The ACEINNA MTLT335 is an easy-to-use high-performance 6-DOF IMU packaged in a rugged sealed over-molded plastic or aluminum housing. The MTLT335 includes triple-redundant 3-Axis MEMS accelerometers and rate gyros, which are fully calibrated over the full operating temperature range. The processing power is provided by a 168MHz ARM M4 CPU with a Floating Point Unit. An internal Kalman Filter provides gyro-compensated and corrected pitch and roll outputs. The MTLT335 has been developed in accordance with the ISO13849 Machine Safety standard, and fulfills the requirements of category 2 as specified in DIN EN ISO 13849-1:2016. It can be used in safety functions up to Performance Level d as specified in DIN EN ISO 13849-1:2016.

MTLT335D

Triple-Redundant 1.3°/h Dynamic Tilt Sensor with CAN Output

The ACEINNA MTLT335 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 automotive, construction and agriculture vehicle markets.

Applications

- Autonomous Vehicles
- Self-Driving Taxis / Delivery Vehicles
- Construction Vehicles
    - Boom, Bucket and Cab Attitude
- Agriculture Vehicles and Implements
- Forklifts
- Robotics Control / Feedback
- Antenna / Camera Gimballing and Stabilization

Features

- 0.1° accuracy over temperature and angle
- Precision 3-axis MEMS Accelerometer
- Low-Drift 3-axis MEMS angular rate sensor
- Triple redundant sensors with fault detection
- CAN 2.0 and RS232 Interfaces
- Built in 16-State EKF algorithm for pitch/roll
- Can be configured as IMU or Tilt Sensor
- Wide Temp Range, -40C to +85C
- Wide Supply Voltage Range, 9 V – 32 V
- IP67 Ampseal Connector
- Fulfills ISO 13849-1:2016
    - DC > 68%
    - MTTFd > 500 years
- Bootloader for field upgrades

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]		1.3	
Bias Stability over Temp (°/s)		0.1	
Scale Factor Accuracy (%FSR)		0.1	
Cross-Axis Error (%FSR)		0.1	
Non-linearity Error (%FSR)		0.1	
Angle Random Walk (°/√hr)[1]		0.1	
Configurable Bandwidth (Hz)	5		50
Acceleration	**MIN**	**TYP[2]**	**MAX**
Range (g)	-8		+8
Bias Instability (µg)[1]		20	
Bias Stability over Temp (mg)		1.3	
Scale Factor Accuracy (%FSR)		0.1	
Cross-Axis Error (%FSR)		0.1	
Linearity Error (%FSR)		0.1	
VRW (m/s/√hr)[1]		0.02	
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]		0.05	

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	< 100 mA
Power	< 400 mW
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 IP67
Mating Connector	TE Connectivity 776531-1

Environmental Specifications

Characteristic	Specification
Operating Temperature	-40 – 85 ºC
Storage Temperature	-40 – 85 ºC
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/s², ½ sine, 6 ms pulse
Mechanical Shock	4	3.2	C	3 Shocks x 3 axis x 2 directions (18 total) 981m/s², 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 MTLT335 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)

Dimensioned Drawing (MTLT335D) mm

Connector Pin Definition

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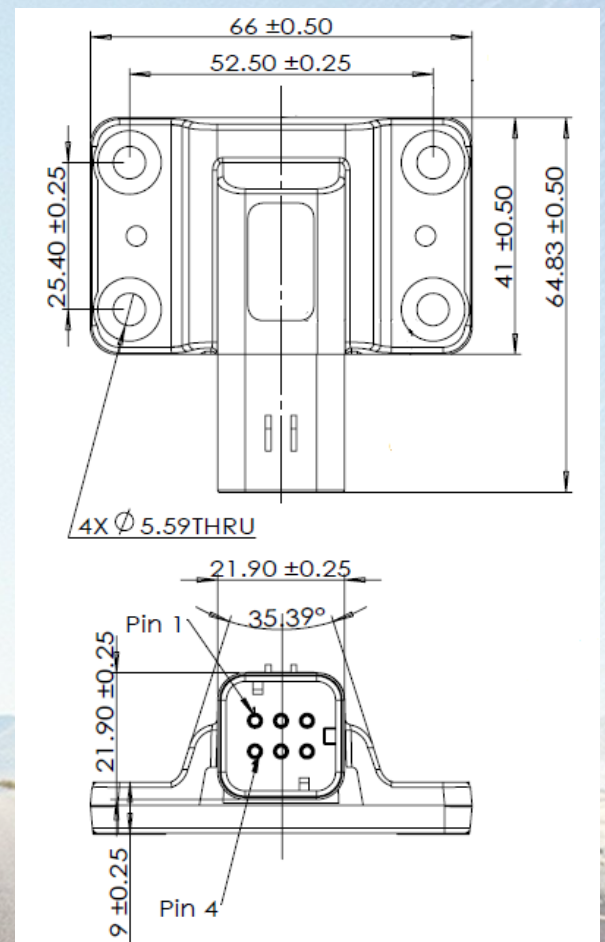
Ordering Information

Part Ordering Information	
Rugged High-Performance IMU / Tilt Sensor	
MTLT335D	6DOF IMU/VG in Plastic/Over molded Housing
MTLT305 Cable	Mating Connector with flying leads