MCT1042T-3

High-Speed Bus Transceiver

Data Sheet

Version: 1.3

Features

- Compliant with ISO11898 standard
- High speed (up to 5 Mbaud)
- Low electromagnetic emissions (EME)
- Differential receiver with a wide common-mode range
- Low EME and high EMI robustness
- Standby mode with remote wake-up via the bus
- Transmit Data (TXD) dominant time-out function
- Bus-dominant time-out function in Standby mode
- I/O voltage range supported from 3.3V to 5V for MCT1042T-3
- Under-voltage detection on pins VCC and VIO
- Equipped with thermal protection functionality
- Bus ESD protection (±8kV)
- Bus DC withstand voltage (±70V)

Contents

Figures

Tables

1. General Introduction

1.1 Product Overview

The MCT1042T-3 is an interface circuit between the Controller Area Network (CAN) protocol controller and the physical bus. It is applicable to automotive and industrial control fields, with speeds of up to 5M baud. The MCT1042T-3 provides differential transmission and reception functionality for the bus CAN controller.
The MCT1042T-3 has excellent EMC performance. It offers ideal passive performance in a power-off state, supports low-power management, and enables remote wake-up functionality.

1.2 Pin arrangement

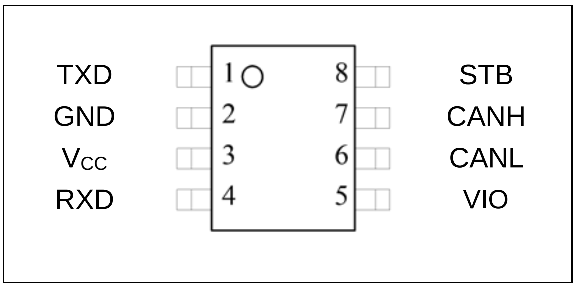

Figure 1 SOP8 pinout diagram

2 Applications

Electric Assisted Vehicle
Industrial Control, Elevator Control

2.1 Pin Configuration

Table 1 Pin Functions

No.	Symbol	Function Description	No.	Symbol	Function Description
1	TXD	Transmit Data Input	5	VIO	3V- VIO supply voltage for I/O level adapter, MCT1042T-3 variants only.
2	GND	Ground	6	CANL	Low-Level CAN Bus
3	VCC	Power Supply	7	CANH	High-Level CAN Bus
4	RXD	Receive Data Output	8	STB	Standby Mode Control Input

Table 2 Ordering Information

Product Name	Package Type	Packing Form	Minimum Packing Quantity
MCT1042T-3	SOP8	Tape and Reel	4K Units

2.2 Circuit Functional Block Diagram

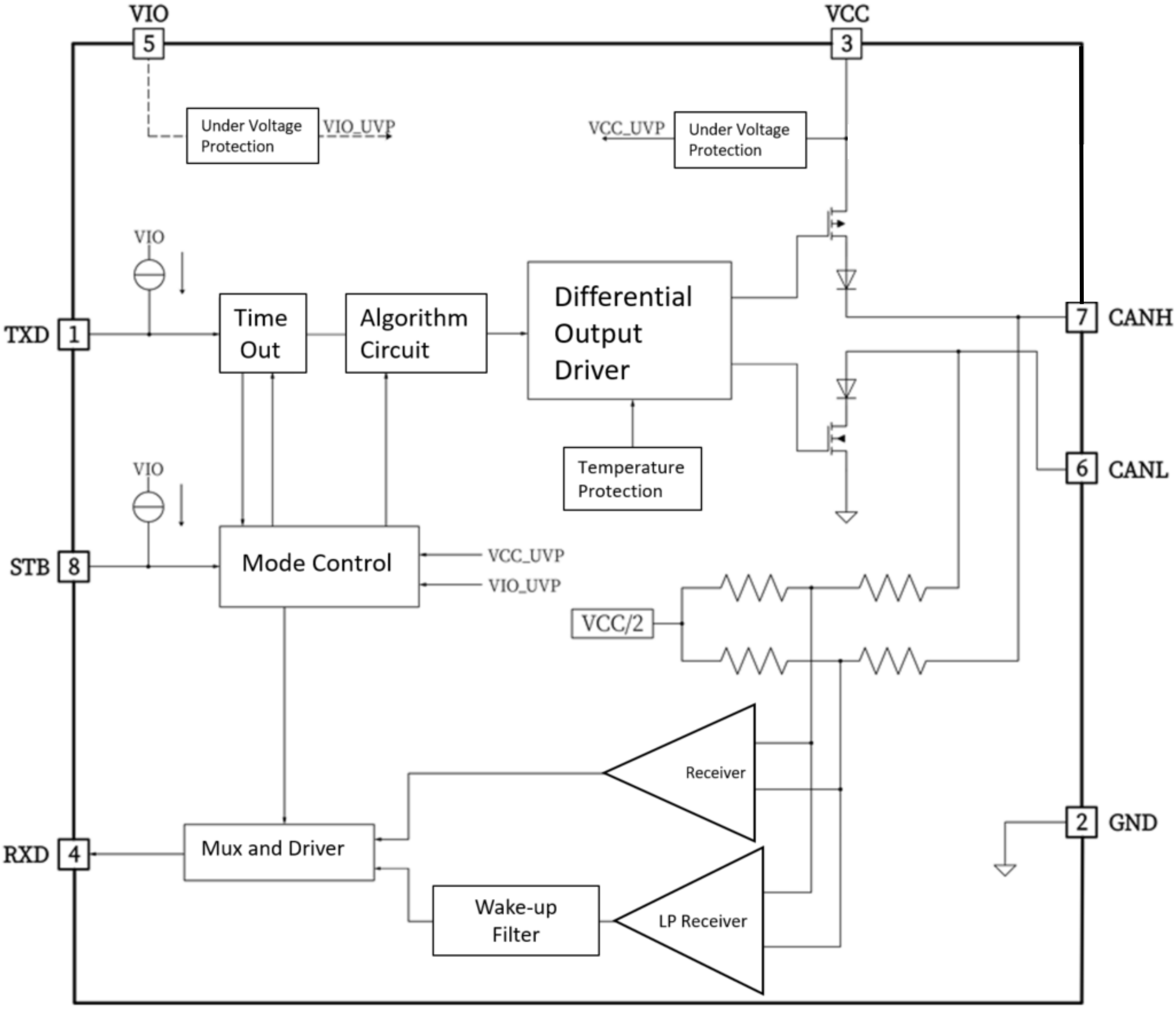

Figure 2 Structure diagram

2.3 Maximum Ratings (Unless Otherwise Specified, TA = 25°C)

Table 3 Maximum rated value

Item	Symbol	Condition		Range	Unit
Supply Voltage	V_{CC}	Tolerable Voltage		−0.3～7	V
		Operating Range		4.5 ~ 5.5	V
	V_{IO}	Tolerable Voltage		−0.3～7	V
		Operating Range		2.8 ~ 5.5	V
CANH, CANL Common-Mode Voltage	V_{CAN}			−70～70	V
Bus Differential Voltage	V_{diff}			−27～27	V
Electrostatic Discharge Voltage	V_{ESD}	Human Body Model		−8～8	kV
		Machine Model		−300～300	V
		Charged Device Model	Corner Pins	-750～750	V
			Other Pins	-500～500	V
Actual Junction Temperature	T_{VJ}			−40～150	℃
Storage Temperature	T_{STG}			−55～150	℃

Electrical Parameters

(All typical values are measured under the conditions of TA = 25°C, VCC = 5V, and RL = 60Ω unless otherwise specified. All voltages are referenced to ground, and positive current flows into the IC.)

Table 4 Bus Electrical Characteristics

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Power Section (VCC/VIO)						
VCC Supply Current	I_{CC}	Normal Mode: Recessive VTXD = VIO	1.5	5	10	mA
		Normal Mode: Dominant VTXD = 0V	20	45	70	mA
		Standby Mode: MCT1042T-3		0.5	5	μA
VIO Supply Current	I_{IO}	Normal Mode: Recessive VTXD = VIO		80	200	μA
		Normal Mode: Dominant VTXD = 0V		350	1000	μA
		Standby Mode: VTXD = VIO		12	17	μA
VCC Under-voltage Protection	V_{uvp_VCC}		3.5		4.5	V
VIO Under-voltage Protection	V_{uvp_VIO}		1.3	2	2.7	V
Transmit Data Input (TXD)						
High-Level Input Voltage	VIH	-	0.7VIO	-	VIO+0.3	V
Low-Level Input Voltage	VIL	-	-0.3	-	0.3VIO	V
High-Level Input Current	IIH	VTXD = VIO	-5		5	μA
Low-Level Input Current	IIL	Normal Mode：VTXD = 0V	-260	-150	-30	μA
Standby Control Input (STB)						
High-Level Input Voltage	VIH	-	0.7VIO		VIO+0.3	V
Low-Level Input Voltage	VIL	-	-0.3		0.3VIO	V
High-Level Input Current	IIH	VSTB = VIO	-1		1	μA
Low-Level Input Current	IIL	VSTB = 0V	-15		-1	μA
Receive Data Output (RXD)						
High-Level Output Current	IOH	Normal Mode：VRXD = VIO - 0.4V	-8	-3	-1	mA
Low-Level Output Current	IOL	VRXD = 0.4V，Bus Dominant	2	5	12	mA

Table 5 Bus Transmitter Characteristics

Pin CANH Dominant Output Voltage	$V_{OH(D)}$	V_{TXD} = 0V	2.75	3.5	4.5	V
Pin CANL Dominant Output Voltage	$V_{OL(D)}$	V_{TXD} = 0V	0.5	1.5	2.25	V
Bus Differential Output Voltage (Dominant)	$V_{O(D)}$	V_{TXD} = 0V	1.5		3	V
Bus Differential Output Voltage (Recessive)	$V_{OD(R)}$	$V_{TXD} = V_{IO}$；Recessive 45Ω<R_L<65Ω	-12	-	12	mV
		$V_{TXD} = V_{IO}$；Recessive No Load	-50	-	50	mV
Dominant Output Voltage Symmetry	$V_{dom(TX)sym}$	$V_{dom(TX)sym}$= V_{CC} - V_{CANH} - V_{CANL}	-400		400	mV
Output Voltage Symmetry	$V_{(TX)sym}$	$V_{(TX)sym}$ = V_{CANH} + V_{CANL}	0.9 V_{CC}		1.1 V_{CC}	V
Short-Circuit Output Current (Dominant)	I_{OS}	V_{CANH} = -12V，V_{CANL} = open	-100	-70		mA
		V_{CANH} = 12V，V_{CANL} = open		0.36	1	mA
		V_{CANL} = -12V，V_{CANH} = open	-1	0.5		mA
		V_{CANL} = 12V，V_{CANH} = open		70	100	mA
Recessive Output Current	$I_{O(R)}$	Normal Mode：$V_{TXD} = V_{IO}$ -27V< V_{CAN} <32V	-5.0		5.0	mA
Propagation Delay (Low to High)	t_{PLH}	V_{STB} = 0V		90		ns
Propagation Delay (High to Low)	t_{PHL}			65		ns
Differential Output Rise Time	t_r			45		ns
Differential Output Fall Time	t_f			45		ns
Standby to Normal Mode Delay	$t_{d(stb-norm)}$				47	µs
TXD Dominant Timeout	t_{dom_TXD}		0.3	2	5	ms
BUS Dominant Timeout	t_{dom_BUS}		0.3	2	5	ms
Bus Wake-Up Time	t_{wake}		0.5		5	µs

Table 6 Bus Receiver Characteristics

Positive Input Threshold	V_{IT+}	V_{STB} = 0V	500	700	900	mV
Negative Input Threshold	V_{IT-}			650		mV
Threshold Hysteresis	V_{HYS}		50	120	200	mV
Bus Input Current During Power-Down	$I_{O(off)}$	V_{CANH} or V_{CANH} = 5V, Other pin = 0V	-5		5	µA
Input Capacitance of CANH, CANL to Ground	C_{IN}				20	pF
Differential Input Capacitance of CANH, CANL	C_{ID}				10	pF
Input Resistance of CANH, CANL to Ground	R_{IN}	V_{TXD} = V_{IO}, V_{STB} = 0V	9	15	28	KΩ
Differential Input Resistance of CANH, CANL	R_{ID}		19	30	52	KΩ
Input Resistance Mismatch	R_{Imatch}		-1		1	%
Common-Mode Voltage Range	V_{COM}		-30		30	V
Propagation Delay (Low to High)	t_{PLH}	V_{STB} = 0V		65		ns
Propagation Delay (High to Low)	t_{PHL}			60		ns
Differential Output Rise Time	t_r			10		ns
Differential Output Fall Time	t_f			10		ns

Device Switching Characteristics

Bit Time of BUS Output Pin	$t_{bit(BUS)}$	$t_{bit(TXD)}$ = 500ns	435		530	ns
		$t_{bit(TXD)}$ = 200ns	155		210	ns
Bit Time of RXD Output Pin	$t_{bit(RXD)}$	$t_{bit(TXD)}$ = 500ns	400		550	ns
		$t_{bit(TXD)}$ = 200ns	120		220	ns
Loop Delay 1: Driver Input to Receiver Output, Recessive to Dominant	$T_{d(LOOP1)}$	V_{STB} = 0V	60		220	ns
Loop Delay 2: Driver Input to Receiver Output, Dominant to Recessive	$T_{d(LOOP2)}$		60		220	ns

Thermal Shutdown

Shutdown Junction Temperature	$T_{j(sd)}$			190		℃

3 Application Notes

3.1 Overview

The MCT1042T-3 serves as an interface between the Controller Area Network (CAN) protocol controller and the physical bus. It can be used in applications such as trucks, buses, passenger cars, and industrial control systems, with speeds of up to 5M baud. The provides differential transmission and reception functionality for CAN bus controllers.

The MCT1042T-3 features excellent EMC performance and offers ideal passive performance in a power-off state. It also supports low-power management and remote wake-up functionality. The I/O voltage range of the MCT1042T-3 is compatible with MCUs operating at 3.3V to 5V.

4 Operating Modes and Wake-Up Function

Table 7 The MCT1042T-3 has two operating modes, as shown in the table below:

Mode	STB	TXD	Bus	RXD
Standby Mode	High or Floating	-	No Wake-Up Request	High
Standby Mode	High or Floating	-	Wake-Up Request Detected	Low
Normal Mode	Low	High or Floating	Recessive State	High
Normal Mode	Low	Low	Dominant State	Low

When the STB pin is set to high or left floating, the circuit enters standby mode, and both the bus driver and receiver are turned off. A low-power receiver monitors the bus state, and if a dominant bus level exceeding the wake-up threshold t_{wake} is detected, the RXD pin output goes low.

When the STB pin is set to low, the circuit enters normal mode, and the bus driver and receiver operate normally. When the TXD pin is high or left floating, the bus is in a recessive state, and the RXD pin output is high. When the TXD pin is set to low, the bus enters a dominant state, and the RXD pin output goes low.

5 Dominant Timeout Function

In normal mode, the falling edge of the TXD pin triggers an internal timer. If the low-level duration on the TXD pin exceeds the threshold t_{dom_TXD}, the transceiver is disabled, and the bus is forced into the recessive state. The rising edge of the TXD pin resets the timer, allowing the transceiver to resume operation.

In standby mode, if the bus remains in the dominant state for a duration exceeding the internal timer value t_{dom_BUS}, the RXD pin is forced high, and the bus is reset to the recessive state.

The dominant timeout function in both modes prevents the TXD pin from being stuck in a permanent low state due to hardware or software failures, which could result in a permanently dominant bus state, blocking network communication. It also prevents permanent wake-ups caused by bus short circuits or failures in other nodes on the network.

6 Overheat Protection

The output driver is equipped with overheat protection. If the temperature exceeds 190°C, the output driver is disabled. Since the driver is the primary energy-consuming component, disabling it reduces power consumption and helps lower the chip temperature. Meanwhile, the receiver and other modules are not affected by the overheat protection and continue to function normally. The output driver will only resume operation once the detected temperature drops below 190°C.

7 Short-Circuit Protection

The MCT1042T-3 driver features current-limiting protection to prevent increased power consumption and driver damage in case of a short circuit to the positive or negative power supply.

8 Under-voltage Protection

The MCT1042T-3 includes Under-voltage detection. If VCC or VIO falls below the Under-voltage threshold, the bus output enters a high-impedance state, providing protection.

9 Fail-Safe Function

The TXD pin has an internal pull-up. When the TXD pin is left floating, the transceiver remains in the recessive state.

The STB pin also has an internal pull-up. When the STB pin is left floating, the transceiver remains in standby mode.

If VCC loses power, the TXD, STB, and RXD pins become floating to prevent reverse currents through these pins.

10 Application Circuit

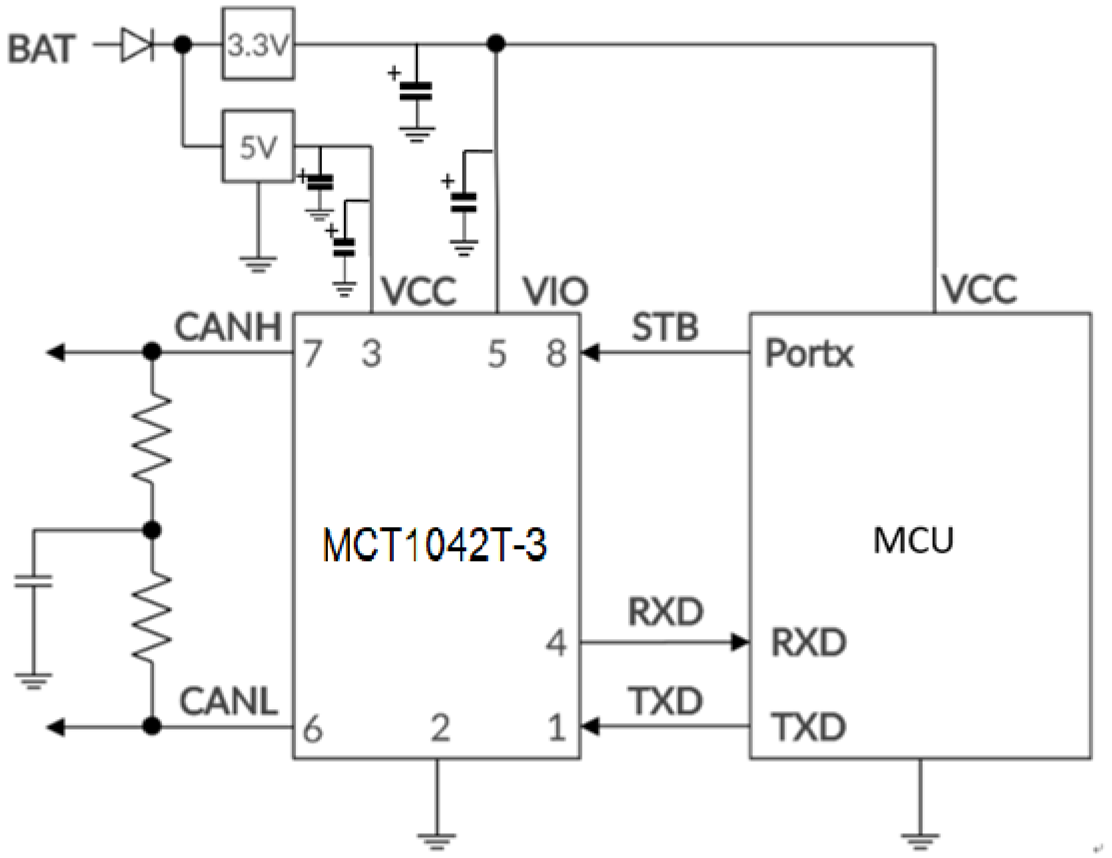

Figure 3 Typical Application of MCT1042T-3 with a 3.3V Microcontroller

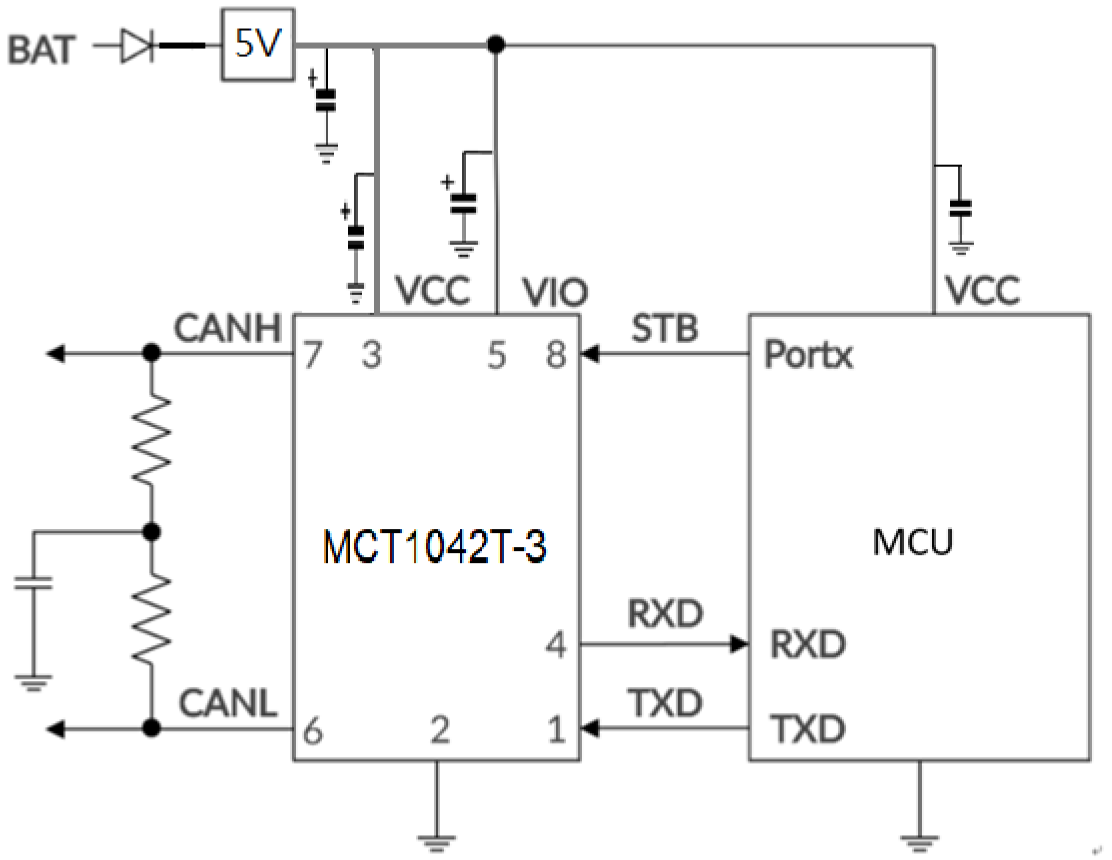

Figure 4 Typical Application of MCT1042T-3 with a 5V Microcontroller

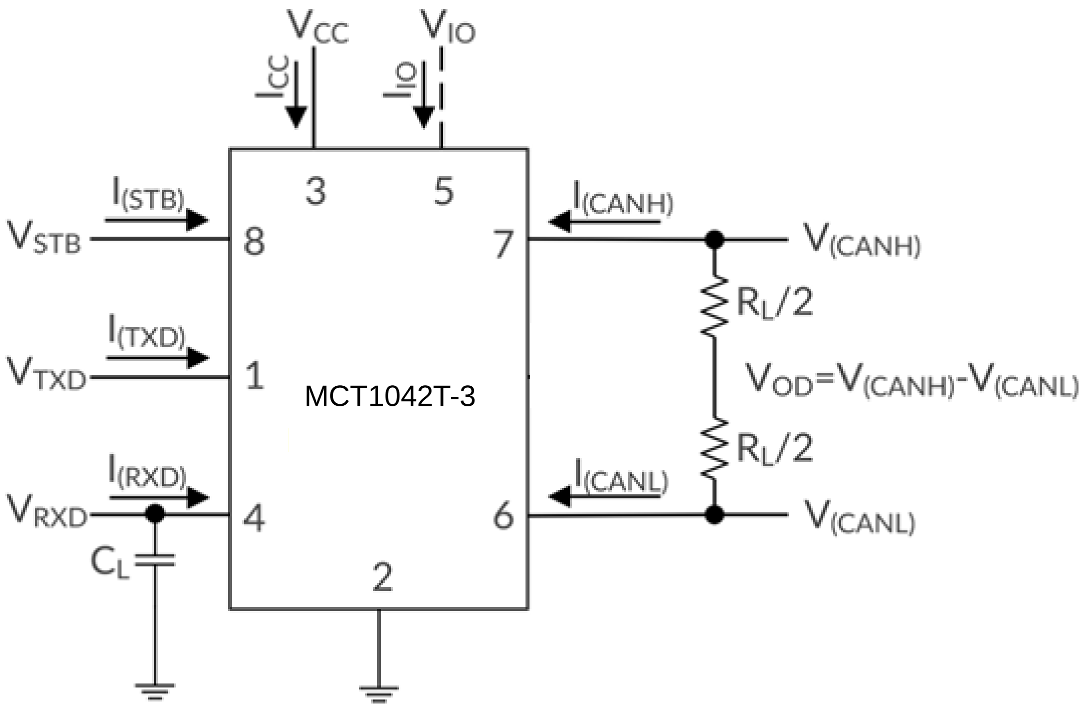

Figure 5 Definitions of Test Voltage and Current

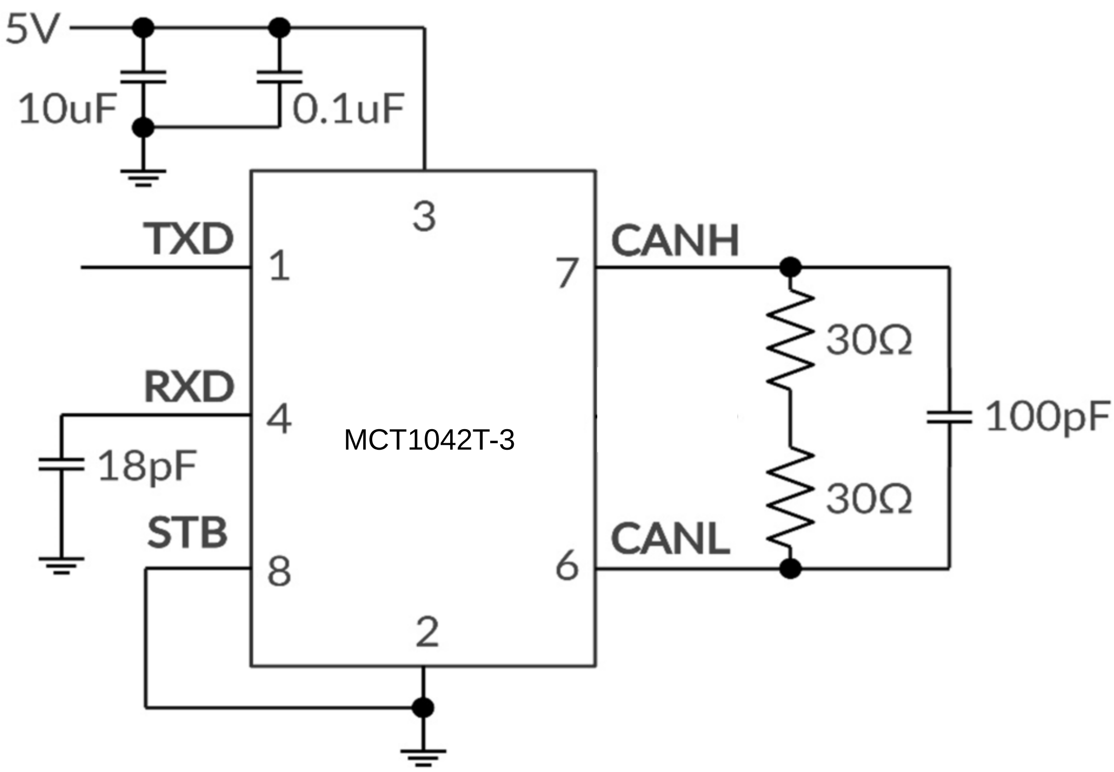

Figure 6 Test Diagram

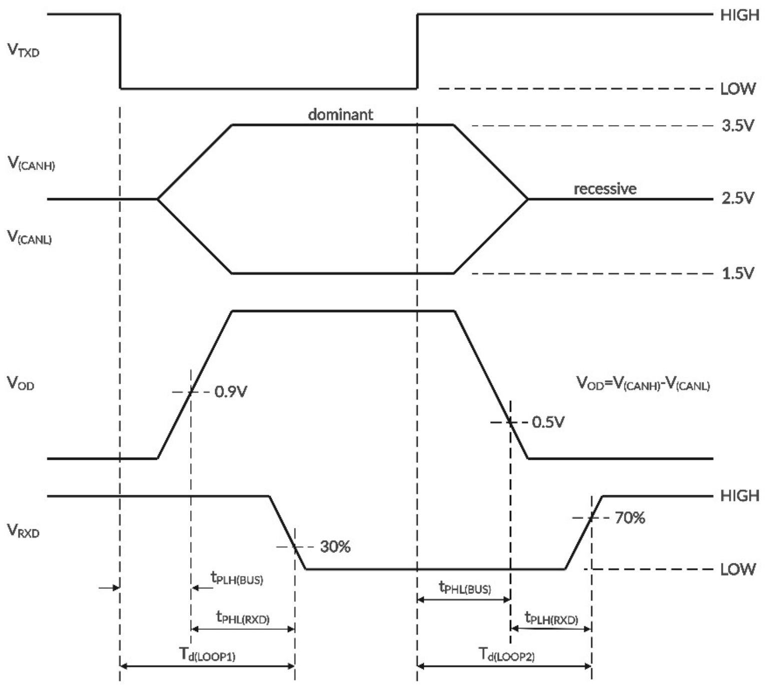

Figure 7 Test Waveforms, Thresholds, and Delay Diagram

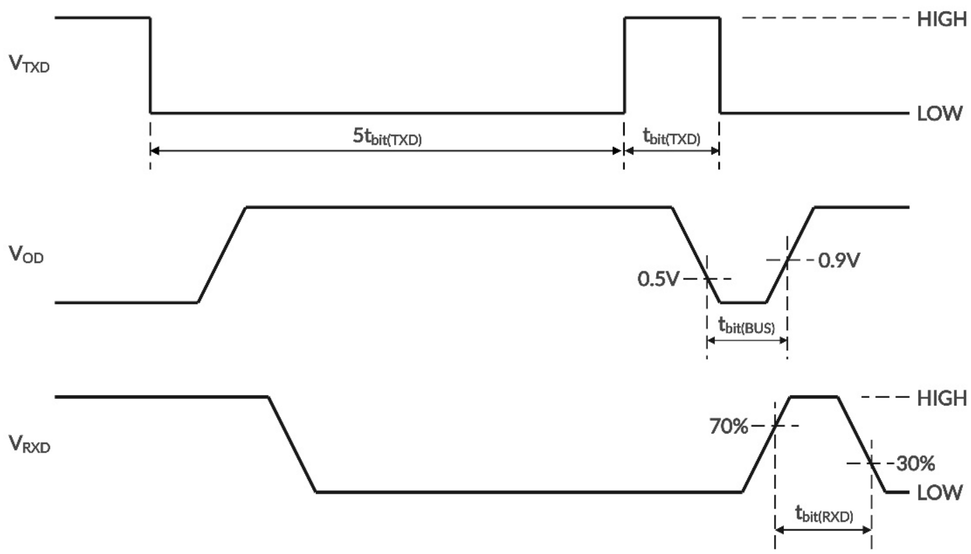

Figure 8 CAN FD Bit Width Test

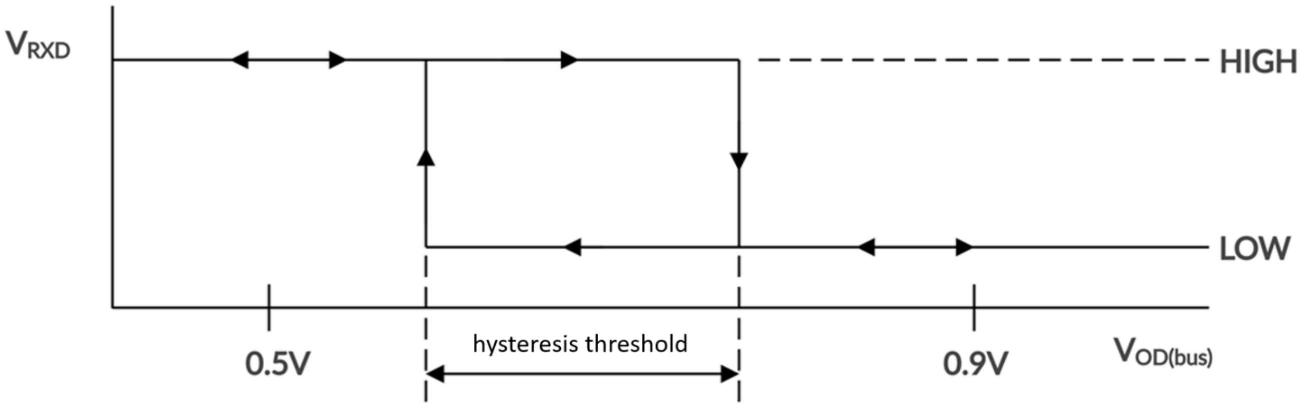

Figure 9 Bus Receiver Threshold Hysteresis

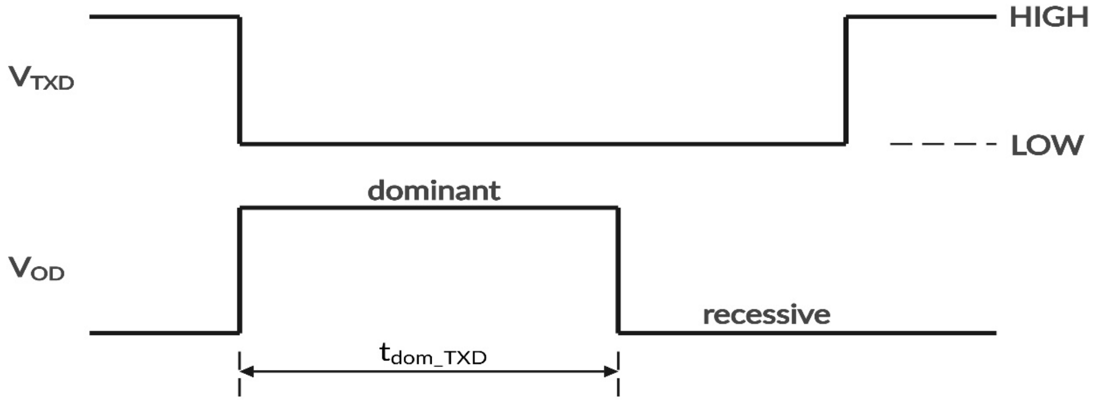

Figure 10 TXD Dominant Timeout

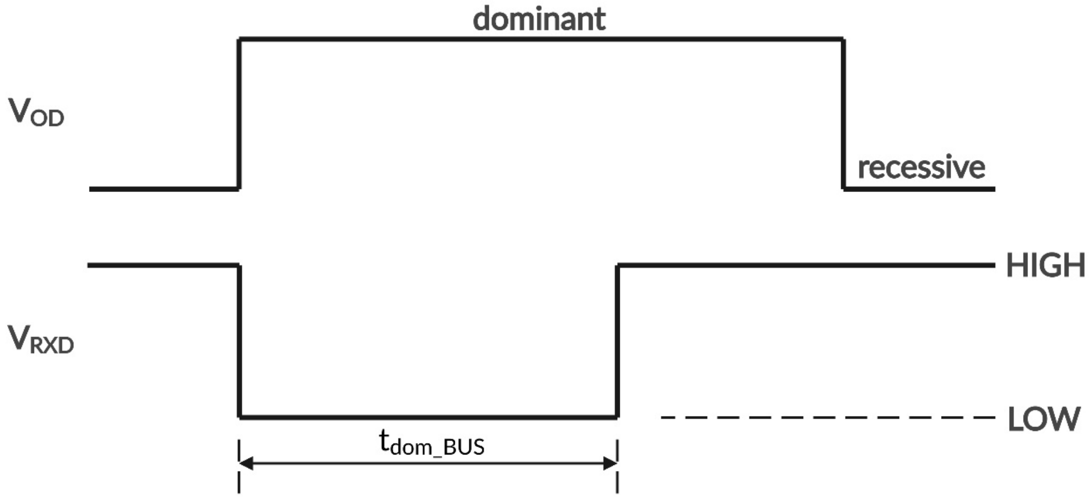

Figure 11 BUS Dominant Timeout

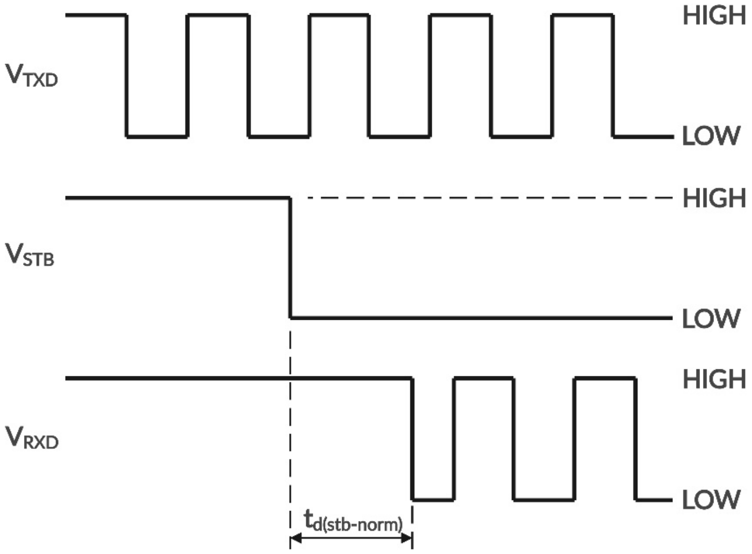

Figure 12 Standby to Normal Mode Delay

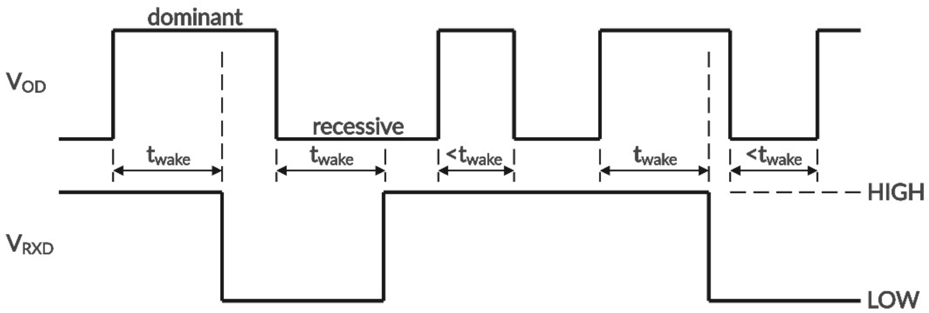

Figure 13 Bus Wake-Up Function in Standby Mode

11 Package outline and dimensions diagram

11.1 SOP8 Package Outline and Dimensions

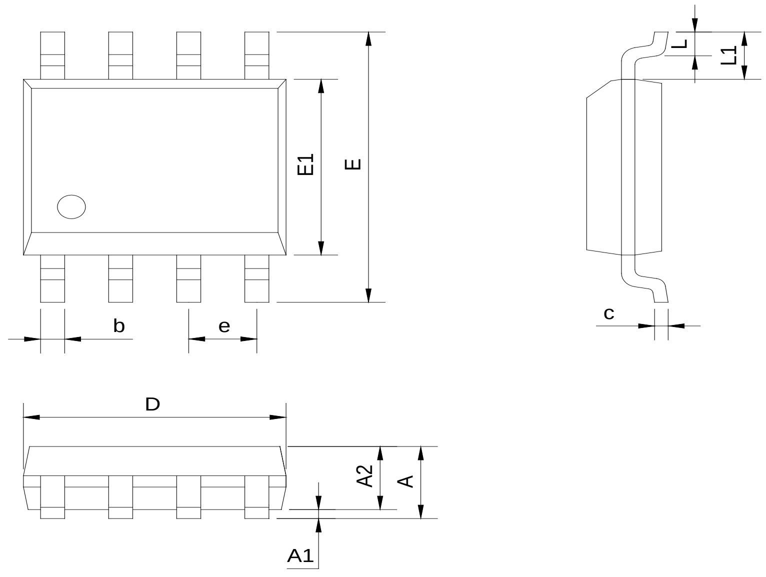

Figure 14 SOP8 package

Table 8 SOP8 Dimensions

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A		1.750		0.069
A1	0.050	0.230	0.002	0.090
A2	1.300	1.500	0.051	0.059
b	0.350	0.470	0.014	0.019
c	0.180	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E1	3.700	4.100	0.146	0.161
E	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	0.800	0.016	0.031

12 Revision History

Revision	History	Data
V1.0	Preliminary version	2025/11/12
V1.1	Correcting model number errors	2025/11/21
V1.2	Added 5V wiring diagram	2026/01/23
V1.3	Update MCT1042T-3	2026/06/12

13 Disclaimers

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