

NB2669A

Low Power, Reduced EMI Clock Synthesizer

The NB2669A is a versatile spread spectrum frequency modulator designed specifically for a wide range of clock frequencies. The NB2669A reduces ElectroMagnetic Interference (EMI) at the clock source, allowing system wide reduction of EMI of all clock dependent signals. The NB2669A allows significant system cost savings by reducing the number of circuit board layers, ferrite beads and shielding that are traditionally required to pass EMI regulations.

The NB2669A uses the most efficient and optimized modulation profile approved by the FCC and is implemented by using a proprietary all digital method.

The NB2669A modulates the output of a single PLL in order to “spread” the bandwidth of a synthesized clock, and more importantly, decreases the peak amplitudes of its harmonics. This results in significantly lower system EMI compared to the typical narrow band signal produced by oscillators and most frequency generators. Lowering EMI by increasing a signal’s bandwidth is called ‘spread spectrum clock generation’.

The NB2669A is targeted towards all portable devices with very low power requirements like MP3 players and digital still cameras.

Features

- Generates an EMI Optimized Clocking Signal at the Output
- Integrated Loop Filter Components
- Operates with a 3.3 V / 2.5 V Supply
- Operating Current less than 4.0 mA
- Low Power CMOS Design
- Input Frequency Range: 6.0 MHz to 12 MHz for 2.5 V
Input Frequency Range: 6.0 MHz to 13 MHz for 3.3 V
- Generates a 1X Low EMI Spread Spectrum clock of the Input Frequency
- Frequency Deviation $\pm 1\%$ @ 10 MHz
- Available in TSOP-6 Package (TSOT-23-6)
- Pb-Free Package is Available



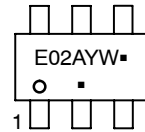
ON Semiconductor®

<http://onsemi.com>

MARKING DIAGRAM*



TSOP-6
(TSOT-23-6)
SN SUFFIX
CASE 318G



E02 = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb-Free Package

(Note: Microdot may be in either location)

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

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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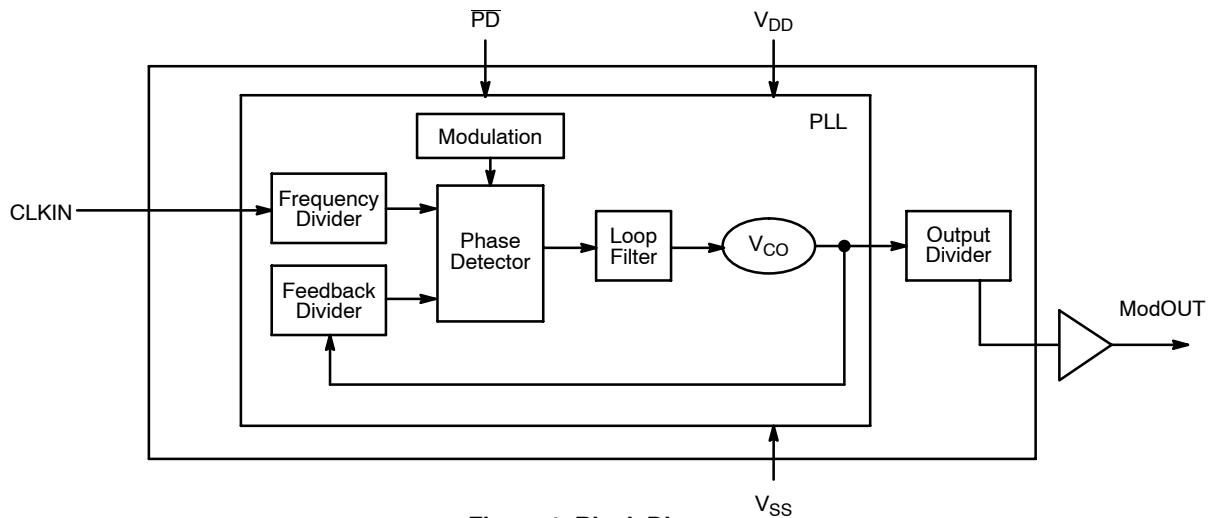


Figure 1. Block Diagram

Table 1. KEY SPECIFICATIONS

| Description | Specification |
|--------------------------|--|
| Supply Voltages | $V_{DD} = 3.3 \text{ V} / 2.5 \text{ V}$ |
| Frequency Range | For 2.5 V Supply: $6 \text{ MHz} < \text{CLKIN} < 12 \text{ MHz}$ For 3.3 V Supply: $6 \text{ MHz} < \text{CLKIN} < 13 \text{ MHz}$ |
| Cycle-to-Cycle Jitter | 200 ps (maximum) |
| Output Duty Cycle | 45/55% (worst case) |
| Modulation Rate Equation | $F_{IN}/256$ |
| Frequency Deviation | $\pm 1\% @ 10 \text{ MHz}$ |

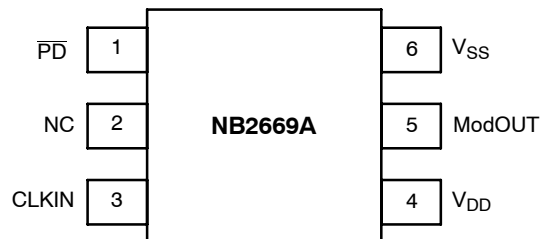


Figure 2. Pin Configuration

Table 2. PIN DESCRIPTION

| Pin # | Pin Name | Type | Description |
|-------|----------|------|--|
| 1 | PD | I | Powerdown control pin. Pull low to enable Powerdown mode. Connect to V_{DD} if not used. |
| 2 | NC | | No connect. |
| 3 | CLKIN | I | External reference frequency input. |
| 4 | V_{DD} | P | Power supply for the entire chip. |
| 5 | ModOUT | O | Spread spectrum clock output. |
| 6 | V_{SS} | P | Ground connection. |

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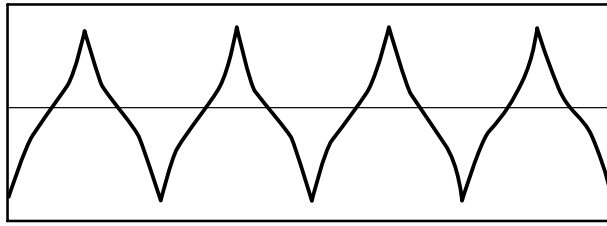


Figure 3. Modulation Profile

Table 3. MAXIMUM RATINGS

| Symbol | Description | Rating | Unit |
|------------------|--|--------------|------|
| V_{DD}, V_{IN} | Voltage on any pin with respect to Ground | 0.5 to + 7.0 | V |
| T_{STG} | Storage Temperature | -65 to +125 | °C |
| T_A | Operating Temperature | 0 to 70 | °C |
| T_s | Max. Soldering Temperature (10 sec) | 260 | °C |
| T_J | Junction Temperature | 150 | °C |
| T_{DV} | Static Discharge Voltage (As per MIL-STD-883, Method 3015) | 2 | kV |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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Table 4. DC ELECTRICAL CHARACTERISTICS FOR 2.5 V SUPPLY (Test Conditions: All parameters are measured at room temperature 25°C)

| Symbol | Description | Min | Typ | Max | Unit |
|------------------|---|-----------|-----|-----------------------|------|
| V _{IL} | Input LOW Voltage | GND – 0.3 | | 0.8 | V |
| V _{IH} | Input HIGH Voltage | 2.0 | | V _{DD} + 0.3 | V |
| I _{IL} | Input LOW Current | | | –35 | μA |
| I _{IH} | Input HIGH Current | | | 35 | μA |
| I _{XOL} | XOUT Output LOW Current (@ 0.5 V, V _{DD} = 2.5 V) | | 3.0 | | mA |
| I _{XOH} | XOUT Output HIGH Current (@ 1.8 V, V _{DD} = 2.5 V) | | 3.0 | | mA |
| V _{OL} | Output LOW Voltage (V _{DD} = 2.5 V, I _{OL} = 8.0 mA) | | | 0.6 | V |
| V _{OH} | Output HIGH Voltage (V _{DD} = 2.5 V, I _{OH} = 8.0 mA) | 1.8 | | | V |
| I _{DD} | Static Supply Current (Note 1) | | | 10 | μA |
| I _{CC} | Dynamic Supply Current (2.5 V, 10 MHz, and No Load) | | 2.0 | | mA |
| V _{DD} | Operating Voltage | 2.375 | 2.5 | 2.625 | V |
| t _{ON} | PLL first locked cycle time (Note 2) | | | 5.0 | mS |
| Z _{OUT} | Clock Output Impedance | | 50 | | Ω |

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 lpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

1. XIN/CLKIN pin and \overline{PD} pin are pulled low.
2. V_{DD} and CLKIN input are stable, \overline{PD} pin is made high from low.

Table 5. AC ELECTRICAL CHARACTERISTICS FOR 2.5 V SUPPLY

| Symbol | Description | Min | Typ | Max | Unit |
|--------------------------|--|-----|-----|----------------|------|
| CLKIN | Input Frequency | 6.0 | | 12 | MHz |
| ModOUT | Output Frequency | 6.0 | | 12 | MHz |
| f _d | Frequency Deviation Input Frequency = 6.0 MHz Input Frequency = 12 MHz | | | ±1.48 ±0.79 | % |
| t _{LH} (Note 3) | Output Rise Time (measured at 0.7 V to 1.7 V) | 0.8 | 1.5 | 1.7 | ns |
| t _{HL} (Note 3) | Output Fall Time (measured at 1.7 V to 0.7 V) | 0.5 | 1.0 | 1.2 | ns |
| t _{JC} | Jitter (Cycle-to-Cycle) | | | 200 | ps |
| t _D | Output Duty Cycle | 45 | 50 | 55 | % |

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 lpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

3. t_{LH} and t_{HL} are measured at capacitive load of 15 pF.

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Table 6. DC ELECTRICAL CHARACTERISTICS FOR 3.3 V SUPPLY (Test Conditions: All parameters are measured at room temperature 25°C)

| Symbol | Description | Min | Typ | Max | Unit |
|------------------|---|-----------|-----|-----------------------|------|
| V _{IL} | Input LOW Voltage | GND – 0.3 | | 0.8 | V |
| V _{IH} | Input HIGH Voltage | 2.0 | | V _{DD} + 0.3 | V |
| I _{IL} | Input LOW Current | | | –35 | μA |
| I _{IH} | Input HIGH Current | | | 35 | μA |
| I _{XOL} | XOUT Output LOW Current (@ 0.4 V, V _{DD} = 3.3 V) | | 3.0 | | mA |
| I _{XOH} | XOUT Output HIGH Current (@ 2.5 V, V _{DD} = 3.3 V) | | 3.0 | | mA |
| V _{OL} | Output LOW Voltage (V _{DD} = 3.3 V, I _{OL} = 8.0 mA) | | | 0.4 | V |
| V _{OH} | Output HIGH Voltage (V _{DD} = 3.3 V, I _{OH} = 8.0 mA) | 2.5 | | | V |
| I _{DD} | Static Supply Current (Note 4) | | | 10 | μA |
| I _{CC} | Dynamic Supply Current (3.3 V, 10 MHz, and No Load) | | 2.5 | | mA |
| V _{DD} | Operating Voltage | 2.7 | 3.3 | 3.6 | V |
| t _{ON} | PLL first locked cycle time (Note 5) | | | 5.0 | mS |
| Z _{OUT} | Clock Output Impedance | | 45 | | Ω |

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 lpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

4. XIN/CLKIN pin and $\overline{\text{PD}}$ pin are pulled low.
5. V_{DD} and CLKIN input are stable, $\overline{\text{PD}}$ pin is made high from low.

Table 7. AC ELECTRICAL CHARACTERISTICS FOR 3.3 V SUPPLY

| Symbol | Description | Min | Typ | Max | Unit |
|--------------------------|--|-----|-----|----------------|------|
| CLKIN | Input Frequency | 6 | | 13 | MHz |
| ModOUT | Output Frequency | 6 | | 13 | MHz |
| f _d | Frequency Deviation Input Frequency = 6.0 MHz Input Frequency = 13 MHz | | | ±1.48 ±0.74 | % |
| t _{LH} (Note 6) | Output Rise Time (measured at 0.8 V to 2.0 V) | 0.5 | 1.3 | 1.5 | ns |
| t _{HL} (Note 6) | Output Fall Time (measured at 2.0 V to 0.8 V) | 0.4 | 0.9 | 1.1 | ns |
| t _{JC} | Jitter (Cycle-to-Cycle) | | | 200 | ps |
| t _D | Output Duty Cycle | 45 | 50 | 55 | % |

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 lpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

6. t_{LH} and t_{HL} are measured at capacitive load of 15 pF.

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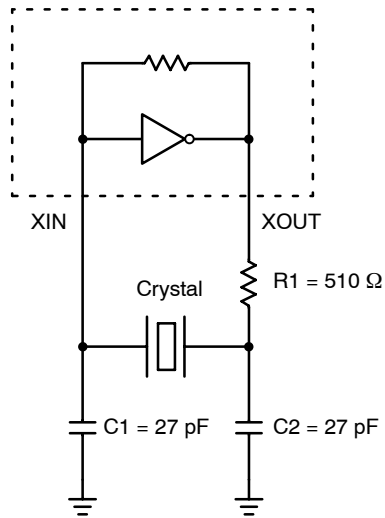


Figure 4. Typical Crystal Oscillator Circuit

Table 8. TYPICAL CRYSTAL SPECIFICATIONS

| Fundamental AT Cut Parallel Resonant Crystal | |
|--|---------------------------|
| Nominal Frequency | 14.31818 MHz |
| Frequency Tolerance | ±50 ppm or better at 25°C |
| Operating Temperature Range | -25°C to +85°C |
| Storage Temperature | -40°C to +85°C |
| Load Capacitance | 18 pF |
| Shunt Capacitance | 7 pF Maximum |
| ESR | 25 Ω |

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ORDERING INFORMATION

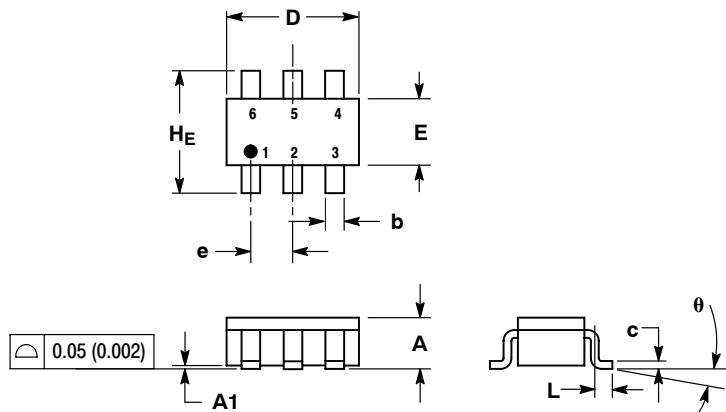
| Device | Marking | Temperature Range | Package | Shipping† | Availability |
|--------------|---------|-------------------|------------------------------------|------------------|---|
| NB2669ASNR2 | E02 | 0°C – 70°C | TSOP-6 (TSOT-23-6) | 2500 Tape & Reel | <i>Now</i> |
| NB2669ASNR2G | E02 | 0°C – 70°C | TSOP-6 (TSOT-23-6) (Pb-Free) | 2500 Tape & Reel | <i>Contact Sales Representative</i> |

†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.

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PACKAGE DIMENSIONS

TSOP-6 CASE 318G-02 ISSUE S

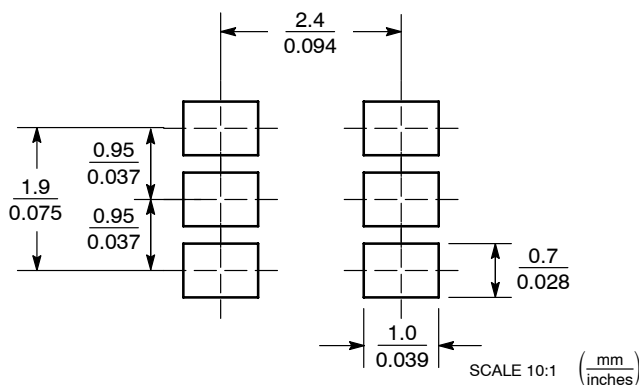


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | MILLIMETERS | | | INCHES | | |
|----------|-------------|------|------|--------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.90 | 1.00 | 1.10 | 0.035 | 0.039 | 0.043 |
| A1 | 0.01 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| b | 0.25 | 0.38 | 0.50 | 0.010 | 0.014 | 0.020 |
| c | 0.10 | 0.18 | 0.26 | 0.004 | 0.007 | 0.010 |
| D | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| E | 1.30 | 1.50 | 1.70 | 0.051 | 0.059 | 0.067 |
| e | 0.85 | 0.95 | 1.05 | 0.034 | 0.037 | 0.041 |
| L | 0.20 | 0.40 | 0.60 | 0.008 | 0.016 | 0.024 |
| HE | 2.50 | 2.75 | 3.00 | 0.099 | 0.108 | 0.118 |
| θ | 0° | - | 10° | 0° | - | 10° |

SOLDERING FOOTPRINT*



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

This product utilizes US Patent #6,646,463 Impedance Emulator Patent issued to Alliance Semiconductor, Dated 11-11-2003.

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