Octal D-Type Latch with 3-State Outputs

With 5 V-Tolerant Inputs

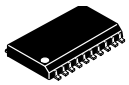
MC74LVX573

The MC74LVX573 is an advanced high speed CMOS octal latch with 3-state outputs. The inputs tolerate voltages up to 5.5 V, allowing the interface of 5.0 V systems to 3.0 V systems.

This 8-bit D-type latch is controlled by a latch enable input and an output enable input. When the output enable input is high, the eight outputs are in a high impedance state.

Features

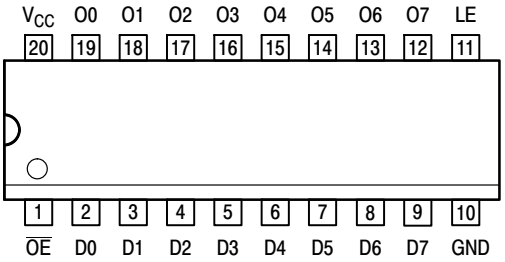
- High Speed: t_{PD} = 6.4 ns (Typ) at V_{CC} = 3.3 V
- Low Power Dissipation: I_{CC} = 4 μA (Max) at T_A = 25 °C
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Low Noise: V_{OLP} = 0.8 V (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 100 mA
- ESD Performance: Human Body Model > 2000 V;
- These Devices are Pb-Free and are RoHS Compliant



SOIC-20
DW SUFFIX
CASE 751D

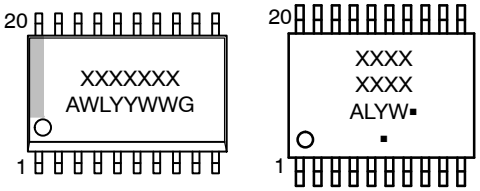
TSSOP-20
DT SUFFIX
CASE 948E

PIN ASSIGNMENT



20-Lead (Top View)

MARKING DIAGRAMS



SOIC-20 **TSSOP-20**

XXXXXXX	= Specific Device Code
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 6 of this data sheet.

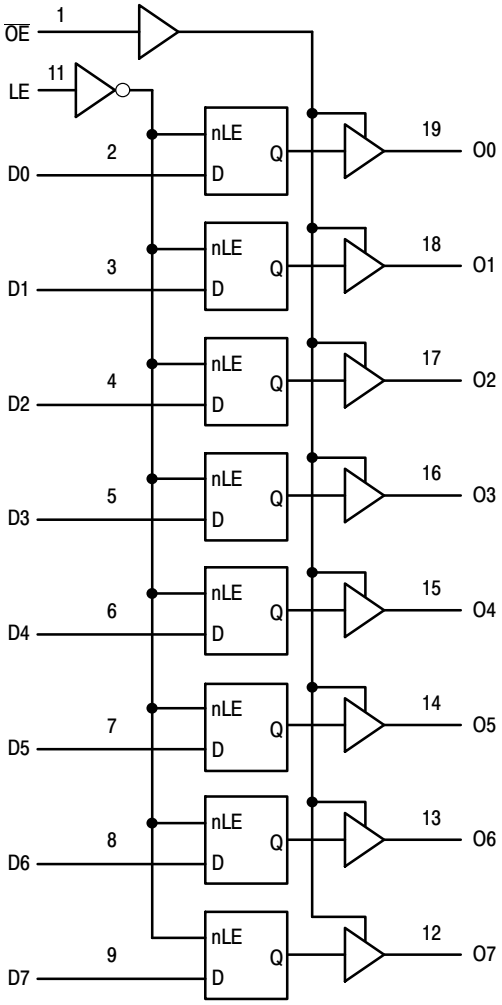


Figure 1. Logic Diagram

PIN NAMES

Pins	Function
$\overline{OE}$	Output Enable Input
LE	Latch Enable Input
D0–D7	Data Inputs
O0–O7	3-State Latch Outputs

TRUTH TABLE

INPUTS			OUTPUTS	OPERATING MODE
OE	LE	Dn	On	
L L	H H	H L	H L	Transparent (Latch Disabled); Read Latch
L L	L L	h l	H L	Latched (Latch Enabled) Read Latch
L	L	X	NC	Hold; Read Latch
H	L	X	Z	Hold; Disabled Outputs
H H	H H	H L	Z Z	Transparent (Latch Disabled); Disabled Outputs
H H	L L	h l	Z Z	Latched (Latch Enabled); Disabled Outputs

H = High Voltage Level; h = High Voltage Level One Setup Time Prior to the Latch Enable High-to-Low Transition; L = Low Voltage Level; l = Low Voltage Level One Setup Time Prior to the Latch Enable High-to-Low Transition; NC = No Change, State Prior to the Latch Enable High-to-Low Transition; X = High or Low Voltage Level or Transitions are Acceptable; Z = High Impedance State; For I_{CC} Reasons DO NOT FLOAT Inputs.

MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V_{CC}	DC Supply Voltage		−0.5 to +6.5	V
V_{IN}	DC Input Voltage		−0.5 to +6.5	V
V_{OUT}	DC Output Voltage		−0.5 to V_{CC} +0.5	V
I_{IN}	DC Input Current, per Pin		±20	mA
I_{OUT}	DC Output Current, Per Pin		±25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins		±75	mA
I_{IK}	Input Clamp Current		−20	mA
I_{OK}	Output Clamp Current		±20	mA
T_{STG}	Storage Temperature Range		−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 s		260	°C
T_J	Junction Temperature Under Bias		+150	°C
θ_{JA}	Thermal Resistance (Note 2)	SOIC-20W	96	°C/W
		TSSOP-20	150	
P_D	Power Dissipation in Still Air at 25 °C	SOIC-20W	1302	mW
		TSSOP-20	833	
MSL	Moisture Sensitivity	SOIC-20W	Level 3	–
		All Other Packages	Level 1	
F_R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V−0 @ 0.573 in	–
V_{ESD}	ESD Withstand Voltage (Note 3)	Human Body Model	2000	V
		Charged Device Model	N/A	
$I_{LATCHUP}$	Latchup Performance (Note 4)		±100	mA

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. Applicable to devices with outputs that may be tri-stated.
2. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
3. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.
4. Tested to EIA/JESD78 Class II.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage	2.0	3.6	V
VI_N	DC Input Voltage (Note 5)	0	5.5	V
V_{OUT}	DC Output Voltage (Note 5)	0	V_{CC}	V
T_A	Operating Temperature	−40	+85	°C
t_r, t_f	Input Rise or Fall Rate	0	100	ns/V

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.

5. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V_{CC} V	T_A = 25 °C			T_A = −40 to 85 °C		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	High-Level Input Voltage		2.0 3.0 3.6	1.5 2.0 2.4	– – –	– – –	1.5 2.0 2.4	– – –	V
V_{IL}	Low-Level Input Voltage		2.0 3.0 3.6	– – –	– – –	0.5 0.8 0.8	– – –	0.5 0.8 0.8	V
V_{OH}	High-Level Output Voltage (V_{in} = V_{IH} or V_{IL})	I_{OH} = −50 μA I_{OH} = −50 μA I_{OH} = −4 mA	2.0 3.0 3.0	1.9 2.9 2.58	2.0 3.0 –	– – –	1.9 2.9 2.48	– – –	V
V_{OL}	Low-Level Output Voltage (V_{in} = V_{IH} or V_{IL})	I_{OL} = 50 μA I_{OL} = 50 μA I_{OL} = 4 mA	2.0 3.0 3.0	– – –	0.0 0.0	0.1 0.1 0.36	– – –	0.1 0.1 0.44	V
I_{in}	Input Leakage Current	V_{in} = 5.5 V or GND	3.6	–	–	±0.1	–	±1.0	μA
I_{OZ}	Maximum 3-State Leakage Current	V_{in} = V_{IL} or V_{IH} V_{out} = V_{CC} or GND	3.6 –	– –	– –	±0.2 5	– –	±2.5 –	μA
I_{CC}	Quiescent Supply Current	V_{in} = V_{CC} or GND	3.6	–	–	4.0	–	40.0	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions		T_A = 25 °C			T_A = −40 to 85 °C		Unit
				Min	Typ	Max	Min	Max	
t_{PLH}, t_{PHL}	Propagation Delay LE to O	V_{CC} = 2.7 V	C_L = 15 pF C_L = 50 pF	– –	8.2 10.7	15.6 19.1	1.0 1.0	18.5 22.0	ns
		V_{CC} = 3.3 ± 0.3 V	C_L = 15 pF C_L = 50 pF	– –	6.4 8.9	10.1 13.6	1.0 1.0	12.0 15.5	
t_{PLH}, t_{PHL}	Propagation Delay D to O	V_{CC} = 2.7 V	C_L = 15 pF C_L = 50 pF	– –	7.6 10.1	14.5 18.0	1.0 1.0	17.5 21.0	ns
		V_{CC} = 3.3 ± 0.3 V	C_L = 15 pF C_L = 50 pF	– –	5.9 8.4	9.3 12.8	1.0 1.0	11.0 14.5	
t_{PZL}, t_{PZH}	Output Enable Time $\overline{OE}$ to O	V_{CC} = 2.7 V R_L = 1 kΩ	C_L = 15 pF C_L = 50 pF	– –	7.8 10.3	15.0 18.5	1.0 1.0	18.5 22.0	ns
		V_{CC} = 3.3 ± 0.3 V R_L = 1 kΩ	C_L = 15 pF C_L = 50 pF	– –	6.1 8.6	9.7 13.2	1.0 1.0	12.0 15.5	
t_{PLZ}, t_{PHZ}	Output Disable Time $\overline{OE}$ to O	V_{CC} = 2.7 V R_L = 1 kΩ	C_L = 50 pF	–	12.1	19.1	1.0	22.0	ns
		V_{CC} = 3.3 ± 0.3 V R_L = 1 kΩ	C_L = 50 pF	–	10.1	13.6	1.0	15.5	
t_{OSHL} t_{OSLH}	Output-to-Output Skew (Note 6)	V_{CC} = 2.7 V V_{CC} = 3.3 ± 0.3 V	C_L = 50 pF C_L = 50 pF	– –	– –	1.5 1.5	– –	1.5 1.5	ns

6. 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_{OSHL}) or LOW-to-HIGH (t_{OSLH}); parameter guaranteed by design.

TIMING REQUIREMENTS

Symbol	Parameter	Test Conditions	T_A = 25 °C		T_A = −40 to 85 °C	Unit
			Typ	Limit	Limit	
$t_{w(h)}$	Minimum Pulse Width, LE	V_{CC} = 2.7 V V_{CC} = 3.3 ± 0.3 V		6.5 5.0	7.5 5.0	ns
t_{su}	Minimum Setup Time, D to LE	V_{CC} = 2.7 V V_{CC} = 3.3 ± 0.3 V		5.0 3.5	5.0 3.5	ns
t_h	Minimum Hold Time, D to LE	V_{CC} = 2.7 V V_{CC} = 3.3 ± 0.3 V		1.5 1.5	1.5 1.5	ns

CAPACITIVE CHARACTERISTICS

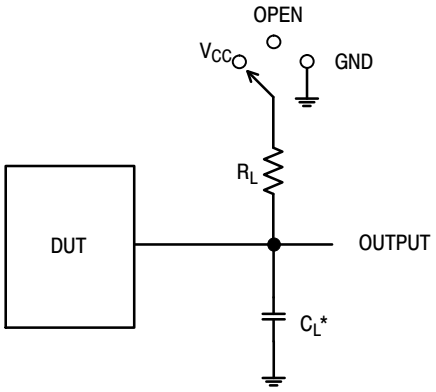
Symbol	Parameter	T_A = 25 °C			T_A = −40 to 85 °C		Unit
		Min	Typ	Max	Min	Max	
C_{in}	Input Capacitance	–	4	10	–	10	pF
C_{out}	Maximum 3-State Output Capacitance	–	6	–	–	–	pF
C_{PD}	Power Dissipation Capacitance (Note 7)	–	29	–	–	–	pF

7. 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: $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}/8$ (per latch). C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

NOISE CHARACTERISTICS (Input $t_r = t_f$ = 3.0 ns, C_L = 50 pF, V_{CC} = 3.3 V)

Symbol	Characteristic	T_A = 25 °C		Unit
		Typ	Max	
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	0.5	0.8	V
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	−0.5	−0.8	V
V_{IHD}	Minimum High Level Dynamic Input Voltage	–	2.0	V
V_{ILD}	Maximum Low Level Dynamic Input Voltage	–	0.8	V

TEST CIRCUITS



Test	Switch Position	C_L	R_L
t_{PLH} / t_{PHL}	Open	See AC Characteristics Table	1 kΩ
t_{PLZ} / t_{PZL}	V_{CC}		
t_{PHZ} / t_{PZH}	GND		

*CL includes probe and jig capacitance
Input $t_R = t_F$ = 3 ns

Figure 2. AC Test Circuit

SWITCHING WAVEFORMS

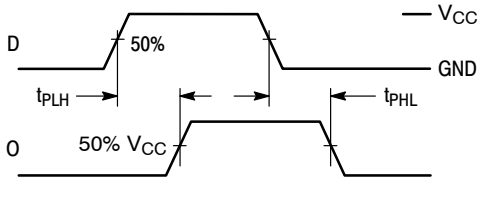


Figure 3.

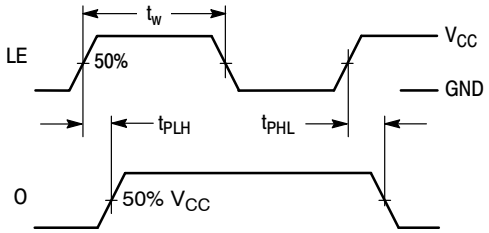


Figure 4.

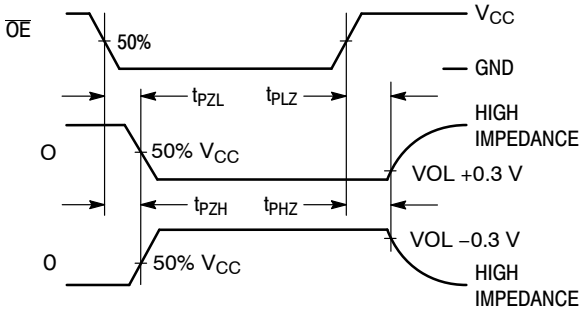


Figure 5.

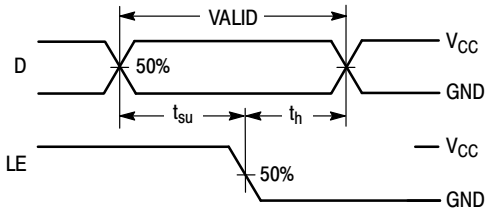


Figure 6.

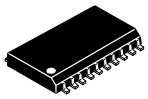
ORDERING INFORMATION

Device	Marking	Package	Shipping†
MC74LVX573DWR2G	LVX573G	SOIC-20 WB	1000 / Tape & Reel
MC74LVX573DTG	LVX 573	TSSOP-20	75 Units / Rail
MC74LVX573DTR2G	LVX 573	TSSOP-20	2500 / Tape & Reel

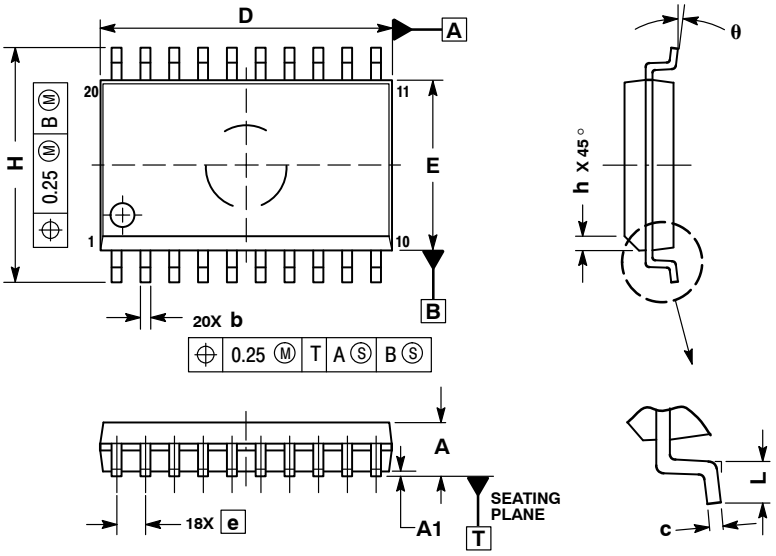
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

SOIC−20 WB
CASE 751D−05
ISSUE H

DATE 22 APR 2015



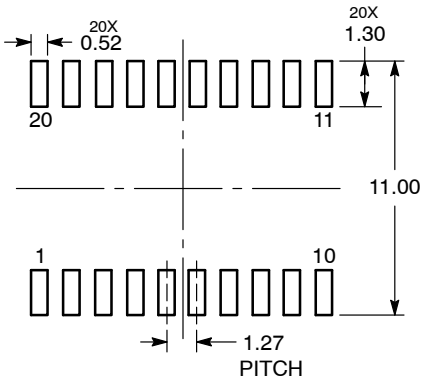
SCALE 1:1



NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	2.35	2.65
A1	0.10	0.25
b	0.35	0.49
c	0.23	0.32
D	12.65	12.95
E	7.40	7.60
e	1.27 BSC	
H	10.05	10.55
h	0.25	0.75
L	0.50	0.90
θ	0°	7°

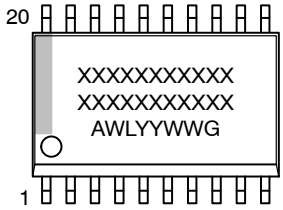
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

GENERIC MARKING DIAGRAM*



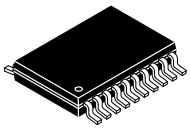
XXXXX = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb−Free Package

*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. Some products may not follow the Generic Marking.

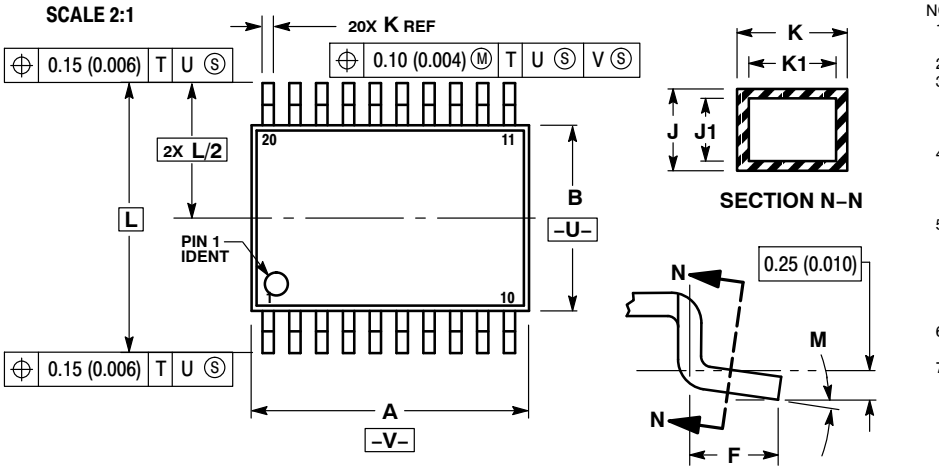
DOCUMENT NUMBER:	**98ASB42343B**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.	
DESCRIPTION:	**SOIC−20 WB**		**PAGE 1 OF 1**

TSSOP–20 WB
CASE 948E
ISSUE D

DATE 17 FEB 2016

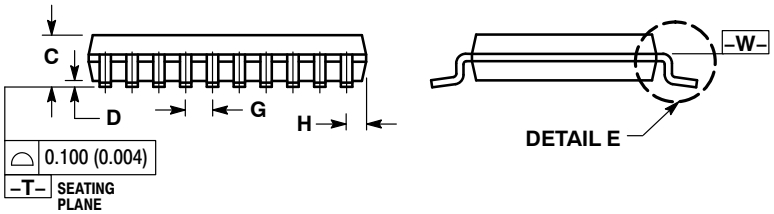


SCALE 2:1



SECTION N–N

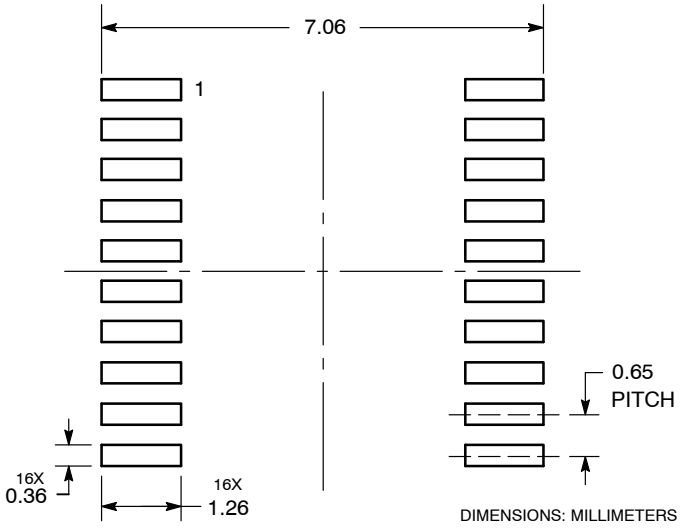
DETAIL E



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	6.40	6.60	0.252	0.260
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	0.27	0.37	0.011	0.015
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°

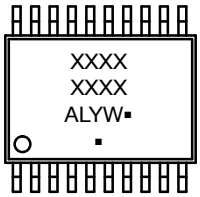
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

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

GENERIC MARKING DIAGRAM*



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb–Free Package

(Note: Microdot may be in either location)

*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. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	**98ASH70169A**	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–20 WB**		**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