A UNIVERSE OF APPLICATIONS

Commercial & Planetary Spacecraft

SiC High Temperature, High Power Electronics

Gasoline & Electric Transportation

Public Power Generation & Distribution

Microwave Communications & Radar

Commercial & High-Performance Aerospace
## Advantages of Silicon Carbide

<table>
<thead>
<tr>
<th>Property</th>
<th>Benefit</th>
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<tbody>
<tr>
<td>Wide Energy Bandgap (6H-SiC = 3.0 eV, 4H-SiC = 3.2 eV)</td>
<td>600 °C Electronics, Extremely Low Leakage Devices</td>
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<tr>
<td>High Breakdown Field (~ 10X of Silicon)</td>
<td>Superior Power Electronics, Radiation Hardened Devices</td>
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<tr>
<td>High Thermal Conductivity (~ 3X of Silicon)</td>
<td>Simpler Heat Rejection Schemes, Increased Power Density</td>
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<td>Excellent Physical Stability</td>
<td>Sustained Use in Hostile Environments</td>
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<tr>
<td>Processing Similarities to Silicon</td>
<td>Potential for Rapid Commercial Development</td>
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Anticipated SiC Applications

Vastly improved systems enabled by unique SiC device capabilities.

High power, somewhat high-f RF, T < 125 °C system ambient.
   HDTV, radar, communications.
   MESFET’s, SIT’s, Schottky diodes.

High power switching, T < 125 °C system ambient.
   Electric motor-drives, high-voltage power transmission & conversion.
   Reduced thermal management, reduced system size, increased efficiency.
   2-terminal (diodes) & 3-terminal (MOSFET, IGBT, etc.) power switches.

High power switching, T > 200 °C ambient.
   Aerospace electric actuators.
   2-terminal (diodes) & 3-terminal (MOSFET, IGBT, etc.) power switches.

Digital and analog signal circuits, T > 300 °C ambient.
   Instrumentation & control electronics for aerospace, automotive,
   and industrial process monitoring.
Case Study: High Speed Civil Transport

300 Seat, Mach 2.4, 5000 NM Range
600 Aircraft for 2005-2015

After Carlin & Ray, 2nd HiTEC, Charlotte, NC, 1994

**Conventional Control System**
(Without High Temperature Electronics)
Each actuator requires 17-26 wires
Average wire run ~ 100 ft.
System wire run weight ~ 600 lbs.
~ 10,000 Connector Pins

**Distributed Control System**
(With High Temperature Electronics)
Control signal multiplexing
System wire run weight < 50 lbs.
~ 1,000 Connector Pins

Wiring & connector problems are #1 cause of propulsion maintenance action in commercial aircraft today!