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OCTAL D-TYPE FLIP FLOP WITH 3 STATE OUTPUTS NON INVERTING

- HIGH SPEED:
 $f_{MAX} = 180 \text{ MHz (TYP.) at } V_{CC} = 3.3\text{V}$
- COMPATIBLE WITH TTL OUTPUTS
- LOW POWER DISSIPATION:
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A=25^\circ\text{C}$
- LOW NOISE:
 $V_{OLP} = 0.5\text{V (TYP.) at } V_{CC} = 3.3\text{V}$
- 75Ω TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OH}| = I_{OL} = 12\text{mA (MIN) at } V_{CC} = 3.0\text{V}$
- PCI BUS LEVELS GUARANTEED AT 24 mA
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE:
 $V_{CC(OPR)} = 2\text{V to } 3.6\text{V (1.2V Data Retention)}$
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 574
- IMPROVED LATCH-UP IMMUNITY

DESCRIPTION

The 74LVQ574 is a low voltage CMOS OCTAL D-TYPE FLIP-FLOP with 3 STATE OUTPUTS NON INVERTING fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. It is ideal for low power and low noise 3.3V applications.

These 8 bit D-Type Flip-Flops are controlled by a clock input (CK) and an output enable input (\overline{OE}). On the positive transition of the clock, the Q

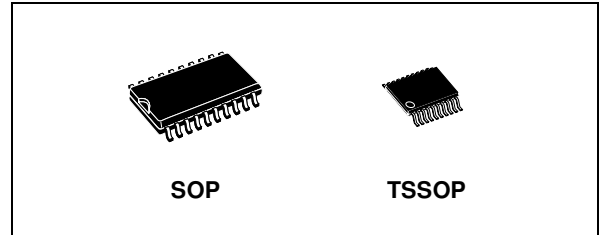


Table 1: Order Codes

PACKAGE	T & R
SOP	74LVQ574MTR
TSSOP	74LVQ574TTR

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) and while 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. In order to enhance PC board layout, the 74LVQ574 offers a pinout having inputs and outputs on opposite side of the package. All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

Figure 1: Pin Connection And IEC Logic Symbols

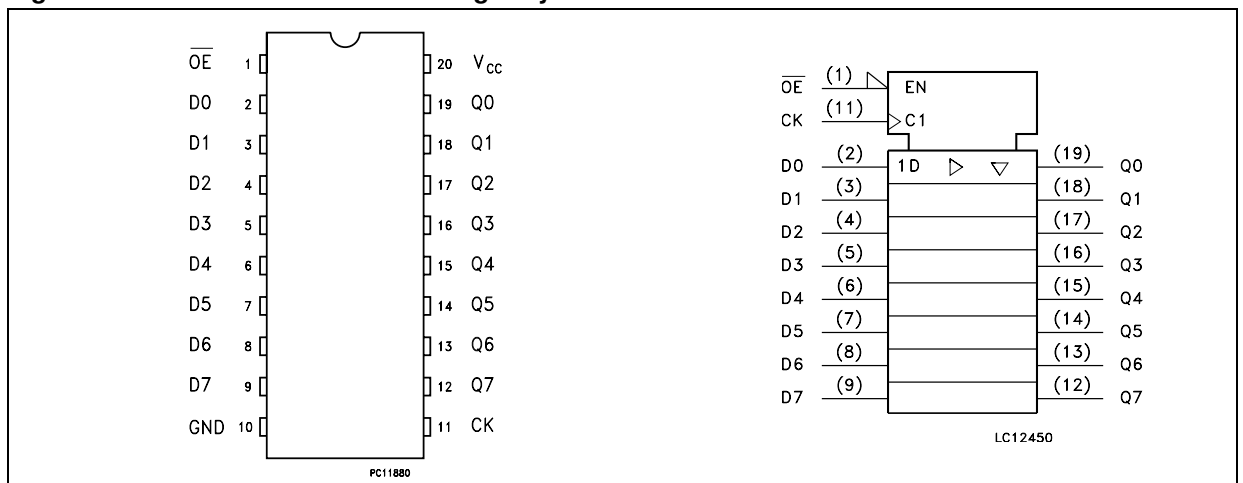


Figure 2: Input And Output Equivalent Circuit

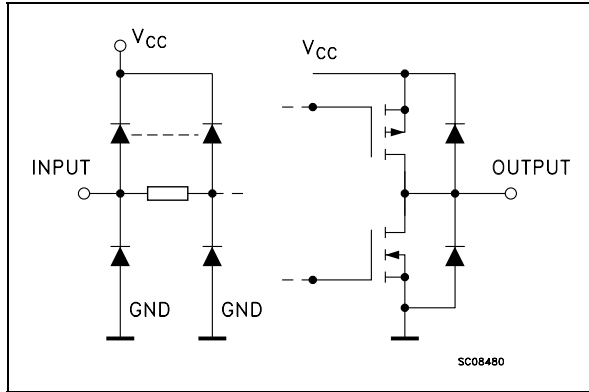


Table 2: Pin Description

PIN N°	SYMBOL	NAME AND FUNCTION
1	\overline{OE}	3-State Output Enable Input (Active LOW)
2, 3, 4, 5, 6, 7, 8, 9	D0 to D7	Data Inputs
12, 13, 14, 15, 16, 17, 18, 19	Q0 to Q7	3-State Outputs
11	CLOCK	Clock Input (LOW-to-HIGH Edge Trigger)
10	GND	Ground (0V)
20	V _{CC}	Positive Supply Voltage

Table 3: 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

Figure 3: Logic Diagram

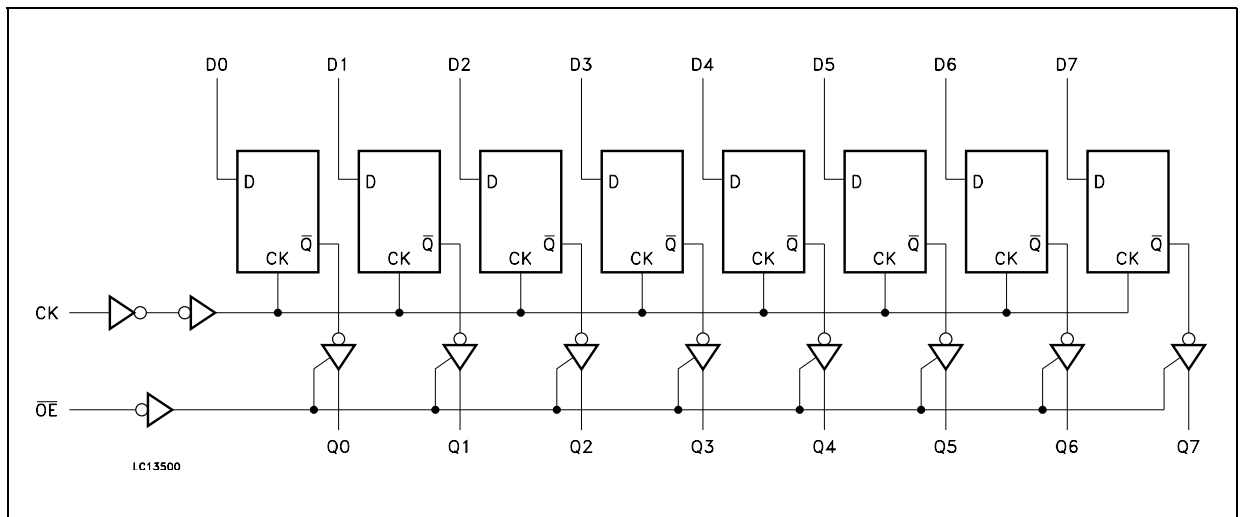


Table 4: Absolute Maximum Ratings

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	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Current	± 50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 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

Table 5: Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage (note 1)	2 to 3.6	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 $V_{CC} = 3.0V$ (note 2)	0 to 10	ns/V

1) Truth Table guaranteed: 1.2V to 3.6V

2) V_{IN} from 0.8V to 2V

Table 6: DC Specifications

Symbol	Parameter	Test Condition		Value						Unit	
		V_{CC} (V)		$T_A = 25^\circ C$			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V_{IH}	High Level Input Voltage	3.0 to 3.6		2.0			2.0		2.0		V
V_{IL}	Low Level Input Voltage				0.8		0.8		0.8		V
V_{OH}	High Level Output Voltage	3.0	$I_O = -50 \mu A$	2.9	2.99		2.9		2.9		V
			$I_O = -12 \text{ mA}$	2.58			2.48		2.48		
			$I_O = -24 \text{ mA}$				2.2		2.2		
V_{OL}	Low Level Output Voltage	3.0	$I_O = 50 \mu A$		0.002	0.1		0.1		0.1	V
			$I_O = 12 \text{ mA}$		0	0.36		0.44		0.44	
			$I_O = 24 \text{ mA}$				0.55		0.55		
I_I	Input Leakage Current	3.6	$V_I = V_{CC}$ or GND			± 0.1		± 1		± 1	μA
I_{OZ}	High Impedance Output Leakage Current	3.6	$V_I = V_{IH}$ or V_{IL} $V_O = V_{CC}$ or GND			± 0.25		± 2.5		± 5.0	μA
I_{CC}	Quiescent Supply Current	3.6	$V_I = V_{CC}$ or GND			4		40		40	μA
I_{OLD}	Dynamic Output Current (note 1, 2)	3.6	$V_{OLD} = 0.8 \text{ V max}$				36		25		mA
I_{OHD}			$V_{OHD} = 2 \text{ V min}$				-25		-25		mA

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

2) Incident wave switching is guaranteed on transmission lines with impedances as low as 75Ω

Table 7: Dynamic Switching Characteristics

Symbol	Parameter	Test Condition		Value						Unit	
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V _{OLP}	Dynamic Low Voltage Quiet Output (note 1, 2)	3.3	C _L = 50 pF		0.5	0.8					V
V _{OLV}				-0.8	-0.6						
V _{IHD}	Dynamic High Voltage Input (note 1, 3)	3.3		2						V	
V _{ILD}	Dynamic Low Voltage Input (note 1, 3)	3.3				0.8					V

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.3V, (n-1) outputs switching and one output at GND.

3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.3V. Inputs under test switching: 3.3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), f=1MHz.

Table 8: AC Electrical Characteristics (C_L = 50 pF, R_L = 500 Ω, Input t_r = t_f = 3ns)

Symbol	Parameter	Test Condition		Value						Unit	
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
t _{PLH} t _{PHL}	Propagation Delay Time CK to Q	2.7			7.4	12.0		14.0		16.0	ns
		3.3(*)			6.1	9.0		10.5		12.0	
t _{PLZ} t _{PHZ}	Output Enable Time	2.7			8.0	12.0		14.0		16.0	ns
		3.3(*)			6.5	9.0		10.5		12.0	
t _{PZL} t _{PZH}	Output Disable Time	2.7			8.0	12.0		14.0		16.0	ns
		3.3(*)			6.5	9.0		10.5		12.0	
t _W	CK Pulse Width HIGH or LOW	2.7		4.0	2.0		4.0		4.0		ns
		3.3(*)		3.0	1.5		3.0		3.0		
t _{sL} t _{sH}	Setup Time D to CK, HIGH or LOW	2.7		3.0	0.0		3.0		3.0		ns
		3.3(*)		2.0	0.0		2.0		2.0		
t _{hL} t _{hH}	Hold Time CK to D, HIGH or LOW	2.7		1.0	0.0		1.0		1.0		ns
		3.3(*)		1.5	0.0		1.5		1.5		
f _{MAX}	Maximum Clock Frequency	2.7		100	150		80		60		MHz
		3.3(*)		120	180		100		80		
t _{OSLH} t _{OSHL}	Output To Output Skew Time (note1, 2)	2.7			0.5	1.0		1.0		1.0	ns
		3.3(*)			0.5	1.0		1.0		1.0	

1) Skew is defined as the absolute value of the difference between the actual propagation delay for any two outputs of the same device switching in the same direction, either HIGH or LOW (t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSHL} = |t_{PHLm} - t_{PHLn}|)

2) Parameter guaranteed by design

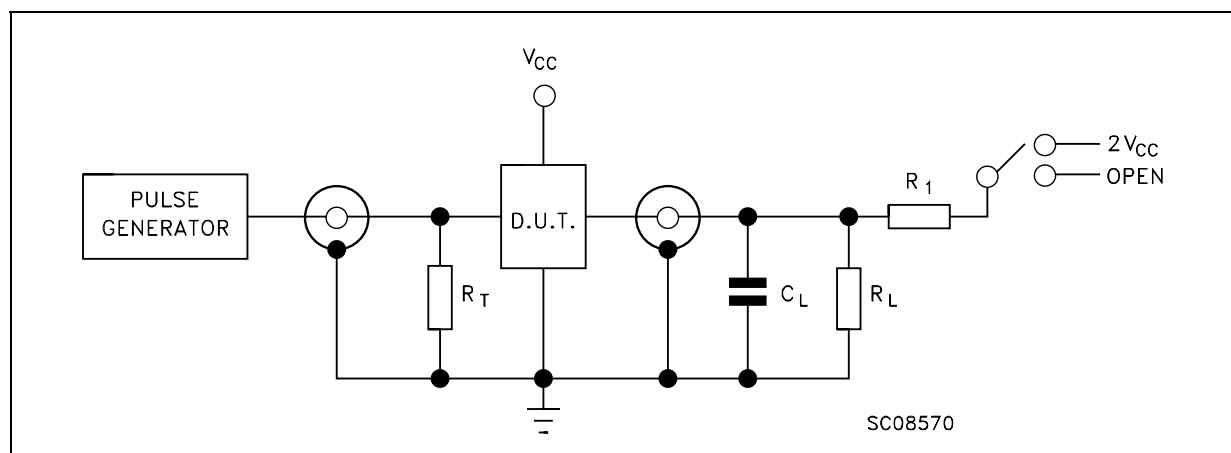
(*) Voltage range is 3.3V ± 0.3V

Table 9: Capacitive Characteristics

Symbol	Parameter	Test Condition		Value						Unit	
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
C _{IN}	Input Capacitance	3.3			4						pF
C _{OUT}	Output Capacitance	3.3			7						pF
C _{PD}	Power Dissipation Capacitance (note 1)	3.3	f _{IN} = 10MHz		15						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(OPR)} = C_{PD} × V_{CC} × f_{IN} + I_{CC}/8 (per Flip Flop)

Figure 4: Test Circuit



TEST	SWITCH
t _{PLH} , t _{PHL}	Open
t _{PZL} , t _{PLZ}	2V _{CC}
t _{PZH} , t _{PHZ}	Open

C_L = 50pF or equivalent (includes jig and probe capacitance)

R_L = R₁ = 500Ω or equivalent

R_T = Z_{OUT} of pulse generator (typically 50Ω)

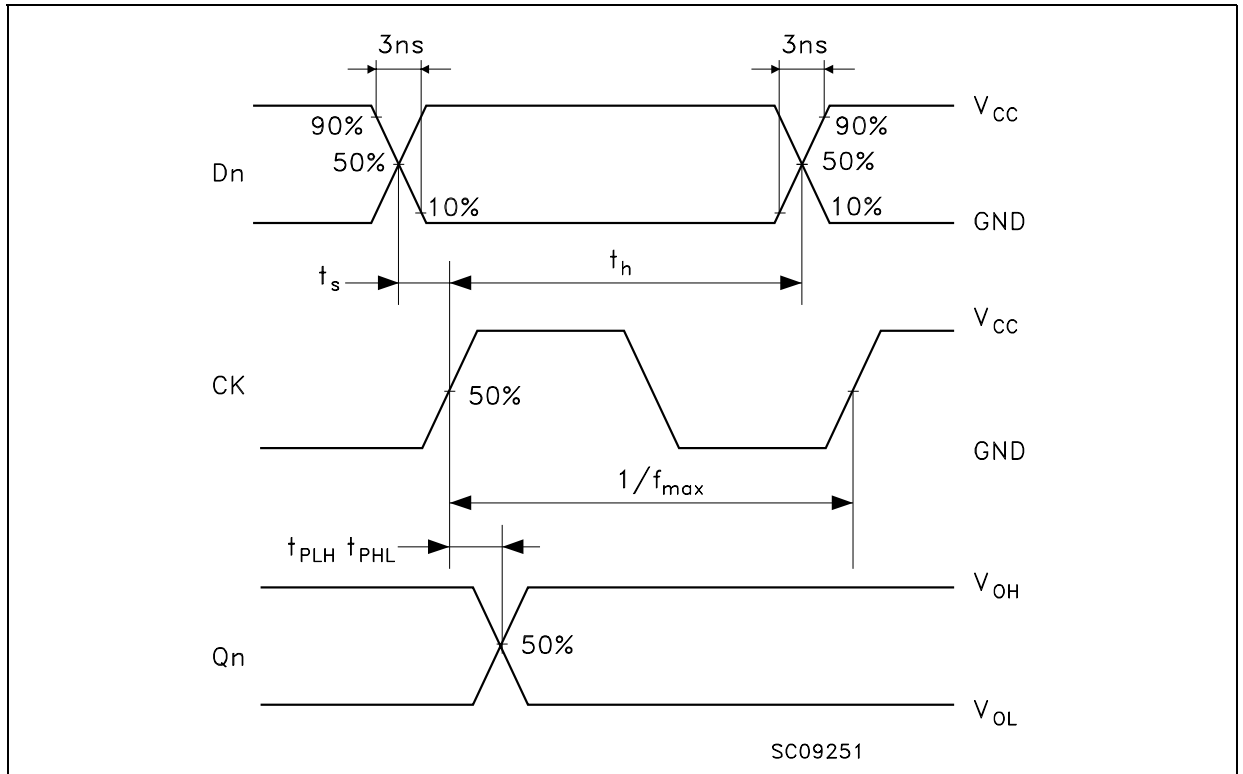
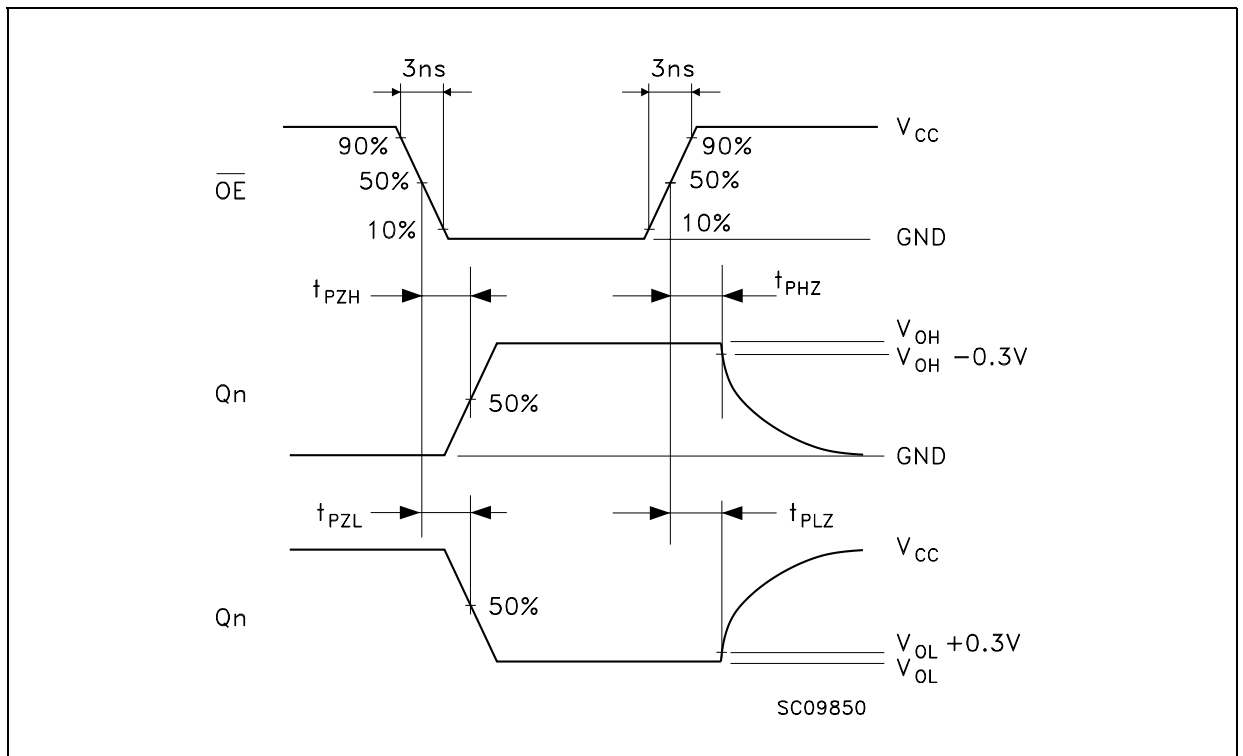
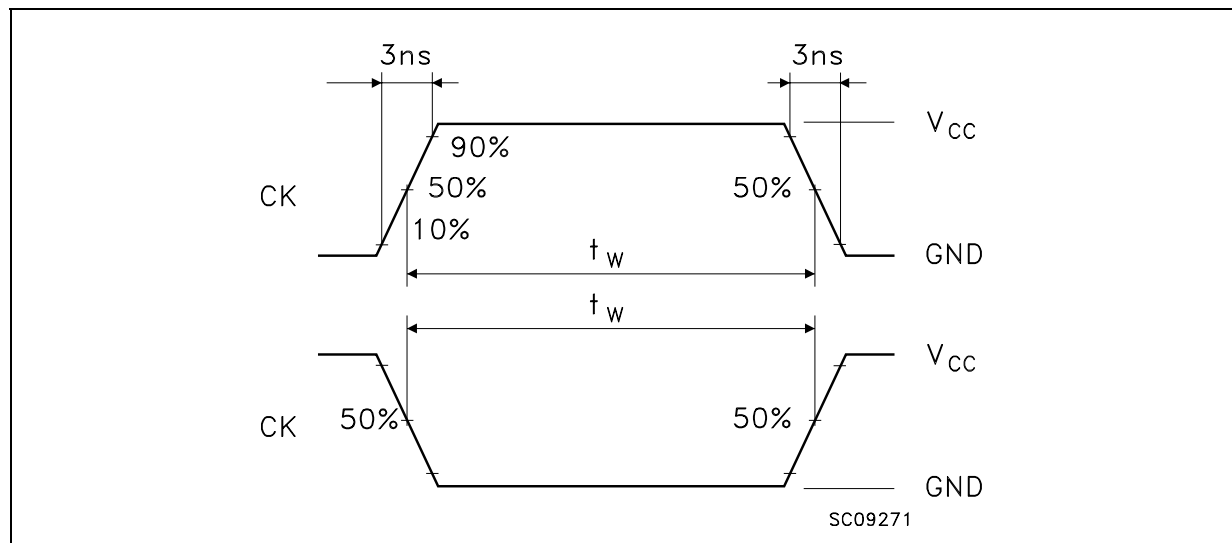
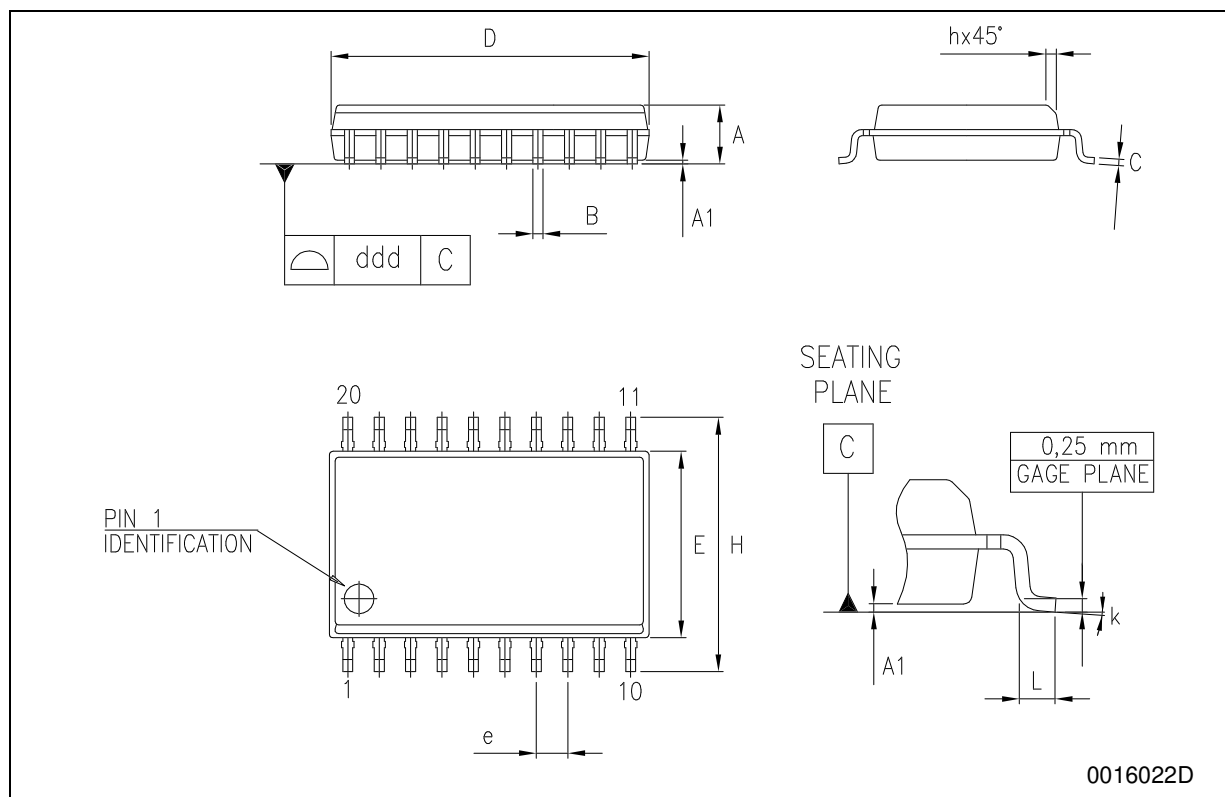
Figure 5: Waveform - Propagation Delays, Setup And Hold Times ($f=1\text{MHz}$; 50% duty cycle)Figure 6: Waveform - Output Enable And Disable Times ($f=1\text{MHz}$; 50% duty cycle)

Figure 7: Waveform - Pulse Width ($f=1\text{MHz}$; 50% duty cycle)

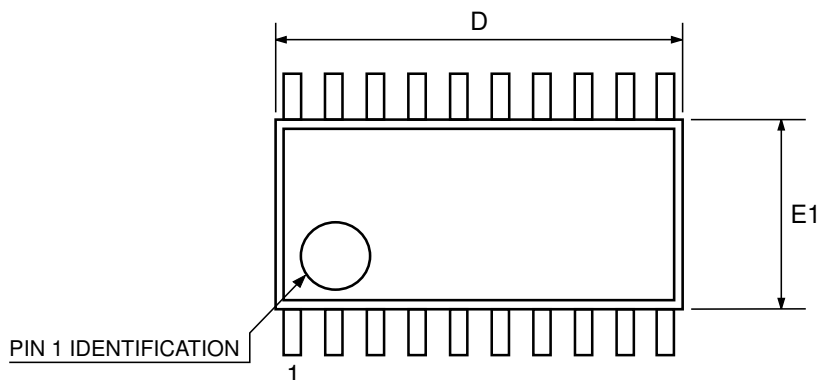
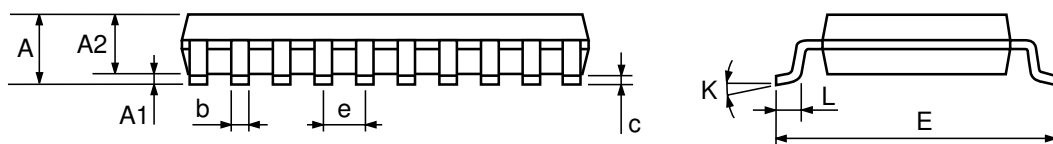
SO-20 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.093		0.104
A1	0.1		0.30	0.004		0.012
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.013
D	12.60		13.00	0.496		0.512
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10.00		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.4		1.27	0.016		0.050
k	0°		8°	0°		8°
ddd			0.100			0.004



TSSOP20 MECHANICAL DATA

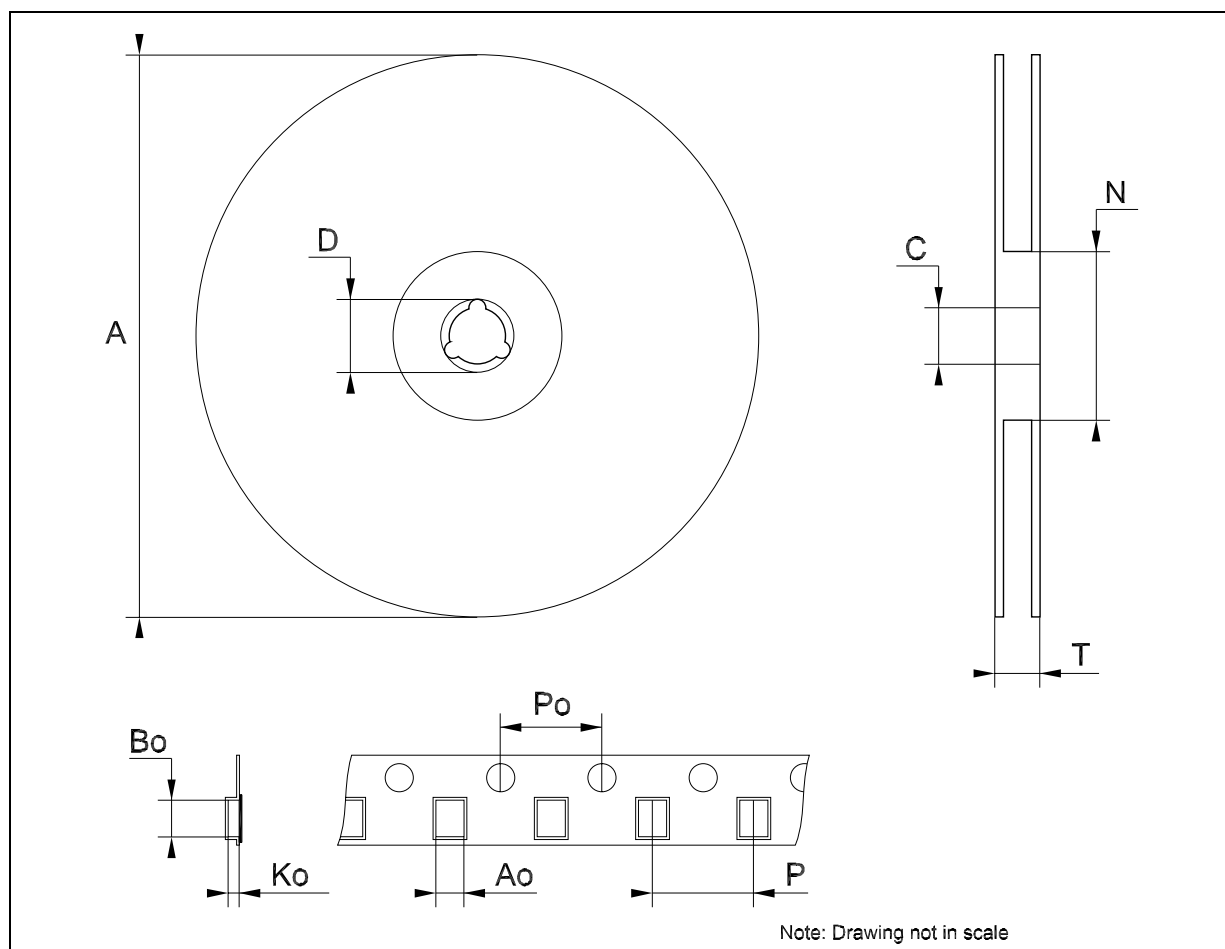
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0079
D	6.4	6.5	6.6	0.252	0.256	0.260
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



0087225C

Tape & Reel SO-20 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			30.4			1.197
Ao	10.8		11	0.425		0.433
Bo	13.2		13.4	0.520		0.528
Ko	3.1		3.3	0.122		0.130
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476



Tape & Reel TSSOP20 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.8		7	0.268		0.276
Bo	6.9		7.1	0.272		0.280
Ko	1.7		1.9	0.067		0.075
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476

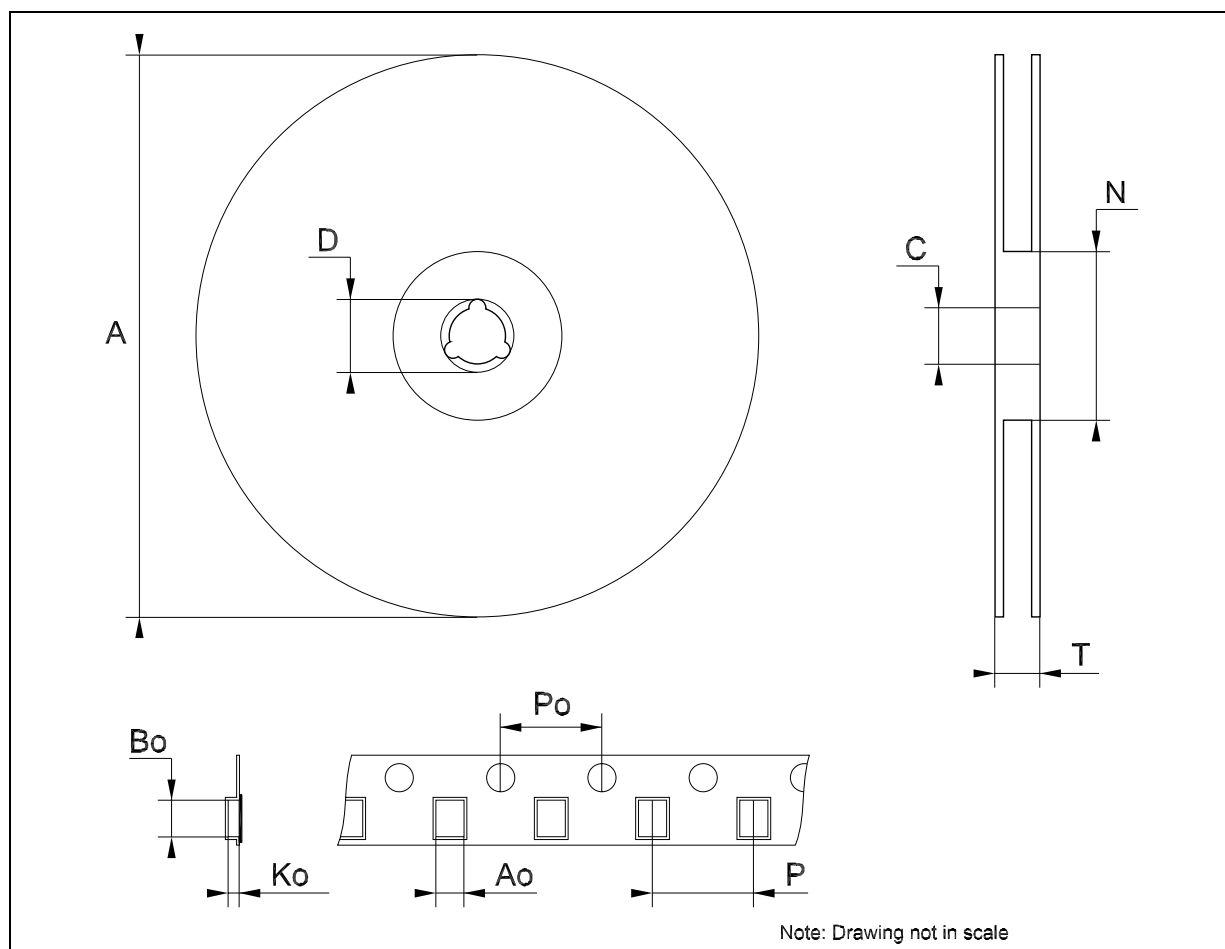


Table 10: Revision History

Date	Revision	Description of Changes
29-Jul-2004	5	Ordering Codes Revision - pag. 1.

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