GIGABYTE AMD A75 CHIPSET OC GUIDE

AMD Llano platform was launched recently and it offers some interesting overclocking abilities and impressive 3D performance boost once system is tweaked. Llano platform has decent potential to make a great all rounder/home media PC, office machine, even a gaming machine on a budget. We finally have an integrated GPU platform with some solid graphics performance thanks to AMD and would like to share an OC guide!

The key to unlocking the potential of Llano platform is overclocking. GIGABYTE A-Series motherboard range has big overclocking capability. The purpose of this guide is to show and analyse that overclocking capability and provide some general pointers and key overclocking parameters, in order to get the most out of the platform to improve end user experience.

Let's start with the test system used. High performance components were chosen purely for testing purposes and to show capability of the platform rather than an indicative mainstream system, it's up to end users to combine what price/performance components they wish to purchase.

SYSTEM:

- **GIGABYTE A75M-D2H v1.0** (F3 shipping bios & F4c beta bios)
- **AMD A8-3850** (quad core, 2.9GHz CPU, 600MHz GPU clock)
- 4GB RAM KIT, Corsair CMGTX3
- 8GB RAM KIT, Corsair CMGTX7
- 750W Corsair HX750 PSU
- H100 Corsair water cooler
- Kingston SSDNow V Series 128GB SSD Drive (SATA0 port)
- ATI 11.7 Display Driver
- Windows 7 64-bit OS

The following benchmarks were used to assess performance and stability.

BENCHMARKS:

- 3DMARK Vantage Performance
- SuperPi 8M
- Cinebench CPU
- Cinebench OpenGL
- Dirt3 game
- wPrime 32M

We chose a variety of CPU and GPU based benchmarks to try and understand how overclocking affects performance. In terms of CPU based benchmarks we chose SuperPi 8M, wPrime 32M and Cinebench CPU which test single and multi core performance. GPU based benchmarks include 3DMARK Vantage Performance, Cinebench OpenGL and Dirt3 DX11 video game.

These benchmarks are in no way a final test of stability and for further stability testing it is recommended to use some form of CPU and GPU stress software. Ultimate stability is still the test of time.

BIOS screenshots

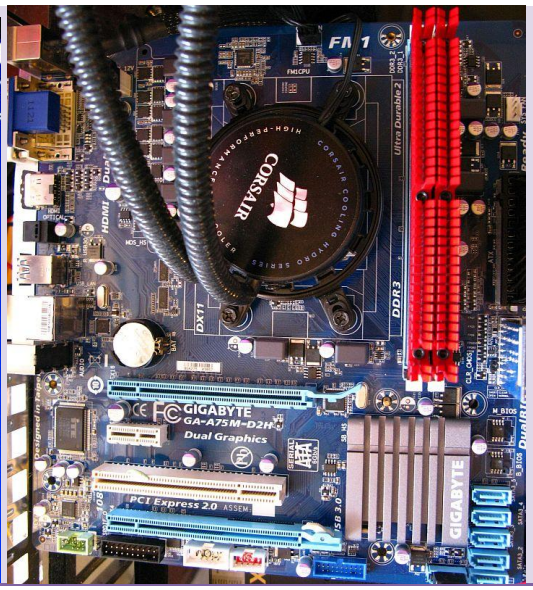
```
CMOS Setup Utility - Copyright (C) 1984-2011
MB Intelligent Tweaker(M.I.T

▶ IGX Configuration          [Press Enter]
  CPU Clock Ratio            [Auto]      2900Mhz
  CPU Host Clock Control     [Auto]
x CPU Frequency(MHz)          100
  PCIe Spread Spectrum       [Disabled]
  Set Memory Clock           [Auto]
x Memory Clock                x8.00      1600Mhz
▶ DRAM Configuration         [Press Enter]
  ******** System Voltage Optimized ********
  System Voltage Control     [Auto]
x FCH Voltage control         Auto
x DDR3 Voltage Control        Auto
x DDR VTT Voltage Control     Auto
x CPU VDDP Voltage Control    Auto
x CPU NB VID Control          Auto
x CPU Voltage Control         Auto
  Normal CPU Vcore           1.4125V
```

```
CMOS Setup Utility - Copyright (C) 1984-2011
DRAM Configuration

  DDR3 Timing Items          [Auto]    SPD     Auto
x 1T/2T Command Timing        Auto      --      --
x CAS# latency                Auto      9T      9T
x RAS to CAS R/W Delay        Auto      9T      9T
x Row Precharge Time          Auto      9T      9T
x Minimum RAS Active Time     Auto      28T     28T
x TwTr Command Delay          Auto      6T      6T
x Trfc0 for DIMM2             Auto      110ns   110ns
x Trfc1 for DIMM1             Auto      110ns   110ns
x Write Recovery Time         Auto      12T     12T
x Precharge Time              Auto      6T      6T
x Row Cycle Time              Auto      37T     37T
x RAS to RAS Delay            Auto      5T      5T
x Four Bank Activate Window   Auto      --      --
  **DCIs Drive Strength**           DCI0
  ProcOdt(ohms)               [Auto]   240
  DQS Drive Strength          [Auto]  .0x
  Data Drive Strength         [Auto]  .0x
  MEMCLK Drive Strength       [Auto]  .5x
```

```
CMOS Setup Utility - Copyright (C) 1984-
PC Health Status

  Reset Case Open Status     [Disabled]
  Case Opened                 Yes
  Vcore                       1.408V
  DDR3 1.5V                   1.504V
  +3.3V                       3.312V
  +12V                       11.858V
  Current System Temperature   25°C
  Current CPU Temperature      21°C
  Current CPU FAN Speed      1106 RPM
  Current SYSTEM FAN Speed   1005 RPM
  CPU Warning Temperature    [Disabled]
  CPU FAN Fail Warning       [Disabled]
  SYSTEM FAN Fail Warning    [Disabled]
  CPU Smart FAN Control      [Enabled]
  CPU Smart FAN Mode         [Auto]
  System Smart FAN Control   [Enabled]
```

```
CMOS Setup Utility - Copyright (C) 19
Advanced BIOS Fea

▶ IGX Configuration          [Press Enter]
  AMD C6 Support             [Disabled]
  Virtualization             [Disabled]
  AMD K8 Cool&Quiet control  [Auto]
  C-state Pmin               [Auto]
▶ Hard Disk Boot Priority    [Press Enter]
  EFI CD/DVD Boot Option     [Auto]
  First Boot Device          [Hard Disk]
  Second Boot Device         [CDROM]
  Third Boot Device          [USB-HDD]
  Password Check             [Setup]
  HDD S.M.A.R.T. Capability  [Disabled]
  Away Mode                  [Disabled]
  Full Screen LOGO Show      [Enabled]
  Init Display First         [PEG]
```

```
CMOS Setup Utility - Copyright (C) 1984
Integrated Peripher

  OnChip SATA Controller     [Enabled]
  OnChip SATA Type           [Native IDE]
x OnChip SATA Port4/5 Type    IDE
x OnChip SATA Port as ESP     Press Enter
  Onboard LAN Function       [Enabled]
  Onboard LAN Boot ROM       [Disabled]
▶ SMART LAN                  [Press Enter]
  Onboard Audio Function     [Enabled]
  Onchip USB 3.0 Controller  [Enabled]
  USB Controllers            [Enabled]
  USB Legacy Function        [Enabled]
  USB Storage Function       [Enabled]
  Onboard Serial Port        [3F8/IRQ4]
```



BASICS/KEY OC PARAMETERS

Please be aware that current APUs are partially locked (locked upwards from max multi/frequency). This means that even though a bios provides extra multipliers for CPUs or frequency adjustment on the GPU, they cannot actually set CPU multi or GPU frequency higher than default values. In A8 3850 APUs case, the max multi is 29x and that is the highest multiplier that can be set. A75M-D2H sees up to 47x multiplier however it will still default to 29x regardless of what value is selected beyond 29x. Monitoring utilities may also show incorrect speeds to the real values in windows. Best way to check is to test both settings and determine where there is any change in the benchmark. This board offers GPU clock frequency change. Once again it is a locked APU and even though you can select frequency higher than 600 it will not accept the change. You can however select lower frequency such as 550 or 500 which will reduce the GPU clock. GPU frequency can only be changed to higher values via base clock adjustment on locked APUs.

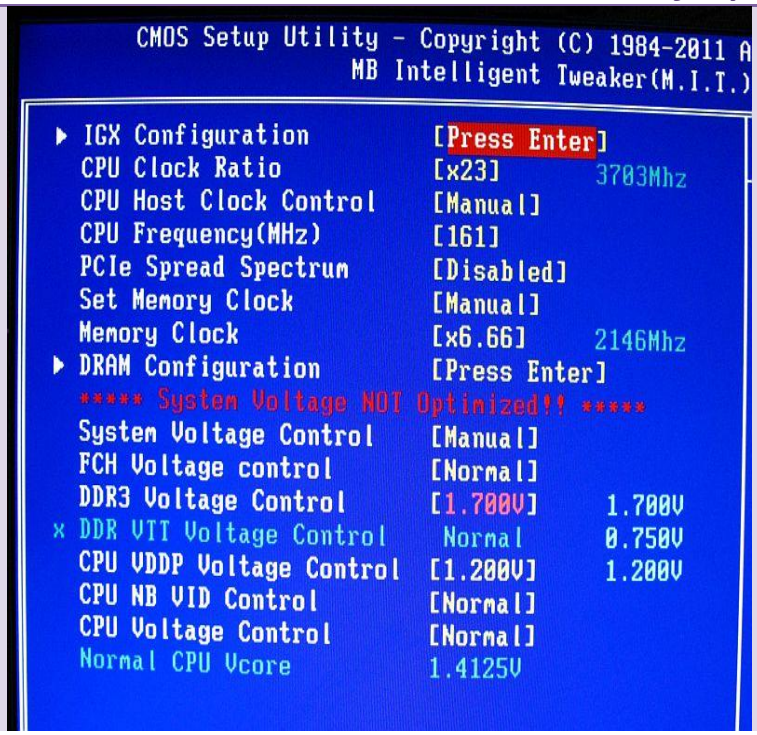
How to OC Llano platform properly?

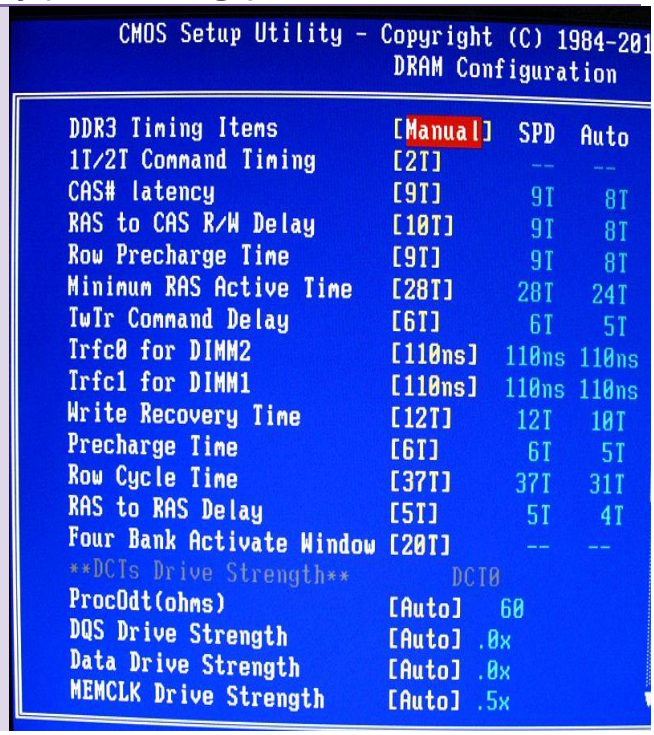
Reference Clock Adjustment

Given the fact APUs are currently locked the only way to properly overclock this platform is to control the reference clock or base clock(bclock). Default value is 100Mhz and it can be adjusted upwards. Bclock will control CPU, memory and GPU frequency. Increasing bclock to 110Mhz will increase CPU, RAM & GPU frequency by 10% for example. If we set 29x multiplier on CPU, x5.33 Memory ratio and 110Mhz bclock, the new CPU frequency will be 3190Mhz(29x110), RAM frequency will increase from 1066MHz to 1172Mhz (110x5.33x2) and GPU frequency will increase from stock 600Mhz to 660MHz (600x1.10).

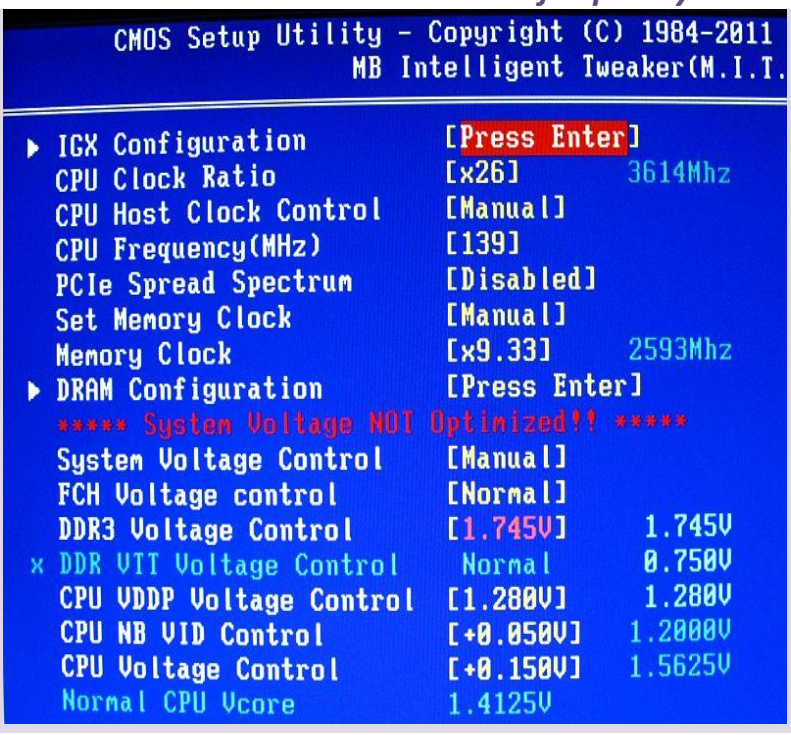
Our testing has two goals, to find the max bclock and to combine the max bclock with max CPU and memory frequency.

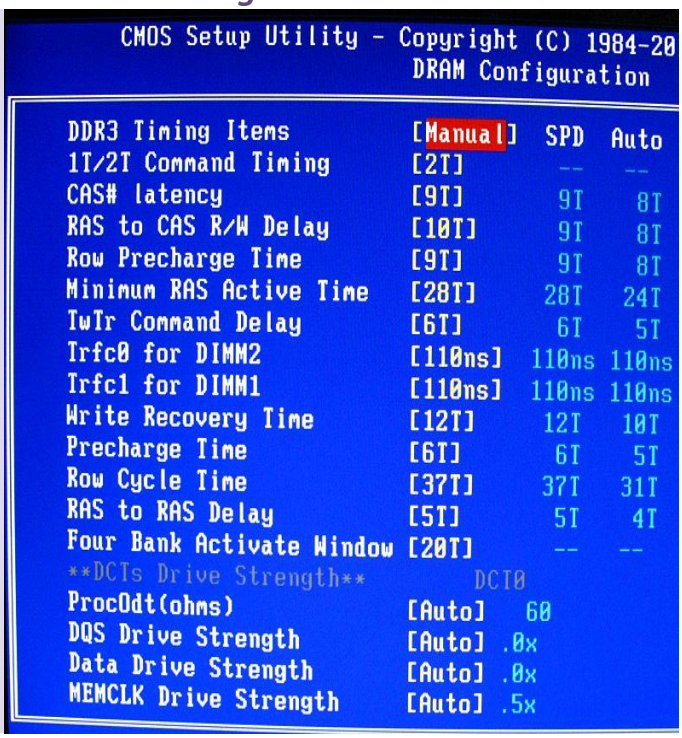
Max bclock: 161MHz frequency (bios settings)



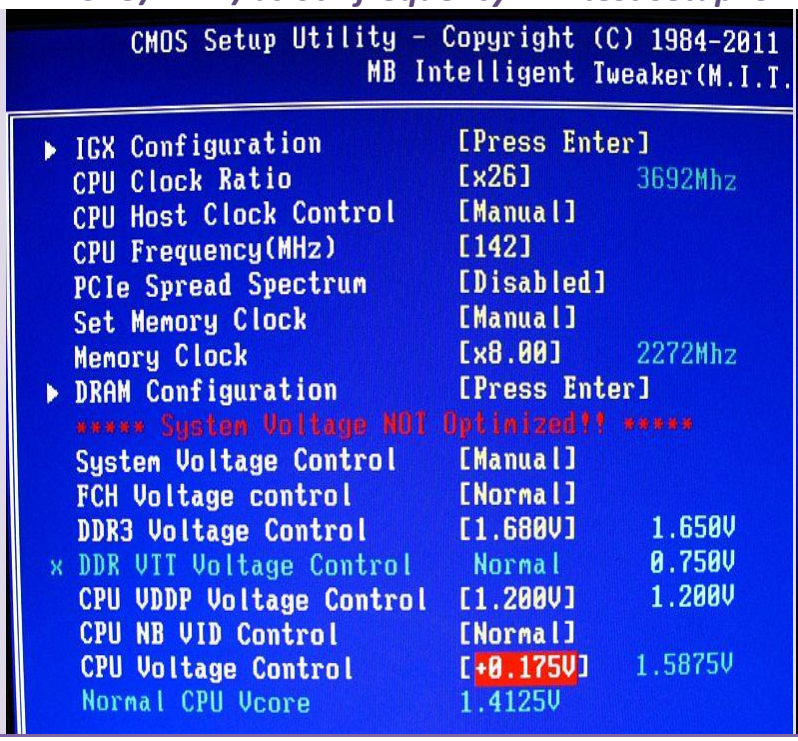


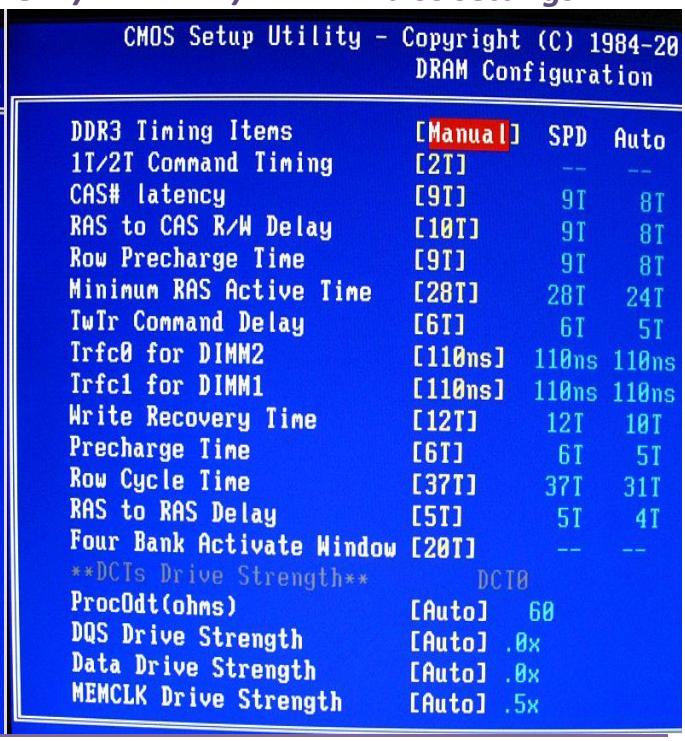
Max RAM frequency: 2593MHz bios settings





CPU/RAM/bclock frequency mix test setup: 3.7GHz/2272Mhz/142Mhz bios settings





Memory speed and timings:

GIGABYTE bioses tend to work well with auto speed and timing controls generally however AMD Llano is the first platform I am aware that has drastic impact on gaming performance and as such it may require some more tuning to max out the memory speeds. Increasing memory frequency can yield 35%+ increase in gaming FPS alone and 84% with combined OC.

Frequency Increase: Memory dividers on AMD A-series platform consist of x5.33, x6.66, x8.00 and x9.33 ratios. We've covered how bclock increases ram frequency previously with x5.33 and 110Mhz bclock. If we change the memory divider to x6.66, the new memory frequency will be 1465Mhz (110x6.66x2). If we change to x8.00 ratio RAM frequency increases to 1760MHz (110x8.00x2) and x9.33 ratios increases it to 2052Mhz (110x9.33x2).

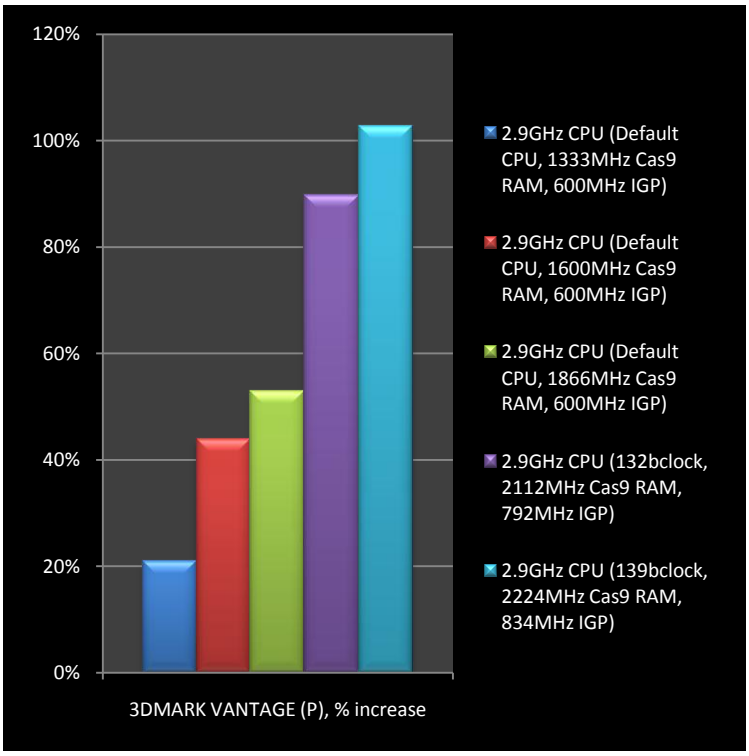
Timing Control: As you increase memory ratios and frequency you may have to adjust (or loosen) memory timings to stabilise the higher frequency overclock. If you select a higher ratio and the system fails to boot it may be the result of memory frequency limit at given volts and timings selected by bios (CAS#, RAS to CAS R/W, Row Precharge Time and Minimum RAS Active Time). CPUz reports these timings as 6-6-6-18 for example. What you may need to do is boot at previously stable multiplier and go to DRAM Configuration menu and manually adjust timings. If you see 8-8-8, try selecting 9-9-9-27 or 10-10-10-30. Some modules will also gain stability if you disable Bank Interleaving. If that is so leave it turned off otherwise turn it on as it improves performance of the system.

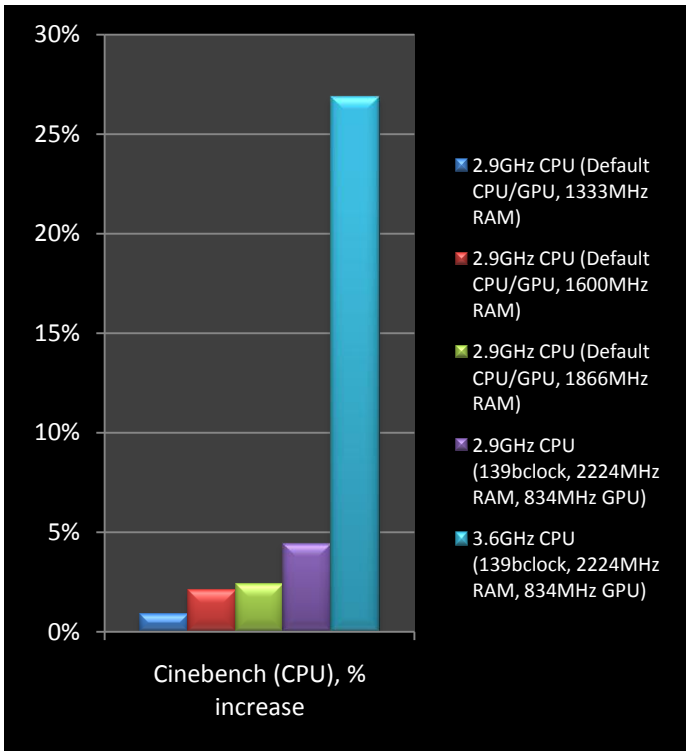
Memory plays a crucial role in improving graphics performance of A-Series APUs and this was very evident when we compared stock 1066Mhz RAM speed to all RAM ratios plus some overclocks past 2000Mhz in the chart below. CPU was left at 2.9GHz stock frequency for all tests.

I've highlighted a couple of different benchmarks and what effect memory OC has on them, 3DMARK Vantage and Cinebench CPU test. 3DMARK Vantage rose from 21% all the way to an astonishing 103%! This benchmark is a well known 3D benchmark and it becomes obvious memory affects 3D in a major way here.

Second benchmark is CPU based and as you can see memory OC has under 5% impact across the ratios. It only rose to 27% once we pushed the CPU frequency from 2.9GHz to 3.6GHz. Memory speed does not seem to have as great an effect on 2D performance as it does on 3D judging by these results.

Effects of memory overclock on system performance (highlighted GPU based benchmark increases)





For a more detailed article on how high performance ram with AMD A-series APUs improves DX11 gaming performance visit GIGABYTE Tech Daily.

VOLTS

There are three groups of volts which need to be tweaked when you start overclocking Llano. They are related to memory , CPU and graphics processor.

DDR3 Voltage Control or VDIMM controls memory voltage. In our case we used memory rated at 1.65v. Some memory ICs scale with higher voltage as frequency and timings are increased beyond manufacturer specifications. Raise this voltage in small steps and check for stability. Our modules are based on Hynix ICs which can scale with volts up to 1.75v. Raising voltage will stabilise higher frequencies or tighter timings in most cases. If the modules don't scale with more voltage leave the volts at stock.

GPU volts

CPU VCORE NB VID Control, this is the main GPU voltage but it only requires a slight bump. Ideally, it should be tested gradually in +0.05 increments. This voltage can be pushed to 1.45v if there is sufficient cooling and if the GPU scales with volts. I've found with this particular A8-3850 CPU that it does not like going past +0.05 hence why I stress the importance of testing in small increments :).

CPU VDDP Voltage Control, helps stabilise GPU, memory and base clock at high frequency. This voltage in most cases can be left at 1.2v (stock) which is what was used in most of our test. We did see some gains when testing big memory clocks and used up to 1.28v to stabilise clocks. Raising higher to 1.3 can negatively affect main GPU voltage control. For max clocks a delicate balance is required between VDDP and core. Every APU will act differently with volts so generally look to increase VDDP only slightly (in +0.02 jumps).

CPU VCORE Control is the main CPU voltage and as you increase the frequency voltage needs to be adjusted accordingly. We've found that you will gain generally 100Mhz with every 0.05v increase in VCORE but heat and silicone frequency limit may affect max clocks.

Other parameters

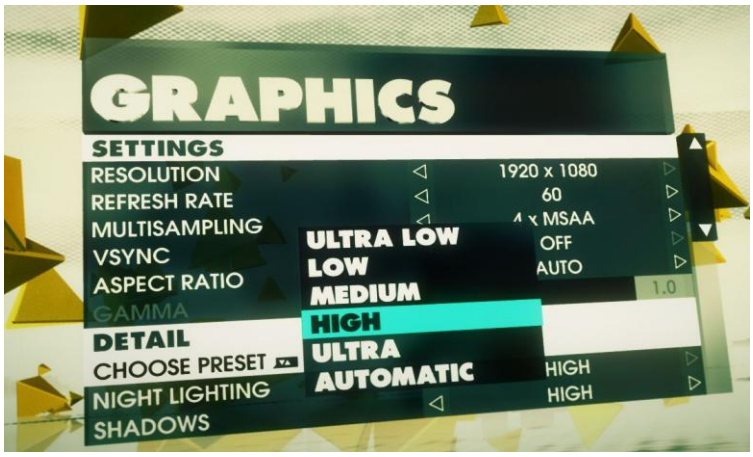
SATA Controller setting: Stick to Native IDE as AHCI has problems clocking bclock past 108Mhz when enabled.

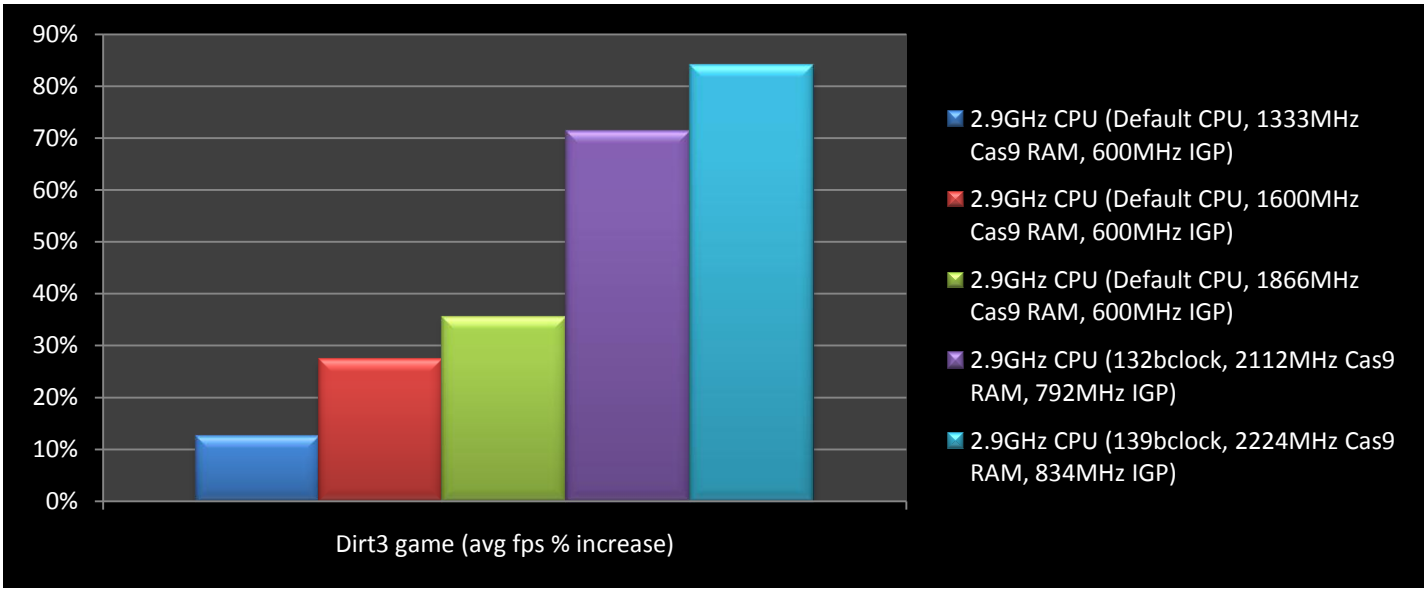
Power Management Options: It is generally recommended to force power options to max performance in windows and disable AMD Cool&Quiet and C-State in bios. Also use DVI/HDMI ports when overclocking.

GAMING - Dirt3

This is really where this APU shines and what gives something tangible to try and extract more MHz out of the stock frequencies. We decided it would be interesting to use Dirt3 at high quality settings and 1920x1080 resolution. It was obvious from the start that the test system was a bit sluggish at default bios settings as even the menus were taking a bit longer than normal to navigate through. Average fps at stock were below 18fps in the in-game benchmark. Not really playable! We needed 25fps+ for it to be smooth. This time around we've discovered that A8 CPU with the right RAM OC will have an even more impressive GPU performance than A6 3650. We even left CPU clock 2.9Ghz. End result was 35fps with 2.9Ghz CPU and (834Mhz CPU via bclock of 139GHz). Pretty impressive from an integrated GPU!

Graphics settings used to test performance





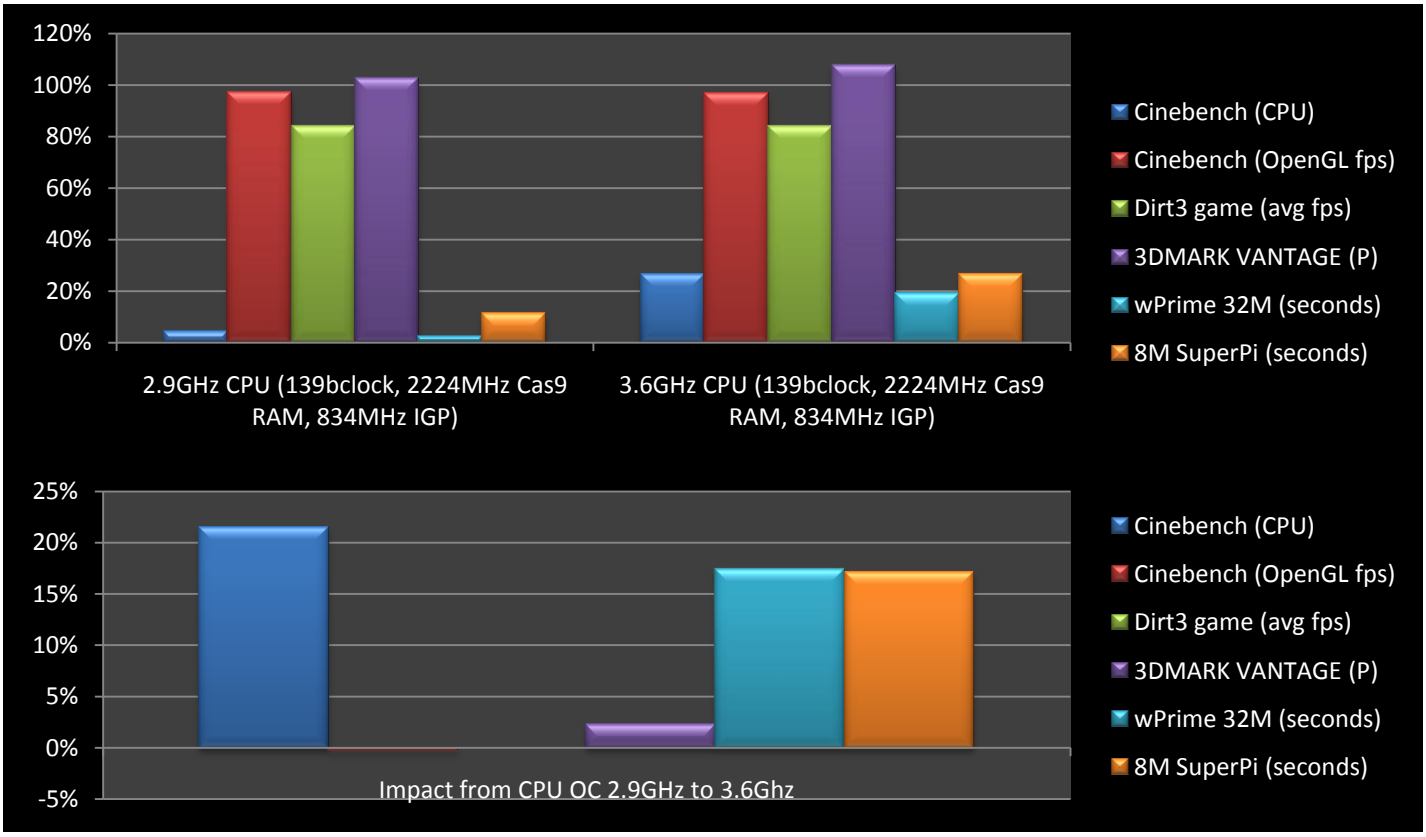
Final overclocking results and conclusions

Key parameters to overclock A-Series AMD platforms are bclock, CPU and memory frequencies. They further require voltage tuning via VCORE, VDDP, VCORE NB and VDIMM. Memory OC is the most important parameter to drastically affect 3D performance while CPU OC is required to show significant jumps in 2D performance.

Final overclocking results charts provided below show 2.9GHz vs 3.6GHz results where only CPU speed was changed. It shows that only CPU based benchmarks benefited up to 22% with raised CPU clocks alone. CPU clocks were raised 24% to achieve this showing that any 2D based benchmarks and applications will only benefit from faster processing if the CPU clocks are raised.

Second set of charts show stock to 3.7Ghz OC with all parameters tuned. We chose this frequency due to very little voltage tuning required (VCORE and VDIMM only change), memory was at 2272MHz and GPU at 852Mhz. The average increase in performance was 64% which was much higher than 27% CPU OC we used suggesting having a good motherboard capable of overclocking memory high will provide better overall system performance. 3D based benchmarks averaged just under 100% OC with 4GB RAM and 110% with 8GB ram running at 2400Mhz. 8GB RAM OC also helped us reach P6244 in 3DMARK Vantage, very cool!

Percentage increase in performance comparison between 2.9GHz and 3.6GHz



Percentage increase in performance comparison between stock settings and 3.7GHz final OC