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FR Family
32-BIT MICROCONTROLLER
MB91230 Series

MB91230series Power Supply and Input Voltage

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Revision History

Revision	Date	Description
1.0	March.30.2010	Initial release

Contents

1 Introduction

This application note explains the roles of the various power supply pins in the MB91230 series. It also explains the structure of analog/digital shared pin inputs and the power supply system circuits, and problems that occur when operating the MCU with the analog power supply voltage in the off state.

2 Roles of Each of the Power Supply Pins and Recommended Operating Voltages

2.1 Roles of Each of the Power Supply Pins

The MB91230 series has the following power supply pins. Supply the voltage corresponding to each of the functions to the appropriate pins. The functions of each of these pins are listed in Table 2-1 below.

Table 2-1 Functions of each power supply pin in the MB91230 series

Pin name	Function
Vcc	Power supply for IO
Vcc3	Power supply for the internal logic
Vcc3B	Backup / dedicated RTC power supply
Vcc3IO	Power supply for analog shared IO
Vss	Digital power supply (GND)
AVcc	Analog power supply
AVss	Analog power supply (GND)
AVRH	Analog reference power supply
AVRL	Analog reference power supply
V0,V1,V2,V3	LCD controller driver reference power supplys

2.2 Recommended Operating Voltages

The recommended operating voltages for each product are shown in the following table.

Table 2-2-1. MB91F233A (FLASH) recommended operating voltages

Parameter	Symbol	Rated value		Units	Remarks
		Min.	Max.		
Power supply voltage	Vcc	4.00	5.25	V	
	Vcc3	3.00	3.60	V	
	Vcc3B	3.00	3.60	V	
		2.20	3.60	V	During backup operation only
	Vcc3IO	3.00	3.60	V	
Analog power supply voltage	AVcc	3.00	3.60	V	
LCD reference voltage	V3	–	5.25	V	

(Warning) During normal usage, operate with Vcc3=Vcc3B=AVcc=Vcc3IO.

Table 2-2-2. MB91F233L (FLASH) and MB91233L (Mask ROM) recommended operating voltages

Parameter	Symbol	Rated value		Units	Remarks
		Min.	Max.		
Power supply voltage	Vcc	3.00	3.60	V	
	Vcc3	3.00	3.60	V	
	Vcc3B	3.00	3.60	V	
		2.20	3.60	V	During backup operation only
	Vcc3IO	3.00	3.60	V	
Analog power supply voltage	AVcc	3.00	3.60	V	
LCD reference voltage	V3	–	3.60	V	

(Warning) During normal usage, operate with Vcc=Vcc3=Vcc3B=AVcc=Vcc3IO.

3 Internal Structure of Power Supply Pins and Analog/Digital Shared Pin Inputs

Protected diodes are inserted between pins in some locations within the device. When a forward-biased voltage is applied across the protective diode, the transistor turns on and current flows. Adhere to the recommended operating voltages because latch up may occur if an excessive current flows. In this section, the case of current flowing through the protective diode between pins for power supply voltage pins, analog voltage pins, and analog input/general-purpose port shared pins is explained. Figure 3-1 shows the locations where protective diodes are inserted in the MB91F233L and MB91233L internal circuit.

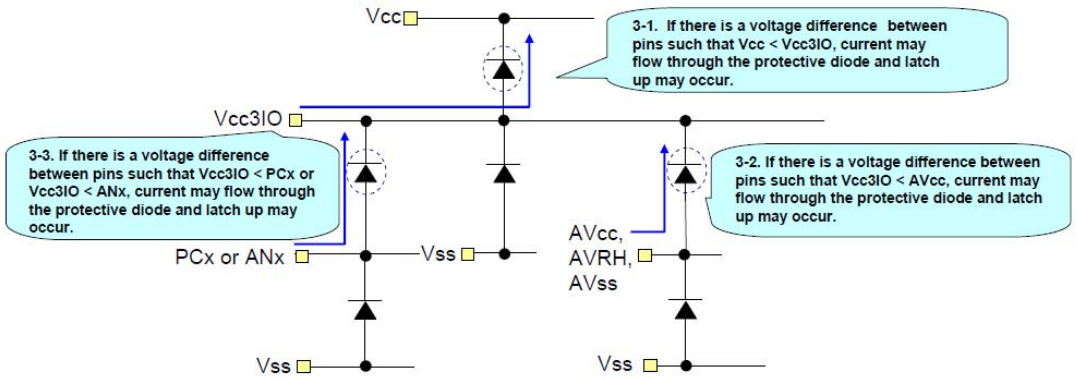

Figure 3-1. MB91F233L and MB91233L internal protection circuit diagram

3.1 Warning Regarding Voltage Difference Between Vcc and Vcc3IO Pins

If the voltage of the Vcc3IO pin is larger than Vcc (Vcc3IO > Vcc), this places a voltage across the protective diode in the forward bias direction. If current flows through the protective diode, this can lead to latch up. To prevent latch up from occurring, ensure that the voltage of Vcc3IO does not exceed the voltage of Vcc.

3.2 Warning Regarding Voltage Difference Between Vcc3IO and AVcc (,AVRH,AVss) Pins

If the voltage of the AVcc (or AVRH or AVss) pin is larger than Vcc3IO (AVcc>Vcc3IO), this places a voltage across the protective diode in the forward bias direction. If current flows through the protective diode, this can lead to latch up. To prevent latch up from occurring, ensure that the voltage of AVcc (and AVRH and AVss) does not exceed the voltage of Vcc3IO.

3.3 Warning Regarding Voltage Difference Between PCx/ANx and Vcc3IO Pins

If the voltage input to PCx/ANx is larger than the voltage of Vcc3IO (PCx > Vcc3IO or ANx > Vcc3IO), this places a voltage across the protective diode in the forward bias direction. If current flows through the protective diode, this can lead to latch up. To prevent latch up from occurring, ensure that the voltage input to PCx/ANx does not exceed the voltage of Vcc3IO.

4 Warning When Operating the MCU with the Analog Power Supply Voltage Off

The question that if the MCU could be operated with the analog power supply voltage turned off when not using the AD/DA converter could be occurred. Considering the internal circuitry of the device, the following problems are conceivable in relationship to this issue.

If taking [AVcc=OPEN or AVcc=0V] during normal operation of the MCU, signals from the analog power supply region to the digital power supply region become undefined. Due to the undefined voltage from the analog power supply region, the Pch/Nch transistors in the digital power supply region do not settle into an on/off state, and instead both transistors become on. In this situation, a shoot-through current may flow in the digital circuit that receives the signal. In order to prevent a shoot-through current from occurring in the digital circuits, it is therefore prohibited to use this product with [AVcc=OPEN or AVcc=0V] even when the AD converter and DA converter are not being used. The following shows an explanatory diagram of this phenomenon.

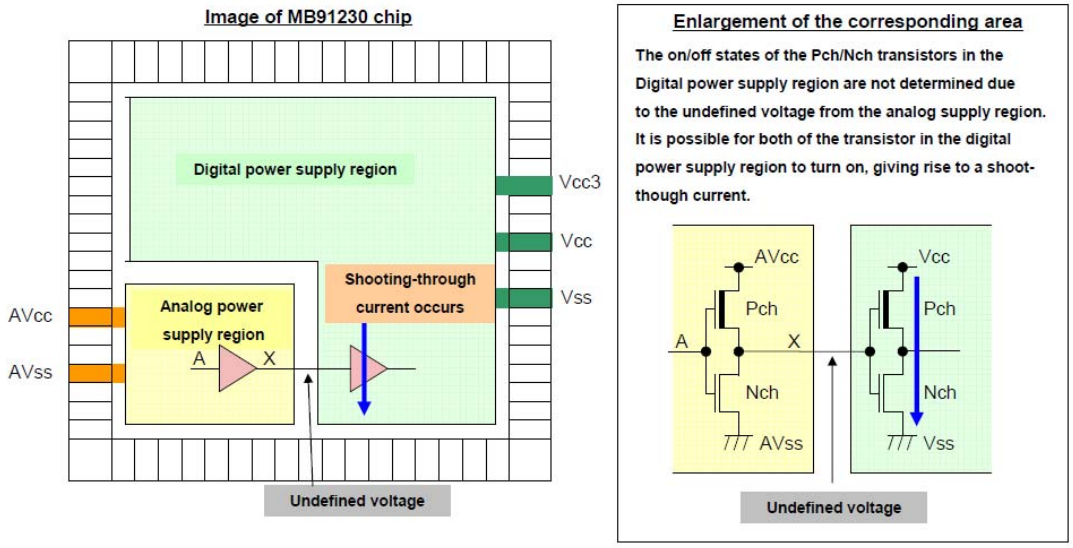

Figure 4-1. Location where problems occur if the device is used with the analog power supply off