# Overclocking Assistant (Performance Tuning Guide) for Intel® NUC Kit NUC8i7HNK and NUC8i7HVK

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# WARNING

Altering PC memory frequency and/or voltage may (i) reduce system stability and useful life of the system, memory, and processor; (ii) cause the processor and other system components to fail; (iii) cause reductions in system performance; (iv) cause additional heat or other damage; and (v) affect system data integrity. Intel assumes no responsibility that the memory included, if used with altered clock frequencies and/or voltages, will be fit for any particular purpose. Check with the memory manufacturer for warranty and additional details.

## Objective

The Purpose of this performance tuning guide is intended for validation and system characterization purposes only.

## **Memory Overclock Performance**

Memory performance tuning is controlled via several platform mechanisms. Beyond this, the platform is also capable of supporting manual overrides to the memory frequency, timings, and voltage levels of both the integrated memory controller (iMC) and the DIMMs.

If you're going to try overclocking the module, you'll have to decide which is more important – the speed or the timings. In most cases, you can't have both.

Follow the settings below if you want to overclock your memory. **Note:** some memory modules don't allow any overclocking.

DDR4 Frequency QCLK	Memory Reference Multiplier (133MHZ/100MHz)	Memory Multiplier
1600	1.33	12
1600	1	16
1700	1	17
1733	1.33	13
1800	1	18
1867	1.33	14
1900	1	19
2000	1.33	15
2000	1	20
2100	1	21
2133	1.33	16
2200	1	22
2267	1.33	17
2300	1	23
2400	1.33	18
2400	1	24
2500	1	25
2533	1.33	19
2667	1.33	20
2700	1	27

2800	1.33	21
2800	1	28
2900	1	29
2933	1.33	22
3000	1	30
3067	1.33	23
3100	1	31
3200	1.33	24

#### Manual Memory Overclocking Example

Example: You have a DDR4 2133 module and want to overclock to 2267 MHz. Using the settings shown in the table above, you need to set the Memory Reference Multiplier at 1.33 and the Memory Multiplier at 17.

- 1. Press F2 during boot to enter BIOS Setup.
- 2. Click the Advanced button
- 3. Select **Performance** > **Memory**.
- 4. Change Memory Profiles to Manual-User Defined.
- 5. Change Memory Multiplier to 17.
- 6. If you want to change the timing, change **Memory Timing** to **USER** (otherwise leave it set to Auto).

Timing Settings		General Settings		
Total Memory Memory Speed	16 GB 21.33 Mhz	Memory Profiles	Manual - User Defined	•
Memory Clock	133Mhz	Memory Reference Multiplier	133	
SOOIMM1 (Memory Channel A)	8 GB	Memory Hultiplier	Hr.	
SCOIMM 2 (Memory Channel II)	8 GB	Memory timing	NSER.	
CAS LATENCY (ICL)	15	10.		15
LAS TO HAS (TRED)	36	1800		15
Active to Precharge (tRAS) Memory Voltage	1.29	TRASmin	— <b>—</b> —	36
		ATREC		278
		TRED		4
		tccni		10
		TPAN		23
		1CWL		14
		KREFT.	_	8316

7. Press F10 and click Yes to save and exit BIOS Setup.

BIOS now shows the memory speed is 2267MHz instead of 2133 MHz. You can use tools such as CPU Z to confirm this.

Timing Settings	General	Settings	
Total Memory 16   Memory Speed 224   Memory Clock 13   SODIMM 1 (Memory Channel A) 8 G   SODIMM 2 (Memory Channel B) 8 C   CAS Latency (ECL) 15   CAS Latency (ECL) 15   Active to Precharge (IRAS) 36   Memory Voltage 12	Memory Pro Mhz hz hz Memory Mut Memory Mut Memory Mut Memory tim tCL tRCD tRASmin tRFC tRRD tWR tCDL tRAW tCWL	files Manual - User Defined erence Multiplier 133 http://www.manual.com/ ing USER	15 15 36 278 4 16 6 23 14

#### Memory XMP Example

Intel® Extreme Memory Profiles are traditionally designed with two distinct performance profiles:

- **Profile 1** is used for the enthusiast/certified settings and is the profile that is tested under the Intel® Extreme Memory Certification program.
- **Profile 2** is designed to host the extreme or fastest possible settings that have no guard band. This profile may or may not work on every system.

Note: Extreme Memory Profiles aren't always defined as overfrequency/over-voltaged parts. In some cases, Extreme Memory Profiles can be used to define extremely power savvy settings or extremely fast latencies.

- 1. Press F2 during boot to enter BIOS Setup.
- 2. Click the Advanced button.
- 3. Select **Performance > Memory**.
- 4. Change Memory Profiles to Profile 1 or Profile 2 (depending on your module).
- 5. Press F10 and click Yes to save and exit BIOS Setup.

Home	Main	Devices	Cooling	Performance	Security	Power	Boot	0	*	1	۶	۲
Process	or Graj	phics Me	mory									
Timing	Setting	S			Genera	l Setting	s					
Total Men OVerridde Memory Cl SODIMM 1 SODIMM 2 XMP Versid CAS Laten CAS to RA: Active to 1 Memory Vo	nory n Memory Sp ock (Memory Cha (Memory Cha on cy (tCL) S (tRCD) Precharge (tl oltage	16 320 13: nnel A) 8 G 2.0 18 18 8 8 8 8 8 8 13	GB 00 Mhz 3Mhz B B 5V		Memory Pr Memory Re Memory Mu Memory Vo Memory tin tCL tRCD tRASmin tRFC	ofiles :ference Mult ultiplier vitage ming	riplier 1.3 24 1.3 Au	file 1: X	MP-300	13		
					tRRD_L tRRD_S tWR tCCDL						11	

You can use tools such as CPU Z to check the memory speed.

Туре	DDR4	Channel #	Dual		
Size	16 GBytes	DC Mode			
		NB Frequency	3492.3 MHz		
limings					
	DRAM Frequency	1496.7 MHz			
	FSB:DRAM	1:30			
	CAS#Latency (CL)	17.0 docks			
RAS4	to CAS≢ Delay (tRCD)	18 docks	2		
	RAS# Precharge (tRP)	18 docks			
	Cycle Time (tRAS)	42 docks			
Row Ret	fresh Cycle Time (tRFC)	526 clocks			
	Command Rate (CR)	21	3		
	DRAM Ide Timer				
	Total CAS# (tRDRAM)				
	Row To Column (tRCD)				

Set the Voltage System Agent in BIOS Setup, based on the requested memory speed above 2993MHz, if board isn't stable. Intel won't provide guidance on this voltage. You can try from 50mv to 200mv.

- 1. Press F2 during boot to enter BIOS Setup.
- 2. Click the **Advanced** button.
- 3. Select **Performance** > **Processor**.
- 4. Increase SA Voltage (for example 0.15v = 150mv).
- 5. Press F10 and click Yes to save and exit BIOS Setup.

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Process	or Graphies	men	ory									
Core S	ettings				Uncore	Settings						
Host Clock Pressency 100 Mhr Max Processor Speed 35 GHz Intel® Hyper-Threeding Technology Intal® Turbe Boost Technology		Processor Ring Fraquency, 3.5 Ghr Ring Max OC Ratio Ring Mis GC Ratio Ring Voltage Mode Addopt					ir 0 0					
ntale Surbe Boost Technology 🕑 Active Processor Cores ALL		Ring Volta Ring Estra Ring Volta	0 = (V)				0	0.00				
2-Core Tor 3-Core Tur 4-Core Tu	rho Ratio rho Ratio rho Ratio	Ξ		34 33 32	5A Voltage	offset (V)	8		-		0	.15
Maximum I Core Max I Core Volta	Non-Turbo Antiu OC Ratio age Mode	adapt	NR.	26								
Core Volta	ege Override (V) Turbo Voltane (V)			0.00								

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