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M_CAN

Modular CAN IP-module

Busoff Recovery Handling

Application Note M_CAN_AN004

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Robert Bosch GmbH
Automotive Electronics

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Revision History

Version	Date	Remark
1.0	29.11.2019	First version

Conventions

The following conventions are used within this document:

Register Names	**RXBC, SIDFC**
Names of files and directories	`directoryname/filename`
Source code	m_can_interrupt_init(. .)

References

This document refers to the following documents:

Ref	Author	Title
[1]	AE/EIY	M_CAN User's Manual

Terms and Abbreviations

This document uses the following terms and abbreviations:

Term	Meaning
BRP	Bit Rate Prescaler
CAN	Controller Area Network
CRC	Cyclic Redundancy Check
DLC	Data Length Code
ISR	Interrupt Service Routine

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1 Target

This application note describes the **busoff recovery handling** in the **M_CAN versions 3.1.0 up to 3.3.0.**

2 Busoff Recovery

The M_CAN enters Busoff state according to CAN protocol conditions. The Busoff state is reported by setting PSR.BO. Additionally, the M_CAN sets CCCR.INIT to stop all CAN operation.

To restart CAN operation, the application software needs to clear CCCR.INIT. After CCCR.INIT is cleared, the M_CAN's CAN state machine waits for the completion of the Busoff Recovery Sequence according to CAN protocol (at least 128 occurrences of Bus Idle Condition, which is the detection of 11 consecutive recessive bits).

In the M_CAN User's Manual the description of Bus_Off recovery states that "Once CCCR.INIT has been cleared by the CPU, the device will then wait for 129 occurrences of Bus Idle (129 * 11 consecutive recessive bits) before resuming normal operation. At the end of the Bus_Off recovery sequence, the Error Management Counters will be reset".

The M_CAN uses its Receive Error Counter to count the occurrences of the Bus Idle Condition. If need be, that can be monitored at ECR.REC. Additionally, each occurrence of the Bus Idle condition is flagged by PSR.LEC = 5 = Bit0Error, which triggers an interrupt (IR.PEA) when IR.PEAE is enabled.

While the Busoff Recovery proceeds, the CAN activity is reported as "Synchronizing", PSR.ACT = 0 and PSR.BO remains set.

The M_CAN does not receive messages while the Busoff Recovery proceeds.

The M_CAN does not start transmissions while the Busoff Recovery proceeds. When a transmission is requested while the Busoff Recovery proceeds, it will be started after the Recovery has completed and CAN activity entered Idle state, PSR.ACT = 1.

When the Busoff Recovery has completed, PSR.BO, ECR.TEC, and ECR.REC are cleared, and PSR.ACT is set to Idle.

After PSR.ACT reaches Idle, it will remain in Idle for at least one CAN bit time. The M_CAN's CAN state machine will become receiver (PSR.ACT = 2) when it samples a dominant bit during Idle state or it will become transmitter (PSR.ACT = 3) when it detects a pending transmission request during Idle state.