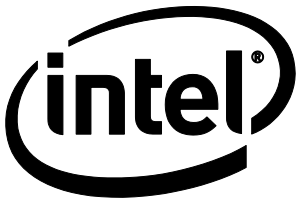


Overclocking Assistant for the Intel® Desktop Board DZ87KLT-75K

June 2013

⚠ WARNING

Altering clock frequency and/or voltage may (i) reduce system stability and useful life of the system 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 has not tested and does not warranty the operation of the processor beyond its specifications.

⚠ 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.

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL® PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER, AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. Intel products are not intended for use in medical, life saving, or life sustaining applications.

Intel may make changes to specifications and product descriptions at any time, without notice.

Intel, Intel Core, and the Intel logo are trademarks of Intel Corporation in the U.S. and/or other countries.

*Other names and brands may be claimed as the property of others.

Copyright © 2013, Intel Corporation. All rights reserved.

Contents

1 Overclocking Assistant 4
1.1 Objective 4
1.2 Visual BIOS Help 4
2 Kinsley-75k using Turbo Ratio OC 10
2.1 Tuning Tab/Performance Settings 10
2.2 Cores > Section of the Performance Dashboard 10
3 Kinsley-75k using BCLK OC 14
3.1 Tuning Tab/Performance Settings 14

1 Overclocking Assistant

1.1 Objective

The Purpose of this performance tuning guide is intended for validation and system characterization purposes only. The setting in this document is not fully validated and may not function across all the available K-processors. It is assumed that CPUs in the same family will have common settings.

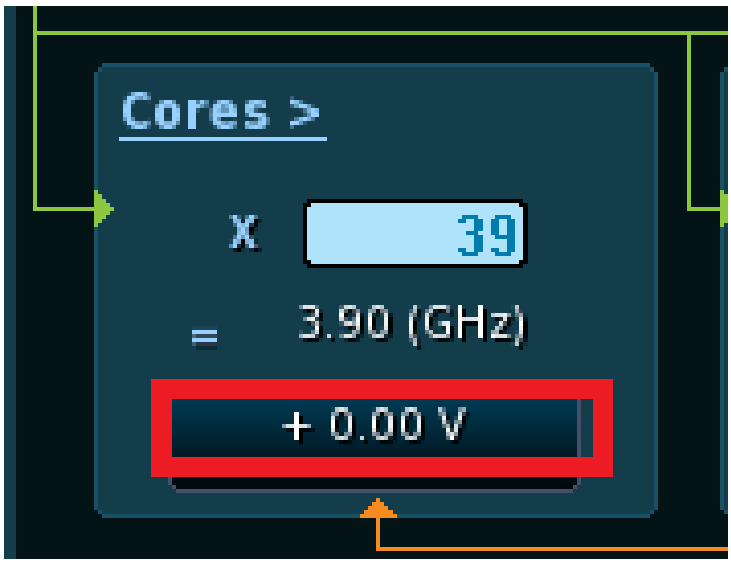
The new feature of the 4th Generation Intel® Core processor is an integrated voltage regulator (IVR). This new voltage regulator is integrated into the processor package and controls a number of voltage rails except Memory (Vddq). These rails include the IA Core rail, GT rail, System Agent rail, and IO-analog and IO-digital.

The 4th Generation Intel® Core processor offers overclocking capability using the Intel® Turbo Boost Technology and with reference (BCLK) overclocking. In Turbo mode the processor could be running at any ratio in the inclusive range between Max Turbo and Max Non-Turbo. In BCLK, the Max Non-Turbo ratio has to be equal or less than the Max Turbo ratio.

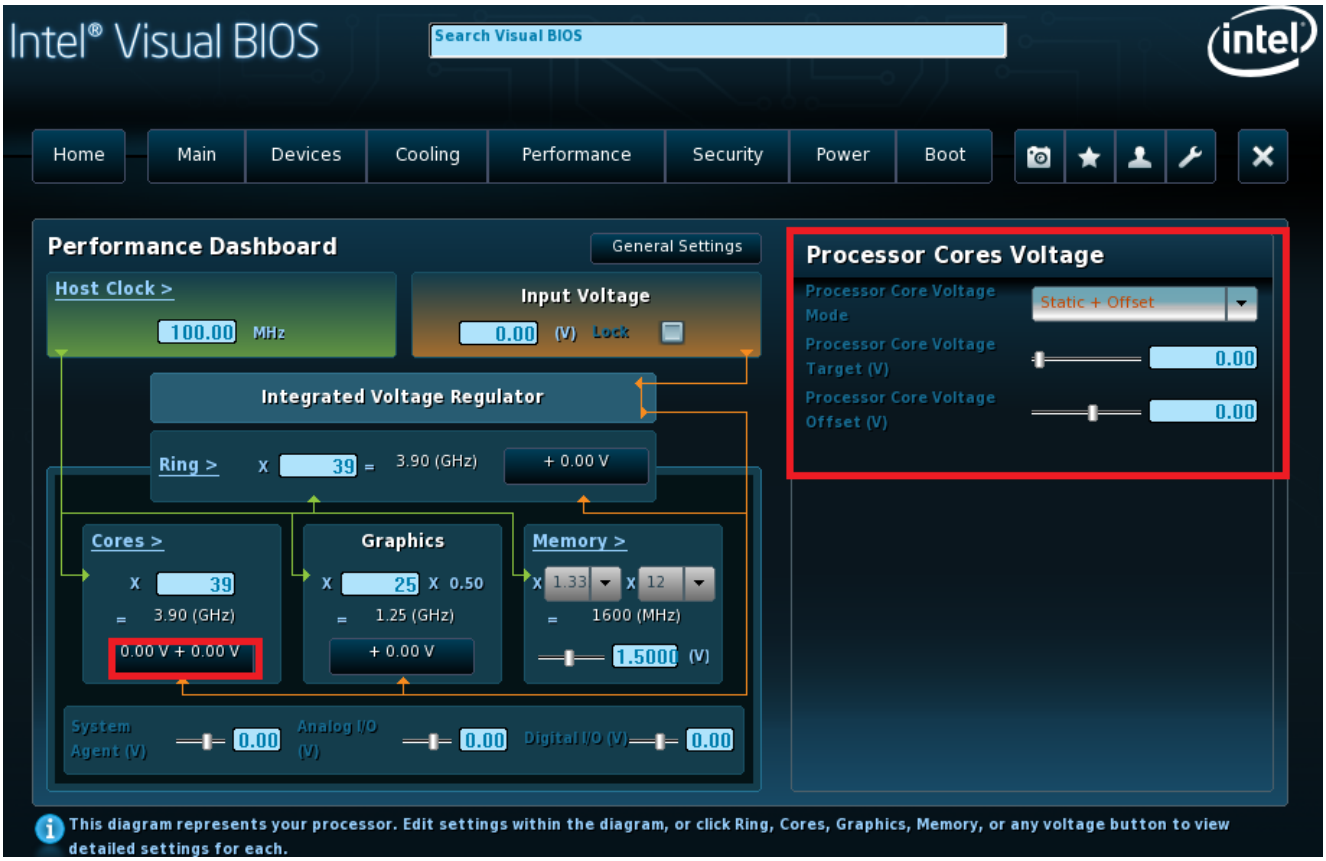
1.2 Visual BIOS Help

There are two main voltage options that are used for overclocking:

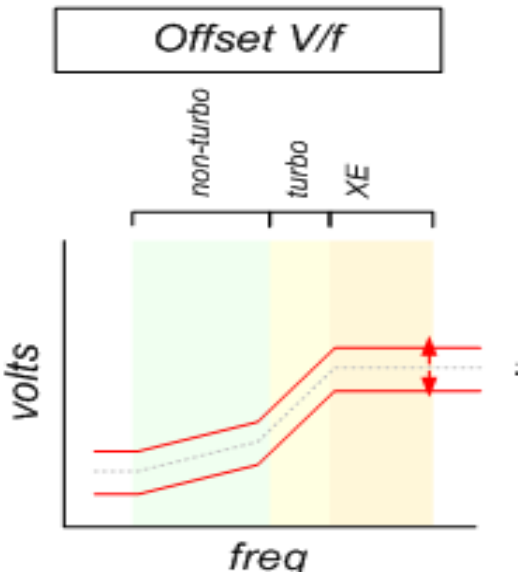
1. This IA Core Voltage has impact on the ability to raise the IA Core Max Turbo ratio as well as the BCLK. Additional voltage beyond the default setting will create more heat and should be a consideration for a reduced processor lifetime.



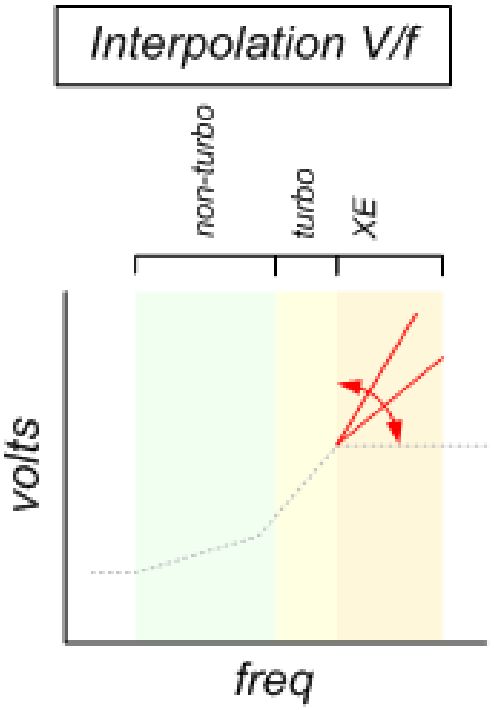
There are 3 settings for this voltage: Offset only, Interpolated + Offset and Static + Offset.



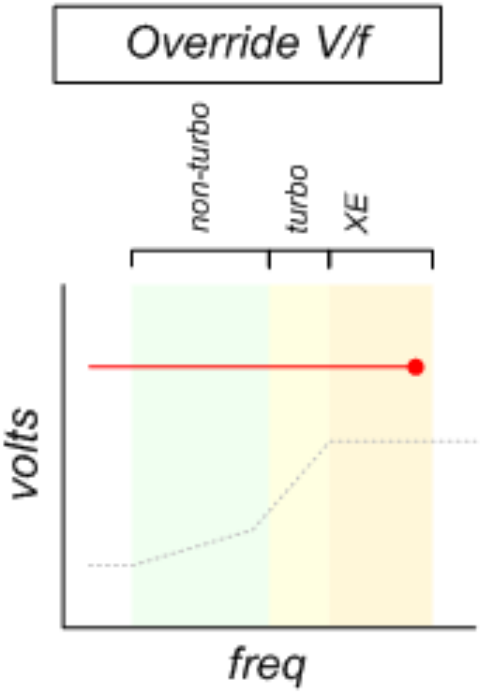
The Offset Mode: Positive and negative offset applied to the entire curve.



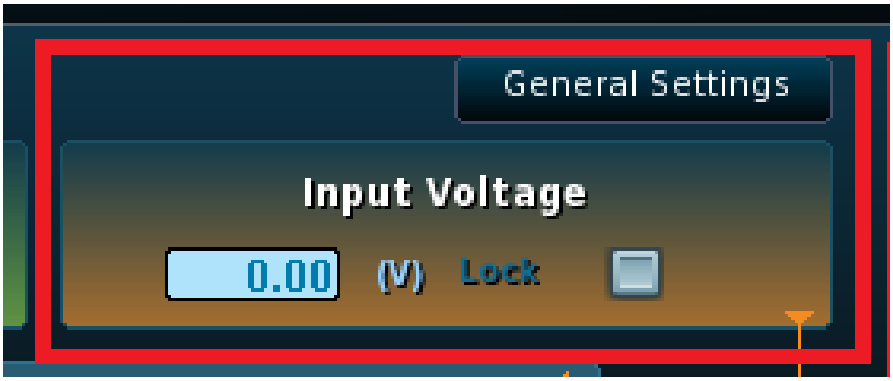
The Interpolated Mode: Sometime is referred to Adaptive mode. This is only applicable for frequencies and voltages beyond the default maximum turbo frequency.



Static + Offset Mode: This Static and Office mode (Override mode) is useful when overclocking or underclocking the BCLK. This method can allow for adjustment of the entire V/f curve.



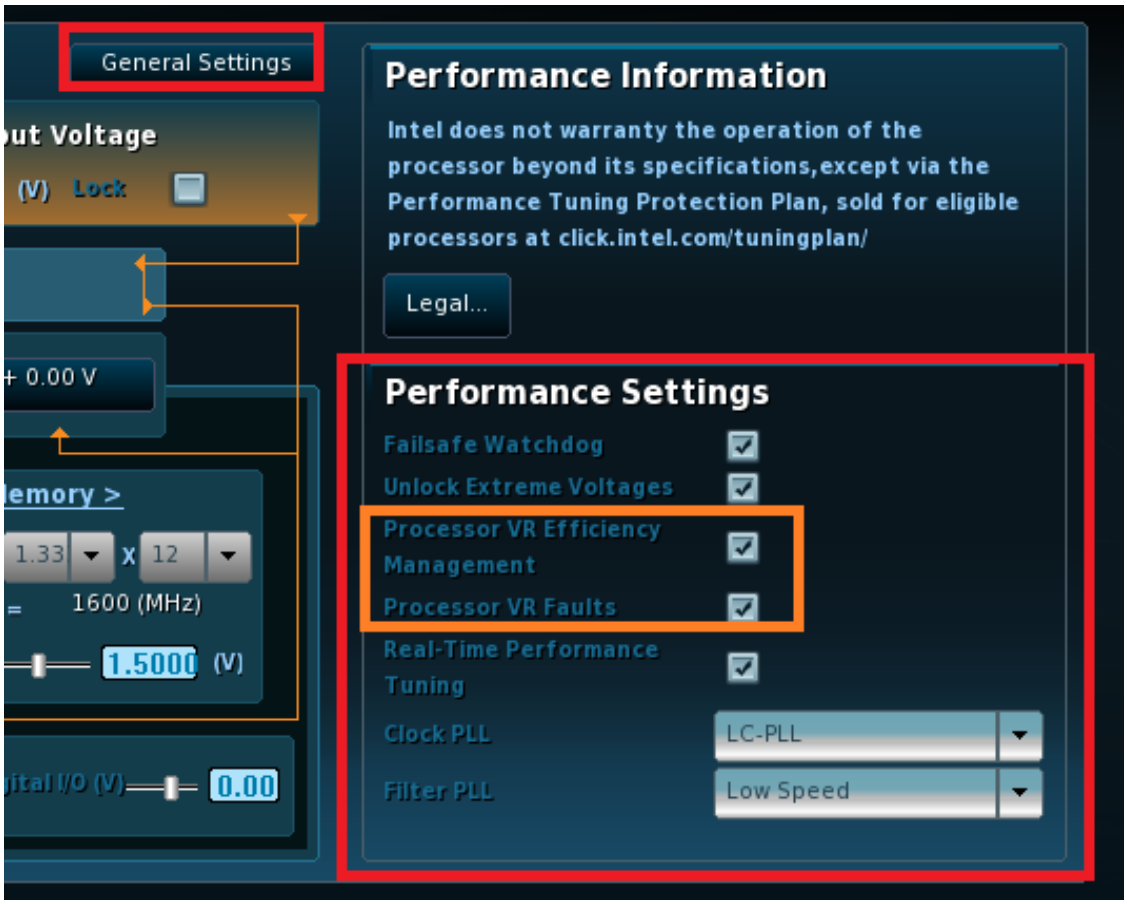
2. The other main voltage that can affect the ability to overclock is SVID override (Input Voltage below). The default for this voltage is 1.7v ~ 1.8v on the Intel® Desktop Board DZ87KLT-75K. The maximum IVR output voltage (IA Cores, The Ring, and The Graphic) is related to this input voltage. It may be required to raise this input voltage, when you raise the IA Core voltage or BCLK. Make sure the minimum voltage between the IVR output voltage (IA cores, Ring, GT) and this input voltage between 400mv to 450mv. For example: Using LN2, if you increase the IA Core voltage to 1.6v, this input voltage should also increase to 2v.



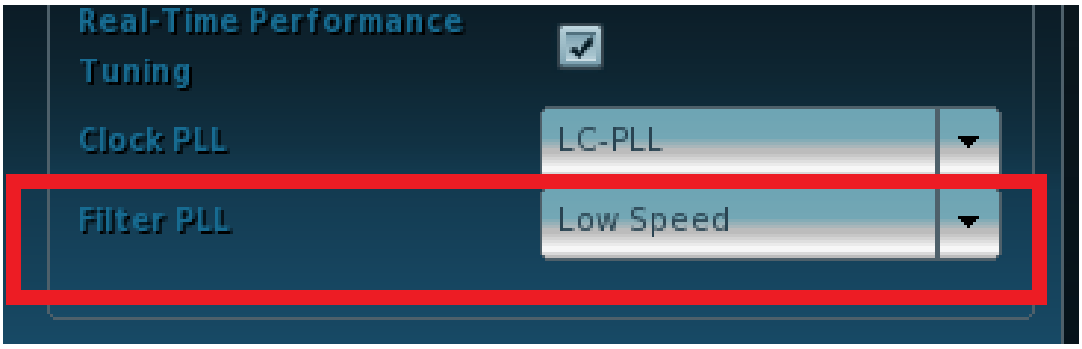
In Turbo ratio and BCLK OC, the Processor VR fault is set to disable (uncheck). This is a risk of using it by the user because the Over-voltage protection (OVP) and

Over-current protection (OCP) will be masked. Reliability of the processor should be concerned by possibly overvoltaging inadvertently.

In turbo mode or BCLK OC, the Processor VR efficiency is set to disable (uncheck). It will force IVR to always run in max power delivery capability mode.



When raising BCLK frequency, this Filter PLL should be set to Low Speed mode. This will have the potential to improve the top end frequency that the processor is able to achieve. For Turbo ratio OC it is recommended set Filter PLL to High Speed.



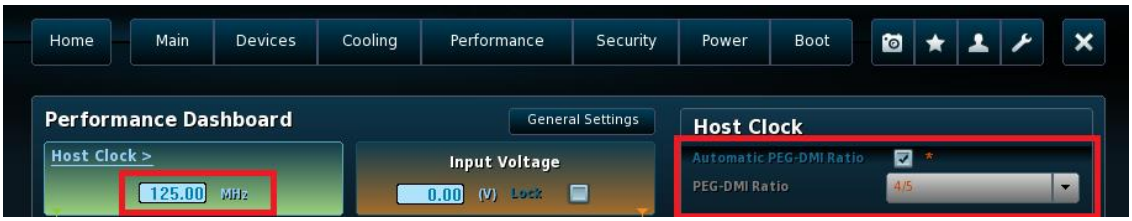
Clock PLL: For Turbo ratio overclocking, set to LC-PLL; For BCLK, set to SB-PLL.

Use the option below for BCLK overclocking with PEG/DMI ratio. The PEG/DMI ratio will automatically change when you adjust the BCLK.

Notes: To adjust the Manual settings, uncheck Automatic PEG-DMI Ratio. In manual control you can adjust the BCLK by 4% to 5% for upside frequency and you can achieve a larger down frequency range.

BCLK:PCIe ratio

5:5 (default-POR) (i.e. BCLK 100: PCIe 100)
4:5 (BCLK 125:PCIe100)
3:5 (167:100)
2:5 (250:100)



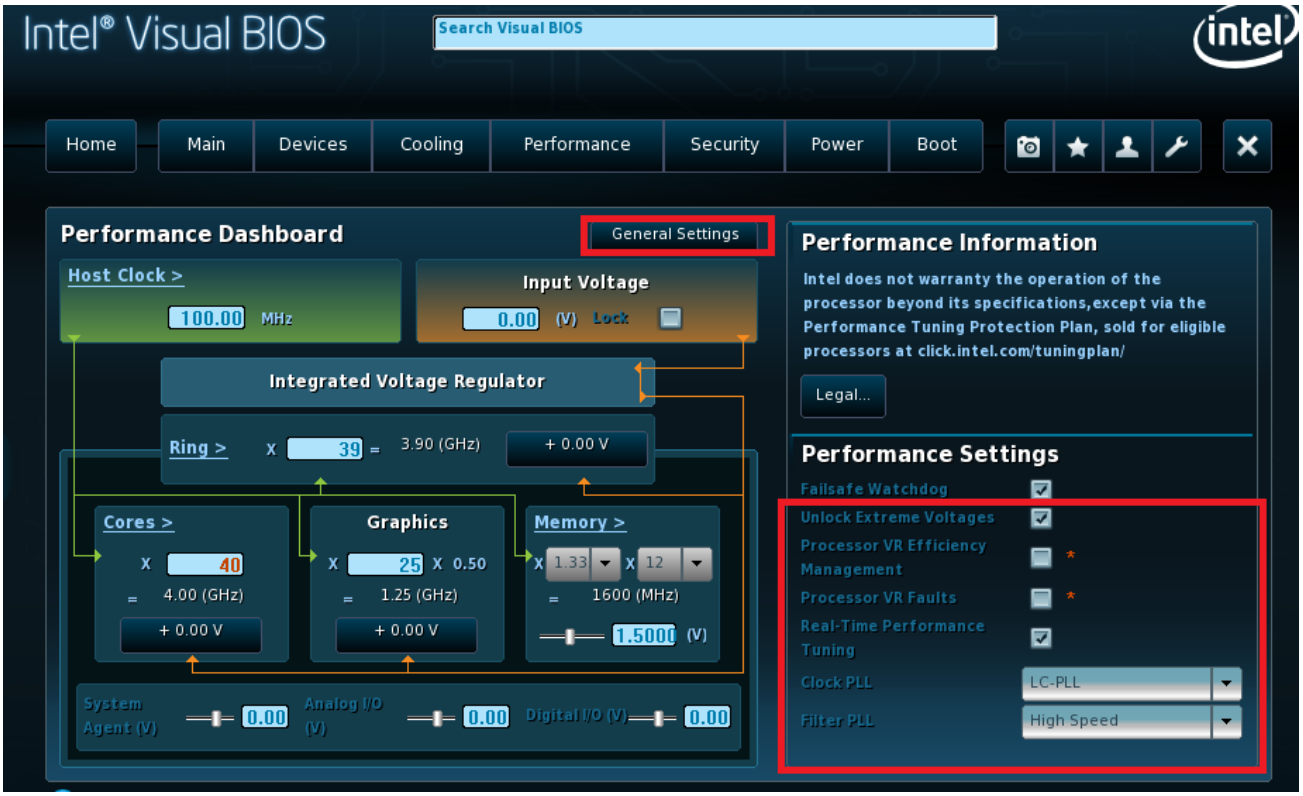
System Agent uses for the BCLK, memory OC and LN2; you do not need to set the Analog I/O and Digital I/O options when doing a BCLK OC or Turbo.

2 Kinsley-75k using Turbo Ratio OC

2.1 Tuning Tab/Performance Settings

Under the Tuning Tab/Performance Settings:

- Check the Unlock Extreme Voltages setting if it is not checked (if you have a K-skew CPU, this should always be checked)
- Uncheck the Processor VR Faults setting (disable).
- Uncheck the Processor VR Efficiency setting (disable).
- Filter PLL → High Speed



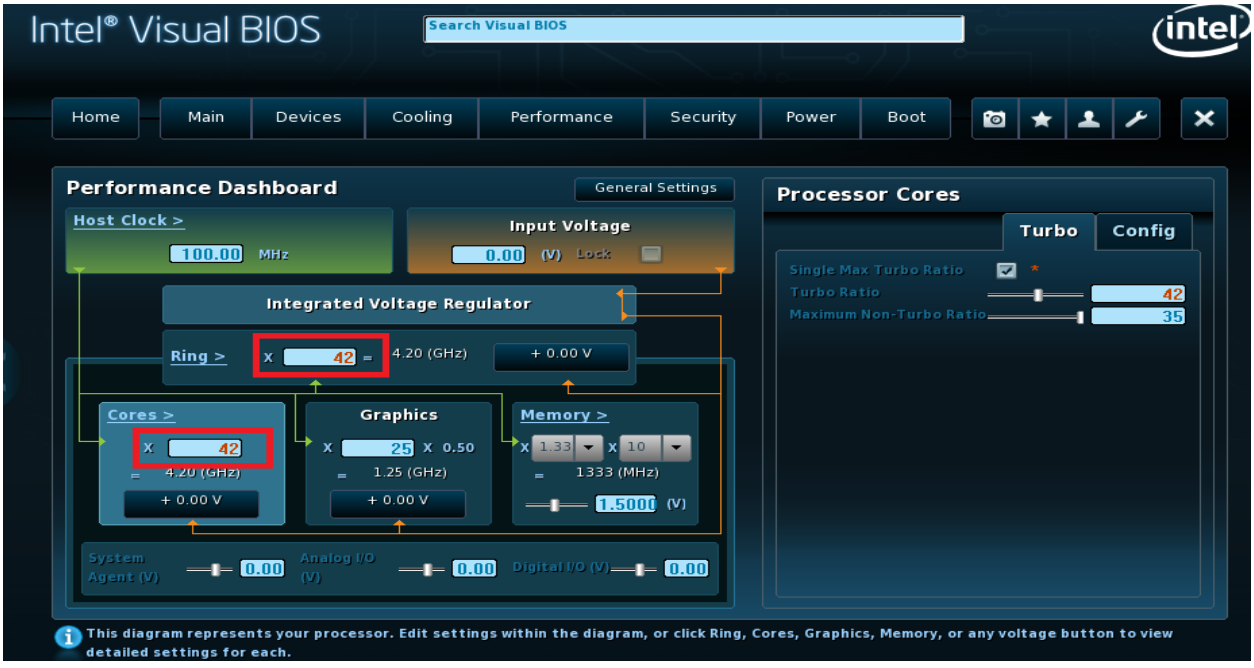
2.2 Cores > Section of the Performance Dashboard

Under the Cores > Section of the Performance Dashboard:

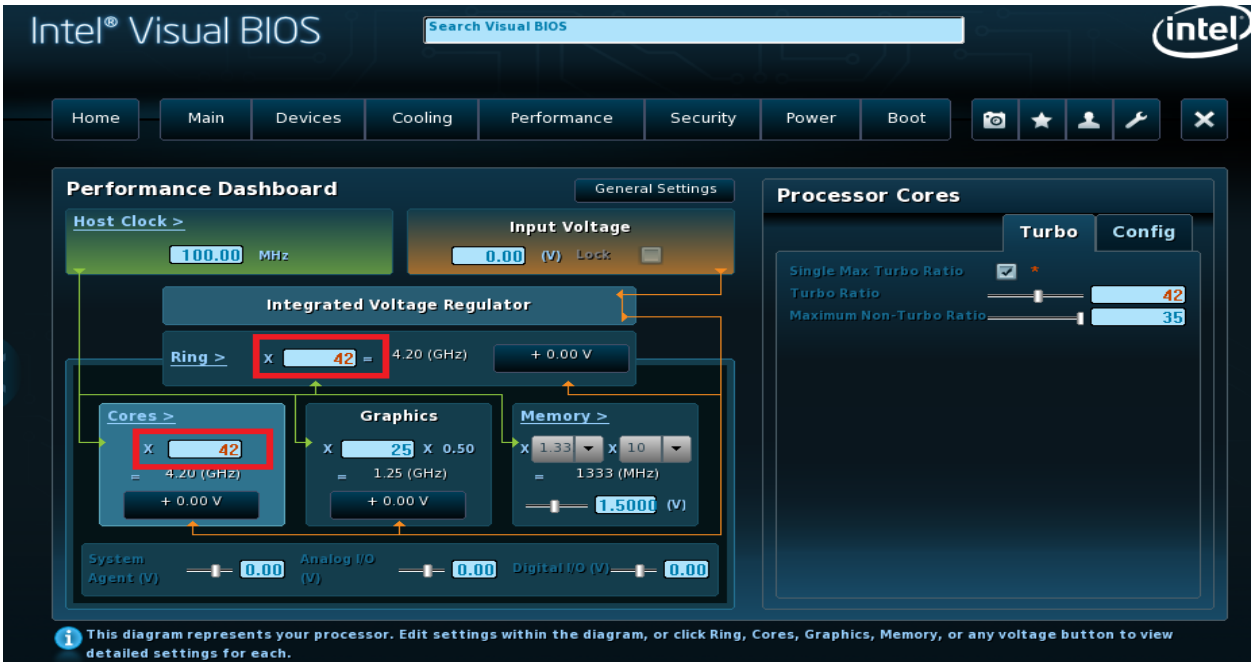
- Click Cores (on the left) to get the Processor Cores Config (on the right).
- Set Processor Current Limit Override ➔ 1000 (This setting should be aligned with the current Voltage regulator on the board).

- Set Burst Mode Power Limit ➔ 1000.
- Set Sustained Mode Power Limit ➔ 1000.

For Example: On Cores > Slide or type to 42 (100 MHz x 42 = 4.2 GHz).



- On Ring >: Slide or type to 42 (Ring multiplier can set the same or lower than Core, but not higher than Core).



- Exit and Save.

To increase the Turbo Ratio, follow the settings in the following table. Notes: Core voltage and Ring Voltage Target in this sheet below is for you to start with. You can increse or decrease to find the stable state of your Board.

Core Turbo Ratio	Unlock CPU	Turbo ratio enable	Core Ratio	Ring Ratio	Processor Current Limit (Amps) ICC-Max	Burst Mode Power Limit (Watts) or Short Term Power Limits or Power Limits 2 Power	Sustained Mode Power Limit (Watts) or Long term Power limits or Power Limits 1 Power	Max Non turbo	Interpolated + offset or offset	Processor Core Voltage (V)	Processor Core Voltage offset (mV)	Ring Voltage (V)	Ring Offset (mv)	VR Fault & VR Effi	LC-PII	High Speed/ Low Speed	Memory
3.9	yes	All Cores	39	39	1000	1000	1000	35		0	0	0	0	disable	LC-PII	High Speed	automatic
4.00	yes	All Cores	40	40	1000	1000	1000	35		0	0	0	0	disable	LC-PII	High Speed	automatic
4.10	yes	All Cores	41	41	1000	1000	1000	35		0	0	0	0	disable	LC-PII	High Speed	automatic
4.20	yes	All Cores	42	42	1000	1000	1000	35		0	0	0	0	disable	LC-PII	High Speed	automatic
4.30	yes	All Cores	43	43	1000	1000	1000	35	offset	0	50	0	50	disable	LC-PII	High Speed	automatic
4.40	yes	All Cores	44	44	1000	1000	1000	35	offset	0	100	0	100	disable	LC-PII	High Speed	automatic
4.50	yes	All Cores	45	45	1000	1000	1000	35	Interpo + offset	1.24	0	1.24	0	disable	LC-PII	High Speed	automatic
4.60	yes	All Cores	46	46	1000	1000	1000	35	Interpo + offset	1.27	0	1.27	0	disable	LC-PII	High Speed	automatic

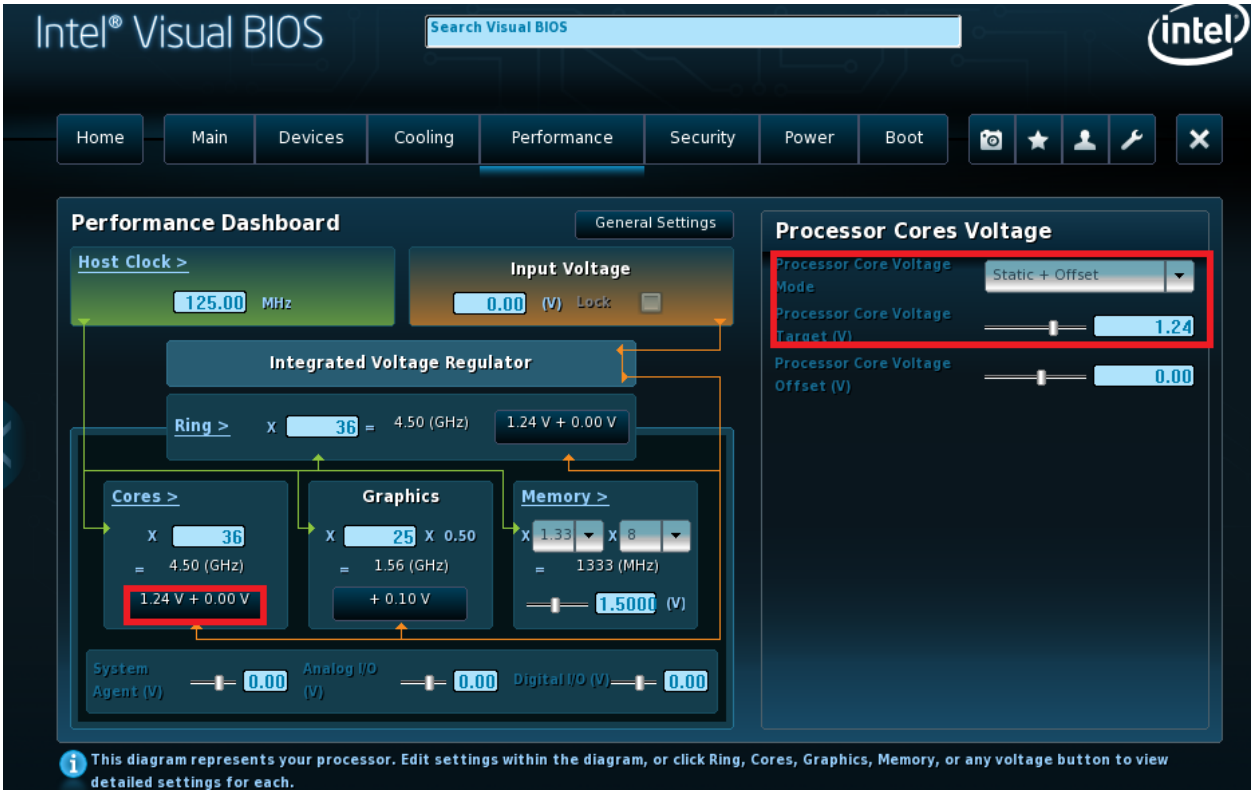
3 Kinsley-75k using BCLK OC

3.1 Tuning Tab/Performance Settings

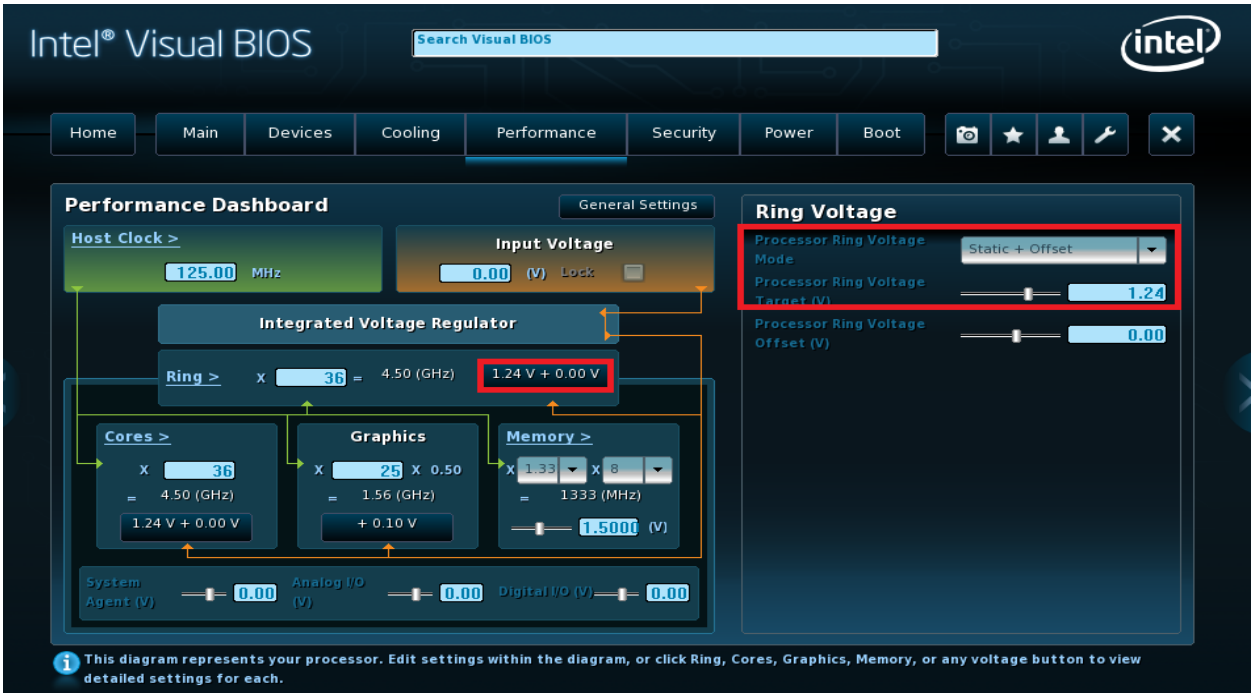
Under Tuning Tab/Performance Settings:

- Check Unlock Extreme Voltages if not check (if you have a K-skew CPU, this should always be checked).
- Uncheck Processor VR Fault (disable).
- Uncheck Processor VR Efficiency (disable).
- Change Clock PLL from LC-PLL to SB-PLL.
- Make sure Filter PLL is set to Low Speed.
- Set BCLK to 125.
- Set Core multiplier to the frequency you want to run (example: 125MHz x 36 = 4.5 GHz).
- Set Ring Multiplier to 36.
- Set Processor Current Limit, Burst Mode and Sustained Mode → 1000.

- Select the red square box on the left.
- Change Processor Core Voltage Mode to Static + Offset.
- Raise Processor Core voltage target to 1.24v.



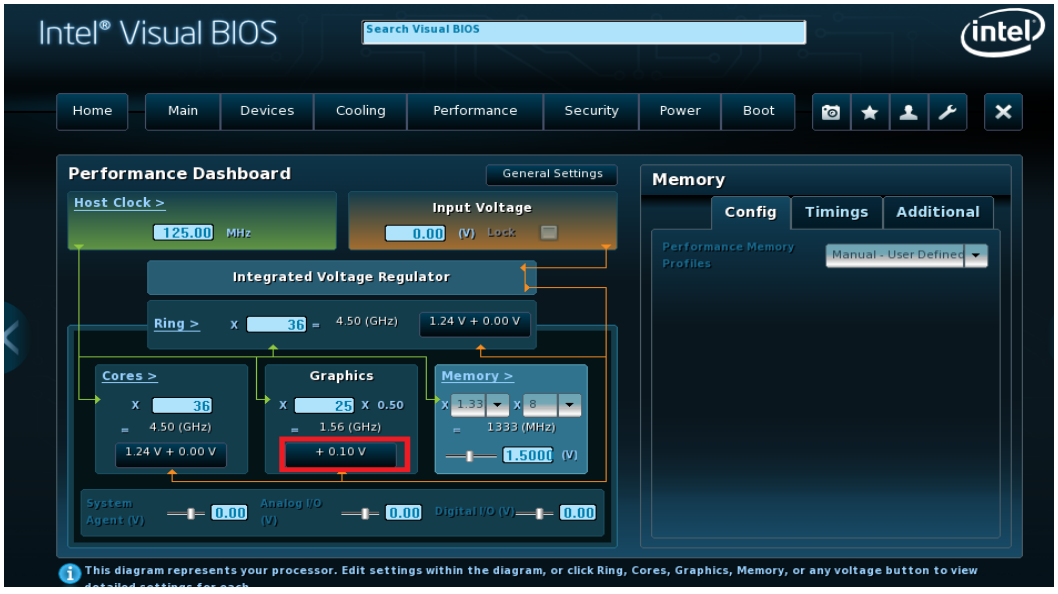
- Select the red square box on the left.
- Change Processor Ring Voltage Mode to Static + Offset.
- Raise Processor Ring voltage target to 1.24v.



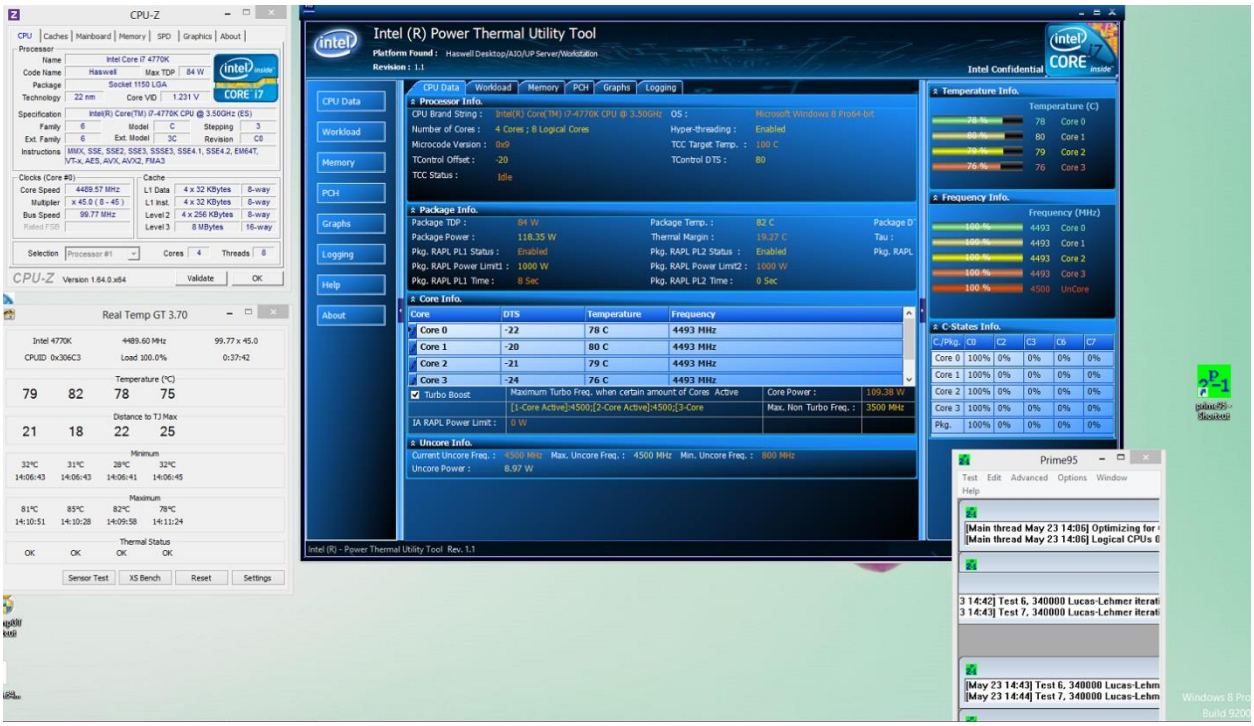
- Change Performance Memory Profile from Automatic to Manual-User Defined.

- Change Memory Multiplier to 8.

- If use onboard graphic. Need to change the Graphic offset to 0.10v.



- Save and boot to windows. Note: Board might need to be rebooted or reset twice.


CPU-Z
Real Temp GT 3.70
Intel (R) Power Thermal Utility Tool
Prime95

Follow the setting below, if you want to increase BCLK=125MHz using external graphic.

Notes: Core voltage and Ring Voltage Target in this sheet below is for you to start with. You can increase or decrease these two voltages Target to find the stable state of your CPU.

Cone Turbo Ratio	Unlock CPU	Turbo ratio enable	Core ratio	Ring Ratio	Processor Current Limit (Amps) ICC-Max	Burst Mode Power Limit (Watts) or Short Term Power Limits or Power Limits 2 Power	Sustained Mode Power Limit (Watts) or Long term Power limits or Power Limits 1 Power	Static + offset	Processor Core Voltage (V)	Processor Core Voltage offset (mV)	Ring Voltage	Ring Offset (mV)	Max Non-Turbo multiplier	Memory Multiplier & from automatic to Manual	VR Fault & VR Effi	LC-PII	High Speed/ Low Speed
4.00	yes	All Cores	32	32	1000	1000	1000	Static + Offset	1.12	0	1.12	0	x32	x8	disable	SB-PII	Low Speed
4.12	yes	All Cores	33	33	1000	1000	1000	Static + Offset	1.12	0	1.12	0	x32	x8	disable	SB-PII	Low Speed
4.25	yes	All Cores	34	34	1000	1000	1000	Static + Offset	1.2	0	1.2	0	x32	x8	disable	SB-PII	Low Speed
4.37	yes	All Cores	35	35	1000	1000	1000	Static + Offset	1.21	0	1.21	0	x32	x8	disable	SB-PII	Low Speed
4.50	yes	All Cores	36	36	1000	1000	1000	Static + Offset	1.24	0	1.24	0	x32	x8	disable	SB-PII	Low Speed
4.62	yes	All Cores	37	37	1000	1000	1000	Static + Offset	1.27	0	1.27	0	x32	x8	disable	SB-PII	Low Speed

Follow the setting below, if you want to increase BCLK =125MHz using internal graphic.

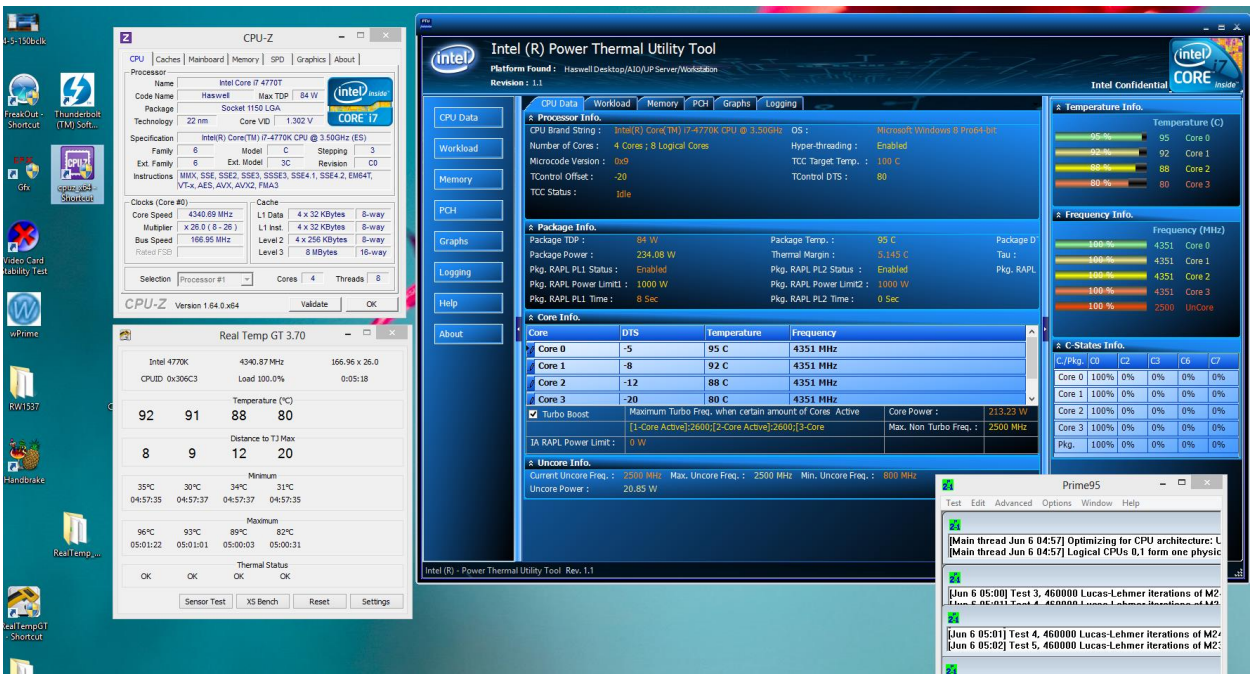
Notes: Core voltage and Ring Voltage Target in this sheet below is for you to start with. You can increse or decrease to find the stable state of your CPU.

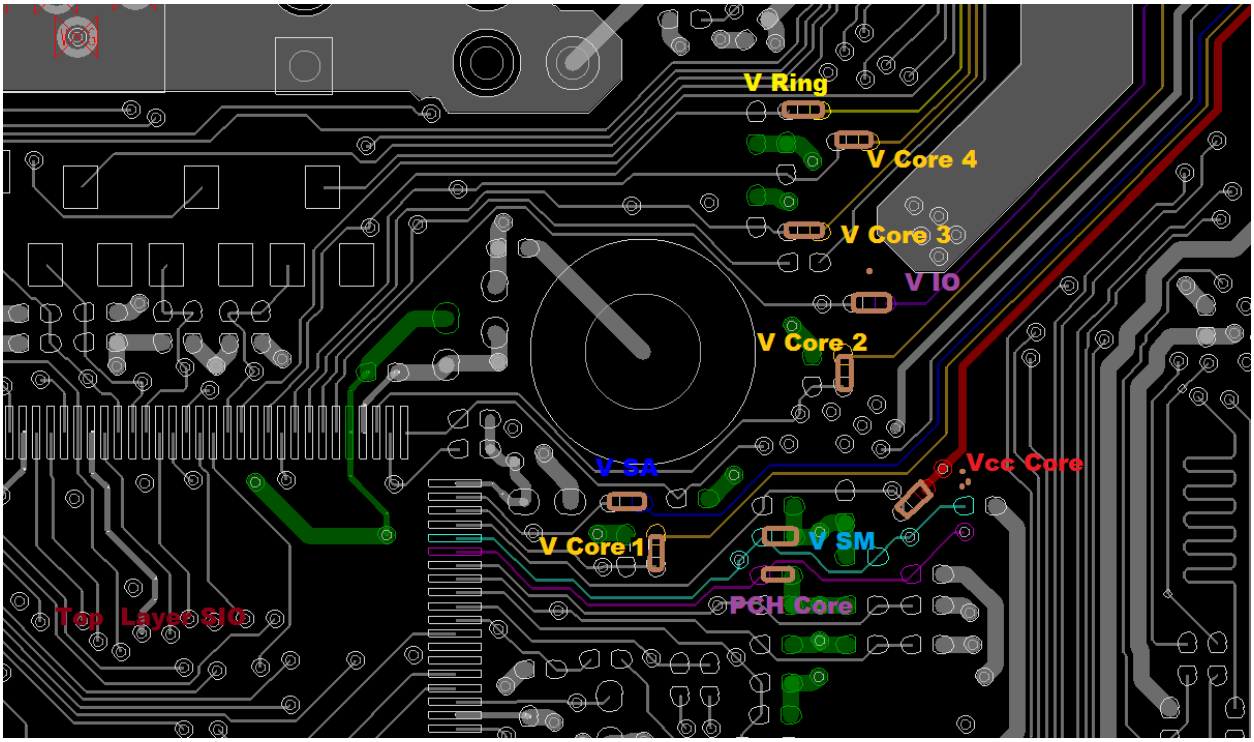
Core Turbo Ratio	Unlock CPU	Turbo ratio enable	Core ratio	Ring Ratio	Processor Current Limit (Amps) ICC-Max	Burst Mode Power Limit (Watts) or Short Term Power Limits or Power Limits 2 Power	Sustained Mode Power Limit (Watts) or Long term Power limits or Power Limits 1 Power	Static + offset	Processor Core Voltage (V)	Processor Core Voltage offset (mV)	Ring Voltage	Ring Offset (mV)	Graphic Target (mv) Offset	Max Non-Turbo multiplier	VR Fault /VR Effic	SB-PLL	High Speed/ Low Speed	Memory Multiplier & set to Manual	PCIE-ASPM
4.00	yes	All Cores	32	32	1000	1000	1000	Static + offset	1.12	0	1.12	0	100	x32	disable	SB-PII	Low Speed	x8	Disable
4.12	yes	All Cores	33	33	1000	1000	1000	Static + offset	1.12	0	1.12	0	100	x32	disable	SB-PII	Low Speed	x8	Disable
4.25	yes	All Cores	34	34	1000	1000	1000	Static + offset	1.2	0	1.2	0	100	x32	disable	SB-PII	Low Speed	x8	Disable
4.37	yes	All Cores	35	35	1000	1000	1000	Static + offset	1.21	0	1.21	0	100	x32	disable	SB-PII	Low Speed	x8	Disable
4.50	yes	All Cores	36	36	1000	1000	1000	Static + offset	1.24	0	1.24	0	100	x32	disable	SB-PII	Low Speed	x8	Disable
4.62	yes	All Cores	37	37	1000	1000	1000	Static + offset	1.27	0	1.27	0	100	x32	disable	SB-PII	Low Speed	x8	Disable

For BCLK > 125 MHz

- **Check the Unlock Extreme Voltages setting if it is not checked (if you have a K-skew CPU, this should always be checked).**
- **Uncheck the Processor VR Faults setting (disable).**
- **Uncheck the Processor VR Efficiency setting (disable).**
- **Filter PLL → Low Speed.**
- **Set Processor Current Limit Override ➔ 1000.**
- **Set Burst Mode Power Limit ➔ 1000.**
- **Set Sustained Mode Power Limit ➔ 1000.**
- **Might need to increase Input Voltage.**
- **Need to increase Core and Ring voltage.**
- **Might need to increase System Agent offset.**
- **Lower memory multiplier.**

Setup for 167MHz (example using Cores set to 4.34GHz)



Example of BCLK= 150MHz

Voltage Check