Thermal Runaway Sensor

AX222058
Relative Humidity, Temperature, Pressure and Hydrogen Concentration

A combination sensor capable of providing up to four measurements including humidity, temperature, pressure and hydrogen concentration specifically for battery system applications. These measurements are designed for the detection of a battery thermal runaway event within the battery pack. Unique technology designed into the sensor to provide unsurpassed accuracy in the marketplace.

Features

- High accuracy temperature, pressure, hydrogen and humidity sensing elements
- CAN2.0B Communication per J1939
- Rugged design incorporates sensing elements with demonstrated reliability

Applications

- Power Battery Banks

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AX222058 Sensor Specifications

Environmental Ratings

Ratings	Min	Max	Unit
Storage Temperature	-55	105	°C
Operating Temperature	-40	105	°C
Pressure	0	30	psi
Relative Humidity	0	100	%
Vibration	0	2.0	GRMS
Flammability		94V-0	

Electrical Performance

Characteristic	Min	Typical	Max	Unit
Supply Voltage	9	12 or 24	60	Volts
Power Consumption Peak (measurement mode)		0.27	0.45	W
Power Consumption Idle		0.07	0.08	W

CAN bus

Characteristic	Min	Typical	Max	Unit
Differential Output Voltage – Dominant[1]	1.5	2	3	V
Differential Output Voltage – Recessive[1]	-0.120		0.012	V
Voltage Range – CANH/CANL	-36		36	V
Voltage Input, Transient Pulse – CANH/CANL	-100		100	V
Unique Source Address[2,3]		0xEB		
Bit Rate[2,3]		.5		Mbps
Broadcast rate		100		ms

1. RL=60Ω
2. Configurable
3. Default Value

AX222058 Sensor Specifications

Humidity Performance

Characteristic	Min	Typical	Max	Units
Relative Humidity Accuracy[1]	-4	±2	+4	%
Relative Humidity Response Time (63%)[2]		17	18	sec
Long Term Drift			0.25	%RH/YR

1. All operating conditions.
2. Measured at 25°C 1m/sec airflow from 33%RH to 90%RH

Pressure Performance

Characteristic	Min	Typical	Max	Unit
Pressure Accuracy (0 to 85°C)	-2		+2	%FSO
Pressure Accuracy (-40 to 125°C)	-3		+3	%FSO
Calibration Range	50		200	kPa
Pressure Response Time (63%)		0.2	0.4	sec

1. All operating conditions.

Temperature Performance

Characteristic	Min	Typical	Max	Unit
Temperature Accuracy (-5 to 75°C)	-2		+2	°C
Temperature Accuracy (-40 to 125°C)	-5		+5	°C
Temperature Response Time (63%)[1]		30	40	sec

1. 5m/s Airflow

Hydrogen Performance

Characteristic	Min	Typical	Max	Unit
Sensing Resolution		5		ppm
Sensing Output Range	0		160,000	ppm
H2 Accuracy[1] – 0 to 80,000 ppm	-8000		8000	ppm
H2 Accuracy[1] – 80,000 to 160,000 ppm	-12000		12000	ppm
H2 Response Time (63%)		1	3	sec

AX222058 Sensor Operation

Modes of Operation

A combination sensor capable of providing up to four measurements including humidity, temperature, pressure The sensor has two modes of operation: **Active and Low Power**.

In **Active Mode**, the sensor module is running with a normal CAN message broadcast interval and all internal peripheral sensor monitoring intervals are at maximum speed. In this mode all available CAN messages are active.

In **Low Power Mode** the sensor module is running without CAN message broadcast and all internal peripheral sensor monitoring is at a user defined interval period. In this mode all only START/STOP CAN messages are active.

Internal Sensor Peripheral	Monitor Interval	
	Active Mode	**Low Power Mode**
Pressure	100ms	100ms to 6425500ms
Relative Humidity	400ms	400ms to 6425500ms
H2 Concentration	500ms	500ms to 6425500ms
Temperature	100ms	100ms to 6425500ms
Internal Temperature	100ms	100ms to 6425500ms
Internal Voltage Levels	100ms	100ms to 6425500ms

The sensor can enter Low Power mode either by Active mode time-out, or can be commanded to go to low power mode using STOP Broadcast Command (See AX222058 – CommunicationProtocol).

From Low Power mode, the AX222058 will switch to Active mode when one of any of the sensor threshold values are breached. It can also be commanded to Active mode using the START Broadcast Command (See AX222058 – CommunicationProtocol).
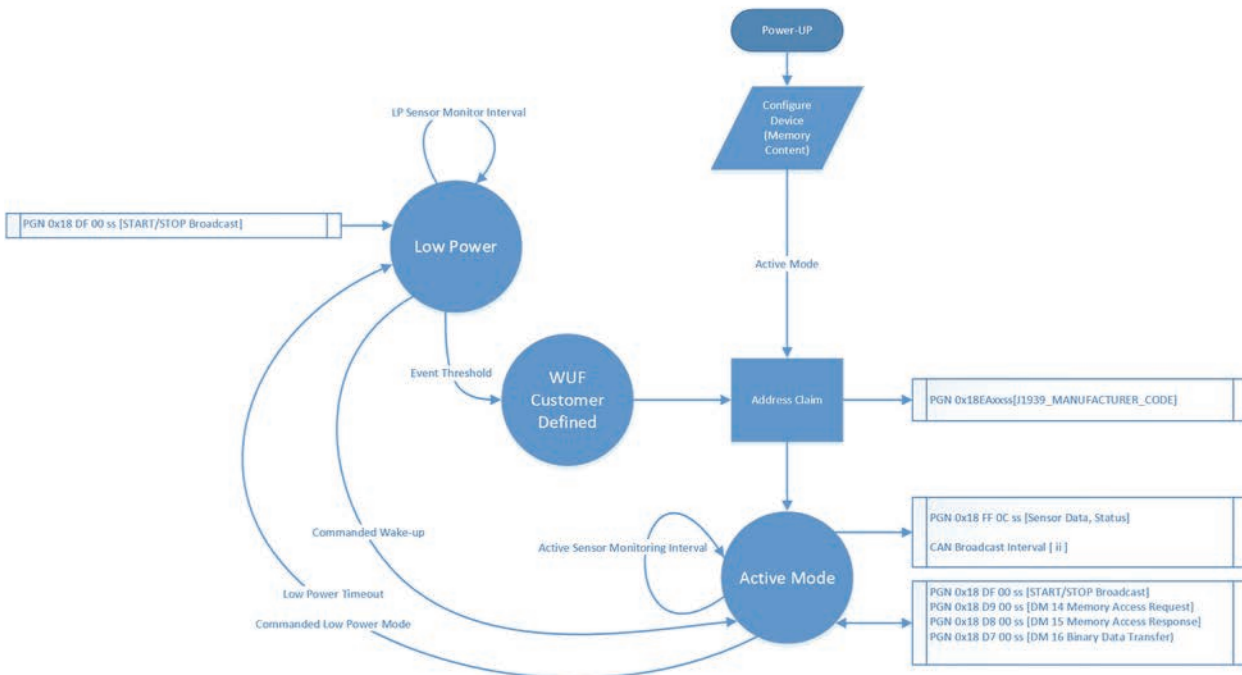
Operation Flow Chart

Figure 1 - Operation Flow Chart

AX222058 Mechanical Specifications

Housing Detail

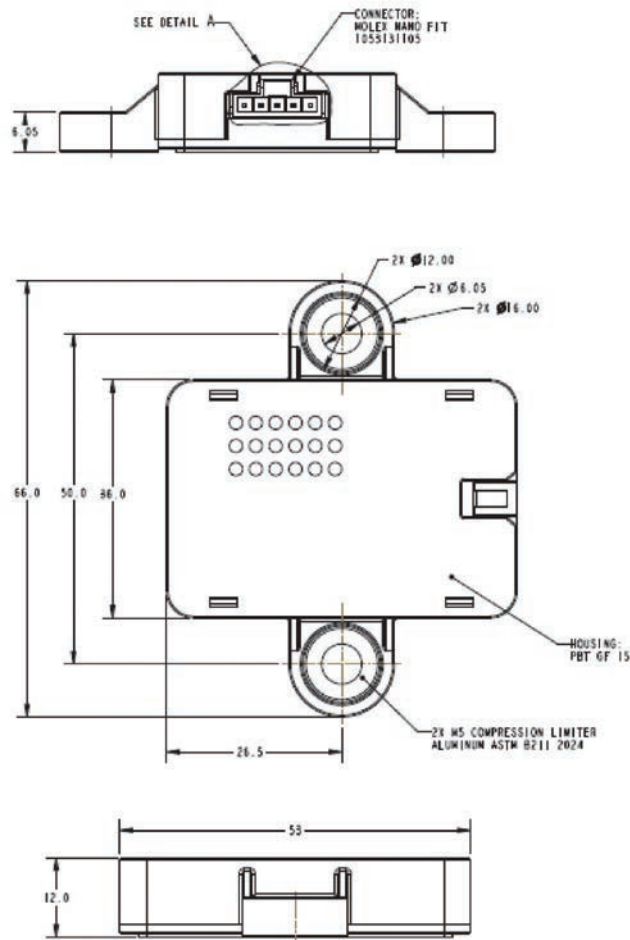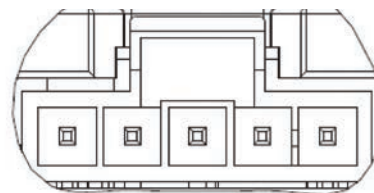|	
Housing Material:	PBT 15GF Black Mass: ~ 19 grams
Connector:	Molex Nano-Fit 1053131105
Mating Connector:	Molex Nano-Fit 5pin 1053071205 Connection System

Figure 2 - Mechanical Detail Diagram

Pin Out

```
5  NC
4  CAN HIGH
3  CAN LOW
2  POWER
1  GROUND
```

PINS: 1   2   3   4   5

Figure 3 - Pin Designations

AX222058 Sensor Specifications

Marking

Marking shall be on back side (non-vent) of sensor containing both Human Readable and Data Matrix marking.

Handling

Sensor contains sensitive electronic components and are tested to withstand ESD levels of both HB and MM (Standard: IEC 61000-4-2). Sensor is capable of being handled in a normal manufacturing environment.

Care shall be taken to keep the sensor dry and free from long exposure of VOCs.

Dropped sensors shall be discarded.

Mounting

The space claim of this sensor shall not exceed the envelope shown below.

imum air gap on
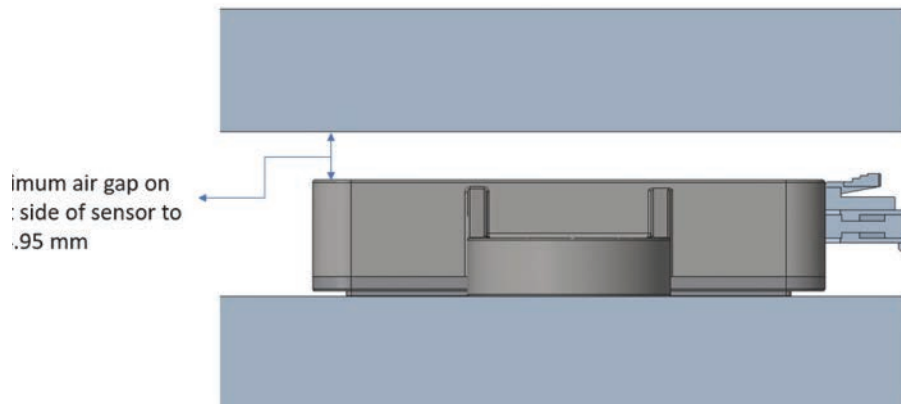: side of sensor to
.95 mm

Figure 4 - Mounting

The sensor requires 4.95 mm (Minimum distance) around the vents to allow for proper sensing.

The sensor clearance requirement for the device to allow the proper sensing. The sensor mounting features contain metal compression limiters.

The sensor is designed to be mounted using M5 X 0.8 X 12 mm hardware with 11Nm maximum torque.

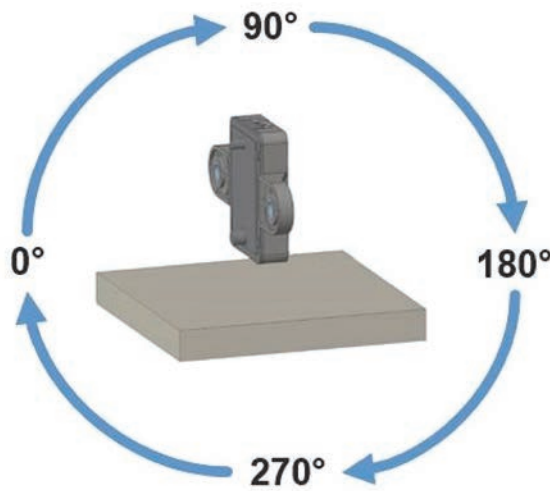Sensor orientation is not restricted but shall meet clearance specification above.

Figure 5 - Sensor Orientation

Wire harness is recommended to be secured on customer geometry no further than 50.8 millimeter perpendicular from the connector side of sensor.

AX222058 Sensor Specifications

Decommissioning

This sensor is an electronic device constructed to meet regulatory requirements listed in the regulatory section of this document. Please follow local eWaste or electronic disposal guidelines when discarding this device.

Communication

Sensor Message PGN			
PGN Name	N/A	PGN ID	N/A
PGN Short Name	N/A	Destination ddress	N/A
PGN Number	65292 (0xFF0C)	DPQ	0 (0x00)
Command Byte 1&2	N/A	PDUF	255 (0xFF)
Data Length (bytes)	8	PDUS	12 (0x0C)
Default Priority	6	PDU Type	N/A
Rep. Rate (ms)	100	Max Bytes	N/A
Variable Length	No	Creation Date	N/A
Incremented By	N/A	Exp/Prod Status	Production
Standards Group		Production Date	
Standards Document		Owner/Contact	N/A
SAE Status	Proprietary Only		

Byte #	SPN	Description	Scale	Offset	Data Range	Units
1-2	5685	Pressure	0.0078125	-250	-250 to 251.99	kPa
3-4	7693	Relative Humidity	0.4	0	0 to 100	%
5-6	NA	H2 Concentration	0.0025	0	0 to 160.6375	%
7	354	Temperature	0.03125	-273	-273 to 1734.96875	%
8	NA	Sensor Status #1	NA	NA	0 to 255	NA

AX222058 Sensor Diagnostics

The CAN message data/parameters shall be as the following for error handling (diagnostics):

Sensor Status #1 Parameters (Byte 8)		
Bit #	*Value/Definition*	*Description*
1	*0* = Normal operation *1* = Error detected	Pressure: Error = Internal sensor failure detected
2	*0* = Normal operation *1* = Error detected	Temperature: Error = Internal sensor failure detected
3	*0* = Normal operation *1* = Error detected	Humidity: Error = Internal sensor failure detected
4	*0* = Normal operation *1* = Error detected	H2 Concentration: Error = Internal sensor failure detected
5	*0* = Normal operation *1* = Error detected	Internal Diagnostics #1 (Voltage Level #1)
6	*0*	Internal Diagnostics #2 (Reserved)
7	*0* = Normal operation *1* = Error detected	Internal Diagnostics #3 (Internal Temperature)
8	*0* = Normal operation *1* = Brown Out detected	Internal Diagnostics #4 (Brown Out Recovery)

Sensor Signal Range wth Error Conditions		
SPN	*Parameter Name*	*Signal Range*
TBD	Pressure	$FEXX_{16}$ XX = FMI value as described in SAE J1939-73, appendix A
TBD	Temperature	$FEXX_{16}$ XX = FMI value as described in SAE J1939-73, appendix A
TBD	Relative Humidity	FE_8
TBD	H2 Concentration	$FEXX_{16}$ XX = FMI value as described in SAE J1939-73, appendix A

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