

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74HC133AP, TC74HC133AF

13-INPUT NAND GATE

The TC74HC133A is a high speed CMOS 13-INPUT NAND GATE fabricated with silicon gate C²MOS technology.

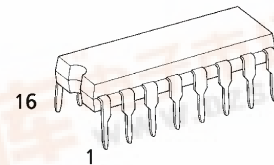
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

The internal circuit is composed of 7 stages, including a buffer output, which provide high noise immunity and stable output.

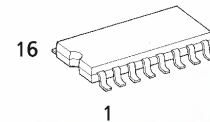
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed..... $t_{pd} = 13\text{ns}$ (typ.) at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 1\mu\text{A}$ (Max.) at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Output Drive Capability..... 10 LSTTL Loads
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 4\text{mA}$ (Min.)
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range... V_{CC} (opr.) = $2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS133

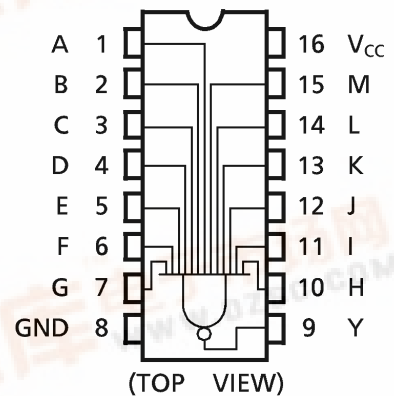


P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)

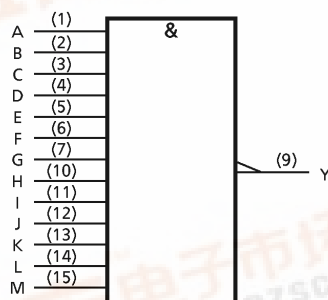


F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)

PIN ASSIGNMENT



IEC LOGIC SYMBOL



TRUTH TABLE

Inputs	Output
All Inputs High	L
All Other Combinations	H

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ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V _{CC}	-0.5~7	V
DC Input Voltage	V _{IN}	-0.5~V _{CC} +0.5	V
DC Output Voltage	V _{OUT}	-0.5~V _{CC} +0.5	V
Input Diode Current	I _{IK}	±20	mA
Output Diode Current	I _{OK}	±20	mA
DC Output Current	I _{OUT}	±25	mA
DC V _{CC} / Ground Current	I _{CC}	±75	mA
Power Dissipation	P _D	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T _{stg}	-65~150	°C

*500mW in the range of Ta = -40°C~65°C. From Ta = 65°C to 85°C a derating factor of -10mW/°C shall be applied until 300mW.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V _{CC}	2~6	V
Input Voltage	V _{IN}	0~V _{CC}	V
Output Voltage	V _{OUT}	0~V _{CC}	V
Operating Temperature	T _{opr}	-40~85	°C
Input Rise and Fall Time	t _r , t _f	0~1000 (V _{CC} = 2.0V) 0~500 (V _{CC} = 4.5V) 0~400 (V _{CC} = 6.0V)	ns

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	Ta = 25°C			Ta = -40~85°C		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.		
High - Level Input Voltage	V _{IH}		2.0	1.50	—	—	1.50	—	V	
			4.5	3.15	—	—	3.15	—		
			6.0	4.20	—	—	4.20	—		
Low - Level Input Voltage	V _{IL}		2.0	—	—	0.50	—	0.50	V	
			4.5	—	—	1.35	—	1.35		
			6.0	—	—	1.80	—	1.80		
High - Level Output Voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -20μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
			6.0	5.9	6.0	—	5.9	—		
			I _{OH} = -4 mA	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
			Low - Level Output Voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 20μA	2.0	—	0.0	
4.5	—	0.0					0.1	—	0.1	
6.0	—	0.0				0.1	—	0.1		
I _{OL} = 4 mA	4.5	—				0.17	0.26	—	0.33	
	6.0	—	0.18	0.26	—	0.33				
Input Leakage Current	I _{IN}	V _{IN} = V _{CC} or GND	6.0	—	—	±0.1	—	±1.0	μA	
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND	6.0	—	—	1.0	—	10.0		

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AC ELECTRICAL CHARACTERISTICS ($C_L = 15\text{pF}$, $V_{CC} = 5\text{V}$, $T_a = 25^\circ\text{C}$, Input $t_r = t_f = 6\text{ns}$)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t_{TLH}		—	4	8	ns
	t_{THL}					
Propagation Delay Time	t_{pLH}		—	13	22	
	t_{pHL}					

AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, Input $t_r = t_f = 6\text{ns}$)

PARAMETER	SYMBOL	TEST CONDITION	$T_a = 25^\circ\text{C}$			$T_a = -40\sim 85^\circ\text{C}$		UNIT	
			$V_{CC}(\text{V})$	MIN.	TYP.	MAX.	MIN.		MAX.
Output Transition Time	t_{TLH}		2.0	—	25	75	—	95	ns
	t_{THL}		4.5	—	7	15	—	19	
			6.0	—	6	13	—	16	
Propagation Delay Time	t_{pLH}		2.0	—	42	130	—	165	
	t_{pHL}		4.5	—	16	26	—	33	
			6.0	—	14	22	—	28	
Input Capacitance	C_{IN}			—	5	10	—	10	pF
Power Dissipation Capacitance	$C_{PD} (1)$			—	29	—	—	—	

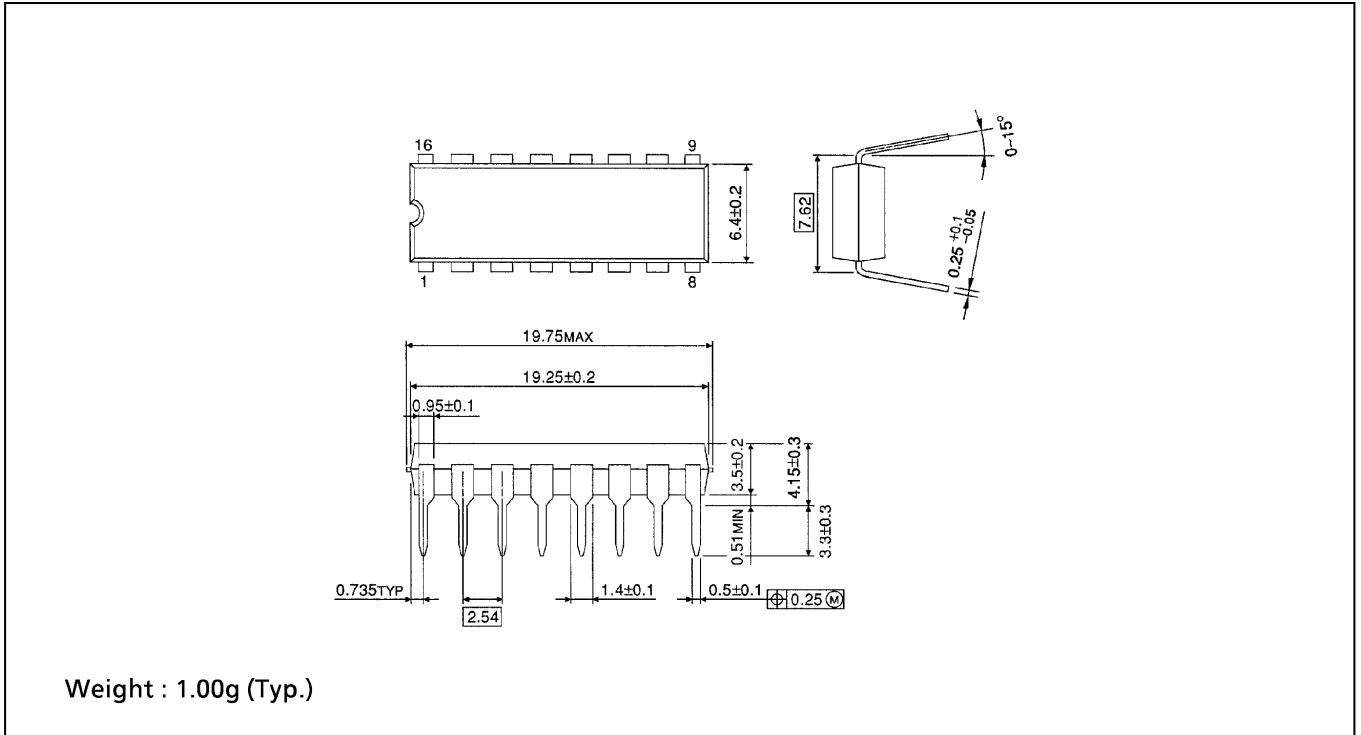
Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54)

Unit in mm



SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27)

Unit in mm

