GARYSMITH EDA

CONSULTING IN ELECTRONIC DESIGN

# EDP 2012
# The Power Chart

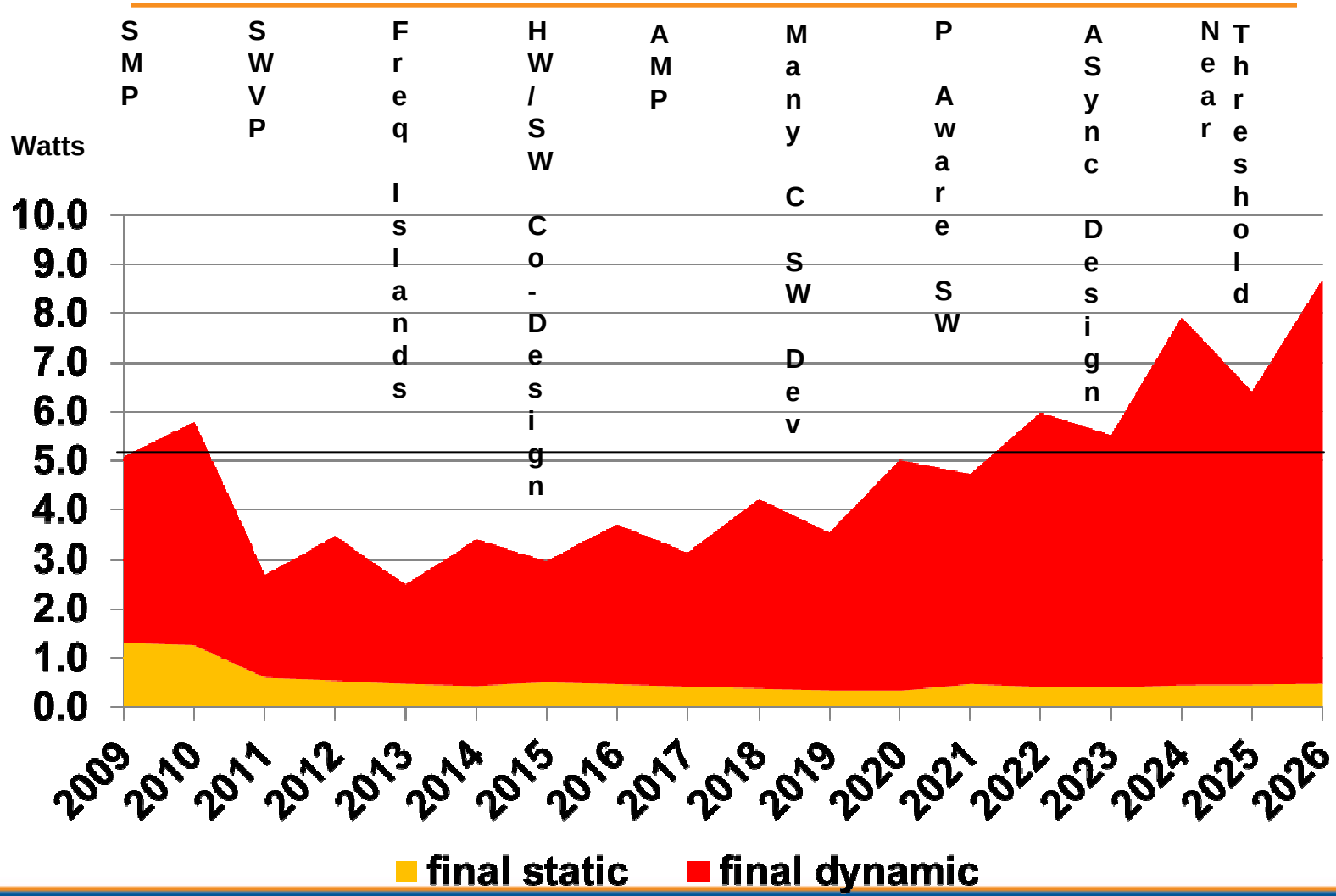
ELECTRONIC DESIGN STRATEGY & MARKET ANALYSIS

www.garysmithEDA.com

# 2011 Power Survey Results

- Average high-end mobile SoC gate count was 104 million gates.
- The average frequency of a low-end cell phone was 400 MHz, for a high-end phone 800 MHz.
- Targeted Average frequency was 400 MHz, highest frequency was 1.2 GHz.
  - **Some reports of packaging limiting the frequency to 1.2 GHz.**

# Q1 2012 – Final Power Chart



# ITRS Power Chart

| *Power Improvement* | *Year* | *Power Improvement dynamic* | *Power Improvement Static* | | *Description of Improvement* |
|---|---|---|---|---|---|
| Clock Gating (Macro Level) | 1996 | .04x | .20x | | **Turning off the SoC when not in use.** |
| Low Power Libraries | 1997 | .09x | .09x | | **Physical Libraries for Low Power Design.** |
| Frequency Scaling | 1999 | .19x | .09x | | **Lowering the frequency for logic outside the critical path.** |
| Clock Gating (Micro Level) | 1999 | .09x | .09x | | **Turning off blocks in the SoC when not in use.** |
| Body Biasing | 2004 | .05x | .20x | | **Setting up a positive or negative voltage below a transistor to reduce. leakage.** |

# ITRS Power Chart

| *Power Improvement* | *Year* | *Power Improvement dynamic* | *Power Improvement Static* | | *Description of Improvement* |
|---|---|---|---|---|---|
| Power Gating | 2004 | .04x | .20x | | **Turning off the power to blocks of the SoC.** |
| Power Islands | 2006 | .09x | .09x | | **Using different power levels for blocks of the SoC.** |
| Voltage Scaling | 2007 | .19x | .09x | | **Decreasing the voltage on blocks during non-peak work loads.** |
| Architecture for Low Power | 2007 | .09x | .09x | | **Minimizing power usage at the architectural level.** |
| HW Accelerators | 2007 | .22x | 0 | | **Using Libraries of hard wired algorithms.** |

# ITRS Power Chart

| *Power Improvement* | *Year* | *Power Improvement dynamic* | *Power Improvement Static* | | *Description of Improvement* |
|---|---|---|---|---|---|
| RTL opt/D gating | 2007 | .22x | 0 | | **Minimizing power at the RT Level.** |
| | | | | | |
| **Total 1996 Thru 2007** | | **2.90x** | **2.20x** | | |

# ITRS Power Chart

| *Power Improvement* | *Year* | *Power Improvement dynamic* | *Power Improvement Static* | | *Description of Improvement* |
|---|---|---|---|---|---|
| Homogeneous (SMP) Parallel Processing | 2009 | 1.50x | 1.00x | | **Using multiple identical processors in a parallel computing architecture.** |
| Software Virtual Prototyping | 2011 | 1.23x | 1.20x | | **Modeling the hardware for the early development of the Software.** |
| Frequency Islands | 2013 | 1.26x | 1.00x | | **Designing blocks that operate at different frequencies.** |
| HW/SW CO-Design | 2015 | 1.18x | 1.00x | | **HW/SW design at the behavioral level based on power.** |
| Heterogeneous (AMP) Parallel Processing | 2017 | 1.18x | 1.00x | | **Using multiple types of processors in a parallel computing architecture.** |

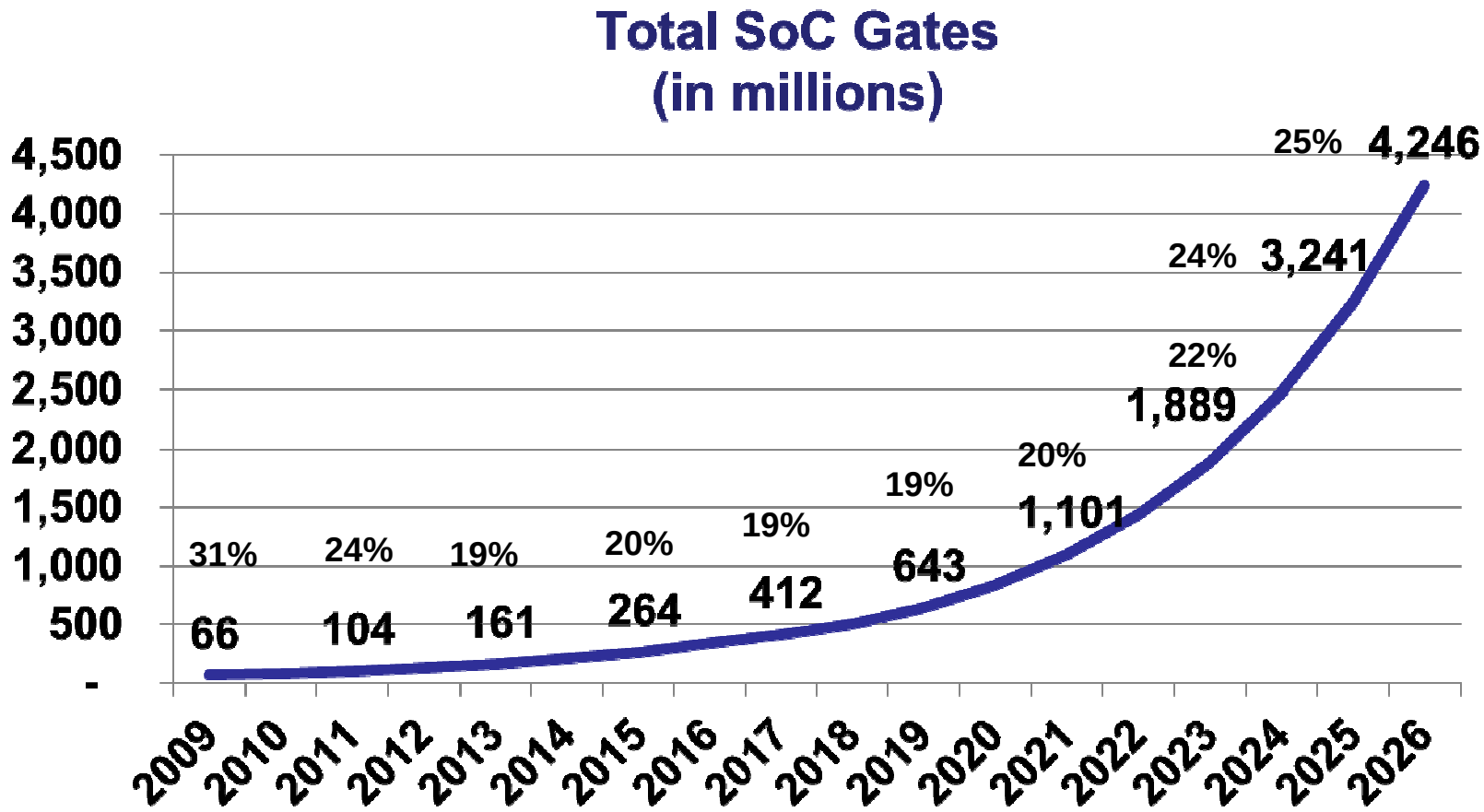
# ITRS Power Chart

| *Power Improvement* | *Year* | *Power Improvement dynamic* | *Power Improvement Static* | | *Description of Improvement* |
|---|---|---|---|---|---|
| Multi-Core Software Development tools | 2019 | 1.20x | 1.00x | | **A set of embedded development tools built for multicore, power aware designs** |
| Power aware Software | 2021 | 1.21x | 1.00x | | **Developing software using power consumption as a parameter.** |
| Asynchronous Design | 2023 | 1.21x | 1.00x | | **Non-clock driven design.** |
| Near Threshold Computing | 2025 | 1.23x | 0.80x | | **Lowering your supply voltage close to the theoretical minimum.** |
| **Total 2009 Thru 2025** | | **11.20x** | **9.00x** | | |

# The Five Design Constraints

- Performance
- Power
- Design time
- Cost of design
- Cost of the packaged SoC

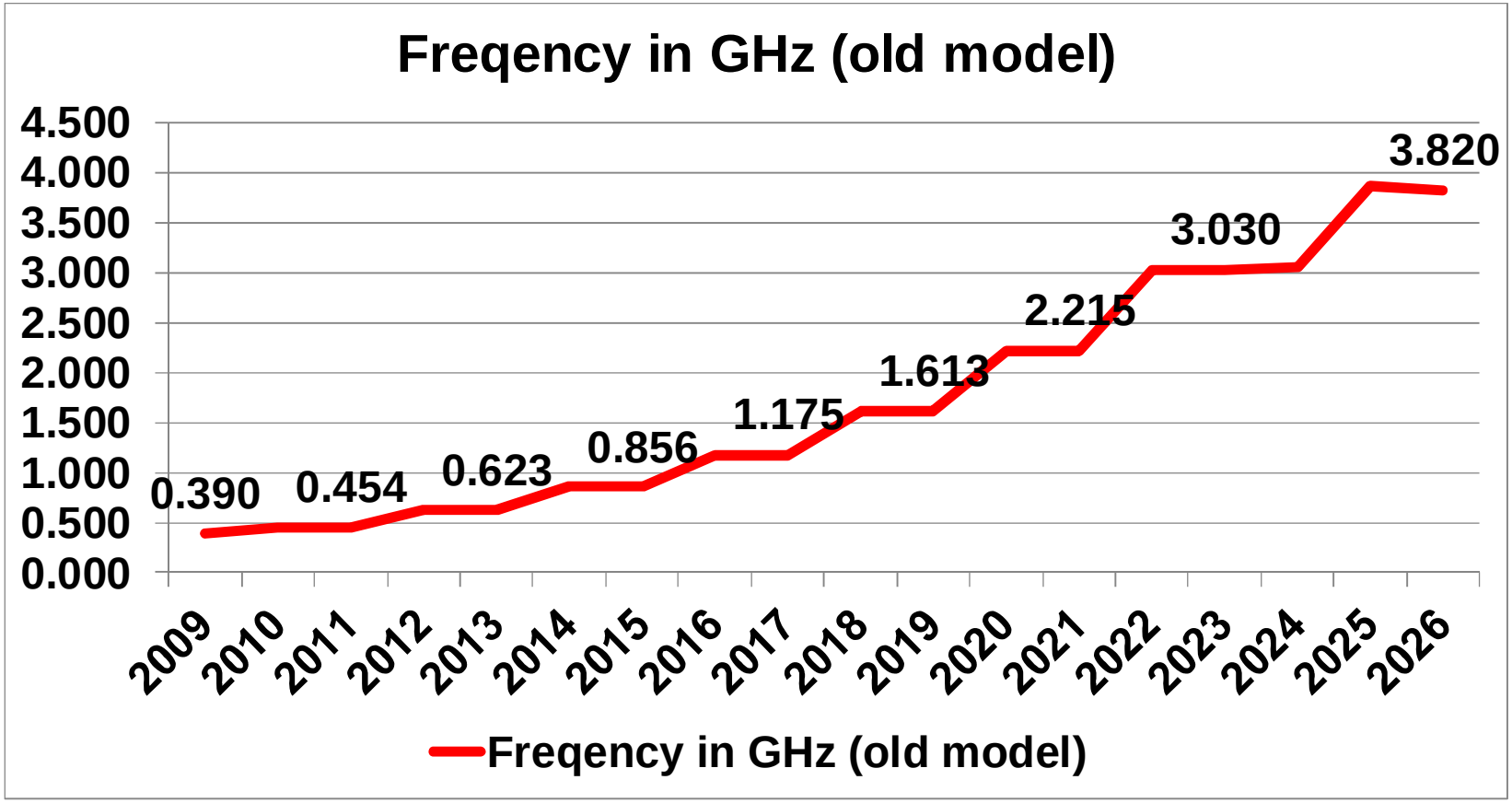
# Average High-End Mobile SoC



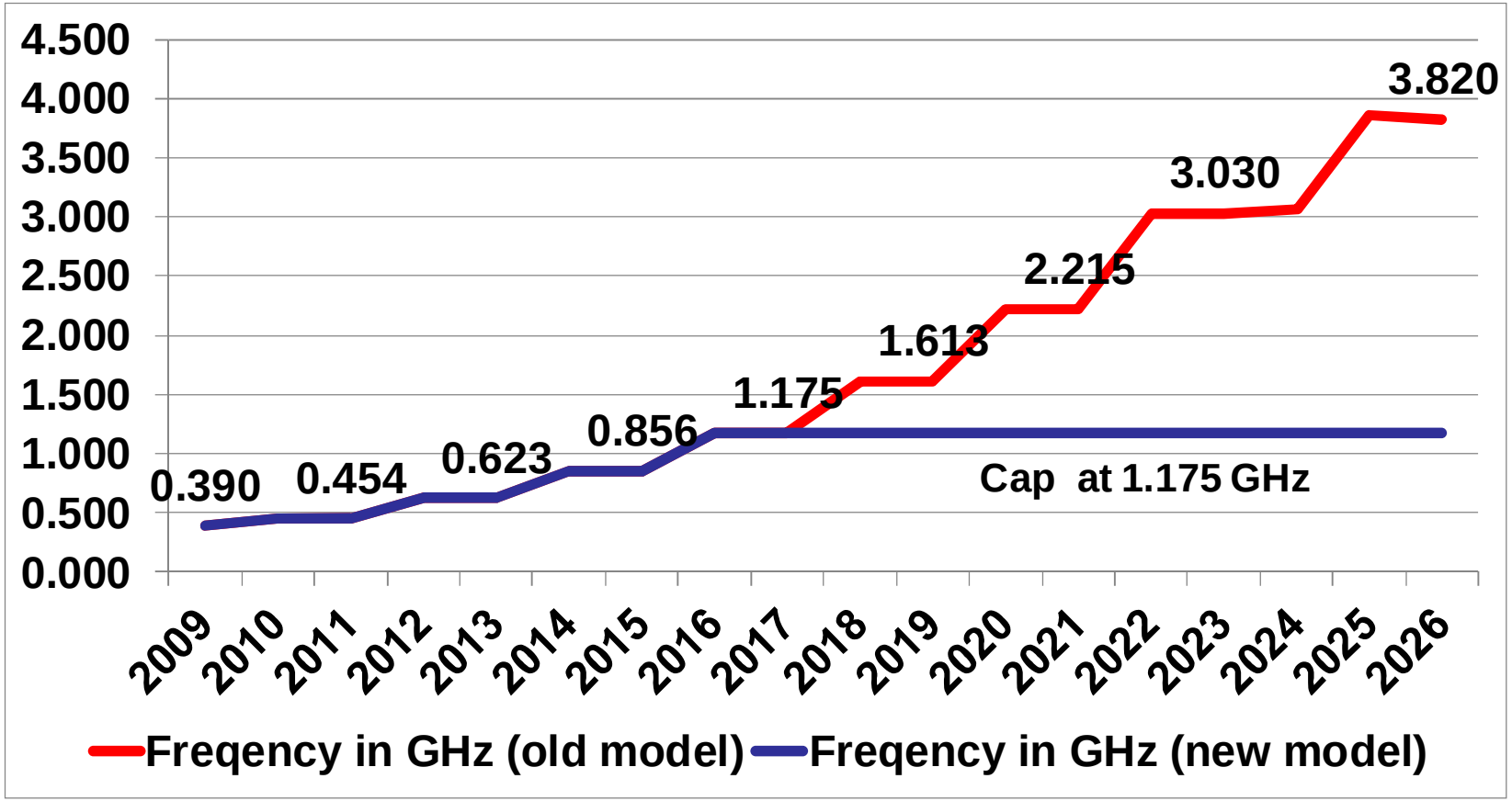
# Design Trade-Offs

- Average Power (Energy)
- Gate Count
- Frequency

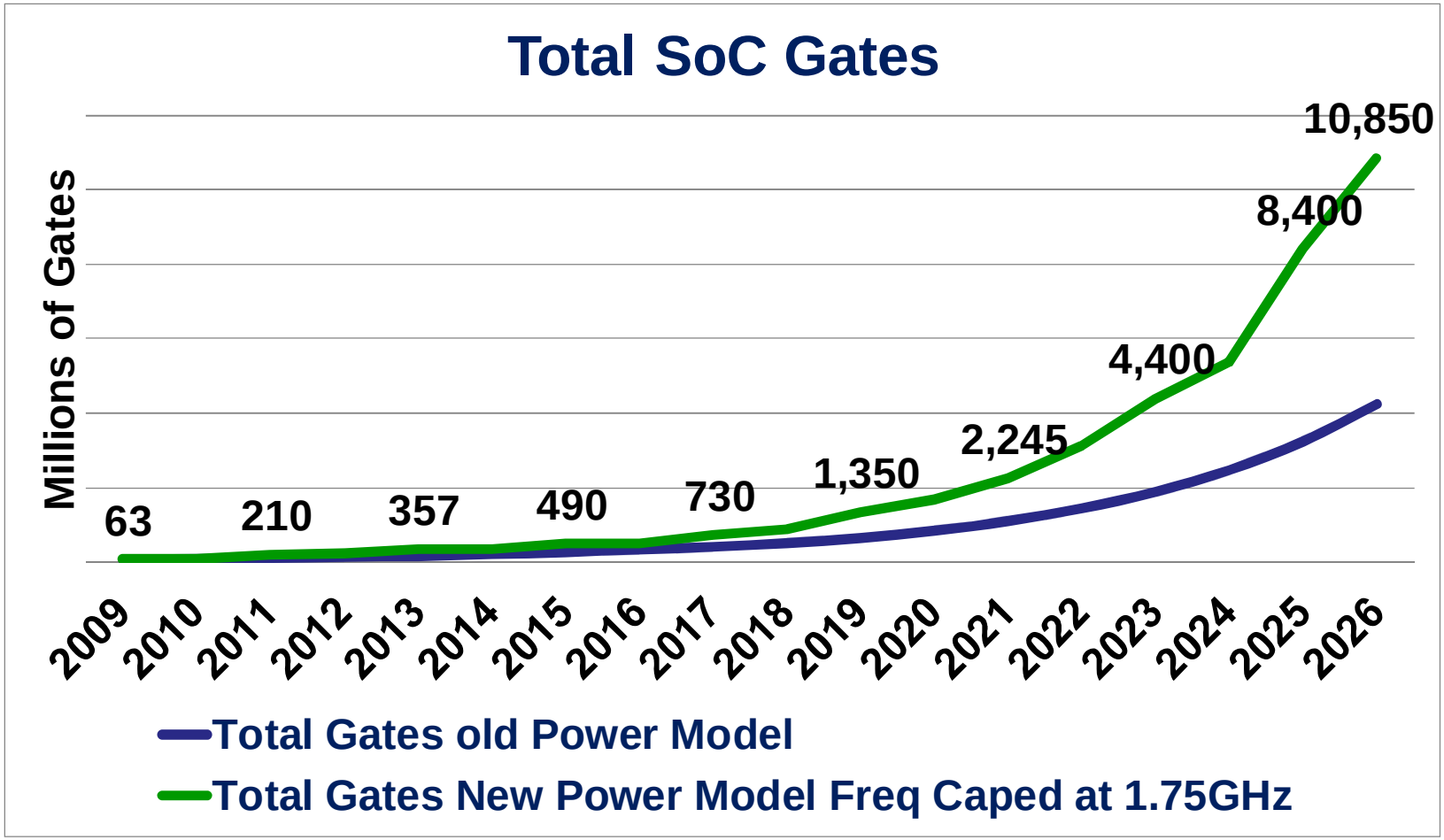
# Frequency Chart @ 5 Watts



# Frequency Chart @ 5 Watts



# Average High-End Mobile SoC




In 2013 we hit the max gate point.