## *AC Output, Wall Plug-in and Dual Cord, Class 2 Transformer*

# A

**Absolute Maximum Ratings** - Specifications that, if exceeded, could cause permanent damage to the converter. These are not continuous ratings, and proper operation is not implied.

**Adaptor** - External Power Supply desktop or wall plug-in linear unregulated or regulated.

**Aging** - operating a converter under con trolled conditions for a predetermined time in order to screen out failures. Also see Burn-in.

**Ambient Temperature** - The room temperature, or effective temperature of the environment in which the power apply is operating.

**Auto-Parallel or automatic parallel operation** - A parallel connection of the outputs of two or more supplies used for obtaining a current output greater than that obtainable from one supply.

**Auto-Series or automatic series operation** - A series connection of the outputs of two or more power supplies used for obtaining a voltage greater than that obtainable from one supply.

# B

**Basic Insulation** - According to internal safety standards (eg. UL60950, EN60950)basic insulation provides basic protection against electric shock.

**Battery Backup** - Subsystem for electronic equipment that provides power in the vent of inout power loss.

**Breakdown Voltage** - The maximum AC or DC Voltage which may be applied from input to output and/or chasis of a power supply without causing damage.

**Burn-in** - Operation of manufactured converted for some period of time prior to shipment. The intent is to stabilize the converter and eliminate infant mortality by aging the device.

# C

**CFM** - Cubic feet per minute, which is a measure of the volume of air flowing in a system.

**Canadian Standards Association (CSA)** - Independent organization that establishes and tests safety standards for electronic components and systems for the Canadian marketplace.

**Case** - See Enclosure.

**Case Temperature** - Temperature of the case when the converter and surrounding system are operating normally. Often used as a specification for converters with extended temperature ranges. Case temperature is at times referred to as Base Plate Temperature.

**Common** - Conductive path used as a return for two or more circuits. Common is used interchangeably with ground, which is not technically correct unless it is connected to earth. Also see Ground.

**Common Mode Noise** - Noise component that is common to both the converter out put and return lines with respect to the input ground.

**Conducted EMI** - Also called radio frequency interface (RFI) EMI is unwanted high-frequency energy caused by the power transformer rectifiers, in adaptors. That portion that is present on the input and output lines is known as Conducted EMI. Most Conducted EMI measurements are done between 150KHz and 30MHz.

**Conduction Cooled** - Cooling a converter via a solid material. Cools a power converter by adding a heat sink or attaching a module to the system chasis or thermal conductive plastic enclosure.

**Constant Current Power Supply** - A regulated power supply which acts to keep its output current constant in spit of changes in load, line, or temperature. Thus, for a change in load resistance, the output current remains constant to a first approximation, while the output voltage changes by whatever amount necessary to accomplish this.

**Constant Voltage Power Supply** - A regulated power supply which acts to keep its output voltage constant in spit of changes in load, line, or temperature. Thus, for a change in load resistance, the output voltage of this type of supply remains constant to a first approximation, while the output voltage changes by what ever amount necessary to accomplish this.

**Constant Voltage/Constant Current (CV/CC) with automatic crossover** - A power supply which acts as a constant voltage source for comparatively large values of load resistnce and as a constant current source for comparatively small values of load resistance. The automatic crossover or transition between these two modes of operation occurs at a “critical” or “crossover” value of load resistance.

**Constant Voltage/Current Limiting (CV/CL) with automatic crossover** - The same as CV/CC operation except for a slightly poorer regulation characteristic for low values of load resistance, i.e., in the”constant current” region of operation.

**Convection Cooled** - Cooling of converter via the movement of air over the surface of its heat dissipating components. “Free-air convection” means that the natural movement of air(unassisted by fan or blower) is sufficient to maintain a converter within specified operating limits.

**Cross Regulation** - For a multiple output converter, the change in voltage on one output (expressed as a percent) caused by a load change on another output.

**Crowbar** - Circuit that crowbars or rapidly shuts down a converters output if a preset voltage level is exceeded. The circuit places a low resistant shunt across the output when an overvoltage condition exists.

**Current Limiting** - Feature that protects the converter (or load) from damage under overload conditions. The maximum converter output current is automatically limited to a predetermined, safe value. If the converter is specified for auto restart, normal operation is automatically restored when overload condition is restored.

**Current Limit Knee** - On a plot of output voltage vs current, the point at which current begins to limit (or foldback).

# D

**Derating** - The specified reduction in an operating parameter to improve reliability. Generally for power supplies, it is the reduction in output power at elevated temperatures.

**Dielectric** - Material used to prevent two points in an electrical circuit from becoming conductively connected. Sometimes called a dielectric barrier.

**Dielectric Withstand Voltage** - Maximum voltage an insulating material can withstand before breaking down(suffering punch through or arcing).
Also see Break Down Voltage and High Potential Test.

**Differential Mode Noise** - Noise component measured between two points with respect to a common point (minus common mode noise).

**Drift** - Change in the output voltage of a converter over a specified period of time. All other operating parameters(load, line, etc.) are assumed to be held constant. Often specified as starting after a warm-up period.

**Dynamic Load** - Output Load that changes Rapidly. Normally Specified as both a load change value and a rate of change.

**Dynamic Response** - Output overshoot that occurs when the converter output load is turned on/off or abruptly changed. This overshoot gives the high frequency output impedance of the converter.
Also see Output impedance.

## E

**Efficiency** - Ratio of total output to input power expressed as a percentage. Efficiency is normally measured at full rated output power and nominal input line conditions.

**Electromagnetic Interference (EMI)** - Noise generated by a converter(typically by the noise generators action of the adaptor.) Usually specified as meeting agency limits for conducted EMI(noise reflected back at the power bus) or radiated EMI(noise emitted into the area surrounding a converter).

**Electrostatic Discharge (ESD)** - Current produced by two objects having a static charge when they are brought close enough to produce an arc or discharge.

**Electrostatic Shield** - See Faraday Shield

**EMI Filter** - Filter placed at the input to a converter that minimizes the effect of EMI on the converter and the associated system.

**Enclosure** - Case or container used to package in small plastic or metal cases that protect the internal components from the outside environment and also improve thermal and noise performance.

**Equivalent Series Inductance (ESL)** - Inductance in series with an "ideal" capacitor. Sources include leads, terminals, electrodes etc.

**Equivalent Series Resistance (ESR)** - Resistance in series with an :ideal" capacitor. Sources include lead resistance, terminal losses, etc. An important specification for high frequency applications

## F

**Failure Mode** - Reason for which a converter either does not meet or stops meeting its specified parameters.

**Faraday Shield** - Electrostatic shied that reduces coupling capacitance in transformers. The shield, which effectively reduces output common mode noise, is placed between the primary and secondary wingdings of a transformer. Fault Mode Current- Input Current drawn by a converter when the output is shorted.

**Federal Communications Commission (FCC)** - US government agence that sets standards for, and governs the testing of conducted and radiated emissions. These are system level standards, but they are typically used in specifying converters.

**Floating Output** - Converter output that is ungrounded and not referenced to another output. Typically, floating outputs are fully isolated and may be referenced positive or negative by the user. Outputs that are not floating share a common return and as such, are referenced to one another.

**Foldback Current Limiting** - Converter Protection Technique. The circuit is protected under overload conditions by reducing the output current as the load approaches short circuit. This minimizes internal power dissipation under short circuit conditions.

**Forced Air Cooling** - Use of a fan (or other air moving equipment) within a (sub) system to move air across heat producing components in order to reduce ambient temperature. Also called forced convection.

**Free Convection** - Operating environment where the natural movement of air (assisted by fans or blowers) maintains the power module within its operating limits. Also called natural convection.

**Front End** - A particular type of AC DC Converter( usually high power) used in Distributed Power Architecture (DPA) systems that provide the DC voltage that is bussed around the system. The bussed voltage is usually +24 VDC or 48 VDC.

**Full Load** - Maximum value of output load specified for converter under continuous operating conditions.

## G

**Ground** - Electrical connection that is made to earth(or to some conductor that is connected to earth). A convertor common is not usually ground unless somehow connected to earth.
Also see common

**Ground Loop** - Condition Caused when two or more ground system components share a common electrical ground line. A feedback loop is unintentionally induces, causing unwanted voltage levels.

## H

**Heat Sink** - Metal Plate, extrusion, case, etc. used to transfer heat away from sensitive components and or circuits.

**High Line** - Maximum value of input line voltage specified for normal converter operation.

**Hi-Pot Test** - High Potential Test. A test to determine of the breakdown voltage of a transformer or power supply exceeds the minimum requirement. It s performed by applying a high voltage between the two isolated test points.

**Hold-Up Time** - The time during which a power supplies output voltage remains within specification following the loss of input power.

**Hot Plug-In** - A common requirement in distributed power systems wherein the power board must be capable of being connected/disconnected from the power bus without damage. Power board components must be protected against the resultant high inrush currents.

## I

**Input Current** - Current drawn from the input power bus by a converter when operating under nominal conditions.

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**Input Line Filter** - Low-pass or Band-reject filter on the converter input(internal or external) that attenuates noise introduced into the converter from the power bus.

**Input Transient** - Spike or step change in the input to the converter. Input transient protection circuits are used to shield sensitive components(such as the semi conductor switch)from possible damage due to transients.

**Input Voltage Range** - Minimum and maximum input voltage limits within which a converter operates to specifications.

**Inrush Current** - Maximum, instantaneous input current drawn by a converter turn on. Also called input Surge Current.

**Inrush Current Limiting** - Protection circuit that limits the current a covert draws at turn on.

**Insulation** - Non-conductive material used to protect and separate electronic components or circuits.

**Insulation Resistance** - Resistance offered by an insulating material to current flow

**International Power Dissipation** - Power dissipated (as heat) within the converted during normal operations. Primarily a function of the power handling capability and efficiency of the converter. Internal power dissipation is normally given as a maximum specification that cannot be exceeded without risking damage to the converter.

**International Electrotechnical Commission (IEC)** - Organization based in Switzerland that sets standards for electronic products and components. IEC does not conduct any testing; however, their standards have been adopted by many of the national safety/standards agencies.

**Isolation** - Electrical separation between the input and output of a converter. Normally determined by transformer characteristics and component spacing.

**Isolation Voltage** - Maximum voltage (AC or DC) that can be continuously applied between isolated circuits without a break down occurring. On converters, this is normally specified as input-output or input-case isolation. Minimum isolation voltage levels must be maintained to meet most safety regulations.

## L

**Leakage Current** - Current flowing from input to output or input to case of an isolated converter at a specified voltage level.

**Life Test** - Reliability test in which a converter is operated (typically under accelerated conditions) over some period of time in order to approximate its life expectancy.

**Line Regulation of a constant current power supply** - The change in the static value of DC output current resulting from a change in AC input voltage from low line to high line or from high line to low line.

**Line Regulation of a constant voltage power supply** - The change in the static value of DC output voltage resulting from a change in AC input voltage from low line to high line or from high line to low line.

**Linear Regulation** - Power supply regulation technique in which the regulating device (typically a transistor) is placed in series or parallel with the load. Voltage variations across the load are controlled by changing the effective resistance of the regulating device to dissipate unused power.

**Load** - Electronic components/circuits connected to the output pins of a converter. The characteristics (resistance, reactance, etc.) of the load determine the amount of power drawn from the converter.

**Load Decoupling** - Placement of filter components (typically uF capacitors) at the power terminals of the load in order to reduce noise.

**Load Regulation of a Constant Current Power Supply** - The change in the static value of DC output current resulting from a change in load resistance from short circuit to a value which gives maximum rated output voltage.

**Load Regulation of a Constant Voltage Power Supply** - The change in the static value of DC output voltage resulting from a change in load resistance from short circuit to a value which yields maximum rated output current.

**Local Sensing** - Using the output terminals of the converter to provide feedback to voltage regulation circuits.

**Logic Inhibit/Enable** - Signal (typically TTL/CMOS compatible) used to turn a power supply output on/off. Also called Remote On/Off.

**Long Term Stability** - Change in output voltage of a converter over time with all other factors (line, load, temp., etc.) remaining constant. Expressed as a percent, the output change is primarily due to component aging.

**Low Line** - Minimum value of input line voltage specified for normal converter operation.

## M

**Master/Slave Operation** - Connection of two or more converters so one (master) controls the operation of the others (slaves). Master/slave configurations are used to provide higher output power, wider input voltage ranges, synchronized operation. Also see Auto -Parallel and Auto-Series Operations.

**Maximum Load** - Highest amount of output load allowable under the continuous operating specifications of a converter.

**Mean Time Between Failure (MTBF)** - Unit of measure, expressed in hours, that gives the relative reliability of a converter. MTBF data is based upon actual operating data(demonstrated) or derived per the conditions of MILHDBK-217F (calculated).

**Minimum Load** - Minimum amount of output load required on a converter in order to maintain normal continuous operating specifications.

**Minimum Operating Temperature** - Minimum ambient temperature at which a converter will start and operate within specifications.

## N

**N+1Redundancy** - A paralleled power system configuration used in distributed power systems. Requires that at least one more current sharing converter module than is necessary be used power a load. If one up to fails the remaining will still supply the load current without interruption.

**No Load Voltage** - Voltage Level present at the output pins of a converter when 0% load is applied.

**Noise** - Unwanted variations in the converter output, normally called "Ripple and Noise" and given as a peak-to-peak value with a specified band width.

**Nominal Value** - Ideal value that is used as a reference point. Typically, it is not the same as the value actually measured.

## O

**Open-Circuit Voltage** - See No Load Voltage

**Open Frame** - A type of power supply which is not encased in a metal or plastic shell or frame and subsequently is not covered with a potting compound. Open Frame converters are easily identified as their component parts are visible.

**Operating Temperature Range** - Range of temperatures over which a converter can be operated safely within specified limits. Normally specified as ambient, however, at times case or base plate temperature are also used.

**OTP: Over Temperature Protection** - A protection system for converters where the converter shuts down if the ambient temperature exceeds the converters ratings. OTP is intended to save the converter and any downstream equipment in the event of a catastrophic failure of a fan or such. OTP usually measures the hottest item on board the converter rather than ambient temperature.

**Output Current Limiting** - An output protection feature which limits the output current to a predetermined value in order to prevent damage to power supply or the load under overload conditions. The supply is automatically restored to normal operation following removal of the over load.

**Output Impedence of a power supply** - At any given frequency of load change, $E_{OUT}/1_{OUT}$. Strictly speaking the definition applies only for a sinusoidal load disturbance, unless, of course, the measurement is made at zero frequency (DC). The output impedance of an ideal constant voltage power supply would be zero at all frequencies, while the output impedance for an ideal constant current power supply would be infinite at all frequencies.

**Output Voltage** - Value of DC voltage measured at the output terminal of a converter.

**Output Voltage Accuracy** - Maximum allowable deviation of the DC output of a converter from its ideal or nominal value. Expressed as a percentage of output value. Often called output voltage tolerance.

**Output Voltage Range** - Minimum and maximum output voltage limits within which a converter meets its operating specifications.

**Overload Protection** - An output protection feature which limits the output current of a power supply under overload conditions so that it will not be damaged.

**Overshoot** - Transient change in output voltage that exceeds specified accuracy limits. Typically occurs on converter turn on/off or with a step change in output load or input line.

**Overvoltage Protection (OVP)** - Output monitoring circuit activated if a preset voltage level is exceeded. Depending on the type of circuit used, the OVP shuts the converter down, "crowbars" the faulty output or switches the converter to a different operating mode.

## P

**Parallel Operation** - Operating mode in which two or more power supplies are connected in parallel. The output currents are summed together in a single load, providing a higher level of output power then that available from a single unit. Parallel operation requires models specifically designed to share loads.
Also see Master-Slave Operation.

**Periodic and Random Deviation (PARD)** - Noise and ripple voltage superimposed on a converter's DC output. Typically specified at full load, it is expressed in peak-to-peak or RMS volts over a given bandwidth.

**Pi Filter** - Input filter consisting of two capacitors connected in parallel with a series inductance. Often used in converters to reduce input reflected ripple current.

**Polarity** - Ability of a converter to produce an output that is positive or negative referenced to ground.
Also see Floating Output.

**Post Regulation** - Output circuit that uses linear regulator to improve line/load regulation and reduce ripple and noise. Post regulation adds expense and degrades converter supply efficiency.

**Power Density** - Ratio of converter output power to converter volume.

**Power Factor Correction** - Design technique usually applied to the input of converters that improves the converter's power factor and minimizes harmonies generated by the converter onto the AC power line.

**Power Good** - Signal (typically a visible LED) that indicates the DC output of the primary channel of a converter is still present.

**Power Rating** - Specified power available at the converter output pins.

**Pre-Regulation** - The regulation at the front end of a power supply, generally by a type of switching regulator, this is followed by output regulation, usually by a linear type regulator.

**Primary Circuit** - Input side of an isolated converter. See secondary Circuit.

**Programmable power Supply** - A power supply with an output controlled by an external resistor, voltage or digital code.

## R

**Radiated EMI** - Also called radio frequency interference (RFI), EMI is unwanted high frequency energy caused by the noise generators of the adaptors. That portion that is radiated through space is known as radiated EMI. Most radiated EMI measurements are done between 30MHz and 300MHz.

**Rated Output Current** - Maximum output current that can be continuously drawn from a converter under specified conditions.

**Redundant Operation** - Parallel configuration of converters used in distributed power system to increase system reliability. Converters may be used in a "N+1" architecture.

**Reference** - The stable voltage, generally a Zener diode, from which the output voltage of a regulated supply is controlled.

**Reflected Ripple Current** - See Input Reflected Ripple Current.

**Regulation** - Ability of a converter to maintain an output voltage to within specified limits under varying conditions of input line and output load.
Also see Linear Regulation.

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**Remote Error Sensing or Remote Sensing** - A feature found on most power supplies, which, by means of two extra wires between the supply and the load, permits the power supply to achieve its optimum regulation at the load terminals rather than at the power supply output terminals, thus compensating for the IR drop present in the current carrying leads connecting the load to its power supply. The current through the sensing leads is so small that in spite of the resistance of these leads, their voltage drop is negligible.

**Remote Programming** - A feature of most power supplies which permits control of the regulated output current or voltage by means of a remotely varied resistance or voltage.

**Remote Programming Speed** - The time (usec) required for the output voltage to change from zero volts to within "X" milli volts of the maximum rated output or from the maximum rated output to within "X" millivolts of zero. "X" is specified separately for each model, generally of the same order as the load regulation specification.

**Remote Shutdown** - See Logic Inhibit/ Enable

**Resolution** - For an adjustable supply, the smallest change in output voltage that can be realized by the adjustment.

**Return** - The name for the common terminal of the output of a power supply; it carries the return current for the outputs.

**Reverse Voltage Protection** - Converter feature that prevents damage to internal components if a reverse voltage is inadvertently applied to the input or output terminals.

**Ripple and Noise** - The residual AC component which is superimposed on the DC output of a regulated power supply. Ripple and noise may be specified ion terms of its RMS or (preferably) peak-to-peak value. When the peak-to-peak value is specified, it should be accompanied by the maximum bandwidth of the measuring instrument, typically DC to 20 MHz. Measuring ripple and noise with an instrument that has insufficient bandwidth may conceal high frequency spikes detrimental to the load.

## S

**Secondary Circuit** - Output side of an isolated DC-DC converter.
Also see primary circuit.

**Sense Line** - Output line used in a remote sensing connection to route the output voltage (at the load) back to the control feedback loop.
Also the Remote Sensing.

**Series Operation** - Master-slave configuration in which two or more isolated converters are connected to obtain a higher output voltage level (converter inputs connected in parallel) or wider input voltage range (converter inputs connected in series) than that obtainable from one module.
Also see Master-Slave Operation.

**Series Regulator** - Linear regulator (internal or external to the converter) placed in series with the load to achieve a constant voltage across the load. This is the most popular method of linear regulation.
Also see Linear Regulation, Post Regulation and Shunt Regulator.

**Short Circuit Protection** - See Current Limit and Foldback Current Limit.

**Shunt Regulator** - Linear regulator (internal or external to the converter) placed in parallel with the load to achieve a constant voltage across the load.
Also see Linear Regulation, Post Regulation and Series Regulator.

**Six-Sided Shielding** - Converter packaging technique in which the unit is placed into a metal case. The metal shielding minimizes any noise radiation from the converter components. A continuous shielded case has the base (or header) welded on, further reducing potential noise leakage.

**Soft Start** - Converter input circuit that limits the inrush current at turn on.

**Split Bobbin Winding** - The method of winding a transformer whereby the primary and secondary are wound side-by-side on a bobbin with an insulation barrier between the two wingdings.

**Stability** - Obviously a misnomer, this term refers to the instability in power supply output which occurs in the presence of constant load, constant line and constant ambient temperature for a stated period of time (usually 8 hrs.) following warm-up. This small output variation which is related in part to the internal temperature rise of the power supply, is the zero frequency component of noise which must be present in any DC amplifier or regulator, even though all input, output, environmental and control parameters are held constant.

**Standby Current** - Current drawn by a converter when it has no load and has been shut down by a logic inhibit signal.

**Step Change** - Sudden change in a converter parameter. Typically used in referring to changes in output load or input line during converter testing. Storage Temperature Range- Range of ambient temperatures over which a converter can be safely stored.

## T

**Technischer Uberwachungs-Verein (TUV)** - Organization approved for testing products to VDE standards. US-based companies often use TUV in place of VDE because they have established facilities in the US.

**Temperature Coefficient** - For a power supply operated at a constant load and under conditions of constant input AC line voltage, the change in output voltage (for a constant voltage supply) for each degree change in the ambient temperature.

**Temperature Range** - See Operating Temperature Range and Storage Temperature Range.

**Thermal Conductivity** - Given materials ability to conduct heat, which is the time rate for heat transfer(via conduction) across a unit material thickness of 1 meter and when the temperature differential of the two opposite faces is 1 deg. k.

**Thermal Gasket** - Flexible pad or wafer with a very low thermal resistance that is put between a power module base plate and heat sink to ensure the high thermal conductivity across the junction.

**Thermal Joint Compound** - A fluid or paste spread between the mating surfaces of a power device baseplate and a heat sink or system chassis.

**Thermal Protection** - Feature that shuts the converter down if the internal temperature exceeds the preset limits. Also called thermal shutdown.

**Thermal Resistance** - Measure of a given materials opposition to the flow of heat. Units are oC/W.

**Thermal Resistivity** - Measure of a materials ability to impede the flow of heat. Typically given in oC T/W, where T is the material thickness and W is the power flowing through the material in watts.

**Three-Terminal Regulator** - Regulator packaged in a standard 3-terminal transistor package. These devices can be a switching type or a linear shunt or series regulator.

**Topology** - This refers to the way in which the power handling part of a power supply is configured. Choice of topology influences many of the basic characteristics of a converter.

**Tracking** - For a multiple output converter the parameter that gives the change in one output voltage caused by a change in the voltage level or load on another output.

**Transient** - Spike or step change in converter parameter. Commonly used in describing input line and output load characteristics.

**Transient Recovery Time** - Sometimes referred to as recovery time, transient response time or response time-loosely speaking-the time required for the output voltage of a power supply to came back to within a level approximating the normal DC output following a sudden change in load current. More exactly, Transient recovery time is the time "X" required for output voltage recovery to within "Y" millivolts of the nominal output voltage following a "Z" amp step change in load current -where:

1) "Y" is specified separately for each model but is generally of the same order as the load regulation specification.
2) The nominal output voltage is defined as the DC level halfway between the static output voltage before and after the imposed load change.
3) "Z" is the specified load current change, normally equal to the full load current rating of the supply.

## U

**Underwriters Laboratories (UL)** - Independent Organization that conducts safety testing of products to established standards.

**Undershoot** - Transient change in a converter output voltage that does not meet the lower limit of the voltage accuracy specification. Typically occurs at converter turn on/off or with some step change in output load or input line.
Also see Voltage Accuracy.

**Uninterruptible Power Supply (UPS)** - Power supply that will continue to operate after the loss of AC input power.

**UVLO-Under Voltage Lock Out** - A protection system for power converters where the converter is deliberately shut down if the input voltage drops below a pre-defined level. Some hyteresis is usually present to prevent the converter ocillating on and off. UVLO is usually needed with battery systems where the voltage decreases gradually with time rather then snaps off quickly.

## V

**Verband Deutsher Elektrotechniker (VDE)** - German organization that sets standards for product safety and noise emissions and tests and certifies products to those standards.

**Voltage Balance** - For multiple output converter, the percentage difference in voltage level of two outputs with opposite polarities and equal nominal values.

## W

**Warmup Drift** - See Drift

**Warmup Time** - Time Required for a converter to operate within specifications after turn-on. This time normally precedes a long-term drift specification.

**Withstand Voltage** - Maximum voltage level that can be applied between circuits or components without causing a break down.
Also see Breakdown Voltage and Isolation.