

# POWERING THE HUMANOID REVOLUTION

Driving Precision, Power, and Safety in Next-Generation Robotics



Humanoid robots are rapidly moving from development labs into the real world, revolutionizing industries from logistics to manufacturing and beyond. For engineers, the ultimate challenge is to replicate the fluidity and complexity of human movement, which demands unprecedented levels of integration and performance. This requires sophisticated solutions for the intricate joints that enable motion, precise motor control for balance and dexterity, and highly efficient power management to handle demanding tasks safely.

Allegro provides a comprehensive portfolio of core technologies essential for creating advanced humanoids. Our high-performance 48V motor drivers, innovative magnetic and inductive position sensors, high current sensors are designed to meet the unique demands of humanoid systems. By addressing the critical challenges of power density, functional safety, and system cost, Allegro is enabling the next wave of autonomous innovation.

## What you can achieve with Allegro solutions

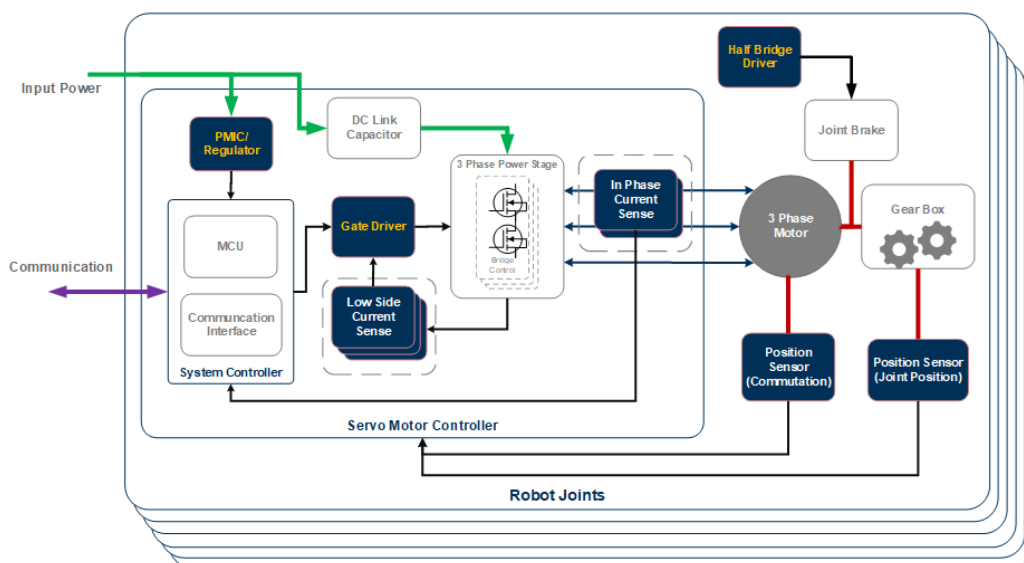
- **Increased Strength & Payload:** Allegro's 48V motor driver solutions deliver the high power and torque needed to enable demanding tasks and increase payload capacity, allowing humanoids to perform more physically intensive work.
- **Enhanced Safety & Reliability:** With a portfolio of products designed for functional safety and ASIL-D certification, Allegro's robust solutions ensure the system reliability and operational safety critical for human-robot interaction.
- **Simplified Design & Lower Cost:** Highly integrated gate drivers, sensors, and power ICs reduce component count, minimize EMI, and cut power loss, which simplifies system design and lowers the overall bill of materials (BOM) cost.



**As humanoids become integral to the future of automation, the underlying electronics that power them are more critical than ever.**

Allegro Microsystems' advanced sensor and power solutions provide the intelligence, strength, and safety required to bring the most sophisticated humanoid robots to life.

## Block Diagram



## Key Products and Solutions

| Subsystem              | Component               | Allegro Parts             | Key Differentiator                                                                   |
|------------------------|-------------------------|---------------------------|--------------------------------------------------------------------------------------|
| Servo Motor Controller | PMIC/Regulator          | APM81815 (Pre-Regulator)  | Highest performance 48V pre-regulator on the market                                  |
|                        |                         | A81411 (PMIC)             | Fully integrated PMIC, reduces external components                                   |
|                        | 48V Gate Driver         | AMT49100 (3-Phase)        | 48V, 3x low-side current sense amplifiers, ASIL                                      |
|                        |                         | A89500 (Half-Bridge)      | 100V absolute max, 3x3 mm DFN package                                                |
|                        | In Phase Current Sensor | ACS39402 (TMR, <30A)      | ±1.0% sns (-40 to +125°C), ±10 to ±30A, 8.6mm <sup>2</sup> package                   |
|                        |                         | ACS71240 (Hall, <50A)     | ±1.0% sns (-40 to +125°C), ±10 to ±50A, 3x3 mm package                               |
|                        |                         | ACS37220 (Hall, 50-200A)  | ±1.4% sns (-40 to +150°C), ±50 to ±200A, 4x4 mm package                              |
| Robot Joints           | Half Bridge Driver      | A89500 (48V)              | 100V absolute max, 3x3 mm DFN package                                                |
|                        |                         | A4950 (12V)               | For 12V brake system, allows for individual control of FETs                          |
|                        |                         | A3942/4 (HS/LS)           | High Side/Low Side Drivers for holding brake systems                                 |
|                        | Motor Commutation       | A33023 (Hall, SFI)        | 12-bit resolution, stray field immune                                                |
|                        |                         | A17803 (Inductive, SFI)   | >18-bit resolution (with 2x), Ideal to replace higher cost optical encoder solutions |
|                        | Joint Position Sensor   | CT310 (End-of-Shaft, TMR) | 17.5-bit resolution, 2x2 mm package                                                  |



To learn more about the Allegro family of products and to explore available design resources, visit [allegromicro.com](https://www.allegromicro.com)