Crystal Bridge to the Future

Oven Controlled Crystal Oscillator (OCXO)

■NH37M28LN Data Sheet

Main Application

- Base stations for system mobile communications (5G CU, 4G BBU)
- IEEE1588, Synchronous Ethernet clock (SyncE)
- Optical transmission systems Stratum 3E
- Frequency synthesizer
- GNSS-DO
- Timing and synchronous measuring equipment
- High resolution audio clock

RoHS Compliant
Directive 2011/65/EU
Directive (EU) 2015/863

Features

- Low height and excellent temperature characteristics.
- Supports wide temperature range.
- Excellent holdover characteristics.
- Frequency adjustment by digital control method (I^2C Control). (Voltage control method (V_{cont}) is also possible.)
- Dimension : 37 × 28 × 12.7 mm

1. Item : Oven Controlled Crystal Oscillator (OCXO)

2. Type : NH37M28LN

3. Nominal Frequency: 10 MHz

4. NDK Spec. No. : NSA3650A, NSA3649A
   Please refer to sections 5 and 6 as the ratings and electrical specifications change depending on NDK spec. No.

5. Rating

Parameters		Sym.	Spec.				Notes
			Min.	Typ.	Max.	Units	
5.1	Nominal Frequency	f_{nom}		10		MHz	
5.2	Supply Voltage	V_{CC}	+4.75	+5.0	+5.25	V	
5.3	Control Voltage	V_{cont}	0	+2.5	+5.0	V	NSA3650A
			0x800000	0x000000	0x7FFFFF	-	NSA3649A 2's complement. In detail, refer to the section 7
5.4	Load	C_L	-	15	-	pF	
5.5	Operating Temperature Range	T_{opr}	-40	-	+85	°C	
5.6	Storage Temperature Range	T_{str}	-40	-	+85	°C	

6. Electrical Specifications
   Unless otherwise specified, meaning condition. T = +25 °C, V_{CC} = +5.0 V, V_{cont} = Center, C_L = 15 pF

Parameters		Sym.	Spec.				Conditions
			Min.	Typ.	Max.	Units	
6.1	Power Consumption						
	6.1.1 During Warm-up	P_{CC}	-	3.0	3.5	W	
	6.1.2 Steady State	P_{CC}	-	-	1.6	W	T = +25 °C
6.2	Frequency Stability						
	6.2.1 Frequency Tolerance	$\Delta f/f_{nom}$	-25	-	+25	ppb	(*1)
	6.2.2 Frequency/ Temperature Characteristics	$\Delta f/f$	-0.5	-	+0.5	ppb	at Operating Temperature Range (*2) NSC5211A, NSC5212A
	6.2.3 Frequency/Voltage Coefficient	$\Delta f/f$	-0.2	-	+0.2	ppb	V_{CC} = +5.0 V ±5 % (*2)
	6.2.4 Long-term Frequency stability	$\Delta f/f$	-0.2	-	+0.2	ppb	1 day (*3)
			-50	-	+50	ppb	1 year (*3)
	6.2.5 Stabilization Time	-	-	-	5	min.	(*4)
	6.2.6 Holdover	-	-	1.0	-	us	8 h (*5)

Parameters		Sym.	Spec.				Conditions
			Min.	Typ.	Max.	Units	
6.3	Frequency Control						
	6.3.1 Frequency Change Polarity	-	Positive Slope			-	
	6.3.2 Frequency Control Range	Δf/f	-0.5	-	-0.3	ppm	V_{cont} = Min. (*2)
			+0.3	-	+0.5	ppm	V_{cont} = Max. (*2)
	6.3.3 Linearity	-	-	-	5	%	
6.4	Output Characteristics						
	6.4.1 Waveform	-	LVCMOS (Square wave)				
	6.4.2 Output Voltage						
	High Level Output Voltage	V_{OH}	+2.4	-	-	V	
	Low Level Output Voltage	V_{OL}	-	-	+0.4	V	
	6.4.3 Symmetry	-	45	-	55	%	at $(V_{OH} + V_{OL})/2$
6.5	Phase Noise at 10 MHz	L(f)	-	-83	-	dBc/Hz	1 Hz offset
			-	-110	-	dBc/Hz	10 Hz offset
			-	-135	-	dBc/Hz	100 Hz offset
			-	-152	-	dBc/Hz	1 kHz offset
			-	-157	-	dBc/Hz	10 kHz offset
			-	-160	-	dBc/Hz	100 kHz offset

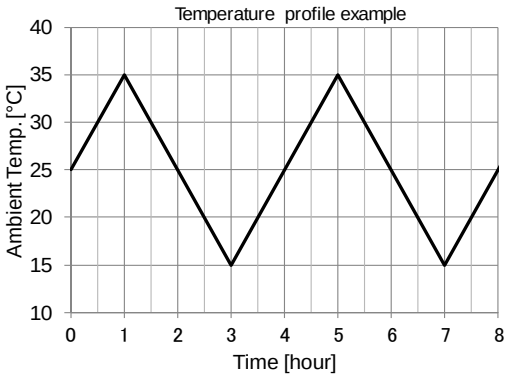
(*1) $\Delta f/f_{nom}$: : Frequency shift from nominal frequency.

(*2) Δf/f: Frequency shift from the reference frequency.
T = +25 °C, V_{CC} = +5.0 V、V_{cont} = Center, C_L = 15 pF

(*3) Based on frequency after 7 days operation.

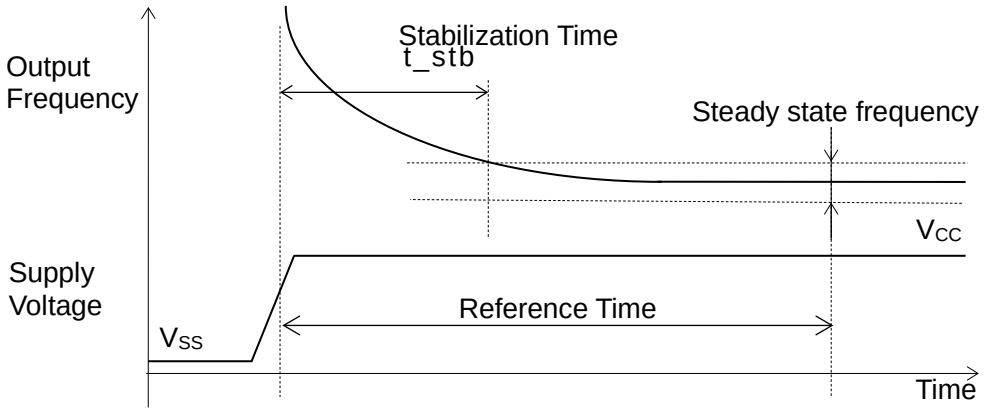
(*4) Within ±10 ppb, based on frequency after 60 minutes. T = +25 °C.

(*5) Conditions for Holdover
Based on frequency after 7 days operation
Temperature range: 20 °C window
Temperature slope: 10 °C/hour

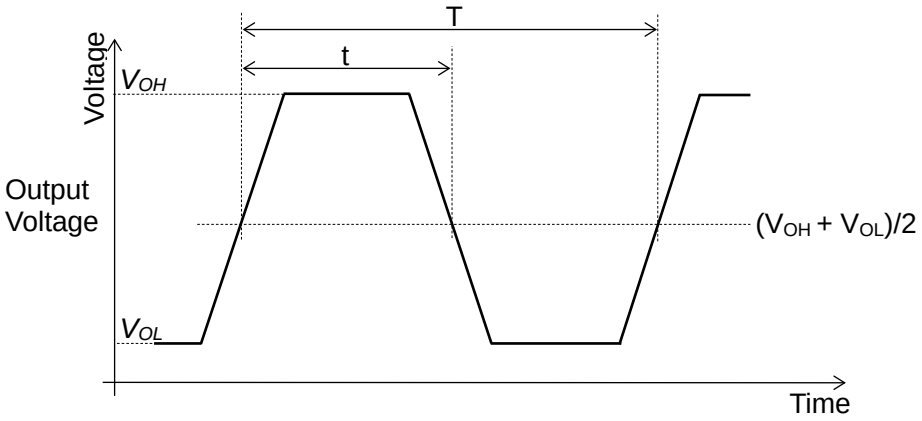


(*6) Typ. Value is for reference only.

Stabilization Time



Waveform



Symmetry (SYM) = t / T x 100 [%]

7. Digital Frequency Tuning (NSA3649A)

7.1 Relation Registers

No.	Register address (hex)	Contents	Initial value after reset (hex)
1	C0	V_{cont} register (bit 23 to 16)	00
2	C1	V_{cont} register (bit 15 to 8)	00
3	C2	V_{cont} register (bit 7 to 0)	00
4	C3	Triger (refer to the section 7.2.4)	00

7.2 How to Set the Registers

No.	Item	Contents
1	To calculate frequency tuning range per 1 bit	Calculating formula: To set A = (Frequency tuning range) / 2^24 e.g.: 400 ppb (i.e. ±200 ppb) / 2^24 = 0.024 ppt / bit
2	To calculate register value from frequency tuning value	Calculation formula: To set B = round {(Frequency tuning value) / A} e.g.: If your requested frequency tuning value is 25 ppb, round {(25 ppb) / 0.024 ppt} = B = 1,041,666
3	To convert the calculated register value to 3 bytes hex by 2's complement	e.g.1: +512 = 00 02 00 (hex) e.g.2: -4096 = FF F0 00 (hex) Note: Please set a limiter by 0x7FFFFF and 0x800000 to avert an overflow.
4	To write 4 bytes: addresses C0, C1, C2 and C3	Note: Data in addresses C0 to C2 are written only after data is written in address C3 00(hex).

7.3 Note for digital frequency tuning

A frequency tuning value which written in the addresses in the section 7.1 by the setting method in the section 7.2 are not saved to a non-volatile memory.

Therefore, please calculate in the section 7.2 and set the intended frequency tuning value to an oscillator once every power-on.

7.4 Access method

This oscillator supports the following four access methods:

No.	Name	Explanation
1	Byte write	To write one byte data to an arbitrary one address in an oscillator.
2	Sequential write	To write four bytes data to sequential four addresses in an oscillator.
3	Random read	To read one byte data from an arbitrary one address in an oscillator.
4	Sequential read	To read four bytes data from arbitrary sequential four addresses in an oscillator.

Timing charts of each access method is shown as follows:

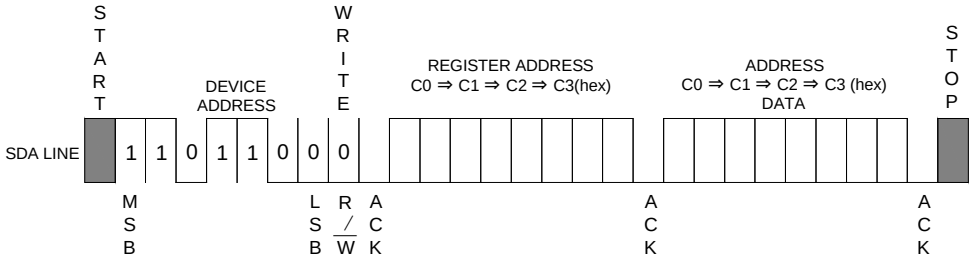


fig. 7.4.1 Byte write

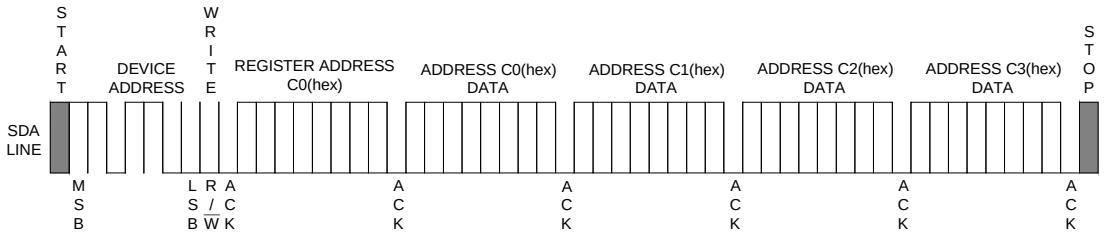


fig7.4.2 Sequential write

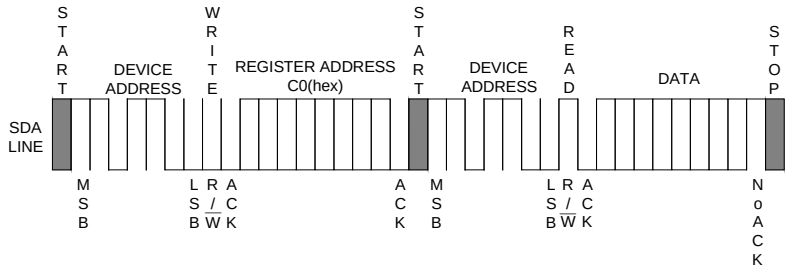


fig7.4.3 Random read