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UL Recognized Power Supply Protection for Set Top Boxes Model Y08SV-312B

In general, set top boxes for both cable and satellite applications are listed under UL 6500, the Standard that applies to "Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use." Section 2.6 of UL 6500 defines two classes of equipment both of which include additional precautions beyond *basic insulation* for protection against electric shock (www.ul.com/av/pag14_2.html). Class I equipment is designed with a protective (earthing) conductor in the fixed wiring so that accessible conductive parts cannot become *hazardous live* in the event of a failure of the *basic insulation*. Class II equipment contains no provision for protective earthing or reliance on installation conditions. Instead *double insulation* or *reinforced insulation* is used to achieve the required additional safety precaution. To qualify as Class I equipment, a set top box must have a grounded three-wire electrical cord. Class II set top boxes use two-wire cords.

Gas Discharge Tubes (GDT's) have proven effective in protecting millions of set top boxes from damage caused by abnormal voltages entering through power lines. In series with an MOV, the GDT provides a permanent defense against multiple unwanted surges. As STB's become more advanced with the addition of storage devices, DVR and Internet capabilities, securing the STB against fluctuations in input power is ever more important.

When employing GDT's as protectors in the power supply circuitry of a STB, design decisions must be made in accordance with the UL 6500 requirements for Class I and Class II boxes. For Class I set top boxes, the specialists at UL have determined that the use of gas discharge tubes Recognized under the 5th Edition of UL Standard 1414 as protectors in the power supply circuit is acceptable. However, they have further ruled that only "gas-tube voltage surge suppressors" (gas discharge tubes) meeting the Y2 requirements of the 6th Edition of UL 1414 provide the *double or reinforced insulation* required for Class II boxes under the UL 6500 Standard.

The 5th and 6th Editions of UL 1414 currently coexist, but the 6th Edition of UL 1414, which was published in February 2000, will become the sole UL 1414 Standard in May 2007 when the 5th Edition officially expires.

The biggest difference between the 5th and 6th Edition of UL 1414 is the increase in voltages applied during the Dielectric Voltage-Withstand Test.

UL 1414	Rating	Class	Dielectric Voltage-Withstand Test	
5th Edition	125V		1250VAC rms, 60Hz	1 minute
	250V		1500VAC rms, 60Hz	1 minute
6th Edition		Y1	4000VAC rms, 60Hz	1 minute
		Y2	2000VAC rms, 60Hz	1 minute

To be Recognized as a Class Y2 component under UL 1414 6th Edition, a GDT must not discharge when subjected to 2000VAC rms for a period of one minute. In the 6th Edition test procedure, the component is subjected to the Dielectric Voltage-Withstand Test several times. The peak voltage the GDT sees is 2828V. To pass the test, it must not discharge at that voltage.

The withstand voltage capability of the set top box varies by manufacturer, but it can be as low as 3900V. In AC Power Surge Testing, STB's are typically subjected to line to line and line to earth transients that rise quickly to 4000V or higher. It is the GDT's job to discharge and redirect those transients to earth before the voltage rises to the level where damage to the sensitive components within the set top box can occur.

Developing an arrester with a DC Breakdown Voltage high enough to pass the 6th Edition test and an Impulse Breakdown Voltage low enough to protect the STB was a difficult challenge, but Sankosha's Model Number Y08SV-312B is uniquely qualified to meet that requirement. It's Impulse Breakdown Voltage of 3700V is significantly lower than other gas tube arresters that have UL 1414 6th Edition Recognition and it provides superior protection for equipment.

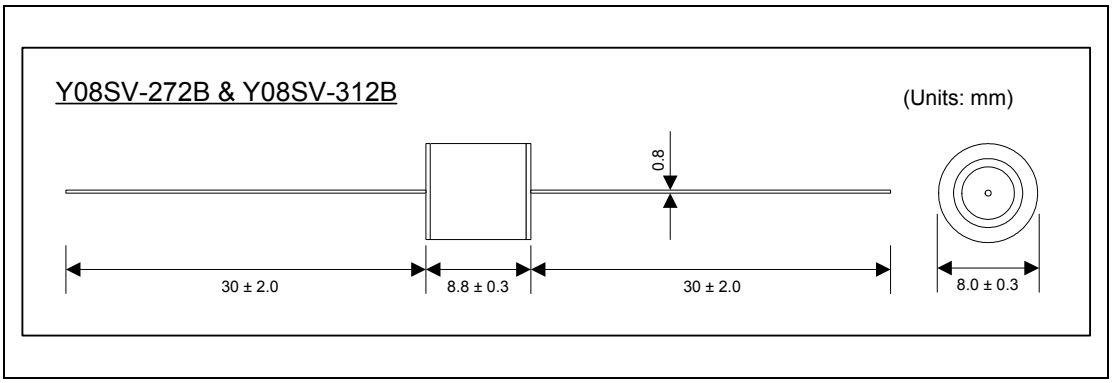
Today Sankosha supplies GDT's for both UL 6500 Class I and Class II applications. The two GDT models and their characteristics are summarized below.

Characteristic		Y08SV-272B	Y08SV-312B
UL 1414 5th Edition Rating		126 – 250V	
UL 1414 6th Edition Class			Y2
DC Breakdown Voltage	5000 V/sec.	2430-3000 V	2850-3500 V
Impulse Breakdown Voltage	100 V/usec	≤ 3,900 V	≤ 3,700 V
Insulation Resistance	DC 1,000 V	≥ 100MΩ	≥ 100MΩ
Capacitance	1 MHz	≤1.0 pF	≤1.0 pF
Impulse Life	8/20 usec, 100A	300 Times	300 Times
Impulse Discharge Current	Repeat 20 Times (10 times each polarity)	3 kA	3 kA

The physical dimensions of Model Y08SV-272B and Model Y08SV-312B are identical. The Y08SV-312B can be used in UL 6500 Class I and Class II equipment, but the Y08SV-272B can only be used in Class I set top boxes where a dedicated ground (three wire electrical cord) is provided. After May 2007, the 5th Edition of UL 1414 will expire and the Y08SV-272B will no longer be acceptable in either application. Product engineers would be wise to choose the 6th Edition Recognized Y08SV-312B in any new designs.

Y08SV-272B

Y08SV-312B



These gas discharge tubes offer significant advantages in power supply protection circuits. Unlike air gaps, which may be influenced by environmental factors like dust and humidity, the GDT's are hermetically sealed and have stable well-defined narrow breakdown voltage ranges. These devices are very robust, able to handle high currents repeatedly and, because they react to transients very quickly, provide superior protection for sensitive components.

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