Application Brief

Sensing in Humanoid Robots

Explore Texas Instrument's Current, Position, and Temperature & Environmental sensing portfolios covering the sensing needs for your humanoid robot designs! From motor control, tactile sensing, and system health needs.

Motor Control

Current sensing provides accurate phase current sensing for motor control feedback loops, high -side sensing for shorts to ground and low-side sensing for short to motor

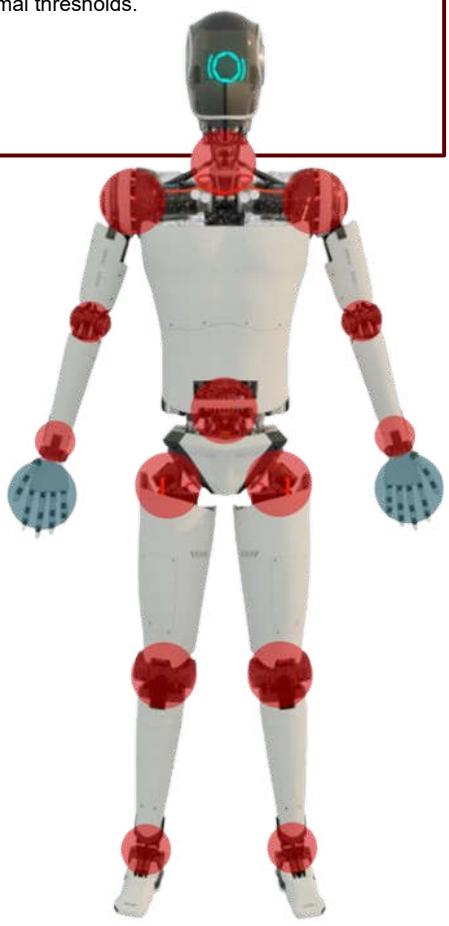
Device	Description	Benefit
INA241A	-5V to 110Vc bidirectional ultraprecise current sense amplifier	PWM rejection for phase current sensing
INA790A	110V, 75Arms integrated shunt, current sense amplifier	Integrated shunt resistor saves board space; PWM rejection for phase current sensing

Position sensing provides precise feedback on position and movement of joints and actuators, enabling accurate real-time motion control.

Device	Description	Benefit
LDC5072	Inductive position sensor front-end with sin/cos interface	Does not required magnets and provides immunity to magnetic stray-fields
TMAG6180	High-precision analog AMR angle sensor with 360 ° angle range	High frequency operation, minimal orthogonality error, extended 360 ° range

Temperature sensing provides motor over-temp protection and operation closer to thermal thresholds.

Device	Description	Benefit
LM50	±2ºC analog temperature sensor (10mV/ºC)	Linear output without external calibration
ISOTMP35	3kVRMS integrated isolation temperature sensor	Direct HV FET contact; <4s response



Tactile Sensing

Position sensors enables the sense of touch and pressure.

Device	Description	Benefit
TMAG3001	3D linear Hall-effect sensor with I²C in wafer chip-scale package	Ultra-small size enables increased and continuous spatial resolution

Optical sensing enables positioning recognition with LEDs in the robotic fingertip.

Device	Description	Benefit
OPT4001	High speed (600µs-800ms) ALS	High sensitivity and dynamic range

System Health

Current sensing provides input power monitoring on all joints

Device	Description	Benefit
INA700	40V, 15Arms 2mΩ integrated shunt digital power monitor	Small 1.2mm × 1.3mm size with integrated shunt saves PCB space
INA740	85V, 35Arms 800µΩ integrated shunt digital power monitor	Integrated shunt resistor saves PCB space

Humidity sensing provides gas sensor calibration for battery thermal runaway

Device	Description	Benefit
HDC3020	±0.5% RH humidity sensor; 4s response	Real-time gas sensor calibration

Resources

INA241A	Product Folder
INA790A	Product Folder
LDC5072	Product Folder
TMAG6180	Product Folder
LM50	Product Folder
ISOTMP35	Product Folder
TMAG3001	Product Folder
OPT4001	Product Folder
INA700	Product Folder
INA740	Product Folder
HDC3020	Product Folder

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