

MC74LCX06

Low-Voltage CMOS Hex Inverter with Open Drain Outputs

With 5 V – Tolerant Inputs

The MC74LCX06 is a high performance hex inverter operating from a 2.3 V to 3.6 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers. These LCX devices have open drain outputs which provide the ability to set output levels, or do active-HIGH AND or active-LOW OR functions. A V_I specification of 5.5 V allows MC74LCX06 inputs to be safely driven from 5.0 V devices.

Features

- Designed for 2.3 V to 3.6 V V_{CC} Operation
- 5.0 V Tolerant Inputs/Outputs
- LVTTL Compatible
- LVCMS Compatible
- 24 mA Output Sink Capability
- Near Zero Static Supply Current (10 μ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- Wired-OR, Wired-AND
- Output Level Can Be Set Externally Without Affecting Speed of Device
- Functionally Compatible with LCX05
- ESD Performance: Human Body Model >1500 V; Machine Model >200 V
- These Devices are Pb-Free and are RoHS Compliant

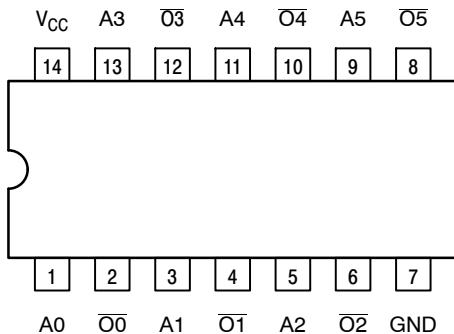


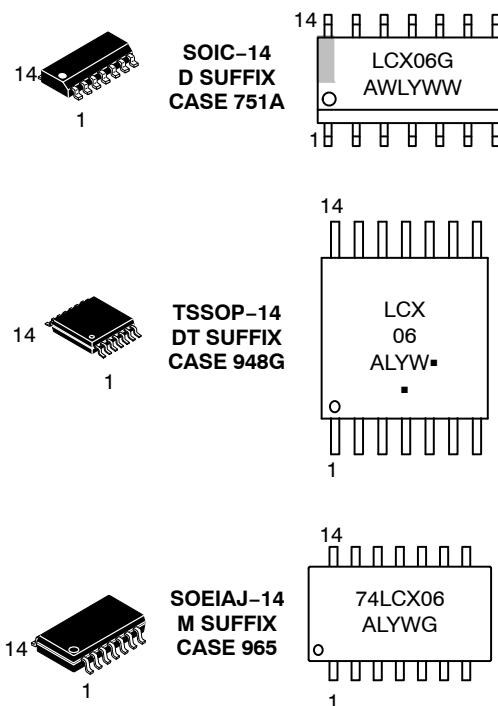
Figure 1. Pinout: 14-Lead (Top View)



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MARKING DIAGRAMS



A = Assembly Location

WL, L = Wafer Lot

Y = Year

WW, W = 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 2 of this data sheet.

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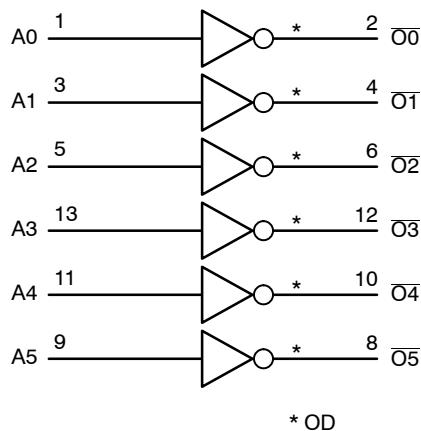


Figure 2. Logic Diagram

Table 1. PIN NAMES

Pins	Function
An On	Data Inputs Outputs

Table 2. TRUTH TABLE

An	$\overline{\text{On}}$
L	Z
H	L

MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Unit
V_{CC}	DC Supply Voltage	-0.5 to +7.0		V
V_I	DC Input Voltage	$-0.5 \leq V_I \leq +7.0$		V
V_O	DC Output Voltage	$-0.5 \leq V_O \leq +7.0$	Output in HIGH or LOW State (Note 1)	V
I_{IK}	DC Input Diode Current	-50	$V_I < \text{GND}$	mA
I_{OK}	DC Output Diode Current	-50	$V_O < \text{GND}$	mA
		+50	$V_O > V_{CC}$	mA
I_O	DC Output/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. I_O absolute maximum rating must be observed.

ORDERING INFORMATION

Device	Package	Shipping [†]
MC74LCX06DG	SOIC-14 (Pb-Free)	55 Units / Rail
MC74LCX06DR2G	SOIC-14 (Pb-Free)	2500 / Tape & Reel
MC74LCX06DTG	TSSOP-14*	96 Units / Rail
MC74LCX06DTR2G	TSSOP-14*	2500 / Tape & Reel
MC74LCX06MG	SOEIAJ-14	50 Units / Rail
MC74LCX06MELG	SOEIAJ-14	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.

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RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit	
V_{CC}	Supply Voltage Operating Data Retention Only	2.0 1.5	2.5, 3.3 2.5, 3.3	3.6 3.6	V	
V_I	Input Voltage	0		5.5	V	
V_O	Output Voltage (HIGH or LOW State)	0		V_{CC}	V	
I_{OL}	LOW Level Output Current Sink	$V_{CC} = 3.0\text{ V} - 3.6\text{ V}$ $V_{CC} = 2.7\text{ V} - 3.0\text{ V}$ $V_{CC} = 2.3\text{ V} - 2.7\text{ V}$			+24 +12 +8	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	

DC ELECTRICAL CHARACTERISTICS ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$)

Symbol	Characteristic	Condition	Min	Max	Unit
V_{IH}	HIGH Level Input Voltage (Note 2)	$2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$	1.7		V
		$2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$	2.0		
V_{IL}	LOW Level Input Voltage (Note 2)	$2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$		0.7	V
		$2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$		0.8	
V_{OL}	LOW Level Output Voltage	$2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; I_{OL} = 100\text{ }\mu\text{A}$		0.2	V
		$V_{CC} = 2.3\text{ V}; I_{OL} = 8\text{ mA}$		0.3	
		$V_{CC} = 2.7\text{ V}; I_{OL} = 12\text{ mA}$		0.4	
		$V_{CC} = 3.0\text{ V}; I_{OL} = 16\text{ mA}$		0.4	
		$V_{CC} = 3.0\text{ V}; I_{OL} = 24\text{ mA}$		0.55	
I_I	Input Leakage Current	$2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; 0\text{ V} \leq V_I \leq 5.5\text{ V}$		± 5.0	μA
I_{OFF}	Power-Off Leakage Current	$V_{CC} = 0\text{ V}; V_I$ or $V_O = 5.5\text{ V}$		10	μA
I_{CC}	Quiescent Supply Current	$2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; V_I = \text{GND}$ or V_{CC}		10	μA
		$2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; 3.6 \leq V_I \leq 5.5\text{ V}$		± 10	μA
ΔI_{CC}	Increase in I_{CC} per Input	$2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}$ One Input at $V_{IH} = V_{CC} - 0.6\text{ V}$		500	μA

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

AC ELECTRICAL CHARACTERISTICS ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$)

Symbol	Parameter	$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ $C_L = 50\text{ pF}$		$V_{CC} = 2.7\text{ V}$ $C_L = 50\text{ pF}$		$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ $C_L = 30\text{ pF}$		Unit
		Min	Max	Min	Max	Min	Max	
t_{PLZ}	Propagation Delay Input to Output	0.8 0.8	3.7 3.7	1.0 1.0	4.1 4.1	0.8 0.8	3.5 3.5	ns ns

DYNAMIC SWITCHING CHARACTERISTICS ($T_A = +25^\circ\text{C}$)

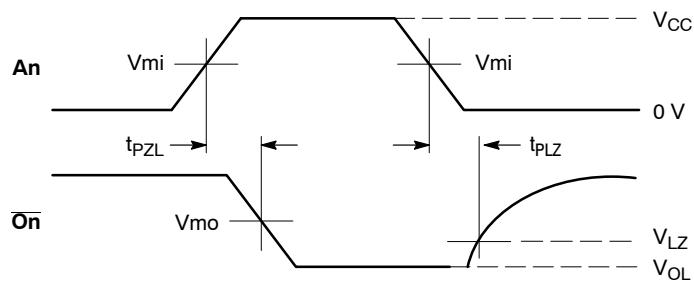
Symbol	Characteristic	Condition	Min	Typ	Max	Unit
V_{OLP}	Dynamic LOW Peak Voltage (Note 3)	$V_{CC} = 3.3\text{ V}, C_L = 50\text{ pF}, V_{IH} = 3.3\text{ V}, V_{IL} = 0\text{ V}$ $V_{CC} = 2.5\text{ V}, C_L = 30\text{ pF}, V_{IH} = 2.5\text{ V}, V_{IL} = 0\text{ V}$		0.9 0.7		V
V_{OLV}	Dynamic LOW Valley Voltage (Note 3)	$V_{CC} = 3.3\text{ V}, C_L = 50\text{ pF}, V_{IH} = 3.3\text{ V}, V_{IL} = 0\text{ V}$ $V_{CC} = 2.5\text{ V}, C_L = 30\text{ pF}, V_{IH} = 2.5\text{ V}, V_{IL} = 0\text{ V}$		-0.8 -0.6		V

3. 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	$V_{CC} = 3.3\text{ V}, V_I = 0\text{ V}$ 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

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PROPAGATION DELAYS

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

Table 3. AC WAVEFORMS

Symbol	V_{CC}		
	$3.3\text{ V} \pm 0.3\text{ V}$	2.7 V	$2.5\text{ V} \pm 0.2\text{ V}$
V_{mi}	1.5 V	1.5 V	$V_{CC} / 2$
V_{mo}	1.5 V	1.5 V	$V_{CC} / 2$
V_{LZ}	$V_{OL} + 0.3\text{ V}$	$V_{OL} + 0.3\text{ V}$	$V_{OL} + 0.15\text{ V}$

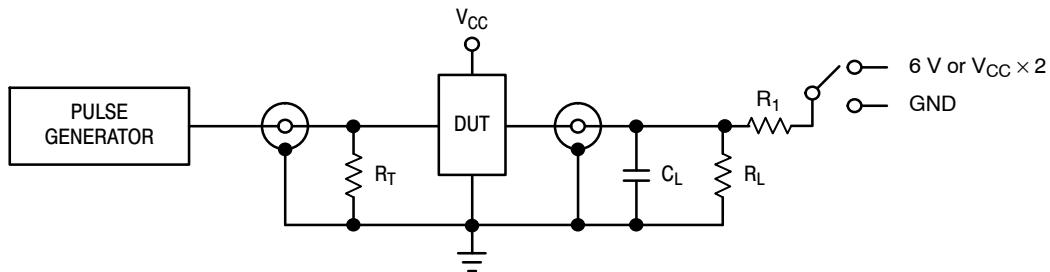


Table 4. TEST CIRCUIT

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

$C_L = 50\text{ pF}$ at $V_{CC} = 3.3 \pm 0.3\text{ V}$ or equivalent (includes jig and probe capacitance)

$C_L = 30\text{ pF}$ at $V_{CC} = 2.5 \pm 0.2\text{ V}$ or equivalent (includes jig and probe capacitance)

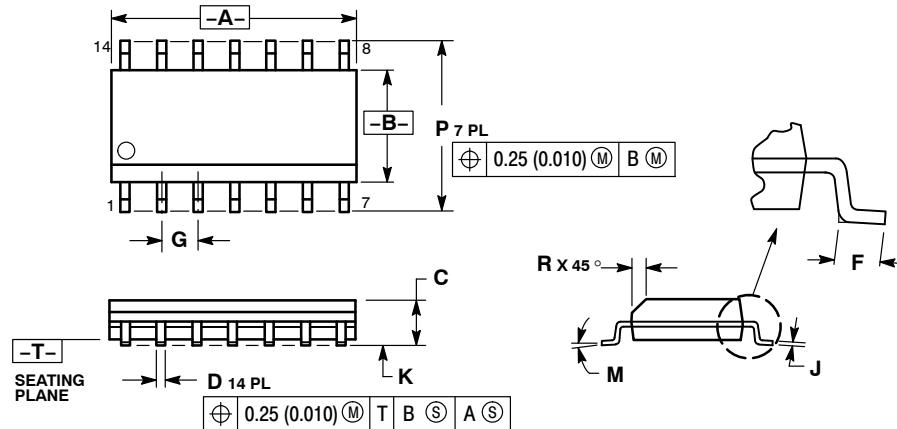
$R_L = R_1 = 500\text{ }\Omega$ or equivalent

$R_T = Z_{OUT}$ of pulse generator (typically $50\text{ }\Omega$)

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PACKAGE DIMENSIONS

**SOIC-14
D SUFFIX
CASE 751A-03
ISSUE J**

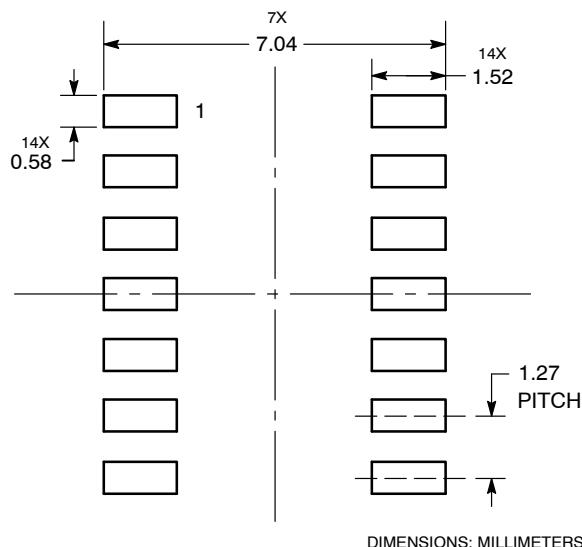


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27	BSC	0.050	BSC
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0 °	7 °	0 °	7 °
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

SOLDERING FOOTPRINT*



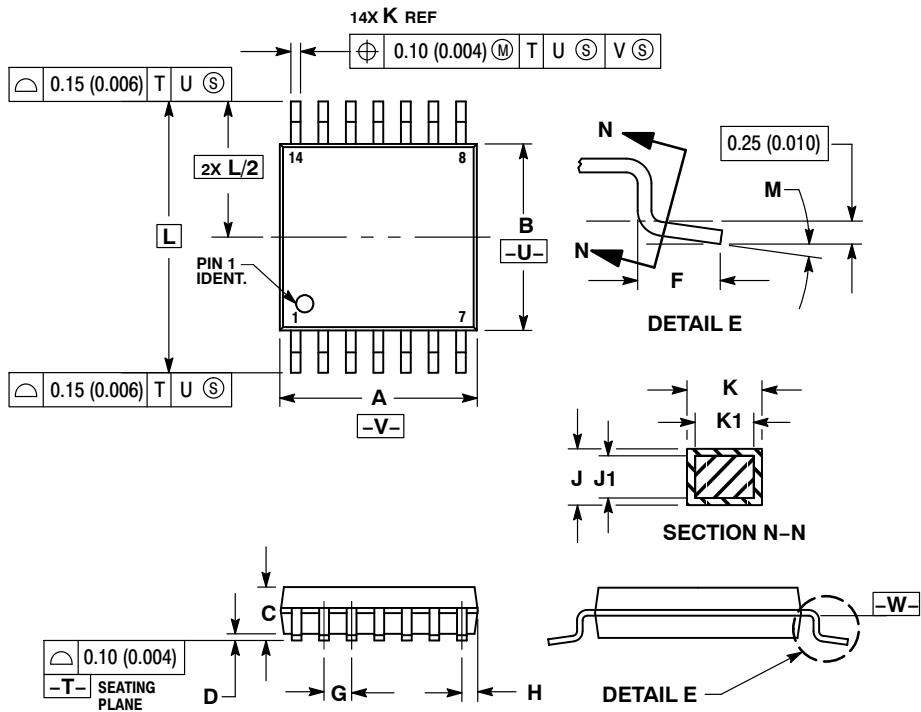
DIMENSIONS: MILLIMETERS

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

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PACKAGE DIMENSIONS

TSSOP-14
DT SUFFIX
CASE 948G-01
ISSUE B

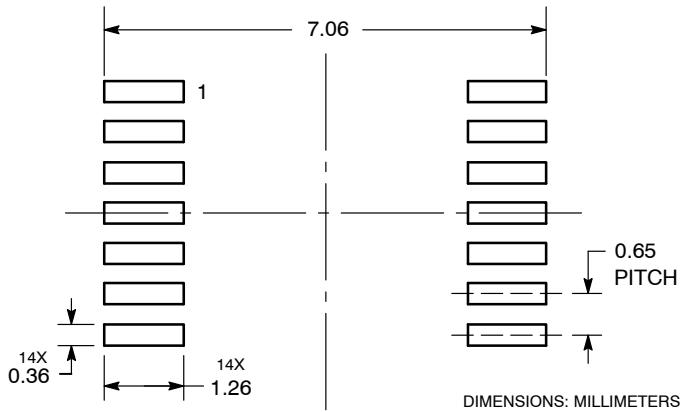


NOTES:

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-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
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	0.50	0.60	0.020	0.024
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

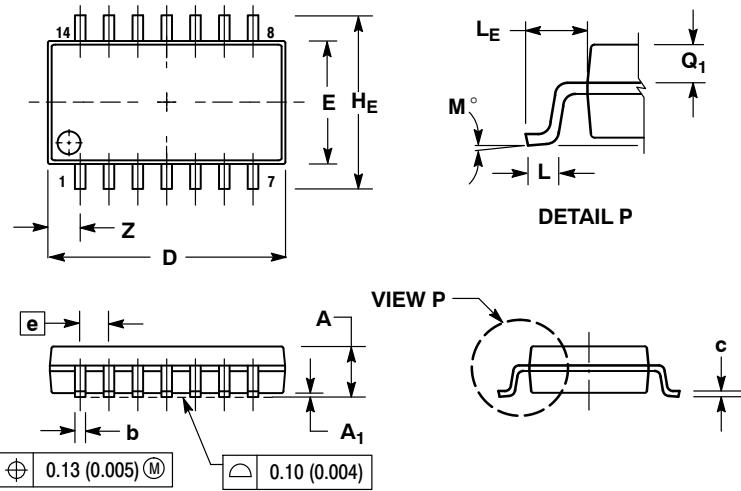
SOLDERING FOOTPRINT*



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

PACKAGE DIMENSIONS

SOEIAJ-14
M SUFFIX
CASE 965-01
ISSUE B



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).

DIM	MILLIMETERS		INCHES	
	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	0.10	0.20	0.004	0.008
D	9.90	10.50	0.390	0.413
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	---	1.42	---	0.056

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