

# 3-STATE Octal D-Type Latch / 3-STATE Octal D-Type Flip-Flop

# MM74HCT373/MM74HCT374

#### **General Description**

The MM74HCT373 octal D-type latches and MM74HCT374 Octal D-type flip flops advanced silicon-gate CMOS technology, which provides the inherent benefits of low power consumption and wide power supply range, but are LS-TTL input and output characteristic & pin-out compatible. The 3-STATE outputs are capable of driving 15 LSTTL loads. All inputs are protected from damage due to static discharge by internal diodes to VCC and ground.

When the MM74HCT373 LATCH ENABLE input is HIGH, the Q outputs will follow the D inputs. When the LATCH ENABLE goes LOW, data at the D inputs will be retained at the outputs until LATCH ENABLE returns HIGH again. When a high logic level is applied to the OUTPUT CONTROL input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

The MM74HCT374 are positive edge triggered flip-flops. Data at the D inputs, meeting the setup and hold time requirements, are transferred to the Q outputs on positive going transitions of the CLOCK (CK) input. When a high logic level is applied to the OUTPUT CONTROL (OC) input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

#### **Features**

- TTL Input Characteristic Compatible
- Typical Propagation Delay: 20 ns
- Low Input Current: 1 μA Maximum
- Low Quiescent Current: 160 μA Maximum
- Compatible with Bus-oriented Systems
- Output Drive Capability: 15 LS-TTL Loads
- These are Pb-Free Devices



SOIC-20 WB CASE 751D-05



SOIC-20, 300 mils CASE 751BJ-01

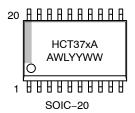


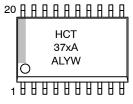
TSSOP20, 4.4x6.5 CASE 948AQ-01



TSSOP-20 WB CASE 948E

#### **MARKING DIAGRAMS**





TSSOP-20 WB

HCT37xA = Specific Device Code

x = 3 or 4

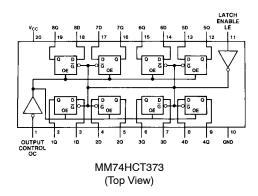
A = Assembly Location

WL, L = Wafer Lot YY, Y = Year WW, W = Work Week

#### **ORDERING INFORMATION**

See detailed ordering and shipping information on page 7 of this data sheet.

#### **Connection Diagrams**



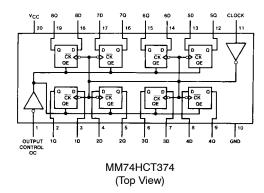


Figure 1. Pin Assignments for SOIC and TSSOP

#### **Truth Tables**

#### **MM74HCT373**

Output Control	LE	Data	373 Output
L	Н	Н	Н
L	Н	L	L
L	L	Х	$Q_0$
Н	Х	Х	Z

NOTES: H = HIGH Level

L = LOW Level

 $Q_0$  = Level of output before steady-state input conditions were established.

Z = High Impedance

#### **MM74HCT374**

Output Control	Clock	Data	374 Output
L	<b>↑</b>	Н	Н
L	1	L	L
L	L	Х	$Q_0$
Н	Х	Х	Z

NOTES: H = HIGH Level

= LOW Level

= Don't Care

= Transition from LOW-to-HIGH

Z = High Impedance State

Q<sub>0</sub> = The level of the output before steady state input conditions were established.

## **Logic Diagrams**

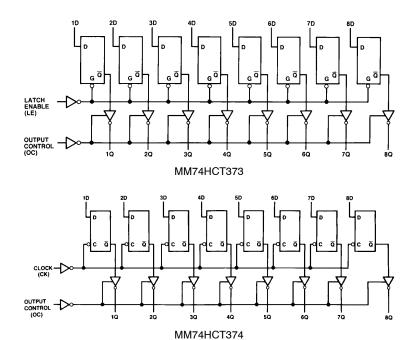


Figure 2. Logic Diagrams

#### ABSOLUTE MAXIMUM RATINGS (Note 1)

Symbol		Parameter	Rating
V <sub>CC</sub>	Supply Voltage		−0.5 to +7.0 V
V <sub>IN</sub>	DC Input Voltage	DC Input Voltage	
V <sub>OUT</sub>	DC Output Voltage	DC Output Voltage	
I <sub>IK</sub> , I <sub>OK</sub>	Clamp Diode Current		±20 mA
l <sub>out</sub>	DC Output Current, per Pin		±35 mA
I <sub>CC</sub>	DC V <sub>CC</sub> or GND Current, per Pin		±70 mA
T <sub>STG</sub>	Storage Temperature Range		–65°C to +150°C
P <sub>D</sub>	Power Dissipation	S.O. Package only	500 mW
TL	Lead Temperature (Soldering 10 S	Seconds)	260°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Max	Unit
V <sub>CC</sub>	Supply Voltage	4.5	5.5	V
V <sub>IN</sub> , V <sub>OUT</sub>	DC Input or Output Voltage	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature Range	<b>–</b> 55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise or Fall Times		500	ns

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

<sup>1.</sup> Unless otherwise specified all voltages are referenced to ground.

# DC ELECTRICAL CHARACTERISTICS ( $V_{CC}$ = 5 V $\pm$ 10%, unless otherwise specified)

			TA	₁ = 25°C	T <sub>A</sub> = -40°C to 85°C	T <sub>A</sub> = -55°C to 125°C	
Symbol	Parameter	Conditions	Тур	Gı	uaranteed Lim	nits	Unit
V <sub>IH</sub>	Minimum HIGH Level Input Voltage		-	2.0	2.0	2.0	V
V <sub>IL</sub>	Maximum LOW Level Input Voltage		-	0.8	0.8	0.8	V
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   = 20 μA	V <sub>CC</sub>	V <sub>CC</sub> - 0.1	V <sub>CC</sub> - 0.1	V <sub>CC</sub> - 0.1	٧
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  = 6.0$ mA, $V_{CC} = 4.5$ V	4.2	3.98	3.84	3.7	٧
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  = 7.2$ mA, $V_{CC} = 5.5$ V	5.7	4.98	4.84	4.7	٧
V <sub>OL</sub>	Maximum LOW Level Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>OUT</sub>   = 20 μA	0	0.1	0.1	0.1	٧
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  = 6.0$ mA, $V_{CC} = 4.5$ V	0.2	0.26	0.33	0.4	٧
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  = 7.2$ mA, $V_{CC} = 5.5$ V	0.2	0.26	0.33	0.4	٧
I <sub>IN</sub>	Maximum Input Current	V <sub>IN</sub> = V <sub>CC</sub> or GND, V <sub>IH</sub> or V <sub>IL</sub>	-	±0.1	±1.0	±1.0	μΑ
I <sub>OZ</sub>	Maximum 3-STATE Output Leakage Current	$V_{OUT} = V_{CC}$ or GND, Enable = $V_{IH}$ or $V_{IL}$	-	±0.5	±5.0	±10	μΑ
I <sub>CC</sub>	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0 \mu A$	-	8.0	80	160	μΑ
		V <sub>IN</sub> = 2.4 V or 0.5 V (Note 2)	-	1.0	1.3	1.5	mA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Measured per pin. All others tied to V<sub>CC</sub> or ground.

#### **AC ELECTRICAL CHARACTERISTICS**

(MM74HCT373:  $V_{CC}$  = 5.0 V,  $T_A$  = 25°C,  $t_r$  =  $t_f$  = 6 ns, unless otherwise specified)

Symbol	Parameter	Conditions	Тур	Guaranteed Limit	Unit
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay Data to Output	C <sub>L</sub> = 45 pF	18	25	ns
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay Latch Enable to Output	C <sub>L</sub> = 45 pF	21	30	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	Maximum Enable Propagation Delay Control to Output	$C_L$ = 45 pF $R_L$ = 1 k $\Omega$	20	28	ns
t <sub>PHZ</sub> , t <sub>PLZ</sub>	Maximum Disable Propagation Delay Control to Output	$C_L = 5 \text{ pF}$ $R_L = 1 \text{ k}\Omega$	18	25	ns
t <sub>W</sub>	Minimum Clock Pulse Width		-	16	ns
t <sub>S</sub>	Minimum Setup Time Data to Clock		_	5	ns
t <sub>H</sub>	Minimum Hold Time Clock to Data		_	10	ns

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

#### **AC ELECTRICAL CHARACTERISTICS**

(MM74HCT373:  $V_{CC}$  = 5.0 V  $\pm$  10%,  $t_r$  =  $t_f$  = 6 ns, unless otherwise specified)

			T <sub>A</sub> =	25°C	T <sub>A</sub> = -40°C to 85°C	T <sub>A</sub> = -55°C to 125°C	
Symbol	Parameter	Conditions	Тур		Guaranteed L	imits	Unit
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation	C <sub>L</sub> = 50 pF	22	30	37	45	ns
	Delay Data to Output	C <sub>L</sub> = 150 pF	30	40	50	60	ns
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation	C <sub>L</sub> = 50 pF	25	35	44	53	ns
	Delay Latch Enable to Output	C <sub>L</sub> = 150 pF	32	45	56	68	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	Maximum Enable Propagation Delay Control to Output	$C_L = 50 \text{ pF}$ $R_L = 1 \text{ k}\Omega$	21	30	37	45	ns
		$C_L$ = 150 pF $R_L$ = 1 k $\Omega$	30	40	50	60	ns
t <sub>PHZ</sub> , t <sub>PLZ</sub>	Maximum Disable Propagation Delay Control to Output	$C_L = 50 \text{ pF}$ $R_L = 1 \text{ k}\Omega$	21	30	37	45	ns
t <sub>THL</sub> , t <sub>TLH</sub>	Maximum Output Rise and Fall Time	C <sub>L</sub> = 50 pF	8	12	15	18	ns
t <sub>W</sub>	Minimum Clock Pulse Width		-	16	20	24	ns
t <sub>S</sub>	Minimum Setup Time Data to Clock		-	5	6	8	ns
t <sub>H</sub>	Minimum Hold Time Clock to Data		-	10	13	20	ns
C <sub>IN</sub>	Maximum Input Capacitance		-	10	10	10	pF
C <sub>OUT</sub>	Maximum Output Capacitance		-	20	20	20	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 3)	OC = V <sub>CC</sub>	-	5	-	-	pF
		OC = GND	-	52	-	-	pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

<sup>3.</sup> C<sub>PD</sub> determines the no load dynamic power consumption, P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup> f + I<sub>CC</sub> V<sub>CC</sub>, and the no load dynamic current consumption, I<sub>S</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup> f + I<sub>CC</sub>.

#### **AC ELECTRICAL CHARACTERISTICS**

(MM74HCT374:  $V_{CC}$  = 5.0 V,  $T_A$  = 25°C,  $t_r$  =  $t_f$  = 6 ns, unless otherwise specified)

Symbol	Parameter	Conditions	Тур	Guaranteed Limit	Unit
f <sub>MAX</sub>	Maximum Clock Frequency		50	30	MHz
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay Data to Output	C <sub>L</sub> = 45 pF	20	32	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	Maximum Enable Propagation Delay Control to Output	$C_L$ = 45 pF $R_L$ = 1 k $\Omega$	19	28	ns
t <sub>PHZ</sub> , t <sub>PLZ</sub>	Maximum Disable Propagation Delay Control to Output	$C_L = 5 \text{ pF}$ $R_L = 1 \text{ k}\Omega$	17	25	ns
t <sub>W</sub>	Minimum Clock Pulse Width		-	20	ns
t <sub>S</sub>	Minimum Setup Time Data to Clock		_	5	ns
t <sub>H</sub>	Minimum Hold Time Clock to Data		_	16	ns

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

#### **AC ELECTRICAL CHARACTERISTICS**

(MM74HCT374:  $V_{CC}$  = 5.0 V  $\pm$  10%,  $t_r$  =  $t_f$  = 6 ns, unless otherwise specified)

			T <sub>A</sub> =	25°C	T <sub>A</sub> = -40°C to 85°C	T <sub>A</sub> = -55°C to 125°C	
Symbol	Parameter	Conditions	Тур		Guaranteed L	imits	Unit
f <sub>MAX</sub>	Minimum Clock Pulse Width		-	30	24	20	MHz
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay to Output	C <sub>L</sub> = 50 pF	22	36	45	48	ns
		C <sub>L</sub> = 150 pF	30	46	57	69	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	Maximum Enable Propagation Delay Control to Output	$C_L$ = 50 pF $R_L$ = 1 k $\Omega$	21	30	37	45	ns
		$C_L$ = 150 pF $R_L$ = 1 k $\Omega$	30	40	50	60	ns
t <sub>PHZ</sub> , t <sub>PLZ</sub>	Maximum Disable Propagation Delay Control to Output	$C_L = 50 \text{ pF}$ $R_L = 1 \text{ k}\Omega$	21	30	37	45	ns
t <sub>THL</sub> , t <sub>TLH</sub>	Maximum Output Rise and Fall Time	C <sub>L</sub> = 50 pF	8	12	15	18	ns
t <sub>W</sub>	Minimum Clock Pulse Width		-	16	20	24	ns
ts	Minimum Setup Time Data to Clock		T -	20	25	30	ns
t <sub>H</sub>	Minimum Hold Time Clock to Data		-	5	5	5	ns
C <sub>IN</sub>	Maximum Input Capacitance		-	10	10	10	pF
C <sub>OUT</sub>	Maximum Output Capacitance		-	20	20	20	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 4)	OC = V <sub>CC</sub>	-	5	-	-	pF
		OC = GND	-	58	-	-	pF

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product

performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. C<sub>PD</sub> determines the no load dynamic power consumption, P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup> f + I<sub>CC</sub> V<sub>CC</sub>, and the no load dynamic current consumption, I<sub>S</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup> f + I<sub>CC</sub>.

#### **ORDERING INFORMATION**

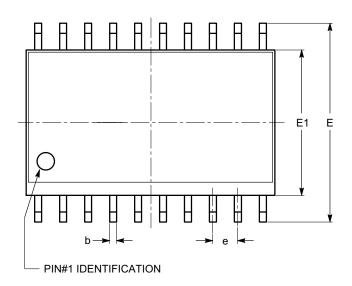
Part Number	Package	Shipping <sup>†</sup>
MM74HCT373WMX	SOIC-20, Case 751BJ (Pb-Free and Halide-Free)	1000 Units / Tape & Reel
MM74HCT373MTCX	TSSOP-20 WB, Case 948E (Pb-Free)	2500 Units / Tape & Reel
MM74HCT374WM	SOIC-20 WB, Case 751D-05	38 Units / Tube
MM74HCT374WMX	(Pb-Free and Halide-Free)	1000 Units / Tape & Reel
MM74HCT374MTCX	TSSOP20, Case 948AQ-01 (Pb-Free)	2500 Units / Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, <u>BRD8011/D</u>.



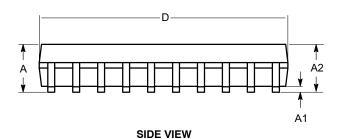
SOIC-20, 300 mils CASE 751BJ ISSUE O

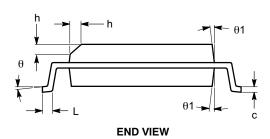
**DATE 19 DEC 2008** 



SYMBOL	MIN	NOM	MAX
А	2.36	2.49	2.64
A1	0.10		0.30
A2	2.05		2.55
b	0.31	0.41	0.51
С	0.20	0.27	0.33
D	12.60	12.80	13.00
E	10.01	10.30	10.64
E1	7.40	7.50	7.60
е		1.27 BSC	
h	0.25		0.75
L	0.40	0.81	1.27
θ	0°		8°
θ1	5°		15°

**TOP VIEW** 





#### Notes:

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MS-013.

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DESCRIPTION:	SOIC-20, 300 MILS		PAGE 1 OF 1		

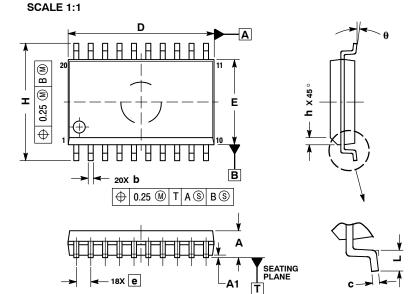
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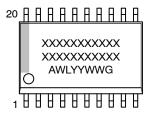
SOIC-20 WB CASE 751D-05 **ISSUE H** 

**DATE 22 APR 2015** 



- DIMENSIONS ARE IN MILLIMETERS.
   INTERPRET DIMENSIONS AND TOLERANCES.
- PER ASME Y14.5M, 1994.
  3. DIMENSIONS D AND E DO NOT INCLUDE MOLD
- PROTRUSION.
  MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
- DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL

	MILLIMETERS		
DIM	MIN	MAX	
Α	2.35	2.65	
A1	0.10	0.25	
b	0.35	0.49	
С	0.23	0.32	
D	12.65	12.95	
E	7.40	7.60	
е	1.27 BSC		
Н	10.05	10.55	
h	0.25	0.75	
L	0.50	0.90	
A	0 °	7 °	



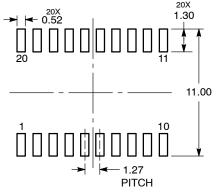
**GENERIC MARKING DIAGRAM\*** 

XXXXX = Specific Device Code = Assembly Location

WL = Wafer Lot ΥY = Year WW = Work Week = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

#### RECOMMENDED **SOLDERING FOOTPRINT\***



DIMENSIONS: MILLIMETERS

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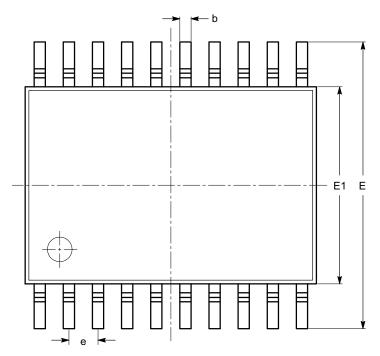
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<sup>\*</sup>For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



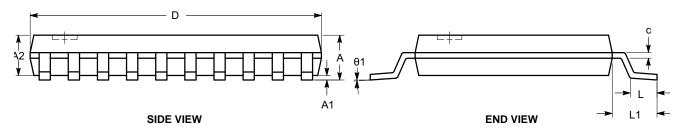
#### TSSOP20, 4.4x6.5 CASE 948AQ ISSUE A

**DATE 19 MAR 2009** 



SYMBOL	MIN	NOM	MAX
Α			1.20
A1	0.05		0.15
A2	0.80		1.05
b	0.19		0.30
С	0.09		0.20
D	6.40	6.50	6.60
Е	6.30	6.40	6.50
E1	4.30	4.40	4.50
е	0.65 BSC		
L	0.45	0.60	0.75
L1		1.00 REF	
θ	0°		8°

#### **TOP VIEW**



#### Notes:

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-153.

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DESCRIPTION:	TSSOP20, 4.4X6.5		PAGE 1 OF 1

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