Data Sheet

XBR8161

X-band Radar Sensor

Introduction

The XBR8161 is a single-chip X-band radar transceiver in RF CMOS technology. The device is designed for applications at intelligent security, intelligent lighting, smart home and other fileds

Key Features

- Integrated 10.525 GHz single-ended transmitter, receiver, baseband and LDO regulator.
- Supply voltage：3.0-3.6 V
  Supply current：60mA for CW mode, 240 uA for pulse mode
- Fast setting time for duty-cycle operation
- TX power：6 dBm
- 2nd and 3rd Harmonic rejection: > 40dBc
- Phase noise at 1 MHz：-106 dBc/Hz
- 1dB compression point：-24 dBm
- Receiver gain：20-100 dB
- Receiver sensitivity：<-95 dBm
- Supports target ranging：

- FSK mode：two-tone space 6 MHz
- FMCW mode：500 MHz

- Operation condition: -30℃ to 85℃
- QFN 24 pins, 4mm x 4mm package

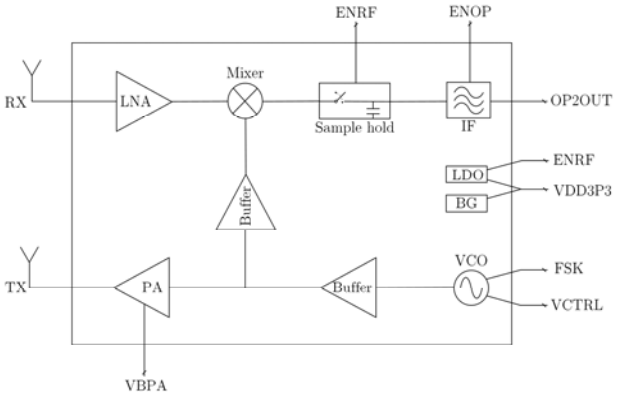
Key Benefits

- ✧ Low power consumption
- ✧ Small system size
- ✧ Low system cost

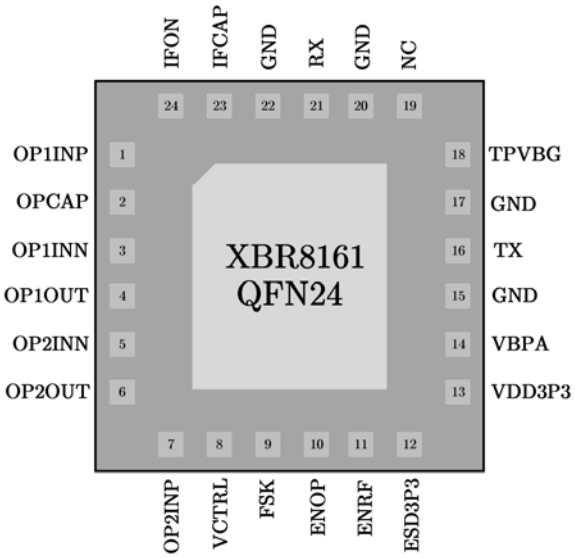
Applications

- ✧ Smart Radar Sensor
- ✧ Lighting Controller
- ✧ Security & Surveillance Products
- ✧ Industrial Applications
- ✧ Consumer Appliances

System Diagram



Pin assignment



PIN No.	PIN Name	PIN Type	Description
1	OP1INP	I	First stage OP IF input P
2	OPCAP	I	OP high-pass filter capacitance
3	OP1INN	I	First stage OP IF input N
4	OP1OUT	O	First stage OP IF output
5	OP2INN	I	Second stage OP IF input N
6	OP2OUT	O	Second stage OP IF output
7	OP2INP	I	Second stage OP IF input P
8	VCTRL	I	FMCW control voltage
9	FSK	I	Digital FSK modulation voltage
10	ENOP	I	Baseband enabled for sleep mode
11	ENRF	I	RF enabled for pulse mode
12	ESD3P3	Power	3.3 V ESD voltage
13	VDD3P3	Power	3.3 V power supply
14	VBPA	Power	RF power adjustment
15	GND	Ground	RF ground
16	TX	O	RF signal output
17	GND	Ground	RF ground
18	TPVBG	I	Power supply noise filter capacitor
19	NC	-	Not connected
20	GND	Ground	RF ground
21	RX	I	RF signal input
22	GND	Ground	RF ground
23	IFCAP	I	IF Noise filter capacitance
24	IFON	O	Raw IF Signal output

● Electrical characteristics

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Power Supply Voltage	VDD3P3 ESD3P3	-0.5	+3.6	V
Digital Control Voltage	ENRF ENOP FSK	-0.5	+3.6	V
Analog Interface	VCTRL	-0.5	+1.8	V
RF Input Level	TX RX		+10	dBm
Operating Ambient Temperature	T_A	-30	+85	℃
Storage Temperature	T_{STG}	-55	+150	℃

ESD Rating

Parameter	Value	Unit
Human-body model (HBM)	±2000	V
Machine model (MM)	±200	V
Charged-device model (CDM)	±500	V

Recommend Operating Ranges

Parameter	Min	Typ	Max	Unit
VDD3P3	3.0	3.3	3.6	V
VCTRL	0	-	1.5	V
VBPA(1)	0	float	1.5	V

NOTE: Recommended Operating Ranges indicate conditions for which the device is intended to be functional.

(1): The pin VBPA is used to adjust the TX output power. It has a default voltage of 0.65 V generated from an internal reference voltage. It is recommended to change VBPA by connecting an external resistive divider instead of directly driving an analog voltage.

Power Supply Specifications

T=25℃,VDD3P3=3.3V

Parameter	Min	Typ	Max	Unit
Power supply current(1)	55	60	65	mA
Power supply current(2)		0.24		mA
Power supply voltage	3.0	3.3	3.6	V
RF power-on time(3)	0.5	0.75	1	us
Logic high input current	-10	-	+10	uA
Logic low input current	-10	-	+10	uA
Logic high input voltage	2.6	-	3.6	V
Logic low input voltage	0	-	0.7	V

(1) Continuous mode; TX output power = 6 dBm.

(2) Pulse mode; Repetition rate for ENRF (0.5‰ duty cycle) and ENOP (5% duty cycle) is 1 kHz. TX output power = 6 dBm.

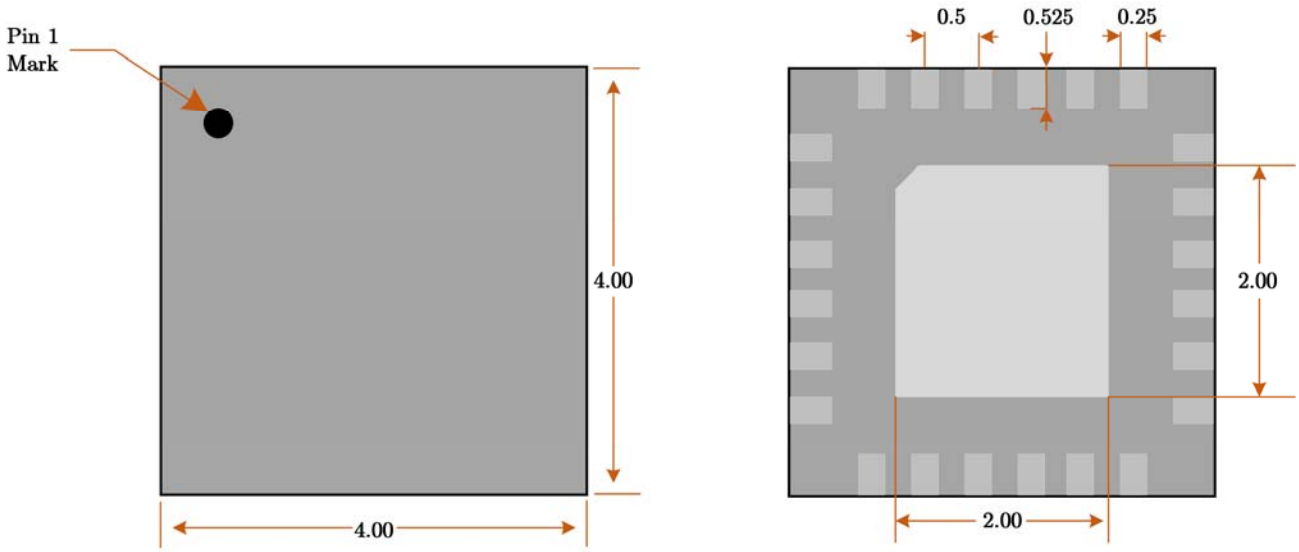
(3) The necessary time for the transceiver entering the full-speed operation state after the ENRF is enabled.

RF and BB Specification

over recommended operating conditions (unless otherwise noted)

Parameter			Min	Typ	Max	Unit
Transmitter	Operating current			50		mA
	Output power	VBPA float (CW)		6		dBm
		VBPA float (FMCW)	4	5	6	dBm
	Phase noise@1 MHz	VCTRL=0		-106		dBc/Hz
	Frequency tuning range			500		MHz
	Frequency pushing	VDD3P3=3.0 to 3.6 V		4		MHz/V
	2^{nd} harmonic suppression			40		dBc
	3^{rd} harmonic suppression			50		dBc
	TX-RX leakage			-40		dBc
	FSK span			6		MHz
Receiver	Operating current			8		mA
	RX S11			-8		dB
	Voltage gain			20		dB
	Input 1dB compression point			-24		dBm
	Noise figure@1 MHz			12		dB
Baseband	Operating current			240		uA
	Voltage gain		0		80	dB
	Output rms noise	8-160 Hz		2		mV

● Package

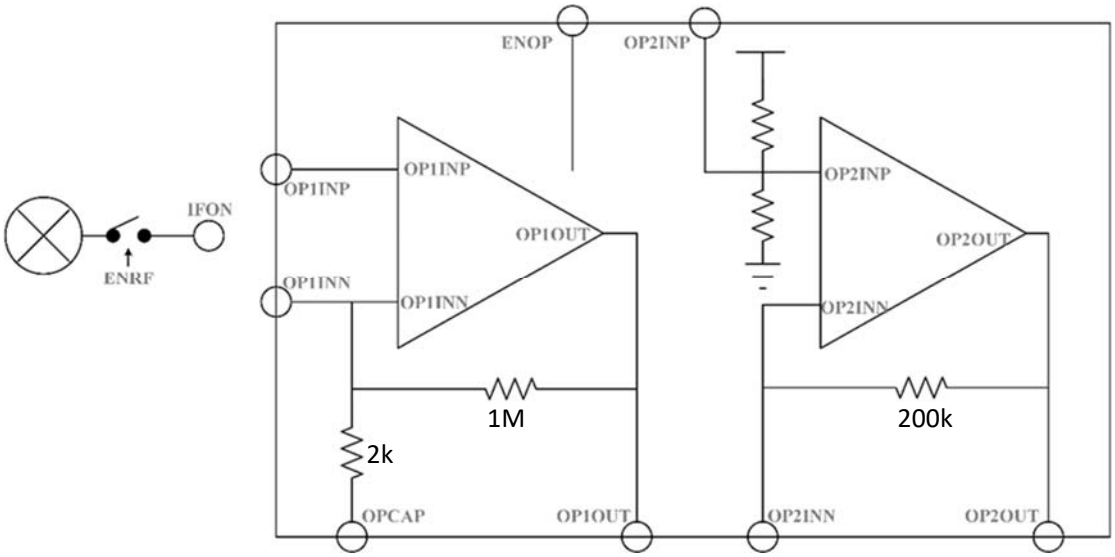


NOTE :

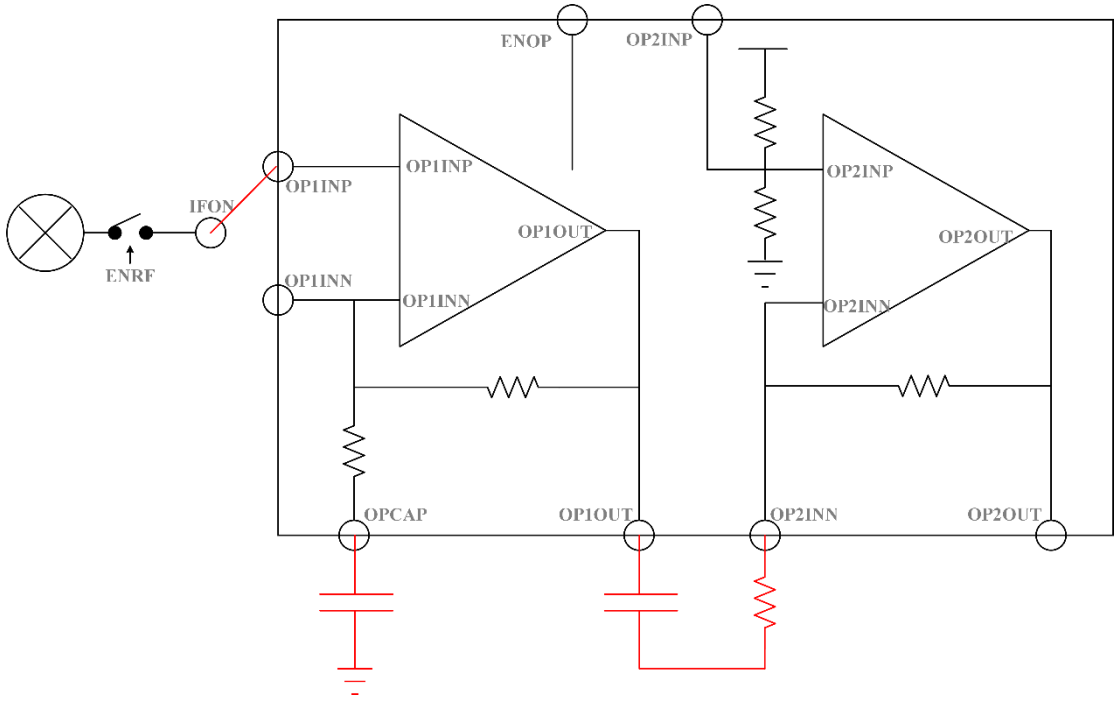
1. All dimensions are measured in millimeters
2. Drawing is not to scale.

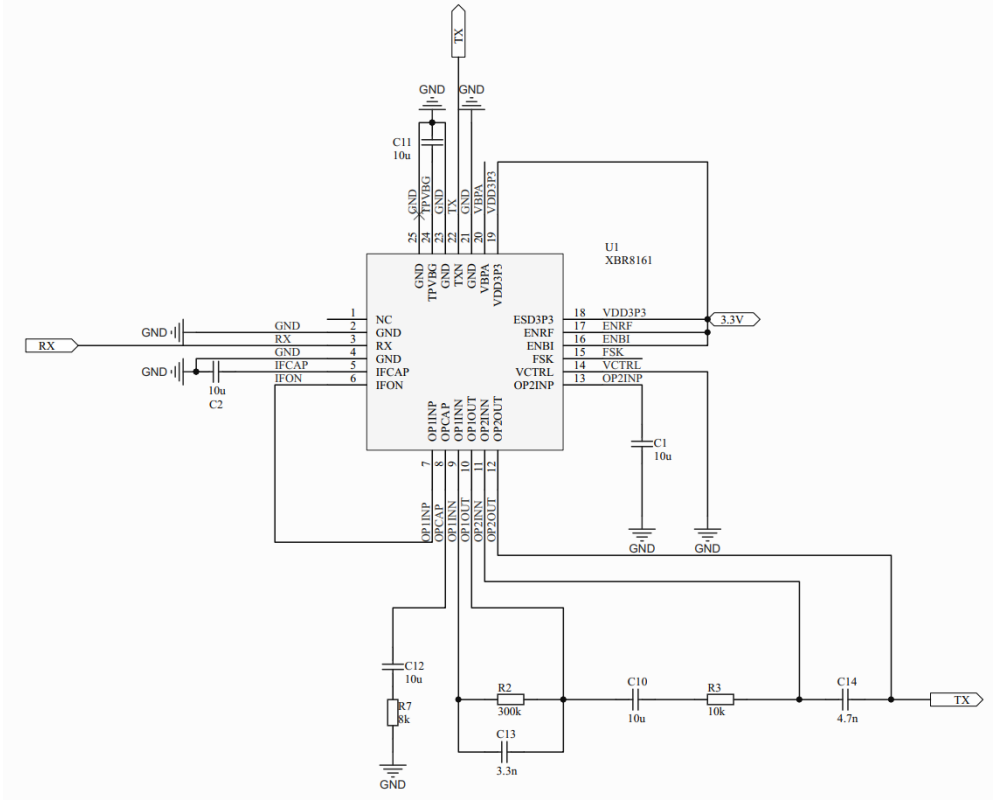
● Application reference

BB interface

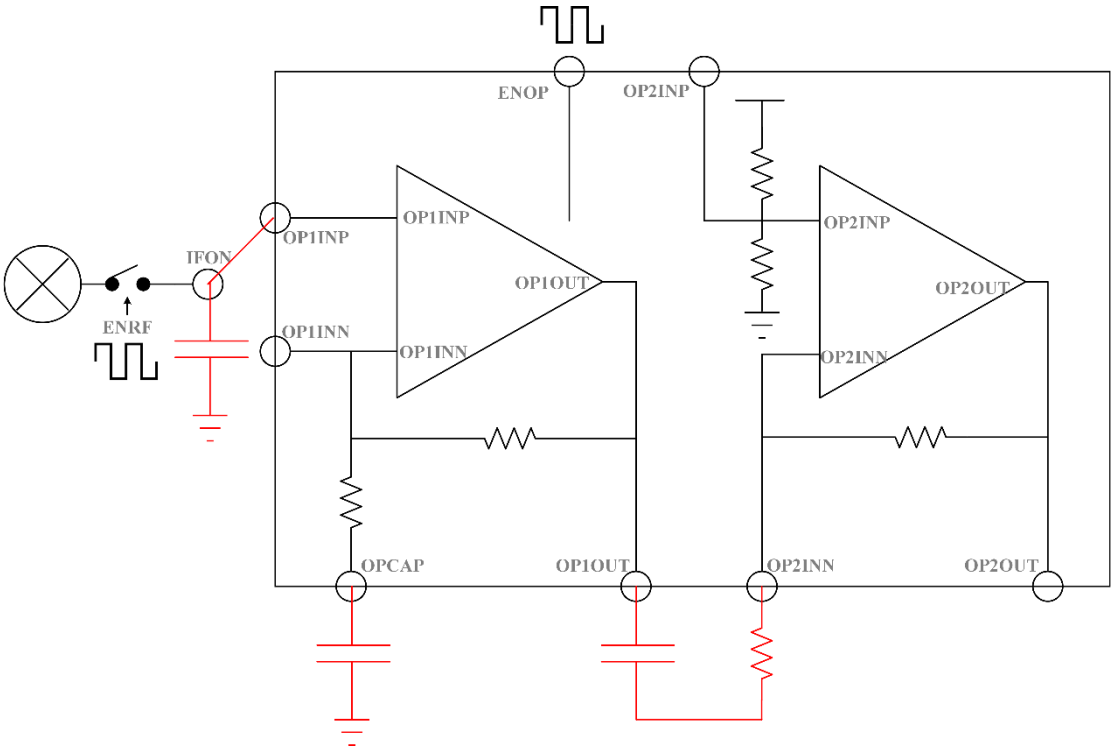


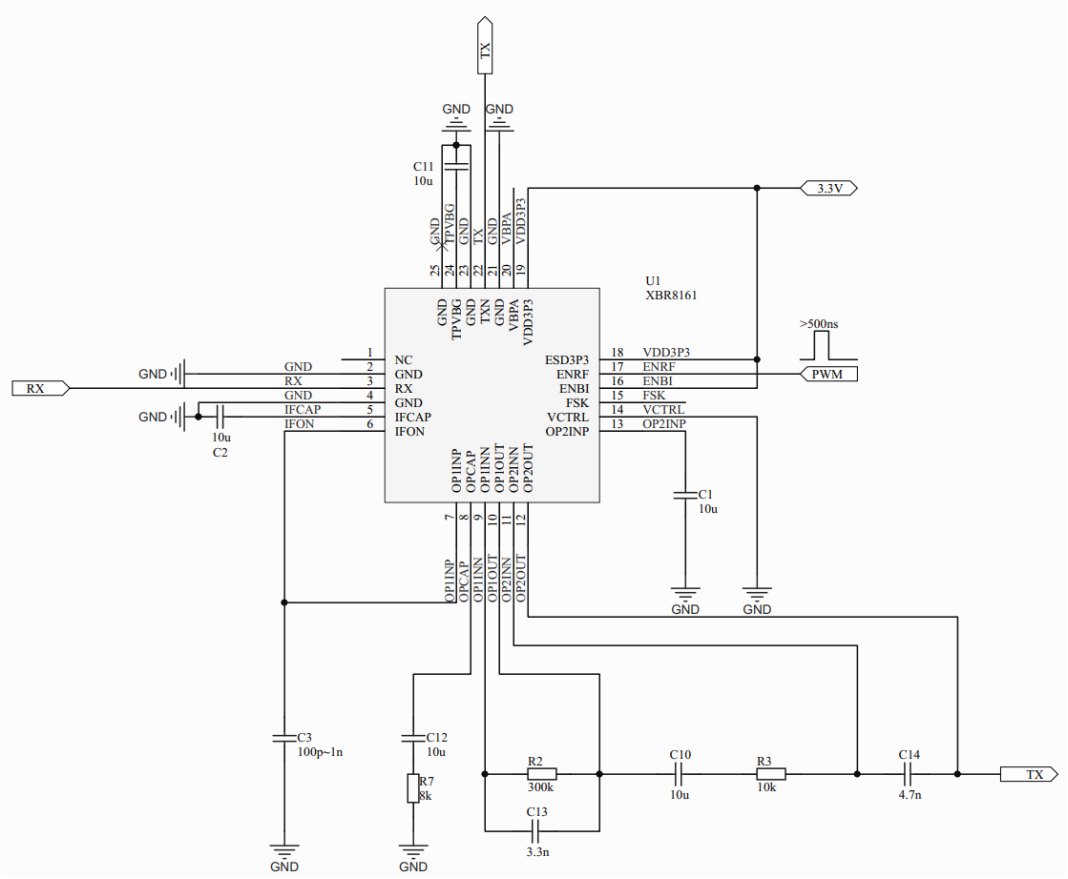
CW mode


ENOP
OP2INP
OP1INP
IFON
OP1INP
OP1OUT
OP2INP
OP2OUT
ENRF
OP1INN
OP1INN
OP2INN
OPCAP
OP1OUT
OP2INN
OP2OUT

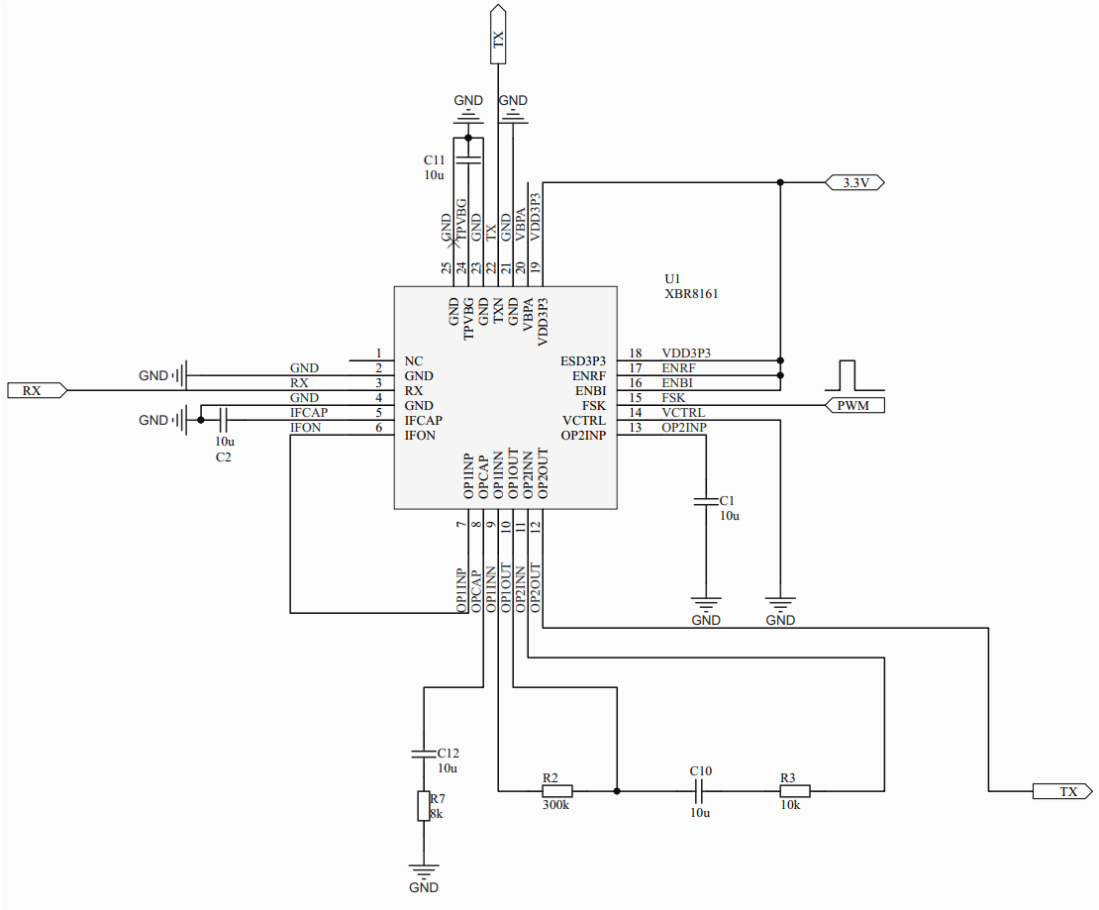

TX
GND
GND
C11
10u
U1
XBR8161
RX
GND
C2
10u
NC
GND
RX
GND
IFCAP
IFON
ESD3P3
ENRF
ENBI
FSK
VCTRL
OP2INP
VDD3P3
ENRF
ENBI
FSK
VCTRL
OP2INP
3.3V
C1
10u
C12
10u
R7
8k
R2
300k
C13
3.3n
C10
10u
R3
10k
C14
4.7n
TX

Pulse mode


ENOP
OP2INP
OP1INP
IFON
OP1INP
OP1OUT
OP2INP
OP2OUT
ENRF
OP1INN
OP1INN
OP2INN
OPCAP
OP1OUT
OP2INN
OP2OUT


TX
GND
GND
C11
10u
3.3V
U1
XBR8161
>500ns
PWM
RX
GND
GND
10u
C2
NC
GND
RX
GND
IFCAP
IFON
ESD3P3
ENRF
ENBI
FSK
VCTRL
OP2INP
VDD3P3
C1
10u
C3
100p~1n
C12
10u
R7
8k
R2
300k
C13
3.3n
C10
10u
R3
10k
C14
4.7n
TX

FSK mode


TX
GND
GND
C11
10u
3.3V
U1
XBR8161
GND
TPVBG
GND
TXN
GND
VBPA
VDD3P3
RX
GND
C2
10u
NC
GND
RX
GND
IFCAP
IFON
ESD3P3
ENRF
ENBI
FSK
VCTRL
OP2INP
VDD3P3
ENRF
ENBI
FSK
VCTRL
OP2INP
PWM
C1
10u
OP1INP
OPCAP
OP1INN
OP1OUT
OP2INN
OP2OUT
C12
10u
R7
8k
R2
300k
C10
10u
R3
10k
TX

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