2.5 V / 3.3 V / 5.0 V 1:4 Clock Fanout Buffer

NB3L553

ON Semiconductor®

www.onsemi.com

Description

The NB3L553 is a low skew 1−to 4 clock fanout buffer, designed for clock distribution in mind. The NB3L553 specifically guarantees low output−to−output skew. Optimal design, layout and processing minimize skew within a device and from device to device.

Features

- Input/Output Clock Frequency up to 200 MHz
- Low Skew Outputs (35 ps), Typical
- RMS Phase Jitter (12 kHz – 20 MHz): 29 fs (Typical)
- Output goes to Three−State Mode via OE
- Operating Range: V_{DD} = 2.375 V to 5.25 V
- 5 V Tolerant Input Clock I_{CLK}
- Ideal for Networking Clocks
- Packaged in 8−pin SOIC
- Industrial Temperature Range
- These are Pb−Free Devices

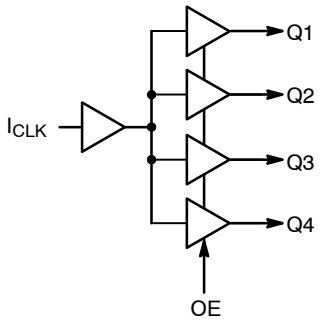


Figure 1. Block Diagram

MARKING DIAGRAMS*

SOIC−8
D SUFFIX
CASE 751

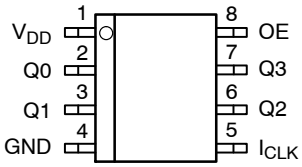
3L553 = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

DFN8
MN SUFFIX
CASE 506AA

6P = Specific Device Code
M = Date Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

*For additional marking information, refer to Application Note AND8002/D.

PINOUT DIAGRAM



ORDERING INFORMATION

Device	Package	Shipping†
NB3L553DG	SOIC−8 (Pb−Free)	98 Units/Rail
NB3L553DR2G	SOIC−8 (Pb−Free)	2500/Tape & Reel
NB3L553MNR4G	DFN−8 (Pb−Free)	1000/Tape & Reel

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

Table 1. OE, OUTPUT ENABLE FUNCTION

OE	Function
0	Disable
1	Enable

Table 2. PIN DESCRIPTION

Pin #	Name	Type	Description
1	V_{DD}	Power	Positive supply voltage (2.375 V to 5.25 V)
2	Q0	(LV)CMOS/(LV)TTL Output	Clock Output 0
3	Q1	(LV)CMOS/(LV)TTL Output	Clock Output 1
4	GND	Power	Negative supply voltage; Connect to ground, 0 V
5	I_{CLK}	(LV)CMOS Input	Clock Input. 5.0 V tolerant
6	Q2	(LV)CMOS/(LV)TTL Output	Clock Output 2
7	Q3	(LV)CMOS/(LV)TTL Output	Clock Output 3
8	OE	(LV)TTL Input	V_{DD} for normal operation. Pin has no internal pullup or pull down resistor for open condition default. Use from 1 to 10 kOhms external resistor to force an open condition default state.
–	EP	Thermal Exposed Pad	(DFN8 only) Thermal exposed pad must be connected to a sufficient thermal conduit. Electrically connect to the most negative supply (GND) or leave unconnected, floating open.

Table 3. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V_{DD}	Positive Power Supply	GND = 0 V	–	6.0	V
V_I	Input Voltage	OE I_{CLK}	GND = 0 V and V_{DD} = 2.375 V to 5.25 V	$GND - 0.5 \leq V_I \leq V_{DD} + 0.5$ $GND - 0.5 \leq V_I \leq 5.75$	V
T_A	Operating Temperature Range, Industrial	–	–	≥ −40 to ≤ +85	°C
T_{stg}	Storage Temperature Range	–	–	−65 to +150	°C
θ_{JA}	Thermal Resistance (Junction−to−Ambient)	0 lfpm 500 lfpm	SOIC−8	190 130	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction−to−Case)	(Note 1)	SOIC−8	41 to 44	°C/W
θ_{JA}	Thermal Resistance (Junction−to−Ambient)	0 lfpm 500 lfpm	DFN8 DFN8	129 84	°C/W °C/W
θ_{JC}	Thermal Resistance (Junction−to−Case)	(Note 1)	DFN8	35 to 40	°C/W

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. JEDEC standard multilayer board – 2S2P (2 signal, 2 power)

Table 4. ATTRIBUTES

Characteristic		Value
ESD Protection	Human Body Model Machine Model Charged Device Model	> 2 kV > 150 V > 2 kV
Moisture Sensitivity, Indefinite Time Out of Drypack (Note 2)		Level 1
Flammability Rating	Oxygen Index: 28 to 34	UL−94 code V−0 @ 0.125 in
Transistor Count		531 Devices
Meets or Exceeds JEDEC Standard EIA/JESD78 IC Latchup Test		

2. For additional Moisture Sensitivity information, refer to Application Note AND8003/D.

Table 5. DC CHARACTERISTICS (V_{DD} = 2.375 V to 2.625 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Min	Typ	Max	Unit
I_{DD}	Power Supply Current @ 135 MHz, No Load	–	25	30	mA
V_{OH}	Output HIGH Voltage – I_{OH} = −16 mA	1.7	–	–	V
V_{OL}	Output LOW Voltage – I_{OL} = 16 mA	–	–	0.4	V
V_{IH}, I_{CLK}	Input HIGH Voltage, I_{CLK}	(V_{DD}÷2)+0.5	–	5.0	V
V_{IL}, I_{CLK}	Input LOW Voltage, I_{CLK}	–	–	(V_{DD}÷2)−0.5	V
V_{IH}, OE	Input HIGH Voltage, OE	1.8	–	V_{DD}	V
V_{IL}, OE	Input LOW Voltage, OE	–	–	0.7	V
ZO	Nominal Output Impedance	–	20	–	Ω
CIN	Input Capacitance, I_{CLK}, OE	–	5.0	–	pF
IOS	Short Circuit Current	–	± 28	–	mA

DC CHARACTERISTICS (V_{DD} = 3.15 V to 3.45 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Min	Typ	Max	Unit
I_{DD}	Power Supply Current @ 135 MHz, No Load	–	35	40	mA
V_{OH}	Output HIGH Voltage – I_{OH} = −25 mA	2.4	–	–	V
V_{OL}	Output LOW Voltage – I_{OL} = 25 mA	–	–	0.4	V
V_{OH}	Output HIGH Voltage – I_{OH} = −12 mA (CMOS level)	V_{DD} − 0.4	–	–	V
V_{IH}, I_{CLK}	Input HIGH Voltage, I_{CLK}	(V_{DD}÷2)+0.7	–	5.0	V
V_{IL}, I_{CLK}	Input LOW Voltage, I_{CLK}	–	–	(V_{DD}÷2)−0.7	V
V_{IH}, OE	Input HIGH Voltage, OE	2.0	–	V_{DD}	V
V_{IL}, OE	Input LOW Voltage, OE	0	–	0.8	V
ZO	Nominal Output Impedance	–	20	–	Ω
CIN	Input Capacitance, OE	–	5.0	–	pF
IOS	Short Circuit Current	–	± 50	–	mA

DC CHARACTERISTICS (V_{DD} = 4.75 V to 5.25 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Min	Typ	Max	Unit
I_{DD}	Power Supply Current @ 135 MHz, – No Load	–	45	85	mA
V_{OH}	Output HIGH Voltage – I_{OH} = −35 mA	2.4	–	–	V
V_{OL}	Output LOW Voltage – I_{OL} = 35 mA	–	–	0.4	V
V_{OH}	Output HIGH Voltage – I_{OH} = −12 mA (CMOS level)	V_{DD} − 0.4	–	–	V
V_{IH}, I_{CLK}	Input HIGH Voltage, I_{CLK}	(V_{DD}÷2) + 1	–	5.0	V
V_{IL}, I_{CLK}	Input LOW Voltage, I_{CLK}	–	–	(V_{DD}÷2) − 1	V
V_{IH}, OE	Input HIGH Voltage, OE	2.0	–	V_{DD}	V
V_{IL}, OE	Input LOW Voltage, OE	–	–	0.8	V
ZO	Nominal Output Impedance	–	20	–	Ω
CIN	Input Capacitance, OE	–	5.0	–	pF
IOS	Short Circuit Current	–	± 80	–	mA

Table 6. AC CHARACTERISTICS; V_{DD} = 2.5 V ±5% (V_{DD} = 2.375 V to 2.625 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Min	Typ	Max	Unit
f_{in}	Input Frequency	–	–	200	MHz
t_r/t_f	Output rise and fall times; 0.8 V to 2.0 V	–	1.0	1.5	ns
t_{pd}	Propagation Delay, CLK to Q_n (Note 4)	2.2	3.0	5.0	ns
t_{skew}	Output−to−output skew; (Note 5)	–	35	50	ps
t_{skew}	Device−to−device skew, (Note 5)	–	–	500	ps

AC CHARACTERISTICS; V_{DD} = 3.3 V ±5% (V_{DD} = 3.15 V to 3.45 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Conditions	Min	Typ	Max	Unit
f_{in}	Input Frequency		–	–	200	MHz
t_{jitter} (ϕ)	RMS Phase Jitter (Integrated 12 kHz – 20 MHz) (See Figures 2 and 3)	$f_{carrier}$ = 100 MHz	–	18	–	fs
t_r/t_f	Output rise and fall times; 0.8 V to 2.0 V		–	0.6	1.0	ns
t_{pd}	Propagation Delay, CLK to Q_n (Note 4)		2.0	2.4	4.0	ns
t_{skew}	Output−to−output skew; (Note 5)		–	35	50	ps
t_{skew}	Device−to−device skew, (Note 5)		–	–	500	ps

AC CHARACTERISTICS; V_{DD} = 5.0 V ±5% (V_{DD} = 4.75 V to 5.25 V, GND = 0 V, T_A = −40°C to +85°C) (Note 3)

Symbol	Characteristic	Min	Min	Typ	Max	Unit
f_{in}	Input Frequency		–	–	200	MHz
t_{jitter} (ϕ)	RMS Phase Jitter (Integrated 12 kHz – 20 MHz) (See Figures 2 and 3)	$f_{carrier}$ = 100 MHz	–	29	–	fs
t_r/t_f	Output rise and fall times; 0.8 V to 2.0 V		–	0.3	0.7	ns
t_{pd}	Propagation Delay, CLK to Q_n (Note 4)		1.7	2.5	4.0	ns
t_{skew}	Output−to−output skew; (Note 5)		–	35	50	ps
t_{skew}	Device−to−device skew, (Note 5)		–	–	500	ps

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.

3. Outputs loaded with external R_L = 33 Ω series resistor and C_L = 15 pF to GND. Duty cycle out = duty in. A 0.01 μF decoupling capacitor should be connected between V_{DD} and GND.
4. Measured with rail−to−rail input clock
5. Measured on rising edges at V_{DD} ÷ 2 between any two outputs with equal loading.

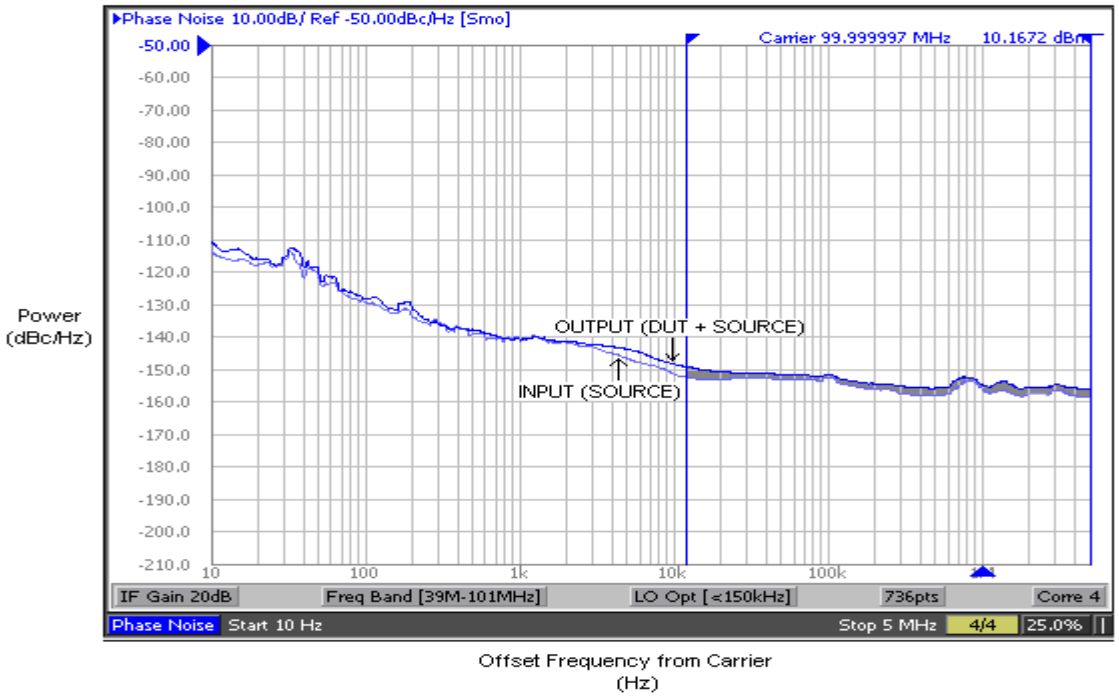


Figure 2. Phase Noise Plot at 100 MHz at an Operating Voltage of 3.3 V, Room Temperature

The above plot captured using Agilent E5052A shows Additive Phase Noise of the NB3L553 device measured with an input source generated by Agilent E8663B. The RMS phase jitter contributed by the device (integrated between 12 kHz to 20 MHz; as shown in the shaded area) is 18 fs (RMS Phase Jitter of the input source is 75.40 fs and Output (DUT+Source) is 93.16 fs).

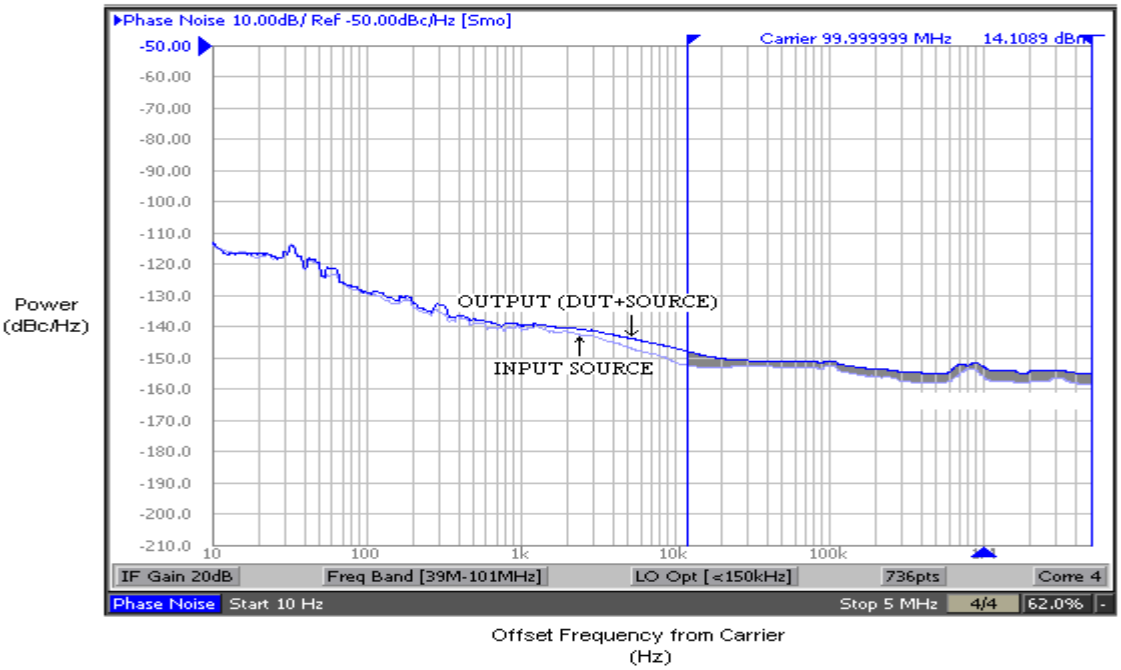
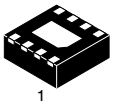


Figure 3. Phase Noise Plot at 100 MHz at an Operating Voltage of 5 V, Room Temperature

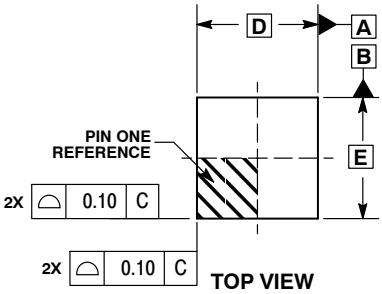
The above plot captured using Agilent E5052A shows Additive Phase Noise of the NB3L553 device measured with an input source generated by Agilent E8663B. The RMS phase jitter contributed by the device (integrated between 12 kHz to 20 MHz; as shown in the shaded area) is 29 fs (RMS Phase Jitter of the input source is 75.40 fs and Output (DUT+Source) is 103.85 fs).

DFN8 2x2, 0.5P
CASE 506AA−01
ISSUE E

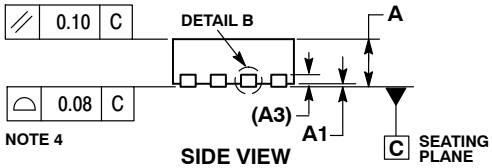
DATE 22 JAN 2010



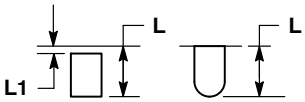
SCALE 4:1



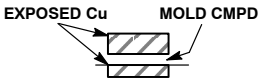
TOP VIEW



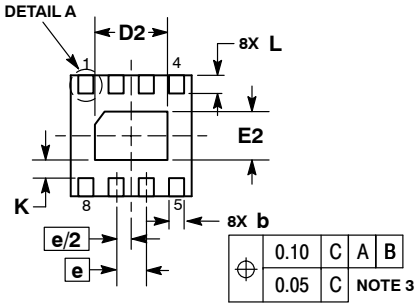
SIDE VIEW



DETAIL A
OPTIONAL CONSTRUCTIONS



DETAIL B
OPTIONAL CONSTRUCTION

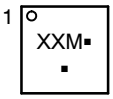


BOTTOM VIEW

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994 .
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS	
DIM	MIN	MAX
A	0.80	1.00
A1	0.00	0.05
A3	0.20 REF	
b	0.20	0.30
D	2.00 BSC	
D2	1.10	1.30
E	2.00 BSC	
E2	0.70	0.90
e	0.50 BSC	
K	0.30 REF	
L	0.25	0.35
L1	−−−	0.10

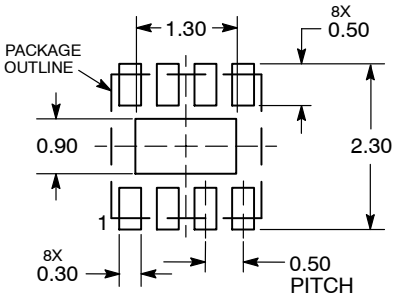
GENERIC MARKING DIAGRAM*



XX = Specific Device Code
M = Date Code
▪ = Pb−Free Device

*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.

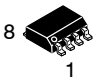
RECOMMENDED SOLDERING FOOTPRINT*



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.

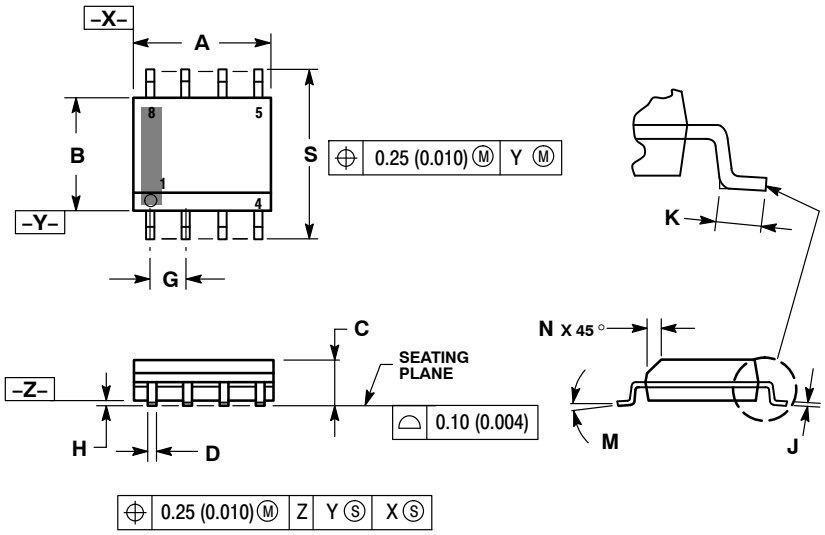
DOCUMENT NUMBER:	98AON18658D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	DFN8, 2.0X2.0, 0.5MM PITCH	PAGE 1 OF 1



SCALE 1:1

SOIC−8 NB
CASE 751−07
ISSUE AK

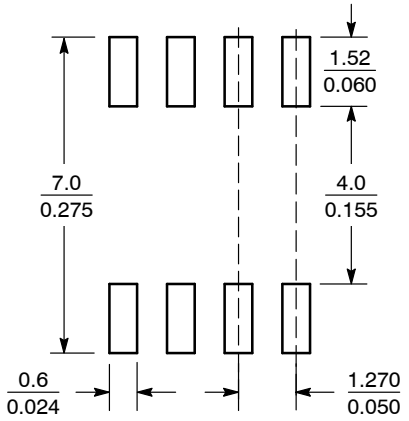
DATE 16 FEB 2011



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

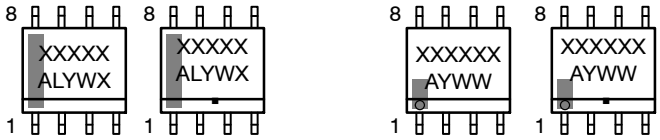
SOLDERING FOOTPRINT*



SCALE 6:1 (mm / inches)

*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
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Package

XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = 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.

STYLES ON PAGE 2

SOIC−8 NB
CASE 751−07
ISSUE AK

DATE 16 FEB 2011

STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. COLLECTOR
4. EMITTER
5. EMITTER
6. BASE
7. BASE
8. EMITTER

STYLE 2:
PIN 1. COLLECTOR, DIE, #1
2. COLLECTOR, #1
3. COLLECTOR, #2
4. COLLECTOR, #2
5. BASE, #2
6. EMITTER, #2
7. BASE, #1
8. EMITTER, #1

STYLE 3:
PIN 1. DRAIN, DIE #1
2. DRAIN, #1
3. DRAIN, #2
4. DRAIN, #2
5. GATE, #2
6. SOURCE, #2
7. GATE, #1
8. SOURCE, #1

STYLE 4:
PIN 1. ANODE
2. ANODE
3. ANODE
4. ANODE
5. ANODE
6. ANODE
7. ANODE
8. COMMON CATHODE

STYLE 5:
PIN 1. DRAIN
2. DRAIN
3. DRAIN
4. DRAIN
5. GATE
6. GATE
7. SOURCE
8. SOURCE

STYLE 6:
PIN 1. SOURCE
2. DRAIN
3. DRAIN
4. SOURCE
5. SOURCE
6. GATE
7. GATE
8. SOURCE

STYLE 7:
PIN 1. INPUT
2. EXTERNAL BYPASS
3. THIRD STAGE SOURCE
4. GROUND
5. DRAIN
6. GATE 3
7. SECOND STAGE Vd
8. FIRST STAGE Vd

STYLE 8:
PIN 1. COLLECTOR, DIE #1
2. BASE, #1
3. BASE, #2
4. COLLECTOR, #2
5. COLLECTOR, #2
6. EMITTER, #2
7. EMITTER, #1
8. COLLECTOR, #1

STYLE 9:
PIN 1. EMITTER, COMMON
2. COLLECTOR, DIE #1
3. COLLECTOR, DIE #2
4. EMITTER, COMMON
5. EMITTER, COMMON
6. BASE, DIE #2
7. BASE, DIE #1
8. EMITTER, COMMON

STYLE 10:
PIN 1. GROUND
2. BIAS 1
3. OUTPUT
4. GROUND
5. GROUND
6. BIAS 2
7. INPUT
8. GROUND

STYLE 11:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. DRAIN 2
7. DRAIN 1
8. DRAIN 1

STYLE 12:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

STYLE 13:
PIN 1. N.C.
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

STYLE 14:
PIN 1. N−SOURCE
2. N−GATE
3. P−SOURCE
4. P−GATE
5. P−DRAIN
6. P−DRAIN
7. N−DRAIN
8. N−DRAIN

STYLE 15:
PIN 1. ANODE 1
2. ANODE 1
3. ANODE 1
4. ANODE 1
5. CATHODE, COMMON
6. CATHODE, COMMON
7. CATHODE, COMMON
8. CATHODE, COMMON

STYLE 16:
PIN 1. EMITTER, DIE #1
2. BASE, DIE #1
3. EMITTER, DIE #2
4. BASE, DIE #2
5. COLLECTOR, DIE #2
6. COLLECTOR, DIE #2
7. COLLECTOR, DIE #1
8. COLLECTOR, DIE #1

STYLE 17:
PIN 1. VCC
2. V2OUT
3. V1OUT
4. TXE
5. RXE
6. VEE
7. GND
8. ACC

STYLE 18:
PIN 1. ANODE
2. ANODE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN
7. CATHODE
8. CATHODE

STYLE 19:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. MIRROR 2
7. DRAIN 1
8. MIRROR 1

STYLE 20:
PIN 1. SOURCE (N)
2. GATE (N)
3. SOURCE (P)
4. GATE (P)
5. DRAIN
6. DRAIN
7. DRAIN
8. DRAIN

STYLE 21:
PIN 1. CATHODE 1
2. CATHODE 2
3. CATHODE 3
4. CATHODE 4
5. CATHODE 5
6. COMMON ANODE
7. COMMON ANODE
8. CATHODE 6

STYLE 22:
PIN 1. I/O LINE 1
2. COMMON CATHODE/VCC
3. COMMON CATHODE/VCC
4. I/O LINE 3
5. COMMON ANODE/GND
6. I/O LINE 4
7. I/O LINE 5
8. COMMON ANODE/GND

STYLE 23:
PIN 1. LINE 1 IN
2. COMMON ANODE/GND
3. COMMON ANODE/GND
4. LINE 2 IN
5. LINE 2 OUT
6. COMMON ANODE/GND
7. COMMON ANODE/GND
8. LINE 1 OUT

STYLE 24:
PIN 1. BASE
2. EMITTER
3. COLLECTOR/ANODE
4. COLLECTOR/ANODE
5. CATHODE
6. CATHODE
7. COLLECTOR/ANODE
8. COLLECTOR/ANODE

STYLE 25:
PIN 1. VIN
2. N/C
3. REXT
4. GND
5. IOUT
6. IOUT
7. IOUT
8. IOUT

STYLE 26:
PIN 1. GND
2. dv/dt
3. ENABLE
4. ILIMIT
5. SOURCE
6. SOURCE
7. SOURCE
8. VCC

STYLE 27:
PIN 1. ILIMIT
2. OVLO
3. UVLO
4. INPUT+
5. SOURCE
6. SOURCE
7. SOURCE
8. DRAIN

STYLE 28:
PIN 1. SW_TO_GND
2. DASIC_OFF
3. DASIC_SW_DET
4. GND
5. V_MON
6. VBULK
7. VBULK
8. VIN

STYLE 29:
PIN 1. BASE, DIE #1
2. EMITTER, #1
3. BASE, #2
4. EMITTER, #2
5. COLLECTOR, #2
6. COLLECTOR, #2
7. COLLECTOR, #1
8. COLLECTOR, #1

STYLE 30:
PIN 1. DRAIN 1
2. DRAIN 1
3. GATE 2
4. SOURCE 2
5. SOURCE 1/DRAIN 2
6. SOURCE 1/DRAIN 2
7. SOURCE 1/DRAIN 2
8. GATE 1

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