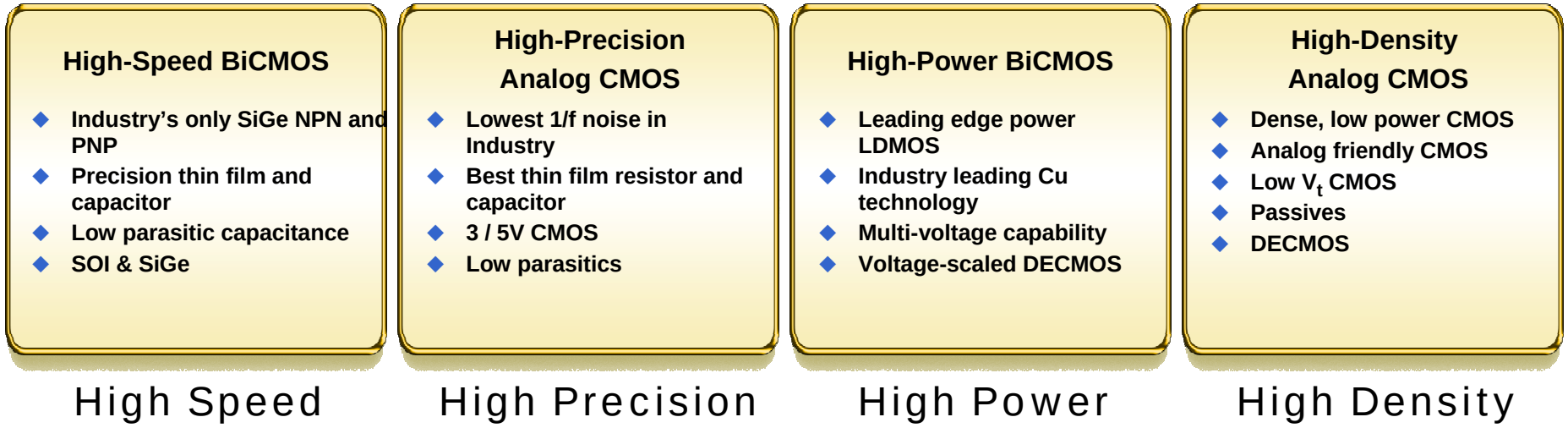
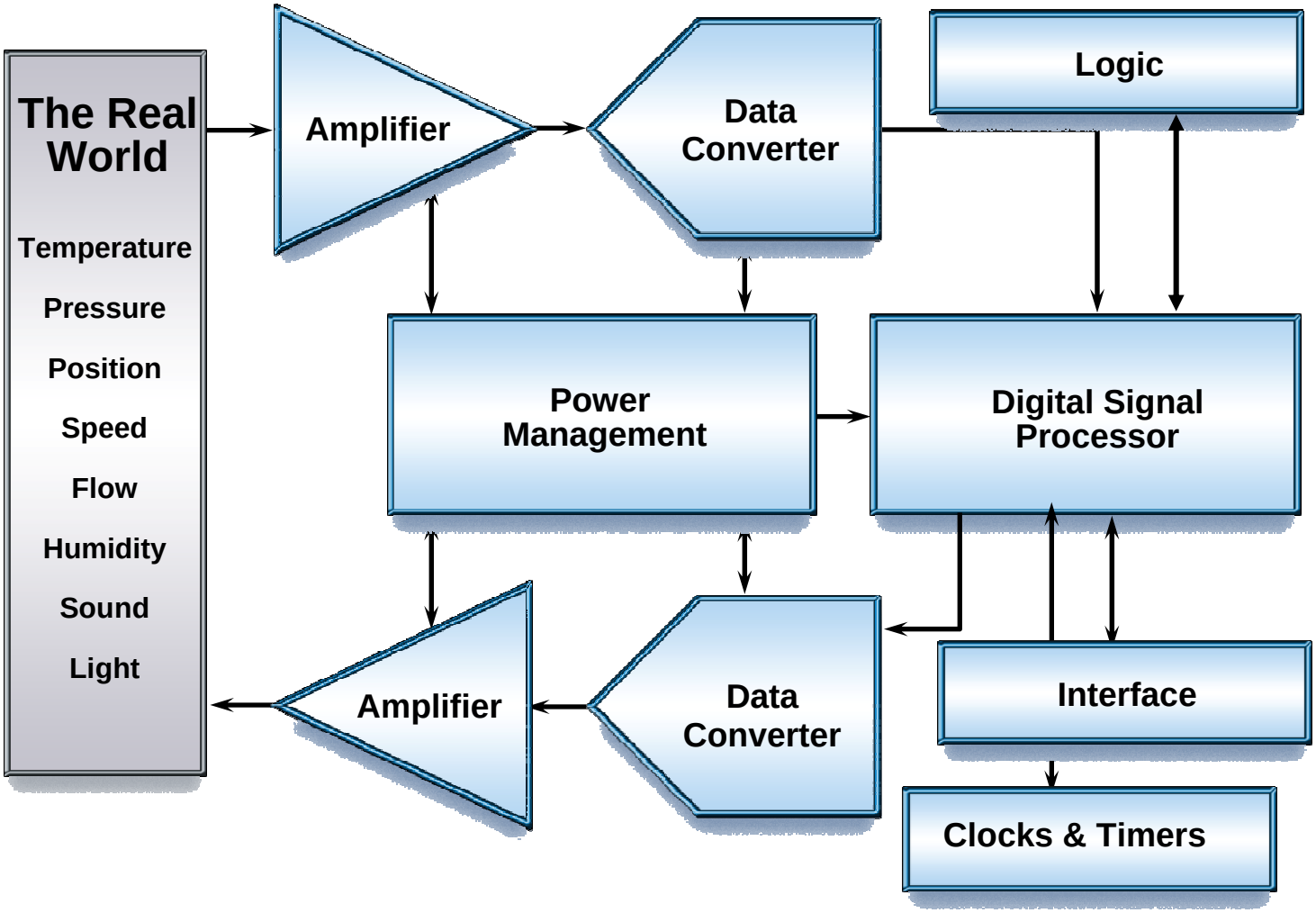
# Analog
# Process Technologies

# Analog Process Technology Roadmap




- **Broadest, deepest analog process technology portfolio**
- **Process differentiation is sustainable competitive advantage**
- **Advanced analog technologies use fully depreciated equipment**
- **New product development programs across four different process platforms**

# Signal Conditioning & Data Converter Needs




## Process Needs

- Transistors
  - Speed
  - Linearity
  - Noise
- Resistors
  - Temperature coefficient
  - Linearity
  - Matching
- Capacitors
  - Linearity
  - Matching
- Technology
  - BiCom3
  - BiCom3HV
  - HPA07
  - C05

# BiCom3: High Speed Fully Complementary Bipolar SiGe Process

| Features | Benefits |
|---|---|
| ◆ Silicon germanium (SiGe)<br>❖ Very fast transistors: 25GHz<br>❖ "Ideal" transistor characteristics | ◆ 30-50% lower power operation<br>◆ Higher speeds / Excellent Dynamic Perf. |
| ◆ Silicon-on-Insulator (SOI)<br>❖ Dramatically reduced transistor size<br>❖ Low-voltage coefficient capacitance | ◆ Reduction in package size<br>◆ Lower distortion from reduced parasitics |
| ◆ Metal-metal capacitor | ◆ Extremely low distortion<br>◆ Improved accuracy |
| ◆ Very low 1/f noise and transistor internal resistance | ◆ Improved Signal-to-Noise Ratio (SNR) |
| ◆ Precision thin-film resistors | ◆ High accuracy<br>◆ Low temperature variation |

# BiCom3HV: High Speed & High Voltage 36V Bipolar SiGe Process

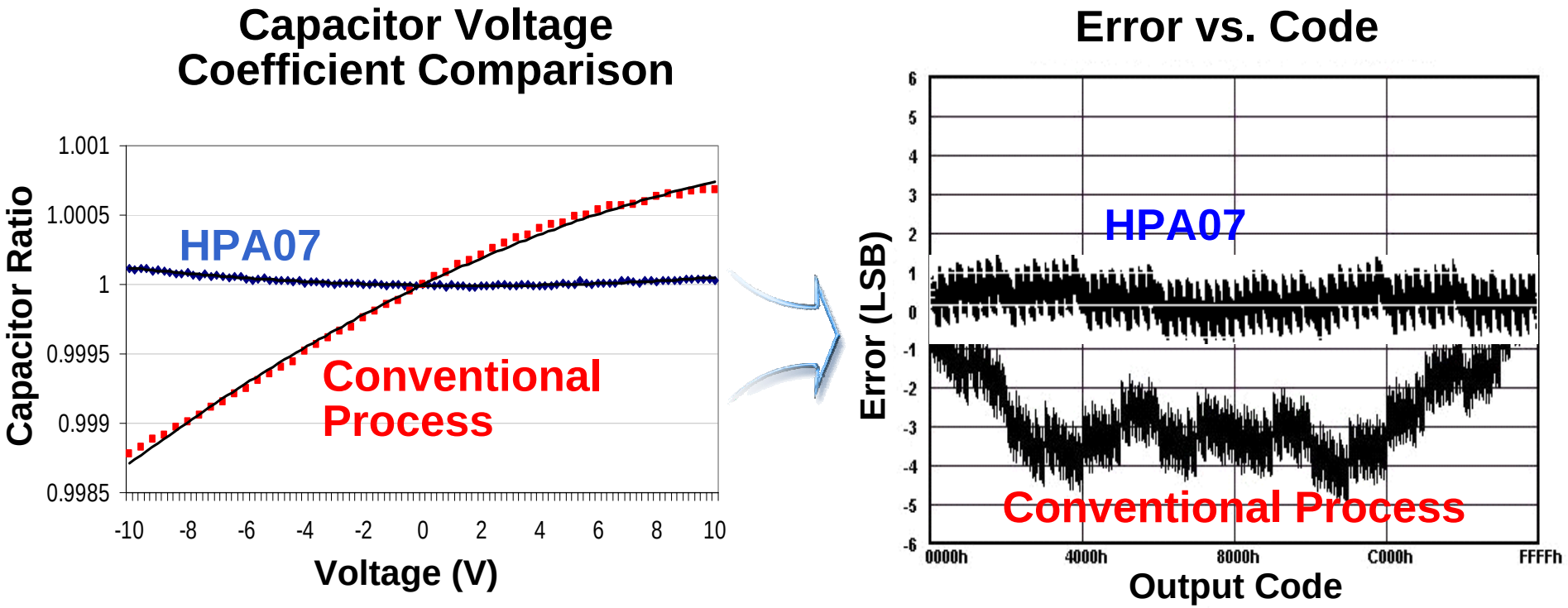
| Features | Benefits |
|---|---|
| ◆ 40V transistors | ◆ Higher voltage for industrial applications |
| ◆ Silicon germanium (SiGe)<br>❖ Very fast transistors: 3GHz<br>❖ “Ideal” transistor characteristics | ◆ 30-50% lower power operation<br>◆ Higher speeds |
| ◆ Silicon-on-Insulator (SOI)<br>❖ Dramatically reduced transistor size<br>❖ Low-voltage coefficient capacitance | ◆ 70% reduction in package size<br>◆ Lower distortion |
| ◆ Very low noise | ◆ Improved Signal-to-Noise Ratio (SNR) |
| ◆ Precision thin-film resistors | ◆ High accuracy |

# HPA07: High-Performance Analog CMOS

HPA07

| Features | Benefits |
| --- | --- |
| ◆ 0.3 µm feature sizes | ◆ Higher speeds and accuracy<br>◆ Low CapEx requirements |
| ◆ 5V isolated CMOS transistors | ◆ Improved Signal-to-Noise Ratio (SNR)<br>◆ Integration of analog and digital |
| ◆ Very low noise | ◆ Improved Signal-to-Noise Ratio (SNR) |
| ◆ Metal-metal capacitor | ◆ 4x increase in accuracy<br>◆ 40% area reduction |
| ◆ Precision thin-film resistors | ◆ Lower test costs<br>◆ 30% reduction in package size |

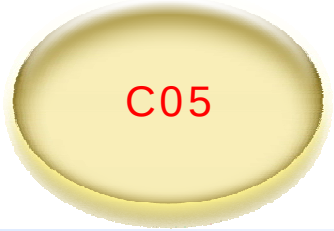
# HPA07: Better Capacitors Mean Better A/D Converters




**The Most Important Component in Precision A/D Converters**

Texas Instruments

# C05: 0.18um Analog Enhanced CMOS




| Features | Benefits |
|---|---|
| ◆ 0.18 μm feature sizes | ◆ High Digital Density<br>◆ Reduced Analog Circuit Parasitics |
| ◆ Low voltage digital logic libraries | ◆ Low Power Integrated Digital Processing |
| ◆ Multiple voltage rating CMOS analog transistors (up to 6V) | ◆ Support for 5V and Li-ion battery connections<br>◆ Optimized transistor vs voltage |
| ◆ Isolated CMOS transistors | ◆ Improved Signal-to-Noise Ratio (SNR) and Total Harmonic Distortion (THD) |
| ◆ Integrated resistors and capacitors optimized for analog design | ◆ Small die size<br>◆ Lower total solution cost<br>◆ Reduced package size |

# LBC7: High-Power BiCMOS Process

| Features | Benefits |
|---|---|
| ◆ 0.25 µm feature sizes | ◆ 70% increase in gate density<br>◆ Lower CapEx requirements |
| ◆ 30V power transistors | ◆ Up to 70% reduction in die size<br>◆ Faster switching speeds |
| ◆ Thick copper power buss | ◆ Reduction in power transistor size<br>◆ Reduction in die size |
| ◆ 3.3V isolated CMOS | ◆ Integration of digital, analog and power functions |
| ◆ Rugged power transistors | ◆ 3x improvement in reliability<br>◆ Reduction in die size |

# A035: High-Density Analog CMOS

| Features | Benefits |
| --- | --- |
| ◆ 0.13 μm feature sizes | ◆ 5x increase in gate density<br>◆ Reduction in package size |
| ◆ 20V power transistors | ◆ 50% reduction in transistor size<br>◆ Integration of power and dense logic |
| ◆ Copper metallization | ◆ Higher gate speed<br>◆ Higher gate density |
| ◆ 1.5V isolated CMOS | ◆ Lower power functions<br>◆ Integration of analog and digital |
| ◆ Dense passives | ◆ Reduction in die size |

# Summary

- Analog process technologies provide sustainable competitive advantage
- Multiple process platforms optimized individually for speed, precision, power and density
- Increasing commitment to analog process leadership