# ZellerTech

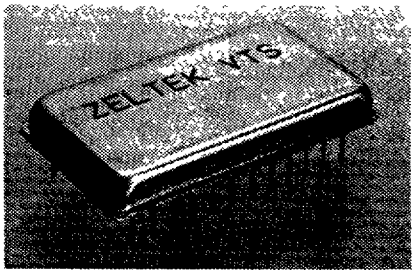
## ZelTek VTS

High Density
Hermetic Package
Dual Symmetrical
Voltage Transient
Suppressor

ZelTek VTS is designed for use in commercial avionics and defense electronics systems where voltage transient and lightning protection is needed in a small, high density package. ZelTek VTS technology provides a highly efficient transient protection solution. The device has the capability of 150 amps surge current with a 70 microsecond wide pulse and is contained in a hermetic package that can protect 23 incoming lines. Combined with outstanding environmental performance, this system can provide protection across operating temperatures of -55 to 125 C. without derating. Transients are initially clipped by zener action until the voltage rises to the breakover level, which causes the device to crowbar. The high crowbar holding current prevents DC latchup as the transient subsides.

### ZelTek VTS Switching Characteristics

| | |
|---|---|
| Test Conditions, | 0.1/10 µs 500 V, Ip 10A |
| Breakover Voltage, V(BO) Max: | +/- 105 V |
| Zener Voltage, Vz Min: | +/- 58 V |
| Holding Current, Ih Min: | 150 ma |
| Switch speed, Tsw: | 1.0 nanosecs |
| Characteristics (Sine wave): | Bidirectional |
| Operating Temperature Range: | -55 C. to 125 C. |

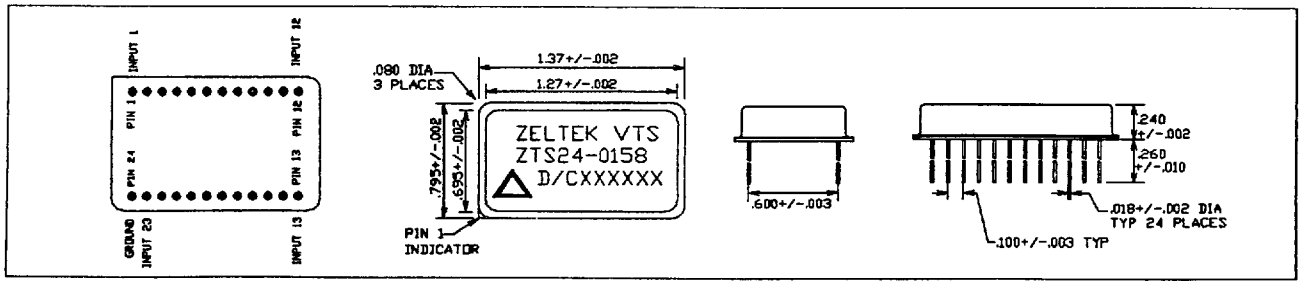



### ZelTek VTS Electrical Properties @ 25 C.

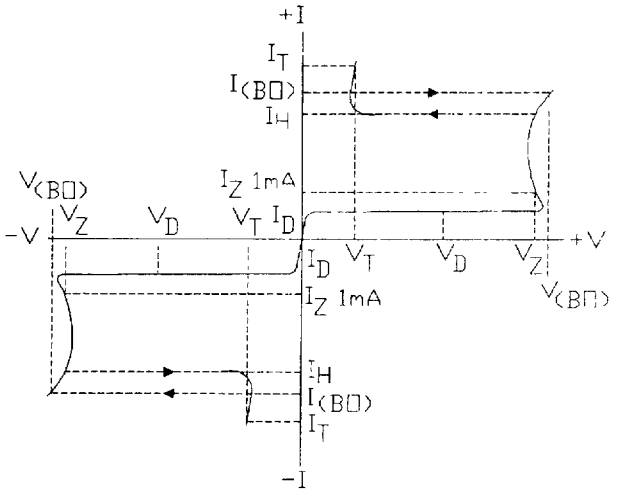
| Parameter | Test Conditions | Minimum | Typical | Maximum |
|---|---|---|---|---|
| Peak surge current at pulsewidth, $I_{PK}$ | 6.4/70 µs | 150 A | _____ | |
| Peak on state voltage, $V_{TM}$ | +/- 5 A | _____ | _____ | +/- 3 V |
| Breakover current at pulsewidth, $I_{(BO)}$ | 100 µs | +/- .15 A | _____ | +/- .6 A |
| Off-state leakage current, $I_D$ | $V_D$ =+/- 50 | _____ | _____ | +/- 10 µA |
| Off-state capacitance, $C_{off}$ | $V_D$ =0 f=1khz, 0.1Vrms | _____ | _____ | 200 pf |

### Specifications

| Type | ZellerTech |
|---|---|
| ZelTek VTS | ZTS 5001 |



## ZelTek VTS Voltage - Current Characteristics




V= VOLTAGE
I = CURRENT
$V_D$ = OFF STATE VOLTAGE
$I_D$= OFF STATE LEAKAGE CURRENT
$V_Z$= ZENER VOLTAGE
$I_Z$= ZENER CURRENT
$V_{(BO)}$= BREAKOVER VOLTAGE
$I_{(BO)}$= BREAKOVER CURRENT
$V_{TM}$= PEAK ON STATE VOLTAGE
$I_T$= PEAK ON STATE CURRENT
$I_H$= HOLDING CURRENT

## Aircraft Lightning Protection

When lightning strikes an aircraft, voltages and currents will be induced into the aircraft's electrical systems. For equipment design and certification purposes, a multiple stroke lightning strike consists of one initial strike of 200 kA followed by as many as 23 restrikes of 50 kA. When this large, fast changing lightning current passes through the aircraft the resulting magnetic and electric fields produced can induce the voltage and current on the electronic systems referred to as indirect effects.

The aircraft regulatory bodies have established transient control levels that are the maximum allowable levels of lightning induced transients in interconnecting wiring and equipment transient design levels that define the transients equipment must tolerate. Various sets of lightning induced voltages and currents, found in interconnecting wiring have been defined. The most common specifications include:

RTCA/DO-160C, Section 22
SAE AE4L 87-3 Rev B 1989
Airbus Industries ABD0007
Euro Fighter Spec SPE-J-000-E-1000

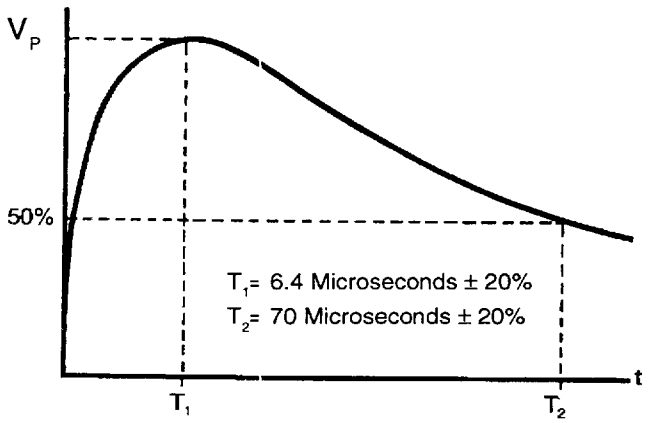
All of these specifications contain various combinations of 3 waveforms at a range of test severity levels. The method of test varies between ground injection, bulk cable injection and pin injection. Since the worst case for a transient protection technology would be direct pin injection of the full threat line by line this has been the test method adopted by ZellerTech.

**Test Level Categories** The category to be applied to a system or equipment often must be chosen before the airframe is sufficiently defined to know the probable lightning environment. Avionics equipment is often designed with the intent that it will be installed in several different types of aircraft. Therefore, if a specific category is not identified in the individual equipment specification, the manufacturer should design and qualify the equipment to the category level that is consistent with its expected use. Test levels for each category are listed in the table on the following page.

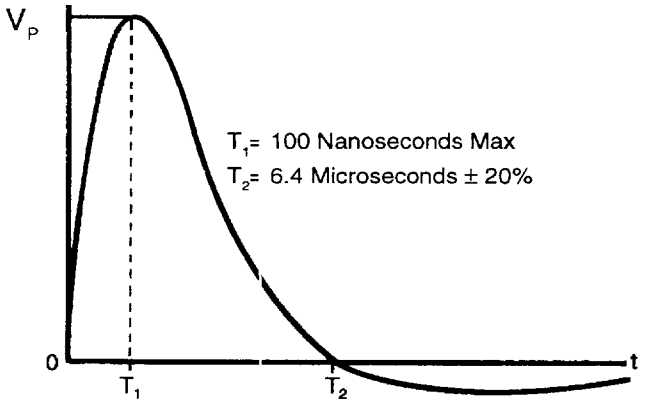
**Category J** is intended for equipment and interconnect wiring that will be installed in a partially protected environment such as an enclosed avionics bay in an all-metallic aircraft.
**Category K** is intended for equipment and interconnect wiring that will be installed in a moderate environment such as the more electromagnetically open areas (e.g. cockpit) of an aircraft composed principally of metal.
**Categories L and M** are for equipment and interconnect wiring that will be installed in severe electromagnetic environments. These levels may be found in all-composite aircraft or exposed areas in metallic aircraft.
**Category X** is intended for equipment for which lightning effects are insignificant or not applicable.

**Long Wave Test** is representative of the voltage potential difference that can appear between interfacing equipment ground references when lightning current flows through the aircraft structure.
**Short Wave Test** is representative of the open loop voltage that would be induced by magnetic fields having the long wave (double exponential ) waveform. These magnetic fields are the result of lightning current flowing through the aircraft.
**Damped Sine Wave Test** is representative of shock excited electrical resonances induced in aircraft wiring by the lightning current pulse flowing through the aircraft.
Waveforms and test levels are detailed on the next page, followed by ZelTek VTS test results.

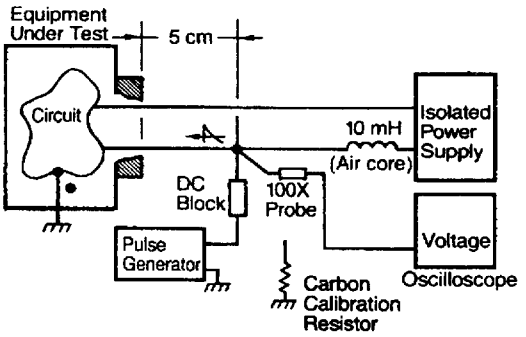
| Category | Test Levels | | | | | |
|---|---|---|---|---|---|---|
| | Long Wave | | Short Wave | | Damped Sinusoidal Wave | |
| | Vp | Ip | Vp | Ip | Vp | Ip |
| J | 125 | 25 | 125 | 25 | 250 | 10 |
| K | 300 | 60 | 300 | 60 | 600 | 24 |
| L | 750 | 150 | 750 | 150 | 1500 | 60 |
| M | 1600 | 320 | 1600 | 320 | 3200 | 128 |
| X | No Test Required | | | | | |




**Long Wave**

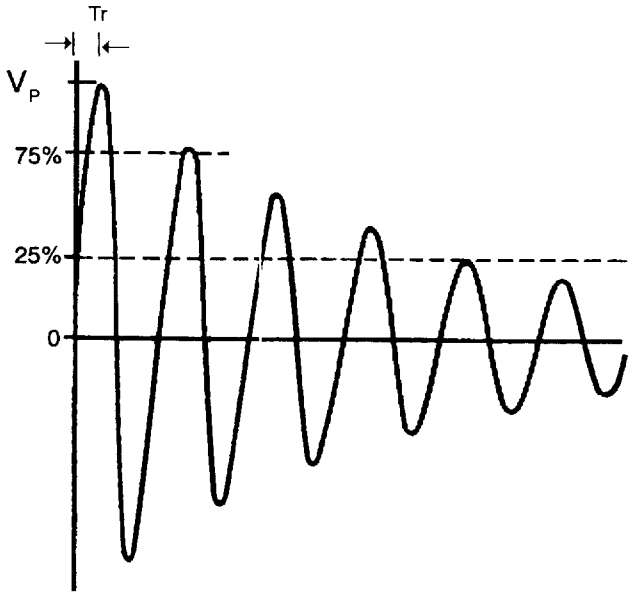



**Short Wave**




● External equipment grounds should be tied to case for these tests.

**Pin Injection test setup**




**Damped Sinusoidal Wave**

| Frequency (Mhz) | Tr Nanoseconds | Damped sinusoid decays to 37% of initial peak within 3 to 5 cycles |
|---|---|---|
| 1 (±20%) | 100 max | |
| 10 (±20%) | 25 max | |