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 μA
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7A
- Chip Complexity: 266 FETs or 66.5 Equivalent Gates
- Pb−Free Packages are Available*

*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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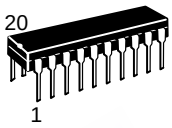
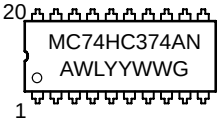
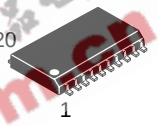
MARKING DIAGRAMS

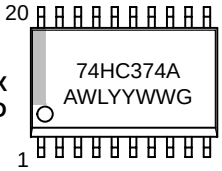


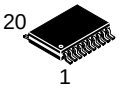
PDIP−20
N SUFFIX
CASE 738



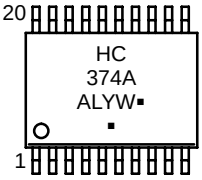


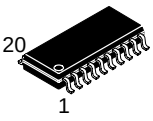
SOIC−20
DW SUFFIX
CASE 751D





TSSOP−20
DT SUFFIX
CASE 948E





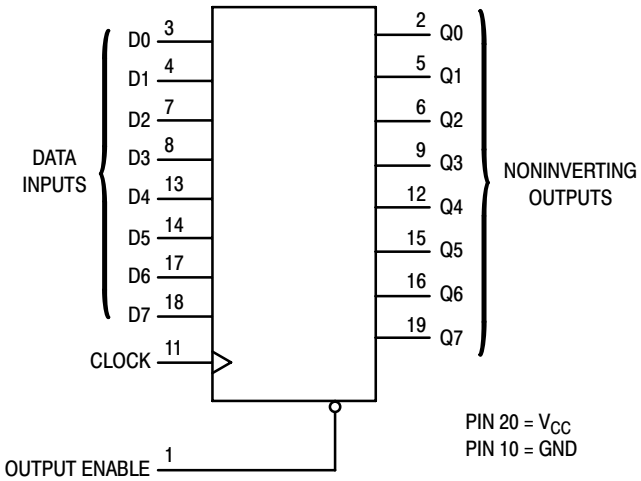
SOEIAJ−20
F SUFFIX
CASE 967

A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
G = Pb−Free Package
▪ = Pb−Free Package
(Note: Microdot may be in either location)

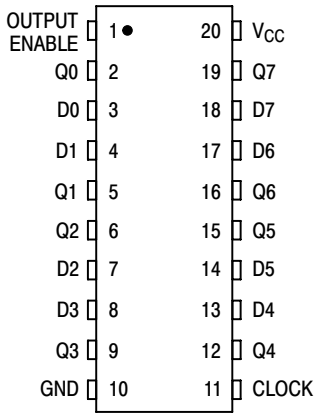
ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

LOGIC DIAGRAM



PIN ASSIGNMENT



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

Device	Package	Shipping†
MC74HC374AN	PDIP−20	18 Units / Box
MC74HC374ANG	PDIP−20 (Pb−Free)	18 Units / Box
MC74HC374ADW	SOIC−20 WIDE	38 Units / Rail
MC74HC374ADWG	SOIC−20 WIDE (Pb−Free)	38 Units / Rail
MC74HC374ADWR2	SOIC−20 WIDE	1000 Tape & Reel
MC74HC374ADWR2G	SOIC−20 WIDE (Pb−Free)	1000 Tape & Reel
MC74HC374ADT	TSSOP−20*	75 Units / Rail
MC74HC374ADTG	TSSOP−20*	75 Units / Rail
MC74HC374ADTR2	TSSOP−20*	2500 Tape & Reel
MC74HC374ADTR2G	TSSOP−20*	2500 Tape & Reel
MC74HC374AF	SOEIAJ−20	40 Units / Rail
MC74HC374AFG	SOEIAJ−20 (Pb−Free)	40 Units / Rail
MC74HC374AFEL	SOEIAJ−20	2000 Tape & Reel
MC74HC374AFELG	SOEIAJ−20 (Pb−Free)	2000 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.
*This package is inherently Pb−Free.

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	± 20	mA
I_{out}	DC Output Current, per Pin	± 35	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 75	mA
P_D	Power Dissipation in Still Air, Plastic DIP† SOIC Package† TSSOP Package†	750 500 450	mW
T_{stg}	Storage Temperature	– 65 to + 150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP, SOIC, SSOP or TSSOP Package)	260	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

†Derating — Plastic DIP: – 10 mW/°C from 65° to 125°C
SOIC Package: – 7 mW/°C from 65° to 125°C
TSSOP Package: − 6.1 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the ON Semiconductor High−Speed CMOS Data Book (DL129/D).

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 ≤ (V_{in} or V_{out}) ≤ 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.

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 V V_{CC} = 4.5 V V_{CC} = 6.0 V	0 0 0	1000 500 400	ns

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

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 V or V_{CC} – 0.1 V $\|I_{out}\|$ ≤ 20 μA	2.0 3.0 4.5 6.0	1.50 2.10 3.15 4.20	1.50 2.10 3.15 4.20	1.50 2.10 3.15 4.20	V
V_{IL}	Maximum Low−Level Input Voltage	V_{out} = 0.1 V or V_{CC} – 0.1 V $\|I_{out}\|$ ≤ 20 μA	2.0 3.0 4.5 6.0	0.50 0.90 1.35 1.80	0.50 0.90 1.35 1.80	0.50 0.90 1.35 1.80	V
V_{OH}	Minimum High−Level Output Voltage	V_{in} = V_{IH} or V_{IL} $\|I_{out}\|$ ≤ 20 μA	2.0 4.5 6.0	1.90 4.40 5.90	1.90 4.40 5.90	1.90 4.40 5.90	V
		V_{in} = V_{IH} or V_{IL} $\|I_{out}\|$ ≤ 2.4 mA $\|I_{out}\|$ ≤ 6.0 mA $\|I_{out}\|$ ≤ 7.8 mA	3.0 4.5 6.0	2.48 2.98 5.48	2.34 3.84 5.34	2.20 3.70 5.20	V
V_{OL}	Maximum Low−Level Output Voltage	V_{in} = V_{IH} or V_{IL} $\|I_{out}\|$ ≤ 20 μA	2.0 4.5 6.0	0.10 0.10 0.10	0.10 0.10 0.10	0.10 0.10 0.10	V
		V_{in} = V_{IH} or V_{IL} $\|I_{out}\|$ ≤ 2.4 mA $\|I_{out}\|$ ≤ 6.0 mA $\|I_{out}\|$ ≤ 7.8 mA	3.0 4.5 6.0	0.26 0.26 0.26	0.33 0.33 0.33	0.40 0.40 0.40	V

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} V	Guaranteed Limit			Unit
				– 55 to 25°C	≤ 85°C	≤ 125°C	
I_{in}	Maximum Input Leakage Current	$V_{in} = V_{CC}$ or GND	6.0	± 0.1	± 1.0	± 1.0	μA
I_{OZ}	Maximum Three−State Leakage Current	Output in High−Impedance State $V_{in} = V_{IL}$ or V_{IH} $V_{out} = V_{CC}$ or GND	6.0	± 0.5	± 5.0	± 10	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC}$ or GND I_{out} = 0 μA	6.0	4	40	160	μA

NOTE: Information on typical parametric values can be found in Chapter 2 of the ON Semiconductor High−Speed CMOS Data Book (DL129/D).

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input $t_r = t_f$ = 6.0 ns)

Symbol	Parameter	V_{CC} V	Guaranteed Limit			Unit
			– 55 to 25°C	≤ 85°C	≤ 125°C	
f_{max}	Maximum Clock Frequency (50% Duty Cycle)	2.0 3.0 4.5 6.0	6 15 30 35	5 10 24 28	4 8 20 24	MHz
t_{PLH} t_{PHL}	Maximum Propagation Delay, Input Clock to Q (Figures 1 and 5)	2.0 3.0 4.5 6.0	125 80 25 21	155 110 31 26	190 130 38 32	ns
t_{PLZ} t_{PHZ}	Maximum Propagation Delay, Output Enable to Q (Figures 3 and 6)	2.0 3.0 4.5 6.0	150 100 30 26	190 125 38 33	225 150 45 38	ns
t_{PLZ} t_{PHZ}	Maximum Propagation Delay, Output Enable to Q (Figures 3 and 6)	2.0 3.0 4.5 6.0	150 100 30 26	190 125 38 33	225 150 45 38	ns
t_{TLH} t_{THL}	Maximum Output Transition Time, Any Output (Figures 1 and 5)	2.0 3.0 4.5 6.0	75 27 15 13	95 32 19 16	110 36 22 19	ns
C_{in}	Maximum Input Capacitance		10	10	10	pF
C_{out}	Maximum Three−State Output Capacitance (Output in High−Impedance State)		15	15	15	pF

NOTE: For propagation delays with loads other than 50 pF, and information on typical parametric values, see Chapter 2 of the ON Semiconductor High−Speed CMOS Data Book (DL129/D).

		Typical @ 25°C, V_{CC} = 5.0 V	
C_{PD}	Power Dissipation Capacitance (Per Enabled Output)*	34	pF

* Used to determine the no−load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$. For load considerations, see Chapter 2 of the ON Semiconductor High−Speed CMOS Data Book (DL129/D).

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

Symbol	Parameter	Figure	V_{CC} Volts	Guaranteed Limit						Unit
				– 55 to 25°C		≤ 85°C		≤ 125°C		
				Min	Max	Min	Max	Min	Max	
t_{su}	Minimum Setup Time, Data to Clock	3	2.0 3.0 4.5 6.0	50 40 10 9		65 50 13 11		75 60 15 13		ns
t_h	Minimum Hold Time, Clock to Data	3	2.0 3.0 4.5 6.0	5.0 5.0 5.0 5.0		5.0 5 0 5.0 5.0		5.0 5.0 5.0 5.0		ns
t_w	Minimum Pulse Width, Clock	1	2.0 3.0 4.5 6.0	60 23 12 10		75 27 15 13		90 32 18 15		ns
t_r, t_f	Maximum Input Rise and Fall Times	1	2.0 3.0 4.5 6.0		1000 800 500 400		1000 800 500 400		1000 800 500 400	ns

SWITCHING WAVEFORMS

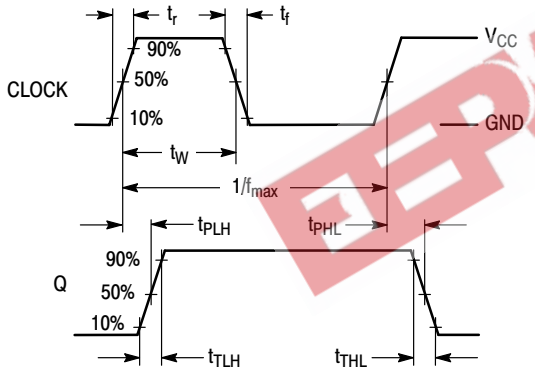


Figure 1.

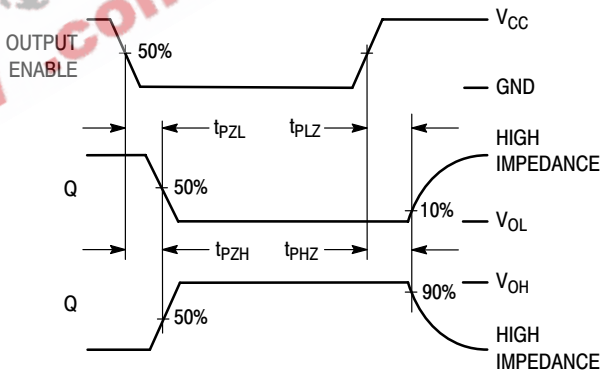


Figure 2.

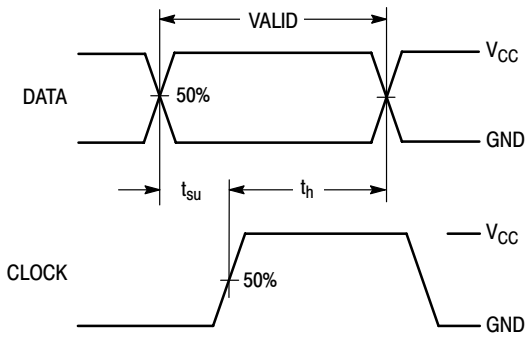
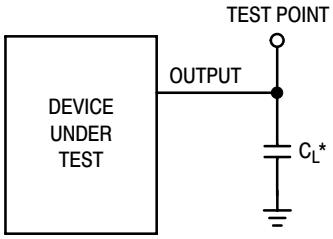


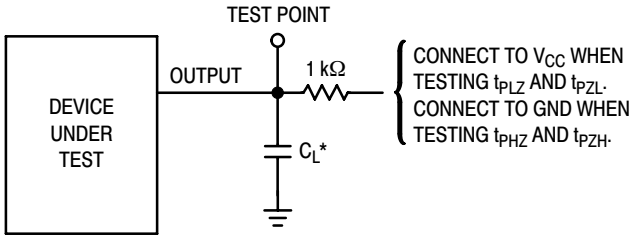
Figure 3.

TEST CIRCUITS



*Includes all probe and jig capacitance

Figure 4.



*Includes all probe and jig capacitance

Figure 5.

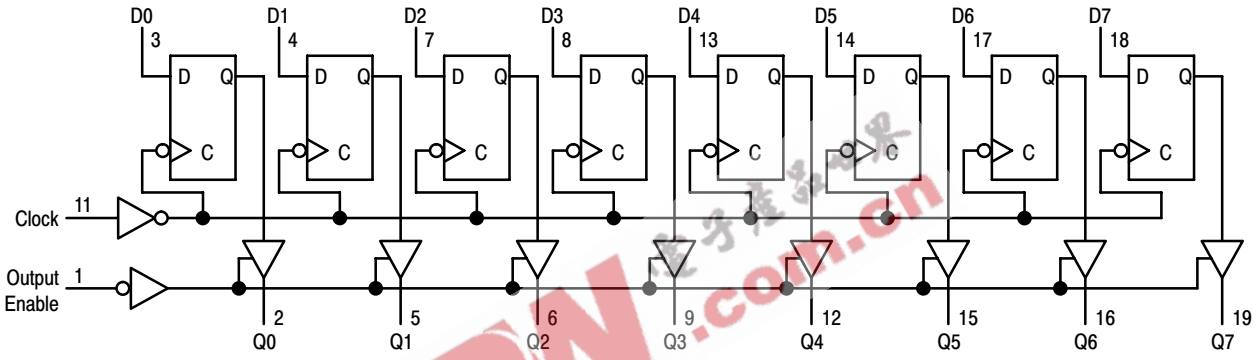
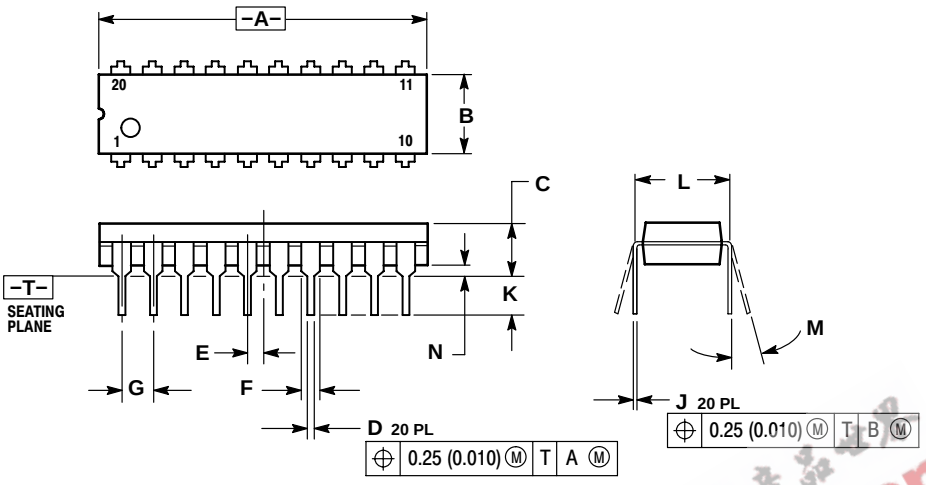


Figure 6. Expanded Logic Diagram

PACKAGE DIMENSIONS

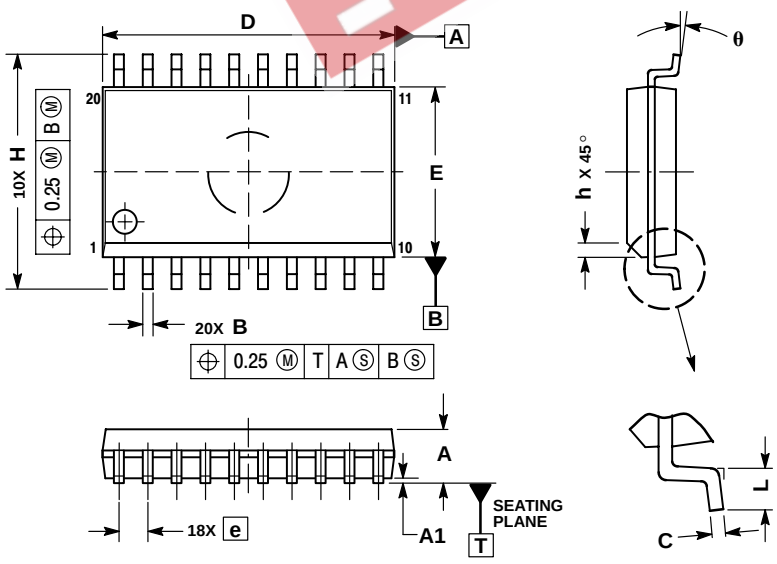
PDIP−20
N SUFFIX
PLASTIC DIP PACKAGE
CASE 738−03
ISSUE E



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.010	1.070	25.66	27.17
B	0.240	0.260	6.10	6.60
C	0.150	0.180	3.81	4.57
D	0.015	0.022	0.39	0.55
E	0.050 BSC		1.27 BSC	
F	0.050	0.070	1.27	1.77
G	0.100 BSC		2.54 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.140	2.80	3.55
L	0.300 BSC		7.62 BSC	
M	0 °	15 °	0 °	15 °
N	0.020	0.040	0.51	1.01

SOIC−20
DW SUFFIX
CASE 751D−05
ISSUE G

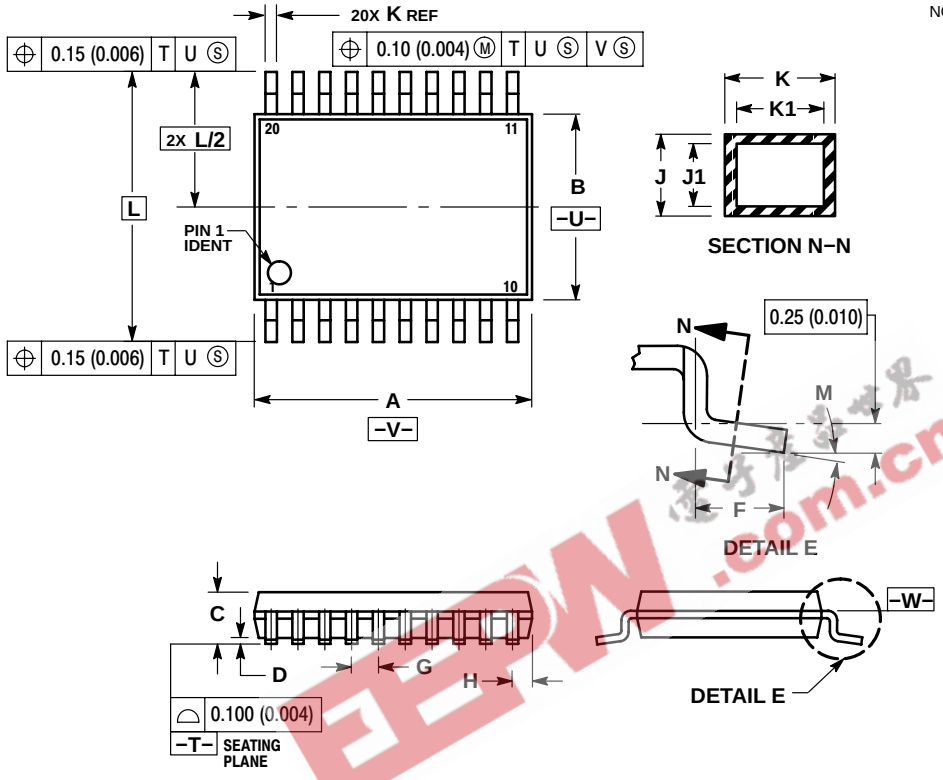


NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS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

	MILLIMETERS	
DIM	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 °

PACKAGE DIMENSIONS

TSSOP−20
DT SUFFIX
CASE 948E−02
ISSUE B

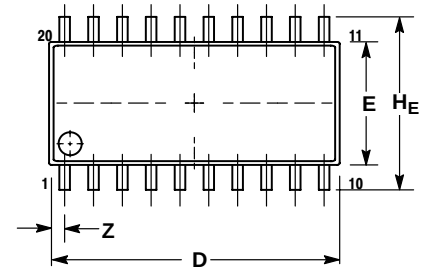


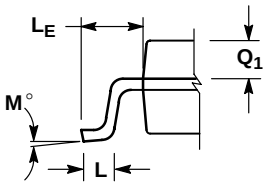
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD 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−.

	MILLIMETERS		INCHES	
DIM	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°

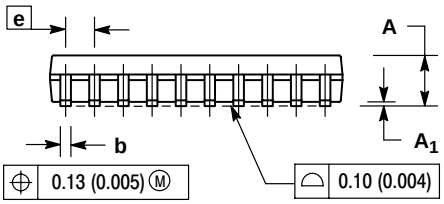
PACKAGE DIMENSIONS

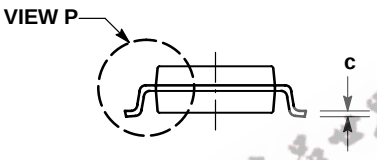
SOEIAJ−20
F SUFFIX
CASE 967−01
ISSUE O





DETAIL P





NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A_1	0.05	0.20	0.002	0.008
b	0.35	0.50	0.014	0.020
c	0.18	0.27	0.007	0.011
D	12.35	12.80	0.486	0.504
E	5.10	5.45	0.201	0.215
e	1.27 BSC		0.050 BSC	
H_E	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
L_E	1.10	1.50	0.043	0.059
M	0 °	10 °	0 °	10 °
Q_1	0.70	0.90	0.028	0.035
Z	---	0.81	---	0.032

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