

OCTAL D-TYPE FLIP FLOP WITH CLEAR

- **HIGH SPEED:**
 $f_{MAX} = 170 \text{ MHz (TYP.) at } V_{CC} = 5V$
- **LOW POWER DISSIPATION:**
 $I_{CC} = 4 \mu A \text{ (MAX.) at } T_A = 25^\circ C$
- **COMPATIBLE WITH TTL OUTPUTS:**
 $V_{IH} = 2V \text{ (MIN.)}, V_{IL} = 0.8V \text{ (MAX)}$
- **POWER DOWN PROTECTION ON INPUTS & OUTPUTS**
- **SYMMETRICAL OUTPUT IMPEDANCE:**
 $|I_{OH}| = I_{OL} = 8 \text{ mA (MIN)}$
- **BALANCED PROPAGATION DELAYS:**
 $t_{PLH} \cong t_{PHL}$
- **OPERATING VOLTAGE RANGE:**
 $V_{CC(OPR)} = 4.5V \text{ to } 5.5V$
- **PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 273**
- **IMPROVED LATCH-UP IMMUNITY**
- **LOW NOISE:** $V_{OLP} = 0.9V \text{ (MAX.)}$

DESCRIPTION

The 74VHCT273A is an advanced high-speed CMOS OCTAL D-TYPE FLIP FLOP WITH CLEAR fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS technology. Information signals applied to D inputs are transferred to the Q outputs on the positive going

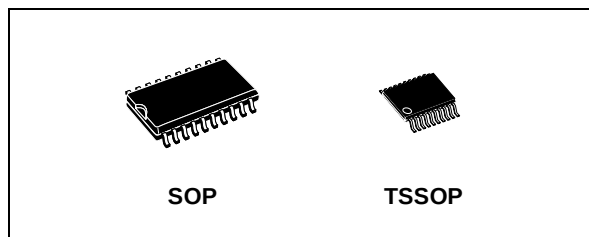


Table 1: Order Codes

PACKAGE	T & R
SOP	74VHCT273AMTR
TSSOP	74VHCT273ATTR

edge of the clock pulse.

When the **CLEAR** input is held low, the Q outputs are held low independently of the other inputs.

Power down protection is provided on all inputs and outputs and 0 to 7V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5V to 3V since all inputs are equipped with TTL threshold.

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

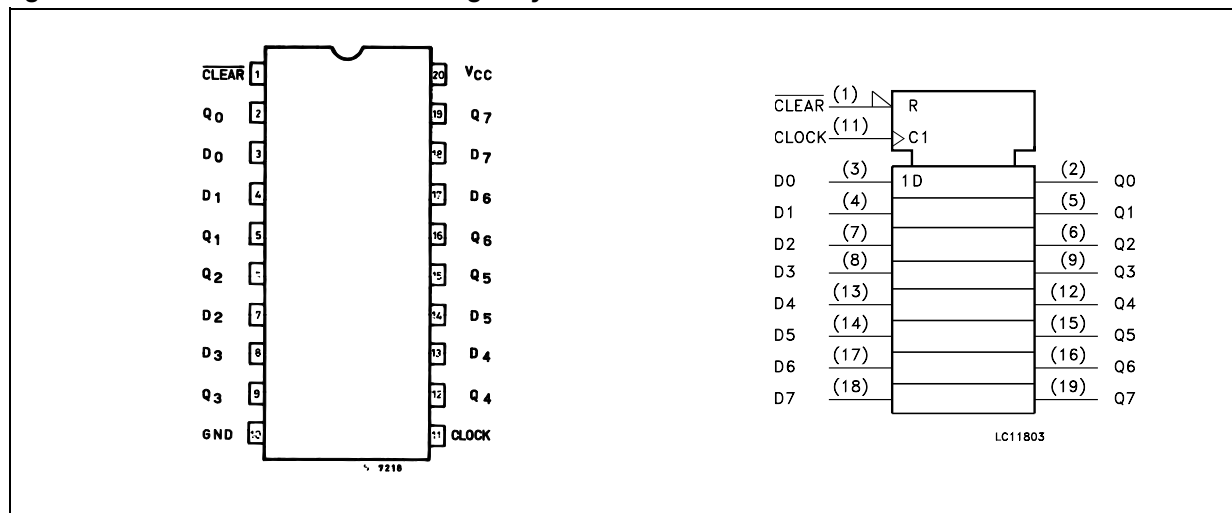


Figure 2: Input Equivalent Circuit

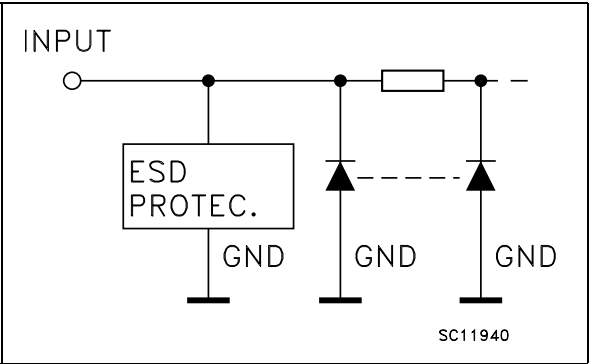


Table 2: Pin Description

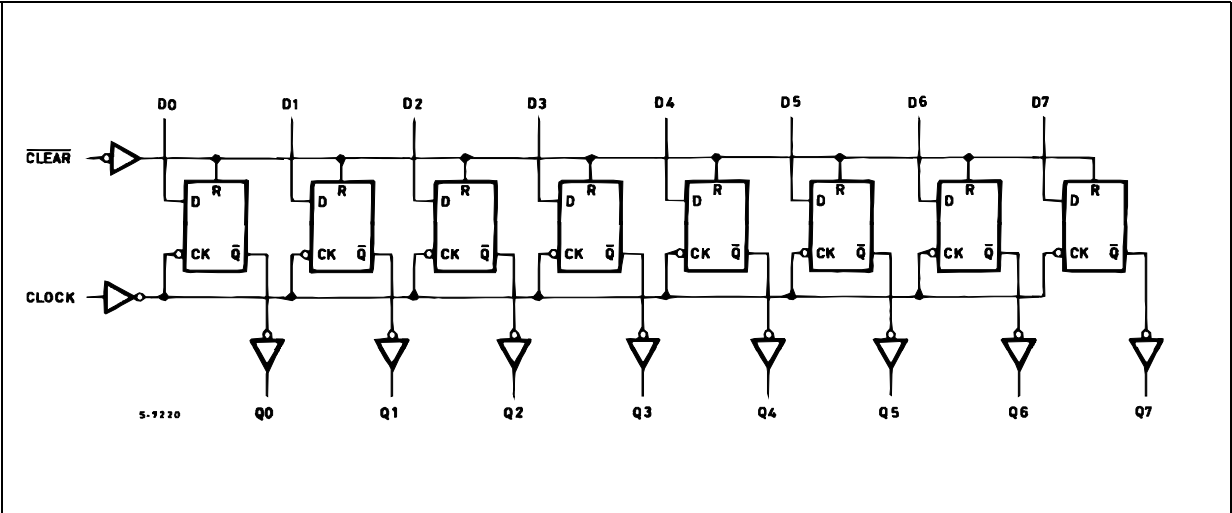
PIN N°	SYMBOL	NAME AND FUNCTION
1	CLEAR	Asynchronous Master Reset (Active LOW)
2, 5, 6, 9, 12, 15, 16,19	Q0 to Q7	Flip-Flop Outputs
3, 4, 7, 8, 13, 14, 17, 18	D0 to D7	Data Inputs
11	CLOCK	Clock Input (LOW-to-HIGH Edge Triggered)
10	GND	Ground (0V)
20	V _{CC}	Positive Supply Voltage

Table 3: Truth Table

INPUTS			OUTPUT	FUNCTION
CLEAR	D	CLOCK	Q	
L	X	X	L	CLEAR
H	L		L	
H	H		H	
H	X		Q _n	NO CHANGE

X: Don't care

Table 4: Logic Diagram



This logic diagram has not be used to estimate propagation delays

Table 5: Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to +7.0	V
V_I	DC Input Voltage	-0.5 to +7.0	V
V_O	DC Output Voltage (see note 1)	-0.5 to +7.0	V
V_O	DC Output Voltage (see note 2)	-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	± 25	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 50	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

1) $V_{CC} = 0V$

2) High or Low State

Table 6: Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	4.5 to 5.5	V
V_I	Input Voltage	0 to 5.5	V
V_O	Output Voltage (see note 1)	0 to 5.5	V
V_O	Output Voltage (see note 2)	0 to V_{CC}	V
T_{op}	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time (see note 3) ($V_{CC} = 5.0 \pm 0.5V$)	0 to 20	ns/V

1) $V_{CC} = 0V$

2) High or Low State

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

Table 7: DC Specifications

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 _{IH}	High Level Input Voltage	4.5 to 5.5		2			2		2		V
V _{IL}	Low Level Input Voltage	4.5 to 5.5				0.8		0.8		0.8	V
V _{OH}	High Level Output Voltage	4.5	I _O =-50 μA	4.4	4.5		4.4		4.4		V
		4.5	I _O =-8 mA	3.94			3.8		3.7		
V _{OL}	Low Level Output Voltage	4.5	I _O =50 μA		0.0	0.1		0.1		0.1	V
		4.5	I _O =8 mA			0.36		0.44		0.55	
I _I	Input Leakage Current	0 to 5.5	V _I = 5.5V or GND			± 0.1		± 1.0		± 1.0	μA
I _{CC}	Quiescent Supply Current	5.5	V _I = V _{CC} or GND			4		40		40	μA
+I _{CC}	Additional Worst Case Supply Current	5.5	One Input at 3.4V, other input at V _{CC} or GND			1.35		1.5		1.5	mA
I _{OPD}	Output Leakage Current	0	V _{OUT} = 5.5V			0.5		5.0		5.0	μA

Table 8: AC Electrical Characteristics (Input t_r = t_f = 3ns)

Symbol	Parameter	Test Condition			Value						Unit	
		V _{CC} (V)	C _L (pF)		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 CLOCK to Q	5.0 ^(**)	15			5.8	8.2	1.0	10.0	1.0	10.0	ns
		5.0 ^(**)	50			6.8	9.2	1.0	11.0	1.0	11.0	
t _{PHL}	Propagation Delay Time CLEAR to Q	5.0 ^(**)	15			7.5	10.0	1.0	11.6	1.0	11.6	ns
		5.0 ^(**)	50			8.5	11.0	1.0	12.6	1.0	12.6	
t _W	CLR Pulse Width LOW	5.0 ^(**)			5.0			5.0		5.0		ns
t _W	CK Pulse Width HIGH or LOW	5.0 ^(**)			5.0			5.0		5.0		ns
t _s	Setup Time D to CLOCK, HIGH or LOW	5.0 ^(**)			2.0			2.0		2.0		ns
t _h	Hold Time D to CK, HIGH or LOW	5.0 ^(**)			2.0			2.0		2.0		ns
t _{REM}	Removal Time CLR to CLOCK	5.0 ^(**)			1.0			1.0		1.0		ns
f _{MAX}	Maximum Clock Frequency	5.0 ^(**)	15		75	170		65		65		MHz
		5.0 ^(**)	50		50	160		45		45		
t _{OSLH} t _{OSHL}	Output to Output Skew time (note 1)	5.0 ^(**)	50				1.0		1.0		1.0	ns

(*) Voltage range is 5.0V ± 0.5V

Note 1: Parameter guaranteed by design. t_{soLH} = |t_{pLHm} - t_{pLHn}|, t_{soHL} = |t_{pHLm} - t_{pHLn}|

Table 9: Capacitive Characteristics

Symbol	Parameter	Test Condition	Value						Unit	
			T _A = 25°C			-40 to 85°C		-55 to 125°C		
		Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
C _{IN}	Input Capacitance			6	10		10		10	pF
C _{PD}	Power Dissipation Capacitance (note 1)			16						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. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$ (per Flip-Flop)

Table 10: Dynamic Switching Characteristics

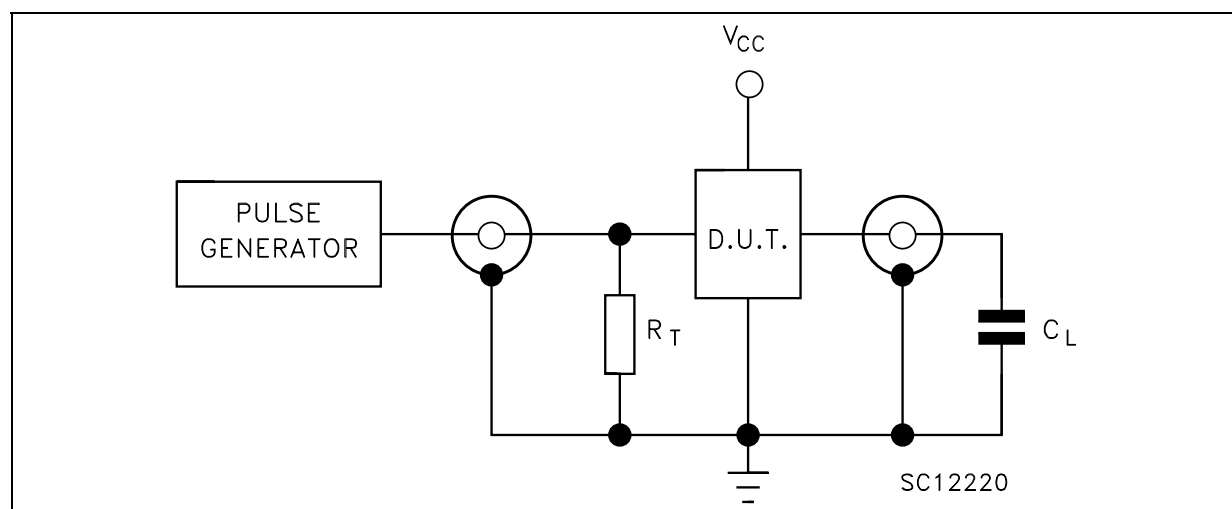
Symbol	Parameter	Test Condition		Value						Unit	
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V _{OLP}	Dynamic Low Voltage Quiet Output (note 1, 2)	5.0	C _L = 50 pF		0.6	0.9					V
V _{OLV}				-0.9	-0.6						
V _{IHD}	Dynamic High Voltage Input (note 1, 3)	5.0		2.0							
V _{ILD}	Dynamic Low Voltage Input (note 1, 3)	5.0				0.8					

1) Worst case package.

2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.0V, (n-1) outputs switching and one output at GND.

3) Max number of data inputs (n) switching. (n-1) switching 0V to 3.0V. Inputs under test switching: 3.0V to threshold (V_{ILD}), 0V to threshold (V_{IHD}), $f=1\text{MHz}$.

Figure 3: Test Circuit



$C_L = 15/50\text{pF}$ or equivalent (includes jig and probe capacitance)
 $R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

Figure 4: Waveform - Propagation Delays, Setup And Hold Times (f=1MHz; 50% duty cycle)

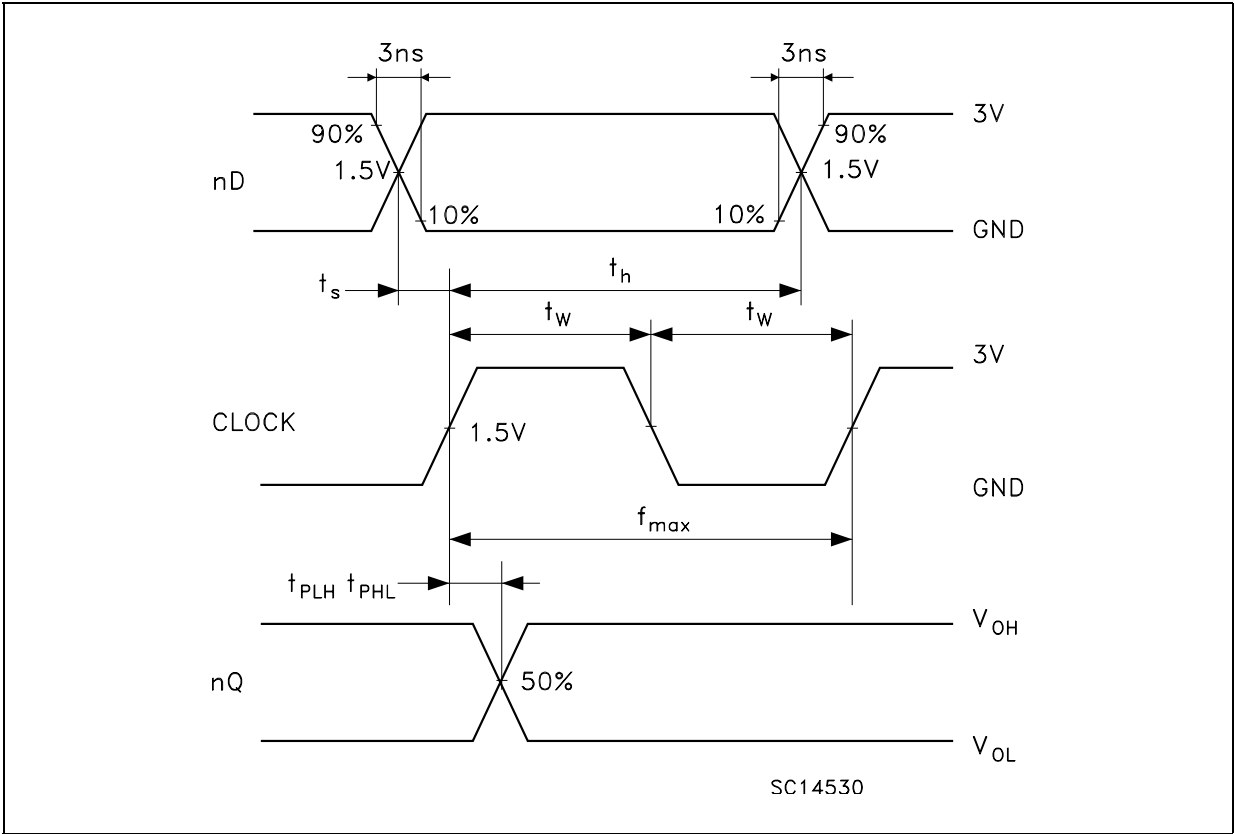


Figure 5: Waveform - Propagation Delays (f=1MHz; 50% duty cycle)

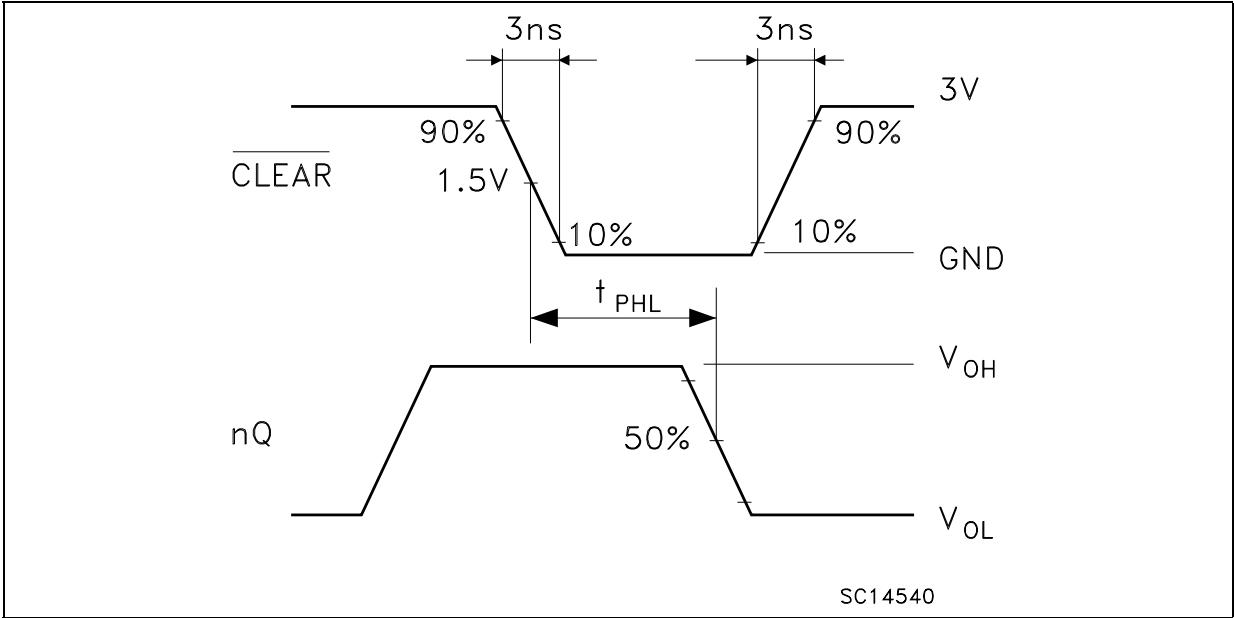
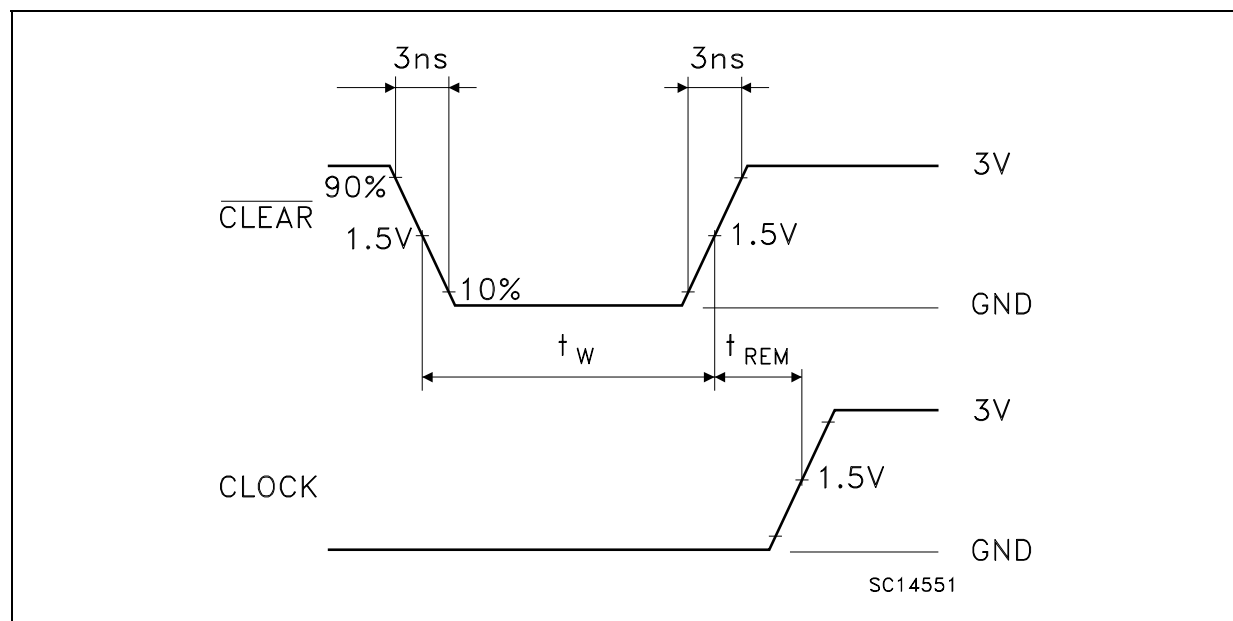


Figure 6: Waveform - Recovery Time ($f=1\text{MHz}$; 50% duty cycle)

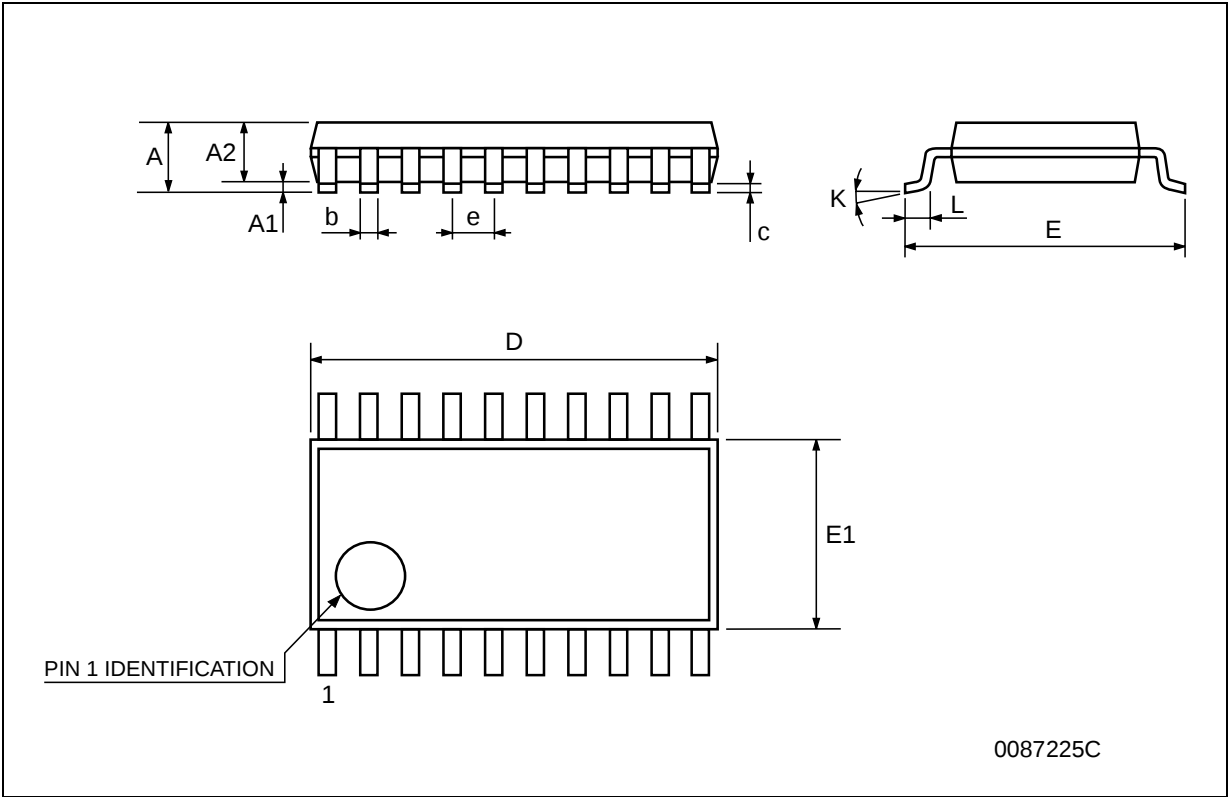
SO-20 MECHANICAL DATA

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



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 11: Revision History

Date	Revision	Description of Changes
16-Dec-2004	3	Order Codes Revision - pag. 1.

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