MC74LCX574

Low-Voltage CMOS Octal D-Type Flip-Flop Flow Through Pinout

With 5 V−Tolerant Inputs and Outputs (3−State, Non−Inverting)

The MC74LCX574 is a high performance, non−inverting octal D−type flip−flop operating from a 2.3 to 3.6 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A V_I specification of 5.5 V allows MC74LCX574 inputs to be safely driven from 5.0 V devices.

The MC74LCX574 consists of 8 edge−triggered flip−flops with individual D−type inputs and 3−state true outputs. The buffered clock and buffered Output Enable ($\overline{OE}$) are common to all flip−flops. The eight flip−flops will store the state of individual D inputs that meet the setup and hold time requirements on the LOW−to−HIGH Clock (CP) transition. With the $\overline{OE}$ LOW, the contents of the eight flip−flops are available at the outputs. When the $\overline{OE}$ is HIGH, the outputs go to the high impedance state. The $\overline{OE}$ input level does not affect the operation of the flip−flops. The LCX574 flow through design facilitates easy PC board layout.

Features

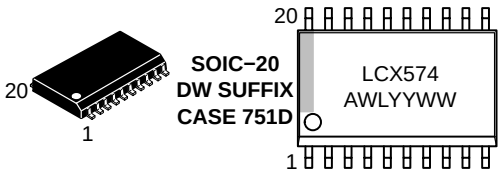
- Designed for 2.3 to 3.6 V V_{CC} Operation
- 5 V Tolerant − Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When V_{CC} = 0 V
- LVTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10 μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V
  Machine Model >200 V
- Pb−Free Packages are Available*

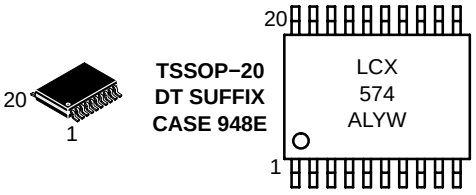
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

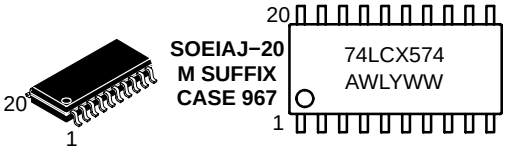
ON Semiconductor®

http://onsemi.com

MARKING DIAGRAMS







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

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

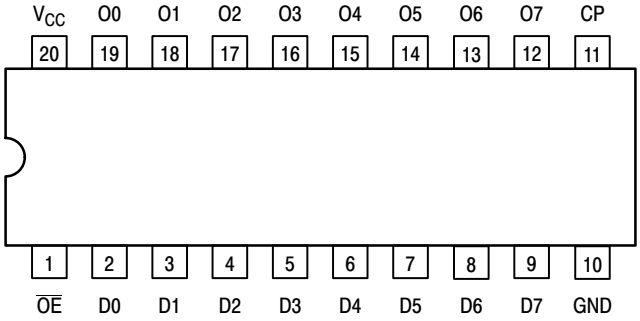


Figure 1. Pinout: 20−Lead (Top View)

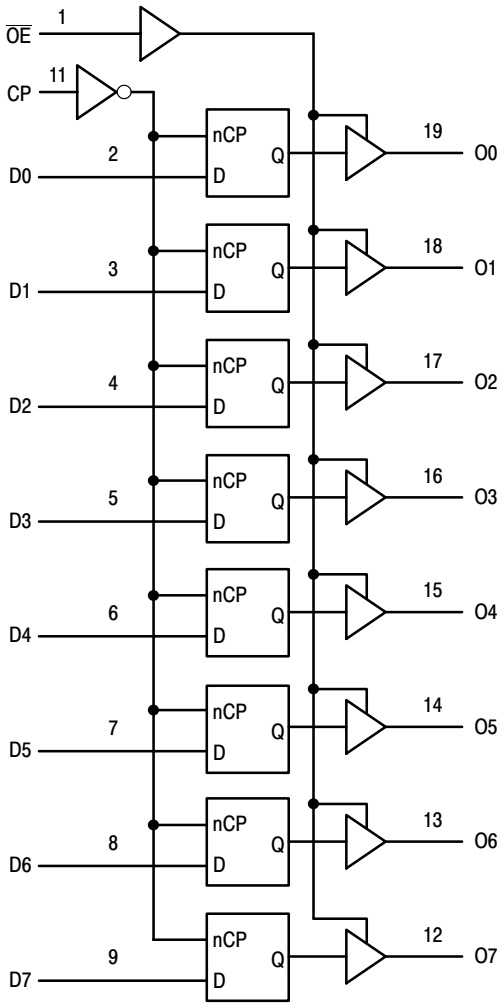


Figure 2. LOGIC DIAGRAM

PIN NAMES

Pins	Function
$\overline{OE}$	Output Enable Input
CP	Clock Pulse Input
D0−D7	Data Inputs
O0−O7	3−State Outputs

TRUTH TABLE

INPUTS			INTERNAL LATCHES	OUTPUTS	OPERATING MODE
$\overline{OE}$	CP	Dn	Q	On	
L L	↑ ↑	l h	L H	L H	Load and Read Register
L	↥	X	NC	NC	Hold and Read Register
H	↥	X	NC	Z	Hold and Disable Outputs
H H	↑ ↑	l h	L H	Z Z	Load Internal Register and Disable Outputs

H = High Voltage Level
h = High Voltage Level One Setup Time Prior to the Low−to−High Clock Transition
L = Low Voltage Level
l = Low Voltage Level One Setup Time Prior to the Low−to−High Clock Transition
NC = No Change
X = High or Low Voltage Level and Transitions are Acceptable
Z = High Impedance State
↑ = Low−to−High Transition
↥ = Not a Low−to−High Transition; For I_{CC} Reasons, DO NOT FLOAT Inputs

MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Unit
V_{CC}	DC Supply Voltage	−0.5 to +7.0		V
V_I	DC Input Voltage	$-0.5 \le V_I \le +7.0$		V
V_O	DC Output Voltage	$-0.5 \le V_O \le +7.0$	Output in 3−State	V
		$-0.5 \le V_O \le V_{CC} + 0.5$	Note 1	V
I_{IK}	DC Input Diode Current	−50	$V_I < GND$	mA
I_{OK}	DC Output Diode Current	−50	$V_O < GND$	mA
		+50	$V_O > V_{CC}$	mA
I_O	DC Output Source/Sink Current	±50		mA
I_{CC}	DC Supply Current Per Supply Pin	±100		mA
I_{GND}	DC Ground Current Per Ground Pin	±100		mA
T_{STG}	Storage Temperature Range	−65 to +150		°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.

1. Output in HIGH or LOW State. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating Data Retention Only	2.0 1.5	3.3 3.3	3.6 3.6	V
V_I	Input Voltage		0		5.5	V
V_O	Output Voltage	(HIGH or LOW State) (3−State)	0 0		V_{CC} 5.5	V
I_{OH}	HIGH Level Output Current, V_{CC} = 3.0 V − 3.6 V				−24	mA
I_{OL}	LOW Level Output Current, V_{CC} = 3.0 V − 3.6 V				24	mA
I_{OH}	HIGH Level Output Current, V_{CC} = 2.7 V − 3.0 V				−12	mA
I_{OL}	LOW Level Output Current, V_{CC} = 2.7 V − 3.0 V				12	mA
T_A	Operating Free−Air Temperature		−40		+85	°C
$\Delta t/\Delta V$	Input Transition Rise or Fall Rate, V_{IN} from 0.8 V to 2.0 V, V_{CC} = 3.0 V		0		10	ns/V

ORDERING INFORMATION

Device	Package	Shipping†
MC74LCX574DWR2	SOIC−20	1000 Tape & Reel
MC74LCX574DWR2G	SOIC−20 (Pb−Free)	1000 Tape & Reel
MC74LCX574DT	TSSOP−20*	75 Units / Rail
MC74LCX574DTR2	TSSOP−20*	2000 Tape & Reel
MC74LCX574MEL	SOEIAJ−20	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.

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = −40°C to +85°C		Unit
			Min	Max	
V_{IH}	HIGH Level Input Voltage (Note 2)	2.7 V ≤ V_{CC} ≤ 3.6 V	2.0		V
V_{IL}	LOW Level Input Voltage (Note 2)	2.7 V ≤ V_{CC} ≤ 3.6 V		0.8	V
V_{OH}	HIGH Level Output Voltage	2.7 V ≤ V_{CC} ≤ 3.6 V; I_{OH} = −100 μA	V_{CC} − 0.2		V
		V_{CC} = 2.7 V; I_{OH} = −12 mA	2.2		
		V_{CC} = 3.0 V; I_{OH} = −18 mA	2.4		
		V_{CC} = 3.0 V; I_{OH} = −24 mA	2.2		
V_{OL}	LOW Level Output Voltage	2.7 V ≤ V_{CC} ≤ 3.6 V; I_{OL} = 100 μA		0.2	V
		V_{CC} = 2.7 V; I_{OL}= 12 mA		0.4	
		V_{CC} = 3.0 V; I_{OL} = 16 mA		0.4	
		V_{CC} = 3.0 V; I_{OL} = 24 mA		0.55	
I_I	Input Leakage Current	2.7 V ≤ V_{CC} ≤ 3.6 V; 0 V ≤ V_I ≤ 5.5 V		±5.0	μA
I_{OZ}	3−State Output Current	2.7 ≤ V_{CC} ≤ 3.6 V; 0 V ≤ V_O ≤ 5.5 V; V_I = V_{IH} or V_{IL}		±5.0	μA
I_{OFF}	Power−Off Leakage Current	V_{CC} = 0 V; V_I or V_O = 5.5 V		10	μA
I_{CC}	Quiescent Supply Current	2.7 ≤ V_{CC} ≤ 3.6 V; V_I = GND or V_{CC}		10	μA
		2.7 ≤ V_{CC} ≤ 3.6 V; 3.6 ≤ V_I or V_O ≤ 5.5 V		±10	μA
ΔI_{CC}	Increase in I_{CC} per Input	2.7 ≤ V_{CC} ≤ 3.6 V; V_{IH} = V_{CC} − 0.6 V		500	μA

2. These values of V_I are used to test DC electrical characteristics only.

AC CHARACTERISTICS (t_R = t_F = 2.5 ns; C_L = 50 pF; R_L = 500 Ω)

Symbol	Parameter	Waveform	Limits				Unit
			T_A = −40°C to +85°C				
			V_{CC} = 3.0 V to 3.6 V		V_{CC} = 2.7 V		
			Min	Max	Min	Max	
f_{max}	Clock Pulse Frequency	1	150				MHz
t_{PLH} t_{PHL}	Propagation Delay CP to On	1	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
t_{PZH} t_{PZL}	Output Enable Time to HIGH and LOW Levels	2	1.5 1.5	8.5 8.5	1.5 1.5	9.5 9.5	ns
t_{PHZ} t_{PLZ}	Output Disable Time from HIGH and LOW Levels	2	1.5 1.5	6.5 6.5	1.5 1.5	7.0 7.0	ns
t_s	Setup TIme, HIGH or LOW Dn to CP	1	2.5		2.5		ns
t_h	Hold TIme, HIGH or LOW Dn to CP	1	1.5		1.5		ns
t_w	CP Pulse Width, HIGH or LOW	3	3.3		3.3		ns
t_{OSHL} t_{OSLH}	Output−to−Output Skew (Note 3)			1.0 1.0			ns

3. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH−to−LOW (t_{OSHL}) or LOW−to−HIGH (t_{OSLH}); parameter guaranteed by design.

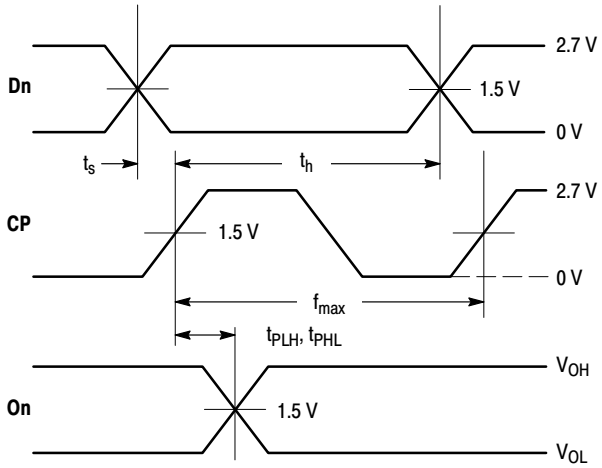
DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = +25°C			Unit
			Min	Typ	Max	
V_{OLP}	Dynamic LOW Peak Voltage (Note 4)	V_{CC} = 3.3 V, C_L = 50 pF, V_{IH} = 3.3 V, V_{IL} = 0 V		0.8		V
V_{OLV}	Dynamic LOW Valley Voltage (Note 4)	V_{CC} = 3.3 V, C_L = 50 pF, V_{IH} = 3.3 V, V_{IL} = 0 V		0.8		V

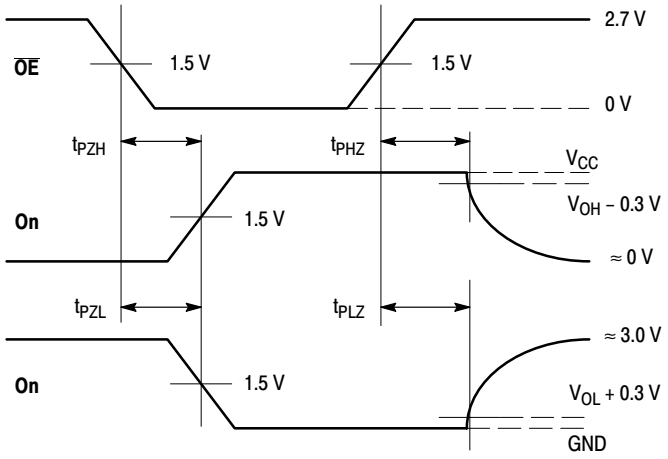
4. Number of outputs defined as “n”. Measured with “n−1” outputs switching from HIGH−to−LOW or LOW−to−HIGH. The remaining output is measured in the LOW state.

CAPACITIVE CHARACTERISTICS

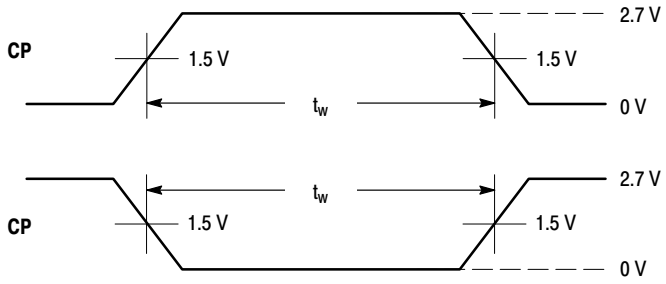
Symbol	Parameter	Condition	Typical	Unit
C_{IN}	Input Capacitance	V_{CC} = 3.3 V, V_I = 0 V or V_{CC}	7	pF
C_{OUT}	Output Capacitance	V_{CC} = 3.3 V, V_I = 0 V or V_{CC}	8	pF
C_{PD}	Power Dissipation Capacitance	10 MHz, V_{CC} = 3.3 V, V_I = 0 V or V_{CC}	25	pF



WAVEFORM 1 – PROPAGATION DELAYS, SETUP AND HOLD TIMES
t_R = t_F = 2.5 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns

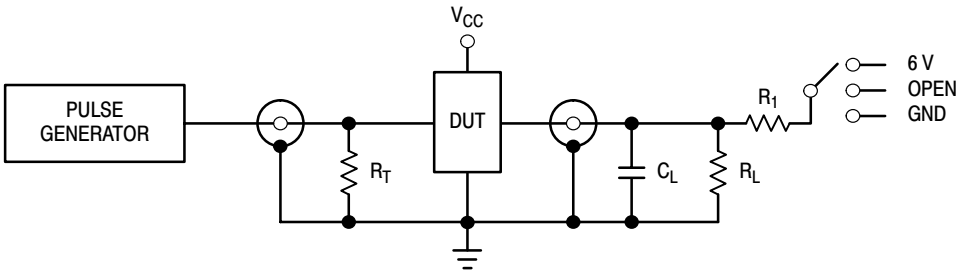


WAVEFORM 2 – OUTPUT ENABLE AND DISABLE TIMES
t_R = t_F = 2.5 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns



WAVEFORM 3 – PULSE WIDTH
t_R = t_F = 2.5 ns (or fast as required) from 10% to 90%;
Output requirements: $V_{OL} \leq 0.8$ V, $V_{OH} \geq 2.0$ V

Figure 3. AC Waveforms



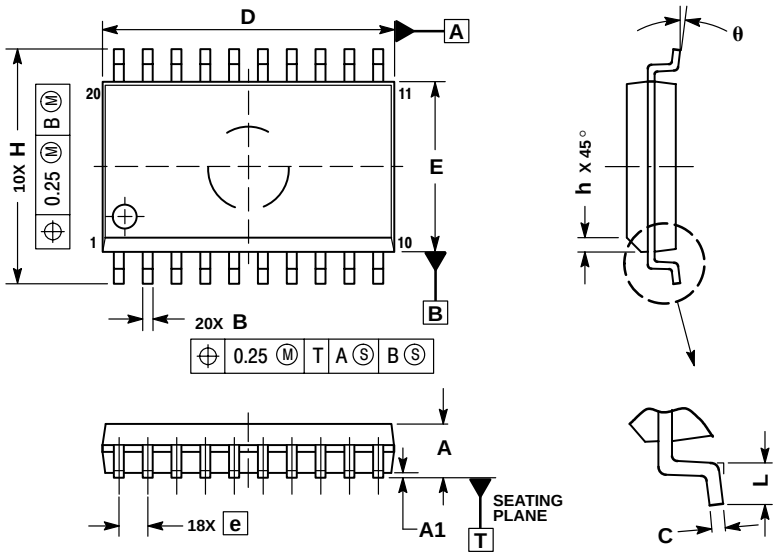
TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6 V
Open Collector/Drain t_{PLH} and t_{PHL}	6 V
t_{PZH}, t_{PHZ}	GND

C_L = 50 pF or equivalent (Includes jig and probe capacitance)
$R_L = R_1$ = 500 Ω or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50 Ω)

Figure 4. Test Circuit

PACKAGE DIMENSIONS

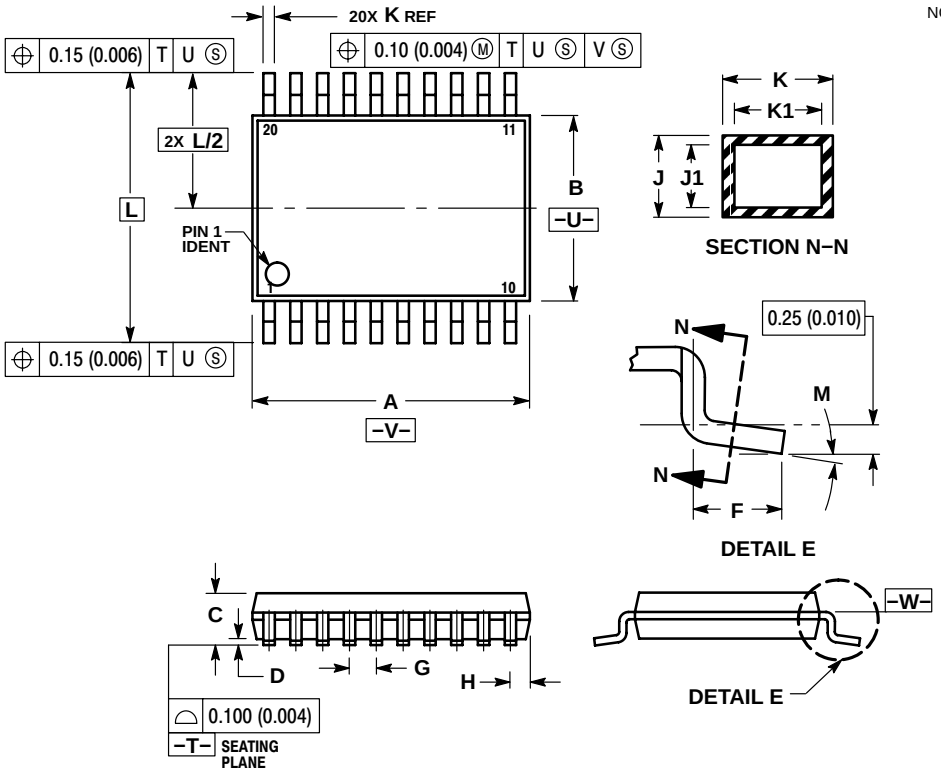
SOIC−20
DW SUFFIX
CASE 751D−05
ISSUE G



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°

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



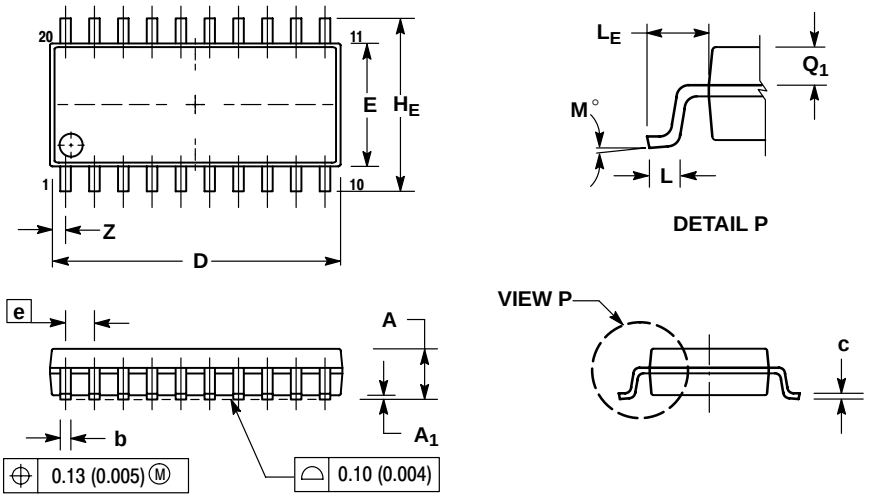
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD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

MC74LCX574

PACKAGE DIMENSIONS

SOEIAJ−20
M SUFFIX
CASE 967−01
ISSUE O



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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center
2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.