FIRST PRINCIPALS
Technology Transfer & Commercialization

Technology Opportunity:
HIGH FREQUENCY, HIGH POWER FIELD EFFECT DEVICES

Opportunity

Welch Allyn, a world leader in the design and production of medical diagnostic equipment and specialty lighting products, is making available a new patented technology which improves performance of III–V compound field effect semiconductor devices.

The new technology offers an exciting licensing opportunity in:

- **Wireless communications applications** in the RF frequency range; specifically, base station cellular applications, satellite and radar systems, and personal communication systems and networks for intra-facility use (PCS and PCN)
- **Power switching applications;** specifically, high power specialty industrial ICs, high power switching for lighting,, and switched mode power supplies for PCs and other consumer applications.
- **High performance substrates;** specifically, applications where substrate defects and/or impurities limit device performance and negatively impact production yields.

The new Welch Allyn FET process offers ***significantly improved product performance*** and capability for these and other applications.

SWITCHING PERFORMANCE CHARACTERISTICS, MESFETS			
	WA Technology GaAs	GaN	Current State-of-Art
Breakdown Voltage	>60V	>200V	~ 20V
Operating Temperatures	125ºC	250ºC	100ºC
Switching Frequency	2-4 GHZ	10 GHz	200 MHz

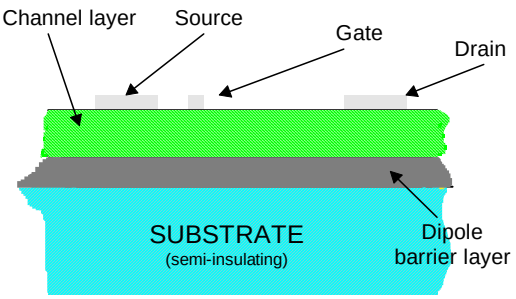
Companies incorporating the technology into their devices will achieve the thermal and physical benefits of the III–V compounds relative to standard silicon technology, while also being ***able to operate at higher voltages, power, and switching frequencies.***

MICROWAVE PERFORMANCE CHARACTERISTICS, HEMTS			
	WA Technology GaAs	GaN	Current State-of-Art
Breakdown Voltage	>15V	>40V	~ 15V
Operating Temperatures	125ºC	250ºC	100ºC
Operating Frequency	3-30 GHZ	3-30 GHz	3-30 MHz
Linearity	Improved	Improved	marginal

As shown in the accompanying tables, the performance improvements in GaAs based devices can be substantial, with the potential for another 5-10X improvement in GaN devices.

Background

The ***worldwide semiconductor market is projected to continue growing at a >15% rate***, with the analog chip market growing at rates well beyond this. This market growth has been fueled by technology improvements some, of which have targeted lower cost and increased performance in smaller packages. The Welch Allyn FET technology targets just such applications.



Technology

The material properties of III–V compounds, such as GaAs and InP, allow the component/device designer to miniaturize devices, resulting in multiple devices on a single chip and increased functionality over a smaller working area. To date, this has been successfully applied only to low voltage applications, particularly in the wireless communications area. The benefits of these compounds are also useful at higher voltages and powers. However, as voltage, power, and/or switching frequency increase, device performance and efficiency are negatively impacted by voltage breakdown. The Welch Allyn technology essentially eliminates this issue.

As shown in the schematic above, a “dipole barrier layer” is inserted between the substrate (the semi-insulating and structural support base of a FET) and the channel layers (where the current flows) to prevent the flow of current through the substrate and to prevent the movement of current carriers out of the substrate into the channel layer. This results in higher voltages of operation. There are three to four known methods of producing the dipole barrier, which in all cases, sets up an electronic barrier that is charge neutral and confines current flow to the channel layer.

The technology is covered by ***U.S. Patent 6,150,680***, along with four associated foreign applications. Using a unique design approach, along with variations in processing, improvements at higher voltage and power can be achieved using III–V compounds such as GaAs, InP, and potentially GaN and SiC.

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