



MTLT305E

4°/h IMU and Dynamic Tilt Sensor with CAN Output



MTLT Series products are rugged sealed 6 Degree-of-Freedom (6DOF) Inertial Measurement Units (IMUs) and dynamic tilt sensors designed for demanding off-road applications. They are packaged in a sealed over molded IP69K housing with CAN (J1939 protocol) and RS232 interfaces and are qualified for 12 V and 24 V vehicle power systems. They feature temperature calibrated 3D Accelerometers and 3D Rate Sensors (Gyros) and an Extended Kalman Filter (EKF) fusing the acceleration and rate data to accurately estimate and report Pitch and Roll. The ACEINNA MTLT305E is an improved replacement for the popular MTLT305D, which provides a lower cost alternative to the MTLT335D for cost sensitive applications. The ACEINNA MTLT305E is compatible with ACEINNA's high-performance triple redundant MTLT335D, providing customers the ability to develop one SW solution that supports both the high performance and lower cost mid-level performance 6DOF IMUs. The MTLT305E integrates highly reliable MEMS based accelerometers and gyroscopes, a 32-bit microprocessor, power protection and supporting circuitry for robust operation in many environments. The MTLT305E uses advanced sensor fusion, Extended Kalman Filtering, and calibration algorithms to achieve 0.5 degree pitch and roll, and <10 milli-g acceleration accuracy in a wide variety of dynamic conditions.

The ACEINNA MTLT305E is designed for use in 12 V and 24 V vehicle platforms. The sealed packaging meets the challenging performance, reliability and cost requirements of the construction and agriculture vehicle markets. Advanced features allow the axes to be re-assigned by the user to accommodate any mounting orientation. A user accessible rotation matrix is available to finely adjust for mounting errors. Widely adopted by the off-road vehicle market, the CAN 2.0 SAE J1939 Protocol makes for easy and fast integration into new and existing vehicle platforms.



Applications

- Agriculture Vehicles and Implements
 - Sprayer Boom Attitude, 3D Acceleration and Rate
 - Cab Leveling
 - Implement Leveling
- Construction Vehicles
 - Excavator Boom, Arm, Bucket and Cab Attitude
 - Wheel and Tracked Loaders Bucket and Chassis Attitude
 - Material Handler Boom and Chassis Attitude
- Agriculture Vehicles and Implements Attitude
- Forklifts
- Robotics Control / Feedback
- Antenna / Camera Gimballing and Stabilization



Features

- 6DOF IMU and Dynamic Inclination
- Precision 3-axis MEMS Accelerometer
- Low-Drift 3-axis MEMS angular rate sensor
- CAN 2.0 SAE J1939 and RS232 Interfaces
- Built Extended Kalman Filter for pitch/roll
 - 0.15° Static accuracy
 - 0.50° Dynamic accuracy
- Wide Temp Range, -40C to +85C
- Wide Supply Voltage Range, 9 V – 32 V
- Field Upgradable
- IP67, IP69K
- RoHS and Reach Compliant
- CE Marked
- 1PPS in (CAN Only)

This product has been developed exclusively for commercial applications. It has not been tested for, and makes no representation or warranty as to conformance with, any military specifications or its suitability for any military application or end-use. Additionally, any use of this product for nuclear, chemical or biological weapons, or weapons research, or for any use in missiles, rockets, and/or UAV's of 300km or greater range, or any other activity prohibited by the Export Administration Regulations, is expressly prohibited without the written consent and without obtaining appropriate US export license(s) when required by US law. Diversion contrary to U.S. law is prohibited. Specifications are subject to change without notice.

Performance Specification

Ta = 25°C, VDC = 12 V, unless otherwise stated

Angular Rate	MIN	TYP ²	MAX
Range (°/s)	-400		+400
Bias Instability (°/hr) ¹		4	
Bias Stability over Temp (°/s)		0.2	
Scale Factor Accuracy (%FSR)		0.2	
Cross-Axis Error (%FSR)		0.1	
Non-linearity Error (%FSR)		0.1	
Angle Random Walk (°/√hr) ¹		0.4	
Configurable Bandwidth (Hz)	5		50
Acceleration	MIN	TYP ²	MAX
Range (g)	-8		+8
Bias Instability (μg) ¹		33	
Bias Stability over Temp (mg)		3	
Scale Factor Accuracy (%FSR)		0.2	
Cross-Axis Error (%FSR)		0.1	
Linearity Error (%FSR)		0.1	
VRW (m/s/√hr) ¹		0.04	
Configurable Bandwidth (Hz)	2		50
Pitch / Roll	MIN	TYP ²	MAX
Pitch Angle Range (°)	-70		+70
Roll Angle Range (°)	-180		+180
Angle Accuracy over Temp (°) ³		0.05	
Angle Accuracy over Angle Range (°) ⁴		0.15	

Note 1: Allan variance curve, constant temperature

Note 2: Typical values are 1-sigma values unless otherwise noted

Note 3: RMS deviation from 25C value (Pitch and Roll = 0 degrees)

Note 4: RMS error over entire angle operating range

Electrical Specifications

Characteristic	Specification
Input voltage	9 – 32 V
Over voltage	36 V
Reverse voltage	-36 V
Current	40 mA @ 12 V Typ
Power	500 mW Typ
Reset response	Automatic after voltage dropout
Start-up time	<2 seconds
Max Output Data Rate	100 / 200 Hz (CAN / Serial)
CAN Baud rate	250k – 1M
RS232 Baud Rate	38400 – 230400

Physical Specifications

Characteristic	Specification
Dimensions	65 x 66 x 27 mm
Weight	< 75 g
Interface Connector	Ampseal 16 – 6 Position
Mating Connector	TE Connectivity 776531-1

Environmental Specifications

Characteristic	Specification
Operating Temperature	-40 – 85 C
Storage Temperature	-40 – 85 C
Ingress Protection	IP69k (IP67 Mated)

Qualification Plan Summary (Not inclusive of all tests)

Electrical Loads	DUTs	Op Mode ³	Function Class ³	Summary
Over Voltage (V)	3	3.2	A	SAE J1455 4.13.1: 36 V, 1 hour
Reverse Voltage (V)	3	1.1	C	SAE J1455 4.13.1: -36 V, 5 minutes
Short Circuit	3	3.2	C	ISO167507-2 4.10.2: Signal Circuits
Starting Profile	3	3.2	A	ISO16750-2 4.6.3: 10 pulses, 24 V System, Level 2
Load dump	3	3.2	A	5 pulses, 56V, 90 s pulse rate; 95 pulses 56V 120 s pulse rate
Reset Behavior at Voltage Drop	3	3.2	B	ISO 16750-2 4.6.2
Mechanical Loads				
Vibration Swept Sine	4	3.2	A	5 – 500 Hz; <10 Hz Displacement = ± 12 mm; >10 Hz = 5 g Pk
Vibration Random	4	3.2	C	5 – 2000 Hz; 15.35 g RMS, 48 hrs/axis
Mechanical Bump	4	3.2	C	100 bumps x 3 axis/DUT (600 Total/DUT) 400m/s ² , ½ sine, 6 ms pulse
Mechanical Shock	4	3.2	C	3 Shocks x 3 axis x 2 directions (18 total) 981m/s ² , ½ sine, 11 ms pulse
Mechanical Drop	2	1.1	C	1 m to steel plate, 1 drop x 3 axis x 2 directions (6 total)

Note 3: ISO 16750-1 Operation Mode and Function Class definition

EMC Specifications

Characteristic	Standard	Test Level / Frequency	
ESD direct contact discharge	ISO 10605	8 kV - Function Class A, Reference Limits IV	
ESD air discharge	ISO 10605	15 kV - Function Class A, Reference Limits IV	
Radiated Immunity Stripline	ISO 11452-5	200 V/m, 0.5 – 250 MHz	
Radiated Immunity ALSE	ISO 11452-2	200 – 1000 MHz	125 V/m
		1000 – 2000 MHz	40 V/m
		2000 – 2400 MHz	15 V/m
		2400 – 2700 MHz	10 V/m
EMC Conducted Transmission	ISO 16750-2; ISO 7637	24V Parameters, Pulse 1, 2a, 2b, 3a, 3b,, 4, 5b	

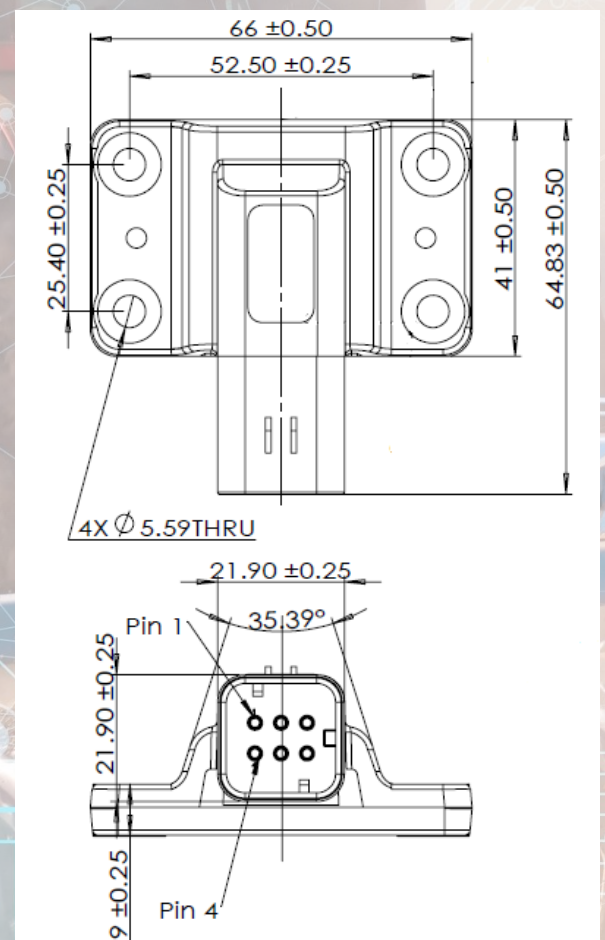
Tools and Support

- NAV-VIEW provides a free, easy to use software evaluation tool, which includes a graphical user interface to display, record, playback and analyze MTLT305E sensor data using your PC.
- NAV-VIEW can also be used to set and experiment with a wide range of user configuration parameters, to optimize system performance for different applications.
- NAV-VIEW is available for download at www.aceinna.com/support (see manuals)

Connector Pin Definition

Pin #	Signal
1	CAN H
2	CAN L
3	Gnd
4	RS-232 RX
5	RS-232 TX
6	Power

Dimensioned Drawing (MTLT305E) mm



Ordering Information

Part Ordering Information	
Rugged High-Performance IMU / Tilt Sensor	
MTLT305E	6DOF IMU/VG in Plastic/Over molded Housing
MTLT Cable	Mating Connector with flying leads