FAIRCHILD SEMICONDUCTOR™

April 1994
Revised April 1999

74VHC273
Octal D-Type Flip-Flop

General Description

The VHC273 is an advanced high speed CMOS Octal D-type flip-flop fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The register has a common buffered Clock (CP) which is fully edge-triggered. The state of each D input, one setup time before the LOW-to-HIGH clock transition, is transferred to the corresponding flip-flop's Q output. The Master Reset ($\overline{MR}$) input will clear all flip-flops simultaneously. All outputs will be forced LOW independently of Clock or Data inputs by a LOW voltage level on the $\overline{MR}$ input.

An input protection circuit insures that 0V to 7V can be applied to the inputs pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery backup. This circuit prevents device destruction due to mismatched supply and input voltages.

Features

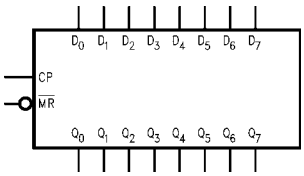
- High Speed: f_{MAX}= 165 MHz (typ) at V_{CC} = 5V
- Low power dissipation: I_{CC} = 4 μA (max) at T_A = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min)
- Power down protection is provided on all inputs
- Low noise: V_{OLP} = 0.9V (max)
- Pin and function compatible with 74HC273

Ordering Code:

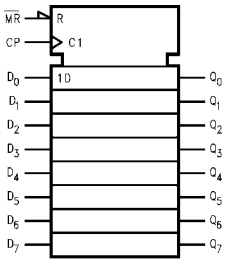
Order Number	Package Number	Package Description
74VHC273M	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
74VHC273SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHC273MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VHC273N	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

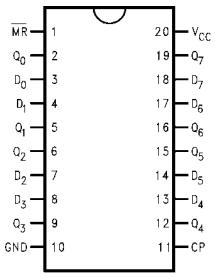
Logic Symbols



IEEE/IEC



Connection Diagram



Pin Descriptions

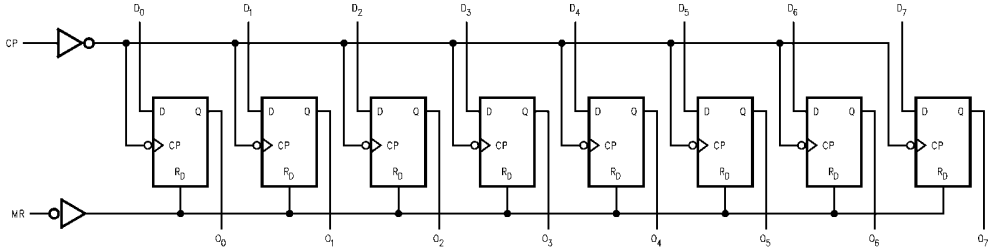
Pin Names	Description
D_0–D_7	Data Inputs
$\overline{MR}$	Master Reset
CP	Clock Pulse Input
Q_0–Q_7	Data Outputs

Function Table

Operating Mode	Inputs			Outputs
	$\overline{MR}$	CP	D_n	Q_n
Reset (Clear)	L	X	X	L
Load '1'	H	⌐	H	H
Load '0'	H	⌐	L	L

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
⌐ = LOW-to-HIGH Transition

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings(Note 1)

Supply Voltage (V_{CC})	−0.5V to +7.0V
DC Input Voltage (V_{IN})	−0.5V to +7.0V
DC Output Voltage (V_{OUT})	−0.5V to V_{CC} + 0.5V
Input Diode Current (I_{IK})	−20 mA
Output Diode Current (I_{OK})	±20 mA
DC Output Current (I_{OUT})	±25 mA
DC V_{CC}/GND Current (I_{CC})	±75 mA
Storage Temperature (T_{STG})	−65°C to +150°C
Lead Temperature (T_L)	
(Soldering, 10 seconds)	260°C

Recommended Operating Conditions (Note 2)

Supply Voltage (V_{CC})	2.0V to +5.5V
Input Voltage (V_{IN})	0V to +5.5V
Output Voltage (V_{OUT})	0V to V_{CC}
Operating Temperature (T_{OPR})	−40°C to +85°C
Input Rise and Fall Time (t_r, t_f)	
V_{CC} = 3.3V ± 0.3V	0 ns/V ~ 100 ns/V
V_{CC} = 5.0V ± 0.5V	0 ns/V ~ 20 ns/V

Note 1: Absolute Maximum Ratings are values beyond which the device may be damaged or have its useful life impaired. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside databook specifications.

Note 2: Unused inputs must be held HIGH or LOW. They may not float.

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	T_A = 25°C			T_A = −40°C to +85°C		Units	Conditions	
			Min	Typ	Max	Min	Max			
V_{IH}	HIGH Level Input Voltage	2.0	1.50			1.50		V		
		3.0 – 5.5	0.7 V_{CC}			0.7 V_{CC}				
V_{IL}	LOW Level Input Voltage	2.0			0.50		0.50	V		
		3.0 – 5.5			0.3 V_{CC}		0.3 V_{CC}			
V_{OH}	HIGH Level Output Voltage	2.0	1.9	2.0		1.9		V	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −50 µA
		3.0	2.9	3.0		2.9				
		4.5	4.4	4.5		4.4				
		3.0	2.58			2.48		V		I_{OH} = −4 mA
		4.5	3.94			3.80				I_{OH} = −8 mA
V_{OL}	LOW Level Output Voltage	2.0		0.0	0.1		0.1	V	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50 µA
		3.0		0.0	0.1		0.1			
		4.5		0.0	0.1		0.1			
		3.0			0.36		0.44	V		I_{OL} = 4 mA
		4.5			0.36		0.44			I_{OL} = 8 mA
I_{IN}	Input Leakage Current	0 – 5.5			±0.1		±1.0	µA	V_{IN} = 5.5V or GND	
I_{CC}	Quiescent Supply Current	5.5			4.0		40.0	µA	V_{IN} = V_{CC} or GND	

Noise Characteristics

Symbol	Parameter	V_{CC} (V)	T_A = 25°C		Units	Conditions
			Typ	Limits		
V_{OLP} (Note 3)	Quiet Output Maximum Dynamic V_{OL}	5.0	0.6	0.9	V	C_L = 50 pF
V_{OLV} (Note 3)	Quiet Output Minimum Dynamic V_{OL}	5.0	−0.6	−0.9	V	C_L = 50 pF
V_{IHD} (Note 3)	Minimum HIGH Level Dynamic Input Voltage	5.0		3.5	V	C_L = 50 pF
V_{ILD} (Note 3)	Maximum LOW Level Dynamic Input Voltage	5.0		1.5	V	C_L = 50 pF

Note 3: Parameter guaranteed by design.

AC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	$T_A = 25°C$			$T_A = -40°C$ to $+85°C$		Units	Conditions	
			Min	Typ	Max	Min	Max			
f_{MAX}	Maximum Clock Frequency	3.3 ± 0.3	75	120		65		MHz		$C_L = 15$ pF
			50	75		45				$C_L = 50$ pF
		5.0 ± 0.5	120	165		100		MHz		$C_L = 15$ pF
			80	110		70				$C_L = 50$ pF
t_{PLH} t_{PHL}	Propagation Delay Time (CK - Q)	3.3 ± 0.3		8.7	13.6	1.0	16.0	ns		$C_L = 15$ pF
				11.2	17.1	1.0	19.5			$C_L = 50$ pF
		5.0 ± 0.5		5.8	9.0	1.0	10.5	ns		$C_L = 15$ pF
				7.3	11.0	1.0	12.5			$C_L = 50$ pF
t_{PHL}	Propagation Delay Time ($\overline{MR}$ - Q)	3.3 ± 0.3		8.9	13.6	1.0	16.0	ns		$C_L = 15$ pF
				11.4	17.1	1.0	19.5			$C_L = 50$ pF
		5.0 ± 0.5		5.2	8.5	1.0	10.0	ns		$C_L = 15$ pF
				6.7	10.5	1.0	12.0			$C_L = 50$ pF
t_{OSLH}	Output to	3.3 ± 0.3			1.5		1.5	ns	(Note 4)	$C_L = 50$ pF
t_{OSHL}	Output Skew	5.0 ± 0.5			1.0		1.0			$C_L = 50$ pF
C_{IN}	Input Capacitance			4	10		10	pF	V_{CC} = Open	
C_{PD}	Power Dissipation Capacitance			31				pF	(Note 5)	

Note 4: Parameter guaranteed by design $t_{OSLH} = |t_{PLH}max - t_{PLH}min|$; $t_{OSHL} = |t_{PHL}max - t_{PHL}min|$.

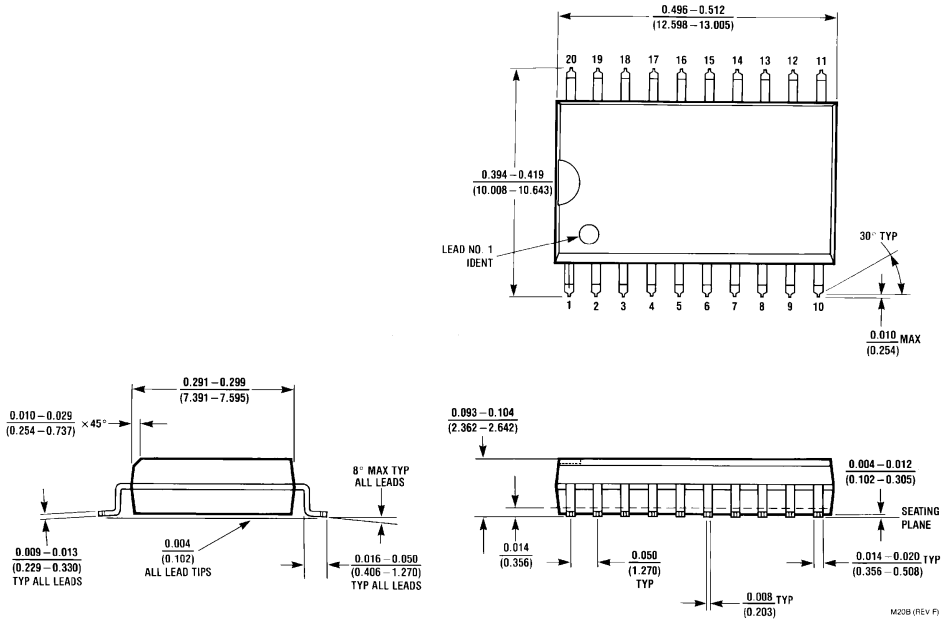
Note 5: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained from the equation: I_{CC} (opr.) = $C_{PD} * V_{CC} * f_{IN} + I_{CC}/8$ (per F/F). The total C_{PD} when n pieces of the Flip Flop operates can be calculated by the equation: C_{PD} (total) = 22 + 9n.

AC Operating Requirements

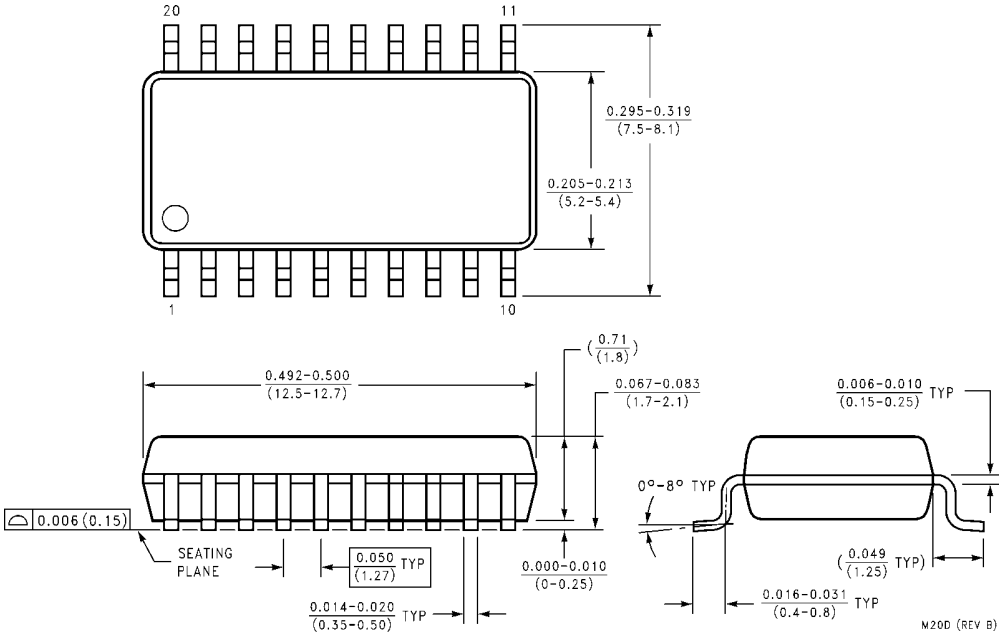
Symbol	Parameter	V_{CC} (V) (Note 6)	$T_A = 25°C$		$T_A = -40°C$ to $+85°C$	Units
			Typ	Guaranteed Minimum		
$t_W(L)$	Minimum Pulse Width (CK)	3.3		5.5	6.5	ns
$t_W(H)$		5.0		5.0	5.0	
$t_W(L)$	Minimum Pulse Width ($\overline{MR}$)	3.3		5.0	6.0	ns
		5.0		5.0	5.0	
t_S	Minimum Setup Time	3.3		5.5	6.5	ns
		5.0		4.5	4.5	
t_H	Minimum Hold Time	3.3		1.0	1.0	ns
		5.0		1.0	1.0	
t_{REC}	Minimum Removal Time ($\overline{MR}$)	3.3		2.5	2.5	ns
		5.0		2.0	2.0	

Note 6: V_{CC} is 3.3 ± 0.3V or 5.0 ± 0.5V

Physical Dimensions inches (millimeters) unless otherwise noted

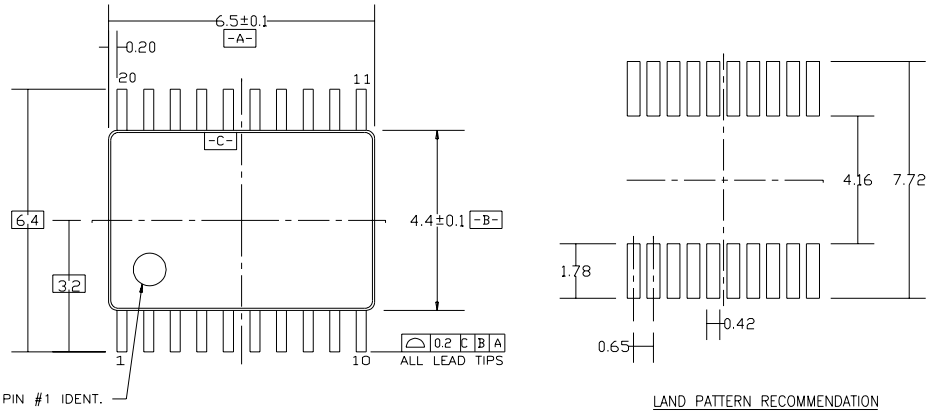


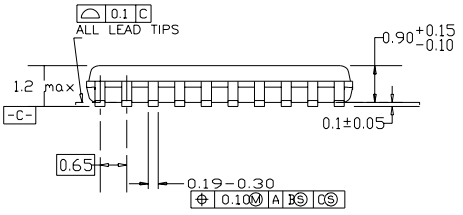
20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300 Wide
Package Number M20B



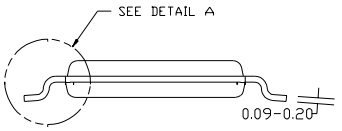
20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M20D

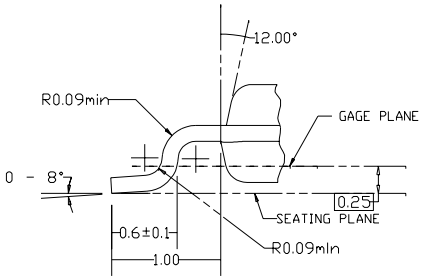
Physical Dimensions inches (millimeters) unless otherwise noted (Continued)





DIMENSIONS ARE IN MILLIMETERS





DETAIL A

NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.

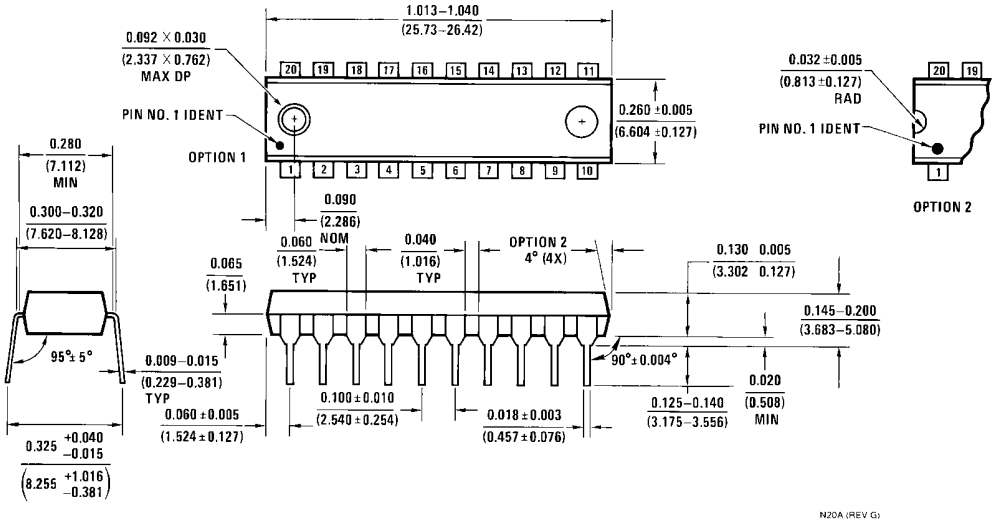
B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC20

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide
Package Number N20A