Negative Ion Module Specification

Model: M3001

Version: V1.0

Issue Date: 2025-06-19

Approved Approve	Reviewed Check	Prepared Prepare

XIAMEN MAXMAC AIR TECHNOLOGY CO., LTD.

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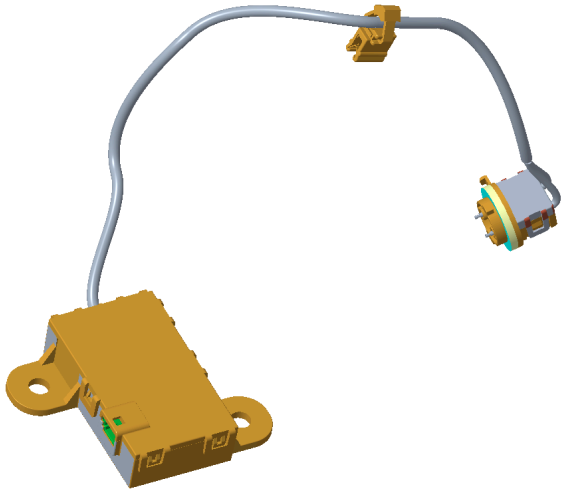


Figure 1-1 Product Rendering

> **Product callouts:** wire-harness clip; carbon-brush discharge end; vehicle mounting point; connector terminal.

2 Negative Ion Module Parameters

Table 1-1 Negative Ion Module System Parameter Table

Item	Test Condition	Parameter	Unit
Rated Voltage		12	V
Operating Voltage		9–16	V
LIN Communication Voltage		8–18	V
Operating Current	DC 12 V operating voltage	≤100	mA
Standby Current	DC 12 V operating voltage	≤0.1	mA
Output Voltage	DC 12 V operating voltage	±3,000 to ±4,000	V
Negative Ion Output	Air speed 5.5 m/s; tested 10 cm from carbon brush; DC 12 V operating voltage	$>2{,}000 \times 10^4$	pcs/cm³
Ozone Limit	DC 12 V operating voltage	≤0.01	ppm
Operating Humidity		35–85%	RH
Operating Temperature		−30 to 85	°C
Storage Temperature		−40 to 85	°C

Table 1-2 LIN Bus Parameters and Interface Definition

Item	Definition / Description
Node Type	Slave node
Baud Rate	19.2K
Deviation	±1.5%
Transceiver Model	SIT1028QT/1/5V0
External Pull-Up Resistor	None
Internal Pull-Up Resistor of Transceiver	25 kΩ

3 System Block Diagram

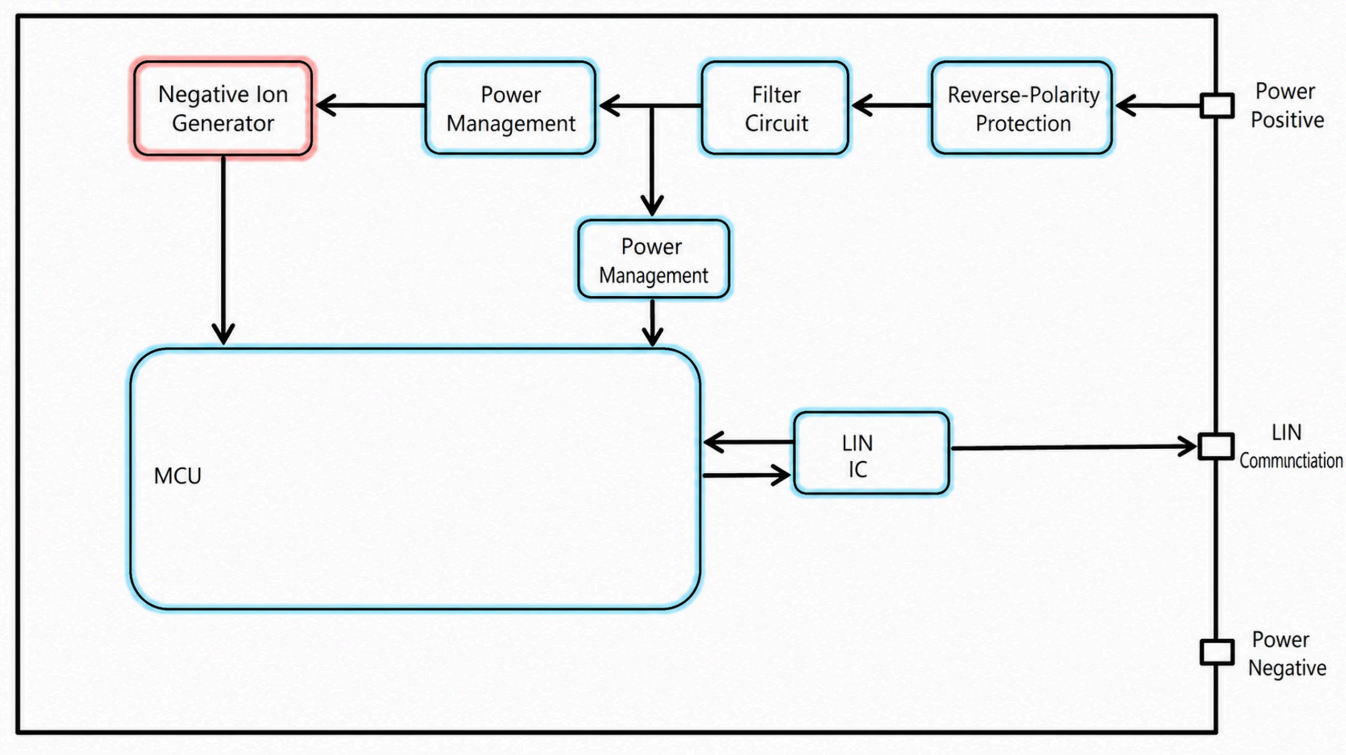


Figure 3-1 System Block Diagram

English diagram legend: power positive → reverse-polarity protection → filter circuit → power management → negative-ion generator. Power management supplies the MCU; the MCU controls ion on/off and receives ion-detection feedback. The LIN IC provides bidirectional LIN communication. Power negative is the system ground.

4 Communication Connector Information

4.1 Connector Port and Pin Definition

The product connector port view and pin definition are shown below. The connector used for this test is a TE connector.

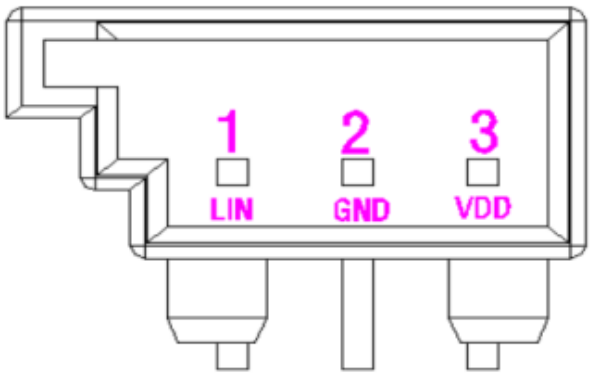
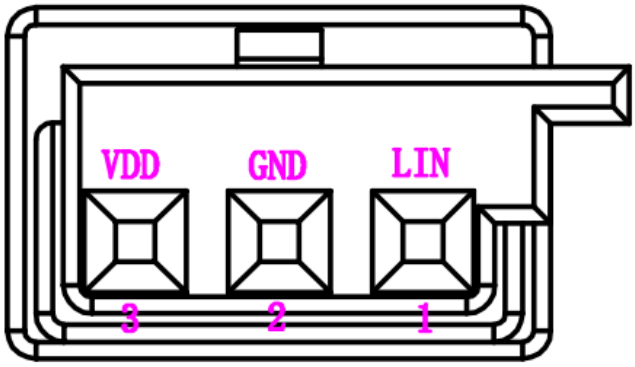


Figure 4-1 Connector Port View



Connector terminal assignment

Pin No.	Signal Name	Input / Output	Valid Level	Harness Type	Signal Function Description
1	LIN	In / Out	LIN	Single wire	LIN signal
2	GND	Out	/	Single wire	Ground
3	VDD	In	+9 V / +16 V	Single wire	Power positive

Note: harness types include single wire, twisted pair, and shielded wire.

4.2 Connector Housing

Connector port model: TE 1-1355730-1
Connector housing model: TE 1-1718346-1

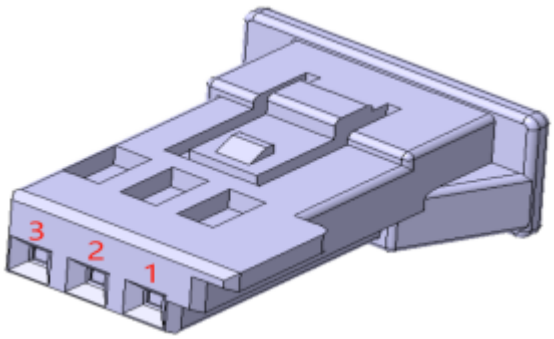


Figure 4-2 Communication Connector Housing

4.3 Connector Terminal

Connector terminal model: TE 5-928999-1

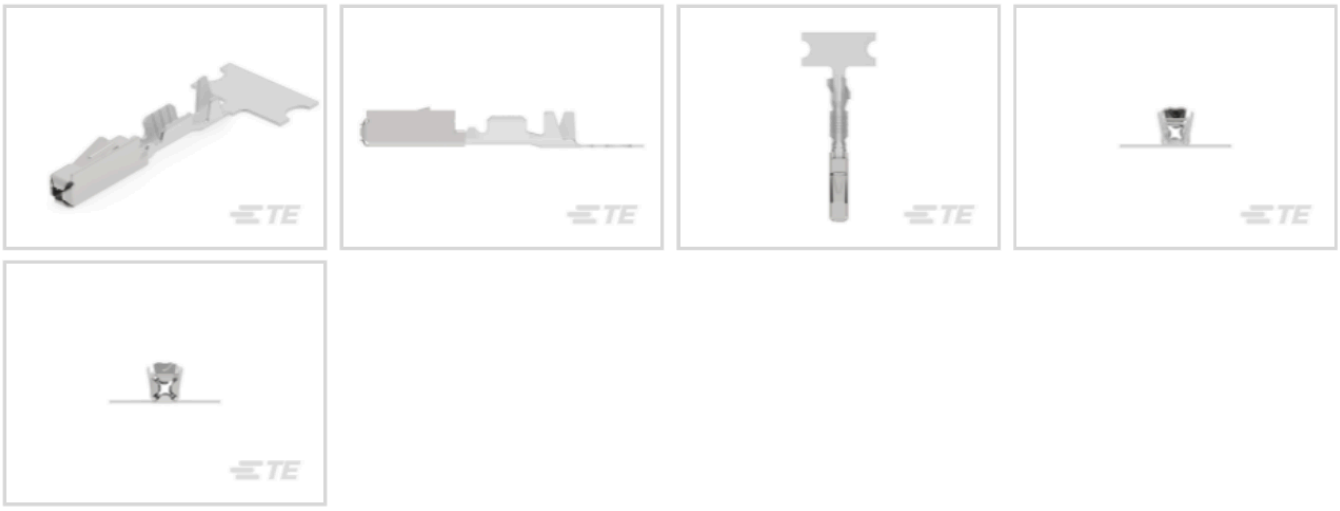


Figure 4-3 Communication Connector Terminal

5 Negative Ion LIN Communication Protocol

5.1 Master Node Transmission

Control ID: 0x19
DLC = 8

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0								
Byte1								
Byte2								
Byte3								
Byte4								
Byte5								
Byte6								
Byte7								Ion operation

Ion operation command: 0x0 Close; 0x1 Open; 0x2 Sleep; 0x3 Reserved.

5.2 Slave Node Response

Response ID: 0x24
DLC = 8

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Byte0	0	0	0	0	Response bus status		Ion running status	Ion operating status
Byte1	0x00							
Byte2	0x00							
Byte3	0x00							
Byte4	0x00							
Byte5	0x00							
Byte6	0x00							
Byte7	0x00							

Response bus status: 0x0 No_Error; 0x1 Resp_Error.

Ion running status: 0x0 Off; 0x1 Running.

Ion operating status: 0x0 Normal; 0x1 Abnormal; 0x2 Short; 0x3 Open.

5.3 Slave Node Response

Response ID: 0x25
DLC = 8

Byte	Signal Definition	
Byte0	IONPartTyp_RZCU_LIN1	
Byte1	IONPartSeqNr1HiNibble_RZCU_LIN1	IONPartSeqNr1LoNibble_RZCU_LIN1
Byte2	IONPartSeqNr2HiNibble_RZCU_LIN1	IONPartSeqNr2LoNibble_RZCU_LIN1

5.3 Slave Node Response — Continued

Byte	Signal Definition	
Byte3	IONPartSeqNr3HiNibble_RZCU_LIN1	IONPartSeqNr3LoNibble_RZCU_LIN1
Byte4	IONPartSeqNr4HiNibble_RZCU_LIN1	IONPartSeqNr4LoNibble_RZCU_LIN1
Byte5	IONPartSeqNr5HiNibble_RZCU_LIN1	IONPartSeqNr5LoNibble_RZCU_LIN1
Byte6	IONPartSeqNr6HiNibble_RZCU_LIN1	IONPartSeqNr6LoNibble_RZCU_LIN1
Byte7	0x00	

5.4 Slave Node Response

Response ID: 0x26
DLC = 8

Byte	High Nibble Signal	Low Nibble Signal
Byte0	IONSerNr1HiNibble_RZCU_LIN1	IONSerNr1LoNibble_RZCU_LIN1
Byte1	IONSerNr2HiNibble_RZCU_LIN1	IONSerNr2LoNibble_RZCU_LIN1
Byte2	IONSerNr3HiNibble_RZCU_LIN1	IONSerNr3LoNibble_RZCU_LIN1
Byte3	IONSerNr4HiNibble_RZCU_LIN1	IONSerNr4LoNibble_RZCU_LIN1
Byte4	IONSerNr5HiNibble_RZCU_LIN1	IONSerNr5LoNibble_RZCU_LIN1
Byte5	IONSerNr6HiNibble_RZCU_LIN1	IONSerNr6LoNibble_RZCU_LIN1
Byte6	IONSerNr7HiNibble_RZCU_LIN1	IONSerNr7LoNibble_RZCU_LIN1
Byte7	IONSerNr8HiNibble_RZCU_LIN1	IONSerNr8LoNibble_RZCU_LIN1

Note: this protocol is prepared according to the supplied **Kunlun_E4U1_RZCULIN1_250602** LIN matrix.

6 Fault Diagnosis

Fault Name	Fault Description	Trigger Criteria	Diagnostic Response	Action After Fault	Recovery Criteria	Recommended Action	LIN Feedback Signal	Fault Value
Overvoltage	Supply voltage above 16.8 V	Module supply voltage >16.8 V for 1 s	LIN matrix protocol response	1. Report negative-ion generator feedback fault; 2. Turn off negative-ion output	Recover when supply voltage remains <16.4 V for 1 s	1. Check whether supply exceeds 16.8 V and whether vehicle power is faulty; 2. Replace the negative-ion generator if supply is normal	LinIon1Sts_RZCU_LIN1	0x01
Undervoltage	Supply voltage below 8.3 V	Module supply voltage <8.3 V for 1 s	LIN matrix protocol response	1. Report negative-ion generator feedback fault; 2. Turn off negative-ion output	Recover when supply voltage remains >8.8 V for 1 s	1. Check whether supply is below 8.3 V and whether vehicle power is faulty; 2. Replace the negative-ion generator if supply is normal	LinIon1Sts_RZCU_LIN1	0x01
HV Package Short Circuit	HV package operating-circuit acquisition voltage >2.44 V	Acquisition voltage >2.44 V for 1 s	LIN matrix protocol response	1. Report negative-ion generator feedback fault; 2. Turn off negative-ion output	Recover when acquisition voltage remains <2.2 V for 1 s	Replace the negative-ion generator	LinIon1Sts_RZCU_LIN1	0x02
HV Package Open Circuit	HV package operating-circuit acquisition voltage <0.05 V	Acquisition voltage <0.05 V for 1 s	LIN matrix protocol response	1. Report negative-ion generator feedback fault; 2. Turn off negative-ion output	Recover when acquisition voltage remains >0.12 V for 1 s	Replace the negative-ion generator	LinIon1Sts_RZCU_LIN1	0x03
MOS Short Circuit	HV package inactive-circuit acquisition voltage >0.12 V	Acquisition voltage >0.12 V for 1 s	LIN matrix protocol response	1. Report negative-ion generator feedback fault; 2. Turn off negative-ion output	Recover when acquisition voltage remains <0.05 V for 1 s	Replace the negative-ion generator	LinIon1Sts_RZCU_LIN1	0x01
LIN Communication Error	LIN checksum, synchronization, byte-field, or stop-bit communication error	Communication fault occurs; recover after one correct response frame	LIN matrix protocol response	1. Resume communication on the next frame after recovery; 2. Clear the fault after one correct communication frame	Recover after one fault-free communication frame	Check LIN communication and harness	LinIon1RespErr_RZCU_LIN1	0x01

Figure 6-1 Fault Diagnosis Matrix

> The source fault-diagnosis matrix defines failure modes, detection conditions, recovery conditions, diagnostic status, response strategy, timing, confirmation counts, and associated LIN response fields. Refer to the controlled source matrix for production diagnostic implementation.

7 Structural Dimensions

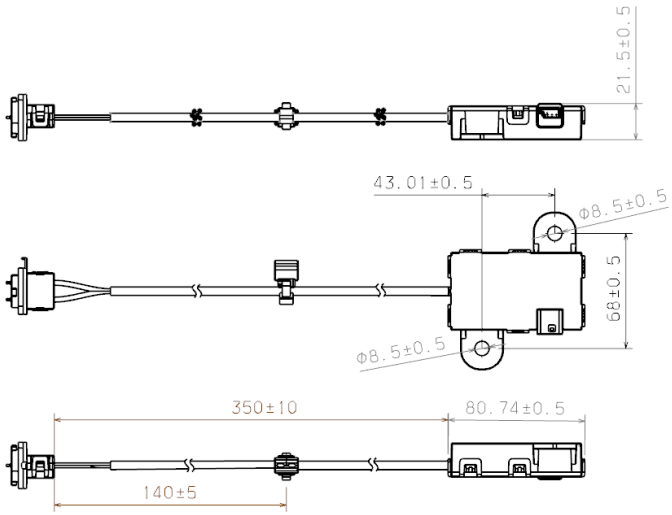


Figure 7-1 Harness and Main Module Dimensions

7 Structural Dimensions — Continued

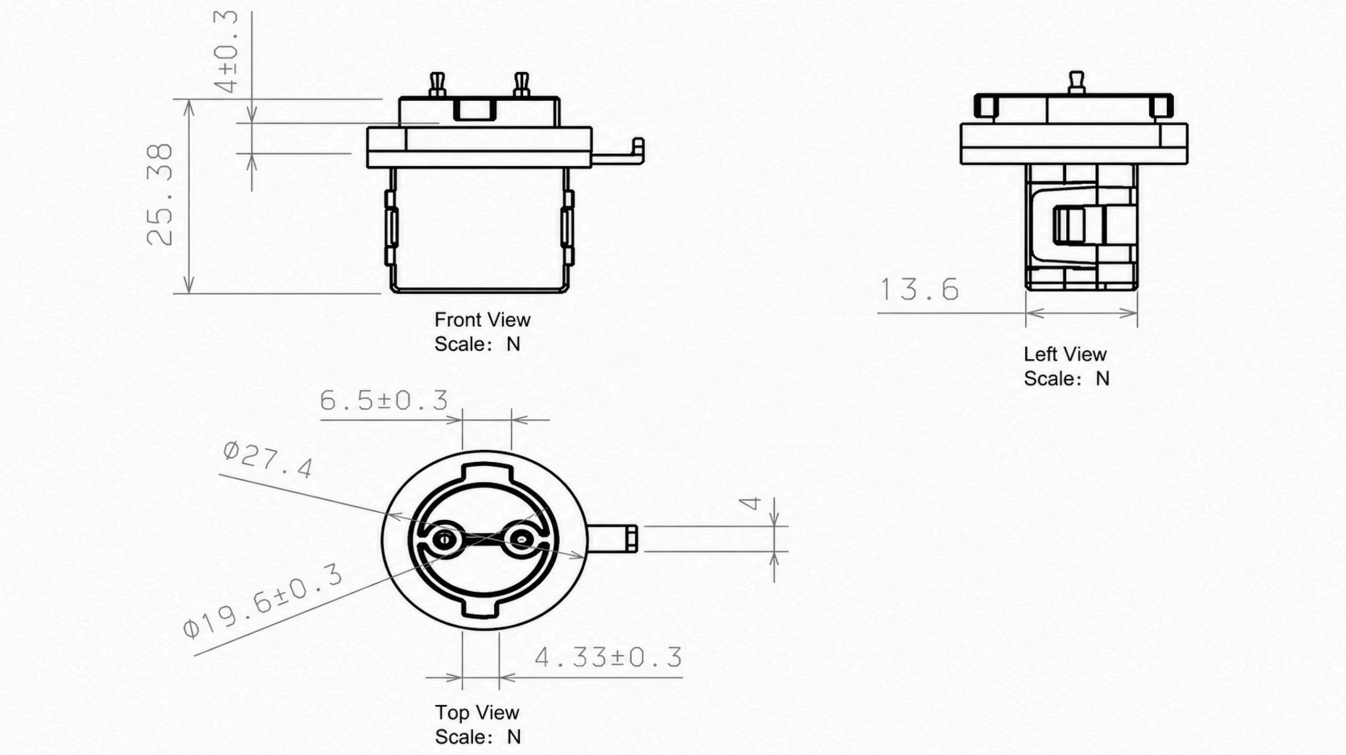


Figure 7-2 Negative Ion Emitter Structural Dimensions

All dimensions are in millimetres. Refer to the controlled mechanical drawing for tolerance interpretation and production installation.