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General Description

The SLG3NB3331 uses a 25 MHz Reference Crystal to provide one 32.768 kHz clock output and three 25 MHz clock outputs. The part supports a non-rechargeable coin cell battery (ex. CR2032) as the power source for the ultra low power Hibernate mode operation.
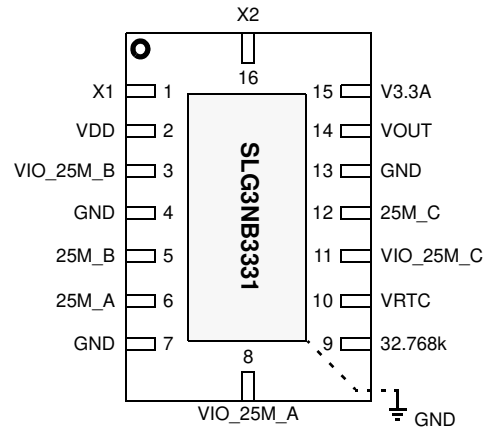
Features

- 32.768 kHz GreenCLK technology for RTC
- Scalable VIO
- Improved performance over temperature
- Supports Industrial temperature range
- Smaller package and layout foot print
- 16-pin TQFN: 2 x 3 x 0.75 mm, 0.4 mm pitch
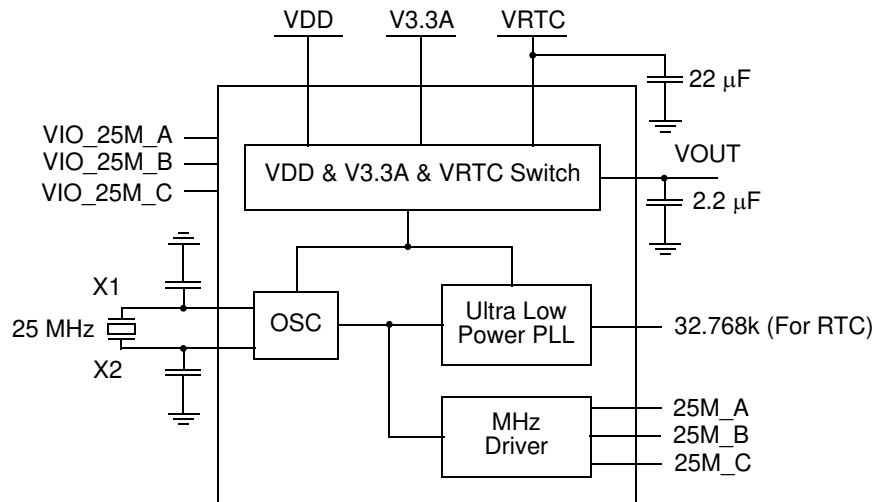- Pb-Free / Halogen-Free / RoHS compliant

Output Summary

- 1x 32.768 kHz clock output (1.8 μA in Hibernate Mode)
- 3x 25 MHz clock outputs (2.5 mA in Active Mode)

Pin Configuration

16-pin TQFN
(Top View)

Block Diagram

Pin Description

Pin #	Pin Name	Type[1]	Pin Description[2]
1	X1	I	**Crystal Interface:** 25 MHz, OSC input
2	VDD	PWR	**Power Supply:** 3.3 V for Active Mode
3	VIO_25M_B	PWR	**Power Supply:** Power for 25M_B output
4	GND	GND	**Ground**
5	25M_B	O, SE	**Clock Output:** 25 MHz output (Stop by $V_{IO\_25M\_B}$)
6	25M_A	O, SE	**Clock Output:** 25 MHz output (Stop by $V_{IO\_25M\_A}$)
7	GND	GND	**Ground**
8	VIO_25M_A	PWR	**Power Supply:** Power for 25M_A output
9	32.768k	O, SE	**Clock Output:** 32.768 kHz output for RTC (Free Running)
10	VRTC	PWR	**Power Supply:** Power for 32.768 kHz output. Connect to a non-rechargeable coin cell battery [3] (ex. CR2032) . 32.768 kHz (32.768k) clock will draw power from this pin during Hibernate Mode (when $V_{3.3A} = 0$ V and $V_{DD} = 0$ V). 22 μF decoupling capacitor is recommended.
11	VIO_25M_C	PWR	**Power Supply:** Power for 25M_C output
12	25M_C	O, SE	**Clock Output:** 25 MHz output (Stop by $V_{IO\_25M\_C}$)
13	GND	GND	**Ground**
14	VOUT	PWR	**Power Output:** 2.2 μF decoupling capacitor is recommended.
15	V3.3A	PWR	**Power Supply:** Power for 32.768 kHz output. 32.768 kHz (32.768k) clock will draw power from this pin during Active and/or Suspend Mode (when $V_{3.3A} = 3.3$ V).
16	X2	O, SE	**Crystal Interface:** 25 MHz, OSC output
Exposed Bottom Pad	GND	GND	**Ground**

Notes:
1. Type Definitions
   - PWR: power
   - GND: ground
   - I: input
   - O: output
   - SE: single ended signal
2. It is recommended that all Power Supply pins have a decoupling capacitor attached (0.1 μF minimum).
3. When CR coin cell battery is used, place a 301 Ω resistor between the coin cell and the decoupling capacitor to meet the UL safety requirement.

Absolute Maximum Ratings

Parameter	Description	Min.	Max.	Unit
V_{DD}	Voltage on VDD pin relative to GND	-0.3	4.2	V
$V_{3.3A}$	Voltage on V3.3A pin relative to GND	-0.3	4.2	V
V_{RTC}	Voltage on VRTC pin relative to GND	-0.3	4.2	V
T_S	Storage Temperature	-65	150	°C
ESD_{HBM}	ESD Protection (Human Body Model)	2000	--	V
MSL	Moisture Sensitivity Level	1		

Note: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Recommended Operating Temperature

Parameter	Description	Min.	Max.	Unit
T_O	Operating Temperature	-40	85	°C

Recommended 25 MHz Reference Crystal Specifications

Description	Conditions	Min	Typ	Max	Unit
Initial Frequency		--	25	--	MHz
Frequency Tolerance	@ 25 °C	--	--	±10	ppm
Frequency Stability over Operating Temperature Range	@ -10 °C to 70 °C	--	--	±10	ppm
Frequency Aging	per year	--	--	1[1]	ppm
Drive Level		--	--	100	μW
Crystal Load Capacitance	Parallel Resonance	8			pF
Fundamental Mode AT Cut Crystal		--	--	--	

Notes:
  1. Vendor Specific: Frequency aging may be different per crystal used. Check with crystal vendor for specific value. SLG3NB3331 outputs will track the crystal frequency aging as stated in other sections of this datasheet.

32.768 kHz Clock Output Characteristics (32.768k in Hibernate/Suspend Mode)

T_A = 25 °C, V_{RTC} = 2.9 V (unless otherwise stated)

Symbol	Description	Conditions	Min	Typ	Max	Unit
32F$_{INI}$	Initial Frequency		--	32.768	--	kHz
32F$_{ERRI}$[1]	Frequency Error at Room Temperature	@ 25 °C	--	±17	±23.0	ppm
			--	±1.5	±2.0	sec/day
32F$_{ERRT}$[1]	Frequency Error over Operating Temperature Range	@ -10 °C to 70 °C	--	±24.2	±34.5	ppm
			--	±2.1	±3.0	sec/day
32F$_{AGE}$	Frequency Aging	per year	Reference Crystal[2]			ppm
DC	Duty Cycle	0.5 V	45	50	55	%
V$_{OH}$	Output Voltage HIGH		0.8	1.0	1.2	V
V$_{OL}$	Output Voltage LOW		--	--	0.3	V

Notes:
1. a. Respective values for this parameter is guaranteed only when the recommended 25 MHz Reference Crystal is used, and the values take into account the crystal variations.
   b. Assumes crystal ppm spec is a σ or Gaussian distribution.
   c. Assumes crystal load capacitors are within ±5% of ideal value.
2. This parameter tracks Reference Crystal characteristics.

32.768 kHz Clock Output Characteristics (32.768k in Active Mode)

T_A = 25 °C, V_{RTC} = 2.9 V, V_{DD} = 3.3 V (unless otherwise stated)

Symbol	Description	Conditions	Min	Typ	Max	Unit
32F$_{INI}$	Initial Frequency		--	32.768	--	kHz
32F$_{ERRI}$	Frequency Error at Room Temperature	@ 25 °C	Reference Crystal[1]			ppm
32F$_{ERRT}$	Frequency Error over Operating Temperature Range	@ -10 °C to 70 °C	Reference Crystal[1]			ppm
32F$_{AGE}$	Frequency Aging	per year	Reference Crystal[1]			ppm
DC	Duty Cycle	0.5 V	45	50	55	%
V$_{OH}$	Output Voltage HIGH		0.8	1.0	1.2	V
V$_{OL}$	Output Voltage LOW		--	--	0.3	V

Notes:
1. This parameter tracks Reference Crystal characteristics.

25 MHz Clock Output Characteristics (25M_A, 25M_B, and 25M_C)

T_A = 25 °C, V_{RTC} = 2.9 V, $V_{3.3A}$ = 3.3 V, V_{DD} = 3.3 V (unless otherwise stated

Symbol	Description	Conditions	Min	Typ	Max	Unit
F_{INI}	Initial Frequency		--	25	--	MHz
F_{ERRI}	Frequency Error at Room Temperature	@ 25 °C	Reference Crystal[1]			ppm
F_{ERRT}	Frequency Error over Operating Temperature Range	@ -10 °C to 70 °C	Reference Crystal[1]			ppm
F_{AGE}	Frequency Aging	per year	Reference Crystal[1]			ppm
DC	Duty Cycle	0.5 x V_{IO}	45	50	55	%
V_{OH}	Output Voltage HIGH	I_{OH} = 1 mA	0.8 x V_{IO}	--	--	V
V_{OL}	Output Voltage LOW	I_{OL} = -1 mA	--	--	0.2 x V_{IO}	V

Notes:
1. This parameter tracks Reference Crystal characteristics.

Power Supply Electrical Specifications (VDD, V3.3A, VRTC, and VIO)

T_A = 25 °C

Symbol	Description	Conditions	Min	Typ	Max	Unit
V_{DD}	Operating Voltage for VDD	Active Mode	3.0	3.3	3.6	V
$V_{3.3A}$	Operating Voltage for V3.3A	Active/Suspend Mode	3.0	3.3	3.6	V
V_{RTC}	Operating Voltage for VRTC	In any Mode	2.3	2.9	3.0	V
$V_{IO\_25M\_A}$	Operating Voltage for VIO_25M_A	Active Mode	3.0	3.3	3.6	V
$V_{IO\_25M\_B}$	Operating Voltage for VIO_25M_B	Active Mode	0.9975	1.05 [2]	1.575	V
$V_{IO\_25M\_C}$	Operating Voltage for VIO_25M_C	Active Mode	3.0	3.3	3.6	V
I_{VRTC}[1]	V_{RTC} current consumption during Hibernate Mode	V_{DD} = 0 V, $V_{3.3A}$ = 0 V, V_{RTC} = 2.9 V	--	1.8	--	μA
$I_{V3.3A}$[1]	$V_{3.3A}$ current consumption during Active and/or Suspend Mode	V_{DD} = 3.3 V or 0 V, $V_{3.3A}$ = 3.3 V, V_{RTC} = 2.9 V	--	7	--	μA
I_{VDD}[1]	V_{DD} current consumption during Active Mode (all outputs active)	V_{DD} = 3.3 V, $V_{3.3A}$ = 3.3 V, V_{RTC} = 2.9 V	--	2.5	--	mA
V_{OUT}	VOUT Output Voltage Level	Hibernate Mode	--	V_{RTC} - 0.5	--	V
		Active/Suspend Mode	--	$V_{3.3A}$ - 0.5	--	V
I_{OUT}[1]	Current Output on VOUT	In any Mode	--	2.5	--	μA

Notes:
 1. Average current depends on application and output load.
 2. Recommended as the clock source for the Intel PCH or ICH.

Full State Table: Power Modes, Power Supply & Output Controls per Clock Output Functions

Power Mode (Power State)	Power Supply[1] & Output Control[2]						Clock Output & V_{OUT} (typ)					Current (typ)		
	V_{RTC}	$V_{3.3A}$	V_{DD}	$V_{IO\_25M\_A}$	$V_{IO\_25M\_B}$	$V_{IO\_25M\_C}$	32.768k	25M_A	25M_B	25M_C	V_{OUT} [V]	I_{VRTC} [μA]	$I_{V3.3A}$ [μA]	I_{VDD} [mA]
Hibernate Mode	H	L[4]	L[4]	L[4]	L[4]	L[4]	ON	OFF	OFF	OFF	V_{RTC} - 0.5	1.8	0	0
Suspend Mode	H	H	L[4]	L[4]	L[4]	L[4]	ON	OFF	OFF	OFF	$V_{3.3A}$ - 0.5	0	7	0
Active Mode	H	H	H	L	V	V	ON	OFF	_[3]	_[3]	$V_{3.3A}$ - 0.5	0	0	2.5
				H				ON						
				V	L	V	ON	_[3]	OFF	_[3]				
					H				ON					
				V	V	L	ON	_[3]	_[3]	OFF				
						H				ON				

Notes:
1. Refer to the Power Supply Electrical Specifications (VDD, V3.3A, VRTC, and VIO) for respective voltage ranges.
   Please note that (V_{RTC} = 2.9 V & $V_{3.3A}$ = 0 V & V_{DD} = 3.3 V) is an illegal condition.
2. States
   • L: Grounded
   • H: Powered
   • V: Valid, must be L or H
   • X: Don't care
3. This output could be ON or OFF depending on the associated V_{IO}.
   • ON: when V_{IO} = H
   • OFF: when V_{IO} = L
4. May be floated.

VRTC Battery Recommendations

Non-rechargeable Coin Cell Battery

Battery Part Number	SLG3NB3331 32.768 kHz Lifetime[1] [years]	Capacity[2] [mAH]	Voltage Range[2] [V]			Max Discharge Current[2] [mA]		Dimensions[2] [mm]	
			95%	50%	5%	Constant	Peak	Dia.	Height
CR2032[3]	5.8 to 6.4	220 to 240	3	2.9	2.3	4 to 6	20	20.0	3.2

Notes:
1. Lifetime calculation assumes 4.3 μA (typ) current consumption for 32.768 kHz (RTC) operation, where 4.3 μA (typ) is the sum of 1.8 μA (typ), consumed by the SLG3NB3331 to provide RTC clock, and 2.5 μA (typ), consumed by the RTC logic device (provided via VOUT pin).
2. Exact values depend on the battery manufacturer (Refer to the battery datasheet for details)
3. Lithium Manganese Dioxide non-rechargeable battery

Package Top Marking System Definition

Part Code ——— XXXXX

Datecode ——— DD LLL ——— Lot

COO ——— CRR ——— Revision

○
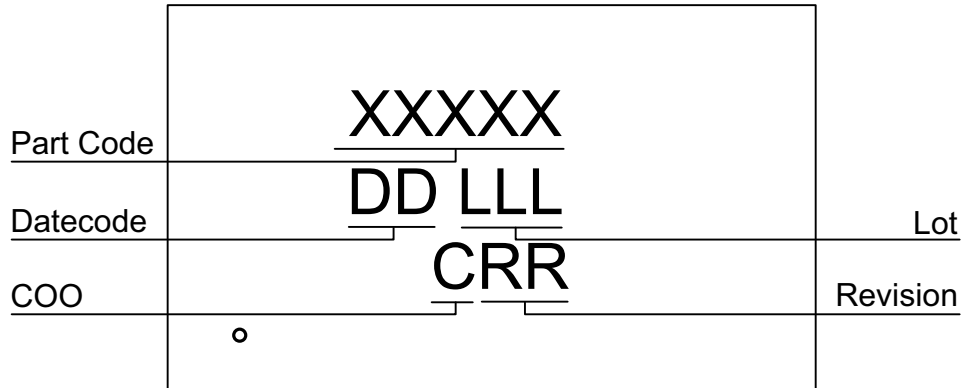
XXXXX – Part ID Field: identifies the specific device configuration
DD – Date Code Field: Coded date of manufacture
LLL – Lot Code: Designates Lot #
C – Assembly Site/COO: Specifies Assembly Site/Country of Origin
RR – Revision Code: Device Revision

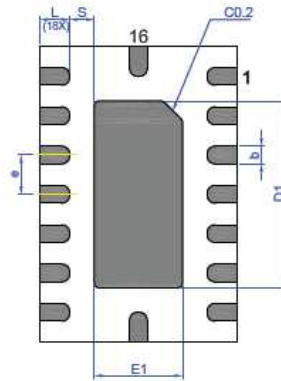**Package Drawing and Dimensions**

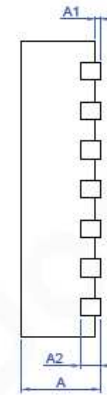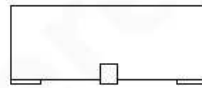**16 Lead TQFN Package**
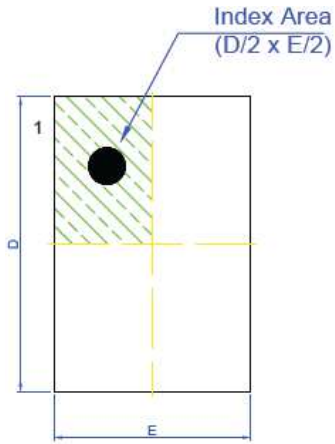
TOP VIEW

BOTTOM VIEW

SIDE VIEW

VIEW "A"

Unit: mm

| Symbol	Min	Nom.	Max	Symbol	Min	Nom.	Max
A	0.700	0.750	0.800	D	2.950	3.000	3.050
A1	0.000	-	0.050	E	1.950	2.000	2.050
A2		0.203 REF		D1	1.85	1.90	1.95
b	0.13	0.18	0.23	E1	0.85	0.90	0.95
e		0.400 BSC		L	0.25	0.30	0.35
S	0.18	-	-				

Tape and Reel Specifications

Package Type	# of Pins	Nominal Package Size [mm]	Max Units		Reel & Hub Size [mm]	Leader (min)		Trailer (min)		Tape Width [mm]	Part Pitch [mm]
			per Reel	per Box		Pockets	Length [mm]	Pockets	Length [mm]		
TQFN 16L Green	16	2 x 3 x 0.75	3,000	3,000	178 / 60	42	168	42	168	8	4

Carrier Tape Drawing and Dimensions

Package Type	Pocket BTM Length	Pocket BTM Width	Pocket Depth	Index Hole Pitch	Pocket Pitch	Index Hole Diameter	Index Hole to Tape Edge	Index Hole to Pocket Center	Tape Width
	A0	B0	K0	P0	P1	D0	E	F	W
TQFN 16L Green	2.25	3.3	1.1	4	4	1.55	1.75	3.5	8

A-A SECTION

B-B SECTION

Refer to EIA-481 specification
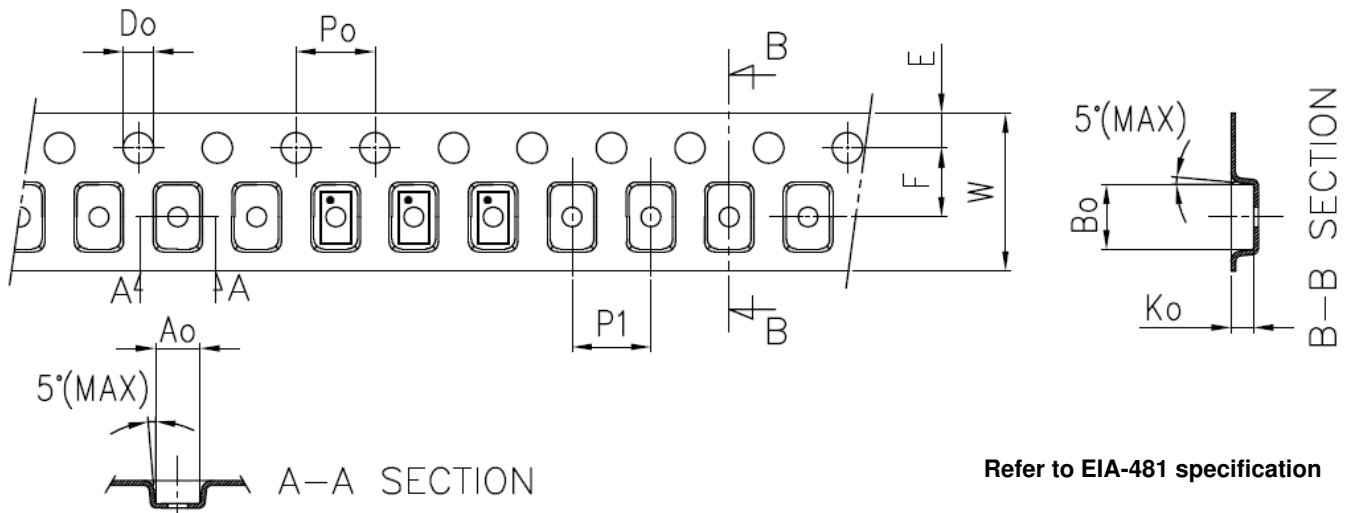
Recommended Reflow Soldering Profile

Please see IPC/JEDEC J-STD-020: latest revision for reflow profile based on package volume of 4.50 mm^3 (nominal). More information can be found at www.jedec.org.

Ordering Information

Part Number	Type	Production Flow
SLG3NB3331V	16-pin TQFN	Extended Commercial, -40 °C to 85 °C
SLG3NB3331VTR	16-pin TQFN (Tape and Reel)	Extended Commercial, -40 °C to 85 °C

Silego Website & Support

Silego Technology Website

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For more information regarding Silego Green products, please visit:

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http://greenpak2.silego.com/	http://greenfet2.silego.com/	http://greenclk2.silego.com/
http://greenpak3.silego.com/	http://greenfet3.silego.com/	http://greenclk3.silego.com/

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Datasheets and errata, application notes and example designs, user guides, and hardware support documents and the latest software releases are available at the Silego website or can be requested directly at info@silego.com.

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