Supplier:	BOSCH
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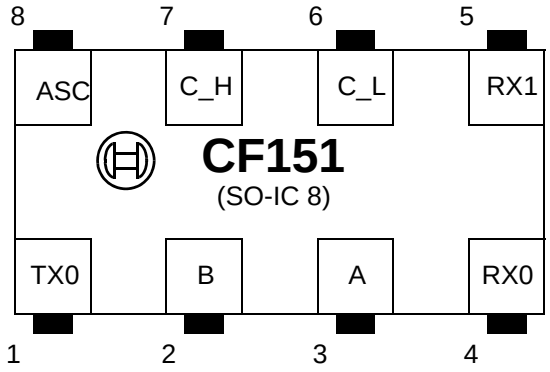
1 279 C04 247 Translation into english	10/24/05
1 039 R00 726 correction on page 12/17 (Switch-off delay ...)	12.08.2010
1 039 R00 760 Revision: refence to part number deleted	09/01/10

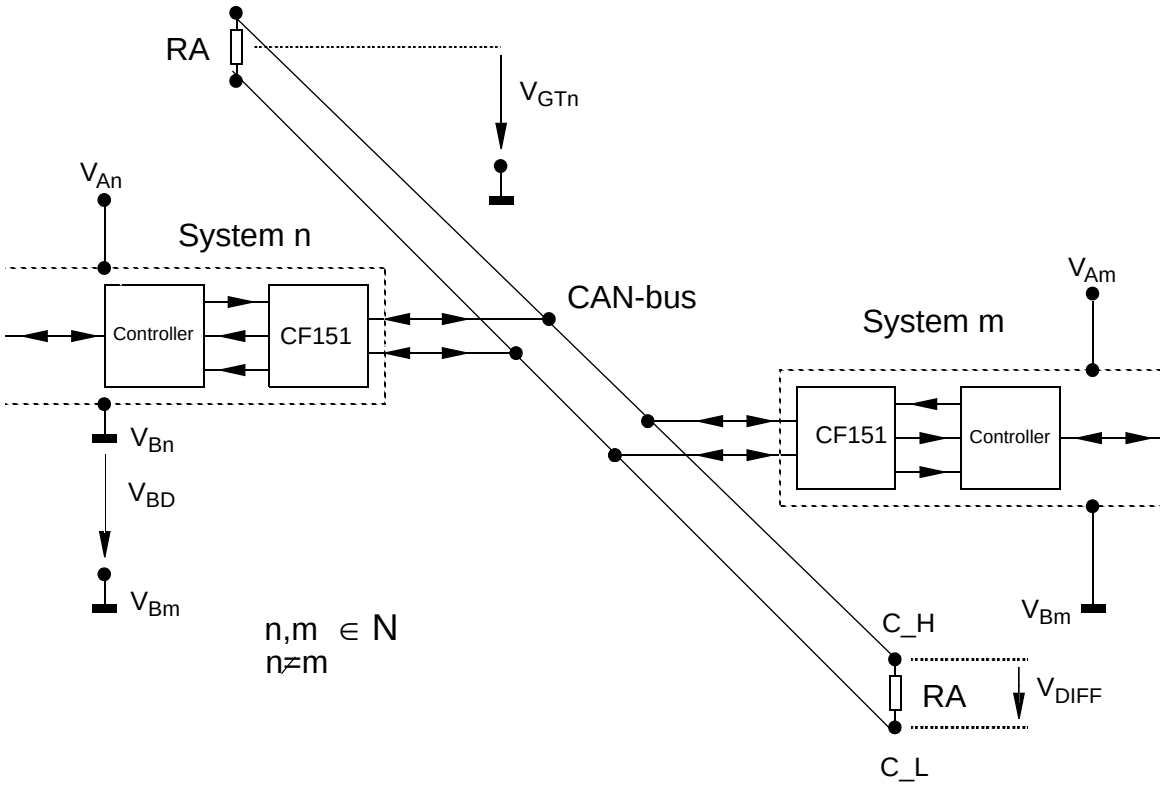
CAN - Transceiver CF151 (UB62)



1. Brief description

The CF151 is a bidirectional transceiver module for signal adaptation and processing between a CAN controller component and a CAN-bus two-wire line for data transmission rates up to 500 KBAUD.
The component consists of a transmitter which converts a digital signal from the controller component into a difference signal onto the CAN-bus. A receiver converts a common mode difference signal from the CAN bus into a digital signal to the CAN controller. A monitoring unit protects the component against destruction in the case of short-circuits and overvoltages on the CAN-bus for vehicle application.
The difference signal is built up with a limited rise time rate to supress reflections and to minimise the radiation in unshielded bus systems. The rise time rate can be set externally to a fast (<500KBaud) or slow mode (<125KBaud).
The component is defined based on the standard ISO/DIS 11898 .

1.1 Function circuit diagram CF151



1.2 Properties of the transmitter output stage

	Block diagram
- CMOS level input	TX0
- High and low side switches in MOS technology for difference signal formation	TH, TL
- 60Ω Generator internal resistance for wave resistance adaptation to the CAN-bus	RG
- voltage-proof in the range from -5V to 36V	C_H, C_L, DH, DL
- high-ohmic voltage regulation to the CAN bus in recessive condition	V_0, R_I
- data transmission rate up to 500 KBAUD	TX0 → C_H, C_L
- adjustable limited rise time rate	ASC

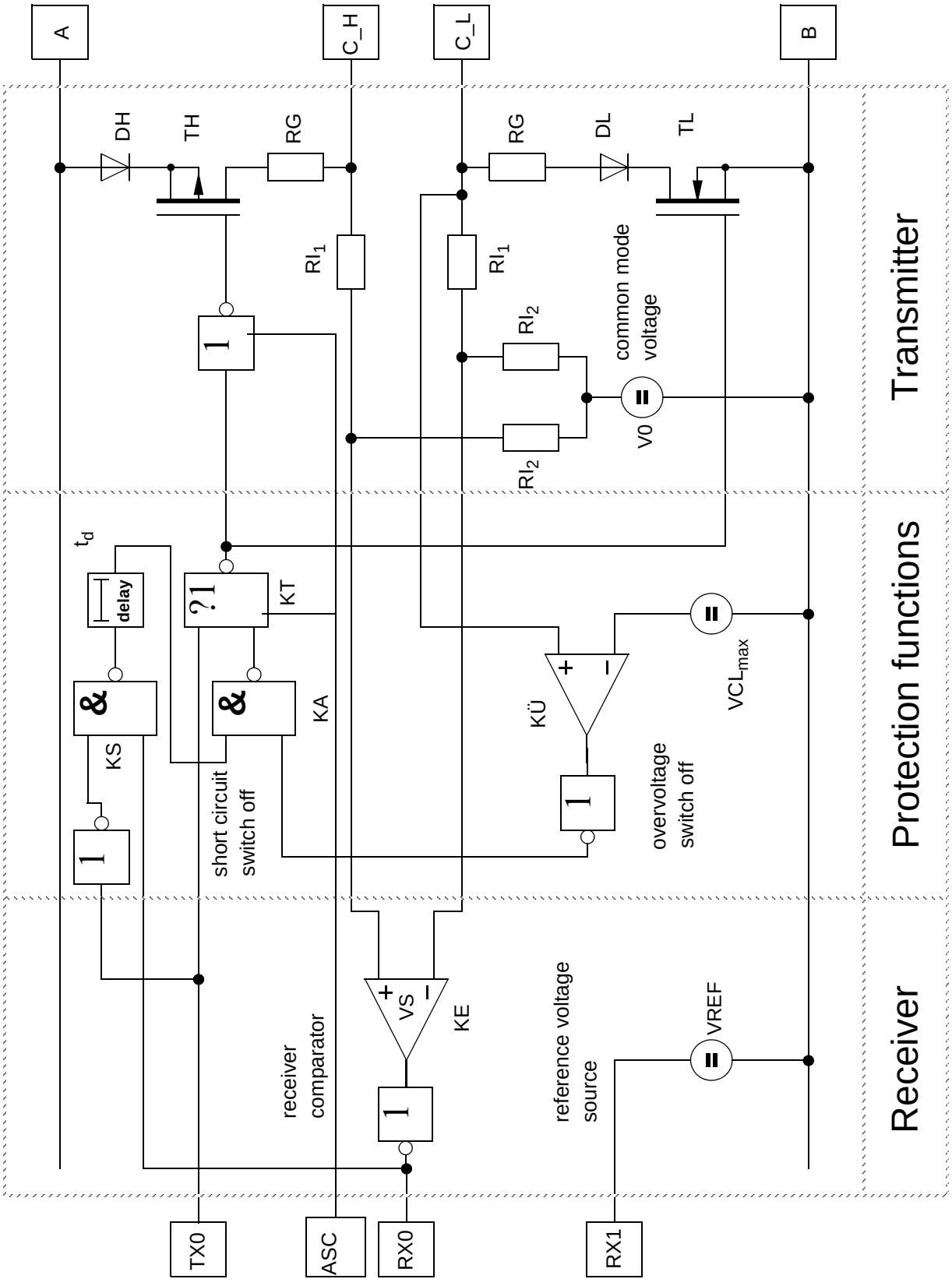
1.3 Properties of the receiver stage

- difference input with constant switching threshold	V_S (KE)
- input common mode voltage up to range above V_A and below V_B	KE
- reference voltage source for difference input of the CAN controller	V_{REF}
- data transmission rate up to 500 KBAUD	C_H, C_L → RX0
- symmetrical load of the bus	KE
- Hysteresis of the receiver comparator	

1.4 Properties of the monitoring functions

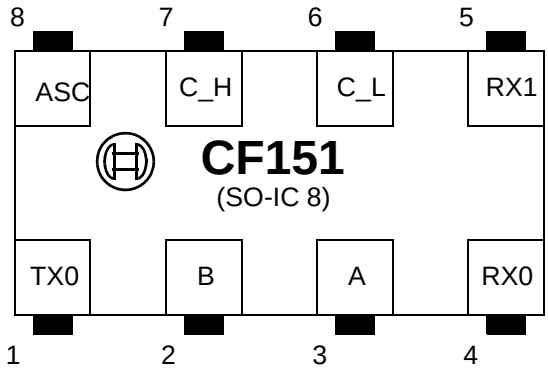
- locking of the transmission function in the event of short circuits at C_L with $V_{C\_L} > V_{C\_Lmax}$	KÜ
- detection of short circuits between C_H and C_L as well as from C_H to ground potential and switching off of the transmission function with a delay	KS, td

1.5 Block diagram CF151



1.6 Connection pinout / pin designation / package

		Pin
TX0	transmitter input	1
B	ground	2
A	supply voltage	3
RX0	receiver output	4
RX1	reference voltage	5
CL	CAN bus terminal Low	6
CH	CAN bus terminal High	7
ASC	rise time rate setting transmitter	8



characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
2. Data sheet	All voltages are referred to pin B. All numeric values under “typ” refer to V_A=5V and T_u=25 C. General designations: - RL: bus simulation 60 Ohm resistance between pin C_H and C_L. - CL: capacitive load of 47pF between pin C_H and C_L. - CRX0: capacitive load of maximum 20pF between pin RX0 and B. - (rec): recessive transmitter (V_{TX0}=V_A) - (dom): dominant transmitter (V_{TX0}=V_B)					
2.1 Maximum Ratings						
2.1.1 Temperatures						
Ambient temperatures		T_u	-40		125	^oC
Junction temperature		T_j	-40		150	^oC
Storage temperature		T_l	-40		150	^oC
2.1.2 Maximum Ratings						
Pin A: .1 Supply voltage	(rec) for V_A<4.5V and V_A>5.5V no overvoltages and no undervoltages at C_H and C_L for V_A> 5.5V	V_A	-0.3	5	7	V
Pin TX0: .2 Input current	V_{TX0}>V_A due to dynamic switching peaks (no continuous operation)	I_{TX0}			10	mA
	V_{TX0}<V_B due to dynamic switching peaks (no continuous operation)	I_{TX0}	-10			mA
.3 Input voltage	continuous operation 4.5V<V_A<5.5V	V_{TX0}	V_B		V_A	

characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Pin ASC:						
.10						
Input current	$V_{ASC}>V_A$ due to dynamic switching peaks (no continuous operation)	I_{ASC}			10	mA
	$V_{ASC}<V_B$ due to dynamic switching peaks (no continuous operation)	I_{ASC}	-10			mA
.11						
Input voltage	Continuous operation $4.5V<V_A<5.5V$	V_{ASC}	V_B		V_A	
Pin RX0:						
.4						
Output voltage	No continuous operation	I_{RX0}	-1		1	mA
Pin RX1:						
.5						
Output voltage		V_{RX1}	V_B		V_A	
Pin C_H:						
.6.0						
Input voltage	(rec) for $V_A<4.5V$	V_{C_H}	-5		36	V
.6.1						
Input voltage	$4.5<V_A<5.5V$	V_{C_H}	-5		36	V
.7.0						
Input current	(rec), $4.5V<V_A<5.5V$, $V_{C\_H}=36V$	I_{C_H}			5	mA
.7.1						
Input current	(rec), $4.5V<V_A<5.5V$, $V_{C\_H}=-5V$	I_{C_H}	-3			mA
.7.2						
Input current	(rec), $V_A=0V$, $V_{C\_H}=36V$	I_{C_H}			5	mA
.7.3						
Input current	(rec), $V_A=0V$, $V_{C\_H}=-5V$	I_{C_H}	-3			mA
Pin C_L:						
.8.0						
Input voltage	(rec) for $V_A<4.5V$	V_{C_L}	-5		36	V
.8.1						
Input voltage	$4.5<V_A<5.5V$	V_{C_L}	-5		36	V
.9.0						
Input current	(rec), $4.5V<V_A<5.5V$, $V_{C\_L}=36V$	I_{C_L}			5	mA
.9.1						
Input current	(rec), $4.5V<V_A<5.5V$, $V_{C\_L}=-5V$	I_{C_L}	-3			mA
.9.2						
Input current	(rec), $V_A=0V$, $V_{C\_L}=36V$	I_{C_L}			5	mA
.9.3						
Input current	(rec), $V_A=0V$, $V_{C\_L}=-5V$	I_{C_L}	-3			mA

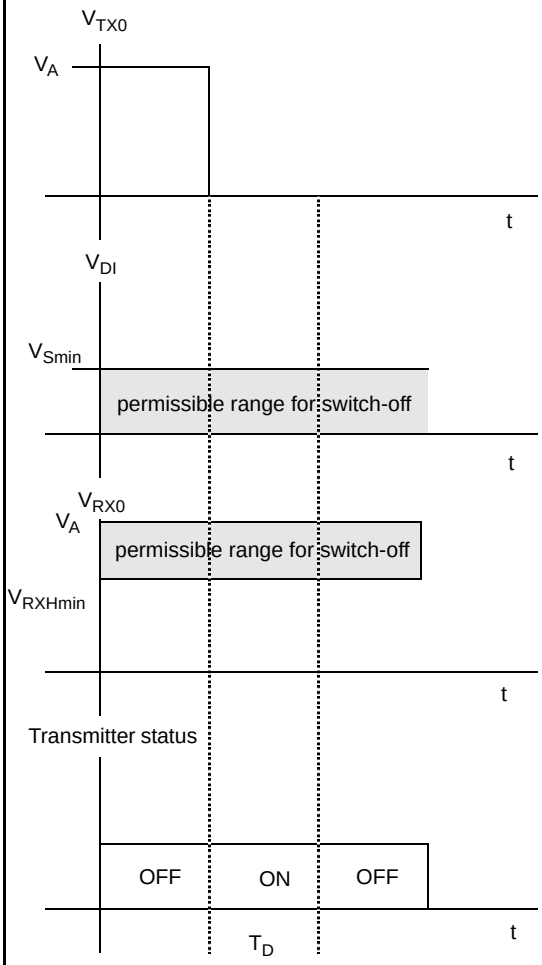
characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
2.1.3 Electrical limits (disturbance pulses)						
Pins C_H, C_L: .1 Input voltage	Disturbance pulses according to ISO/DIS 7637-1:1990(E), 4.6.3 Test Pulse 3a, 3b	V_{Puls}	-150		100	V
2.1.4 Electrical limits (ESD)						
all pins: .1 ESD test voltage	Human Body, 100pF, 1.5KOhm	V_{ESD}	-2		2	KV

characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
2.2 Characterstics						
2.2.1 Temperatures						
Ambient temperatures		T_u	-40		125	°C
Depletion layer temperatures		T_j	-40		150	°C
2.2.2 Electrical Characterstics	unless specified otherwise it applies that: $4.5V<V_A<5.5V$ $V_{DI} = V_{C\_H} - V_{C\_L}$					
Pin A:						
.1 Supply voltage		V_A	4.5	5	5.5	V
.2.0 Current consumption	RL, (dom)	I_A			80	mA
.2.1 Current consumption	RL, (rec)	I_A			20	mA
Rise time setting						
Pin ASC:						
.28 Input capacitance	$V_B<V_{ASC}<V_A$	CIN		25		pF
.29 Input current	$V_{ASC}=V_A$, (internal pulldown)	I_{ASC}			275	µA
.30 Input current	$V_{ASC}=V_B$	I_{ASC}	-2	0	2	µA
.31 Input level Low Speed	RL, CL	V_{ASH}	0.8		1	$*V_A$
.32 Input level High Speed	RL,CL	V_{ASL}	0		0.2	$*V_A$
Transmitter input DC						
Pin TX0:						
.3 Input capacitance	$V_B<V_{TX0}<V_A$	CIN		25		pF
.4 Input current	(dom), (internal pullup)	I_{TX0}	-275			µA
.5 Input current	(rec)	I_{TX0}	-2	0	2	µA
.6 Input level High level	RL, $V_{DI}<V_{DILmax}$	V_{TXH}	0.7		1	$*V_A$
.7 Input level Low level	RL, $V_{DI}>V_{DIHmin}$	V_{TXL}	0		0.3	$*V_A$

characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Transmitter outputs DC						
Pins C_H, C_L:						
.8 Output quiescent voltage C_H	(rec)	V_{CHR}	0.4	0.5	0.6	$*V_A$
.9 Output quiescent voltage C_L	(rec)	V_{CLR}	0.4	0.5	0.6	$*V_A$
.10 Output quiescent current C_H	(rec), $-2V<V_{CH}<7V$	I_{CHR}	-0.7		0.7	mA
.11 Output quiescent current C_H	(rec), $1V<V_{CH}<4V$	I_{CHR}	-0.3		0.3	mA
.12 Output quiescent current C_L	(rec), $-2V<V_{CL}<7V$	I_{CLR}	-0.7		0.7	mA
.13 Output quiescent current C_L	(rec), $1V<V_{CH}<4V$	I_{CLR}	-0.3		0.3	mA
.14 Output difference voltage	$V_{DIL(H)}=V_{C\_H}-V_{C\_L}$					
.14.1 recessive	$V_{TX0}>V_{TXHmin}$	V_{DIL}	-500	0	50	mV
.14.2 dominant	RL, $V_{TX0}<V_{TXLmax}$	V_{DIH}	1.5		3	V
Receiver input DC						
Pins C_H, C_L						
.16 threshold voltage	$V_S=V_{C\_H}-V_{C\_L}$	V_S	500	700	900	mV
.33 hysteresis voltage		V_{HYS}		200		mV
.17 Input common mode voltage	$V_{COM}=(V_{C\_H}+V_{C\_L})/2$ with $V_{C\_Hmax}=V_{C\_Lmax}=7V$ $V_{C\_Hmin}=V_{C\_Lmin}=-2V$	V_{COM}	-2		7	V
Receiver output DC						
Pin RX0:						
Output voltage						
.18 Low level	$V_{DI}>0.9V$ $-0.3mA<I_{RX0}<1mA$ $V_B<VRX0<V_A$	V_{RXL}			0.5	V
.19 High level	$V_{DI}<0.5V$ $-0.3mA<I_{RX0}<0.3mA$ $V_B<V_{RX0}<V_A$	V_{RXH}	0.9			$*V_A$

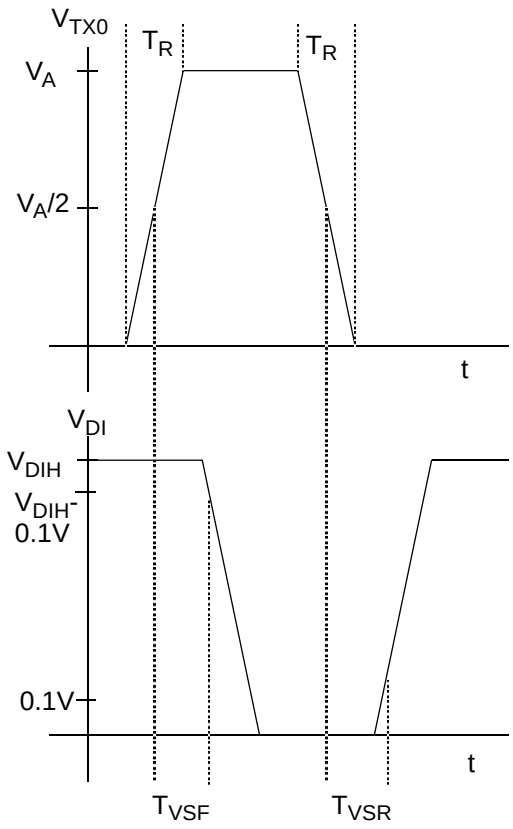
characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Reference voltage source						
Pin RX1: .20 Output voltage	I_{RX1}=0A	V_{RX1}	0.45	0.5	0.55	$*V_A$
.21 Output resistance	RA=dV_{RX1}/dI_{RX1} at the point $V_{RX1}=V_A/2$	RA			20	kOhm

characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Protection circuit						
Pin C_L: .22 Response threshold of the overvoltage switch-off	In the event of short-circuits between bus cables and/or overvoltages and/or ground, the CAN controller components switches the transmitter stage off after 20 to 80 bit times, but after 1 ms at the maximum.	V_{CLM}	7	8	10	V
Pin C_H, C_L: .23 Switch-off delay time at short-circuit detection	Short-circuit resistance RKS<1Ohm Switch-off condition and definition of T_D ON: TH, TL are switched on OFF: TH, TL are switched off	T_D	1.5	5.5	10	µs

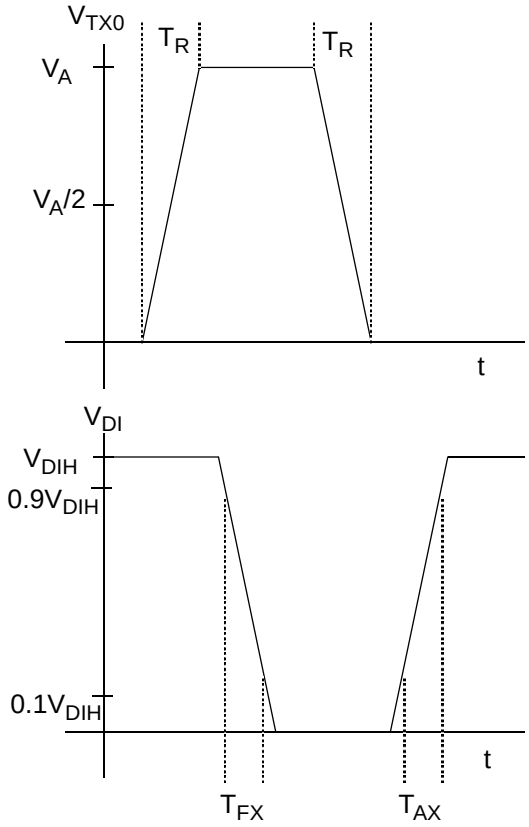


characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Pin A: .24 Peak current consumption in short-circuit operation	(dom), short-circuit Pin C_H to B (limited to T_{max}=10µs by short-circuit detection)	I_{AM}		200		mA

characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Transmitter AC						
.25						
Signal delay time from Transmitter input TX0 to Transmitter output C_H, C_L	RL, CL, T_R<2ns, V_{ASC}<V_{ASL} V_A=5V, T_u=25°C	T_{VSF}			50	ns
		T_{VSR}			50	ns

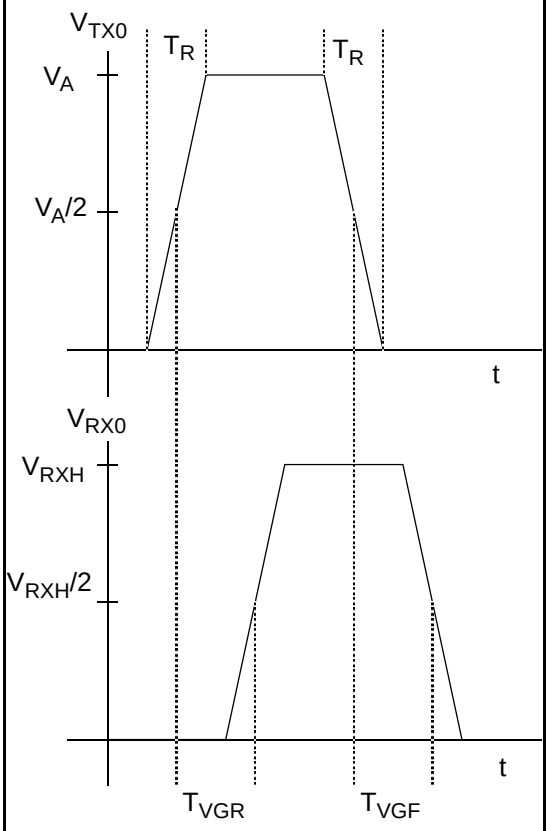


characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Transmitter AC						
.25a Rise time rate transmitter output, High Speed C_H, C_L	RL, CL, T_R<2ns, V_{ASC}<V_{ASL} V_A=5V, T_u=25°C	S_{AH}	20		50	V/µs
.25b Fall time rate transmitter output, High Speed C_H, C_L	RL, CL, T_R<2ns, V_{ASC}<V_{ASL} V_A=5V, T_u=25°C	S_{FH}	20		50	V/µs
.25c Rise time rate transmitter output, Low Speed C_H, C_L	RL, CL, T_R<2ns, V_{ASC}>V_{ASH} V_A=5V, T_u=25°C	S_{AL}	5		20	V/µs
.25d Fall time rate transmitter output, Low Speed C_H, C_L	RL, CL, T_R<2ns, V_{ASC}>V_{ASH} V_A=5V, T_u=25°C	S_{FL}	5		20	V/µs



$S_{XX}=(0.9V_{DIH}-0.1V_{DIH})/T_{XX}$

characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Transmitter and receiver AC						
.26						
Signal delay time from Transmitter input TX0 to Receiver output RX0	RL, CL, CRX0, T_R<2ns, CUH, CUL $V_{ASC}<V_{ASL}$ V_A=5V, T_u=25°C	T_{VGR}			280	ns
		T_{VGF}			280	ns



characteristic value or connection point	conditions	Symbol	numeric value min.	numeric value typ.	numeric value max.	unit
Receiver AC						
.27						
Signal delay time from Receiver input C_H, C_L to after Receiver output RX0	CRX0, T_R<2ns V_A=5V, T_u=25°C	T_{VEF}			150	ns
		T_{VER}			150	ns