Freescale Semiconductor
Chip Errata

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MC13233C

Low Cost SoC Remote Control Platform for the 2.4 GHz IEEE® 802.15.4 Standard

1 Introduction

These errata pertain to all MC13233C devices. This is a known issue and will be fixed in the next version of silicon.

2 Errata

The MC13233C device has been found to have the errata described in the following paragraphs.

2.1 Low Temperature (–40°C to 0°C) Sensitivity to Power Supply (VBATT) Risetime

At operating temperatures below 0°C, the MC13233C exhibits sensitivity to the VBATT risetime such that if the risetime is too quick, the onboard voltage regulators will not start properly. The onboard regulators normally output approximately 1.8V as the operating voltage for internal logic and analog circuitry. The faulty regulator operation is a “pass-through’ mode where the regulator output voltage follows the VBATT input voltage and can supply voltages to the circuitry that is too high. The problem is exacerbated by higher operating VBATT voltage and lower operating temperature.

NOTE

The source of anomaly is known and will be corrected with a device revision that is in process and is expected to be released in Q2 2012.

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Evaluation has shown that if the VBATT risetime (0V to 2.0V) is extended to NO LESS than 5 ms, the problem is prevented and normal operation is possible.

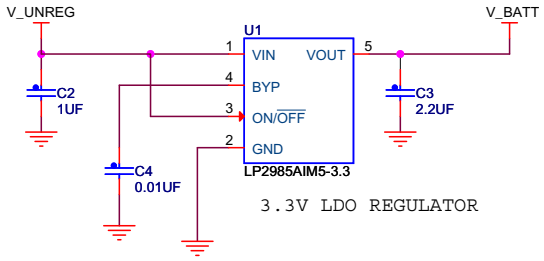
Recommended operating options include:

1. If possible, restrict operating temperature range to 0°C and above.
2. If low temperature operation is required, do not use a battery to directly drive VBATT, always use a voltage regulator
   - If operation is possible at external regulator output voltage of 2.1 V to 2.3 V, then any regulator may be used.
   - For all other cases, a voltage regulator capable of providing a VBATT risetime of 5 ms or longer should be used. It is also suggested to limit VBATT to 3.0 V or 3.3 V.

NOTE

If a voltage regulator is used, it is suggested to lay out the circuit such that the regulator can be removed when new MC13223C revision is provided. A zero ohm resistor site can be added to connect around the regulator when it is not mounted.

Figure 1 shows a preferred LDO regulator and its circuit.



Notes:
1. Preferred LDO - National LP2985AIM5-3.3
2. Capacitor on bypass pin controls turn-on time.

Figure 1. Slow Risetime Voltage Regulator Circuit

2.2 Sensitivity to Power Supply (VBATT) Risetime Over All Temperatures

The MC13233C exhibits a second sensitivity to the VBATT risetime over all temperatures. Again if the risetime is too quick, the power-on reset (POR) may not operate properly. This problem may not always occur and can be exhibited as either not entering reset or staying in reset.

NOTE

- Section 2.1, "Low Temperature (–40°C to 0°C) Sensitivity to Power Supply (VBATT) Risetime" dominates at temperatures below 0°C because the risetime required to prevent error is longer than the risetime required to prevent the reset sensitivity.
- The source of anomaly is known and will be corrected with a device revision that is in process and is expected to be released in Q2 2012.

Evaluation has shown that if the VBATT risetime (0 V to 2.0 V) is extended to NO LESS than 500 µs, the problem is prevented and normal operation is possible.

Recommended operating options for 0°C and above include:

1. Use of any voltage regulator with a turn-on time of 500 µs or greater.
2. Use of a battery source can cause problems
   - It may limit or eliminate use of a regulator
     - The regulator can reduce useful battery life by subtracting from the usable voltage range of the battery.
     - It can also reduce useful battery life by requiring additional current (for the regulator) during low power or "sleep".
   - A good battery has very low source impedance making it difficult to slow the VBATT risetime.
   - Use of a "soft-start" circuit is recommended.

Figure 2 illustrates a low-cost "soft-start" circuit that can be used to slow the VBATT risetime to the MC13233C.

- After the switch is closed, the VBATT voltage to the load (including MC13233C) is initially supplied through the 33 Ω soft-start, series resistor.
- The initial load current plus its bypass capacitance will determine the risetime to the load, and this should be 500 µs or longer. Add additional bypass/load capacitance as required; the MC13233C initial current is typically 5 mA or less.
- A logic-level gate threshold P-channel MOSFET is wired in parallel to the soft-start resistor - The FET has an RC circuit on it gate input that delays the turn-on of the FET until after the desired VBATT risetime. After the gate voltage enables the FET, the FET provides a very low impedance path to the system VBATT supply to allow for higher currents (needed for the radio) without significant loss to the battery operating voltage.
- When new MC13223C revision is provided, a zero Ω resistor site can be substituted for R1 and the rest of the circuit can be not mounted.

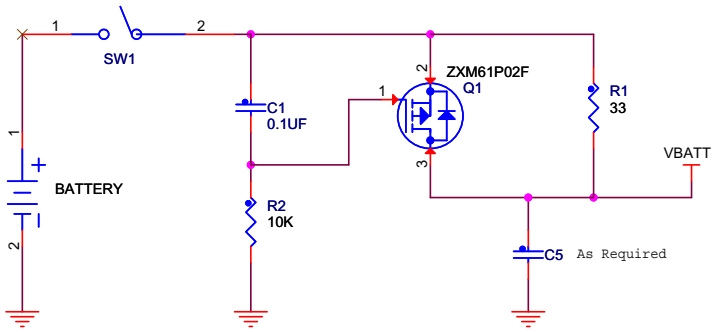


Figure 2. Soft-start Circuit for Battery Operation

2.3 32 kHz Crystal Oscillator Fails to Start @ Low Temperature

Evaluation has shown that the optional 32 kHz crystal oscillator can fail to start at low temperature depending on the VBATT operating voltage. The oscillator may not start at temperatures –30°C and below if the operating voltage VBATT is +3.4 V and above.

Do not use the 32 kHz oscillator when the supply voltage is above +3.4 V AND temperature is colder than –30°C.

NOTE

This anomaly will also be corrected in a future revision.

How to Reach Us:

Home Page:
www.freescale.com

E-mail:
support@freescale.com

USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064, Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

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