C&S Conformance Test
CAN – Data Link Layer
Register Functionality Test Specification
CLASSIC Frame Format
(Processor Interface Test Specification)

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1 Introduction

1.1 General

The Register Functionality tests supplement the ISO test cases specified in ISO 16845. All tests are normally executed for all available message buffers of the CAN implementation.

The Processor Interface Specification Version 3 supports the testing of devices, which are able to operate in Classic CAN Mode and in FD enabled Mode. The FD Mode is restricted to classic Frame handling.

Testing of special features is handled as part of the Chapter Miscellaneous. The documented cases can be performed, if the feature is supported by the device.

Please have a look to the device documentation about supported features.

1.2 Definitions

1.2.1 Abbreviations

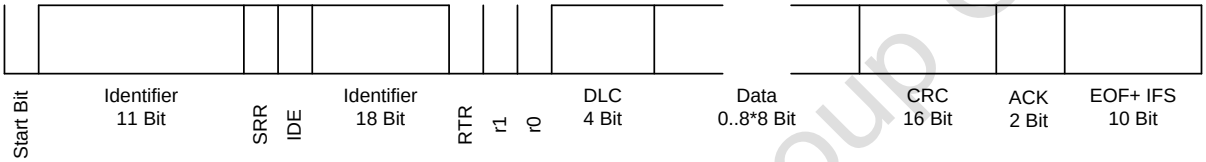
CAN	Controller Area Network
CAN FD	Controller Area Network Flexible Data Rate
UT	Upper Tester
LT	Lower Tester
IUT	Implementation Under Test
PI	Processor Interface
RF	Register Functionality
SOF	Start Of Frame
ID	Identifier
STD	Standard Frame Format
EXT	Extended Frame Format
RTR	Remote Transmission Request
IDE	Identifier Extension
DLC	Data Length Code
ACK	Acknowledge
M_EOT	End Of Test Frame
M_SOT	Start Of Test frame
M_Probe	Configuration frame; send by the UT as part of the correct adjusted bitrate,
M_Ready	Configuration frame; send by the UT. Ready for the test execution of the test procedure.
M_EOT	End Of Test Frame
d_SOT	Data Start Of Test frame
d_EOT	Data End Of Test frame
CC_CC	Classic CAN Mode
FD_CC	Classic CAN Mode with FD Mode Enabled

1.2.2 CAN-Frames

1.2.2.1 Data Frames

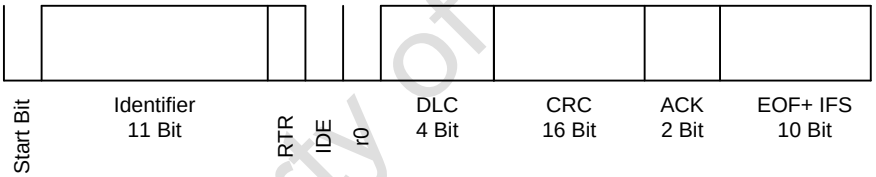
Standard Frame Format

Extended Frame Format

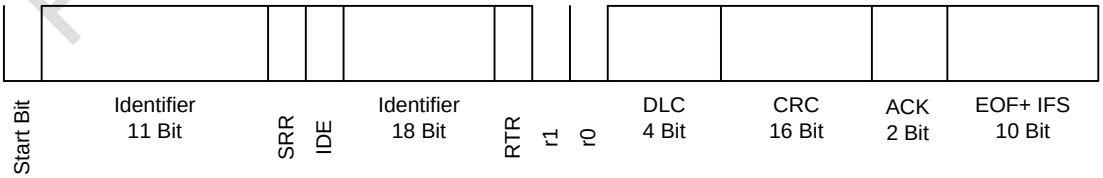


1.2.2.2 Remote Frames

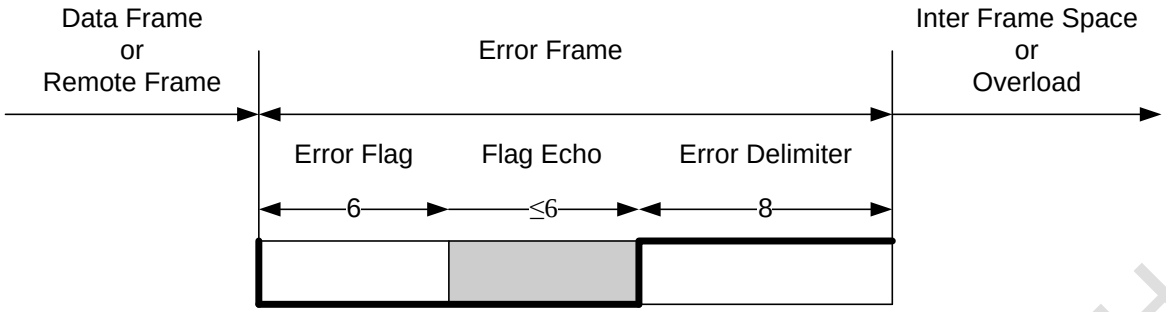
Standard RTR Frame Format



Extended RTR Frame Format



1.2.2.3 Error Frame



1.2.3 Error / Status handling

Each test case must be able to support a return value. The returned value is used as part of the Data Field of the EOT Message which is transmitted at the end of each test sequence.

Error Code definition:

- Only the case <0> = NO_ERROR is defined. NO_ERROR is the as default returned value.
- Every different value can be an ERROR Code or Status Code and is defined individually by the test cases.
- The interpretation of the returned value if the value is an Error Code or a Status Code is part of the usage of each test case and the used script preparation.

E.g. using as Status Code:

The configured test script defines that the Device must send the observed flag <STUFF_ERROR> as Status Code:

The test case defines the following Status Codes:

```
0x01 = BIT_ERROR
…
0x08 = STUFF_ERROR
```

Test script:

```
#define = STUFF_ERROR 0x08
…
LowerTesterReceivesEOT(STUFF_ERROR, 0)
```

The observation of the STUFF_ERROR Flag is flagged and the Upper Tester sends this information as part of the Data Field of the EOT Message.

The handling can be used to optimize the analyzing process, because sometimes the used test function is not able to allow breakpoints at critical test steps. In such cases it is easier to flag a Status Code to the developer, with the information of e.g. <STUFF_ERROR> observed.

The same handling can although be used to flag Errors like a <COMPARE_ERROR>. But this is a result which should not happen.

1.2.4 Test Groups

1.2.4.1 Test Mode CC_CC

General Setup:

Device Mode	Classic CAN Mode
Message Length	$DLC = \in \{0 \dots 15\} = \{0,1,2,3,4,5,6,7,8,9 \dots 15\}$
Mailbox structure	8 Byte per Mailbox
Implementation details	The DUT shall be implemented to use a mailbox structure which supports up to 8 Byte per Message Buffer.

1.2.4.2 Test Mode FD_CC

General Setup:

Device Mode	Classic CAN Mode with FD Mode enabled
Message Length	$DLC = \in \{0 \dots 15\} = \{0,1,2,3,4,5,6,7,8,9 \dots 15\}$
BRS	$BRS = \in \{0\}$
FDF	$FDF = \in \{0\}$
Mailbox structure	8 Byte per Mailbox
Implementation details	The DUT shall be implemented to use a mailbox structure which supports up to 64 Byte per Message Buffer. The Data Length is restricted to Classic Mode settings.

2 Receive Messages

2.1 Receive into single message buffer

2.1.1 Receive into single message buffer / standard identifier

2.1.1.1 Receive into single message buffer / standard identifier (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested message buffer exclusively. All frames have to be received without any errors.

The receive interrupt is disabled.

- This test has to be performed for all receive message buffers.
- This test has to be performed with all DLC configurations.

2.1.1.2 Receive into single message buffer / standard identifier (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested message buffer exclusively. All frames have to be received without any errors.

The receive interrupt is enabled.

- This test has to be performed for all receive message buffers.
- This test has to be performed with all DLC configurations.

2.1.2 Receive into single message buffer / extended identifier

2.1.2.1 Receive into single message buffer / extended identifier (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested message buffer exclusively. All frames have to be received without any errors.

The receive interrupt is disabled.

- This test has to be performed for all receive message buffers.
- This test has to be performed with all DLC configurations.

2.1.2.2 Receive into single message buffer / extended identifier (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested message buffer exclusively. All frames have to be received without any errors.

The receive interrupt is enabled.

- This test has to be performed for all receive message buffers.
- This test has to be performed with all DLC configurations.

2.1.3 Overrun handling

2.1.3.1 Overrun handling (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a receive message buffer which receives more than one frame without reading out the message buffer performs an overrun handling. Only the first received frame has to be stored in the message buffer.

- This test has to be performed for all possible receive message buffers.
- This test can only be performed, if the DUT supports Overrun handling.

Buffer configurations in Fifo Mode shall not be used.

2.1.3.2 Overrun handling (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a receive message buffer which receives more than one frame without reading out the message buffer performs an overrun handling. Only the first received frame has to be stored in the message buffer.

- This test has to be performed for all possible receive message buffers.
- This test can only be performed, if the DUT supports Overrun handling.

Buffer configurations in Fifo Mode shall not be used.

Interrupts Flags are enabled.

2.1.3.3 Overrun handling (1 – x), remote flag set / Polling

Test Description:

The purpose of this test is to verify that a receive message buffer which receives more than one frame without reading out the message buffer performs an overrun handling. Only the first received frame has to be stored in the message buffer.

- This test has to be performed for all possible receive message buffers.
- This test can only be performed, if the DUT supports Overrun handling.
- Remote Frames shall be used.

Buffer configurations in Fifo Mode shall not be used.

2.1.3.4 Overrun handling (1 – x), remote flag set / Interrupt

Test Description:

The purpose of this test is to verify that a receive message buffer which receives more than one frame without reading out the message buffer performs an overrun handling. Only the first received frame has to be stored in the message buffer.

This test has to be performed for all possible receive message buffers.

This test can only be performed, if the DUT supports Overrun handling.

Buffer configurations in Fifo Mode shall not be used.

2.1.4 Overwrite handling

2.1.4.1 Overwrite handling (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a receive message buffer which receives more than one frame without reading out the message buffer performs an overwrite handling. The last received frame has to be stored in the message buffer.

This test has to be performed for all possible receive message buffers.

Buffer configurations in Fifo Mode shall not be used.

2.1.4.2 Overwrite handling (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a receive message buffer which receives more than one frame without reading out the message buffer performs an overwrite handling. The last received frame has to be stored in the message buffer. The overwrite interrupt generation is checked also.

This test has to be performed for all possible receive message buffers.

Buffer configurations in Fifo Mode shall not be used.

2.1.4.3 Overwrite handling (1 – x), remote flag set / Polling

Test Description:

The purpose of this test is to verify that a receive message buffer which receives more than one frame without reading out the message buffer performs an overwrite handling. The last received frame has to be stored in the message buffer.

This test has to be performed for all possible receive message buffers.

Buffer configurations in Fifo Mode shall not be used.

2.1.4.4 Overwrite handling (1 – x), remote flag set / Interrupt

Test Description:

The purpose of this test is to verify that a receive message buffer which receives more than one frame without reading out the message buffer performs an overwrite handling. The last received frame has to be stored in the message buffer. The overwrite interrupt generation is checked also.

This test has to be performed for all possible receive message buffers.

Buffer configurations in Fifo Mode shall not be used.

2.2 Receive into multiple message buffers / receive buffer order

2.2.1 Receive into multiple message buffers – even message buffers

Test Description:

The purpose of this test is to verify that several received frames are stored in the correct message buffer order when more than one message buffer is configured for reception.

Applicable for single message buffers only.

2.2.2 Receive into multiple message buffers – odd message buffers

Test Description:

The purpose of this test is to verify that several received frames are stored in the correct message buffer order when more than one message buffer is configured for reception.

Applicable for single message buffers only.

2.2.3 Receive into multiple message buffers – all message buffers

Test Description:

The purpose of this test is to verify that several received frames are stored in the correct message buffer order when more than one message buffer is configured for reception.

Applicable for single message buffers only.

2.3 Receive into multiple message buffers / message filtering

2.3.1 Message filtering / standard ID (1 – x)

Test Description:

The mask is built depending on the mask-architecture of the IUT. If there are multiple mask-architectures possible the test has to be executed for every mask-architecture.

Check that a receive message buffer linked to the mask(s) only accept frames matching the mask criteria.

Concept: The IUT transmits before a sequence starts a synchronization frame with the ID 0x444. After this the IUT has finished the mask update. The Test System starts to transmit two frames. First frame with ID = 0x000 and a second frame with the matching frame id.

At the end of the sequence, the IUT starts to transmit the synchronization frame.

2.3.2 Message filtering / extended ID (1 – x)

Test Description:

The mask is built depending on the mask-architecture of the IUT. If there are multiple mask-architectures possible the test has to be executed for every mask-architecture.

Check that a receive message buffer linked to the mask(s) only accept frames matching the mask criteria.

Concept: The IUT transmits before a sequence starts a synchronization frame with the ID 0x00000444. After this the IUT has finished the mask update. The Test System starts to transmit two frames. First frame with

ID = 0x0000000 and a second frame with the matching frame id.

At the end of the sequence, the IUT starts to transmit the synchronization frame.

2.4 Message Acceptance Filter Combination

2.4.1 Message Acceptance Filter Combination (1 – x)

Test Description:

This test must be configured in a custom way, because there are different possible constructions.

- An IUT has several global masks.(Can be handled, is local mask, see chapter 2.3)
- An IUT can split the mask into a low and high mask.
- An IUT has local and global masks. For this both masks must be tested as separate masks. After this, a second test verifies the combination of local and global masks.

2.5 Timestamp tests for receive message buffers

2.5.1 Timestamp for a single receive message buffer on SOF (1 – x)

Test Description:

The purpose of this test is to verify that a timestamp for a receive message buffer is updated on reception of a valid frame. The timestamp value must be captured at the start of frame bit (SOF) of the received frame.

This test has to be executed for every possible message buffer.

2.5.2 Timestamp for a single receive message buffer on EOF (1 – x)

Test Description:

The purpose of this test is to verify that a timestamp for a receive message buffer is updated on reception of a valid frame. The timestamp value must be captured at the end of frame bit (EOF) of the received frame.

This test has to be executed for every possible message buffer.

3 Transmit Messages

3.1 Transmit from single message buffer

3.1.1 Transmit from single message buffer / STD identifier (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a transmit message buffer changes register values linked to the tested message buffer exclusively.

All frames have to be transmitted without any errors. The transmit interrupt is disabled.

This test has to be performed for all possible transmit message buffers.

3.1.2 Transmit from single message buffer / standard identifier (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a transmit message buffer changes register values linked to the tested message buffer exclusively.

All frames have to be transmitted without any errors. The transmit interrupt is enabled.

This test has to be performed for all possible transmit message buffers.

3.1.3 Transmit from single message buffer / extended identifier (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a transmit message buffer changes register values linked to the tested message buffer exclusively.

All frames have to be transmitted without any errors. The transmit interrupt is disabled.

This test has to be performed for all possible transmit message buffers.

3.1.4 Transmit from single message buffer / extended identifier (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a transmit message buffer changes register values linked to the tested message buffer exclusively.

All frames have to be transmitted without any errors. The transmit interrupt is enabled.

This test has to be performed for all possible transmit message buffers.

3.2 Transmit from multiple message buffers

Requirement on how to setup:

- The IUT uses an internal arbitrary order of how to handle the transmission requests of each message buffer.
- Each Message Buffer shall be configured with a different message IDs in increased order. (see picture below).
- The transmit requests for all Messages Buffers shall be set at the same time. This allows the internal arbitrary system to select the first configured message (lowest message id) to be send as first.

  If this is not applicable, because of each message buffer must be triggered individual. Set the transmit request flag as fast as possible. Set

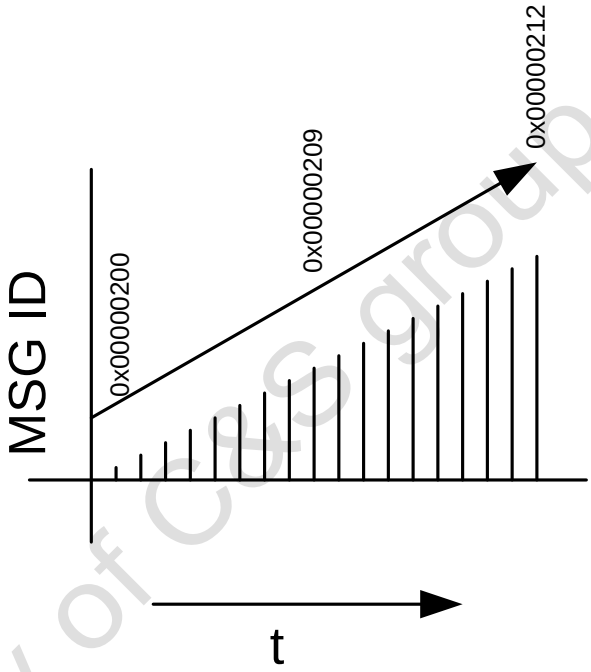


Figure 1 Expected transmission order

3.2.1 Transmit message buffer order / Message buffer priority

Test Description:

The purpose of this test is to verify that multiple transmit requests on different message buffers are executed in the correct order.

One test has to be performed with transmit order given by message buffer number.

The test is applicable, if the device supports the functionality of Message Buffer priority.

3.2.2 Transmit message buffer order / Identifier priority

Test Description:

The purpose of this test is to verify that a multiple transmit requests from different message buffers are executed in the correct order.

One test has to be performed with transmit order given by identifier

The test is applicable, if the device supports the functionality of Message Buffer ID priority.

3.2.3 Transmit message buffer order / Message buffer priority and arbitration lost

Test Description:

The purpose of this test is to verify that a multiple transmit requests from different message buffers are executed in the correct order.

The transmit order must be independent of any loss of arbitration during the test sequence

One test has to be performed with transmit order given by message buffer no.

3.2.4 Transmit message buffer order / Identifier priority and arbitration lost

3.2.4.1 Message Buffer Order

Test Description:

The purpose of this test is to verify that multiple transmit requests from different message buffers are executed in the correct order.

The transmit order must be independent of any loss of arbitration during the test sequence

One test has to be performed with transmit order given by message buffer no.

The test is applicable, if the device supports the functionality of Message Buffer priority.

3.2.4.2 ID Priority Order

Test Description:

The purpose of this test is to verify that multiple transmit requests from different message buffers are executed in the correct order.

The transmit order must be independent of any loss of arbitration during the test sequence

One test has to be performed with transmit order given by message buffer no.

The test is applicable, if the device supports the functionality of Message Buffer ID priority.

3.2.5 Transmit message buffer order / Message buffer priority and bus - errors

3.2.5.1 Message Buffer order

Test Description:

The purpose of this test is to verify that a multiple transmit requests from different message buffers are executed in the correct order.

The transmit order must be independent of any bus error occurrence during the test sequence

One test has to be performed with transmit order given by message buffer no.

The test is applicable, if the device supports the functionality of Message Buffer priority.

3.2.5.2 Id Priority Order

Test Description:

The purpose of this test is to verify that a multiple transmit requests from different message buffers are executed in the correct order.

The transmit order must be independent of any bus error occurrence during the test sequence

One test has to be performed with transmit order given by message buffer no.

The test is applicable if the device supports the functionality of Message Buffer ID priority.

3.2.6 Transmit message buffer order / Identifier priority and bus - errors

3.2.6.1 Message Buffer Order

Test Description:

The purpose of this test is to verify that a multiple transmit requests from different message buffers are executed in the correct order.

The transmit order must be independent of any bus error occurrence during the test sequence

One test has to be performed with transmit order given by identifier.

The test is applicable, if the device supports the functionality of Message Buffer priority.

3.2.6.2 ID Priority Order

Test Description:

The purpose of this test is to verify that a multiple transmit requests from different message buffers are executed in the correct order.

The transmit order must be independent of any bus error occurrence during the test sequence

One test has to be performed with transmit order given by identifier.

The test is applicable, if the device supports the functionality of Message Buffer ID priority.

3.3 Stop transmission

3.3.1 Abort transmission (1 – x)

Test Description:

The purpose of this test is to verify that a message buffer which is transmitting a frame never interrupts the transmission when an abort is requested before the transmit sequence is completed.

This test has to be performed for all possible transmit message buffers.

3.3.2 Abort transmission during arbitration lost (1 – x)

Test Description:

The purpose of this test is to verify that a message buffer which is transmitting a frame never interrupts the transmission when an abort is requested during the case of arbitration lost.

The transmit sequence is completed after the arbitration is lost.

This test has to be performed for all possible transmit message buffers.

3.3.3 Abort transmission during bus - errors (1 – x)

Test Description:

The purpose of this test is to verify that a message buffer which is transmitting a frame never interrupts the transmission when an abort is requested until the transmit sequence is completed.

The transmit sequence is completed after an error frame has been sent.

This test has to be performed for all possible transmit message buffers.

3.4 Timestamp tests for transmit message buffers

3.4.1 Timestamp for a single transmit message buffer on SOF (1 – x)

Test Description:

This Test verifies the behaviour of the transmit time stamp, measured at SOF.

The application must be implemented to use 2 Mailboxes. This is necessary to get the fastest performance of the IUT's CAN core.

This test has to be performed for all possible transmit message buffers.

3.4.2 Timestamp for a single transmit message buffer on EOF (1 – x)

Test Description:

This Test verifies the behaviour of the transmit timestamp, measured at EOF.

The application must be implemented to use 2 Mailboxes. This is necessary to get the fastest performance of the IUT's CAN core.

This test has to be performed for all possible transmit message buffers.

4 Remote Message Handling

4.1 Remote frame reception

4.1.1 Remote frame reception / standard identifier

4.1.1.1 Remote frame reception / standard identifier (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested message buffer exclusively.

All frames have to be received without any errors.

This test has to be performed for all possible receive message buffers.

4.1.1.2 Remote frame reception / standard identifier (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested message buffer exclusively.

The generation of a receive Interrupt is checked.

All frames have to be received without any errors.

This test has to be performed for all possible receive message buffers

4.1.2 Remote frame reception / extended identifier

4.1.2.1 Remote frame reception / extended identifier (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested message buffer exclusively.

All frames have to be received without any errors.

This test has to be performed for all possible receive message buffers.

4.1.2.2 Remote frame reception / extended identifier (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested message buffer exclusively.

The generation of a receive Interrupt is checked.

All frames have to be received without any errors.

This test has to be performed for all possible receive message buffers.

4.2 Remote frame transmission

4.2.1 Remote frame transmission / standard identifier

4.2.1.1 Remote frame transmission / standard identifier (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a transmit message buffer changes register values linked to the tested message buffer exclusively.

The transmit interrupt generation is checked also. All frames have to be transmitted without any errors.

This test has to be performed for all possible transmit message buffers.

4.2.1.2 Remote frame transmission / standard identifier (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a transmit message buffer changes register values linked to the tested message buffer exclusively.

The transmit interrupt generation is checked also. All frames have to be transmitted without any errors.

This test has to be performed for all possible transmit message buffers.

4.2.2 Remote frame transmission / extended identifier

4.2.2.1 Remote frame from single message buffer / extended identifier (1 – x) / Polling

Test Description:

The purpose of this test is to verify that a transmit message buffer changes register values linked to the tested message buffer exclusively.

All frames have to be transmitted without any errors. The transmit interrupt is disabled.

This test has to be performed for all possible transmit message buffers.

4.2.2.2 Remote Frame from single message buffer / extended identifier (1 – x) / Interrupt

Test Description:

The purpose of this test is to verify that a transmit message buffer changes register values linked to the tested message buffer exclusively.

All frames have to be transmitted without any errors. The transmit interrupt is enabled.

This test has to be performed for all possible transmit message buffers.

4.3 Auto Answer Mode

4.3.1 Automatic remote frame reply / standard identifier (1 – x)

Test Description:

The purpose of this test is to verify that a message buffer automatically answers the reception of a remote frame without setting the transmission start bit by software.

All frames have to be transmitted and received without any errors.

This test has to be performed for all possible transmit message buffers.

4.3.2 Automatic remote frame reply / extended identifier (1 – x)

Test Description:

The purpose of this test is to verify that a message buffer automatically answers the reception of a remote frame without setting the transmission start bit by software.

All frames have to be transmitted and received without any errors.

This test has to be performed for all possible transmit message buffers.

4.4 Remote frame handling with a single message buffer

4.4.1 Remote frame transmission and reception in the same message buffer / std. id. (1 – x)

Test Description:

The purpose of this test is to verify that a Remote frame transmission and reply can be handled with only on message buffer. All frames have to be transmitted and received without any errors.

This test has to be performed for all possible transmit message buffers.

4.4.2 Remote frame transmission and reception in the same message buffer / ext. id. (1 – x)

Test Description:

The purpose of this test is to verify that a Remote frame transmission and reply can be handled with only on message buffer. All frames have to be transmitted and received without any errors.

This test has to be performed for all possible transmit message buffers.

5 Error signalling

5.1 Error signalling during reception

5.1.1 Signalling ‘Form Error’

Test Description:

The purpose of this test is to verify that a CAN node, which is receiving a frame with formal errors, detects the FORM Error and write it into the LEC Field. There are three test cases to perform

5.1.2 Signalling ‘CRC Error’

Test Description:

The purpose of this test is to verify that a CAN node, which is receiving a frame with a CRC error, detects the CRC Error and write it into the LEC Field.

5.1.3 Signalling ‘Stuff Error’

Test Description:

The purpose of this test is to verify that a CAN node, which is receiving a frame with a Stuff error, detects the Stuff Error and write it into the LEC Field.

5.2 Error signalling during transmission

5.2.1 Signalling ‘Form Error’

Test Description:

The purpose of this test is to verify that a CAN node, which is transmitting a frame with formal errors, detects the FORM Error and write it into the LEC Field.

5.2.2 Signalling ‘Bit Error’

Test Description:

The purpose of this test is to verify that a CAN node, which is transmitting a frame with a Bit0 error, detects the Bit0 Error and write it into the LEC Field.

5.2.3 Signalling ‘Bit Error’,arbitration field

Test Description:

The purpose of this test is to verify that a CAN node, which is transmitting a frame with a Bit1 error detecting the Bit1 Error and write it into the LEC Field.

5.2.4 Signalling ‘Stuff Error’

Test Description:

The purpose of this test is to verify that a CAN node, which is transmitting a frame with a Stuff error detecting the Stuff Error and write it into the LEC Field.

5.2.5 Signalling ‘Acknowledge Error’

Test Description:

The purpose of this test is to verify that a CAN node, which is transmitting a frame with an ACK error detecting the ACK Error and write it into the LEC Field.

6 Controller state signalling

6.1 Status change due to REC

6.1.1 Transition from ‘Error Active’ over ‘Error Warning’ to ‘Error Passive’

Test Description:

The purpose of this test is to verify that a CAN node which is receiving a frame with more than one bit error changes its status to warning and then to error passive. For each status change an interrupt has to be generated (if implemented). The REC value must equal 96 at warning level and 128 at error passive state.

6.1.2 Transition from ‘Error Passive’ to ‘Error Active’

Test Description:

The purpose of this test is to verify that a CAN node which is in Error Passive state recovers to Error Active when REC becomes ≤ 127.

6.2 Status change due to TEC

6.2.1 Transition from ‘Error Active’ over ‘Error Warning’ to ‘Error Passive’

Test Description:

The purpose of this test is to verify that a CAN node which is transmitting a frame with more than one bit error changes its status to warning and then to error passive. For each status change an interrupt has to be generated (if implemented). The TEC value must equal 96 at warning level and 128 at error passive state.

6.2.2 Transition from ‘Error Passive’ to ‘Error Active’

Test Description:

The purpose of this test is to verify that a CAN node which is in Error Passive state recovers to Error Active when TEC becomes ≤ 127.

6.3 Bus Off state

6.3.1 Entering ‘Bus Off’ state and recovery sequence

Test Description:

The purpose of this test is to verify that a CAN node which is transmitting a frame with more than one bit error changes its status to Bus Off state. For the status change an interrupt has to be generated (if implemented). The TEC value must equal 256 at Bus Off state.

7 CAN Power Mode Tests

7.1 Sleep mode Tests

The meaning of Sleep Mode is the transition of the CAN Core into a Low Power State. Most CAN Cores do not support this feature. It is only possible to deactivate the CAN Core clock itself. But this deactivates the CAN Module (Mailbox Memory, Register and the CAN Core) immediately, Independently of the actual bus traffic. The Low Power State is implemented as part of the CPU itself. This is out of the scope of the processor Interface test specification.

The transition into the low power state should only be carried out, if the CAN Core is in IDLE State.

7.1.1 Entering sleep mode during bus idle

7.1.1.1 Entering sleep mode by setting sleep request during bus idle

Test Description:

The purpose of this test is to verify that a CAN node in idle state which is requested for sleep mode enters this state immediately.

7.1.2 Entering sleep mode during reception

7.1.2.1 Entering sleep mode during reception

Test Description:

The purpose of this test is to verify that a CAN node in idle state which is requested for sleep mode enters this state only if the reception sequence is finished.

7.1.2.2 Entering sleep mode during reception and bus errors

Test Description:

The purpose of this test is to verify that a CAN node in idle state which is requested for sleep mode enters this state only if the reception sequence is finished.

7.1.3 Entering sleep mode during transmission

7.1.3.1 Entering sleep mode during transmission

Test Description:

The purpose of this test is to verify that a CAN node which is requested for Sleep mode enters this state only if the transmission sequence is finished.

7.1.3.2 Entering sleep mode during transmission and arbitration lost

Test Description:

The purpose of this test is to verify that a CAN node which is requested for Sleep mode enters this state only if the transmission and reception sequence is finished.

7.1.3.3 Entering sleep mode during transmission and bus errors

Test Description:

The purpose of this test is to verify that a CAN node which is requested for Sleep mode enters this state only if the error handling sequence is finished.

7.1.4 Leaving sleep mode

7.1.4.1 Leaving sleep mode by resetting sleep request

Test Description:

The purpose of this test is to verify that a CAN node in Sleep mode which is requested for leaving Sleep mode enters normal mode immediately.

7.1.4.2 Leaving sleep mode by auto wake up mode

Test Description:

The purpose of this test is to verify that a CAN node in Sleep mode enters normal mode after detecting a dominant bus value and checking 11 recessive bits on the bus.

7.2 Halt/Init mode tests

7.2.1 Entering Halt/Init mode during bus idle

7.2.1.1 Entering Halt/Init mode by setting Halt/Init mode request during bus idle

Test Description:

The purpose of this test is to verify that a CAN node in idle state which is requested for Halt mode enters this state immediately.

7.2.2 Entering Halt/Init mode during reception

7.2.2.1 Entering Halt/Init mode during reception

Test Description:

The purpose of this test is to verify that a CAN node which is requested for Halt mode enters this state only if the reception sequence is finished.

7.2.2.2 Entering Halt/Init mode during reception and bus errors

Test Description:

The purpose of this test is to verify that a CAN node which is requested for Halt mode enters this state only if the reception sequence is finished.

7.2.3 Entering Halt/Init mode during transmission

7.2.3.1 Entering Halt/Init mode during transmission

Test Description:

The purpose of this test is to verify that a CAN node which is requested for Halt mode enters this state only if the transmission sequence is finished.

7.2.3.2 Entering Halt/Init mode during transmission and arbitration lost

Test Description:

The purpose of this test is to verify that a CAN node which is requested for Halt mode enters this state only if the transmission and reception sequence is finished

7.2.3.3 Entering Halt/Init mode during transmission and bus errors

Test Description:

The purpose of this test is to verify that a CAN node which is requested for Halt mode enters this state only if the error handling sequence is finished.

7.2.4 Leaving Halt/Init Mode

7.2.4.1 Leaving Halt/Init mode by resetting Halt/Init mode request

Test Description:

The purpose of this test is to verify that a CAN node in Halt mode which is requested for leaving Halt mode enters normal mode immediately.

8 Miscellaneous

The in the following chapter listed test cases can be performed, if the functionality is supported by the device.

Please have a look to the device documentation about supported features.

New features can be attached as new test case.

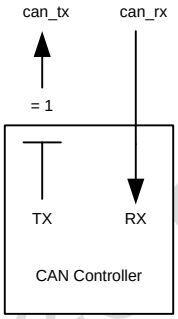
A test documentation shall be added to the report, if the designed test case differs from the actual implementation.

8.1 Test mode tests

8.1.1 Listen mode test

Test Description:

The purpose of this test is to verify that a receive message buffer changes register values linked to the tested buffer exclusively, during the CAN node is in Listen Mode.



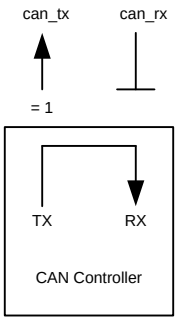
Listen Only Mode

8.2 Loop back mode tests

8.2.1 Loop back mode (Internal)

Test Description:

The purpose of this test is to verify that a CAN node which is entered to Loop Back Mode (internal) is able to receive and transmit frames from. The CAN node shall not send to or receive messages from extern.



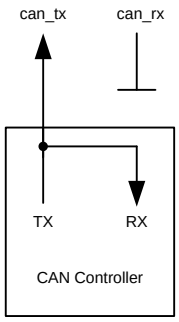
Internal Loop Back Mode

8.2.2 Loop back mode (External)

Test Description:

The purpose of this test is to verify that a CAN node which is entered to Loop Back Mode (external) is not able to receive messages from extern.

Check that a CAN node which is entered to Loop Back Mode (external) is able to transmit messages to the CAN Bus.



External Loop Back Mode

8.3 Error counter tests

8.3.1 Write error counters

8.3.1.1 Write REC Counter

Test Description: (applicable, if the feature is supported)

The purpose of this test is to verify that the CAN Node is able to write the REC Error counter.

8.3.1.2 Write TEC

Test Description: (applicable, if the feature is supported)

The purpose of this test is to verify that the CAN Node is able to write the TEC Error counter.

8.3.2 Reset error counters

Test Description: (applicable, if the feature is supported)

The purpose of this test is to verify that it is able to reset the Error counter.

8.4 Signalling overload frame interrupt

Test Description:

The purpose of this test is to verify that a CAN node generates an Overload Interrupt when LT sends a frame where the Overload flag is set.

8.5 Disable automatic retransmission for message buffer x

Test Description:

The purpose of this test is to verify that after an Error, the DUT does not trigger the retransmission of the before disturbed can frame.

The disable automatic retransmission control can be part of the functionality of the CAN Core or local as part of a single message object.

8.6 Auto Bus on

Test Description:

The purpose of this test is to verify that a CAN node which is in Bus Off State is able to immediately set the CAN node to normal state. The CAN node has to take care about the Bus Off recovery time.

Applicable, if Auto Bus On Control is available.

8.7 FIFO Mode

8.7.1 FIFO: Receive Buffer

Test Description:

tbd

8.7.2 FIFO: Receive order with overrun indication / Interrupt

Test Description:

tbd

8.7.3 FIFO: Receive Buffer Full

Test Description:

tbd

8.7.4 FIFO: Receive Buffer Full; MSG Lost Signalling

Test Description:

tbd

8.7.5 FIFO: Transmit Buffer

Test Description:

tbd

8.7.6 FIFO: Transmit Buffer Full

Test Description:

tbd

8.7.7 FIFO: Msg Lost Blocking Mode

Test Description:

tbd

8.7.8 FIFO: Msg Lost Overwrite Mode

Test Description:

tbd

8.8 Data Update

Test Description:

The purpose of this test is to verify that a CAN node which is set on Message Data Update Mode (if available) transmits a frame without any errors, is set into data Update mode, change the Data, reset data update mode and transmit a 2nd frame with new data without any errors.

8.9 Timestamp

8.9.1 Timestamp Overflow Flag

Test Description:

Verify the Flags in case of the Timestamp

8.9.2 FIFO Buffer Watchdog Timeout guard (MCAN)

Test Description:

Observe the Fifo Buffer Flags, if a buffer timeout is flagged.

There should be no timeout flagged during the watchdog time.