Application Report
SPRACF1–April 2018

AM570x Power Consumption Summary

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ABSTRACT

This application report discusses the power consumption for common system application usage scenarios for the AM570x Sitara™ processors. The metrics contained in this document serve to provide a better understanding of the AM570x active power behaviors, making it easier to determine a suitable configuration to meet a given power budget.

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Trademarks

1 Introduction

Power consumption is highly dependent on the individual user's application; however, this document focuses on providing several AM570x application-usage case scenarios and the environment settings that were used to perform such power measurements. This collection of real power measurements was measured on internal AM570x boards with an on-board power measurement device (TI INA226).

1.1 Power Measurement Setup

The following section details power measurements taken on a AM570x platform for typical use case applications. The software being used is the TI Processor SDK Linux 4.02 for AM57xx Sitara Processors. Static power or leakage current consumption varies across manufacturing process,temperature and voltage. All of the readings shown here are on a nominal part and taken at room temperature. These measurements have been performed on an internal evaluation reference system and they were only captured once. Changes in the SDK version or software configuration can affect the results.

1.2 AM570x Power Supplies

Table 1 describes the power supplies for AM570x.

Table 1. AM570x Power Supplies

Power Supply Group	Signal	Description
VDD_CORE	vdd	Core, MPU, and GPU voltage domain supply
VDD_DSP	vdd_dsp	DSP and IVA voltage domain supply
VDDS_DDR (1.35 V/1.5 V)	vdds_ddr	EMIF power supply
Analog PHY (1.8 V)	vdda_pcie	DPLL_PCIe_REF and PCIe analog power supply
	vdda_csi	CSI Interface 1.8 V power supply
	vdda_usb1	DPLL_USB and HS USB1 analog power supply
	vdda_usb2	HS USB2 analog power supply
	vdda_hdmi	HDMI analog power supply
	vdda_usb3	DPLL_USB_OTG_SS and USB3.0 RX/TX analog power supply
Analog DPLL (1.8 V)	vdda_gpu	DPLL_GPU analog power supply
	vdda_video	DPLL_VIDEO1 analog power supply
	vdda_mpu_abe	DPLL_MPU analog power supply
	vdda_osc	HFOSC analog power supply
	vdda_per	DPLL_PER, and PER HSDIVIDER analog power supply
	vdda_ddr	DPLL_DDR and DDR HSDIVIDER analog power supply
	vdda_debug	DPLL_DEBUG analog power supply
	vdda_dsp_iva	DPLL_DSP and DPLL_IVA analog power supply
	vdda_core_gmac	DPLL_CORE and CORE HSDIVIDER analog power supply
Analog USB PHY (3.3 V)	vdda33v_usb1	HS USB1 3.3 V analog power supply
	vdda33v_usb2	HS USB2 3.3 V analog power supply
1. 8 V I/O	vdds18v_ddr1	EMIF1 bias power supply
	vdds18v	1.8 V power supply
	vdds_mlbp	MLBP I/O Power Supply
3.3 V I/O	vddshv[1-11]	Dual voltage power supply

2 High-Level Summary

This section describes the high-level power summary of the device with each application use case.

- OS Idle - No application is running on Linux.
- Dhrystone - The Dhrystone benchmark application is running on single Coretex-A15 core.
- Graphics 3D Chameleon Man - The 3D graphics application is showing a matrix skinned character in combination with bump mapping.
- Ethernet - Ethernet throughput benchmark application (iperf) is running on Linux.
- USB - USB benchmark application (Bonnie) is running on Linux.
- Memeory - DDR memory test application (memtester) is running on Linux.

Table 2 contains a default OPP's of device domains.

Table 2. Default OPP

MPU	GPU	DSP	IVA
NOM	NOM	HIGH	HIGH

Table 3 contains a high-level summary of the total device power (measured in milliwatts) for each application use case and configuration.

Table 3. Power Summary

Test Case	Power (mW)
OS Idle	1346
Dhrystone	2244
Graphics	1904
Ethernet	1440
USB	1970
Memtester	2477

3 AM570x Power Measurement Results

3.1 OS Idle

In this measurement, no applications are running on Linux.

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
vddshv_3v3	3.263	18.190	59.353
vdda_usb3v3	3.299	2.630	8.676
vddshv8	1.794	0.420	0.754
vdda_1v8_phy	1.794	104.970	188.294
vdda_1v8_pll	1.797	30.550	54.892
vdd_ddr_1v35	1.351	116.500	157.364
vdds_1v8	1.801	52.120	93.845
vdd_dsp	0.932	9.690	9.035
vdd_core	1.077	718.360	773.368
Total Power			1345.58
vdd_ddr	1.355	157.050	212.791

3.2 Dhrystone

In this measurement, the Dhrystone benchmark (runDhrystone) is running continuously on the single Cortex-A15 core on Linux.

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
vddshv_3v3	3.256	18.360	59.782
vdda_usb3v3	3.299	2.610	8.612
vddshv8	1.794	0.500	0.897
vdda_1v8_phy	1.794	104.450	187.364
vdda_1v8_pll	1.797	30.620	55.019
vdd_ddr_1v35	1.351	116.640	157.527
vdds_1v8	1.801	55.410	99.774
vdd_dsp	0.933	10.530	9.822
vdd_core	1.096	1519.320	1665.609
Total Power			2244.4
vdd_ddr	1.355	158.590	214.921

3.3 Graphics

In this measurement, runOGLES2ChameleonManContinously.sh is running on Linux.

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
vddshv_3v3	3.253	107.870	350.853
vdda_usb3v3	3.299	2.650	8.742
vddshv8	1.794	0.430	0.772
vdda_1v8_phy	1.794	104.830	188.043
vdda_1v8_pll	1.797	34.300	61.627
vdd_ddr_1v35	1.351	150.620	203.469
vdds_1v8	1.800	71.490	128.711
vdd_dsp	0.932	10.560	9.846
vdd_core	1.081	881.130	952.369
Total Power			1904.43
vdd_ddr	1.356	319.860	433.738

3.4 Ethernet

In this measurement, an Ethernet throughput benchmark (iperf) is running on Linux.

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
vddshv_3v3	3.258	43.260	140.934
vdda_usb3v3	3.299	2.580	8.512
vddshv8	1.794	0.420	0.754
vdda_1v8_phy	1.794	104.740	187.884
vdda_1v8_pll	1.797	30.630	55.047
vdd_ddr_1v35	1.351	116.080	156.814
vdds_1v8	1.801	55.230	99.444
vdd_dsp	0.932	10.340	9.641
vdd_core	1.077	725.610	781.446
Total Power			1440.48
vdd_ddr	1.354	171.340	232.033

3.5 USB

In this measurement, a USB benchmark application (Bonnie++) is running on Linux.

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
vddshv_3v3	3.258	18.390	59.918
vdda_usb3v3	3.299	4.770	15.736
vddshv8	1.794	0.470	0.843
vdda_1v8_phy	1.794	105.480	189.218
vdda_1v8_pll	1.797	30.600	54.984
vdd_ddr_1v35	1.350	107.410	145.038
vdds_1v8	1.800	54.500	98.122
vdd_dsp	0.933	9.970	9.298
vdd_core	1.091	1280.830	1396.841
Total Power			1970
vdd_ddr	1.355	175.280	237.465

3.6 Memory

In this measurement, a DDR memory test application (memtester) is running on Linux.

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
vddshv_3v3	3.252	18.220	59.246
vdda_usb3v3	3.299	2.630	8.677
vddshv8	1.795	0.420	0.754
vdda_1v8_phy	1.794	104.850	188.105
vdda_1v8_pll	1.797	30.680	55.137
vdd_ddr_1v35	1.353	280.450	379.368
vdds_1v8	1.801	88.320	159.076
vdd_dsp	0.933	11.380	10.615
vdd_core	1.096	1475.210	1616.407
Total Power			2477.39
vdd_ddr	1.359	653.410	888.287

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