

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**

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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.

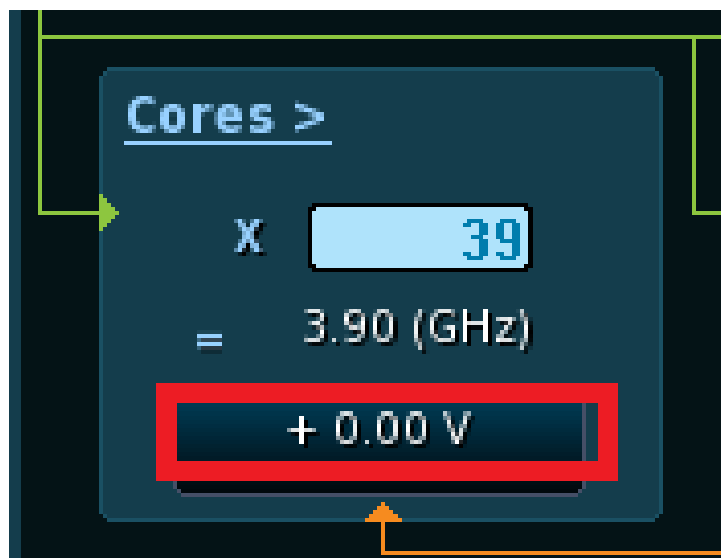
The new feature of the 4th Generation Intel® Core processor is an integrated voltage regulator (IVR). This new voltage regulator is integrated into the processor package and controls a number of voltage rails except Memory (Vddq). These rails include the IA Core rail, GT rail, System Agent rail, and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



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

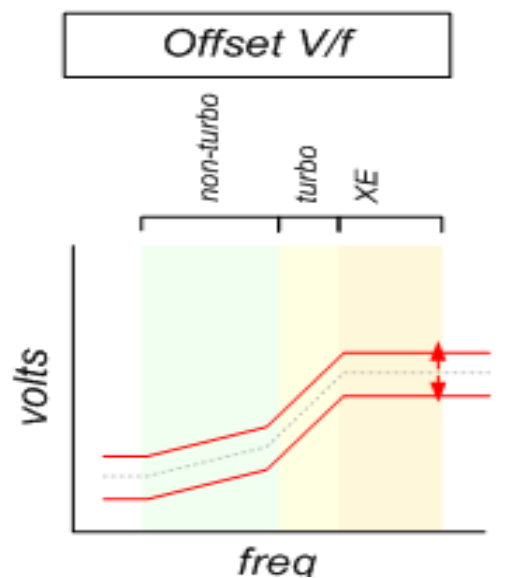
The screenshot shows the Intel Visual BIOS interface. The 'Performance Dashboard' is active, displaying various system settings. A red box highlights the 'Processor Cores Voltage' settings on the right side of the dashboard. The settings are as follows:

- Processor Core Voltage Mode: Static + Offset
- Processor Core Voltage Target (V): 0.00
- Processor Core Voltage Offset (V): 0.00

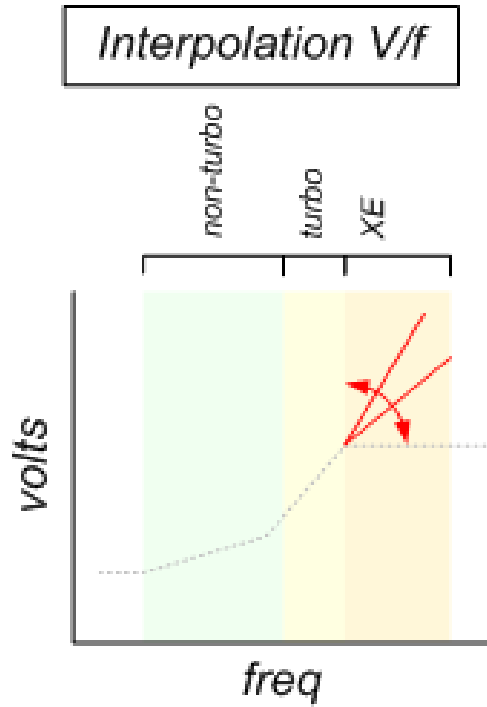
The 'Cores >' section on the left shows a multiplier of 39, resulting in a core frequency of 3.90 GHz. The 'Cores >' section also shows a voltage offset of 0.00 V + 0.00 V. The 'Input Voltage' section shows a target of 0.00 V. The 'Memory >' section shows a multiplier of 12, resulting in a memory frequency of 1600 MHz. The 'System Agent (V)' section shows a target of 0.00 V. The 'Analog I/O (V)' section shows a target of 0.00 V. The 'Digital I/O (V)' section shows a target of 0.00 V.

i This diagram represents your processor. Edit settings within the diagram, or click Ring, Cores, Graphics, Memory, or any voltage button to view detailed settings for each.

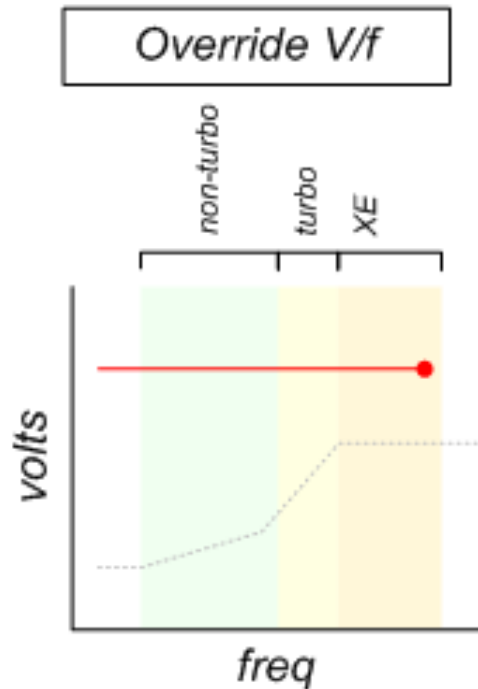
The Offset Mode: Positive and negative offset applied to the entire curve.



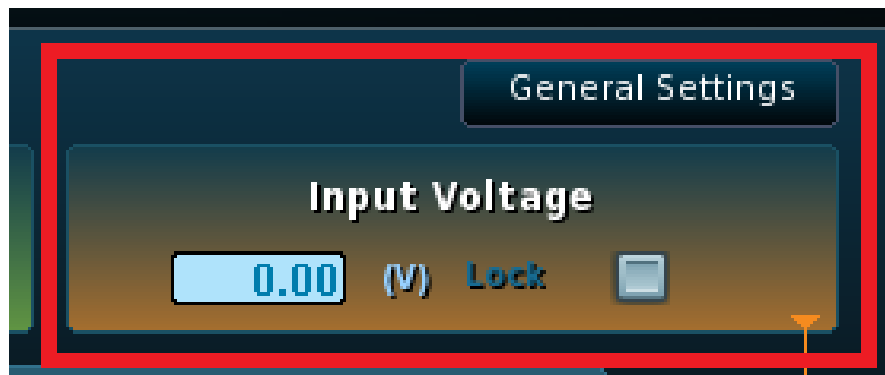
The Interpolated Mode: Sometime is referred to Adaptive mode. This is only applicable for frequencies and voltages beyond the default maximum turbo frequency.



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.



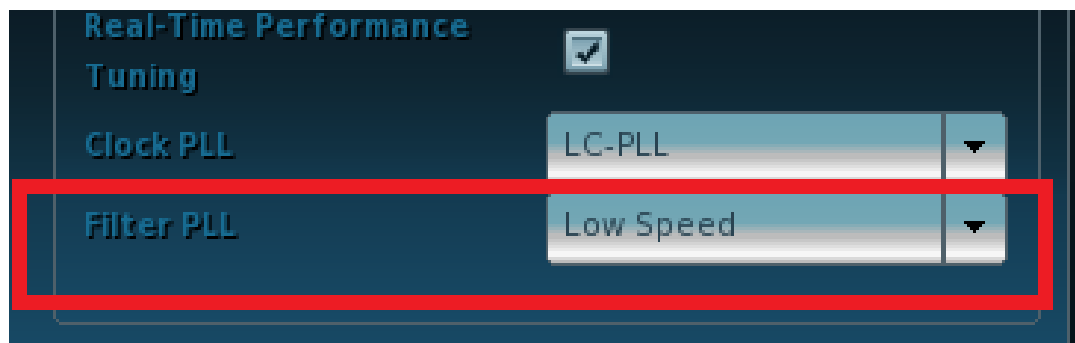
In Turbo ratio and BCLK OC, the Processor VR fault is set to disable (uncheck). This is a risk of using it by the user because the Over-voltage protection (OVP) and

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

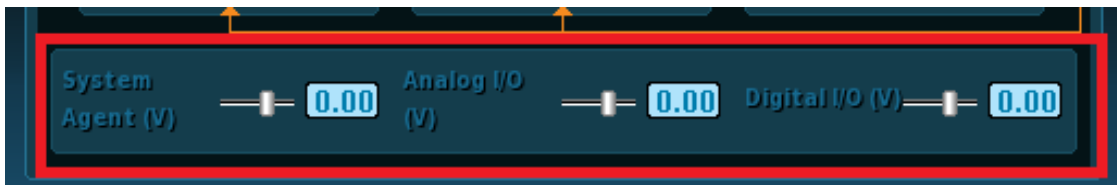
Notes: To adjust the Manual settings, uncheck Automatic PEG-DMI Ratio. In manual control you can adjust the BCLK by 4% to 5% for upside frequency and you can achieve a larger down frequency range.

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 Efficiency setting (disable).
- Uncheck the Processor VR Faults 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).

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

The screenshot shows the Intel Visual BIOS interface. The Performance Dashboard is active, displaying various system settings. The Host Clock is set to 100.00 MHz. The Ring multiplier is set to 39, resulting in a 3.90 GHz processor clock. The Processor Cores section is expanded, showing settings for Turbo and Config. The Processor Current Limit (Amps) is set to 1000. The Burst Mode Power Limit (Watts) is set to 1000. The Sustained Mode Time (Seconds) is set to 8. The Sustained Mode Power Limit (Watts) is set to 1000. The Cores multiplier is also set to 39, resulting in a 3.90 GHz processor clock.

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

The screenshot shows the Intel Visual BIOS interface. The Performance Dashboard is active, displaying various system settings. The Host Clock is set to 100.00 MHz. The Ring multiplier is set to 42, resulting in a 4.20 GHz processor clock. The Processor Cores section is expanded, showing settings for Turbo and Config. The Single Max Turbo Ratio is checked. The Turbo Ratio is set to 42. The Maximum Non-Turbo Ratio is set to 35. The Cores multiplier is also set to 42, resulting in a 4.20 GHz processor clock.

i This diagram represents your processor. Edit settings within the diagram, or click Ring, Cores, Graphics, Memory, or any voltage button to view detailed settings for each.

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

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

The screenshot displays the Intel Visual BIOS interface, specifically the Performance Dashboard. The interface is dark-themed with various settings panels. At the top, there are navigation tabs: Home, Main, Devices, Cooling, Performance, Security, Power, and Boot. The Performance Dashboard includes sections for Host Clock (100.00 MHz), Input Voltage (0.00 V), and an Integrated Voltage Regulator. The Ring multiplier is set to 42, resulting in a 4.20 GHz clock. The Cores multiplier is also set to 42, resulting in a 4.20 GHz core clock. The Graphics multiplier is set to 25, resulting in a 1.25 GHz graphics clock. The Memory multiplier is set to 1.33, resulting in a 1333 MHz memory clock. The Processor Cores section on the right shows Turbo Ratio set to 42 and Maximum Non-Turbo Ratio set to 35. A red box highlights the Ring and Cores multiplier settings. A blue box highlights the Turbo Ratio setting. A blue box highlights the Maximum Non-Turbo Ratio setting. A blue box highlights the Host Clock setting. A blue box highlights the Input Voltage setting. A blue box highlights the System Agent Voltage setting. A blue box highlights the Analog I/O Voltage setting. A blue box highlights the Digital I/O Voltage setting. A blue box highlights the Memory Voltage setting.

Intel® Visual BIOS Search Visual BIOS

Home Main Devices Cooling Performance Security Power Boot

Performance Dashboard General Settings

Host Clock > 100.00 MHz

Input Voltage 0.00 (V) Lock

Integrated Voltage Regulator

Ring > x 42 = 4.20 (GHz) + 0.00 V

Cores > x 42 = 4.20 (GHz) + 0.00 V

Graphics x 25 x 0.50 = 1.25 (GHz) + 0.00 V

Memory > x 1.33 x 1.0 = 1333 (MHz) 1.5000 (V)

System Agent (V) 0.00 Analog I/O (V) 0.00 Digital I/O (V) 0.00

Processor Cores Turbo Config

Single Max Turbo Ratio *

Turbo Ratio 42

Maximum Non-Turbo Ratio 35

i This diagram represents your processor. Edit settings within the diagram, or click Ring, Cores, Graphics, Memory, or any voltage button to view detailed settings for each.

- Exit and Save.

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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 increase 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-Pll	High Speed/ Low Speed	Memory
3.9	yes	All Cores	39	39	1000	1000	1000	35		0	0	0	0	disable	LC-Pll	High Speed	automatic
4.00	yes	All Cores	40	40	1000	1000	1000	35		0	0	0	0	disable	LC-Pll	High Speed	automatic
4.10	yes	All Cores	41	41	1000	1000	1000	35		0	0	0	0	disable	LC-Pll	High Speed	automatic
4.20	yes	All Cores	42	42	1000	1000	1000	35		0	0	0	0	disable	LC-Pll	High Speed	automatic
4.30	yes	All Cores	43	43	1000	1000	1000	35	offset	0	50	0	50	disable	LC-Pll	High Speed	automatic
4.40	yes	All Cores	44	44	1000	1000	1000	35	offset	0	100	0	100	disable	LC-Pll	High Speed	automatic
4.50	yes	All Cores	45	45	1000	1000	1000	35	Interpo + offset	1.24	0	1.24	0	disable	LC-Pll	High Speed	automatic
4.60	yes	All Cores	46	46	1000	1000	1000	35	Interpo + offset	1.27	0	1.27	0	disable	LC-Pll	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.

The screenshot shows the Intel Visual BIOS Performance Dashboard. The 'Host Clock' is set to 125.00 MHz. The 'Input Voltage' is set to 0.00 V. The 'Ring' multiplier is set to 36, resulting in a 4.50 GHz frequency. The 'Cores' multiplier is also set to 36, resulting in a 4.50 GHz frequency. The 'Graphics' multiplier is set to 25, resulting in a 1.56 GHz frequency. The 'Memory' multiplier is set to 1.33, resulting in a 1333 MHz frequency. The 'Performance Settings' panel on the right shows 'Unlock Extreme Voltages' checked, 'Processor VR Efficiency Management' unchecked, 'Processor VR Faults' unchecked, 'Real-Time Performance Tuning' checked, 'Clock PLL' set to SB-PLL, and 'Filter PLL' set to Low Speed. A red box highlights the 'Cores' multiplier and the 'Performance Settings' panel.

Performance Dashboard

Host Clock > 125.00 MHz

Input Voltage 0.00 (V) Lock

Integrated Voltage Regulator

Ring > x 36 = 4.50 (GHz) 1.20 V + 0.00 V

Cores > x 36 = 4.50 (GHz) 1.20 V + 0.00 V

Graphics x 25 x 0.50 = 1.56 (GHz) + 0.10 V

Memory > x 1.33 x 8 = 1333 (MHz) 1.5000 (V)

System Agent (V) 0.00 Analog I/O (V) 0.00 Digital I/O (V) 0.00

Performance Information

Intel does not warranty the operation of the processor beyond its specifications, except via the Performance Tuning Protection Plan, sold for eligible processors at click.intel.com/tuningplan/

Legal...

Performance Settings

Failsafe Watchdog

Unlock Extreme Voltages

Processor VR Efficiency Management *

Processor VR Faults *

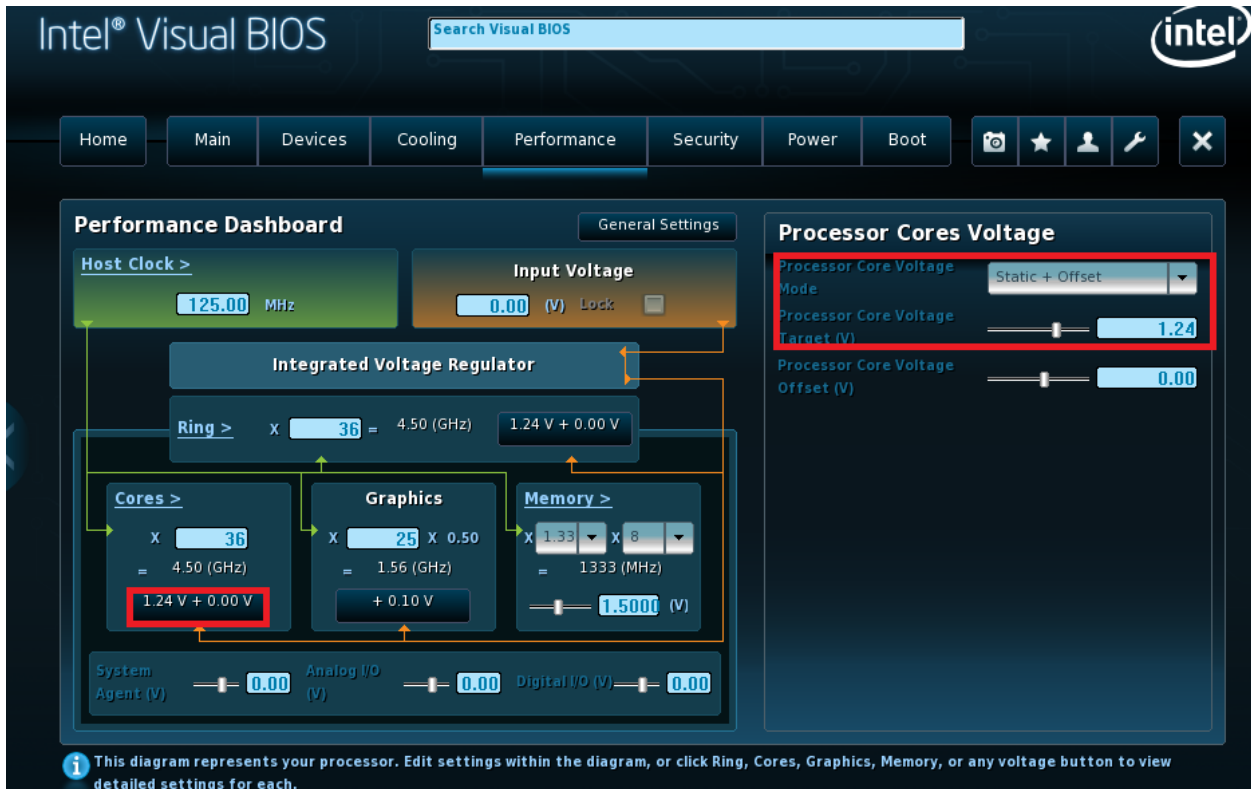
Real-Time Performance Tuning

Clock PLL SB-PLL

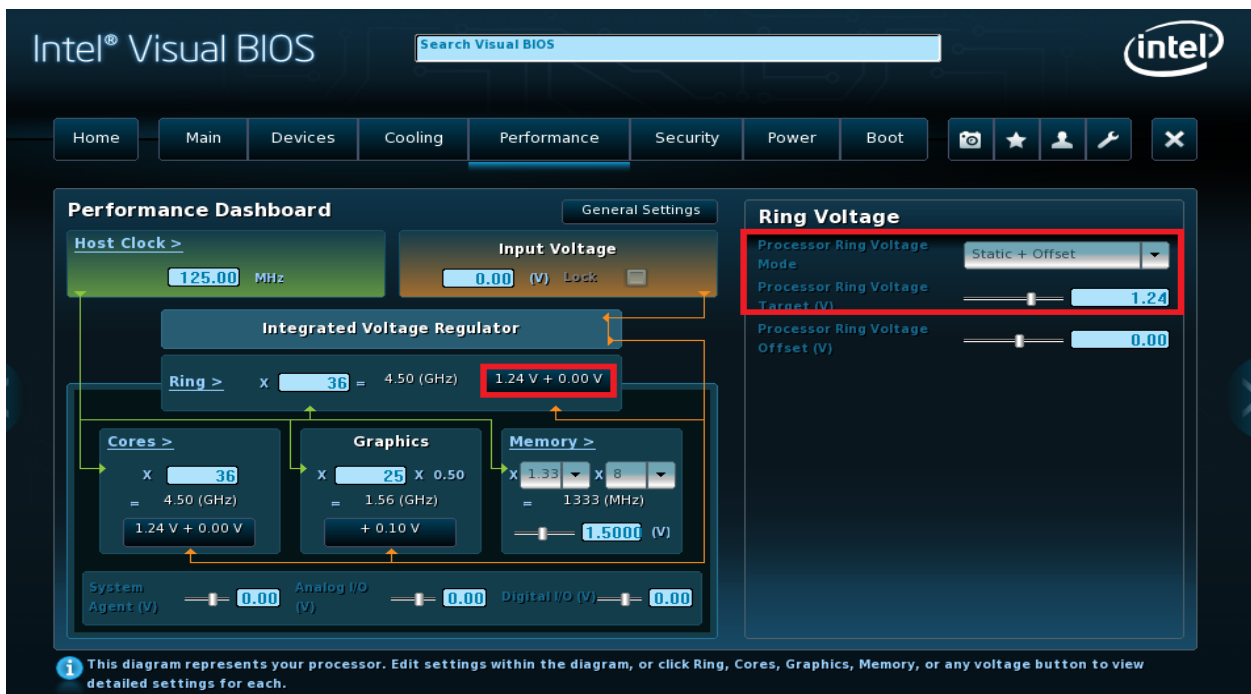
Filter PLL Low Speed

i This diagram represents your processor. Edit settings within the diagram, or click Ring, Cores, Graphics, Memory, or any voltage button to view detailed settings for each.

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



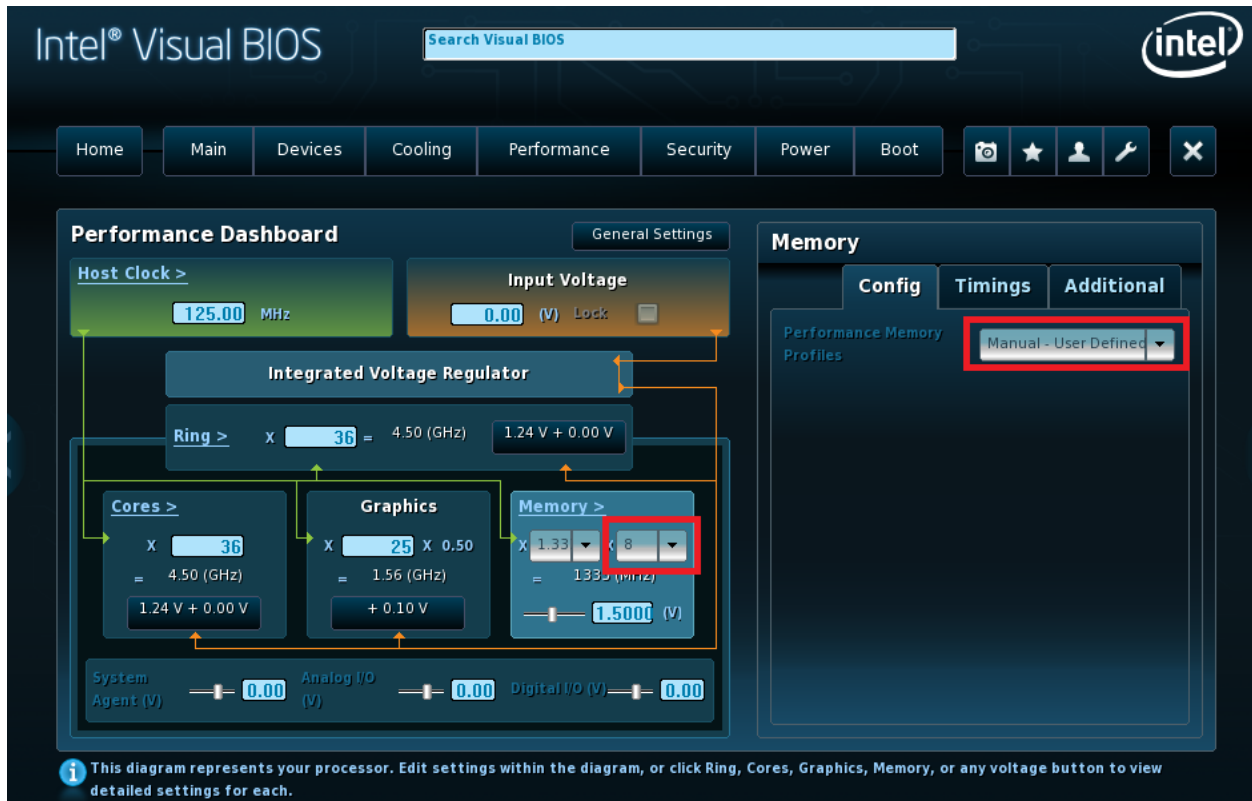
- Select the red square box on the left.
- Change Processor Ring Voltage Mode to Static + Offset.
- Raise Processor Ring voltage target to 1.24v.



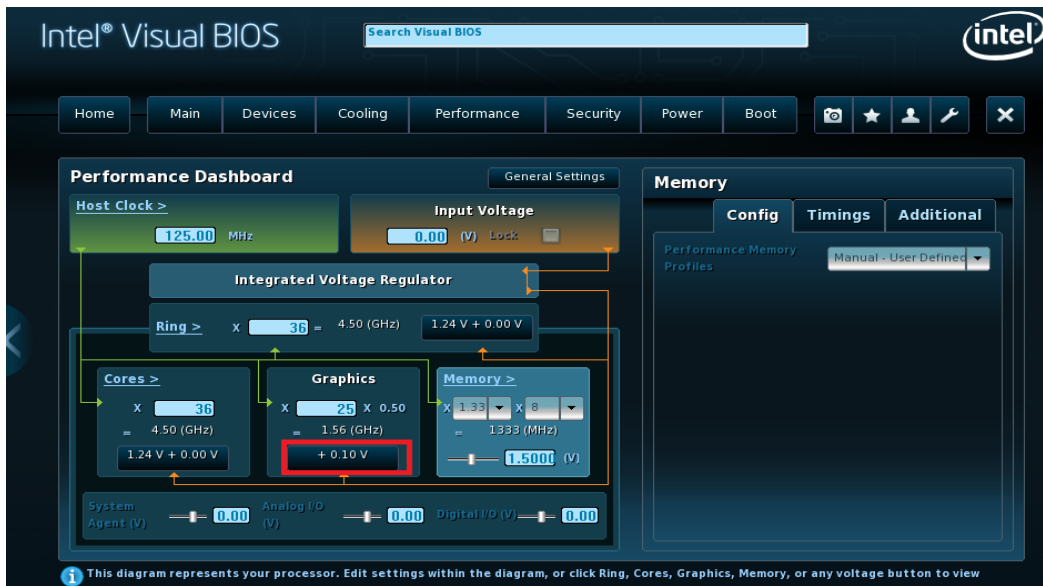
- Change Performance Memory Profile from Automatic to Manual-User Defined.

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- 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.

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

The image displays a Windows 8 desktop environment with several utility windows open. The primary window is the Intel (R) Power Thermal Utility Tool, which provides detailed system information and real-time monitoring for an Intel Core i7-4770K processor. The tool is set to 'Idle' and shows the following key metrics:

- Processor Info:** Intel(R) Core(TM) i7-4770K CPU @ 3.50GHz, OS: Microsoft Windows 8 64-bit, 4 Cores / 8 Logical Cores, Hyper-threading: Enabled, TCC Target Temp.: 100 C, TControl Offset: -20, TControl DTS: 80.
- Package Info:** Package TDP: 84 W, Package Temp.: 82 C, Package Power: 118.35 W, Thermal Margin: 19.37 C, Pkg. RAPL PL1 Status: Enabled, Pkg. RAPL PL2 Status: Enabled, Pkg. RAPL Power Limit1: 1000 W, Pkg. RAPL Power Limit2: 1000 W, Pkg. RAPL PL1 Time: 0 Sec, Pkg. RAPL PL2 Time: 0 Sec.
- Core Info Table:**

Core	DTS	Temperature	Frequency
Core 0	-22	78 C	4493 MHz
Core 1	-20	80 C	4493 MHz
Core 2	-21	79 C	4493 MHz
Core 3	-24	76 C	4493 MHz
- Uncore Info:** Current Uncore Freq.: 800 MHz, Max. Uncore Freq.: 4500 MHz, Min. Uncore Freq.: 800 MHz, Uncore Power: 8.97 W.

Other visible windows include CPU-Z (showing Intel Core i7 4770K, 4489.57 MHz, 99.77 MHz bus speed), Real Temp GT 3.70 (showing 79°C core temperature), and Prime95 (running a stress test with a main thread at 14:06). A small 'gigabyte' logo is visible in the bottom right corner of the desktop.

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.

Core Turbo Ratio	Unlock CPU	Turbo ratio enable	Core ratio	Ring Ratio	Processor Current Limit (Amps) (Amps) (ICC-Max)	Burst Mode Power Limit (Watts) (Watts) (Short Term Power Limits 2 or Power Power)	Sustained Mode Power Limit (Watts) (Watts) (Long term Power Limits 1 or Power 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 increase or decrease to find the stable state of your CPU.

Core Turbo Ratio	Unlock CPU Turbo ratio enable	Core ratio	Ring Ratio	Processor Current (Amper) VCC Max	Burst Mode Power Limit (Watts) or Short Term Power Limits 1 Power	Sustained Mode Power Limit (Watts) or Long term Power Limits 2 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	1000	1000	1000	Static + offset	1.12	0	1.12	0	100	x32	disable	SB-PLL	Low Speed	x8	Disable
4.12	yes	All Cores	33	1000	1000	1000	Static + offset	1.12	0	1.12	0	100	x32	disable	SB-PLL	Low Speed	x8	Disable
4.25	yes	All Cores	34	1000	1000	1000	Static + offset	1.2	0	1.2	0	100	x32	disable	SB-PLL	Low Speed	x8	Disable
4.37	yes	All Cores	35	1000	1000	1000	Static + offset	1.21	0	1.21	0	100	x32	disable	SB-PLL	Low Speed	x8	Disable
4.50	yes	All Cores	36	1000	1000	1000	Static + offset	1.24	0	1.24	0	100	x32	disable	SB-PLL	Low Speed	x8	Disable
4.62	yes	All Cores	37	1000	1000	1000	Static + offset	1.27	0	1.27	0	100	x32	disable	SB-PLL	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)

Performance Dashboard

Host Clock > **167.00** MHz

Input Voltage **1.90** (V) Lock

Integrated Voltage Regulator

Ring > $\times 25 = 4.17$ (GHz) **1.28 V + 0.00 V**

Cores > $\times 26 = 4.34$ (GHz) **1.30 V + 0.00 V**

Graphics $\times 25 \times 0.50 = 2.08$ (GHz) **+ 0.15 V**

Memory > $\times 1.333 \times 8 = 1781$ (MHz) **1.5250** (V)

System Agent (V) **0.20** Analog I/O (V) **0.00** Digital I/O (V) **0.00**

Performance Information

Intel does not warranty the operation of the processor beyond its specifications, except via the Performance Tuning Protection Plan, sold for eligible processors at click.intel.com/tuningplan/

Performance Settings

- Failsafe Watchdog
- Unlock Extreme Voltages
- Processor VR Efficiency Management
- Processor VR Faults
- Real-Time Performance Tuning
- Clock PLL: SB-PLL
- Filter PLL: Low Speed

General Settings

1 This diagram represents your processor. Edit settings within the diagram, or click Ring, Cores, Graphics, Memory, or any voltage button to view detailed settings for each.

Intel (R) Power Thermal Utility Tool

Platform Found: Haswell Desktop/AIO/UP Server/Workstation

Revision: 1.1

CPU Data

Processor Info: Intel(R) Core(TM) i7-4770K CPU @ 3.50GHz OS: Microsoft Windows 8 Pro 64-bit

Number of Cores: 4 Cores, 8 Logical Cores

Hyper-threading: Enabled

Microcode Version: 0x9

TCC Control Offset: -20

TCC Status: Idle

Package Info

Package TDP: 94 W

Package Power: 234.08 W

Package Temp.: 95 C

Thermal Margin: 5,145 C

Package D: Tau: 1

Pkg. RAPL P1 Status: Enabled

Pkg. RAPL P2 Status: Enabled

Pkg. RAPL Power Limit1: 1000 W

Pkg. RAPL Power Limit2: 1000 W

Pkg. RAPL P1 Time: 8 Sec

Pkg. RAPL P2 Time: 0 Sec

Core Info

Core	DTS	Temperature	Frequency
Core 0	-5	95 C	4351 MHz
Core 1	-8	92 C	4351 MHz
Core 2	-12	88 C	4351 MHz
Core 3	-20	80 C	4351 MHz

Uncore Info

Current Uncore Freq.: 2500 MHz Max. Uncore Freq.: 2500 MHz Min. Uncore Freq.: 800 MHz

Uncore Power: 20.85 W

Temperature Info

Core	Temperature (C)
Core 0	95
Core 1	92
Core 2	88
Core 3	80

Frequency Info

Core	Frequency (MHz)
Core 0	4351
Core 1	4351
Core 2	4351
Core 3	4351
Uncore	2500

C-States Info

C/Pkg	C0	C2	C3	C6	C7
Core 0	100%	0%	0%	0%	0%
Core 1	100%	0%	0%	0%	0%
Core 2	100%	0%	0%	0%	0%
Core 3	100%	0%	0%	0%	0%
Pkg.	100%	0%	0%	0%	0%

Prime95

```

[Main thread Jun 6 04:57] Optimizing for CPU architecture: L
[Main thread Jun 6 04:57] Logical CPUs 0,1 form one physic
[Jun 6 05:00] Test 3, 460000 Lucas-Lehmer iterations of M2:
[Jun 6 05:01] Test 4, 460000 Lucas-Lehmer iterations of M2:
[Jun 6 05:01] Test 4, 460000 Lucas-Lehmer iterations of M2:
[Jun 6 05:02] Test 5, 460000 Lucas-Lehmer iterations of M2:
    
```

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

Example of BCLK = 150MHz

The image displays two software windows: CPU-Z and Intel (R) Power Thermal Utility Tool. CPU-Z shows the processor as Intel Core i7-4770K CPU @ 3.50GHz (ES) with a core speed of 4500.00 MHz and a bus speed of 150.00 MHz. The Intel Power Thermal Utility Tool provides detailed information about the processor, including its brand string, number of cores, microcode version, and various power and thermal limits. It also displays a table of core temperatures and frequencies, and a C-states table.

CPU-Z Processor Information:

- Name: Intel Core i7
- Code Name: Haswell
- Package: Socket 1150 LGA
- Technology: 22 nm
- Specification: Intel(R) Core(TM) i7-4770K CPU @ 3.50GHz (ES)
- Family: 6
- Ext. Family: 8
- Instructions: MMX, SSE, SSE2, SSE3, SSSE3, SSE4.1, SSE4.2, EM64T, VT-x, AES, AVX, AVX2, FMA3
- Cache: 4 x 32 Kbytes
- Core Speed: 4500.00 MHz
- Bus Speed: 150.00 MHz
- Selection: Processor #1, Cores: 4, Threads: 8

Intel (R) Power Thermal Utility Tool Processor Info:

- CPU Brand String: Intel(R) Core(TM) i7-4770K CPU @ 3.50GHz
- OS: Microsoft Windows 8 Pro 64-bit
- Number of Cores: 4 Cores ; 8 Logical Cores
- Hyper-threading: Enabled
- Microcode Version: 0x0
- TCC Target Temp.: 100 C
- TControl Offset: -20
- TControl DTS: 80
- TCC Status: Idle

Package Info:

- Package TDP: 84 W
- Package Power: 1.48 W
- Pkg. RAPL PL1 Status: Enabled
- Pkg. RAPL Power Limit1: 1000 W
- Pkg. RAPL PL1 Time: 8 Sec
- Package Temp.: 87 C
- Thermal Margin: -5.843 C
- Pkg. RAPL PL2 Status: Enabled
- Pkg. RAPL Power Limit2: 1000 W
- Pkg. RAPL PL2 Time: 0 Sec

Core Info Table:

Core	DTS	Temperature	Frequency
Core 0	-13	87 C	4441 MHz
Core 1	-18	82 C	4441 MHz
Core 2	-23	77 C	4441 MHz
Core 3	-27	73 C	4441 MHz

C-States Info Table:

C/Pkg.	C0	C2	C3	C6	C7
Core 0	100%	0%	0%	0%	0%
Core 1	100%	0%	0%	0%	0%
Core 2	100%	0%	0%	0%	0%
Core 3	100%	0%	0%	0%	0%
Pkg.	100%	0%	0%	0%	0%

Voltage Check

