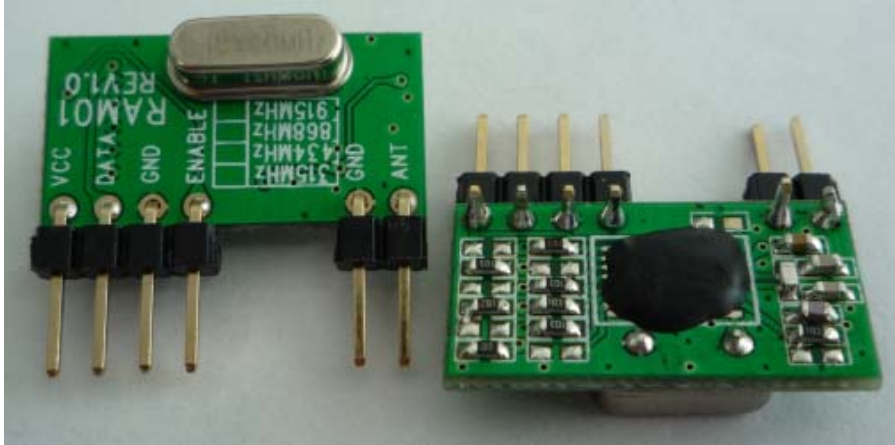


RAM01 ISM Band OOK Receiver Module



DESCRIPTION

HopeRF's RAM01 is a highly-integrated, low power, multi-channel OOK receiver module designed for use in applications requiring FCC or ETSI conformance for unlicensed use in the 433, 868 and 915 MHz bands. Used in conjunction with HopeRF's transmitters, the RAM01 is a flexible, low cost, and highly integrated solution that does not require production alignments. All required RF functions are integrated.

The RAM01 has a completely integrated PLL for easy RF design, and its rapid settling time allows for fast frequency hopping, bypassing multipath fading, and interference to achieve robust wireless links. The PLL's high resolution allows the usage of multiple channels in any of the bands. The baseband bandwidth (BW) is programmable to accommodate various deviations, data rate. The module employs the low-IF approach; therefore, no external components are needed in a typical application. The RAM01 is a complete analog RF and baseband receiver, including a multi-band PLL synthesizer with an LNA, down converter mixers, baseband filters and amplifiers, and demodulator.

The module support Stand alone mode, that means it can receive data without MCU configuration. This mode mainly simplify the customer application complexity and can be replace traditional super- regenerative receiver and super-heterodyne receiver.
but frequency can be selected.

for more details about RAM01, please see RA01's datasheet from <http://www.hoperf.com>

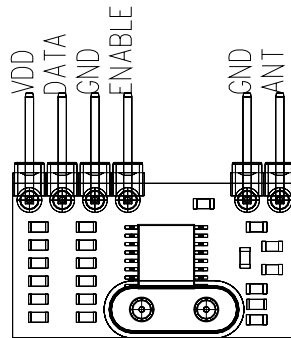
FEATURES

- Fully integrated receiver module
- No alignment required in production
- Fast settling, programmable, high-resolution PLL
- Fast frequency hopping capability
- Programmable bit rate (up to 40 kbps)
- 50 ohm single-ended antenna input
- Programmable baseband bandwidth (85 to 340 kHz)
- Data filtering and clock recovery
- RX pattern recognition
- SPI compatible serial control interface
- Readable registers
- Clock and reset signals for microcontroller
- 64 bit RX data FIFO
- Accurate Wake-up timer
- Low battery detector
- 2.2 to 3.8 V supply voltage
- Low power consumption
- Low standby current (typ. 0.2 μ A)

TYPICAL APPLICATIONS

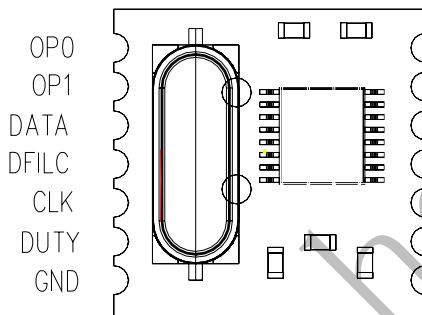
- Remote control
- Home security and alarm
- Wireless keyboard/mouse and other PC peripherals
- Toy control
- Remote keyless entry
- Tire pressure monitoring
- Telemetry
- Personal/patient data logging
- Remote automatic meter reading

Over view and Pin out



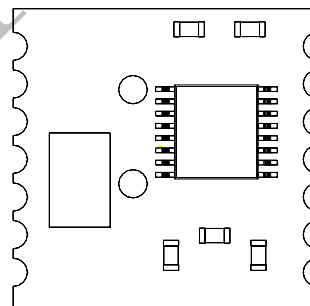
RAM01-D

Pin number	Name	Type	Function
1	VDD	P	Power supply
2	DATA	DO	Demodulated data output
3, 5	GND	P	Ground
4	ENABLE	DI	Receiving control(active high)
6	ANT	AI	50 ohm antenna input



RAM01-S1

FR2
FR1
FR0
GND
GND
VDD
ANT



RAM01-S2

FR2
FR1
FR0
GND
GND
VDD
ANT

Pin number	Name	Type	Function
1	OP0	DI	Operation frequency band selection pins
2	OP1	DI	
3	DATA	DO	Demodulated data output
4	DFILC	AO	Data filter capacitor connection
5	CLK	DO	Divide clock output
6	DUTY	DI	Duty-cycle mode receiving enable.
7, 10, 11	GND	P	Ground
8	ANT	AI	50 ohm antenna input
9	VDD	P	Power supply
12	FR0	DI	Operation frequency selection pins
13	FR1	DI	
14	FR2	DI	

GENERAL DEVICE SPECIFICATIONS

All voltages are referenced to V_{ss} , the potential on the ground reference pin VSS.

Absolute Maximum Ratings (non-operating)

Symbol	Parameter	Min	Max	Units
V_{dd}	Positive supply voltage	-0.5	6.0	V
V_{in}	Voltage on any pad	-0.5	$V_{dd}+0.5$	V
I_{in}	Input current into any pad except VDD and VSS	25	25	mA
ESD	Electrostatic discharge with human body model		1000	V
T_{st}	Storage temperature	55	125	°C
T_{ld}	Lead temperature (soldering, max 10 s)		260	°C

Recommended Operating Range

Symbol	Parameter	Min	Max	Units
V_{dd}	Positive supply voltage	2.2	3.8	V
T_{op}	Ambient operating temperature	40	+85	°C

ELECTRICAL SPECIFICATION

(Min/max values are valid over the whole recommended operating range, typical conditions: $T_{op} = 27\text{ °C}$; $V_{dd} = V_{oc} = 2.7\text{ V}$)

DC Characteristics

Symbol	Parameter	Conditions/Notes	Min	Typ	Max	Units
I_{dd}	Supply current	all bands		9.6	12	mA
I_{pd}	Standby current	all blocks disabled		0.2		μA
I_{lb}	Low battery voltage detector and wake-up timer current			4		μA
I_x	Idle current	crystal oscillator is ON		0.5		mA
V_{lb}	Low battery detection threshold	programmable in 0.1 V steps	2.0		3.5	V
V_{lba}	Low battery detection accuracy			± 2.5		%
V_{POR}	V_{dd} threshold required to generate a POR			1.5		V
$V_{POR,hys}$	POR hysteresis	larger glitches on the V_{dd} generate a POR even above the threshold V_{POR}		0.6		V
SR_{Vdd}	V_{dd} slew rate	for proper POR generation	0.1			V/ms
V_{il}	Digital input low level				$0.3 \cdot V_{dd}$	V
V_{ih}	Digital input high level		$0.7 \cdot V_{dd}$			V
I_{il}	Digital input current	$V_{il} = 0\text{ V}$	-1		1	μA
I_{ih}	Digital input current	$V_{ih} = V_{dd}$, $V_{dd} = 3.8\text{ V}$	-1		1	μA
V_{ol}	Digital output low level	$I_{ol} = 2\text{ mA}$			0.4	V
V_{oh}	Digital output high level	$I_{oh} = -2\text{ mA}$	$V_{dd}-0.4$			V

AC Characteristics

Symbol	Parameter	Conditions/Notes	Min	Typ	Max	Units
f_{LO}	Receiver frequency	433 MHz band, 10 kHz resolution 868 MHz band, 20 kHz resolution 915 MHz band, 20 kHz resolution	400.96 801.92 881.92		439.03 878.06 930.00	MHz
BW	Baseband filter bandwidth	mode 1 mode 2 mode 3 mode 4 mode 5	75 125 180 235 305	85 140 200 260 340	95 155 220 295 375	kHz
BR_{NRZ}	OOK bit rate	with internal digital filters, NRZ data	4.8		40	kbps
BR_M	OOK bit rate	with internal digital filters, manchester coded data	2.4		20	kbps
P_{min}	Receiver sensitivity	BER $3 \cdot 10^{-3}$, BW = 85 kHz, PN9,		-110		dBm

		BR = 9.6 kbps, Average signal power				
IIP3 _{outh}	Input IP3	out of band interferers f-f _{LO} > 5MHz		-18		dBm
CCR	Co-channel rejection	BER = 10 ⁻² with continuous wave interferer in the channel		-4		dB
BR _{100kHz}	Blocking ratio	BER = 10 ⁻² with continuous wave interferer, BW = 85 kHz, interferer offset 100 kHz		45		dB
BR _{1MHz}	Blocking ratio	same as above, interferer offset 1 MHz		50		dB
BR _{10MHz}	Blocking ratio	same as above, interferer offset 10 MHz		67		dB
P _{maxh}	Maximum input power	LNA: high setting min 99.99% OOK modulation			-15	dBm
P _{maxa}	Maximum input power	LNA: automatic or low gain setting min 99.9% OOK modulation			0	dBm
R _{in}	RF input impedance real part (differential) (Note 1)			250		Ohm
C _{in}	RF input capacitance			460		fF
RS _a	RSSI accuracy			+/-7		dB
RS _r	RSSI range	With automatic 32 dB LNA gain switch		90		dB
RS _{resp}	DRSSI response time	Until the RSSI output goes high after the input signal exceeds the preprogrammed limit, C _{ARRSI} = 5nF		500		µs
f _{ref}	PLL reference frequency	(Note 2)		10		MHz
f _{resLB}	PLL frequency resolution	434 MHz Band		10		kHz
f _{resHB}	PLL frequency resolution	868 MHz or 915 MHz Band		20		kHz
T _{settl}	PLL settling time	Frequency error < 1 kHz after 1 MHz step		30		µs
t _{st1, P}	PLL startup time	Initial calibration after power-up with running crystal oscillator			500	µs
P _{spur}	Spurious emission			-60		dBm
C _{xl}	Crystal load capacitance, see crystal selection guide	Programmable in 0.5 pF steps, tolerance +/- 10%	8.5		16	pF
t _{POR}	Internal POR pulse width (Note 3)	After V _{DD} has reached 90% of final value		50	100	ms
t _{sx}	Crystal oscillator startup time	Crystal ESR < 30 Ω			5	ms
t _{Pbt}	Wake-up timer clock period	Calibrated every 30 seconds (Note 4)	0.995	1	1.005	ms
t _{wake-up}	Programmable wake-up time		1		8.4*10 ⁶	ms
C _{in, D}	Digital input capacitance				2	pF
t _{r, f}	Digital output rise/fall time	15 pF pure capacitive load			10	ns
t _{r, f, ckout}	Clock output rise/fall time	10 pF pure capacitive load			15	ns
f _{ckout, slow}	Slow clock frequency	Tolerance +/- 1 kHz		32		kHz

Note 1: See matching circuit parameters and antenna design guide for information, and Application Notes available from <http://www.hoperf.com>.

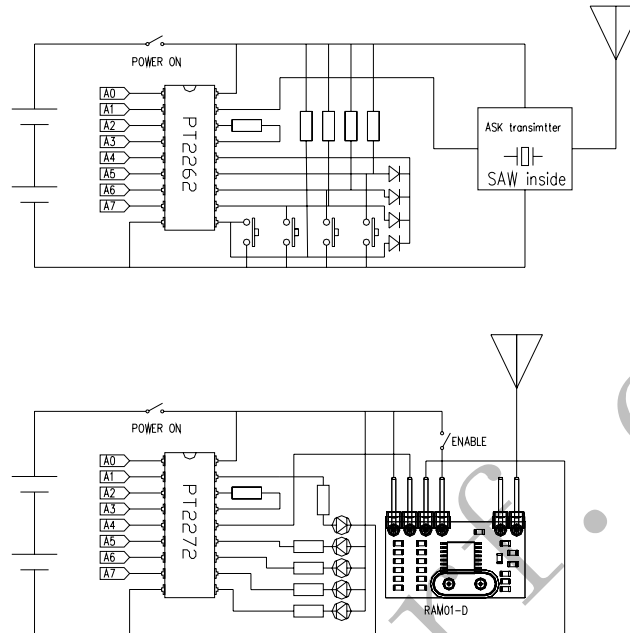
Note 2: Using other than a 10 MHz crystal is not recommended because the crystal referred timing and frequency parameters will change accordingly.

Note 3: During this period, commands are not accepted by the chip.

Note 4: Autocalibration can be turned off.

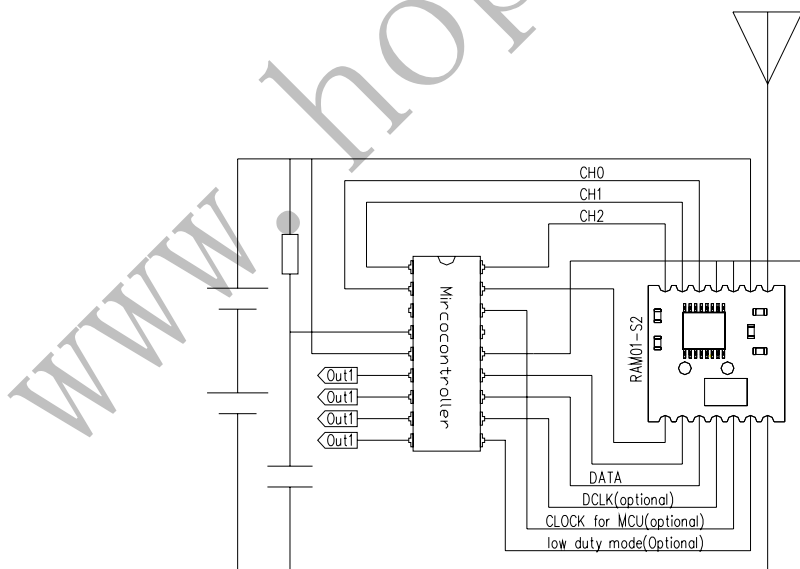
Application example

a. 4 key single channel remote controller



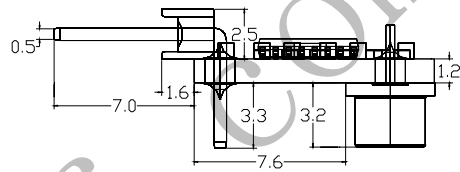
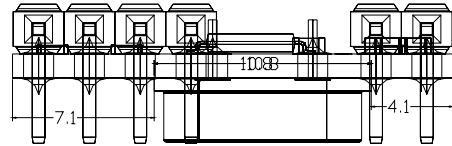
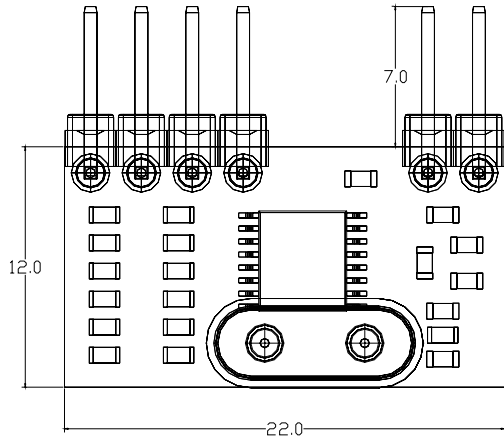
Note: This type of RAM01 is use to replace traditional ASK receiver, no any modification of customer software and hardware. It is a pin-to-pin compliance solution.

b. 8 channel remote controller

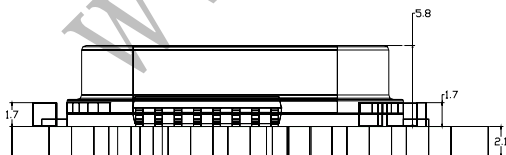
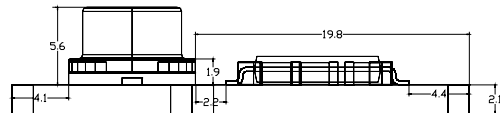
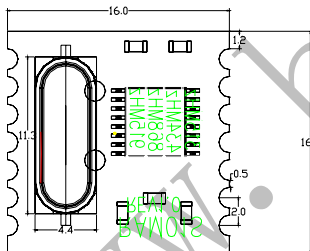


Note: This type of RAM01 is designed for more flexible applications witch requiring receiving data from multi-transmitters, these transmitters send data at different frequency channels. Frequency channel selection can be done by MCU software or hardware jumpers.

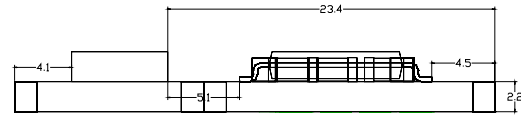
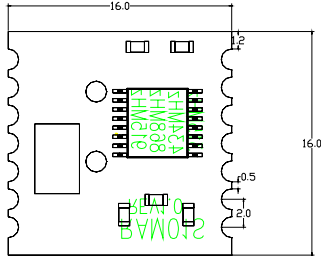
Mechanical information



RAM01-D



RAM01-S1



RAM01-S2

Ordering information

Part number	Package type	Frequency band	Note
RAM01-433D	DIP	433MHz	Operation frequency channel should be clarified when ordering
RAM01-868D		868MHz	
RAM01-915D		915MHz	
RAM01-433S1	SMD	433MHz	Operation frequency channel can be selected by customer
RAM01-868S1		868MHz	
RAM01-915S1		915MHz	
RAM01-433S2	Thin SMD	433MHz	
RAM01-868S2		868MHz	
RAM01-915S2		915MHz	

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