



**THE DATASHEET OF  
MC74HC374ADWR2G**



# MC74HC374A

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

### High-Performance Silicon-Gate CMOS

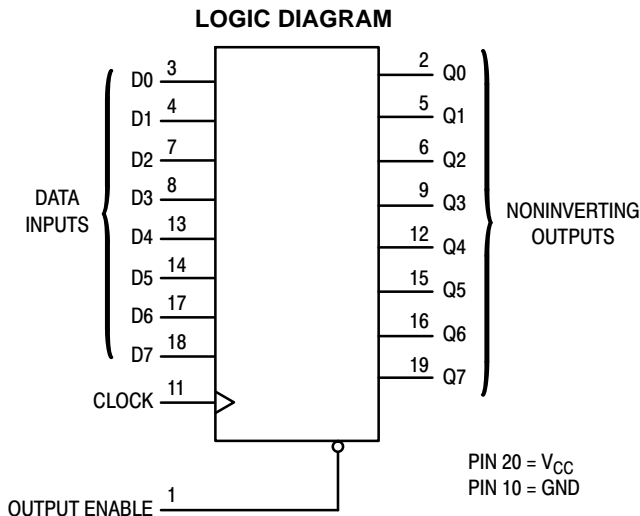
The MC74HC374A is identical in pinout to the LS374. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

Data meeting the setup 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, the outputs are forced to the high-impedance state; thus, data may be stored even when the outputs are not enabled.

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

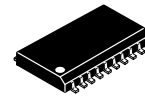
#### Features

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- 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: 266 FETs or 66.5 Equivalent Gates
- NLV Prefix 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

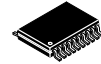


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**SOIC-20**  
**DW SUFFIX**  
**CASE 751D**

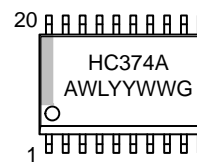


**TSSOP-20**  
**DT SUFFIX**  
**CASE 948E**

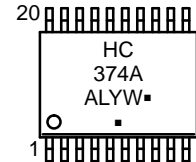
#### PIN ASSIGNMENT

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

#### MARKING DIAGRAMS



**SOIC-20**



**TSSOP-20**

- 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

Inputs		Output	
Output Enable	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 in the package dimensions section on page 5 of this data sheet.

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## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
$V_{in}$	DC Input Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
$V_{out}$	DC Output Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
$I_{in}$	DC Input Current, per Pin	$\pm 20$	mA
$I_{out}$	DC Output Current, per Pin	$\pm 35$	mA
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	$\pm 75$	mA
$P_D$	Power Dissipation in Still Air, SOIC Package† TSSOP Package†	500 450	mW
$T_{stg}$	Storage Temperature	-65 to +150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds (SOIC, SSOP or TSSOP Package)	260	°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . 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.

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.

†Derating: SOIC Package: -7 mW/°C from 65° to 125°C  
TSSOP Package: -6.1 mW/°C from 65° to 125°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	2.0	6.0	V
$V_{in}, V_{out}$	DC Input Voltage, Output Voltage (Referenced to GND)	0	$V_{CC}$	V
$T_A$	Operating Temperature, All Package Types	-55	+125	°C
$t_r, t_f$	Input Rise and Fall Time (Figure 1)	$V_{CC} = 2.0 \text{ V}$ $V_{CC} = 4.5 \text{ V}$ $V_{CC} = 6.0 \text{ V}$	0 1000 500 400	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.

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	$V_{CC}$ V	Guaranteed Limit			Unit
				-55 to 25°C	$\leq 85^\circ\text{C}$	$\leq 125^\circ\text{C}$	
$V_{IH}$	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	$\pm 0.1$	$\pm 1.0$	$\pm 1.0$	$\mu\text{A}$

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## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND) (continued)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	Guaranteed Limit			Unit
				-55 to 25°C	≤ 85°C	≤ 125°C	
I <sub>OZ</sub>	Maximum Three-State Leakage Current	Output in High-Impedance State V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>out</sub> = V <sub>CC</sub> or GND	6.0	±0.5	±5.0	±10	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	6.0	4	40	160	μA

## AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

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 1 and 5)	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 3 and 6)	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 3 and 6)	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 1 and 5)	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			

\* Used to determine 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>.

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## TIMING REQUIREMENTS ( $C_L = 50$ pF, Input $t_r = t_f = 6.0$ ns)

Symbol	Parameter	Figure	V <sub>CC</sub> Volts	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	3	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	3	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	1	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	1	2.0		1000		1000		1000	ns
			3.0		800		800		800	
			4.5		500		500		500	
			6.0		400		400		400	

## SWITCHING WAVEFORMS

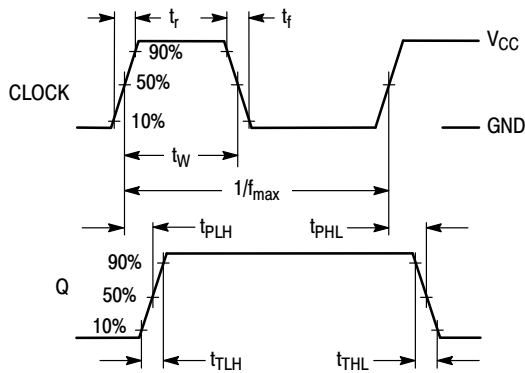


Figure 1.

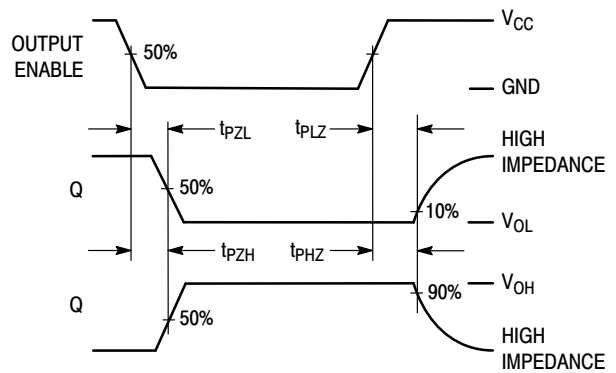


Figure 2.

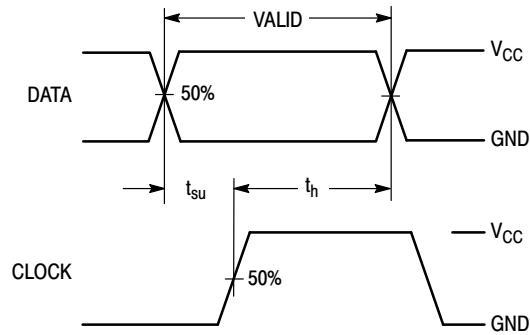
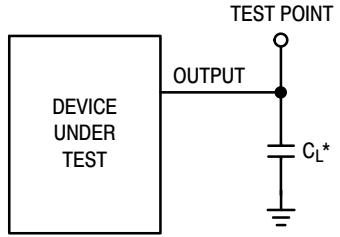


Figure 3.

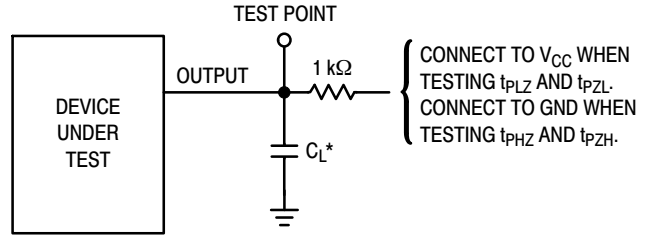
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## TEST CIRCUITS



\*Includes all probe and jig capacitance

Figure 4.



\*Includes all probe and jig capacitance

Figure 5.

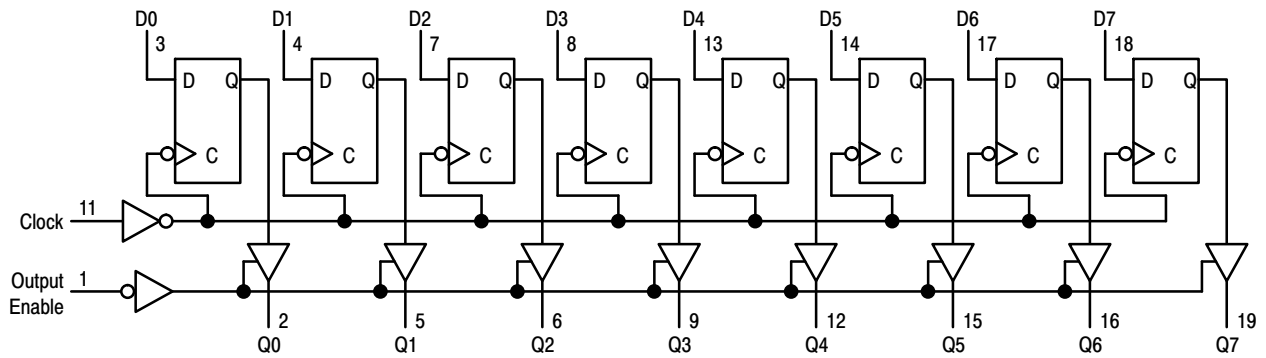


Figure 6. Expanded Logic Diagram

### ORDERING INFORMATION

Device	Package	Shipping†
MC74HC374ADWG	SOIC-20 WIDE (Pb-Free)	38 Units / Rail
NLV74HC374ADWG*	SOIC-20 WIDE (Pb-Free)	38 Units / Rail
MC74HC374ADWR2G	SOIC-20 WIDE (Pb-Free)	1000 Tape & Reel
NLV74HC374ADWR2G*	SOIC-20 WIDE (Pb-Free)	1000 Tape & Reel
MC74HC374ADTG	TSSOP-20 (Pb-Free)	75 Units / Rail
MC74HC374ADTR2G	TSSOP-20 (Pb-Free)	2500 Tape & Reel
NLV74HC374ADTR2G*	TSSOP-20 (Pb-Free)	2500 Tape & Reel

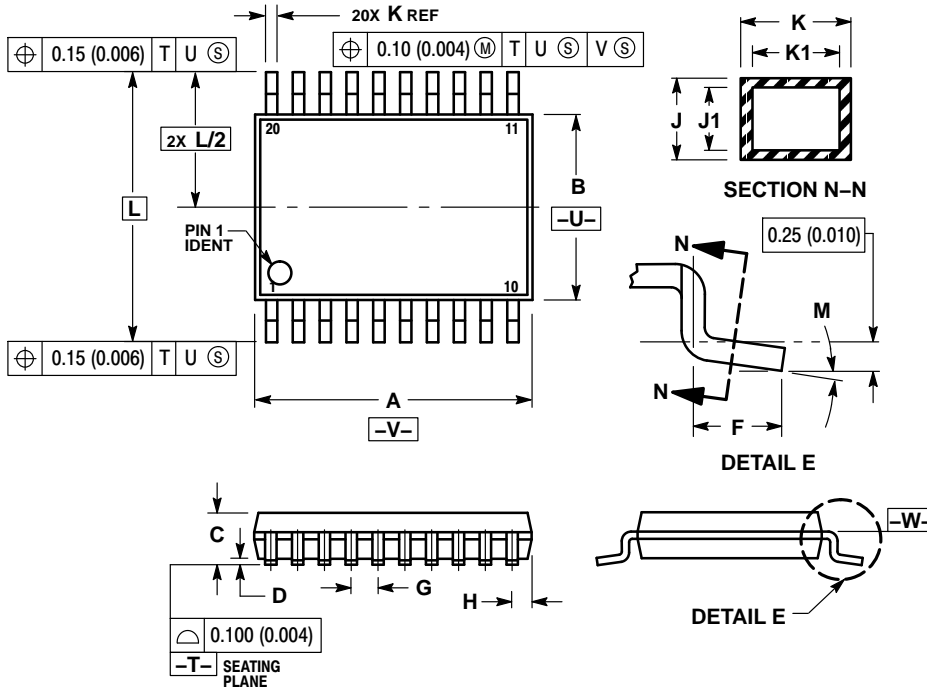
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

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## PACKAGE DIMENSIONS

TSSOP-20  
DT SUFFIX  
CASE 948E  
ISSUE C

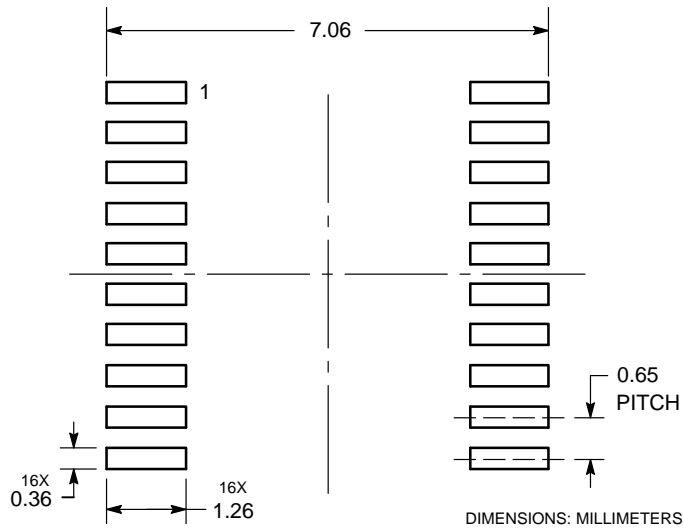


NOTES:

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\*

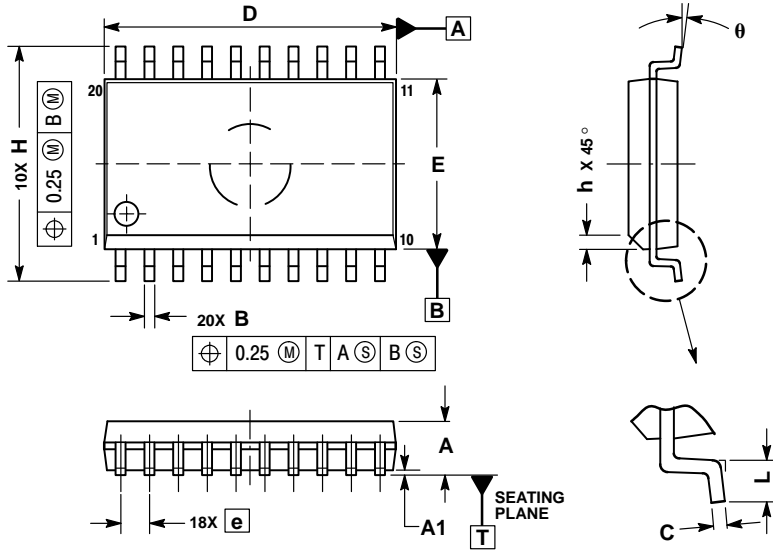


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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## PACKAGE DIMENSIONS

SOIC-20  
DW SUFFIX  
CASE 751D-05  
ISSUE H

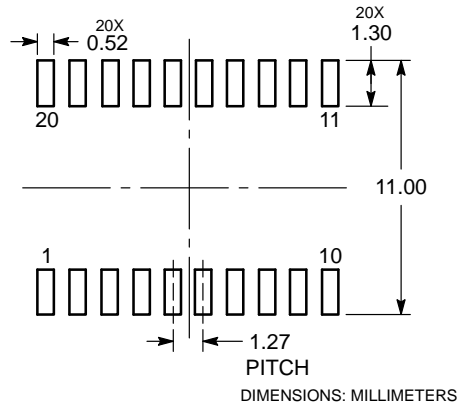


NOTES:

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\*



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

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