HT6P237A/HT6P247A
Learning RF Encoder

Features

- Operating voltage: 2.0V ~3.6V
- Average Operating Current:
  - 20mA @ V_{DD}=3.0V, 12dBm;
  - 30mA @ V_{DD}=3.0V, 16dBm
- Standby current: 1.0μA (Max.) @ V_{DD}=3V
- HT6P237A codes are fully compatible with HT6P20B
- Up to 4 data pins
- Providing 2 compound data trigger pins
- Up to 2^{24} address codes
- 8 bit time option via 2 pin selection
- Integrated complete UHF transmitter
- Frequency range 300MHz to 450MHz
- Supports ASK/OOK modulation
- 3 output power levels 12dBm/14dBm/16dBm via 1 pin selection
- Minimal external components
- 16-Pin NSOP package

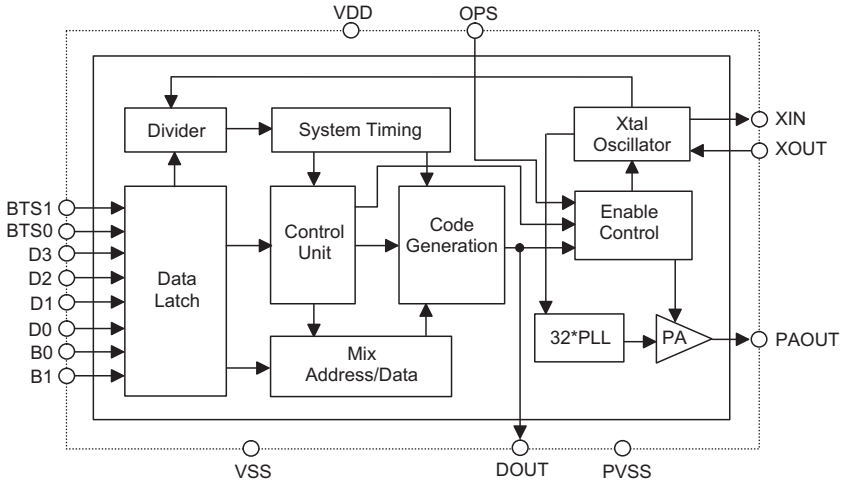
Applications

- Burglar alarm systems
- Smoke and fire alarm systems
- Car alarm systems
- Garage door remote controllers
- Home Security systems
- Other remote control systems

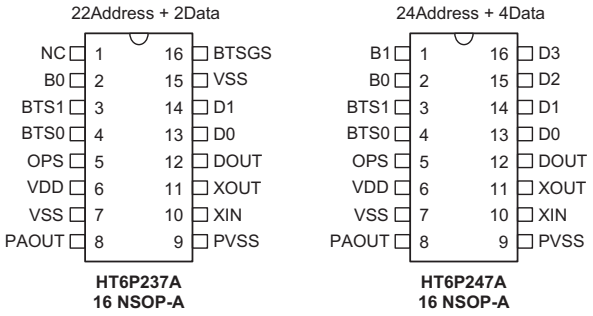
General Description

The HT6P2x7A devices form a series of data encoders which include fully integrated ASK transmitters for remote control system applications. These highly integrated devices are true "switch-in, antenna-out" monolithic devices. They encode 22 or 28 bits of information and then serially transmits the data out on their PAOUT pin upon receipt of transmission enable (Data pins: D0~D3 or B0~B1) signals. They encode address and data information into a coded waveform suitable for modulation and transmission using their integrated RF circuits. The devices offer high performance in two areas: power delivery and operating temperature. In terms of power, the devices are capable of delivering +16 dBm into a 50Ω load. This power level enables a small form factor transmitter such as a key fob transmitter to operate with a maximum distance. In terms of temperature, they can operate from -40˚C to 85˚C with very little frequency drift. They additionally offer exceptional ease of use and can easily pass FCC/ETSI regulations. One only needs a few additional components for harmonic filtering. The devices are used with ASK/OOK (Amplitude Shift Keying/On-Off Keyed) UHF receiver types from wide-band super-regenerative radios to narrow-band, high performance super-heterodyne receivers to form a complete remote system.

Block Diagram



Pin Assignment



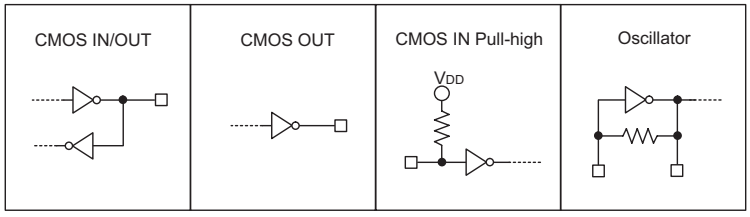
Selection Table

Part No.	V_{DD}	Addr. No.	Data No.	Compound Data No.	Trig.	Frequency Band	RF Type	Package
HT6P237A	2.0V~3.6V	22	2	2	Data Low	300MHz~450MHz	ASK TX	16NSOP
HT6P247A	2.0V~3.6V	24	4	2	Data Low	300MHz~450MHz	ASK TX	16NSOP

Pin Description

Pin No.	Pin Name	I/O	Internal Connection	Description
1~2	B1~B0	I	CMOS IN	Compound pin – D0~D3 for B0 and D1~D2 for B1 in HT6P247A Compound pin – D0~D1 for B0 in HT6P237A
3~4	BTS1~BTS0	I	CMOS IN	Bit Time Select Pins Set to V_{DD}, floating or ground to select 8 bit width types
5	OPS	I	CMOS IN	Output Power Select Pin. Set to V_{DD}, floating or ground to select one of 3 power output levels V_{DD}: 16dBm, Floating: 14dBm, Gnd: 12dBm
6	VDD	P	—	Positive power supply
7/15	VSS	P	—	Negative power supply, ground Pin 15 in the HT6P237A should be grounded
8	PAOUT	O	Power Amplify Output	L/C matching circuit
9	PVSS	P	—	RF negative power supply, ground
10	XIN	I	Oscillator	13.56MHz Crystal oscillator input for 433.92MHz RF
11	XOUT	O	Oscillator	13.56MHz Crystal oscillator output for 433.92MHz RF
12	DOUT	O	CMOS OUT	Encoder data out
13~16	D0~D3	I	CMOS IN	Data input and transmission enable; active low
16	BTSGS (HT6P237A only)	I	CMOS IN	Bit time group select 0: Bit time group 1 1: Bit time group 2 This pin must be either high or low and not allowed to float

Approximate Internal Connections



Absolute Maximum Ratings

Logic Supply Voltage ..... V_{SS}-0.3V to V_{SS}+3.6V
Logic Input Voltage ..... V_{SS}-0.3V to V_{DD}+0.3V
Logic Output Voltage ..... V_{SS}-0.3V to V_{DD}+0.3V
Storage Temperature ..... -55˚C to 150˚C
Operating Temperature ..... -40˚C to 85˚C
ESD HBM ..... > ±5KV
ESD MM ..... > ±400V

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

D.C. Characteristics

Ta=25°C

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
		V_{DD}	condition				
V_{DD}	Logic Supply Voltage	—	—	2.0	3	3.6	V
I_{SB}	Stand-by current	3V	No load. Input pins floating	—	—	1.0	μA
V_{IH}	"H" Input Voltage	—	—	0.8V_{DD}	—	—	V
V_{IL}	"L" Input Voltage	—	—	—	—	0.2V_{DD}	V
R_{PL}	Pull-high Resistance	3V	D0~D3, B0~B1	—	500	—	kΩ
I_{OH}	Hi-level output current	3V	V_{OH}=0.9V_{DD}; D_{OUT}	—	-7	—	mA
I_{OL}	Low-level output current	3V	V_{OL}=0.1V_{DD}; D_{OUT}	—	2	—	mA

R.F. Characteristics

Specifications apply for V_{DD}=3.0V, T_A=25°C, Freq 433MHz unless otherwise noted. RL 50Ω load (matched)

P	Parameter	Test Conditions			Min	Typ	Max	Units
		V_{DD}	Conditions					
I_1	Average Data Current* (Data is 50% duty cycle)	3V	@ 433MHz, POUT=+16dBm		—	21	—	mA
			@ 433MHz, POUT=+12dBm			12		
I_0	Data LOW current	3V	—		—	5	—	mA
RF and Crystal								
	Output power level	3V	OPS	0	—	12	—	dBm
				Floating	—	14	—	
				1	—	16	—	
	Extinction ratio for ASK 10Kbps	3V	—		—	76	—	dBc
	Output Blanking	3V	STDBY transition from Low to High		—	1800	—	μs
	ASK to RF Out Response Time	3V	Delta between ASK Input Transition from Low to High to RF Output Transition from Low to High		—	1	—	μs
	Harmonic output for 433.92 MHz	3V	@867.84MHz, 2nd harm		—	-50	—	dBc
			@1301.76MHz, 3rd harm			-51		
	Occupied Bandwidth	3V	@433.92MHz		—	<1000	—	kHz
	433.92 MHz Single Side Band Phase Noise	3V	@100kHz from Carrier		—	-70	—	dBc/Hz
			@1000kHz from Carrier			-75		
	XTLIN, XTLOUT	3V	Pin capacitance		—	15	—	pF

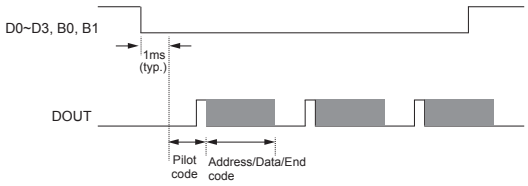
Note: It is recommended that V_{DD} power on stability time should be less than 500μs to allow the device to operate normally.

Functional Description

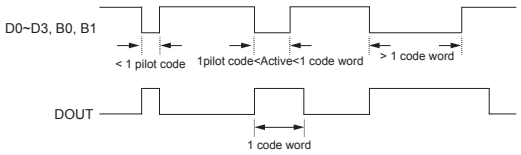
The devices encode both address and data information into an encoded waveform and output it on DOUT. This waveform is fed to the RF modulator for transmission purposes.

Normal Operation

The devices encode and transmits the address/data information to a decoder upon receipt of a trigger signal. The transmission function of the series are enabled by the data inputs, which are the active low pins D0~D3 and B0~B1. The following diagram shows the transmission timing of these devices.



The transmission sequence is Pilot, Address, Data, End code.



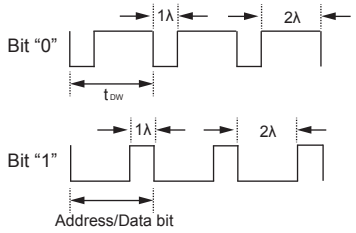
Transmission Timing Diagram

Code bits

A code bit is the basic component of the encoded waveform, and can be classified as either an address/data bit or a pilot-code which is a synchronous bit.

Address/Data bit waveform

An address/data bit can be designated as either a ”0” or “1” bit depending upon its waveform type. A one bit waveform consists of one pulse cycle, as shown in the following diagram.



Note: 1. A “0” consists of a “low” pulse for 1λ then a “high” pulse for 2λ.

2. A “1” consists of a “low” pulse for 2λ then a “high” pulse for 1λ.

One-Bit Data Width

There are 8 different one-bit data widths as shown in the following table. They are selected by the control pins BTS1 and BTS0. In the table “F” refers to a floating input level.

Symbol	Parameter	Pin condition		Group 1	Group2	Unit
t_{DW}	One bit data width (t_{DW}) @433.92MHz	BTS1/BTS0	0/0	1.1	0.4	ms
			0/F	1.2	0.5	
			0/1	1.3	0.6	
			F/0	1.4	0.7	
			F/F	1.5	0.8	
			F/1	1.6	0.9	
			1/0	1.76	2.0	
			1/ F	1.9	2.1	
			1/1	NC	NC	—

Note: 1. Group2 is only available for the HT6P237A.

2. The BTS0 and BTS1 pins can be set either high, low or floating.

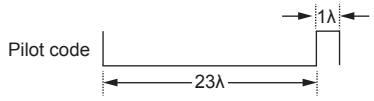
3. The BTS0 and BTS1 pins should never be both high as this may cause erroneous operation.

4. If there is an overlap bit time range then select the closest typical bit time. For example if the desired bit time is 1.46ms, choosing the 1.5ms setting is best.

5. For other frequencies, the bit time will be the ratio of 433.92/freq. For example, for a frequency of 315MHz, the bit time 1.1ms will be 1.1×433.92/315=1.51ms.

Synchronous bit Waveform

The synchronous bit waveform is 8-bits long and exhibits a low pulse for 23λ followed by a high pulse for 1λ as shown in the following below:



Code Word

A group of code bits is called a code word. A code word consists of a Pilot-code (Synchronous bit) followed by the address/data bits and end-code as shown in the following diagram.

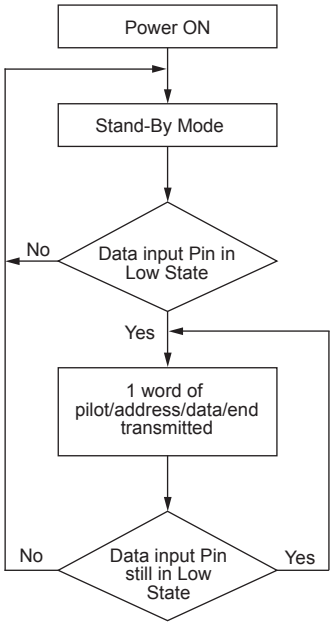
- **HT6P237A**

Pilot-code	A0~A21	D1~D0	“0101”

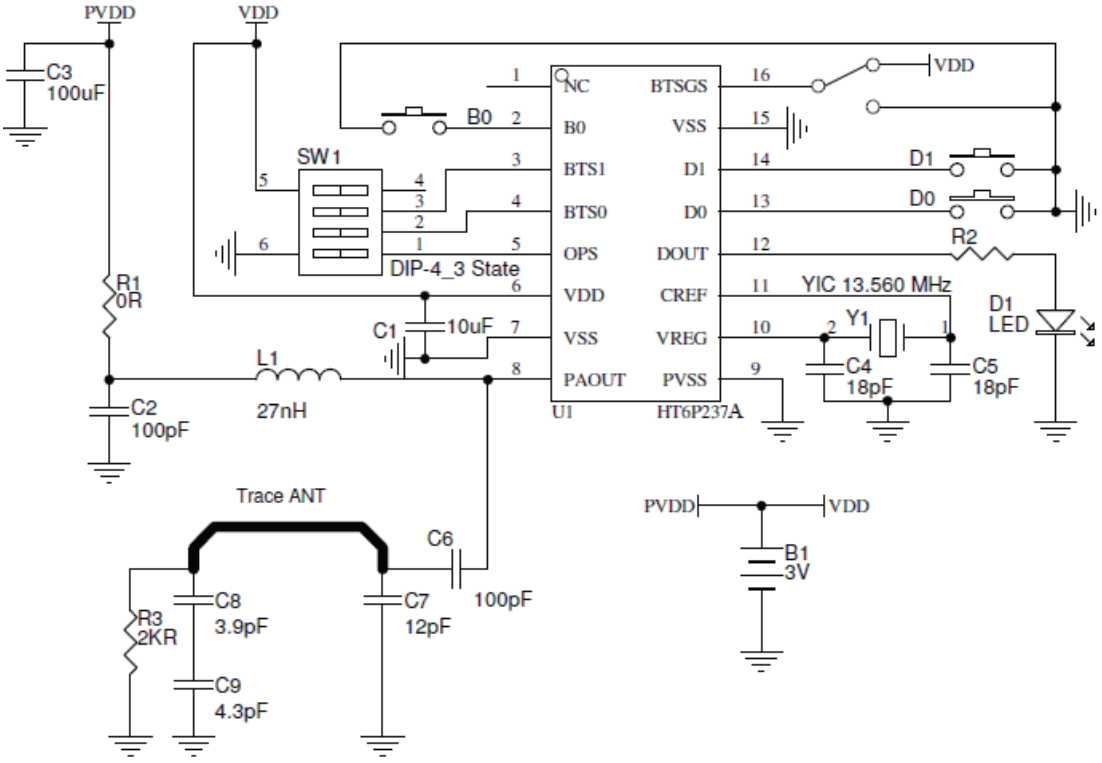
- **HT6P247A**

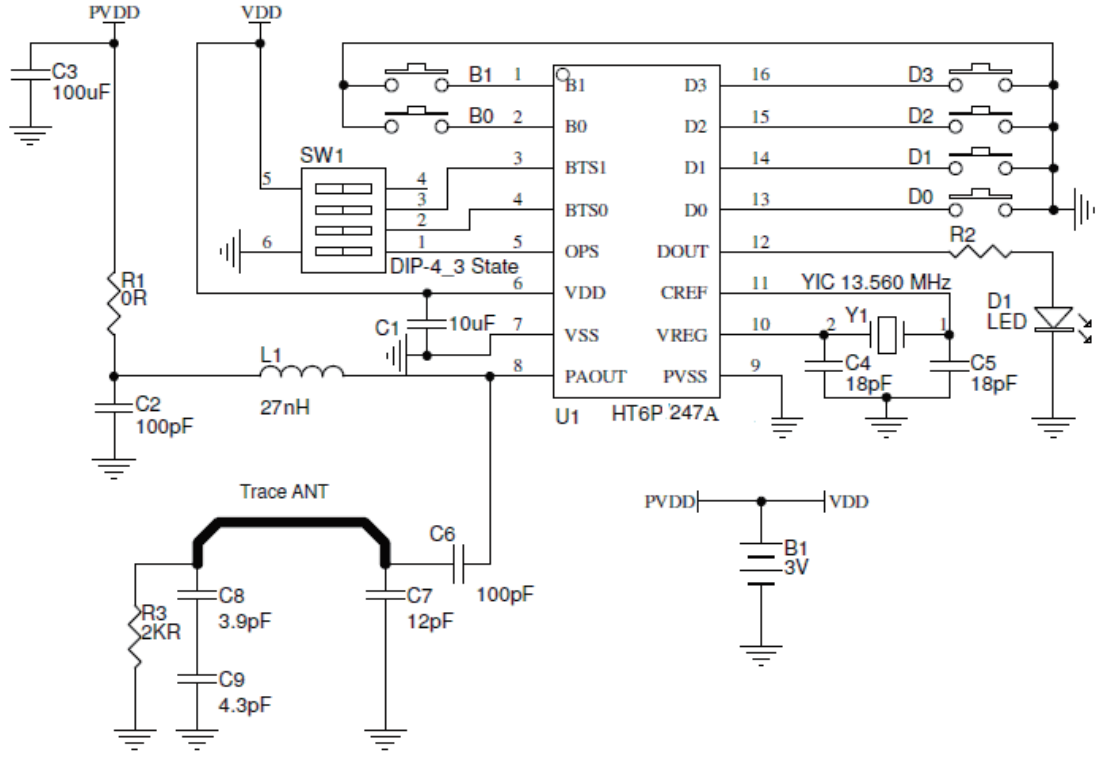
Pilot-code	A0~A23	D3~D0	“0101”

Operation Flowchart



Application Circuit





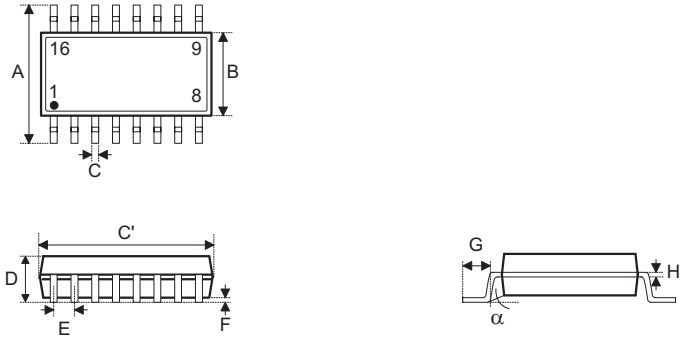
Package Information

Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the Holtek website for the latest version of the Package/Carton Information.

Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

- Package Information (include Outline Dimensions, Product Tape and Reel Specifications)
- The Operation Instruction of Packing Materials
- Carton information

16-pin NSOP (150mil) Outline Dimensions



Symbol	Dimensions in inch		
	Min.	Nom.	Max.
A	—	0.236 BSC	—
B	—	0.154 BSC	—
C	0.012	—	0.020
C'	—	0.390 BSC	—
D	—	—	0.069
E	—	0.050 BSC	—
F	0.004	—	0.010
G	0.016	—	0.050
H	0.004	—	0.010
α	0°	—	8°

Symbol	Dimensions in mm		
	Min.	Nom.	Max.
A	—	6.000 BSC	—
B	—	3.900 BSC	—
C	0.31	—	0.51
C'	—	9.900 BSC	—
D	—	—	1.75
E	—	1.270 BSC	—
F	0.10	—	0.25
G	0.40	—	1.27
H	0.10	—	0.25
α	0°	—	8°

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