FERMIONIC

FD3R4411A

Low Power, Low Noise, High Linearity X-band 4-Channel Beamforming IC

Description

FD3R4411A is a quad transceiver beamforming IC operating in 8-12GHz band. It supports 4-antennas, each multiplexed between TX and RX in TDD mode. In RX mode, input signals received from four antennas in four RX channels are combined in a common RF_IO pin, after independent gain and phase adjustments in the four channels. In TX mode, input signal at the RF_IO pin is split and passed through four TX channels to drive four antennas, again after independent gain and phase adjustments in the four channels. In both modes, the devices provide 2.8^0 phase-shift and 0.5dB gain-adjustment resolution.

The device can be configured using a four-wire SPI interface. The device contains four independent power-detectors. It also reports device temperature measured by a 9-bit SAR ADC for diagnostics.

Features

- Frequency Range : 8-12 GHz
- Supports 4-antennas, each multiplexed between TX and RX in TDD mode
- Fast Beam Steering: 50 ns stabilization time
- Fast RX/TX TDD switching: 100 ns switching time
- TX Psat : 18dBm, gain : 20dB
- RX 2-port NF: 10.5 dB, Coherent Gain: 6 dB, Input P1dB: 0 dBm
- Phase Control LSB: 2.8-Degrees, Accuracy: 2-Degrees, Range: 360-Degrees
- Gain Control Step: 0.5dB, Range: 31dB
- Integrated Power Detector, Temperature Sensor, 9-bit SAR ADC
- 4-wire SPI interface

Parameter	FD3R4411	Competitor 1	Competitor 2	Unit	FermionIC Advantage
Freq Band	8 - 12	8 - 16	8.5 - 10.5	GHz	Most Applications are in the 8-12 GHz band
TX Psat	18	12	15	dBm	"FD3R4411 is able to drive the PA directly without a pre-PA, Reduces BOM Cost and Power Consumption"
RX 2-Port Input P1dB	0	-16	-4	dBm	"Provides better OIP3 and SFDR thereby reducing clutter, on the RADAR systems, especially on airborne radar system"
Ext PA/LNA Bias	"4 PA Bias, 4 LNA Bias"	"4 PA Bias, Single LNA Bias"	Not Present		"Eliminates external gate/drain switches, Reduces BOM and board complexity"
Ext PD Measurement	Available	Not Present	Not Present		Eliminates need for external ADC for FEMs with integrated PD
SPI Addr Bits	5	2	NA		32 devices can reuse the same CSB trace thus reducing board routing
RX Coherenet Gain	6	22	9	dB	"Less gain along with better input P1dB improves, spur performance and leads to less clutter"
RX NF @ Max Gain	10.5	8	15	dB	"Slightly poorer NF does not affect RX-chain NF as the device is preceded with an external LNA with ~27dB gain and ~2.5dB NF"
RX Power	1053/550	900/528	850	mW	
RX RMS Ph Err	3	2	5.6	deg	"Slightly poorer RMS phase-error does not affect overall phase error. PCB antenna-spacing error in the PCB limits system RMS Ph Err"
TX RMS Ph Err	3	2	5.6	deg	
Package	FCBGA	LGA with EP	WLCSP		Eases heat-sink design as it needs to tough the exposed die on top

Get in Touch

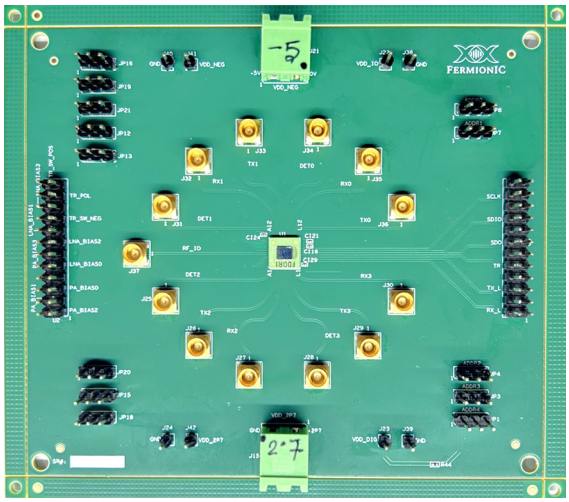
www.fermionic.design | info@fermionic.design | 9243083297 | Inspire Workplace, Bk No 134 135, Karthiknagar Doddanekundi, LRDE Layout, Bangalore KA, 560037

Specification

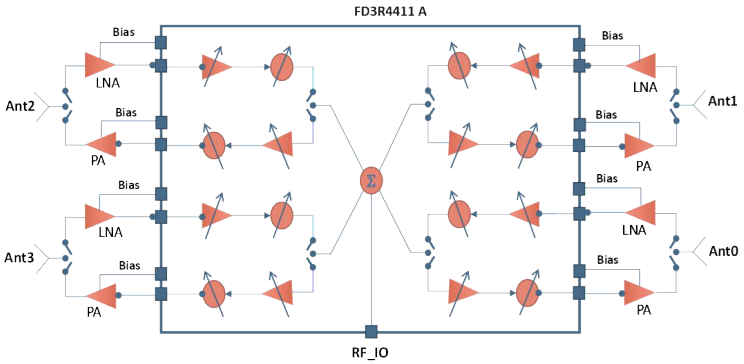
Parameters	Test Conditions & Description	Min	Typ	Max	Unit
TX P_{SAT}	P_{IN}=5dBm		18		dBm
RX Coherent Gain	Coherent Gain = Two port RX Gain + 12dB		6		dB
RX Noise Figure (NF)	Two-port NF		10.5		dB
RX Input P1dB			0		dBm
RX Input return Loss			-10		dB
TX/RX gain flatness over 1GHz frequency range		-1		1	dB
TX/RX gain step			0.5		dB
TX/RX gain range			31		dB
TX/RX phase step			2.8		degrees
TX/RX RMS Phase error			2		degrees
TX/RX phase range			360		degrees
Return loss at RF_INOUT pin in TX/RX modes			-10		dB
TDD switching time (TX to RX or RX to TX)			100		ns
Phase-change time (TX or RX mode)			50		ns
Channel to channel isolation	TX to TX, RX to RX		40		dB
Power Detector range	At individual Power-Detector input pins DET0-3	-20		10	dBm
VDD	Nominal Bias Mode		2.7		V
	Low Bias Mode		2.5		
Current Consumption from VDD (4-Channel ON)	TX Mode-Nominal Bias Mode		1.2		A
	TX Mode-Low Bias Mode		0.8		
	RX Mode-Nominal Bias Mode		0.375		
	RX Mode-Low Bias Mode		0.22		

**VDD_NEG = –5 V, VDD = 2.7 V, TA = 25°C, Frequency=10GHz, unless otherwise specified.

Evaluation Board



Application Diagram



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