GLOSSARY OF TERMS

ITW Switches

GLOSSARY OF TERMS

A comprehensive list of key words used in the electronics industry.

Active Area (contact): Electrical junction comprising a multitude of contact a- spots through which electrical current passes from one connector component to the other.

Actuation Force: The force required to change a switch actuator from one position to another. Measured exactly when switch changes state. Torque for rotary products.

Actuator: A movable part of a switch which causes a change in the electrical configuration of the switch. e.g. : Toggle, Rocker, Slider, Paddle, Pushbuttons, Shaft

Actuation: Operating or releasing a switch by depressing or releasing its actuator or rotating its shaft.

Air Gap: The minimum distance between separated mating contacts in their fully open position.

Alternate Action: Push to close and push to open the switch. A given circuit condition remains after removal of actuating force. Also known as "push-push switching action". Typically, alternate action pushbuttons do not visually indicate the position of the contacts. Contrast to latching action.

AC: Alternating current; electric current that continually reverses direction at a fixed frequency (see VAC).

Alloy: A metal created by combining two or more metals to obtain a specific physical property

Ambient: Surrounding operating conditions external to the switch. This includes physical atmosphere, as well as the form and nature of applied electrical and mechanical loads.

American Wire Gauge: A standard system used for designating the size of electrical conductors. Abbreviated AWG. Based on specified ranges of circular mil area. American Gauge numbers have an inverse relationship to size.

Ampere (A): A unit of electrical current.

Antistatic Switch: An antistatic device will withstand a specified potential without conducting between the actuator and any conducting element. Usually the terminals or bushing. Unit of measure : typical value 8-20 kilovolts DC.

ANSI: American National Standard Institute; a standard-setting agency of the United States which approves the design and/or performances of electronic/electrical components distributed in the world market.

Arc: Gaseous electrical discharge between separated contacts of a switch, involving a stream of electrons, metal vapors and ions.

Arcing: The flow of electric current between switch contacts during opening or closing of the contacts. This current flow can be damaging to the contacts of a switch.

AWG: A standard system used for designating the size of electrical conductors. Abbreviated AWG. Based on specified ranges of circular mil area. American Gauge numbers have an inverse relationship to size.

Bezel Mount: Switch mounting method from the front of the panel that has an attractive portion of the switch exposed on the front panel.

Blade: The moveable component of the switch used to complete the electrical circuit. (See Figure 1)

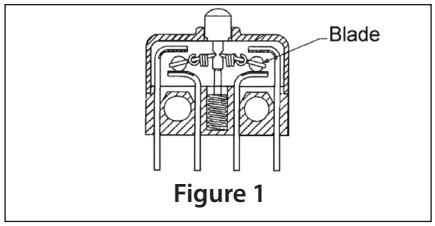


Figure 1

Bifurcated Contact: A wiping movable contact consisting of spring fingers that grip the fixed contact. Typically found in slide switches. Self-cleaning action. See Wiping Contact.

Boot: A rubber part used to protect a switch from water or dust. Usually found between the button of a switch and the case inside of the switch. An external boot can be placed over a button or toggle lever to protect the switch from water or dust.

Bounce: Rebounding of moving contact from the fixed contact during contact transfer (during switch operation).

Brass: An alloy of zinc and copper

Break: An interruption in a circuit. Denotes the number of pairs of separated contacts the switch introduces into each circuit it opens.

Break Before Make: The moving contacts of a double throw switch interrupts one circuit before completing another circuit.

Butt Contact: A contact mechanism in which the movable contact makes contact with the stationary contact without wiping motion between the surfaces. Typical of toggle and pushbutton switches.

Bus Bars: Rigid conductors serving as a connection for two or more circuits.

Butterfly: The snap-action mechanism in a switch composed of the spring guide, two switch blades and extension spring: a double break mechanism.

Cadmium Oxide: A compound added to silver to make it more able to resist welding.

Capacity: Usually refers to the current handling capability of a switch.

Capacitive load: A load in which the initial current on making (closing) of the contacts is higher than the steady state current. Current leads voltage in capacitive loads. See Resistive Load, Inductive Load, Power Factor, Inrush.

Carrying current: The maximum current that can be passed through the already closed contacts of a switch. Contrast with "Contact Rating".

CE: The CE mark is a symbol that indicates a product complies with the "essential requirements" of the European laws. It indicates conformity to the legal requirements of the European Union (EU) Directive with respect to safety, health, environmental, and consumer protection.

Chatter: Rapid opening and closing of contacts, usually exhibited during extreme vibration and/or shock.

Clearance (spacing): Distance through air between electrically live parts of opposite polarity or to ground.

Conductive Rubber: Elastomer filled with carbon or metallic particles which render the material electrically conductive.

Contact: The component of the switch that disengages to cause the actual circuit interruption.

Contacts: Switch element, which directly provide make-break operation (circuit interruption).

Contact bounce (Bounce): The time during switching in which electrical instability (bounce) caused by the rebound of the contacts is observed. Relative mass of the contacts, forces and frequency of supporting members are all components that determine the extent of bounce. Total transfer time consists of the time for the contacts to close plus bounce. Transfer time should be rapid so natural bounce time is short.

Contact Configuration: Poles, throws, and sequence designated by alpha characters.

Contact Gap: The distance that separates two contacts when the circuit is open.

Contact Pressure: The amount of force holding the movable and stationary contacts together. While this should be termed Contact Force, by convention in the United States, it is called Contact Pressure.

Contact Force: The force that the movable contact in a switch exerts on the fixed terminal.

Contact rating (Switching rating): The capacity to switch (connect or interrupt) an electrical load. Load characteristic (resistive, inductive, capacitive, power factor). Contrast with non-switching rating.

GLOSSARY OF TERMS

Contact Resistance (CR): Resistance, measured in milliohms, of an electrical circuit caused by the contacts.

Contact Wipe: Sliding of one contact on another during actuation of switch.

Creepage: The unwanted flow of electrical current from one conductive part to another.

CSA (Canadian Standards Agency): A testing and safety certification agency.

Current-Carrying Capacity: Specified maximum current which can flow through the switch contacts. Determined by contacts size, shape, material and the force with which they are pressed together.

Current Rating: The nominal or name plate current capacity of a device. The maximum current rating, listed by UL, is the current that can be carried continuously without causing the temperature of the switch terminals to rise more than 30 C above the ambient temperature.

Cycle: The complete program of operations required to return switch to the same condition that existed at the beginning of the cycle.

Cyclic: A grip used to control the left/right or forward/ backward movement of an aircraft.

D-Flat: A flat edge on one side of a cylinder for orientation and anti-rotation.

Dead Break: Open circuit condition, usually caused when actuating a switch slowly. Dead break results from low contact pressure, contact lift off or friction in the switch mechanism.

Detent: A mechanism intended to hold actuator and contacts in a fixed position after the actuation force is removed or reduced to less than a specified value. Can also be referred to as tactile feel or feedback as it also identifies actuator position by means of tactile feel.

Dielectric: Non-conductive material, electrical isolation.

Dielectric Breakdown: Rupture of insulating material when the electric stress exceeds the dielectric strength of the material (Voltage Breakdown).

Dielectric Strength: A specific voltage that a switch can withstand without leakage current between insulated conductors before it starts to conduct electricity. Most often applies to insulator between switch terminals and metal exposed to operator of the switch.

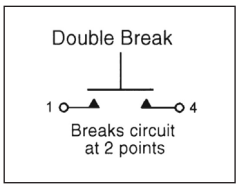
Differential Travel: Distance the button travels between actuation and reset point.

Direct Current (DC): Type of electrical current having constant polarity, generally associated with electricity from a battery.

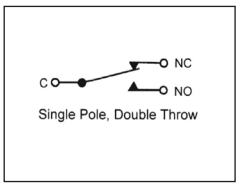
DIP: Dual-in-line package refers to a component with two rows of PC terminals. The terminals most commonly have pitch of 0.100 and located at 0.30 across the package.

Double D: Flat edges on two sides of a cylinder used for orientation and anti-rotation.

Double Break: A contact mechanism using two sets of contacts to make or break a given circuit. The contact gap opens twice as fast, reducing the arc duration, contact surface temperature and material erosion. This improves heat dissipation and provides better power handling capacity for a longer switch life. Typical of high-power industrial switches and DC Circuit application.
See Single-Break Contacts. Please refer to the ITW Switches Characteristics/Circuits for more detail.



Double Throw: Contact arrangement that allows current to flow from the common terminal to a normally closed terminal and then to a normally open terminal. Please refer to the ITW Switches Characteristics/Circuits for more detail.



DPDT (Double Pole Double Throw) Switch Configuration: Double pole means two independent circuits are actuated by the button. Double throw means the common terminal of each circuit (pole) can transfer current to a normally closed terminal and then alternately to a normally open terminal.

DPST (Double Pole Single Throw) Switch Configuration: Double pole means two independent circuits are actuated by the button. Single throw means each circuit only has two terminals and only operates as an on/off switch.

Dusttight: Sealed switch that will withstand sand and dust environments per MIL-PRF-8805 Design 2.

Dome: Dome-shaped metal elastomer switch component used as tactile element/return spring.

Dry Circuit: Low power level or Logic circuit. Power levels do not cause arcing, melting or softening of contacts. Typically requires gold plated contacts for reliable switch operation. At such low levels, and since no arc occurs, silver contacts would not be self-cleaned and would be less reliable.

DWV (Dielectric Withstanding Voltage): The maximum voltage that can be applied to an insulator or switch before it will break down and begin to conduct electricity.

Electrical Life: Life of a switch (number of operations) under a specified combination of electrical load, actuation, environment, and criterion of failure.

Electrical Load: The amount of electricity that is applied to the switch or the circuit.

EMC: Electro-Magnetic Compatibility.

EMI: Electro-Magnetic Interference.

Environmentally Sealed Switch: A switch that is sealed to protect the internal contacts from the external environment.

Erosion (Contact): The transfer or vaporization of contact material resulting from the arc due to breaking or opening the circuit.

ESD: Electrostatic discharge, the static charge that is built up that can amount to several thousand volts. Can destroy electronic components.

Fixed Contact (Stationary Contact): The non-moving contact. Typically, integral to the end of the terminal inside the switch body.

Flash Plating: Plating thickness of 10 micro inches (0.00001) or less, typically done with gold plate.

Flux: Chemical used for cleaning metal surfaces for welding. Fluxes turn contaminated metal surfaces into clean, solderable part.

Form / Switch Form:
Please refer to the ITW Switches Characteristics/Circuits for more detail.

Form A: A single pole, single throw, normally open contact or SPST NO.

Form B: A single pole, single throw, normally closed contact or SPST NC.

Form C: A single pole, double throw contact or SPDT.

Form Z: A two circuit double break switch such as a Single Pole Double Throw Double Break switch.

GLOSSARY OF TERMS

Force (Contact): The force, holding closed contact together.

Free Position: The position of the button or toggle of a switch in its normal position. The free position is usually measured from the center of the mounting holes to the top of the button on a basic switch or from the top of the button to a reference point on a pushbutton switch.

Gap: The shortest straight-line distance between two separate contacts.

Gated: Restricted movement in XY axis only.

Gold Flash: A plating of gold typically less than 10 micro-inches (millionths) thick. Used only as a barrier to oxidation or corrosion of terminals to maintain solderability.

Ground: Used to indicate a negative side or ground side of a battery or electrical supply (ac or dc).

Hall Effect Sensor: An electronic device that changes state (voltage output) when exposed to a magnetic field.

Header: The part of a switch that groups terminals or wires together to allow entry or exit.

Heat Rise: An indirect measurement of a contact resistance used by rating agencies. The temperature rise of a contact carrying a prescribed current is measured to determine acceptable limit.

Hermetic: An environmental seal specification grade that requires no air, gas or liquid will leak into, or out of, the switch.

Housing: A three-dimensional enclosure, a container for a switch.

Hz: Unit of measure of frequency. Reciprocal of time period: 1 Hz= 1/sec

Inrush Current: Current that drawn by electrical motor during start-up transitioning or by a lamp filament during heating to its operating resistance.

IC (Integrated Circuit): An electrical circuit composed of many components etched on a semiconductor chip.

IEC: International Electrotechnical Commission

IECQ: IEC's Quality Assessment system for Electronic Components, created in 1983 to facilitate national and international trade in certified electronic components. A worldwide certification system which provides a method whereby electronic components made and handled by approved manufacturers and distributors can be used anywhere without further testing.

Immersion Proof: A switch or product able to withstand submersion in water to a depth of 3 feet or more for 30 minutes without leaking.

Inductive Load: A load in which the initial current on making (closing) of the contacts is lower than steady state and rises slowly. On breaking (opening) of the contacts, the current is greater than steady state. The stored energy of the inductor provokes a long and severe arcing time. Current lags voltage in inductive loads. Motors are the most common inductive load. Inductive loads are the most troublesome of circuit conditions. See Resistive Load. Capacitive Load.

Inrush: The initial transitory high-level of current at contact closing (making). A characteristic of capacitive and some resistive loads. The inrush currents can be large and long enough to cause severe degradation of the contacts. See Resistive Load. Capacitive Load. Power Factor.

High Inrush: A brief pulse of very high electrical current, much greater than the design load, that occurs when the electrical load is initially applied to the circuit.

Insert Mold: In switches used to refer to terminations that are placed in the mold so that plastic is molded around the terminations. The chief benefit is an inherent seal against the intrusion of flux into the body of the device. Therefore, no epoxy terminal seal is required.

Insulation Resistance: The electrical resistance between two normally insulated parts; measured at a specific high potential (1000 Vrms). Typical value for switches is 1 G.

IP (Ingress Protection): Numbers used to rate the environmental seal of an enclosure.

IP64: IP rating indicating that the item is resistant to dust and protected against splashing water.

IP65: IP rating indicating that the item is resistant to dust and protected against water projected by a 6.3 mm nozzle against enclosure for 3 minutes at 100 liters per minute of 100 kN/m^2 at distance of 3 meter.

IP67: IP rating indicating means the item is resistant to dust can be placed into a body of water up to a meter deep for 30 minutes.

IP68: IP rating indicating that the product is resistant to dust and sealed against continuous immersion under 1 meter of water for a minimum of 30 minutes, not operated.

IP69K: IP rating indicating the product is protected against for high-pressure, high-temperature wash-down applications. Such enclosures must not only be resistant to dust, but it must also be able to withstand high-pressure and steam cleaning.

Lamp Load: A type of electrical load imposed using incandescent light bulbs.

Latching Action: See alternate action (or push-push). Actuator position typically indicates contact position.

Leakage Barrier: A ridge or web molded into a switch housing between terminals or contacts to increase the surface distance between them.

Leakage Resistance: Dielectric strength

LED (Light Emitting Diode): A solid state device that is capable of emitting light.

Lever Actuator: A lever that is attached to a basic switch to allow actuation of the switch from a place other than its button.

Lever Lock: A part of the toggle on a switch that keeps the toggle lever from being moved accidentally. Its spring detent requires an outward pull on the toggle lever to operate the switch.

Life Electrical: The life of a switch, controlling a specified electrical load.

Life Mechanical: The number of cycles of operation that a switch will perform with no voltage applied to the contacts.

Limit Switch: A type of switch used to determine the position of a moving component that activates it.

Lockout Collar: Part of the switch bushing that prevents the toggle lever from being moved accidentally. There are many styles to allow for the desired operating features of the switch.

Logic Level: An electrical load that simulates a computer input circuit, typically 5 volts at 10 milliamps or less.

Low Level: A very small load; 30 millivolts at 10 milliamps.

Maintained: A position of a switch which remains unchanged when actuation force is removed from switch actuator. Contrast with Momentary.

Make: Indicates that a switch has completed the dynamics of closing an electrical circuit.

Make & Break Contacts: Contacts that make/break current flow. They are differentiated from those that operate principally in a sliding mode.

GLOSSARY OF TERMS

Make Before Break: The moving contacts of a double throw switch complete one circuit before interrupting another circuit.

Moistureproof: A seal rating of a switch. Moistureproof seals withstand high humidity and limited exposure to water or liquid spray.

Momentary Action: Switch that requires the operator to hold the button or lever in the operating position. The button or toggle will return to the free position (rest position) when it is let go.

Movable Contact: The contact moved by the switch actuator into and away from contact with a fixed contact thus forming the electrical circuits possible for a given device.

Non-shorting contacts: Break-before-make.

Non-Switching Rating: The power carrying capacity of a switch after contact closure and end of contact bounce. Typically, far higher than the contact rating (switching rating) of a switch.

Normally Closed: A term used to describe contacts which establish a circuit when in the normal position.

Normally Open: A term used to describe contacts which interrupt the circuit when in their normal position.

Motor Load: A switch load that simulates an electric motor, it usually specifies an in-rush current seven times the running current.

Movement Differential: The distance the button moves from the operate point to the release point (hysteresis).

Normally Closed (NC): A normally closed circuit allows electricity to flow through when the switch is in its free position; it prevents the electrical flow when actuated.

Normally Open (NO): A normally open circuit prevents the flow of electricity to flow through the circuit in its free position; it allows the electrical flow when it is actuated.

Null Hysteresis: The measure of output after release from deflected position; usually only used in transducers.

Null Output: Voltage output of a device at rest, usually measured in transducers.

OEM: Original Equipment Manufacturer.

O-Ring: The rubberised sealing washer supplied with the switch.

Open Frame: Typical to slide switches; open frame construction allows for automatic solder process and post solder cleaning. Contrast with "washable".

Operate Force: The amount of force it takes to make the toggle or button operate the switch, measured immediately before the switch operates.

Operating Point: The position of the button or toggle of a switch when the switch operates. The operating point is usually measured from the top of the button to the center of the mounting holes in basic switches or from the free position of the button in pushbutton switches.

Operating Temperature: The range of temperature within which the device may be used.

Overtravel: The distance the actuator may move between initial electrical contact position and the extreme mechanical position of the actuator. See Travel, Pretravel.

Panel Seal: Sealed against the panel by way of o-ring or sealing washer preventing the ingress of dirt, dust or moisture based on the IP rating stated.

Passive Components: Components which have no gain characteristics, such as capacitors and resistors.

PCB: Printed circuit board.

Pretravel: Distance the switch button or toggle travels from the free position until it reaches the operating point.

Pitch: The spacing between centers of adjacent leads/terminals.

Pole: The number of completely separate circuits that can pass through the switch at one time.

Push-On / Push-Off: See Alternate Action.

QPL (Qualified Products List): A government report that lists which companies are approved to make a particular product for military use.

Quick-Connect Terminal: Flat tab or blade style terminals designed to accept push-on female wire connectors (instead of soldering). The most popular sizes are: 0.250". 0.187". 0.110" wide.

Rating: See contact rating

Release Force: The force that is applied to the button or toggle when the switch contacts return to their unoperated position.

Resistance (Electrical): Ability of the element, component, conductor or a system to obstruct current flow.

Resistance (Insulation): Resistance of electrical isolator between two electrodes, defined by Ohms Law as result of division of the applied voltage and measured current. Not to be confused with dielectric strength.

Resistivity (Specific Resistance): property of material that impedes electrical current when a sample of specified unit dimensions is considered.

Resistive Load: An electrical load in which the current instantly rises to its steady state when applied and instantly drops to zero when discontinued.

Shorting Contacts: Make-before-break. Referred to rotaries and slides.

Sliding Contact: Contacts that make or interrupt current flow by means of tangential motion (rotary, slip ring).

Slow Make-Slow Break: Purposely designed switch mechanism ("see–saw" type) with relatively slow operation to provide a slight time delay, permitting the ac wave to go through its zero-energy level (natural current zero duration is 8.35 msec).

Shroud: A wall or housing that surrounds a switch, button or toggle to protect the switch from accidental operation.

Single Throw: A switch configuration using a common and only one other contact.

Single Break: A switch mechanism with one fixed terminal and one moving terminal that interrupts the flow of electricity at only one place. Please refer to the ITW Switches Characteristics/Circuits for more detail.

Snap Action: The abrupt opening or closing of contacts from one position to another. Snap-action switches operate relatively independent of the speed of the button or actuator.

SPDT (Single Pole Double Throw) Switch Configuration: A single circuit or switch with one common terminal that is capable of switching electricity between two other terminals or circuits. Please refer to the ITW Switches Characteristics/Circuits for more detail.

Splashproof: A seal rating for a switch that will withstand high humidity and limited exposure to water or liquid spray.

GLOSSARY OF TERMS

SPST (Single Pole Single Throw) Switch Configuration: A single circuit or switch with one common terminal that is only capable of switching between one other terminal for on/off operation of the circuit. Please refer to the ITW Switches Characteristics/Circuits for more detail.

Spring Return: See Momentary.

Storage Temperature: The range of temperature within which the device may be stored. Typically, this is a wider range than operating temperature.

Subminiature: A switch that is smaller than 25mm (1 inch) long.

Sub-subminiature: A switch that is smaller than 12.5mm (½ inch) long

Surface Mounting (SMT): A method of soldering packages directly onto the surface of printed-circuit boards without insertion of the leads through hole in the board.

Switch Abbreviations: SPST: Single-pole single-throw; SPDT: Single-pole double-throw; DPST: Double-pole single-throw; DPDT: Double-pole double-throw. (See also Forms). Please refer to the ITW Switches Characteristics/Circuits for more detail

Tactile Feedback: The feel of increased or decreased force transmitted through the button or toggle of a switch when actuated. The snap feel of a switch.

Terminal: The metal portion of a switch, exterior to the body, that is used to connect the switch to an electrical circuit. Example: PC, wire lug, quick-connect, wirewrap, etc. Please refer to the ITW Switches Characteristics/Circuits for more detail.

Throw: Denotes the number of different circuits that each individual pole can control.

Translucent: Transmitting light so that objects lying beyond cannot be seen distinctly.

Transparent: Transmitting light so that objects lying beyond can be seen distinctly.

Total Travel: The distance that a button or actuator of a switch travels from the rest or un-operated position until the button stops after actuation.

Transducer: A device that converts a mechanical input into an electrical output.

Travel: The distance that a switch button moves between events like operate point, reset point or other point of interest when operating the switch.

Trim Switch: A switch used to provide 2 or 4-way actuation - often up/down or up down/right left control.

Trip Point: The position of the button or toggle of a switch when the switch operates.

Truth Tables: The output code or connection sequence from a thumbwheel switch.

Two Circuit: Refer to Form Z. Includes single pole, double throw and double break configurations.

UL (Underwriters Laboratories): A testing and safety certification agency for consumer products.

VAC: Voltage, alternating current (see AC)

VDC: Voltage, direct current (see DC)

VDE: Verdband Dentscher Electrotechniker Germany's equivalent to USA Underwriters' Laboratories.

Voltage Drop: Change in voltage that results from a current passing through a device. For switches Voltage drop is typically referred as Contact drop DV.

Washable: Applied to PC board mounted devices indicating compatibility with cleaning processes used after soldering. No degradation of electrical or mechanical parameters occurs. A switch is sealed to keep contaminants out of the contact area.

Watertight: A seal rating that indicates that water cannot get in when the item is submerged in 3 feet of water.

Wiping Action: The travel of the moveable contact over the fixed contact as the switch operates. This action helps clean the contacts of contamination.

Wave Soldering: A method of soldering in which a wave of molten solder contacts the components on the PCB as the PC Board with the components is passed over a solder bath

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ITW Switches

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