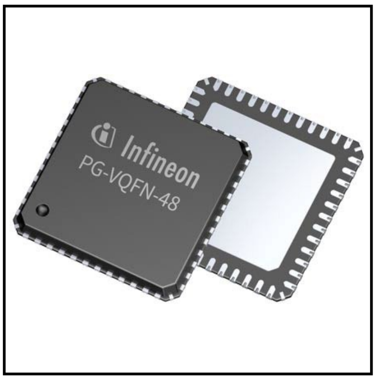
英飞凌OPTIREG™ PMIC TLF35584QVHSx

功能安全电源管理 IC

AEC Qualified RoHS ISO26262 compliant



勘误表

Reference: Datasheet Rev 2.0 (TLF35584QVHSx)

摘要

数据手册 Rev 2.0 (TLF35584QVHSx) 描述了 D11-step silicon 目标功能。

本文档列出了 D11-step silicion 相对于数据手册 Rev 2.0 (TLF35584QVHSx) 的偏差。这些偏差是 D11-step silicion 的偏差。

D11-step silicon 可根据下表通过IC上的标识进行识别。该标志位于 IC 封装的顶部。

Type	Package	Marking
TLF35584QVHS1 (5.0 V Variant)	PG-VQFN-48	TLF35584 / HS1
TLF35584QVHS2 (3.3 V Variant)	PG-VQFN-48	TLF35584 / HS2

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1 框图

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

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3 产品一般特性

3.1 绝对最大额定值

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

3.2 工作范围

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

3.3 热阻抗

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

3.4 静态消耗电流

TLF35584 数据手册 Rev 2.0 (TLF35584QVHSx) 和 D11-step silicon 的静态消耗电流存在差异。下表列出了这些偏差：

表 1 静态消耗电流仅适用于 D11-step silicon[1)]

V_{VS}= 6.0 V to 40 V；T_j = -40°C 至 +175°C，所有电压均相对于接地，正向流入引脚的电流（除非另有说明）

Parameter	Symbol	Values			Unit	Note / Test Condition	Number
		Min.	Typ.	Max.			
SLEEP state	I_q	–	–	500	µA	T_j ≤ 85°C ; only if PFM of step down regulator reached (see below)	P_4.4.6

1) 所有静态电流参数均在 T_j ≤ 85°C 和 10 V ≤ V_{VS} ≤ 28 V、零负载且所有可选选项（输出、看门狗、定时器、升压转换器）关闭的情况下测量。

此外，D11-step silicon 在休眠状态下存在额外的偏差，这可能会触发降压调节器从 PFM 模式切换到 PWM 模式。由于内部振荡器的激活以及降压调节器 PWM 开关的额外模块，这将导致类似于 INIT、NORMAL 和 WAKE 状态的消耗电流增加。详情请参阅 **第5.2章** 中与休眠状态相关的偏差描述。

4 唤醒功能

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon 。

5 预调节器

5.1 升压调节器

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon 。

5.2 降压调节器

TLF35584 数据手册修订版 2.0（TLF35584QVHSx）和 D11-step silicon 之间的降压调节器存在差异。下表列出了这些偏差：

表2 降压调节器功能的偏差

Number	Function	Description
1	Step down regulator behavior in SLEEP state	• The PFM to PWM (and vice versa) switch-over might not happen at the expected current thresholds. It may influence additionally the current consumption and switching behavior of the TLF35584 being in SLEEP. The TLF35884 might change continously between PWM and PFM. Switching in PWM is activating internal oscillators and other blocks leading to a current consumption similar to INIT, NORMAL and WAKE state. • It is recommended to ensure currents significantly lower than 5 mA consumed from V_{PreReg} in case SLEEP state is used in the application. Nevertheless there might be some devices which cannot ensure PFM mode entry even without load current as the threshold might be influenced by noise on the current monitor for the step-down pre-regulator. • Please mind, that current thresholds defined for the D11-step silicon in **Table 3** are only given as reference values and not subject to production test.
2	Step down regulator behavior in SLEEP state (f_{SW} = 400 kHz)	• In case the step down converter is configured for 400 kHz switching frequency (FRE-pin connected to GND) and operated in SLEEP mode with disabled step up regulator (STU-pin connected to GND), the D11-step silicon might get stuck in 100% duty cycle mode (step down regulator dropout condition). This might happen in case of a supply voltage transient leading to dropout condition. • Being stuck in 100% duty cycle mode the step down regulator output voltage might follow the rising supply voltage until the OV-threshold $V_{RT,FB1,high}$ is reached, triggering the movement to FAILSAFE and reset in the system. • According to the described misbehavior it is not recommended to use SLEEP state in case of low frequency switching of step down regulator without a activated step up regulator at the input.
3	Move-to-POWERDOWN triggered in SLEEP	• In a particular situation (sinking ~10 mA from the step-down pre regulator and applying battery voltage transients) the D11-step silicon might behave in a way that the step down pre regulator (being in PFM) influences the internal supplies. This influence by internal load transients may lead to an UV detection of the internal supplies and the TLF35584 moves to POWERDOWN state. Shortly after the internal supply will recover and the TLF35584 restarts in INIT state. This deviation from the expected behavior might prevent the device to stay surely in SLEEP state and keep the application continuously supplied.

表 3　　电气特性：降压调节器仅对 D11-step silicon

V_{VS} = 6.0 V 至 40 V；T_j = -40°C 至 +175°C，所有电压均相对于接地点（除非另有说明）

Parameter	Symbol	Values			Unit	Note / Test Condition	Number
		Min.	Typ.	Max.			
Current threshold for transition from PWM to PFM	$I_{PWM/PFM}$	0	57	110	mA	[1] $T_j \leq$ 150°C	P_6.3.2.12
Current threshold for transition from PWM to PFM	$I_{PWM/PFM}$	0	68	128	mA	[1]	P_6.3.2.22
Current threshold for transition from PFM to PWM	$I_{PFM/PWM}$	0	145	190	mA	[1] $T_j \leq$ 150°C	P_6.3.2.13
Current threshold for transition from PFM to PWM	$I_{PFM/PWM}$	0	174	228	mA	[1]	P_6.3.2.23

1）基准数据来自评估，未经生产测试。

5.3　　频率设定

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

6　　后置稳压器

6.1　　简介

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

6.2　　微处理器供电

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

6.3　　通信

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

6.4　　电压参考

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

6.5　　Tracker 1 & 2

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

6.6 用于核心供电的外部后置稳压器（可选）

TLF35584 数据手册 Rev 2.0 (TLF35584QVHSx) 和 D11-step silicion 的外部后置稳压器控制行为存在差异。下表列出了这些偏差：

表4 外部后置稳压器控制的偏差

Number	Function	Description
1	Synchronization output signal with active spread spectrum	• There is a weakness of the D11-step silicon for the synchronization output signal for the optional core voltage regulator during activated spread spectrum. • In case the synchronization output SYN is being used and connected to an external switched mode power supply, it should be taken into consideration that the SYN-output signal might be interrupted unintentionally in a random way for activated spread spectrum. • In **Figure 1** and **Figure 2** it is shown how the signal of SYN might look like. The figures have been generated using the synchronization without phase shift (DEVCFG2.ESYNPHA = 0). For this configuration the SYN output signal will stuck to low signal temporarily. For configuration with 180° phase shift (DEVCFG2.ESYNPHA = 1) the stuck signal would be high level.

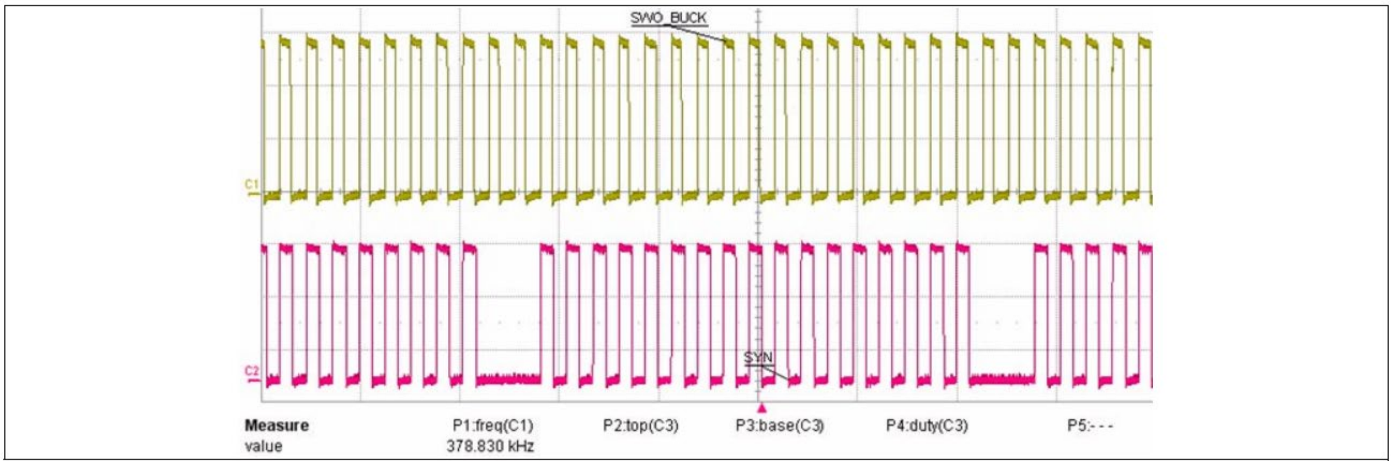

图 1 activated spread spectrum 时 SYN 输出中断（FRE pin to GND - LF）

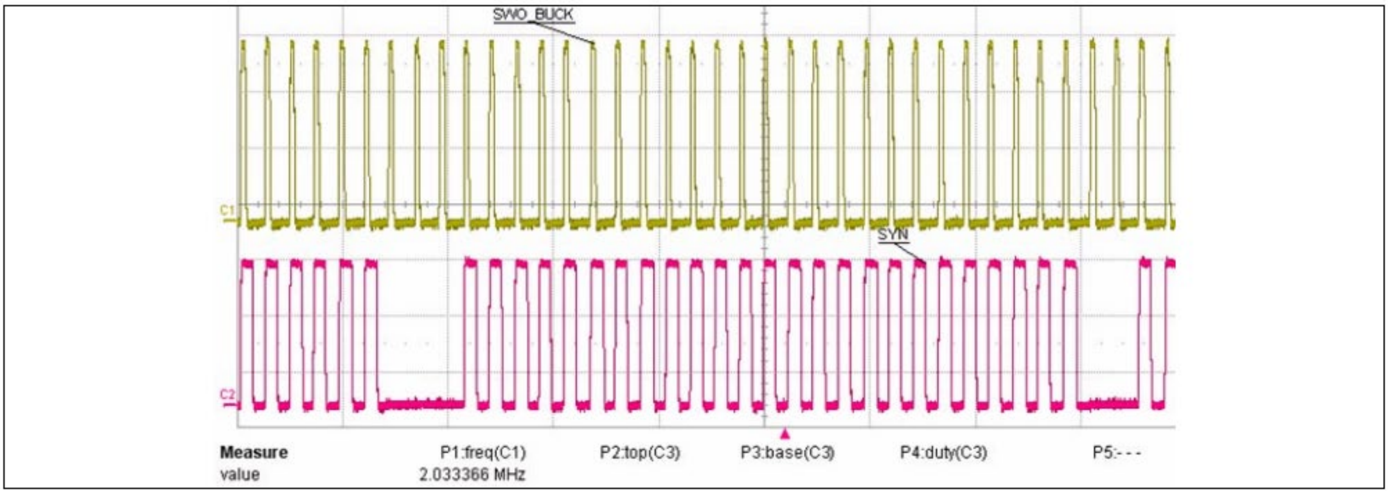

图 2 activated spread spectrum 时 SYN 输出中断（FRE pin open - HF）

6.7 电源序列

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon 。

7 监测功能

TLF35584 数据手册 Rev 2.0 (TLF35584QVHSx) 与 D11-step silicon 的电压监测功能存在差异。下表列出了这些偏差：

表5 复位功能偏差

Number	Function	Description
1	Reset output ROT behavior in Move-to-FAILSAFE conditions	• There is a weakness of the D11-step silicon related to the reset output pin ROT, in case the TLF35584 moves to FAILSAFE state. In a safety context the reset function and the reset output ROT are considered to be QM, accordingly safety is not affected. • The output driver of the open drain transistor in the reset output ROT is disabled together with the microcontroller supply LDO (QUC). According to the fact that the QUC is disabled/switched off in case of a Move-to- FAILSAFE event, the reset output is not longer pulled to low signal and is pulled up to QUC. As the QUC is disabled and the output cap is discharged by the load and an internal active pull-down of ~80 Ω, this is reflected in a transient behavior which is shown in the figures below. The observation and relevance strongly depends on the failure case and its boundary conditions. These conditions are elaborated in the following list. – QUC shorted to GND: The voltage monitoring detects the UV and pulls down ROT. SS1/2 are going low and application is in safe state. QUC is shorted to GND and has 0V accordingly, but provides current (still enabled). After typ. 3ms TLF35584 moves to FAILSAFE state and disables the LDO and resets the output driver of ROT. Due to the short to GND ROT stays low as it is pulled to QUC. (no problem) Please refer to **Figure 3**. – QUC overloaded by current. The voltage monitoring detects the UV due to the decreased output voltage by current limitation or dropout voltage (only without boost) and pulls down ROT. SS1/2 are going low and application is in safe state. Due to the assertion of ROT the microcontroller is switched off and decreases its current consumption dramatically. The output voltage of QUC might recover into valid voltage range and the TLF35584 restarts in INIT state. (no problem) – Continuous UV or short to GND on QST or VCI: The voltage monitoring detects the UV on the respective rail and pulls down ROT. SS1/2 are going low and application is in safe state. QUC continues to regulate to its nominal output voltage. After typ. 3ms TLF35584 moves to FAILSAFE state and disables all LDO and resets the output driver of ROT. The reset output might be pulled up to the discharging QUC (by the attached load and an active pull-down of ~80 Ω). This might result into a temporary high level at ROT during the shutdown transition. A undervoltage monitoring of the microcontroller could prevent undesired start of the microcontroller operation. Please refer to **Figure 4**. – Continued on the next page.

监测功能

表5　　复位功能偏差

Number	Function	Description
1 (cont'd)	Reset output ROT behavior in Move-to-FAILSAFE conditions (cont'd)	• Continued: – QUC shorted to an higher voltage rail: The voltage monitoring detects the OV on the QUC rail and SS1/2 are going low and application is in safe state. TLF35584 will move to FAILSAFE which is disabling QUC as well as all other regulators and activates the active pull-down of ~80 Ω on QUC output, trying to discharge the rail. The FAILSAFE state disables also the output driver of ROT. The reset output might be pulled up to QUC. This might result into a high level at ROT during presence of the external overvoltage. Still the application will be safely shut down during in this case by SS1/2. Please refer to **Figure 5**.
2	Reset output ROT behavior for Move-to-STANDBY transitions	• There is a weakness of the D11-step silicon related to the reset output pin ROT, in case the TLF35584 moves to STANDBY state. In a safety context the reset function and the reset output ROT is considered to be QM, accordingly safety is not affected. • The output driver of the open drain transistor in the reset output ROT is disabled shortly after the microcontroller supply LDO (QUC). According to the fact that the QUC is disabled/switched off at the point in time when the device enters into STANDBY state (transition delay time expired or in case of QUC current monitoring usage after a decrease below the current threshold), the reset output shortly pulled to low, but pulled up to the output voltage of QUC right after. Nevertheless the output of QUC is actively discharged by the load and an internal active pull-down of ~80 Ω, this is reflected in a transient behavior which is shown in **Figure 6** below.

图 3 至 **图 6** 是示波器截图。顶部的模拟通道显示以下信号：

- 蓝色：QUC 的输出电压，垂直刻度为 2V/Div
- 绿色：QST 输出电压，垂直刻度为 2V/Div
- 红色：复位输出 ROT，垂直刻度为 2V/Div

底部的数字通道的标签位于左侧。

关于水平刻度（时间），请参阅相应图表中的信息。

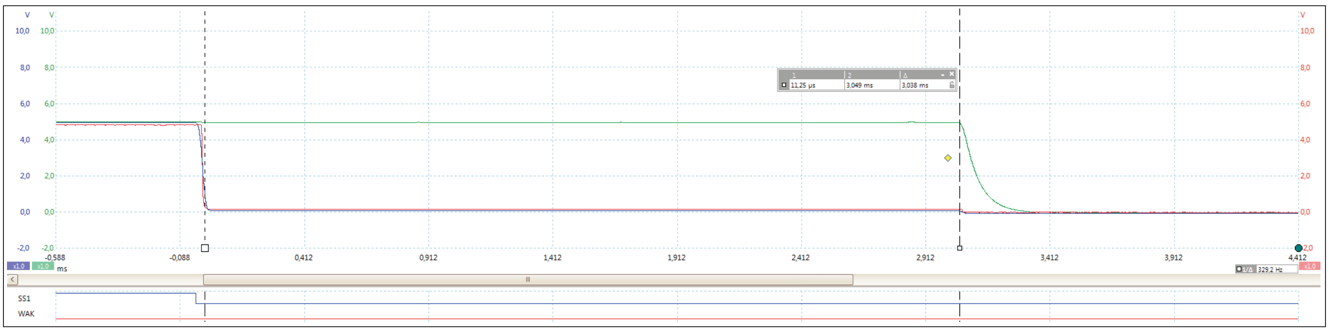

图3　　复位输出 (ROT) 弱信号 - 示例：QUC 接地短路检测

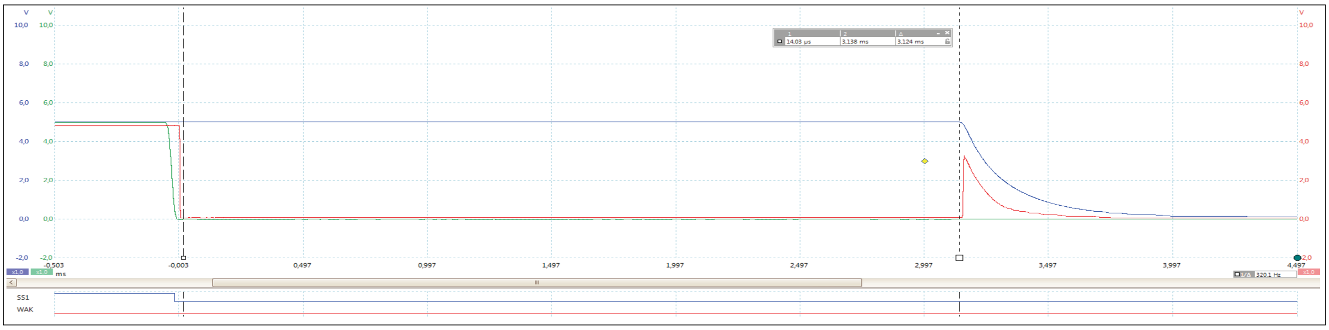

图4 复位输出 (ROT) 弱信号 - 示例：QST(或 VCI)接地短路检测

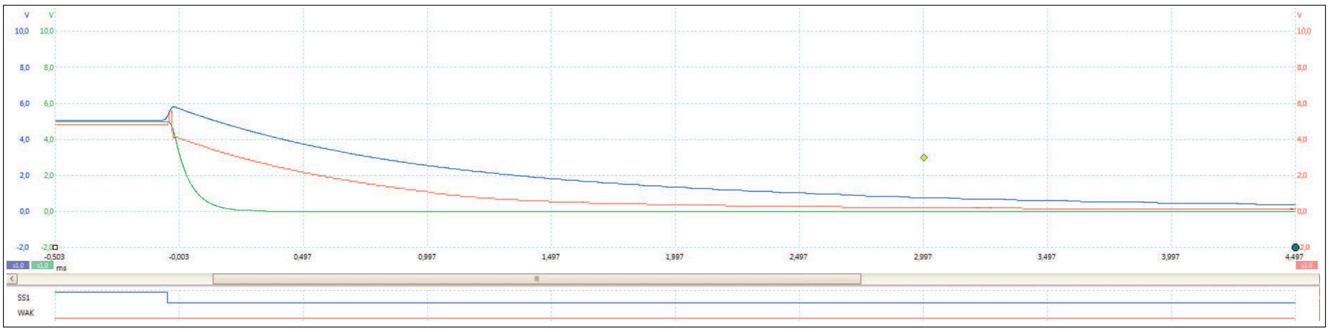

图5 复位输出 (ROT) 弱信号 - 示例：输出 QUC 处过压

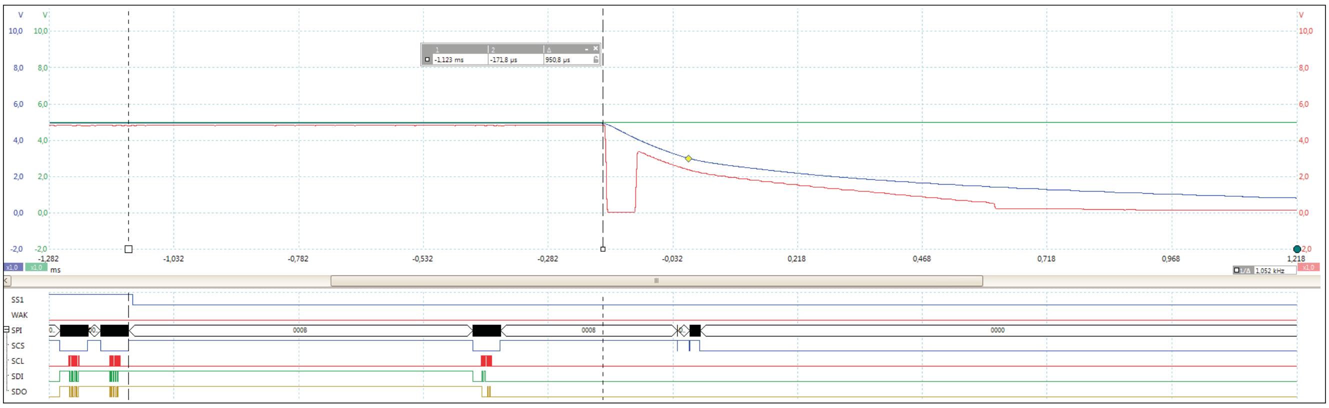

图6 复位输出 (ROT) 弱信号 - 示例：STANDBY 转换

8 备用 LDO 和内部电源

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

9 唤醒定时器

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

10 状态机

TLF35584 数据手册 Rev 2.0 (TLF35584QVHSx) 与 D11-step silicon 的状态机功能存在差异。下表列出了这些偏差：

表6 状态机功能偏差

Number	Function	Description
1	"Hard reset" for second initialization time-out	• For the 5V variant of the TLF35584 (TLF35584QVHS1) there might be a difference in the behavior for the second expiry of the initialization timer triggering a "hard reset" according to the description in chapter 11.4.2.1.2. in the data sheet. This event is disabling the regulator outputs for the hard reset time t_{SDT} (typ. 10ms) and restarts the power sequence afterwards. • The behavioral difference depends on the chosen output capacitance for PreReg, the step-down converter frequency selection and the present input voltage. The condition only appears in case of the not responding microcontroller (Initialization time-out). • The TLF35584 D11-step silicon discharges the output cap of PreReg only with a very low active pull-down (roughly 100 kΩ). Considering the hard reset time t_{SDT} (typ. 10ms), this might lead to a condition of an output capacitor C_{PreReg} still charged with a voltage close or higher than the UV-threshold of pre regulator output. This condition accelerates the power-sequencing, leading to a fast start of QUC regulator with the step down preregulator still in the early phase of its softstart (low duty cycle). This early load step (QUC output charging) might lead to a bigger undershoot on the step down preregulator output close to 5V, influencing the QUC regulator it self. • It might lead to an UV detection on the QUC rail (Move-to-INIT event) resetting the initialization time-out counter, that decides to move the device to FAILSAFE after the third initialization failure. This might lead to unexpected number of soft and hard reset cycles in case of a not responding microcontroller.
2	SS2 low in WAKE state	• In a particular condition the microcontroller is able to trigger a behavior of the TLF35584 that is pulling SS2 temporarily to high for the SS2 delay time, where it is not supposed to be pulled high. The microcontroller shall prevent the condition explained in the following bullet point. • The undesired behavior is triggered by the microcontroller in case it is changing the configuration of the SS2DEL in the register SYSPCFG1 from "no delay" to any delay different to "no delay" being in WAKE state of the TLF35584. Configuration in the INIT state of the TLF35584 is not affected. Accordingly it is highly recommended to not change the safety related configuration of the TLF35584 in WAKE state or to make sure that the SS2DEL is always kept enabled (anything different to "no delay") or disabled ("no delay"). This ensures to not trigger the SS2 high for the SS2 delay time after a re-configuration in WAKE state.

表6 状态机功能偏差

Number	Function	Description
3	Prerequisite for transition WAKE to NORMAL (ERR-monitoring)	• A minor deviation from the specification is the different prerequisite for the transition from WAKE to NORMAL state in terms of ERR-pin monitoring. • The Datasheet Rev 2.0 (TLF35584QVHSx) describes that the transition from WAKE to NORMAL requires 3 valid periods of the ERR signal before it is accepted. Whereas the D11-step silicon is accepting also a single period before the GoToNormal request. • This deviation is not affecting safety or general functionality, it just differs from the behavior of the device for a transition from INIT to NORMAL where 3 periods of ERR signal are required.
4	Transition WAKE to SLEEP	• The transition from WAKE to SLEEP state is showing differences to the expected behavior in case the window and/or functional watchdog are deactivated for SLEEP mode (WDCFG1.WDSLPEN = 0) and activated globally (WDCFG0.WWDEN = 1 and/or WDCFG0.WWDEN = 1). • In this condition the Watchdogs are restarted entering into SLEEP state from WAKE instead of being switched off. This will lead to interrupts (INT) and finally to reset (ROT), in case the microcontroller is not reacting (providing service again) on the notification by interrupt. According to this misbehavior of the D11-step silicon the transition from WAKE to SLEEP state shall not be used in the condition mentioned above. • Workarounds: – Transition from WAKE to SLEEP state via NORMAL state in a two step approach. – Disable the watchdog(s) globally being in WAKE state before proceeding with the transition from WAKE to SLEEP directly. Please ensure proper global reactivation of watchdog(s) after wake-up from SLEEP.
5	Pre-regulator pull-down in STANDBY	• There is a active pull-down at the pre-regulator output which is supposed to discharge the output rail in case the device is being disabled. In case of a STANDBY transition this pull-down is supposed to be activated after entering into STANDBY state, but in the D11-step silicon this pull- down is disabled again 50 µs after the device has entered STANDBY state. • This deviation of the D11-step silicon might result in a slower discharge time of the pre-regulator output, as in this case the pre-regulator rail is discharged by leakage currents, resistor dividers and optionally attached loads only.
6	SLEEP state	• Due to some deviations of the D11-step silicon is not recommended to use the SLEEP state of the TLF35584. Nevertheless it can be used with special attention to the described misbehavior of the D11-step silicon in respect to SLEEP state described by **Table 1**, **Table 2** and item 6 of **Table 6**.
7	Stay in Current State (being in SLEEP state)	• In case of high silicon junction temperature of more than 130°C being in SLEEP state, there might be a multiple triggering of the interrupt line indicating a thermal prewarning of the step-down pre-regulator by the flag registers (IF.OTW and OTWRNSF.PREG) due to the activation and deactivation of the thermal sensor during PWM-PFM switching described in **Table 2** Item **1**.

表6　　状态机功能偏差

Number	Function	Description
8	LDO_µC current monitoring for low power states	• The LDO_µC current monitoring for low power states of the D11-step silicon has a worse accuracy than specified in Datasheet Rev 2.0 (TLF35584QVHSx). The achievable values for the D11-step silicon are defined in **Table 7** for different conditions and settings. • Use cases: – According to the shown discrepancy for lower current thresholds, like 30 mA for output capacitors greater than 10 µF and 10 mA in general, it is not allowed to use the TLF35584's LDO_µC current monitoring (DEVCFG2.CMOMEN = 1) for transitions into SLEEP and STANDBY in this configuration and condition as proper transition based on the monitoring cannot be ensured. – For SLEEP state itself, it is not recommended at all to select the configurations for lower current thresholds, like 30 mA for output capacitors greater than 10 µF and 10 mA in general, as it cannot be ensured that the device stays in SLEEP state properly without transition to WAKE state. • For others configurations and conditions the decreased accuracy according to **Table 7** shall be considered. • Please mind, that those current thresholds are currently only given as reference values and not subject to production test.
9	Microcontroller programming support (MPS) influence to state transition NORMAL/WAKE to STANDBY	• The chapter 11.7 in the Datasheet Rev 2.0 (TLF35584QVHSx) describes influences to the overall device behavior of the TLF35584. Beside the described differences there is a unintended influences to the device behavior in case of microcontroller programming support being active (MPS-Pin high) for the movement NORMAL/WAKE to STANDBY. – For the particular case of an interrupted state transition from NORMAL/WAKE to STANDBY due to a wake-up event by WAK (level) or ENA(edge) during the transition, the TLF35584 is not triggering ROT to low when moving to INIT state. Accordingly the behavior with and without MPS being activated can be compared by **Figure 7** and **Figure 8**. Nevertheless the interrupted transition is triggering in both cases an interrupt event and reports the interrupted state transition by the interrupt register IF.SYS and the subsequent diagnostic register SYSSF.TRFAIL.

表6 状态机功能偏差

Number	Function	Description
10	Microcontroller programming support (MPS) influence to state transition Move-to-INIT	• The chapter 11.7 in the Datasheet Rev 2.0 (TLF35584QVHSx) describes influences to the overall device behavior of the TLF35584. Beside the described differences there is an unintended influences to the device behavior in case of microcontroller programming support being active (MPS-Pin high) for the part of the Move-to-INIT events triggered by Window Watchdog, Functional Watchdog or Error Monitoring. – Error Monitoring failure moving the device into INIT state: Following registers will keep their configuration data instead of being reset to their default according to reset class *R3): - RSYSPCFG1 (Configuration of Error Monitoring is kept) - RWDCFG0, RWDCFG1, RFWDCFG, RWWDCFG0 & RWWDCFG1 (Configuration of Window and Functional Watchdog is kept) - WWDSTAT (Error Counter status of Window Watchdog) - FWDSTAT0 and FWDSTAT1 (Status of Functional Watchdog) The Error Monitoring itself will wait after movement to INIT state for the next edge of the ERR signal until it gets active again. – Window Watchdog failure moving the device into INIT state: Following registers will keep their configuration data instead of being reset to their default according to reset class *R3): - RSYSPCFG1 (Configuration of Error Monitoring is kept) - RWDCFG0, RWDCFG1, RFWDCFG, RWWDCFG0 & RWWDCFG1 (Configuration of Window and Functional Watchdog is kept) - FWDSTAT0 and FWDSTAT1 (Status of Functional Watchdog) The Window Watchdog status (WWDSTAT) itself is reset properly. Note that according to the configuration of the Window Watchdog being kept, the first open window after INIT state entry will be either 60 ms (600x 100 µs) or 600 ms (600 x 1 ms) depending on the previous configuration of RWDCFG0.WDCYC. The windows after the first proper service will be considered as configured before. – Functional Watchdog failure moving the device into INIT state: Following registers will keep their configuration data instead of being reset to their default according to reset class *R3): - RSYSPCFG1 (Configuration of Error Monitoring is kept) - RWDCFG0, RWDCFG1, RFWDCFG, RWWDCFG0 & RWWDCFG1 (Configuration of Window and Functional Watchdog is kept) - WWDSTAT (Status of Window Watchdog) The Functional Watchdog status (FWDSTAT0 and FWDSTAT1) itself is reset to its default properly. Only in the particular case of a heartbeat time-out during a FWD service sequence (in between the 4 responses), the FWD response counter (FWDSTAT0.FWDRSPC) will be kept. • Looking to the 3 supervision functions independently, they will continue their operation (ERR signal monitoring, window- and heartbeat timer state) in parallel to the state movement. • In case the configuration to the protected registers is rewritten after the movement to INIT state, the requested configuration will be applied after valid LOCK sequence as usual.

表6 状态机功能偏差

Number	Function	Description
11	Wake-up from SLEEP state after simultaneous event occurrence	• In the particular and unlikely case of simultaneous events related to wake up from SLEEP state and a FAILSAFE transition, it may happen that the corresponding wake-up notification by INT in case of movement from SLEEP to WAKE, which was interrupted before, is not available after restart of the device. Nevertheless the device will move to WAKE state. • The potentially affected events and flags are: – WKSF.WKSPI – WKSF.WKTIM – WKSF.CMON – WKSF.ENA – WKSF.WAK – IF.WK (only in respect to the affected event listed above!) • The function can be recovered by a transition into STANDBY state followed by a restart to INIT state. Hint: For autonomous transition back to INIT, the built-in wake-up timer might be used with a low timer value.
12	ABIST after simultaneous event occurrence	• In the particular and unlikely case of simultaneous events related to ABIST finalization event (IF.ABIST) and a FAILSAFE transition, it may happen that the corresponding completion-notification by INT and IF.ABIST, which was interrupted before, is not available after restart of the device. • The function can be recovered by a transition into STANDBY state followed by a restart to INIT state. Hint: For autonomous transition back to INIT, the built-in wake-up timer might be used with a low timer value.
13	VMONSTAT and peripheral voltage comparators after simultaneous event occurrence	• In the particular and unlikely case of simultaneous events related to INT contributing UV events and a FAILSAFE transition, it may happen that the corresponding flag in the register VMONSTAT as well as the diagnostic notification (flag and interrupt) of the corresponding UV comparator is not available after restart of the device. • The potentially affected events are: – MONSF2.PREGUV – MONSF2.COMUV – MONSF2.VREFUV – MONSF2.TRK1UV – MONSF2.TRK2UV • This malfunction can be detected by ABIST checking the comparators or by validation of the register bits in VMONSTAT (except for PREGUV) against the assumed state (on/off) of the regulators. • The function can be recovered by a transition into STANDBY state followed by a restart to INIT state. Hint: For autonomous transition back to INIT, the built-in wake-up timer might be used with a low timer value.

表6 状态机功能偏差

Number	Function	Description
14	ERR monitoring after simultaneous event occurrence	• In the particular and unlikely case of simultaneous events related error monitoring event detection and a FAILSAFE transition, it may happen that the corresponding diagnostic notification (flag and interrupt) of the corresponding function is not available after restart of the device. • The potentially affected events are: – SYSSF.ERRMISS in combination with IF.SYS (only for ERRMISS!) – INITERR.ERRF (Only the diagnostic flag. State transition and SS1/2 reaction are appropriate!) • This malfunction can be detected by test of the error monitoring function. • The function can be recovered by a transition into STANDBY state followed by a restart to INIT state. Hint: For autonomous transition back to INIT, the built-in wake-up timer might be used with a low timer value.
15	Prerequisite for transition INIT/WAKE to NORMAL (functional watchdog)	• A minor deviation from the specification is the different prerequisite for the transition from INIT/WAKE to NORMAL state in terms of functional watchdog. • The Datasheet Rev 2.0 (TLF35584QVHSx) describes that the transition from INIT/WAKE to NORMAL requires at least one valid service of the functional watchdog before it is accepted. Whereas the D11-step silicon is accepting the transition to NORMAL state also in case there was at least one valid service of the functional watchdog since the last startup in INIT state. This means an event sequence of enabling the FWD, providing a valid service to FWD, disabling the FWD and enabling the FWD again without a further valid service is not blocking the request for transition into NORMAL state. A missing functional watchdog service will trigger the expected failure reaction (INT or SS1/2) latest with time-out of the heartbeat timer. • This deviation is not affecting safety or general functionality, it just differs from the prerequisite description of the device in respect to the transition from INIT/WAKE to NORMAL.

表7 电气特性：状态机

V_{VS}= 6.0V至40V；T_j = -40°C 至 +175°C，所有电压均相对于接地，正向流入引脚的电流（除非另有说明）

Parameter	Symbol	Values			Unit	Note / Test Condition	Number
		Min.	Typ.	Max.			
LDO_µC current monitoring for low power states	$I_{LDO\_µC,att}$	-40	–	+40	%	[1] DEVCFG2.CTHR: set to 2 (60 mA) or 3 (100mA) ; $V_{PREREG} > V_{QUC} + V_{dr,QUC}$	P_11.5.5
LDO_µC current monitoring for low power states	$I_{LDO\_µC,att}$	-50	–	+40	%	[1] $C_{QUC} \leq 10$ µF ; DEVCFG2.CTHR: set to 1 (30mA) ; $V_{PREREG} > V_{QUC} + V_{dr,QUC}$	P_11.5.5
LDO_µC current monitoring for low power states	$I_{LDO\_µC,att}$	-100	–	+40	%	[1] $C_{QUC} \leq 47$ µF ; DEVCFG2.CTHR: set to 0 (10 mA) or 1(30mA) ; $V_{PREREG} > V_{QUC} + V_{dr,QUC}$	P_11.5.5

1）基准数据来自评估，未经生产测试。

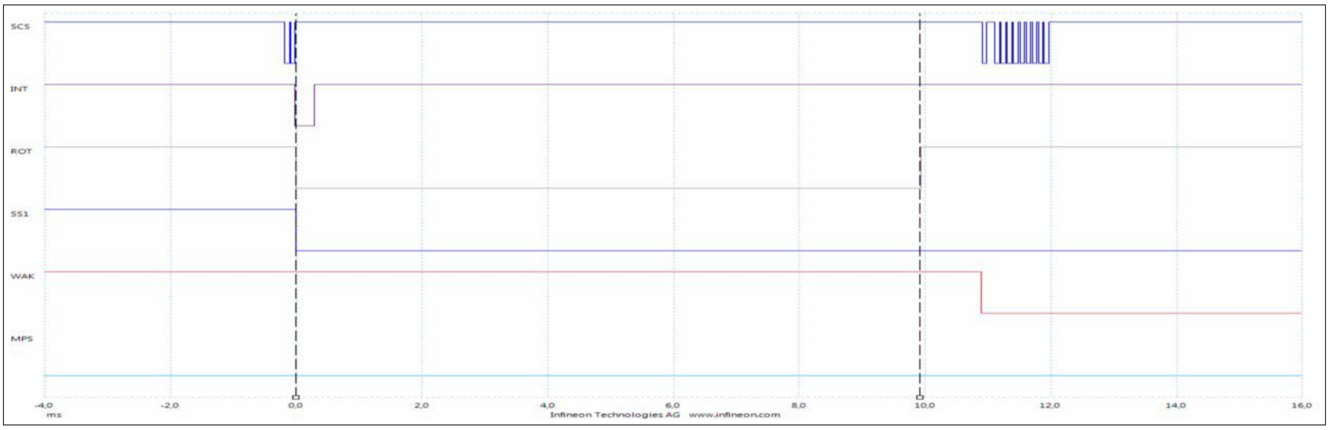

图7 **中断状态切换 NORMAL-STANDBY（MPS 引脚置位低）**

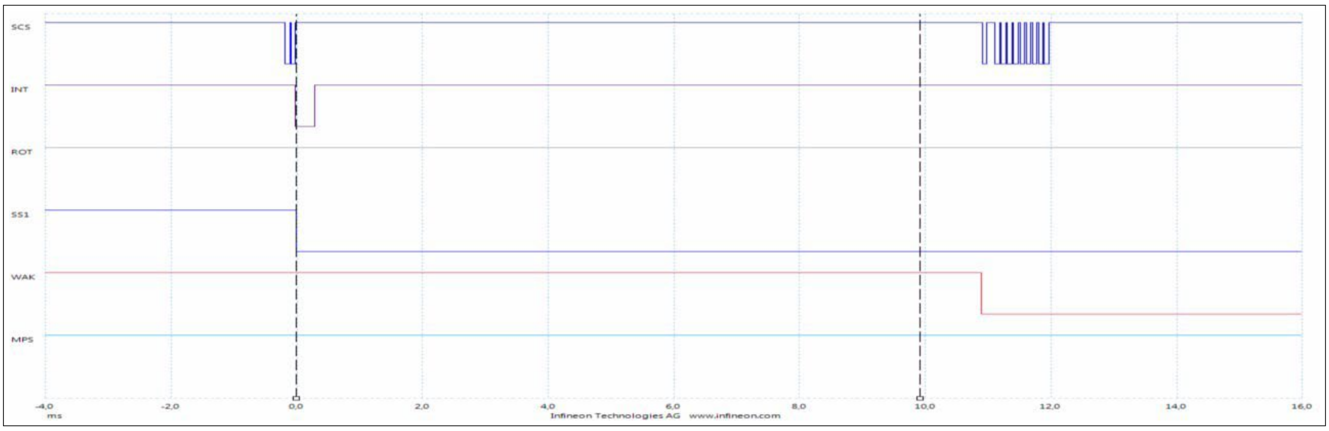

图8 **中断状态转移 NORMAL-STANDBY，具有主动编程支持（MPS 引脚置位高）**

11 安全状态控制功能

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon 。

12 SPI - 串行外设接口

TLF35584 数据手册 Rev 2.0 (TLF35584QVHSx) 与 D11-step silicon 在 SPI 和寄存器方面的功能存在差异。下表列出了这些偏差：

表8 SPI/寄存器功能偏差

Number	Function	Description
1	VMONSTAT register function	• The function of the register VMONSTAT differs from the behavior described in the Datasheet Rev 2.0 (TLF35584QVHSx). The bits in the register are not indicating the out of range condition of the respective regulator. The register is only indicating whether the regulator is enabled or disabled.

13 中断生成

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

14 窗口看门狗和功能看门狗

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

15 应用信息

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

16 封装外形

本章对 TLF35584 数据手册 Rev 2.0（TLF35584QVHSx）的描述适用于 D11-step silicon。

17 修订记录

Revision	Date	Changes
Rev. 3.1	2020-10-09	Initial Errata Sheet for TLF35584QVHSx based on the Datasheet Rev 2.0 (TLF35584QVHSx).

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