

High-speed CAN FD transceiver

Features

- Fully compliant to ISO 11898-2:2024 and SAE J2284-4/-5
- Loop delay symmetry for controller area network (CAN) FD data frames up to 5 Mbit/s
- Very low electromagnetic emission (EME) allows the use without additional common mode choke
- Excellent electrostatic discharge (ESD) robustness
- TxD timeout function
- Very low CAN bus leakage current in power-down state
- Overtemperature protection
- Protected against automotive transients according to ISO 7637 and SAE J2962-2
- Receive-only mode and power-save mode
- Green Product (RoHS compliant)

Potential applications

- Engine control units
- Electric power steering
- Transmission control units (TCUs)
- Chassis control modules

Product validation

Qualified for automotive applications. Product validation according to AEC-Q100.

Description

The TLE9350BSJ is a high speed CAN transceiver, used in HS CAN systems for automotive applications as well as for industrial applications. It is designed to fulfill the requirements of ISO 11898-2:2024 physical layer specification as well as SAE J1939 and SAE J2284.

The TLE9350BSJ is available in a Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) compliant, halogen free PG-DSO-8 package.

As an interface between the physical bus layer and the HS CAN protocol controller, the TLE9350BSJ is designed to protect the microcontroller against interferences generated inside the network. A very high ESD robustness and the optimized RF immunity allows the use in automotive applications without additional protection devices, such as suppressor diodes or common mode chokes.

Based on the high symmetry of the CANH and CANL output signals, the TLE9350BSJ provides a very low level of EME within a wide frequency range. The TLE9350BSJ fulfills even stringent electromagnetic compatibility (EMC) test limits without an additional external circuit, such as a common mode choke.

The optimized transmitter symmetry combined with the optimized delay symmetry of the receiver enables the TLE9350BSJ to support CAN FD data frames. The device supports data transmission rates up to 5 Mbit/s, depending on the size of the network and the inherent parasitic effects.

Fail-safe features, such as overtemperature protection, output current limitation or the TxD timeout feature are designed to protect the TLE9350BSJ and the external circuitry from irreparable damage.



Type	Package	Marking
TLE9350BSJ	PG-DSO-8	9350B

Table of contents

	Features	1
	Potential applications	1
	Product validation	1
	Description	1
	Table of contents	2
1	Block diagram	4
2	Pin configuration	5
2.1	Pin assignment	5
2.2	Pin definitions and functions	5
3	General product characteristics	6
3.1	Absolute maximum ratings	6
3.2	Functional range	7
3.3	Thermal resistance	7
4	High speed CAN functional description	8
4.1	High speed CAN physical layer	8
5	Modes of operation	10
5.1	Normal-operating mode	10
5.2	Receive-only mode	11
5.3	Power-save mode	11
5.4	Power-down state	11
6	Fail safe functions	13
6.1	Short circuit protection	13
6.2	Unconnected logic pins	13
6.3	V_{CC} undervoltage	13
6.4	TxD timeout feature	13
6.5	Delay time for mode change	13
6.6	Overtemperature protection	14
7	Electrical characteristics	15
7.1	Power supply interface	15
7.1.1	Electrical characteristics current consumption	15
7.1.2	Electrical characteristics undervoltage detection	16
7.2	Electrical characteristics CAN controller interface	17
7.3	Electrical characteristics receiver	18
7.4	Electrical characteristics transmitter	19
7.5	Electrical characteristics dynamic transceiver parameters	21
7.6	Diagrams	23



8	Application information	25
8.1	ESD robustness according to IEC 61000-4-2	25
8.2	Application example	26
8.3	Further application information	26
9	Package information	27
	Glossary	28
	Revision history	29
	Disclaimer	30

1 Block diagram

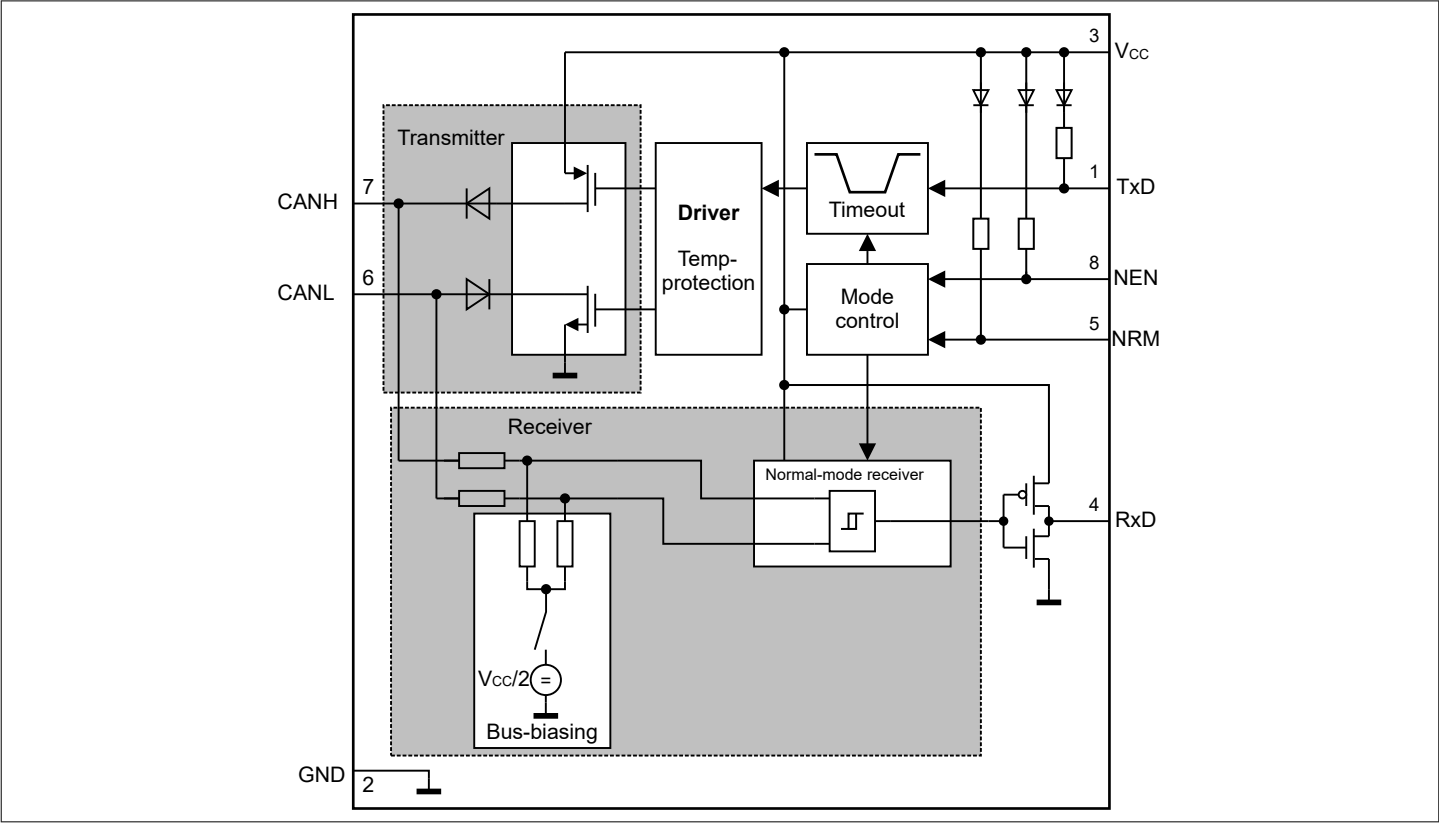


Figure 1 Block diagram

2 Pin configuration

2.1 Pin assignment

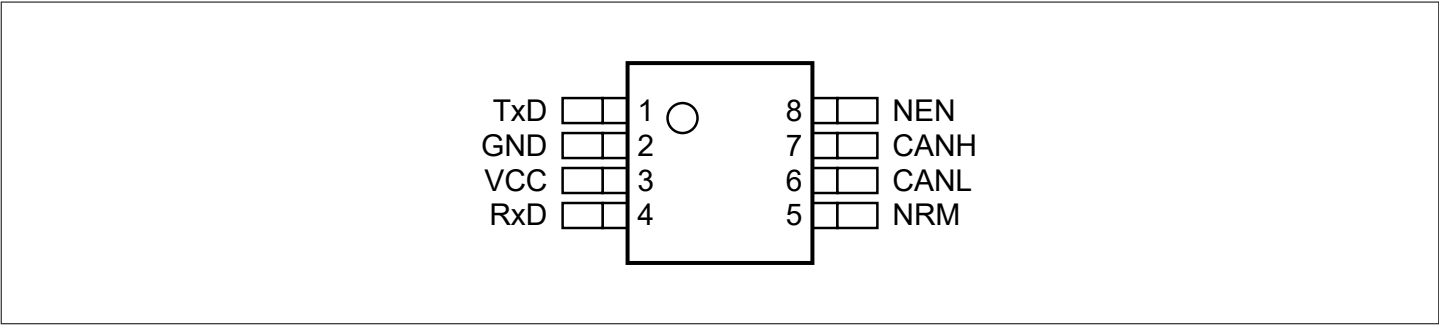


Figure 2 Pin configuration

2.2 Pin definitions and functions

Table 1 Pin definitions and functions

Pin No.	Symbol	Function
1	TxD	Transmit data input; Internal pull-up to V_{CC} , "low" for dominant state.
2	GND	Ground
3	VCC	Transmitter supply voltage; A decoupling capacitor of 1 μ F to <i>ground (GND)</i> is recommended.
4	RxD	Receive data output; "Low" in dominant state.
5	NRM	Not receive-only input; Control input to select receive-only mode, Internal pull-up to V_{CC} , "low" for receive-only mode.
6	CANL	CAN bus low level <i>input/output (I/O)</i>; Bus level on the CANL input/output.
7	CANH	CAN bus high level I/O; Bus level on the CANH input/output.
8	NEN	Not enable input; Internal pull-up to V_{CC} ; "Low" for normal-operating mode or receive-only mode.

3 General product characteristics

3.1 Absolute maximum ratings

Table 2 Absolute maximum ratings voltages, currents and temperatures ¹⁾

All voltages with respect to ground; positive current flowing into pin;
(unless otherwise specified)

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Voltages							
Transmitter supply voltage	V _{CC}	-0.3	–	6.0	V	–	P_7.1.1
CANH and CANL DC voltage versus <i>GND</i>	V _{CANH}	-40	–	40	V	–	P_7.1.3
Differential voltage between CANH and CANL	V _{CAN_Diff}	-40	–	40	V	–	P_7.1.4
Voltage at the digital input pins: NEN, NRM, TxD	V _{MAX_IO}	-0.3	–	6.0	V	–	P_7.1.5
Voltage at the digital output pin: RxD	V _{MAX_RxD}	-0.3	–	V _{CC} +0.3	V	–	P_7.1.9
Currents							
RxD output current	I _{RxD}	-5	–	5	mA	–	P_7.1.6
Temperatures							
Junction temperature	T _j	-40	–	150	°C	–	P_7.1.7
Storage temperature	T _S	-55	–	150	°C	–	P_7.1.8
ESD robustness							
ESD robustness at CANH, CANL versus GND	V _{ESD_HBM_CAN}	-10	–	10	kV	²⁾ HBM;	P_7.1.10
ESD robustnessat all other pins	V _{ESD_HBM_ALL}	-2	–	2	kV	²⁾ HBM;	P_7.1.11
ESD robustness at corner pins	V _{ESD_CDM_CP}	-750	–	750	V	³⁾ CDM	P_7.1.14
ESD immunity at any other pins	V _{ESD_CDM}	-500	–	500	V	³⁾ CDM	P_7.1.12

1) Not subject to production test, specified by design.

2) Human body model (*human body model (HBM)*) robustness according to AE - Q100-002.

3) Charged device model (*charged device model (CDM)*) robustness according to AEC - Q100-011 Rev-D; voltage level refers to test condition (TC) mentioned in the standard.

Note: Latchup robustness: class II according to AEC - Q100-04.

3.2 Functional range

Table 3 Functional range

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Supply voltages							
Transmitter supply voltage	V _{CC}	4.5	–	5.5	V	–	P_7.2.1
Thermal parameters							
Junction temperature	T _j	-40	–	150	°C	1)	P_7.2.3

1) Not subject to production test, specified by design.

Note: Within the functional range the *integrated circuit (IC)* operates as described in the circuit description. The electrical characteristics are specified within the conditions given in the related electrical characteristics table.

3.3 Thermal resistance

Note: This thermal data was generated in accordance with JEDEC JESD51 standards. For more information, please visit www.jedec.org.

Table 4 Thermal resistance ¹⁾

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Thermal resistance							
Junction to ambient PG-DSO-8	R_{thJA_DSO8}	–	120	–	K/W	2)	P_7.3.2
Thermal shutdown (junction temperature)							
Thermal shutdown temperature, rising	T_{JSD}	170	180	190	°C	Temperature falling: minimum 150°C	P_7.3.3
Thermal shutdown hysteresis	ΔT	5	10	20	K	–	P_7.3.4

1) Not subject to production test, specified by design

2) Specified R_{thJA} value is according to JEDEC JESD51-2,-7 at natural convection on FR4 2s2p board. The product was simulated on a $76.2 \times 114.3 \times 1.5 \text{ mm}^3$ board with two inner copper layers ($2 \times 70\mu\text{m Cu}$, $2 \times 35\mu\text{m Cu}$).

4 High speed CAN functional description

HS CAN is a serial bus system that connects microcontrollers, sensors and actuators for real-time control applications. ISO 11898 describes the use of the CAN within road vehicles. According to the 7-layer OSI reference model the physical layer of a HS CAN bus system specifies the data transmission from one CAN node to all other CAN nodes available within the network. The physical layer specification of a CAN bus system includes all electrical specifications of a CAN. The CAN transceiver is part of the physical layer specification.

4.1 High speed CAN physical layer

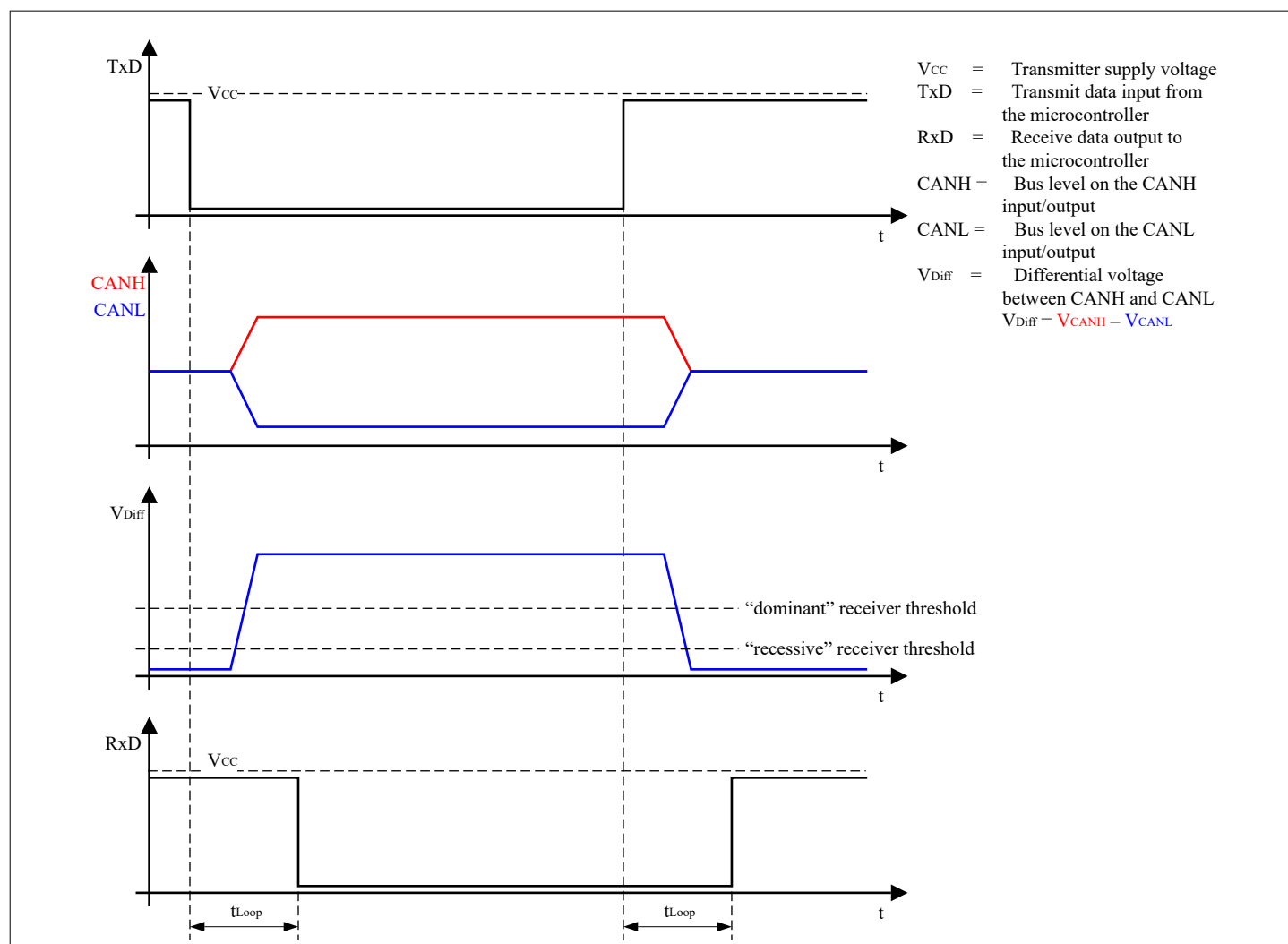


Figure 3 High speed CAN bus signals and logic signals

The device operates as an interface between the [CAN](#) controller and the physical bus medium. A HS CAN is a two wire differential network which allows data transmission rates up to 5 Mbit/s. The characteristics for a HS CAN are the two signal states on the CAN bus: dominant and recessive (see [High speed CAN physical layer](#)).

The CANH and CANL pins are the interface to the CAN bus and both pins operate as an input and output simultaneously. The RxD and TxD pins are the interface to the microcontroller. The pin TxD is the serial data input from the CAN controller, the RxD pin is the serial data output to the CAN controller. As shown in [Figure 1](#) , the device includes a receiver and a transmitter unit, allowing the transceiver to send data to the bus medium and monitor the data from the bus medium at the same time. The device converts the serial data stream which is available on the transmit data input TxD, into a differential output signal on the CAN bus, provided by the CANH and CANL pins. The receiver stage of the device monitors the data on the CAN bus and converts them to a serial, single-ended signal on the RxD output pin. A "low" signal on the TxD pin creates a dominant signal on the CAN bus, followed by a logical "low" signal on the RxD pin (see [High speed CAN physical layer](#)). The feature of broadcasting data to the CAN bus and listening to the data traffic on the CAN bus simultaneously is essential to support the bit-to-bit arbitration within CAN.

ISO 11898-2:2024 specifies the voltage levels for HS CAN transceivers. Whether a data bit is dominant or recessive depends on the voltage difference between the CANH and CANL pins ($V_{\text{Diff}} = V_{\text{CANH}} - V_{\text{CANL}}$).

To transmit a dominant signal to the CAN bus the amplitude of the differential signal V_{Diff} is higher than or equal to 1.5 V. To receive a recessive signal from the CAN bus the amplitude of the differential V_{Diff} is lower than or equal to 0.5 V.

In partially-supplied high speed CAN network, the bus nodes of one common network have different power supply conditions. Some nodes are connected to the power supply, while other nodes are disconnected from the power supply and in power-down state. Regardless of whether the CAN bus subscriber is supplied or not, each subscriber connected to the common bus media must not interfere with the communication. The device is designed to support partially-supplied networks. In power-down state, the receiver input resistors are switched off and the transceiver input has a high resistance.

For permanently supplied ECUs, the device provides a power-save mode . In power-save mode , the power consumption of the device is optimized to a minimum

The voltage level on the digital input TxD and the digital output RxD is determined by the power supply level at the V_{CC} pin. Depending on the voltage level at the V_{CC} pin, the signal levels on the logic pins (STB, TxD and RxD) are compatible with microcontrollers having a 5 V [I/O](#) supply.

5 Modes of operation

The device supports the following modes of operation):

- Normal-operating mode
- Power-save mode
- Receive-only mode

The mode selection input pin NEN and NRM triggers mode changes. An undervoltage event on the supply V_{CC} powers down the device.

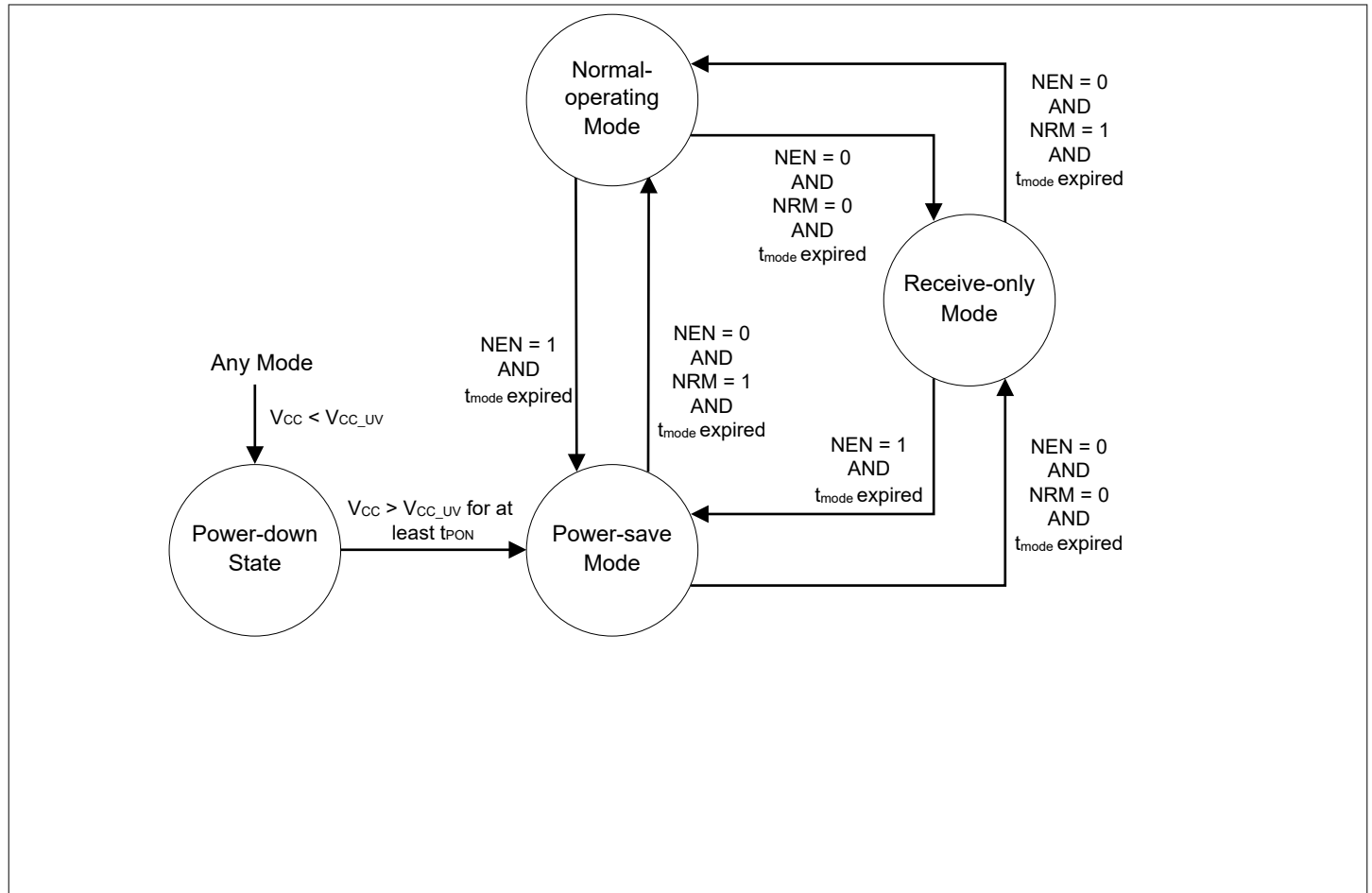


Figure 4 Mode state diagram

5.1 Normal-operating mode

In normal-operating mode all functions of the device are available and the device is fully functional. Data can be received from the HS CAN bus as well as transmitted to the HS CAN bus.

- The transmitter is enabled and drives the serial data stream on the TxD input pin to the bus pins CANH and CANL.
- The receiver is enabled and converts the signal from the bus to a serial data stream on the RxD output pin.
- The bus biasing is connected to $V_{CC}/2$ for $V_{CC} > V_{CC_UV}$.
- The TxD timeout function is enabled (see Chapter 6.4).
- The overtemperature protection is enabled (see Chapter 6.6).
- The undervoltage detection on V_{CC} is enabled (see Chapter 6.3).

The device enters normal-operating mode by setting the mode selection pins NEN to "low" and NRM to "high", see Figure 4. Normal-operating mode can be entered if the device supply V_{CC} is higher than V_{CC_UV} . The device enters normal-operating mode after t_{mode} expires.

Note: *If the device recognizes a recessive signal on the TxD input pin during a mode change from any mode to normal-operating mode, then it enables the transmit path after the mode change.*

If the device recognizes a dominant signal on the TxD input pin during a mode change to normal-operating mode, then it keeps the transmit path disabled and it blocks the dominant signal in order to not disturb the bus communication. As soon as the device recognizes a recessive signal on the TxD input pin, it enables the transmit path again.

5.2 Receive-only mode

In receive-only mode the transmitter is disabled and the receiver is enabled. The TLE9350BSJ can receive data from the HS CAN bus, but cannot transmit data to the HS CAN bus.

- The transmitter is disabled and the data available on the TxD input is blocked.
- The receiver is enabled and converts the signal from the bus to a serial data stream on the RxD output pin.
- The bus biasing is connected to $V_{CC}/2$ for $V_{CC} > V_{CC_UV}$.
- The TxD timeout function is disabled.
- The undervoltage detection on V_{CC} is enabled (see [Chapter 6.3](#)).

If the mode selection pin NRM is set to "low" while NEN is set to "low", then the TLE9350BSJ enters receive-only. V_{CC} must be higher than V_{CC_UV} as a prerequisite to enter receive-only mode. The device enters receive-only mode after t_{mode} expires.

5.3 Power-save mode

In power-save mode the transmitter and receiver are disabled. (see also [Figure 4](#)):

- The transmitter is disabled and the data available on the TxD input is blocked.
- The receiver is disabled and the data available on the bus is blocked.
- The RxD output pin is permanently set to logical "high".
- The bus biasing is connected to high impedance.
- The NEN and NRM input pins are active and change the mode of operation to normal-operating mode or receive-only mode.
- The overtemperature protection is disabled.
- The undervoltage detection on V_{CC} is enabled.

Power-save mode can be entered from normal-operating mode or receive-only mode by setting the NEN pin to logical "high". The device enters this mode after t_{mode} expires or after the period of t_{PON} when coming from power-down state.

5.4 Power-down state

If the supply voltage $V_{CC} < V_{CC_UV}$, then the device powers down independently of Independent of NRM and NEN input pins (see [Figure 5](#)). In power-down state all functions of the device are disabled and the device is switched off. The input resistors of the receiver are disconnected. The CANH and CANL bus interface of the device is floating and acts as a high impedance input with a very low leakage current. The high impedance input does not influence the recessive level of the CAN and allows an optimized EME performance of the entire network. In power-down state the transceiver is an invisible node to the bus. t_{pon} must expire as a prerequisite for the device to exit power-down state.

- The transmitter and receiver are disabled.
- The bus biasing is connected to high impedance.
- The TxD timeout function is disabled.
- The overtemperature protection is disabled.
- The undervoltage detection on V_{CC} is enabled.

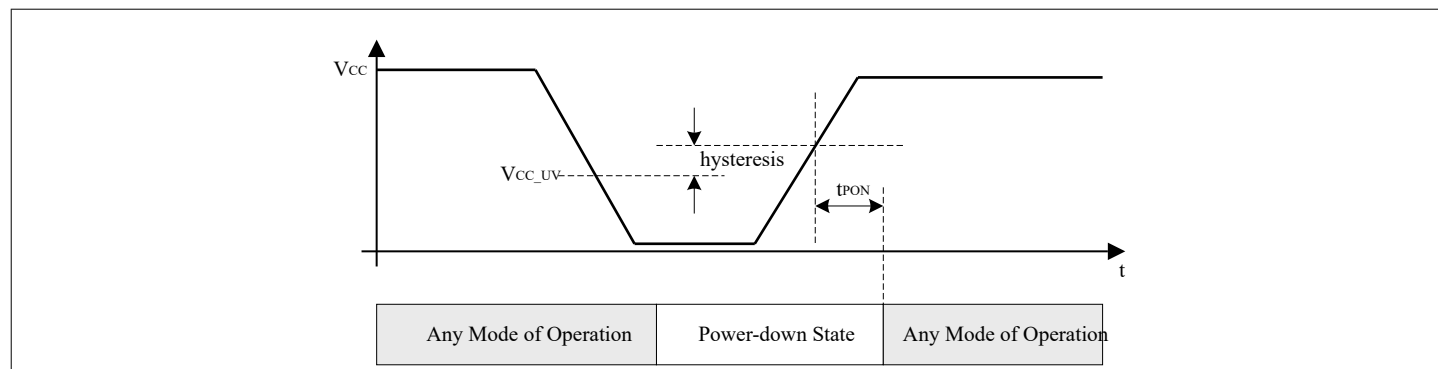


Figure 5 **Power-down and power-up behavior and V_{CC}**

6 Fail safe functions

6.1 Short circuit protection

The CANH and CANL bus outputs are short circuit proof to *GND* and short circuit proof to a supply voltage. The current limiting circuit is designed to protect the transceiver from damage. If the device heats up due to a continuous short on the CANH or CANL, then the internal overtemperature protection switches off the bus transmitter.

6.2 Unconnected logic pins

All logic input pins have an internal pull-up resistor to V_{CC} . If the V_{CC} supply is active and the logical pins are open, the device enters the power-save mode by default.

6.3 V_{CC} undervoltage

If the transceiver supply is in undervoltage condition $V_{CC} < V_{CC_UV}$, then the device switches to power down mode (see Figure 5).

6.4 TxD timeout feature

The TxD timeout feature protects the *CAN* bus against permanent blocking in case the logical signal on the TxD pin is continuously "low". A continuous "low" signal on the TxD pin might have its root cause in a locked-up microcontroller or in a short circuit on the printed circuit board, for example.

In normal-operating mode, a "low" signal on the TxD pin for the time $t > t_{TxD}$ enables the TxD timeout feature and the device disables the transmitter, see Figure 6. The receiver is still active and the device continues to monitor data on the bus via the RxD output pin.

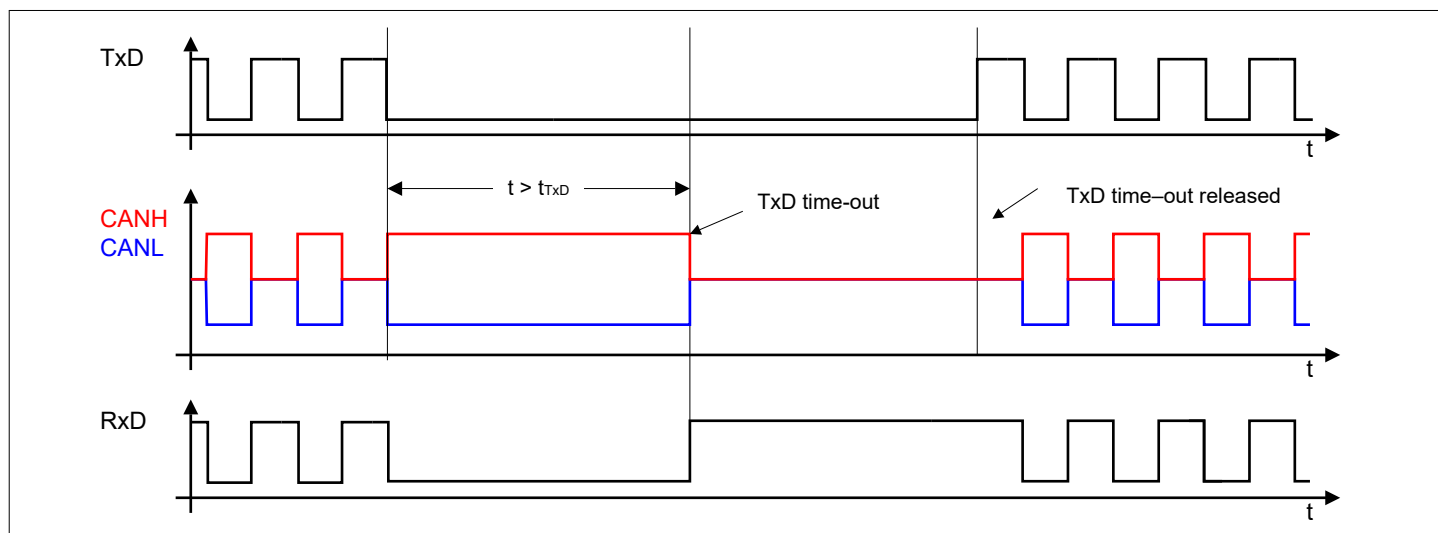


Figure 6 TxD timeout function

Figure 6 shows how the transmitter is deactivated and activated again. A permanent "low" signal on the TxD input pin activates the TxD timeout and deactivates the transmitter. To release the transmitter after a TxD timeout event, the device requires a signal change on the TxD input pin from "low" to "high".

6.5 Delay time for mode change

The device changes the mode of operation within the time window t_{Mode} . During the mode change from power-save mode to non-low power mode the device sets the RxD output "high" permanently, so it does not reflect the status on the CANH and CANL input pins.

After the mode change is completed, the device releases the RxD output pin.

6.6 Overtemperature protection

The device has an integrated overtemperature detection, which is designed to protect the device against thermal overstress of the transmitter. The overtemperature protection is only active in normal-operating mode. In case of an overtemperature condition, the temperature sensor disables the transmitter while the transceiver remains in normal-operating mode. After the device cools down it enables the transmitter again (see [Figure 7](#)). A hysteresis is implemented within the temperature sensor.

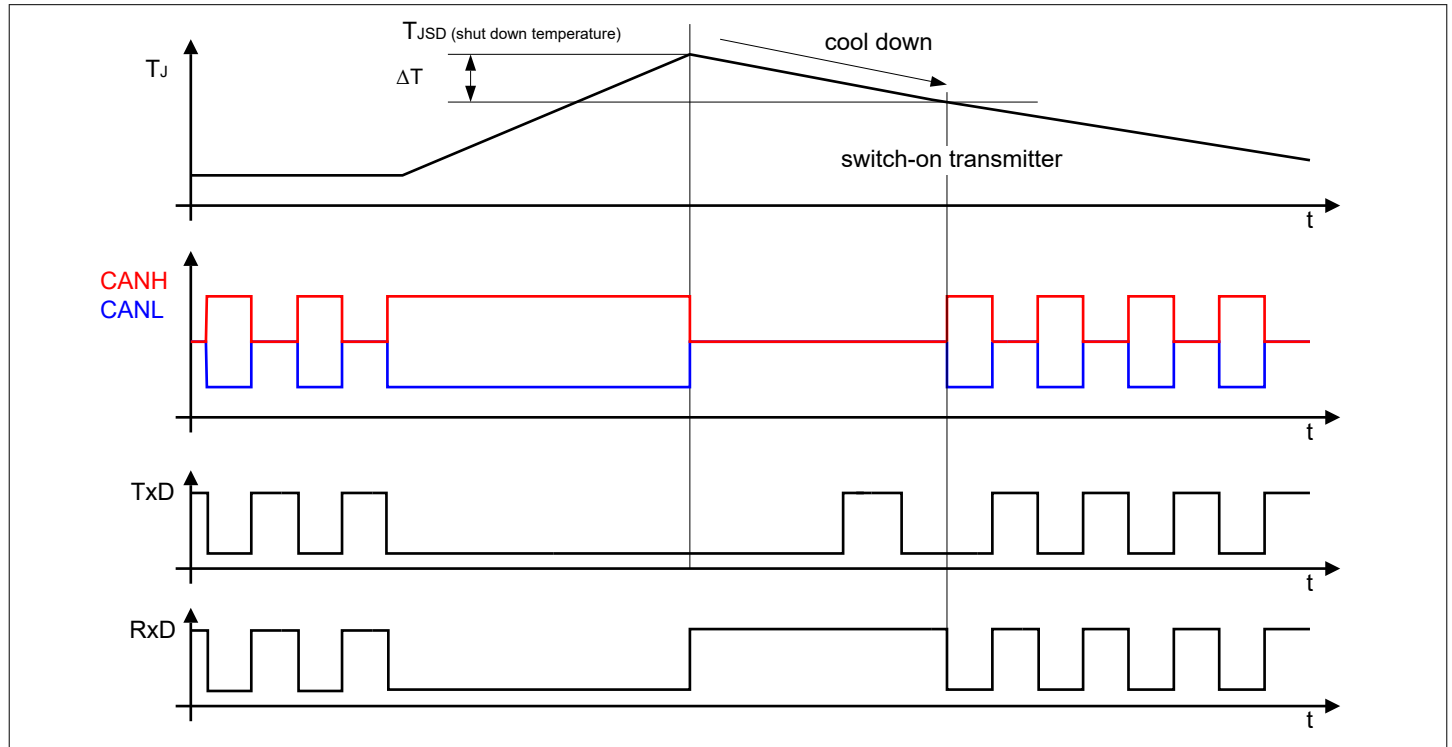


Figure 7 Overtemperature protection

7 Electrical characteristics

7.1 Power supply interface

7.1.1 Electrical characteristics current consumption

Table 5 Electrical characteristics current consumption

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Current consumption at V_{CC} normal-operating mode, recessive state	I_{CC_R}	–	1.4	4	mA	$V_{TxD} = V_{CC}$; $V_{NEN} = 0 \text{ V}$; $V_{NRM} = V_{CC}$; $V_{CANH} = V_{CANL} = V_{CC}/2$	P_8.1.1
Current consumption at V_{CC} normal-operating mode, dominant state	I_{CC_D}	–	34	48	mA	$V_{TxD} = V_{NEN} = 0 \text{ V}$; $V_{NRM} = V_{CC}$	P_8.1.2
Current consumption at V_{CC} power-save mode	$I_{CC} \text{ (PSM)}$	–	5	20	μA	$V_{TxD} = V_{NEN} = V_{NRM} = V_{CC}$	P_8.1.4
Current consumption at V_{CC} receive-only mode	$I_{CC} \text{ (ROM)}$	–	1.5	2.5	mA	$V_{NRM} = V_{NEN} = 0 \text{ V}$;	P_8.1.9

7.1.2 Electrical characteristics undervoltage detection

Table 6 Electrical characteristics undervoltage detection

$4.5\text{ V} < V_{CC} < 5.5\text{ V}$; $R_L = 60\ \Omega$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
V_{CC} undervoltage threshold	V_{CC_UV}	3.8	4.2	4.5	V	See Figure 5	P_8.1.11
V_{CC} undervoltage filter time	$t_{VCC_UV_filter}$	4	6	10	μs	¹⁾ See	P_8.1.13
V_{CC} delay time power-up	t_{PON}	–	40	280	μs	¹⁾ See Figure 5	P_8.1.19

1) Not subject to production test, specified by design.

7.2 Electrical characteristics CAN controller interface

Table 7 Electrical characteristics CAN controller interface

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Receiver output RxD							
"High" level output current	$I_{\text{RxD_H}}$	–	-2.5	-1	mA	$V_{\text{RxD}} = V_{\text{CC}} - 0.4 \text{ V};$ $V_{\text{Diff}} < 0.5 \text{ V}$	P_8.2.1
"Low" level output current	$I_{\text{RxD_L}}$	1	2.5	–	mA	$V_{\text{RxD}} = 0.4 \text{ V};$ $V_{\text{Diff}} > 0.9 \text{ V}$	P_8.2.2
Transmission input TxD							
"High" level input voltage	$V_{\text{TxD_H}}$	$0.7 \times V_{\text{CC}}$	–	6.0	V	Recessive state	P_8.2.3
"Low" level input voltage	$V_{\text{TxD_L}}$	-0.3	–	$0.3 \times V_{\text{CC}}$	V	Dominant state	P_8.2.4
Internal pull-up resistor TxD	R_{TxD}	35	55	70	kΩ	–	P_8.2.7
Input capacitance	C_{TxD}	–	–	10	pF	1)	P_8.2.8
TxD permanent dominant timeout	t_{TxD}	1	2.3	4	ms	Normal-operating mode	P_8.2.9
NRM and NEN input							
"High" level input voltage	$V_{\text{NRM_H/}}/$ NEN_H	$0.7 \times V_{\text{CC}}$	–	6.0	V	–	P_8.2.13
"Low" level input voltage	$V_{\text{NRM_L/}}/$ NEN_L	-0.3	–	$0.3 \times V_{\text{CC}}$	V	–	P_8.2.14
Internal pull-up resistor NRM, NEN input	$R_{\text{NRM/ NEN}}$	35	55	70	kΩ	–	P_8.2.16
Input capacitance	$C_{(\text{NRM}) (\text{NEN})}$	–	–	10	pF	1)	P_8.2.20

1) Not subject to production test, specified by design.

7.3 Electrical characteristics receiver

Table 8 Electrical characteristics receiver

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Differential range dominant normal-operating mode	$V_{\text{Diff_D_Range}}$	0.9	–	8.0	V	¹⁾ $-12 \text{ V} \leq V_{\text{CMR}} \leq 12 \text{ V}$	P_8.3.3
Differential range recessive normal-operating mode	$V_{\text{Diff_R_Range}}$	-3.0	–	0.5	V	¹⁾ $-12 \text{ V} \leq V_{\text{CMR}} \leq 12 \text{ V}$	P_8.3.5
Common mode voltage	V_{CMR}	-12	–	12	V	–	P_8.3.11
Single ended internal resistance	$R_{\text{CAN_H}}, R_{\text{CAN_L}}$	6	40	50	k Ω	¹⁾ Recessive state; $-2 \text{ V} \leq V_{\text{CANH}} \leq 7 \text{ V}$; $-2 \text{ V} \leq V_{\text{CANL}} \leq 7 \text{ V}$	P_8.3.12
Differential internal resistance	R_{Diff}	12	80	100	k Ω	¹⁾ Recessive state; $-2 \text{ V} \leq V_{\text{CANH}} \leq 7 \text{ V}$; $-2 \text{ V} \leq V_{\text{CANL}} \leq 7 \text{ V}$	P_8.3.14
Input resistance deviation between CANH and CANL	ΔR_i	-2	–	2	%	¹⁾ Recessive state; $V_{\text{CANH}} = V_{\text{CANL}} = 5 \text{ V}$	P_8.3.16
Input capacitance CANH, CANL versus GND	C_{In}	–	–	40	pF	^{1) 2)} Recessive state; normal-operating mode	P_8.3.17
Differential input capacitance	C_{InDiff}	–	4	20	pF	^{1) 2)} Recessive state; normal-operating mode	P_8.3.18

1) Not subject to production test, specified by design.

2) S2P-method; $f = 10 \text{ MHz}$.

7.4 Electrical characteristics transmitter

Table 9 Electrical characteristics transmitter

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
CANL, CANH recessive output voltage normal-operating mode	$V_{\text{CANL,H}}$	2.0	2.5	3.0	V	$V_{\text{TXD}} = V_{\text{CC}}$; no load	P_8.4.1
CANH, CANL recessive output voltage difference normal-operating mode	$V_{\text{Diff_R_NM}} = V_{\text{CANH}} - V_{\text{CANL}}$	-50	-10	50	mV	$V_{\text{TXD}} = V_{\text{CC}}$; no load	P_8.4.2
CANL dominant output voltage normal-operating mode	V_{CANL}	0.5	1.5	2.25	V	$V_{\text{TXD}} = 0 \text{ V}$; $50 \Omega < R_L < 65 \Omega$	P_8.4.3
CANH dominant output voltage normal-operating mode	V_{CANH}	2.75	3.4	4.5	V	$V_{\text{TXD}} = 0 \text{ V}$; $50 \Omega < R_L < 65 \Omega$	P_8.4.4
Differential voltage dominant normal-operating mode $V_{\text{Diff}} = V_{\text{CANH}} - V_{\text{CANL}}$	$V_{\text{Diff_D_NM}}$	1.5	1.9	2.5	V	$V_{\text{TXD}} = 0 \text{ V}$; $50 \Omega < R_L < 65 \Omega$; $4.75 \text{ V} < V_{\text{CC}} < 5.25 \text{ V}$	P_8.4.5
Differential voltage dominant extended bus load normal-operating mode	$V_{\text{Diff_EXT_BL}}$	1.4	1.9	3.3	V	$V_{\text{TXD}} = 0 \text{ V}$; $45 \Omega < R_L < 70 \Omega$; $4.75 \text{ V} < V_{\text{CC}} < 5.25 \text{ V}$	P_8.4.6
Differential voltage dominant high extended bus load normal-operating mode	$V_{\text{Diff_HEXT_BL}}$	1.5	3.5	5.0	V	¹⁾ $V_{\text{TXD}} = 0 \text{ V}$; $R_L = 2240 \Omega$; static behavior; $4.75 \text{ V} < V_{\text{CC}} < 5.25 \text{ V}$	P_8.4.7
Driver symmetry ($V_{\text{SYM}} = V_{\text{CANH}} + V_{\text{CANL}}$)	V_{SYM}	$0.9 \times V_{\text{CC}}$	$1.0 \times V_{\text{CC}}$	$1.1 \times V_{\text{CC}}$	V	^{1) 2)} $C_1 = 4.7 \text{ nF}$	P_8.4.10
CANL short circuit current	I_{CANLsc}	-115	90	115	mA	¹⁾ $-3 \text{ V} < V_{\text{CANLshort}} < 18 \text{ V}$; $t < t_{\text{TXD}}$; $V_{\text{TXD}} = 0 \text{ V}$	P_8.4.11
CANH short circuit current	I_{CANHsc}	-115	-90	115	mA	¹⁾ $-3 < V_{\text{CANHshort}} < 18 \text{ V}$; $t < t_{\text{TXD}}$; $V_{\text{TXD}} = 0 \text{ V}$	P_8.4.13
Leakage current, CANH	$I_{\text{CANH,lk}}$	-5	1	5	μA	$V_{\text{CC}} = 0 \text{ V}$; $0 \text{ V} < V_{\text{CANH}} \leq 5 \text{ V}$; $V_{\text{CANH}} = V_{\text{CANL}}$	P_8.4.19

(table continues...)

Table 9 (continued) Electrical characteristics transmitter

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Leakage current, CANL	$I_{CANL, lk}$	-5	1	5	μA	$V_{CC} = 0 \text{ V}$; $0 \text{ V} < V_{CANL} \leq 5 \text{ V}$; $V_{CANH} = V_{CANL}$	P_8.4.20
CANH, CANL output voltage difference slope, recessive to dominant	$V_{diff_slope_rd}$	–	42	70	$\text{V}/\mu\text{s}$	1) 30% to 70% of measured differential bus voltage; $C_2 = 100 \text{ pF}$; $R_L = 60 \Omega$; $4.75 \text{ V} < V_{CC} < 5.25 \text{ V}$	P_8.4.21
CANH, CANL output voltage difference slope, dominant to recessive	$V_{diff_slope_dr}$	-70	-42	–	$\text{V}/\mu\text{s}$	1) 70% to 30% of measured differential bus voltage; $C_2 = 100 \text{ pF}$; $R_L = 60 \Omega$; $4.75 \text{ V} < V_{CC} < 5.25 \text{ V}$	P_8.4.22

1) Not subject to production test, specified by design.

2) V_{SYM} is observed during dominant and recessive state and also during the transition from dominant to recessive state and vice versa, while TxD is stimulated by a square wave signal with a frequency of 1 MHz .

7.5 Electrical characteristics dynamic transceiver parameters

Table 10 Electrical characteristics dynamic transceiver parameters

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Propagation delay TxD-to-RxD	t_{Loop}	80	150	235	ns	$C_1 = 0 \text{ pF}$; $C_2 = 100 \text{ pF}$; $C_2 = 150 \text{ pF}$; (see Figure 9)	P_8.5.1
Propagation delay increased load TxD-to-RxD	$t_{\text{Loop}_{150}}$	80	180	330	ns	$C_1 = 0 \text{ pF}$; $C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; $R_L = 150 \Omega$	P_8.5.2
Propagation delay TxD to bus "low" to dominant	$t_{\text{d(L)}_T}$	30	70	140	ns	$C_1 = 0 \text{ pF}$; $C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; (see Figure 9)	P_8.5.3
Propagation delay TxD to bus "high" to recessive	$t_{\text{d(H)}_T}$	30	90	140	ns	$C_1 = 0 \text{ pF}$; $C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; (see Figure 9)	P_8.5.4
Propagation delay bus to RxD dominant to "low"	$t_{\text{d(L)}_R}$	30	90	140	ns	$C_{\text{RxD}} = 15 \text{ pF}$; Independent of t_{Bit} ; (see Figure 9)	P_8.5.5
Propagation delay bus to RxD recessive to "high"	$t_{\text{d(H)}_R}$	30	100	140	ns	$C_{\text{RxD}} = 15 \text{ pF}$; Independent of t_{Bit} ; (see Figure 9)	P_8.5.6

Delay times

Delay time for mode change	t_{Mode}	–	12	20	μs	¹⁾	P_8.5.7
----------------------------	-------------------	---	----	----	---------------	---------------	---------

CAN FD characteristics

Received recessive bit width variation up to 2 Mbit/s	$t_{\text{Bit(RxD)}_{2M}}$	-100	–	50	ns	$C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; $t_{\text{Bit}} = 500 \text{ ns}$; see Figure 10	P_8.5.13
--	----------------------------	------	---	----	----	--	----------

(table continues...)

Table 10 (continued) Electrical characteristics dynamic transceiver parameters

4.5 V < V_{CC} < 5.5 V; $R_L = 60 \Omega$; $-40^\circ\text{C} < T_j < 150^\circ\text{C}$; all voltages with respect to ground; positive current flowing into pin; unless otherwise specified.

Parameter	Symbol	Values			Unit	Note or Test Condition	Number
		Min.	Typ.	Max.			
Received recessive bit width variation up to 5 Mbit/s	$t_{\text{Bit(RxD)}}_{5\text{M}}$	-80	–	20	ns	$C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; $t_{\text{Bit}} = 200 \text{ ns}$; see Figure 10	P_8.5.14
Transmitted recessive bit width variation up to 2 Mbit/s	$t_{\text{Bit(Bus)}}_{2\text{M}}$	-45	–	10	ns	$C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; $t_{\text{Bit}} = 500 \text{ ns}$; see Figure 10	P_8.5.15
Transmitted recessive bit width variation up to 5 Mbit/s	$t_{\text{Bit(Bus)}}_{5\text{M}}$	-45	–	10	ns	$C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; $t_{\text{Bit}} = 200 \text{ ns}$; see Figure 10	P_8.5.16
Receiver timing symmetry up to 2 Mbit/s $\Delta t_{\text{Rec}_2\text{M}} = t_{\text{Bit(RxD)}}_{2\text{M}} - t_{\text{Bit(Bus)}}_{2\text{M}}$	$\Delta t_{\text{Rec}_2\text{M}}$	-45	-23	15	ns	$C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; $t_{\text{Bit}} = 500 \text{ ns}$; $4.75 \text{ V} < V_{CC} < 5.25 \text{ V}$; see Figure 10	P_8.5.17
Receiver timing symmetry up to 5 Mbit/s	$\Delta t_{\text{Rec}_5\text{M}}$	-45	-23	15	ns	$C_2 = 100 \text{ pF}$; $C_{\text{RxD}} = 15 \text{ pF}$; $t_{\text{Bit}} = 200 \text{ ns}$; $4.75 \text{ V} < V_{CC} < 5.25 \text{ V}$; see Figure 10	P_8.5.18

1) Not subject to production test, specified by design.

7.6 Diagrams

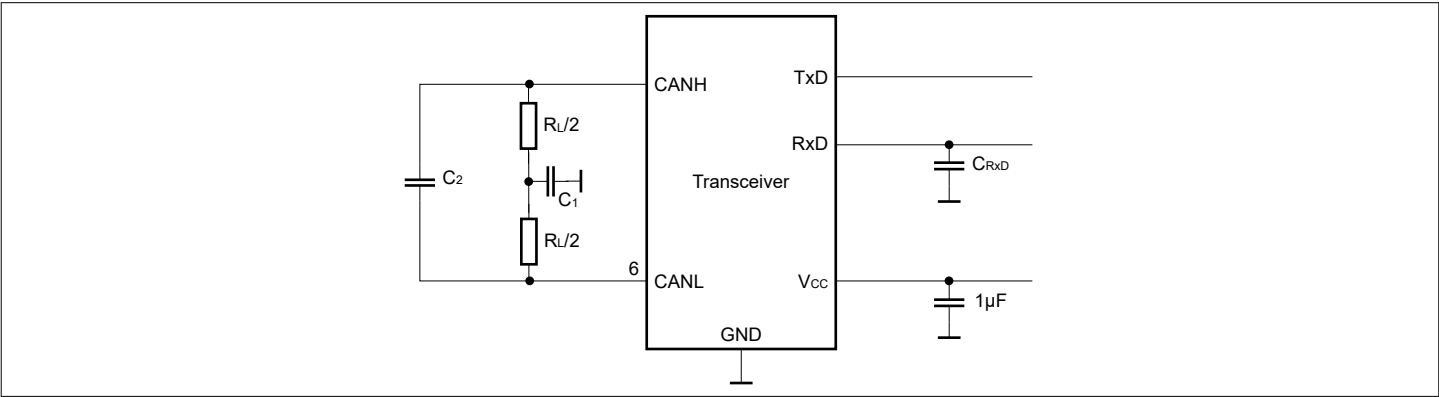


Figure 8 Test circuit

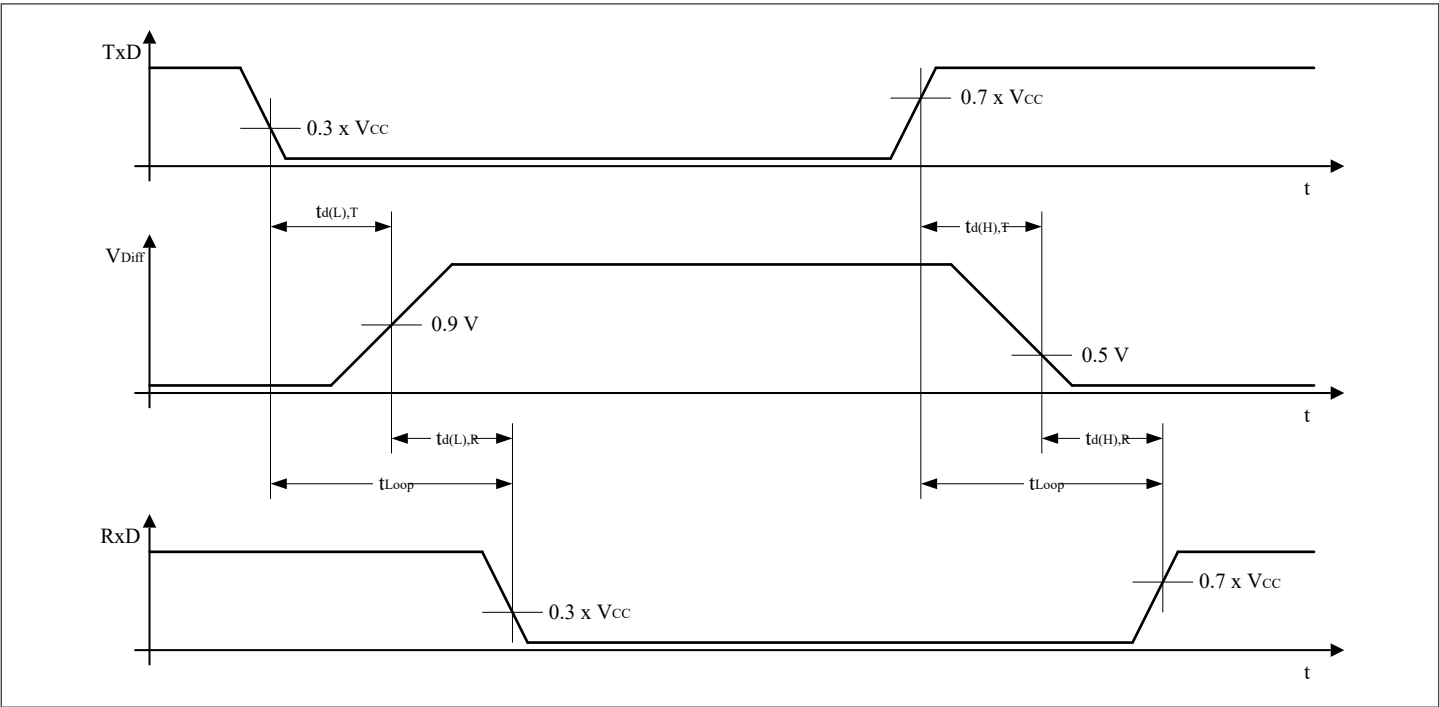


Figure 9 Timing diagrams for dynamic characteristics

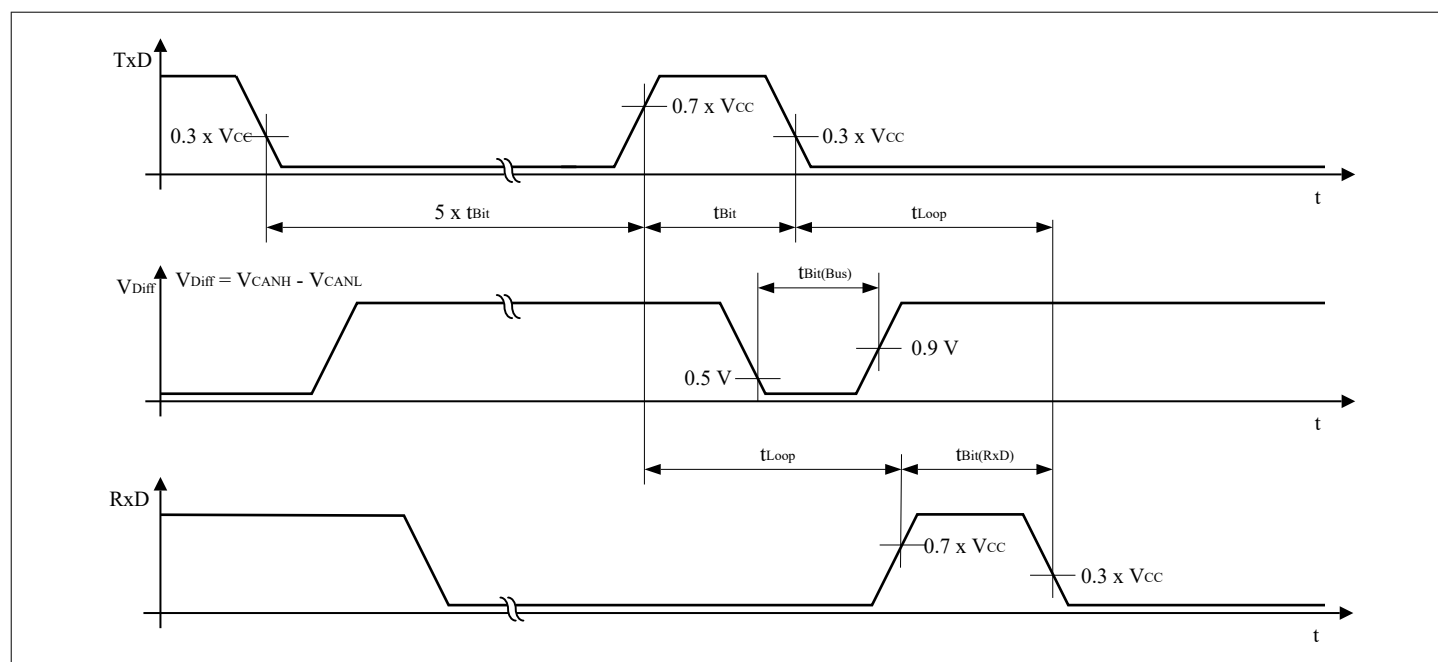


Figure 10 Recessive bit time for five dominant bits followed by one recessive bit

8 Application information

8.1 ESD robustness according to IEC 61000-4-2

Tests for [ESD](#) robustness according to IEC 61000-4-2 Gun test (150 pF, 330 Ω) have been performed. The results and test conditions are available in a separate test report.

Table 11 ESD robustness according to IEC 61000-4-2

Performed test	Result	Unit	Remarks
Electrostatic discharge voltage at pin CANH and CANL versus GND	$\geq +8$	kV	¹⁾ Positive pulse
Electrostatic discharge voltage at pin CANH and CANL versus GND	≤ -8	kV	¹⁾ Negative pulse

- 1) Not subject to production test. ESD robustness "ESD GUN" according to GIFT/ICT paper: "[EMC](#) Evaluation of [CAN](#) Transceivers, version IEC TS62228", section 4.3. (DIN EN61000-4-2)
 Tested by external test facility (IBEE Zwickau).

8.2 Application example

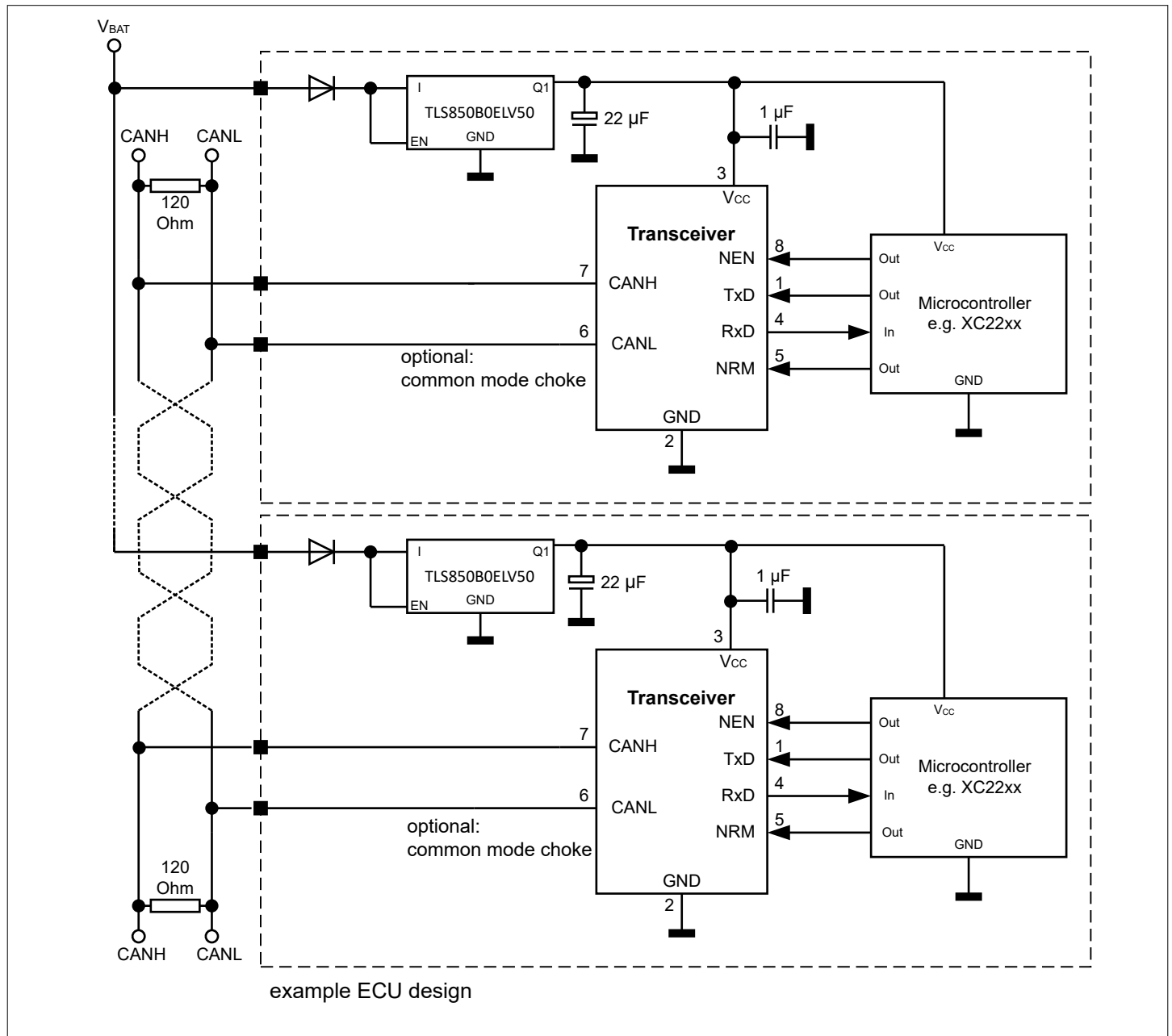


Figure 11 Application circuit

8.3 Further application information

For further information you may visit: <https://www.infineon.com/automotive-transceiver>

9 Package information

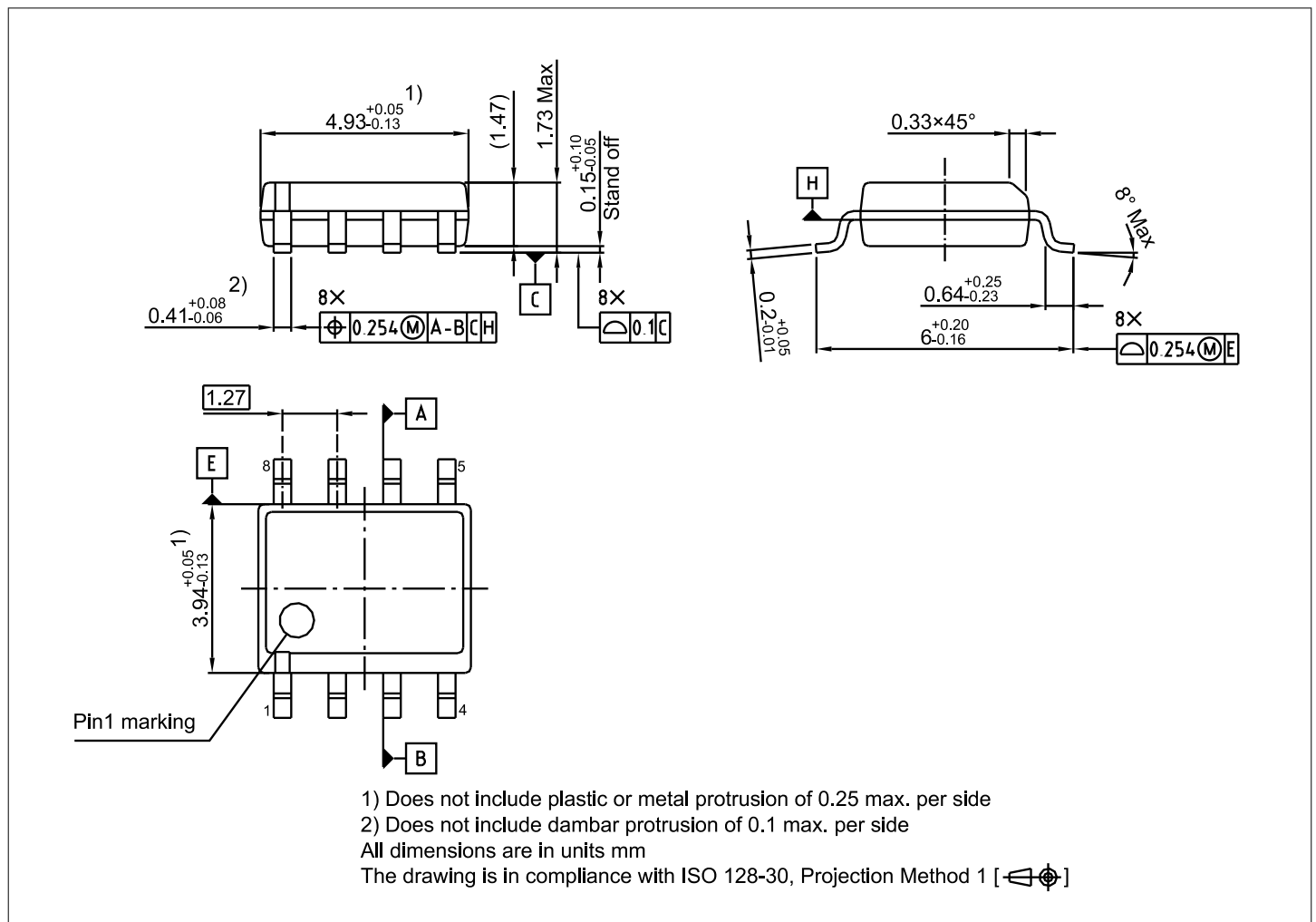


Figure 12 PG-DSO-8

Green Product (RoHS compliant)

To meet the world-wide customer requirements for environmentally friendly products and to be compliant with government regulations, the device is available as a Green Product. Green Products are RoHS compliant (Pb-free finish on leads and suitable for Pb-free soldering according to IPC/JEDEC J-STD-020).

Information on packages

For more information on packages, such as recommendations on assembly, refer to www.infineon.com/packages.

Glossary

CAN

controller area network (CAN)

CDM

charged device model (CDM)

A model for characterizing the susceptibility of an electronic device to damage from electrostatic discharge (ESD).

EMC

electromagnetic compatibility (EMC)

The ability of electrical equipment and systems to function acceptably in their electromagnetic environment, by limiting the unintentional generation, propagation and reception of electromagnetic energy which may cause unwanted effects such as electromagnetic interference (EMI) or even physical damage in operational equipment.

EME

electromagnetic emission (EME)

An emission within the electromagnetic spectrum.

ESD

electrostatic discharge (ESD)

A sudden and momentary flow of electric current between two electrically charged objects caused by contact, an electrical short or dielectric breakdown.

GND

ground (GND)

HBM

human body model (HBM)

A model for characterizing the susceptibility of an electronic device to damage from electrostatic discharge (ESD) based on a human body.

I/O

input/output (I/O)

The communication between an information processing system and another information processing system.

IC

integrated circuit (IC)

A miniature electronic circuit built on the surface of a thin substrate of a semiconductor material.

RoHS

Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS)

European Union (EU) rules restricting the use of hazardous substances in electrical and electronic equipment to protect the environment and public health.

Revision history

Revision	Date	Changes
1.02	2025-12-18	Editorial changes: Datasheet updated according to ISO 11898-2:2024
1.01	2025-10-17	- Datasheet updated according to ISO 11898-2:2024 - Editorial changes
1.00	2023-08-11	Datasheet created

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2025-12-18

Published by

Infineon Technologies AG
81726 Munich, Germany

© 2025 Infineon Technologies AG
All Rights Reserved.

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-awv1752764654512
Z8F80194901

Important notice

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenhheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.