

MC74LCX374

Low-Voltage CMOS Octal D-Type Flip-Flop

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

The MC74LCX374 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 MC74LCX374 inputs to be safely driven from 5 V devices.

The MC74LCX374 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.

Features

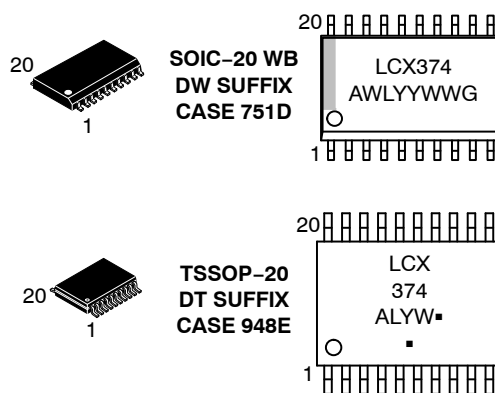
- Designed for 2.3 to 3.6 V V_{CC} Operation
- 5 V Tolerant – Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0$ V
- LVTTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10 μ A)
Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance:
 - ♦ Human Body Model >2000 V
 - ♦ Machine Model >200 V
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



ON Semiconductor®

<http://onsemi.com>

MARKING DIAGRAMS



A = Assembly Location
L, WL = Wafer Lot
Y, YY = Year
W, WW = Work Week
G or ■ = 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 3 of this data sheet.

MC74LCX374

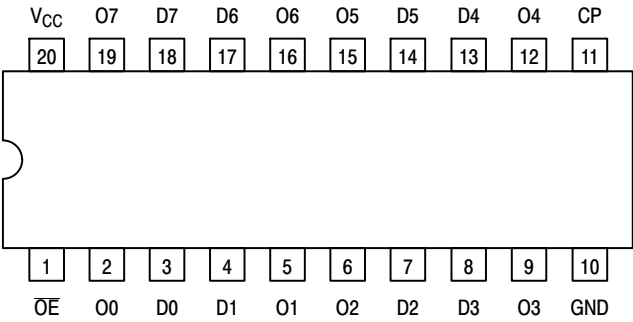


Figure 1. Pinout: 20-Lead (Top View)

PIN NAMES

Pins	Function
OE	Output Enable Input
CP	Clock Pulse Input
D0–D7	Data Inputs
O0–O7	3-State Outputs

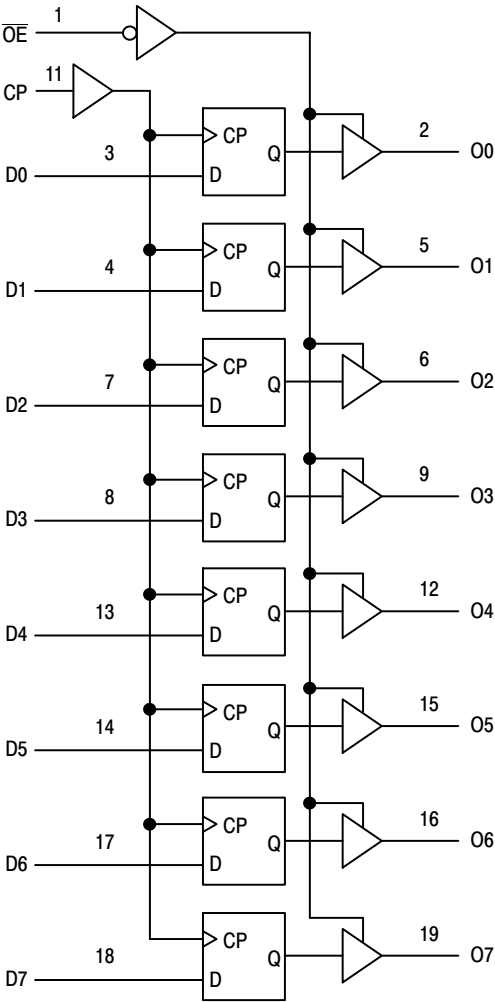


Figure 2. LOGIC DIAGRAM

TRUTH TABLE

INPUTS			OUTPUTS	OPERATING MODE
OE	CP	Dn	On	
L	↑	L	L	Load and Read Register
L	↑	H	H	
L	↑	X	NC	Hold and Read Register
H	↑	X	Z	Hold and Disable Outputs
H	↑	L	Z	Load Internal Register and Disable Outputs
H	↑	H	Z	

- 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, State Prior to Low-to-High Clock Transition
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

MC74LCX374

MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Units
V_{CC}	DC Supply Voltage	-0.5 to +7.0		V
V_I	DC Input Voltage	$-0.5 \leq V_I \leq +7.0$		V
V_O	DC Output Voltage	$-0.5 \leq V_O \leq +7.0$	Output in 3-State	V
		$-0.5 \leq V_O \leq V_{CC} + 0.5$	(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
MSL	Moisture Sensitivity		Level 1	

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	Units
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, $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$			-24	mA
I_{OL}	LOW Level Output Current, $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$			24	mA
I_{OH}	HIGH Level Output Current, $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$			-12	mA
I_{OL}	LOW Level Output Current, $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$			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, $V_{CC} = 3.0\text{ V}$	0		10	ns/V

ORDERING INFORMATION

Device	Package	Shipping [†]
MC74LCX374DWR2G	SOIC-20 WB (Pb-Free)	1000 Tape & Reel
MC74LCX374DTR2G	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.

MC74LCX374

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T _A = -40°C to +85°C		Units
			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 _{OZ}	3-State Output Current	V _{CC} = 3.6 V, V _{IN} = V _{IH} or V _{IL} , V _{OUT} = 0 to 5.5 V		±5	μA
I _{OFF}	Power Off Leakage Current	V _{CC} = 0, V _{IN} = 5.5 V or V _{OUT} = 5.5 V		10	μA
I _{IN}	Input Leakage Current	V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND		±5	μA
I _{CC}	Quiescent Supply Current	V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND		10	μA
ΔI _{CC}	Increase in I _{CC} per Input	2.3 ≤ 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				Units
			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 O _n	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	7.5 7.5	1.5 1.5	8.5 8.5	ns
t _s	Setup Time, HIGH or LOW D _n to CP	1	2.5		2.5		ns
t _h	Hold Time, HIGH or LOW D _n 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.

MC74LCX374

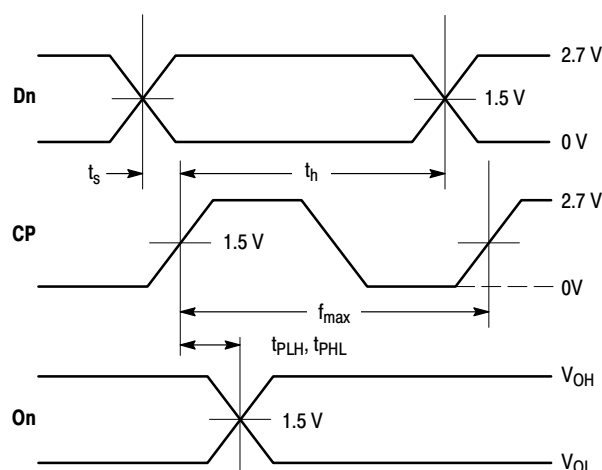
DYNAMIC SWITCHING CHARACTERISTICS

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

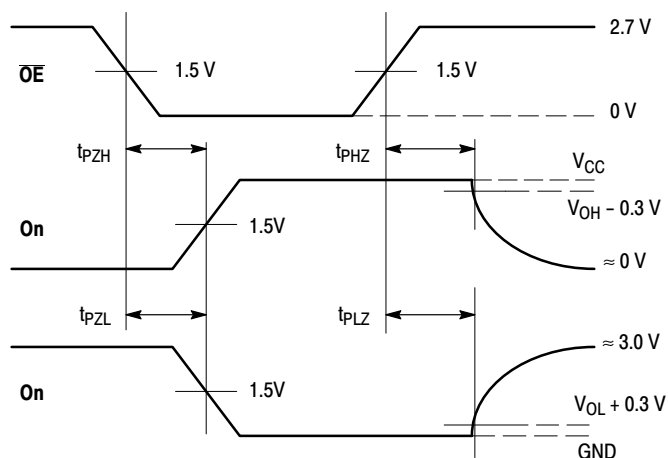
CAPACITIVE CHARACTERISTICS

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



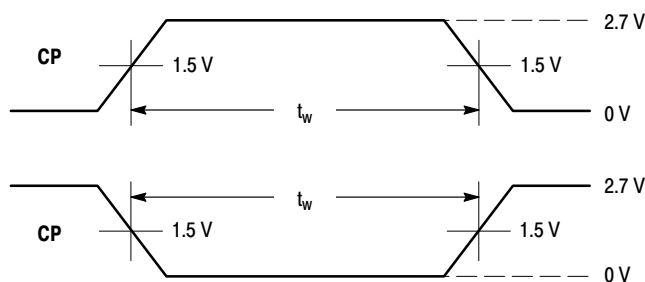
WAVEFORM 1 - PROPAGATION DELAYS, SETUP AND HOLD TIMES

$t_R = t_F = 2.5\text{ ns}$, 10% to 90%; $f = 1\text{ MHz}$; $t_W = 500\text{ ns}$



WAVEFORM 2 - OUTPUT ENABLE AND DISABLE TIMES

$t_R = t_F = 2.5\text{ ns}$, 10% to 90%; $f = 1\text{ MHz}$; $t_W = 500\text{ ns}$

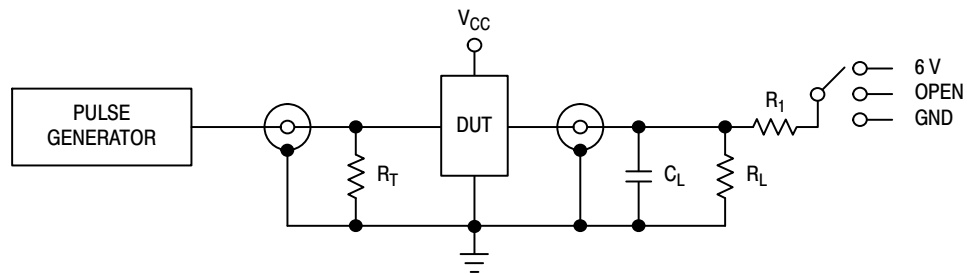


WAVEFORM 3 - PULSE WIDTH

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

Figure 3. AC Waveforms

MC74LCX374



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

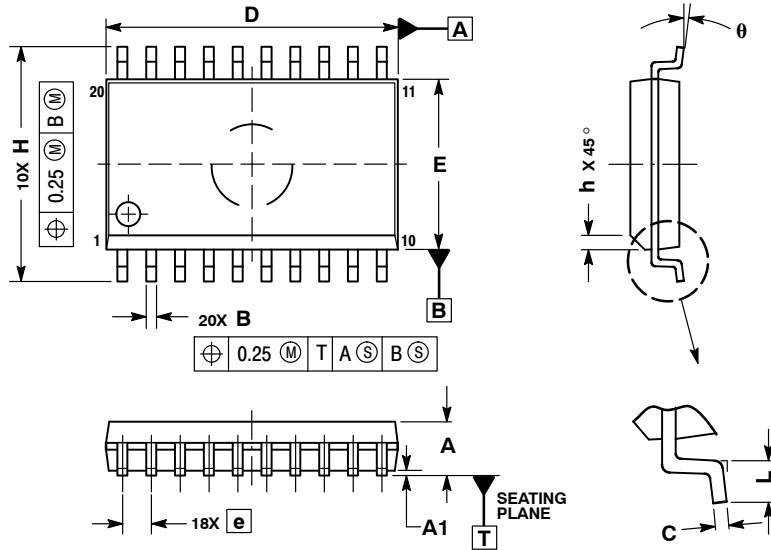
R_T = Z_{OUT} of pulse generator (typically 50 Ω)

Figure 4. Test Circuit

MC74LCX374

PACKAGE DIMENSIONS

SOIC-20 WB
DW SUFFIX
CASE 751D-05
ISSUE G



NOTES:

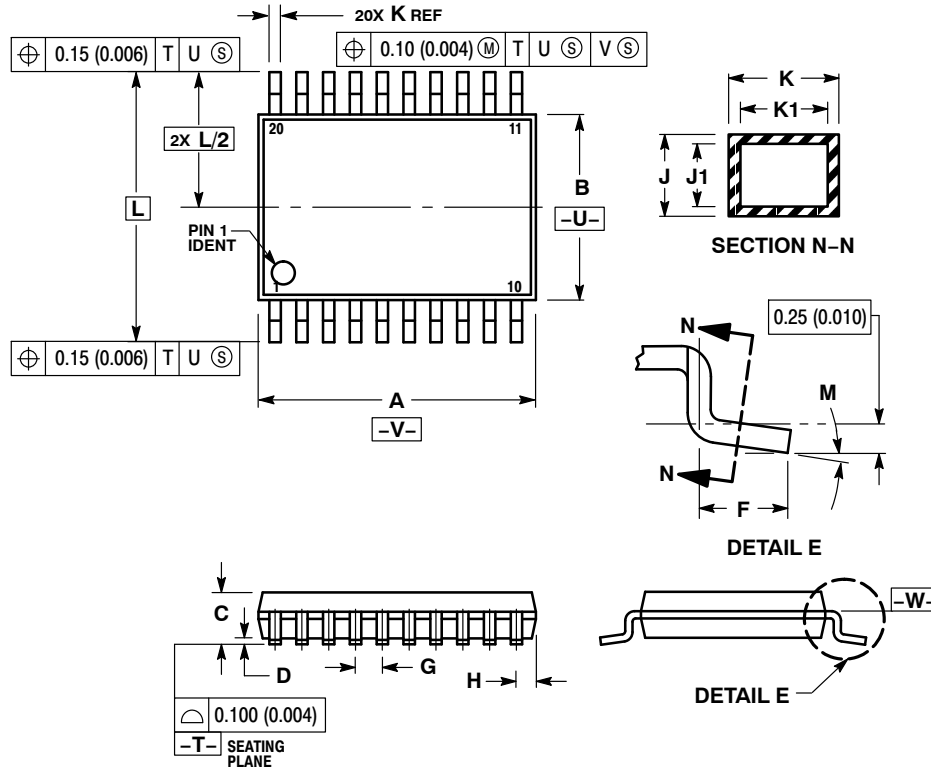
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION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

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°

MC74LCX374

PACKAGE DIMENSIONS

TSSOP-20
DT SUFFIX
CASE 948E-02
ISSUE C

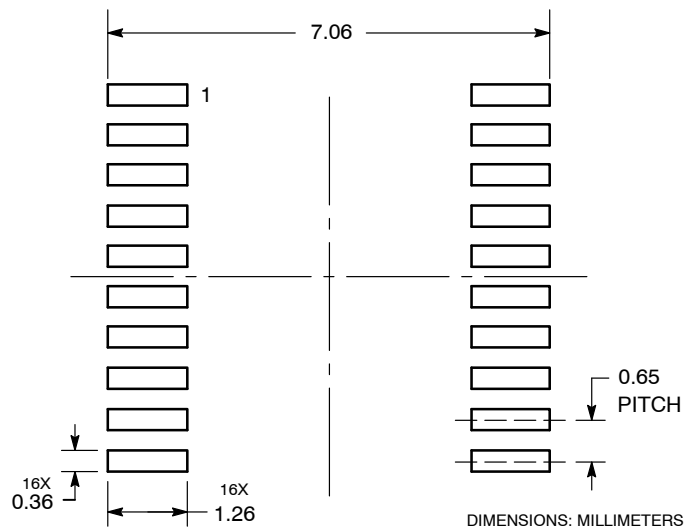


NOTES:

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



ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

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

Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910

Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local
Sales Representative