

Quad D-Type Flip-Flop With Clear

MM74HC175

Description

The MM74HC175 high speed D-type flip-flop with complementary outputs utilizes advanced silicon-gate CMOS technology to achieve the high noise immunity and low power consumption of standard CMOS integrated circuits, along with the ability to drive 10 LS-TTL loads. Information at the D inputs of the MM74HC175 is transferred to the Q and \bar{Q} outputs on the positive going edge of the clock pulse. Both true and complement outputs from each flip flop are externally available. All four flip-flops are controlled by a common clock and a common CLEAR. Clearing is accomplished by a negative pulse at the CLEAR input. All four Q outputs are cleared to a logical "0" and all four \bar{Q} outputs to a logical "1." The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

- Typical Propagation Delay: 15 ns
- Wide Operating Supply Voltage Range: 2–6 V
- Low Input Current: 1 μ A Maximum
- Low Quiescent Supply Current: 160 μ A Maximum (74HC)
- High Output Drive Current: 4 mA Minimum (74HC)
- These are Pb-Free Devices

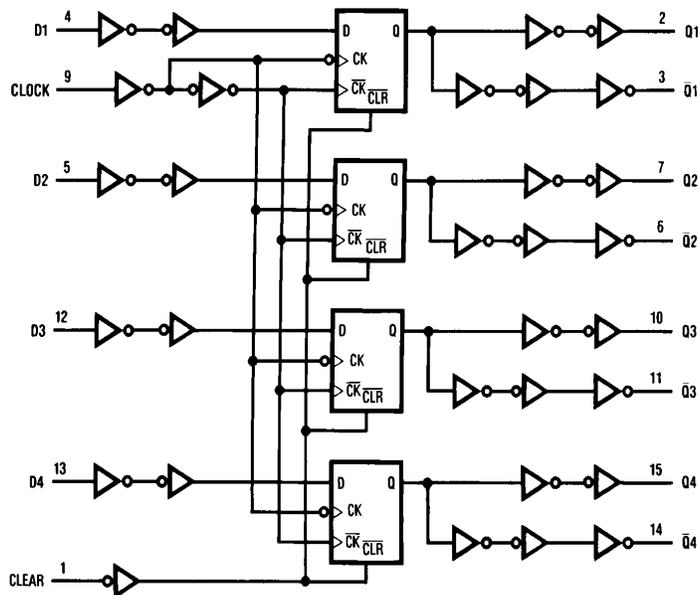
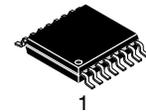


Figure 1. Logic Diagram

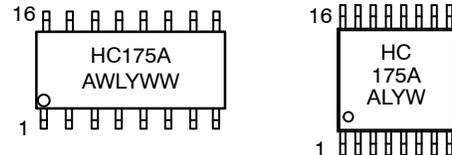


SOIC-16
CASE 751B



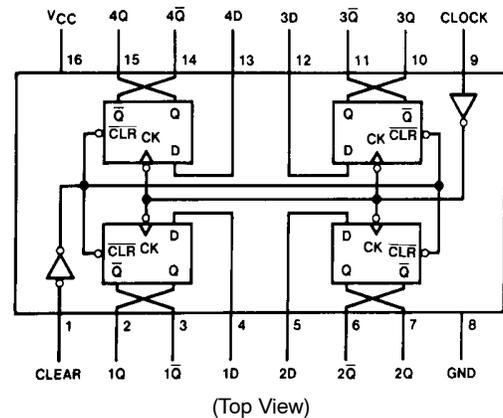
TSSOP-16
CASE 948F

MARKING DIAGRAMS



- HC175A = Specific Device Code
- A = Assembly Location
- L/WL = Wafer Lot
- Y/YY = Year of Production, Last Number
- W/WW = Work Week Number

CONNECTION DIAGRAM



TRUTH TABLE (Each Flip Flop)

Inputs			Outputs	
Clear	Clock	D	Q	\bar{Q}
L	X	X	L	H
H	\uparrow	H	H	L
H	\uparrow	L	L	H
H	L	X	Q ₀	\bar{Q}_0

- H = HIGH Level (steady state)
- L = LOW Level (steady state)
- X = Irrelevant
- \uparrow = Transition from LOW-to-HIGH level
- Q₀ = The level of Q before the indicated steady-state input conditions were established

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 4 of this data sheet.

MM74HC175

ABSOLUTE MAXIMUM RATINGS (Note 1)

Symbol	Parameter	Value	Unit
V _{CC}	Supply Voltage	-0.5 to +7.0	V
V _{IN}	DC Input Voltage	-0.5 to V _{CC} + 0.5	V
V _{OUT}	DC Output Voltage	-0.5 to V _{CC} + 0.5	V
I _{IK} , I _{OK}	Clamp Diode Current	±20	mA
I _{OUT}	DC Output Current, per Pin	±25	mA
I _{CC}	DC V _{CC} or GND Current, per Pin	±50	mA
T _{STG}	Storage Temperature Range	-65 to +150	°C
P _D	Power Dissipation (Note 2) S. O. Package Only	600 500	mW
T _L	Lead Temperature (Soldering 10 seconds)	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Unless otherwise specified all voltages are referenced to ground.
2. Power Dissipation temperature derating – plastic “N” package: 12 mW/°C from 65°C to 85°C.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	Supply Voltage	2	6	V
V _{IN} , V _{OUT}	DC Input or Output Voltage	0	V _{CC}	V
T _A	Operating Temperature Range	-55	+125	°C
t _r , t _f	Input Rise or Fall Times V _{CC} = 2.0 V V _{CC} = 4.5 V V _{CC} = 6.0 V	–	1000 500 400	ns

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC ELECTRICAL CHARACTERISTICS (Note 3)

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C		T _A = -40°C to 85°C		T _A = -55°C to 125°C		Unit
				Typ	Guaranteed Limits					
V _{IH}	Minimum HIGH Level Input Voltage		2.0	–	1.5	1.5	1.5	1.5	V	
			4.5	–	3.15	3.15	3.15			
			6.0	–	4.2	4.2	4.2			
V _{IL}	Maximum LOW Level Input Voltage		2.0	–	0.5	0.5	0.5	0.5	V	
			4.5	–	1.35	1.35	1.35			
			6.0	–	1.8	1.8	1.8			
V _{OH}	Minimum HIGH Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0	2.0	1.9	1.9	1.9	V		
			4.5	4.5	4.4	4.4	4.4			
			6.0	6.0	5.9	5.9	5.9			
		V _{OL}	Maximum LOW Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 20 μA	2.0	0	0.1	0.1	0.1	V
					4.5	0	0.1	0.1	0.1	
					6.0	0	0.1	0.1	0.1	
V _{OL}	Maximum LOW Level Output Voltage	V _{IN} = V _{IH} or V _{IL} I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA	4.5	0.2	0.26	0.33	0.4	V		
			6.0	0.2	0.26	0.33	0.4			
			6.0	0.2	0.26	0.33	0.4			

MM74HC175

DC ELECTRICAL CHARACTERISTICS (Note 3) (continued)

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C		T _A = -40°C to 85°C	T _A = -55°C to 125°C	Unit
				Typ	Guaranteed Limits			
I _{IN}	Maximum Input Current	V _{IN} = V _{CC} or GND	6.0	-	±0.1	±1.0	±1.0	μA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND I _{OUT} = 0 μA	6.0	-	8	80	160	μA

3. For a power supply of 5 V ±10% the worst case output voltages (V_{OH}, and V_{OL}) occur for HC at 4.5 V. Thus the 4.5 V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at V_{CC} = 5.5 V and 4.5 V respectively. (The V_{IH} value at 5.5 V is 3.85 V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0 V values should be used.

AC ELECTRICAL CHARACTERISTICS (V_{CC} = 5 V, T_A = 25°C, C_L = 15 pF, t_r = t_f = 6 ns)

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Unit
f _{MAX}	Maximum Operating Frequency		60	35	MHz
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Clock to Q or \bar{Q}		15	25	ns
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Reset to Q or \bar{Q}		13	21	ns
t _{REC}	Minimum Removal Time, Clear to Clock		-	20	ns
t _S	Minimum Setup Time, Data to Clock		-	20	ns
t _H	Minimum Hold Time, Data from Clock		-	0	ns
t _W	Minimum Pulse Width, Clock or Clear		10	16	ns

AC ELECTRICAL CHARACTERISTICS (V_{CC} = 2.0 V to 6.0 V, C_L = 50 pF, t_r = t_f = 6 ns unless otherwise specified)

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C		T _A = -40°C to 85°C	T _A = -55°C to 125°C	Unit
				Typ	Guaranteed Limits			
f _{MAX}	Maximum Operating Frequency		2.0	12	6	5	4	MHz
			4.5	60	30	24	20	
			6.0	70	35	28	24	
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Clock to Q or \bar{Q}		2.0	80	150	190	225	ns
			4.5	15	30	38	45	
			6.0	13	26	32	38	
t _{PHL} , t _{PLH}	Maximum Propagation Delay, Reset to Q or \bar{Q}		2.0	64	125	158	186	ns
			4.5	14	25	32	37	
			6.0	12	21	27	32	
t _{REM}	Minimum Removal Time, Clear to Clock		2.0	-	100	125	150	ns
			4.5	-	20	25	30	
			6.0	-	17	21	25	
t _S	Minimum Setup Time, Data to Clock		2.0	-	100	125	150	ns
			4.5	-	20	25	30	
			6.0	-	17	21	25	
t _H	Minimum Hold Time, Data from Clock		2.0	-	0	0	0	ns
			4.5	-	0	0	0	
			6.0	-	0	0	0	
t _W	Minimum Pulse Width, Clock or Clear		2.0	30	80	100	120	ns
			4.5	9	16	20	24	
			6.0	8	14	17	20	
t _r , t _f	Maximum Input Rise and Fall Time		2.0	-	1000	1000	1000	ns
			4.5	-	500	500	500	
			6.0	-	400	400	400	
t _{TLH} , t _{THL}	Maximum Output Rise and Fall Time		2.0	30	75	95	110	ns
			4.5	9	15	19	22	
			6.0	8	13	16	19	

MM74HC175

AC ELECTRICAL CHARACTERISTICS ($V_{CC} = 2.0\text{ V to }6.0\text{ V}$, $C_L = 50\text{ pF}$, $t_r = t_f = 6\text{ ns}$ unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = 25^\circ\text{C}$		$T_A = -40^\circ\text{C to }85^\circ\text{C}$	$T_A = -55^\circ\text{C to }125^\circ\text{C}$	Unit
				Typ	Guaranteed Limits			
C_{PD}	Power Dissipation Capacitance (Note 4)	(per package)	– –	150 – –	– – –	– – –	– – –	pF
C_{IN}	Maximum Input Capacitance		–	5	10	10	10	pF

4. C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

ORDERING INFORMATION

Device	Package	Shipping [†]
MM74HC175M	SOIC-16 (Pb-Free)	48 Units / Tube
MM74HC175MX	SOIC-16 (Pb-Free)	2500 / Tape & Reel
MM74HC175MTCX	TSSOP-16 (Pb-Free)	2500 Units / Tube

[†]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](#).

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

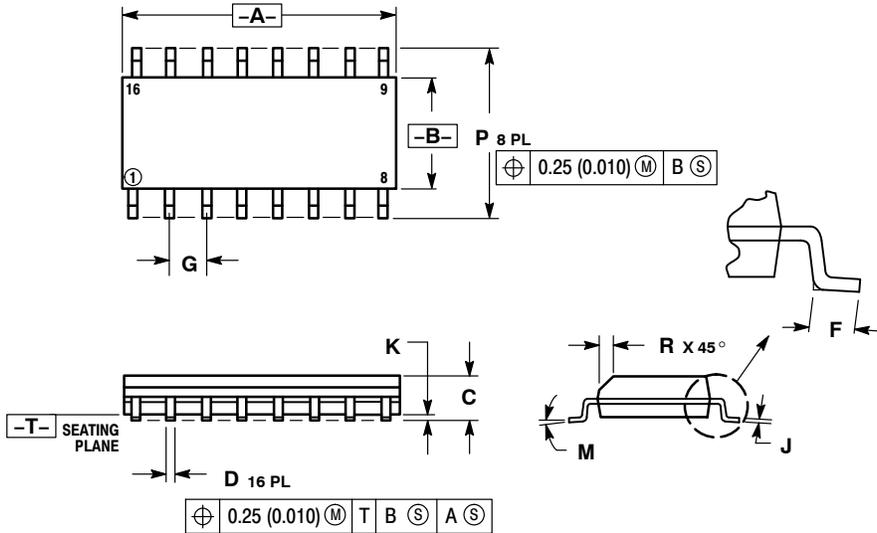
ON Semiconductor®



SCALE 1:1

SOIC-16
CASE 751B-05
ISSUE K

DATE 29 DEC 2006



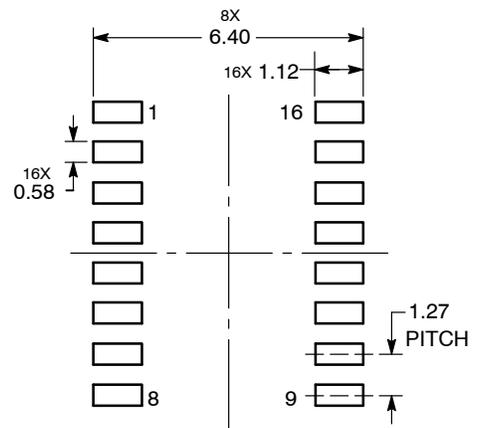
NOTES:

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	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

- | | | | |
|--|--|--|--|
| <p>STYLE 1:</p> <p>PIN 1. COLLECTOR</p> <p>2. BASE</p> <p>3. EMITTER</p> <p>4. NO CONNECTION</p> <p>5. EMITTER</p> <p>6. BASE</p> <p>7. COLLECTOR</p> <p>8. COLLECTOR</p> <p>9. BASE</p> <p>10. EMITTER</p> <p>11. NO CONNECTION</p> <p>12. EMITTER</p> <p>13. BASE</p> <p>14. COLLECTOR</p> <p>15. EMITTER</p> <p>16. COLLECTOR</p> | <p>STYLE 2:</p> <p>PIN 1. CATHODE</p> <p>2. ANODE</p> <p>3. NO CONNECTION</p> <p>4. CATHODE</p> <p>5. CATHODE</p> <p>6. NO CONNECTION</p> <p>7. ANODE</p> <p>8. CATHODE</p> <p>9. CATHODE</p> <p>10. ANODE</p> <p>11. NO CONNECTION</p> <p>12. CATHODE</p> <p>13. CATHODE</p> <p>14. NO CONNECTION</p> <p>15. ANODE</p> <p>16. CATHODE</p> | <p>STYLE 3:</p> <p>PIN 1. COLLECTOR, DYE #1</p> <p>2. BASE, #1</p> <p>3. EMITTER, #1</p> <p>4. COLLECTOR, #1</p> <p>5. COLLECTOR, #2</p> <p>6. BASE, #2</p> <p>7. EMITTER, #2</p> <p>8. COLLECTOR, #2</p> <p>9. COLLECTOR, #3</p> <p>10. BASE, #3</p> <p>11. EMITTER, #3</p> <p>12. COLLECTOR, #3</p> <p>13. COLLECTOR, #4</p> <p>14. BASE, #4</p> <p>15. EMITTER, #4</p> <p>16. COLLECTOR, #4</p> | <p>STYLE 4:</p> <p>PIN 1. COLLECTOR, DYE #1</p> <p>2. COLLECTOR, #1</p> <p>3. COLLECTOR, #2</p> <p>4. COLLECTOR, #2</p> <p>5. COLLECTOR, #3</p> <p>6. COLLECTOR, #3</p> <p>7. COLLECTOR, #4</p> <p>8. COLLECTOR, #4</p> <p>9. BASE, #4</p> <p>10. EMITTER, #4</p> <p>11. BASE, #3</p> <p>12. EMITTER, #3</p> <p>13. BASE, #2</p> <p>14. EMITTER, #2</p> <p>15. BASE, #1</p> <p>16. EMITTER, #1</p> |
| <p>STYLE 5:</p> <p>PIN 1. DRAIN, DYE #1</p> <p>2. DRAIN, #1</p> <p>3. DRAIN, #2</p> <p>4. DRAIN, #2</p> <p>5. DRAIN, #3</p> <p>6. DRAIN, #3</p> <p>7. DRAIN, #4</p> <p>8. DRAIN, #4</p> <p>9. GATE, #4</p> <p>10. SOURCE, #4</p> <p>11. GATE, #3</p> <p>12. SOURCE, #3</p> <p>13. GATE, #2</p> <p>14. SOURCE, #2</p> <p>15. GATE, #1</p> <p>16. SOURCE, #1</p> | <p>STYLE 6:</p> <p>PIN 1. CATHODE</p> <p>2. CATHODE</p> <p>3. CATHODE</p> <p>4. CATHODE</p> <p>5. CATHODE</p> <p>6. CATHODE</p> <p>7. CATHODE</p> <p>8. CATHODE</p> <p>9. ANODE</p> <p>10. ANODE</p> <p>11. ANODE</p> <p>12. ANODE</p> <p>13. ANODE</p> <p>14. ANODE</p> <p>15. ANODE</p> <p>16. ANODE</p> | <p>STYLE 7:</p> <p>PIN 1. SOURCE N-CH</p> <p>2. COMMON DRAIN (OUTPUT)</p> <p>3. COMMON DRAIN (OUTPUT)</p> <p>4. GATE P-CH</p> <p>5. COMMON DRAIN (OUTPUT)</p> <p>6. COMMON DRAIN (OUTPUT)</p> <p>7. COMMON DRAIN (OUTPUT)</p> <p>8. SOURCE P-CH</p> <p>9. SOURCE P-CH</p> <p>10. COMMON DRAIN (OUTPUT)</p> <p>11. COMMON DRAIN (OUTPUT)</p> <p>12. COMMON DRAIN (OUTPUT)</p> <p>13. GATE N-CH</p> <p>14. COMMON DRAIN (OUTPUT)</p> <p>15. COMMON DRAIN (OUTPUT)</p> <p>16. SOURCE N-CH</p> | |

SOLDERING FOOTPRINT



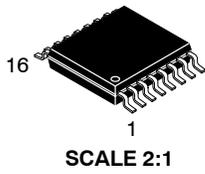
DOCUMENT NUMBER:	98ASB42566B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOIC-16	PAGE 1 OF 1

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

MECHANICAL CASE OUTLINE

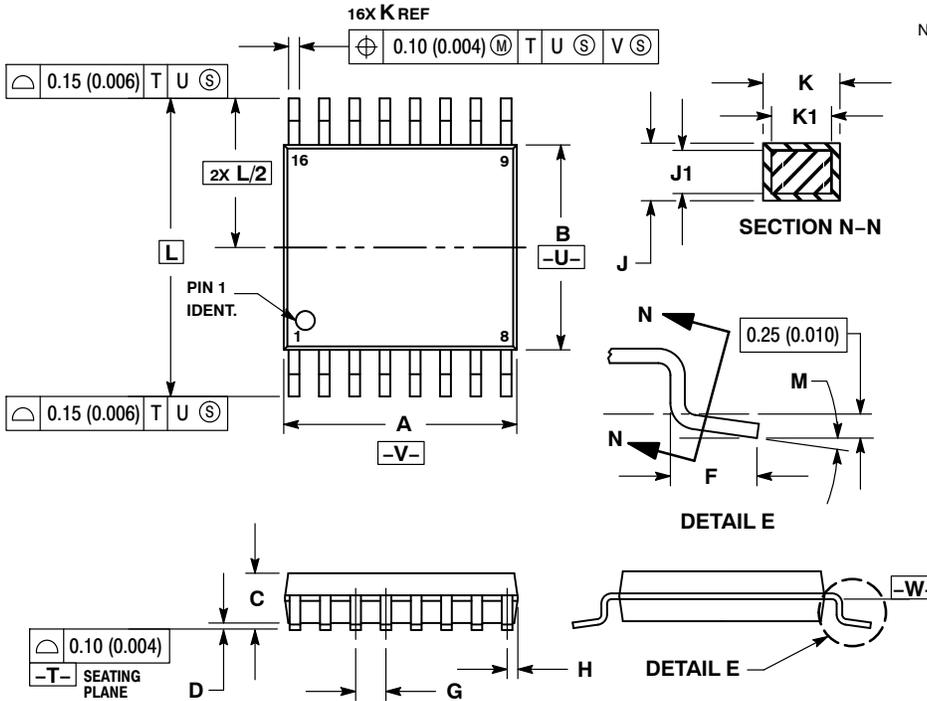
PACKAGE DIMENSIONS

ON Semiconductor®



TSSOP-16
CASE 948F-01
ISSUE B

DATE 19 OCT 2006

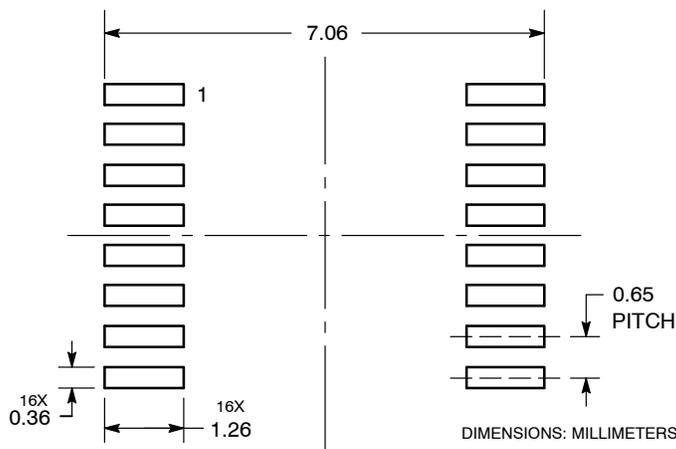


NOTES:

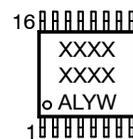
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD 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	0.18	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



GENERIC MARKING DIAGRAM*



- XXXX = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- G or ■ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present.

DOCUMENT NUMBER:	98ASH70247A	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TSSOP-16	PAGE 1 OF 1

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales