



**THE DATASHEET OF  
M74HC563RM13TR**

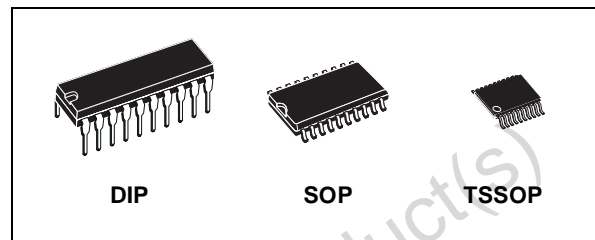




# M74HC563

## OCTAL D-TYPE LATCH WITH 3 STATE OUTPUT INVERTING

- HIGH SPEED:  
 $t_{PD} = 13\text{ns}$  (TYP.) at  $V_{CC} = 6\text{V}$
- 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.)
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 6\text{mA}$  (MIN)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE:  
 $V_{CC}$  (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 563



### ORDER CODES

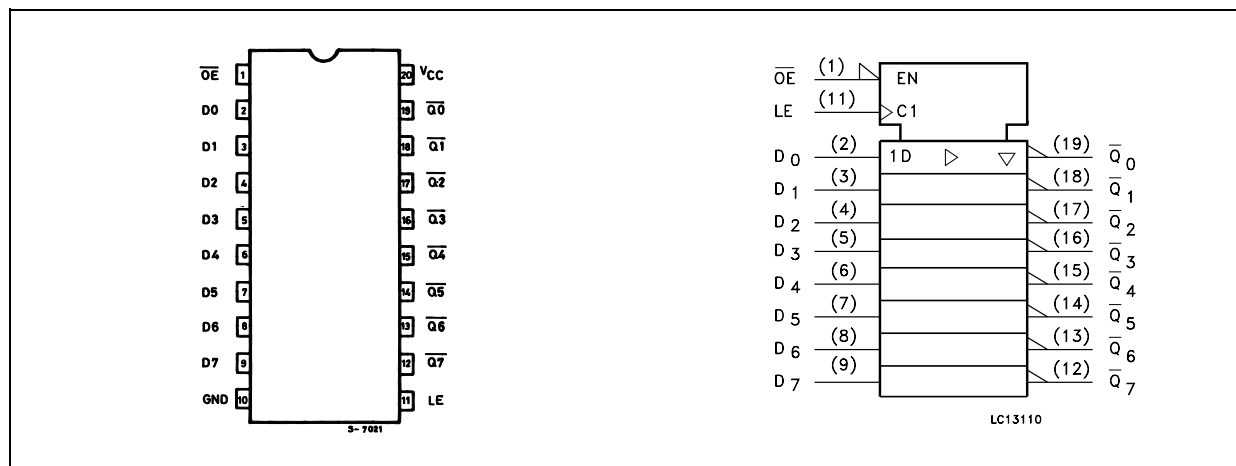
PACKAGE	TUBE	T & R
DIP	M74HC563B1R	
SOP	M74HC563M1R	M74HC563RM13TR
TSSOP		M74HC563TTR

### DESCRIPTION

The M74HC563 is an high speed CMOS OCTAL LATCH WITH 3-STATE OUTPUTS fabricated with silicon gate C<sup>2</sup>MOS technology. This 8-BIT D-Type latches is controlled by a latch enable input (LE) and output enable input (OE). While the LE input is held at a high level, the Q outputs will follow the data input inversely. When the LE is taken, the Q outputs will be latched inversely at the logic level of D input data.

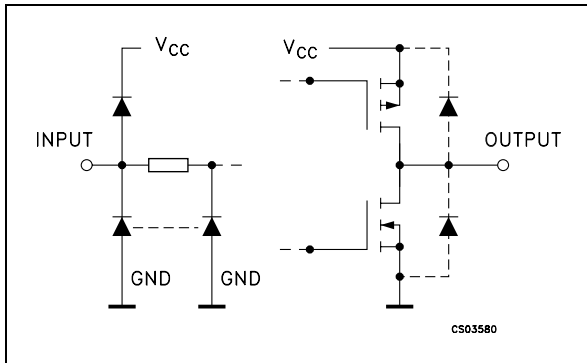
While the  $\overline{OE}$  input is at low level, the eight outputs will be in a normal logic state (high or low logic level) and while  $\overline{OE}$  is in high level the outputs will be in a high impedance state. The 3-State output configuration and the wide choice of outline make bus organized system simple. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



# M74HC563

## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

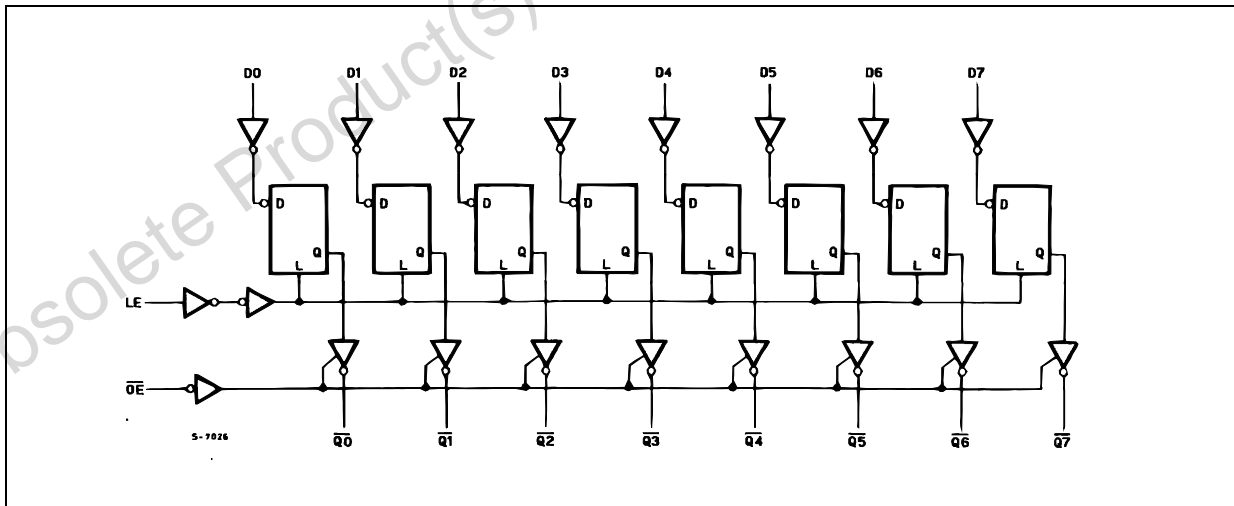
PIN No	SYMBOL	NAME AND FUNCTION
1	$\overline{OE}$	3 State Output Enable Input (Active LOW)
2, 3, 4, 5, 6, 7, 8, 9	D0 to D7	Data Inputs
12, 13, 14, 15, 16, 17, 18, 19	Q0 to Q7	3 State Latch Outputs
11	LE	Latch Enable Input
10	GND	Ground (0V)
20	V <sub>CC</sub>	Positive Supply Voltage

## TRUTH TABLE

INPUTS			OUTPUTS
$\overline{OE}$	LE	D	$\overline{Q}$
H	X	X	Z
L	L	X	NO CHANGE (*)
L	H	L	H
L	H	H	L

X: Don't Care  
 Z: High Impedance  
 (\*): Q outputs are latched at the time when the LE input is taken low logic level.

## LOGIC DIAGRAM



**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	$\pm 35$	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current	$\pm 70$	mA
$P_D$	Power Dissipation	500(*)	mW
$T_{stg}$	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

(\*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 65°C to 85°C

**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	
$t_r, t_f$	Input Rise and Fall Time	$V_{CC} = 2.0V$	0 to 1000	ns
		$V_{CC} = 4.5V$	0 to 500	ns
		$V_{CC} = 6.0V$	0 to 400	ns

## 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	2.0		1.5			1.5		1.5		V
		4.5		3.15			3.15		3.15		
		6.0		4.2			4.2		4.2		
V <sub>IL</sub>	Low Level Input Voltage	2.0				0.5		0.5		0.5	V
		4.5				1.35		1.35		1.35	
		6.0				1.8		1.8		1.8	
V <sub>OH</sub>	High Level Output Voltage	2.0	I <sub>O</sub> =-20 μA	1.9	2.0		1.9		1.9		V
		4.5	I <sub>O</sub> =-20 μA	4.4	4.5		4.4		4.4		
		6.0	I <sub>O</sub> =-20 μA	5.9	6.0		5.9		5.9		
		4.5	I <sub>O</sub> =-6.0 mA	4.18	4.31		4.13		4.10		
		6.0	I <sub>O</sub> =-7.8 mA	5.68	5.8		5.63		5.60		
V <sub>OL</sub>	Low Level Output Voltage	2.0	I <sub>O</sub> =20 μA		0.0	0.1		0.1		0.1	V
		4.5	I <sub>O</sub> =20 μA		0.0	0.1		0.1		0.1	
		6.0	I <sub>O</sub> =20 μA		0.0	0.1		0.1		0.1	
		4.5	I <sub>O</sub> =6.0 mA		0.17	0.26		0.33		0.40	
		6.0	I <sub>O</sub> =7.8 mA		0.18	0.26		0.33		0.40	
I <sub>I</sub>	Input Leakage Current	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND			± 0.1		± 1		± 1	μA
I <sub>OZ</sub>	High Impedance Output Leakage Current	6.0	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	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND			4		40		80	μA

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

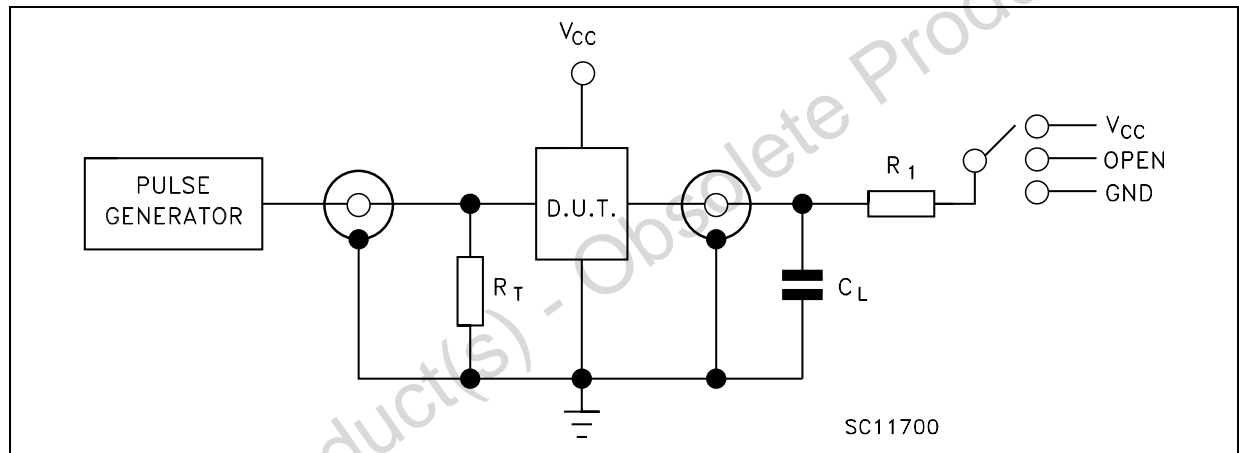
Symbol	Parameter	Test Condition			Value						Unit	
		$V_{CC}$ (V)	$C_L$ (pF)		$T_A = 25^\circ\text{C}$			$-40$ to $85^\circ\text{C}$		$-55$ to $125^\circ\text{C}$		
					Min.	Typ.	Max.	Min.	Max.	Min.		Max.
$t_{TLH}$ $t_{THL}$	Output Transition Time	2.0	50			25	60		75		90	ns
		4.5			7	12		15		18		
		6.0			6	10		13		15		
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time (LE - $\bar{Q}$ )	2.0	50			50	115		145		175	ns
		4.5			15	23		29		35		
		6.0			13	20		25		30		
		2.0	150			60	155		195		235	ns
		4.5			20	31		39		47		
		6.0			17	26		33		40		
$t_{PLH}$ $t_{PHL}$	Propagation Delay Time (D - $\bar{Q}$ )	2.0	50			42	110		140		165	ns
		4.5			14	22		28		33		
		6.0			12	19		24		28		
		2.0	150			57	150		190		225	ns
		4.5			19	30		38		45		
		6.0			16	26		32		38		
$t_{PZL}$ $t_{PZH}$	High Impedance Output Enable Time	2.0	50	$R_L = 1\text{ K}\Omega$		55	140		175		210	ns
		4.5				17	28		35		42	
		6.0				14	24		30		36	
		2.0	150	$R_L = 1\text{ K}\Omega$		66	180		225		270	ns
		4.5				22	36		45		54	
		6.0				19	31		38		46	
$t_{PLZ}$ $t_{PHZ}$	High Impedance Output Disable Time	2.0	50	$R_L = 1\text{ K}\Omega$		40	125		155		190	ns
		4.5				17	25		31		38	
		6.0				15	21		26		32	
$t_{W(L)}$ $t_{W(H)}$	Minimum Pulse Width	2.0	50			40	75		95		110	ns
		4.5			8	15		19		22		
		6.0			7	13		16		19		
$t_s$	Minimum Set-up Time	2.0	50			16	50		65		75	ns
		4.5			5	10		13		15		
		6.0			3	9		11		13		
$t_h$	Minimum Hold Time	2.0	50				5		5		5	ns
		4.5				5		5		5		
		6.0				5		5		5		

**CAPACITIVE CHARACTERISTICS**

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.
C <sub>IN</sub>	Input Capacitance					5	10		10		10	pF
C <sub>OUT</sub>	Output Capacitance					10						pF
C <sub>PD</sub>	Power Dissipation Capacitance (note 1)					49						pF

1) C<sub>PD</sub> 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<sub>CC(opr)</sub> = C<sub>PD</sub> × V<sub>CC</sub> × f<sub>IN</sub> + I<sub>CC</sub>/8 (per Flip Flop) and the C<sub>PD</sub> when n pcs of Flip Flop operate, can be gained by the following equation: C<sub>PD(TOTAL)</sub> = 33 + 16 × n (pF)

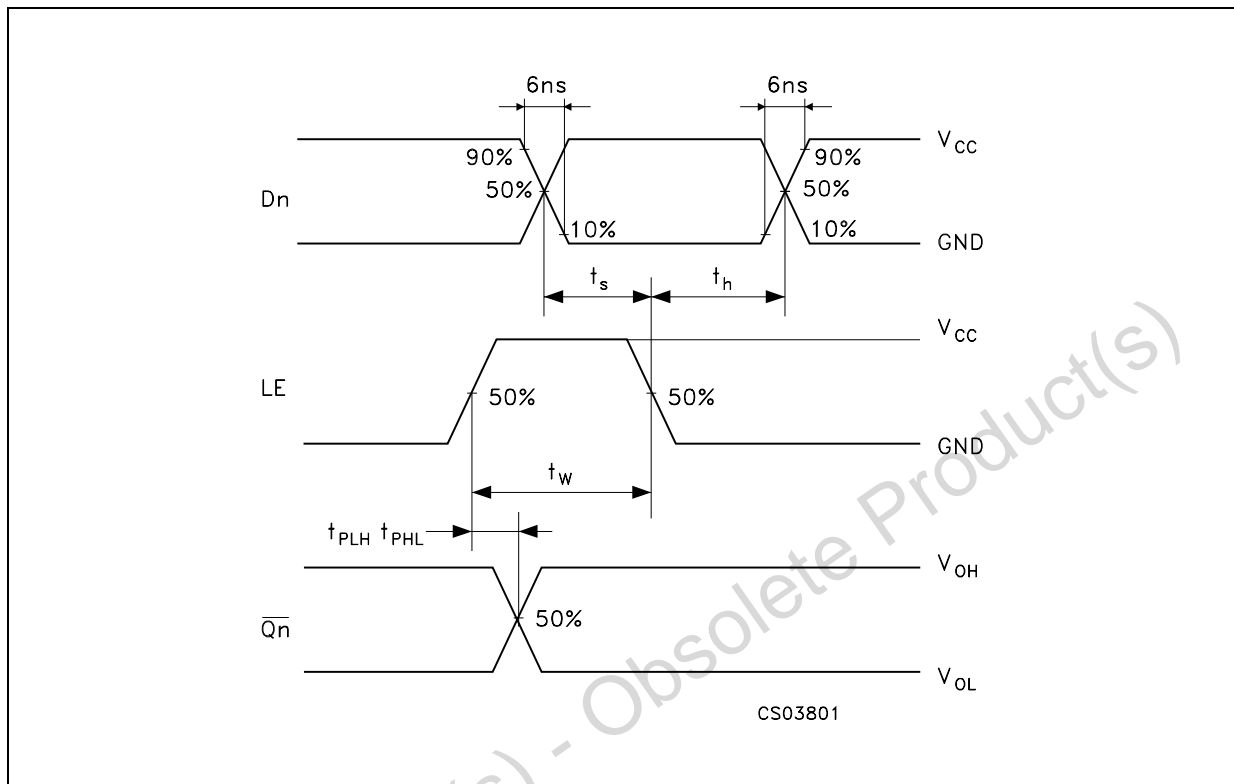
**TEST CIRCUIT**



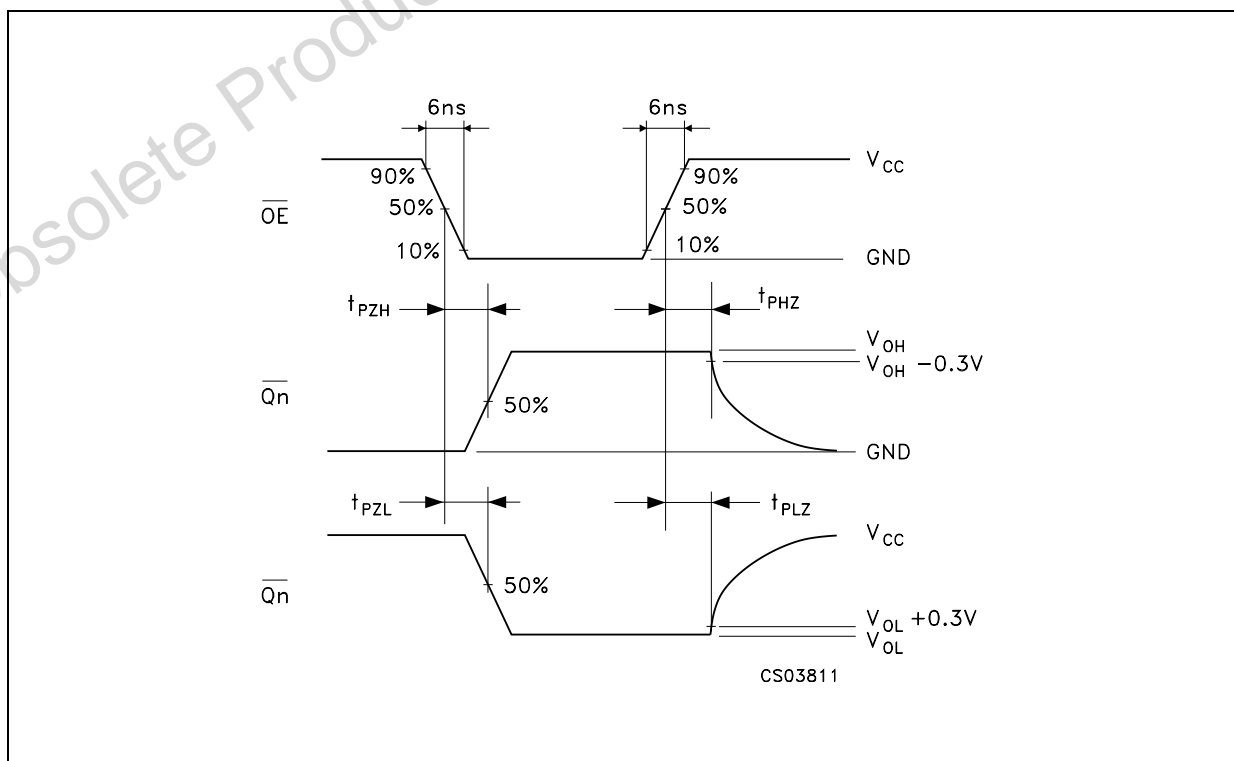
TEST	SWITCH
t <sub>PLH</sub> , t <sub>PHL</sub>	Open
t <sub>PZL</sub> , t <sub>PLZ</sub>	V <sub>CC</sub>
t <sub>PZH</sub> , t <sub>PHZ</sub>	GND

C<sub>L</sub> = 50pF/150pF or equivalent (includes jig and probe capacitance)  
 R<sub>1</sub> = 1KΩ or equivalent  
 R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω)

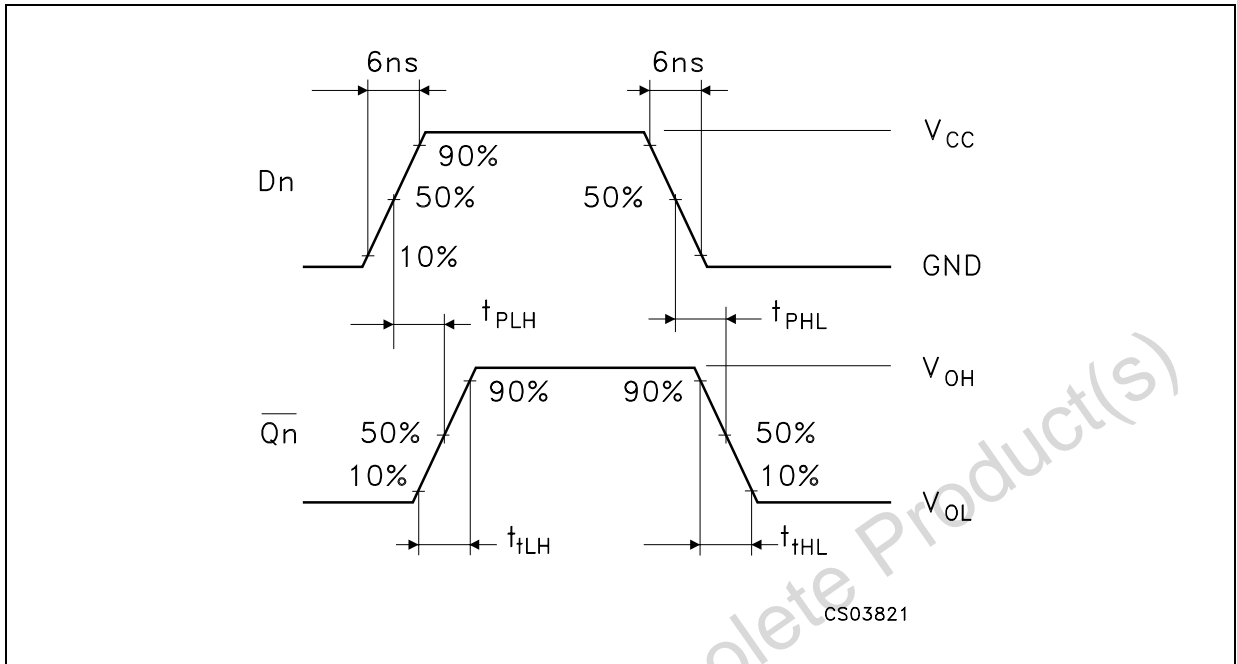
**WAVEFORM 1: LE TO Qn PROPAGATION DELAYS, LE MINIMUM PULSE WIDTH, Dn TO LE SETUP AND HOLD TIMES (f=1MHz; 50% duty cycle)**



**WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIMES (f=1MHz; 50% duty cycle)**

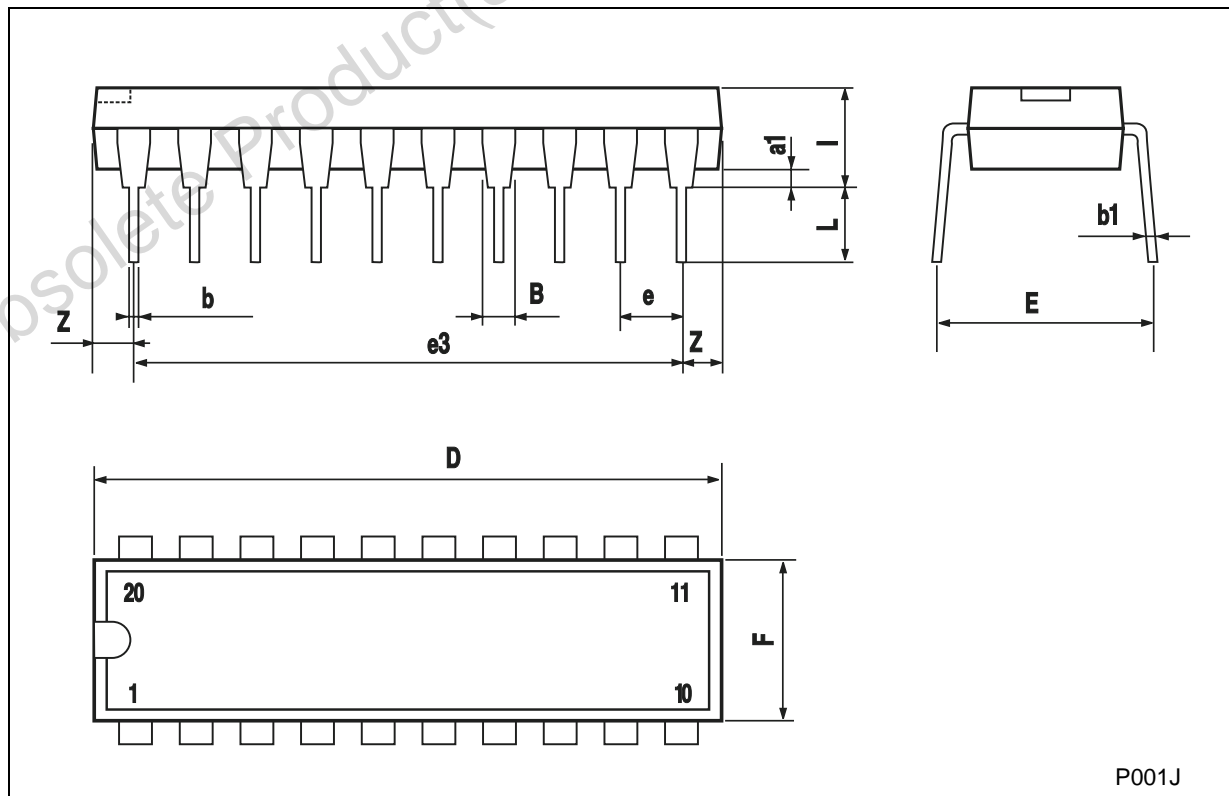


WAVEFORM 3: PROPAGATION DELAY TIMES (f=1MHz; 50% duty cycle)



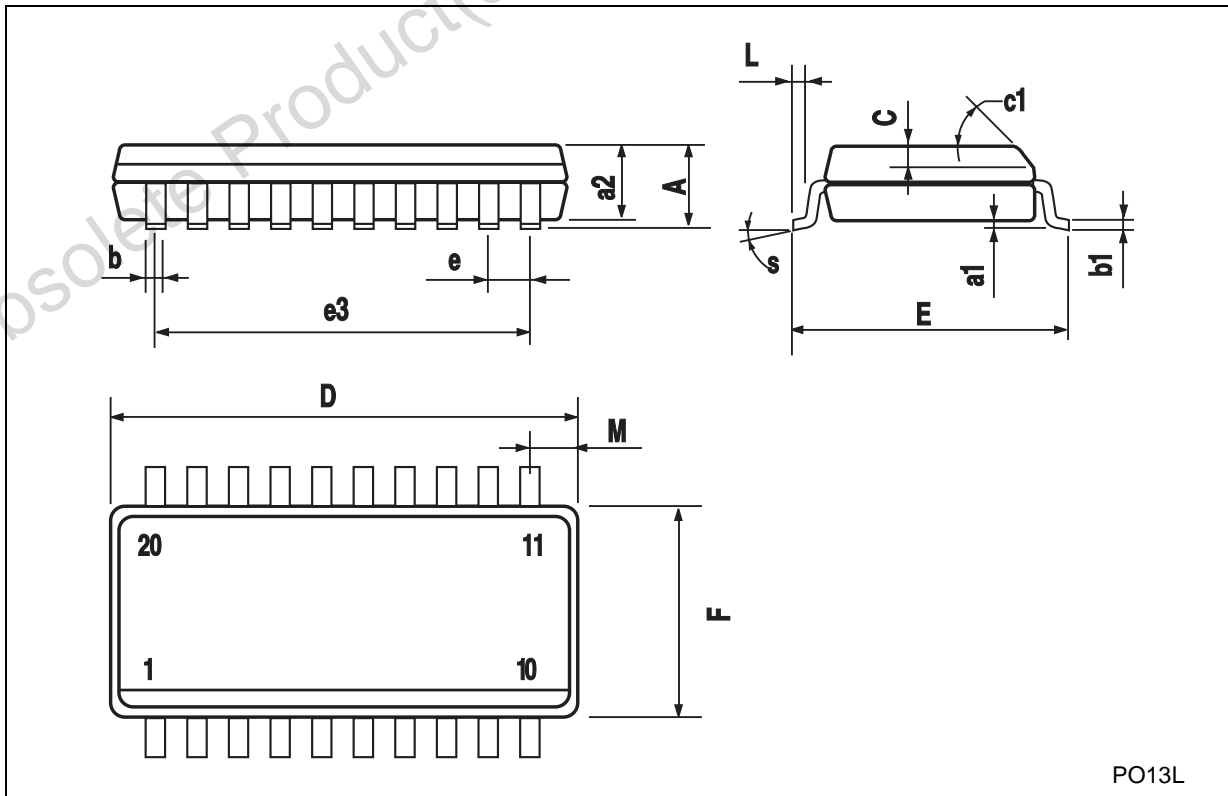
### Plastic DIP-20 (0.25) MECHANICAL DATA

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**

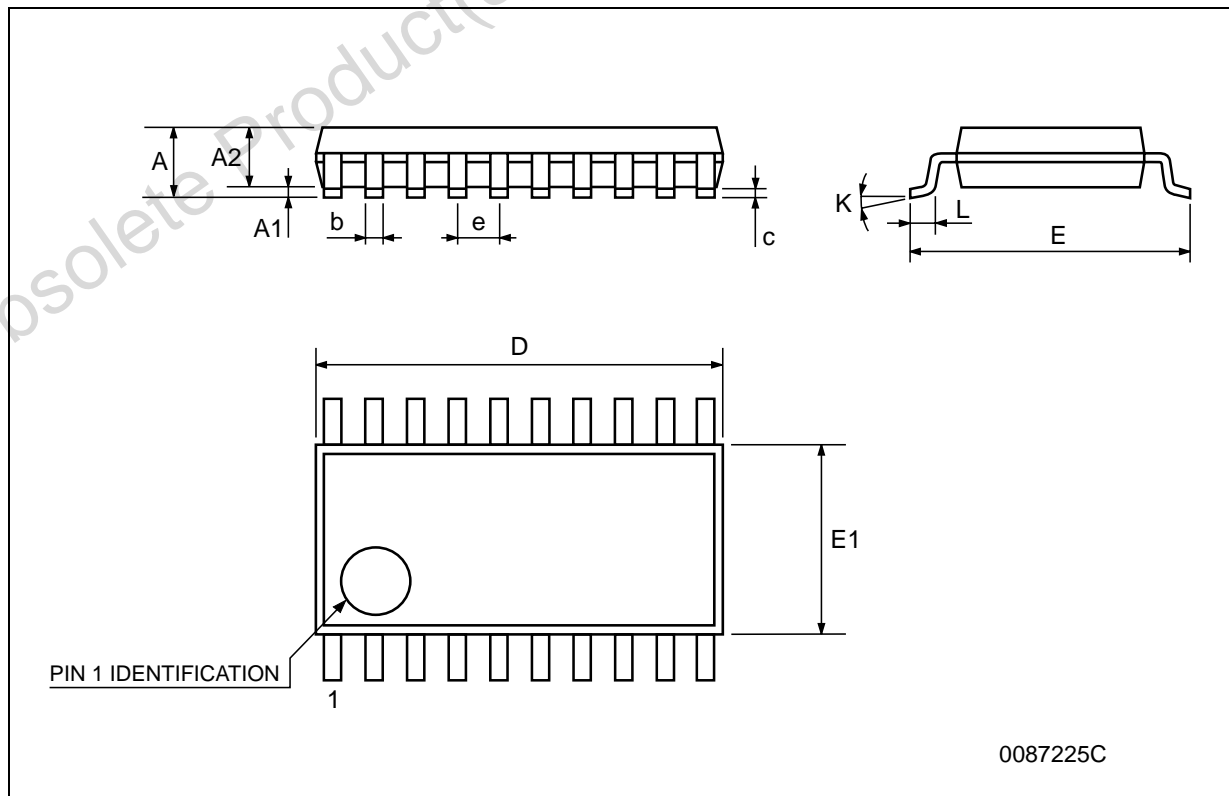
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.2	0.004		0.008
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.300
L	0.50		1.27	0.020		0.050
M			0.75			0.029
S	8° (max.)					



PO13L

## 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		0.0089
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



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