HT6P427A/HT6P437A
Learning RF Encoder with Crystal SOC

Features

- Operating voltage: 2.0V ~3.6V
- Average Operation Current
  - 13mA @ V_{DD}=3.0V, 12dBm, 315MHz
  - 22mA @ V_{DD}=3.0V, 16dBm, 315MHz
- Standby current: 1.0μA (Max.) @ V_{DD}=3V
- Up to 4 data pins
- Provides 2 compound Data trigger pins
- Up to 2^{24} address codes
- 8 bit time 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
- High noise immunity
- 16-Pin NSOP package

Applications

- Burglar alarm systems
- Smoke and fire alarm systems
- Personal alarm systems
- Car/Garage door controllers
- Home/office/car security systems
- Other remote control systems

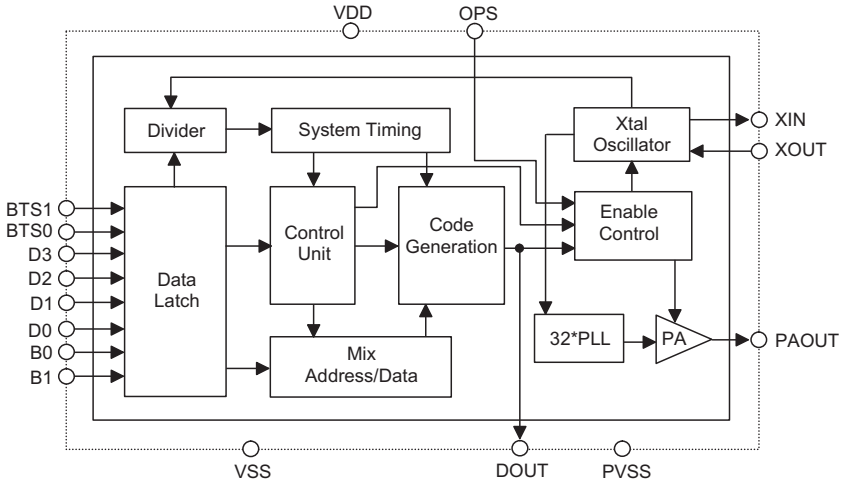
General Description

The HT6P4x7A devices form a series of data encoders which include fully integrated ASK transmitters for remote control system applications. These highly integrated chips are true “switch-in, antenna-out” monolithic devices. They encode 24 or 28 bits of information and then serially transmit the data out on their PAOUT pin upon receipt of a transmission enable (Data pins: D0~D3 or B0~B1) signal. 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 level and operating temperature. In terms of power level, the devices are capable of delivering +16dBm 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 -40ºC to 85ºC with very little frequency drift. They additionally offer exceptional ease of use. One only needs a reference frequency generated from an external crystal to create a complete versatile transmitter. 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.

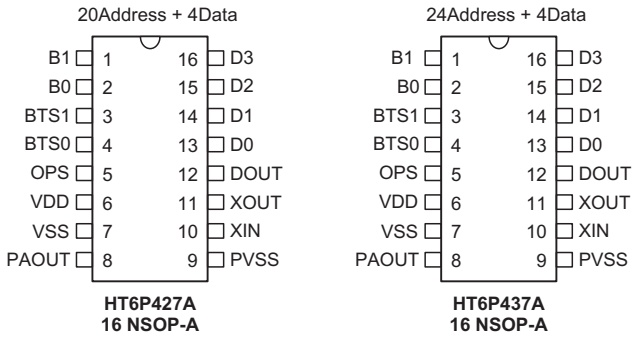
Selection Table

Part No.	V_{DD}	Addr. No.	Data No.	Compound Data No.	Trig.	Frequency Band	RF Type	Package
HT6P427A	2.0V~3.6V	20	4	2	Data High	300~450MHz	ASK TX	16NSOP
HT6P437A	2.0V~3.6V	24	4	2	Data High	300~450MHz	ASK TX	16NSOP

Block Diagram



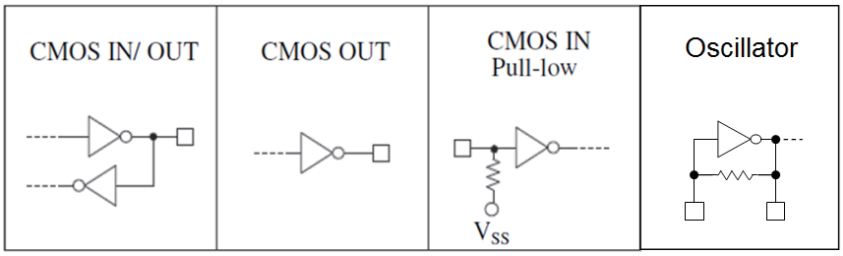
Pin Assignment



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 Transmission enable active high
3~4	BTS1~BTS0	I	CMOS IN	Bit Time Select Pins. Set to VDD, floating or ground to select 8 bit width types.
5	OPS	I	CMOS IN	Output Power Select Pin. Set to VDD, floating or ground to select one of 3 power output levels. VDD : 16dBm, Floating: 14dBm, GND: 12dBm
6	VDD	P	—	Positive power supply
7	VSS	P	—	Negative power supply, ground
8	PAOUT	O	Power Amplify Output	This pin should be combined with an external matching circuit
9	PVSS	P	—	RF negative power supply, ground
10	XIN	I	Oscillator	9.84375MHz Crystal oscillator input for 315MHz RF. Crystal selection is the desired RF frequency/32.
11	XOUT	O	Oscillator	9.84375MHz Crystal oscillator output for 315MHz RF
12	DOUT	O	—	Encoder data out
13~16	D0~D3	I	CMOS IN	Data input and transmission - enable active high

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	3.0	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 315MHz unless otherwise noted. R_L 50Ω load (matched)

Symbol	Parameter	Test Conditions			Min	Typ	Max	Units
		V_{DD}	Conditions					
I_1	Average Data Current* 50% Duty Cycle Data	3V	@ 315MHz, POUT=+16dBm		—	22	—	mA
			@ 315MHz, POUT=+12dBm			13		
I_0	Data Low Current	3V	—		—	4.5	—	mA
RF and Crystal								
	Output Power Level @315MHz	3V	OPS	0	—	12	—	dBm
				Floating	—	14	—	
				1	—	16	—	
	Extinction Ratio for ASK 10Kbps	3V	—		—	70	—	dBc
	Output Blanking	3V	STDBY transition from Low to Hihg		—	10	—	ms
	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
	Harmonics output for 315MHz	3V	@630MHz, 2nd harm		—	-45	—	dBc
			@945MHz, 3rd harm		—	-49	—	dBc
	Occupied Bandwidth	3V	@315MHz		—	<700	—	kHz
	315 MHz Single Side Band Phase Noise	3V	@100kHz from Carrier		—	-70	—	dBc/Hz
			@1000kHz from Carrier		—	-75	—	
	XTLIN, XTLOUT	3V	Pin capacitance		—	2	—	pF

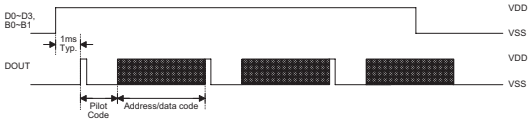
Note: It is recommended that the V_{DD} power on rise time should be less than 500μs to allow the device to power up normally and start normal operation.

Functional Description

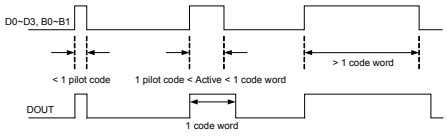
The devices encode both address and data information into an encoded waveform and output it on D_{OUT}. This waveform is fed to the RF modulator for transmission purposes.

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 high pins D0~D3 and B0~B1. The following diagram shows the transmission timing of these devices.



The transmission sequence is Pilot, Address, Data code.



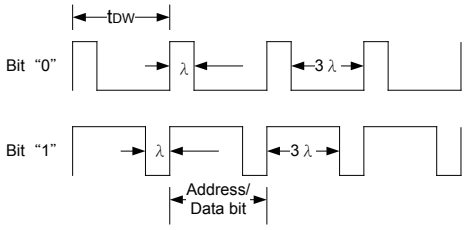
Transmission Timing Diagram

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" bit consists of a "high" pulse for 1λ and then a "low" pulse for 3λ.

2. A "1" bit consists of a "high" pulse for 3λ and then a "low" pulse for 1λ.

Single-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		HT6P4x7A	Unit
t_{DW}	Single bit data width @315MHz	BTS1/BTS0	0/0	0.75	ms
			0/Floating	0.83	
			0/1	0.91	
			Floating/0	1.00	
			Floating/Floating	1.10	
			Floating/1	1.22	
			1/0	1.34	
			1/Floating	1.47	
			1/1	NC	—

Note: 1. The BTS0 and BTS1 pins can be set either high, low or floating.

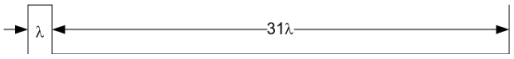
2. The BTS0 and BTS1 pins should never be both high as this may cause erroneous operation.

3. If there is an overlap bit time range then select the closest typical bit time. For example if the desired bit time is 1.06ms, choosing the 1.1ms setting is best.

4. For other frequencies, the bit time will be the ratio of 315/FREQ. For example, for a frequency of 433MHz, the bit time will be 1.47 x 315/433 = 1.07ms

Synchronous Bit Waveform

he synchronous bit waveform is 8-bits long and exhibits a high pulse for 1λfollowed by a low pulse for 31λ as shown in the following diagram.



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 as shown in the following diagram.

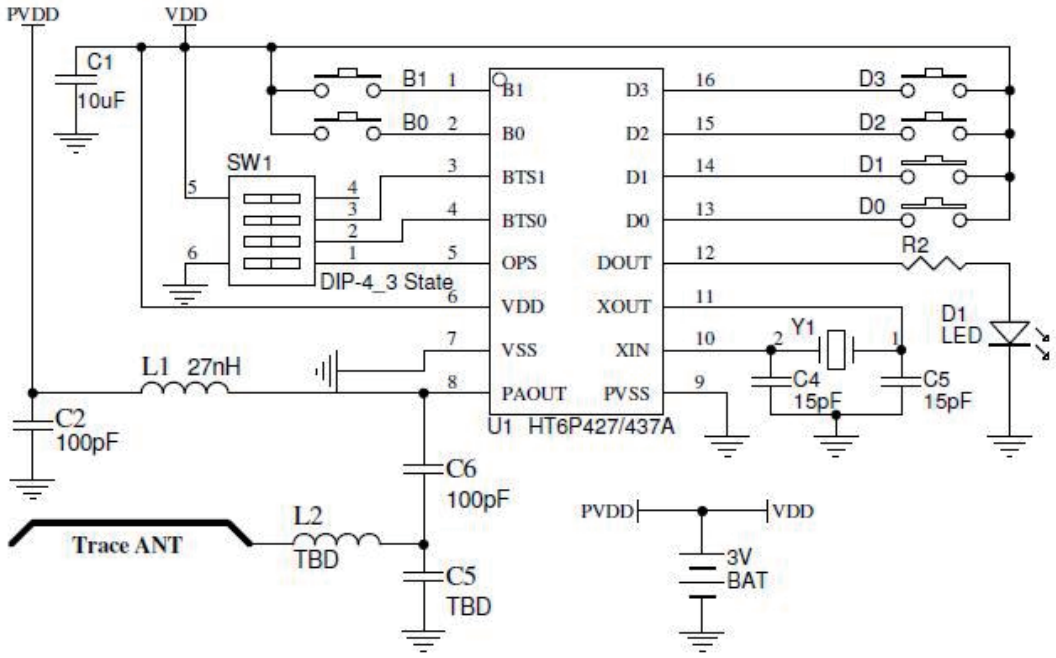
- **HT6P427A**

Pilot-code	A0~A19	D0~D3

- **HT6P437A**

Pilot-code	A0~A23	D0~D3

Application Circuits



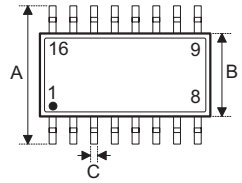
Package Information

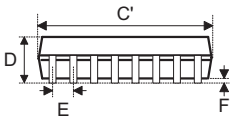
Note that the package information provided here is for consultation purposes only. As this information may be updated at regular intervals users are reminded to consult the Holtek website for the latest version of the Package/Carton Information.

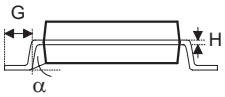
Additional supplementary information with regard to packaging is listed below. Click on the relevant section to be transferred to the relevant website page.

- 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°