

Low-Voltage CMOS Octal Buffer

With 5 V-Tolerant Inputs and Outputs
(3-State, Non-Inverting)

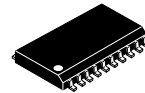
MC74LCX244

The MC74LCX244 is a high performance, non-inverting octal buffer operating from a 1.65 to 5.5 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A V_I specification of 5.5 V allows MC74LCX244 inputs to be safely driven from 5 V devices. The MC74LCX244 is suitable for memory address driving and all TTL level bus oriented transceiver applications.

Current drive capability is 24 mA at the outputs. The Output Enable ($\overline{OE}$) input, when HIGH, disables the output by placing them in a HIGH Z condition.

Features

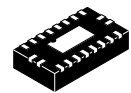
- Designed for 1.65 to 5.5 V V_{CC} Operation
- 5 V Tolerant – Interface Capability With 5 V TTL Logic
- Supports Live Insertion and Withdrawal
- I_{OFF} Specification Guarantees High Impedance When $V_{CC} = 0$ V
- LVTTL Compatible
- LVC MOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current in All Three Logic States (10 μ A)
Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance:
 - Human Body Model >2000 V
- 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/BFR Free and are RoHS Compliant



SOIC-20 WB
DW SUFFIX
CASE 751D

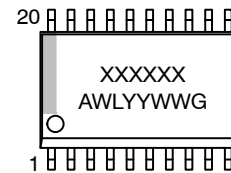


TSSOP-20
DT SUFFIX
CASE 948E

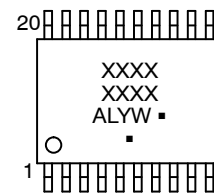


QFN20
MN SUFFIX
CASES 485AA
& 485CB

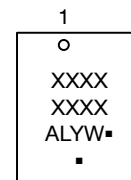
MARKING DIAGRAMS



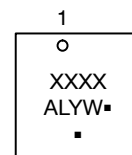
SOIC-20 WB



TSSOP-20



QFN20 – 485AA



QFN20 – 485CB

A = Assembly Location
L, WL = Wafer Lot
Y, YY = Year
W, WW = Work Week
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 8.

MC74LCX244

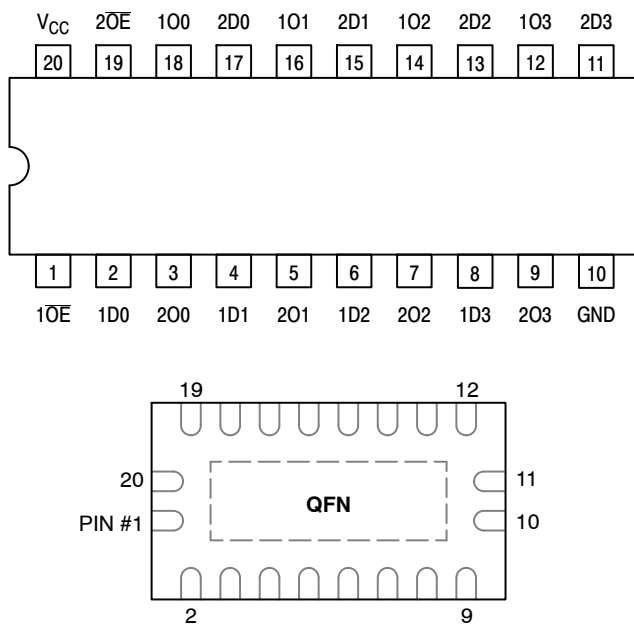


Figure 1. Pinouts: 20-Lead (Top View)

PIN NAMES

PINS	FUNCTION
$\overline{1OE}$, $\overline{2OE}$	Output Enable Inputs
1Dn, 2Dn	Data Inputs
1On, 2On	3-State Outputs

TRUTH TABLE

INPUTS		OUTPUTS
$\overline{1OE}$ $\overline{2OE}$	1Dn 2Dn	1On, 2On
L	L	L
L	H	H
H	X	Z

H = High Voltage Level

L = Low Voltage Level

Z = High Impedance State

X = High or Low Voltage Level and Transitions are Acceptable

For I_{CC} reasons, DO NOT FLOAT Inputs

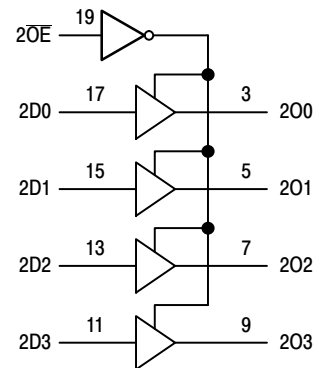
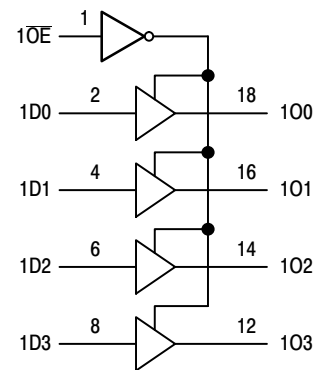


Figure 2. Logic Diagram

MC74LCX244

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage	–0.5 to +6.5	V
V_I	DC Input Voltage (Note 1)	–0.5 to +6.5	V
V_O	DC Output Voltage (Note 1) Active–Mode (High or Low State)	–0.5 to $V_{CC} + 0.5$	V
	Tri–State Mode	–0.5 to +6.5	
	Power–Down Mode ($V_{CC} = 0$ V)	–0.5 to +6.5	
I_{IK}	DC Input Diode Current $V_{IN} < GND$	–50	mA
I_{OK}	DC Output Diode Current $V_{OUT} < GND$	–50	mA
I_O	DC Output Source/Sink Current	±50	mA
I_{CC} or I_{GND}	DC Supply Current per Supply Pin or Ground Pin	±100	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 2) SOIC–20W	96	°C/W
	WQFN20	99	
	QFN20	111	
	TSSOP–20	150	
P_D	Power Dissipation in Still Air SOIC–20W	1302	mW
	WQFN20	1256	
	QFN20	1127	
	TSSOP–20	833	
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 3) Human Body Model	> 2000	V
	Charged Device Model	N/A	

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. I_O absolute maximum rating must be observed.
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.

MC74LCX244

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit	
V _{CC}	Supply Voltage	Operating	1.65	3.3	5.5	V
		Data Retention Only	1.5	3.3	5.5	
V _I	Digital Input Voltage	0	–	5.5	V	
V _O	Output Voltage	Active Mode (High or Low State)	0	–	V _{CC}	V
		Tri-State Mode	0	–	5.5	
		Power Down Mode (V _{CC} = 0 V)	0	–	5.5	
T _A	Operating Free-Air Temperature	–55	–	+125	°C	
t _r , t _f	Input Rise or Fall Rate	V _{CC} = 1.65 V to 1.95 V	0	–	20	nS/V
		V _{CC} = 2.3 V to 2.7 V	0	–	20	
		V _I from 0.8 V to 2.0 V, V _{CC} = 3.0 V	0	–	10	
		V _{CC} = 4.5 V to 5.5 V	0	–	5	

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 V_{CC}). Unused outputs must be left open.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V_{CC} (V)	$T_A = -40^{\circ}\text{C to } +85^{\circ}\text{C}$		$T_A = -55^{\circ}\text{C to } +125^{\circ}\text{C}$		Unit
				Min	Max	Min	Max	
V_{IH}	High-Level Input Voltage		1.65 to 1.95	$0.65 \times V_{CC}$		$0.65 \times V_{CC}$		V
			2.3 to 2.7	1.7		1.7		
			2.7 to 3.6	2.0		2.0		
			4.5 to 5.5	$0.7 \times V_{CC}$		$0.7 \times V_{CC}$		
V_{IL}	Low-Level Input Voltage		1.65 to 1.95		$0.35 \times V_{CC}$		$0.35 \times V_{CC}$	V
			2.3 to 2.7		0.7		0.7	
			2.7 to 3.6		0.8		0.8	
			4.5 to 5.5		$0.3 \times V_{CC}$		$0.3 \times V_{CC}$	
V_{OH}	High-Level Output Voltage	$V_I = V_{IH}$ or V_{IL}						V
		$I_{OH} = -100 \mu\text{A}$	1.65 to 5.5	$V_{CC} - 0.1$	–	$V_{CC} - 0.1$	–	
		$I_{OH} = -4 \text{ mA}$	1.65	1.2	–	1.2	–	
		$I_{OH} = -8 \text{ mA}$	2.3	1.8	–	1.8	–	
		$I_{OH} = -12 \text{ mA}$	2.7	2.2	–	2.2	–	
		$I_{OH} = -16 \text{ mA}$	3.0	2.4	–	2.4	–	
		$I_{OH} = -24 \text{ mA}$	3.0	2.2	–	2.2	–	
		$I_{OH} = -32 \text{ mA}$	4.5	3.8		3.8		
V_{OL}	Low-Level Output Voltage	$V_I = V_{IH}$ or V_{IL}						V
		$I_{OL} = 100 \mu\text{A}$	1.65 to 5.5	–	0.1	–	0.1	
		$I_{OL} = 4 \text{ mA}$	1.65	–	0.45	–	0.45	
		$I_{OL} = 8 \text{ mA}$	2.3	–	0.6	–	0.6	
		$I_{OL} = 12 \text{ mA}$	2.7	–	0.4	–	0.4	
		$I_{OL} = 16 \text{ mA}$	3.0	–	0.4	–	0.4	
		$I_{OL} = 24 \text{ mA}$	3.0	–	0.55	–	0.55	
		$I_{OL} = 32 \text{ mA}$	4.5		0.6		0.6	

MC74LCX244

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = -40°C to +85°C		T _A = -55°C to +125°C		Unit
				Min	Max	Min	Max	
I _I	Input Leakage Current	V _I = 0 to 5.5 V	3.6	–	±5.0	–	±5.0	μA
I _{OZ}	3-State Output Leakage Current	V _I = V _{IH} or V _{IL} , V _O = 0 V to 5.5 V	3.6	–	±5.0	–	±5.0	μA
I _{OFF}	Power Off Leakage Current	V _I = 5.5 V or V _O = 5.5 V	0	–	10	–	10	μA
I _{CC}	Quiescent Supply Current	V _I = 5.5 V or GND	3.6	–	10	–	10	μA
ΔI _{CC}	Increase in I _{CC} per Input	V _{IH} = V _{CC} – 0.6 V	2.3 to 3.6	–	500	–	500	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.

5. These values of V_I are used to test DC electrical characteristics only.

AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Condition	V _{CC} (V)	T _A = -40°C to +85°C		T _A = -55°C to +125°C		Unit
				Min	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation Delay, D to O	See Figures 3 and 4	1.65 to 1.95	–	10.3	–	10.3	ns
			2.3 to 2.7	–	7.8	–	7.8	
			2.7	–	7.5	–	7.5	
			3.0 to 3.6	–	6.5	–	6.5	
			4.5 to 5.5	–	5.9	–	5.9	
t _{PZH} , t _{PZL}	Output Enable Time, OE to O	See Figures 3 and 4	1.65 to 1.95	–	13.0	–	13.0	ns
			2.3 to 2.7	–	10.0	–	10.0	
			2.7	–	9.0	–	9.0	
			3.0 to 3.6	–	8.0	–	8.0	
			4.5 to 5.5	–	7.3	–	7.3	
t _{PHZ} , t _{PLZ}	Output Disable Time, OE to O	See Figures 3 and 4	1.65 to 1.95	–	11.0	–	11.0	ns
			2.3 to 2.7	–	8.4	–	8.4	
			2.7	–	8.0	–	8.0	
			3.0 to 3.6	–	7.0	–	7.0	
			4.5 to 5.5	–	6.0	–	6.0	
t _{OSHL} , t _{OSLH}	Output to Output Skew (Note 5)		1.65 to 1.95	–	–	–	–	ns
			2.3 to 2.7	–	–	–	–	
			2.7	–	–	–	–	
			3.0 to 3.6	–	1.0	–	1.0	

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.

MC74LCX244

DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Characteristic	Condition	T _A = +25°C			Unit
			Min	Typ	Max	
V _{OLP}	Dynamic LOW Peak Voltage (Note 7)	V _{CC} = 3.3 V, C _L = 50 pF, V _{IH} = 3.3 V, V _{IL} = 0 V V _{CC} = 2.5 V, C _L = 30 pF, V _{IH} = 2.5 V, V _{IL} = 0 V		0.8 0.6		V
V _{OLV}	Dynamic LOW Valley Voltage (Note 7)	V _{CC} = 3.3 V, C _L = 50 pF, V _{IH} = 3.3 V, V _{IL} = 0 V V _{CC} = 2.5 V, C _L = 30 pF, V _{IH} = 2.5 V, V _{IL} = 0 V		−0.8 −0.6		V

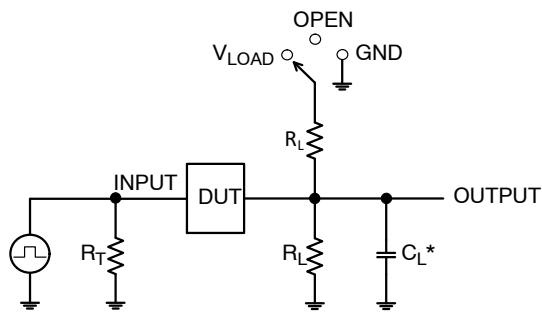
7. Number of outputs defined as “n”. Measured with “n−1” outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typ	Unit
C _{IN}	Input Capacitance	V _{CC} = 3.3 V, V _I = 0 V or V _{CC}	7	pF
C _{OUT}	Output Capacitance	V _{CC} = 3.3 V, V _I = 0 V or V _{CC}	8	pF
C _{PD}	Power Dissipation Capacitance (Note 8)	10 MHz, V _{CC} = 3.3 V, V _I = 0 V or V _{CC}	25	pF

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

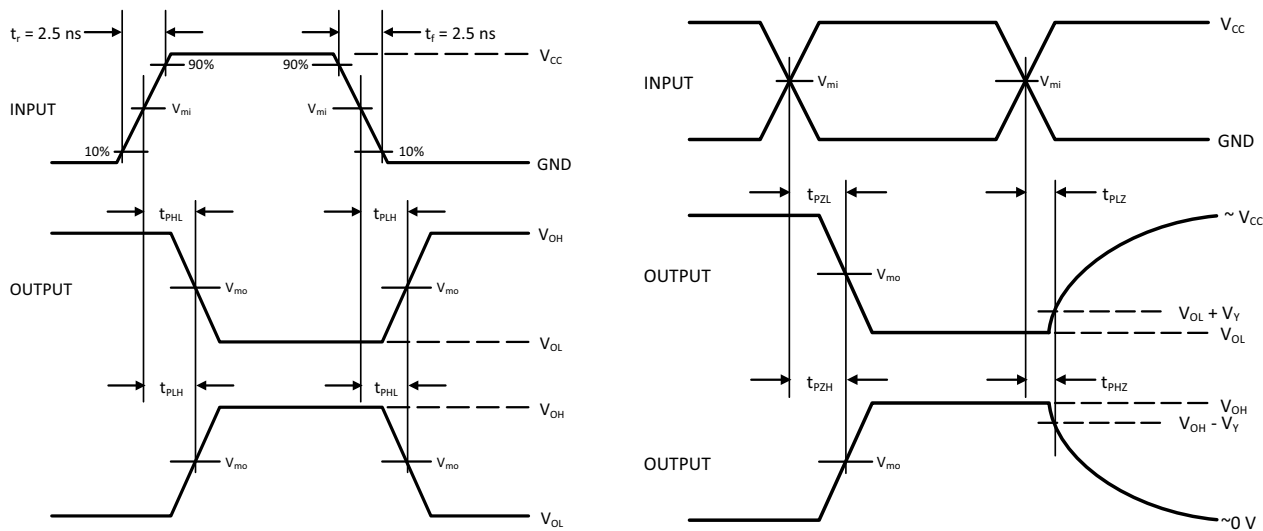
MC74LCX244



C_L includes probe and jig capacitance
 R_T is Z_{OUT} of pulse generator (typically 50 Ω)
 $f = 1$ MHz

Test	Switch Position
t_{PLH} / t_{PHL}	Open
t_{PLZ} / t_{PZL}	V_{LOAD}
t_{PHZ} / t_{PZH}	GND

Figure 3. Test Circuit



V_{CC}, V	R_L, Ω	C_L, pF	V_{LOAD}	V_{mi}, V	V_{mo}, V	V_Y, V
1.65 to 1.95	500	30	$2 \times V_{CC}$	$V_{CC}/2$	$V_{CC}/2$	0.15
2.3 to 2.7	500	30	$2 \times V_{CC}$	$V_{CC}/2$	$V_{CC}/2$	0.15
2.7	500	50	6 V	1.5	$V_{CC}/2$	0.3
3.0 to 3.6	500	50	6 V	1.5	$V_{CC}/2$	0.3
4.5 to 4.5	500	50	$2 \times V_{CC}$	$V_{CC}/2$	$V_{CC}/2$	0.3

Figure 4. Switching Waveforms

MC74LCX244

ORDERING INFORMATION

Device	Marking	Package	Shipping [†]
MC74LCX244DWG	LCX244	SOIC-20 WB	38 Units / Rail
MC74LCX244DWR2G	LCX244	SOIC-20 WB	1000 / Tape & Reel
MC74LCX244DTG	LCX 244	TSSOP-20	75 Units / Rail
MC74LCX244DTR2G	LCX 244	TSSOP-20	2500 / Tape & Reel
MC74LCX244DTR2G-Q*	LCX 244	TSSOP-20	2500 / Tape & Reel
MC74LCX244MNTWG	LCX 244	QFN20, 2.5x4.5	3000 / Tape & Reel (4 mm pitch carrier tape)

DISCONTINUED (Note 9)

NLV74LCX244DTR2G*		TSSOP-20 (Pb-Free)	2500 / Tape & Reel
MC74LCX244MN2TWG		QFN20, 2.5x3.5 (Pb-Free)	3000 / Tape & Reel (4 mm pitch carrier tape)

[†]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.

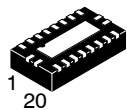
*-Q Suffix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

9. **DISCONTINUED:** These devices are not recommended for new design. Please contact your **onsemi** representative for information. The most current information on these devices may be available on www.onsemi.com.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

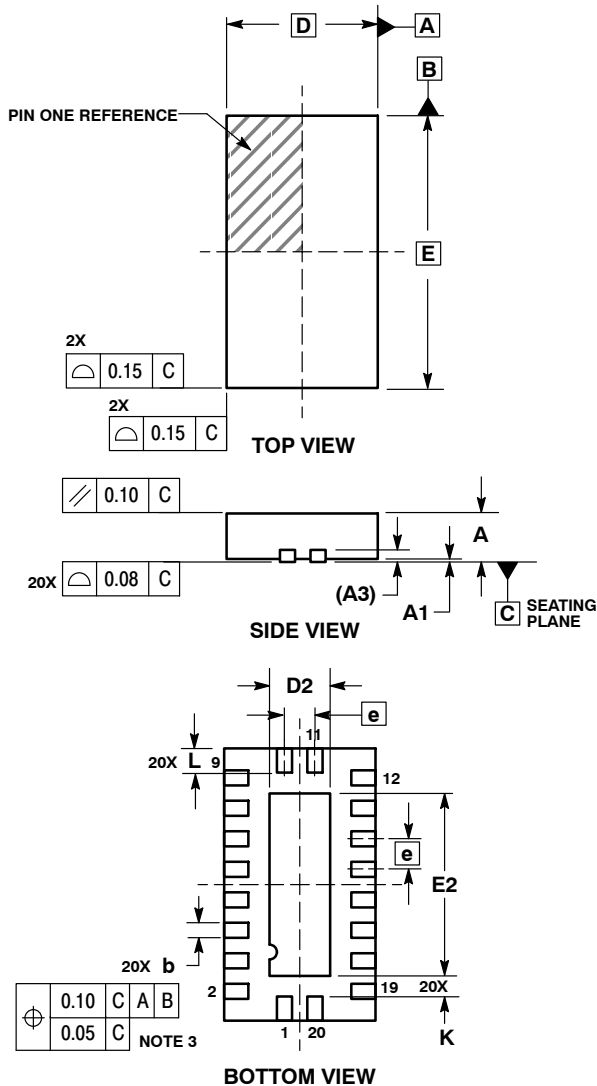
ON Semiconductor®



SCALE 2:1

QFN20, 2.5x4.5 MM
CASE 485AA-01
ISSUE B

DATE 30 APR 2010

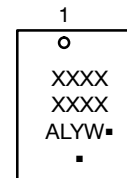


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20 REF	
b	0.20	0.30
D	2.50 BSC	
D2	0.85	1.15
E	4.50 BSC	
E2	2.85	3.15
e	0.50 BSC	
K	0.20	---
L	0.35	0.45

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
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.

DOCUMENT NUMBER:	98AON12653D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	QFN20. 2.5X4.5 MM	PAGE 1 OF 1

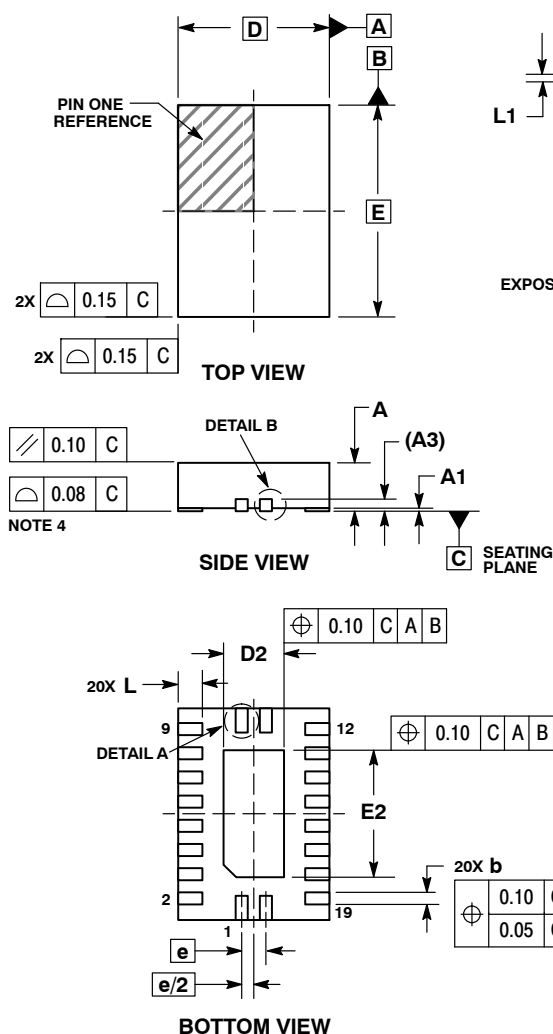
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SCALE 2:1

QFN20, 2.5x3.5, 0.4P
CASE 485CB
ISSUE 0

DATE 25 OCT 2011

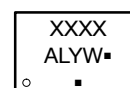


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20 REF	
b	0.15	0.25
D	2.50 BSC	
D2	0.90	1.10
E	3.50 BSC	
E2	2.00	2.20
e	0.40 BSC	
L	0.35	0.45
L1	---	0.15

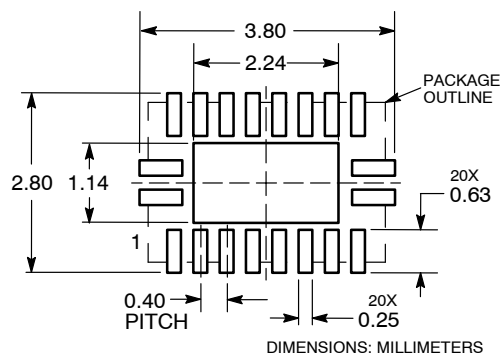
GENERIC MARKING DIAGRAM*



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(Note: Microdot may be in either location)

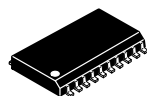
*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

SOLDERING FOOTPRINT*

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

DOCUMENT NUMBER:	98AON65196E	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	QFN20, 2.5X3.5, 0.4P	PAGE 1 OF 1

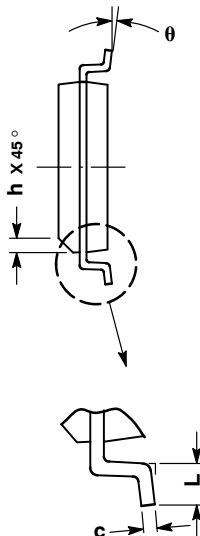
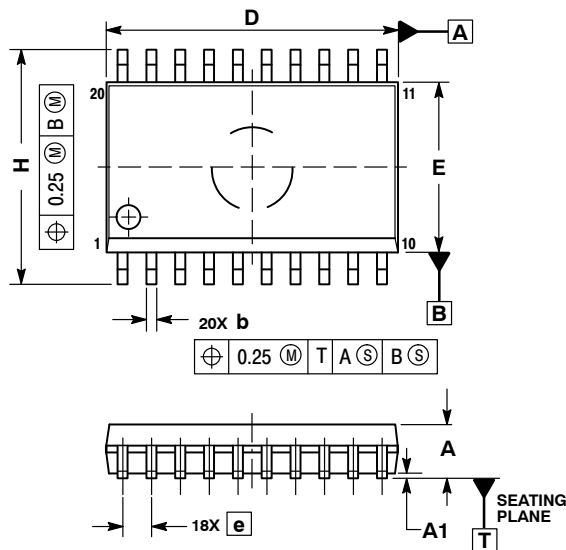
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SCALE 1:1

SOIC-20 WB
CASE 751D-05
ISSUE H

DATE 22 APR 2015

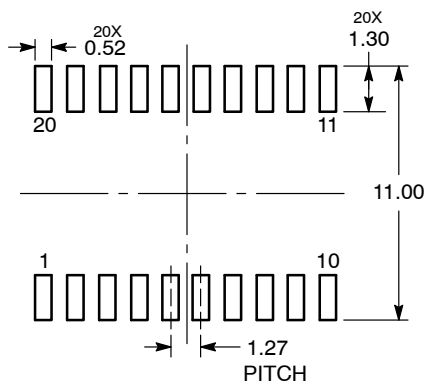


NOTES:

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°

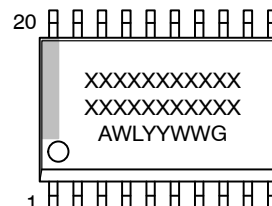
RECOMMENDED
SOLDERING FOOTPRINT*



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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