

SR-uSOM-MX6 Suspend to Memory Power Measurements

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Documentation Revision History

Date	Owner	Revision	Notes
8-Jan-2015	Rabeeh Khoury	1.0	Initial release

Introduction

The SolidRun SR-uSOM-MX6 is a high performance micro system on module that is based on the highly integrated Freescale i.MX6 family of products.

This application note provides information on power consumption of the MicroSOM suspend to memory feature.

Suspend to memory is a feature that enables putting the whole system in memory retention mode where waking up the whole system back again is very fast. In this case the DDR memories are put in self-refresh-mode where its content is preserved and used when the system is awakened.

As a preparation for the measurement the following components were selected –

1. HummingBoard base with the below modifications
2. SR-uSOM-MX6 i.MX6 solo with 512Mbyte memory
3. SR-uSOM-MX6 i.MX6 solo with 512Mbyte memory and AR8035 Gigabit Ethernet PHY
4. SR-uSOM-MX6 i.MX6 solo with 512Mbyte memory, AR8035 Gigabit Ethernet PHY and BCM4330 wifi/bt SiP
5. SR-uSOM-MX6 i.MX6 dual lite with 1GByte of memory and AR8035 Gigabit Ethernet PHY
6. SR-uSOM-MX6 i.MX6 dual with 1GByte of memory and AR8035 Gigabit Ethernet PHY
7. SR-uSOM-MX6 i.MX6 quad with 2GByte of memory, AR8035 Gigabit Ethernet PHY and BCM4330 wifi/bt SiP.

Notice that the configurations of the MicroSOM in items #3 through #7 above are standard configurations that are shipped from SolidRun as HummingBoard-i1 and HummingBoard-i1w etc... while #2 is exactly like #3 but with the Gigabit Ethernet phy removed.

The modifications to the HummingBoard base were done in order to have a PCB that has only the 5v and 3.3v power rails coming from an external power supply where the HummingBoard itself will consume almost no power when the SR-uSOM-MX6 is disconnected (i.e. to really test the power consumption of the MicroSOM alone).

The following modifications were done on HummingBoard base configuration –

1. Remove Red LED – Remove D3
2. Remove PWM audio - Removed R7, C7 and D4
3. uSD is power directly from 3.2v - Remove R24, Q1, R3013 and short R3
4. Remove 5v to 3.2v LDO and supply 3.2v from external power supply - Remove U8, R22, C64 and R21
5. Remove USB current limiter – Remove U9

With the previous modifications the following was achieved while measuring the currents on the 5V and 3.2V power rails while the SR-uSOM-MX6 is **NOT inserted**; i.e. measure leakages only on HummingBoard itself –

HummingBoard carrier without MicroSOM	Current on 5V rail	Current on 3.2v rail
uSD inserted	0.6	1mA
uSD not inserted	0.6	0.2mA

The conclusion is that the uSD card that was used consumes 0.8mA in idle mode.

SR-uSOM-MX6 Power Measurements

The following measurements are on the 5V and 3.2V rails while running Linux kernel 3.0.35.

In Linux we run the following two commands where the first set the debug console as an interface to wake the system from (by pressing any key) and second line puts the system in suspend to memory state.

```
echo enabled > /sys/devices/platform/imx-uart.0/tty/ttymx0/power/wakeup
```

```
echo mem > /sys/power/state
```

Pressing any key on the console awakens the system. The wakeup time for the system is reported to be 168 msec. Notice that external peripherals on USB for example are awakened later on.

Following is the power consumption of 3 different configurations of the SR-uSOM-MX6 –

MicroSOM name	MicroSOM Details	5V rail (mA)	3.2v rail (mA) (*)	Total power (mW)
l1 without gig phy	SR-uSOM-MX6 solo with 512Mbyte memory without Gigabit phy	6.83	1.23	38 mW
l1	SR-uSOM-MX6 solo with 512Mbyte and Gigabit phy	6.92	6.21	54 mW
l1w	SR-uSOM-MX6 solo with 512Mbyte memory, Gigabit phy and wifi/bt SiP (**)	10.7	6.78	75 mW
l2	SR-uSOM-MX6 dual lite with 1GByte memory and Gigabit phy	8.79	6.19	64 mW
l2ex	SR-uSOM-MX6 dual with 1GByte memory and Gigabit phy	8.7	6.15	63 mW
l4pro	SR-uSOM-MX6 quad with 2GByte memory, Gigabit phy and wifi/bt SiP (**)	14.2	7.05	93.5 mW

(*) When the current is measured the uSD card was removed in order to measure the current that is consumed by the MicroSOM

(**) WiFi/B T are put into reset by setting the gpio that controls the regulator to 0 (gpio3, bit 19) – devmem 0x020a4000 32 0x00400000

Conclusion

A system using the MicroSOM can use the suspend to memory feature and consume, depending on the configuration, down to **38mW to 93.5mW** power.