

# Microwave Customised Hybrids

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LINWAVE

# Linwave Technology – about us

Linwave Technology is a supplier of novel custom RF & Microwave products for a wide range of applications; based in Lincoln UK . Each of our solutions is tailored to meet a specific customer challenge and enhance their overall system performance.

Product Examples include Analogue and Digital Transceivers, Power Amplifiers, Sources, Multi-chip Hybrids, Millimetre wave Diode assemblies. Our products have already supported customers in Defence, Avionics, Marine, Industrial, Satcom, Healthcare, Space, Wireless, Transport and Security.

We have a unique combination of broad market alignment and deep technology understanding that can help solve some of today's hardest RF problems. Linwave solutions can range from open die IC's -utilising on site wire bonding and clean room facilities, up to modules with integrated software GUI. Products can be subjected to environmental approval plans in association with appropriate market & legislative directives proving compliance ahead of further systems integration. Our engineered integrated solutions provide top tier customers with options to add functionality and performance for enhanced systems performance for key SWaP advantages (size weight power).

Unique bespoke solutions need close working relationships.

We excel at close collaboration to ensure project scope is understood and can be delivered effectively.



# Linwave Technology – about us

- Product is structured around four key product pillars to exploit key skills and technologies within the Business:-

Converters and Transceivers / Power Amplifiers / Hybrid Multichip QFN Modules / [Semiconductors](#)

- Offer a broad range of design and manufacturing capability which is unique amongst UK SMEs, including:-
  - RF design and performance enhancement capability.
  - Specialist vertical design integration from die up.
  - Chip and wire design and build capability.
  - Design & test capability to 94GHz.
  - ITAR-free designs where needed.
  - On-site prototyping to volume manufacturing capability & experience.

# Facilities & Capabilities – Clean Room

- Class 10000 clean room.
- Temperature and humidity controlled.
- Inert gas hermetic sealing – vacuum furnace and projection welding facilities.
- Wafer probe capability.
- Manual and Semi-Automated ball, wedge tape and wire bonding.



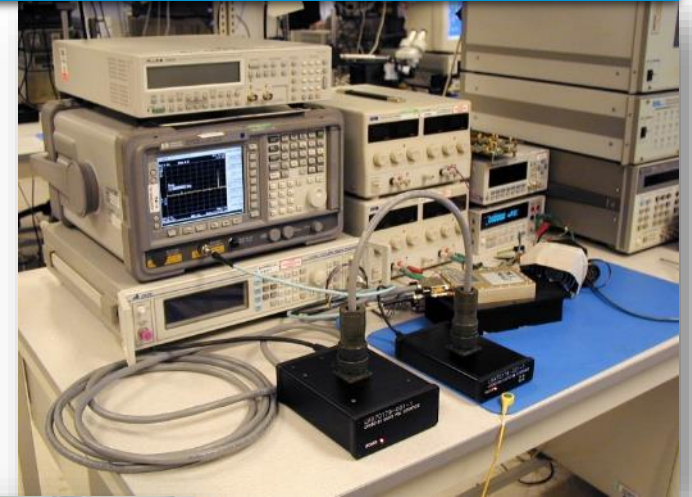
# Facilities & Capabilities - Assembly

- Hybrid chip & wire assembly capability:-
  - Eutectic die attach.
  - Epoxy die attach.
  - Gold wedge, ball, ribbon bonders.
  - Bond pull tester.
  - Wet etch capability.
  - Dry Nitrogen backfill.
  - Gap welder.
  - Vacuum furnace.
  - Custom specific tooling.



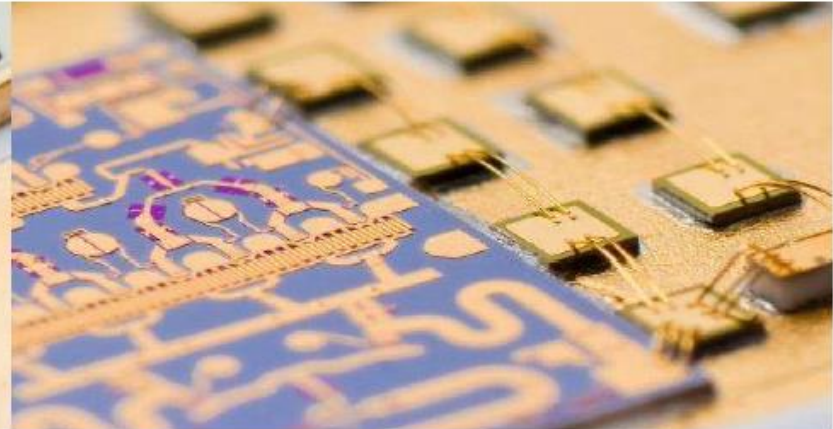
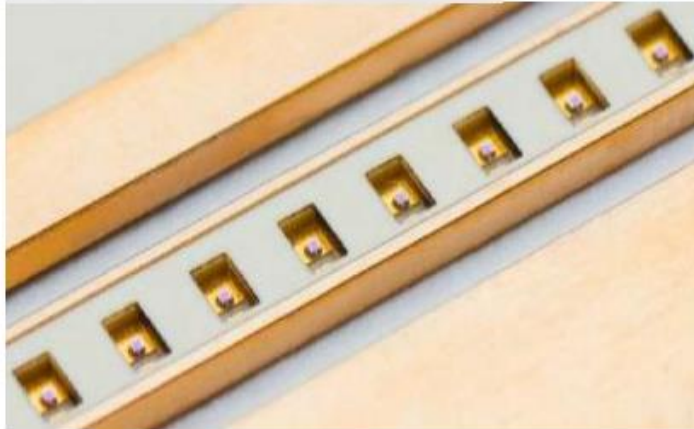
# Facilities & Capabilities - Test

- Spectrum, Vector, Power, Noise and Scalar Analysis to 110 GHz.
- Modulated test sources & AW capability.
- Phase noise capability.
- Temp cycle facilities.
- Measurement automation routines for repetitive tests.
- Environmental testing including hot / cold store, Burn-in ovens and operational vibration and shock tests.



# Product Range

- Packaged GaAs Gunn Diodes
  - 24 - 110GHz frequency range
  - 50mW output power typical
- Custom Varactor Designs
  - Obsolescence Replacements
  - Custom Packaging Options
- Mixer Diodes
- ASPAT Diodes
- Design optimization
  - Stand-alone components
  - Package optimization
  - Matching components and associated circuitry



# Capability Case Study – Gunn Diodes

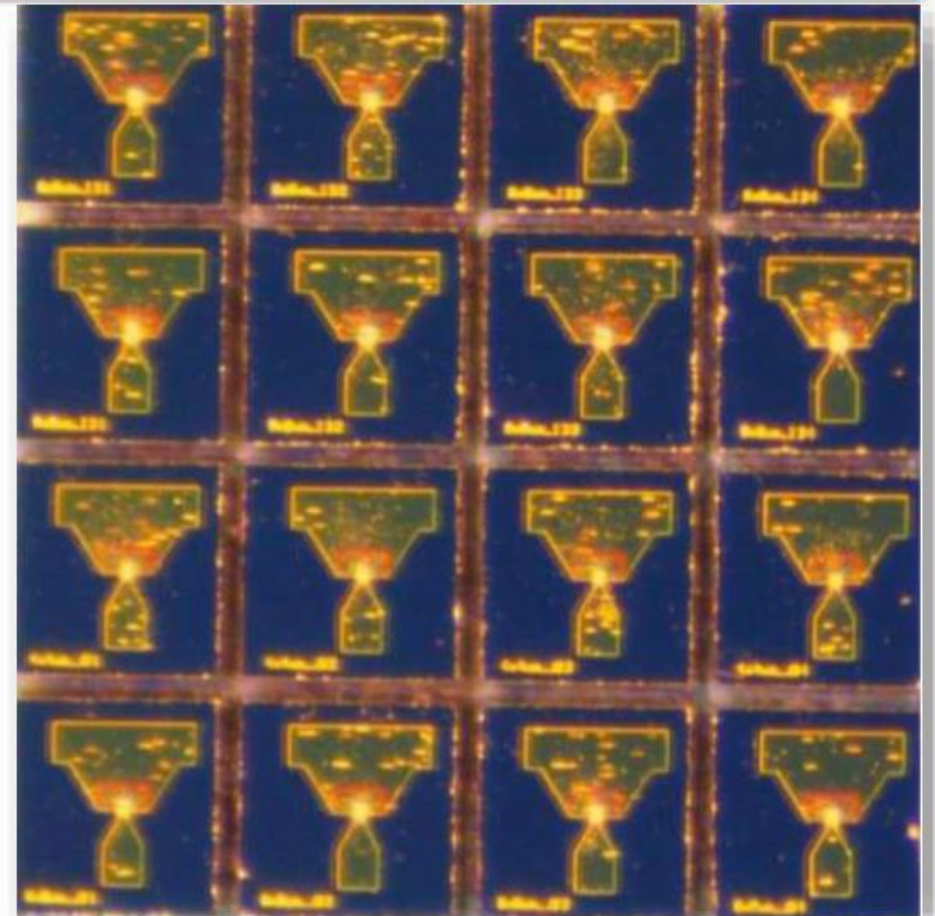
- Range of standard products offered.
- Frequency range covered 24-110 GHz.
- Output power typically 50mW minimum.
- Tested in range of standard oscillator cavities.
- Offer set-up and test in customer cavities.
- Environmental test and burn-in / screen options available.

Linwave Part	Legacy Part No.	Performance Details
LW36-600003	DC1276F-T	26-40GHz, typically 50mW output
LW36-600007	DC1276G-T	26-40GHz, typically 100mW output
LW36-600005	DC1276H-T	26-40GHz, typically 200mW output
LW36-701123	DC1277F-T	40-60GHz, typically 50mW output
LW36-700156	DC1277G-T	40-60GHz, typically 100mW output
LW36-701122	DC1279F-T77	75-110GHz, optimised at 77GHz, typically 50mW output at this freq.
LW36-600006	DC1279F-T94	75-110GHz, optimised at 94GHz, typically 50mW output at this freq.



# Capability Case Study – ASPAT Detector Diodes

- Asymmetric Spacer Layer (ASPAT) Diode
- Joint Venture with Cambridge University and ICS Manchester
- incorporates a single tunnel barrier of AlAs in a crystal of GaAs with an asymmetric doping profile; shares the same sensitivity as a Schottky barrier
- Zero bias operation
- Wide dynamic range with especially high sensitivity to low incident powers
- Operation 100 GHz +
- Extremely temperature stable up to 300°C



# Capability Case Study – Hyper Abrupt GaAs pn Junction Varactor Diodes

- Customer specified performance parameters.
- Joint Venture with die supplier to develop process:-
  - Simulation activity.
  - Mask set design.
  - Hardware realisation and evaluation.
  - Packaging options and optimisation of performance.
- Good temperature stability up to 300°C.
- Low series resistance  $<1.0\Omega$

## Case Study 1

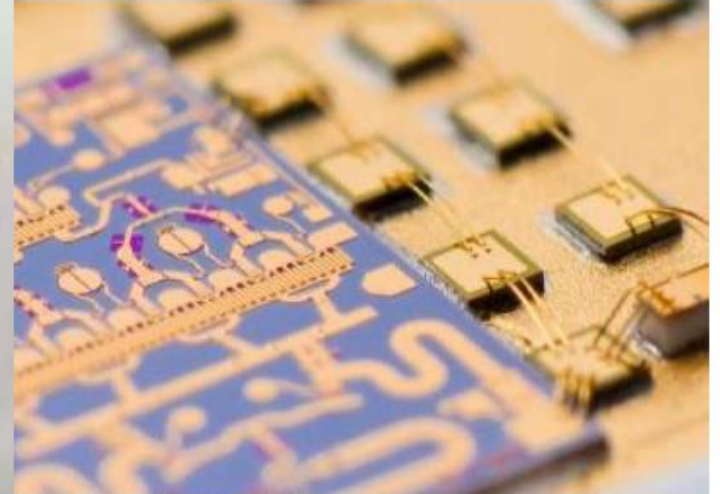
Parameter	Result
Capacitance	0.68pf
Tuning Ratio	2.7-3.3
Leakage Current	2nA @ 20v reverse bias

## Case Study 2

Parameter	Result
Capacitance	90pf
Tuning Ratio	25

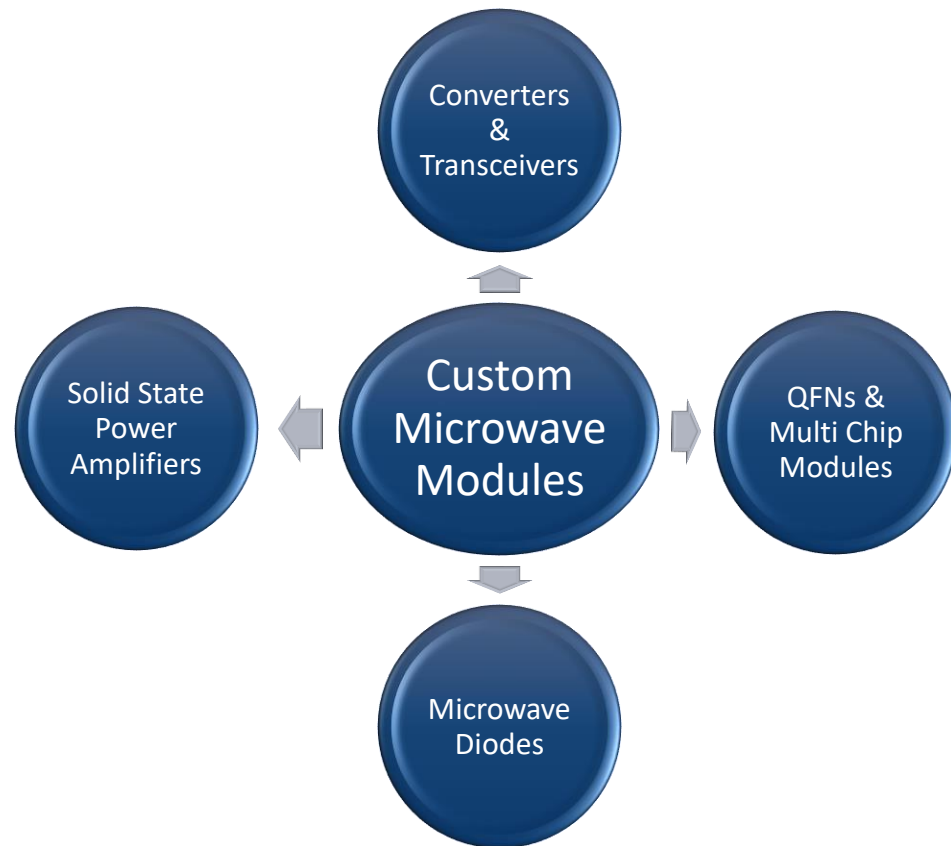
# Further Capabilities

- Semiconductor die provided via small number of key suppliers.
- Custom tooling for packaging die in a range of standard formats.
- RF test, tune and performance optimisation.
- Direct naked die mount into circuits.
- Semi-conductor development activity for custom diodes, component obsolescence, etc.
- Oscillator design and development service.
  - Including broad band array design / development service.
- Build-to-print service offered for oscillator and higher level custom assemblies.





# Products & Technologies Summary



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