

# Octal 3-State Non-Inverting D Flip-Flop

## High-Performance Silicon-Gate CMOS

### MC74HC374A, MC74HCT374A

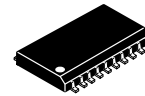
The MC74HC374A/MC74HCT374A is identical in pinout to the LS374. The MC74HC374A inputs are compatible with standard CMOS outputs; with pull-up resistors, they are compatible with LSTTL outputs. The MC74HCT374A may be used as a level converter for interfacing TTL or NMOS outputs to High Speed CMOS inputs.

Data meeting the set-up time is clocked to the outputs with the rising edge of the Clock. The Output Enable input does not affect the states of the flip-flops but when Output Enable is high, all device outputs are forced to the high-impedance state. Thus, data may be stored even when the outputs are not enabled.

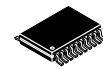
The HC374A/HCT374A is identical in function to the HC574A/HCT574A which has the input pins on the opposite side of the package from the output. This device is similar in function to the HC534A/HCT534A which has inverting outputs.

#### Features

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V (HC), 4.5 to 5.5 V (HCT)
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity: 276 FETs or 69 Equivalent Gates
- -Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant



SOIC-20  
DW SUFFIX  
CASE 751D

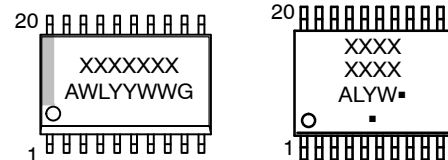


TSSOP-20  
DT SUFFIX  
CASE 948E

#### PIN ASSIGNMENT

OUTPUT ENABLE	1	20	V <sub>CC</sub>
Q0	2	19	Q7
D0	3	18	D7
D1	4	17	D6
Q1	5	16	Q6
Q2	6	15	Q5
D2	7	14	D5
D3	8	13	D4
Q3	9	12	Q4
GND	10	11	CLOCK

#### MARKING DIAGRAMS



SOIC-20

TSSOP-20

XXXXXXXX = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week  
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

#### FUNCTION TABLE

Output Enable	Inputs		Output
	Clock	D	Q
L		H	H
L		L	L
L	L,H,	X	No Change
H	X	X	Z

X = don't care

Z = high impedance

#### ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

# MC74HC374A, MC74HCT374A

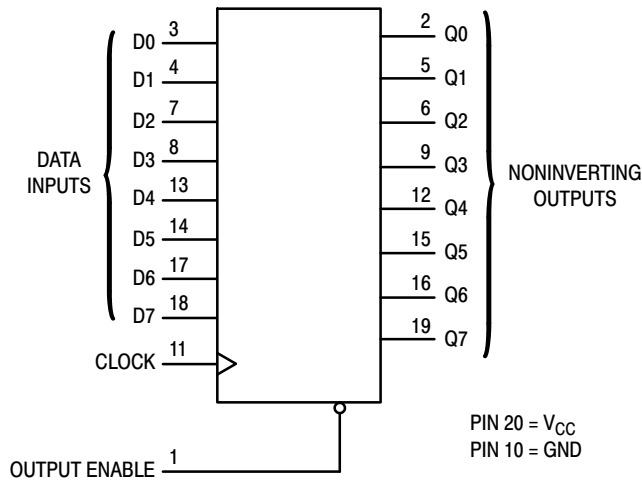


Figure 1. Logic Diagram

## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit	
$V_{CC}$	DC Supply Voltage	-0.5 to +6.5	V	
$V_{IN}$	DC Input Voltage	-0.5 to $V_{CC}+0.5$	V	
$V_{OUT}$	DC Output Voltage	-0.5 to $V_{CC}+0.5$	V	
$I_{IN}$	DC Input Diode Current, per Pin	$\pm 20$	mA	
$I_{OUT}$	DC Input Diode Current, Per Pin	$\pm 35$	mA	
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	$\pm 75$	mA	
$I_{IK}$	Input Clamp Current ( $V_{IN} < 0$ or $V_{IN} > V_{CC}$ )	$\pm 20$	mA	
$I_{OK}$	Output Clamp Current ( $V_{OUT} < 0$ or $V_{OUT} > V_{CC}$ )	$\pm 20$	mA	
$T_{STG}$	Storage Temperature Range	-65 to +150	$^{\circ}C$	
$T_L$	Lead Temperature, 1 mm from Case for 10 secs	260	$^{\circ}C$	
$T_J$	Junction Temperature Under Bias	+150	$^{\circ}C$	
$\theta_{JA}$	Thermal Resistance (Note 1)	SOIC-20W	96	$^{\circ}C/W$
		WQFN20	99	
		QFN20	111	
		TSSOP-20	150	
$P_D$	Power Dissipation in Still Air at 25 $^{\circ}C$	SOIC-20W	1302	mW
		WQFN20	1256	
		QFN20	1127	
		TSSOP-20	833	
MSL	Moisture Sensitivity	Level 1	-	
$F_R$	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
$V_{ESD}$	ESD Withstand Voltage (Note 2)	Human Body Model	> 2000	V
		Charged Device Model	> 1000	

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.

1. Measured with minimum pad spacing on an FR4 board, using 76 mm-by-114 mm, 2-ounce copper trace no air flow per JESD51-7.
2. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

# MC74HC374A, MC74HCT374A

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
<b>MC74HC</b>				
$V_{CC}$	DC Supply Voltage	2.0	6.0	V
$V_{IN}, V_{OUT}$	DC Input Voltage, Output Voltage (Note 3)	0	$V_{CC}$	V
$T_A$	Operating Free-Air Temperature	-55	+125	°C
$t_r, t_f$	Input Rise or Fall Time	$V_{CC} = 2.0\text{ V}$ $V_{CC} = 4.5\text{ V}$ $V_{CC} = 6.0\text{ V}$	1000 500 400	ns
<b>MC74HCT</b>				
$V_{CC}$	DC Supply Voltage	4.5	5.5	V
$V_{IN}, V_{OUT}$	DC Input Voltage, Output Voltage (Note 3)	0	$V_{CC}$	V
$T_A$	Operating Free-Air Temperature	-55	+125	°C
$t_r, t_f$	Input Rise or Fall Time	0	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.

3. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

## DC ELECTRICAL CHARACTERISTICS (MC74HC374A)

Symbol	Parameter	Test Conditions	$V_{CC}$ V	Guaranteed Limit			Unit	
				-55 to 25°C	≤ 85°C	≤ 125°C		
$V_{IH}$	Minimum High-Level Input Voltage	$V_{out} = 0.1\text{ V or } V_{CC} - 0.1\text{ V}$ $ I_{out}  \leq 20\ \mu\text{A}$	2.0	1.50	1.50	1.50	V	
			3.0	2.10	2.10	2.10		
			4.5	3.15	3.15	3.15		
			6.0	4.20	4.20	4.20		
$V_{IL}$	Maximum Low-Level Input Voltage	$V_{out} = 0.1\text{ V or } V_{CC} - 0.1\text{ V}$ $ I_{out}  \leq 20\ \mu\text{A}$	2.0	0.50	0.50	0.50	V	
			3.0	0.90	0.90	0.90		
			4.5	1.35	1.35	1.35		
			6.0	1.80	1.80	1.80		
$V_{OH}$	Minimum High-Level Output Voltage	$V_{in} = V_{IH}\text{ or } V_{IL}$ $ I_{out}  \leq 20\ \mu\text{A}$	2.0	1.90	1.90	1.90	V	
			4.5	4.40	4.40	4.40		
			6.0	5.90	5.90	5.90		
		$V_{in} = V_{IH}\text{ or } V_{IL}$	$ I_{out}  \leq 2.4\text{ mA}$ $ I_{out}  \leq 6.0\text{ mA}$ $ I_{out}  \leq 7.8\text{ mA}$	3.0	2.48	2.34	2.20	V
				4.5	2.98	3.84	3.70	
				6.0	5.48	5.34	5.20	
$V_{OL}$	Maximum Low-Level Output Voltage	$V_{in} = V_{IH}\text{ or } V_{IL}$ $ I_{out}  \leq 20\ \mu\text{A}$	2.0	0.10	0.10	0.10	V	
			4.5	0.10	0.10	0.10		
			6.0	0.10	0.10	0.10		
		$V_{in} = V_{IH}\text{ or } V_{IL}$	$ I_{out}  \leq 2.4\text{ mA}$ $ I_{out}  \leq 6.0\text{ mA}$ $ I_{out}  \leq 7.8\text{ mA}$	3.0	0.26	0.33	0.40	V
				4.5	0.26	0.33	0.40	
				6.0	0.26	0.33	0.40	
$I_{in}$	Maximum Input Leakage Current	$V_{in} = V_{CC}\text{ or GND}$	6.0	±0.1	±1.0	±1.0	μA	
$I_{OZ}$	Maximum Three-State Leakage Current	Output in High-Impedance State $V_{in} = V_{IL}\text{ or } V_{IH}$ $V_{out} = V_{CC}\text{ or GND}$	6.0	±0.5	±5.0	±10	μA	
$I_{CC}$	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC}\text{ or GND}$ $I_{out} = 0\ \mu\text{A}$	6.0	4	40	160	μA	

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.

# MC74HC374A, MC74HCT374A

## AC ELECTRICAL CHARACTERISTICS (MC74HC374A)

Symbol	Parameter	V <sub>CC</sub> V	Guaranteed Limit			Unit
			-55 to 25°C	≤ 85°C	≤ 125°C	
f <sub>max</sub>	Maximum Clock Frequency (50% Duty Cycle)	2.0	6	5	4	MHz
		3.0	15	10	8	
		4.5	30	24	20	
		6.0	35	28	24	
t <sub>PLH</sub> t <sub>PHL</sub>	Maximum Propagation Delay, Input Clock to Q (Figures 2 and 3)	2.0	125	155	190	ns
		3.0	80	110	130	
		4.5	25	31	38	
		6.0	21	26	32	
t <sub>PLZ</sub> t <sub>PHZ</sub>	Maximum Propagation Delay, Output Enable to Q (Figures 2 and 4)	2.0	150	190	225	ns
		3.0	100	125	150	
		4.5	30	38	45	
		6.0	26	33	38	
t <sub>PZL</sub> t <sub>PZH</sub>	Maximum Propagation Delay, Output Enable to Q (Figures 2 and 4)	2.0	150	190	225	ns
		3.0	100	125	150	
		4.5	30	38	45	
		6.0	26	33	38	
t <sub>TLH</sub> t <sub>THL</sub>	Maximum Output Transition Time, Any Output (Figures 2 and 3)	2.0	75	95	110	ns
		3.0	27	32	36	
		4.5	15	19	22	
		6.0	13	16	19	
C <sub>in</sub>	Maximum Input Capacitance		10	10	10	pF
C <sub>out</sub>	Maximum Three-State Output Capacitance (Output in High-Impedance State)		15	15	15	pF

C <sub>PD</sub>	Power Dissipation Capacitance (Per Enabled Output)*	Typical @ 25°C, V <sub>CC</sub> = 5.0 V			pF
		34			

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.

\*Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .

## TIMING REQUIREMENTS (MC74HC374A)

Symbol	Parameter	Figure	V <sub>CC</sub> V	Guaranteed Limit						Unit
				-55 to 25°C		≤ 85°C		≤ 125°C		
				Min	Max	Min	Max	Min	Max	
t <sub>su</sub>	Minimum Setup Time, Data to Clock	5	2.0	50		65		75		ns
			3.0	40		50		60		
			4.5	10		13		15		
			6.0	9		11		13		
t <sub>h</sub>	Minimum Hold Time, Clock to Data	5	2.0	5.0		5.0		5.0		ns
			3.0	5.0		5.0		5.0		
			4.5	5.0		5.0		5.0		
			6.0	5.0		5.0		5.0		
t <sub>w</sub>	Minimum Pulse Width, Clock	2	2.0	60		75		90		ns
			3.0	23		27		32		
			4.5	12		15		18		
			6.0	10		13		15		
t <sub>r</sub> , t <sub>f</sub>	Maximum Input Rise and Fall Times	2	2.0		1000		1000		1000	ns
			3.0		800		800		800	
			4.5		500		500		500	
			6.0		400		400		400	

# MC74HC374A, MC74HCT374A

## DC ELECTRICAL CHARACTERISTICS (MC74HCT374A)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	Guaranteed Limit			Unit
				-55 to 25° C	≤ 85° C	≤ 125° C	
V <sub>IH</sub>	Minimum High-Level Input Voltage	V <sub>out</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>out</sub>   ≤ 20 μA	4.5 5.5	2.0 2.0	2.0 2.0	2.0 2.0	V
V <sub>IL</sub>	Maximum Low-Level Input Voltage	V <sub>out</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>out</sub>   ≤ 20 μA	4.5 5.5	0.8 0.8	0.8 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	4.5 5.5	4.4 5.4	4.4 5.4	4.4 5.4	V
		V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 6.0 mA	4.5	3.98	3.84	3.7	
V <sub>OL</sub>	Maximum Low-Level Output Voltage	V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 20 μA	4.5 5.5	0.1 0.1	0.1 0.1	0.1 0.1	V
		V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 6.0 mA	4.5	0.26	0.33	0.4	
I <sub>in</sub>	Maximum Input Leakage Current	V <sub>in</sub> = V <sub>CC</sub> or GND	5.5	±0.1	±1.0	±1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current (per Package)	V <sub>in</sub> = V <sub>CC</sub> or GND I <sub>out</sub> = 0 μA	5.5	4.0	40	160	μA
I <sub>OZ</sub>	Maximum Three-State Leakage Current	V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> (Note 4) V <sub>out</sub> = V <sub>CC</sub> or GND	5.5	-0.5	-5.0	-10	μA

ΔI <sub>CC</sub>	Additional Quiescent Supply Current	V <sub>in</sub> = 2.4 V, Any One Input V <sub>in</sub> = V <sub>CC</sub> or GND, Other Inputs I <sub>out</sub> = 0 μA	5.5	≥ -55° C	25° C to 125° C		mA
				2.9	2.4		

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. Output in high-impedance state.

# MC74HC374A, MC74HCT374A

## AC ELECTRICAL CHARACTERISTICS (MC74HCT374A)

Symbol	Parameter	Guaranteed Limit			Unit
		-55 to 25°C	≤ 85°C	≤ 125°C	
f <sub>MAX</sub>	Maximum Clock Frequency (50% Duty Cycle)	30	24	20	MHz
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Clock to Q	30	38	45	ns
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Propagation Delay, Output Enable to Q	28	35	42	ns
t <sub>PZH</sub> , t <sub>PZL</sub>	Maximum Propagation Delay Time, Output Enable to Q	28	35	42	ns
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output	12	15	18	ns
C <sub>in</sub>	Maximum Input Capacitance	10	10	10	pF

C <sub>PD</sub>	Power Dissipation Capacitance (Per Flip-Flop)*	Typical @ 25°C, V <sub>CC</sub> = 5.0 V		pF
		58		

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.

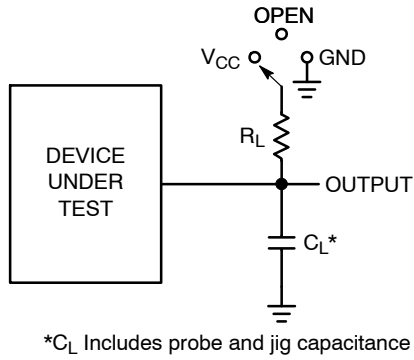
\*Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .

## TIMING REQUIREMENTS (MC74HCT374A)

Symbol	Parameter	Guaranteed Limit						Unit
		- 55 to 25°C		≤ 85°C		≤ 125°C		
		Min	Max	Min	Max	Min	Max	
t <sub>su</sub>	Minimum Setup Time, Data to Clock	10		13		15		ns
t <sub>h</sub>	Minimum Hold Time, Clock to Data	5.0		5.0		5.0		ns
t <sub>w</sub>	Minimum Pulse Width, Clock	15		19		22		ns
t <sub>r</sub> , t <sub>f</sub>	Maximum Input Rise and Fall Times		500		500		500	ns

# MC74HC374A, MC74HCT374A

## SWITCHING WAVEFORMS



Test	Switch Position	$C_L$	$R_L$
$t_{PLH} / t_{PHL}$	Open	50 pF	1 k $\Omega$
$t_{PLZ} / t_{PZL}$	$V_{CC}$		
$t_{PHZ} / t_{PZH}$	GND		

Figure 2. Test Circuit

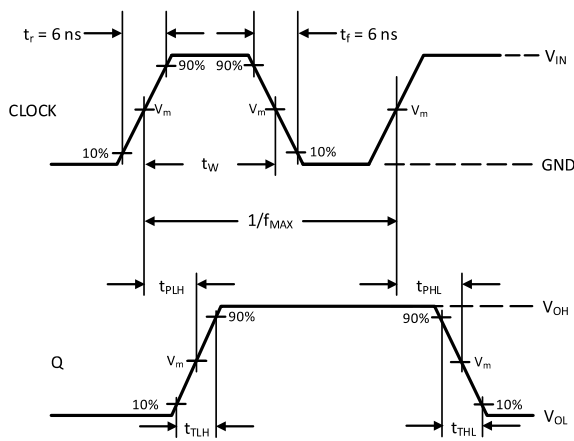


Figure 3.

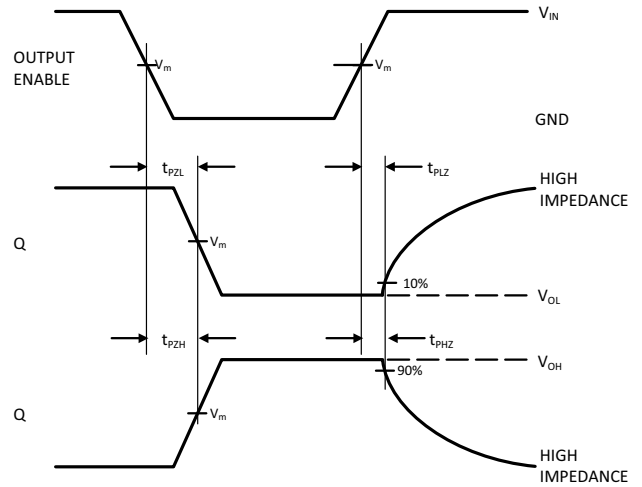


Figure 4.

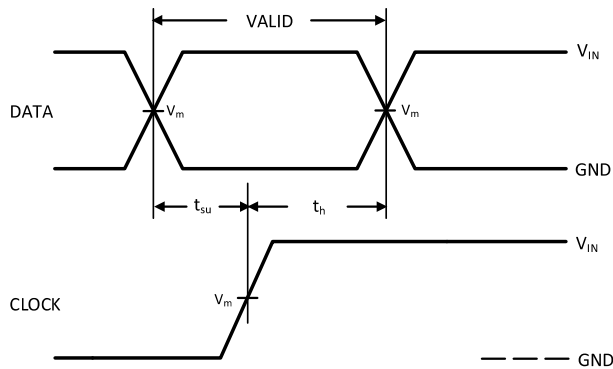
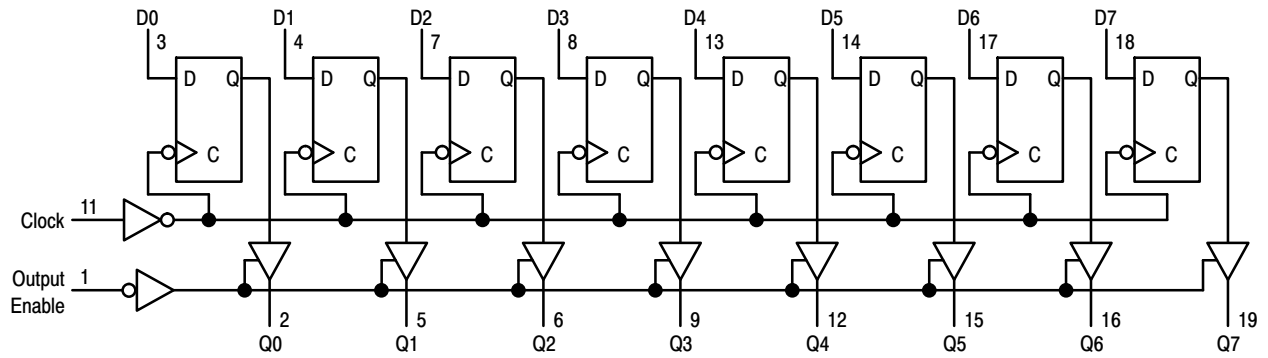


Figure 5.

Device	$V_{IN}, V$	$V_m, V$
MC74HC374A	$V_{CC}$	$50\% \times V_{CC}$
MC74HCT374A	3 V	1.3 V

## MC74HC374A, MC74HCT374A



**Figure 6. Expanded Logic Diagram**

### ORDERING INFORMATION

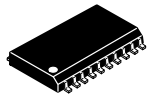
Device	Marking	Package	Shipping <sup>†</sup>
MC74HC374ADWG	HC374A	SOIC-20 Wide	38 Units / Rail
MC74HC374ADWR2G	HC374A	SOIC-20 Wide	1000 / Tape & Reel
MC74HC374ADWR2G-Q*	HC374A	SOIC-20 Wide	1000 / Tape & Reel
MC74HC374ADTR2G	HC 374A	TSSOP-20	2500 / Tape & Reel
MC74HC374ADTR2G-Q*	HC 374A	TSSOP-20	2500 / Tape & Reel
MC74HCT374ADWG	HCT374A	SOIC-20 Wide	38 Units / Rail
MC74HCT374ADWR2G	HCT374A	SOIC-20 Wide	1000 / Tape & Reel
MC74HCT374ADWR2G-Q*	HCT374A	SOIC-20 Wide	1000 / Tape & Reel
MC74HCT374ADTR2G	HCT 374A	TSSOP-20	2500 / Tape & Reel
MC74HCT374ADTR2G-Q*	HCT 374A	TSSOP-20	2500 / 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, BRD8011/D.

\*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.



# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-20 WB  
CASE 751D-05  
ISSUE H

DATE 22 APR 2015



NOTES:

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

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

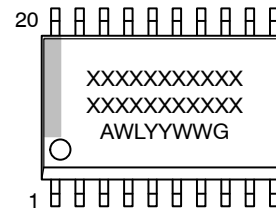
RECOMMENDED  
SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

GENERIC  
MARKING DIAGRAM\*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- YY = Year
- WW = Work Week
- G = 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.

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DESCRIPTION:	SOIC-20 WB	PAGE 1 OF 1

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



TSSOP-20 WB  
CASE 948E  
ISSUE D

DATE 17 FEB 2016

SCALE 2:1



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°



SOLDERING FOOTPRINT



GENERIC MARKING DIAGRAM\*



- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

\*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.

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