CONNECTING, PROTECTING AND POWERING THE WORLD

Solutions

POWER & GARDEN TOOLS

- LAWN & GARDEN
- INDUSTRIAL
- CONSUMER
- SPECIALTY

FEATURING

Motor Control

Battery Management

qorvo

CONNECTING,

PROTECTING

AND POWERING

THE WORLD

POWER & GARDEN TOOL EXAMPLES

High Level Design Considerations

- **Ergonomics:** Lightweight, balanced housings reduce user fatigue
- **Runtime:** Reduced work stoppage with longer run-times
- **Noise & Vibration:** Quiet, low-vibration operation improves user comfort and neighborhood acceptance
- **Battery Ecosystem:** Flexible series or parallel pack configurations enable optimized voltage and capacity to match performance needs
- **Motor Control:** Maintains high torque for consistent cutting through dense grass, obstacles and rough terrain

BRIDGING GAPS WITH INNOVATIVE SOLUTIONS

For Current Challenges

Flexible BMS for varying power levels

Single chip BMS solutions support 10s-20s applications across a wide range of cell chemistries

Robust BLDC control at a low cost

Space-saving integration of MCU, gate drivers and power management reduces BOM cost and component count

High user safety

Smart motor control solutions with nBrake/ DRV/DIS feature to ensure safe operation

Configurable on-chip MCU

Firmware-tunable features, limits, and protections to speed variants and enable maximum performance

Smarter BMS for longer runtimes

OV/UV, over-current & thermal safeguards with cell balancing to maximize runtime and pack life

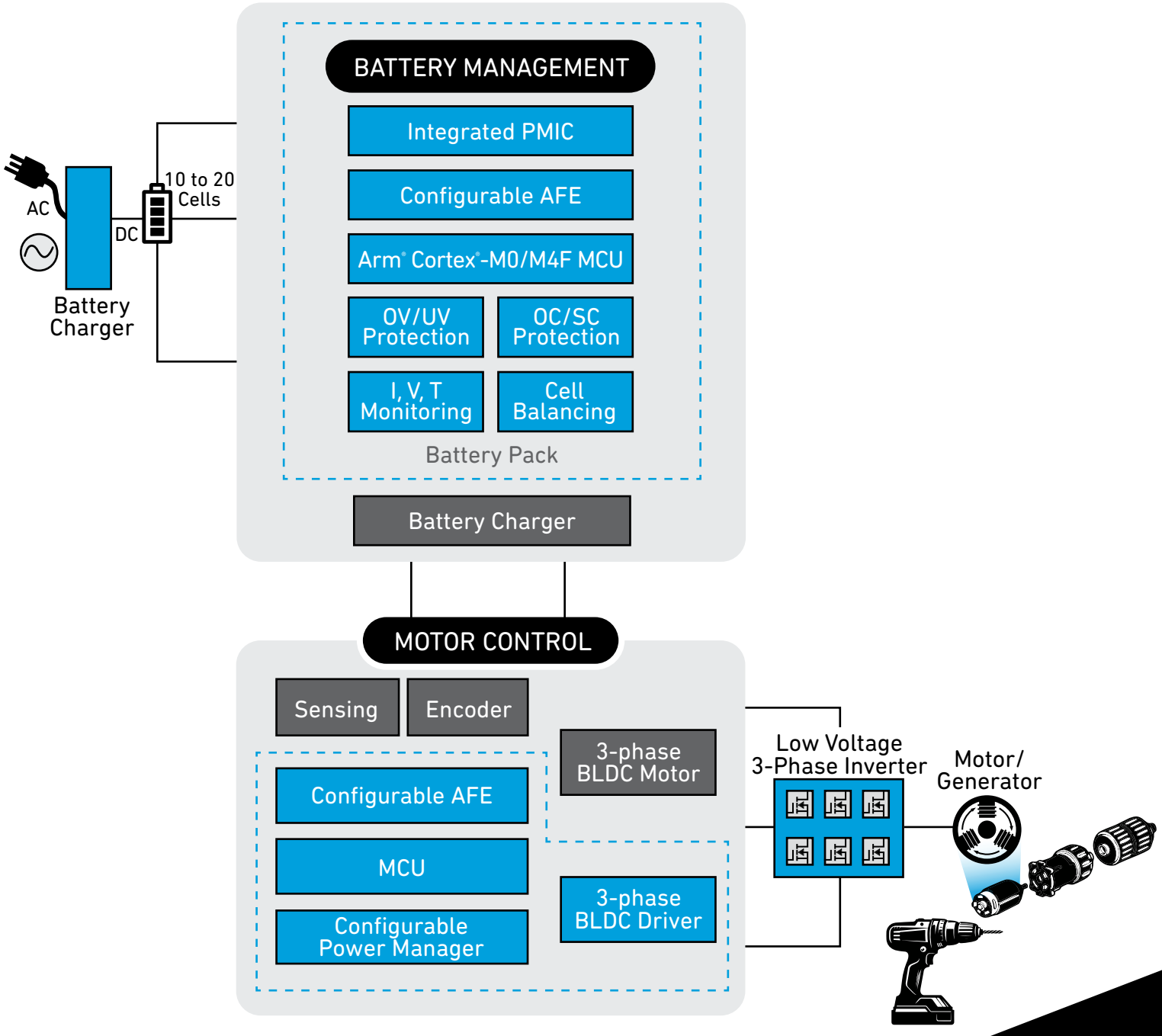
Shelf-life you can trust

Efficient sleep states minimize pack drain, keeping battery powered equipment ready for use

Delivering Intelligent Performance for Workbench to Backyard

REFERENCE DESIGN

Block Diagram



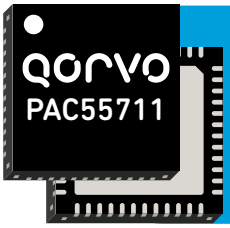
Look for blue blocks!

Qorvo content shown in blue blocks

LEARN MORE

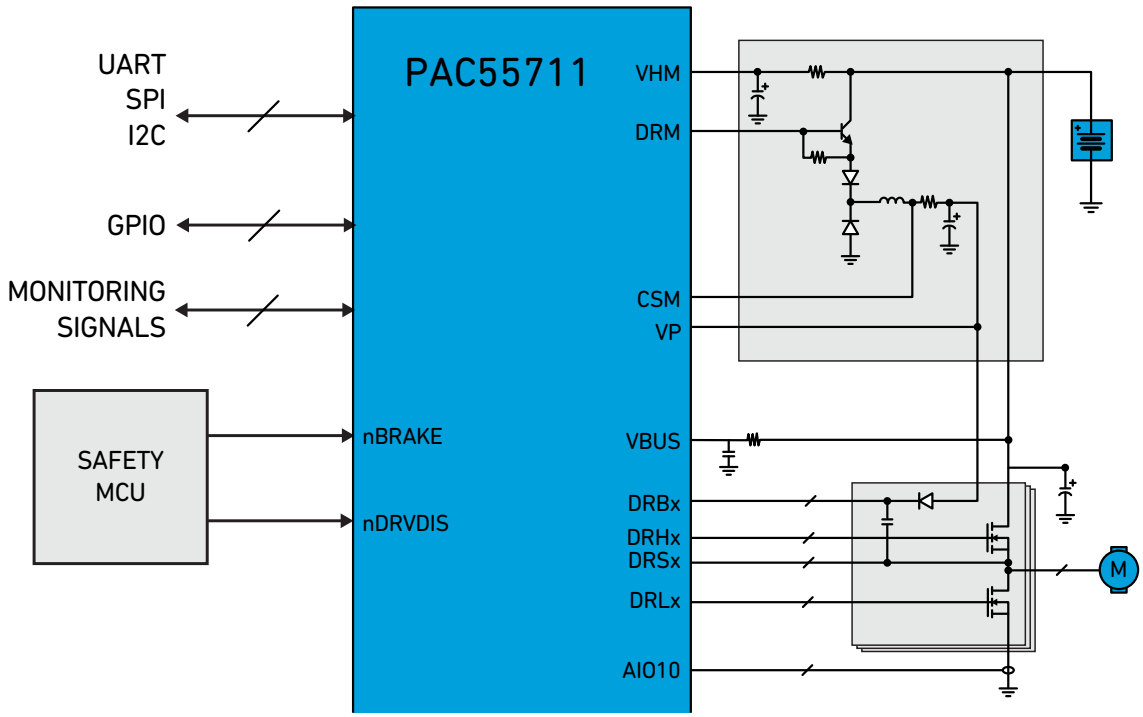
MOTOR CONTROL

Motor Controller & Driver



72V BLDC Motor Controller and Driver with Integrated Multimode Power Manager and Configurable AFE with V_{DS} Sensing, nBRAKE & DRV/DIS

- 150 MHz Arm Cortex-M4F MCU (128 kB Flash/32 kB SRAM) for fast FOC and diagnostics
- 72V buck/SEPIC power manager + 5V/200 mA rail, no extra DC-DCs or LDOs
- Three half-bridge gate drivers (3 x 72V HS + 3 x 20V LS, 1.2A/1.8A source/sink) efficiently drive inverter
- V_{DS} sensing, nBRAKE & DRV/DIS, cycle-by-cycle OCP features boost safety and reliability
- Configurable analog front end (3 × diff + 4 × single PGAs) with simultaneous 3-phase S/H ensures precise current feedback
- Compact 6×6mm QFN saves board space for slimmer cordless garden tools



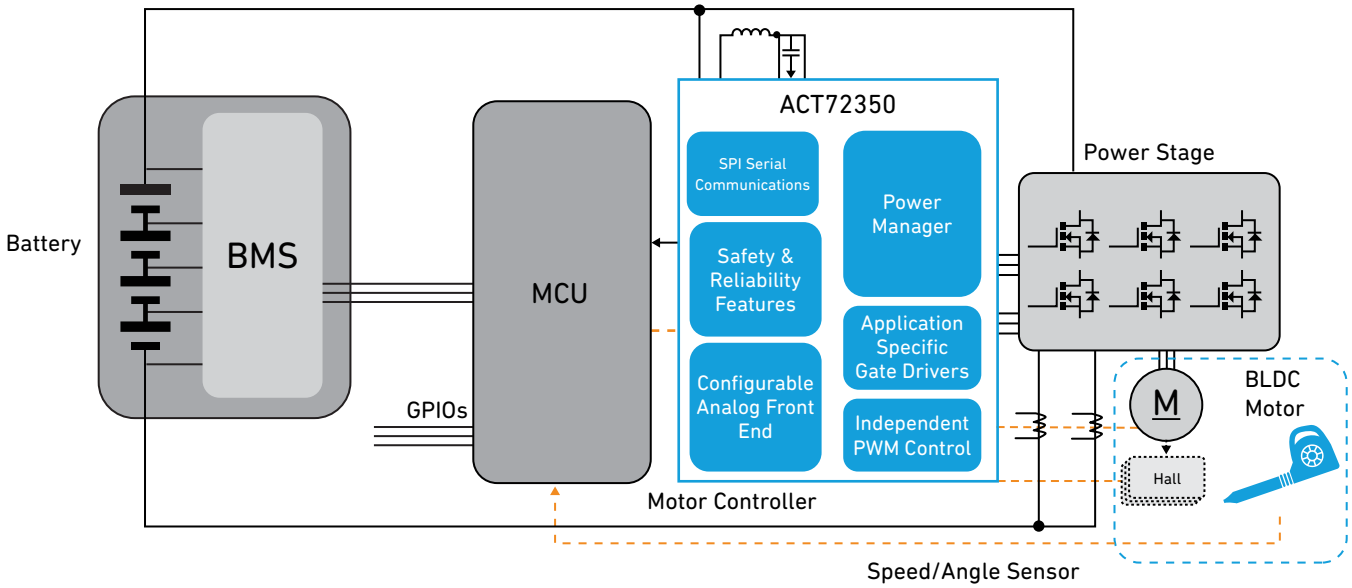
LEARN MORE

MOTOR CONTROL

Motor Driver

160V 3-phase BLDC Motor Driver with Integrated Power Manager & Configurable AFE

- 25V to 160V input range handles everything from 36V prosumer packs to 100V industrial batteries
- Buck DC-DC and on-chip LDOs power internal rails and the existing MCU, eliminating extra regulators
- Three half-bridge drivers (3 x 160V HS, 3 x 20V LS, 2A source/sink) reliably drive high-torque BLDCs
- Cycle-by-cycle protection, V_{DS} sensing and programmable OCP shut down motor fast on stalls or shorts, protecting packs and MOSFETs
- Configurable AFE with 3 diff + 4 single PGAs and 3-phase sample-and-hold gives precise current feedback
- Compact 6×6mm QFN frees board space for slimmer, lighter garden tools

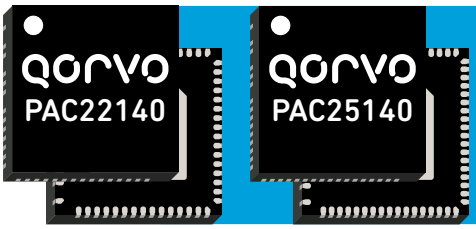


LEARN MORE

LEARN MORE

BATTERY MANAGEMENT

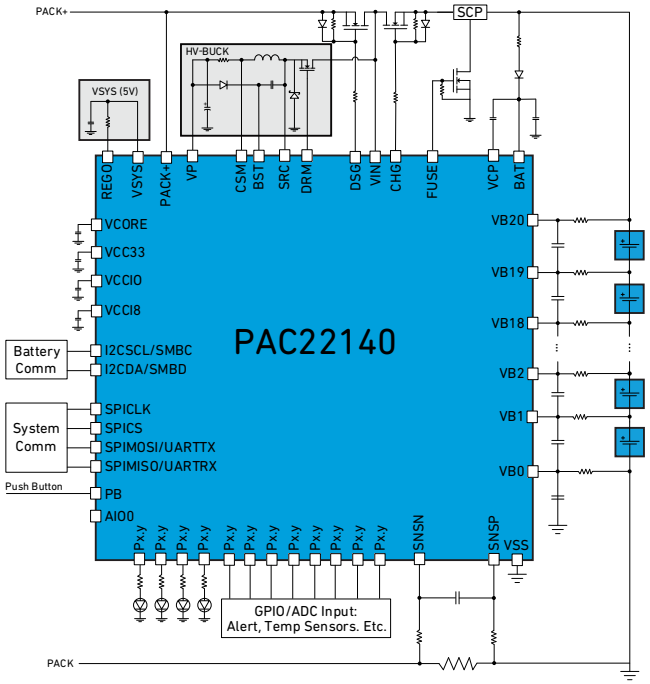
System on Chip



Up to 20s Intelligent Battery Management SoC with Arm Cortex MCU, Integrated PMIC, and BMS AFE, Including Cell Balancing

- Fully programmable industry-standard Arm
  - PAC22140 50 MHz Arm-M0 32 kB flash/8 kB SRAM
  - PAC25140 150 MHz Arm-M4F 128 kB/32 kB SRAM
- Three ADCs for monitoring key parameters
  - 16-bit SD ADC for current sense with differential PGA
  - 16-bit SD ADC for voltage sense and cell balancing
  - 10/12-bit SAR ADC for additional voltage/temperature sense
- Complete power solution
  - 145V DC/DC buck
  - 5V 225mA
  - 3.3V 90mA
  - MCU V_{core}

Single IC required for complete BMS solution



PARTS OVERVIEW

Motor Control		72V BLDC Motor Controller and Driver with Integrated Multimode Power Manager and Configurable AFE with V_{DS} Sensing, nBRAKE & DRV/DIS
Motor Control		160V 3-phase BLDC Motor Driver with Integrated Power Manager and Configurable AFE
Battery Management		Intelligent Battery Management SoC with Integrated Arm Cortex-M0 MCU and Cell Balancing
Battery Management		Intelligent Battery Management SoC with Integrated Arm Cortex-M4F MCU and Cell Balancing

FIND YOUR QORVO MOTOR CONTROL

Fit for Power and Garden Tools

Part # / Feature	MCU	600V	160V	72V	40-52V	AC-DC Flyback	AC Input	HV + MV Buck	Buck	SEPIC	Simultaneous-SH	CBC	WWDT	V_{DS} Sense	nBRAKE/nDRVDIS	Diff-PGA	PGA	Notes
PAC5256	M0	●					●	●				●				3	4	
PAC5556[A]	M4F	●					●	●				●	●			3	4	PAC5556A is more recent
PAC5250/5	M0	●				●			●		●					3	4	6 low, 3 high, 2 low OD drivers 5 ≤ Vin ≤ 52 but high-side driver 600V PAC5255 adds a clock out
PAC5253	M0	●				●			●		●					3	4	4 low, 3 high, 2 low OD drivers 5 ≤ Vin ≤ 52 but high-side driver 600V
PAC5253[A]	M0		●					●				●				3	4	[A] eliminates buck restart delay
PAC5253[A,B]	M4F		●					●				●	●			3	4	[A,B] eliminate buck restart delay
ACT72350	–		●					●				●			●	3	4	No integrated MCU
PAC5223/5	M0			●		●			●	●	●					3	4	PAC5225 adds a clock out
PAC52700	M0			●							●					1	4	5 ≤ Vin ≤ 20 but high-side 72V
PAC52723	M0			●					●	●	●	●				3	4	
PAC52710	M0			●					●	●	●	●		●		3	4	
PAC52711	M0			●					●	●	●	●		●	●	1	4	
PAC5523/4[A]	M4F			●					●	●			●			3	4	PAC5524[A] 64- vs. 48-pin pkg [A] versions use v2 vs. v1 MCU
PAC55723/4[L]	M4F			●					●	●	●	●	●			3	4	PAC55724 64- vs. 48-pin pkg [L] wider pitch, larger package
PAC55710/12	M4F			●					●	●	●	●	●	●		3	4	PAC55712 64- vs. 48-pin pkg
PAC55711/13	M4F			●					●	●	●	●	●	●	●	1	4	PAC55713 64- vs. 48-pin pkg
PAC5210	M0				●	●			●		●					3	4	3 low-side OD drivers
PAC5220	M0				●	●			●		●					3	4	3 low, 3 high, 2 low OD drivers
PAC552400	M0				●						●					1	4	5 ≤ Vin ≤ 20 but high-side driver 44V
PAC552410	M0				●				●	●	●	●		●		3	4	
PAC552411	M0				●				●	●	●	●		●	●	1	4	
PAC552422	M0				●				●	●	●	●				3	4	
PAC5222	M0				●				●	●	●					3	4	
PAC5285	M0				●											1	0	Charge pump, internal MOSFETs
PAC5526[A]	M4F				●							●	●			1	5	Charge pump, MV buck-boost
PAC5527[A]	M4F				●							●	●			3	7	[A] versions use v2 vs. v1 MCU

READ MORE

Outdoor Power Equipment Design Guide

Motor Control & Drive System Guide

Battery Management System Design Guide