Littelfuse®

Expertise Applied | Answers Delivered

System Solutions for Major Appliances

Appliances

REV0724

Common design principles across many types of appliances

Cold storage

Commercial ice maker

Vending machine

Residential AC unit

Induction cook top

Major Appliances

Rice cooker

Coffee machine

Blender

Microwave oven

Air purifier

Major appliance market: ~760M units in 2023

Market trends and drivers

IoT and smart technologies enable remote control and automation of appliances, which boosts demand for advanced electronics.

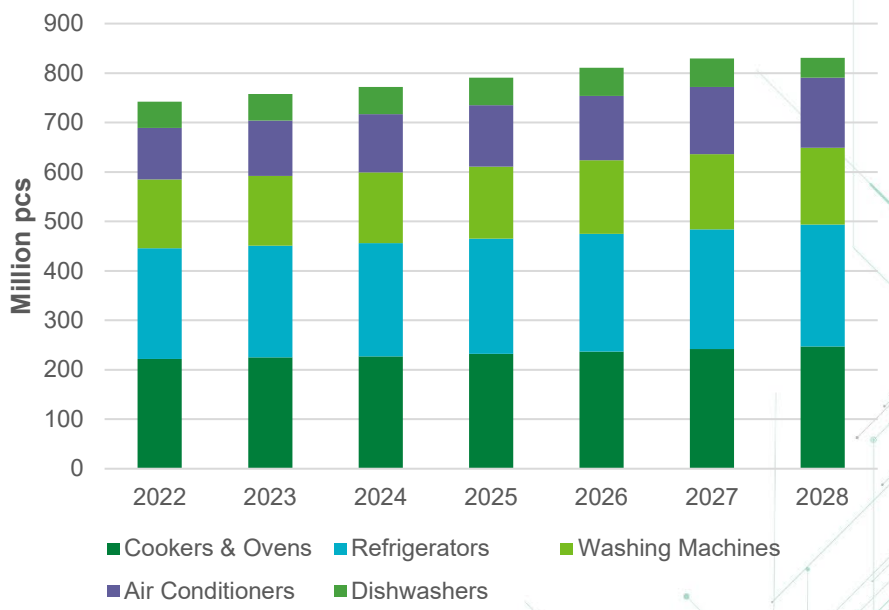
Emphasis on energy-efficient appliances driven by regulations and consumer demand, with technologies such as inverter-driven motors and sensing options.

Enhanced safety features, including advanced circuit protection solutions, help improve appliance reliability and user safety.

Rising incomes in developing regions, especially Asia Pacific, drive growth in appliance sales.

AI, machine learning, and sensor technologies enable new features such as diagnostics and predictive maintenance.

Projections for major appliances CAGR ~2%

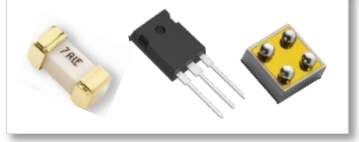


Sources: *Statista Market Insights and Littelfuse estimate*

Littelfuse technologies for appliances

1 Input protection
Fuse, MOV

2 Power supply
Fuse , TVS Diode, Load Switch



3 Control Board
PPTC, Current Sensing Resistor, TRIAC

4 User interface
TVS Diode Array, Polymer ESD, Switch

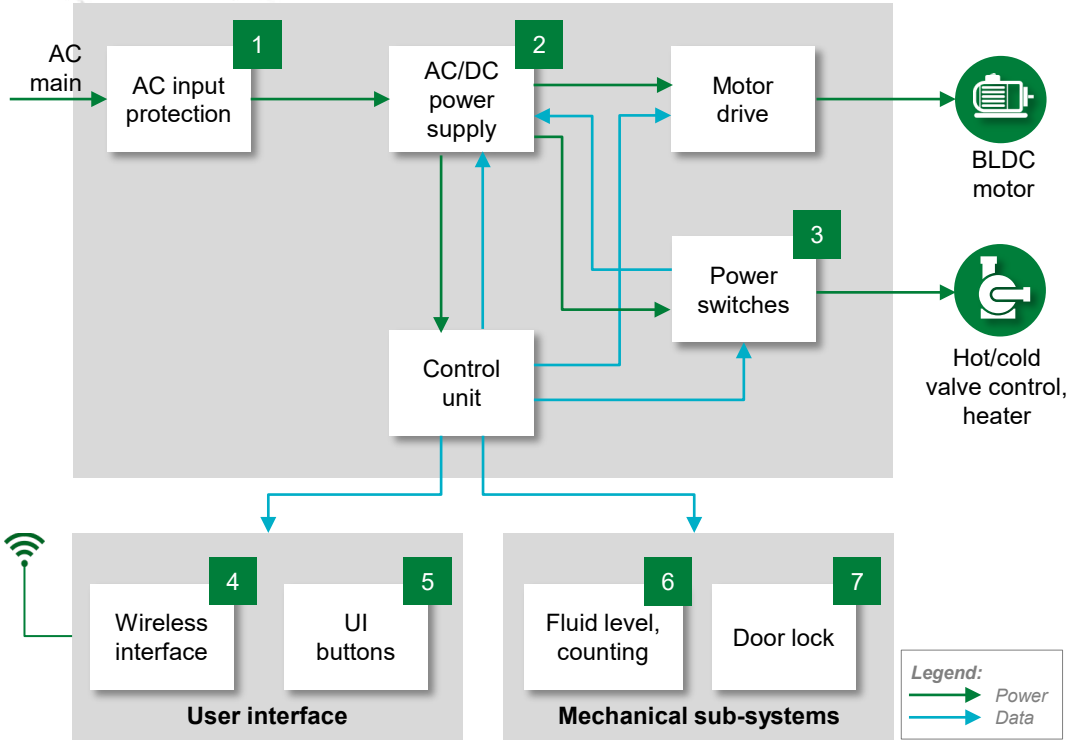
5 Mechanical subsystems
TMR Sensor, NTC,
Custom Reed Sensor, Reed Switch

Acronyms:
MOV: Metal Oxide Varistor
TVS: Transient Voltage Suppressor
PPTC: Polymeric Positive Temperature Coefficient
TRIAC: Triode For Alternating Current
ESD: Electrostatic Discharge
TMR: Tunnel Magnetoresistance
NTC: Negative Temperature Coefficient

Littelfuse
Expertise Applied | Answers Delivered

Click the product series in the table below for more info

Functional block diagram for washing machine



	Technology	Series
1	Fuse	5X20mm Fuse
	MOV	M3, Xtreme
2	Fuse	Nano 448
	TVS Diode	SACB, SMAJ
	Load Switch	LQ050
3	PPTC	LVR
	Current Sensing Resistor	WPB
	TRIAC	QJxx16xHx, QS8004xHx
4	TVS Diode Array	SP3423, SP1064
	Polymer ESD	PESD
5	Switch	PTS
6	TMR Sensor	54140
	NTC	USP12755
	Reed Sensor	Reed switch PCB, customized
7	Reed Switch	HA-15

Acronyms:
AC: Alternate Current
DC: Direct Current
UI: User Interface
BLDC: Brushless Direct Current
IC: Integrated Circuit

Littelfuse
Expertise Applied | Answers Delivered

Click the product series in the table below for more info

Features and benefits of a typical refrigeration unit

	Technology	Function in application	Product series	Benefits	Features
1	Fuses	Protects the power stage from overcurrent	5X20mm Fuse	Reduces design qualification time by complying with third-party safety standards such as UL/IEC	Third-party compliance with UL/IEC; low internal resistance; shock-safe; vibration resistant
	MOV	Protects power unit from voltage surges. Supports UL/IEC requirements.	M3, Xtreme	Reduces design qualification time by complying with third-party safety standards such as UL/IEC	Peak current up to 15000 A; maximum operating temperature of 125 °C
2	Fuse	Overcurrent protection for auxiliary power supply	Nano 448	Helps solve the problem of nuisance “opening”	Wide range of current rating available (0.375A to 12A), has enhanced inrush withstand characteristics,
	TVS Diode	Protects sensitive circuits by clamping excessive transient voltages	SACB, SMAJ	Improves system reliability by clamping the voltage at safe levels during transients	Excellent clamping capability
	Load Switch	Controls the flow of power to subsystems	LQ050	Slew rate control; integrated output discharge switch, and internal EN pull-down resistor	Ultra-low I_Q: 7 nA Typ @ 5.5 V_{IN}; low R_{ON} = 31 mΩ Typ @ 5.5 V_{IN}
3	PPTC	Resets itself after clearing a fault	LVR	Fast time to trip; saves board space; reduces design qualification time by complying with UL/IEC	Line voltage ratings of 120 VAC and 240 VAC; low resistance; holds current up to 2 A; compact size
	Current Sensing Resistor	Part of current measurement circuitry	WPB	Cost-effective solution compared to competing technologies; low profile	Tolerance down to 0.5%; power rating up to 3 W
	TRIAC	AC switching for heater or motor control loads	QJxx16xHx	Enables easier thermal management and higher surge handing capability	High TJ of 150 °C; surge capability of 200 A at 60 Hz half cycle
	TRIAC	Switching for valve control	QS8004xHx	High voltage clamping function to ensure ability to withstand high over-voltage events	Surge capability up to 55 A; requires only a short gate activation pulse in each half-cycle
4	TVS Diode Array	Protect sensitive chipsets from ESD while maintaining signal integrity	SP3423, SP1064	Small, space-saving design; low capacitance to prevent signal disruption	µDFN-2 (0201) footprint; ±30 kV ESD withstand voltage
	Polymer ESD		PESD	Ultra-low leakage current; available in many form factors	<0.01 µA leakage current; 0.25 pF capacitance
5	Switch	Various user interface functions: cycle control, timing etc.	PTS	Provides tactile feedback; enhances user interface experience	Sealed construction for protection against dust and moisture
6	TMR Sensor	Position detection or water level detection	54140	Ultra-low power consumption at 1.5 uA; longevity of up to 20 billion operations	IP67 rated; 17 Gauss sensitivity
	NTC	Measures water/liquid temperature	USP12755	Customized probes and assemblies to meet individual customer requirements	Wide range of requirements for customer-specific applications; various precision levels available
	Reed Sensor	Magnetic level or position detection	Reed switch PCB, customized	Highly reliable; long operational life	Simple mechanical design; capable of switching in high humidity environments; custom design available
7	Reed Switch	Magnetic position detection for door lock	HA-15	Durable; no power required for operation	Can be used in harsh environments; high current switching

Custom magnetic sensors

Sensor modeling

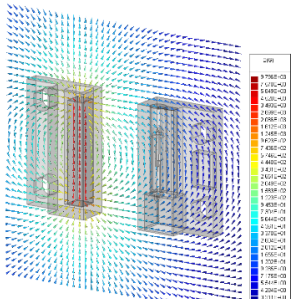
- Reduce cost and increase reliability
- Tolerance variation analysis
- Rapid prototyping with 3D printing

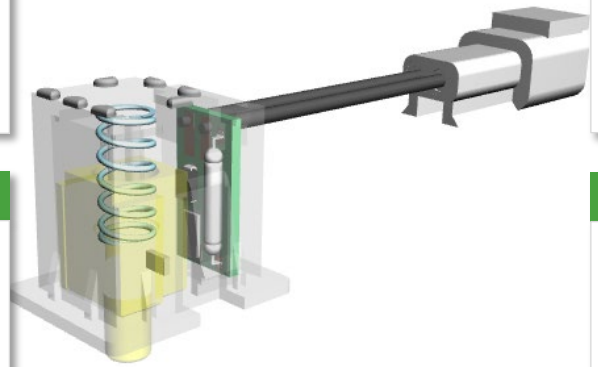
Encapsulation and sealing

- Transfer and low-pressure overmold
- Epoxy or urethane
- Meter or mix dispensing
- Ultrasonic welding or heat staking

Sensor effect assembly

- Automated, cellular, and manual
- Custom reed switch forming
- Integral magnets within sensors





Circuit board assembly

- Vision systems
- SMD pick-and-place automation
- In-circuit test

Terminations

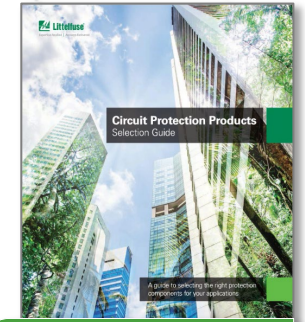
- Injection or insert molding
- Automated cut, strip, and crimp
- Connector type flexibility

Performance and reliability test

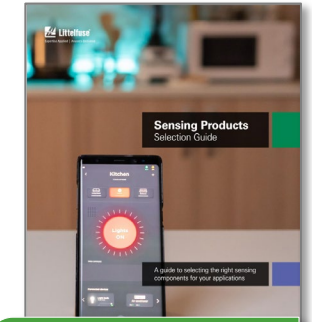
- Validation testing
- 100% automatic end-line testing
- Actuation and contact resistance
- Long-term reliability testing

Additional information can be found on Littelfuse.com

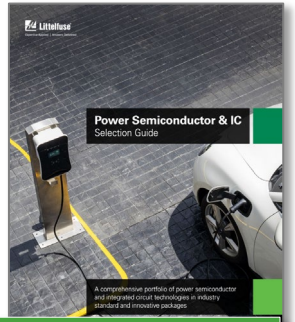
Explore the world of Littelfuse with the electronics eCatalogs (ecatalogs.littelfuse.com)



Circuit Protection Selection Guide



Sensor Selection Guide



Power Semiconductor Catalog

Fuseology Selection Guide

C&K Switches Selection Guide

Click on images for more information

ESD Protection Design Guide

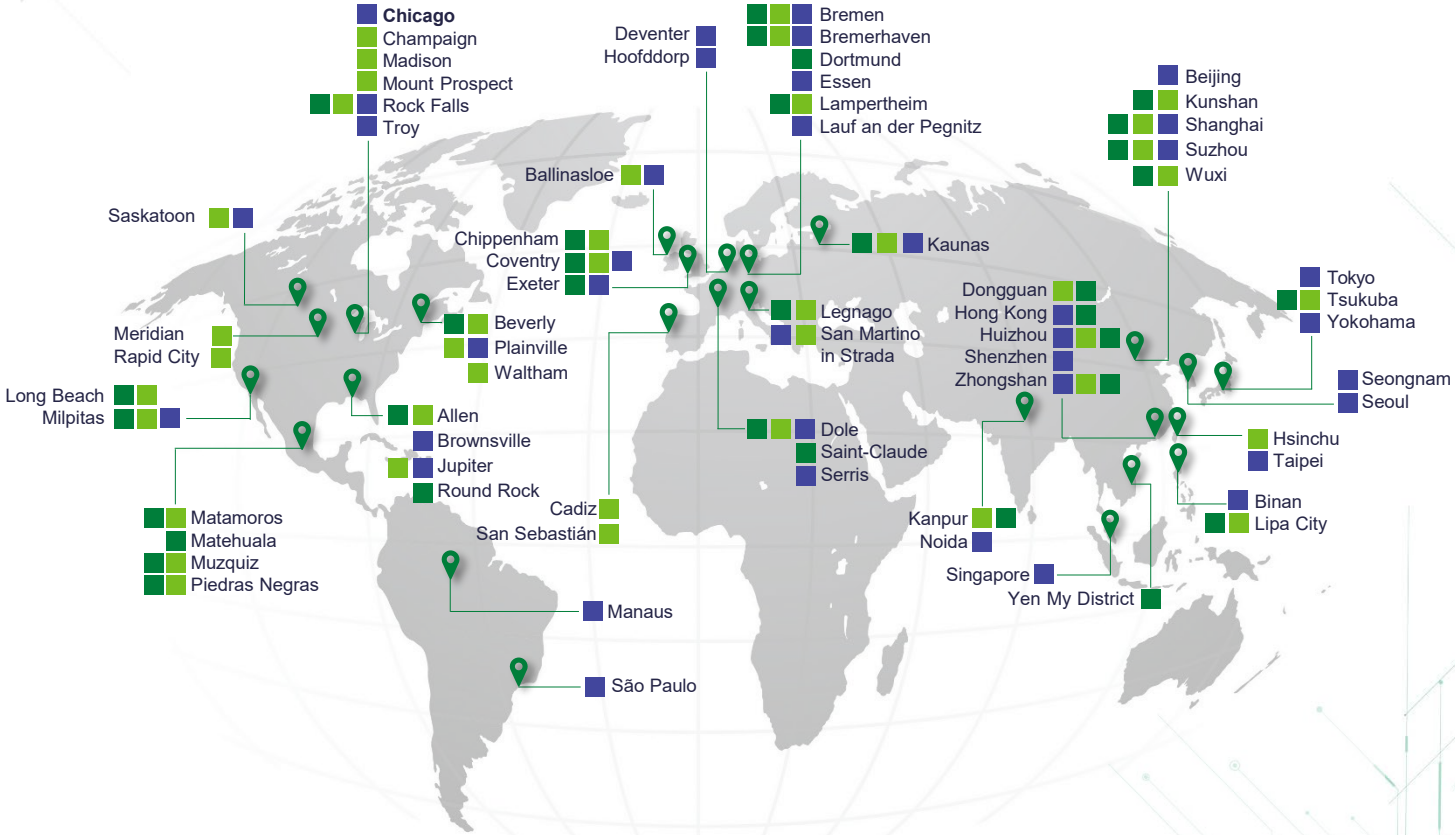
ESD Suppression Design Guide

Small Appliances Spotlight Presentation

Scan the code to learn more!

Littelfuse
Expertise Applied | Answers Delivered

Local resources supporting our global customers



Legend

- ***Sales***
- ***R&D***
- ***Manufacturing***

Littelfuse

Expertise Applied | Answers Delivered

Partner for tomorrow’s electronic systems

Broad Product Portfolio

We are an industrial technology manufacturing company empowering a sustainable, connected, safer world.

Testing Capabilities

We help customers get products to market faster, and we offer certification testing to global regulatory standards.

Application Expertise

Our engineers partner directly with customers to help accelerate product design and meet their unique needs.

Compliance and Regulatory

We help customers in the design process to account for requirements set by global regulatory authorities.

Global Customer Service

Our global customer service team is with you to anticipate your needs and ensure a seamless experience.

Global Manufacturing

Our high-volume manufacturing is committed to the highest quality standards.

Littelfuse
Expertise Applied | Answers Delivered

Littelfuse.com