



VPIN Structure Cross-Section

General Description

The VPIN (Vertical P-I-N) GaAs Diode process is excellent for low-loss limiters, switches, and phase shifters. Using this process, TriQuint has produced switches with high power handling capability, low on-state resistance, and low off-state capacitance. The higher cutoff frequency of the PIN diode element makes this switch ideal for broadband electronic components and communication systems. Passives include 2 thick-metal interconnect layers, precision TaN resistors, GaAs resistors, MIM capacitors and through-substrate vias. The via-under-cap process aids in size compaction and offers excellent grounds at higher frequencies. Air bridges produce minimal interconnect capacitance.

Features

- Multiple P-I-N diode sizes
- Low on-state resistance
- Low off-state capacitance
- Device passivation
- High Q passives
- MIM capacitors
- TaN resistors
- 2 metal layers
- Air bridges
- Substrate vias

Applications

- Communications
- Space
- Military
- Phase shifters
- Limiters
- Switches
- Variable attenuators

VPIN Process Details			
Element	Parameter	Typical Value	Units
Diodes			
MIM capacitors	density	300	pF/mm ²
Capacitors over vias		yes	
TaN resistors	sheet resistance	50	Ω/sq
Vias		yes	
Substrate	thickness	100	μm

VPIN Models Available		
Size (μm)	Layout Type	Substrate (μm)
15	round	100
25	round	100
30	round	100

Application Examples

DC to 20 GHz SP4T PIN Switch TGS 2304-SCC:

The TriQuint TGA2304-SCC is a GaAs monolithic P-I-N diode single-pole, four-throw switch that operates from DC to 20 GHz. At a bias current of 10 mA per output arm, typical midband performance is 0.6 dB insertion loss with 40 dBm isolation in the off-arms. Isolation and insertion loss can be adjusted by varying the output arm bias current of the switch.

Wideband Dual Stage Limiter TGL 2201:

This limiter is a 3 to 25 GHz limiter with less than 0.75 dB loss at X-band and 15 dB return losses. The limiter's RF leakage is less than 18 dBm at 1 W P_{in} and it has an input power survivability greater than 5 W.

Prototyping and Development

- Prototype Wafer Option (PWO)
 - Customer-specific masks
 - Customer schedule
 - 2 wafers delivered
 - Backside via process included
 - PCM (process control monitor) qualified wafers

Design Tools

- Device libraries of circuit elements:
 - Diodes
 - Thin-film resistors
 - Capacitors
 - Inductors
- Agilent ADS design kit

Training

- GaAs design classes:
 - Half-day introduction upon request
 - 3-day technical training upon request at the TriQuint Texas facility

Process Status

- VPIN (Vertical P-I-N) GaAs Diode is fully released and qualified
Contact TriQuint or visit <http://www.triquint.com/company/quality/> for more information on quality and reliability.

Applications Services

- Tiling of GDSII stream files including PCM (process control monitor)
- Design rule checking
- Layout versus schematic checking
- Engineering:
 - On-wafer DC test
 - On-wafer RF test
 - Thermal analysis
 - Yield enhancement
- Part qualification
- Failure analysis
- Space Qualification

Manufacturing Services

- Mask making
- Wafer thinning
- Wafer dicing
- Substrate vias
- DC die-sort testing
- RF die-sort testing
- Final visual testing