

Octal 3-State Noninverting Bus Transceiver

High-Performance Silicon-Gate CMOS

MC74HC245A, MC74HCT245A

MC74HC245A/MC74HCT245A is identical in pinout to the LS245. The MC74HC245A inputs are compatible with Standard CMOS outputs. External pull-up resistors make them compatible with LSTTL outputs. The MC74HCT245A may be used as a level converter for interfacing TTL or NMOS outputs to high speed CMOS inputs.

The HC245A/HCT245A is a 3-state noninverting transceiver that is used for 2-way asynchronous communication between data buses. The device has an active-low Output Enable pin, which is used to place the I/O ports into high-impedance states. The Direction control determines whether data flows from A to B or from B to A.

Features

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V (HC), 4.5 to 5.5 V (HCT)
- Low Input Current: 1 μ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity: 308 FETs or 77 Equivalent Gates
- -Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

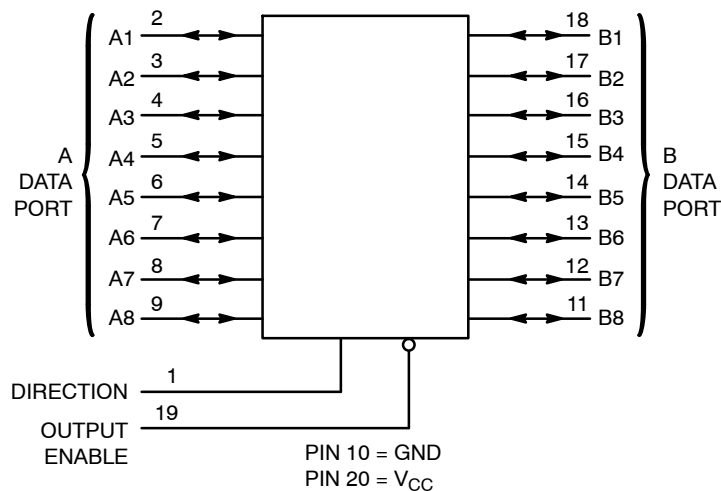
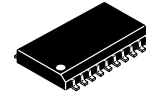


Figure 1. Logic Diagram

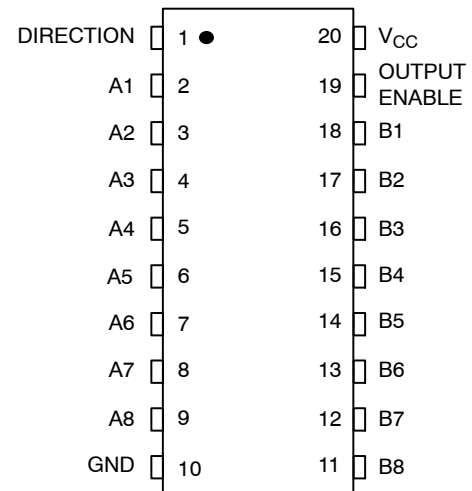


SOIC-20
DW SUFFIX
CASE 751D

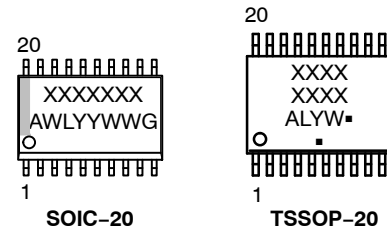


TSSOP-20
DT SUFFIX
CASE 948E

PIN ASSIGNMENT



MARKING DIAGRAMS



XXXXXXX = Specific Device Code

A = Assembly Location

WL, L = Wafer Lot

YY, 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 7 of this data sheet.

MC74HC245A, MC74HCT245A

FUNCTION TABLE

Control Inputs		Operation
Output Enable	Direction	
L	L	Data Transmitted from Bus B to Bus A
L	H	Data Transmitted from Bus A to Bus B
H	X	Buses Isolated (High-Impedance State)

X = don't care

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 $V_{CC}+0.5$	V
V_{OUT}	DC Output Voltage	-0.5 to $V_{CC}+0.5$	V
I_{IN}	DC Input Diode Current, per Pin	± 20	mA
I_{OUT}	DC Input Diode Current, Per Pin	± 35	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 75	mA
I_{IK}	Input Clamp Current ($V_{IN} < 0$ or $V_{IN} > V_{CC}$)	± 20	mA
I_{OK}	Output Clamp Current ($V_{OUT} < 0$ or $V_{OUT} > V_{CC}$)	± 20	mA
T_{STG}	Storage Temperature Range	-65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 secs	260	°C
T_J	Junction Temperature Under Bias	+150	°C
θ_{JA}	Thermal Resistance (Note 1)	SOIC-20W WQFN20 QFN20 TSSOP-20	96 99 111 150 °C/W
P_D	Power Dissipation in Still Air at 25°C	SOIC-20W WQFN20 QFN20 TSSOP-20	1302 1256 1127 833 mW
MSL	Moisture Sensitivity	SOIC-20W All Other Packages	Level 3 Level 1 -
F_R	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in -
V_{ESD}	ESD Withstand Voltage (Note 2)	Human Body Model Charged Device Model	> 2000 > 1000 V
$I_{LATCHUP}$	Latchup Performance (Note 3)		± 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. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
2. 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.
3. Tested to EIA/JESD78 Class II.

MC74HC245A, MC74HCT245A

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
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MC74HC

V_{CC}	DC Supply Voltage	2.0	6.0	V
V_{IN}, V_{OUT}	DC Input, Output Voltage (Note 4)	0	V_{CC}	V
T_A	Operating Free-Air Temperature	-55	+125	°C
t_r, t_f	Input Rise or Fall Time	$V_{CC} = 2.0\text{ V}$ $V_{CC} = 4.5\text{ V}$ $V_{CC} = 6.0\text{ V}$	1000 500 400	ns

MC74HCT

V_{CC}	DC Supply Voltage	4.5	5.5	V
V_{IN}, V_{OUT}	DC Input, Output Voltage (Note 4)	0	V_{CC}	V
T_A	Operating Free-Air Temperature	-55	+125	°C
t_r, t_f	Input Rise or Fall Time	0	500	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.

4. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or VCC). Unused outputs must be left open.

MC74HC245A, MC74HCT245A

DC ELECTRICAL CHARACTERISTICS (MC74HC245A)

Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				-55 to 25°C	≤ 85°C	≤ 125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{out} = V _{CC} - 0.1 V I _{out} ≤ 20 μA	2.0 3.0 4.5 6.0	1.5 2.1 3.15 4.2	1.5 2.1 3.15 4.2	1.5 2.1 3.15 4.2	V
V _{IL}	Maximum Low-Level Input Voltage	V _{out} = 0.1 V I _{out} ≤ 20 μA	2.0 3.0 4.5 6.0	0.5 0.9 1.35 1.8	0.5 0.9 1.35 1.8	0.5 0.9 1.35 1.8	V
V _{OH}	Minimum High-Level Output Voltage	V _{in} = V _{IH} I _{out} ≤ 20 μA	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} I _{out} ≤ 2.4 mA I _{out} ≤ 6.0 mA I _{out} ≤ 7.8 mA	3.0 4.5 6.0	2.48 3.98 5.48	2.34 3.84 5.34	2.2 3.7 5.2	
V _{OL}	Maximum Low-Level Output Voltage	V _{in} = V _{IL} I _{out} ≤ 20 μA	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		V _{in} = V _{IL} I _{out} ≤ 2.4 mA I _{out} ≤ 6.0 mA I _{out} ≤ 7.8 mA	3.0 4.5 6.0	0.26 0.26 0.26	0.33 0.33 0.33	0.4 0.4 0.4	
I _{in}	Maximum Input Leakage Current	V _{in} = V _{CC} or GND	6.0	±0.1	±1.0	±1.0	μA
I _{OZ}	Maximum Three-State Leakage Current	Output in High-Impedance State V _{in} = V _{IL} or V _{IH} V _{out} = V _{CC} or GND	6.0	±0.5	±5.0	±10	μA
I _{CC}	Maximum Quiescent Supply Current (per Package)	V _{in} = V _{CC} or GND I _{out} = 0 μA	6.0	4.0	40	160	μA

AC ELECTRICAL CHARACTERISTICS (MC74HC245A)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			−55 to 25°C	≤ 85°C	≤ 125°C	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, A to B, B to A (Figures 2 and 3)	2.0 3.0 4.5 6.0	75 55 15 13	95 70 19 16	110 80 22 19	ns
t _{PLZ} , t _{PHZ}	Maximum Propagation Delay, Direction or Output Enable to A or B (Figures 2 and 3)	2.0 3.0 4.5 6.0	110 90 22 19	140 110 28 24	165 130 33 28	ns
t _{PZL} , t _{PZH}	Maximum Propagation Delay, Output Enable to A or B (Figures 2 and 3)	2.0 3.0 4.5 6.0	110 90 22 19	140 110 28 24	165 130 33 28	ns
t _{TLH} , t _{THL}	Maximum Output Transition Time, Any Output (Figures 2 and 3)	2.0 3.0 4.5 6.0	60 23 12 10	75 27 15 13	90 32 18 15	ns
C _{in}	Maximum Input Capacitance (Pin 1 or Pin 19)	–	10	10	10	pF
C _{out}	Maximum Three-State I/O Capacitance (I/O in High-Impedance State)	–	15	15	15	pF
C _{PD}	Power Dissipation Capacitance (Per Transceiver Channel) (Note 5)	Typical @ 25°C, V _{CC} = 5.0 V				pF
		40				

5. Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

MC74HC245A, MC74HCT245A

DC ELECTRICAL CHARACTERISTICS (MC74HCT245A)

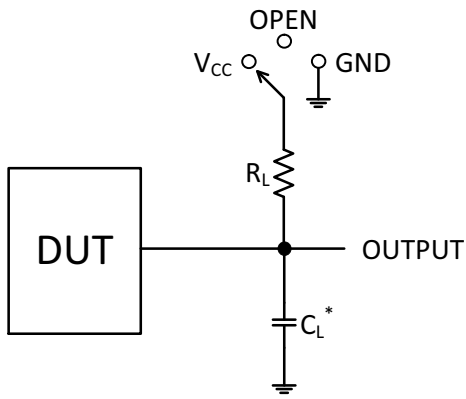
Symbol	Parameter	Test Conditions	V _{CC} V	Guaranteed Limit			Unit
				– 55 to 25°C	≤ 85°C	≤ 125°C	
V _{IH}	Minimum High-Level Input Voltage	V _{out} = 0.1 V or V _{CC} – 0.1 V I _{out} ≤ 20 μA	4.5 5.5	2.0 2.0	2.0 2.0	2.0 2.0	V
V _{IL}	Maximum Low-Level Input Voltage	V _{out} = 0.1 V or V _{CC} – 0.1 V I _{out} ≤ 20 μA	4.5 5.5	0.8 0.8	0.8 0.8	0.8 0.8	V
V _{OH}	Minimum High-Level Output Voltage	V _{in} = V _{IH} or V _{IL} I _{out} ≤ 20 μA	4.5 5.5	4.4 5.4	4.4 5.4	4.4 5.4	V
		V _{in} = V _{IH} or V _{IL} I _{out} ≤ 6.0 mA	4.5	3.98	3.84	3.7	
V _{OL}	Maximum Low-Level Output Voltage	V _{in} = V _{IH} or V _{IL} I _{out} ≤ 20 μA	4.5 5.5	0.1 0.1	0.1 0.1	0.1 0.1	V
		V _{in} = V _{IH} or V _{IL} I _{out} ≤ 6.0 mA	4.5	0.26	0.33	0.4	
I _{in}	Maximum Input Leakage Current	V _{in} = V _{CC} or GND, Pins 1 or 19	5.5	± 0.1	± 1.0	± 1.0	μA
I _{CC}	Maximum Quiescent Supply Current (per Package)	V _{in} = V _{CC} or GND I _{out} = 0 μA	5.5	4.0	40	160	μA
I _{OZ}	Maximum Three-State Leakage Current	Output in High-Impedance State V _{in} = V _{IL} or V _{IH} V _{out} = V _{CC} or GND, I/O Pins	5.5	± 0.5	± 5.0	± 10	μA
ΔI _{CC}	Additional Quiescent Supply Current	V _{in} = 2.4 V, Any One Input V _{in} = V _{CC} or GND, Other Inputs I _{out} = 0 μA	5.5	≥ –55°C	25°C to 125°C		mA
				2.9	2.4		

AC ELECTRICAL CHARACTERISTICS (MC74HCT245A)

Symbol	Parameter	Guaranteed Limit			Unit
		– 55 to 25° C	≤ 85° C	≤ 125° C	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, A to B or B to A (Figures 2 and 3)	22	28	33	ns
t _{PLZ} , t _{PHZ}	Maximum Propagation Delay, Direction or Output Enable to A or B (Figures 2 and 3)	30	36	42	ns
t _{PZL} , t _{PZH}	Maximum Propagation Delay, Output Enable to A or 8 (Figures 2 and 3)	30	36	42	ns
t _{TLH} , t _{THL}	Maximum Output Transition Time. any Output (Figures 2 and 3)	12	15	18	ns
C _{in}	Maximum Input Capacitance (Pin 1 or 19)	10	10	10	pF
C _{out}	Maximum Three–State I/O Capacitance, (I/O in High–Impedance State)	15	15	15	pF
C _{PD}	Power Dissipation Capacitance (Per Enabled Output)*	Typical @ 25°C, V _{CC} = 5.0 V			pF
		97			

* Used to determine the no-load dynamic power consumption: P_D = C_{PD} V_{CC}²f + I_{CC} V_{CC}.

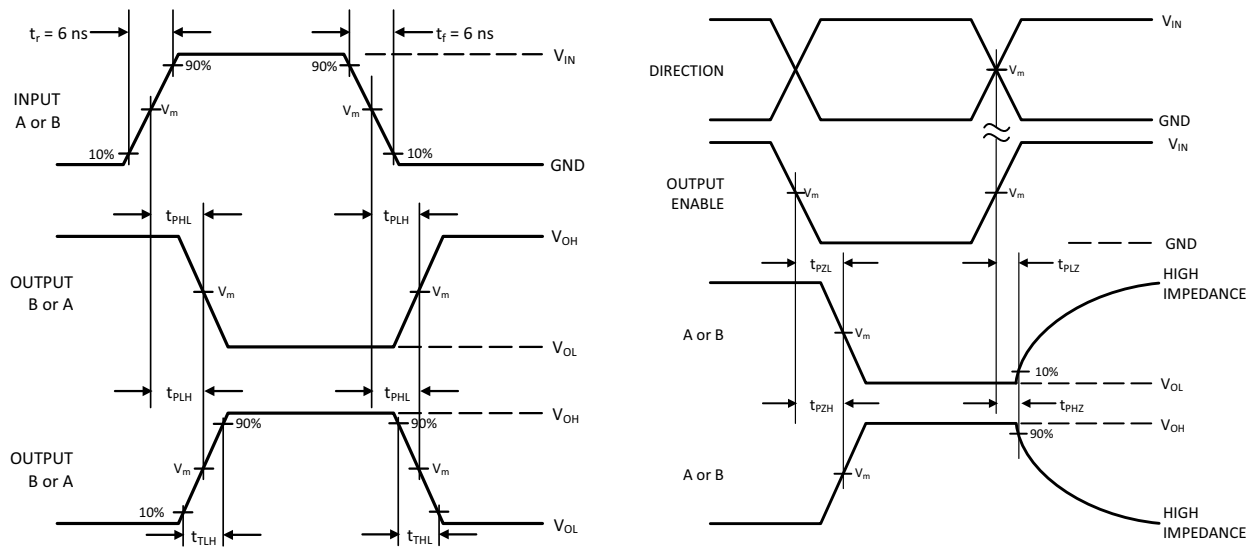
MC74HC245A, MC74HCT245A



* C_L Includes probe and jig capacitance

Test	Switch Position	C_L	R_L
t_{PLH} / t_{PHL}	Open	50 pF	1 k Ω
t_{PLZ} / t_{PZL}	V_{CC}		
t_{PHZ} / t_{PZH}	GND		

Figure 2. Test Circuit



Device	V_{IN}, V	V_m, V
MC74HC245A	V_{CC}	$50\% \times V_{CC}$
MC74HCT245A	3 V	1.3 V

Figure 3. Switching Waveforms

MC74HC245A, MC74HCT245A

ORDERING INFORMATION

Device	Package	Marking	Shipping†
MC74HC245ADWG	SOIC-20 Wide	HC245A	38 Units / Rail
MC74HC245ADWR2G	SOIC-20 Wide	HC245A	1000 Units / Tape & Reel
MC74HC245ADWR2G-Q*	SOIC-20 Wide	HC245A	1000 Units / Tape & Reel
MC74HC245ADTG	TSSOP-20	HC 245A	75 Units / Rail
MC74HC245ADTR2G	TSSOP-20	HC 245A	2500 Units / Tape & Reel
MC74HC245ADTR2G-Q*	TSSOP-20	HC 245A	2500 Units / Tape & Reel
MC74HCT245ADWG	SOIC-20 Wide	HCT245A	38 Units / Rail
MC74HCT245ADWR2G	SOIC-20 Wide	HCT245A	1000 Units / Tape & Reel
MC74HCT245ADTG	TSSOP-20	HCT 245A	75 Units / Rail
MC74HCT245ADTR2G	TSSOP-20	HCT 245A	2500 Units / Tape & Reel
MC74HCT245ADTR2G-Q*	TSSOP-20	HCT 245A	2500 Units / 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.

*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC – Q100 Qualified and PPAP Capable.

MC74HC245A, MC74HCT245A

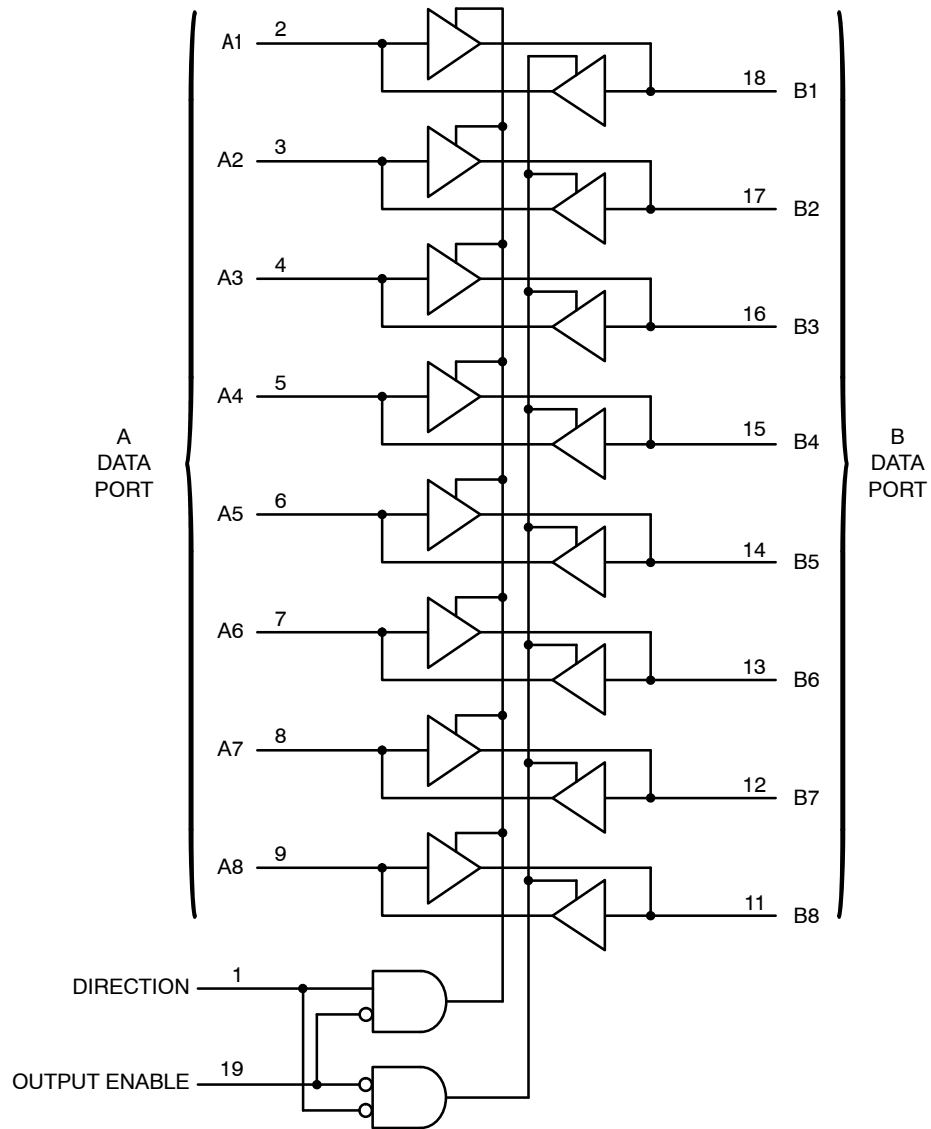


Figure 4. Expanded Logic Diagram



SCALE 1:1

SOIC-20 WB
CASE 751D-05
ISSUE H

DATE 22 APR 2015



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.

DIM	MILLIMETERS	
	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*



XXXXXX = 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.

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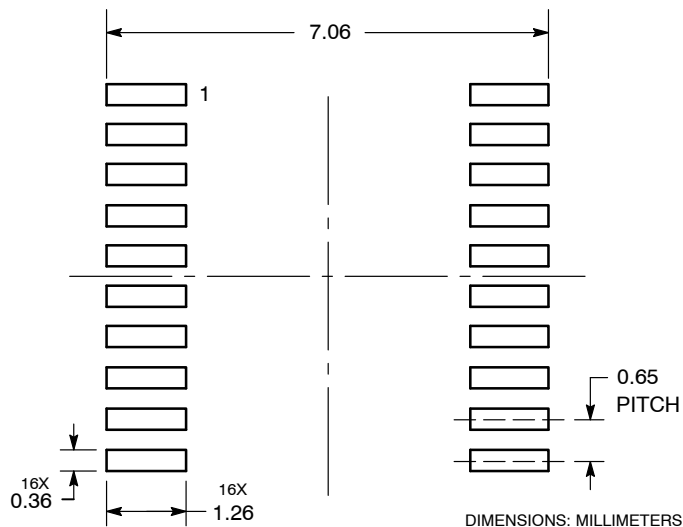

TSSOP-20 WB
CASE 948E
ISSUE D

DATE 17 FEB 2016

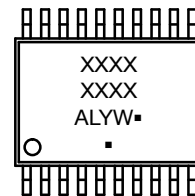

NOTES:

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	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***


*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.

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