3.3 V LVTTL/LVCMOS 2:1 MUX to 4 LVPECL Differential Clock Fanout Buffer Outputs with Clock Enable and Clock Select

NB3N853501E

Description

The NB3N853501E is a pure 3.3 V supply 2:1:4 clock distribution fanout buffer. Input MUX selects one of two LVCMOS/LVTTL CLK lines by the CLK_SEL pin (HIGH for CLK1, LOW for CLK0) using LVCMOS/LVTTL levels. Outputs are LVPECL levels and are synchronously enabled by CLK_EN using LVCMOS/LVTTL levels (HIGH to enable outputs, LOW to disable output).

Features

- Four differential LVPECL Outputs
- Two Selectable LVCMOS/LVTTL CLOCK Inputs
- Up to 266 MHz Clock Operation
- Output to Output Skew: 30 ps (Max.)
- Device to Device Skew 250 ps (Max.)
- Propagation Delay 2.0 ns (Max.)
- Operating range: V_{CC} = 3.3 ±5% V(3.135 to 3.465 V)
- Additive Phase Jitter, RMS: 62 fs (Typ)
- Synchronous Clock Enable Control
- Industrial Temp. Range (−40°C to 85°C)
- Pb−Free TSSOP20 Package
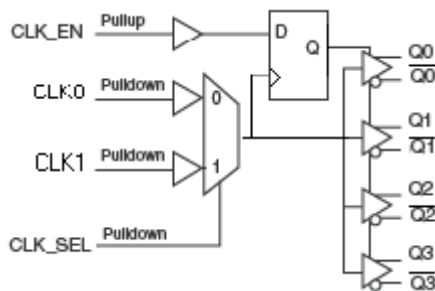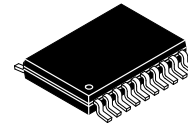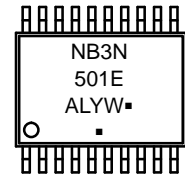- These are Pb−Free Devices

MARKING DIAGRAM

TSSOP−20
DT SUFFIX
CASE 948E

NB3N
501E
ALYW▪

A	= Assembly Location
L	= Wafer Lot
Y	= Year
W	= Work Week
▪	= 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.
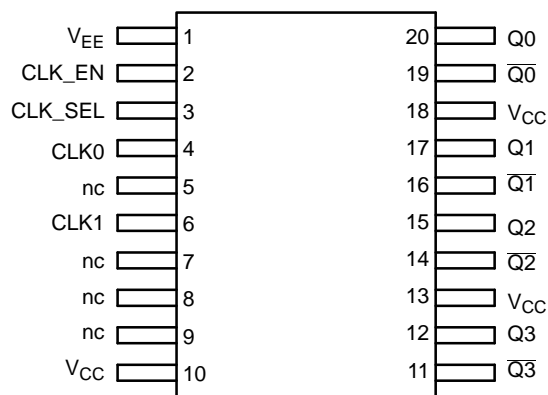

Figure 1. Simplified Logic Diagram

NB3N853501E

Figure 2. Pinout Diagram (Top View)

Table 1. PIN DESCRIPTION

Number	Name	I/O	Open Default	Description
1	V_{EE}			Negative (Ground) Power Supply pin must be externally connected to power supply to guarantee proper operation.
2	CLK_EN	LVCMOS / LVTTL	Pullup	Synchronized Clock Enable when HIGH. When LOW, outputs are disabled (Qx HIGH, $\overline{Qx}$ LOW)
3	CLK_SEL	LVCMOS / LVTTL	Pulldown	Clock Input Select (HIGH selects CLK1, LOW selects CLK0 input)
4	CLK0	LVCMOS / LVTTL	Pulldown	Clock 0 Input. Float open when unused.
5, 6, 8, 9	nc			No Connect
6	CLK1	LVCMOS / LVTTL	Pulldown	Clock 1 Input. Float open when unused.
10, 13, 18	V_{CC}			Positive Power Supply pins must be externally connected to power supply to guarantee proper operation.
11, 14, 16, 19	$\overline{Q[3:0]}$	LVPECL		Invert Differential Outputs
12, 15, 16, 20	Q[3:0]	LVPECL		True Differential Outputs

Table 2. FUNCTIONS

Inputs			Outputs		
CLK_EN	CLK_SEL	Input Function	Output Function	Qx	$\overline{Qx}$
0	0	CLK0 input selected	Disabled	LOW	HIGH
0	1	CLK1 Input Selected	Disabled	LOW	HIGH
1	0	CLK0 input selected	Enabled	CLK0	Invert of CLK1
1	1	CLK1 Input Selected	Enabled	CLK1	Invert of CLK1

1. After CLK_EN switches, the clock outputs are disabled or enabled following a rising and falling input clock edge as show in Figure 3.
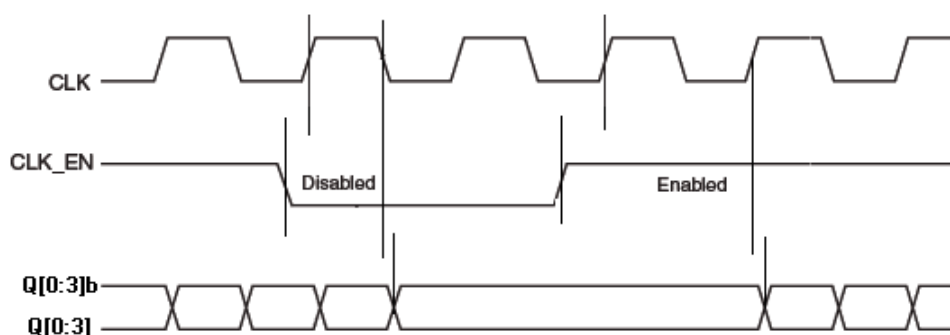
NB3N853501E

Figure 3. CLK_EN TIMING DIAGRAM

Table 3. ATTRIBUTES (Note 2)

Characteristics	Value
Internal Input Pullup Resistor	50 kΩ
Internal Input Pulldown Resistor	50 kΩ
ESD Protection Human Body Model Machine Model	> 2 kV > 200 V
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 2)	Level 1
Flammability Rating Oxygen Index	UL 94 V–0 @ 0.125 in 28 to 34
Transistor Count	317 Devices
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test	

2. For additional information, see Application Note AND8003/D.

Table 4. MAXIMUM RATINGS (Note 3)

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{CC}	Supply Voltage			4.6	V
V_{in}	Input Voltage			$-0.5 \leq V_I \leq V_{CC} + 0.5$	V
C_{in}	Input Capacitance			4	pF
I_{out}	Output Current	Continuous Surge		50 100	mA
T_A	Operating Temperature Range, Industrial			-40 to $\leq +85$	°C
T_{stg}	Storage Temperature Range			-65 to $+150$	°C
θ_{JA}	Thermal Resistance (Junction–to–Ambient)	0 lfpm 500 lfpm	TSSOP–20	140 50	°C/W
θ_{JA}	Thermal Resistance (Junction–to–Ambient)	0 lfpm	Single–Layer PCB (700 mm^2, 2 oz)	128	°C/W
		200 lfpm	Multi–Layer PCB (700 mm^2, 2 oz)	94	
θ_{JC}	Thermal Resistance (Junction–to–Case)	(Note 4)	TSSOP–20	23 to 41	°C/W
T_{sol}	Wave Solder			265	°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.
3. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and not valid simultaneously. If stress limits are exceeded device functional operation is not implied, damage may occur and reliability may be affected.
4. JEDEC standard multilayer board – 2S2P (2 signal, 2 power).

Table 5. DC CHARACTERISTICS V_{CC} = 3.3 ±5% V (3.135 to 3.465 V), GND = 0 V, T_A = −40°C to +85°C (Note 5)

Symbol	Characteristic		Min	Typ	Max	Unit
I_{EE}	Power Supply Current				50	mA
V_{IH}	Input HIGH Voltage		2		V_{CC} + 0.3	V
V_{IL}	Input LOW Voltage	CLK0 CLK1 CLK_EN CLK_SEL	−0.3 −0.3		1.3 0.8	V
I_{IH}	Input High Current (V_{CC} = V_{in} = 3.456 V)	CLKx, CLK_SEL CLK_EN			150 5	μA
I_{IL}	Input LOW Current (V_{CC} = 3.456 V; V_{in} = GND)	CLKx, CLK_SEL CLK_EN	−5 −150			μA
V_{OH}	Output HIGH Voltage		V_{CC} − 1.4		V_{CC} − 0.9	V
V_{OL}	Output LOW Voltage		V_{CC} − 2.0		V_{CC} − 1.7	V
$VOUT_{SWING}$	Output Voltage Swing (peak–to–peak)		0.6		1.0	V

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm.

5. Outputs terminated 50 Ω to V_{CC} − 2.0 V, see Figure 4. Input levels of 0.8 V and 2.4 V unless stated otherwise.

Table 6. AC CHARACTERISTICS V_{CC} = 3.3 ±5% V (3.135 to 3.465 V), GND = 0 V, T_A = −40°C to +85°C (Note 6)

Symbol	Characteristic	Min	Typ	Max	Unit
F_{MAX}	Maximum Operating Frequency	0		266	MHz
t_{PD}	Propagation Delay	0.9		2.0	ns
$tSKEW_{DC}$	Duty Cycle Skew same path similar conditions at 50 MHz	48	50	52	%
$tSKEW_{O-O}$	Output to Output Skew Within A Device			30	ps
$tSKEW_{D-D}$	Device−to−Device Skew similar path and conditions			250	ps
t_{JIT}	Additive Phase Noise Jitter (RMS) @ 155.52 MHz (Integrated from 12 kHz to 20 MHz) See Figure 6.		0.062		ps
t_r/t_f	Output rise and fall times @ 266 MHz (20% and 80% points)	240		700	ps

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm.

6. Outputs terminated 50 Ω to V_{CC} − 2.0 V, see Figure 4. Input levels of 0.8 V and 2.4 V unless stated otherwise. Measured from Input Midpoint (V_{DD}/2) to differential Output crosspoints, see Figure 5.
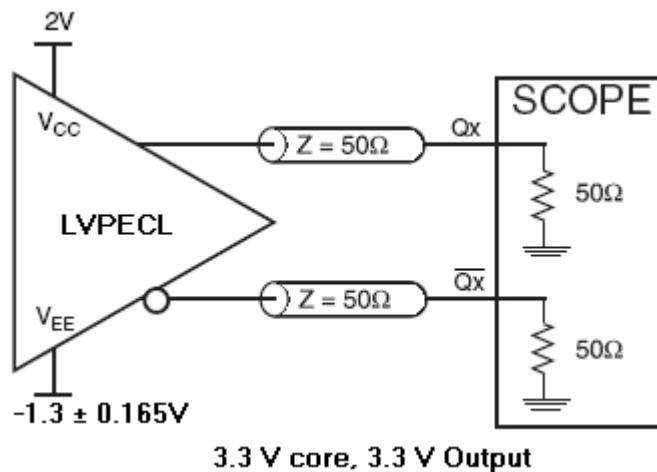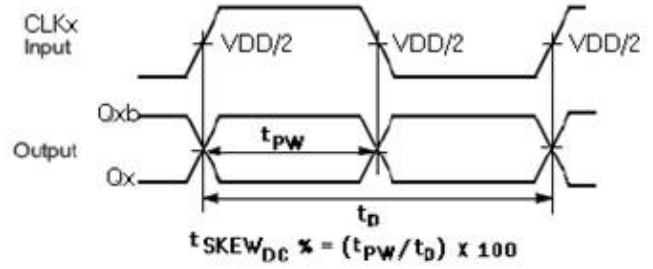

Figure 4. Typical Test Setup and Termination for Evaluation. The V_{CC} of 2.0 V and V_{EE} of −1.3 ±0.165 V Split supply allows a direct connection to an oscilloscope 50 Ω impedance input module. Also reference AND8020.

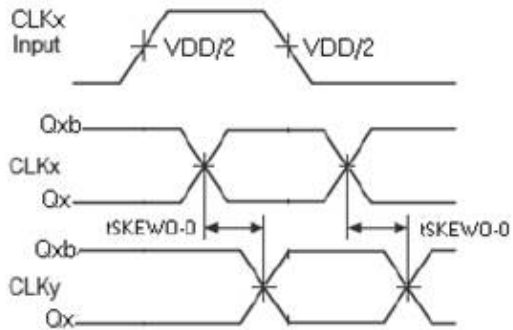**Propagation Delay**
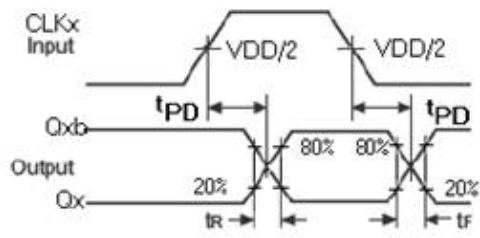
Duty Cycle Skew — tSKEWDC

$$t_{SKEW_{DC}} \% = (t_{PW}/t_D) \times 100$$

Output to Output Skew

Device to Device Skew
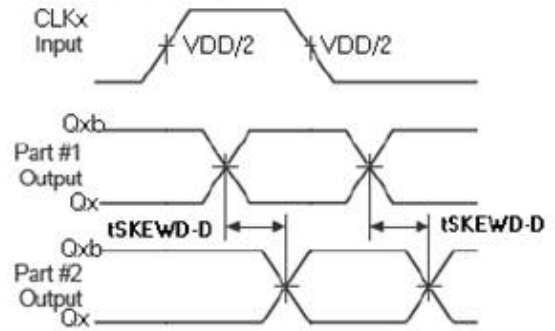
Figure 5. AC Measurement Reference

Phase Noise 10.00dB/ Ref -20.00dBc/Hz [Smo]

Carrier 155.519996 MHz   1.4087 dBm

```
1:  10 kHz    -142.5899 dBc/Hz
2:  100 kHz   -149.2666 dBc/Hz
3:  1 MHz     -156.3140 dBc/Hz
>4: 10 MHz    -157.2219 dBc/Hz
X:  Start 12 kHz
    Stop 20 MHz
    Center 10.006 MHz
    Span 19.988 MHz
=== Noise ===
Analysis Range X: Band Marker
Analysis Range Y: Band Marker
Intg Noise: -83.8110 dBc / 19.99 MHz
  RMS Noise: 91.194 μrad
             5.22503 mdeg
RMS Jitter: 93.325 fsec
Residual FM: 1.00211 kHz
```
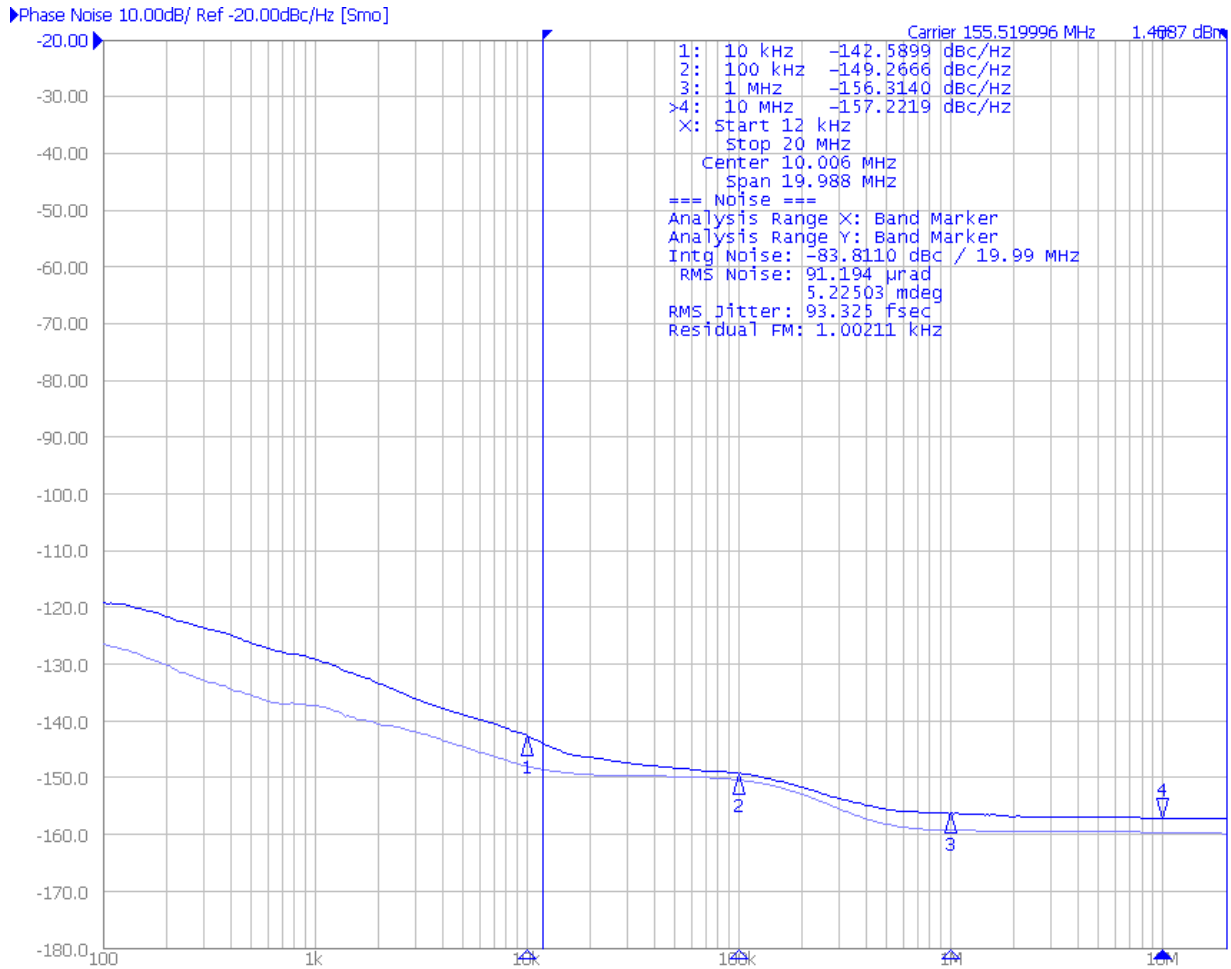
Figure 6. For 155.52 MHz carrier, the NB3N853501E Additive Phase Noise (dBc/Hz) verses SSB Offset Frequency (Hz) Integrated Jitter from 12 kHz to 20 MHz (Upper Heavy Line) is 93.3 fs RMS. The E8663B Source Generator Additive Phase Noise (Lower Light Line) is 70.1 fs RMS. Where $t_{JIT} = \sqrt{(t_{JIToutput})^2 - (t_{JITinput})^2} = 61.6$ fs

ORDERING INFORMATION

Device	Package	Shipping†
NB3N853501EDTR2G	TSSOP−20 (Pb−Free)	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.

onsemi™

TSSOP−20 WB
CASE 948E
ISSUE D

DATE 17 FEB 2016

SCALE 2:1

20X K REF

| 0.15 (0.006) | T | U | Ⓢ |

| 0.10 (0.004) | Ⓜ | T | U | Ⓢ | V | Ⓢ |

2X L/2

L

PIN 1
IDENT

| 0.15 (0.006) | T | U | Ⓢ |

A
−V−

20 11

B
−U−

10

K
K1

J J1

SECTION N−N

N

| 0.25 (0.010) |

M

N

F

DETAIL E

C

D   G   H

| 0.100 (0.004) |

−T− SEATING
PLANE

−W−

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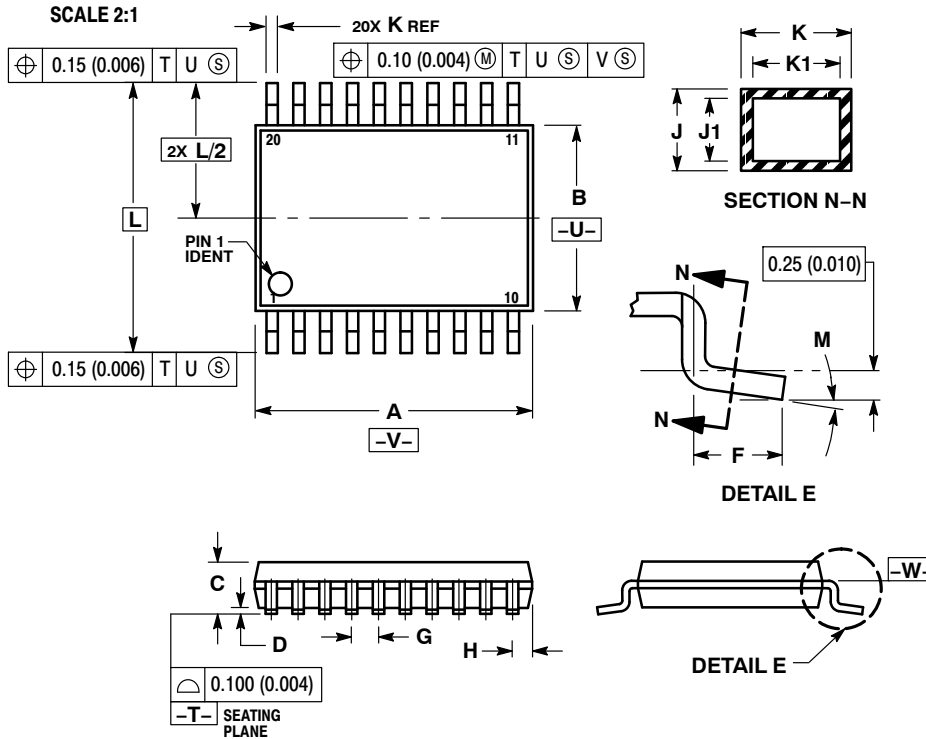
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD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

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***

7.06

1

0.65
PITCH

16X
0.36

16X
1.26

DIMENSIONS: MILLIMETERS

**GENERIC
MARKING DIAGRAM***
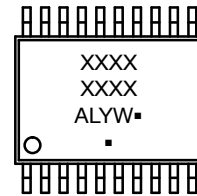
XXXX
XXXX
ALYW▪

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.

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

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

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