VARISCITE LTD.

VAR-SOM-OM44 v1.0

Thermal Application Note

Rev: 1.0

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Document Revision History

Revision	Date	Notes
1.0	14/12/2011	Initial

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1 Introduction

The VAR-SOM-OM44, based on the TI OMAP4460, is a high-performance SOM.

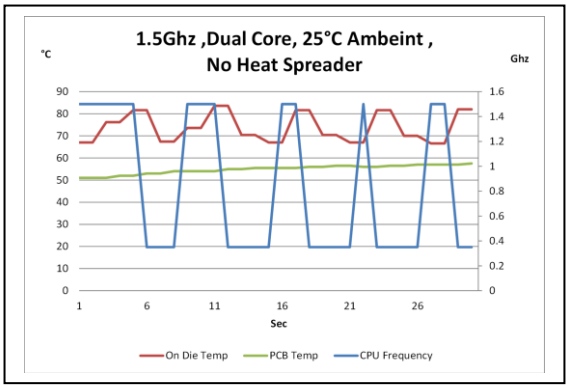
Graphics and Video accelerators consume only ~100mW and therefore have minor effect on heat dissipation.

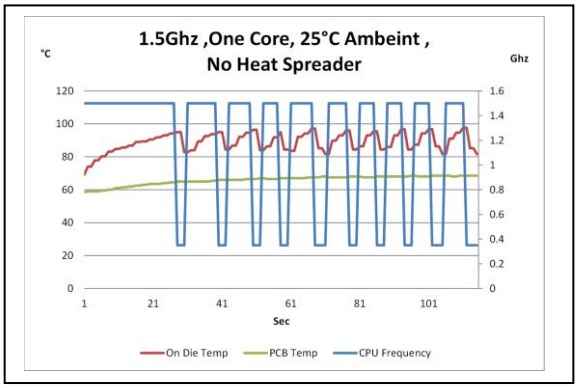
Most applications use the 1.5 GHz at bursts of a few seconds, upon demand. In such case there is no need for special thermal heat dissipation or heat spreader.
The heat spreader is used only for applications that continuously utilize the 1.5 GHz dual core at 100% CPU utilization

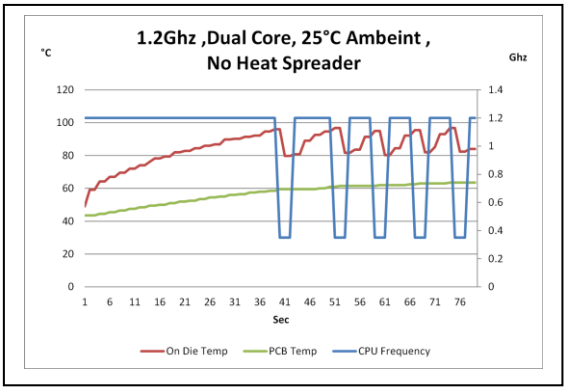
This document provides examples of various typical usage scenarios, presents optional thermal management approaches.

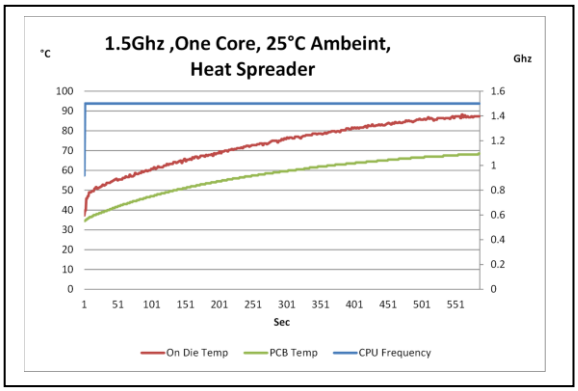
2 Thermal Measurements

2.1 100% CPU utilization (Dhrystone test)

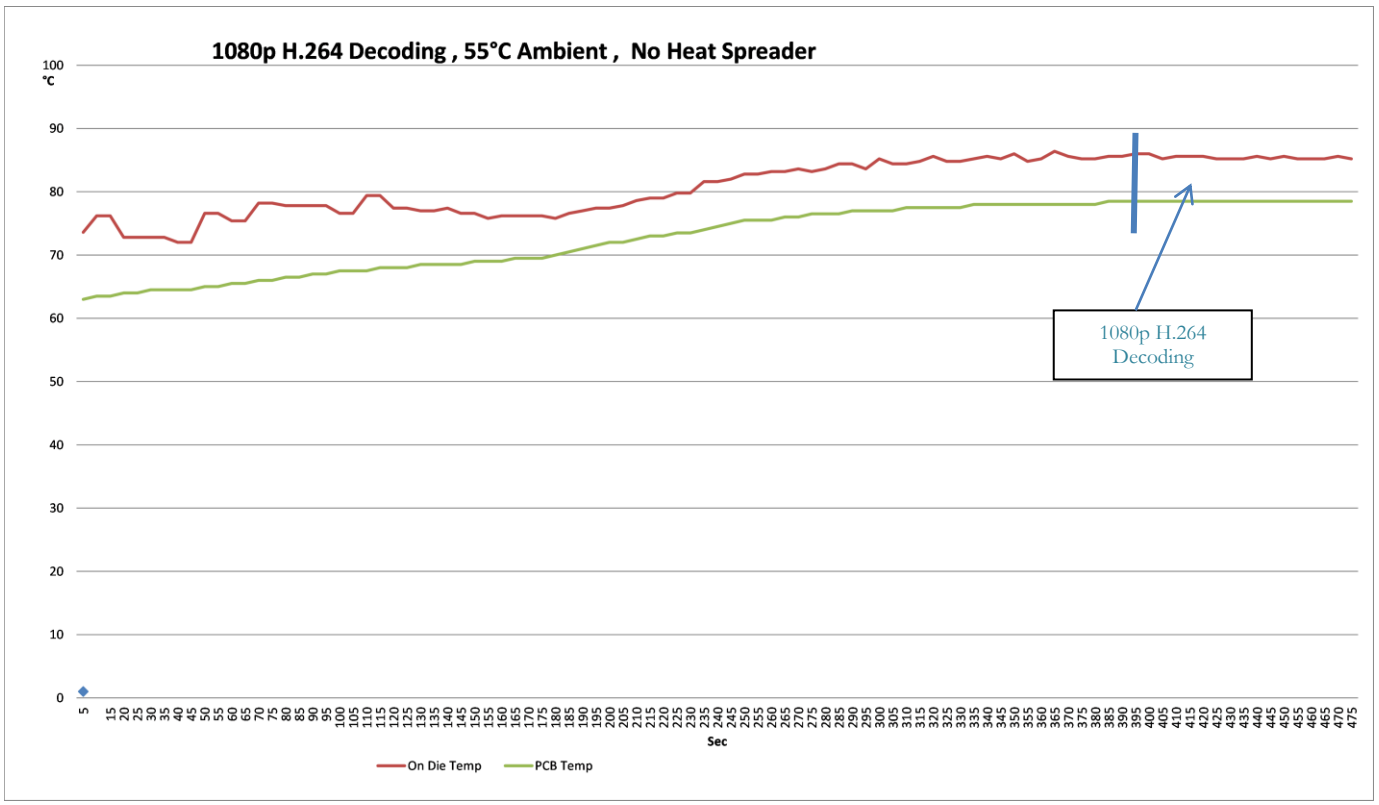


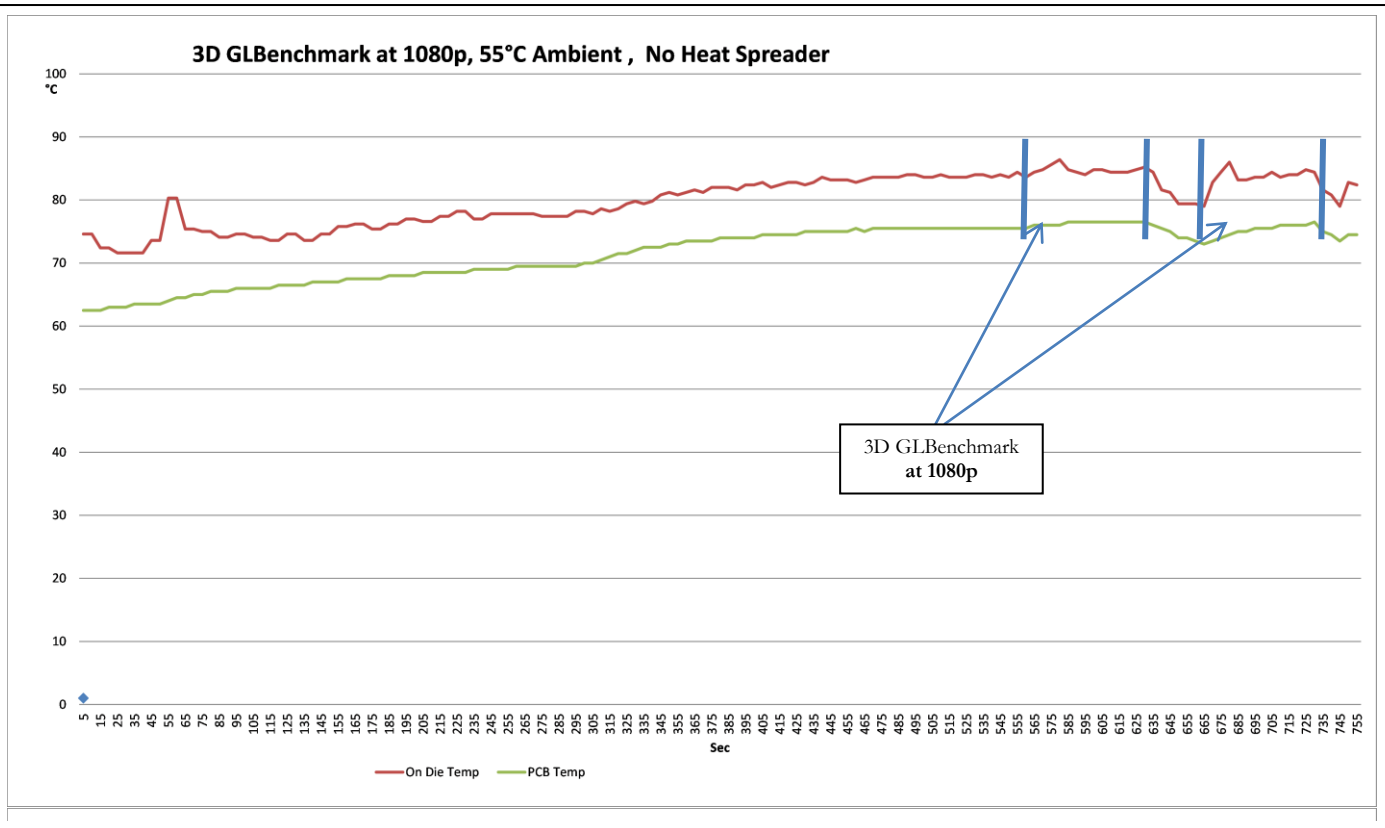






2.2 Multimedia





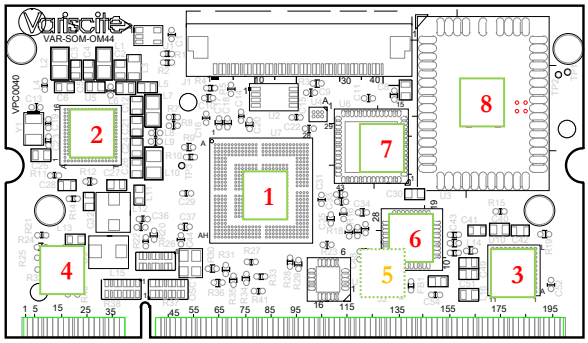
3 Power Consumption

The VAR-SOM-OM44 power consumption depends mainly on the CPU core utilization and vary from 1W to 3W. Please refer to the VAR-SOM-OM44 data sheet for measured power consumption at various operating conditions & scenarios. TI's industry-leading SmartReflex™ technologies, originally designed for the cellular & tablet markets is supported, enabling high performance and low power by reducing the device operating frequencies and voltages to a minimum when possible. Setting Linux's "ondemand" governor ensures high performance bursts when required by the application.
The below table summarize the VAR-SOM-OM44 components thermal data.

#	Device	Device Data Sheet	Power Consumption[1]	Manufacturer Thermal Data	Note
1	OMAP4460 SOC	NA	2.35W @ 1Ghz 2.75W@ 1.2hz 0.2W@1080p,x.264 dec. 0.1W@1080p, 3D OpenGL	Ta = -30°C - 85°C Tja = 22.6 °C/W Tjb = 9.5 °C/W (@2.6W) Tjmax = 125°C	Tjmax Avarage = 110°C
2	TWL6030 PMIC	NA	Powers mainly OMAP4460 & LAN7500 >80% efficiency	Ta = -30°C - 85°C Tja = 31 °C/W Tjc= 12°C/W Tjb = 19 °C/W Tjmax = 125°C	
3	TWL6040 Audio Codec	NA	<200mW -Estimated	Ta = -30°C - 85°C Tja = 34 °C/W Tjc= 8°C/W Tjb = 22 °C/W Tjmax = 125°C	Only Headphone driver and line in input are utilized
4	TPS62361B	http://www.ti.com/lit/ds/symlink/tps62361b.pdf	>80% efficiency ,2.5A Max (OMAP4 @1.5Ghz full operating)	Ta = -40°C - 85°C Tja = 94.8 °C/W Tjctop= 25°C/W Tjb = 60 °C/W Tjmax = 150°C	
5	USB3320 PHY	ftp://smsc.com/pub/Data_Sheets/3320.pdf	~100mW Typical	Ta = -40°C - 85°C [2] Tja = 42 °C/W Tjc = 3 °C/W Tjmax = 89.54 °C/W [2]	
6	USB2514B USB HUB	http://www.smsc.com/media/Downloads_Public/Data_Sheets/251x.pdf	400mW Max (Two USB ports are in use)	Ta = -40°C - 85°C [2] Tja = 31.6 °C/W Tjc = 3 °C/W Tjmax = 94.2 °C/W [2]	
7	LAN7500 G.Ethernet MAC+PHY	http://www.smsc.com/media/Downloads_Public/Data_Sheets/7500.pdf	620mW Typical (1000BaseT Full duplex)	Ta = -40°C - 85°C [2] Tja = 25 °C/W Tjc = 2 °C/W Tjmax = 99.98 °C/W [2]	
8	Wi-Fi	http://www.lsr.com/downloads/tiwi_r2/TiWi_R2_Datasheet.pdf	Wi-Fi: 924mW Typical @ Max current Tx Mode BT: 148mW Typical @ Max current Tx Mode	Ta = -40°C - 85°C	

[1] Theoretical, IC manufacturer values
[2] For Extended temperature Configuration

VAR-SOM-OM44 Main Power Dissipation ICs layout



4 Thermal Management Means

Variscite offers basic mechanisms for both hardware & software that improve thermal management in case of high CPU load for long duration. However, an end-product thermal design should take into account its specific operation scenario, specific operation conditions and other thermal factors in order to maximize the VAR-SOM-OM44 performance.

4.1 Software

TheVAR-SOM-OM44 software supports a thermal management mechanism that prevents the on board devices from being exposed to a hazardous thermal condition by monitoring both the OMAP4460 on die and VAR-SOM-OM44 PCB temperatures. If thermal hazardous zone is reached, The OMAP4 CPU operation frequency will be decreased in order to allow the VAR-SOM-OM44 to cool.

4.2 Hardware

The heat spreader is for aim only for applications that continuously utilize the dual core at high frequency at 100% CPU utilization. At 1.5 GHz, the OMAP4 provides 7000 MIPS (higher than Intel ATOM™), and requires heat spreading.
Variscite heat spreader allows adding a proprietary heat sink on top of it, or spreading the heat in any other way. It fits on the VAR-SOM-OM44 board top side. By thermally coupling the OMAP4460 SoC to a relatively large aluminum plain, the time period in which the VAR-SOM-OM44 can operate in a very high frequency without reaching its thermal hazard conditions is improved.
For the end product thermal design, if required, the customer can:

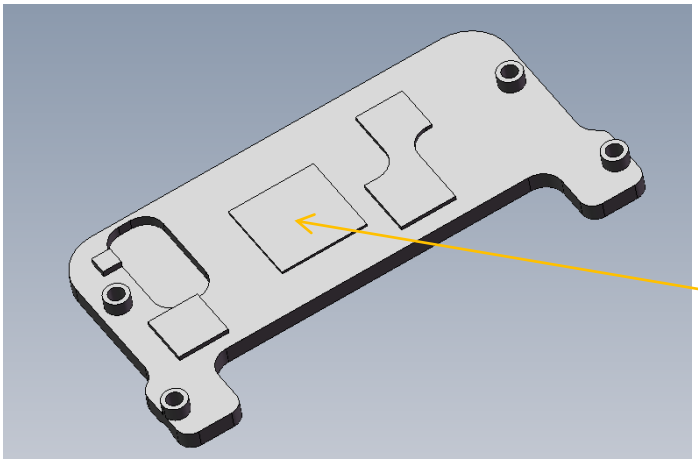
1. Use the heat spreader as is. Variscite can deliver the heat spreader in high volumes.

2. Add a heat sink on top of the heat spreader or thermally connect it to the end product case for better heat dissipation.

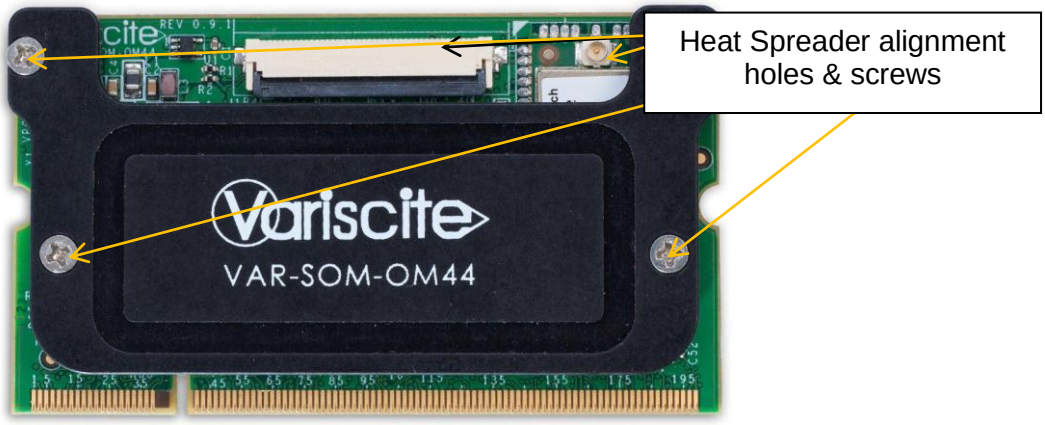
3. Design a custom head spreader. All CAD data required for such a design are available on Variscite web site.

4.2.1 Heat Spreader Assembly

1. Attach the 12x12mm thermal pad on the internal side of the heat spreader (see below). Make sure that the two plastic covers, on both sides of thermal pads are removed before attaching the pad.



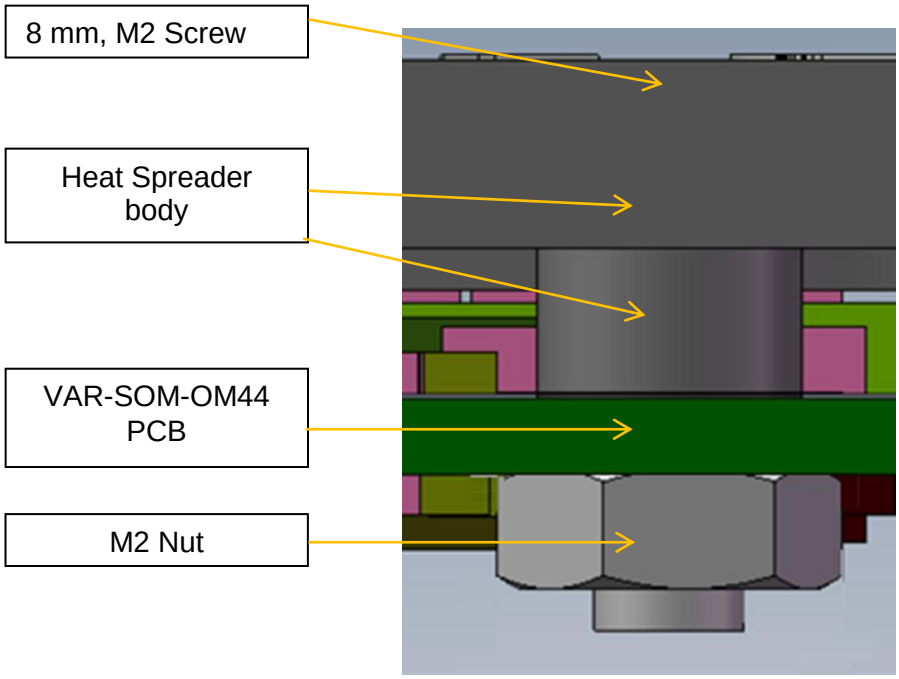
2. Assemble the heat spreader on top side of the VAR-SOM-OM44. Use the mechanical holes in order to align the heat spreader to VAR-SOM-OM44 PCB.



3. Insert the M2 screws from the heat spreader top direction.

4. Tight the head spreader to the VAR-SOM-OM44 using the supplied nuts.

VAR-SOM-OM44 Heat Spreader screws assembly order



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