# electronics component symbol and function Study Guide

electronics component symbol and function

Understanding the symbols and functions of electronic components is fundamental for anyone involved in electronics design, repair, or education. The electronics component symbol and function provide a standardized visual language that allows engineers and technicians to interpret circuit diagrams accurately. These symbols not only streamline communication but also facilitate troubleshooting and circuit analysis. In this comprehensive guide, we will explore the most common electronic component symbols, their functions, and how they are represented in circuit diagrams, helping both beginners and experienced professionals deepen their understanding of electronics.

Overview of Electronics Components and Their Symbols

Electronic components serve as the building blocks of circuits, each with specific functions and corresponding symbols. Recognizing these symbols is essential for reading schematics and designing electronic devices.

Why Are Symbols Important?

- Standardization: Ensures everyone interprets circuit diagrams consistently.
- Simplification: Condenses complex components into simple visual representations.
- Efficiency: Speeds up circuit design, troubleshooting, and documentation processes.
- Compatibility: Facilitates communication across different teams and industries.

Basic Electronic Components: Symbols and Functions

Resistors

Function: Resistors limit current flow and divide voltages within circuits.

Symbol:

- Fixed Resistor: A zigzag line or a rectangle.
- Variable Resistor (Potentiometer): An arrow across a resistor symbol indicating adjustability.

Key Points:

- Resistors are measured in ohms (?).
- Used for current limiting, voltage division, and biasing active devices.

Capacitors

Function: Store electrical energy temporarily, filter signals, or block DC while passing AC.

Symbol:

- Two parallel lines, with one line often curved for polarized capacitors.
- Polarized capacitors (electrolytic) have symbols indicating polarity.

Key Points:

- Capacitance measured in farads (F).
- Used in filtering, timing, coupling, and decoupling applications.

Inductors

Function: Store energy in a magnetic field, filter signals, and manage AC currents.

Symbol:

- A series of loops or a coil symbol.

Key Points:

- Inductance measured in henrys (H).
- Utilized in filters, transformers, and energy storage.

Diodes

Function: Allow current to flow in one direction only, acting as a one-way valve.

Symbol:

- A triangle pointing to a line.
- Variants include LEDs, Zener diodes, and Schottky diodes.

Key Points:

- Used for rectification, voltage regulation, signal demodulation, and light emission.

Transistors

Function: Amplify signals or switch electronic signals on and off.

Types & Symbols:

- Bipolar Junction Transistor (BJT): With symbols indicating NPN or PNP types.
- Field-Effect Transistor (FET): Symbols include N-channel or P-channel types.

Key Points:

- Transistors are the core of amplification and digital switching.
- Marked with a combination of arrows and terminals (collector, base, emitter).

Switches

Function: Open or close a circuit, controlling current flow.

Symbol:

- Break in a line with a movable contact.
- Variants include SPST (single-pole single-throw), SPDT, DPST, etc.

Key Points:

- Used for manual control or automation in circuits.

Power Sources

Function: Provide electrical energy to circuits.

Symbols:

- Battery: Multiple cells in series.
- DC Power Supply: A line with a positive (+) and negative (-) terminal.

Key Points:

- Power sources are crucial for circuit operation.

Advanced and Specialized Components

Integrated Circuits (ICs)

Function: Contain multiple electronic components integrated into a single package for complex functions like amplification, computation, or regulation.

Symbol:

- A rectangle with pins numbered around the perimeter.
- Functional block diagrams inside the rectangle for specific IC functions.

Key Points:

- Used extensively in modern electronics.
- Symbols vary widely based on the IC type.

Relays

Function: Electrically operated switches that control circuits with a low-power signal.

Symbol:

- Coil symbol with contacts (normally open or normally closed).

Key Points:

- Enable circuit isolation and switching high voltages or currents.

Sensors

Function: Detect physical phenomena (light, temperature, pressure) and convert them into electrical signals.

Symbols:

- Vary depending on sensor type; often represented as a box with specific annotations.

Key Points:

- Essential in automation and measurement systems.

Recognizing Symbols in Circuit Diagrams

Understanding how symbols translate into physical components is vital. Here are tips for effective recognition:

- Color Coding: Some diagrams use colors or annotations for clarity, especially in complex schematics.
- Pinouts: Review component datasheets for pin configurations and symbols.
- Standardization: Use internationally recognized symbols (e.g., IEEE, IEC standards).

Practical Applications of Symbols and Functions

Designing Circuits

- Accurate symbol recognition ensures correct component placement.
- Understanding functions aids in selecting appropriate components.

Troubleshooting

- Recognize symbols to locate faulty components.
- Interpret circuit behavior based on component functions.

Educational Purposes

- Learning symbols enhances comprehension of circuit operation.
- Facilitates diagram reading and circuit analysis.

Conclusion

Mastering the electronics component symbol and function is fundamental for anyone engaged in electronics. From resistors and capacitors to transistors and integrated circuits, each symbol represents a vital function within electronic systems. Recognizing these symbols enables efficient circuit design, effective troubleshooting, and clear communication among engineers and technicians. As technology advances, the set of symbols continues to evolve, reflecting new components and innovations. Building a solid understanding of these symbols and their functions lays the foundation for success in electronics projects, education, and professional engineering.

Additional Resources

- IEC and IEEE Standards for electronic symbols.
- Component datasheets for detailed symbol and pinout information.
- Circuit simulation tools like SPICE for virtual testing of circuits.
- Educational websites and tutorials on electronics schematics.

By familiarizing yourself with the universal symbols and their functions, you are better equipped to interpret and create professional electronic circuit diagrams, paving the way for innovation and problem-solving in electronics.

Electronics Component Symbol and Function: An In-Depth Exploration

In the realm of electrical engineering and electronics design, understanding the symbols used to represent various components is fundamental. These symbols serve as visual shorthand, enabling engineers, technicians, and students to interpret circuit diagrams efficiently and accurately. The study of electronics component symbol and function is not merely an exercise in memorization but a critical foundation for designing, troubleshooting, and innovating in electronic systems.

This comprehensive review delves into the history, standardization, types, and functions of electronic component symbols, emphasizing their significance in modern electronics. We will explore the symbolic representations of passive components, active devices, and complex systems, illustrating how these symbols encapsulate the essence of their physical counterparts.

## The Importance of Standardized Symbols in Electronics

In electronic schematics, symbols are the universal language that transcends linguistic and regional barriers. Standardized symbols ensure clear communication among engineers and technicians worldwide, reducing errors and confusion during the design, fabrication, and maintenance of electronic systems.

Historical Evolution

The development of standardized symbols dates back to the early 20th century, influenced by the need for clear documentation during the rapid expansion of electrical technology. Organizations like the International Electrotechnical Commission (IEC), the Institute of Electrical and Electronics Engineers (IEEE), and the American National Standards Institute (ANSI) have established guidelines that promote uniformity.

Advantages of Standardization

- Clarity and Readability: Simplifies complex circuits, making them easier to interpret.
- Efficiency: Accelerates the design process and troubleshooting.
- Universal Understanding: Facilitates collaboration across borders and disciplines.
- Documentation and Maintenance: Ensures consistency in manuals and repair guides.

## Categories of Electronic Component Symbols

Electronic components can be broadly categorized into:

- Passive Components: Resistors, capacitors, inductors, transformers.
- Active Components: Diodes, transistors, integrated circuits.
- Electromechanical Components: Switches, relays, connectors.
- Sensors and Transducers: Temperature sensors, photodiodes, microphones.

Each category has specific symbols that encapsulate their structural and functional attributes.

## Symbols and Functions of Common Passive Components

Passive components are fundamental elements that do not require external power to operate but influence the flow of current and voltage within a circuit.

## Resistors

Symbol:

The resistor symbol is a zigzag line (IEC standard) or a rectangular box (ANSI standard).

Function:

- Limiting current flow.
- Dividing voltages.
- Dissipating power as heat.
- Setting bias points in circuits.

Example:

A resistor with a resistance of 1k? is represented by a zigzag line labeled "1k?."

## Capacitors

Symbol:

- Non-polarized capacitor: Two parallel lines, one straight and one curved (IEC).
- Polarized capacitor (electrolytic): Two parallel lines with a '+' sign indicating polarity.

Function:

- Storing electrical energy temporarily.
- Filtering signals.
- Coupling and decoupling AC signals.
- Timing applications.

Types:

- Ceramic capacitors.

- Electrolytic capacitors.
- Film capacitors.

### Inductors

Symbol:

A series of loops or a coil symbol.

Function:

- Opposing changes in current.
- Filtering signals.
- Energy storage in magnetic fields.

## Active Component Symbols and Their Functions

Active components can control the flow of electricity and require power to operate. Their symbols often reflect their internal structure and operation.

### Diodes

Symbol:

An arrow pointing in the forward conduction direction, with a bar representing the barrier.

Function:

- Allow current flow in one direction.
- Rectification (AC to DC conversion).
- Signal demodulation.
- Protection against voltage spikes.

Variants:

- Zener diodes (voltage regulation).
- Light-emitting diodes (LEDs).
- Schottky diodes.

## Transistors

Symbol:

- Bipolar Junction Transistor (BJT): Three terminals (Base, Collector, Emitter) with arrows indicating current direction.
- Field-Effect Transistor (FET): Similar, with a different symbol indicating gate terminal.

Function:

- Amplification.
- Switching.
- Signal modulation.

Types:

- NPN and PNP BJTs.
- N-channel and P-channel FETs.

## Integrated Circuits (ICs)

Symbol:

A rectangle with multiple connecting pins, sometimes schematic symbols for specific functions (e.g., op-amps).

Function:

- Complex processing.
- Signal amplification.
- Logic operations.
- Microcontroller functions.

# Specialized and Complex Symbols

Beyond the basic components, modern electronics employ symbols for specialized devices and complex modules.

## Transformers

Symbol:

Two inductors coupled via a core, often shown as two coils with a magnetic core.

Function:

- Voltage step-up or step-down.
- Impedance matching.
- Isolation.

## Switches and Relays

Symbol:

- Single-pole, single-throw (SPST): a break in the line with a switch symbol.
- Multiple positions: SPDT, DPDT configurations.

Function:

- Opening or closing circuits.
- Automating control.

## Connectors and Terminals

Symbol:

Lines or dots representing connection points.

Function:

- Physical electrical connections.
- Interfacing different modules.

# Interpreting and Using Symbols in Circuit Design

Understanding electronics component symbol and function enables engineers to:

- Design accurate schematics.
- Troubleshoot faulty circuits effectively.
- Communicate ideas clearly.
- Ensure compliance with standards.

Best Practices:

- Always refer to the latest IEC or ANSI standards.
- Use clear, unambiguous symbols.
- Label components with values and identifiers.
- Cross-reference symbols with component datasheets.

## Future Trends and developments in Component Symbols

As electronics evolve, so do the symbols used to represent components:

- Miniaturization and integration have led to more complex symbols for System-on-Chip (SoC) modules.
- Emerging components like MEMS sensors and nanotechnology devices are prompting updates to symbolic standards.
- Digital representation: Software tools now include dynamic symbols that reflect real-time operational states.

Standardization bodies continue to adapt, ensuring symbols remain intuitive and comprehensive for future technological advances.

## Conclusion

The study of electronics component symbol and function is a cornerstone of electrical engineering literacy. From simple resistors to complex integrated circuits, symbols distill intricate physical structures into universally recognizable diagrams, fostering efficient communication and innovation. Mastery of these symbols is essential for anyone involved in designing, analyzing, or repairing electronic systems.

As technology advances, so will the symbolic language, but the core principles of clarity, standardization, and functional representation will remain vital. Continuous education and

adherence to evolving standards ensure that electronic schematics will continue to serve as reliable blueprints for the world's electronic innovations.

QuestionAnswer What is the purpose of using symbols for electronic components? Electronic component symbols provide a standardized way to represent components in circuit diagrams, making it easier to understand, design, and troubleshoot electronic circuits. How can I differentiate between a resistor and a capacitor symbol in a circuit diagram? A resistor symbol is typically a zigzag or rectangular line, while a capacitor symbol consists of two parallel lines (one curved for polarized capacitors) representing its storage of electric charge. What does the diode symbol represent and what is its function? The diode symbol shows an arrow pointing in the direction of current flow, and its function is to allow current to flow in one direction while blocking it in the opposite direction. Why are ground symbols important in electronic schematics? Ground symbols indicate a common reference point for voltages within the circuit, ensuring proper operation and safety by providing a return path for current. What is the function of the transistor symbol in a circuit diagram? The transistor symbol represents a semiconductor device used to amplify or switch electronic signals, with different symbols for NPN and PNP types. How are inductors represented in circuit symbols and what is their function? Inductors are depicted as a series of curved lines or a coil symbol, and they store energy in a magnetic field when current flows through them, used for filtering and tuning applications. What does an LED symbol look like and what is its primary function? An LED symbol is a diode with arrows pointing outward, indicating light emission, and its primary function is to emit visible light when current flows through it. How do integrated circuit (IC) symbols differ from discrete components? IC symbols are represented as rectangles with multiple connections or pins, indicating complex functionality within a single package, unlike simple discrete component symbols. Why is it important to understand the function of each component symbol in electronics? Understanding component symbols allows engineers and technicians to accurately read schematics, troubleshoot circuits effectively, and design functioning electronic systems.

**Related keywords:** resistor symbol, capacitor symbol, inductor symbol, diode symbol, transistor symbol, integrated circuit symbol, LED symbol, switch symbol, relay symbol, circuit diagram

## Rcd Circuit Symbol

### RCD Circuit Symbol

An understanding of electrical symbols is essential for anyone working with electrical circuits, whether professionally or as a hobbyist. One of the most critical symbols in electrical safety and circuit design is the RCD circuit symbol. RCD, which stands for Residual Current Device, is a safety device designed to prevent electric shocks and protect wiring from damage caused by leakage

currents. Recognizing the RCD circuit symbol is vital for reading electrical diagrams, ensuring proper installation, maintenance, and troubleshooting.

## What is an RCD?

Before delving into the symbol itself, it?s important to understand what an RCD does. A Residual Current Device detects imbalances between live and neutral conductors in an electrical circuit. If a leakage current exceeds a predetermined threshold?typically 30 milliamps?the RCD disconnects the circuit almost instantly, thus preventing potential electric shocks and reducing fire risks. RCDs are commonly used in residential, commercial, and industrial settings, especially in areas where electrical safety is paramount, such as bathrooms and outdoor installations.

## Understanding the RCD Circuit Symbol

### Basic Appearance of the RCD Circuit Symbol

The RCD circuit symbol is a standardized graphical representation used in electrical diagrams. It visually indicates the presence of an RCD device within a circuit. The symbol usually resembles a modified circuit breaker with specific markings to denote its residual current detection feature.

Typically, the symbol comprises:

- A rectangle or a box representing the device
- A toggle or switch symbol indicating the manual control
- An arrow or a special mark indicating residual current detection

In most schematic diagrams, the RCD symbol is simplified for clarity but adheres to international standards such as IEC 60417 or IEEE standards.

### Common RCD Circuit Symbols

While variations exist depending on regional standards or diagram conventions, the most common RCD circuit symbols include:

- **Standard RCD symbol:** A rectangle with a curved or straight line indicating the device, often with a test button symbol (a small circle or a 'T' inside)
- **RCD with test button:** The symbol includes a small circle or square labeled 'T' or 'Test' to denote the test button for checking device functionality
- **RCBO (Residual Current Breaker with Overcurrent):** A combination symbol indicating both

residual current and overcurrent protection, often integrated with the RCD symbol

## Standardized RCD Circuit Symbols According to International Standards

International standards help ensure consistency across electrical diagrams globally. The most widely recognized standards include IEC 60417 and IEEE standards, which provide detailed symbols for various electrical components, including RCDs.

### IEC 60417 RCD Symbol

Under IEC 60417, the RCD symbol is identified as symbol number 5019. It generally features:

- A rectangle representing the device
- A switch symbol within the rectangle
- The designation ?R? or ?Residual? to emphasize its function

The symbol may also include a test button symbol, such as a small circle, to denote the manual testing feature.

### IEEE Standard Symbols for RCDs

IEEE standards provide similar symbols, often with slight variations, emphasizing clarity and ease of understanding in complex diagrams.

## How to Recognize the RCD Circuit Symbol in Diagrams

Being able to identify the RCD circuit symbol quickly is vital for circuit comprehension and troubleshooting. Here are some tips:

- Look for a rectangle or box with a switch symbol inside
- Check for the presence of a test button indicator (small circle or 'T')
- Notice the labeling, such as 'RCD,' 'RC,' or residual current markings
- Observe the connection points: RCDs are connected in series with the live and neutral conductors

## Applications of the RCD Circuit Symbol in Electrical Diagrams

The RCD circuit symbol appears in various contexts, including:

- **Residential Wiring:** Protecting household circuits, especially in bathrooms, kitchens, and outdoor outlets
- **Commercial Installations:** Ensuring safety in office buildings and public spaces
- **Industrial Settings:** Protecting machinery and personnel from electrical faults
- **Generator and Panel Diagrams:** Indicating residual current protection in power distribution panels

Using this symbol correctly ensures that safety devices are properly documented and understood.

## Designing Circuits with RCD Symbols

When designing electrical diagrams, proper placement and representation of RCDs are crucial. Considerations include:

- Positioning of the RCD in the circuit for optimal safety
- Marking the test button location
- Indicating the rated residual current (e.g., 30mA, 100mA)
- Including appropriate labels for clarity

Using standardized symbols guarantees that anyone reading the diagram can quickly identify the safety features incorporated.

## Benefits of Recognizing and Using the RCD Circuit Symbol

Understanding the RCD circuit symbol offers several advantages:

- Facilitates accurate interpretation of electrical diagrams
- Ensures proper installation and maintenance of safety devices
- Helps in troubleshooting electrical faults efficiently
- Promotes compliance with safety standards and regulations
- Enhances communication among electricians, engineers, and inspectors

## Conclusion

The **RCD circuit symbol** is a fundamental element in electrical schematics, representing the Residual Current Device crucial for electrical safety. Recognizing this symbol allows professionals and enthusiasts to interpret diagrams accurately, ensuring proper installation, operation, and safety compliance. Whether in residential, commercial, or industrial settings, understanding the standard symbols related to RCDs enhances safety measures and promotes best practices in electrical

design and maintenance. Always refer to regional standards such as IEC 60417 or IEEE for precise symbol representations to maintain consistency and clarity in your electrical diagrams.

RCD Circuit Symbol: An In-Depth Exploration of Safety and Standardization

Introduction

**RCD circuit symbol** is a fundamental component in electrical diagrams, serving as a visual cue for a device that plays a crucial role in protecting individuals from electric shocks and preventing electrical fires. As electrical systems become increasingly complex and safety standards more stringent, understanding the significance and representation of RCDs (Residual Current Devices) in circuit diagrams is vital for engineers, electricians, and safety inspectors alike. This article delves into the intricacies of the RCD circuit symbol?its meaning, standardization, variations, and practical applications?offering a comprehensive guide for readers seeking to deepen their knowledge of electrical safety symbols.

Understanding the RCD and Its Importance

What is an RCD?

An RCD, or Residual Current Device, is a safety device designed to prevent fatal electric shocks and reduce the risk of electrical fires caused by leakage currents. It continuously monitors the current flowing through live and neutral wires; if it detects an imbalance?indicating a leakage to ground or a person?the device swiftly disconnects the power supply, typically within milliseconds.

Why is the RCD Critical?

- Human Safety: Protects individuals from severe electric shocks that can occur through faulty appliances, damaged wiring, or accidental contact.
- Fire Prevention: Detects leakage currents that could ignite flammable materials, preventing potential fires.
- Regulatory Compliance: Many electrical safety standards worldwide mandate the use of RCDs in residential, commercial, and industrial installations.

The Significance of Circuit Symbols in Electrical Diagrams

Standardization in Symbols

Circuit diagrams serve as universal languages for engineers and electricians. The clarity and consistency of symbols ensure that anyone reading the diagram can accurately interpret the

components and their functions, regardless of language barriers or technical expertise.

Role of the RCD Circuit Symbol

The RCD circuit symbol visually communicates the presence of residual current protection within a system. It allows for quick identification during installation, inspection, troubleshooting, or maintenance, ensuring safety features are correctly implemented and functioning.

The RCD Circuit Symbol: Design and Variations

The Standard Symbol

The typical symbol for an RCD in electrical diagrams is a combination of standardized graphical elements, often adhering to international standards such as IEC (International Electrotechnical Commission) or BS (British Standards). Its core features include:

- A rectangle or a box representing the device.
- A test button symbol, often depicted as a small circle or a triangle within or near the rectangle.
- Connection lines indicating the live, neutral, and possibly earth connections.
- An internal arrow or line indicating the residual current detection mechanism.

Variations Across Standards

Different standards and regions may adopt slight variations in the symbol:

- IEC Standard: The symbol often includes a rectangle with a diagonal or a specific internal marking, sometimes accompanied by a test button symbol.
- British Standards (BS): The symbol may resemble a rectangle with a curved line or a specific "RCD" notation.
- ANSI/NEC (North American): The symbol may differ, often represented by a circle with an "R" or "RC" notation or specific device symbols.

Key Elements of the RCD Symbol

- Detection Mechanism Indicator: A small internal arrow or symbol indicating residual current detection.
- Test Button: Often represented as a small circle or a "T" within the device symbol, emphasizing the presence of a test function.

- Connection Lines: Show how the device is wired within the circuit, including live, neutral, and ground connections.

Interpreting the RCD Circuit Symbol in Practice

Reading Circuit Diagrams

When electricians or engineers encounter the RCD symbol within schematics:

- They recognize the device's location within the electrical system.
- Understand its purpose?residual current protection.
- Identify the connections for proper installation or troubleshooting.

Practical Implications

- Ensuring that the symbol correctly indicates the device's type and function.
- Verifying that the symbol matches the actual installed device.
- Checking for additional features like test buttons, surge protection, or combination devices.

Practical Applications and Safety Considerations

Installation Guidelines

- RCDs should be installed in appropriate circuits, especially in areas with increased risk like bathrooms, kitchens, and outdoor outlets.
- Proper wiring according to the symbol ensures correct operation and safety.

Testing and Maintenance

- The test button symbol indicates the device's test function.
- Regular testing (using the button) verifies the device's operation.
- Visual inspection of the symbol in diagrams helps in scheduled maintenance routines.

Troubleshooting Using Symbols

- Recognizing the RCD symbol aids in quick diagnosis.

- If an RCD trips frequently, the symbol helps identify its location within the circuit for inspection.

Standards and Future Trends

International Standards

Organizations like IEC, BS, and NEC have established guidelines for the RCD symbol to maintain consistency globally. Adhering to these standards ensures safety and interoperability across regions.

Emerging Technologies

- Smart RCDs: Integration with home automation systems may introduce new symbols or annotations.
- Digital Schematics: As electrical diagrams become more digital, symbols may evolve but retain core recognizable features.

Conclusion

**RCD circuit symbol** serves as a vital visual cue within electrical diagrams, encapsulating complex safety functions into a standardized graphical form. Its clear understanding enables professionals to design, install, inspect, and maintain electrical systems that prioritize safety and compliance. As electrical systems continue to advance, the importance of consistent, clear, and universally recognized symbols like the RCD continues to grow, safeguarding lives and property worldwide. Whether you're an aspiring electrician, a seasoned engineer, or a safety inspector, mastering the RCD circuit symbol is an essential step toward ensuring electrical safety in every project.

QuestionAnswer What does the RCD circuit symbol represent in electrical diagrams? The RCD circuit symbol represents a Residual Current Device, which is a safety device designed to prevent electric shocks and protect against earth faults by disconnecting the circuit when imbalance is detected. How can I identify the RCD symbol in a circuit diagram? The RCD symbol typically looks like a rectangle with a test button inside, often marked with 'T' or a circle with a line through it, and may include labels such as 'RCD' or 'RCBO' to indicate its function. Why is understanding the RCD circuit symbol important for electrical safety? Knowing the RCD symbol helps electricians and engineers quickly identify safety devices in a circuit, ensuring proper installation, maintenance, and troubleshooting to prevent electric shocks and fire hazards. Are there different variations of the RCD circuit symbol used in different standards? Yes, different electrical standards and regions may use slight variations of the RCD symbol, but the core design?a rectangle with a test button or a specific marking?remains consistent for easy recognition. Can the RCD circuit symbol be used to identify different types of residual current devices? While the basic symbol indicates an RCD, specific

symbols or annotations may differentiate types such as RCBOs (Residual Current Breaker with Overcurrent protection) or RCCBs (Residual Current Circuit Breakers), depending on the diagram standards.

**Related keywords:** residual current device symbol, RCD symbol, RCD diagram, residual current circuit symbol, RCD icon, residual current device diagram, electrical safety symbol, RCD representation, residual current protection symbol, circuit breaker symbol

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