

SIM100 MLP™

Active Insulation Monitoring Device

The SIM100MLP is the first high-voltage isolation monitoring device for EV/HEVs capable of operating correctly even when the battery is active, and experiencing large voltage variations, no variations, or even if the battery is not connected. The SIM100MLP continuously monitors the isolation resistance between a vehicle's IT (Isolated Terra) power system and chassis for deterioration of isolation and potentially dangerous levels of leakage current. The module detects not only resistive leakages but also capacitively stored energy that could be harmful to human operators.

Due to a proprietary, patented and patent-pending advanced algorithm, the module is capable of detecting all sources of leakage, including multiple, simultaneous symmetrical and asymmetrical faults, as well as resistive paths between the chassis and points in the battery with the same potential as the chassis. In the case of an isolation fault, the unit identifies the position of the fault in relation to the battery's terminals. Battery-connected voltage inputs can measure ± 1.1 kV (max, see ordering options for other ranges) in reference to Chassis (0 V). Communications are achieved via an isolated CAN 2.0B interface and the unit operates over a wide temperature range of -40 °C to $+105$ °C. The SIM100MLP was designed as a component for systems complying with ISO 6469-3:2011-12, UL 2231-1, UL2231-2, IEC 61557-A, CFR 571.305 and other applicable standards.

Highlights

Usability

- Reports battery voltage
- Reports uncertainty for all measured and calculated values
- Provides nonvolatile storage for the value of the maximum (design) voltage of the battery (used in calculations of the isolation resistance and stored energy)
- Provides nonvolatile storage for calibration of the voltage measurements and other parameters

Performance

- Measures voltage of each battery terminal with reference to chassis
- Reports accurate estimates of the isolation status while the battery is having large voltage variations
- Initializes in under 6 seconds
- Detects an insulation value change in less than 5 secs
- Measures and reports the value of capacitance from each battery terminal to chassis
- Calculates and reports the energy stored by the total capacitance between the battery and chassis
- Provides high immunity to common-mode noise that can be present on the battery terminals

Safety

- Measures and reports modeled leakage resistances per model adapted by the safety standards ISO6469-1, FMVSS §571.305, and others
- Reports calculated isolation resistance in Ω/V per requirements of the safety standards
- The unit continuously monitors both the connections of the voltage sense lines to the battery terminals and its own connection to the chassis, reporting any inadequate connections in either case
- Provides built-in galvanically isolated and intrinsically leakage-safe excitation source
- A single CAN message provides sufficient information for determination of the safety status of the system
- Warning and Fault alerts provided in the STATUS byte for low insulation resistance values

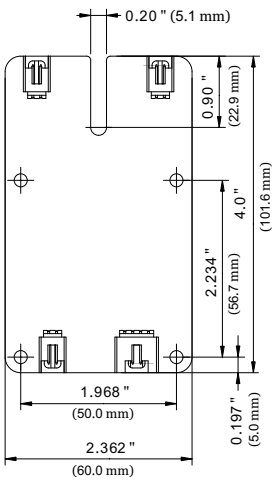
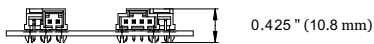
Benefits

- Ensures accurate isolation resistance measurements even when the battery is not connected or if the battery voltage drops below 15 V
- Improves overall system safety with continuous monitoring and fault alerts
- Optimizes system performance with rapid initialization and detection capabilities
- Provides robust data storage and automatic calibration for consistent accuracy

Applications



SIM100MLP™ Technical Specifications



Operating Specifications

Parameters	Value
Power supply	+4.8 to +53 V (variable, accommodating +5 V to +48 V power supplies)
Interface	CAN 2.0B isolated, 120 Ω termination resistor (optional)
Voltage measurement range	2 Channels: ±1100 (max) V/channel continuous, no signal clipping
Rating	Automotive
Power consumption	< 375 mW (+5 V power supply), < 475 mW (+48 V power supply)
Module operating temperature range	-40 OC to +125 OC for electronics (-40 OC to +105 OC with connectors)

Parameter	Min	Typical	Max	Units	Conditions / Comments
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Power and General

Electronics operating temperature range	-40		+125	°C	
Connector temperature ratings	-40		+105	°C	
Supply Voltage	4.8		53	V	
Supply Power			500	mW	
Start-up time		6		s	From application of power and power supply stabilization to availability of initial isolation values

Isolation Resistance Measurements

Isolation resistance monitoring range	0		2.727	MΩ	From each side of the battery to chassis. (includes SIM100 resistances)
Isolation monitoring lines resistance		2.726		MΩ	This is the impedance imposed on the IT system by each of the two battery voltage monitoring lines and the maximum isolation resistance that can be measured
Isolation monitoring uncertainty		±5		%	For isolation resistance range of 100 kΩ to 500 kΩ, battery voltage above 15 V. The total measurement uncertainty includes the contribution by the noise and operations of the target system
Isolation values calculation period		0.5		s	The SIM100MLP calculates all reportable isolation values every 500 ms
Resistance value flagged as a short	0		5	kΩ	Reported isolation resistance value will be exactly 0 Ω/V

SIM100MLP™ Technical Specifications

Parameter	Min	Typical	Max	Units	Conditions / Comments
Voltage Measurement					
Nominal full-scale voltage range	±1520 ±1109	±1552 ±1132		V V	For SIM100MLP-xNx For SIM100MLP-xMx
Voltage offset error	-1	±0.2	+1	V	VX = 0 V, applies over the full ambient operating temperature range, TA = -40 °C to +125 °C
Voltage gain error	-1	±0.1	+1	%	Over the full ambient operating temperature range. Calibration and typical
Voltage noise error		200		mV _{RMS}	1 Hz reporting rate
Voltage measurement resolution		1		V	Minimum reportable voltage change
Permitted battery voltage	0 0		1500 1109	V V	For SIM100MLP-xNx For SIM100MLP-xKx If the battery voltage is under 15 V, only parallel resistance and capacitance will be accurate
Capacitance Measurement					
Capacitance monitoring range	0.1	1	2	µF	Capacitance from each terminal of the battery to chassis. A 100 nF capacitance (minimum) is required for normal functioning
Capacitance monitoring uncertainty		±15		%	200 nF to 2 µF, when battery voltage has at least 2 V periodic variations
Capacitance measurement resolution		1		nF	
Temperature Measurement					
Absolute temperature measurement error	-5	±0.5	+5	°C	Built-in temperature sensor
Temperature measurement resolution			10	m°C	Practical temperature measurement granularity
Noise Immunity of Measurements					
Common mode voltage on the battery terminals	20			V _{PK-PK}	No observable effect on isolation resistance value; measured with square and triangular wave test signals at 1 kHz, 10 kHz and 30 kHz
Differential mode voltage on the battery terminals (battery voltage variations)		100		V _{PK-PK}	No observable effect on isolation resistance value; tested with a battery-voltage driving profile that has multiple instantaneous voltage changes up to ±100 V and overall slow battery voltage fluctuation from 330 V to 125 V and back to 330 V
Test voltage			3	kV _{DC}	CAN interface to chassis, 1 min. duration
ESD tolerance			25	kV	Air discharge to VX1/VX2 terminals; CAN connector's signals and/or Chassis connector signals have continuity to reference GND of the ESD tester
			±15 k	kV	Contact discharge to VX1/VX2 terminals, same conditions as above
Communication					
Interface	Spec		Speed		Termination
CAN	2.0B		500 or 250 kbit/s		120 Ω termination resistor optional

SIM100MLP™ Technical Specifications

Connectors

Interface	Manufacturer	Position	Part Number	Description
CAN & power on board	Molex	4	705510038	P1: 4 pos. right angle header, shrouded connector (2.54 mm), through hole tin
Can & power mating con.	Molex	4	50579404 50579704 (with TPA)	Use appropriate crimp contacts (available for AWG 22, 24 and 26)
Voltage sensing on board	Molex	2	705510036	J1, J3, J4: MINIFIT JR HDR 02P 94V-030AU
Voltage sensing mating con.	Molex	2	50579402 50579702 (with TPA)	MINIFIT JR RCPT DR SIDETABS 2 CKT 94V-0. Crimp contacts available for AWG 22 to 28

The SIM100MLP uses Molex connectors, part numbers: 705510036 and 705510038. For more details please go to www.molex.com

Ordering Information

Part Number	Description
SIM100MLP-XXX	SIM100MLP module. See table below for XXX options.

Ordering Options (XXX)

SIM100MLP-XXX	CAN bus	Voltage	Connectors & CAN termination
	A - 500 kbit/s	L - 100 V	A - All connectors, termination
	B - 250 kbit/s	K - 1100 V	B - All connectors, no termination
		N - 1500 V	

xLx & xNx versions with special order

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