production
PAC5220	56-pin 8x8 TQFN	5-52V	3	4	10	11	3 LS (1A) 3 HS (1A) 2 OD (40V/50mA)	6 GD 6 GPIO	28		3-phase control, Buck DC/DC	In Production
PAC5223 PAC5225	48-pin 6x6 TQFN	5.2-70V	3	4	10	10	3 LS (1A) 3 HS (1A)	6 GD 4 GPIO	25		3 half bridge, 3 phase control PAC5225: Class B optimized	In Production
PAC5232	51-pin 8x8 QFN	25V to 160V	3	4	10	9	3 LS (2A) 3 HS (2A)	6 GD 6 GPIO	29		3 half bridge, 3 phase control, Class B Optimized	In Production
PAC5250 PAC5255	57-pin 10x10 TQFN	5.2V to 600V	3	4	10	9	6 LS (1A) 3 HS (0.25A/0.5A) 2 OD (24V/50mA)	9 GD 5 GPIO	25		AC Powered White Goods, Appliances, Power Tools	In Production
PAC5253	43-pin 8x8 TQFN	5.2V-600V	3	4	10	8	4 LS (1A) 3 HS (0.25A/0.5A)	6 GD 2 GPIO	20		AC Powered White Goods, Appliances, Power Tools	In Production

Optimized for General-purpose/IPM

Optimized for Battery Powered Control

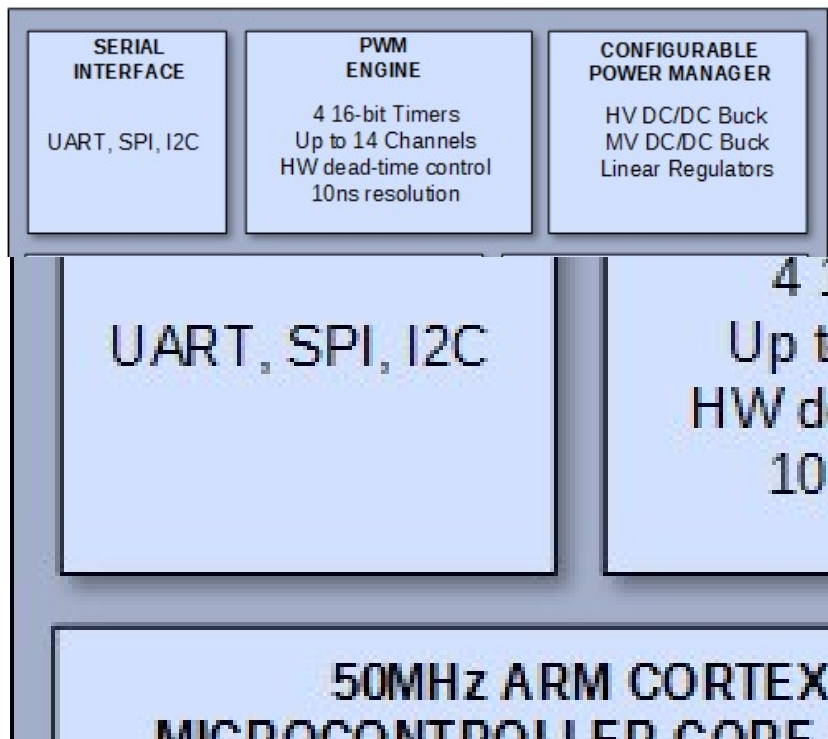
Optimized Solutions Higher voltage systems

NEW

Power Application Controller[®] (PAC[®]) Architecture



Scalable Platform with MCU and Sophisticated Power & Analog Peripherals



- Industry-leading 32-bit ARM[®] Cortex[®] M0 processor with patented smart peripherals
- Patented all-in-one power conversion solution
- First-in-market integrated 600V gate drivers
- Sophisticated yet easily configurable analog front-end
- Proven analog array methodology allows quick silicon spins

Advance features of Power Application Controller[®] (PAC[®])



➤ New M4 core with powerful features:

- 150MHz speed, FPU, 32K RAM, 128K Flash, 12Bit 2.5MSPS ADC, CAN

➤ Flexible product selection for COST and Performance:

Cortex-M0

Lowest cost, low power

50MHz

32K Flash, 8K RAM

Cortex-M4

Mainstream control and DSP

150MHz

128K Flash, 32K RAM

FPU, CAN



70V NCH Buck, SEPIC DC/DC
70V 1A/1A Gate driver
3 PGA Differential Amplifier

160V NCH Buck
MV DC/DC Buck
160V 2A/2A Gate driver
3 PGA Differential Amplifier

600V AC/DC Fly back
600V 250mA/500mA Gate driver
3 PGA Differential Amplifier

PAC5XXX Firmware and Software IP



- IDE Support
 - Coocox Colde (open source)
 - IAR Embedded Workbench for ARM
 - Keil uVision 5.X for ARM
- PAC5XXX SDK
 - Software Development Kit for FW development using the PAC5XXX family of controllers
 - ARM CMSIS Peripheral Header Files
 - C-Language API for peripheral configuration
 - FLASH loader, SVD Device Descriptor for IDE debuggers
- Application Firmware
 - Peripheral Firmware Example Projects
 - High-Speed Trapezoidal BLDC with hall sensors with Windows GUI
 - High-Speed Trapezoidal Sensorless BEMF with Windows GUI
 - High-Speed Sensorless FOC with Windows GUI
 - **ActiveSafe** IEC60730 Class B Safety Libraries
 - **ActiveFlash** Field update bootloader application with Windows GUI
- Documentation:
 - EVK Collateral (SCH, PCB, Layout)
 - EVK User Guides
 - Firmware User Guides



应用实例介绍

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无刷枪钻控制器



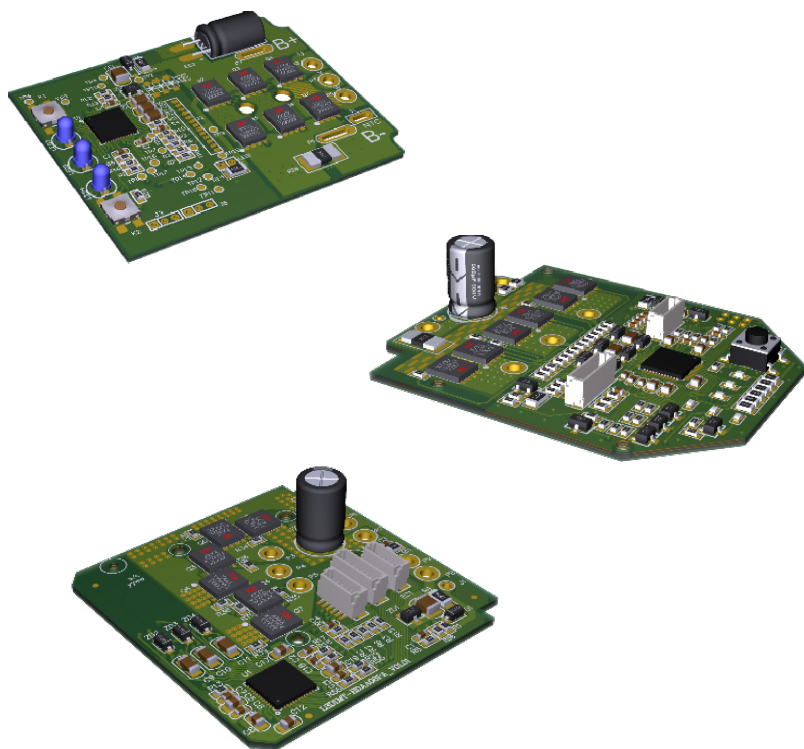
基本功能

- 软启动 – 时间可调
- 正反转 – 可中置保护
- 无极调速 – 起动行程可调
- 停机刹车 – 智能柔性刹车
- 辅助照明 – 开机预亮 · 延时熄灭
- 过流保护 – 硬件快速保护
- 堵转保护 – 智能分级保护
- 过载保护 – 分级可调
- 过温保护 – 控制器 · 电池
- 霍尔失效保护 – 实时快速响应
- 电池包放电保护 – 电压 · 电流 · 温度
- 保护指示 – 异常类型识别

接口资源

- 电机U/V/W
- 电机霍尔 (可选)
- 开关接口 – 支持 功率开关 · 信号开关

无刷电扳手控制器



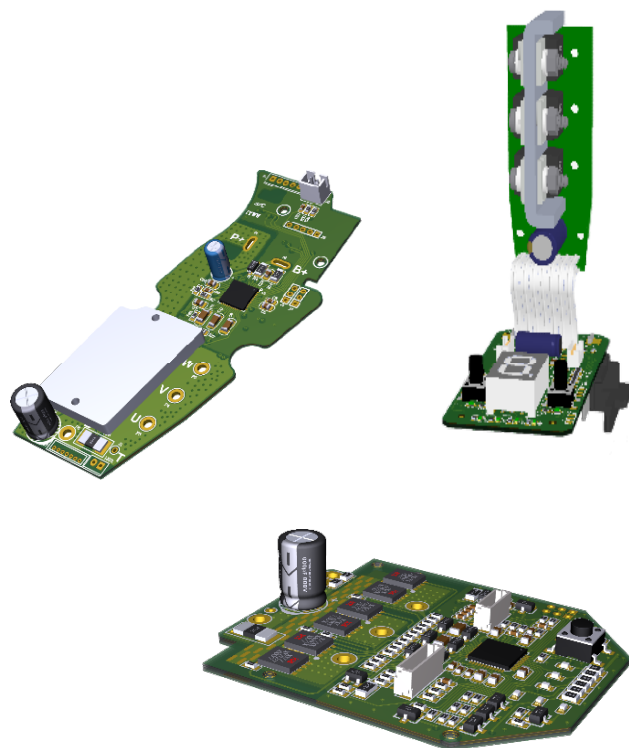
基本功能

- 软启动 – 时间可调
- 正反转 – 可中置保护
- 无极调速 – 起动行程可调
- 停机刹车 – 智能柔性刹车
- 辅助照明 – 开机预亮 · 延时熄灭
- 电子齿轮 – 多级可选
- 反转自停 – 智能识别
- 过流保护 – 硬件快速保护
- 堵转保护 – 智能分级保护
- 过载保护 – 分级可调
- 过温保护 – 控制器 · 电池
- 霍尔失效保护 – 实时快速响应
- 电池包放电保护 – 电压 · 电流 · 温度
- 保护指示 – 异常类型识别

接口资源

- 电机U/V/W
- 电机霍尔 (可选)
- 开关接口 – 支持功率开关 信号开关

电子扭力螺丝刀控制器



基本功能

- 软启动 – 时间可调
- 正反转 – 可中置保护
- 无极调速 – 起动行程可调
- 停机刹车 – 智能柔性刹车
- 辅助照明 – 开机预亮 · 延时熄灭
- 电子齿轮 – 多级可选
- 智能扭力 – 螺丝到位自识别
- 过流保护 – 硬件快速保护
- 堵转保护 – 智能分级保护
- 过载保护 – 分级可调
- 过温保护 – 控制器 · 电池
- 霍尔失效保护 – 实时快速响应
- 电池包放电保护 – 电压 · 电流 · 温度
- 保护指示 – 异常类型识别

接口资源

- 电机U/V/W
- 电机霍尔（可选）
- 开关接口 - 支持功率开关 信号开关

无刷电锤控制器



基本功能

- 软启动 – 时间可调
- 正反转 – 可中置保护
- 无极调速 – 起动行程可调
- 停机刹车 – 智能柔性刹车
- 辅助照明 – 开机预亮 · 延时熄灭
- 过流保护 – 硬件快速保护
- 堵转保护 – 智能分级保护
- 过载保护 – 分级可调
- 过温保护 – 控制器 · 电池
- 霍尔失效保护 – 实时快速响应
- 电池包放电保护 – 电压 · 电流 · 温度
- 保护指示 – 异常类型识别

接口资源

- 电机U/V/W
- 电机霍尔
- 开关接口 – 支持 功率开关 · 信号开关

高速无刷吸尘器

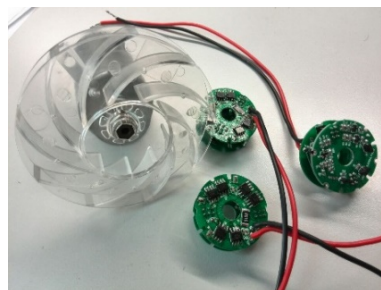


基本功能

- 快速软启动
- 稳速控制
- 自动重启
- 缺相保护
- 过流保护
- 欠压保护
- 堵转保护
- 恒功率

接口资源

- 电机U/V/W
- 电源
- 上位机通信接口



36/48V通用割草机控制器

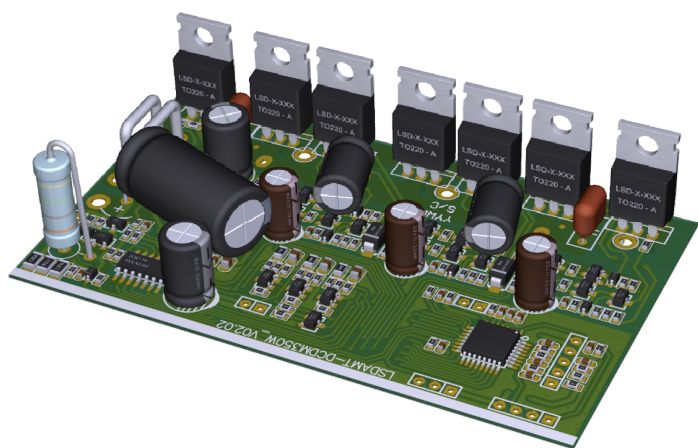


基本功能

- 软启动
- 分级调速
- 停机刹车
- 省电模式
- 稳速控制
- 限流控制
- MOS过流保护
- 电池欠压保护
- 电池过流保护
- 通信异常保护
- 无位置传感器

接口资源

- 电机U/V/W
- 通信接口
- 标准10PIN面板接口



120V园林工具平台 – 割草机

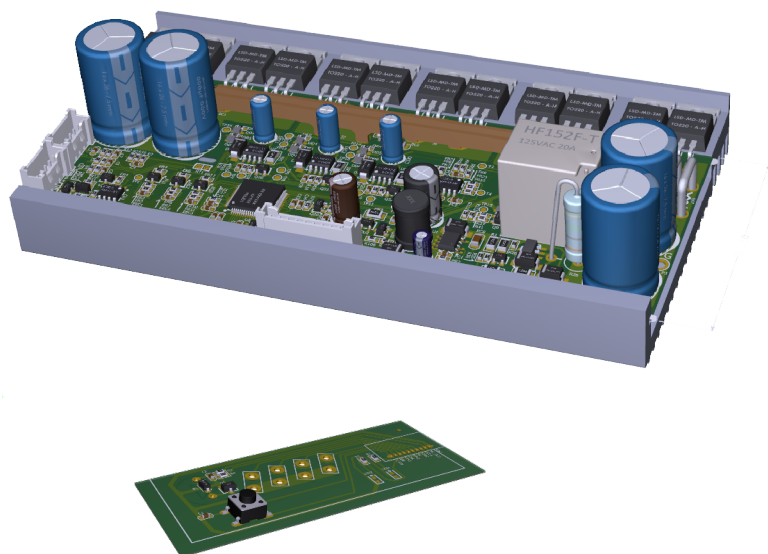


基本功能

- 软启动
- 停机刹车
- 紧急刹车
- 省电模式
- 稳速控制
- 限流控制
- 智能分级调速
- MOS过流保护
- MOS过温保护
- 电池欠压保护
- 电池过流保护
- 电机霍尔失效保护
- 通信异常保护
- 无位置传感器

接口资源

- 电机U/V/W
- 通信接口
- 标准10PIN面板接口





谢谢大家!

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