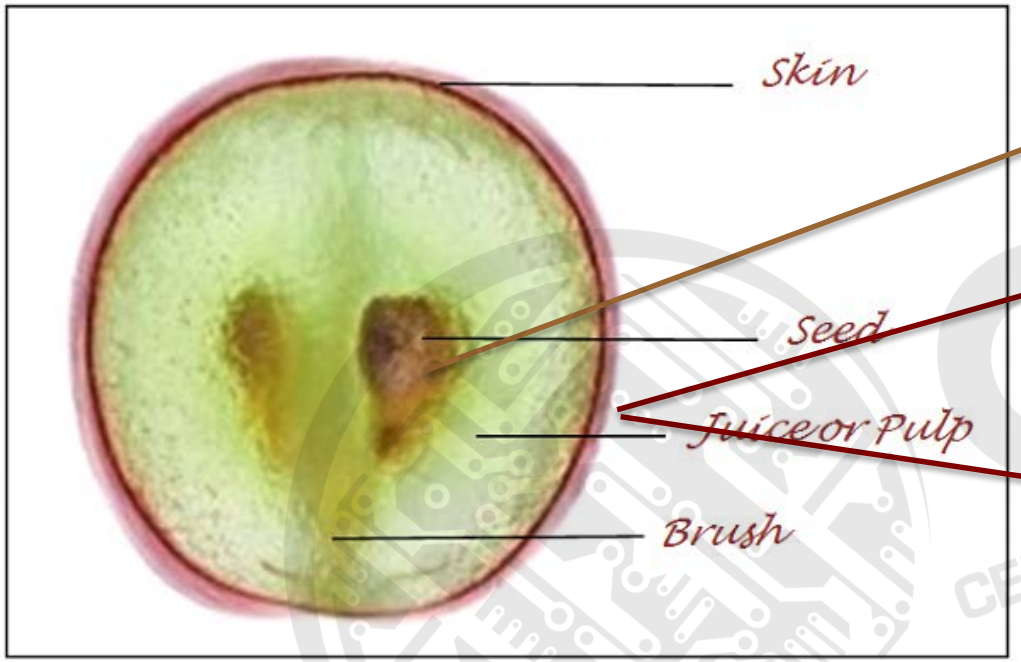
# Why Heterogeneous SoC
# *And Blending of Wine*
# Makes Fine Products

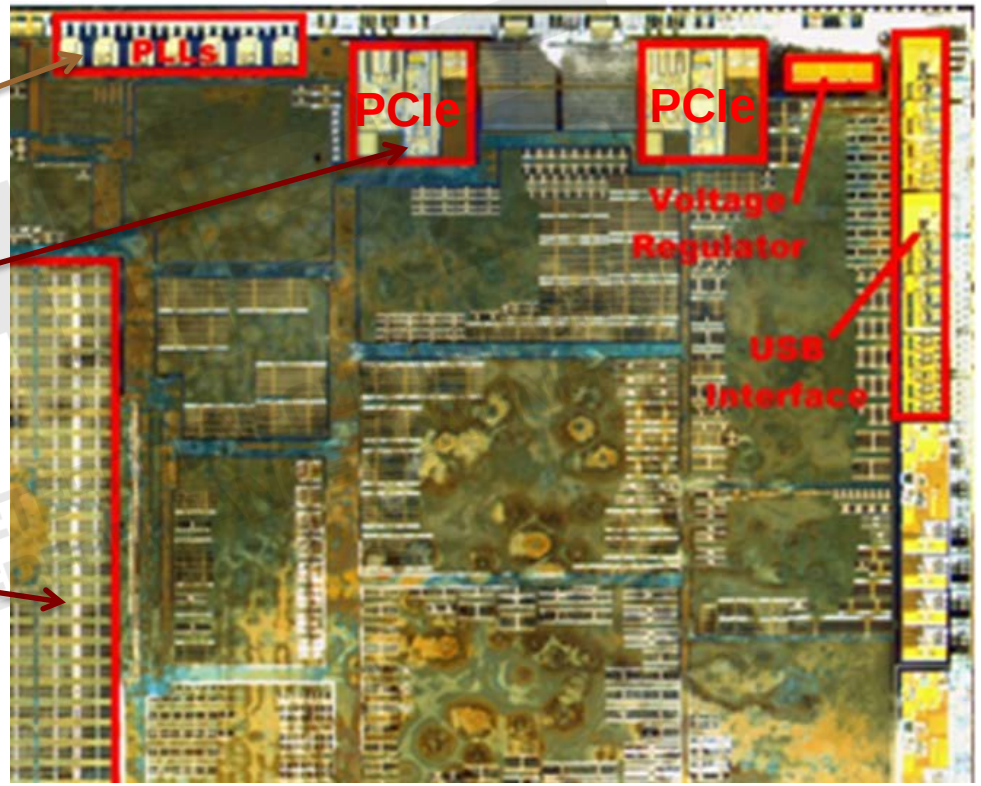
ANALOG BITS

# Milestones in Evolution of Vinification vs SoC Industry

| *Milestones* | **Vinification** | **SoC Industry** |
|---|---|---|
| *Philosophy: Integration of* | Traditional: Old World<br>Modern: New World | Analog, Interface, RF<br>Digital, Memory |
| *Science* | Controlled Fermentation | Moore's Law |
| *Industrialization* | Refrigeration | EDA/Foundry/IP |
| *Downturn* | Phylloxera | Global Recession |
| *Disaggregation* | Vineyard -> Bottle 1 entity<br>Vineyard,WineMaker,Channel | IDM-> Silicon<br>Fabless, EDA/IP, Fabs |

# Cross Section of a Wine Grape vs SoC



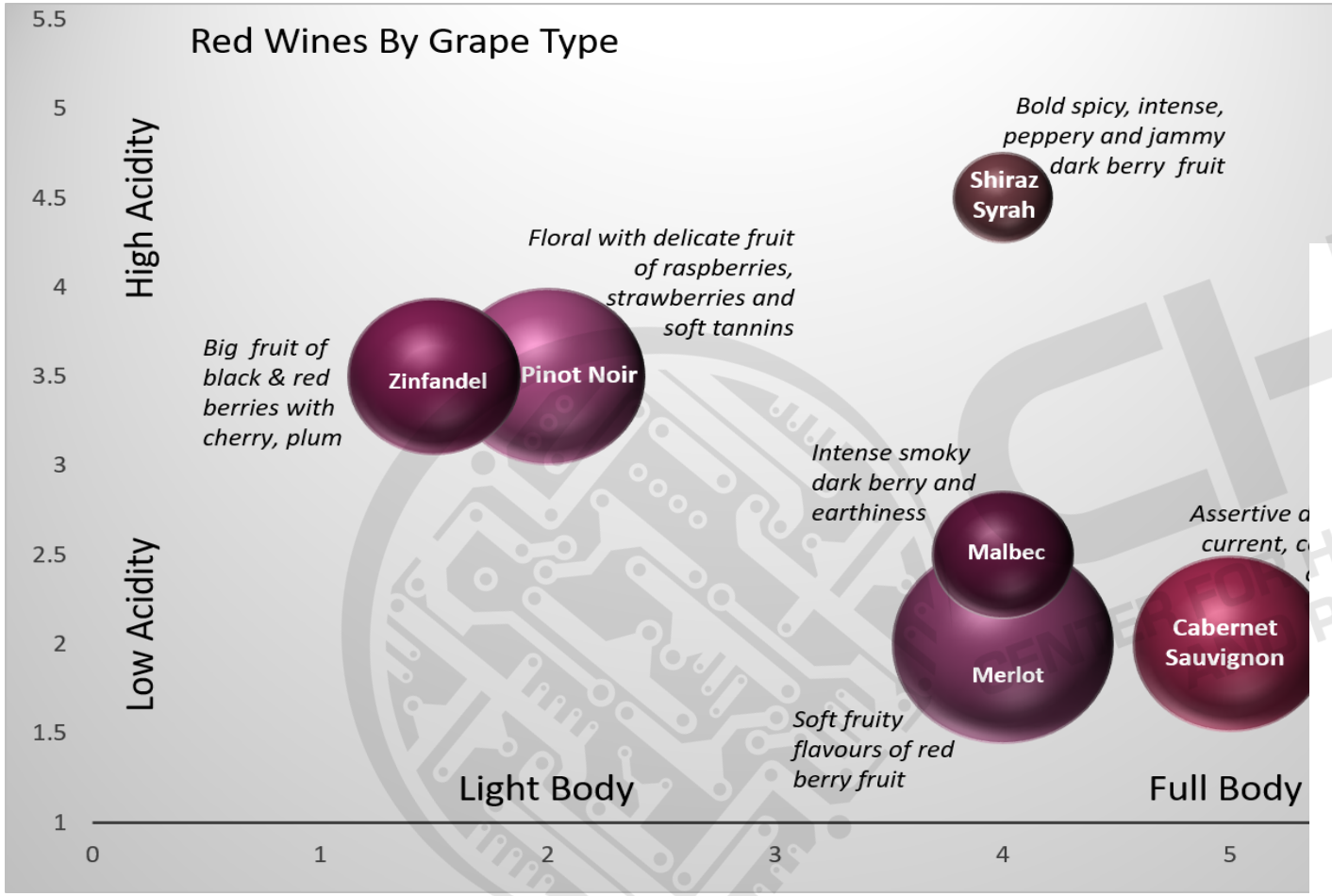



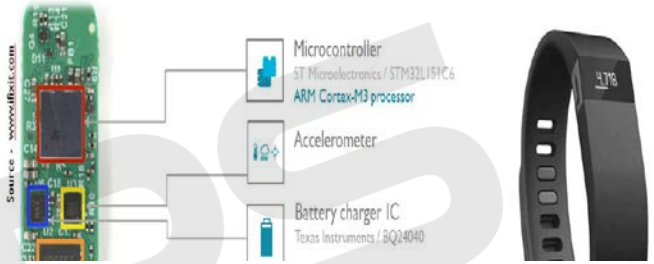

***Tanin is the Analog Mixed Signal IP***

***Pulp (Sugar) is Digital Logic***

Unparalleled Power Performance ANALOG BITS

# Sizes and Compositions of Wine Grapes in a Bottle vs SoC's in a System



# The FinFet Digital Terroir – Logic and Memory

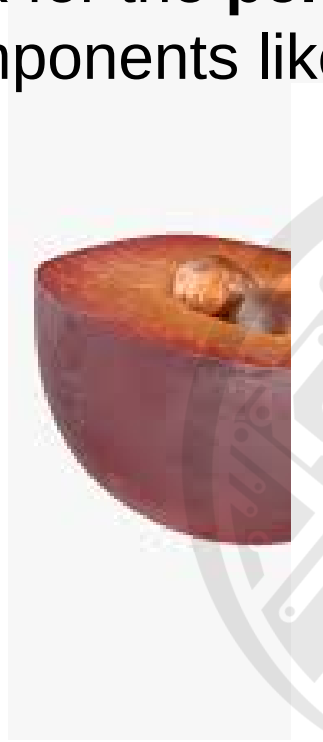
- 100’s of Billions of Transistors
- Defined and prescribed methodology with EDA tools and endorsed by fabs
- Lots of engineers working on RTL
- Even more engineers working on verification
- Lots of EDA tools
- Huge compute and server farms
- Cloud-based computing
- Project managers for every block

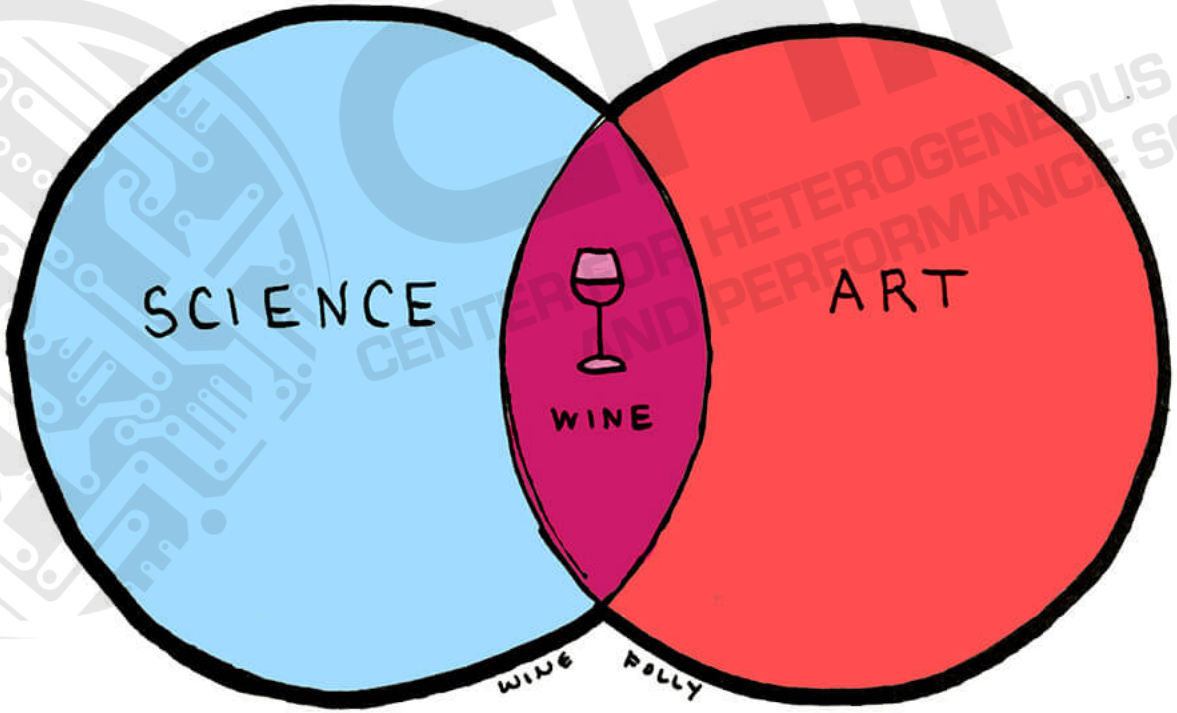
# The FinFet Analog Terroir – Analog and Interfaces

- Precision and patience
- Start everything from *physics* and *metal* – EM/IR/RC challenges
- Metal first design for high speed SERDES and Clocking
- Parasitic not just due to RC but due to gate resistance in FinFets
- Worry about layout topology and FinFet structures
- Leakage at 150C for automotive applications changes architecture
- Aging of transistors and flicker noise impact on performance

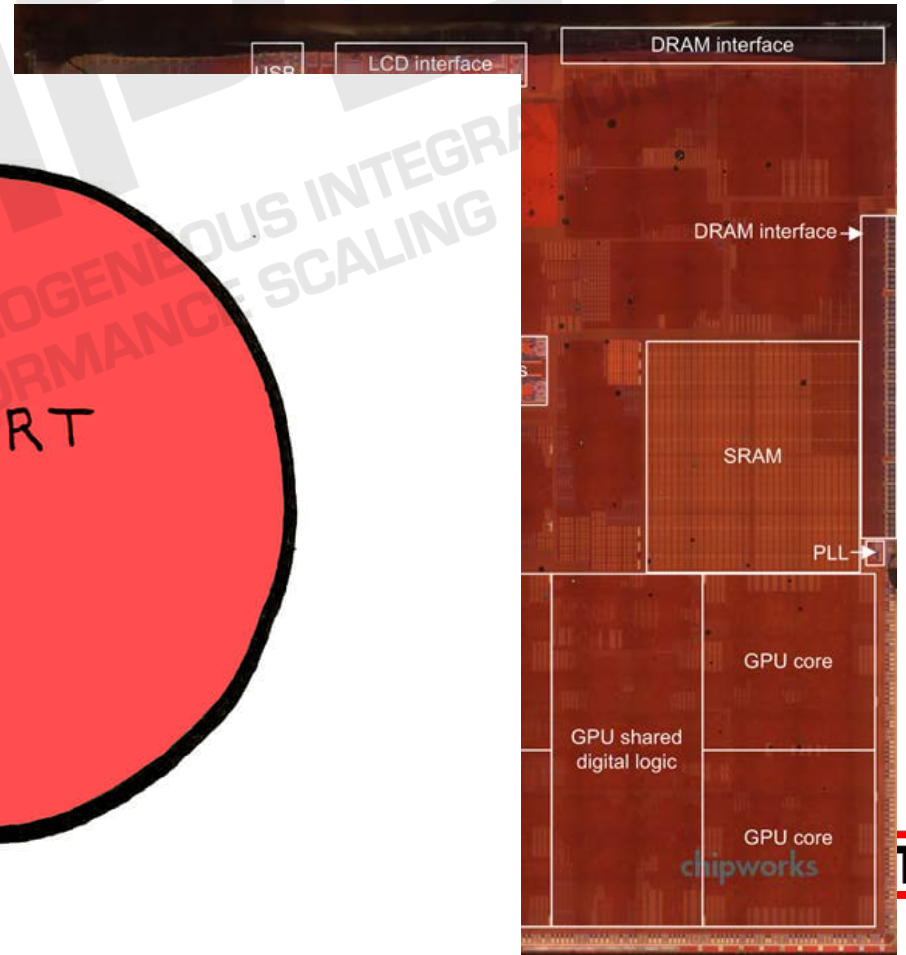
# What Makes the Perfect Blend

**Wine** is all about balance, and winemakers look for the **perfect** balance between flavor components like sugar, acid, and tannin.

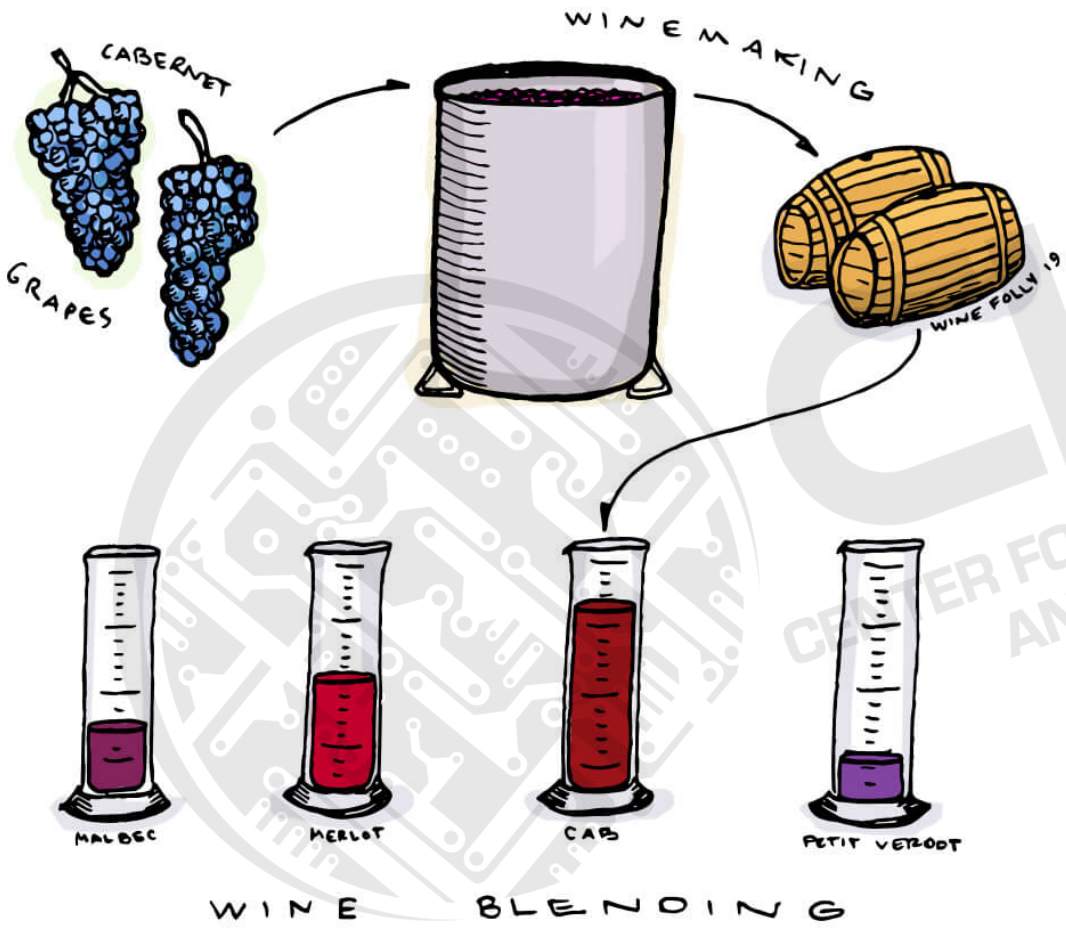


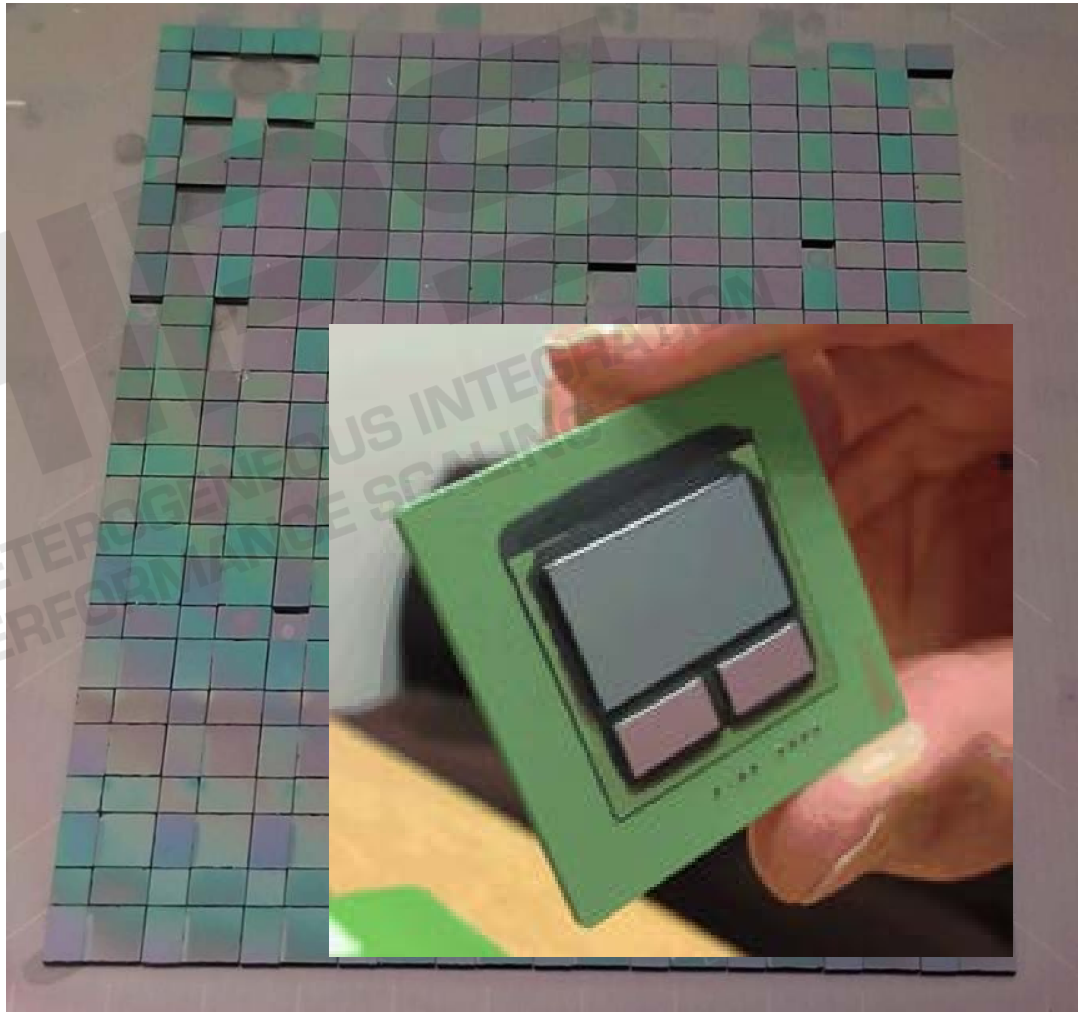



SOC is about Perfect Amalgamation of Analog and Digital



# Wine Blending vs Heterogeneous



Unparalleled Power Performance ANALOG BITS

MERLOT
CAB. FRANC
PETIT VERDOT
CABERNET SAUVIGNON
LEFT BANK
BORDEAUX
CABERNET SAUVIGNON
DOMINANT BLEND
WINE FOLLY

FAMOUS WINE BLENDS OF THE WORLD
CHÂTEAUNEUF-DU-PAPE
RHÔNE, FRANCE
Grenache
Syrah
Mourvèdre
Bourboulenc*
Cinsault
Clairette Blanche*
Counoise
Grenache Blanc*
Muscardin
Picardan*
Picpoul Blanc*
Roussanne*
Terret Noir
Vaccarèse
* white grapes
RED BORDEAUX
FRANCE
Merlot
Cabernet Sauvignon
Cabernet Franc
Petit Verdot
Malbec
WHITE BORDEAUX
FRANCE
Sémillon
Sauvignon Blanc
Muscadelle
RED BOURGOGNE
FRANCE
Pinot Noir >80%
Gamay
WHITE BOURGOGNE
FRANCE
Chardonnay >80%
Aligote
RED RHÔNE / GSM
FRANCE, USA & AUSTRALIA
Grenache
Syrah
Mourvèdre
Others
WHITE RHÔNE
FRANCE & USA
Marsanne
Roussanne
Viognier
Clairette
Grenache Blanc
Bourboulenc
Others
SOAVE
VENETO, ITALY
Garganega >70%
Trebbiano
Chardonnay
Pinot Blanc
Others
CHIANTI
TUSCANY, ITALY
Sangiovese >70%
Cabernet Sauvignon
Cabernet Franc
Others
SUPER TUSCAN
TUSCANY, ITALY
Merlot
Cabernet Sauvignon
Sangiovese
Syrah
Cabernet Franc
Others
AMARONE DELLA VALPOLICELLA
VENETO, ITALY
Corvina
Molinara
Rondinella
Others
RIOJA
SPAIN
Tempranillo >70%
Mazuelo (Carignan)
Graciano
Maturana Tinta
WHITE RIOJA
SPAIN
Viura (Macabeo)
Malvasia
Verdejo
Garnacha Blanca
Others
PRIORAT
SPAIN
Grenache
Syrah
Carignan
Cabernet Sauvignon
Merlot
MERITAGE
USA
Cabernet Sauvignon
Merlot
Cabernet Franc
Petit Verdot
Malbec
Carménère
PORT
DOURO, PORTUGAL
Touriga Nacional
Touriga Franca
Tinta Roriz
Tinta Barroca
Tinto Cão
Others
PROVENCE ROSÉ
FRANCE
Cinsault
Grenache
Syrah
Rolle* (Vermentino)
Others
* white grape
CHAMPAGNE
FRANCE
Chardonnay
Pinot Meunier*
Pinot Noir*
* red grapes
CAVA
SPAIN
Macabeo
Parellada
Xarello
Chardonnay
DIGITAL VERSION - FOR PERSONAL/DIGITAL USE ONLY
http://winefolly.com/update/famous-wine-blends-poster/
WineFolly
Learn to drink wine

CHARDONNAY
AMPAGNE
BLEND
OIR, CHARDONNAY
PINOT MEUNIER
WINE FOLLY
PINO

# Broadest Portfolio of Low Power Differentiated IP

ANALOG BITS

7nm Working Silicon Design Kits Available

## Cut SERDES Power In Half

16/12 FinFET Production Silicon

75+ Processes | 350+ Customers | 800+ Products

**MIXED SIGNAL IP**

- **PVT SENSORS**
  - PVT 0.04mm²
  - POR 0.02mm²
  - Fully Integrated
  - 190nJ/Measurement
- **I/O**
  - Densest Integration
  - 50+ Products
  - High Linearity
- **SERDES**
  - 1-32G Multi-Protocol
  - 3.8mW/Gbps
  - 75+ Products
  - 10G Wire Bond
- **MEMORY**
  - 1GHz TCAM
  - 30M Transistor
  - Cycle-Selectable Operations
- **CLOCKS**
  - 0.02 mm²
  - 0.5 µA/MHz
  - 100fs RMS Jitter
  - 32KHz to 100 MHz X-tal OSC

Lowest System Cost

Greatest Reliability

Smartest Systems

CHIPS CENTER FOR HETEROGENEOUS INTEGRATION AND PERFORMANCE SCALING

# Corporate Background

**Heritage**

Focused on differentiated low power mixed-signal IP
- Founded in 1995, based in the Silicon Valley
- Independent with no external funding

**Track Record**

World-class mixed signal CMOS engineering staff
- Extensive experience in advanced SoC designs
- IP in billions of silicon from 0.25µm to 5nm FF

**Core Values**

Premier IP partner from architecture to silicon
- Customer-centric business engagement
- Engineering-centric support

**Client Base**

Global customer base: 50% US, 50% international
- 500+ Customers in 70+ Processes

# Analog Engineer and Wine Maker – The Eternal Artists

***If your circuit has a mistake you own it and fix it***

***If your bottle is a mistake you own it and deal with it***

Thinks ***electrons*** all day - uses paper and pens and scientific calculator (1+1 is never2)

Imagines and challenge to solve problems in projects and fights to succeed

Loves physics, geek talks and labs

Circuit Sims, layout checks, EM/IR, IBIS/AMI

Checks every result carefully with relentless patience and decides with 1000's data points

Thinks ***brix*** all day –Soil, Fermentation, Barrels, Bubbling. 1+1 is never 2

Imagination to take a grape to wine and later realize it in winery relentless

Loves chemistry, microbiology and labs

pH, titration, sugar by refractometer, YAN analysis, malic acid

1000's of decisions