# Datasheet

## BIOS PSP DA830 Datasheet

### 02.00.01

This page has been intentionally left blank.

# IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third–party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information 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.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Mailing Address:

Texas Instruments

Post Office Box 655303

Dallas, Texas 75265

This page has been intentionally left blank.

# TABLE OF CONTENTS

# 1    Introduction

The PSP package consists of peripheral device drivers for the DA830 device. The drivers enable rapid software development on the DA830 platform. This document provides the performance data for each of the drivers on DSP/BIOS™.

# 2    BIOS PSP Drivers - Features

- Supported Devices
    - o   DA830
- Developed and tested on DA830 EVM
- Tools used to build DSP/BIOS™ PSP drivers
    - o   DSP/BIOS Version 6.20.00.37
    - o   Code composer studio Version 4 Beta 5
    - o   CG tools 6.1.9
- EDMA3 LLD version used – 02.00.01.04
- XDC Tool Version used – 3.15.00.50
- Drivers supported on DSP/BIOS™:
    - o   I2C
    - o   SPI
    - o   UART
    - o   PSC
    - o   GPIO
    - o   McASP
    - o   Audio Interface
    - o   Aic31 codec
    - o   LCD Raster
    - o   LCD LIDD
    - o   MMCSD
    - o   NAND
    - o   BLK Media
    - o   EVM lib (For EVM specific initializations)

# 3    Performance data for BIOS PSP drivers

The performance data for the drivers is captured into five different sections

- Features supported/not supported

- Memory usage

  The following statistics are taken from drivers built in release mode.

    o   Program memory

    o   Data memory (Initialized and Un-Initialized memory)

- Resource usage

    o   The OS and system resources consumed by each instance of the driver in different modes are listed.

    o   OS resources include usage of semaphores

    o   System resources include usage of EDMA3 resources (channels, PaRAMs), interrupts and timers

- I/O Throughput and CPU loading

  I/O throughput and corresponding CPU loading numbers are available for I2C, SPI, UART, McASP, LCDC Raster, MMC/SD and NAND driver.

## 3.1 I2C Driver

### 3.1.1 Features supported

- Multi-instantiable and re-entrant driver
- Each instance can operate as an receiver and/or transmitter
- Supports Polled, Interrupt and DMA Interrupt Mode of operation

### 3.1.2 Features not supported

None

### 3.1.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **I2C** | 17312 | 96 | 0 | 96 |
| **I2c Edma** | 3840 | 32 | 0 | 32 |
| Total | **21152** | 128 | 0 | **128** |

### 3.1.4 Resource usage

*3.1.4.1 Polled mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| 1 | For synchronization of the Submit API |

*3.1.4.2 Interrupt mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| None | NA |

| INTERRUPTS | DESCRIPTION |
|---|---|
| 1 | For Transmit and receive channels |

*3.1.4.3 DMA mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| None | NA |

| EDMA3 CHANNELS | DESCRIPTION |
|---|---|
| 1 | For Transmit Channel |

| 1 | For Receive Channel |
|---|---|

| EDMA3 PARAMS | DESCRIPTION |
|---|---|
| 1 | For Transmit Channel |
| 1 | For Receive Channel |

### 3.1.5   I/O Throughput

The following are setup details for measuring the throughput in different modes

Slave device: EEPROM CAT24W256

No of bytes transferred: 66 bytes (Including slave address and address in EEPROM)

Methodology: Time taken and CPU load to write and read 66 bytes to EEPROM at different I2C bus frequencies in different modes of operation (DMA, Interrupt and Polled)

### *3.1.5.1    I/O Write Performance*

The following graphs represent throughput numbers and CPU loads at different bus frequencies
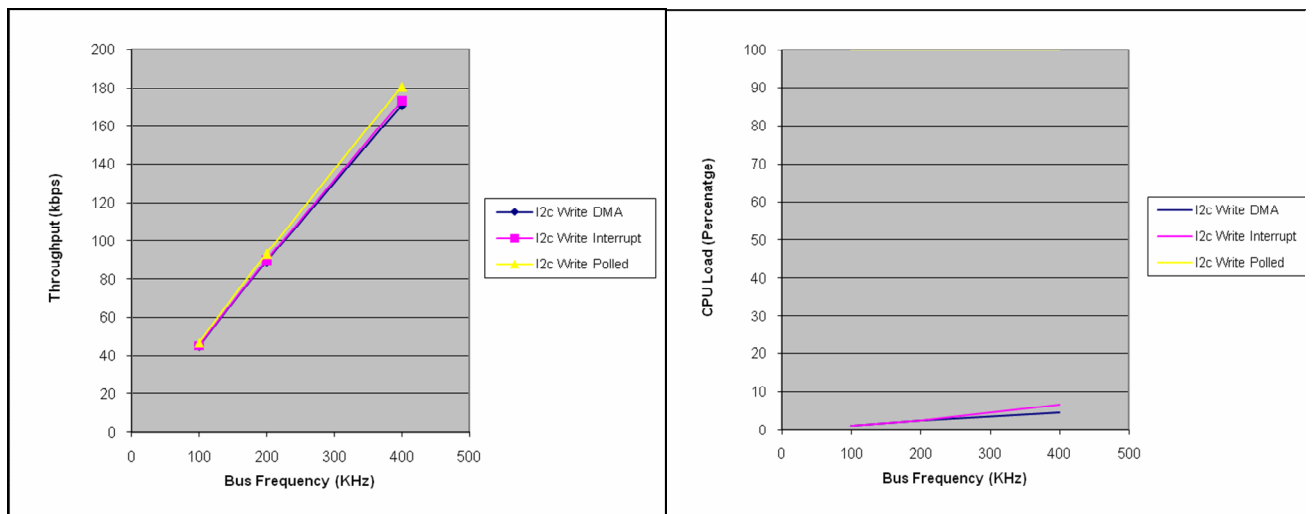


Fig: I2C write performance

![Texas Instruments logo]

DMA mode:

| Bus Frequency (in KHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 100 | 12.88 | 45.19 | 1.21 |
| 200 | 6.53 | 89.13 | 2.52 |
| 400 | 3.41 | 170.85 | 4.58 |

Interrupt mode:

| Bus Frequency (KHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 100 | 12.80 | 45.47 | 1.12 |
| 200 | 6.49 | 89.68 | 2.47 |
| 400 | 3.36 | 173.22 | 6.73 |

Polled mode:

| Bus Frequency (KHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 100 | 12.39 | 46.98 | 100.00 |
| 200 | 6.25 | 93.13 | 100.00 |
| 400 | 3.22 | 180.76 | 100.00 |

### 3.1.5.2    I/O Read Performance

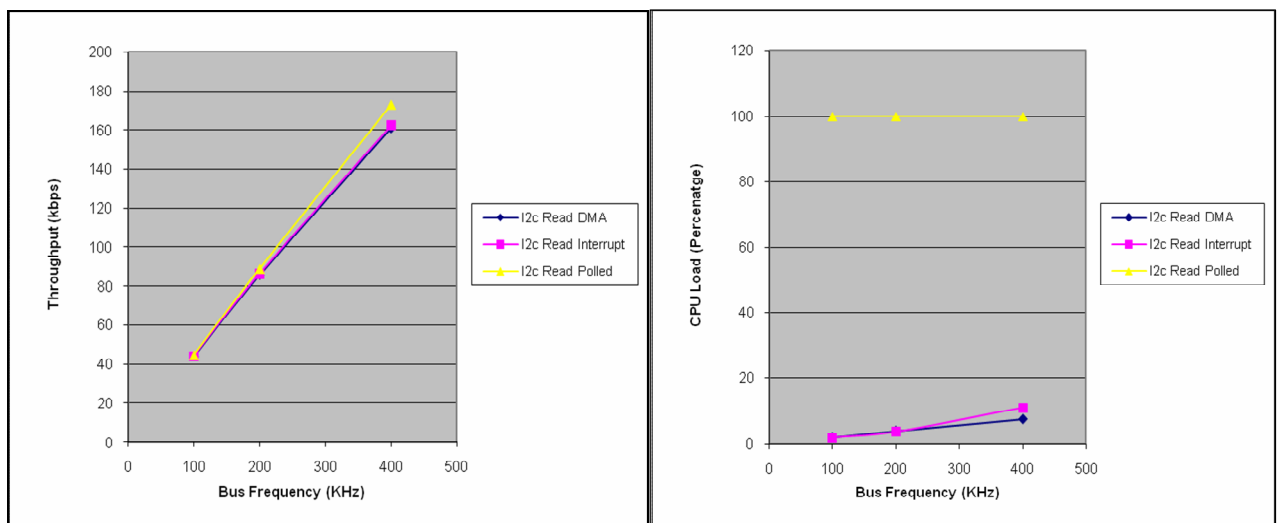The following graphs represent throughput numbers and CPU loads at different bus frequencies



Fig: I2C read performance

DMA mode:

| Bus Frequency (KHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 100 | 13.24 | 43.96 | 1.99 |
| 200 | 6.80 | 85.59 | 3.87 |
| 400 | 3.62 | 160.78 | 7.28 |

Interrupt mode:

| Bus Frequency (KHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 100 | 13.18 | 44.16 | 1.86 |
| 200 | 6.75 | 86.23 | 3.64 |
| 400 | 3.59 | 162.13 | 10.74 |

Polled mode:

| Bus Frequency (KHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 100 | 13.00 | 44.77 | 100.00 |
| 200 | 6.54 | 88.95 | 100.00 |
| 400 | 3.37 | 172.71 | 100.00 |

## 3.2 SPI Driver

### 3.2.1 Features supported

- Multi-instanceable and re-entrant driver
- Each instance can operate as an receiver and or transmitter
- Supports Polled, Interrupt and DMA Interrupt Mode of operation

### 3.2.2 Features not supported

- NA

### 3.2.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
| --- | --- | --- | --- | --- |
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| Spi | 19712 | 52 | 0 | 52 |
| Spi Edma | 6848 | 224 | 0 | 224 |
| Total | 26560 | 276 | 0 | 276 |

### 3.2.4 Resource usage

*3.2.4.1 Polled mode*

| SEMAPHORES | DESCRIPTION |
| --- | --- |
| 1 | For synchronization of submit API |

*3.2.4.2 Interrupt mode*

| SEMAPHORES | DESCRIPTION |
| --- | --- |
| None | NA |

| INTERRUPTS | DESCRIPTION |
| --- | --- |
| 1 | For Transmit and receive channel |

*3.2.4.3 DMA mode*

| SEMAPHORES | DESCRIPTION |
| --- | --- |
| None | NA |

| EDMA3 CHANNELS | DESCRIPTION |
| --- | --- |

| 1 | For Transmit Channel |
|---|---|
| 1 | For Receive Channel |

| EDMA3 PARAMS | DESCRIPTION |
|---|---|
| 1 | For Transmit Channel |
| 1 | For Receive Channel |

### 3.2.5 I/O Throughput

The following are setup details for measuring the throughput in different modes

Slave device: SPI Flash (W25X32).

No of bytes transferred: 256 bytes.

#### 3.2.5.1 I/O Write Performance

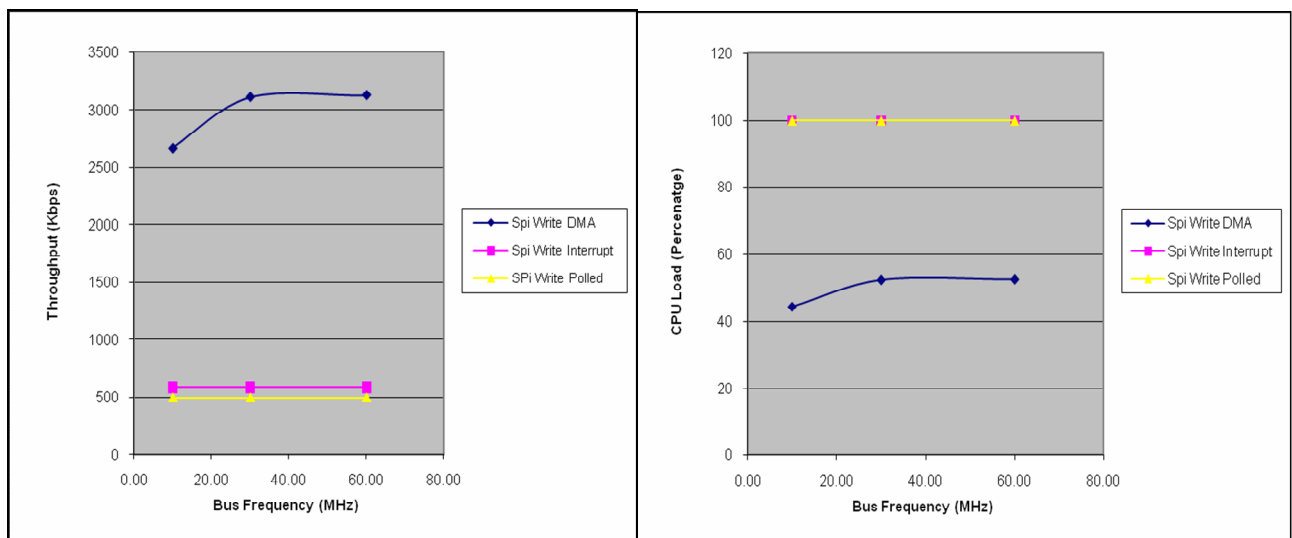The following graphs represent throughput numbers and CPU loads at different bus frequencies



Fig: Write performance

DMA mode:

| Bus Frequency (MHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 10.00 | 0.75 | 2666.67 | 44.25 |
| 30.00 | 0.64 | 3108.81 | 52.46 |
| 60.00 | 0.64 | 3125.00 | 52.63 |

Interrupt mode:

| Bus Frequency (MHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 10.00 | 3.44 | 581.40 | 100.00 |
| 30.00 | 3.44 | 581.40 | 100.00 |
| 60.00 | 3.44 | 581.40 | 100.00 |

Polled mode:

| Bus Frequency (MHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 10.00 | 3.84 | 520.83 | 100.00 |
| 30.00 | 3.84 | 520.83 | 100.00 |
| 60.00 | 3.84 | 520.83 | 100.00 |

*3.2.5.2      I/O Read Performance*

The following graphs represent throughput numbers and CPU loads at different bus frequencies
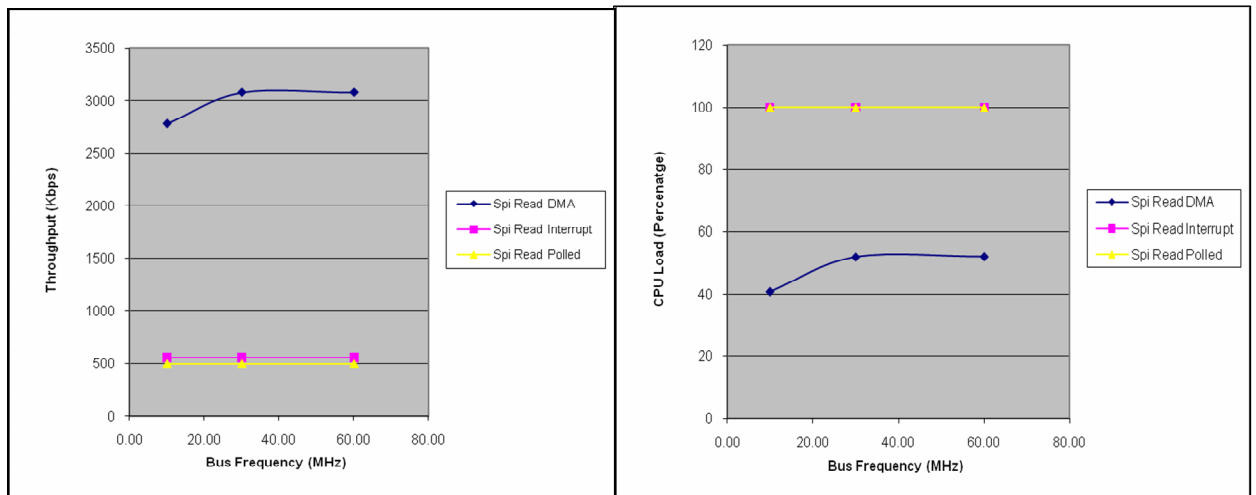


Fig: Read performance

DMA mode:

| Bus Frequency (MHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 10.00 | 0.72 | 2777.78 | 40.76 |
| 30.00 | 0.65 | 3076.92 | 51.98 |
| 60.00 | 0.65 | 3076.92 | 52.09 |

Interrupt mode:

| Bus Frequency (MHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 10.00 | 3.60 | 556.07 | 100.00 |
| 30.00 | 3.59 | 557.10 | 100.00 |
| 60.00 | 3.59 | 557.10 | 100.00 |

Polled mode:

| Bus Frequency (MHz) | Time Taken (milli-sec) | Throughput (Kbps) | CPU LOAD (%) |
|---|---|---|---|
| 10.00 | 4.02 | 497.51 | 100.00 |
| 30.00 | 4.02 | 497.51 | 100.00 |
| 60.00 | 4.02 | 497.51 | 100.00 |

### 3.3 UART Driver

#### 3.3.1 Features supported

- Multi-instance support and re-entrant driver
- Each instance supports a transmit channel and a receive channel
- Supports Polled, Interrupt and DMA Interrupt Mode of operation
- Supports buffering on Transmit operation if enabled.

#### 3.3.2 Features not supported

- Loopback is not supported in interrupt mode
- In case of time bound IO requests, on timeout the driver is not able to perform any operations on the peripheral. (This peripheral limitation is documented in the technical reference manual of I2C under ICMDR register).

#### 3.3.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **UART** | 28288 | 176 | 4 | 180 |
| **UART EDMA** | 3136 | 88 | 0 | 88 |
| Total | 31424 | 264 | 4 | 268 |

#### 3.3.4 Resource usage

*3.3.4.1 Polled mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| 1 | For synchronization of submit API |

*3.3.4.2 Interrupt mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| None | NA |

| INTERRUPTS | DESCRIPTION |
|---|---|
| 1 | For Transmit and receive channels |

*3.3.4.3 DMA mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| None | NA |

| EDMA3 CHANNELS | DESCRIPTION |
|---|---|
| 1 | For Transmit Channel |
| 1 | For Receive Channel |

| EDMA3 PARAMS | DESCRIPTION |
|---|---|
| 1 | For Transmit Channel |
| 1 | For Receive Channel |

### 3.3.5 I/O Throughput

The following are setup details for measuring the throughput in different modes

Host device for transferring the data: PC (Teraterm software)

Baud rate: 115200

Char Length: 8 Bits.

Stop Bits: 1 Bit.

### 3.3.5.1 I/O Write Performance

The following graphs represent throughput numbers and CPU loads at different buffer sizes
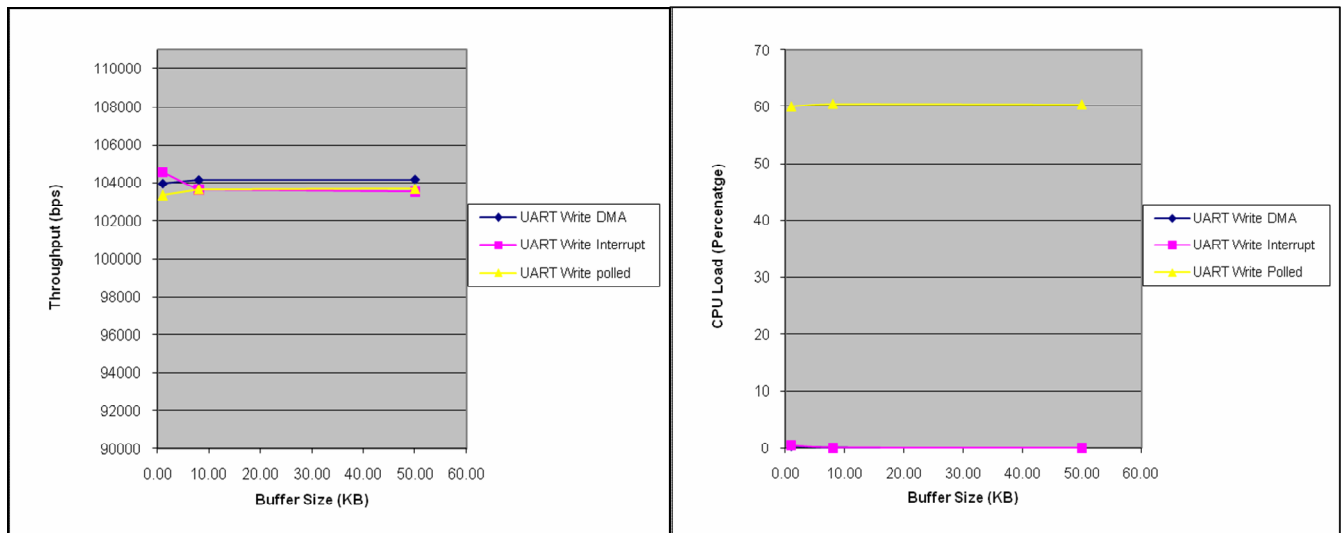


Fig: Write performance

DMA mode:

| Buffer Size (KB) | Time Taken (milli-sec) | Throughput (bps) | CPU LOAD (%) |
|---|---|---|---|
| 1.00 | 88.67 | 103935.94 | 0.32 |
| 8.00 | 707.98 | 104139.03 | 0.03 |
| 50.00 | 4423.90 | 104161.49 | NA |

Interrupt mode:

| Buffer Size (KB) | Time Taken (milli-sec) | Throughput (bps) | CPU LOAD (%) |
|---|---|---|---|
| 1.00 | 88.14 | 104564.88 | 0.51 |
| 8.00 | 711.45 | 103630.13 | 0.06 |
| 50.00 | 4451.44 | 103516.99 | 0.01 |

Polled mode:

| Buffer Size (KB) | Time Taken (milli-sec) | Throughput (bps) | CPU LOAD (%) |
|---|---|---|---|
| 1.00 | 89.18 | 103341.56 | 60.02 |
| 8.00 | 711.37 | 103642.75 | 60.46 |
| 50.00 | 4444.81 | 103671.40 | 60.37 |

Note: Please note that CPU load "NA" represent data load is negligible.

### 3.3.5.2    I/O Read Performance

The following graphs represent throughput numbers and CPU loads at different buffer sizes
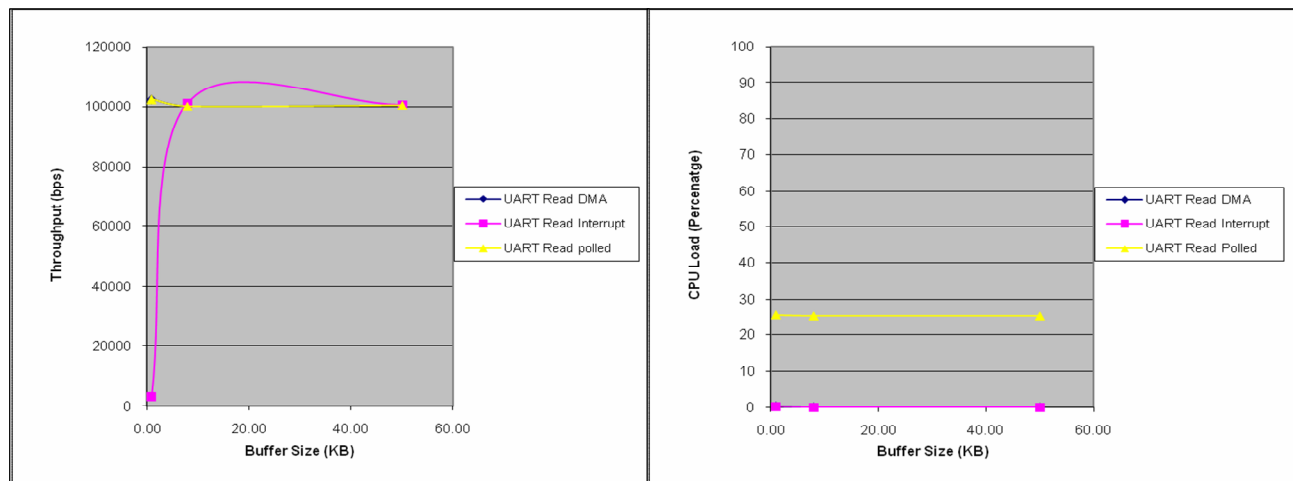


Fig: Read performance

DMA mode:

| Buffer Size (KB) | Time Taken (sec) | Throughput (bps) | CPU LOAD (%) |
|---|---|---|---|
| 1.00 | 0.09 | 102400.00 | 0.26 |
| 8.00 | 0.74 | 100083.26 | 0.03 |
| 50.00 | 4.59 | 100392.16 | NA |

Interrupt mode:

| Buffer Size (KB) | Time Taken (in sec) | Throughput (bps) | CPU LOAD (%) |
|---|---|---|---|
| 1.00 | 2.97 | 3103.38 | 0.15 |
| 8.00 | 0.73 | 100997.26 | 0.02 |
| 50.00 | 4.59 | 100465.12 | NA |

Polled mode:

| Buffer Size (KB) | Time Taken (in sec) | Throughput (bps) | CPU LOAD (%) |
|---|---|---|---|
| 1.00 | 0.09 | 102400.00 | 25.53 |
| 8.00 | 0.74 | 100083.26 | 25.22 |
| 50.00 | 4.59 | 100392.16 | 25.19 |

Note: Please note that CPU load "NA" represent data load is negligible.

## 3.4 BLKMEDIA Driver

### 3.4.1 Features supported

- Provides both Sync access for File system as well as for Raw/Sector level access (for e.g. USB MSC Class).
- Provides interfaces for Mass Storage Class clients like USB, NAND to talk to Storage Block devices in a uniform way.
- Provides support for big block sector sizes.
- Supports cache alignment on unaligned buffers from application.
- Provides Write Protect support and Removable media support.
- Supports POLLED and DMA modes of operation.

### 3.4.2 Features not supported

None

### 3.4.3 Memory usage

#### 3.4.3.1 File System

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **blkmedia** | 16768 | 300 | 1562032 | 1562332 |
| Total | 16768 | 300 | 1562032 | 1562332 |

#### 3.4.3.2 Raw

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **blkmedia** | 13344 | 300 | 1562032 | 1562332 |
| Total | 13344 | 300 | 1562032 | 1562332 |

### 3.4.4 Resource usage

#### 3.4.4.1 Polled mode

| SEMAPHORES | DESCRIPTION |
|---|---|
| NA | NA |

#### 3.4.4.2 Interrupt mode

| SEMAPHORES | DESCRIPTION |
|---|---|
| NA | NA |

*3.4.4.3    DMA mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| 10 | Assuming MMC & NAND are attached to BlockMedia<br>EDMA memcopy for I/O (Filesystem) is Enabled.<br>EDMA memcopy for I/O (Sector level) is Enabled. |

### 3.4.5    Brief usage of Semaphores:

1. Semaphore-1: For BlockMedia Event i.e. for attaching of device.
2. Semaphore-1: For BlockMedia Mount i.e. Mounting drives on File system.
3. Semaphores-6: For each BlockMedia device Semaphores-3, each for Sector I/O, File system I/O & IOCTLs invocation.
4. Semaphores-2: Each For BlockMedia EDMA memcopy for File system I/O and async (Sector Level I/O).

| EDMA3 CHANNELS | DESCRIPTION |
|---|---|
| 1 | For file system access |
| 1 | For RAW access |

| EDMA3 PARAMS | DESCRIPTION |
|---|---|
| 1 | For file system access |
| 1 | For RAW access |

### 3.4.6    I/O Throughput for MMCSD using Block media

The following are setup details for measuring the throughput in different modes using raw library of the Block media.

No of bytes transferred: 10485760 bytes (10 MB)

Card Size: 256 MB SD.

Card Make: SanDisk.

### 3.4.6.1    I/O Write Performance

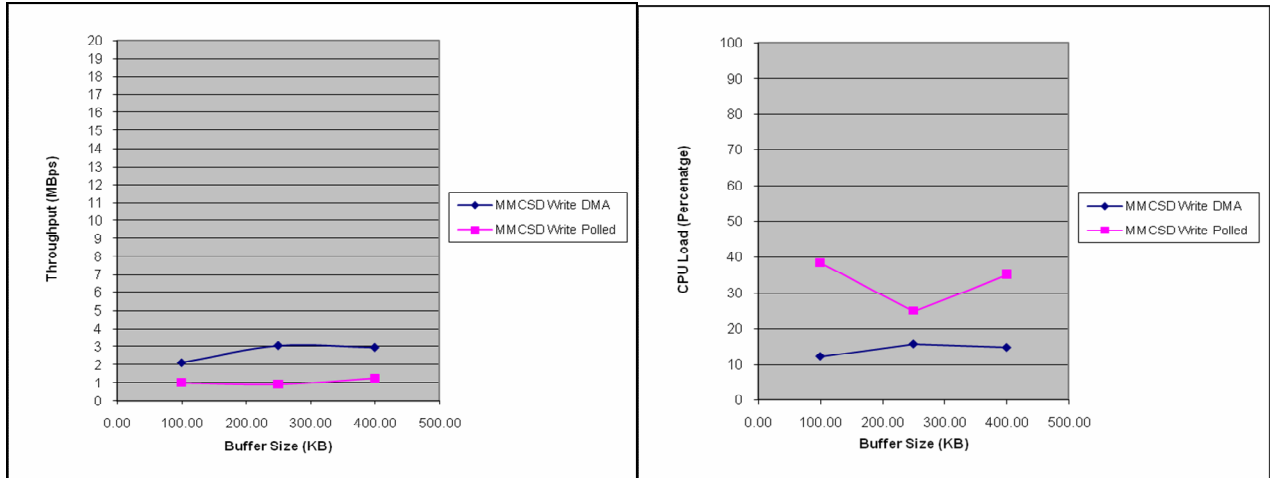The following graphs represent throughput numbers and CPU loads at different buffer sizes.



Fig:  Write performance

DMA mode:

| Buffer Size (KB) | Time Taken (seconds) | Throughput (MBps) | CPU LOAD (%) |
|---|---|---|---|
| 100.00 | 4.72 | 2.12 | 12.06 |
| 250.00 | 3.26 | 3.07 | 15.60 |
| 400.00 | 3.38 | 2.96 | 14.63 |

Polled mode:

| Buffer Size (KB) | Time Taken (seconds) | Throughput (MBps) | CPU LOAD (%) |
|---|---|---|---|
| 100.00 | 10.07 | 0.99 | 38.33 |
| 250.00 | 10.86 | 0.92 | 24.86 |
| 400.00 | 7.97 | 1.26 | 35.06 |

*3.4.6.2    I/O Read Performance*

The following graphs represent throughput numbers and CPU loads at different buffer sizes.



Fig: Read performance

DMA mode:

| Buffer Size (KB) | Time Taken (seconds) | Throughput (MBps) | CPU LOAD (%) |
|---|---|---|---|
| 100.00 | 1.45 | 6.90 | 38.55 |
| 250.00 | 1.38 | 7.25 | 36.64 |
| 400.00 | 1.36 | 7.35 | 36.14 |

Polled mode:

| Buffer Size (KB) | Time Taken (seconds) | Throughput (MBps) | CPU LOAD (%) |
|---|---|---|---|
| 100.00 | 2.23 | 4.48 | 100.00 |
| 250.00 | 2.19 | 4.57 | 100.00 |
| 400.00 | 2.18 | 4.59 | 100.00 |

![Texas Instruments logo]

### 3.4.7 I/O Throughput for NAND using Block media

The following are setup details for measuring the throughput in different modes using raw library of the Block media.

No of bytes transferred: 5242880bytes (5 MB)

Size of NAND: 512 MB.

Make: MT29F4G08AA.

Type: 8 Bit.

#### 3.4.7.1 *I/O Write Performance*

The following graphs represent throughput numbers and CPU loads at different buffer sizes.



Fig: Write performance

DMA mode:

| Buffer Size (KB) | Time Taken (seconds) | Throughput (MBps) | CPU LOAD (%) |
|---|---|---|---|
| 150.00 | 8.15 | 0.61 | 57.40 |
| 250.00 | 7.05 | 0.71 | 57.63 |
| 1000.00 | 5.68 | 0.88 | 59.97 |

Polled mode:

| Buffer Size (KB) | Time Taken (seconds) | Throughput (MBps) | CPU LOAD (%) |
|---|---|---|---|
| 150.00 | 11.88 | 0.84 | 100.00 |
| 250.00 | 8.90 | 1.12 | 100.00 |
| 1000.00 | 5.95 | 1.68 | 100.00 |

### 3.4.7.2    I/O Read Performance

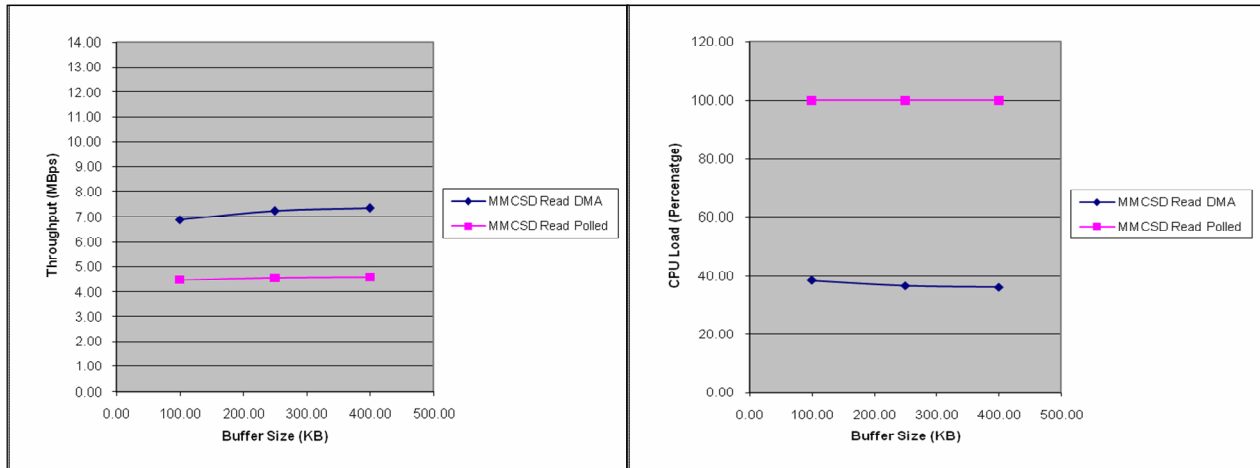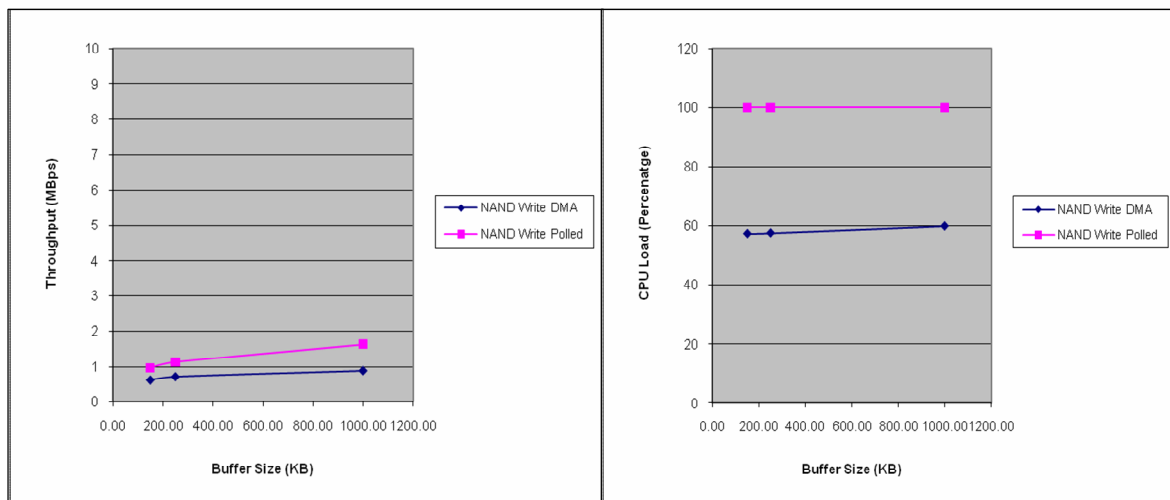The following graphs represent throughput numbers and CPU loads at different buffer sizes.
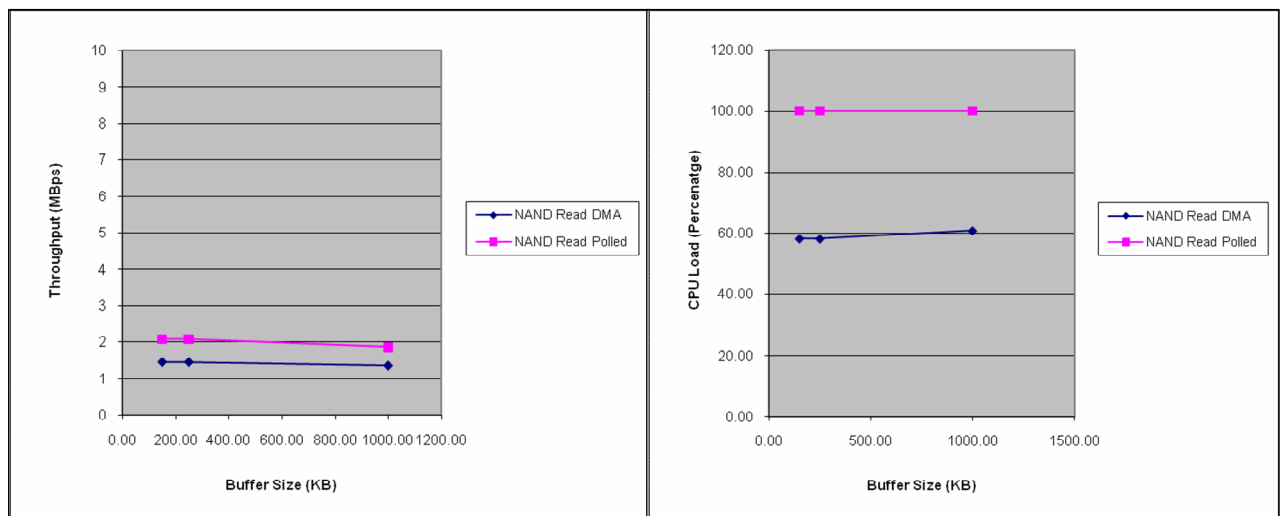


Fig: Read performance

DMA mode:

| Buffer Size (KB) | Time Taken (seconds) | Throughput (MBps) | CPU LOAD (%) |
|---|---|---|---|
| 150.00 | 3.42 | 1.46 | 58.23 |
| 250.00 | 3.42 | 1.46 | 58.19 |
| 1000.00 | 3.66 | 1.36 | 60.92 |

Polled mode:

| Buffer Size (KB) | Time Taken (seconds) | Throughput (MBps) | CPU LOAD (%) |
|---|---|---|---|
| 150.00 | 2.42 | 2.07 | 100.00 |
| 250.00 | 2.42 | 2.07 | 100.00 |
| 1000.00 | 2.68 | 1.86 | 100.00 |

## 3.5 GPIO

### 3.5.1 Features supported

- Setting GPIO pin directions
- Marking pins or banks as available for use
- Enabling and Disabling of bank interrupts
- Registering interrupt handlers for a pin or bank interrupt
- Getting or setting a group of pins to a value

### 3.5.2 Features not supported

None

### 3.5.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **gpio** | 11136 | 0 | 0 | 0 |
| Total | 11136 | 0 | 0 | 0 |

### 3.5.4 Resource usage

*3.5.4.1 Semaphores*

| SEMAPHORES | DESCRIPTION |
|---|---|
| NA | NA |

*3.5.4.2 EDMA resources*

| EDMA3 CHANNELS | DESCRIPTION |
|---|---|
| NA | NA |

| EDMA3 PARAMS | DESCRIPTION |
|---|---|
| NA | NA |

## 3.6 LCDC LIDD Driver

### 3.6.1 Features supported

- Multi-instance able, asynchronous and re-entrant driver.
- Each instance operates as a LIDD controller instance of the LCDC
- Supports multiple display types

### 3.6.2 Features not supported

- The LCDC controller has two modes of operation. One is the Raster mode and the other is the LIDD mode. However, only one mode can be operation can be chosen at a time. Following this constraint, the drivers for these two modes have been separated out and the each mode has a different driver/module, namely Raster and Lidd. Only one driver should be used at a time.

### 3.6.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
| --- | --- | --- | --- | --- |
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **Lidd** | 27040 | 20 | 0 | 20 |
| Total | 27040 | 20 | 0 | 20 |

### 3.6.4 Resource usage

*3.6.4.1 Polled mode*

| SEMAPHORES | DESCRIPTION |
| --- | --- |
| NA | NA |

*3.6.4.2 Interrupt mode*

| SEMAPHORES | DESCRIPTION |
| --- | --- |
| NA | NA |

*3.6.4.3 DMA mode*

| SEMAPHORES | DESCRIPTION |
| --- | --- |
| None | NA |

| EDMA3 CHANNELS | DESCRIPTION |
| --- | --- |
| None | None |

## 3.7 LCDC RASTER Driver

### 3.7.1 Features supported

- Supports QVGA display.

- Supports enabling and disabling of raster.

- Supports display at various bits per pixel configurations – 1, 2, 4, 8, 12 and 16bpp.

- Supports channel creation and deletion through SIO create and delete APIs and queueing and dequeing of buffers through SIO issue and reclaim APIs.

- Supports ioctls to retrieve the raster and sub panel configuration.

- Supports ioctls for setting the sub panel and DMA configurations(frame buffer mode, burst size and end of frame interrupt).

- Supports adding and clearing events and event stats.

### 3.7.2 Features not supported

- The LCDC controller has two modes of operation. One is the Raster mode and the other is the LIDD mode. However, only one mode can be operation can be chosen at a time. Following this constraint, the drivers for these two modes have been separated out and the each mode has a different driver/module, namely Raster and Lidd. Only one driver should be used at a time.

### 3.7.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **Raster** | 56736 | 84 | 4 | 88 |
| Total | 56736 | 84 | 4 | 88 |

### 3.7.4 Resource usage

#### 3.7.4.1 Polled mode

| SEMAPHORES | DESCRIPTION |
|---|---|
| NA | NA |

#### 3.7.4.2 Interrupt mode

| SEMAPHORES | DESCRIPTION |
|---|---|
| NA | NA |

#### 3.7.4.3 DMA mode

| SEMAPHORES | DESCRIPTION |
|---|---|
| None | NA |

| EDMA3 CHANNELS | DESCRIPTION |
|---|---|
| None | NA |

| EDMA3 PARAMS | DESCRIPTION |
|---|---|
| None | NA |

### 3.7.5  I/O throughput

The following are setup details for measuring the performance in LCDC Raster driver.

Frame per second: 60

Mode: 16 bpp

CPU load: 36.77%

![Texas Instruments logo]

## 3.8    McASP Driver

### 3.8.1    Features supported
- Multi-instance support and re-entrant driver
- Each instance can operate as a receiver and/or transmitter
- Supports multiple data formats
- Can be configured to operate in multi-slot TDM, I2S, DSP and DIT (S/PDIF) modes
- Mechanism to transmit desired data (such as NULL tone) when idle
- Explicit control of PIN directions for High Clock, Bit Clock and Frame Sync PINS.
- FIFO support for both TX and RX sections.

### 3.8.2    Features not supported
- Sample rate change IOCTL is not supported in master mode.

### 3.8.3    Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **Mcasp** | 39488 | 116 | 4 | 120 |
| **Mcasp Edma** | 9952 | 124 | 0 | 124 |
| **Mcasp ioctl** | 17600 | 116 | 0 | 116 |
| Total | **67040** | 356 | 4 | **360** |

### 3.8.4    Resource usage

*3.8.4.1    DMA mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| 0 | NA |

| INTERRUPTS | DESCRIPTION |
|---|---|
| 1 | For transmit and receive combined. |

| EDMA3 CHANNELS | DESCRIPTION |
|---|---|
| 1 | Per channel |

| EDMA3 PARAMS | DESCRIPTION |
|---|---|
| 2 | Per channel |

### 3.8.5 I/O Throughput

The following are setup details for measuring the performance in different sample size.

Codec device: AIC3106

Sample Rate: 48000 Hz

*3.8.5.1    I/O Read-Write Performance*

The following graphs represent latency period and CPU loads at different sample size.
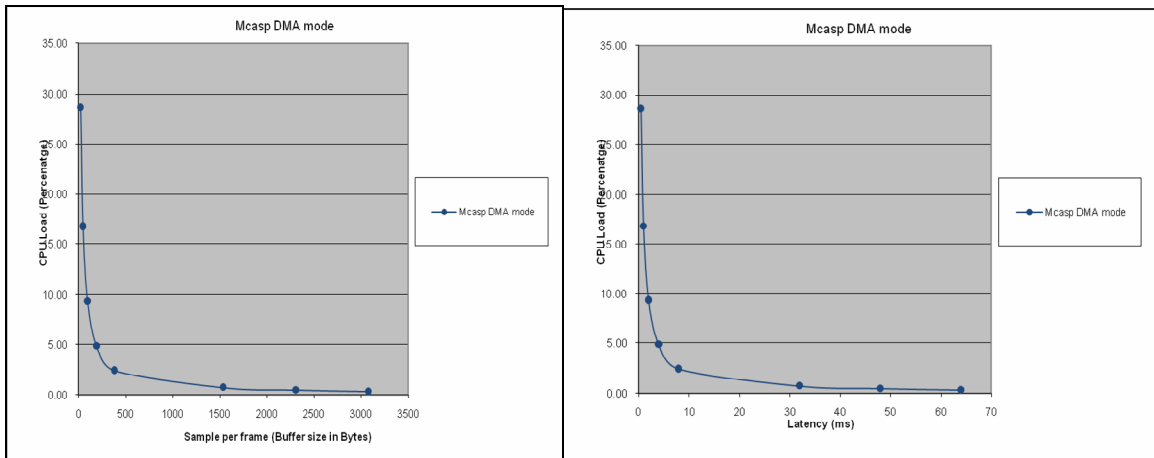


Fig: Read-Write performance

The following graph represent latency period at different sample size.



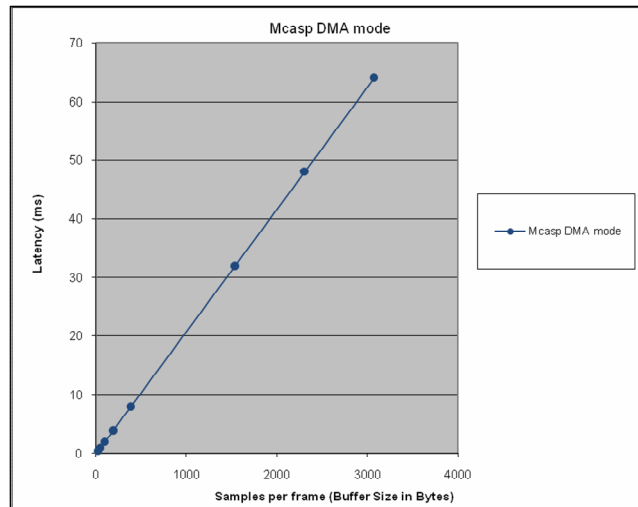Fig: Latency v/s Sample Size

DMA mode:

| Latency (ms) | Sample Size | CPU Load (%) |
|---|---|---|
| 0.5 | 24 | 28.64 |
| 1 | 48 | 16.83 |
| 2 | 96 | 9.38 |
| 4 | 192 | 4.88 |
| 8 | 384 | 2.44 |
| 32 | 1536 | 0.74 |
| 48 | 2304 | 0.50 |
| 64 | 3072 | 0.36 |

TEXAS
INSTRUMENTS

## 3.9 Audio Interface Driver

### 3.9.1 Features supported

- Multi-instance support and re-entrant driver.
- Each instance can be used to configure a complete receive and transmit section of an audio configuration consisting of an audio device and multiple audio codecs.

### 3.9.2 Features not supported

None

### 3.9.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|-----------|---------|---------|---------|---------|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **Audio.c** | 4800 | 0 | 0 | 0 |
| Total | **4800** | 0 | 0 | **0** |

### 3.9.4 Resource usage

None

TEXAS
INSTRUMENTS

## 3.10 Aic31 codec Driver

### 3.10.1 Features supported

- Multi-instance support and re-entrant driver.
- Each instance can operate as a receiver and or transmitter.
- Interfaces to control the codec specific features like sample rate etc.

### 3.10.2 Features not supported

None

### 3.10.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| Aic31.c | 16224 | 60 | 0 | 60 |
| Total | 16224 | 60 | 0 | **60** |

### 3.10.4 Resource usage

| SEMAPHORES | DESCRIPTION |
|---|---|
| 1 | For Both TX and RX channels combined. |

TEXAS
INSTRUMENTS

## 3.11 MMCSD Driver

### 3.11.1 Features supported

- Re-entrant safe driver
- Provides Async IO mechanism
- Configurable to operate in Polled and DMA mode
- Supports hot removal and insertion of MMC/SD card
- Supports variety of SD and MMC cards

### 3.11.2 Features not supported

None

### 3.11.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **dda_mmcsdBios** | 5472 | 240 | 44 | 284 |
| **dda_mmcsdCfg** | 0 | 14 | 8 | 22 |
| **ddc_mmcsd** | 45024 | 150 | 1205 | 1355 |
| **llc_mmcsd** | 7104 | 16 | 0 | 16 |
| Total | 57600 | 420 | 1257 | 1677 |

### 3.11.4 Resource usage

*3.11.4.1 Polled mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| 3 | Blkmedia callback, driver alignment and sync operations. |

*3.11.4.2 Interrupt mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| NA | NA |

*3.11.4.3 DMA mode*

| SEMAPHORES | DESCRIPTION |
|---|---|
| 3 | Blkmedia callback, driver alignment and sync operations. |

| EDMA3 CHANNELS | DESCRIPTION |
|:---:|:---:|
| 1 | For Transmit Channel |
| 1 | For Receive Channel |

| EDMA3 PARAMS | DESCRIPTION |
|:---:|:---:|
| 1 | For Transmit Channel |
| 1 | For Receive Channel |

## 3.12 NAND Driver

### 3.12.1 Features supported

- Supports 512-byte page and 2048-byte page NAND devices.
- Supports 8-bit and 16-bit NAND devices
- Error correction using 4-bit ECC mechanism
- Supports wear-leveling and bad-block management functionalities
- Supports protecting a portion of the NAND flash from application access

### 3.12.2 Features not supported

None

### 3.12.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|-----------|-----------------|-------------|---------------|-------|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| dda_nandBios | 4000 | 66 | 32 | 98 |
| ddc_nandFtl | 16672 | 18 | 20288 | 20306 |
| ddc_nand | 992 | 36 | 32 | 68 |
| llc_nand | 16128 | 322 | 152 | 474 |
| Total | 37792 | 442 | 20504 | 20946 |

### 3.12.4 Resource usage

#### 3.12.4.1 Polled mode

| SEMAPHORES | DESCRIPTION |
|------------|-------------|
| 1 | For exclusive locking of IO APIs, erase IOCTL, driver registration, and completion callback to blkmedia driver. |

#### 3.12.4.2 Interrupt mode

| SEMAPHORES | DESCRIPTION |
|------------|-------------|
| NA | NA |

#### 3.12.4.3 DMA mode

| SEMAPHORES | DESCRIPTION |
|------------|-------------|
| 2 | For exclusive locking of IO APIs, erase IOCTL, driver registration, completion callback to blkmedia driver and edma syncronisation |

| EDMA3 CHANNELS | DESCRIPTION |
|----------------|-------------|

| 1 | For Transmit and receive Channel |
|---|---|

| EDMA3 PARAMS | DESCRIPTION |
|---|---|
| 1 | For Transmit and receive Channels |

### 3.12.5 I/O Throughput

The following are setup details for measuring the throughput in different modes

Raw NAND read write through BLK Media driver

No of sectors involved in transfer:

Sector size: Bytes

Total bytes = Bytes

| MODE | WRITE OPERATION | READ OPERATION |
|---|---|---|
| DMA | | |

## 3.13 PSC

### 3.13.1 Features supported

- Does NOT support instances. Simple module level functions.
- Standalone module (driver) does not implement IOM interface.

### 3.13.2 Features not supported

None

### 3.13.3 Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| **Psc** | 1856 | 12 | 0 | 12 |
| Total | 1856 | 12 | 0 | 12 |

### 3.13.4 Resource usage

NA

### 3.14   EVM LIB

#### 3.14.1   Features supported

- Does NOT support instances. Simple module level functions.
- Standalone module (driver) does not implement IOM interface.
- Provides the EVM specific startup functions for the different drivers.

#### 3.14.2   Features not supported

None

#### 3.14.3   Memory usage

| Component | Memory Statistics (Bytes) | | | |
|---|---|---|---|---|
| | Program Memory | Data Memory | | Total |
| | | Initialized | Un-Initialized | |
| audio_evmInit | 128 | 0 | 0 | 0 |
| gpio_evmInit | 128 | 0 | 0 | 0 |
| i2c_evmInit | 96 | 0 | 0 | 0 |
| lcdlidd_evmInit | 576 | 8 | 0 | 0 |
| lcdraster_evmInit | 576 | 8 | 0 | 0 |
| mcaspDit_evmInit | 96 | 0 | 0 | 0 |
| mmcsd_evmInit | 960 | 184 | 0 | 0 |
| mmcsd_startup | 512 | 288 | 0 | 0 |
| nand_evmInit | 800 | 8 | 0 | 0 |
| nand_startup | 384 | 0 | 0 | 0 |
| spi_evmInit | 96 | 0 | 0 | 0 |
| uart_evmInit | 96 | 0 | 0 | 0 |
| Total | 4448 | 496 | 0 | 496 |

#### 3.14.4   Resource usage

NA