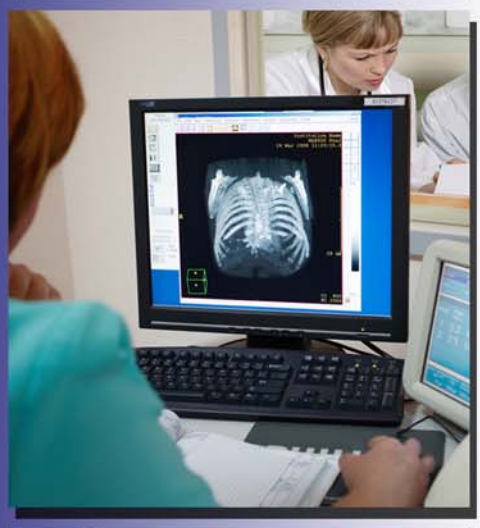
RESISTORS FOR MEDICAL EQUIPMENT

Ohmite's reputation with the world's medical equipment manufacturers is based on the ability to design and develop components which can be used with total reliability in situations and applications which are literally a matter of life and death.

In this document, we are featuring some of the many essential applications which have benefitted from our design and manufacture expertise and our thorough knowledge of the pitfalls and problems likely to be encountered by high specification medical equipment manufacturers.



We have identified three specific product types which are most commonly used:

SURGE RESISTORS - used with defibrillation and medical cables. Ohmite OX/OY, TFS, and A Series are in this category.

HIGH VOLTAGE RESISTORS - used to measure and divide voltages in high voltage circuits such as X-Ray and Tomotherapy. Slim Mox and Macrochip would be the choice here.

WIREWOUND RESISTORS - are used for current sensing and motion control (braking).
MRI machines have a 5KW power supply which spins a camera around the patient to create a 3D image. Most battery powered, hand held equipment can use a current sense (low value) resistor to avoid excessive battery drain.
280 Series and WFH for braking. LVK and FCSL for current sensing. Data sheets for all products mentioned can be found on our website.

Such a reputation is particularly important to us and for this reason we would like to share with you, some of the many applications which benefit from using Ohmite resistors.

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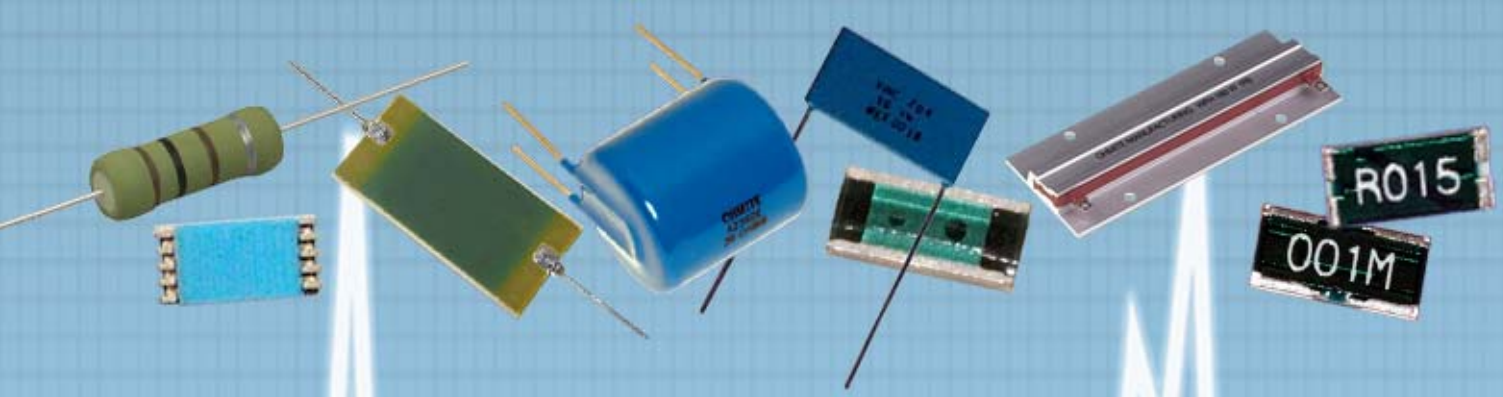

A particularly important medical technique is called TOMOTHERAPY (sometimes referred to as HELICAL TOMOTHERAPY or INTENSIFIED MODULATED RADIATION THERAPY). The process was developed at the University of Wisconsin (Madison) and essentially, it is radiation therapy for cancer patients, which, coupled with the technology behind CT Scanners, is a highly focused form of radiation therapy, directed at the tumors only and not the surrounding healthy tissue. The equipment used to perform Tomotherapy uses Ohmite resistors.

In one application, Ohmite has two surface mount versions of the TFSB resistor approved. This non-inductive, high energy, thick film resistor has been of interest to a number of our customers, especially in medical electronics. However, one obstacle, up to now, had been its axial leaded format. After several alterations involving different terminal types, an optimal solution was arrived at. The TFSB Surface Mount (sold under the 66810 Spec Number) replaces wirewound resistors. The high resistance values (4990 and 20,000 ohms) were inherently less reliable in wirewound construction due to the fine wire involved. They were also inductively wound causing some circuit interference which the TFSB resolves. Finally, the wirewounds were axial leaded types, while the application is primarily SMD, allowing the customer to take advantage of the PCB space savings and high speed pick and place manufacturing. As always, price was also an issue, and through careful selection of the terminal type and investments in automated production, we were also able to meet the cost objectives of our customers.

Ohmite TFS Series Replaces Carbon/Ceramic Comp Resistors in High End ECG Cables

A leading manufacturer of cables for the medical equipment industry, has recently adopted Ohmite's TFS Series for installation in various ECG Cable configurations. For years, medical cable manufacturers have used carbon and ceramic comp resistors to provide surge protection against AED shock when defibrillating a patient hooked up to ECG monitors. Loose tolerances and a high TCR value have made these resistors less than optimal for the application, causing many cables to be discarded after only a few shocks. With its high energy rating, its availability in 1% tolerance, and attractive stability, the TFS Series offered such customers a performance upgrade. A series of difficult qualification tests ensued and now the TFS Series is embedded across a wide range of high end ECG Cables

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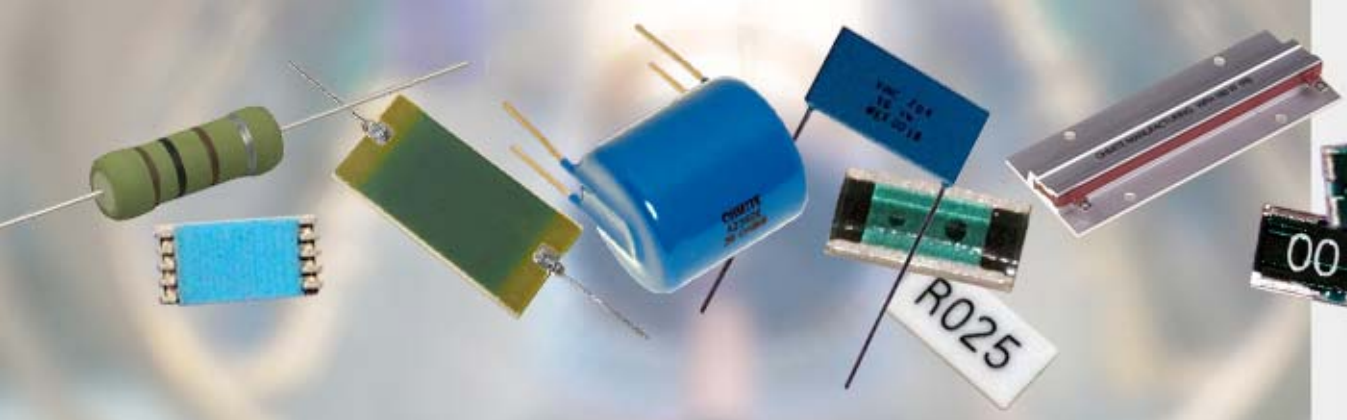

SURGE RESISTORS ASSIST HEART MONITORING

Ohmite Ceramic Comp resistors have been selected for use in a product involving the heart - a wearable cardiac defibrillator. Worn like a vest, it continually monitors the patient with non adhesive electrodes listening for any abnormalities in heart rhythm. It then alerts the patient before a shock is delivered. A conscious patient can disarm the device prior to the shock and seek help. If the patient is unconscious, a gel is released over the electrodes and then a shock is delivered to restore normal heart rhythm. The heart monitor records data which can be sent ahead to the hospital via modem. In cases of cardiac fibrillation, time is of the essence. For each minute the brain is robbed of oxygen, we lose approximately 10% of our brain function permanently. By the time an ambulance arrives at the scene, it is usually too late, which is why we see AEDs in so many public places today. High risk patients sometimes have devices implanted, by surgery, to restore normal heart rhythm. The vest is a non-surgical solution which is already saving lives.

Public Access Defibrillator uses three resistors

This user friendly public access defibrillator is designed to allow practically anyone to operate it and enhances survival odds since it can be brought into play so quickly. Its widespread usage will definitely lead to saving lives. Our high voltage Slim Mox resistors were selected for use by the design team and each defibrillation unit contains three different resistors of the same type.

PRODUCT FOCUS

The TFS Series of resistors from Ohmite has been specifically designed and developed to absorb much more energy compared to standard film resistors. Ideal for medical surge protection applications, these low profile, thick film resistors offer non-inductive performance in an axial package. Available in six standard sizes, the flat, axial leaded and surface mount devices cover a range from 0.5 to 2W, with energy ratings from 6 to 55 joules for a single impulse. Operating voltages range from 3 to 11kV, with a resistance range from 100 ohms to 100,000, down to 1% tolerance, with a TCR of 100ppm. Other applications for this RoHS compliant range include electron microscopes and X-ray systems

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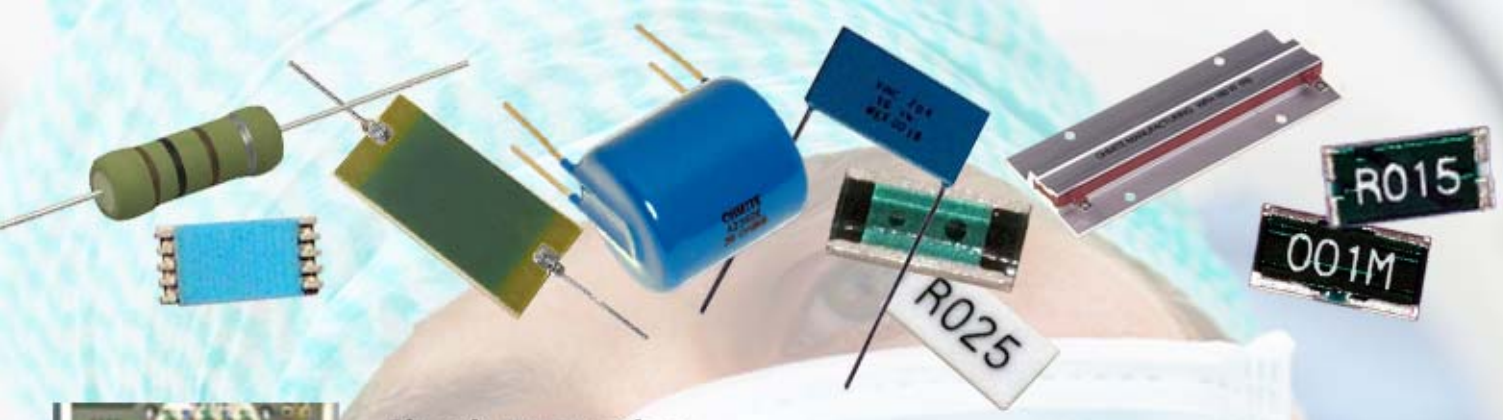
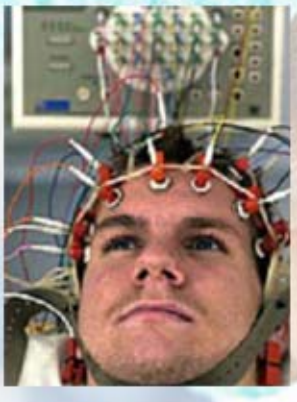




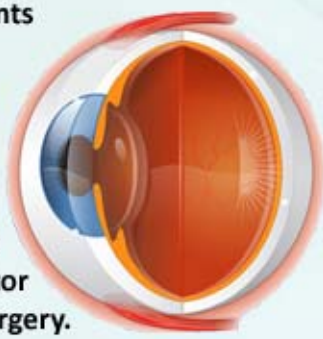
Circuit Protection

Ohmite's TFS Series is used in a brainwave monitor which requires protection from electric shock in order to protect the internal circuitry. If a patient required defibrillation while attached to the monitor by the numerous pads attached to his head, staff would not have to remove them prior to the 360 joule shock. To achieve this, each machine uses 12 resistors, all TFSD size and capable of 33 joules impulse energy, 7000 VDC. Each TFSD will protect 1 lead from the patient to the machine, enabling medical personal to attend to the cardiac emergency immediately, without concern about damage to the brainwave monitor.

MEDICAL BREAKTHROUGH - OHMITE THERE TO ASSIST

Ohmite's WFH and TGH heat sinkable power resistors are being used in equipment designed to help female patients recovering from mastectomies. In an experimental program called Cdt-Enhanced reconstruction, a method has been devised for mixing stem cells from a woman's fat into a concentrated mixture than can be placed in a cartridge and then placed in a woman's breast. The stem cells encourage new tissue to grow. Trials with patients in Japan yielded excellent results with few side effects. Studies continue to see how long the treatment lasts. The System has been introduced in Europe into the plastic and reconstructive surgery market and launched in Japan for cryopreserving a patient's own stem and regenerative cells. Clinical trials are ongoing or planned in cardiovascular disease, spinal disc degeneration, gastrointestinal disorders and other unmet medical needs.

OHMITE HELPS SURGEONS TO SEE THE PROBLEM



A specific type of surgery called Vitreo-Retinal is being used to treat patients with conditions of the retina such as retinal detachment, intraocular tumours, sever eye trauma and the ocular complications of diabetes or sickle cell disease. This surgical system uses 3D technology to provide surgeons with a higher level of control to make posterior, anterior and combined surgeries more efficient. With options for micro-incision vitrectomy surgery in 20, 23 and 25 gauge, the system allows the surgeon to choose the best option for each individual patient. The Xenon illuminator provides the surgeon with enhanced illumination during Vitreo-Retinal surgery.

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