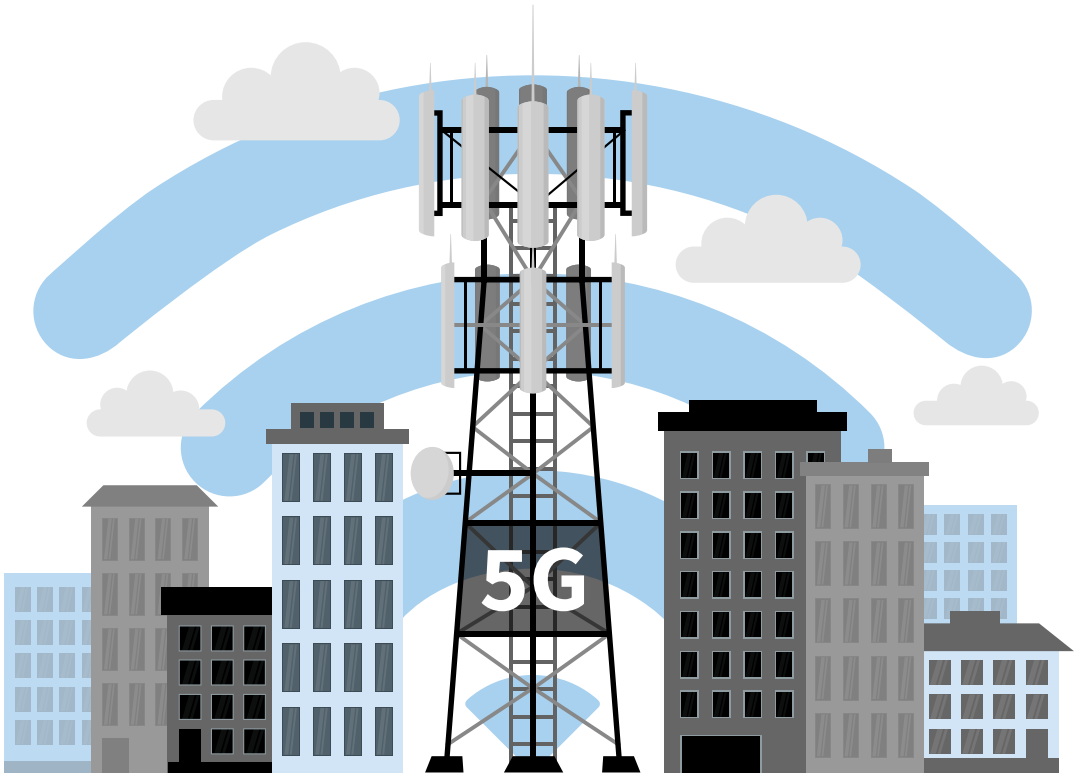
Qorvo® 5G Solutions:
RF Coverage from MHz to mmWave

Leading Portfolio of Discrete and Integrated ICs, Modules, Sub-Systems and Antennas



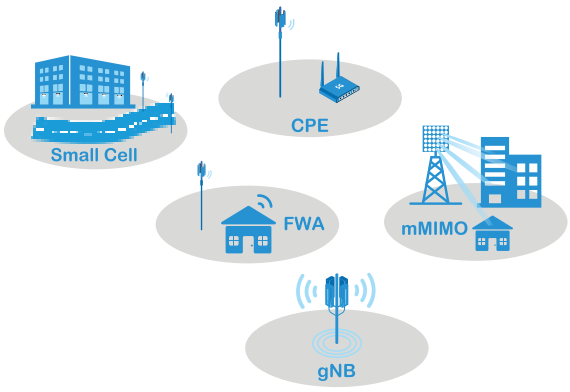
qorvo®
all around you

Your Trusted Infrastructure Partner

Qorvo is enabling trillions of connections through the industry's top performing products. We provide the best technology solutions for any application, connecting the world seamlessly from megabits to multi-gigabits. Whether it's small cells, fixed wireless access (FWA), CPE, massive MIMO or gNobeB, we support a wide range of use cases, with coverage from megahertz to millimeter wave. Our portfolio of discrete and integrated ICs, modules, subsystems and antennas support the evolving needs of 5G connectivity.

Supporting All Use Cases

- Small Cells
- FWA
- CPE
- mMIMO
- gNodeB



RF Coverage
from MHz to mmWave

Innovative Solutions That Deliver

- Best-in-class semiconductor technologies for 5G and beyond
- Insight from device to full systems
- In-house fab that accelerates innovation and scale
- mmWave ICs set new standards for 5G economics

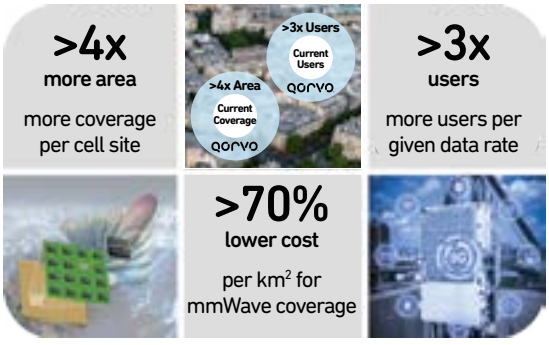
Manufacturing Expertise

- Optimizes cost, reliability and dependability
- Leveraging handset scalability for infrastructure applications
- In-house manufacturing and global partners
- Leader in Advanced Packaging

Featured Products

- **QPA9862**
  Wide instantaneous bandwidth compatible, high linearity, low power dissipation pre-driver for 5G mMIMO.

- **QPB9850, QPQ3509, QPQ3550**
  Switch LNA and BAW filter solutions for C-band networks.



- **AWMF-0221, AWMF-0224**
  Setting new standards for network performance, cost of deployment and operational expenses for mmWave networks.

Join us in connecting the world with Qorvo's innovative 5G portfolio and shape the future of global communication together.

qorvo.com/applications/network-infrastructure/wireless

Qorvo is making 5G deployment a reality and supporting the growth of mobile data with a broad range of RF connectivity solutions. Our robust RF portfolio for both infrastructure and smartphone applications include PAs, phase shifters, LNAs, gain block amplifiers, switches, integrated modules and other high-performance RF solutions. Qorvo's leadership in 5G comes from our legacy of DC to millimeter wave (mmWave) R&D and product development in the defense and aerospace markets, as well as a leading supplier of sub-6 GHz RF and mmWave solutions to the world's leading 4G & 5G base station manufacturers.

Qorvo offers a family of high-performance discrete RF components to provide flexibility to system designers, as well as the highest level of integration of multifunction building blocks to reduce size, lower costs and accelerate time to market.

Our highly integrated front-end modules feature switch LNA modules in a single or dual-channel configuration and are targeted for 5G massive MIMO or TDD macro base stations.

Switch LNA Modules for Sub-6 GHz 5G

Frequency (GHz)	# of Channels	IL (dB)	Noise Figure (dB)	Gain (dB)	OP1dB (dBm)	OIP3 (dBm)	Tx Pin (W)	Package (mm)	Part Number
3.1-4.2	1	0.7	1.2	35.5	16.8	29	8	5x3	QPB9362
2.3-2.7	1	0.4	1.3	35.5	16	25.5	8	5x3	QPB9361
2.3-5.0	1	0.5	1.1	34	18	31	8	3x3	QPB9850
1.7-4.2	2	0.5	1.2	37	20	35	15	6x6	QPB9348
2.3-5.0	2	0.5	1.1	34	18	35	22	6x6	QPB9378
2-3-4.2	2	0.5	1.0	38	16.8	34	22	6x6	QPB9380

Qorvo continues to lead the industry with lowest noise figure amplifiers across multiple process technologies. Qorvo's portfolio includes gain block amplifiers to be used in systems where additional gain is required.

Low Noise Amplifiers for Sub-6 GHz 5G

Frequency (GHz)	Noise Figure (dB)	Gain (dB)	OP1dB (dBm)	OIP3 (dBm)	Vd (V)	Package (mm)	Part Number
0.1-6	0.3	19.5	23	38	5	2x2	QPL9547
0.6-4.2	0.67	20	21.7	41.5	5	2x2	TQL9093
0.7-4.5	0.5	20	19	35	5	2x2	QPL9057
1-5	0.6	18	21	35	5	2x2	QPL9058
2-6	0.7	21.5	18	34.5	5	2x2	QPL9504

Gain Block Amplifiers for Sub-6 GHz 5G

Frequency (GHz)	Gain (dB)	OP1dB (dBm)	OIP3 (dBm)	Noise Figure (dB)	Vd (V)	Package (mm)	Part Number
1-6	16	20	35	1.4	5	2x2	QPA9126
1-6	20	19.5	35	1.4	5	2x2	QPA9127
0.02-4	22	22	39.5	1.3	5	3x3	TQP3M9019
0.02-4	20.5	21	37	1.3	5	3x3	TQP3M9018
0.05-6	16	21.3	40.3	1.5	5	2x2	TQL9062
0.05-4	14.5	20.8	35.5	1.6	5	2x2	TQL9047
0.05-4	14.9	21.6	39.5	2	5	3x3	TQP3M9038

Driver Amplifiers for Sub-6 GHz 5G

Frequency (GHz)	Gain (dB)	OP1dB (dBm)	OIP3 (dBm)	Noise Figure (dB)	Vd (V)	Id (mA)	Package (mm)	Part Number
3.3-4.2	36.5	29.5	38	3.8	5	110	3x3	QPA9862
3.3-4.2	39	28	35	4.5	5	145	3x3	QPA9822
0.6-2.8	15.5	30	44	5.7	5	230	4x4	QPA9442
1.7-5	28	22	36	1.5	5	95	3x3	QPA9120
2.3-5	27	25.5	34	5	5	95	3x3	QPA9121
2.3-5	37	25.5	34	5	5	90-120	3x3	QPA9122M
2.7-3.8	18.5	25	38	2.3	5	280	5x5	QPA9842

Switch Solutions for Sub-6 GHz 5G

Frequency (GHz)	Type	Termination Type	IL (dB)	Isolation (dB)	P_{IN} Max (dBm)	Vcc (V)	Package (mm)	Part Number
0.005-6	SP2T	R	0.3	37	37	3 to 5	2x2	RFSW1012
0.005-6	SP2T	R	0.25	46	37	3 to 5	1.1x1.5	QPC1022
0.005-6	SP4T	R	0.45	34	35	3 to 5	2.5x2.5	RFSW6042
0.005-6	SP2T	A	0.7	70	35	3 to 5	4x4	RFSW6024
0.005-6	SP4T	A	0.98	50	36	3 to 5	4x4	QPC6044
0.005-4.2	SPDT	R	0.4	40	40	5	5x5	QPC3025
0.005-6	2xSPDT	R	0.4	23	36	3	2x2	RFSW6222
0.005-6	SPST	A	0.85	55	35	5	2x2	QPC6014

RF Filters

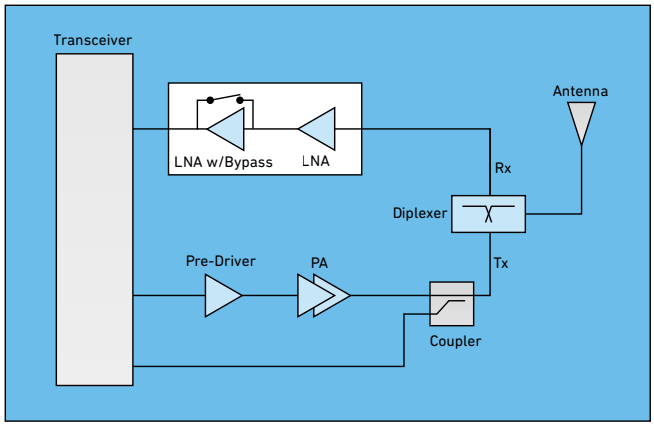
Frequency (MHz)	Bands	Description	Technology	IL Typ (dB)	Package (mm)	Part Number
3550-3700	B48	CBRS Band 48 Bandpass Filter	BAW	2.7 Max	2x1.6	QPQ3550
699-716, 7290756, 777-787	B12/B13, UL/DL	LTE Band 12/Band 13 Triplexer Filter Module	TC-SAW	3 Max	4x5	QPQ1214
1710-1785, 1805-1880	B3	Band 3 BAW Duplexer	BAW	2.3	2x2.5	QPQ1297
2500-2570, 2620-2690	B7	Band 7 BAW Duplexer	BAW	2.4	2x2.5	QPQ1270
2515-2675	B41	Band 41, 160 MHz Sub-Band Filter	BAW	2.5	2x1.6	QPQ1298
3300-3600	B52, B42	Band 52+42, 300 MHz Bandpass Filter	BAW	3.2 Max	2x1.6	QPQ3501
3400-3600	B42	Band 42, 200 MHz Bandpass Filter	BAW	3.2 Max	2x1.6	QPQ3500
3700-3980	C-band	1W C-band BAW Bandpass Filter	BAW	3 Max	3x2	QPQ3509
4800-4960	n79	Sub-band n79, 160 MHz Bandpass Filter	BAW	2.2 Max	2x1.6	QPQ4900

Small Cells & Densification

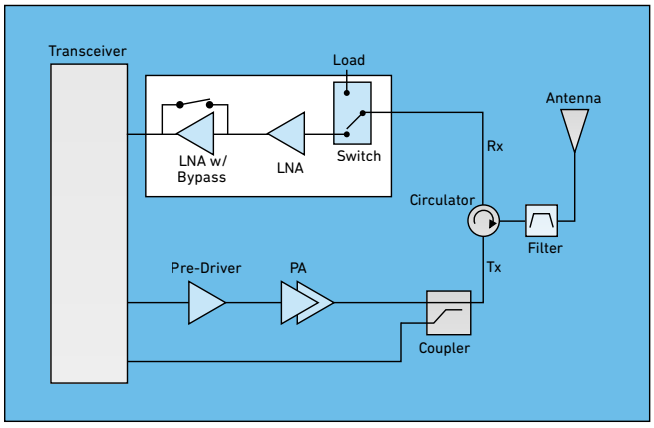
Carriers can add capacity and make better use of their networks by either deploying more spectrum or densification of existing networks. Regardless of the choice, the need for more small-cell deployments is happening with 5G rollout providing the tailwinds. Densification of small cells, both indoor and outdoor, greatly increases capacity for different use cases and also improves cell edge performance, therefore increasing value of their existing spectrum. In the small cell arena no one size fits all. Small cells differ in their power level, geographical coverage, regional band allocation and the number of users serviced. Therefore, OEMs must produce small cells to accommodate several SKUs (stock keeping unit).

Qorvo's Small Cell Solution and Product Response

Qorvo's continuous innovation of its core RF solutions such as filters, amplifiers and switches enable our customers to meet new design requirements for small cell applications.



Small Cells FDD



Small Cells TDD

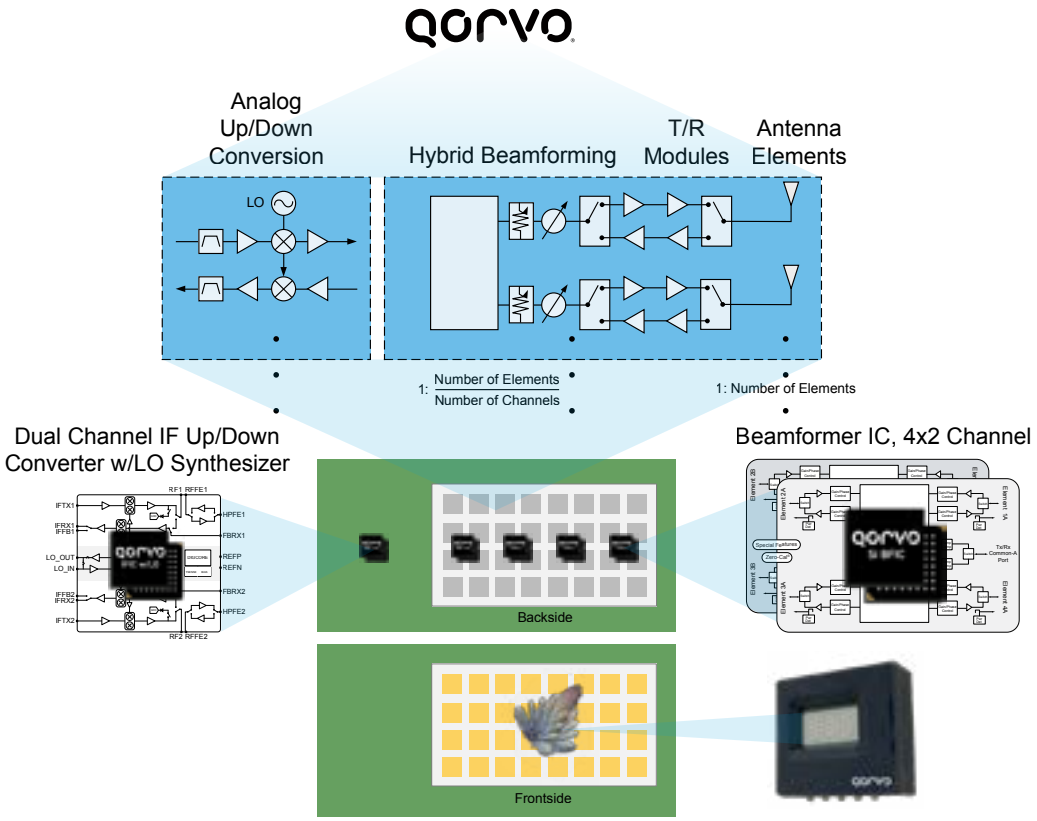
System Solutions for FDD and TDD Small Cell Front-End Designs

Band			12, 13, 14, 17, 20	5, 18, 19, 26, 8	3	2, 25	1, 4, 10, 66	30, 40, 75	7, 41	42, N78	N79	46	Package
Freq			729-821 MHz	851-960 MHz	1.805-1.88 GHz	1.93-2 GHz	2.11-2.2 GHz	2.3-2.4 GHz	2.5-2.7 GHz	3.3-4.0 GHz	4.8-5.0 GHz	5.1-5.9 GHz	(mm)
Duplexer/Filter			857182	QPQ6108	QPQ1297		QPQ1282 QPQ1289		QPQ1270				2.5x2
			QPQ1214		QPQ1297				QPQ1270 QPQ1298	QPQ3500 QPQ3501 QPQ3509 QPQ3550	QPQ4900		2x2
LNAs			QPL9547		QPL9547, TQL9092, TQL9093, QPL9057, QPL9058					QPL9503, QPL9504			2x2
Bypass LNAs			TQL9063										2x2
			QPL9095		QPL9096					QPL9097	QPL9098		
		PA Pavg											
Power Amplifiers	Linear PA	24 dBm			TQP9218	QPA9219	TQP9221	TQP9224	QPA9226	QPA9501			7x7
		27 dBm			QPA9418	QPA9419	QPA9421	QPA9424	QPA9426				7x7
	Non-linear* (Required DPD)	28 dBm	QPA9909	QPA9908	QPA9903		QPA9901	QPA9940		QPA9942			5x5

5G mmWave Solutions

Higher frequency mmW bands are expected to expand both network capacity and wireless use cases, with theoretical 5G transfer speeds of up to 10 gigabits per second. These mmW bands operate over a significantly shorter range than lower frequency bands, driving a significant increase in residential and commercial placements of short-range, smaller cell sites. As 5G continues to evolve, FWA is emerging as one of the strongest use cases for demonstrating the potential of 5G to enable seamless, high-performance connectivity that meets the demands of an increasingly connected world.

Qorvo has over a decade of experience supporting mmW applications and solutions. Qorvo combines mmW systems expertise and the industry's most comprehensive high-power RF product and technology portfolio to help leading manufacturers quickly launch next-generation infrastructure products.



Benefits of mmWave Si Technology:

- Lowest $/dBm commercially available today
- Multi-band performance
- Advanced digital core simplifying design
- Smart integration
- Complete signal chain solutions (IQ, IF, RF, mmW, antennas, algorithms)
- Scalable quad architecture
- Zero-Cal® reduces calibration
- System level support for optimized solutions
- 300 mm CMOS for lowest cost
- Proven in volume in fielded radios

Applications:

- Military/commercial radar
- SATCOM LEO/MEO, mobile GEO
- mmWave 5G
- Future FR3

Featured Products

Market	IC Type	Frequency (GHz)	Feature	Part Number
mmW 5G	Tx/Rx Beamformer IC	24 to 30	4x2 Dual Pol	AWMF-0221
mmW 5G	IF Up/Down Converter IC	24 to 30	Single Channel; Wideband	AWMF-0210
mmW 5G	IF Transceiver IC	24 to 30	Dual Channel; Wideband	AWMF-0224
mmW 5G	Tx/Rx Beamformer IC	37 to 43.5	4x2 Dual Pol	AWMF-0236
mmW 5G	IF Up/Down Converter IC	37 to 43.5	Single Channel; Wideband	AWMF-0218
mmW 5G	IF Transceiver IC	37 to 48.2	Dual Channel; Wideband	AWMF-0196
All Markets	32-Element mmW-IF Antenna	24 to 30	4x2 Dual Pol	AWA-0213

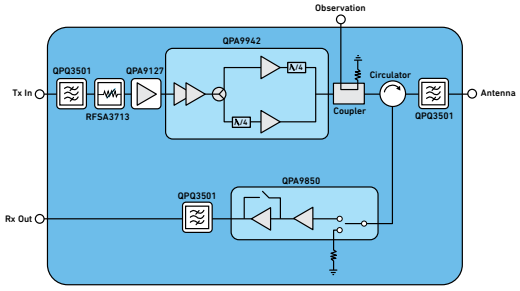
Your Design Journey Begins Here: Discover Our Evaluation and Developer Kits

Qorvo's evaluation and developer kits accelerate the design and prototyping process. The kits provide a pre-built platform with essential components and software, allowing customers to quickly test and validate new ideas without starting from scratch. By experimenting with real-world hardware and software, customers can identify potential design flaws, optimize performance and ensure compatibility early in the development cycle, ultimately reducing time-to-market and reducing the risks associated with new product development.

Featured Evaluation Resources

FWA or Small Cell RF Front-End Reference Board

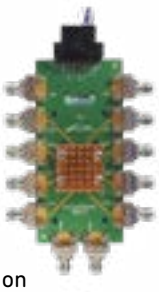
2T2R, 3.4 to 3.8 GHz

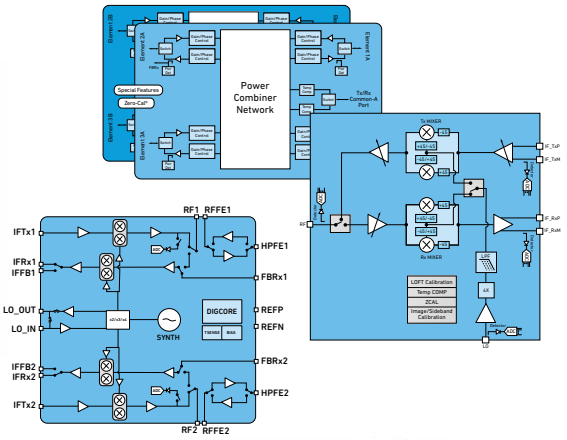


- Functional blocks:
  - QPA9942 small cell Doherty PA
  - QPB9850 switch-LNA
  - QPA9127 gain block
  - QPQ3501 BAW filter
  - RFSA3713 7-bit serially controlled DSA
  - Directional coupler for DPD
  - Circulator for TDD operation
- Easy to bias with 5V supply
- TDD switching for Tx and Rx from single logic control
- 50 dB Tx lineup gain capable of 200 MHz IBW
- Tx output power adjustable via DSA

mmWave Developer Kits

4x2 BFICs, IFICs, IF Transceivers





- Kits for all mmWave 5G ICs:
  - AWMF-0221 24 to 30 GHz BFIC
  - AWMF-0210 24 to 30 GHz IFIC
  - AWMF-0224 24 to 30 GHz IF transceiver
  - AWMF-0236 37 to 43.5 GHz BFIC
  - AWMF-0218 37 to 43.5 GHz IFIC
  - AWMF-0196 37 to 48.2 GHz IF transceiver
- Includes all hardware for device interface
- Test board designed to provide channel to channel isolation
- Custom GUI to easily control test board
- Comprehensive performance data included

mmWave to IF Active Antenna Innovator's Kit

n257/261 32-element Antenna Array

- mmWave to IF antenna front end: includes beamformer ICs and integrated IF up/down converters and port for external LO connection
- Passively cooled mechanical enclosure with a single regulated power supply and fast SPI control interface
- Array control hardware configured to support either Windows or Linux
- Easily customized to meet equipment manufacturer's specific 5G radio requirements

qorvo.com/applications/network-infrastructure/wireless

Check Out Our Design Hub

Qorvo connects the world. From the IoT and smartphones to defense and everything in between. Explore our resources to find out how.

Resource Categories:

Downloadable Software

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- QSPICE®

GaN Models

- Modelithics
- Qorvo GaN Library

Array Calculators

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- 5G Array Calculator

Design Tools

- PCB Trace Power Handling Calculator
- Cascade Calculator
- RF Impedance Matching Calculator
- Block Diagrams
- Blogs
- Brochures
- White Papers
- eBooks
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- Technical Articles
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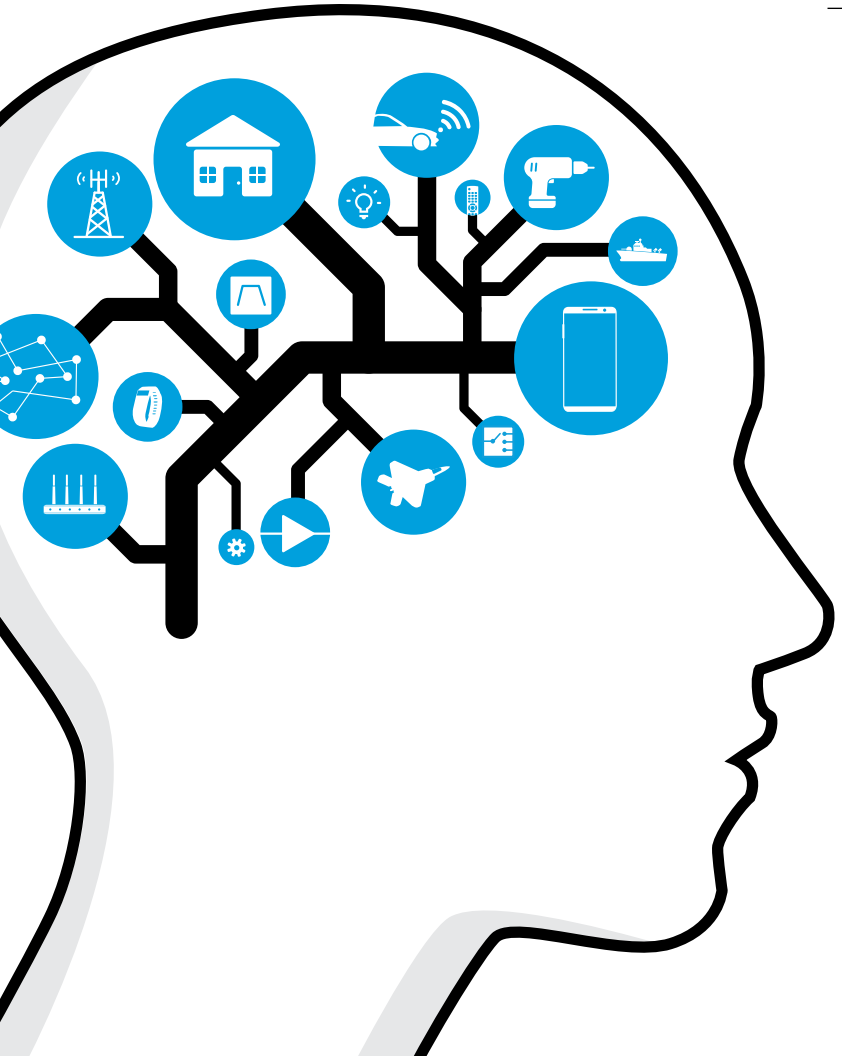

Here to Inspire and Help

Qorvo has a long and proud history of providing RF designers and engineers, from around the world, with the inspiration and technical support they need to make their designs a reality. In addition to designing and manufacturing the industry's best in class RF and mmWave products, Qorvo provides the system level technical know-how that enables true design collaboration. Qorvo stands ready to support our valued customers so they can overcome their toughest design challenges together.

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