Getac

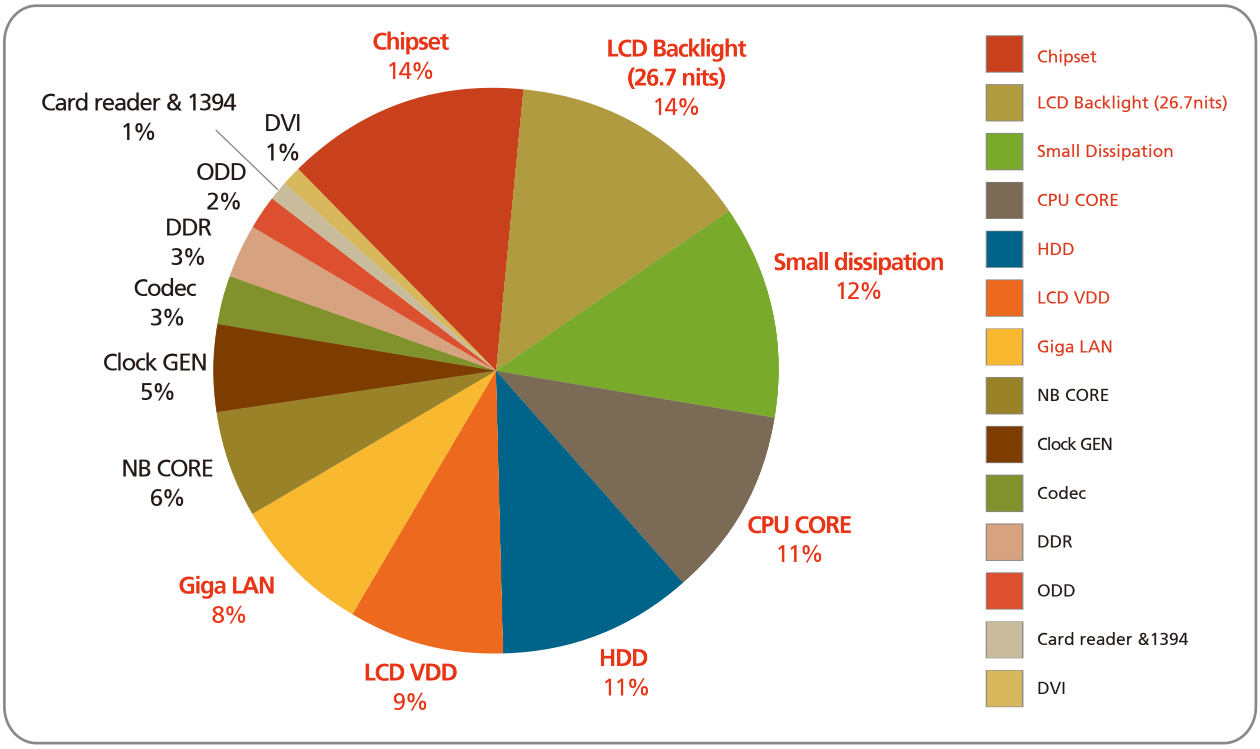
Technology Brief — Getac Power Saving Technology

Getac's Power Management Technology Achieves Next Level of Excellence for Rugged Mobile Computing Solutions

Power saving technology is increasingly important due to petroleum shortage and environmental protection issues. There is an urgent need to develop power saving technology in order to cater to the demand of end customers for longtime use of their mobile devices. Getac's research and development center has been diligently researching power saving technology for years, which not only enables a key selling feature for Getac's rugged mobile computing products but also represents our strong commitment to our home – the Earth.

Finding idle power consumption factors is the first step in our research, which helps us identify the major issues that we can focus on to improve the energy depletion of a system. In Figure 1, the pie chart shows the power depletion of an Intel Santa Rosa-based laptop, we outline major power depletion components such as LCD Backlight, Chipset, Small Dissipation, CPUCore, Hard Disk Drive (HDD) etc. The pie chart is derived when the system is running in heavy load mode. The sequence will subject to change as per different test conditions. In this case, the heavy load test will be proceeded through four programs; Prime95, SPEEDY and MPEG-2 AVI files from HDD, in which Prime95 is focused on CPU calculation, SPEEDY is for graphic performance. And MPEG-2 AVI files from HDD are for CPU, HDD, VGA and data bus burning in chipsets.

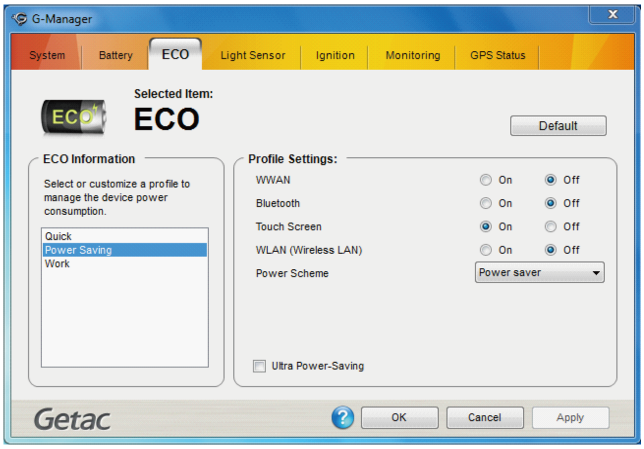
Classes of attributes of devices were analyzed based on the data collected. Currently, Getac has four key solutions for power saving system; they are power saving for static devices, power saving for dynamic devices, high accuracy power source design, and a demand-based power supply system.



[Figure 1] Power Depletion of Santa Rosa Platform

01 Power saving for static devices

For those plug-and-play (PnP) devices, that turning off power when they are not in use is basic approach for power saving. Getac's research and development center has integrated the resources of Hardware, Software, Driver and Application teams to develop a convenient, smart utility, G-Manager (Figure 2) to control the power of PnP devices. Users will be able to define power control mechanisms of such devices by themselves in order to optimize the utility to meet their requirements. G-Manager also provides the default "Ultra Power Saving" mode that helps turn off all PnP devices to enable ease in use.



[Figure 2] G-Manager

02 Power Saving for Dynamic Devices

In addition to PnP devices, collaboration among Hardware, Software, Driver and Mechanical engineers at Getac has developed technologies for fixed devices. As these devices are irremovable and do not offer random control, software must check the status of such devices by reading the registers in chipset or driver, while the embedded controller and BIOS are in charge of switching the devices on or off automatically based on device status.

A. Optical Disk Drive (ODD)

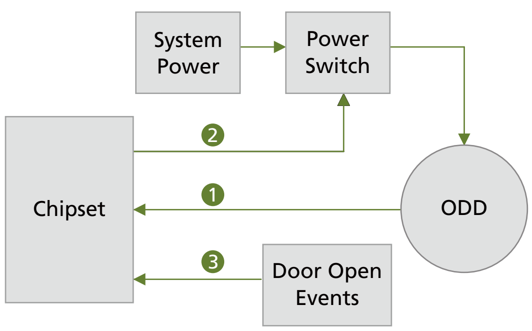
Turning off ODD directly will cause system errors. BIOS must check the status of ODD cyclically and determine the next step accordingly. The power of ODD will only be allowed to be turned off if no disk exists and idle after a setting time.

The Mechanism of ODD Power Control

01. BIOS to check if disk exists in ODD. If yes, then ODD idle counter will be activated.

02. If ODD idle attains a setting time (eg. 2 minutes or 3 minutes), BIOS will cut ODD power off by turning off Power Switch.

03. If a 'Door Open Events' occurrs, BIOS will switch on the ODD power.



B. Hard Disk Drive (HDD)

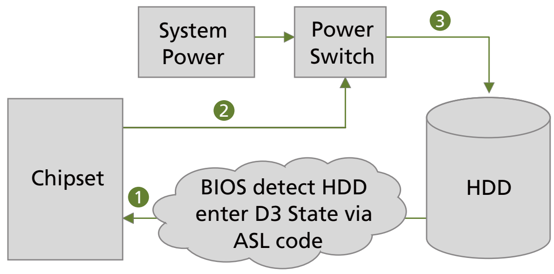
HDD reports a different power control mechanism from that of ODD, linking to device driver layer for status check. BIOS sets ACPI Script Language (ASL) code to get the device status and take power-control actions.

The Mechanism of HDD Power Control

01. BIOS uses driver layer ASL code to get the HDD status.

02. If HDD enters D3 state, BIOS will cut ODD power off by turning off Power Switch.

03. BIOS will power on HDD again if access command is detected. BIOS will send command to hold the system access command for a while before HDD resumes replying

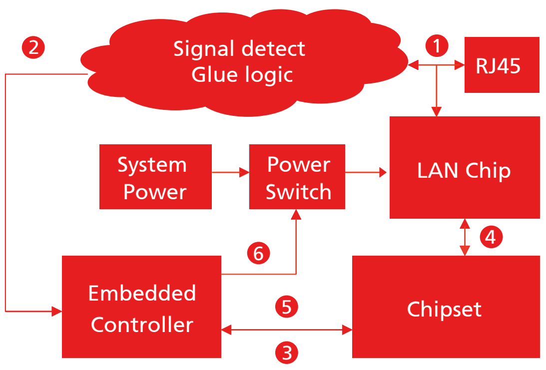


C. LAN

Similar to Intel's Auto Connect Battery Saver (ACBS) technology, this is a more efficient power-saving method developed by Getac to turn off the LAN chip power completely. The circuit is compatible with 10MB, 100MB and 1GB network systems. An embedded controller (EC) will check the LAN cable status by the signal provided from the LAN signal detection glue logic. The glue logic will generate a logic low level signal periodically while the LAN cable is connected to an RJ45 connector and linked to the network, and the signal will keep logic high permanently if no LAN cable is connected. Chipset follows the information from EC to deal with bus isolation and initialization. Both EC and Chipset must work closely to enable the ACBS function. On the one hand, EC must get the grant signal from Chipset to make sure the bus is isolated and then turns off the LAN chip power of. On the other hand, Chipset must receive the LAN chip power ready message from EC before the LAN chip is initialized. The following two diagrams show the detailed mechanisms of LAN chip detachment and attachment respectively.

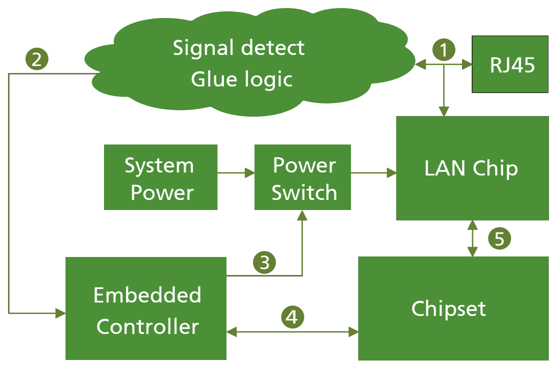
Mechanism of LAN Chip Detachment

01. The Signal detects glue logic latch the LAN signal.
02. If LAN signal doesn't exist, the glue logic circuits will drive a high signal to EC (embedded controller) and increment the counter once EC counts till a predefined time, e.g. 2 minutes or 3 minutes.
03. EC will inform the Chipset the Cable does not exist.
04. Chipset will isolate the interface with LAN Chip.
05. Chipset informs EC the LAN Chip is ready to switch off.
06. EC turns LAN Chip power off .



Mechanism of LAN Chip Attachment

01. The Signal detects glue logic latch the LAN signal.
02. If LAN signal exists, the glue logic circuits will drive a low signal to EC (embedded controller). EC will reset counter accordingly.
03. EC will turn LAN Chip power on if it was off previously.
04. EC informs Chipset the LAN Chip is power on.
05. Chipset links to LAN Chip interface and initialize it.



03 Accuracy power source design

Intrinsic static idle power consumption is the characteristic of semiconductor devices. No matter the system is in standby, sleep or power down mode, there will be a fix current to continuously deplete energy. Giving an equation $P = I \times V$, the P value will vary by V when the I value is fixed. The P value will decrease when V decreases. In most cases, engineers will increase the voltage from DC/DC output modestly to compensate the propagation loss and make sure the end point chips receive correct power supply. Getac engineers reduce the power propagation loss by improving the mother board PCB layout design technique and the stable DC/DC system design. By doing so, Getac engineers implement an accuracy power supply system that meets the requirement of chips and reduces unnecessary power depletion. Table 1 provides power saving data on applying the accuracy power design to our Santa Rosa platform.

D/D Decrease Voltage Level				
Original Voltage	3.31V	5.1 1V	1.507V	1.811V
Idle Power	3.48W/hr	1.75W/hr	1.64W/hr	0.43W/hr
BatteryMark4.01 Power	3.51Whr	2.02W/hr	1.72W/hr	0.44W/hr
Decrease~3% Voltage	3.21V	4.957V	1.462V	1.757V
Idle Power	3.29W/hr	1.62W/hr	1.51W/hr	0.30W/hr
BatteryMark4.01 Power	3.3W/hr	1.88W/ hr	1.59W/hr	0.30W/hr
Spec. Defined Voltage	3.135V	4.75V	1.425V	1.71V
Power Saved	~0.12W/hr	~0.13W/hr	~0.13W/hr	~0.13W/hr
Total Power Saved	~0.51W/hr			

[Table 1] Power Saving Through Accuracy Power Design

04 Demand-based power supply technology and Automatic Power Measure and Analyze system

How do we achieve a demand-based power supply? A demand-based power supply system shall only provide adequate energy to the mother board. An over -designed DC/DC will increase the bill of material (BOM) cost while insufficient DC/DC design will reduce efficiency and cause energy to convert to heat, and lead to more energy consumed for cooling purpose eventually. A fully-satisfactory power design not only helps save costs but also increase the power module design efficiency to lead to more power saving.

Designing an adequate DC/DC power supply module is always a challenge to engineers. It is because some sub-portions of DC/DC that generated by other high voltage DC/DC will make it difficult to identify the instant power requirement of all sub-DC/DC at the same time, particularly the CPU core voltage, which changes frequently

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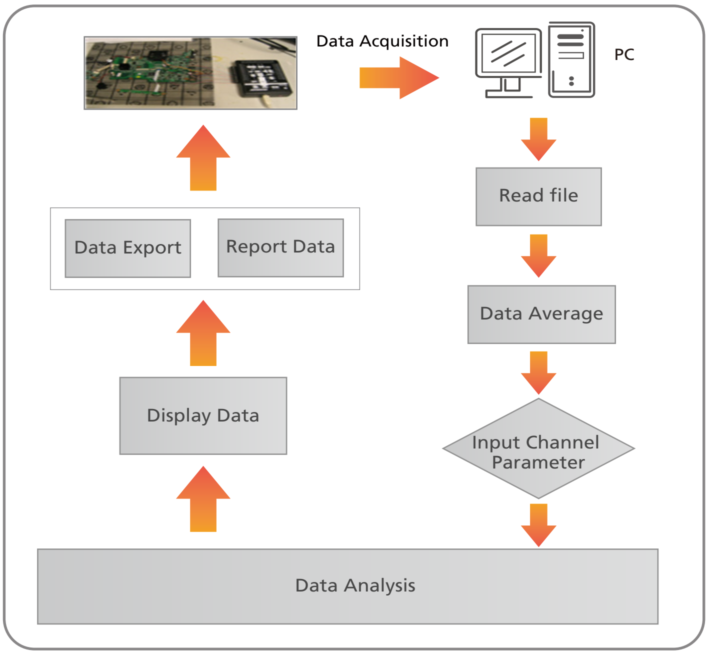
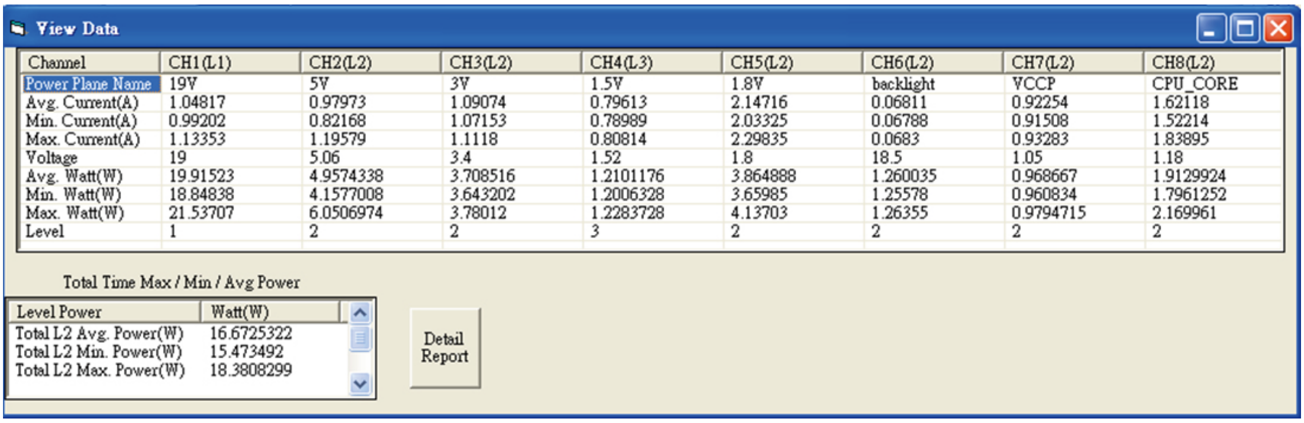


[Figure 3] Structure of APMA System

The Auto Power Measure and Analyze utility (APMA) will automatically calculate the data latched from the data acquisition equipment and output useful information such as maximum current, maximum power, average current, average power etc...Figure 4 indicates an utility sample. And also, the APMA can export the data to Microsoft Excel format files for further use.

Here an Intel PineTrail platform system is used to verify the APMA system. Table 2 shows a power requirement list based on the specification of chips. These values are calculated by accumulating the maximum power consumption of all chips, in which there is a large gap among all power planes compared to the results obtained through the APMA in Table 3, system thermal test and power department test reports are exactly compliant with the measurement results of the APMA, which proves that the APMA is a reliable utility.

Power saving technology can effectively help reduce the system heat, where a cool system will help reduce the problem caused by thermal issue with more power saved to deal with the thermal. It is indeed, a positive loop and a significant progress for us. Getac will keep developing advanced power saving technology in the future.



View Data

Channel	CH1(L1)	CH2(L2)	CH3(L2)	CH4(L3)	CH5(L2)	CH6(L2)	CH7(L2)	CH8(L2)
Power Plane Name	19V	5V	3V	1.5V	1.8V	backlight	VCCP	CPU_CORE
Avg. Current(A)	1.04817	0.97973	1.09074	0.79613	2.14716	0.06811	0.92254	1.62118
Min. Current(A)	0.99202	0.82168	1.07153	0.78989	2.03325	0.06788	0.91508	1.52214
Max. Current(A)	1.13353	1.19579	1.1118	0.80814	2.29835	0.0683	0.93283	1.83895
Voltage	19	5.06	3.4	1.52	1.8	18.5	1.05	1.18
Avg. Watt(W)	19.91523	4.9574338	3.708516	1.2101176	3.864888	1.260035	0.968667	1.9129924
Min. Watt(W)	18.84838	4.1577008	3.643202	1.2006328	3.65985	1.25578	0.960834	1.7961252
Max. Watt(W)	21.53707	6.0506974	3.78012	1.2283728	4.13703	1.26355	0.9794715	2.169961
Level	1	2	2	3	2	2	2	2

Total Time Max / Min / Avg Power

Level Power	Watt(W)
Total L2 Avg. Power(W)	16.6725322
Total L2 Min. Power(W)	15.473492
Total L2 Max. Power(W)	18.3808299

Detail Report

[Figure 4] Sample of APMA system utiliey

	Total	5V	3.3	1.5V	1.8V	+GFX_CORE	VCCP	CPUCORE
Max power (W)	57 329	24.512	9.365	2.235	12.434	1.288	3.353	4.2

[Table 2] Estimated System Power Requirement

Channel numbers	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
Power plane name	+19V	+5V	+3V	+1.5VS	+1.8V	+GFX_CORE	+VCCP	+CPU_CORE
Vortage	19	5	3.3	1.5	1.8	0.89	1.05	0.95
Average Power(Watt)	27.15106	10.39158	3.902501	1.332255	4.204675	0.449990321	0.965842	1.55562157
Min Power(Watt)	25.39601	9.512448	3.829495	1.277252	3.682764	0.419247672	0.947327	1.09923911
Max Power(Watt)	28.49761	11.35862	3.997149	1.37085	4.600573	0.464300362	0.979673	1.72257743

[Table 3] Measurement of System Power Consumption

Value for Customers

- Enabling outdoor applications, particularly essential to mission critical use in outdoor environment without power.
- Unrivaled Effective Contrast Ratio (E.C.R) technology making the LCD display more readable in an outdoor environment and being the greatest sunlight readability in the world.
- Strong engineering design, test & manufacturing capabilities that help customers differentiate themselves from their rivals in the vertical marketplace.
- Full-range product support : possessing versatile know-how in optical designs which enable Getac to reinforce customization scalability by fulfilling customers' requirements, offering flexibility, and achieving differentiation.

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