

Semiconductor Technology Impact on Microwave and Millimeter Wave Markets

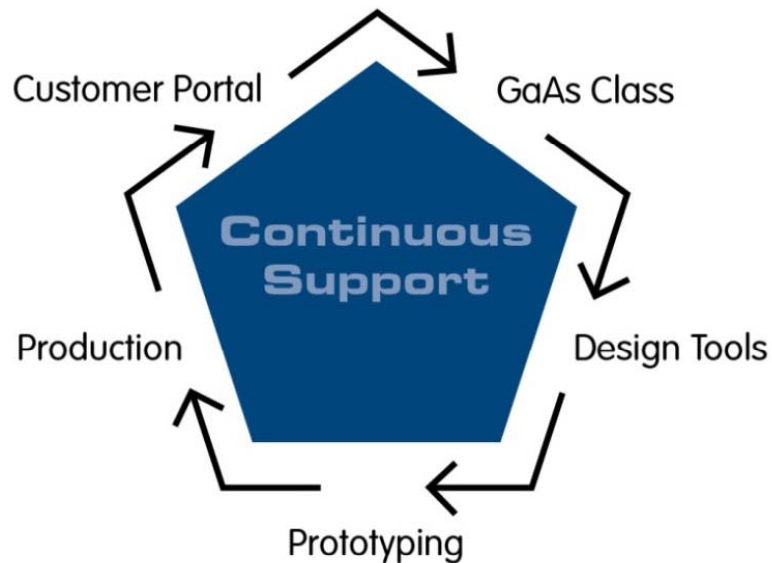
Glen Riley – VP Commercial Foundry

Connecting the Digital World to the Global Network®



TriQuint Commercial Foundry Business Unit

- ◆ Leading GaAs foundry supplier for over 25 years
- ◆ Broadest range of GaAs and GaN foundry technologies
- ◆ Unmatched support and service



GaAs Technology Drives RF Communications

◆ Cellular and WLAN Power Amplifiers (1-5 GHz)

- Over 1 Billion cell phones per year now
- Over 1 Billion WiFi systems projected in 2013
- Smart phones driving more GaAs content
 - \$5-\$8 per phone
 - \$0.50-\$1.50 per device/module
 - Multi-chip, laminate based, plastic molded packages

◆ Base Stations (1-5 GHz)

- Demand for data and video is exploding around the world
- GaAs mixers, VCO's, driver amplifiers
- GaAs HBT and GaN FET high power amplifiers



GaAs Technology Drives RF Communications

◆ Pt-Pt Radio (10-40 GHz)

- Backhaul for base stations
- GaAs mixers, VCO's, driver amplifiers
- Higher frequencies require higher performance circuits

◆ Emerging Markets

- Automotive Radar (24 GHz, 77 GHz)
- WiGig (60 GHz)
- E,V Band Pt-Pt Radio (70-90 GHz)
- mmWave Imaging (80-95 GHz)
- New Commercial Applications



GaAs Manufacturing – High Volume & Performance

- ◆ World wide GaAs capacity is greater than one million 150mm wafers per year
- ◆ High Volume = Optical Gate Photolithography
- ◆ High Performance = e-Beam Gate Lithography
- ◆ Full MMIC Processing
 - Monolithic Transistors, Resistors, Inductors, Capacitors
 - Prototypes <\$50K
 - Mask sets <\$50K

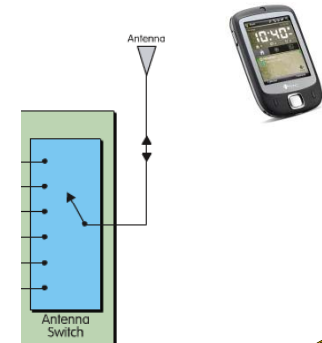


TriQuint Commercializing mmWave Markets – Optical Gates

TQPED
0.5um E/D

Ft=27GHz

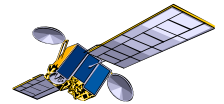
Integrated WLAN,
Antenna Switches



TQP25
0.25um D
0.35um E

Ft=45GHz

GSM Switches,
Pt-Pt, Ku Band
PA's, LNA's



TQP15
0.15um D

Ft=75GHz

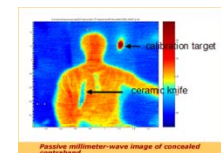
VSAT, Pt-Pt,
Ka Band PA's



TQP13
0.13um D

Ft=100GHz

LNA's, LNB's,
WiGig, Automotive
Radar, Imaging



Summary

- ◆ GaAs being expensive is a myth
 - Key enabling technology for cell phones and WiFi
 - Prototype wafers & production mask sets <\$50K
 - Devices <\$1
- ◆ New applications are pushing frequencies to 100GHz
- ◆ GaAs and GaN enable products that silicon can't

