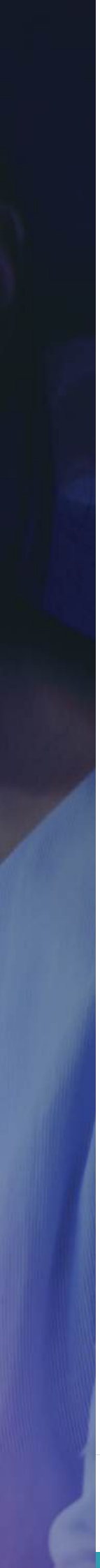
PRODUCT CATALOGUE

Unparalleled Wireless networks & connectivity

RF/mmWave Solutions

Enabling AI at the edge through world's best wireless uplink solutions



ABOUT US

We enable next-gen wireless networking & connectivity solutions

Our products lower the total-cost-of-ownership of wireless networks and systems, through peerless innovation in RF/mmWave chips.

MILLIBEAM is an Australian fabless semiconductor company with a long-term vision to bring advanced wireless networks and connectivity employing mmWave spectrum to mass deployment and adoption at a fraction of what it costs today.

MILLIBEAM has wide-ranging and innovative IP spanning radio systems and transceivers, integrated circuits, antennas, embedded systems and FPGAs. We have a global footprint and work along side partners and customers to bring next-generation networking and connectivity to life. We are transforming markets such as:

1. *Terrestrial 5G/6G Networks*
2. *Terrestrial 5G/6G Connectivity*
3. *Non-terrestrial networks, D2C & D2D*
4. *Dual-use autonomous sensing*

Our product suite includes:

1. Energy-efficient multi-band RF/mmWave transceiver ICs
2. Wide-band Beamformer RFICs
3. Antenna-in-package (AiP) solutions
4. High-power RF PA solutions
5. MMICs such as low-noise amplifiers, Mixers and Frequency multipliers

MILLIBEAM is a full-suite end-to-end radio technology company, which offers fully-optimised base-station and radio reference designs - including base-band support and linearisation - engineered to solve customer challenges.

OUR MARKETS

Terrestrial 5G/6G Networks

Terrestrial 5G or 6G networks are the key means of delivering gigabit-speed wireless networks with low latency. Today, the terrestrial 5G market encompasses all systems using 5G signals across FR1 (< 6GHz) and FR2 bands (24 - 30 GHz, 37-41 GHz and 54-67 GHz), with terrestrial 6G to use signals in the FR3 band (6.675 - 7.125 GHz).

Typical systems include beamforming transceivers, MIMO-based radios and distributed active antenna systems, which are used in the radio access network of a base-station.

The key challenges faced by system integrators and OEMs (and ultimately telco operators) include limited radio coverage, and low quality of service due to signal propagation losses and base-station's low energy-efficiency when operating at FR2 frequencies. These challenges are a result of performance inadequacies of the mmWave chipsets, which in turn lead to enormous increase in total-cost-of-ownership (TCO) of 5G networks. In addition, increase in the number of frequency bands within 5G/6G also requires increased number of base-stations, further increasing TCO.

Non-terrestrial Networks & D2C/D2D

Non-terrestrial Networks

Non-terrestrial networks (NTNs) are wireless systems that operate over the earth's surface and can be comprised of satellites in the low-earth orbit (LEO) or high-altitude platform systems (HAPS), unmanned aerial vehicles (UAVs) or drones. Non-terrestrial networks are essential to achieving wireless connectivity in areas that are not well-served by traditional terrestrial base-stations. In an NTN, a user employs a terminal to connect to a satellite or HAPS, which then on-transmits the signal received from the user terminal to the ground stations, from where it is routed to the destination.

Direct-to-cellular (D2C)

Direct-to-cellular (D2C) is an emerging technology which provides satellite-based cellular service, with the goal of complementing traditional cellular/mobile networks. Direct-to-cellular is an ideal solution for parts of the globe where significant connectivity gaps exist and D2C enables cell phones or mobile handsets to bypass terrestrial base-stations and connect directly to the satellites. D2C as a concept is very much within the classification of non-terrestrial networks and can even work with 4G cell phones without the need for additional hardware. However, modern handsets employing 5G will require a new generation of advanced RF/mmWave chips for optimal uplink performance needed to enable a seamless direct satellite connectivity.

Direct-to-device (D2D)

Direct-to-device (D2D) technology enables satellite connectivity to the internet-of-things (IoT) devices. In D2D, satellites are used to transmit data from sensors located in geographically inaccessible or remote locations. D2D applications include asset trackers, agricultural sensors or warehousing solution.

OUR MARKETS

Terrestrial 5G/6G Connectivity

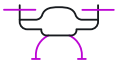

FWA


Handsets

Terrestrial 5G and 6G connectivity solutions rely on personal mobile devices such as smartphones or handsets and fixed-wireless access devices for high-speed internet access in residential and office buildings. Both mobile and fixed-wireless access devices suffer from reduced data rates during uplink connectivity, the mode where the devices transfers data to the base-station.

The performance limitations during uplink are a result of limited signal coverage and unreliable connectivity, which increase with frequency of operation. The uplink performance is severely limited in a handset (or a smart phone), due its use as a mobile device operating under ever-changing signal propagation conditions, a scenario exacerbated during mmWave operation. Although the uplink performance in the fixed-wireless access case is less impacted than a mobile device, uplink is a still a bottleneck, particularly when relying on the mmWave or FR2 spectrum for enhanced data rates.

Dual-use Autonomous Sensing


UAV Sensors

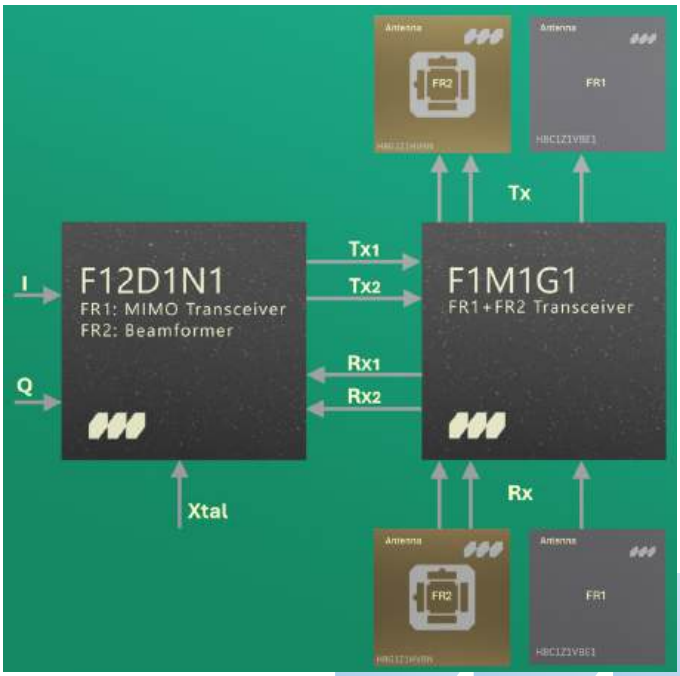

Radar

Sensors such as radars play an important in defence applications, due to their ability to provide real-time identification and tracking of adversarial or unidentified planes. Electronic warfare jammers offer electronic counter measures to curtail the offensive actions or threats emanating from the adversarial aircrafts.

In recent times, drones have been used in offensive actions, but drones have as much utility in defensive situations when integrated with multi-sensor radios that combine the functionalities of radar, imaging, electronic warfare and high-speed telemetry within the same system. Such systems require radios that can concurrently support a range of frequencies over non-contiguous frequency bands. Software-defined radio is the obvious choice due its ability to support large range of frequencies. However, software-defined radio solutions have poor energy efficiency and as a result cannot support long distance and longer duration flights due to increased payload.

Highly energy-efficient RF transceivers operating concurrently across multiple non-contiguous frequency bands offer a superior means of implementing multi-sensor drone platforms with longer range and duration.

Enabling tomorrow's mission-critical applications through world-leading innovation in semiconductor devices and radios.



SOLUTION PLATFORM : HIGH-POWER APPLICATIONS

FARBEAM

Base station | Private 5G/6G | FWA | Satcom | UAV Sensors

FARBEAM solution platform comprises of a wide-band beamformer IC F12D1N1, an energy-efficient and high-power Multi-band FR1 and FR2 transceiver IC F1M1G1 and a pair of wide-band antenna-in-package devices H8G1Z1HVBN and H8C1Z1VBE1.

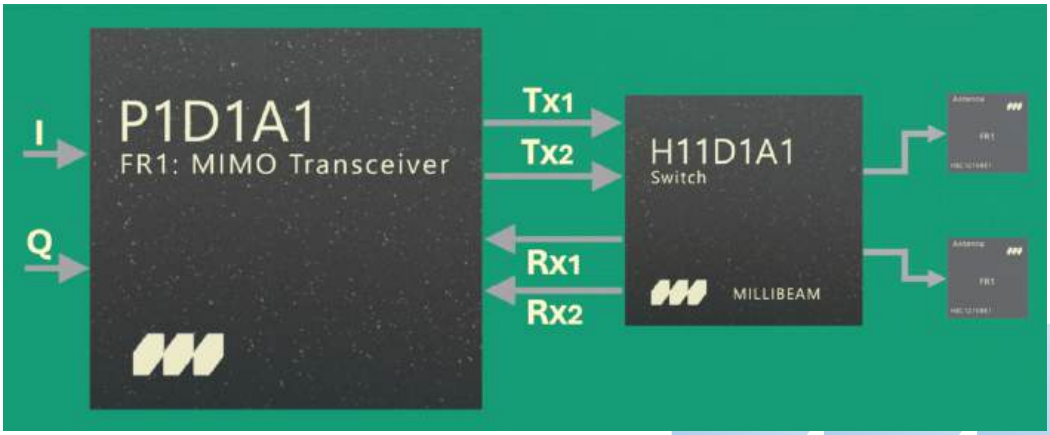
FARBEAM supports dual-connectivity mode for FR1 and FR2 operation. FARBEAM combines functionality of beamforming, transceiver and front-end along with transmit and receive antennas for the 26.5 - 29.5 GHz FR2 band. For the FR1 applications, FARBEAM comes with a 2x2 MIMO, transceiver and a front-end, along with transmit and receive antennas covering 3.3 - 4.1 GHz band.

FARBEAM is a dual-connectivity solution that supports non-contiguous frequency bands over a 3.9 GHz bandwidth, making it the widest-bandwidth solution that is perfectly-suited for carrier aggregation.

In addition, the dual-connectivity mode enables the use of FR2 spectrum with a built-in redundancy in the form of FR1 operation. This redundancy improves reliability and alleviates coverage challenges. Conversely, FARBEAM enables highest data rates and low-latency, when the available FR1 spectrum is inadequate.

FARBEAM solution also provides high output powers at the antenna, 5W (FR1) and 1W (FR2). High output power before the antenna enables adaptive beamwidth, whereby the beamwidth is made wider when the signal is impeded by obstructions or narrower when signal range is critical. FARBEAM comes with high energy efficiency even during FR2 operation, making it the best solution in the market for lowering total-cost-of-ownership.

FWA



Handsets

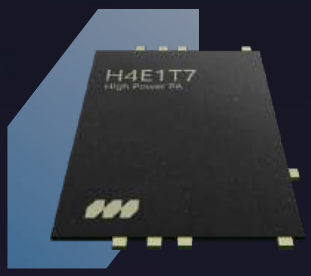
SOLUTION PLATFORM: LOW-POWER APPLICATIONS

PHASEBEAM

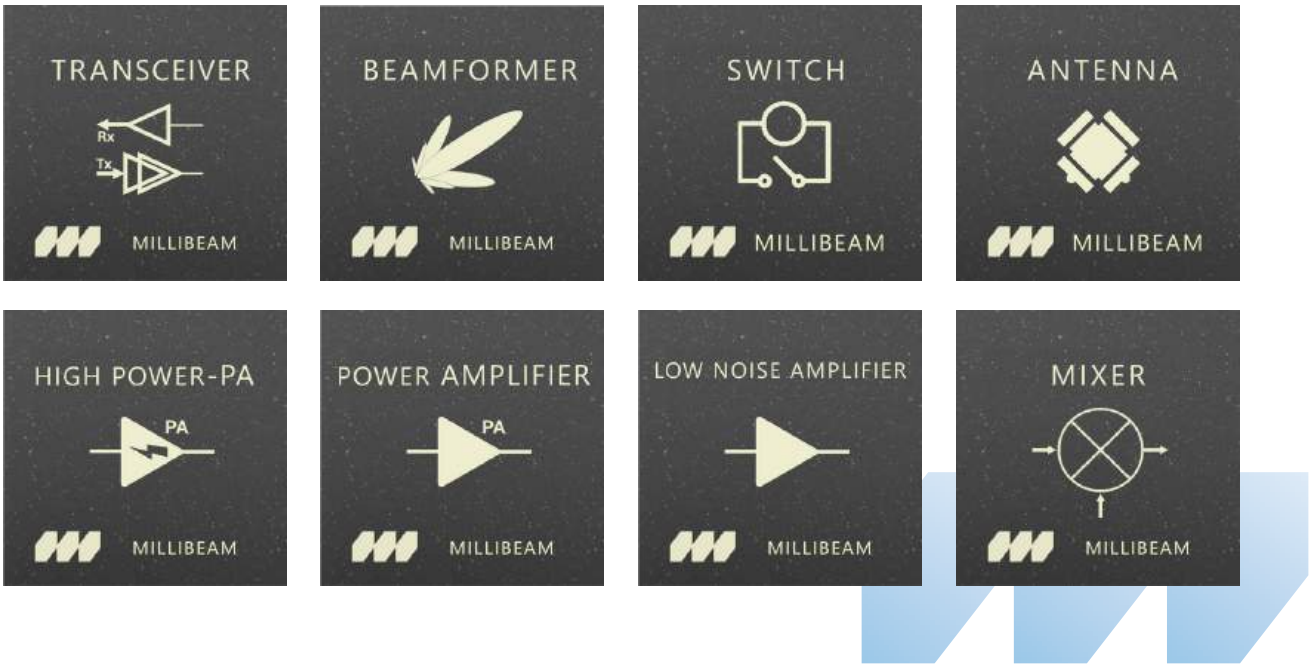
Handsets FWA Terminal

PHASEBEAM is a low-cost solution platform, which is ideal for low-power FR1 5G applications spanning 3.3 – 4.1 GHz.

PHASEBEAM is based on P1D1A1, which is a multi-channel transceiver designed for use as a 2x2 MIMO transceiver. P1D1A1 can be used in both handsets and FWA devices. In the case of a handset, P1D1A1 is used in conjunction with H11D1A1, which is a 2-channel single-pole double-throw RF switch that interfaces the P1D1A1 to 2Tx and 2Rx MIMO antennas. For an FWA device, P1D1A1 is used with 4x FR1 antennas, supporting 2Tx paths and 2Rx paths.



Advances in PA architectures & packaging for energy-efficient base-stations



DISCRETE PRODUCT LINEUP

HEAVISIDE

HEAVISIDE is an ever-expanding portfolio of high-performance RF/mmWave MMIC, RFIC and discrete circuit building blocks, such as wideband beamformers, multi-band transceivers, RF front ends, high-efficiency and linear RF Power Amplifier ICs (from 5W to 300W), efficient and linear driver amplifiers (up to 5W), general-purpose amplifiers (GPAs), low-noise amplifiers, mixers, antennas, antenna arrays, switches, integrated RF front-ends and integrated transceivers from d.c. – 40 GHz.

Heaviside product lineup has been created for radio system integrators, ODMs and OEMs targeting applications such as base stations, satcom, radars, point-to-point communications, and instrumentation.

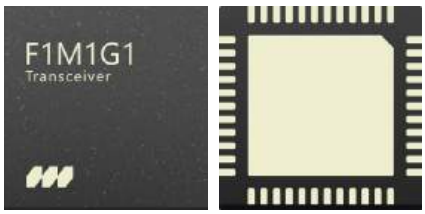
Heaviside lineup also features high-power RF amplifiers that enable generational improvements in base-station efficiency, bandwidth, size and cost. Heaviside PAs also offer a number of additional benefits such as:

1. Reduced BOM cost and PCB footprint size through:
   - Single gate/drain supply pins for multi-stage PAs
   - Integrated high-power PAs >200W of output power
2. Wideband performance enabling:
   - Exceptional efficiency and linearity
   - Single device for multiple bands
3. Variable drain supply voltage:
   - PAs designed to handle supply voltages from 5V to 30V
   - Facilitates wide-band envelope tracking PAs
4. Robust performance for demanding applications
   - Designed for ESD robustness
   - Rugged performance and stability

HEAVISIDE TRANSCEIVERS

F1M1G1

5G NR Dual-Connectivity Multi-band FR1+FR2 Transceiver (2Tx+2Rx)



Description

The F1M1G1 is a two-channel RF+mmWave transceiver IC that enables interleaved dual-connectivity and multi-band phased-array solutions for 5G applications such as macro base stations, small cells, FWA, satellite non-terrestrial networks (NTN). It supports 5G FR1 and FR2 bands with a peak transmit output power of 5W and 1W respectively before the antenna. A base station or FWA device with the F1M1G1 is capable of beamforming with high EIRP, without reliance on expensive high-gain antenna arrays or a high number of Tx/Rx elements requiring power-intensive and expensive calibration.

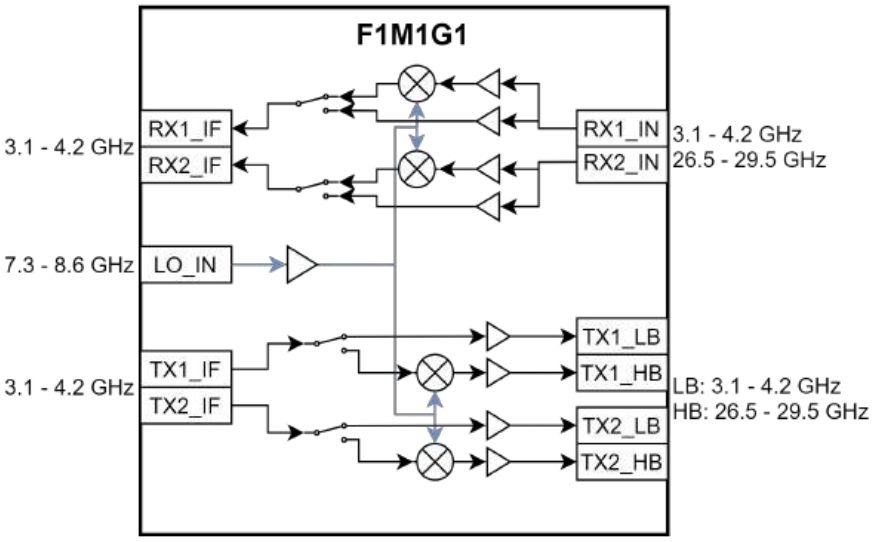
Features

- Concurrent Tx/Rx across 5G FR1 n77 and FR2 n257 bands
- 2Tx + 2Rx high-power transceiver solution
- High output power and high average efficiency
- High EIRP with smaller arrays and reduced calibration complexity
- Adaptive beam-width management
- Supports carrier aggregation with a total RF bandwidth of over 3.9 GHz

Applications

- 5G FR1/FR2: Small cells, FWA
- 5G NTN: Satellite constellations and ground terminals
- Defence applications: Phased-arrays for radar

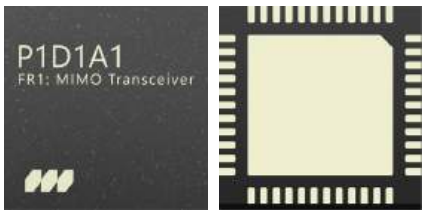
Functional Block Diagram



HEAVISIDE TRANSCEIVERS

P1D1A1

5G NR 3.3 - 4.1 GHz 2Tx + 2Rx MIMO Transceiver



Description

The P1D1A1 is a two-channel RF transceiver IC which enables multi-band MIMO across n77 and n78 bands. It is ideal for handsets and is also well-suited for fixed-wireless access (FWA), when paired with a front-end.

P1D1A1 is also designed to cater for digital-drive PA operation for use with high-efficiency 5G power amplifiers in base-stations.

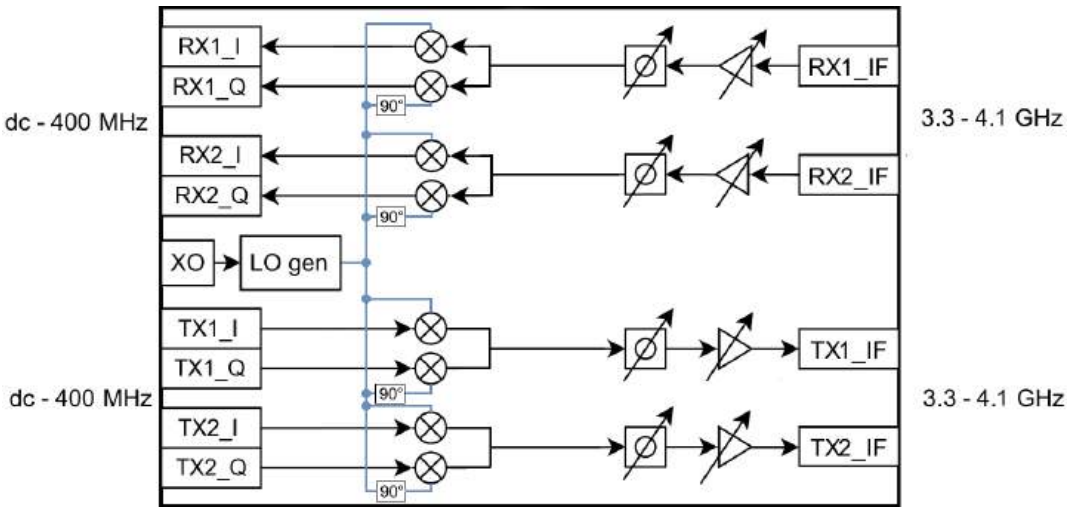
Features

- 2Tx + 2Rx Transceiver Solution
- 2x2 MIMO in 5G FR1 n77 and n78 bands
- Internal Phase-shifters
- Variable Gain Amplification
- Internal Local Oscillator

Applications

- 5G FR1: MIMO for handsets and FWA
- 5G FR1: Base-stations and Small Cells
- 5G FR2: IF beamforming and IF Up and Down-conversion Support

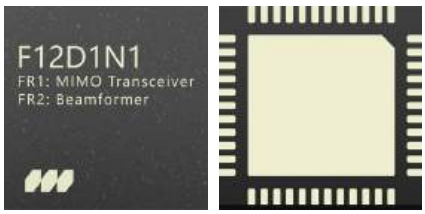
Functional Block Diagram



HEAVISIDE BEAMFORMERS

F12D1N1

2Tx + 2Rx RFIC: 3.3 - 4.1 GHz FR1 MIMO Transceiver and FR2 Beamformer



Description

The F12D1N1 is a two-channel RFIC which simultaneously functions as a multi-band FR1 2x2 MIMO transceiver (3.3 - 4.1 GHz) and as a wide-band beamformer for FR2 (26.5 - 29.5 GHz).

When operating as a 2x2 MIMO transceiver, F12D1N1 can be used independently or paired with an RF front-end. When operating as an FR2 beamformer, F12D1N1 needs to be paired with the F1M1G1 2Tx+2Rx FR2 transceiver.

F12D1N1 enables a dual-mode connectivity and allows operators to develop a single radio which can operate across FR1 and FR2 bands.

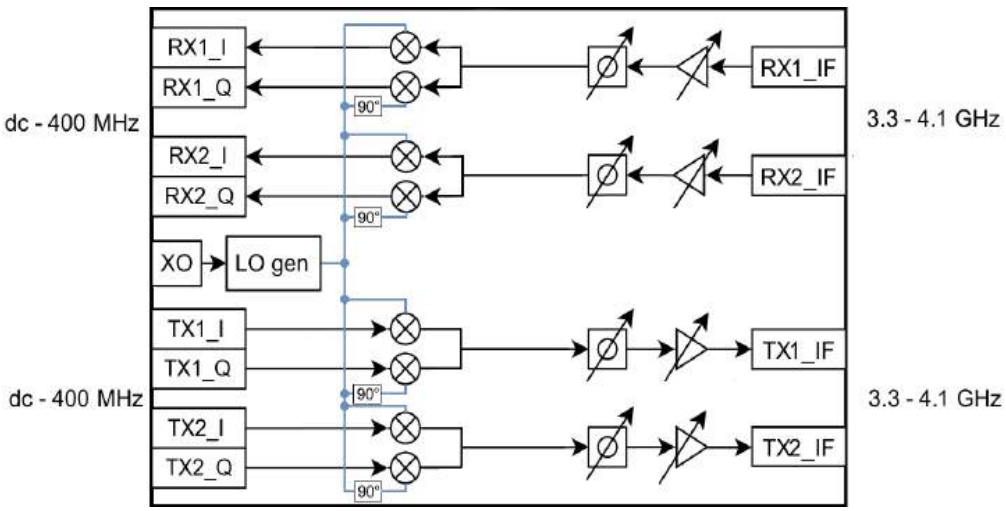
Features

- FR1: 2x2 MIMO Transceiver
  - Frequency: 3.3 - 4.1 GHz
  - Bands: n77 and n78
  - Tx Pout ~ 4 dBm
  - Tx Gain: 0 to 7 dB
  - Rx Gain: 0 to 40 dB
- FR2: 2Tx + 2Rx Beamformer
  - Frequency: 3.3 - 4.1 GHz
  - Bands: n77 and n78
  - Tx Gain: 0 to 7 dB
  - Rx Gain: 0 to 40 dB
- Internal Frequency Synthesiser
- Internal Bandgap Reference

Applications

- 5G FR1: Handsets and FWA
- 5G FR2: Base-stations, small-cells, FWA.

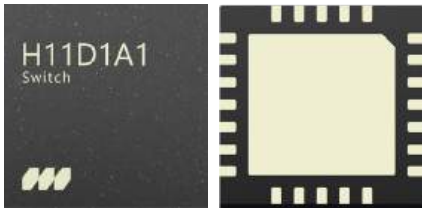
Functional Block Diagram



HEAVISIDE RF SWITCHES

H11D1A1

2.5-5 GHz, 1.5 dB Insertion Loss, 45 dB Isolation, 25 dBm P1dB, Highly Linear GaN RF Switch for 2x2 MIMO 5G NR Applications



Description

The H11D1A1 is a high-performance, multi-path GaN RF switch for 5G NR applications such as handsets and fixed-wireless access. It supports two separate Tx + Rx paths required to interface a 2x2 MIMO transceiver to a 2x2 MIMO antennas.

H11D1A is a wideband RF switch with two transceiver outputs, each designed to switch between a Tx and Rx pair, needed to support a 2x2 MIMO.

It comes with fast switching speed, high input intercept point, low-insertion loss, high-degree of Tx-Rx isolation, all in a low-cost package. The switch is co-designed with package for 50-ohm input and output impedances. It is housed in a 4 mm x 5 mm QFN package for a low-cost footprint.

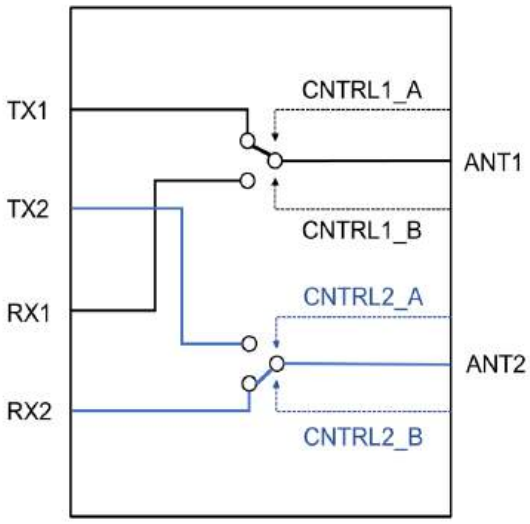
Features

- Frequency range = 2.5 – 5 GHz
- Supports n77, n78 and n79 5G NR bands
- 1.5 dB Insertion loss, with +/-0.2 dB flatness
- 25 dBm P1dB
- 45 dB path isolation or Tx-Rx isolation
- <2ns switching time
- High linearity
- 50 Ω matched at input and output RF terminals

Applications

- Handsets
- FWA

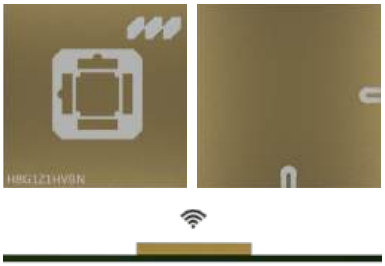
Functional Block Diagram



HEAVISIDE ANTENNAS

H8G1Z1HVBN

26.5-29.5 GHz, H/V-polarization, 5.5 dBi Gain, Discrete AiP Unit



Description

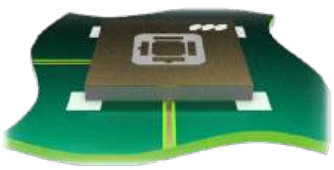
The H8G1Z1HVBN is a surface-mounting AiP designed for operation in the mmWave frequency band, support dual-polarization radiation profiles in both horizontal and vertical directions. It delivers high-performance radiation across the n257 band (26.5 GHz to 29.5 GHz), offering a realized gain of at no less than 5.5 dBi, a VSWR < 2, and a 70-deg half-power beamwidth. The antenna is housed in a compact 10 mm x 10 mm footprint with a quad-flat feeding pad, enabling direct connection to a 50-ohm microstrip line on a universal motherboard PCB (wide range of thickness and Dk value) without need for external matching elements. The package has a height of 1.1 mm.

Features

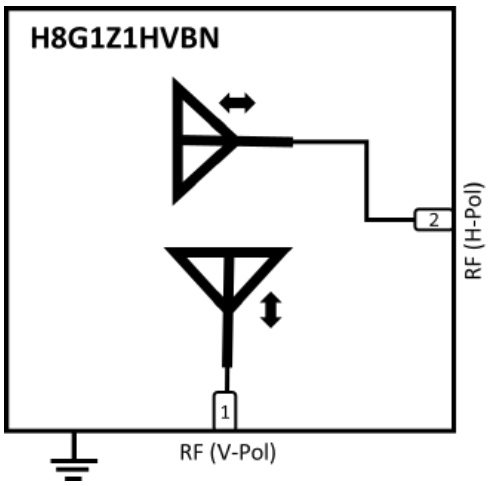
- 5.5 dBi realized gain
- 95% radiation efficiency
- 50-ohm matched Impedance bandwidth 26~30 GHz (VSWR<2)
- H/V ports Isolation >20 dB
- Half Power Beam Width: 70 deg
- Cross Polarization Discrimination > 20 dB
- 10 mm x 10 mm footprint, 1.1 mm height
- Tool-free integration onto the PCB as a surface-mount device (SMD)
- Designed for robustness, ensuring compatibility with PCBs across a variety of substrate thicknesses and dielectric constants (Dk)
- High tolerance on mounting misalignment
- 10 mm edge-to-edge clearance between surrounding components on PCB

Applications

- 5G macro and micro base-stations
- 5G FWA
- Internet of Things (high speed)
- Wireless Communications
- Measurement and instrumentation



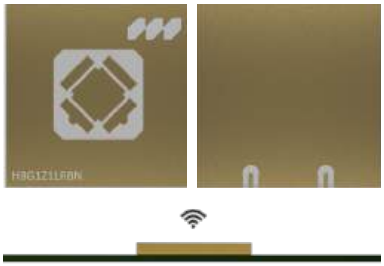
Functional Block Diagram



HEAVISIDE ANTENNAS

H8G1Z1LRBN

26.5-29.5 GHz, Left/Right Hand Circular Polarization, 5.3 dBi Gain, Discrete AiP Unit



Description

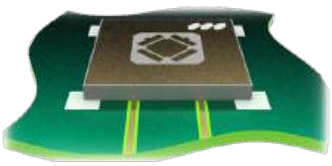
The H8G1Z1LRBN is a surface-mounting AiP designed for operation in the mmWave frequency band, support dual-circular-polarization radiation profiles in both left- and right-hand. It delivers high-performance radiation across the n257 band (26.5 GHz to 29.5 GHz), offering a realized gain of at no less than 5.3 dBi, a VSWR < 2, and a 70-degree half-power beamwidth. The antenna is housed in a compact 10 mm x 10 mm footprint with a quad-flat feeding pad, enabling direct connection to a 50-ohm microstrip line on a universal motherboard PCB (wide range of thickness and Dk value) without need for external matching elements. The package has a height of 1.1 mm.

Features

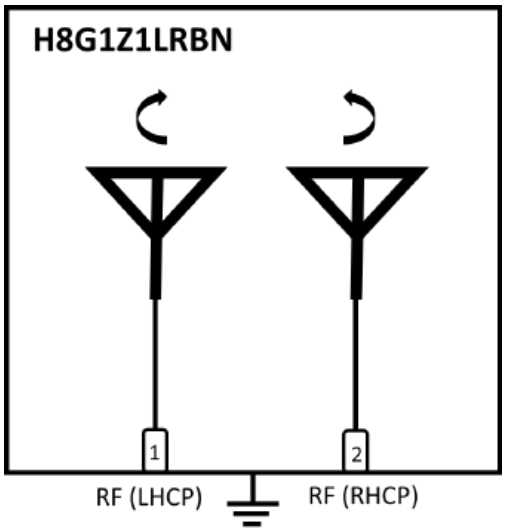
- 5.3 dBi realized gain
- 91% radiation efficiency
- 50-ohm matched Impedance bandwidth 26.5~29.5 GHz (VSWR<2)
- LHCP/RHCP ports Isolation >20 dB
- Half Power Beam Width: 70 deg
- Cross Polarization Discrimination > 20 dB
- 10 mm x 10 mm footprint, 1.1 mm height
- Tool-free integration onto the PCB as a surface-mount device (SMD)
- Designed for robustness, ensuring compatibility with PCBs across a variety of substrate thicknesses and dielectric constants (Dk).
- High tolerance on mounting misalignment
- 10 mm edge-to-edge clearance between surrounding components on PCB

Applications

- LEO/MEO satellite ground terminals
- Global Positioning System
- Wireless Communications
- Measurement and instrumentation



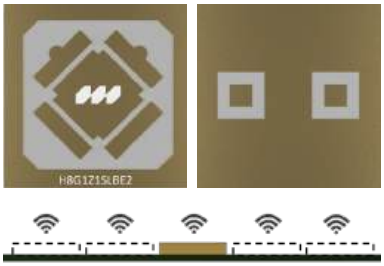
Functional Block Diagram



HEAVISIDE ANTENNAS

H8G1Z1SLBE2

26.5-29.5 GHz, +/-45 deg Slant Polarization, Planar Phased Array Cell AiP



Description

The H8G1Z1SLBE2 is surface-mounting AiP designed for operation in the mmWave frequency band, support +/-45 deg slant polarized radiation profiles. It delivers high-performance radiation across the n257 band (26.5 GHz to 29.5 GHz) as an embedded unit cell in the planar phased array, offering an $|S_{ii}| < -10$ dB, within a 60-degree beamforming range. The antenna is housed in a compact 5.8 mm x 5.8 mm footprint with a pull-back QFN feeding pad, enabling direct soldering onto a footprint connected with 50-ohm stripline on a universal motherboard PCB (wide range of thickness and Dk value) without need for external matching elements. The package has a height of 1.1 mm. The pitch distance of the phased array can range from 6.0~6.4 mm

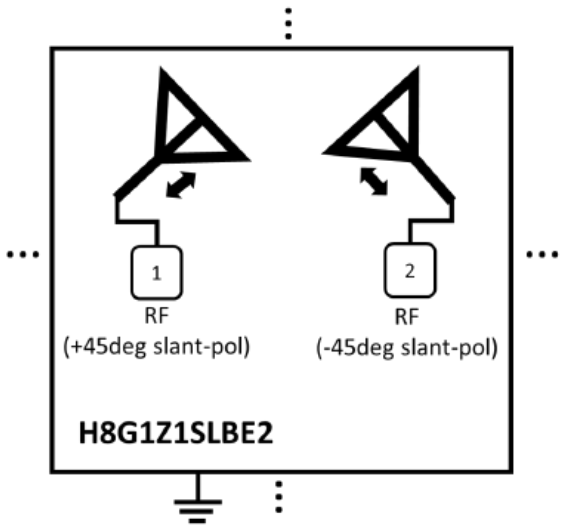
Features

- 95% radiation efficiency
- 50-ohm matched Impedance bandwidth 26.5~29.5 GHz (VSWR<2)
- Slant-pol ports Isolation >18 dB
- Beamforming range: +/- 60 deg
- Cross Polarization Discrimination (XPD) > 20 dB
- 5.8 mm x 5.8 mm footprint, 1.1 mm height
- Supporting phased array with pitch distance over 6.0~6.4 mm
- Tool-free integration onto the PCB as a surface-mount device (SMD).
- Designed for robustness, ensuring compatibility with PCBs across a variety of substrate thicknesses and dielectric constants (Dk).
- High tolerance on mounting misalignment

Applications

- 5G macro and micro base-stations
- 2D Planar phased array
- FMCW radar
- MIMO communication
- Active beamforming system

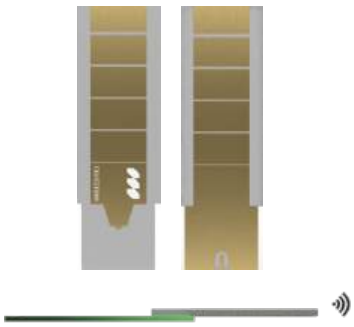
Functional Block Diagram



HEAVISIDE ANTENNAS

H8G1Z1VEE1

26.5-29.5 GHz, End-fire Radiation, 5.0 dBi Gain, Linear Phased Array Cell AiP



Description

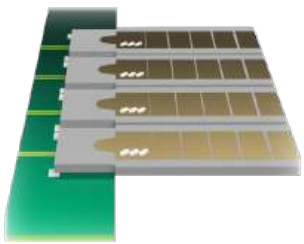
The H8G1Z1VEE1 is a PCB-edge-mounting AiP designed for operation in the mmWave frequency band, featuring end-fire radiation with vertical-polarization profile. It delivers high-performance radiation across the n257 band (26.5 GHz to 29.5 GHz), offering a realized gain of 5.0 dBi, a VSWR < 2, and a 60-deg half-power beamwidth. This AiP could also works with multiple unit in the linear phased array, supporting +/-45 deg of beamforming range. Each AiP structure is housed in a compact 5.8 mm x 19 mm footprint with a quad-flat feeding pad, enabling direct connection to a 50-ohm microstrip line on edge of motherboard PCB without need for external matching elements. The package has a height of 0.7 mm.

Features

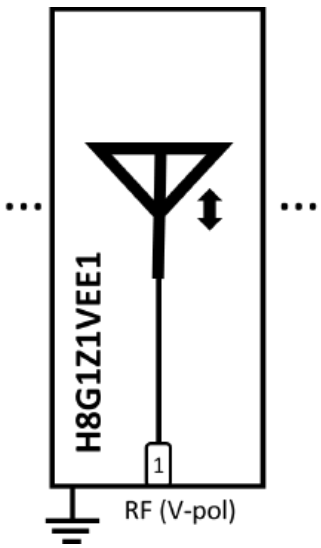
- 5.0 dBi realized gain
- 85% radiation efficiency
- 50-ohm matched Impedance bandwidth 26~30 GHz (VSWR<2)
- Half Power Beam Width: 60 deg
- 5.8 mm x 19 mm footprint, 0.7 mm height
- Tool-free integration onto the PCB as a surface-mount device (SMD)
- Designed for robustness, ensuring compatibility with PCBs across a variety of substrate thicknesses and dielectric constants (Dk)
- High tolerance on mounting misalignment
- Vertical polarizations orthogonal to the motherboard PCB plane

Applications

- 5G micro base-stations
- End-user compact devices
- AR/VR devices
- Internet of Things (high speed)
- Mobile devices



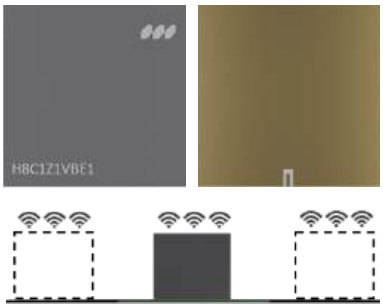
Functional Block Diagram



HEAVISIDE ANTENNAS

H8C1Z1VBE1

3.3-3.8 GHz, V-pol, 5.5 dBi Gain, Discrete AiP



Description

The H8C1Z1VBE1 is a surface mounting AiP designed for operation within the FR1 band across 3.3~3.8 GHz featuring linear polarization profiles in vertical direction. It could either 1) used as a unit cell in a linear phased array supporting +/-60 deg beamforming or 2) operates in a discrete manner delivers a realized gain of 5.5 dBi, VSWR < 2, and a 70-degree half-power beamwidth. The antenna is housed in a compact 16 mm x 16 mm footprint with a quad-flat feeding pad, enabling direct connection to a 50-ohm microstrip line on a universal motherboard PCB (wide range of thickness and Dk value) without need for external matching elements. The package has a height of 12.9 mm.

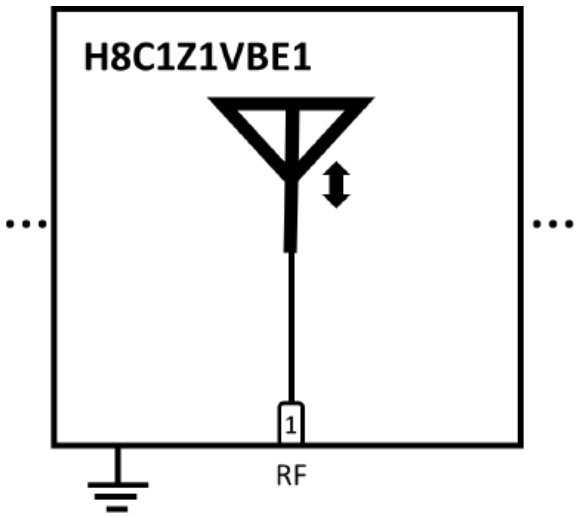
Features

- 95% radiation efficiency
- 50-ohm matched Impedance bandwidth 3.3~3.8 GHz (VSWR<2)
- Beamforming range: +/- 60 deg (embed)
- Half Power Beam Width: 70 deg (discrete)
- 16 mm x 16 mm footprint, 12.9 mm height
- Supporting phased array with pitch distance over 42~50 mm
- Tool-free integration onto the PCB as a surface-mount device (SMD).
- Designed for robustness, ensuring compatibility with PCBs across a variety of substrate thicknesses and dielectric constants (Dk).
- High tolerance on mounting misalignment
- Only 5 mm edge-to-edge clearance between surrounding components on PCB

Applications

- 4G/5G macro and micro base-stations
- Internet of Things
- Sub-6 GHz Wireless Communications
- End-user wireless terminal
- Measurement and instrumentation

Functional Block Diagram



HEAVISIDE PAs

H4E1T7

250W, 22 dB Gain, High Efficiency 4.55 – 4.9 GHz GaN Doherty Power Amplifier MMIC in a Low-cost Package

Description

The H4E1T7 is a high-average efficiency, multi-stage Gallium Nitride (GaN) Doherty power amplifier for use in macro 5G NR base-stations. H4E1T7 provides 250 Watts of saturated RF output power across the 4.55 – 4.9 GHz n79 5G NR band. It is designed to support wide signal bandwidths, carrier aggregation and large peak-to-average ratios with high average power, exceptional back-off efficiency, outstanding exceptional linearity. It comes with 50 Ω input and output impedances without the need for external matching elements. The H4E1T7 GaN Doherty PA is housed in a low-cost package and facilitates a compact, low-cost PCB design.

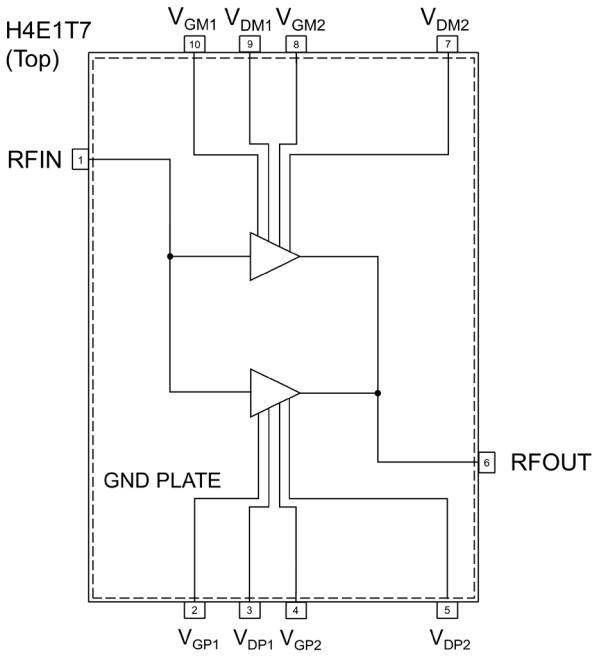
Features

- Frequency = 4.55 – 4.9 GHz
- Gain >22 dB, ±1 dB gain flatness
- Saturated Output power = 54 dBm
- High average PAE across the band
- Excellent video bandwidth
- Exceptional linearity and EVM
- Supports 100 MHz signal bandwidth
- Supports CA - 2x 100 MHz
- 50 Ω matching at input & output
- ESD protection

Applications

- 5G NR Macro base-stations

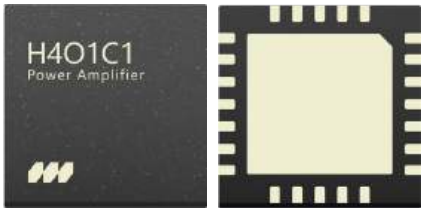
Functional Block Diagram



HEAVISIDE PAs

H4O1C1

3.3-3.8 GHz, 2 W, 33 dB Gain, GaN MMIC Power Amplifier in a Low-cost Package



Description

The H4O1C1 is a high-performance, multi-stage radio frequency power amplifier (PA) ideal for use as a pre-driver stage in a 5G base station PA lineup or as a final-stage PA in a 5G Fixed Wireless Access (FWA) devices. The amplifier provides >2 Watts of saturated RF power across the 3.3 - 3.8 GHz band, along with high gain and superior efficiency. It has 50 Ω input and output impedances without the need for external matching elements. This GaN MMIC is housed in a 4 mm x 5 mm QFN package. It enables a small-footprint, low-cost PCB design, as only four pins are needed for all external connections, including RF input and output signals, and multi-stage gate and drain supply voltages.

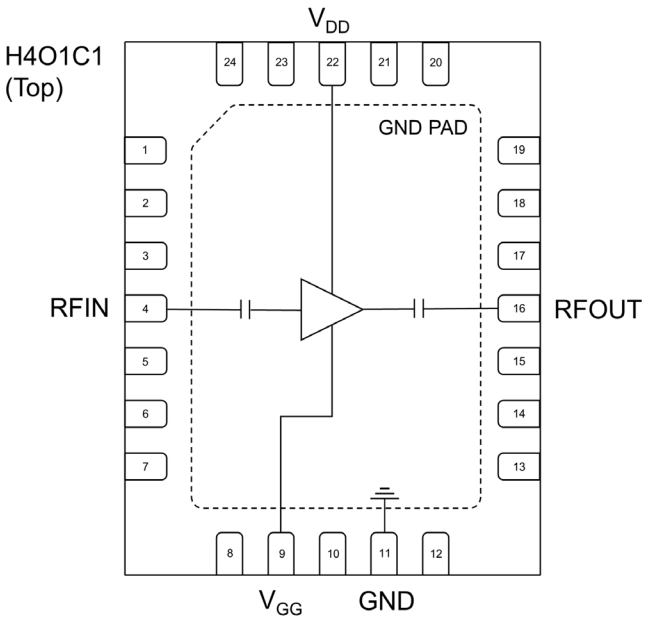
Features

- 33 dB small signal gain, ±1 dB gain flatness
- 33 dBm of output power
- PAE > 40% across the band
- Excellent EVM performance
- Unconditional RF stability from DC to 40 GHz
- 50 Ω matched at input and output RF terminals
- Single V_{GG} and V_{DD} supply pins for all stages
- Robustness to ESD

Applications

- 5G Macro Base Stations and Small Cells
- 5G FWA Devices

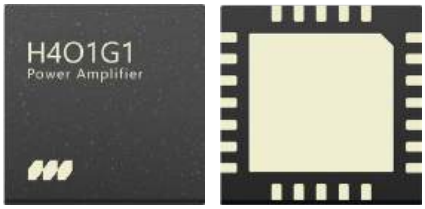
Functional Block Diagram



HEAVISIDE PAs

H4O1G1

3.0-5.5 GHz, 5 W, 37 dB Gain, GaN MMIC Power Amplifier in a Low-cost Package



Description

The H4O1G1 is a high-performance, multi-stage radio frequency power amplifier (PA) ideal for use as a driver or pre-driver stage in 5G base stations, S-Band or C-band radars and satcom systems, and as a final-stage PA in 5G Fixed Wireless Access (FWA) devices. It provides >5 Watts of RF power over a 2.5 GHz bandwidth (>50% relative bandwidth). The amplifier offers exceptional linearity and comes with 50 Ω input and output impedances without the need for external matching elements. This GaN MMIC is housed in a 4 mm x 5 mm QFN package and facilitates a compact, low-cost PCB design by requiring only four pins for all external connections, including RF input and output signals, and multi-stage gate and drain supply voltages.

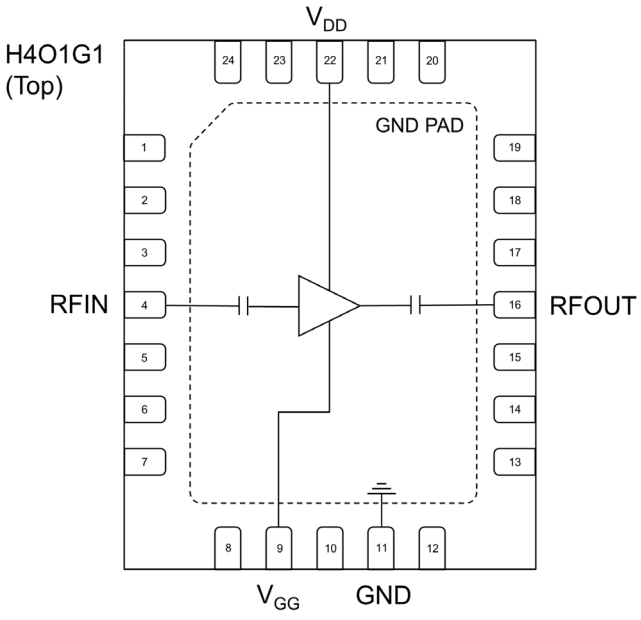
Features

- 37 dB small signal gain, ±3 dB gain flatness
- 37 dBm of output power
- PAE > 40% across the 3.0-4.0 GHz band
- Excellent EVM performance
- Unconditional RF stability from DC to 40 GHz
- 50 Ω matched at input and output RF terminals
- Single V_{GG} and V_{DD} supply pins for all stages
- Robustness to ESD

Applications

- 5G Macro and Micro Base Stations
- 5G FWA
- Defence Applications (Radar, UAV)
- Satellite Communications

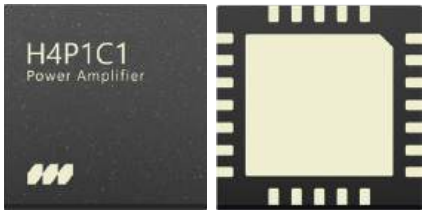
Functional Block Diagram



HEAVISIDE PAs

H4P1C1

4.4-5.0 GHz, 2 W, 30 dB Gain, GaN MMIC Power Amplifier in a Low-cost Package



Description

The H4P1C1 is a high-performance, multi-stage radio frequency (RF) power amplifier (PA) for use as a pre-driver stage in a 5G base station PA lineup or as a final-stage PA in a 5G Fixed Wireless Access (FWA) devices. The amplifier provides >2 Watts of saturated RF power across the 4.4–5.0 GHz frequency band, along with high gain and exceptional gain flatness, superior efficiency and 50 Ω input and output impedances without the need for external matching elements. This GaN MMIC is housed in a 4 mm x 5 mm QFN package and enables a small-footprint, low-cost PCB design, as only four pins are needed for all external connections including RF input and output signals, and multi-stage gate and drain supply voltages.

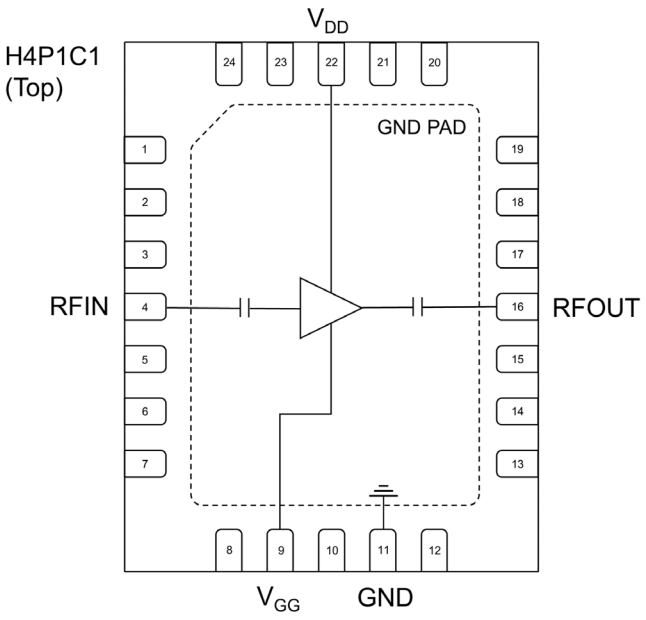
Features

- 30 dB small signal gain with ±0.3 dB gain flatness
- 33 dBm of output power
- PAE > 40% across the band
- Excellent EVM performance
- Unconditional RF stability from DC to 40 GHz
- 50 Ω matched at input and output RF terminals
- Single V_{GG} and V_{DD} supply pins for all transistor stages
- Robustness to ESD

Applications

- 5G Macro Base Stations and Small Cells
- 5G FWA Devices

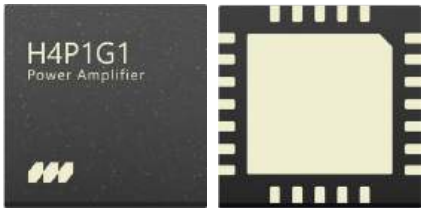
Functional Block Diagram



HEAVISIDE PAs

H4P1G1

4.5-6.0 GHz, 5 W, 33 dB Gain, GaN MMIC Power Amplifier in a Low-cost Package



Description

The H4P1G1 is a high-performance, multi-stage power amplifier (PA) for use as a pre-driver in C-band radars and satcom systems. The amplifier provides >5 Watts of RF power over a 1.5 GHz bandwidth (>50% relative bandwidth). It offers superior efficiency, high gain, and comes with 50 Ω input and output impedances without the need for external matching elements. This GaN MMIC is housed in a 4 mm x 5 mm QFN package and facilitates a compact, low-cost PCB design by requiring only four pins for all external connections, including RF input and output signals, and multi-stage gate and drain supply voltages.

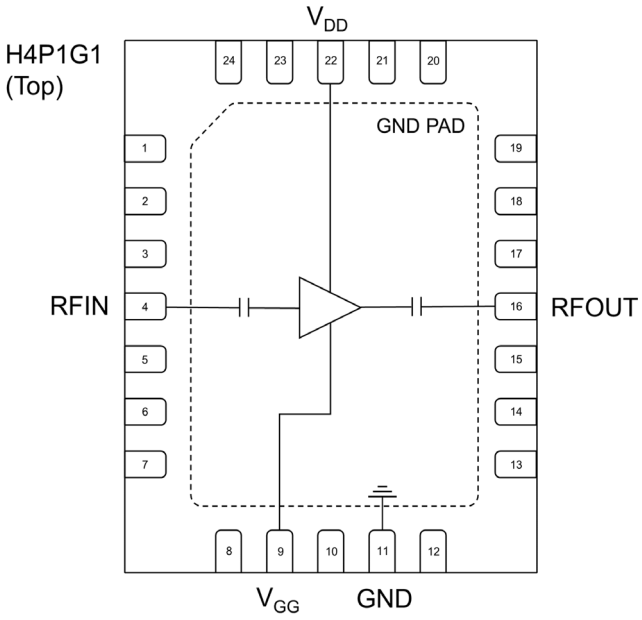
Features

- 33 dB small signal gain with ±1.5 dB gain flatness
- 37 dBm of output power
- PAE > 40% across the 4.5-5.2 GHz band
- Excellent EVM performance
- Unconditional RF stability from DC to 40 GHz
- 50 Ω matched at input and output RF terminals
- Single V_{GG} and V_{DD} supply pins for all transistor stages
- Robustness to ESD

Applications

- Defence Applications (Radar, UAV)
- Satellite Communications
- Radio System Integration

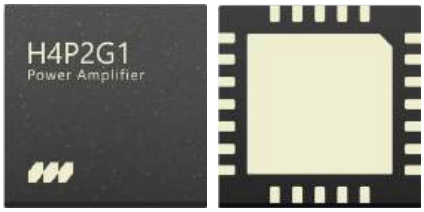
Functional Block Diagram



HEAVISIDE PAs

H4P2G1

4.4-5.0 GHz, 5 W, 33 dB Gain, GaN MMIC Power Amplifier in a Low-cost Package



Description

The H4P2G1 is a high-performance, multi-stage radio frequency power amplifier (PA) for use as a pre-driver or a driver stage in a 5G base station PA lineup, or as a final-stage PA in 5G Fixed Wireless Access (FWA) devices. The amplifier provides > 5 Watts of saturated RF power across the 4.4-5.0 GHz frequency band, along with high gain and exceptional gain flatness, superior efficiency and 50 Ω input and output impedances without the need for external matching elements. This GaN MMIC is housed in a 4 mm x 5 mm QFN package. It enables a small-footprint, low-cost PCB design, as only four pins are needed for all external connections including RF input and output signals, and multi-stage gate and drain supply voltages.

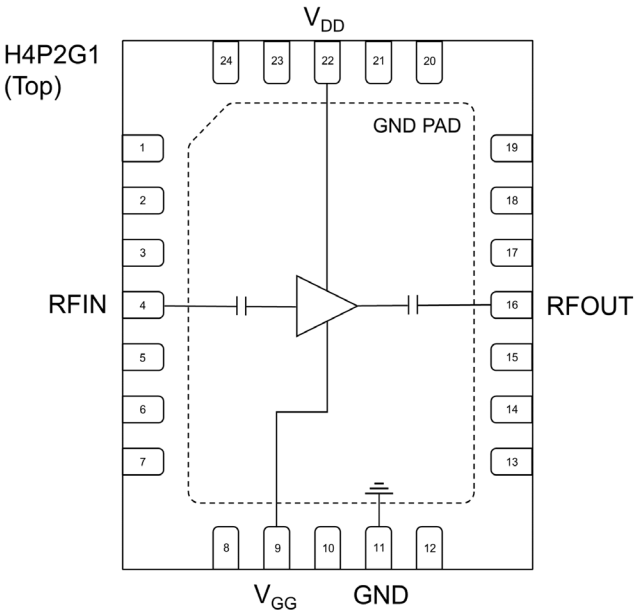
Features

- 33 dB small signal gain, ±0.5 dB gain flatness
- 37 dBm of output power
- PAE > 30% across the band
- Excellent EVM performance
- Unconditional RF stability from DC to 40 GHz
- 50 Ω matched at input and output RF terminals
- Single V_{GG} and V_{DD} supply pins for all stages
- Robustness to ESD

Applications

- 5G Macro Base Stations and Small Cells
- 5G FWA Devices

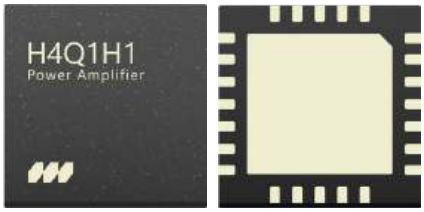
Functional Block Diagram



HEAVISIDE PAs

H4Q1H1

8-12 GHz, 6 W, 36 dB Gain, GaN MMIC Power Amplifier In A Low-cost Package



Description

The H4Q1H1 is a high-performance, multi-stage power amplifier for use in radar, satcom systems and point-to-point radio implementations. The amplifier provides 6 Watts of RF power over a bandwidth of 8-12 GHz. It offers exceptional linearity and comes with 50 Ω input and output impedances without the need for external matching elements. The GaN MMIC is housed in a 4 mm x 5 mm QFN package. It facilitates a compact, low-cost PCB design by requiring only four pins for all external connections, including RF input and output signals, and multi-stage gate and drain supply voltages.

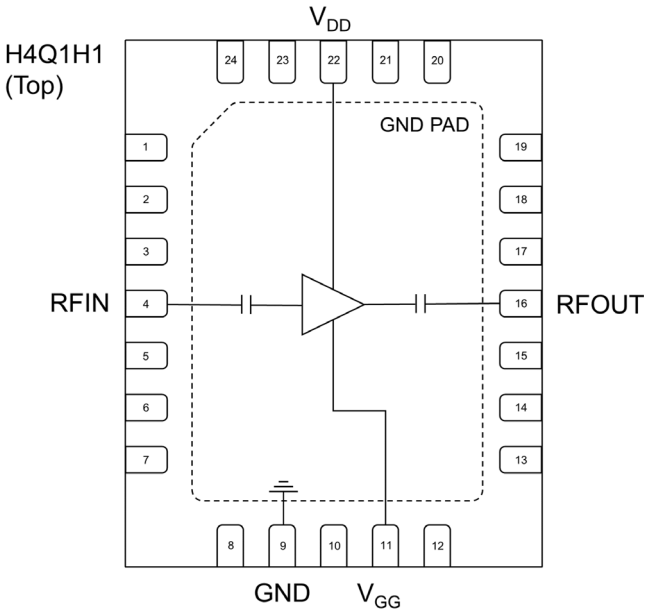
Features

- 36 dB Small Signal Gain with ±1.5 dB flatness
- Consistent output power and high PAE across the band
- High linearity and excellent EVM performance
- Unconditional RF stability from DC to 40 GHz
- 50 Ω matched at input and output RF terminals
- Single V_{GG} and V_{DD} supply pins for all transistor stages
- ESD protection

Applications

- Defence Applications (Radar, UAV)
- Satellite Communications
- Measurement and Instrumentation
- Radio System Integration
- Wireless Communications

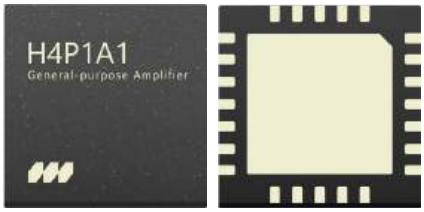
Functional Block Diagram



HEAVISIDE GPAs

H4P1A1

4.4-5.0 GHz, 24 dBm Psat, 17 dB Gain, GaN MMIC General-purpose Amplifier



Description

The H4P1A1 is a general-purpose radio frequency (RF) amplifier for use in 5G FR1 applications. It provides a saturated output power of 24 dBm across the 4.4–5.0 GHz frequency band. The amplifier offers exceptional linearity and comes with 50 Ω input and output impedances without the need for external matching elements. The GaN MMIC is housed in a 4 mm x 5 mm QFN package and enables a small-footprint, low-cost PCB design, as only four pins are needed for all external connections including RF input and output signals, and multi-stage gate and drain supply voltages.

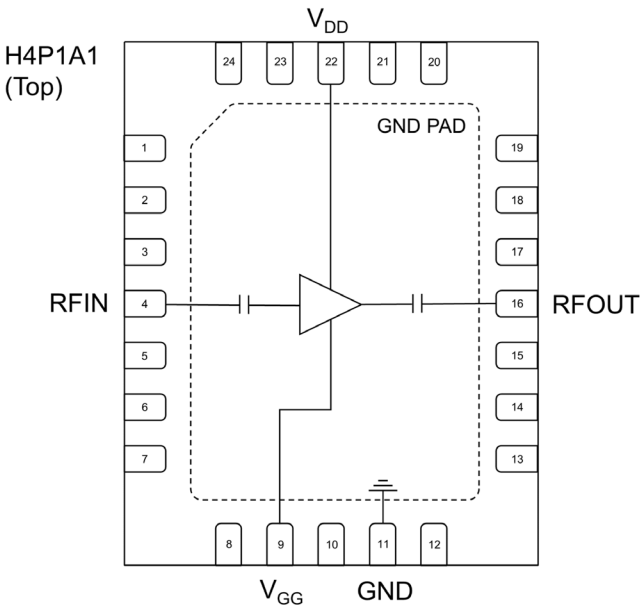
Features

- 5V V_{DD}
- 17 dB small signal gain with ±1 dB gain flatness
- 24 dBm of output power
- PAE > 30% across the band
- Excellent EVM performance
- Unconditional RF stability from DC to 40 GHz
- 50 Ω matched at input and output RF terminals
- Single V_{GG} and V_{DD} supply pins for all transistor stages
- Robustness to ESD

Applications

- 5G Macro Base Stations and Small Cells

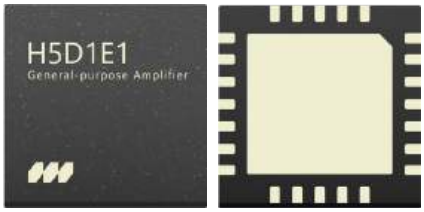
Functional Block Diagram



HEAVISIDE GPAs

H5D1E1

3.1-4.2 GHz, GaN MMIC General-purpose Amplifier in a Low-cost Package



Description

The H5D1E1 is a general-purpose amplifier that is optimal for local oscillator (LO), buffer amplifiers and general-purpose amplifiers requiring low-noise figure operating in the 3.1-4.2 GHz bandwidth. It is used in 5G, radar, satcom systems and point-to-point radio implementations. Built on reliable, compact and cost efficient GaN silicon technology, this MMIC is housed in a 4 mm x 5 mm QFN package, suitable for use in a 50 Ω environment without external matching elements.

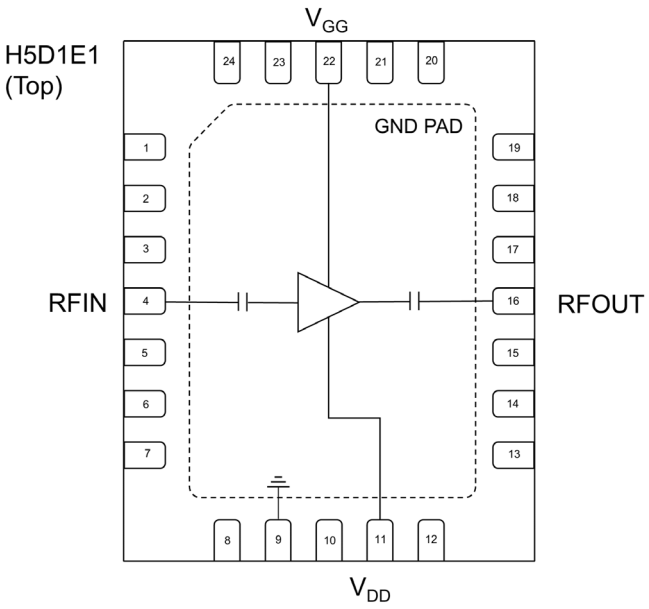
Features

- Robust General-purpose Amplifier without the need for input power protection through RF limiters
- Excellent Noise Figure of 3 dB
- 30 dB gain and exceptional gain flatness (±0.5 dB across the band)
- High linearity - guaranteed high IP3
- 50 Ω matched at input and output RF terminals
- 2-stage GaN amplifier MMIC, V_{DD} = 20V
- Single V_{GG} and V_{DD} supply pins for all transistor stages
- ESD protection

Applications

- Defence Applications (Radar, UAV)
- Satellite Communications
- Measurement and Instrumentation
- Radio System Integration
- Wireless Communications

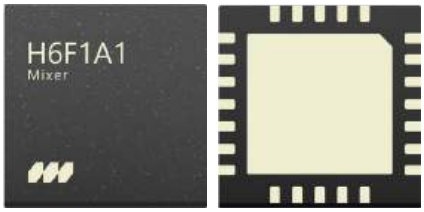
Functional Block Diagram



HEAVISIDE MIXERS

H6F1A1

IF 0-3 GHz, LO 11.4-13.2 GHz, RF 22.8-29.4 GHz, GaN MMIC Subharmonic Balanced Single-sideband Up-Conversion Mixer



Description

The H6F1A1 is a GaN MMIC subharmonic single-sideband up-conversion mixer with a conversion loss of 6 dB over an IF bandwidth of 0-3 GHz and an LO frequency range of 11.4-13.2 GHz. It offers excellent linearity and isolation and is suitable for use in a 50 Ω environment without external matching. This GaN MMIC is housed in a 4 mm x 5 mm QFN package.

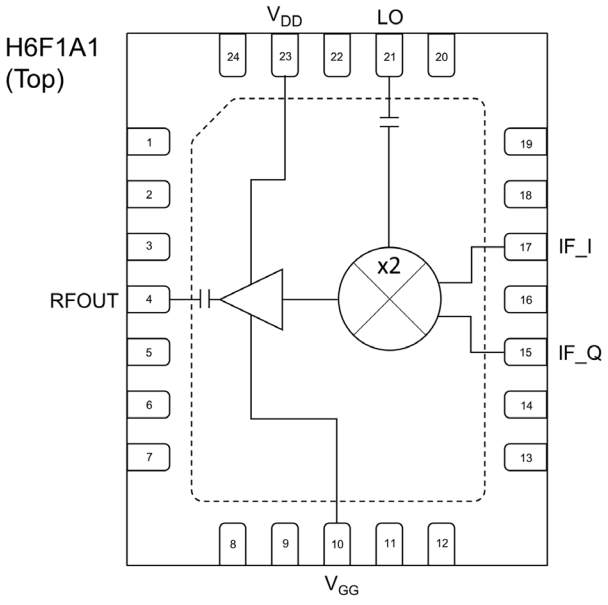
Features

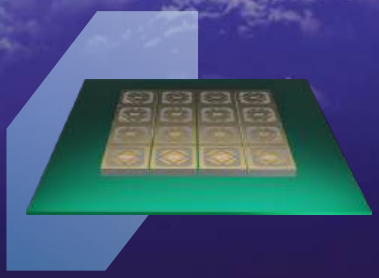
- -6 dB Conversion Gain with +/-1 dB flatness
- 16 dB LSB Rejection (2LO - IF)
- IF = 0 - 3 GHz
- LO = 11.4 - 13.2 GHz
- RF = 22.8 - 29.4 GHz
- High isolation and excellent linearity
- Unconditional RF stability from DC to 40 GHz
- 50 Ω matched at all ports

Applications

- Defence Applications (Radar, UAV)
- Satellite Communications
- Measurement and Instrumentation
- Radio System Integration
- Wireless Communications

Functional Block Diagram





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