

# Implantable Medical Electronics



# Heritage of Reliability

From its start a half century ago, Microsemi has focused on supplying devices of highest reliability, initially for mission-critical defense and aerospace applications. Drawing upon this expertise, Microsemi has spent more than 30 years serving and investing in the unique requirements of implantable medical technology. It's an unmatched commitment and a mark of our leadership.

- **More than 30 years experience supporting implantable device designs**
- **Proven reliability through 100's of millions of hours protecting patients**
- **Consistent investment in innovative performance enhancements.**
- **Innovative packaging with extensive product customization capabilities**
- **MIL/ISO/AS qualified production facilities**

Throughout our history as a leading supplier of circuit protection and power management semiconductors and modules, Microsemi has developed close relationships that allow us to create customized solutions supporting customer innovations and new product developments. We understand your unique design and safety requirements.

Simultaneously, Microsemi embraces a conservative product obsolescence policy that provides long product lifetimes, ensuring a reliable continuity of supply.

Our medical protection portfolio includes Schottky diodes, Zener diodes, high voltage diodes, transient voltage suppressors, thyristor surge protection devices, IGBTs and MOSFETs. Our solutions include bare die, arrays of die and a broad range of discrete and integrated packaged parts.

## **Microsemi Implantable Technologies**

### **Zener Diodes**

- Temperature compensated ultra-stable reference diodes
- High surge current capability
- Low reverse leakage
- 2V to 200V

### **High Voltage Rectifiers**

- Soft recovery ultra fast diodes
- 200V to 1200V

### **MOSFETs**

- Fast switching or low RDS(ON)
- 100V to 1200V
- Up to 100A
- Fast switching 20KHz to 1MHz
- Low RDS(ON)

### **IGBTs**

- 300V to 1200V
- Up to 150A
- 20KHz to 200KHz

### **Protection Devices**

Transient Voltage Suppression (TVS)

- Ultra low capacitance < 3 pF for fast response time
- Unidirectional and bidirectional devices
- Low voltage protection, from 1 to 400 volts

### **TVS Protection Array Packaging**

- $\mu$ BGA/ $\mu$ DFN
- PSOI™
- STRAP

### **Thyristors/SCR/RGT**

- 200V to 1600V

### **Power Conditioning**

Schottky Diodes

- Low Vf, fastest switching
- 5V to 200V

### **Transistors**

- Bipolar small signal

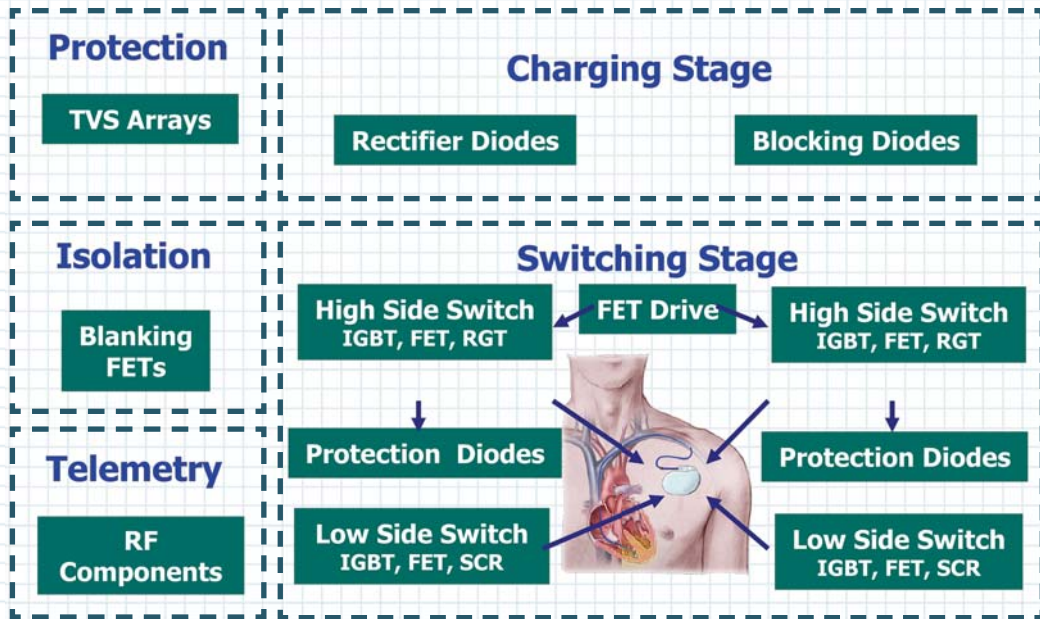
### **RF/Telemetry**

### **Pin Diodes**

### **Varactor Diodes**

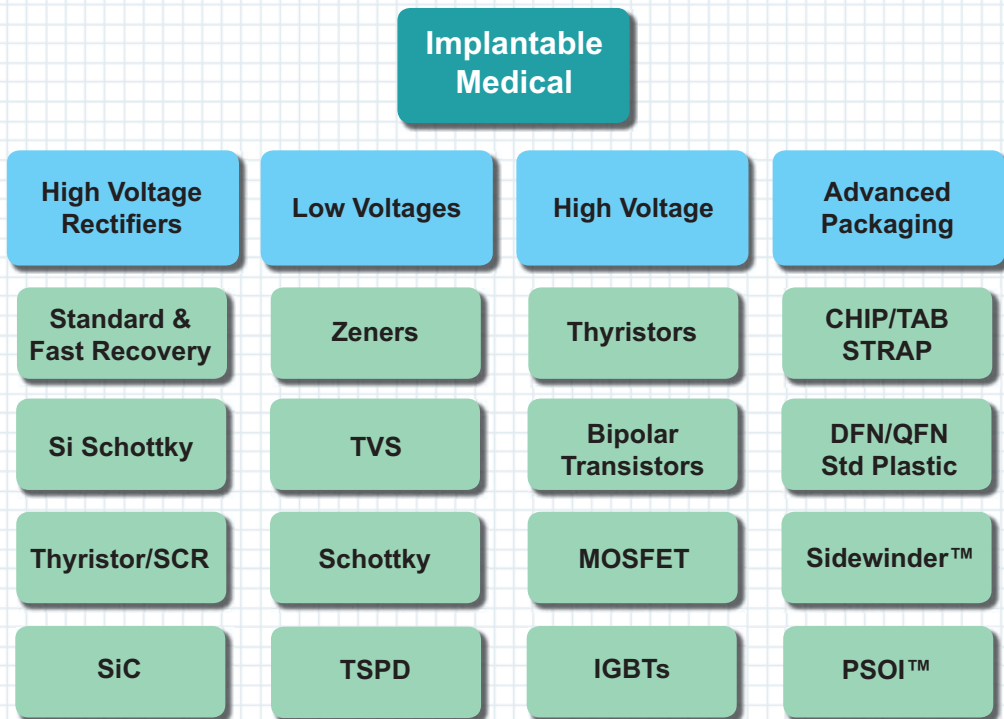
### **RF MOSFETs**

# Implantable Cardio Defibrillator



*Optimized solutions for your charging, switching and protecting requirements.*

# Implantable Power Management Portfolio



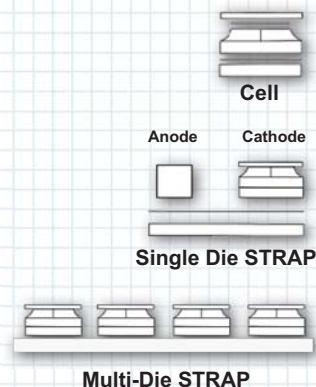
*A comprehensive portfolio for all your power management needs.*

# Advanced Packaging

Microsemi offers a full range of packaging options to satisfy the needs of Hi-Rel application designs. Included are die and flip chip,  $\mu$ DFN/QFN,  $\mu$ BGAs, arrays, STRAPs and cell, tabs disc-die-disc, Power Silicon on Insulator (PSOI)<sup>™</sup>, and standard plastic surface mounts. Our packaging is RoHS compliant, with tin/lead finishes also available.

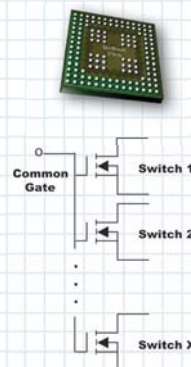
## Cells and STRAPs

- CELL – adds molybdenum discs to die to provide mechanical protection
- STRAP - brings Anode “up” using tungsten strap to eliminate wire bonds
- Reduces footprint by 20% over chip and wire



## High Voltage $\mu$ BGA

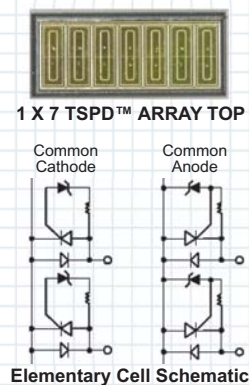
- Industry standard pitches
- Industry standard ball heights
- Ease of assembly, stacking and inspection
- Custom sizes and layouts are available



## Flip Chip TVS Arrays

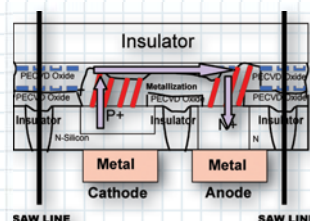
### Thyristor Surge Protection Device (TSPD)<sup>™</sup>

- Monolithic surge protection
- Provides ~ 50 percent size reduction compared to ship and wire while maintaining surge performance
- Available with wire bondable or solderable contacts
- Applicable to low voltage only



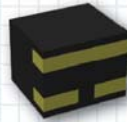
## PSOI<sup>™</sup>—Power Silicon on Insulator

- Stronger and easier to handle than conventional flip chip designs
- Stackable for 3D
- Excellent thermal characteristics
- Excellent surge characteristics
- Available in Zener, TVS, Schottky, and FRR configurations



## ***High Voltage Sidewinder™***

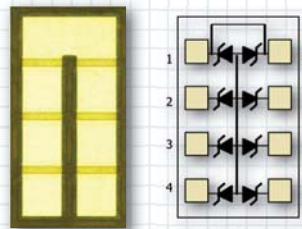
- Turns HV die on edge
- Smallest footprint for a given rating
- 72 percent footprint reduction over an equivalent chip and wire
- Maintains safe spacing for high voltages
- No wire bonding required



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## ***PSOI™ TVS Arrays***

- Reduces footprint while maintaining surge performance
- Eliminates cross talk
  - Complete isolation by design
- No wire bonds
  - Enhanced device reliability
  - Reduces parasitic inductance and capacitance

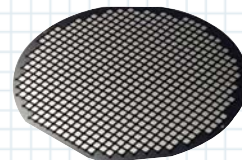


2 x 4 PSOI Array Top  
Looking through Glass Insulator

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## ***Die and Wafers***

- Provides 100% Electrical Screening
- Provides 100% Visual Inspection
- Package Burn-in
- Lot Acceptance Testing (LAT)
- Wafer-level Traceability and Documentation
- Custom die designs
- WafflePack, Tape & Reel, or Sawn on Frames



**Silicon Wafer**



**Silicon Carbide**

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## ***Standard Packages Available***



SOT-23



SOT-563



SOD-523



SOD-963



SOD-923



DFN/QFN

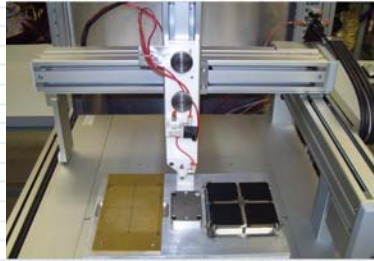


Powermite

# Value Added Services

Microsemi Hi-Rel products undergo extensive electrical, visual, burn-in and LAT/WAT screening. Manufacturing processes to include our exclusive Microvalidation reports, Micromap™ and Microguard™ services. We offer wafer/die bank services, as well as buffer stock inventory management.

## Microguard Services

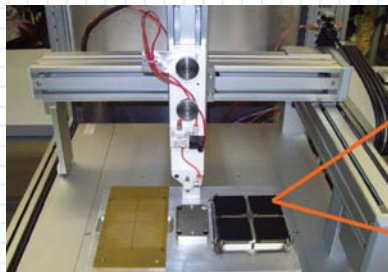


Proprietary outlier elimination software utilized during testing to trim distributions

29	Microguard	Method 887				
30		Vz at 75 mA				
31						
32						
33						
34	1	12.04	12.09	12.06	12.04	12.05
35	2	12.05	12.07	12.09	12.09	12.06
36	3	12.07	12.09	12.06	12.06	12.09
37	4	12.06	12.06	12.06	12.06	12.06
38	5	12.09	12.08	12.06	12.06	12.09
39	6	12.09	12.09	12.09	12.08	12.05
40	7	12.08	12.08	12.06	12.07	12.06
41	8	12.05	12.06	12.09	12.08	12.07
42						
43	Mean	12.07		Min	12.09	
44	Median	12.06		Max	12.04	
45	Std Dev	0.01		Range	0.05	
46						
47						

29	Microguard	None				
30		Vz at 75 mA				
31						
32						
33						
34	1	12.00	12.10	12.06	12.04	12.05
35	2	12.05	12.07	12.09	12.09	12.06
36	3	12.03	12.09	12.08	12.08	12.09
37	4	12.06	12.08	12.06	12.02	12.06
38	5	12.09	12.02	12.06	12.06	12.02
39	6	12.09	12.09	12.09	12.09	12.05
40	7	12.08	12.08	12.06	12.07	12.06
41	8	12.02	12.02	12.09	12.08	12.07
42						
43	Mean	12.07		Min	12.10	
44	Median	12.06		Max	12.00	
45	Std Dev	0.03		Range	0.10	
46						
47						

## Micromap Services

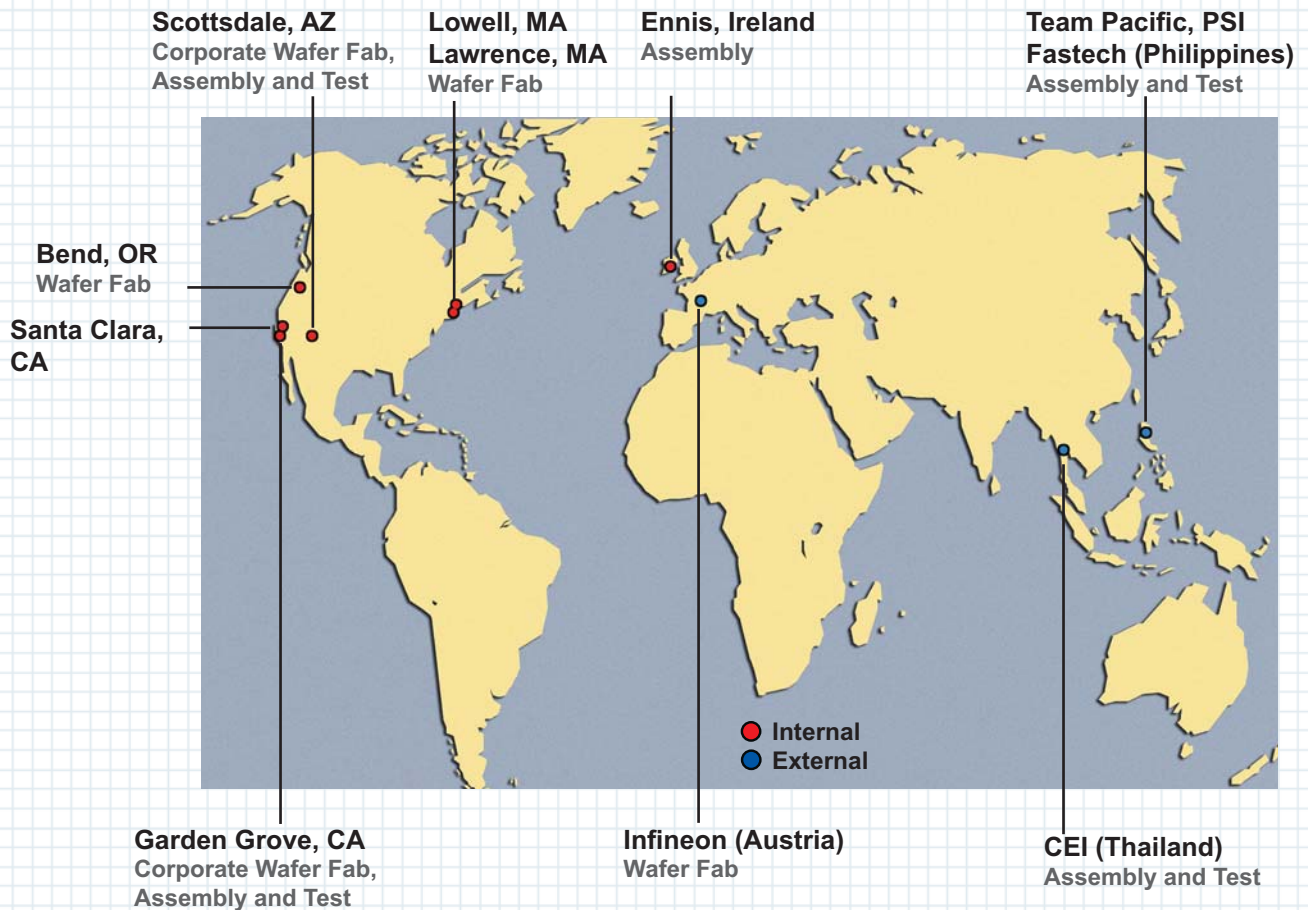


- Serialized testing via bar code
- Waffle pack Micromap of parametric data
- Enables individual component traceability w/o additional test OH
- Facilitates customer CIM strategies
- Web accessible parametric data
- Now in development

31		Vz at 75 mA				
32						
33						
34	1	12.00	12.10	12.06	12.04	12.05
35	2	12.05	12.07	12.09	12.09	12.06
36	3	12.03	12.09	12.08	12.08	12.09
37	4	12.06	12.08	12.06	12.02	12.06
38	5	12.09	12.02	12.06	12.06	12.02
39	6	12.09	12.09	12.09	12.09	12.05
40	7	12.08	12.08	12.06	12.07	12.06
41	8	12.02	12.02	12.09	12.08	12.07
42						
43	Mean	12.07		Min	12.10	
44	Median	12.06		Max	12.00	
45	Std Dev	0.03		Range	0.10	
46						
47						

# Global Manufacturing

Most die are manufactured at our wafer fabrication facilities in the United States. Our Microsemi Scottsdale, AZ facility is your focal point for implantable medical products. Standard plastic packaging is available from in-house and contract manufacturers.



# ***One-Stop Coordination For Medical Applications***

*Microsemi has a team of  
specialists available to provide  
innovative solutions for your  
implantable medical requirements.*

*Call for more information and to  
discuss your specific needs.*

*Microsemi Corporation  
Implantable Medical Products  
8700 East Thomas Road  
Scottsdale, AZ 85252*

*Specialist Direct: (480) 941-6536*

*Sales Direct: (602) 320-5916*

*Fax: (480) 947-1503*



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