

**Features**

- Operating voltage: 2.4V~12V
- Low power consumption and high noise immunity CMOS technology
- Built-in oscillator needs only 5% resistor
- 5 control functions: forward, backward, turbo forward, left turn, and right turn
- 2<sup>2</sup> address codes
- Power driving capability to drive a high current transistor
- Twice check
- Easily interface with an RF or an IR medium

**General Description**

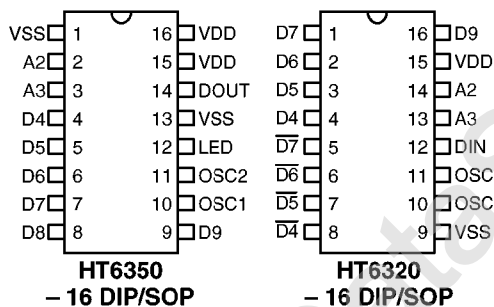
The HT6350/HT6320 are a pair of encoder/decoder CMOS LSIs designed for use in toy car remote control system.

The HT6350 encodes 8-bit address/data, and then serially transmits it upon receipt of a control key signal.

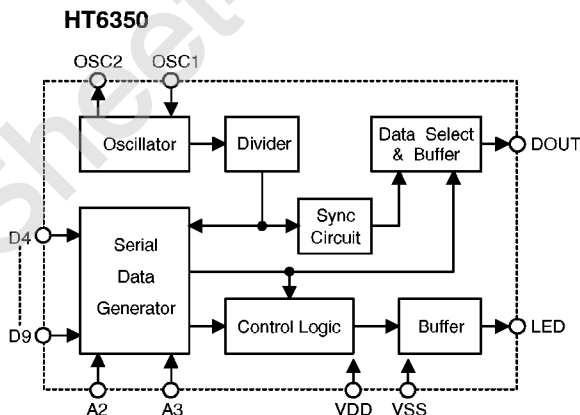
The HT6320, on the other hand, receives a 10-

bit word on its DIN pin and interprets the first 4 bits as address (A0 = "0" and A1 = "1") and the last 6 bits as data that are directly interfaced to a car motor. The 5 data actions of the HT6320 are forward, backward, forward turbo, left turn, and right turn. In the turbo state the motor has a 100% duty cycle. Otherwise it has a 50% duty cycle.

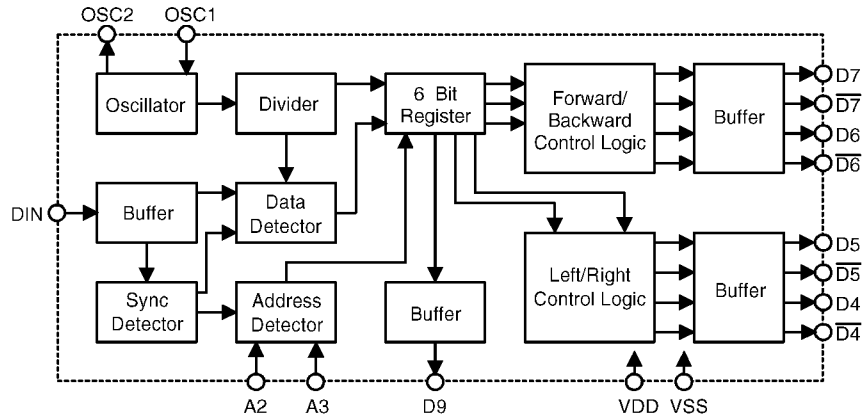
**Pin Assignment**



**Block Diagram**



**HT6320**



**Pin Description**

**HT6350 — 16 Pins**

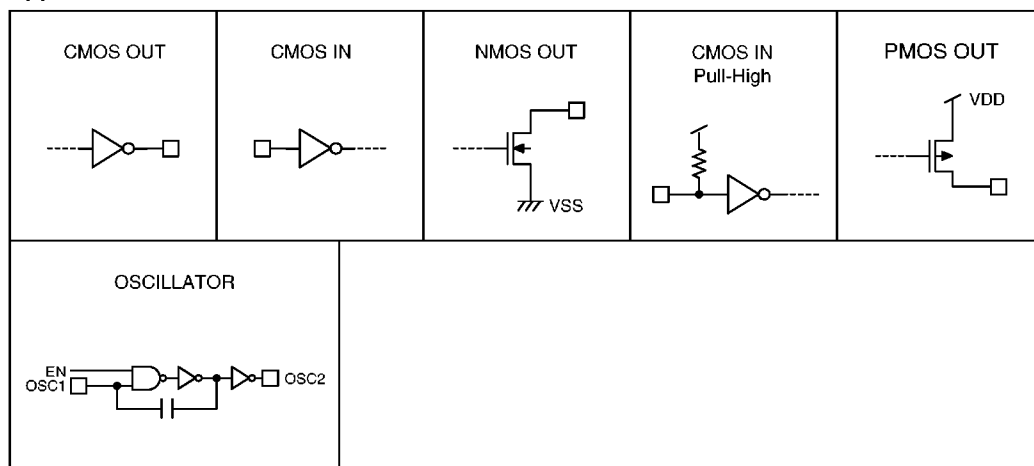
Pin No.	Pin Name	I/O	Internal Connection	Description
1	VSS	I	—	Negative power supply (GND)
2	A2	I	CMOS IN Pull-High	Address input pin It can be externally set to VSS or floating
3	A3	I	CMOS IN Pull-High	Address input pin It can be externally set to VSS or floating
4	D4	I	CMOS IN Pull-High	Left turn control input pin, active low
5	D5	I	CMOS IN Pull-High	Right turn control input pin, active low
6	D6	I	CMOS IN Pull-High	Backward control input pin, active low
7	D7	I	CMOS IN Pull-High	Forward control input pin, active low
8	D8	I	CMOS IN Pull-High	Turbo forward control input pin, active low
9	D9	I	CMOS IN Pull-High	Other use control input pin, active low
10	OSC1	I	OSCILLATOR	Oscillator input pin
11	OSC2	O	OSCILLATOR	Oscillator output pin
12	LED	O	NMOS OUT	Transmission enable indicator

Pin No.	Pin Name	I/O	Internal Connection	Description
13	VSS	I	—	Negative power supply (GND)
14	DOUT	O	CMOS OUT	Serial transmission output pin
15	VDD	I	—	Positive power supply
16	VDD	I	—	Positive power supply

**HT6320 — 16 Pins**

Pin No.	Pin Name	I/O	Internal Connection	Description
1	D7	O	PMOS OUT	Forward control signal output (+)
2	D6	O	PMOS OUT	Backward control signal output (+)
3	D5	O	PMOS OUT	Right turn control signal output (+)
4	D4	O	PMOS OUT	Left turn control signal output (+)
5	$\overline{D7}$	O	NMOS OUT	Forward control signal output (-)
6	$\overline{D6}$	O	NMOS OUT	Backward control signal output (-)
7	$\overline{D5}$	O	NMOS OUT	Right turn control signal output (-)
8	$\overline{D4}$	O	NMOS OUT	Left turn control signal output (-)
9	VSS	I	—	Negative power supply (GND)
10	OSC1	I	OSCILLATOR	Oscillator input pin
11	OSC2	O	OSCILLATOR	Oscillator output pin
12	DIN	I	CMOS IN	Serial data input pin
13	A3	I	CMOS IN Pull-High	A3 address input pin It can be externally set to VSS or floating
14	A2	I	CMOS IN Pull-High	A2 address input pin It can be externally set to VSS or floating
15	VDD	I	—	Positive power supply
16	D9	O	CMOS OUT	Other control signal output It is the inverse to D9 of the HT6350

Note: When D8 of the encoder is “Hi”, D7 and D6 of the HT6320 have a 50% duty cycle output.  
 When D8 of the encoder is “Lo”, D7 and D6 of the HT6320 have a 100% duty cycle output.

**Approximate internal connection circuits**

**Absolute Maximum Ratings\***

Supply Voltage .....	-0.3V to 13V	Storage Temperature.....	-50°C to 125°C
Input Voltage.....	V <sub>SS</sub> -0.3 to V <sub>DD</sub> +0.3V	Operating Temperature.....	-20°C to 75°C

\*Note: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Electrical Characteristics**
**HT6350**

 (T<sub>a</sub>=25°C)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit	
		V <sub>DD</sub>	Conditions					
V <sub>DD</sub>	Operating Voltage	—	—	2.4	—	12	V	
I <sub>STB</sub>	Standby Current	12V	Oscillator stops	—	2	5	μA	
I <sub>DD</sub>	Operating Current	12V	No load F <sub>OSC</sub> =100kHz	—	800	1000	μA	
V <sub>IH</sub>	“H” Input Voltage	—	—	0.8V <sub>DD</sub>	—	V <sub>DD</sub>	V	
V <sub>IL</sub>	“L” Input Voltage	—	—	0	—	0.2V <sub>DD</sub>	V	
R <sub>PH</sub>	D4~D9 Pull-High Resistance	12V	V <sub>IN</sub> =0V	—	150	300	kΩ	
I <sub>DOUT</sub>	Output Current	Source	12V	V <sub>OH</sub> =0.9V <sub>DD</sub>	-2	-5	—	mA
		Sink	12V	V <sub>OL</sub> =0.1V <sub>DD</sub>	2	5	—	mA
F <sub>OSC</sub>	Oscillator Frequency	12V	R <sub>OSC</sub> =240kΩ	—	100	—	kHz	

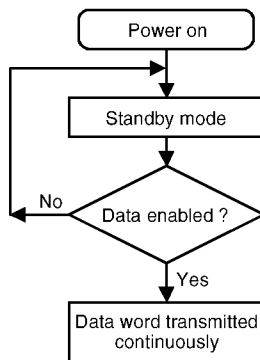
**HT6320**

(Ta=25°C)

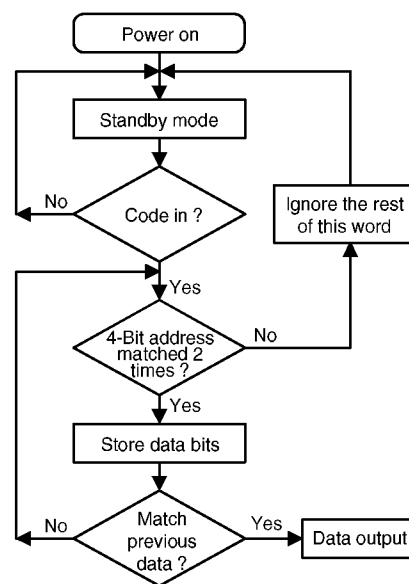
Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V <sub>DD</sub>	Conditions				
V <sub>DD</sub>	Operating Voltage	—	—	2.4	—	12	V
I <sub>STB</sub>	Stand-by Current	12V	Oscillator stops	—	2	5	μA
I <sub>DD</sub>	Operating Current	12V	No load F <sub>OSC</sub> =100kHz	—	800	1000	μA
V <sub>IH</sub>	“H” Input Voltage	—	—	0.8V <sub>DD</sub>	—	V <sub>DD</sub>	V
V <sub>IL</sub>	“L” Input Voltage	—	—	0	—	0.2V <sub>DD</sub>	V
F <sub>OSC</sub>	Oscillator Frequency	12V	R <sub>osc</sub> =240kΩ	—	100	—	kHz
I <sub>O</sub>	Output Drive Current (D4~D7, D4~D7, D9)	12V	V <sub>OH</sub> =0.9V <sub>DD</sub> (Source)	-10	-20	—	mA
			V <sub>OL</sub> =0.1V <sub>DD</sub> (Sink)	30	40	—	mA

**Functional Description**

**HT6350 flowchart**



**HT6320 flowchart**

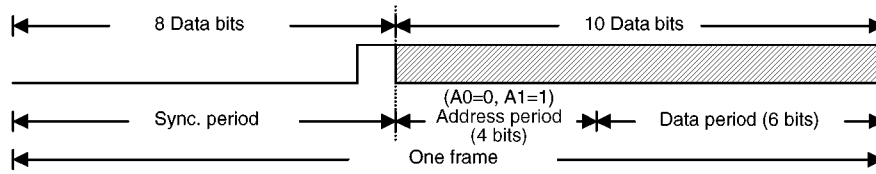


**Decoder operation**

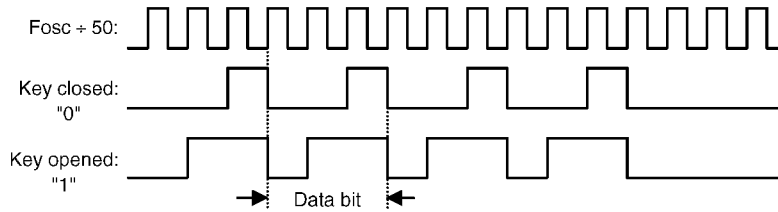
The HT6320 receives data transmitted by the HT6350, and interprets the first 4 bits as address and last 6 bits as data. It then checks the received data word twice continuously. If all the received addresses match the contents of the decoder, the HT6350 then transfers the received data to activate the data pins.

**Encoder operation**

The HT6350 encodes and transmits the address/data to the decoder of the HT6320 upon receipt of a trigger signal (one of D4~D9 is held low). A complete data word consists of three periods as shown:

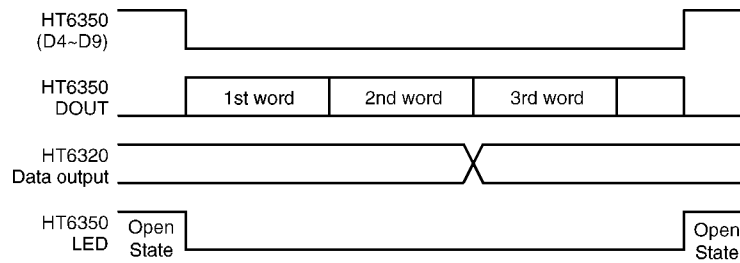


The HT6350 detects the logic state of the address and data pins, and then transmits the detected state during the code period. Each pin can be set to one of the following two logic states:

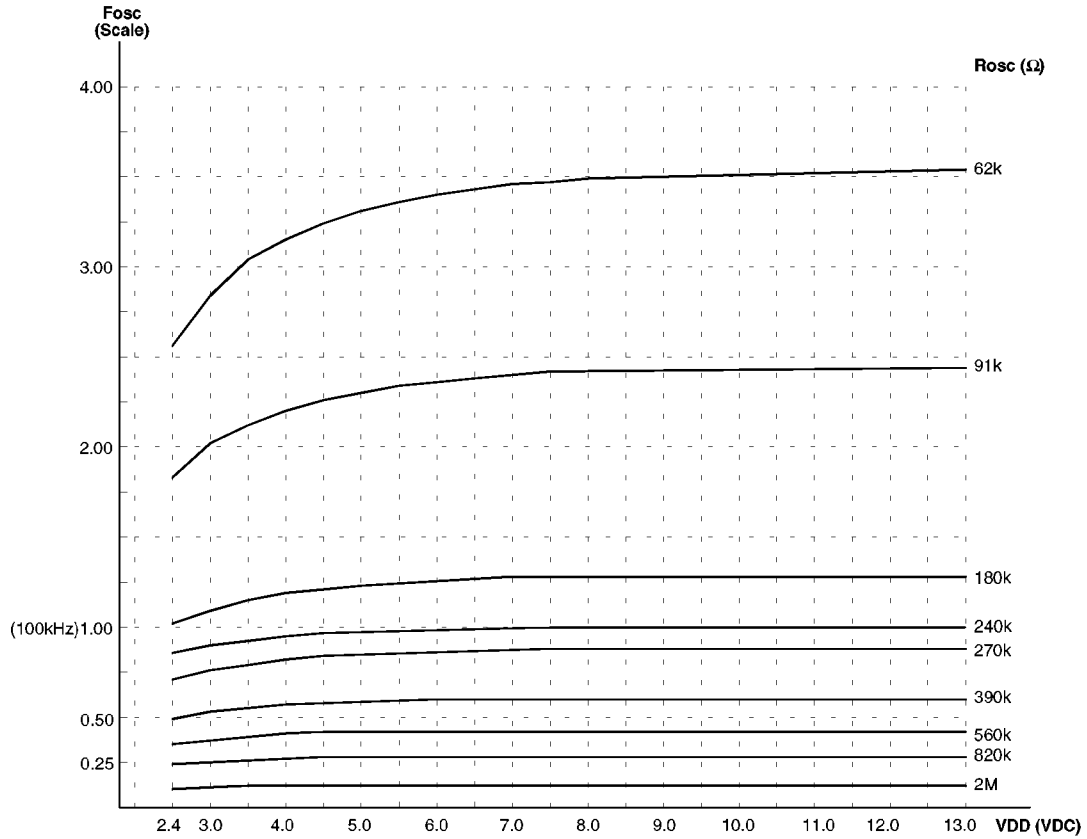


When  $F_{OSC}=100\text{kHz}$ , the data bit time=1.5ms

**Encoder/Decoder timing**

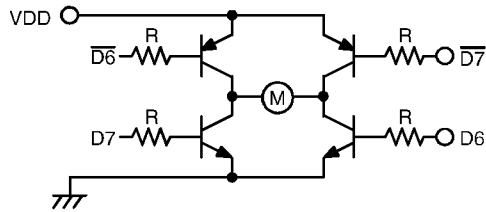


Oscillator frequency vs supply voltage

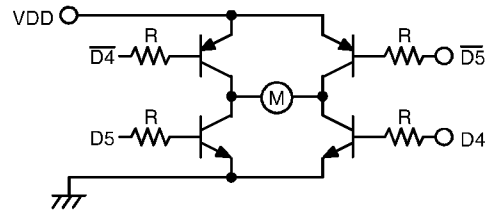


The recommended oscillator frequency is  $F_{OSCD}$  (HT6320 decoder)  $\cong$   $F_{OSCE}$  (HT6350 encoder).

Output driving configuration



Forward/backward control circuit



Left/right control circuit



$R=1k\Omega$


**Direction Control Table**

HT6350		HT6320				Function
Encoder I/P		Decoder O/P				
D4	D5	D4	$\overline{D4}$	D5	$\overline{D5}$	
0	1	1	0	Z	Z	Left turn
1	0	Z	Z	1	0	Right turn

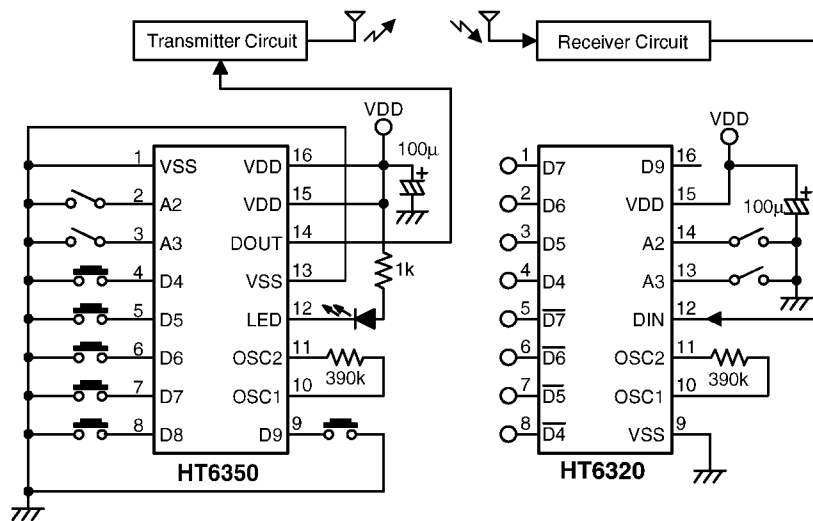
0: Low 1: High Z: High impedance

**Speed Control Table**

HT6350			HT6320				Function
Encoder I/P			Decoder O/P				
D6	D7	D8	D6	$\overline{D6}$	D7	$\overline{D7}$	
0	1	1		0	Z	Z	Backward
1	0	1	Z	Z		0	Forward
1	1	0	Z	Z	1	0	Forward turbo

0: Low 1: High Z: High impedance  : 50% duty

**Application Circuit**



Note: Typical infrared diode: EL-1L2 (KODENSHI CORP.)  
 Typical RF transmitter: JR-220 (JUWA CORP.)  
 Typical infrared receiver: PIC-12043T/PIC-12043S (KODESHI CORP.)  
 or LTM9052 (LITEON CORP.)  
 Typical RF receiver: JR-200 (JUWA CORP.)