

MPC56xxB/C/D Wakeup Unit Usage

1 Introduction

The wakeup unit (WKPU) on MPC56xxB/C/D parts is an always-active module that provides a means of generating interrupts, restarting the device from low-power modes, and also provides the capability to trigger a Non-Maskable Interrupt via the WKPU2 (PA1) pin.

There are three low-power modes in the MPC56xxB/C/D family. These are, in decreasing current consumption, HALT, STOP, and STANDBY modes. HALT mode requires an interrupt to exit back into the previous RUN mode, whilst STANDBY requires a wakeup to restart the system. STOP mode, depending upon configuration, can use either interrupts or wakeups to return to the previous RUN mode.

The MPC56xxB/C/D design uses the same port mappings for different wakeup (WKPU) triggers across the family, but the available WKPU triggers varies by part.

This document describes the wakeups available on different cuts of the MPC5602D (256K), MPC5604B/C (512K), and MPC5607B (1M5) variants, and describes errata common to the various devices. This information should assist in the production of code that is portable between MPC56xxB/C/D devices.

Where the implementation does not allow all features to be used, the issue is described along with identification of the appropriate errata in the form of a PS and ERR number. The document numbers for each errata document are listed in

Contents

1	Introduction.....	1
2	Device-specific wakeup capabilities.....	2
2.1	MPC5602D (256K).....	2
2.2	MPC5604B/C (512K).....	2
2.3	MPC5607B (1M5).....	3
3	Non-maskable interrupts.....	3
4	Commonality across parts.....	4
5	References.....	4

[References](#). The latest versions of these documents can be downloaded, by searching using the document numbers, from www.freescale.com.

2 Device-specific wakeup capabilities

The following sections summarize the wakeup capabilities for the MPC5602D, MPC5604B/C, and MPC5607B devices.

Furthermore, there is family-wide advice regarding using pin PA1/Non-Maskable Interrupt (NMI) as a wakeup input. This is described in more detail in [Non-maskable interrupts](#).

2.1 MPC5602D (256K)

There are currently two cuts of the MPC5602D device, cut 1.0 and cut 1.1. They are identified by mask IDs 0M18Y and 1M18Y, respectively.

On these devices, WKPU0–14, WKPU19, and WKPU25–28 are available. However, there is a difference when resuming from standby mode on WKPU27/28 (PD0/1), which is fully described in erratum PS9684/ERR3288. Resume from stop and halt mode is functional for all WKPU signals. WKPU5–7, WKPU14, and WKPU27 are not accessible on 64-pin QFP packaged parts.

MPC5602D devices exhibit behavior common to all MPC56xxB/C/D devices:

- PS9175/ERR3249 (cut 1.0) and PS9683/ERR3287 (cut 1.1)

Wakeup on pins shared with analog ports affecting the operation of wakeups on pins PB10, PD0, and PD1. PB8 and PB9 are additionally affected on cut 1.0. These pins should be driven high or low using either internal or external pullups/pulldowns, to prevent leakage and additional current consumption in standby mode.

- PS9676/ERR3286

When any FlexCAN module is active, by using the ME_RUN_PCx / ME_PCTLx registers and MCR.B.MDIS=0, no low-power mode can be entered. FlexCAN must be frozen using FLEXCANx_MCR[FRZ]=1 before attempting to enter low-power modes.

2.2 MPC5604B/C (512K)

There are currently five cuts of the MPC5604B/C device: cut 1.0, 1.1, 2.0, 2.1, and 2.3. These are identified by mask IDs 0M07N, 1M07N, 0M27V, 1M17V, and 2M27V respectively. Cut 2.0 and newer are described here.

On these devices, WKPU0–19 are available. WKPU5–7 and WKPU14–18 are not accessible on 64-pin QFP packaged parts and WKPU15–18 are not accessible on 100-pin QFP packaged parts.

All MPC5604B/C devices also exhibit behavior common to all MPC56xxB/C/D devices:

- PS9033/ERR3240

Wakeup on pins shared with analog ports affecting the operation of wakeups on pin PB10. These pins should be driven high or low using either internal or external pullups/pulldowns to prevent leakage and additional current consumption in standby mode.

- PS7316/ERR3176

When any FlexCAN module is active, by using the ME_RUN_PCx / ME_PCTLx registers and MCR.B.MDIS=0, no low-power mode can be entered. FlexCAN must be frozen using FLEXCANx_MCR[FRZ]=1 before attempting to enter low-power modes.

Furthermore, there is an issue whereby an external reset from standby on MPC5604B/C devices is requested through software (PS8270/ERR3198). This results in the RGM_FES[F_SOFT] bit being set although no software reset was requested.

2.3 MPC5607B (1M5)

There are currently three cuts of the MPC5607B 1M5 device: cut 1.0, 2.0, and 2.2. These are identified by mask IDs 0M94V, 0M03Y, and 1M03Y respectively.

On these devices, WKPU0–28 are available. However, there is an issue on resuming from standby mode for WKPU25–28. Resume from stop and halt mode is functional for all WKPU signals. WKPU15–18 and WKPU20–24 are not accessible on 100-pin QFP packaged parts, and WKPU23–24 are not accessible on 144-pin QFP packaged parts.

The reference manual for these devices describes the issue using WKPU25/26 (PB8/9), whilst erratum PS8948/ERR3236 details the issue on WKPU27/28 (PD0/1).

All MPC5607B devices also exhibit behavior common to all MPC56xxB/C/D devices:

- PS9073/ERR3242

Wakeups on pins shared with analog ports affecting the operation of wakeups on pins PB10, PD0, and PD1. These pins should be driven high or low using either internal or external pullups/pulldowns to prevent leakage and additional current consumption in standby mode.

- PS9140/ERR3247

When any FlexCAN module is active, by using the ME_RUN_PCx / ME_PCTLx registers and MCR.B.MDIS=0, no low-power mode can be entered. FlexCAN must be frozen using FLEXCANx_MCR[FRZ]=1 before attempting to enter low-power modes.

3 Non-maskable interrupts

Common Non-Maskable Interrupt (NMI) errata exists for all MPC56xx devices with the following errata numbers:

MPC5602D	PS9180/ERR3250
MPC5604B/C	PS8378/ERR3203
MPC5607B	PS8499/ERR3209

The following information is applicable where the NMI is to be used as a WKPU source. This errata states that the NMI pin cannot be configured to generate Non Maskable Interrupt event to the core (WKPU_NCR[NDSS] = "00") if the following standby mode is to be used:

- NMI pin enabled for wake-up event
- Standby exit sequence boot from RAM
- Code flash module power-down on standby exit sequence

With the following configuration, the following scenario may happen:

1. System is in standby.
2. NMI event is triggered on PA[1].

Commonality across parts

3. System wakes up z0 core power domain.
4. z0 core reset is released and NMI event is sampled by core on first clock-edge.
5. z0 core attempts to fetch code at 0x10 address (IVPR is not yet initialized by application) and receives an exception since flash is not available.
6. z0 core enters machine check and execution is stalled.

If NMI is configured as wakeup source, WKPU_NCR[NDSS] must be configured as "11". This will ensure no NMI event is trigger on the core but ensure system wakeup is triggered.

After standby exit, core will boot and configure its IVOR/IVPR. It may then re-configure WKPU_NCR:DSS to the appropriate configuration for enabling NMI/CI/MCP.

4 Commonality across parts

On most MPC56xxB/C/D devices and for most low-power modes, the wakeup capabilities work in exactly the same way. In terms of availability, WKPU2–14 and WKPU19 are available on all devices, although WKPU5–7 and WKPU14 may not be accessible depending upon package type.

Additionally, there are two errata that exist, with different errata numbers, for all devices. These are:

- Wakeups on pins shared with analog ports affecting the operation of wakeups on pins PB10 (WKPU8), PD0 (WKPU27, where available), and PD1 (WKPU28, where available). These pins should be driven high or low using either internal or external pullups/pulldowns to prevent leakage and additional current consumption in standby mode.
- When any FlexCAN module is active, by using the ME_RUN_PCx/ME_PCTLx registers and MCR.B.MDIS=0, no low-power mode can be entered. FlexCAN must be frozen using FLEXCANx_MCR[FRZ]=1 before attempting to enter low-power modes.

Care must also be taken to ensure low-power modes consume as little power as possible by using a pullup or pulldown on all wakeup lines, including those that are not accessible due to the package type. Further information on this can be found in the WKPU chapter of the appropriate reference manual.

When the Non-Maskable Interrupt (NMI) feature is required and used in conjunction with the STANDBY low-power mode, care must be taken to ensure that this is handled correctly by the core.

5 References

Further information on all errata can be found in individual mask set errata reports. These are listed for each device below.

- Errata documents for MPC5602D devices:
 - MPC5602D0M18Y: MPC5602D Errata, Mask Set Errata report for _0M18Y
 - MPC5602D1M18Y: MPC5602D Errata, Mask Set Errata report for _1M18Y
- Errata document references for MPC5604B/C devices:
 - MPC5604B0M27V: MPC5604B Errata, Mask Set Errata report for _0M27V
 - MPC5604B1M27V: MPC5604B Errata, Mask Set Errata report for _1M27V
 - MPC5604B2M27V: MPC5604B Errata, Mask Set Errata report for _2M27V
- Errata document references for MPC5607B devices:
 - MPC5607B0M03Y: MPC5607B Errata, Mask Set Errata report for _0M03Y
 - MPC5607B1M03Y: MPC5607B Errata, Mask Set Errata report for _1M03Y

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