

# Low-Voltage CMOS Quad 2-Input NAND Gate

## With 5V-Tolerant Inputs

The MC74LCX00 is a high performance, quad 2-input NAND gate operating from a 2.3 to 3.6V 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 5.5V allows MC74LCX00 inputs to be safely driven from 5V devices.

Current drive capability is 24mA at the outputs.

- Designed for 2.3 to 3.6V  $V_{CC}$  Operation
- 5V Tolerant Inputs — Interface Capability With 5V TTL Logic
- LVTTL Compatible
- LVCMOS Compatible
- 24mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current (10 $\mu$ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500mA
- ESD Performance: Human Body Model >2000V; Machine Model >200V

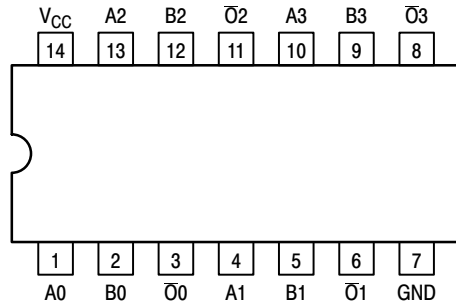


Figure 1. LOGIC DIAGRAM

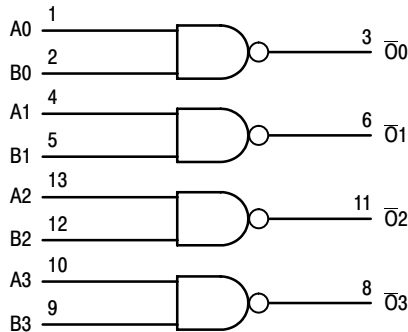


Figure 2. Pinout: 14-Lead (Top View)

# MC74LCX00

# LCX

## LOW-VOLTAGE CMOS QUAD 2-INPUT NAND GATE

**D SUFFIX**  
PLASTIC SOIC  
CASE 751A-03

**M SUFFIX**  
PLASTIC SOIC EIAJ  
CASE 965-01

**DT SUFFIX**  
PLASTIC TSSOP  
CASE 948G-01

### PIN NAMES

Pins	Function
An, Bn	Data Inputs
On	Outputs

### FUNCTION TABLE

Inputs		Outputs
An	Bn	$\bar{O}n$
L	L	H
L	H	H
H	L	H
H	H	L

# MC74LCX00

## ABSOLUTE MAXIMUM RATINGS\*

Symbol	Parameter	Value	Condition	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0		V
V <sub>I</sub>	DC Input Voltage	-0.5 ≤ V <sub>I</sub> ≤ +7.0		V
V <sub>O</sub>	DC Output Voltage	-0.5 ≤ V <sub>O</sub> ≤ V <sub>CC</sub> + 0.5	Note 1.	V
I <sub>IK</sub>	DC Input Diode Current	-50	V <sub>I</sub> < GND	mA
I <sub>OK</sub>	DC Output Diode Current	-50	V <sub>O</sub> < GND	mA
		+50	V <sub>O</sub> > V <sub>CC</sub>	mA
I <sub>O</sub>	DC Output Source/Sink Current	±50		mA
I <sub>CC</sub>	DC Supply Current Per Supply Pin	±100		mA
I <sub>GND</sub>	DC Ground Current Per Ground Pin	±100		mA
T <sub>STG</sub>	Storage Temperature Range	-65 to +150		°C

\* Absolute maximum continuous ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute-maximum-rated conditions is not implied.

1. Output in HIGH or LOW State. I<sub>O</sub> absolute maximum rating must be observed.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit
V <sub>CC</sub>	Supply Voltage	Operating	3.3	3.6	V
		Data Retention Only	1.5	3.6	
V <sub>I</sub>	Input Voltage	0		5.5	V
V <sub>O</sub>	Output Voltage (HIGH or LOW State)	0		V <sub>CC</sub>	V
I <sub>OH</sub>	HIGH Level Output Current, V <sub>CC</sub> = 3.0V – 3.6V			-24	mA
I <sub>OL</sub>	LOW Level Output Current, V <sub>CC</sub> = 3.0V – 3.6V			24	mA
I <sub>OH</sub>	HIGH Level Output Current, V <sub>CC</sub> = 2.7V – 3.0V			-12	mA
I <sub>OL</sub>	LOW Level Output Current, V <sub>CC</sub> = 2.7V – 3.0V			12	mA
T <sub>A</sub>	Operating Free-Air Temperature	-40		+85	°C
Δt/ΔV	Input Transition Rise or Fall Rate, V <sub>IN</sub> from 0.8V to 2.0V, V <sub>CC</sub> = 3.0V	0		10	ns/V

## DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T <sub>A</sub> = -40°C to +85°C		Unit
			Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage (Note 2.)	2.7V ≤ V <sub>CC</sub> ≤ 3.6V	2.0		V
V <sub>IL</sub>	LOW Level Input Voltage (Note 2.)	2.7V ≤ V <sub>CC</sub> ≤ 3.6V		0.8	V
V <sub>OH</sub>	HIGH Level Output Voltage	2.7V ≤ V <sub>CC</sub> ≤ 3.6V; I <sub>OH</sub> = -100μA	V <sub>CC</sub> - 0.2		V
		V <sub>CC</sub> = 2.7V; I <sub>OH</sub> = -12mA	2.2		
		V <sub>CC</sub> = 3.0V; I <sub>OH</sub> = -18mA	2.4		
		V <sub>CC</sub> = 3.0V; I <sub>OH</sub> = -24mA	2.2		
V <sub>OL</sub>	LOW Level Output Voltage	2.7V ≤ V <sub>CC</sub> ≤ 3.6V; I <sub>OL</sub> = 100μA		0.2	V
		V <sub>CC</sub> = 2.7V; I <sub>OL</sub> = 12mA		0.4	
		V <sub>CC</sub> = 3.0V; I <sub>OL</sub> = 16mA		0.4	
		V <sub>CC</sub> = 3.0V; I <sub>OL</sub> = 24mA		0.55	

2. These values of V<sub>I</sub> are used to test DC electrical characteristics only.

# MC74LCX00

## DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Characteristic	Condition	T <sub>A</sub> = -40°C to +85°C		Unit
			Min	Max	
I <sub>I</sub>	Input Leakage Current	2.7V ≤ V <sub>CC</sub> ≤ 3.6V; 0V ≤ V <sub>I</sub> ≤ 5.5V		±5.0	μA
I <sub>CC</sub>	Quiescent Supply Current	2.7 ≤ V <sub>CC</sub> ≤ 3.6V; V <sub>I</sub> = GND or V <sub>CC</sub>		10	μA
		2.7 ≤ V <sub>CC</sub> ≤ 3.6V; 3.6 ≤ V <sub>I</sub> ≤ 5.5V		±10	μA
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	2.7 ≤ V <sub>CC</sub> ≤ 3.6V; V <sub>IH</sub> = V <sub>CC</sub> - 0.6V		500	μA

## AC CHARACTERISTICS (t<sub>R</sub> = t<sub>F</sub> = 2.5ns; C<sub>L</sub> = 50pF; R<sub>L</sub> = 500Ω)

Symbol	Parameter	Waveform	Limits			Unit
			T <sub>A</sub> = -40°C to +85°C			
			V <sub>CC</sub> = 3.0V to 3.6V		V <sub>CC</sub> = 2.7V	
			Min	Max	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation Delay Input to Output	1	1.5 1.5	5.2 5.2	6.0 6.0	ns
t <sub>OSHL</sub> t <sub>OSLH</sub>	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<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter guaranteed by design.

## DYNAMIC SWITCHING CHARACTERISTICS

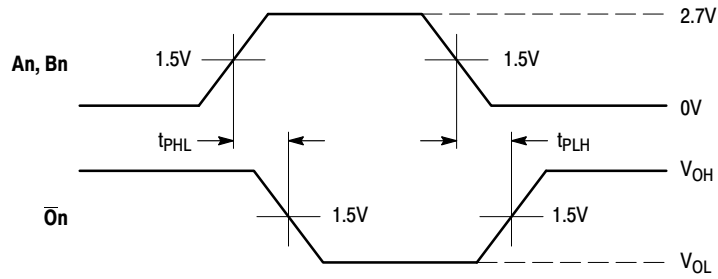
Symbol	Characteristic	Condition	T <sub>A</sub> = +25°C			Unit
			Min	Typ	Max	
V <sub>OLP</sub>	Dynamic LOW Peak Voltage (Note 4.)	V <sub>CC</sub> = 3.3V, C <sub>L</sub> = 50pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V		0.8		V
V <sub>OLV</sub>	Dynamic LOW Valley Voltage (Note 4.)	V <sub>CC</sub> = 3.3V, C <sub>L</sub> = 50pF, V <sub>IH</sub> = 3.3V, V <sub>IL</sub> = 0V		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 <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub>	7	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub>	8	pF
C <sub>PD</sub>	Power Dissipation Capacitance	10MHz, V <sub>CC</sub> = 3.3V, V <sub>I</sub> = 0V or V <sub>CC</sub>	25	pF

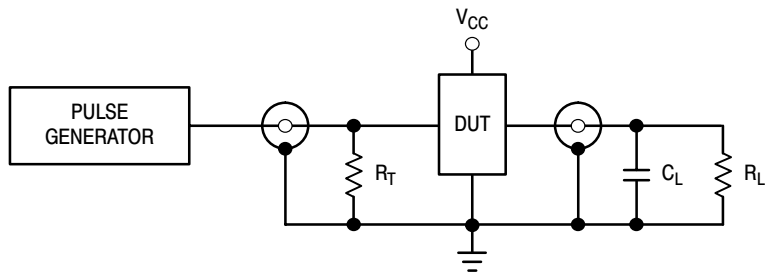
# MC74LCX00



## PROPAGATION DELAYS

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

Figure 3. AC Waveforms



$C_L = 50\text{pF}$  or equivalent (Includes jig and probe capacitance)

$R_L = R_1 = 500\Omega$  or equivalent

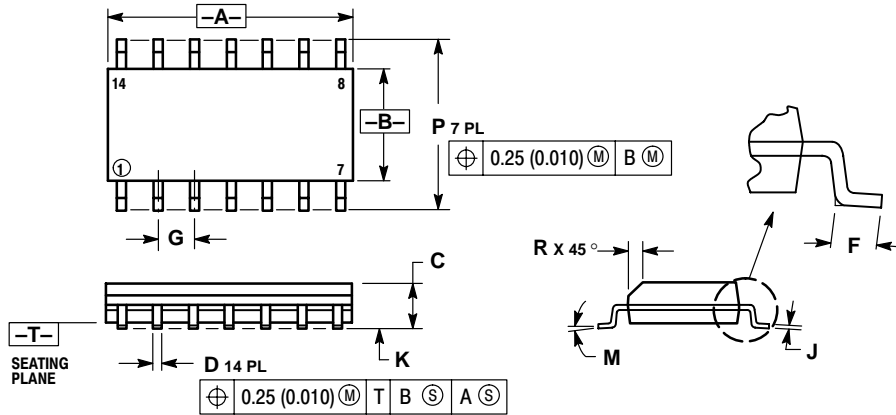
$R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

Figure 4. Test Circuit

# MC74LCX00

## OUTLINE DIMENSIONS

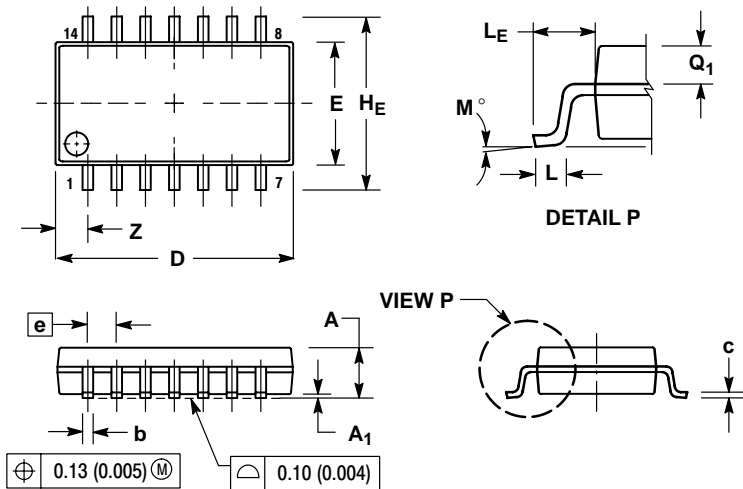
**D SUFFIX**  
 PLASTIC SOIC PACKAGE  
 CASE 751A-03  
 ISSUE F



- 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

**M SUFFIX**  
 PLASTIC SOIC EIAJ PACKAGE  
 CASE 965-01  
 ISSUE O



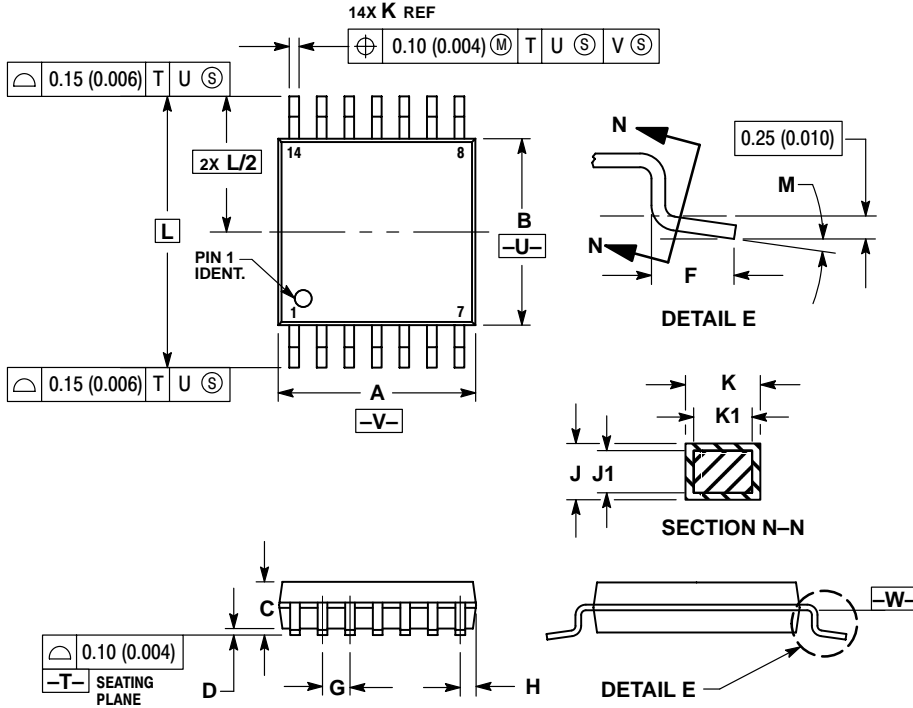
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. TERMINAL NUMBERS ARE SHOWN 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).

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	---	2.05	---	0.081
A <sub>1</sub>	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	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 <sub>E</sub>	7.40	8.20	0.291	0.323
0.50	0.50	0.85	0.020	0.033
L <sub>E</sub>	1.10	1.50	0.043	0.059
M	0°	10°	0°	10°
Q <sub>1</sub>	0.70	0.90	0.028	0.035
Z	---	1.42	---	0.056

# MC74LCX00

## OUTLINE DIMENSIONS

DT SUFFIX  
 PLASTIC TSSOP PACKAGE  
 CASE 948G-01  
 ISSUE O



### 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°

**Notes**

SENFET is a trademark of Semiconductor Components Industries, LLC.

**ON Semiconductor** and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). 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.

## PUBLICATION ORDERING INFORMATION

### **NORTH AMERICA 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:** ONlit@hibbertco.com  
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

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

**EUROPE:** LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (Mon-Fri 2:30pm to 7:00pm CET)  
**Email:** ONlit-german@hibbertco.com  
**French Phone:** (+1) 303-308-7141 (Mon-Fri 2:00pm to 7:00pm CET)  
**Email:** ONlit-french@hibbertco.com  
**English Phone:** (+1) 303-308-7142 (Mon-Fri 12:00pm to 5:00pm GMT)  
**Email:** ONlit@hibbertco.com

**EUROPEAN TOLL-FREE ACCESS\*: 00-800-4422-3781**

\*Available from Germany, France, Italy, UK, Ireland

### **CENTRAL/SOUTH AMERICA:**

**Spanish Phone:** 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)  
**Email:** ONlit-spanish@hibbertco.com  
**Toll-Free from Mexico:** Dial 01-800-288-2872 for Access –  
then Dial 866-297-9322

**ASIA/PACIFIC:** LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)  
**Toll Free from Hong Kong & Singapore:**  
**001-800-4422-3781**  
**Email:** ONlit-asia@hibbertco.com

**JAPAN:** ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031  
**Phone:** 81-3-5740-2700  
**Email:** r14525@onsemi.com

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local Sales Representative.