

Application Brief

Sensing in Humanoid Robots



Explore Texas Instruments' portfolios of current, position, temperature and environmental sensors covering motor control, tactile sensing, and system health monitoring needs in your humanoid robot designs!

Motor Control



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

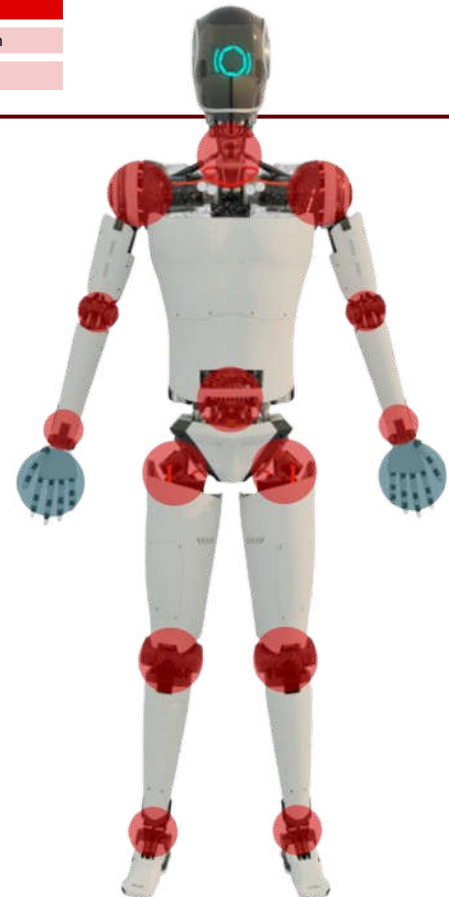
Device	Description	Benefit
INA241A	-5V to 110Vc bidirectional ultraprecise current sense amplifier	PWM rejection for phase current sensing
INA790A	110V, 75Arms 400μΩ integrated shunt current sense amplifier	Integrated shunt resistor saves board space; PWM rejection for phase current sensing

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 require magnets and provides immunity to magnetic stray-fields
TMAG618x	High-precision analog AMR angle sensor with 360° angle range (TMAG6180-Q1) or integrated turns counter (TMAG6181-Q1)	High frequency operation, minimal orthogonality error with low latency (<2μs), extended 360° range, or low power turns

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

Device	Description	Benefit
LM50	±2°C analog temperature sensor (10mV/°C)	Linear output without external calibration
ISOTMP35	3kV _{RMS} integrated isolation temperature sensor	Direct HV FET contact; <4s response



Tactile Sensing



Position sensors enable the sense of touch and pressure.

Device	Description	Benefit
TMAG3001	3D linear Hall-effect sensor with I ² C addressability in a WCSP	Ultra-small size enables increased and continuous spatial resolution

Optical sensing enables positioning recognition with LEDs in 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-Q1	Product Folder
TMAG6181-Q1	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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