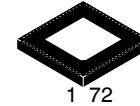


3.3 V 100/133 MHz Differential 1:19 HCSL Clock ZDB/Fanout Buffer for PCIe®

NB3N1900K



QFN72
 MN SUFFIX
 CASE 485DK

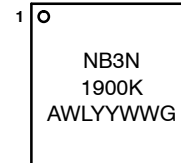
Description

The NB3N1900K differential clock buffers are designed to work in conjunction with a PCIe compliant source clock synthesizer to provide point-to-point clocks to multiple agents. The device is capable of distributing the reference clocks for Intel® QuickPath Interconnect (Intel QPI & UPI), PCIe Gen1, Gen2, Gen3, Gen4. The NB3N1900K internal PLL is optimized to support 100 MHz and 133 MHz frequency operation. The NB3N1900K supports HCSL output levels.

Features

- Fixed Feedback Path for Lowest Input-to-Output Delay
- Eight Dedicated OE# Pins for Hardware Control of Outputs
- PLL Bypass Configurable for PLL or Fanout Operation
- Selectable PLL Bandwidth
- Spread Spectrum Compatible: Tracks Input Clock Spreading for Low EMI
- SMBus Programmable Configurations
- 100 MHz and 133 MHz PLL Mode to Meet the Next Generation PCIe Gen2/Gen3/Gen4 and Intel QPI & UPI Phase Jitter
- 2 Tri-Level Addresses Selection (Nine SMBUS Addresses)
- Cycle-to-Cycle Jitter: < 50 ps
- Output-to-Output Skew: < 65 ps
- Input-to-Output Delay: Fixed at 0 ps
- Input-to-Output Delay Variation: < 50 ps
- Phase Jitter: PCIe Gen3 < 1 ps rms
- Phase Jitter: PCIe Gen4 < 0.5 ps rms
- Phase Jitter: QPI 9.6GB/s < 0.12 ps rms
- QFN 72-pin Package, 10 mm x 10 mm
- These are Pb-Free Devices

MARKING DIAGRAM*



NB3N1900K = Specific Device Code
 A = Assembly Location
 WL = Wafer Lot
 YY = Year
 WW = Work Week
 G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information on page 20 of this data sheet.

NB3N1900K

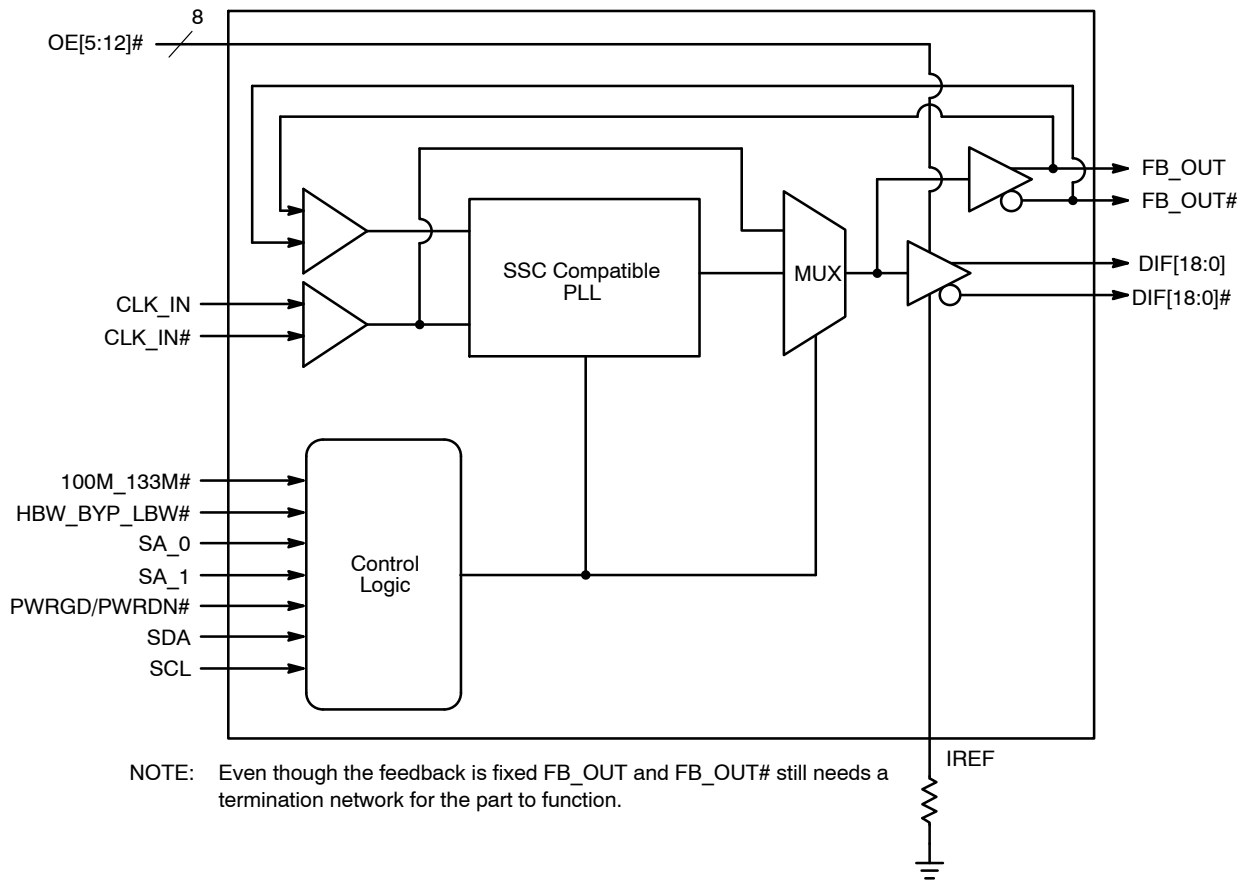
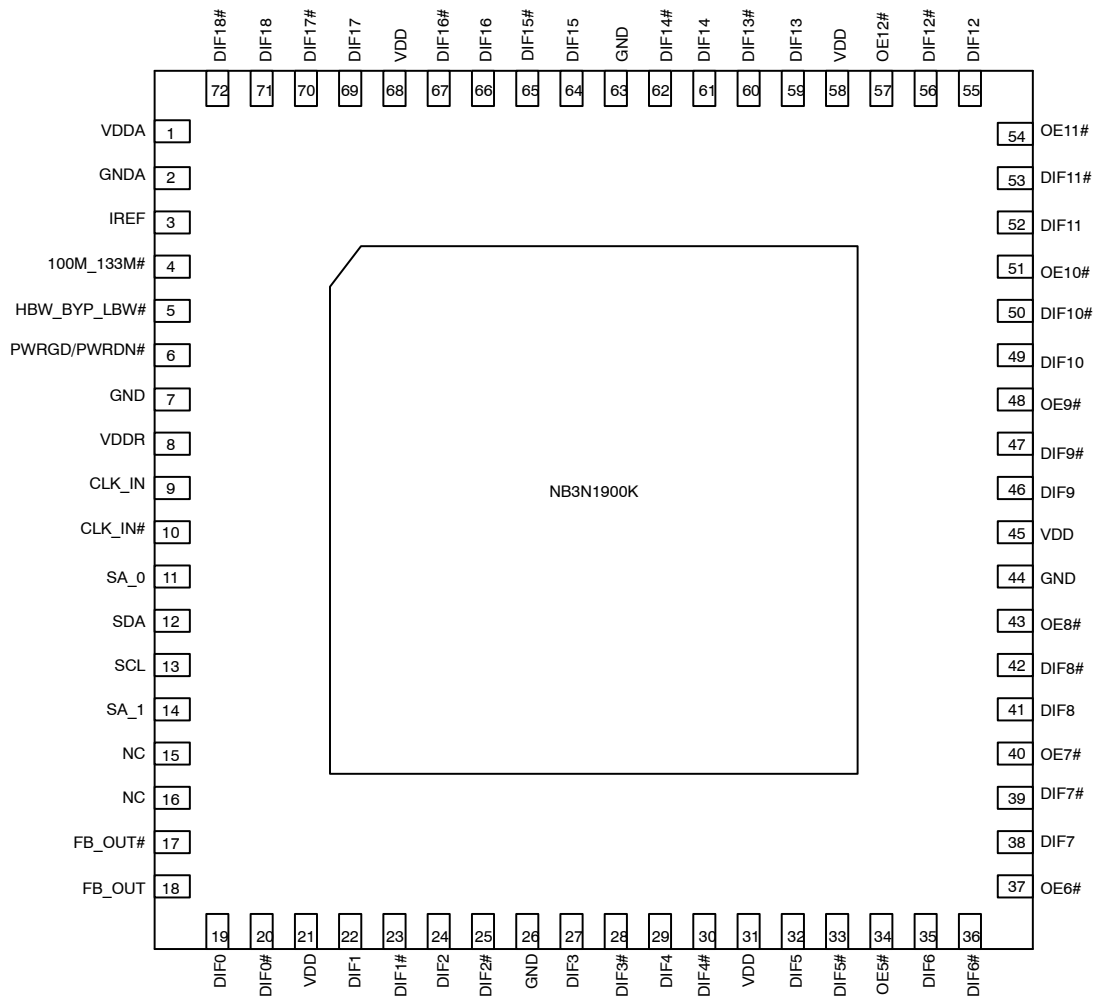


Figure 1. Simplified Block Diagram of NB3N1900K

NB3N1900K



FB_OUT pins loaded the same as the DIF outputs.

Figure 2. Pin Configuration
(Top View)

NB3N1900K

Table 1. PLL OPERATING MODE READBACK TABLE

| HBW_BYP_LBW# | Byte0, bit 7 | Byte 0, bit 6 |
|----------------|--------------|---------------|
| Low (Low BW) | 0 | 0 |
| Mid (Bypass) | 0 | 1 |
| High (High BW) | 1 | 1 |

Table 2. POWER CONNECTIONS

| Pin Number | | Description |
|-----------------------|------------|--------------|
| VDD | GND | |
| 1 | 2 | Analog PLL |
| 8 | 7 | Analog Input |
| 21, 31, 45, 58, 68 | 26, 44, 63 | DIF clocks |

Table 3. FUNCTIONALITY AT POWER UP (PLL MODE)

| 100M_133M# | CLK_IN (MHz) | DIF (MHz) |
|------------|--------------|-----------|
| 1 | 100.00 | CLK_IN |
| 0 | 133.33 | CLK_IN |

Table 4. NB3N1900K SMBus ADDRESSING

| Pin | | SMBus Address – 8 bit (Rd/Wrt bit = 0) |
|------|------|---|
| SA_1 | SA_0 | |
| 0 | 0 | D8 |
| 0 | M | DA |
| 0 | 1 | DE |
| M | 0 | C2 |
| M | M | C4 |
| M | 1 | C6 |
| 1 | 0 | CA |
| 1 | M | CC |
| 1 | 1 | CE |

Table 5. PLL OPERATING MODE

| HBW_BYP_LBW# | MODE |
|--------------|-----------|
| Low | PLL Lo BW |
| Mid | Bypass |
| High | PLL Hi BW |

NOTE: PLL is OFF in Bypass

Table 6. MODE TRI-LEVEL INPUT THRESHOLD

| Level | Voltage |
|-------|-------------------|
| Low | < 0.8 V |
| Mid | 1.2 < Vin < 1.8 V |
| High | Vin > 2.2 V |

NB3N1900K

Table 7. PIN DESCRIPTION

| Pin # | Pin Name | Pin Type | Description |
|-------|---------------|----------|---|
| 1 | VDDA | PWR | 3.3 V power for the PLL core. |
| 2 | GND A | PWR | Ground pin for the PLL core. |
| 3 | IREF | OUT | This pin establishes the reference for the differential current-mode output pairs. It requires a fixed precision resistor to ground. 475 Ω is the standard value for 100 Ω differential impedance. Other impedances require different values. See data sheet. |
| 4 | 100M_133M# | IN | Input to select operating frequency 1 = 100.00 MHz, 0 = 133.33 MHz |
| 5 | HBW_BY_P_LBW# | IN | Trilevel input to select High BW, Bypass or Low BW mode. See PLL Operating Mode Table for Details. |
| 6 | PWRGD/PWRDN# | IN | Notifies device to sample latched inputs and start up on first high assertion, or exit Power Down Mode on subsequent assertions. Low enters Power Down Mode. |
| 7 | GND | PWR | Ground pin. |
| 8 | VDDR | PWR | 3.3 V power for differential input clock (receiver). This VDD should be treated as an analog power rail and filtered appropriately. |
| 9 | CLK_IN | IN | 0.7 V Differential true input |
| 10 | CLK_IN# | IN | 0.7 V Differential complementary Input |
| 11 | SA_0 | IN | SMBus address bit. This is a tri-level input that works in conjunction with the SA_1 to decode 1 of 9 SMBus Addresses. |
| 12 | SDA | I/O | Data pin of SMBus circuitry, 5V tolerant |
| 13 | SCL | IN | Clock pin of SMBus circuitry, 5V tolerant |
| 14 | SA_1 | IN | SMBus address bit. This is a tri-level input that works in conjunction with the SA_0 to decode 1 of 9 SMBus Addresses. |
| 15 | NC | N/A | No Connection. |
| 16 | NC | N/A | No Connection. |
| 17 | FB_OUT# | OUT | Complementary half of differential feedback output, provides feedback signal to the PLL for synchronization with input clock to eliminate phase error. |
| 18 | FB_OUT | OUT | True half of differential feedback output, provides feedback signal to the PLL for synchronization with the input clock to eliminate phase error. |
| 19 | DIF0 | OUT | 0.7 V differential true clock output |
| 20 | DIF0# | OUT | 0.7 V differential complementary clock output |
| 21 | VDD | PWR | Power supply, nominal 3.3 V |
| 22 | DIF1 | OUT | 0.7 V differential true clock output |
| 23 | DIF1# | OUT | 0.7 V differential complementary clock output |
| 24 | DIF2 | OUT | 0.7 V differential true clock output |
| 25 | DIF2# | OUT | 0.7 V differential complementary clock output |
| 26 | GND | PWR | Ground pin. |
| 27 | DIF3 | OUT | 0.7 V differential true clock output |
| 28 | DIF3# | OUT | 0.7 V differential complementary clock output |
| 29 | DIF4 | OUT | 0.7 V differential true clock output |
| 30 | DIF4# | OUT | 0.7 V differential complementary clock output |
| 31 | VDD | PWR | Power supply, nominal 3.3 V |
| 32 | DIF5 | OUT | 0.7 V differential true clock output |
| 33 | DIF5# | OUT | 0.7 V differential complementary clock output |
| 34 | OE5# | IN | Active low input for enabling DIF pair 5. 1 = disable outputs, 0 = enable outputs |
| 35 | DIF6 | OUT | 0.7 V differential true clock output |
| 36 | DIF6# | OUT | 0.7 V differential complementary clock output |
| 37 | OE6# | IN | Active low input for enabling DIF pair 6. 1 =disable outputs, 0 = enable outputs |

NB3N1900K

Table 7. PIN DESCRIPTION

| Pin # | Pin Name | Pin Type | Description |
|-------|----------|----------|---|
| 38 | DIF7 | OUT | 0.7 V differential true clock output |
| 39 | DIF7# | OUT | 0.7 V differential complementary clock output |
| 40 | OE7# | IN | Active low input for enabling DIF pair 7. 1 = disable outputs, 0 = enable outputs |
| 41 | DIF8 | OUT | 0.7 V differential true clock output |
| 42 | DIF8# | OUT | 0.7 V differential complementary clock output |
| 43 | OE8# | IN | Active low input for enabling DIF pair 8. 1 = disable outputs, 0 = enable outputs |
| 44 | GND | PWR | Ground pin. |
| 45 | VDD | PWR | Power supply, nominal 3.3 V |
| 46 | DIF9 | OUT | 0.7 V differential true clock output |
| 47 | DIF9# | OUT | 0.7 V differential complementary clock output |
| 48 | OE9# | IN | Active low input for enabling DIF pair 9. 1 = disable outputs, 0 = enable outputs |
| 49 | DIF10 | OUT | 0.7 V differential true clock output |
| 50 | DIF10# | OUT | 0.7 V differential complementary clock output |
| 51 | OE10# | IN | Active low input for enabling DIF pair 10. 1 = disable outputs, 0 = enable outputs |
| 52 | DIF11 | OUT | 0.7 V differential true clock output |
| 53 | DIF11# | OUT | 0.7 V differential complementary clock output |
| 54 | OE11# | IN | Active low input for enabling DIF pair 11. 1 = disable outputs, 0 = enable outputs |
| 55 | DIF12 | OUT | 0.7 V differential true clock output |
| 56 | DIF12# | OUT | 0.7 V differential complementary clock output |
| 57 | OE12# | IN | Active low input for enabling DIF pair 12. 1 = disable outputs, 0 = enable outputs |
| 58 | VDD | PWR | Power supply, nominal 3.3 V |
| 59 | DIF13 | OUT | 0.7 V differential true clock output |
| 60 | DIF13# | OUT | 0.7 V differential complementary clock output |
| 61 | DIF14 | OUT | 0.7 V differential true clock output |
| 62 | DIF14# | OUT | 0.7 V differential complementary clock output |
| 63 | GND | PWR | Ground pin. |
| 64 | DIF15 | OUT | 0.7 V differential true clock output |
| 65 | DIF15# | OUT | 0.7 V differential complementary clock output |
| 66 | DIF16 | OUT | 0.7 V differential true clock output |
| 67 | DIF16# | OUT | 0.7 V differential complementary clock output |
| 68 | VDD | PWR | Power supply, nominal 3.3 V |
| 69 | DIF17 | OUT | 0.7 V differential true clock output |
| 70 | DIF17# | OUT | 0.7 V differential complementary clock output |
| 71 | DIF18 | OUT | 0.7 V differential true clock output |
| 72 | DIF18# | OUT | 0.7 V differential complementary clock output |

NB3N1900K

Table 8. ABSOLUTE MAXIMUM RATINGS (Note 1)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------|--|----------------------------|-----------|------|-----------------------|------|
| V _{DDA} | 3.3 V Core Supply Voltage (Note 2) | | | | 4.6 | V |
| V _{DD} | 3.3 V Logic Supply Voltage (Note 2) | | | | 4.6 | V |
| V _{IL} | Input Low Voltage | | GND – 0.5 | | | V |
| V _{IH} | Input High Voltage | Except for SMBus interface | | | V _{DD} + 0.5 | V |
| V _{IHSMB} | Input High Voltage | SMBus clock and data pins | | | 5.5 | V |
| T _s | Storage Temperature | | –65 | | 150 | °C |
| T _J | Junction Temperature | | | | 125 | °C |
| T _c | Case Temperature | | | | 130 | °C |
| ESD | ESD protection | Human Body Model | 2000 | | | V |
| θ _{JA} | Thermal Resistance Junction-to-Ambient | Still air | | 18.1 | | °C/W |
| θ _{JC} | Thermal Resistance Junction-to-Case | | | 5.0 | | °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. Guaranteed by design and characterization, not tested in production.
2. Operation under these conditions is neither implied nor guaranteed.

NB3N1900K

Table 9. ELECTRICAL CHARACTERISTICS – INPUT/SUPPLY/Common PARAMETERS

($V_{DD} = V_{DDA} = 3.3\text{ V} \pm 5\%$, $T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$). See Test Loads for Loading Conditions.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------|-------------------------------|--|--------------------|--------|----------------|---------------|
| V_{IH} | Input High Voltage | Single-ended inputs, except SMBus, low threshold and tri-level inputs (Note 3) | 2 | | $V_{DD} + 0.3$ | V |
| V_{IL} | Input Low Voltage | Single-ended inputs, except SMBus, low threshold and tri-level inputs (Note 3) | $\text{GND} - 0.3$ | | 0.8 | V |
| V_{IH_FS} (Note 4) | Input High Voltage | | 0.7 | | $V_{DD} + 0.3$ | V |
| V_{IL_FS} (Note 4) | Input Low Voltage | | $\text{GND} - 0.3$ | | 0.35 | V |
| I_{IN} | Input Current | Single-ended inputs, $V_{IN} = \text{GND}$, $V_{IN} = V_{DD}$ (Note 3) | -5 | | 5 | μA |
| F_{IBYP} | Input Frequency | $V_{DD} = 3.3\text{ V}$, Bypass mode (Notes 3, 5 and 6) | 33 | | 400 | MHz |
| F_{IPLL} | | $V_{DD} = 3.3\text{ V}$, 100.00 MHz PLL mode (Note 5) | 99 | 100.00 | 101 | MHz |
| F_{IPLL} | | $V_{DD} = 3.3\text{ V}$, 133.33 MHz PLL mode (Notes 5) | 132.33 | 133.33 | 134.33 | MHz |
| L_{PIN} | Pin Inductance | (Note 3) | | | 7 | nH |
| C_{IN} | Capacitance | Logic Inputs, except CLK_IN (Note 3) | 1.5 | | 5 | pF |
| C_{INDIF_IN} | | CLK_IN differential clock inputs (Notes 3 and 7) | 1.5 | | 2.7 | pF |
| C_{OUT} | | Output pin capacitance (Note 3) | | | 6 | pF |
| T_{STAB} | Clk Stabilization | From V_{DD} Power-Up and after input clock stabilization or de-assertion of PD# to 1st clock (Notes 3 and 5) | | | 1.8 | ms |
| f | Input SS Modulation Frequency | Allowable Frequency (Triangular Modulation) (Note 3) | 30 | | 33 | kHz |
| $t_{LATO\#}$ | OE# Latency | DIF start after OE# assertion DIF stop after OE# de-assertion (Note 3) | 4 | | 12 | cycles |
| t_{DRVPD} | Tdrive_PD# | DIF output enable after PD# de-assertion (Note 3) | | | 300 | μs |
| t_f | Tfall | Fall time of control inputs (Notes 3 and 5) | | | 5 | ns |
| t_R | Trise | Rise time of control inputs (Notes 3 and 5) | | | 5 | ns |
| V_{ILSMB} | SMBus Input Low Voltage | (Note 3) | | | 0.8 | V |
| V_{IHSMB} | SMBus Input High Voltage | (Note 3) | 2.1 | | V_{DDSMB} | V |
| V_{OLSMB} | SMBus Output Low Voltage | @ I_{PULLUP} (Note 3) | | | 0.4 | V |
| I_{PULLUP} | SMBus Sink Current | @ V_{OL} (Note 3) | 4 | | | mA |
| V_{DDSMB} | Nominal Bus Voltage | 3 V to 5 V $\pm 10\%$ (Note 3) | 2.7 | | 5.5 | V |
| t_{RSMB} | SCL/SDA Rise Time | (Max $V_{IL} - 0.15$) to (Min $V_{IH} + 0.15$) (Note 3) | | | 1000 | ns |
| t_{FSMB} | SCL/SDA Fall Time | (Min $V_{IH} + 0.15$) to (Max $V_{IL} - 0.15$) (Note 3) | | | 300 | ns |
| f_{MAXSMB} | SMBus Operating Frequency | Maximum SMBus operating frequency (Notes 3 and 8) | | | 100 | kHz |

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. Guaranteed by design and characterization, not tested in production.

4. 100M_133M# Frequency Select (FS).

5. Control input must be monotonic from 20% to 80% of input swing.

6. Fmax measured until output violates output duty cycle specifications and output V_{High} , V_{Low} specification.

7. CLK_IN input

8. The differential input clock must be running for the SMBus to be active.

NB3N1900K

Table 10. ELECTRICAL CHARACTERISTICS – CLOCK INPUT PARAMETERS

($V_{DD} = V_{DDA} = 3.3\text{ V} \pm 5\%$, $T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$), See Test Loads for Loading Conditions.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------|---|--|----------------|-----|------|---------------|
| V_{IHDIF} | Input High Voltage – CLK_IN (Note 9) | Differential inputs (single-ended measurement) | 600 | | 1150 | mV |
| V_{ILDIF} | Input Low Voltage – CLK_IN (Note 9) | Differential inputs (single-ended measurement) | $V_{SS} - 300$ | | 300 | mV |
| V_{COM} | Input Common Mode Voltage – CLK_IN (Note 9) | Common Mode Input Voltage | 300 | | 1000 | mV |
| V_{SWING} | Input Amplitude – CLK_IN (Note 9) | Peak to Peak value | 300 | | 1450 | mV |
| dv/dt | Input Slew Rate – CLK_IN (Notes 9 and 10) | Measured differentially | 0.4 | | 8 | V/ns |
| I_{IN} | Input Leakage Current (Note 9) | $V_{IN} = V_{DD}$, $V_{IN} = \text{GND}$ | -5 | | 5 | μA |
| d_{tin} | Input Duty Cycle (Note 9) | Measurement from differential waveform | 45 | | 55 | % |
| J_{DIFin} | Input Jitter – Cycle to Cycle (Note 9) | Differential Measurement | 0 | | 125 | 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.

9. Guaranteed by design and characterization, not tested in production.

10. Slew rate measured through $\pm 75\text{ mV}$ window centered around differential zero.

Table 11. ELECTRICAL CHARACTERISTICS – DIF 0.7 V CURRENT MODE DIFFERENTIAL OUTPUTS

($V_{DD} = V_{DDA} = 3.3\text{ V} \pm 5\%$, $T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$), See Test Loads for Loading Conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------|---|---|------|-----|------|------|
| dV/dt | Slew rate (Notes 11, 12 and 13) | Scope averaging on | 1 | | 4 | V/ns |
| $\Delta dV/dt$ | Slew rate matching (Notes 11, 12 and 14) | Slew rate matching, Scope averaging on | | | 20 | % |
| ΔTrf | Rise/Fall Time Matching (Notes 11, 12 and 18) | Rise/fall matching, Scope averaging off | | | 125 | ps |
| V_{High} | Voltage High (Note 11) | Statistical measurement on single-ended signal using oscilloscope math function. (Scope averaging on) | 660 | | 850 | mV |
| V_{Low} | Voltage Low (Note 11) | | -150 | | 150 | |
| V_{max} | Max Voltage (Note 11) | Measurement on single ended signal using Absolute value. (Scope averaging off) | | | 1150 | mV |
| V_{min} | Min Voltage (Note 11) | | -300 | | | |
| V_{swing} | Vswing (Notes 11 and 12) | Scope averaging off | 300 | | | mV |
| V_{cross_abs} | Crossing Voltage (abs) (Notes 11 and 15) | Scope averaging off | 250 | | 550 | mV |
| ΔV_{cross} | Crossing Voltage (var) (Notes 11 and 16) | Scope averaging off | | | 140 | mV |

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.

11. Guaranteed by design and characterization, not tested in production. $I_{REF} = V_{DD}/(3 \times R_{REF})$. For $R_{REF} = 475\ \Omega$ (1%), $I_{REF} = 2.32\text{ mA}$. $I_{OH} = 6 \times I_{REF}$ and $V_{OH} = 0.7\text{ V}$ @ $Z_O = 50\ \Omega$ ($100\ \Omega$ differential impedance).

12. Measured from differential waveform.

13. Slew rate is measured through the Vswing voltage range centered around differential 0 V. This results in a $\pm 150\text{ mV}$ window around differential 0 V.

14. Matching applies to rising and falling edge rate of differential waveform. It is measured using a $\pm 75\text{ mV}$ window centered on the average cross point where the clock rising meets clock# falling. The median cross point is used to calculate voltage thresholds that the oscilloscope uses to calculate the slew rate. Measurement taken using a $100\ \Omega$ differential impedance 5" trace PCB.

15. Vcross is defined as voltage where Clock = Clock# measured on a component test board and only applies to the differential rising edge (i.e. Clock rising and Clock# falling).

16. The total variation of all Vcross measurements in any particular system. Note that this is a subset of V_{cross_min}/max (V_{cross} absolute) allowed. The intent is to limit Vcross induced modulation by setting V_{cross_delta} to be smaller than V_{cross} absolute.

17. Measured from single-ended waveform

18. Measured with scope averaging off, using statistics function. Variation is difference between min and max.

NB3N1900K

Table 12. ELECTRICAL CHARACTERISTICS – CURRENT CONSUMPTION

($V_{DD} = V_{DDA} = 3.3\text{ V} \pm 5\%$, $T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$), See Test Loads for Loading Conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|------------------------------------|--|-----|-----|-----|------|
| $I_{DD3.3OP}$ | Operating Supply Current (Note 19) | All outputs active @ 100.00 MHz, $C_L = \text{Full load}$ | | | 550 | mA |
| $I_{DD3.3PDZ}$ | Powerdown Current (Note 19) | All differential pairs tri-stated | | | 36 | mA |

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.

19. Guaranteed by design and characterization, not tested in production.

Table 13. ELECTRICAL CHARACTERISTICS – SKEW AND DIFFERENTIAL JITTER PARAMETERS

($V_{DD} = V_{DDA} = 3.3\text{ V} \pm 5\%$, $T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$), See Test Loads for Loading Conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------|---|--|------|-----|-----|------|
| t_{SPO_PLL} | CLK_IN, DIF[x:0] (Notes 20, 21, 23, 24 and 27) | Input-to-Output Skew in PLL mode nominal value @ 25°C, 3.3 V | -100 | | 100 | ps |
| t_{PD_BYP} | CLK_IN, DIF[x:0] (Notes 20, 21, 22, 24 and 27) | Input-to-Output Skew in Bypass mode nominal value @ 25°C, 3.3 V | 2.5 | | 4.5 | ns |
| t_{DSPO_PLL} | CLK_IN, DIF[x:0] (Notes 20, 21, 22, 24 and 27) | Input-to-Output Skew Variation in PLL mode across voltage and temperature | | | 100 | ps |
| t_{DSPO_BYP} | CLK_IN, DIF[x:0] (Notes 20, 21, 22, 24 and 27) | Input-to-Output Skew Variation in Bypass mode across voltage and temperature | -250 | | 250 | ps |
| t_{SKEW_ALL} | DIF{x:0} (Notes 20, 21, 22 and 27) | Output-to-Output Skew across all outputs (Common to Bypass and PLL mode) | | | 65 | ps |
| $j_{peak-hibw}$ | PLL Jitter Peaking (Notes 26 and 27) | HBW_BYP_LBW# = 1 | 0 | | 2.5 | dB |
| $j_{peak-lobw}$ | PLL Jitter Peaking (Notes 26 and 27) | HBW_BYP_LBW# = 0 | 0 | | 2 | dB |
| p_{llHIBW} | PLL Bandwidth (Notes 27 and 28) | HBW_BYP_LBW# = 1 | 2 | | 4 | MHz |
| p_{llLOBW} | PLL Bandwidth (Notes 27 and 28) | HBW_BYP_LBW# = 0 | 0.7 | | 1.4 | MHz |
| t_{DC} | Duty Cycle (Notes 20 and 27) | Measured differentially, PLL Mode | 45 | 50 | 55 | % |
| t_{DCD} | Duty Cycle Distortion (Notes 20 and 29) | Measured differentially, Bypass Mode @ 100.00 MHz | -2 | 0 | 2 | % |
| $t_{jyc-cyc}$ | Jitter, Cycle to cycle (Notes 20, 27 and 30) | PLL mode | | | 50 | ps |
| | | Additive Jitter in Bypass Mode | | | 50 | 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.

20. Measured into fixed 2 pF load cap. Input to output skew is measured at the first output edge following the corresponding input.

21. Measured from differential cross-point to differential cross-point. This parameter can be tuned with external feedback path, if present.

22. All Bypass Mode Input-to-Output specs refer to the timing between an input edge and the specific output edge created by it.

23. This parameter is deterministic for a given device.

24. Measured with scope averaging on to find mean value. CLK_IN slew rate must be matched to DIF output slew rate.

25. t is the period of the input clock.

26. Measured as maximum pass band gain. At frequencies within the loop BW, highest point of magnification is called PLL jitter peaking.

27. Guaranteed by design and characterization, not tested in production.

28. Measured at 3 db down or half power point.

29. Duty cycle distortion is the difference in duty cycle between the output and the input clock when the device is operated in bypass mode. @ 100.00 MHz.

30. Measured from differential waveform.

NB3N1900K

Table 14. ELECTRICAL CHARACTERISTICS – PHASE JITTER PARAMETERS

(V_{DD} = V_{DDA} = 3.3 V ±5%, T_A = -10°C to +70°C), See Test Loads for Loading Conditions.

| Symbol | Parameter | Conditions (Notes 31 and 36) | Min | Typ | Max | Unit |
|-------------------------|---|---|------------------------------|------|------|----------|
| t _{jphPCleG1} | Jitter, Phase | PCIe Gen 1 (Notes 32 and 33) | | 12 | 86 | ps (p-p) |
| t _{jphPCleG2} | | PCIe Gen 2 Lo Band 10 kHz < f < 1.5 MHz (Note 32) | | 0.2 | 3 | ps (rms) |
| | | PCIe Gen 2 High Band 1.5 MHz < f < Nyquist (50 MHz) (Note 32) | | 1.0 | 3.1 | ps (rms) |
| t _{jphPCleG3} | | PCIe Gen 3 (PLL BW of 2–4 MHz, CDR = 10 MHz) (Note 32) | | 0.29 | 1 | ps (rms) |
| t _{jphPCleG4} | | PCIe Gen 4 (PLL BW of 2–4 MHz, CDR = 10 MHz) | | 0.29 | 0.5 | ps (rms) |
| t _{jphUPI} | | UPI (9.6 Gb/s, 10.4 Gb/s or 11.2 Gb/s, 100 MHz, 12 UI) | | 0.7 | 1.0 | ps (rms) |
| t _{jphQPI_SMI} | | QPI & SMI (100.00 MHz or 133.33 MHz, 4.8 Gb/s, 6.4 Gb/s 12UI) (Note 34) | | 0.3 | 0.5 | ps (rms) |
| | | QPI & SMI (100.00 MHz, 8.0 Gb/s, 12UI) (Note 34) | | 0.1 | 0.3 | ps (rms) |
| | | QPI & SMI (100.00 MHz, 9.6 Gb/s, 12UI) (Note 34) | | 0.08 | 0.12 | ps (rms) |
| t _{jphPCleG1} | | Additive Phase Jitter, Bypass mode | PCIe Gen 1 (Notes 32 and 33) | | | 10 |
| t _{jphPCleG2} | PCIe Gen 2 Lo Band 10 kHz < f < 1.5 MHz (Notes 32 and 35) | | | | 0.3 | ps (rms) |
| | PCIe Gen 2 High Band 1.5 MHz < f < Nyquist (50 MHz) (Notes 32 and 35) | | | | 0.7 | ps (rms) |
| t _{jphPCleG3} | PCIe Gen 3 (PLL BW of 2–4 MHz, CDR = 10 MHz) (Notes 32 and 35) | | | | 0.3 | ps (rms) |
| t _{jphQPI_SMI} | QPI & SMI (100.00 MHz or 133.33 MHz, 4.8 Gb/s, 6.4 Gb/s 12UI) (Notes 34 and 35) | | | | 0.3 | ps (rms) |
| | QPI & SMI (100.00 MHz, 8.0 Gb/s, 12UI) (Notes 34 and 35) | | | | 0.1 | ps (rms) |
| | QPI & SMI (100.00 MHz, 9.6 Gb/s, 12UI) (Notes 34 and 35) | | | | 0.1 | ps (rms) |

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.

31. Applies to all outputs.

32. See <http://www.pcisig.com> for complete specs

33. Sample size of at least 100K cycles. This figures extrapolates to 108 ps pk-pk @ 1M cycles for a BER of 1-12.

34. Calculated from Intel-supplied Clock Jitter Tool v 1.6.3.

35. For RMS figures, additive jitter is calculated by solving the following equation: (Additive jitter)² = (total jitter)² - (input jitter)²

36. Guaranteed by design and characterization, not tested in production

NB3N1900K

Table 15. CLOCK PERIODS – DIFFERENTIAL OUTPUTS WITH SPREAD SPECTRUM DISABLED

| SSC OFF | Center Freq. MHz | Measurement Window | | | | | | | Unit | Notes |
|---------|------------------|------------------------|-----------------------------|-----------------------------|----------------------|-----------------------------|-----------------------------|------------------------|------|------------|
| | | 1 Clock | 1us | 0.1s | 0.1s | 0.1s | 1us | 1 Clock | | |
| | | -c2c jitter AbsPer Min | -SSC Short-Term Average Min | - ppm Long-Term Average Min | 0 ppm Period Nominal | + ppm Long-Term Average Max | +SSC Short-Term Average Max | +c2c jitter AbsPer Max | | |
| DIF | 100.00 | 9.94900 | | 9.99900 | 10.00000 | 10.00100 | | 10.05100 | ns | 37, 38, 39 |
| | 133.33 | 7.44925 | | 7.49925 | 7.50000 | 7.50075 | | 7.55075 | ns | 37, 38, 40 |

37. Guaranteed by design and characterization, not tested in production.

38. All Long Term Accuracy specifications are guaranteed with the assumption that the input clock complies with CK420BQ/CK410B+ accuracy requirements (± 100 ppm). The 9ZX21901 itself does not contribute to ppm error.

39. Driven by SRC output of main clock, 100.00 MHz PLL Mode or Bypass mode

40. Driven by CPU output of main clock, 133.33 MHz PLL Mode or Bypass mode

Table 16. CLOCK PERIODS – DIFFERENTIAL OUTPUTS WITH SPREAD SPECTRUM ENABLED

| SSC ON | Center Freq. MHz | Measurement Window | | | | | | | Unit | Notes |
|--------|------------------|------------------------|-----------------------------|-----------------------------|----------------------|-----------------------------|-----------------------------|------------------------|------|------------|
| | | 1 Clock | 1us | 0.1s | 0.1s | 0.1s | 1us | 1 Clock | | |
| | | -c2c jitter AbsPer Min | -SSC Short-Term Average Min | - ppm Long-Term Average Min | 0 ppm Period Nominal | + ppm Long-Term Average Max | +SSC Short-Term Average Max | +c2c jitter AbsPer Max | | |
| DIF | 99.75 | 9.94906 | 9.99906 | 10.02406 | 10.02506 | 10.02607 | 10.05107 | 10.10107 | ns | 41, 42, 43 |
| | 133.00 | 7.44930 | 7.49930 | 7.51805 | 7.51880 | 7.51955 | 7.53830 | 7.58830 | ns | 41, 42, 44 |

41. Guaranteed by design and characterization, not tested in production.

42. All Long Term Accuracy specifications are guaranteed with the assumption that the input clock complies with CK420BQ/CK410B+ accuracy requirements (± 100 ppm). The 9ZX21901 itself does not contribute to ppm error.

43. Driven by SRC output of main clock, 100.00 MHz PLL Mode or Bypass mode

44. Driven by CPU output of main clock, 133.33 MHz PLL Mode or Bypass mode

Table 17. POWER MANAGEMENT TABLE

| Inputs | | Control Bits/Pins | | | | Outputs | PLL State |
|--------------|----------------|-------------------|---------|------------------------|-----------------|------------------|-----------|
| PWRGD/PWRDN# | CLK_IN/CLK_IN# | SMBus EN bit | OE# Pin | DIF(5:12) / DIF(5:12)# | Other DIF/ DIF# | FB_OUT / FB_OUT# | |
| 0 | X | X | X | Hi-Z (Note 45) | Hi-Z (Note 45) | Hi-Z (Note 45) | OFF |
| 1 | Running | 0 | X | Hi-Z (Note 45) | Hi-Z (Note 45) | Running | ON |
| | | 1 | 0 | Running | Running | Running | ON |
| | | 1 | 1 | Hi-Z (Note 45) | Running | Running | ON |

45. Due to external pull down resistors, HI-Z results in Low/Low on the True/Complement outputs

NB3N1900K

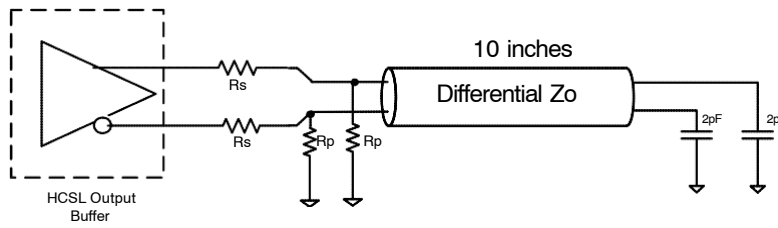


Figure 3. NB3N1900K Differential Test Loads

Table 18. DIFFERENTIAL OUTPUT TERMINATION TABLE

| DIF Zo (Ω) | Iref (Ω) | Rs (Ω) | Rp (Ω) |
|---------------------|-------------------|-----------------|-----------------|
| 100 | 475 | 33 | 50 |
| 85 | 412 | 27 | 42.2 or 43.2 |

PWRGD/PWRDN#

PWRGD/PWRDN# is a dual function pin. PWRGD is asserted high and de-asserted low. De-assertion of PWRGD (pulling the signal low) is equivalent to indicating a powerdown condition. PWRGD (assertion) is used by the NB3N1900K to sample initial configurations such as frequency select condition and SA selections.

After PWRGD has been asserted high for the first time, the pin becomes a PWRDN# (Power Down) pin that can be used to shut off all clocks cleanly and instruct the device to invoke power savings mode. PWRDN# is a completely asynchronous active low input. When entering power savings mode, PWRDN# should be asserted low **prior to shutting off the input clock or power** to ensure all clocks shut down in a glitch free manner. When PWRDN# is

asserted low by two consecutive rising edges of DIF#, all differential outputs are held tri-stated on the next DIF# high to low transition. The assertion and de-assertion of PWRDN# is absolutely asynchronous.

WARNING: Disabling of the CLK_IN input clock prior to assertion of PWRDN# is an undefined mode and not recommended. Operation in this mode may result in glitches, excessive frequency shifting, etc.

Table 19. PWRGD/PWRDN# FUNCTIONALITY

| PWRGD/PWRDN# | DIF | DIF# |
|--------------|-----------|-----------|
| 0 | Tri-state | Tri-state |
| 1 | Running | Running |

Buffer Power-Up State Machine

Table 20. BUFFER POWER-UP STATE MACHINE

| State | Description |
|-------|--|
| 0 | 3.3 V Buffer power off |
| 1 | After 3.3 V supply is detected to rise above 3.135 V, the buffer enters State 1 and initiates a 0.1 ms–0.3 ms delay. |
| 2 | Buffer waits for a valid clock on the CLK input and PWRDN# de-assertion (or PWRGD assertion low to high) |
| 3 | Once the PLL is locked to the CLK_IN input clock, the buffer enters state 3 and enables outputs for normal operation. (Notes 46, 47) |

46. The total power up latency from power on to all outputs active must be less than 1.8 ms (assuming a valid clock is present on CLK_IN input).
 47. If power is valid and powerdown is de-asserted (PWRGD asserted) but no input clocks are present on the CLK_IN input, DIF clocks must remain disabled. Only after valid input clocks are detected, valid power, PWRDN# de-asserted (PWRGD asserted) with the PLL locked/stable and the DIF outputs enabled.

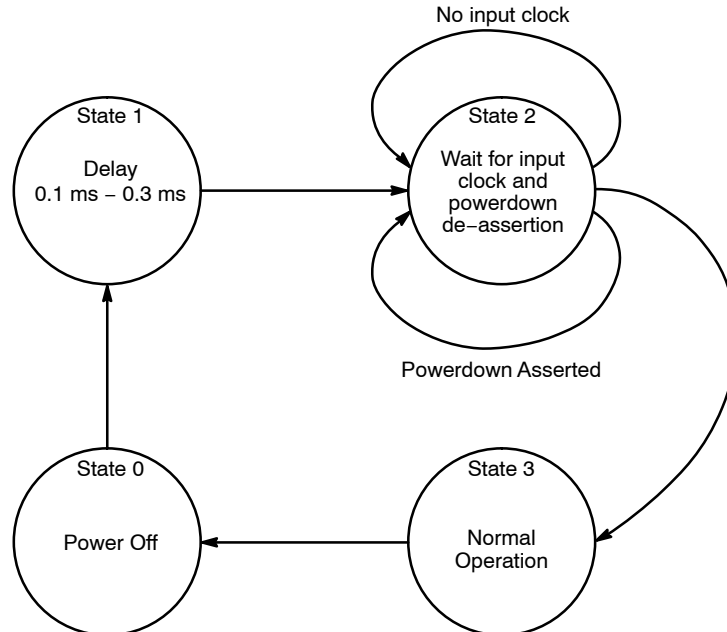


Figure 4. Buffer Power-Up State Diagram

Device Power-Up Sequence

Follow the power-up sequence below for proper device functionality:

1. PWRGD/PWRDN# pin must be Low.
2. Assign remaining control pins to their required state (100M_133M#, HBW_BYPASS_LBW#, SDA, SCL)

3. Apply power to the device.
4. Once the VDD pin has reached a valid VDDmin level (3.3V -5%), the PWRGD/PWRDN# pin must be asserted High. See Figure 5.

Note: If no clock is present on the CLK_IN/CLK_IN# pins when device is powered up, there will be no clock on DIF/DIF# outputs.

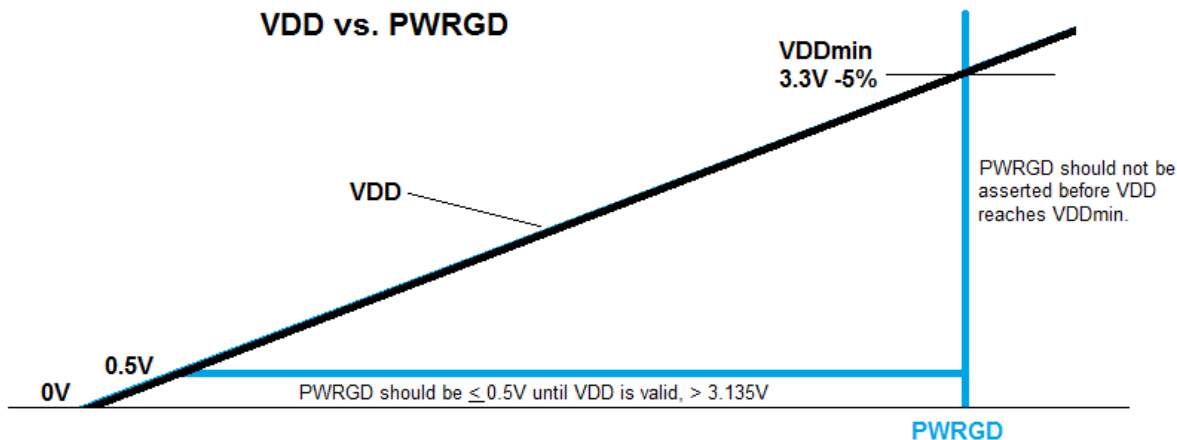


Figure 5. PWRGD and VDD Relationship Diagram

NB3N1900K

GENERAL SMBUS SERIAL INTERFACE INFORMATION FOR THE NB3N1900K

How to Write:

- Controller (host) sends a start bit.
- Controller (host) sends the write address $XX_{(H)}$
- Clock(device) will **acknowledge**
- Controller (host) sends the beginning byte location = N
- Clock(device) will **acknowledge**
- Controller (host) sends the data byte count = X
- Clock(device) will **acknowledge**
- Controller (host) starts sending **Byte N through Byte N + X - 1**
- Clock(device) will **acknowledge** each byte **one at a time**
- Controller (host) sends a Stop bit

Table 21. INDEX BLOCK WRITE OPERATION

| Controller (Host) | | Clock (Device) | |
|--------------------------|-----------|----------------|-----|
| T | starT bit | | |
| Slave Address $XX_{(H)}$ | | | |
| WR | WRite | | |
| | | ACK | |
| Beginning Byte = N | | | |
| | | ACK | |
| Data Byte Count = X | | | |
| | | ACK | |
| Beginning Byte N | | | |
| | | X Byte | ACK |
| | | | |
| O | | | O |
| O | | | O |
| | | | O |
| Byte N + X - 1 | | | |
| | | ACK | |
| P | stoP bit | | |

Note: $XX_{(H)}$ is defined by SMBus address select pins

How to Read:

- Controller (host) will send start bit.
- Controller (host) sends the write address $XX_{(H)}$
- Clock(device) will **acknowledge**
- Controller (host) sends the beginning byte location = N

- Clock(device) will **acknowledge**
- Controller (host) will send a separate start bit.
- Controller (host) sends the read address $YY_{(H)}$
- Clock(device) will **acknowledge**
- vclock will send the data byte count = X
- Clock(device) sends **Byte N + X - 1**
- Clock(device) sends **Byte 0 through byte X (if $X_{(H)}$ was written to byte 8)**.
- Controller (host) will need to acknowledge each byte
- Controller (host) will send a not acknowledge bit
- Controller (host) sends a Stop bit

Table 22. INDEX BLOCK READ OPERATION

| Controller (Host) | | Clock (Device) | |
|--------------------------|-----------------|---------------------|------------------|
| T | starT bit | | |
| Slave Address $XX_{(H)}$ | | | |
| WR | WRite | | |
| | | ACK | |
| Beginning Byte = N | | | |
| | | ACK | |
| RT | Repeat starT | | |
| Slave Address $YY_{(H)}$ | | | |
| RD | ReaD | | |
| | | ACK | |
| | | | |
| | | Data Byte Count = X | |
| ACK | | | |
| | | X Byte | Beginning Byte N |
| ACK | | | |
| | | | O |
| O | | | O |
| O | | | O |
| | | | |
| | | | Byte N + X - 1 |
| N | Not acknowledge | | |
| P | stoP bit | | |

Note: $XX_{(H)}$ is defined by SMBus address select pins

NB3N1900K

Table 23. SMBusTable: PLL MODE, AND FREQUENCY SELECT REGISTER

| Byte 0 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|------------|----------------------------------|------|---------------------------------------|---------|---------|
| Bit 7 | 5 | PLL Mode 1 | PLL Operating Mode Rd back 1 | R | See PLL Operating Mode Readback Table | | Latch |
| Bit 6 | 5 | PLL Mode 0 | PLL Operating Mode Rd back 0 | R | | | Latch |
| Bit 5 | 72/71 | DIF_18_En | Output Control overrides OE# pin | RW | Hi-Z | Enable | 1 |
| Bit 4 | 70/69 | DIF_17_En | Output Control overrides OE# pin | RW | Hi-Z | Enable | 1 |
| Bit 3 | 67/66 | DIF_16_En | Output Control overrides OE# pin | RW | Hi-Z | Enable | 1 |
| Bit 2 | | Reserved | | | | | 0 |
| Bit 1 | | Reserved | | | | | 0 |
| Bit 0 | 4 | 100M_133M# | Frequency Select Readback | R | 133 MHz | 100 MHz | Latch |

Table 24. SMBusTable: OUTPUT CONTROL REGISTER

| Byte 1 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|----------|----------------------------------|------|------|--------|---------|
| Bit 7 | 39/38 | DIF_7_En | Output Control overrides OE# pin | RW | Hi-Z | Enable | 1 |
| Bit 6 | 35/36 | DIF_6_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 5 | 32/33 | DIF_5_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 4 | 29/30 | DIF_4_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 3 | 27/28 | DIF_3_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 2 | 24/25 | DIF_2_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 1 | 22/23 | DIF_1_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 0 | 19/20 | DIF_0_En | Output Control overrides OE# pin | RW | | | 1 |

Table 25. SMBusTable: OUTPUT CONTROL REGISTER

| Byte 2 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|-----------|----------------------------------|------|------|--------|---------|
| Bit 7 | 65/64 | DIF_15_En | Output Control overrides OE# pin | RW | Hi-Z | Enable | 1 |
| Bit 6 | 62/61 | DIF_14_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 5 | 60/59 | DIF_13_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 4 | 56/55 | DIF_12_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 3 | 53/52 | DIF_11_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 2 | 50/49 | DIF_10_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 1 | 47/46 | DIF_9_En | Output Control overrides OE# pin | RW | | | 1 |
| Bit 0 | 42/41 | DIF_8_En | Output Control overrides OE# pin | RW | | | 1 |

Table 26. SMBusTable: OUTPUT ENABLE PIN STATUS READBACK REGISTER

| Byte 3 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|---------|-----------------------------|------|-------------|--------------|-----------|
| Bit 7 | 57 | OE_RB12 | Real Time readback of OE#12 | R | OE# pin Low | OE# Pin High | Real time |
| Bit 6 | 54 | OE_RB11 | Real Time readback of OE#11 | R | | | Real time |
| Bit 5 | 51 | OE_RB10 | Real Time readback of OE#10 | R | | | Real time |
| Bit 4 | 48 | OE_RB9 | Real Time readback of OE#9 | R | | | Real time |
| Bit 3 | 43 | OE_RB8 | Real Time readback of OE#8 | R | | | Real time |
| Bit 2 | 40 | OE_RB7 | Real Time readback of OE#7 | R | | | Real time |
| Bit 1 | 37 | OE_RB6 | Real Time readback of OE#6 | R | | | Real time |
| Bit 0 | 34 | OE_RB5 | Real Time readback of OE#5 | R | | | Real time |

NB3N1900K

Table 27. SMBusTable: RESERVED REGISTER

| Byte 4 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|------|------------------|------|---|---|---------|
| Bit 7 | | | Reserved | | | | 0 |
| Bit 6 | | | Reserved | | | | 0 |
| Bit 5 | | | Reserved | | | | 0 |
| Bit 4 | | | Reserved | | | | 0 |
| Bit 3 | | | Reserved | | | | 0 |
| Bit 2 | | | Reserved | | | | 0 |
| Bit 1 | | | Reserved | | | | 0 |
| Bit 0 | | | Reserved | | | | 0 |

Table 28. SMBusTable: VENDOR & REVISION ID REGISTER

| Byte 5 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|------|------------------|------|---|---|---------|
| Bit 7 | - | RID3 | REVISION ID | R | - | | X |
| Bit 6 | - | RID2 | | R | | | X |
| Bit 5 | - | RID1 | | R | | | X |
| Bit 4 | - | RID0 | | R | | | X |
| Bit 3 | - | VID3 | VENDOR ID | R | - | - | 1 |
| Bit 2 | - | VID2 | | R | - | - | 1 |
| Bit 1 | - | VID1 | | R | - | - | 1 |
| Bit 0 | - | VID0 | | R | - | - | 1 |

Table 29. SMBusTable: DEVICE ID

| Byte 6 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|------|-------------------|------|-------------------------------------|---|---------|
| Bit 7 | - | | Device ID 7 (MSB) | R | Device ID is 120 decimal or 78 hex. | | 1 |
| Bit 6 | - | | Device ID 6 | R | | | 1 |
| Bit 5 | - | | Device ID 5 | R | | | 0 |
| Bit 4 | - | | Device ID 4 | R | | | 1 |
| Bit 3 | - | | Device ID 3 | R | | | 1 |
| Bit 2 | - | | Device ID 2 | R | | | 0 |
| Bit 1 | - | | Device ID 1 | R | | | 1 |
| Bit 0 | - | | Device ID 0 | R | | | 1 |

Table 30. SMBusTable: BYTE COUNT REGISTER

| Byte 7 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|------|---|------|---|---|---------|
| Bit 7 | | | Reserved | | | | 0 |
| Bit 6 | | | Reserved | | | | 0 |
| Bit 5 | | | Reserved | | | | 0 |
| Bit 4 | - | BC4 | Writing to this register configures how many bytes will be read back. | RW | Default value is 8 hex, so 9 bytes (0 to 8) will be read back by default. | | 0 |
| Bit 3 | - | BC3 | | RW | | | 1 |
| Bit 2 | - | BC2 | | RW | | | 0 |
| Bit 1 | - | BC1 | | RW | | | 0 |
| Bit 0 | - | BC0 | | RW | | | 0 |

NB3N1900K

Table 31. SMBusTable: RESERVED REGISTER

| Byte 8 | Pin # | Name | Control Function | Type | 0 | 1 | Default |
|--------|-------|------|------------------|------|---|---|---------|
| Bit 7 | | | Reserved | | | | 0 |
| Bit 6 | | | Reserved | | | | 0 |
| Bit 5 | | | Reserved | | | | 0 |
| Bit 4 | | | Reserved | | | | 0 |
| Bit 3 | | | Reserved | | | | 0 |
| Bit 2 | | | Reserved | | | | 0 |
| Bit 1 | | | Reserved | | | | 0 |
| Bit 0 | | | Reserved | | | | 0 |

| DIF Reference Clock | | |
|--|--------------------|----------|
| Common Recommendations for Differential Routing | Dimension or Value | Unit |
| L1 length, route as non-coupled 50 Ω trace (Figure 6) | 0.5 max | inch |
| L2 length, route as non-coupled 50 Ω trace (Figure 6) | 0.2 max | inch |
| L3 length, route as non-coupled 50 Ω trace (Figure 6) | 0.2 max | inch |
| Rs (Figure 6) | 33 | Ω |
| Rt (Figure 6) | 49.9 | Ω |

| Down Device Differential Routing | | |
|---|---------------------|------|
| L4 length, route as coupled microstrip 100 Ω differential trace (Figure 6) | 2 min to 16 max | inch |
| L4 length, route as coupled stripline 100 Ω differential trace (Figure 6) | 1.8 min to 14.4 max | inch |

| Differential Routing to PCI Express Connector | | |
|---|-----------------------|------|
| L4 length, route as coupled microstrip 100 Ω differential trace (Figure 7) | 0.25 to 14 max | inch |
| L4 length, route as coupled stripline 100 Ω differential trace (Figure 7) | 0.225 min to 12.6 max | inch |

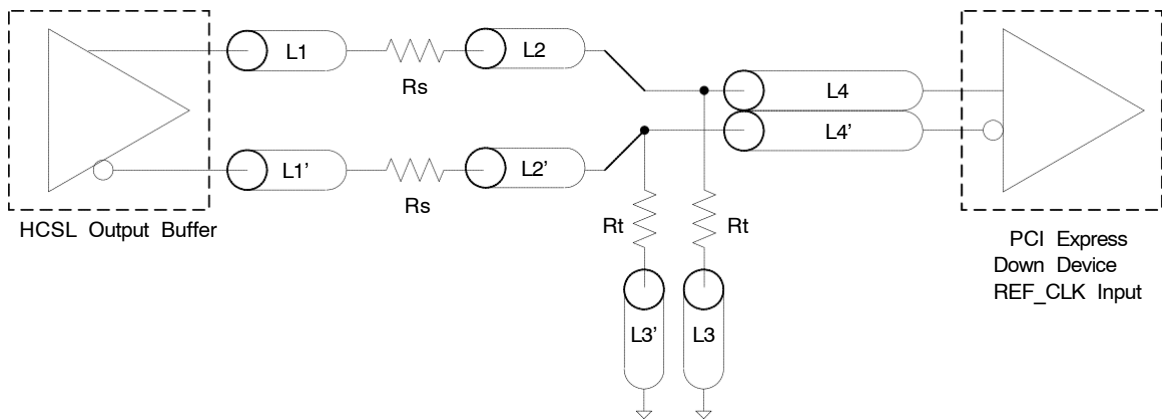


Figure 6. Down Device Routing

NB3N1900K

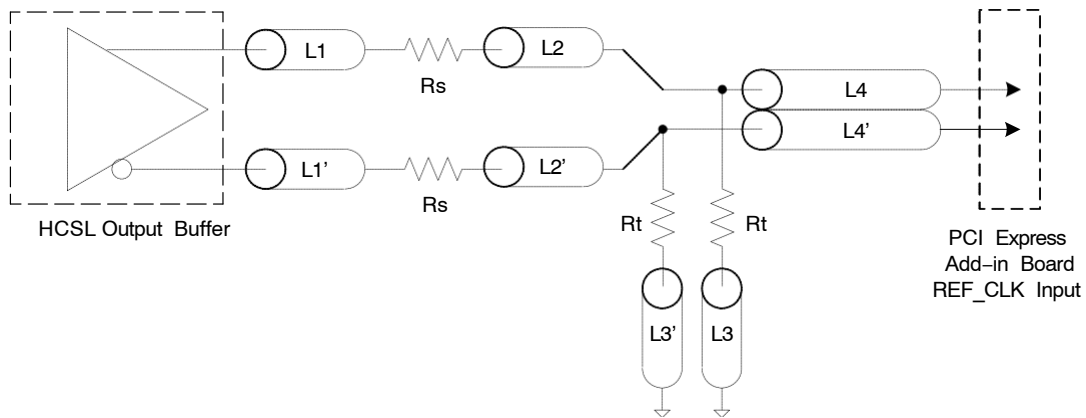


Figure 7. PCI Express Connector Routing

Table 32. ALTERNATIVE TERMINATION FOR LVDS AND OTHER COMMON DIFFERENTIAL SIGNALS (Figure 8)

| Vdiff (V) | Vpp (V) | Vcm (V) | R1 (Ω) | R2 (Ω) | R3 (Ω) | R4 (Ω) | Note |
|-----------|---------|---------|--------|--------|--------|--------|---------------|
| 0.45 | 0.22 | 1.08 | 33 | 150 | 100 | 100 | |
| 0.58 | 0.28 | 0.6 | 33 | 78.7 | 137 | 100 | |
| 0.60 | 0.3 | 1.2 | 33 | 174 | 140 | 100 | Standard LVDS |

R1a = R1b = R1
R2a = R2b = R2

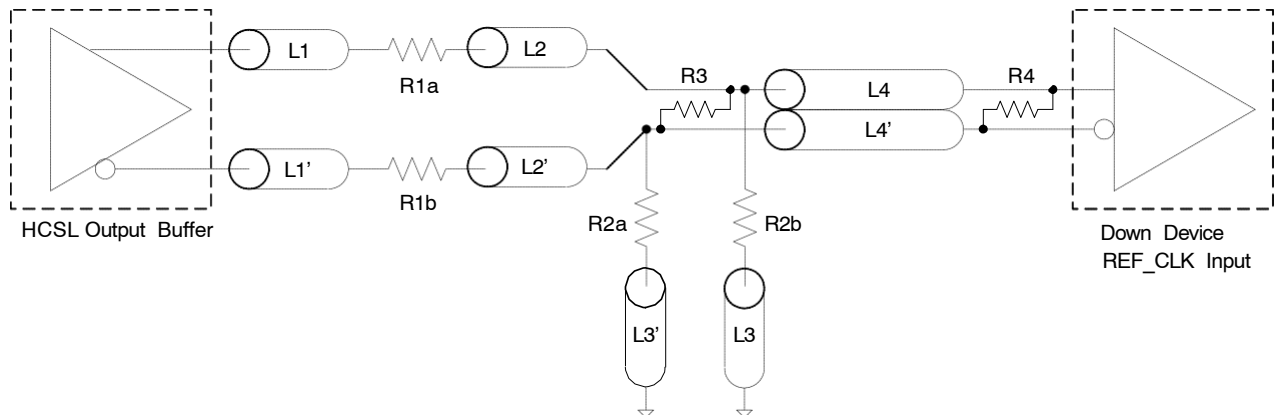


Figure 8. Alternate Termination for LVDS

Table 33. CABLE CONNECTED AC COUPLED APPLICATION (Figure 9)

| Component | Value | Note |
|-----------|---------|------|
| R5a, R5b | 8.2k 5% | |
| R6a, R6b | 1k 5% | |
| Cc | 0.1 μF | |
| Vcm | 0.350 V | |

NB3N1900K

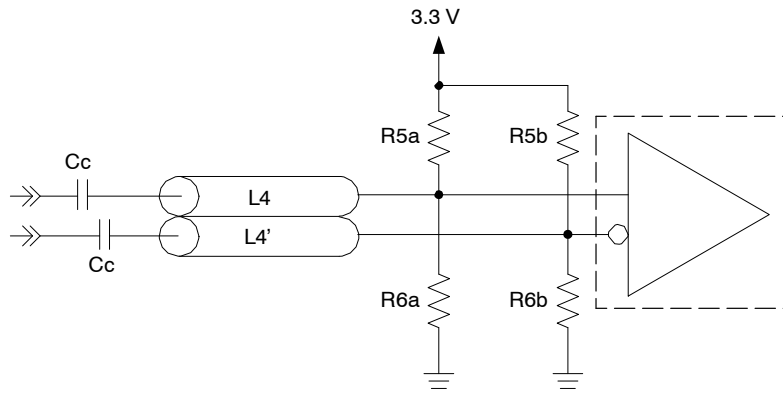


Figure 9. Cable-Connected AC Coupled Application

POWER FILTERING EXAMPLE

Ferrite Bead Power Filtering

Recommended ferrite bead filtering equivalent to the following:

600 Ω impedance at 100 MHz, $\leq 0.1 \Omega$ DCR max., ≥ 800 mA current rating.

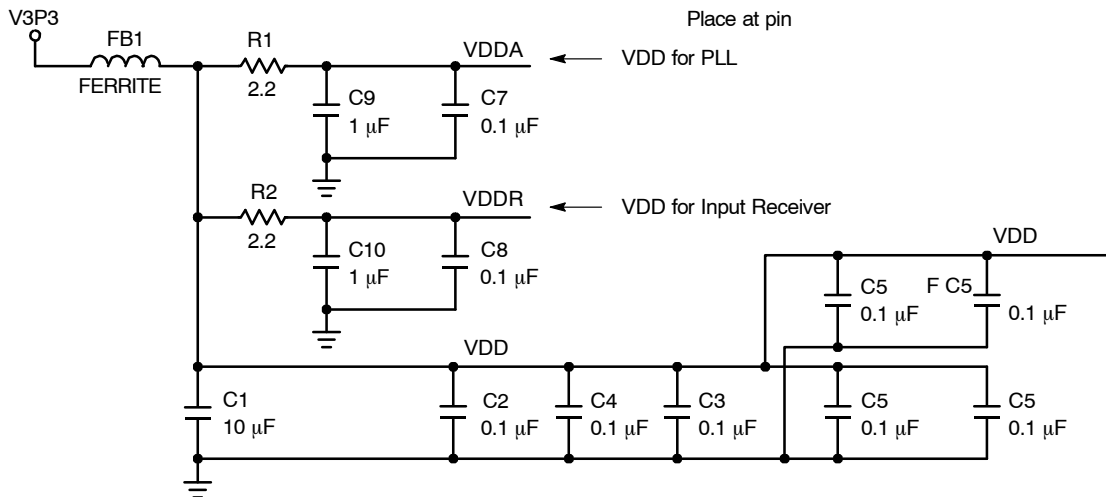


Figure 10. Schematic Example of the NB3N1900K Power Filtering

Table 34. ORDERING INFORMATION

| Device | Package | Shipping [†] |
|----------------|---------------------|-----------------------|
| NB3N1900KMNG | QFN-72 (Pb-Free) | 168 Units / Tray |
| NB3N1900KMNTXG | QFN-72 (Pb-Free) | 1000 / Tape & Reel |
| NB3N1900KMNTWG | QFN-72 (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 Specifications Brochure, [BRD8011/D](#).

NOTE: Pin 1 orientation for TWG Suffix is Quadrant 1, upper left; Pin 1 orientation for TXG Suffix is Quadrant 2, upper right

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

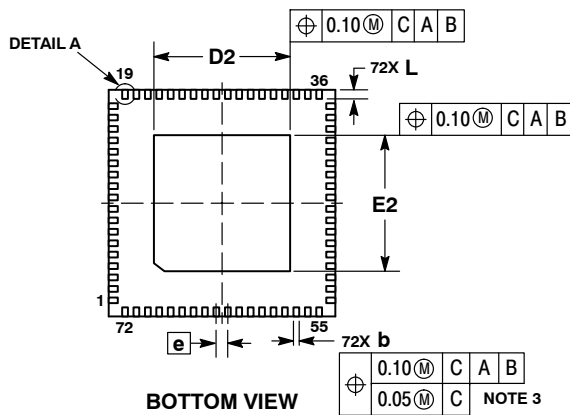
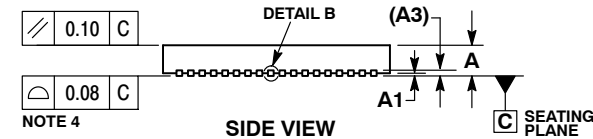
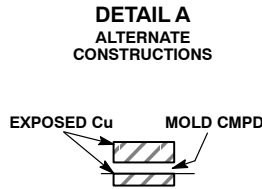
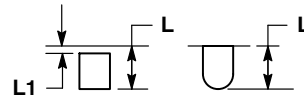
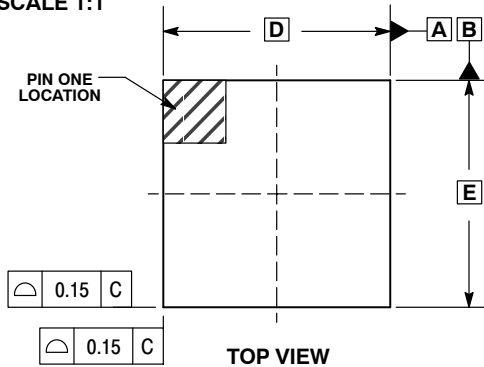
ON Semiconductor®



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CASE 485DK
ISSUE O

DATE 12 NOV 2013

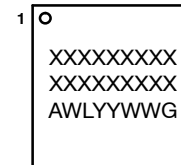


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25mm FROM THE 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 | 0.18 | 0.30 |
| D | 10.00 BSC | |
| D2 | 5.85 | 6.15 |
| E | 10.00 BSC | |
| E2 | 5.85 | 6.15 |
| e | 0.50 BSC | |
| L | 0.30 | 0.50 |
| L1 | 0.00 | 0.15 |

GENERIC MARKING DIAGRAM*

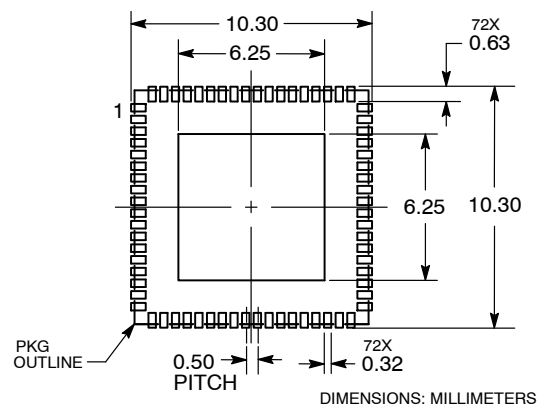


- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- YY = Year
- WW = Work Week
- G = Pb-Free Package

*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.

RECOMMENDED SOLDERING FOOTPRINT



| | | |
|------------------|-------------------|--|
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| DESCRIPTION: | QFN72 10x10, 0.5P | PAGE 1 OF 1 |

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