



Expertise Applied | Answers Delivered

GFCI/AFCI Receptacles & Breakers



Building Solutions

Users must independently evaluate the suitability of, and test each product selected for their own specific applications. It is the user's sole responsibility to determine fitness or use of a particular system based on their own performance criteria, conditions, specific application, compatibility with other parts, and environmental conditions. Users must independently provide appropriate design and operating safeguards to minimize any risks associated with their applications and products. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at [littelfuse.com/disclaimer-electronics](https://www.littelfuse.com/disclaimer-electronics).

Smart buildings and homes are equipped with intelligent technologies that make lives more convenient and energy efficient



Littelfuse offers protect, control, and sense technologies to improve the safety, reliability, and energy efficiency of buildings.

GFCI/AFCI outlets and breakers market overview

Market trends

GFCI/AFCI outlet:

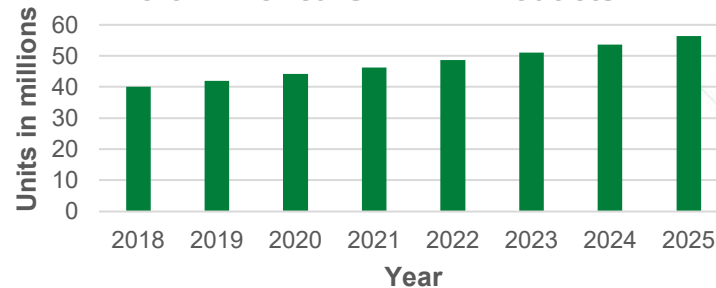
- Mature market growing at a CAGR of ~5%.
- GFCI/AFCI wall receptacles almost exclusively used only in NA, ~60 M units/year
- Other regions have residual current detector or RSD in breaker distribution panel
- Manufacturers evaluating combined GFCI and AFCI in one product

GFCI/AFCI breaker:

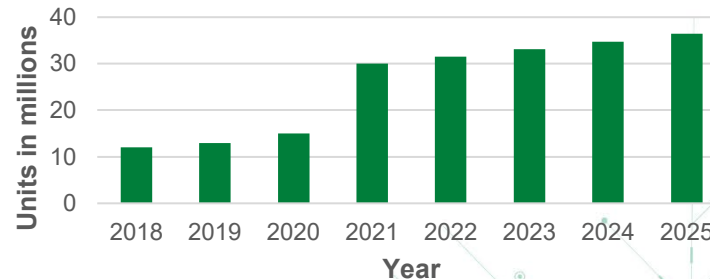
- NEC2023 code requiring more GFCI and AFCI protection in homes is driving step function growth
- New home builds outfitted with protection at breaker level
- Growth will continue as more states adopt NEC2023 code

GFCI/AFCI outlets and breakers market

North America GFCI/AFCI outlets



North America GFCI/AFCI breakers

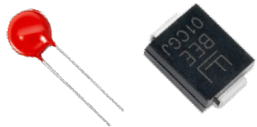


Littelfuse solutions for GFCI/AFCI receptacle and breaker

1

Input protection

MOV, TVS Diode



2

Trip circuit

SCR



GFCI/AFCI
Receptacle

3

Input protection

MOV, TVS Diode



4

Trip circuit

SCR



Breaker

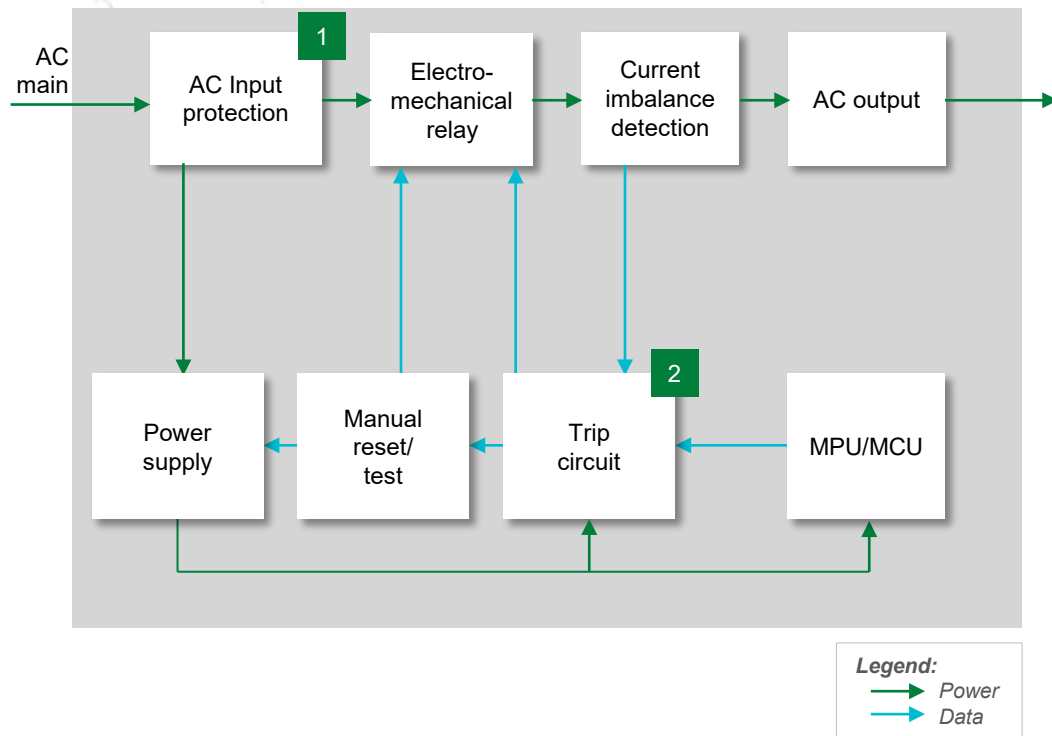
Functions:

- **GFCI outlet**, ground fault circuit interrupter, is a circuit breaker which shuts off internal circuit breaker when it senses an imbalance between outgoing and incoming circuit. The main purpose is to protect people from electrical shock. The US National Electric Code defines when required.
- **AFCI outlet**, arc fault circuit interrupter, is a circuit breaker that detects electrical arcs and protects against electrical fires. In the US over 40,000 fires are attributed to home electric wiring which resulted in 350 deaths and 14,000 injuries each year according to US Product Safety Commission.
- **Conventional circuit breakers** only respond to overloads and short circuits.



Click on the product series in the table below for more info

GFCI/AFCI receptacle architecture



	Technology	Product series
1	MOV	UltraMOV , Xtreme
	TVS Diode	SMCJ
2	SCR	SJxx08xSx/SJxx08xx , NYC222



GFCI/AFCI receptacle

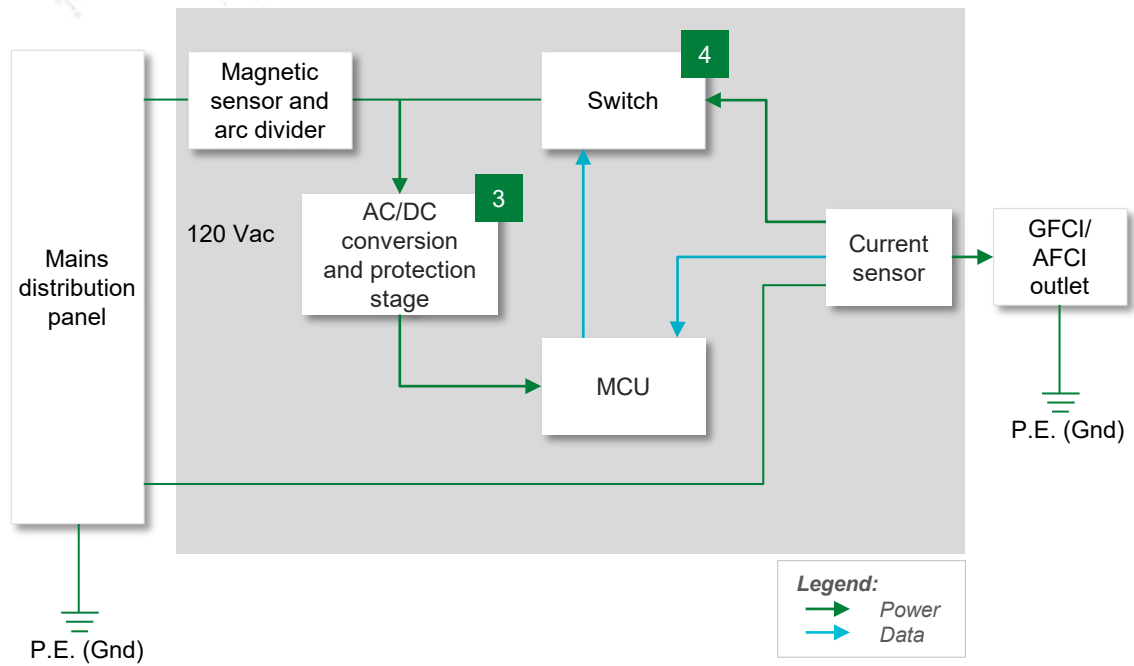


Click on the product series in the table below for more info

Benefits of Littelfuse products in GFCI/AFCI receptacle

	Technology	Function in application	Product series	Benefits	Features
1	MOV	Protects power unit from voltage surges such as lighting, transients	UltraMOV , Xtreme	Reduces customer qualification time by complying with third party safety standards such as UL/IEC	High peak surge current rating up to 10 kA, High operating temperature range up to 125° C
	TVS diode	Protects sensitive electronic components from voltage transients	SMCJ	Improves system reliability by protecting downstream components from transients on power lines	1500 W peak pulse capability, compatible with lead-free solder reflow temperature profile
2	SCR	Triggers electro-mechanical relay to disengage electrical contacts during fault	SJxx08xSx / SJxx08xx , NYC222	Allows for efficient and compact design due to simple control circuit and quick turn on	Up to 600 V capability, high surge capability up to 100 A

Block diagram of GFCI/AFCI breaker



	Technology	Product series
3	MOV	UltraMOV
	TVS Diode	1KSMB
4	SCR	Sx02xS_EV





Click on the product series in the table below for more info

Benefits of Littelfuse products in GFCI/AFCI breaker

	Technology	Function in application	Series	Benefits	Features
3	MOV	Protects power unit from voltage surges such as lighting, transients	UltraMOV	Reduces customer qualification time by complying with third party safety standards such as UL/IEC	High peak surge current rating up to 10 kA, High operating temperature range up to 125 °C
	TVS Diode	Protects sensitive electronic components from voltage transients	1KSMB	Improves system reliability by protecting downstream components from transients on power lines	Low profile package; excellent clamping capability; fast response time; excellent clamping capability
4	SCR	Triggers electro-mechanical relay to disengage electrical contacts during fault	Sx02xS EV	Allows for efficient and compact design due to simple control circuit and quick turn on	Surge capability > 15 Amps; blocking voltage (V_{DRM}/V_{RRM}) capability—up to 600 V; high dv/dt noise immunity; improved turn-off time (T_q) < 35 μ sec

Standards and compliances

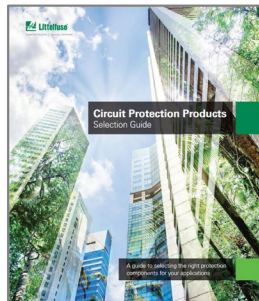
Standard	Title	General scope	Region
UL 943	Standard for Safety for GFCI	Class A, single and three-phase GFCI intended for personnel protection	North America
IEC 61008	RCCB without integral overcurrent protection for household	Protection against safety hazard (RCCB rated <440 V, 125 A)	Global
UL 1699	Standard for Safety for Arc-Fault Circuit-Interrupters	Covers AFCIs maximum rating of 20 A and are intended for use in 120 Vac, 60 Hz circuits. Cord AFCIs are rated up to 30 A	North America
IEC 62606	General requirements for arc fault detection devices	applies to arc fault detection devices (AFDD) for household and similar uses in AC circuits	Global
IEC 61000-4-2	Testing – Electrostatic Discharge (ESD)	Checks capability of the equipment to survive repetitive electrical fast transients and bursts	Global
IEC 61000-4-4	Electrical fast transient/burst immunity test	Evaluating the immunity of equipment when subjected to electrical fast transient/bursts on supply, signal, control, and earth ports	Global
IEC 61000-4-5	Fast Transient Surge Test	Evaluate the immunity of equipment when subjected to surges	Global

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

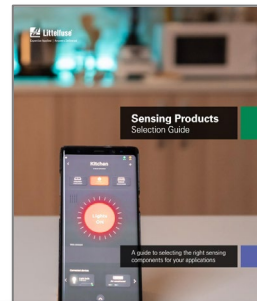
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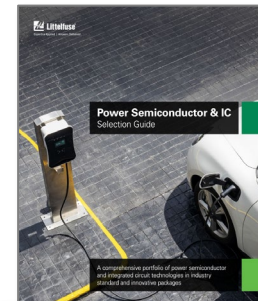
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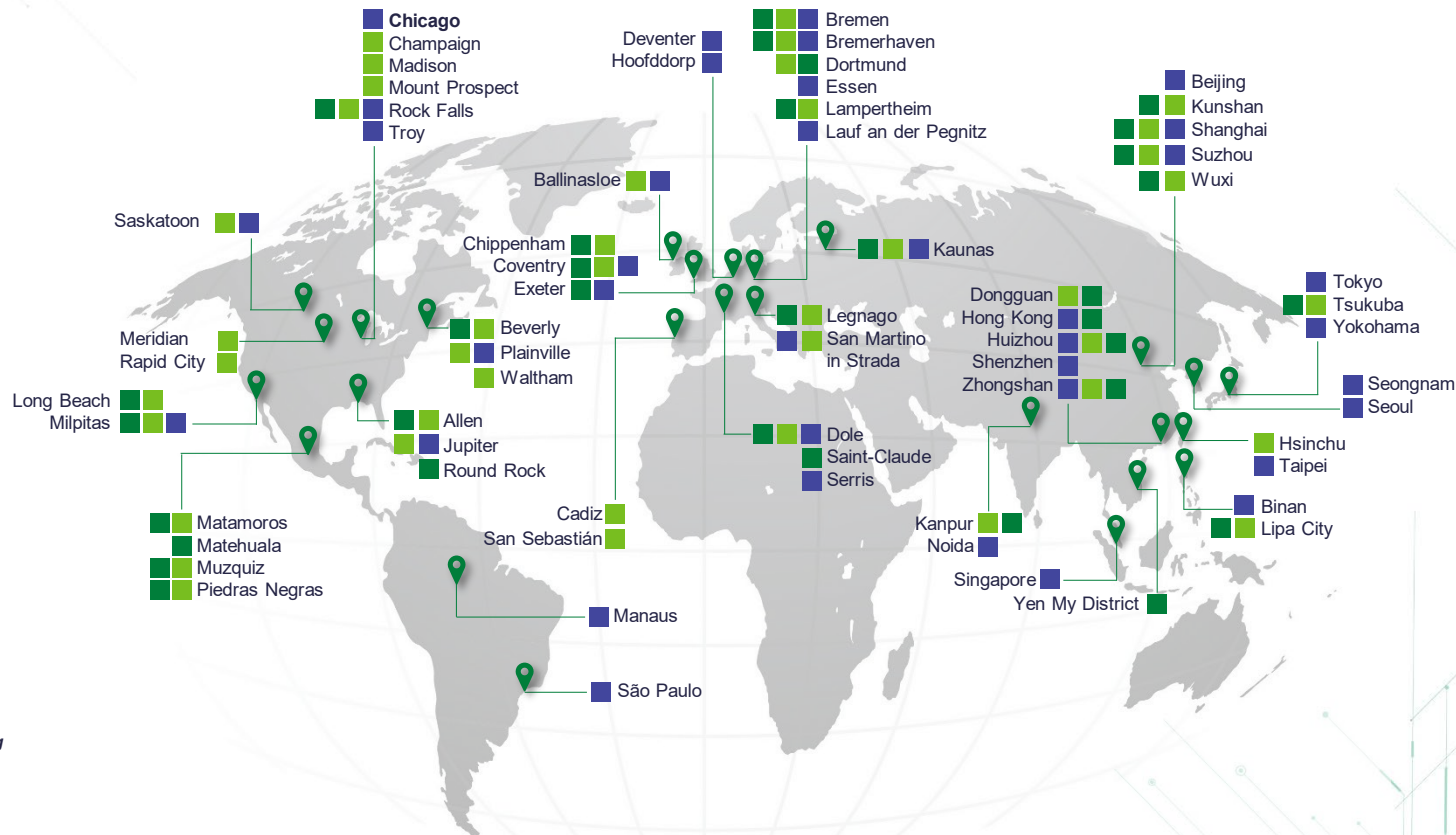
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