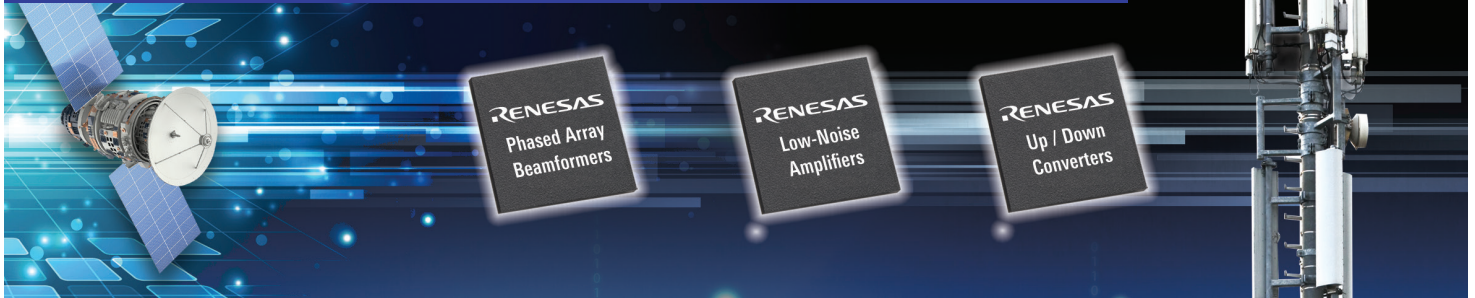


## COMPLETE LINE-UP OF MMWAVE BEAMFORMING ICs



Renesas offers a complete portfolio of industry-leading phased array beamformer ICs for mmWave 5G, Satellite Communications and Radar applications. Our highly integrated, complete RF front-end solutions not only offer best-in-class RF performance, but also simplify the system design to accelerate your time-to-market.

Renesas Active Beamforming ICs for Phased Arrays enable cost-effective, next generation system solutions for 5G, Satcom and radar applications. Each beamforming IC contains multiple independently controlled active channels for element-level beam pattern shaping in electronically scanned array antennas (ESAs). The compact ICs are available in planar BGA packages enabling the realization of very low profile and small form factor phased array antennas with  $\lambda/2$  element spacing. Transmit-only (Tx), receive-only (Rx) or transmit/receive (TRx) ICs cover all of the popular 5G mmWave, Satcom and Radar frequency bands with product variants. Renesas' beamformer product line is rapidly expanding to address the growing commercial demand for affordable phased array antennas.

### Featured products

- TRx active beamformer ICs for 5G
- Rx active beamformer ICs for Satcom / Radar
- Tx active beamformer ICs for Satcom / Radar
- Low-noise amplifiers
- Up / down converters

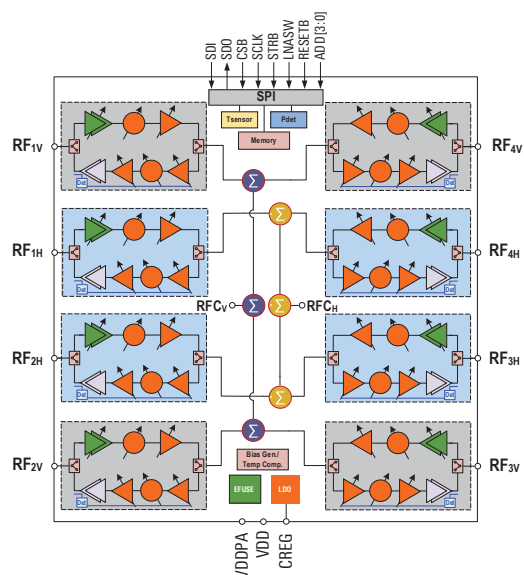
### Key advantages for 5G systems

- Highest linear power >15.5 dBm
- Programmable third generation solutions
- Dynamic Array Power (DAP™)

### Key advantages for Satcom / Radar

- True dual beam with lowest noise figure
- Lowest power consumption
- Precise gain / phase control

Multi-element phased array diagram



# COMPLETE LINE-UP OF MMWAVE BEAMFORMING ICs

The Renesas portfolio of active beamforming ICs, up/down converters and LNAs are market-tested and deliver the industry's best RF performance for next-generation phased array antennas.

## TRx Active Beamforming ICs for 5G mmWave

Part Number	Description	Frequency (GHz)	Tx Gain (dB)	Tx OP1dB (dBm)	Tx Linear Power <sup>2</sup> (dBm)	Rx Electronic Gain (dB) <sup>1</sup>	RX NF (dB)	Voltage (V)	Package (mm)
F5268	4T4R DP 26 GHz	24.25 – 27.5	31	20.5 (23 <sup>1</sup> )	13.5 (15.5 <sup>1</sup> )	25	4.5	2.4 - 2.6	5.1 x 5.1, 118-BGA
F5288	4T4R DP 28 GHz	26.5 – 29.5	30	20 (22 <sup>1</sup> )	13 (15.3 <sup>1</sup> )	24	4.5	2.4 - 2.6	5.1 x 5.1, 118-BGA
F5280	4T4R SP 28 GHz	26.5 – 29.5	27	13	5	22	5.5	2.3 - 2.7	3.6 x 3.6, 49-BGA

## Rx Dual-Beam\* Active Beamforming ICs for Satcom / Radar

Part Number	Description	Frequency (GHz)	Electronic Gain (dB)	Voltage (V)	Package (mm)
F6121	16-channel Ku-Band	10.7 – 12.75	11	2.1 – 2.5	3.8 x 4.6, 63-BGA
F6123	16-channel Ku / CDL-Band	14 – 17	11	2.1 – 2.5	3.8 x 4.6, 63-BGA
F6212	16-channel Ka-Band	17.7 – 21.2	27	2.1 – 2.5, 0.9 – 1.0	7.6 x 7.6, 165-BGA

## Tx Active Beamforming ICs for Satcom / Radar

Part Number	Description	Frequency (GHz)	Gain (dB)	OP1dB (dBm)	Voltage (V)	Package (mm)
F6521	8-ch Tx Ku-Band	13.75 – 14.5	25	10.5	2.1 – 2.5	3.8 x 4.6, 62-BGA
F6522	8-ch Ka-Band	27.5 – 31.0	28	11	2.1 – 2.5	3.8 x 4.6, 62-BGA
F6513	8-ch Ku / CDL-Band	14 – 17	23	12.5	2.1 – 2.5	3.8 x 4.6, 62-BGA

<sup>1</sup> 3.3V VDD operation mode for PA

<sup>2</sup> Output power level at 3% EVM for 400 MHz 5G-NR waveform

\* All dual-beam ICs are programmable for single-beam mode operation resulting in a 30-40% reduction in power consumption. The F6212 is also available as a lower cost single-beam variant under P/N F6202.

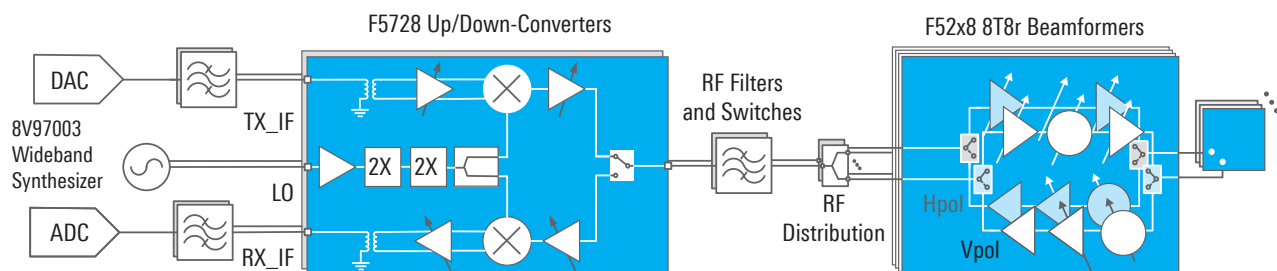
## Up / Downconverters for 5G mmWave\*

Part Number	Description	RF Freq. (GHz)	IF Freq. (GHz)	RX Gain (dB)	RX NF (dB)	TX Gain (dB)	OP1dB (dBm)	Voltage (V)	Package (mm)
F5728	1T1R Up/Down Converter	24.25 – 29.5	2 – 7	21 – 23	6 – 6.5	31 – 32	16 – 17	2.3 – 2.7	4 x 4, 49-BGA

\* Various orderable part numbers deliver specific parameters

## Low Noise Amplifiers for Satcom / Radar

Part Number	Description	Frequency (GHz)	Gain (dB)	NF (dB)	OP1dB (dBm)	OIP3 (dBm)	Voltage (V)	Current (mA/ch)	Package (mm)
F6921	Dual-ch LNA, Ku-Band Satcom	10.7 – 12.75	19.5	1.4	-7	2	0.9 – 1.0	13	2.7 x 2.7, 23-BGA
F6922	Dual-ch LNA, Ka-Band Satcom	17.7 – 21.2	19.5	1.8	-2	10	0.9 – 1.0	16	2.7 x 2.7, 23-BGA
F6923	Dual-Ch LNA, Ku / CDL-Band	14 – 17	19.5	1.5	-2	10	0.9 – 1.0	17	2.7 x 2.7, 23-BGA



Visit [renesas.com/beamformers](https://www.renesas.com/beamformers) to request samples, download documentation and learn more.



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