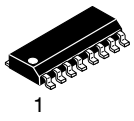
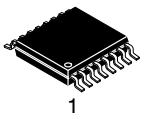
Quad D-Type Flip-Flop With Clear

MM74HC175



SOIC−16
CASE 751B



TSSOP−16
CASE 948F

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 $\overline{Q}$ 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 $\overline{Q}$ 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 μA Maximum
- Low Quiescent Supply Current: 160 μA Maximum (74HC)
- High Output Drive Current: 4 mA Minimum (74HC)
- These are Pb−Free Devices

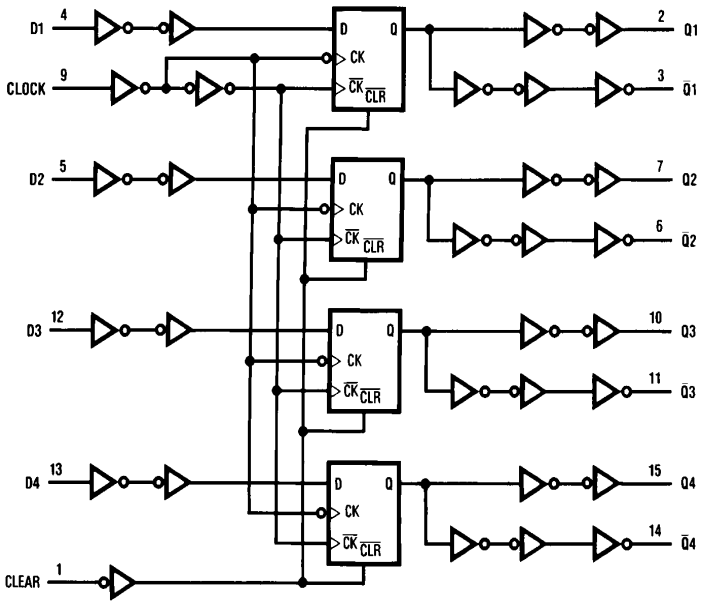
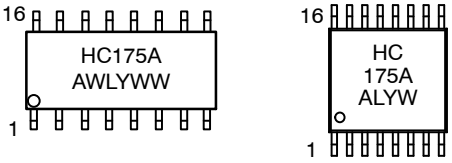


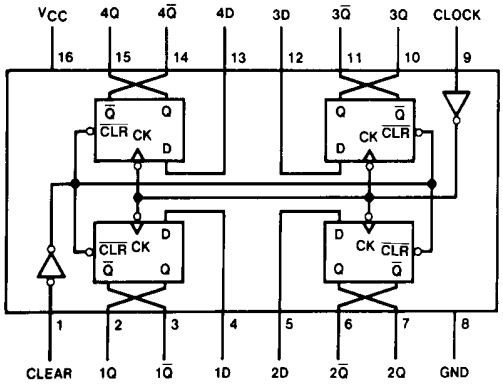
Figure 1. Logic Diagram

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



(Top View)

TRUTH TABLE

(Each Flip Flop)

Inputs			Outputs	
Clear	Clock	D	Q	$\overline{Q}$
L	X	X	L	H
H	↑	H	H	L
H	↑	L	L	H
H	L	X	Q_0	$\overline{Q_0}$

H = HIGH Level (steady state)
L = LOW Level (steady state)
X = Irrelevant
↑ = Transition from LOW−to−HIGH level
Q_0 = 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.

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 OPERATIONG 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 4.5 6.0	− − −	1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V
V_{IL}	Maximum LOW Level Input Voltage		2.0 4.5 6.0	− − −	0.5 1.35 1.8	0.5 1.35 1.8	0.5 1.35 1.8	V
V_{OH}	Minimum HIGH Level Output Voltage	V_{IN} = V_{IH} or V_{IL} $\|I_{OUT}\| \le 20\ \mu A$	2.0 4.5 6.0	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		V_{IN} = V_{IH} or V_{IL} $\|I_{OUT}\| \le 4.0$ mA $\|I_{OUT}\| \le 5.2$ mA	4.5 6.0	4.2 5.7	3.98 5.48	3.84 5.34	3.7 5.2	V
V_{OL}	Maximum LOW Level Output Voltage	V_{IN} = V_{IH} or V_{IL} $\|I_{OUT}\| \le 20\ \mu A$	2.0 4.5 6.0	0 0 0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		V_{IN} = V_{IH} or V_{IL} $\|I_{OUT}\| \le 4.0$ mA $\|I_{OUT}\| \le 5.2$ mA	4.5 6.0	0.2 0.2	0.26 0.26	0.33 0.33	0.4 0.4	V

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, CL = 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 $\overline{Q}$		15	25	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay, Reset to Q or $\overline{Q}$		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 4.5 6.0	12 60 70	6 30 35	5 24 28	4 20 24	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay, Clock to Q or $\overline{Q}$		2.0 4.5 6.0	80 15 13	150 30 26	190 38 32	225 45 38	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay, Reset to Q or $\overline{Q}$		2.0 4.5 6.0	64 14 12	125 25 21	158 32 27	186 37 32	ns
t_{REM}	Minimum Removal Time, Clear to Clock		2.0 4.5 6.0	– – –	100 20 17	125 25 21	150 30 25	ns
t_S	Minimum Setup Time, Data to Clock		2.0 4.5 6.0	– – –	100 20 17	125 25 21	150 30 25	ns
t_H	Minimum Hold Time, Data from Clock		2.0 4.5 6.0	– – –	0 0 0	0 0 0	0 0 0	ns
t_W	Minimum Pulse Width, Clock or Clear		2.0 4.5 6.0	30 9 8	80 16 14	100 20 17	120 24 20	ns
t_r, t_f	Maximum Input Rise and Fall Time		2.0 4.5 6.0	– – –	1000 500 400	1000 500 400	1000 500 400	ns
t_{TLH}, t_{THL}	Maximum Output Rise and Fall Time		2.0 4.5 6.0	30 9 8	75 15 13	95 19 16	110 22 19	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)

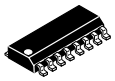
Symbol	Parameter	Conditions	V_{CC} (V)	T_A = 25°C	T_A −40°C to 85°C	T_A = −55°C to 125°C	Unit
				Typ	Guaranteed Limits		
C_{PD}	Power Dissipation Capacitance (Note 4)	(per package)	– –	150 –	– –	– –	– –	pF
C_{IN}	Maximum Input Capacitance		–	5	10	10	10	pF

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

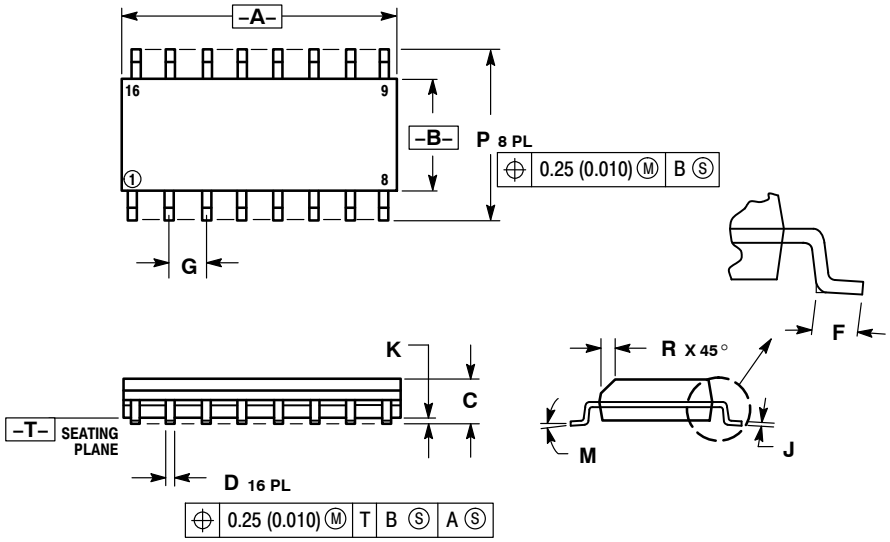
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



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.

	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

STYLE 1:
PIN 1. COLLECTOR
2. BASE
3. EMITTER
4. NO CONNECTION
5. EMITTER
6. BASE
7. COLLECTOR
8. COLLECTOR
9. BASE
10. EMITTER
11. NO CONNECTION
12. EMITTER
13. BASE
14. COLLECTOR
15. EMITTER
16. COLLECTOR

STYLE 2:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION
4. CATHODE
5. CATHODE
6. NO CONNECTION
7. ANODE
8. CATHODE
9. CATHODE
10. ANODE
11. NO CONNECTION
12. CATHODE
13. CATHODE
14. NO CONNECTION
15. ANODE
16. CATHODE

STYLE 3:
PIN 1. COLLECTOR, DYE #1
2. BASE, #1
3. EMITTER, #1
4. COLLECTOR, #1
5. COLLECTOR, #2
6. BASE, #2
7. EMITTER, #2
8. COLLECTOR, #2
9. COLLECTOR, #3
10. BASE, #3
11. EMITTER, #3
12. COLLECTOR, #3
13. COLLECTOR, #4
14. BASE, #4
15. EMITTER, #4
16. COLLECTOR, #4

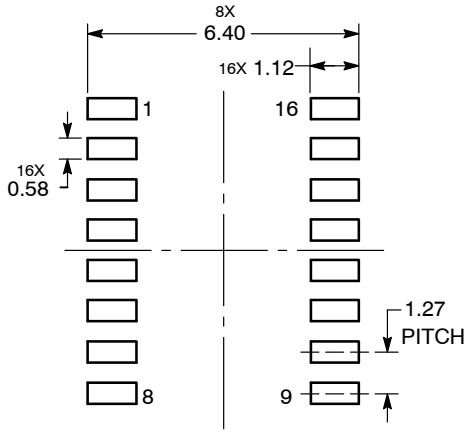
STYLE 4:
PIN 1. COLLECTOR, DYE #1
2. COLLECTOR, #1
3. COLLECTOR, #2
4. COLLECTOR, #2
5. COLLECTOR, #3
6. COLLECTOR, #3
7. COLLECTOR, #4
8. COLLECTOR, #4
9. BASE, #4
10. EMITTER, #4
11. BASE, #3
12. EMITTER, #3
13. BASE, #2
14. EMITTER, #2
15. BASE, #1
16. EMITTER, #1

STYLE 5:
PIN 1. DRAIN, DYE #1
2. DRAIN, #1
3. DRAIN, #2
4. DRAIN, #2
5. DRAIN, #3
6. DRAIN, #3
7. DRAIN, #4
8. DRAIN, #4
9. GATE, #4
10. SOURCE, #4
11. GATE, #3
12. SOURCE, #3
13. GATE, #2
14. SOURCE, #2
15. GATE, #1
16. SOURCE, #1

STYLE 6:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE
15. ANODE
16. ANODE

STYLE 7:
PIN 1. SOURCE N-CH
2. COMMON DRAIN (OUTPUT)
3. COMMON DRAIN (OUTPUT)
4. GATE P-CH
5. COMMON DRAIN (OUTPUT)
6. COMMON DRAIN (OUTPUT)
7. COMMON DRAIN (OUTPUT)
8. SOURCE P-CH
9. SOURCE P-CH
10. COMMON DRAIN (OUTPUT)
11. COMMON DRAIN (OUTPUT)
12. COMMON DRAIN (OUTPUT)
13. GATE N-CH
14. COMMON DRAIN (OUTPUT)
15. COMMON DRAIN (OUTPUT)
16. SOURCE N-CH

SOLDERING FOOTPRINT

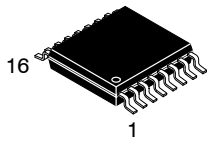


DIMENSIONS: MILLIMETERS

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

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

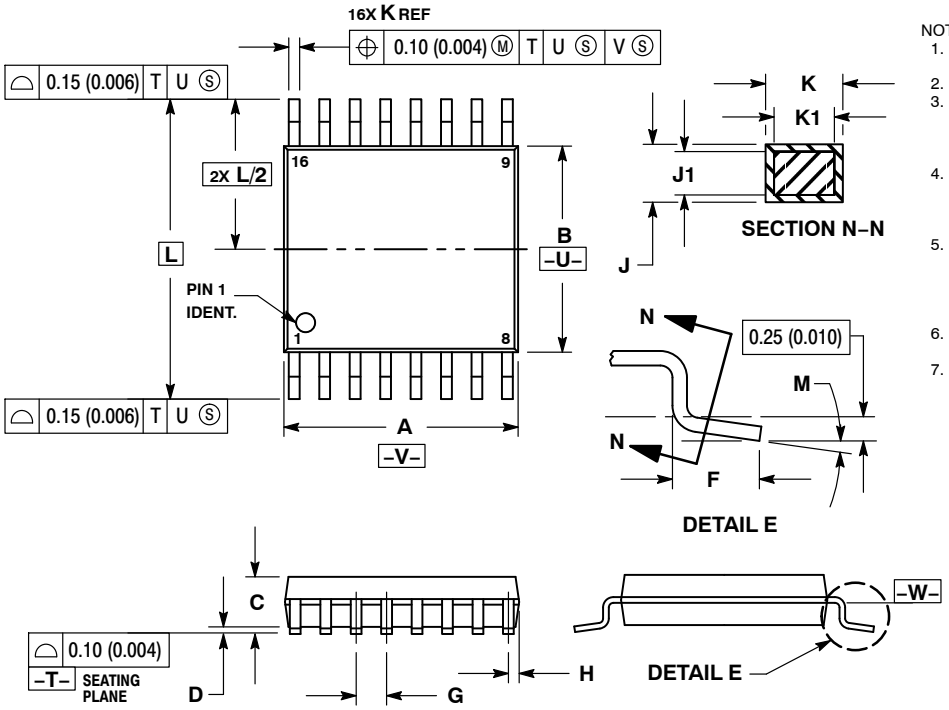
ON Semiconductor®



SCALE 2:1

TSSOP−16
CASE 948F−01
ISSUE B

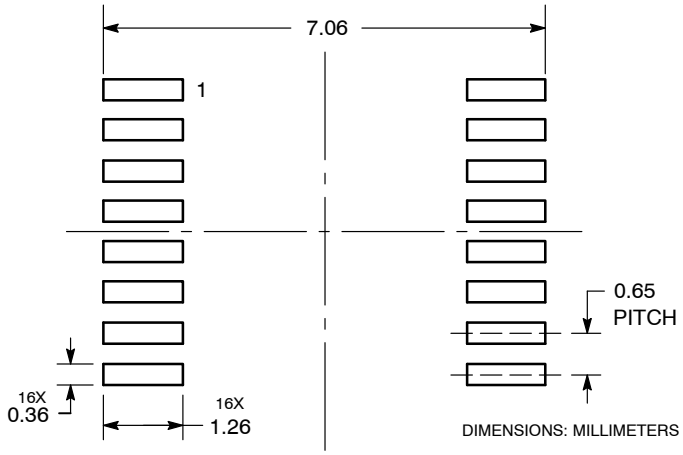
DATE 19 OCT 2006



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−.

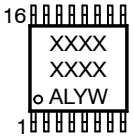
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	−−−	1.20	−−−	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.18	0.28	0.007	0.011
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010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

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

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

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