Application Report
SPRAC79–March 2017

AM572x Power Consumption Summary

ABSTRACT

This application report discusses the power consumption for common system application usage scenarios for the AM572x Sitara™ processors. The metrics contained in this document serve to provide users with a better understanding of AM572x active power behaviors: making it easier to determine a suitable configuration to meet a given power budget.

Contents

List of Tables

Trademarks

1 Introduction

Power consumption is highly dependent on the individual user's application; however, this document focuses on providing several AM572x 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 AM572x boards with on-board power measurement device (TI INA226).

For additional details about the AM572x processor, see the AM5728 product page.

1.1 Power Measurement Setup

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

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 AM572x Power Supplies

Table 1 describes the power supplies for AM572x.

Table 1. AM572x 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
	vdds_ddr2	EMIF2 power supply
Analog PHY (1.8 V)	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
	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_pcie1	PCIe ch1 RX/TX analog power supply
Analog DPLL (1.8 V)	vdda_osc	HFOSC analog power supply
	vdda_iva	DPLL_IVA analog power supply
	vdda_gpu	DPLL_GPU analog power supply
	vdda_debug	DPLL_DEBUG analog power supply
	vdda_dsp_eve	DPLL_DSP analog power supply
	vdda_video	DPLL_VIDEO1 and DPLL_VIDEO2 analog power supply
	vdda_hdmi	PLL_HDMI and HDMI analog power supply
	vdda_gmac_core	DPLL_CORE and CORE HSDIVIDER analog power supply
	vdda_ddr	DPLL_DDR and DDR HSDIVIDER analog power supply
	vdda_mpu	DPLL_MPU analog power supply
	vdda_abe_per	DPLL_ABE, DPLL_PER, and PER 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	vdds_mlbp	MLB Power Supply
	vdds18v_ddr1	EMIF1 bias power supply
	vdds18v_ddr2	EMIF2 bias power supply
	vdds18v	1.8V 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	2314.3
OD	NOM	NOM	NOM	2433.7
HIGH	NOM	NOM	NOM	2679.1
HIGH	HIGH	HIGH	HIGH	2815.4

2.2 Dhrystone - Single Core

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

Table 3. Dhrystone - Single Core

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	3115.8
OD	NOM	NOM	NOM	3514.6
HIGH	NOM	NOM	NOM	4194.7

2.3 Dhrystone - Dual Core

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

Table 4. Dhrystone - Dual Core

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	3993.5
OD	NOM	NOM	NOM	4759.3
HIGH	NOM	NOM	NOM	6493.8

2.4 Graphics - 3D Chameleon Man

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

Table 5. Graphics - 3D Chameleon Man

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	3145.9
HIGH	HIGH	HIGH	HIGH	4055.0

2.5 Video - H.264 Decode

In this measurement, the H.264 decode application is running a gstreamer playbin pipeline to decode H264 using IVAHD and playing back audio as well.

Table 6. Video - H.264 Decode

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	2638.0

2.6 Ethernet

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

Table 7. Ethernet

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	3279.8

2.7 USB

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

Table 8. USB

MPU	GPU	DSP	IVA	Power (mW)
NOM	NOM	NOM	NOM	3136.9

3 AM572x Power Measurment Results

3.1 OS Idle: All Domains at NOM

3.1.1 OPP

Table 9. OS Idle: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.1.2 Power Consumption

Table 10. OS Idle: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	645.2	641.9
VDD_MPU	1.05	280.3	295.4
VDD_DSP	1.00	270.0	270.7
VDD_IVA	1.00	11.3	11.3
VDD_GPU	1.03	181.1	185.8
VDDS_DDR	1.35	278.3	375.7
Analog PHY	1.78	100.8	179.9
Analog DPLL	1.79	35.9	64.1
Analog USB PHY	3.30	1.5	4.9
1.8V IO	1.81	103.2	186.5
3.3V IO	3.27	30.0	98.1
Total Power			**2314.3**
VDD_DDR	1.34	431.0	578.1

3.2 OS Idle: MPU Domain at OD

3.2.1 OPP

Table 11. OS Idle: MPU Domain at OD - OPP

MPU	GPU	DSP	IVA
OD	NOM	NOM	NOM

3.2.2 Power Consumption

Table 12. OS Idle: MPU Domain at OD - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	651.1	647.8
VDD_MPU	1.11	349.7	389.8
VDD_DSP	1.00	275.3	276.0
VDD_IVA	1.00	12.3	12.4
VDD_GPU	1.03	183.8	188.6
VDDS_DDR	1.35	280.5	378.7
Analog PHY	1.78	101.0	180.2
Analog DPLL	1.79	36.2	64.7
Analog USB PHY	3.30	1.5	4.9
1.8V IO	1.81	106.5	192.6
3.3V IO	3.27	30.0	98.1
Total Power			**2433.7**
VDD_DDR	1.34	438.0	587.7

3.3 OS Idle: MPU Domain at HIGH

3.3.1 OPP

Table 13. OS Idle: MPU Domain at HIGH - OPP

MPU	GPU	DSP	IVA
HIGH	NOM	NOM	NOM

3.3.2 Power Consumption

Table 14. OS Idle: MPU Domain at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	658.4	655.1
VDD_MPU	1.20	504.4	603.4
VDD_DSP	1.00	280.0	280.7
VDD_IVA	1.00	12.5	12.5
VDD_GPU	1.03	190.0	195.0
VDDS_DDR	1.35	281.6	380.1
Analog PHY	1.78	101.1	180.3
Analog DPLL	1.79	35.8	63.8
Analog USB PHY	3.30	1.5	4.9
1.8V IO	1.81	113.5	205.2
3.3V IO	3.27	30.0	98.1
Total Power			**2679.1**
VDD_DDR	1.34	439.6	589.7

3.4 OS Idle: All Domains at HIGH

3.4.1 OPP

Table 15. OS Idle: MPU Domain at HIGH - OPP

MPU	GPU	DSP	IVA
HIGH	HIGH	HIGH	HIGH

3.4.2 Power Consumption

Table 16. OS Idle: All Domains at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	660.5	657.2
VDD_MPU	1.20	502.8	601.5
VDD_DSP	1.06	342.5	364.3
VDD_IVA	1.12	23.8	26.7
VDD_GPU	1.08	216.3	232.7
VDDS_DDR	1.35	281.2	379.6
Analog PHY	1.78	101.2	180.5
Analog DPLL	1.79	35.5	63.4
Analog USB PHY	3.30	1.5	4.9
1.8V IO	1.81	114.3	206.6
3.3V IO	3.27	30.0	98.1
Total Power			**2815.4**
VDD_DDR	1.34	439.9	590.1

3.5 Dhrystone: Single Core - All Domains at NOM

3.5.1 OPP

Table 17. Dhrystone: Single Core - All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.5.2 Power Consumption

Table 18. Dhrystone: Single Core - All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	656.3	653.0
VDD_MPU	1.06	990.6	1050.1
VDD_DSP	1.00	277.2	277.9
VDD_IVA	1.00	13.8	13.8
VDD_GPU	1.03	197.8	203.0
VDDS_DDR	1.35	277.6	374.8
Analog PHY	1.78	101.1	180.4
Analog DPLL	1.79	36.0	64.3
Analog USB PHY	3.30	1.5	4.9
1.8V IO	1.81	108.3	195.7
3.3V IO	3.27	30.0	98.1
Total Power			**3115.8**
VDD_DDR	1.34	431.4	578.7

3.6 Dhrystone: Single Core - MPU Domain at OD

3.6.1 OPP

Table 19. Dhrystone: Single Core - MPU Domain at OD - OPP

MPU	GPU	DSP	IVA
OD	NOM	NOM	NOM

3.6.2 Power Consumption

Table 20. Dhrystone: Single Core - MPU Domain at OD - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	665.3	662.6
VDD_MPU	1.12	1255.0	1410.1
VDD_DSP	1.00	284.7	285.4
VDD_IVA	1.00	15.0	15.0
VDD_GPU	1.03	206.3	211.7
VDDS_DDR	1.35	279.6	377.5
Analog PHY	1.78	101.1	180.3
Analog DPLL	1.79	36.3	64.7
Analog USB PHY	3.30	1.5	4.9
1.8V IO	1.81	113.0	204.3
3.3V IO	3.27	30.0	98.1
Total Power			**3514.6**
VDD_DDR	1.34	437.4	586.8

3.7 Dhrystone: Single Core - MPU Domain at HIGH

3.7.1 OPP

Table 21. Dhrystone: Single Core - MPU Domain at HIGH - OPP

MPU	GPU	DSP	IVA
HIGH	NOM	NOM	NOM

3.7.2 Power Consumption

Table 22. Dhrystone: Single Core - MPU Domain at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	681.7	679.2
VDD_MPU	1.21	1671.6	2018.4
VDD_DSP	1.00	294.1	295.1
VDD_IVA	1.00	17.5	17.5
VDD_GPU	1.03	226.1	232.0
VDDS_DDR	1.35	280.6	378.8
Analog PHY	1.78	101.3	180.6
Analog DPLL	1.79	36.0	64.3
Analog USB PHY	3.30	1.5	4.9
1.8V IO	1.81	124.8	225.8
3.3V IO	3.27	30.0	98.1
Total Power			**4194.7**
VDD_DDR	1.34	439.6	589.8

3.8 Dhrystone: Dual Core - All Domains at NOM

3.8.1 OPP

Table 23. Dhrystone: Dual Core - All Domains at NOM

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.8.2 Power Consumption

Table 24. Dhrystone: Dual Core - All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	676.3	673.7
VDD_MPU	1.07	1730.9	1847.8
VDD_DSP	1.00	289.1	290.1
VDD_IVA	1.00	16.4	16.4
VDD_GPU	1.03	231.4	237.5
VDDS_DDR	1.35	280.7	378.9
Analog PHY	1.78	101.0	180.2
Analog DPLL	1.79	36.3	64.7
Analog USB PHY	3.30	1.6	5.3
1.8V IO	1.81	116.8	211.1
3.3V IO	3.27	26.9	87.8
Total Power			**3993.5**
VDD_DDR	1.34	435.3	584.2

3.9 Dhrystone: Dual Core - MPU Domain at OD

3.9.1 OPP

Table 25. Dhrystone: Dual Core - MPU Domain at OD - OPP

MPU	GPU	DSP	IVA
OD	NOM	NOM	NOM

3.9.2 Power Consumption

Table 26. Dhrystone: Dual Core - MPU Domain at OD - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	696.9	695.1
VDD_MPU	1.13	2227.5	2523.3
VDD_DSP	1.00	304.7	305.8
VDD_IVA	1.00	20.0	20.1
VDD_GPU	1.03	257.5	264.6
VDDS_DDR	1.35	281.9	380.6
Analog PHY	1.78	101.3	180.7
Analog DPLL	1.79	36.5	65.2
Analog USB PHY	3.30	1.7	5.7
1.8V IO	1.81	126.3	228.4
3.3V IO	3.27	27.5	89.9
Total Power			**4759.3**
VDD_DDR	1.34	443.5	595.1

3.10 Dhrystone: Dual Core - MPU Domain at HIGH

3.10.1 OPP

Table 27. Dhrystone: Dual Core - MPU Domain at HIGH - OPP

MPU	GPU	DSP	IVA
HIGH	NOM	NOM	NOM

3.10.2 Power Consumption

Table 28. Dhrystone: Dual Core - MPU Domain at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	747.7	746.7
VDD_MPU	1.23	3307.8	4052.1
VDD_DSP	1.00	333.1	334.6
VDD_IVA	1.00	28.8	28.8
VDD_GPU	1.03	323.4	332.7
VDDS_DDR	1.35	281.8	380.4
Analog PHY	1.78	101.7	181.4
Analog DPLL	1.79	36.5	65.2
Analog USB PHY	3.30	1.8	5.8
1.8V IO	1.81	152.7	276.2
3.3V IO	3.27	27.5	89.9
Total Power			**6493.8**
VDD_DDR	1.34	445.4	597.8

3.11 Graphics 3D Chameleon Man: All Domains at NOM

3.11.1 OPP

Table 29. Graphics 3D Chameleon Man: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.11.2 Power Consumption

Table 30. Graphics 3D Chameleon Man: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	666.9	663.5
VDD_MPU	1.06	412.5	435.2
VDD_DSP	1.00	213.8	214.0
VDD_IVA	1.00	12.0	12.0
VDD_GPU	1.04	670.8	694.4
VDDS_DDR	1.35	358.3	483.7
Analog PHY	1.78	101.4	180.8
Analog DPLL	1.79	36.3	64.7
Analog USB PHY	3.30	1.5	4.9
1.8V IO	1.81	115.4	208.7
3.3V IO	3.27	56.3	183.8
Total Power			**3145.9**
VDD_DDR	1.34	505.6	678.2

3.12 Graphics 3D Chameleon Man: All Domains at HIGH

3.12.1 OPP

Table 31. Graphics 3D Chameleon Man: All Domains at HIGH - OPP

MPU	GPU	DSP	IVA
HIGH	HIGH	HIGH	HIGH

3.12.2 Power Consumption

Table 32. Graphics 3D Chameleon Man: All Domains at HIGH - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	714.1	712.3
VDD_MPU	1.20	780.3	935.4
VDD_DSP	1.06	302.5	321.8
VDD_IVA	1.12	32.5	36.5
VDD_GPU	1.09	795.8	865.4
VDDS_DDR	1.35	366.9	495.8
Analog PHY	1.78	101.3	180.7
Analog DPLL	1.79	36.3	64.7
Analog USB PHY	3.30	1.7	5.5
1.8V IO	1.81	138.3	250.1
3.3V IO	3.27	57.2	186.8
Total Power			**4055.0**
VDD_DDR	1.34	528.5	708.9

3.13 Video: H.264 Decode - All Domains at NOM

3.13.1 OPP

Table 33. Video: H.264 Decode - All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.13.2 Power Consumption

Table 34. Video: H.264 Decode - All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	674.5	671.4
VDD_MPU	1.05	393.1	414.5
VDD_DSP	1.00	250.6	251.3
VDD_IVA	1.00	54.8	55.1
VDD_GPU	1.03	195.9	201.1
VDDS_DDR	1.35	321.1	433.4
Analog PHY	1.78	102.2	182.2
Analog DPLL	1.79	37.1	66.3
Analog USB PHY	3.30	1.8	5.8
1.8V IO	1.81	111.7	201.8
3.3V IO	3.27	47.5	155.2
Total Power			**2638.0**
VDD_DDR	1.34	451	604.9

3.14 Ethernet: All Domains at NOM

3.14.1 OPP

Table 35. Ethernet: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.14.2 Power Consumption

Table 36. Ethernet: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	675.2	672.6
VDD_MPU	1.06	900.3	953.5
VDD_DSP	1.00	279.4	280.1
VDD_IVA	1.00	16.3	16.3
VDD_GPU	1.03	225.5	231.4
VDDS_DDR	1.35	294.9	398.1
Analog PHY	1.78	101.5	181.1
Analog DPLL	1.79	36.5	65.2
Analog USB PHY	3.30	1.6	5.2
1.8V IO	1.81	118.4	214.1
3.3V IO	3.27	80.3	262.3
Total Power			**3279.8**
VDD_DDR	1.34	435.9	585.0

3.15 USB: All Domains at NOM

3.15.1 OPP

Table 37. USB: All Domains at NOM - OPP

MPU	GPU	DSP	IVA
NOM	NOM	NOM	NOM

3.15.2 Power Consumption

Table 38. USB: All Domains at NOM - Power Consumption

Power Supply Group	Voltage [V]	Current [mA]	Power [mW]
VDD_CORE	1.00	684.7	682.1
VDD_MPU	1.06	857.5	908.1
VDD_DSP	1.00	281.9	282.6
VDD_IVA	1.00	15.0	15.0
VDD_GPU	1.03	219.4	225.1
VDDS_DDR	1.35	280.3	378.3
Analog PHY	1.78	103.1	183.9
Analog DPLL	1.79	36.5	65.2
Analog USB PHY	3.30	3.5	11.5
1.8V IO	1.81	113.5	205.2
3.3V IO	3.27	55.0	179.7
Total Power			**3136.9**
VDD_DDR	1.34	436.0	585.1

IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ('TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products http://www.ti.com/sc/docs/stdterms.htm), evaluation modules, and samples (http://www.ti.com/sc/docs/sampterms.htm).

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