



Expertise Applied | Answers Delivered

Small appliances

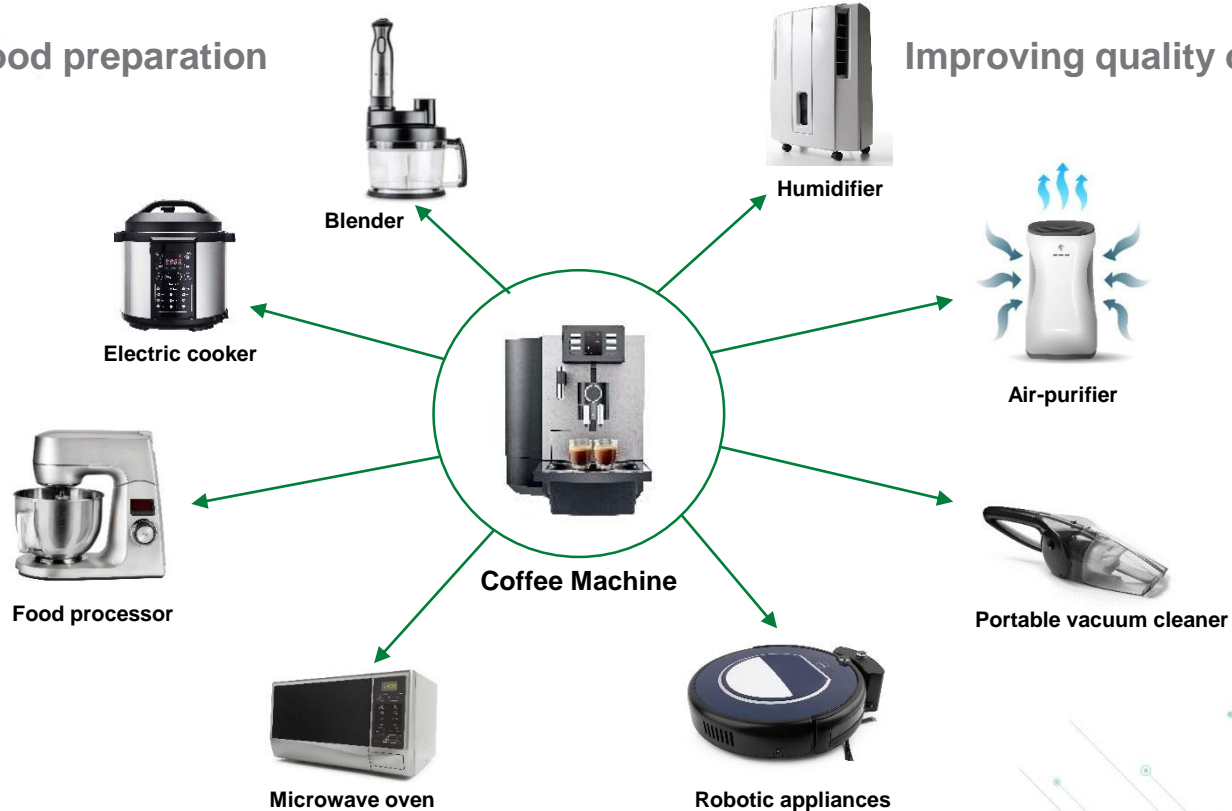


Appliances

Small appliances: continued evolution with more electronic content, more sensors, and battery powered

Food preparation

Improving quality of life



Market trends of small appliances

Market trends and drivers

Small appliances include: smart kitchen appliances (coffee machine, e-cooker, etc.), robotic appliances and others

Global small appliances shipments in 2019 ~3.3B units with growth expected at CAGR of ~1.4% from 2019-2023

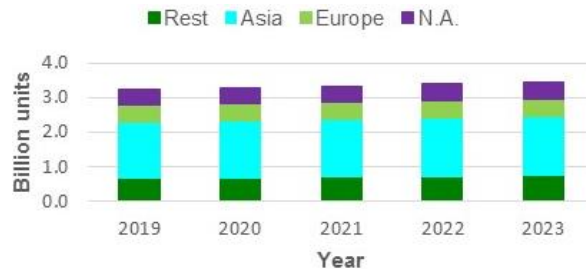
Small kitchen appliance shipments comprise ~60% of global small appliance market at ~2B units shipped annually

Global smart kitchen appliances volume (a subset of small appliances) is growing rapidly at CAGR of 17.2% between 2019-2027

Consumers in developed countries are rapidly adopting appliances with increased safety features such as safety interlocks and sensors

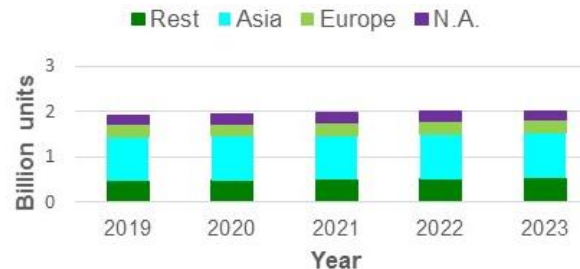
Small appliance shipments (2019-2023)

Small appliances shipments (2019-2023)



Source: [Electrolux market overview \(2018\)](#), [Marketwatch \(July 2019\)](#)

Small kitchen appliances shipments (2019-2023)



Source: [Small appliances report \(Statista \(August 2019 small appliance report\)\)](#)

Component recommendations for coffee machine

Display

- TVS diode
- TVS diode array



Motherboard

- Fuse
- MOV
- TVS diode
- Schottky barrier rectifier diode
- TRIAC



Main motor/Pump

- TVS diode
- NTC (temperature)



Compartments and doors

- Reed switch or sensor



Acronyms:

NTC: negative temperature co-efficient

MOV: metal oxide varistor

TVS: transient voltage suppressor



Protect

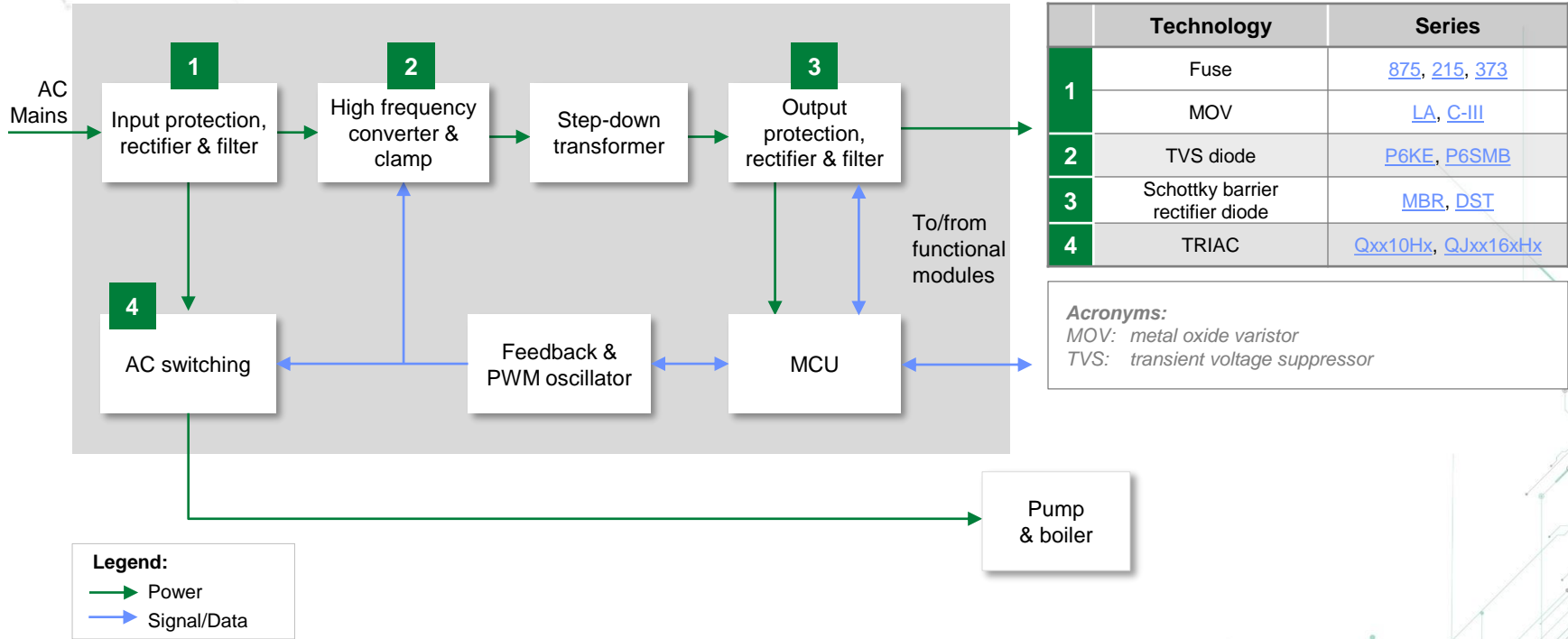


Control



Sense

Small appliance motherboard block diagram

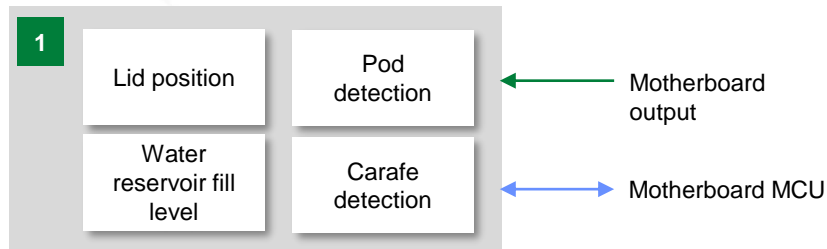


Motherboard: components usage and benefits

	Technology	Function in application	Series	Benefits	Features
1	Fuse	Helps to protect equipment and users from hazards due to overcurrent equipment faults	875 , 215 , 373	Reduces customer qualification time by complying with regulatory safety standards such as UL/IEC	Compliant with UL/IEC standards, low internal resistance, shock safe, vibration resistant
	MOV	Helps protect power unit from voltage surges and lightning events on AC line	LA , C-III	Reduces customer qualification time by complying with regulatory safety standards such as UL/IEC	Can meet wide set surge withstand specifications: 40J – 530J (2mS)
2	TVS diode	Protect power unit from wide range of voltage transients	P6KE , P6SMB	Fast response time (<1pS)	600 W peak pulse capability; compatible with high reflow temperature profile (260°C/40S)
3	Schottky barrier rectifier diode	Rectification and blocking in power supply units	MBR , DST	Low heat generation (efficient) enables compact designs, improves power supply efficiency due to fast recovery time	Low forward voltage drop, high frequency operation, high junction temperature capability
4	TRIAC	AC switching and motor speed control (pump & boiler)	Qxx10Hx , Qjxx16xHx	Solid-state (non mechanical) switching and no audible noise operation; enables power efficient, compact design	High voltage withstand capability (1kA), high surge capability up to 200A, solid-state switching eliminates contact bounce

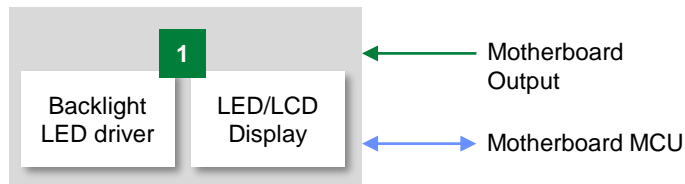
Components for mechanical and display subsystems

Mechanical sub-systems:



	Technology	Series
1	Reed switch	59045 , 59165
	Reed sensor	59140 , 59141
	Magnetic actuator	57045 , H-31 , 57140

Display:



	Technology	Series
1	TVS diode	SME , SMF4L
	TVS diode array	SP3423 , SP1064 , SP1002

Legend:

- Power
- ↔ Signal/Data

Acronyms:

TVS: transient voltage suppressor
MCU: microcontroller Unit

Mechanical and displays components usage

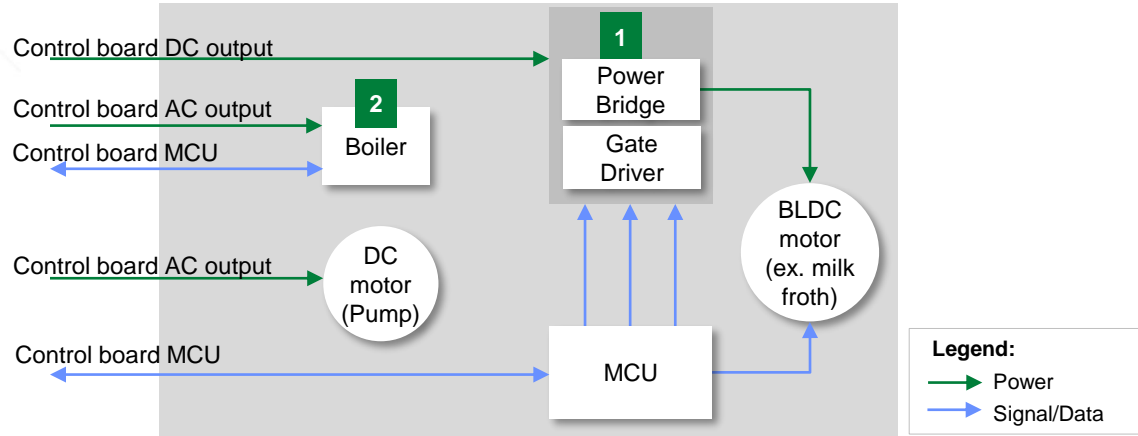
Mechanical sub-systems:

	Technology	Function in Application	Series	Benefits	Features
1	Reed Switch or reed sensor	Provides open/close control signal of functional blocks to protect from physical harm or equipment damage	59045 , 59140 , H-31	Hermetically sealed, suitable for humid, wet or contaminated environments	Application-specific customization available, wide range of sensitivity's available

Display:

	Technology	Function in Application	Series	Benefits	Features
1	TVS diode	Helps protect equipment from user induced ESD on power line	SME , SMF4L	Small form-factor enables compact design, improves reliability by protecting system from transients on power lines	400W peak pulse power capability, fast response time (<1nS), low inductance
	TVS diode array	Helps protect equipment from user induced ESD on signal line	SP3423 , SP1064 , SP1002	Smaller form-factor and multi-line protection enables compact designs	Low leakage current, low capacitance per I/O

Pump, heater, and small motor block diagram



	Technology	Function in Application	Series	Benefits	Features
1	Gate Driver	Provides required drive current to power MOSFETS	IX3120 , IX3180	Efficient fast MOSFET switching	Capable of sourcing and sinking up to 2A, wide operating voltage range, 3750Vrm input-output isolation
	NTC	Temperature measurement of power MOSFETs (during normal operation & detecting fault conditions)	RA , RB , MM	SMD form-factor allows for compact design; non-standards resistance values available	Surface mountable; fast thermal response
2	NTC	Measuring water temperature	H6246 series	Customized probes and assemblies to meet individual customer requirements	Can meet wide range of customer-specific application requirement, various precision levels available

Components for rice cooker & table-top appliances

Display:

- TVS diode
- TVS diode array



Compartment and doors:

- Reed Sensor
- NTC (temperature)



Motherboard:

- Fuse
- MOV
- Schottky barrier rectifier diode
- TRIAC



Acronyms:

NTC: *negative temperature co-efficient*
MOV: *metal oxide varistor*
TVS: *transient voltage suppressor*



Protect

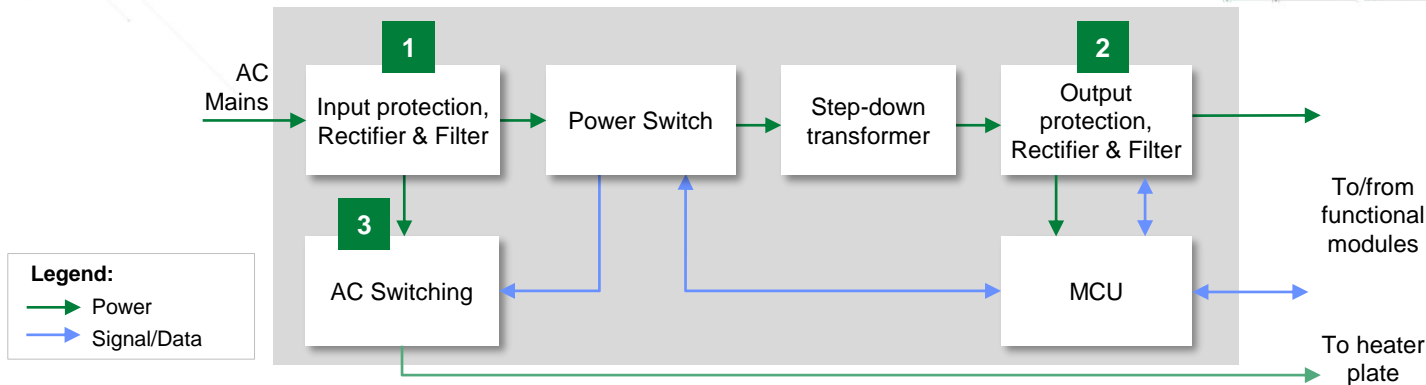


Control



Sense

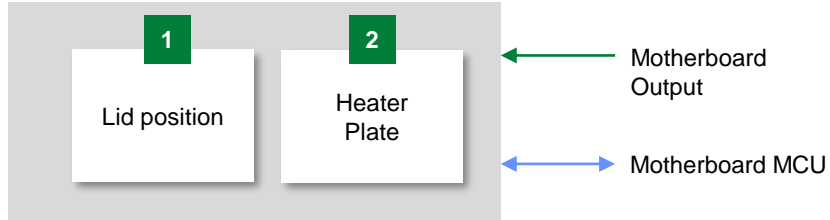
Motherboard component recommendations



	Technology	Function in Application	Series	Benefits	Features
1	Fuse	Helps to protect equipment and users from hazards due to overcurrent equipment faults	875 , 215 , 373	Reduces customer qualification time by complying with regulatory safety standards such as UL/IEC	Compliant with UL/IEC standards, low internal resistance, shock safe, vibration resistant
	MOV	Helps protect power unit from voltage surges and lightning events on AC line	LA , C-III	Reduces customer qualification time by complying with regulatory safety standards such as UL/IEC	Can meet wide set surge withstand specifications: 40J – 530J (2mS)
2	Schottky barrier rectifier diode	Rectification and blocking in power supply units	MBR , DST	Low heat generation (efficient) enables compact designs, improves power supply efficiency due to fast recovery time	Low forward voltage drop, high frequency operation, high junction temperature capability
3	TRIAC	AC switching (Heater plate)	Qxx10Hx , QJxx16xHx	Solid-state (non mechanical) switching and no audible noise during operation; enables power efficient, compact design	High voltage withstand capability (1kA), high surge capability up to 200A, solid-state switching eliminates contact bounce

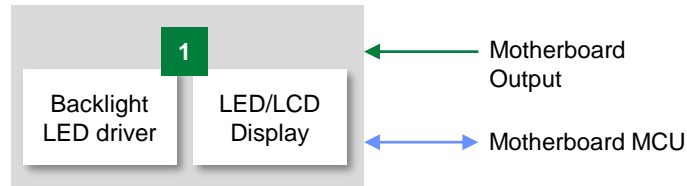
Components for mechanical and display subsystems

Mechanical sub-systems:

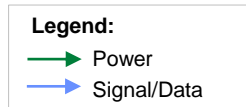


	Technology	Series
1	Reed sensor	59140 , 59141
	Magnetic actuator	57140 , 57141
2	NTC (lead)	H6246 series

Display:



	Technology	Series
1	TVS diode	SMF , SMF4L
	TVS diode array	SP3423 , SP1064 , SP1002



Acronyms:
 NTC: *negative temperature co-efficient*
 TVS: *transient voltage suppressor*

Mechanical and displays components usage

Mechanical sub-systems:

	Technology	Function in Application	Series	Benefits	Features
1	Reed Switch or reed sensor	Provides open/close control signal of functional blocks to protect from physical harm or equipment damage	59140 , 59141	Hermetically sealed, suitable for humid, wet or contaminated environments	Application-specific customization available, wide range of sensitivity available
2	NTC	Measuring operating temperature of heater plate	H6246 series	Customized probes and assemblies to meet individual customer requirements	Can meet wide range of customer-specific application requirement, various precision levels available

Display:

	Technology	Function in Application	Series	Benefits	Features
1	TVS diode	Protect ICs from ESD induced through Display	SMF , SMF4L	Improves system reliability by protecting downstream components from transients on power lines	400W peak pulse power capability, fast response time (<1nS), low inductance
	TVS diode array	Protect ICs from ESD induced on signal line through Display	SP3423 , SP1064 , SP1002	Smaller form-factor and multi-line protection enables ease of design	Low leakage current, low capacitance per I/O

Safety and compliance standards

Industry standard	Sub-section requirement	Technology	Implications on the system
IEC 60335-1 Household and Similar Electrical Appliances – Safety – Part 1: General Requirements and IEC 60335-2-15 Household and Similar Electrical Appliances – Safety – Particular requirements for appliances for heating liquids. (covers both coffee makers and rice cookers)	14 Transient overvoltage	MOVs	MOVs maybe used to meet the 1.2/50 μ s impulse at the voltages listed in Table 6
	19.11.2 Abnormal operation	Fuses	Fuses meeting the requirement of IEC 60127 series may be relied upon to meet the requirements of abnormal operation
UL 1082 Household Electric Coffee Makers and Brewing Type Appliances	6.3 Components shall comply with requirements of applicable UL standard	Fuses	All fuses are UL recognized to UL 248 series
	22A.2 NTCs used as a protective or operating control shall comply with UL 60730-1 or UL 1434	NTCs	Select Littelfuse NTCs are UL recognized to their either UL 60730-1 or UL 1434
	26B.1 Surge protective devices shall comply with UL 1449	MOVs	All of Littelfuse applicable surge protective components are UL recognized to UL 1449
	47.5.4 Voltage surges in accordance with IEC 61000-4-5	MOVs	MOVs will operate during test and reduce likelihood of increased risk of fire or electric shock

Safety and compliance standards

Industry standard	Sub-section requirement	Technology	Implications on system
UL1026 Electric Household Cooking and Food Serving Appliances	5.3 Components shall comply with requirements of applicable UL standard	Fuses	All fuses are UL recognized to UL 248 series
	18 General overcurrent protection	Fuses	Product must have overcurrent protection up to 20A
	26.5 NTCs used as a protective or operating control shall comply with UL 60730-1 or UL 1434	NTCs	Majority of Littelfuse PTCs and select NTCs are UL recognized to their either UL 60730-1 or UL 1434
	30.3 Use of overvoltage device for spacing	MOVs	The use of UL 1449 recognized MOVs allows the reduction of spacings per Clearance B of UL 480
	35 Surge protective devices shall comply with UL 1449	MOVs	All of Littelfuse applicable surge protective components are UL recognized to UL 1449

Additional information can be found on [Littelfuse.com](https://www.littelfuse.com)

Circuit Protection Solutions:

https://www.littelfuse.com/~media/electronics/product_catalogs/littelfuse_product_selection_guide.pdf.pdf

Sensor Solutions:

<https://info.littelfuse.com/hubfs/Electronics/Documents/Littelfuse%20Sensing%20Products%20Selection%20Guide.pdf>

ESD Protection Solutions:

https://www.littelfuse.com/~media/electronics/design_guides/esd/littelfuse_esd_suppression_design_guide.pdf.pdf

TVS Diode Solutions:

<http://electronicscatalogs.littelfuse.com/tvsdiode/TVS-Diode-Catalog-and-Design-Guide/1/#>

TVS Diode Array Solutions:

https://www.littelfuse.com/~media/electronics/product_catalogs/littelfuse_tvs_diode_array_catalog.pdf.pdf

Power Semiconductor Solutions:

<http://www.ixys.com/Documents/Selectorguide.pdf>

Why choose Littelfuse

- Global leader with broad product portfolio covering key protection, sensing, and power components.
- Application expertise combined with product design guidelines to help you select best components for your application
- Littelfuse has extensive experience in application-specific custom sensor simulation and design. For information on custom sensors please contact:
 - Magnetic sensors: [littelfuse.com/sensorscontact](https://www.littelfuse.com/sensorscontact)
 - Temperature sensors: [littelfuse.com/sensorform](https://www.littelfuse.com/sensorform)
- Testing capabilities and assistance to support product selection
- High-volume manufacturing, committed to the highest quality standards
- Global company with local support

We are committed to supporting your success



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