

Models: MHVSW-002V, -005V, -008V, -011V

Instructions for use of Fast High-Voltage MOSFET Switches

- Caution: High Voltage is dangerous. This switch is to be used by those with sufficient knowledge and experience with the dangers and precautions needed to work safely with high voltage circuits
- The required power supply for the switch is +5V to the pigtail connection: red lead +5V and black lead ground.
 - At power on the switch has a large inrush current of ~2 Amps for a few milliseconds. If you are using a power supply with a current limiter set to below ~2 Amps it may trigger when the power supply is turned on. This may create a condition that damages the switch and applies an out of specification voltage to the switch.
- Triggering
 - The trigger input is a 50 Ω SMA connector
 - The trigger input is pulled down to ground through a 1000 Ω resistor
 - The switch is edge triggered
 - The switch turns ON on the rising edge of the trigger and turns OFF on the falling edge of the trigger
 - The HIGH trigger level can be between 3 and 6 volts
 - The LOW trigger level can be between 0 and < 1 Volt
 - Do not use trigger pulses with a rise/fall of greater than 10 ns/V (< 50 ns rise time for 5 volt trigger). This can cause damage to the trigger and gate drive circuitry.
 - We recommend a CMOS level trigger with a 50 Ω output impedance and rise/fall time \leq 10 ns to insure low switching jitter and minimize spurious trigger errors caused by noise.
 - Use a 50 Ω terminator at the SMA trigger connector with this configuration
 - Don't use a trigger pulse that is shorter than approximately 50 ns, shorter pulses might result in the switch not turning off or other unpredictable behavior.
 - The longest allowable pulse width is infinite, i.e. the trigger input can be HIGH (switch ON) for as long as is desired. This is a new capability for switches sold after 9/27/2010. Switch purchased before this time have a maximum ON time of 20 ms. For these earlier model switches on pulses longer than 20 ms will result in unpredictable behavior of the switch.

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- Do not exceed a total 15 kV difference between either output of the switch to ground.
- The switch is made up of a stack of MOSFETs. The total voltage drop allowable across the switch is approximately 1000 Volts higher than the rating of the switch.
- The switch is polarized; the positive terminal must always be biased at a positive voltage with respect to the negative terminal.
- The high voltage circuit into which the switch is placed should protect the switch from over voltage, over current and reverse biasing.
 - Failure to do this could result in damage to the switch.
- The maximum average power dissipation of the switch is limited to approximately 15 Watts unless some form of active cooling is used. However if the average power dissipation is greater than approximately 5 Watts the temperature of the switch should be monitored and kept below approximately 70 °C.
- Thermal shut down. Switches purchased after 9/26/2010 have a thermal shut down feature. If the internal sensor detects a temperature over approximately 70 °C the switch is set to an open (off) condition and triggering of the switch is inhibited until the supply voltage is cycled. With the standard option, a red LED is lit during thermal shutdown.
- Switches purchased after 9/26/2010 have a maximum repetition rate of 150kHz
 - At approximately 25kHz the switch duty cycle is 100%
 - At frequencies between 25 and 150kHz the switch can be operated in bursts with a duty cycle (see eq. below) and a maximum burst length (number of switching events, and time, see eq. below)
 - Approximate $DutyCycle = 100 * Exp\left(-\frac{(Freq(kHz) - 25) * \ln(6)}{125}\right) \%$
 - Approximate maximum burst length

$$BurstLength = \frac{7.5 \times 10^7}{Freq(kHz) - 25} \text{ Switching Events}$$
 - Approximate maximum burst length

$$BurstLength = T_{on} = \frac{7.5 \times 10^7}{(Freq(kHz) - 25) \times Freq(kHz) \times 1000} \text{ Seconds}$$
 - Switch must be left off between bursts for a time

$$T_{off} = T_{on} \frac{100 - DC}{DC}$$
 - These are approximate values. Ambient temperature and heat dissipated into MOSFETs will derate these values.

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- At maximum repetition rate of 150kHz the 5 Volt Power Supply will draw a peak current of 4 Amps (20 Watts) during burst on time.
- Shorter bursts at higher repetition rates are possible please contact us with your application
- Switches Purchased before 9/26/2010 have a maximum repetition rate of 1000 Hz with a duty cycle of 100%
- Limited liability Warranty Policy: The high voltage switches are covered for 90 days by a limited liability warranty from defects in material and workmanship. During the warranty period we will rectify free of charge any defects which can be proved to result from material or construction faults. This warranty does not apply if, in the judgment of Willamette High Voltage, the product fails due to damage from shipment, handling, storage, accident, abuse or misuse, or if it has been used or maintained in a manner not conforming to product's instruction or has been modified in any way. The maximum liability of Willamette High Voltage is the product purchase price.