MC74VHCT139A

Dual 2-to-4 Decoder/ Demultiplexer

The MC74VHCT139A is an advanced high speed CMOS 2−to−4 decoder/demultiplexer fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL devices while maintaining CMOS low power dissipation.

When the device is enabled ($\overline{E}$ = low), it can be used for gating or as a data input for demultiplexing operations. When the enable input is held high, all four outputs are fixed high, independent of other inputs.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output.

The device output is compatible with TTL−type input thresholds and the output has a full 5.0 V CMOS level output swing. The input protection circuitry on this device allows overvoltage tolerance on the input, allowing the device to be used as a logic−level translator from 3.0 V CMOS logic to 5.0 V CMOS logic, or from 1.8 V CMOS logic to 3.0 V CMOS logic while operating at the high−voltage power supply

The MC74VHCT139A input structure provides protection when voltages up to 7.0 V are applied, regardless of the supply voltage. This allows the MC74VHCT139A to be used to interface 5.0 V circuits to 3.0 V circuits. The output structures also provide protection when V_{CC} = 0 V. These input and output structures help prevent device destruction caused by supply voltage−input/output voltage mismatch, battery backup, hot insertion, etc.

Features

- High Speed: t_{PD} = 5.0 ns (Typ) at V_{CC} = 5.0 V
- Low Power Dissipation: I_{CC} = 4 μA (Max) at T_A = 25°C
- TTL−Compatible Inputs: V_{IL} = 0.8 V; V_{IH} = 2.0 V
- Power Down Protection Provided on Inputs and Outputs
- Balanced Propagation Delays
- Designed for 2.0 V to 5.5 V Operating Range
- Low Noise: V_{OLP} = 0.8 V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance:
  - Human Body Model > 2000 V;
  - Machine Model > 200 V
- Chip Complexity: 100 FETs or 25 Equivalent Gates
- These Devices are Pb−Free and are RoHS Compliant

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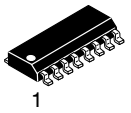
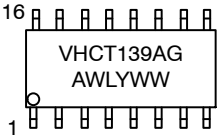
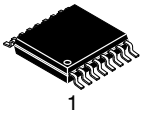
MARKING DIAGRAMS

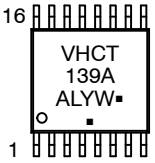


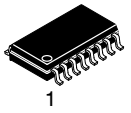
SOIC−16
D SUFFIX
CASE 751B



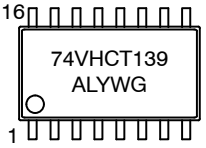


TSSOP−16
DT SUFFIX
CASE 948F





SOEIAJ−16
M SUFFIX
CASE 966



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)

FUNCTION TABLE

Inputs			Outputs			
$\overline{E}$	A1	A0	$\overline{Y0}$	$\overline{Y1}$	$\overline{Y2}$	$\overline{Y3}$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

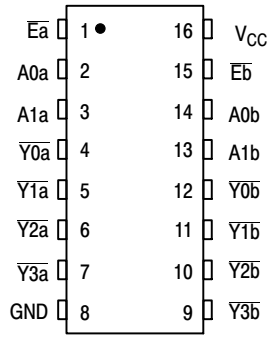


Figure 1. Pin Assignment

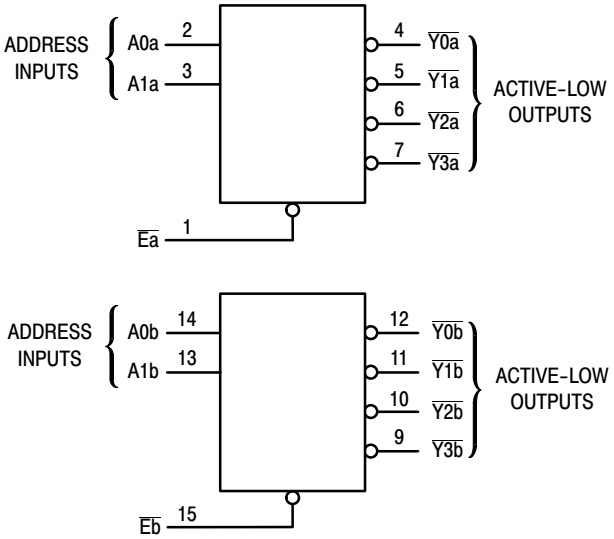


Figure 2. Logic Diagram

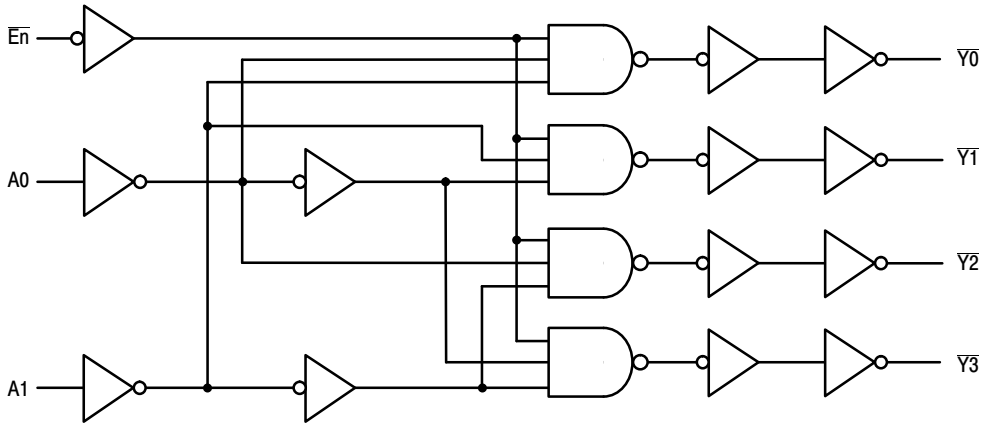


Figure 3. Expanded Logic Diagram
(1/2 of Device)

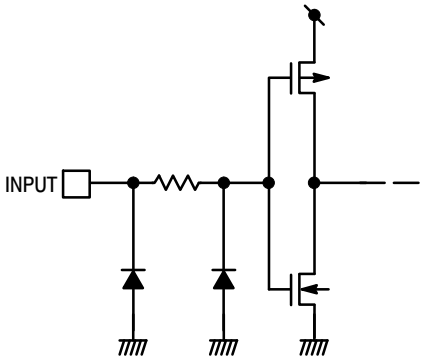


Figure 4. Input Equivalent Circuit

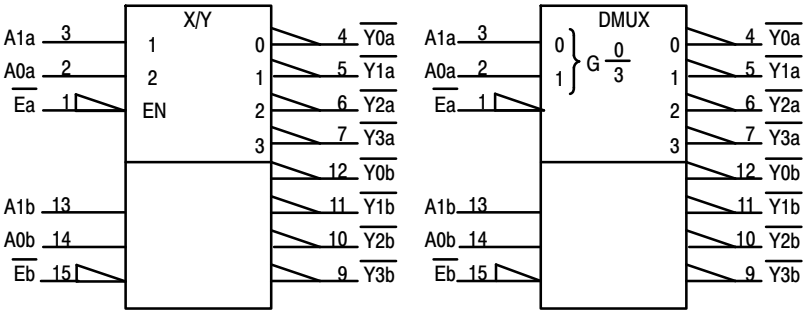


Figure 5. IEC Logic Diagram

MAXIMUM RATINGS (Note 1)

Symbol	Parameter		Value	Unit
V_{CC}	Positive DC Supply Voltage		−0.5 to +7.0	V
V_{IN}	Digital Input Voltage		−0.5 to +7.0	V
V_{OUT}	DC Output Voltage	Output in 3−State High or Low State	−0.5 to +7.0 −0.5 to V_{CC} +0.5	V
I_{IK}	Input Diode Current		−20	mA
I_{OK}	Output Diode Current		±20	mA
I_{OUT}	DC Output Current, per Pin		±25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins		±75	mA
P_D	Power Dissipation in Still Air	SOIC Package TSSOP	200 180	mW
T_{STG}	Storage Temperature Range		−65 to +150	°C
V_{ESD}	ESD Withstand Voltage	Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4)	>2000 >200 >2000	V
$I_{LATCHUP}$	Latchup Performance	Above V_{CC} and Below GND at 125°C (Note 5)	±300	mA
θ_{JA}	Thermal Resistance, Junction−to−Ambient	SOIC Package TSSOP	143 164	°C/W

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. Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.
2. Tested to EIA/JESD22−A114−A
3. Tested to EIA/JESD22−A115−A
4. Tested to JESD22−C101−A
5. Tested to EIA/JESD78

RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	Max	Unit
V_{CC}	DC Supply Voltage	4.5	5.5	V
V_{IN}	DC Input Voltage	0	5.5	V
V_{OUT}	DC Output Voltage Output in 3−State High or Low State	0 0	5.5 V_{CC}	V
T_A	Operating Temperature Range, all Package Types	−55	125	°C
t_r, t_f	Input Rise or Fall Time V_{CC} = 5.0 V ± 0.5 V	0	20	ns/V

DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

Junction Temperature °C	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

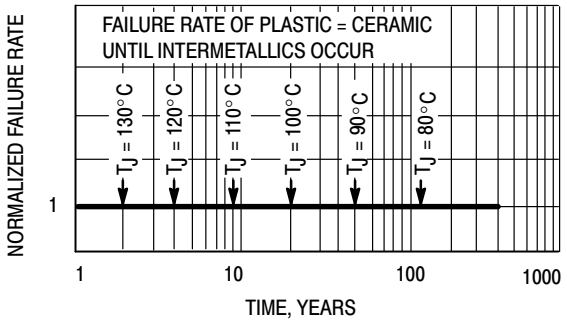


Figure 6. Failure Rate vs. Time Junction Temperature

DC CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Condition	V_{CC} (V)	T_A = 25°C Min	T_A = 25°C Typ	T_A = 25°C Max	$T_A \le$ 85°C Min	$T_A \le$ 85°C Max	T_A = – 55 to 125°C Min	T_A = – 55 to 125°C Max	Unit
V_{IH}	Minimum High–Level Input Voltage		4.5 to 5.5	2			2		2		V
V_{IL}	Maximum Low–Level Input Voltage		4.5 to 5.5			0.8		0.8		0.8	V
V_{OH}	Maximum High–Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -50$ μA	4.5	4.4	4.5		4.4		4.4		V
		$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -8$ mA	4.5	3.94			3.8		3.66		
V_{OL}	Maximum Low–Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 50$ μA	4.5		0	0.1		0.1		0.1	V
		$V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = 8$ mA	4.5			0.36		0.44		0.52	
I_{IN}	Input Leakage Current	V_{IN} = 5.5 V or GND	0 to 5.5			±0.1		±1.0		±1.0	μA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND	5.5			4.0		40.0		40.0	μA
I_{CCT}	Additional Quiescent Supply Current (per Pin)	Any one input: V_{IN} = 3.4 V All other inputs: $V_{IN} = V_{CC}$ or GND	5.5			1.35		1.5		1.5	μA
I_{OPD}	Output Leakage Current	V_{OUT} = 5.5 V	0			0.5		5		5	μA

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f$ = 3.0ns)

Symbol	Parameter	Test Conditions	T_A = 25°C Min	T_A = 25°C Typ	T_A = 25°C Max	$T_A \le$ 85°C Min	$T_A \le$ 85°C Max	T_A = – 55 to 125°C Min	T_A = – 55 to 125°C Max	Unit
t_{PLH}, t_{PHL}	Maximum Propagation Delay, A to Y	V_{CC} = 3.3 ± 0.3 V C_L = 15 pF		7.2	11.0	1.0	13.0	1.0	13.0	ns
		V_{CC} = 3.3 ± 0.3 V C_L = 50 pF		9.7	14.5	1.0	16.5	1.0	16.5	
		V_{CC} = 5.0 ± 0.5 V C_L = 15 pF		5.0	7.2	1.0	8.5	1.0	8.5	
		V_{CC} = 5.0 ± 0.5 V C_L = 50 pF		6.5	9.2	1.0	10.5	1.0	10.5	
t_{PLH}, t_{PHL}	Maximum Propagation Delay, $\overline{E}$ to Y	V_{CC} = 3.3 ± 0.3 V C_L = 15 pF		6.4	9.2	1.0	11.0	1.0	11.0	ns
		V_{CC} = 3.3 ± 0.3 V C_L = 50 pF		8.9	12.7	1.0	14.5	1.0	14.5	
		V_{CC} = 5.0 ± 0.5 V C_L = 15 pF		4.4	6.3	1.0	7.5	1.0	7.5	
		V_{CC} = 5.0 ± 0.5 V C_L = 50 pF		5.9	8.3	1.0	9.5	1.0	9.5	
C_{IN}	Maximum Input Capacitance			4	10		10		10	pF

		Typical @ 25°C, V_{CC} = 5.0V	
C_{PD}	Power Dissipation Capacitance (Note 6)	26	pF

6. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}/2$ (per decoder). C_{PD} is used to determine the no–load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

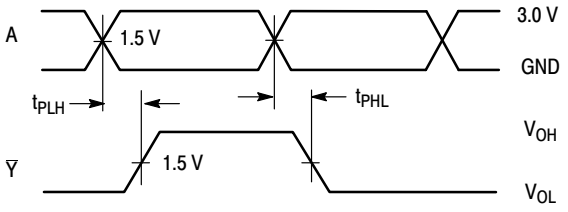


Figure 7. Switching Waveform

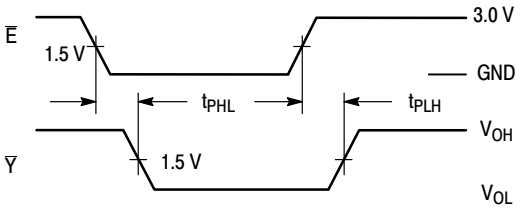
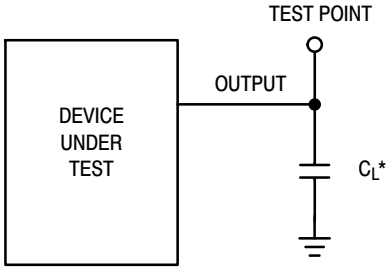


Figure 8. Switching Waveform



*Includes all probe and jig capacitance

Figure 9. Test Circuit

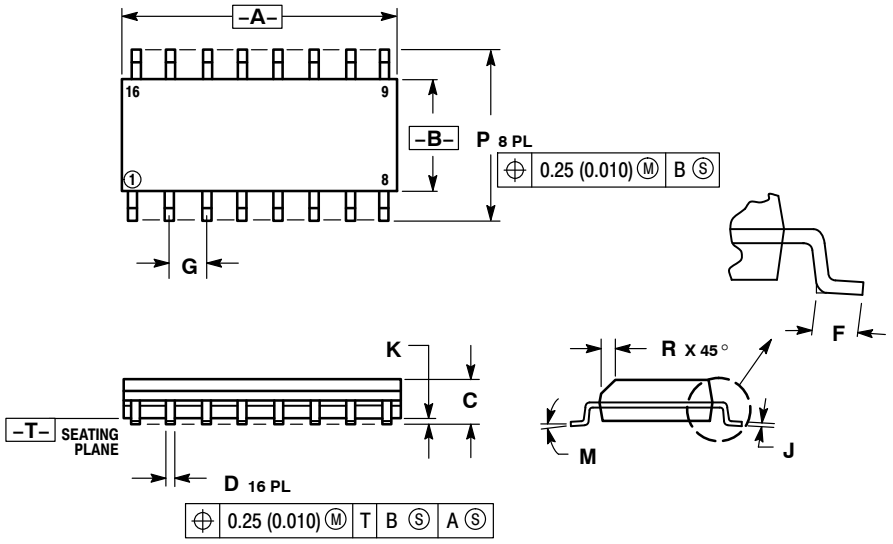
ORDERING INFORMATION

Device	Package	Shipping†
MC74VHCT139ADG	SOIC−16 (Pb−Free)	48 Units / Rail
MC74VHCT139ADR2G	SOIC−16 (Pb−Free)	2500 Tape & Reel
MC74VHCT139ADTG	TSSOP−16*	96 Units / Rail
MC74VHCT139ADTRG	TSSOP−16*	2500 Tape & Reel
MC74VHCT139AMG	SOEIAJ−16 (Pb−Free)	50 Units / Rail
MC74VHCT139AMELG	SOEIAJ−16 (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.

PACKAGE DIMENSIONS

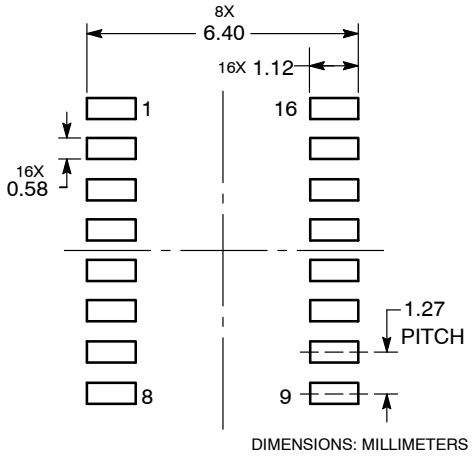
SOIC−16
CASE 751B−05
ISSUE K



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.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
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	0.229	0.244
R	0.25	0.50	0.010	0.019

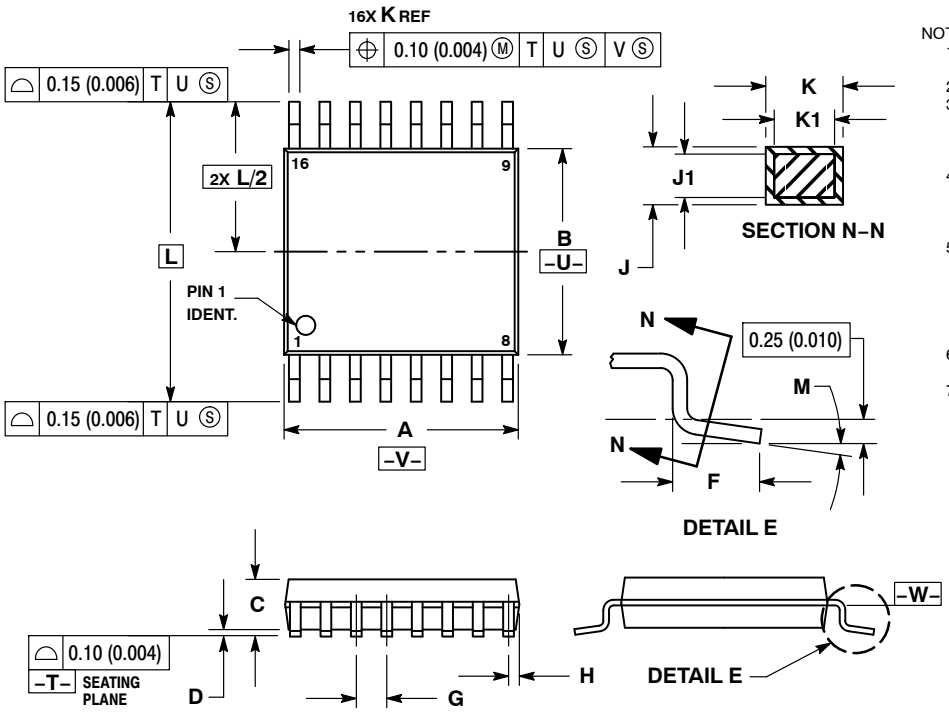
SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

PACKAGE DIMENSIONS

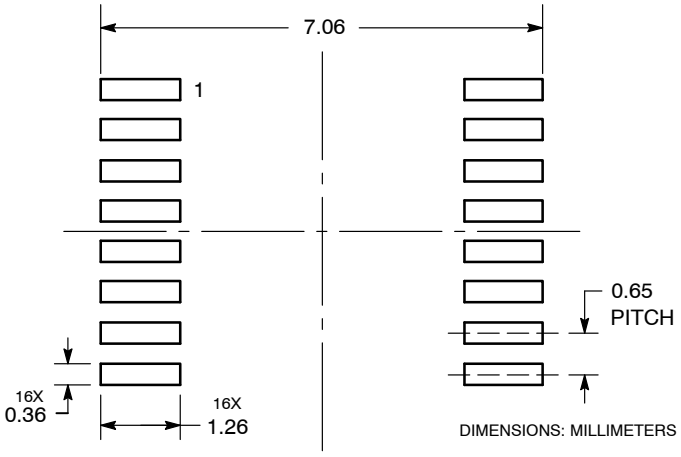
TSSOP−16
CASE 948F−01
ISSUE B



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−.

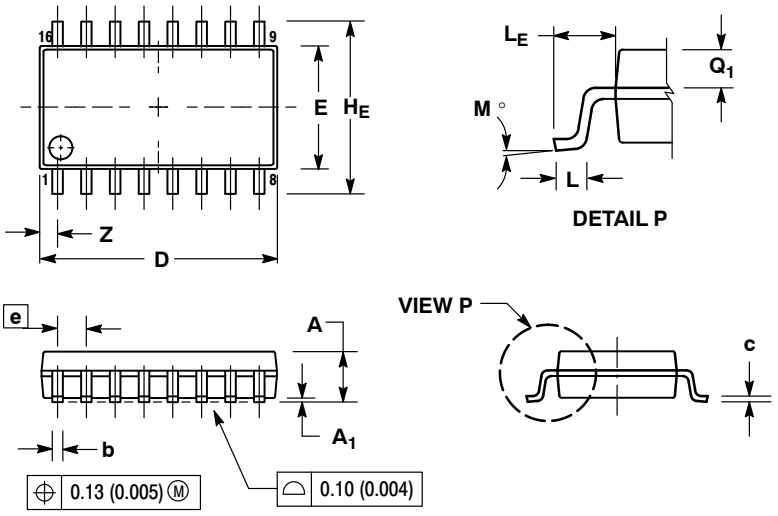
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	−−−	1.20	−−−	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.18	0.28	0.007	0.011
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0 °	8 °	0 °	8 °

SOLDERING FOOTPRINT



PACKAGE DIMENSIONS

SOEIAJ−16
CASE 966−01
ISSUE A



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	0.10	0.20	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_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	---	0.78	---	0.031

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: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

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

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Живое партнерство

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Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- *Конкурентоспособные цены и скидки постоянным клиентам.*
- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

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