RS74HCT04 six-channel Inverters

## 1 FEATURES

- **Operating Voltage Range: 2.0V to 5.5V**
- **Low Power Consumption: 1µA (Max)**
- **Operating Temperature Range: -40°C to +125°C**
- **TTL Input are Compatible**
- **Input Accept Voltage to 5.5V**
- **Output Drive: ±32mA at Vcc=5.0V**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **Micro SIZE PACKAGES: SOIC14,TSSOP14**

2 APPLICATIONS

- **AC Receiver and**
- **Home Theaters**
- **Blu-ray Players and Home Theaters**
- **Desktops or Notebook PCs**
- **Digital Video Cameras (DVC)**
- **Mobile Phones**
- **Personal Navigation Device (GPS)**
- **Portable Media Player**

LOGIC SYMBOL
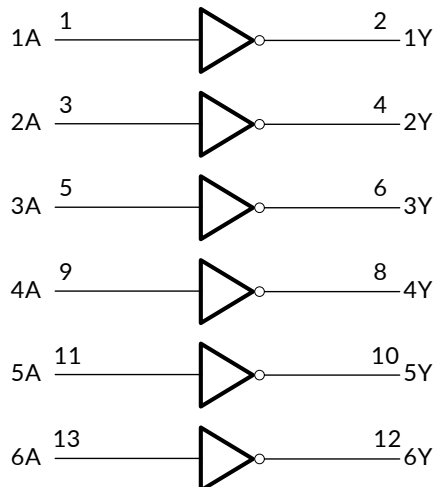
3 DESCRIPTIONS

The RES74HCT04 six-channel inverters is designed for 2.0V to 5.5V V_{CC} operation. The RS6GT04 device contains six inverter and performs the Boolean function $Y=\overline{A}$.

This device is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

The RES74HCT04D,RES74HCT04PW is available in Green SOIC14and TSSOP14 packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information [(1)]

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RES74HCT04D	SOIC14	8.65mm×3.90mm
RES74HCT04PW	TSSOP14	5.00mm×4.40mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

4 FUNCTION TABLE

INPUT	OUTPUT
A	Y
H	L
L	H

$Y=\overline{A}$
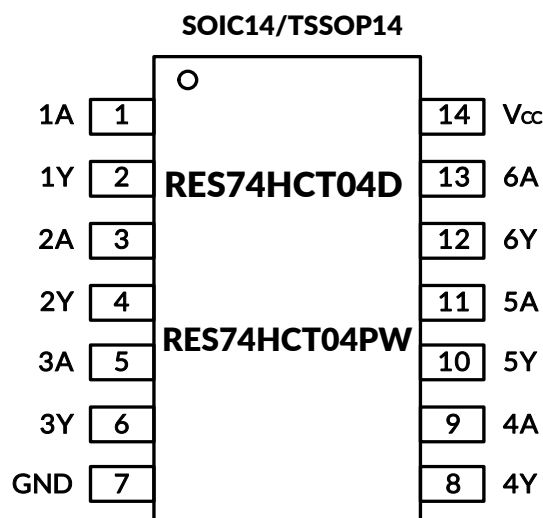H=High Voltage Level
L=Low Voltage Level

6 PACKAGE/ORDERING INFORMATION [(1)]

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING [(2)]	MSL[(3)]	PACKAGE OPTION
RES74HCT04	RES74HCT04D	-40℃ ~+125℃	SOIC14	RES74HCT04D	MSL3	Tape and Reel,4000
	RES74HCT04PW	-40℃ ~+125℃	TSSOP14	RES74HCT04PW	MSL3	Tape and Reel,4000

NOTE:
(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.
(2) There may be additional marking, which relates to the lot trace code information(data code and vendor code)，the logo or the environmental category on the device.
(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

7 PIN CONFIGURATIONS

SOIC14/TSSOP14

1A	1		14	V$_{CC}$
1Y	2	RES74HCT04D	13	6A
2A	3		12	6Y
2Y	4		11	5A
3A	5	RES74HCT04PW	10	5Y
3Y	6		9	4A
GND	7		8	4Y

PIN DESCRIPTION

NAME	RES74HCT04D, RES74HCT04PW SOIC14/TSSOP14	I/O [(1)]	DESCRIPTION
1A	1	I	Input 1
1Y	2	O	output 1
2A	3	I	Input 2
2Y	4	O	output 2
3A	5	I	Input 3
3Y	6	O	output 3
GND	7	P	Ground
4Y	8	O	output 4
4A	9	I	Input 4
5Y	10	O	output 5
5A	11	I	Input 5
6Y	12	O	output 6
6A	13	I	Input 6
V$_{CC}$	14	P	Power pin

(1) I=input, O=output, P=power, G= Ground.

8 SPECIFICATIONS

8.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) [1]

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		-0.5	6.5	V
V_I	Input voltage range [2]		-0.5	6.5	V
V_O	Voltage range applied to any output in the high-impedance or power-off state [2]		-0.5	6.5	V
V_O	Voltage range applied to any output in the high or low state [2] [3]		-0.5	V_{CC}+0.5	V
I_{IK}	Input clamp current	$V_I<0$		-50	mA
I_{OK}	Output clamp current	$V_O<0$		-50	mA
I_O	Continuous output current			±50	mA
	Continuous current through V_{CC} or GND			±100	mA
θ_{JA}	Package thermal impedance [4]	SOIC14		105	°C/W
		TSSOP14		90	
T_J	Junction temperature [5]		-65	150	°C
T_{stg}	Storage temperature		-65	150	°C

(1)   Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2)   The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

(3)   The value of V_{CC} is provided in the Recommended Operating Conditions table.

(4)   The package thermal impedance is calculated in accordance with JESD-51.

(5)   The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

8.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), MIL-STD-883K METHOD 3015.9	±2000	V
		Charged-device model (CDM), ANSI/ESDA/JEDEC JS-002-2018	±1000	V
		Machine Model (MM), JESD22-A115C (2010)	±200	V

ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

8.3 AC Characteristics

PARAMETER	SYMBOL	TEST CONDITIONS		MIN[2]	TYP[3]	MAX[2]	UNIT
Propagation Delay	t_{pd}	V_{CC}=2.0V±0.2V	C_L=30pF, R_L=500Ω		3.9		ns
		V_{CC}=3.3V±0.3V	C_L=50pF, R_L=500Ω		3.3		
		V_{CC}=5V±0.5 V	C_L=50pF, R_L=500Ω		2.8		
Power dissipation capacitance	C_{pd}	V_{CC}=5V	f=10MHz		25		pF

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

(2) This parameter is ensured by design and/or characterization and is not tested in production.

(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

9 ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (TYP values are at T_A = +25°C, Full=-40°C to 125°C, unless otherwise noted.) [1]

9.1 Recommended Operating Conditions

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Supply voltage	V_{CC}	Operating	2.0	5.5	V
High-level input voltage	V_{IH}	V_{CC}=2.0V	1.0		V
		V_{CC}=3.3V	1.5		
		V_{CC}=4.5V to 5.5V	2.0		
Low-level input voltage	V_{IL}	V_{CC}=2.0V		0.3	V
		V_{CC}=3.3V		0.55	
		V_{CC}=4.5V to 5.5V		0.8	
Input voltage	V_I		0	5.5	V
Output voltage	V_O		0	V_{CC}	V
Input transition rise or fall	$\Delta t / \Delta v$	V_{CC}=2.0V to 5.5V		5	ns/V
Operating temperature	T_A		-40	125	°C

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

9.2 DC Characteristics

| PARAMETER		TEST CONDITIONS	V_{CC}	TEMP	MIN[2]	TYP[3]	MAX[2]	UNIT
V_{OH}		I_{OH} = -100μA	2.0V to 5.5V	Full	V_{CC}-0.1			V
		I_{OH} = -8mA	2.0		1.6			
		I_{OH} = -24mA	3.3		2.5			
		I_{OH} = -32mA	4.5V		3.8			
			5V		4.2			
			5.5V		4.8			
V_{OL}		I_{OL} = 100μA	2.0V to 5.5V	Full			0.1	V
		I_{OH} = 8mA	2.0				0.45	
		I_{OH} = 24mA	3.3				0.55	
		I_{OL} = 32mA	4.5V				0.55	
			5V				0.5	
			5.5V				0.45	
I_I	A inputs	V_I=5.5V or GND	0V to 5.5V	+25°C		±0.1	±1	μA
				Full			±5	
I_{off}		V_I or V_O=5.5V	0V	+25°C		±0.1	±1	μA
				Full			±10	
I_{CC}		V_I=5.5V or GND, I_O=0	2.0V to 5.5V	+25°C		0.1	1	μA
				Full			10	
I_{CCT}		One input at 3.4V, Other inputs at V_{CC} or GND	5.5V	Full			500	μA
C_i (Input Capacitance)		V_{CC}=0V, f=10MHz	0V	+25°C		6		pF

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
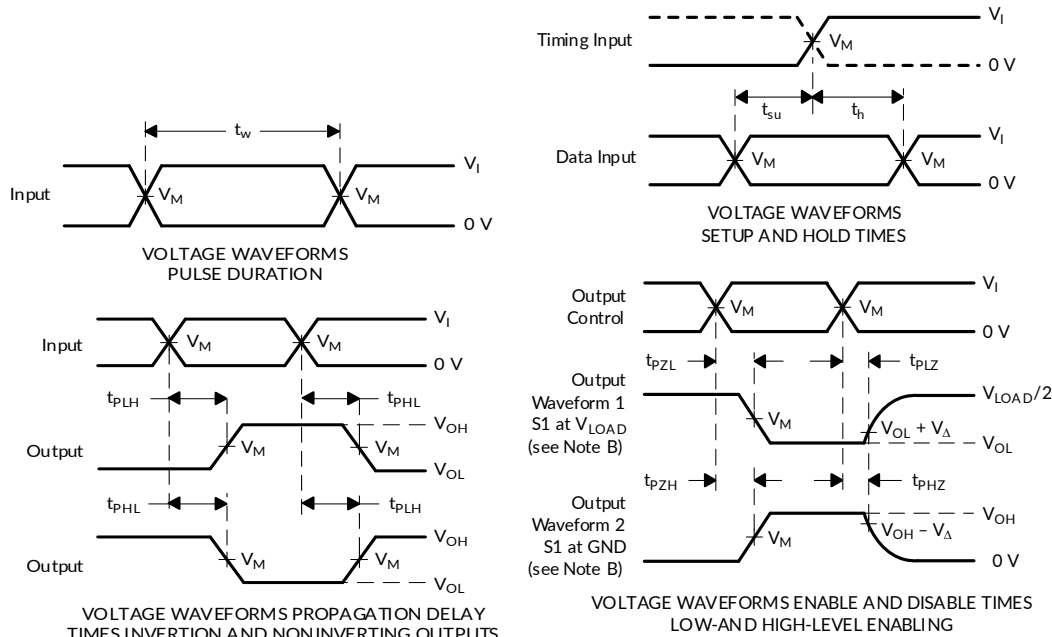
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

10 Parameter Measurement Information
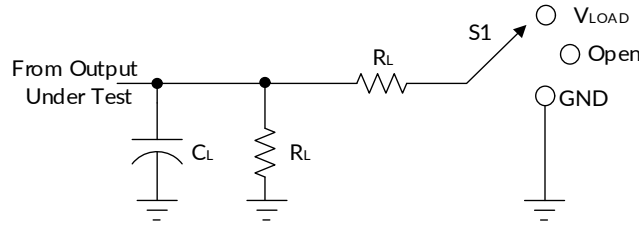
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_Δ
	V_I	t_r/t_f					
2.0V±0.2V	V_{CC}	≤2ns	$V_{CC}/2$	2 x V_{CC}	30pF	500Ω	0.15V
3.3V±0.3V	3V	≤2.5ns	1.5V	6V	50pF	500Ω	0.3V
5V±0.5V	V_{CC}	≤2.5ns	$V_{CC}/2$	2 x V_{CC}	50pF	500Ω	0.3V

VOLTAGE WAVEFORMS
PULSE DURATION

VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES

VOLTAGE WAVEFORMS PROPAGATION DELAY
TIMES INVERTION AND NONINVERTING OUTPUTS

VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES
LOW-AND HIGH-LEVEL ENABLING

NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50Ω.
D. The outputs are measured one at a time, with one transition per measurement.
E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
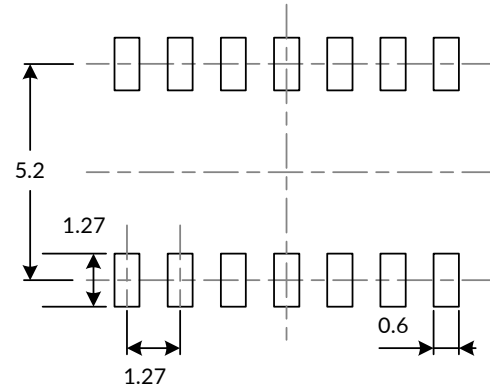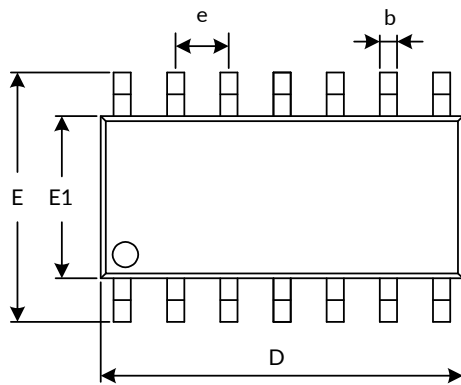F. t_{PZL} and t_{PZH} are the same as t_{en}.
G. t_{PLH} and t_{PHL} are the same as t_{pd}.
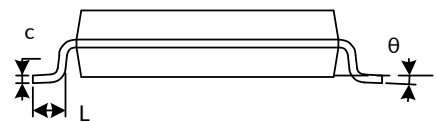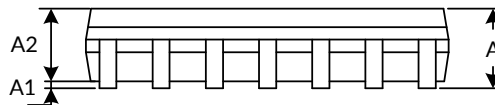H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

11 PACKAGE OUTLINE DIMENSIONS
SOIC14 [3]

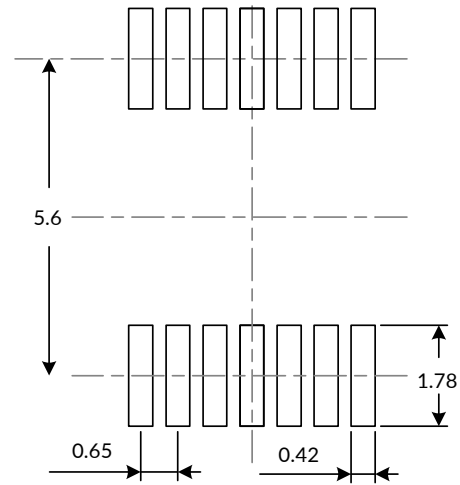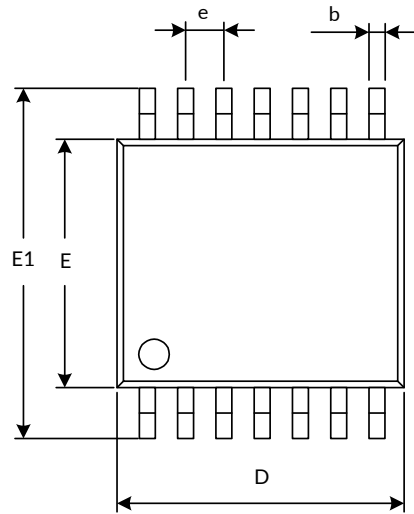RECOMMENDED LAND PATTERN (Unit: mm)

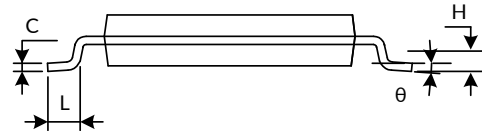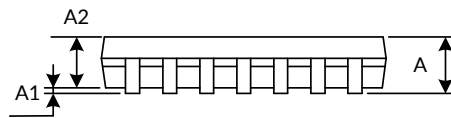| Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A [1]		1.750		0.069
A1	0.100	0.250	0.004	0.010
A2	1.300	1.500	0.051	0.059
b	0.390	0.470	0.015	0.019
c	0.200	0.240	0.008	0.009
D [1]	8.550	8.750	0.336	0.344
e	1.270(BSC) [2]		0.050(BSC) [2]	
E	5.800	6.200	0.228	0.244
E1 [1]	3.800	4.000	0.150	0.157
L	0.500	0.800	0.020	0.031
θ	0°	8°	0°	8°

NOTE:
   1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
   2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
   3. This drawing is subject to change without notice.

TSSOP14 [3]

RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A [1]		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.900	1.050	0.035	0.041
b	0.200	0.300	0.008	0.012
c	0.130	0.170	0.005	0.007
D [1]	4.860	5.100	0.191	0.201
E [1]	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650(BSC) [2]		0.026(BSC) [2]	
L	0.450	0.750	0.018	0.030
H	0.250(TYP)		0.010(TYP)	
θ	0°	8°	0°	8°

NOTE:
    1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
    2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
    3. This drawing is subject to change without notice.

12 TAPE AND REEL INFORMATION
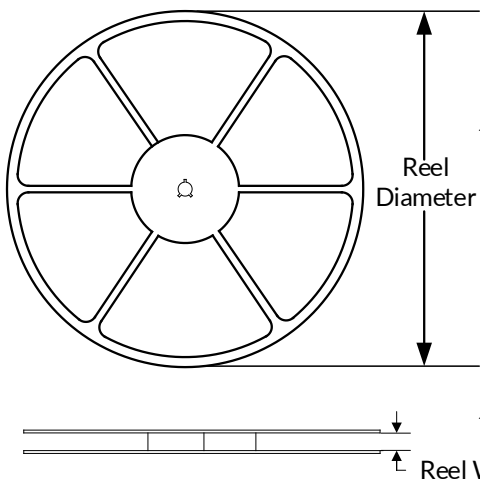
REEL DIMENSIONS   **TAPE DIMENSION**
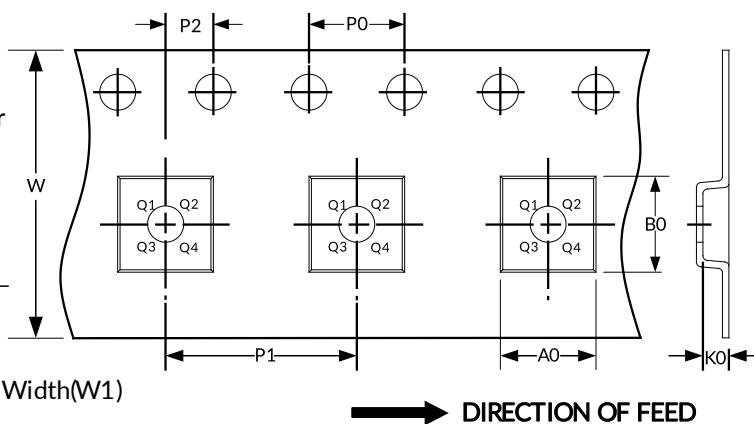
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOIC14	13"	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1
TSSOP14	13"	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	Q1

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.