TMS320F28055, TMS320F28054, TMS320F28053, TMS320F28052, TMS320F28051, TMS320F28050 Piccolo MCU

Silicon Errata

Literature Number: SPRZ362A
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TMS320F2805x Piccolo MCU Silicon Errata

1 Introduction

This document describes the silicon updates to the functional specifications for the TMS320F2805x microcontrollers (MCUs).

The updates are applicable to:

- 80-pin Low-Profile Quad Flatpack, PN Suffix

2 Device and Development Support Tool Nomenclature

To designate the stages in the product development cycle, TI assigns prefixes to the part numbers of all [TMS320] DSP devices and support tools. Each TMS320™ DSP commercial family member has one of three prefixes: TMX, TMP, or TMS (for example, **TMS**320F28055). Texas Instruments recommends two of three possible prefix designators for its support tools: TMDX and TMDS. These prefixes represent evolutionary stages of product development from engineering prototypes (with TMX for devices and TMDX for tools) through fully qualified production devices and tools (with TMS for devices and TMDS for tools).

TMX Experimental device that is not necessarily representative of the final device's electrical specifications

TMP Final silicon die that conforms to the device's electrical specifications but has not completed quality and reliability verification

TMS Fully qualified production device

Support tool development evolutionary flow:

TMDX Development-support product that has not yet completed Texas Instruments internal qualification testing

TMDS Fully qualified development-support product

TMX and TMP devices and TMDX development-support tools are shipped against the following disclaimer:
"Developmental product is intended for internal evaluation purposes."

TMS devices and TMDS development-support tools have been characterized fully, and the quality and reliability of the device have been demonstrated fully. TI's standard warranty applies.

Predictions show that prototype devices (TMX or TMP) have a greater failure rate than the standard production devices. Texas Instruments recommends that these devices not be used in any production system because their expected end-use failure rate still is undefined. Only qualified production devices are to be used.

TI device nomenclature also includes a suffix with the device family name. This suffix indicates the package type (for example, PN) and temperature range (for example, T).

3 Device Markings

Figure 1 provides an example of the 2805x device markings and defines each of the markings. The device revision can be determined by the symbols marked on the top of the package as shown in Figure 1. Some prototype devices may have markings different from those illustrated. Figure 2 shows an example of the device nomenclature.

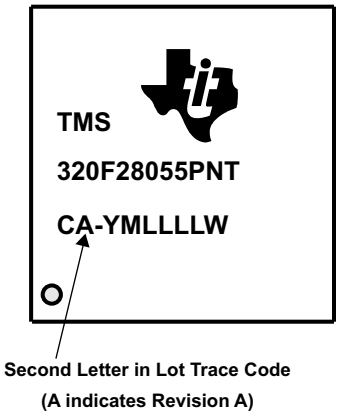

Figure 1. Example of Device Markings

Table 1. Determining Silicon Revision From Lot Trace Code(1)

SECOND LETTER IN PREFIX OF LOT TRACE CODE	SILICON REVISION	REVISION ID (0x0883)	COMMENTS
Blank (no second letter in prefix)	Indicates Revision 0	0x0000	This silicon revision is available as TMX.
A	Indicates Revision A	0x0000	This silicon revision is available as TMS.

(1) Boot-ROM contents changed between Rev. 0 silicon and Rev. A silicon. For more details, see the *TMS320x2805x Piccolo Technical Reference Manual* (literature number SPRUHE5).

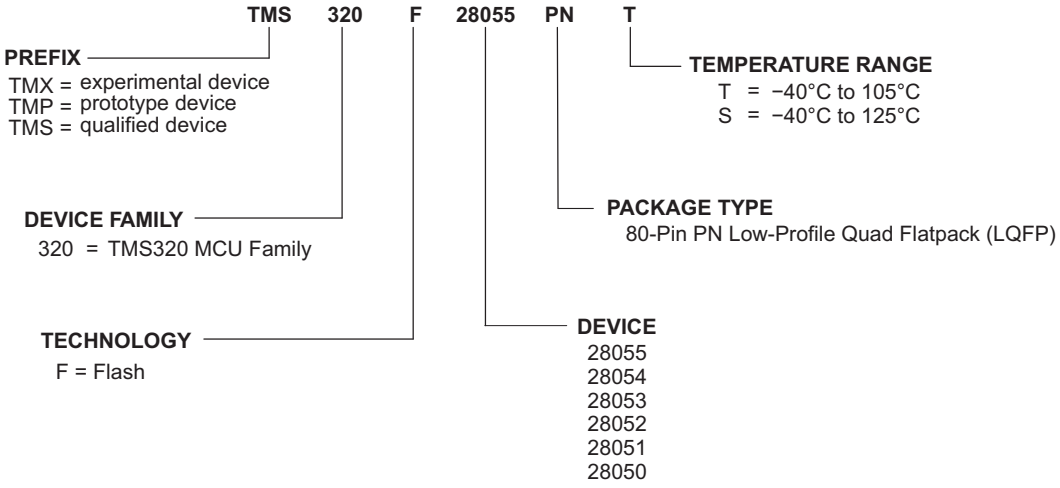

Figure 2. Example of Device Nomenclature

4 Known Design Marginality and Exceptions to Functional Specifications

Table 2. Advisory List

Advisory — *ADC: Initial Conversion*

Revision(s) Affected 0, A

Details When the ADC conversions are initiated by any source of trigger in either sequential or simultaneous sampling mode, the first sample may not be the correct conversion result.

Workaround(s) For sequential mode, discard the first sample at the beginning of every series of conversions. For instance, if the application calls for a given series of conversions, SOC0→SOC1→SOC2, to initiate periodically, then set up the series instead as SOC0→SOC1→SOC2→SOC3 and only use the last three conversions, ADCRESULT1, ADCRESULT2, ADCRESULT3, thereby discarding ADCRESULT0.

For simultaneous sample mode, discard the first sample of both the A and B channels at the beginning of every series of conversions.

User application should validate if this workaround is acceptable in their application.

The following is applicable:

- For 30-MHz operation and below, this issue is fixed completely by writing a 1 to the ADCNONOVERLAP and CLKDIV2EN bits in the ADCTRL2 register. This action will give a 30-MHz ADC clock when the CPU clock = 60 MHz, and will only allow the sampling of ADC channels when the ADC is finished with any pending conversion.
- For 60-MHz or 40-MHz operation, the first sample deviation is still under characterization by TI. The current recommendation is to observe the rev 0 errata until this characterization is complete.

Advisory — *ADC: Temperature Sensor Minimum Sample Window Requirement*

Revision(s) Affected 0, A

Details If an insufficient sample window is used, the result of a temperature sensor conversion can have a large error, making the result unreliable for the system.

Workaround(s)

1. If double-sampling of the temperature sensor is used to avoid the corrupted first sample issue, the temperature sensor result is valid. Double-sampling is equivalent to giving the sample-and-hold (S/H) circuit adequate time to charge.
2. In all other conditions, the sample-and-hold window used to sample the temperature sensor should not be less than 550 ns.

Advisory — *ADC: Offset Self-Recalibration Requirement*

Revision(s) Affected

0, A

Details

The factory offset calibration from Device_cal() may not ensure that the ADC offset remains within specifications under all operating conditions in the customer's system.

Workaround(s)

- To ensure that the offset remains within the data sheet's “single recalibration” specifications, perform the AdcOffsetSelfCal() function after Device_cal() has completed and the ADC has been configured.
- To ensure that the offset remains within the data sheet's “periodic recalibration” specifications, perform the AdcOffsetSelfCal() function periodically with respect to temperature drift.

For more details on AdcOffsetSelfCal(), refer to the ADC Zero Offset Calibration section in the "Analog-to-Digital Converter and Comparator" chapter of the *TMS320x2805x Piccolo Technical Reference Manual* (literature number SPRUHE5).

Advisory — *Memory: Prefetching Beyond Valid Memory*

Revision(s) Affected

0, A

Details

The C28x CPU prefetches instructions beyond those currently active in its pipeline. If the prefetch occurs past the end of valid memory, then the CPU may receive an invalid opcode.

Workaround

The prefetch queue is 8 x16 words in depth. Therefore, code should not come within 8 words of the end of valid memory. This restriction applies to all memory regions and all memory types (flash, OTP, SARAM) on the device. Prefetching across the boundary between two valid memory blocks is all right.

Example 1: M1 ends at address 0x7FF and is not followed by another memory block. Code in M1 should be stored no farther than address 0x7F7. Addresses 0x7F8-0x7FF should not be used for code.

Example 2: M0 ends at address 0x3FF and valid memory (M1) follows it. Code in M0 can be stored up to and including address 0x3FF. Code can also cross into M1 up to and including address 0x7F7.

Advisory — *eCAN: Abort Acknowledge Bit Not Set*

Revision(s) Affected 0, A

Details

After setting a Transmission Request Reset (TRR) register bit to abort a message, there are some rare instances where the TRRn and TRSn bits will clear without setting the Abort Acknowledge (AAn) bit. The transmission itself is correctly aborted, but no interrupt is asserted and there is no indication of a pending operation.

In order for this rare condition to occur, all of the following conditions must happen:

1. The previous message was not successful, either because of lost arbitration or because no node on the bus was able to acknowledge the message or because an error frame resulted from the transmission. The previous message need not be from the same mailbox in which a transmit abort is currently being attempted.
2. The TRRn bit of the mailbox should be set in a CPU cycle immediately following the cycle in which the TRSn bit was set. The TRSn bit remaining set due to incompletion of transmission satisfies this condition as well; that is, the TRSn bit could have been set in the past, but the transmission remains incomplete.
3. The TRRn bit must be set in the exact SYSCLKOUT cycle where the CAN module is in idle state for one cycle. The CAN module is said to be in idle state when it is not in the process of receiving or transmitting data.

If these conditions occur, then the TRRn and TRSn bits for the mailbox will clear t_{clr} SYSCLKOUT cycles after the TRR bit is set where:

t_{clr} = [(mailbox_number) * 2] + 3 SYSCLKOUT cycles

The TAn and AAn bits will not be set if this condition occurs. Normally, either the TA or AA bit sets after the TRR bit goes to zero.

Workaround(s)

When this problem occurs, the TRRn and TRSn bits will clear within t_{clr} SYSCLKOUT cycles. To check for this condition, first disable the interrupts. Check the TRRn bit t_{clr} SYSCLKOUT cycles after setting the TRRn bit to make sure it is still set. A set TRRn bit indicates that the problem did not occur.

If the TRRn bit is cleared, it could be because of the normal end of a message and the corresponding TAn or AAn bit is set. Check both the TAn and AAn bits. If either one of the bits is set, then the problem did not occur. If they are both zero, then the problem did occur. Handle the condition like the interrupt service routine would except that the AAn bit does not need clearing now.

If the TAn or AAn bit is set, then the normal interrupt routine will happen when the interrupt is re-enabled.

Advisory — *GPIO: GPIO Qualification*

Revision(s) Affected 0, A

Details If a GPIO pin is configured for "n" SYSCLKOUT cycle qualification period (where 1 ≤ n ≤ 510) with "m" qualification samples (m = 3 or 6), it is possible that an input pulse of [n * m – (n – 1)] width may get qualified (instead of n * m). The occurrence of this incorrect behavior depends upon the alignment of the asynchronous GPIO input signal with respect to the phase of the internal prescaled clock, and hence, is not deterministic. The probability of this kind of wrong qualification occurring is "1/n".

Worst-case example:

If n = 510, m = 6, a GPIO input width of (n * m) = 3060 SYSCLKOUT cycles is required to pass qualification. However, because of the issue described in this advisory, the minimum GPIO input width which may get qualified is [n * m – (n – 1)] = 3060 – 509 = 2551 SYSCLKOUT cycles.

Workaround(s) None. Ensure a sufficient margin is in the design for input qualification.

Advisory — *Zero-Pin Oscillator: Modification to Oscillator Frequency Parameter*

Revision(s) Affected 0, A

Details The zero-pin oscillator is now specified with the center frequency at a defined temperature and temperature coefficient to calculate the absolute frequency at any operational temperature. Customers will need to check their temperature profile to ensure the zero-pin oscillator meets their requirement.

Workaround(s) If the frequency output does not meet a needed tolerance, software compensation can be used to achieve improved accuracy at any temperature. For accuracy specification, see the *TMS320F28055, TMS320F28054, TMS320F28053, TMS320F28052, TMS320F28051, TMS320F28050 Piccolo Microcontrollers Data Manual* (literature number SPRS797).

Advisory	***Watchdog: Incorrect Operation of CPU Watchdog When WDCLK Source is OSCCLKSRC2***
Revision(s) Affected	0, A
Details	When OSCCLKSRC2 is used as the clock source for CPU watchdog, the watchdog may fail to generate a device reset intermittently.
Workaround(s)	WDCLK should be sourced only from OSCCLKSRC1 (INTOSC1). The CPU may be sourced from OSCCLKSRC2 or OSCCLKSRC1 (INTOSC1).

Advisory

Oscillator: CPU Clock Switching to INTOSC2 May Result in Missing Clock Condition After Reset

Revision(s) Affected

0, A

Details

After at least two system resets (not including power-on reset), when the application code attempts to switch the CPU clock source to internal oscillator 2, a missing clock condition will occur, and the clock switching will fail under the following conditions:

- X1 and X2 are unused (X1 is always tied low when unused).
- GPIO38 (muxed with TCK and XCLKIN) is used as JTAG TCK pin only.
- JTAG emulator is disconnected.

The missing clock condition will recover only after a power-on reset when the failure condition occurs.

Workaround(s)

Before switching the CPU clock source to INTOSC2 via the OSCCLKSRCSEL and OSCCLKSRC2SEL bits in the CLKCTL register, the user must toggle the XCLKINOFF and XTALOSCOFF bits in the CLKCTL register as illustrated in the below sequence:

```
CLKCTL |= 0x6000;     // XCLKINOFF = 1, XTALOSCOFF = 1
CLKCTL &=~0x6000;     // XCLKINOFF = 0, XTALOSCOFF = 0
CLKCTL |= 0x6000;     // XCLKINOFF = 1, XTALOSCOFF = 1
CLKCTL &=~0x6000;     // XCLKINOFF = 0, XTALOSCOFF = 0
CLKCTL |= 0x6000;     // XCLKINOFF = 1, XTALOSCOFF = 1
```

Once the above procedure is executed, then the OSC2 selection switches can be configured.

If the JTAG emulator is connected, and GPIO38 (TCK) is toggling, then the above procedure is unnecessary, but will do no harm.

If no clock is applied to GPIO38, TI also recommends that a strong pullup resistor on GPIO38 be added to V_{DDIO}.

5 Documentation Support

For device-specific data sheets and related documentation, visit the TI web site at: http://www.ti.com.

For more information regarding the TMS320F2805x Piccolo devices, see the following documents:

- *TMS320F28055, TMS320F28054, TMS320F28053, TMS320F28052, TMS320F28051, TMS320F28050 Piccolo Microcontrollers Data Manual* (literature number SPRS797)
- *TMS320x2805x Piccolo Technical Reference Manual* (literature number SPRUHE5)

6 Revision History

This revision history highlights the technical changes made to the SPRZ362 errata document to make it an SPRZ362A revision.

Scope: Added information/data about silicon revision A (TMS).
See table below.

LOCATION	ADDITIONS, DELETIONS, AND MODIFICATIONS
Figure 1	Example of Device Markings: • Updated figure to show silicon revision A example markings
Table 1	Determining Silicon Revision From Lot Trace Code: • Added silicon revision A data • Added footnote about Boot-ROM contents
Figure 2	Example of Device Nomenclature: • Updated figure to show "TMS" example
Section 4	Known Design Marginality and Exceptions to Functional Specifications: • Updated Workaround in "Zero-Pin Oscillator: Modification to Oscillator Frequency Parameter" advisory

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