FUNCTION TABLE

Inputs			Output
Output Enable	Latch Enable	D	Q
L	H	H	H
L	H	L	L
L	L	X	No Change
H	X	X	Z

X = Don't Care
Z = High Impedance

Design Criteria	Value	Units
Internal Gate Count*	58.5	ea
Internal Gate Propagation Delay	1.5	ns
Internal Gate Power Dissipation	5.0	μW
Speed Power Product	0.0075	pJ

*Equivalent to a two−input NAND gate.

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	−0.5 to + 7.0	V
V_{in}	DC Input Voltage (Referenced to GND)	−0.5 to V_{CC} + 0.5	V
V_{out}	DC Output Voltage (Referenced to GND)	−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	±50	mA
P_D	Power Dissipation in Still Air SOIC Package† TSSOP Package†	500 450	mW
T_{stg}	Storage Temperature	−65 to +150	°C
T_L	Lead Temperature, 1 mm from Case for 10 Seconds (TSSOP or SOIC Package)	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.
†Derating: SOIC Package: −7 mW/°C from 65° to 125°C
TSSOP Package: −6.1 mW/°C from 65° to 125°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high−impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range GND ≤ (V_{in} or V_{out}) ≤ V_{CC}.

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.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	4.5	5.5	V
V_{in}, V_{out}	DC Input Voltage, Output Voltage (Referenced to GND)	0	V_{CC}	V
T_A	Operating Temperature, All Package Types	−55	+125	°C
t_r, t_f	Input Rise and Fall Time (Figure 1)	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.

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

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 $\|I_{out}\| \le 20$ 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 $\|I_{out}\| \le 20$ 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} $\|I_{out}\| \le 20$ 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} $\|I_{out}\| \le 6.0$ mA	4.5	3.98	3.84	3.7	
V_{OL}	Maximum Low–Level Output Voltage	V_{in} = V_{IH} or V_{IL} $\|I_{out}\| \le 20$ 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} $\|I_{out}\| \le 6.0$ mA	4.5	0.26	0.33	0.4	
I_{in}	Maximum Input Leakage Current	V_{in} = V_{CC} or GND	5.5	±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	5.5	±0.5	±5.0	±10	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	V_{in} = V_{CC} or GND $I_{out} \le 0$ μA	5.5	4.0	40	160	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		≥ –55°C	25°C to 125°C		
			5.5	2.9	2.4		mA

AC ELECTRICAL CHARACTERISTICS (V_{CC} = 5.0 V ±10%, C_L = 50 pF, Input $t_r = t_f$ = 6.0 ns)

Symbol	Parameter	Guaranteed Limit			Unit
		–55 to 25°C	≤ 85°C	≤ 125°C	
t_{PLH}, t_{PHL}	Maximum Propagation Delay, Input D to Output Q (Figures 1 and 5)	30	38	45	ns
t_{PLH} t_{PHL}	Maximum Propagation Delay, Latch Enable to Q (Figures 2 and 5)	30	38	45	ns
T_{PLZ}, T_{PHZ}	Maximum Propagation Delay, Output Enable to Q (Figures 3 and 6)	28	35	42	ns
t_{TZL}, t_{TZH}	Maximum Propagation Delay, Output Enable to Q (Figures 3 and 6)	28	35	42	ns
t_{TLH}, t_{THL}	Maximum Output Transition Time, any Output (Figures 1 and 5)	12	15	18	ns
C_{in}	Maximum Input Capacitance	10	10	10	pF
C_{out}	Maximum Three–State Output Capacitance (Output in High–Impedance State)	15	15	15	pF

		Typical @ 25°C, V_{CC} = 5.0 V	
C_{PD}	Power Dissipation Capacitance (Per Enabled Output)*	48	pF

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

TIMING REQUIREMENTS (V_{CC} = 5.0 V ±10%, C_L = 50 pF, Input $t_r = t_f$ = 6.0 ns)

Symbol	Parameter	Fig.	Guaranteed Limit						Unit
			–55 to 25°C		≤ 85°C		≤ 125°C		
			Min	Max	Min	Max	Min	Max	
t_{su}	Minimum Setup Time, Input D to Latch Enable	4	10		13		15		ns
t_h	Minimum Hold Time, Latch Enable to Input D	4	5.0		5.0		5.0		ns
t_w	Minimum Pulse Width, Latch Enable	2	15		19		22		ns
t_r, t_f	Maximum Input Rise and Fall Times	1		500		500		500	ns

SWITCHING WAVEFORMS

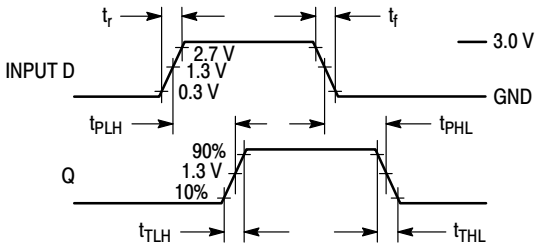


Figure 1.

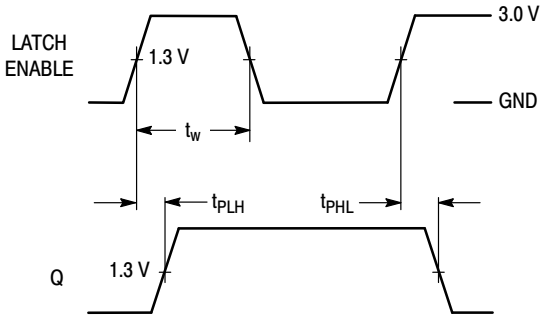


Figure 2.

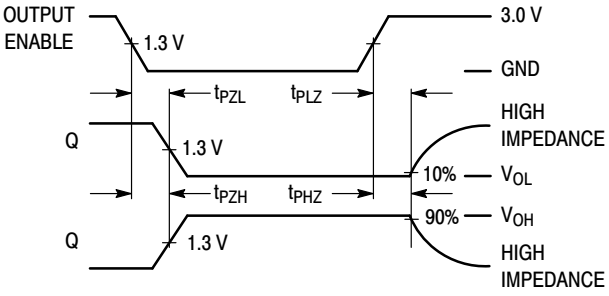


Figure 3.

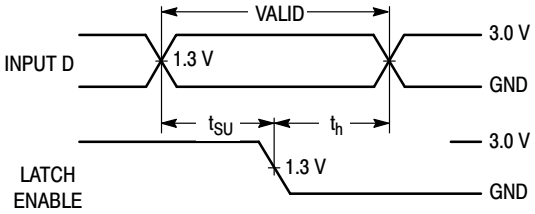
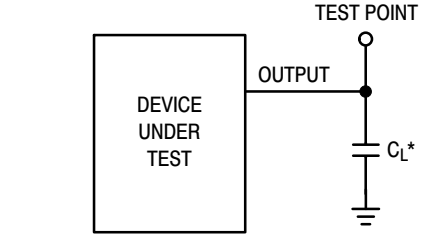
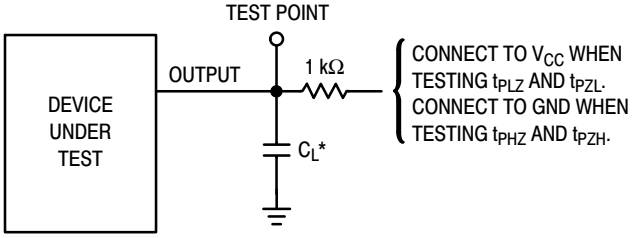


Figure 4.



*Includes all probe and jig capacitance

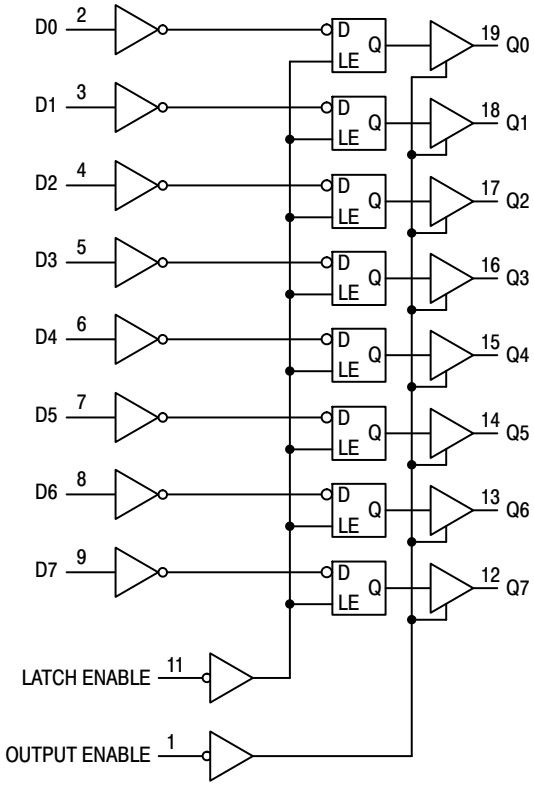
Figure 5. Test Circuit



*Includes all probe and jig capacitance

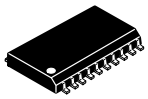
Figure 6. Test Circuit

EXPANDED LOGIC DIAGRAM



MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

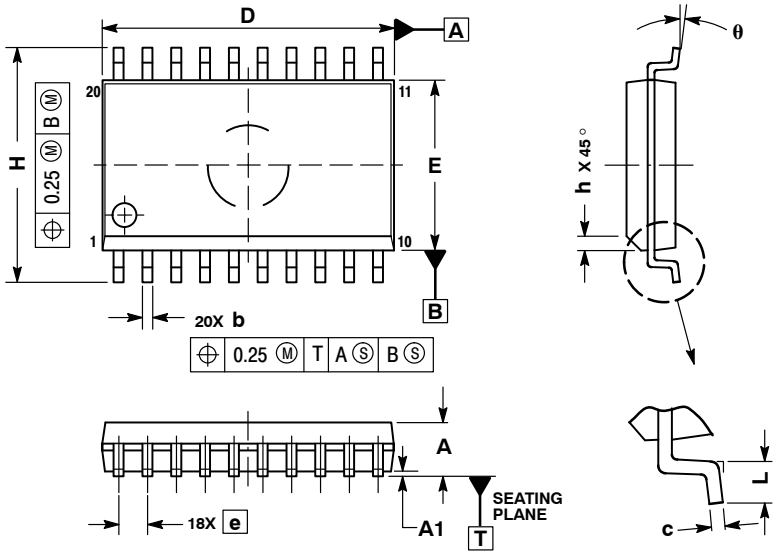
ON Semiconductor®



SCALE 1:1

SOIC–20 WB
CASE 751D–05
ISSUE H

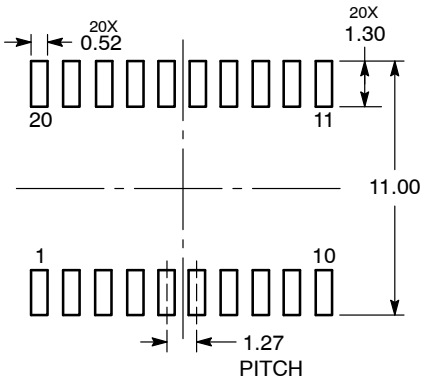
DATE 22 APR 2015



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.

	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°

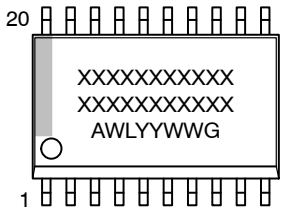
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor 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.

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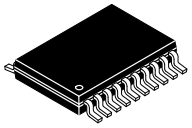
DESCRIPTION:	**SOIC–20 WB**	**PAGE 1 OF 1**

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

TSSOP−20 WB
CASE 948E
ISSUE D

DATE 17 FEB 2016



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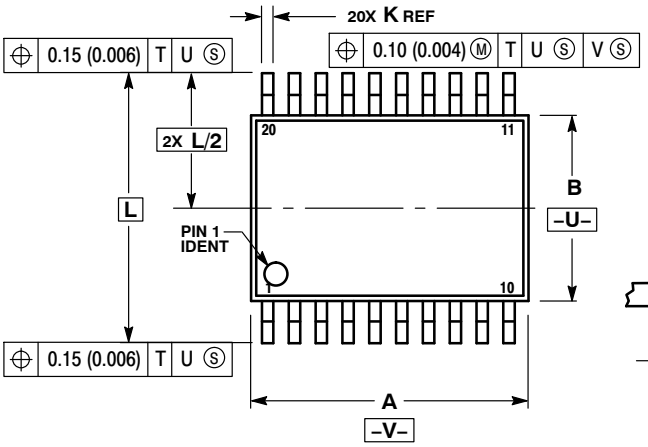
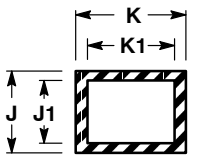
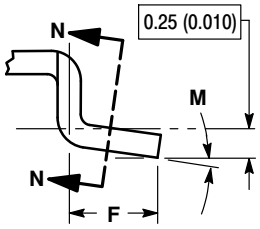
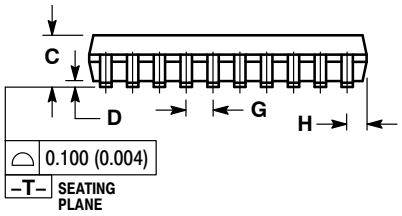


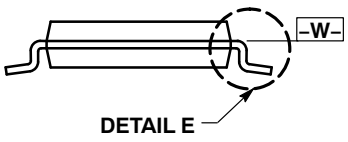


SECTION N−N



DETAIL E

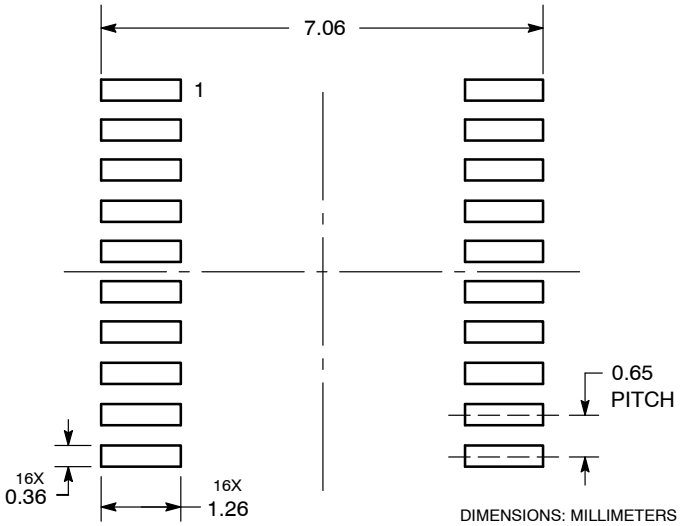




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD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

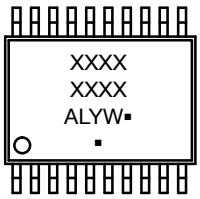
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	6.40	6.60	0.252	0.260
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.27	0.37	0.011	0.015
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

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.

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