



# 74AC374

## OCTAL D-TYPE FLIP-FLOP WITH 3 STATE OUTPUTS (NON INVERTED)

- HIGH SPEED:  
 $f_{MAX} = 270\text{MHz}$  (TYP.) at  $V_{CC} = 5\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- HIGH NOISE IMMUNITY:  
 $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (MIN.)
- 50Ω TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 24\text{mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 374
- IMPROVED LATCH-UP IMMUNITY



### ORDER CODES

PACKAGE	TUBE	T & R
DIP	74AC374B	
SOP	74AC374M	74AC374MTR
TSSOP		74AC374TTR

### DESCRIPTION

The 74AC374 is an advanced high-speed CMOS OCTAL D-TYPE FLIP-FLOP with 3 STATE OUTPUT NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

These 8 bit D-Type Flip-Flop are controlled by a clock input (CK) and an output enable input ( $\overline{OE}$ ). On the positive transition of the clock, the Q outputs will be set to the logic that were setup at

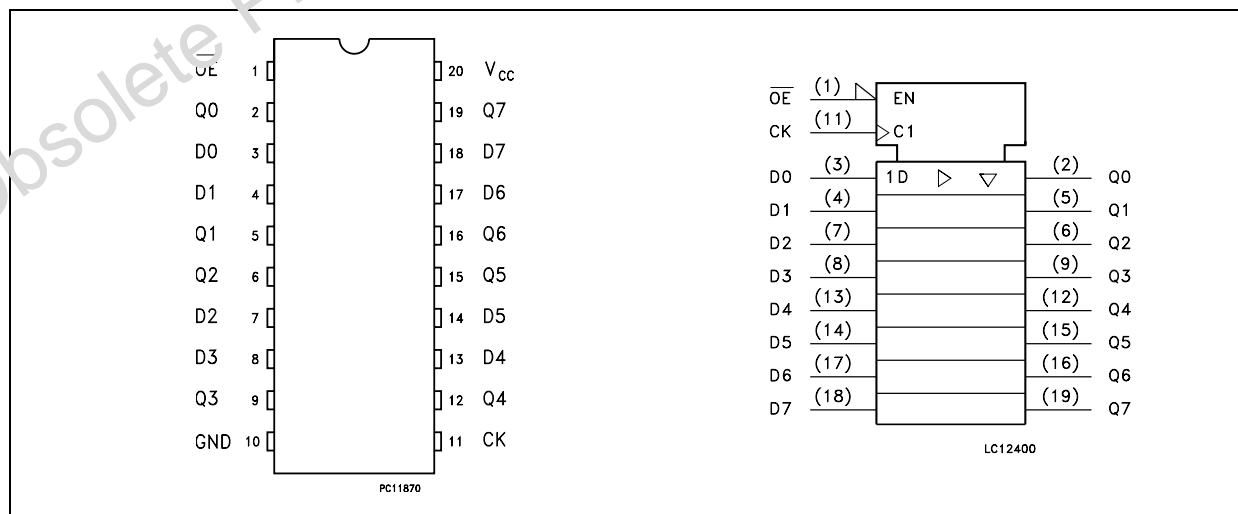
the D inputs.

While the ( $\overline{OE}$ ) input is low, the 8 outputs will be in a normal logic state (high or low logic level); while  $\overline{OE}$  is in high level, the outputs will be in a high impedance state.

The output control does not affect the internal operation of flip-flops; that is, the old data can be retained or the new data can be entered even while the outputs are off.

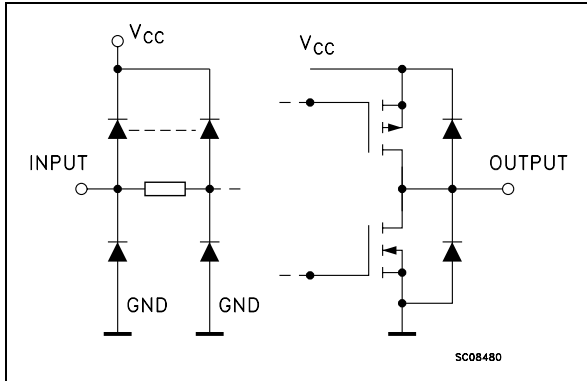
All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# 74AC374

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

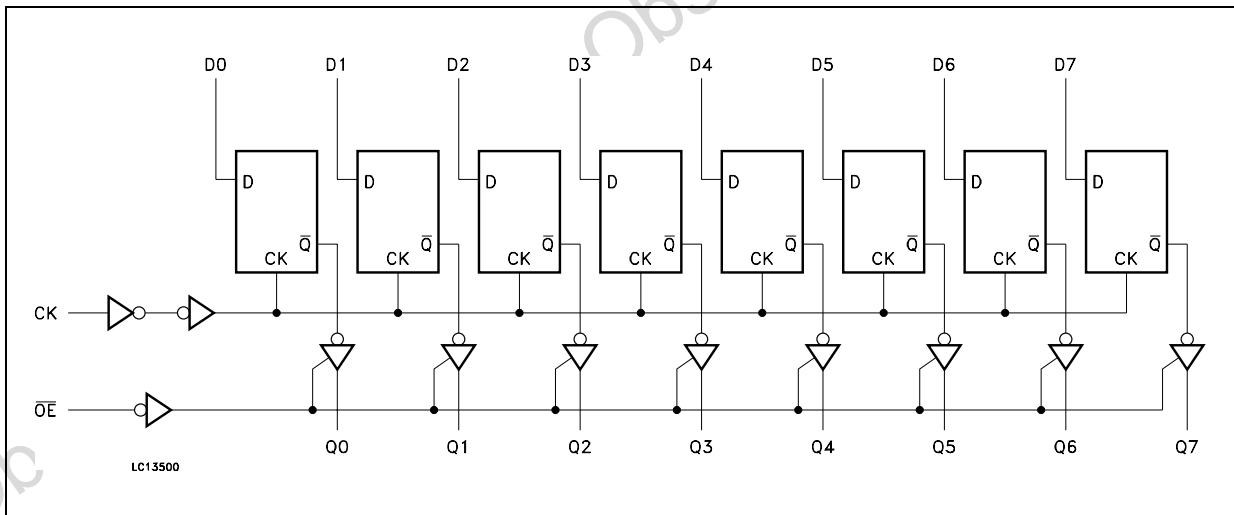
PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{OE}$	3-State Output Enable (Active LOW)
2, 5, 6, 9, 12, 15, 16, 19	Q0 to Q7	3-State Outputs
3, 4, 7, 8, 13, 14, 17, 18	D0 to D7	Data Inputs
11	CLOCK	Clock Input (LOW-to-HIGH Edge Trigger)
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive Supply Voltage

## TRUTH TABLE

INPUTS			OUTPUT
$\overline{OE}$	CK	D	Q
H	X	X	Z
L		X	NO CHANGE
L		L	L
L		H	H

X : Don't Care  
Z : High Impedance

## LOGIC DIAGRAM



This logic diagram has not been used to estimate propagation delays

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	-0.5 to +7	V
$V_I$	DC Input Voltage	-0.5 to $V_{CC} + 0.5$	V
$V_O$	DC Output Voltage	-0.5 to $V_{CC} + 0.5$	V
$I_{IK}$	DC Input Diode Current	$\pm 20$	mA
$I_{OK}$	DC Output Diode Current	$\pm 20$	mA
$I_O$	DC Output Current	$\pm 50$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current	$\pm 400$	mA
$T_{stg}$	Storage Temperature	-65 to +150	°C
$T_L$	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	2 to 6	V
$V_I$	Input Voltage	0 to $V_{CC}$	V
$V_O$	Output Voltage	0 to $V_{CC}$	V
$T_{op}$	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time $V_{CC} = 3.0, 4.5$ or $5.5V$ (note 1)	8	ns/V

1)  $V_{IN}$  from 30% to 70% of  $V_{CC}$

## DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value						Unit	
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>IH</sub>	High Level Input Voltage	3.0	V <sub>O</sub> = 0.1 V or V <sub>CC</sub> -0.1V	2.1	1.5		2.1		2.1		V
		4.5		3.15	2.25		3.15		3.15		
		5.5		3.85	2.75		3.85		3.85		
V <sub>IL</sub>	Low Level Input Voltage	3.0	V <sub>O</sub> = 0.1 V or V <sub>CC</sub> -0.1V		1.5	0.9		0.9		0.9	V
		4.5			2.25	1.35		1.35		1.35	
		5.5			2.75	1.65		1.65		1.65	
V <sub>OH</sub>	High Level Output Voltage	3.0	I <sub>O</sub> =-50 μA	2.9	2.99		2.9		2.9		V
		4.5	I <sub>O</sub> =-50 μA	4.4	4.49		4.4		4.4		
		5.5	I <sub>O</sub> =-50 μA	5.4	5.49		5.4		5.4		
		3.0	I <sub>O</sub> =-12 mA	2.56			2.46		2.4		
		4.5	I <sub>O</sub> =-24 mA	3.86			3.76		3.7		
		5.5	I <sub>O</sub> =-24 mA	4.86			4.76		4.7		
V <sub>OL</sub>	Low Level Output Voltage	3.0	I <sub>O</sub> =50 μA		0.002	0.1		0.1		0.1	V
		4.5	I <sub>O</sub> =50 μA		0.001	0.1		0.1		0.1	
		5.5	I <sub>O</sub> =50 μA		0.001	0.1		0.1		0.1	
		3.0	I <sub>O</sub> =12 mA			0.36		0.44		0.5	
		4.5	I <sub>O</sub> =24 mA			0.36		0.44		0.5	
		5.5	I <sub>O</sub> =24 mA			0.36		0.44		0.5	
I <sub>I</sub>	Input Leakage Current	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND			± 0.1		± 1		± 1	μA
I <sub>oz</sub>	High Impedance Output Leakage Current	5.5	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> = V <sub>CC</sub> or GND			± 0.5		± 5		± 10	μA
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>I</sub> = V <sub>CC</sub> or GND			4		40		80	μA
I <sub>OLD</sub>	Dynamic Output Current (note 1, 2)	5.5	V <sub>OLD</sub> = 1.65 V max					75		50	mA
I <sub>OHD</sub>			V <sub>OHD</sub> = 3.85 V min					-75		-50	mA

1) Maximum test duration 2ms, one output loaded at a time

2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50Ω

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 50 \text{ pF}$ ,  $R_L = 500 \Omega$ , Input  $t_r = t_f = 3\text{ns}$ )

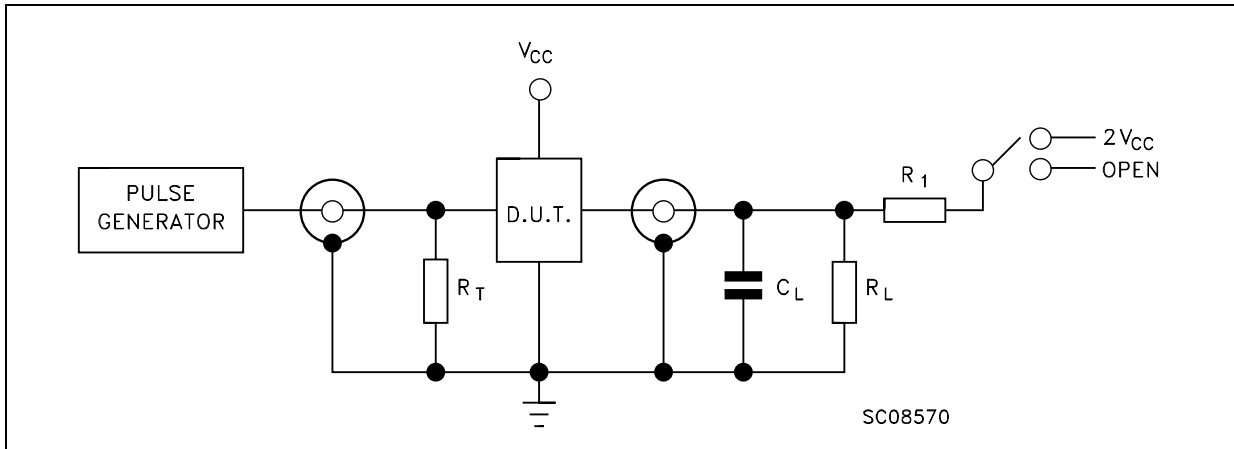
Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$		$-55 \text{ to } 125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time CK to Q	3.3(*)			6.5	13.5		15.5		16.5	ns
		5.0(**)			5.0	9.5		10.5		12.0	
$t_{PZL}$ $t_{PZH}$	Output Enable Time	3.3(*)			7.5	12.0		13.0		14.0	ns
		5.0(**)			5.5	9.0		9.5		10.5	
$t_{PLZ}$ $t_{PHZ}$	Output Disable Time	3.3(*)			7.5	12.5		14.5		16.0	ns
		5.0(**)			6.0	11.0		12.5		12.5	
$t_W$	CLOCK Pulse Width HIGH or LOW	3.3(*)			1.5	5.0		6.0		6.0	ns
		5.0(**)			1.5	4.0		5.0		5.0	
$t_s$	Setup Time D to CK, HIGH or LOW	3.3(*)			-0.5	5.0		5.0		5.0	ns
		5.0(**)			-0.5	4.0		4.0		4.0	
$t_h$	Hold Time D to CK, HIGH or LOW	3.3(*)			0.5	2.0		3.0		3.0	ns
		5.0(**)			0.5	2.0		3.0		3.0	
$f_{MAX}$	Maximum Clock Frequency	3.3(*)		60	250		60		60		MHz
		5.0(**)		100	270		100		100		

(\*) Voltage range is  $3.3\text{V} \pm 0.3\text{V}$ (\*\*) Voltage range is  $5.0\text{V} \pm 0.5\text{V}$ 
**CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Test Condition		Value						Unit	
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$		$-55 \text{ to } 125^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$C_{IN}$	Input Capacitance	5.0			4						pF
$C_{OUT}$	Output Capacitance	5.0			8						pF
$C_{PD}$	Power Dissipation Capacitance (note 1)	5.0	$f_{IN} = 10\text{MHz}$		18						pF

1)  $C_{PD}$  is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(oper)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/n$  (per circuit)

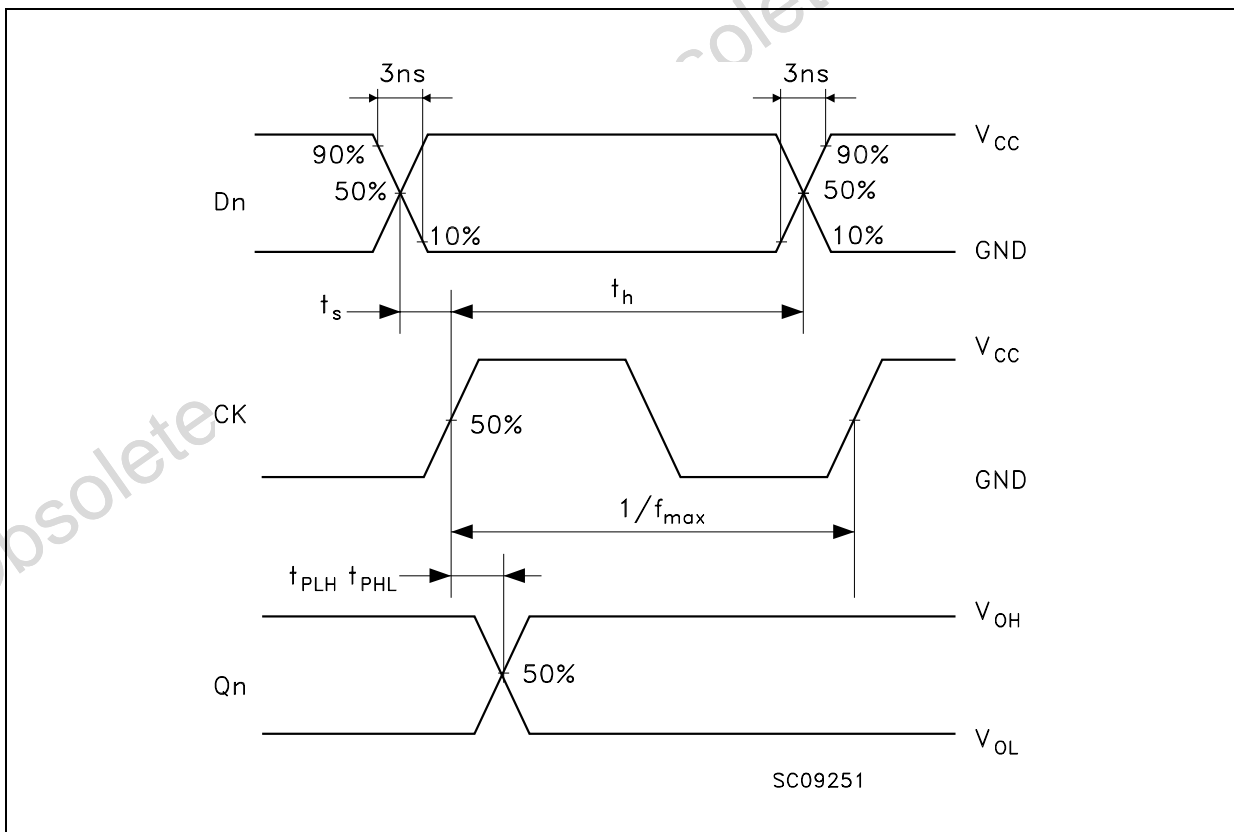
TEST CIRCUIT

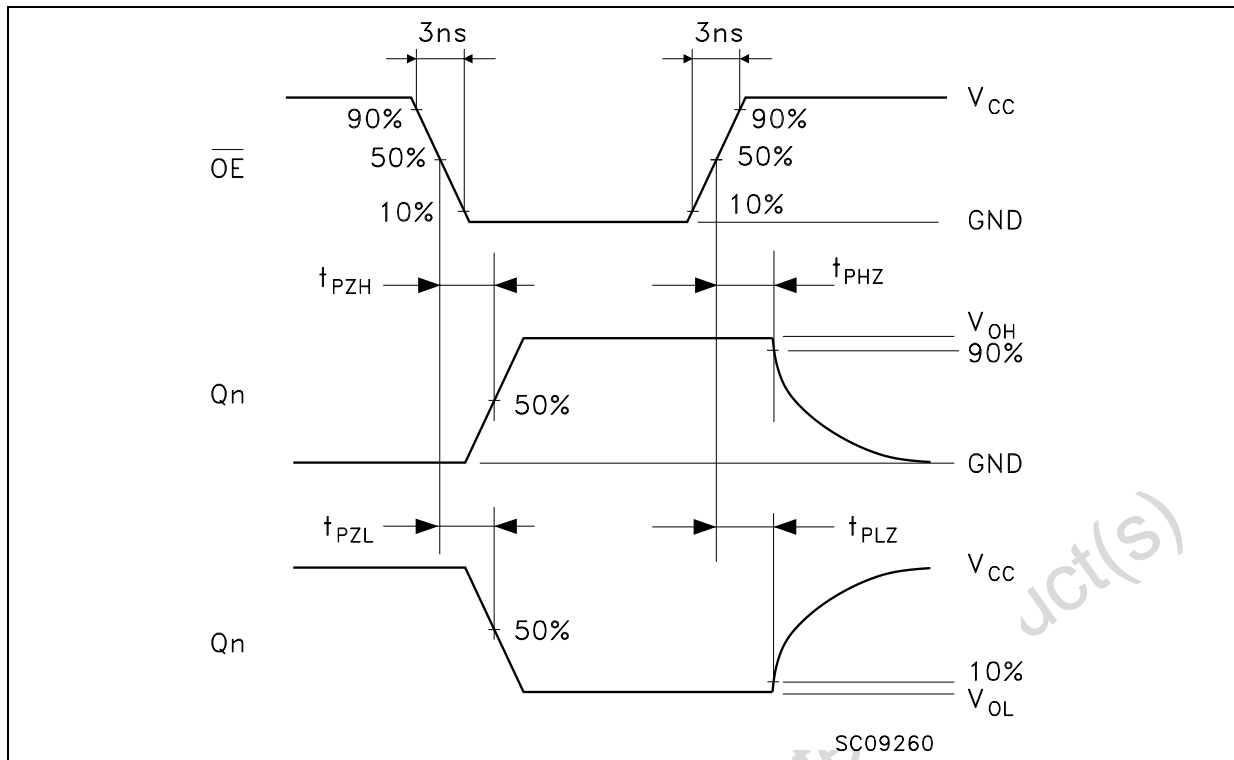
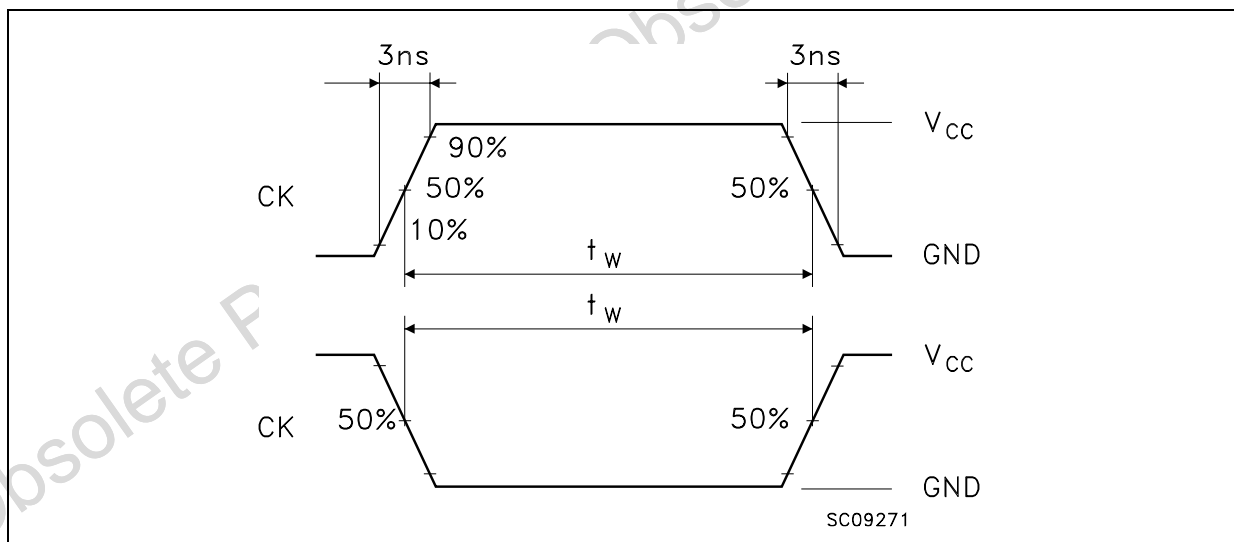


TEST	SWITCH
$t_{PLH}$ , $t_{PHL}$	Open
$t_{PZL}$ , $t_{PLZ}$	$2V_{CC}$
$t_{PZH}$ , $t_{PHZ}$	Open

$C_L = 50\text{pF}$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_1 = 500\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

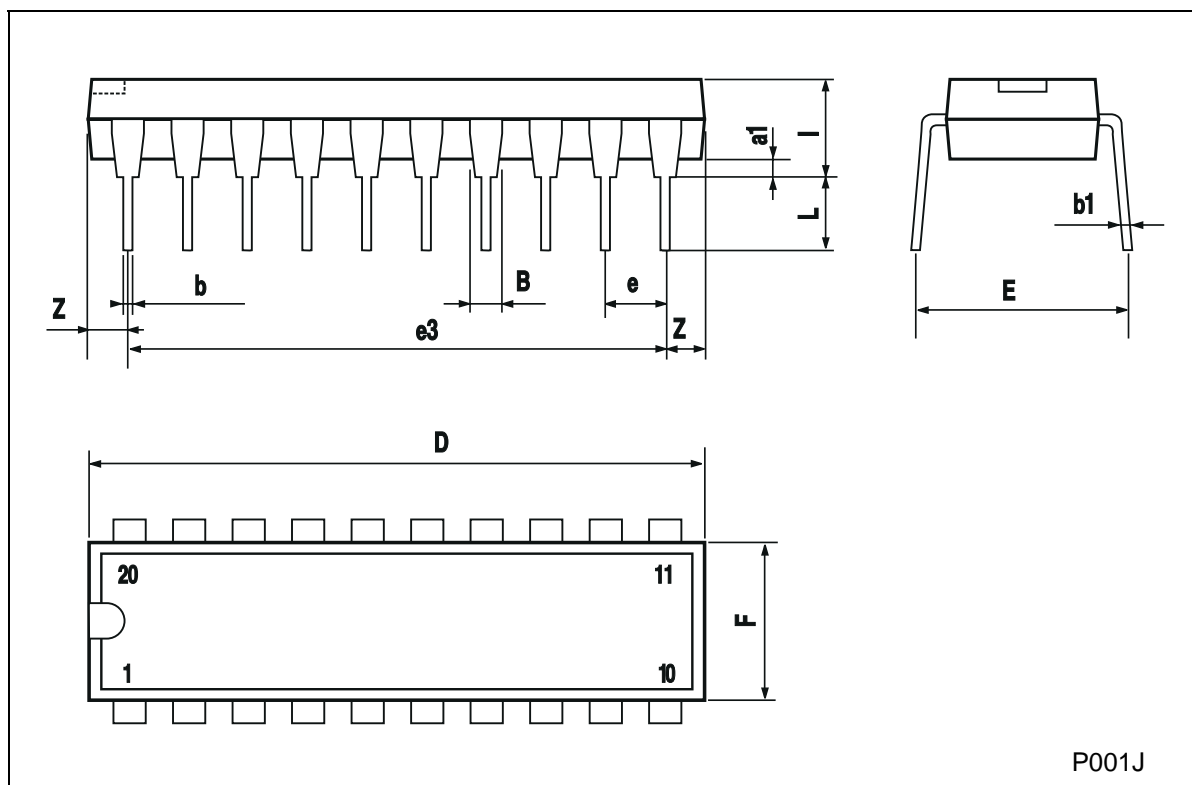
WAVEFORM 1: PROPAGATION DELAYS, SETUP AND HOLD TIMES ( $f=1\text{MHz}$ ; 50% duty cycle)



**WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIMES** ( $f=1\text{MHz}$ ; 50% duty cycle)**WAVEFORM 3: PULSE WIDTH** ( $f=1\text{MHz}$ ; 50% duty cycle)

### Plastic DIP-20 (0.25) MECHANICAL DATA

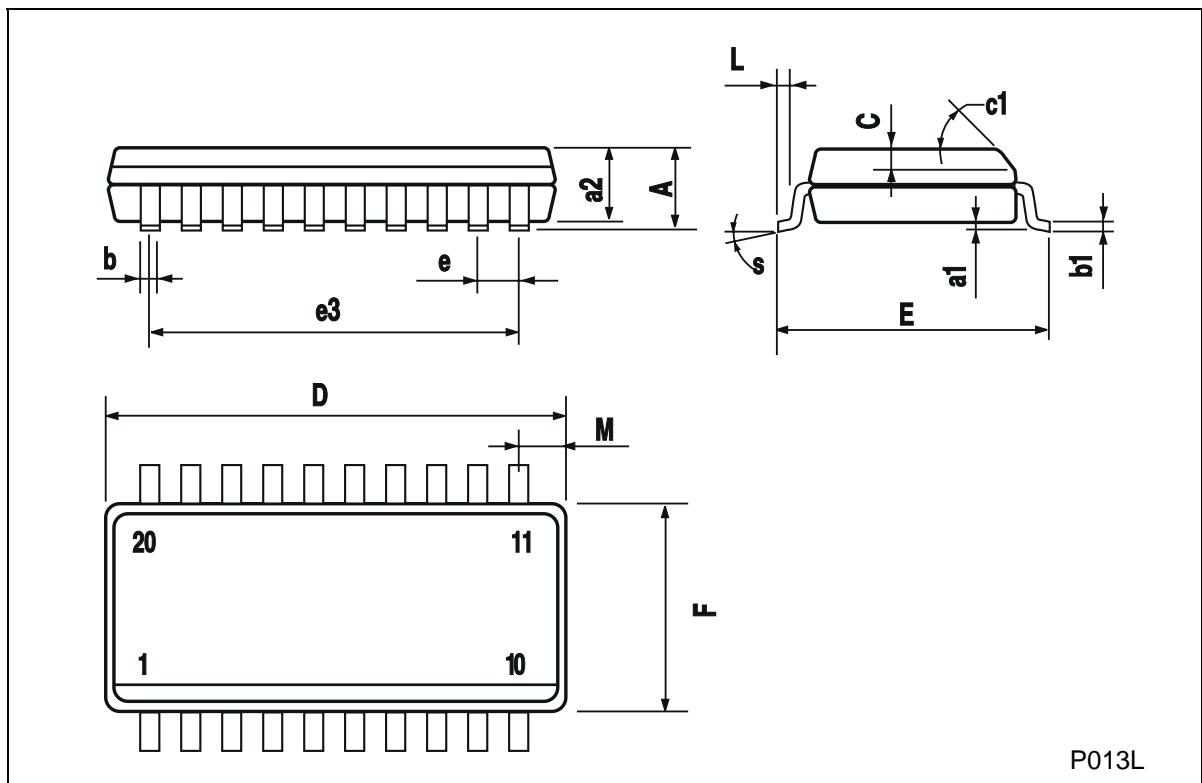
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.45			0.018	
b1		0.25			0.010	
D			25.4			1.000
E		8.5			0.335	
e		2.54			0.100	
e3		22.86			0.900	
F			7.1			0.280
I			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053





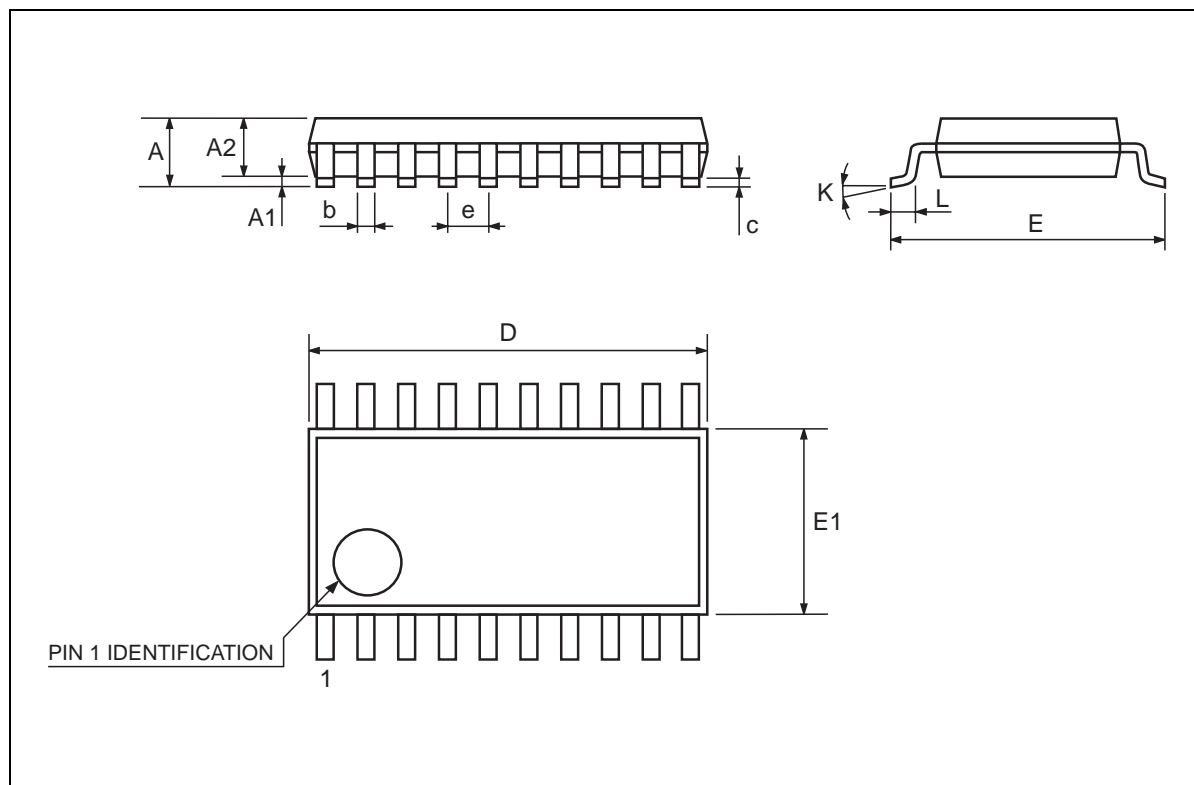
## SO-20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.10		0.20	0.004		0.007
a2			2.45			0.096
b	0.35		0.49	0.013		0.019
b1	0.23		0.32	0.009		0.012
C		0.50			0.020	
c1	45 (typ.)					
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.299
L	0.50		1.27	0.19		0.050
M			0.75			0.029
S	8 (max.)					



## TSSOP20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.1			0.433
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	0.85	0.9	0.95	0.335	0.354	0.374
b	0.19		0.30	0.0075		0.0118
c	0.09		0.2	0.0035		0.0079
D	6.4	6.5	6.6	0.252	0.256	0.260
E	6.25	6.4	6.5	0.246	0.252	0.256
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°	4°	8°	0°	4°	8°
L	0.50	0.60	0.70	0.020	0.024	0.028



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