

AM571x Power Consumption Summary

ABSTRACT

This application report discusses the power consumption for common system application usage scenarios for the AM571x Sitara™ processors. The metrics contained in this document serve to provide users with a better understanding of AM571x active power behaviors: making it easier to determine a suitable configuration to meet a given power budget.

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1 Introduction

Power consumption is highly dependent on the individual user's application; however, this document focuses on providing several AM571x 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 AM571x boards with on-board power measurement device (TI INA226).

1.1 Power Measurement Setup

The following section details power measurements taken on a AM571x platform for typical use case applications. These measurements have been performed on an internal test evaluation reference system and not on the AM572x evaluation module (TMDXEVM5728) or AM571x Industrial Development Kit (TMDXIDK5718).

NOTE: The software being used is a TI Linux Core SDK for AM57X Sitara™ Processors. Static power or leakage current consumption varies across manufacturing process, temperature and voltage. All of the readings shown here are taken at room temperature (25°C).

1.2 AM571x Power Supplies

Table 1 describes the power supplies for AM571x.

Table 1. AM571x Power Supplies

Power Supply Group	Signal	Description
VDD_CORE	vdd	Core voltage domain supply
VDD_MPU	vdd_mpu	MPU voltage domain supply
VDD_DSP	vdd_dsp	DSP voltage domain supply
VDD_IVA	vdd_iva	IVA voltage domain supply
VDD_GPU	vdd_gpu	GPU voltage domain supply
VDDS_DDR (1.35 V/1.5 V)	vdds_ddr1	EMIF1 power supply
Analog PHY (1.8 V)	vdda_sata	DPLL_SATA and SATA RX/TX analog power supply
	vdda_pcie	DPLL_PCIE_REF and PCIe analog power supply
	vdda_pcie0	PCIe ch0 RX/TX 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_usb3	DPLL_USB_OTG_SS and USB3.0 RX/TX analog power supply
Analog DPLL (1.8 V)	vdda_pll_spare	DPLL_SPARE analog power supply
	vdda_gpu	DPLL_GPU analog power supply
	vdda_hdmi	PLL_HDMI and HDMI 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

The following tables contain a high-level summary of the total device power (measured in milliwatts) for each application use case and configuration.

2.1 OS Idle

In this measurement, no application is running on Linux.

Table 2. OS Idle

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	1169
OD	NOM	NOM	NOM	1196
HIGH	NOM	NOM	NOM	1282
HIGH	HIGH	HIGH	HIGH	1307

2.2 Dhrystone

In this measurement, the Dhrystone benchmark application is running on single Cortex-A15 core.

Table 3. Dhrystone

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	1845
OD	NOM	NOM	NOM	2189
HIGH	NOM	NOM	NOM	2956

2.3 Graphics - 3D Chameleon Man

In this measurement, the 3D Graphics application is showing a matrix skinned character in combination with bump mapping.

Table 4. Graphics - 3D Chameleon Man

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	1546
HIGH	HIGH	HIGH	HIGH	1825

2.4 Ethernet

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

Table 5. Ethernet

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	1282

2.5 USB

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

Table 6. USB

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	1917

2.6 Memory Test

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

Table 7. Memory Test

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	2286

3 AM571x Power Measurement Results

3.1 OS Idle: All Domains at NOM

3.1.1 OPP

Table 8. OS Idle: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.1.2 Power Consumption

Table 9. OS Idle: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	0.99	71	71
VDD_GPU	0.99	110	110
VDD_CORE	1.09	419	457
VDDS18V	1.80	53	96
VDD_DDR	1.35	156	212
VDDSHV8	2.98	1	1
VDDSHV5	3.27	26	85
VDDA_1V8_PHY	1.81	39	71
VUSB_3V3	3.29	2	6
VDDA_1V8_PLL	1.79	34	61
Total Power			1169
VDD_DDR	1.35	101	137

3.2 OS Idle: MPU Domain at OD

3.2.1 OPP

Table 10. OS Idle: MPU Domain at OD - OPP

MPU	GPU	DSP	IVA
OD	NOM	NOM	NOM

3.2.2 Power Consumption

Table 11. OS Idle: MPU Domain at OD - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.06	90	95
VDD_GPU	0.99	110	110
VDD_CORE	1.09	420	458
VDDS18V	1.81	53	95
VDD_DDR	1.35	157	213
VDDSHV8	2.98	1	1
VDDSHV5	3.27	26	86
VDDA_1V8_PHY	1.81	39	71
VUSB_3V3	3.29	2	6
VDDA_1V8_PLL	1.79	34	62
Total Power			1196
VDD_DDR	1.35	100	136

3.3 OS Idle: MPU Domain at HIGH

3.3.1 OPP

Table 12. OS Idle: MPU Domain at HIGH - OPP

MPU	GPU	DSP	IVA
HIGH	NOM	NOM	NOM

3.3.2 Power Consumption

Table 13. OS Idle: MPU Domain at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.21	141	171
VDD_GPU	0.99	110	110
VDD_CORE	1.09	422	460
VDDS18V	1.81	59	106
VDD_DDR	1.35	155	210
VDDSHV8	2.99	0	1
VDDSHV5	3.27	26	86
VDDA_1V8_PHY	1.80	40	71
VUSB_3V3	3.29	2	6
VDDA_1V8_PLL	1.79	34	61
Total Power			1282
VDD_DDR	1.36	101	137

3.4 OS Idle: All Domains at HIGH

3.4.1 OPP

Table 14. OS Idle: All Domains at HIGH

MPU	GPU	DSP	IVA
HIGH	HIGH	HIGH	HIGH

3.4.2 Power Consumption

Table 15. OS Idle: All Domains at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.21	148	180
VDD_GPU	1.07	124	132
VDD_CORE	1.09	427	465
VDDS18V	1.81	60	108
VDD_DDR	1.35	144	195
VDDSHV8	2.99	0	1
VDDSHV5	3.27	26	86
VDDA_1V8_PHY	1.80	40	72
VUSB_3V3	3.29	2	6
VDDA_1V8_PLL	1.79	34	61
Total Power			1307
VDD_DDR	1.36	125	169

3.5 Dhrystone: All Domains at NOM

3.5.1 OPP

Table 16. Dhrystone: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.5.2 Power Consumption

Table 17. Dhrystone: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.00	734	737
VDD_GPU	0.99	113	113
VDD_CORE	1.09	423	462
VDDS18V	1.81	55	99
VDD_DDR	1.35	155	210
VDDSHV8	2.99	0	1
VDDSHV5	3.27	26	85
VDDA_1V8_PHY	1.81	39	71
VUSB_3V3	3.29	2	6
VDDA_1V8_PLL	1.79	34	61
Total Power			1845
VDD_DDR	1.36	101	137

3.6 Dhrystone: MPU Domain at OD

3.6.1 OPP

Table 18. Dhrystone: MPU Domain at OD - OPP

MPU	GPU	DSP	IVA
OD	NOM	NOM	NOM

3.6.2 Power Consumption

Table 19. Dhrystone: MPU Domain at OD - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.08	996	1073
VDD_GPU	0.99	113	113
VDD_CORE	1.09	426	464
VDDS18V	1.80	56	101
VDD_DDR	1.35	158	213
VDDSHV8	2.99	0	1
VDDSHV5	3.27	26	85
VDDA_1V8_PHY	1.80	39	71
VUSB_3V3	3.29	2	6
VDDA_1V8_PLL	1.79	35	62
Total Power			2189
VDD_DDR	1.35	101	137

3.7 Dhrystone: MPU Domain at HIGH

3.7.1 OPP

Table 20. Dhrystone: MPU Domain at HIGH - OPP

MPU	GPU	DSP	IVA
HIGH	NOM	NOM	NOM

3.7.2 Power Consumption

Table 21. Dhrystone: MPU Domain at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.24	1486	1835
VDD_GPU	0.99	112	112
VDD_CORE	1.09	425	464
VDDS18V	1.81	61	110
VDD_DDR	1.35	155	210
VDDSHV8	2.99	0	1
VDDSHV5	3.27	26	86
VDDA_1V8_PHY	1.80	39	71
VUSB_3V3	3.29	2	6
VDDA_1V8_PLL	1.79	34	61
Total Power			2956
VDD_DDR	1.35	100	136

3.8 Graphics 3D Chameleon Man: All Domains at NOM

3.8.1 OPP

Table 22. Graphics 3D Chameleon Man: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.8.2 Power Consumption

Table 23. Graphics 3D Chameleon Man: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	0.99	72	72
VDD_GPU	1.00	162	162
VDD_CORE	1.09	502	548
VDDS18V	1.81	72	130
VDD_DDR	1.36	195	264
VDDSHV8	2.99	0	1
VDDSHV5	3.27	70	229
VDDA_1V8_PHY	1.80	38	68
VUSB_3V3	3.29	1	2
VDDA_1V8_PLL	1.79	39	70
Total Power			1546
VDD_DDR	1.36	262	356

3.9 Graphics 3D Chameleon Man: All Domains at HIGH

3.9.1 OPP

Table 24. Graphics 3D Chameleon Man: All Domains at HIGH - OPP

MPU	GPU	DSP	IVA
HIGH	HIGH	HIGH	HIGH

3.9.2 Power Consumption

Table 25. Graphics 3D Chameleon Man: All Domains at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.21	223	207
VDD_GPU	1.07	194	207
VDD_CORE	1.09	507	554
VDDS18V	1.81	79	143
VDD_DDR	1.36	208	282
VDDSHV8	2.99	0	1
VDDSHV5	3.27	69	226
VDDA_1V8_PHY	1.80	39	70
VUSB_3V3	3.29	1	2
VDDA_1V8_PLL	1.79	39	69
Total Power			1825
VDD_DDR	1.36	256	348

3.10 Ethernet: All Domains at NOM

3.10.1 OPP

Table 26. Ethernet: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.10.2 Power Consumption

Table 27. Ethernet: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	0.99	151	151
VDD_GPU	0.99	110	110
VDD_CORE	1.09	424	463
VDDS18V	1.81	58	105
VDD_DDR	1.35	152	206
VDDSHV8	2.99	0	1
VDDSHV5	3.27	33	107
VDDA_1V8_PHY	1.80	40	73
VUSB_3V3	3.29	2	6
VDDA_1V8_PLL	1.79	34	61
Total Power			1282
VDD_DDR	1.36	161	219

3.11 USB: All Domains at NOM

3.11.1 OPP

Table 28. USB: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.11.2 Power Consumption

Table 29. USB: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.00	766	768
VDD_GPU	0.99	113	113
VDD_CORE	1.09	443	483
VDDS18V	1.81	59	106
VDD_DDR	1.35	156	211
VDDSHV8	2.99	0	1
VDDSHV5	3.27	26	86
VDDA_1V8_PHY	1.80	41	74
VUSB_3V3	3.29	4	13
VDDA_1V8_PLL	1.79	34	61
Total Power			1917
VDD_DDR	1.36	148	201

3.12 Memory Test: All Domains at NOM

3.12.1 OPP

Table 30. Memory Test: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.12.2 Power Consumption

Table 31. Memory Test: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_MPU	1.00	783	786
VDD_GPU	0.99	114	114
VDD_CORE	1.09	470	513
VDDS18V	1.81	83	151
VDD_DDR	1.36	365	497
VDDSHV8	2.99	0	1
VDDSHV5	3.27	26	85
VDDA_1V8_PHY	1.80	39	71
VUSB_3V3	3.29	2	7
VDDA_1V8_PLL	1.79	34	61
Total Power			2286
VDD_DDR	1.36	594	810

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
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