

UNIVERSAL ISM BAND FSK TRANSCEIVER MODULE

RCS-S09U

General Introduction

RCS-S09U is a low cost ISM band transceiver module implemented with unique PLL. It works signal ranges from 433/868/915MHZ bands, comply with FCC, ETSI regulation. The SPI interface is used to communicate with microcontroller for parameter setting.

Features:

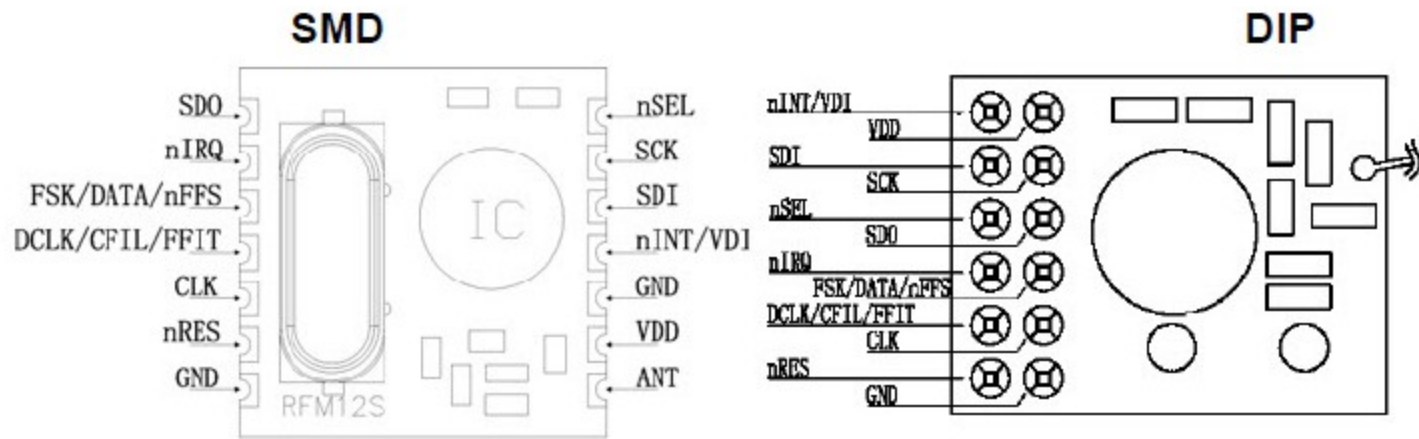
- Low costing, high performance and price ratio
- Tuning free during production
- PLL and zero IF technology
- Fast PLL lock time
- High resolution PLL with 2.5 KHz step
- High data rate (up to 115.2 kbps with internal demodulator, with external RC filter highest data rate is 256 kbps)
- Differential antenna input/output
- Automatic antenna tuning
- Programmable TX frequency deviation (from 15 to 240 KHz)
- Programmable receiver bandwidth (from 67 to 400 kHz)
- Analog and digital signal strength indicator (ARSSI/DRSSI)
- Automatic frequency control (AFC)
- Data quality detection (DQD)
- Internal data filtering and clock recovery
- RX synchron pattern recognition
- SPI compatible serial control interface
- Clock and reset signal output for external MCU use
- 16 bit RX Data FIFO
- Two 8 bit TX data registers
- Standard 10 MHz crystal reference
- Wakeup timer
- 2.2V – 3.8V power supply
- Low power consumption
- Standby current less than 0.3uA
- Supports very short packets (down to 3 bytes)



Typical Application:

- Remote control
- Wireless data collection
- Toys
- Remote sensor
- Home security system
- Tire pressure monitoring system

Pin Definition:



definition	Type	Function
nINT/VDI	DI/ DO	Interrupt input (active low)/Valid data indicator
VDD	S	Positive power supply
SDI	DI	SPI data input
SCK	DI	SPI clock input
nSEL	DI	Chip select (active low)
SDO	DO	Serial data output with bus hold
nIRQ	DO	Interrupts request output (active low)
FSK/DATA/nFFS	DI/DO/DI	Transmit FSK data input/ Received data output (FIFO not used)/ FIFO select
DCLK/CFIL/FFIT	DO/AIO/DO	Clock output (no FIFO)/ external filter capacitor(analog mode)/ FIFO interrupts(active high)when FIFO level set to 1, FIFO empty interruption can be achieved
CLK	DO	Clock output for external microcontroller
nRES	DIO	Reset output (active low)
GND	S	Power ground

Electrical Parameter:

Maximum (not at working mode)

symbol	parameter	minimum	maximum	Unit
V _{dd}	Positive power supply	-0.5	6.0	V
V _{in}	All pin input level	-0.5	V _{dd} +0.5	V
I _{in}	Input current except power	-25	25	mA
ESD	Human body model		1000	V
T _{st}	Storage temperature	-55	125	°C
T _{ld}	Soldering temperature(10s)		260	°C

Recommended working range

symbol	parameter	minimum	maximum	Unit
V _{dd}	Positive power supply	2.2	3.8	V
T _{op}	Working temperature	-40	85	°C

Field testing range

Band	Test condition	Distance
433MHz band	Receiver bandwidth =67KHz, data rate=1.2kbps, transmitter frequency deviation =45KHZ In free open area	>200M
868MHz band	Receiver bandwidth=67KHz,data rate =1.2kbps,Transmitter frequency deviation =45KHZ in free open area	>200M
915MHz band	Receiver bandwidth=67KHz,data rate =1.2kbps,Transmitter frequency deviation =45KHZ in free open area	>200M

DC characteristic

symbol	parameter	Remark	minimum	typical	maximum	Unit
I _{dd_TX_0}	Supply current (TX mode, P _{out} = 0dBm)	315,433MHz band		15	17	mA
		868MHz band		16	18	
		915MHz band		17	19	
I _{dd_TX_PMAX}	Supply current (TX mode, P _{out} = P _{max})	315,433MHz band		22	24	mA
		868MHz band		23	25	
		915MHz band		24	26	
I _{dd_RX}	Supply current (RX mode)	315,433MHz band		11	13	mA
		868MHz band		12	14	
		915MHz band		13	15	
I _x	Idle current	Crystal oscillator on		0.62	1.2	mA
I _{pd}	Sleep mode current	All blocks off		0.3		uA
I _{lb}	Low battery detection			0.5		uA
V _{lb}	Low battery detect threshold	0.1V per step	2.2		3.7	V
V _{lba}	Low battery detection accuracy		0		5	%
V _{il}	Low level input				0.3*V _{dd}	V
V _{ih}	High level input		0.7*V _{dd}			V
I _{il}	Leakage current	V _{il} =0V	-1		1	uA
I _{ih}	Leakage current	V _{ih} =V _{dd} , V _{dd} =5.4V	-1		1	uA
V _{ol}	Low level output	I _{ol} =2mA			0.4	V
V _{oh}	High level output	I _{oh} =-2mA	V _{dd} -0.4			V

AC characteristic

symbol	parameter	remark	min	typical	max	Unit
f_{ref}	PLL frequency		9	10	11	MHz
f_{LO}	frequency (10MHz crystal used)	433 MHz band, 2.5KHz step 868 MHz band, 5KHz step 915 MHz band, 7.5KHz step	430.24 860.48 900.72		439.75 879.51 929.27	MHz
f_{LO}	frequency (9MHz crystal used)	433 MHz band, 2.5KHz step 868 MHz band, 5KHz step 915 MHz band, 7.5KHz step	387.22 774.43 810.65		395.76 791.56 836.34	MHz
f_{LO}	frequency (11MHz crystal used)	433 MHz band, 2.5KHz step 868 MHz band, 5KHz step 915 MHz band, 7.5KHz step	473.26 946.53 990.79		483.73 967.46 1022.2	MHz
BW	Receiver bandwidth	mode 0 mode 1 mode 2 mode 3 mode 4 mode 5	60 120 180 240 300 360	67 134 200 270 350 400	75 150 225 300 375 450	KHz
t_{lock}	PLL lock time	After 10MHz step hopping, frequency error <10 kHz		30		us
tst, P	PLL startup time	With a running crystal oscillator		200	300	us
BR	Data rate	With internal digital demodulator	0.6		115.2	kbps
BR _A	Data rate	With external RC filter			256	kbps
P_{min}	sensitivity	BER 10 ⁻³ , BW=134KHz, BR=1.2kbps, 433MHz band BER 10 ⁻³ , BW=134KHz, BR=1.2kbps, 868MHz band BER 10 ⁻³ , BW=134KHz, BR=1.2kbps, 915MHz band		-109 -105 -105	-100 -100 -100	dBm
AFC _{range}	AFC working range	df_{FSK} : FSK deviation in the received signal		0.8* df_{FSK}		
RS _A	RSSI accuracy			±5		dB
RS _R	RSSI range			46		dB
C _{ARSSI}	ARSSI filter			1		nF
RS _{STEP}	RSSI programmable step			6		dB
RS _{RESP}	DRSSI response time	RSSI output high after valid , C _{ARSSI} =5nF		500		us

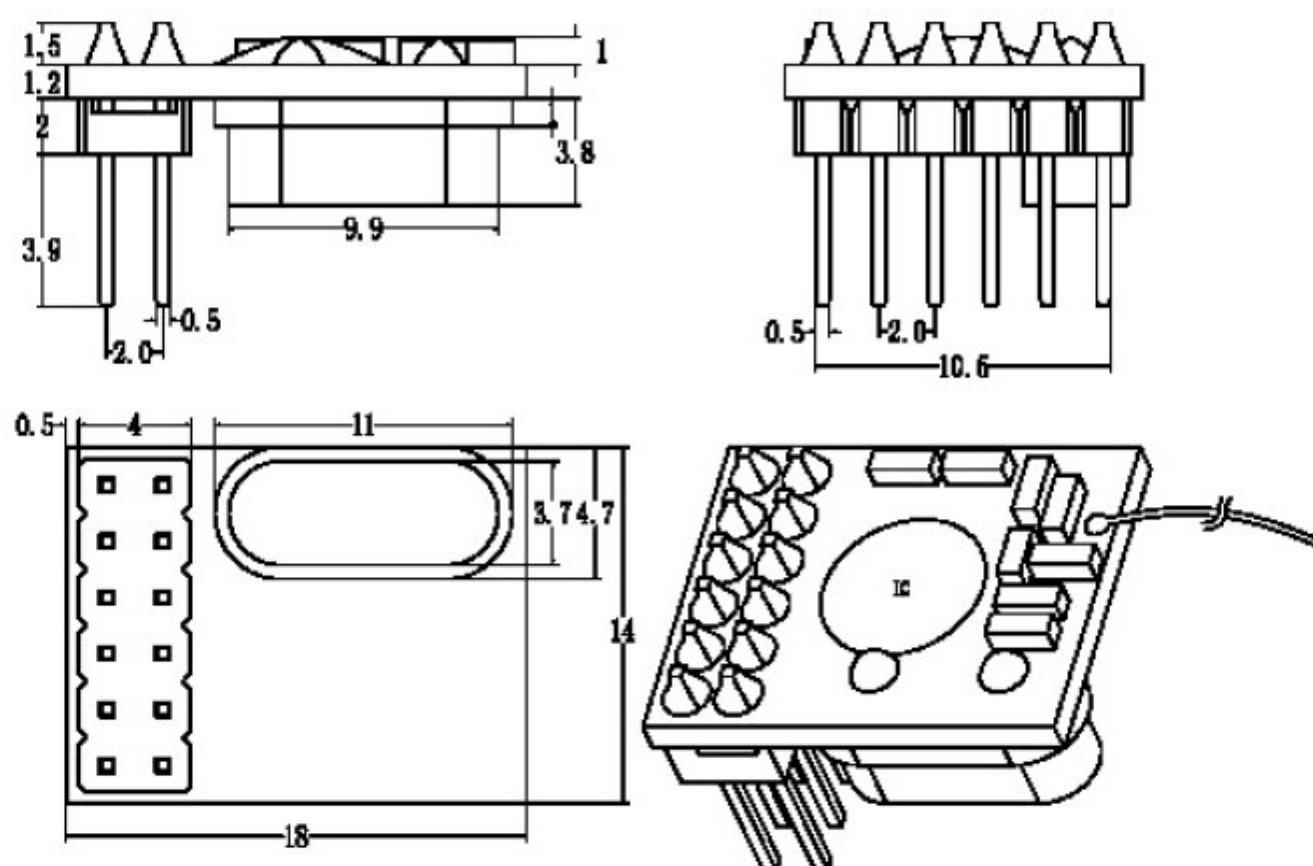
AC characteristic(Transmitter)

symbol	parameter	remark	min	typical	max	Unit
P_{max}	Max. available output power	433MHz band	3	5		dBm
		868MHz band	2	4		
		915MHz band	2	4		
P_{out}	Typical output power	Selectable in 3 dB steps	$P_{max}-21$		P_{max}	dbm
C_o	Output capacitance (set by the automatic antenna tuning circuit)	In low bands	2	2.6	3.2	pf
		In high bands	2.1	2.7	3.3	
Q_o	Quality factor of the output capacitance	In low bands	13	15	17	
		In high bands	8	10	12	
L_{out}	Output phase noise	100 kHz from carrier			-80	dbc/HZ
		1 MHz from carrier			-103	
BR_{TX}	FSK bit rate	Via internal TX data register			172	kbps
BRA_{TX}	FSK bit rate	TX data connected to the FSK input			256	kbps
df_{fsk}	FSK frequency deviation	Programmable in 15 kHz steps	15		240	kHZ

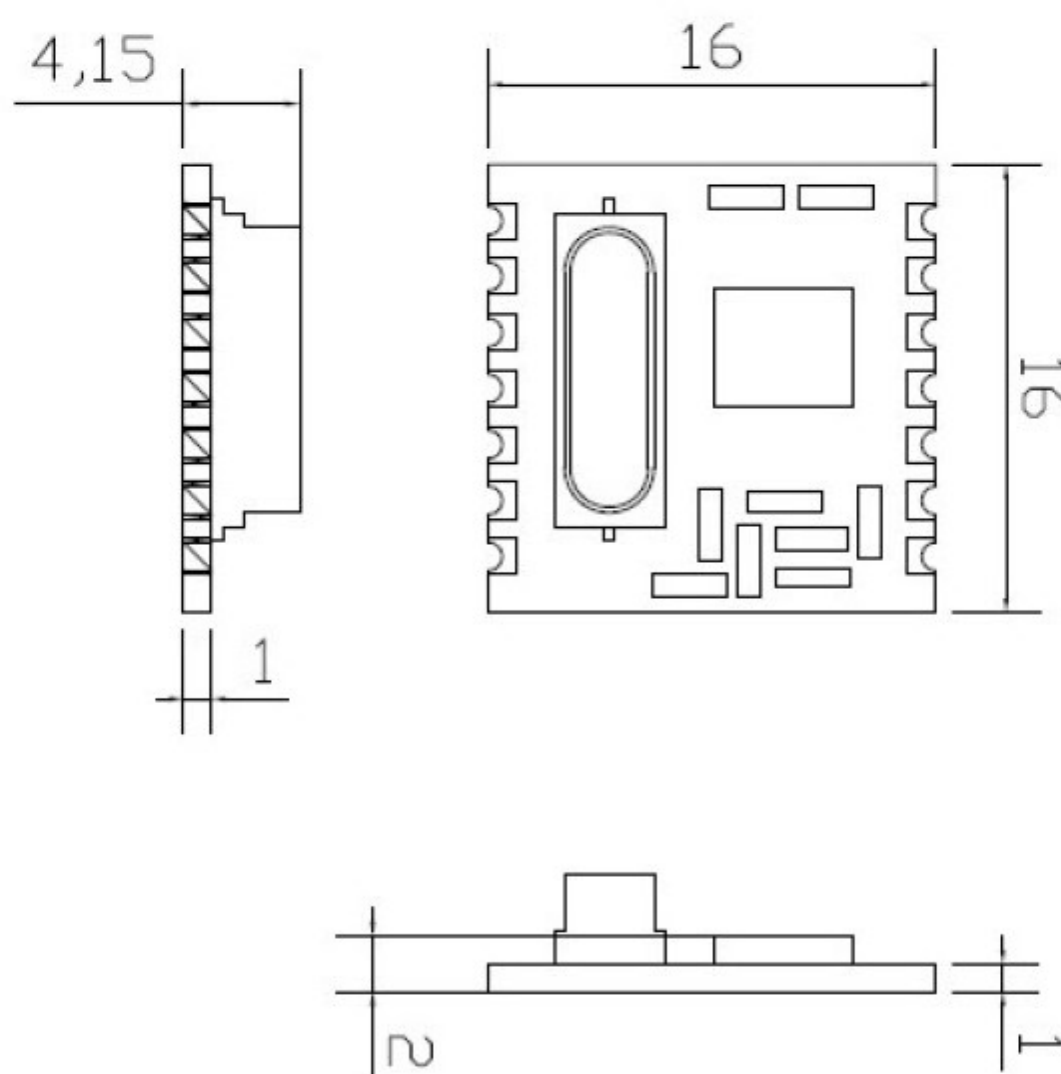
AC characteristic(Turn-on/Turnaround timings)

symbol	parameter	remark	min	typical	max	Unit
T_{st}	Crystal oscillator startup time	Crystal ESR < 100		1	5	ms
$T_{tx_XTAL_ON}$	Transmitter turn-on time	Synthesizer off, crystal oscillator on with 10 MHz step		250		us
$T_{rx_XTAL_ON}$	Receiver turn-on time	Synthesizer off, crystal oscillator on with 10 MHz step		250		us
$T_{tx_rx_SYNT_ON}$	Transmitter – Receiver turnover time	Synthesizer and crystal oscillator on during TX/RX change with 10 MHz step		150		us
$T_{rx_tx_SYNT_ON}$	Receiver – Transmitter turnover time	Synthesizer and crystal oscillator on during RX/TX change with 10 MHz step		150		us
C_{xl}	Crystal load capacitance	Programmable in 0.5 pF steps, tolerance+/- 10%	8.5		16	pf
t_{POR}	Internal POR timeout	After V_{dd} has reached 90% of final value			100	ms
t_{PBt}	Wake-up timer clock period	Calibrated every 30 seconds	0.96		1.05	ms
$C_{in, D}$	Digital input apacitance				2	pf
$t_{r, f}$	Digital output rise/fall time	15pF pure capacitive load			10	ns

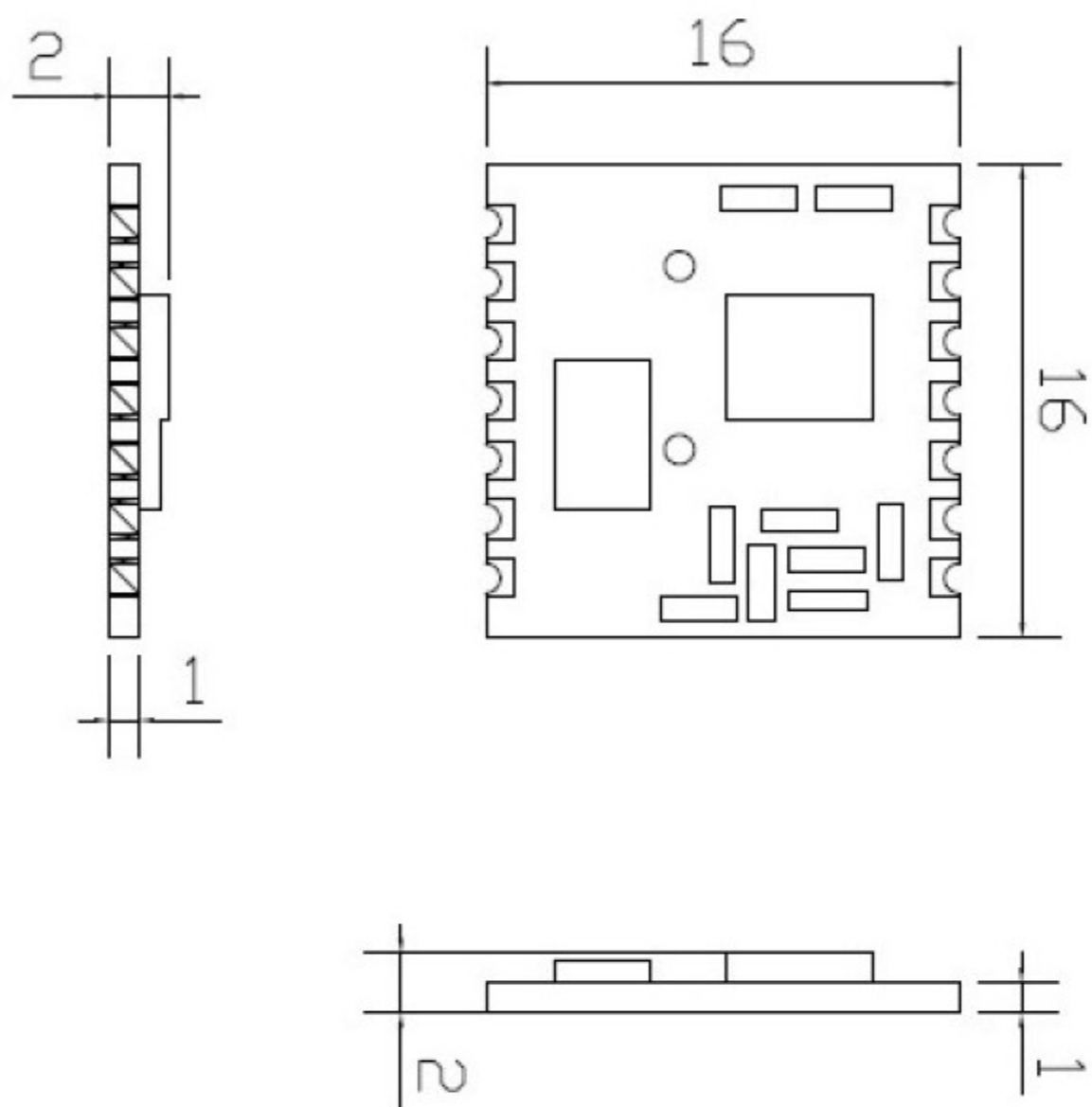
DIP PACKAGE (D)



SMD PACKAGE (S1P)



SMD PACKAGE (S2P)



DIP PACKAGE (DP)

